



# National Water Quality Monitoring Network for U.S. Coastal Waters and Their Tributaries



**Briefing For**  
**NJ Water Monitoring Coordination Council**  
January 25, 2006

Al Korndoerfer, NJDEP/WM&S



# Presentation Outline

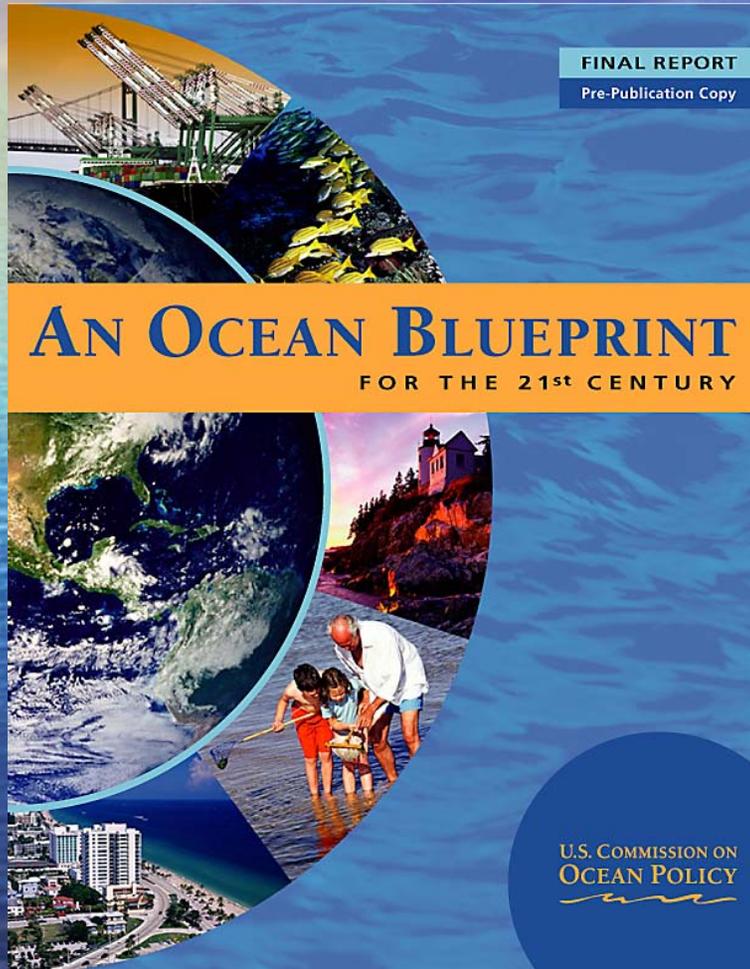
- Review history of the project
- Process for report preparation
- Overview of the report's content
- Next steps



# Background

- The Oceans Act of 2000
  - Created U.S. Commission on Ocean Policy
  - To focus on:
    - Protection of life and property
    - Stewardship of resources
    - **Protection of environment and pollution prevention**
    - Enhancement of marine commerce
    - Closer cooperation among government agencies

# U.S. Commission on Ocean Policy



**31 Chapters with 200+  
specific  
recommendations**

**Draft sent for review by  
55 states and  
territories**

**Chapter 15**

***Creating a National  
Monitoring Network***



## Chapter 15: Recommendations for “Creating a National Monitoring Network”

- **15-1: Develop a national monitoring network that coordinates and expands existing efforts, including monitoring of atmospheric deposition**
- **15-2: Ensure that the national monitoring network includes adequate coverage in both coastal areas and the upland areas that affect them, and ... linked to the IOOS**
- **15-3: Ensure that the monitoring network has clear goals, specific core variables and an appropriate sampling framework**



# The Administration's Response

- Created a Committee on Ocean Policy
  - Coordinate the activities of executive departments and agencies
  - Facilitate coordination and consultation among Federal, State, tribal, local governments, the private sector, foreign governments and international organizations
- Issued the U.S. Ocean Action Plan (December 17, 2004)



## CEQ and NSTC Charge to ACWI

- Charge formally accepted by ACWI in February, 2005
- Delegated responsibility to NWQMC
- Progress report to SWAQ in May, 2005
- Progress report to ACWI in September, 2005
- Task to be completed by January, 2006

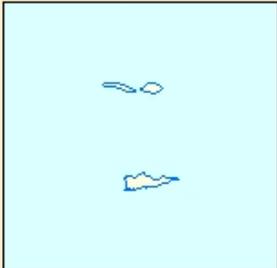
Alaska



Hawaii



Virgin Is.

