



Needle in a Haystack? Found it!

How to Locate GSI in Dense Urban Environments

NYWEA-NEWEA Joint Spring Technical Conference and Exhibition

Presented by Peter Garvey, PE and Michael Hanley, EIT

Friday, June 9, 2023 - 9:30 am

Agenda

- Introduction and Background Information
- Challenges of Green Stormwater Infrastructure (GSI) in Dense Urban Areas
- Criteria for GSI Siting
- Proactive vs Reactive Approach
- Automating the Process of GSI Candidate Siting
- Innovations and Successes of GSI Siting Tool
- Potential Future Improvements and Applications
- Summary, Conclusions, Q&A

Key Team Members



Peter Garvey, PE
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GIS Developer

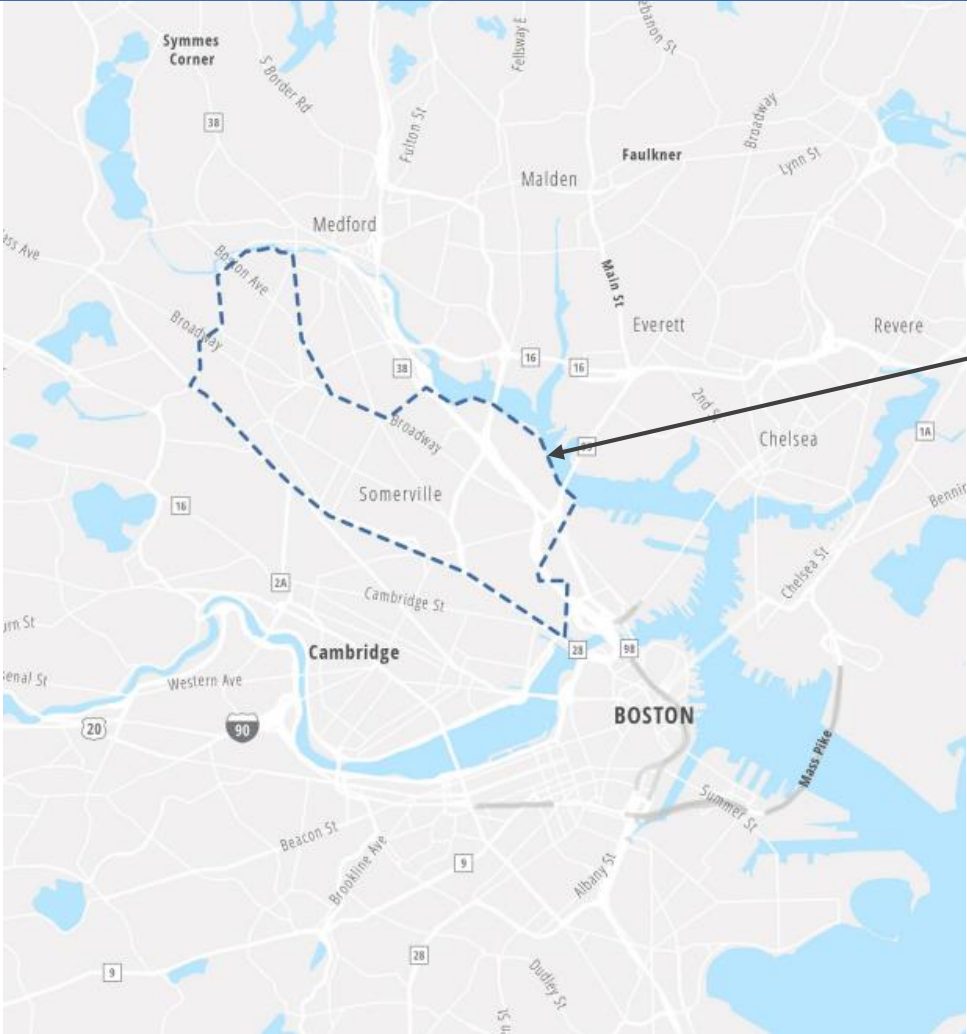


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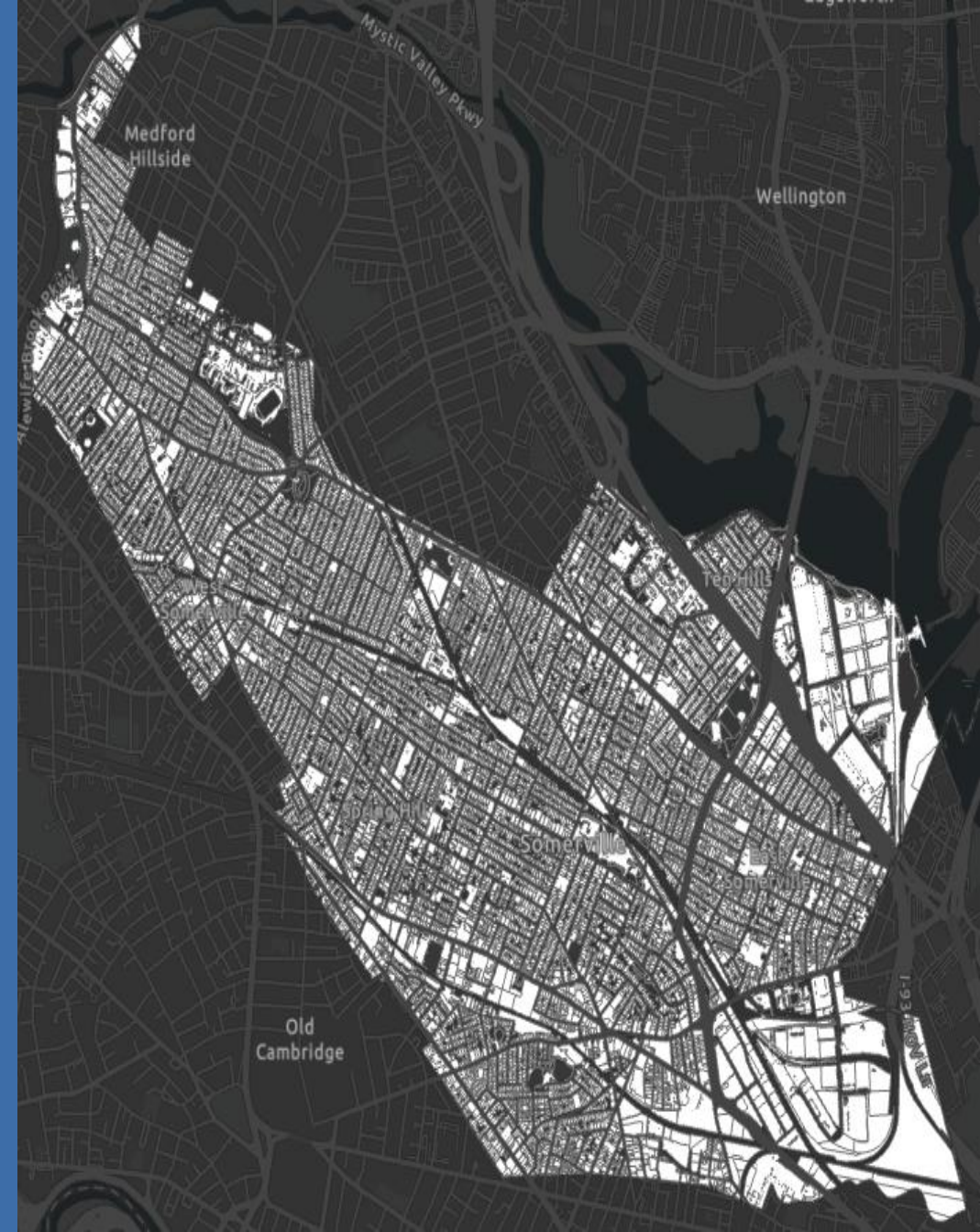
Somerville, MA



