Northeast Ohio
Regional Sewer District

Lower Shaker Lake Project

EXPLORING OUR LOWER SHAKER LAKE DAM RECOMMENDATION PAST & PRESENT

Northeast Ohio
Regional Sewer District

Glad you’re here.

JENN ELTING, APR

SENIOR MANAGER OF COMMUNITY & MEDIA RELATIONS

NORTHEAST OHIO REGIONAL SEWER DISTRICT

ELTINGJ@NEORSD.ORG

Housekeeping

- Open Houses for additional discussion:
  - Wednesday, August 20, 11A-1P and 5P-7P
  - Cleveland Heights Public Library (Lee Rd.)

neorsd.org/LowerLake

Zoom Q&A

askus@neorsd.org

Kyle Dreyfuss-Wells

CHIEF EXECUTIVE OFFICER, NORTHEAST OHIO REGIONAL SEWER DISTRICT

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Regional Sewer District

Agenda

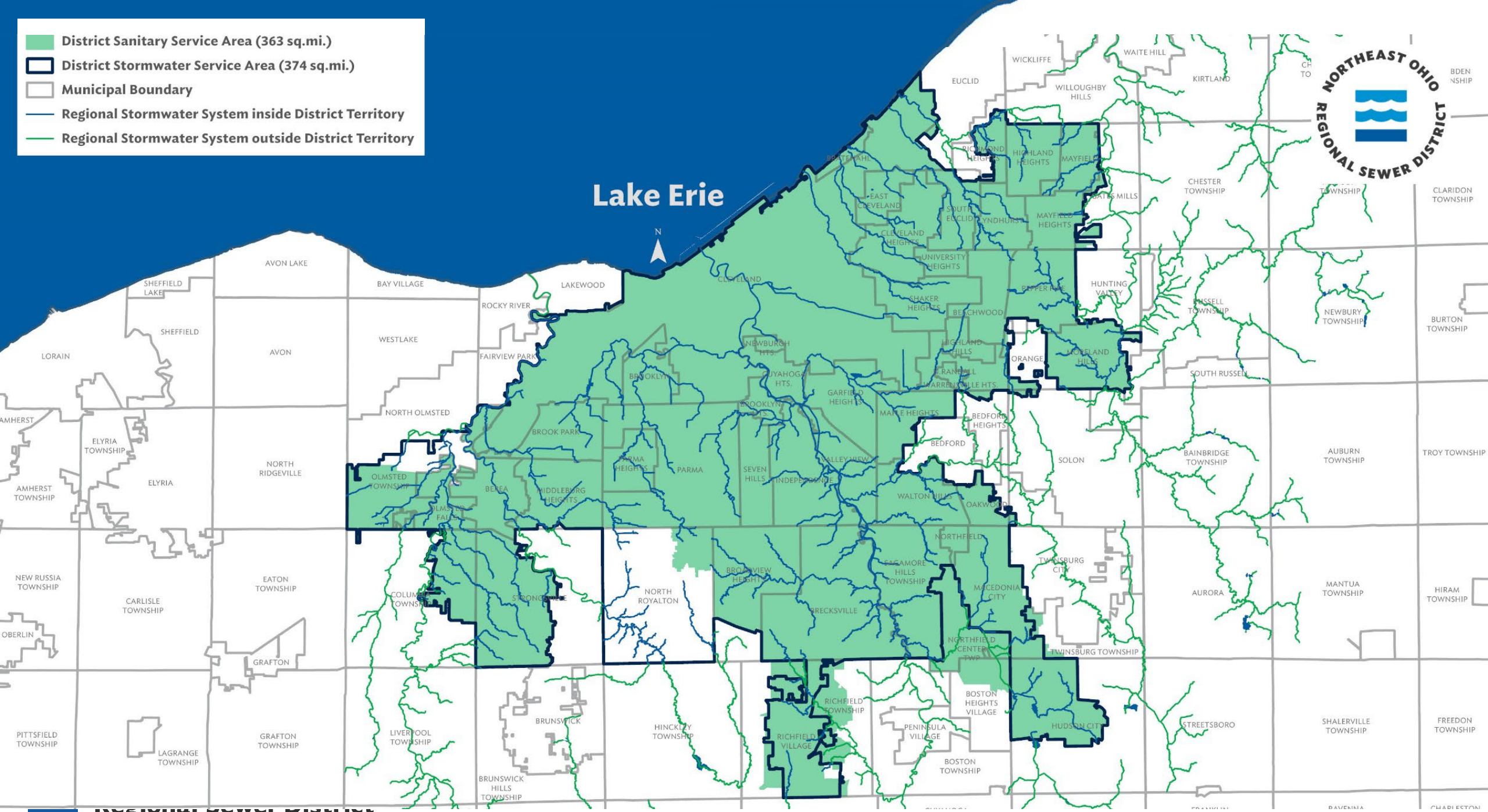
- NEORSD's work in the region
- Understanding our Regional Stormwater Management Program
- Lower Shaker Lake in context
  - Doan Brook Watershed
  - Update on Doan Brook Restoration at Horseshoe Park

Agenda (cont.)

- Lower Shaker Lake updates
  - 2021 Stormwater Masterplan recommendations
  - Updated information and analysis
  - 2025 revised recommendation for Lower Lake Dam
  - Costs and next steps

NEORSD: At a glance

- **Services:** Sanitary and stormwater management to the City of Cleveland and 62 municipalities across 4 counties
- **Governance:** Independent political subdivision of the State of Ohio governed by a 7-member Board of Trustees


District Sanitary Service Area (363 sq.mi.)
District Stormwater Service Area (374 sq.mi.)
Municipal Boundary
Regional Stormwater System inside District Territory
Regional Stormwater System outside District Territory
Lake Erie
N
NORTHEAST OHIO REGIONAL SEWER DISTRICT
WICKLIFFE
WAITE HILL
EUCLID
WILLOUGHBY HILLS
KIRTLAND
RICHMOND HEIGHTS
HIGHLAND HEIGHTS
MAYFIELD
EAST CLEVELAND
SOUTH EUCLID
LYNDHURST
MAYFIELD HEIGHTS
CLEVELAND HEIGHTS
UNIVERSITY HEIGHTS
GATES MILLS
CHESTER TOWNSHIP
CLARIDON TOWNSHIP
AVON LAKE
SHEFFIELD LAKE
BAY VILLAGE
LAKEWOOD
ROCKY RIVER
CLEVELAND
SHAKER HEIGHTS
BEECHWOOD
PEPPER PIKE
HUNTING VALLEY
RUSSELL TOWNSHIP
NEWBURY TOWNSHIP
BURTON TOWNSHIP
SHEFFIELD
LORAIN
AVON
WESTLAKE
FAIRVIEW PARK
NEWBURGH HTS.
BROOKLYN
CUYAHOGA HTS.
GARFIELD HEIGHTS
RANDALL
WARRENSVILLE HTS.
HIGHLAND HILLS
ORANGE
MORELAND HILLS
SOUTH RUSSELL
NORTH OLMSTED
BROOKLYN
MAPLE HEIGHTS
BEDFORD HEIGHTS
BROOK PARK
BEDFORD
AMHERST
ELYRIA TOWNSHIP
ELYRIA
NORTH RIDGEVILLE
OLMSTED TOWNSHIP
BEREA
MIDDLEBURG HEIGHTS
PARMA HEIGHTS
PARMA
SEVEN HILLS
INDEPENDENCE
VALLEY VIEW
SOLON
BAINBRIDGE TOWNSHIP
AUBURN TOWNSHIP
TROY TOWNSHIP
AMHERST TOWNSHIP
OLMSTED FALLS
WALTON HILLS
OAKWOOD
NORTHFIELD
NEW RUSSIA TOWNSHIP
EATON TOWNSHIP
CARLISLE TOWNSHIP
COLUMBIA TOWNSHIP
STRONGSVILLE
NORTH ROYALTON
BROADVIEW HEIGHTS
SYCAMORE HILLS TOWNSHIP
TWINSBURG CITY
AURORA
MANTUA TOWNSHIP
HIRAM TOWNSHIP
OBERLIN
BRECKSVILLE
MACEDONIA CITY
NORTHFIELD CENTER TWP.
TWINSBURG TOWNSHIP
GRAFTON
RICHFIELD TOWNSHIP
BOSTON HEIGHTS VILLAGE
PITTSFIELD TOWNSHIP
LAGRANGE TOWNSHIP
GRAFTON TOWNSHIP
LIVERPOOL TOWNSHIP
BRUNSWICK
HINCKLEY TOWNSHIP
RICHFIELD VILLAGE
PENINSULA VILLAGE
HUDSON CITY
STREETSBORO
SHALERVILLE TOWNSHIP
FREEDON TOWNSHIP
BOSTON TOWNSHIP
BRUNSWICK HILLS TOWNSHIP

Easterly Wastewater Treatment Plant

Wastewater treatment

- 3 plants
- 77 billion gallons in 2024
- Certified lab

Doan Valley Tunnel construction

Project Clean Lake

- $3 billion, 25 years
- Cut annual CSO volume by 4 billion gallons
- Sewer fees

Willey Creek, Moreland Hills

Addressing flooding, erosion

- $58 million budget 2024
- Regional approach
- Impervious surface fee

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WEATHER | ALERT
FLOODING TURNS MLK DR. INTO A RIVER

$1.4 billion

STORMWATER MANAGEMENT NEEDS ACROSS THE REGION

Matt Scharver

DIRECTOR OF WATERSHED PROGRAMS, NORTHEAST OHIO REGIONAL SEWER DISTRICT

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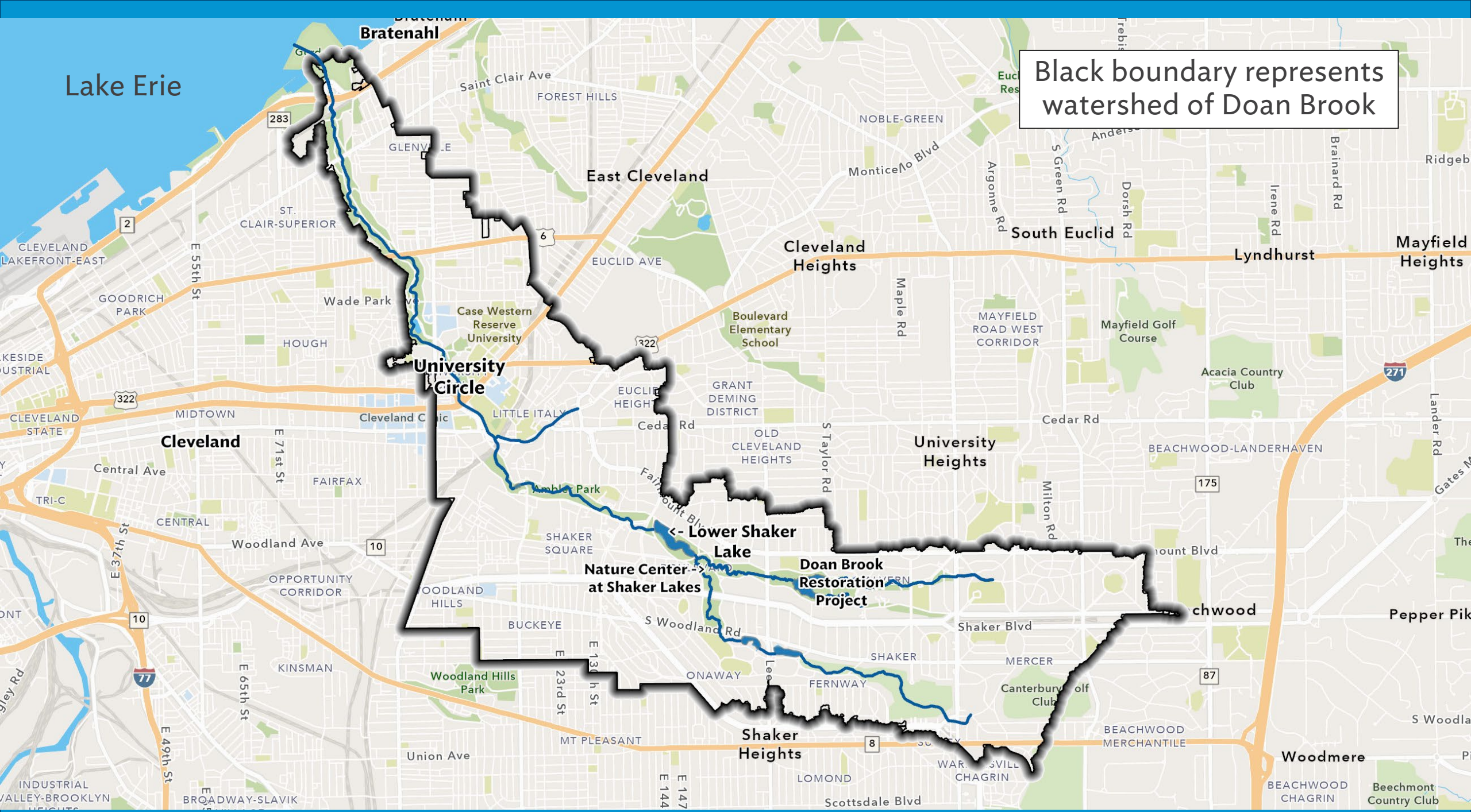
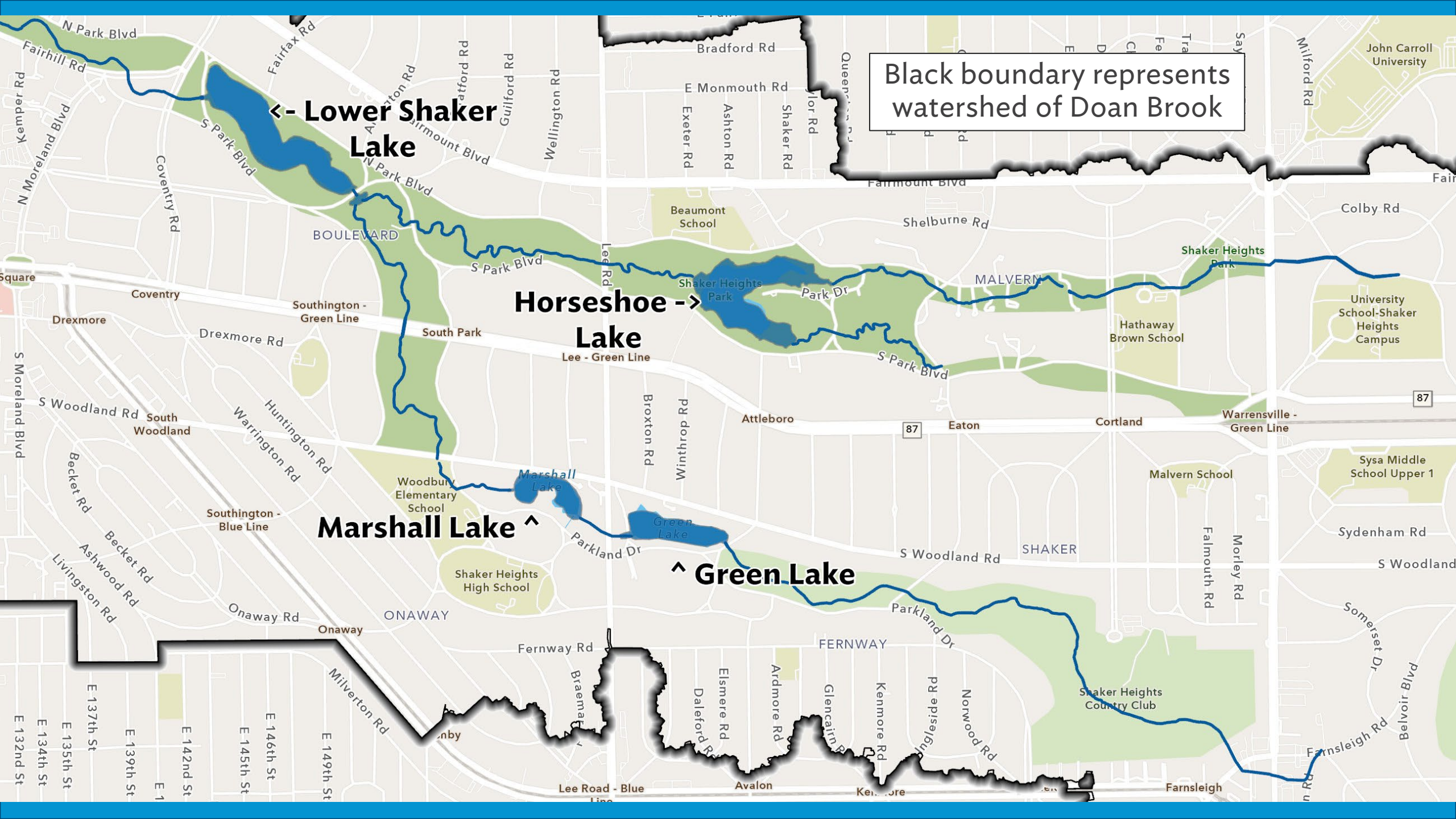
Lower Shaker Lake in context

