FUSS & O'NEILL

Whitwell Avenue Drainage Investigation and Flooding Analysis

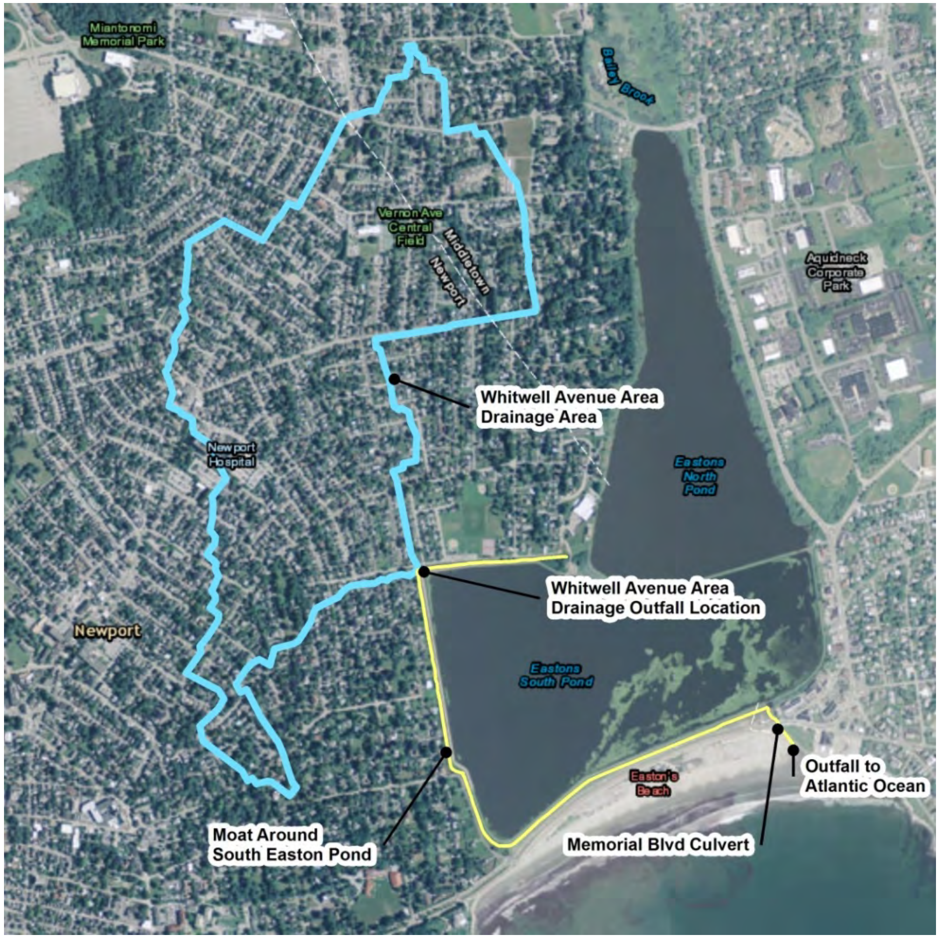
Second Public Informational Meeting
December 7, 2016
Project No. 16-040
City of Newport
Department of Utilities

Agenda

- Project and Watershed Area Overview
- Model Setup and Calibration
- Existing Conditions Flooding
- Alternatives Considered
- Model Results for Alternatives
- Conclusions

