



**PROJECT GROUNDWORK**  
*your pipeline to clean water*

# Lick Run Watershed

## Technical Overview

Communities of the Future Advisory Committee (CFAC)

Presented by:

**MaryLynn Lodor, MSDGC**

**John Lyons, Strand Associates, Inc.**

August 4, 2011

# Overview

## Regulatory and Economic Challenges

### Lick Run Wet Weather Strategy Overview

- Default Solution (Deep Tunnel)
- Sustainable Wet Weather Solution

### Conveyance Corridor: Conceptual Alternatives

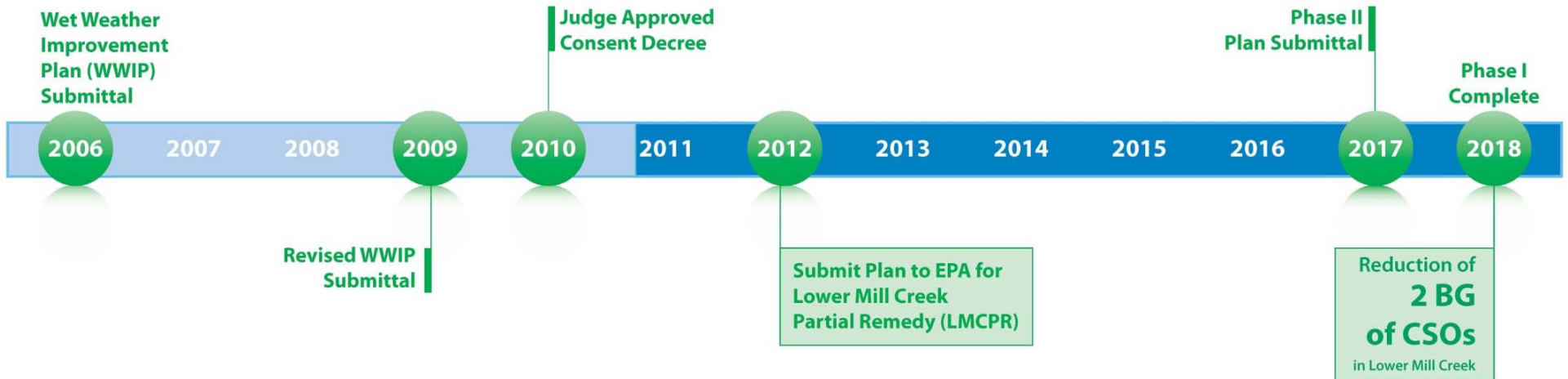
- Separate Storm Sewers
- Uniform Surface Channel
- Urban Waterway

### Proposed Hybrid Conveyance System

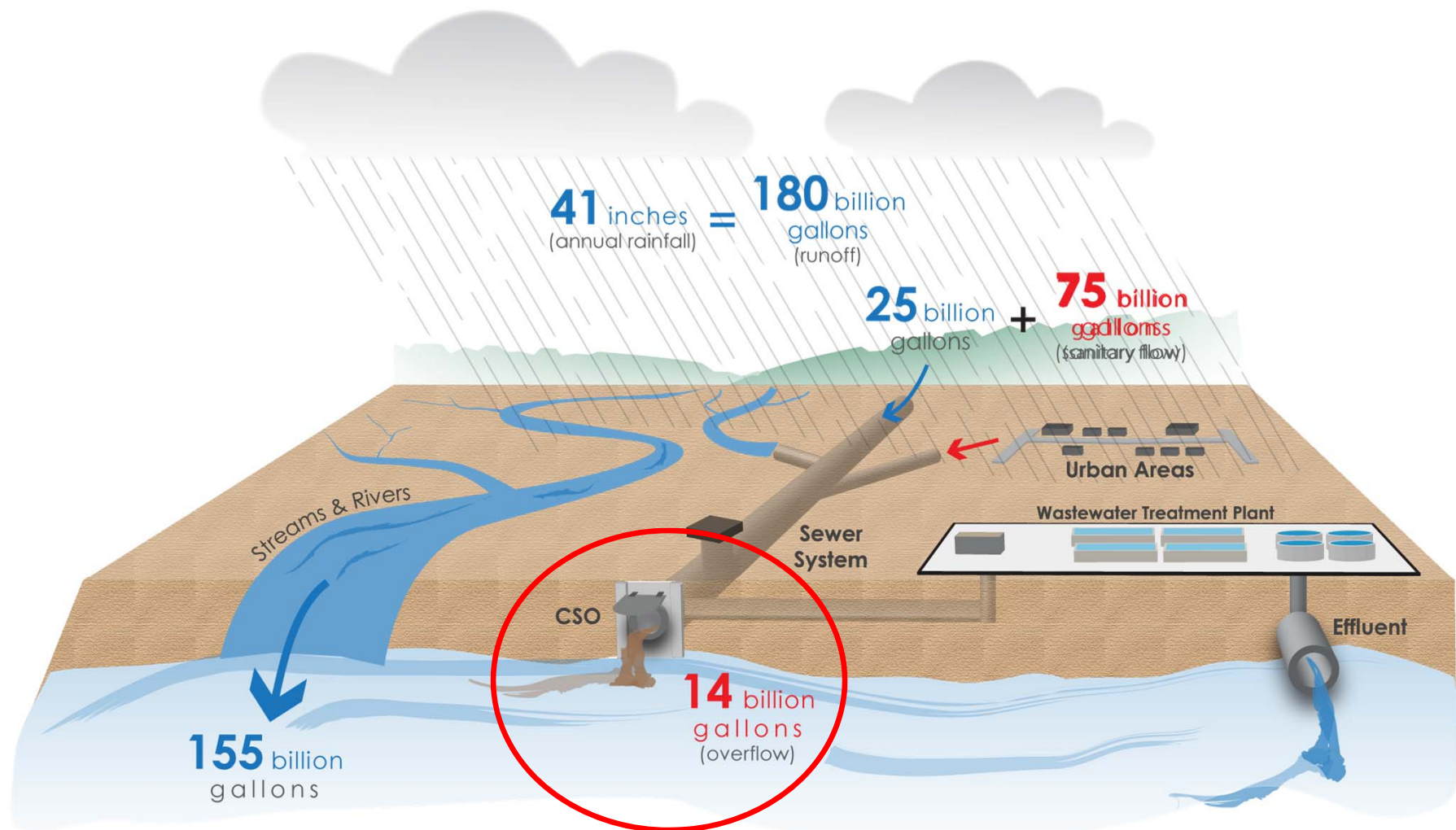
- Flow Configuration
- Base Flow to Channel
- Storm Sewer to Box Conduit

### Safety and Maintenance Considerations

# Consent Decree Timeline



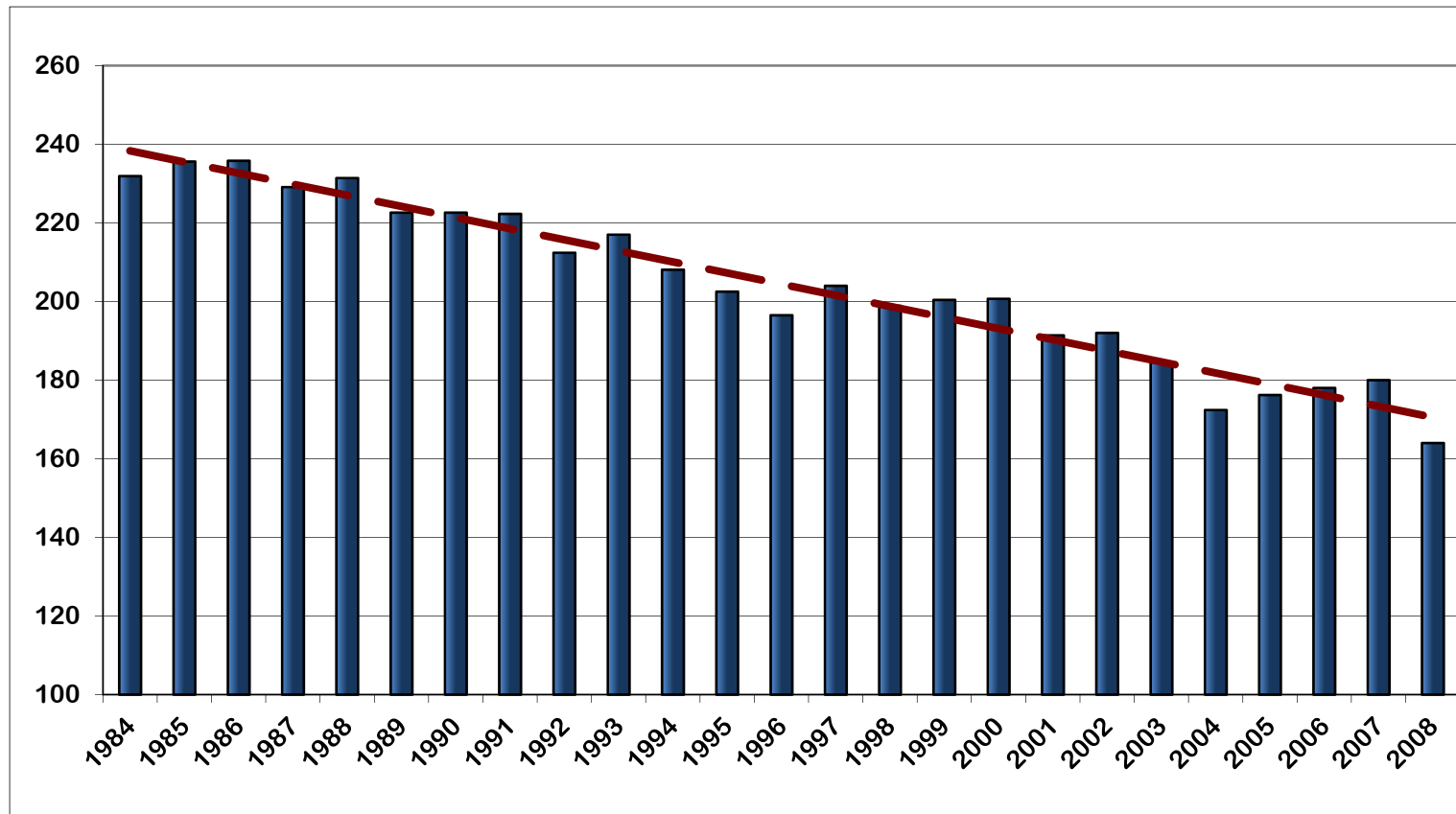
# MSD Current Environmental Challenge



MSD is among the Top 5 CSO dischargers in the US

# MSD Economic Challenges

- Maintaining affordability of residential usage
- Declining usage per account



# Context

## Communities of the Future

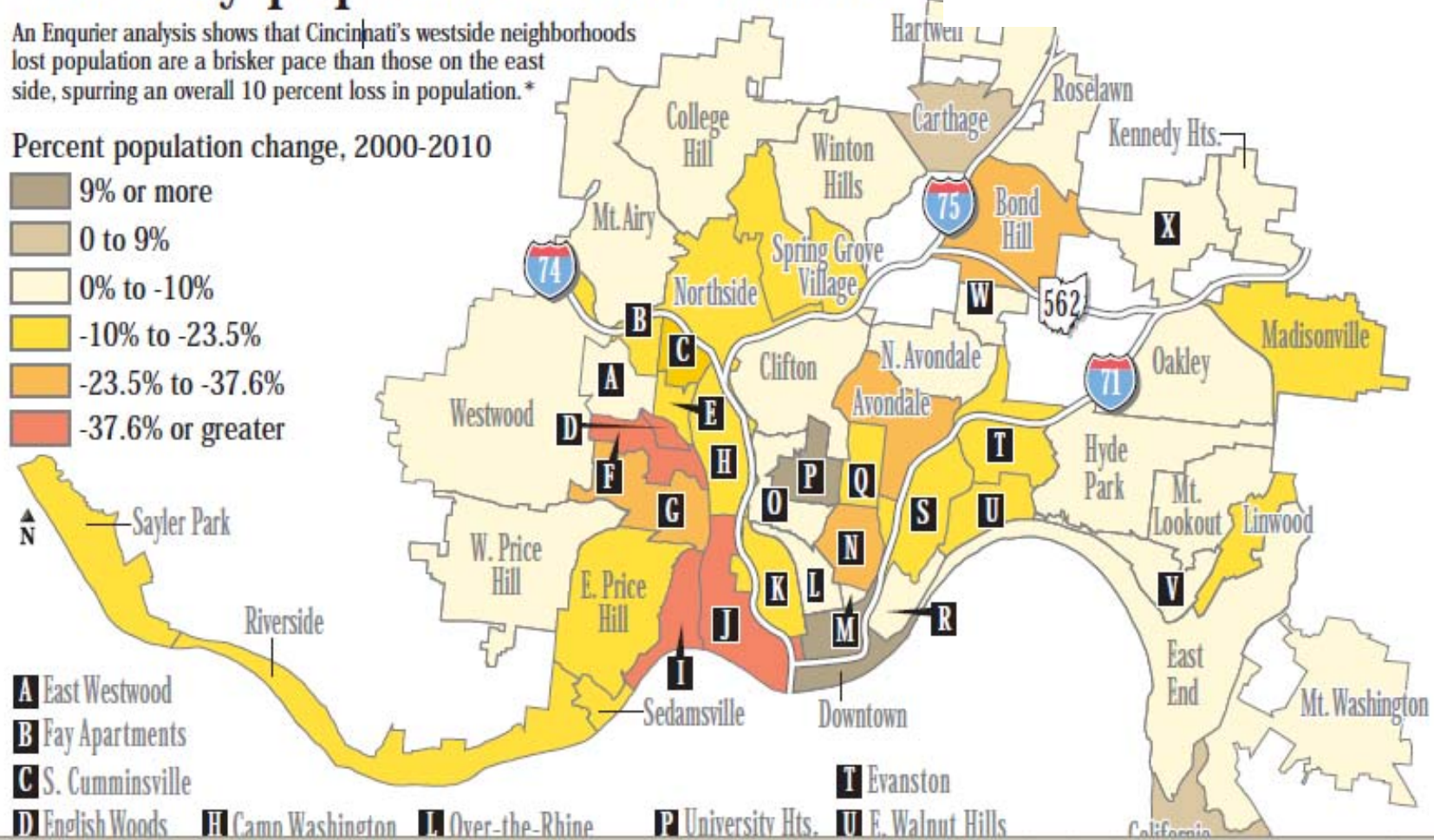
# How city population has shifted

April 7, 2011

An Enquirer analysis shows that Cincinnati's westside neighborhoods lost population at a brisker pace than those on the east side, spurring an overall 10 percent loss in population.\*

Percent population change, 2000-2010

- 9% or more
- 0 to 9%
- 0% to -10%
- 10% to -23.5%
- 23.5% to -37.6%
- 37.6% or greater



# Context

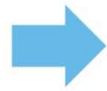
## Communities of the Future

April 21, 2011

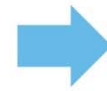
## Hamilton County property values drop \$5B



Current Conditions  
in the Community



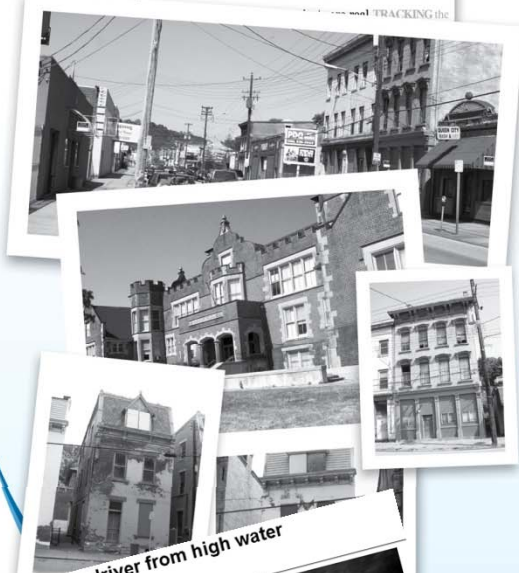
Leverage  
MSD's Investment



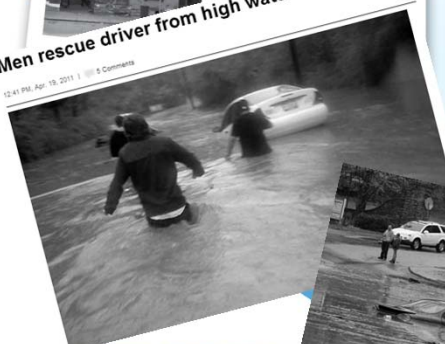
Community's Vision  
for the Future

THE CINCINNATI ENQUIRER

Property value at a substantial decline



Men rescue driver from high water



METROPOLITAN  
SEWER DISTRICT

of greater

CINCINNATI

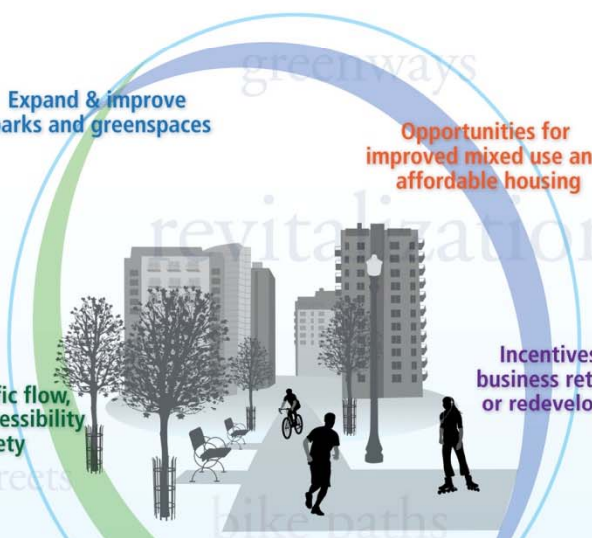


Expand & improve  
parks and greenspaces

Opportunities for  
improved mixed use and  
affordable housing

Improve traffic flow,  
pedestrian accessibility  
and safety

Incentives for  
business retention  
or redevelopment

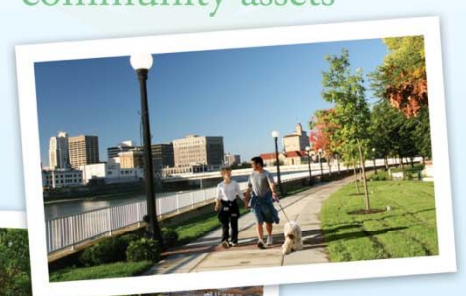


**MSD**

Metropolitan Sewer District

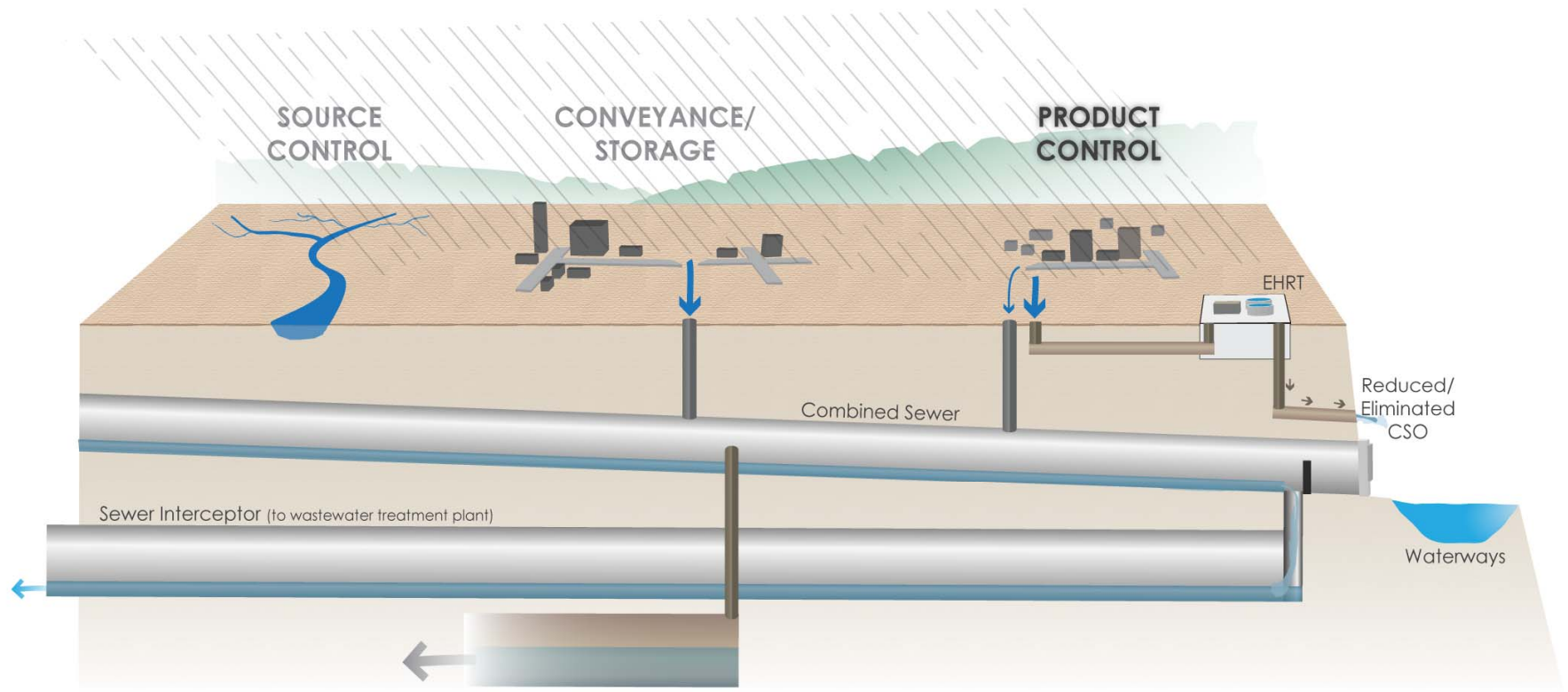
Investment to reduce sewer overflows  
and meet federal mandates

economics  
sustainability  
infill  
jobs  
bike trails  
recreational opportunities  
better education  
community gardens  
community assets  
quality place

