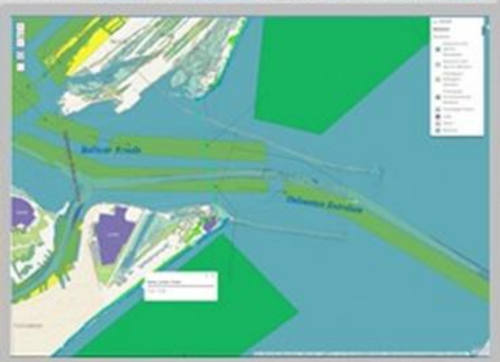
The Natural Infrastructure Opportunities Tool

Safra Altman
Environmental Laboratory
US Army Engineer Research and Development Center

Rose Dopsovic
US Army Corps of Engineers, Mobile District



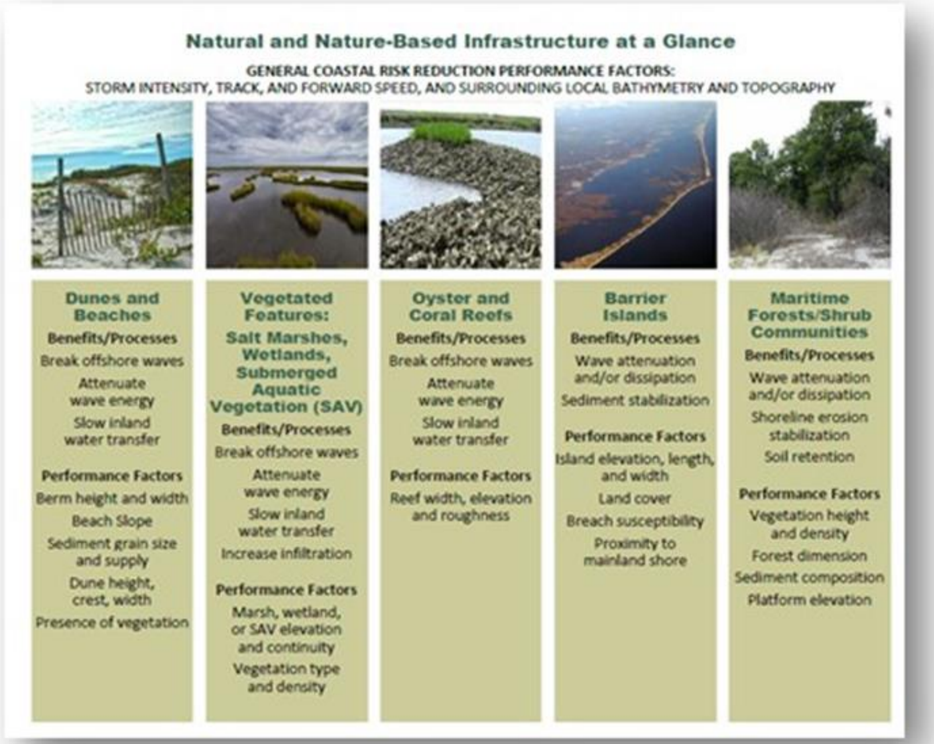
Engineering With Nature®

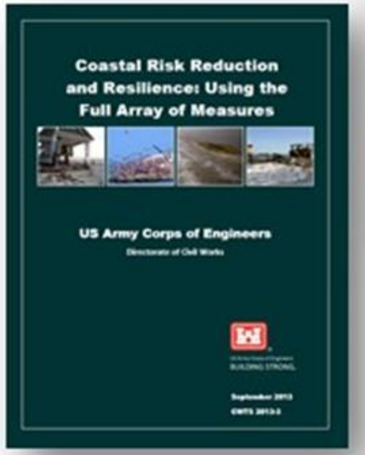
US Army Corps of Engineers®

ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

Natural and Nature-Based Features

NNBF are **landscape features** that are developed to provide **engineering functions** relevant to **flood risk** management while producing additional **economic**, **environmental** and **social benefits**.





CALM BEFORE THE STORM

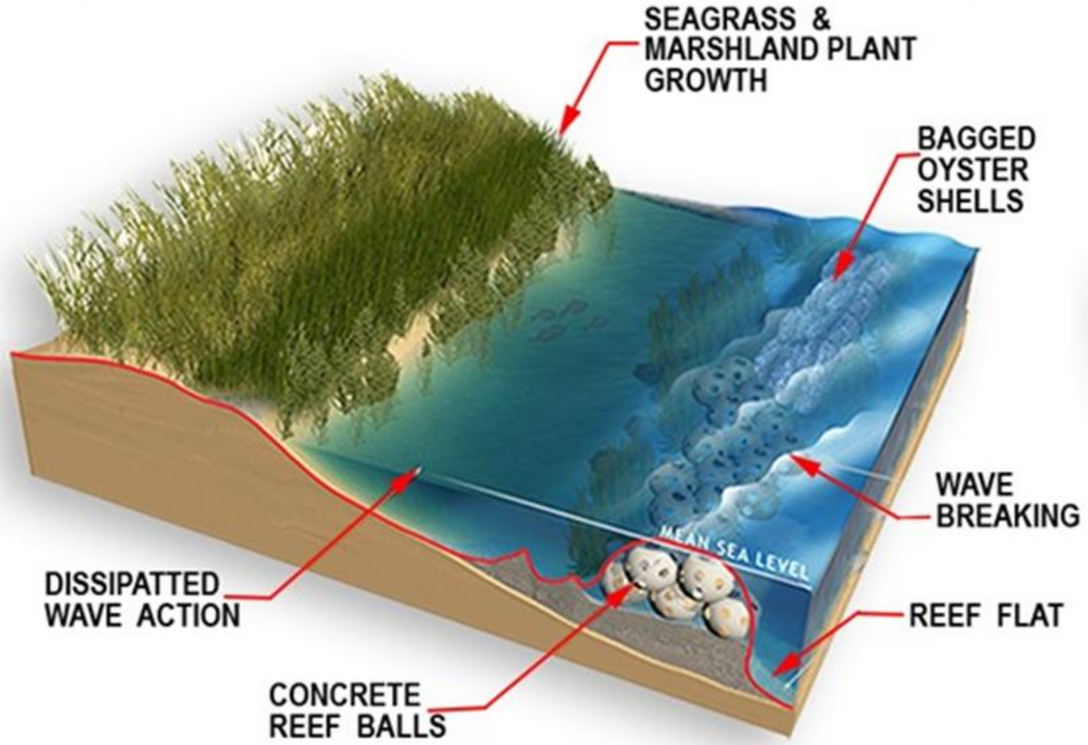
PREPARE • RESIST

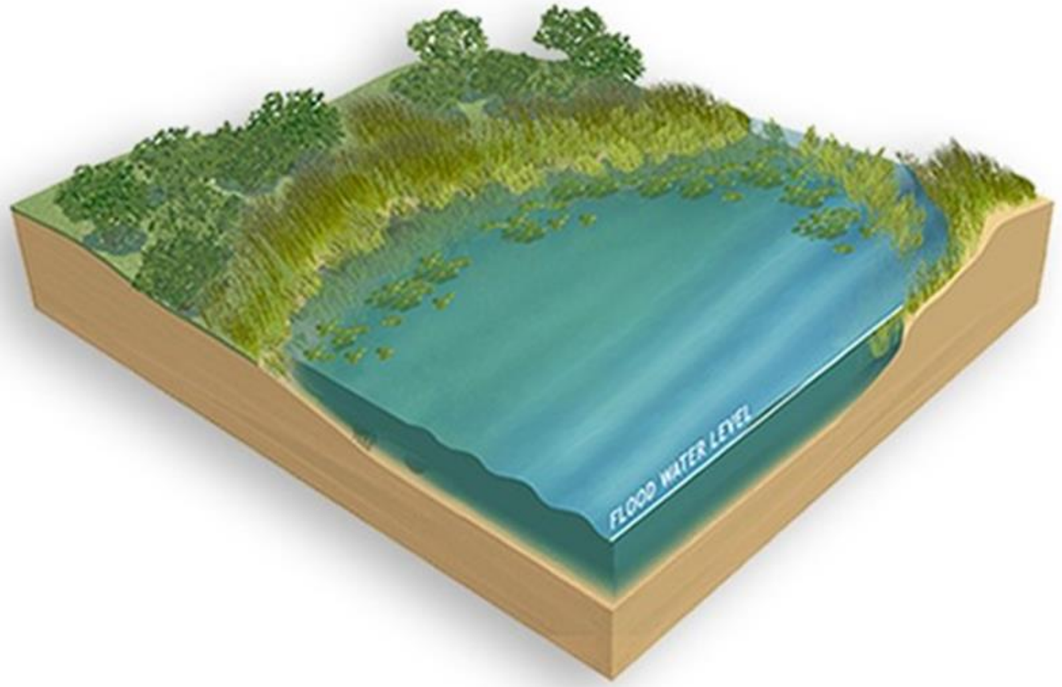
combine nonstructural and structural measures to deliver full array of ecosystem goods and services

THE STORM

RECOVER • ADAPT

NNBF features can help attenuate waves offering improved flood protection during storms