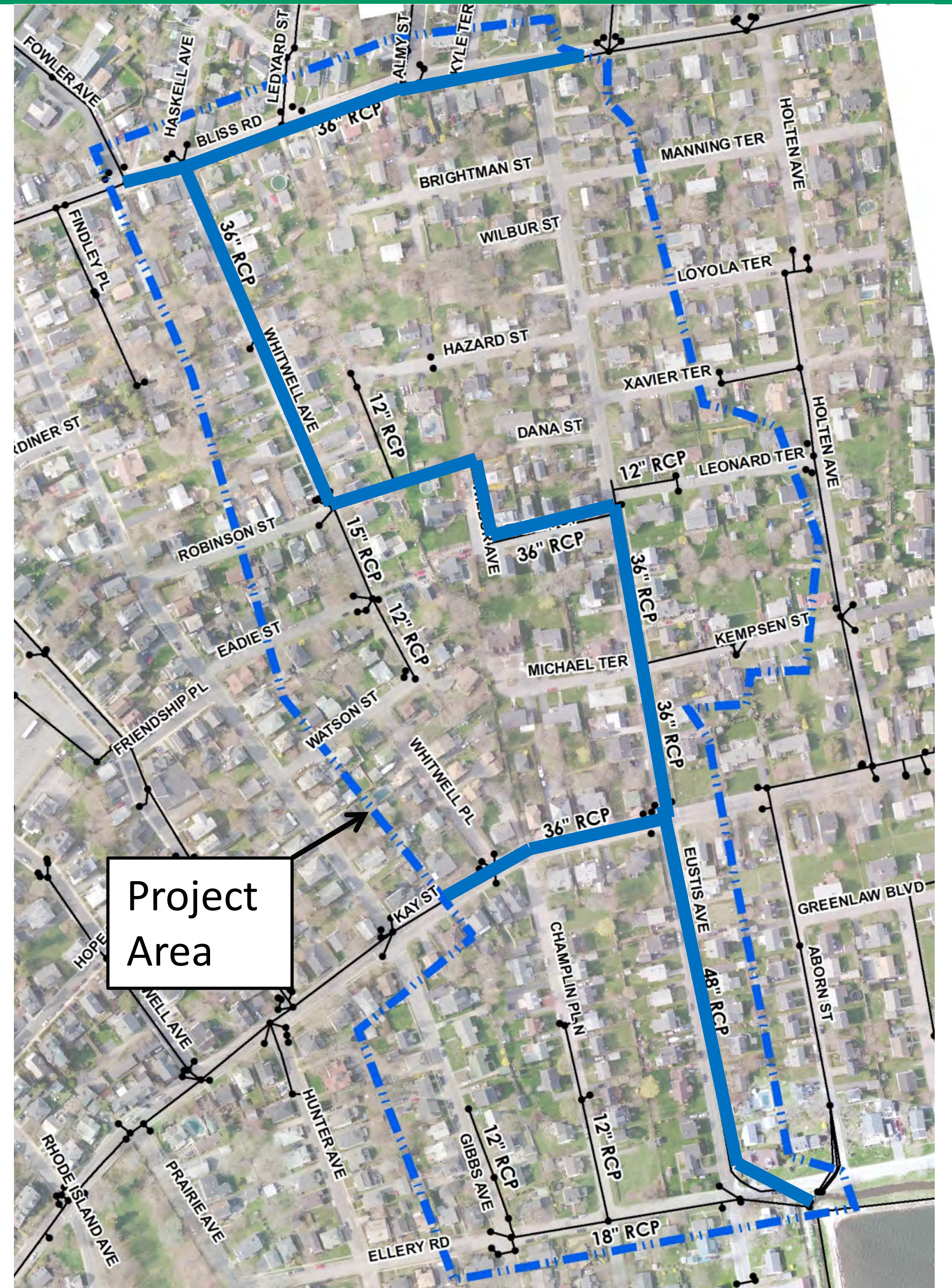
Whitwell Avenue Drainage Area

- 262 acre drainage area to Moat
- Completely built-out
- Poorly drained soils throughout the watershed
  - Little water infiltrates, mostly runs off
- Very challenging conditions



Existing Drainage System

- 36” trunk storm sewer through neighborhood
  - Drains runoff from neighborhoods to north and west.
- 48” trunk storm sewer under Eustis Ave to the Moat



Low Area Between Whitwell and Eustis

Source: Google Earth

Studied Storm Events

- Studied impacts from two events
  - One real storm, August 15, 2012
  - One theoretical storm, used for design of new construction

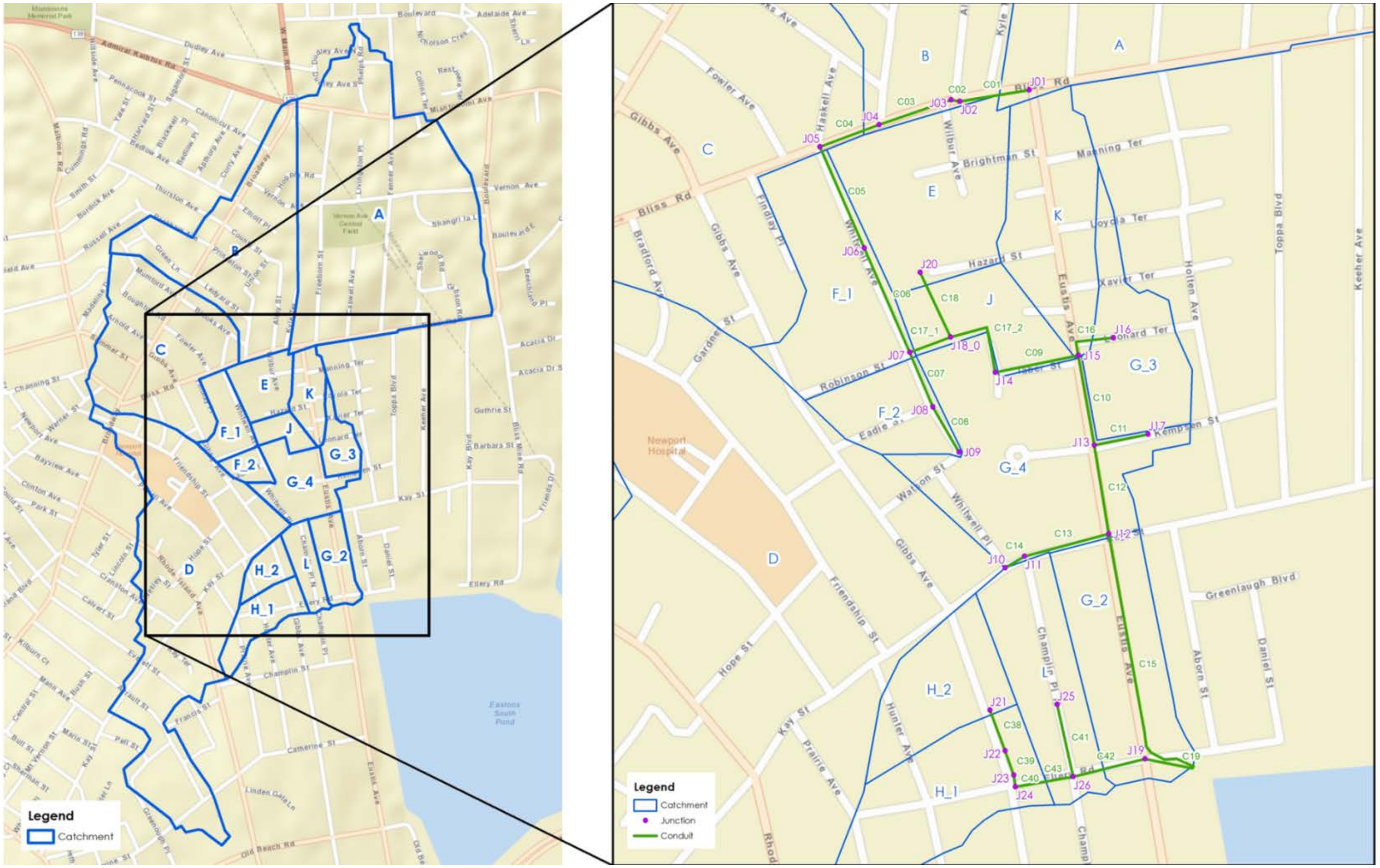
Storm	Total Rainfall Depth (in)	Duration (hr)	Peak Intensity (in/hr)
August 15, 2012	1.78	4	1.17
10-Year Storm Event	5.02	24	1.26

