Sediment Characterization and Management of New Jersey's Coastal Waterways

A Study Program Consisting of Three Integrated Projects

Coastal Research Center
Richard Stockton College
&
Ocean and Coastal Consultants
&
The Bay Waters Alliance

Talking Points…

- State of Dredging Affairs
- Project Overview
- Current Status & Potential Challenges
- Anticipated Results

Tidal Wetland Development

Maintenance of Developed Waterways

- 1890s… Initial Development Begins Following End of Civil War in 1865
- 1940s… Post-War Development Surges
- 1970… Development Regulated With the "Wetlands Act"
- Today… Over 30-years of Sediment Accumulation

Tidal Wetland Development

Over 30-Years Time Sediment Accumulation Has Rendered Many Lagoons Nearly Useless As Fine Material Built Up to Be Exposed at Low Tide

Economic Concerns

Sediment-Choked Waterways Hazardous & Devalue Properties

- Private and Commercial Waterway Sedimentation
  - Navigation hazards
  - Lower property values due to loss of waterway access
- Jersey Shore Contributes Much to the State's Bay Waters and ICW Recreational Usage
  - 71% in economic output in 2003
  - 71% in jobs in 2003
- Economic Prosperity and Quality of Life Affected
  - Bay waters & ICW host to many recreational & commercial activities
  - Unsafe passage through waterways curtails usage and activities
  - 1996-2001, fishing related expenditures alone decline 46%

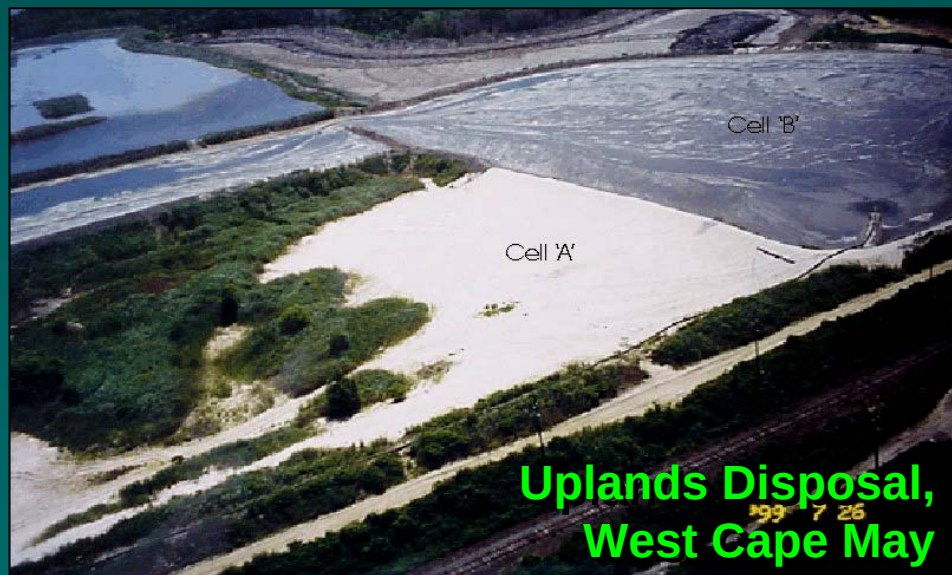
Economic Statistics from Richard C. Perniciaro, Center for Regional and Business Research, Atlantic Cape Community College

Environmental Concerns

Dredge Material Disposal

- Proper disposal is expensive and difficult to arrange
  - Low value and high transportation & storage costs
- Traditionally disposed in marshlands adjacent to the project site
  - Mystic Islands (Tuckerton, NJ)
  - Ocean City (Dredge Island)
- This practice was reformed to "upland disposal" sites which must meet NJDEP criteria:
  - Low volatile organic hydrocarbons and metal oxide content

Dredge Island, Ocean City



Uplands Disposal, West Cape May

The New Resource

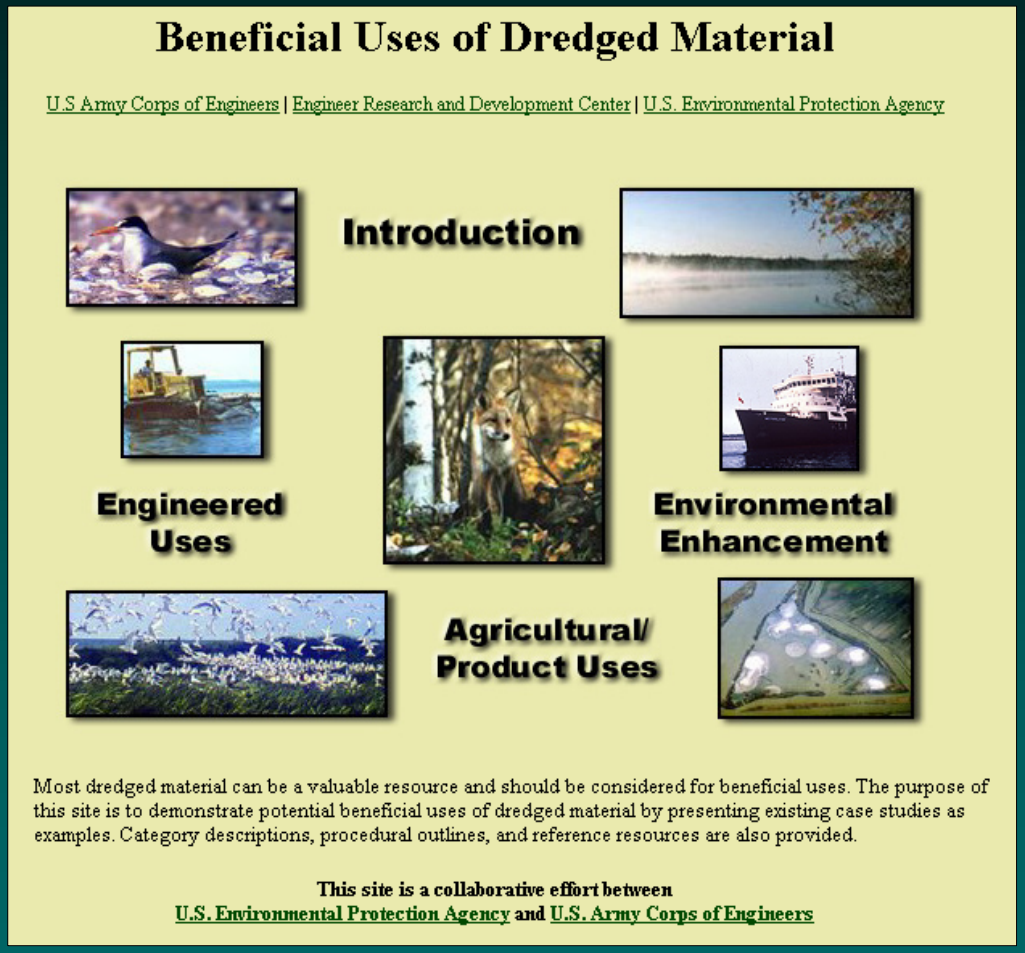
Composition and Beneficial-Use of Dredge Sediments

- NJDEP Has Determined That Acceptable Uses for Dredged Material Include:
  - Beach nourishment, dune creation, and artificial island construction
  - Road and parking lot construction fill and blending material
  - Landfill and Brownfield cover
  - Mine site reclamation

- What About Finer-Grained Materials, Such as ***Mud*** ?