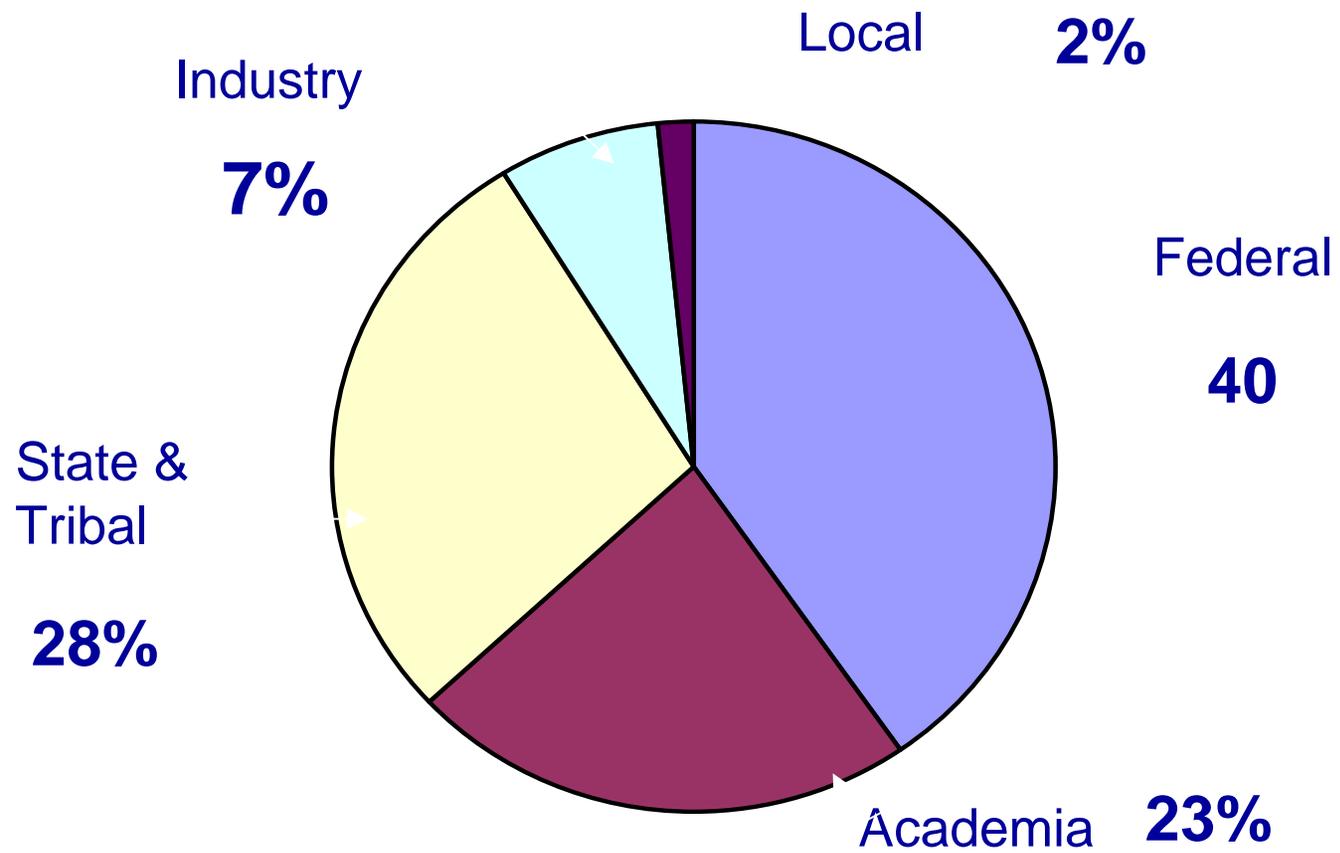


### Participants in the National Water Quality Monitoring Network Design

Affiliation Categories



## Participant Affiliation



# Design Features

- Clear objectives linked to management questions
- Linked to IOOS
- Linked monitoring of linked resources
- Flexibility over time
- Includes
  - metadata,
  - quality assurance, and
  - data management system that provides accessible data

# The Design Will Not:

- Provide data on all water resources
  - **Small rivers**
  - **Lakes and Reservoirs**
  - **Local aquifers**
- Replace State Clean Water Act use attainments monitoring
  - **305 (b)**
  - **303 (d)**
- Deal with compliance monitoring



# Management Questions

- What is the condition of the Nation's surface, ground, estuarine, and coastal waters?
- Where, how, and why are water quality conditions changing over time?
- Are programs to prevent or remediate problems working effectively?



# Management Questions

- Are water quality goals and standards being met?
- Where/What are the problems related to water quality?
- What is causing the problems?



# Management Questions

- What research activities are needed to support these important resources and ensure they are understood and sustainable?

# Goals & Objectives of the National Water Quality Monitoring Network

- Goals:
  - Integrate, coordinate, and as necessary, enhance water quality monitoring efforts needed to make informed management decisions for sustainable use of aquatic resources.
  - Communicate the availability of quality assured data, and disseminate information products relevant to national, regional and local needs.

# Goals & Objectives of the National Water Quality Monitoring Network

- Objectives:
  - Define status and trends of key water quality parameters and conditions on a nationwide basis.
    - Water quality status refers to current or recent water quality conditions
    - Requires knowledge of local natural conditions (e.g., geology and hydrology) and natural variability associated with sample collection and measurement efforts.

# Goals & Objectives of the National Water Quality Monitoring Network

- Typically require *a priori* knowledge of an area to be sampled or several years of monitoring efforts to establish a baseline.
- Water quality parameters and conditions include physical / chemical constituents, and biological characteristics
- All three necessary to understanding status and trends in water quality and associated freshwater, estuarine, and marine ecosystems

# Goals & Objectives of the National Water Quality Monitoring Network

- **Trends in water quality imply changes in particular parameters or indices over space or time.**
  - Time trends usually involve repeated measurements of the same parameters at the same location over time.
  - Trends in spatial coverage can also be important.
- **Interpretation of trend data must consider changes in factors that affect water quality such as geology, temperature, flow, and other hydrologic characteristics.**

# Goals & Objectives of the National Water Quality Monitoring Network

- Objectives (cont.):
  - Provide data relevant to determining whether goals, standards, and resource management objectives are being met, thus contributing to sustainable and beneficial use of coastal and inland water resources

# Goals & Objectives of the National Water Quality Monitoring Network

- The Network will include monitoring protocols and approaches that provide data relevant to a variety of management issues such as:
  - Water quality summaries prepared by state or Federal scientific and management agencies;
  - Assessments of coastal conditions;
  - Fisheries management;
  - Determination of the status of freshwater, estuarine, and marine habitats and biological communities;
  - Recreational beach quality;
  - Atmospheric deposition; and
  - Availability of water for sustaining coastal ecosystems.

