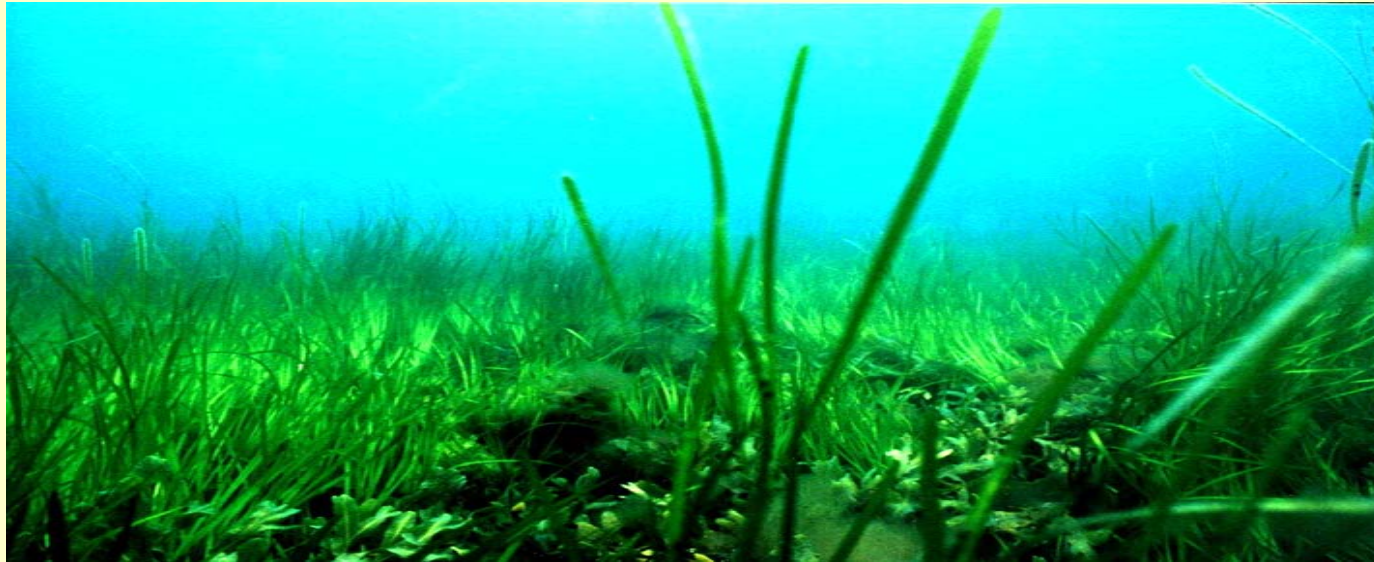




Developing Soil Maps and Interpretations for Shallow – Subtidal Habitats

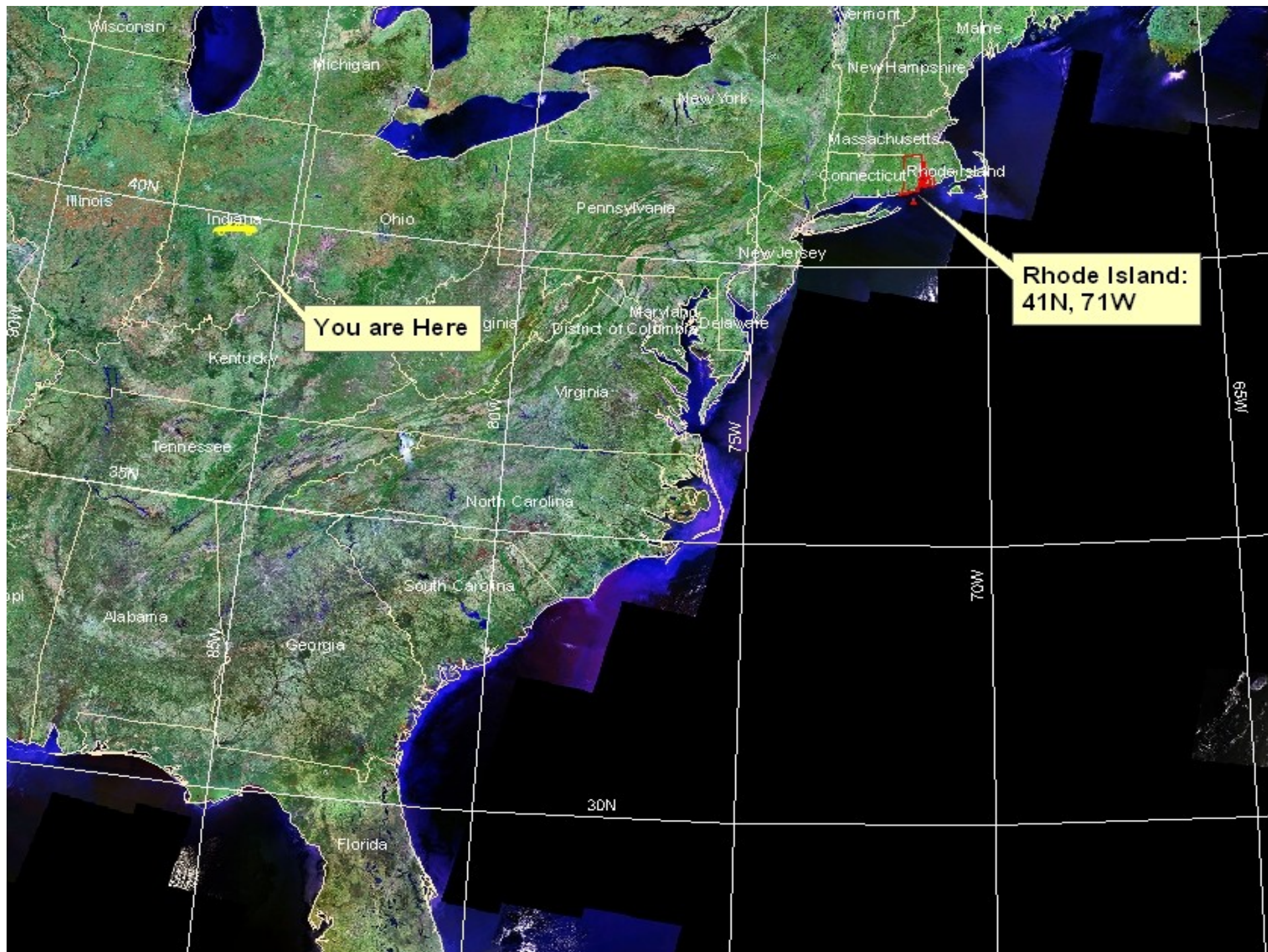
James D. Turenne

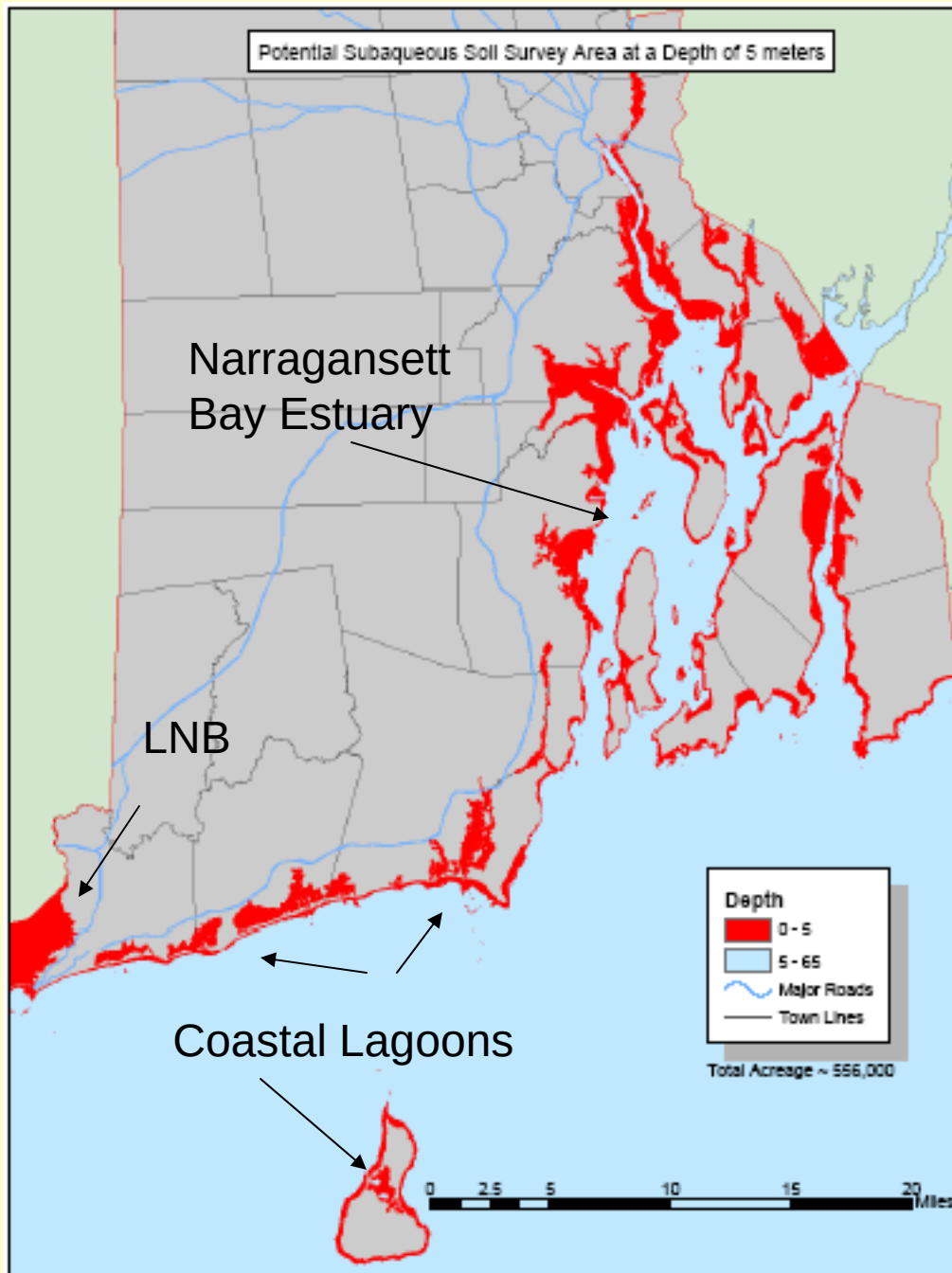
Assistant State Soil Scientist

Rhode Island (The Ocean State)

USDA-NRCS







Rhode Island Stats:

Size = 4 million hectares.

Shoreline = 560 km.

Relief = 248 m to sea level.

Population = 1 million (mostly along shoreline).

Geology/Soils: Bedrock is mainly Proterozoic to Paleozoic, late Wisconsinan glacial till/fluvial, soils are mostly Inceptisols, Entisols, and Histosols.

Subaqueous Soils:

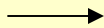
Approximately 300,000 acres (areas <5m and coastal soils).

RI NRCS Subaqueous Timeline

- 1996 – Complete SSURGO soils available for terrestrial RI.
- 2000 – 2001 Bradley, Stolt subaqueous soil survey thesis Ninigret Pond, RI.
- 2002 – 2003 RI NRCS Adopts “Working Waters” Strategy – \$1 million eelgrass funds, major emphasis in coastal issues.
- 2003 Gap in RI soil data identified – no subaqueous soil data to incorporate into site selection models – Action Plan: Establish a Center for Excellence in SAS.
- 2003 – National Workshop on SAS, RI gets new A.S.S.S. (yours truly) – given top priority by State Conservationist to establish a Center for SAS in RI.

