A Real-time Water Quality Monitoring Program for Dredging and Capping on Onondaga Lake

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Onondaga Lake Project Overview

- Lake restoration
  - 2.6 million cy of dredging
  - 580 acres of capping
- Construction water quality management program relies on real-time turbidity monitoring
  - Enables rapid response to adverse water quality conditions
  - Ensures control measures achieve desired protectiveness

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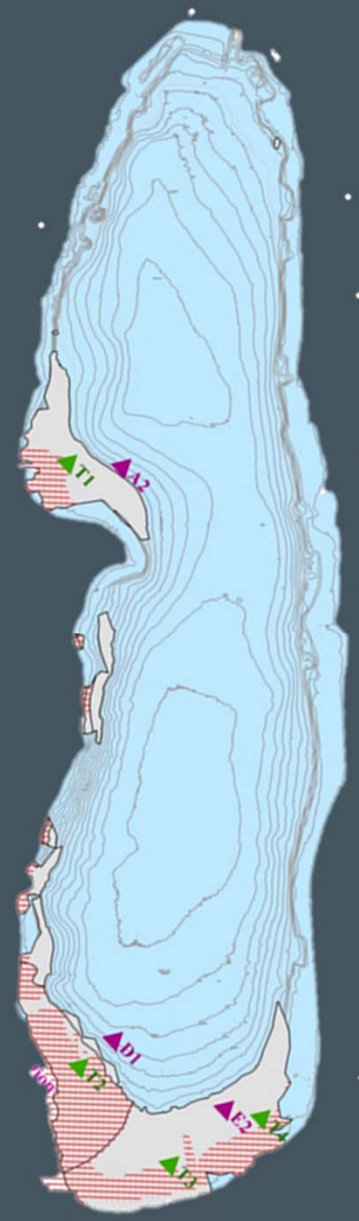
Monitoring Program Challenges

- Detecting construction-related water quality impacts over ambient conditions
  - Ambient turbidity in the Lake can vary significantly
- Maintaining project efficiency
  - Detect and mitigate issues early, before water quality issues force work stoppages
  - Avoid unwarranted investigations
- Water quality criteria require continuous analysis and computation
  - Project is active 24 hours/day, 6 days/week

Baseline Monitoring Program

- Aimed at understanding how the Lake responds to meteorologic and hydrologic forcing
  - Ambient conditions monitored in remediation areas over 2 field seasons
- Used continuous monitoring techniques to obtain data on relevant time scales
- Results informed construction monitoring program design



Legend

- Dredge Areas
- Remediation Areas
- 2005 Bathymetry (displayed every 5 ft)
- 2011 Continuous Turbidity Monitoring Station
- 2010 Continuous Turbidity Monitoring Station