# Goals & Objectives of the National Water Quality Monitoring Network

- While data from the Network will be useful to end users in determining whether goals and standards are being met, the Network will not make such determinations itself.
- Network reports will provide **results based on absolute values** rather than specific water quality standards
- Results presented by natural geographical zones to account for spatial differences due to natural causes.
- Temporal trends will be evaluated by examining absolute values through time.

# Goals & Objectives of the National Water Quality Monitoring Network

- Objectives (cont.):
  - Provide data to identify and rank existing and emerging problems to help target more intensive monitoring, preventive actions, or remediation.
    - Network will track changes in baseline conditions to help identify changes before they become major problems.

# Goals & Objectives of the National Water Quality Monitoring Network

- Provide data to support analysis of the effectiveness of preventive actions or remediation or whether targeted, more intensive monitoring is needed to better determine causes and appropriate action.
- In most cases, intensive studies will be beyond the scope of the Network and will be designed and conducted by local and regional agencies.

# Goals & Objectives of the National Water Quality Monitoring Network

- Objectives (cont.):
  - Provide data to support and define coastal oceanographic and hydrologic research, including influences of freshwater inflows.
    - Network will provide data that will help to integrate and strengthen research and modeling studies, including development of:
      - Better understanding of scales and trends in physical alteration of watersheds, freshwater delivery, and water quality parameters;

# Goals & Objectives of the National Water Quality Monitoring Network

- Model linkages between land, water and air across spatial and temporal scales, and that can forecast ecological response to changing patterns of land and resource use;
- Relationships between pollution loads and habitat quality;
- Criteria and indicators to assure habitat quality and restoration; and
- Insight into sources, transport, transformation, fate and effects of toxic chemicals, excess nutrients, pathogens and other sources of environmental degradation.

# Goals & Objectives of the National Water Quality Monitoring Network

- Objectives (cont.):
  - Provide quality-assured data for use in the preparation of interpretive reports and educational materials.
    - Guiding principle used in developing the Network was that monitoring efforts must provide data that are useful and used.
    - Network will provide data in a timely fashion with appropriate metadata so that the data can be used for a variety of purposes as outlined in objectives

# Goals & Objectives of the National Water Quality Monitoring Network

- Easy accessibility will be a key to effective use of the monitoring network data
- Network managers will provide a written summary of national water quality conditions on a regular basis

# Network Design Features

- The Network focuses on **coastal waters**
- Proposes a significant monitoring effort to determine conditions and trends in **estuaries, near shore coastal waters (0-3 NM), off shore coastal waters (3 NM to seaward edge of EEZ), and the Great Lakes**
- Monitoring component for **rivers** because of the need for data on **flow and loads** of constituents to coastal waters

# Network Design Features

- **Ground water** will be monitored where appropriate as will **atmospheric deposition** to determine direct loads to coastal waters
- **Coastal beaches and wetlands** are included in the list of resources to be monitored but the design of those efforts is **deferred** at present because of technical considerations

# Network Design Features

- The design is linked with the **Integrated Ocean Observing System (IOOS)**
- Data produced by the Network will be aggregated and reported upon using the eleven IOOS Regions
- IOOS Regional Associations will have an important role in establishing final specifications for some of the Network resource components

