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Using Stream Restoration to Enhance a CSO Control Project

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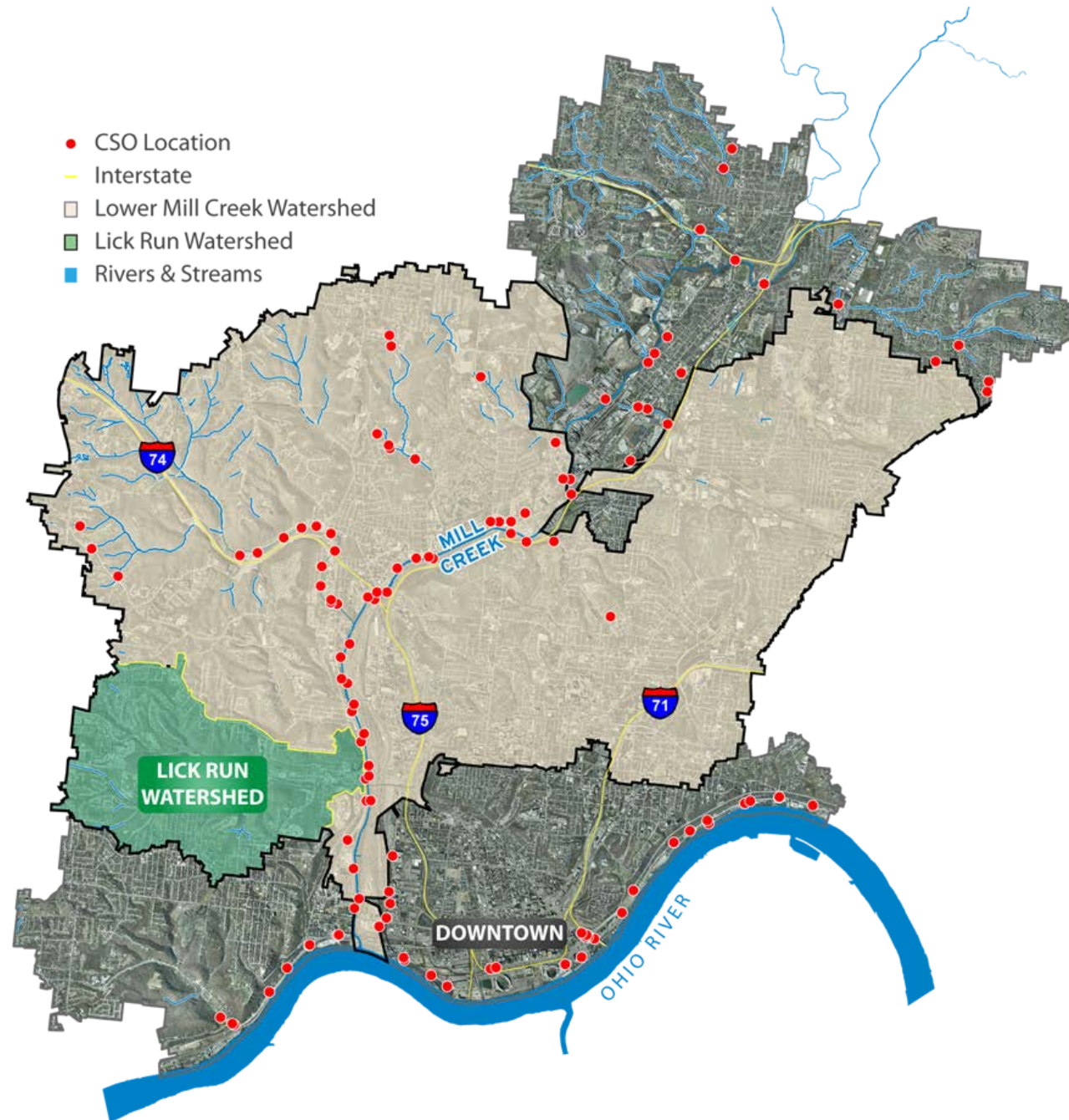
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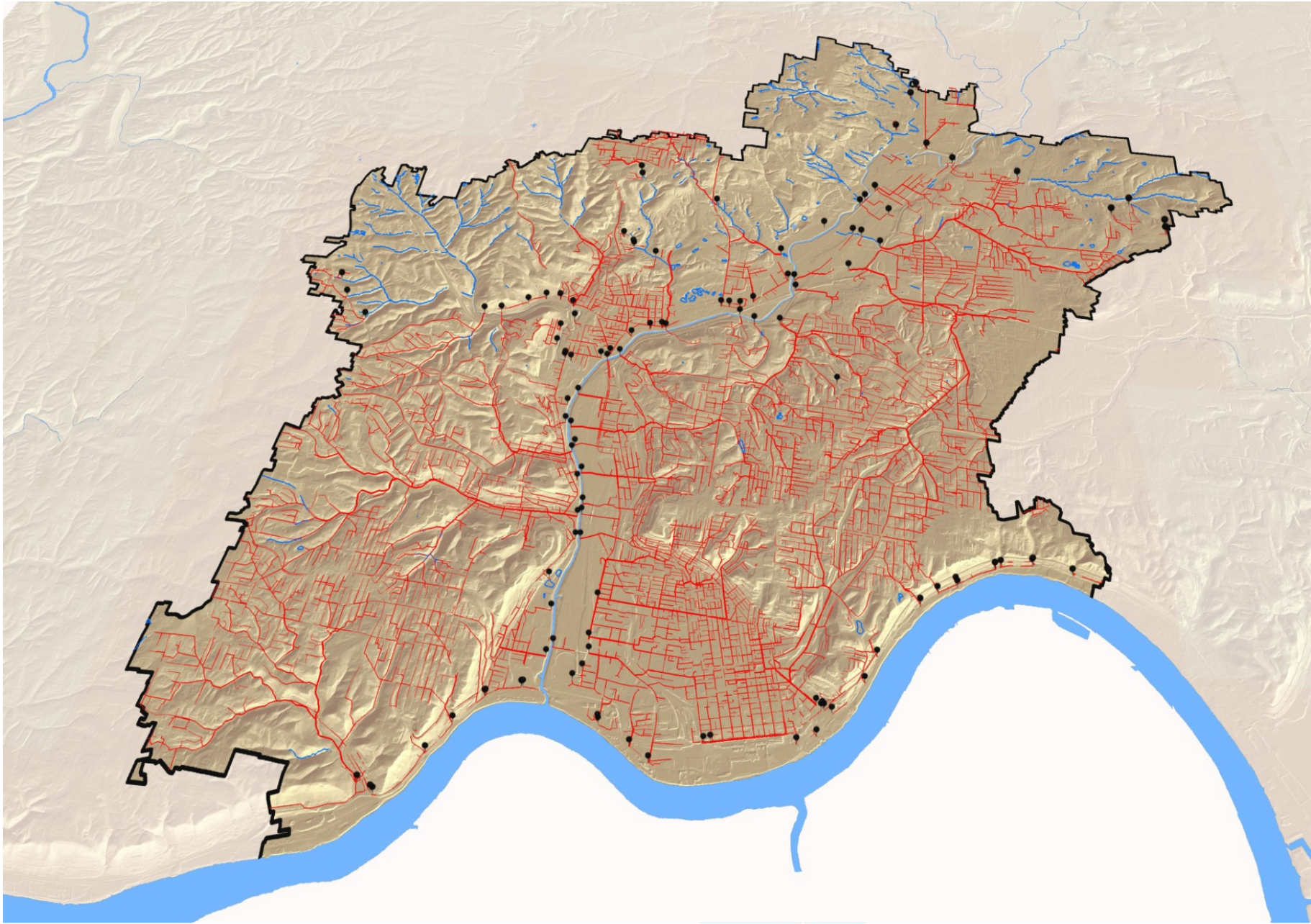
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Lick Run Watershed

