COASTAL ZONE AND SUBAQUEOUS SOIL SURVEY

HISTORY

- Mapping "underwater soils" was first considered in 1862
- Europe started using the term "soil" to describe sediment in rivers, bays, and lakes because they realized they undergo pedogenic processes and have horizons
- U.S. didn't accept this and maintained that in relation to soil: "It's upper limit is air and or shallow water. At its margins it grades to deeper water……"

HISTORY

- Soil Scientists slowly began to work their way into the marshes during the 1970's
- In 1993 – "Submerged Soils: A New Frontier in Soil Survey" by Dr. George Demas was published in Soil Survey Horizons.
- Dr. Demas pioneered the concept of Subaqueous Soils, differentiating them from sediment.

Submerged Soils: A New Frontier in Soil Survey

G.P. Demas[1]

Through my assignments to four soil survey projects on the Atlantic Coastal Plain in Maryland and Delaware, I have become increasingly aware of situations where information about soils could go a long way towards providing the supporting data needed to make intelligent environmental management decisions. A major area of environmental concern, especially on the Delmarva Peninsula, is the deteriorating quality of both subsurface and surface water. Among the myriad of negative effects caused by poor water quality is the decrease in health and populations of aquatic organisms. Regulatory and voluntary programs are presently in place on the Delmarva Peninsula that address such items as nonpoint source pollution, on-site sewage disposal, sediment and erosion control, wetland protection and restoration, and the restoration and enhancement of aquatic plant and animal populations. Soil survey information is playing a key role in many of these programs through the gathering, interpretation, and dissemination of previously unavailable soil data directly related to environmental issues.

HISTORY

Dr. George Demas 1958 - 1999

- NRCS Soil Survey Project Leader
- Pioneer of Subaqueous Soils
- USDA Secretary's honor for scientific research
- SSSA Emil Truog award for outstanding contribution to soil science

SEDIMENT OR SOIL?

- Pedogenic Processes:

  Additions/Losses/Tr s

Additions

Additions of mineral sedime storm losses, tidal currents.
overwash materials, flo ganic matter.
Biological additio **Transfers**
Anthropoge – hi to low concentrations.
disturb urbation.

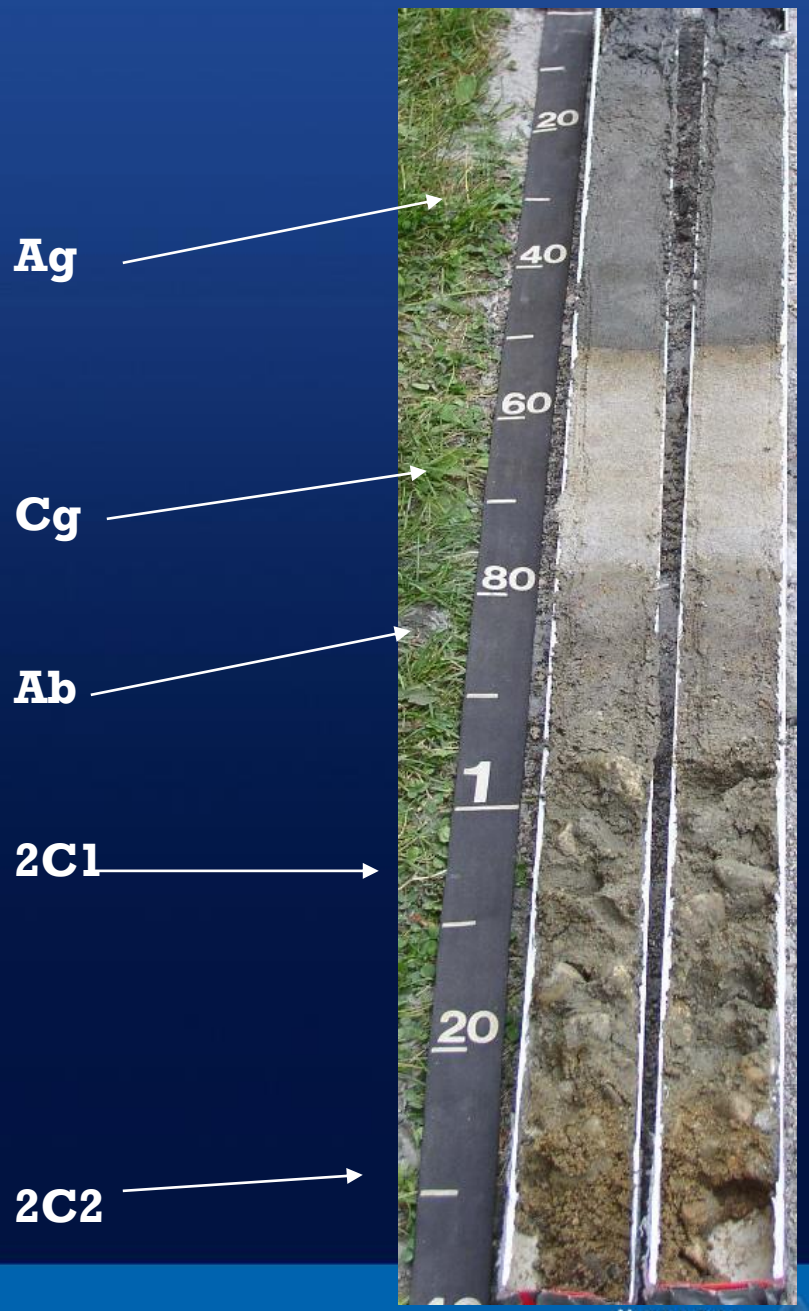
Transformations

Iron / sulfide reduction
OM decomposition

Bottom line: Shallow water Environments can best be studied as SOIL!

SOIL FORMATION: SOIL HORIZONS

- Organic and mineral (A and C) horizons.
- Predominantly dealing with AC type soils (Entisols).
- Numerous buried A and O horizons.
- Some subaqueous and submerged soils have buried B horizons.



2014NJ029028
07-08-2015
0-213 cm

2015NJ029030
09-14-16
0-233cm

2015NJ027033
09-13-16
0-230cm

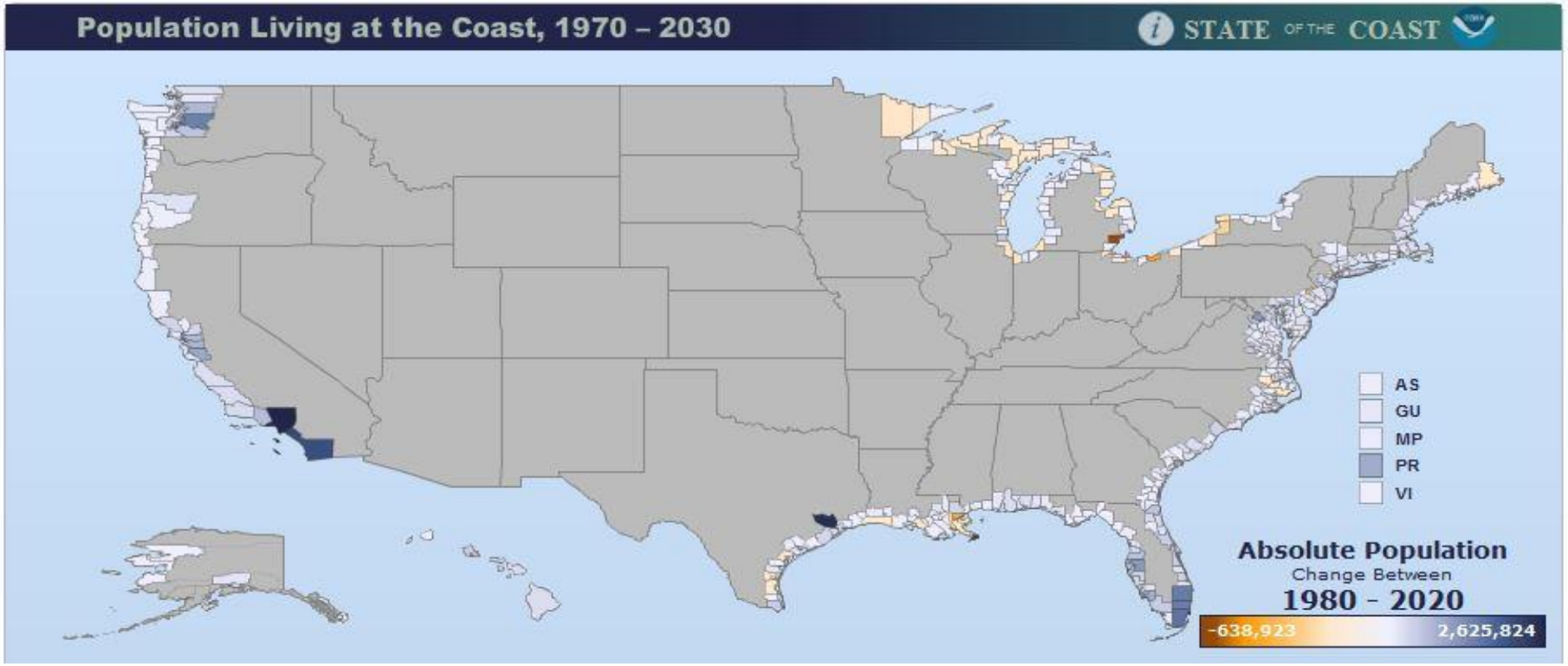
COASTAL ZONE SOIL SURVEY – WHY?