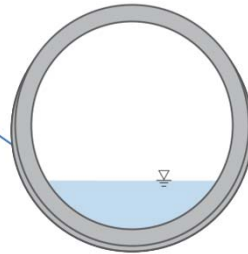




# MSD's Wet Weather Strategy



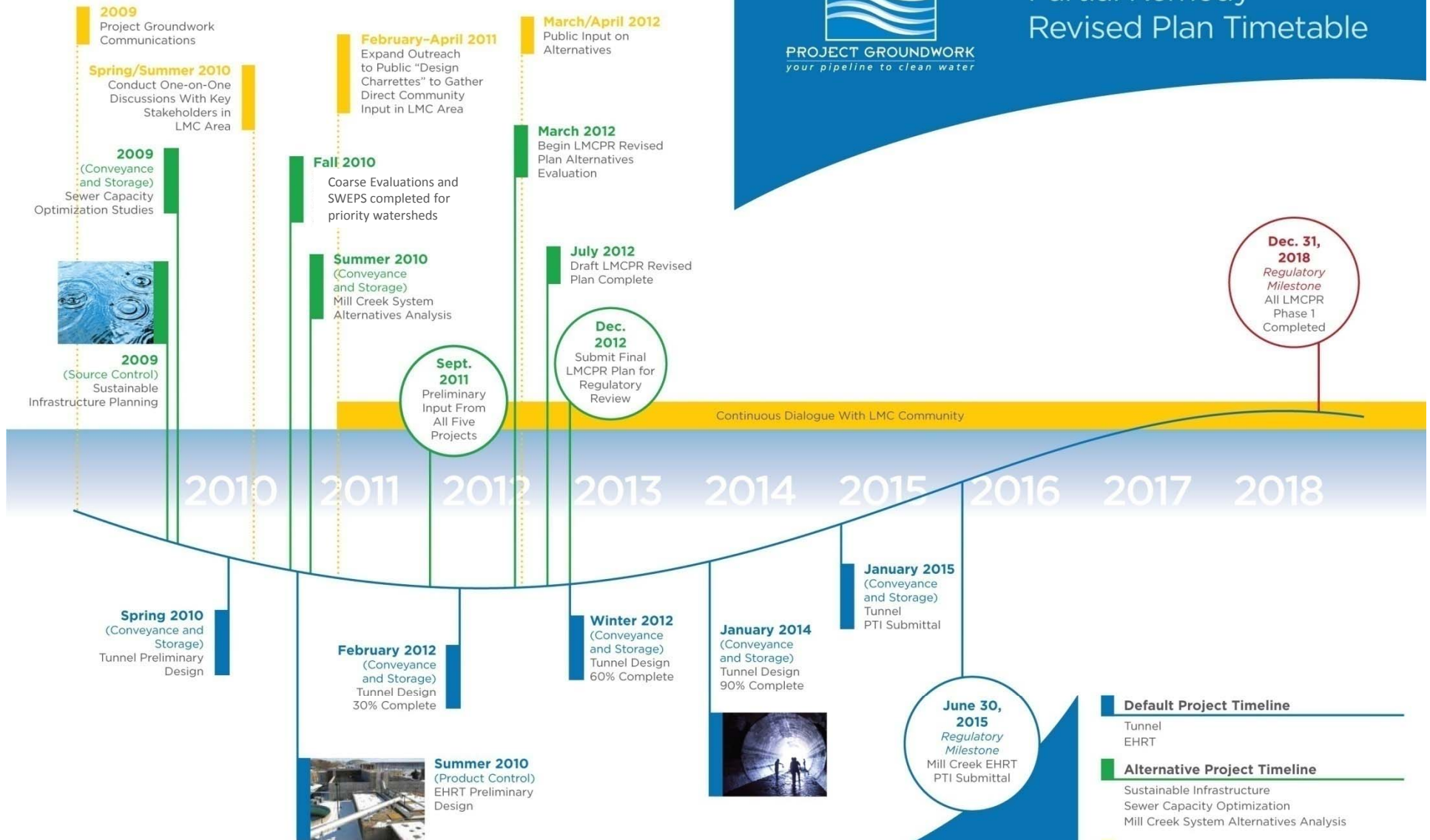
Hydraulic grade line inside sewer





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# Lower Mill Creek Partial Remedy Revised Plan Timetable



Default Project Timeline
Tunnel
EHRT

Alternative Project Timeline
Sustainable Infrastructure
Sewer Capacity Optimization
Mill Creek System Alternatives Analysis

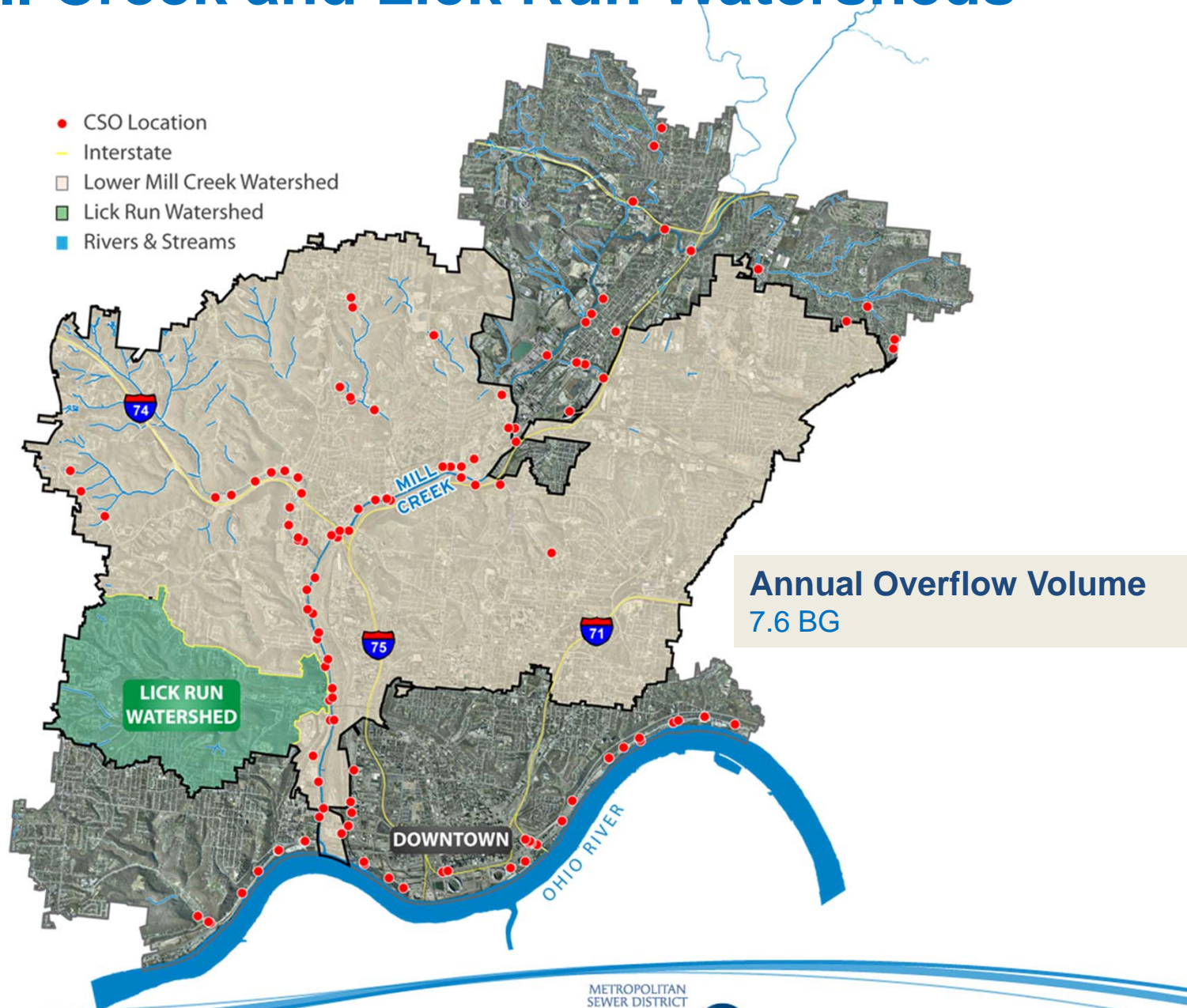
  

Community Involvement
Continuous Dialogue With LMC Community

EHRT = Enhanced High Rate Treatment  
 PTI = Permit to Install (Regulatory Go Ahead)  
 LMCP = Lower Mill Creek Partial Remedy

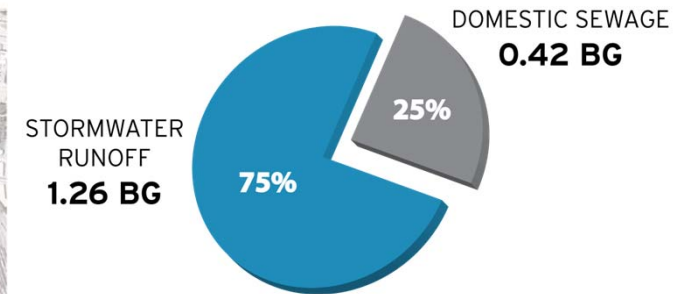
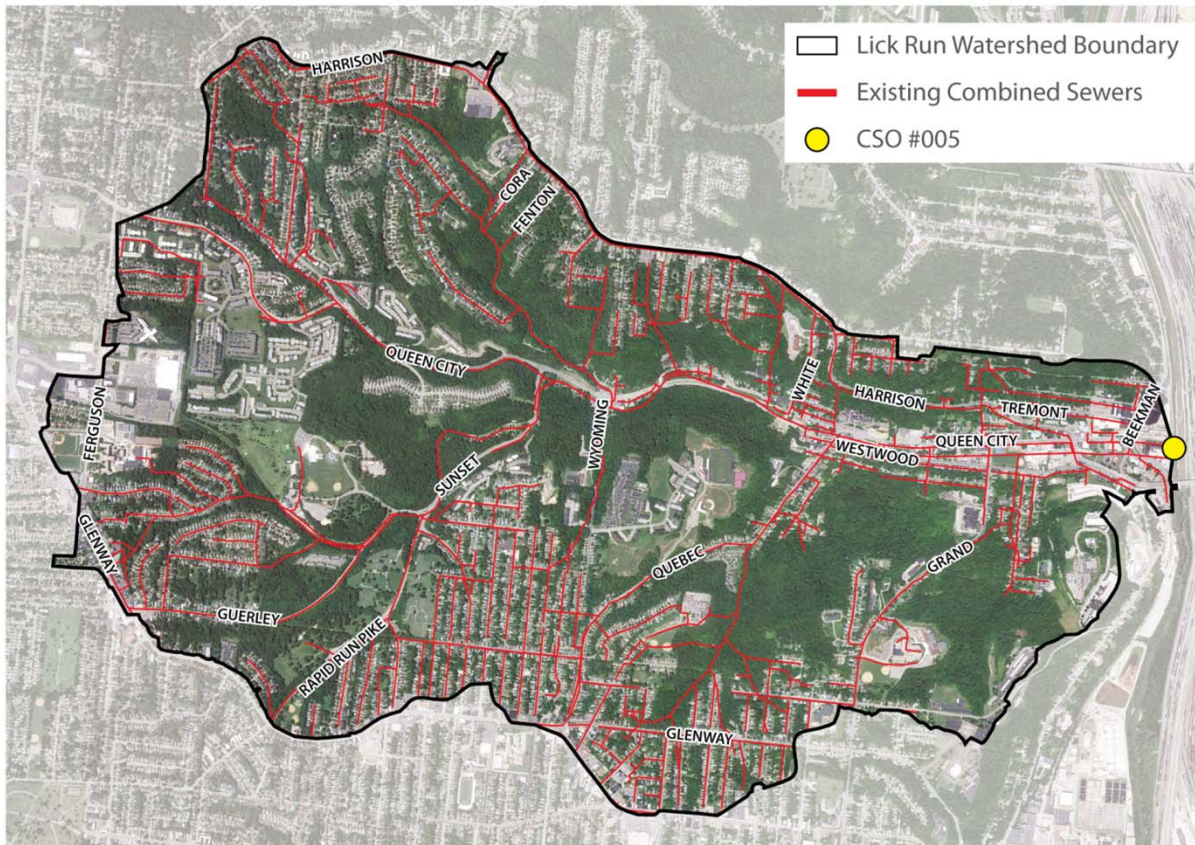
# Lick Run Wet Weather Strategy Overview

# Lower Mill Creek and Lick Run Watersheds



# Lick Run Watershed

The Lick Run Watershed contributes the largest volume of overflows from combined sewers of any watershed in Hamilton County.



**CSO #005 during wet weather**

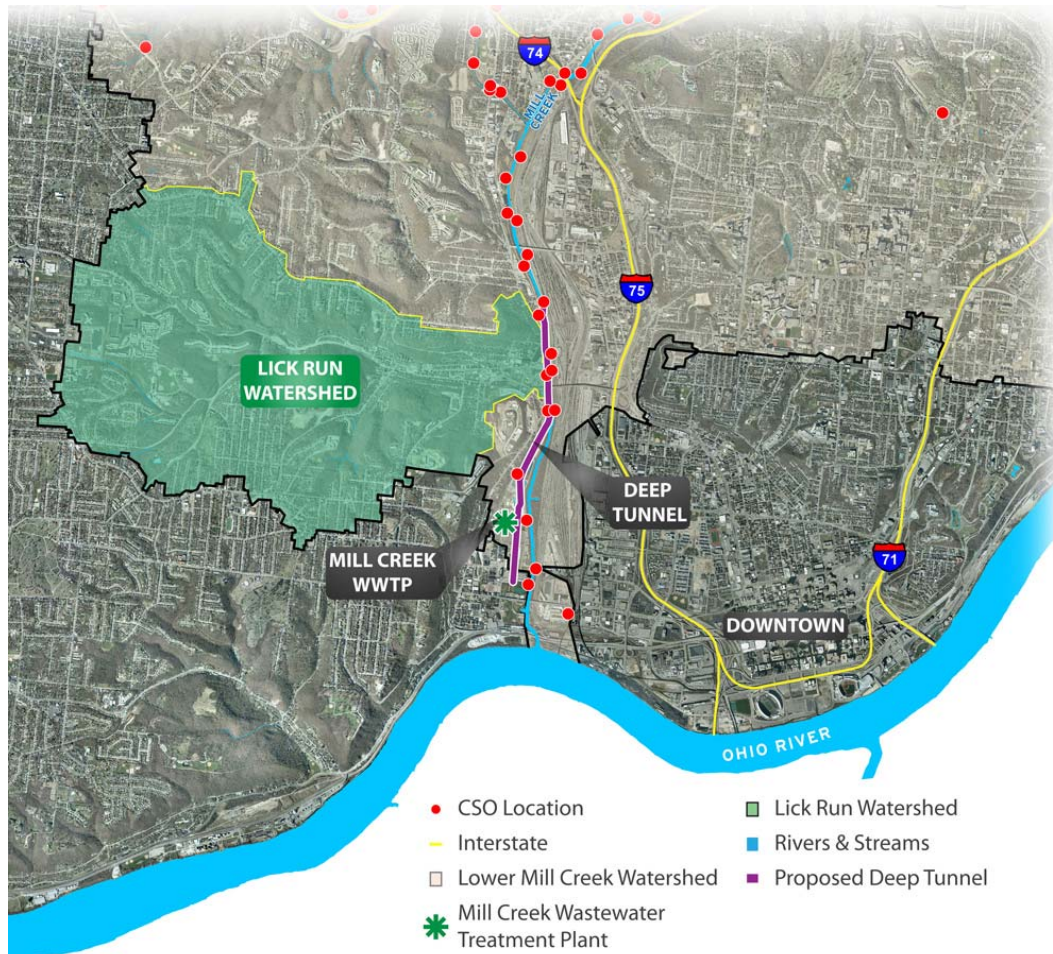


# Lick Run Watershed



# “Default” Solution

The “default” solution specified in MSD’s Consent Decree is an underground storage tunnel parallel to Mill Creek.