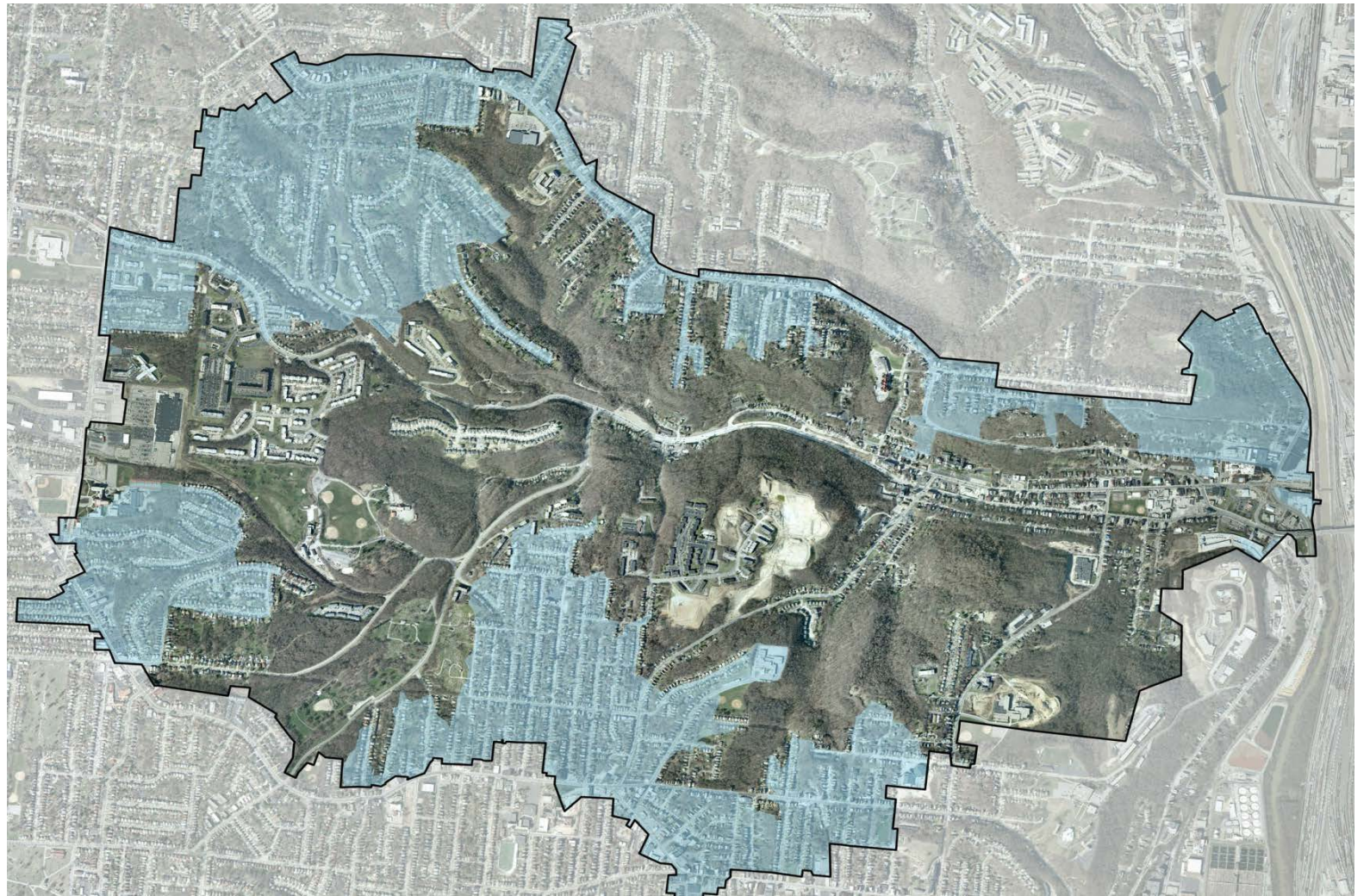
CSO #5, in the Lick Run Watershed, is MSDGC's largest CSO within the system.



History of Lick Run Watershed



Strategic Separation



Watershed Wide Strategy

1 Harrison Avenue Phase A

Completed in Fall 2013. New storm sewers along Harrison Avenue. Coordinated with Cincinnati Department of Transportation & Engineering (CDOTE) road work. A curb-side bumpout planter at Tremont Street was installed in Spring 2014.

2 Rapid Run Park

Completed in Fall 2014. First green project completed in Lick Run. Bioswale at Rapid Run Park and new storm sewers. MSD partnered with Cincinnati Park Board on this project.



3 Harrison Avenue Phase B

Completed in Spring 2015. New storm sewers along Harrison Avenue, Moellering Avenue and Beekman Street near the Western Hills Viaduct.

4 Queen City Avenue Phase 1

Completed in Spring 2015. New storm sewers along Queen City Avenue from the Bypass to Sunset Avenue and along Tillie/Champlain.

Early Success Projects

A San Antonio Church

Permeable pavers and four small bioinfiltration basins (rain gardens) were installed in 2011.



B St. Francis Court Apartments

Two unused parking lots were converted to bioinfiltration basins (rain gardens) in 2010.