Somerville, MA

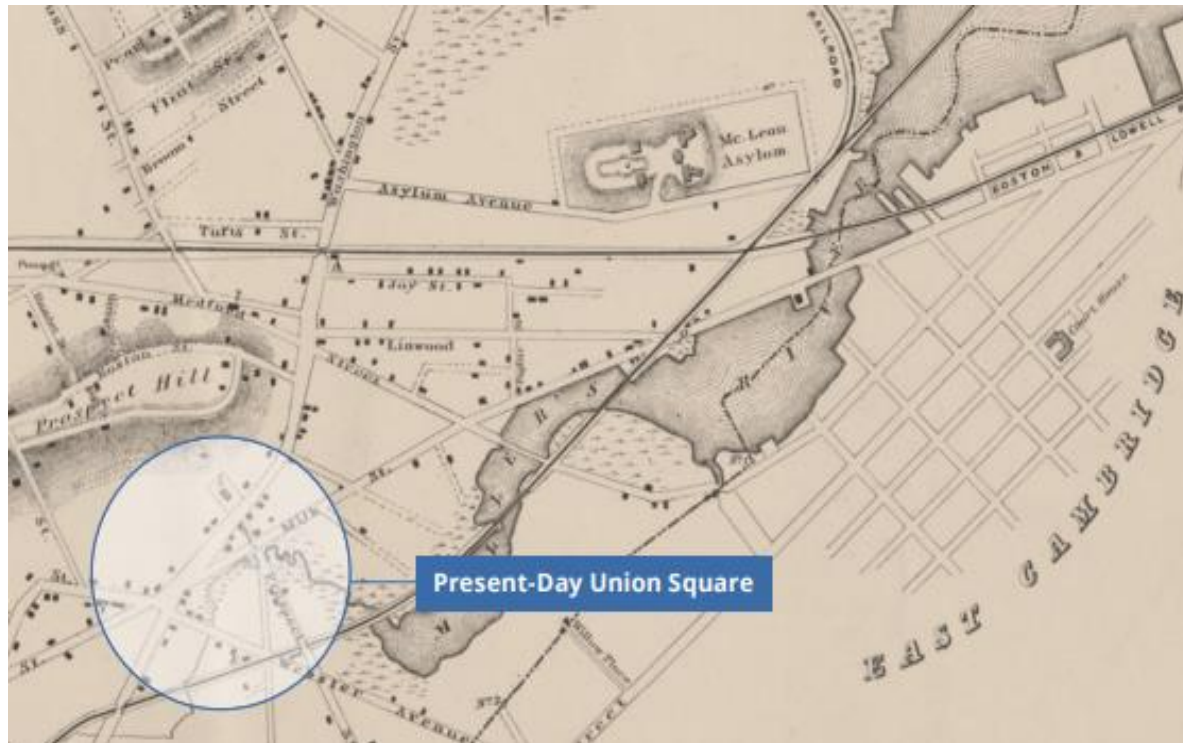
City of Somerville, MA

- Most Densely Populated City in New England
- Rapid Development = Rapid Increase in Imperviousness
- Green Line Extension
- Significant Transit Footprint
- Decreased Absorption
- Increased Flood Occurrence
- Administrative Consent Order

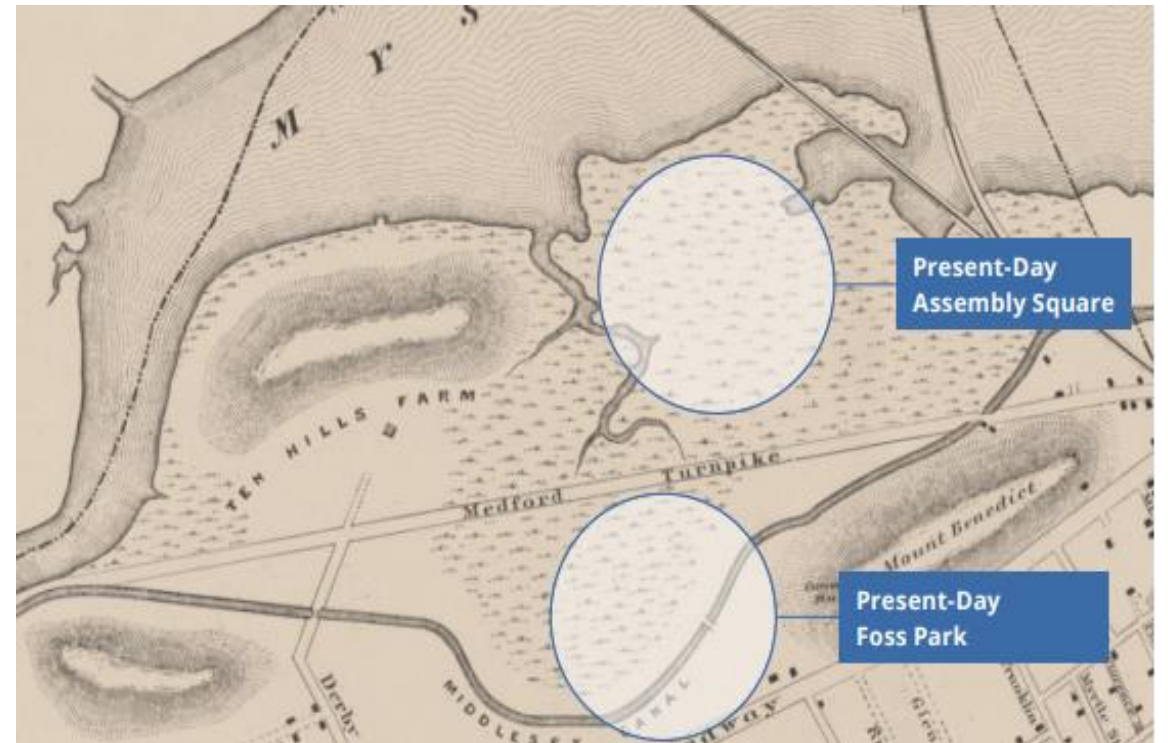


City of Somerville, MA

- Topography with hills and valleys
- History of filling rivers, wetlands, and marsh areas



