

# From Data to Decisions

Developing Tools to Inform Regional Restoration

Joshua Moody & LeeAnn Haaf

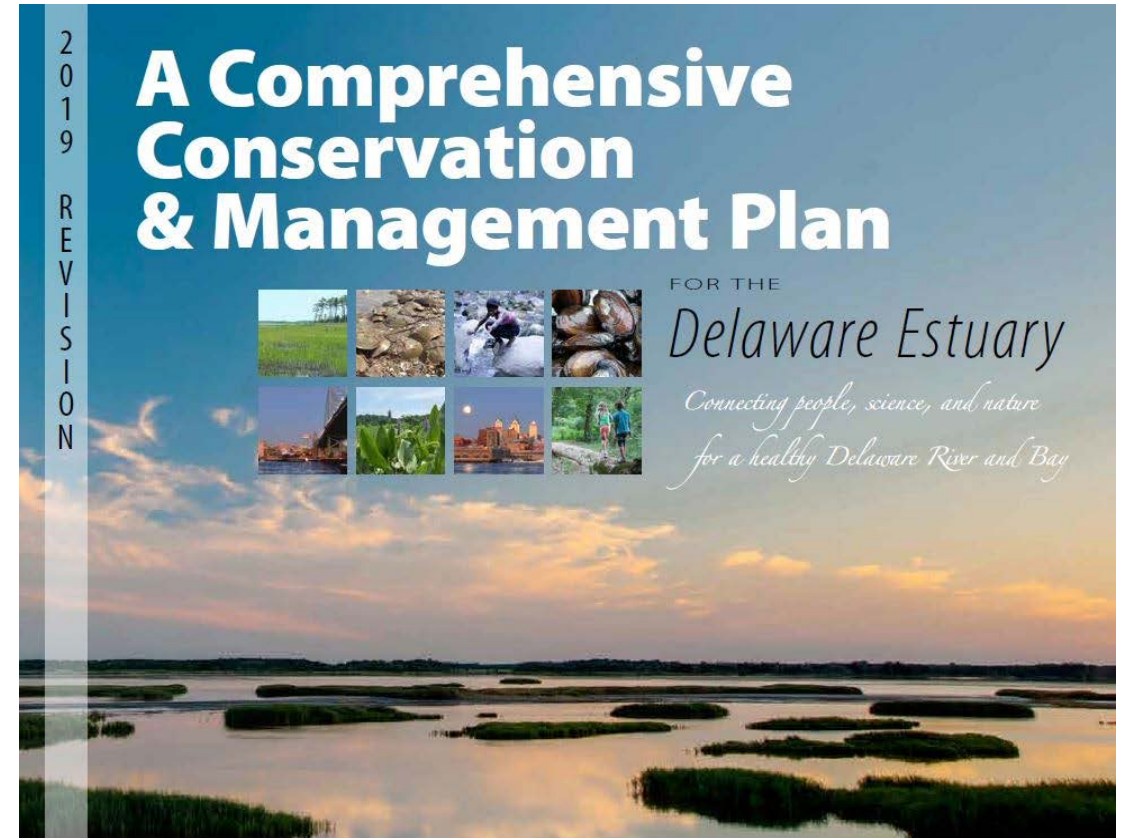
Partnership for the Delaware Estuary

[jmoody@delawareestuary.org](mailto:jmoody@delawareestuary.org)



# Understanding vulnerability & restoration are priorities

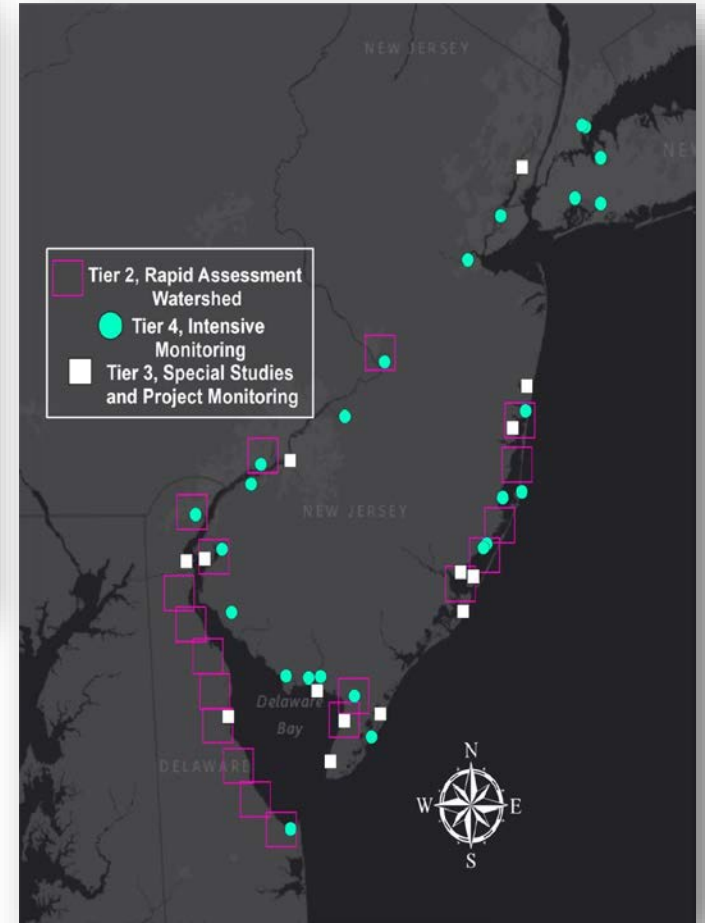
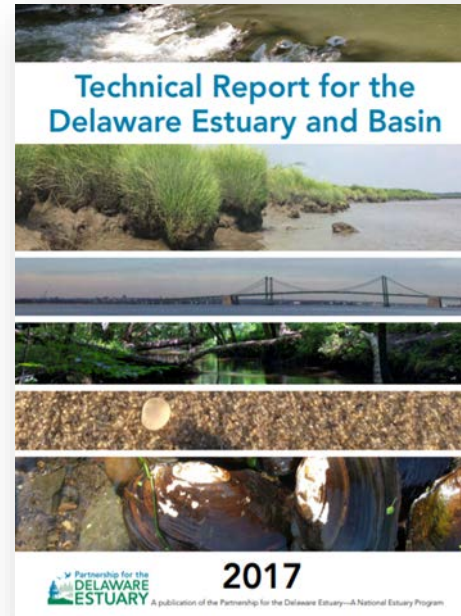
- Goal 1: Prevent Wetland Loss
  - H1.2: Restore....tidal wetlands
  - H1.3: Develop/implement NNBS
  - H1.4: Protect, enhance...non-tidal...
- Goal 3: Increase/Improve Shellfish Habitat
  - H3.2: Restore oyster beds...
  - H3.3:...restore...mussel populations
  - H3.4: Protect/restore HSC & habitat...



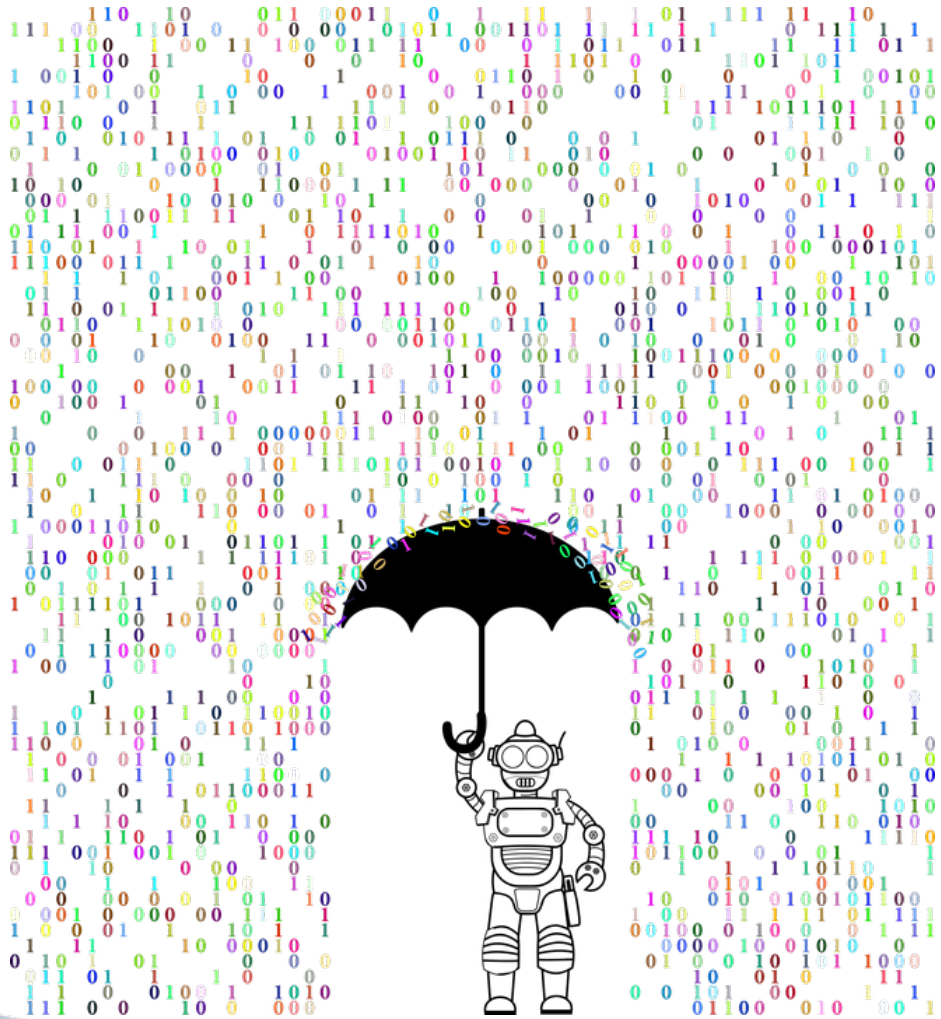


# PDE is a Science-based Organization: Data Collection & Synthesis

- Mid-Atlantic Coastal Wetland Assessment (MACWA)
  - Regional wetland health
- Delaware Living Shoreline Initiative
  - Implementation (on-the ground)
- Freshwater Mussel Recovery Program
  - Conservation/Restoration, Reintroduction



# How can we translate data into decisions?



# Tools organize data and can inform intervention decisions

## Level 1: Site Prioritization

Where should we focus resources (dependent on goals)?



## Level 2: Site-specific Issue Diagnosis

What is the problem and where is it located?  
Is the problem occurring now or upcoming?



## Level 3: Issue-specific Tactic Selection

What method will address the issue today and tomorrow?

- CERAP: Coastal Ecological Restoration & Adaptation Plan

- WATCH: Wetland Assessment Tool for Condition & Health

- Living Shoreline Feasibility Model
- Marsh Futures

# Complementary tools & data sources form a pathway from investigation to intervention

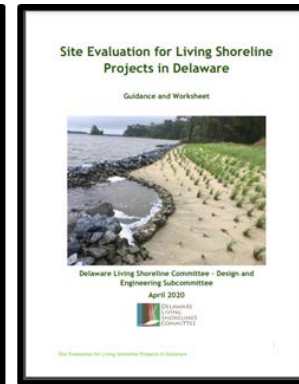
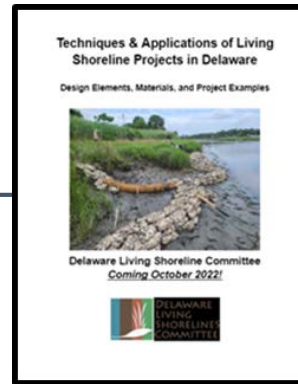
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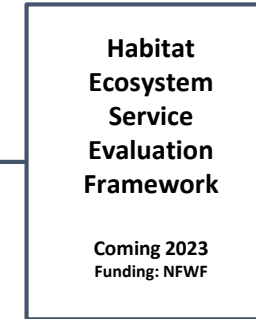
2. What is the problem?