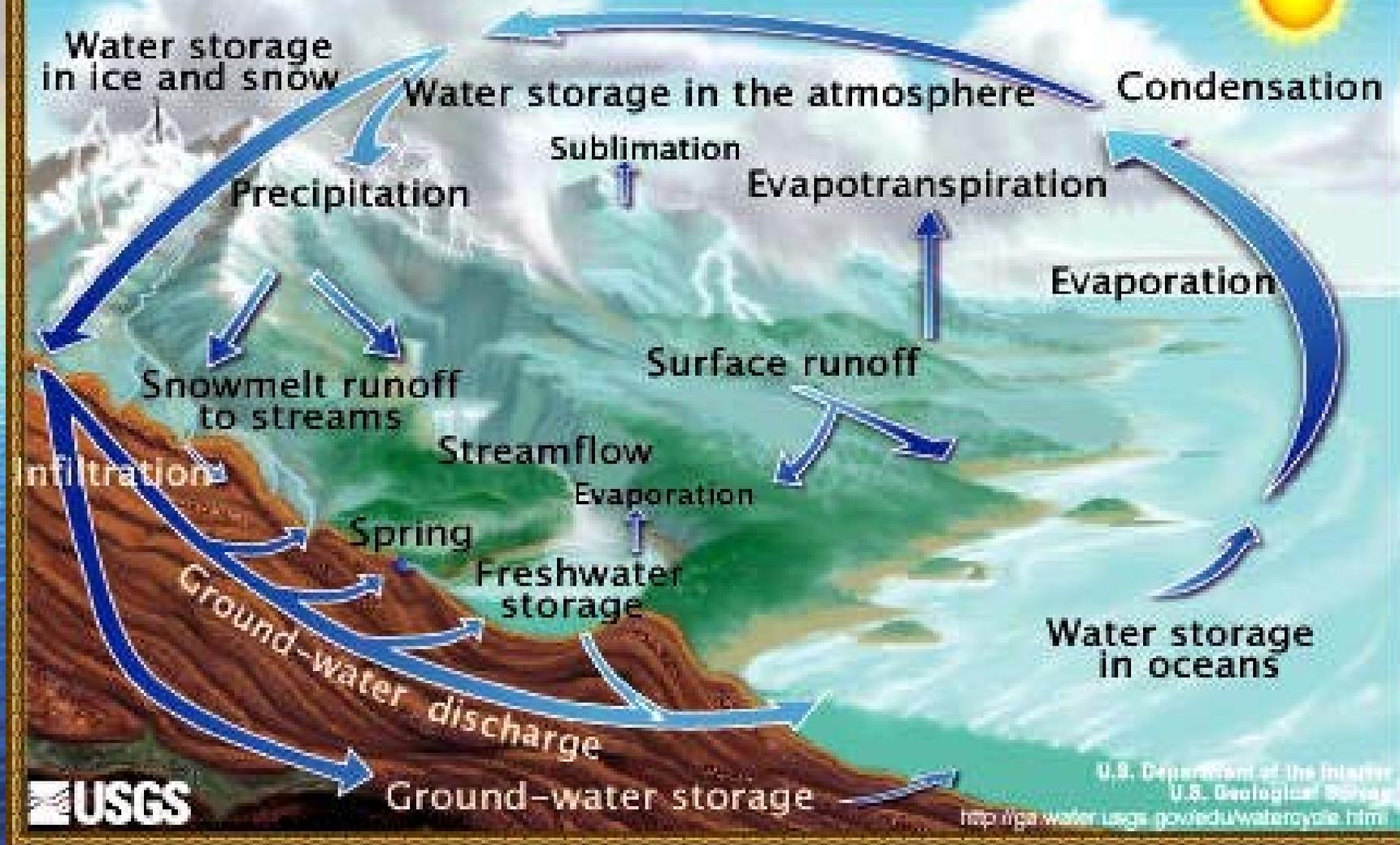
# IOOS Regions



# Network Design Features

- Network monitoring addresses water resource compartments in an integrated and coordinated fashion

# The Water Cycle



U.S. Department of the Interior  
U.S. Geological Survey  
<http://ga.water.usgs.gov/edu/watercycle.html>

# Network Design Features

- Many of the same physical, chemical, and biological measurements are made for different resources; thus it will be possible to make inferences about transport of constituents from uplands to the coast.

# Network Design Features

- The Network designed to be flexible and to change over time
- Network data will be continuously interpreted to identify those locations that might be dropped or sampled less frequently
- The design recognizes that technological improvements will facilitate new monitoring approaches and constituents

# Network Design Features

- The Network stresses the importance of metadata and procedures to enhance comparability of data
- Data storage and data access are also important to the overall design

# Need for Monitoring Outside the Network

- Great deal of important monitoring that does not fall under the general umbrella of the proposed Network
  - **Many problems need to be identified and environmental responses tracked at a finer scale than the Network is designed to detect.**
  - **Monitoring at this finer scale in small rivers, lakes, reservoirs, local ground water aquifers, and in smaller watersheds will continue to be needed and will be the primary responsibility of State and local agencies**

# Need for Monitoring Outside the Network

- Great deal of important monitoring does not fall under the general umbrella of the proposed Network (cont.)
  - **Drinking water** monitoring is **not** specifically **included**, although it is certainly critical to the health of the nation
  - The proposed Network **does not** incorporate or **replace** all **existing water quality monitoring**. There are important needs and important monitoring that is not included in the design characteristics of the Network.

# Network Design

- The Network will address a specific group of stressors:
  - **Oxygen depletion**
  - **Nutrient enrichment**
  - **Toxic contamination**
  - **Sedimentation**
  - **Harmful algal blooms**
  - **Habitat degradation**
  - **Invasions by exotic species**
  - **Pathogens (indicator bacteria)**



# Constituent Categories

- **Physical:** Flow magnitude and direction, physical habitat, sediments
- **Chemical:**
  - **Inorganic:** Water-quality characteristics, major ions, nutrients, metals and metalloids
  - **Organic:** Bulk organics, volatile organic compounds, pesticides, halogenated hydrocarbons, polycyclic aromatic hydrocarbons, contaminants with new and emerging concerns
- **Biological:** Diversity, toxicity

# Network Design

- Many of the measurements are made in all resource components
- No measurement is made for fewer than three of the components
- Continuity of measurements will allow linkages among the resources
- Where appropriate, ground water and atmospheric deposition will also be monitored for the same group of constituents

# Network Design

- **Condition of U.S. estuaries by IOOS region**
  - 50 sites per IOOS region selected using probability-based design, 500 sites nationally
  - Sample once per year
  - Sample interval is once every 5 yr. Reselect sites each year; repeat year 1 sites in year 6

# Network Design

- **Condition of U.S. estuaries by IOOS region (cont.)**
  - 30 estuaries sampled per year, 50 sites (except for small) per estuary
  - Selected using probability-based design, 1500 stations per year
  - Sample monthly for physical/chemical & once/yr. for biological and sediment
  - Sample interval is once every 5 yr. Reselect sites each year; repeat year 1 sites in year 6

