

***Beyond A European
Perspective on Sediment
Management
What Really is the Future...***

**E.A. Stern
U.S. Environmental Protection
Agency
Region 2
New York , NY**



**3rd International SedNet Conference
The Future of Sediment Management in Europe
Venice International University, San Servolo
25-26 November 2004**

New Jersey's Comprehensive Sediment Management Strategy

Technology Applications

*Manufactured Aggregate
Manufactured Soil
Construction Fill
Decontamination
In-Situ Remediation
Sedimentation Engineering
Environmental Dredging*

Beneficial Use

*Brownfield Reclamation
Wetlands Restoration
Habitat Development
Landfill Operations
Transportation Projects
Mine Reclamation
Pollution Prevention*

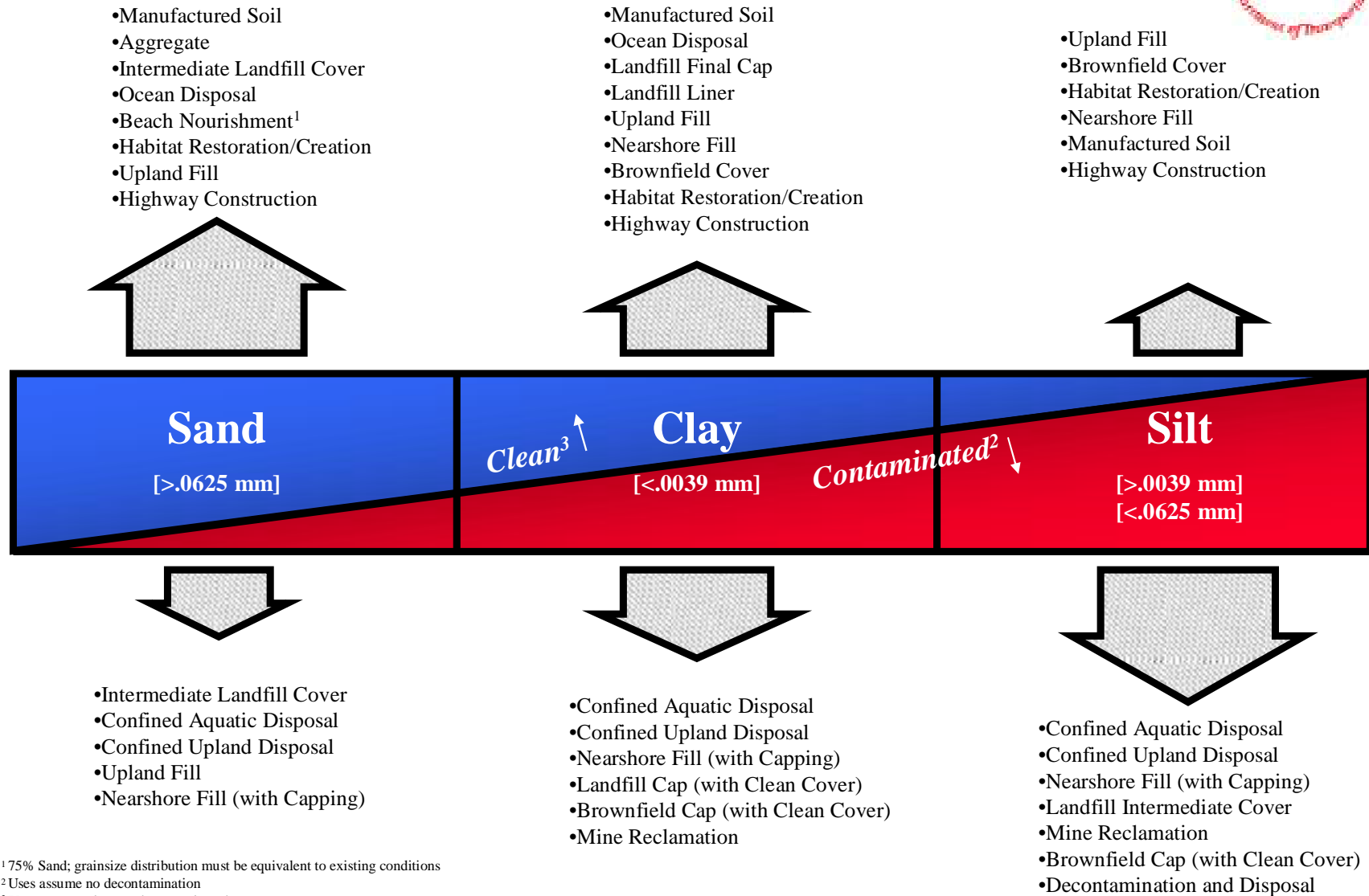
Placement

*Beach Replenishment
Multiple Use CDF's
Ocean Remediation
Confined Aquatic Disposal
Confined Upland Disposal*

Planning

*Harbor Modeling
Toxics Trackdown/Reduction
Air Quality Monitoring
Channel Optimization
Port Redevelopment
Public Education*

What Happens to Our Dredged Material?



¹ 75% Sand; grainsize distribution must be equivalent to existing conditions

² Uses assume no decontamination

³ Uses assume clean or decontaminated

Sediments are Not Pretty



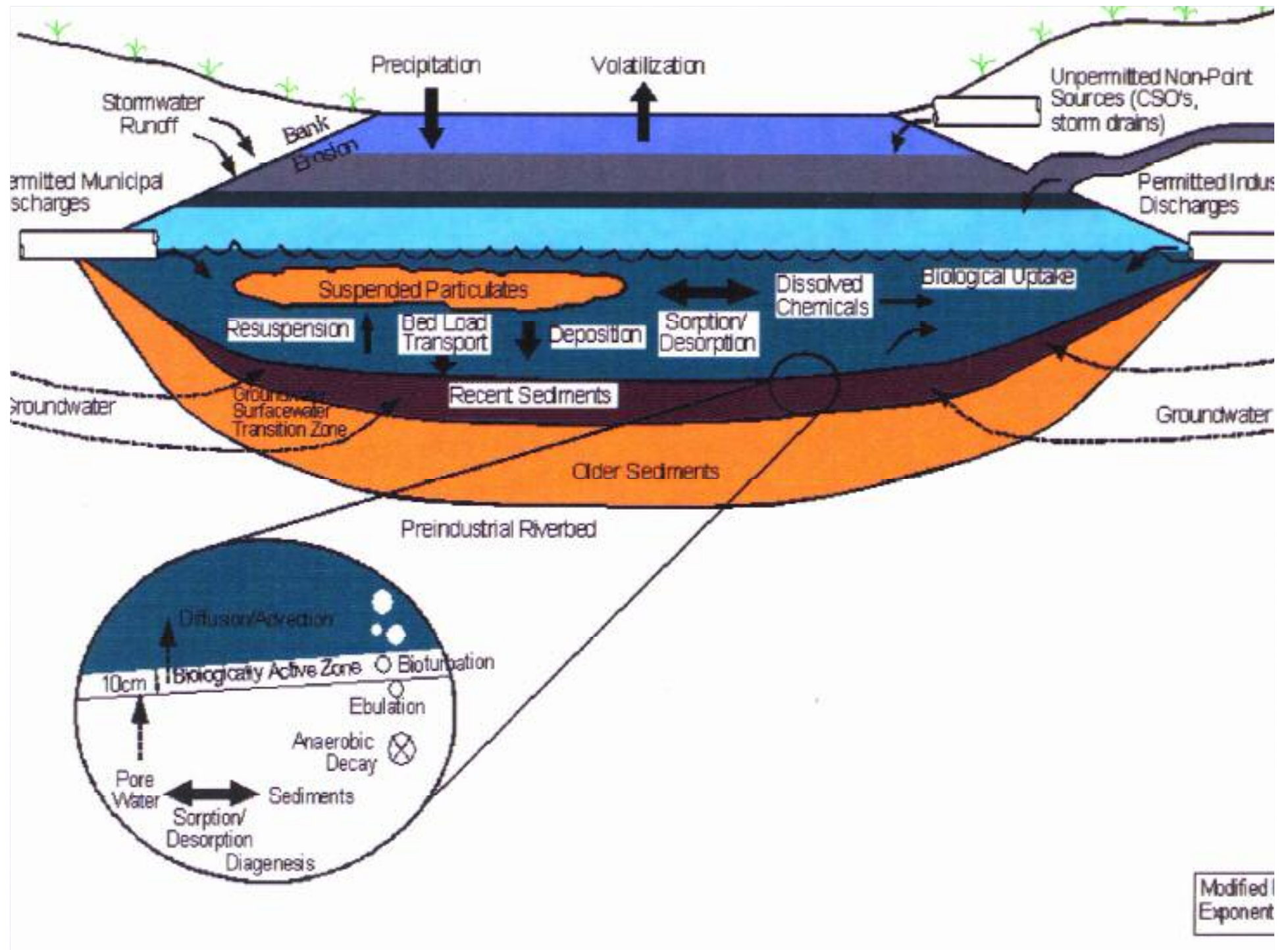
DREDGED ESTUARINE SEDIMENT

Hudson River, New York



Gowanus Canal
Brooklyn, New York

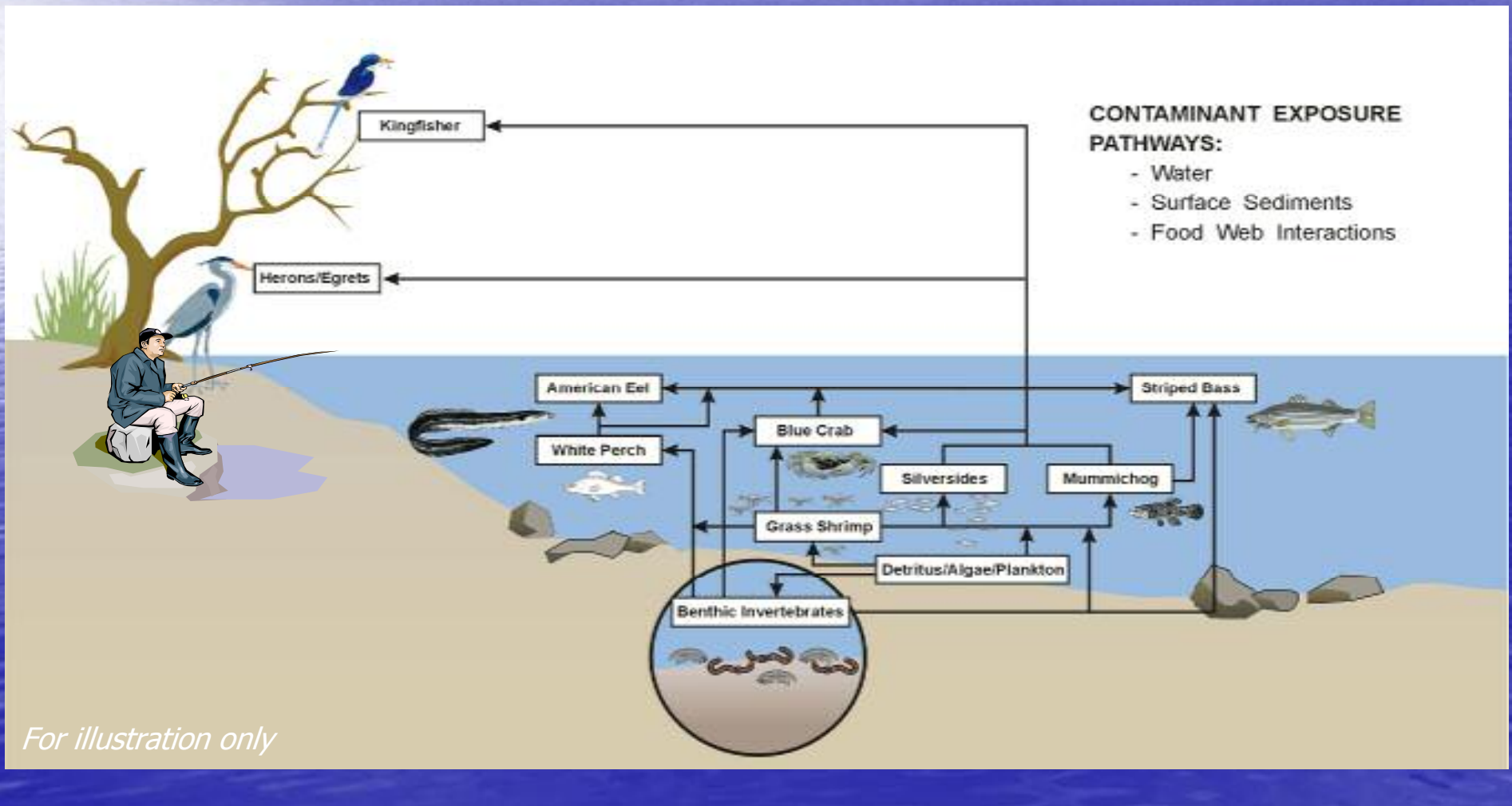




Modified
Exponent

Risk Assessments

- Human Health & Ecological



Sediment Flux Modeling

ECOM

ECOMSED

SWEM

RCATOX

Bioaccum

Models:

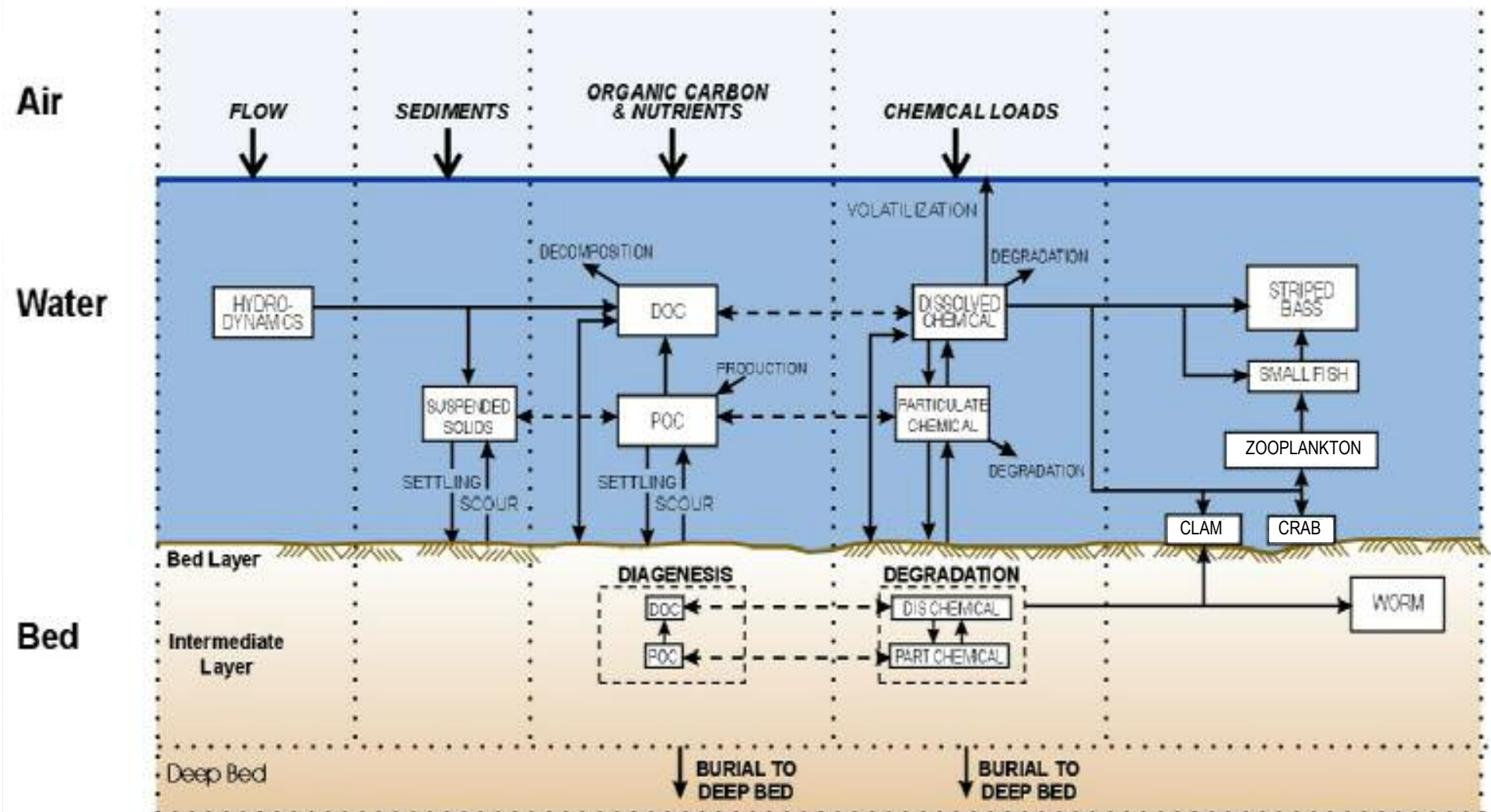
Hydrodynamic/
Fluid Transport

Sediment
Transport

Organic Carbon
Cycling

Chemical Fate
and Transport

Bioaccumulation
and Toxicity



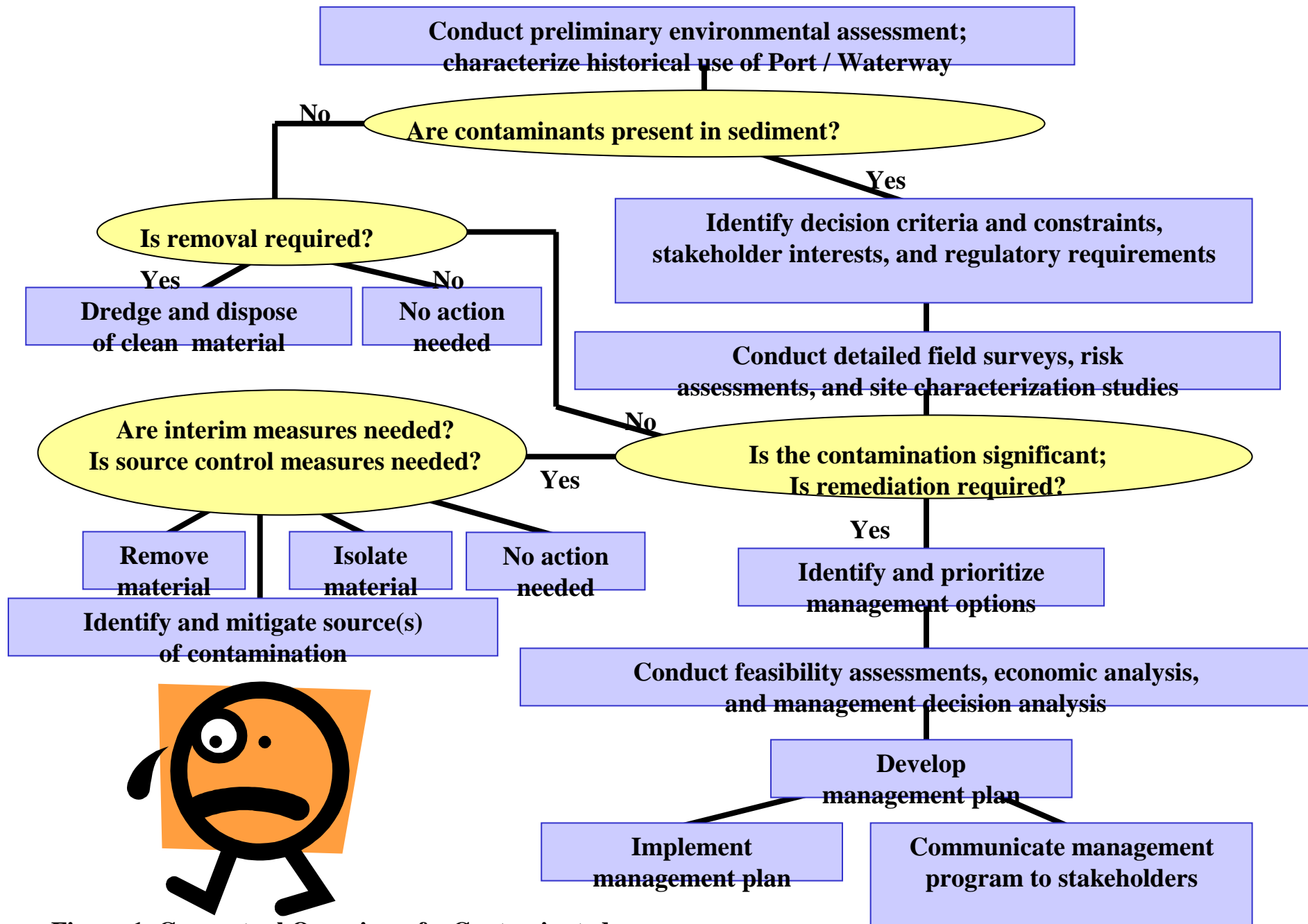


Figure 1. Conceptual Overview of a Contaminated Sediment Management Program (adopted with revisions from NAS ,1997)

Sediment Management Decision Making



Preindustrial
Zone

Judgement Zone

Hazardous
Waste Zone

SQV: Background

Assessment Tool Depends on Situation

SQV: RCRA



The Future of Sediment Management

- **Public Education / Outreach (K-12)**
- **Policy**
- **Program of Research**
- **Program Integration**
- **Public-Private Partnerships**
- **Promote Trans-boundary / International Partners**
- **Positioning for the Future**

Will it really be about sediments?

The Future of Sediment Management

- **Public Education / Outreach**

Without an adequate technical basis for decision making, the special interests that are always present will tend to dominate the process.

There is never enough information or data to answer all questions – hence decision making in the presence of uncertainty.

DEFEAT



the **MUCK MONSTER**

Sediments Going Hollywood





Firestone

Black Lagoon

Elizabeth Park North Canal

Elizabeth Park South Canal Inlet



Basic Pokémon
Grimer

50 HP



Sludge Pokémon. Length: 2' 11", Weight: 66 lbs.



Nasty Goo Flip a coin. If heads, the Defending Pokémon is now Paralyzed.

10



Minimize All damage done by attacks to Grimer during your opponent's next turn is reduced by 20 (after applying Weakness and Resistance).

weakness

resistance

retreat cost



Appears in filthy areas. Thrives by sucking up polluted sludge that is pumped out of factories. LV. 17 #88

The Future of Sediment Management

- **Policy**

- Consistent cross-agency, authorities
- Waste? Resource? Navigation? Remediation
- Dirt is Dirt.....

- ***Administrations come and go***

- Policy decisions are made that will have future implications
- Political short term fix vs. long-term strategy
- Need structures in place to succeed in the long-term.