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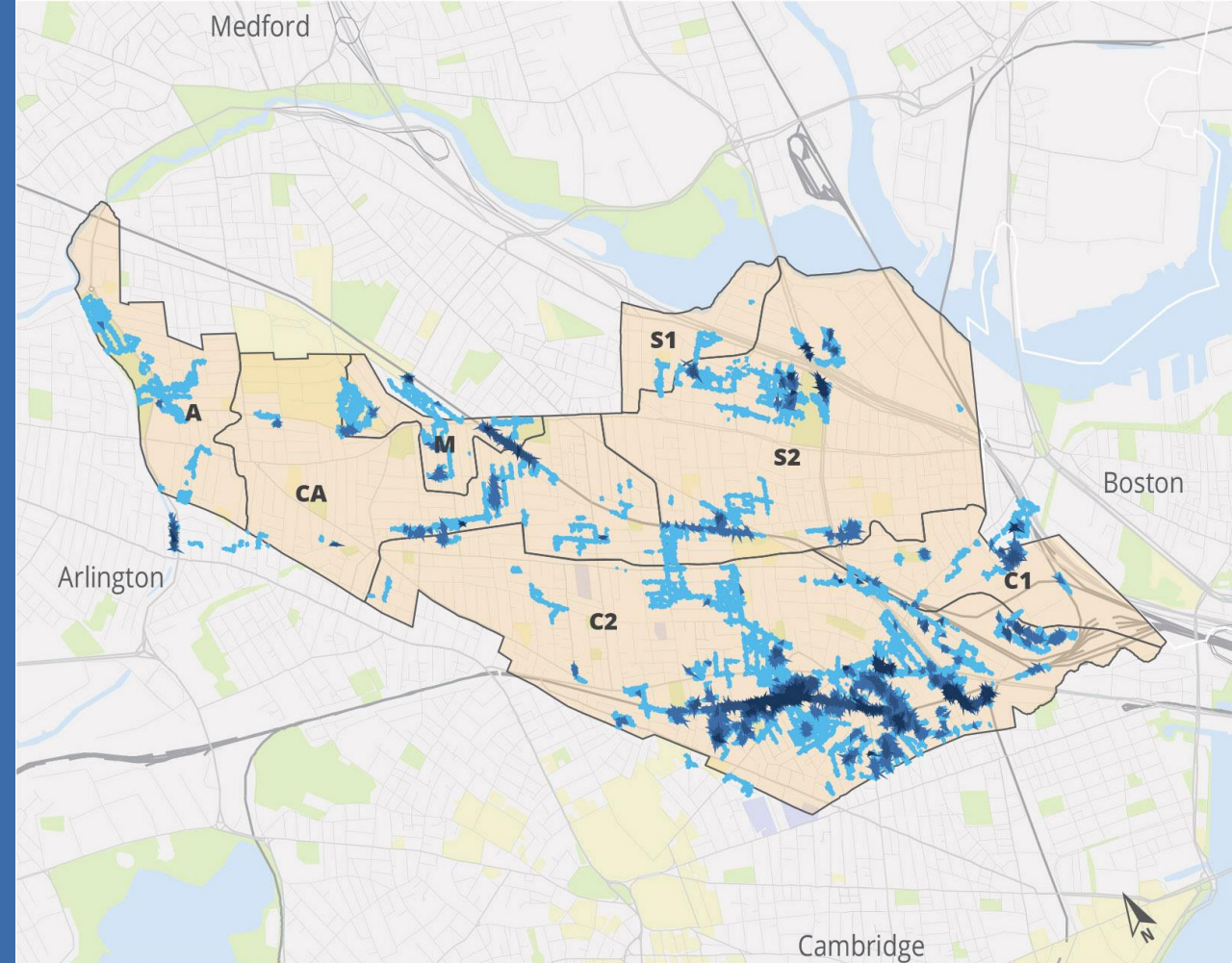


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Flooding in Somerville, MA

Development of a Citywide Drainage and Water Quality Master Plan:

- Options to reduce CSOs
- Mitigate localized flooding
- Evaluate water quality
- One option...GSI



Flood Depth (feet) ■ <1.0 ■ 1.0-2.0 ■ 2.0-3.0 ■ >3.0

What is GSI? The Basics

- **Runoff from stormwater/rain events can cause flooding and pollution**
- **Gray infrastructure** – pipes, catch basins etc
- **Green infrastructure** – filters and absorbs stormwater where it falls
 - *The range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface water*
 - *Examples - Rain Gardens, planter boxes, green parking, and others*

Challenges of GSI in Dense Urban Areas

- **Distributed nature of GSI**
- **Site-specific challenges and variables**
 - Must be located away from utilities
 - Required soil parameters
 - Required ground sloping
 - Required drainage volumes
 - ...and many more



