



SOURCE TO STREAM

2024 Conference

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Stormwater and Erosion
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Conference

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March 26, 2024

Naturalization of the Don River Mouth

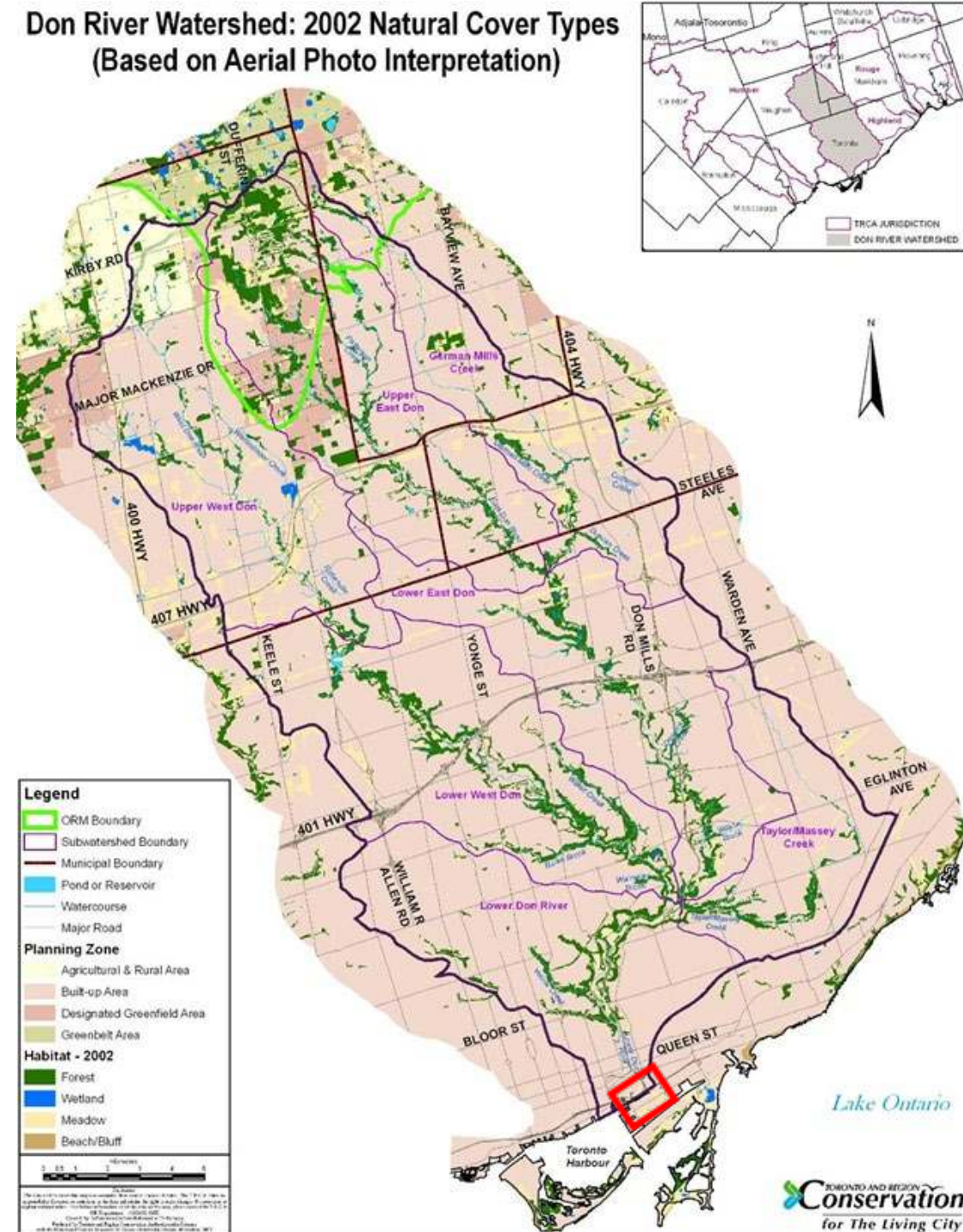
A component of the Port Lands Flood Protection Project, Toronto, ON
Source to Stream Conference

