# Living Shoreline Suitability Model for Tampa Bay: A GIS Approach

**Final report to the**
**Gulf of Mexico Alliance**
**Habitat Resources Priority Issue Team**

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**In fulfillment of**
**GOMA Grant No.: 121623-00**
**FWRI File No.: 4314**

**February 9, 2018**

Recommended citation:

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 pages including appendices

*Keywords*: Florida, Tampa Bay, Living Shorelines, Geographic Information Systems

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**Acknowledgements**

FWC would like to thank Marcia Berman and Tamia Rudnicky from College of William and Mary's Virginia Institute of Marine Science Center for Coastal Resource Management Program and David TidWell from the Geological Survey of Alabama for their assistance with the preliminary data structure development and initial explanations of the VIMS LSSM.

## Executive Summary

The Florida Fish and Wildlife Conservation Commission: Fish and Wildlife Research Institute (FWC: FWRI) received grant funding from the Gulf of Mexico Alliance: Habitat Resources Priority Issue Team (GOMA: HRT) to apply Virginia Institutes of Marine Science: Center for Coastal Resource Management's (VIMS: CCRM) Living Shoreline Suitability Model (LSSM) to the Tampa Bay region in Florida.

The LSSM considers environmental variables, such as fetch, bank height, existing shoreline conditions, and human installed structures, before recommending shoreline and upland best management practices (BMPs). The model's recommended BMPs can be further generalized into three categories: suitable for living shoreline stabilization, suitable for a hybrid shoreline stabilization technique, and not suitable for a living shoreline. The results of the LSSM application to the Tampa Bay region were presented to numerous stakeholder groups and included in the development of educational and outreach materials developed for web dissemination.

The results of the Tampa Bay LSSM and the presentation of the education and outreach materials are presented here as deliverables to the project.

## Introduction

Tampa Bay is an estuary located on the west-central coast of Florida's peninsula. This estuary includes approximately 400 square miles of surface water with inputs from four major rivers. The region includes Hillsborough, Manatee, and Pinellas counties, which were first settled in the late 1800s, with considerable population growth and development occurring in the 1950s to present. Since the last census in April 2010, it is estimated that the 2016 population in this tri-county area had grown by approximately 9.9% to over 2.7 million residents[1], increasing urban development in the area and putting additional stressors on the surrounding environments.

With the realized threat of sea level rise in Tampa Bay and erosion affecting waterfront parcels and their property values, considerable attention has been focused on shoreline protection. In the recent past, shorelines have been "stabilized with hardened structures, such as bulkheads, revetments, and concrete seawalls. Ironically, these structures often increase the rate of coastal erosion, remove the ability of the shoreline to carry out natural processes, and provide little habitat for estuarine species."[2] Alternatively, government agencies responsible for resource protection have proposed more natural bank stabilization and erosion control called "living shorelines," which the U.S. National Oceanic and Atmospheric Administration (NOAA) defines as: "… a range of shoreline stabilization techniques along estuarine coasts, bays, sheltered coastlines, and tributaries… [that]… incorporates [natural] vegetation or other living, natural 'soft' elements alone or in combination with some type of harder shoreline structure (e.g. oyster reefs or rock sills) for added stability… [to] maintain continuity of the natural land-water interface and reduce erosion while providing habitat value and enhancing coastal resilience."[3]

On a more local scale, the Tampa Bay Estuary Program (TBEP) has identified living shorelines as an objective in action BH-6 of their revised comprehensive plan:

> *Expand use of living shorelines instead of traditional seawalls along waterfront properties. Support demonstration projects; explore regulatory rule revisions to support living shorelines; assess the use of living shorelines to mitigate climate change; and support education of waterfront homeowners about the benefit of living shorelines.*[4]

TBEP has worked with the University of South Florida Water Institute to identify restoration project sites throughout the Tampa Bay area, including the Ulele Spring restoration in downtown Tampa, MacDill Air Force Base Living Shoreline project, reef balls along the downtown St. Petersburg and Tampa waterfronts, and reef ball/oyster breakwater installations along the Alafia Bank Bird Sanctuary.[5]

The Florida Fish and Wildlife Conservation Commission: Fish and Wildlife Research Institute (FWC: FWRI) has taken an interest in living shorelines in the Tampa Bay region and, as a state partner in the Gulf of Mexico Alliance (GOMA), became aware of the Virginia Institute of

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[1] (U.S. Census Bureau, 2016)
[2] (National Oceanic and Atmospheric Administration, n.d.)
[3] (National Oceanic and Atmospheric Administration (NOAA), 2015)
[4] (Tampa Bay Estuary Program, 2017)
[5] (Tampa Bay Estuary Program, n.d.)

Marine Science's (VIMS) Living Shoreline Suitability Model (LSSM)[6] and its application in Mobile Bay, Alabama.[7] Because of the LSSM's success in identifying locations where a living shoreline restoration project may be successful, FWRI staff received grant funding from GOMA's Habitat Resources Team (HRT) to apply the LSSM to the Tampa Bay region.

***Project Objective***

The GOMA HRT funded FWC: FWRI to apply VIMS' LSSM to the Tampa Bay region (Figure 1) and provide educational and outreach materials to local stakeholder groups, including regional governmental bodies, local homeowners' associations, and individual landowners. This undertaking includes gathering existing data sources required to inform the LSSM data inputs, compiling a model input dataset that complies with the LSSM required input table schema, run the LSSM for the Tampa Bay region and modify the model as necessary, and communicate the results to stakeholders.

[6] (College of William and Mary: Virginia Institute Of Marine Science: Center for Coastal Resource Management, 2018)

[7] (Woodrey, 2016)

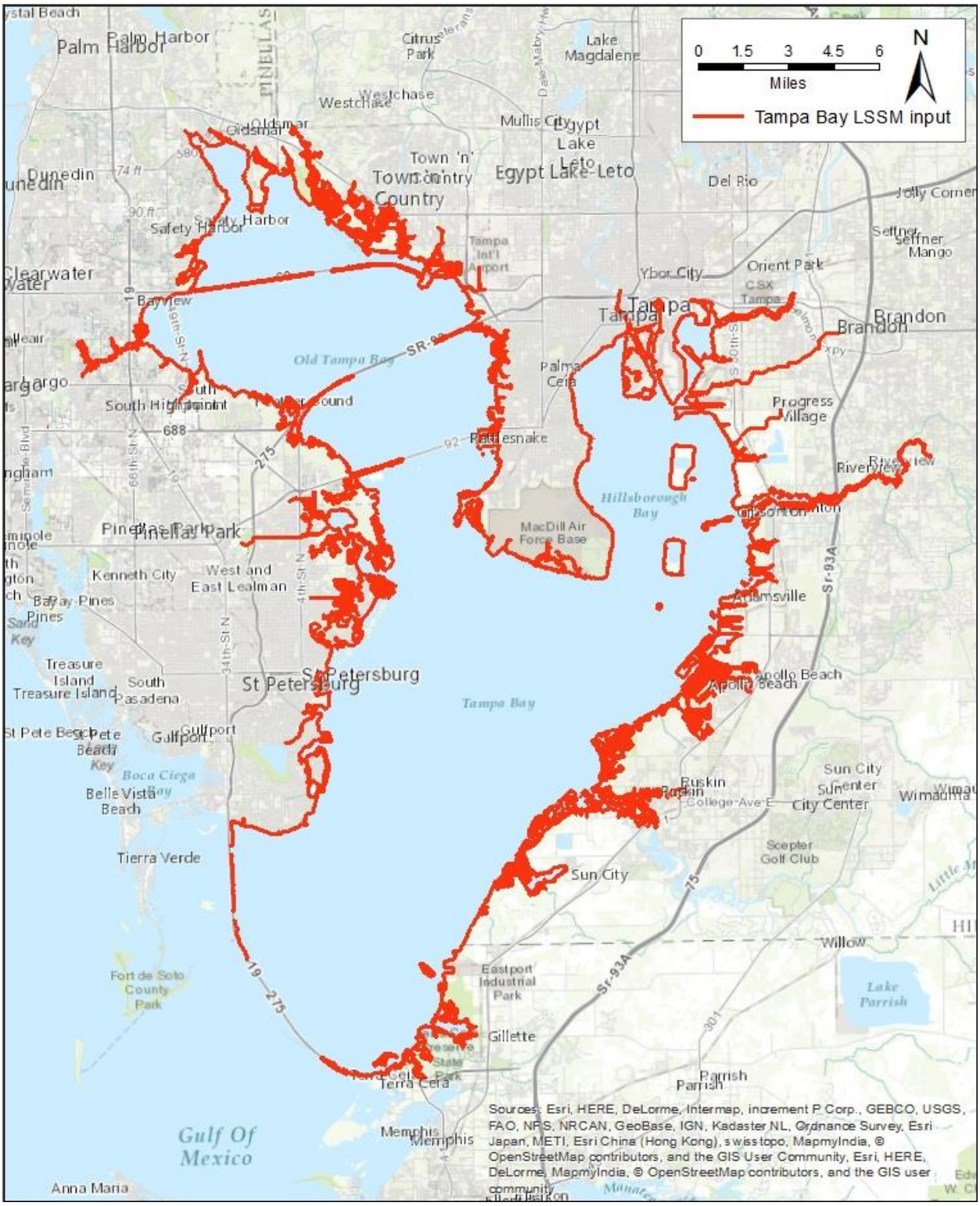


*Figure 1. Tampa Bay Living Shoreline Suitability Model study area*

**Living Shoreline Suitability Model**

VIMS' Center for Coastal Resource Management (CCRM) developed the LSSM to

support policies approved in 2011 by the Virginia General Assembly, which "encourages the use of living shorelines as the preferred alternative for stabilizing tidal shorelines"[8] with the intention to "advise a regulatory or management action in response to a request for some erosion abatement technique."[9] Even though the original intended end users of the model were state resource management agencies, a secondary user group of homeowners and marine contractors was quickly realized. This secondary user group had increased localized priorities of long-term property protection. Because Florida does not have a state law similar to Virginia Administrative Code §28.2-104.1 that requires a living shoreline to be the preferred alternative for shoreline stabilization, the intended end-users for the application of the model to Tampa Bay are private waterfront landowners, homeowners' associations, and regional governmental bodies.

***Model Development***

VIMS developed the LSSM using the Environmental Systems Research Institute's (ESRI) Model Builder in their ArcGIS for Desktop software platform to take advantage of the spatial analysis capabilities of a Geographic Information System (GIS). The ArcGIS Model Builder environment uses a graphical user interface (GUI) to allow the user to systematically apply an analysis methodology or, in the case of the LSSM, a decision tree that can be used to identify appropriate living shoreline treatments to an area. "Studies by CCRM, 2007 and Duhring et al.; (2005) were used to determine the criteria for mapping living shoreline treatments"[10] and are outlined in the decision tree depicted in *Figure 2*.