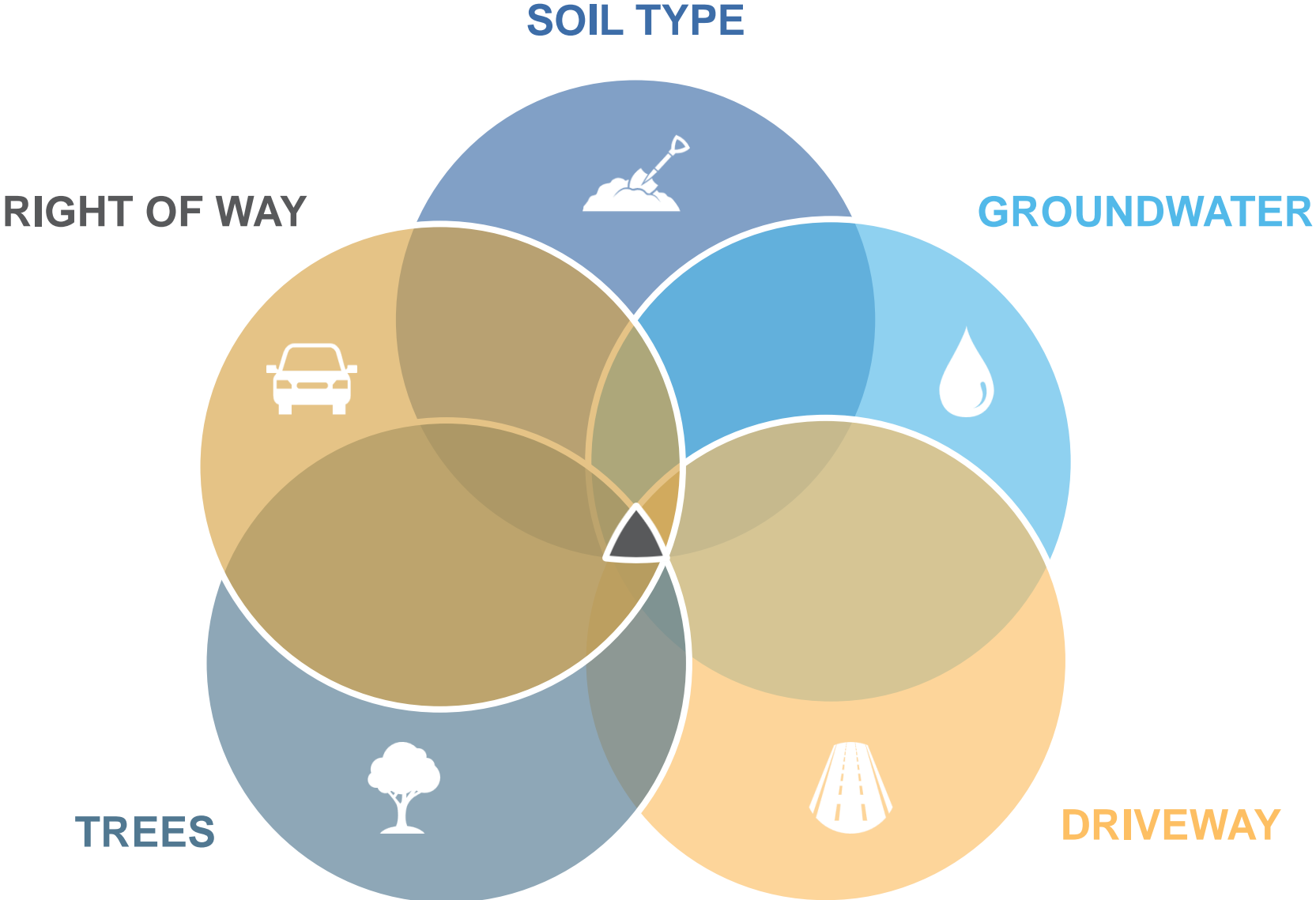
Criteria for GSI Siting

PARAMETER	CRITERION	SOURCE
Somerville ROW	In park, sidewalk or road adjacent to curb	Somerville GIS
Slope	Less than 5%	NOAA LiDAR
Soil Type	Hydrologic soil type A or B, C acceptable	NRCS Web Soil Survey Tool
Water, Sewer, Drain	3.5 feet clearance	Somerville GIS
Buildings	7 feet clearance	Somerville GIS
Trees	10 feet clearance	Somerville GIS
Parking Meters	5 feet clearance	Somerville GIS
Sidewalk	At least 4 feet wide	Somerville GIS
Railroad	25 feet clearance	MassGIS
Driveway/curb cut	5-foot clearance	GIS not available, orthophoto imagery used where possible
Crosswalks/sidewalk ramps	5-foot clearance	GIS not available, orthophoto imagery used where possible
Underground utilities (other than sewer and drain)	3.5-foot clearance	GIS not available
Groundwater	At least 7 feet below ground	GIS not available

GIS 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	<ul style="list-style-type: none"> • Parking Lane present (restrict width to the width of parking spot) • 2-way streets with at least 26 ft combined width • 16 feet of pavement clearance for Emergency Vehicles
Subsurface Trench	Available footprint and drainage, but not enough space for either bumpout or planter box