Flooding on Hazard Avenue, August 15, 2012

Flooding on Whitwell Avenue, August 15, 2012

Hydrology & Hydraulics Model Approach

- EPA SWMM (Stormwater Management Model)
  - Rainfall/runoff model for modeling closed conduit systems, with 2D component for surface flooding
- 15 Catchments; 26 Conduits; 26 Nodes (Manholes); 2 Outfalls



Watershed Hydrology

	Peak Flow into the Moat (Cubic Feet per Second)	Volume of Runoff from the Watershed (Gallons)
August 15, 2012 Storm	160	6.0 million
10-Year Storm	189	14.6 million

- Total runoff volume for August 15, 2012 storm
  - Generated outside the project area = 5.3 million gallons
  - Generated from within the project area = 0.7 million gallons

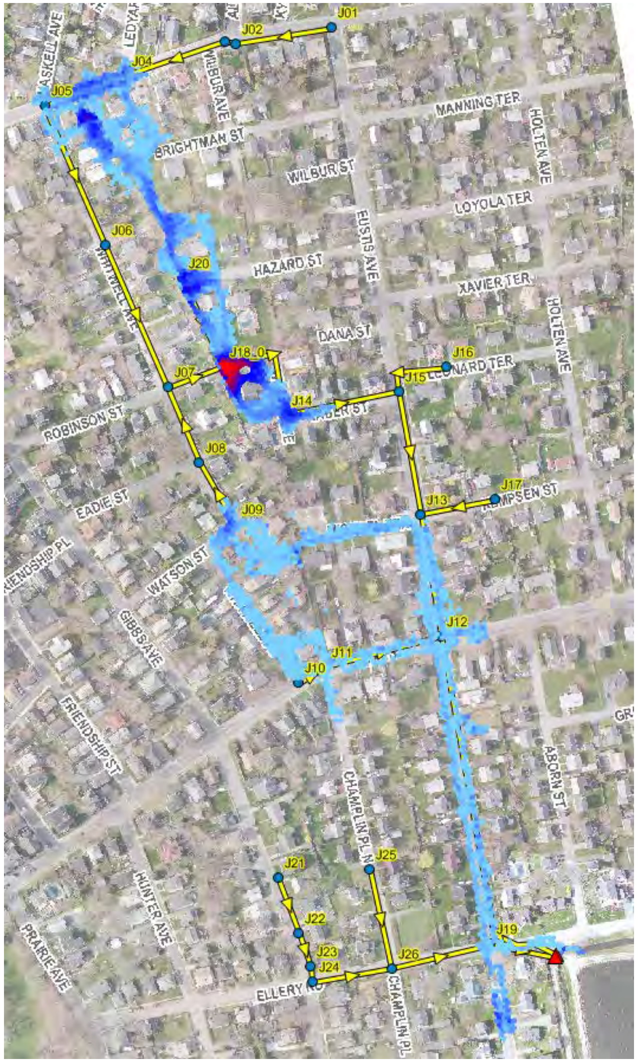
Existing Conditions – Videos

August 15, 2012 Storm

10 Year Storm

Existing Conditions – Peak Flows

August 15, 2012 Storm



10 Year Storm

Model Calibration

- Model calibration using known flooding from August 15, 2012

Whitwell Avenue and Watson Street
- ~2-3 inches of flooding in photograph
- Average modeled flooding depth is 3 inches

Hazard Street
- ~10 inches of flooding in photograph
- Maximum modeled flooding depth is 13 inches