Ken Dion and Netami Stuart, Waterfront Toronto

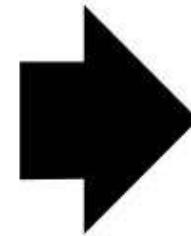
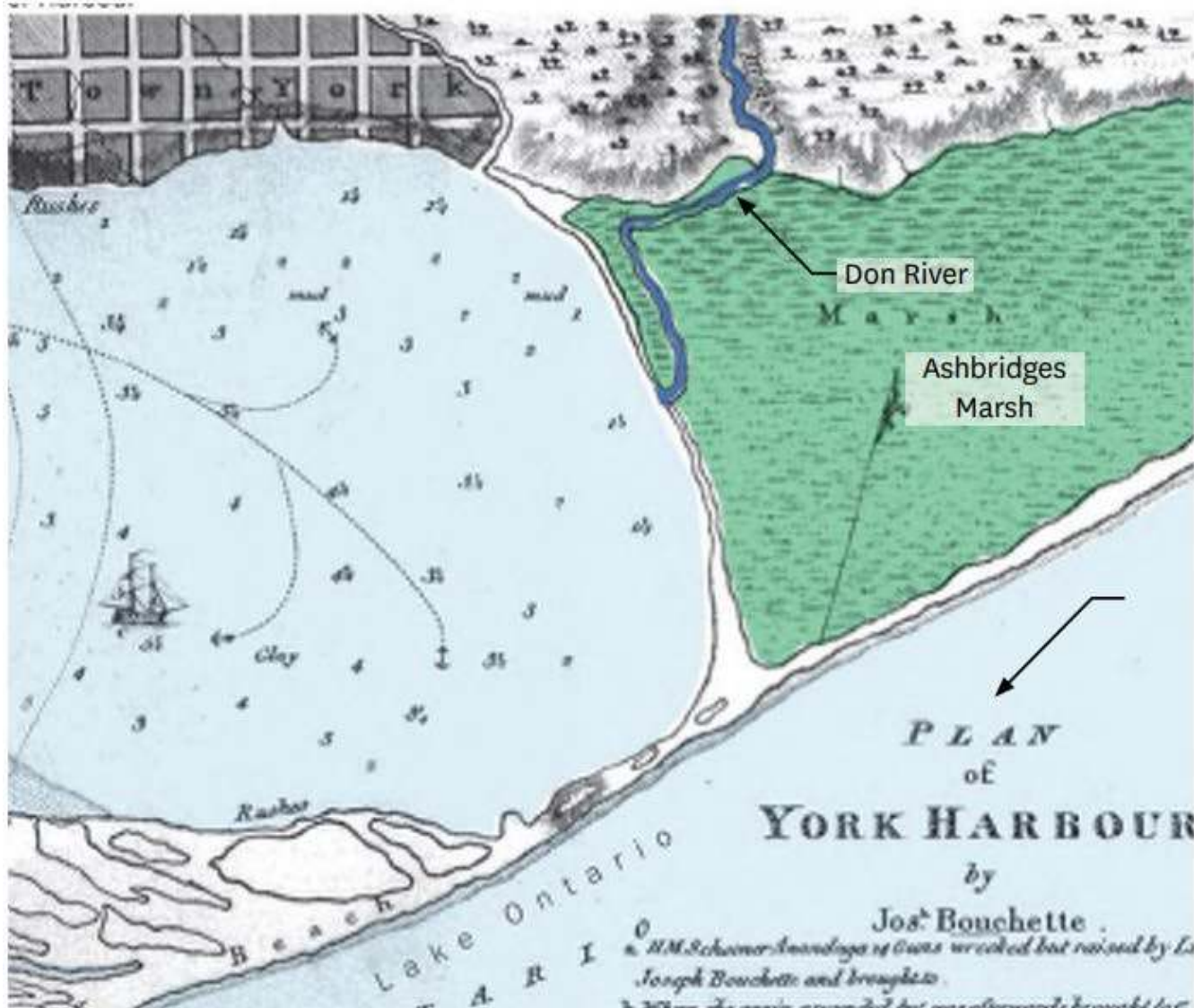
Background