2003 Develop strategy:

- a. Internal = proposal for an MLRA project office for coastal and subaqueous soils for MO-12.
- b. External = work with URI to organize an end-users conference to obtain input from our customers.



MapCoast is Born!

www.mapcoast.org

The Mapping Partnership for Coastal Soils and Sediment.... *In the Beginning*

A lot happening in coastal soils/sediment mapping

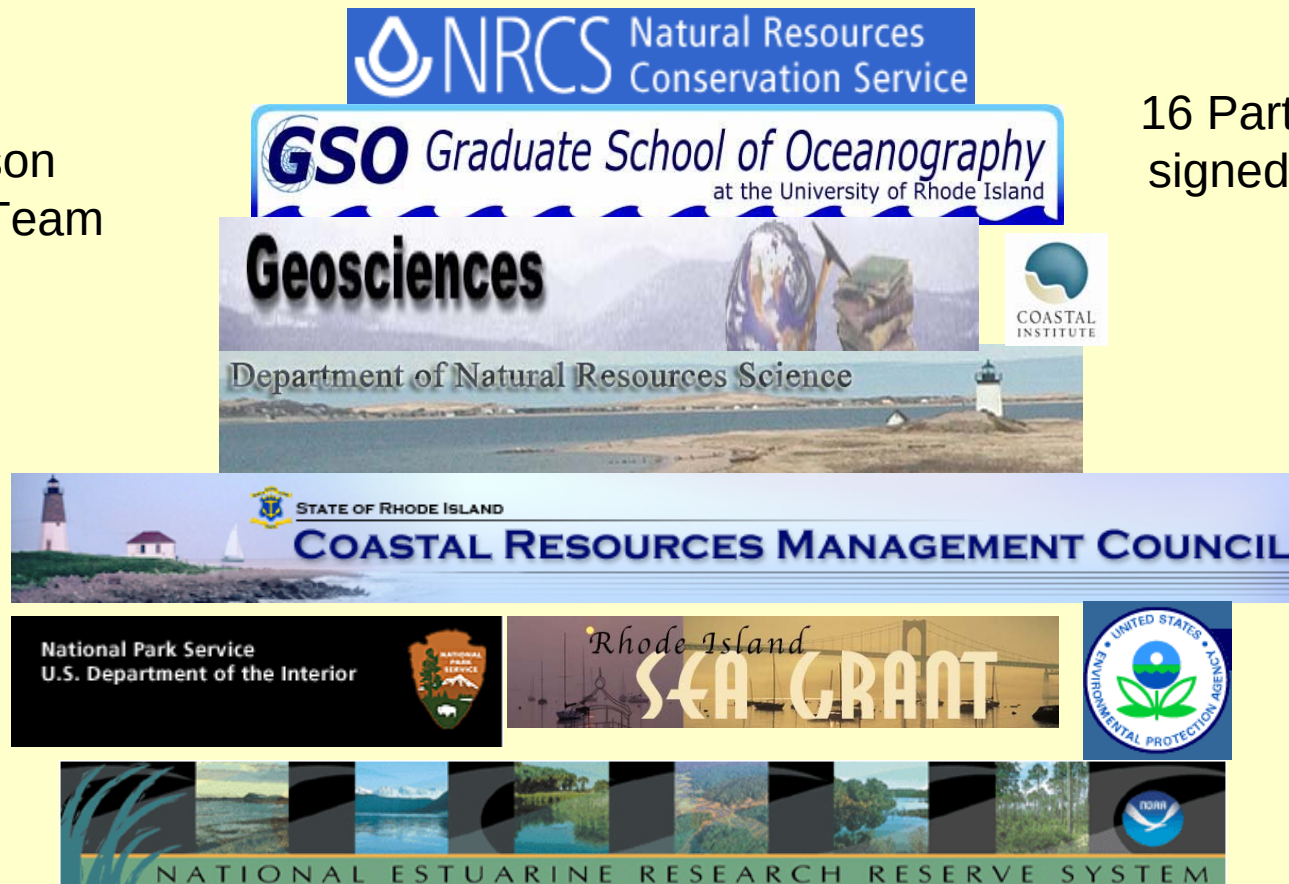


The MapCoast Partnership - *A* *timely alignment of people, ideas, needs* *and goals*

Mapping Partnership for Coastal Soils and Sediment

12 Person
Steering Team

16 Partners have
signed our MOU



Common Ground

MapCoast understands the need to develop a common hierarchal system of coastal soil and sediment classification that encompasses all disciplines including biology, wetlands, geology and pedology.

Common Objectives

- Develop mapping **standards** and **protocols** to produce accurate and useful maps.
- Build multiple **interpretations** of the data to service the coastal resource management community.
- Ensure that data collected will be made **available** to all users.
- Work will be conducted in a **cooperative** manner.
- Partners will **share** resources, technology, and knowledge.
- Provide **training** and **educate** users about the soils and sediment data and maps.