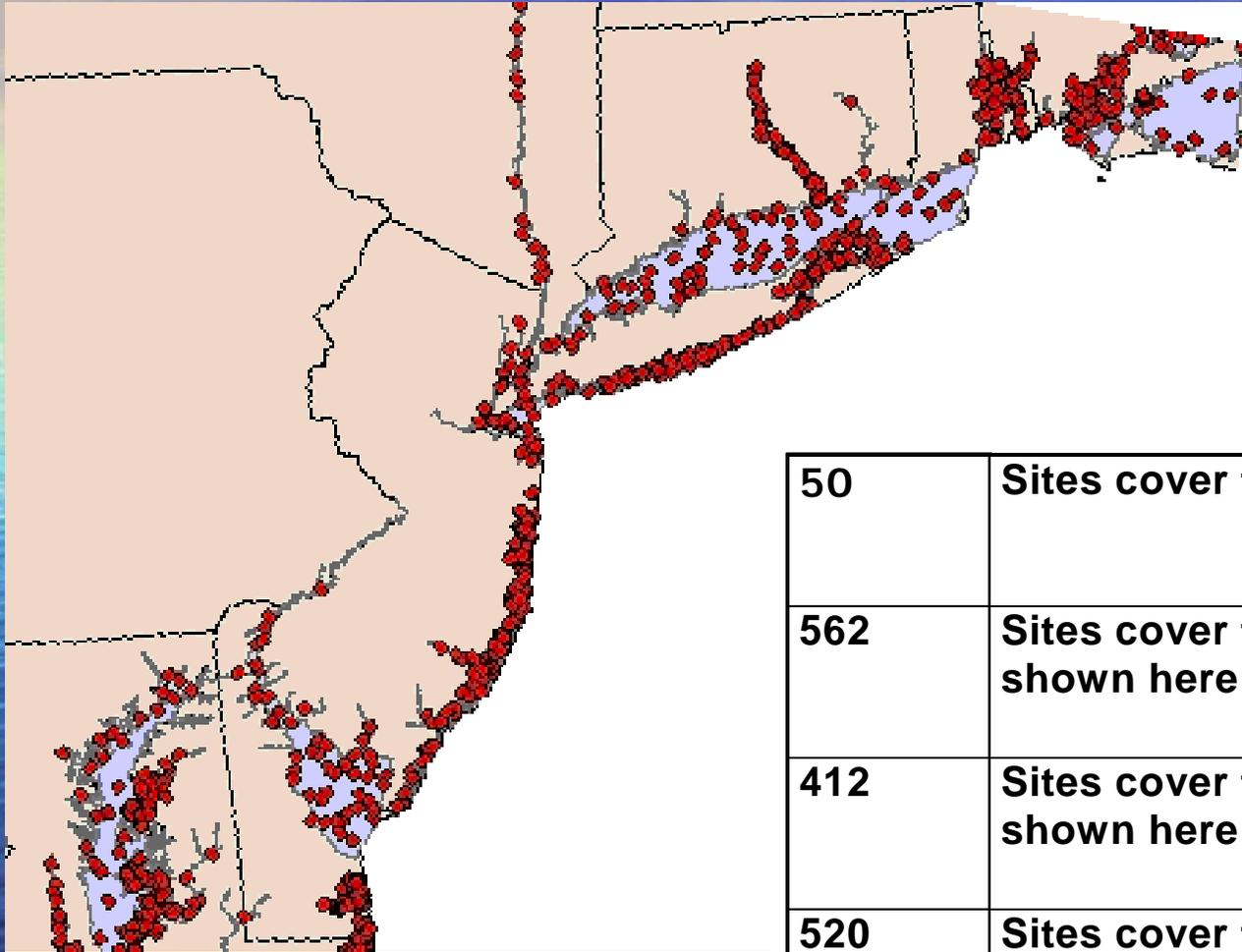
# Network Design

- **Transport through each of the 149 Network estuaries**
  - 15 sites per estuary distributed along salinity gradient
  - Sample monthly for physical and chemical in water column
  - Sample interval will be On-Going

# Network Design

- **Short-Term Variability in Subset of Network estuaries**
  - 2 sites per estuary, one at each end of salinity gradient
  - Sampled via continuous monitoring

# Monitoring Estuaries



50	Sites cover the IOOS Region
562	Sites cover the 10 estuaries shown here
412	Sites cover the 6 NEP estuaries shown here
520	Sites cover the 5 states shown

# Network Design

- **Condition of Near Shore Waters**
  - 50 sites per IOOS region
  - Selected using probability-based design, 500 stations per year
  - Sampled once per year

# Network Design

- **Condition of Near Shore Waters (cont.)**
  - Variable number of fixed station sites per National & IOOS region
  - Site selection and sampling frequency determined by Resource Management Agencies & IOOS Regional Associations