39%
Percent of the nation's total population that lived in Coastal Shoreline Counties in 2010 (less than 10% of the total land area excluding Alaska).
Source: U.S. Census Bureau, 2011

34.8 million
Increase in U.S. Coastal Shoreline County population from 1970 to 2010 (or a 39% increase).
Source: U.S. Census Bureau, 2011

446 persons/mi²
Average population density of the Coastal Shoreline Counties (excluding Alaska). Density in U.S. as a whole averages 105 persons/mi².
Source: U.S. Census Bureau, 2011

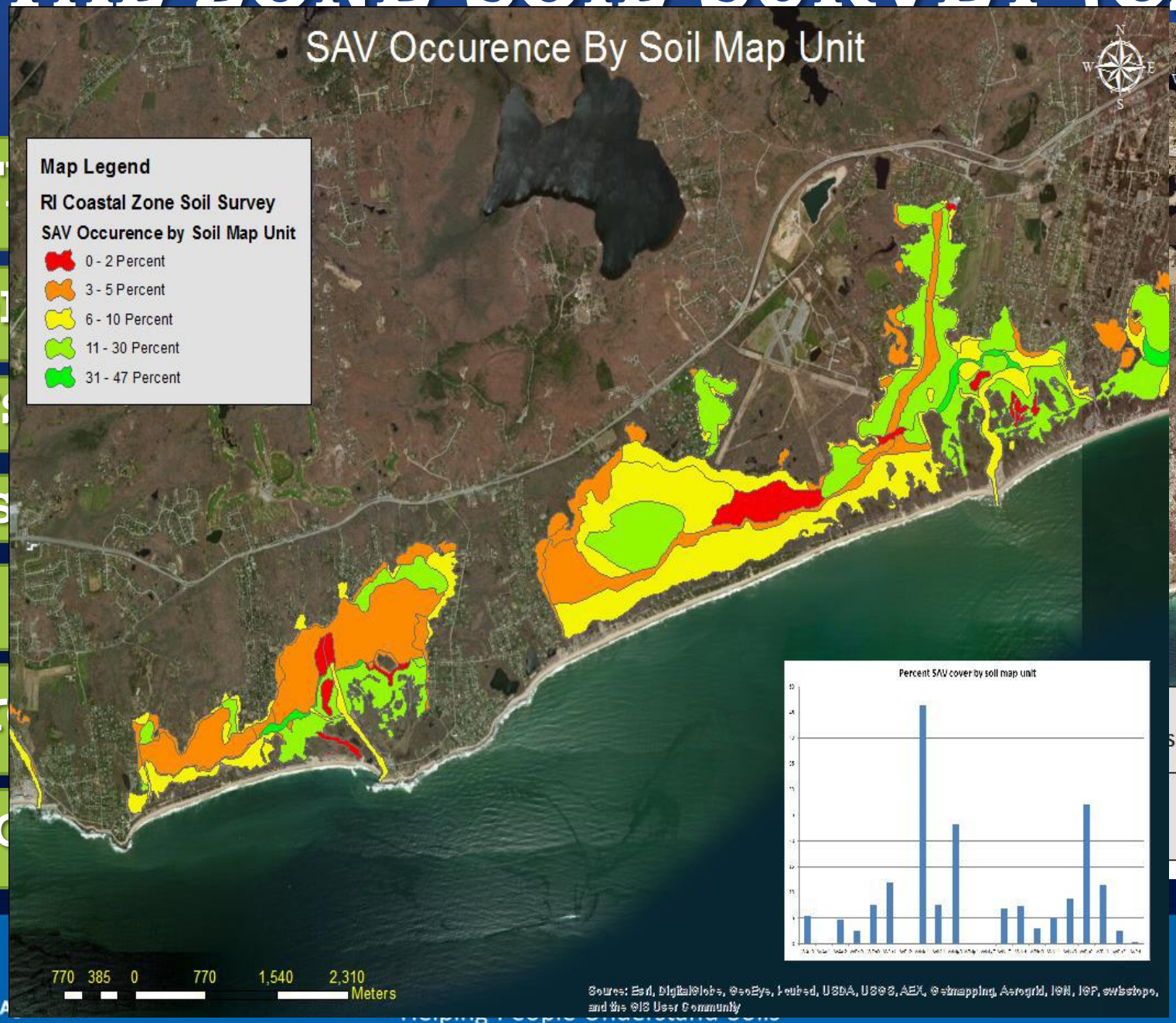
37 persons/mi²
Expected increase in U.S. Coastal Shoreline County population density from 2010–2020. Expected increase for entire U.S. is 11 persons/mi².
Source: Woods & Poole, 2011; NOAA, 2012



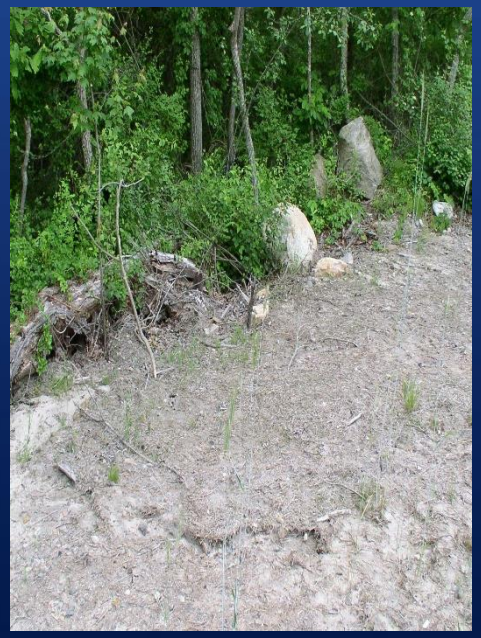
August 2012
North View

COASTAL ZONE SOIL SURVEY (CZSS) –

- Connect F
- Restoratio
  - Salt Mar
  - Eelgrass
  - Shellfish
- ID Beach r
- Volumetric



COASTAL ZONE SOIL SURVEY (CZSS) – WHY?



- Accurate inventory maps on acid sulfate soils
- Blue carbon sequestration – what soils and where have the greatest storage / potential?
- Restoration – Ecological Site Descriptions (ESD's)
- Wave / Wake Exposure Maps
- Accurate SS Inventory for Climate Change & interpretations to safeguard lives and property

COASTAL ZONE SOIL SURVEY (CZSS)

- Update existing subaerial (terrestrial) and subaqueous soils which include:

1) tidal marshes
2) dredge spoil areas
3) Formerly mapped miscellaneous land areas (beaches / urban land)
4) the barrier islands / beaches
5) The coastal lagoons / estuaries (subaqueous soil areas)
6) mainland soil areas adjacent to coastal lagoons / estuary

- Best mapped using **SOME** of the procedures and protocols established by the NCSS.
- These coastal areas were mapped very broadly in the 19th century and were considered the "easy acres" of the county datasets, e.g. tidal marsh areas = tidally flooded twice daily, barrier island areas = a pile of sand, or coastal lagoon = "water" mapunit.