The Future of Sediment Management

- **Policy (continued)**
- **Throwing \$\$ at problem w/o implementing policy changes that will at least give a program a chance to succeed is wasting \$\$**
- **Changes in legislation and regulatory requirements**

The Future of Sediment Management

- **Program of Research**

- ***Basic and Applied***

- Academia / University Research
- Consulting
 - Technology Development Firms
- Policy and Decision Makers



Integrated Sediment Management Research vs. Applied/Directed

- **Managers and policy makers seem to have difficulty motivating the scientific community to carry out the needed research, perhaps because it is perceived as to “too applied”**

Integrated Sediment Management Research vs. Applied/Directed

- **Similarly, researchers complain that they do not get a clear messages from policy makers as to what is needed and, furthermore, that the managers and policy makers do not seem to use much of the information scientists have already produced**
 - **Cicin-Sain, B and R.W. Knecht (1998).
Integrated Coastal and Ocean Management**

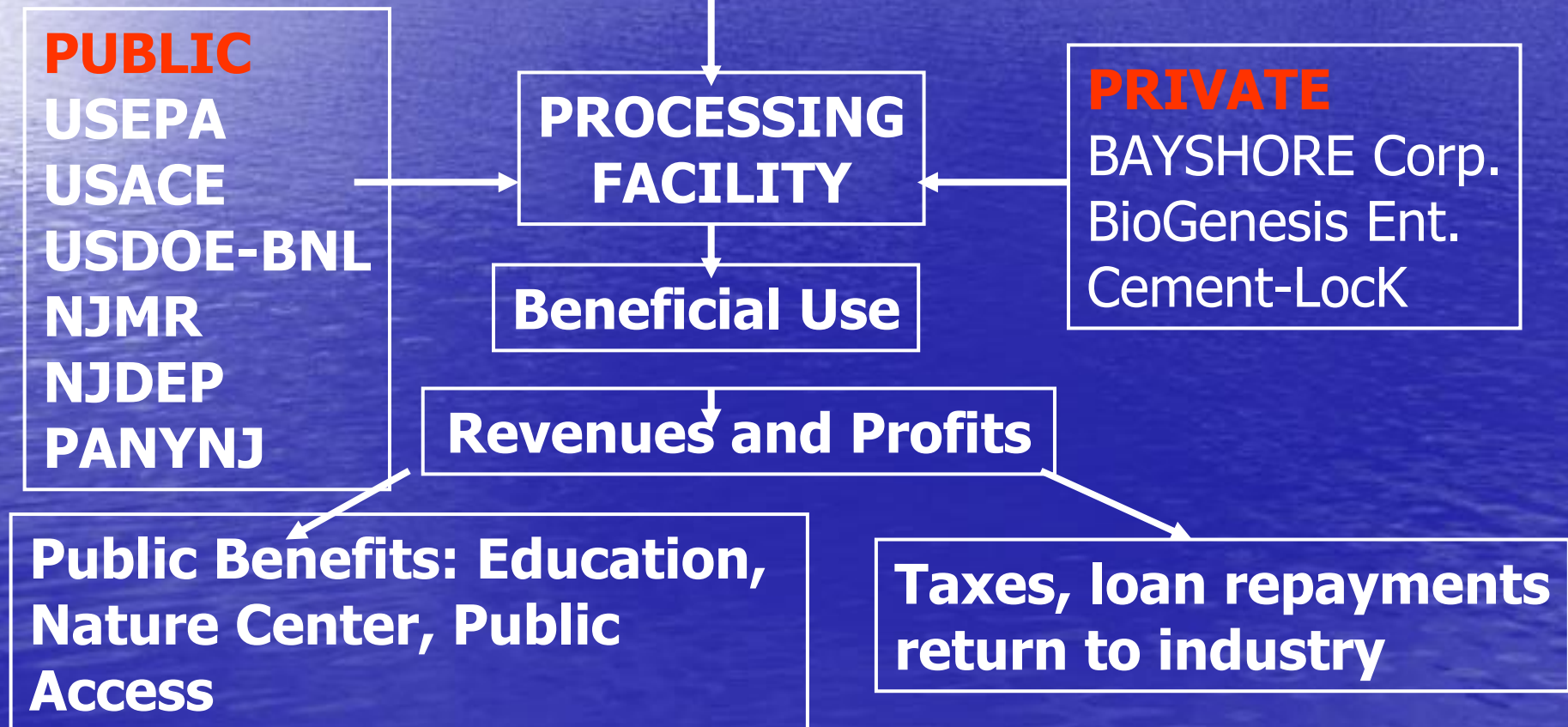
The Future of Sediment Management

- **Program Integration**
 - ***Sediments are cross-program***
 - Dredged material (Navigation)
 - Superfund (Remediation)
 - Aquatic Brownfields (Superfund)
 - Solid Waste Industrial Sites
 - Remediation/Clean-up
 - *Run for the Hills.....*
at the end - dirt is dirt.....

• TRUE PUBLIC-PRIVATE PARTNERSHIPS

RISK SHARING (Gov't/Private)

Sediments from navigational and restoration projects



The Future of Sediment Management

- **Promote Transboundary - International Partnerships**

- **It's more than technical transfer....**

Venice, Italy – January 2004



Kearny, NJ – January 2000



Sediment Treatment Pilot Project

Venice, Italy



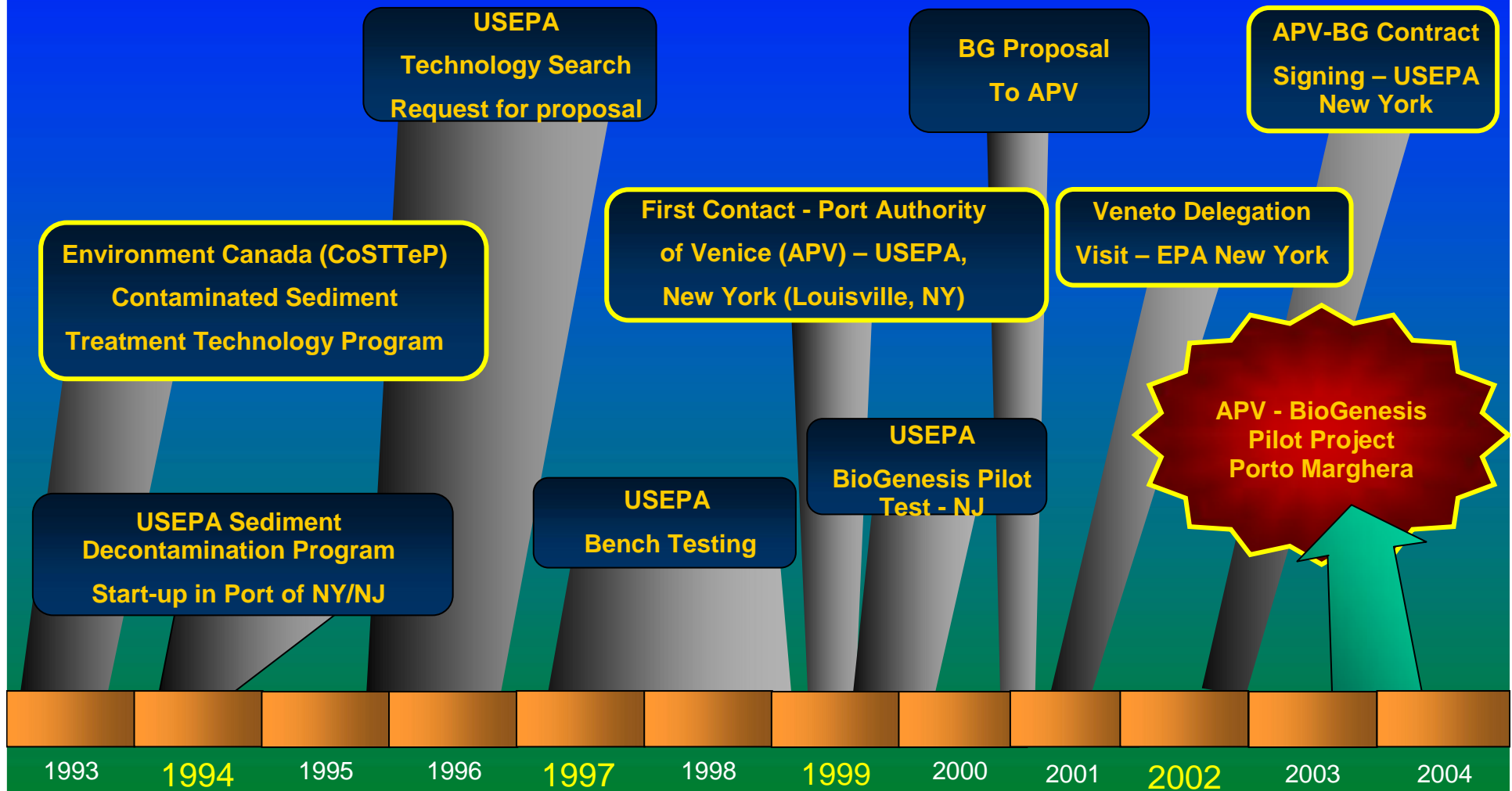
Autorità Portuale di Venezia



MWH



USEPA – Venice Port Authority Partnership



The Future of Sediment Management

- **Positioning for the Future**
- **Develop Long-term Self Sustaining Enterprises in the Environmental Management of Sediments**
 - *Sediments are a Resource*

