Mystic River Eutrophication Study Project Update

Mystic River Watershed Steering Committee Meeting

October 11, 2018

Mystic River Watershed Eutrophication Analysis Project Objectives

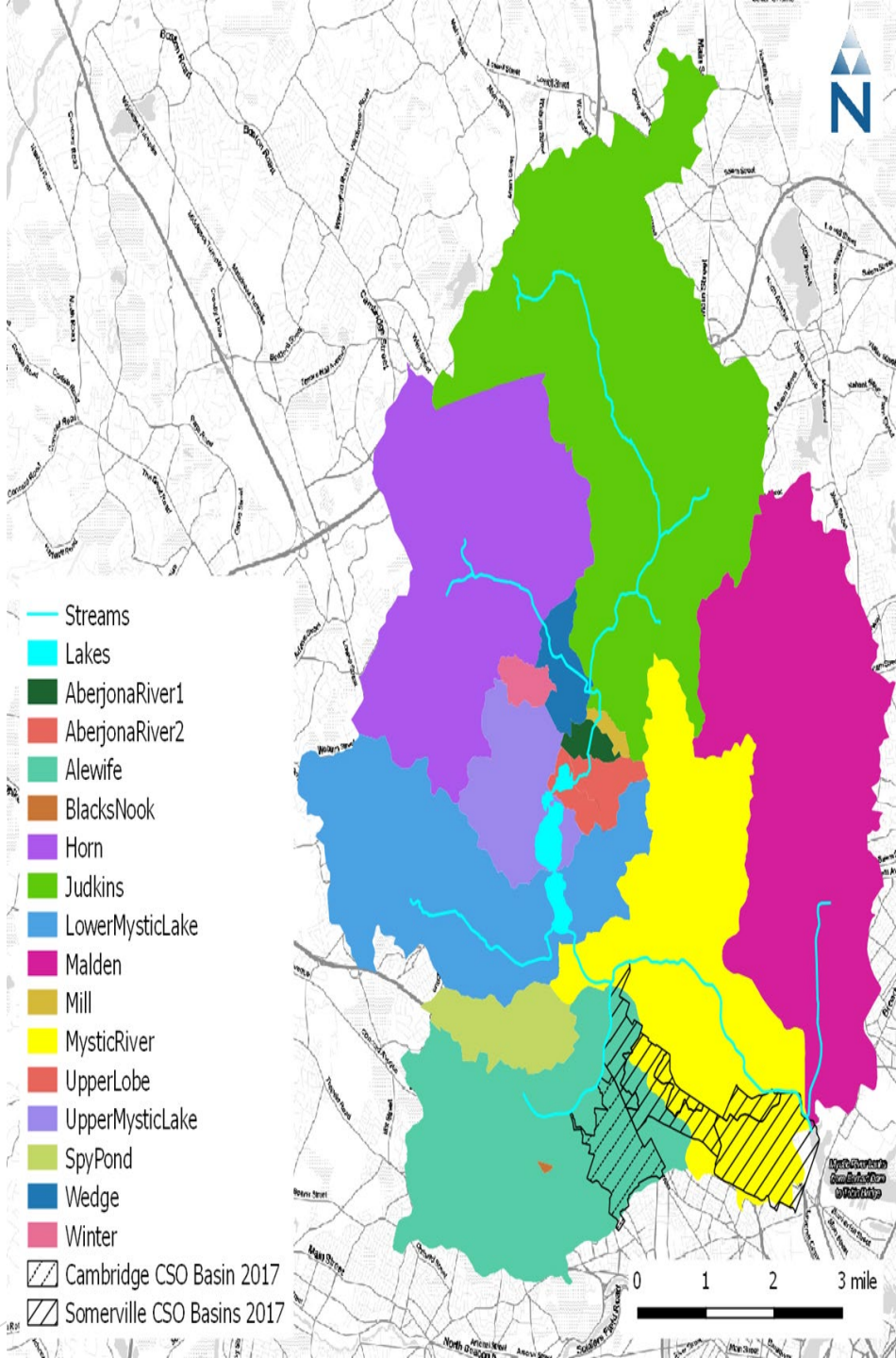
- Identify management needs through TMDL-like analyses to address cultural eutrophication of the fresh water portion of the Mystic River Watershed
  - Develop predictive watershed phosphorus loading and receiving water quality response models
  - Develop estimates of watershed based phosphorus load reductions needed to attain nutrient related MA Surface Water Quality Standards at critical locations in the watershed
    - 3 Critical Locations: Lower Mystic River; Upper-Lobe to Upper Mystic Lake; Main body of Upper Mystic Lake
    - 5 ponds/lakes impaired by excessive nutrients (analyses being conducted by EPA and MassDEP separately from the main project being discussed today)
  - Introduce broad-based optimized stormwater (SW) management strategies using effective SW control technologies customized to urban/suburban landscapes
  - Identify typical “no regret” SW/GI management opportunities associated with normal municipal business operations

Project Partners and Technical Steering Committee (TSC)