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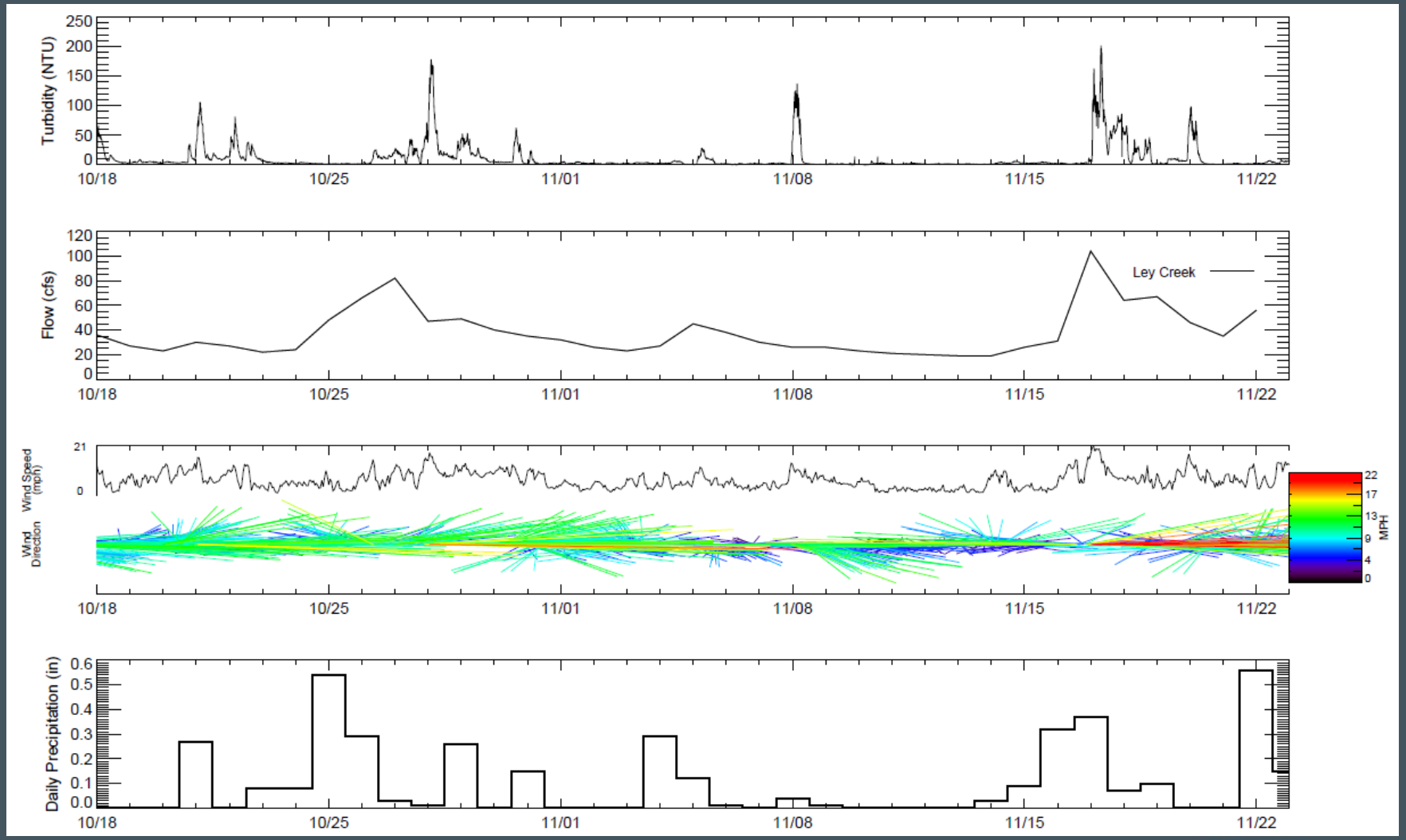
Example Baseline Data Analysis



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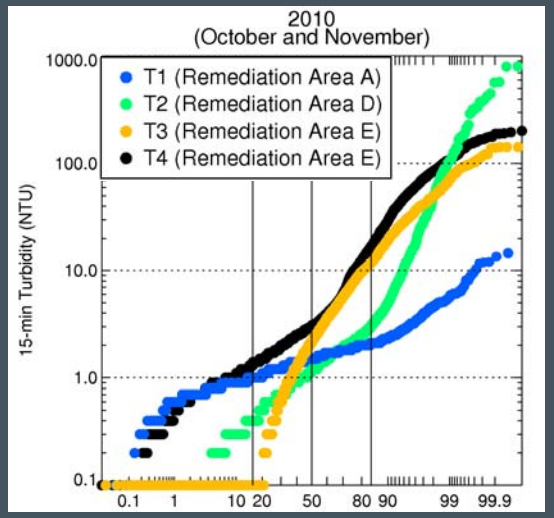
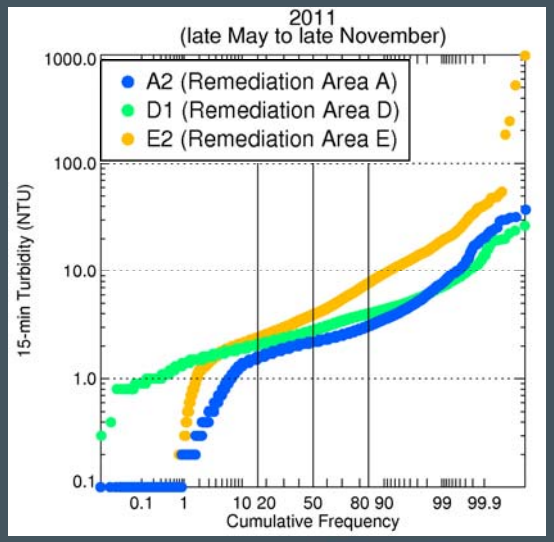
Baseline Monitoring Conclusions

