TAYLOR ENGINEERING, INC.

The Engineering Analytics Behind FDEP's New SLIP Tool

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Overview

- Florida Statute Defining SLIP
- What is a SLIP Study?
- SLIP Website Demo
- Sample Calculation

New Florida Statute – 2020 - Section 161.551

- SB 178 passed by FL Legislature in 2020 session with bipartisan support
- Applies to state-financed major construction
- Location it applies: the Coastal Building Zone
- DEP to develop a standard for a sea level impact projection (SLIP) study
- SLIP studies to be published on DEP website

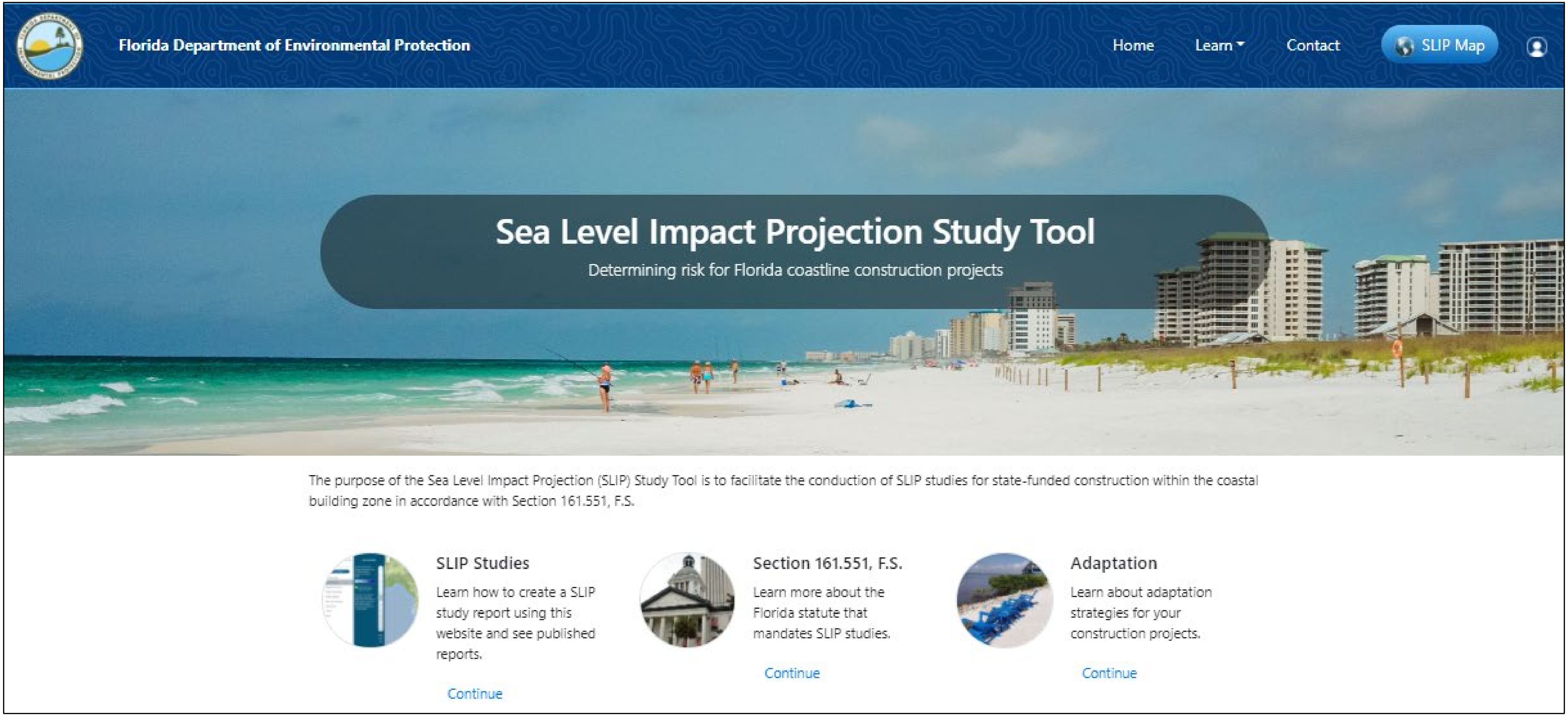
What is a SLIP Study?

- Uses a **systematic, interdisciplinary, and scientifically accepted approach** in the natural sciences and construction design
- Assess the **flooding, inundation, and wave action damage risks** relating to the coastal structure over its expected life or 50 years, whichever is less
- Provide the **average annual chance of substantial flood damage** over the expected life of the coastal structure or 50 years, whichever is less
- Provide **alternatives for the coastal structure's design and siting**

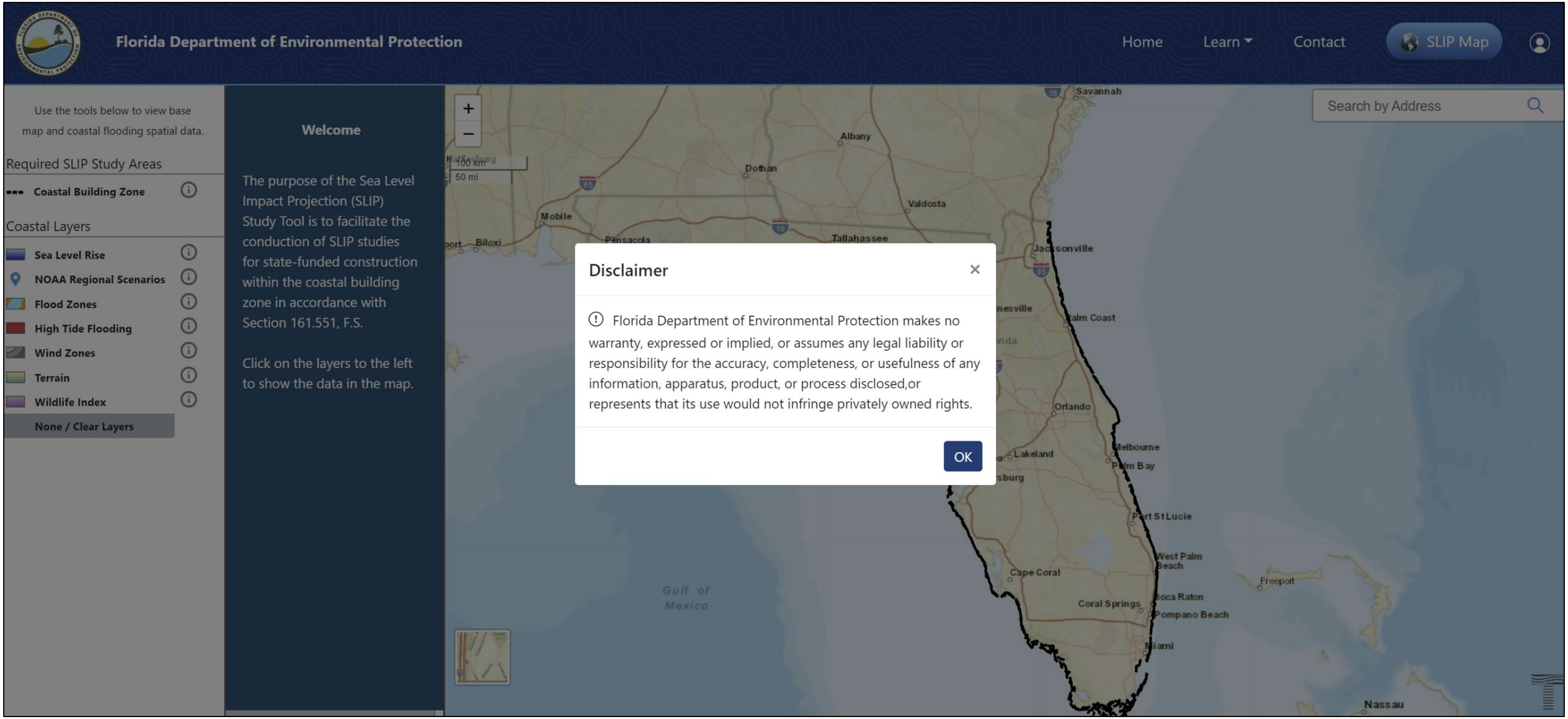
FDEP's Requirements for SLIP Tool Website

- #1 – User-friendly
- Mapping tool for viewing by general public
  - Illustrates risks using credible data
  - Informative in nature
- SLIP Report Creation
  - Secure sign-in for public entities
  - Minimal inputs needed by user
  - Quick generation of SLIP Report

