



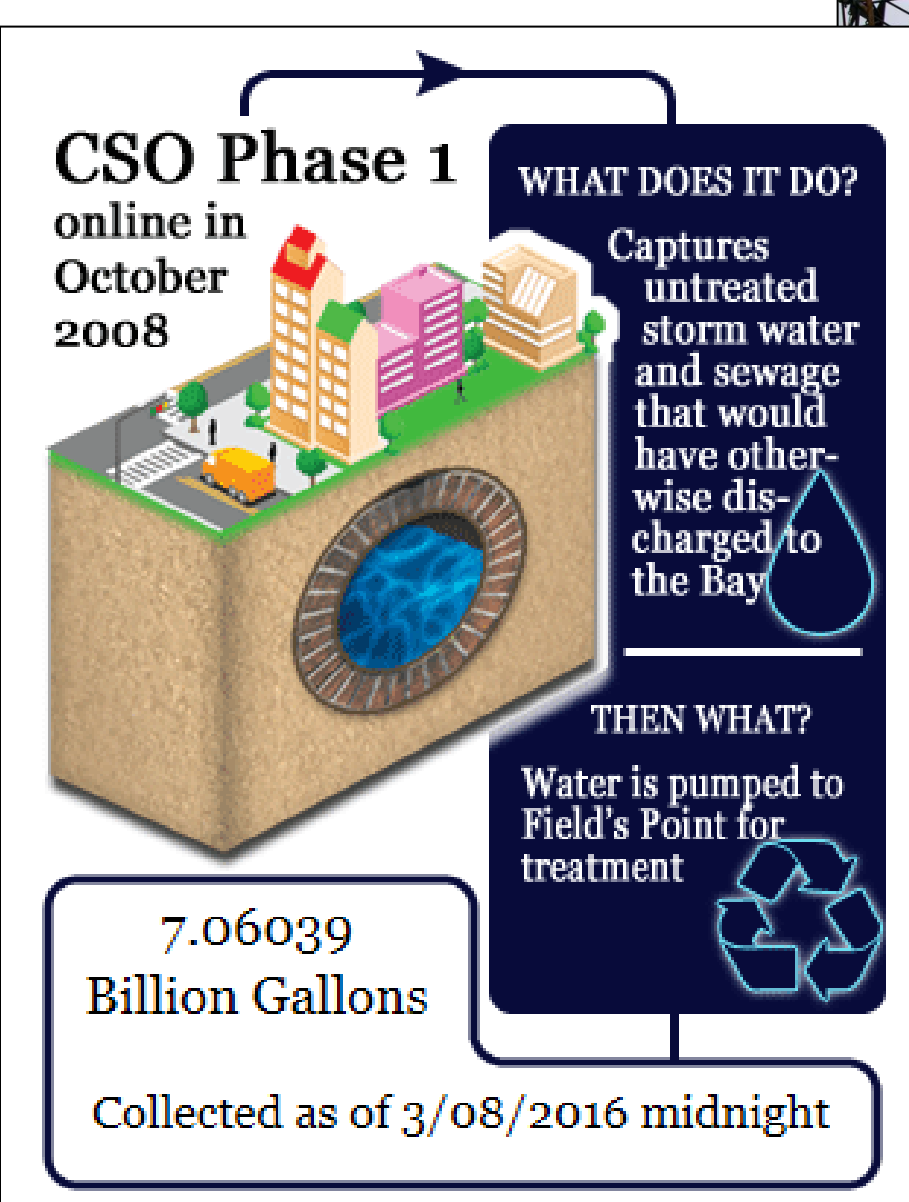
Measuring Water Quality Improvements in Narragansett Bay – What Can We Learn Through Benthic Video Monitoring?

