



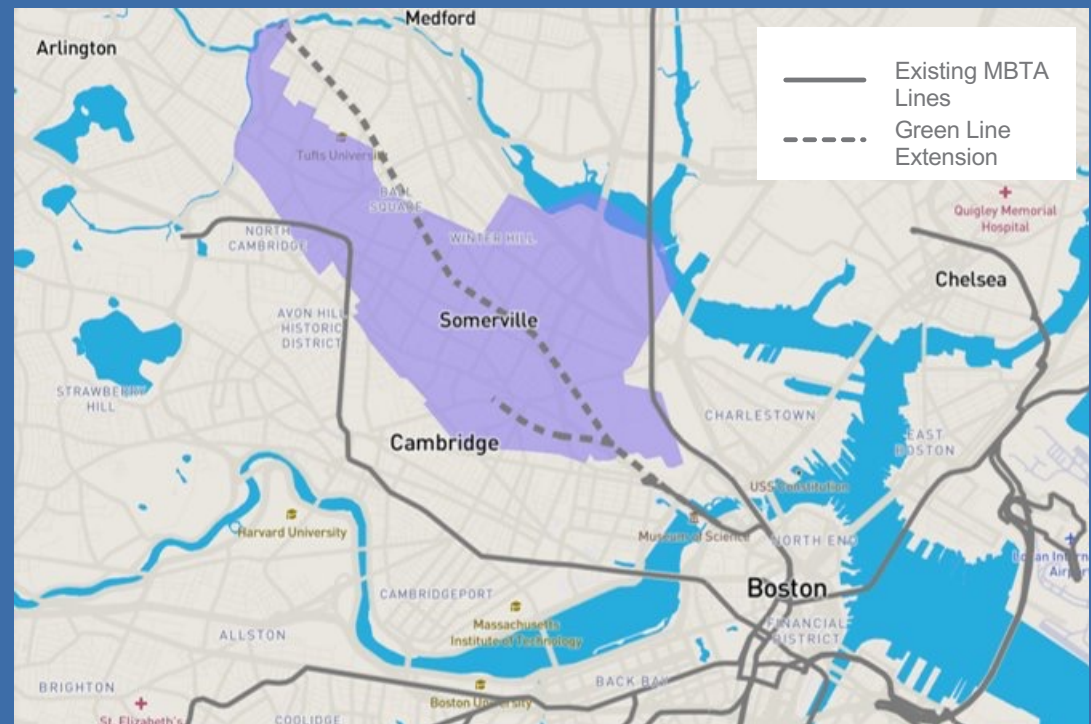
How Somerville is Planning for City-Wide Flood Resilience and Water Quality Improvements One (Vulnerable) Neighborhood at a Time

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NEWEA Spring Conference
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City of Somerville

- Northwest of Boston
- Population: Approx. 81,600 (2018)
- Area: 4.2 square miles
- Combined System: 68 miles
- Sanitary system: 62 miles
- Storm drain: 35 miles



