

Receiving Waters Monitoring Following WWTF Upgrades to Reduce Nitrogen Loading

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NEERS – October 21, 2016 – Block Island



Narragansett Bay Commission

- Owner and operator of two major WWTFs in the state of Rhode Island.

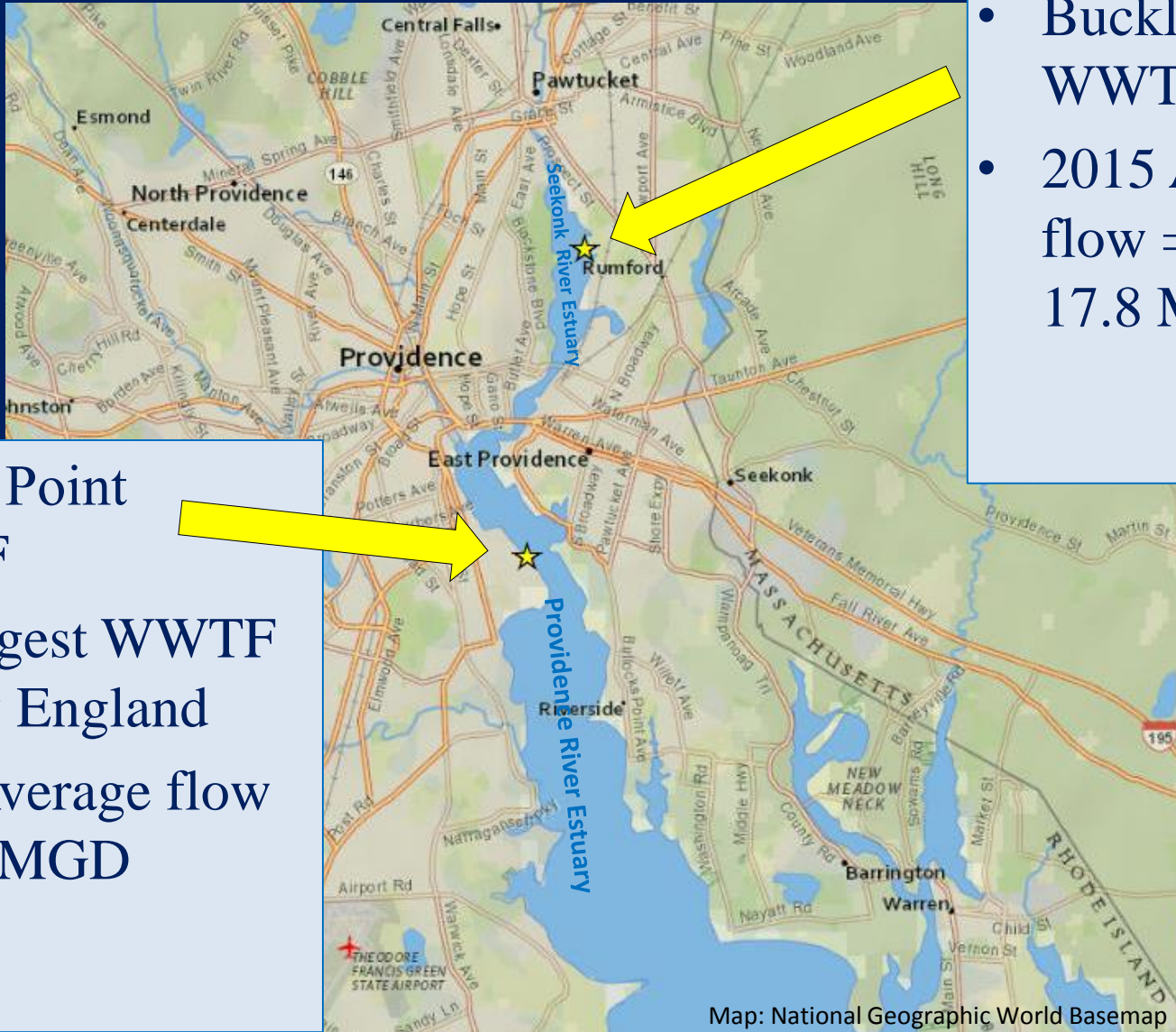


Narragansett Bay Commission

- Owner and operator of two major WWTFs in the state of Rhode Island.
- Serve 360,000+ residents and 8,000+ businesses in ten RI communities.



Narragansett Bay Commission



- Bucklin Point WWTF
- 2015 Average flow = 17.8 MGD

- Field's Point WWTF
- 2nd largest WWTF in New England
- 2015 Average flow = 38.6 MGD

Hypoxia in Narragansett Bay

- Seasonal - summer
- Northern areas, embayments
- Stratification, circulation patterns
- Intermittent – hours to days
- Freshwater flows, rainfall
- Historical eutrophication (N)
- Fish kill in Greenwich Bay 2003 accelerated plans by RIDEM to initiate N reductions at WWTFs



N Reductions at WWTFs

- RIDEM Goal: Cut loads to the bay by 50%
- Stringent NPDES permit limits set throughout watershed

5 mg/L	8 mg/L
NBC – Field’s Point	Cranston
NBC – Bucklin Point	West Warwick
East Greenwich	Warwick
Warren	Smithfield (10 mg/L)
East Providence (5.9 mg/L)	Northbridge (max. extent)
Woonsocket (3 mg/L)	Burrillville (max. extent)
UBWPAD	North Attleborough
	Attleboro
	Grafton
	Uxbridge

Not all facilities currently meeting these limits - Construction ongoing

Biological Nutrient Removal (BNR)

- Optimize conditions for nitrification and denitrification
- NBC Permit limit (5 mg/L) in effect May – October