Our Work

- 2004 – User Conference – 70 people, break-out session to develop list of user needs (Synthesis Document).
- Develop Mapping Protocol.
- Use to map Ninigret



Appendix B – Breakout Group Summary

Information Currently Used (paper and electronic maps):

- Bathymetry
- Elevation (topography)
- Ortho-imagery
- GIS data such as soil survey, wetlands, Eelgrass beds, transportations, land use, and habitat maps

Data Needed	Information Needed	Uses, Benefits, and Other Comments
Bathymetry	Dredging information, esp. recently dredged areas	Archaeological uses
	High-resolution digital terrain model	Bathymetric and topographic
	Minimum 2 foot contours	Emergency planning – sea-level rise, FEMA, etc
Chemical and Physical Properties	Chemical and physical analysis of soil and sediment	Grain size distribution, sulfides, salinity throughout cores. Potential turbidity of dredged sediments
	Metals in sediment and bioavailability	Health issues, locating toxins
	Oxic/Anoxic layer	Where does it occur?
	Soil biochemistry, salinity	Salinity drives habitat types
	Water clarity, temperature, nutrients	
Cultural Resources	Drowned village locations	From historic sea level elevation data

MapCoast - 2005

- Field team merge on Ninigret - collect cores, bathy, RTK, side-scan, subbottom, SPI, video, map soil – analyze the data, develop GIS data.
- End season – Feature Segment local news.
- Host 2nd User Conference



2006 – Our Data



- 3rd User Conference – support for MapCoast (Senate, NRCS, State).
- Unveiling of our Ninigret Data.
- Uses of the Data.
- More input from users.

Data

The MapCoast Steering Team is pleased to announce the release of the Ninigret dataset. All of the data sets are displayed using ESRI ArcIMS (Interactive Map Server) technology.

Bathymetry

- [IMS](#)
- [data download](#)

Imagery (EPA and SAIC)

- [IMS](#)
- [data download](#)

Sidescan Imagery and Habitat Data

- [IMS](#)
- [data download](#)

Soil Survey Data

- [IMS](#)
- [data download](#)

Ninigret Geology

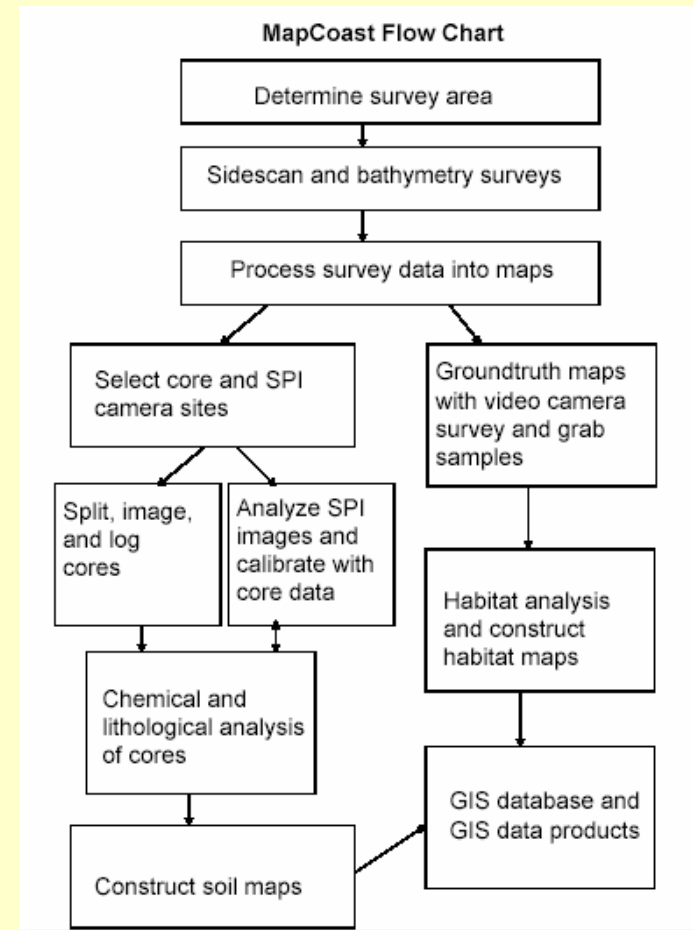
- [IMS](#)
- [data download](#)

Misc. Data

- [EPA Photos](#) (map view of the pond bottom)

Mapping Protocol

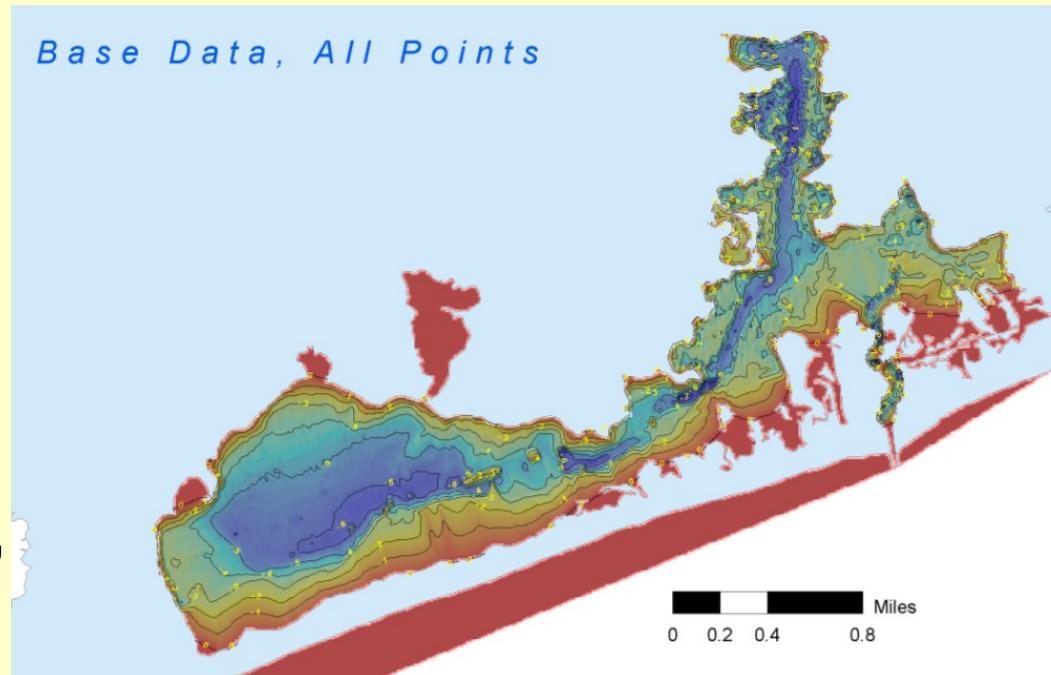
MapCoast has developed a protocol to map and provide interpretive data our users outline in our user conference. A field team (subaqueous SWAT team) has been assembled to collect the data, produce maps and metadata, and provide the data.



Bathymetry – *number 1 data need!*

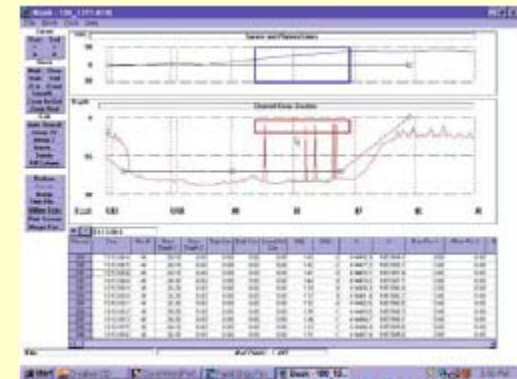
Goal: Accurate, seamless, detailed terrain model that includes bathymetry and topography.

- Field verified, measured accuracy, common datum (NAVD 88), Raster grid format (30 foot pixel).