**\$244 million**

Estimated cost (in 2006 dollars)

**\$1,100 per MG of treatment**

Estimated operations and maintenance costs

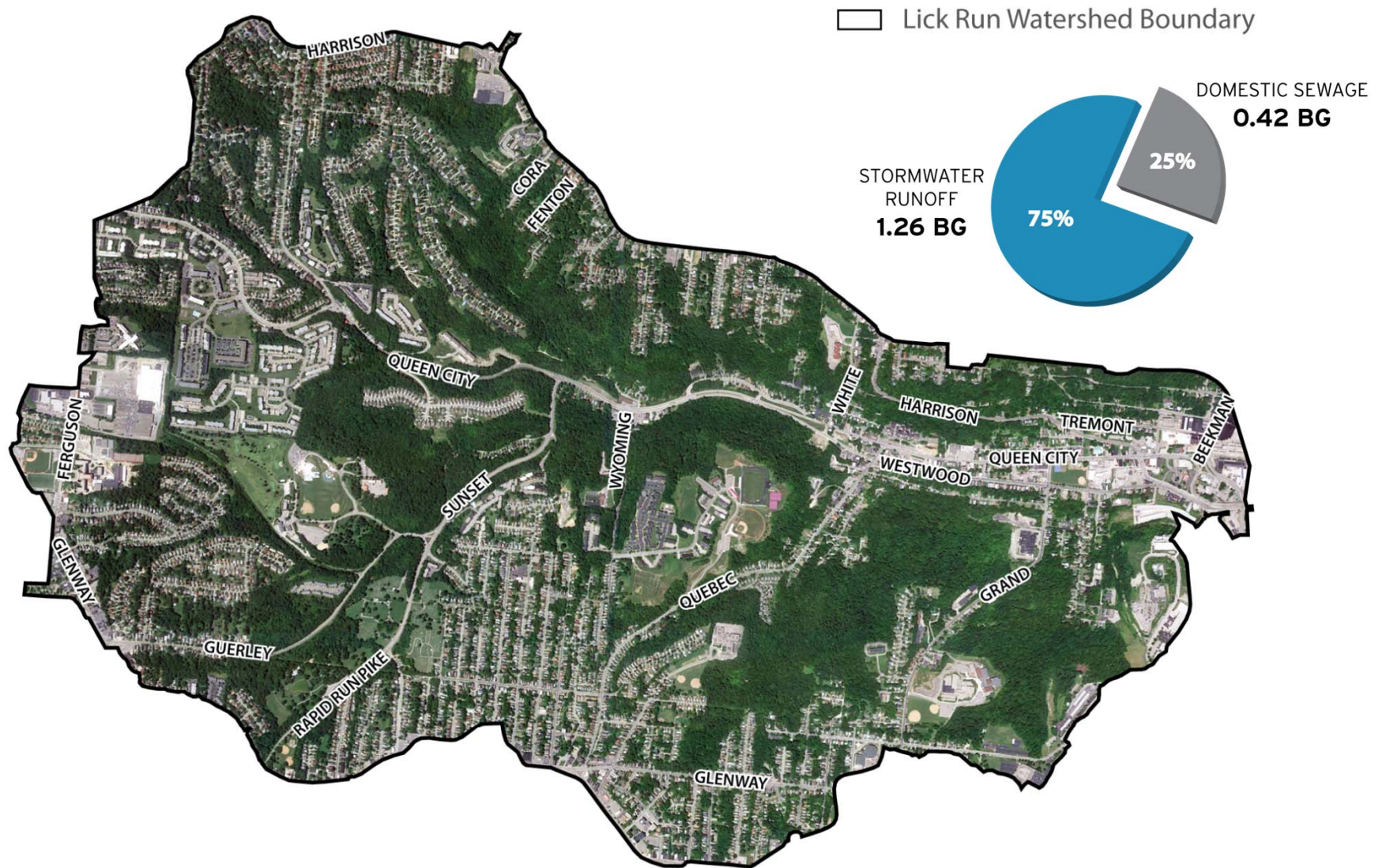
**547,800 megawatts**

Estimated power demand of pumping 2 Billion Gallons over 10 years

**377,739 metric tons**

Estimated CO<sub>2</sub> emissions from pumping 2 Billion Gallons over 10 years

# Sustainable Wet Weather Solution: Source Control





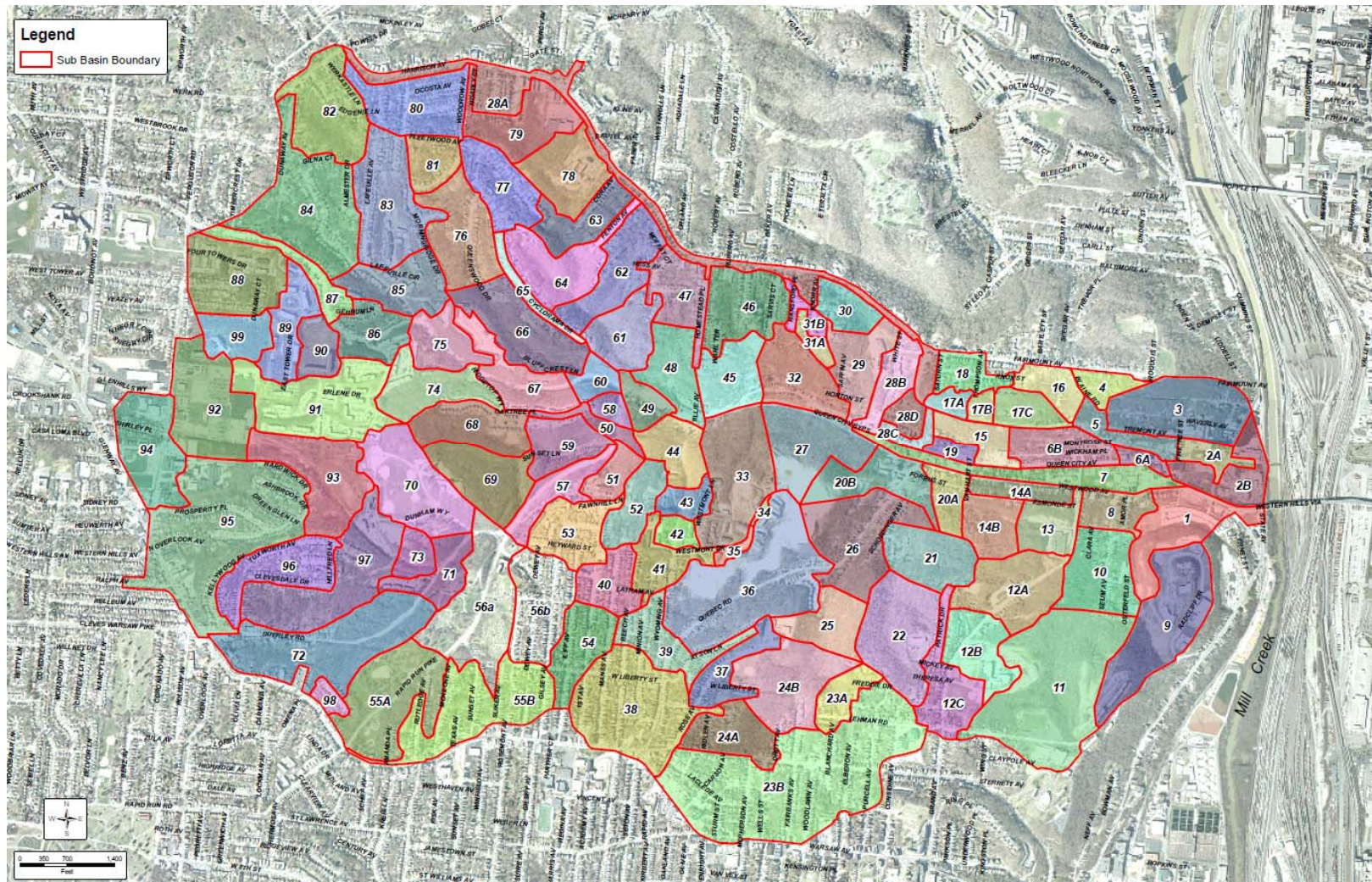
# Sustainable Wet Weather Solution

## Design Objectives

- Cost Effective CSO Reduction
  - Targeted Source Control as a foundation
- Provide Measurable Benefits for rate payer investment
  - Integrated solution to leverage other investments to address multiple needs
- Provide a Water Quality Improvement
- Develop a Sustainable Solution
  - Utilize Triple Bottom Line Approach
- Support Communities of the Future Objectives