Modeled Three Viable Alternatives

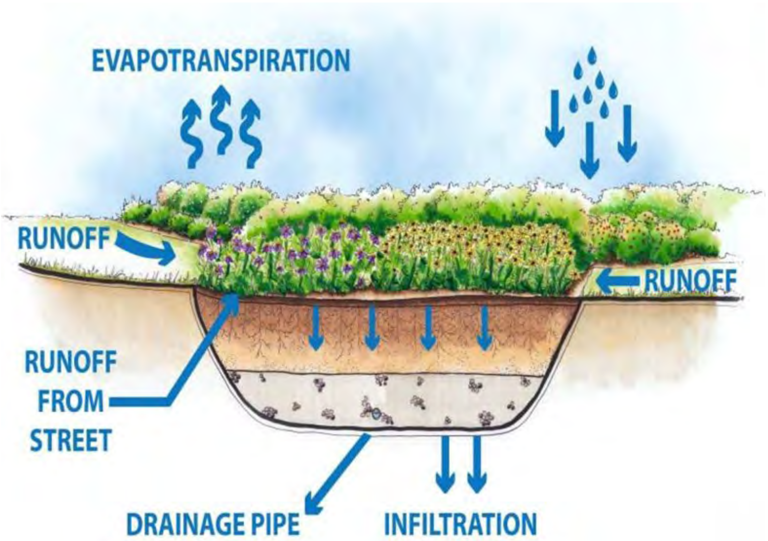
1. Increase Trunk Storm Sewer from 36-inch to 48-inch

2. Increase Pipe Sizes & Connect Watson Street with Kay Street

3. Install Subsurface Storage System

Other Alternatives Considered

- Green Infrastructure
  - Relies on well-drained soils to disconnect runoff from storm drains
  - Poor soils in watershed make this inefficient
  - Requires about 37 acres of space to reduce flooding
- Storage in Braga Field
  - Too low, inundated by Moat during floods

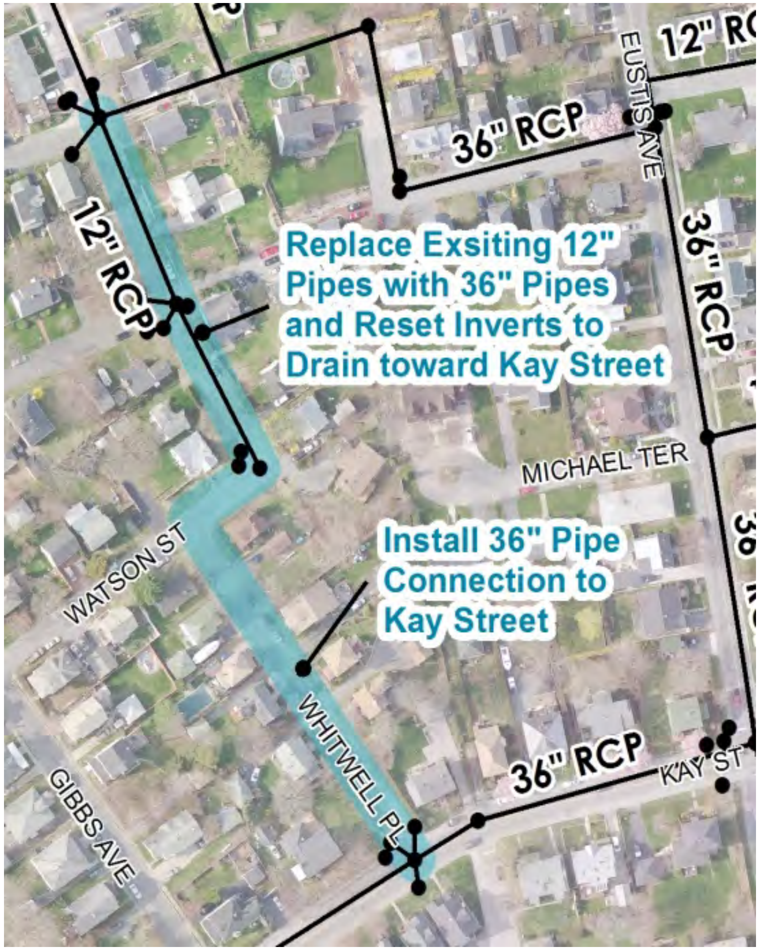


1. Increase Pipe Sizes

- Replace 2,500 linear feet of 36-inch pipe with 48-inch pipe
  - 80% increase in capacity
- Replace 900 linear feet of 12- and 18-inch pipe with 24-inch pipe
  - 150% increase in capacity

2. Connect Watson Street with Kay Street

- 830 linear feet of new 36-inch storm drain
  - Redirect Whitwell Ave pipes to Whitwell Place and Kay Street
  - Alternative diverts over-loaded Whitwell Avenue drain away from Robinson Street and Wilbur Avenue



2. Connect Watson Street with Kay Street

- Initial analysis determined that this alternative alone would increase flooding on Kay Street
  - Not Acceptable
  - Modeled Depth of Water above Rim

	Existing Conditions		**Connect Watson Street with Kay Street Only**	
	August 15, 2012 Storm	*10-Year Storm*	*August 15, 2012 Storm*	*10-Year Storm*
Whitwell Place & Kay Street	--	--	0.35 feet	1.00 feet
Kay St & Champlin Place North	--	--	0.33 feet	0.82 feet