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Narragansett Bay Commission

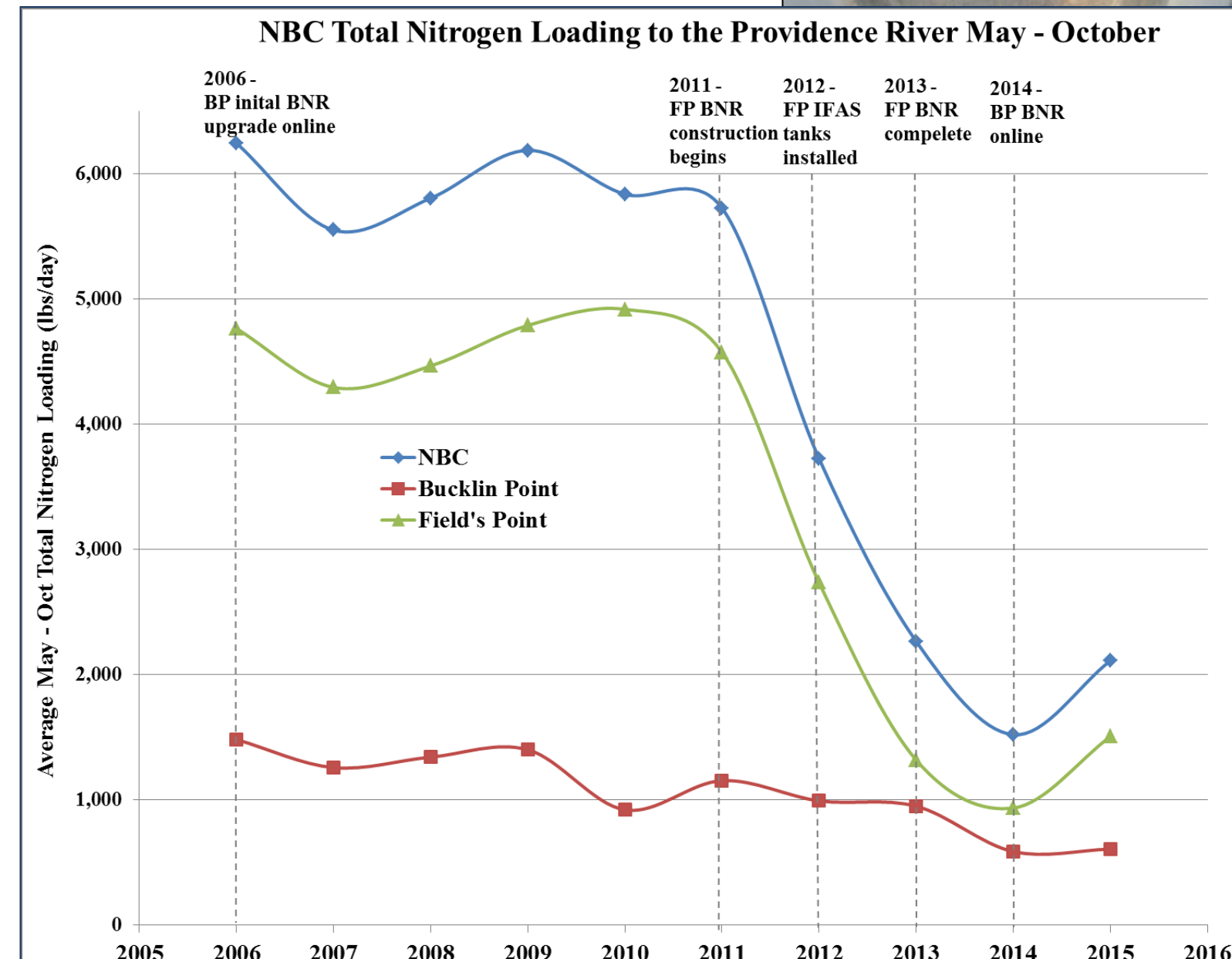
Narragansett Bay Commission: Owner and operator of the two largest wastewater treatment facilities in Rhode Island.
NBC Mission: To maintain a leadership role in the *protection and enhancement of water quality* in Narragansett Bay and its tributaries by providing safe and reliable wastewater collection and treatment services to its customers at a reasonable cost.