# Sustainable Wet Weather Solution

## Catchment Areas

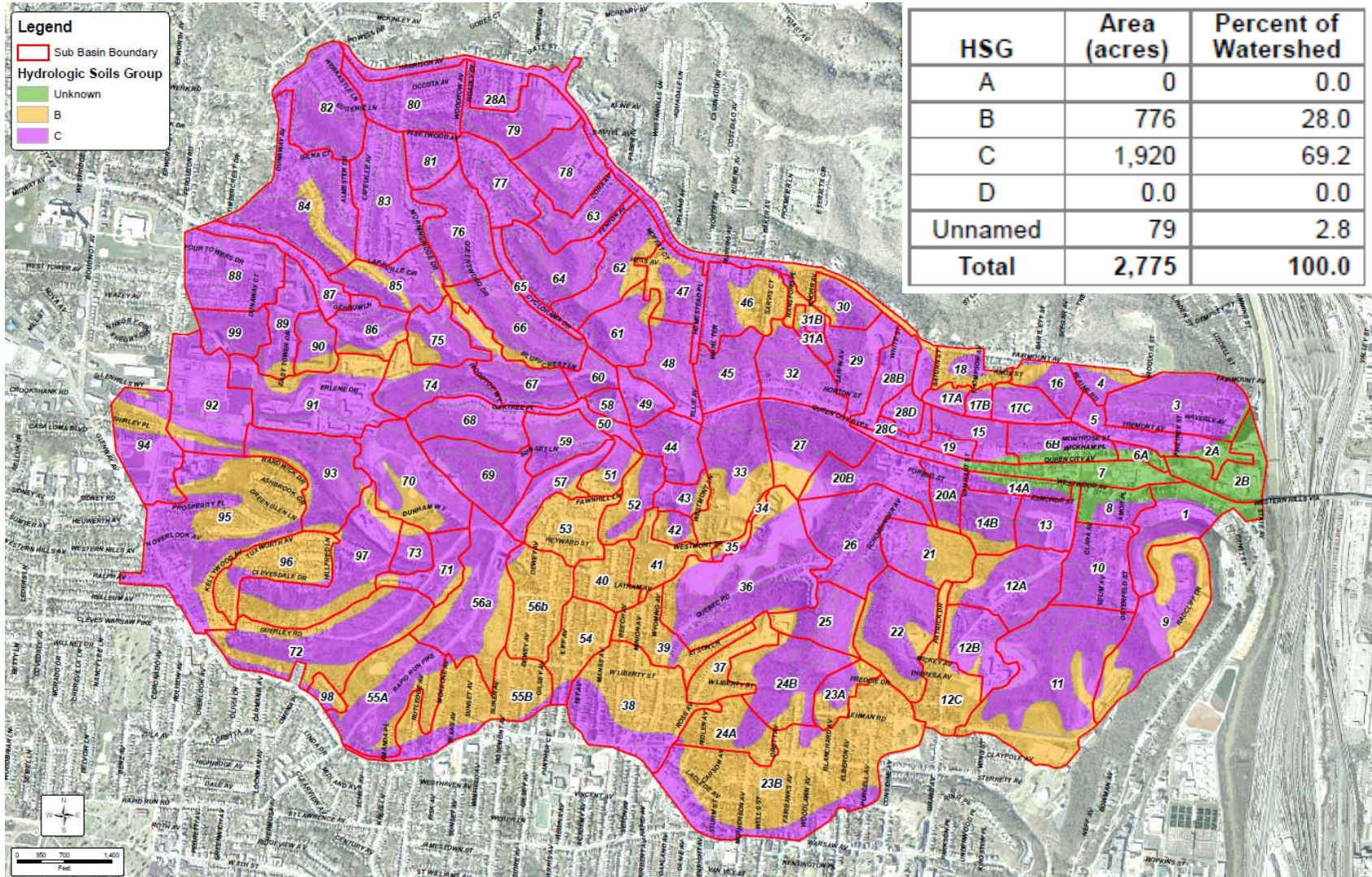


Entire Lick Run watershed included in the main channel hydrologic model



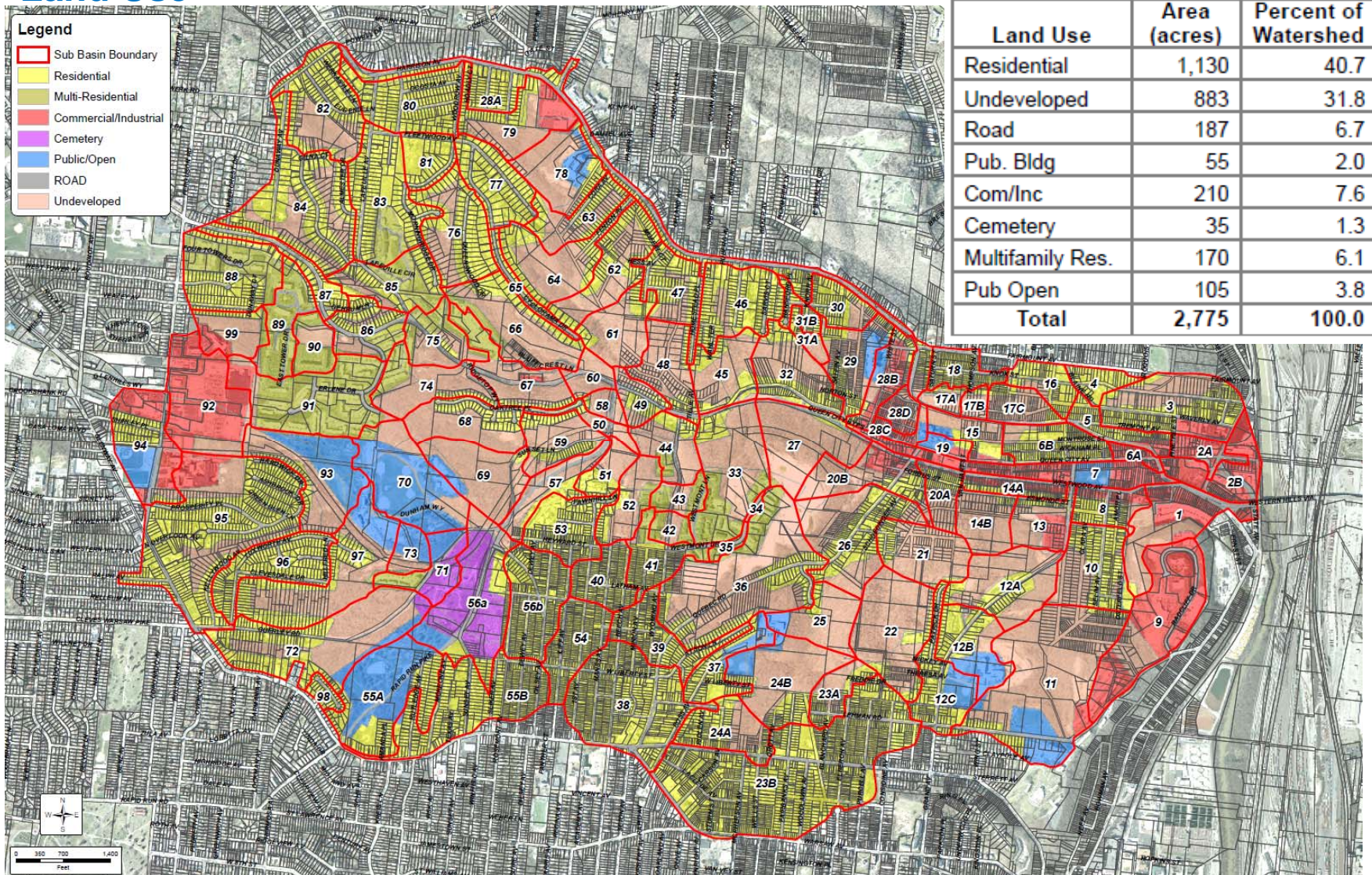
# Sustainable Wet Weather Solution

## Hydrologic Soils Groups

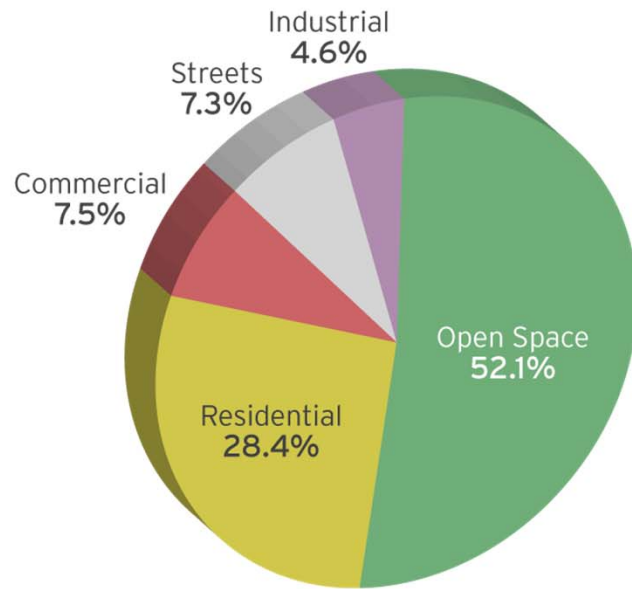


# Sustainable Wet Weather Solution

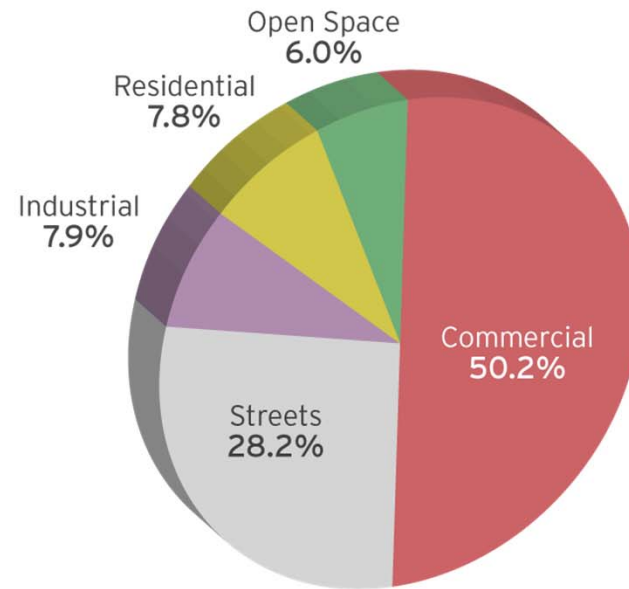
## Land Use



# Land Use Characteristics



**LICK RUN WATERSHED**  
SEPARATED AREA  
(1,827 acres)

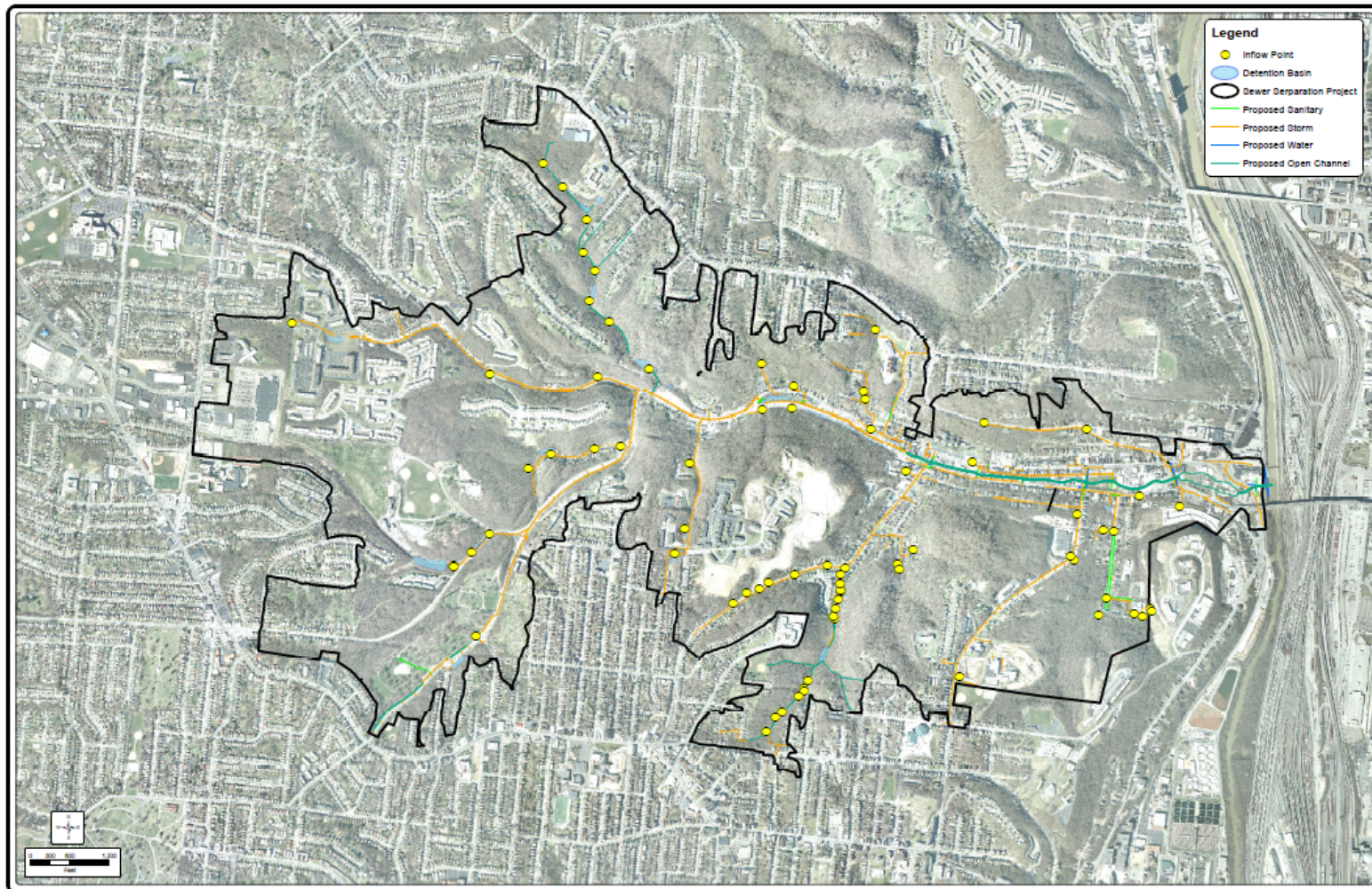


**DOWNTOWN CINCINNATI**  
CBD + OTR  
(1,610 acres)



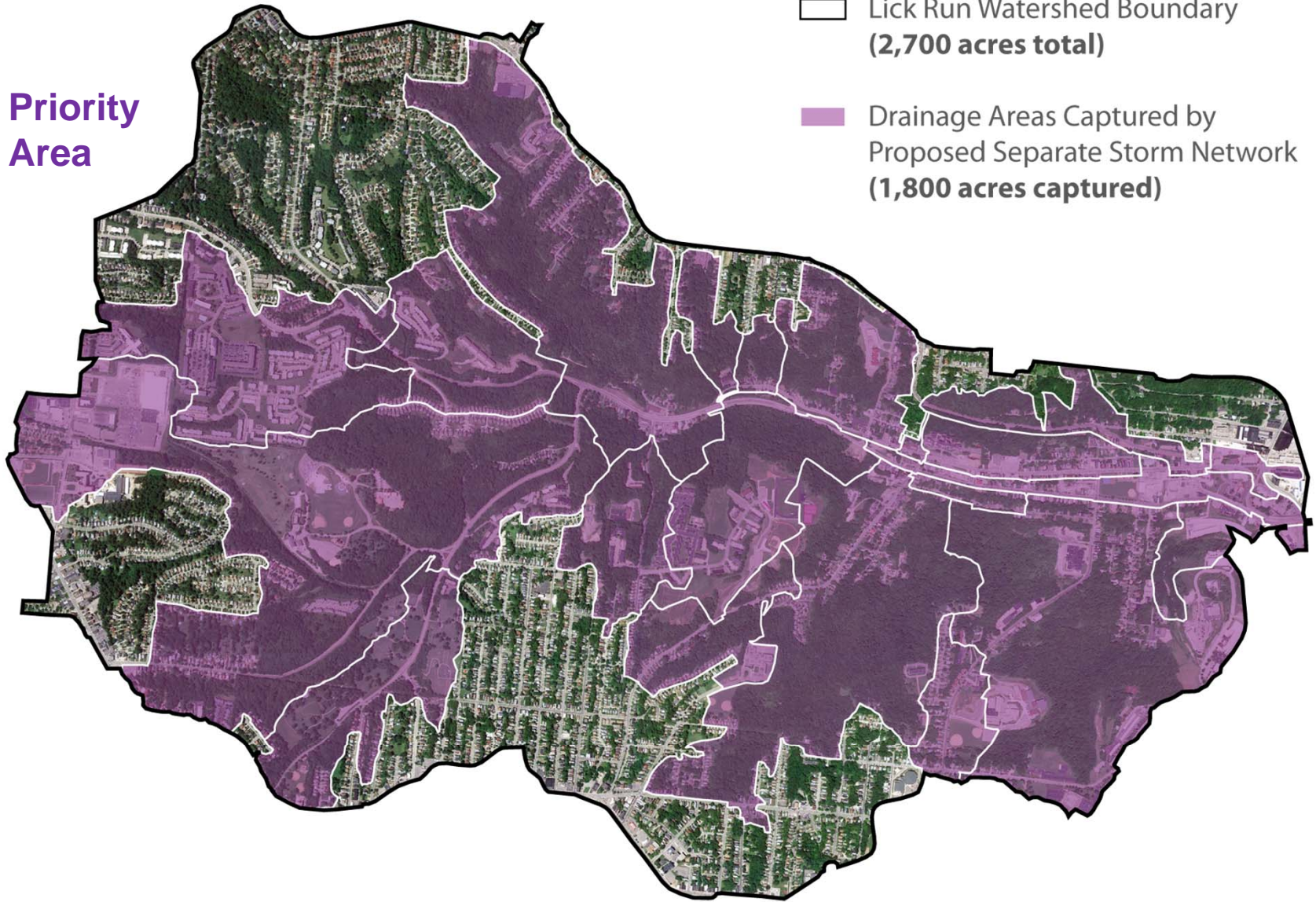
# Sustainable Wet Weather Solution

Targeted stream entry points, large undeveloped hillsides and areas already separated but discharge to CSS

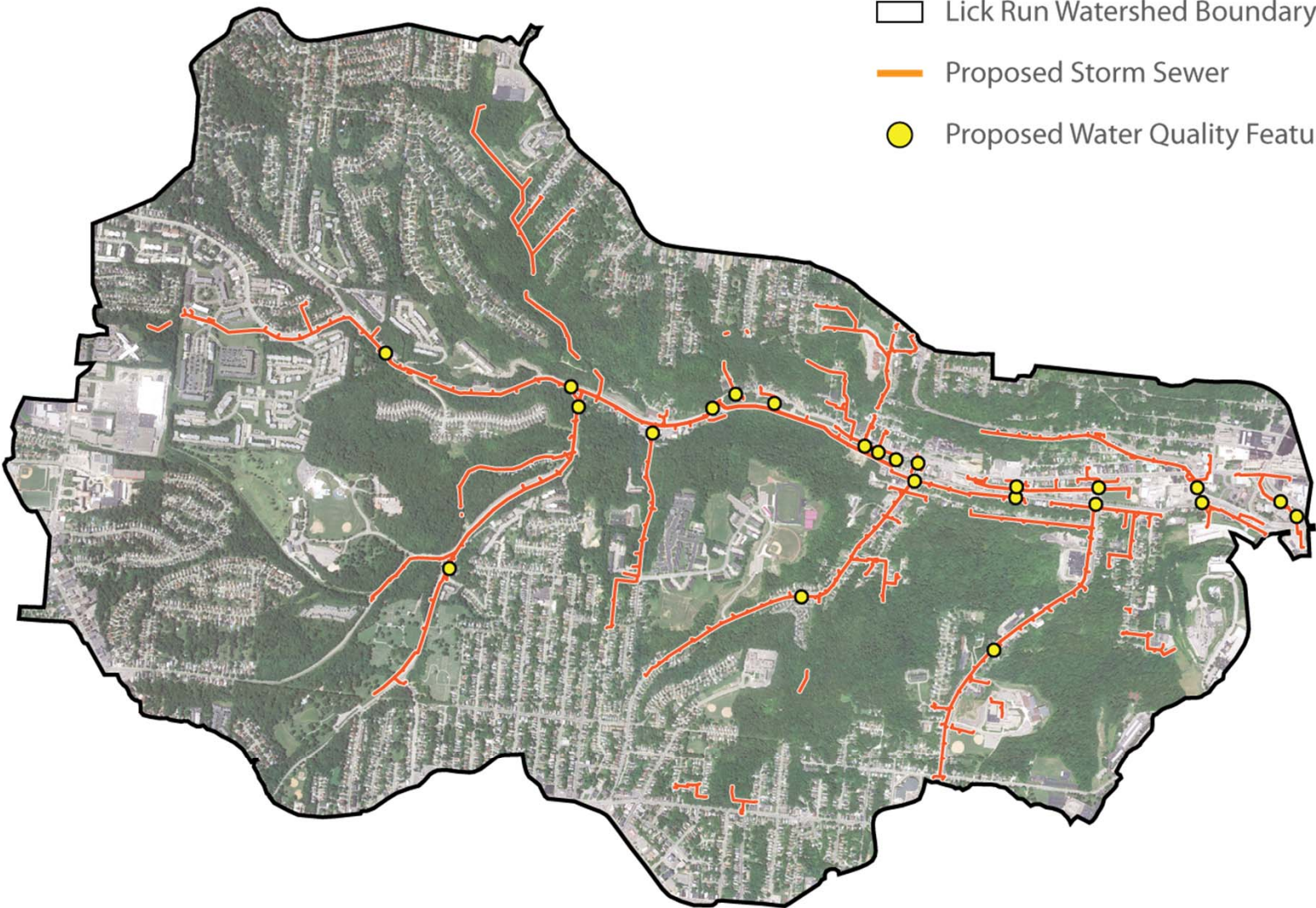


# Sustainable Wet Weather Solution

Priority  
Area



# Sustainable Wet Weather Solution

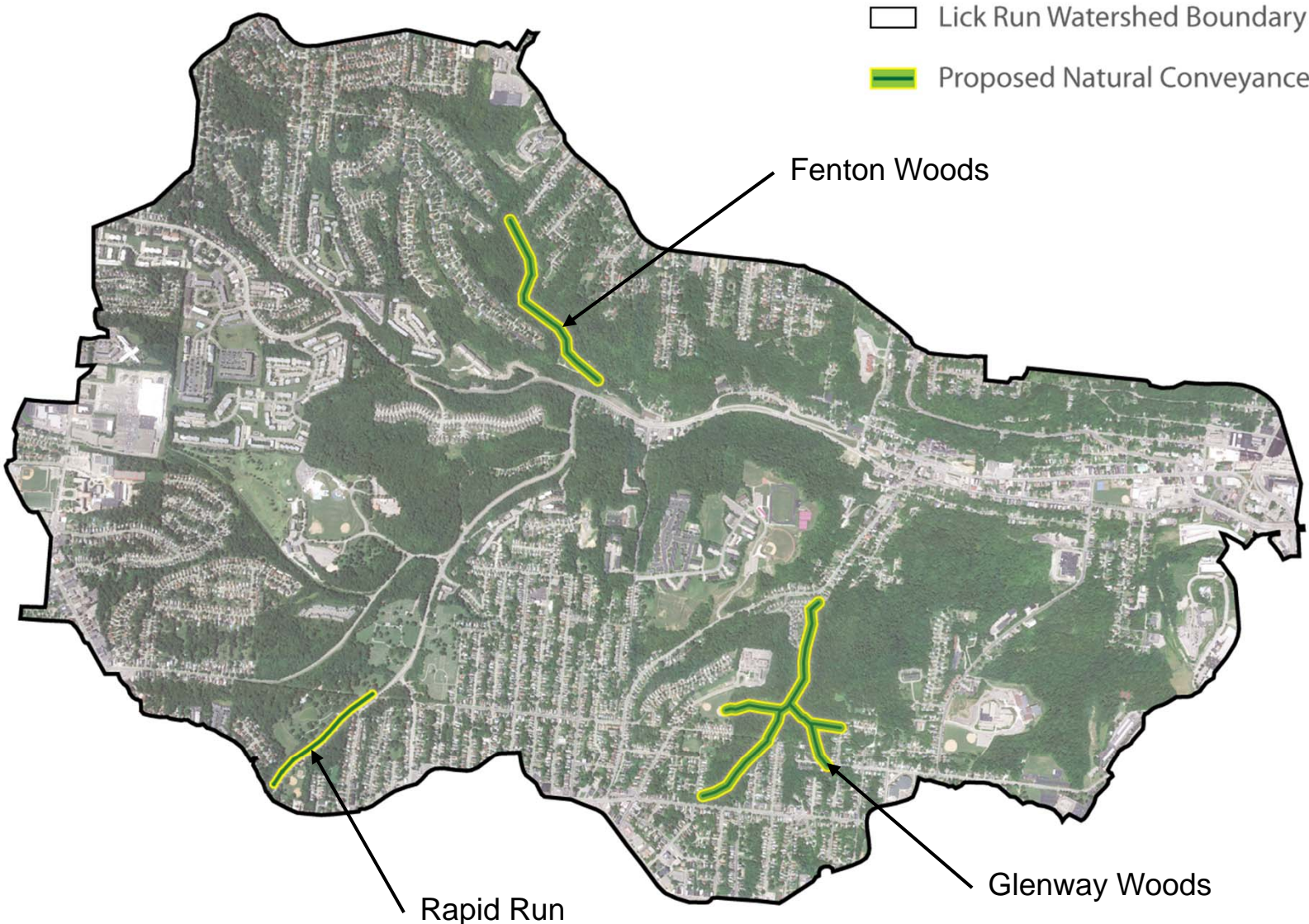


- Lick Run Watershed Boundary
- Proposed Storm Sewer
- Proposed Water Quality Features