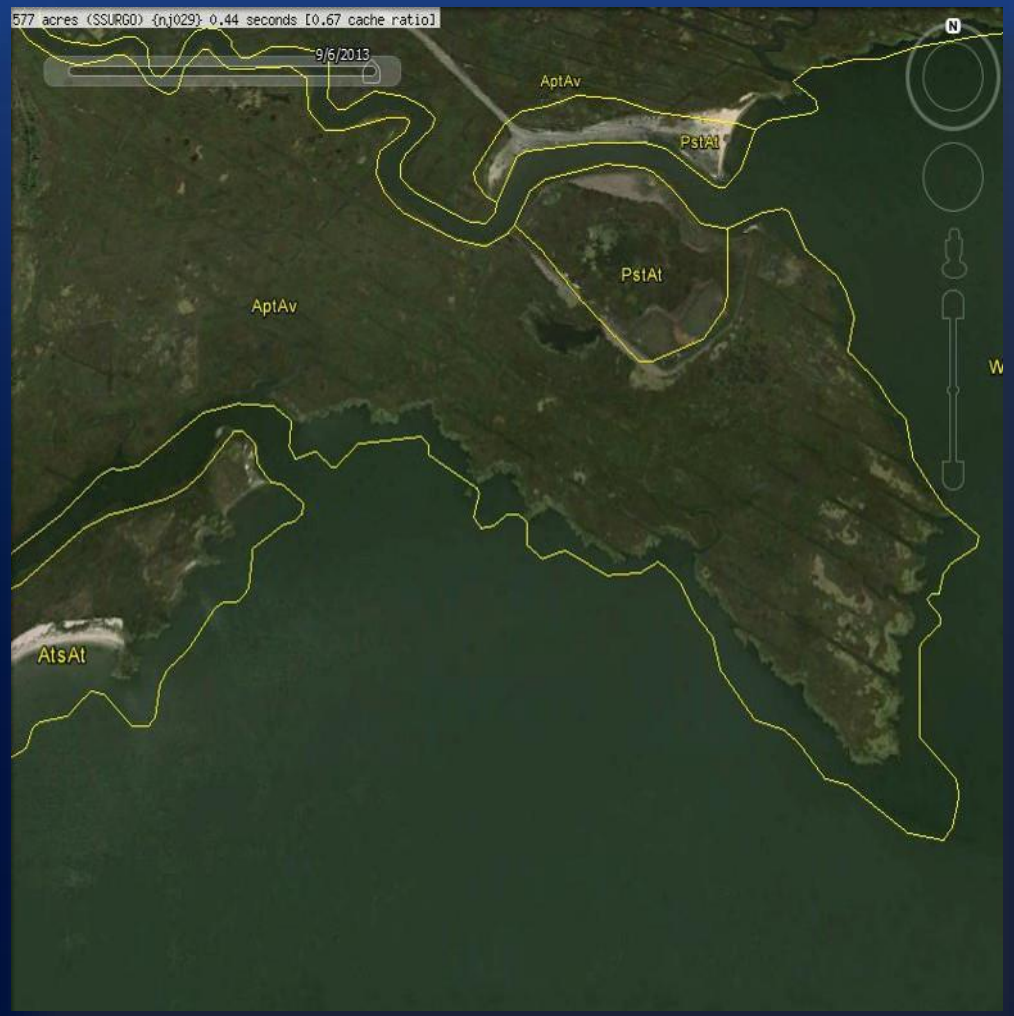
CZSS INITIATIVE IMPACTS

What are the CZSS issues / problems / deficiencies to be improved?

- 1 – Spatial deficiencies / shoreline loss
- 2 – Outdated mapunit design
- 3 – Field documentation data deficiency
- 4 – Soil interpretation issues
- 5 – New soil series concepts for subaqueous areas and outdated subaerial series concepts

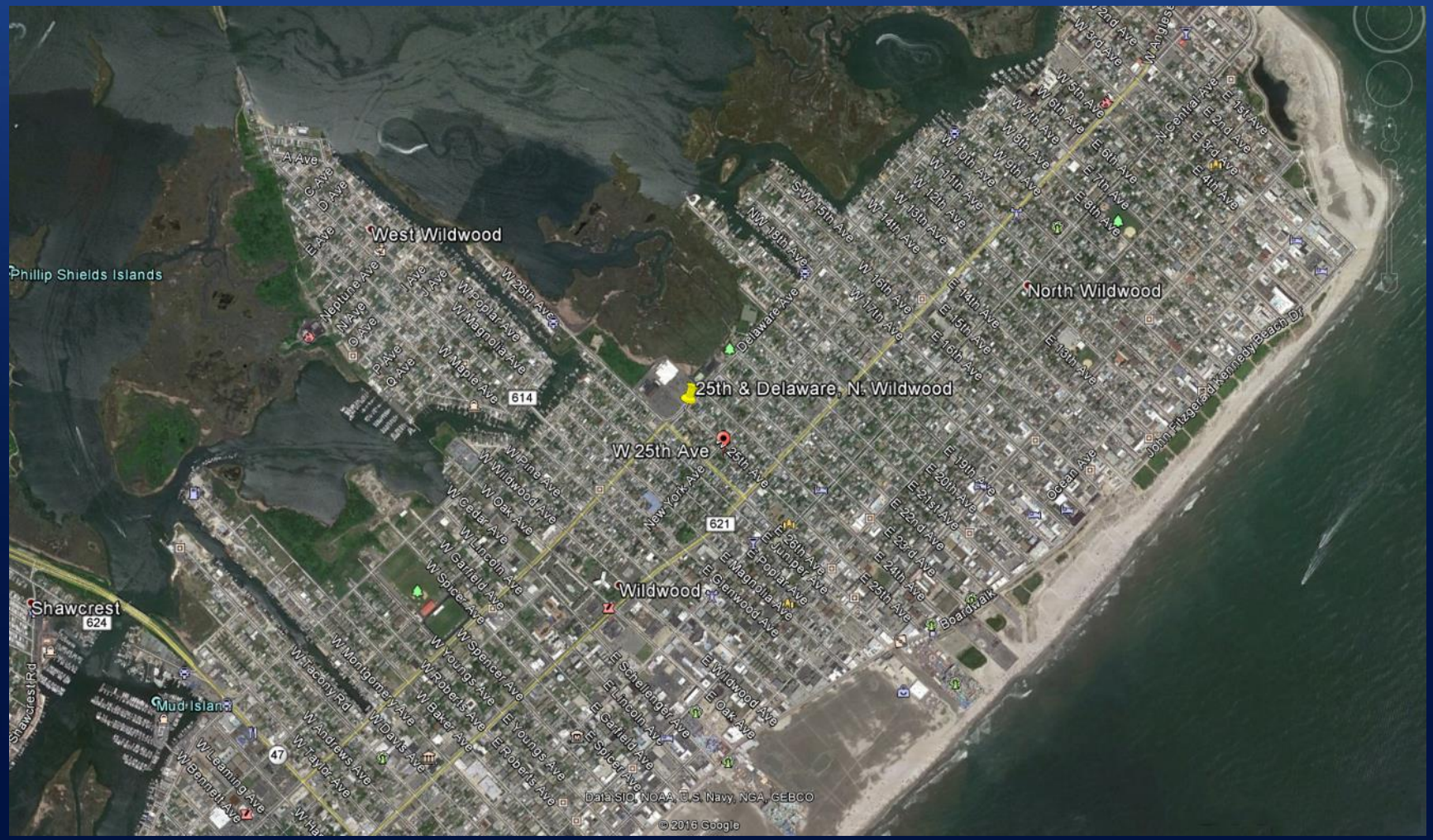
CZSS – SHORELINE CHANGE – SPATIAL DEFICIENCY

(NOAA NATIONAL SHORELINE)