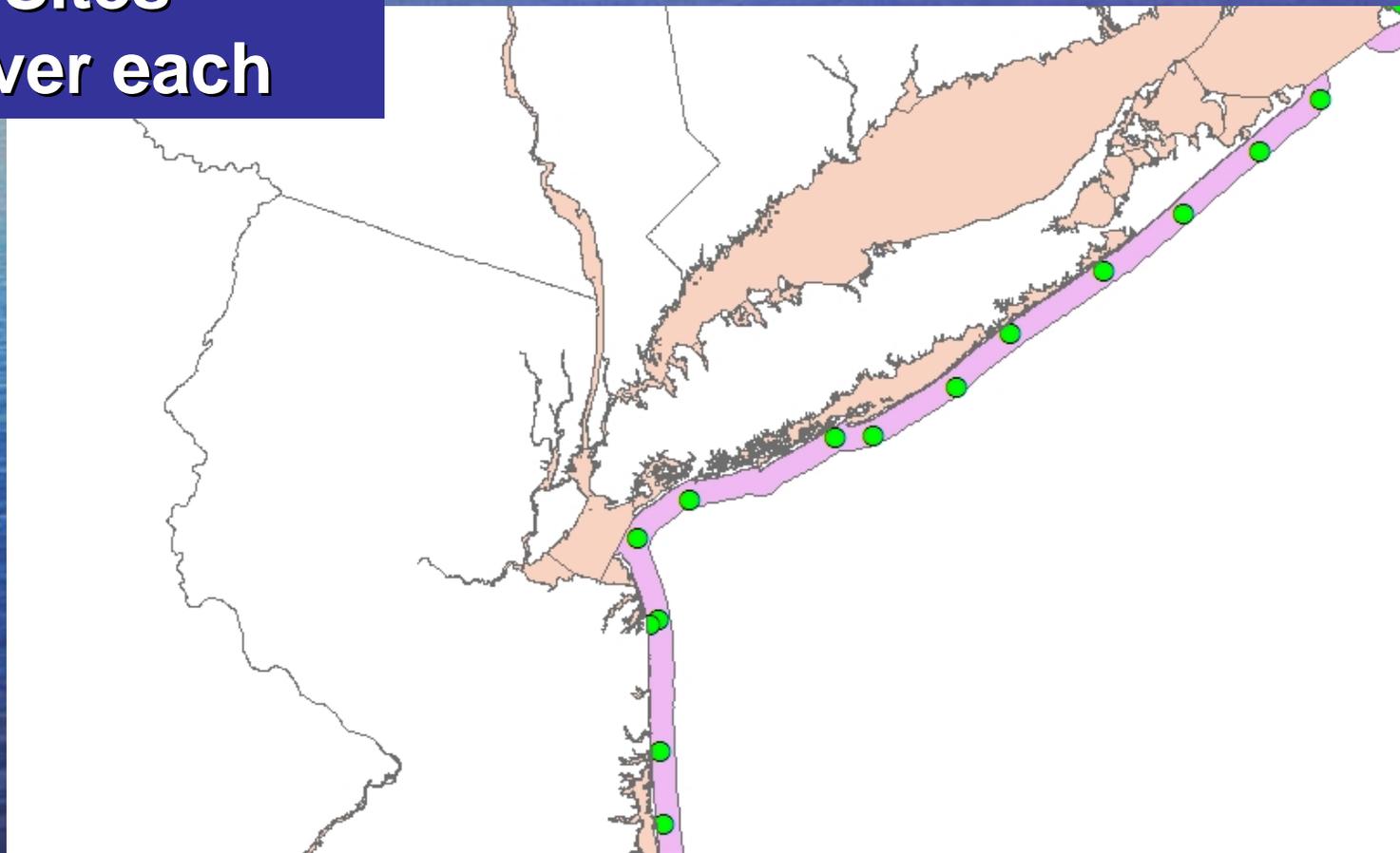
# Network Design

- **Condition of Near Shore Waters (cont.)**

- Remote sensing and autonomous underwater vehicles used to assess the entire resource
- Monitoring continuous and on-going

# Monitoring Near Shore

**50 Sites  
cover each**



# Network Design

- **Condition of Off Shore Waters**
  - Variable number of fixed station sites collected during shipboard surveys and from buoys
  - Site selection and sampling frequency determined by Resource Management Agencies & IOOS Regional Associations

# Network Design

- **Condition of Off Shore Waters (cont.)**
  - Remote sensing and autonomous underwater vehicles used to assess the entire resource
  - Monitoring continuous and on-going

# Network Design

- **Condition of Great Lakes**
  - 50 sites per lake in lakewide, depth-stratified design
  - Selected using probability-based design, 50 stations per year
  - Sampled once per year
  - Sample interval is once every 5 yr. Reselect sites each year; repeat year 1 sites in year 6