- The Mystic River Watershed Association (MyRWA) - Water quality monitoring, USGS flow gaging project management, technical steering committee
- The MWRA - Water quality monitoring, financial support, technical steering committee
- The MassDEP -Technical and policy support, technical steering committee, pond/lake phosphorus load reduction analyses
- EPA Region 1 - EPA Contractor support, water quality monitoring, laboratory analyses, technical and policy support, technical steering committee, pond/lake load reduction analyses
- EPA's Contractor: Environmental Research Group (ERG) - Team includes PG Environmental, Horsley Witten Group, & Paradigm Environmental - Overall technical support including data analyses, water quality endpoints, watershed and receiving water modeling

Project Approach Overview

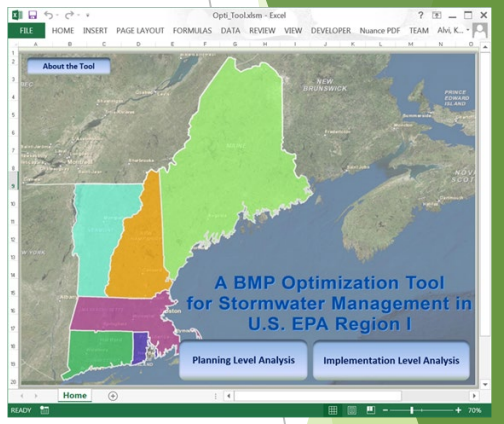
- Phase 1 & 2 Funded by EPA TMDL program
- Engage with partners: Mystic River Watershed Association, MassDEP, MA Water Resources Authority (MWRA)
- Phase 1($100k): Convene TSC, Assess/analyze available data, Select nutrient targets, Select appropriate model(s), Watershed phosphorus loading analysis
- Phase 2 ($110k): BATHTUB modeling of Mystic River and Upper & Lower Mystic Lakes, finalize watershed loading estimates and needed reductions; public outreach
- Ancillary Task: (EPA -MassDEP): Lake Loading Response Model for 5 impaired lakes

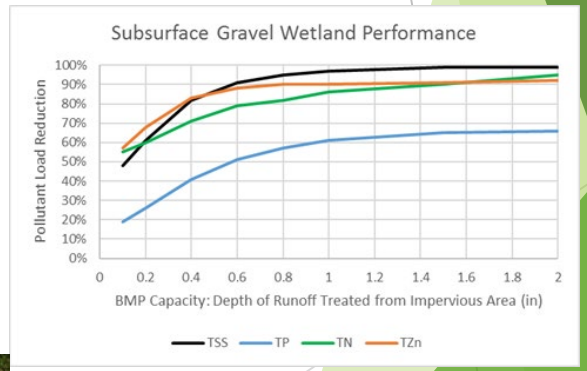


Project Approach Overview (continued)

Study Design to Facilitate Implementation of SW Load Reductions

- Seamless translation of SW load estimates and reductions using credible accounting information developed by Region for MS4 permitting (incorporated into Opti-Tool)
- Demonstrate the power of cumulative BMP performance estimates for GI of all sizes in urban settings
- Identify immediate opportunities for action by communities (e.g., redevelopment and urban renewal projects)