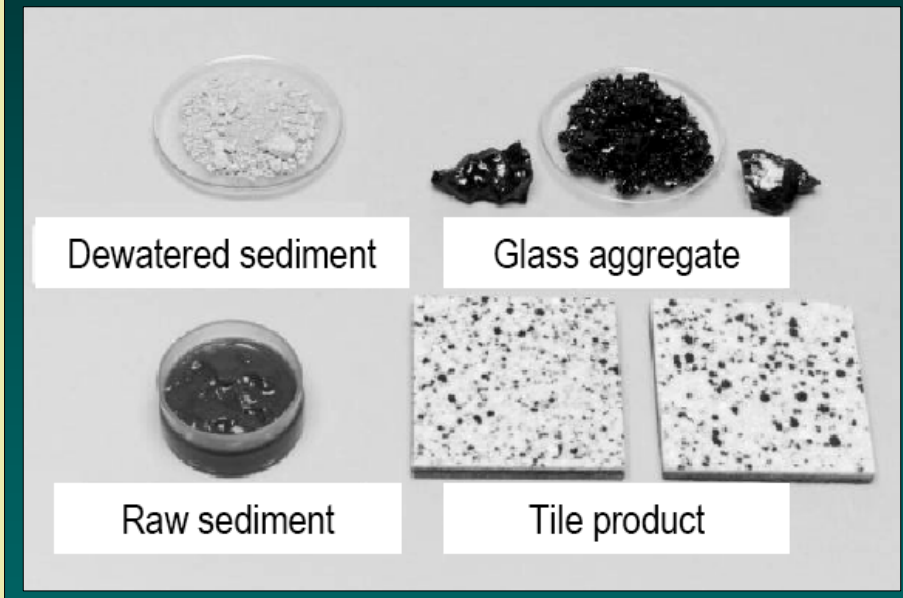
The New Resource: Dredged Mud

Some Beneficial-Use Options for Dredged Mud



http://www.wes.army.mil/el/dots/budm/budm.html

Decontamination and Beneficial Reuse of Dredged Estuarine Sediment: The Westinghouse Plasma Vitrification Process



(http://www.bnl.gov/wrdadcon/publication/articles/westinghouse-weda.pdf)

Talking Points…

- State of Dredging Affairs
- Project Overview
- Current Status & Potential Challenges
- Anticipated Results

CRC – OCC Study Program

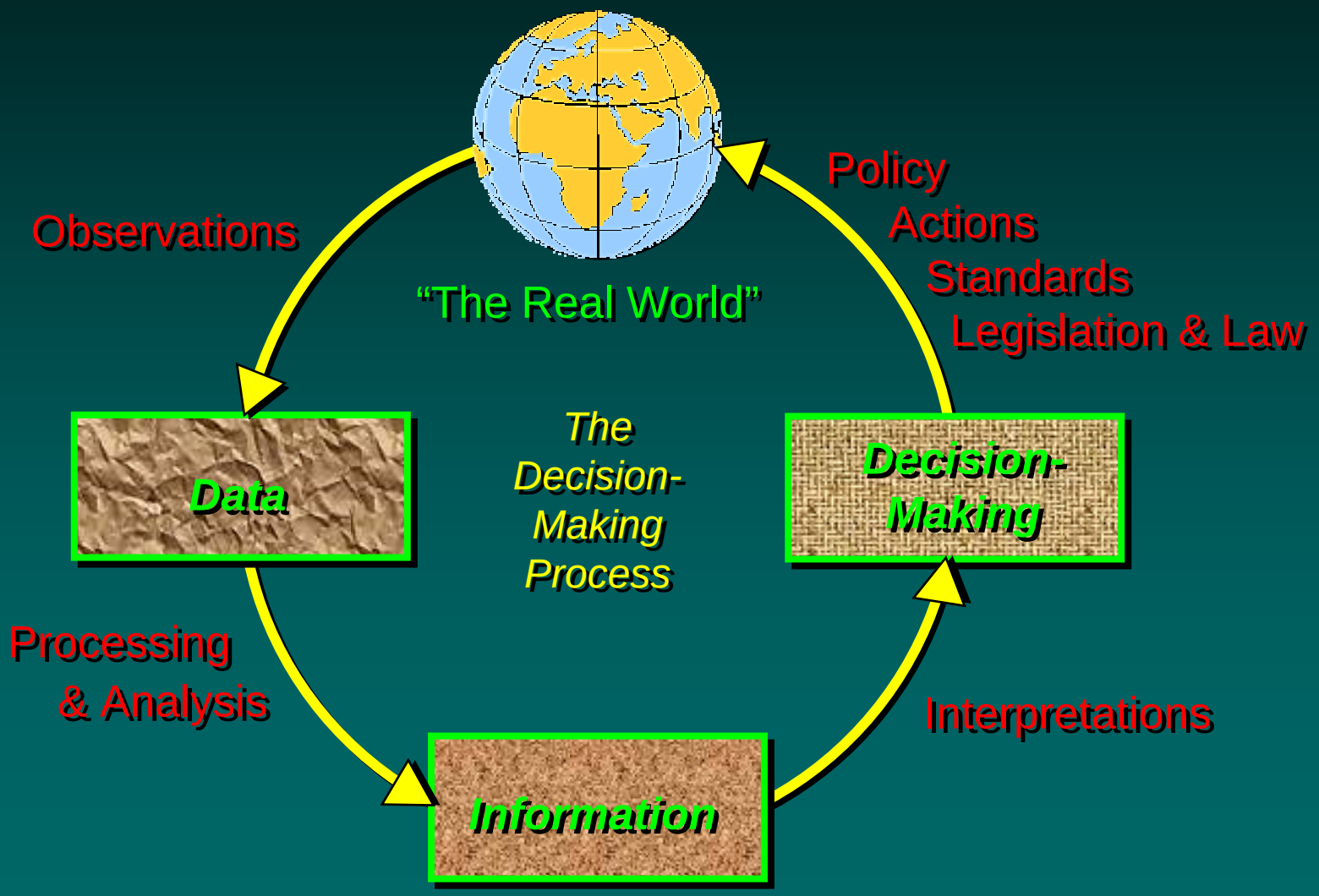
Joint Project Study Program –
Dredge Sediment Characterization & Management

- Coastal Research Center…
  - Dr. Stew Farrell
  - Dr. Mark Mihalasky
  - CRC Staff
  - Kim McKenna

- Ocean and Coastal Consultants…
  - Doug Gaffney
  - Keil Schmid
  - Ed Gorleski

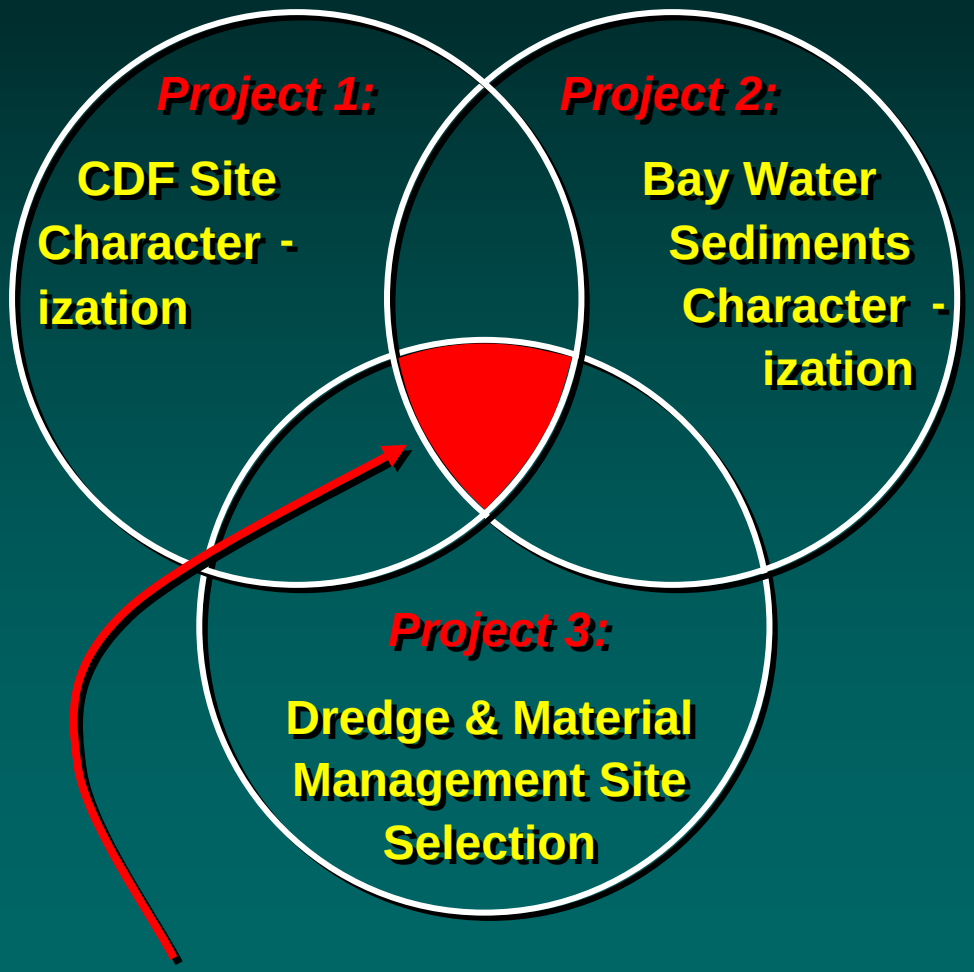
Informed Decision-Making...