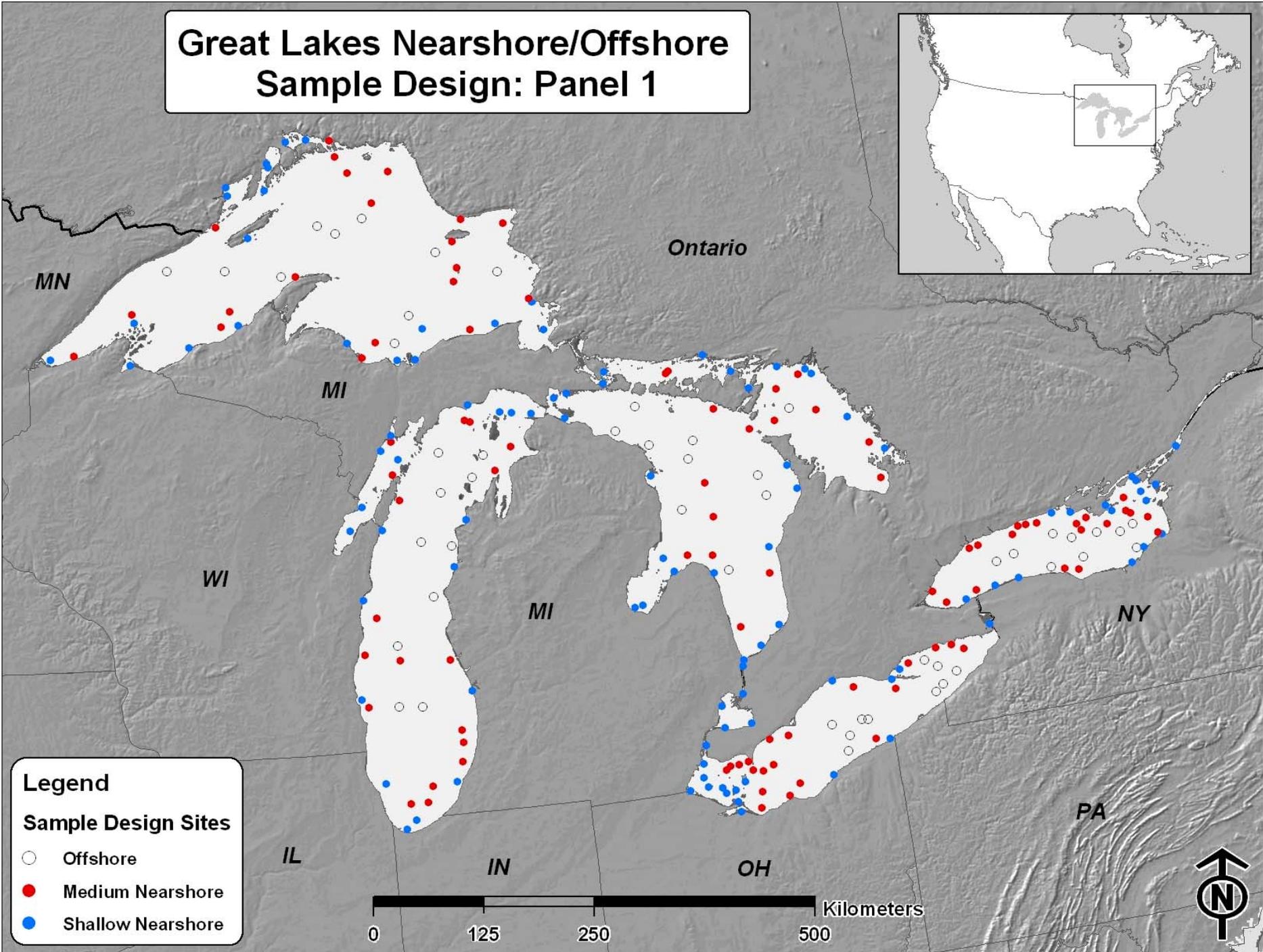
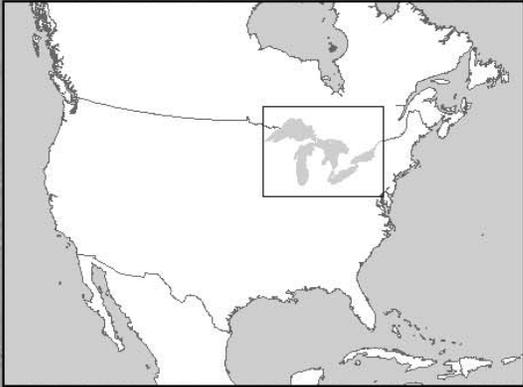
# Network Design

- **Condition of Great Lakes (cont.)**
  - Remote sensing and autonomous underwater vehicles used to assess the entire resource
  - Site selection and sampling frequency determined by Resource Management Agencies & IOOS Regional Associations
  - Monitoring continuous and on-going

# Network Design

- **Condition of Great Lakes Embayments**
  - 50 embayments
  - Variable number of sites per embayment
  - Selected using probability-based design
  - Sampled once per year

