



Louis Berger

Numerical Modeling Simulation of the Impact of Source Controls on Site Recovery in Dead-End Tidal Waterbodies

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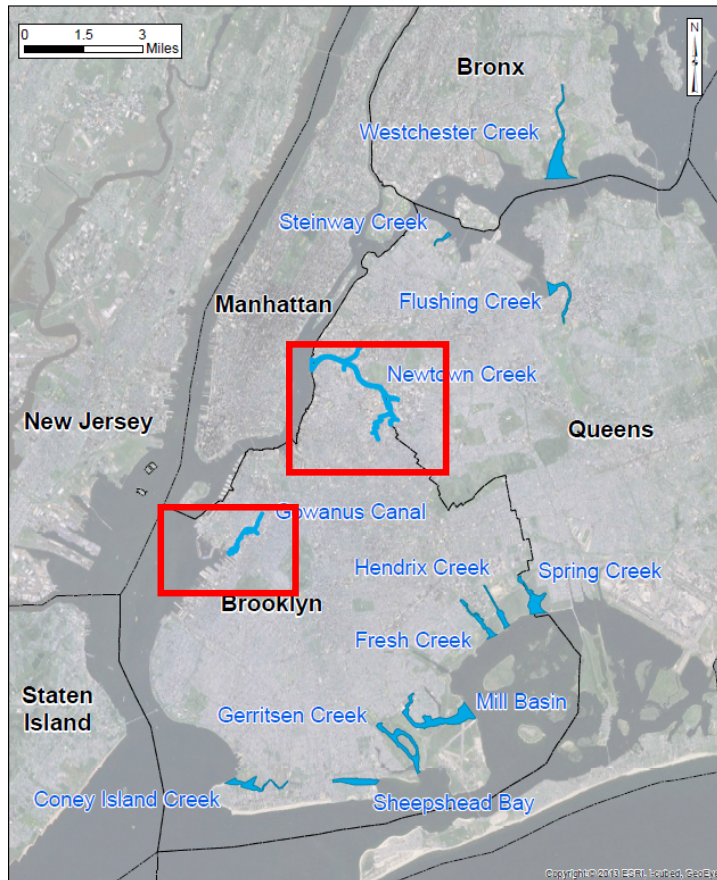
Ron Weissbard and Dabeiba Marulanda | New York City Department of Environmental Protection / New York, NY

Outline

- Site description and sediment contamination problem
- Assessment of impact of municipal point sources
- Other significant sources to the creek
- Contaminant concentrations in seeps, NAPL, Ebullition, Groundwater (GW)
- Conceptual model
- Model development and verification
- Results
- Summary of future work
- Conclusions



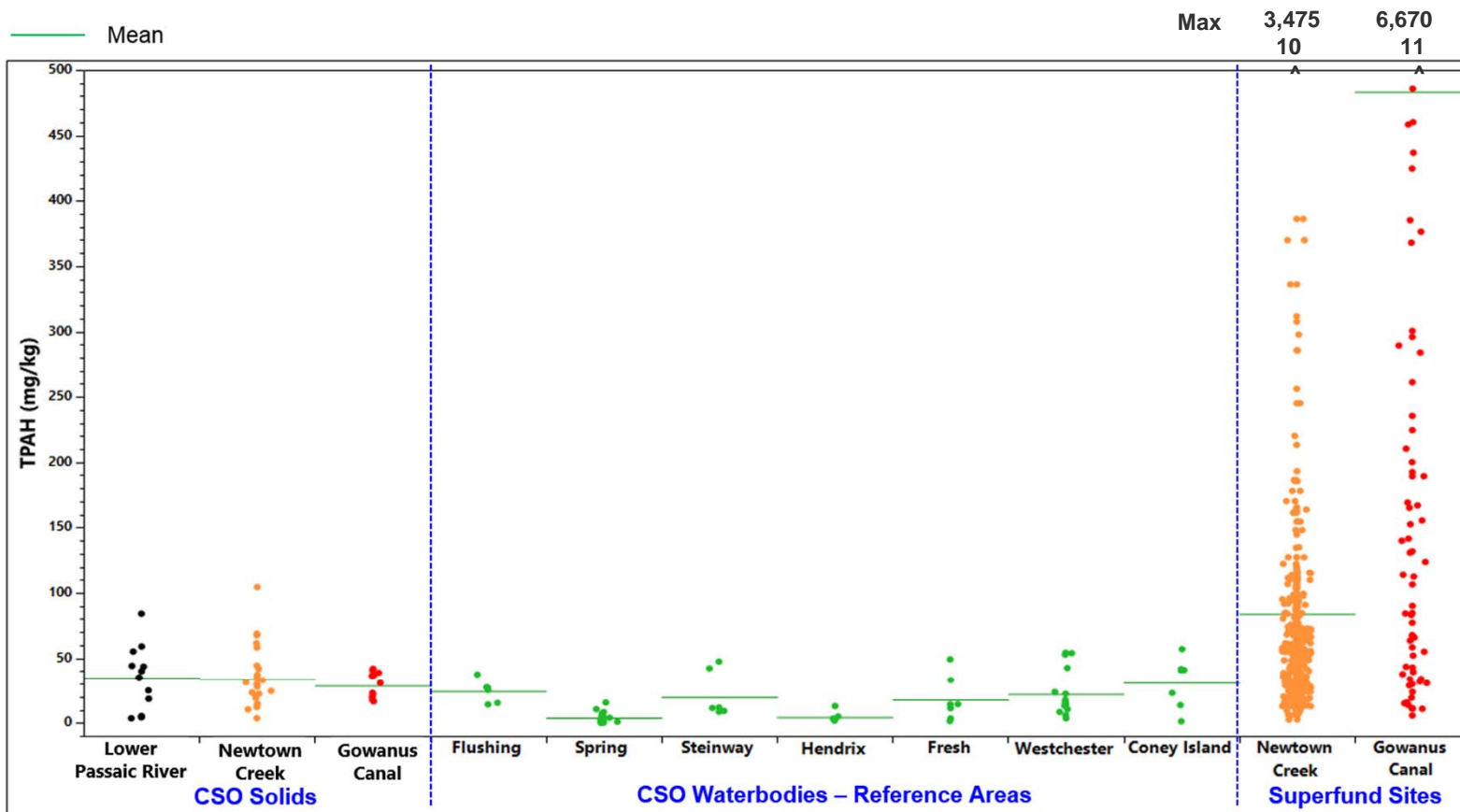
Site Description



- **Newtown Creek and Gowanus Canal were listed on EPA NPL in 2010**
- **Historical and current land use is largely industrial along the banks of these two sites**
 - Six MGP sites
 - Over 50 refineries
 - Copper smelter
 - LNG operations, oil storage and transfer facilities
 - Transportation, waste transfer, scrap yard, concrete supply
- **Freshwater flow to these waterbodies includes:**
 - CSOs and stormwater during wet weather
 - Groundwater
 - Treated discharges from upland facilities
- **The other dead end waterbodies are similar to these two waterbodies**
 - Tidally influenced waterbodies
 - Freshwater inflows