Total NBC Upgrade Cost: \$44 Million

Field's Point

- Integrated Fixed Film Activated Sludge (IFAS) –
Largest in the world achieving 5 mg/L!
- 5 mg/L Permit limits in effect
May 2014

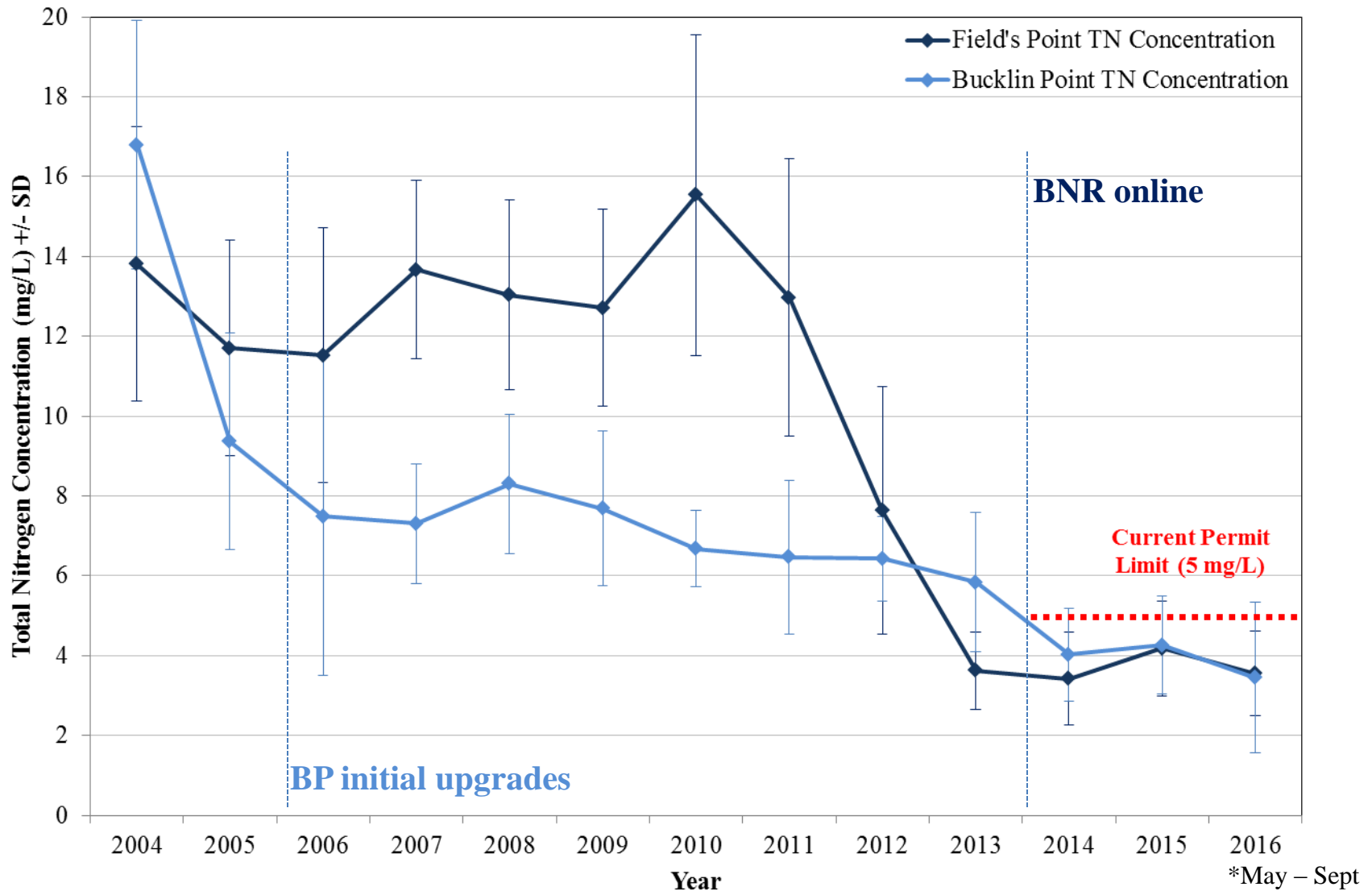


Bucklin Point

- Initial upgrades completed in 2006
- 5 mg/L limit in effect July 2014

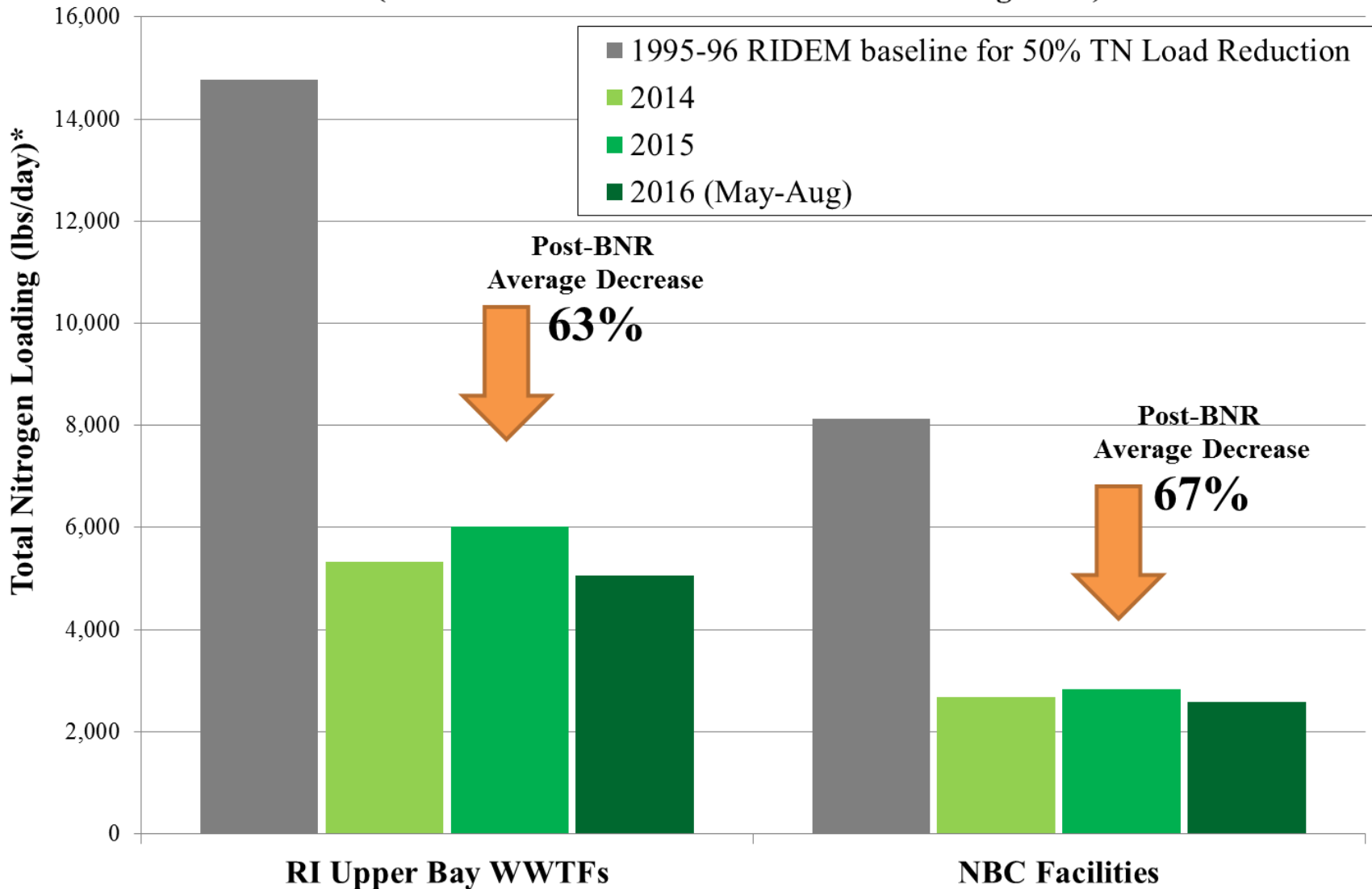


Field's Point and Bucklin Point Seasonal (May - Oct) Average Effluent Total Nitrogen



Nitrogen Reductions Realized

Seasonal (May - October) Total Nitrogen Loading
(*based on maximum concentration & average flow)



*Loading calculations based upon monthly TN maximum concentration and monthly average flow