[8] (Commonwealth of Virginia, 2011)
[9] (Berman & Rudnicky, 2008)
[10] (Berman & Rudnicky, 2008)

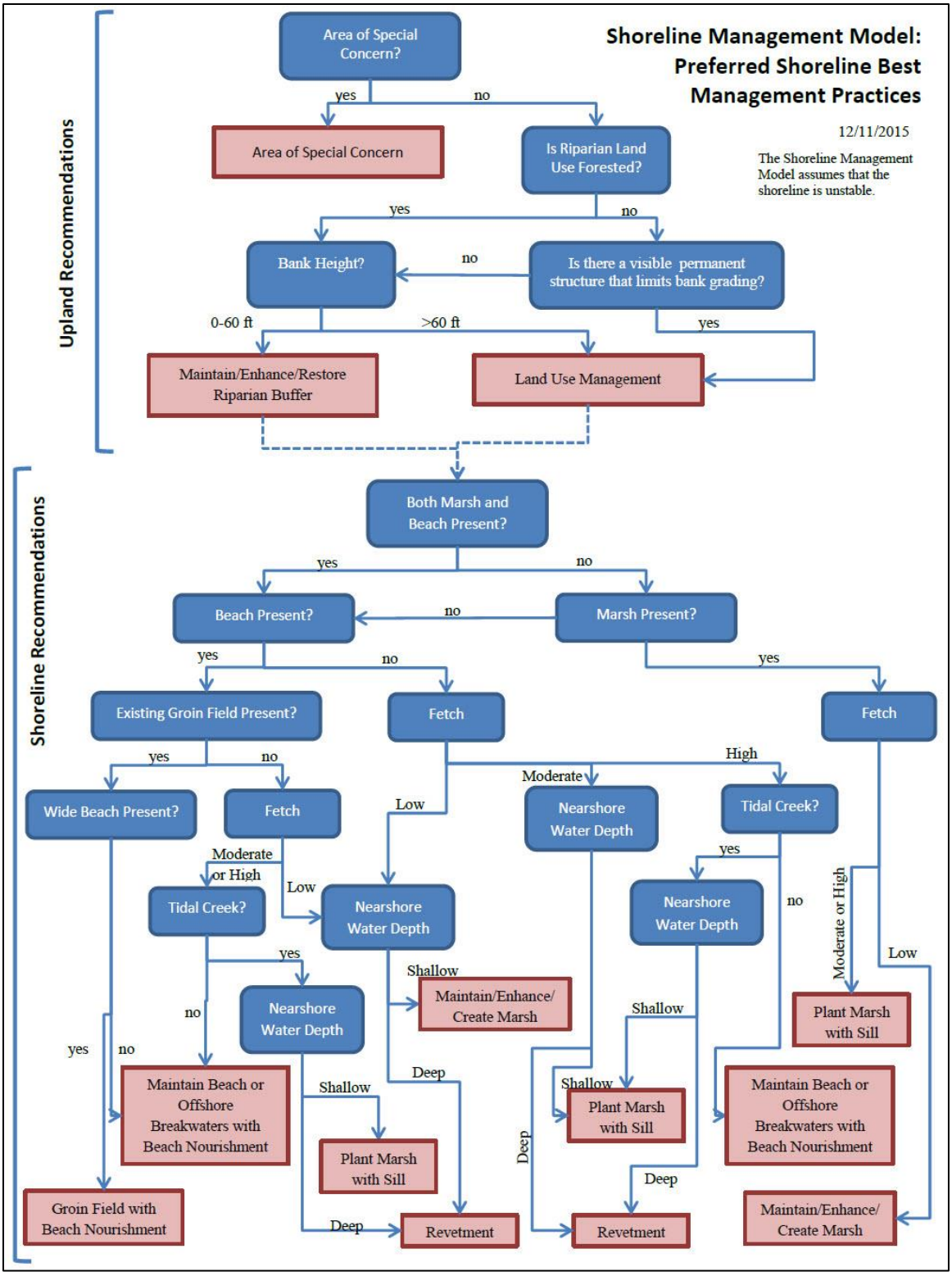


*Figure 2. LSSM decision tree flow chart.*[11]

VIMS provides two caveats to the use of this model and they apply to the application of the model to the Tampa Bay area. First, the model is designed around the best available existing data at the time of the project commencement. No additional data collection efforts were funded or completed through this grant. The second caveat is that the model assumes that the current shoreline is either actively being eroded or that existing shoreline protection techniques are failing. Therefore, "the model does not currently consider a 'Do Nothing' alternative"[10] for a shoreline best management practice recommendation, which is different than the "No Action Needed" upland best management practice recommendation. FWC analysts believe this to be a fair assumption for this project, as users of the model outputs will most likely either be investigating a particular property's ability to support a living shoreline as a shoreline protection method or examining the Tampa Bay Estuary to find locations of potential mitigation or restoration projects.

***Data Input***

VIMS designed the ArcGIS Model Builder model around the existence of the Chesapeake Bay Shoreline Inventory and warns that "substantial changes to the model would be necessary to run the model in a location where an inventory of these shoreline conditions are not available." [12] The shoreline conditions that the LSSM requires are listed in Table 1. A full definition of each of these attributes have been included as part of Appendix A.

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[11] (College of William and Mary: Virginia Institute Of Marine Science: Center for Coastal Resource Management, 2018)

[12] (Berman & Rudnicky, 2008)

*Table 1. Living Shoreline Suitability Model required shoreline condition attributes*

| Field Name | Field Alias | Domain Values | Source |
|---|---|---|---|
| RiparianLU | Riparian Land Use | Commercial, Forested, Industrial, Military, Government, Marsh Island, Extensive Marsh, Detached Marsh, Residential | Environmental Sensitivity Index (ESI) shoreline classification (2016), Florida Cooperative Land Cover (v 3.1, FWC 9/2015), 1-foot resolution aerial photography (FL Dept. of Transportation (FDOT), 2014), vintage 1-meter aerial photography (U.S. Department of Agriculture's National Agriculture Imagery Program (NAIP), 2015) |
| bathymetry | Bathymetry | Shallow, Deep | United States Geological Survey (USGS) Tampa Bay Topobathy (2006) |
| marsh_all | Marsh Type | Marsh present, Marsh Island, No | ESI shoreline classification (2016) |
| bnk_height | Bank Height | 0-5ft, 5-30ft, >30ft, >60ft | USGS Tampa Bay Topobathy (2006) |
| canal | canal | <Null>, Canal | ESI shoreline classification (2016) |
| SandSpit | Sand Spit | <Null>, Yes | 1-foot resolution aerial photography (FDOT, 2014) |
| forestshl | Forested Shoreline | <Null>, Yes | ESI shoreline classification (2016) |
| Structure | Upland Erosion Control | <Null>, Bulkhead, Debris, Marina <50 slips, Marina >50 slips, Riprap, Unconventional, Wharf | ESI shoreline classification (2016) |
| offshorest | Offshore Erosion Control | <Null>, Breakwater, Groin, Marsh Toe | ESI shoreline classification (2016) |
| defended | Defended Shoreline | <Null>, Yes | ESI shoreline classification (2016) |
| Exposure | Exposure | Low, Moderate, High | Manual measurements taken in ArcGIS from shoreline to closest body of land (note, these measurements do not take into account prevailing wind or water current directions) |
| roads | Roads | <Null>, Roads | 1-foot resolution aerial photography (FDOT, 2014) |
| PermStruc | Permanent Structure | <Null>, Permanent Structure | 1-foot resolution aerial photography (FDOT, 2014) |
| Beach | Beach | Yes, No | ESI shoreline classification (2016) |
| WideBeach | Wide Beach | <Null>, Yes | ESI shoreline classification (2016) |
| tribs | Tidal Creek | <Null>, Tidal creek | 1-foot resolution aerial photography (FDOT, 2014) |

*Source Datasets***.**

Tampa Bay does not have a data collection effort identical to that of the Chesapeake Bay Shoreline Inventory. However, the Environmental Sensitivity Index (ESI) "shoreline classification scheme is a numeric characterization of the sensitivity of coastal environments"[13] and contains much of the same information necessary to inform the LSSM's required attributes. The ESI data for the Tampa Bay region was recently updated and delivered to FWC from their contractors in June 2016. For this reason, the ESI linear shoreline dataset was used to identify the extent of the shoreline to be analyzed by the LSSM, the base of the shoreline segments to be classified, and the source of many of the attribute classifications. The remaining attributes were classified according to the best available data at the time of the project commencement. These sources are identified in Table 1

*Input data classification.*

For efficiency and to avoid human error during the data classification phase, FWC staff created an ArcGIS format geodatabase with a feature class that includes each of the required attributes with the prescribed domains from Table 1. The ESI shoreline classification dataset was loaded into the created feature class, retaining the shoreline segments identified by ESI and the ESI_Description field, which identifies the dominant shoreline habitat along these shoreline segments. The FWC analyst systematically selected groups of shoreline segments using the ESI_Description field's value and individually classified the segment's attributes using the ancillary data listed in **Error! Reference source not found.**'s sources field. ESI shoreline c lassifications were split and classified appropriately by the data analyst where an attribute required by the LSSM was not consistent across the ESI segment. Once all 5,162 ESI segments included in the base dataset were analyzed in this manner, Quality Assurance tests consistent with FWC's standard operating procedures (see Logical Consistency Report section of the metadata in Appendix B) were applied to the result and the input dataset was exported out of the file geodatabase in ArcGIS shapefile format, as is required by the LSSM ArcGIS Model Builder model.

***Model Results***

The VIMS LSSM model provides an output shapefile with derived upland and shoreline best management practice (BMP) recommendations based upon the input dataset. The possible best management practice recommendations are listed below and definitions are provided by VIMS CRMP in their Shoreline Management Model Glossary.[14]

*Upland Best Management Practices:*

- Land Use Management
- Maintain/Enhance/Restore Riparian Buffer
- Area of Special Concern

[13] (FWC: FWRI)

[14] (VIMS: Center for Coastal Resource Management Program, 2015)

- No Action Needed

*Shoreline Best Management Practices:*

- *Maintain/Enhance/Create Marsh*
- *Plant Marsh with Sill*
- *Maintain Beach OR Offshore Breakwaters with Beach Nourishment*
- *Groin Field with Beach Nourishment*
- *Revetment*

FWC staff executed the LSSM Model Builder model using the classified data as the data input. The model completed in less than an hour and provided shoreline and upland BMPs as expected; however, it quickly became evident that the model does not incorporate recommendations for the prevalent mangrove habitat in Tampa Bay. FWC organized and hosted a conferenced phone call between the model developers from VIMS, and other living shoreline experts to discuss appropriate measures to modify the LSSM and incorporate mangrove habitat into the ArcGIS Model Builder model.[15] The group decided that, although the natural habitat recruitment cycle differs, mangrove and salt marsh habitat recruit in similar environments, and therefore can be included together in the LSSM BMPs.

