AKRON, OHIO

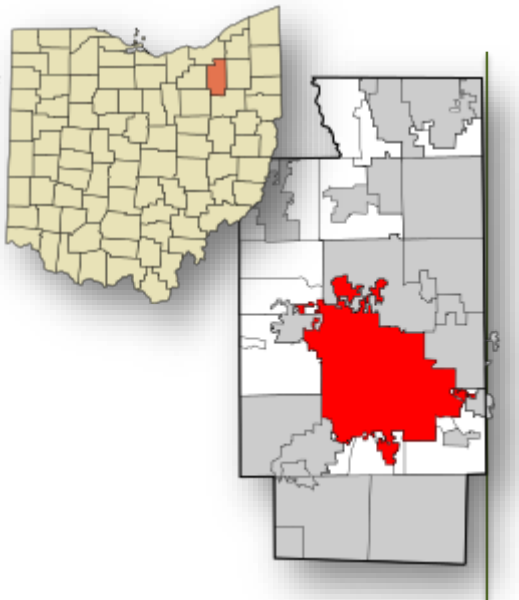
AQUEDUCT STREET GREEN PROJECT

"Water is the DRIVING force of all nature"

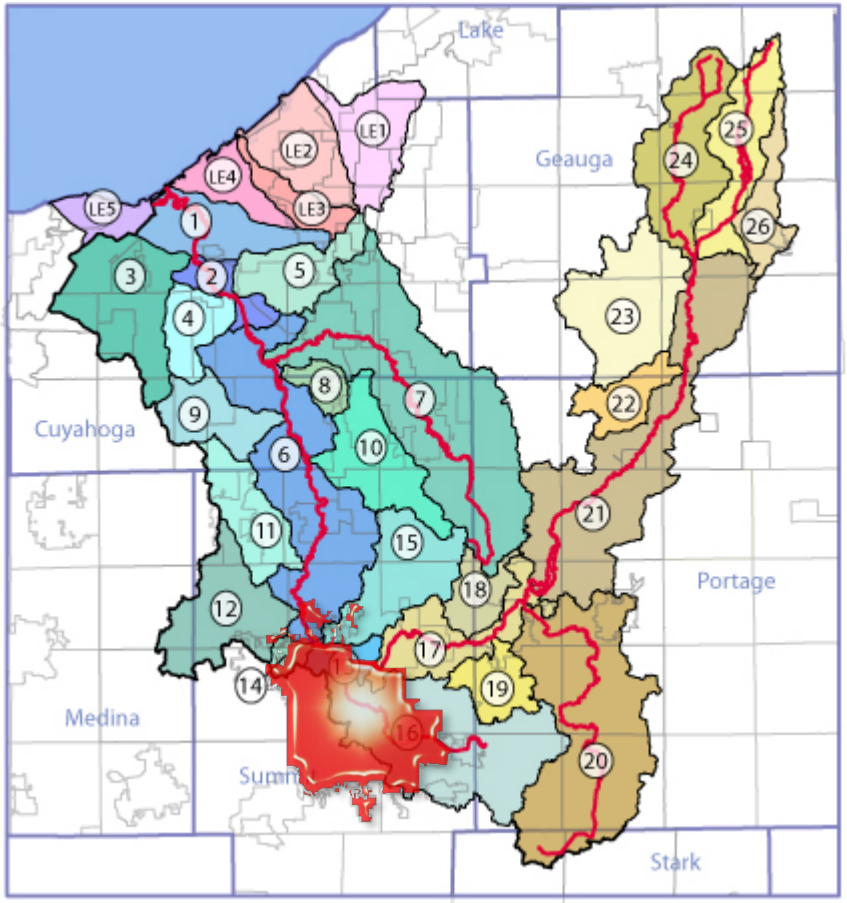
– Leonardo da Vinci

Environmental Design Group
The community impact people.

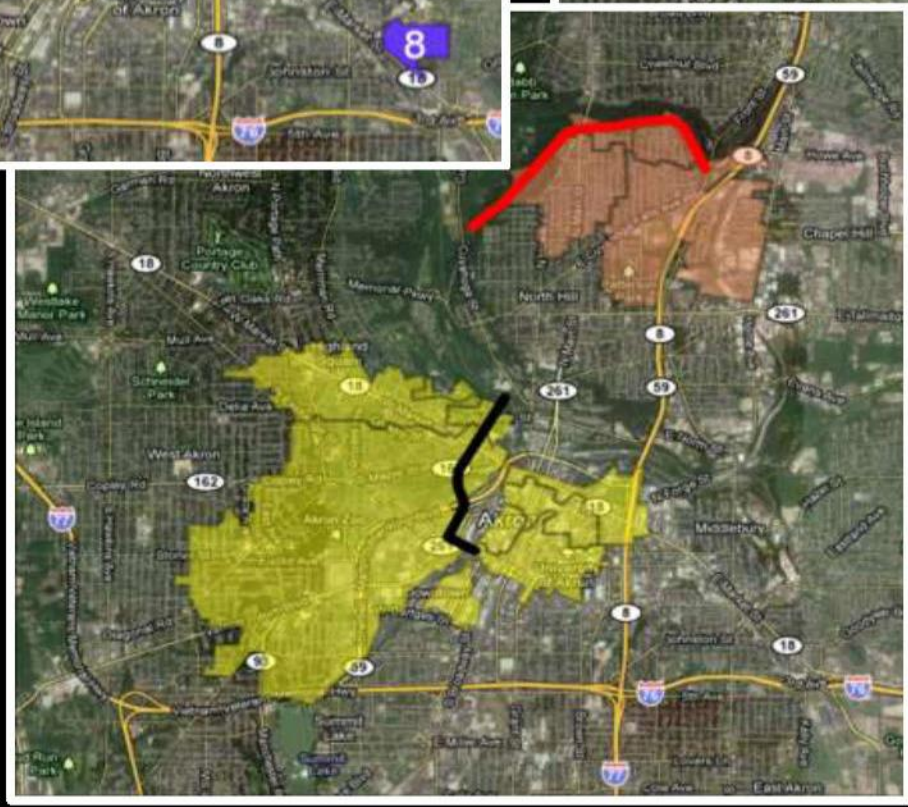
CIVIL ENGINEERING / LANDSCAPE ARCHITECTURE / PLANNING / SURVEYING / ENVIRONMENTAL SERVICES / CONSTRUCTION MANAGEMENT

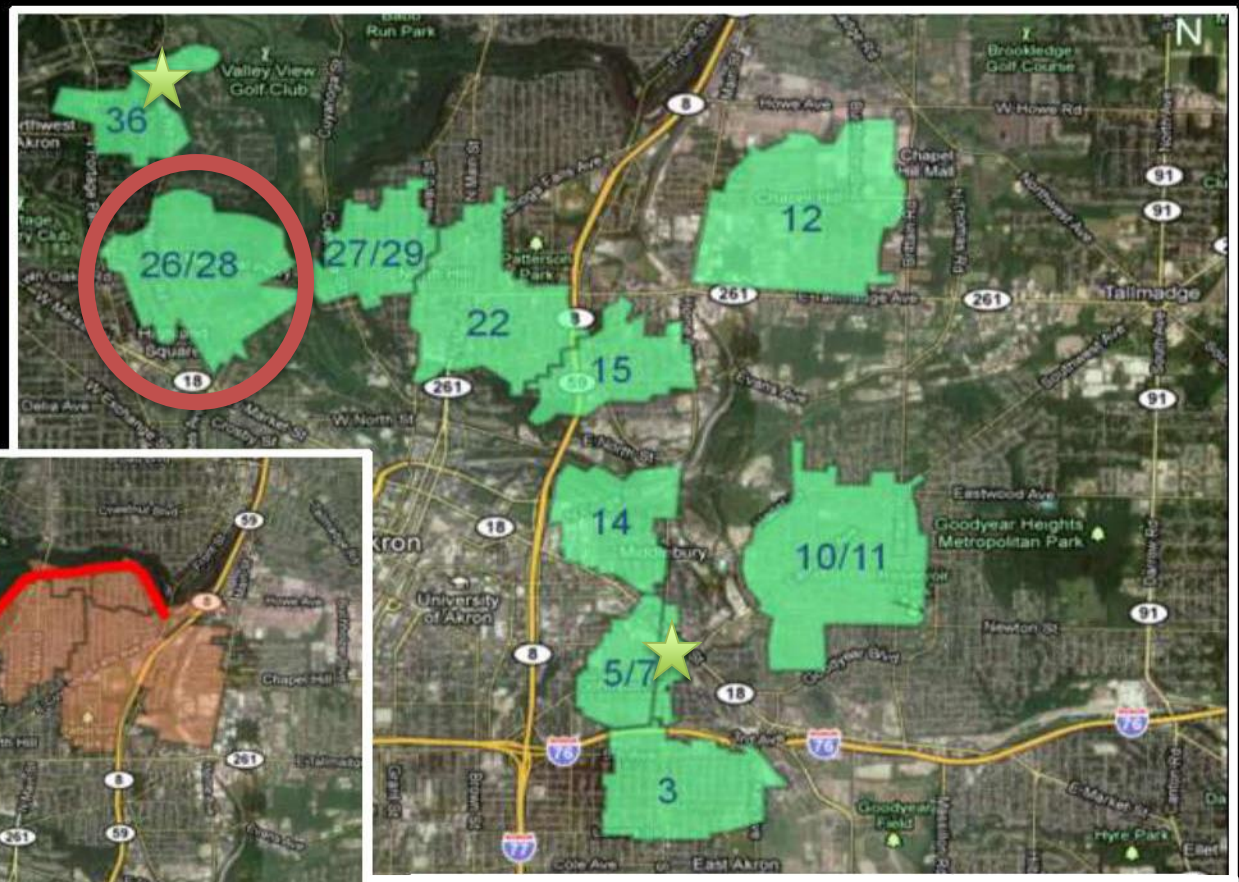


Akron, Ohio



- On the Cuyahoga River (Great Lakes) & Tuscarawas River (Ohio River)
- 2028 is the current completion date of the Akron CSO LTCP
- Many CSO projects completed and ahead of schedule