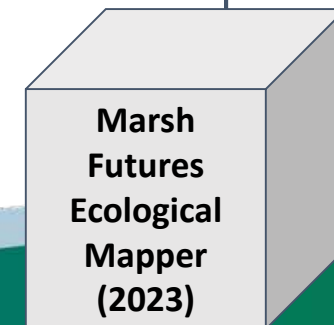
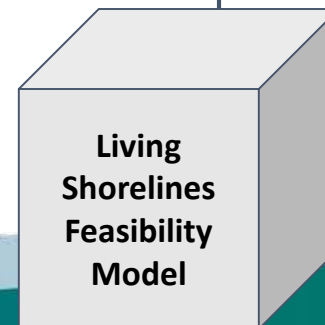
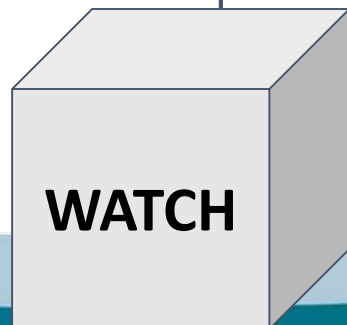
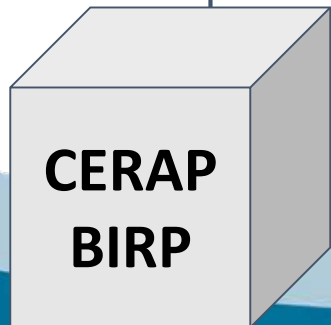
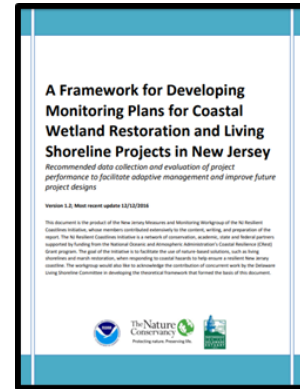
3. What are my design considerations?



4. What are the effects of different tactics?

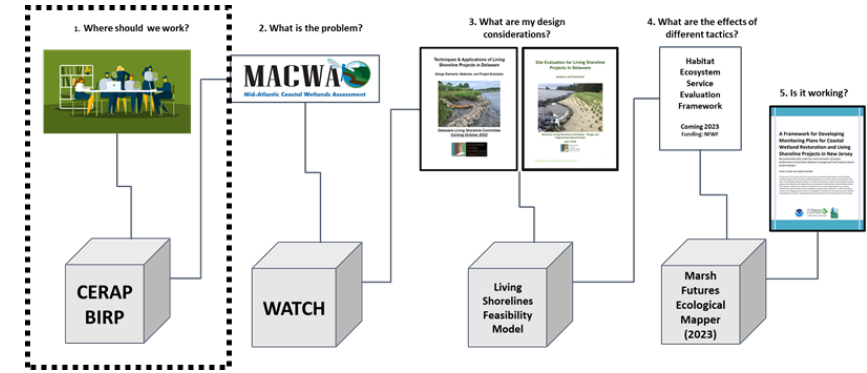


5. Is it working?

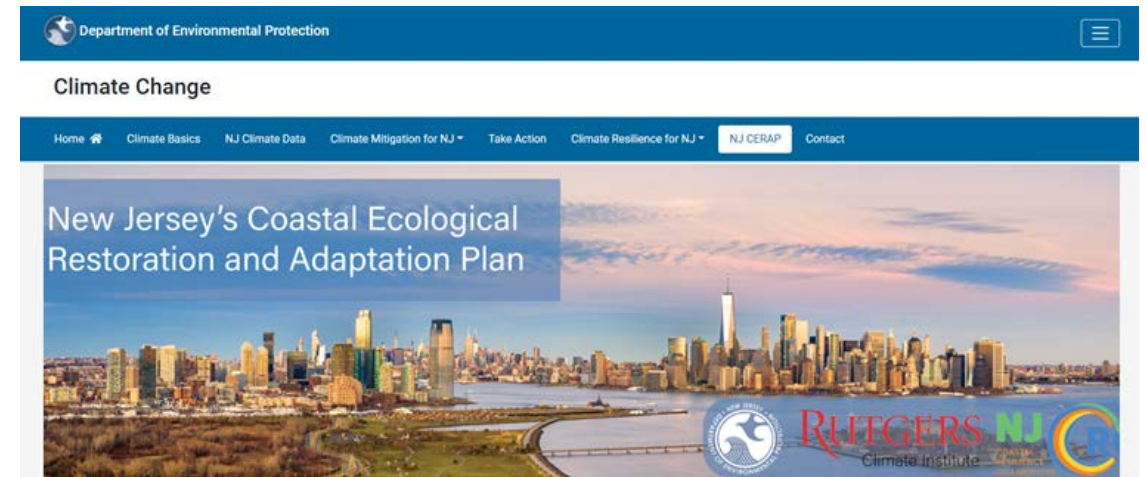




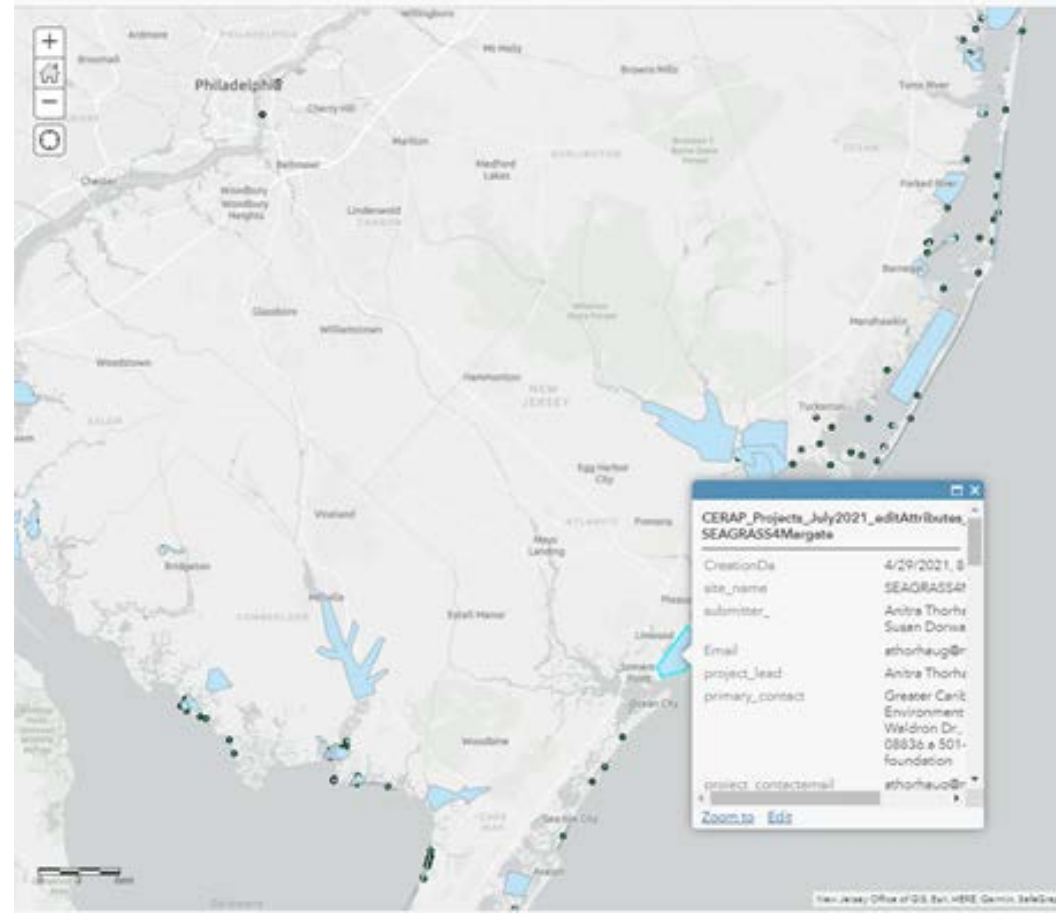
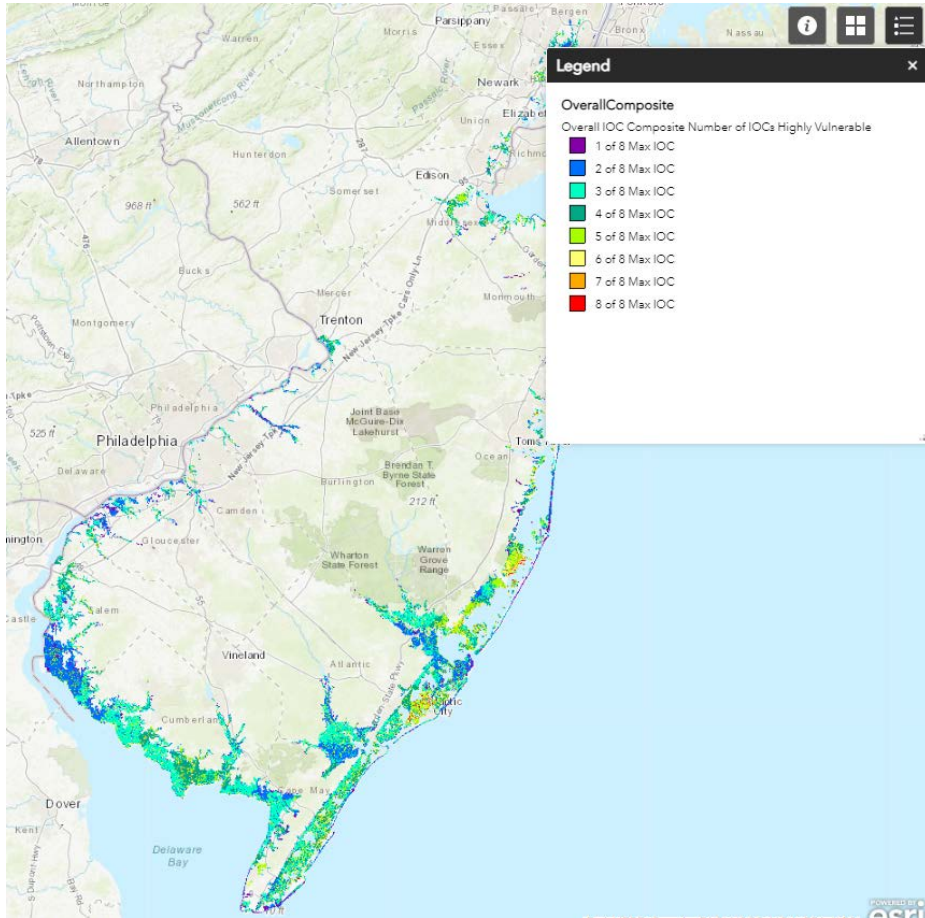
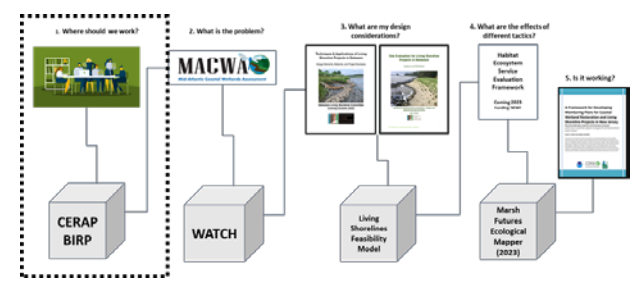
# CERAP: Where should we work?