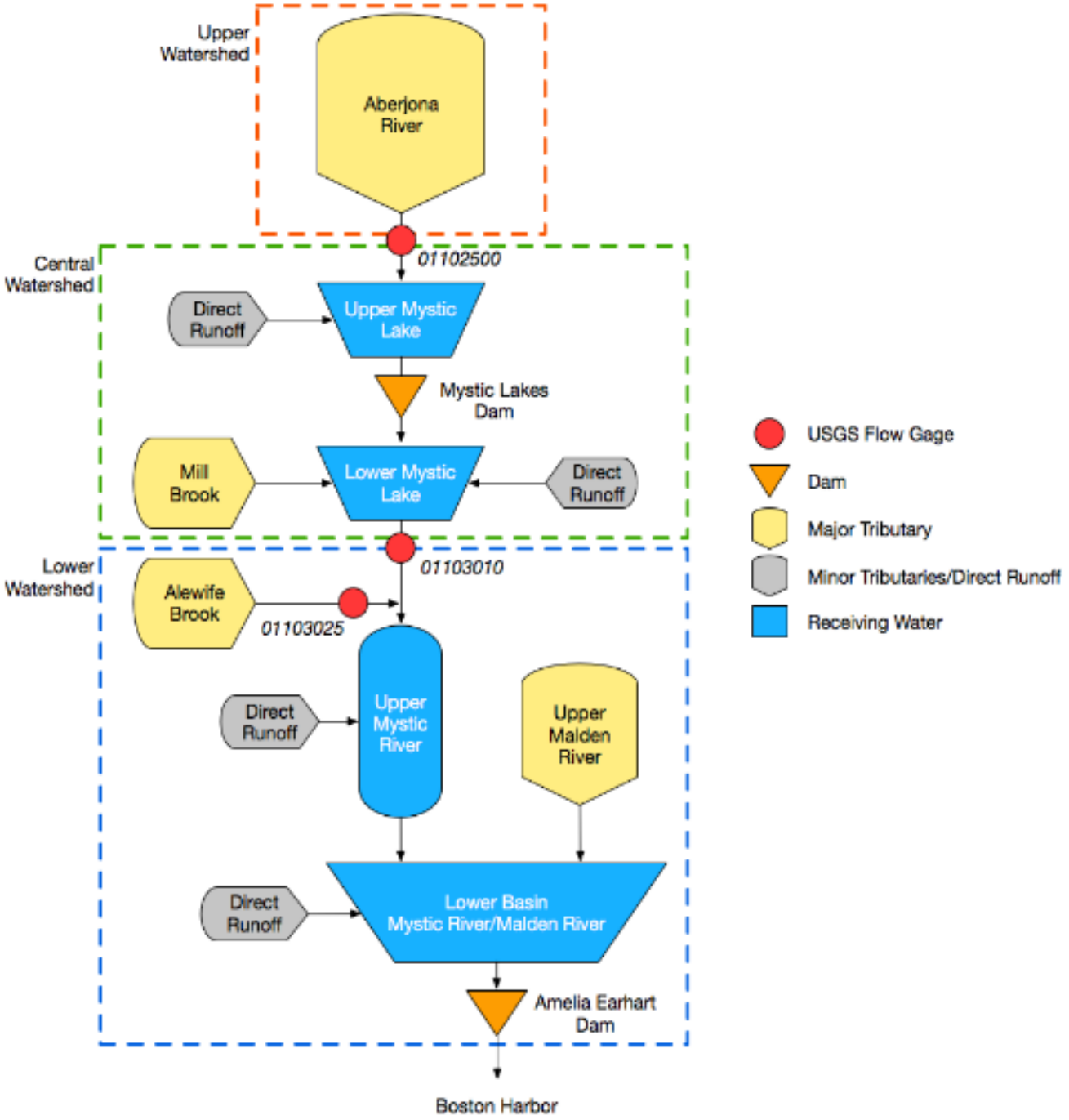




Phase 1 – Draft Report

Completed June 2017

- Phase 1 Draft Report compiles project tech memos:
  - Conceptual Model memo
  - Data Review memo
  - Water Quality Targets memo
  - Model Approach Alternatives memo



Phase 1 – Draft Report Summary

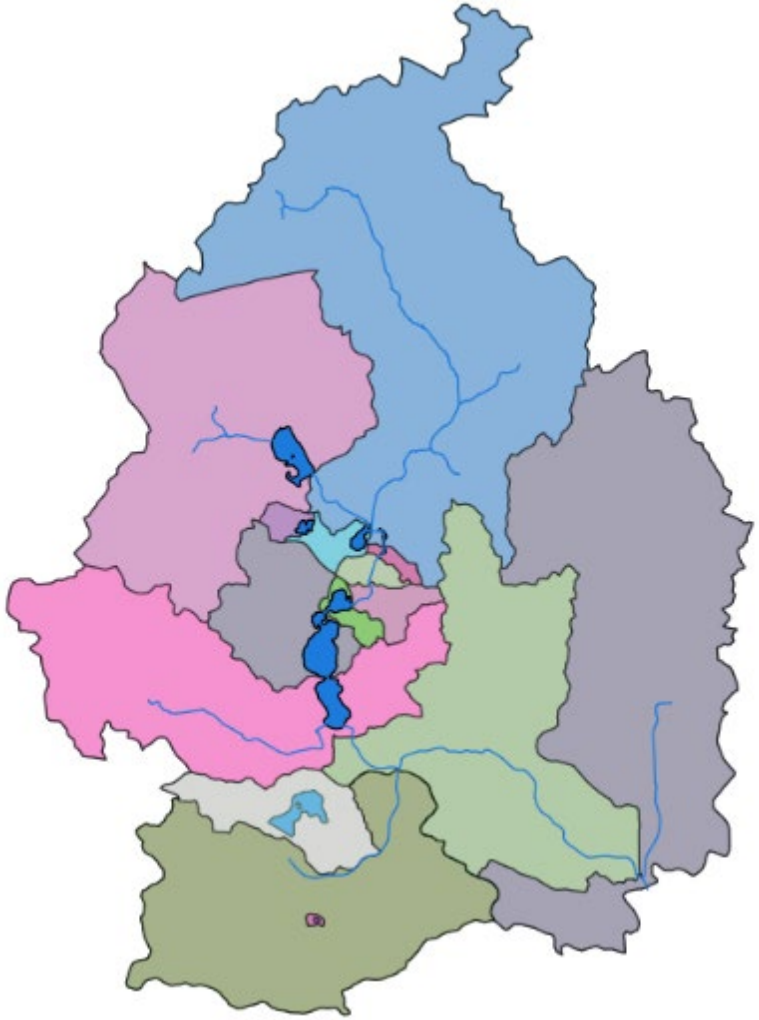
- Phase 1 conclusions to date:
  - Conceptual – Focus modeling on 3 critical waterbody segments:
    - Upper Lobe of Upper Mystic Lake
    - Upper Mystic Lake
    - Lower Basin
  - Data gaps – Use land loading model to fill in TP loading gaps
  - Water quality target in 3 critical segments
    - Seasonal average Chlorophyll-a <10 µg/L (Same as used for Lower Charles)
    - 90th Percentile Chlorophyll-a <20 µg/L
  - Model Approach
    - SWMM Hydrologic Response Unit (HRU) modelling within Opti-tool for land-loading model
    - BATHTUB for water quality response modeling in three main sections