Otherwise, Special Interests Dominate the Process



CRC – OCC Study Program

Baywaters Statewide, Concentrating on State-Owned Waters

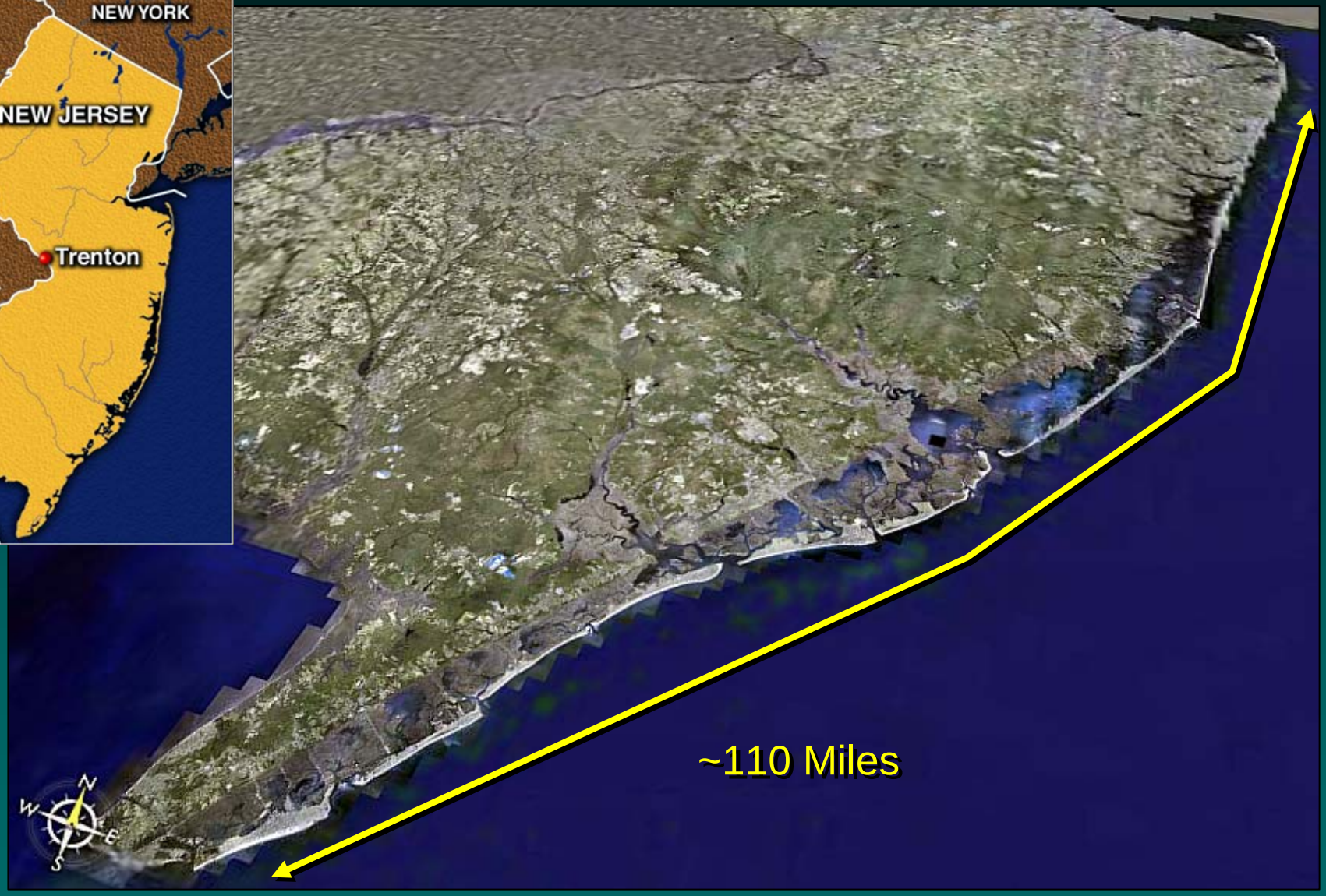


1. Regional Confined Disposal Facility (CDF) Mapping and Resource Definition
2. Characterization, Mapping, and Dynamics of Sediment in Coastal Waterways
3. Spatial Analysis & Suitability Modeling for Identifying Priority Dredging Sites and Locating Dredged Material Management Sites
4. $605,000 Total Project Cost
   - 90% NJDOT
   - 10% Bay Waters Alliance

Foundation of Informed Decision Making & Regional Approach

Regional-Scale in Extent

Bay Waters of Monmouth, Ocean, Atlantic, Burlington, & Cape May Counties



Project #1

CDF Mapping & Resource Definition

- Baseline for CDF Mining
  - Inventory of dredge material
  - Prioritization of CDFs
- Agency Coordination and Management of Dredged Related Activities State-Wide
  - First Step Towards "Perpetual Placement Sites"
- Guidance
  - Stakeholder Input (Site Owners, Resource Users)
- Define Process for Entire Study Program

1995 DOQQ of Corson's Inlet and southern Ocean City

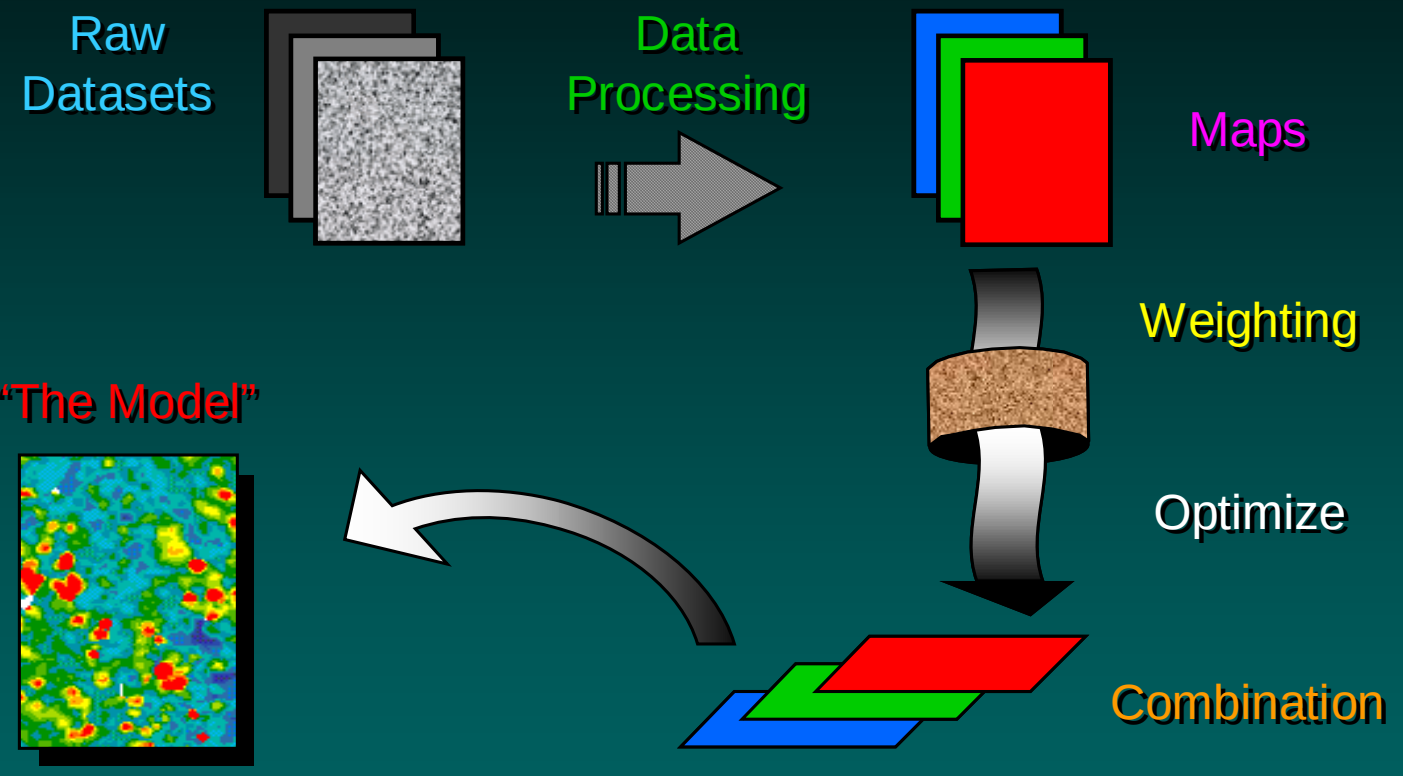
Project #2

Characterization, Mapping, and Dynamics of Sediment in New Jersey's Coastal Waterways

- Describe and Characterize Bayfloor Sediment
  - Composition
  - Bathymetry
- Highlight Areas in Need of Dredging
  - Define Priority Dredging/Shoaling Areas
- Quantify Rates and Types of Material to Be Dredged
  - Sediment Transport Dynamics