- What sites **align** with state-defined issues of concern
- Virtual registry & Vulnerability Map
- Annual nomination period
- Stakeholder info collected
- Searchable by goals/IOCs
- Available end 2022

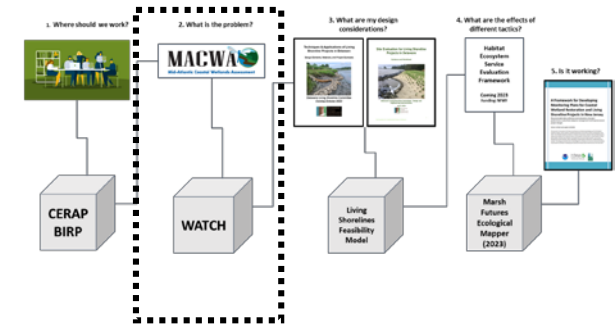
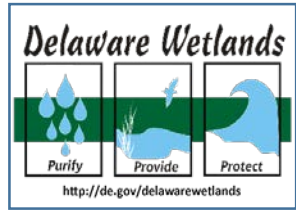


# CERAP: Where should we work?





# WATCH: What is the Problem?



An ecological framework to holistically evaluate

1. multiple qualities shown to be fundamental for salt marsh function
2. using scientifically defensible methods

Currently on-line & web-based tool available winter 2022

WATCH Workshop Examples - Excel

Metric	Method	Current or Most Recent Metric			Criteria Metric				Trajectory Metric				
		Value	Units	Measurement Justification	Low	High	Units	Type	Criteria Standard Justification	Low	High	Units per Year	Justification
Shoreline Position	RTK-GPS Survey	100	m	Average distance from road along 100m 1m transects	75	100	m	Reference	Modeled minimum width that would keep flooding off road =75m	-2.00	-4.00	m	Mean of 6 local marshes from google

Instructions | Regulatory Checklist | Horizontal Position | Vertical Position | Biology | Hydrology | Soil Condition | Water Chemistry | Output Summary | Output Reflection | Metrics & Methods | Tool Scoring and Rule Overview

# WATCH: What is the Problem?

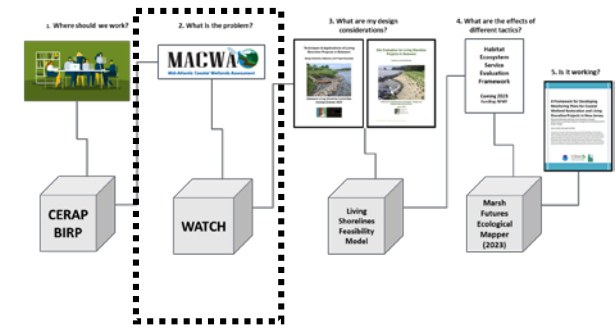
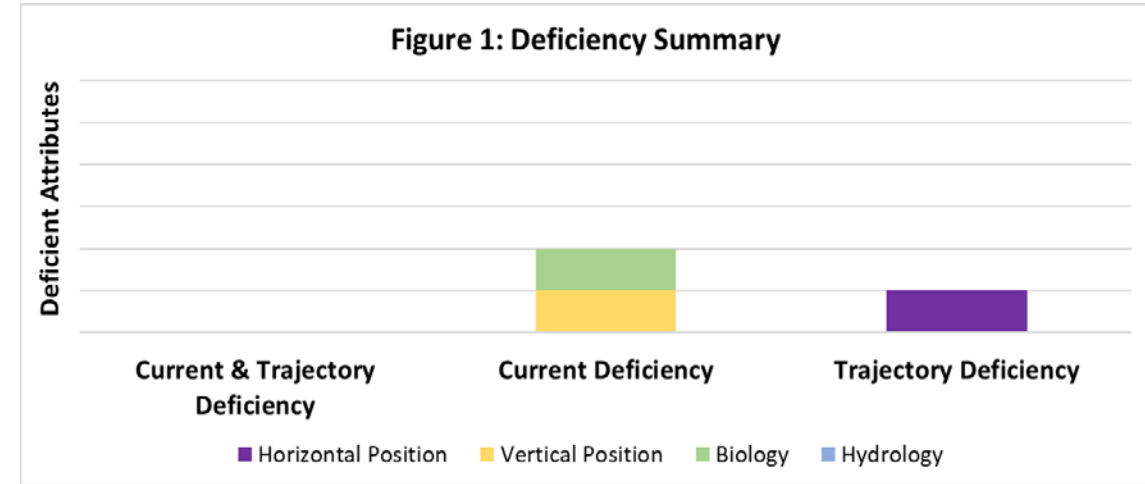


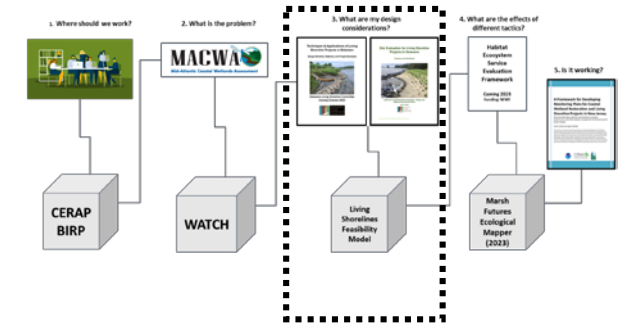
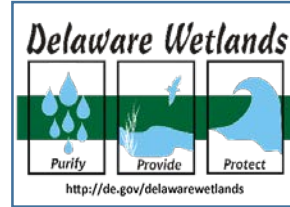
Table 1: Output Summary				
STATUS	Deficiency Detected			
	Horizontal Position	Vertical Position	Biology	Hydrology
<b>Attribute Violations</b>	1	0	0	0
Current Violation	0	1	1	0
Trajectory Violation	1	0	0	0
Associated attributes				
<i>Synopsis:</i>	<i>[sentences]</i>			

Table 2. Soil and sediment consideration summary		
Soil	Purnell	Consideration: moderate soil stability
Relationship	Consideration	
V & H	Building concentrated in low marsh	
V & TSS	Investigate subsidence, surface accretion, & decomp	
V & Decomp	Platform building but potentially soft/unstable	
H & TSS	Good sediment delivery to low marsh	
H & Decomp	Low marsh building but potentially soft/unstable	
TSS & Decomp	Investigate source and composition of TSS	

Table 3. Water chemistry consideration summary		
	Output	consideration:
Salinity	mesohaline (11-13 ppt)	good carbon seq potential/ribbed mussel
Nutrients	& [nutrient situation]**	N and P from map



# Living Shoreline Feasibility Model: What are My Design Considerations?



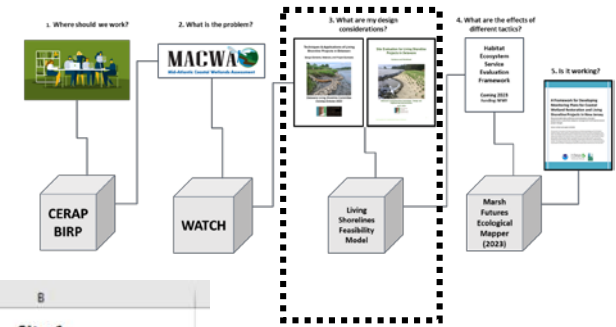
An integrative tool to:

1. **Evaluate** considerations regarding the **installation and maintenance**;
2. **Catalogue differences** (sites, stakeholder perspectives, multi-phased projects)
3. **Inform** team building prior to project initiation

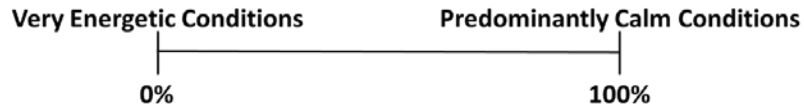
**Currently on-line  
& web-based tool  
available summer  
2023**



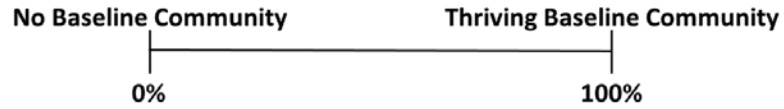
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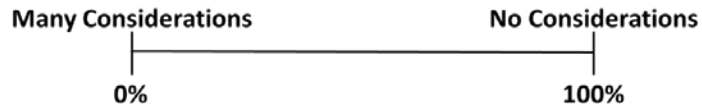
- Physical Conditions



- Biological Baseline



- Site Access

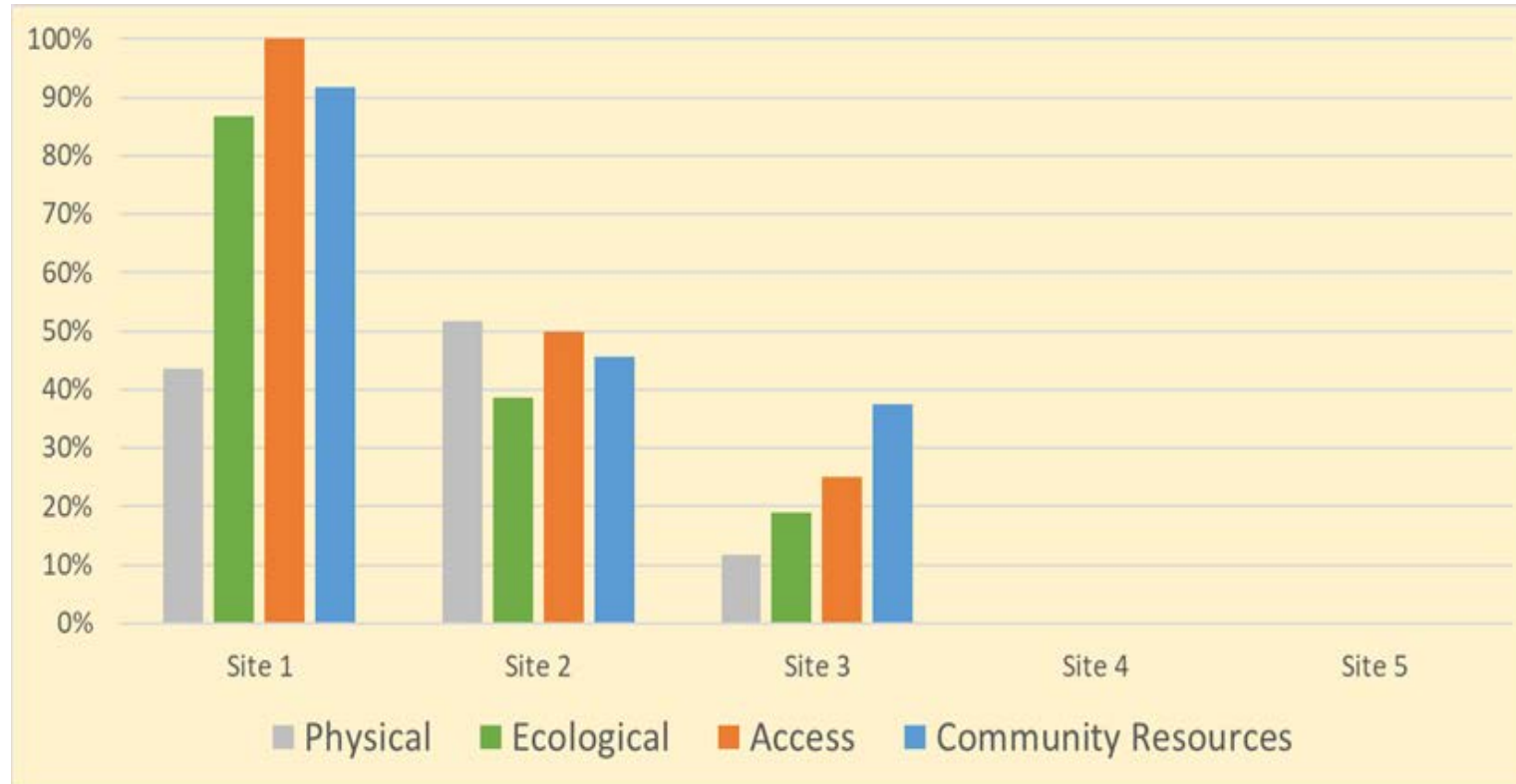
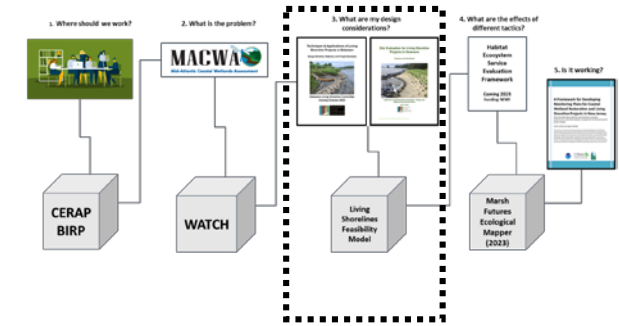