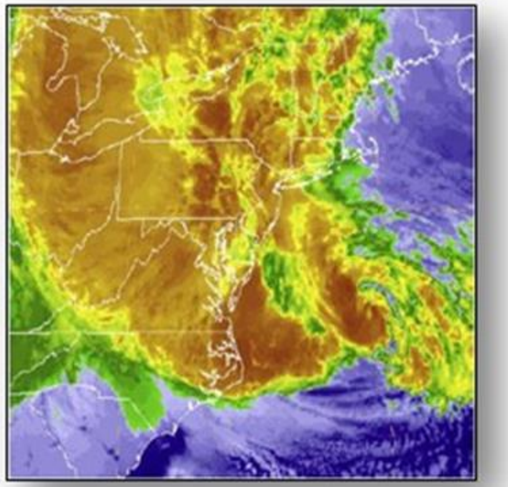


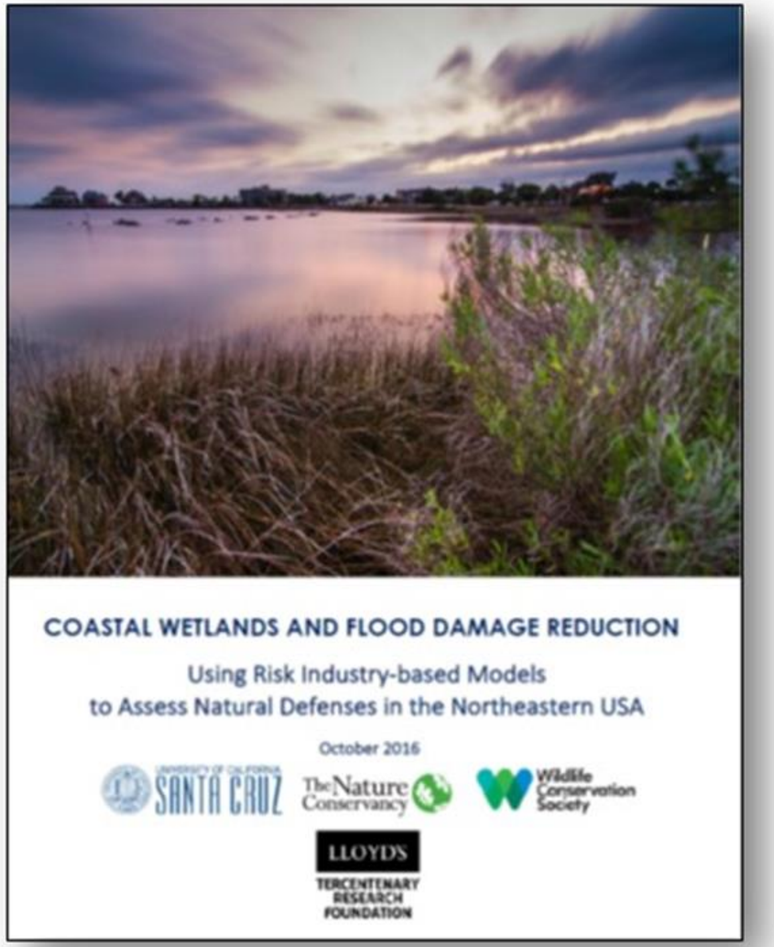
https://ewn.el.erdc.dren.mil/nnbf.html

Leveraging nature for engineering value

Following Hurricane Sandy:

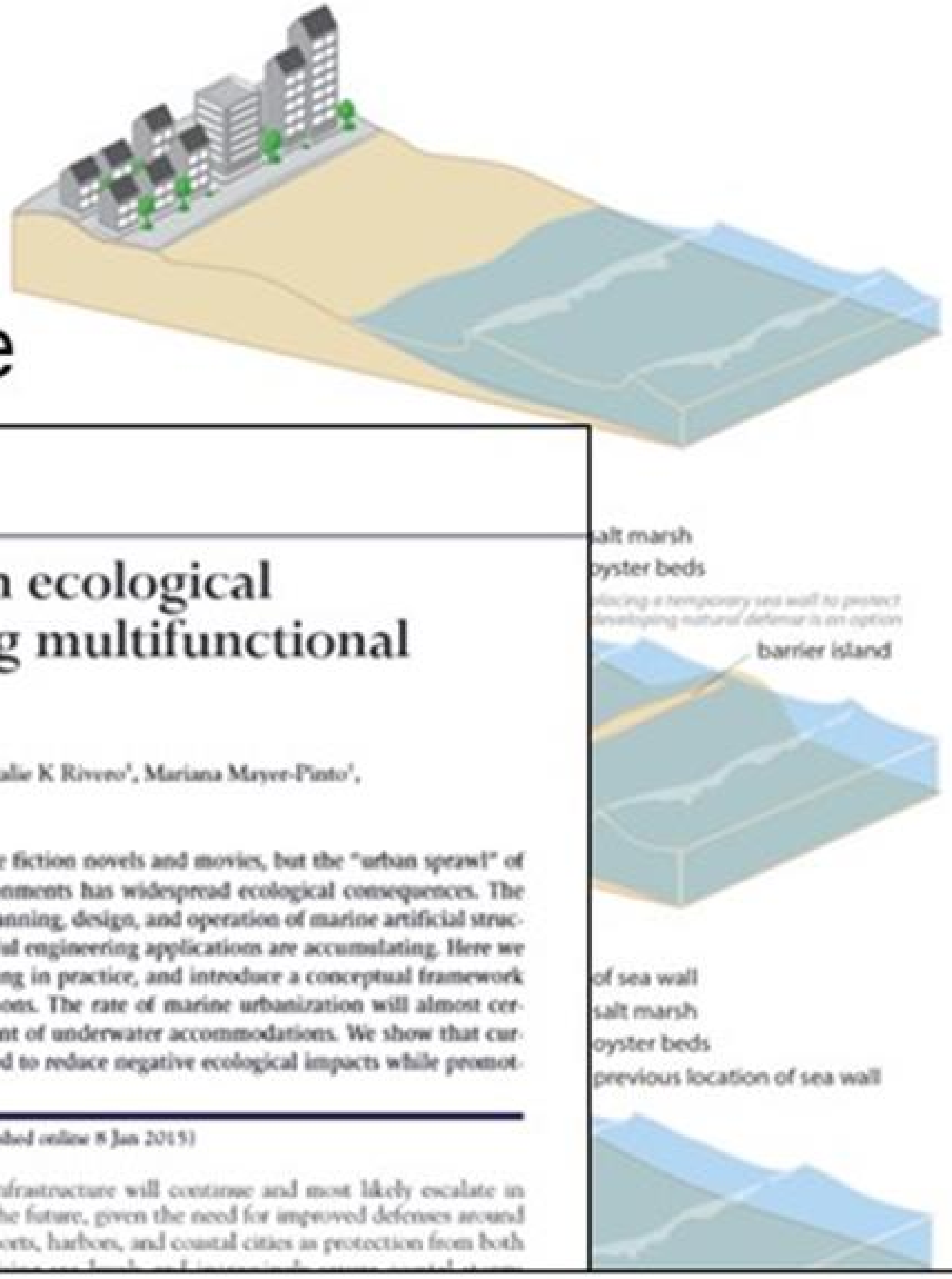
- **Risk industry-based tools used to quantify the economic benefits of coastal wetlands**
  - **Temperate coastal wetlands saved more than $625 million in flood damages.**
  - **In Ocean County, New Jersey, salt marsh conservation can significantly reduce average annual flood losses by more than 20%.**





Importance of Natural Infrastructure

Minimal Defense



...es provide ...on.

...natural...

Hyb...

...n and Devel...

ENVIRONMENTAL SCIENCE & POLICY 51 (2015) 137–148

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/envsci

ELSEVIER

Review

Future of our coasts: The potential for natural and hybrid infrastructure to enhance the resilience of our coastal communities, economies and ecosystems

Ariana E. Sutton-Grier, Kateryna Wowk, Holly Bamford

ARTICLE INFO

ABSTRACT

REVIEWS REVIEWS REVIEWS

Marine urbanization: an ecological framework for designing multifunctional artificial structures

Katherine A Dafforn, Tim M Glasby, Laura Airoldi, Natalie K Rivero, Mariana Mayer-Pinto, and Emma L Johnston

EDF ENVIRONMENTAL DEFENSE FUND

Finding the ways that work

Performance of Natural Infrastructure and Nature-based Measures as Coastal Risk Reduction Features

Authors

Shannon Cunniff[1]
and
Aaron Schwartz[2]

Journal of Environmental Economics and Management

Volume 85, September 2017, Pages 62-80

ELSEVIER

Benefits and ancillary costs of natural infrastructure: Evidence from the New Jersey coast ☆

Steven J. Dundas

Show more

https://doi.org/10.1016/j.jeem.2017.04.008

Get rights and content

Abstract

Collaboration with the Private Sector

- Caterpillar Inc.
  - Restoring Natural Infrastructure Summit; November 4th 2015; New York City
  - Natural Infrastructure Initiative – USACE Collaboration Work Streams
    1. NI Opportunity Evaluation Tool. Capitalizing on enterprise-level capability: CE Dredge Decision Support Tool
    2. Evaluation and Decision Making
    3. Field Application and Demonstration
- Western Dredging Association (WEDA)
  - Collaborative technical workshop on engineering and construction techniques for Engineering With Nature

http://www.caterpillar.com/en/company/sustainability/natural-infrastructure.html

Natural Infrastructure Initiative

Natural Infrastructure Initiative is an informal grouping of companies and organizations working to promote the use of natural infrastructure

High level objectives:

- Accelerate investment in water based natural infrastructure projects as part of a solution set for infrastructure needs
- Embed natural infrastructure as part of ongoing discussions about improving investment in water-based infrastructure. Promote the use of natural infrastructure in general

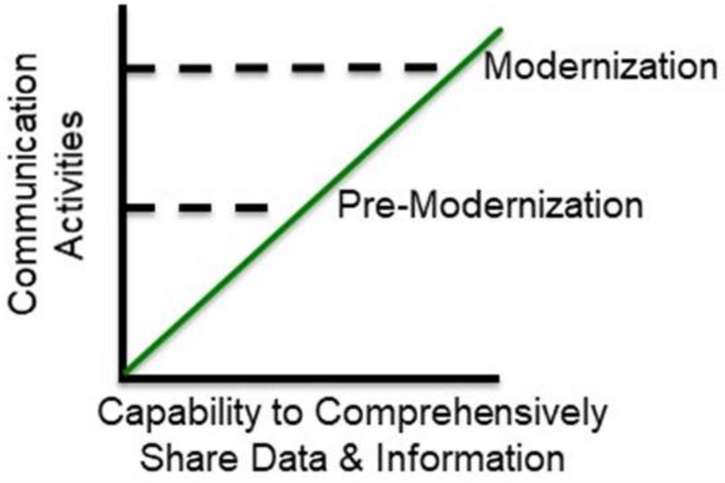
Vision:

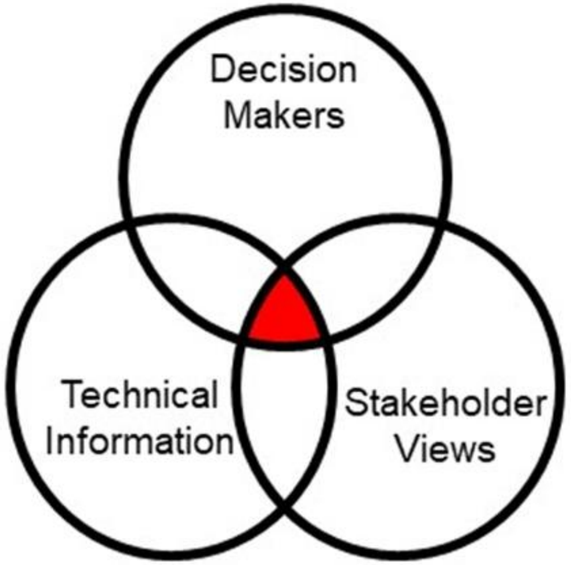
The widespread acceptance of, and increased investment, in natural infrastructure projects as a means to advance the economic vitality, environmental health and security of our nation.