- Water quality fluctuates in response to weather and hydrologic conditions
  - Wind waves, tributary inflows
- Magnitude of fluctuations depends on location
  - Locations closer to shore experienced greater variability
- Results used to develop construction monitoring program



Near-shore



Away from shore

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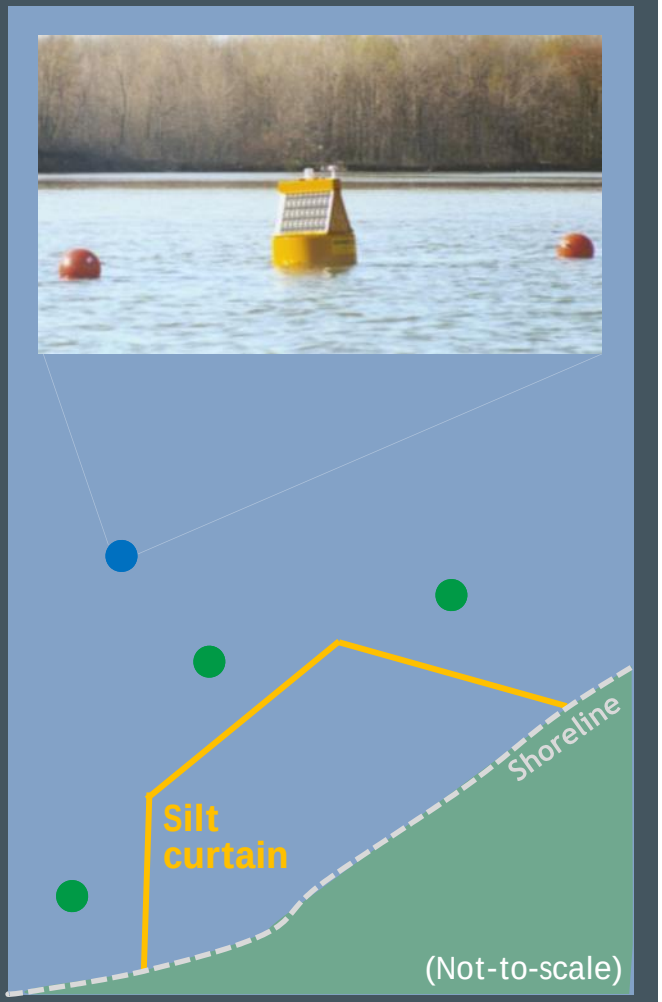
Water Quality Performance Standard

- Site-specific turbidity criteria
  - Informed by baseline monitoring and past dredging programs
- Tiered monitoring design and criteria enables early identification and mitigation of water quality issues

Level	Criterion (NTU)	Location
Alert	25	200 ft. from control structure
Action	50	500 ft. from control structure

Program Configuration

- Near-field and far-field stations
  - Near-field serves as early warning
  - Compliance evaluated at far-field
- Turbidity evaluated as 2-hour running average relative to real-time background conditions
  - Accounts for fluctuating ambient conditions and anomalous high values
- Concurrent activities may need separate monitoring operations
  - Stations may be shared between adjacent operations