- Community Resources

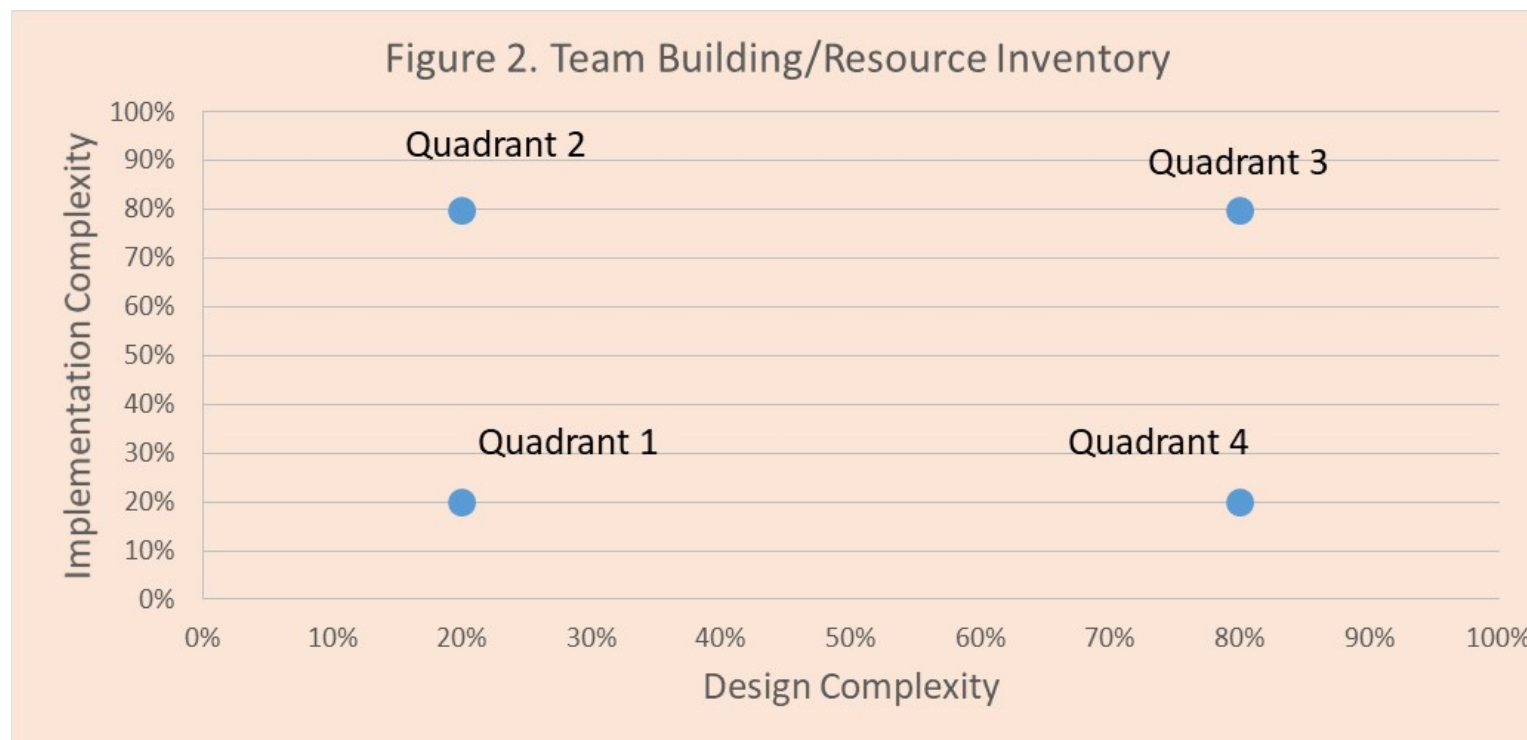
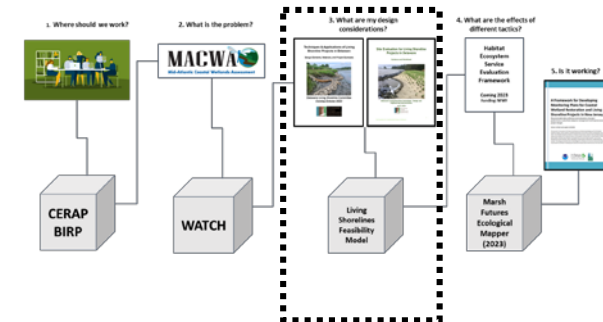


	A	B
	Metric	Site 1
1		
2		
3		
4	Water Body Energy	
5	Positional Energy	
6	Storm Event Energy	
7	Persistent Wave Energy	
8	Boat Wake Energy	
9	Nearshore Slope (Stevens guide)	
10	On-site Shoreline Condition	
11	Surrounding Shoreline Condition	
12	<b>Physical Score</b>	#N/A
13		
14	Percent Canopy Shading	
15	Intertidal Vegetation Community Status	
16	Intertidal Vegetation Substrate	
17	Subtidal Vegetation Community Status	
18	Subtidal Vegetation Substrate	
19	Upland Vegetation Community Status	
20	Upland Vegetation Substrate	
21	Shellfish Community	
22	<b>Ecological Score</b>	#N/A
23	<b>Physical + Biological Score</b>	#N/A
24		
25		
26	Material Delivery	
27	Landowner Agreement	
28	Personnel Access	
29	Working Window	
30	Regulatory Considerations	
31	<b>Site Access Score</b>	#N/A
32		
33	Public Outreach/Education Potential	
34	Community Stewardship	
35	Resource/Capital Availability	
36	Enthusiasm for Nature Based Infrastructure	
37	Community Protection	
38	Environmental Justice Leverage Potential	
39	<b>Community Resources Score</b>	#N/A
40	<b>MC&amp;C and CS Score</b>	#N/A
41		
42		
43		
44		

# Living Shoreline Feasibility Model: What are My Design Considerations?



# Living Shoreline Feasibility Model: What are My Design Considerations?





# Marsh Futures Mapper: What are the Effects of Different Tactics?

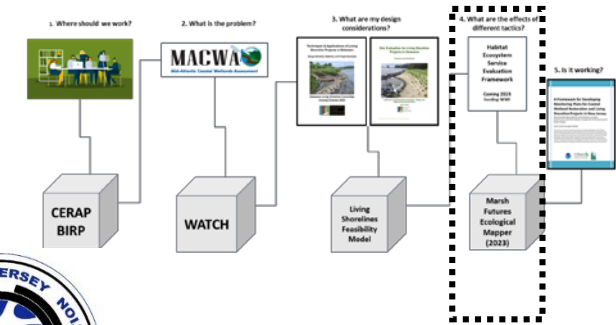
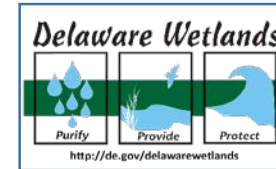


NFWF



RUTGERS

Center for Remote Sensing and Spatial Analysis

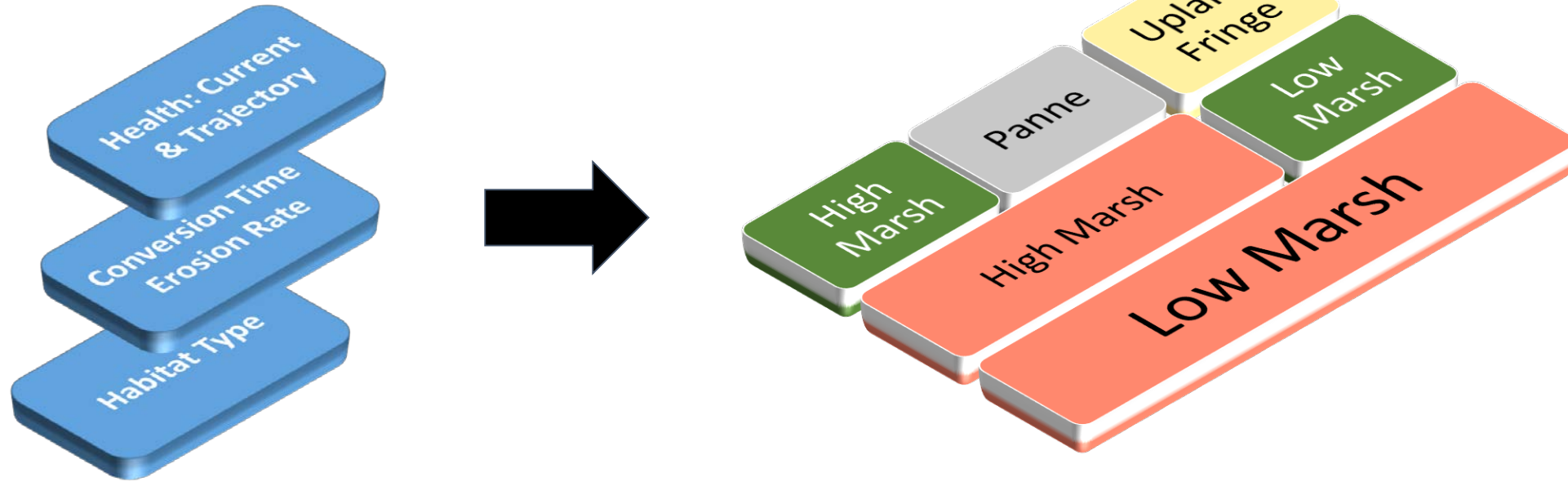
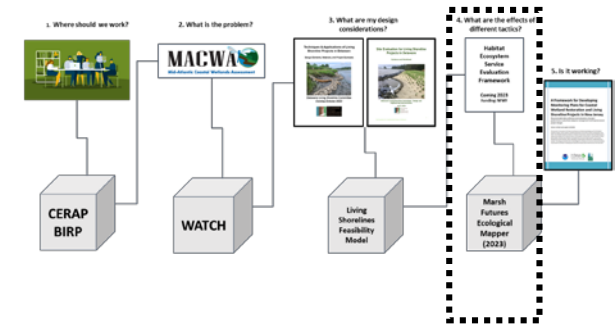


A GIS mapper that:

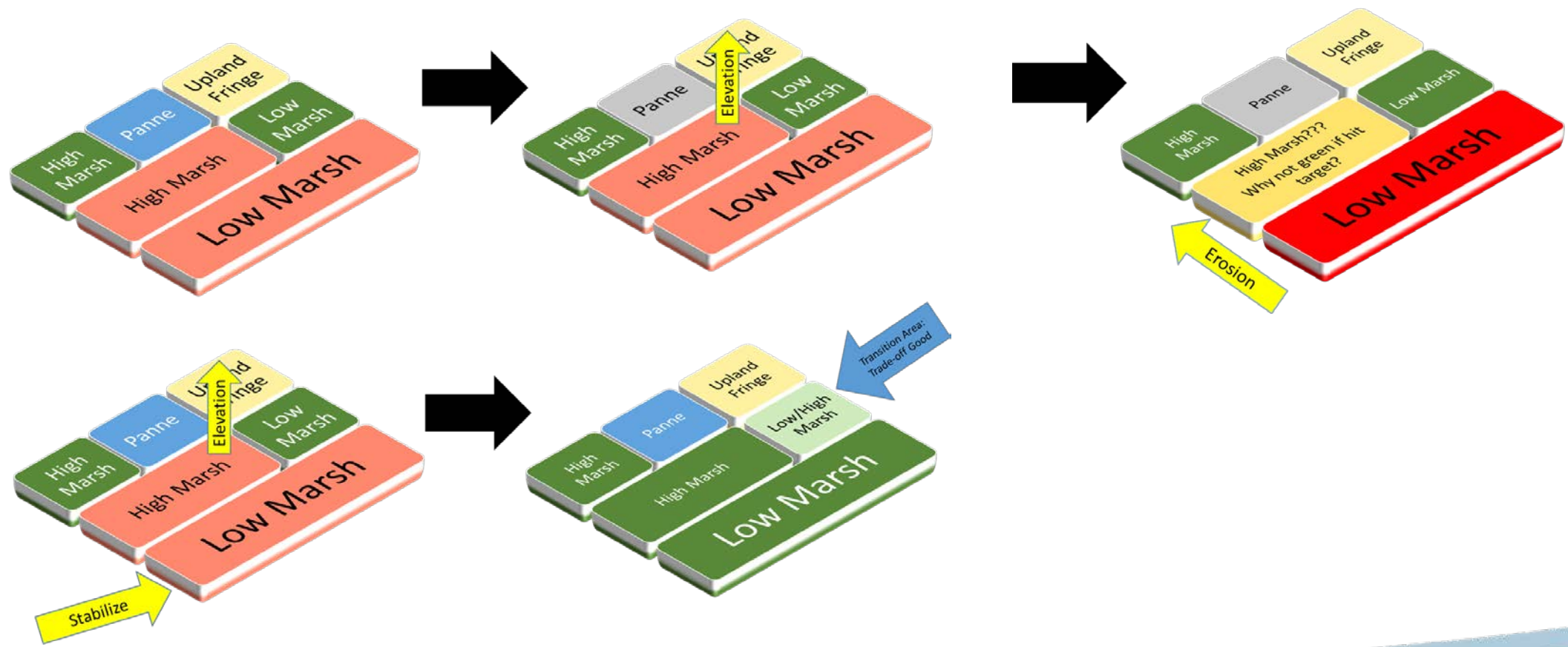
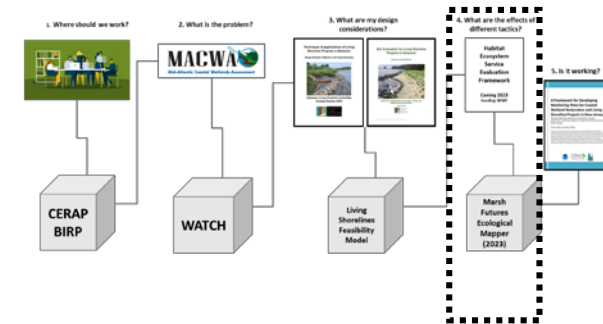
1. Develops a landscape-level health mosaic, and
2. Evaluates spatial changes in vulnerabilities due to changes at a single location



# Marsh Futures Mapper: What are the Effects of Different Tactics?



# Marsh Futures Mapper: What are the Effects of Different Tactics?





# Complementary tools & data sources form a pathway from investigation to intervention

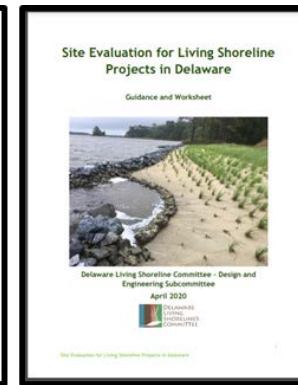
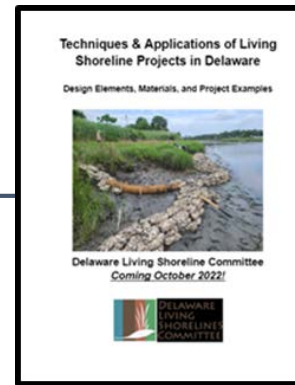
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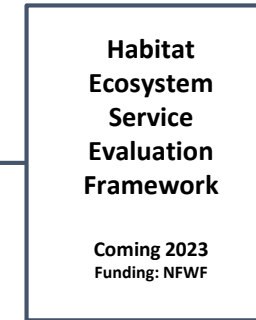
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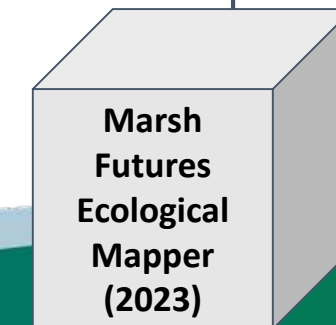
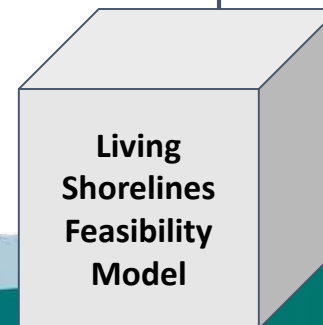
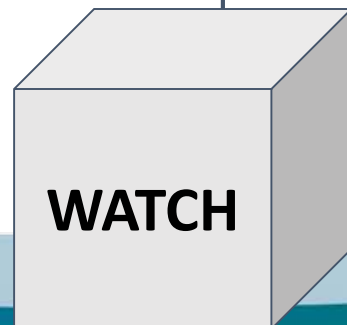
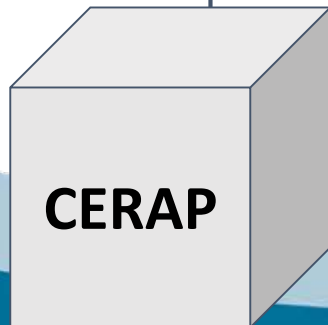
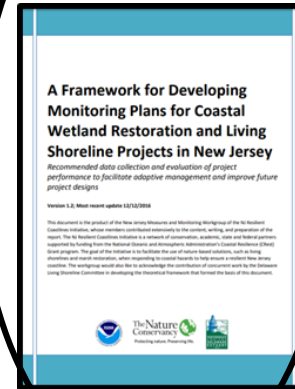
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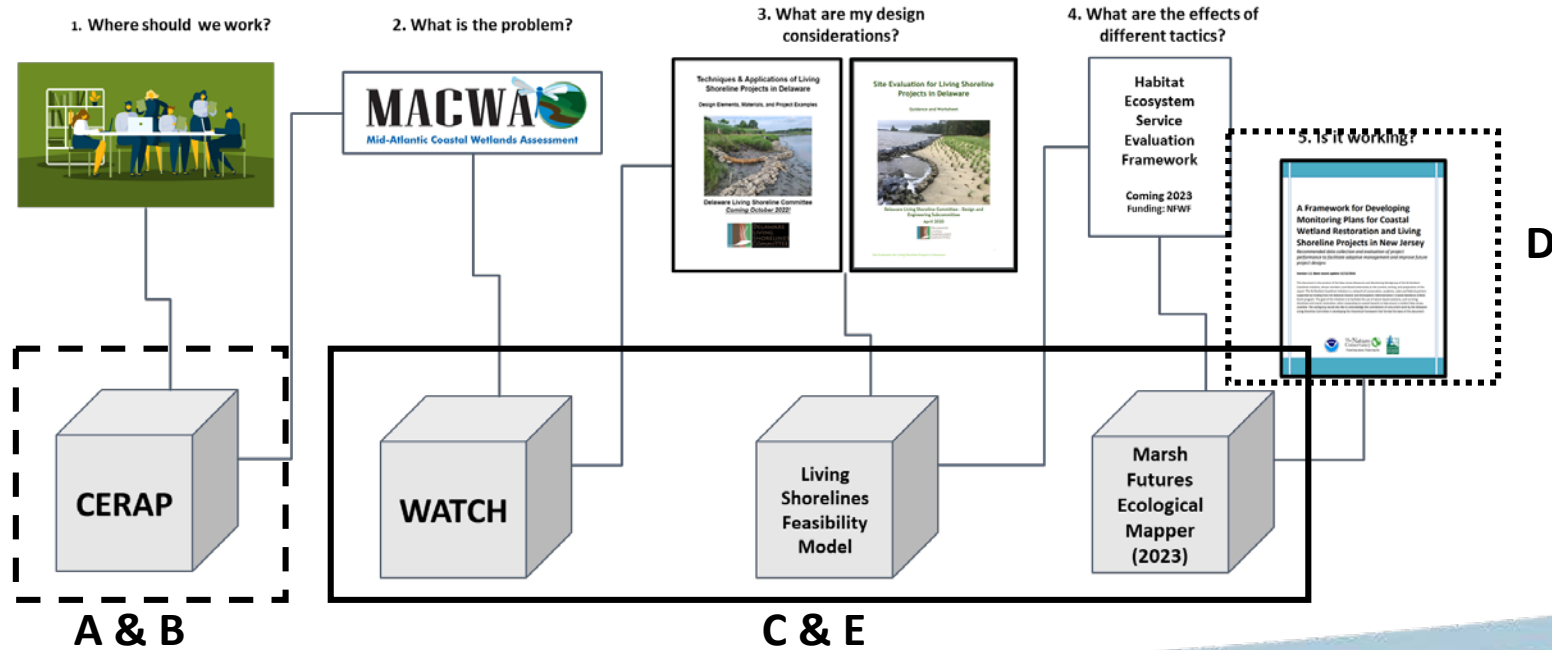
5. Is it working?





# Topics/challenges

- A. Capacity building for improved management of wetland and coastal community resilience
- B. Working with stakeholders: human-centered design
- C. Translating scientific information for decision making at all levels
- D. Barriers and opportunities for successful implementation of management actions
- E. Dealing with uncertainty associated with data and information limitations



# Questions & Discussion

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Restoration Programs Manager

Partnership for the Delaware Estuary

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# ResTOr Suite - Restoration Tool Organization Suite (WATCH/MF/LSFM?/etc...)