- Doan Brook Watershed
- Update on Doan Brook Restoration at Horseshoe Park


Lake Erie
Black boundary represents watershed of Doan Brook
Bratenahl
Saint Clair Ave
FOREST HILLS
NOBLE-GREEN
East Cleveland
Monticello Blvd
Argonne Rd
S Green Rd
Dorsh Rd
Irene Rd
Brainard Rd
South Euclid
Lyndhurst
Mayfield Heights
Cleveland Heights
EUCLID AVE
ST. CLAIR-SUPERIOR
CLEVELAND LAKEFRONT-EAST
GOODRICH PARK
Wade Park
Case Western Reserve University
Boulevard Elementary School
Maple Rd
MAYFIELD ROAD WEST CORRIDOR
Mayfield Golf Course
Acacia Country Club
HOUGH
University Circle
EUCLID HEIGHTS
GRANT DEMING DISTRICT
LITTLE ITALY
Cedar Rd
OLD CLEVELAND HEIGHTS
S Taylor Rd
University Heights
BEACHWOOD-LANDERHAVEN
Lander Rd
MIDTOWN
CLEVELAND STATE
Cleveland
Central Ave
E 71st St
FAIRFAX
Ambler Park
Fairmount Blvd
Milton Rd
TRI-C
CENTRAL
Woodland Ave
E 37th St
SHAKER SQUARE
<- Lower Shaker Lake
Nature Center ->
at Shaker Lakes
Doan Brook Restoration Project
OPPORTUNITY CORRIDOR
WOODLAND HILLS
BUCKEYE
S Woodland Rd
Shaker Blvd
Pepper Pike
KINSMAN
Woodland Hills Park
E 65th St
E 23rd St
E 131st St
ONAWAY
SHAKER
MERCER
FERNWAY
Canterbury Golf Club
E 49th St
MT PLEASANT
Shaker Heights
BEACHWOOD MERCHANTILE
Woodmere
Union Ave
LOMOND
CHAGRIN
BEACHWOOD
Beechmont Country Club
INDUSTRIAL VALLEY-BROOKLYN
BROADWAY-SLAVIK
Scottsdale Blvd
283
2
6
322
271
175
10
77
87
8


Black boundary represents watershed of Doan Brook
<- Lower Shaker Lake
Horseshoe -> Lake
Marshall Lake ^
^ Green Lake
N Park Blvd
Fairhill Rd
Fairfax Rd
S Park Blvd
Coventry Rd
N Moreland Blvd
Kemper Rd
Fairmount Blvd
Guilford Rd
Wellington Rd
Bradford Rd
E Monmouth Rd
Exeter Rd
Ashton Rd
Shaker Rd
Queenston Rd
Milford Rd
John Carroll University
BOULEVARD
Beaumont School
Shelburne Rd
Colby Rd
Lee Rd
Shaker Heights Park
Park Dr
MALVERN
Shaker Heights Park
Hathaway Brown School
University School-Shaker Heights Campus
Square
Coventry
Drexmore
Drexmore Rd
Southington - Green Line
South Park
Lee - Green Line
S Park Blvd
S Moreland Blvd
S Woodland Rd
South Woodland
Warrington Rd
Huntington Rd
Broxton Rd
Winthrop Rd
Attleboro
87
Eaton
Cortland
Warrensville - Green Line
Becket Rd
Ashwood Rd
Livingston Rd
Woodbury Elementary School
Marshall Lake
Green Lake
Parkland Dr
Malvern School
Sysa Middle School Upper 1
Falmouth Rd
Morley Rd
Sydenham Rd
S Woodland
Southington - Blue Line
Shaker Heights High School
SHAKER
Onaway Rd
Onaway
ONAWAY
Fernway Rd
FERNWAY
Parkland Dr
Shaker Heights Country Club
Somerset Dr
Belvoir Blvd
Farnsleigh Rd
Milverton Rd
Braemar Rd
Daleford Rd
Elsmere Rd
Ardmore Rd
Glencairn Rd
Kenmore Rd
Englesider Rd
Norwood Rd
Lee Road - Blue Line
Avalon
Farnsleigh
E 132nd St
E 134th St
E 135th St
E 137th St
E 139th St
E 142nd St
E 145th St
E 146th St
E 149th St

Doan Brook Restoration at Horseshoe Park

- 100% design plans submitted, moving through approvals
- Construction to start in early 2026
- Project includes plantings, trails, nature play area, sensory garden, outdoor classroom, overlooks
- Estimated Construction Costs:
  - NEORSD: $23,964,782
  - Cities: $7,198,110

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DOAN BROOK RESTORATION AT HORSESHOE PARK

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DOAN BROOK RESTORATION AT HORSESHOE PARK
90 PERCENT DESIGN, CONCEPTUAL RENDERING

Lower Shaker Lake findings from Stormwater Master Planning to today.

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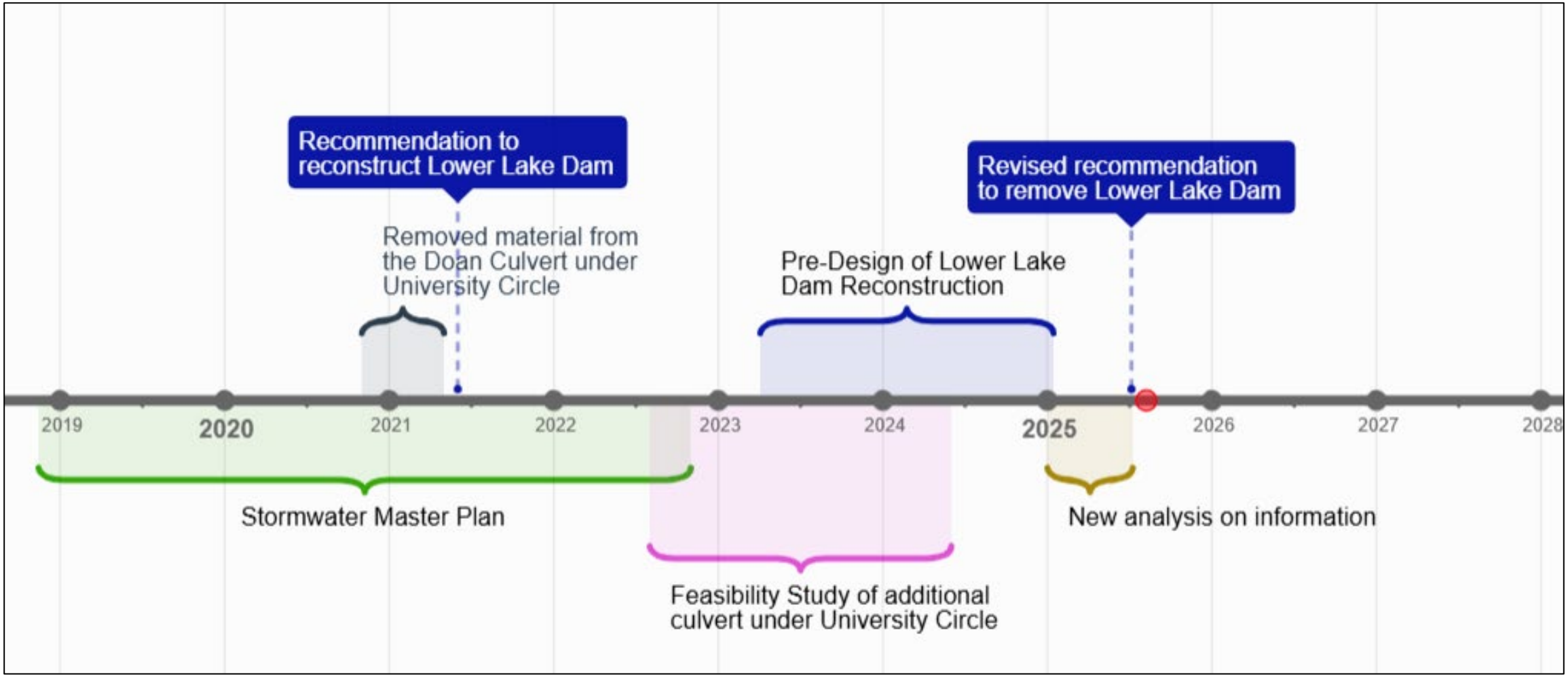
Lower Shaker Lake Timeline

- 2021 Stormwater Masterplan findings
- 2023 Dam Reconstruction Pre-Design
- Updated information and analysis
  - Additional Culvert in University Circle Study
  - Model updates
- 2025 revised recommendation for Lower Lake Dam
  - Costs and next steps

Lower Shaker Lake Timeline



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Stormwater Master Plan Findings: Doan Brook Watershed Concerns

- Lower Shaker Lake Class I High Hazard dam is out of compliance
- Flooding at Lower Shaker Lake and in University Circle

Lower Lake Class I High Hazard Dam: Roles and Responsibilities*

- **Ohio Department of Natural Resources (ODNR):**
  Assess, enforce State of Ohio dam compliance

*PREVIOUSLY PRESENTED

Lower Lake Class I High Hazard Dam: Roles and Responsibilities*

- **Ohio Department of Natural Resources (ODNR):** Assess, enforce State of Ohio dam compliance
- **Shaker Heights and Cleveland Heights:** Dam operators; responsible to comply with ODNR standards

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- **Shaker Heights and Cleveland Heights:** Dam operators; responsible to comply with ODNR standards
- **City of Cleveland:** Property owner; long-term lease to Cities of Shaker Heights and Cleveland Heights
- **NEORSD:** Regional Stormwater Management Program

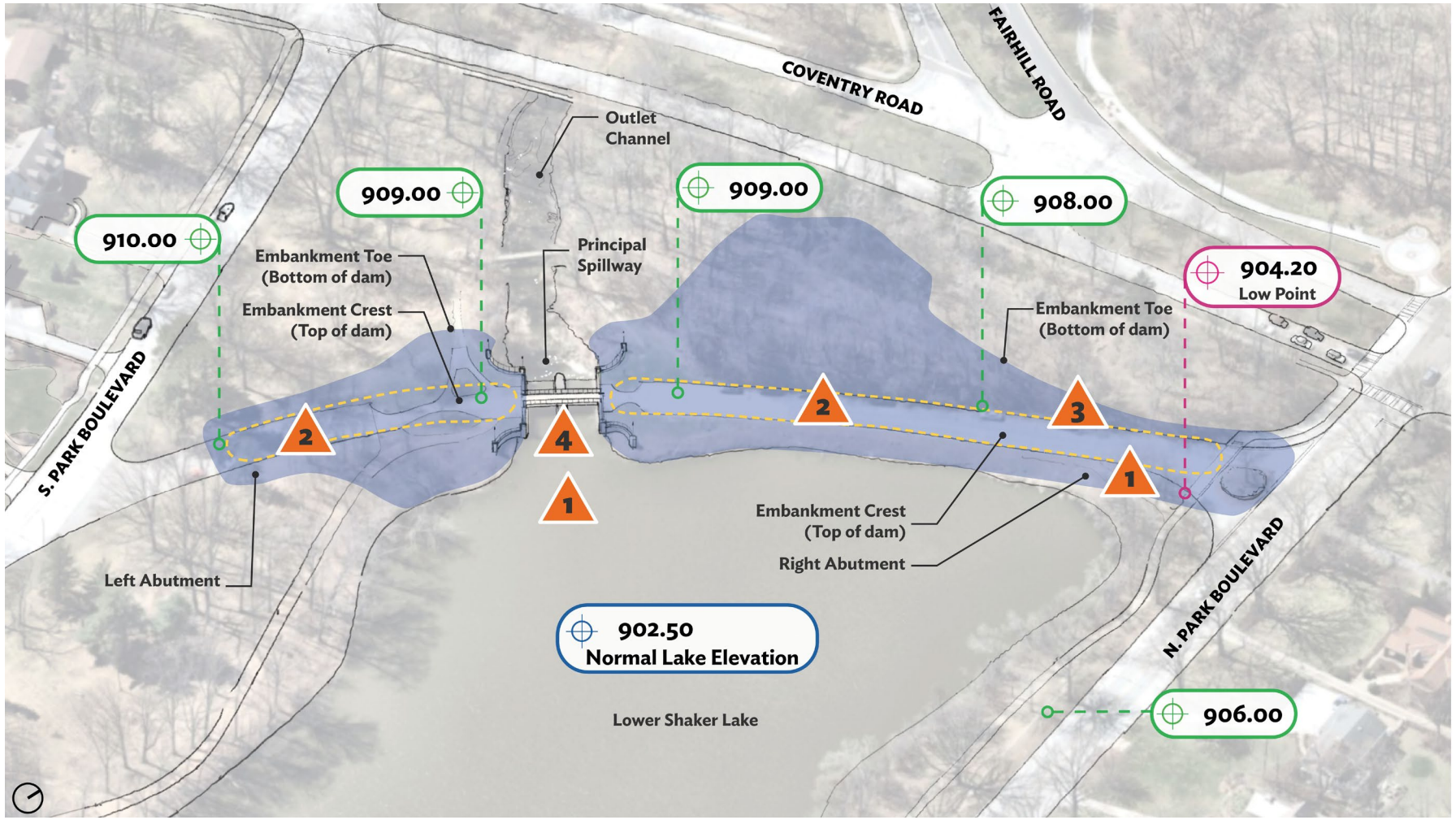
*PREVIOUSLY PRESENTED

Lower Lake Class I High Hazard Dam

Status: Non-compliance with State Regulations, ODNR Class I High Hazard Dam

- Not built to modern engineering standards
- Failure would result in probable loss of life and property damage
- Cannot pass Probable Maximum Flood
- Must reconstruct or remove, per ODNR

Lower Lake Class I High Hazard Dam Safety Deficiencies*



Dam Safety Deficiencies

1. Inadequate Spillway Capacity
2. Inadequate Embankment Protection & Uneven Crest Elevation
3. Inadequate Embankment Stability/Seepage
4. Inadequate Masonry Spillway Stability

Embankment Limits

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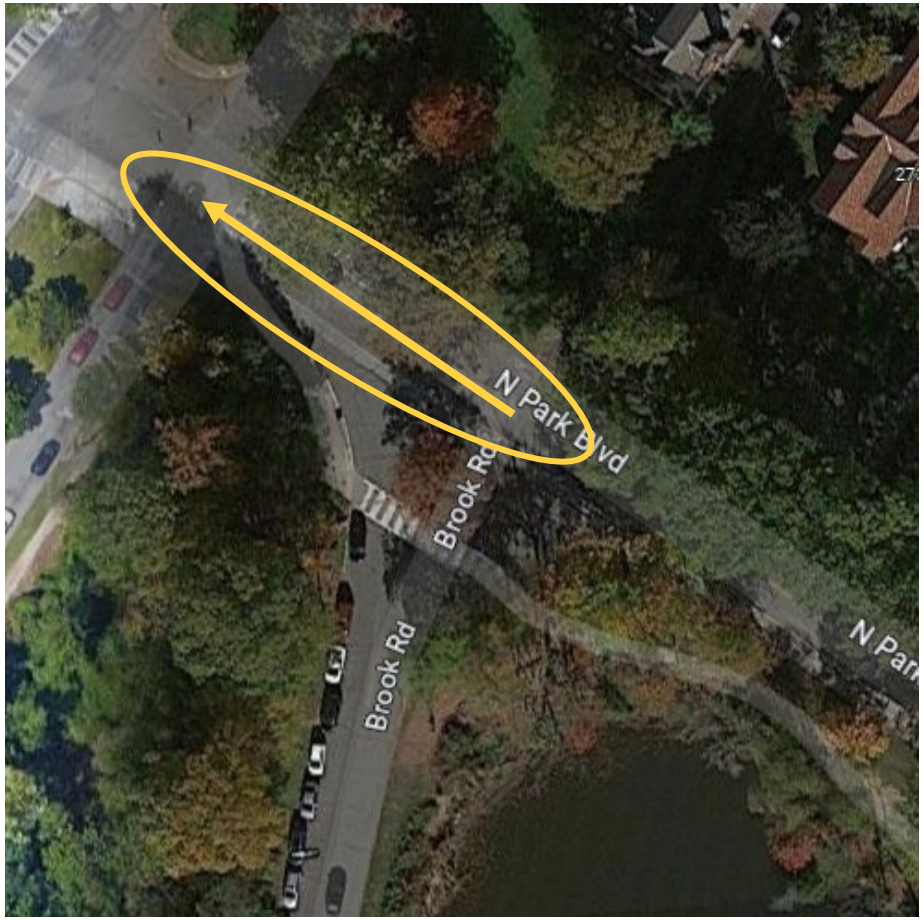
*PREVIOUSLY PRESENTED

Stormwater Master Plan Findings: Doan Brook Watershed Concerns

- Lower Shaker Lake Class I High Hazard dam is out of compliance
- Flooding at Lower Shaker Lake and in University Circle

Flooding at Lower Lake, North Park Overtops July 17, 2021*



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*PREVIOUSLY PRESENTED

S1: Existing, current conditions without Horseshoe Dam
1-yr inundation (1.9” 24-hrs)

2-Dimensional Mesh Stormwater Modeling

Uses a grid-like structure to simulate how stormwater flows across a surface, accounting for two-dimensional flow patterns

S1: Existing, current conditions without Horseshoe Dam
2-yr inundation (2.3” 24-hrs)

2-Dimensional Mesh Stormwater Modeling

Uses a grid-like structure to simulate how stormwater flows across a surface, accounting for two-dimensional flow patterns

S1: Existing, current conditions without Horseshoe Dam
5-yr inundation (2.9” 24-hrs.)