GIS Watershed Analysis, Phosphorus Loading Analysis

- Develop a watershed delineation to support land loading model for TP
- Characterize land-use, impervious cover, and hydric soil characteristics
- Use Opti-tool/SWMM to develop estimated TP loads for period of interest

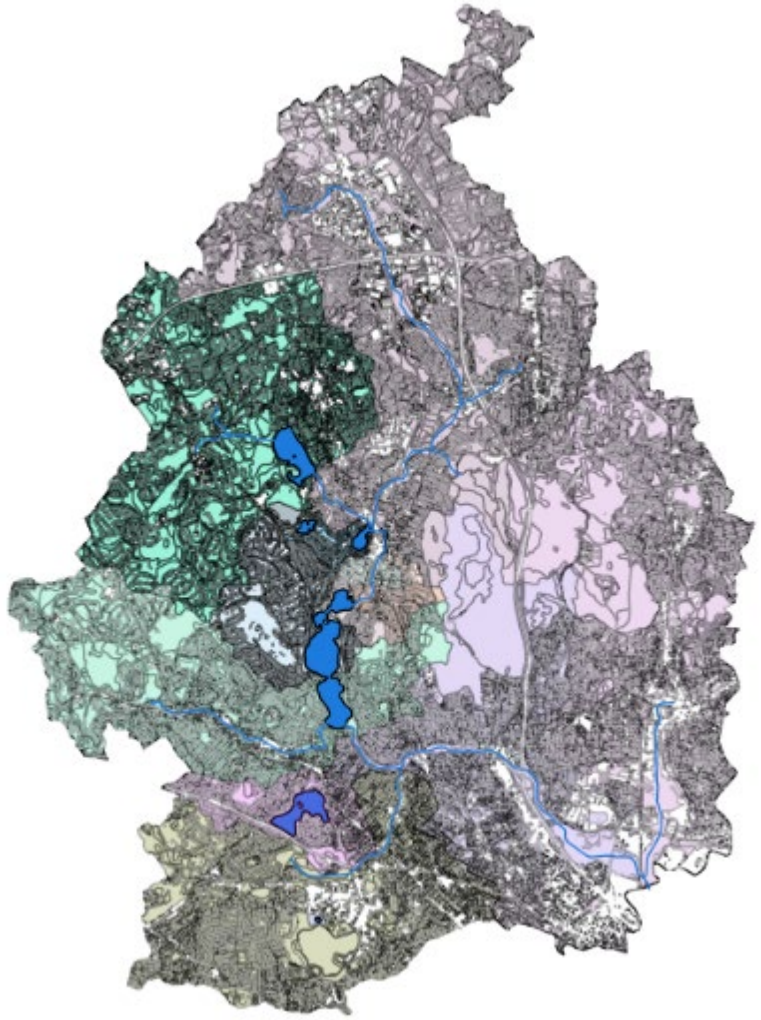
Delineate Sub-basins in Watershed

- Delineation should allow us to estimate loads for the following
  - Critical Mystic waterbody segments: (1) Upper Lobe, (2) Upper Lake, (3) Lower Basin
  - Calibration points/USGS flow gauges
  - 5 impaired ponds in watershed



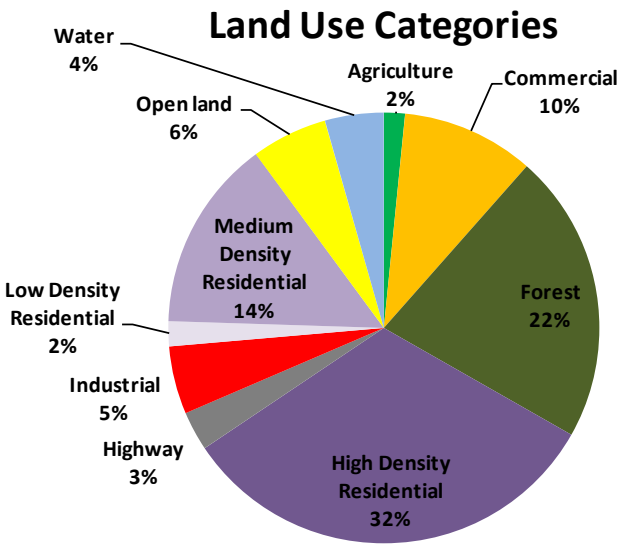
Characterize Watershed

- MassGIS – Land Use (2005)
  - After GIS, land uses are aggregated according to opti-tool land use inputs
  - Aggregation scheme follow 2016 MS4 general permit
- MassGIS – Impervious Surface (2005)
- NRCS SSURGO-Certified Soils (2012)