Consent Decree

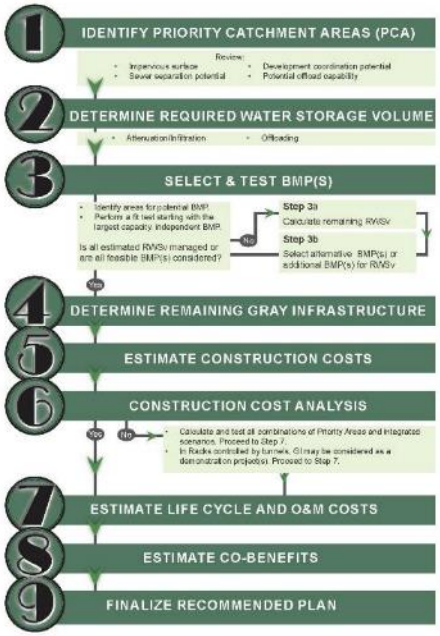
Filed: Nov. 2009

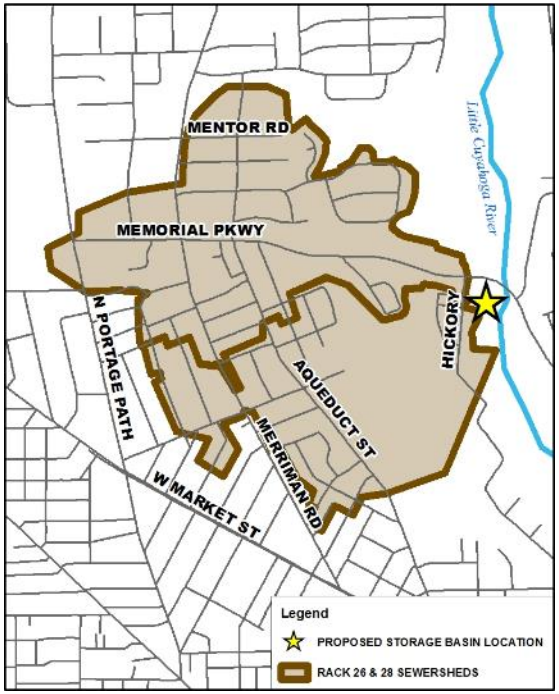
LTCP Update: Nov. 2011

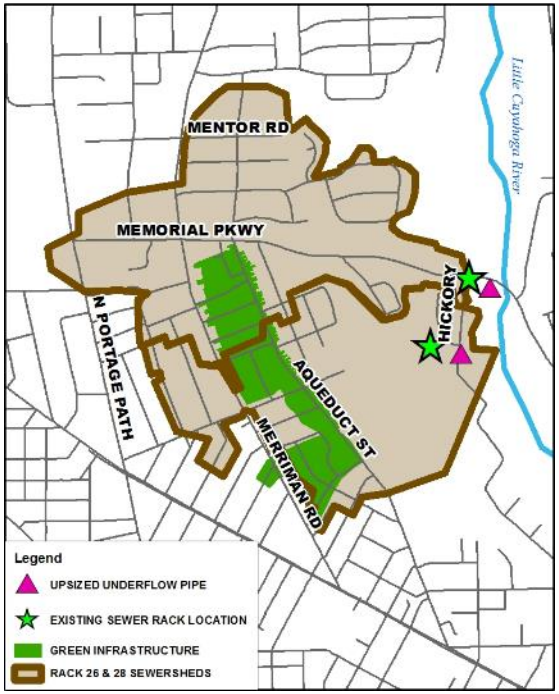
CD entered: Jan. 2014

LTCP Update: Oct. 2027

CD Complete all LTCP Projects: Oct. 2028







It starts with Planning.

Memorial
(CSO Rack 26/28)

- LTCP identified a 2.3 MG
- Recalibrated model identified a 1.5 MG basin
- Exhibit 3 (green with gray)….. the City investigated ways to use provide a more cost-effective option with an improved environmental benefit

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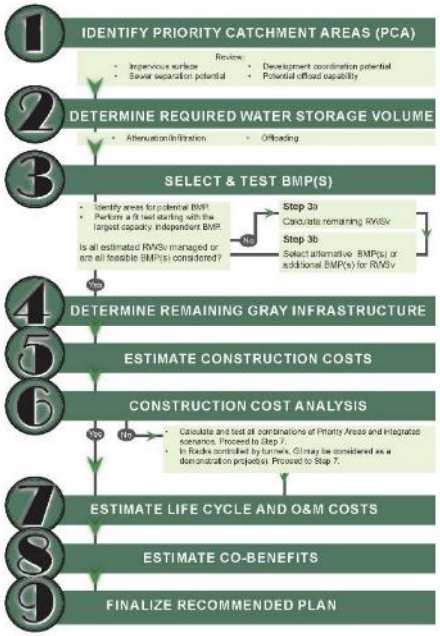
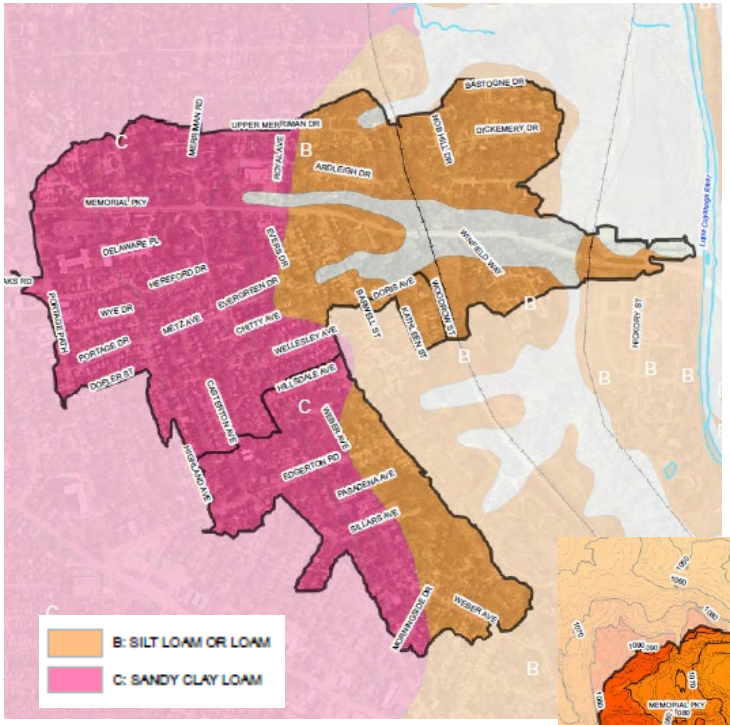
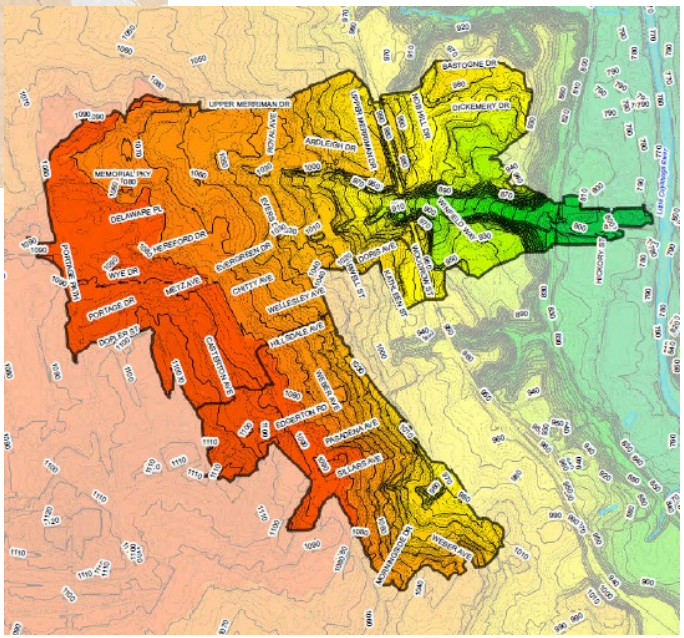
The community impact people.

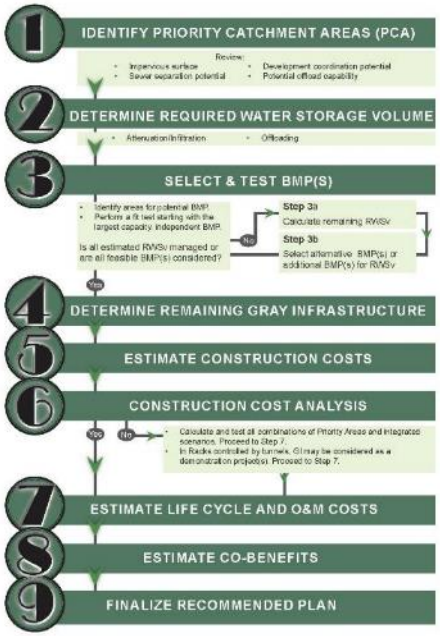


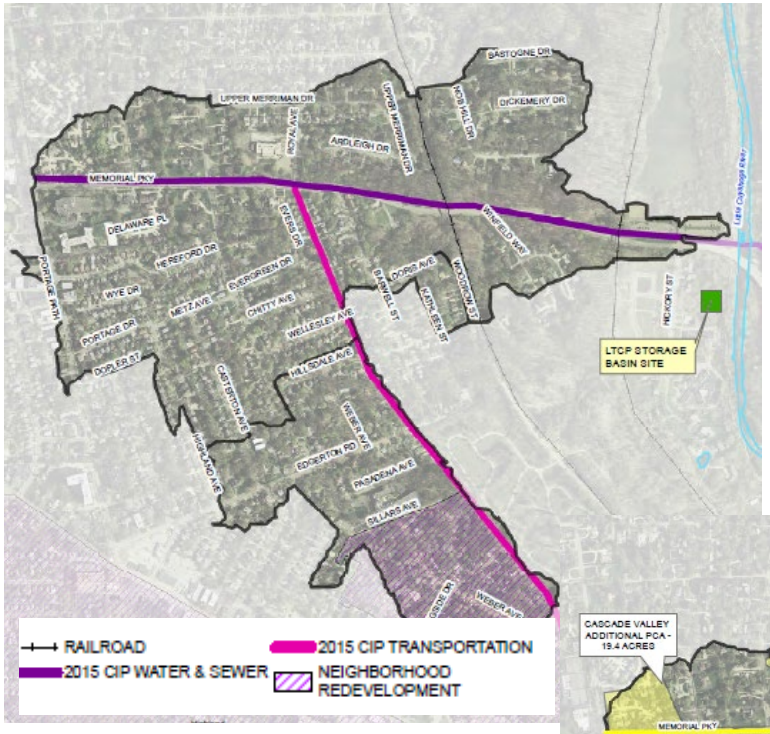


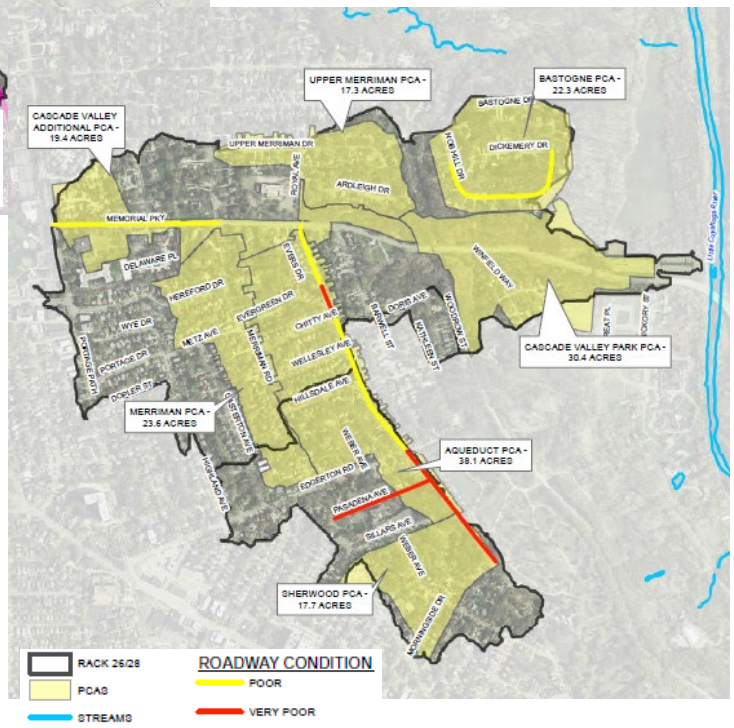


Memorial
(CSO Rack 26/28)

Environmental Design Group
The community impact people.