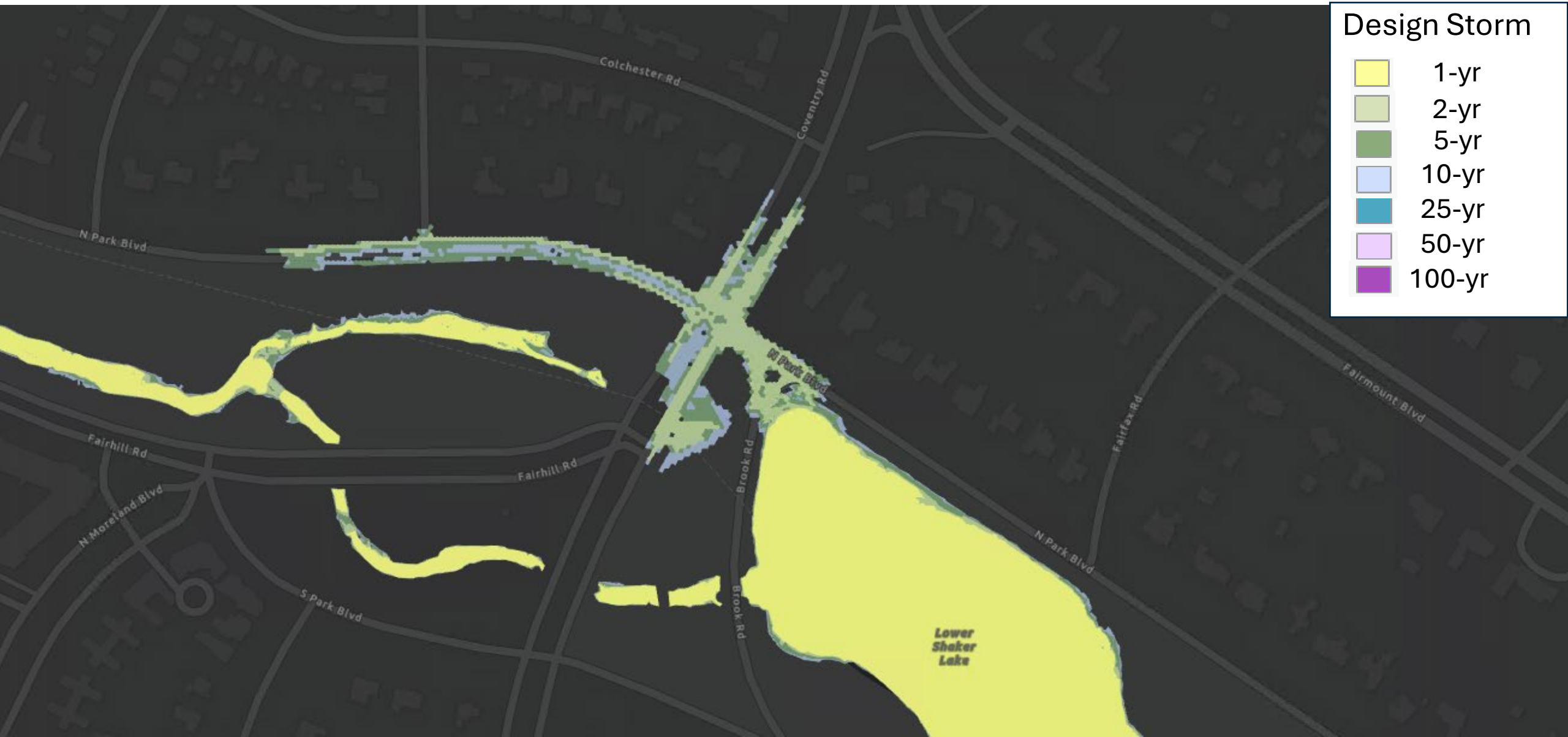
2-Dimensional Mesh Stormwater Modeling

Uses a grid-like structure to simulate how stormwater flows across a surface, accounting for two-dimensional flow patterns

S1: Existing, current conditions without Horseshoe Dam
10-yr inundation (3.4” 24-hrs.)

2-Dimensional Mesh Stormwater Modeling

Uses a grid-like structure to simulate how stormwater flows across a surface, accounting for two-dimensional flow patterns



S1: Existing, current conditions without Horseshoe Dam
25-yr inundation (4.1” 24-hrs.)

2-Dimensional Mesh Stormwater Modeling

Uses a grid-like structure to simulate how stormwater flows across a surface, accounting for two-dimensional flow patterns

S1: Existing, current conditions without Horseshoe Dam
50-yr inundation (4.7” 24-hrs.)

2-Dimensional Mesh Stormwater Modeling

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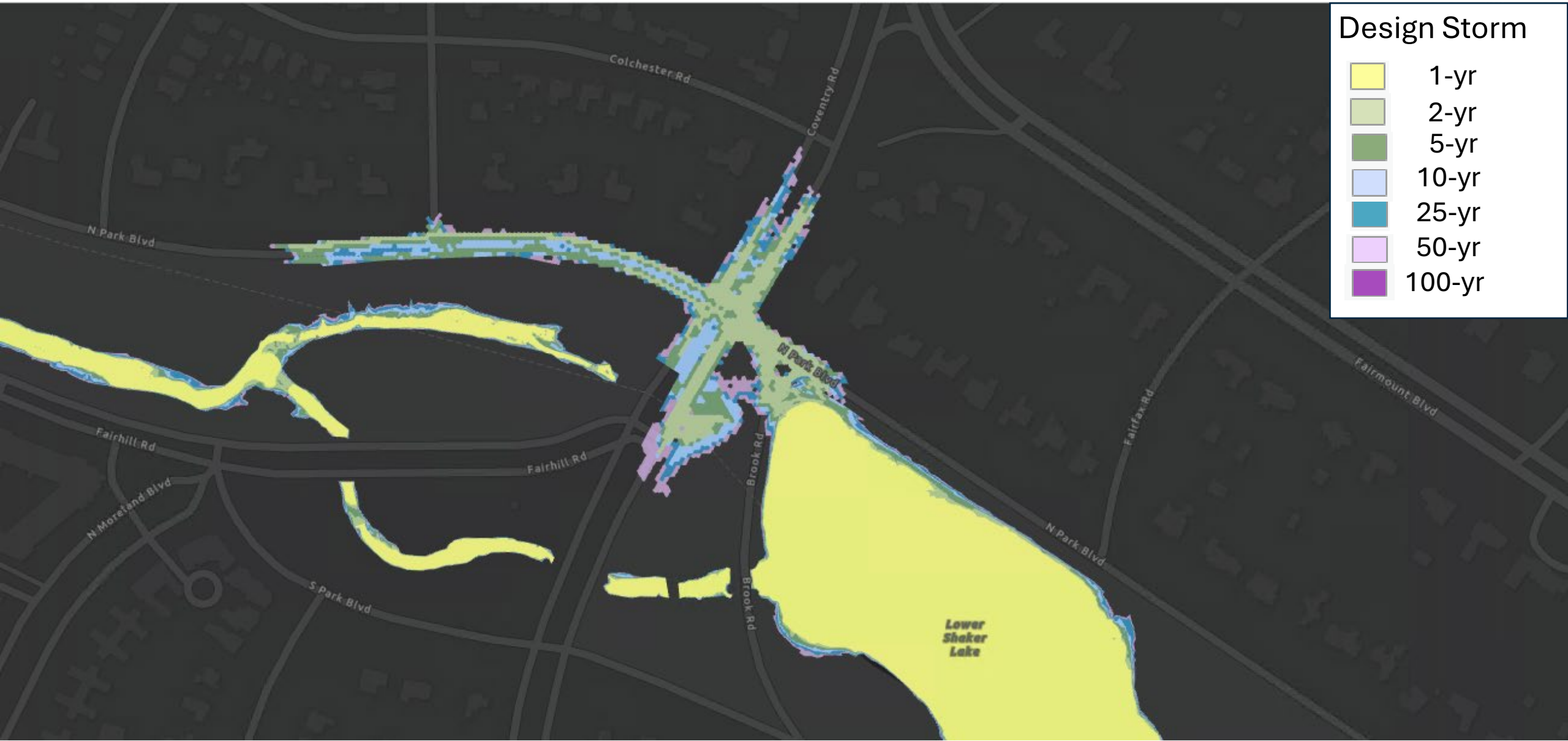

S1: Existing, current conditions without Horseshoe Dam
100-yr inundation (5.3” 24-hrs.)

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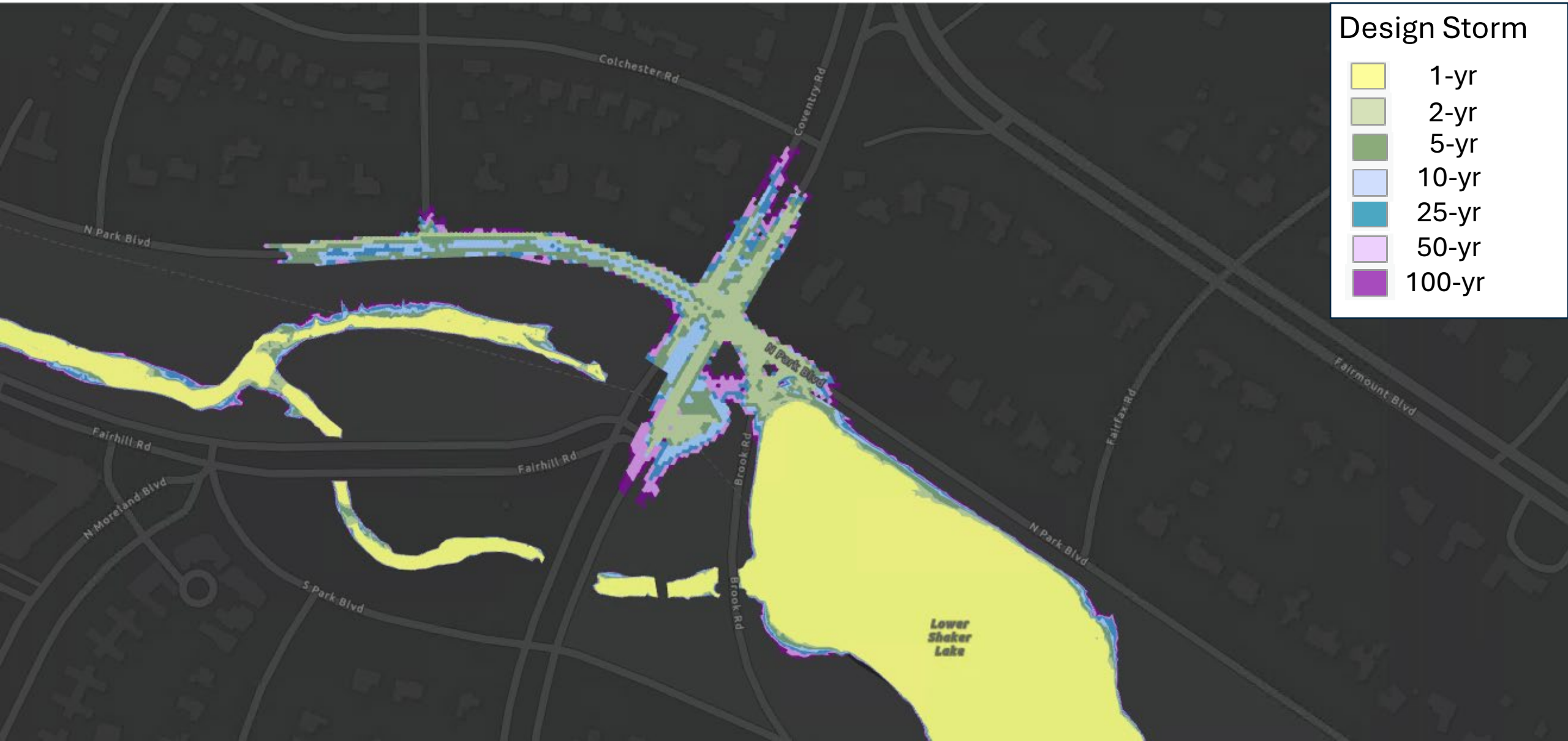