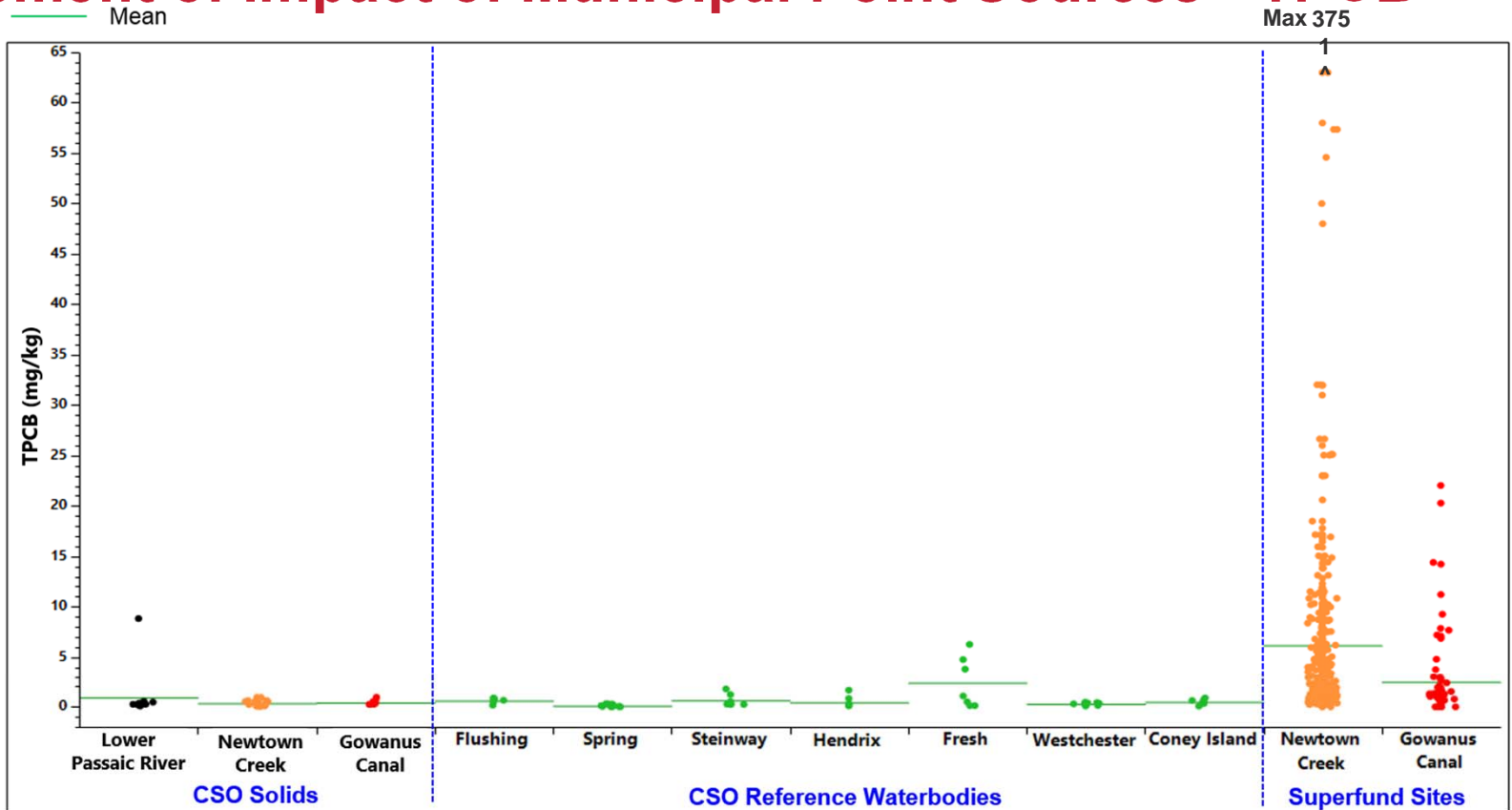
Assessment of Impact of Municipal Point Sources - TPAH



**TPAH levels in CSO waterbodies are similar to CSO solid concentrations.
CSO contributions cannot be causing elevated concentrations at
Newtown and Gowanus.**