Memorial
(CSO Rack 26/28)

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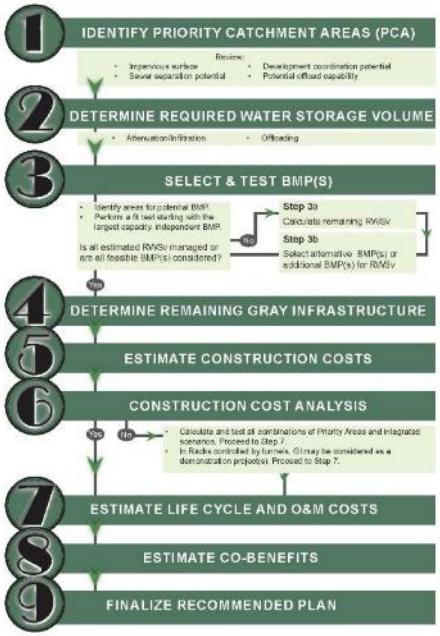

Memorial
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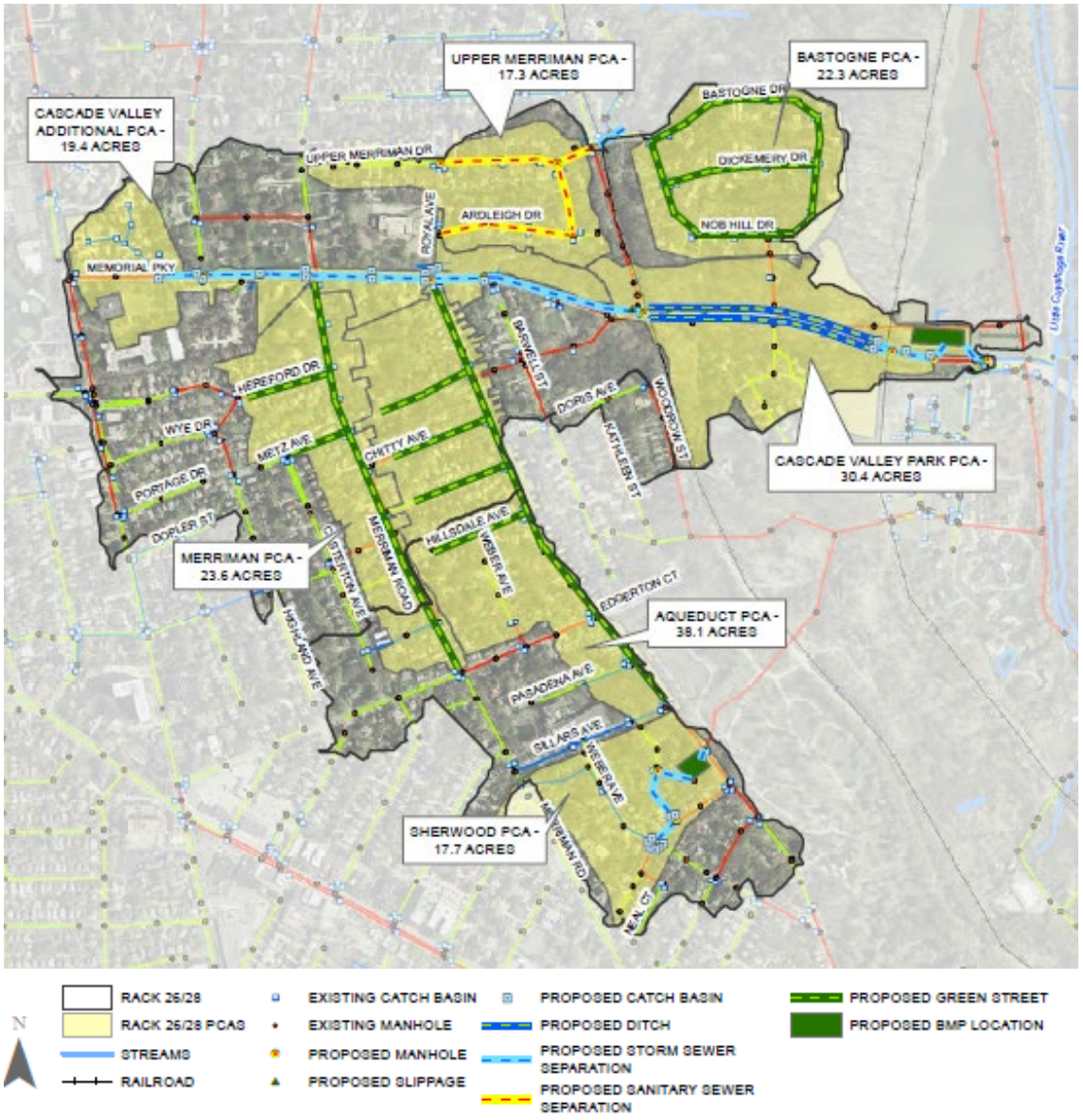

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Memorial
(CSO Rack 26/28)

	Total Capital $_{pv}$	O&M$_{pv}$	Total Project $_{pv}$
1.5 MG Storage Basin	$20.3M	$2M	$22.3M
All GI and Upsized Underflow	$13.1M	$4.2M	$17.3M
Upsized Underflow and Some GI	$5.4M	$1.1M	$6.5M
Complete Sewer Separation	$35.7M	$1M	$36.7M

IP Planning Level BMP RWSv Summary			
	BMP Size	BMP Type	BMP Volume (RWSv)
Aqueduct PCA	20,474 SF (0.47 acres)	Bioretention (infiltrating)	60,984 CF (1.4 ac-ft)
Sherwood PCA	16,117 SF (0.37 acres)	Constructed Stormwater Wetland	37,026 CF (0.85 ac-ft)

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Complete, Livable And Green Streets

"For Everyone"

Bike and Pedestrian Friendly

Connect Neighbors

Safe Route to School

Promote Health

Live, Work, and Play

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Aqueduct Street Green Project

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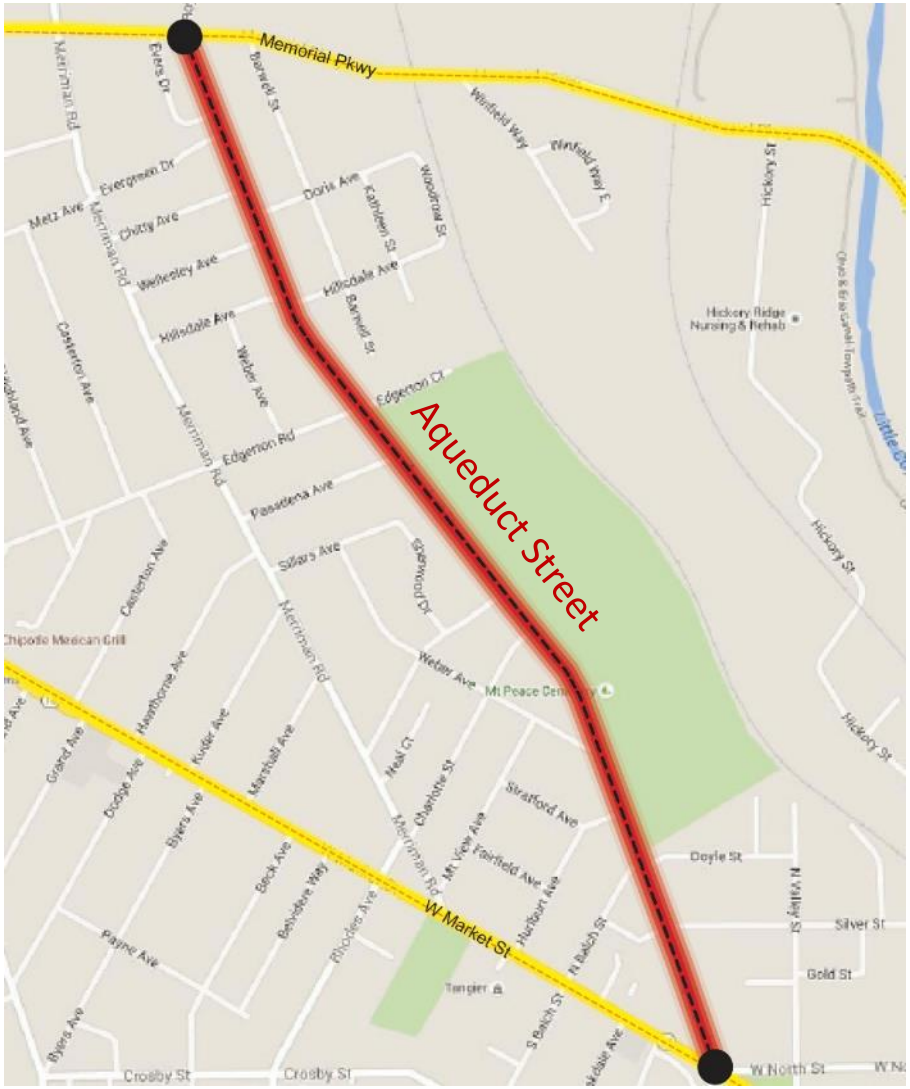
6 University of Akron Students

City of Akron Transportation Staff

Project Limits: West Market Street to Memorial Parkway



Aqueduct Street Green Project

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Section Existing

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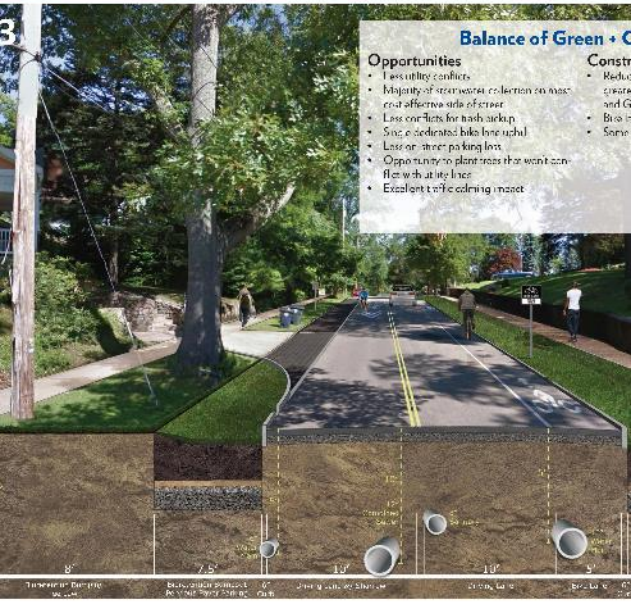
- Residential Collector
- Originally built as a Brick Street in 1921
- 30’ Wide Pavement
- On-Street Parking