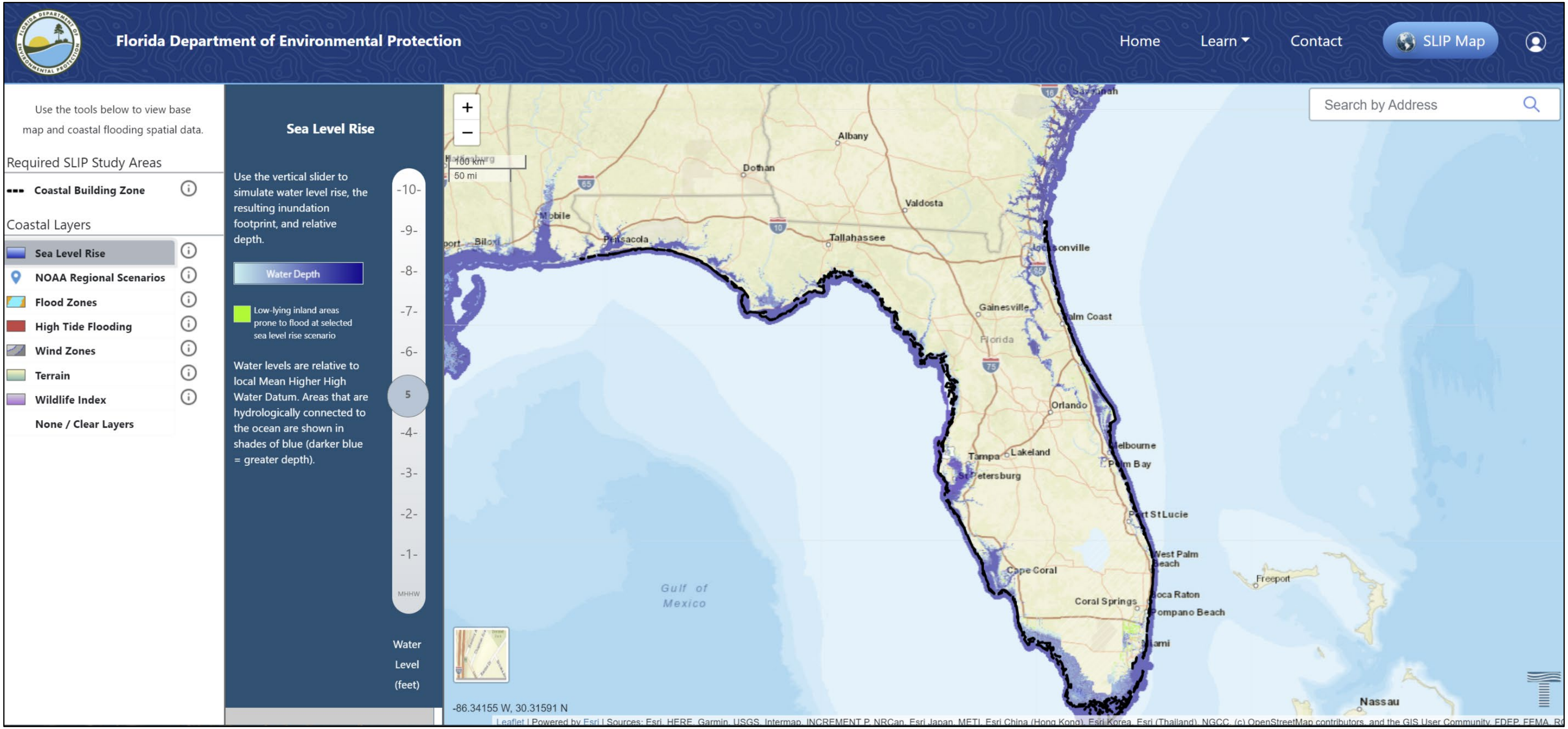
Homepage: www.floridadep-slip.org



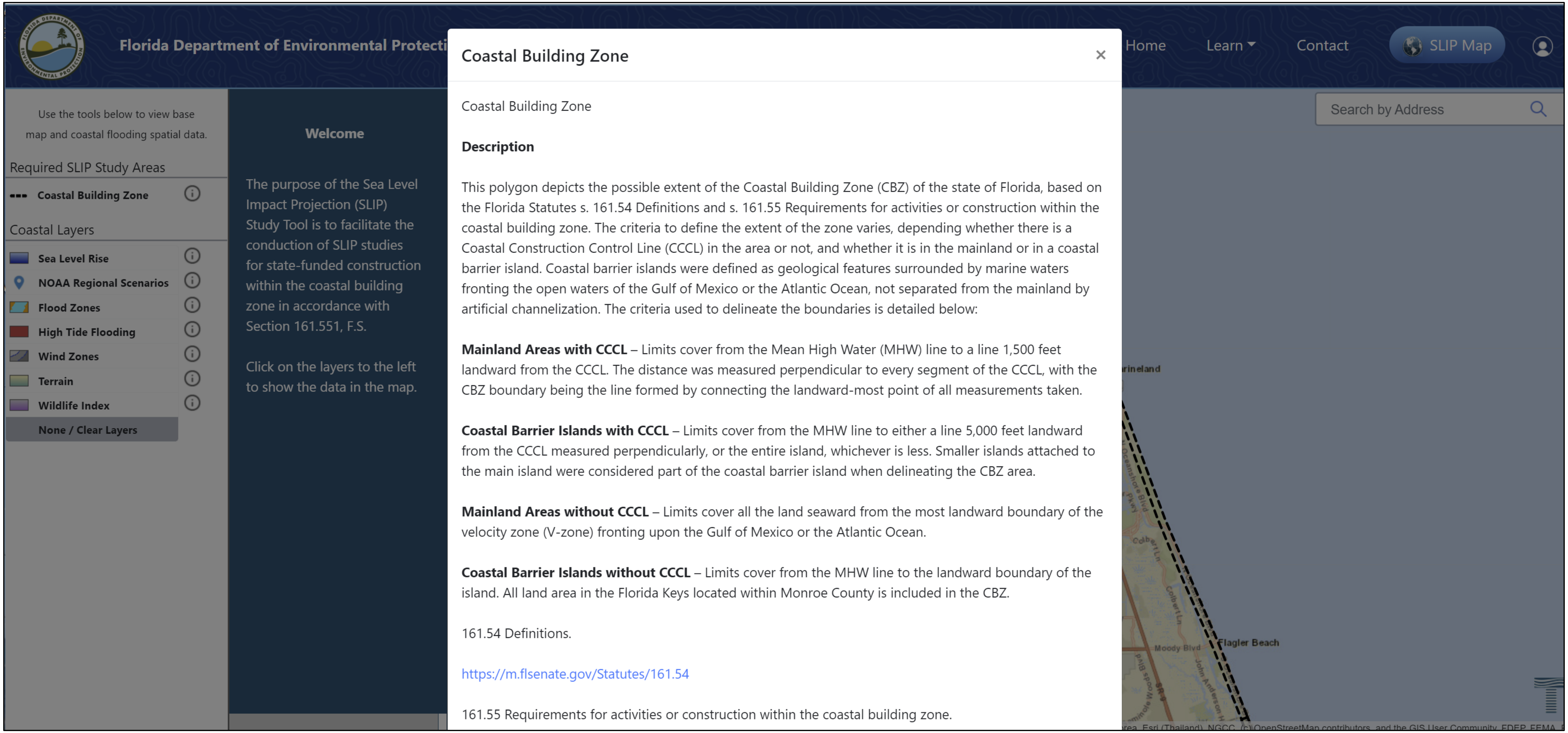
Public View: Map



Public View: NOAA SLR Viewer



Public View: Coastal Building Zone Definition



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SLIP Map

Use the tools below to view base map and coastal flooding spatial data.

Required SLIP Study Areas

- Coastal Building Zone

Coastal Layers

- Sea Level Rise
- NOAA Regional Scenarios
- Flood Zones
- High Tide Flooding
- Wind Zones
- Terrain
- Wildlife Index
- None / Clear Layers

Welcome

The purpose of the Sea Level Impact Projection (SLIP) Study Tool is to facilitate the conduction of SLIP studies for state-funded construction within the coastal building zone in accordance with Section 161.551, F.S.

Click on the layers to the left to show the data in the map.

Coastal Building Zone

Coastal Building Zone

Description

This polygon depicts the possible extent of the Coastal Building Zone (CBZ) of the state of Florida, based on the Florida Statutes s. 161.54 Definitions and s. 161.55 Requirements for activities or construction within the coastal building zone. The criteria to define the extent of the zone varies, depending whether there is a Coastal Construction Control Line (CCCL) in the area or not, and whether it is in the mainland or in a coastal barrier island. Coastal barrier islands were defined as geological features surrounded by marine waters fronting the open waters of the Gulf of Mexico or the Atlantic Ocean, not separated from the mainland by artificial channelization. The criteria used to delineate the boundaries is detailed below:

Mainland Areas with CCCL – Limits cover from the Mean High Water (MHW) line to a line 1,500 feet landward from the CCCL. The distance was measured perpendicular to every segment of the CCCL, with the CBZ boundary being the line formed by connecting the landward-most point of all measurements taken.

Coastal Barrier Islands with CCCL – Limits cover from the MHW line to either a line 5,000 feet landward from the CCCL measured perpendicularly, or the entire island, whichever is less. Smaller islands attached to the main island were considered part of the coastal barrier island when delineating the CBZ area.

Mainland Areas without CCCL – Limits cover all the land seaward from the most landward boundary of the velocity zone (V-zone) fronting upon the Gulf of Mexico or the Atlantic Ocean.

Coastal Barrier Islands without CCCL – Limits cover from the MHW line to the landward boundary of the island. All land area in the Florida Keys located within Monroe County is included in the CBZ.