C Immanuel United Church

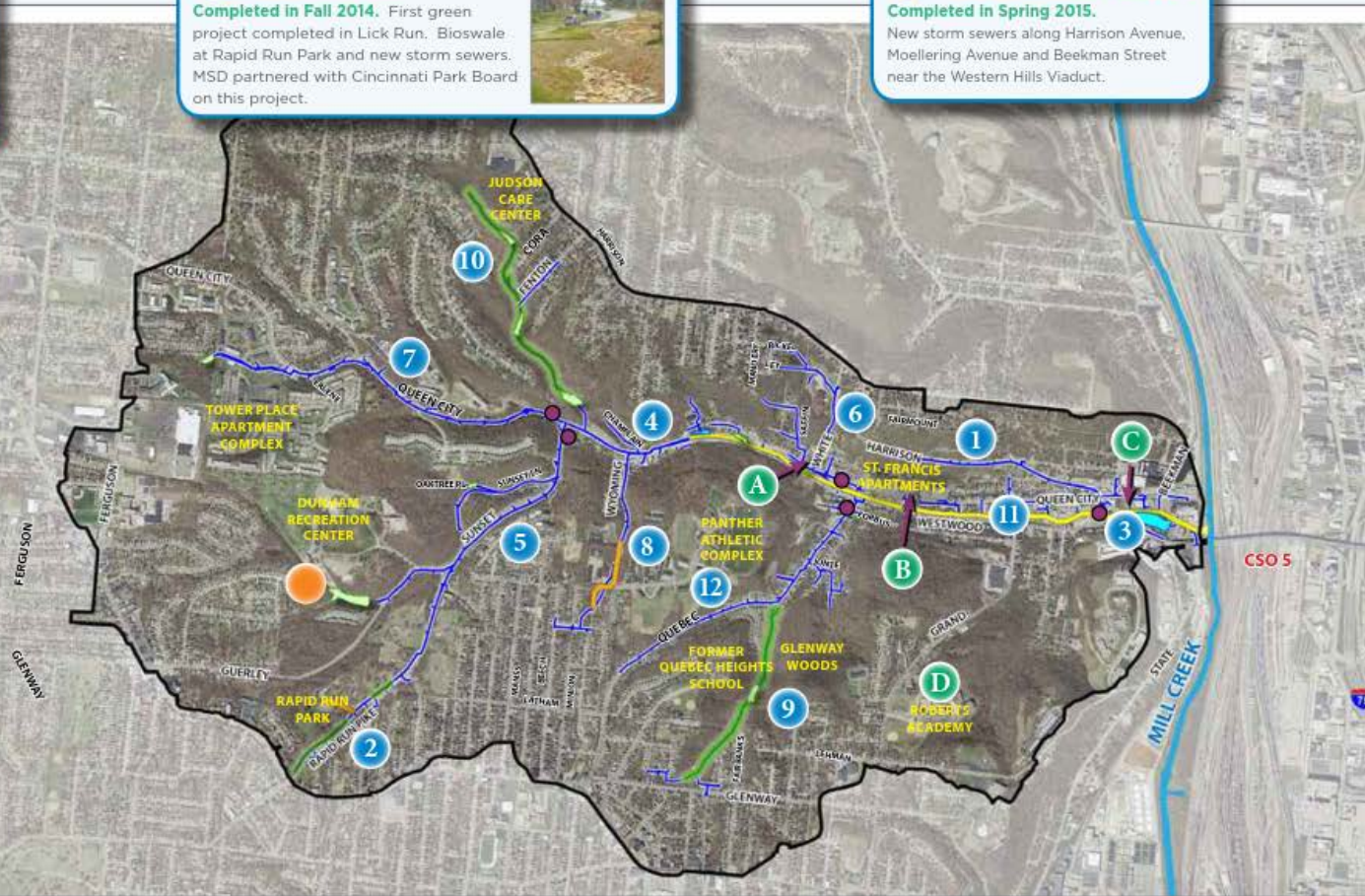
A bioinfiltration basin (rain garden) was installed in 2010.

D Roberts Academy

Retrofit of an existing stormwater detention basin and five new bioinfiltration basins installed in 2014.

Guerley Road Detention Dam

Completed in Summer 2014. Large stormwater detention dam off Guerley Road. This project will help reduce street flooding and CSOs.



5 Sunset Avenue

Under Construction. New storm sewers along Sunset Avenue/Rapid Run Pike, Sunset Lane and Guerley Road and a new stormwater detention basin. Construction: Fall 2015 - Spring 2017.

6 White Street

Under Construction. New storm sewers along White Street and multiple adjacent streets. Construction: Winter (Feb) 2016 - Spring 2017.

7 Queen City Avenue Phase 2

Starting this Fall. New storm sewers along Queen City Avenue from Sunset Avenue to the Tower Place apartment complex off East Tower Drive and retrofit of one existing stormwater detention basin. Anticipated construction: Fall 2016 - Winter (Dec) 2018 (substantially complete)..

12 Quebec Road

New storm sewers along Quebec Road and multiple adjacent streets. Anticipated construction: Summer 2017 - Summer 2018.

11 Lick Run Greenway

Stormwater conveyance system with an urban waterway and underground stormwater conveyance box. Anticipated construction: Fall 2016 - Winter (Dec) 2018 (substantially complete). *See back page for more details.*

10 Queen City and Cora Avenues

Starting this Fall. Restoration of a stream in a ravine behind the Judson Care Center that was enclosed in a combined sewer, retrofit of three existing stormwater detention basins and new storm sewer along Fenton Avenue and at bottom of ravine. Anticipated construction: Fall 2016 - Fall 2017.

9 Quebec Heights

Starting this Fall. Restoration of a stream in Glenway Woods that was enclosed in a combined sewer, retrofit of one existing stormwater detention basin and new storm sewer. Partnering with Cincinnati Parks. Anticipated construction: Fall 2016 - Fall 2017.

8 Wyoming & Minion Avenues

Starting this Fall. New storm sewers along Wyoming Avenue and multiple adjacent streets. Anticipated construction: Fall 2016 - Fall 2017.

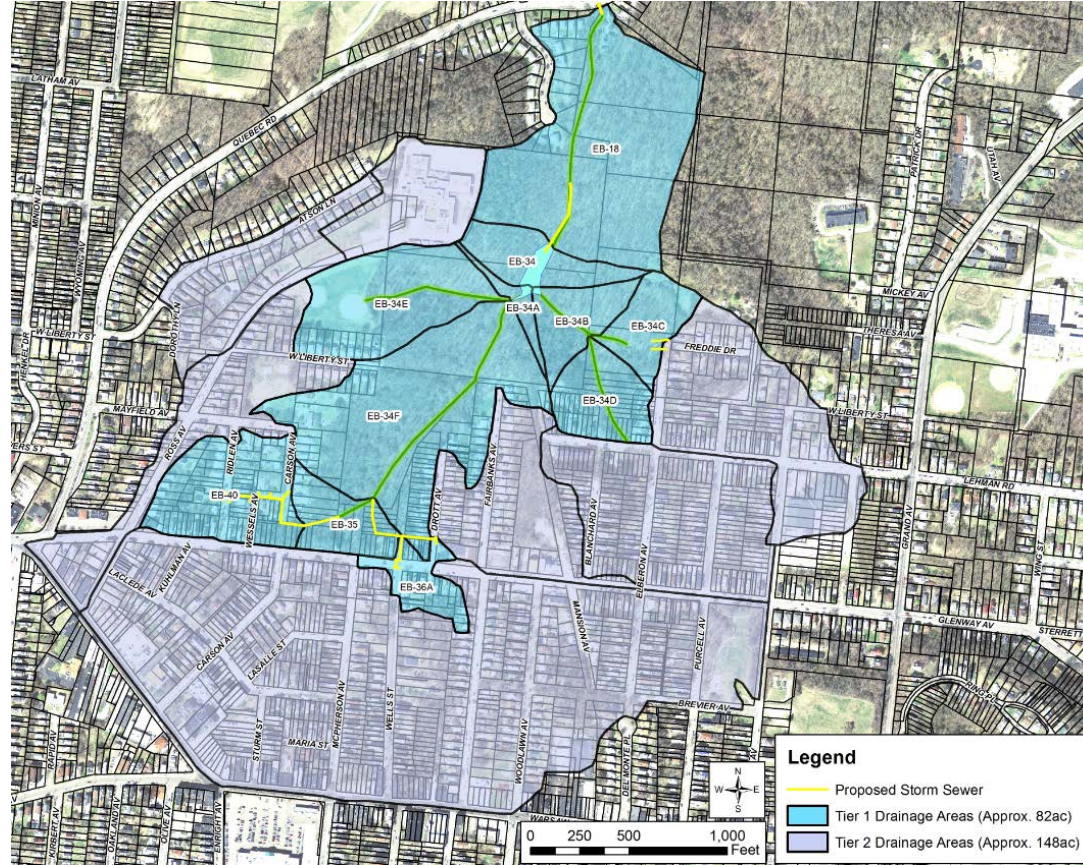
Quebec Heights Stream Restoration Site

- One of two strategic sewer separation projects utilizing a naturalized open channel within the Lick Run Watershed.