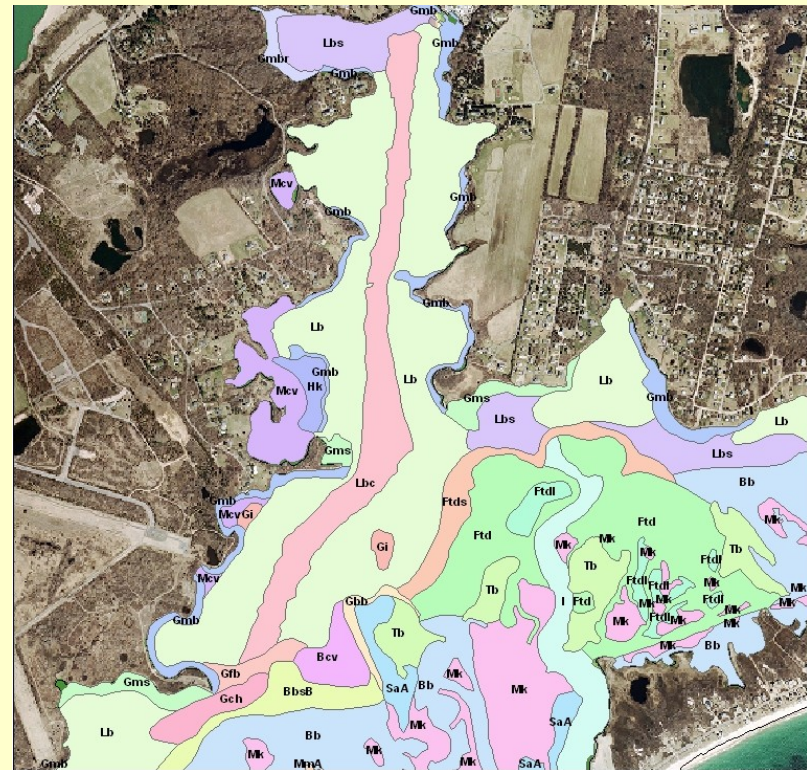
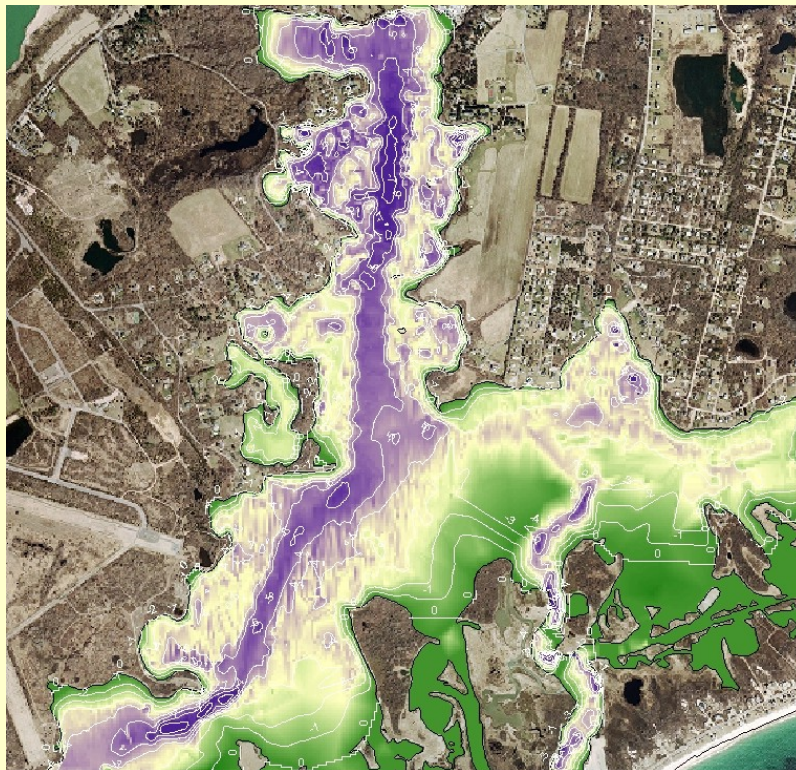


Bathy Methods -

Detailed steps can be found on MapCoast Website.



The Product - *All Elevation Data in NAVD-88, NAD83 Datum*



Point data and raster grids available on web

Remote Sensing Data used to construct Soil, Geology, and Habitat maps.

The MapCoast field crew also employs the following technology to map underwater features:

- Side-scan sonar (acoustic map).
- Subbottom – structures down to 70 feet.
- High Resolution Imagery (number 2 data request).
- SPI Imagery.
- Still and video images of the bottom.
- GPR and EMI for Coastal Soils.

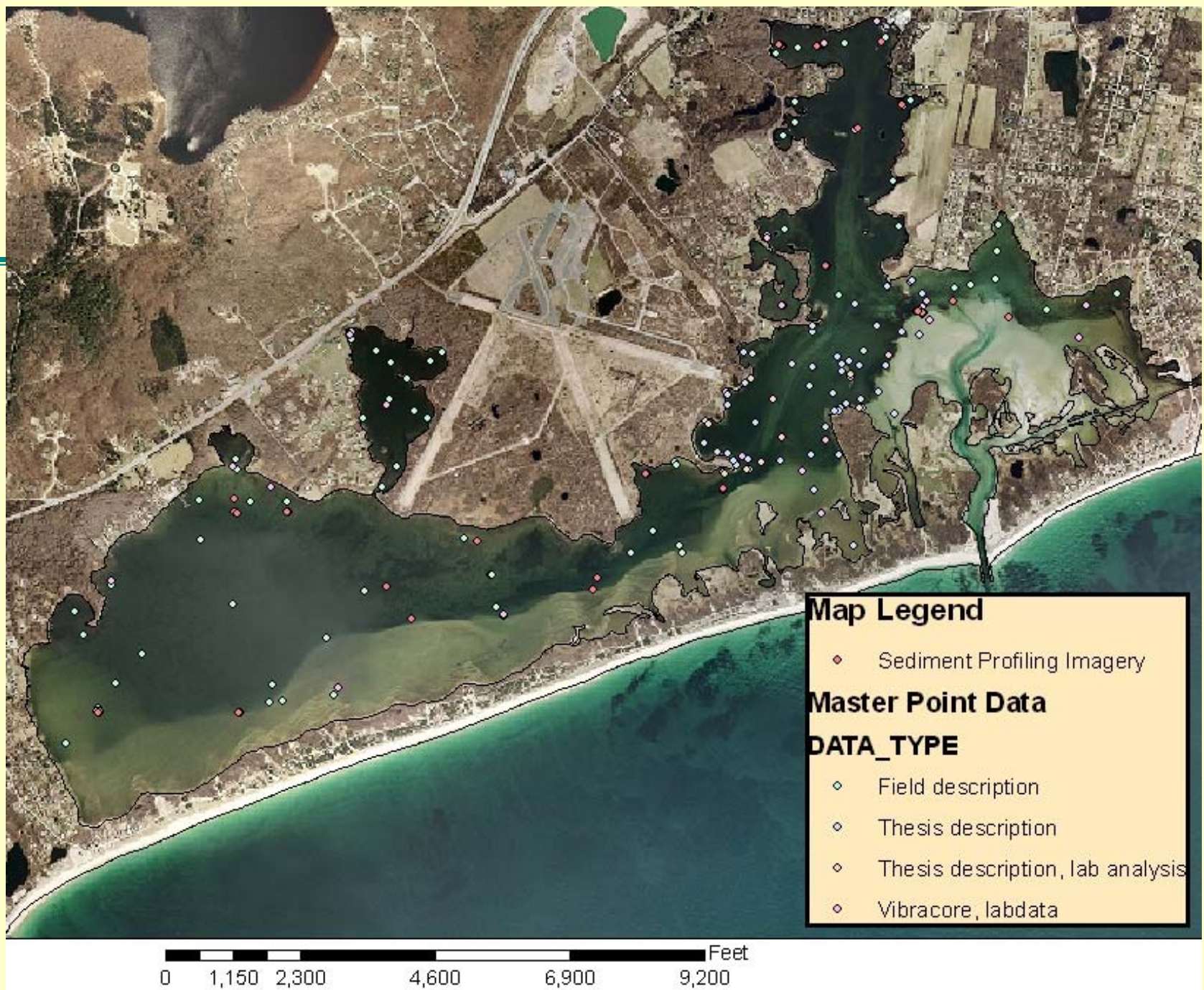


Side-scan sonar map of Wickford Harbor

Subaqueous Soil Mapping

- Bathymetry and other data is integrated to draw landscape units and soil mapping units (bouldery phases, intertidal units, etc.).
- Field investigations consist of collecting point observations of selected areas with hand tools (auger, McCauley, rods).
- Points are geo-referenced, described on boat, entered into tablet in a spreadsheet.





Coring - *Selected (representative) areas are then cored using a vibracore or hammer core.*



Rossfelder Vibracore – obtains a 4 in diameter PVC core – any depth.

Biologic core for highly fluid soils (4" Polycarbonate tube).



Core Cutting and Describing –

cores are stored at 4C.