161.54 Definitions.

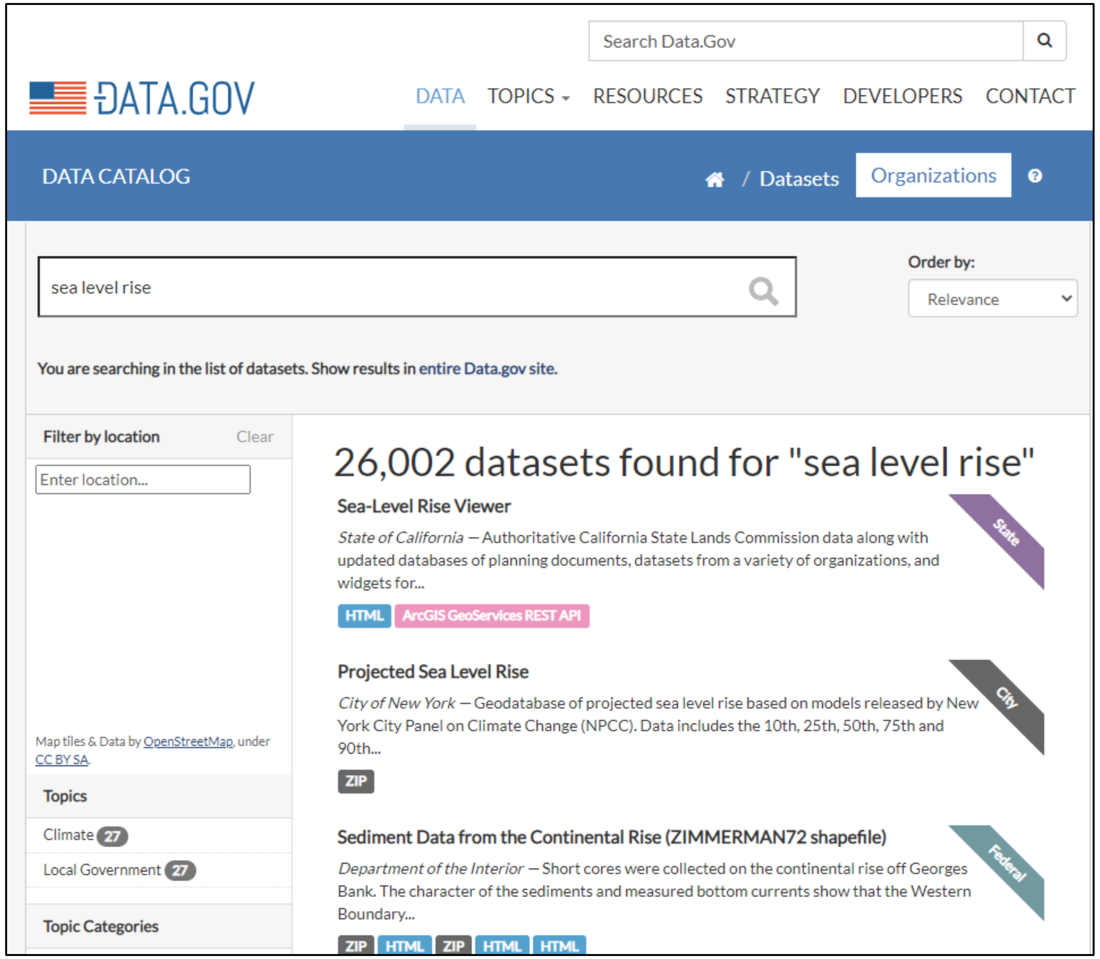
https://m.flsenate.gov/Statutes/161.54

161.55 Requirements for activities or construction within the coastal building zone.

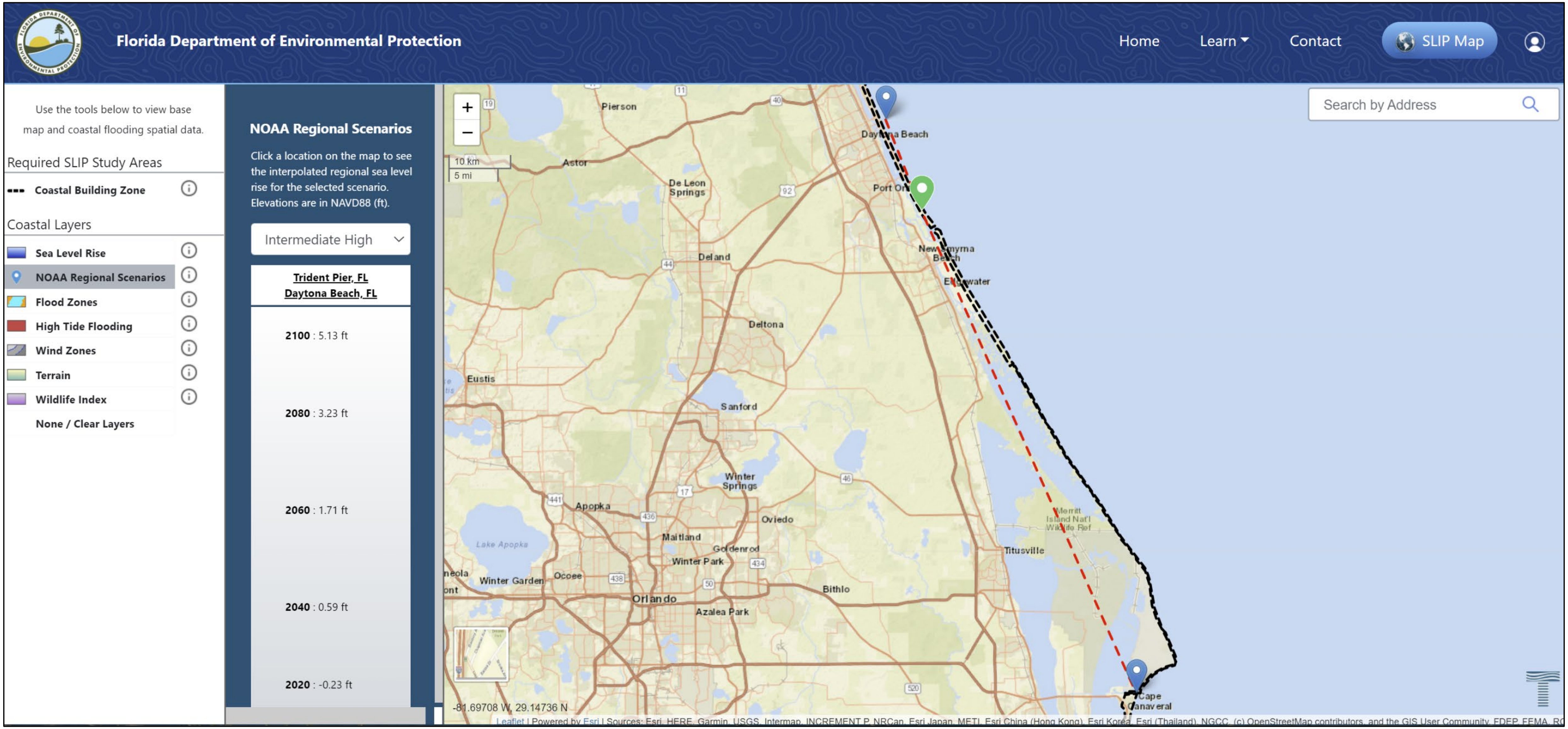
Search by Address

Data Sources in SLIP Tool

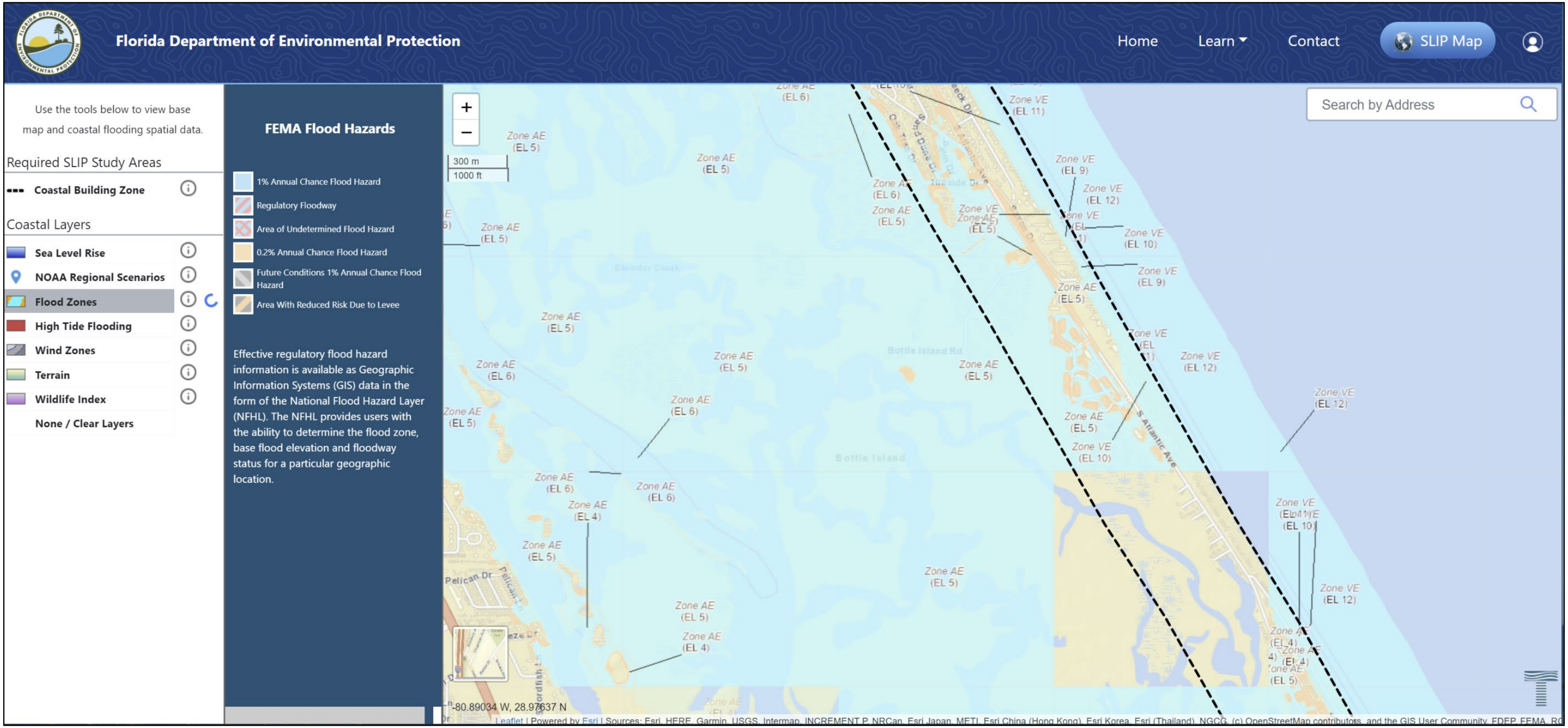
- NOAA Sea Level Rise viewer
- NOAA Regional SLR Scenarios
- NOAA High Tide Flooding Estimates
- FEMA Storm Surge Flood Depths (1% annual chance to 10% annual chance)
- FEMA Special Flood Hazard Zones
- FL Building Codes - Maximum Winds
- USACE Depth Damage Functions
- NOAA/EPA Adaptation Measures