Major Initiatives to Reduce Point-Source Pollution from WWTFs in the Last 10 Years:

CSO Abatement – Reducing discharge of untreated combined sewage and bacteria by 50%



Biological Nutrient Removal – Treatment modifications to drastically reduce nitrogen concentrations in wastewater effluent

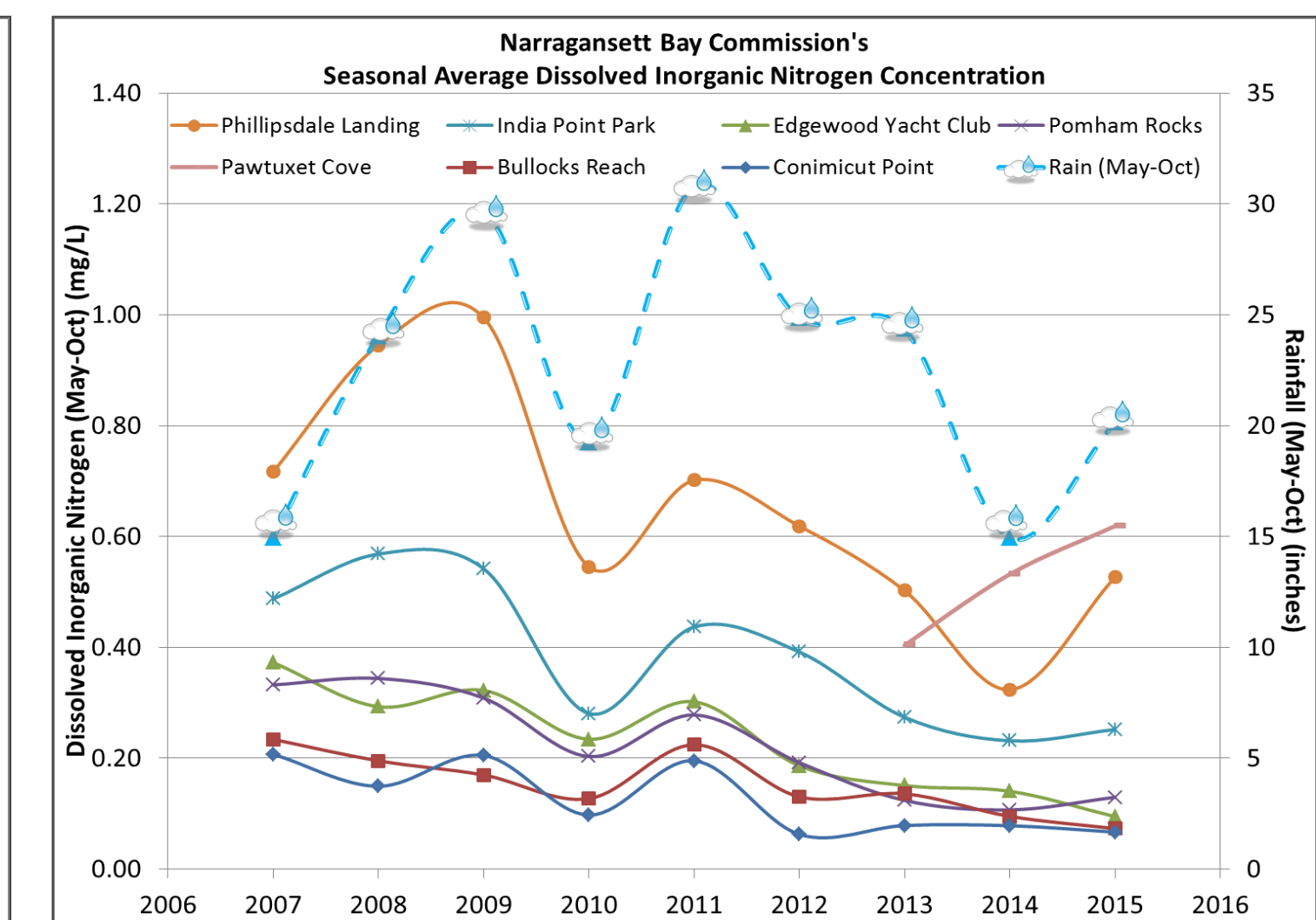
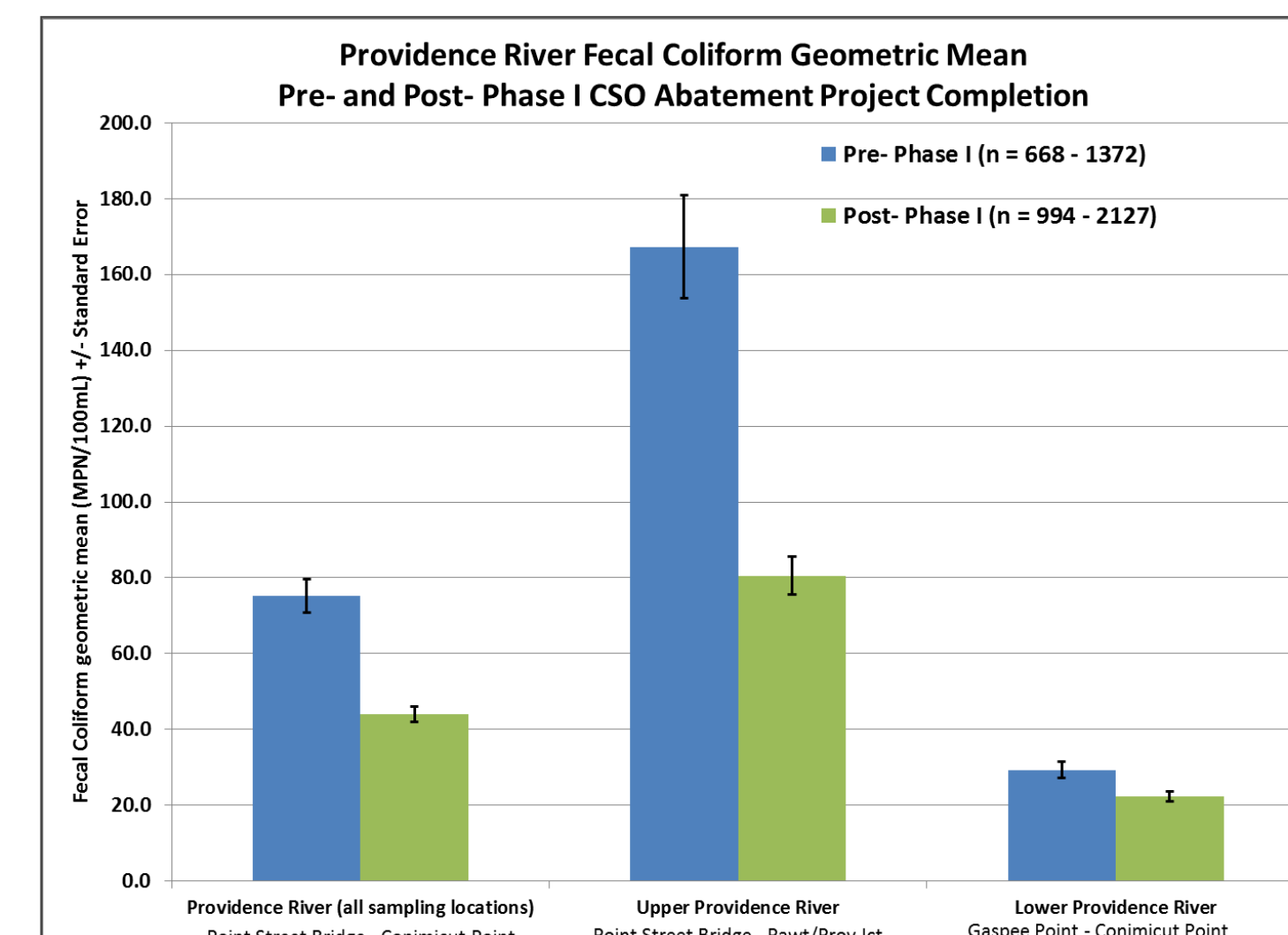