Green and Complete Street | Aqueduct Street Green CSO 26/28



Green and Complete Street | Aqueduct Street Green CSO 26/28

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Green and Complete Street | Aqueduct Street Green CSO 26/28

Aqueduct Street Green Improvements

April 4, 2016

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HOW GREEN INFRASTRUCTURE WORKS

Attenuating

"Hold"

Infiltrating

"Seep"

Offloading

"Transfer"

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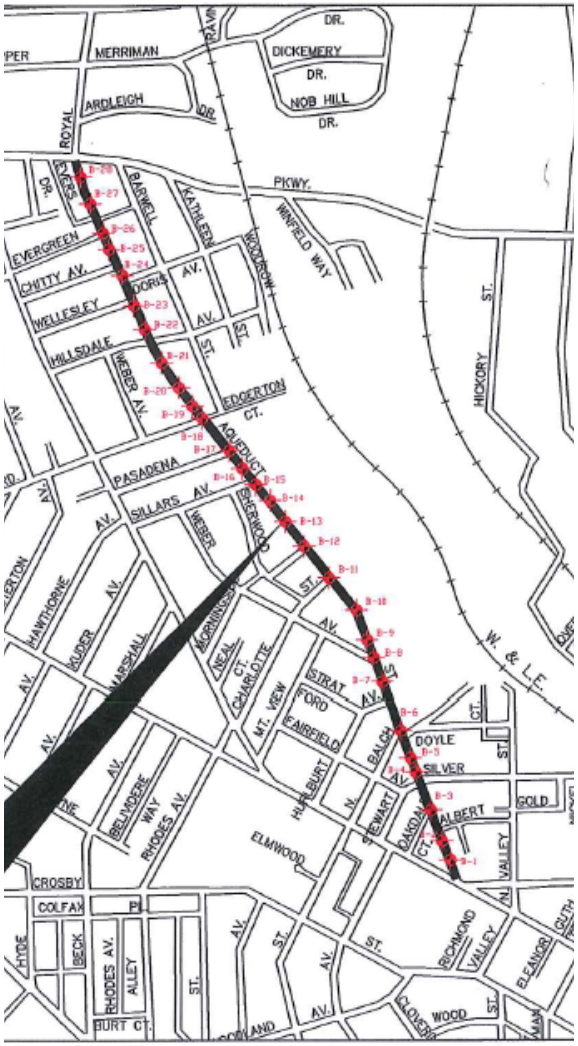

AQUEDUCT STREET LAB DATA AND INFILTRATION RATES

TEST LOCATION	SOIL TEXTUTURE AT 3.5 TO 8 FEET DEPTH	PERCENT FINES	LIMITATING LAYER BELOW 5 FEET	GROUND WATER DEPTH	DESIGN INFILTRATION RATE DAMP CONDITION INCHES PER HOUR
B-1	SAND (FILL)	<12%	NO	±12'	4
B-2	SAND, MINOR SILT	<16%	NO	BELOW 15'	3
B-3	SAND, TRACE OF SILT	<7%	NO	BELOW 15'	5
B-4	SAND, TRACE OF SILT	<5%	NO	BELOW 15'	5
B-5	SAND, TRACE OF SILT	<4%	NO	BELOW 15'	5
B-6	SAND, TRACE OF SILT	<7%	NO	BELOW 15'	5
B-7	SAND, MINOR SILT	<13%	NO	BELOW 15'	4
B-8	SILT	<97%	NO	BELOW 15'	0.2
B-9	N/A	N/A	N/A	N/A	N/A
B-10	N/A	N/A	N/A	N/A	N/A
B-11	SILT, SOME SAND	<74%	NO	BELOW 15'	0.4
B-12	SILT, SOME SAND	<76%	NO	BELOW 15'	0.4
B-13	SILT AND SAND	<47%	NO	BELOW 15'	0.4
B-14	SAND	<10.5%	NO	BELOW 15'	3
B-15	SILT (FILL)	<95%	NO	BELOW 15'	0.2
B-16	SAND (FILL)	<18%	NO	BELOW 15'	2
B-17	N/A	N/A	N/A	N/A	N/A
B-18	SILT (SANDSTONE AT 7')	<75%	NO	BELOW 15'	0.4
B-19	SILT (SANDSTONE AT 7')	<63%	NO	BELOW 15'	0.4
B-20	GRAVEL, SOME SAND & SILT	<32%	YES	BELOW 15'	0.6
B-21	SAND (SANDSTONE AT 7')	<15%	NO	BELOW 15'	4
B-22	SILT AND SAND	N/A	NO	11.5'	0.4
B-23	N/A	N/A	N/A	N/A	N/A
B-24	SILT AND SAND	N/A	NO	9'	0.4
B-25	SAND, SOME GRAVEL	<13%	NO	10'	4
B-26	SAND, SOME SILT	<33%	NO	BELOW 15'	0.6
B-27	SAND, SOME SILT	<27%	NO	BELOW 15'	0.6
B-28	SAND, MINOR GRAVEL	<6%	NO	BELOW 15'	5

- 28 soil borings
- We hit bedrock on some
- We hit sand on some

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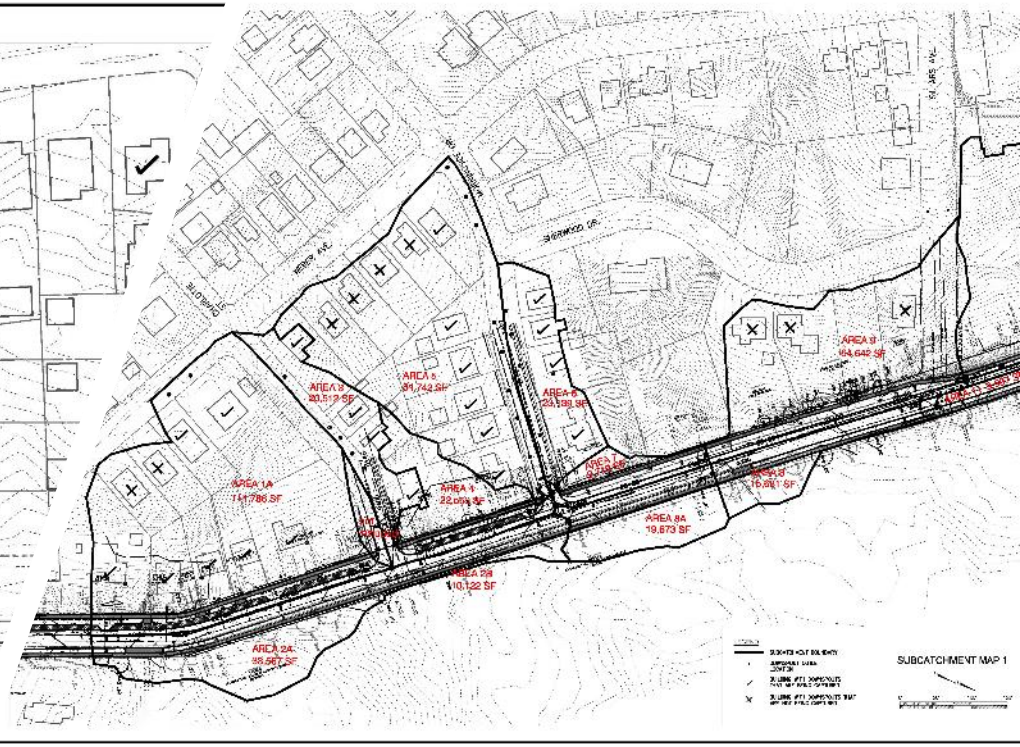
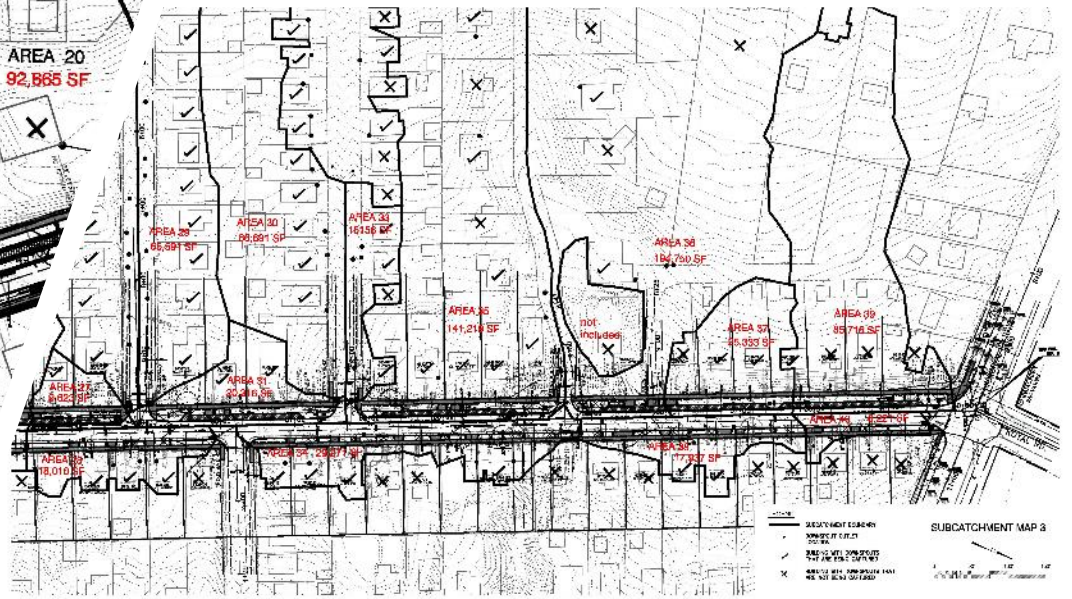
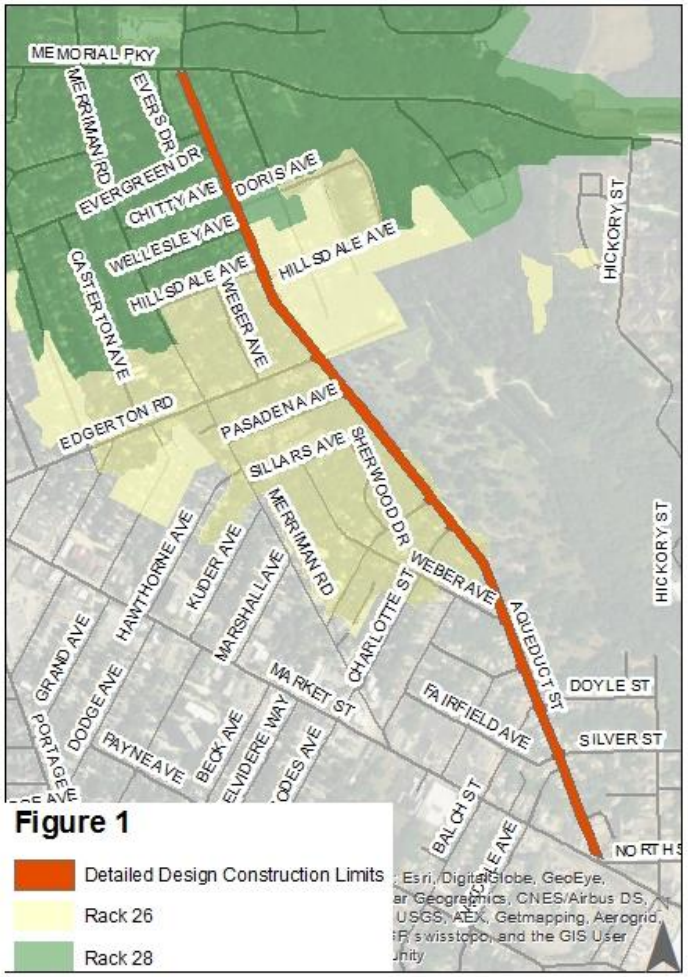