Project Background

- Combined sewer located in the channel area conveys flow from surrounding neighborhoods.
- Stormwater from the stream channel allowed to enter the combined sewer through various inter-connections.
- Existing erosion/hydromodification issues in the channel.



EXISTING INLET



CLOGGED EXISTING INLET



BANK EROSION AT MANHOLE

Quebec Heights Stream Restoration Concept Plan

- Open channel conveyance - stabilize and enhance 5,500 linear feet.
- Approx. 1,300 linear feet of separate storm sewer ranging from 12 inches to 15 inches.
- Capturing stormwater runoff from 82 acres - 49 million gallons of runoff volume per year.
- Remove this flow from the combined sewer, and reduce CSOs.



Concept Plan



STREAM CHANNEL TREATMENT ZONES:

- = MAINTAIN/ MONITOR
(no disturbance to channel, some repair/ maintenance of pipes or manholes)
- = AUGMENT
(keep existing form but stabilize)
- = STABILIZE
(try to keep existing form, heavy stabilization)
- = CONSTRUCT
(light/ moderate excavation / channel re-alignment)

see enlargement plans & cross-sections for more detailed study



LEGEND

- Existing Combined Sewer
- Existing Storm Sewer
- CPB Boundary
- Proposed Detention Feature
- Proposed Storm Sewer

METROPOLITAN SEWER DISTRICT OF GREATER CINCINNATI
LICK RUN WATERSHED
*** GLENWAY WOODS CONCEPT PLAN:
TREATMENT ZONES**

* THE CONCEPT PLAN DEPICTED HERE IS IN DRAFT FORM AND AWAITING FINALIZATION BASED ON POLICY DECISIONS FROM MSD.

Figure A-4
01/23/2012

Design Objective – Water Quality

- Improve water quality by passing runoff through a series of stormwater best management practices.
- Preserve and enhance habitat/ecology by designing around high quality trees.



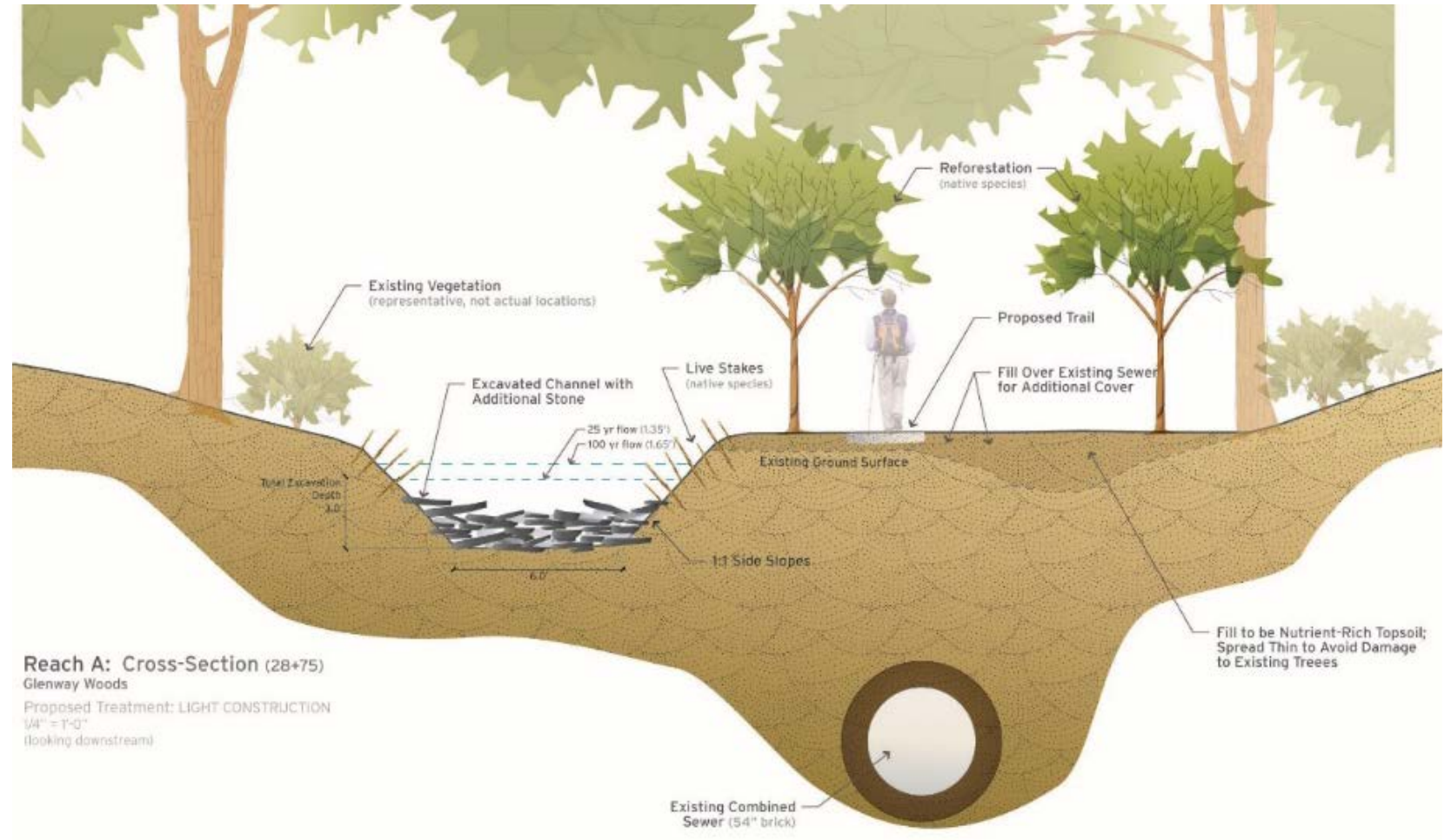
Design Objective – Water Quantity

- Use surface features to provide water quantity benefit
- Convey the 25-year event in the channel
- Safely pass the 100-year event in the valley