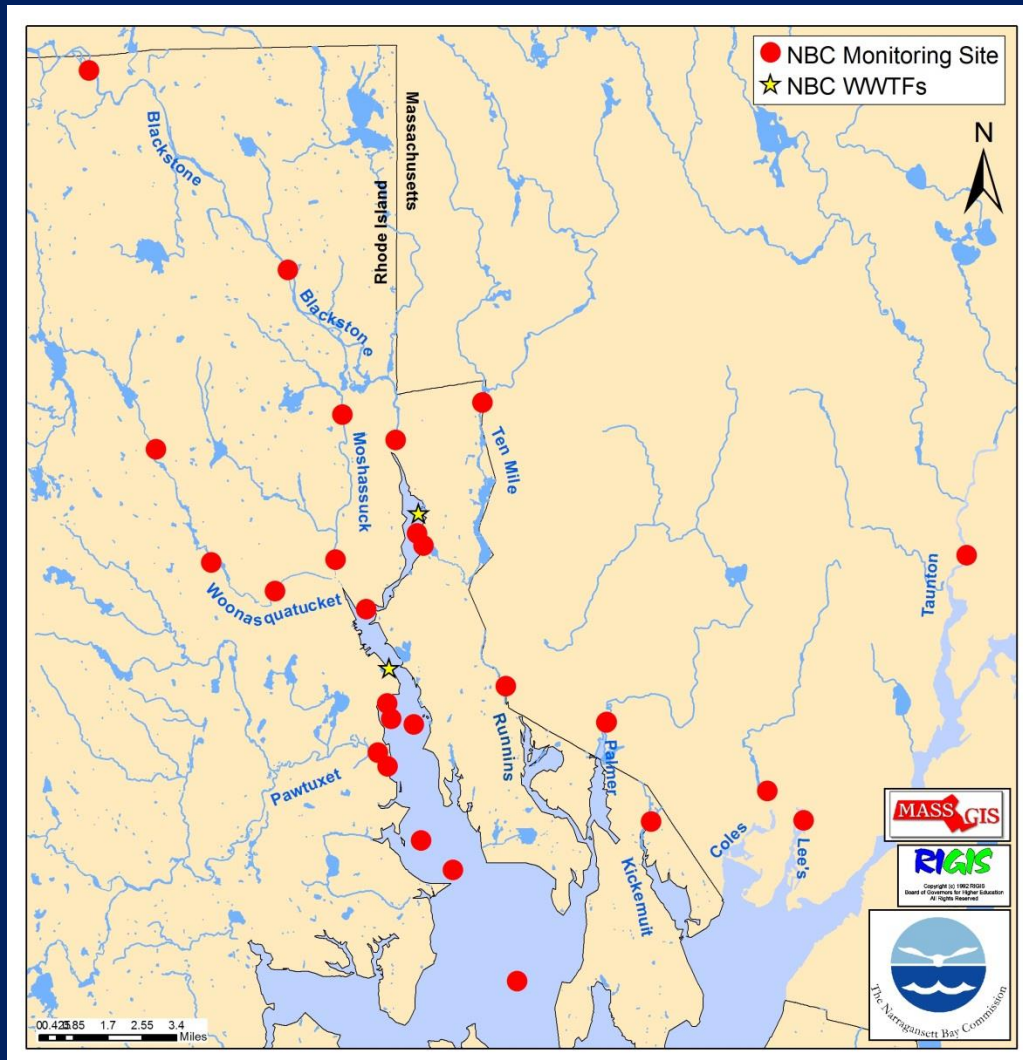
NBC Nutrient Monitoring

- **Why:**
 - To support decision making for future infrastructure investments.
 - To support partner organizations conducting large-scale nutrient budgets and modeling efforts.
- **What:**
 - Dissolved inorganic nitrogen (DIN) = nitrite, nitrate, ammonia
 - Total dissolved nitrogen, total nitrogen, and orthophosphate
- **When:**
 - Every two weeks (weather permitting)



Data available online: <http://snapshot.narrabay.com>

NBC Nutrient Monitoring



- **Where:**

- River monitoring:

- 15 sites in RI and MA;
- 11 Rivers
- Loading calculated using USGS flow data

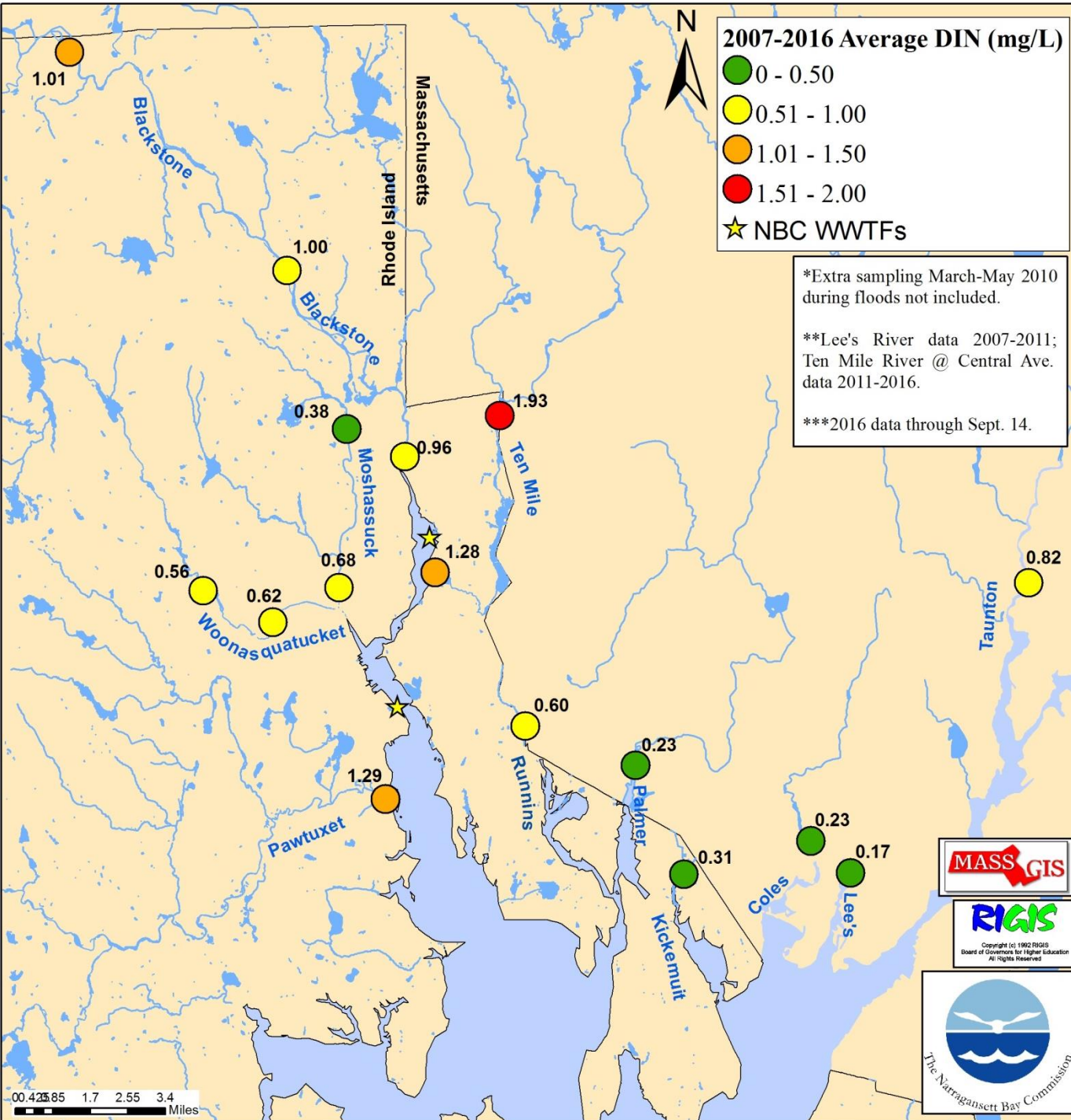
- Bay Monitoring:

- 7 sites in the Seekonk and Providence River estuaries

Data available online: <http://snapshot.narrabay.com>

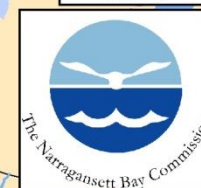
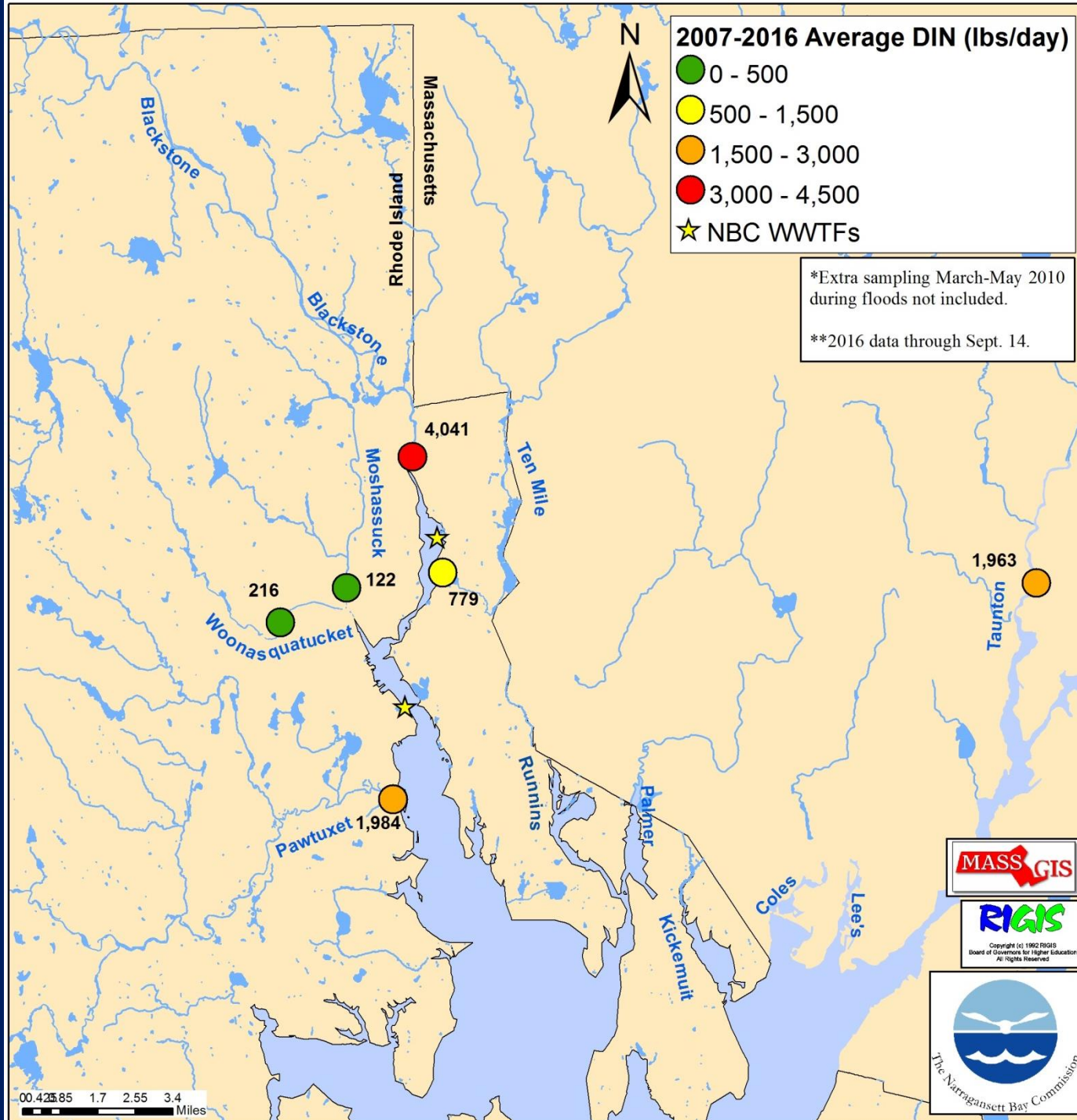
River DIN 2007 to Present

- Relatively high concentrations at Ten Mile River and Pawtuxet River.
- Moderately high at Blackstone River



DIN Loading

- Highest loads – Blackstone River
- Taunton River and Pawtuxet Rivers also substantial