Using the information acquired from this phone call, FWC staff modified the VIMS LSSM to include additional attribute values in the domains used for the "RiparianLU" and "marsh_all" fields. Edits to the ArcGIS model builder portion of the LSS model were also required and were comprised of modifying attribute selections to include mangrove habitat with the marsh classifications and modifying the BMP fields output messages to include mangrove recommendations. Finally, FWC staff had to reclassify the model input feature class to more accurately attribute the shoreline segments identified in the ESI shoreline classification as mangrove habitat.

The modified LSSM was again applied to the updated model input feature class and produced a model classification of the Tampa Bay area shoreline. The results of this secondary model run can be reviewed in the BMP Pie charts (*Figure 3* and Figure 4) and the spatial extend can be reviewed in the model output maps (Figure 5 and Figure 6).

[15] (Berman, Marcia, Christopher Boland, Dr. Christopher Boyd, & Lee Anne Wilde, personal communication, May 18, 2017)

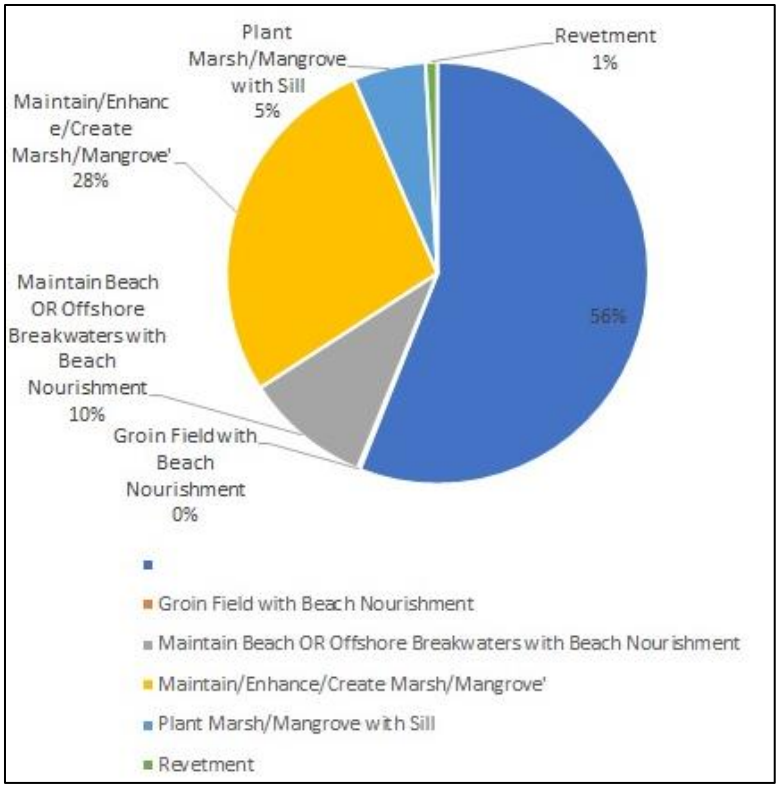


*Figure 3. Recommended Shoreline Best Management Practices*

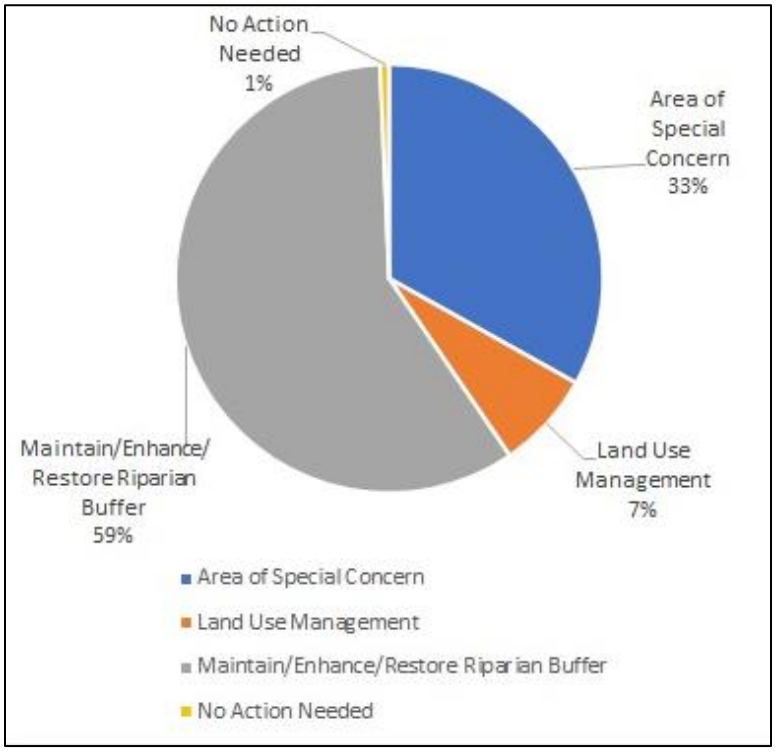


*Figure 4. Recommend Upland Best Management Practices*

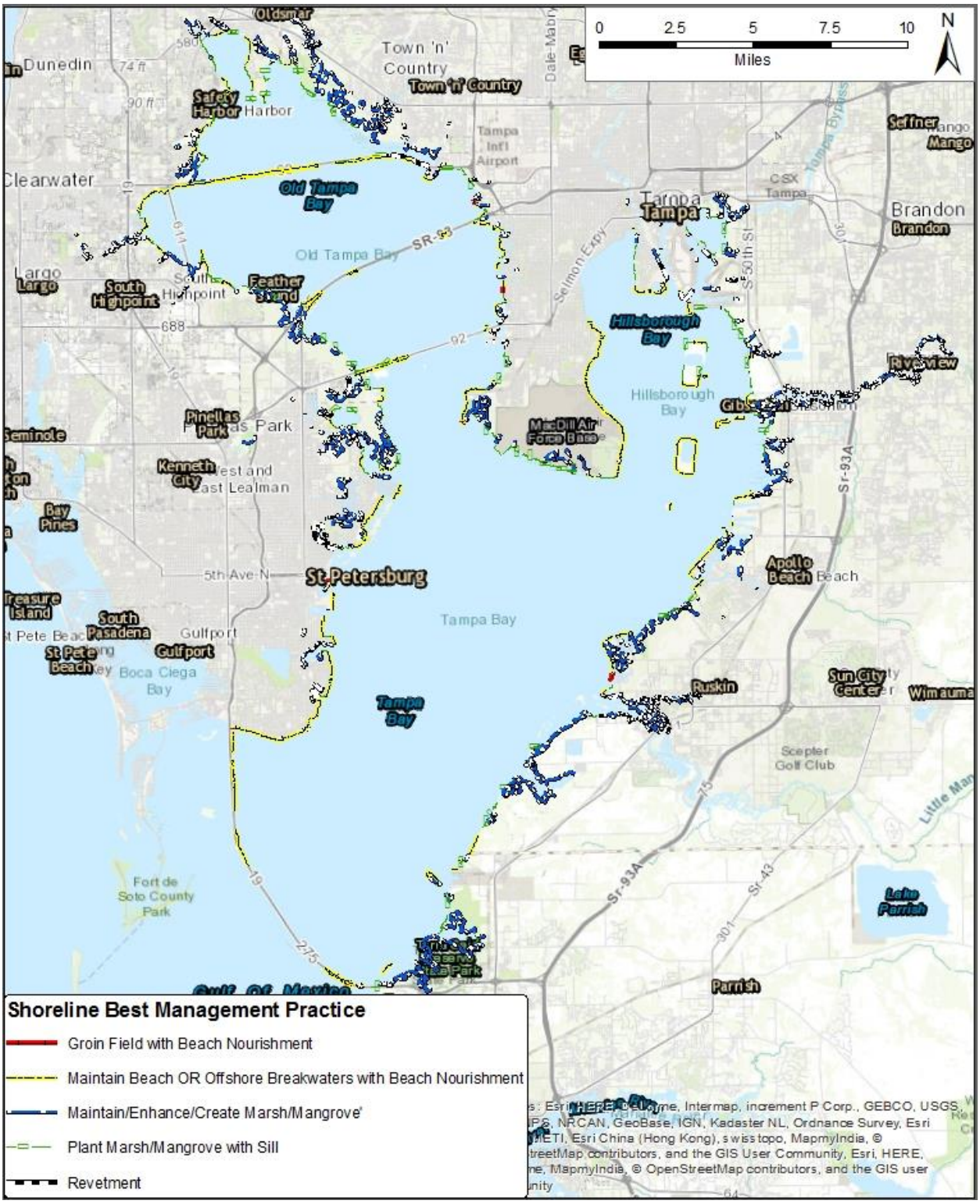


*Figure 5. Recommended Shoreline Best Management Practices Map*

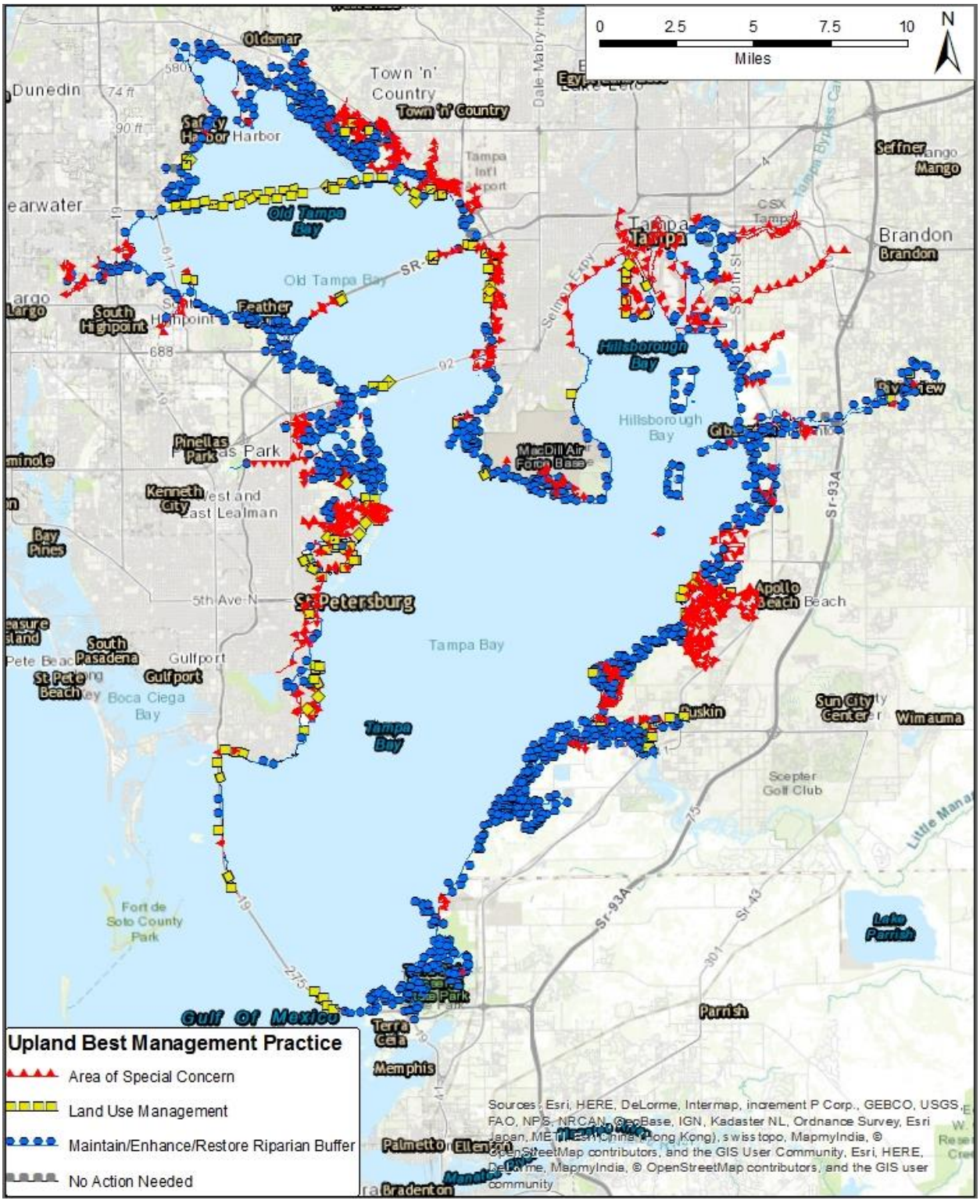


*Figure 6. Recommended Upland Best Management Practices Map*

Overall, the modified LSSM recommended the installation of some sort of living shoreline BMP to approximately 33% of the shoreline; including either the "Plant Marsh/Mangrove with Sill" and "Maintain / Enhance / Create Marsh/Mangrove" BMP recommendations. About 11% of the shoreline is recommended to be protected by a "harder" landscape protection method, such as "revetment," "Breakwaters with Beach Nourishment," or "Groins with Beach Nourishment." Finally, the majority of the Tampa Bay area's shoreline (56%) received a blank classification in the shoreline BMP field.