Flooding



City Response

Planning & Analysis

Sewer System Condition
Evaluation

Municipal Vulnerability
Preparedness (MVP) Analysis

City-wide Flood Mitigation and
Water Quality Improvements

Capital Projects

Somerville Ave Utility &
Streetscape Improvements

Poplar Street Pump Station

Spring Hill Sewer Separation

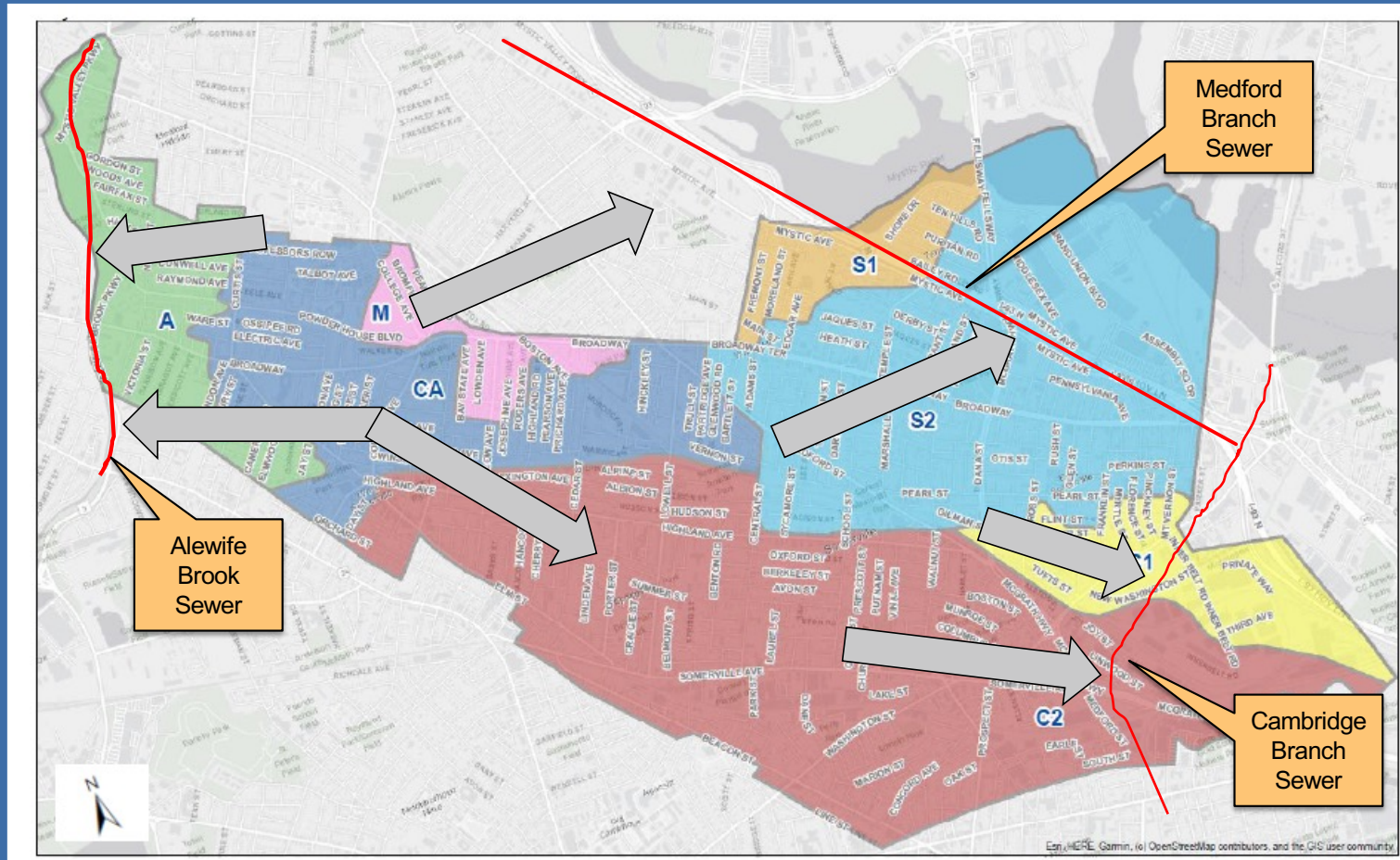
Information & Engagement

Flooding Database

MVP Public Information
Campaign

Flood Ready Webpage

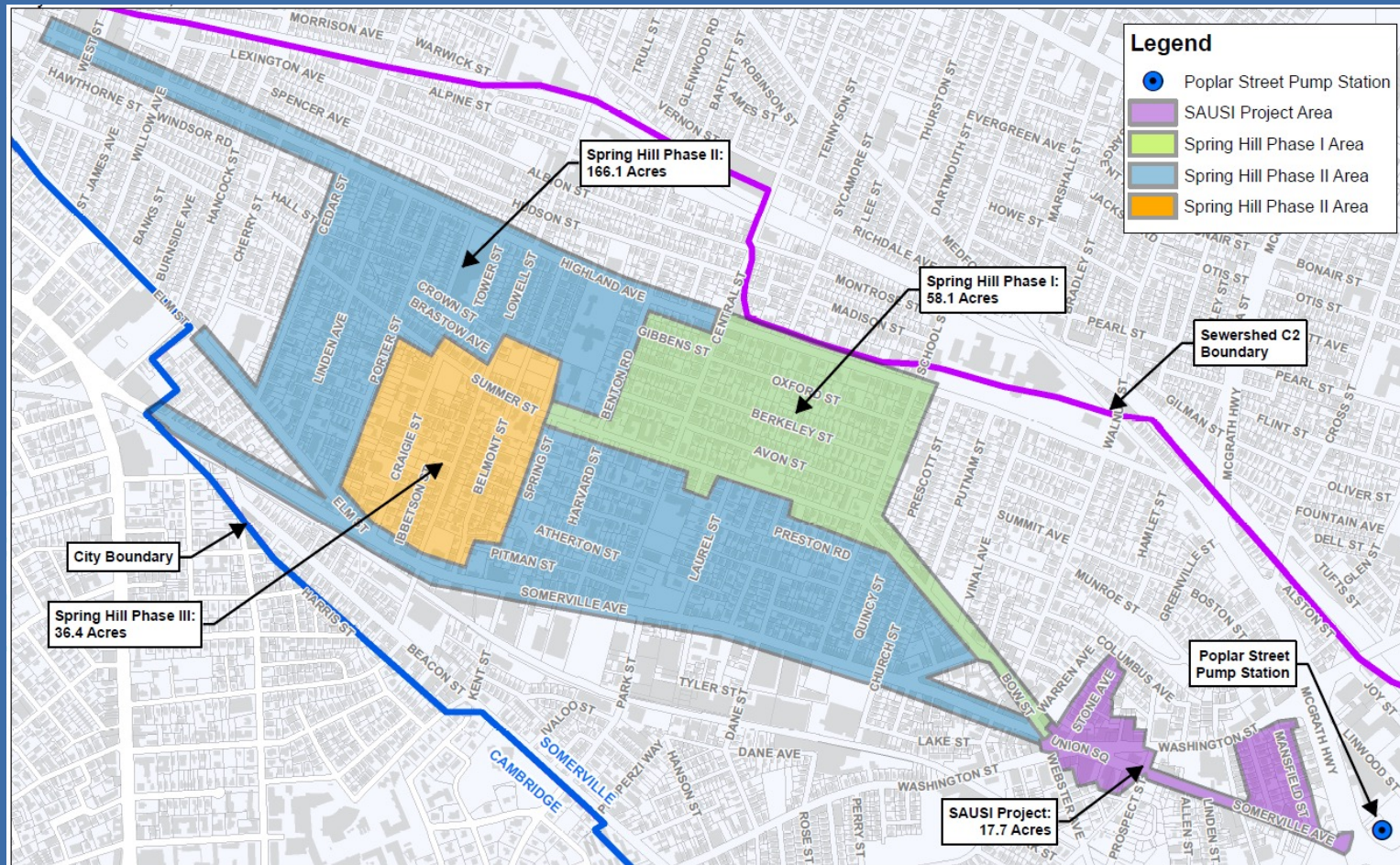
City of Somerville Drainage



Current System Limitations

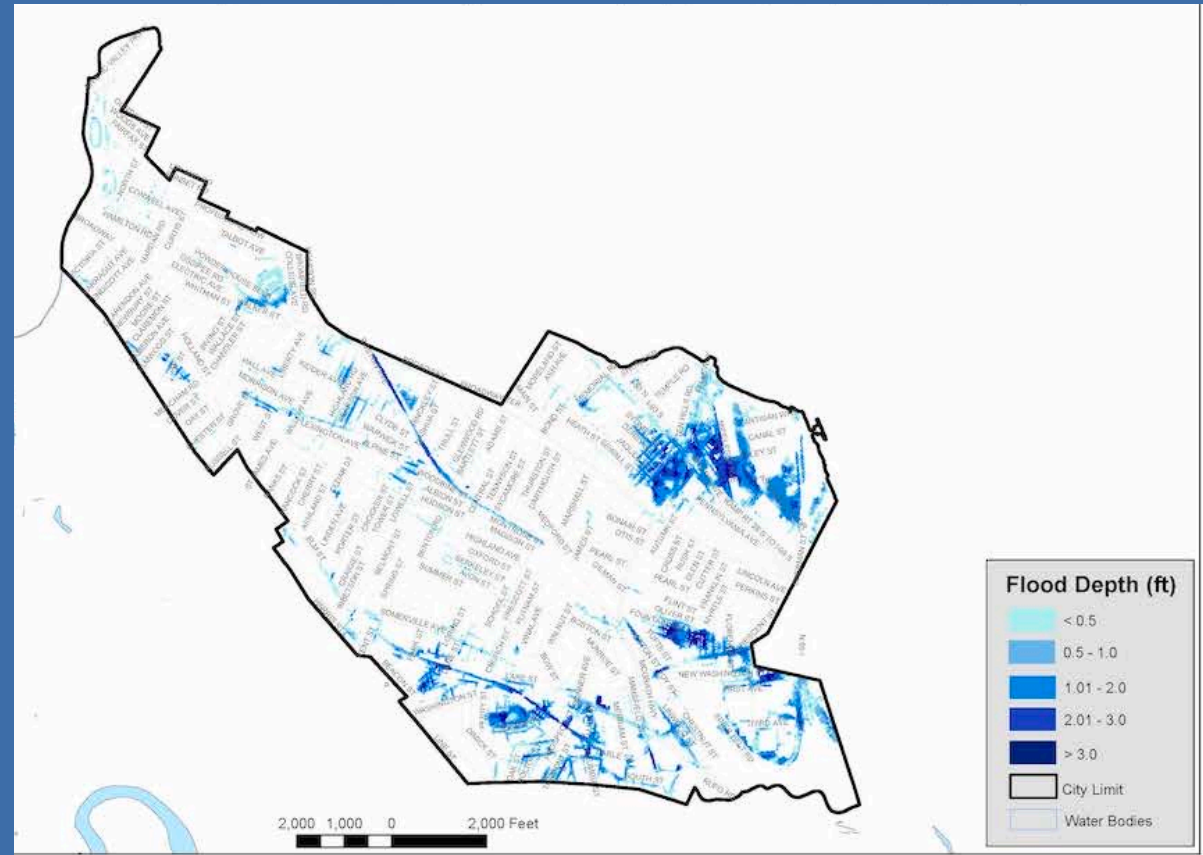
- Some of Somerville's drainage sewersheds are very large and converge at the MWRA outlet point.
- The MWRA system has limited capacity to accept additional flows, which result in CSOs for relief
- The trunk system was designed and built over a century ago with a different set of demands