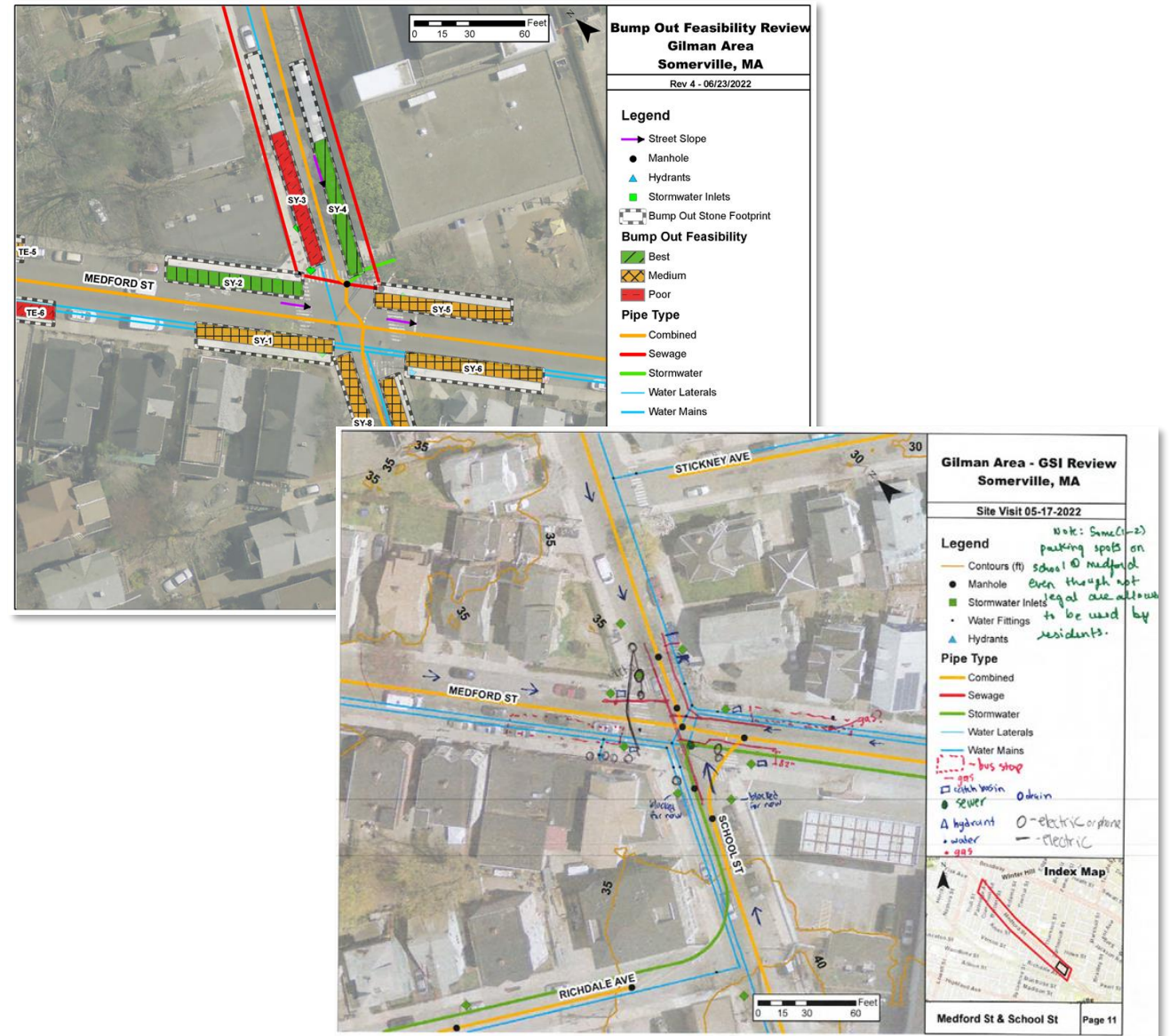


GSI Siting – Venn Diagram Approach

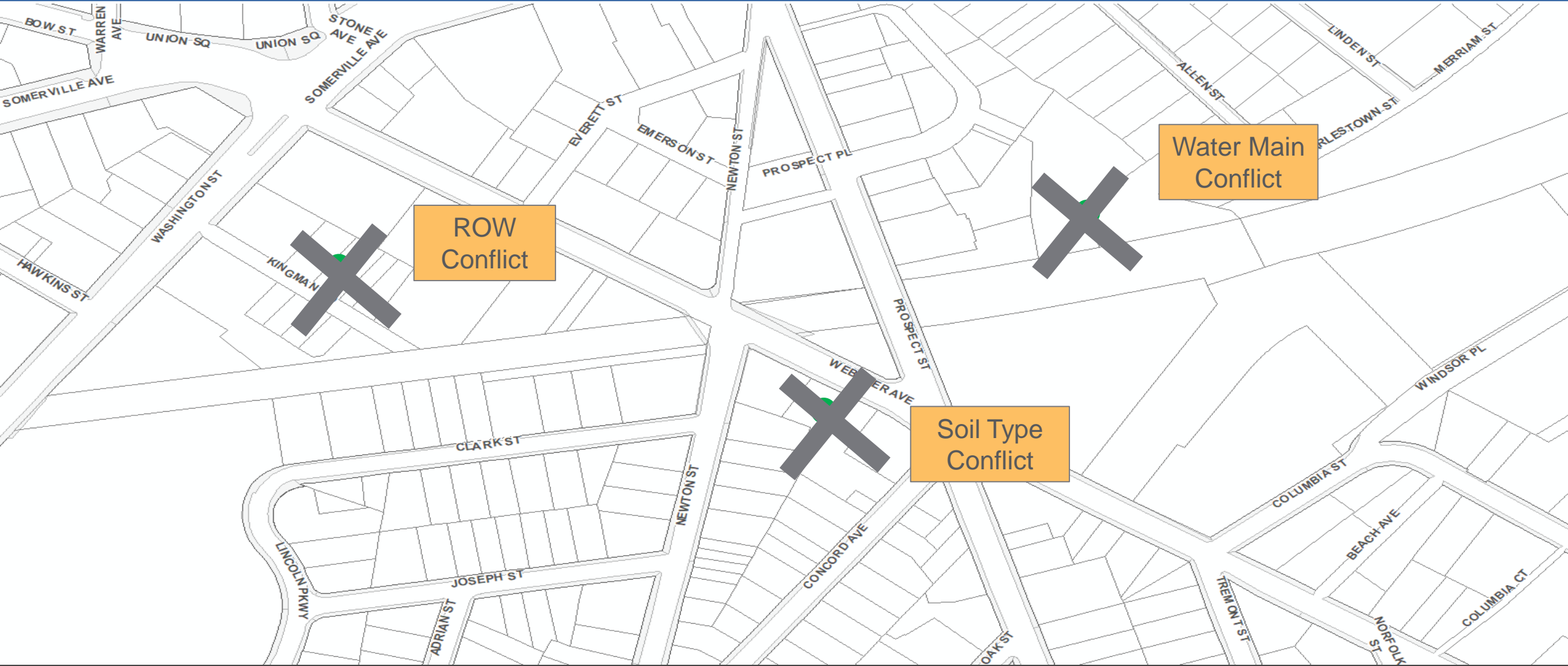


Traditional GSI Siting Approach

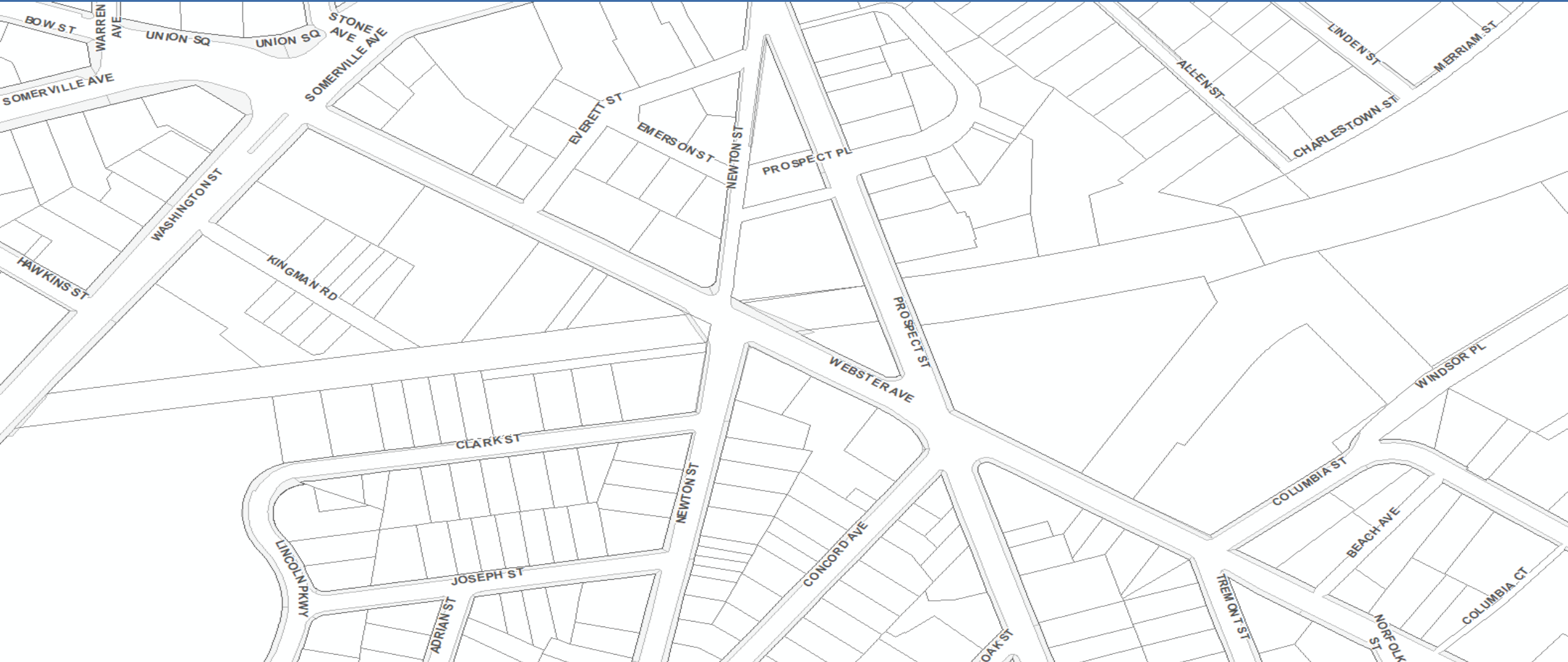
- Field inspections and site-by-site analyses
- Finding candidates in-person, then checking that they meet all the criteria
- Effective approach, but also costly and time-consuming