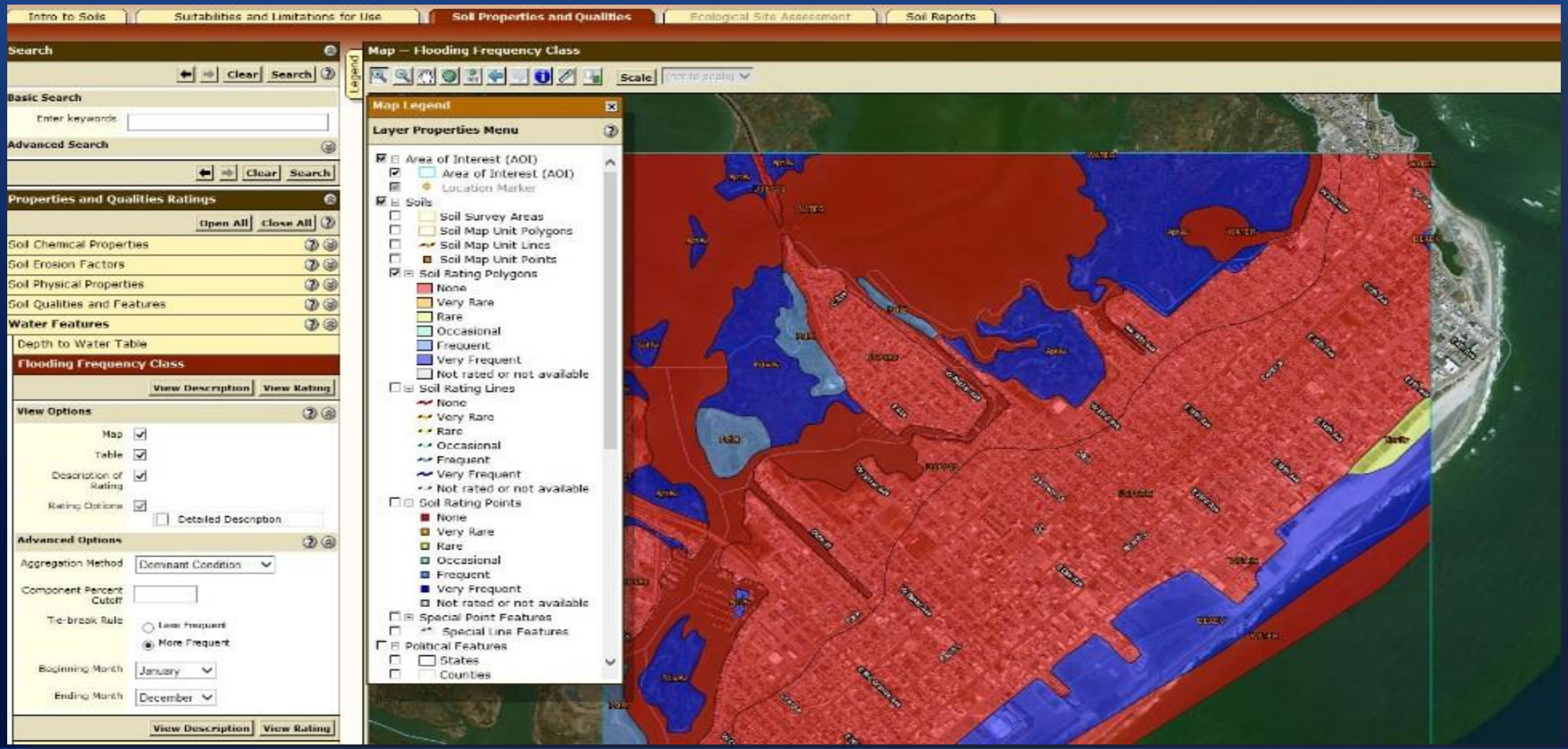


WINTER STORM JONAS

25TH AVE. & DELAWARE AVE. N WILDWOOD, NJ



WINTER STORM JONAS



WINTER STORM JONAS

View Soil Information By Use: All Uses

Printable Version

Intro to Soils | Suitabilities and Limitations for Use | Soil Properties and Qualities | Ecological Site Assessment | Soil Reports

Search

Clear | Search

Basic Search

Enter keywords

Advanced Search

Clear | Search

Suitabilities and Limitations Ratings

Open All | Close All

Building Site Development

- Corrosion of Concrete
- Corrosion of Steel
- **Dwellings With Basements**

View Description | View Rating

View Options

- Map ☑
- Table ☑
  - ☑ Component Breakdown and Rating Reasons
    - ☑ Numeric Values
- Description of Rating ☑
- Rating Options ☑
  - ☐ Detailed Description

Advanced Options

View Description | View Rating

- Dwellings Without Basements
- Lawns, Landscaping, and Golf Fairways
- Local Roads and Streets
- Shallow Excavations
- Small Commercial Buildings
- Unpaved Local Roads and Streets

Construction Materials

Disaster Recovery Planning

Land Classifications

Legend

Map — Dwellings With Basements

Scale (not to scale)

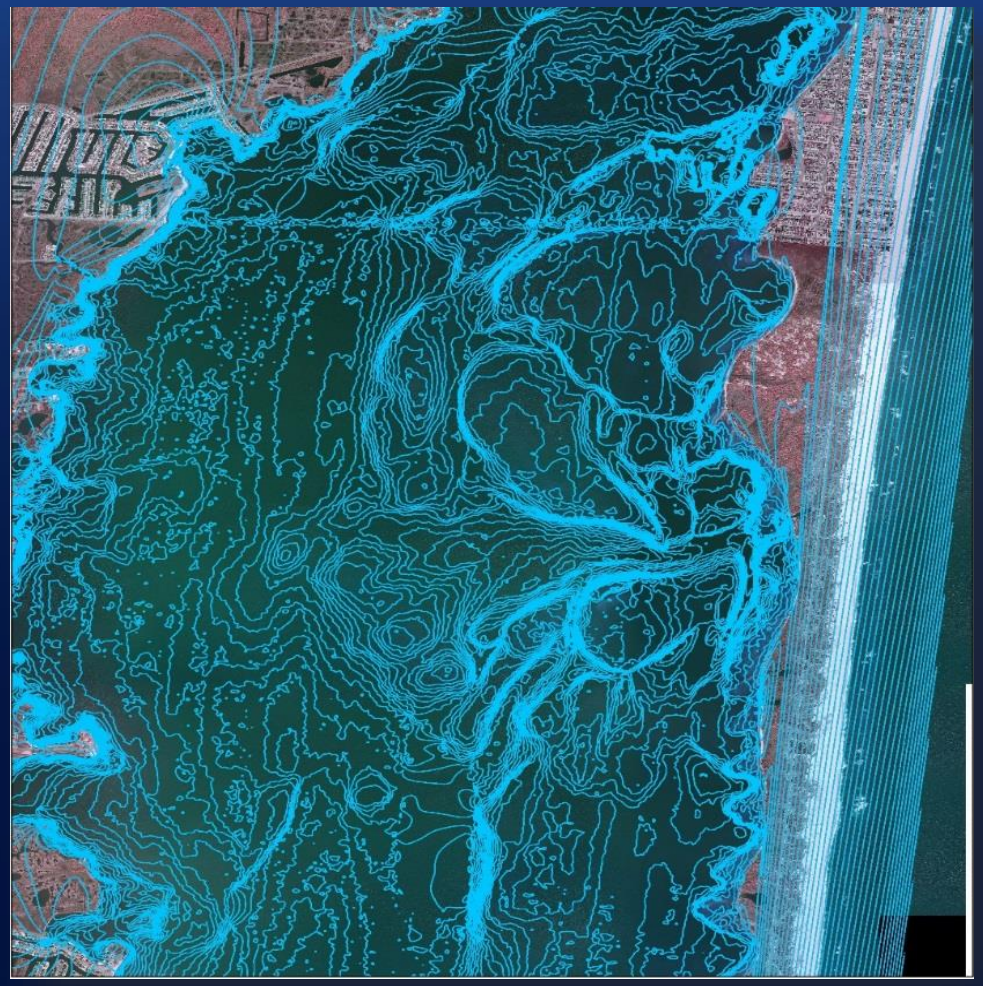
Map Legend

Layer Properties Menu

- ☑ Area of Interest (AOI)
  - ☑ Area of Interest (AOI)
  - ☑ Location Marker
- ☑ Soils
  - ☐ Soil Survey Areas
  - ☐ Soil Map Unit Polygons
  - ☐ Soil Map Unit Lines
  - ☐ Soil Map Unit Points
  - ☑ Soil Rating Polygons
    - Very limited
    - Somewhat limited
    - Not limited
    - Not rated or not available
  - ☐ Soil Rating Lines
    - Very limited
    - Somewhat limited
    - Not limited
    - Not rated or not available
  - ☐ Soil Rating Points
    - Very limited
    - Somewhat limited
    - Not limited
    - Not rated or not available
  - ☐ Special Point Features
  - ☐ Special Line Features
- ☐ Political Features
  - ☐ States
  - ☐ Counties
  - ☐ Urban Areas
  - ☐ Cities
  - ☐ Postal Code
  - ☐ PLSS Township and Range
  - ☐ PLSS Section
- ☐ Federal Land
  - ☐ Bureau of Land Management
  - ☐ Bureau of Reclamation