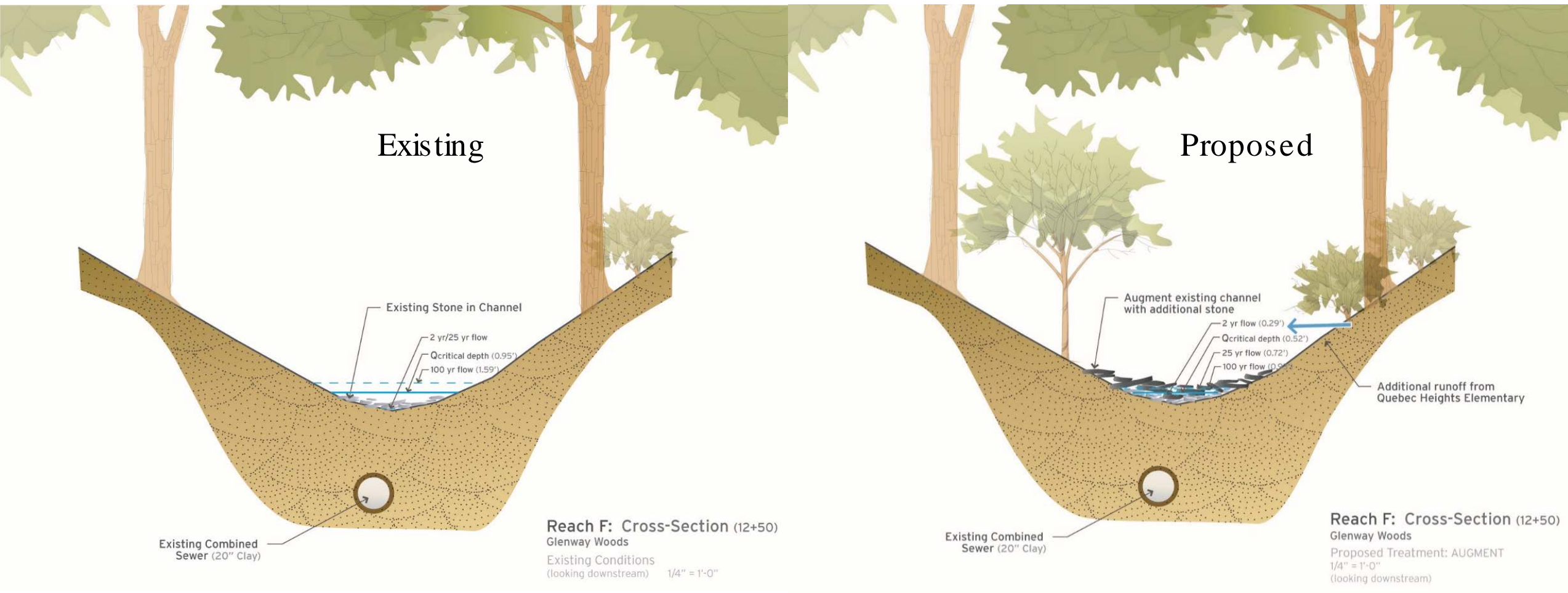


Quebec Heights Stream Restoration

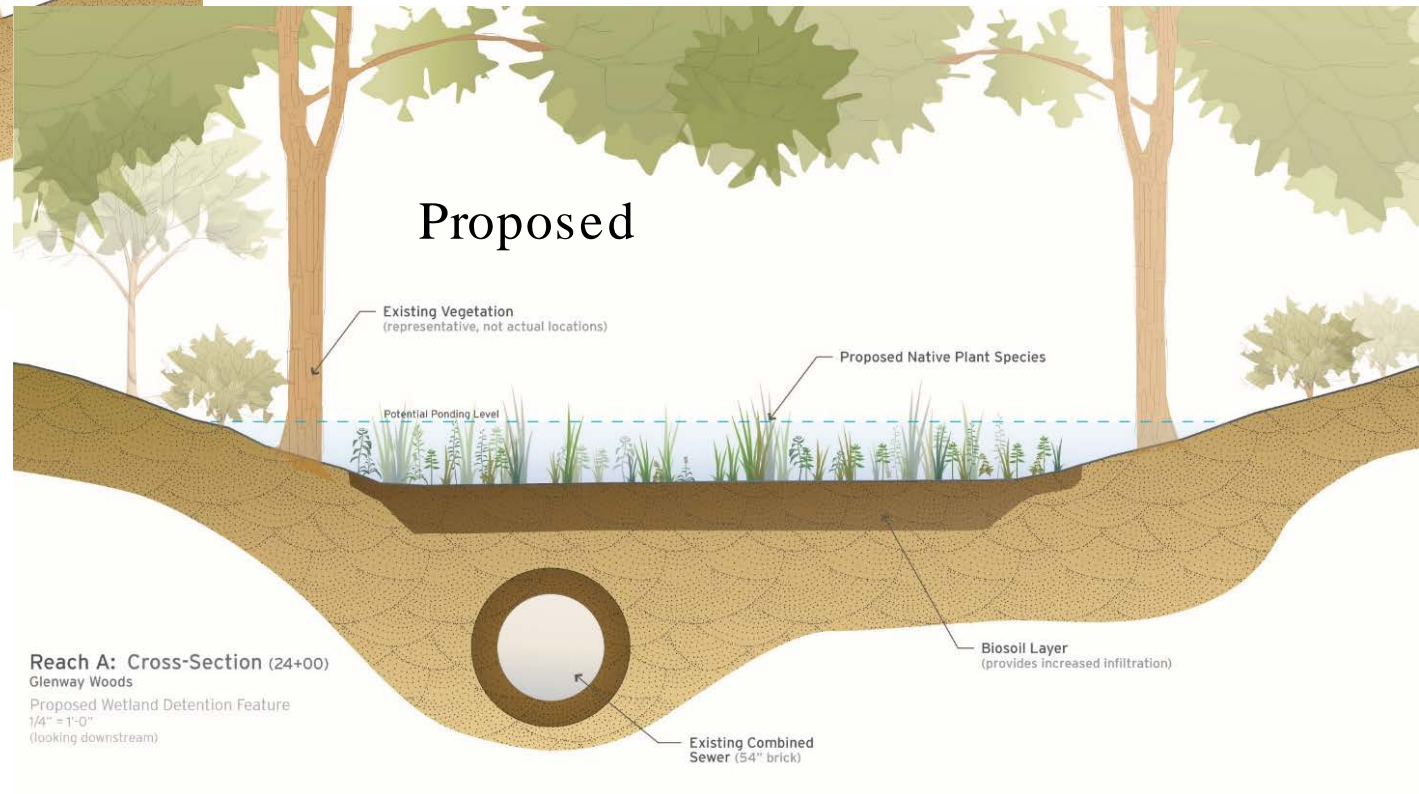
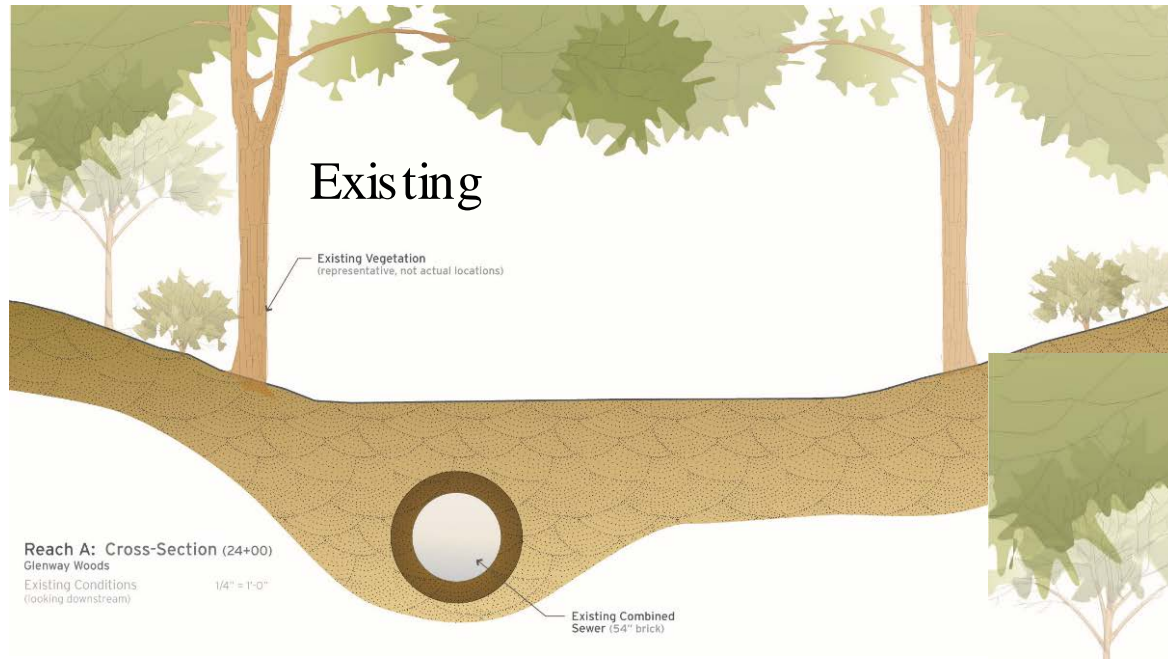
- Approx. 3,100 LF channel restoration with rock
- 3,500 tons Rip-Rap
- 5,300 tons Limestone Creek Rock