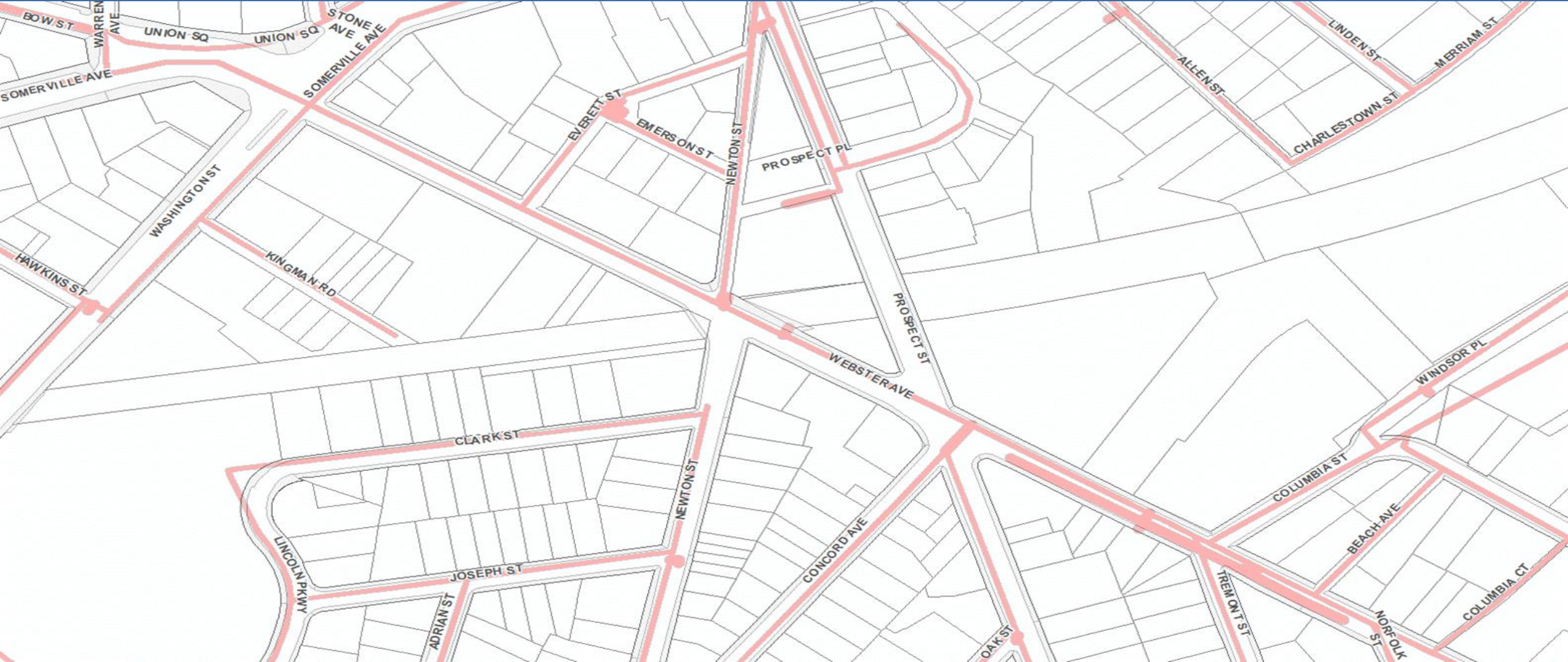
Reactive Approach



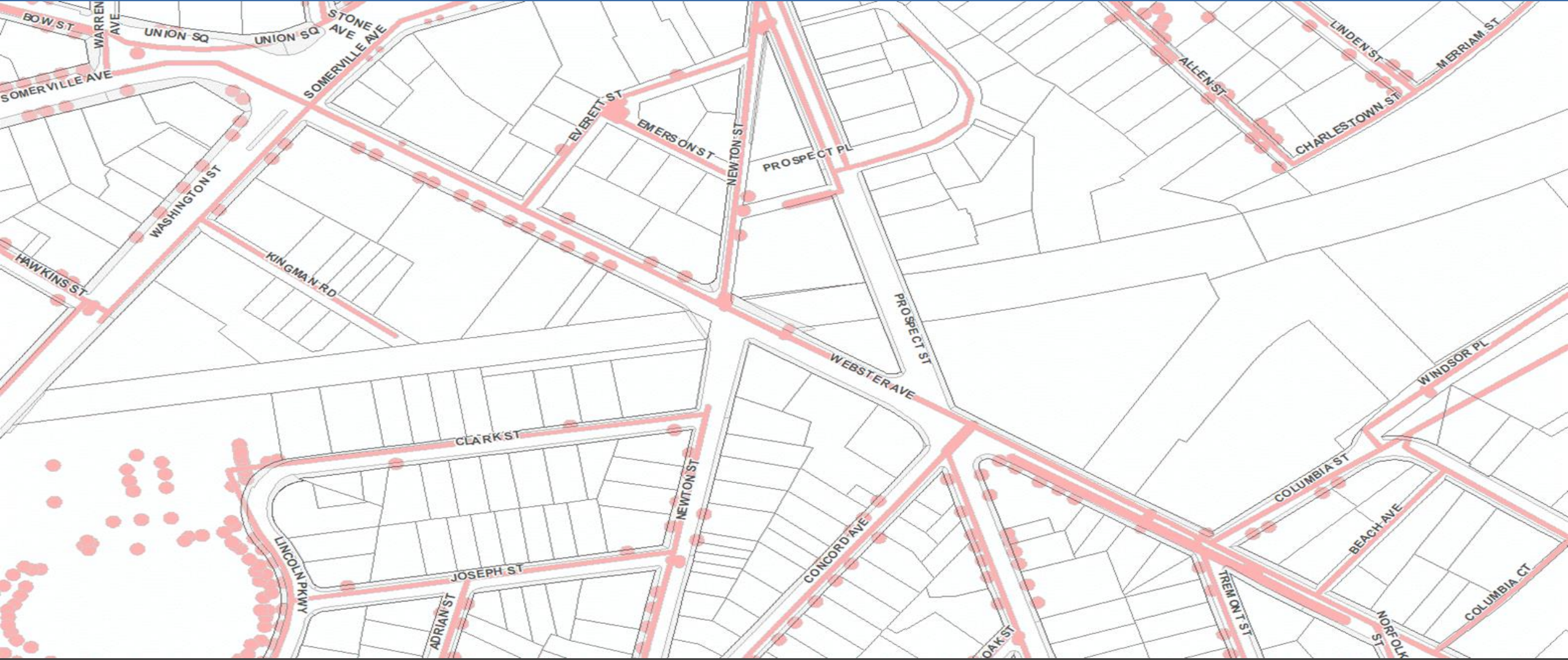
Proactive Approach for GSI Siting



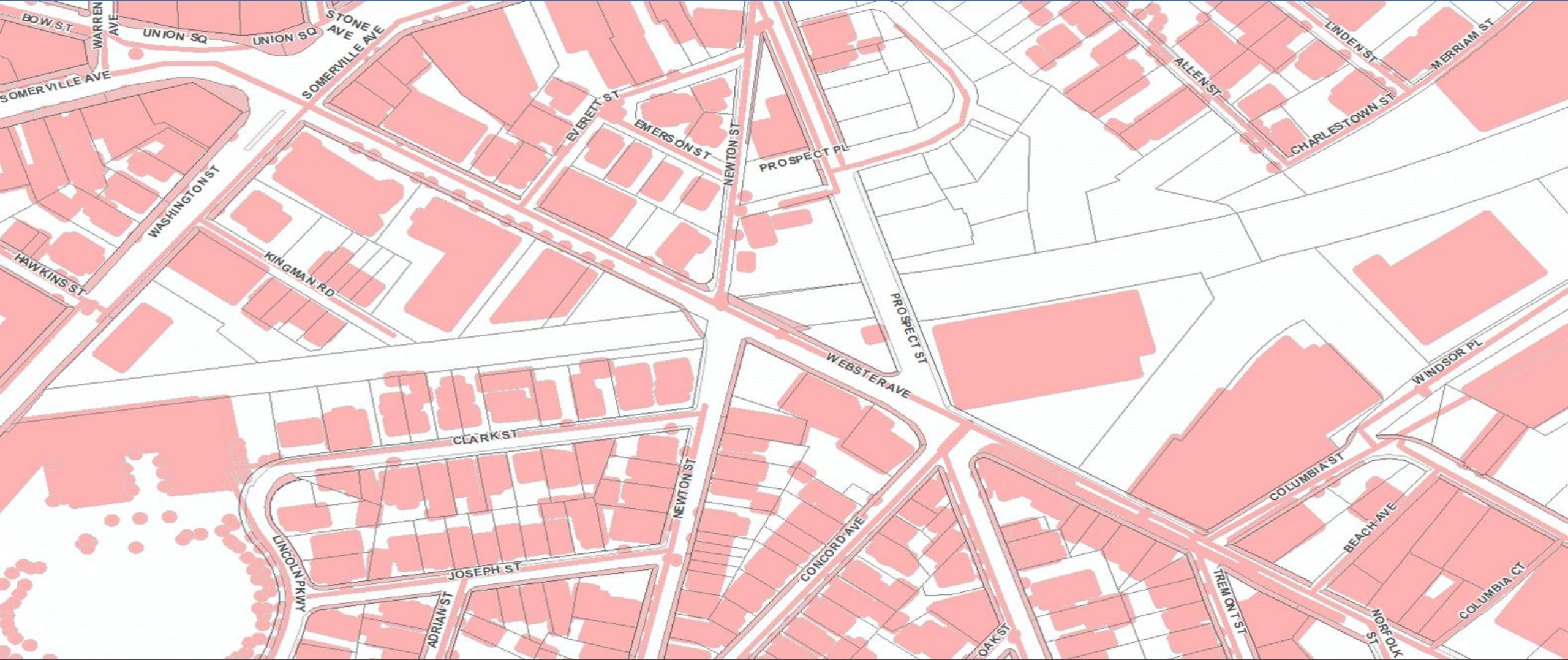