How Do We Monitor The Effect on Water Quality in Narragansett Bay?

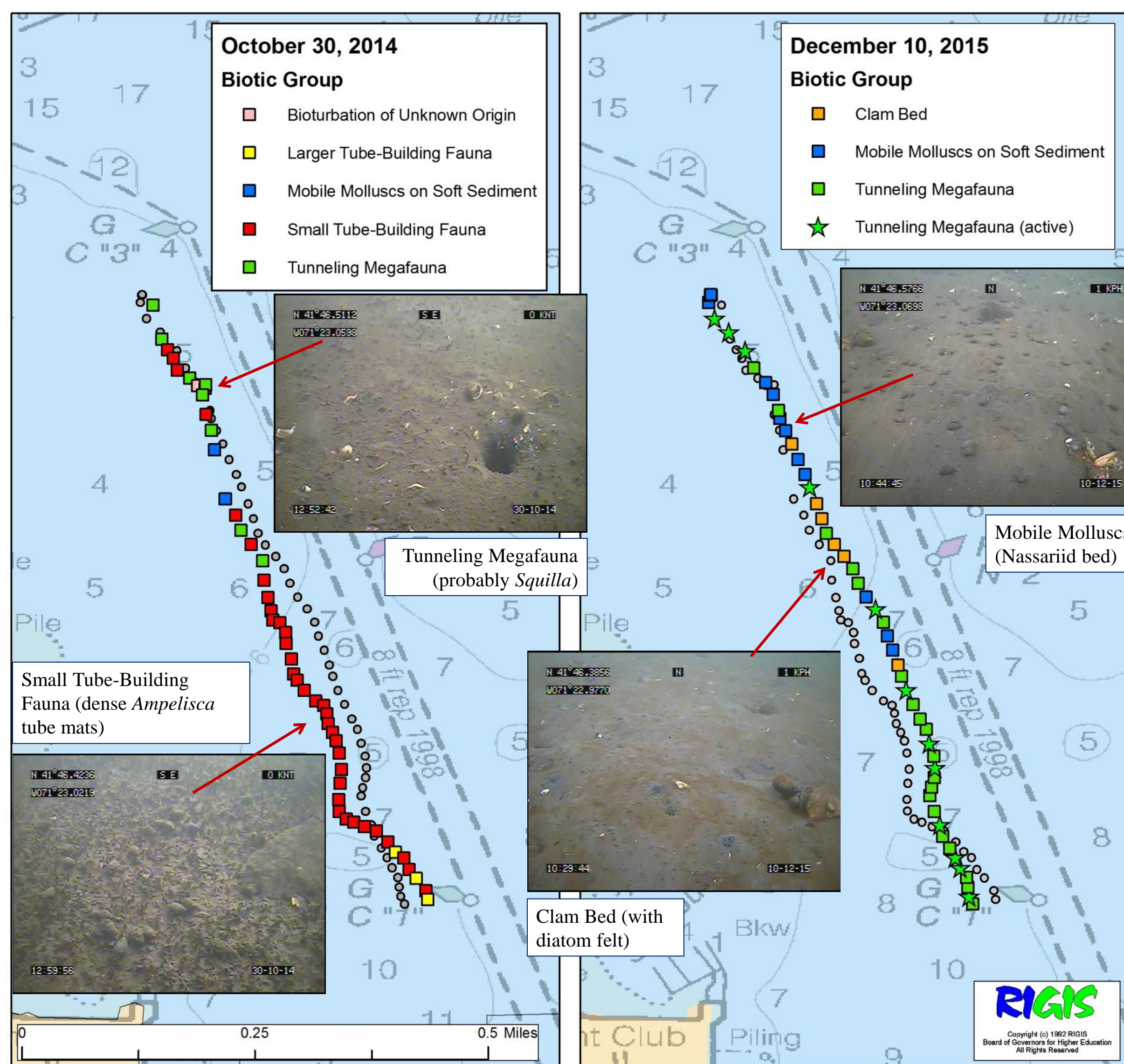
Water Quality Monitoring Programs - Measure water quality and ecological changes in receiving waters

- River and Bay Nutrients
- Water Clarity
- Water Quality Buoys
- Surface Chlorophyll Mapping
- River and Bay Bacteria
- Water Column Profiles
- Phytoplankton Identification and Abundance