On-Going Projects: Union Sq. Program



Main Challenges

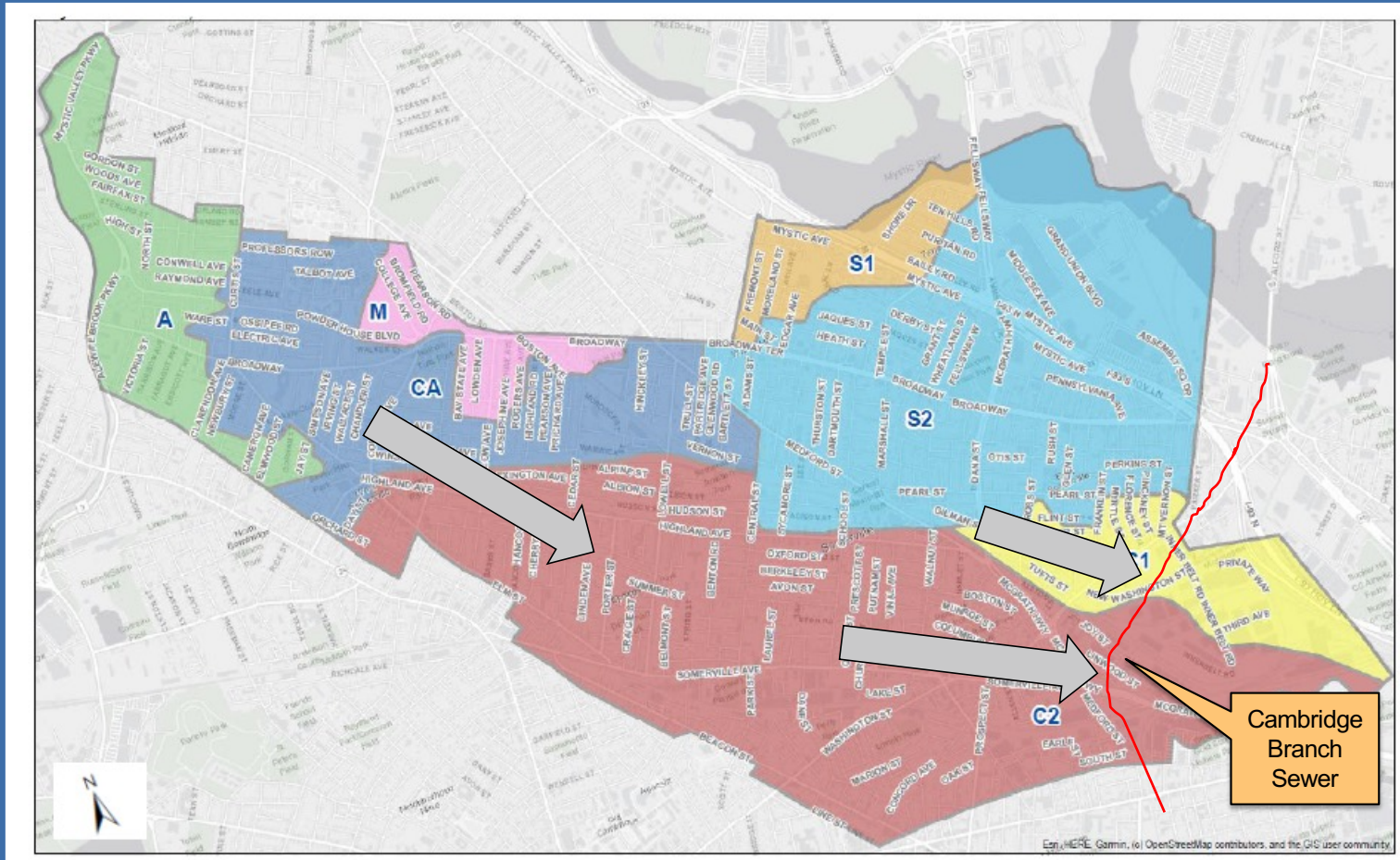
- Vulnerable Neighborhoods
- NPDES Small MS4 General Permit requirements



Systematic Approach

- The City decided to approach these challenges in a systematic way:
 1. Develop a plan on a sewershed by sewershed basis
 2. Understand the main causes of flooding in each sewershed using the City's hydraulic model in a systematic way.
 - Systemic sewershed limitations
 - Trunk system limitations
 - Local conditions
 3. Develop interventions to mitigate flooding in vulnerable areas
 4. Evaluate ways to reduce phosphorus loadings from proposed project areas
 - Structural BMPs (green and gray)
 - Non-structural BMPs (street sweeping, leaf litter collection, catch basin cleaning)