Project #3

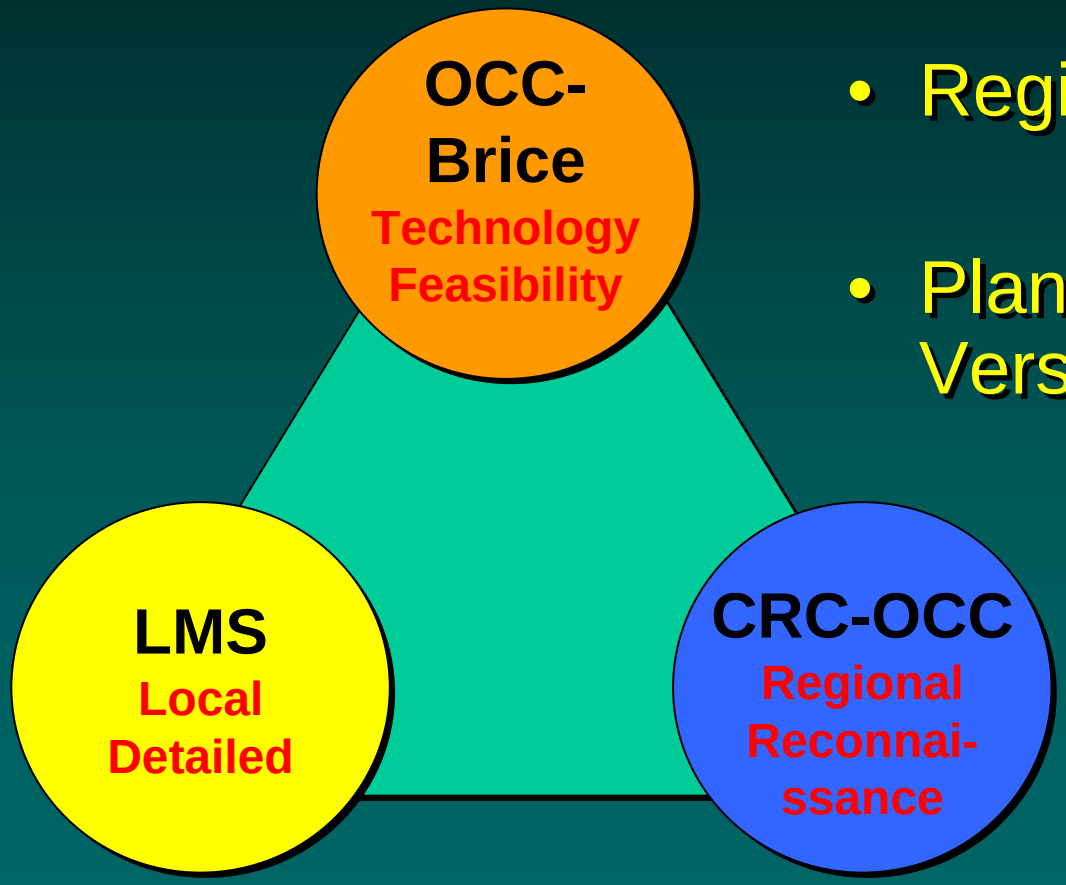
Spatial Analysis & Site Suitability Modeling



- "Dredged Material Processing Site Suitability" Map
  - Determine sites suitable for prospective dredged material processing
- "Dredge Site Priority" Map
  - Identify & prioritize areas in need of maintenance dredging

CRC – OCC Study Program

Relation to Other IBoat NJ Projects



- Regional Versus Local
- Planning and Management Versus Technology

CRC – OCC Study Program

Partnerships and Opportunities

- State
  - DOT
  - DEP
- Federal
  - USACE
  - EPA
- Counties
- Municipalities
- Civil / Public Education Groups
  - Bay Waters Alliance
- Private Marine Concerns
  - Yacht Clubs
  - Marinas
  - Charter Boats
- Contractors
- Boat Builders

Talking Points…

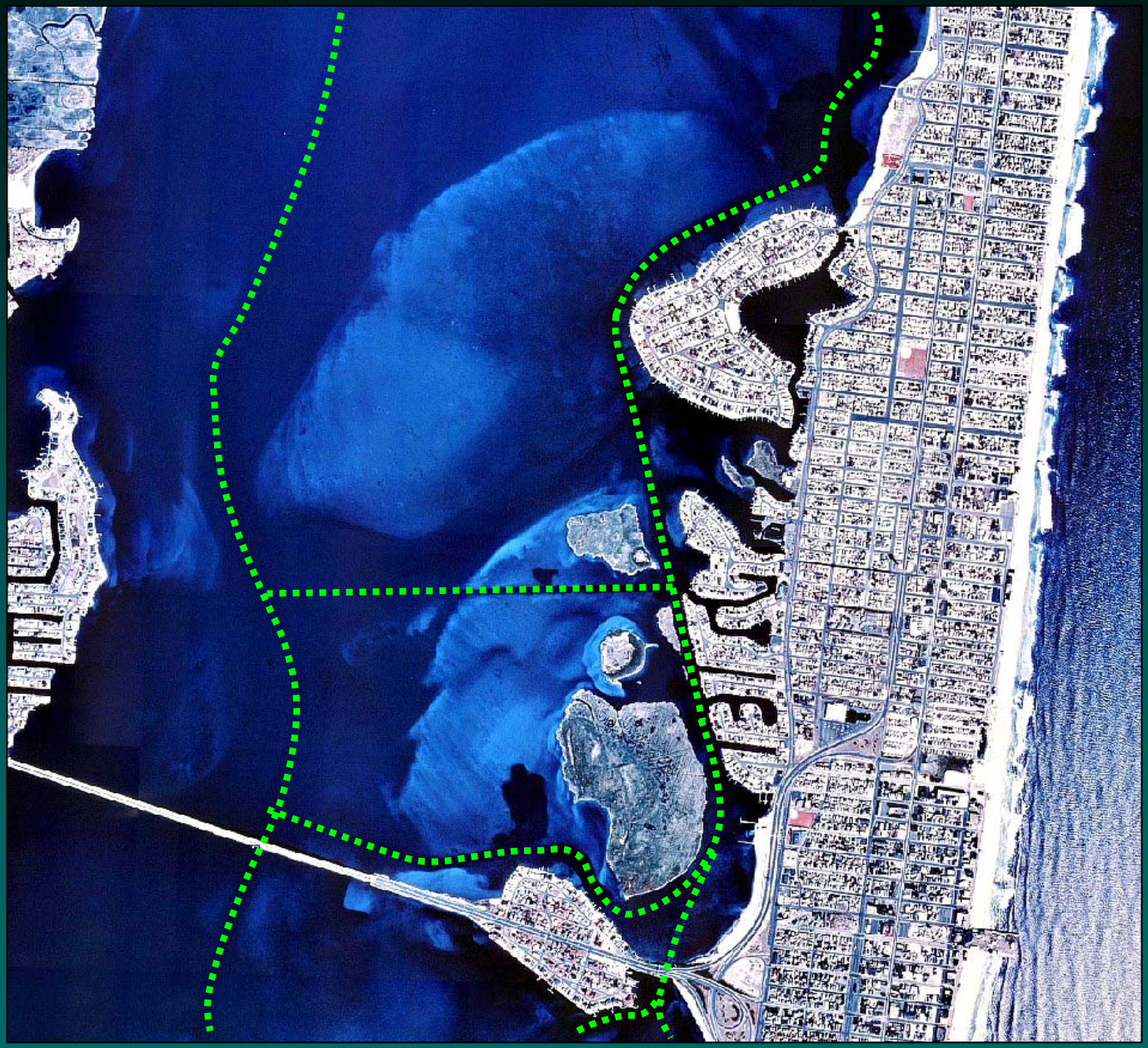
- State of Dredging Affairs
- Project Overview
- Current Status & Potential Challenges
- Anticipated Results

Base & Index Maps/Dataset

Nomenclature & Waterway Framework

- Delineation of Waterways…
  - Existing GPS'd channel markers
  - Aerial photos, navigation charts
  - NJDEP expert knowledge
- Waterway Naming Convention…
  - Legacy channel names preserved
  - Adopt and adapt NJDOT Standard Route ID System
- Linear Referencing System …
  - Locating features along or adjacent to waterways
  - Dynamic segmentation, similar to NJDOT road network
  - Local reference point off-set
    - May be real or cartographic features (northing)