HOW?
CZSS – BARNEGAT BAY SUBAQUEOUS BATHYMETRY

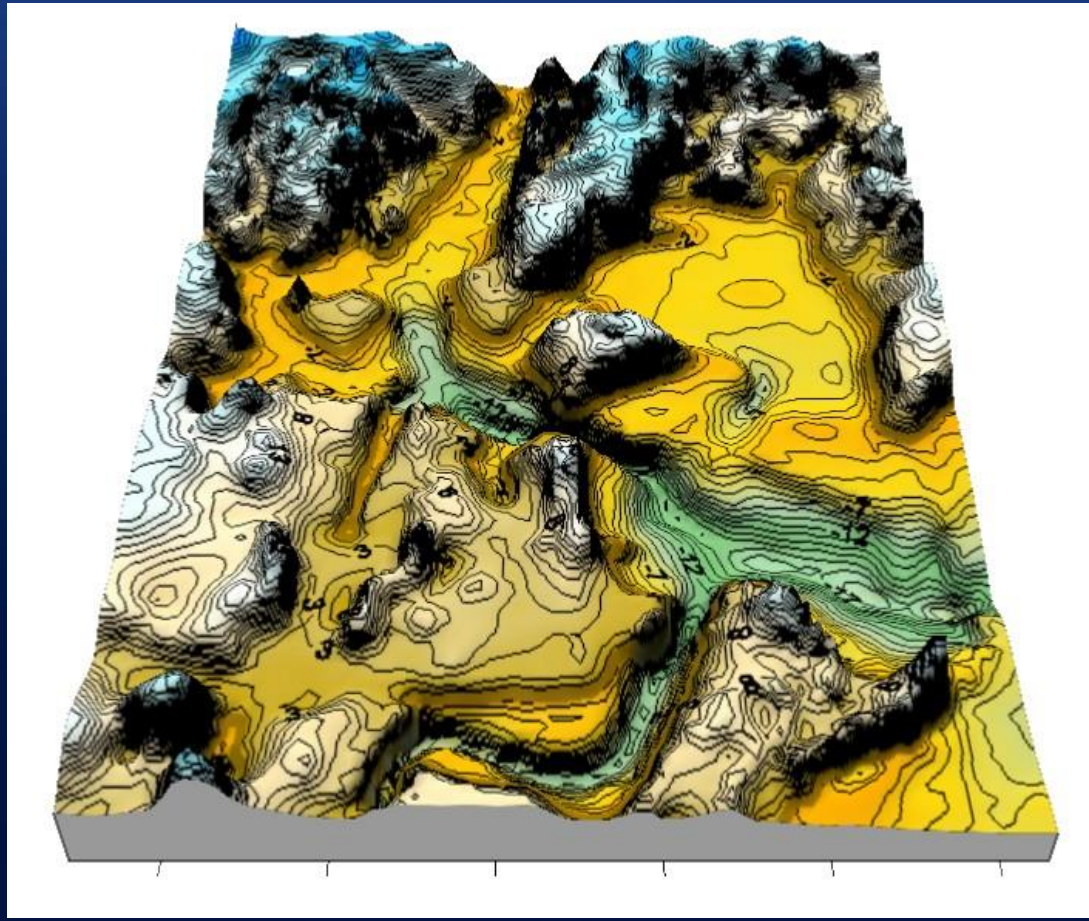
National Ocean Service (NOS) 1934 – 1936 estuarine bathymetry



Pre-Sandy USGS EAARL-B LiDAR 2015 (ds885)

How are Subaqueous Soils Mapped?

- Need to use or develop a bathymetric map which is used for subaqueous landform identification.
- Can use existing NOAA charts or create detailed bathymetry using fathometer and RTK GPS.
- Detailed bathymetry was the number 1 data need at our user conferences.
- Bathymetric data collection and interpolation method has been developed by MapCoast.
- Traditional imagery is also helpful.
- Develop soil-landscape model, delineate map units, field map using standard tools.
- Collect vibracore samples in representative areas, describe, sample, classify.
- Assemble map and NASIS entry.

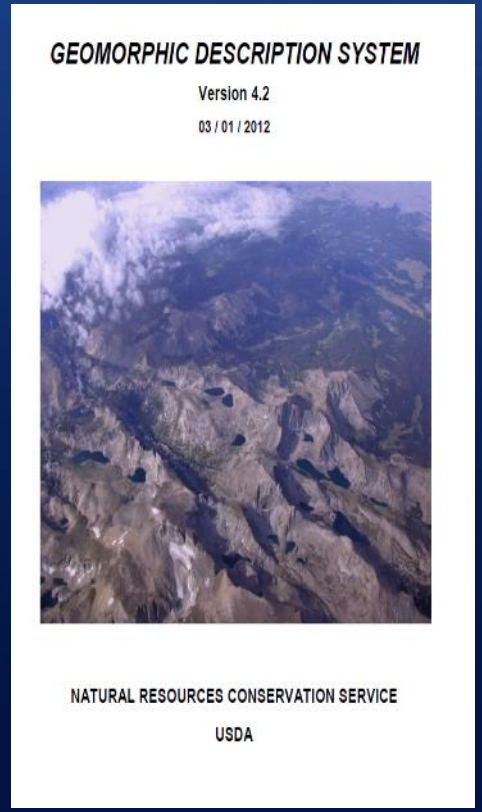


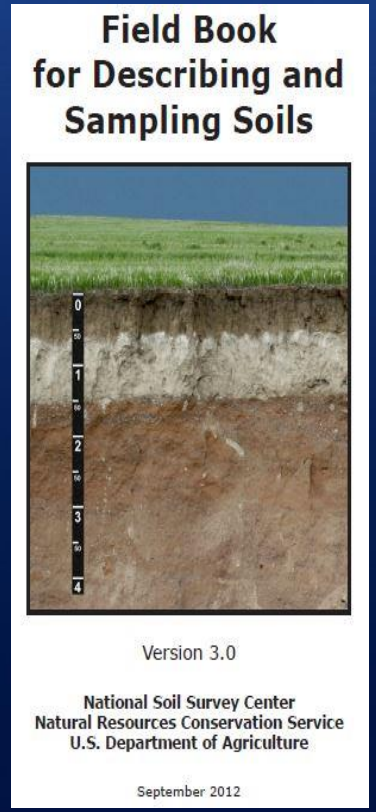
REMOTE

Wide array of remote sensing tool and techniques are available and can be employed to improve accuracy of the mapping:

- Side-scan sonar (acoustic map) – bottom type, benthic geologic habitat mapping.
- Sub-Bottom profiling (low frequency acoustic) – map deep structures.
- High-resolution imagery/pictometry (NOAA protocol).
- SPI Imagery, still and video images of the bottom.
- AUV's and other marine data.
- GPR and EMI for freshwater subaqueous soils.
- Resistivity.
- Divers.

SUBAQUEOUS LANDFORMS





16. SUBAQUEOUS FEATURES [Discrete underwater features (that commonly can support rooted plants), and adjacent features, ordinarily found below permanent open water. *[Historically, in Soil Survey Reports these underwater features have been included in the generic map unit "water"].* Subaqueous "Landscape" terms are obviously not terrestrial, but are **functionally equivalent** Earth surface features.