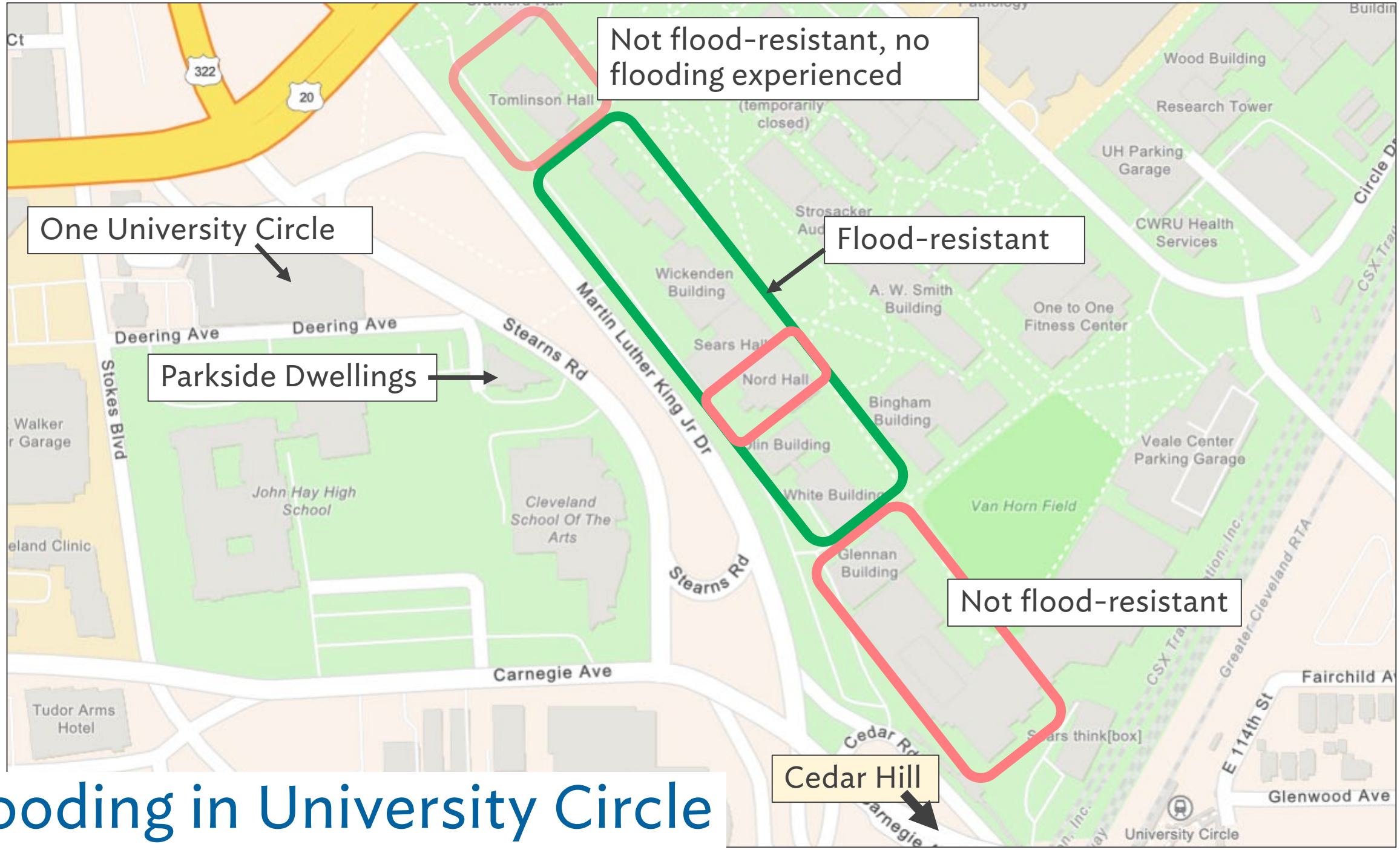

Flooding in University Circle

S1: Existing, current conditions without Horseshoe Dam
1-yr inundation (1.9” 24-hrs)

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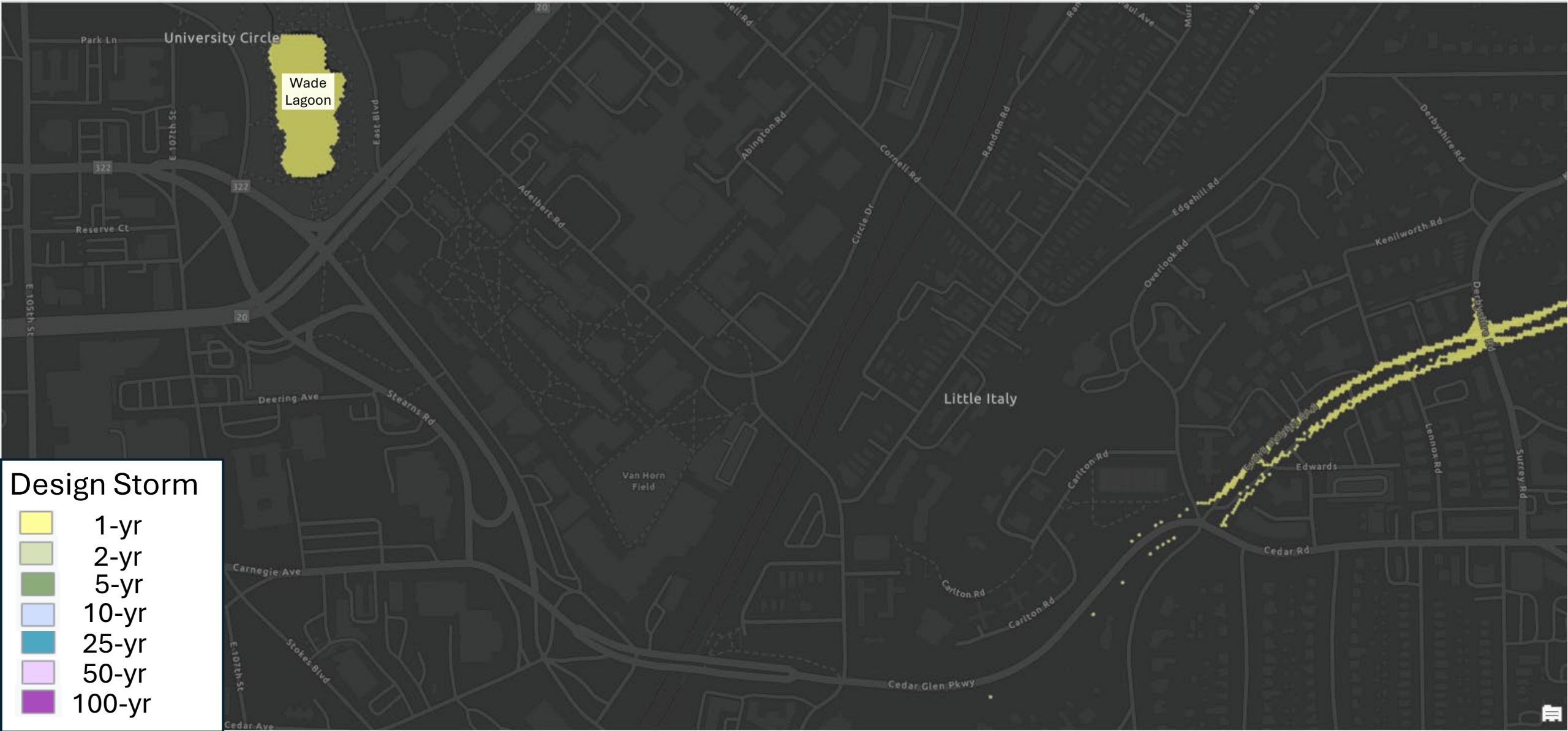

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2-yr inundation (2.3” 24-hrs)

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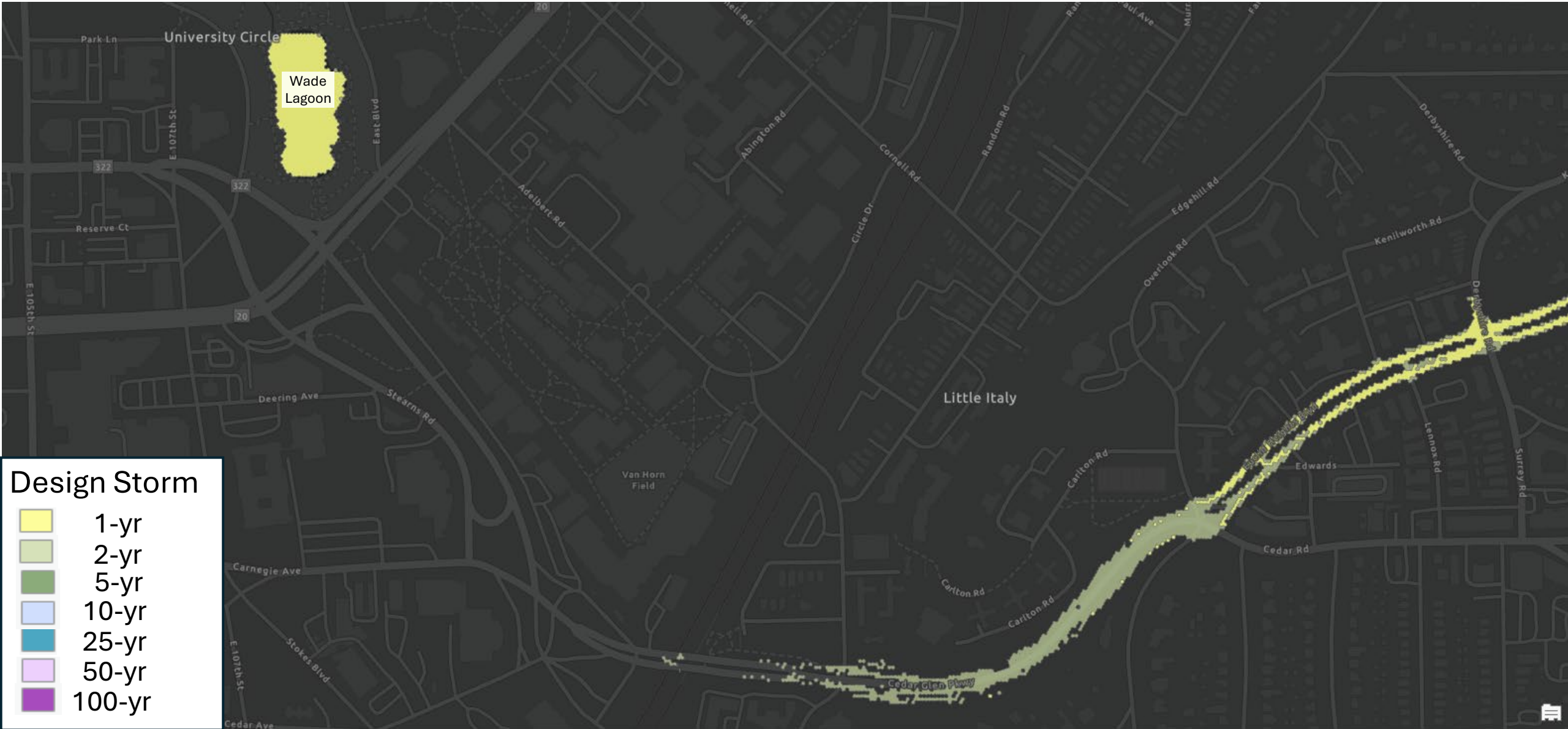

S1: Existing, current conditions without Horseshoe Dam
5-yr inundation (2.9” 24-hrs.)

2-Dimensional Mesh Stormwater Modeling

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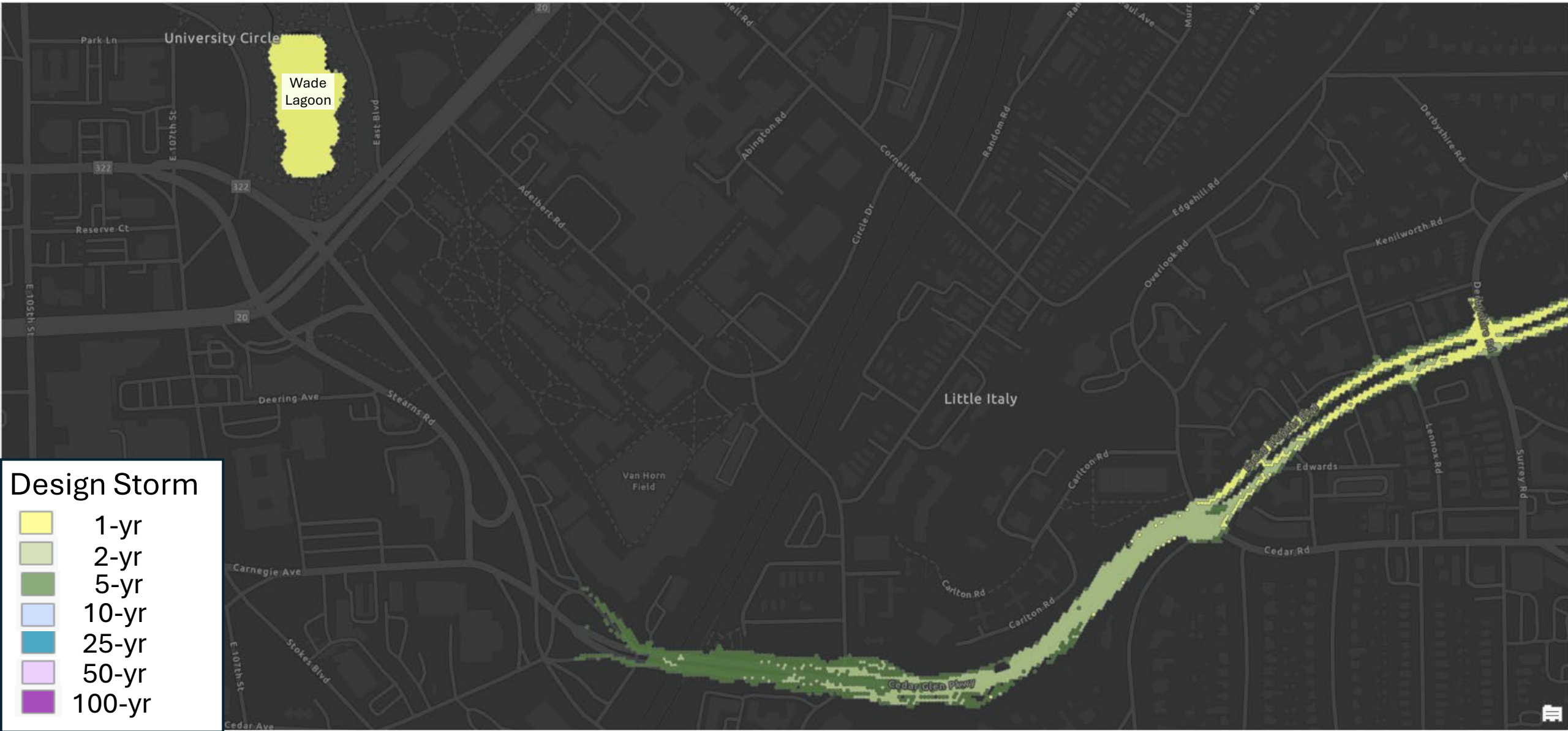

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10-yr inundation (3.4” 24-hrs.)

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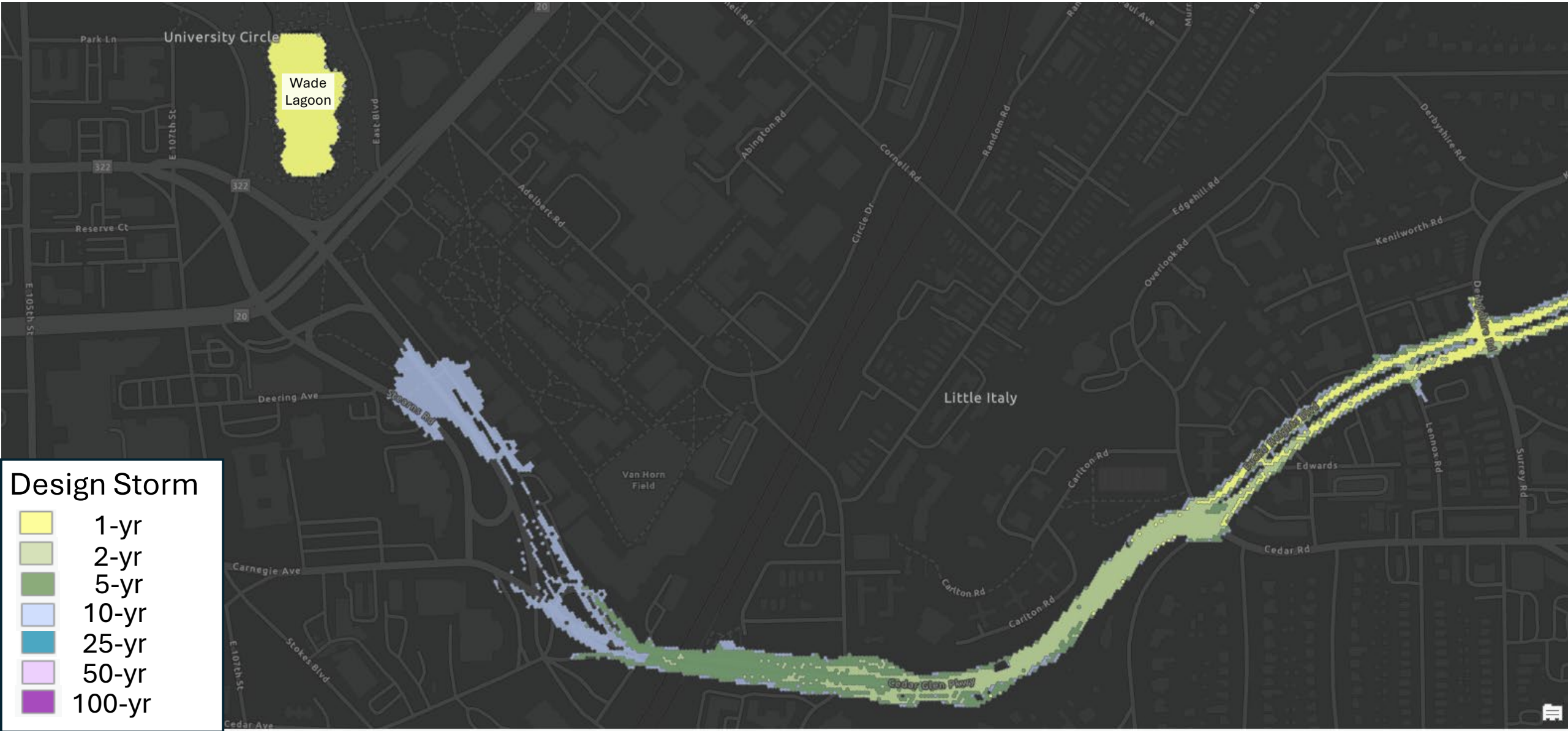

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25-yr inundation (4.1” 24-hrs.)