Delineating Waterways

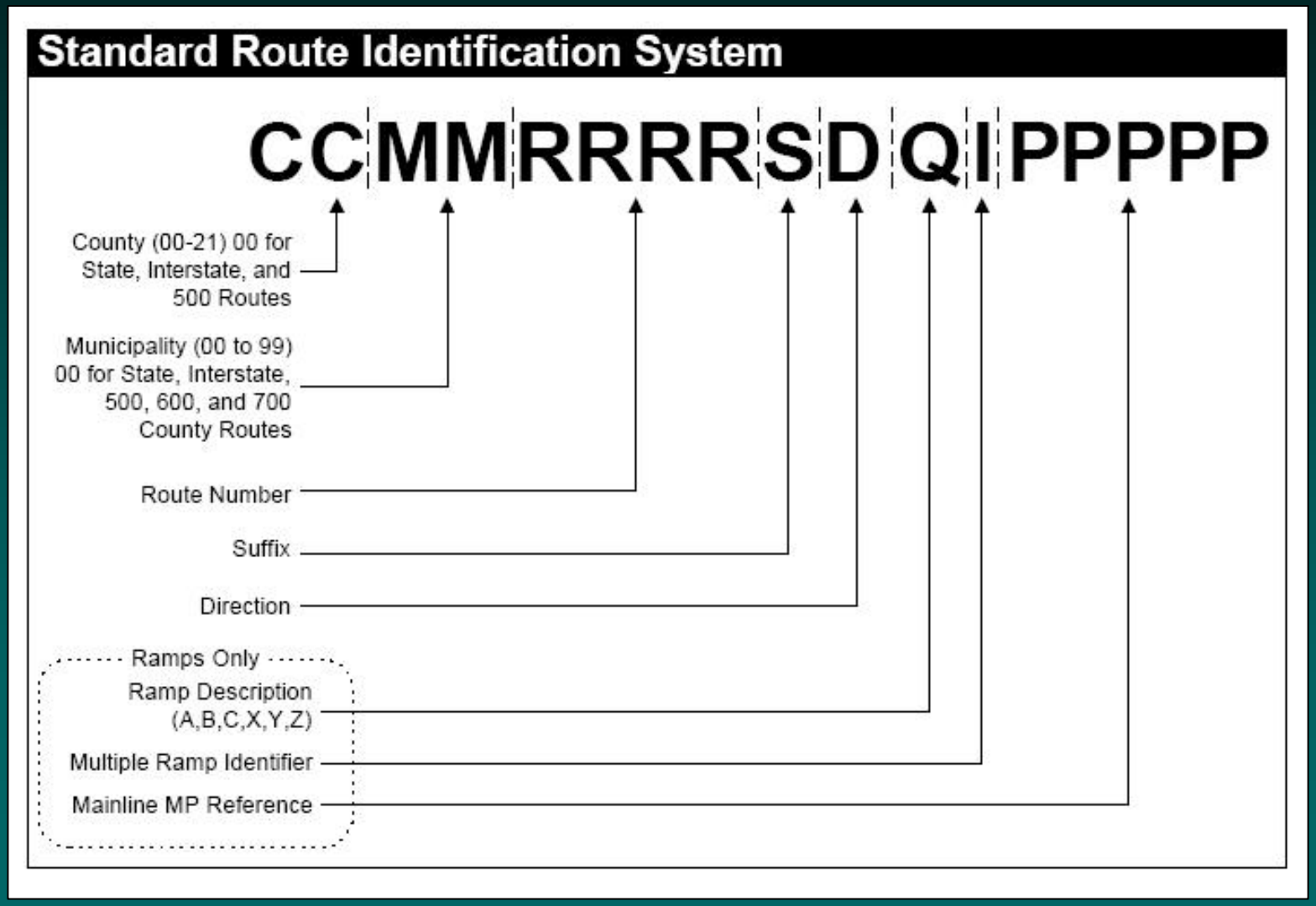


Aerial Digital Photography

- Heads-up digitized using aerial photographs & charts where possible
- Verify using NJDEP expert knowledge