## Education & Outreach

### *Education & Outreach Material Development*

Using the LSSM output, FWC staff crafted education and outreach materials to educate the public in the Tampa Bay area, including homeowner associations and private businesses, about using living shorelines as an alternative shoreline stabilization technique and to inform management bodies, including state and non-profit entities, about potential locations for living shoreline enhancement project locations. The education and outreach materials were formed in two stages, considering the varying levels of expertise and familiarity the stakeholders may have with living shorelines.

An ESRI ArcGIS Online story map was developed and can be found at http://arcg.is/0CPKD9 (Figure 7).

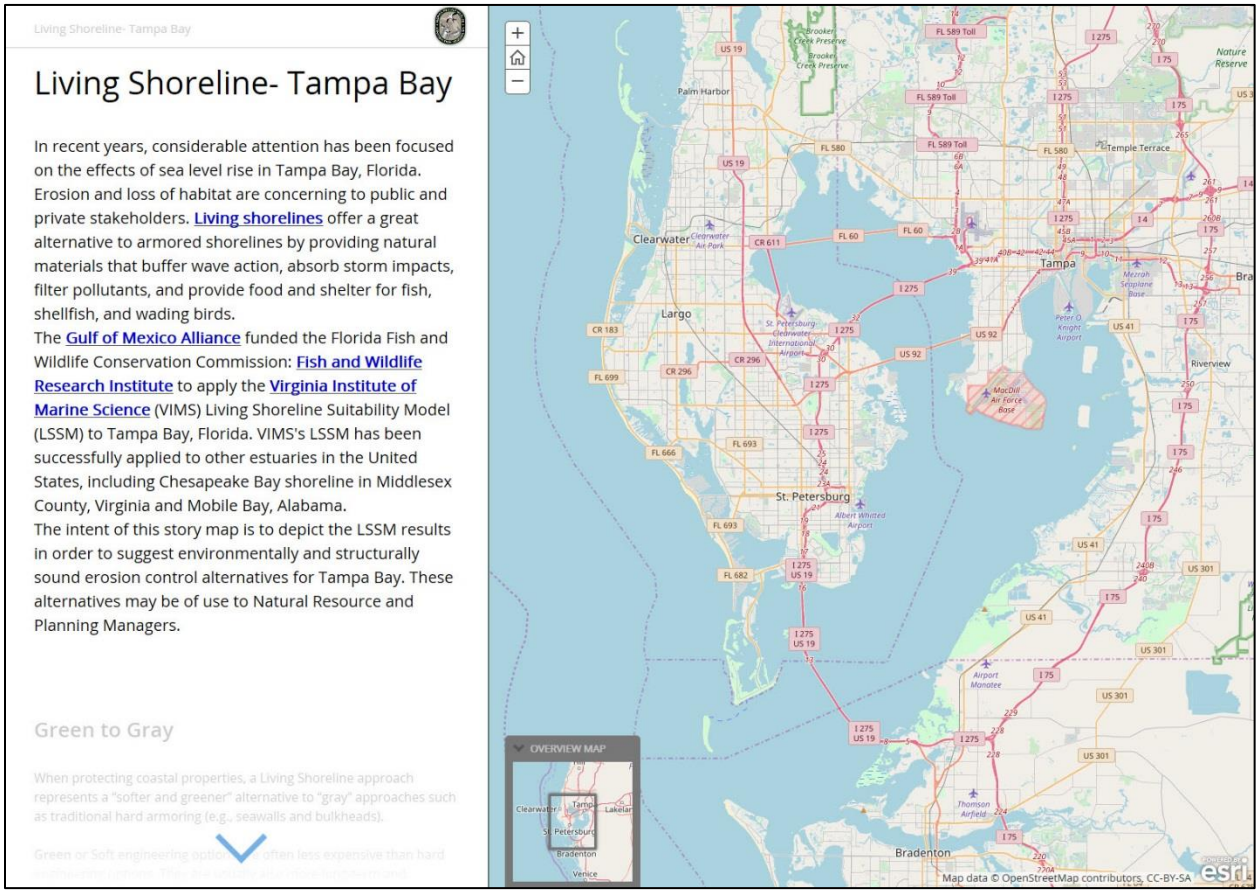


*Figure 7. FWC Living Shoreline Suitability Model Results Story Map Homepage*

This ESRI story map was developed to educate less informed stakeholders, such as private home owners or small business property managers, of the importance of sustainable shoreline protection and living shorelines as an alternative shoreline stabilization technique. It includes information about the "Green to Gray" spectrum of shoreline stabilization techniques, which ranges from a greener, or more natural and vegetated shoreline, to a grayer, more industrial shoreline stabilization solution, such as a bulkhead. It also emphasizes the temporary nature of the more industrial "gray" shoreline stabilization techniques because of natural processes, such as the "toe scouring" or undermining of a bulkhead due to natural wave energy. Finally, it provides the alternative living shoreline technique and displays the Tampa Bay LSSM results, with links to a JavaScript based web mapping application that will allow the user to explore the results in more depth.

A JavaScript web mapping application was developed and can be found at http://arcg.is/2gr3Fca (*Figure 8*).

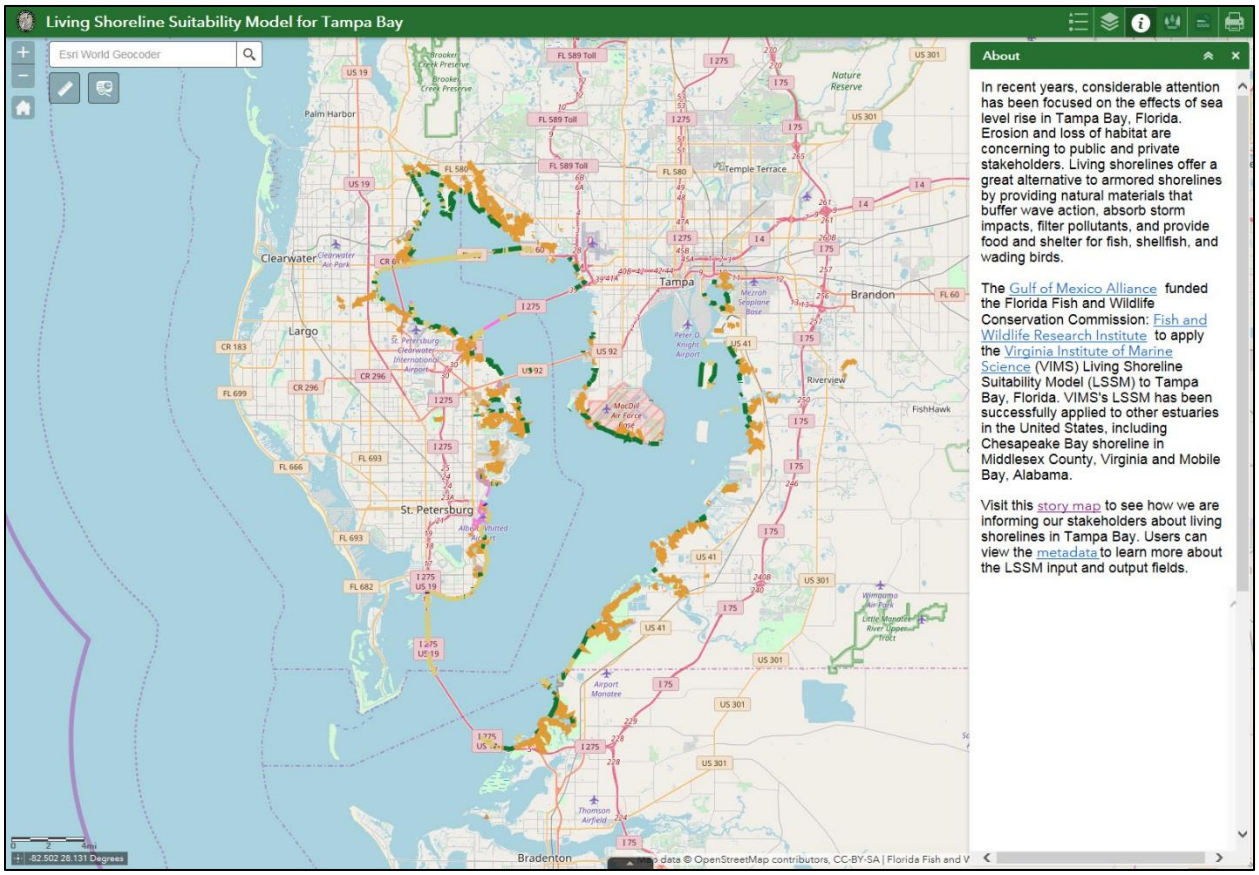


*Figure 8. FWC Living Shoreline Suitability Model Results JavaScript based web mapping application*