Natural *AND* Built Infrastructure, not OR

Increase integration of information through a connected data network

- Consistent access to authoritative data
- Simplified & expedited dredging analyses
- Multi-objective systems optimization
- Dynamic visualization
- Enhances communications
  - Within USACE
  - With non federal sponsors and partners
  - With environmental agencies





Improved Communication, Shared Visioning, and Alignment of Mutual Objectives

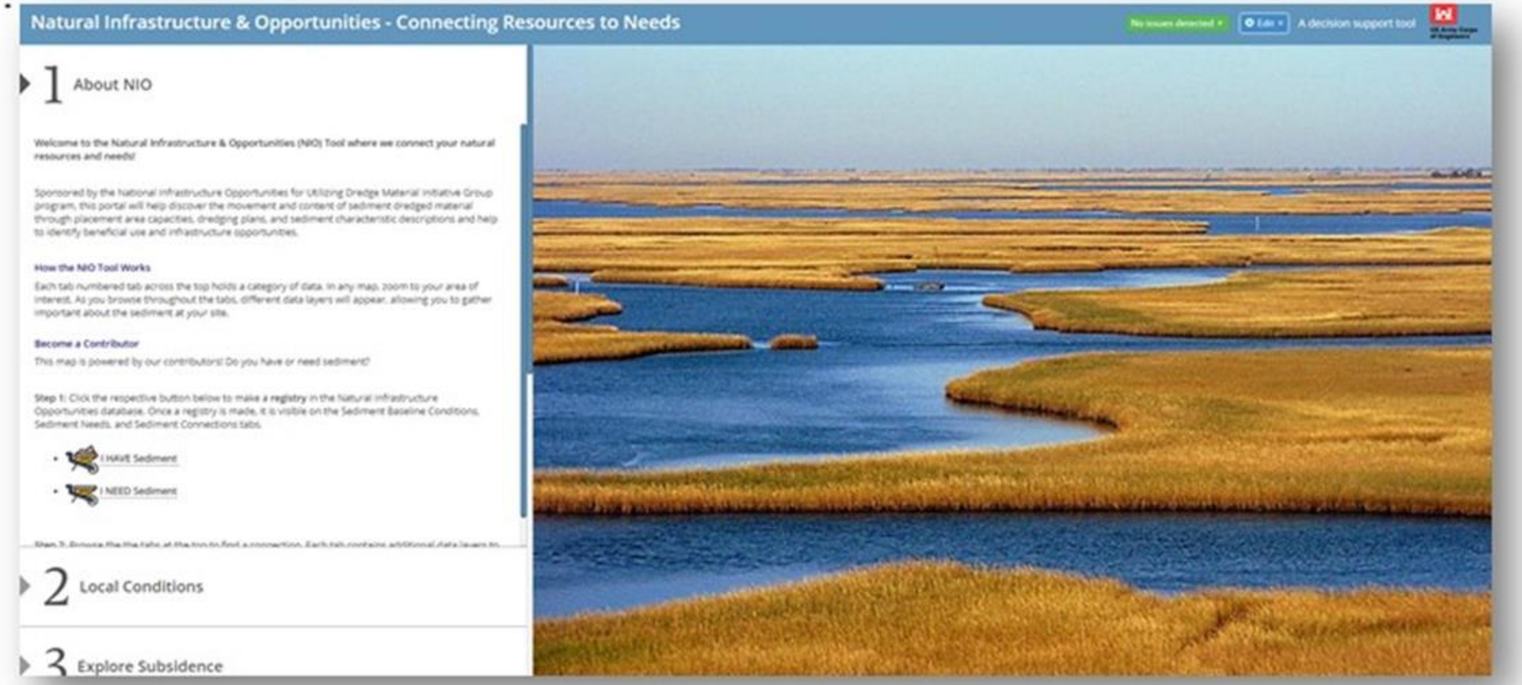
Tool Development: Natural Infrastructure Opportunities Tool

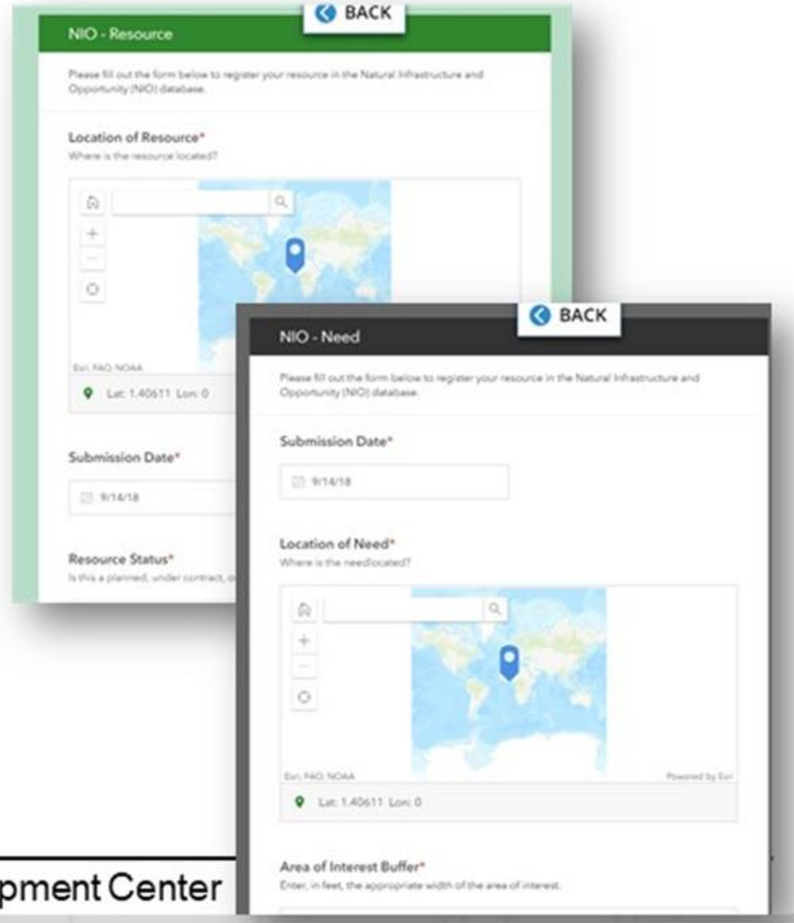
- The public facing *NIOT* web-viewer, developed in collaboration with the Natural Infrastructure Initiative, focuses on identifying beneficial use an natural infrastructure opportunities.
- The initial version of viewer developed to address a number of questions identified by NII group including:

Where are the sediment sources?
Where are the current placement areas?
Where are the restoration, shore protection, and nearshore placement projects?
What volume of material was (or is planned to be) placed?
Where are potential placement sites?
What capacity is available?
What are the upcoming dredging/navigation needs?
What are the opportunities for new beneficial use?
Are there opportunities to link multiple projects?

What is the Natural Infrastructure Opportunities Tool?

By using map based visualizations of environmental, geomorphic and sediment conditions, as well as upcoming USACE projects, and an interface for users to add their resource needs and resource availability, this portal will help discover natural infrastructure connections and inspire innovative opportunities.



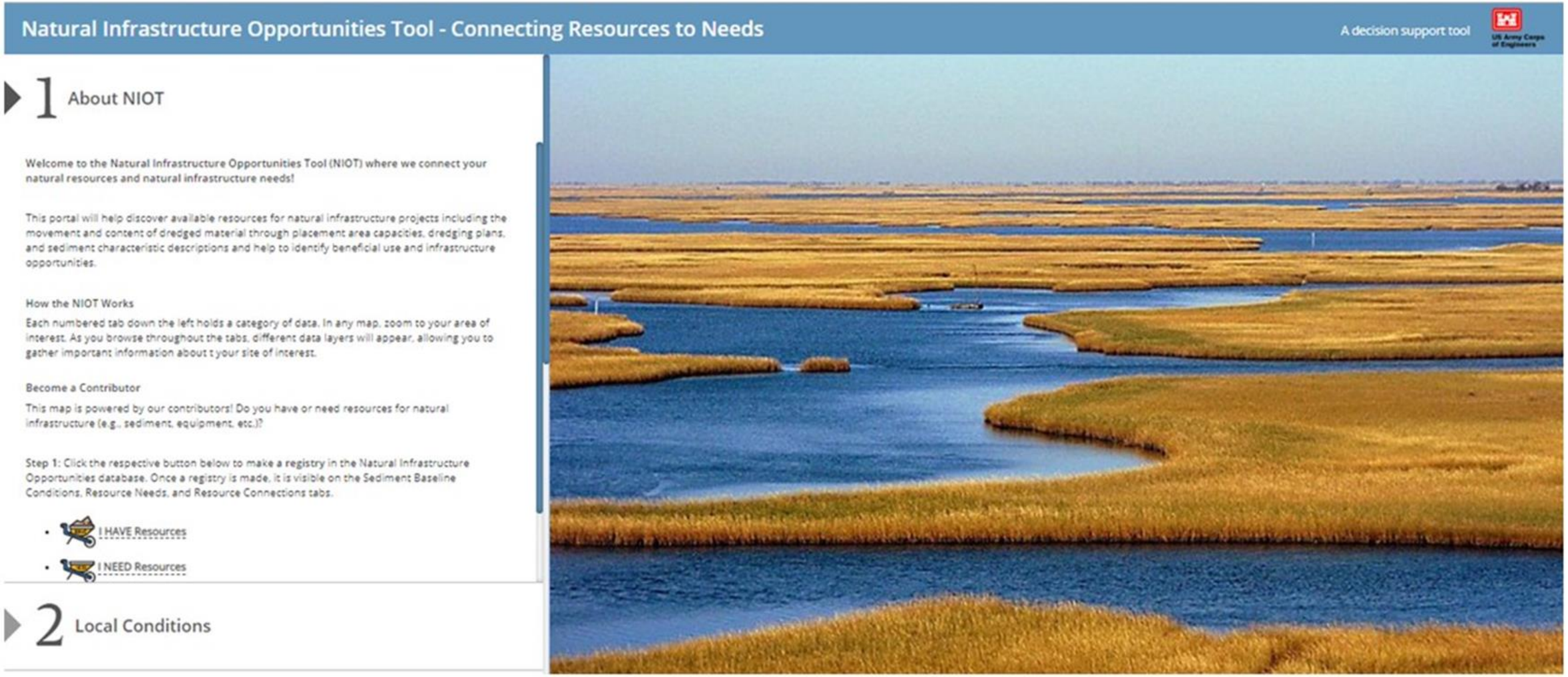


How the NIOT Works

- The NIOT brings together datasets from multiple sources all in one place using an open, online Arc Story Maps platform
- Data is organized in a map. The map will change based on what links are clicked – either the category number or any hyperlinks in the category description
- There are 11 tabs. Each tab holds a subset of data organized for that category. Interested in seeing all data together? Tab 10 provides access to all data layers in the NIO tool.