Landscapes:

bay [coast] (water body; also LF)	*BY*	sea (water body; also Landform)	*SEA*
estuary (also Landform)	*ES*	sound (water body; also Landform)	*SO*
gulf (water body; also Landform)	*GU*	strait (water body; also Landform)	*ST*
lagoon (water body; also Landform)	*LA*		
ocean (water body)	*OC*		

Landforms:

barrier cove	*BAC*	mainland cove	*MAC*
bay [coast] (water body; also Landscape)	*BAY*	marine lake	*ML*
bay bottom	*BOT*	nearshore zone	*NZ*
cove (water body)	*CO*	reef	*RF*
estuary (also Landscape)	*WD*	sea (water body; also Landscape)	*SEA*
flood-tidal delta	*FTD*	shoal	*WR*
flood-tidal delta flat	*FTF*	sound (water body; also Landscape)	*SO*
flood-tidal delta slope	*FTS*	strait (water body; also Landscape)	*STT*
fluviomarine bottom	*FMB*	submerged back-barrier beach	*SBB*
gulf (water body; also Landscape)	*GU*	submerged mainland beach	*SMB*
inlet	*IL*	submerged point bar [coastal]	*SPB*
lagoon (also Landscape)	*WI*	submerged wave-built terrace	*SWT*
lagoon bottom	*LBO*	submerged wave-cut platform	*SWP*
lagoon channel	*LCH*	tidal inlet	*TI*
lake	*WJ*	tidal inlet [relict]	*TIR*
lakebed	*LB*	washover-fan flat	*WFF*
longshore bar	*LON*	washover-fan slope	*WFS*

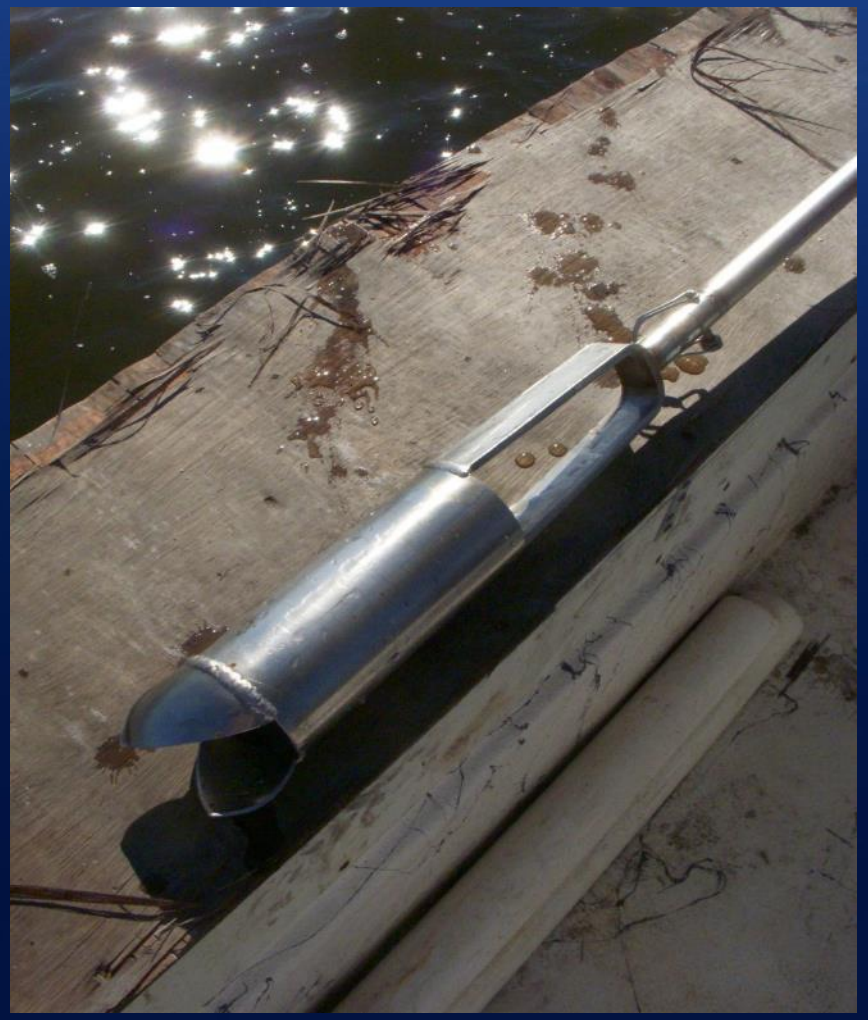
Microfeatures:

channel (permanent water)	*CH*	gut (channel; water body)	*WH*

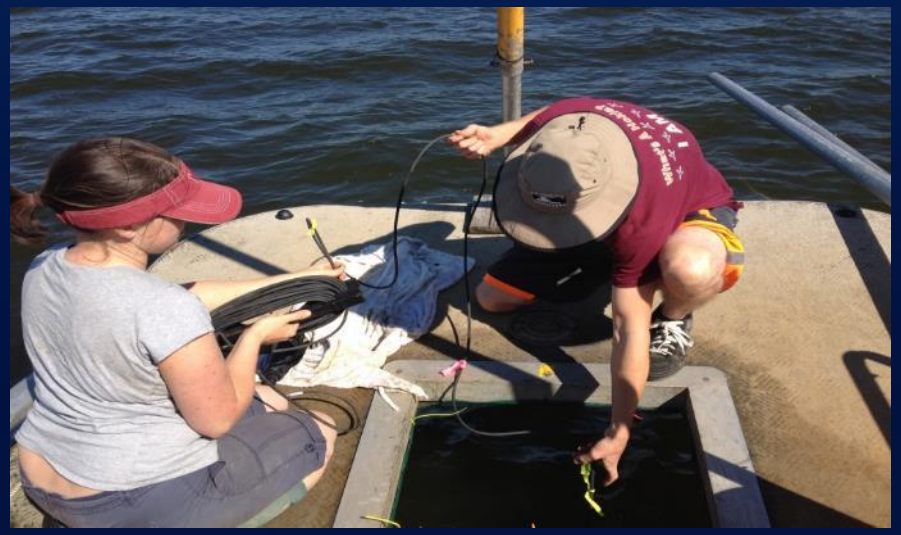
Anthropogenic Features:

dredge-deposit shoal	*DDS*	dredged channel	*DC*

SUBAQUEOUS SOIL SURVEY FIELD DATA COLLECTION METHODS / TOOLS



SUBAQUEOUS VIBRACORING



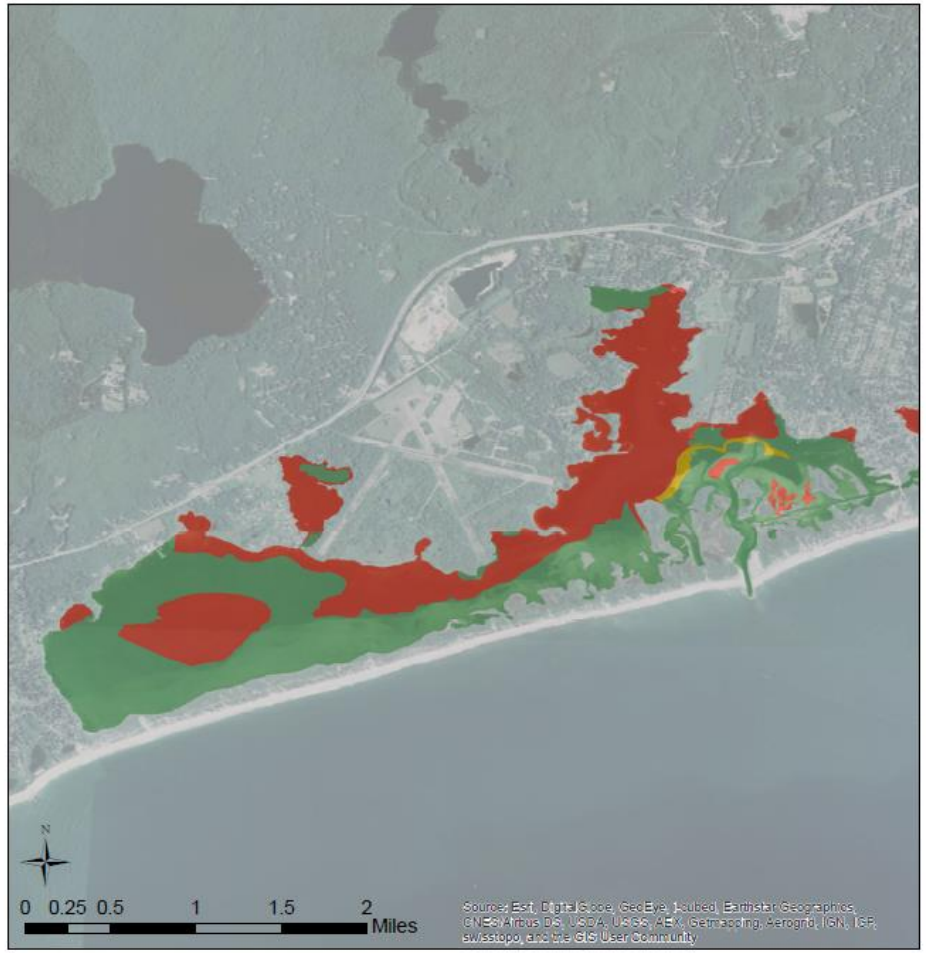
SUBAQUEOUS SOIL SURVEY VIBRACORING

Results

Comparison of 1996 and 2011 RI SSURGO

Comparison of 2015 and 2016 Barnegat Bay - NJ

pretatior



Oyster Habitat soil rating

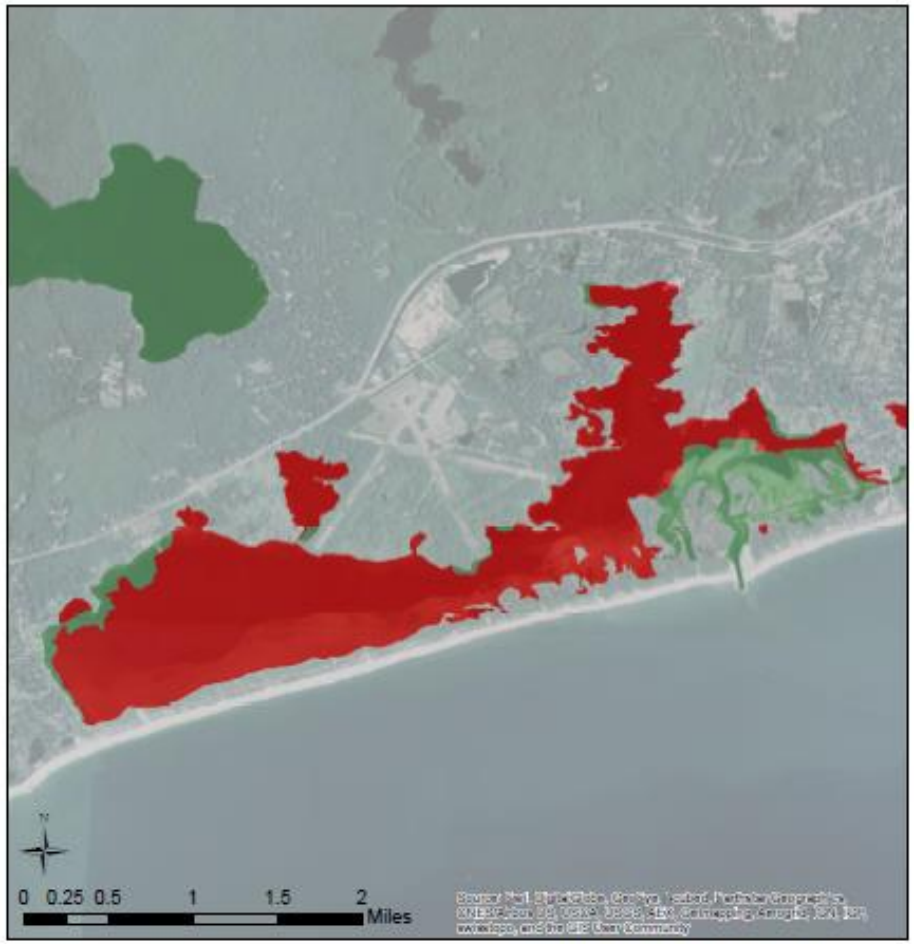
Legend

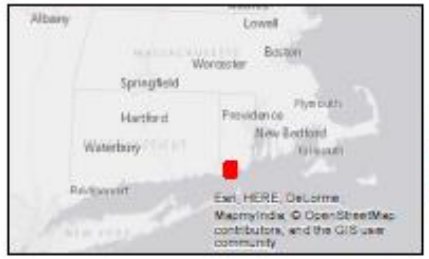
soilmu_a_ri600

SAS - Oysters (Crassostrea virginica) substrate_rating

- Not rated
- Not limited
- Somewhat limited
- Very limited

Date: 12/29/2016





Dredge material disposal soil ratings

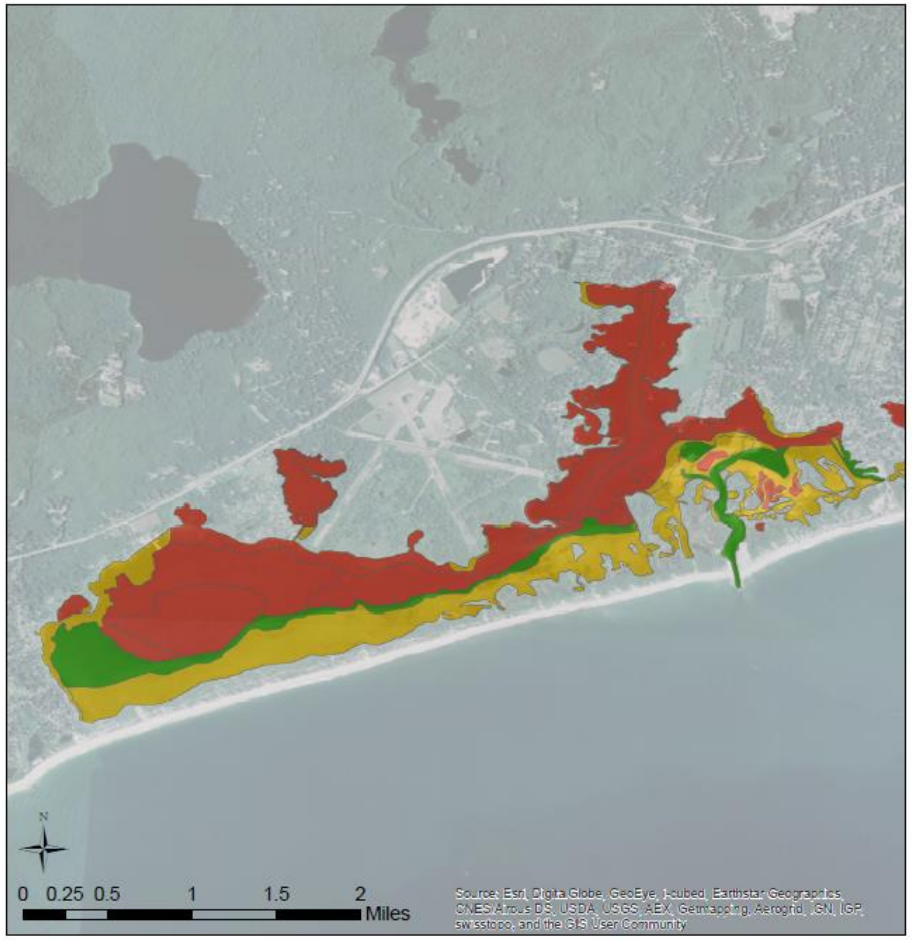
Legend

soilmu_a_ri600

SAS - Land Utilization of Dredged Materials (RI) NEW__rating