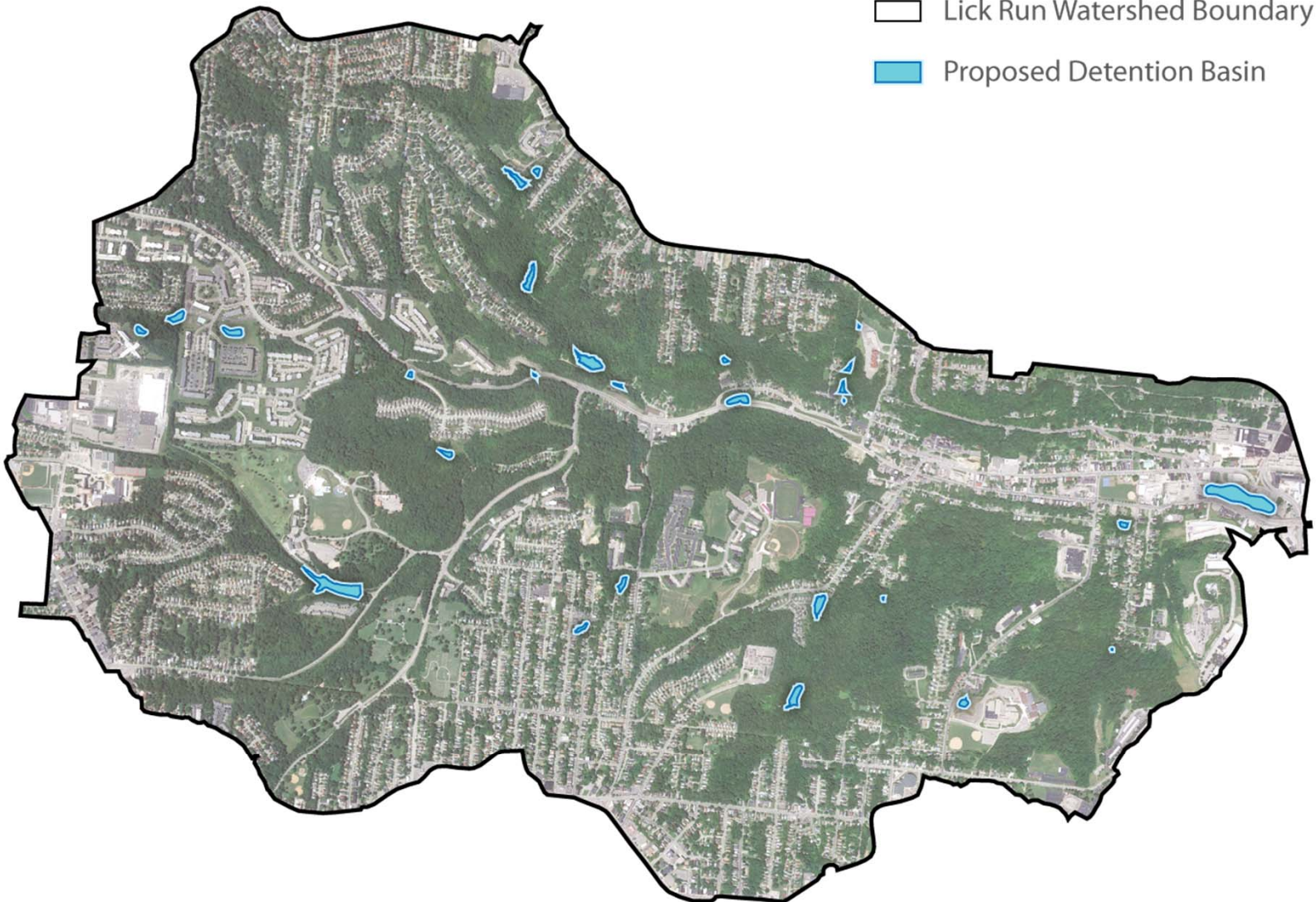




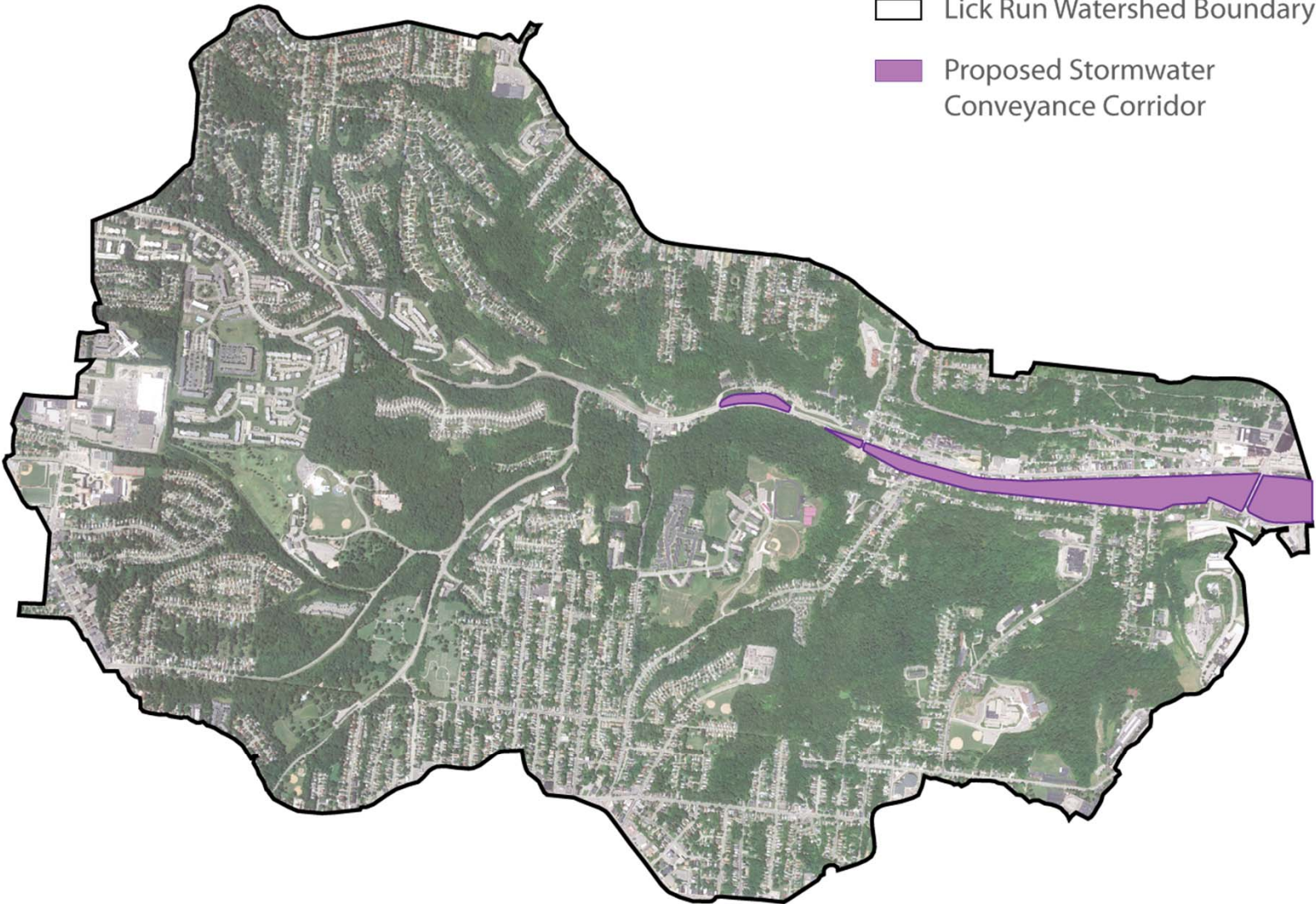
# Sustainable Wet Weather Solution



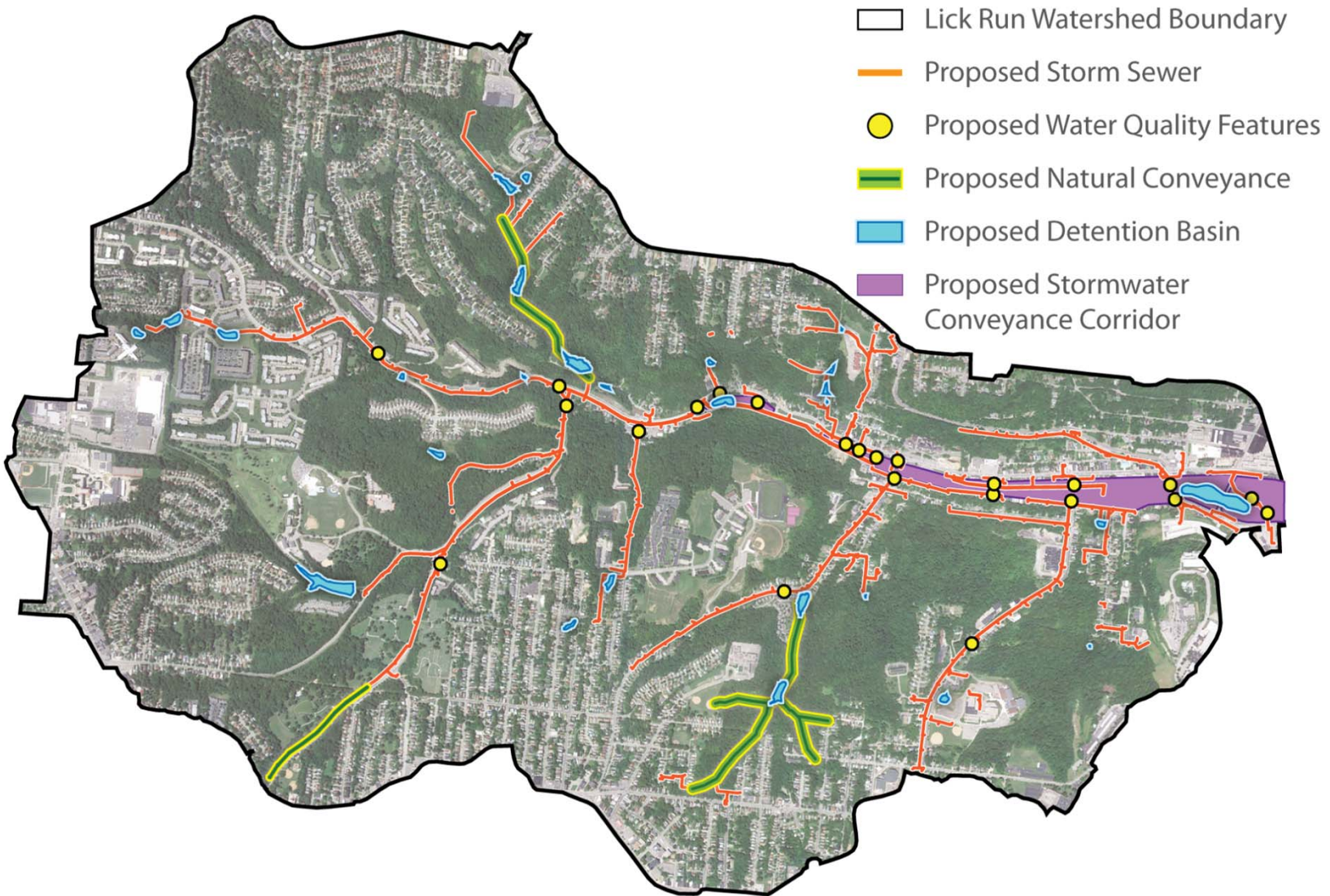
# Sustainable Wet Weather Solution



# Sustainable Wet Weather Solution



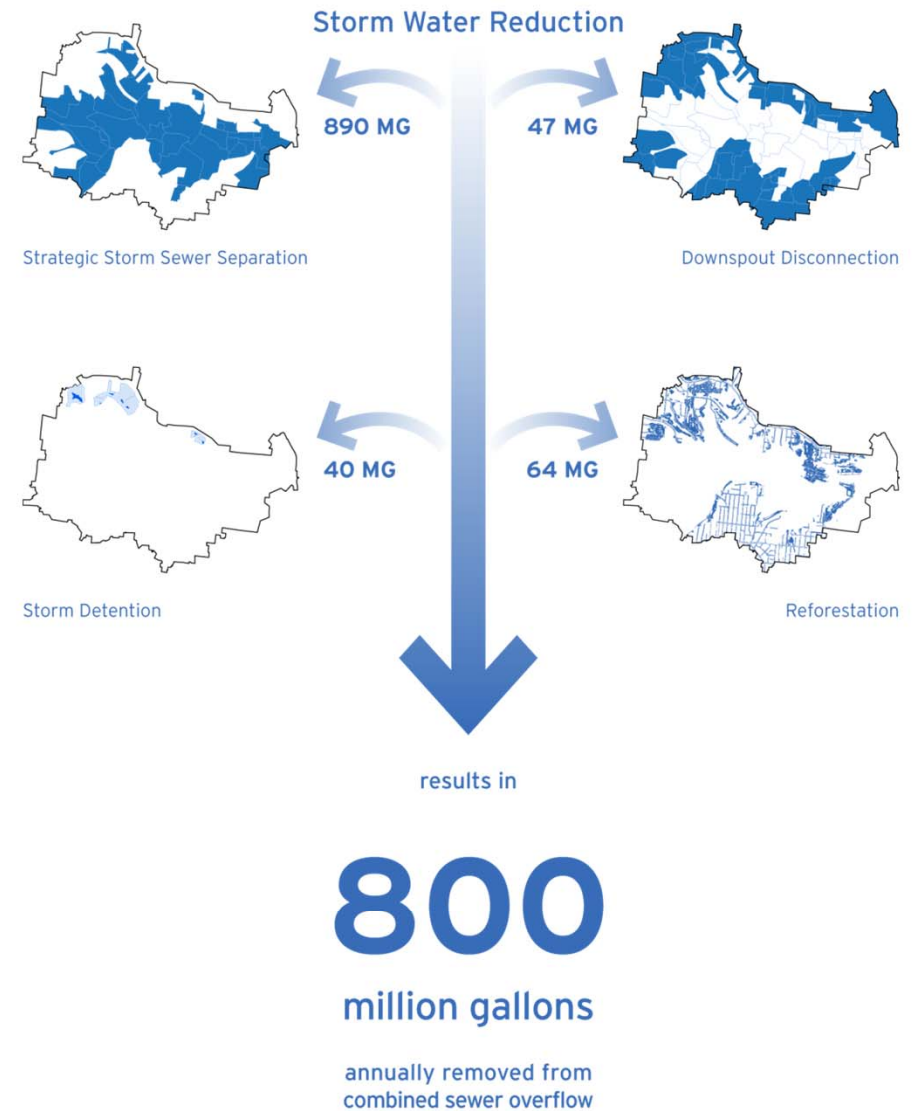
# Sustainable Wet Weather Solution



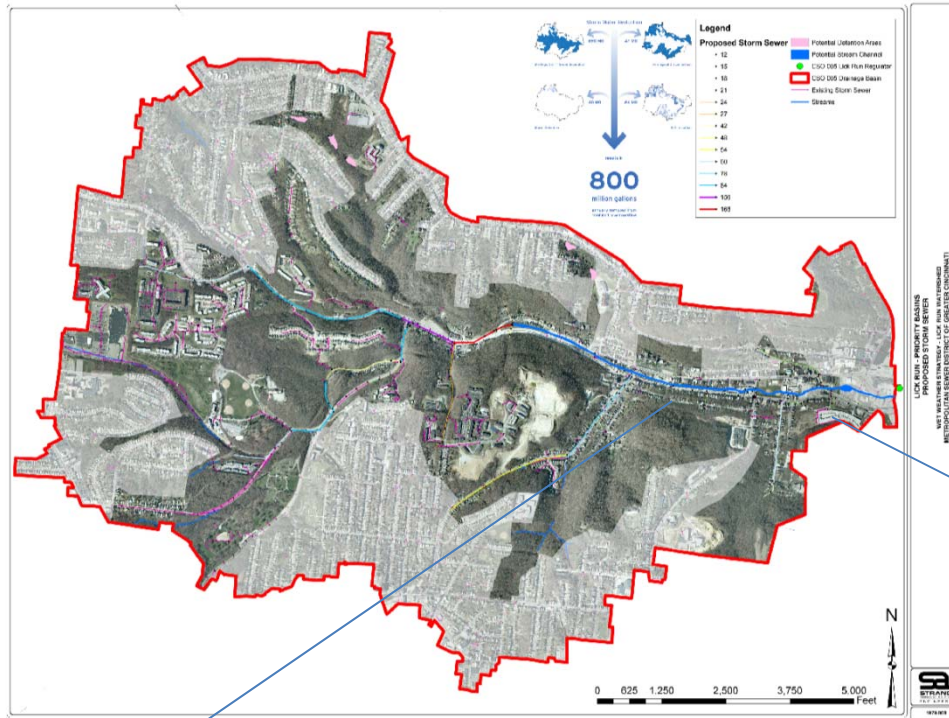
# Sustainable Wet Weather Solution

## Estimated Impact:

- Based on a preliminary evaluation of the Lick Run Wet Weather Strategy
- Lick Run Conveyance Components
  - Stormwater Pipe = 70,000 LF
  - Natural Conveyance = 11,000 LF
  - Urban Waterway = 5,600 LF



# Lick Run: Sustainable Infrastructure Alternative



## Lick Run Strategies

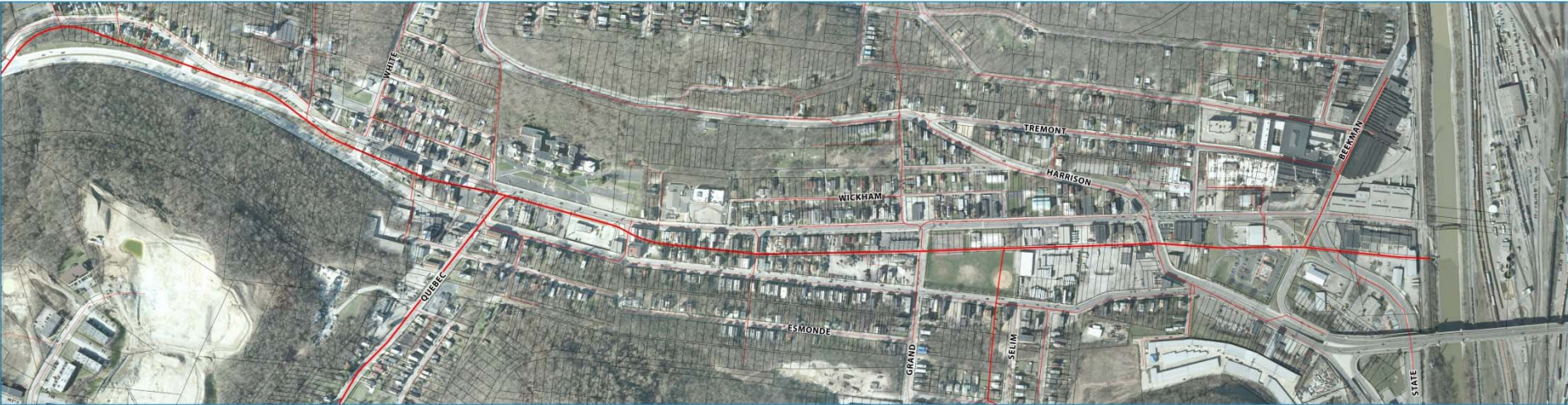
1. Strategic Separation & Daylighting
2. Detention
3. Downspout Disconnection
4. Reforestation



# Wet Weather Strategy & Conveyance Corridor: Conceptual Analysis

# Community Opportunities Plan

Existing Conditions



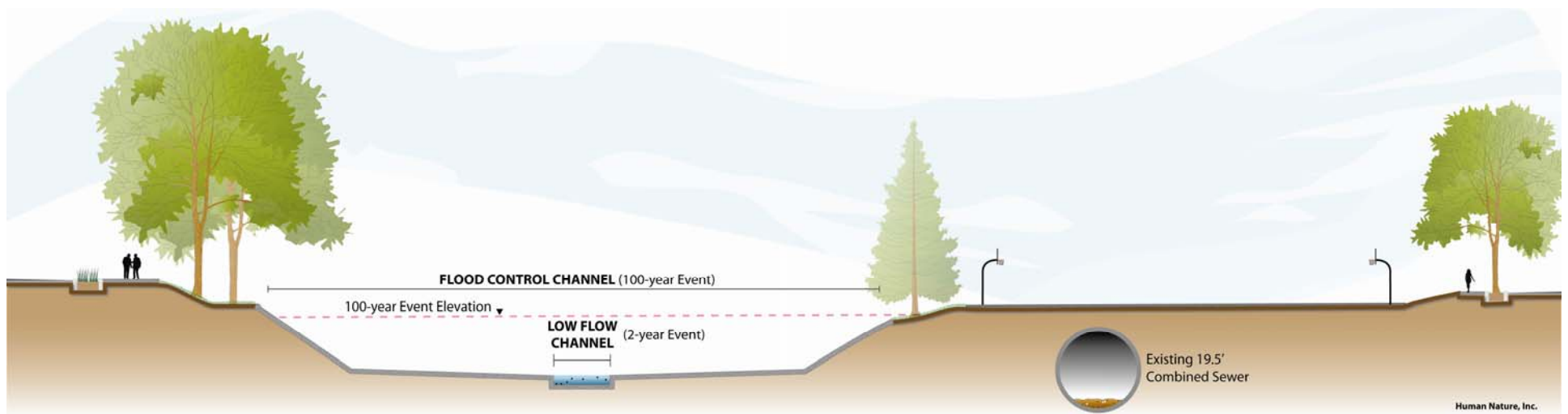
## Stream Restoration with Potential Leveraged Benefits





# Uniform Surface Channel

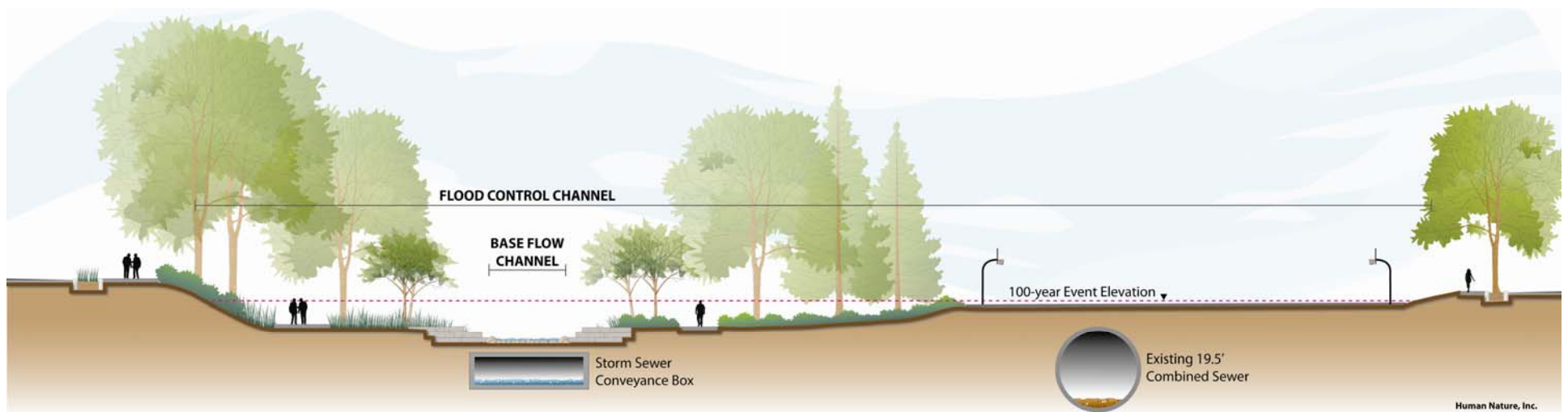
Location Immediately Downstream of Grand Ave.



- Aboveground conveyance channel
- Uniform shape and made of concrete
- Retaining walls and fencing for public safety

# Urban Waterway (Hybrid System)

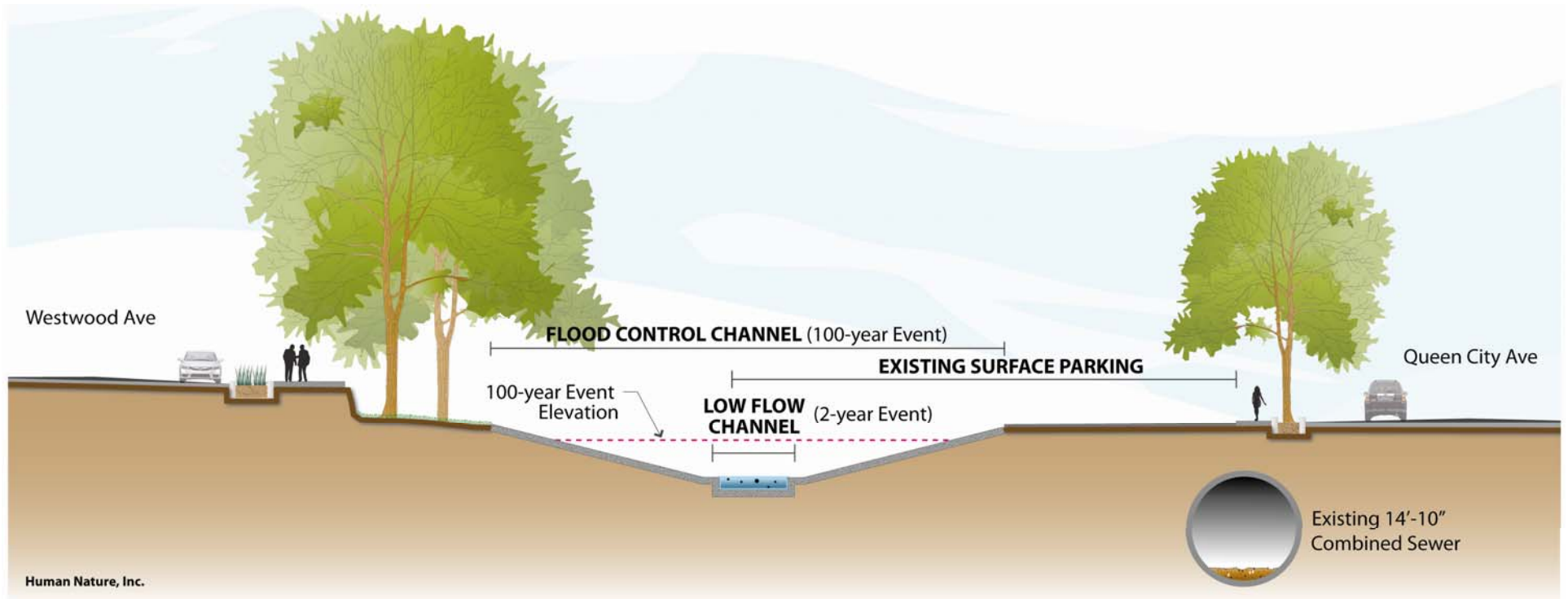
Location Immediately Downstream of Grand Ave.