<http://snapshot.narrabay.com>



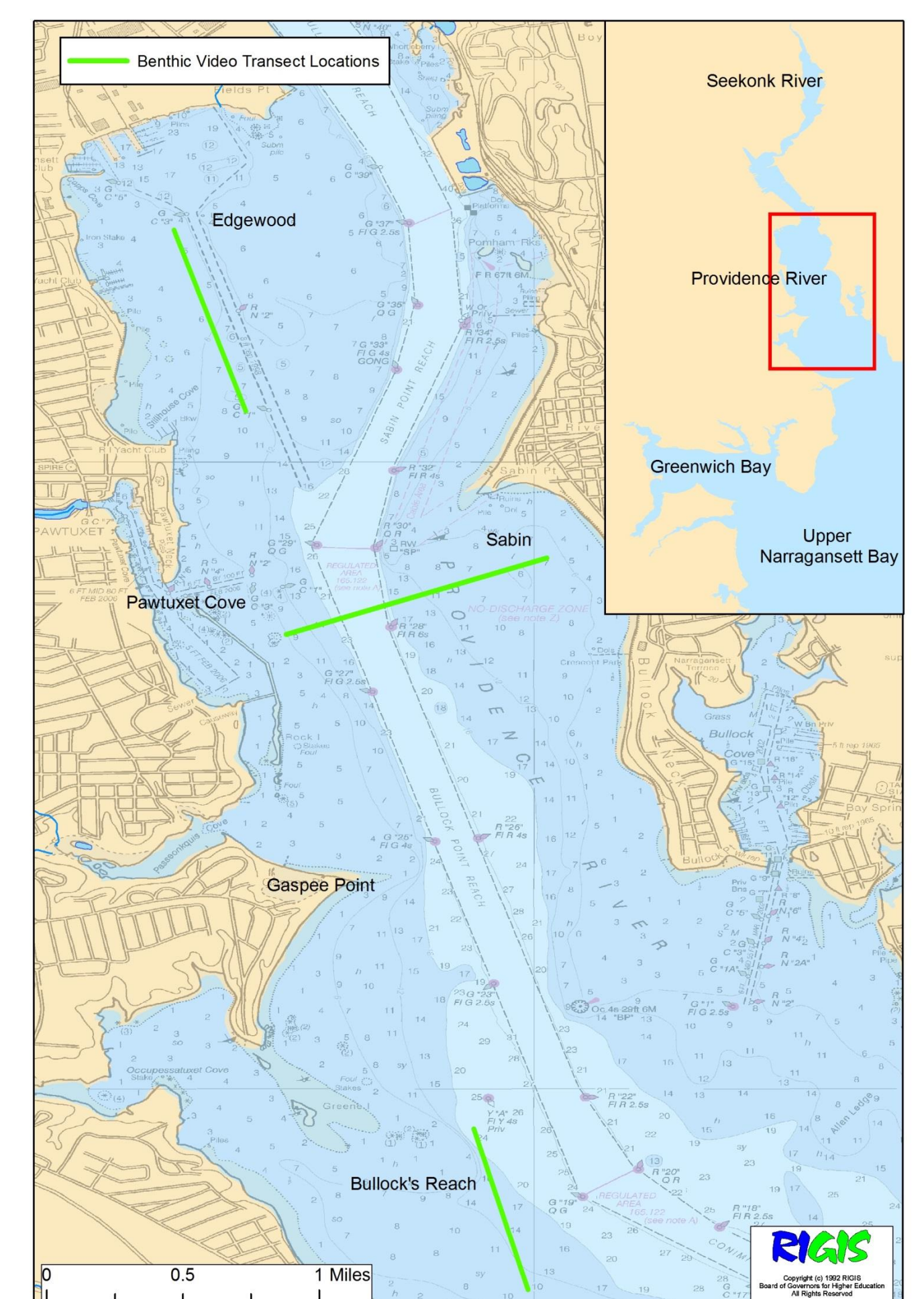
Benthic Video Surveys – NBC's Newest Monitoring Initiative



- Goal:** Monitor for change in benthic community structure over time and in response to WWTF/stormwater improvements.
- Monthly surveys target three regions in the estuarine Providence River – all ~1.5 – 3 m depth.
- Characterize substrate and biological community using **Coastal and Marine Ecological Classification Standard (CMECS)²** – data comparable to others studying the region at differing scales and with differing methods.