Sediment Stabilization

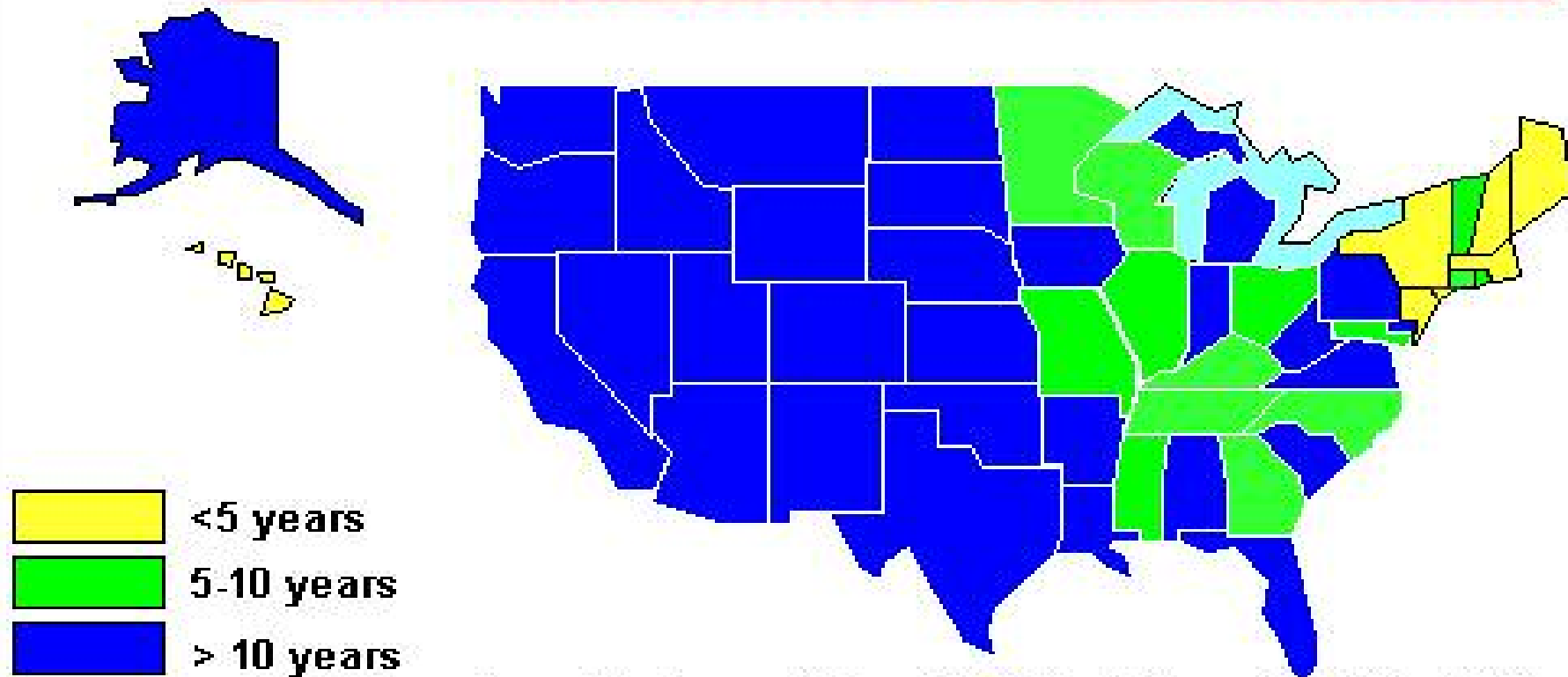


Landfill Closure / Brownfield Development



LANDFILL CAPACITY WILL BECOME EVERMORE CRITICAL IN THE NORTHEAST U.S

YEARS OF REMAINING LANDFILL CAPACITY



Source: Directory and Atlas of Solid Waste Disposal Facilities, 1996

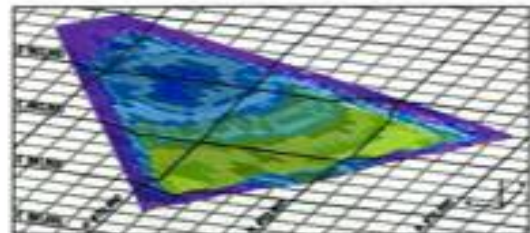
**WASTE MANAGEMENT INC. REPORTS AVERAGE LANDFILL
LIFE AT 18 YEARS**

Bark Camp. PA Mine Demonstration

320,000 m³

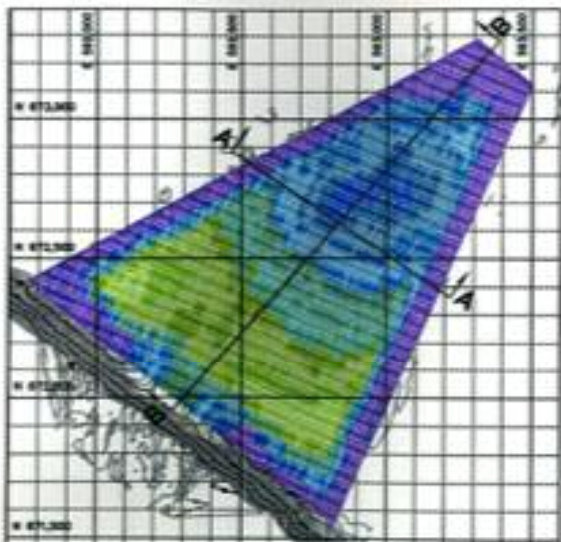
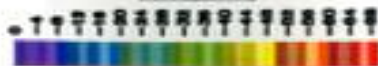


Newark Bay, New Jersey Confined Disposal Facility

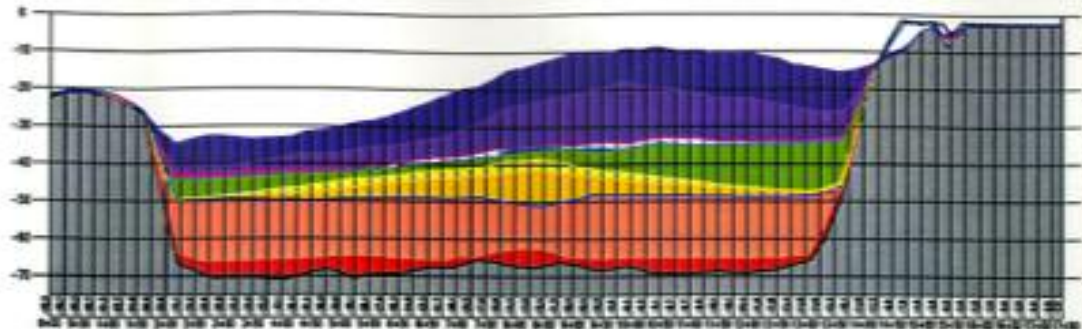


SURVEY 11- ISOMETRIC VIEW
FEBRUARY 1, 2002

DEPTH (FT. MLLW)



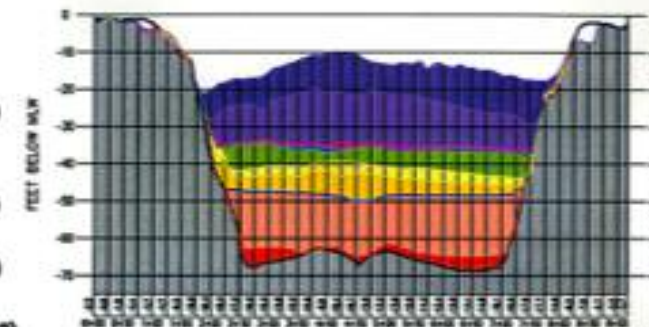
SURVEY 11 - PLAN VIEW
FEBRUARY 1, 2002



CROSS-SECTION B-B

CROSS-SECTION KEY

- SURVEY 1 (SURVEY MARCH, 1995)
- SURVEY 2 (SURVEY MAY, 1995)
- SURVEY 3 (SURVEY JULY, 1995)
- SURVEY 4 (SURVEY SEPTEMBER, 1995)
- SURVEY 5 (SURVEY JANUARY, 1999)
- SURVEY 6 (SURVEY MAY, 1999)
- SURVEY 7 (SURVEY SEPTEMBER, 1999)
- SURVEY 8 (SURVEY JULY, 2000)
- SURVEY 9 (SURVEY SEPTEMBER, 2000)
- SURVEY 10 (SURVEY AUGUST, 2001)
- SURVEY 11 (SURVEY FEBRUARY 1, 2002)



CROSS-SECTION A-A

- NOTES**
1. DIMENSIONS ARE IN FEET AND ARE REFERENCED TO THE NEW JERSEY STATE PLANE COORDINATE SYSTEM (NAD 83).
 2. ELEVATIONS ARE IN FEET AND ARE REFERENCED TO MEAN LOW WATER. SURVEY DATA IS BASED ON 100 POINTS WHICH WERE USED TO ESTIMATE A DATUM OF MEAN LOW WATER.
 3. SURVEY DATA WAS OBTAINED FROM SURVEYS CONDUCTED BY THE NEW JERSEY DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE DEVELOPMENT. SURVEY DATA IS BASED ON 100 POINTS WHICH WERE USED TO ESTIMATE A DATUM OF MEAN LOW WATER.
 4. THE INFORMATION PROVIDED IS BASED ON SURVEY DATA PROVIDED BY THE NEW JERSEY DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE DEVELOPMENT. THE INFORMATION PROVIDED SHOULD BE CONSIDERED AS INDICATING THE GENERAL LOCATION OF THE FACILITY AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE.

- 1.2 mil m³ capacity
- \$36/m³ cost recovery fee

MALCOLM PIERRE

THE PORT AUTHORITY
OF NY & NJ

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY
NEWARK, NEW JERSEY
NEWARK BAY CONFINED DISPOSAL FACILITY

BATHYMETRIC SURVEY - 11
WITH REFERENCE TO SURVEYS 1-10

DATE: AUGUST 2002
FIGURE 2
SCALE: AS SHOWN

Port of NY & NJ



Hart - Miller Island

Chesapeake Bay, Maryland



Geotubes



Rock – Artificial Reef Habitat



Uncertainties in Developing Long -Term Enterprises

- **Unpredictable dredging volume estimates**
- **Unpredictable dredging cycles**
 - **Fish migratory windows**
- **Superfund Construction Schedules**
- **Litigation – we're going to court...**
- **Long-Term Contracts**
- **Government Risk Sharing**



Positioning for the Future

- **Life Cycle Assessment – WP4**
 - What is the cost associated (long-term)?
 - Environmental, economic, social
 - Of not (environmental sustainability)
 - Diminishing natural resources
 - Waste minimization
 - Landfill Closures
 - Lack of real-estate (CAD/CDF)
 - Loss of Benthic Habitat / wetlands

Positioning for the Future

- **Environmental Sustainability**
 - Industrial Ecology
 - Environmental, Economic and Social
- **Environmental Manufacturing**
 - *Beneficial Use*
 - Environmental Restoration
 - Economic Revitalization
 - Social Consciousness
 - Shrinking Natural Resources
- **Consistent with SedNet**

Treatment Technologies Tested USEPA/NJDOT Decontamination Programs (1994-present)

- **Sediment Washing**
- **Thermo-Chemical Rotary Kiln**
- **Plasma-Arc Vitrification**
- **Base-Catalyzed Decomposition**
- **Thermal Desorption**
- **Solvent Extraction**
- **Solidification/Stabilization with Oxidation**
- **Fluidized Bed Reactor**

NY/NJ Harbor Sediment Treatment Technologies (full/commercial scale)

- **Gas Technology Institute**
 - Thermo-chemical rotary kiln (**cement**)
- **BioGenesis Enterprises**
 - Sediment washing (**soil - bricks**)
- **BayCycle Aggregates**
 - Rotary kiln (**light-weight aggregate**)
- **Harbor Resource Environmental Group, Inc**
 - Solidification/stabilization/oxidation (**structural fill**)
- **Westinghouse/The Solena Group**
 - Plasma-arc vitrification (**tiles and co-generation**)

New York / New Jersey Harbor Sediment Decontamination & Beneficial Use Demonstration Project **Cement-Lock® Technology**

Sponsored By:

- Gas Research Institute
- U.S. Environmental Protection Agency Region 2
- U.S. Department of Energy
Brookhaven National Laboratory
- U.S. Army Corps of Engineers
(New York District)
– *funding from the federal
Water Resources Development
Act (WRDA)*
- New Jersey Office of Maritime Resources
– *funding from NJ Environmental
Bond Issue*



Technology Developer:

Gas Technology Institute



Site Host:

International-Matex Tank
Terminal – Bayonne



General Contractor:

RPMS Consulting
Engineers



Equipment Manufacturer:

Andersen 2000 Inc.



Technology Licensor:

Cement-Lock Group, L.L.C.