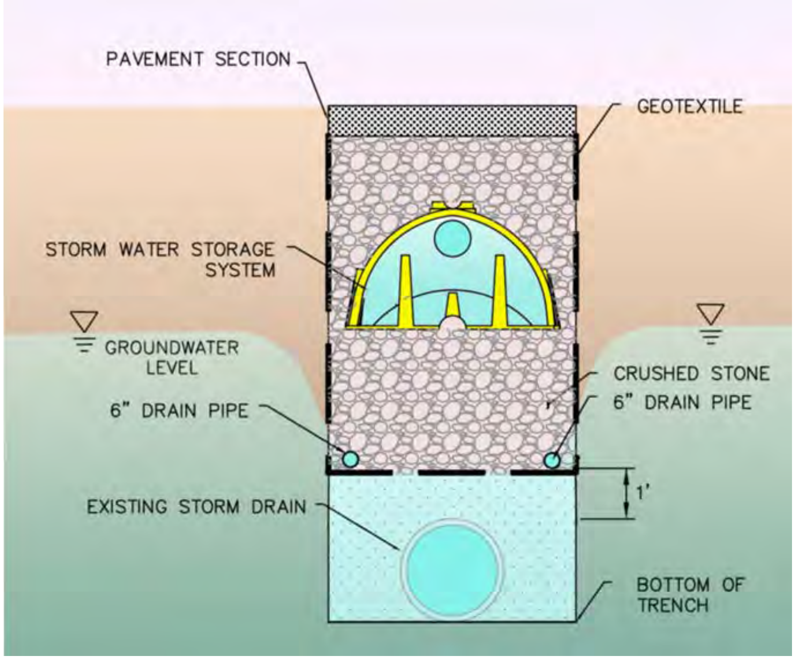
- Evaluated with Alternative 1 to avoid increasing flooding on other streets

3. Install Subsurface Storage System

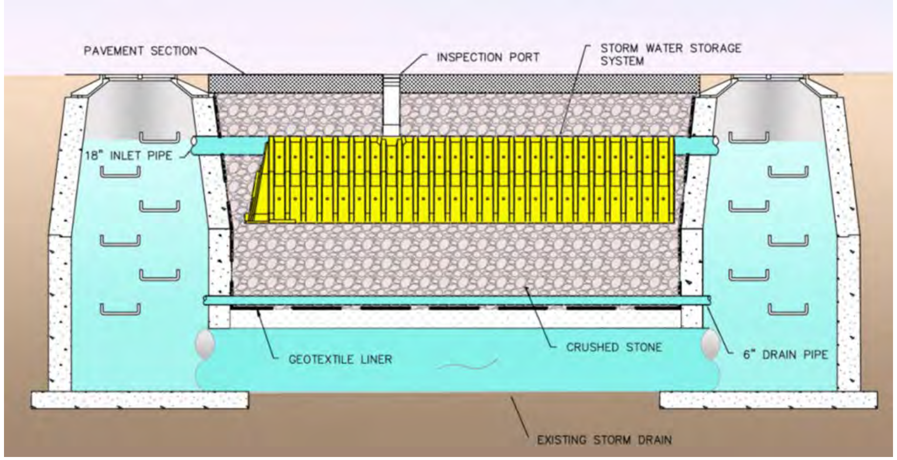
- 2,900 linear feet of subsurface storage system
- Replace 2,900 linear feet of existing 36” pipe below the subsurface storage system