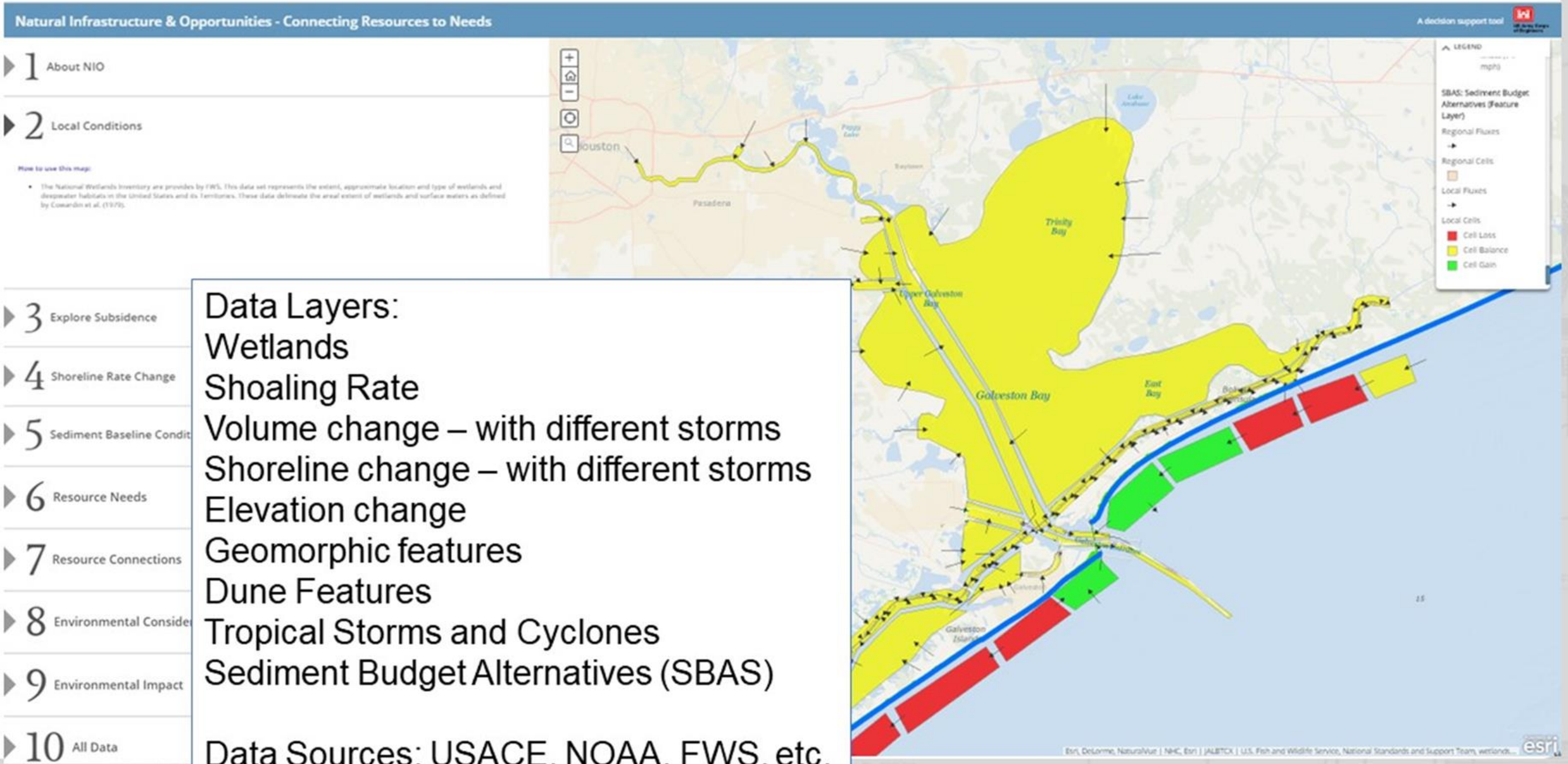
Interested in finding contacts who are also exploring natural infrastructure opportunities? Tab 11 provides contact offices for users of the NIOT.

Open, Online Application



Supported by Arc Story Maps

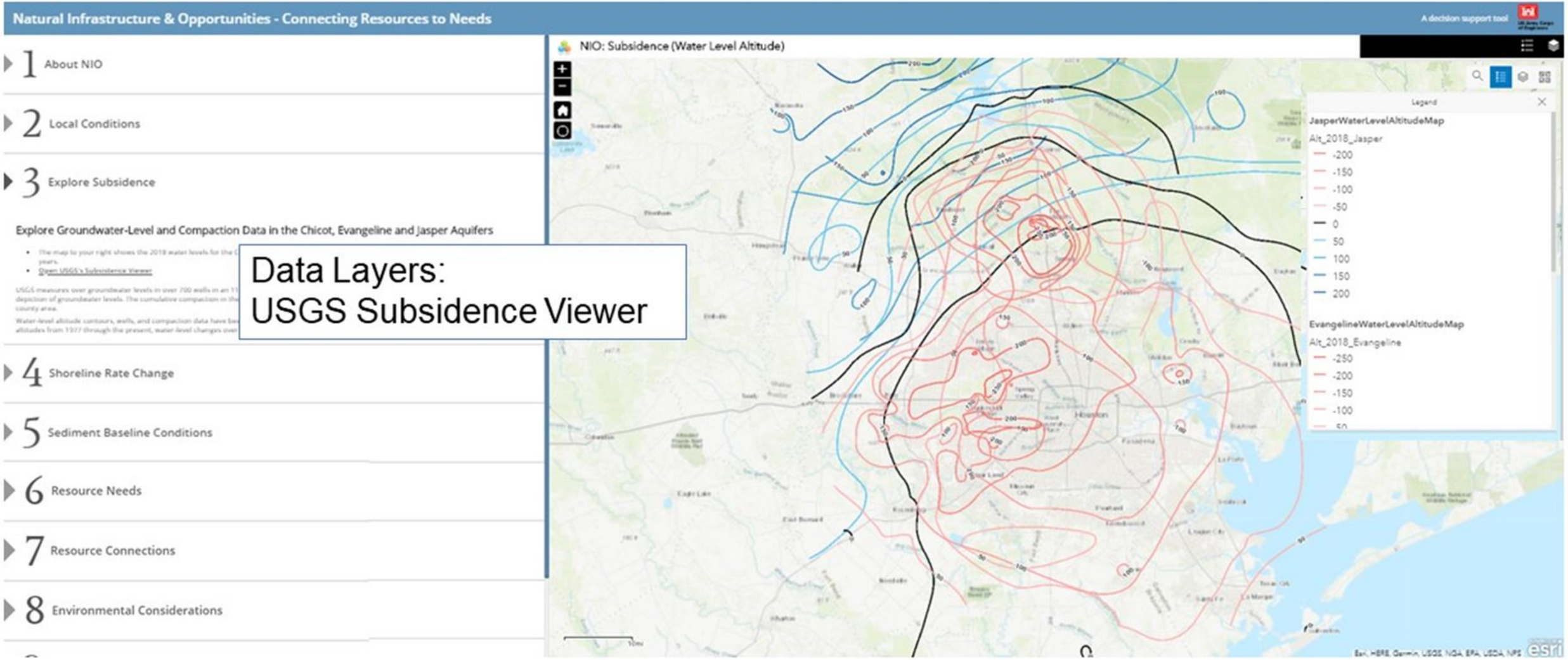
Local Conditions



Data Layers:
Wetlands
Shoaling Rate
Volume change – with different storms
Shoreline change – with different storms
Elevation change
Geomorphic features
Dune Features
Tropical Storms and Cyclones
Sediment Budget Alternatives (SBAS)

Data Sources: USACE, NOAA, FWS, etc.

Subsidence



Data Layers:
USGS Subsidence Viewer

Shoreline Change

Natural Infrastructure & Opportunities - Connecting Resources to Needs

A decision support tool

US Army Corps of Engineers

1 About NIO

2 Local Conditions

3 Explore Subsidence

4 Shoreline Rate Change

How to use this map:

- Click to show Corps Shoalin
- Click to show change rate (
- Click to show change rate (
- Click to show change rate (

Other options to explore:

- Bureau of Economic Geolo
- CSAT mapping application
- CSAT data sources

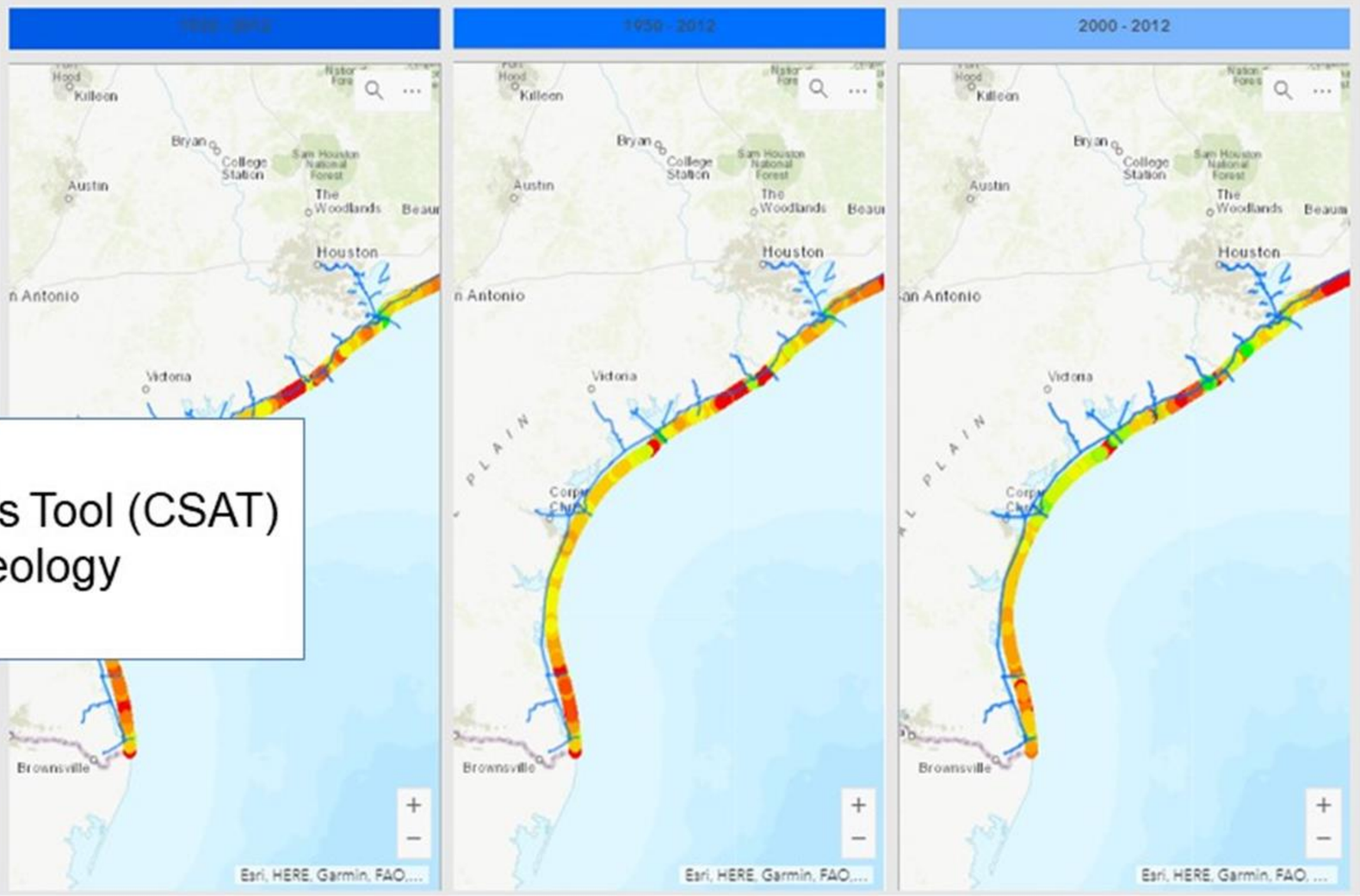
Note:

Data for this change rate (1930s - 2012) application are taken from Paine, Caudle, and Andrews (2014), where the methods, data sources, and results are discussed. The individual data points (shoreline movement rates at 11,497 points along the 2012 Texas Gulf coast shoreline) can be downloaded from the Bureau's coastal studies download page. Project sponsored by the General Land Office of Texas under CEPRA contract no. 09-074-000.

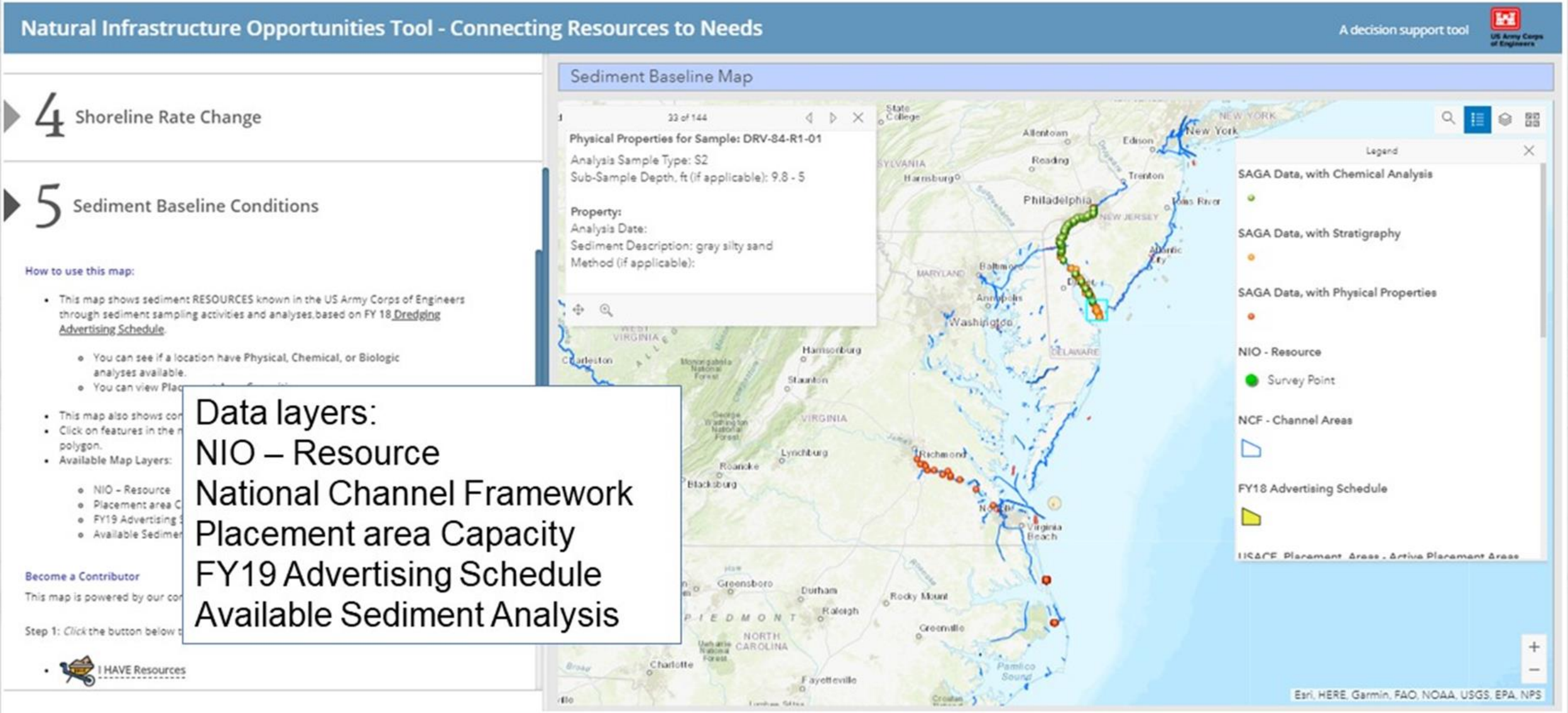
Sponsoring and Participating Organizations

Data Layers:
Corps Shoaling Analysis Tool (CSAT)
Bureau of Economic Geology
Shoreline Change

Shoreline Rate Change: 1930 - 2012

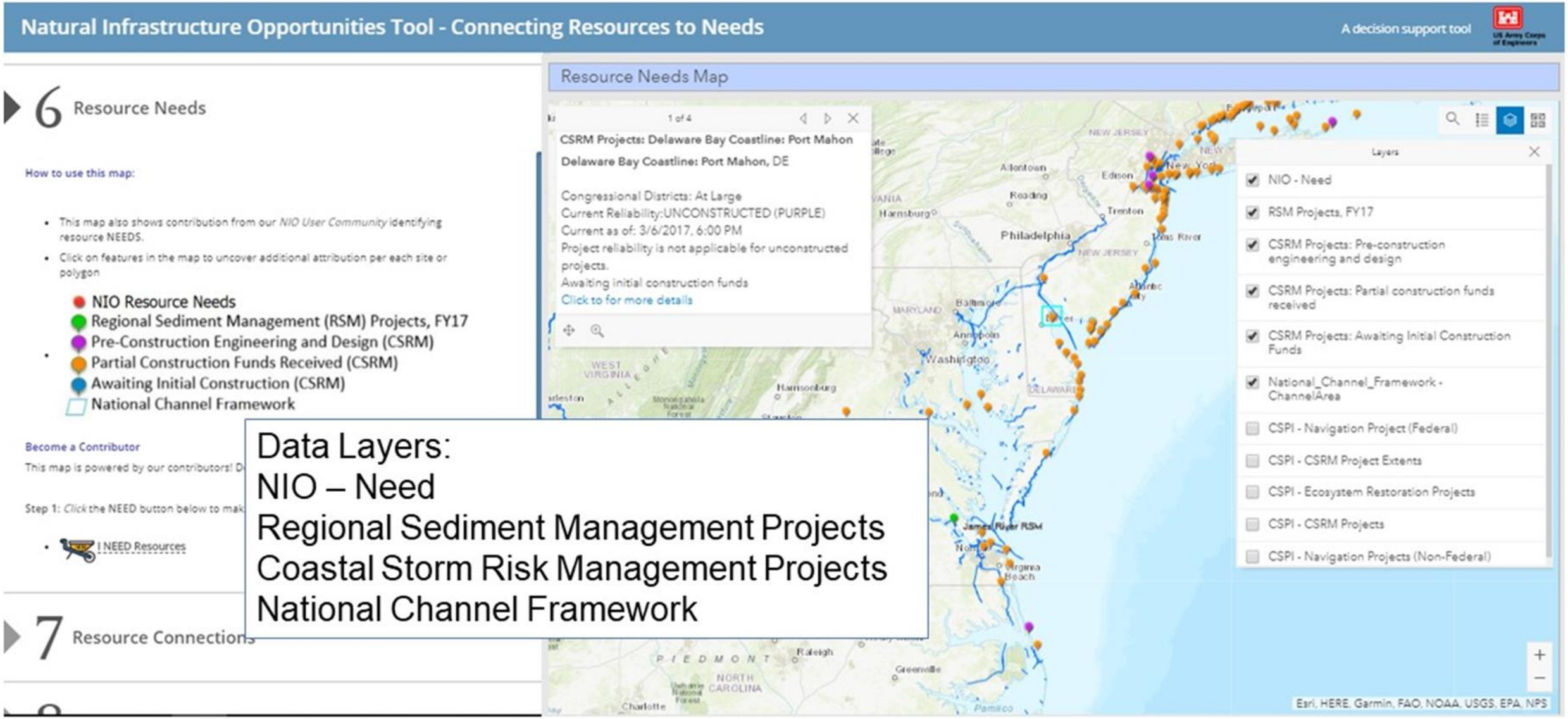


Baseline Conditions



Data layers:
NIO – Resource
National Channel Framework
Placement area Capacity
FY19 Advertising Schedule
Available Sediment Analysis