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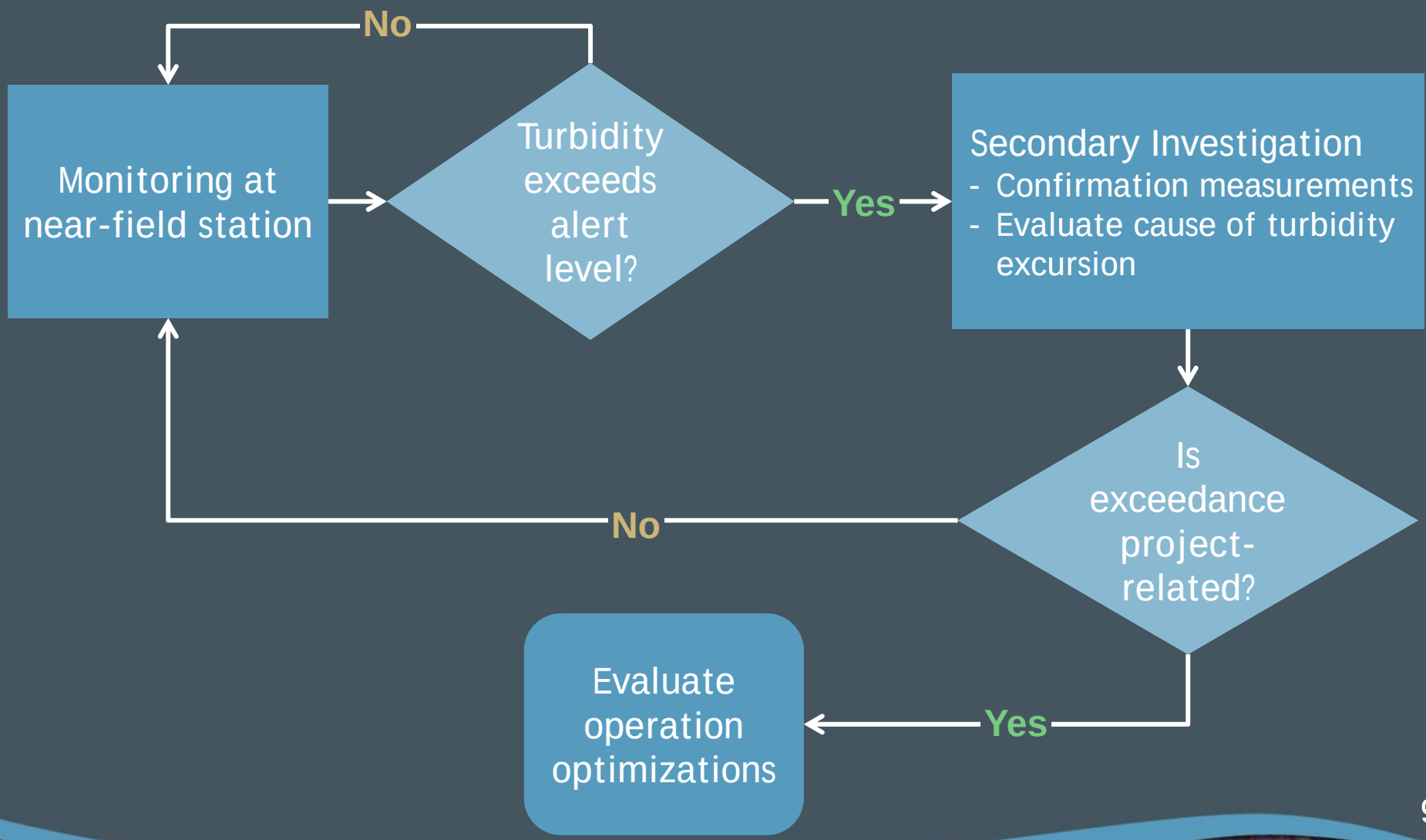
Response Actions