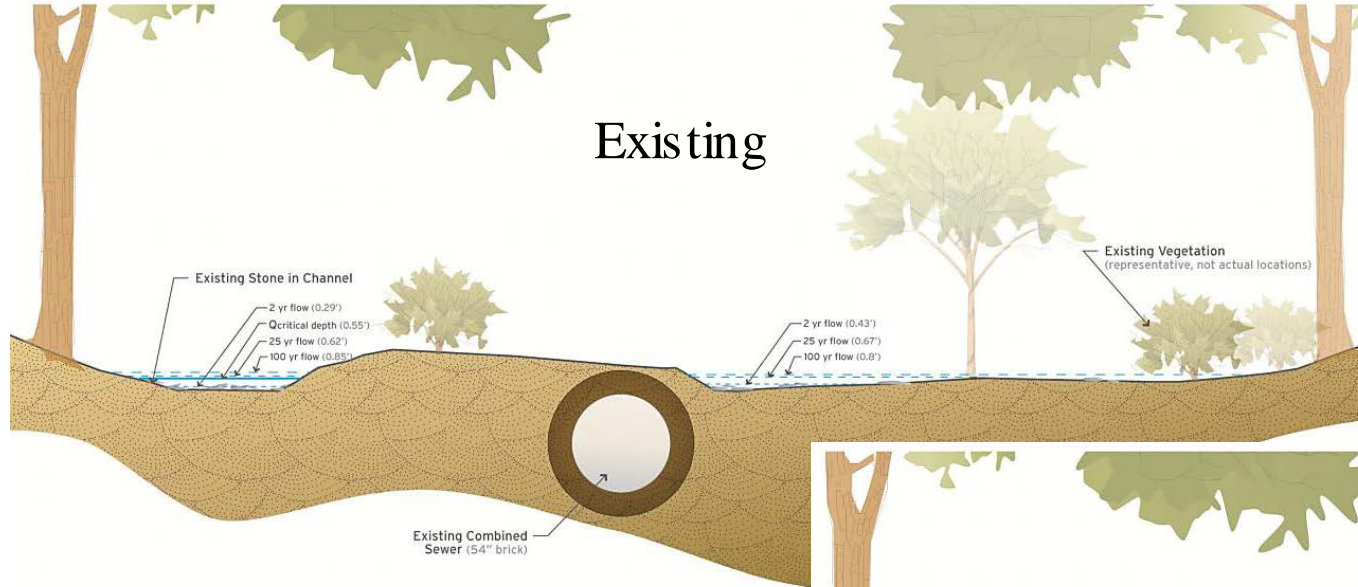
Reach A (12+50) – Upstream – Augment Channel



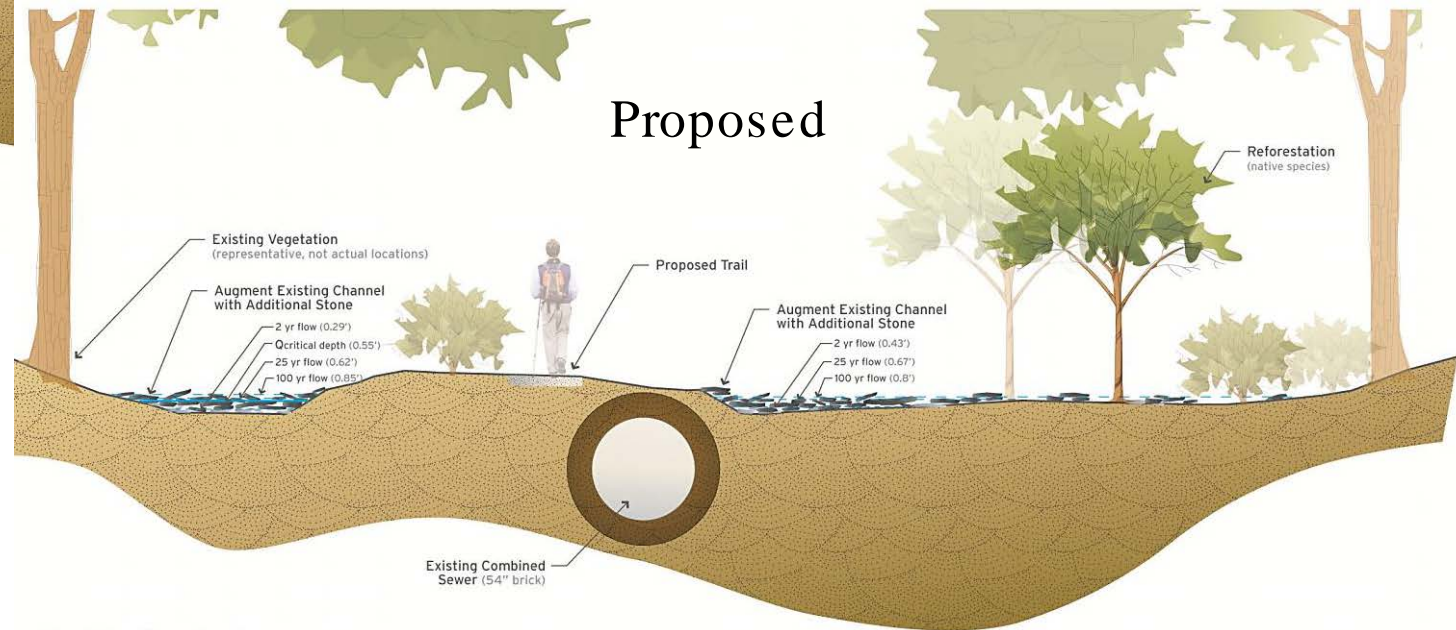
Reach A (24+00) – Detention Pond



Reach A (37+75) - Downstream



Reach A: Cross-Section (37+75)
Glenway Woods
Existing Conditions
(looking downstream)
1/4" = 1'-0"



Reach A: Cross-Section (37+75)
Glenway Woods
Proposed Treatment: STABILIZE
1/4" = 1'-0"
(looking downstream)

Flat and Wide Reaches



- Medium creek rock mixed with rip rap to create natural habitat, allow for gradual infiltration and promote the development of self-forming pools and riffles

