



Infrastructure Information

Part One:

Somerville's Urban Hydrology

Part Two:

Proposed Major Infrastructure Projects

Mayor Joseph A. Curtatone

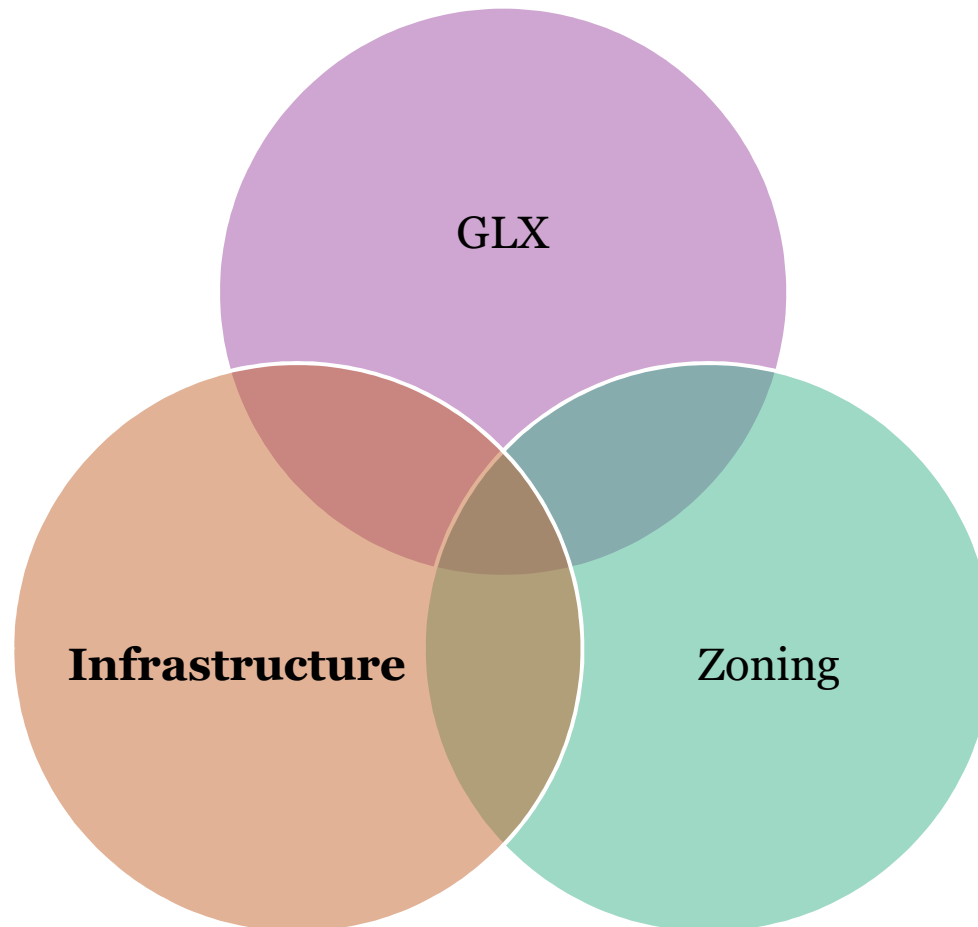
Presented by

Richard E. Raiche, PE, PMP, Director of Engineering

Robert T. King, PE, Director of Capital Projects

Spring 2017

Delivering on SomerVision: 3 key commitments



Infrastructure Information

Part One:

Somerville's Urban Hydrology

Somerville Geography

4.2 square miles – every square foot is valuable!

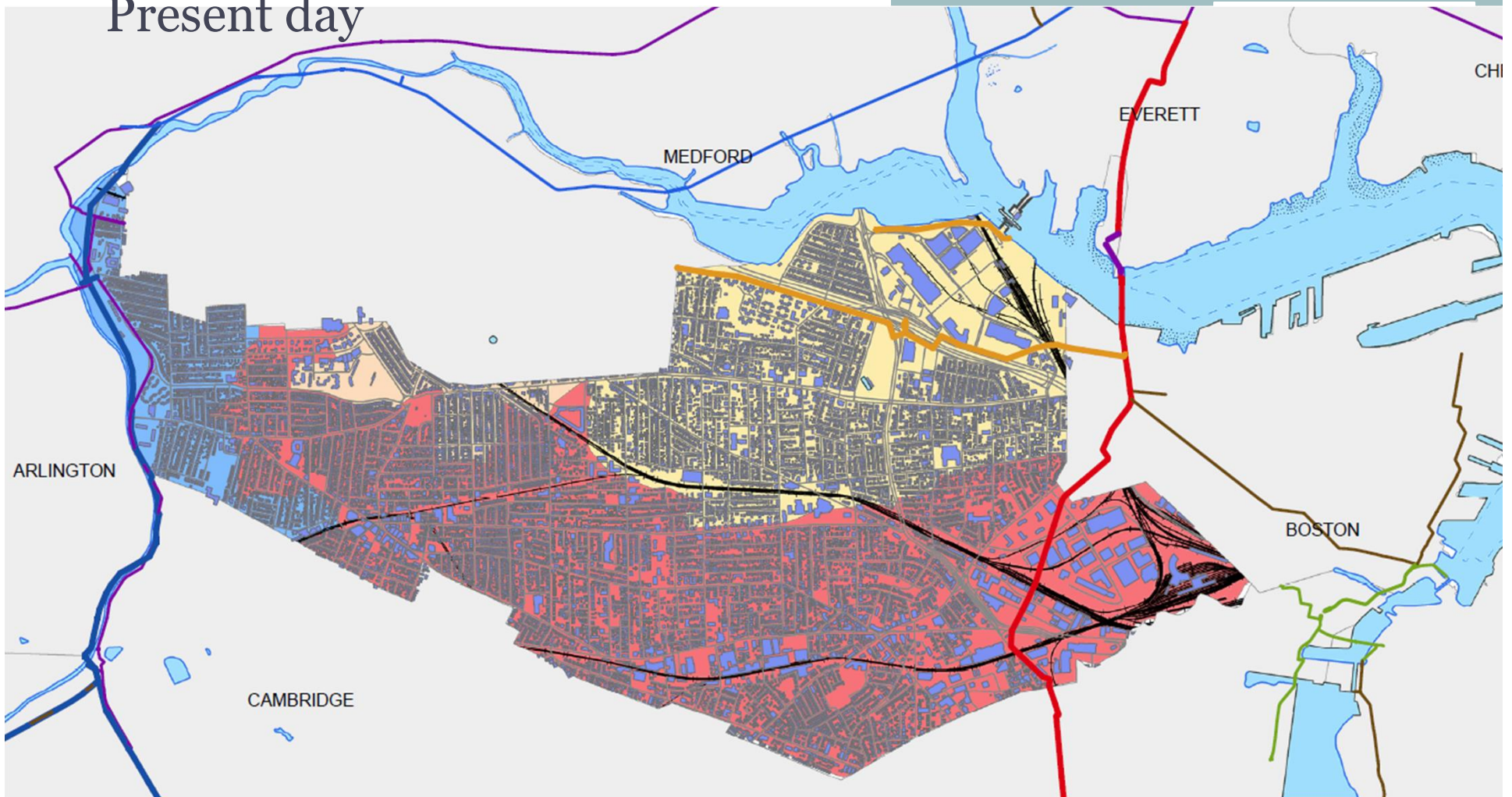
Somerville: Geography 101 Hills, wetlands, and rivers