NI Resource Need

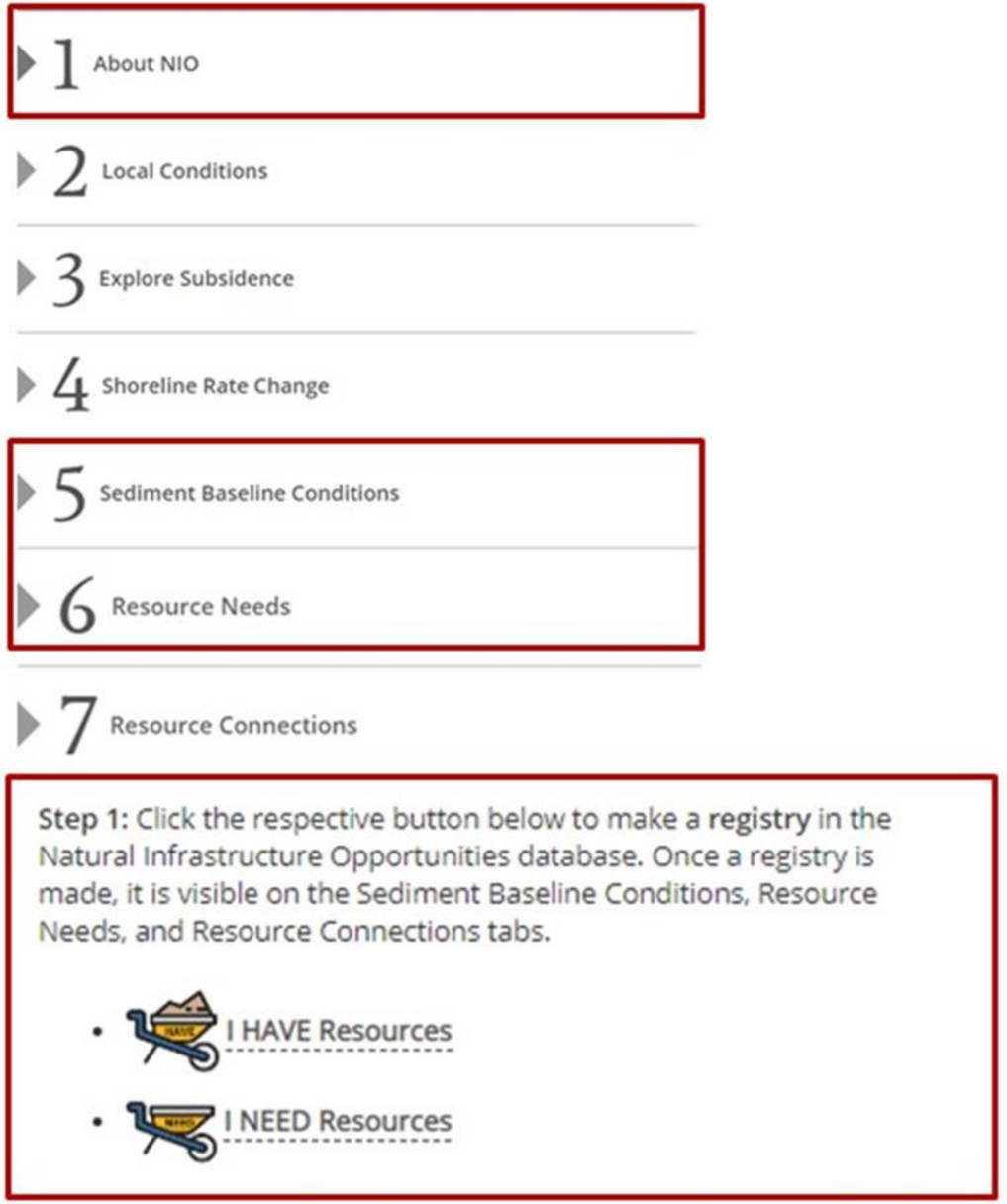


Data Layers:
NIO – Need
Regional Sediment Management Projects
Coastal Storm Risk Management Projects
National Channel Framework

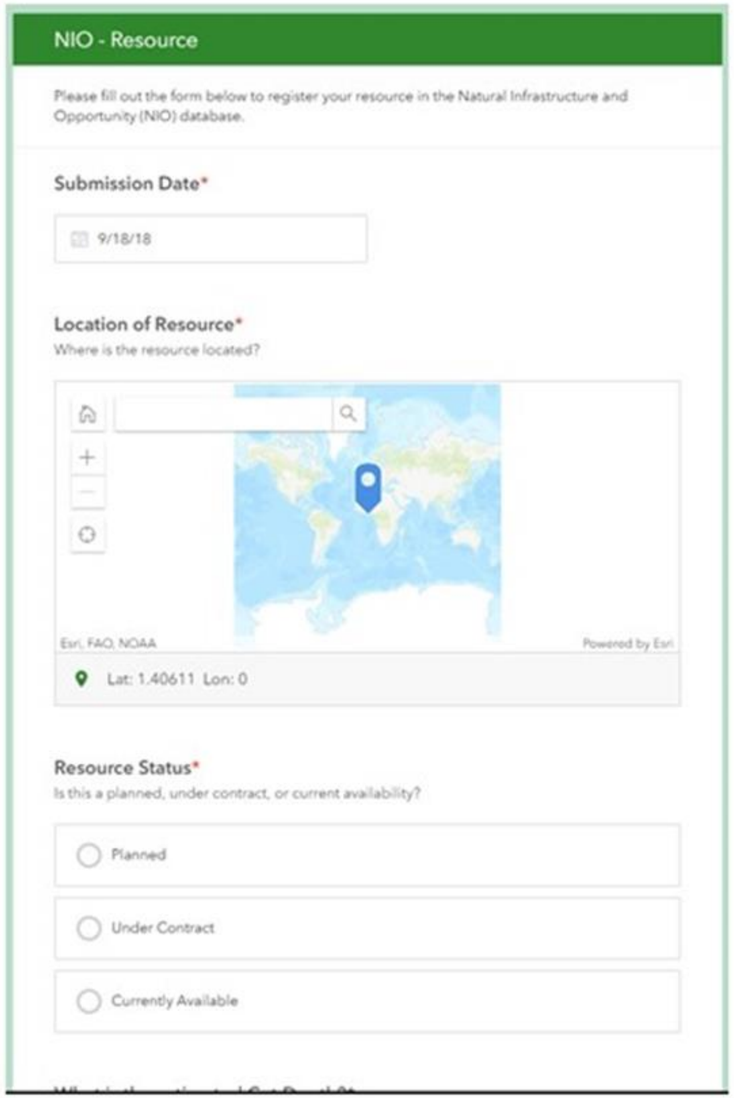
US Army Corps of Engineers • Engineer Research and Development Center

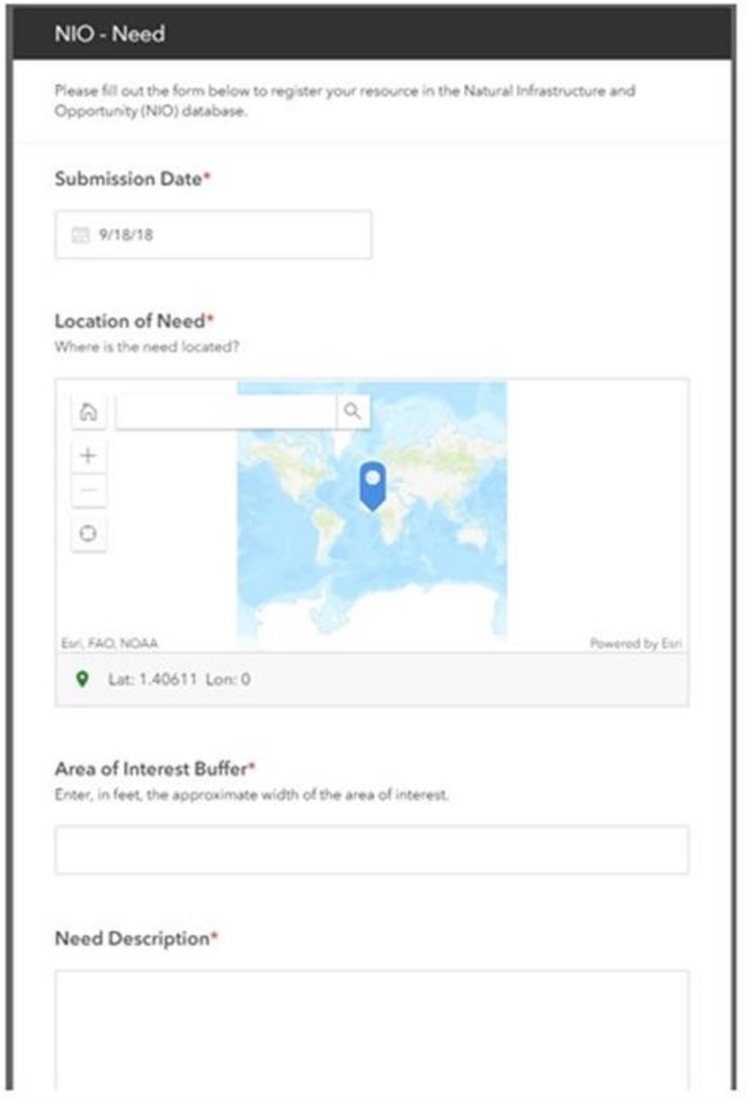
NIO Contributors

- The mapping tools allows the community of users to submit “announcements” of resources or needs.
- Tabs 1, 5, and 6 have links to create a mapped “announcement” of Available Resources or Resource Needs.
- Click the respective link to open the online entry form
  - Users supply location and basic descriptions of resources that they need or have.



NIO Contributors | Forms





NIO Resource Connections

Natural Infrastructure & Opportunities - Connecting Resources to Needs

A decision support tool

US Army Corps of Engineers

7 Resource Connections

How to use this map:

- This map only shows contributions from our *NIO User Community* and Regional Sediment Management (RSM) Projects for the current fiscal year.
- Click on the Legend and Layers buttons at the bottom of the map to discover what data is available.
- Click on features in the map to uncover additional attribution per each site or polygon.