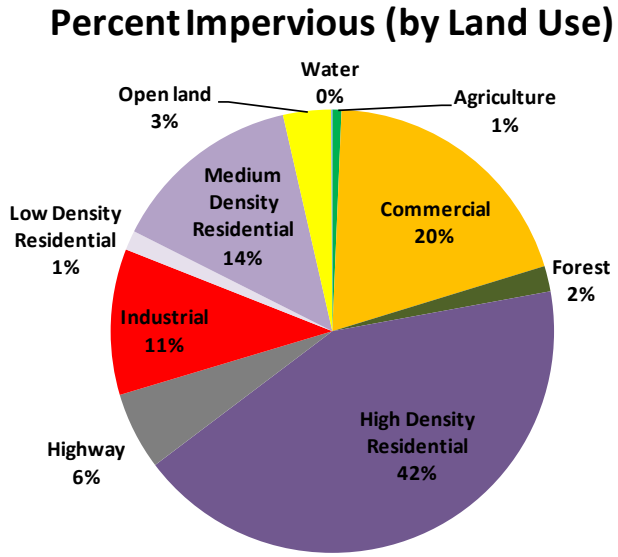


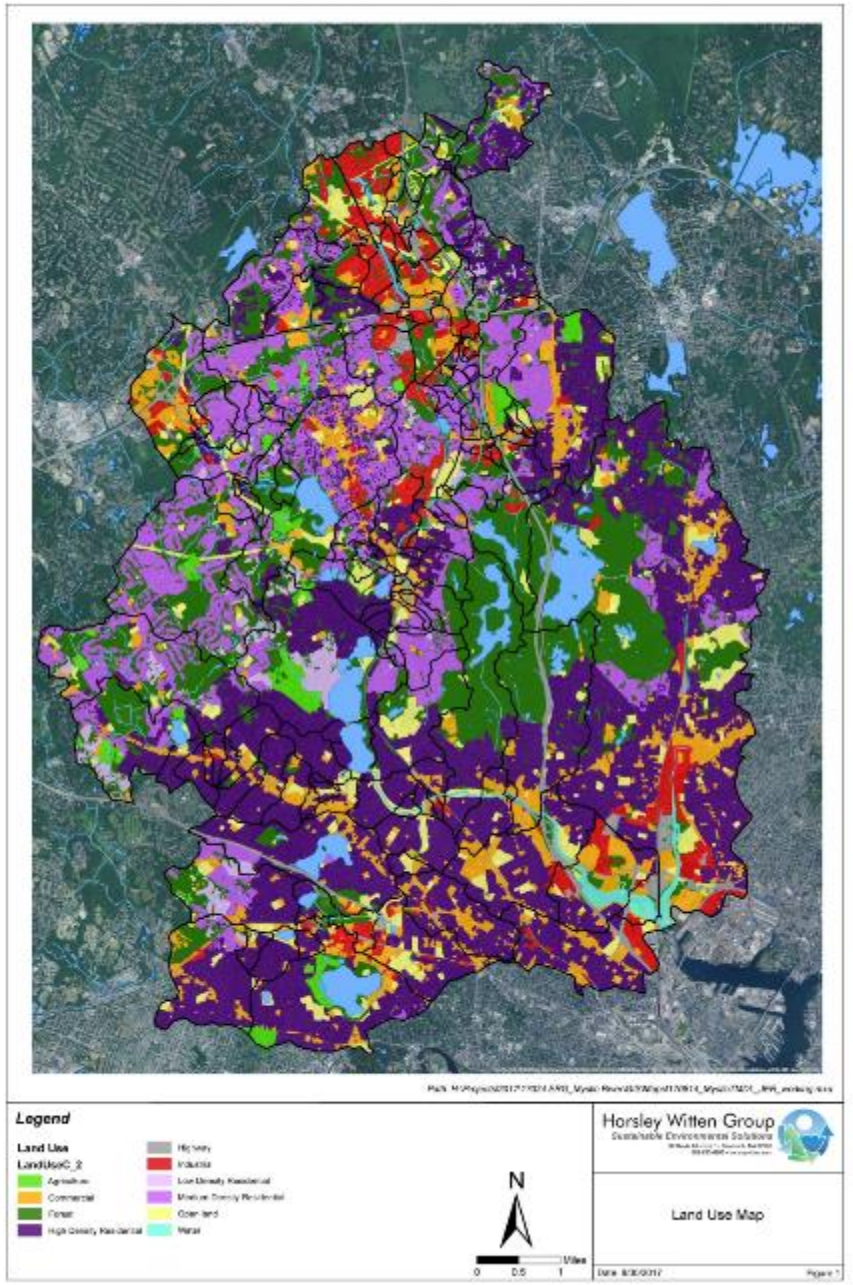
GIS Data Analyses

- **Land Use Data**
  - 46% High Density Residential (HDR) and Medium Density Residential (MDR)
  - 22 % Forest
  - 15% Commercial and Industrial



- **Impervious Cover Data**
  - 56% impervious in HDR and MDR
  - 31% impervious in Commercial and Industrial