Assessment of Impact of Municipal Point Sources - TPCB

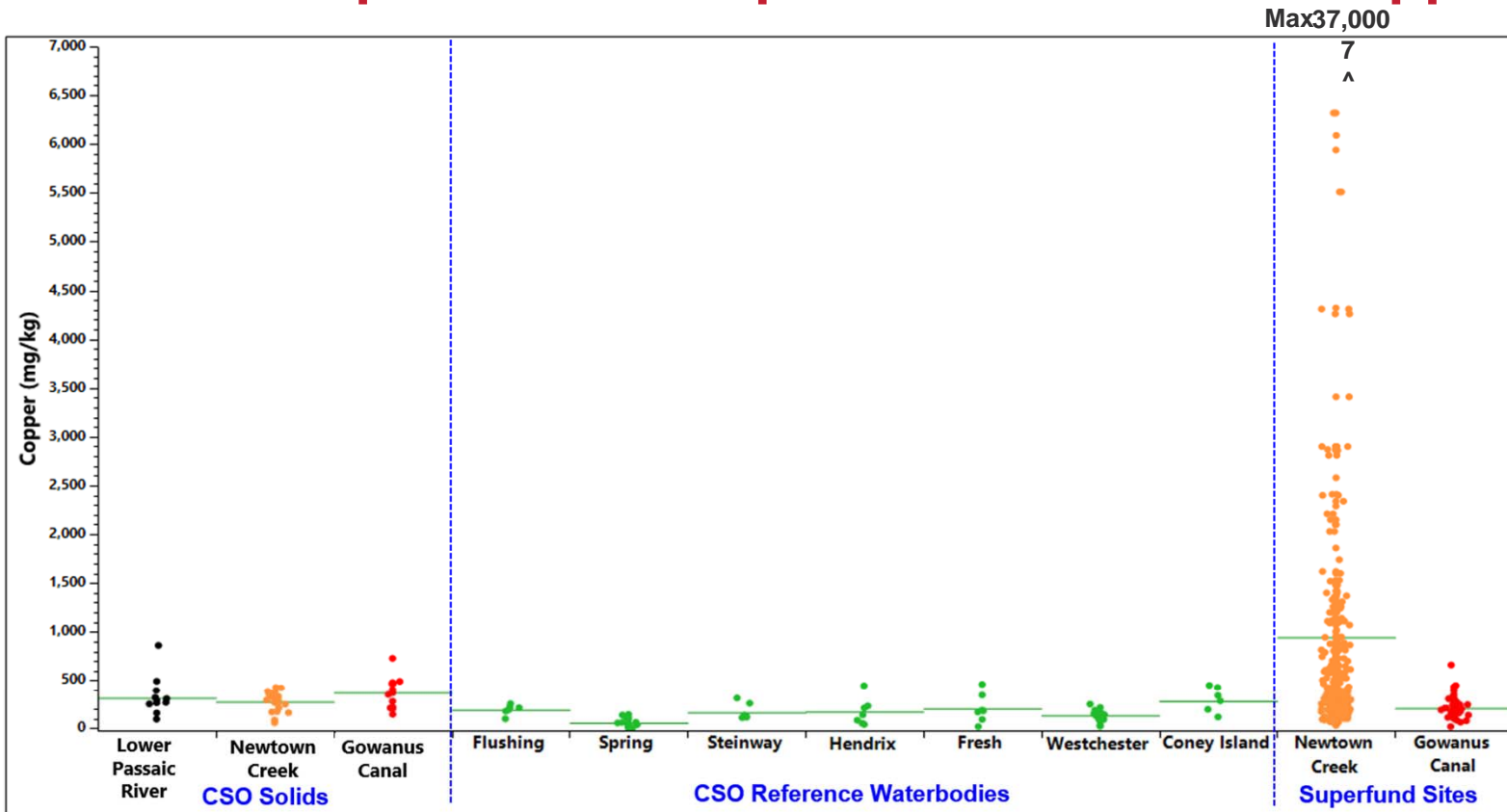


TPCB levels follow the same pattern as TPAH.

Non-CSO sources are causing the elevated surface concentrations at Newtown and Gowanus. Concentrations are even higher at depth.



Assessment of Impact of Municipal Point Sources - Copper



While the copper relationship between CSO waterbodies and CSO solids is similar as for the other COPCs, Gowanus does not show elevated copper levels. Newtown is the site of a former Copper smelter.



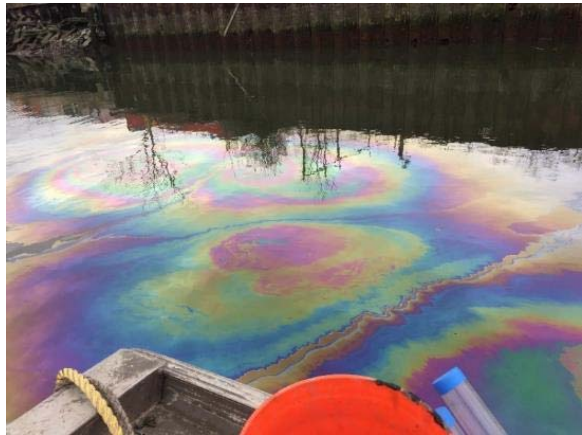
Other Known Significant Sources

- Other known significant sources to these waterbodies include
 - NAPL migration due to ebullition
 - Ongoing NAPL migration from upland sites
 - Groundwater