Cement Lock Demo Plant





Interior View of Kiln – 1345 C° – Molten Sediment

EcoMelt



0 INCHES

1

2

3

4

5

6

0 CM

1

2

3

4

5

6

7

8

9

10

12

13

14

15



TIMER

about your



Pulverized EcoMelt

Beneficial Use

Construction Grade Cement/Concrete



BioGenesis

Pilot-scale Demonstration – Kearny, NJ 1999-2000

- **BioGenesis Sediment Washing Technology**
 - Separation of “clean” fractions, surfactants/oxidizing agents for organics, and metals treated separately
 - Target low to moderate contaminated sediments
 - Topsoil and bricks as beneficial use products
 - Facility to process 191,000 m³/yr expected to be operational by first ¼ 2005.
 - Superfund Innovative Technology Evaluation (SITE) project



They're making people every day, but they ain't making any more dirt – Will Rodgers

- **Topsoil is being depleted avg/yr 18X faster than what is being built up in nature**
 - Takes 2000 yrs to build up 1in of topsoil
- **US/California**
 - CA agriculture depleting as much as 1in TS every 25 years. 80x faster than nature
- **Developing Nations – 36x**
- **China – 54x**
 - C.J. Barrow. Land Degradation, Cambridge U. Press. (1981)
 - National Resources Inventory. Soil Conservation Service. USDA, Washington, DC (1992)

BioGenesis Pilot-Scale Demo Venice, Italy Port Authority

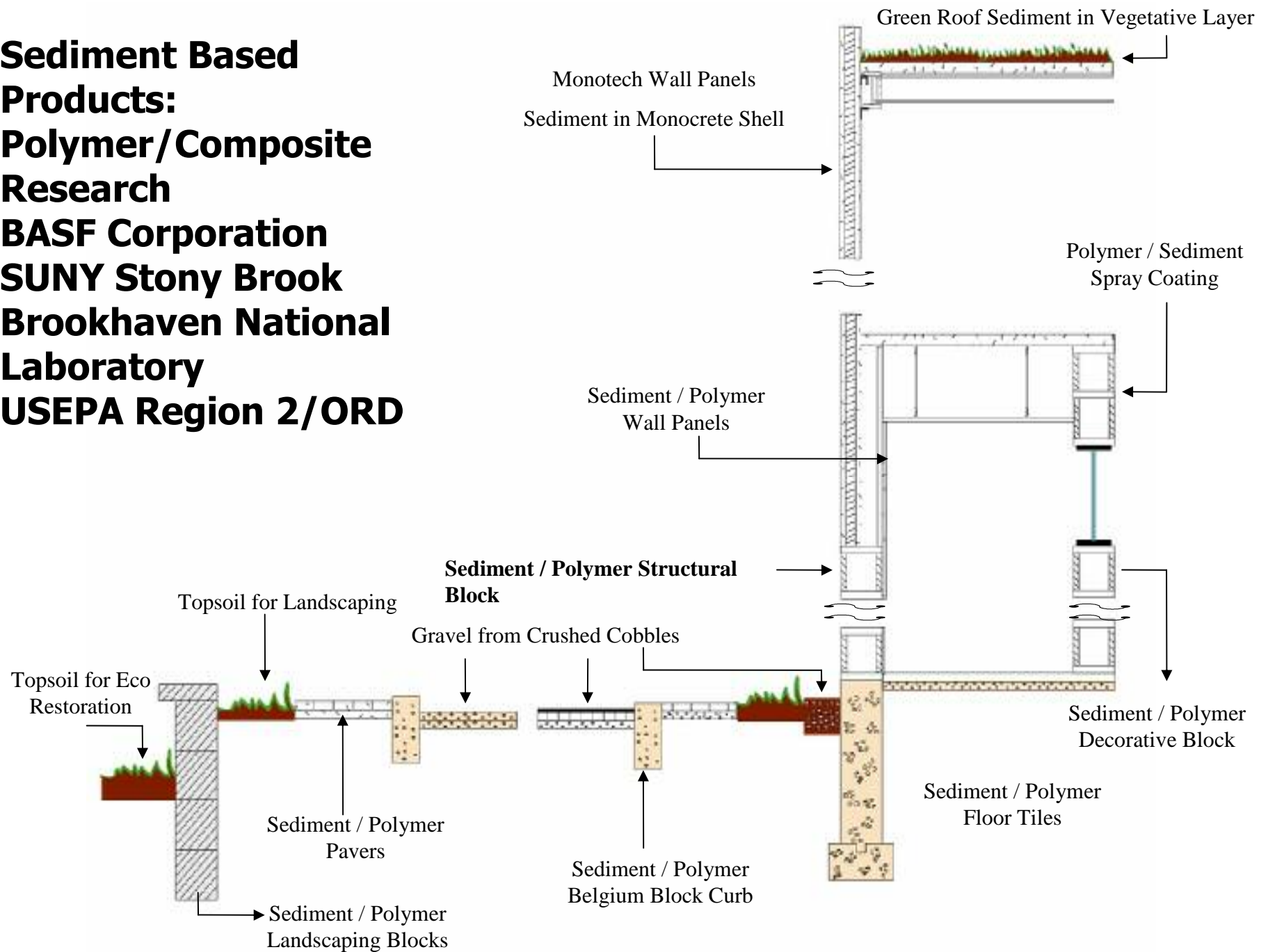


Advantages of Polymer/Sediment Building Materials



- **33% lighter than LW concrete**
 - Less structural support needed
 - Faster to build
 - Cheaper to transport
- **Can be cast in molds**
- **Water tight**
- **Replaces cement reducing CO₂ emissions**
- **Has improved insulating characteristics**
- **More flexural strength**

**Sediment Based
Products:
Polymer/Composite
Research
BASF Corporation
SUNY Stony Brook
Brookhaven National
Laboratory
USEPA Region 2/ORD**



Upcycle Associates

Light-Weight Aggregate



Plasma-Arc Vitrification ARCHITECTURAL GLASS TILE



Plasma-Arc Vitrification Sediment Beneficial Use Applications

- Architectural Tile Manufacture
- Glass Fiber (Rock Wool Insulation)
- Sandblasting Grit (Black Beauty[®])
- Roadbed Aggregate ("Glasphalt")
- Roofing Granules (Shingle Manufacture)
- Recycle Glass Cullet
- **Integrated Plasma Gasification**

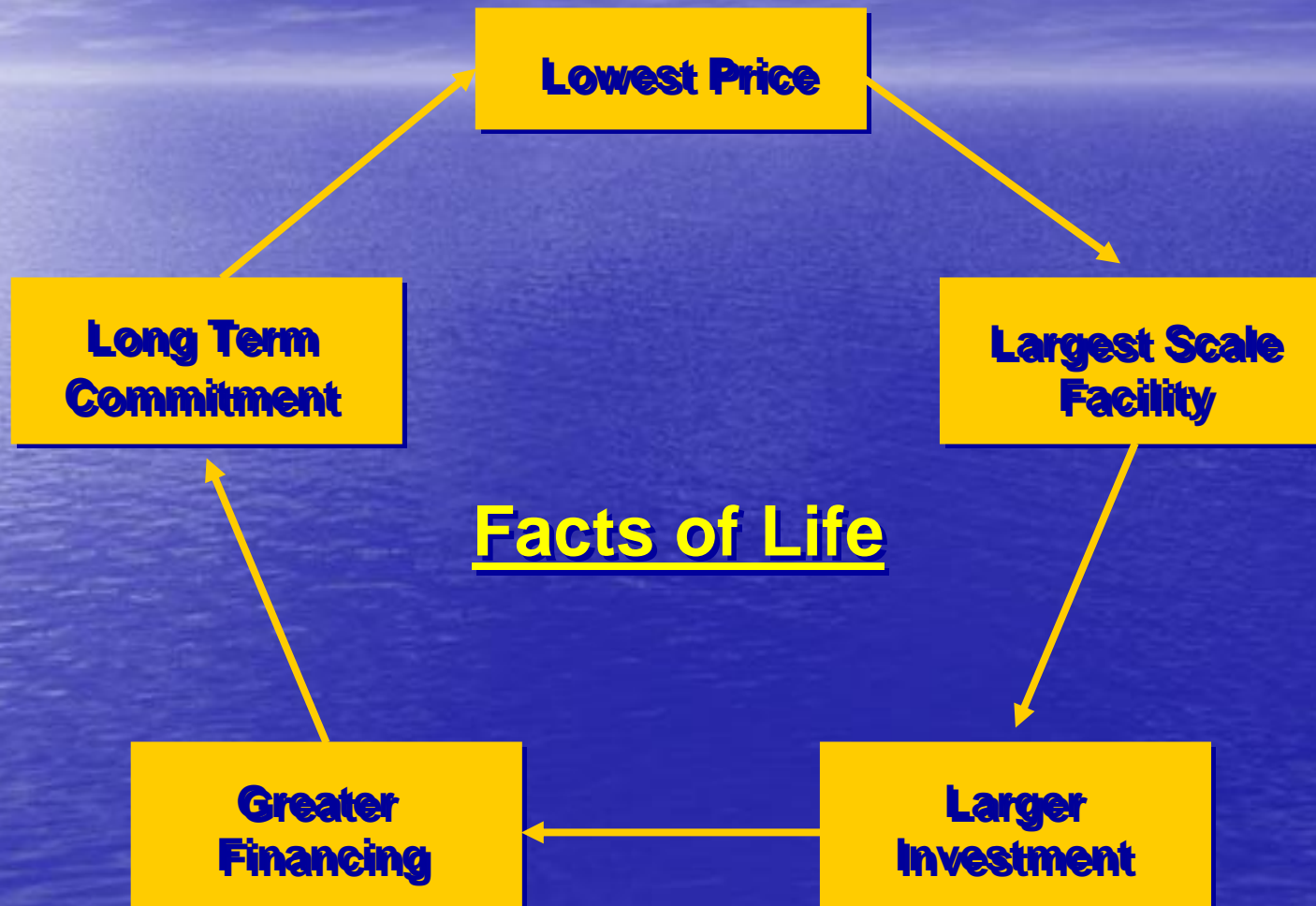
**Sediment Treatment
(component) Fits Into a Matrix
of Dredged Material /
Contaminated Sediment
Management, Environmental
Restoration Scenarios**

Coupled with **Economic** Drivers
for Re-Vitalization/Development
using **Beneficial Use** products
Derived from Dredged Materials
for Ports and Waterways

Beneficial Use - Restoration

- **Beneficial use products for local development**
 - **Buildings, bike paths, landscaping, roadways, greenways**
- **Waterfront Development**
 - **Allow Public Access**
- **Brownfield Reclamation and Landfill Closure**
- **Wetland Restoration**

Financing Conclusions



The Future of Sediment Management

- **Positioning for the Future**
- **Develop Long-term Self Sustaining Enterprises in the Environmental Management of Sediments**
 - *Sediments and other mixed media*

Sustainable Use of Resources

Positioning for the Future

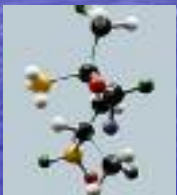
Material Inputs



Pollution Prevention



Waste Minimization



Materials Processing



Materials Outputs



Safe Disposal



Releases & Emissions



REUSE

RECYCLE

Safely Manage the Wheel

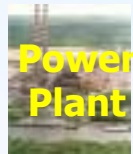


Creating a New Industry - Integrating Sediment Technologies

Coal Ash is the by-product of combustion in a coal-fired boiler to produce electricity or heat for steam generation.