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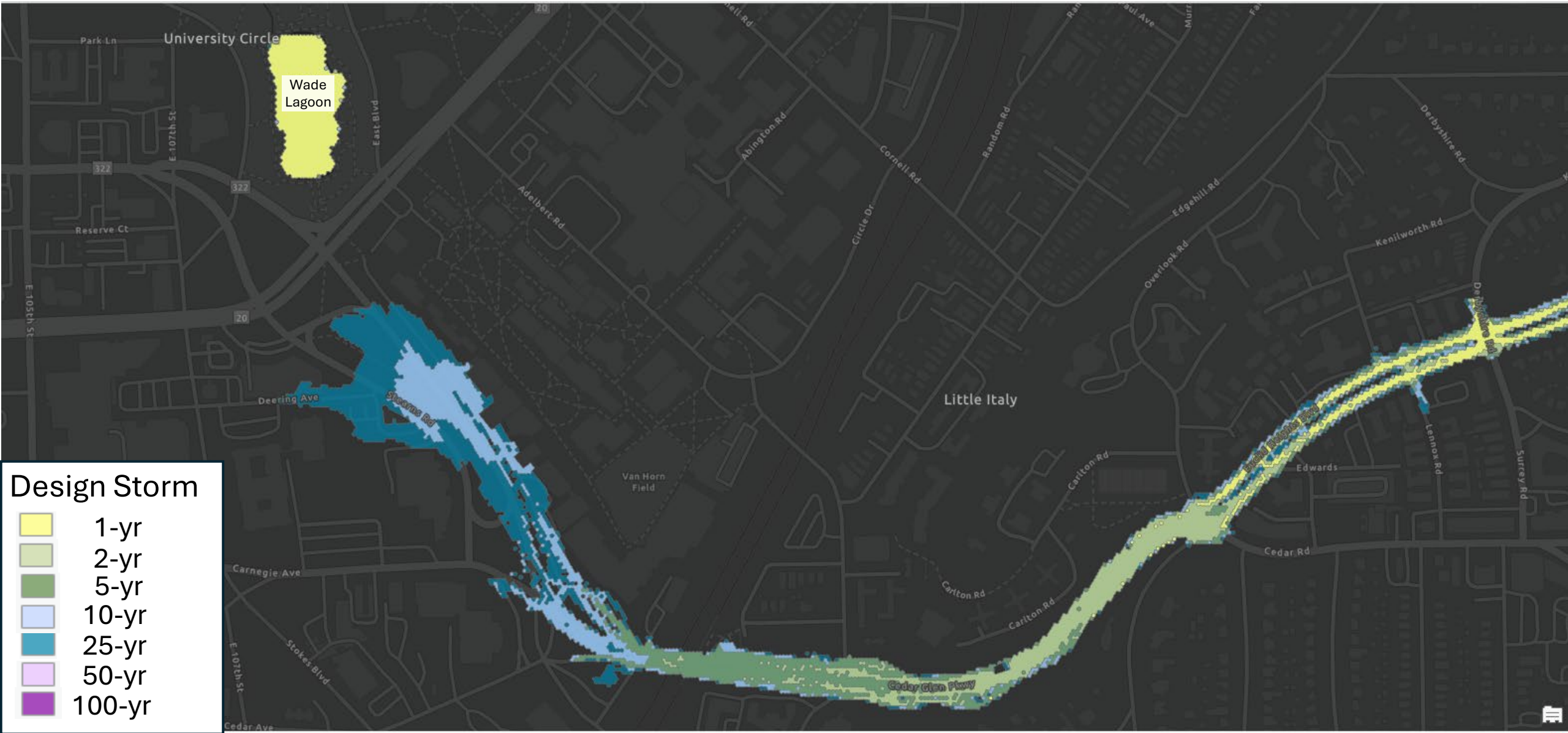

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50-yr inundation (4.7” 24-hrs.)

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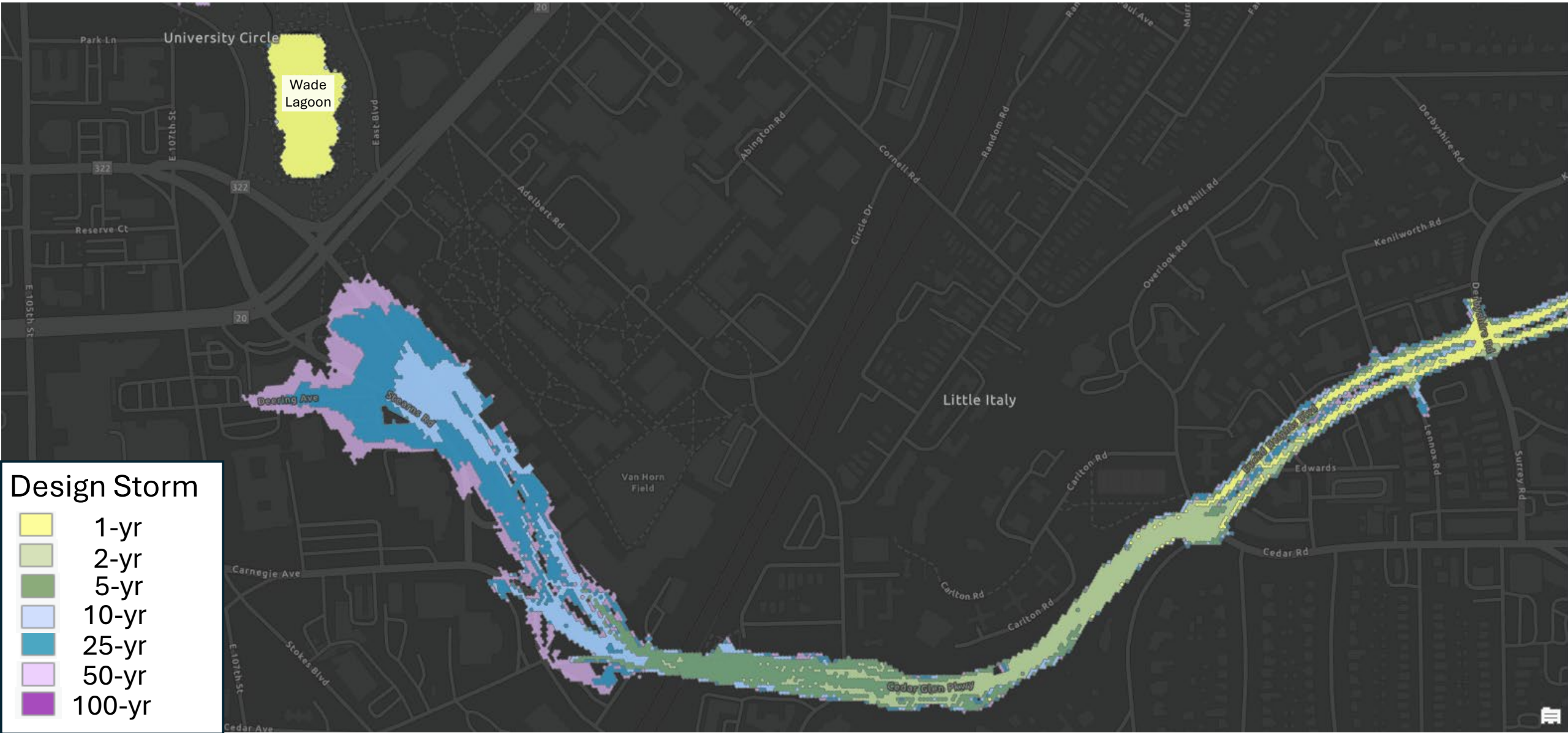

S1: Existing, current conditions without Horseshoe Dam
100-yr inundation (5.3” 24-hrs.)

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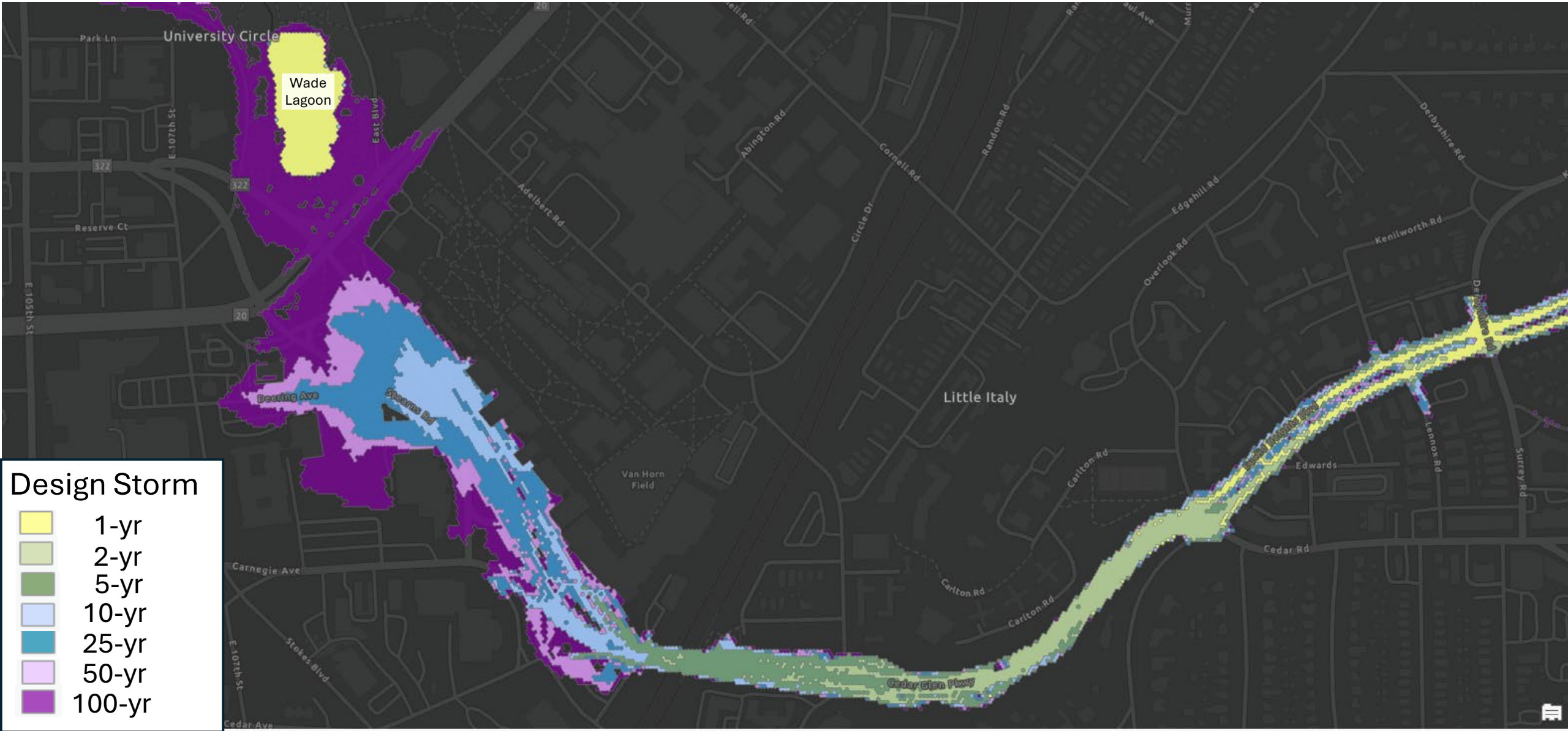


Regional Stormwater Management Program

To address flooding and dam compliance:

- June 2021: District made the recommendation to remove Horseshoe Lake Dam and reconstruct Lower Lake Dam

Lower Shaker Lake Timeline

- 2021 Stormwater Masterplan findings
- 2023 Dam Reconstruction Pre-Design

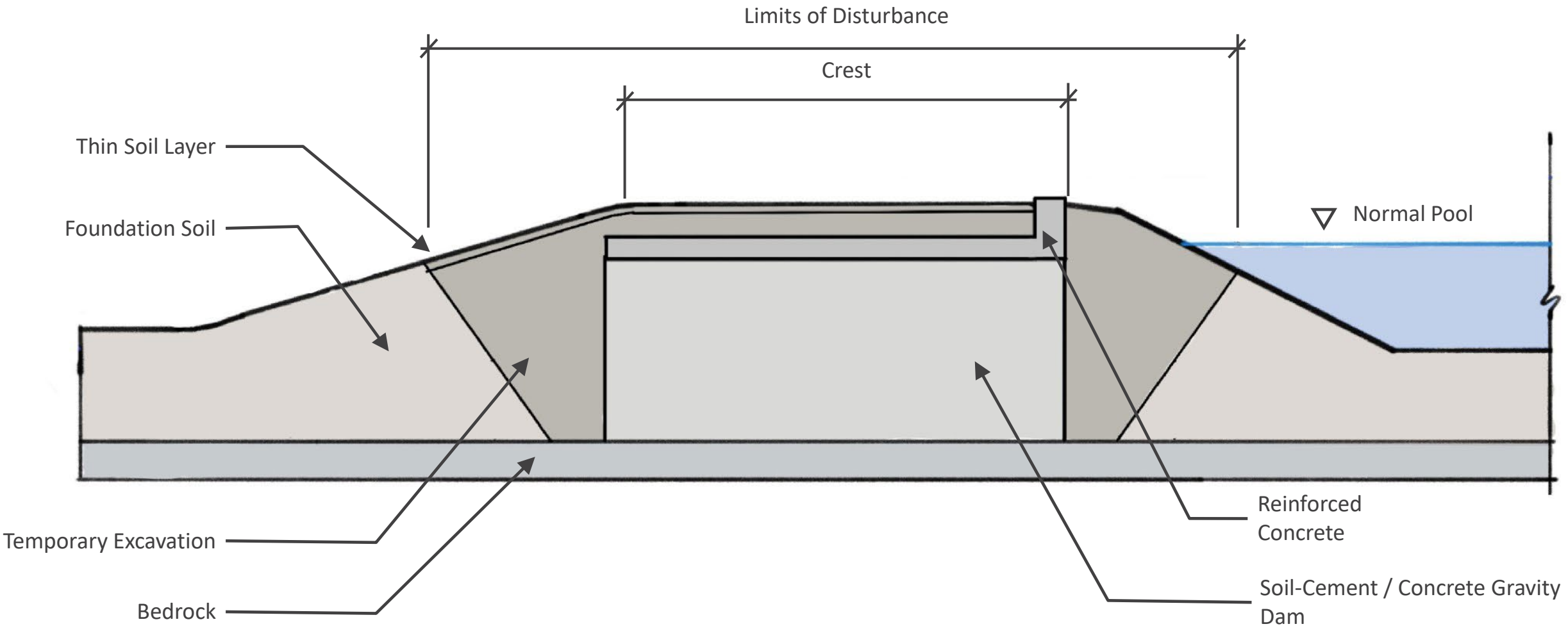
Lower Shaker Lake Dam Reconstruction

- District began pre-design in 2023 on Lower Lake Dam Reconstruction

Lower Shaker Lake Dam Reconstruction

- District began pre-design in 2023 on Lower Lake Dam Reconstruction
- New design features to meet standards:
  - Concrete gravity dam