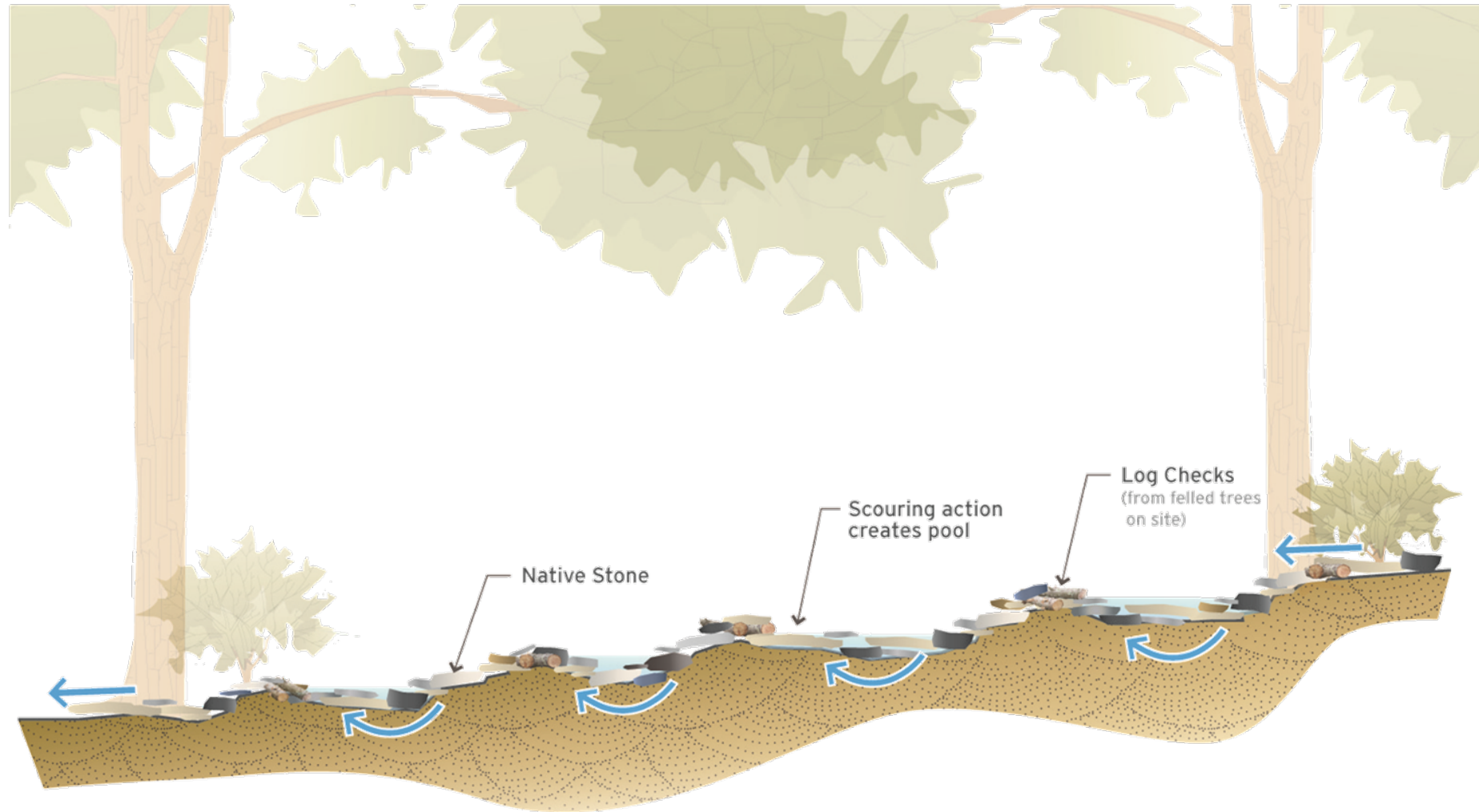
Steep and Narrow Reaches



- Ledge rock cascade to maintain stability and prevent erosion

Step Pools Concept

- Step pools provide energy dissipation and habitat in steeper reaches

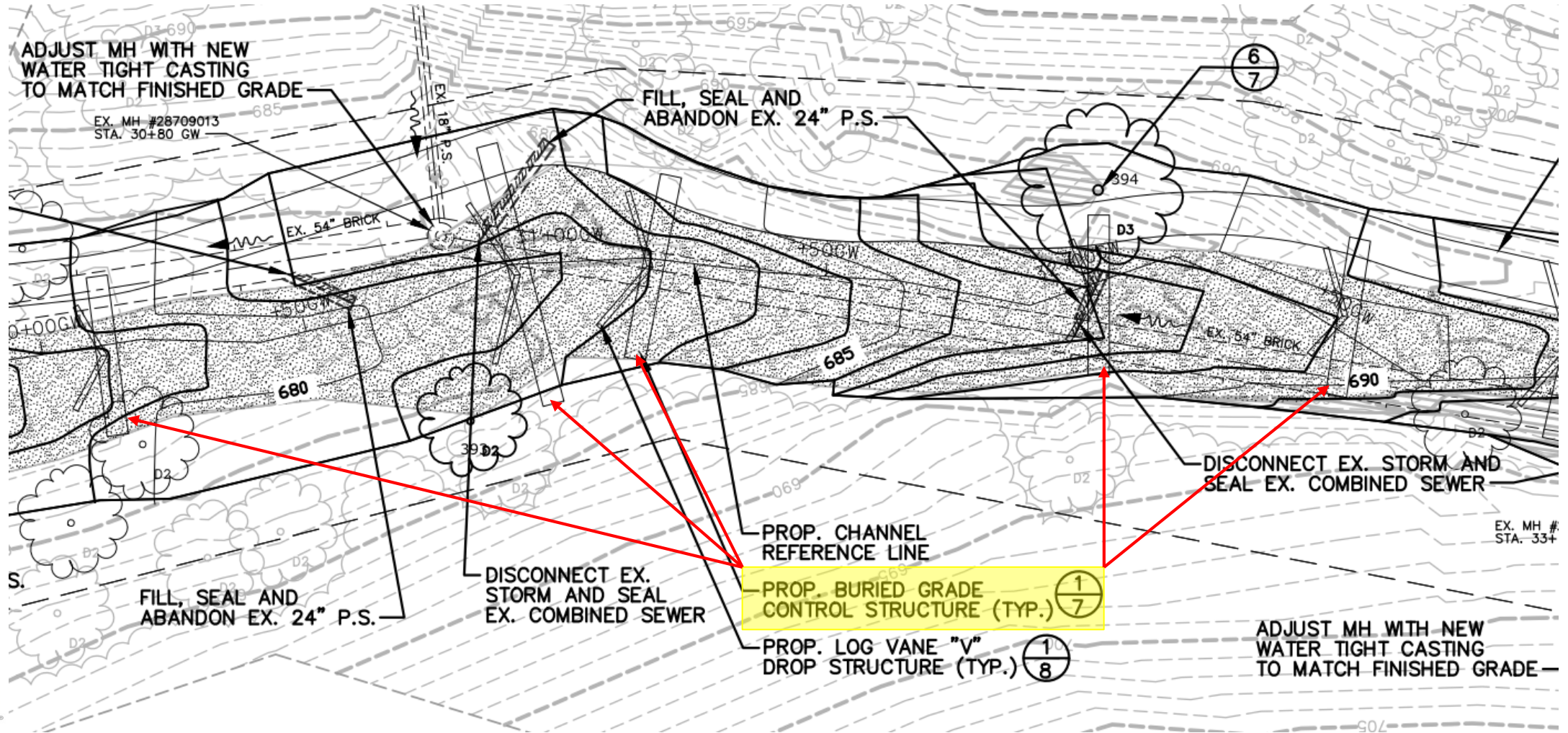


Step Pools



Grade Control Structures

- Buried Grade Control Structures located along channel
- At intervals corresponding to every 3-foot elevation drop with 1' overlap
- Provide additional support to prevent erosion