1852

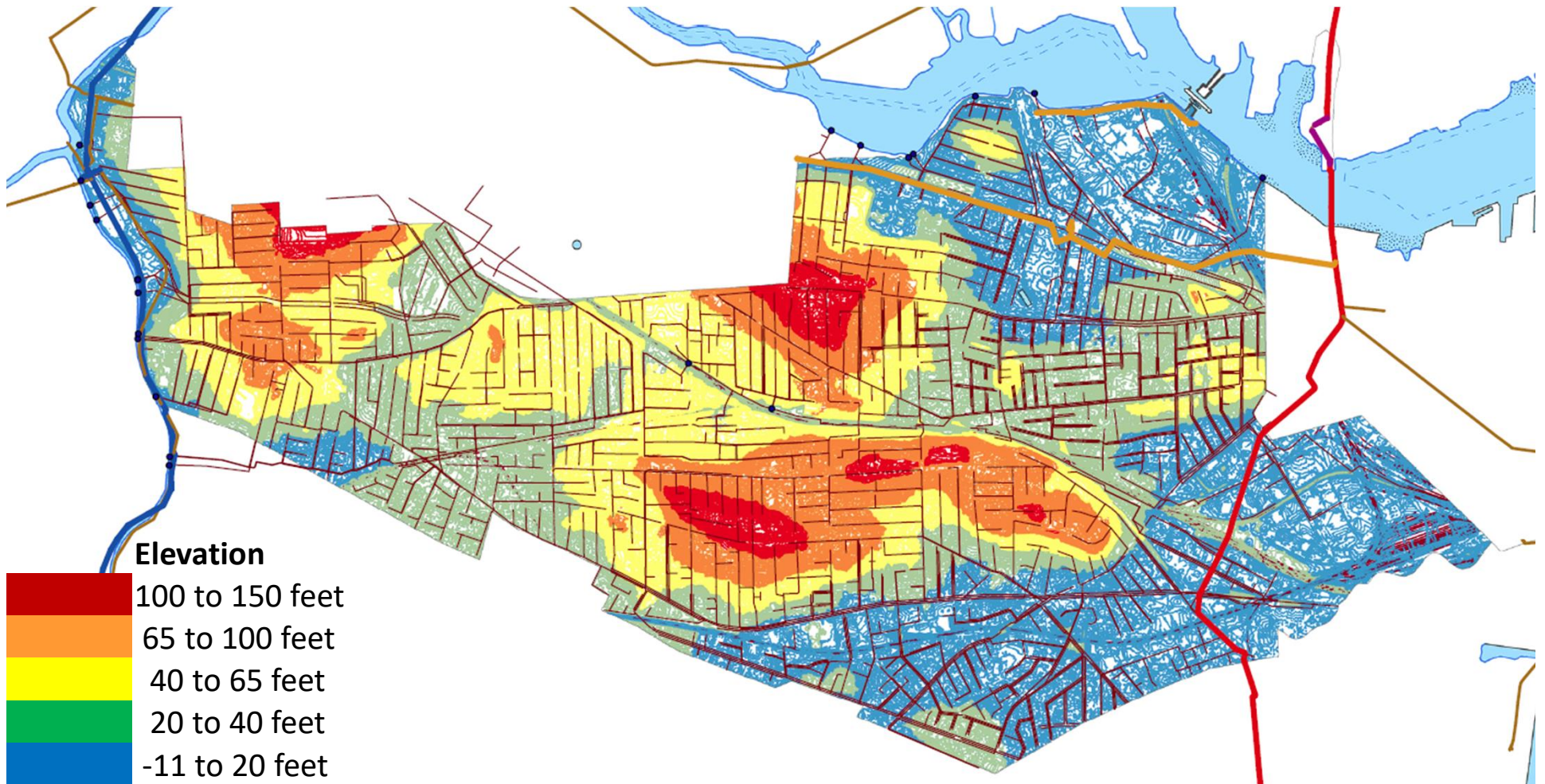


Fill, Development, and MDC pipes

Present day



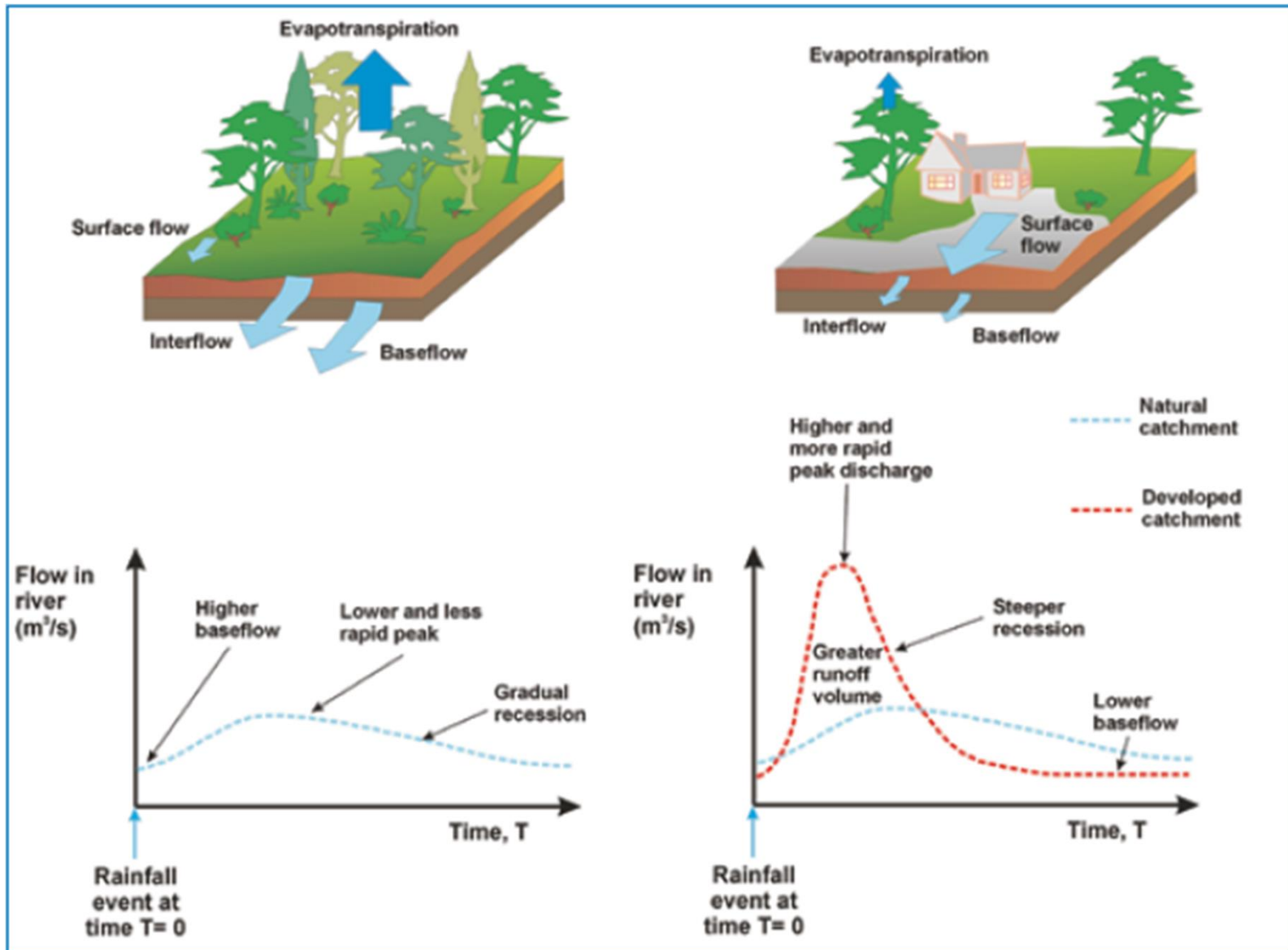
Water flows downhill, and to MWRA pipes



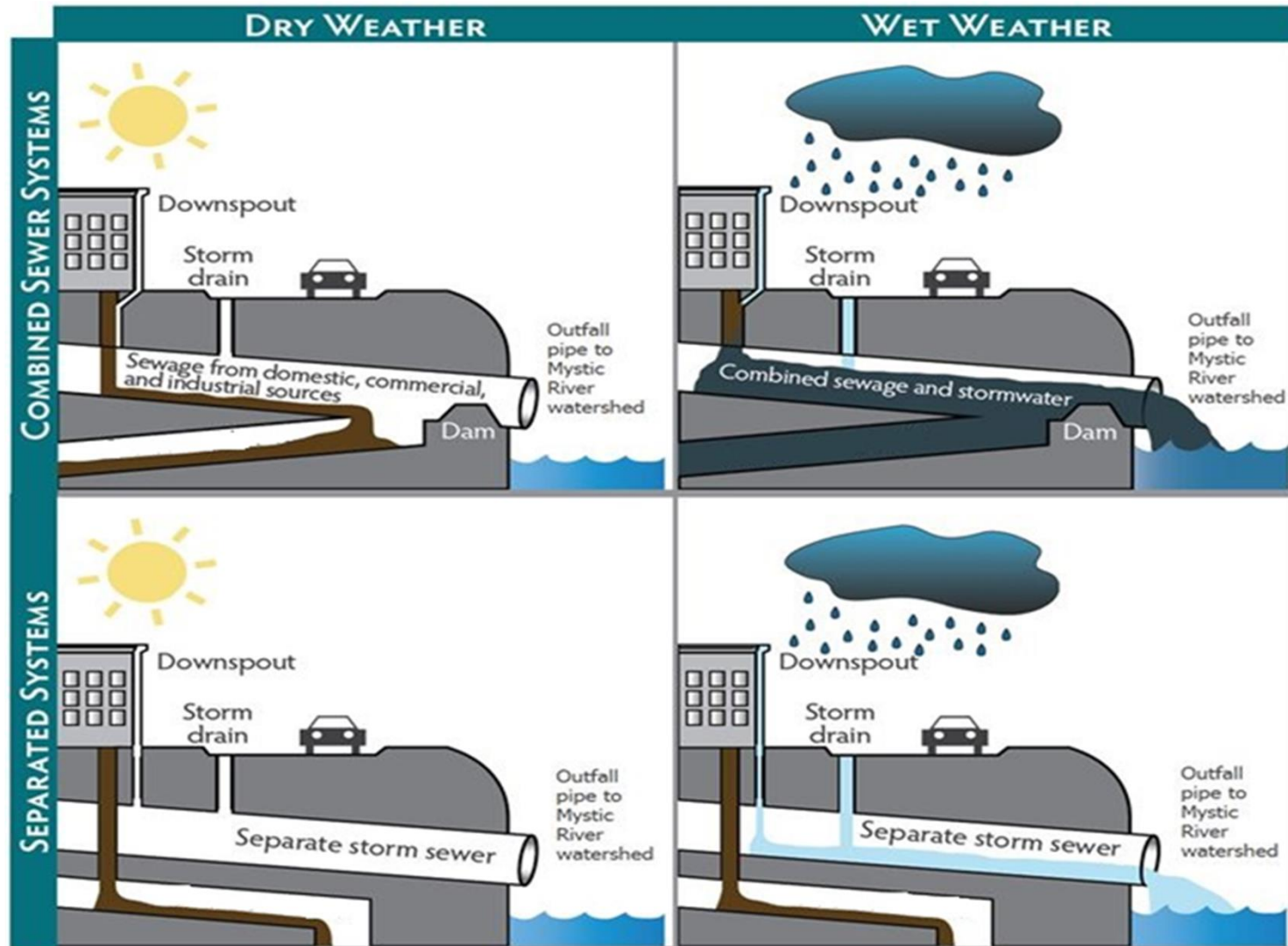
Urban Hydrology

Where does water go, and why doesn't it go there sometimes?

Hydrologic Cycle



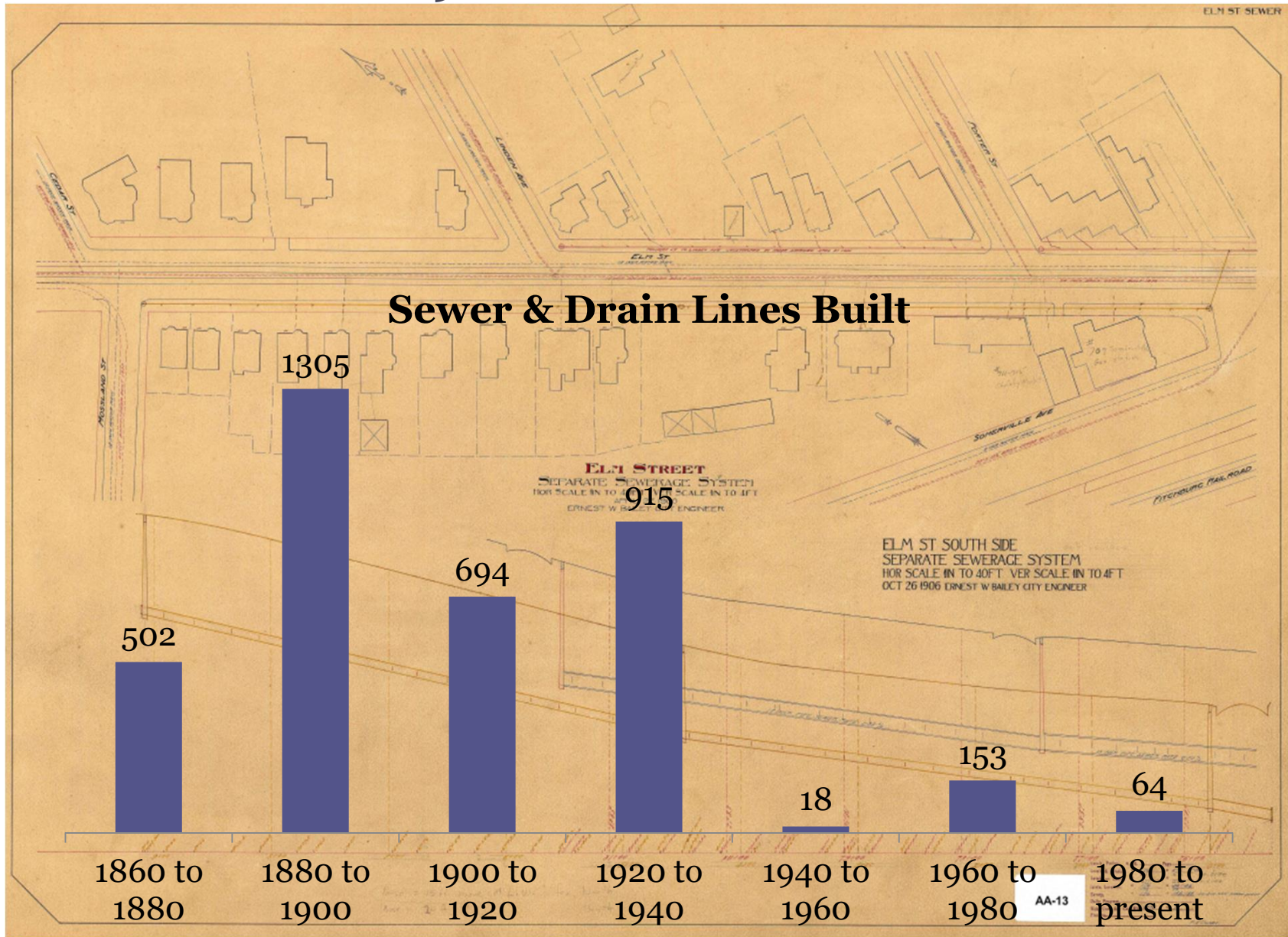
Storm drains, sanitary sewers and combined systems







Somerville's System

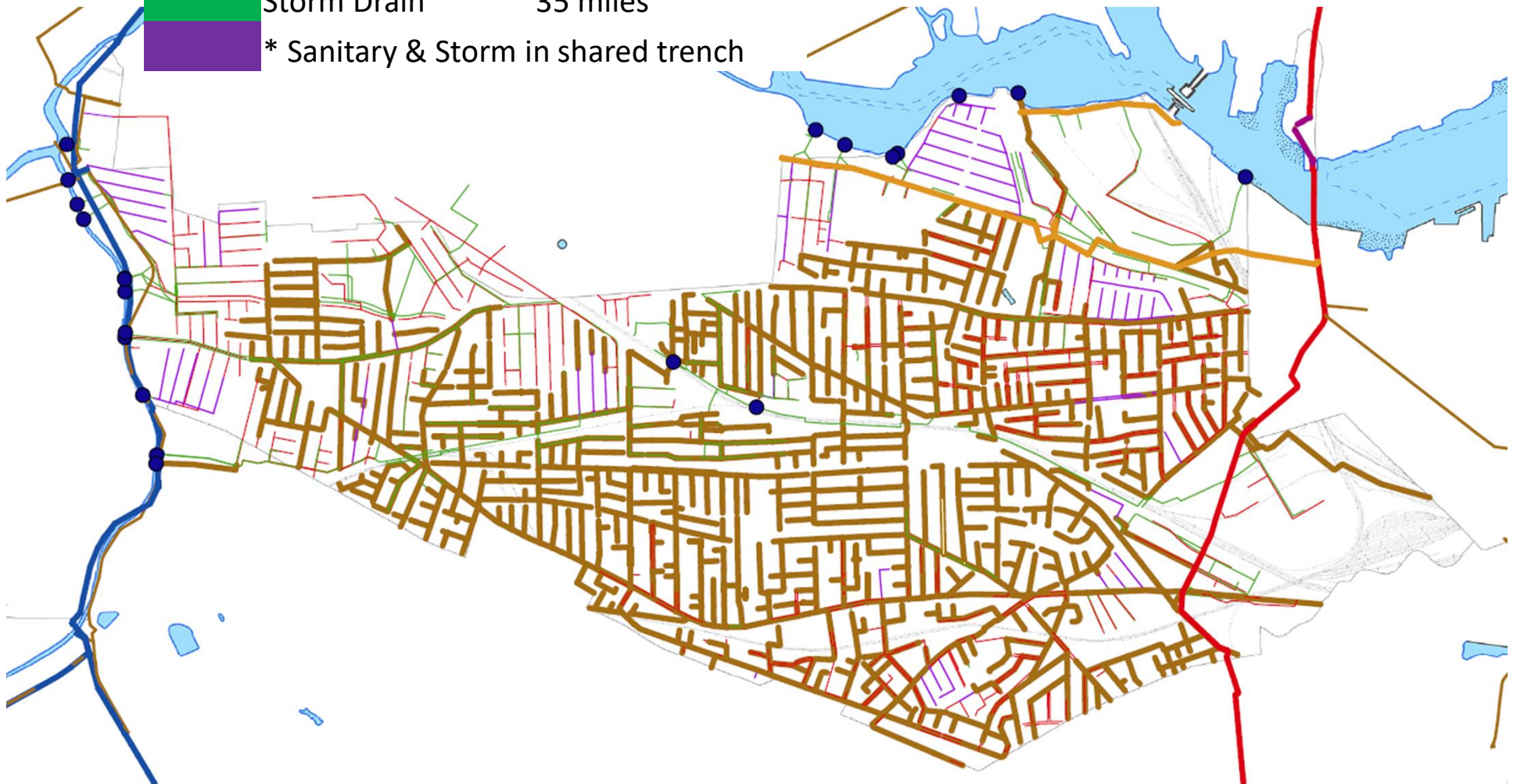
State of the Art water handling...
in 1890

Collection System







Combined sewers

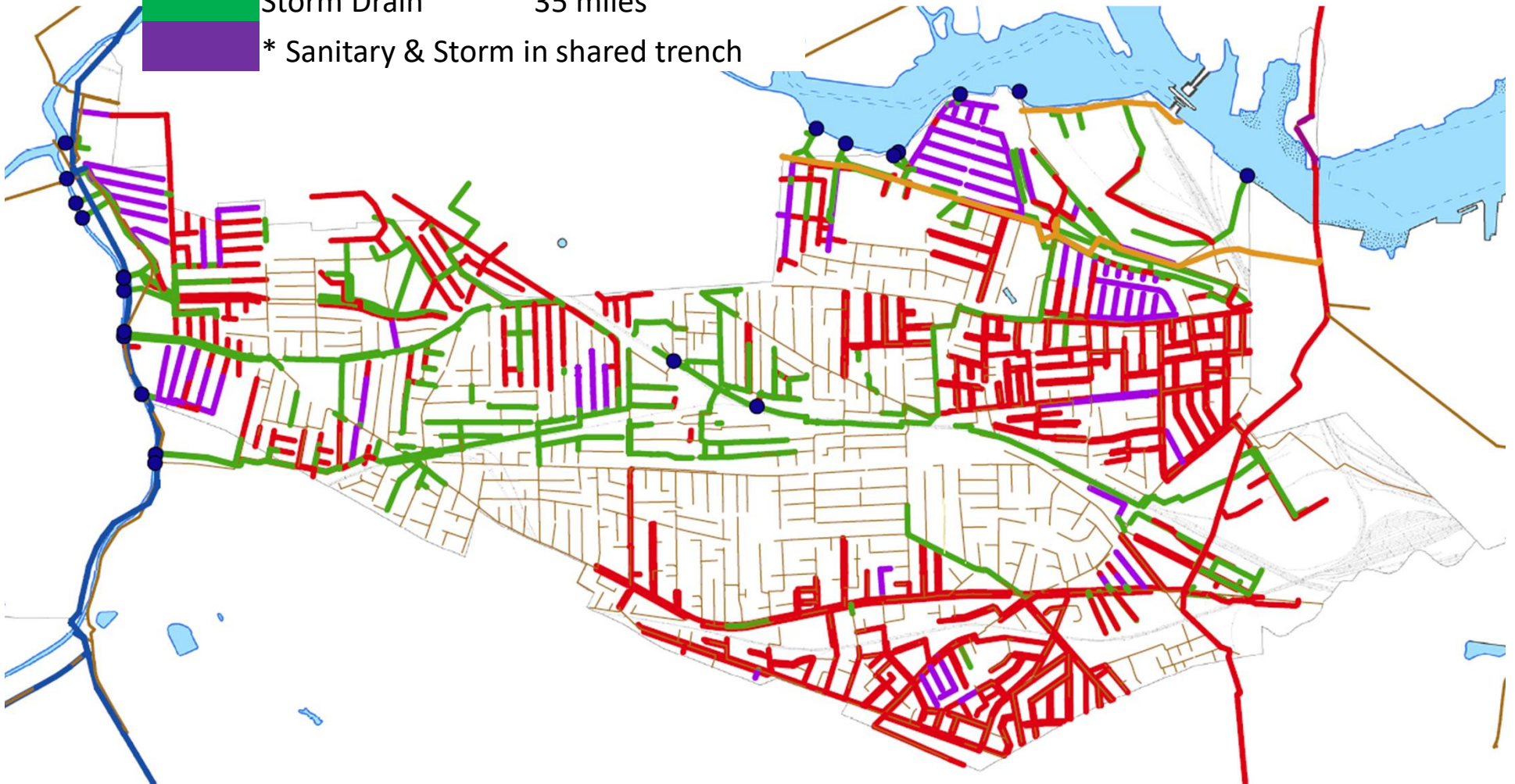
	Combined	68 miles
	Sanitary	62 miles
	Storm Drain	35 miles
	* Sanitary & Storm in shared trench	



Two pipe roads

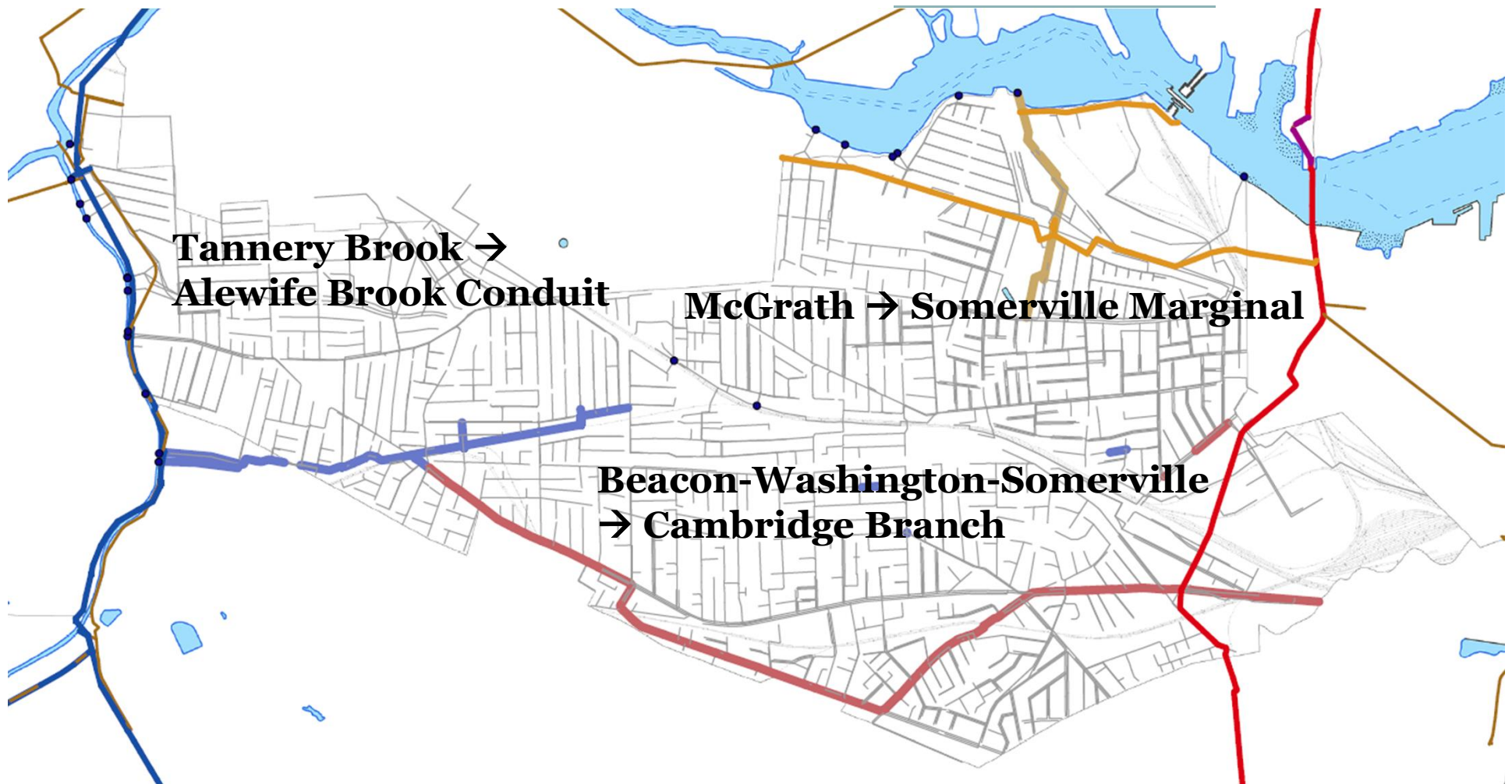
... but not really separate

	Combined	68 miles
	Sanitary	62 miles
	Storm Drain	35 miles
	* Sanitary & Storm in shared trench	