**Biology**

Metric

Method

Current or Most Recent Metric

Value [ ] Units [ ]

Justification:

Criteria Metric

Low [ ] High [ ]

Units \_\_\_ Type [ ]

Justification:

Trajectory Metric

Low [ ] High [ ]

Units per Year [ ]

Justification:

Forecasted or Projected Metric

Years in Future [ ]

Justification:

Low \_\_\_ High \_\_\_ Units \_\_\_

Current Violation  
 Trajectory Violation

Deficiency Detected Attribute Status

**Layer Options Dropdown**

- WQ
- LULC
- Salinity
- Soils

Text box like associated with CERAP sites/areas that has summary of available data that could be used by WATCH/MF(?) user when they "click" on a station

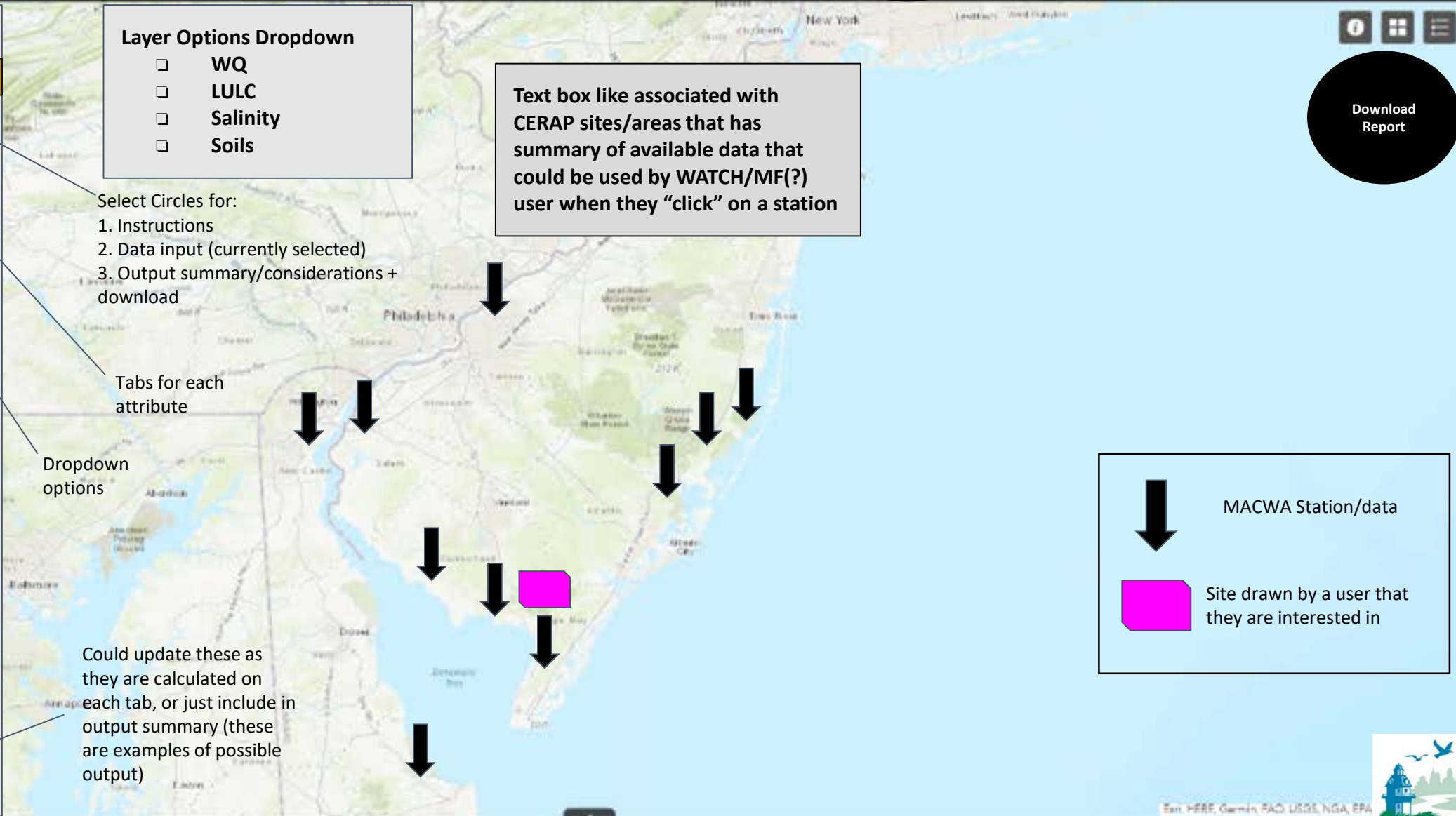
Select Circles for:

1. Instructions
2. Data input (currently selected)
3. Output summary/considerations + download

Tabs for each attribute

Dropdown options

Could update these as they are calculated on each tab, or just include in output summary (these are examples of possible output)

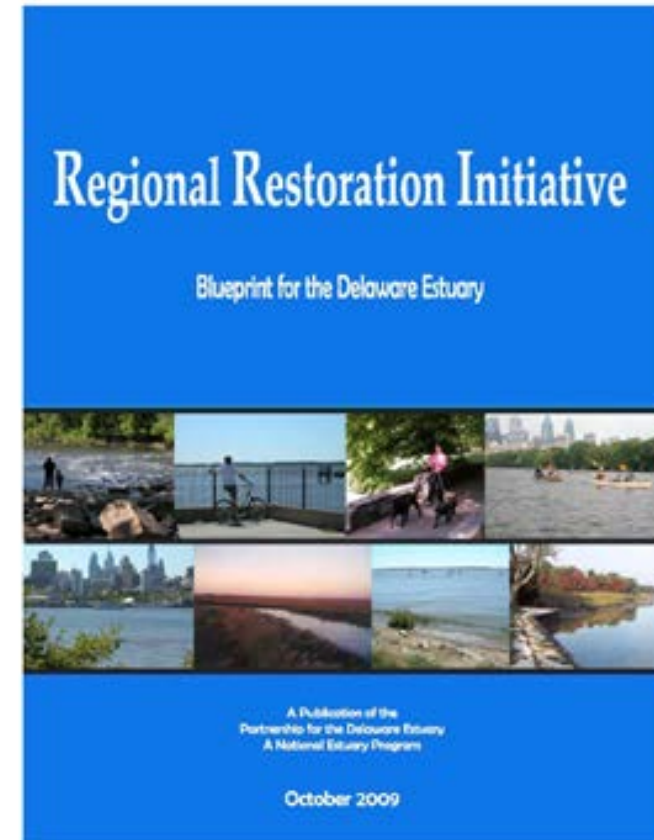


MACWA Station/data  
 Site drawn by a user that they are interested in

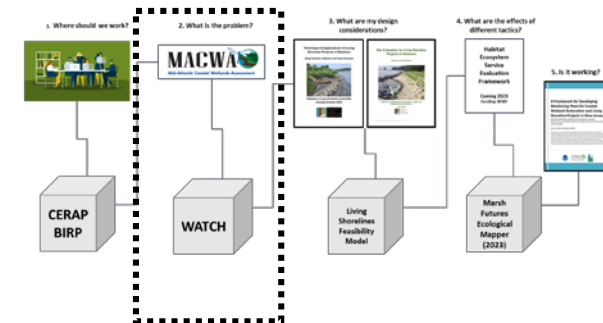


# The Regional Restoration Initiative

- 2009 Goals:
  - Develop sci-based decision-making tools
  - ID high value restoration/natural capital
  - Prioritize and rank\*
- Initial Target Tools
  - Project registry
  - Decision matrices
- New Understanding
  - Resources required to manage such a database
  - Variability in data sources and manipulation needs/expertise
  - Variability in goals: align not rank\*
  - Multi-tool needs
- Need a path forward through partnership



# WATCH: What is the Problem?

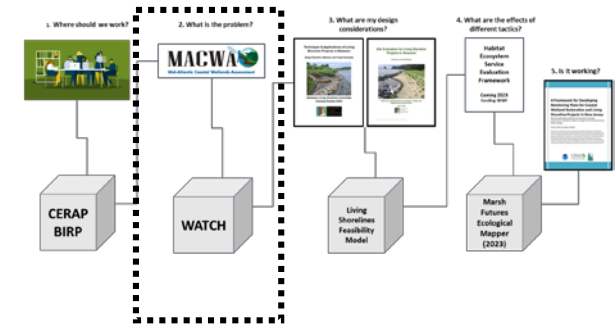
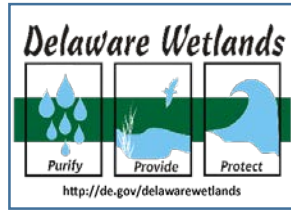


WATCH Workshop Examples - Excel

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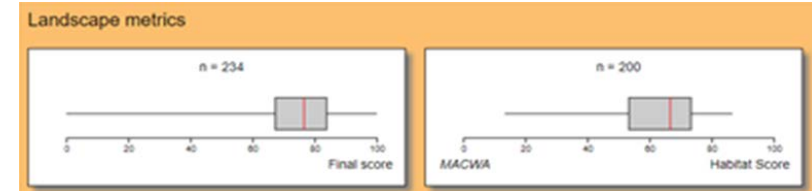
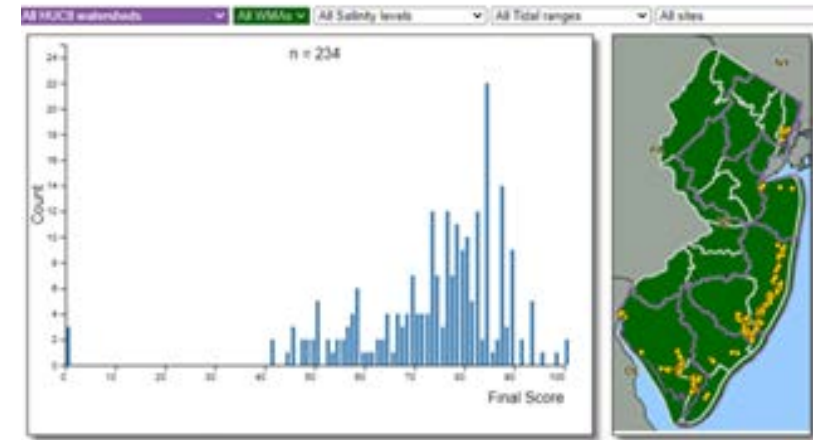
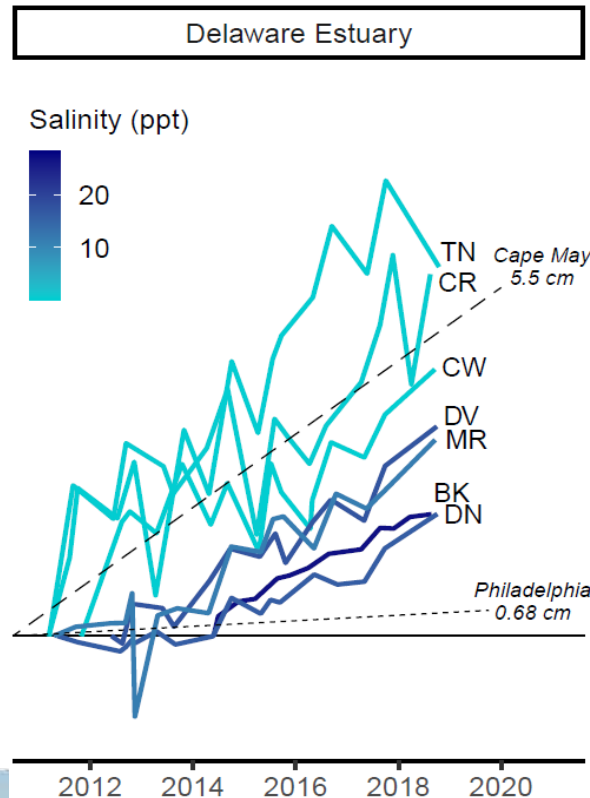


Reference Data:

MACWA

Reference Wetlands Database

Current State & Trajectory



<https://delawareestuary.org/science-and-research/tools/>



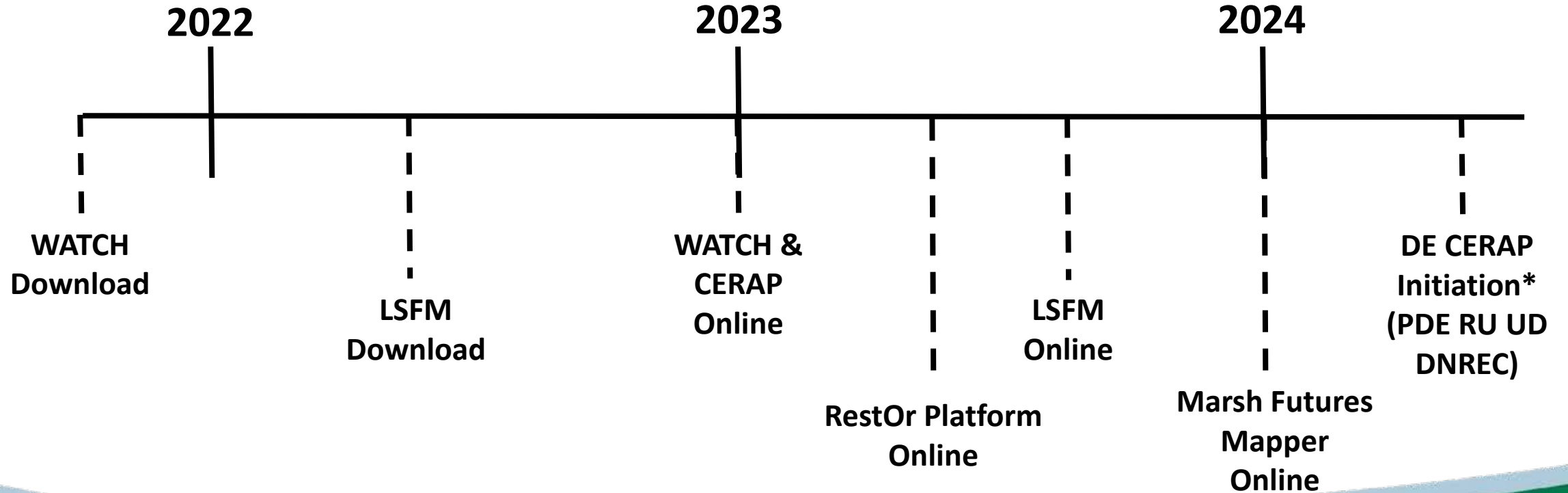
# Timeline: PDE & Rutgers

Richard Lathrop: Director Grant F. Walton Center For Remote Sensing and Spatial Analysis  
Lucas Marxen: Associate Director, Office of Research Analytics

2020 NFWF DWCF: WATCH

2021 NFWF DWCF: Marsh Futures Mapper

2022 NFWF CRF: CERAP II (Submitted)

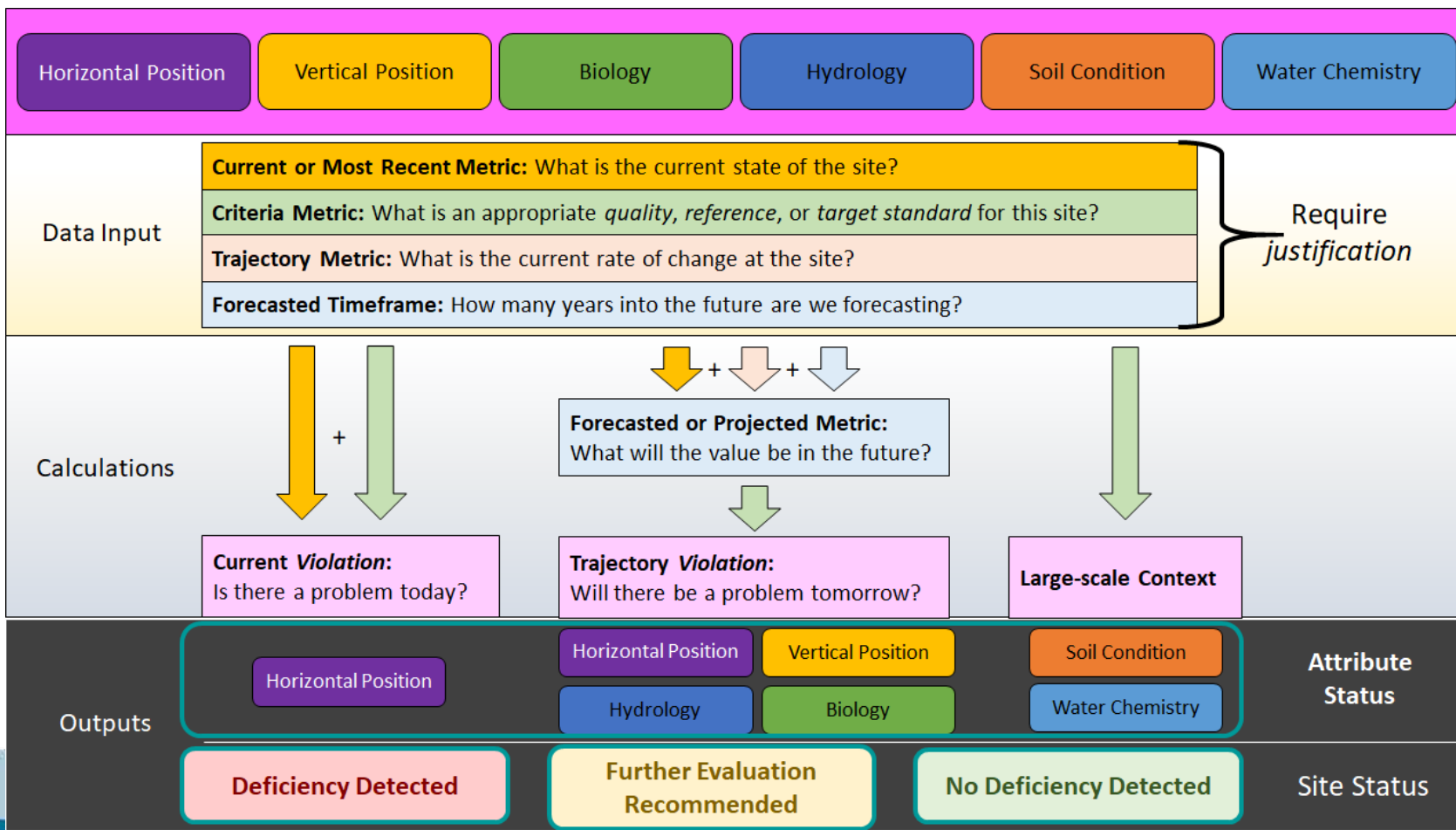
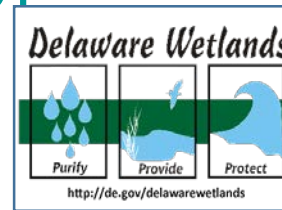




# What is the problem?

## WATCH: Wetland Assessment Tool for Condition & Health

<https://delawareestuary.org/science-and-research/tools/watch-tool/>





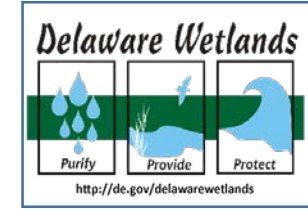
NFWF

# What are my design considerations?

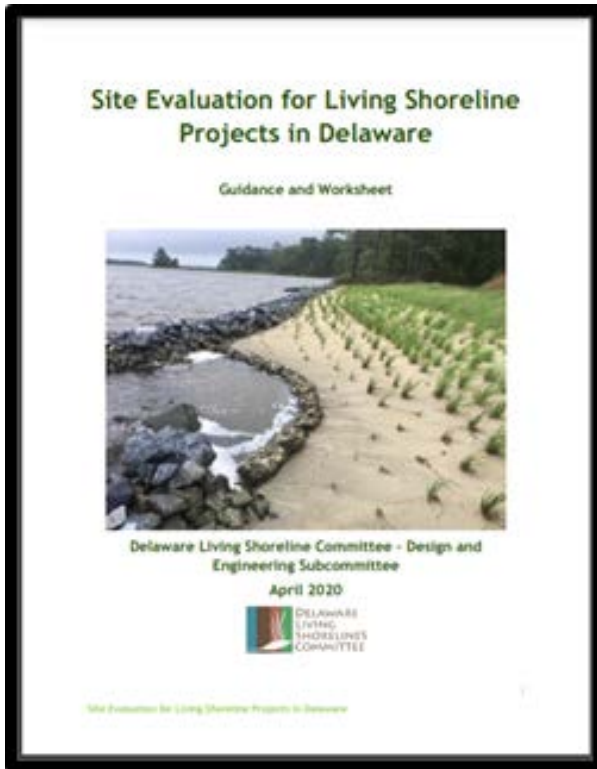


## Living Shoreline Feasibility Model

Coming May 2022: Excel-based Worksheet & User's Guide



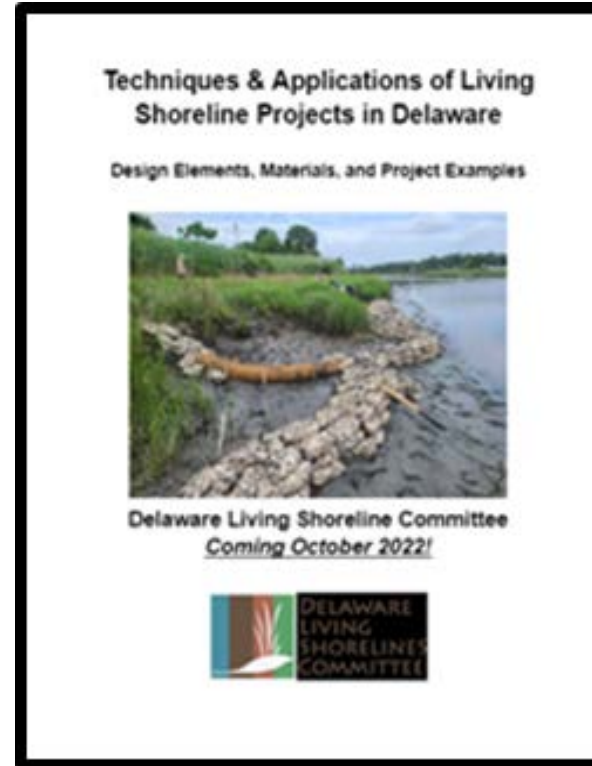
Data:      Site Evaluation      Techniques & Applications (Coming Winter 2022)



### Data Collection

- Orientation
- Change Rate
- Bank Position
- Fetch Wind
- Wave Climate
- Flooding
- Tide
- Ownership
- Flora/Fauna