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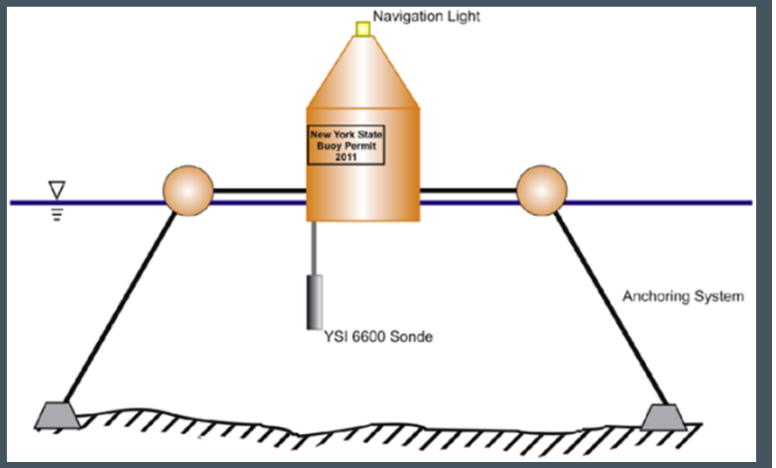
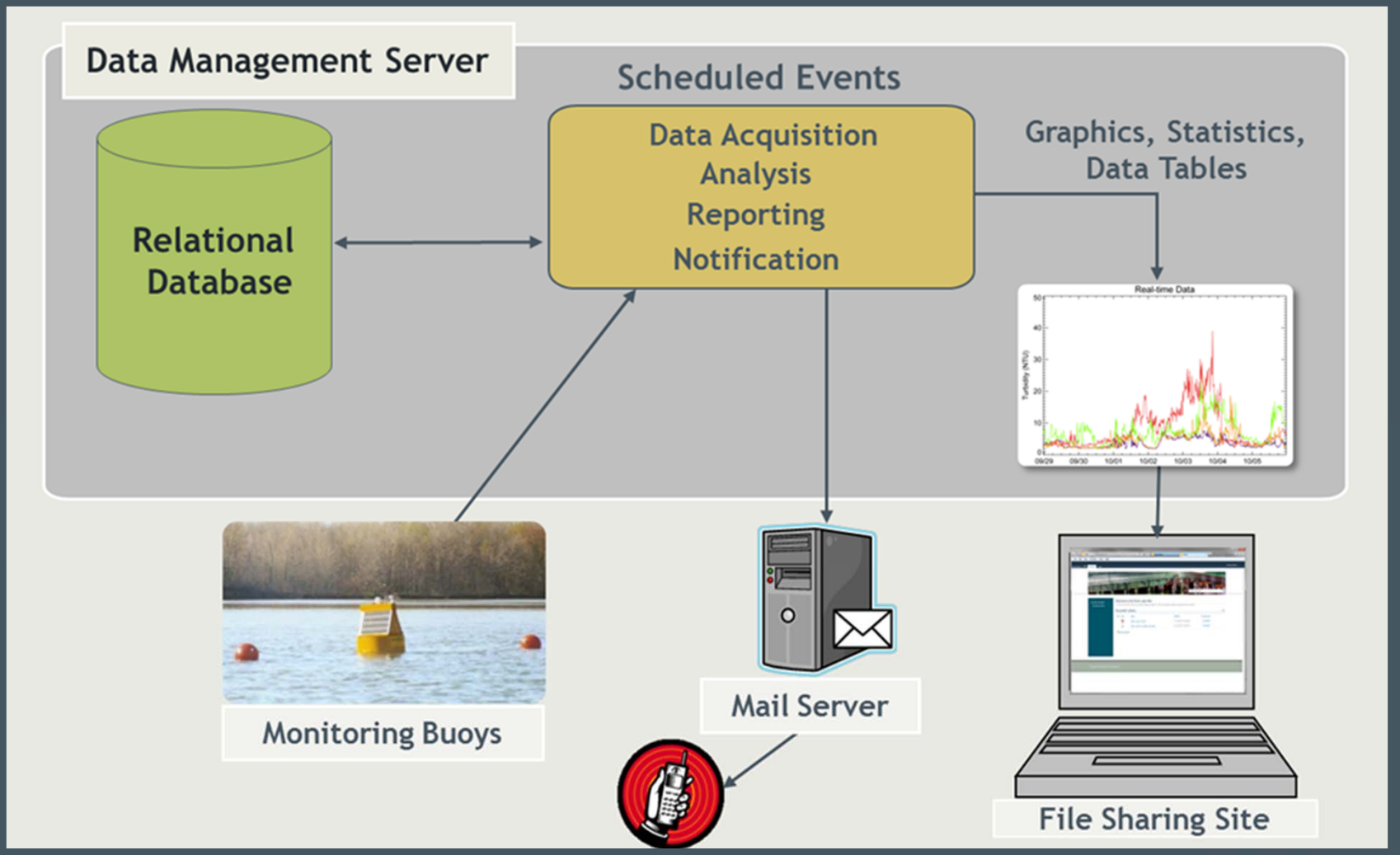
Program Implementation