Concrete Gravity Dam*

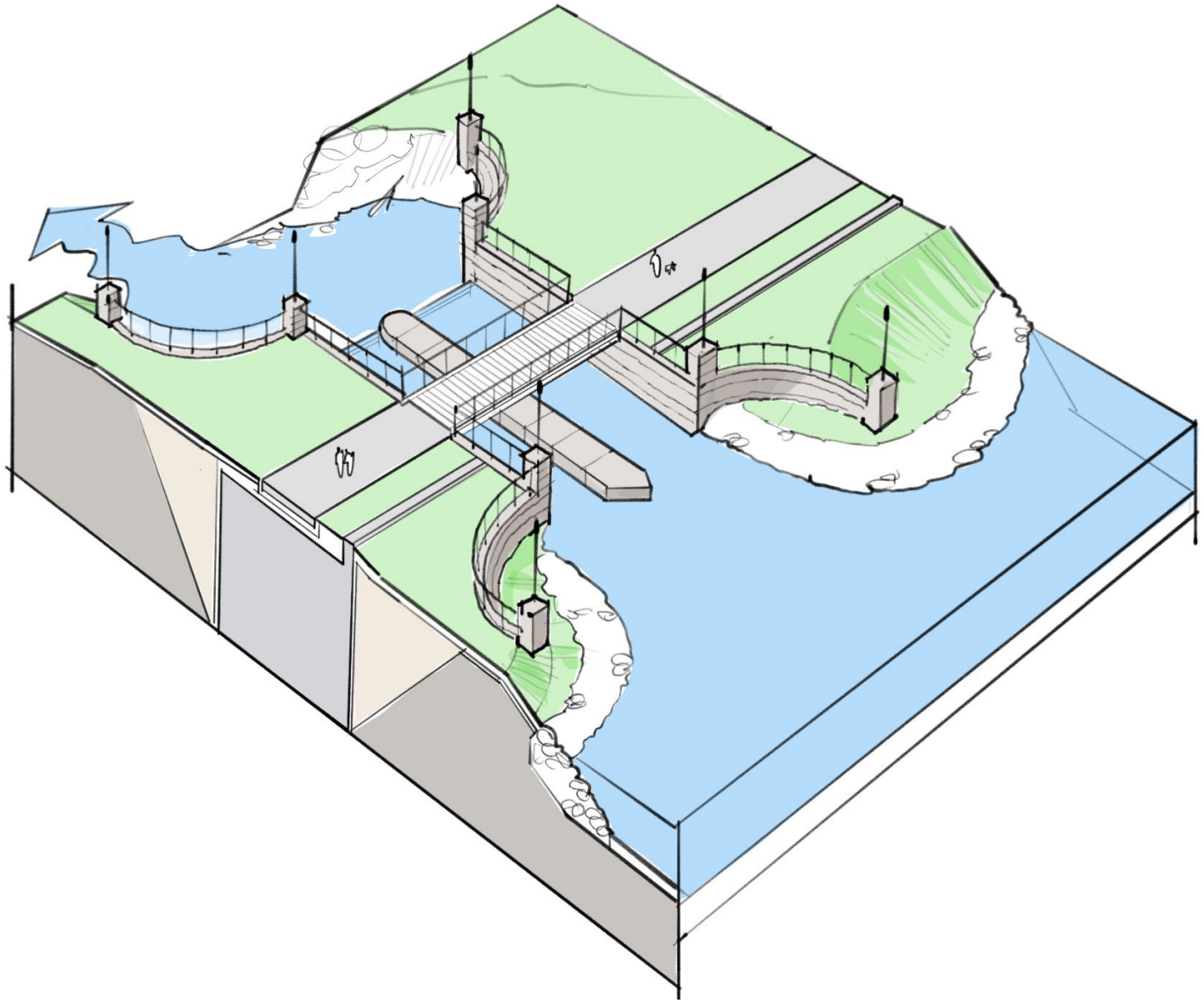


*PREVIOUSLY PRESENTED

Lower Shaker Lake Dam Reconstruction

- District began pre-design in 2023 on Lower Lake Dam Reconstruction
- New design features to meet standards:
  - Concrete gravity dam
  - Principal spillway rebuild

Reconstructed Principal Spillway



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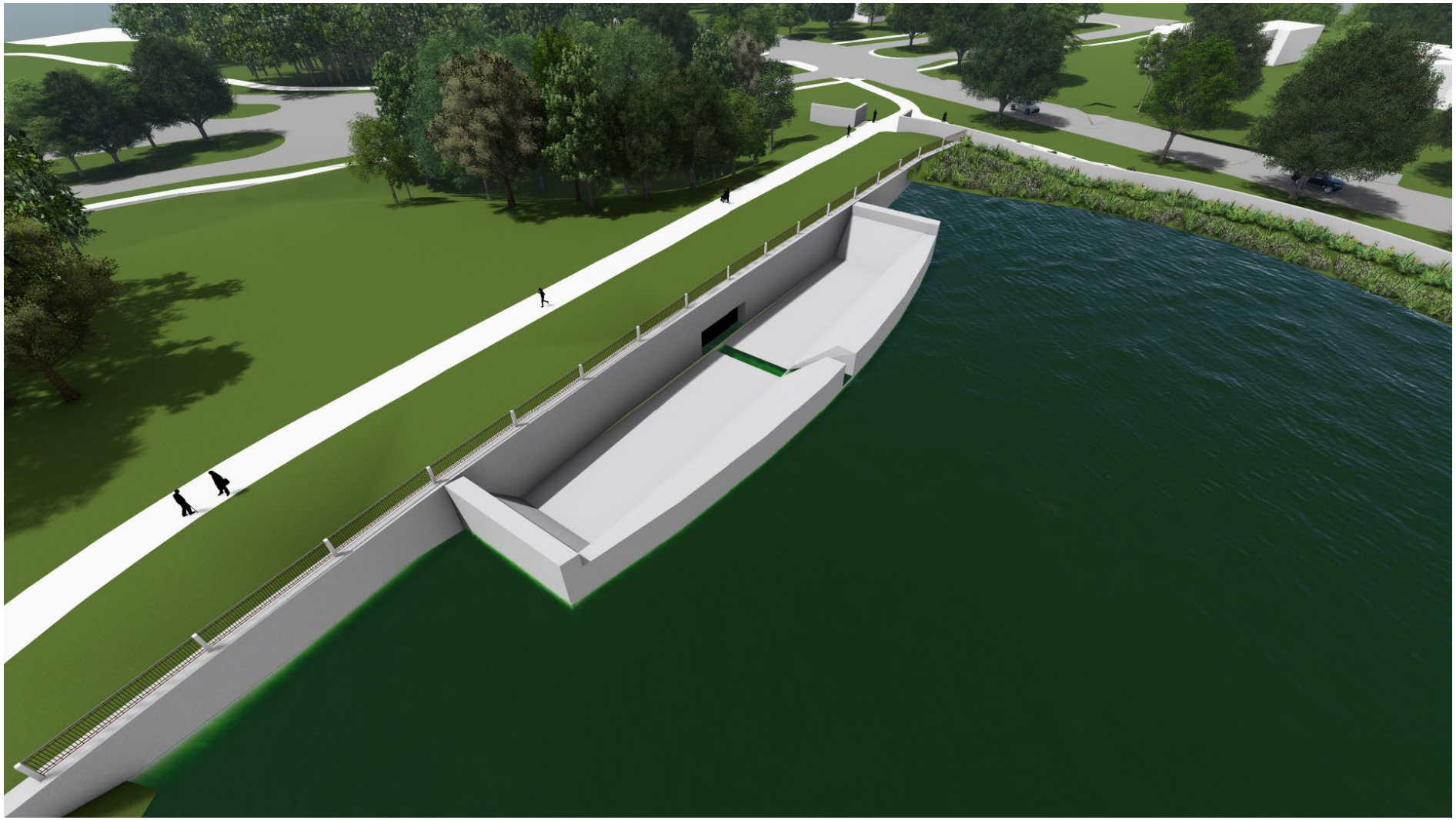
Regional Sewer District

Lower Shaker Lake Dam Reconstruction

- District began pre-design in 2023 on Lower Lake Dam Reconstruction
- New design features to meet standards:
  - Concrete gravity dam
  - Principal spillway rebuild
  - Very large auxiliary spillway

Dam: What will it look like?
(slide from 2024 outreach)*



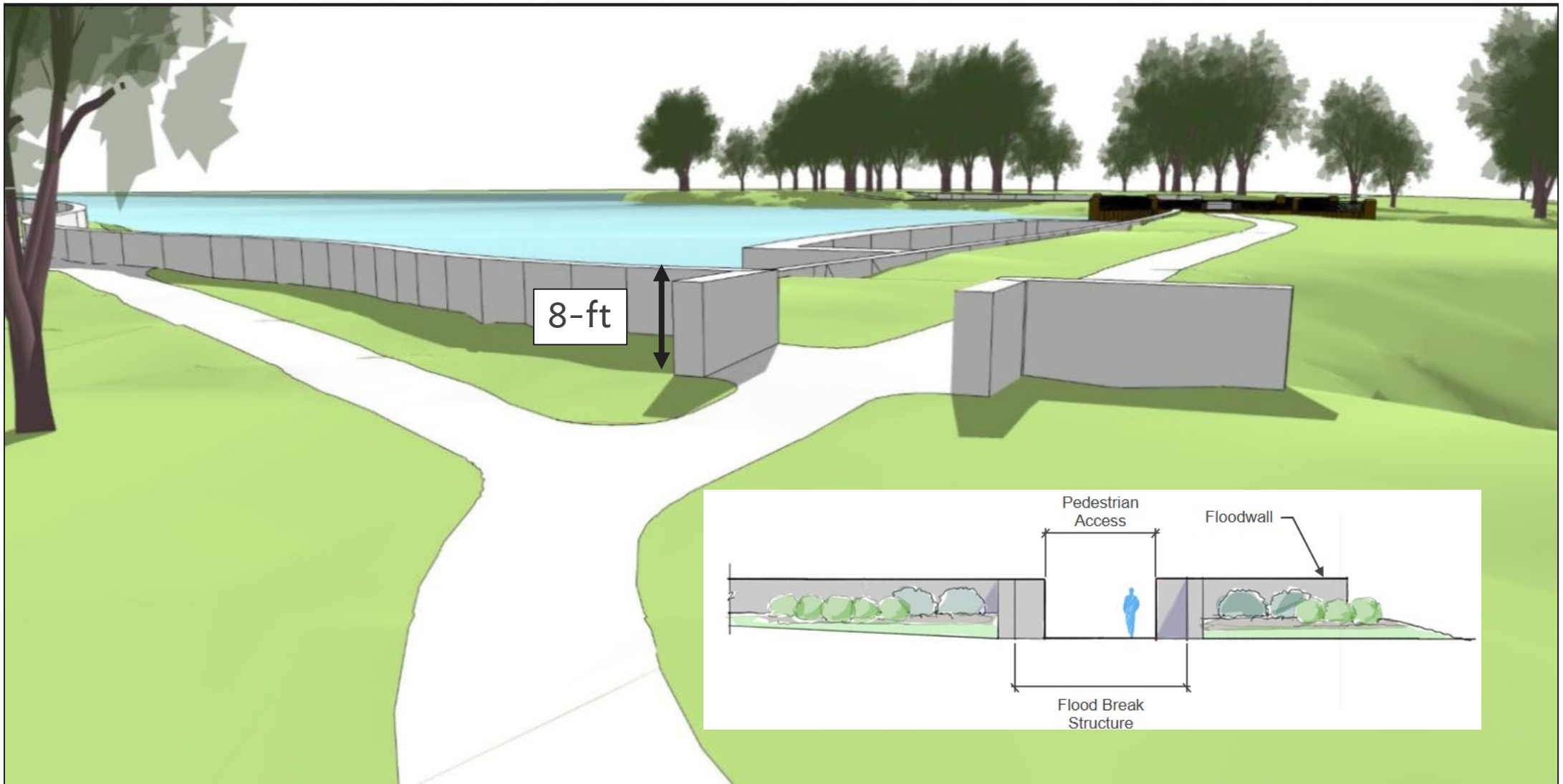
*PREVIOUSLY PRESENTED

Lower Shaker Lake Dam Reconstruction

- District began pre-design in 2023 on Lower Lake Dam Reconstruction
- New design features to meet standards:
  - Gravity dam
  - Principal spillway rebuild
  - Very large auxiliary spillway
  - Floodwalls

Dam: What will it look like?

(draft rendering of flood control walls)



Lower Shaker Lake Timeline

- 2021 Stormwater Masterplan findings
- 2023 Dam Reconstruction Pre-Design
- Updated information and analysis
  - Additional Culvert in University Circle Study
  - Model updates

During pre-design, new information continued to be refined…

- Modeling updates, and more data analysis
- Capacity improvements downstream within University Circle culvert

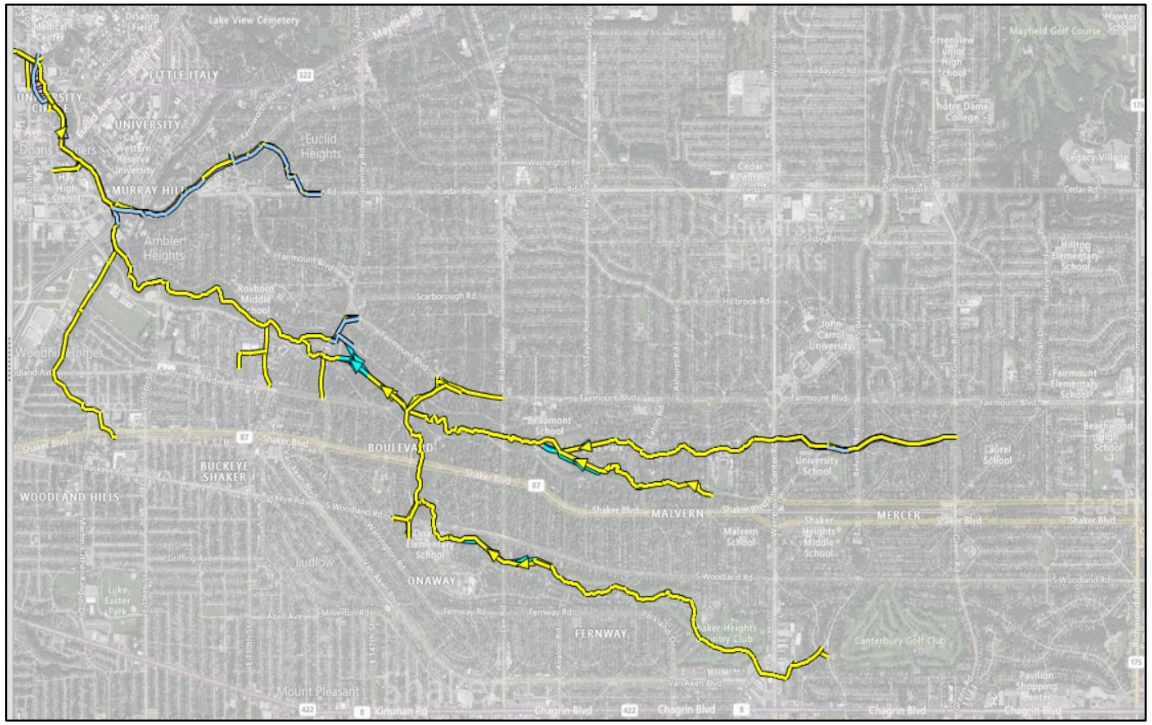
Updated model

- Enhancements to model inputs
- More local storm sewers and connections added
- Used recent storms to calibrate revised model
- Additional stream flow monitors and level sensors