Other Known Significant Sources

NAPL Migration Due to Ebullition



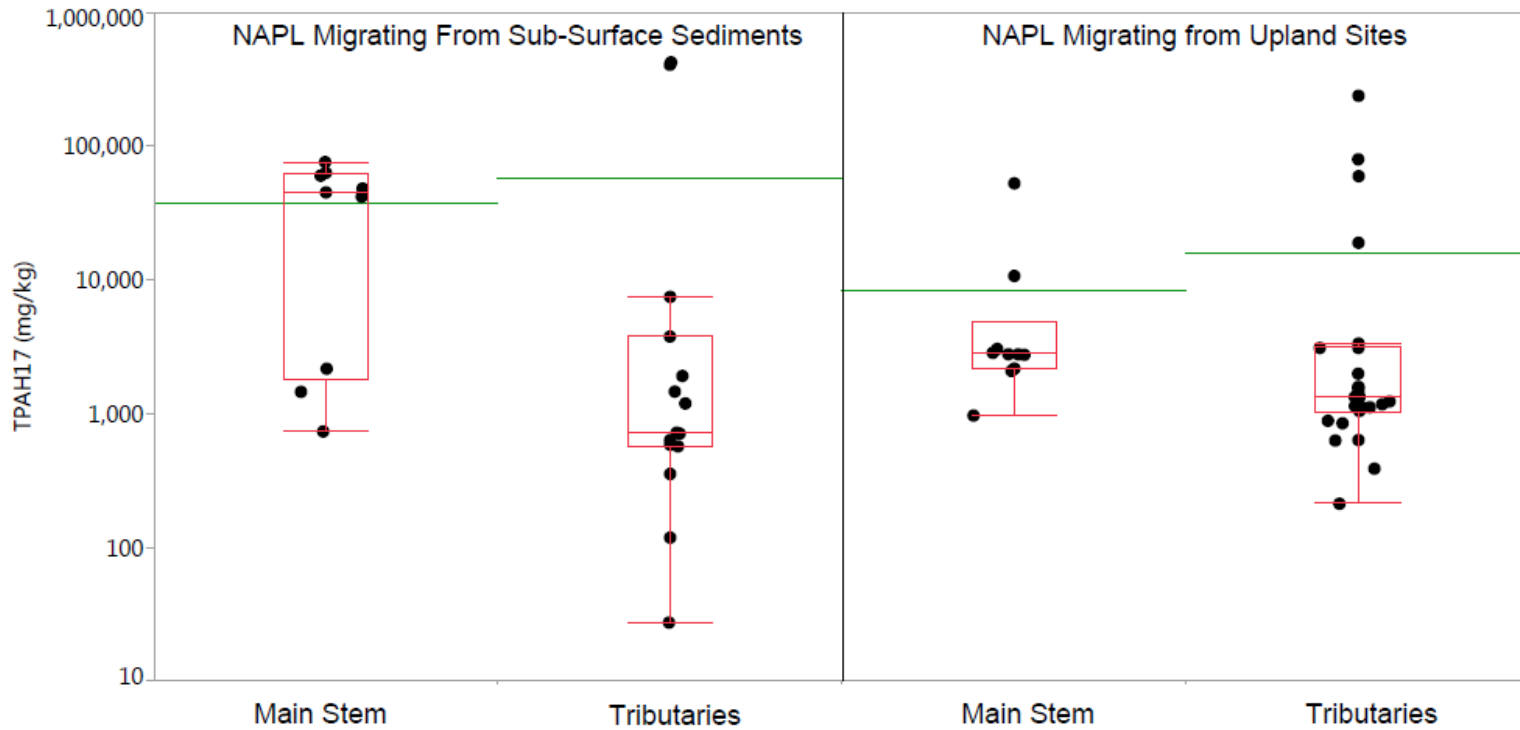
Other Known Significant Sources

NAPL Migration from Upland Sites



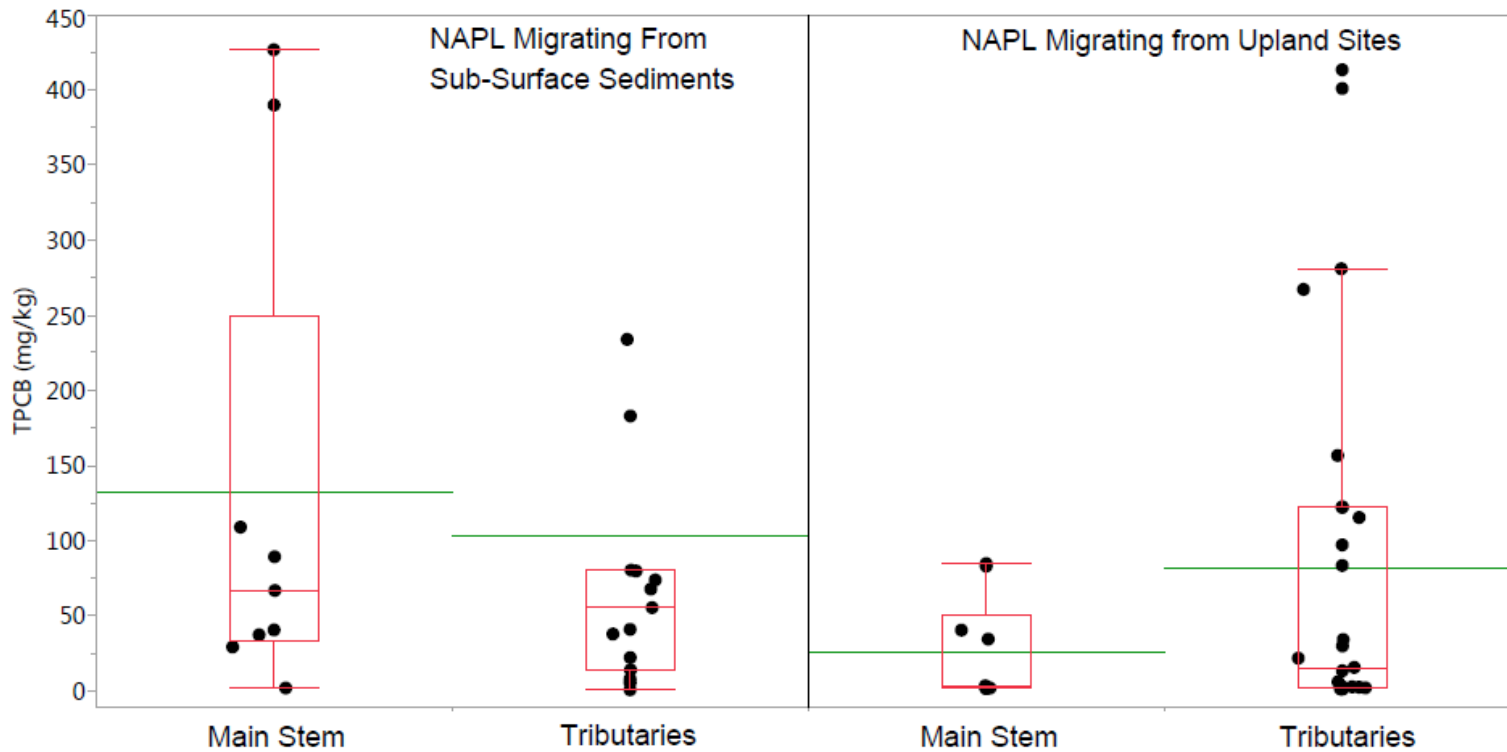
Other Known Significant Sources

TPAH Concentrations in NAPL



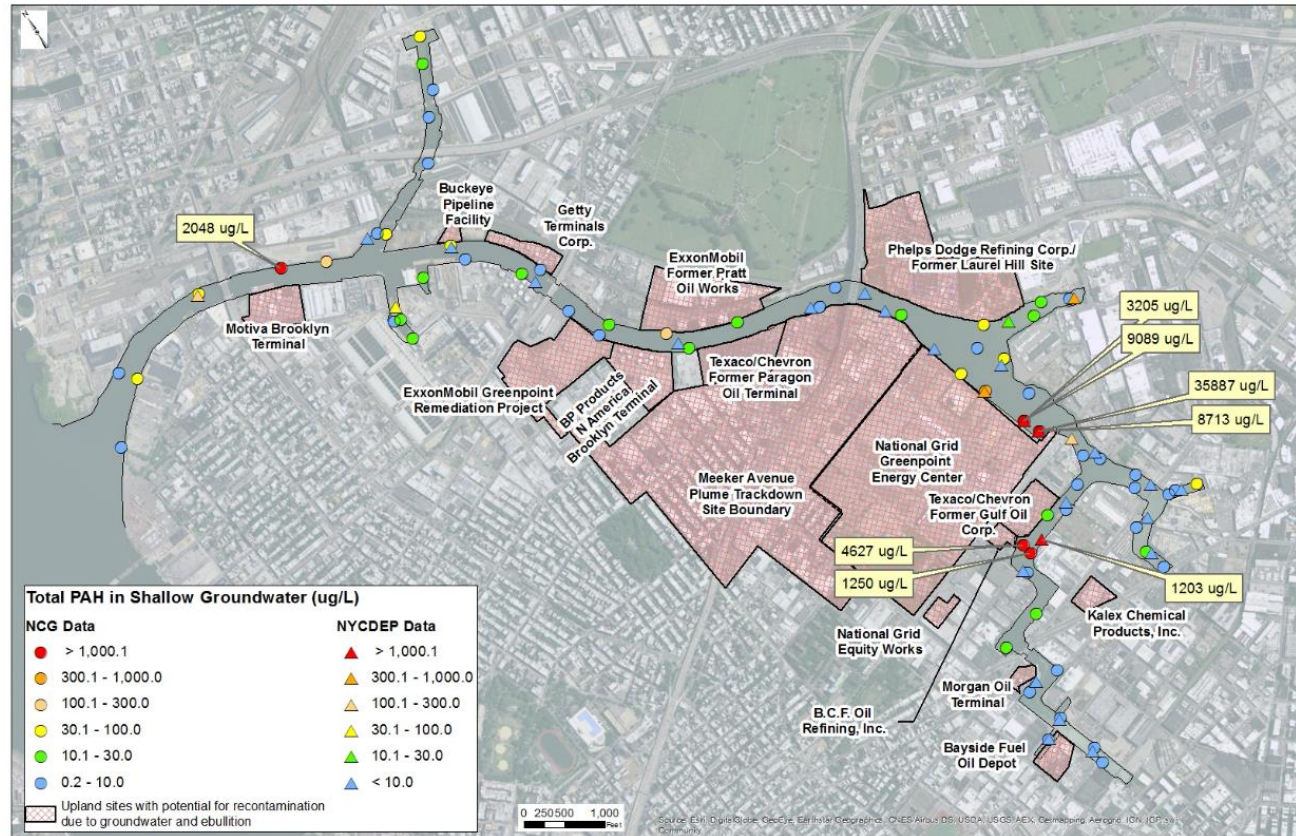
Other Known Significant Sources