DIN Concentrations in the Bay

- Compared to National Coastal Condition Assessment Guidelines

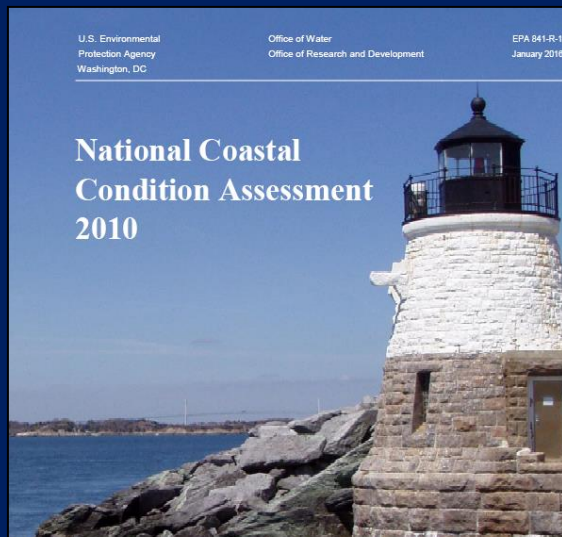
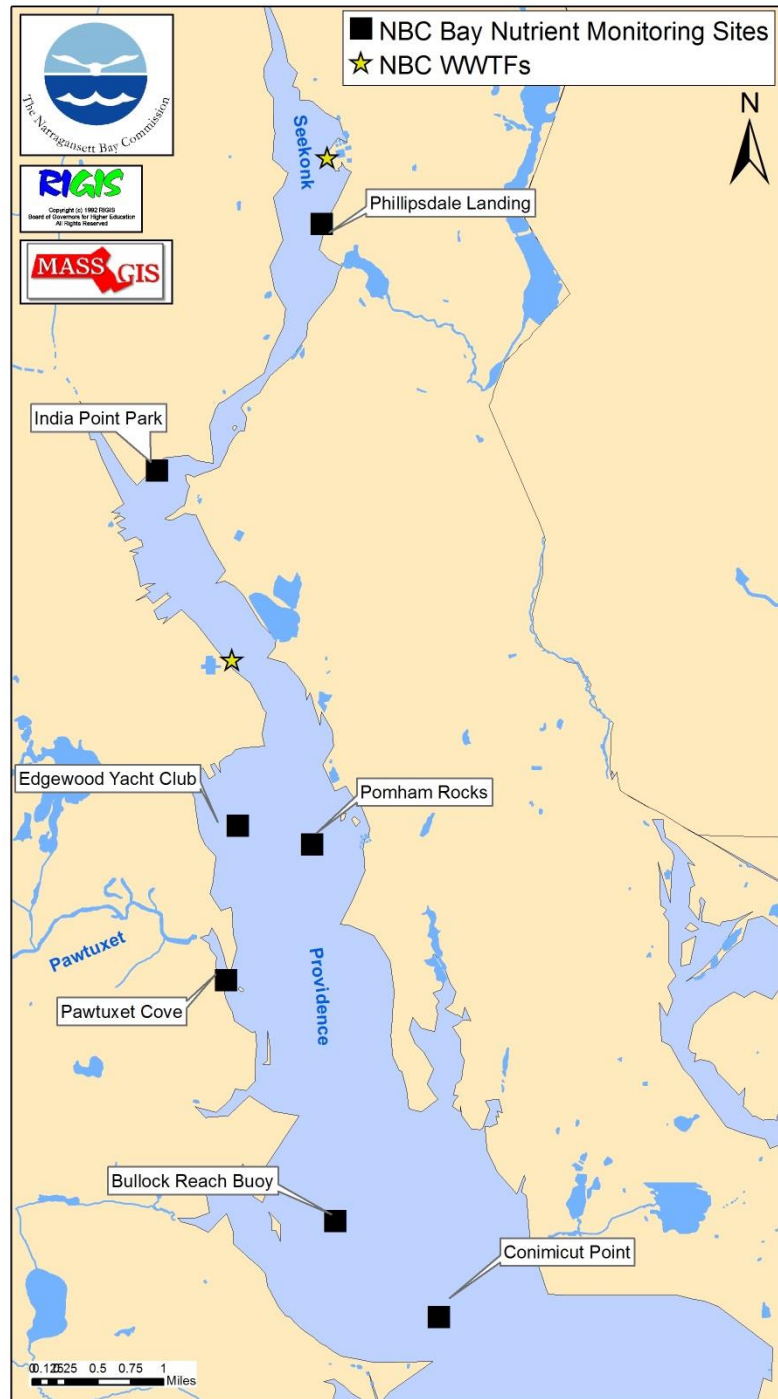


Table 2-5. NCCA guidelines for evaluating the five component indicators used in the water quality index to assess estuarine coastal condition.