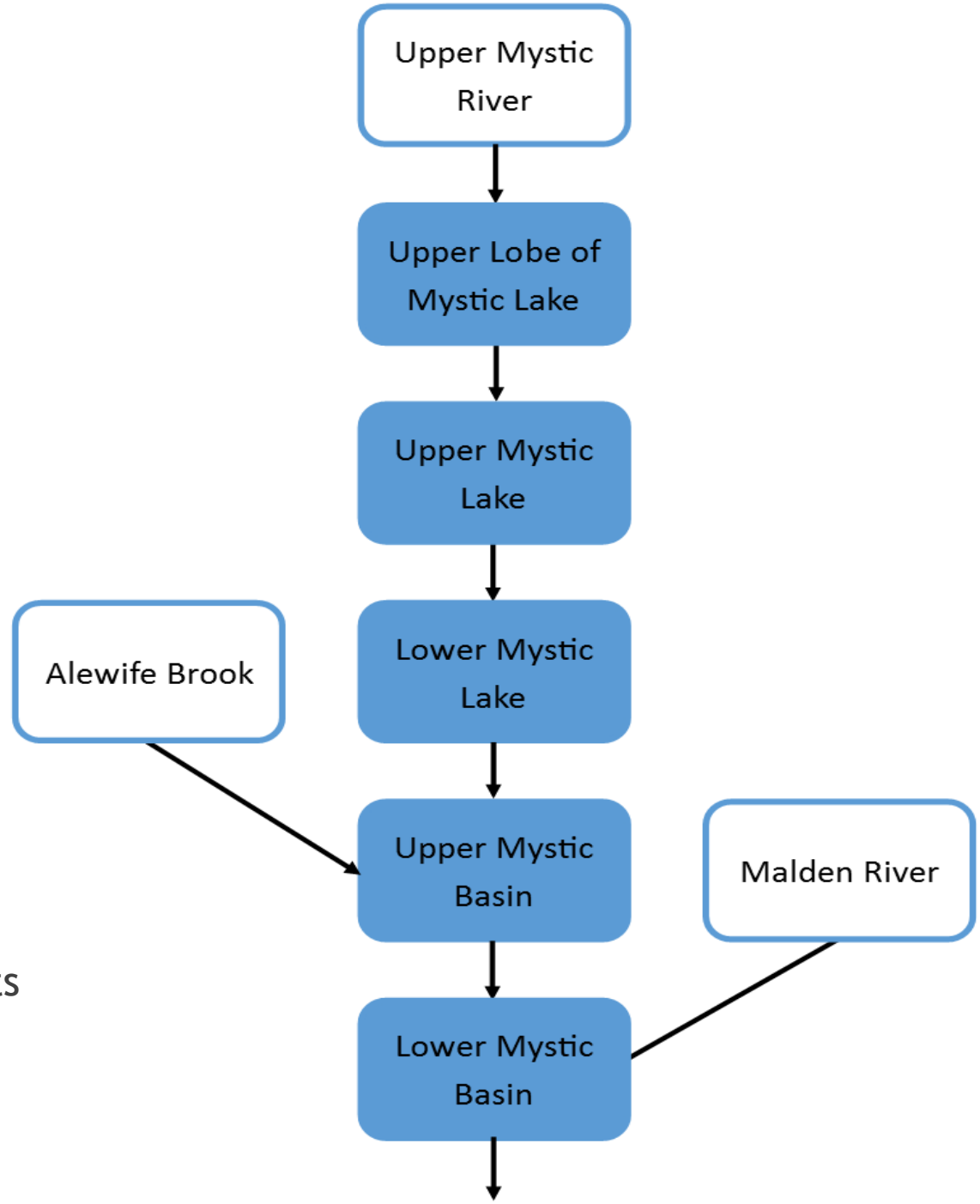


Phase 2 Scope of Work Overview

- Finalize Watershed Phosphorus Loading Estimates (complete)
- Develop and Calibrate BATHTUB Models for the Mystic River Watershed (complete)
- Conduct Watershed Phosphorus Load Reduction Analysis (Ongoing to early November 2018)
- Develop Broad-Based Nutrient Stormwater Management Strategies for Mystic River Watershed study area using Opti-Tool (ongoing to mid November, 2018)
- Independent Technical Reviews (November – December, 2018)
- Final Report (early January 2019)

Calibration of the BATHTUB Model

- Selection of critical period (2007-2016)
  - Complete
- Calibration of reach loads (2007-2016)
  - Complete
- Calibration of BATHTUB model (2005)
  - Original 3 critical reaches expanded to 5 reaches
  - Upper and Lower Basin split into two parts