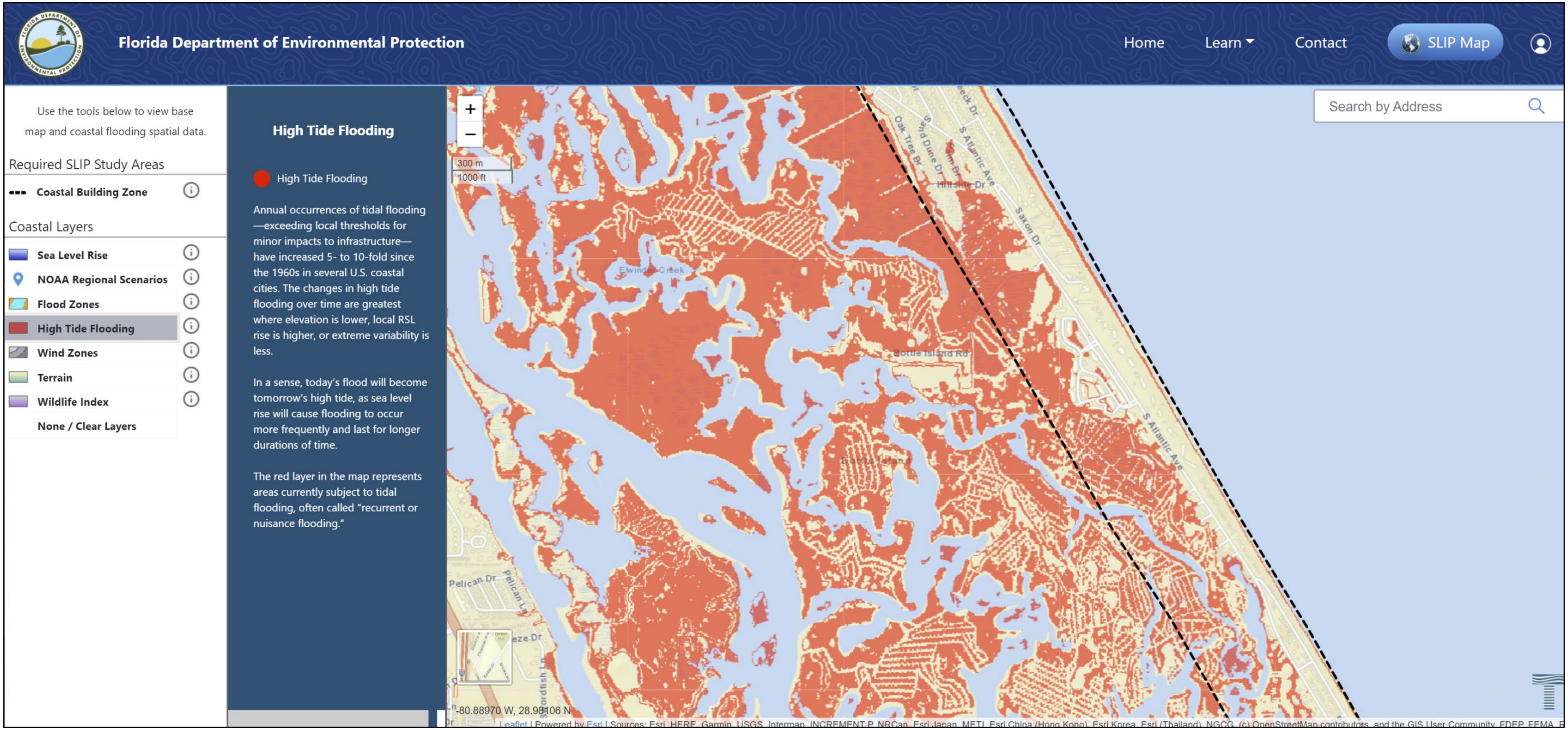
Public View: Regional SLR Scenarios (localized)