- Monitoring buoys
  - Water quality meter with turbidity and other sensors
  - Data logger and cellular modem
  - Solar panels
- Required field support
  - Weekly buoy maintenance
  - Buoy relocation to follow operations and avoid interference



Automated Compliance System



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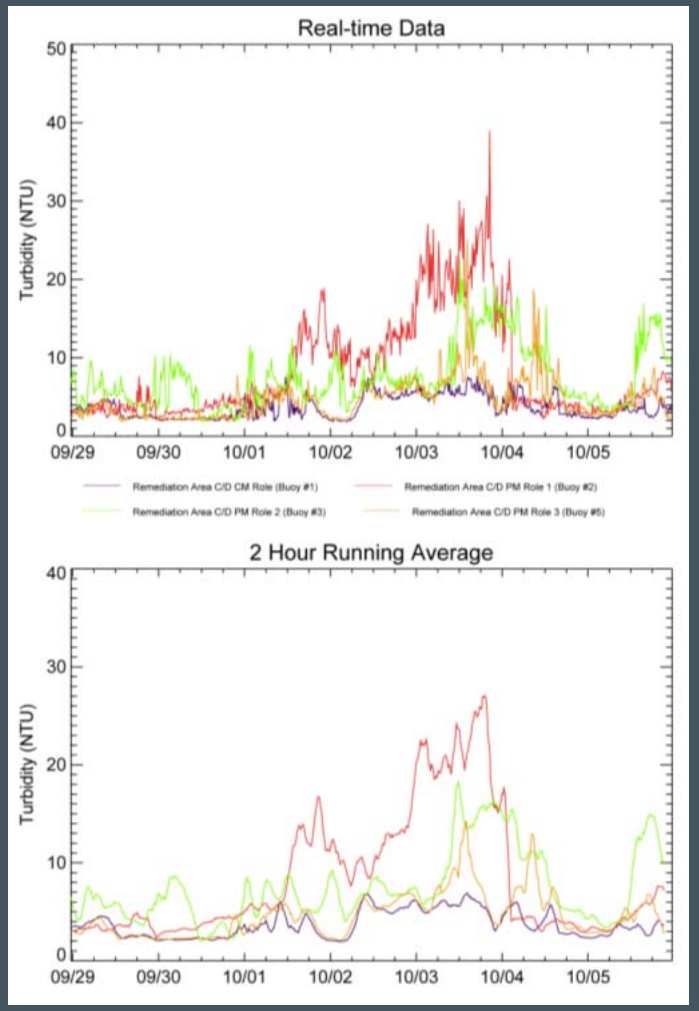
Real-time Compliance Calculations

- Computes running average for each data point
  - Avoids spurious notification due to data spikes
- Identifies current background condition for each operation
  - Uses lowest value from near-field stations
- Evaluates turbidity relative to background at each station
  - Email notification if criteria exceeded in near- or far-field



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Monitoring Role Management

- Relationships between buoys and construction activities change frequently
  - Stations repositioned to track construction
  - Buoys swapped out of service for maintenance
- Data significance determined by buoy role
  - Near-field vs. far-field monitoring roles
  - Roles change in time and amongst operations
- Monitoring role data stored in software system
  - Changes communicated from field to data system
  - Role history stored for post-hoc data interpretation

Summary

- Understand baseline conditions
  - Differentiate normal turbidity fluctuations from project-related impacts
- Provide an early warning system with tiered criteria
  - Avoid work stoppages through timely mitigation
- Automate data management and compliance analysis
  - Enable timely notifications and investigations
  - Minimize staff effort

- *To date, no construction-related water quality exceedance has occurred, demonstrating the effectiveness of proactive water quality management*

Questions?

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