This web mapping application is intended for a more technical audience, such as the resource managers, state agencies, regional planning bodies, non-profit organizations, and the more technically inclined public audience, to explore the LSSM results in the Tampa Bay region. This web mapping application assumes that the users have an idea of what a living shoreline is and how their property may be able to benefit from one, now that they've either been redirected to it

from the story map or have a technical understanding. The web mapping application provides users with the ability to find a property by street address (i.e. homeowner's property or permitee property) and review the LSSM recommendations for that property, to create a summary report of the LSSM recommendations within a specified area of interest, and to create LSSM recommendation summary statistics in the form of pie charts for the visible map extent. This tool would be useful in assisting managers in identifying potential preservation and mitigation areas.

***Education & Outreach Public Meeting Summaries***

FWC staff presented the education and outreach materials at a series of public and non-profit entity meetings, including the TBEP Technical Advisory Committee meeting, Tampa Bay Regional Planning Council's (TBRPC) Agency for Bay Management, and TBRPC's One Bay Resilience meeting (Agendas available as Appendix C). In turn, the information presented at these meetings were then passed onto subsequent interested parties, such as TBEP's Citizen Advisory Committee, the Southwest Florida Water Management District's (SWFWMD) Surface Water Improvement (SWIM) Program, and the Sarasota Bay Estuary Program.

The presentation consisted of a short PowerPoint presentation that introduced GOMA's desire to apply the VIMS LSSM model to Tampa Bay and a quick introduction to the ESI data that formed the base analysis layer of the model. It goes on to explain that the Tampa Bay LSSM project is a preamble to a larger NOAA Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies (RESTORE) Council funded project (https://restoreactscienceprogram.noaa.gov/funded-projects/living-shoreline-tool), which will apply the LSSM to four additional estuaries in the Gulf of Mexico and develop a Decision Support Tool (DST), which will assist stakeholders in the decision process of installing a living shoreline option on a more local level. The DST is funded to include the model results from this Tampa Bay LSSM. Finally, the presentation describes the LSSM, the input criteria and necessary attributes before demonstrating the education and outreach materials.

Overall, stakeholder response at the meetings was positive. Stakeholders agreed with the inputs to the LSSM, the execution of the model in Tampa Bay, and appreciated the development of the education and outreach materials that were developed to inform stakeholders of living shoreline alternatives. However, they did voice some concerns regarding some of the model recommendations in Tampa Bay. There was an overwhelming sentiment that there had to be a more thorough resolution to the incorporation of mangrove habitat into the BMPs. Additionally, some concerns were voiced regarding some of the terminology used in the BMPs. Particularly, the terms "Area of Special Concern" in the upland BMPs and the term "revetment" in the shoreline BMP recommendations. Stakeholders thought that the term "Area of Special Concern" reminded them of a term used by the NOAA National Marine Fisheries Service in management actions and therefore implied a higher level of protection. The term "revetment" implied to the stakeholders a hardscape installation of concrete or similar substrate to attenuate wave action. Their preference would be to suggest a more natural revetment substrate, such as oyster bags, artificial reef balls, or something similar. These suggestions have been passed onto the model developers at VIMS. Stakeholders also provided comments regarding the map symbology of the LSSM results and a user guide in the web mapping application. Where applicable, both the definition modifications and symbology suggestions have been incorporated into the final education and outreach deliverable products.

## Conclusion

The application of the VIMS LSSM to the Tampa Bay area successfully identified sites that may be receptive to a living shoreline alternative to shoreline stabilization. Although the modifications FWC staff made to the LSSM model to include mangrove habitat addressed the unidentified habitat issue, before future applications to regions with natural mangrove recruitment, modifications to the LSSM ArcGIS Model Builder model are necessary. These modifications should include either edits to the model to allow for further shoreline segment selections and classifications to include mangrove habitat shoreline BMPs and a guidance document on how to modify the ArcGIS Model Builder model to include similarly unforeseen habitat selections. Additionally, the feedback received from the stakeholder groups regarding the terminology used in the model output BMPs are valid concerns and should be addressed in with future edits to the LSSM and any DST developed by the NOAA RESTORE Council funded project.

The education and outreach materials developed by this project sufficiently inform stakeholders with multiple levels of technical expertise regarding living shorelines and alternative shoreline stabilization techniques. The simple linear output of the story map makes the complex information easy to understand for less technical stakeholders, and the analysis tools available in the web mapping application allow more technically inclined stakeholders to summarize and display the data in meaningful reports for management decisions. The edits to these materials suggested at the stakeholder meetings have been incorporated into the final deliverables; however, as FWC staff receives additional feedback from stakeholders and the public, these outreach materials may continue to be updated..

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# Appendix A: Living Shoreline Suitability Model (v4) Metadata

**SMM Preferred SHL BMP (v4)**
Title **Shoreline Management Model Preferred Shoreline Best Management Practices (v4)**
Summary
The Shoreline Management Model (SMM) version 4 creates a new shapefile and calculates preferred shoreline best management practices for the upland/shoreline bank and for tidal wetland, beach, and shoreline areas. The Shoreline Management Model assumes that ALL the shoreline is unstable.

Usage
**The input polyline shapefile needs to be created prior to running this model. All data is added to one shapefile. Data needed: bathymetry, tidal marshes, beaches, riparian land use/ land cover, bank height, sand spits, canals, shoreline protection structures, shoreline expsure (fetch), roads, permanent structures, and tidal creek designations.**

- Begin with a polyline shapefile representing the shoreline.
- Add field "RiparianLU". Code the shoreline with riparian land use/land cover. The model will query for the following attributes: 'Commercial', 'Forested', 'Industrial', 'Military', 'Government', 'Marsh Island', 'Extensive Marsh', and 'Detached Marsh'. The marsh attributes are optional in the RiparianLU field. If encountered, they will be given an UplandBMP = 'No Action Needed'. 'Military' and ' Government' are also optional attributes.
- Add field "bathymetry" with attributes 'Shallow' or 'Deep'. Nearshore bathymetry is used to determine if the area is suitable for marsh planting. Nearshore bathymetry is considered 'Deep' if the -1m bathymetric contour is within 10m of the shoreline (slope will be too steep and water too deep for marsh planting). If the contour is > 10m off shore then the bathymetry is 'Shallow'.
- Add field "marsh_all" with attributes "Marsh present', 'Marsh Island', or 'No'.
- Add field "bnk_height" with attributes "0-5", "5-30", ">30", and ">60". Bank Height is the height of the bank from the base to the top and is measured in feet. Height can be estimated from imagery, field inspection and/or LIDAR.
- Add field "canal" with an attribute of 'Canal' if a man-made, navigable canal is present.
- Add field "SandSpit" with an attribute of 'Yes' if a sand spit is present. A sand spit is a narrow coastal landform tied to the upland shoreline at one end resulting from the deposition of sand moved by tides and currents. Spit features are generally sandy and may be dominated by beach, dune, and/or marsh habitats.
- Add field "forestshl" with an attribute of 'Yes' if "RiparianLU" = 'Forested' or if there is a wide tree fringe (the dominant land use is not forested but a wide margin of trees (>100 feet) is maintained along the bank edge).
- Add fields "Structures" and "offshorest". "Structures" are erosion control structures typically situated on the bank, while "offshorest" (offshore structures) are those built in the water. "Structure" attributes include 'Bulkhead', 'Debris', 'Riprap', 'Unconventional', 'Wharf', 'Marina <50 slips', and 'Marina >50 slips'. The 'Marina' designation encompasses the infrastructure associated with the marina (bulkheading, docks, wharfs, etc), thereby eliminating the need to digitize the structures individually. Attributes for "offshorest" are 'Breakwater', 'Groin', and 'Marsh Toe'.
- Add field 'defended" with an attribute of 'Yes' if the shoreline has coded values within the "Structures' or "offshorest" fields.
- Add field "Exposure" with attributes of 'Low', 'Moderate', and 'High'. Exposure represents the maximum fetch for a section of shoreline. Low exposure is 0 - 0.5 mile; Moderate = 0.5 - 2 miles; High = >2 miles.
- Add fields "roads" and "PermStruc". These fields respresent obstacles near the shoreline that would prevent bank grading. Buffer the shoreline based on 3x the maximum height in the bank height category plus 20 feet. Use this buffer to locate roads and permanent structures (buildings, swimming pools, earthen dams, etc). Code the shoreline "roads" = 'Roads' if a road adjacent to the shoreline is within the buffer. Code the shoreline "PermStruc" = 'Permanent Structure' if a permanent structure adjacent to the shoreline is within the buffer.
- Add fields "Beach" and 'WideBeach" with attributes 'Yes' or 'No'. A beach is a persistent sandy shore that is visible during high tides. It may have a wide or thin lense of sand. A wide beach is a sandy beach with visible beach area (at least 10 feet wide) above the regular high tide line.

- Add field "tribs" with an attribute of 'Tidal creek' if the section of shoreline is part of a small stream or river that is tidally influenced and drains into a major tributary. A tidal creek has limited shoreline exposure to fetch > 2 miles.

**When the input polyline shapefile is prepared, run the model. A new shapefile will be generated in the workspace designated in the parameters. The shapefile name will be "{name}_SMM_Preferred_BMPs_{date}.shp" where {name} and {date} are user designated parameters. Shoreline management model recommendations are listed in the fields "UplandBMP" and "ShorelBMP".**

**UplandBMP** :

- Land Use Management
- Maintain/Enhance/Restore Riparian Buffer
- Area of Special Concern
- No Action Needed

**ShoreBMP** :

- Groin Field with Beach Nourishment
- Maintain Beach OR Offshore Breakwaters with Beach Nourishment
- Maintain/Enhance/Create Marsh
- Plant Marsh with Sill
- Revetment

Shoreline with an "UplandBMP" of 'No Action Needed' or 'Area of Special Concern' will not have recommendations in the the "ShoreBMP" field.