A Closer Look at Edgewood Shoal

- Extensive cover of *Ampelisca* sp. tube mats in 2014 suggestive of **transitional** period from poor water quality to better, though excess organic material remaining.
- Observed in Boston Harbor following MWRA outfall extension – initially abundant, then decline¹.
- By early winter 2015, tube mats appear to be declining.

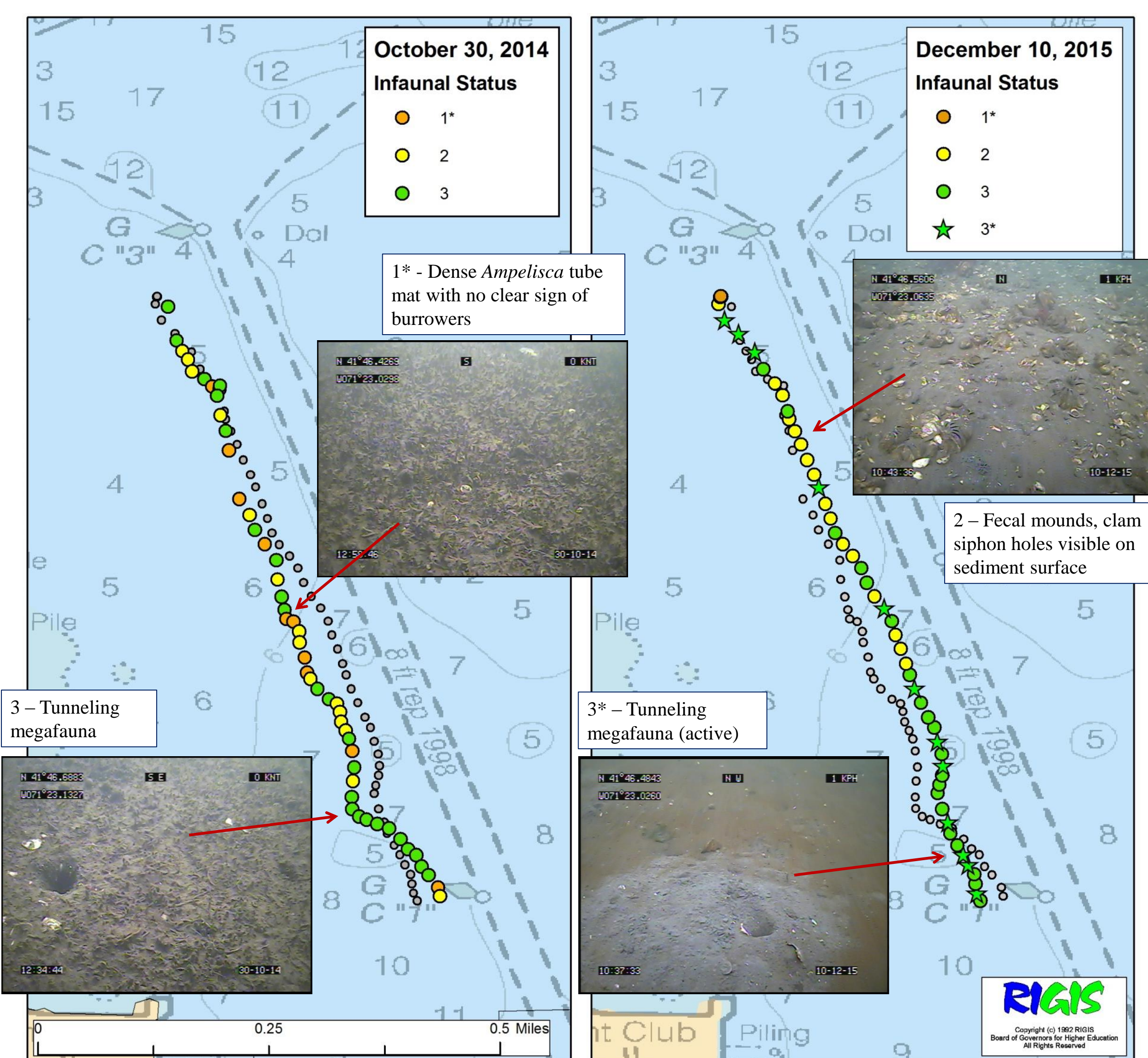
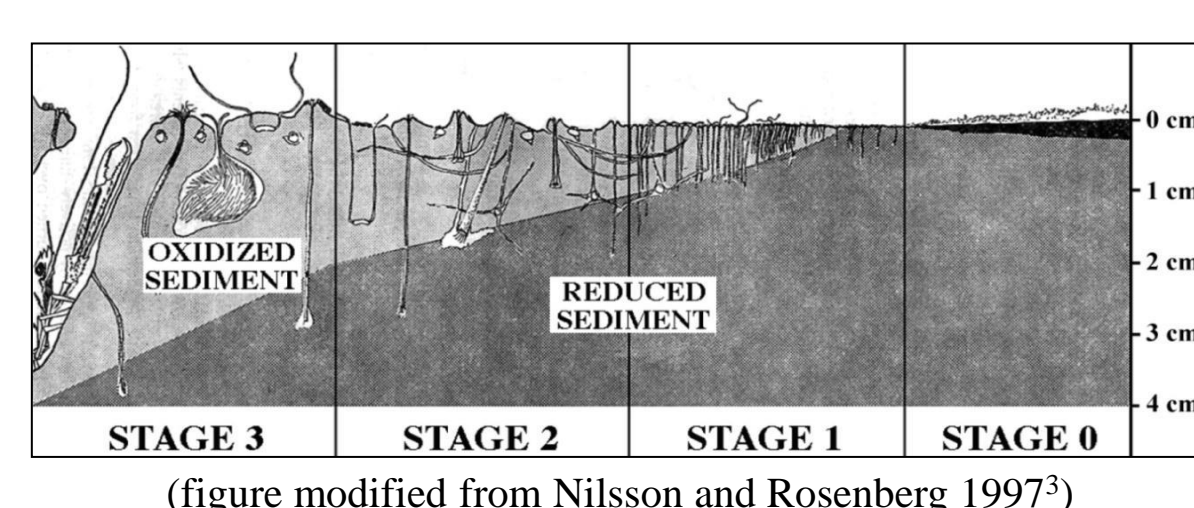