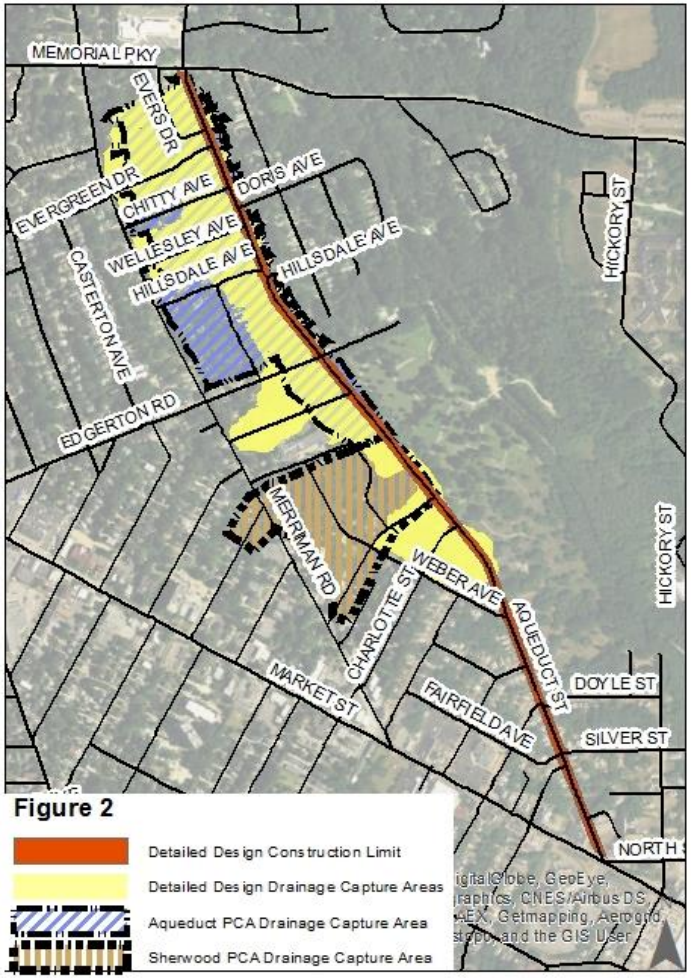


AQUEDUCT STREET GREEN IMPROVEMENTS
CITY OF AKRON

BMP DRAINAGE MAP

3 of 3





- Original Upsized Underflow with some GI ($6.5 Million)
- Need to control stormwater as much as possible cost effectively
- Still need dollars to do the upsized underflow & maintenance

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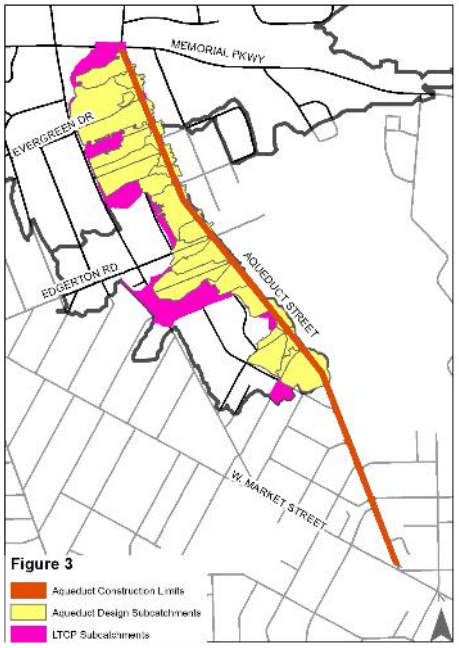

Name	Drainage Capture Area	Captured DCIAacres*
Aqueduct PCA (IP)	38.1 acres	10.4 acres (453,024 SF)
Sherwood PCA (IP)	17.7 acres	4.176 acres (181,906 SF)
IP Total	55.2 acres	14.576 acres (634,930 SF)
Detailed Design	43.08 acres	14.43 acres (628,581 SF)
Difference	- 12.12 acres or -22%	- 0.146 acres (6,349 SF) or -1%

- DCIA – Directly Connected Impervious Area
- IP model est. 0.2 in/hr
- Detailed Design 5 in/hr to 0.2 in/hr with an average of 0.7 in/hr

- Upsized Underflow
  - 30 inch Rack 26
  - 33 inch Rack 28

Aqueduct Street Green Project

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Aqueduct Street Green Improvements

April 4, 2016

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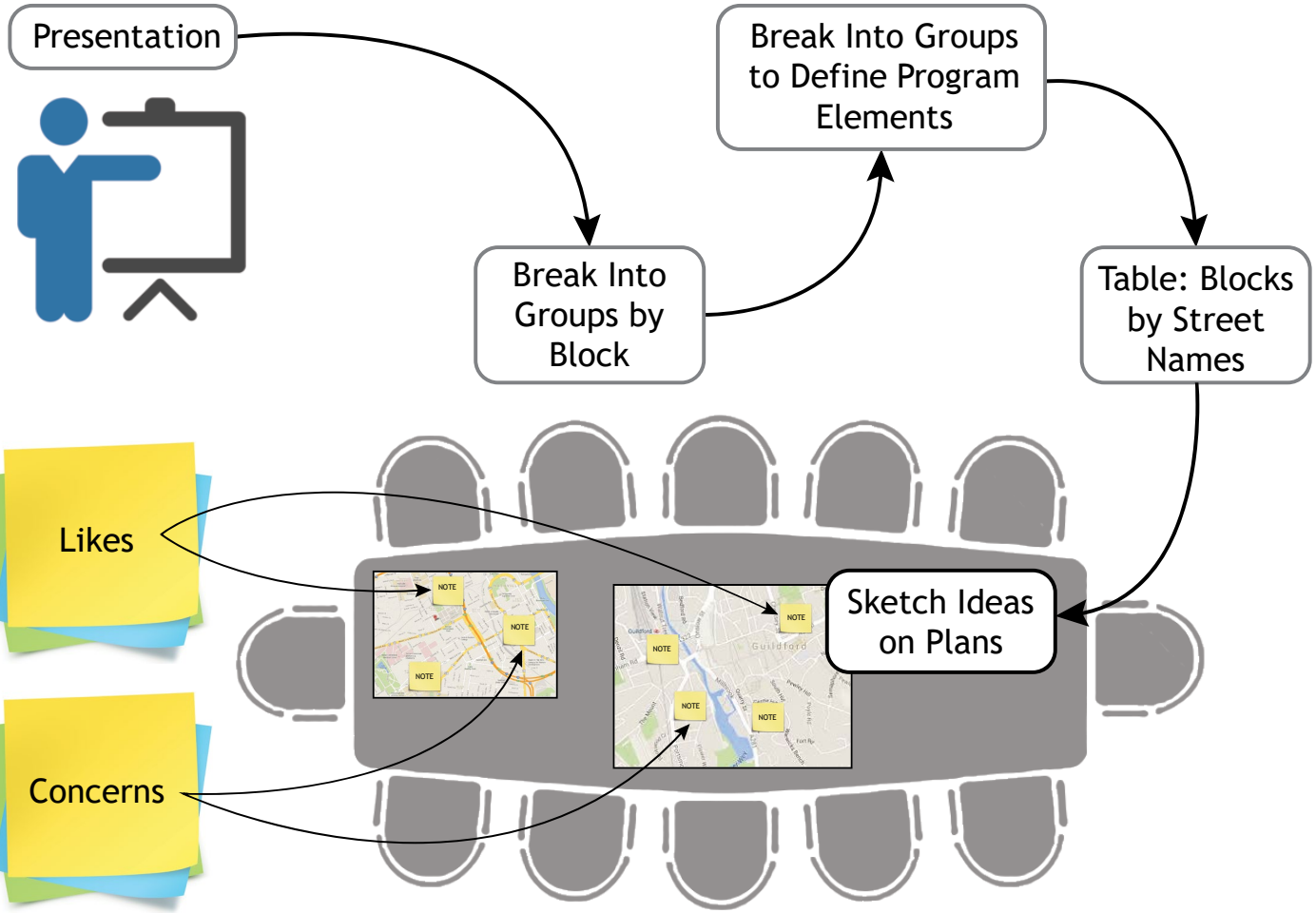
Make Decisions About Program Elements



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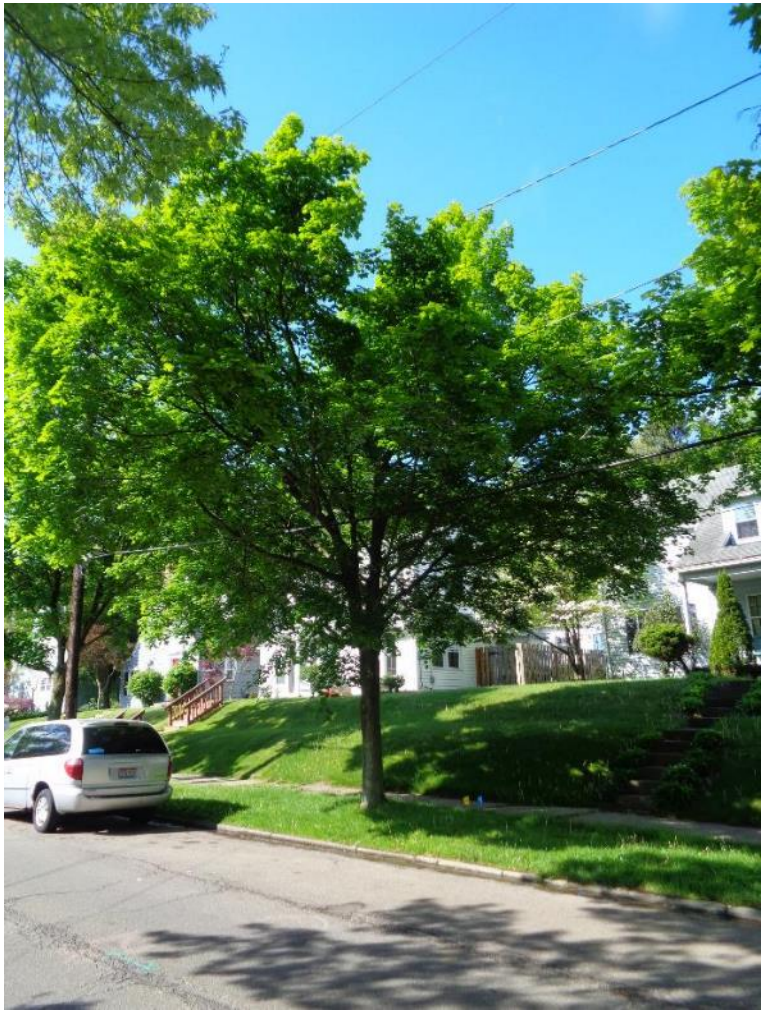
Public Input