Project Location

- Mouth of the Don River, Toronto
- Don Watershed has 7 sub-watersheds covering ~36,000ha
- River flows 38 km from Oak Ridges Moraine to the Keating Channel in the Toronto Inner Harbour of Lake Ontario
- Area consists of 85% urban land uses, 14% natural cover, and 1% remaining rural lands in the headwaters (as of 2013)



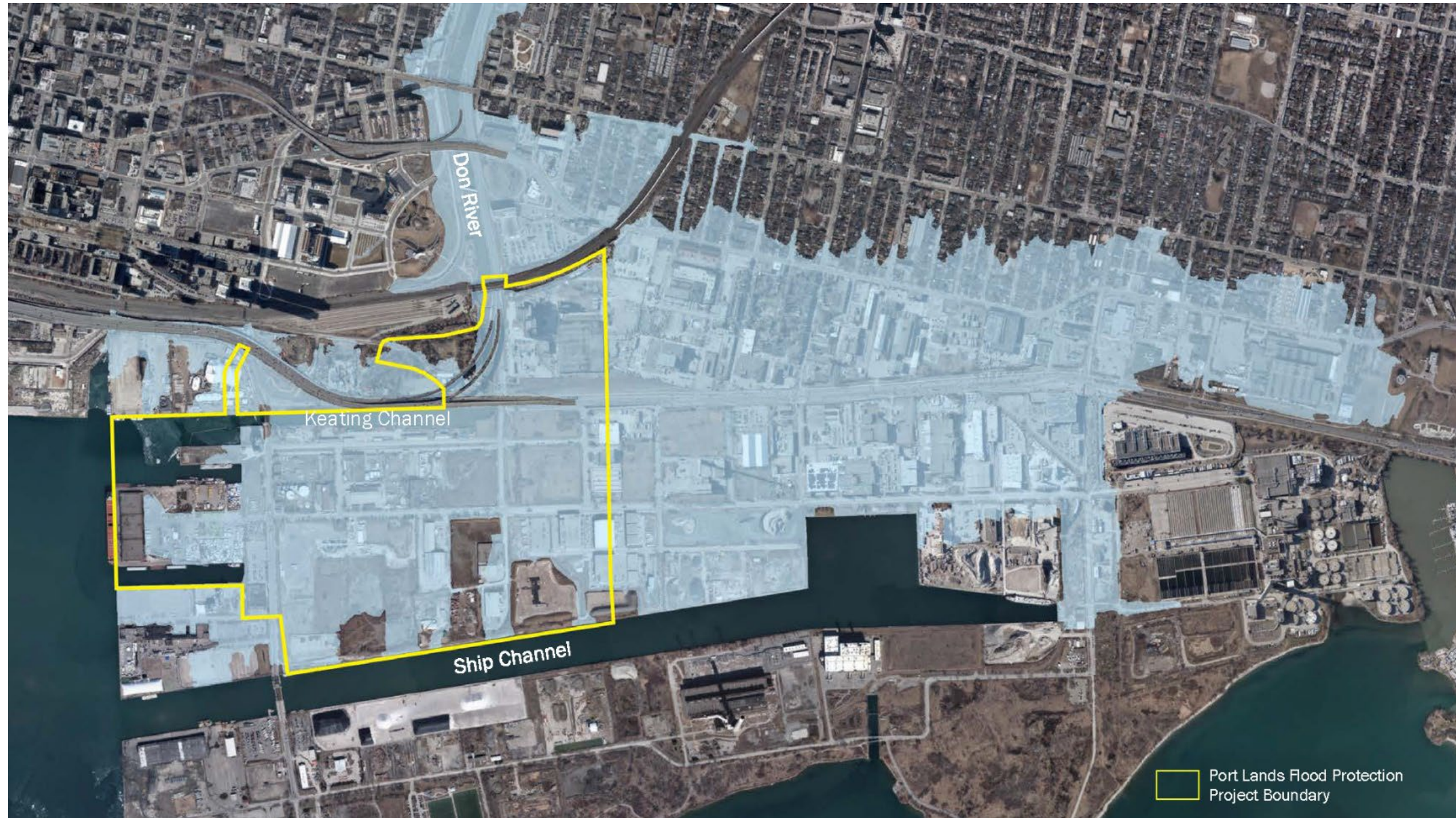
Infilling Ashbridge's Bay Marsh and Toronto Inner Harbour