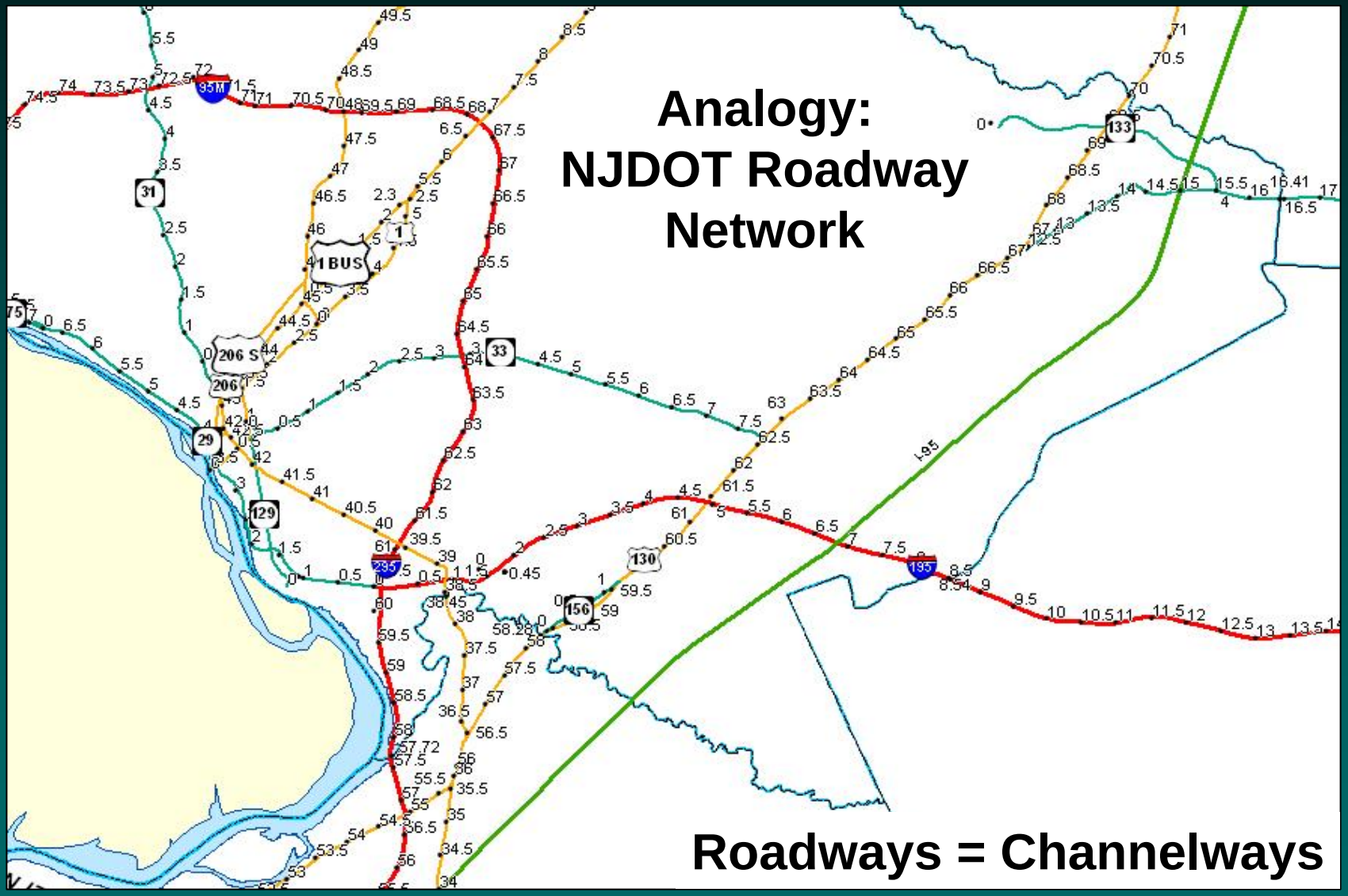
Naming Waterways

Modification of NJDOT Standard Route ID System



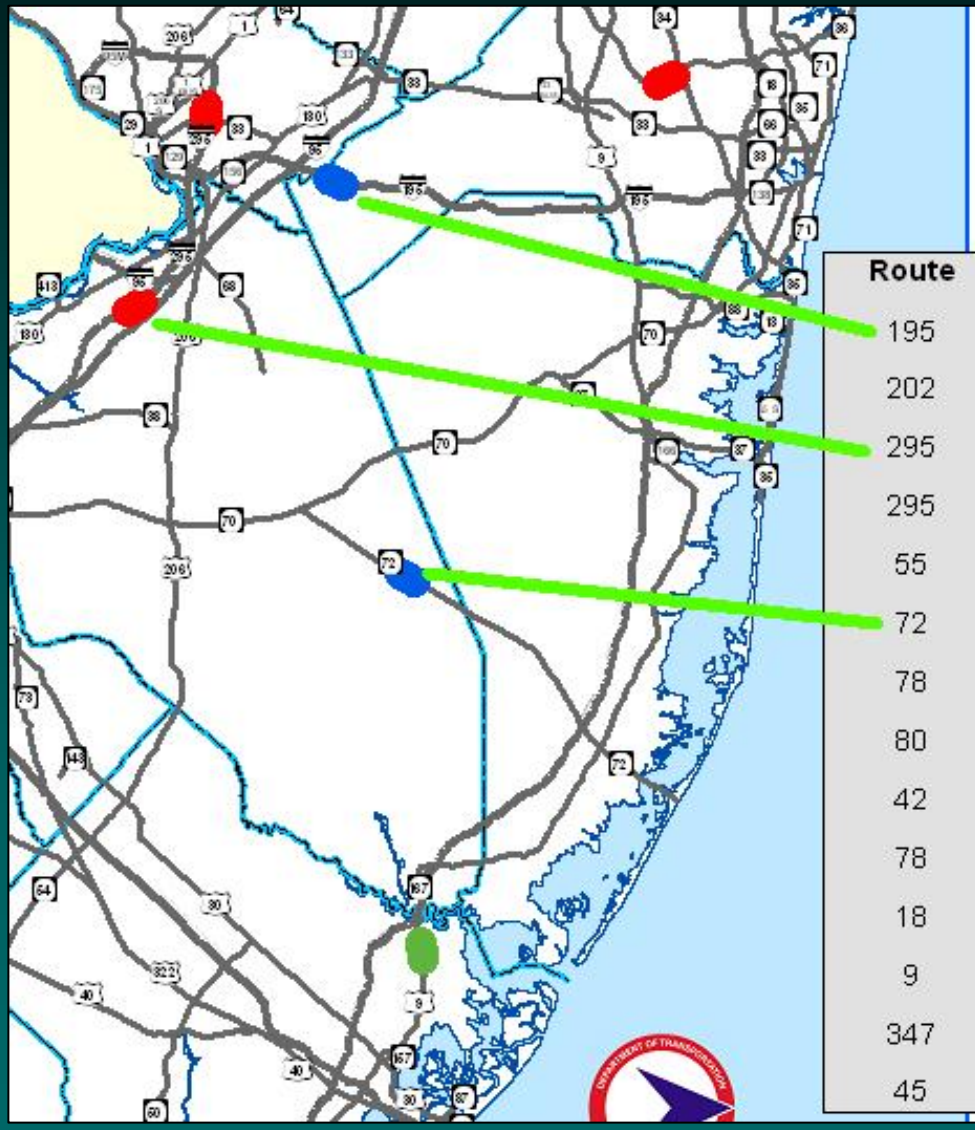
Location Referencing

Mile Post Markers Along Highway Network



Location Referencing

Specific Features & Events Referenced in Transportation Network



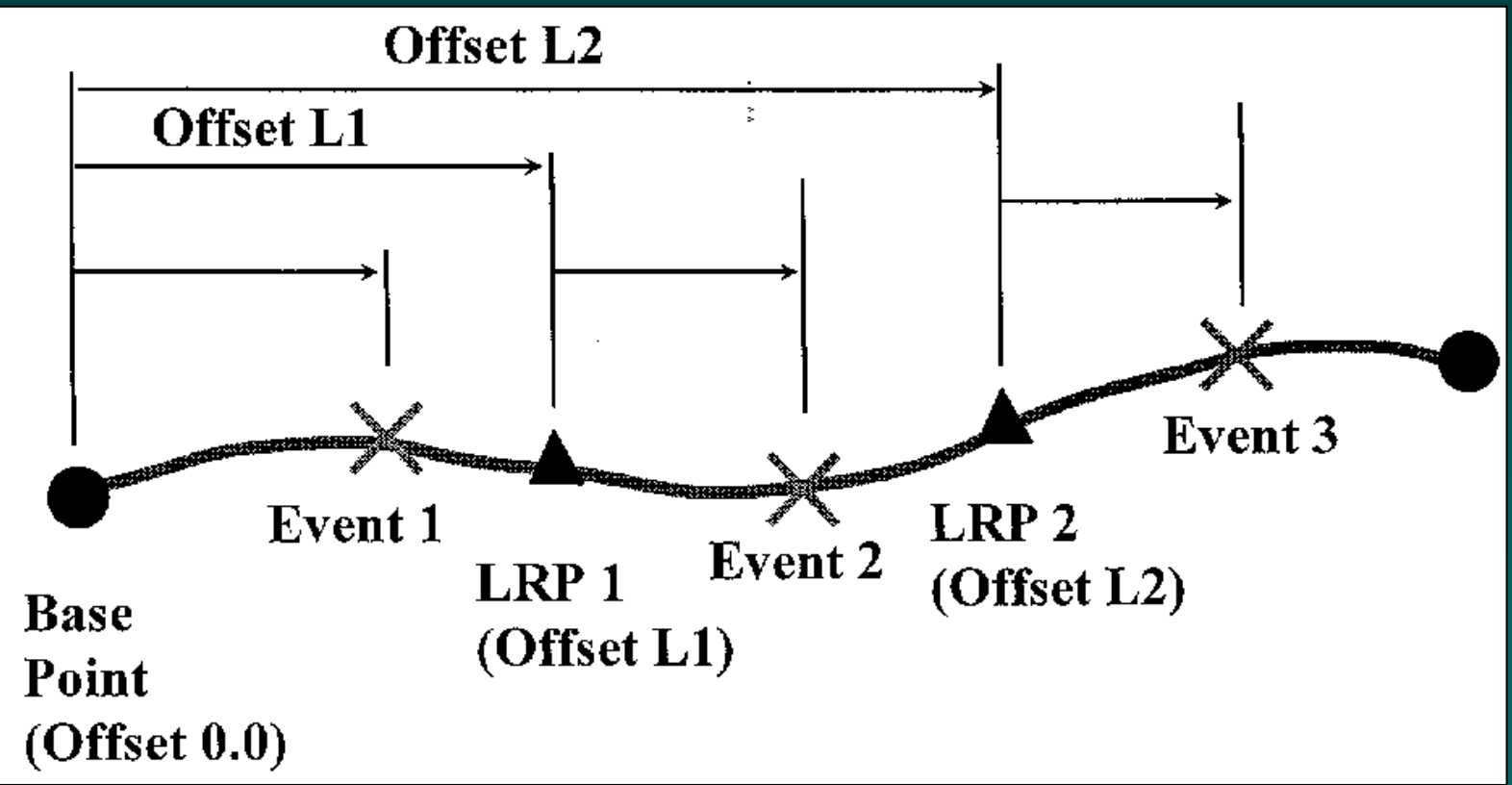
Route	Direction	Mp Start	MP End
195	Eastbound	8.90	9.90
202	Northbound	3.20	4.20
295	Southbound	51.50	50.50
295	Southbound	65.00	64.00
55	Northbound	31.40	32.40
72	Eastbound	7.00	8.00
78	Eastbound	10.40	11.40
80	Eastbound	31.10	32.10
42	Southbound	6.50	7.50
78	Eastbound	45.40	46.40
18	Southbound	20.50	19.50
9	Northbound	49.75	50.75
347	Northbound	6.00	7.00
45	Northbound	0.80	1.80

Attribute Table Underlying the Line Network

Linear Referencing System

What is it ? What Do We Use as Channel "Mile Post Markers" ?

- A one-dimensional location referencing system
- Locate data "events" as measured "offsets" from a known "linear reference point" along a waterway