DECIDUOUS TREE (Growing into power lines)

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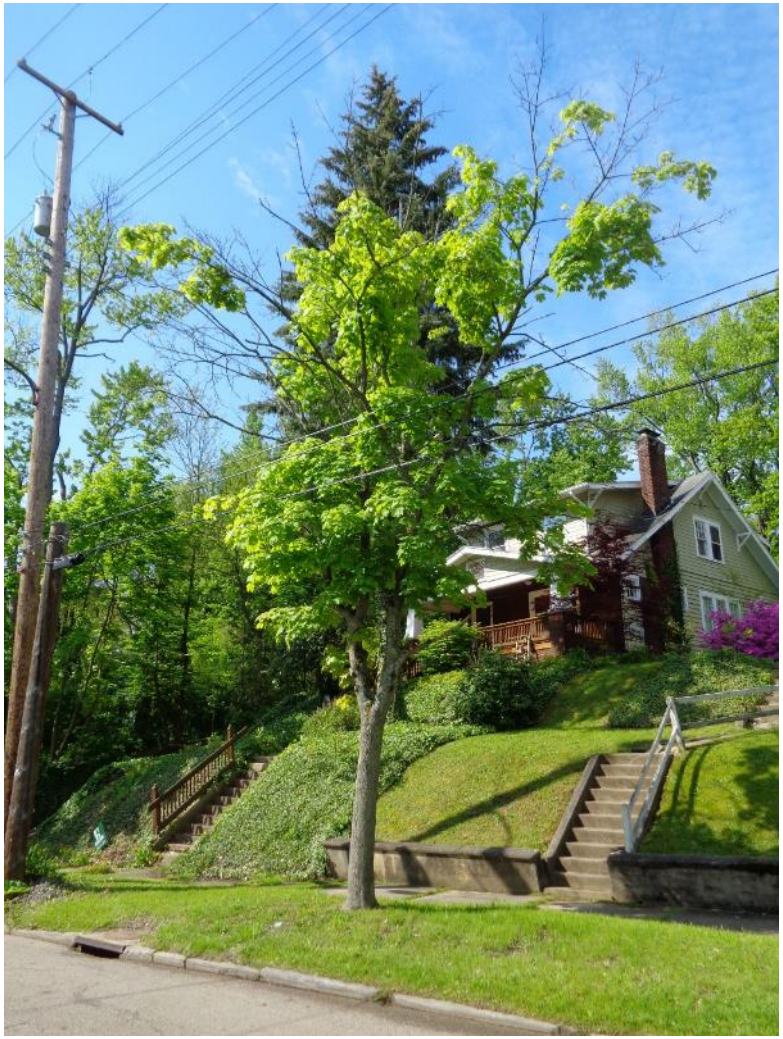
Existing Tree Inventory



DECIDUOUS TREE (Growing into power lines)

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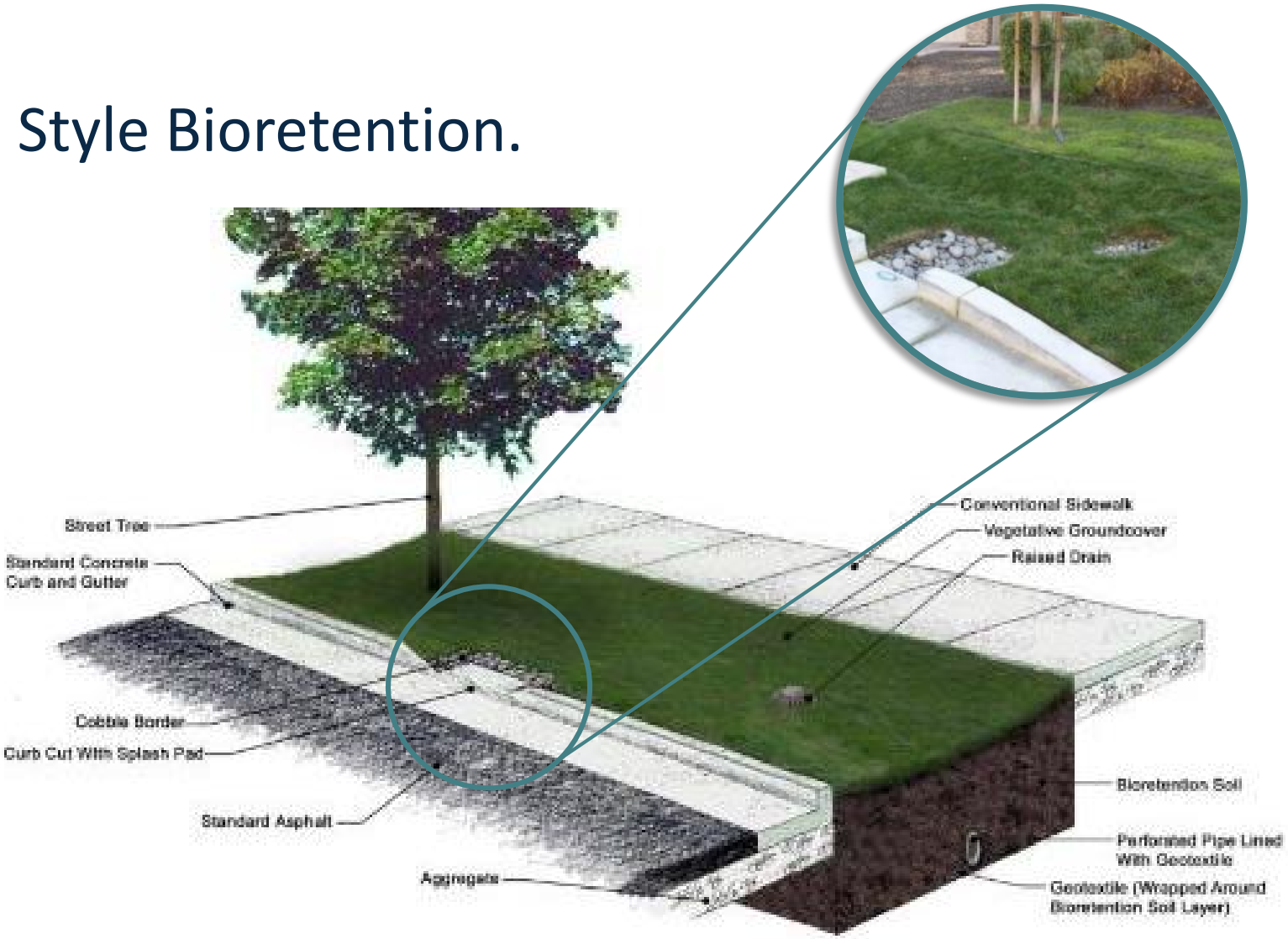
Existing Tree Inventory

Lawn Style Bioretention.



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On Street Parking.
Bike Access.
New Sidewalks.
Utilities.

Firestone Pkwy.

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Aqueduct Street Green Project

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Lots of Gray Infrastructure.

- 6,000 linear feet of FULL DEPTH roadway reconstruction.
- New 6” water main
- New 12” water main
- Replacement of LEAD water lines
- 2,644 feet of COMBINED SEWER reconstruction
- 185 house drains
- Sanitary laterals
- New concrete sidewalks, drive aprons and curb ramps retaining walls, steps, etc.

All while the street was OPEN TO RESIDENTS

BMP RWSv Recalculation with Infiltration Sizing Factor		
	IP BMP Volume (RWSv)	Recalculated IP BMP Volume (RWSv) with Infiltration
Aqueduct PCA	60,984 CF (1.4 ac-ft)	42,689 CF (0.98 ac-ft)
Sherwood PCA	37,026 CF (0.85 ac-ft)	11,108 CF (0.255 ac-ft)
	Total:	53,797 CF (1.235 ac-ft)

Aqueduct Street Green Project

Account for Infiltrating Soils.

- IP model est. 0.0 in/hr (Sherwood) to 0.2 in/hr
- Detailed Design 5 in/hr to 0.2 in/hr with an average of 0.7 in/hr
- Consider infiltration, to determine a new planning level goal

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- Use science and technologies to control stormwater
- Limit visible standing water

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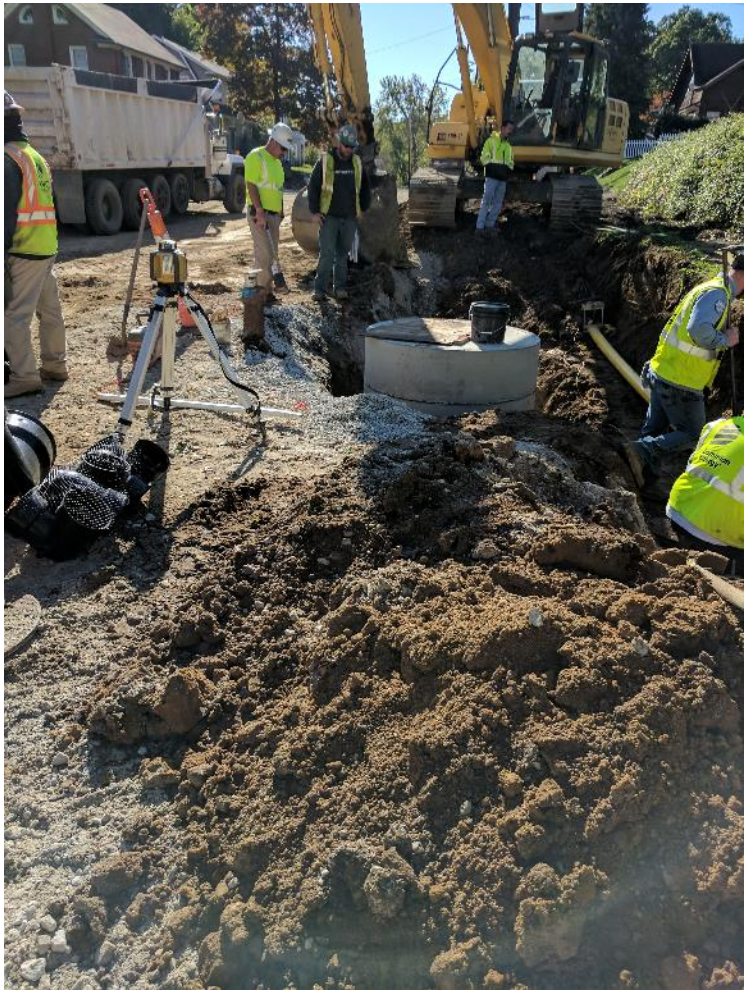