Future Directions

- Monitor observable change to the benthos in response to reductions in eutrophication and hypoxia.
- Inform and support others studying Narragansett Bay water quality – potential for collaboration with USEPA, numerous universities.
- Demonstrate effectiveness of expensive facility upgrades to ratepayers and stakeholders.
- Monthly spot surveys vs. quarterly surveys with greater areal coverage?
- Program still evolving, takes years to observe community change.

Infaunal Stage

- The CMECS Infaunal Stage biotic modifier can be used as a loose proxy for successional stage using the general size or evidence of size of organisms utilizing benthic habitat.
- Late fall 2014 – numerous large tunnel openings observed – unclear if active.
- Early winter 2015 Edgewood characterized by numerous active mantis shrimp burrows
- Majority of survey area estimated Stage 2-3 – Improving?



Acknowledgements: Thank you to the NBC EMDA Monitors who collect video survey footage and all monitoring data for us to analyze. Thank you to Pam Reitsma, Jim Kelly, John Motta, Terri Breeden, and Tom Uva for poster and content review and NBC Construction Department for printing assistance.

References: ¹Diaz, R.J. et al. 2008. Long-term trends of benthic habitats related to reduction in wastewater discharge to Boston Harbor. *Estuaries and Coasts* 31:1184-1197; ²Federal Geographic Data Committee. 2012. Coastal and Marine Ecological Classification Standard. FGDC-STD-018-2012.; ³Nilsson, H.C. and R. Rosenberg. 1997. Benthic habitat quality assessment of an oxygen stressed fjord by surface and sediment profile images. *Journal of Marine Systems*. 11:249-264. **Contact:** emoore@narrabay.com