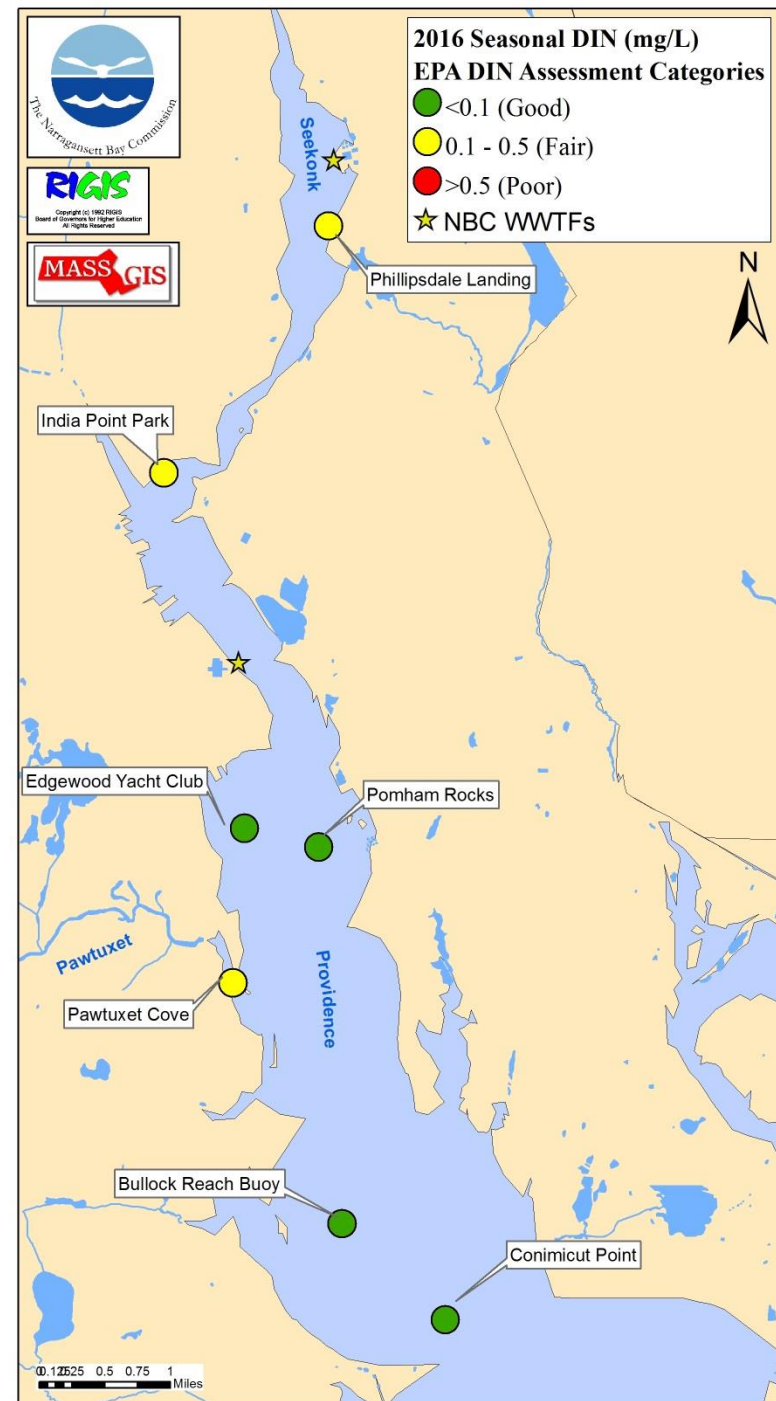
	Estuarine Water Quality Thresholds			
	Region	Good	Fair	Poor
Surface Concentrations of Dissolved Inorganic Nitrogen (DIN): Estuaries	Northeast Southeast Gulf	< 0.1 mg/L	0.1 – 0.5 mg/L	> 0.5 mg/L
	West	< 0.35 mg/L	0.35 – 0.5 mg/L	> 0.5 mg/L
	Tropical ^a	< 0.05 mg/L	0.05 – 0.1 mg/L	> 0.1 mg/L