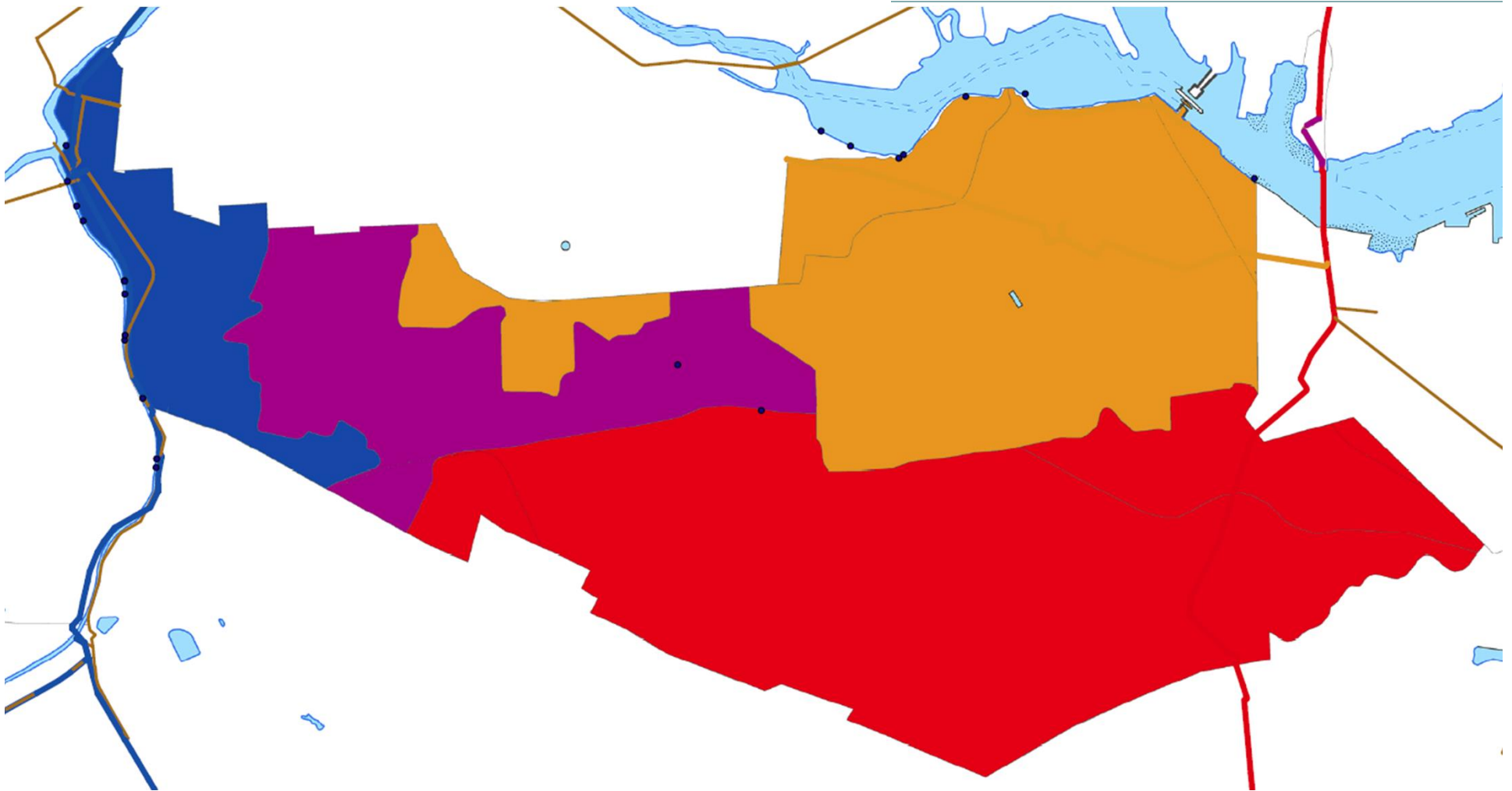


Smaller pipes flow to larger ones

- 3 major interceptors

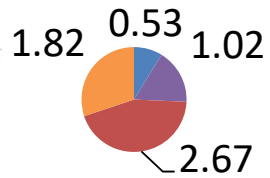


Major Subsystems

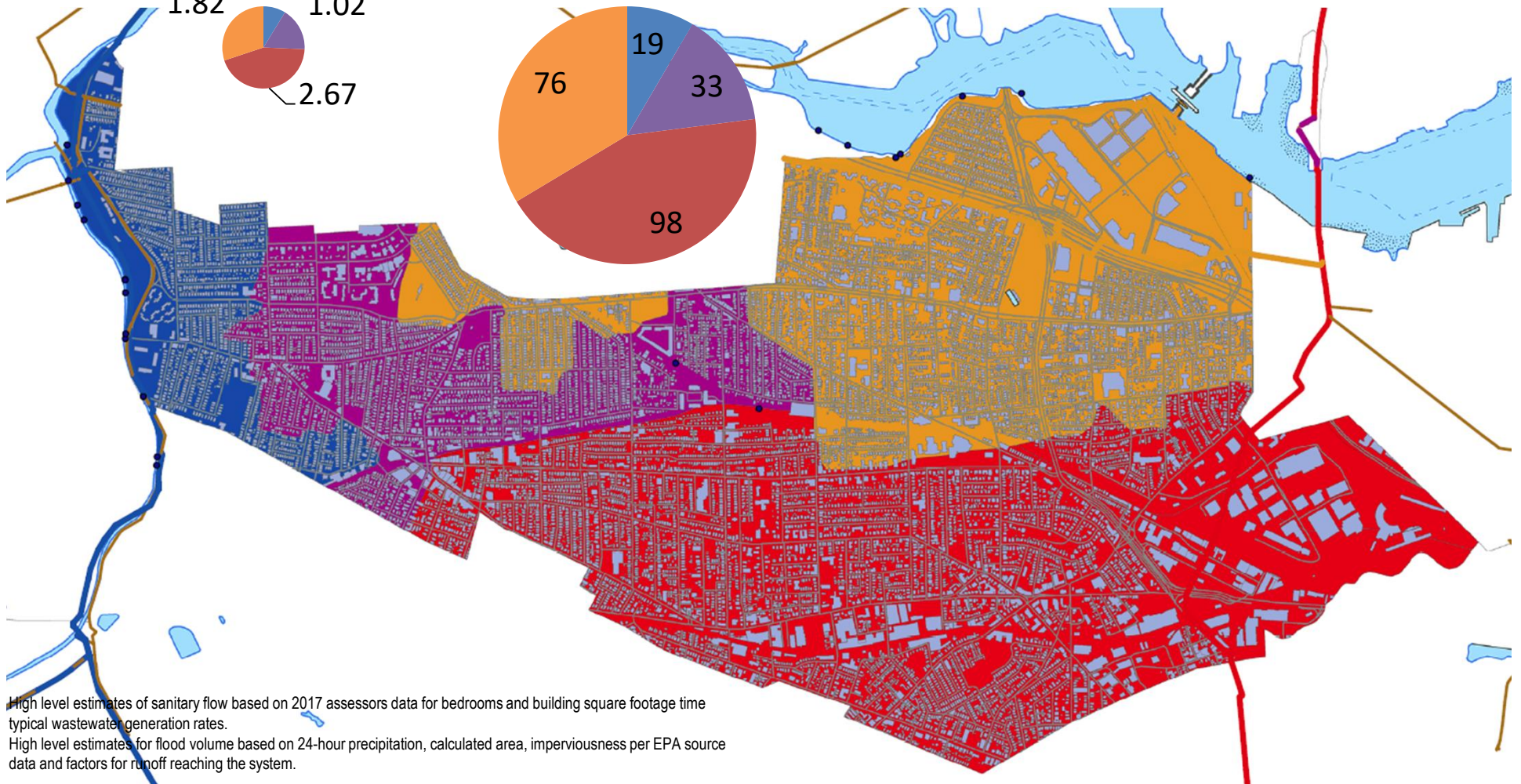
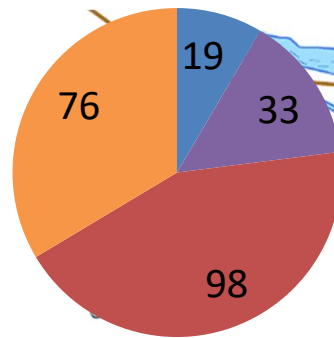


Subsystem statistics

Sanitary Flow
(mgd)



10-Year Flood Volume
(mgd)



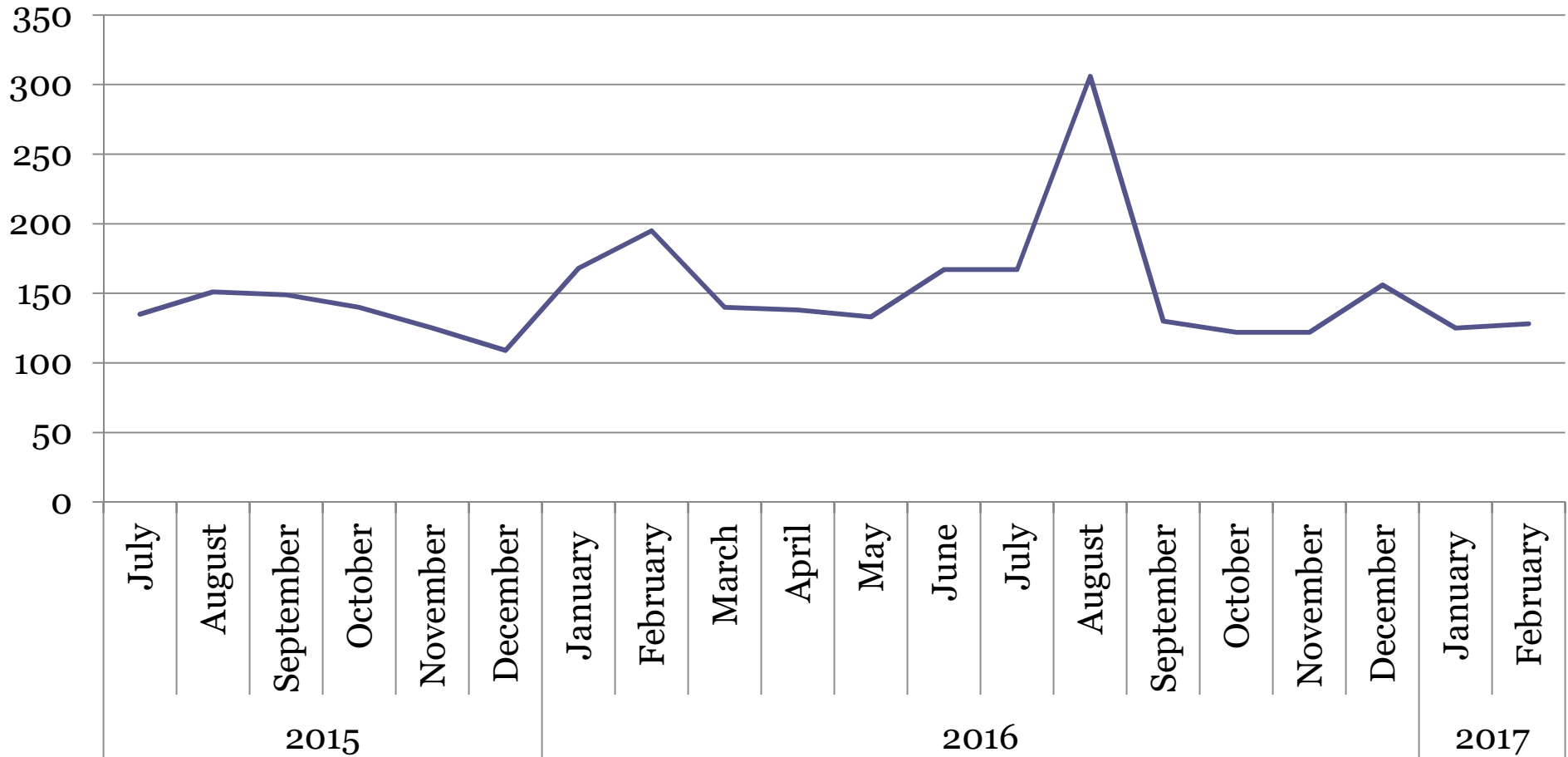
High level estimates of sanitary flow based on 2017 assessors data for bedrooms and building square footage time typical wastewater generation rates.
High level estimates for flood volume based on 24-hour precipitation, calculated area, imperviousness per EPA source data and factors for runoff reaching the system.

Problems

- Why do things go wrong?