- Surface channel + underground box conduit
- Maximizes water quality benefits
- Minimizes risks to public safety
- Provides opportunities for amenities

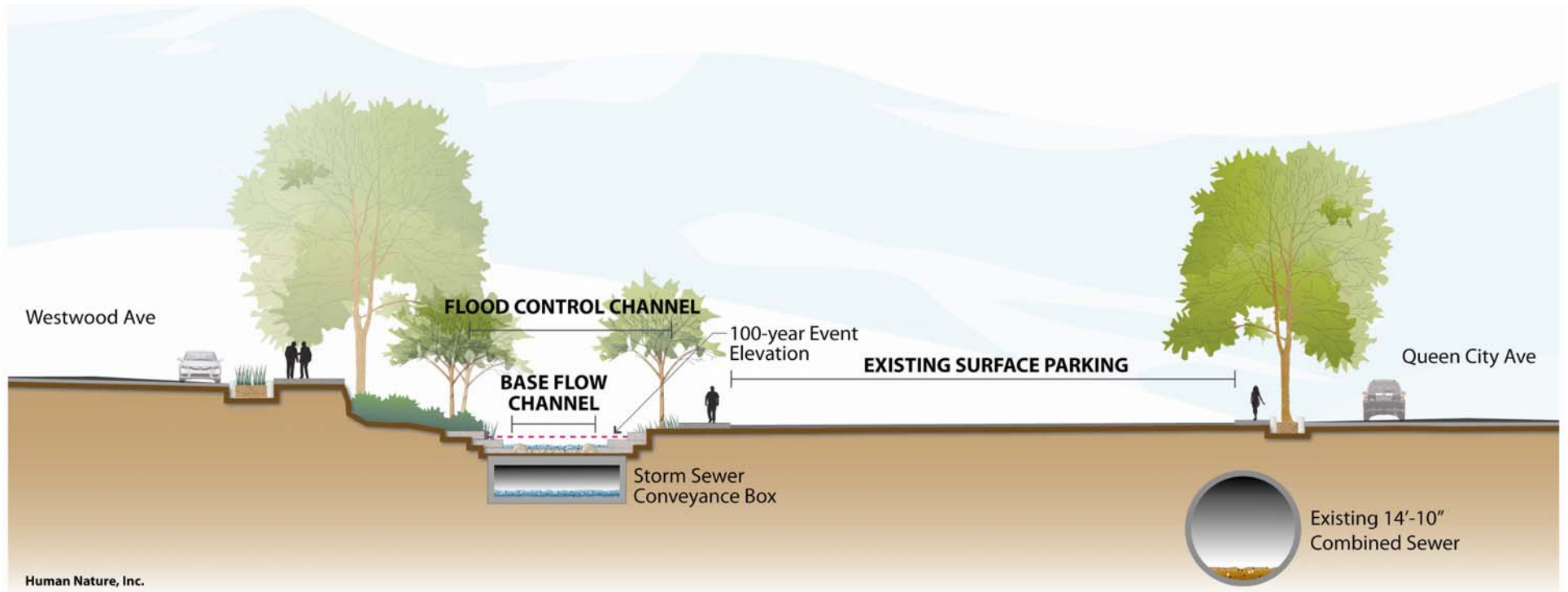
# Uniform Surface Channel

Location 350' Downstream of Quebec Road



# Urban Waterway (Hybrid System)

Location 350' Downstream of Quebec Road



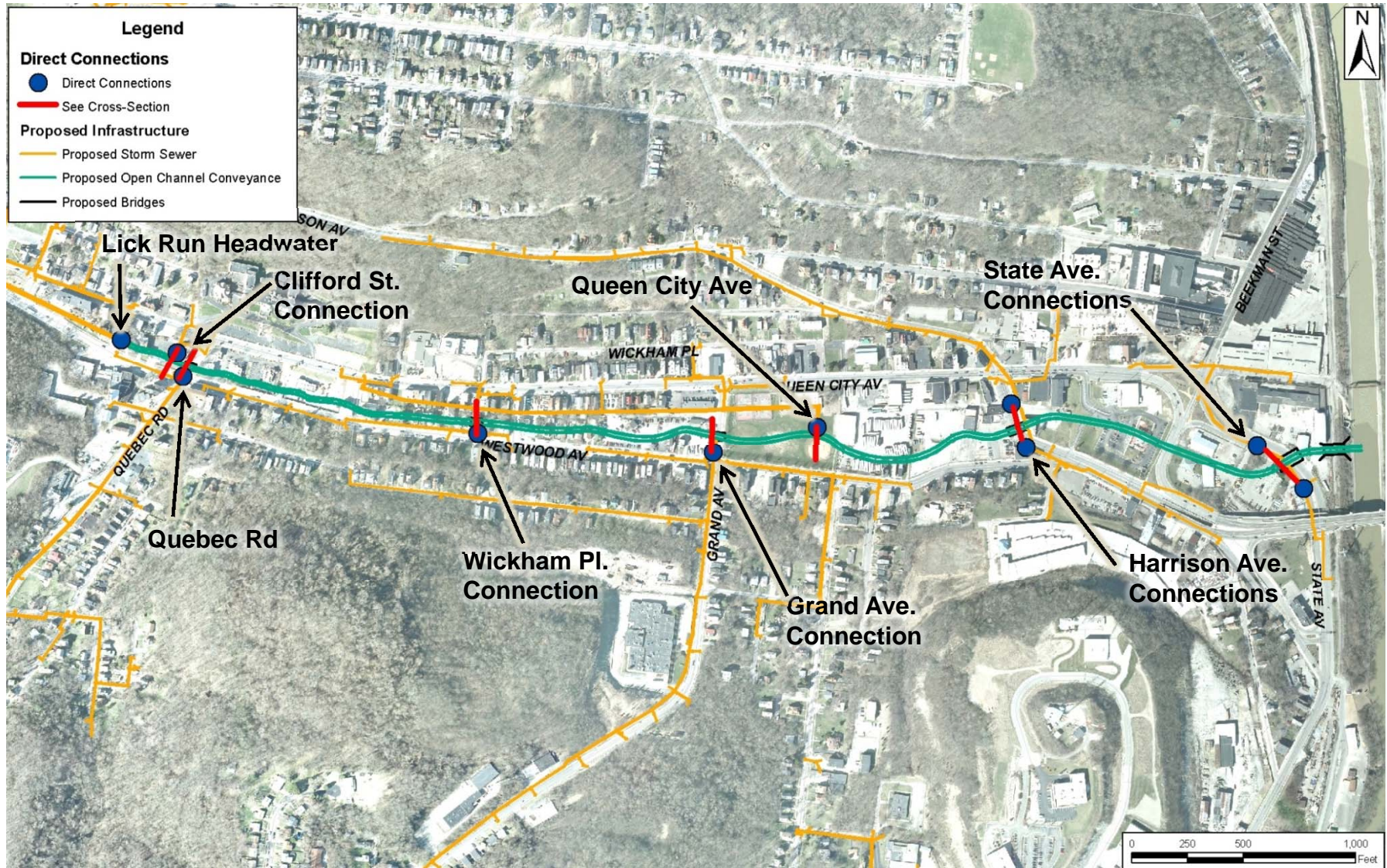
# Proposed Hybrid Conveyance System

# Lick Run Source Control

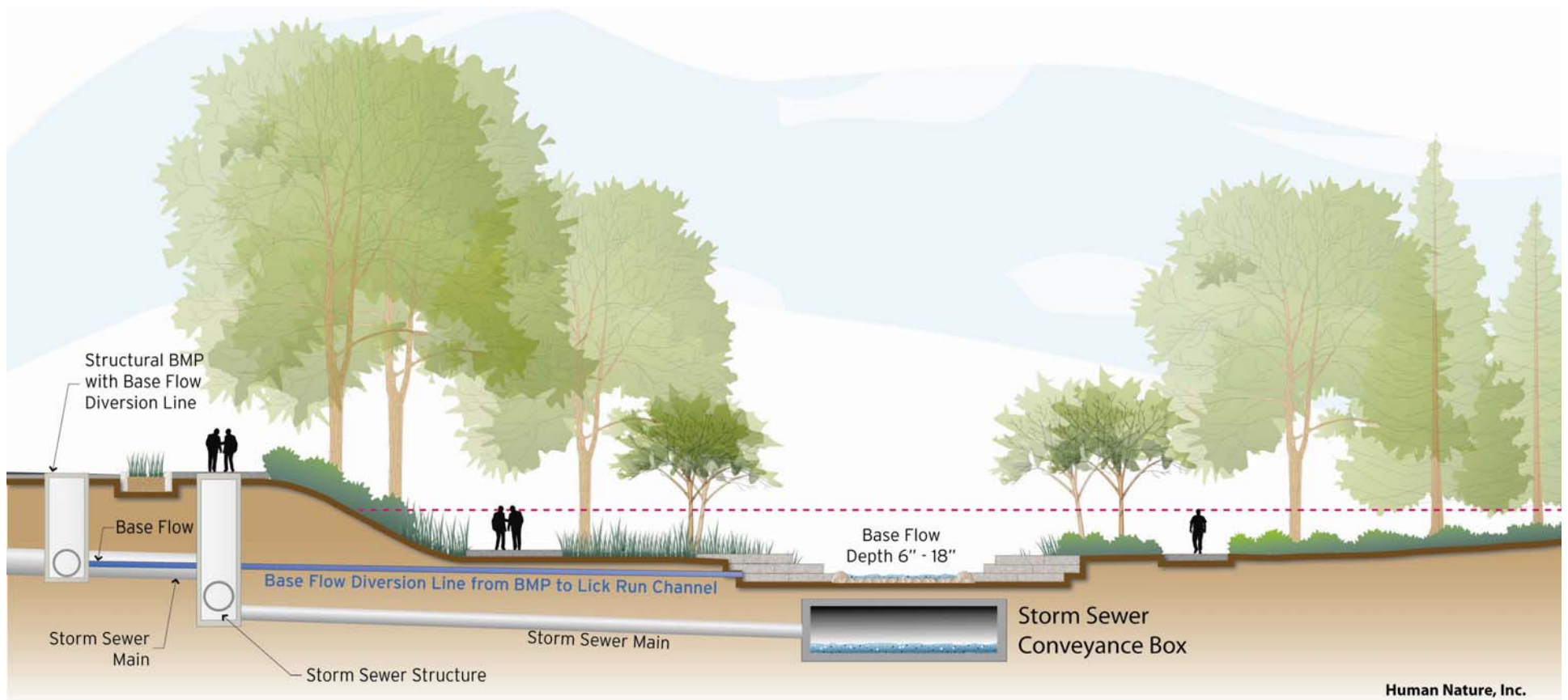
## Design Constraints

- Existing Utilities
- Topography/Grades
- Stormwater Volume
- Stormwater Peak Flows
- Roadways
- Maintenance of Traffic
- Architectural/Historical Issues
- Property Acquisition
- Environmental Factors
- Public Safety

# Stormwater Connection Locations

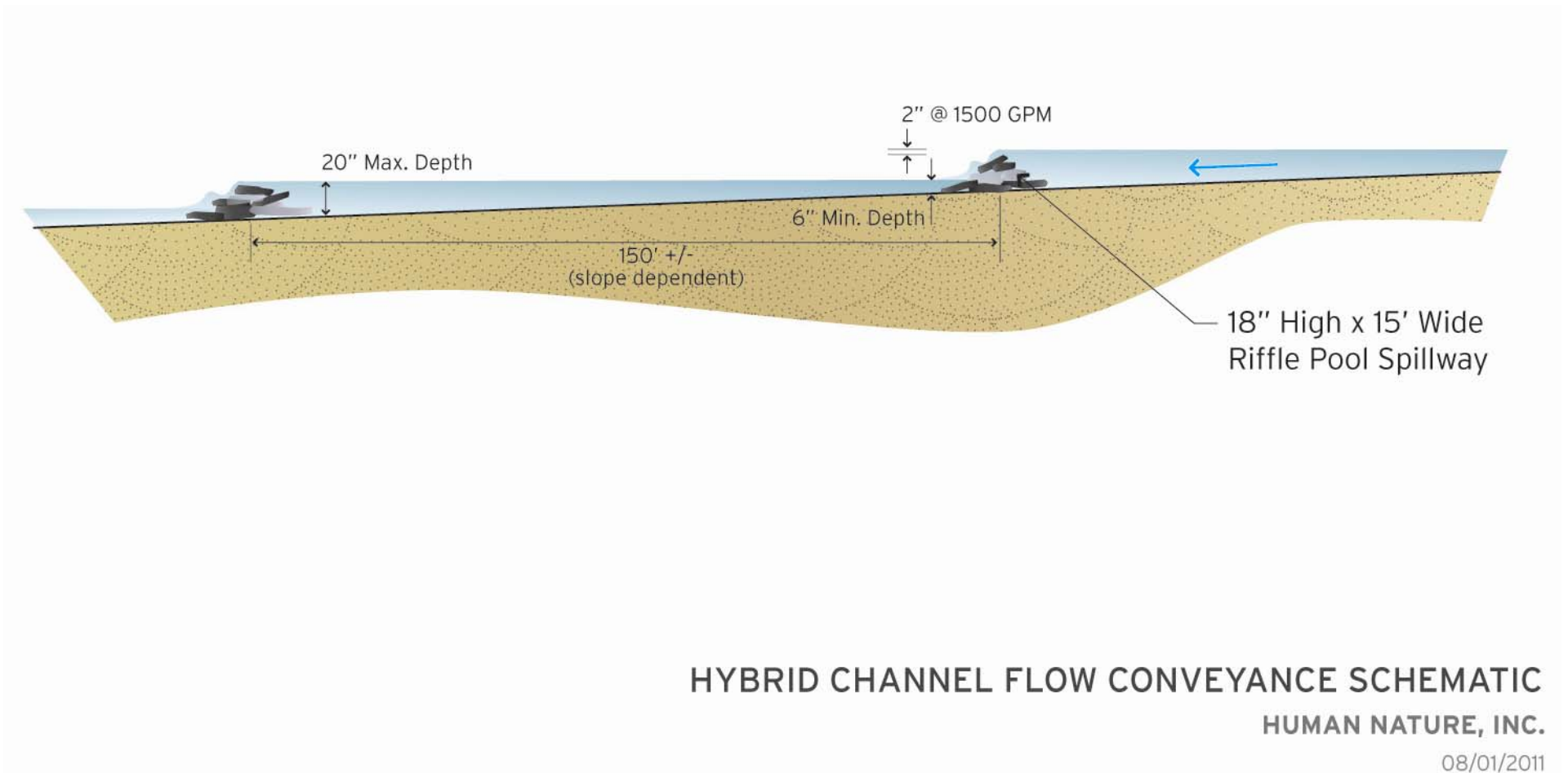


# Connection Schematic



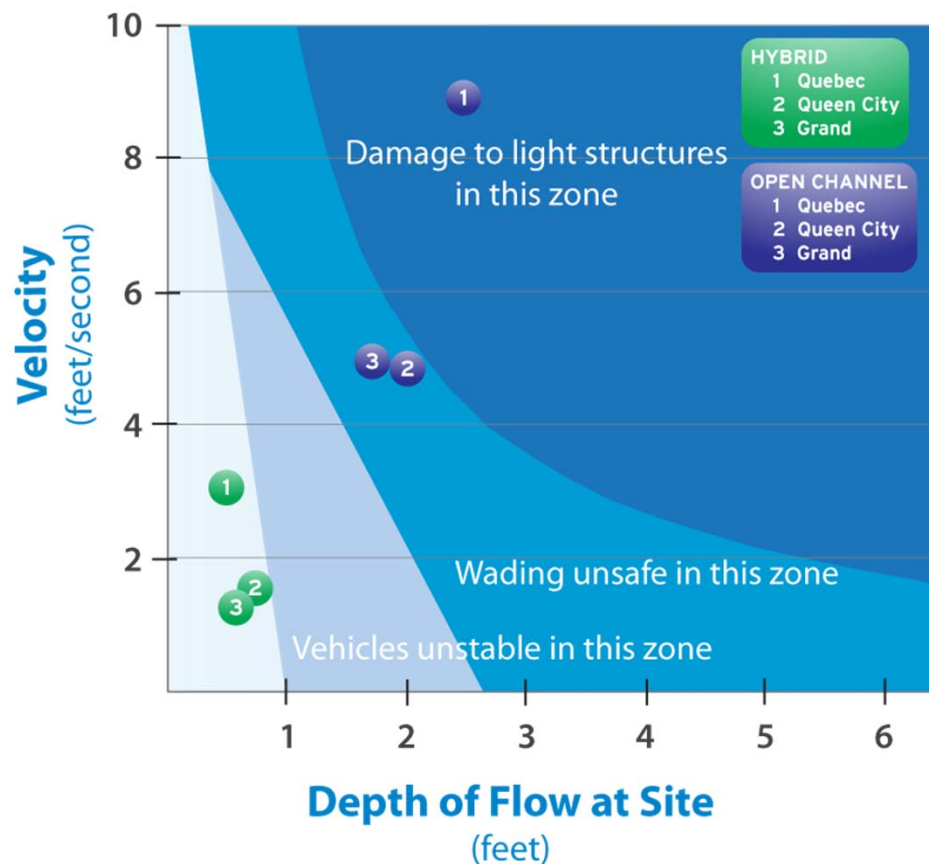


# Hybrid Channel Base Flow Conveyance Schematic



# Safety Considerations

# Public Safety



NSW Floodplain Development Manual Guidelines

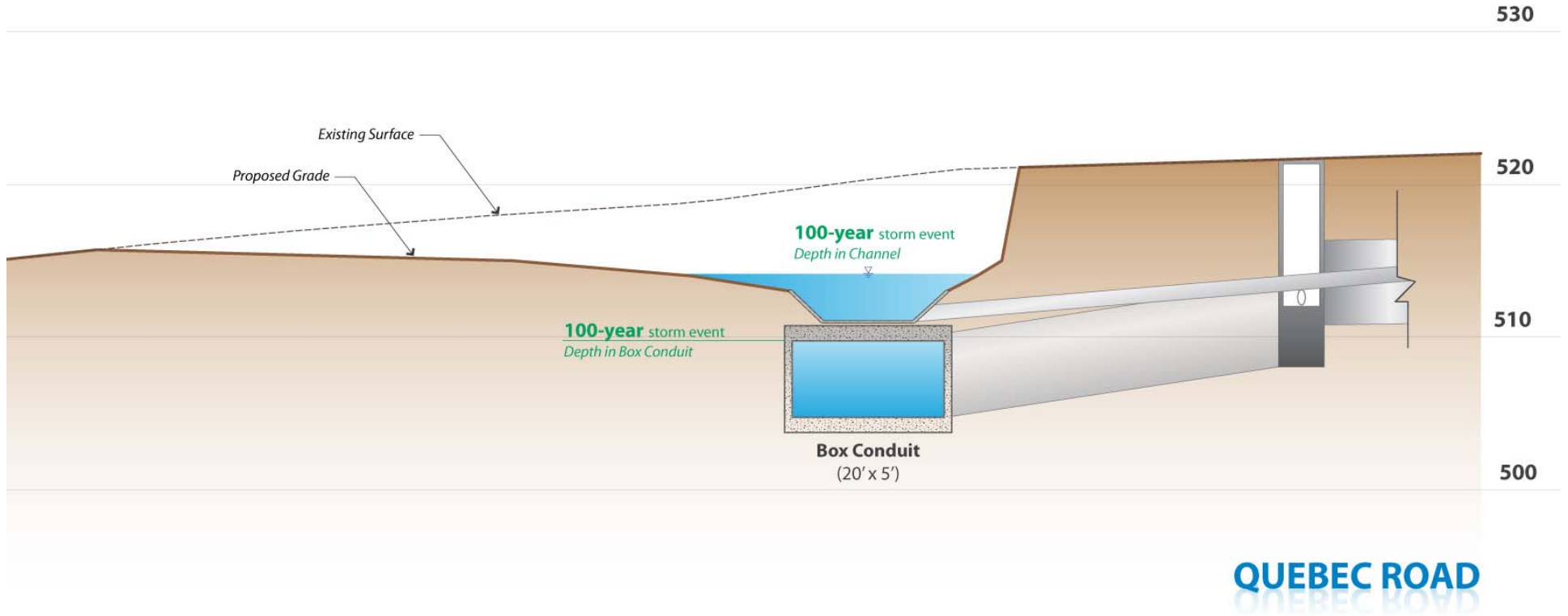
## DEPTH VS. VELOCITY EXAMPLES

- A common rule-of-thumb for 'safe' wading says that the product of velocity in feet/second times depth in feet should be less than 10 for safe wading in streams

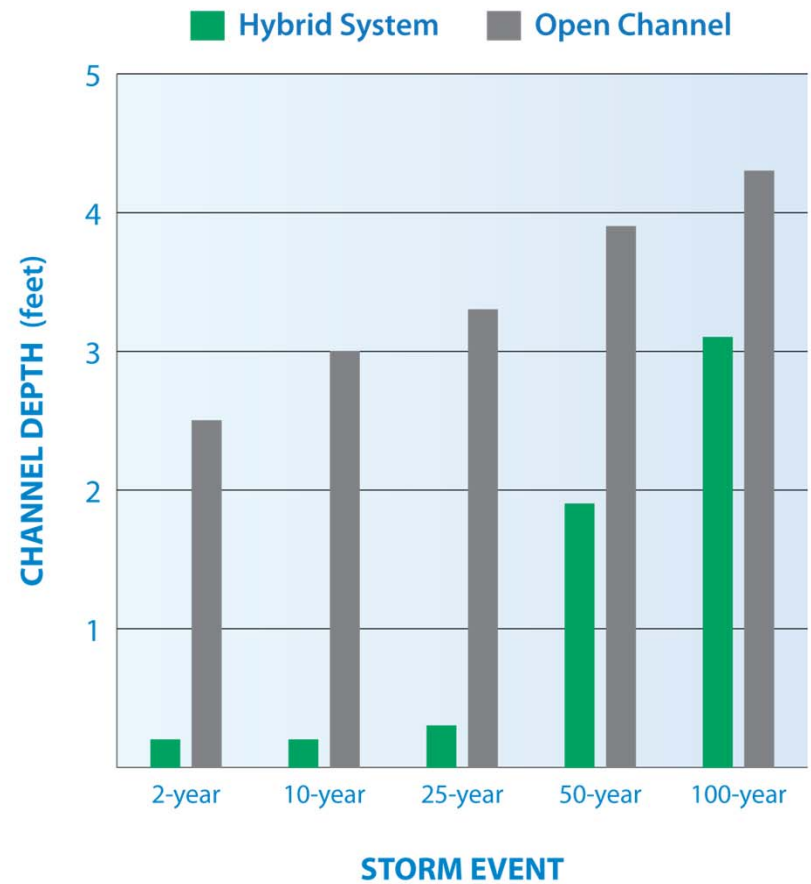
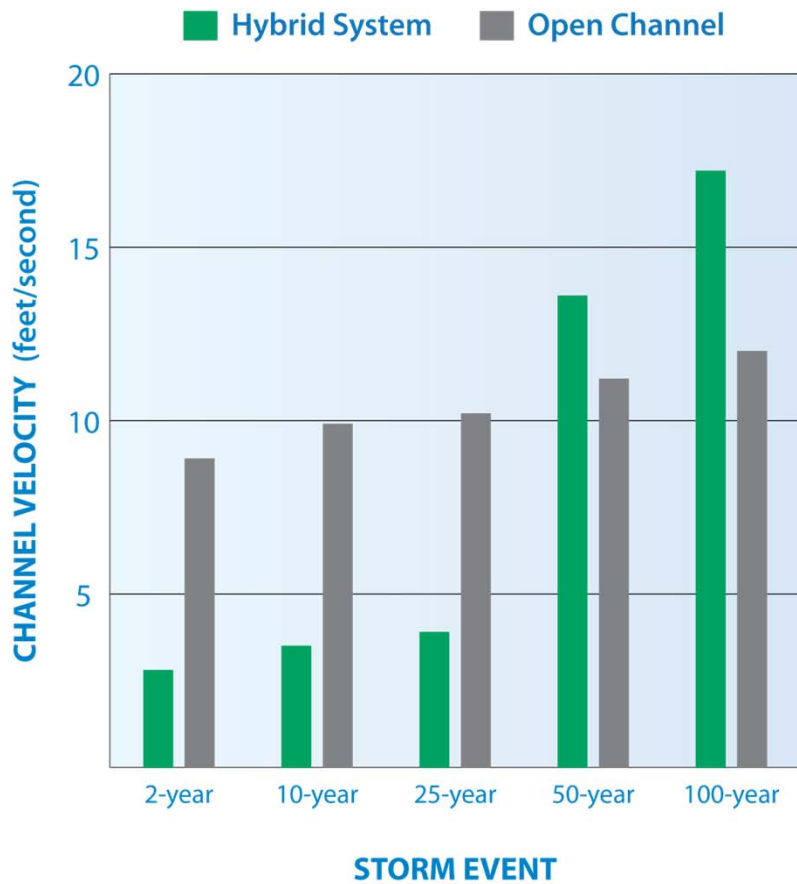
$$5 \text{ fps (velocity)} * 2 \text{ ft (deep)} = 10$$