2016 Surface DIN

May – September 14, 2016
 Rainfall Total: 11.64 inches

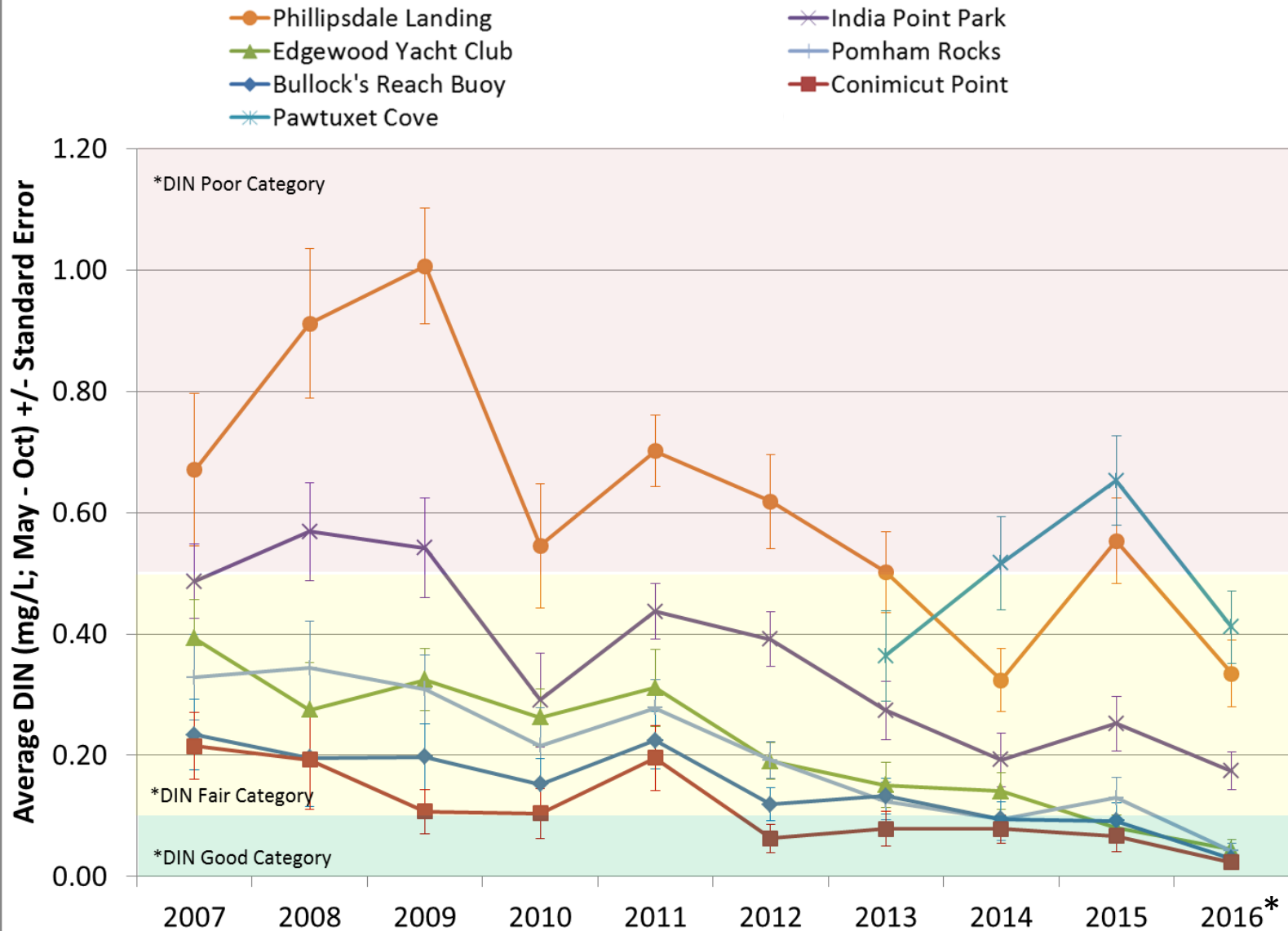
Station	DIN (mg/L)	EPA CCR Category
Phillipsdale Landing	0.33	Fair
India Point Park	0.17	Fair
Edgewood Yacht Club	0.04	Good
Pomham Rocks	0.04	Good
Pawtuxet Cove	0.41	Fair
Bullock's Reach	0.03	Good
Conimicut Point	0.02	Good