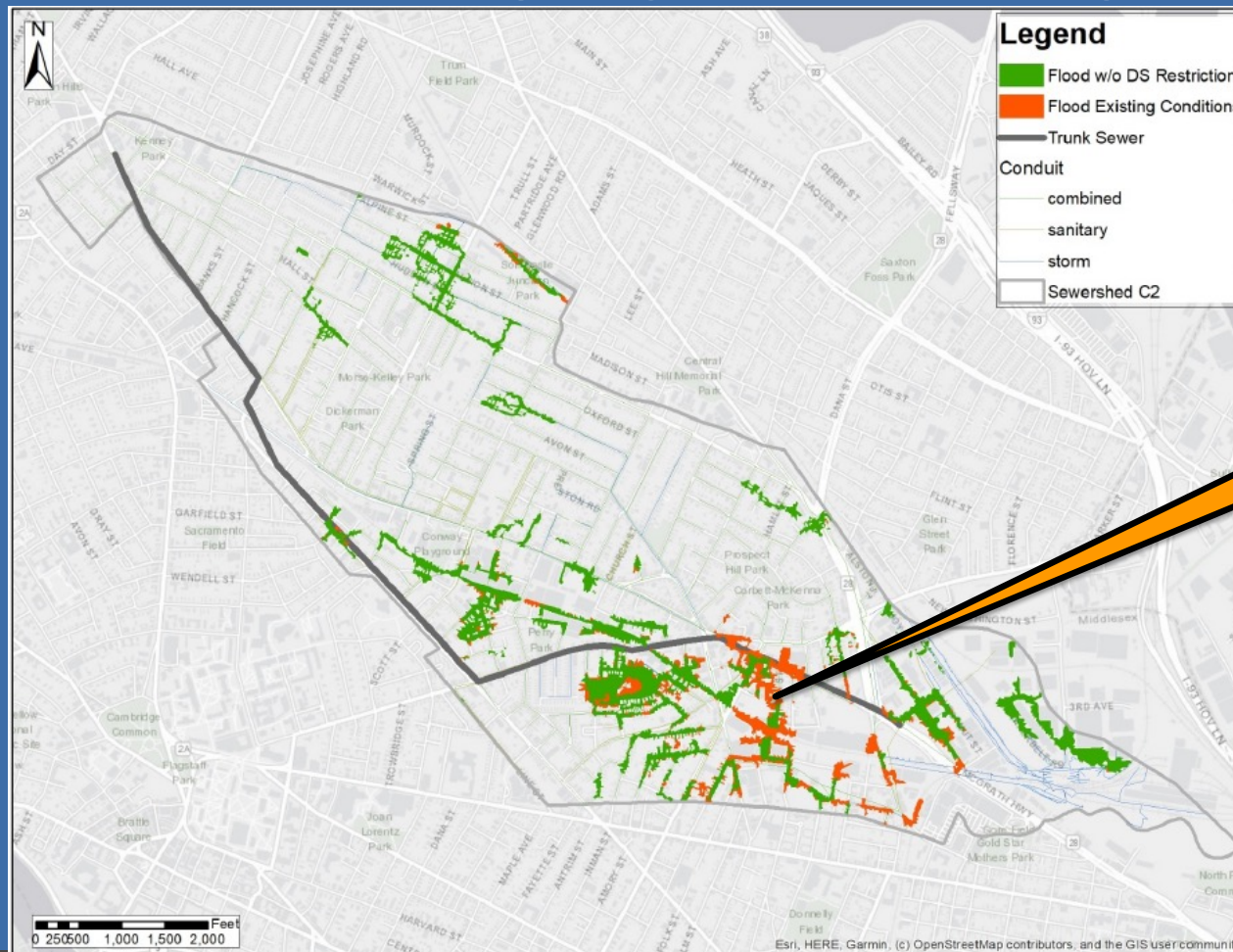
Sewershed C2



Sewershed C2 2019 Flood Complaints

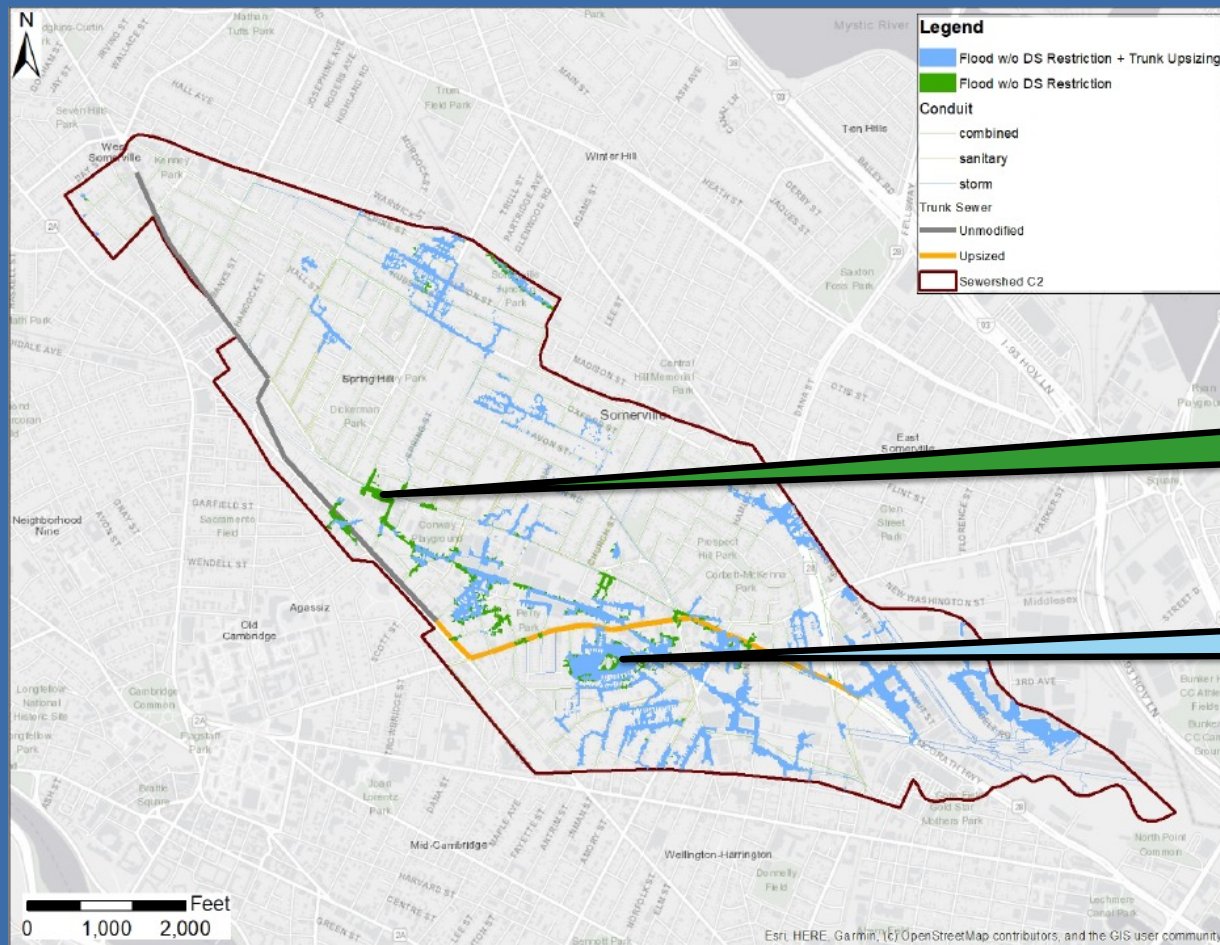


Causes of Flooding – Systemic Flooding



Flooding due to boundary conditions limitations

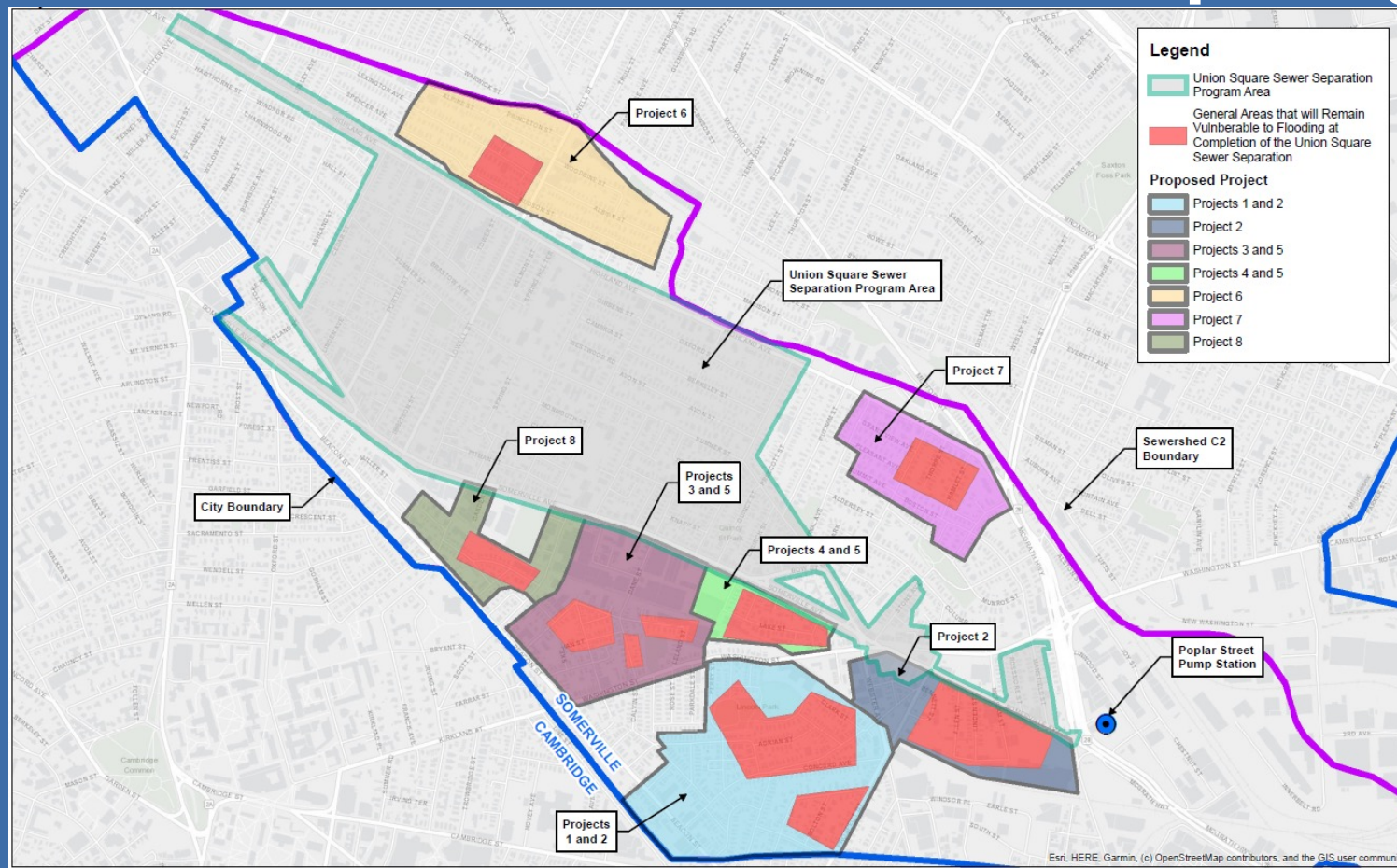
Causes of Flooding – Trunk System Limitations