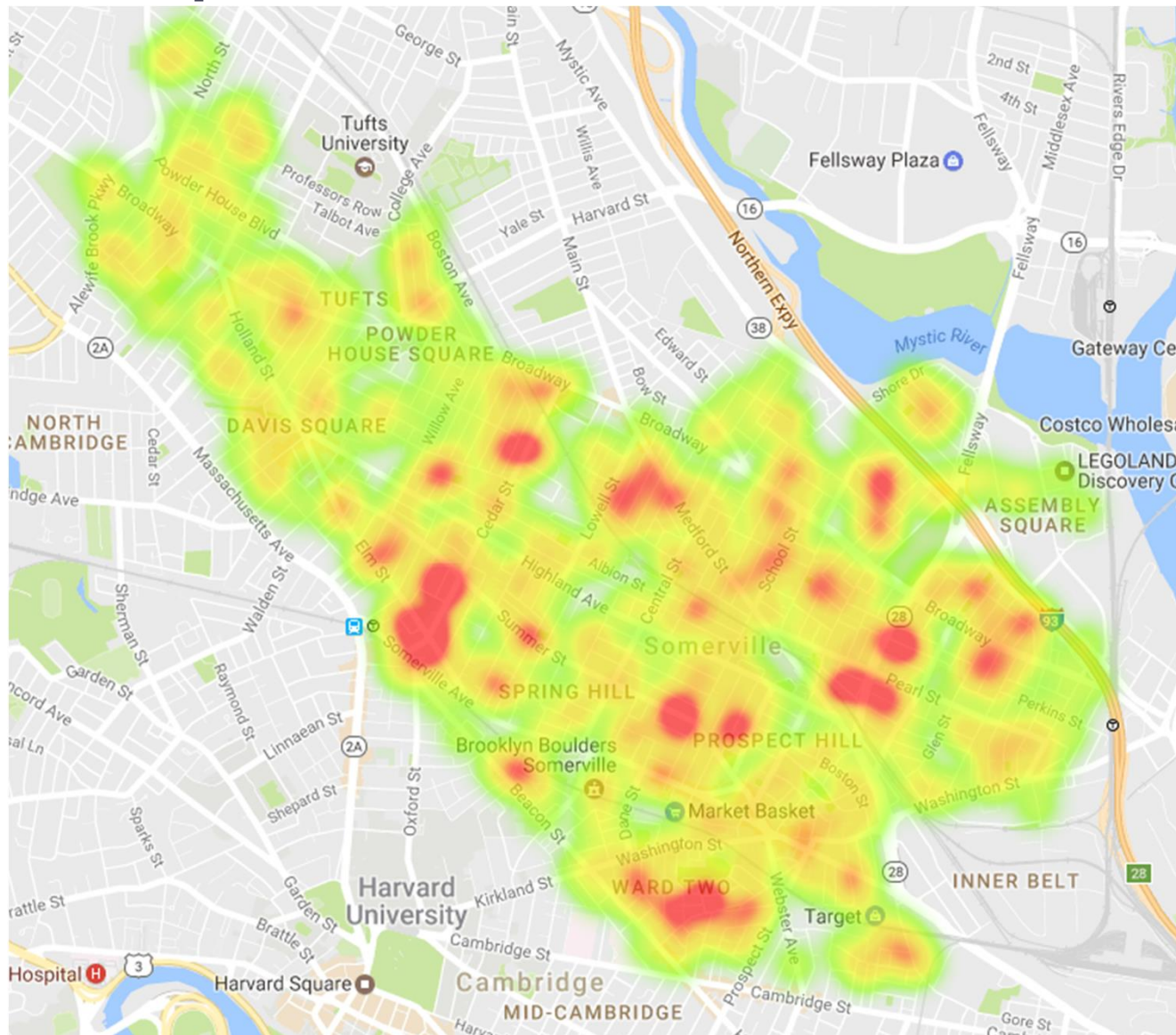
311 Reports

311 Water & Sewer Related Calls,* 2015-2017



- Call types include: sewage, sewer, water inquiries, water issues, water leak in house, water emergency

Heat Map: CY2016 311 W&S Calls



Blockages and Collapses

Maintenance and Repairs

- Blockages can be cleared
- Collapses require emergency repairs



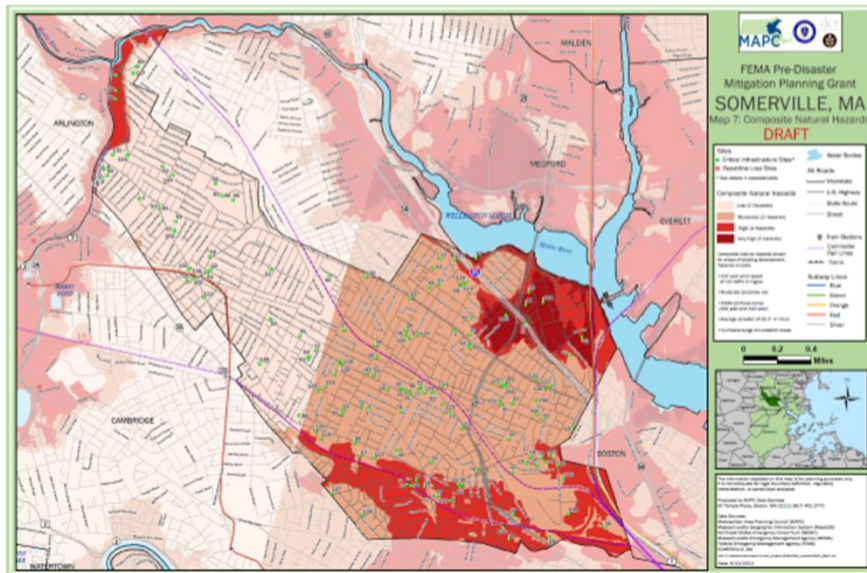
Systematic Flooding

- Load exceeds capacity



Flood Hazards

CITY OF SOMERVILLE HAZARD MITIGATION PLAN UPDATE



- Twelve events noted 1968 to 2010
- Twelve high risk areas defined
- Model predicts damages between \$38.5M and \$192.5M



Metropolitan Area Planning Council

Draft for Review
December 2013

Constraints

- What is out of Somerville's control?

Regulatory & Permit Restrictions

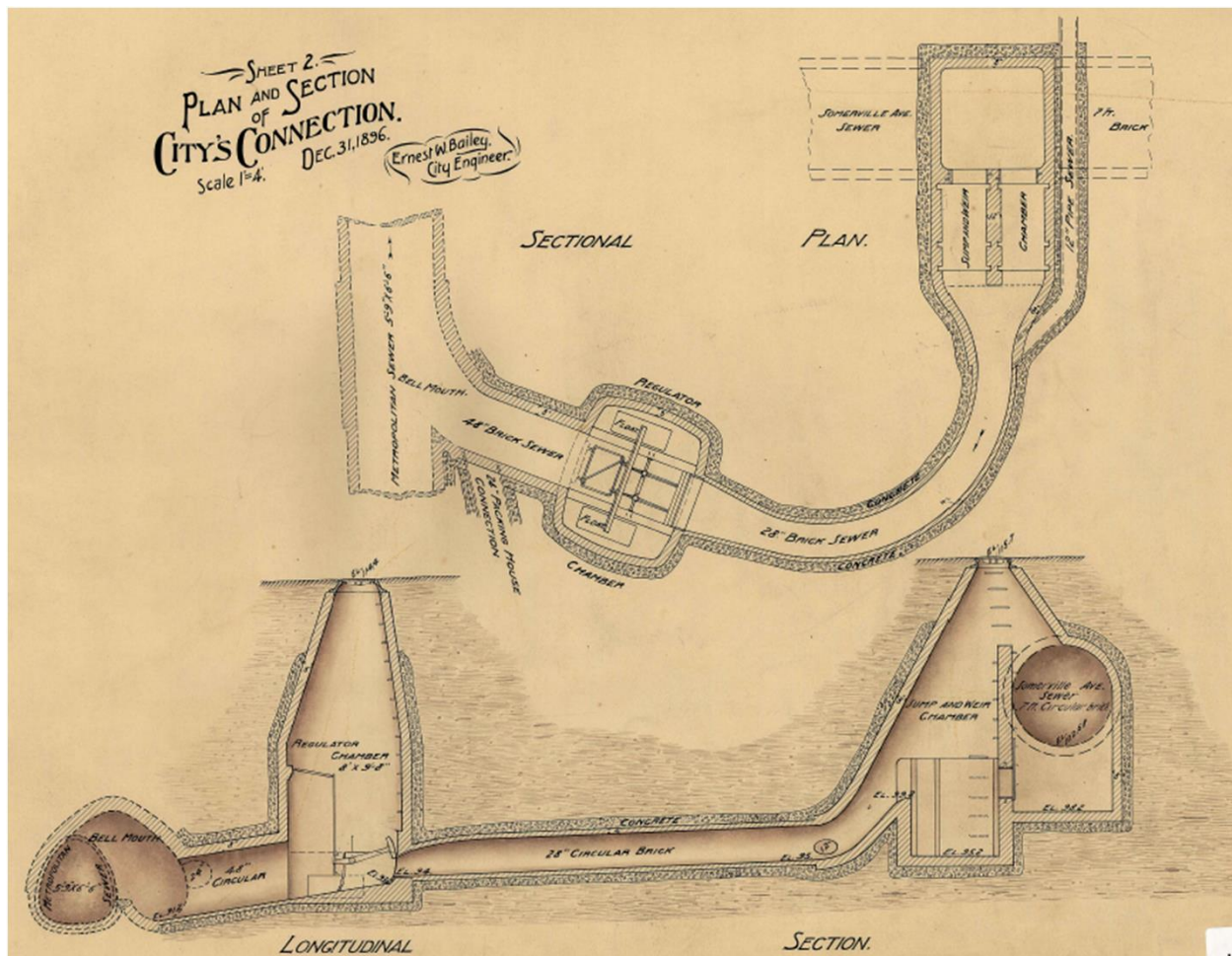
Our use is regulated by permits issued by:

- MWRA Municipal Sewer
- EPA/DEP NPDES CSO
- EPA/DEP NPDES MS4

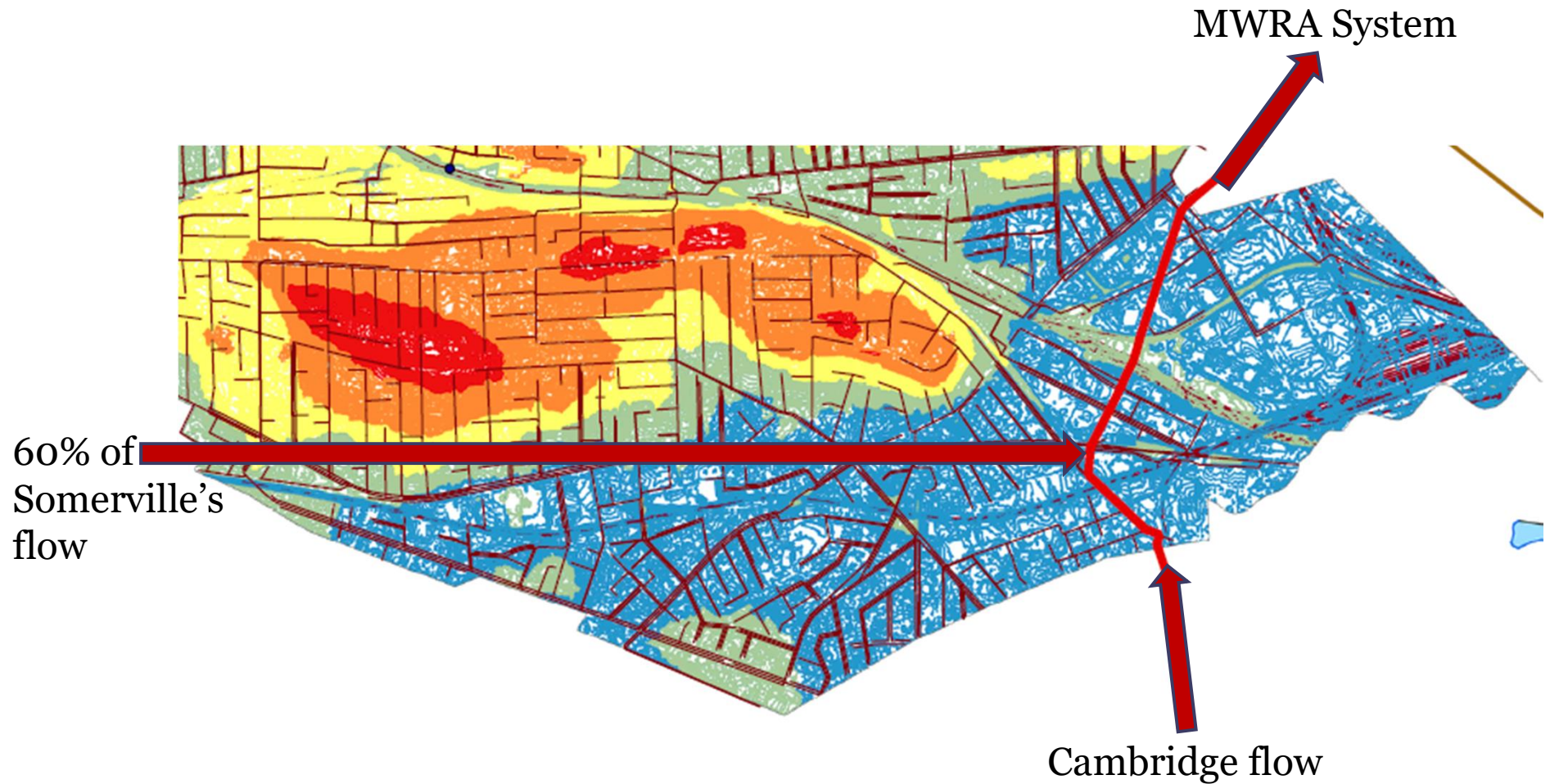


Physical limitations

- MWRA interceptors

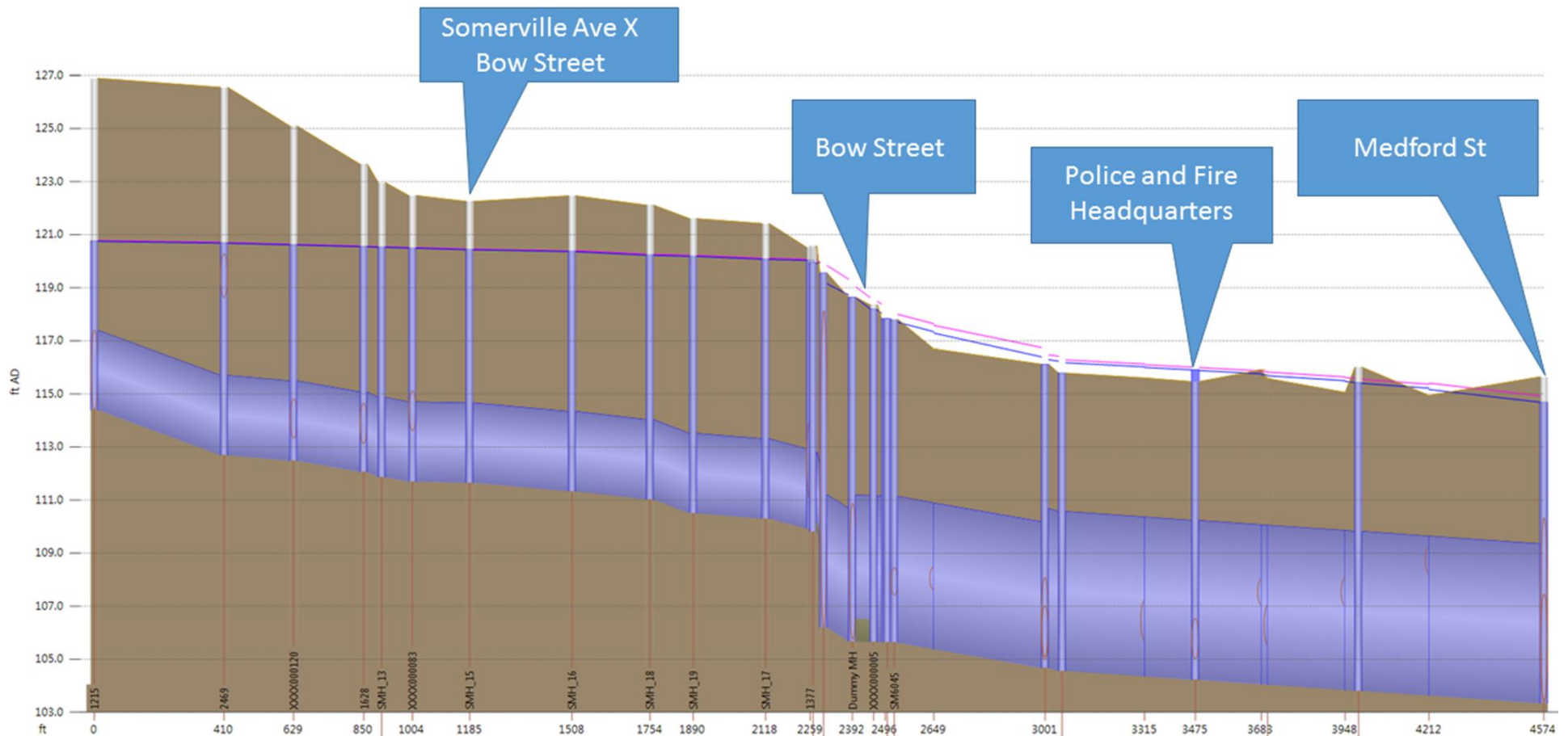


Union Square - Nexus of Flows



- Uphill / Up-pipe areas all contribute to flooding

Rain from above.. trouble from below

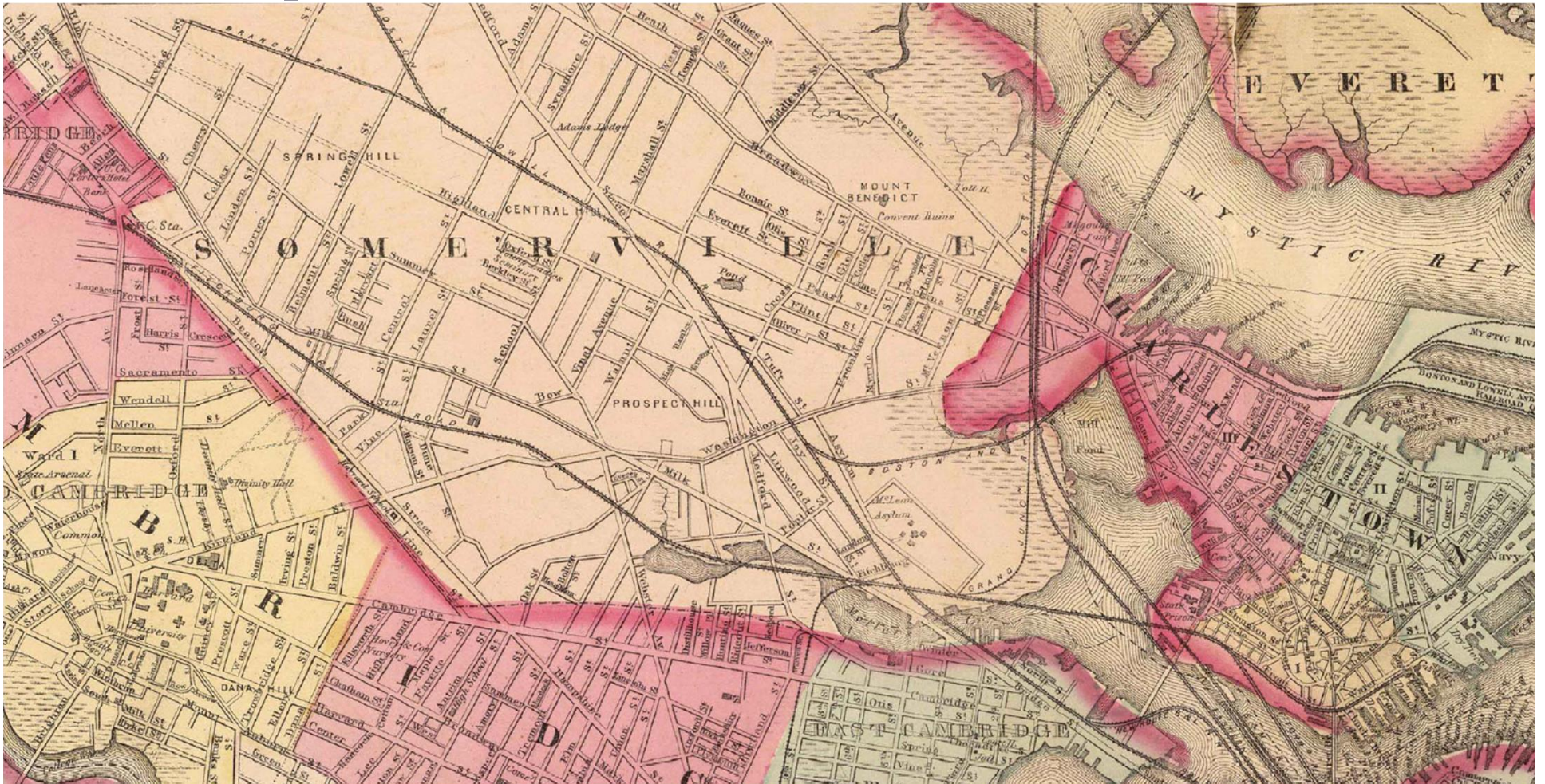


Past Planning

These aren't new problems, what has been done to find solutions?

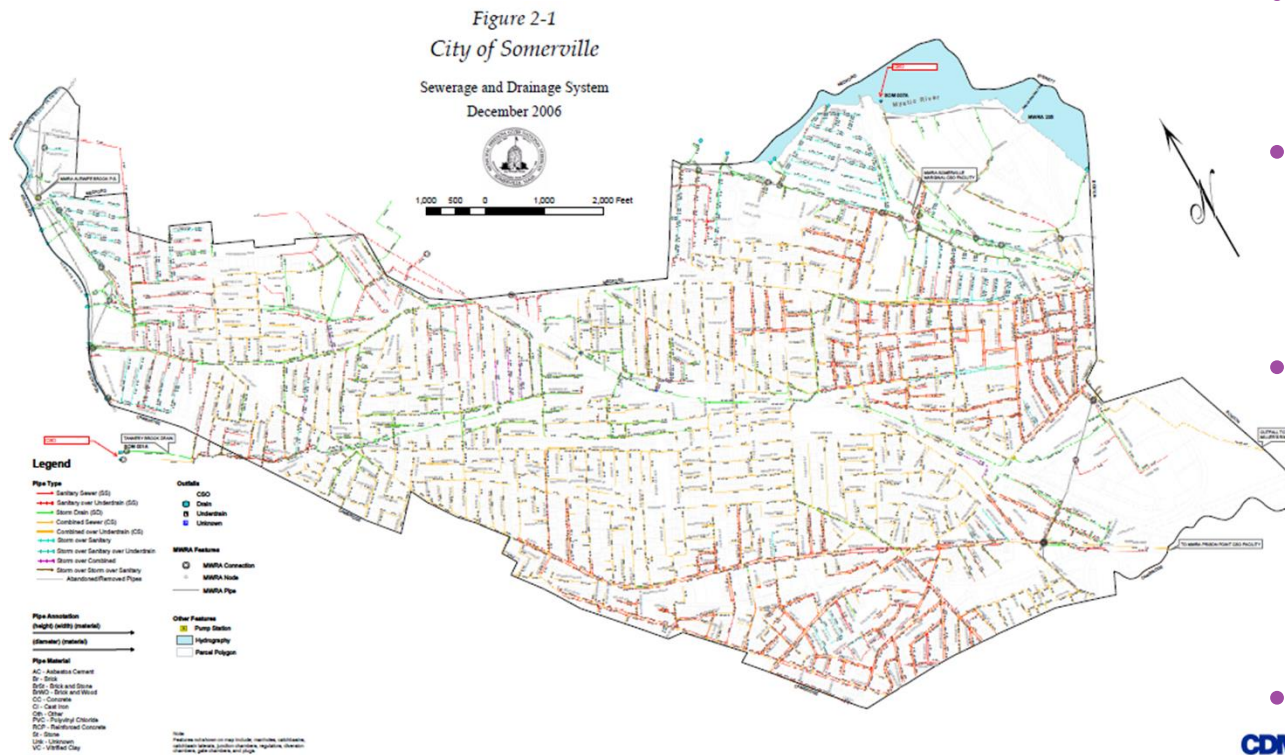
Millers River Drainage - Capacity in MBTA System

1990s - present



Sewer Separation - Cost Prohibitive

CDM Reports 1994 – 2009



- Marginal sewer separation \$74M 2009\$
- Tannery Brook partial sewer separation \$33M 2006\$
- Cambridge Branch partial sewer separation \$115M plus \$?? stormwater pumping & outfall 2009\$
- **No projects resulted**

CDM

SomerVision

2009 - present

- Increase level of service
- Remove stormwater from system
- Reduce flooding and CSOs

Transportation & Infrastructure Sewer & Stormwater

Sewer Separation

What's it all about?
Somerville has an old "combined" sewer system that often puts sewage and stormwater in the same pipes. This means that during storms, the system can overflow, spilling raw sewage into our rivers or even backing up sewer pipes into homes. To minimize these risks, cities can improve infrastructure to separate stormwater from sewer water. Low-cost stormwater management plans can also minimize the need for expensive construction by limiting the amount of storm drainage entering the system.

VIII. Goal: Improve stormwater and wastewater management systems to increasingly separate storm water and sewerage systems and support desired levels of future growth.

- A. Policy: The City should provide a stormwater and sewer system that is able to accommodate extreme events without flooding or causing combined sewer overflows (CSOs).**
1. Action: Continue to separate sewer and stormwater drains by working with the Massachusetts Water Resources Authority, the Environmental Protection Agency and others to develop strategies and secure funding.
 2. Action: Develop and adopt a comprehensive Action Plan that will produce a stormwater system with the capacity to accommodate flooding, greater frequency and intensity of storms, and rising sea levels.
 3. Action: Establish and ensure new development follows stormwater management guidelines.
 4. Action: Investigate the potential cost and benefit of installing pumping stations at key areas to alleviate flooding issues.
 5. Action: Ensure all catch-basins are cleaned on a regular and sufficient basis.

Somerville Sewers

Somerville's collection system consists of 62 miles of sewer, 68 miles of combined sewers, and 35 miles of storm drains. The pipes range in diameter from six inches to more than three feet. The largest pipes serve what were historically rivers and streams, such as the Millers River in Union Square and the Tannery Brook near Davis Square. Our sewer system drains more than 150 million gallons of stormwater and wastewater every day, with most of this flowing to a headworks in Chelsea and from there to the regional treatment plant in Boston Harbor.



Deer Island in Boston Harbor

Transportation & Infrastructure Sewer & Stormwater

B. Policy: The City should create incentives and zoning regulations to infiltrate stormwater and to limit stormwater runoff from entering the wastewater system.

1. Action: Establish a permitting requirement for increased impervious surface for projects in residential districts that do not otherwise require a zoning or building permit.
2. Action: Heighten enforcement of non-compliance with sewer and stormwater regulations.
3. Action: Create incentive or educational programs for green roofs, rainwater catchment systems, rain gardens and other stormwater re-use options.
4. Action: Ensure that any new City projects include provisions for water and drainage runoff.
5. Action: Make rain barrels available at more frequent intervals and advertise broadly.
6. Action: Design street reconstruction and renovation projects to capture and release stormwater runoff slowly, where feasible.
7. Action: Design and install landscaped medians to increase pervious surface and capture runoff where possible.
8. Action: Continue to increase the number of healthy street trees and, where possible, incorporate climate-appropriate vegetation to slow velocity of stormwater runoff on both private and public lands.
9. Action: Consider designing and implementing systems to harvest rainwater and collect stormwater for irrigation use in new parks and other public projects.
10. Action: Investigate the potential use of grey water systems in public and private projects.

Stormwater Runoff

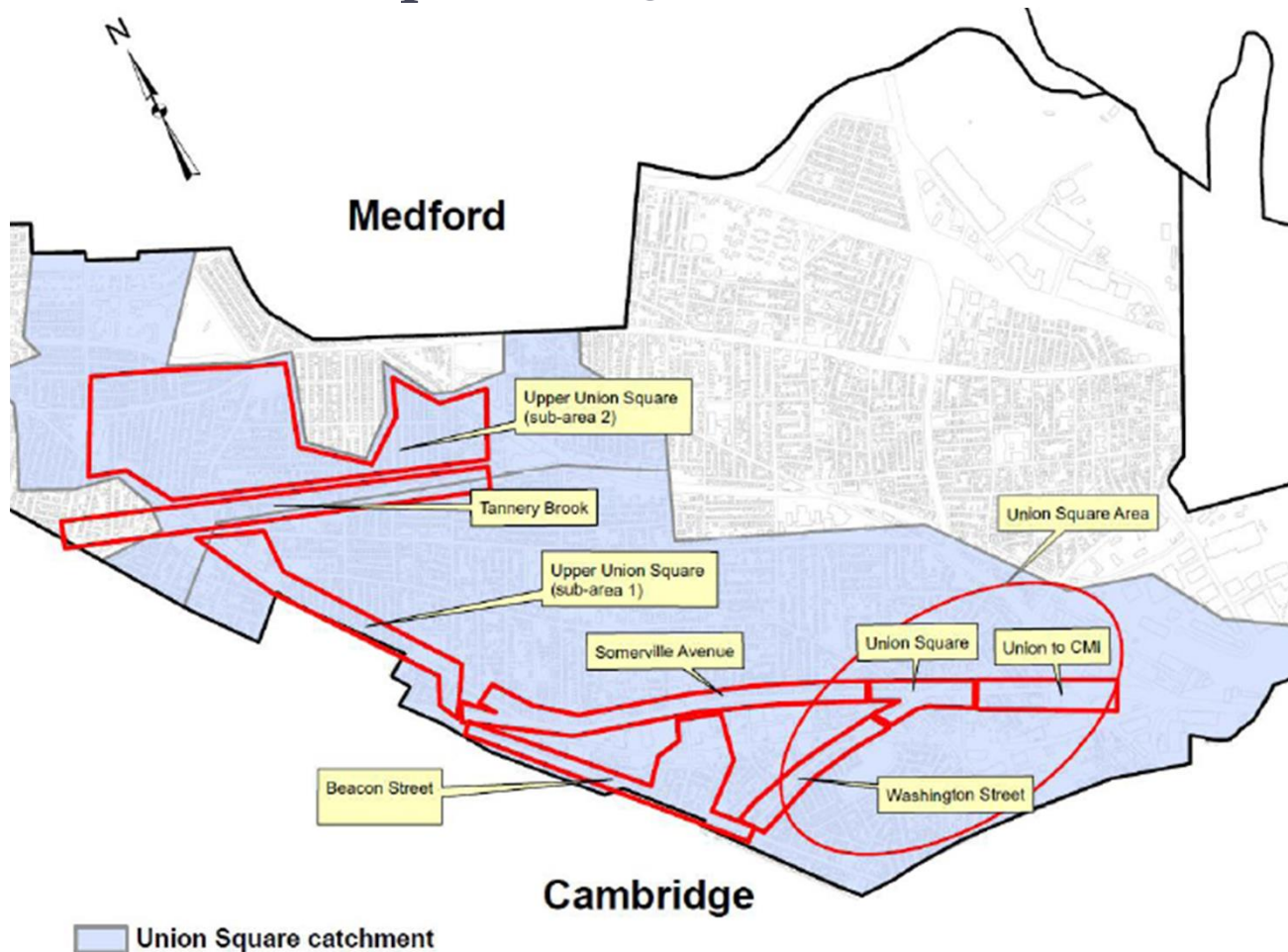
What's it all about?
Stormwater runoff is bad for taxpayers and bad for the environment. When water goes into storm drains, we pay for it to travel all the way to the regional sewage treatment plant in Boston Harbor. We can save money and energy by adding pervious surfaces to our driveways and yards, instead of impervious surfaces like concrete and asphalt.



Pervious pavers use materials that allow water to percolate through.

Stormwater Management

MWH Report 2013







- Shifted focus
- Previous solutions
 - Bottom of hill
 - End-of-pipe
 - Increase capacity
- New solutions
 - Intercept rain
 - Distributed throughout catchment
 - Preserve capacity