New Industry (Opportunity)

- Embrace New Industry Opportunity
- Collaborate with sister industries to achieve
- Communicate to Agencies your interest



Electricity

Collaborating

Valuing Resource (Solid Waste)

- Change your ideology NOT waste but valuable resources
- Under used resources
- Characterize your resources



Coal Ash
Quality Improvement

Technology Transfer

- Embrace existing Technology to improve results
- Agency is looking for technology to develop new industries
- Mobilizing of on use Physical Capital



Technology
Development

Economize (Creating Value)

- Beneficial use materials have financial benefits.
- Agency is encouraging technology to develop new industries



RCRA Vision
Zero Waste

USEPA

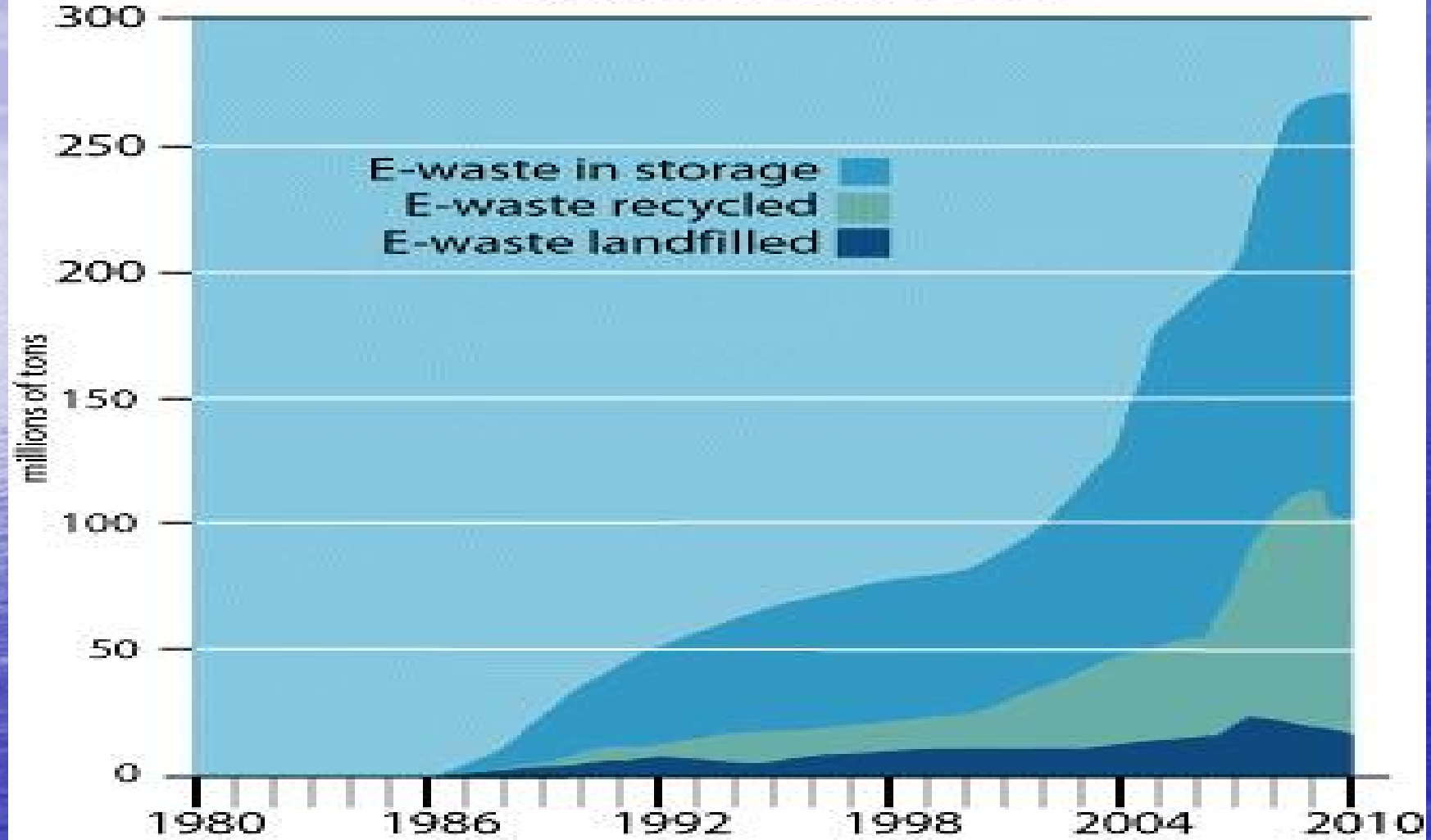
Environmental Technology Council

- Facilitate innovative technology solutions to environmental problems, particularly problems with multi-media applications
- **National Action Team Project Plan**
 - Technologies Promoting the Sustainable Use of Contaminated Sediments and the Beneficial Use of Waste Related Materials
 - **Integrated Approach to materials management**
 - **E.A. Stern – Action Team Leader**

Electronic Waste Crisis



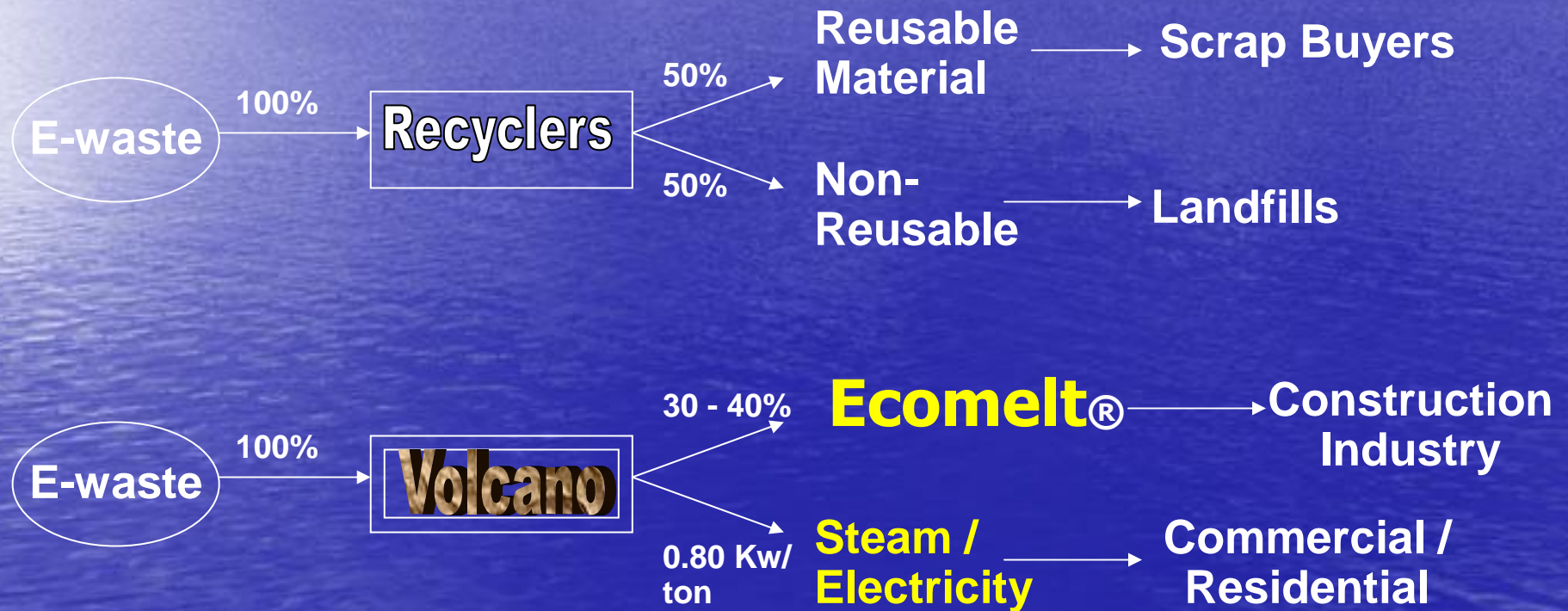
E-waste Tsunami



E Waste Market

- **E Waste classified as hazardous in U.S., Europe & Japan**
- **Governments banning E Waste disposal in landfills**
- **Multibillion dollar global market**
- **Recycling only partial solution**
- **Less than 50% of recycled E Waste material is reusable**
- **Lack of safe / cost efficient disposal alternatives**
- **Growing worldwide demand for environmentally safe and cost effective methods of converting waste into energy**

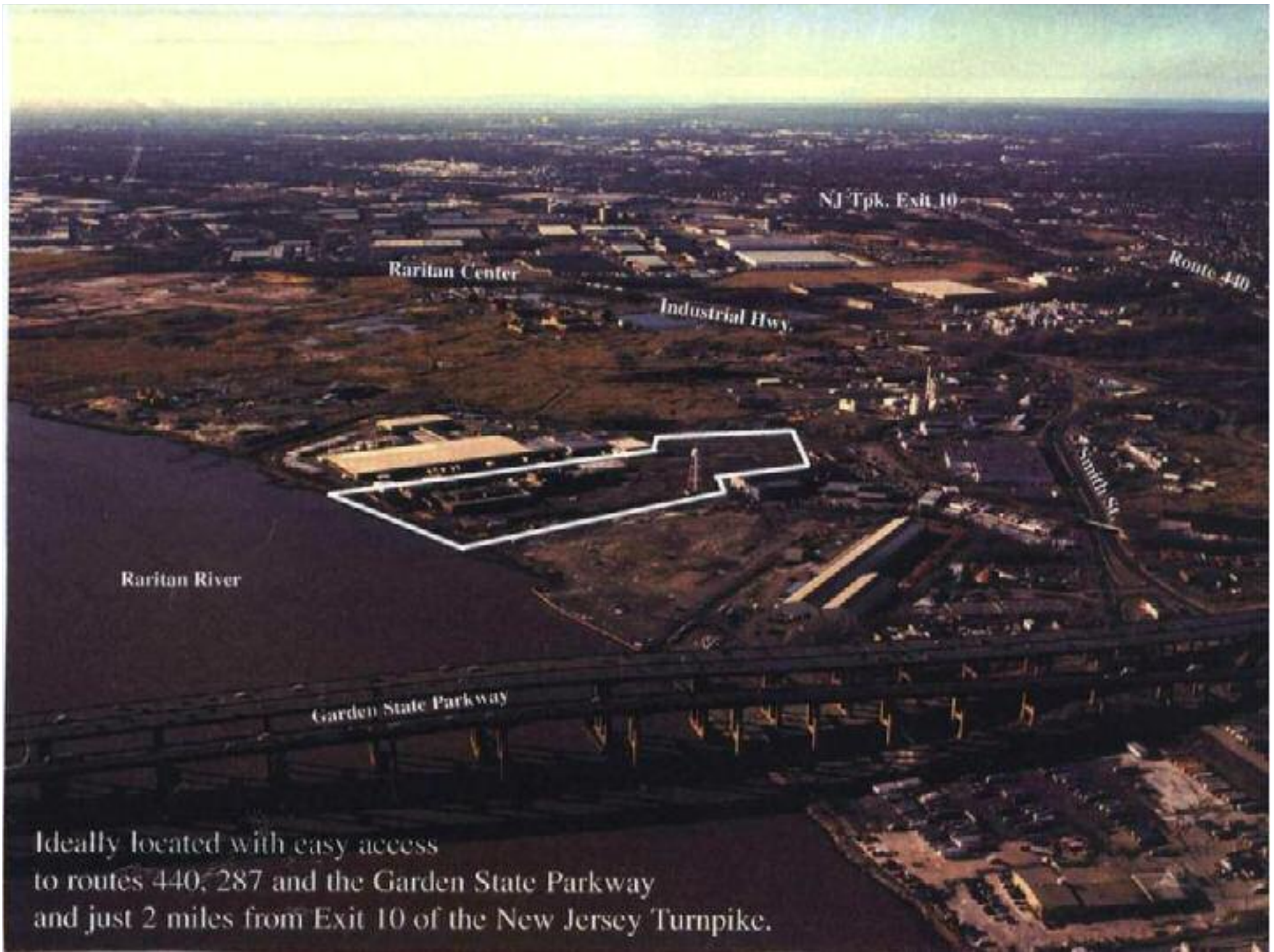
Landfills vs. Volcano Inc. Business Model



**Ecomelt – GTI Cement-Lock Rotary Kiln
for contaminated sediments**

Environmental Manufacturing

- **Multiple Feeds of:**
 - Dredged Material
 - Contaminated Sediments (Superfund)
 - Contaminated Soils
 - Coal Ash
 - Construction and Debris
 - Electronic waste
 - Sewage sludge
 - Medical Waste
 - Tires
- **Keeps system economics by supplying constant feed of material (no down time) – 24/7**
- **Diversity of Beneficial Use Products**
- **Operators are not pulled off job when one feed stream is reduced**



Ideally located with easy access to routes 440, 287 and the Garden State Parkway and just 2 miles from Exit 10 of the New Jersey Turnpike.