Surface DIN

*2016 DIN May-Sept 14

Seasonal Average Dissolved Inorganic Nitrogen Concentration

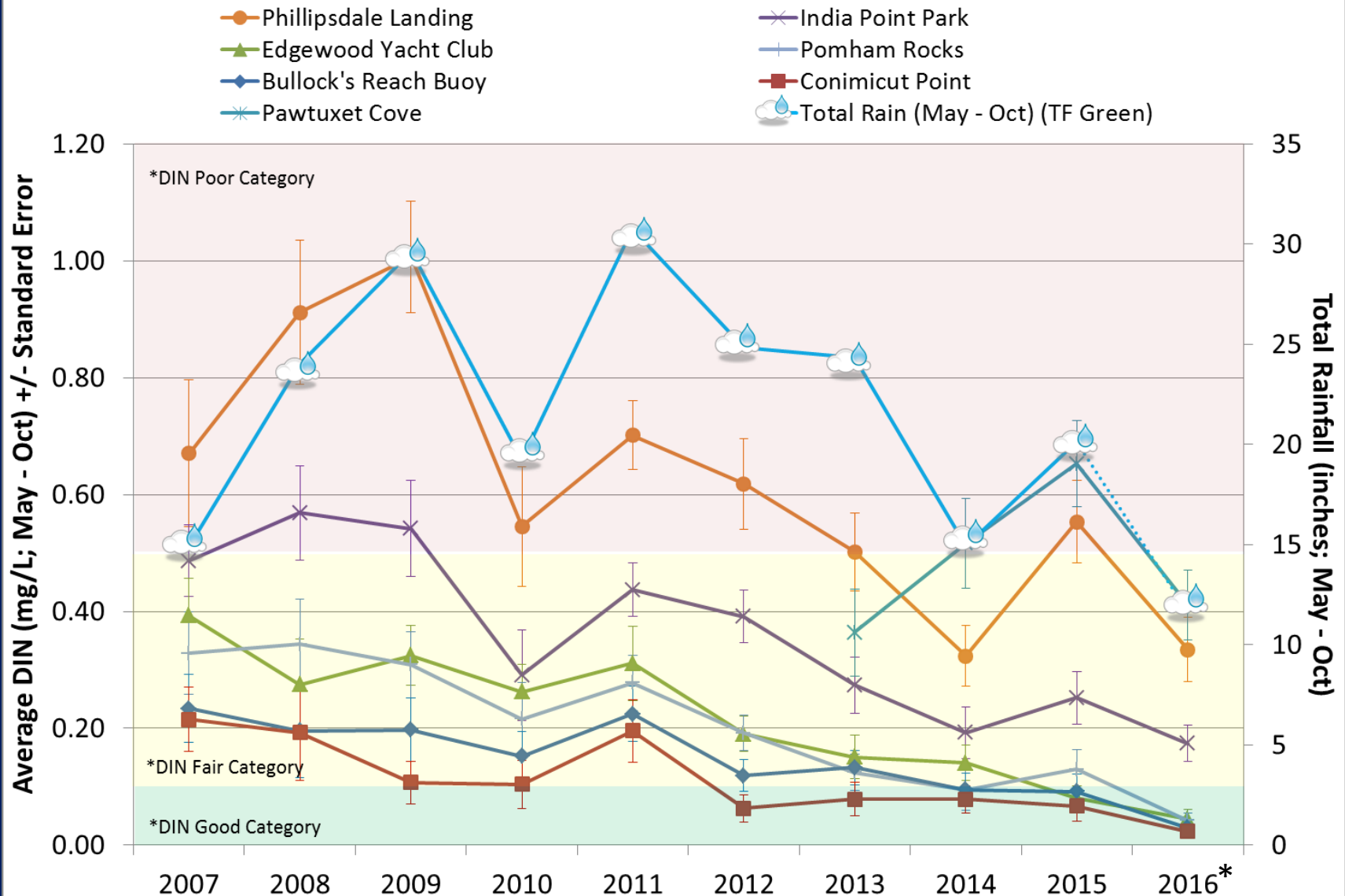


*Categories from National Coastal Condition Report

Surface DIN

*2016 DIN May-Sept 14
 *2016 Rain total May -Sept 14

Seasonal Average Dissolved Inorganic Nitrogen Concentration



*Categories from National Coastal Condition Report

Looking Ahead...

- WWTF upgrades have substantially reduced point-source nitrogen loadings –
 - Impacts on hypoxia unclear, confounded by dry summers
- Further reductions by WWTFs may have diminishing returns
 - Increasing financial and environmental cost
- Future approaches to reducing nitrogen impacts
 - Address non-point sources through fertilizer/stormwater controls
 - Restoration of shellfish (oyster reefs) to increase resilience



Acknowledgements

- C. Comeau (co-author)
- P. Reitsma, T. Breeden,
K. Cortes
- NBC Environmental
Monitoring and Data
Analysis team
- NBC Laboratory
- Policy, Planning, &
Regulation staff