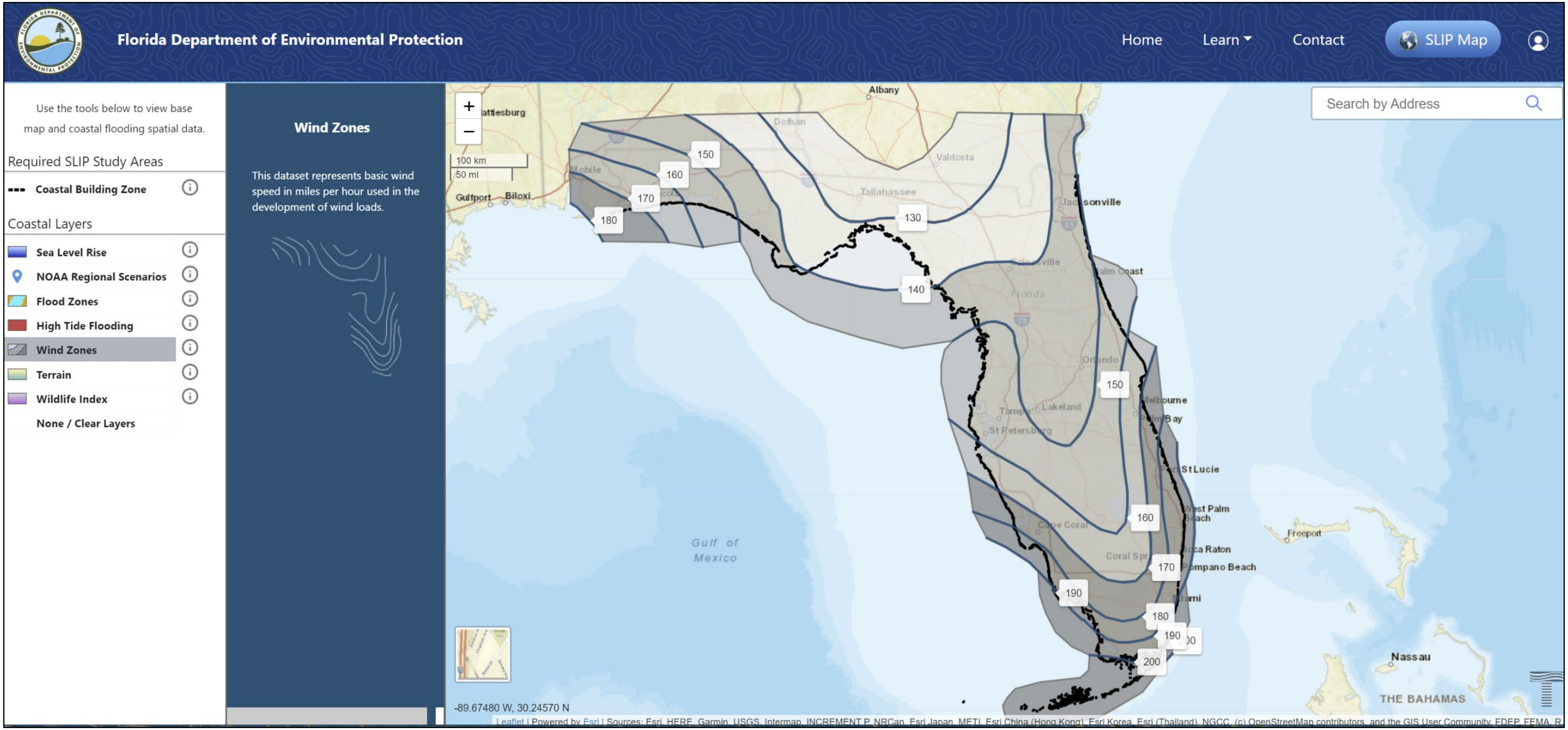
Public View: FEMA Flood Hazard Layer



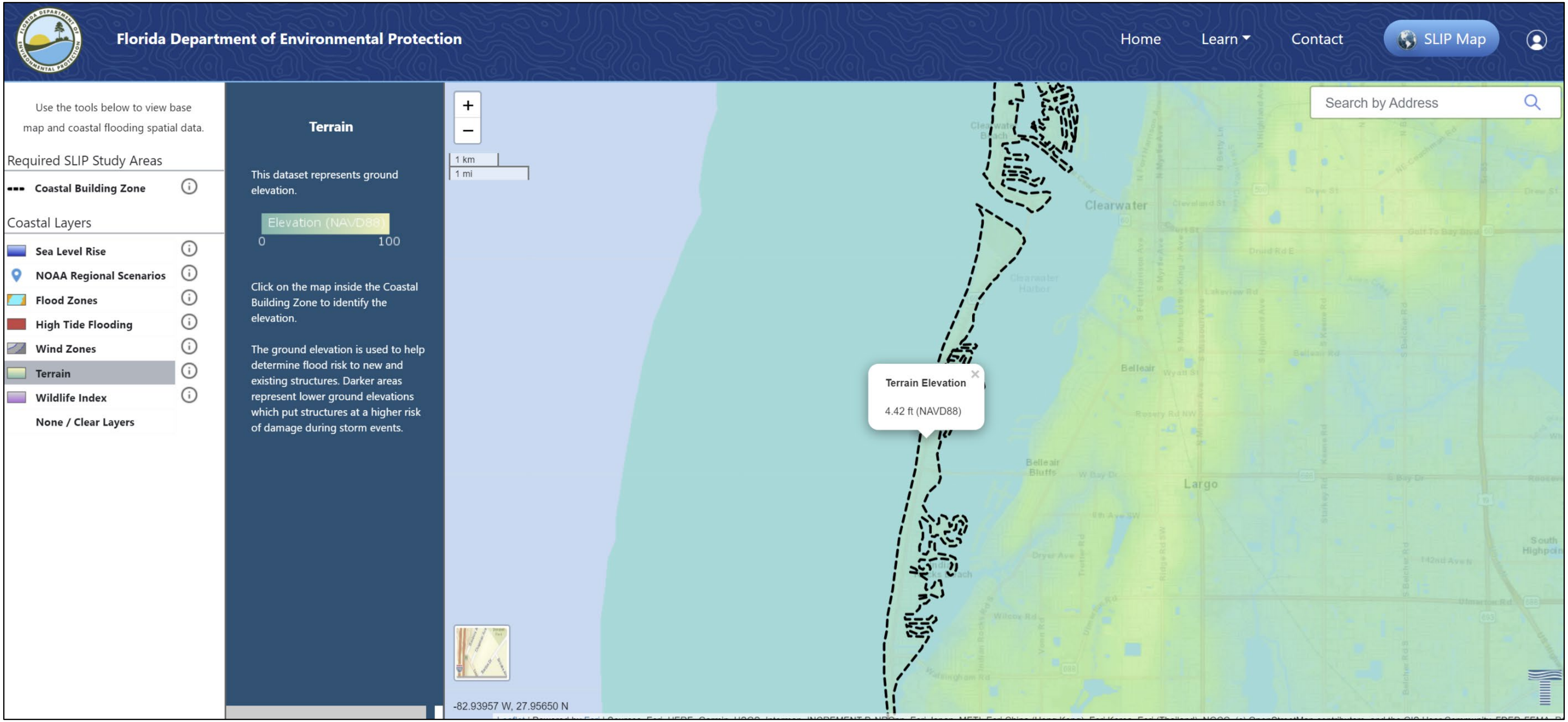
Public View: NOAA High Tide Flooding



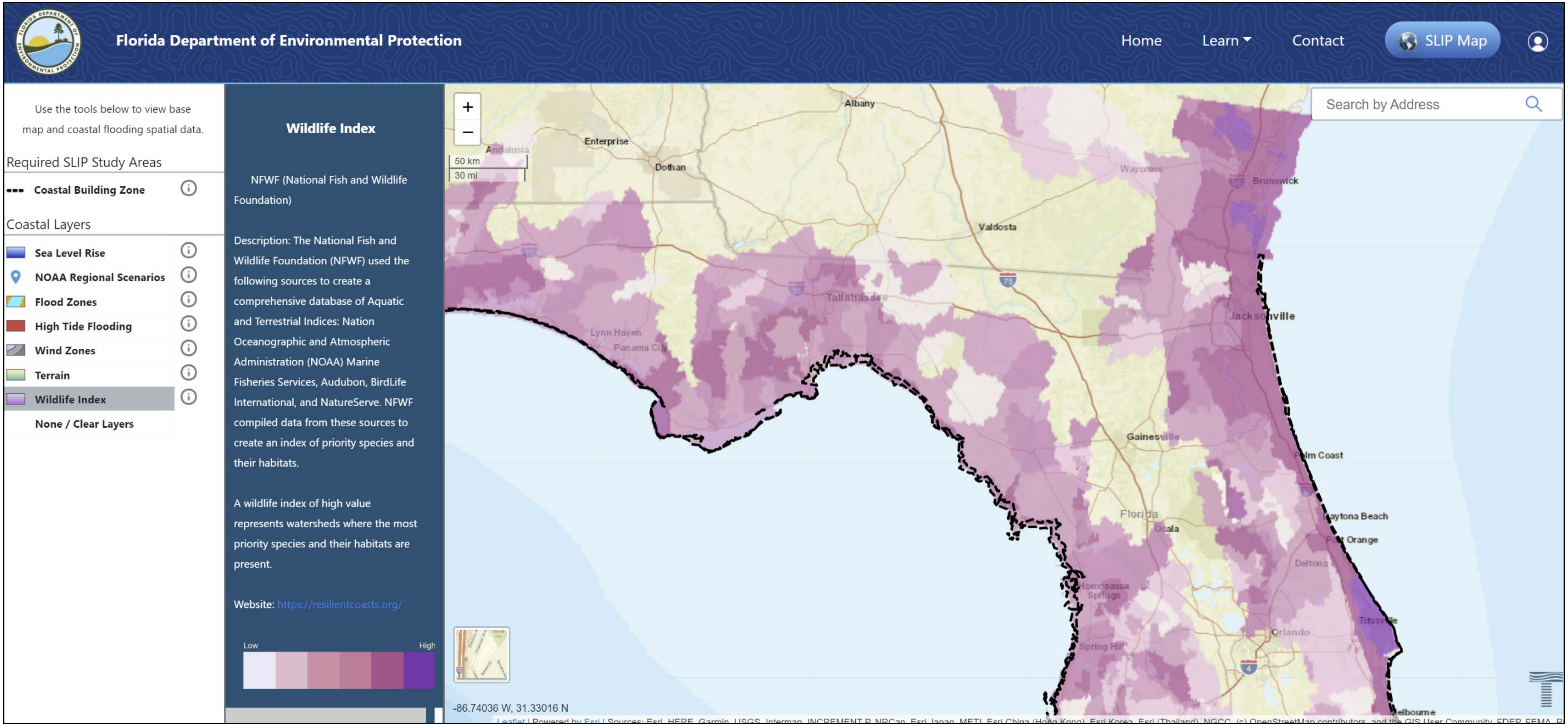
Public View: Wind Zone



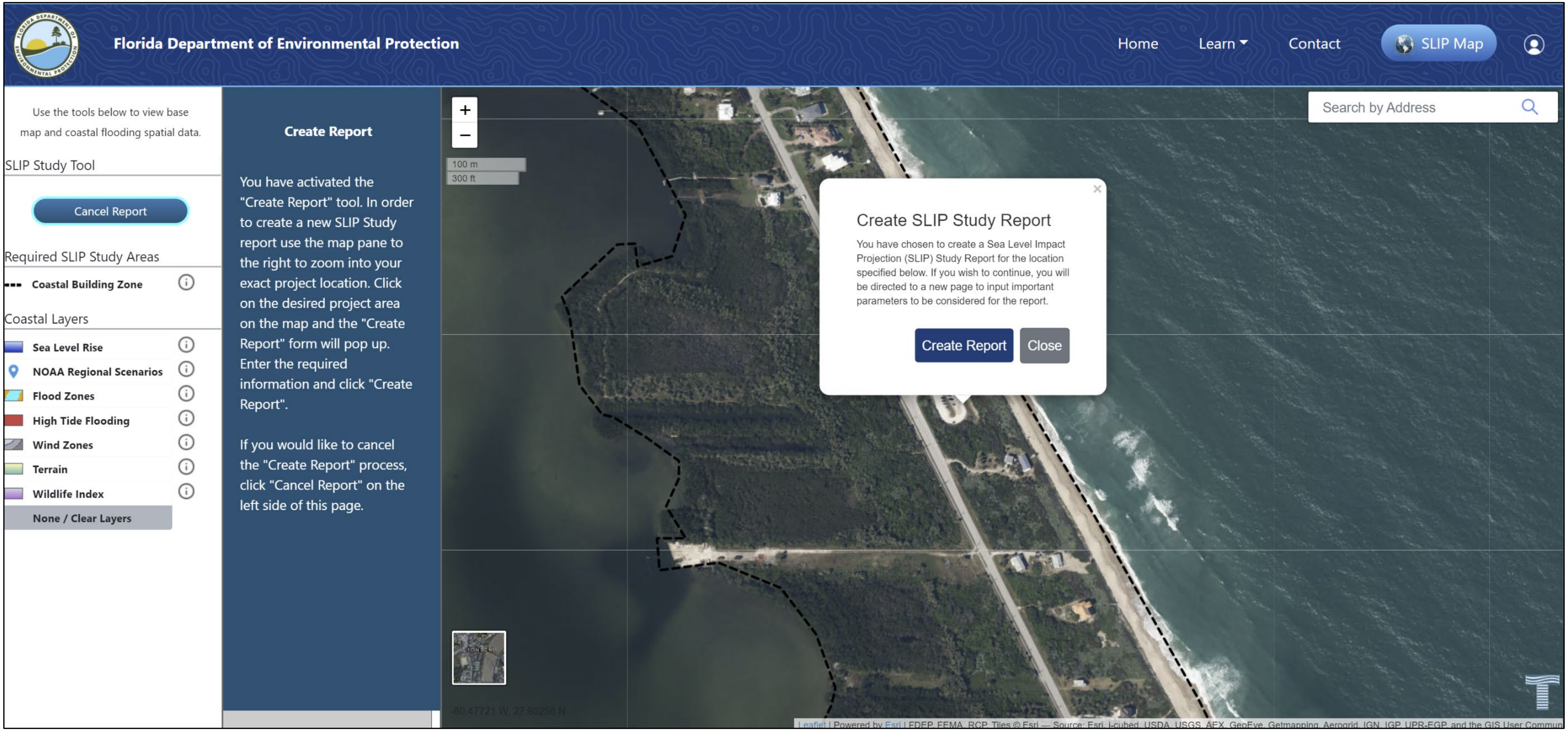
Public View: Terrain Elevation



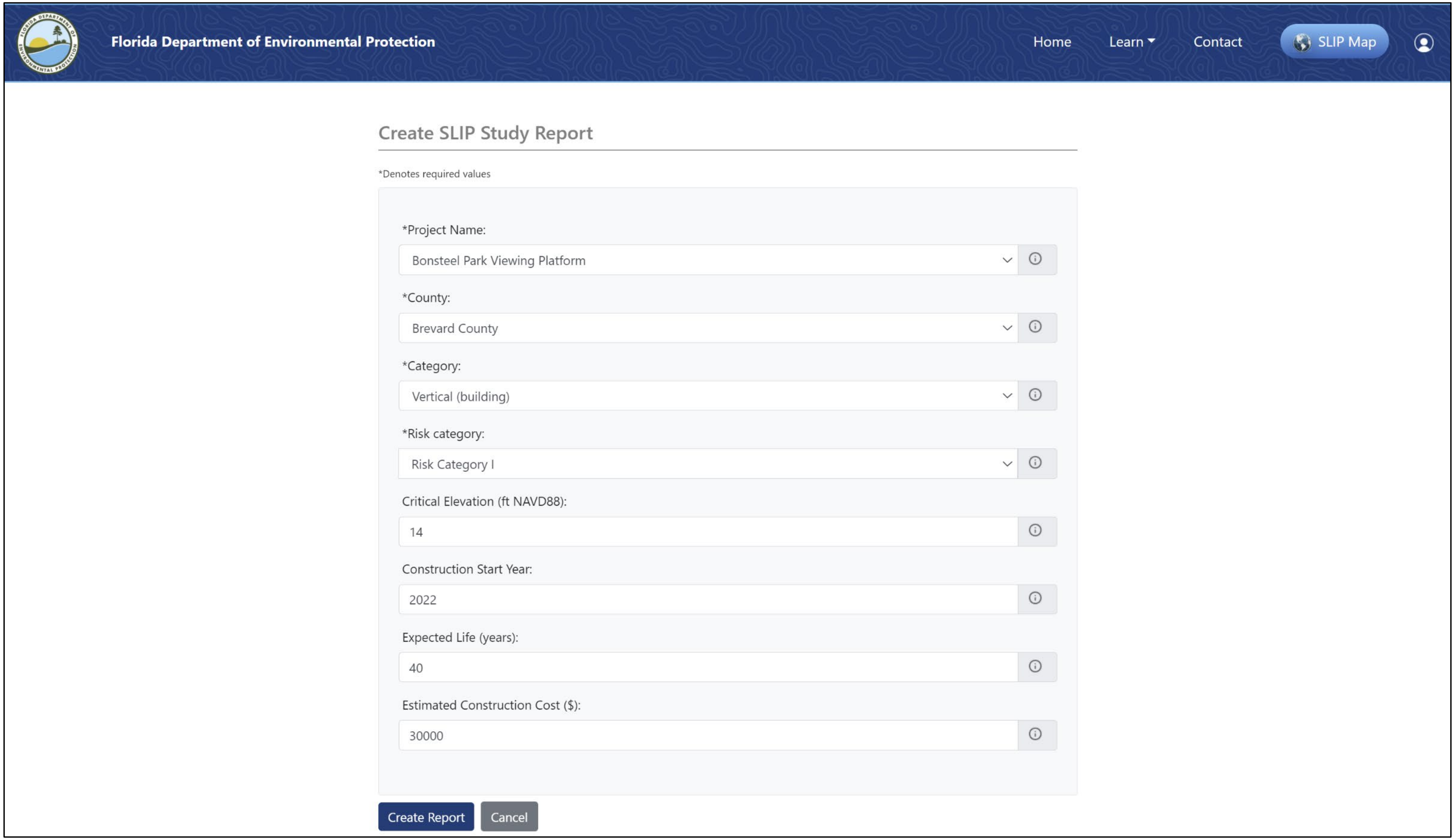
Public View: Wildlife Index



Signed-in User: Create SLIP Report



Signed-in User: SLIP Report Inputs



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Create SLIP Study Report

*Denotes required values

*Project Name:
Bonsteel Park Viewing Platform

*County:
Brevard County

*Category:
Vertical (building)

*Risk category:
Risk Category I

Critical Elevation (ft NAVD88):
14

Construction Start Year:
2022

Expected Life (years):
40

Estimated Construction Cost ($):
30000

Create Report | Cancel

Signed-in User: Waiting for the SLIP Report

Please wait while we pull data for the report...