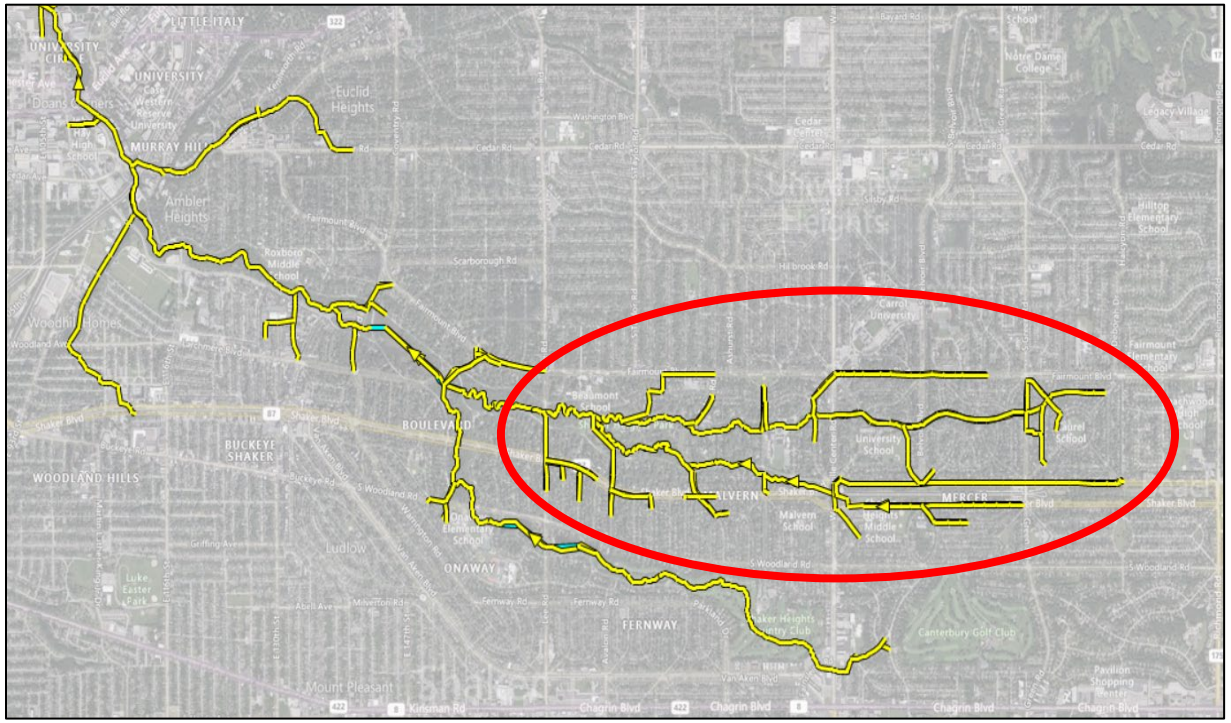
Level Monitor at South Woodland Road Crossing

Doan Brook Channel

2021 modeled drainage network



2024-25 modeled drainage network



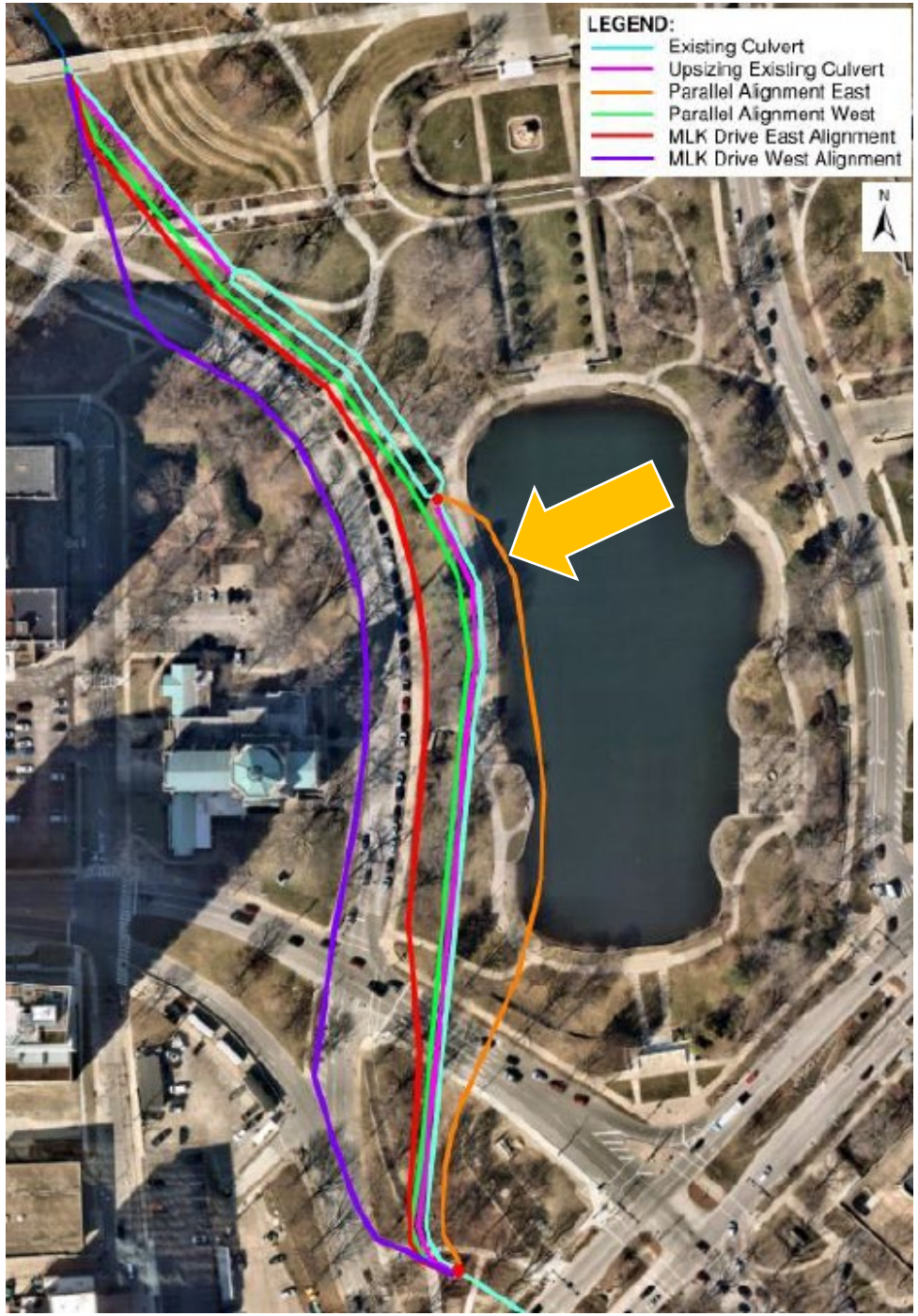
Northeast Ohio
Regional Sewer District

Updated model

- Upgraded our model inputs
  - More local sewers and connections added
  - Used recent storms to calibrate model
  - Additional flow monitors and level sensors
- Upgraded our model method (shown in earlier slides)
  - 2-Dimensional model- for detail on depth, direction, duration of flooding
  - Improves understanding of how and where the flooding happens

Feasibility Study: University Circle Culvert Conveyance

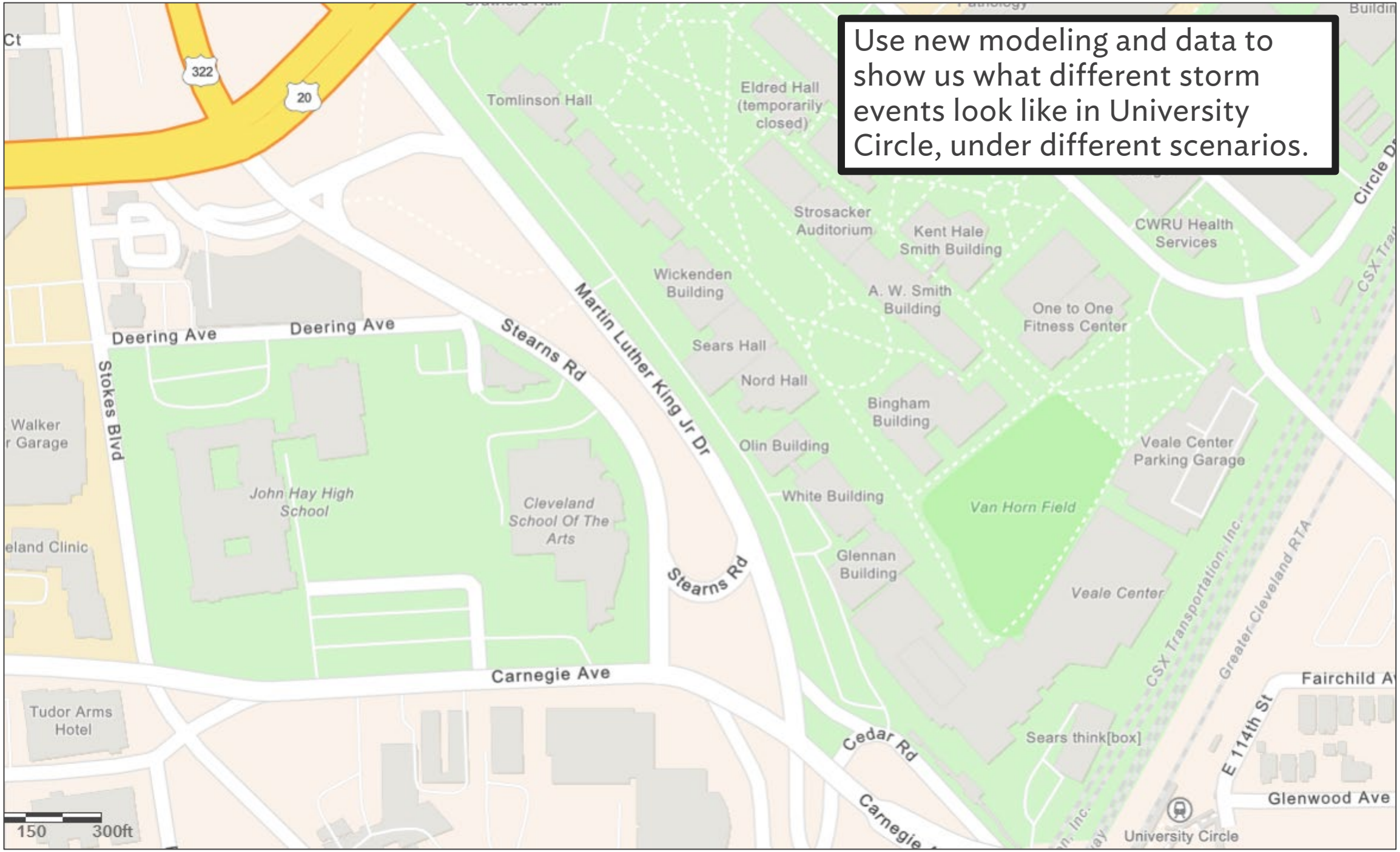
- Conducted a feasibility study for alignment of added conveyance, or culvert capacity (*image right*)
- Knew we needed this, did not see a clear way forward previously (*2021*)
- Opportunity arose with Cleveland Museum of Art (*2024*)
- No interaction with Wade Lagoon hydraulically



With this new information

- Ran the new, updated model with added University Circle culvert flow routing

We will now walk through that analysis.


Use new modeling and data to show us what different storm events look like in University Circle, under different scenarios.
322
20
Tomlinson Hall
Eldred Hall (temporarily closed)
Strosacker Auditorium
Kent Hale Smith Building
CWRU Health Services
Wickenden Building
A. W. Smith Building
One to One Fitness Center
Sears Hall
Nord Hall
Bingham Building
Olin Building
Veale Center Parking Garage
White Building
Van Horn Field
Glennan Building
Veale Center
Sears think[box]
Deering Ave
Deering Ave
Stearns Rd
Martin Luther King Jr Dr
Stearns Rd
Stokes Blvd
Walker Garage
John Hay High School
Cleveland School Of The Arts
Carnegie Ave
Tudor Arms Hotel
Cedar Rd
Carnegie
Circle Dr
CSX Transportation, Inc.
Greater Cleveland RTA
E 114th St
Fairchild Av
Glenwood Ave
University Circle
150
300ft

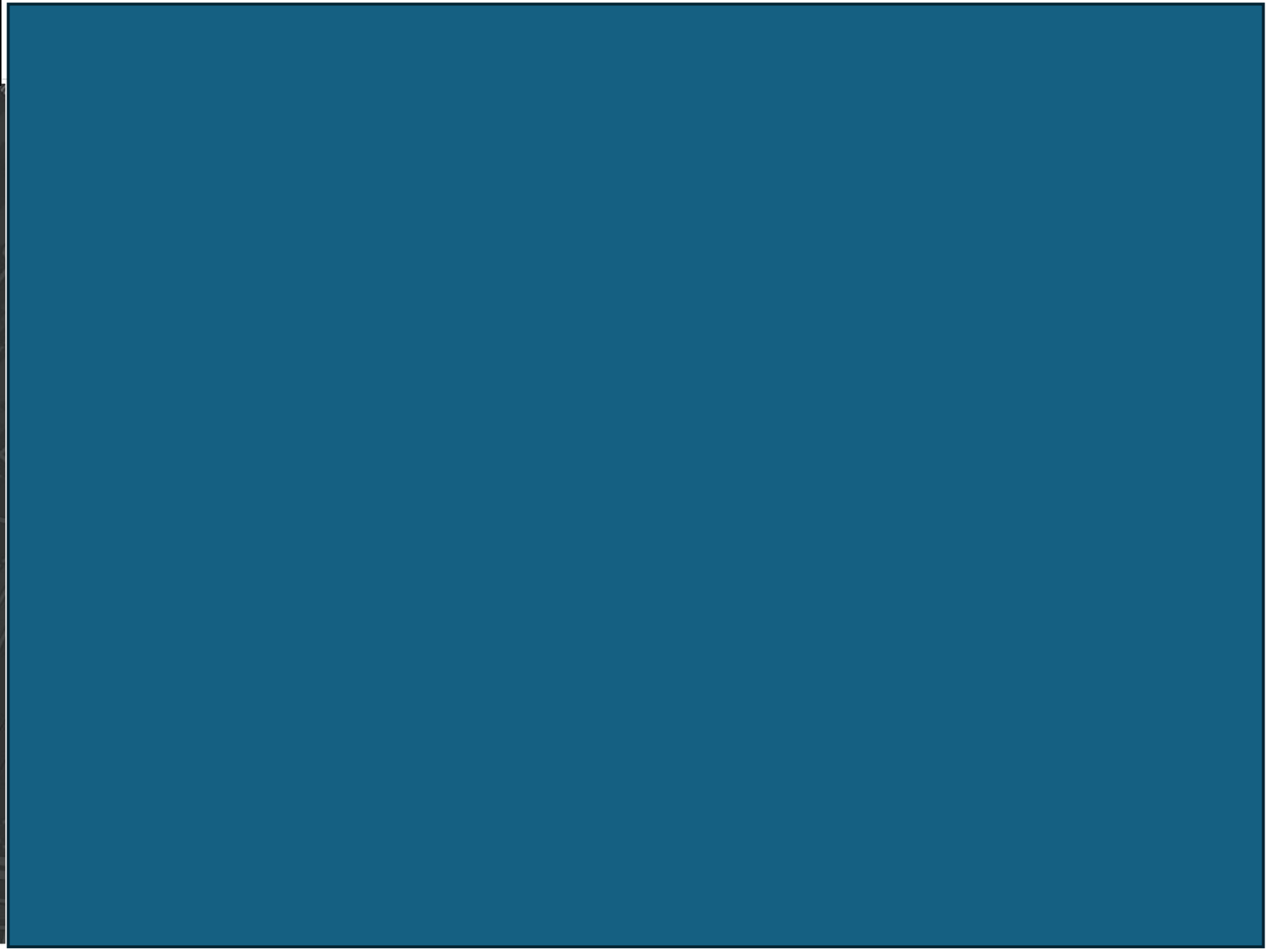
Three modeling scenarios

1. With existing Lower Lake Dam
2. With added University Circle culvert and no Lower Lake Dam
3. With added University Circle culvert and new Lower Lake Dam (reconstructed)