Legend

- USACE Projects
- NIO Resource
- NIO Need

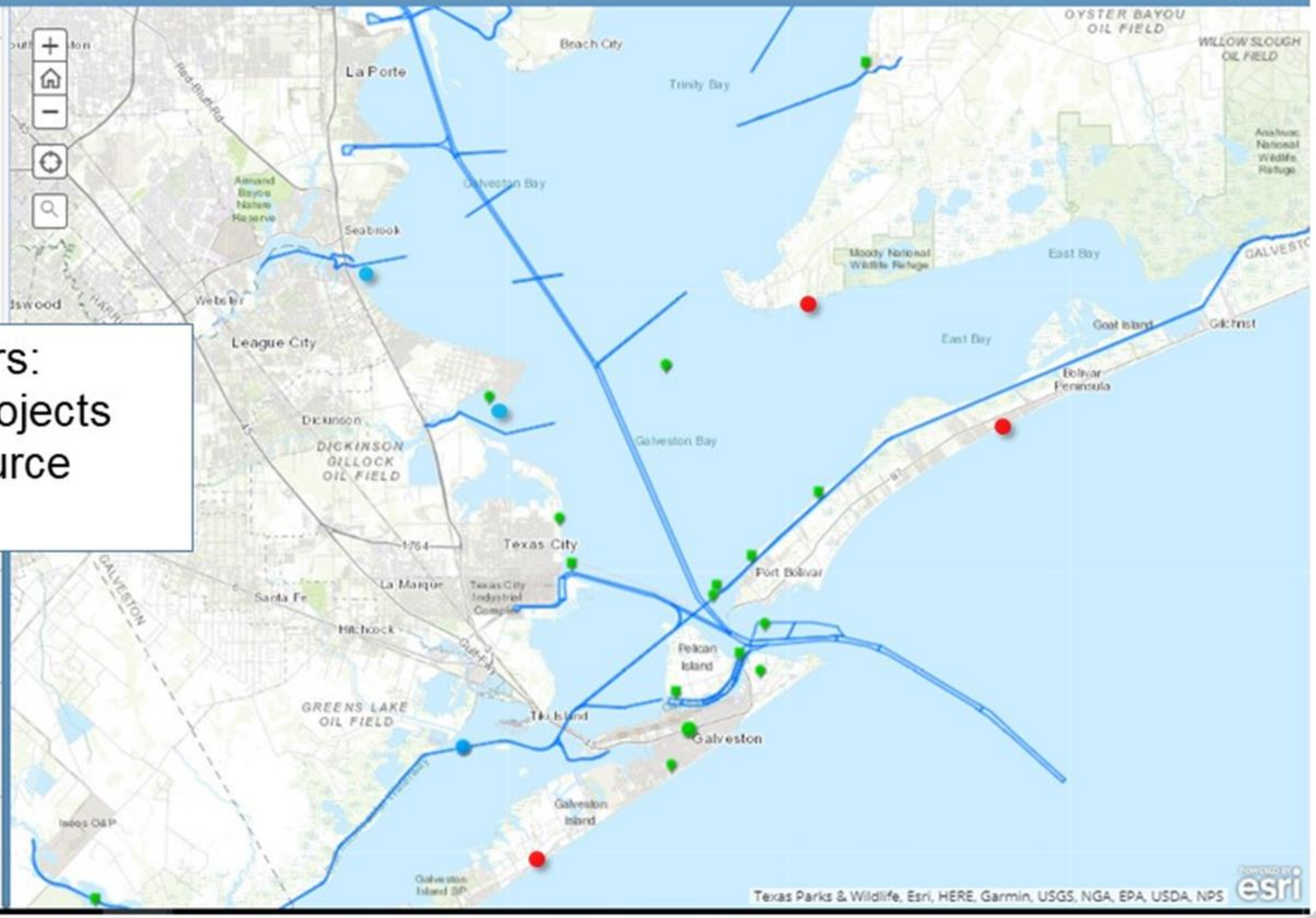
Sources: NIO, RSM

Data Layers:
USACE Projects
NIO Resource
NIO Need

8 Environmental Considerations

9 Environmental Impact

10 All Data



Environmental

Natural Infrastructure Opportunities Tool - Connecting Resources to Needs

A decision support tool

US Army Corps of Engineers

5 Sediment Baseline Conditions

6 Resource Needs

7 Resource Connections

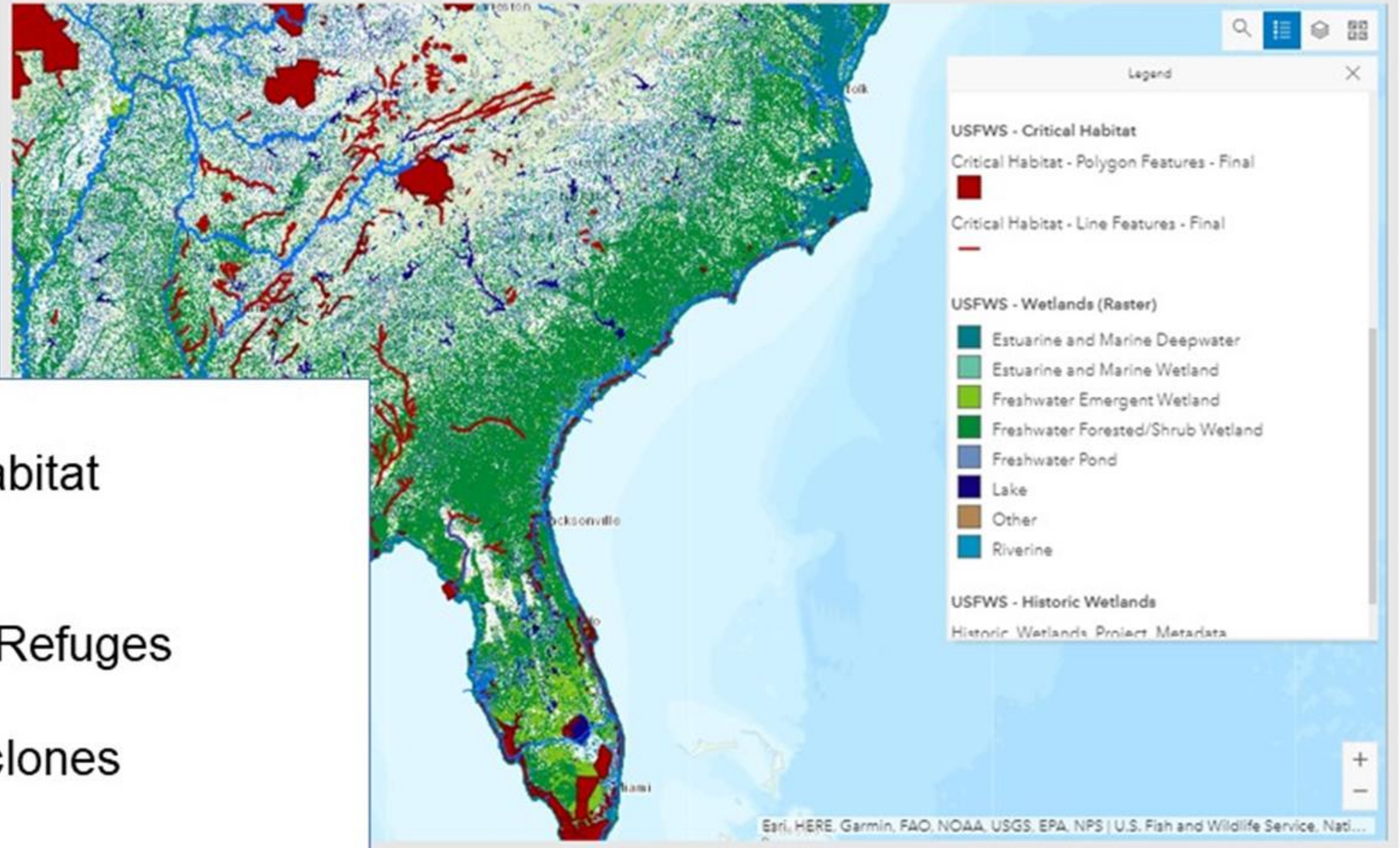
8 Environmental Considerations

9 Environmental Impact

How to use this map:

- View the NIO Environmental Impact Map
  - Zoom to your area of interest and di
    considerations.
  - Click on the Legend button in the up
    available.
  - Click on features in the map to unco
    site.
  - Use the map tools in the upper righ
  - Available Map Layers:
    - National Wildlife Refuge

Environmental Impact Map



Data Layers:
Essential Fish Habitat
Oyster Beds
Seagrasses
National Wildlife Refuges
Wetlands
Major Global Cyclones
Hurricanes
NCF-Channel area

Research and Development Center

Contacts and Connections

Natural Infrastructure Opportunities Tool - Connecting Resources to Needs

A decision support tool

US Army Corps of Engineers

8 Environmental Considerations

9 Environmental Impact

10 All Data

11 Connections & Contacts

The Natural Infrastructure Initiative membership includes: Caterpillar, AECOM, Great Lakes Dredge & Dock, The Nature Conservancy, Ducks Unlimited, University of Georgia - Institute for Resilient Infrastructure Systems, Brown & Root, and Dawson & Associates.

The NIOT was developed in collaboration with the Natural Infrastructure Initiative, US Army Corps of Engineers Engineer Research and Development Center (ERDC), and US Army Corps of Engineers Mobile District.

Use the lists on the right to view each of the Have/Need Resources submitted by

Need Resources

Vicksburg, MS
Wetlands and Coastal Ecology
ERDC TEST
https://www.erdc.usace.army.mil/Locations/EL/
Demo

Name of Need Here
USACE
ERDC-RDE-EL-MS
www.usace.army.mil
A description of your resource need goes here

Name of Need Here
Organization name Here
Office Name Here
yourwebsite.com
I need sandy material

Last update: 2 hours ago

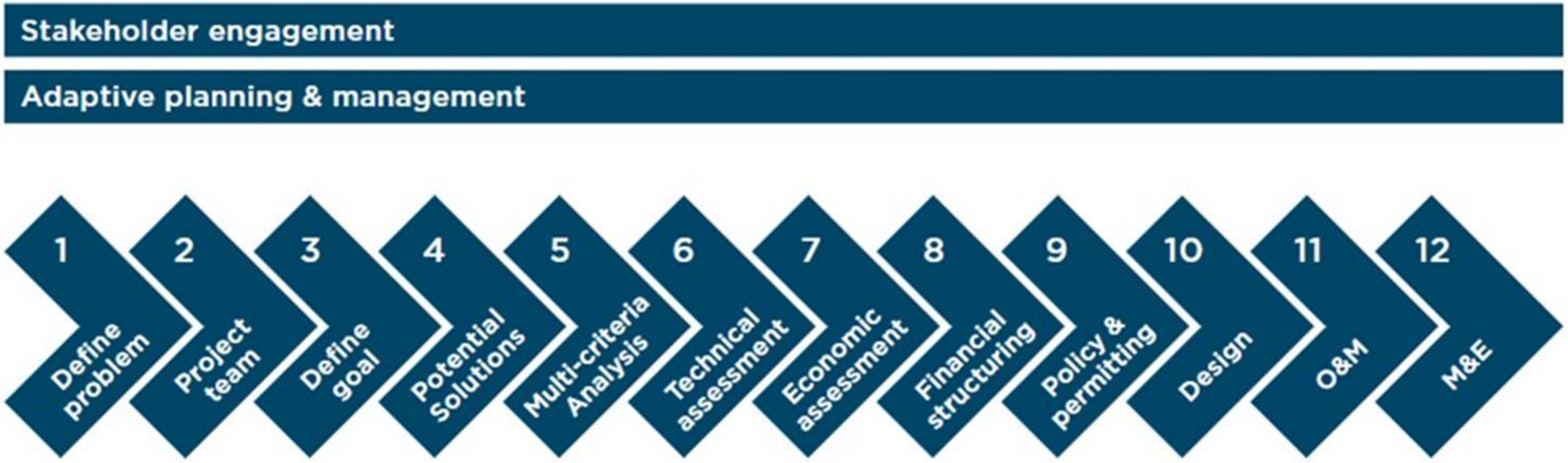
Have Resources

Title of Resource Here
Your Agency Name Here
Your Office Name Here
Your Website Here
Amount of Resource: 10000 cy