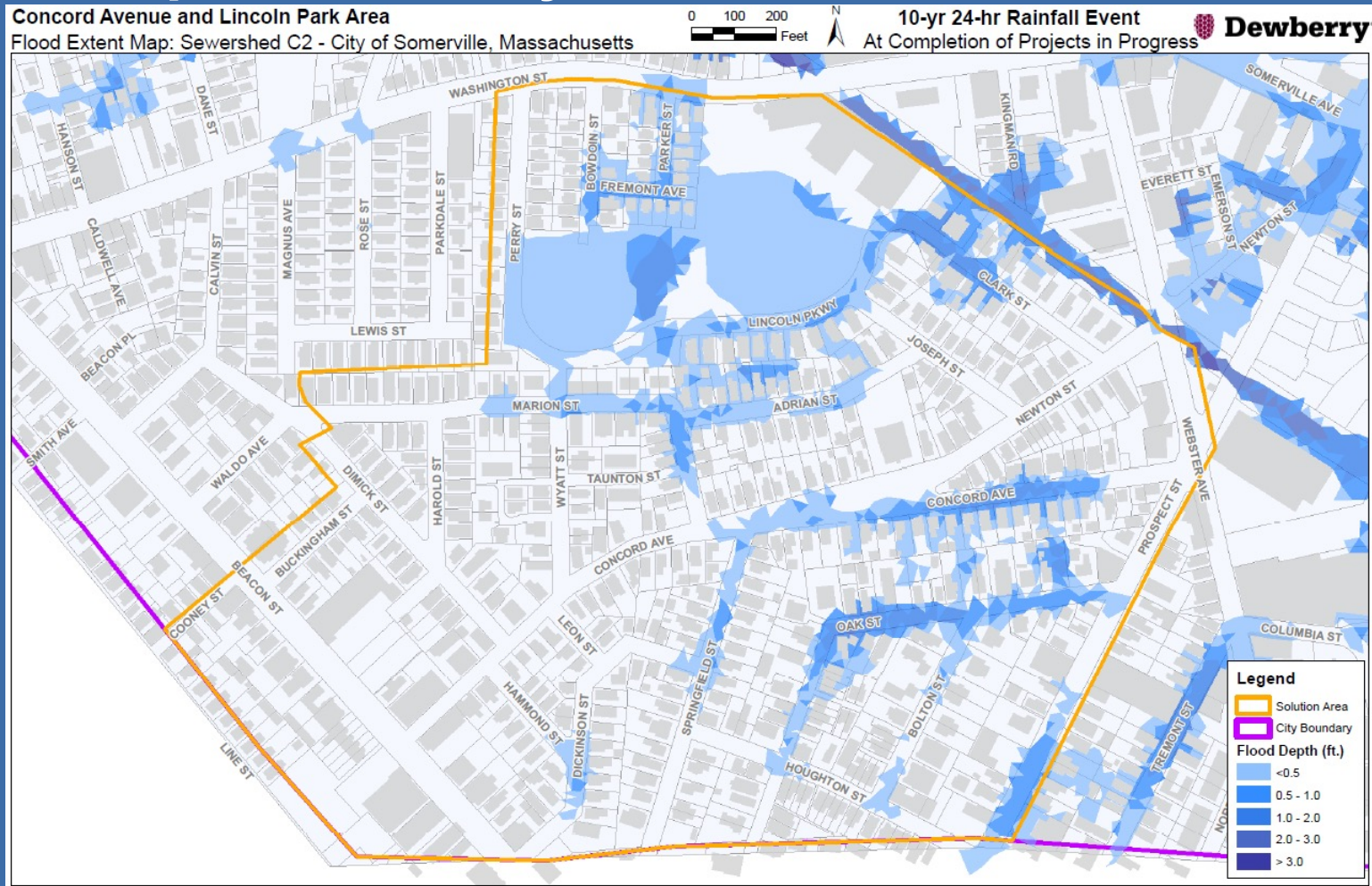
Flooding due to
trunk system
limitations