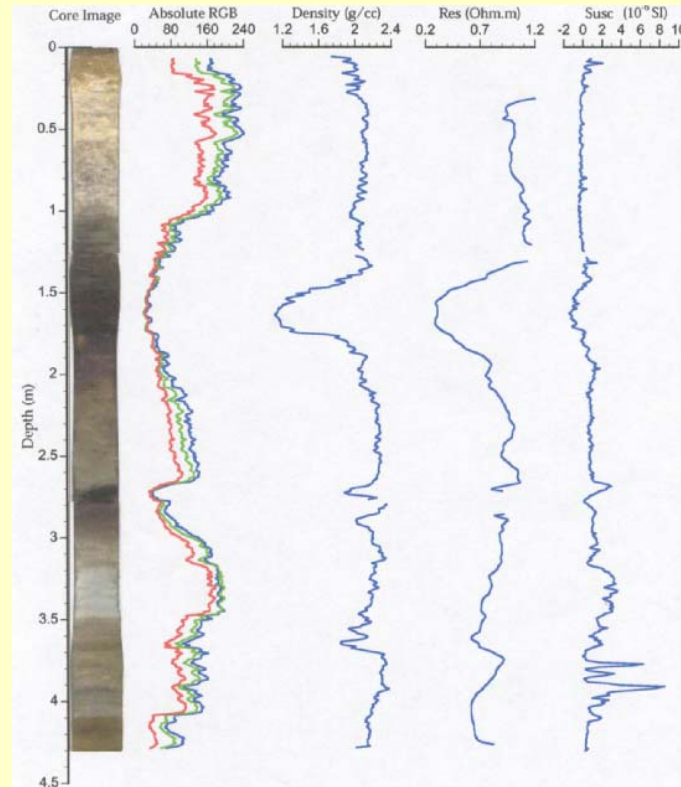
Cores are cut and a full description is taken. One section is sampled and imaged, the other is stored as an archive sample forever.



Core Imaging – *Geotek Core Analyzer and Niton XRF*

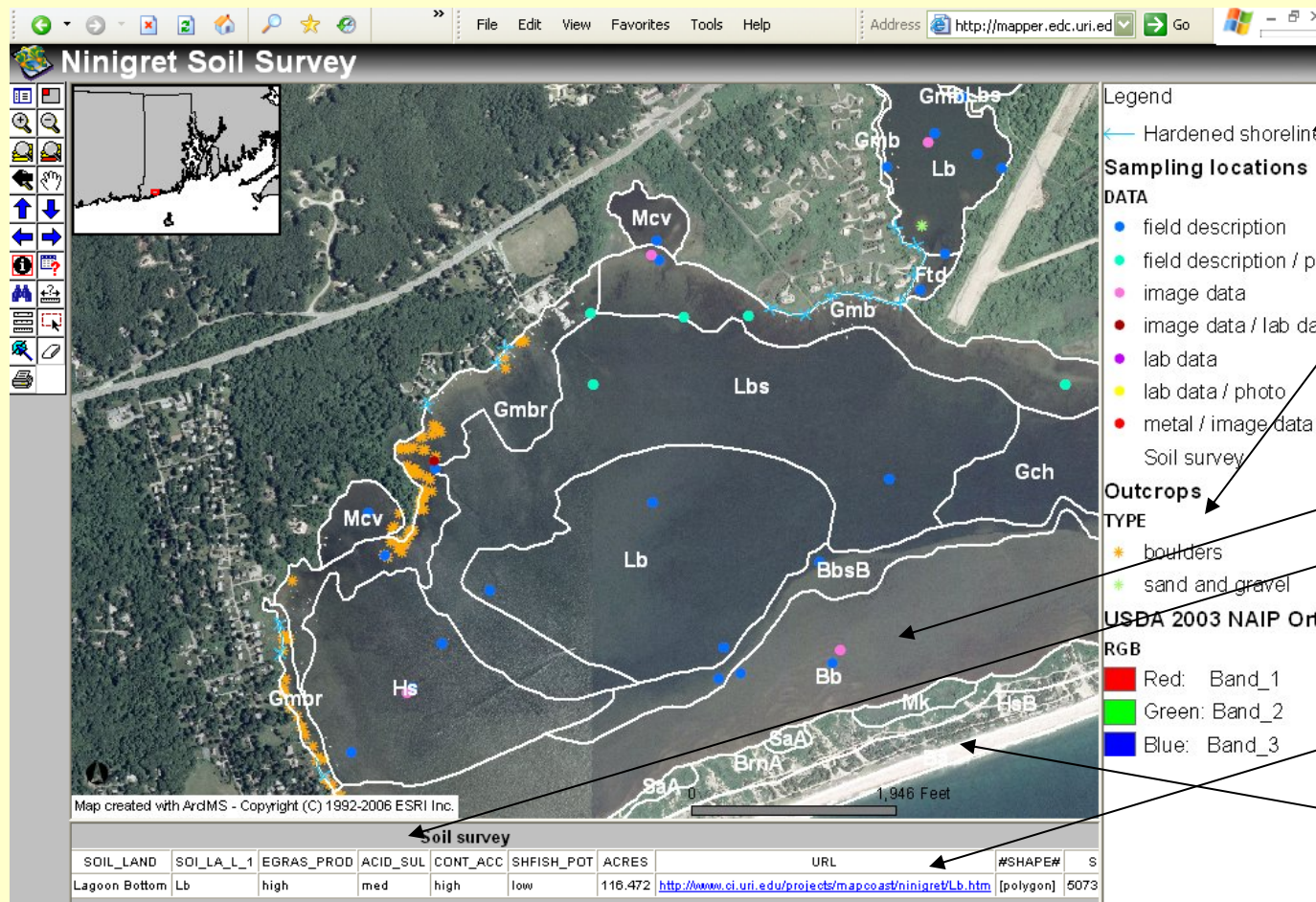


-High resolution image, RGB color, Density, Magnetic data, resistivity.



X-Ray
Flourence
-Heavy
metal data
15
elements.
Rapid data
collection.

Soil Landscape Units → Soil Map



Lines –
shoreline
protection, etc.

Points –
AdHoc spot
symbols.

Polygons –
spatial info
with attribute
data

Links

Coastal soils

Interpretations – *Who Needs SAS Data (So What)?*

The Narragansett Times • Wednesday, October 19, 2005 • Page 3A

The Narragansett Times

Serving Narragansett and South Kingstown

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MIDWEEK

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RAVAGED

Nine days of wind,
rain wreak havoc

By David Henley
Independent Staff Writer

SOUTH KINGSTOWN—While people seem willing to pay almost any price to bury beachfront property along the South Shore, one family that bought here recently is finding itself paying a bundle to get away from the ocean.

Retired IBM sales executive Warren Williams and his wife, Betty, paid \$1.4 million six years ago for property at 1155 Charlestown Beach Road, with a beach house so remote you need a four-wheel drive to get to it. The two-story house stands out on the dunes east of the Charlestown town line, commanding a majestic view of Block Island to the south and Green Hill Pond to the north. They also bought 11 surrounding lots, a total of around 12 acres of dunes and sparinas.

They had no idea how quickly they would need that extra land. "We knew of course that erosion was going to be a problem, and even expected that we would someday have to move the house back, but we thought

that project was a good 10 or 15 years out," Williams said from his home in Wilton, Conn., Tuesday. "The previous owner had installed what they call dune guard fencing, and it seemed to do a pretty good job for about six years. Then after one storm last December our contractor called and said the fence was above ground, that the footings were exposed. I was thinking about calling the company that installed it to see if they could save it when we had another event and my contractor said it was gone."

Without the fence, the dunes in front of the house quickly succumbed to the sea. December's storm ate away dozens of feet of property.

"I made the decision to move the house within 10 minutes of seeing the devastation those storms caused in December," Williams said.

The move, including house renovations and a new septic system, will cost the couple nearly \$1 million.

After buying the 30-year-old

Owners/A4

Major dredging planned for Harbor of Refuge Sand would replenish nearby East Matunuck State Beach

By GALEN MCGOVERN

SOUTH COUNTY—A proposal by the U.S. Army Corps of Engineers to dredge the Harbor of Refuge and east and west channels into Point Judith Pond is getting positive reaction locally. Michael Walsh, project manager with the Corps, said, "Everyone I've talked to agrees it's needed and wants this to happen."

That includes Interstate Navigation, which runs the Block Island Ferry, the state Department of Environmental Management, the Coastal Resources Management Council, the Coast Guard, commercial fishermen, the Narragansett Harbormaster and the towns of South Kingstown and Narragansett. He hasn't heard any opposition to date, Walsh said.

A total of 110,000 cubic yards will be removed, and in order to protect the spawning and juvenile migration of fish, the dredging has to be done in the fall/winter time period.

The earliest the dredging can begin is a year from now. Walsh estimates it will take two months to complete, the price tag—paid by the federal government—will range from \$1-\$2 million.

Dredging hasn't been done in the area since 1977 and the sand is clean, so there is no worry about contamination.

The sand will be moved to East Matunuck State Beach, selected because it is the nearest, easiest and cheapest disposal site for the clean sand.