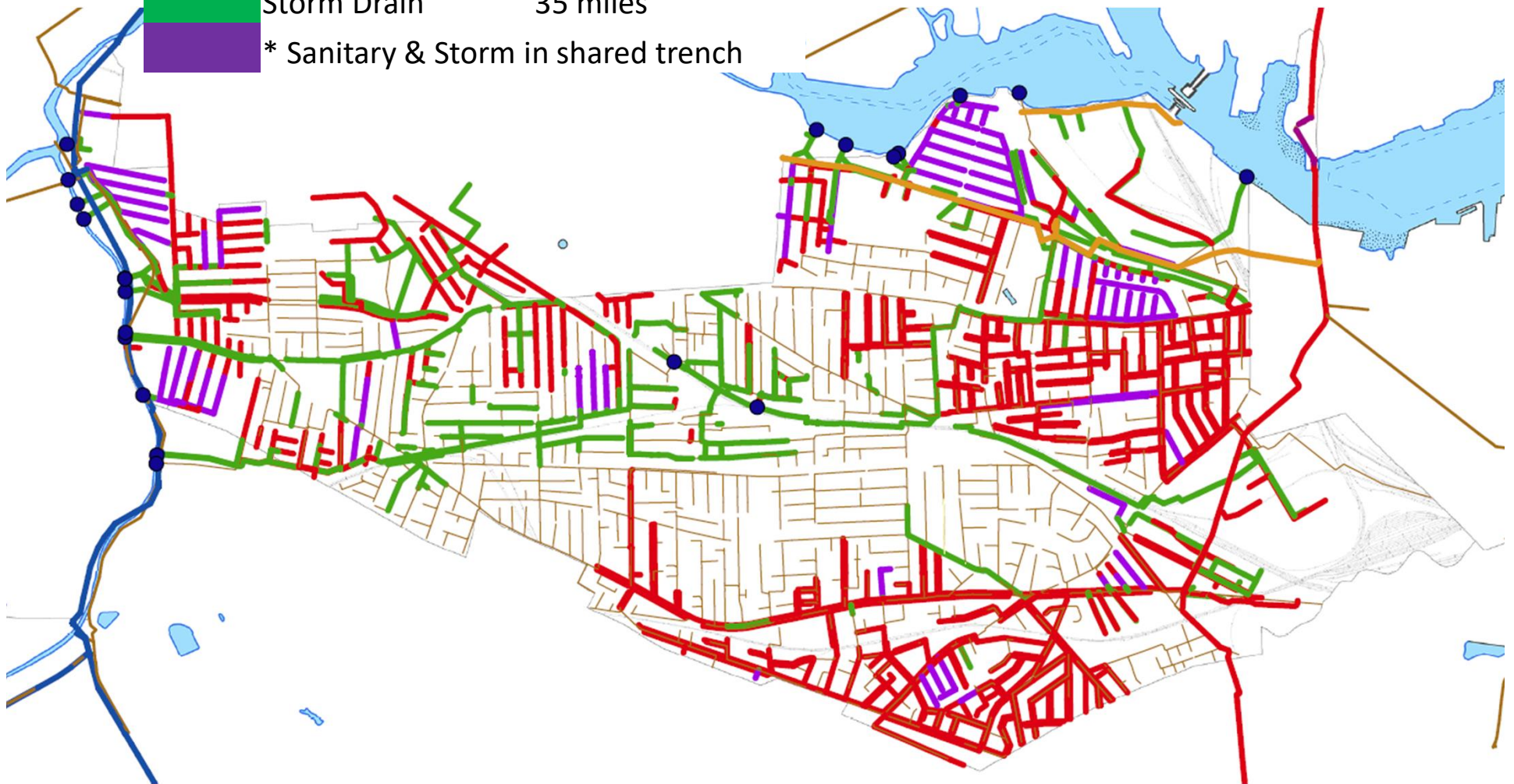
Stormwater Management Strategies

- Runoff management
- Surface storage
- Underground storage
- Pipe capacity



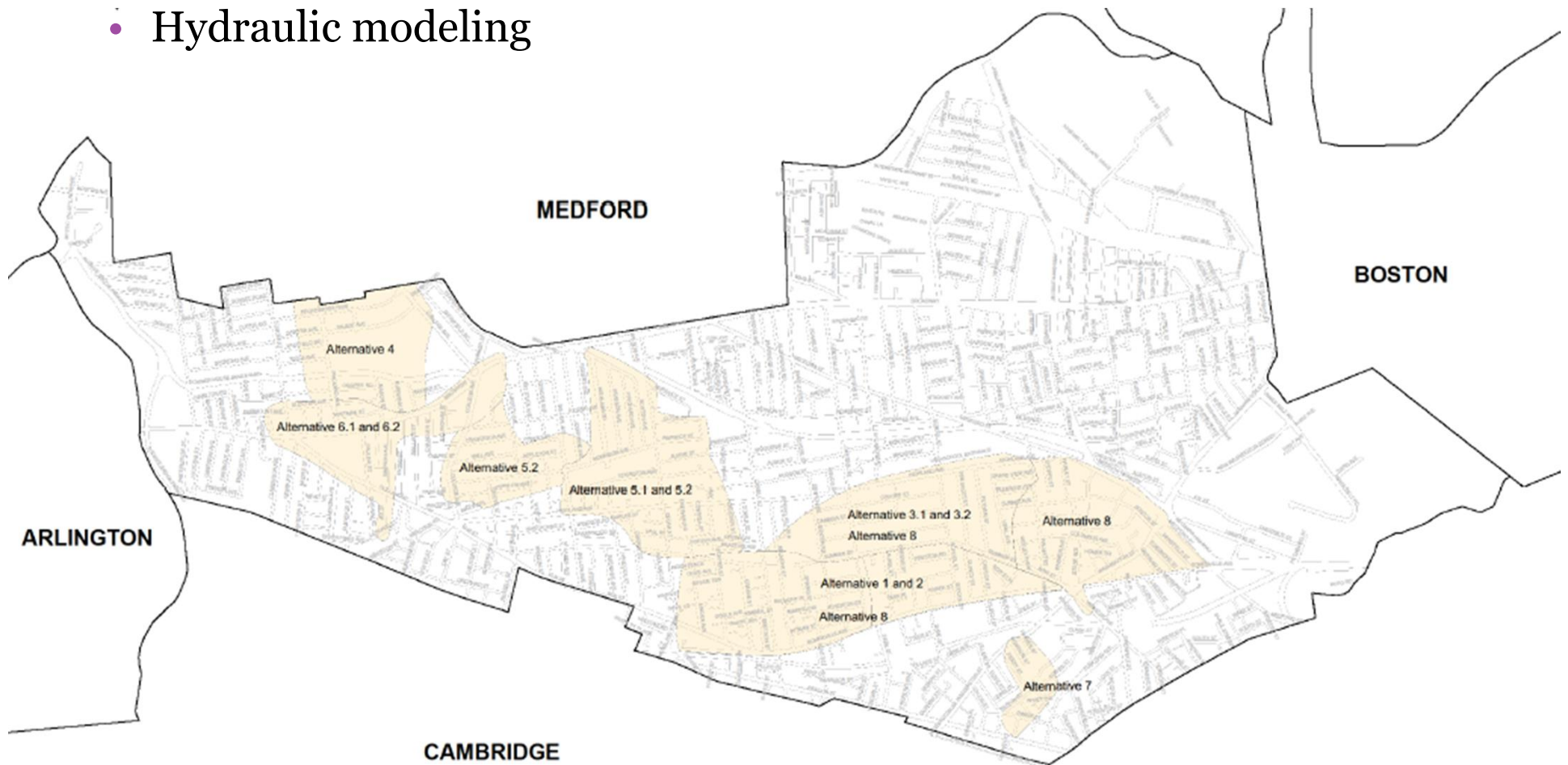
Locally separate stormwater pipes

	Combined	68 miles
	Sanitary	62 miles
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Project identification and evaluation

- Concept designs – 8 areas / 11 sub-alternatives
- Cost estimates
- Hydraulic modeling



Project ranking

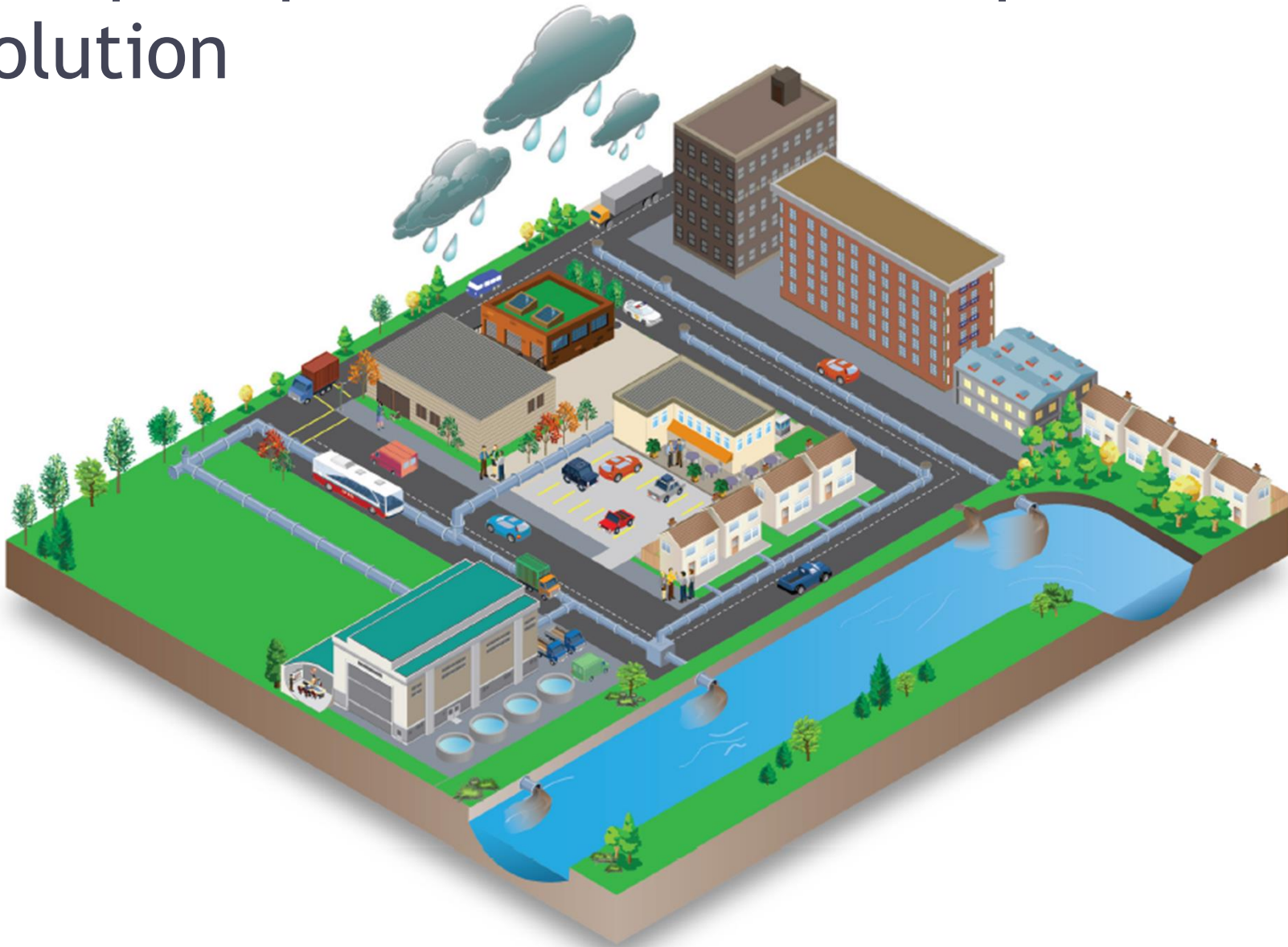
- Flood Reduction
 - What is the total benefit of the project?
- Cost-Effectiveness
 - What is the cost per gallon of benefit?
- Conclusions
 - Lincoln Park is most cost-effective, but has smaller impact
 - Somerville Ave Drain has most impact, but expensive
 - Nunziato most balanced, with high impact and cost-effective
 - Conway half as beneficial at similar cost range
- No other projects provide substantial benefits cost-effectively

System Problems - Systematic Solutions

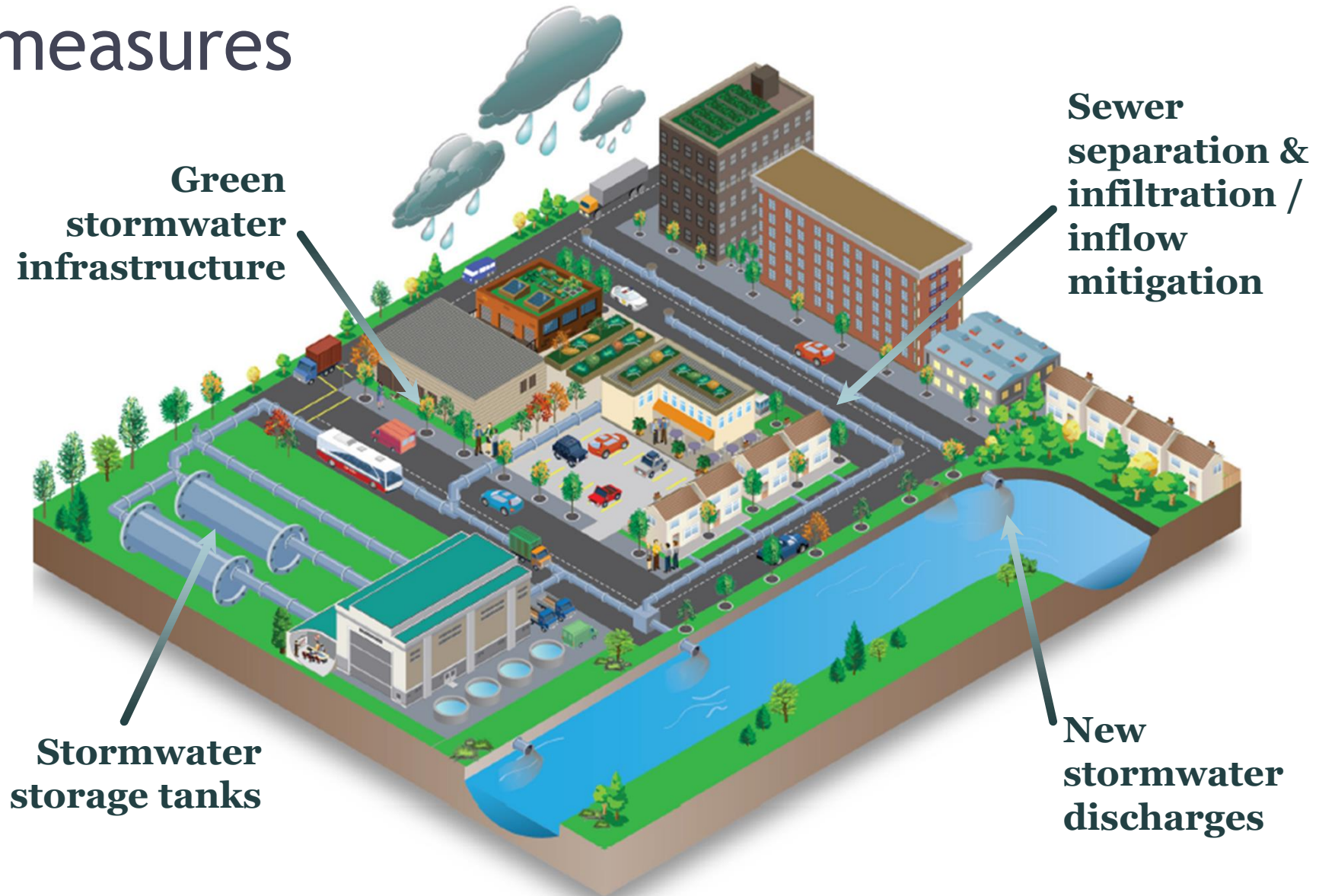
Flooding occurs because the system moves water downhill.

Solutions need to be system-wide.