All scenarios assume no Horseshoe Lake Dam

1: No University Circle conveyance, Existing Lower Lake Dam

13 buildings flooded at 100-yr event

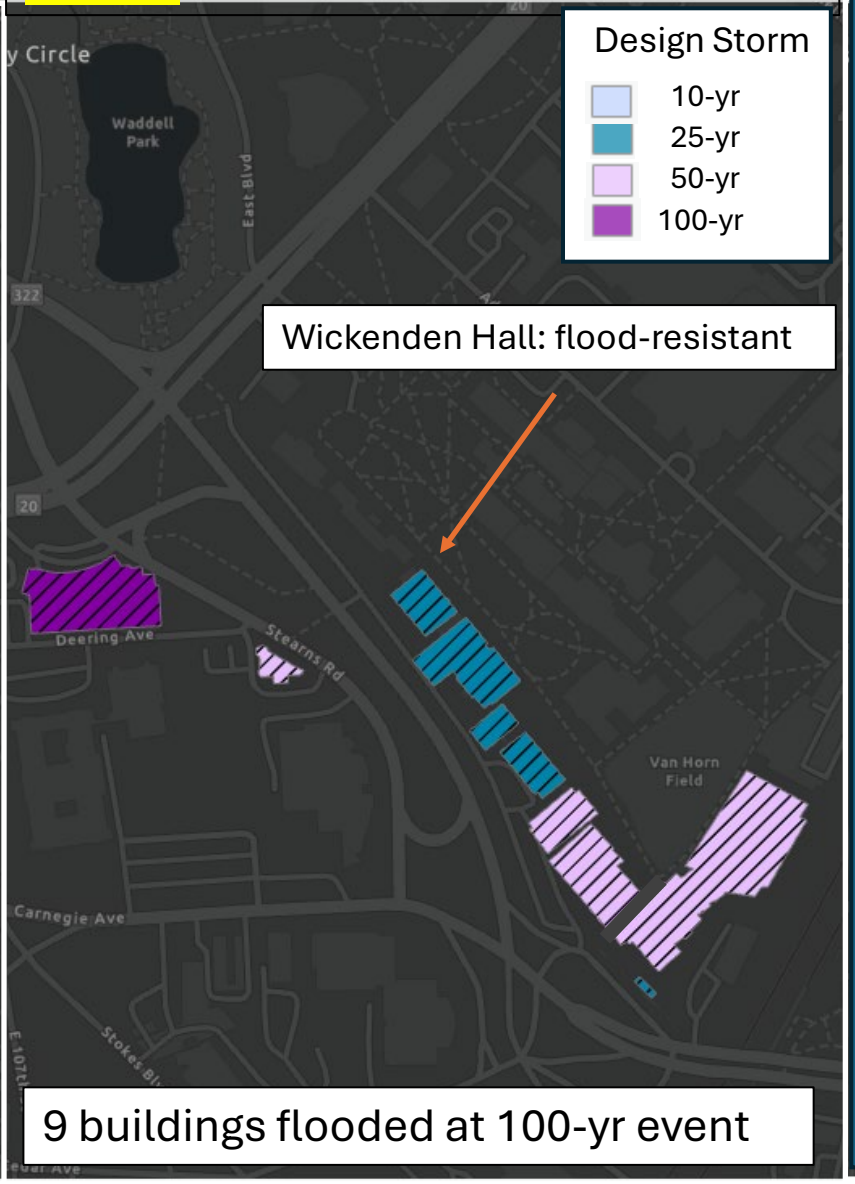


All scenarios assume Horseshoe Lake dam is removed

1: No University Circle conveyance, Existing Lower Lake Dam

13 buildings flooded at 100-yr event

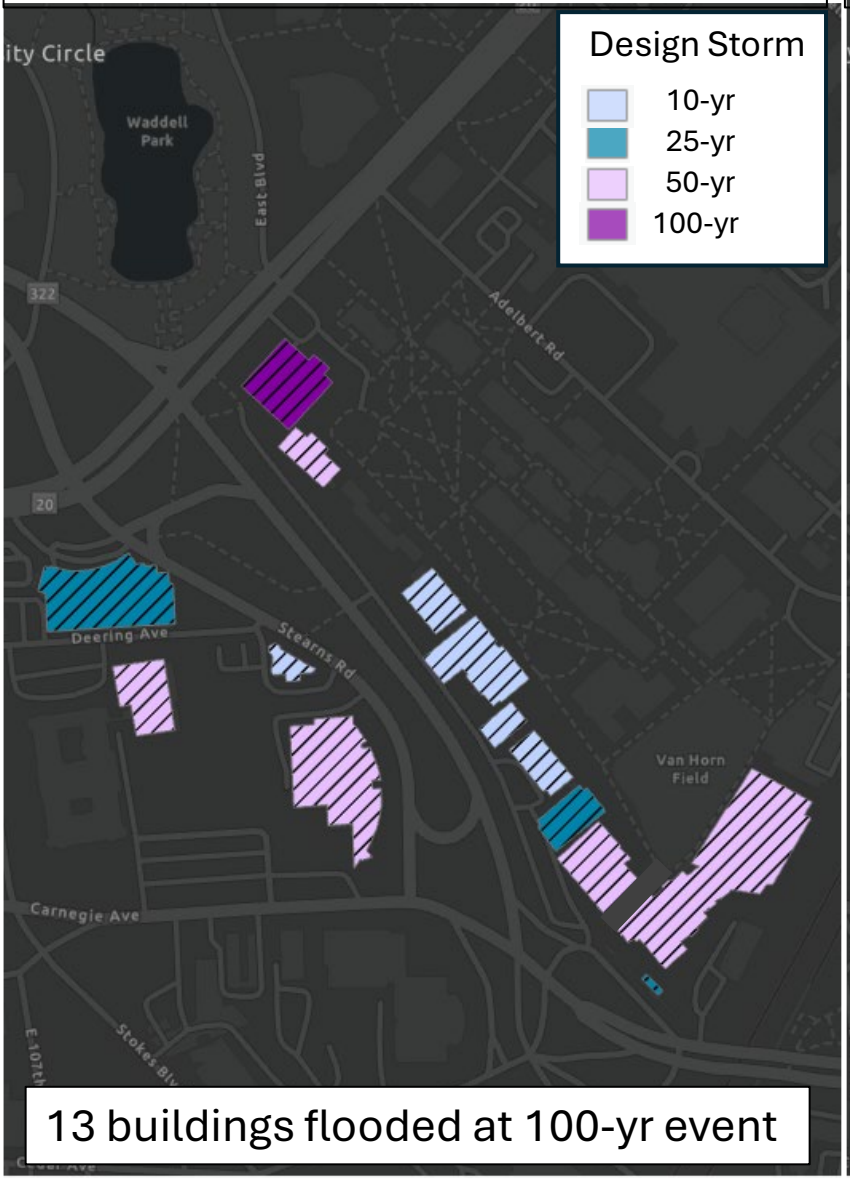
2: University Circle Conveyance ***Without*** Class I Lower Lake Dam



9 buildings flooded at 100-yr event

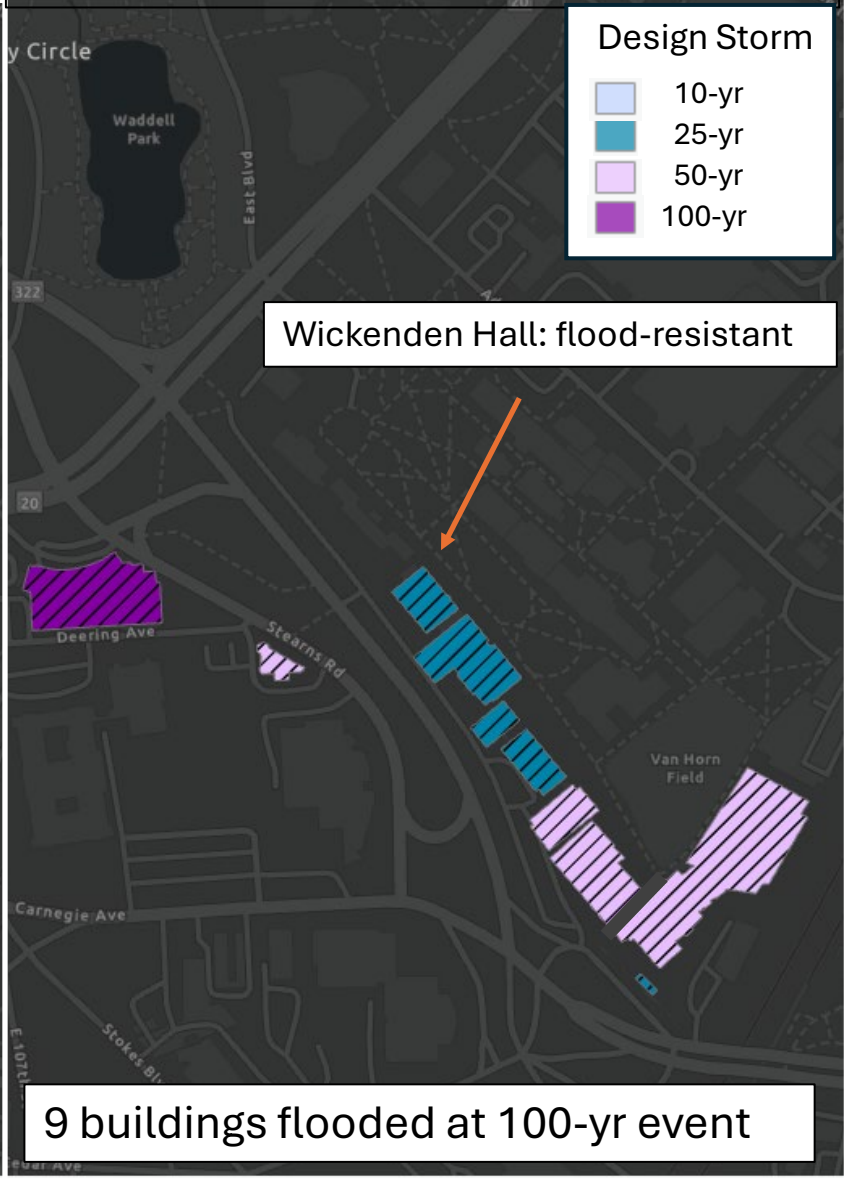
All scenarios assume Horseshoe Lake dam is removed

1: No University Circle conveyance, Existing Lower Lake Dam



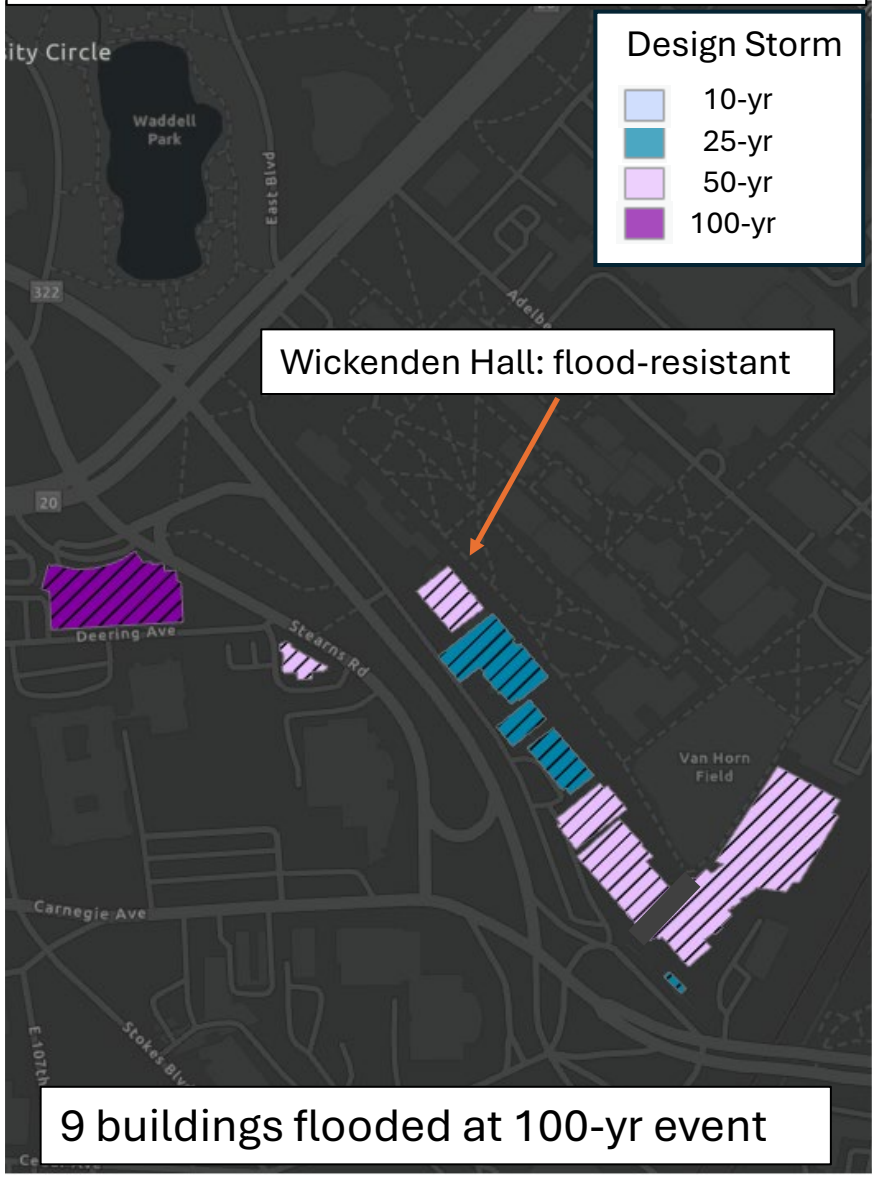
13 buildings flooded at 100-yr event

2: University Circle Conveyance ***Without*** Class I Lower Lake Dam



9 buildings flooded at 100-yr event

3: University Circle Conveyance ***With*** Class I Lower Lake Dam



9 buildings flooded at 100-yr event

All scenarios assume Horseshoe Lake dam is removed

Findings

Flooding in University Circle:

- Results indicate that the added University Circle culvert conveyance, not the Lower Lake Dam, is what improves University Circle flooding conditions

Findings

Flooding at Lower Lake:

- During 100-yr storm event, flooding near Lower Lake on North Park and Coventry Roads can be resolved with either a reconstructed Class I Dam or dam removal and restored stream channel

Additional Considerations

- Ecological impact of dams to water quality
- On-going maintenance and operation costs of Class 1 dam
- Insurance and liability of Cities as dam operators

Lower Shaker Lake Timeline

- 2021 Stormwater Masterplan findings
- 2023 Dam Reconstruction Pre-Design
- Updated information and analysis
  - Additional Culvert in University Circle Study
  - Model updates
- 2025 revised recommendation for Lower Lake Dam
  - Costs and next steps

Updated recommendation

Northeast Ohio Regional Sewer District, to best align with Programmatic Purpose:

- Recommends removal of the Class I high hazard dam at Lower Shaker Lake and restoration of Doan Brook
- Will pursue installation of the University Circle additional culvert conveyance

Cost Comparison – Dam Reconstruction vs. Dam Removal & Stream Restoration Estimates

	Dam Reconstruction	Dam Removal & Stream Restoration
Professional Design Services	$8,700,000	$6,000,000
BASE CONSTRUCTION ESTIMATE	$21,195,122	$19,494,384
Construction Contingencies & Escalation	$13,468,000	$12,368,992
SUB-TOTAL Project Costs	**$43,363,122**	**$37,863,376**
Sediment Removal in Lower Lake*	$12,000,000	$0
Improvements at Coventry and Fairhill crossings*	$0	$7,383,725
TOTAL PROJECT COSTS	**$55,363,122**	**$45,247,101**

Includes management of all sediment in lake.

*LIKELY WORK EITHER AS FUTURE PHASE OR PART OF PROJECT

Northeast Ohio Regional Sewer District

Summary

- 2021 Stormwater Master Plan Recommendation
- 2023-2024 Culvert Feasibility Study
- 2024 Additional Culvert Alignment Confirmed
- 2025 Lower Lake Dam Reconstruction Pre-Design
- Current: Recommendation to remove Lower Lake Dam

Next Steps

- Continue outreach and discussion of Lower Lake Dam with cities and residents
- Continue University Circle culvert pre-design

PUBLIC EVENTS

Lower Shaker Lake Project

WEBINAR

August 19

6:00-7:30 p.m.

Registration required at the link below:

IN-PERSON

August 20

11 a.m-1 p.m. and 5-7 p.m.

Lee Road Library

neorsd.org/LowerLake

NEORSD

For more updates and information

- neorsd.org/LowerLake
  - askus@neorsd.org
- Main Contact:
  - Cisco Rivera, Watershed Team Leader, RiveraF@neorsd.org

Q&A