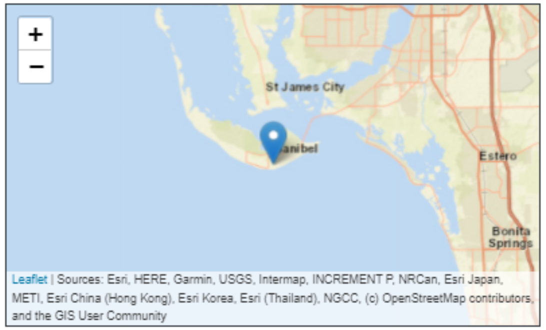
Getting stillwater information...

Signed-in User: SLIP Report

Back to Map | Save Report | Export/Print

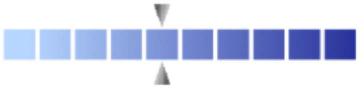
Sea Level Impact Projection (SLIP) Study Report

Project name	Test Project
County	Charlotte County
Coordinates	-82.07294 W, 26.42658 N
Project category	Vertical
Risk category	Risk Category II
Construction start year	2023
Expected life (years)	40
Estimated Construction Cost ($)	$1,250,000
Critical elevation (ft NAVD88)	7
Organization	Taylor Engineering, Inc.
Report Date	1/31/2022, 3:36:31 PM



Results

Average Annual Chance of Substantial Flood Damage: 3.77%



Moderate

Metric	Value
FEMA Flood Hazard Zone	AE
Base Flood Elevation (ft NAVD88)	10
Terrain Elevation (ft NAVD88)	3.58
Int-High Sea Level Rise (year 2060) (ft NAVD88)	2.26
Wind Zone (mph)	180

Average Annual Chance of Substantial Flood Damage (AACSFD) is calculated using NOAA sea level projections, FEMA coastal storm surge events, and associated wave heights. This flood risk probability does not include high-tide flooding, precipitation (stormwater), or riverine flooding.

Potential Beneficial Adaptation Strategies

Based on the results of the SLIP Study, the following adaptation strategies may be beneficial to consider in the construction design. These are not recommendations, merely standard strategies used to mitigate risk.

Build on Partially Elevated Areas

Sea level varies based on the rate of sea level rise relative to land elevation in a particular location. It amplifies near-term vulnerability to storm surge and increases long-term flood and inundation risks. Building on partially elevated areas can mitigate and reduce these risks.

Solution Timeline	Long Term
Scale	Micro
Adaptation Infrastructure	Hybrid
Degree of Protection	Medium
Relative Cost ($, $$, $$$)	$$

Check Valve / Non-Return Valves

A check valve or non-return valve can be installed in pipes that are vulnerable to backflow during various flood conditions. The valve will work by blocking the flow of water if it is entering in the wrong direction. This will help with flooding control, standing water control, and water quality issues. Different size and shape valves can be used, as needed.

Projects:

R1928 - St. Augustine Stormwater Outfall Resiliency Retrofit

Solution Timeline	Intermediate
Scale	Macro
Adaptation Infrastructure	Gray
Degree of Protection	Medium
Relative Cost ($, $$, $$$)	$$$

Elevated Flood Wall / Flood Gate

A flood wall can be constructed to protect individual buildings or facilities against flooding. Flood walls can either be permanent or dismountable depending on short or long-term goals. Sometimes flood gates are built in a flood wall to create space for roads. These gates are only closed during a flood event.

Resources:

FEMA - Floodwall with Passive Floodgates Signals Commitment

Solution Timeline	Long Term
Scale	Macro
Adaptation Infrastructure	Gray
Degree of Protection	High
Relative Cost ($, $$, $$$)	$$$

Flood Barriers (Passive or Active)

Flood barriers are used around a building or its utility components to protect from flooding. Flood barriers can be categorized as either passive or active devices. Passive flood barriers operate automatically during a flood or storm event and do not require any human intervention or power source. An example of a passive flood barrier is a floodwall or levee. Active flood barriers require warnings in advance to deploy during a flood or storm event. This strategy is of limited value when flash floods are frequent. FEMA recommends passive flood barrier devices when planning and building.

Solution Timeline	Intermediate
Scale	Micro
Adaptation Infrastructure	Gray
Degree of Protection	Medium
Relative Cost ($, $$, $$$)	$$

Signed-in User: SLIP Report

Potential Public Safety and Environmental Impacts

Based on the results of the SLIP Study, consider the following potential public safety and environmental impacts:

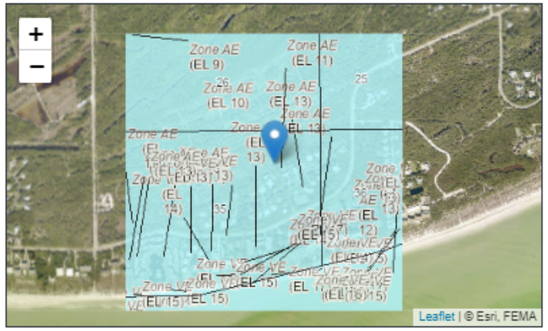
Flood Risk
When factoring in the flood zone, base flood elevation, terrain, and sea level rise trends for the project location, a moderate flood risk is present.

Wind Risk
The project location was found to be located in an area of high wind risk with a maximum wind speed of 180 mph. There is potential risk from flying debris.

Explosion Risk
The high wind risk in this project location may contribute to a higher risk of explosion due to potential downed powerlines.

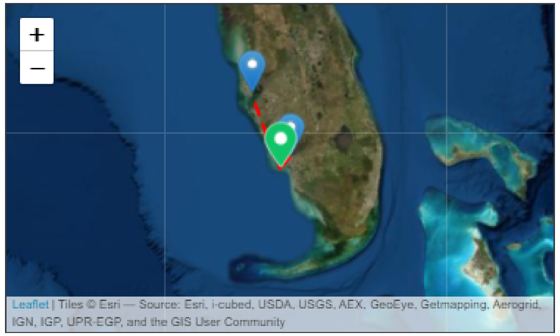
FEMA Flood Hazard Information

Flood Zone	AE
Zone subtype	
Static BFE (ft NAVD88)	10
Vertical Datum	NAVD88



The base flood elevation (BFE) is provided in NAVD88 for VE, AE, and AH special flood hazard zones.

Regional Sea Level Rise Scenarios

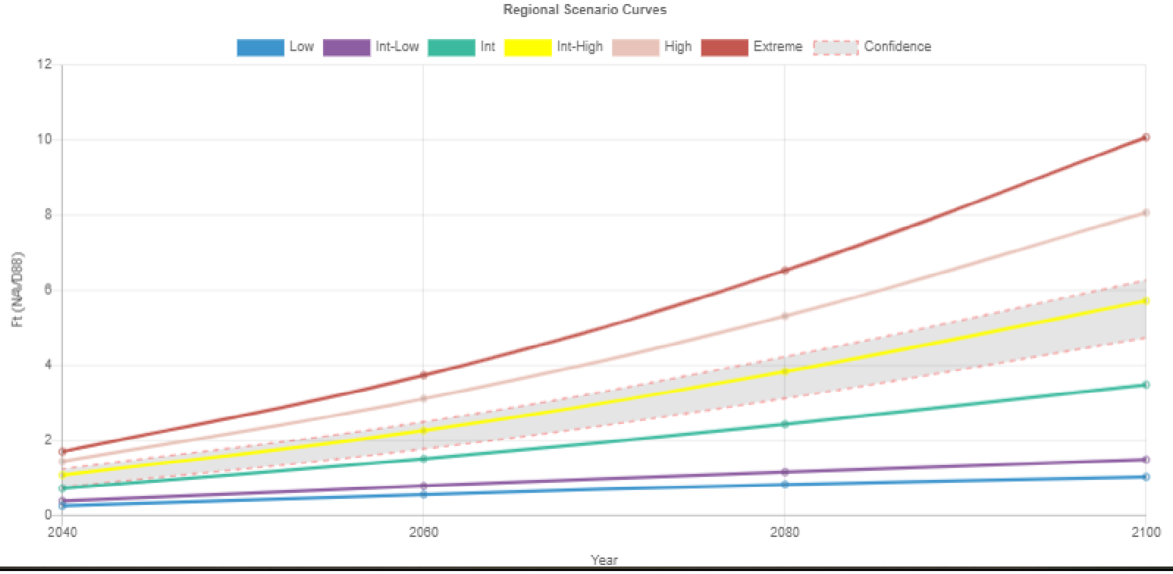


NOAA Regional Scenarios (ft NAVD88)

Scenario	2040	2060	2080	2100
Low	0.25	0.55	0.82	1.02
Intermediate Low	0.38	0.78	1.15	1.48
Intermediate	0.71	1.50	2.43	3.48
Intermediate High	**1.07**	**2.26**	**3.83**	**5.72**
High	1.43	3.11	5.31	8.07
Extreme	1.69	3.73	6.53	10.08