Complex problem without simple solution

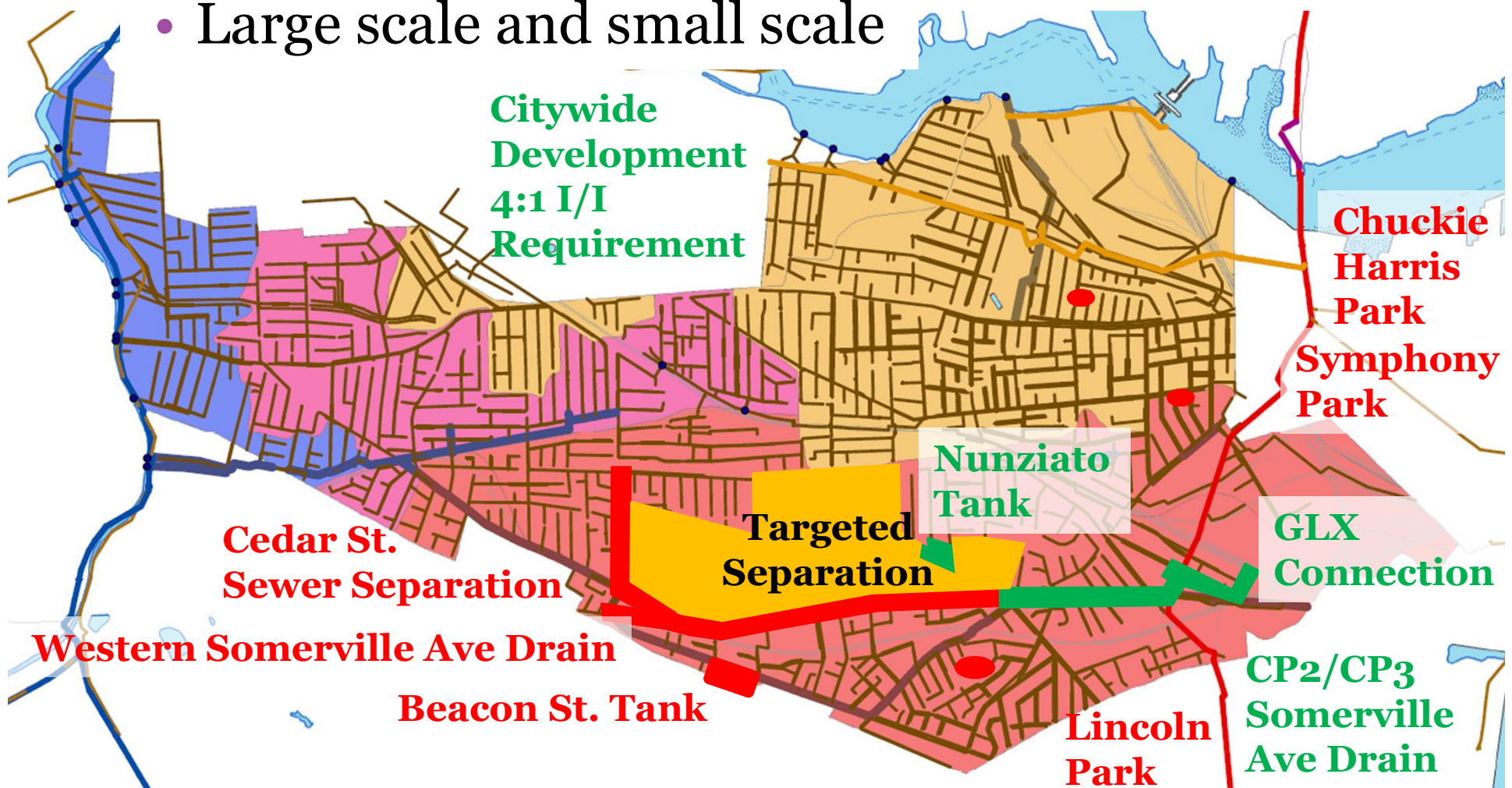


Requires suite of targeted control measures



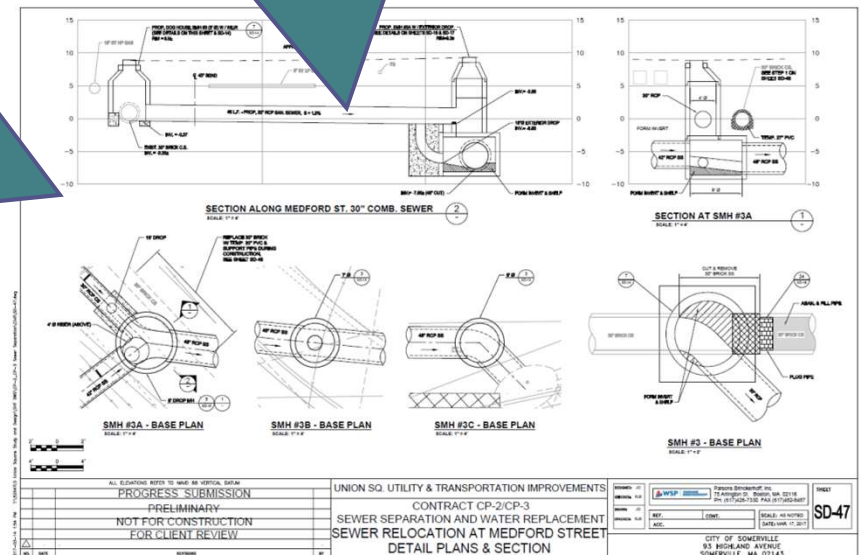
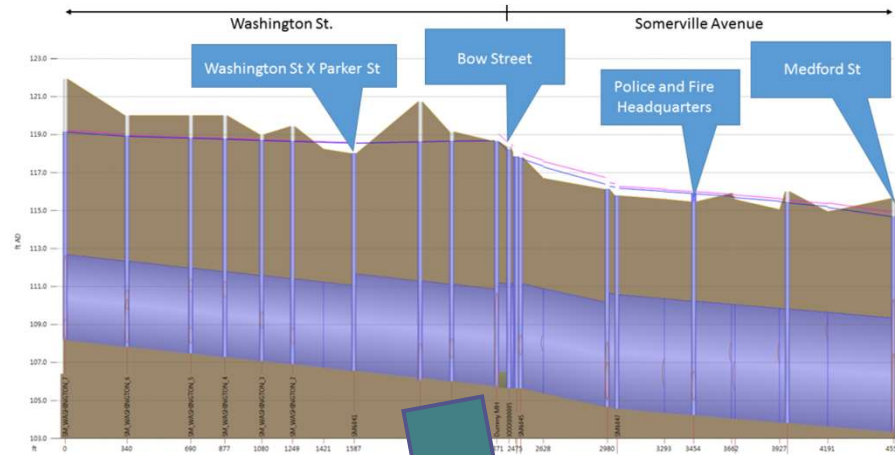
Ongoing and evolving strategy

- **Past** – **Present** – **Future**
- Large scale and small scale



Data-driven planning and design

- State of the Art for the 21st Century



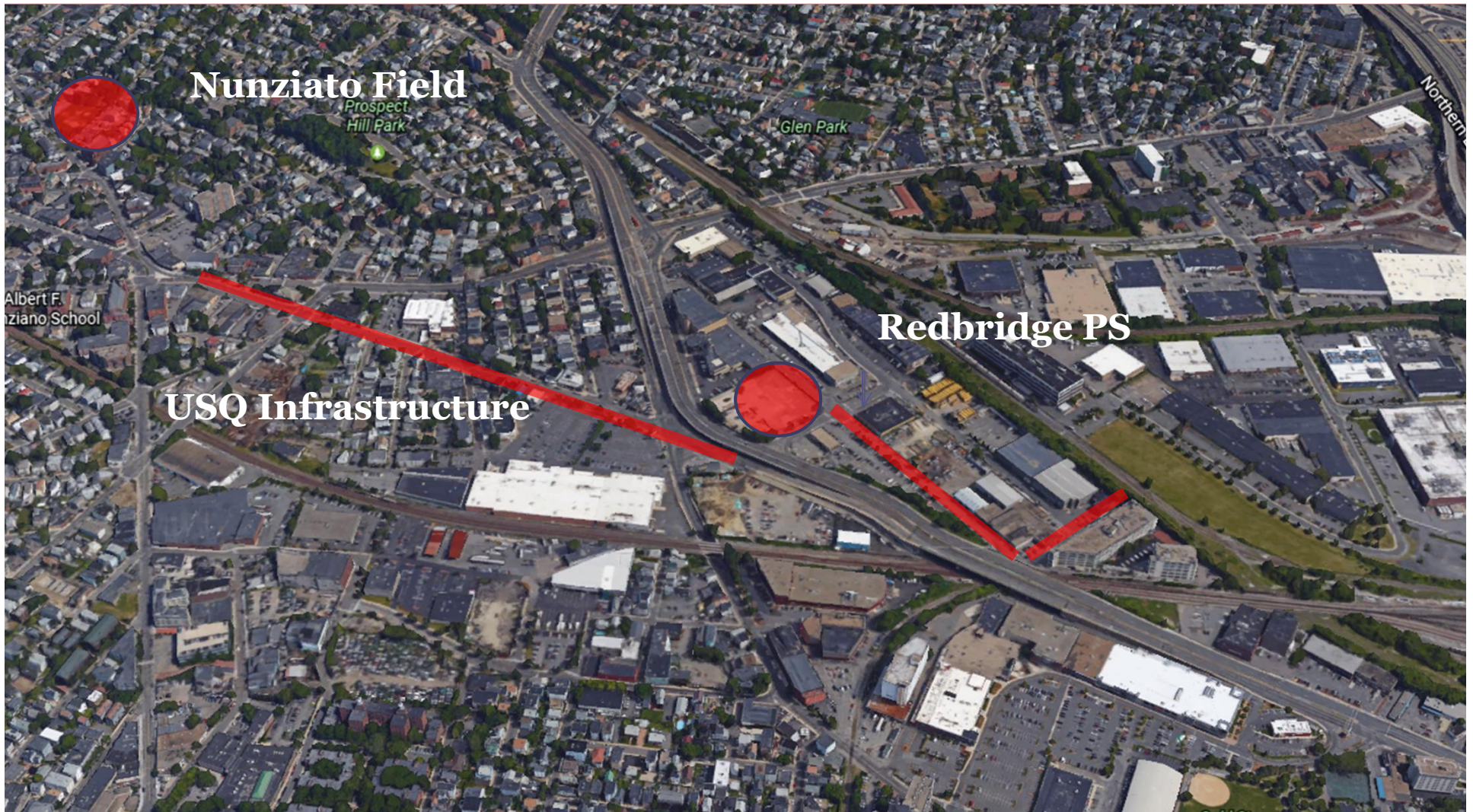
ALL ELEVATIONS REFER TO MEAD AS VERTICAL DATUM PROGRESS SUBMISSION PRELIMINARY NOT FOR CONSTRUCTION FOR CLIENT REVIEW		UNION SQ. UTILITY & TRANSPORTATION IMPROVEMENTS CONTRACT CP-2/CP-3 SEWER SEPARATION AND WATER REPLACEMENT SEWER RELOCATION AT MEDFORD STREET DETAIL PLANS & SECTION		SHEET NO. SD-47 DATE: 08/11/2014 SCALE: AS NOTED CITY OF SOMERVILLE 93 HIGHLAND AVENUE SOMERVILLE, MA 02143
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Infrastructure Information

Part Two:

Proposed Major Infrastructure Projects

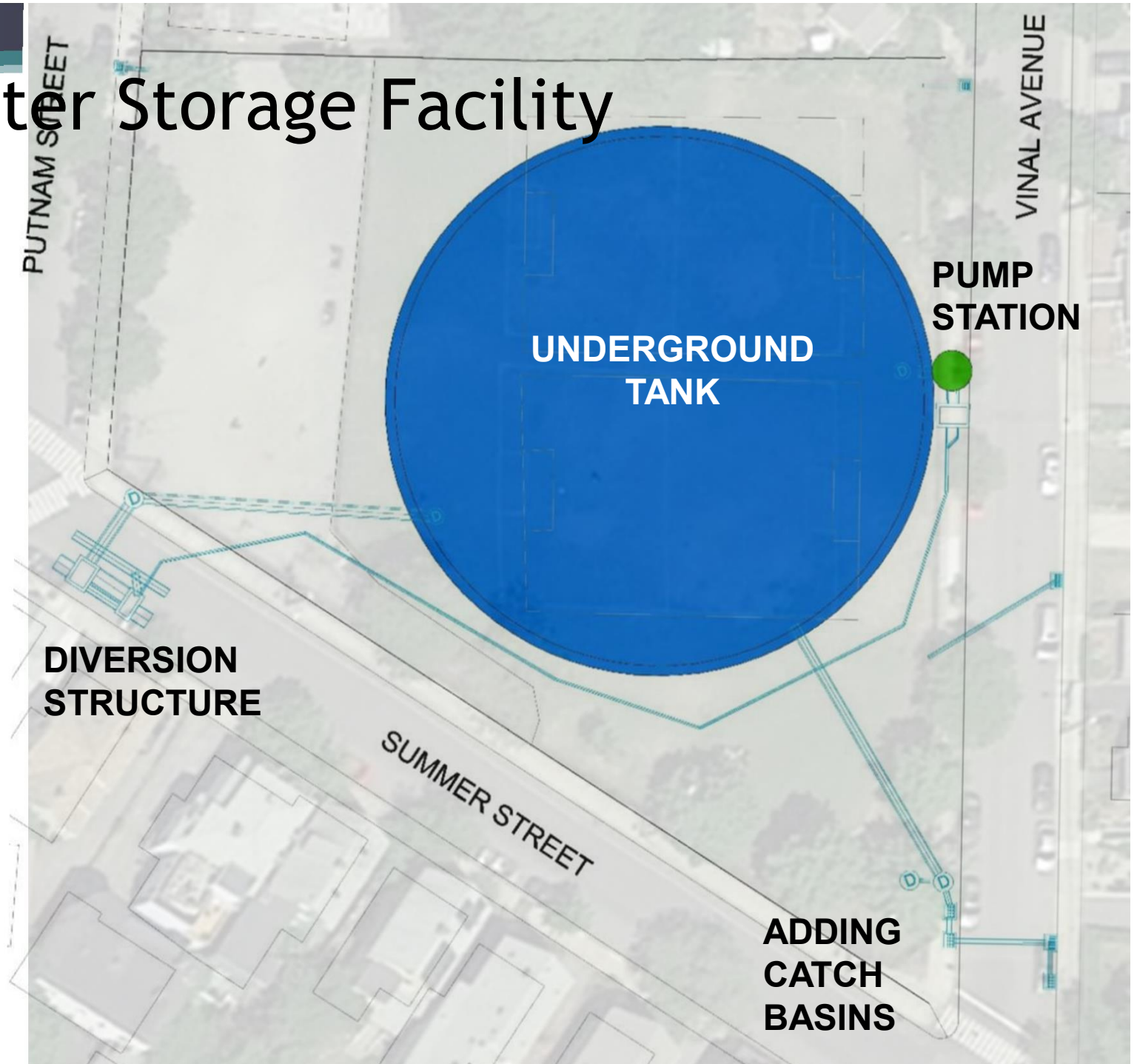
3 Project Overview





**Nunziato Field
Stormwater Storage
Green Infrastructure
Field Upgrades**

Stormwater Storage Facility



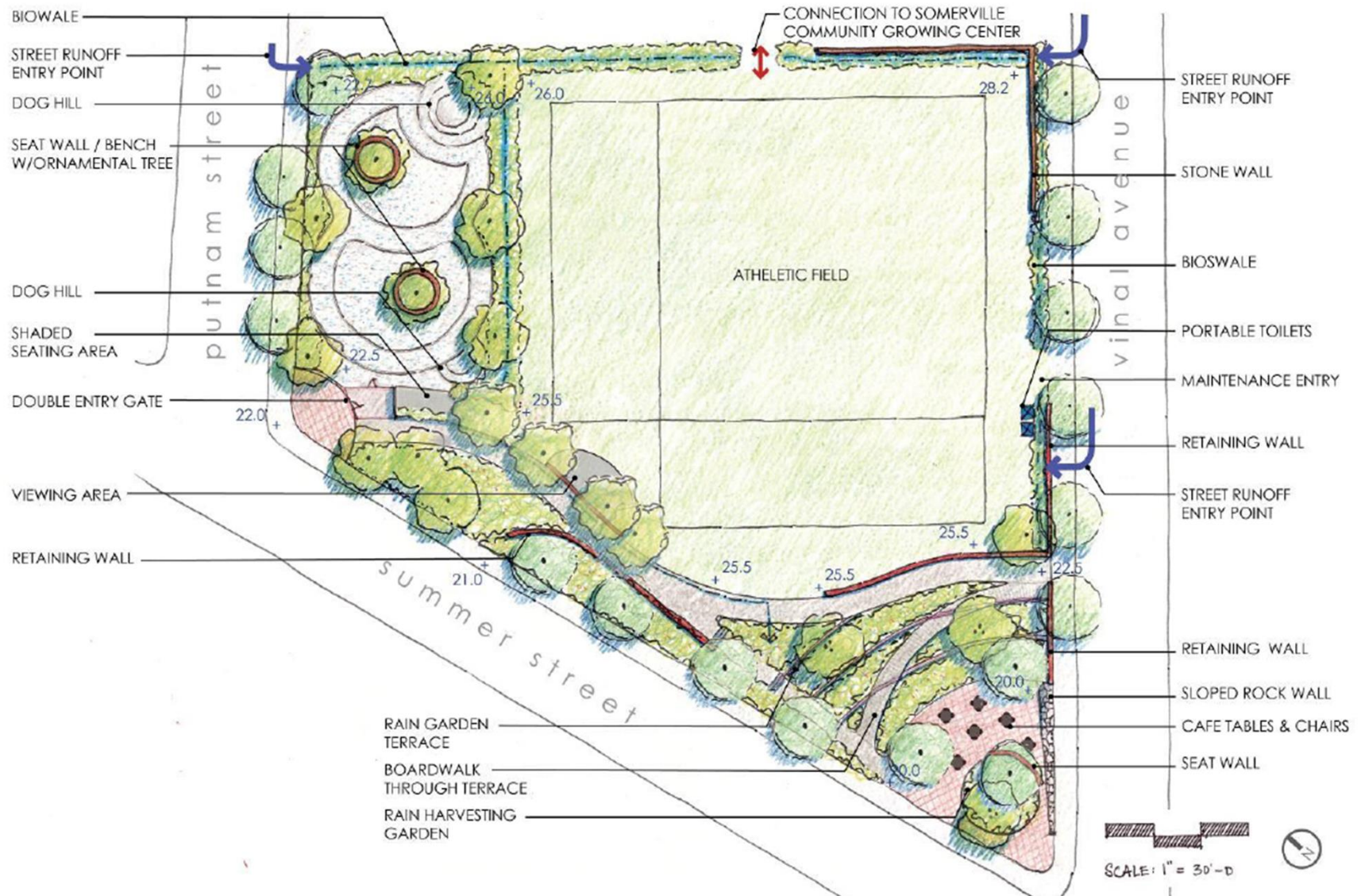
Tank Excavation



Sewer & Drain Vaults



Park Improvements



Existing Example Beacon Street (1 MG Storage)