Program Needs

Waterfront Access

Truck and/or Rail
Access

Sufficient area,
preferably under cover

Municipal support

23-38,000 m³ storage
capacity

Bayshore Location

Waterfront Access

Truck and Rail Access
~74,000 m² covered
space

Fully supported by
municipal officials

Currently working in
aggregate/soil market

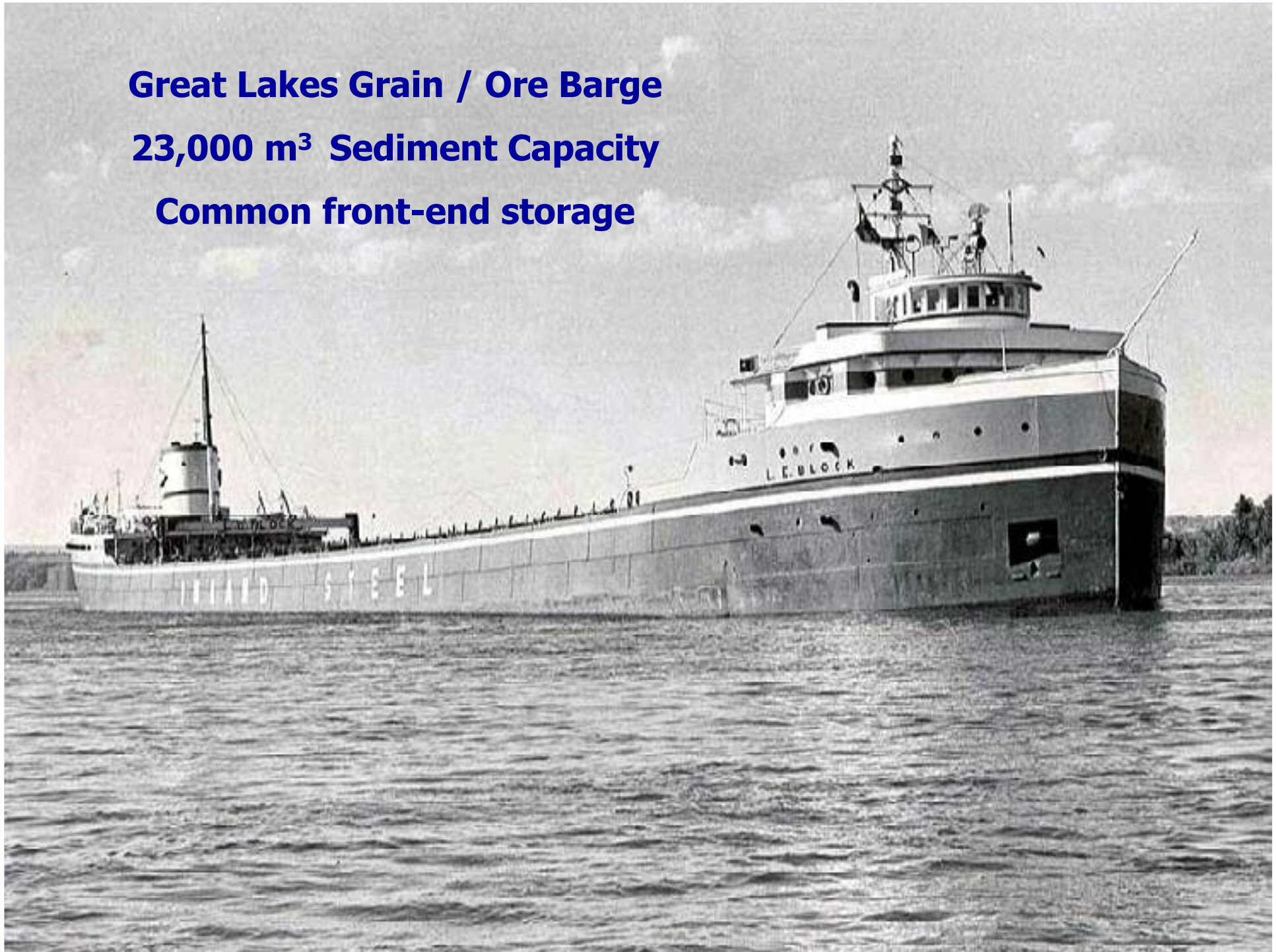
*No on-land storage
capacity*

Bayshore Recycling
Keasbey, New Jersey

Great Lakes Grain / Ore Barge

23,000 m³ Sediment Capacity

Common front-end storage





Common up-front Storage

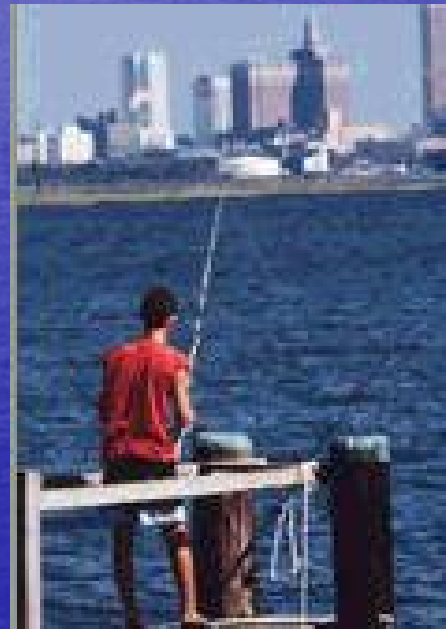




Environmental and Economic Revitalization



The New Jersey Performing Arts Center (NJPAC) in Newark



Ecosystem Watershed Approach





US Army Corps
of Engineers
New York District

Gowanus Canal, Hudson-Raritan Estuary (Environmental Restoration Feasibility Study)

- **Gowanus Canal Ecosystem Restoration Project**
- **creation, enhancement and restoration of aquatic, wetland and adjacent upland habitats,**
- **contaminated sediments and environmental dredging.**
- **Public Access**





US Army Corps
of Engineers
New York District

Lower Passaic River, Hudson-Raritan Estuary (Environmental Restoration Feasibility Study)

- Lower Passaic River Ecosystem Restoration Project
- Creation, enhancement and restoration of aquatic, wetland and adjacent upland habitats, and environmental dredging
- Dioxin
 - ◆ Multi-contaminants
 - ◆ 40 responsible parties
- Upland Superfund – River Study Area



Passaic River, NJ

- 27 km, tidal
- Dundee Dam to Newark Bay



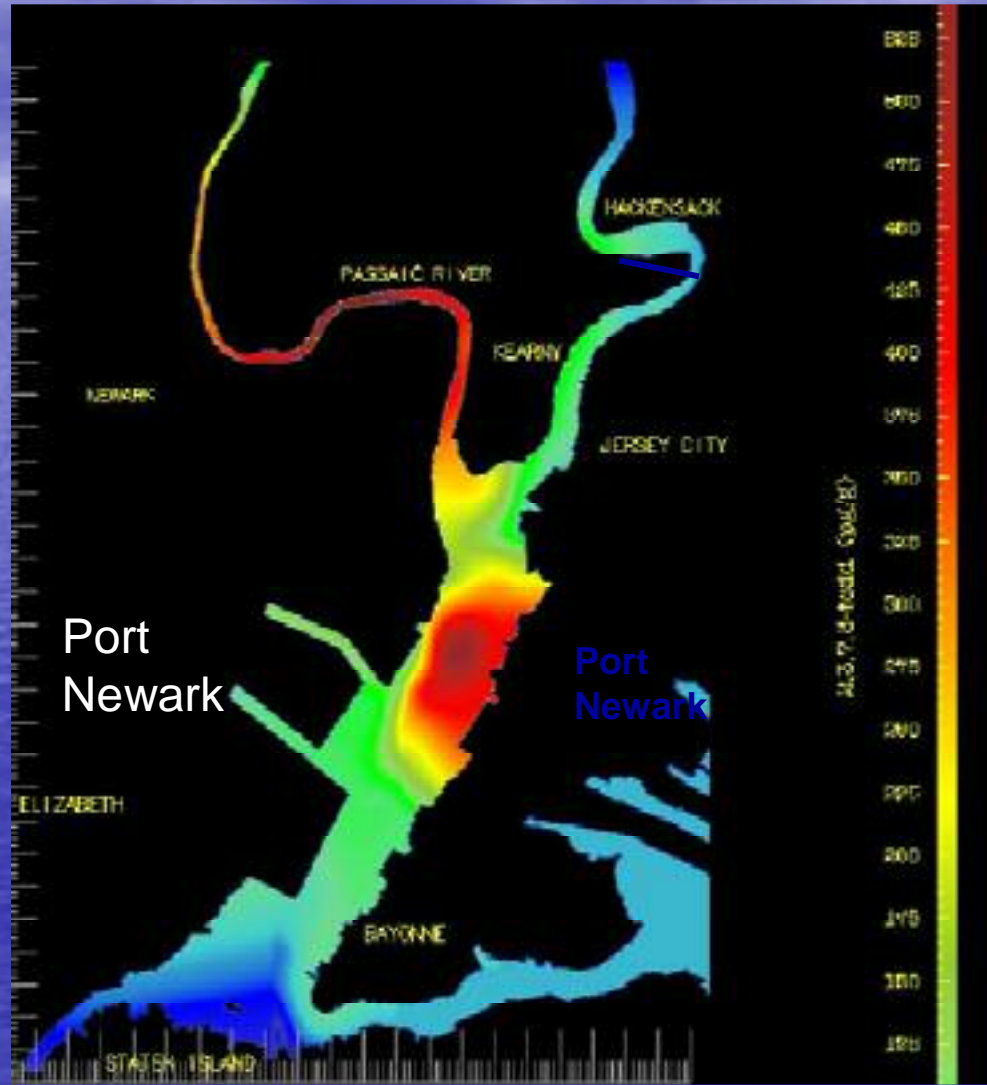
Passaic River, NJ – Key to the U.S. Industrial Revolution

Since the early/mid 1800's – economic boom included the following industries:

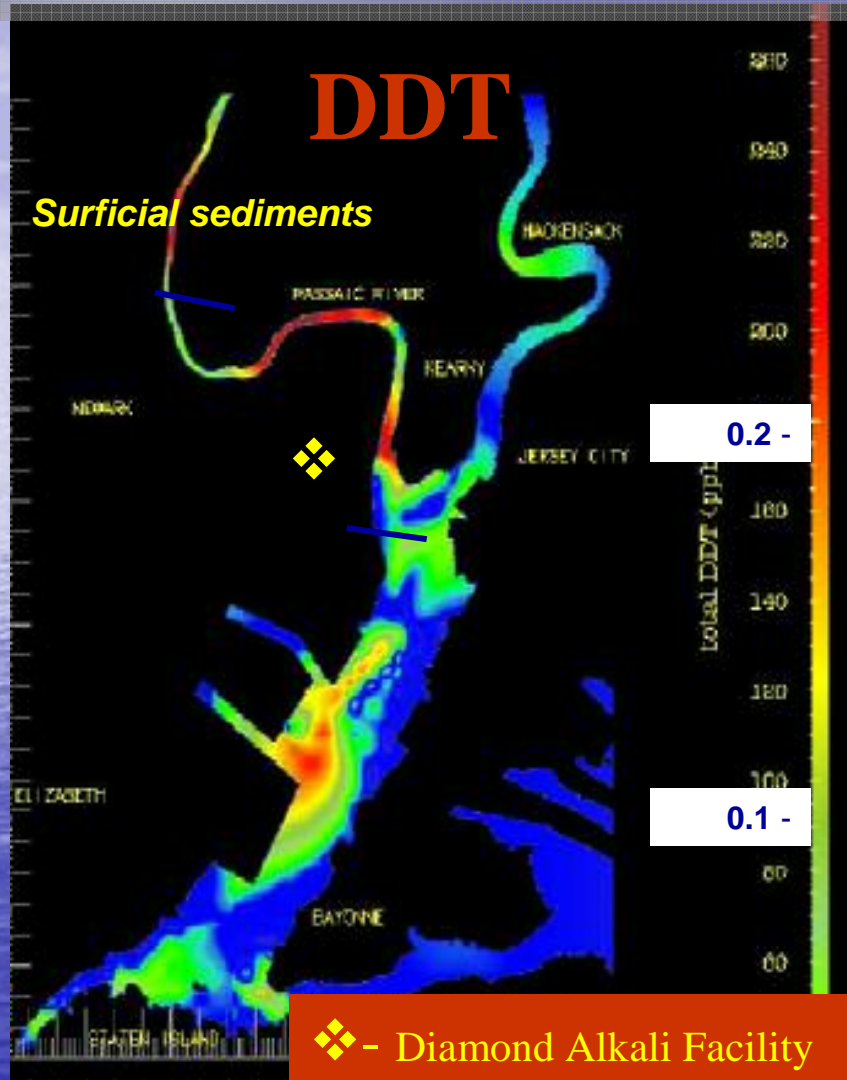
- Chemicals
- Leather
- Paints & Dyes
- Petroleum Refining
- Shipping
- Creosote Wood Preservers
- Manufactured Gas
- Paper Products
- Pharmaceuticals
- Tanneries
- Electric Power Generation
- Metal Recyclers
- Pesticides
- Rubber Manufacturers
- Textiles



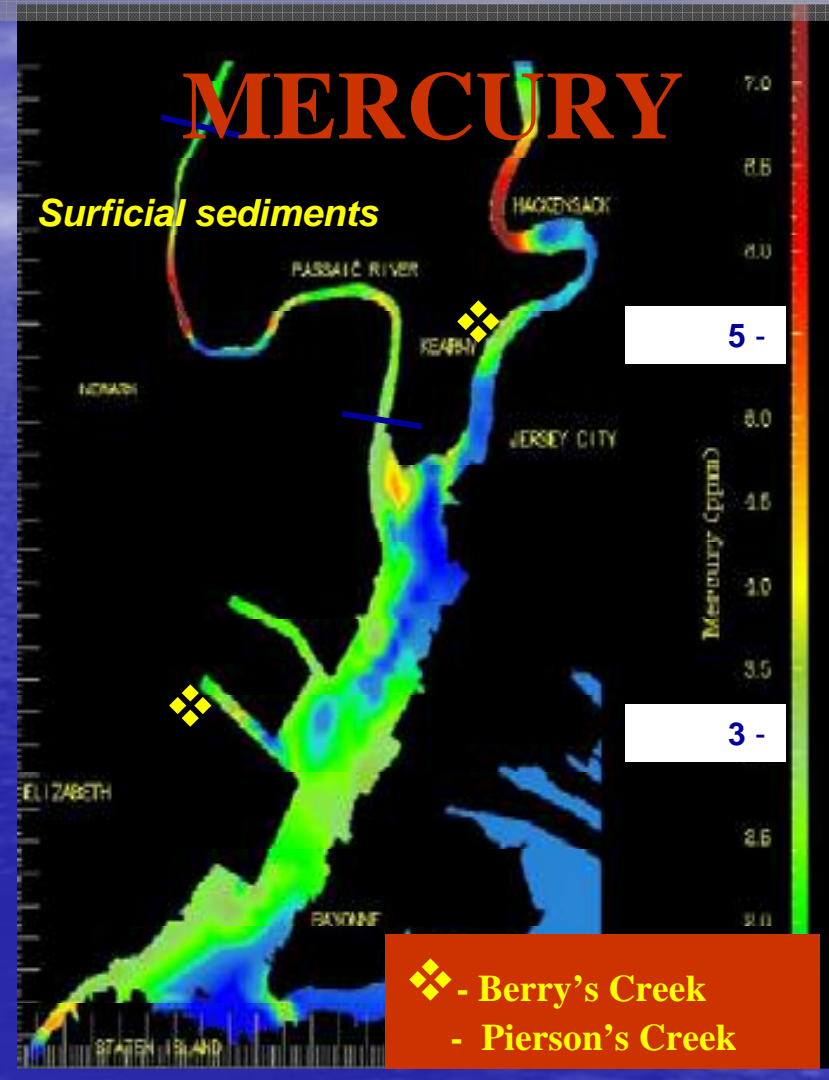
Dioxin Contamination from the Passaic River also affects the Port of NY/NJ



Passaic River / Newark Bay



Passaic River / Newark Bay



Passaic River / Newark Bay

NJDEP: 0.0016 / .0460 mg/kg

NJDEP: 0.15 / .71 mg/kg

Dredging/Treatability Pilot Summer 2005

- Dredging Technology Evaluation
- Dredging Performance
- Monitor Sediment Plume/Resuspension Rates
- Engineering Controls for full scale
- Decontamination



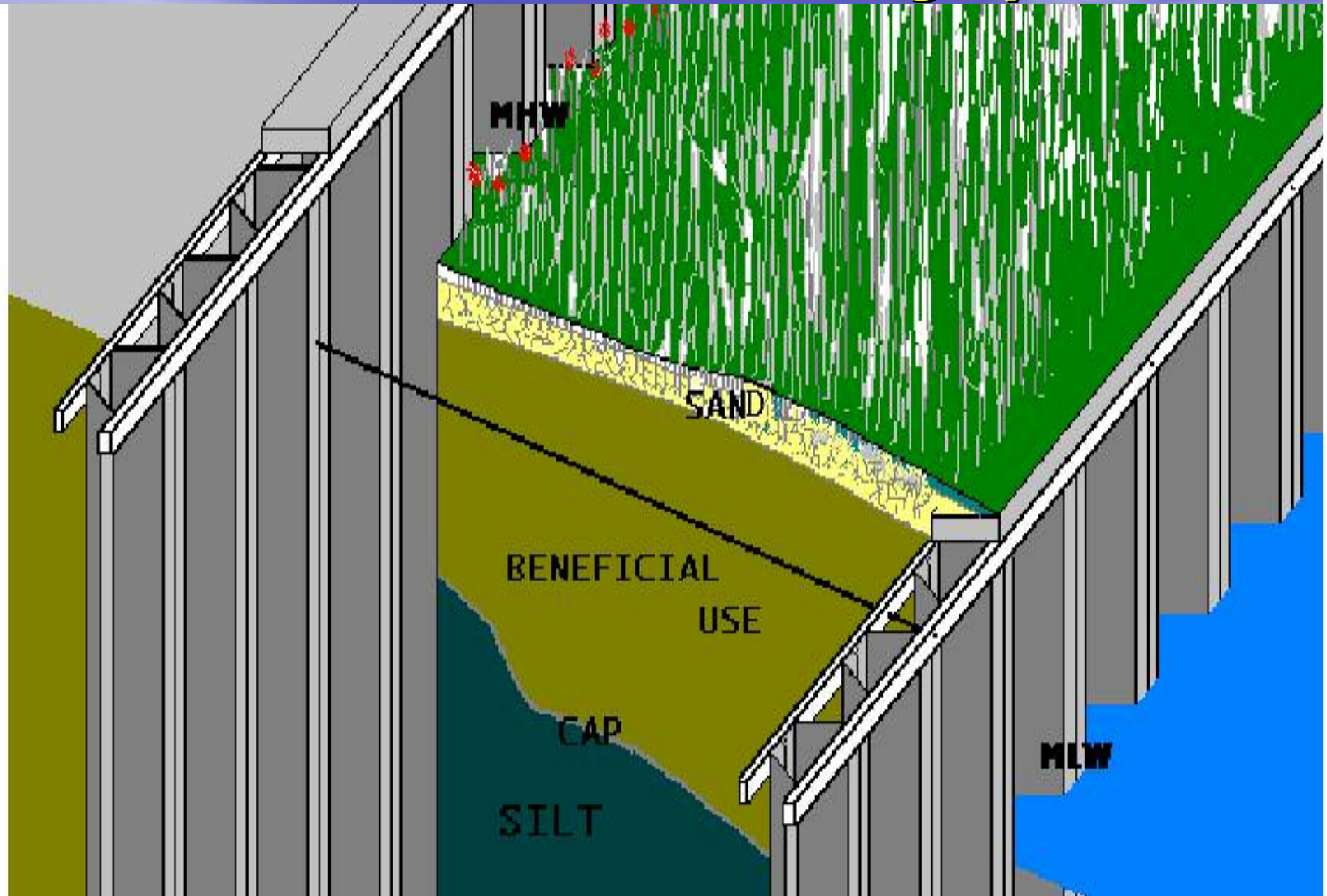
Passaic River Dredging Pilot Implementation

- **NJDOT Request for Proposal- January 2005 (international)**
- **July 2005- 3,800 cubic meters**
- **Water Quality Monitoring**
- **Air Quality Monitoring**

Sediment Ecosystem Restoration Reactive Capping with Benthic Habitat Enhancements



Bionautics Bulk and Tiering System



Bionautics Bulk and Tiering System



Renewable CDF/CADs w/ Integrated Treatment Facilities

- Difficulty of re-siting in areas of port expansion - sensitive habitats - aquatic environments, environmental opposition
- Construct (1) CDF with separated compartment for the most contaminated dredged material
 - provides immediate storage capacity
 - project goes to construction on time

Renewable CDF

- Construct dewatering and treatment facility(s) with beneficial use applications adjacent to CDF
- CDF renews itself by having continuous capacity by recycling the dredged material

Positioning for the Future Summary

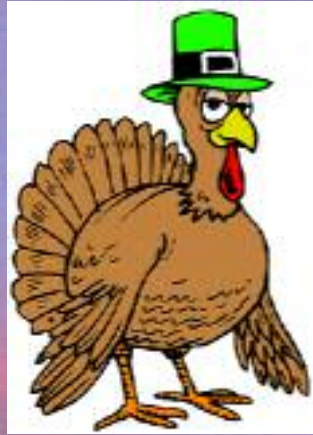
- **Public Education / Outreach (K-12)**
- **Policy**
- **Program of Research**
- **Program Integration**
- **Public-Private Partnerships**
- **Promote Trans-boundary / International Partners**

- **Processing sediments and mixed feeds to**
 - **– Sustain long-term business model**
 - Maximize beneficial use**
 - Reduce demand for non-renewable resources**
 - **Sustainable use of contaminated sediments**

The Future of Sediment Management

- **Program of Research**
- **Multi-National/International R&D Center for Sustainable Use of Contaminated Sediments and the Beneficial Use of Waste-Related Materials**

Happy Thanksgiving!



Sunset over Bayonne, NJ

GTI Cement-Lock Rotary Kiln