Local Reference Offset Approach

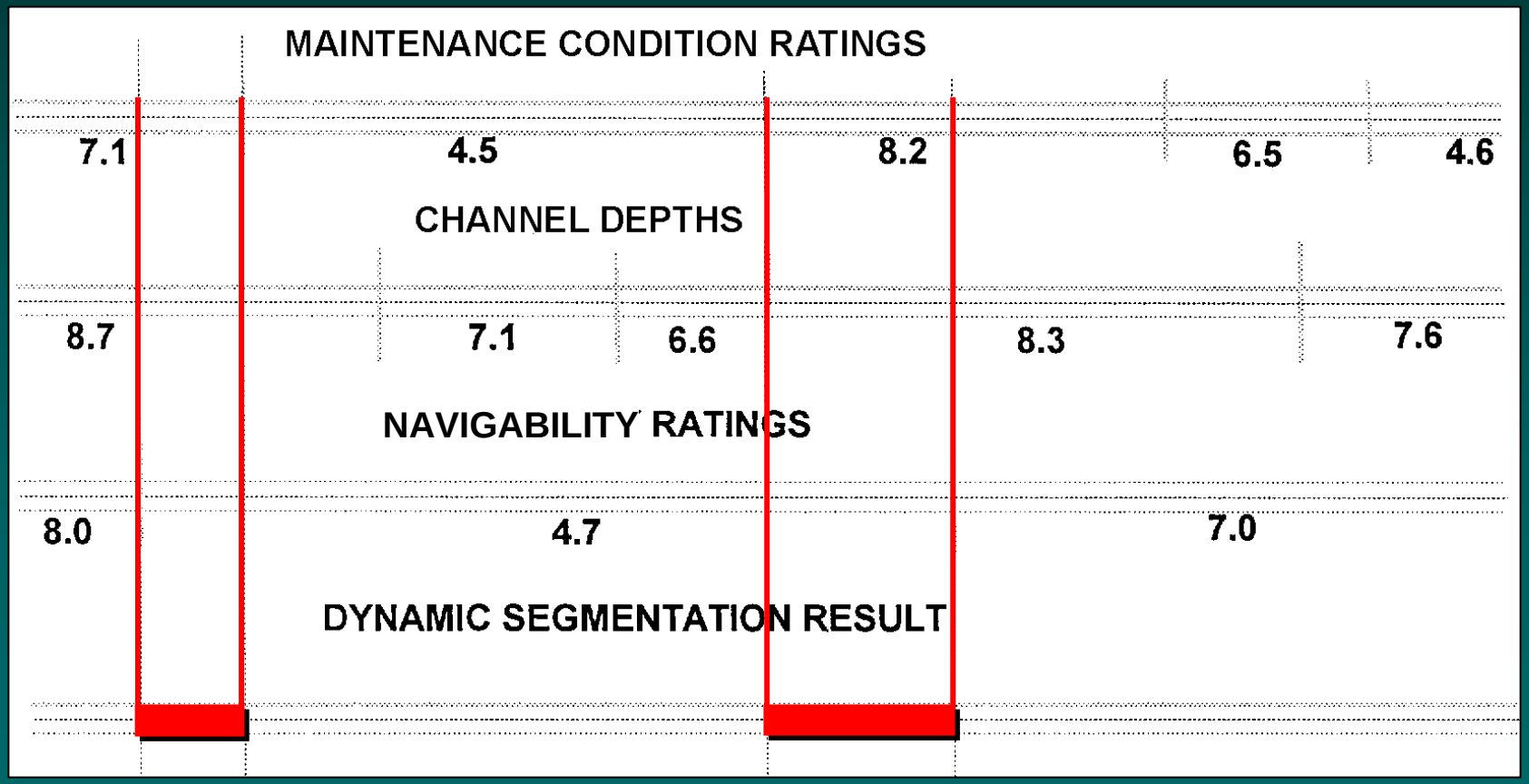
Dynamic Segmentation

Process of Computing Locations of Events on Linear Features

GIS Database Query…

Locate Segments Where:

MAINTENANCE CONDITION RATING >7
CHANNEL DEPTH > 8
NAVIGABILITY RATINGS < 6



CDF Site Access & Sampling

Site #103, Nummy Island, Stone Harbor

CDF Site Access & Sampling

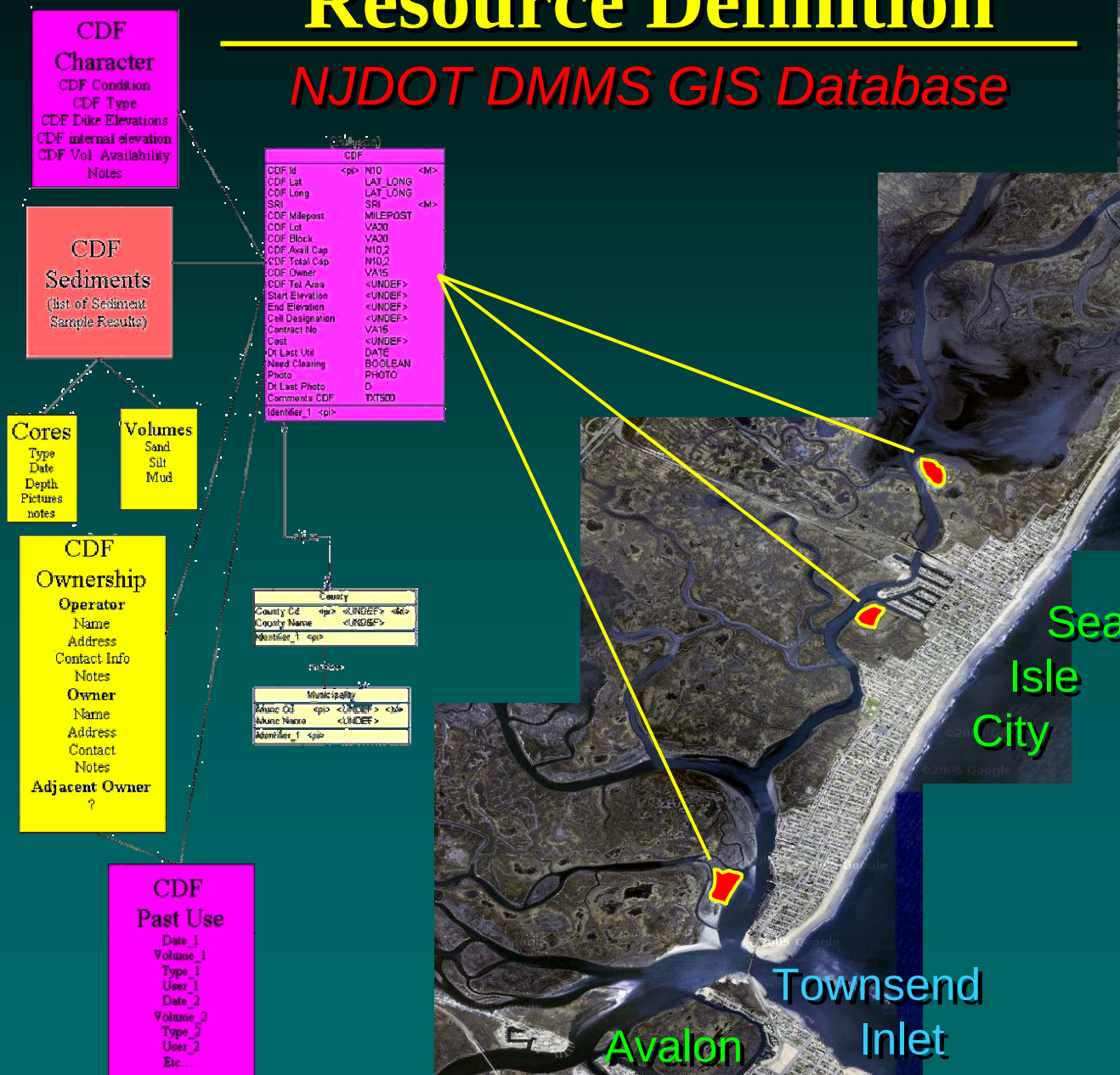
Sediment Sampling with Hand Auger

Talking Points…

- State of Dredging Affairs
- Project Overview
- Current Status & Potential Challenges
- Anticipated Results

CDF Mapping and Resource Definition

NJDOT DMMS GIS Database



CDFs visible in aerial photography along the NJ Intracoastal Waterway...

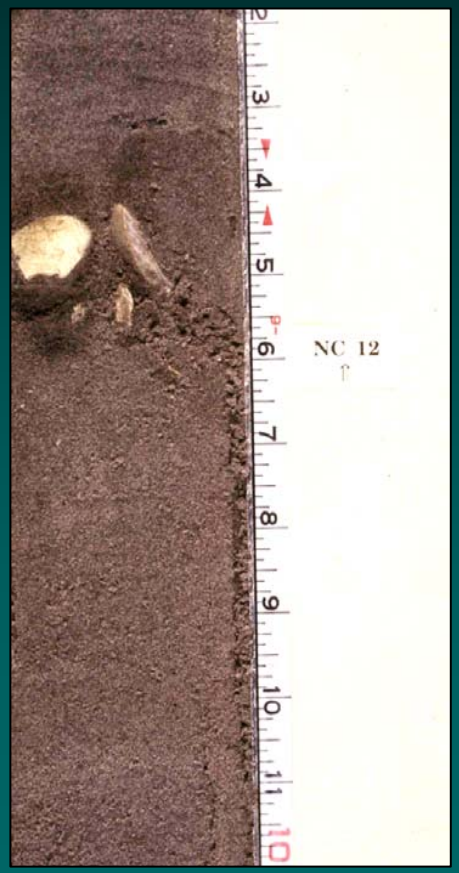
The Average New Jersey Bay Sediment

- Marsh:
  - 35 to 50% Water
  - 40 to 45% Organic Matter
  - 25 to 5% Silicates
- Mudflat:
  - 25 to 35% Water
  - 25 to 40% Organic Matter
  - 50 to 25% Silicates
- Inlets:
  - 5 to 30% Carbonate
  - Trace to 5% Organic Matter
  - 95 to 65% Silicates

Bay Sediments – Around Tidal Inlets

More Sandy and Layered with Mud

PURE SAND



MIXED LAYERS

OCCASIONAL SAND LAYERS

Closer to Inlets...