Local drainage
limitations

Vulnerable Areas after Union Sq. Program



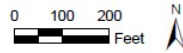
Example Area – 10yr, 24h event



Example Area – 10yr, 30-minute event

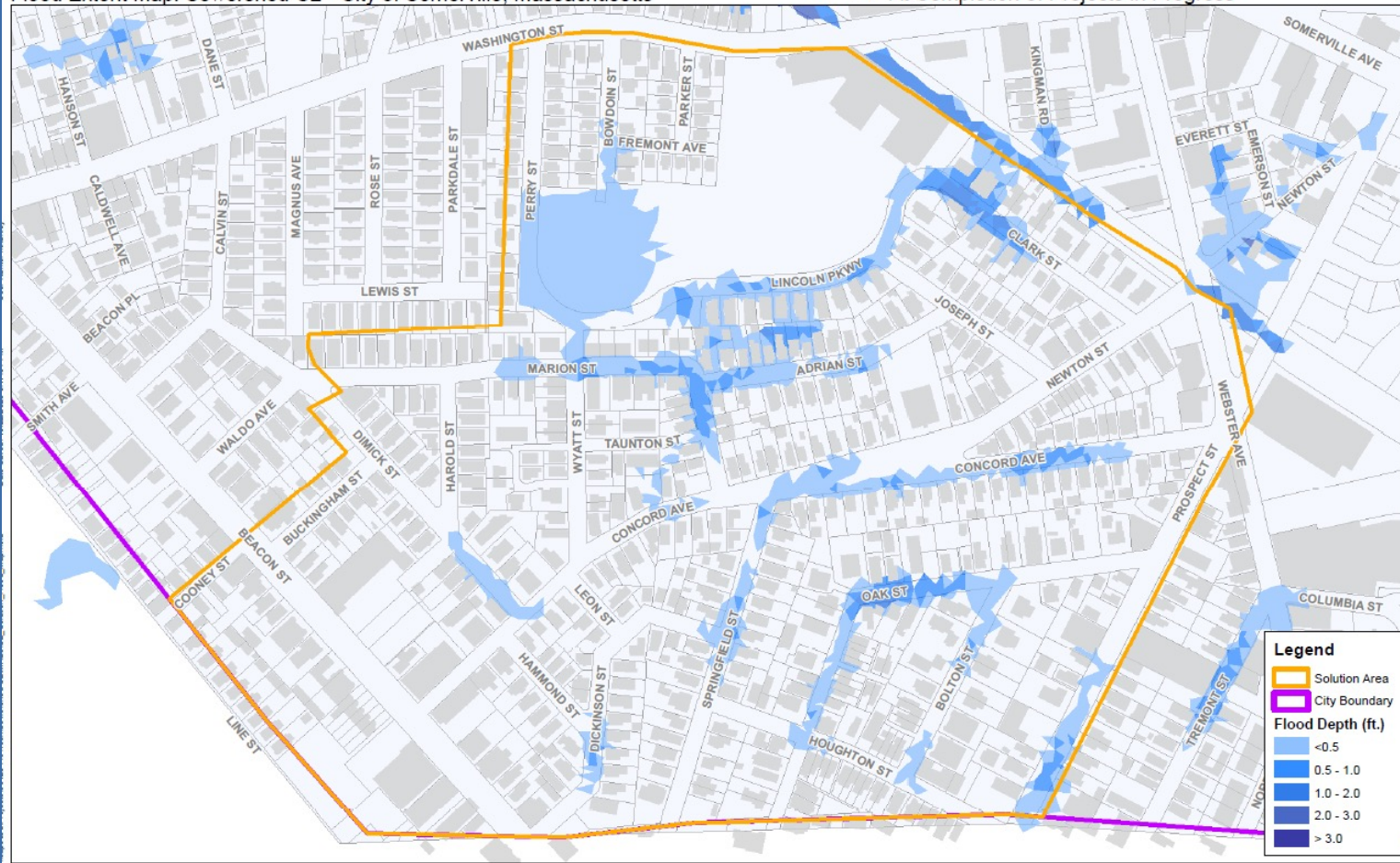
Concord Avenue and Lincoln Park Area

Flood Extent Map: Sewershed C2 - City of Somerville, Massachusetts



10-yr 30-min Rainfall Event

At Completion of Projects in Progress

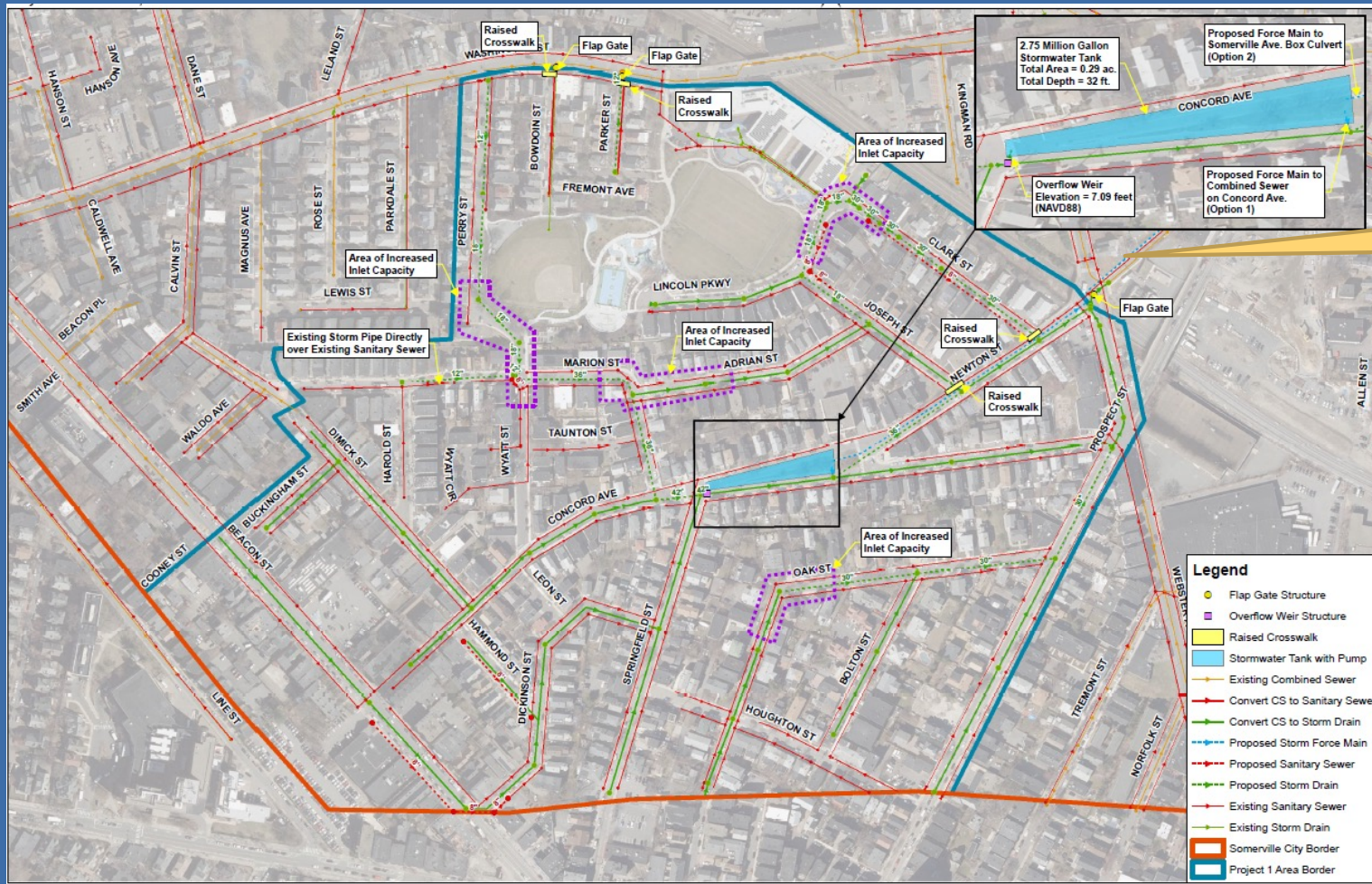


Example of Flood Mitigation Project – Lincoln Park Area



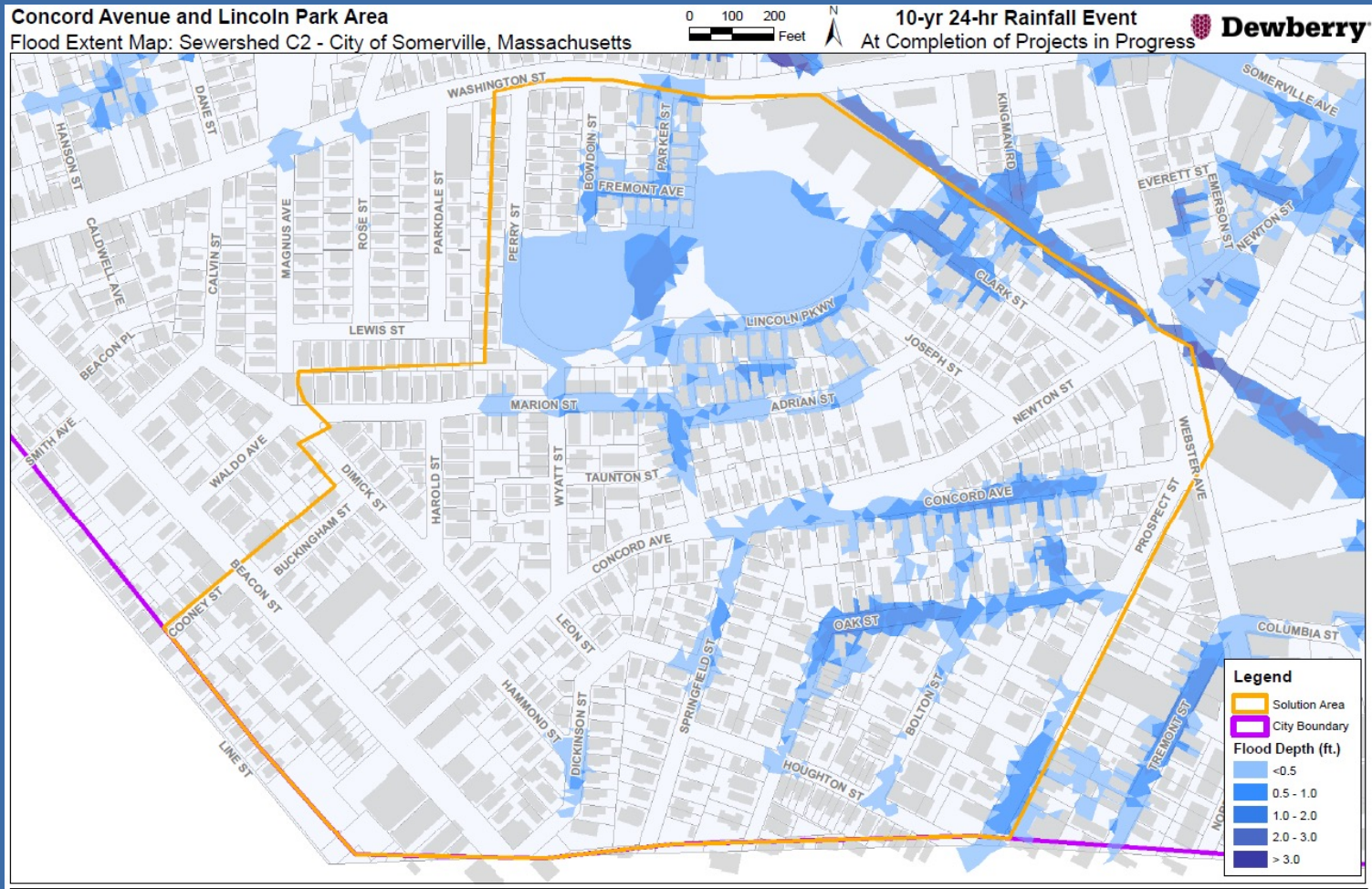
New stormwater
box culvert to
Poplar Street PS