<https://www.delawarelivingshorelines.org/>



### Goal-based Design Elements

- Toes/Sills
- Drainage
- Interstitial Space
- Compartmentalization

### Common Materials

- Shell
- Coir
- Composite
- Gabions

### Examples

- Per goal
- Along energy grad



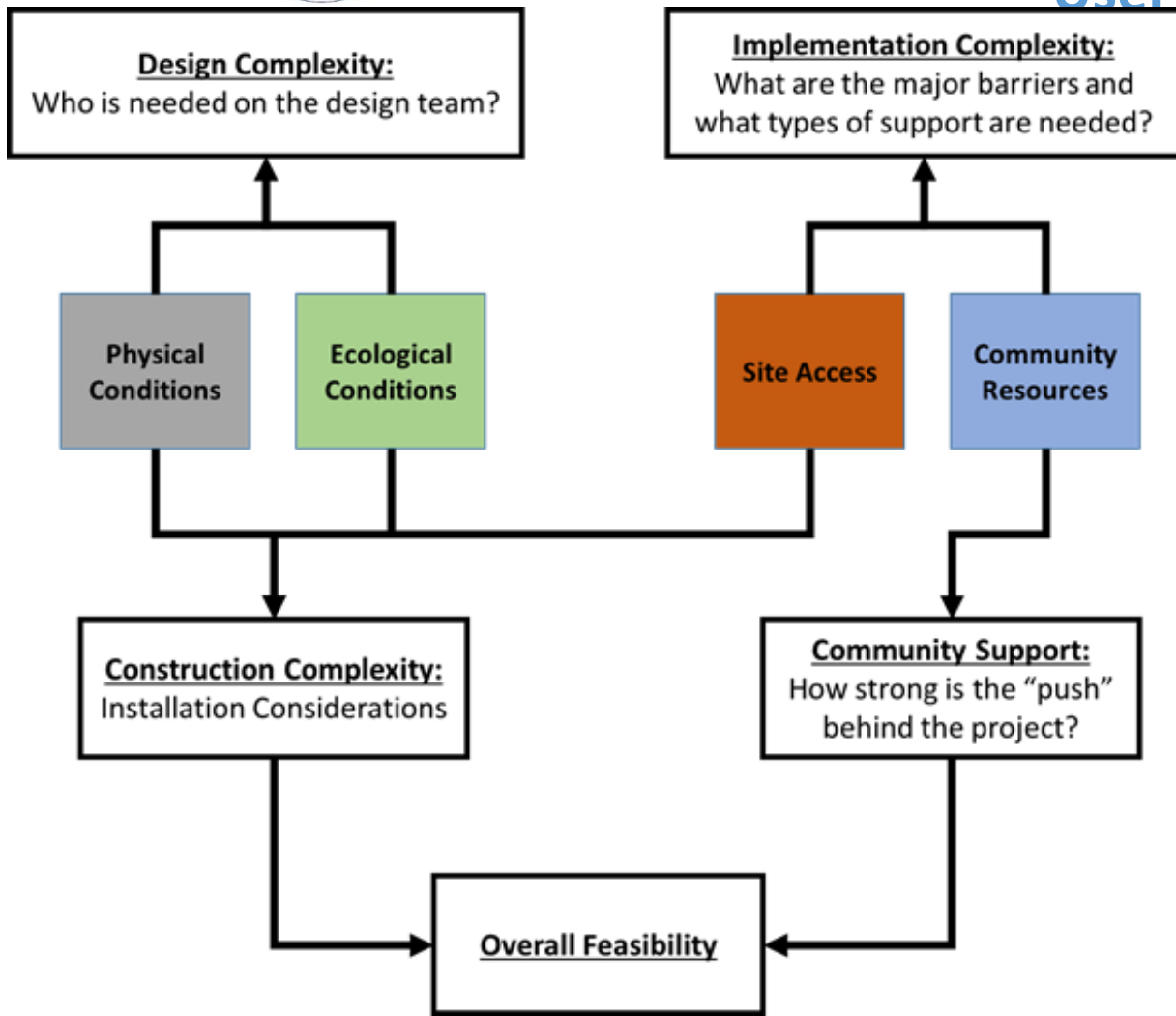
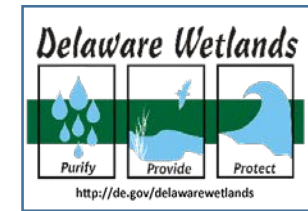
# What are my design considerations?



## Living Shoreline Feasibility Model

Coming May 2022: Excel-based Worksheet &

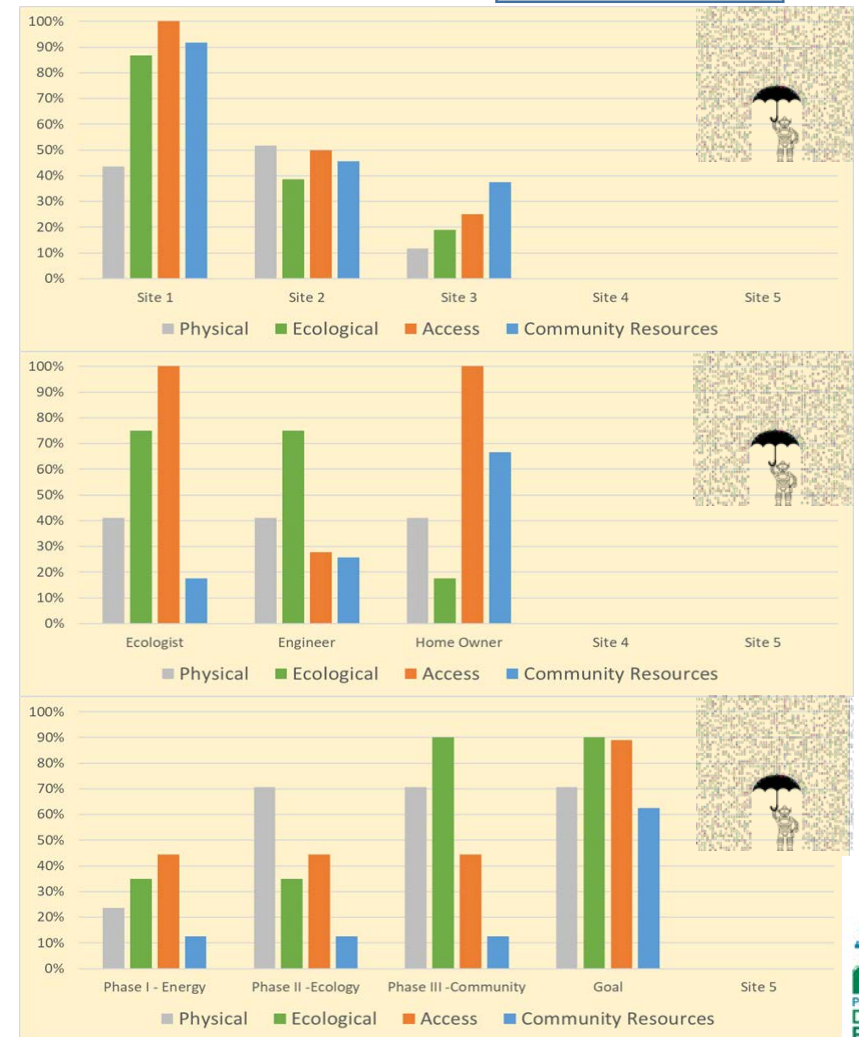
User's Guide



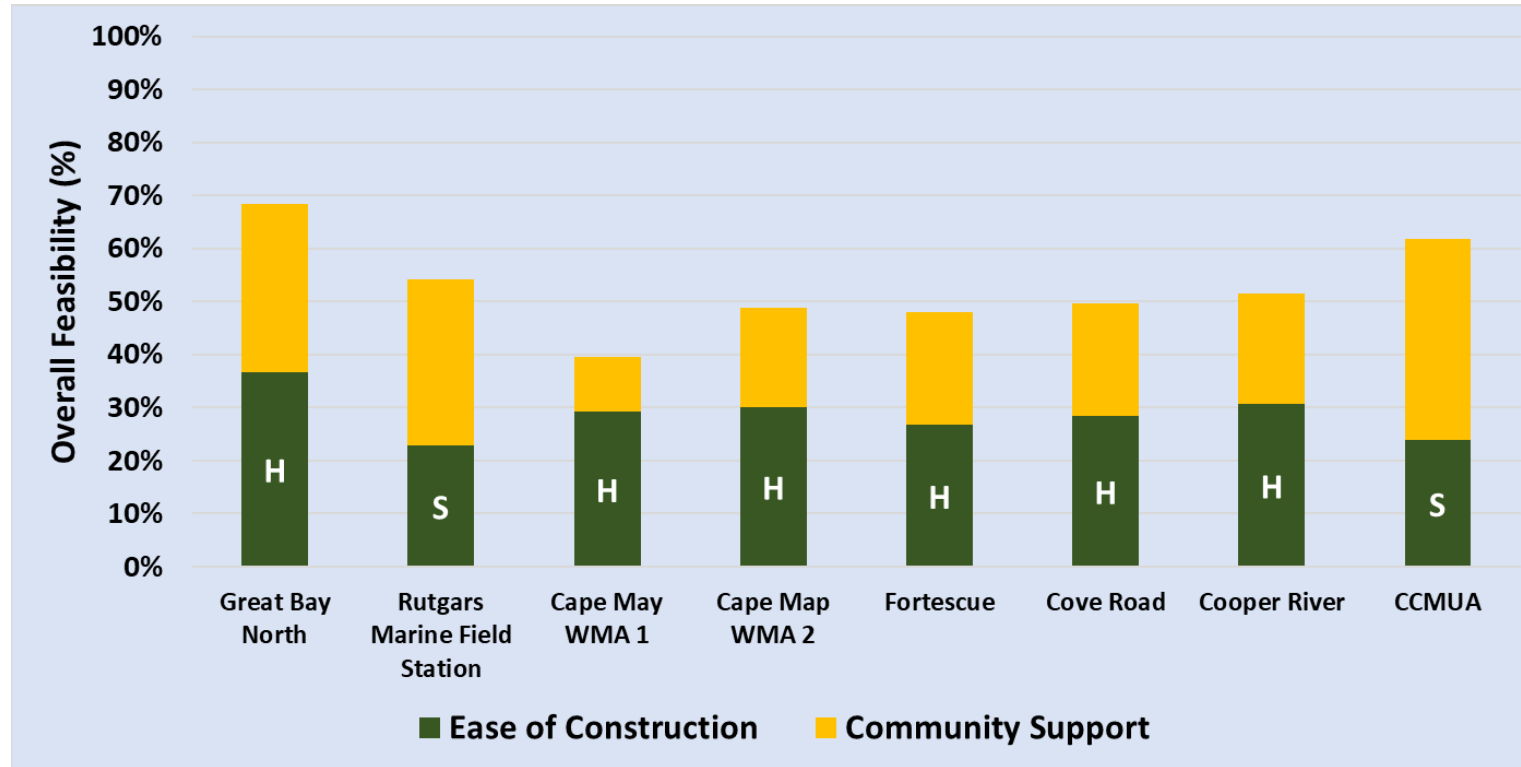
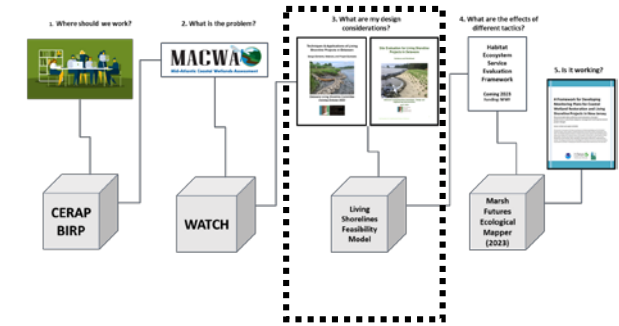
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# Living Shoreline Feasibility Model: What are My Design Considerations?







NFWF

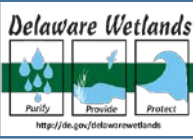
RUTGERS

Center for Remote Sensing and Spatial Analysis



# What are the Effects of Different Tactics? Marsh Futures Ecological Mapper

Coming May 2023: Web-based tool integrated with WATCH & MACWA



## Reference Data:

### WATCH

### Habitat ESS Eval Frmwk

#### NJ spatial datasets

- LULC
- Conversion rates (PDE/CRSSA, NOAA \$)
- Salinity
- Soils

#### -Health diagnosis per habitat

#### -Uses MACWA data

- Current states
- Expectation
- Trends

#### -NJ TWMN

#### -Habitats

- Low/high marsh
- Coastal forests
- Beaches
- Mudflats
- Upland fringe

#### -Qualities ( $\Delta$ )

- Elevation
- Horiz extent
- Neighbors

#### -Tactical effects

- Sed application
- Shoreline stabilization
- Hydro repair