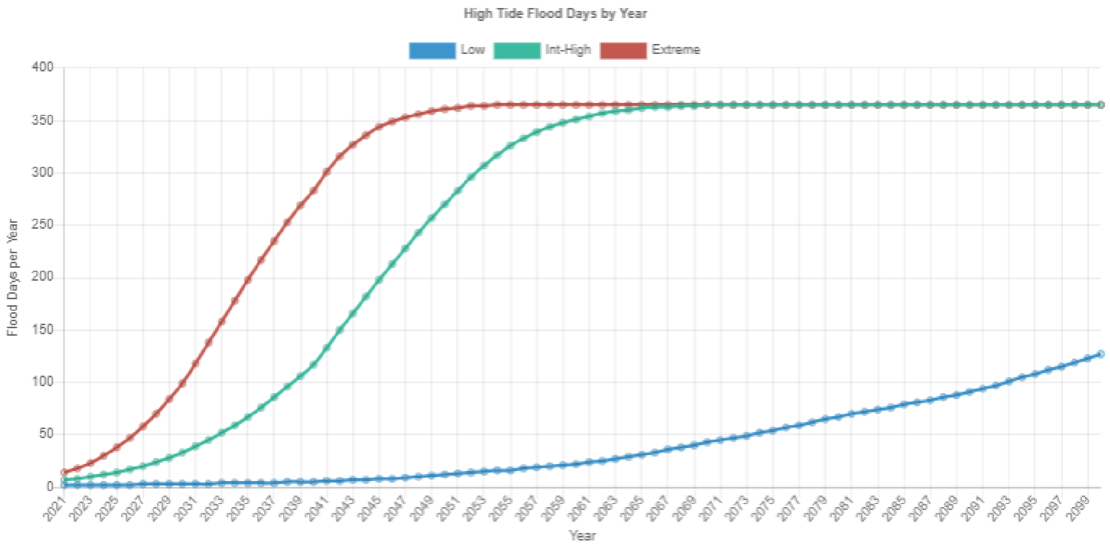
The five relative sea level rise (RSL) scenarios shown in this report are derived from NOAA Technical Report NOS CO-OPS 083 "Global and regional sea level rise scenarios for the United States" using the same methods as the USACE Sea Level Rise Calculator. These new scenarios were developed by the Sea Level Rise and Coastal Flood Hazard Scenarios and Tools Interagency Task Force, jointly convened by the U.S. Global Change Research Program (USGCRP) and the National Ocean Council as input to the USGCRP Sustained Assessment process and 4th National Climate Assessment. These RSL scenarios provide a revision to the (Parris et. al, 2012) global scenarios which were developed as input to the 3rd National Climate Assessment.

These RSL scenarios begin in year 2020 and take into account global mean sea level rise (GMSL), regional changes in ocean circulation, changes in Earth's gravity field due to ice melt redistribution, and local vertical land motion.



Signed-in User: SLIP Report

NOAA High Tide Flooding Information



High Tide Flood Days by Year

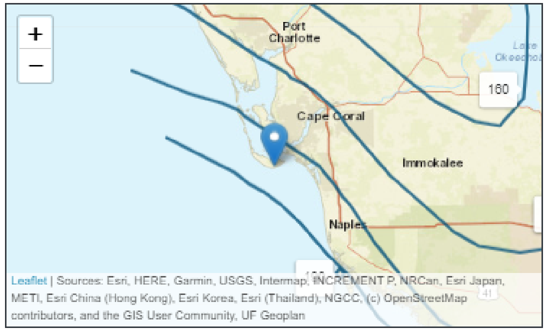
Year	Low	Int-High	Extreme
2021	2	7	14
2040	5	117	283
2070	43	365	365

Annual occurrences of tidal flooding—exceeding local thresholds for minor impacts to infrastructure—have increased 5- to 10-fold since the 1960s in several U.S. coastal cities. The changes in high tide flooding over time are greatest where elevation is lower, local RSL rise is higher, or extreme variability is less.

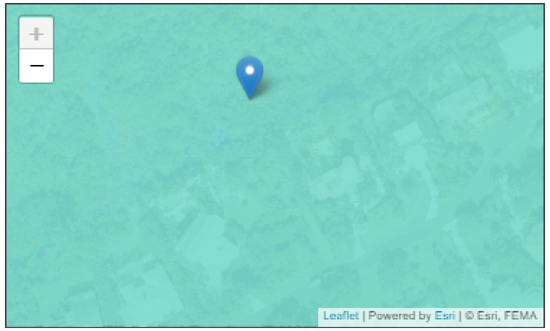
In a sense, today's flood will become tomorrow's high tide, as sea level rise will cause flooding to occur more frequently and last for longer durations of time.

Wind Zones

Metric	Value
Maximum Wind Speed	180mph



Terrain



Metric	Value
Elevation (ft)	3.58
Vertical Datum	NAVD 88

This terrain elevation is derived from the latest compilation of terrain data from NOAA. This dataset contains the best publicly available terrain data in a 3m resolution.

Design Alternatives

The selection of a construction project location involves a considerable number of factors, including but not limited to regulatory issues, engineering, and logical decisions. The SLIP Study Tool may be run multiple times with different project locations and critical elevations, to achieve a desired result. Please use the SLIP Map along with the Coastal Hazard layers to assist you in selecting the optimal location. Review this report and assess the risks which may be mitigated by changing the design parameters, then run the SLIP Study Tool again.

Public View: Adaptation Matrix

CATEGORY	HORIZONTAL (Construction other than a Building)						VERTICAL (Building)				This columns overrides all others	To address the added wave hazard, more stringent building practices are required in Zone VE, such as elevating a home on pilings so that waves can pass beneath it, or a prohibition to building on fill, which can be easily washed away by waves. https://www.fema.gov/flood-maps/coastal/insurance-rate-maps
SUB-CATEGORY	Road (Evacuation Route)	Road (Non-Evacuation)	Parking Lot	Bridge	Utilities (Below Grade)	Utilities (Elevated)	I	II	III	IV		
DESCRIPTOR							Low Hazard to Human Life in the Event of Failure	Structures not in Categories I, III, or IV	Substantial Hazard to Human Life in the Event of Failure	Essential Facilities	Location: if on the open coast (within the VE zone)	
Build on Partially Elevated Areas	X	X	X	X	X			X	X	X	Not an option	
Check Valve / Non-Return Valves					X			X	X	X		
Elevated Flood Wall / Flood Gate	X							X	X	X		
Flood Barriers (Passive or Active)	X						X	X	X	X		
Flood Damage-Resistant Materials	X	X	X	X	X		X	X	X	X		
Living Shoreline											X	
Raising Land	X		X	X		X		X	X	X	Not an option	
Reduced Paved Surfaces			X					X	X	X		
Utility Elevation					X			X	X	X		
Foundation Flood Vents							X	X				
Elevate Finished First Floor								X	X	X		
Relocate Structure											X	
Dune Restoration / Beach Nourishment											X	
Wetland Restoration / Retention Pond	X								X	X		
Floodable Park / Water Square		X	X					X	X			
Increase Plantings	X		X				X	X	X	X	X	

Public View: AACSFD Sample Calculation

AVERAGE ANNUAL CHANCE OF SUBSTANTIAL FLOOD DAMAGE SAMPLE CALCULATION

The FDEP Sea Level Impact Projection Study (SLIP) webtool calculates average annual chance of substantial flood damage to a coastal structure. Applying existing regional study data provided by FEMA, NOAA, and USACE, the calculations account for sea level rise as well as for storm surge and waves due to tropical cyclones. Structure-specific user input allows the webtool to identify an elevation threshold at which substantial damage would occur and calculate the average annual probability of water level reaching that elevation.

The input data must meet several requirements to return a valid result:

- The first floor elevation of the structure must exceed the terrain elevation.
- The structure placement must fall within the inundation extents defined by the FEMA 0.02% annual chance floodplain.
- The water level at which substantial damage would occur must not exceed the FEMA 0.02% annual chance water level; that is, the tool does not extrapolate water levels at frequencies lower than 0.02%.

The following example at Sand Key Park in Clearwater Beach, FL demonstrates the calculation for finding average annual chance of substantial damage:

INPUT DATA

User-defined input:

First floor elevation	7.75 ft-NAVD

Terrain:

Topographic elevation	6.99 ft-NAVD

FEMA Coastal Flood Insurance Study data:

FEMA Base Flood Elevation	12.00 ft-NAVD
FEMA 0.2% annual chance stillwater level	11.94 ft-NAVD
FEMA 1% annual chance stillwater level	8.95 ft-NAVD
FEMA 2% annual chance stillwater level	7.08 ft-NAVD
FEMA 10% annual chance stillwater level	5.28 ft-NAVD

Sea Level Rise:

End year of structure design life	2070
NOAA Intermediate-High SLR	1.60 ft

STEP 1: Fit an annual exceedance probability (AEP) curve to the FEMA stillwater elevation (SWEL) data.

- In this example, the location selected for the coastal structure falls within the 10% annual chance floodplain extent. However, the topographic elevation at the site exceeds the FEMA 10% annual chance SWEL, so the tool removes the 10% annual chance SWEL from the curve fit input data. Note that this situation can occur for high-frequency FEMA SWEL values coinciding with isolated high spots in the terrain surface.
- The tool fits FEMA 2%, 1%, and 0.2% annual chance SWEL values to a log-normal function curve: *y = m * ln(x) + b*
  - m = -2.066, b = -0.823
- Note that the tool only calculates the log-normal curve fit if the selected location falls within the 1% annual chance floodplain; if the location lies outside of the 1% annual chance floodplain but inside the 0.2% annual chance floodplain, then the tool adds SLR to the 0.2% annual chance SWEL and compares the resulting elevation with the substantial damage elevation.

STEP 2: Determine how well the curve fit represents the FEMA known SWEL values.

- Next, the tool calculates SWEL using the log-normal curve fit equation *m* and *b* values for the FEMA SWEL AEPs: *Calculated SWEL = m * ln(FEMA AEP) + b*
- The calculated SWEL values allow the tool to report R^2 value to the user as a representation of how well the curve fit *m* and *b* represent the FEMA SWEL values.
  - $R^2 = 0.99$

STEP 3: Generate arrays of SWEL and associated AEP for the full frequency space with curve fit equation.

- The tool applies the *m* and *b* curve fit values to produce an array of SWEL values corresponding to an array of AEP values that cover the frequency space from 10% to 0.2% annual chance with approximately 500 bins: *Curve SWEL = m * ln(AEP bin) + b*
- The first 50 values in both arrays (AEP and associated curve SWEL) are printed below. Note that SWEL values do not exist at the high-frequency bins; because their calculated depths are negative, the tool removes them. This can occur for high-frequency AEPs at isolated high spots in the terrain.
  - AEP(1:50) =

```
[0.1         0.09090909 0.08333333 0.07692308 0.07142857 0.06666667
0.0625      0.05882353 0.05555556 0.05263158 0.05       0.04761905
0.04545455 0.04347826 0.04166667 0.04       0.03846154 0.03703704
0.03571429 0.03448276 0.03333333 0.03225806 0.03125    0.03030303
0.02941176 0.02857143 0.02777778 0.02702703 0.02631579 0.02564103
0.025      0.02439024 0.02380952 0.02325581 0.02272727 0.02222222
0.02173913 0.0212766  0.02083333 0.02040816 0.02       0.01960784
0.01923077 0.01886792 0.01851852 0.01818182 0.01785714 0.01754386
0.01724138 0.01694915]
```

  - Curve SWEL(1:50) =

```
[-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
-- -- -- -- -- -- -- -- -- -- 6.996021890076962 7.042453737828759
7.087865022323944 7.132299643945352 7.175798729996781 7.218400863452832
7.260142288597747 7.301057096299749 7.341177391294016 7.380533443530911
7.419153825376911 7.4570655362260805 7.494294115883376 7.5308637479123774
7.566797353994843 7.602116680224116]
```

Public View: AACSFD Sample Calculation -2

STEP 4: Shift curve SWEL to account for SLR.