Criteria for GSI Siting



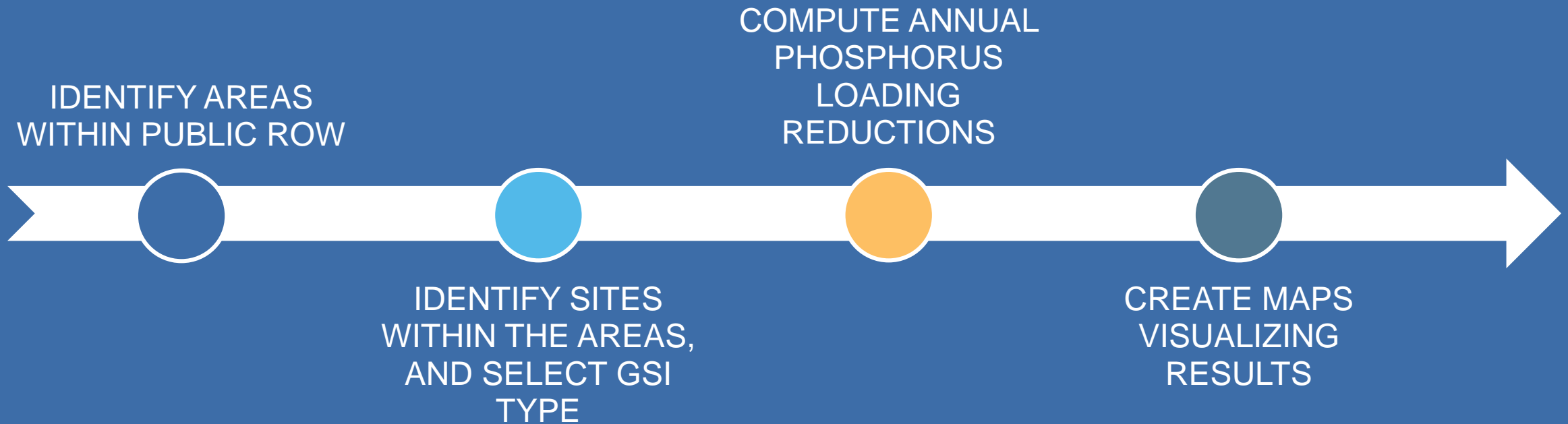
Criteria for GSI Siting



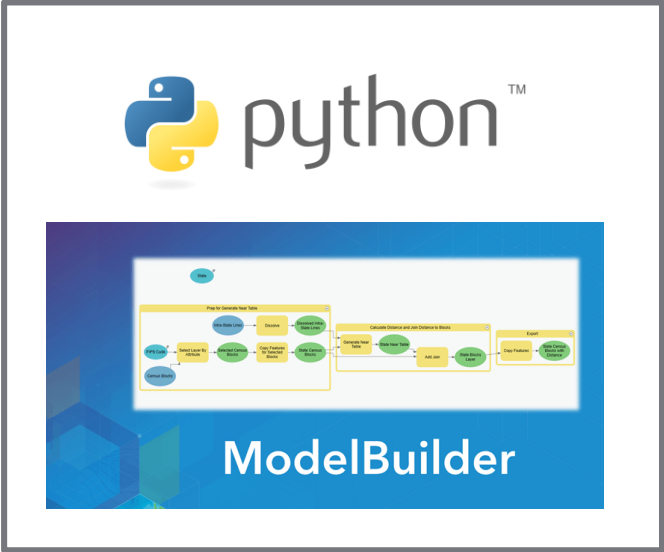
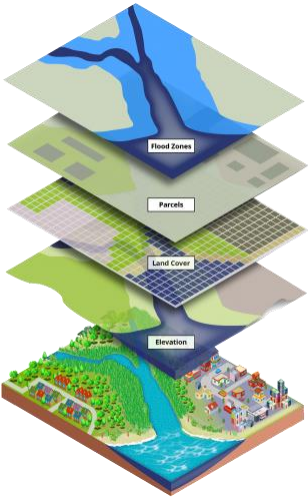
Criteria for GSI Siting