3. Install Subsurface Storage System

- Typical Section

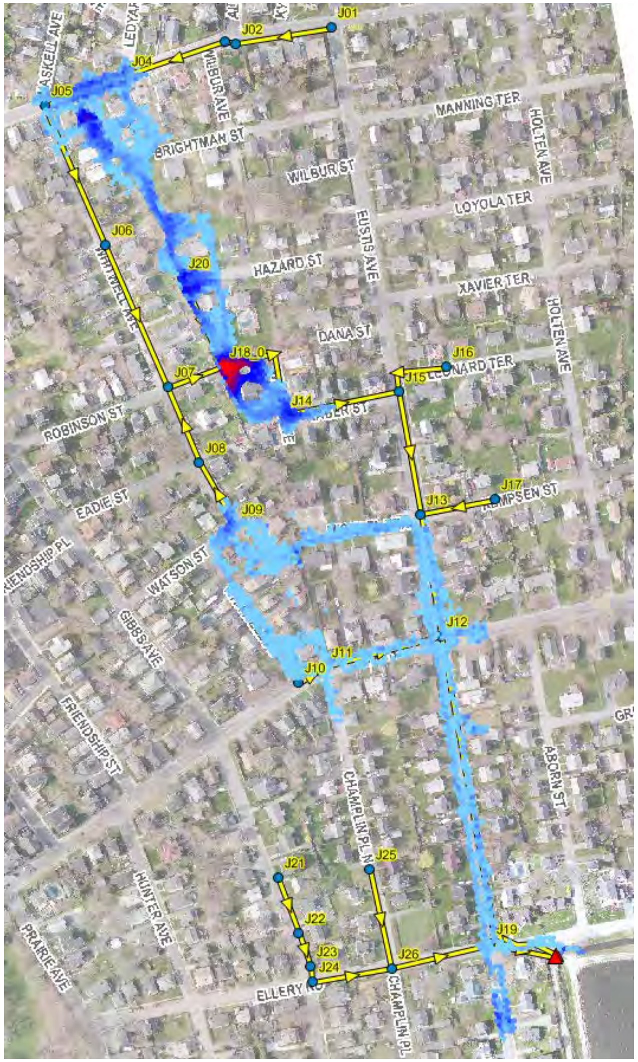


- Typical Profile



August 15, 2012 Storm-Flooding Eliminated

Existing Conditions

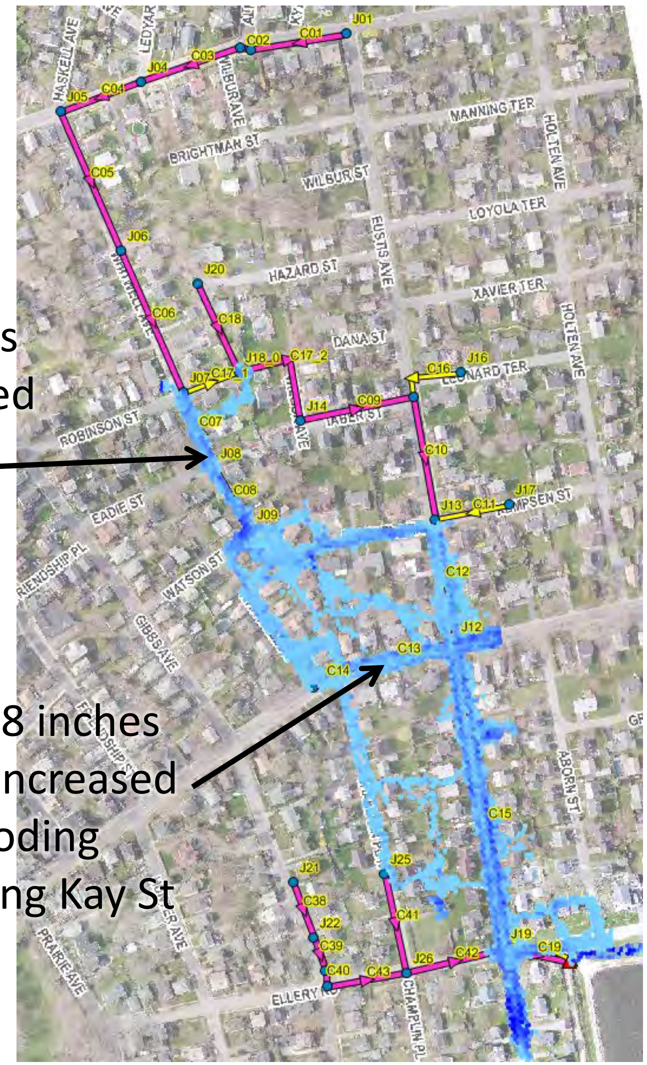


Alternative 1: Increase Pipe Sizes

10 Year Storm-Substantial Flooding in Lower Areas

Existing Conditions

Alternative 1: Increase Pipe Sizes



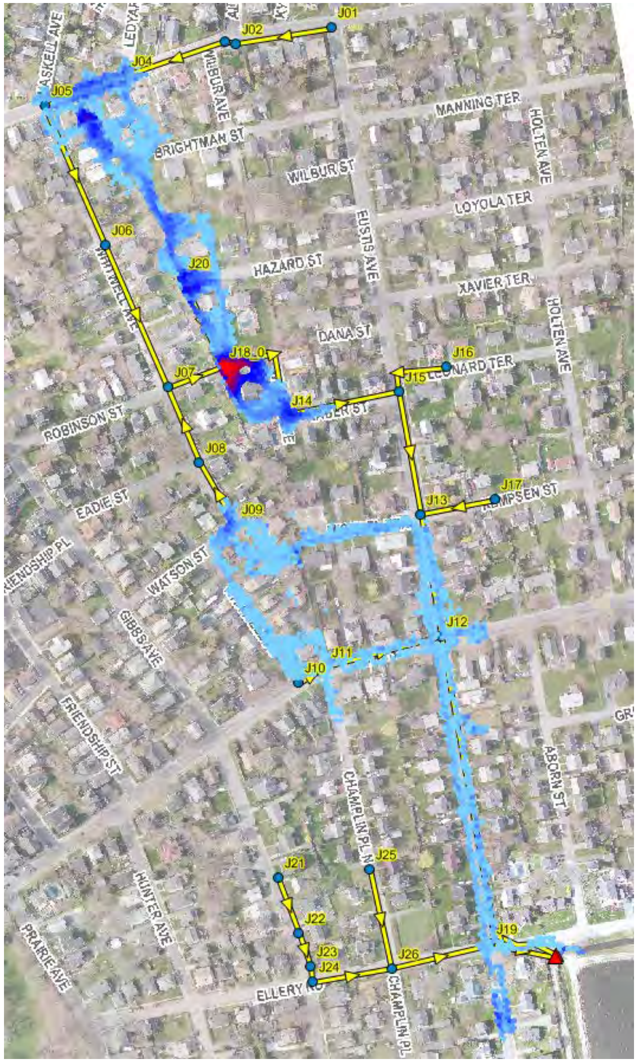
2 - 7 inches of increased flooding along Whitwell Ave