- The tool shifts the curve SWEL vertically to account for SLR: *Curve SWEL with SLR = Curve SWEL + SLR*
- The tool again checks for negative SWEL depth values and removes them after SLR is accounted for. Note fewer nan values (--) in the shifted SWEL data compared to SWEL from Step 3:
    - Curve SWEL_with_SLR(1:50) =

```
[-- -- -- -- -- -- -- -- -- -- -- 7.067773105551828 7.163889518062552
7.255732650309534 7.343666357982371 6 7.428009916583337 7.509045019279608
7.587021453362501 7.662161743868966 7.734664981980435 7.80471000413149
7.872458049646854 7.93805499629951 8.001633251759824 8.063313362602479
8.123205390018084 8.181410091679641 8.2380199416441 8.293120014215107
8.346788752976877 8.399098642448628 8.450116796791713 8.499905477566235
8.548522550557166 8.596021890076962 8.642453737782876 8.687865022323944
8.732299643945352 8.775798729996781 8.818400863452831 8.860142288597746
8.901057096299748 8.941177391294016 8.980533443530911 9.019153825376911
9.05706553622608 9.094294115883375 9.130863747912377 9.166797353994843
9.202116680224115]
```

STEP 5: Adjust wave height to SWEL depth ratio or "wave ratio" associated with FEMA Base Flood Elevation (BFE) to account for SLR.

- The FEMA BFE establishes the wave height associated with the 1% annual chance SWEL. The BFE includes the SWEL plus the contribution of the wave height that lies above the stillwater surface.
- The FEMA BFE modeling process assumes that 70% of the controlling wave height lies above the SWEL, and that waves break at condition of wave height to stillwater depth ratio of 0.78. Note that this webtool maintains these assumptions (Figure 1).
- Because FEMA models wave height only at the 1% annual chance level, the webtool applies the Wave Ratio Method (currently in testing as part of the FEMA Coastal Probabilistic Flood Risk Assessment framework) to scale the 1% annual chance wave height to other AEPs. The Wave Ratio method assumes that the ratio of wave height to SWEL depth remains constant across the frequency space.
- Adjusting the FEMA 1% annual chance wave height for SLR determines the wave ratio applied for other AEPs in the next step.
    - If the FEMA 1% annual chance wave is non-breaking, then wave height remains constant when accounting for SLR, as SLR does not impact wind wave generation. In this case, SLR acts to decrease the ratio of wave height to SWEL depth.
    - If the FEMA 1% annual chance wave is a breaking wave, then the tool assumes wave breaking for SLR condition as well; the wave height increases when accounting for SLR such that the ratio of wave height to SWEL depth remains 0.78. Notably, this case assumes that SLR does not exceed the threshold above which the breaking wave would transform to a non-breaking wave.
    - From the FEMA BFE, wave height h = (12.00 – 8.95) / 0.7 = 4.36 ft
    - Breaking wave height h_b = 0.78 * (8.95 – 6.99) = 1.53 ft
    - Because h > h_b, the FEMA BFE wave is breaking and the tool sets R = 0.78

STEP 6: Find wave heights associated with curve SWEL based on SLR-adjusted wave ratio R.

- Apply the wave ratio calculated in Step 5 to find wave heights at all AEPs. Wave height = wave ratio * SWEL depth including SLR, or *H = R * (Curve SWEL with SLR – Topographic elevation)*
    - H(1:50) =

```
[-- -- -- -- -- -- -- -- -- -- -- 0.06066302233042535 0.13563382408879052
0.20727146724143658 0.27585975922624967 0.34164773493500245
0.40485511503809 38 0.46567673362275 09 0.5242861602177932
0.5808386859447393 0.635473803222562 0.6883172787245457
0.7394828971136175 0.7890739363726623 0.8371844228299332
0.8839002042141054 0.9292998715101201 0.9734555544823972
1.0164336110877836 1.0582952273219641 1.0990969411099298
1.138891101497536 1.1777262725016635 1.2156475894345895 1.2526970742600 3
1.2889139155064324 1.3243347174126763 1.358993722277374
1.3929230093974891 1.4261526734932084 1.458710985106242
1.4906245351138037 1.521918365209332 1.5526160859541105
1.5827399837939904 1.6123111182563423 1.6413494103890327
1.669873723371654 1.6979019361159775 1.7254510105748 1]
```

STEP 7: Find total water level (SWEL plus wave crest contribution) adjusted for SLR.

- The webtool assumes that wave crest contribution to total water level contributes to the depth of flooding (Figure 2).
- Maintain the FEMA assumption that 70% of the wave height lies above the SWEL surface to calculate total water level for all curve AEPs: *Curve TWL = Curve SWEL with SLR + (0.7 * H)*
    - TWL_with_SLR(1:50) =

```
[-- -- -- -- -- -- -- -- -- -- -- 7.110237221183126 7.20635363369385
7.298196765940832 7.38613047361367 7.470474032214635 7.55150913491090 6
7.629485568993799 5 7.704625859500264 7.777129097611733 7.847174119762788
7.914922165278152 7.980519111930808 8.044097367391121 8.105777478233776
8.165669505649381 8.223874207310939 8.280484057275396 8.335584129846405
8.389252868608175 8.441562758079925 8.492580912423 01 8.542369593197533
8.590986666188464 9.472909842058982 9.544693478683262 9.614899324512818
9.683595249539513 9.750844836575023 9.816707734898078 9.881239978172115
9.944494270879 41 10.006520246940548 10.067364703698788 10.127071814032703
10.185683319005 52 10.243238703155699 10.299775354272535
10.355328709276026 10.409932387626483]
```

STEP 8: Find substantial damage elevation.

- Substantial flood damage occurs when flooding results in the loss of at least 25% of the market value of the structure. USACE NACCS found that substantial damage is "most likely" associated with flood depth of 1.5 ft relative to the first floor elevation (Figure 3).
- Substantial damage elevation (SDE) is set to the first floor elevation plus an additional 1.5 ft.
    - SDE = 7.75 ft-NAVD + 1.5 ft = 9.25 ft-NAVD

STEP 9: Interpolate AEP and wave height associated with water level reaching the substantial damage elevation.

- The tool does not allow extrapolation outside of the 10% to 0.2% annual chance frequency range.

Public View: AACSFD Sample Calculation -3

- The tool applies linear interpolation between bin values; while the log-normal curve fit equation is not linear, the bin is sufficiently small to allow linear for interpolation between adjacent bins.
  - AEP = 2.3% for inundation reaching TWL with SLR of 9.25 ft-NAVD.

STEP 10: Output information to the user.

- The tool prints AEP for substantial damage to the potential building.
- The tool also prints substantial damage elevation, the wave ratio, the wave height, and the total water level at the 10% and 0.2% annual chance bins. The latter provides the user with the range of potential flood elevations at that specific location.
- Finally, the tool generates a scatter plot (Figure 4) that overlays FEMA SWEL, FEMA BFE, curve SWEL, curve SWEL with SLR, and curve TWL with SLR as visual presentation of results.

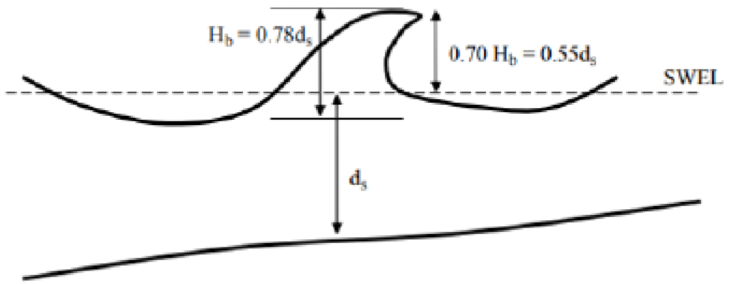


Figure 1. FEMA wave breaking relationships, where H_b = breaking wave height and d_s = SWEL depth.

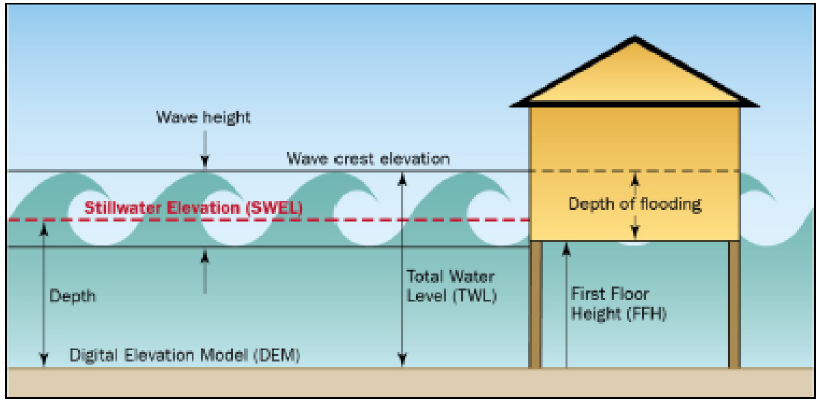


Figure 2. FEMA depth of flooding diagram.

THANK YOU
Questions?

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Proposed Legislation – 2022 – SB1434 Amends SLIP (161.551)

- "Public Financing of Potentially At-risk Structures and Infrastructure"
- Redefines "Coastal Building Zone" to "Areas at risk due to sea-level rise"
  - any location that is projected to be below the threshold for tidal flooding within the next 50 years (using NOAA 2017 Int-High SLR projection)
  - the threshold for tidal flooding is 2 feet above mean higher high water
- Replaces the definition of "coastal structure" with "potentially at-risk structure or infrastructure"
- Redefines "Significant ~~substantial~~ flood damage"
  - flood, erosion, inundation, or wave action damage resulting from a discrete or compound natural hazard event, such as a flood or tropical weather system
  - Where such damage exceeds: A defined threshold established by the department in coordination with the Department of Transportation and water management districts