Example of Flood Mitigation Project –Lincoln Park Area



Force main to
stormwater box
culvert

Results with Project Completed – 10yr, 24-hr event



Results with Project Completed – 10yr, 30-min event

Concord Avenue and Lincoln Park Area

Flood Extent Map: Sewershed C2 - City of Somerville, Massachusetts

0 100 200
Feet

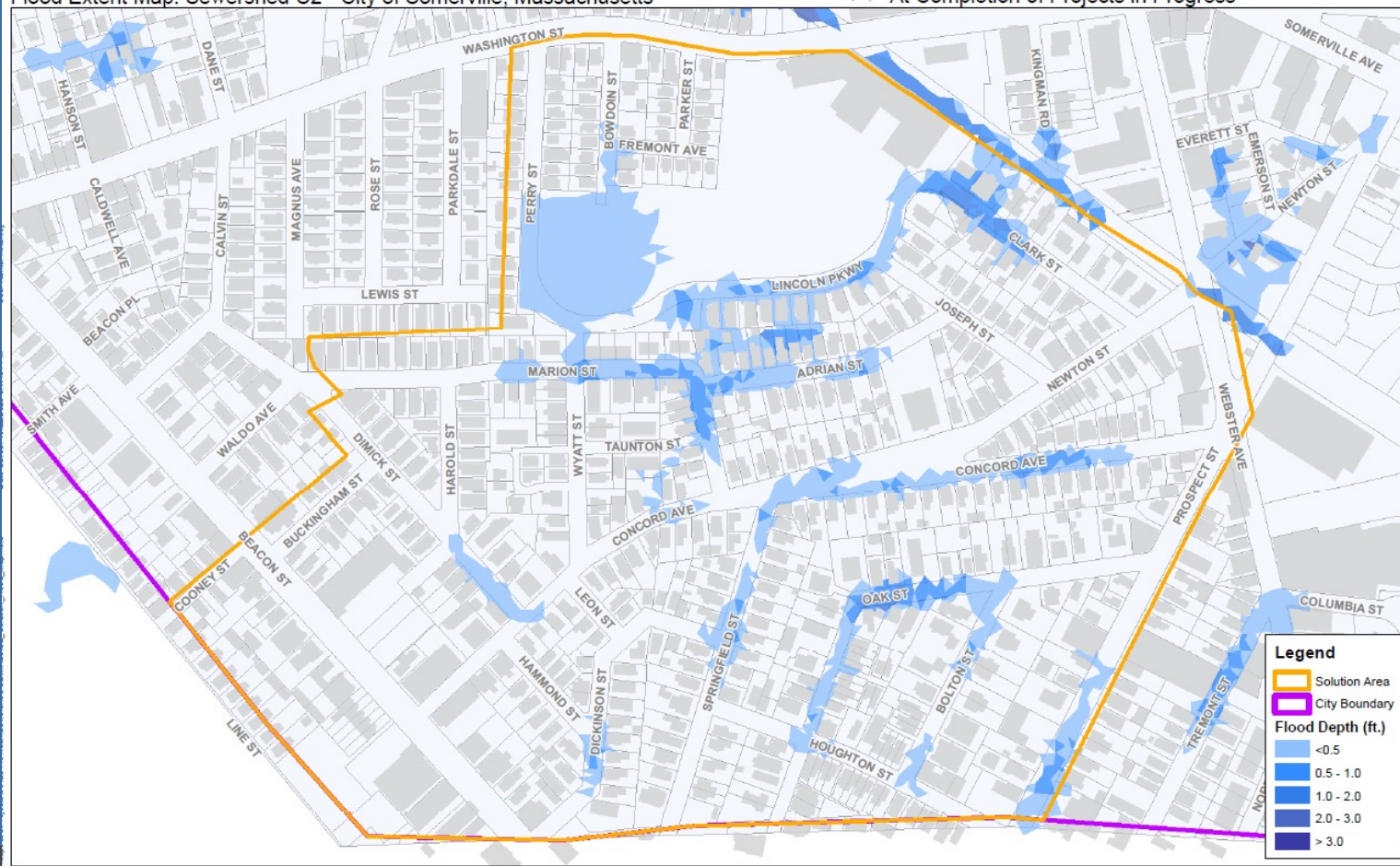


10-yr 30-min Rainfall Event

At Completion of Projects in Progress



Dewberry

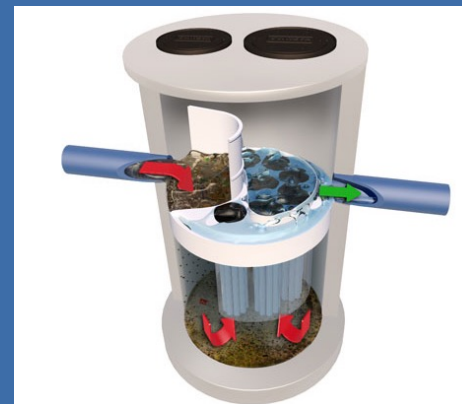


Water Quality

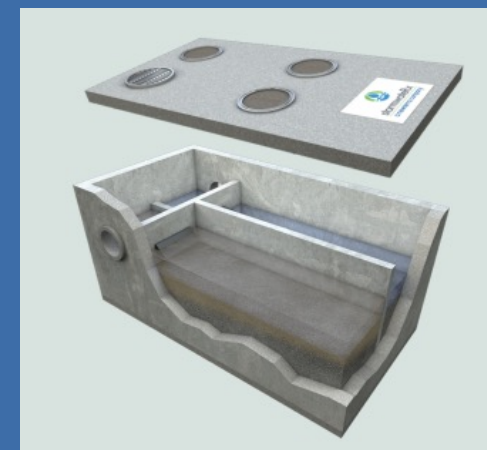
- New Stormwater discharges are subject to phosphorus load limitations (62% reduction at a minimum)
- TP reduction alternatives analyzed
 - Structural BMPs
 - Gray: Filters, engineered media, settling tanks
 - Green: Curb bumpouts, sidewalk planters, rain gardens, sidewalk trenches
 - Non-structural BMPs: Street sweeping, leaf litter collection, catch basin cleaning

Water Quality – Gray-Type BMPs

- These BMPs are more targeted because they only have to deal with stormwater runoff that has entered the pipes and will be discharged to a stormwater main via a pump station.
- A filter system could achieve up to a 60% TP removal if properly sized and maintained (based on manufacturer's data)
- Settling tanks could reduce TP by 50% (based on literature values of how much TP attached to particles).