Last update: 2 hours ago

Integrating Natural Infrastructure

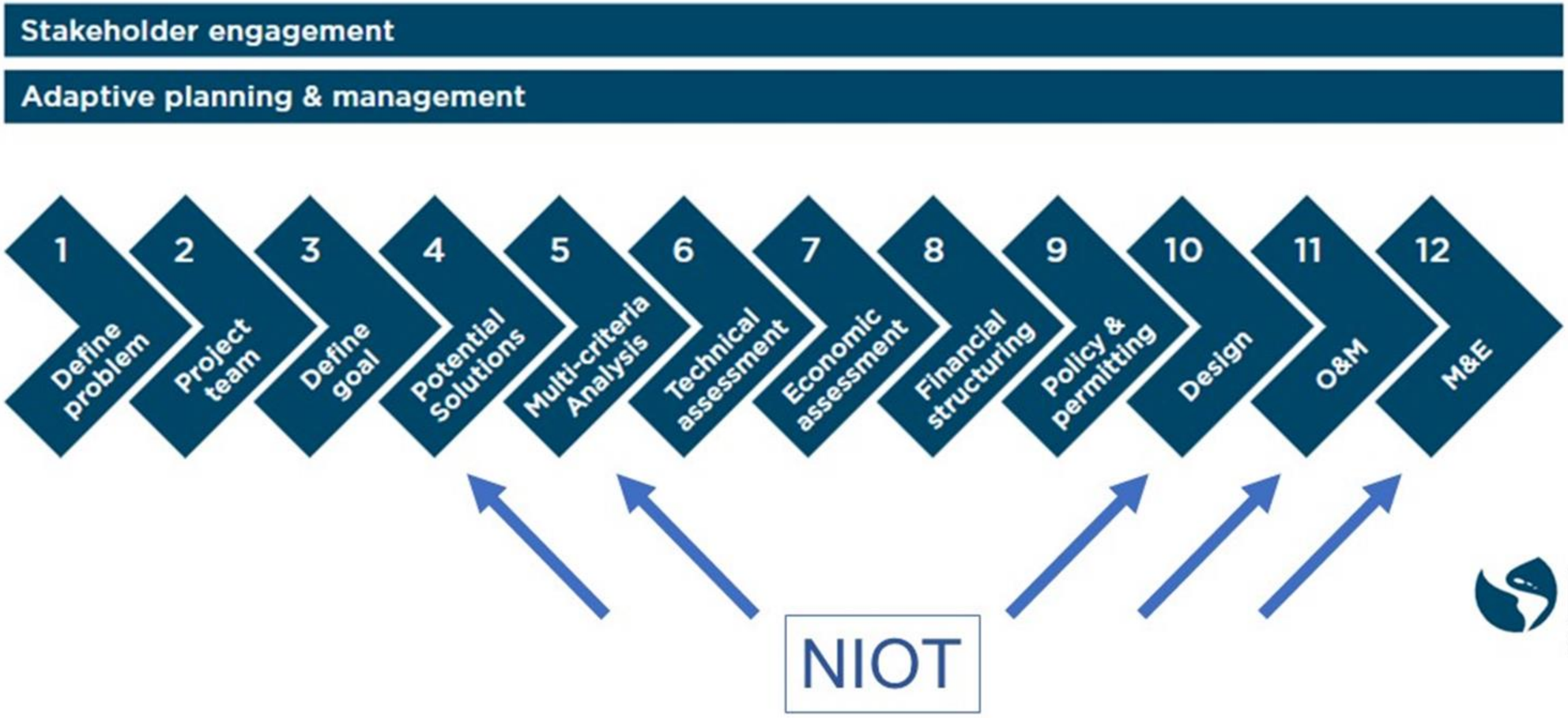
Increasing infrastructure resilience with Nature-based Solutions (NbS)



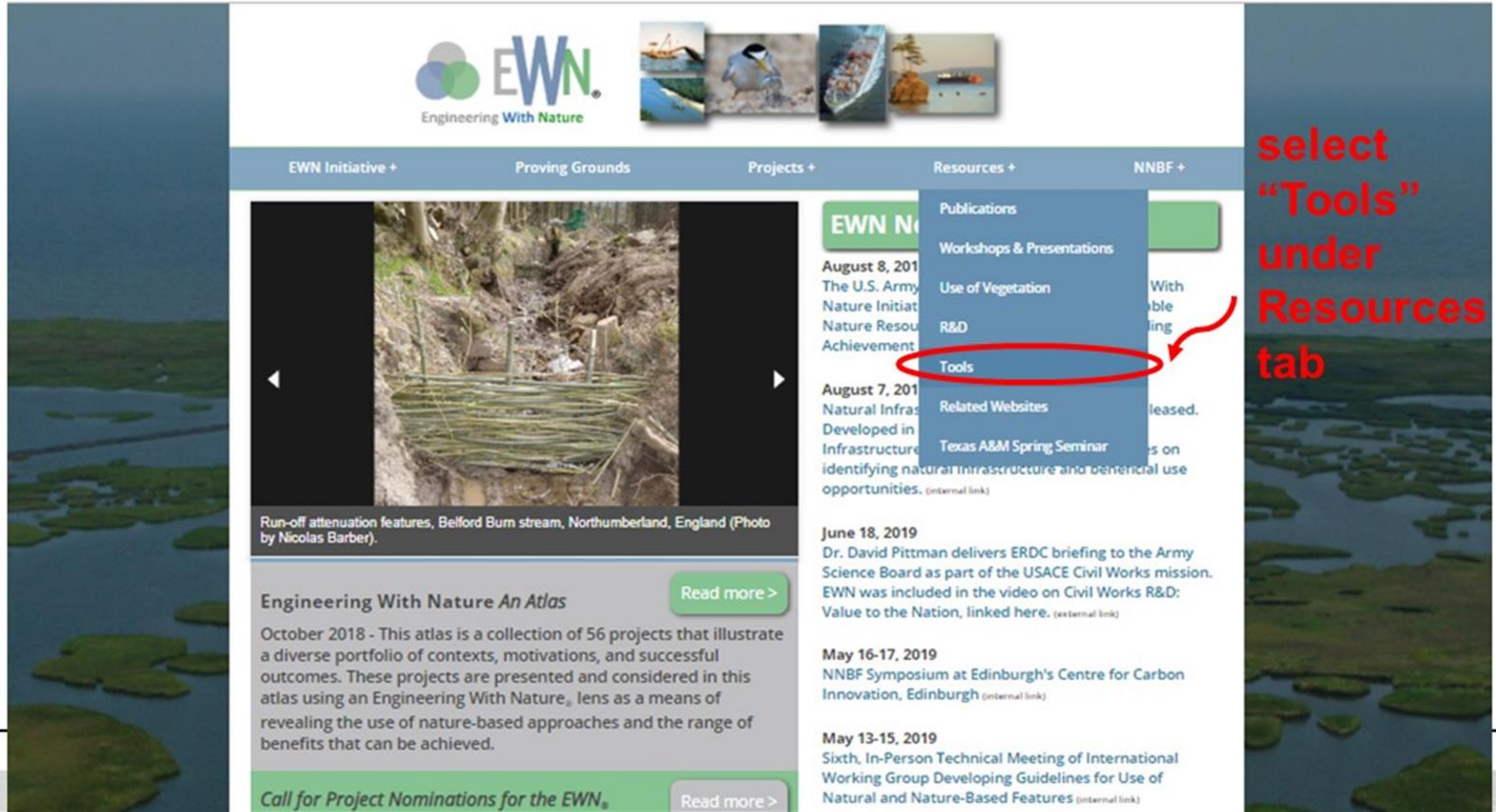
IDB
Inter-American Development Bank

Integrating Natural Infrastructure

Increasing infrastructure resilience with Nature-based Solutions (NbS)



Where to find NIOT: https://ewn.el.erdc.dren.mil/ http://engineeringwithnature.org



https://ewn.el.erdc.dren.mil/tools.html

EWN
Engineering With Nature

EWN Initiative + | Proving Grounds | Projects + | Resources + | NNBF +

Tools

Natural Infrastructure Opportunities Tool

The public facing *Natural Infrastructure Opportunities Tool (NIOT)*, developed in collaboration with the Natural Infrastructure Initiative, focuses on identifying natural infrastructure and beneficial use opportunities. Through map-based visualizations of environmental, geomorphic, and sediment conditions, as well as upcoming USACE projects, and an interface for users to add their resource needs and resource availability, this portal will help discover natural infrastructure connections and inspire innovative opportunities.

The aim of the viewer is to provide a data informed perspective for multiple stakeholders with the goal of finding mutually beneficial strategies to improve and increase investment in the use and creation of natural infrastructure. The viewer is intended to be used in collaboration, as a platform to generate new ideas about natural infrastucture projects during the planning stages.

The NIOT viewer was developed through iterative collaboration with representatives from Caterpillar Inc., The Nature Conservancy, Great Lakes Dredge and Dock, AECOM, USACE ERDC and USACE Mobile District. The viewer brings together datasets from multiple sources in one place and also allows users to identify current infrastructure projects, and directly add resource or project needs. Resource connections, as well as points of contact, are integrated into supporting databases and appear on the viewer map. The viewer includes national and regional datasets, and also provides users the option to request the addition of user-identified geospatial data layers, allowing NIOT to be adapted for regional use and fine tuned for local application.

Type: Web application
User: Public and USACE
POC: Safra.Altman@usace.army.mil
NIO Tool User Guide (PDF)
Visit Natural Infrastructure Opportunities Tool web application

---

Engineering With Nature Project Mapper (ProMap)

ProMap is a geography-based data viewer for projects that fit within the EWN context. The aim of the mapper is to allow users to explore information that can be helpful in developing EWN ideas during the planning of their own projects. Projects can be viewed based upon infrastructure type (e.g., dredging project, breakwater, lock & dam) or by their intended environmental or social benefits.
(see User's Guide)

Type: Web Application
User: Public and USACE
ProMap Platform Presentation (PDF)
ProMap Poster Presentation (PDF)
ProMap ERDC Technical Note

Concluding Thoughts

- USACE ERDC, Mobile and Galveston Districts have developed an extensible framework that uses available Corps enterprise databases and integrates data collection and analysis tools.
- Database capabilities, tools, and methods are extendable to other projects, USACE Districts, and infrastructure opportunities.
- In collaboration with the Natural Infrastructure Initiative the public facing *NIOT* web-viewer focuses on identifying beneficial use and infrastructure opportunities.

Future Directions

- Getting user feedback and adding additional data (Virtual Workshop)
- Developing contacts, documenting use, connections and collaboration
- Developing case studies
- Phase II – Developing tool capability
  - Overlay tools to identify NI project types for a given region
  - Overlay tools for spatial prioritization

We need feedback and data! Check out the viewer!

http://engineeringwithnature.org