According to Steven Wright, superintendent of Parks for DEM, "the west side of the beach is predominantly rocky compared to the east side. It always has been. This will absolutely be beneficial."

There may be other beaches in more dire need of replenishment, but transporting the sand is cost prohibitive. For example, if South Kingstown wanted the sand for the badly-eroded town beach in Matunuck, "that additional cost would have to

be picked up by a local sponsor," according to Walsh.

Bruce Kaiser, director of Administrative Services for South Kingstown, hopes if the current is right that the South Kingstown Town Beach "might be the beneficiary of it (the sand) at some time."

The dredging is good news for all boaters, but especially for bigger craft like the commercial fishing vessels and the ferry, which could have trouble navigating the channel at low tide. When completed, the dredged channels will be 15 feet below the average of the lower low tides. "There are two low tides (every day) and one is lower. Most of the fishing vessels draft at 12 feet and they need the extra under clearance," explained Walsh.

South Kingstown has received significant complaints from recreational boaters about shoaling and shallow water in the navigation channel, according to Kaiser. The channel is not only shallow, it is narrow and this "causes boats to pass much closer" to one another which can be a safety issue, said Kaiser.

Recreational boater Skip Nelson keeps his boat at Channel Marina, around the corner from Snug Harbor. "When I am really needs to be dredged. It's shoaling up a bit." He expressed the need for dredging the whole area around Snug Harbor and Newport Marina.

"It would be great to let all the marinas in that end of the pond know about the dredging. Maybe they could dredge a little further north." So far, there is no proposal to do this and the Army Corps didn't see a need for it. "But I've been wrong before," added Walsh.

Nelson said he hasn't noticed any problems with his boat near the entrance to Point Judith Pond, but his boat only drafts three and a half feet. Walsh made it clear the Corps is not interested



The west end of East Matunuck State Beach is extremely rocky and few people spread their blankets there in the summer. With the addition of 110,000 cubic yards of sand, that will change. At left is Matunuck Point. The marshes at the right are home to piping plovers.

with working around fishing fleets. "We are always cognizant of how to get traffic out of there," he said.

The contractor for the Corps will be using a hydraulic dredger with a submerged pipeline in the navigation channel. The pipe will run over the breakwater and snake toward the beach.

The Corps hasn't addressed going across private properties yet and will contact owners for access if they need it. They are currently seeking

aspects of the project as well as public comment from all those interested.

Comments referencing this proposal should be submitted no later than November 10, 2005 to the U.S. Army Corps of Engineers, New England District, Project Management Division (Attn: Mr. Michael Walsh, 690 Virginia Road, Chelsea, MA 01742-2751). No public meeting has been scheduled.

Erosion forces owners to move beach house

By David Henley
Independent Staff Writer

SOUTH KINGSTOWN—While people seem willing to pay almost any price to bury beachfront property along the South Shore, one family that bought here recently is finding itself paying a bundle to get away from the ocean.

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The move, including house renovations and a new septic system, will cost the couple nearly \$1 million.

After buying the 30-year-old



PHOTO: DAVID HENLEY

Owners Warren and Betty Williams already had begun renovating this summer house on Charlestown Beach Road when storms eroded the dunes in front of the house. They have decided to move the house 200 feet away from the shore, a move that will gain them only 50 years, according to a state geologist.

REED SECURED FEDERAL FUNDING FOR RHODE ISLAND FOR FISCAL YEAR 2006

Natural Resources Conservation Service (NRCS) Soil Survey Management Office: \$100,000

The Natural Resources Conservation Service (NRCS) will receive \$100,000 to develop coastal and underwater soil mapping techniques, classification, and soil analysis, as well as provide ongoing training. [\[Click to go back to the top of the page.\]](#)

Pawtuxet Cove Federal Navigation Project Maintenance Dredging: \$1,440,000
Cranston/Warwick

The Army Corps of Engineers will receive \$1,440,000 to remove 90,000 cubic yards of material to restore the 6-foot entrance channel, turning basin and anchorage area in Pawtuxet Cove. The Pawtuxet Cove Federal Navigation Project is an important gateway for vessel traffic serving both the cities of Cranston and Warwick. [\[Click to go back to the top of the page.\]](#)

Narrow River Aquatic Ecosystem Restoration Project: \$150,000
Narragansett/South Kingstown

The Army Corps of Engineers will receive \$150,000 in federal funding to conduct a feasibility study to restore aquatic habitats along the Narrow River in Narragansett and South Kingstown. The Army Corps of Engineers is providing a Preliminary Restoration Study to reduce the sedimentation between the river and Rhode Island Sound. [\[Click to go back to the top of the page.\]](#)

Roger Williams University Center for Aquaculture Development (CAD): \$1,000,000
Bristol

Roger Williams University (RWU) in Bristol will receive \$1,000,000 to support the establishment of a Center for Aquaculture Development (CAD). The CAD will be established within the University's successful Center for Economic and Environmental Development which has an active aquaculture research program and operates the only shellfish hatchery in Rhode Island. [\[Click to go back to the top of the page.\]](#)

East Providence Waterfront Storm Water Management Analysis: \$250,000

The City of East Providence will receive \$250,000 to analyze and develop an innovative storm water management plan for its newly revitalized waterfront. [\[Click to go back to the top of the page.\]](#)

Bullocks Point Cove Federal Navigation Project Maintenance Dredging: \$630,000
East Providence/Barrington

The Army Corps of Engineers will receive \$630,000 to remove 50,000 cubic yards of dredged material to restore the project's 8-foot entrance channel, the 6-foot inner channel, and the 6-foot mooring and turning basins. [\[Click to go back to the top of the page.\]](#)

Charlestown Breachway navigation study: \$90,000
Charlestown

The Army Corps of Engineers will receive \$90,000 to complete a navigation study and initiate and complete the project design for the Charlestown Breachway and Inlet. There is growing concern for navigation safety through the breachway, which connects Ninigret Pond to Rhode Island Sound. The Army Corps of Engineers is considering a project to remove large boulders on the ocean side of the breachway as well as some dredging of the natural channel farther inland. The Corps will already be dredging in Ninigret Pond for habitat purposes under the South Coast Habitat Restoration Project, minimizing the impact of the project. [\[Click to go back to the top of the page.\]](#)

Boyd's Point Town Salt Marsh Restoration: \$100,000
Barrington

The Rhode Island Coastal Resources Management Council will receive \$100,000 to continue the construction of Boyd's Point Salt Marsh Restoration Project. The project will restore 13 acres of salt marsh habitat and provide a wildlife refuge and a second boating area. [\[Click to go back to the top of the page.\]](#)

Brush Neck Environmental Restoration: \$150,000
Warwick

The Army Corps of Engineers and the Rhode Island Coastal Resources Management Council will receive \$150,000 to continue to develop a feasibility study for Brush Neck Cove in Greenwich Bay. [\[Click to go back to the top of the page.\]](#)

Allins Cove Environmental Restoration: \$300,000
Barrington

The Rhode Island Coastal Resources Management Council will receive \$300,000 to continue the restoration of degraded coastal wetlands at Allins Cove in Barrington. This project will restore coastal habitat and salt marsh by improving tidal flushing through removal of dredged material associated with a Federal navigation project. [\[Click to go back to the top of the page.\]](#)

Ten Mile River Fisheries Restoration: \$250,000

The Rhode Island Coastal Resources Management Council will receive \$250,000 to support the restoration of fish runs in the Ten Mile River, which runs in eastern Rhode Island and southeastern Massachusetts. The construction of dams over the last 200 years has prevented fish passage to upstream spawning habitat. Restoring the fish run to the lower Ten Mile River would provide a wide range of benefits to the freshwater and marine fishery and to the surrounding communities. The bill also includes \$14,000 for Inspection of Completed Works by the Army Corps of Engineers, \$360,000 for Project Condition Surveys, and \$525,000 for the Fox Point Hurricane Barrier to upgrade its 40-year old electrical system. [\[Click to go back to the top of the page.\]](#)

New England Lobster Disease Research: \$3 million
University Of Rhode Island

The National Sea Grant College Program will receive \$3 million to establish a cooperative research program to study the causes of lobster disease and the decline in the lobster fishery in New England waters. [\[Click to go back to the top of the page.\]](#)