Source: Imbrium Systems



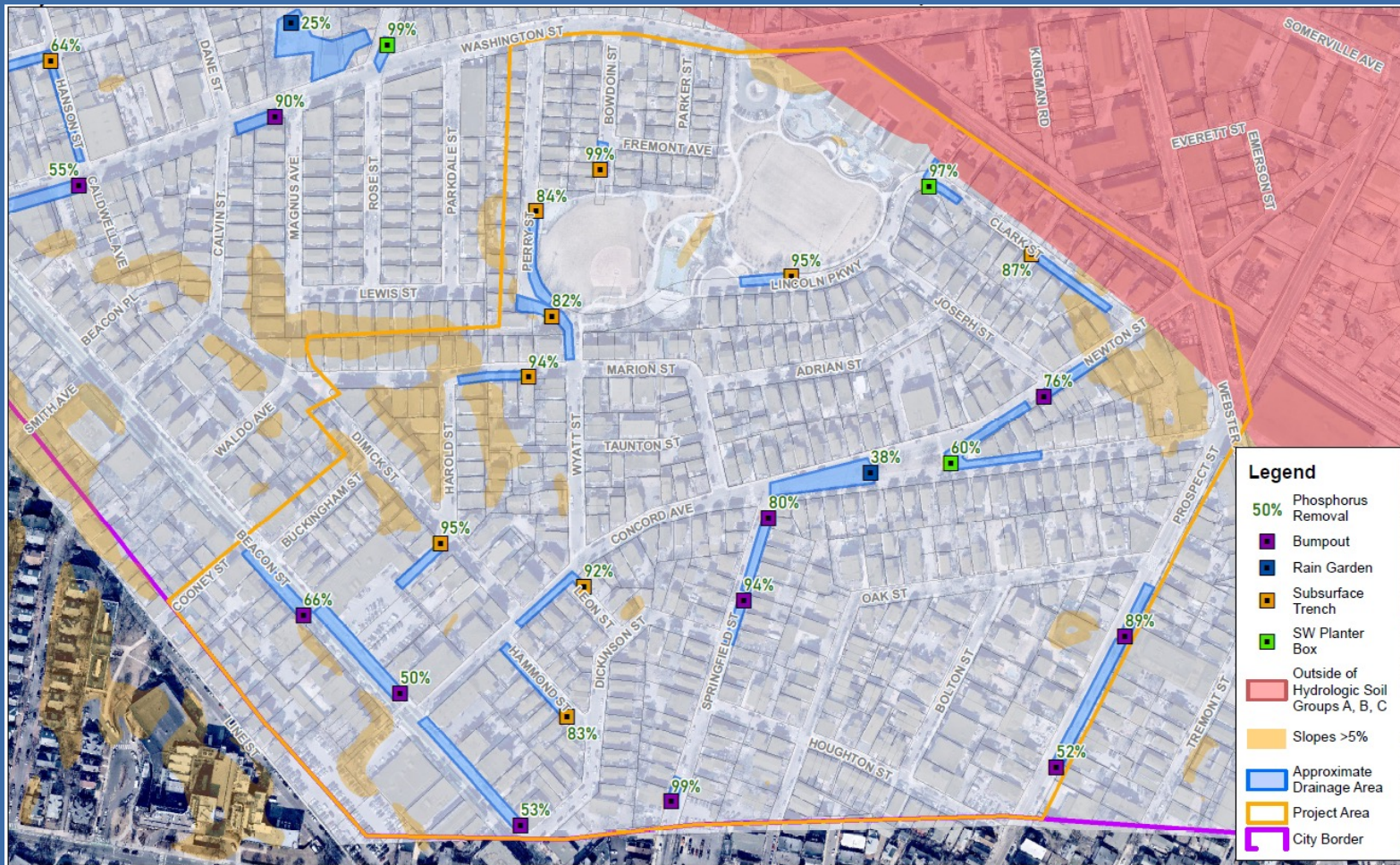
Source: Stormwater Rx

Water Quality – Green BMPs

- These BMPs are less targeted because they deal with surface runoff before it concentrates in pipes so they need to have a high level of coverage to achieve high TP removal values.
 - Identification of feasible public ROW areas
 - Location of GI sites within feasible areas
 - Selection of best GI type at each site
 - Compute TP removal effectiveness at each site



Water Quality – Green Infrastructure



Water Quality – Non-Structural BMPs

BMP TYPE	Anticipated TP credit
Street Cleaning (Apr 1-Dec 1)	Monthly - 0.5%- 1.5%
	Bi-Weekly - 0.7% - 1.65%
	Weekly - 0.9% - 1.8%
Catch Basin Cleaning	Bi-annual - 1.3%
Leaf litter collection program	Yearly - 2.7%
TOTAL MAXIMUM	5.8%

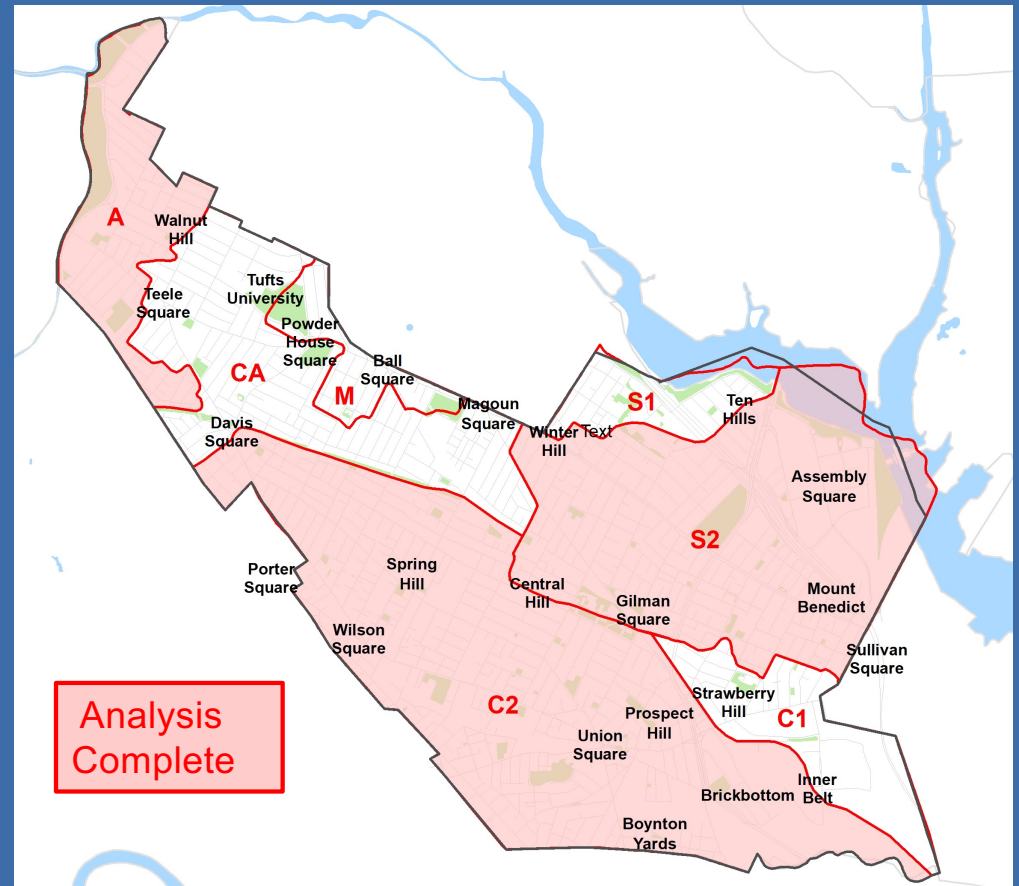


Water Quality – Non-Structural BMPs Potential Scenarios

BMP Type	Anticipated Removal	Capital Cost	O&M Commitment
Non-Structural + GI	10-15%	Medium-High	High
Non-Structural + Filter	~65%	Medium	Medium-High
Non-Structural + Engineered Media	~86%	Medium	High/Very High
Non-Structural + Settling tanks	55%-60%	Low additional cost	Low additional cost

Next Steps

- Complete analysis in remaining sewersheds
- Compile sewershed analysis and recommend city-wide sequencing of interventions
- Develop a timeline for execution



Thank you

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Water Quality – GI Feasibility Analysis

PARAMETER	CRITERION
Somerville ROW	In park, sidewalk or road adjacent to curb
Slope	Less than 5%
Soil Type	Hydrologic soil type A or B, C acceptable
Water, Sewer, Drain	3.5 feet clearance
Buildings	7 feet clearance
Trees	10 feet clearance
Parking Meters	5 feet clearance
Sidewalk	At least 4 feet wide
Railroad	25 feet clearance
Driveway/curb cut	5-foot clearance
Crosswalks/sidewalk ramps	5-foot clearance
Underground utilities (other than sewer and drain)	3.5-foot clearance
Groundwater	At least 7 feet below ground

Water Quality – Green-Type BMPs Selection

GSI TYPE	SITING PARAMETERS
Rain Garden	In a public space (park or existing green space) adjacent to impervious area
Planter Box	Sidewalk width: At least 9 feet
Curb Bumpout	• Parking Lane present (restrict width to the width of parking spot) • 2-way streets with at least 26 ft combined width or • One way with 16 feet of pavement clearance for Emergency Vehicles
Subsurface Trench	Available footprint and drainage, but not enough space for either bumpout or planter box