- Underground work
- It is a utility
- Balance of aesthetics, science, maintenance

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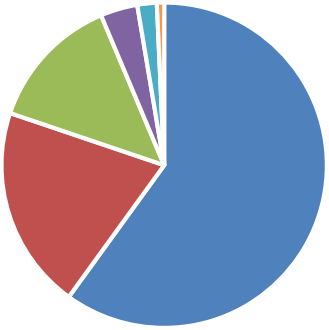
BMP Volume (RWSv)



- Gravel Storage
- HFR Bioretention
- Storage Chambers
- Pavement Removal
- Pervious Pavers
- Dry Wells

DETAILED DESIGN		
BMP Type	BMP Size	BMP Volume (RWSv)
Pervious Pavers (Pavedrain)	15,689 SF	1,354 CF
High flow rate bioretention (Haydite)	10,510 SF	14,188 CF
Aggregate Underground storage (infiltration) – under pavers and bioretention and sidewalks	1,477 SF (under sidewalk only)	42,093 CF
Dry Wells incorporated into high flow rate bioretention and aggregate underground storage	327 SF (total for 7 units)	506 CF
Storage chambers, infiltration galleries, etc.	9,870 SF	9,451 CF
Pavement Removal	24,577 SF	2,590 CF
Total:	62,450 SF	70,182 CF (1.61 ac-ft)

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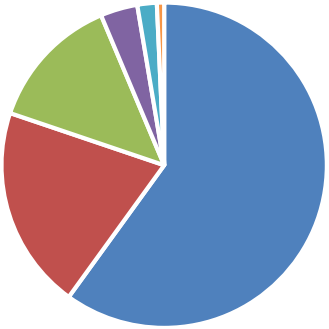
BMP Volume (RWSv)



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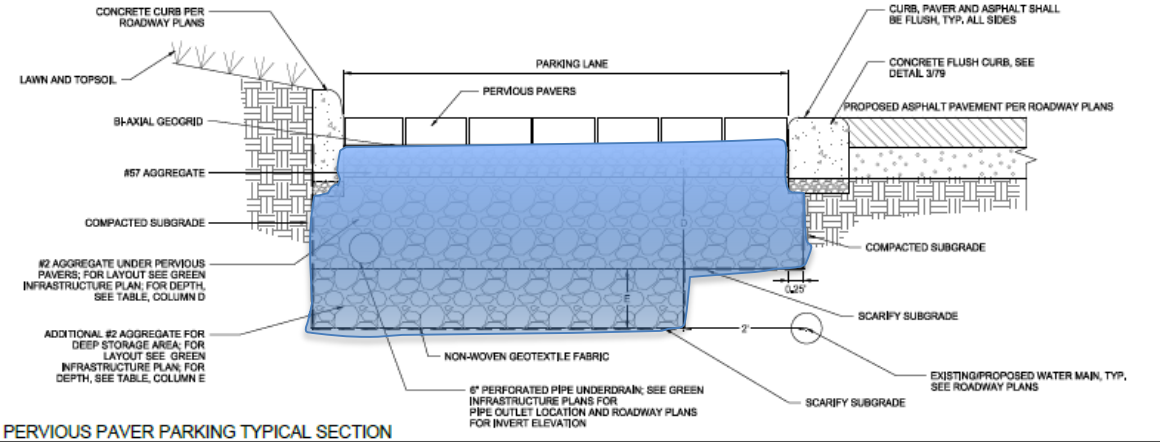
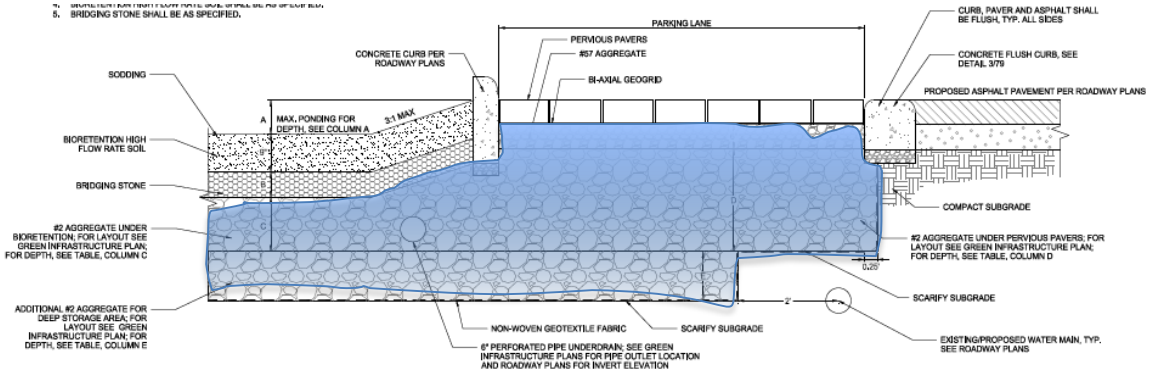


1/72 PERVIOUS PAVER PARKING TYPICAL SECTION
NOT TO SCALE



2/72 PARKING LANE WITH BIORETENTION BUMP-IN AND DEEP STONE STORAGE TYPICAL SECTION
NOT TO SCALE

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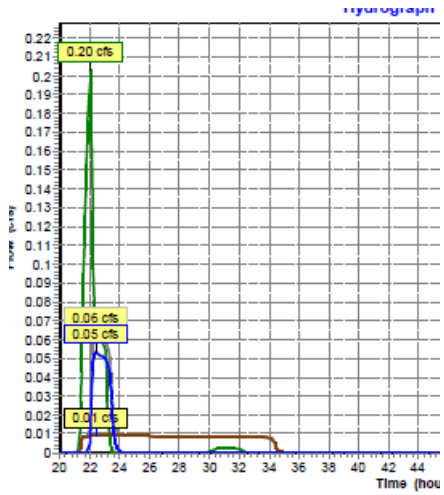

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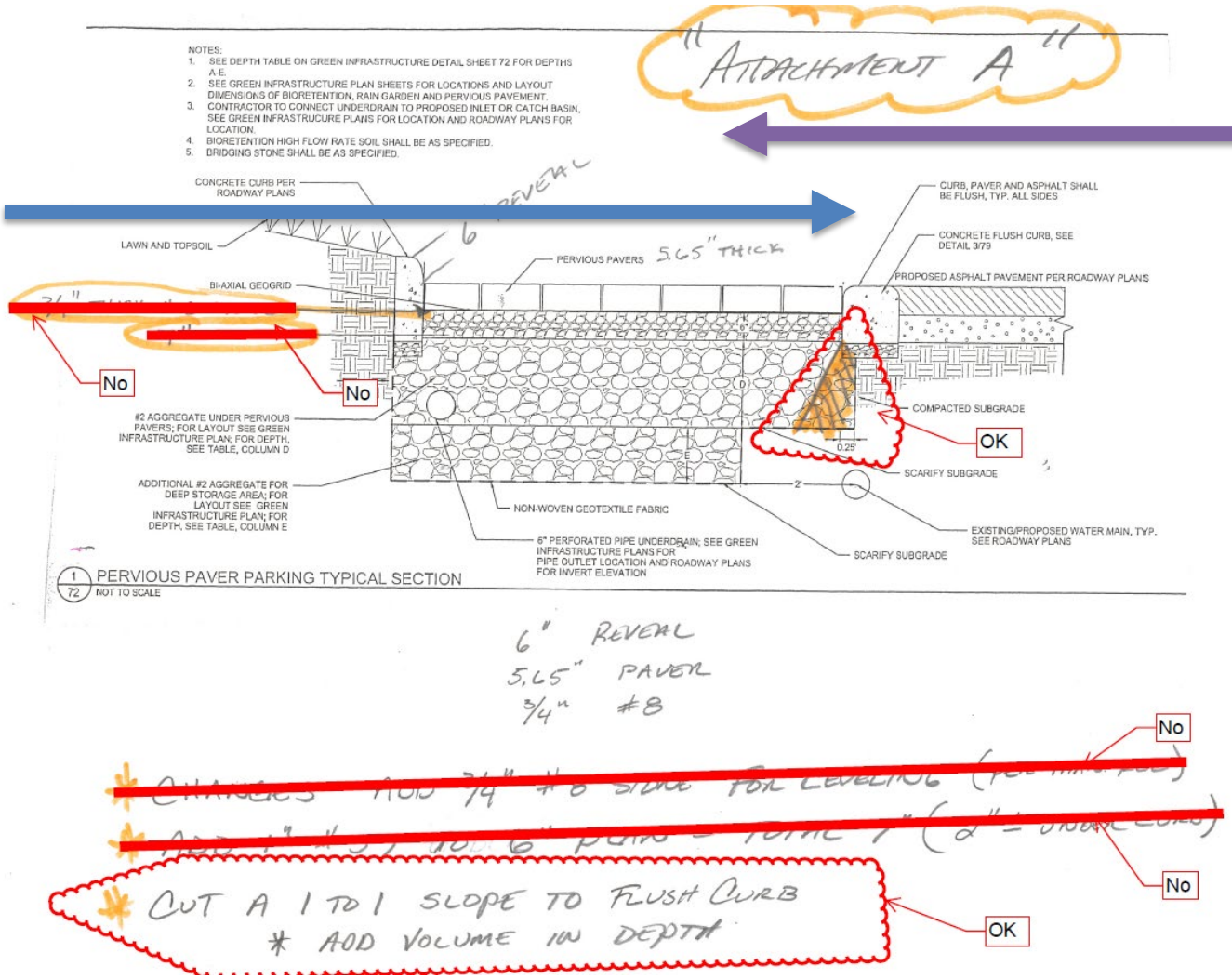
- LTCP Controlling Storm
  - July 7, 1994 – 1.39 inches in 3 hours
  - Secondary Controlling event, April 11 – 12, 1994 2.36 inches in 24 hours
- Aqueduct Drainage area
  - Currently contributes 0.57 MGD (July event) - combined
  - Design reduces it to 0.27 MGD (July event) - combined
  - Can't reduce the sanitary flows, only the stormwater
- Reduces 6.28 MGD (stormwater)/typical year



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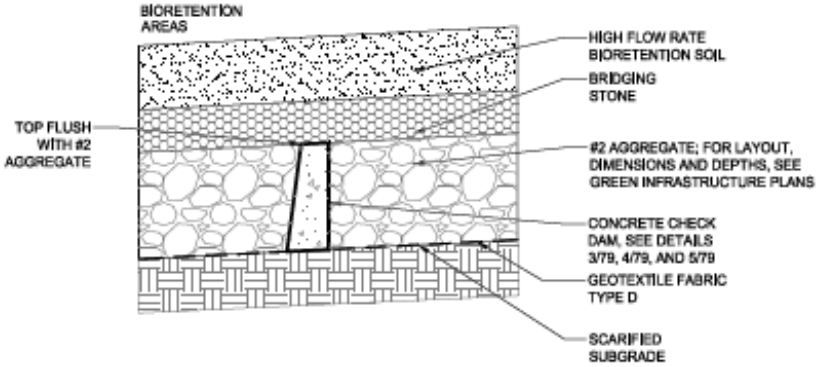
MOT – Contractor supplied

NOTES:
1. UNDERGROUND CHECK DAMS TO BE LOCATED AS INDICATED ON PLANS.
2. TOP OF CHECK DAM MATERIAL SHALL MEET BOTTOM OF BRIDGING STONE LAYER.
3. CHECK DAM MATERIAL TO BE SET ON SUB-GRADE.