Phosphorus Load Reductions

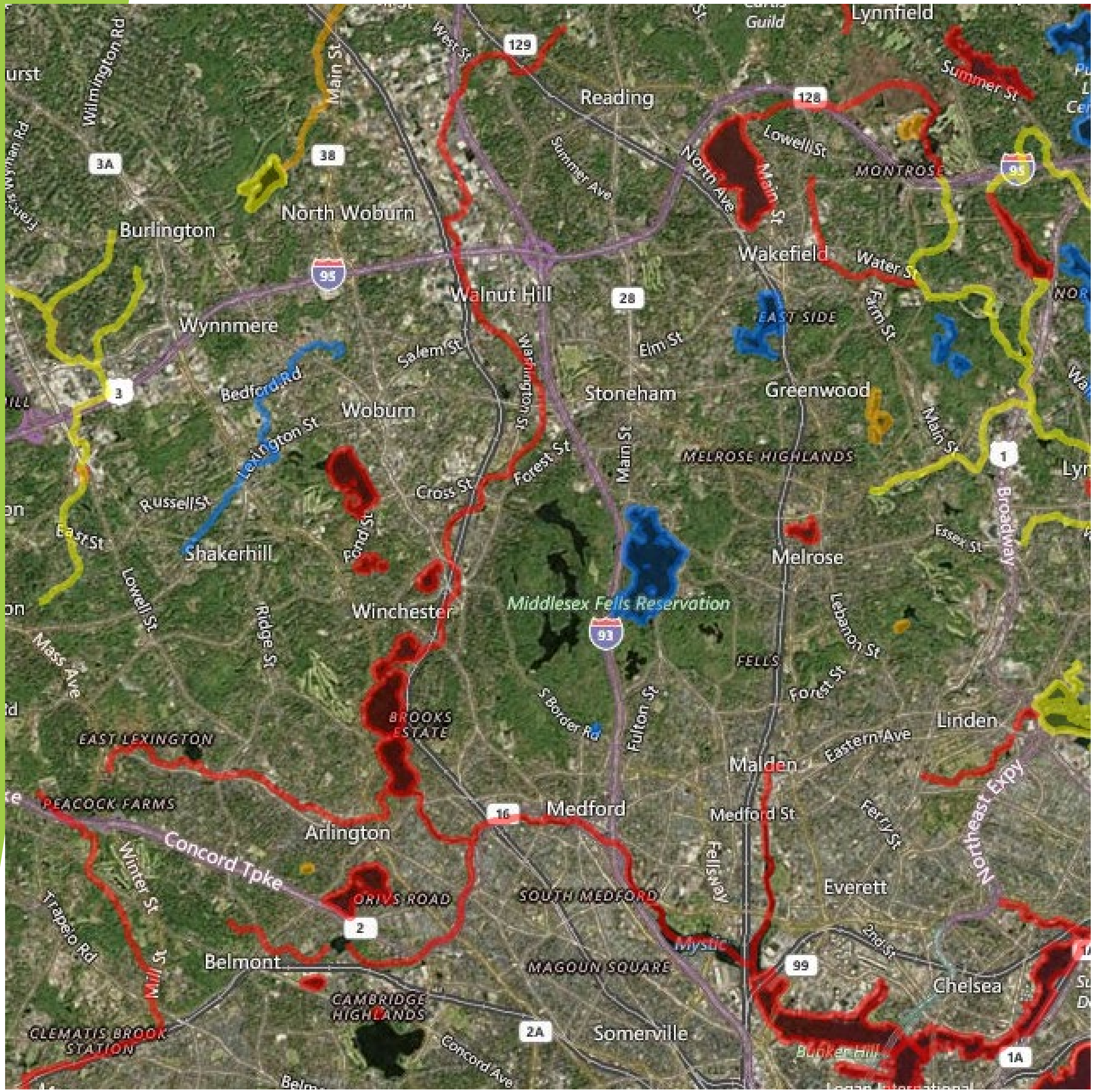
- Critical Period of Interest
  - 10-year period from 2007 to 2016
  - Includes 2 wet years (2008, 2011), 2 dry years (2015, 2016)
  - Watershed Phosphorus Loading Estimates for Critical Period
    - Average annual flows and loads from land loads, groundwater, sediment, CSO/SSOs
    - Attenuated loads from the tributaries, unattenuated loads from direct discharges to segments
- Very Preliminary Results indicates SW P load reductions of 40-60% may be needed to attain nutrient related WQS.