# Great Lakes Nearshore/Offshore Sample Design: Panel 1



**Legend**

**Sample Design Sites**

- Offshore
- Medium Nearshore
- Shallow Nearshore

0 125 250 500 Kilometers



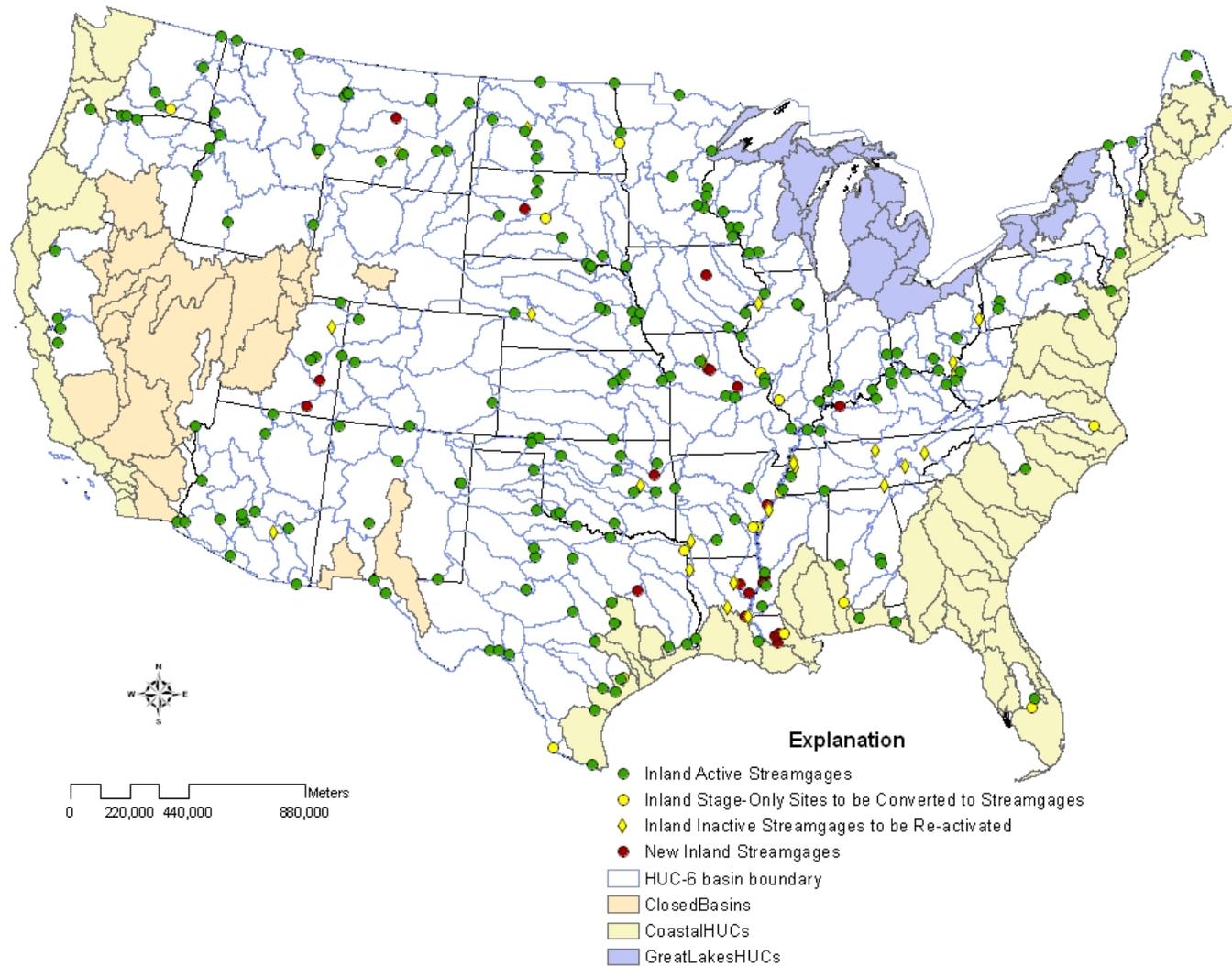
# Network Design

- **Rivers: flow and loads from inland HUC - 6 watersheds**
  - 258 sites at outlet of HUC-6 basins, 1-3 per watershed
  - Sites located to represent 90% of freshwater outflow from HUC-6 watershed
  - Sample monthly plus high flows, once per year for biological characterization
  - On-going

# Network Design

- **Rivers: flow and loads to Estuaries**
  - 200 sites in Network estuaries, 1-10 per estuary
  - Sites located to represent 90% of freshwater inflow to Network estuaries
  - Sample monthly plus high flows, once per year for biological characterization

# Proposed Riverine Stations



# Network Design

- **Rivers: flow and loads to Great Lakes**
  - 56 sites in watersheds, 1 per watershed
  - Sites located to represent outflow of basins draining 250 square miles or more
  - Sample monthly plus high flows, once per year for biological characterization

# Proposed Riverine Stations – Great Lakes

## Explanation

- Active monitoring sites
- Inactive or active stage-only monitoring sites
- Great Lakes Accounting Units
- State Boundaries



# Network Design

- **Groundwater**

- Assess direct inflow to coastal waters
- Site variable depending on priority of aquifer
- Sites selected by local and regional experts
- Sample frequency and interval variable

# Network Design

- **Atmospheric Deposition**
  - Assess Direct loads to estuaries and Great Lakes
  - Number of Sites variable depending on size of reporting unit
  - Site selection and sampling frequency determined by Resource Management Agencies & IOOS Regional Associations

# Network Design

- **Beaches**

- Establish condition of beaches based on bacterial contamination
- Beaches to be aggregated by region
- Design deferred

# Network Design

- **Wetlands**
  - Design deferred



# Structure of the Design

- Nine Resource compartments
- Fixed station and probabilistic designs
- Stations identified
- Parameters and sampling frequencies specified
- Provisions for data comparability, management & access

## A continuum of Observations

- Estuaries
- Nearshore
- Offshore and EEZ
- Great Lakes
- Coastal Beaches (BEACH Act)
- Wetlands

## With Flow and Flux from

- Rivers
- Atmosphere
- Groundwater

# Data Issues

- Metadata documentation using long-standing Council/ACWI data element format
- Results and metadata storage to be electronic
- Access to be assured via web service portals via XML

# Network Implementation

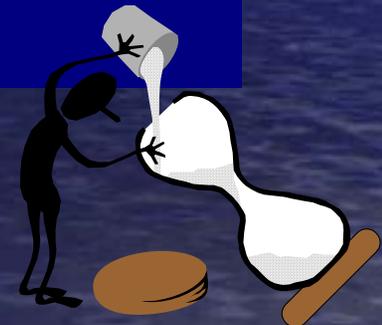
- Six important issues to be addressed as part of Network implementation:
  - Finalize details of Network design
  - General concept for incorporating existing monitoring efforts into the Network and building upon them
  - Need a full inventory of on-going monitoring that might meet Network specifications

# Network Implementation

- Six important issues to be addressed as part of Network implementation (cont.):
  - Metrics to track progress in Network implementation
  - Develop reports that document Network design issues, Network status, and present and interpret Network data; and
  - Highlight the importance of cooperation, collaboration, and coordination within the monitoring community

# What Next?

- **January 6, 2006 -**
  - Final report presented to ACWI
- **February 10, 2006 -**
  - ACWI final comments on the draft report back to NWQMC
- **March 10, 2006 -**
  - Steering Committee to respond to ACWI comments



# What Next?

- **March 15, 2006 -**
  - ACWI members to take final vote on Network Report
- **March 22, 2006 -**
  - ACWI formally submits report to CEQ, NSTC/SWAQ, and JSC