TPCB Concentrations in NAPL










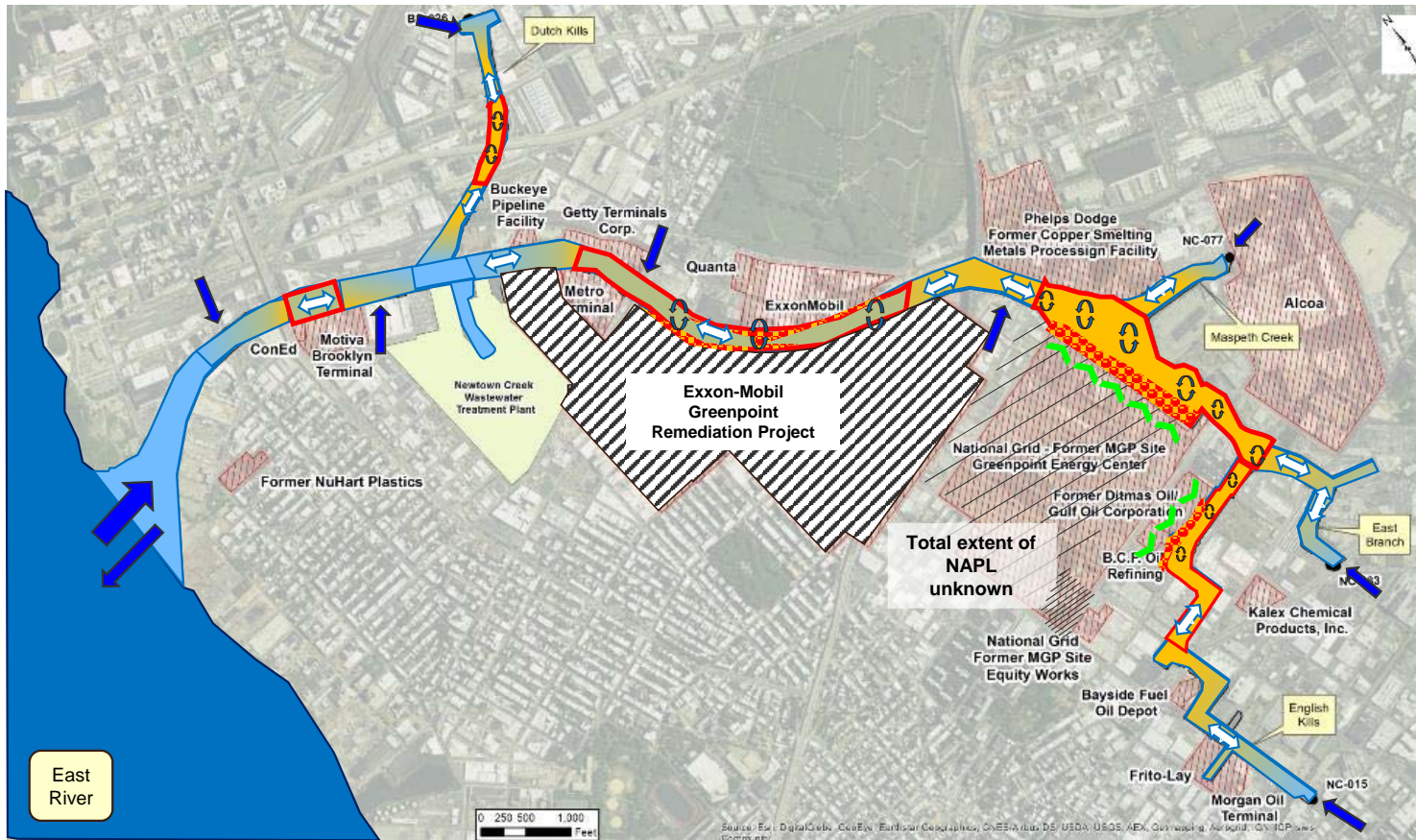
Other Known Significant Sources

TPAH Concentrations in Groundwater

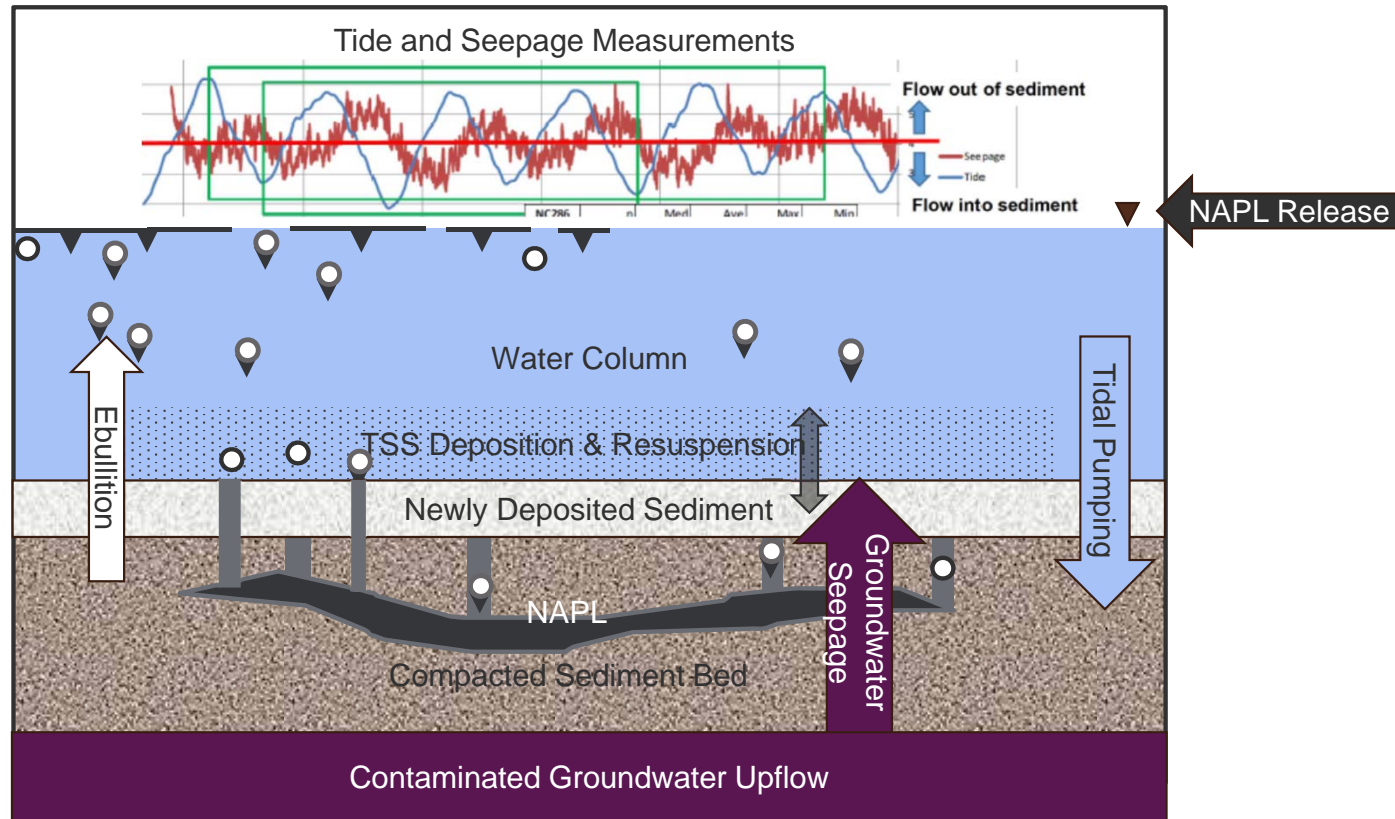


Conceptual Model for the Site

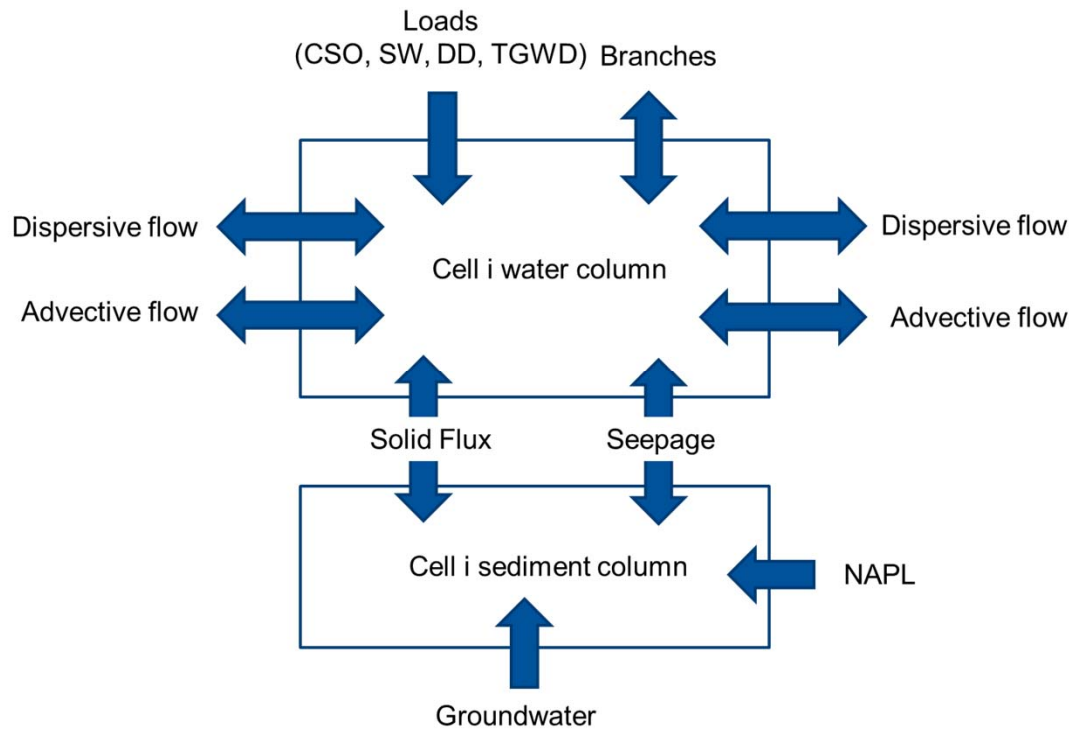
-  Solids Loads – East River, CSO, stormwater and direct drainage at regional background concentrations
-  Upland areas with subsurface NAPL
-  Areas of elevated sediment concentrations and likely ongoing NAPL source areas
-  Likely ongoing NAPL and contaminated GW transport
-  Areas with NAPL migration from upland bulkheads and ebullition
-  Tidal transport
-  Resuspension and mixing of contaminated sediments