\$9 Million

Interpretations

- **SAV Restoration**
- **Crab Habitat**
- **Clam Stocking**
- **Management for Sustainable Production - Shellfish**
- **Nutrient Reduction**
- **Benthic Preservation Site Identification**
- **Wildlife Management**
- **Critical Habitats for Wading Shore Birds**
- **Nurseries and Spawning areas**
- **Habitat Protection for Horseshoe Crabs**
- **Dredging Island Creation**
- **Tidal Marsh Protection and Creation**
- **Bathymetric Map**
- **Navigational Channel Creation/ Maintenance**
- **Effects of Dredging on Benthic Ecology**
- **Off Site Disposal of Dredge Spoil**
- **Acid-Sulfate Weathering Hazards**
- **Dune Maintenance/Replenishment**

Appendix B – Breakout Group Summary (Con't)

Data Needed	Information Needed	Uses, Benefits, and Other Comments
Elevation	Tidal data – Mean High Water and Mean Low Water	Beach access, regulatory applications (property lines), drowned village locations
GIS and Cartographic Information	Rock outcrops and depth to bedrock	Engineering structures, pylon and bulkhead construction
	Hardened shorelines	Regulatory uses, habitat evaluation, erosion hazards. Rock outcrops may be locations of former villages
	Land use change	Identify former wetlands and drainage
Imagery	Ortho images flow every 2-3 years	Map resolution as high as possible (0.25 acre minimum)
	Rectified, digital historic imagery	Archived photos and data
	Side-scan sonar and bottom analysis	Location of shipwrecks
	Thermal imagery	Fresh water movement into estuary
Regulatory	Location of docks and moorings	Cumulative impact on and relation to Eelgrass growth
	Structure permits, including structural information	Detailed attributes of structures
Soil and Sediment Data	Bed configuration	Use to assess current flow information
	Classification and distribution of subaqueous soils	
	Coastal erosion hazards – changing coastline	Accretion rates and relation to sea level rise
	Interpretations of classified soils	Environmental interpretations, health and water quality benefits
	Mapping of filled areas and structures	Re-mapping of old soil survey
	Mapping to beyond 25 meters	
	Soil permeability	Septic systems, risk assessment; include slopes, near shore soils, upland soils

Numerous other Interpretation Needs:

- Accretion rates.
- Heavy Metals / Health Issues.
- Freshwater Inputs.
- Archeological – prehistoric landscapes.
- Baseline Data – chemical, spatial, habitat.
- Classification of the soils.
- Coastal soils information.

Restoration

Eelgrass Suitability Mapping: Critical Variables

Site Selection Model

Wave Exposure (exposure & current speed)

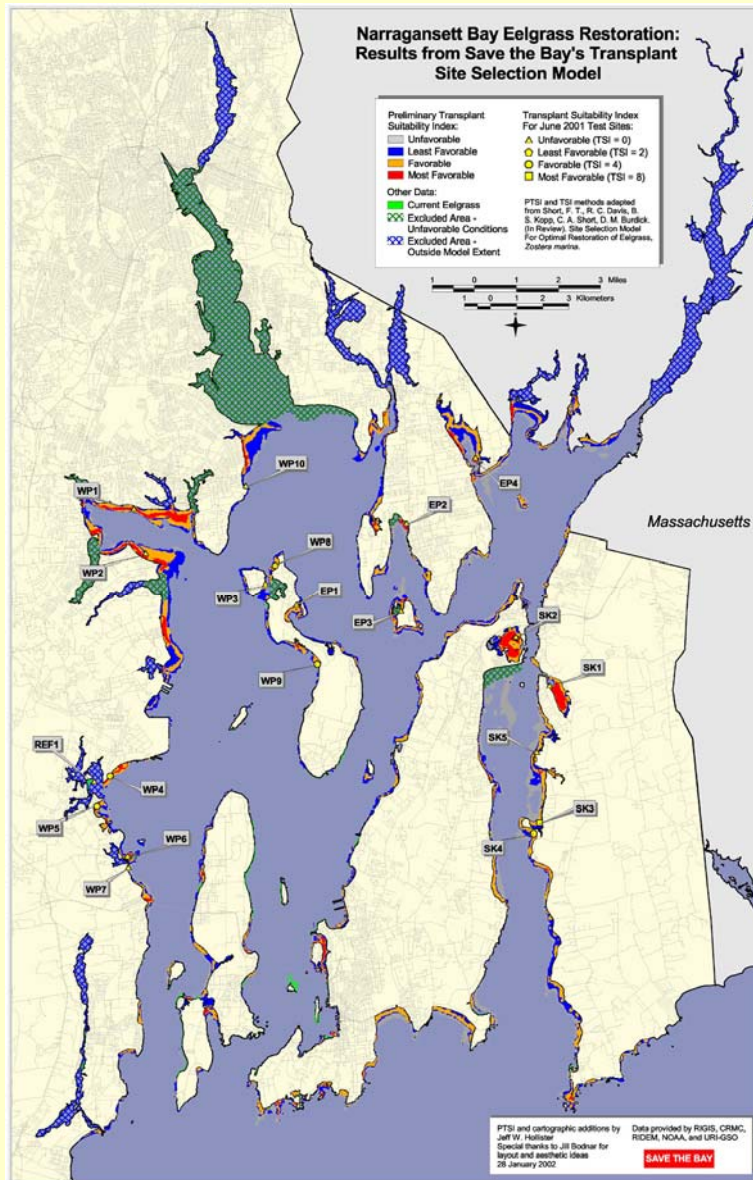
Soil Characteristics (texture,
sulfide, organic matter)

Bioturbator Abundance

Temperature

Bathymetry (Critical Depth)

Missing!



EPA need: assess habitat and other stressors at larger scales so as to manage cumulative effects of small alterations . . .

- provide suites of species-habitat models**
- combine models with habitat mapping**
- create GIS tools for managers**