Click here for a printable pdf version of the Shoreline Management Model Glossary.

Syntax

SMMDec2015v4 (Input_shapefile, workspace, date, name)

| Parameter | Explanation | Data Type |
|---|---|---|
| Input_shapefile | **Dialog Reference**<br>A polyline shapefile representing the shoreline. It MUST include the following Fields / Attributes:<br>**Field / Attributes** (queried in model) **:**<br>RiparianLU / Commercial, Forested, Industrial, Military, Government. may also contain Marsh Island, Extensive Marsh, Detached Marsh. other land use attributes (Agriculture, Residential, etc) are not queried in the model.<br>marsh_all / Marsh present, Marsh Island, No<br>bathymetry / Shallow, Deep<br>bnk_height / 0-5, 5-30, >30, >60<br>canal / Canal<br>Exposure / Low, Moderate, High<br>SandSpit / Yes<br>defended / Yes<br>forestshl / Yes<br>WideBeach / Yes<br>PermStruc / Permanent Structure<br>roads / Roads<br>Beach / Yes, No<br>Structure / Bulkhead, Debris, Mariina <50 slips, Marina >50 slips, Riprap, Unconventional, Wharf | Shapefile |

| | | |
|---|---|---|
| | offshorest / Breakwater, Groin, Marsh Toe<br>tribs / Tidal creek<br>There is no python reference for this parameter. | |
| workspace | **Dialog Reference**<br>The folder in which the new shapefile will be created. This workspace must already exist.<br>There is no python reference for this parameter. | Workspace |
| date | **Dialog Reference**<br>Today's date. It will be part of the newly created shapefile's name.<br>There is no python reference for this parameter. | Any value |
| name | **Dialog Reference**<br>A name representing shapefile's location.<br>The newly created shapefile name is constructed using the name and date variables:<br>{name}_SMM_Preferred_BMPs_{date}.shp<br>There is no python reference for this parameter. | Any value |

Code Samples

**SMM Preferred SHL BMP (v4)**

There is no description for this code sample.

Tags

Shoreline Management Model, Preferred Shoreline Best Management Practices, Living Shorelines, Shoreline Conditions, Shoreline Structures, Riparian Land Use, Shoreline Inventory, Erosion Control, Shoreline Treatments

Credits

Center for Coastal Resources Management. 2015. Shoreline Management Model, version 4. Center for Coastal Resources Management, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia.

Use limitations

These data should be used to guide the decision making process on how best to manage an erosion problem. Recommendations are made without consideration of property length, ownership, or value. Treatment recommendations are based on models that utilize best available data which may not reflect the actual conditions present on the shoreline.

The Shoreline Management Model (SMM) is a product of the Center for Coastal Resources Management, Virginia Institute of Marine Science, College of William and Mary. SMM is an open source program with a pending license. Access to the code is granted with the understanding that the SMM can not be distributed without permission by the author. The following citation should be included in all products generated: "Center for Coastal Resources Management, 2015. Shoreline Management Model, version 4., Center for Coastal Resources Management, Virginia Institute of Marine Science, College of William and Mary".

**Appendix B**: **Living Shoreline Suitability Model for Tampa Bay, Florida**

**Federal Geographic Data Committee (FGDC) Metadata**

**Living Shoreline Suitability Model for Tampa Bay, Florida**
**Metadata:**



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*Identification_Information:*

*Citation:*

*Citation_Information:*

*Originator:*

Florida Fish and Wildlife Conservation Commission - Fish and Wildlife Research Institute

*Publication_Date:* Unpublished Material

*Title:* Living Shoreline Suitability Model for Tampa Bay, Florida

*Geospatial_Data_Presentation_Form:* vector digital data

*Online_Linkage:* <http://myfwc.com/research>

*Description:*

*Abstract:*

In recent years, considerable attention has been focused on the effects of sea level rise in Tampa Bay, FL. Erosion and loss of habitat are concerning to public and private stakeholders. Living shorelines offer a great alternative to armored shorelines by providing natural materials that buffer wave action, absorb storm impacts, filter pollutants, and provide food and shelter for fish, shellfish, and wading birds.

The Gulf of Mexico Alliance (GOMA) funded the Florida Fish and Wildlife Conservation Commission: Fish and Wildlife Research Institute (FWRI) to apply the Virginia Institute of Marine Science (VIMS) Living Shoreline Suitability Model (LSSM) to Tampa Bay, Florida. VIMS's LSSM has been successfully applied to other estuaries in the United States, including Chesapeake Bay shoreline in Middlesex County, Virginia, State of Connecticut's coastal shoreline, and Mobile Bay, Alabama.

This dataset represents the shoreline of Tampa Bay, Florida divided into segments based upon user-defined environmental attributes that are used as inputs to the VIMS LSSM. It includes additional fields that were calculated as results of the LSSM. The output and the highlights of this dataset are the "ShoreBMP" and "UplandBMP" fields, which represent the recommended Best Management Practices for that segment of shoreline based upon the user-defined input variables.

*Purpose:*

This dataset was developed to propose living shoreline recommended best

management practices for upland and waterward sides of Tampa Bay, Florida shoreline segments.

*Supplemental_Information:*

Prior to July 1, 2004, the Fish and Wildlife Research Institute (FWRI) was known as the Florida Marine Research Institute (FMRI). The institute name has not been changed in historical data sets or references to work completed by the Florida Marine Research Institute. The institute name has been changed in references to ongoing research, new research, and contact information.

*Time_Period_of_Content:*
*Time_Period_Information:*
*Single_Date/Time:*
*Calendar_Date:* 20170630
*Currentness_Reference:* publication date
*Status:*
*Progress:* Complete
*Maintenance_and_Update_Frequency:* None planned
*Spatial_Domain:*
*Bounding_Coordinates:*
*West_Bounding_Coordinate:* -82.763150
*East_Bounding_Coordinate:* -82.292377
*North_Bounding_Coordinate:* 28.040910
*South_Bounding_Coordinate:* 27.578168
*Keywords:*
*Theme:*
*Theme_Keyword_Thesaurus:* ISO 19115 Topic Category
*Theme_Keyword:* biota
*Theme_Keyword:* environment
*Theme_Keyword:* inlandWaters
*Theme:*
*Theme_Keyword_Thesaurus:* User
*Theme_Keyword:* aquatic vegetation
*Theme_Keyword:* benthic
*Theme_Keyword:* biology
*Theme_Keyword:* coastal
*Theme_Keyword:* estuaries
*Theme_Keyword:* GIS
*Theme_Keyword:* wetlands
*Place:*
*Place_Keyword_Thesaurus:* None
*Place_Keyword:* Florida
*Place_Keyword:* Tampa Bay
*Access_Constraints:*

These data are unrestricted. Where possible, always acquire this dataset directly from FWC as other sources may have altered the original data.

*Use_Constraints:*

Users are encouraged to read and fully comprehend the metadata record prior to

using these data. Please acknowledge the Florida Fish and Wildlife Conservation Commission (FWC) as the data source for any products developed from these data. Users should be aware that comparison with other data sets for the same area may be inaccurate due to inconsistencies resulting from changes in mapping conventions, data collection techniques, and computer processes over time. FWC shall not be liable for improper or incorrect use of these data.

*Point_of_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* GISLibrarian
*Contact_Organization:*
Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute
*Contact_Position:* GIS Data Librarian
*Contact_Address:*
*Address_Type:* mailing and physical address
*Address:* Fish and Wildlife Research Institute
*Address:* 100 Eighth Avenue Southeast
*City:* St. Petersburg
*State_or_Province:* Florida
*Postal_Code:* 33701
*Contact_Voice_Telephone:* 727-896-8626
*Contact_Facsimile_Telephone:* 727-893-1679
*Contact_Electronic_Mail_Address:* GISLibrarian@MyFWC.com
*Data_Set_Credit:*
Christopher Boland, GISP Enterprise Geodatabase Administrator Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute
*Security_Information:*
*Security_Classification_System:* FWRI-DC
*Security_Classification:* Available without restriction
*Security_Handling_Description:* Available without restriction
*Native_Data_Set_Environment:* ArcGIS Desktop 10.4.1

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*Data_Quality_Information:*
*Logical_Consistency_Report:*
A variety of attribute verification tests were performed for integrity using attribute table queries on related fields to confrim that the values were in a defined range of each other. Below is a list of those tests: 1. "Marsh_all" field equal to "Marsh Present" if it was adjacent to fresh or salt marsh from ESIP dataset 2. "RiparianLU" NOT IN ("Detached Marsh", "Extensive Marsh", "Marsh Island"), but adjacent marsh in ESIP dataset 3. Confirm no records contained following attribute pairs: * "Marsh_all" = "No" and "RiparianLU" IN ("Detached Marsh", "Extensive Marsh", "Marsh Island") * "Marsh_all" = "Marsh Island" and "RiparianLU" NOT IN ("Detached Marsh", "Extensive Marsh", "Marsh Island") 4. Confirm no records contained NULL values in following fields: * RiparianLU * bathymetry * Marsh_all * Bank_Height * exposure * beach
*Completeness_Report:*

All shoreline segments were classified according to the VIMS LSSM guildbook.
*Positional_Accuracy:*
*Horizontal_Positional_Accuracy:*
*Horizontal_Positional_Accuracy_Report:*
No geographic edits were completed on the data, so horizontal accuracy was inherited from the ESIL dataset.
*Lineage:*
*Source_Information:*
*Source_Citation:*
*Citation_Information:*
*Originator:* Research & Planning Inc. (RPI)
*Publication_Date:* 201606
*Title:*
Environmental Sensitivity Index (ESI) Tampa Bay shoreline classification
*Type_of_Source_Media:* vector dataset
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Single_Date/Time:*
*Calendar_Date:* 201606
*Source_Currentness_Reference:* publication date
*Source_Citation_Abbreviation:* ESIL
*Source_Contribution:*
provided the base shoreline and shoreline segments to be analyzed in Tampa Bay. Used the ESI_type field to help classify the "RiparianLU" field. Used to create various shoreline buffers which in turn were used to inform the bathymetry, forested shoreline, and exposure fields.
*Source_Information:*
*Source_Citation:*
*Citation_Information:*
*Originator:* Research and Planning Inc. (RPI)
*Publication_Date:* 201606
*Title:*
Environmental Sensitivity Index (ESI) Tampa Bay adjacent land classification
*Geospatial_Data_Presentation_Form:* vector digital data
*Type_of_Source_Media:* vector dataset
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Single_Date/Time:*
*Calendar_Date:* 201606
*Source_Currentness_Reference:* publication date
*Source_Citation_Abbreviation:* ESIP
*Source_Contribution:*
used to identify upland shore types and the geographic extent of those upland land uses.
*Source_Information:*
*Source_Citation:*