- A moderate sized person begins to lose stability at 2 fps in 3 ft of water
- Swift flowing water can knock a person down in depths of only 6 inches

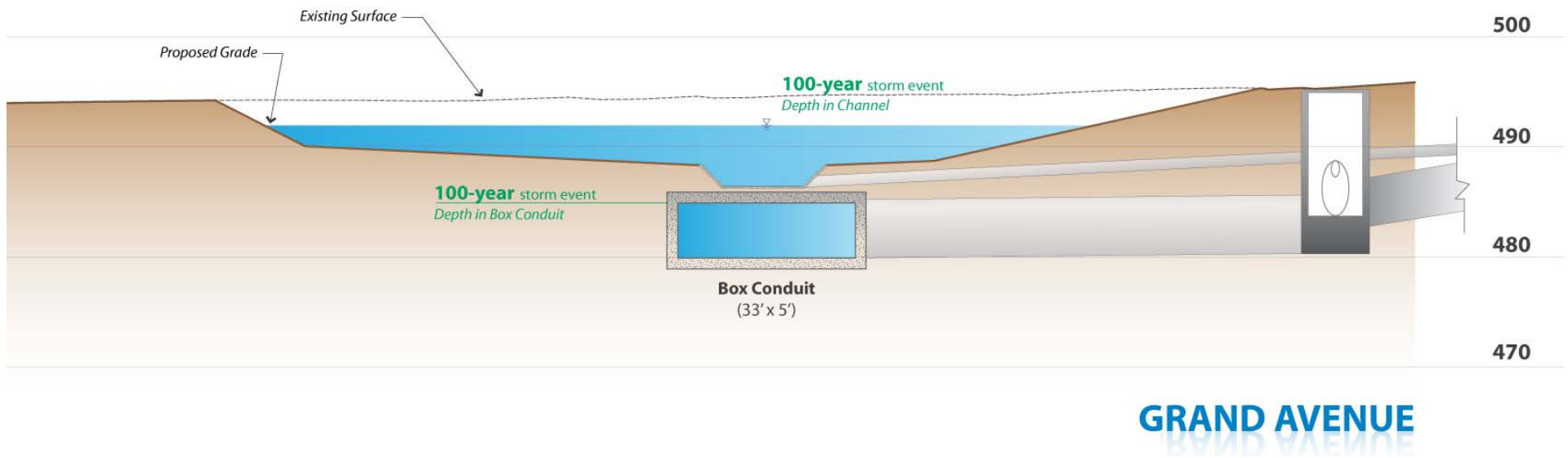
# Preliminary Quebec Road Cross Section



# Quebec Road Cross Section



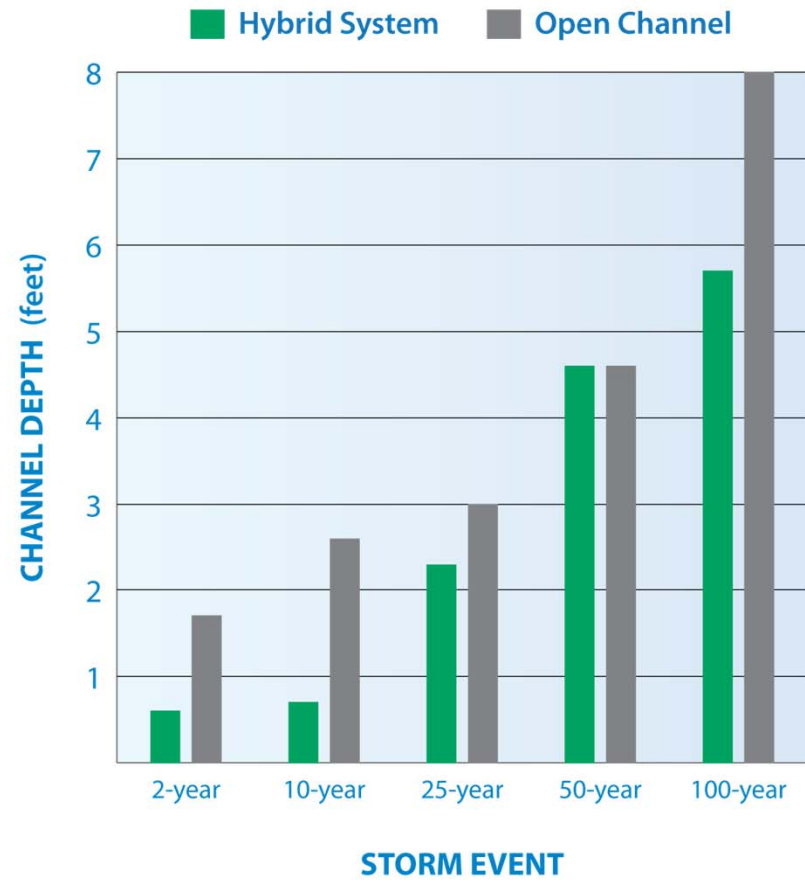
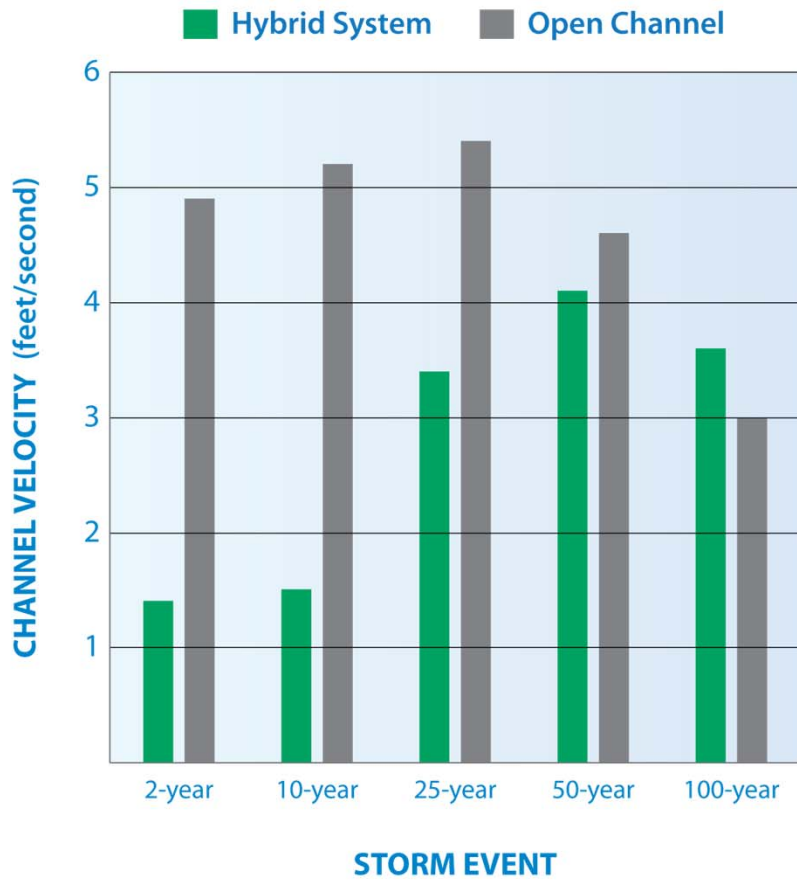
# Preliminary Grand Avenue Cross Section



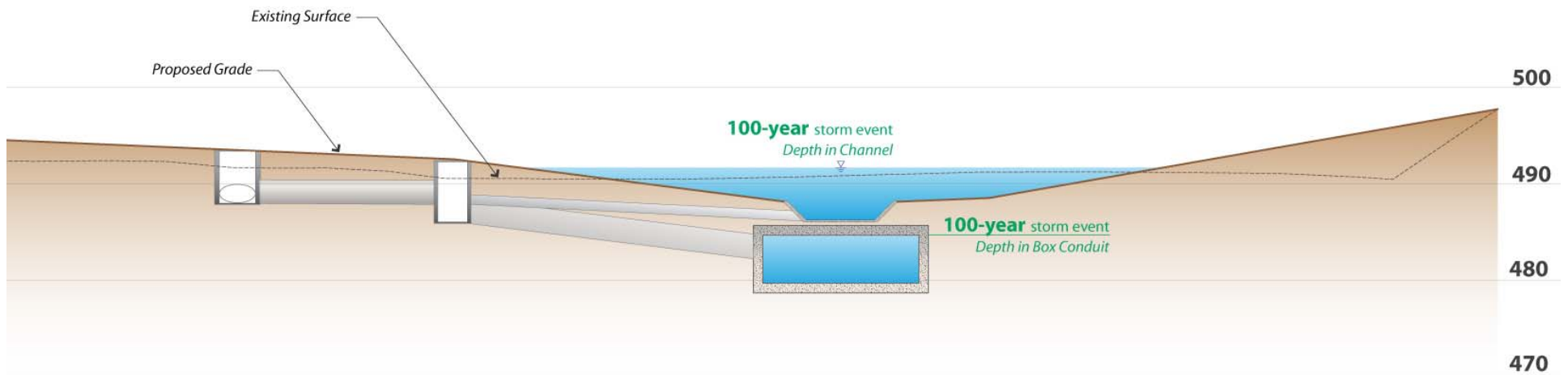
**GRAND AVENUE**



# Grand Avenue Cross Section



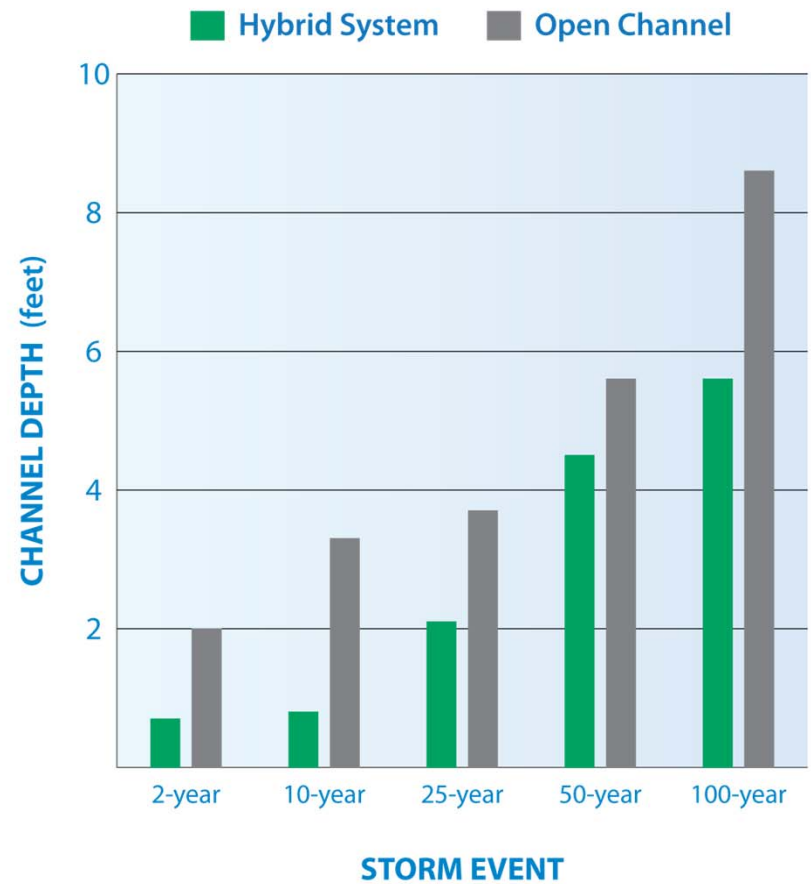
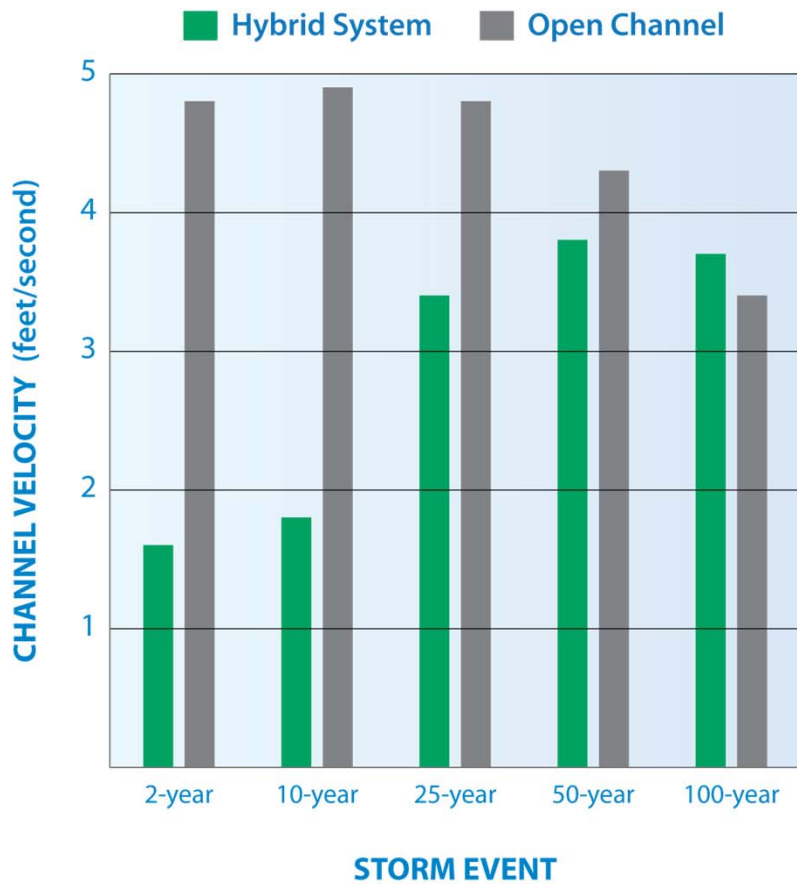
# Preliminary Queen City Avenue Cross Section