**Thus the
Mapcoast
partnership...**

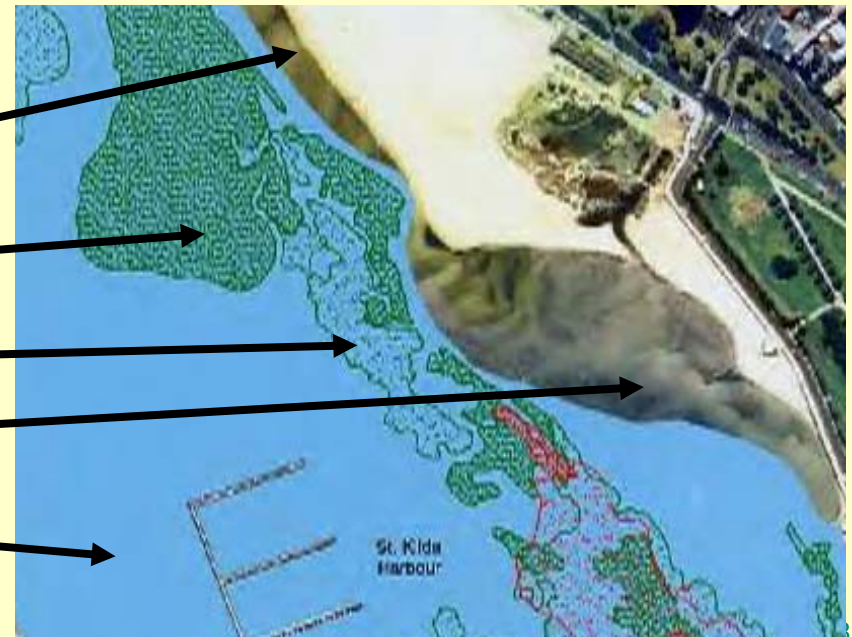
marsh

seagrass

algae

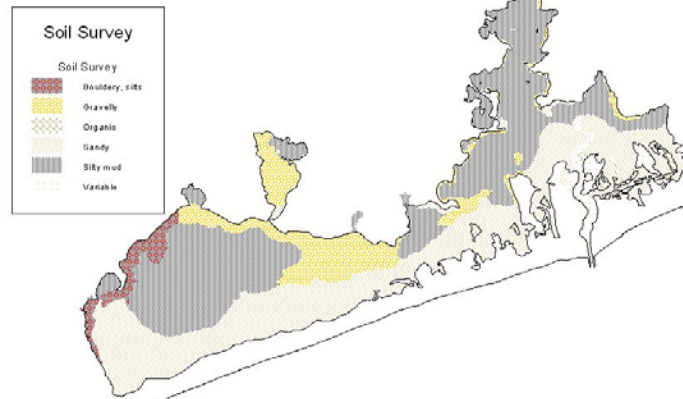
soil 1

soil 2



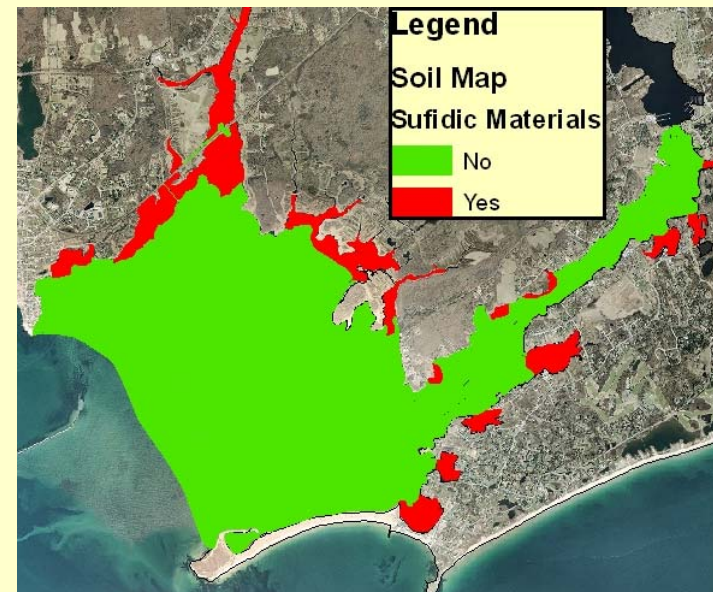
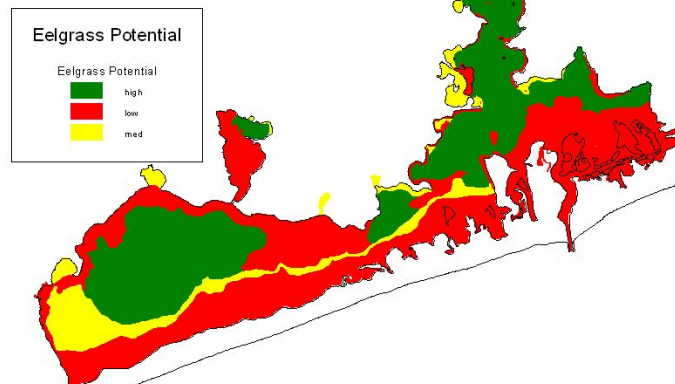
Examples of Interpretive Maps / Data

Ninigret Soil Survey - Bottom Types



Shape	Area	Soil Land	Soil La. lab	Egras. prod	Acid. sul	Cont. acc	Shlish. pot	Acres	Bottom
Polygon	235087.23690532474	Mainland Submerged Erosional	GmbD	low	med	low	high	5.397	Boulderly, silts
Polygon	384759.10078438418	Mainland Cove	McvB	med	med	med	low	8.833	Silty mud
Polygon	3152152.87145703800	Mid-lagoon Channel	GchD	low	med	low	med	72.363	Gravelly
Polygon	37122.14080215571	Salt Marsh Island	SI	low	med	low	low	0.852	Organic
Polygon	104322.88471123297	Salt Marsh Island	SI	low	med	low	low	2.395	Organic
Polygon	133285.37011049362	Mainland Cove	McvB	med	med	med	low	3.060	Silty mud
Polygon	1491106.80578614400	Lagoon Bottom	Lb	high	med	high	low	34.231	Silty mud
Polygon	377003.87770744041	Mid-lagoon Channel	GchD	low	med	low	med	8.695	Gravelly
Polygon	231759.86242866283	Mainland Submerged Beach	GmsC	med	med	low	high	5.320	Sandy
Polygon	56898.05662249867	Salt Marsh Island	SI	low	med	low	low	1.306	Organic
Polygon	149014.27884337772	Mainland Cove	McvB	med	med	med	low	3.421	Silty mud
Polygon	224670.05195549550	Glacial Fluvial Bar	Gfb	low	med	low	high	5.158	Gravelly
Polygon	98455.88323423080	Salt Marsh Island	SI	low	med	low	low	2.031	Organic
Polygon	323883.92810968601	Mainland Cove	McvB	med	med	med	low	7.435	Silty mud
Polygon	5285.64277089015	Salt Marsh Island	SI	low	med	low	low	0.121	Organic
Polygon	881551.79206649121	Back-barrier Sand Flat	Bb	low	high	low	high	20.238	Sandy
Polygon	429333.25068374700	Back-barrier Sand Flat	Bb	low	high	low	high	9.856	Sandy

Ninigret Soil Survey - Eelgrass Potential



Baseline Data – *Chemical and Physical Properties*

PISHAGQUA SERIES

Ninigret Pond Soil Pedon Description: S04-RI-009-001 (Site 10 – Lagoon Bottom) Core Analyzer Data (information about this to be provided later)

Quick Links:

[Site Information](#)

[Pedon Description](#)

[URI Lab Data](#)

[XRF Heavy Metal Analysis](#)

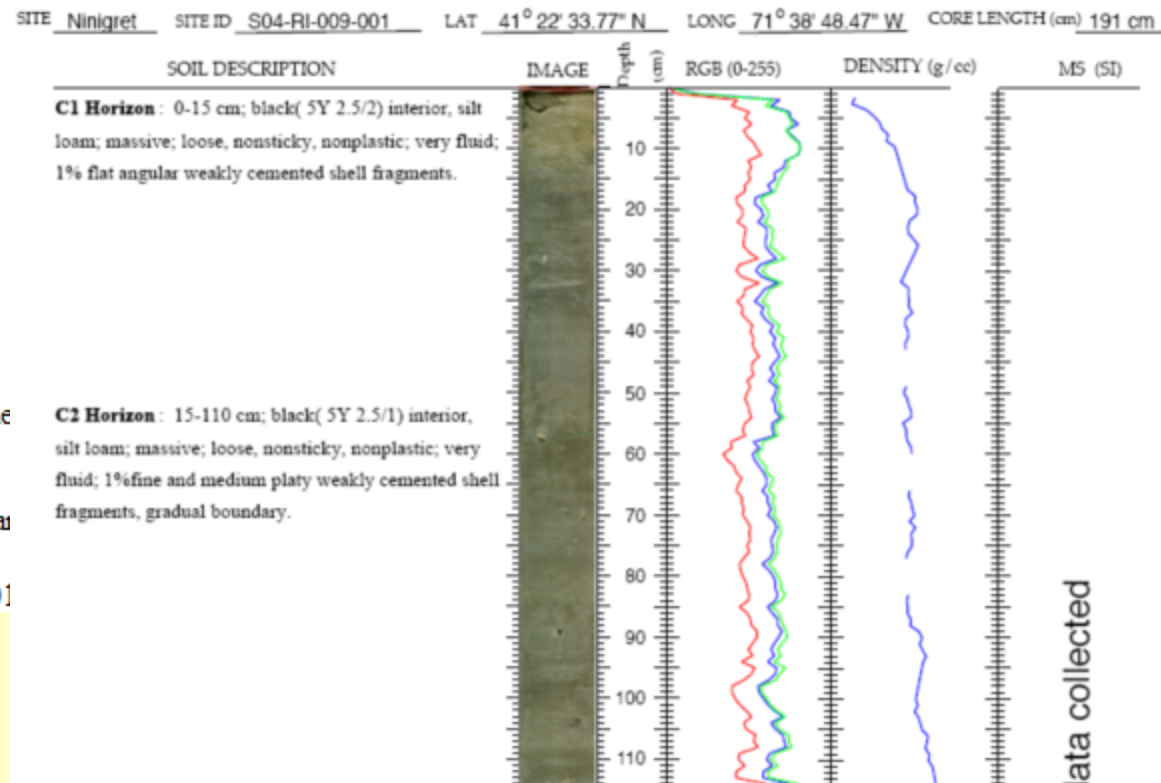
[Core Analyzer Data](#)

[Soil Profile Image](#)

Site Information:

Print Date: 11/08/2004
Description Date: 09/01/2004
Describer: Bradley, Turenne
Site ID: Site 10
Site Notes: Hammer core sample available
Pedon ID: S04-RI-009-001

Below is core data collected with a Geotek core analyzer



MapCoast Future Plans

- Await for word on Coastal Zone Soil Survey Initiative funding = RI Center for Subaqueous Soils.
- 2007 – 2008 NOAA funding to develop mapping protocol and procedure for subaqueous soil mapping – publish paper.
- Work on building interpretations, classification system, integrate other disciplines and their data (shellfish folks, benthic, etc.).
- Continue mapping and data collection – improve process and dissemination.



www.mapcoast.org or nesoil.com/sas

Questions?

Hmm...
How did I
manage to
get stuck in
this soil?