*Citation_Information:*
*Originator:* United States Geological Survey
*Publication_Date:* 2006
*Title:* Topobathymetric contours of Tampa Bay
*Type_of_Source_Media:* vector dataset
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Range_of_Dates/Times:*
*Beginning_Date:* 1945
*Ending_Date:* 2004
*Source_Currentness_Reference:* ground condition
*Source_Citation_Abbreviation:* Topobathy contours
*Source_Contribution:* Used to inform the bathymetry field classification.
*Source_Information:*
*Source_Citation:*
*Citation_Information:*
*Originator:* United States Geological Survey
*Publication_Date:* 2006
*Title:* Topobathymetric hybrid elevation model of Tampa Bay
*Type_of_Source_Media:* raster dataset
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Range_of_Dates/Times:*
*Beginning_Date:* 1945
*Ending_Date:* 2004
*Source_Currentness_Reference:* ground condition
*Source_Citation_Abbreviation:* Raster Topobathy
*Source_Contribution:* Used to inform the bank height attribute field classification.
*Source_Information:*
*Source_Citation:*
*Citation_Information:*
*Originator:* Florida Fish and Wildlife Conservation Commission (FWC)
*Originator:* Florida Natural Areas Inventory (FNAI)
*Publication_Date:* 20161010
*Title:* Florida Cooperative Land Cover
*Edition:* 3.2
*Geospatial_Data_Presentation_Form:* vector digital data
*Online_Linkage:*
<http://myfwc.com/research/gis/applications/articles/fl-land-cover-classification/>
*Type_of_Source_Media:* vector dataset
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Range_of_Dates/Times:*
*Beginning_Date:* 20081010
*Ending_Date:* 20110101
*Source_Currentness_Reference:* ground condition

*Source_Citation_Abbreviation:* FLCLC
*Source_Contribution:* verification of RiparianLU field classification
*Source_Information:*
*Source_Citation:*
*Citation_Information:*
*Originator:* Aerial Cartographics of America
*Originator:* Florida Department of Transportation
*Publication_Date:* 2014
*Title:*
6in resolution Digital Orthophotography of Hillsborough County, FL (2013-2014)
*Geospatial_Data_Presentation_Form:* remote-sensing image
*Source_Scale_Denominator:* 6 inch pixel resolution
*Type_of_Source_Media:* digital aerial photography
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Range_of_Dates/Times:*
*Beginning_Date:* 20140116
*Ending_Date:* 20140217
*Source_Currentness_Reference:* ground condition
*Source_Citation_Abbreviation:* 2014_Hillsborough_DOQQ
*Source_Contribution:*
aerial imagery used to verify ground conditions for various attribute classifications.
*Source_Information:*
*Source_Citation:*
*Citation_Information:*
*Originator:* Aerial Cartographics of America
*Originator:* Pinellas County Property Appraiser
*Originator:* Florida Department of Revenue
*Publication_Date:* 2014
*Title:* Six Inch Orthophotos of Pinellas County, FL
*Geospatial_Data_Presentation_Form:* remote-sensing image
*Source_Scale_Denominator:* 6 inch pixel resolution
*Type_of_Source_Media:* raster dataset
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Range_of_Dates/Times:*
*Beginning_Date:* 20131224
*Ending_Date:* 20140124
*Source_Currentness_Reference:* ground condition
*Source_Citation_Abbreviation:* 2014_Pinellas_DOQQ
*Source_Contribution:*
aerial imagery used to verify ground conditions for various attribute classificaitons
*Source_Information:*
*Source_Citation:*

*Citation_Information:*
*Originator:* United States Department of Agriculture
*Publication_Date:* 2015
*Title:* Florida National Agricultural Imagery Program (2015)
*Geospatial_Data_Presentation_Form:* remote-sensing image
*Online_Linkage:*
https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/
*Online_Linkage:* https://gis.apfo.usda.gov/arcgis/rest/services
*Type_of_Source_Media:* raster dataset
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Single_Date/Time:*
*Calendar_Date:* 2015
*Source_Currentness_Reference:* publication date
*Source_Citation_Abbreviation:* NAIP 2015
*Source_Contribution:*
verifcation of ground condition used to classify various attribute values.
*Source_Information:*
*Source_Citation:*
*Citation_Information:*
*Originator:*
Virginia Institute of Marine Science: Center for Coastal Resources Management
*Publication_Date:* 20161208
*Title:*
Shoreline Management Model Preferred Shoreline Best Management Practices (v4)
*Publication_Information:*
*Publication_Place:* Gloucester Point, VA
*Publisher:* VIMS
*Other_Citation_Details:*
Received by Chris Boland (FWRI) from Tamia Rudnicky (VIMS) via email on 12/8/2016.
*Type_of_Source_Media:* electronic mail system
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Single_Date/Time:*
*Calendar_Date:* 20161208
*Source_Currentness_Reference:* publication date
*Source_Citation_Abbreviation:* VIMS LSSM Guidebook
*Source_Contribution:* domains and definitions used for field attributes.
*Source_Information:*
*Source_Citation:*
*Citation_Information:*
*Originator:* Virginia Institute of Marine Science
*Publication_Date:* 20150903

*Title:* Shoreline Management Model Glossary
*Online_Linkage:*
<http://cmap2.vims.edu/CCRMP/SMM_pdfs/PreferredShorelineBMPs_Glossary_Updated2015.pdf>
*Type_of_Source_Media:* online
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Single_Date/Time:*
*Calendar_Date:* 20150903
*Source_Currentness_Reference:* publication date
*Source_Citation_Abbreviation:* Glossary
*Source_Contribution:* definition of BMPs described in the ShoreBMP & UplandBMP fields
*Source_Information:*
*Source_Citation:*
*Citation_Information:*
*Originator:* Virginia Institute of Marine Science
*Publication_Date:* 20161128
*Title:* Shoreline Management Model (SMM) Preferred SHL BMP (v4)
*Other_Citation_Details:*
received via emails by Chris Boland, GISP (FWRI) from Tamia Rudnicky (VIMS) on 12/8/2016.
*Type_of_Source_Media:* electronic mail system
*Source_Time_Period_of_Content:*
*Time_Period_Information:*
*Single_Date/Time:*
*Calendar_Date:* 20161128
*Source_Currentness_Reference:* publication date
*Source_Citation_Abbreviation:* LSSM metadata
*Source_Contribution:* definition of attributes calculated by VIMS LSSM
*Process_Step:*
*Process_Description:*
FWRI staff coordinated with VIMS staff to acquire the LSSM and the associated metadata and guidebook. FWRI staff then created a file geodatabase with a polyline feature class representing the Tampa Bay shoreline to be analyzed by the LSSM. The base shoreline data used in the feature class originates from the June 2016 Environmental Sensitivity Index (ESI) Tampa Bay shoreline classification data, which segments the shoreline based upon the most sensitive habitat type present at that location. The extent of the ESI shoreline classification data was restricted to Tampa Bay shoreline landward of the Interstate 275 (locally known as the Sunshine Skyway Bridge), which resulted in 5,162 shoreline segments remaining to be classified. The sixteen (16) attribute fields and the associated field domains listed in the LSSM guidebook as being required were added to the feature class and file geodatabase. FWRI staff used the referenced data sources and derived shoreline buffers to inform the classification of the shoreline segments' required sixteen attribute fields. The classification of the shoreline segments was completed in May 2017.

*Process_Date:* 20170101-20170505
*Process_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Christopher Boland, GISP
*Contact_Organization:*
Florida Fish and Wildlife Conservation Commission: Fish and Wildlife Research Institute
*Contact_Position:* Enterprise Geodatabase Administrator
*Contact_Address:*
*Address_Type:* mailing and physical address
*Address:* Fish and Wildlife Research Institute
*Address:* 100 Eighth Avenue Southeast
*City:* Saint Petersburg
*State_or_Province:* Florida
*Postal_Code:* 33701
*Contact_Voice_Telephone:* 727-896-8626 x4863
*Contact_Facsimile_Telephone:* 727-893-1679
*Contact_Electronic_Mail_Address:* Chris.Boland@MyFWC.com
*Process_Step:*
*Process_Description:*
During the original classification process, FWRI staff noticed that the LSSM guidebook did not provide clear guidance on the classification of mangrove habitat, as it does not fit the LSS model's definition of marsh or forest. An email discussion between FWRI staff, VIMS staff, and other experts resulted in a meeting on May 18th to discuss the correct classification of mangrove habitat and modifications to the LSS model to include this unique habitat type. The group decided to classify mangrove habitat like marsh habitat. As a result, the mangrove shoreline segments were reclassified and modifications were made to the LSS model. These modifications were completed in mid-June 2017. A variety of quality control and quality assurance checks were run against the datasets.
*Process_Date:* 20170518-20170630
*Process_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Christopher Boland, GISP
*Contact_Organization:*
Florida Fish and Wildlife Conservation Commission: Fish and Wildlife Research Institute
*Contact_Position:* Enterprise Geodatabase Administrator
*Contact_Address:*
*Address_Type:* mailing and physical address
*Address:* 100 8th Ave. SE
*Address:* Mailstation J3N-CAMRA
*City:* Saint Petersburg
*State_or_Province:* Florida

*Postal_Code:* 33701
*Contact_Voice_Telephone:* 727-896-8626 x4863
*Contact_Facsimile_Telephone:* 727-893-1679
*Contact_Electronic_Mail_Address:* Chris.Boland@MyFWC.com

---

*Spatial_Data_Organization_Information:*
*Direct_Spatial_Reference_Method:* Vector
*Point_and_Vector_Object_Information:*

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*Spatial_Reference_Information:*
*Horizontal_Coordinate_System_Definition:*
*Planar:*
*Planar_Coordinate_Information:*
*Planar_Coordinate_Encoding_Method:* coordinate pair
*Coordinate_Representation:*
*Abscissa_Resolution:* 0.000001
*Ordinate_Resolution:* 0.000001
*Planar_Distance_Units:* meters
*Geodetic_Model:*
*Horizontal_Datum_Name:* North American Datum of 1983
*Ellipsoid_Name:* Geodetic Reference System 80
*Semi-major_Axis:* 6378137.000000
*Denominator_of_Flattening_Ratio:* 298.257222

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*Entity_and_Attribute_Information:*
*Detailed_Description:*
*Entity_Type:*
*Entity_Type_Label:*
TampaBay_MangAsMarsh_SMM_Preferred_BMPs_20170630
*Entity_Type_Definition:*
Recommended Shoreline Best Management Practices for Marsh and Mangrove habitat in Tampa Bay, FL
*Entity_Type_Definition_Source:* FWRI
*Attribute:*
*Attribute_Label:* FID
*Attribute_Definition:* Internal feature number.
*Attribute_Definition_Source:* Esri
*Attribute_Domain_Values:*
*Unrepresentable_Domain:*
Sequential unique whole numbers that are automatically generated.
*Attribute:*
*Attribute_Label:* Shape
*Attribute_Definition:* Feature geometry.
*Attribute_Definition_Source:* Esri
*Attribute_Domain_Values:*
*Unrepresentable_Domain:* Coordinates defining the features.