Stormwater Management Strategies Opti-Tool

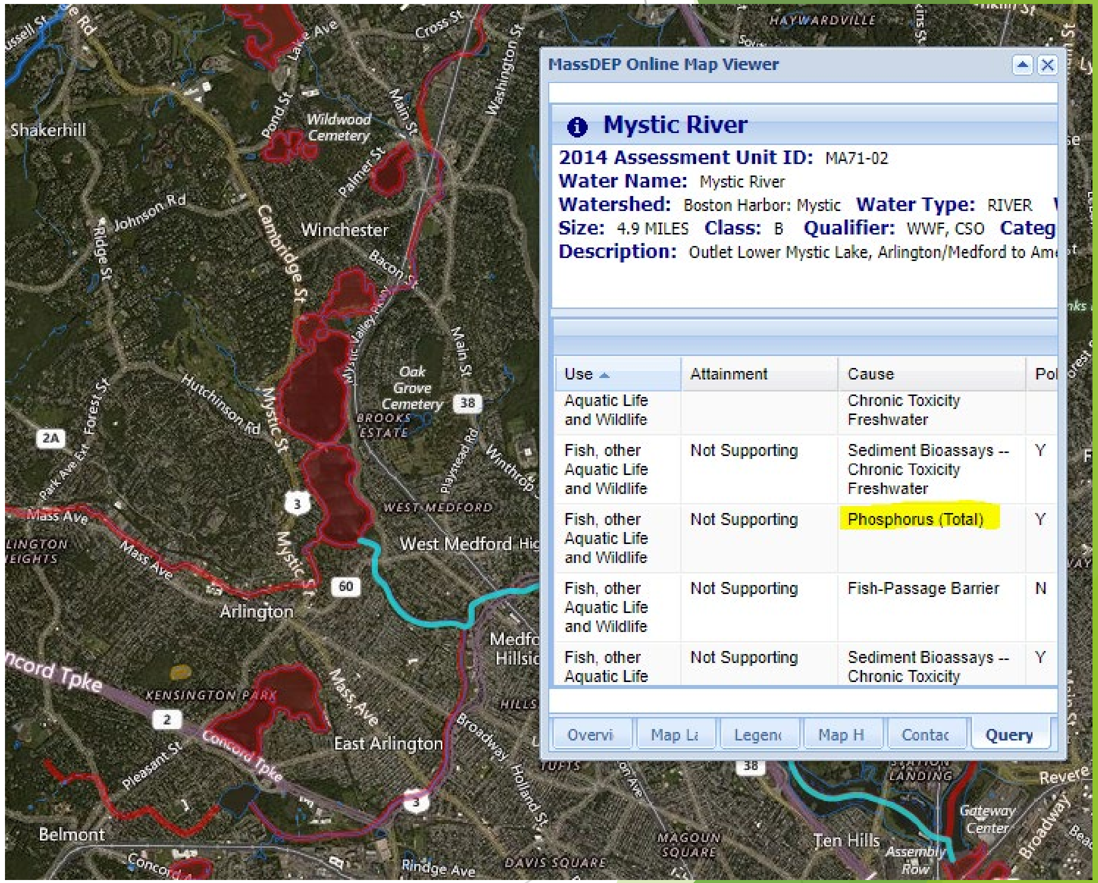
- GOALS:
  - Develop a step-by-step, high-level approach
    - Generalize approach
    - Treating impervious areas
    - Structural BMPs only
  - Demonstrate cost-benefits of optimization at sub-watershed scale (pilot watershed demonstration)
    - Include all storm events using hourly rainfall to assess cumulative benefits (2007–2016)
    - Develop most cost-effective solutions for varying TP load reductions
  - Provide real-world SW control retrofit examples

Discussion

2016 MS4 Permit Requirements: Addressing nutrient impairments in stormwater management



Reading
Lynnfield
North Woburn
Burlington
Wakefield
Walnut Hill
Wynnmere
Woburn
Stoneham
Greenwood
MELROSE HIGHLANDS
Shakerhill
Melrose
Middlesex Fells Reservation
Winchester
BROOKS ESTATE
EAST LEXINGTON
PEACOCK FARMS
Arlington
Medford
Malden
Linden
Everett
Concord Tpke
ORIVS ROAD
SOUTH MEDFORD
Mystic
Belmont
MAGOUN SQUARE
Chelsea
CAMBRIDGE HIGHLANDS
Somerville
CLEMATIS BROOK STATION
Northeast Expy
Bunker Hill



MassDEP Online Map Viewer
Mystic River
2014 Assessment Unit ID: MA71-02
Water Name: Mystic River
Watershed: Boston Harbor: Mystic Water Type: RIVER
Size: 4.9 MILES Class: B Qualifier: WWF, CSO Categ
Description: Outlet Lower Mystic Lake, Arlington/Medford to Am
Use | Attainment | Cause | Pol
Aquatic Life and Wildlife | | Chronic Toxicity Freshwater |
Fish, other Aquatic Life and Wildlife | Not Supporting | Sediment Bioassays -- Chronic Toxicity Freshwater | Y
Fish, other Aquatic Life and Wildlife | Not Supporting | Phosphorus (Total) | Y
Fish, other Aquatic Life and Wildlife | Not Supporting | Fish-Passage Barrier | N
Fish, other Aquatic Life | Not Supporting | Sediment Bioassays -- Chronic Toxicity | Y
Query
Shakerhill
Winchester
Oak Grove Cemetery
West Medford
Arlington
East Arlington
Belmont
Ten Hills

Appendix H Part II – Impairment due to Phos.

- Annual public education on nutrient sources in stormwater
  - yard waste
  - pet waste
  - fertilizer use
  - leaf litter
- Updated ordinance to require phosphorus removal optimization
- Good housekeeping for grass cuttings, Leaf litter, 2x yr street sweeping

Appendix H Part II – Impairment due to Phos.

- Phosphorus source identification report (impervious area, land use, monitoring)
- Plan for structural retrofits
  - Schedule to retrofit municipal properties
  - One demonstration project required
  - Track P load reductions

Mystic River Watershed Stormwater Management Community Support

Making Water Quality Progress through Stormwater Management Innovation

- Happens at the local level
- Is unique to each community
- Can reduce costs significantly
- Has many cobenefits for water resources

The project team:

- Arlington
- Winchester
- UNH Stormwater Center
- Eastern Research Group (ERG)
- EPA and MassDEP
- MyRWA

Possible topics of discussion

- Stormwater management challenges
- New research and technologies
- Lower-cost and smaller-scale stormwater best management practices (BMPs)
- Finding stormwater management opportunities in routine

Benefits/outcomes

- Mutual learning and problem solving
- Learn about the latest research and innovations
- Create a local stormwater management strategy for the next few years to implement innovations

For More Information…

- https://www.epa.gov/mysticriver
- https://www.epa.gov/npdes-permits/massachusetts-small-ms4-general-permit
- https://www.epa.gov/npdes-permits/stormwater-tools-new-england