New Steps for GSI Candidate Siting

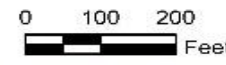


Automating the Process



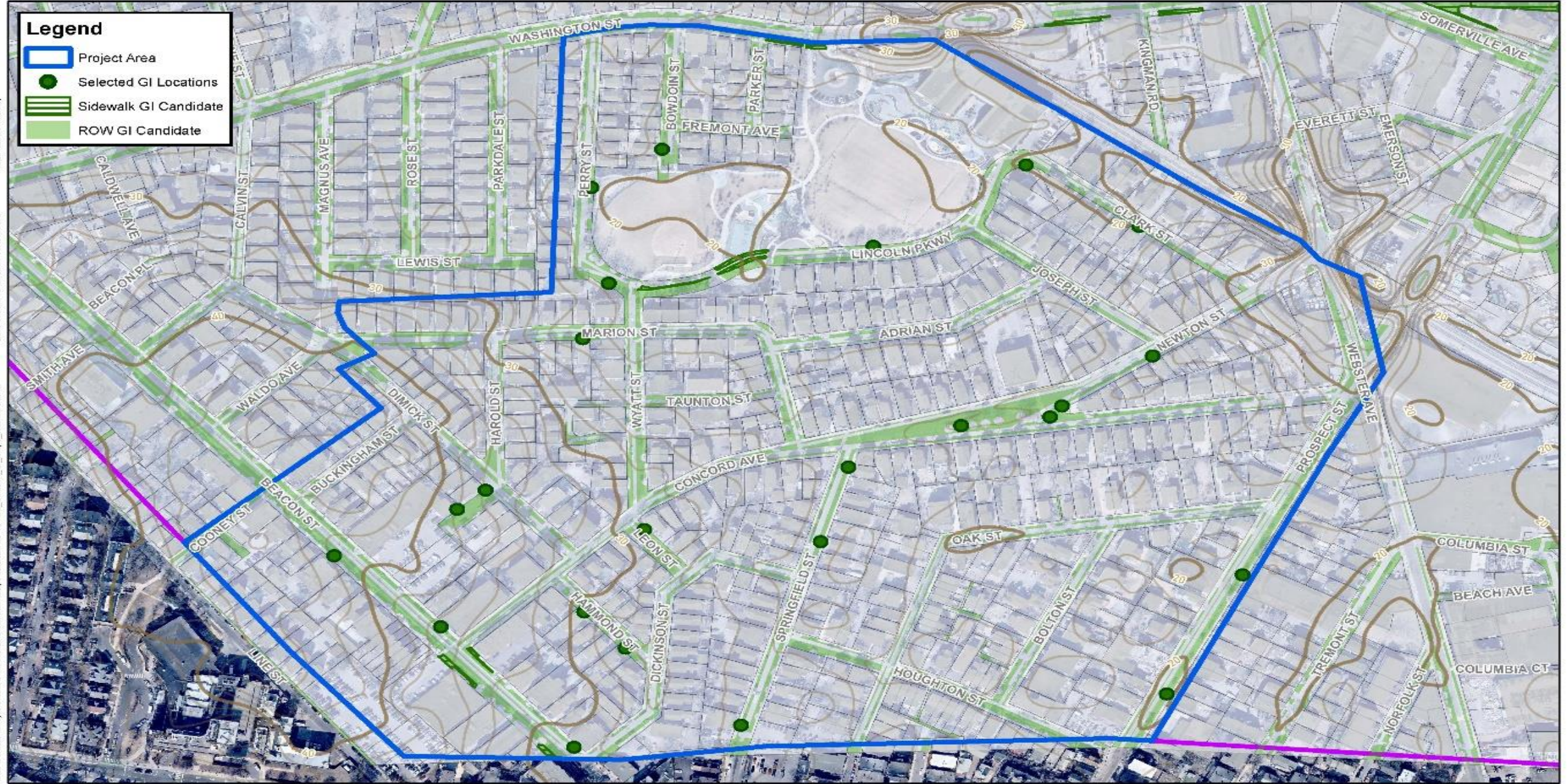
Concord Avenue and Lincoln Park Area

Sewershed C2: Green Infrastructure Suitable Areas and Selected Sites



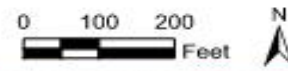
Legend

- Project Area
- Selected GI Locations
- Sidewalk GI Candidate
- ROW GI Candidate



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Concord Avenue and Lincoln Park Area
Project 1: Green Infrastructure Candidate Locations



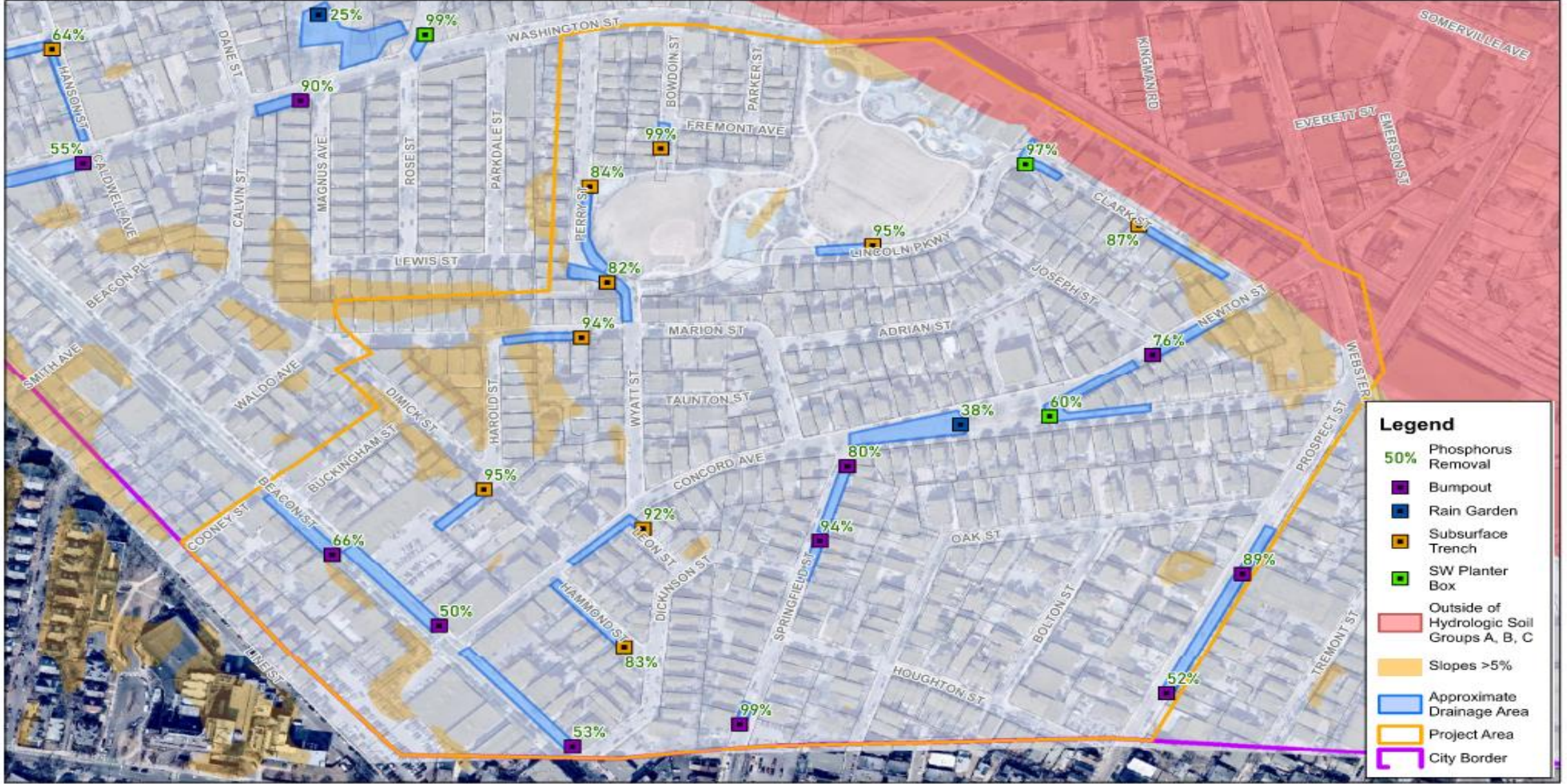
Sewershed C2,
City of Somerville, Massachusetts



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Innovations of our GSI Candidate Siting Tool

- Can **quickly** perform the necessary analysis in a user-defined area, or municipality
- Easily **customizable** based on siting criteria and available spatial data
- Greatly **simplifies** computation of annual phosphorus loading reductions at candidate GSI sites
- **Facilitates** of public outreach maps showing GSI candidate siting locations

Public Outreach

Color Code:

-  Flood Mitigation
-  Water Quality
-  Combined Sewage Management

Examples of Available Tools:

-  **Increase Pipe Size**
-  **Green Infrastructure**
-  **Sewer Separation**
-  **Stormwater Storage Tank**
-  **New Catch Basins**
-  **Combined Sewage Storage Tank**



Potential Enhancements

- The ability for the tool to select BMPs, and handle missing GIS data layers (image recognition for driveways, etc.)
- Drainage Area Delineation built in
- Complete automation with no manual steps

Looking Forward

- Applications of this approach/toolbox for other infrastructure types and transportation assets
- Applications to other pollutants
- Improving the tool for even more detailed and cost-effective GSI siting
- How would you use this? Any other applications?

Conclusions

- GSI – Important part of flood mitigation and the water quality management toolkit
- Siting GSI – Dependent on cumulative impact of multiple criteria
- GSI Siting Application
 - Simplified, efficient, and accurate approach to spotlight locations meeting GSI criteria
 - Can leverage diverse data sets
 - Estimates water quality improvements
 - Can be applied to your project area, catchment, or municipality

Q&A - Discussion



Peter Garvey, PE

Vice President,
Business Unit Manager



WATER ADVOCATES