...Further from Inlets

Bay Sediments – In the Back Bays

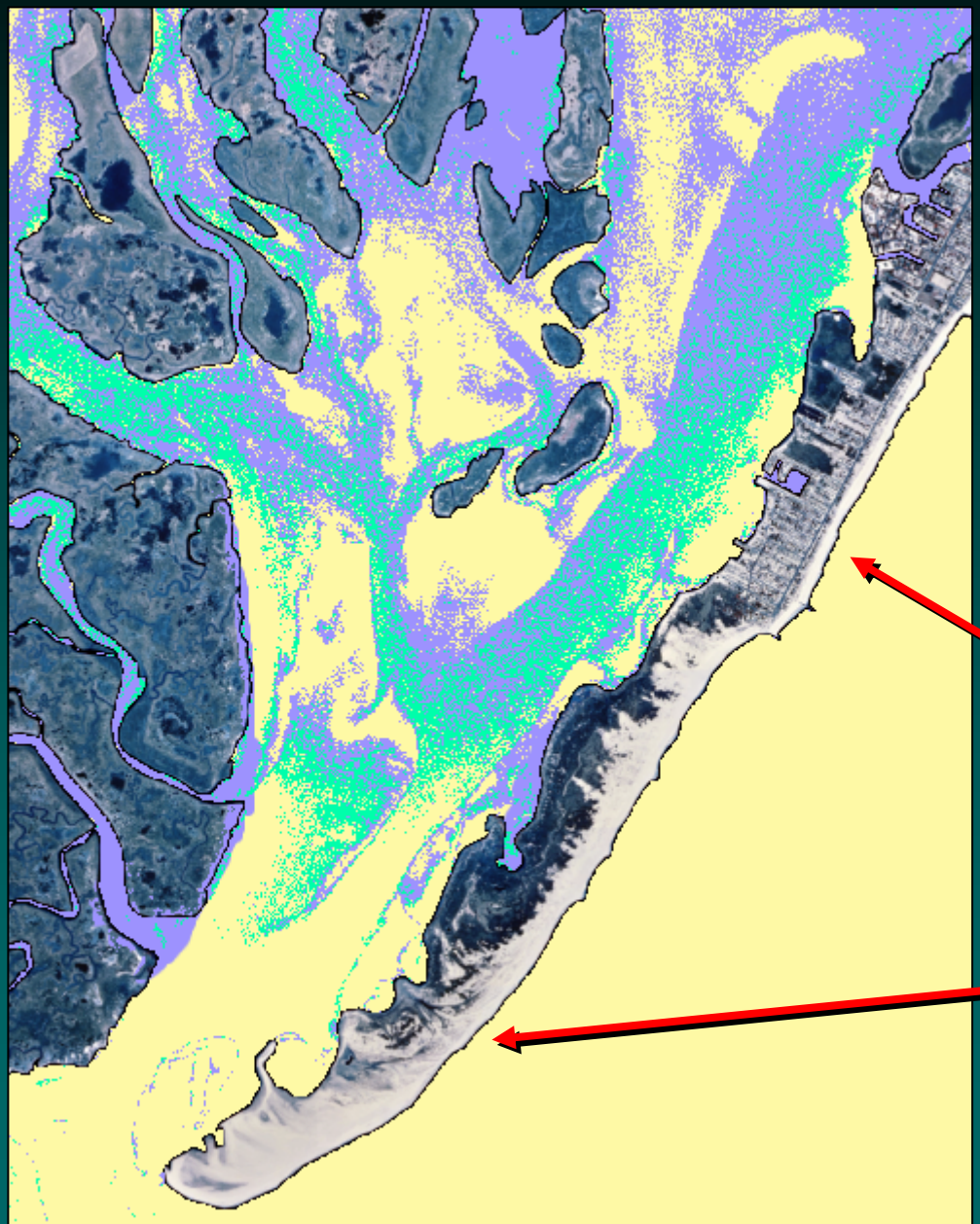
Finer Grain and More Organic-Rich Sediments

MUD & FOSSILS

MUD & PLANTS

MARSH SOD

Bay Floor Sediment Distribution



Example –
Subaqueous Sediment Map,
Little Egg Inlet Area

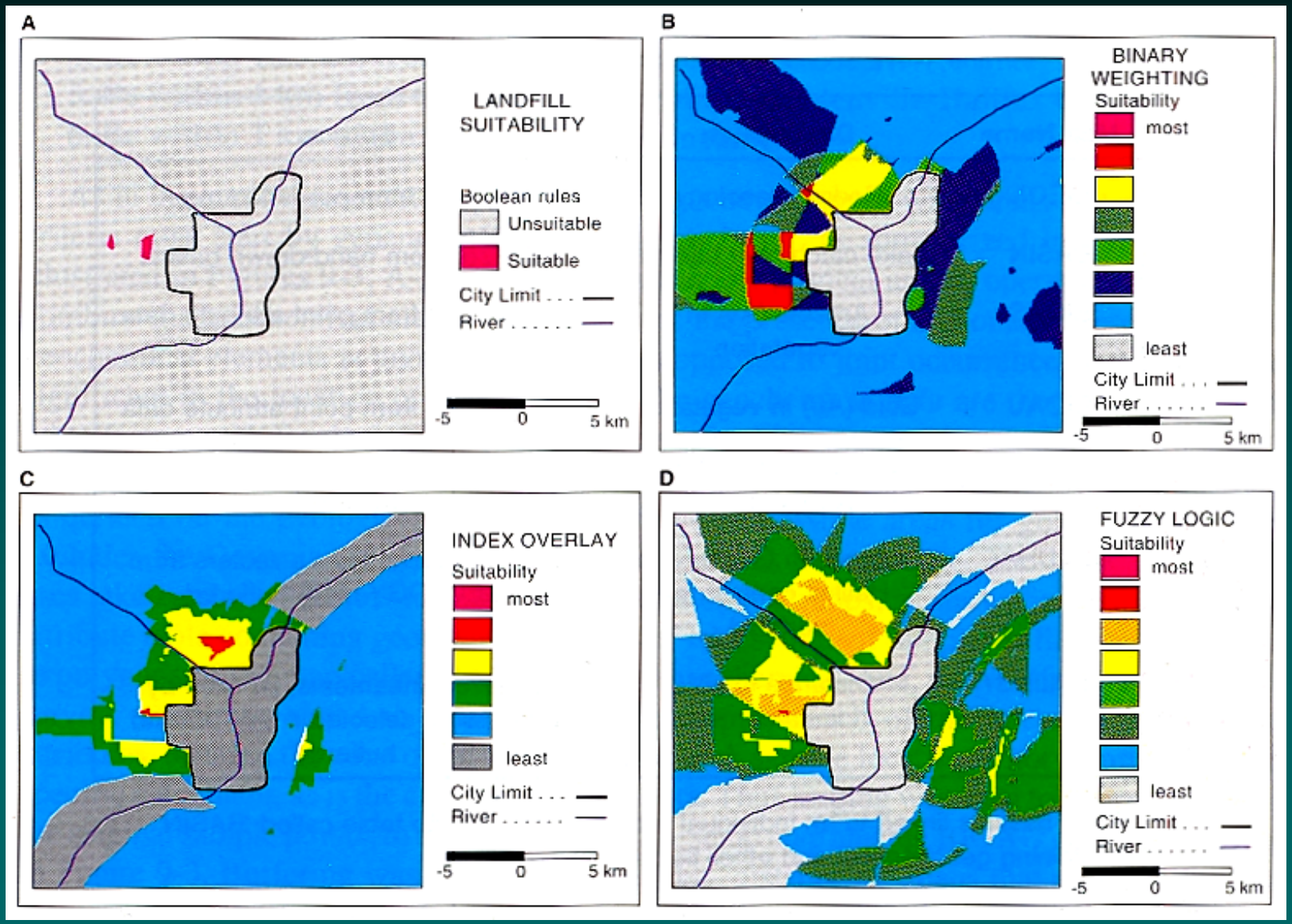
- Predominantly Sand
- Sandy Mud
- Predominantly Mud

Holgate,
Long Beach Island

Edwin B. Forsythe
National Wildlife Refuge

Spatial Analysis & Site Suitability Modeling

Modeling Analogy – Landfill Site Suitability



Thank You...

Resource, Not Spoil

•

Placement, Not Disposal