Wetland Detention

- Designed for the 10 and 25-year design storms



Wetland Detention



Detention Pond Forebay



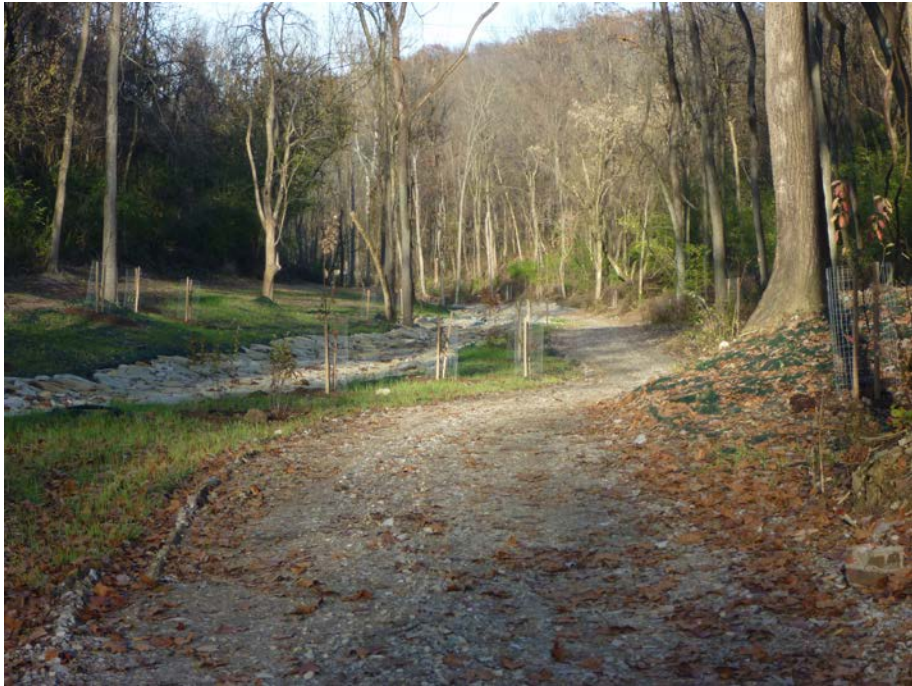
Detention Outlet
Control Structure



Detention Pond Spillway

Trees and Vegetation

- 229 trees planted along channel
- 8,229 SY Native Seeding
- 32,612 Native Plugs
- 177 Woody Shrubs



Native Plants and Habitat



Site Timber Reuse

- Log vanes and large woody debris installed for habitat, water quality, geomorphic and ecological benefits.
- 16 total log vanes installed.



Maintenance Path

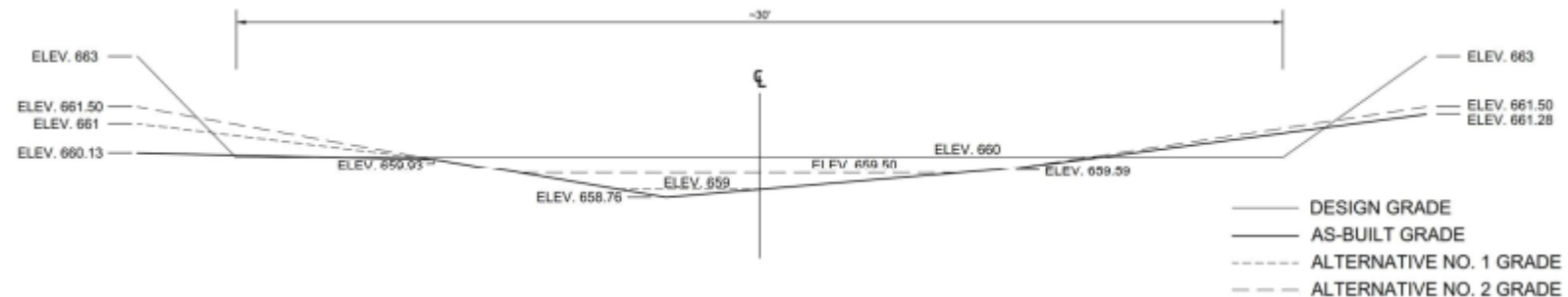
- Minimum 8-foot-wide path adjacent to channel
- Potential to be used as a multi-use path



Lessons Learned

- As constructed, the overflow spillway did not conform to the design to control the 10-year and 25-year design storms
- Two modification alternatives were presented to MSDGC to meet design intent with minimal additional work.
- MSDGC decided on modifying the spillway according to alternative #2

	Design	Alt #1	Alt #2
Top Elevation of Spillway (ft)	663.00	661.00	661.50
Spillway Elevation (ft)	660.00	659.00	659.50
10-Year WSE (ft)	658.76	658.97	658.97
25-Year WSE (ft)	659.36	659.52	659.58
10-Year Total Peak Discharge (cfs)	11.79	5.74	5.74
25-Year Total Peak Discharge (cfs)	50.98	56.47	51.84
10-Year Flow Through Spillway (cfs)	0.00	0.00	0.00
25-Year Flow Through Spillway (cfs)	0.00	9.43	0.60



Lessons Learned

- Detention basin outlet structure clogged with debris.
- Recommendations:
 - Remove trash grate and restrictor plate
 - Install perforated 4" PVC pipe and cleanout
 - Cover pipe with stone to filter out large debris



Construction Cost

- Final Construction Cost: \$3.14 million
- Significant Construction Elements
 - Channel Restoration: \$1.3 million
 - Storm Sewers: \$565,000
 - Ledge Rock Retaining Wall: \$42,000
 - Log Vanes and Grade Control: \$147,000
 - Trees, Vegetation, Erosion Mat: \$375,000
 - Adjust Combined Sewer Castings: \$40,000

Quebec Heights By The Numbers

- 5,500 Total Feet of Channel
- 3,200 Feet of Channel Restoration
- 1,300 Feet of Storm Sewer
- 16 Log Vane Structures
- 16 Buried Grade Control
- 825 LF of Step Pools
- 11,500 SY Erosion Control Mat
- 8,229 SY Native Seeding
- 32,612 Native Plugs
- 177 Woody Shrubs
- 229 Trees 1.5" Caliper



Project Summary

- Benefits of using natural open channel conveyance for combined sewer separation
 - Minimize disturbance to the natural areas
 - Convey the 100-year flow
 - Provide flood control benefits with in-line pond
 - Stabilize eroding channel
 - Eliminate cross-connections with sewers
 - Provide natural habitat – additional vegetation
 - Provide water quality and quantity benefits through BMPs