*Attribute:*
*Attribute_Label:* RiparianLU
*Attribute_Definition:* Riparian or Upland Land Use
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Codeset_Domain:*
*Codeset_Name:* RiparianLU
*Codeset_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* bathymetry
*Attribute_Definition:* classification of nearshore bathymetry
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Shallow
*Enumerated_Domain_Value_Definition:* 1m depth contour is closer to shore than 10 meters
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Deep
*Enumerated_Domain_Value_Definition:* 1m depth contour is further from shore than 10 meters
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* marsh_all
*Attribute_Definition:* present or absence of Marsh or mangrove habitat
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Marsh Present
*Enumerated_Domain_Value_Definition:* marsh habitat present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Marsh Island
*Enumerated_Domain_Value_Definition:* marsh island present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Mangrove Present
*Enumerated_Domain_Value_Definition:* mangrove habitat present
*Enumerated_Domain_Value_Definition_Source:* FWRI
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Mangrove Island

*Enumerated_Domain_Value_Definition:* mangrove island present
*Enumerated_Domain_Value_Definition_Source:* FWRI
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* No
*Enumerated_Domain_Value_Definition:* no marsh or mangrove habitat present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* bnk_height
*Attribute_Definition:*
Bank Height is the height of the bank from the base to the top and is measured in feet. Height can be estimated from imagery, field inspection and/or LIDAR.
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* 0-5
*Enumerated_Domain_Value_Definition:* 0 to 5 ft high
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* 5-30
*Enumerated_Domain_Value_Definition:* 5 to 30 ft high
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* >30
*Enumerated_Domain_Value_Definition:* more than 30 ft high
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* >60
*Enumerated_Domain_Value_Definition:* more than 60 feet high
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* canal
*Attribute_Definition:* man-made, navigable canal is present
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Canal
*Enumerated_Domain_Value_Definition:* canal present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* <NULL>
*Enumerated_Domain_Value_Definition:* canal not present

*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* SandSpit
*Attribute_Definition:*
sand spit is present. A sand spit is a narrow coastal landform tied to the upland shoreline at one end resulting from the deposition of sand moved by tides and currents. Spit features are generally sandy and may be dominated by beach, dune, and/or marsh habitats.
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Yes
*Enumerated_Domain_Value_Definition:* sandspit present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* <Null>
*Enumerated_Domain_Value_Definition:* sandspit not present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* forestshl
*Attribute_Definition:*
attribute of 'Yes' if "RiparianLU" = 'Forested' or if there is a wide tree fringe (the dominant land use is not forested but a wide margin of trees (>100 feet) is maintained along the bank edge).
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Yes
*Enumerated_Domain_Value_Definition:* present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* <Null>
*Enumerated_Domain_Value_Definition:* not present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* Structure
*Attribute_Definition:* erosion control structures typically situated on the bank
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Codeset_Domain:*
*Codeset_Name:* Structure domain list
*Codeset_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* offshorest

*Attribute_Definition:* (offshore structures) are those built in the water.
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Codeset_Domain:*
*Codeset_Name:* offshorest domain list
*Codeset_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* defended
*Attribute_Definition:*
is the shoreline defended by either a structure or an offshore structure?
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Yes
*Enumerated_Domain_Value_Definition:* defended shoreline
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* <NULL>
*Enumerated_Domain_Value_Definition:* undefended shoreline
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* Exposure
*Attribute_Definition:*
Exposure represents the maximum fetch for a section of shoreline.
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Low
*Enumerated_Domain_Value_Definition:* 0 - 0.5 mile
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Moderate
*Enumerated_Domain_Value_Definition:* 0.5 - 2 miles
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* High
*Enumerated_Domain_Value_Definition:* >2 miles
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* roads
*Attribute_Definition:*
is a road adjacent to the shoreline within a 3x maximum height of bank + 20 feet?
*Attribute_Definition_Source:* VIMS LSSM Guidebook

*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Roads
*Enumerated_Domain_Value_Definition:* road present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* <Null>
*Enumerated_Domain_Value_Definition:* road not present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* PermStruc
*Attribute_Definition:*
is a permanent structure adjacent to the shoreline within a 3x maximum height of bank + 20 feet?
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Permanent Structure
*Enumerated_Domain_Value_Definition:* structure present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* <NULL>
*Enumerated_Domain_Value_Definition:* structure not present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* Beach
*Attribute_Definition:* is a persistent sandy shore visible during high tides?
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Yes
*Enumerated_Domain_Value_Definition:* beach present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* No
*Enumerated_Domain_Value_Definition:* beach not present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* WideBeach
*Attribute_Definition:*
is a persistent sandy shore => 10 ft wide visible during high tides?
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*

*Enumerated_Domain:*
*Enumerated_Domain_Value:* Yes
*Enumerated_Domain_Value_Definition:* wide beach present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
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*Enumerated_Domain_Value:* <NULL>
*Enumerated_Domain_Value_Definition:* wide beach not present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* tribs
*Attribute_Definition:*
'Tidal creek' if the section of shoreline is part of a small stream or river that is tidally influenced and drains into a major tributary. A tidal creek has limited shoreline exposure to fetch > 2 miles.
*Attribute_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* Tidal creek
*Enumerated_Domain_Value_Definition:* tidal creek present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute_Domain_Values:*
*Enumerated_Domain:*
*Enumerated_Domain_Value:* <NULL>
*Enumerated_Domain_Value_Definition:* tidal creek not present
*Enumerated_Domain_Value_Definition_Source:* VIMS LSSM Guidebook
*Attribute:*
*Attribute_Label:* rd_pstruc
*Attribute_Definition:*
road or permanent structure is present within the shoreline buffer
*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Codeset_Domain:*
*Codeset_Name:* rd_pstruc domain
*Codeset_Source:* LSSM metadata
*Attribute:*
*Attribute_Label:* ShlType
*Attribute_Definition:* shoreline defended or undefended based on time of survey
*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Codeset_Domain:*
*Codeset_Name:* ShlType domain
*Codeset_Source:* LSSM metadata
*Attribute:*
*Attribute_Label:* spath
*Attribute_Definition:* internal coding item for shoreline management model

*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Unrepresentable_Domain:*
pertains to the shoreline management model. Values range between 0-4 and indicate which "path" the model is using. Values can be used in the qa/qc process.
*Attribute:*
*Attribute_Label:* EnergyRisk
*Attribute_Definition:* Risk of shoreline habitat to waterway energy
*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Codeset_Domain:*
*Codeset_Name:* EnergyRisk domain
*Codeset_Source:* LSSM metadata
*Attribute:*
*Attribute_Label:* SpecConcrn
*Attribute_Definition:*
Area of Special Concern include developed marsh and/or barrier islands, sandspits, marinas, canals, and commercial, industrial, military, or government areas with bulkhead or wharf.
*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Codeset_Domain:*
*Codeset_Name:* SpecConcrn domain
*Codeset_Source:* LSSM metadata
*Attribute:*
*Attribute_Label:* select
*Attribute_Definition:* internal coding item for shoreline management model
*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Unrepresentable_Domain:* a value (yes) used when processing the model
*Attribute:*
*Attribute_Label:* StrucList
*Attribute_Definition:* list of shoreline structures present
*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Unrepresentable_Domain:*
combines the structures listed in the "Structure" and "offshorest" attributes into one attribute list
*Attribute:*
*Attribute_Label:* fshl
*Attribute_Definition:* a value generated during the model processing
*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Unrepresentable_Domain:* a value (yes) used when processing the model
*Attribute:*
*Attribute_Label:* UplandBMP

*Attribute_Definition:*
preferred shoreline best management practices for upland and bank areas.
*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Codeset_Domain:*
*Codeset_Name:*
Preferred Shoreline Best Management Practices: Upland & Bank Areas
*Codeset_Source:* Glossary
*Attribute:*
*Attribute_Label:* ShoreBMP
*Attribute_Definition:*
preferred shoreline best management practices for tidal wetland, beach, and shoreline areas.
*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Codeset_Domain:*
*Codeset_Name:*
Preferred Shoreline Best Management Practices: Tidal Wetland – Beach - Shoreline Areas
*Codeset_Source:* Glossary
*Attribute:*
*Attribute_Label:* bmpCount
*Attribute_Definition:* shoreline management model qa/qc attribute
*Attribute_Definition_Source:* LSSM metadata
*Attribute_Domain_Values:*
*Unrepresentable_Domain:*
lists the number of recommendations (either 1 or 2) for a site. The number can be used for qa/qc.

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*Distributor:*
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*Contact_Person_Primary:*
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*Contact_Organization:*
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*Address:* Fish and Wildlife Research Institute
*Address:* 100 Eighth Avenue Southeast
*City:* St. Petersburg
*State_or_Province:* Florida
*Postal_Code:* 33701
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*Metadata_Date:* 20170707
*Metadata_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* GISLibrarian
*Contact_Organization:*
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*Contact_Position:* GIS Data Librarian
*Contact_Address:*
*Address_Type:* mailing and physical address
*Address:* Fish and Wildlife Research Institute

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*City:* St. Petersburg
*State_or_Province:* Florida
*Postal_Code:* 33701
*Contact_Voice_Telephone:* 727-896-8626
*Contact_Facsimile_Telephone:* 727-893-1679
*Contact_Electronic_Mail_Address:* GISLibrarian@MyFWC.com
*Metadata_Standard_Name:* FGDC Content Standards for Digital Geospatial Metadata
*Metadata_Standard_Version:* FGDC-STD-001-1998
*Metadata_Time_Convention:* local time
*Metadata_Access_Constraints:* No restrictions on metadata
*Metadata_Use_Constraints:* Metadata must be distributed with the data set.
*Metadata_Security_Information:*
*Metadata_Security_Classification_System:* FWRI-MC
*Metadata_Security_Classification:* Available
*Metadata_Security_Handling_Description:* Metadata must be distributed with the data set.

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