Construction Estimate

Nunziato Field Stormwater Storage and Park Upgrades

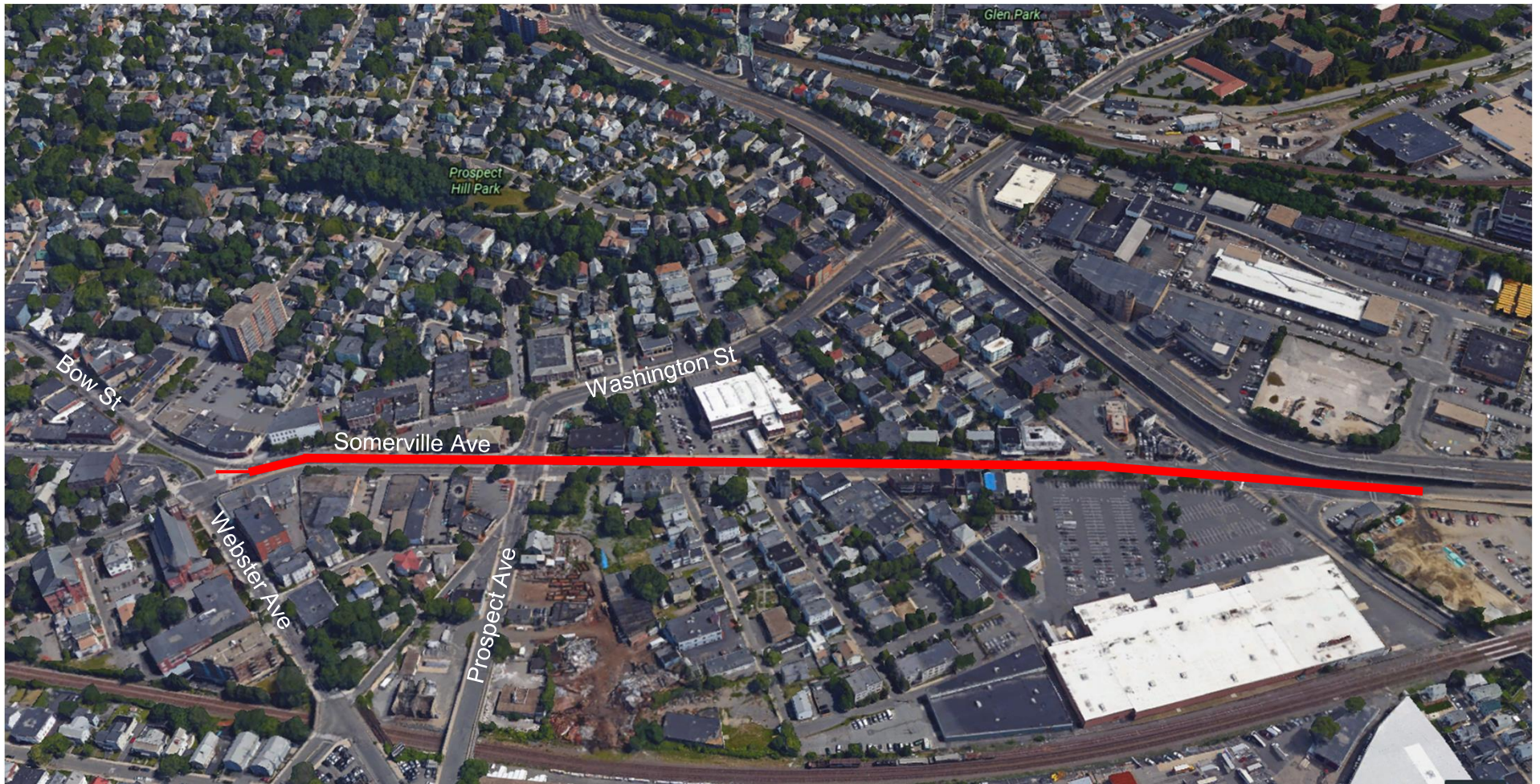
Estimated construction timeframe:

- 27 months of phased construction
 - Storage Tank
 - Diversion Structure
 - Putnam and Vinal Improvements
- 9 months of park work.
 - Field
 - Dog Park
 - Plaza

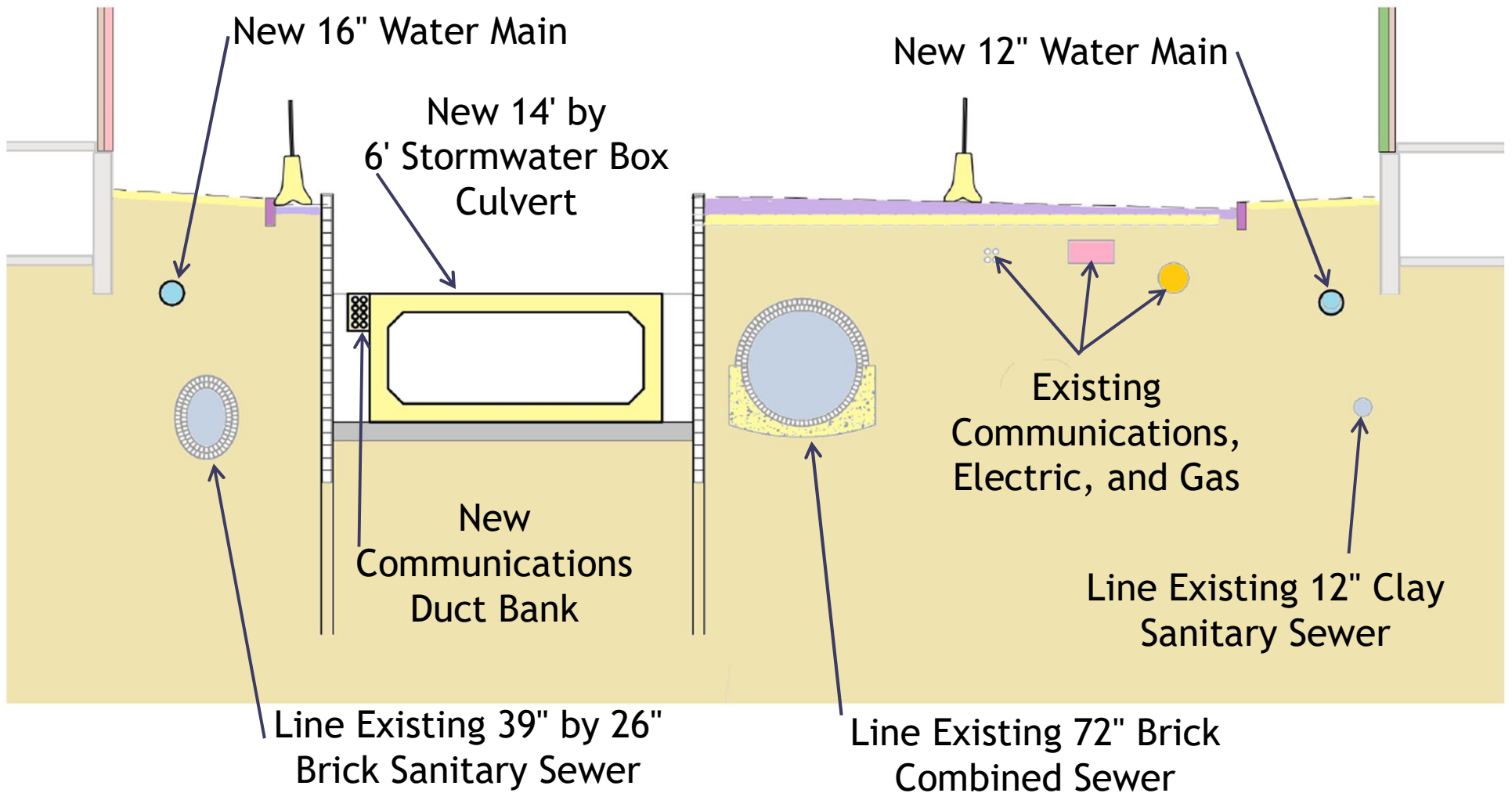
Estimated construction cost:

- \$14,600,000 (construction and construction oversight)

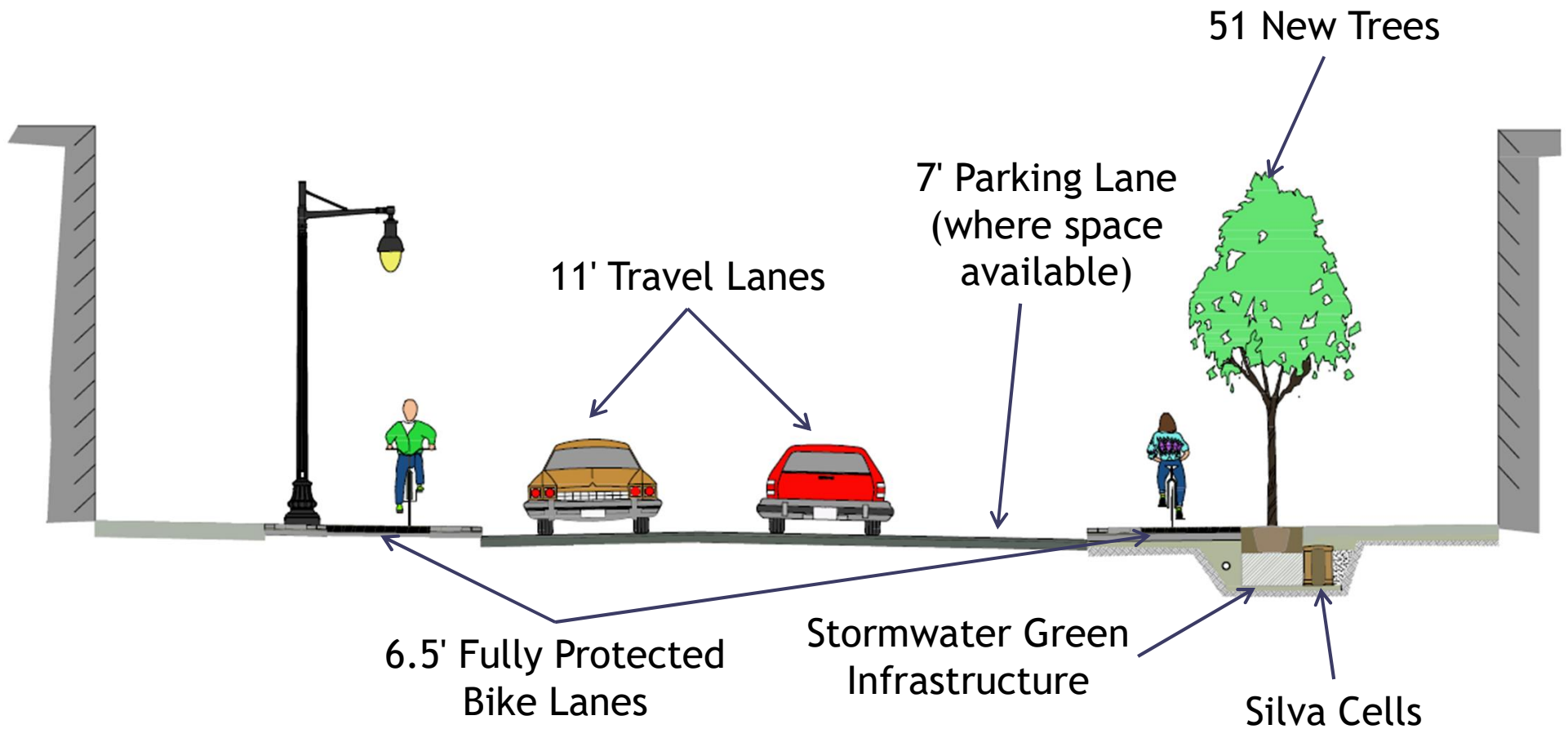
USQ - Somerville Ave Sewer Separation and Streetscapes Restoration



Box Culvert and Utilities - Cross-Section



Streetscapes - Typical Section



Streetscapes



Construction Estimate

Somerville Avenue Sewer Separation and Streetscape Upgrades

Estimated construction timeframe:

- 3 full construction seasons (3 years if we start in March/April)
- Anticipated construction includes the infrastructure constructed from Bow Street to Medford Street with the Streetscape to follow behind.

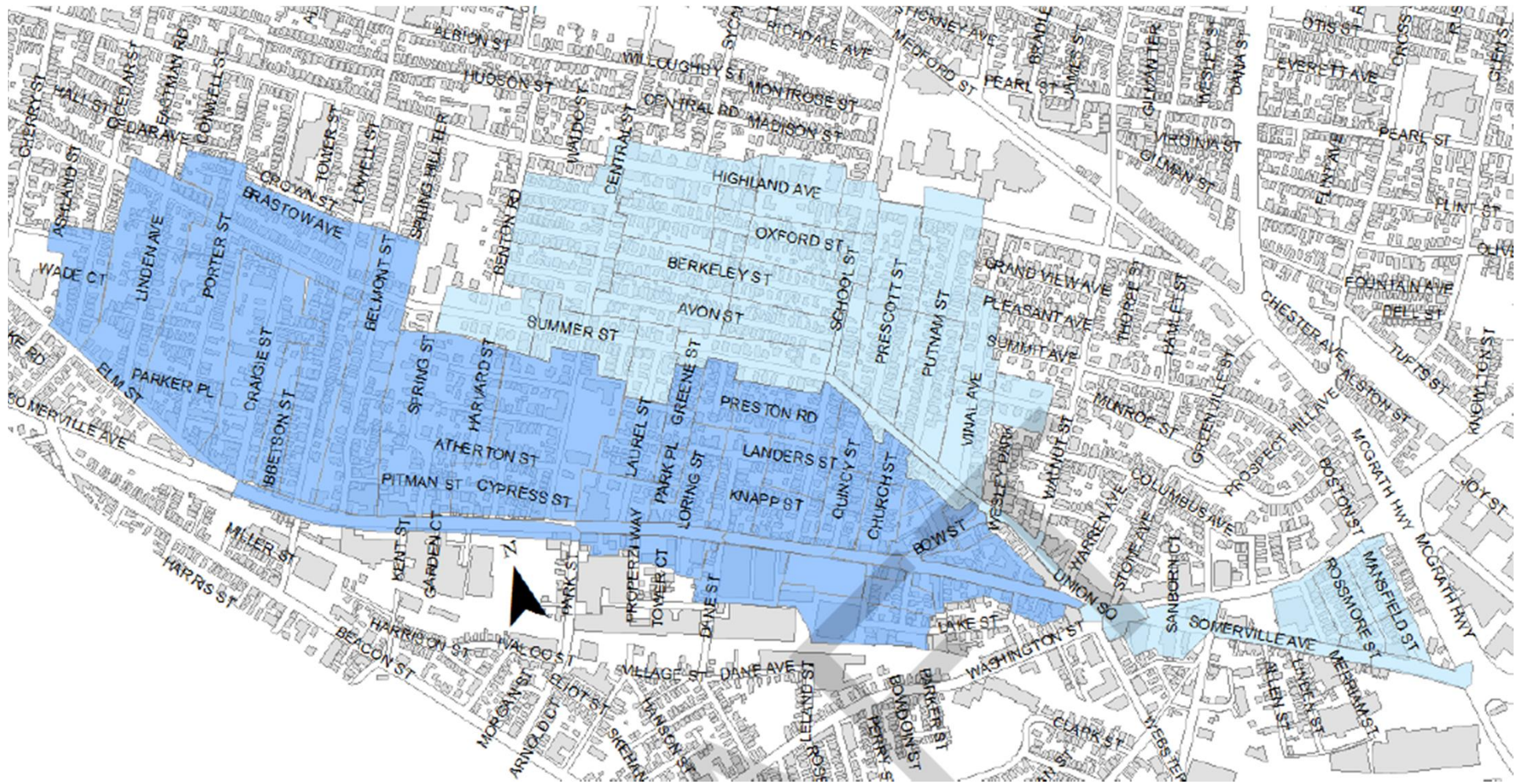
Estimated construction cost:

- \$50,350,000 (currently working to finalize estimate)
- MassWorks as partner will save the City **\$13,000,000**
 - **MassWorks has deadlines**

Redbridge Pump Station



Separation Opportunities



Proposed Connection



Construction Estimate

Redbridge Pump Station

Design has not been started (work pending Board approval)

Estimated design timeframe:

- Secure OPM
- Secure Architect
- 1 year design.

Estimated construction timeframe:

- 1.5 – 2 years of construction
 - Building / Pump Station / Wetwell
 - Force main connection

Estimated design & construction cost:

- \$19,600,000



Questions?



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