- Limited
- Not Limited
- Not rated

Date: 12/29/2016



Hard Clams (Mercenaria Mercenaria) soil habitat suitability ratings

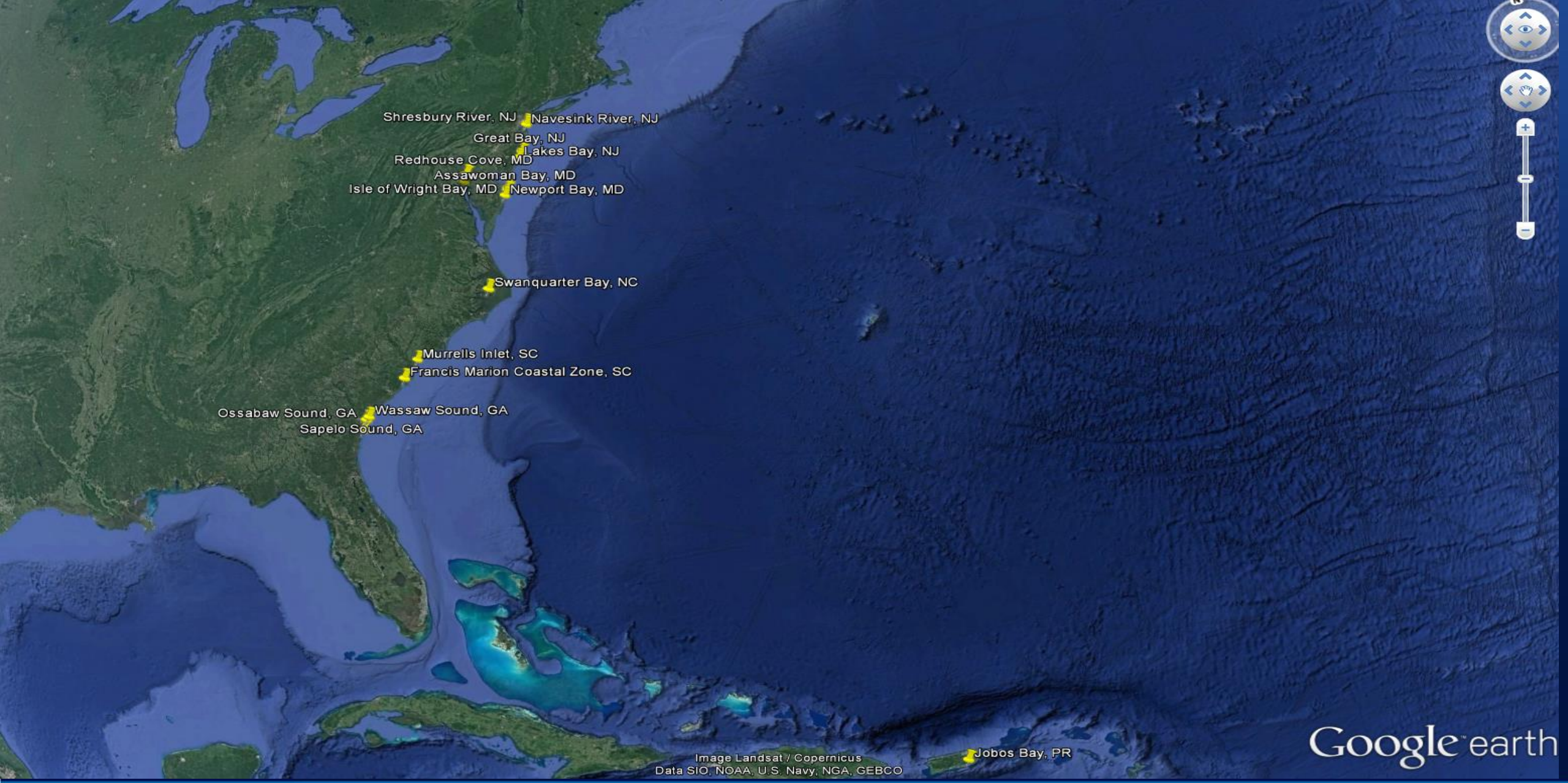
Legend

soilmu_a_ri600

SAS - Hard clams (Mercenaria mercenaria L)_rating

- Not rated
- Not limited
- Somewhat limited
- Very limited

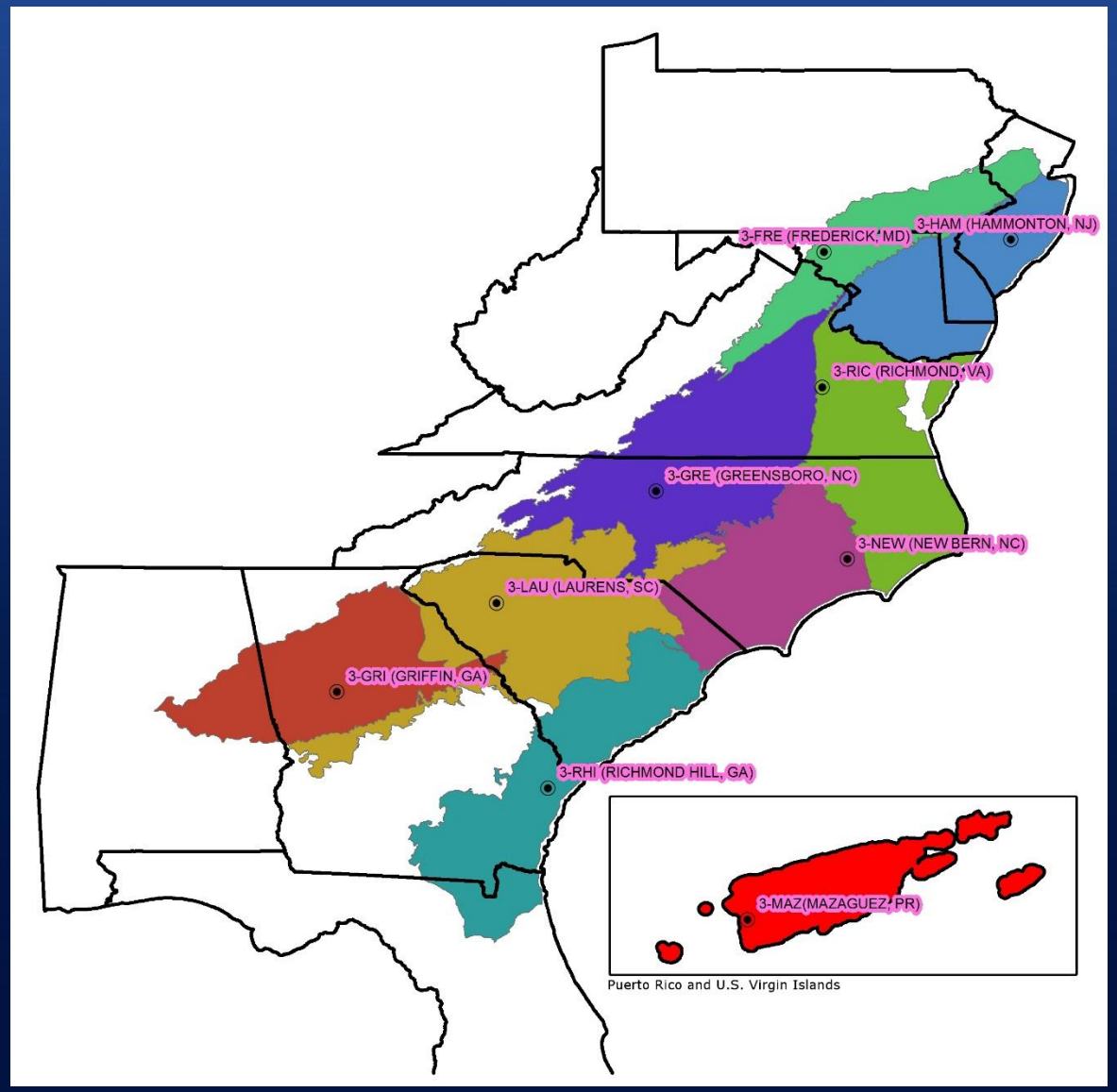
Date: 12/29/2016


Shresbury River, NJ
Navesink River, NJ
Great Bay, NJ
Lakes Bay, NJ
Redhouse Cove, MD
Assawoman Bay, MD
Isle of Wright Bay, MD
Newport Bay, MD
Swanquarter Bay, NC
Murrells Inlet, SC
Francis Marion Coastal Zone, SC
Ossabaw Sound, GA
Wassaw Sound, GA
Sapelo Sound, GA
Jobos Bay, PR
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth

Region 3

9 MLRA Soil Survey Offices

11 States



Questions?
WERNER