Conceptual Model for the Site – Numerical Model



Model Development



Conceptual mass balance and mass exchange between water column and sediment

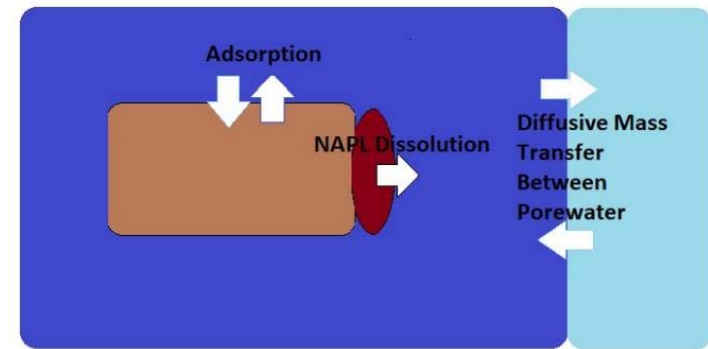
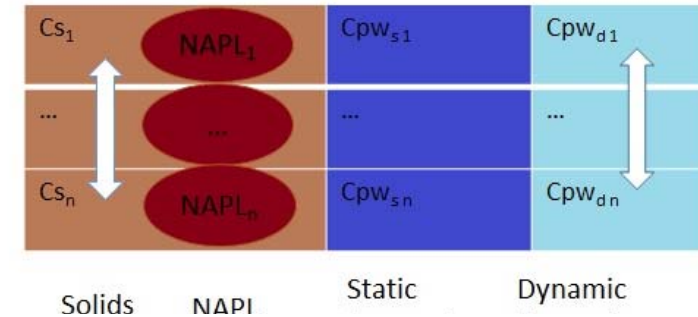
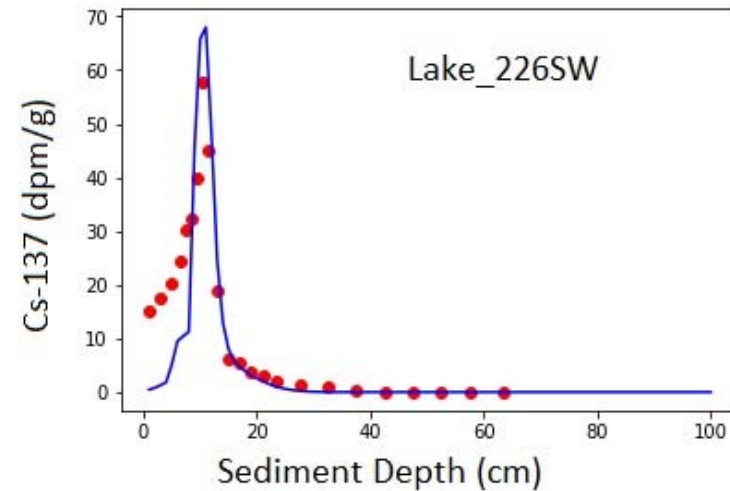
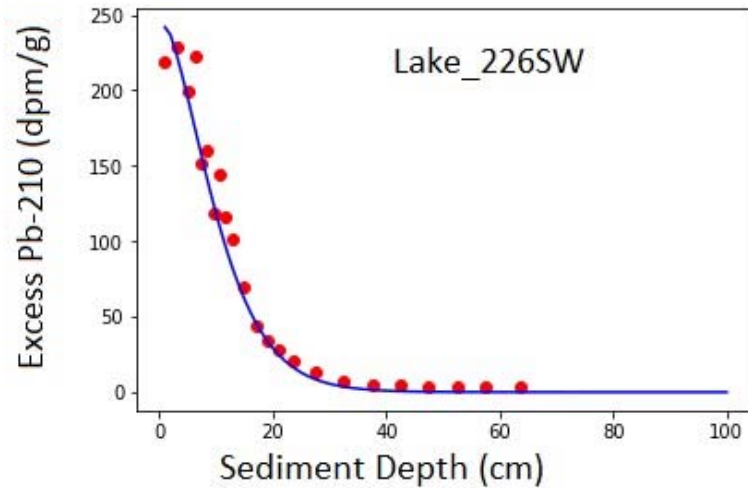


Illustration of the four phases of media and the mass exchange in sediment column