3/81 CONCRETE CHECK DAM TYPICAL INSTALLATION
NOT TO SCALE

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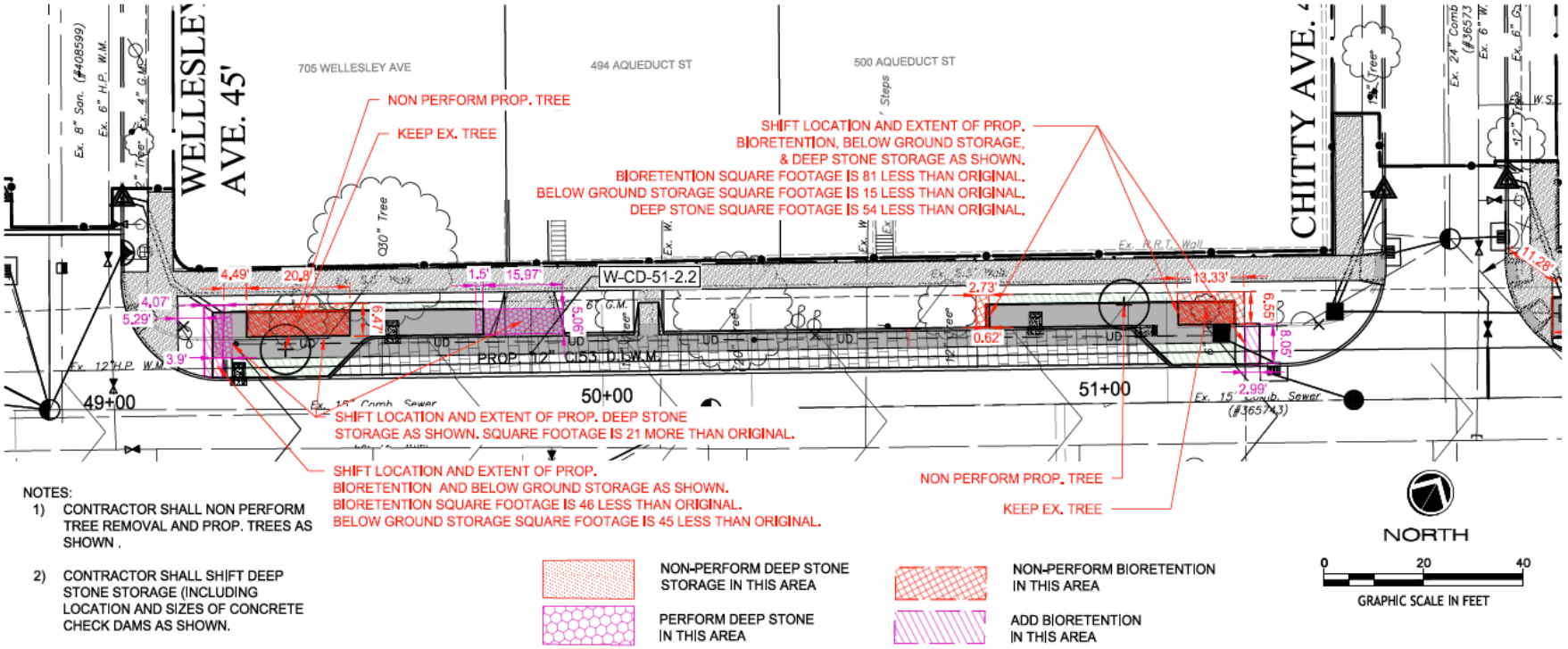
Material changes



NOTES:

1) CONTRACTOR SHALL NON PERFORM TREE REMOVAL AND PROP. TREES AS SHOWN .

2) CONTRACTOR SHALL SHIFT DEEP STONE STORAGE (INCLUDING LOCATION AND SIZES OF CONCRETE CHECK DAMS AS SHOWN.

NON-PERFORM DEEP STONE STORAGE IN THIS AREA

PERFORM DEEP STONE IN THIS AREA

NON-PERFORM BIORETENTION IN THIS AREA

ADD BIORETENTION IN THIS AREA

GREEN INFRASTRUCTURE LAYOUT - WEST

ITEM #	DESCRIPTION	KEY	STATION	OFFSET	LENGTH	WIDTH	DEPTH	RIM ELEV
SPEC	CONCRETE CHECK DAM	W-CD-51-2.2	49+84.53	11.64'	9.0'			

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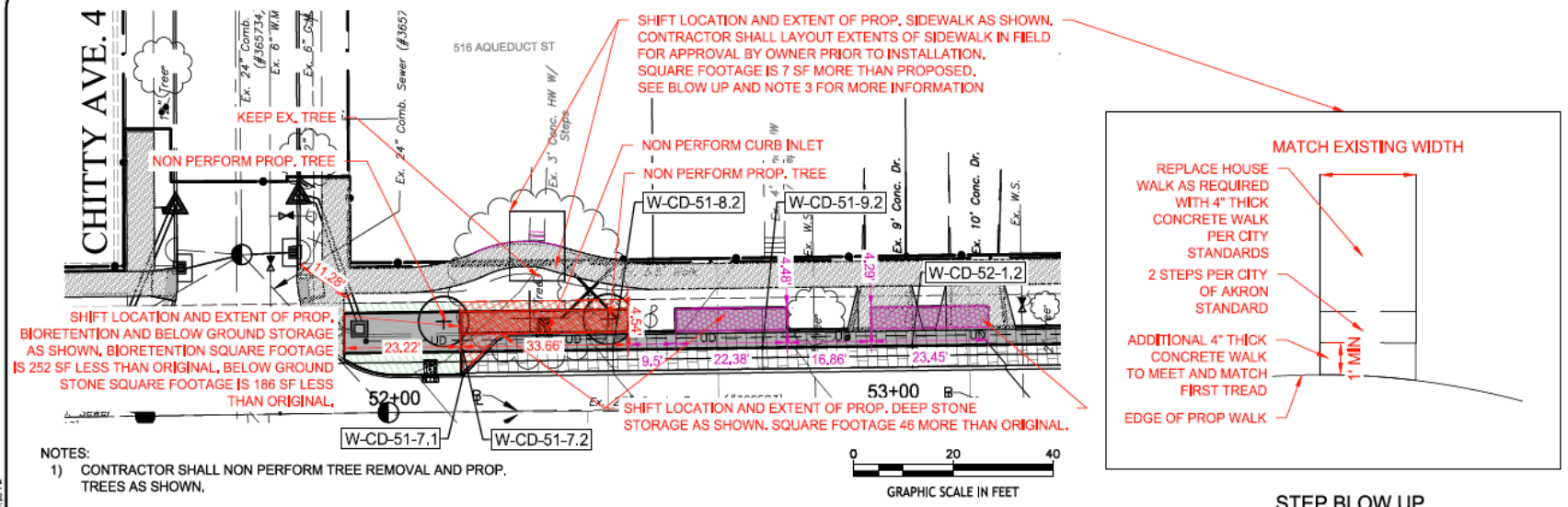
Resident changes



NOTES:

1) CONTRACTOR SHALL NON PERFORM TREE REMOVAL AND PROP. TREES AS SHOWN,

2) CONTRACTOR SHALL SHIFT DEEP STONE STORAGE (INCLUDING LOCATION AND SIZES OF CONCRETE CHECK DAMS AS SHOWN.

3) CONTRACTOR SHALL SHIFT PROP. CONCRETE SIDEWALK AS SHOWN, CONCRETE STEPS SHALL BE PERFORMED PER CITY OF AKRON STANDARDS. POUR NEW CONCRETE & GRADE SLOPES ON EITHER SIDE OF WALK/STEP AT 3:1 MAX SLOPE THEN SEED ALL DISTURBED AREAS.

4) CONTRACTOR SHALL PERFORM TOPSOIL, SEED AND MULCH IN DISTURBED AREAS BEHIND SIDEWALK, CONTRACTOR SHALL PERFORM SODDING IN DISTURBED AREAS BETWEEN SIDEWALK AND CURB.

NON-PERFORM DEEP STONE STORAGE IN THIS AREA

PERFORM DEEP STONE IN THIS AREA

NON-PERFORM BIORETENTION IN THIS AREA

ADD BIORETENTION IN THIS AREA

GREEN INFRASTRUCTURE LAYOUT - WEST

ITEM #	DESCRIPTION	KEY	STATION	OFFSET	LENGTH	WIDTH	DEPTH	RIM ELEV
SPEC	CONCRETE CHECK DAM	W-CD-51-7.1	52+13.89	7.50'	4.5'			
SPEC	CONCRETE CHECK DAM	W-CD-51-7.2	52+13.89	12.00'	3.7'			
SPEC	CONCRETE CHECK DAM	W-CD-51-8.2	52+43.48	12.02'	3.5'			
SPEC	CONCRETE CHECK DAM	W-CD-51-9.2	52+73.48	12.01'	8.0'			
SPEC	CONCRETE CHECK DAM	W-CD-52-1.2	53+03.48	11.87'	7.8'			

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Resident changes

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CIVIL ENGINEERING / LANDSCAPE ARCHITECTURE / PLANNING / SURVEYING / ENVIRONMENTAL SERVICES / CONSTRUCTION MANAGEMENT

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	Total Capital $_{pv}$	O&M$_{pv}$	Total Project $_{pv}$
1.5 MG Storage Basin	$20.3M	$2M	$22.3M
All GI and Upsized Underflow	$13.1M	$4.2M	$17.3M
Upsized Underflow and Some GI	$5.4M	$1.1M	$6.5M
Complete Sewer Separation	$35.7M	$1M	$36.7M

- Reduces 6.28 MGD (stormwater)/typical year
- $6.05 million dollars
  - $5.5M Aqueduct ($5.2M bid +$200k CO + $48k 1-year GI O&M)
  - - $2.45 OPWC grant,
  - $1.5M upsized underflow,
  - $1.5M O&M ~32 years
- $0.97/gallon (stormwater)
- $16 million dollars Akron doesn't have to borrow or spend
- Better environmental benefit – quicker!

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Memorial
(CSO Rack 26/28)

2015

- Recalibrated LTCP model
- Exhibit 3 Green Infrastructure Identified

2016

- University of Akron & City of Akron Roadway Project
- EDG GI Design

2017

- Bidding – 4 bidders; $5.3 million Karvo (12% below estimate)
- Karvo – Construction (August 2017)

2018

- Substantial Completion (Nov 2018)

2019

- Construction contractor performing 1 year of Maintenance
- Major CD modification
- Upsized underflow design

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Balancing ecology, engineering and aesthetics.