4 - 8 inches of increased flooding along Kay St

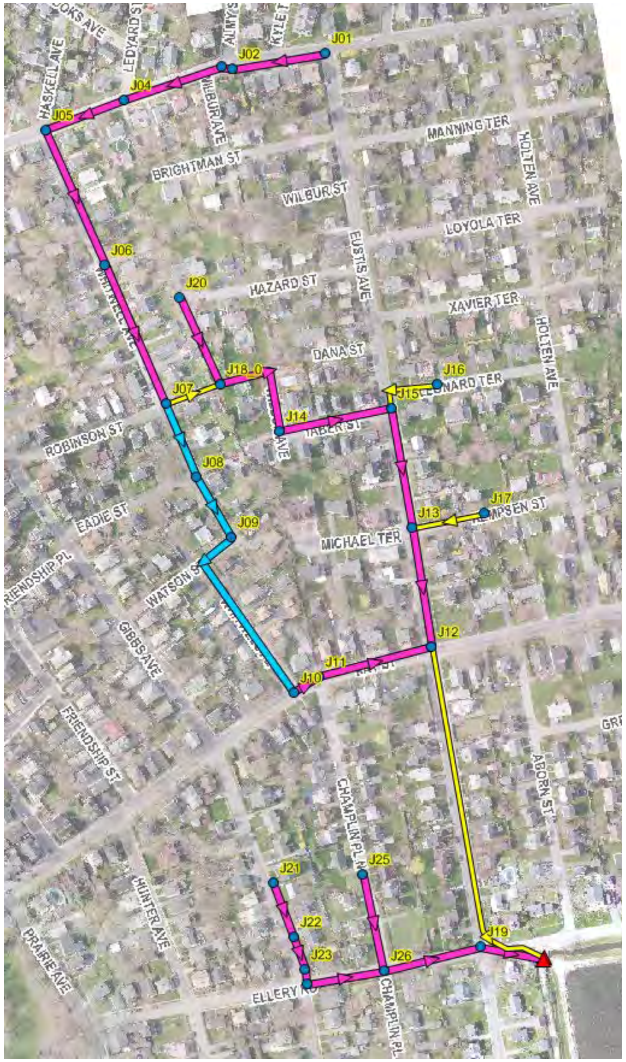
Modeling Results - Connect Watson Street with Kay Street

August 15, 2012 Storm-Flooding Eliminated

Existing Conditions



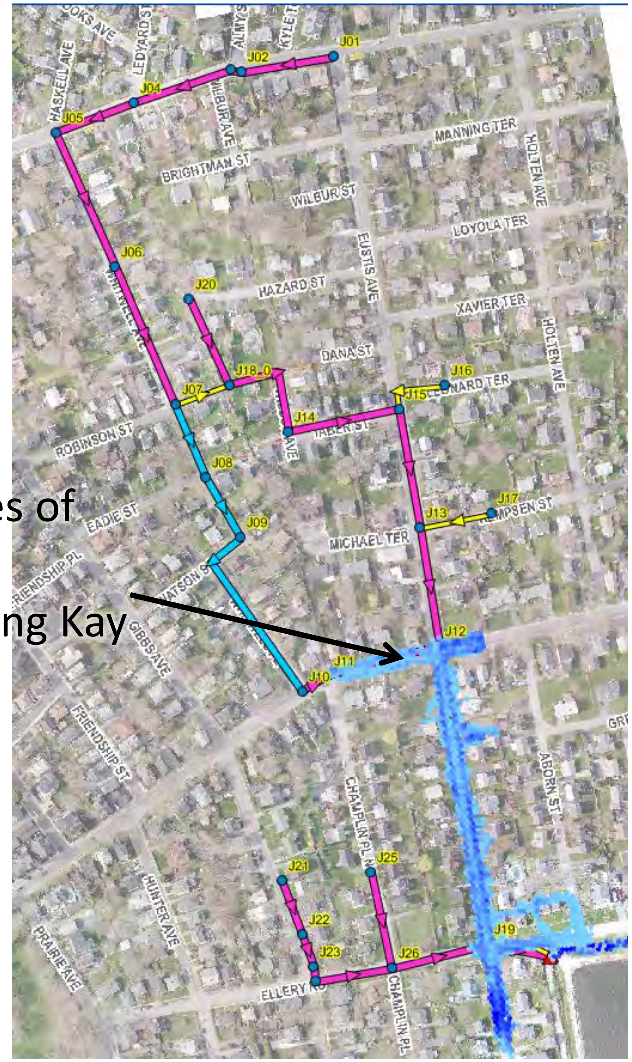
Alternative 2: Increase Pipe Sizes & Connect Watson St with Kay St