Model Verification

Sediment Tracer (Cs-137 & Pb-210) deposition

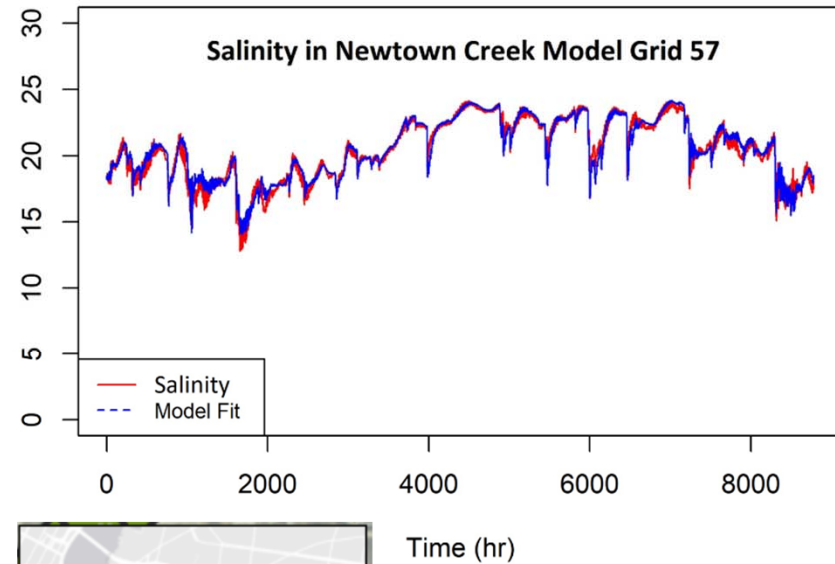
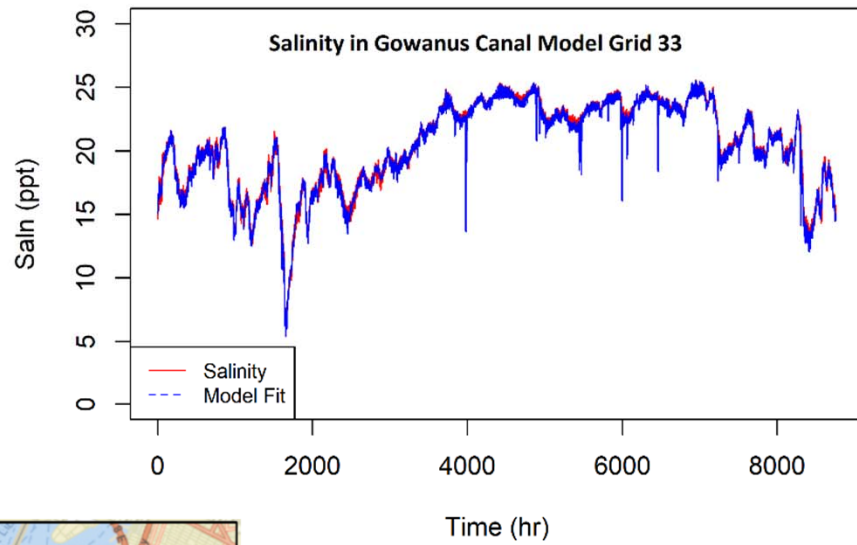


Model verification using sediment radioactivity profiles (Pb-210 and Cs-137) in Lake_226SW sediments (data from Crusius, 1992)



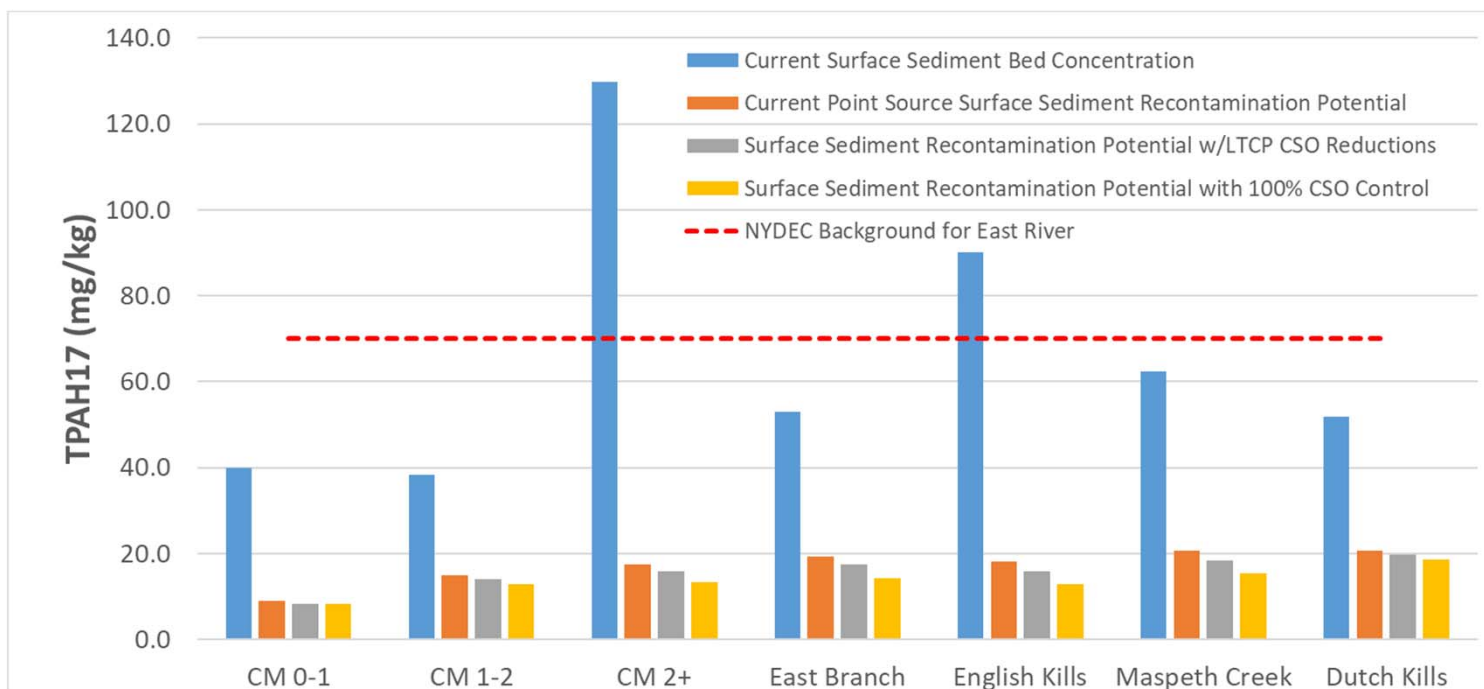
Model Verification

Water Column Salinity



Results

Newtown Creek



Compare current surface sediment and simulated long term TPAH concentrations assuming initial clean bed with different CSO controls in Newtown surface sediments. CM = Creek Mile.



Results Summary

- Elevated COPC concentrations in the surface sediments cannot be explained by on-going municipal discharges (CSOs and stormwater) and other point source discharges
- Current concentration of PAHs and PCBs in CSO discharges will not result in recontamination of remediated surface sediments above potential clean up goals and site background
- NAPL (from upland sites and subsurface sediments) and groundwater are significant sources of COPCS to the study area
- Overall, the analysis indicates that failure to adequately quantify all the significant sources of contamination to the waterbodies will result in an incomplete conceptual site model, and will significantly affect the future recovery of any sediment remedy implemented at these sites



Future Work

- Further development of the model includes:
 - Development of spatially representative source analysis for NAPL and GW inputs
 - Accounting for all significant sources, and performing model development and verification for these inputs/processes
 - Evaluation of the impact of these sources on different remedial alternatives
 - Assessment of the achievability of sediment remediation goals for varying levels of source control options