QUEEN CITY AVENUE



# Queen City Avenue Cross Section



# Water Quality Considerations

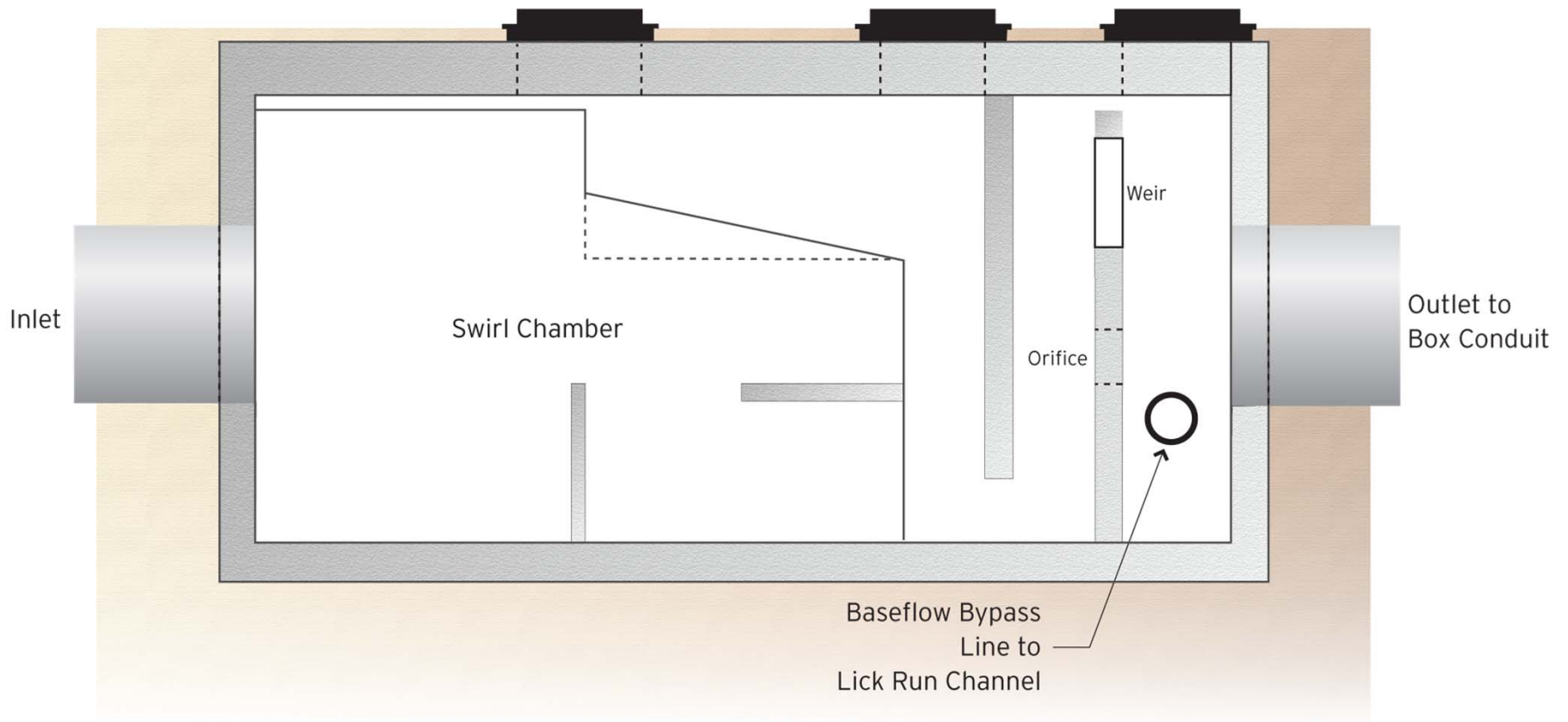
# Water Quality Considerations



Sediment, floatables, and nutrients

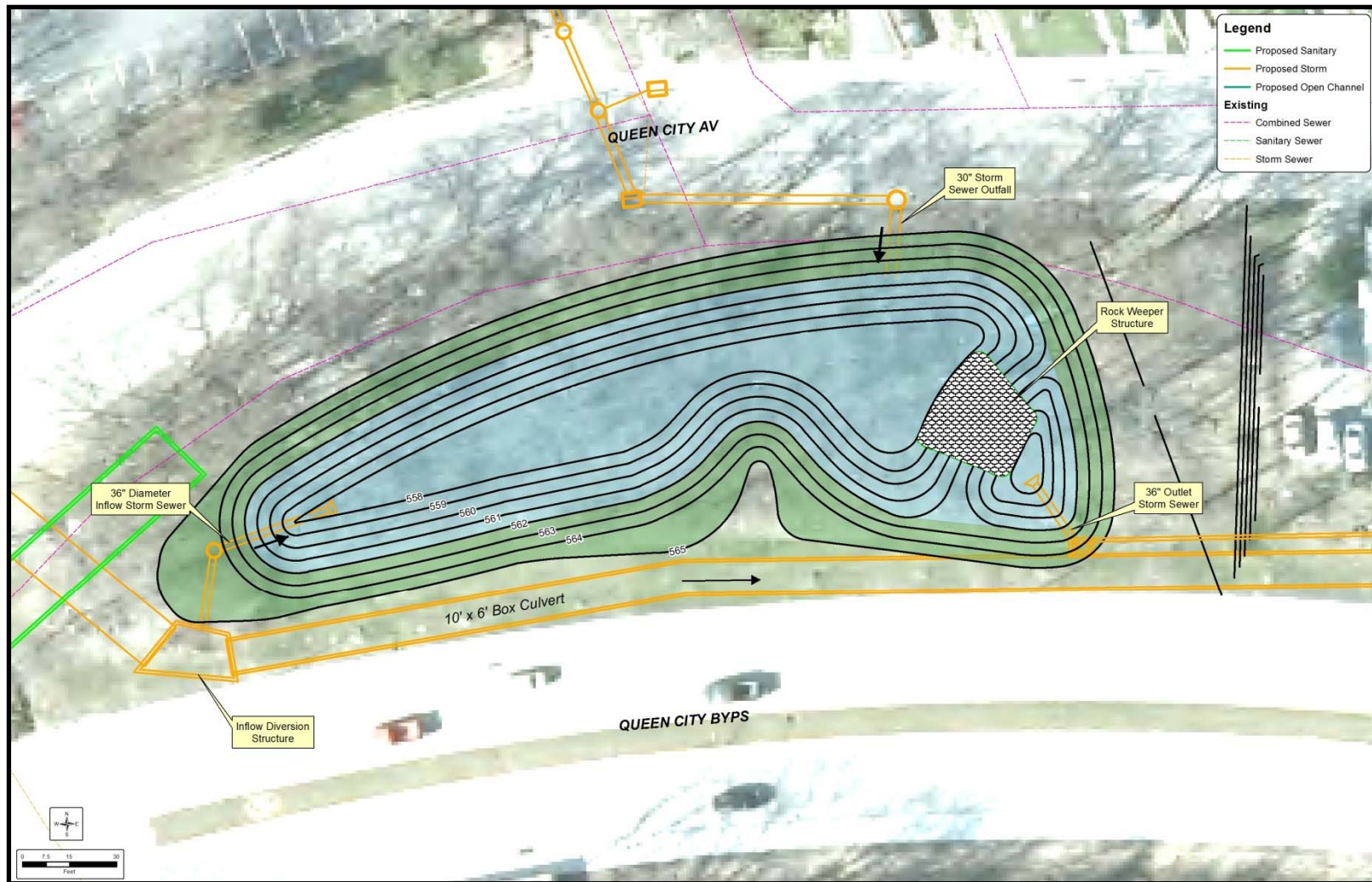


# Structural BMPs



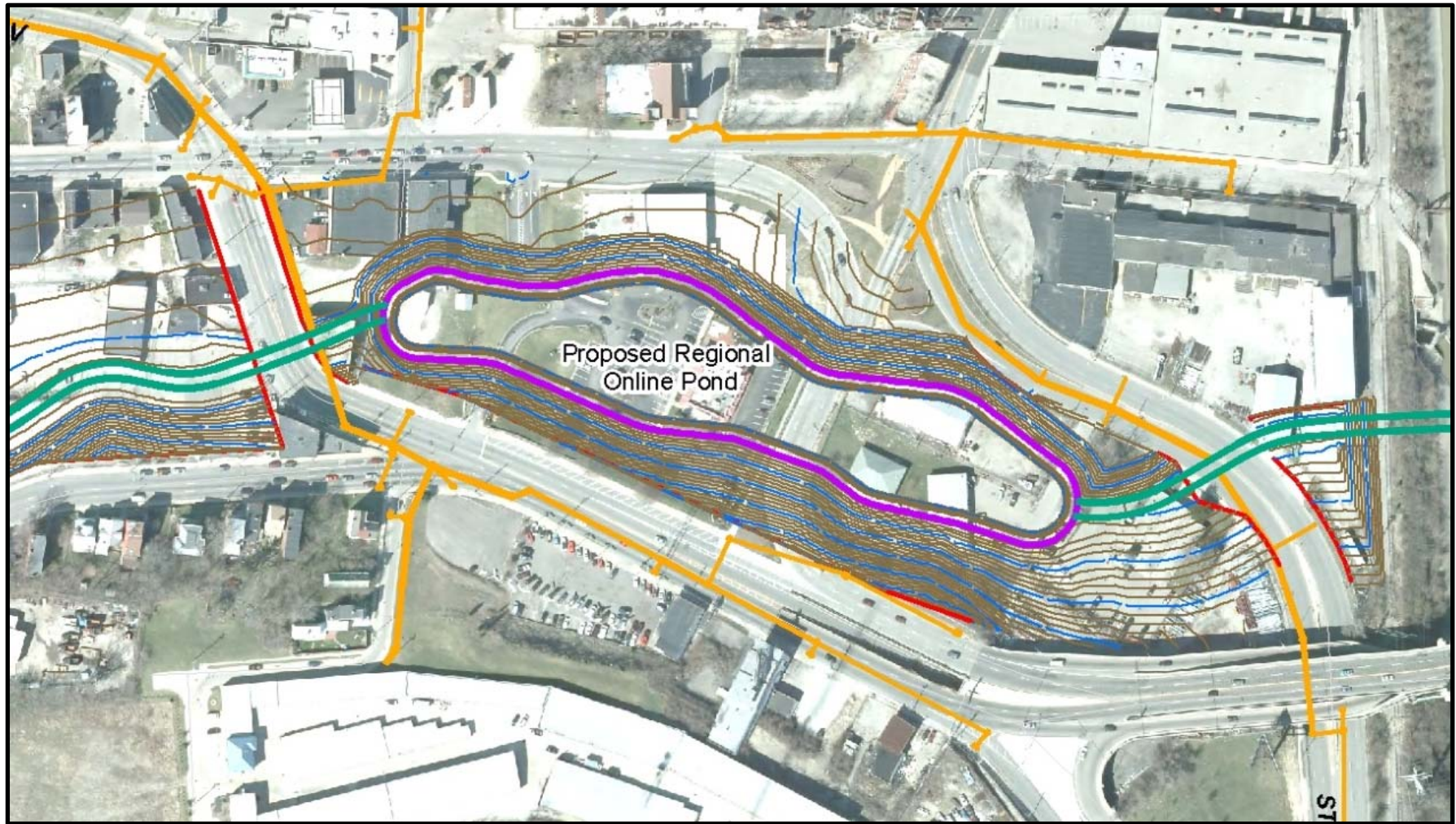
- Capture and direct natural base flow to Lick Run Channel
- Large-volume flows directed to separate storm conveyance
- Remove 80% of total suspended solids (> 110 micron)

# Large-Scale Retention Feature



Proposed forebay on Queen City Avenue (sized for 0.75-inch rain event)

# Large-Scale Retention Feature



Large-scale retention feature

# Stormwater Runoff Pollutant Loadings

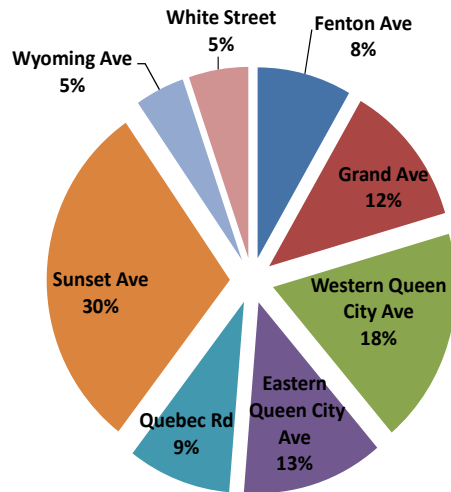
Preliminary Water Quality Modeling Results Indicated the Following:

Annual (Typ. Year) Pollutant Loads by Major Catchments

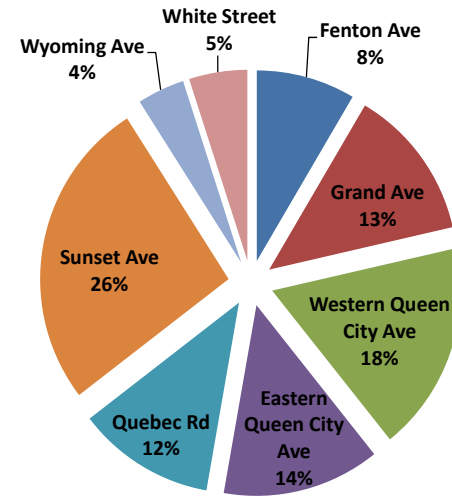
Lick Run Catchment	Approximate Catchment Area (acres)	Total Annual Phosphorus Load (kg)	Total Annual Nitrogen Load (kg)	Total Annual Suspended Solids Load (kg)	Total Annual Bacteria Load (#)
Fenton Ave	145.7	220	495	50,535	1.29E+08
Grand Ave	271.8	322	752	70,936	2.57E+08
Western Queen City Ave	222.3	483	1,038	88,472	4.28E+08
Eastern Queen City Ave	314.5	331	787	73,531	2.74E+08
Quebec Rd	273.8	241	688	74,851	1.46E+08
Sunset Ave	468.9	792	1,533	149,985	4.52E+08
Wyoming Ave	67.8	116	236	22,752	7.43E+07
White Street	83.3	139	290	26,648	1.02E+08

# Stormwater Runoff Pollutant Loadings

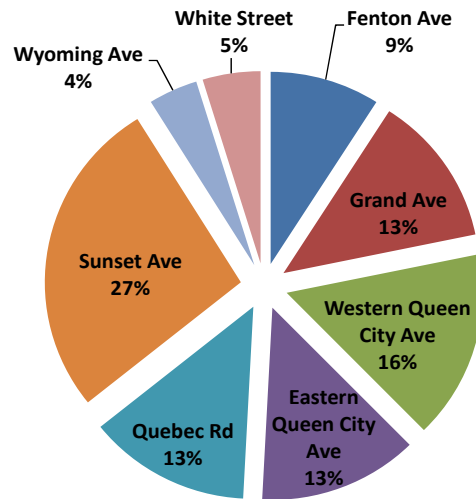
Lick Run Annual Total Phosphorus Loading



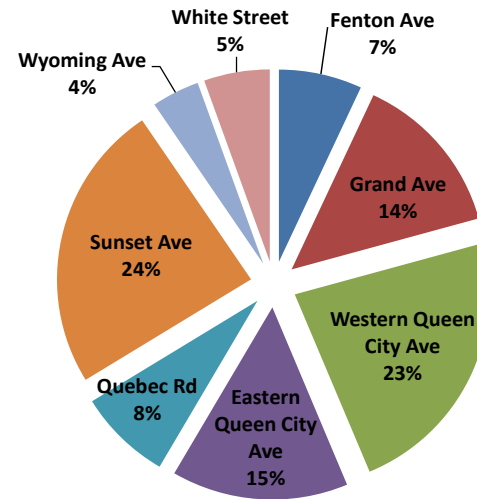
Lick Run Annual Total Nitrogen Loading



Lick Run Annual TSS Loading

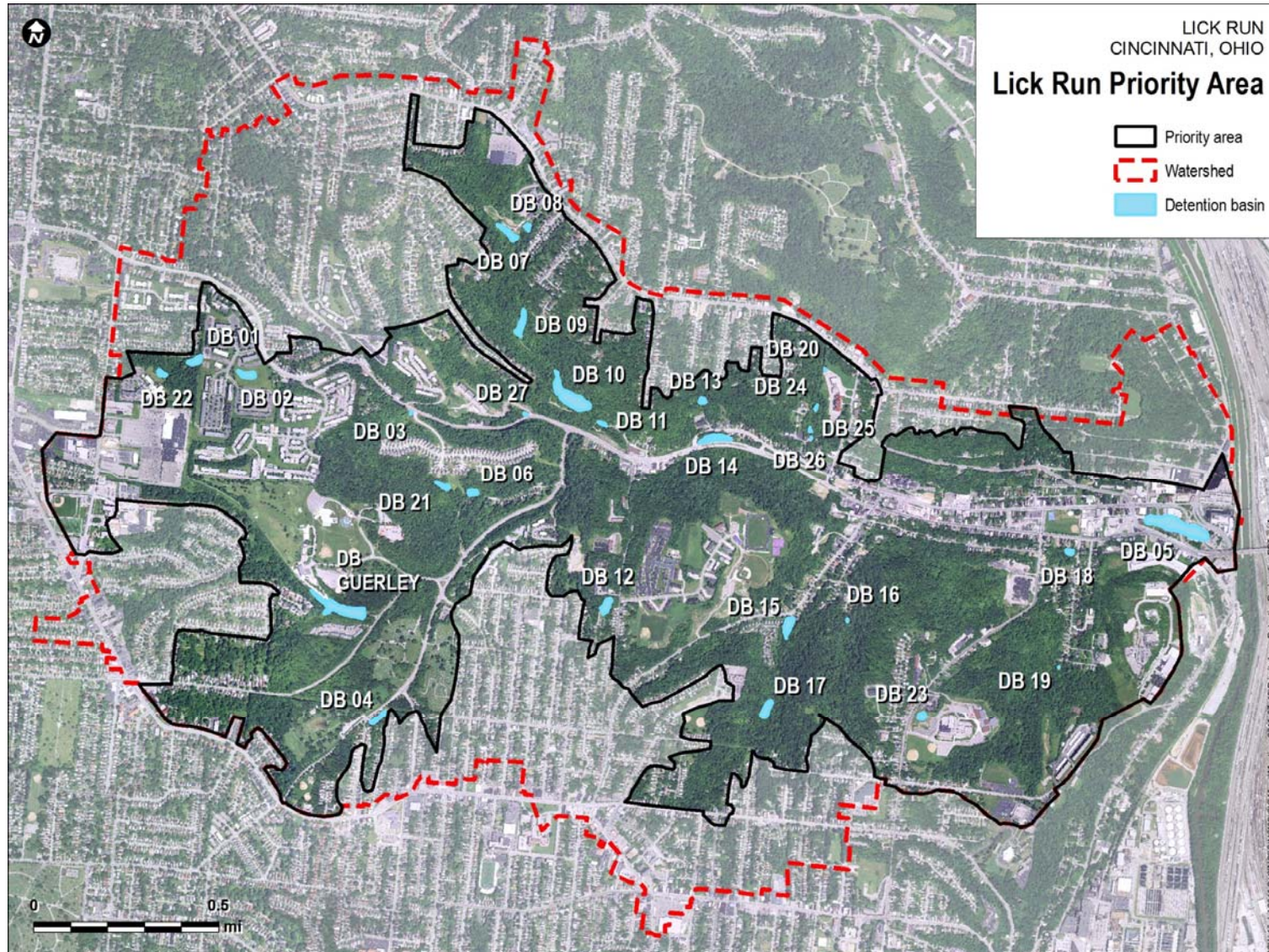


Lick Run Annual Bacteria Loading





# Detention Basin Results



# Detention Basin Results

## Estimated Detention Basin Annual Pollutant Load and Reduction

Basin ID	Subcatchment	PHOSPHORUS			NITROGEN			SUSPENDED SOLIDS			BACTERIA		
		Annual Load (kg)	Load Reduction (kg)	% Reduction	Annual Load (kg)	Load Reduction (kg)	% Reduction	Annual Load (kg)	Load Reduction (kg)	% Reduction	Annual Load (#)	Load Reduction (#)	% Reduction
DB 14	Eastern Queen City Ave	1,579	395	25%	3,288	658	20%	313,431	172,387	55%	1.10E+09	6.00E+08	55%
DB Guerley	Sunset Ave	296	104	35%	599	180	30%	46,518	30,237	65%	2.60E+08	2.00E+08	77%
DB 10	Fenton Ave	220	68	31%	494	129	26%	50,503	30,807	61%	1.30E+08	9.00E+07	69%
DB 09	Fenton Ave	154	45	29%	353	85	24%	34,758	20,507	59%	1.00E+08	7.00E+07	70%
DB 03	Western Queen City Ave	161	43	27%	354	78	22%	28,968	16,512	57%	1.50E+08	1.00E+08	67%
DB 07	Fenton Ave	77	27	35%	169	51	30%	15,654	10,175	65%	5.80E+07	5.00E+07	86%
DB 19	Grand Ave	82	25	30%	205	53	26%	22,413	13,672	61%	4.00E+07	3.00E+07	75%
DB 15	Quebec Rd	70	18	26%	220	44	20%	24,506	13,478	55%	4.20E+07	3.00E+07	71%
DB 17	Quebec Rd	52	17	33%	159	45	28%	16,843	10,611	63%	3.30E+07	3.00E+07	91%
DB 02	Western Queen City Ave	33	14	42%	67	26	39%	5,177	3,676	71%	3.20E+07	3.00E+07	94%
DB 27	Western Queen City Ave	50	13	26%	102	22	22%	11,373	6,483	57%	1.80E+07	1.00E+07	56%
DB 22	Western Queen City Ave	33	12	36%	70	21	30%	6,579	4,276	65%	2.50E+07	2.00E+07	80%
DB 01	Western Queen City Ave	33	11	33%	70	20	29%	6,579	4,145	63%	2.50E+07	2.00E+07	80%
DB 12	Wyoming Ave	29	11	38%	60	21	35%	5,169	3,515	68%	2.60E+07	2.00E+07	77%
DB 24	White Street	31	10	32%	66	17	26%	6,284	3,833	61%	2.00E+07	1.00E+07	50%
DB 23	Grand Ave	19	8	42%	37	14	38%	3,280	2,329	71%	1.40E+07	1.00E+07	71%
DB 16	Quebec Rd	31	8	26%	96	21	22%	11,157	6,359	57%	1.30E+07	8.00E+06	62%
DB 25	White Street	31	8	26%	66	14	21%	6,284	3,582	57%	2.00E+07	1.00E+07	50%
DB 21	Sunset Ave	19	7	37%	48	14	29%	6,109	3,971	65%	8.90E+05	7.00E+05	79%
DB 20	White Street	23	7	30%	48	12	25%	4,437	2,706	61%	1.70E+07	1.00E+07	59%
DB 06	Sunset Ave	19	6	32%	48	12	25%	6,109	3,726	61%	8.90E+05	6.00E+05	67%
DB 08	Fenton Ave	13	4	31%	29	8	28%	2,878	1,813	63%	8.20E+06	6.00E+06	73%
DB 18	Grand Ave	10	4	40%	23	9	39%	1,688	1,199	71%	1.20E+07	1.00E+07	83%
DB 13	Eastern Queen City Ave	10	3	30%	28	6	21%	3,265	1,861	57%	3.60E+06	2.00E+06	56%
DB 04	Sunset Ave	11	3	27%	20	5	25%	2,069	1,179	57%	4.90E+06	3.00E+06	61%
DB 11	Eastern Queen City Ave	5	1	20%	12	3	25%	1,329	811	61%	2.30E+06	2.00E+06	87%
DB 26	White Street	2	1	50%	5	1	20%	473	308	65%	1.50E+06	1.00E+06	67%

# Maintenance Considerations

## Floatables and Large Sediment

- BMPs- Cleaning Anticipated Necessary 2-3 times/yr
- Forebay and Online Pond- Periodic Cleaning

## Fine Sediment

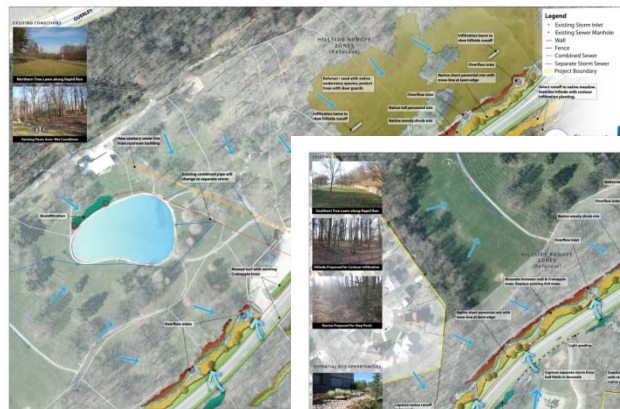
- Box Conduit- Scouring Velocities will prevent deposition and accumulation of sediments, Infrequent Cleaning Required
- Forebay and Online Pond- Dredging requirements, dependent on BMP effectiveness and site management used for disturbed areas

# Implementation- Early Success Projects

## St. Francis Apartments



## San Antonio Church



## Rapid Run Pike



## Beekman St Stormwater Park



# Lick Run Watershed Community Engagement

- Open House January 2011
- Watershed Tours
- August 11, 2011 Design Workshop
  - October & February Planned for Master Plan development

[www.projectgroundwork.org/lickrun](http://www.projectgroundwork.org/lickrun)



# DISCUSSION