10 Year Storm-Less Flooding than Alternative 1

Existing Conditions

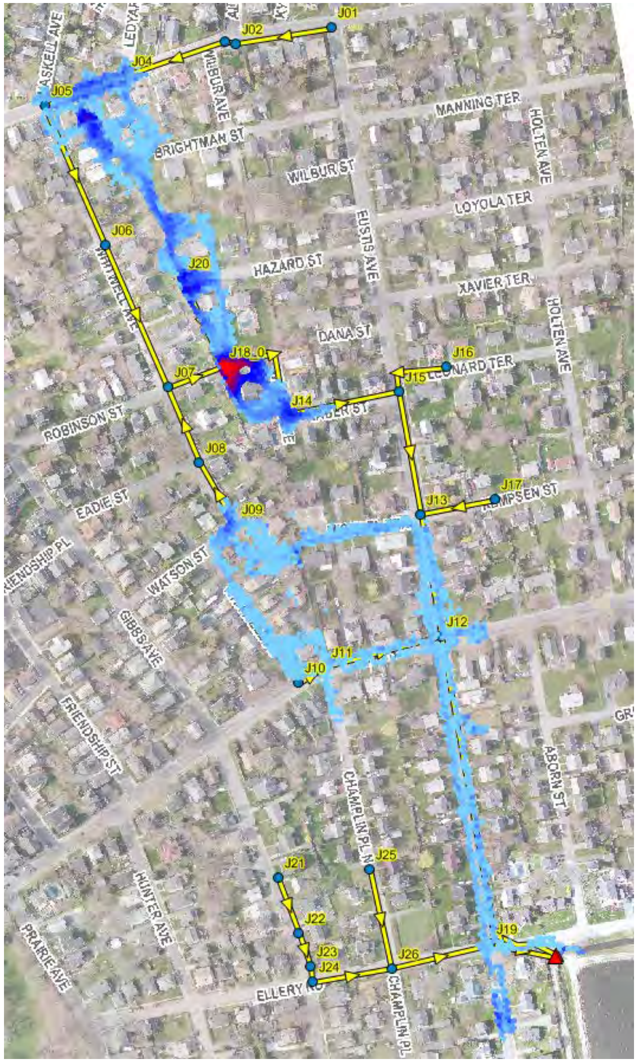
Alternative 2: Increase Pipe Sizes & Connect Watson St with Kay St



3 – 10 inches of increased flooding along Kay Street

August 15, 2012 Storm-Flooding Eliminated

Existing Conditions



Alternative 3: Subsurface Storage

10 Year Storm-Marginal Improvement

Existing Conditions

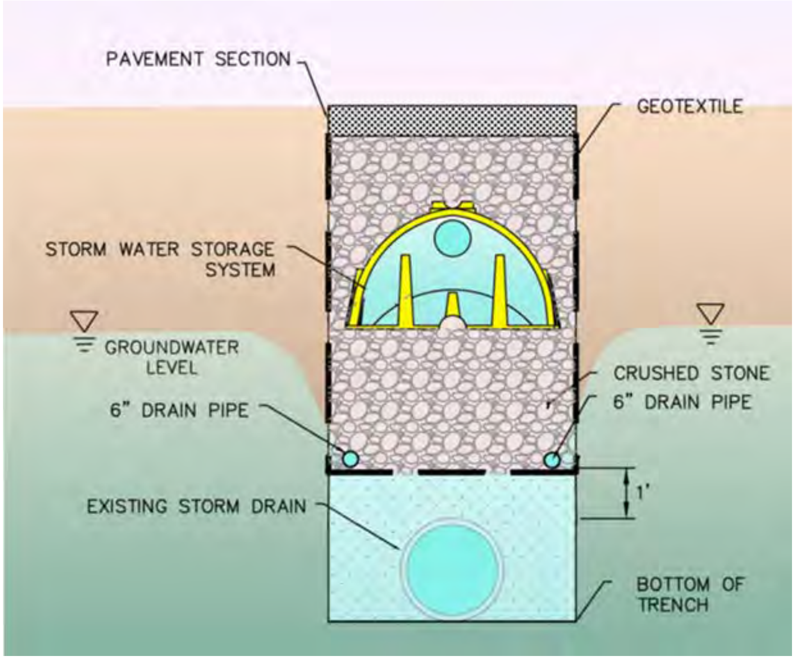
Alternative 3: Subsurface Storage

Summary of Alternatives

- All manage floods to scale of August 15, 2012
- Alternative 1-Increase Pipe Sizes
  - Major concern is that it increases flows downstream
    - 160 cfs to 189 cfs (18% increase during August 15, 2012)
    - **Increase risk of downstream flooding**
- Alternative 2-Increase Pipe Sizes and Connect Watson and Kay Streets
  - Major concern is that it increases flows downstream
    - 160 cfs to 190 cfs (19% increase during August 15, 2012)
    - **Increase risk of downstream flooding**

Summary of Alternatives

- Alternative 3-Install Subsurface Storage System
  - No increase in downstream flooding
  - Very innovative design
    - Design needs to be carefully developed
  - Storage system trench will complicate future replacement/repair of utility services to homes



Summary of Costs

- Only preliminary costs (-30% to 50 %) developed
- Based on conceptual plans, refine after preliminary design

Item of Work	Alternatives		
	1. Increase Pipe Sizes	2. Increase Pipe Sizes & Connect Watson and Kay Streets	3. Install Subsurface Storage
Site Prep	$190,000	$280,000	$230,000
Water Control	$65,000	$98,000	$70,000
Earthwork	$380,000	$520,000	$550,000
Site Restoration	$570,000	$710,000	$480,000
Drainage Improvements	$1,600,000	$2,000,000	$1,600,000
Miscellaneous (e.g. engineering, insurance, etc.)	$850,000	$1,100,000	$890,000
Subtotal (To Nearest $100,000)	**$3,700,000**	**$4,700,000**	**$3,800,000**

Conclusion

- Major challenges in watershed
  - No easy solutions
  - Problem will not go away quickly
    - Consider adaptation
    - Need to address stormwater whenever improvements made
- While subsurface storage system could improve flooding it has liabilities
  - Difficulty in future repairing and replacing utility services
  - Innovative design carries risks, need to be careful
    - No case histories or design guidance that applies past lessons learned
  - Will not solve every storm!
- Recommendation
  - Implement one upstream section of subsurface storage system
    - Better understand how best to design and construct before implementing entire system