Channelizing the Keating Channel



Extent of Flooding – Regulatory Event



Aquatic and Terrestrial Habitat

- Vertical concrete dockwalls
- Absence of physical habitat structure (within water column and adjacent floodplain)
- Lack of submergent and riparian vegetation (due to deep water, high turbidity and regular dredging)
- Impaired water quality:
 - Low summer oxygen concentrations, and
 - Periodic algal blooms
- Poor fish, bird, wildlife and insect communities



Contamination from Past Industrial Uses



Annual Sedimentation and Dredging

- ~30,000 - 40,000 m³ of sediment is deposited in Keating Channel each year
- Dredging is required annually in the Keating Channel
- Tonnes of floating garbage removed from Keating Channel each year



Design of the New Don River Mouth

Port Lands Solution - 2024

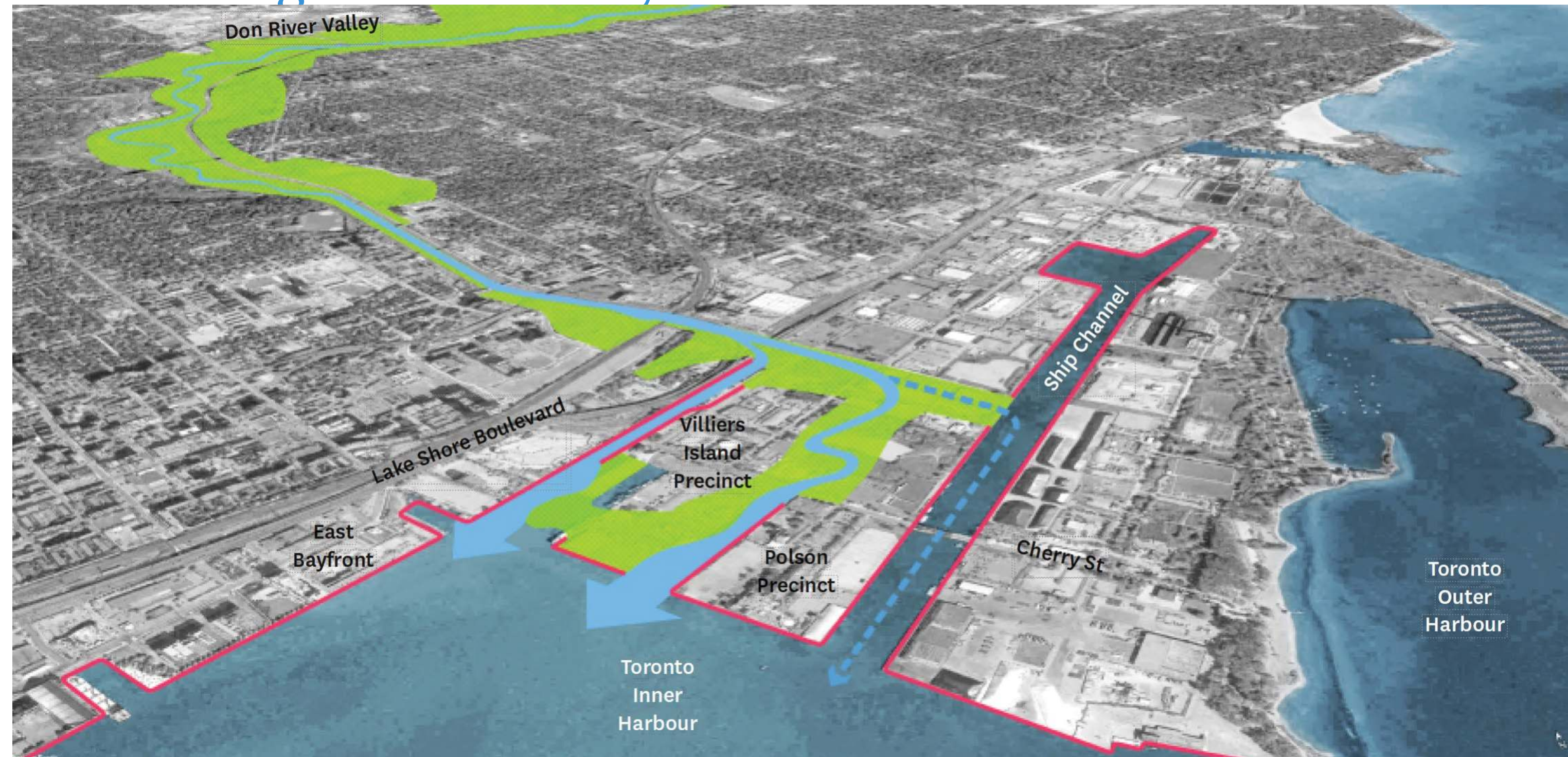


Full Vision for Villiers Island

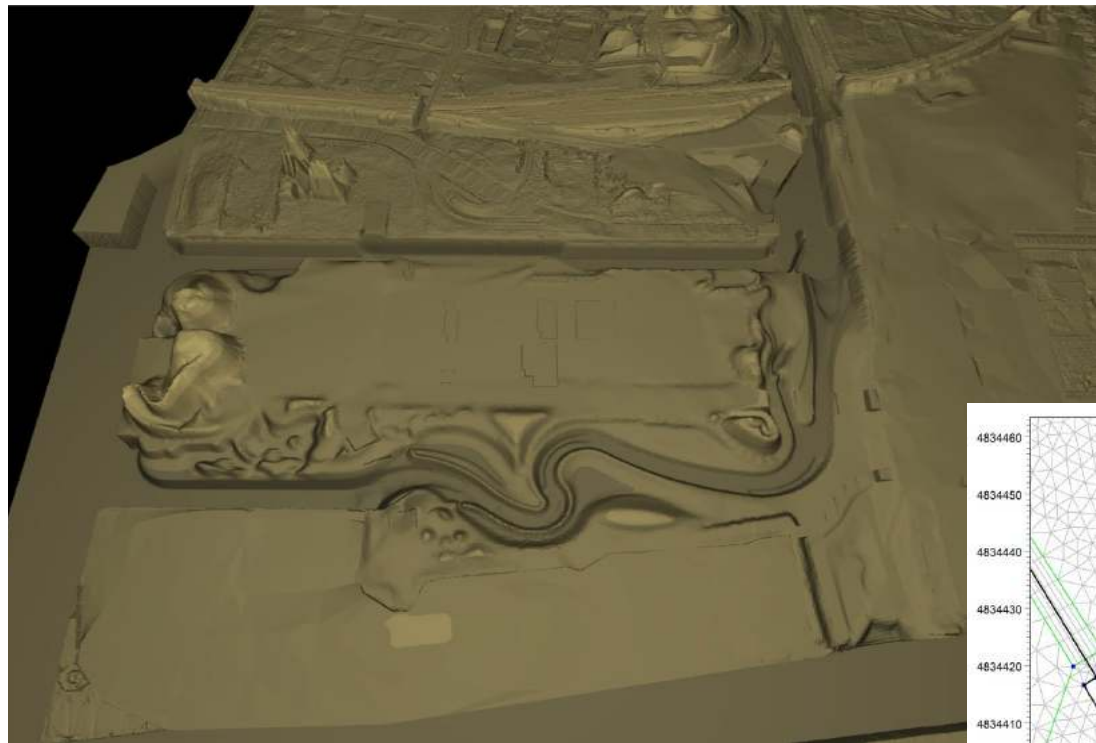


Hydraulics, Hydrology, Morphology and Ecological Design

Extending the Don Valley into the Port Lands

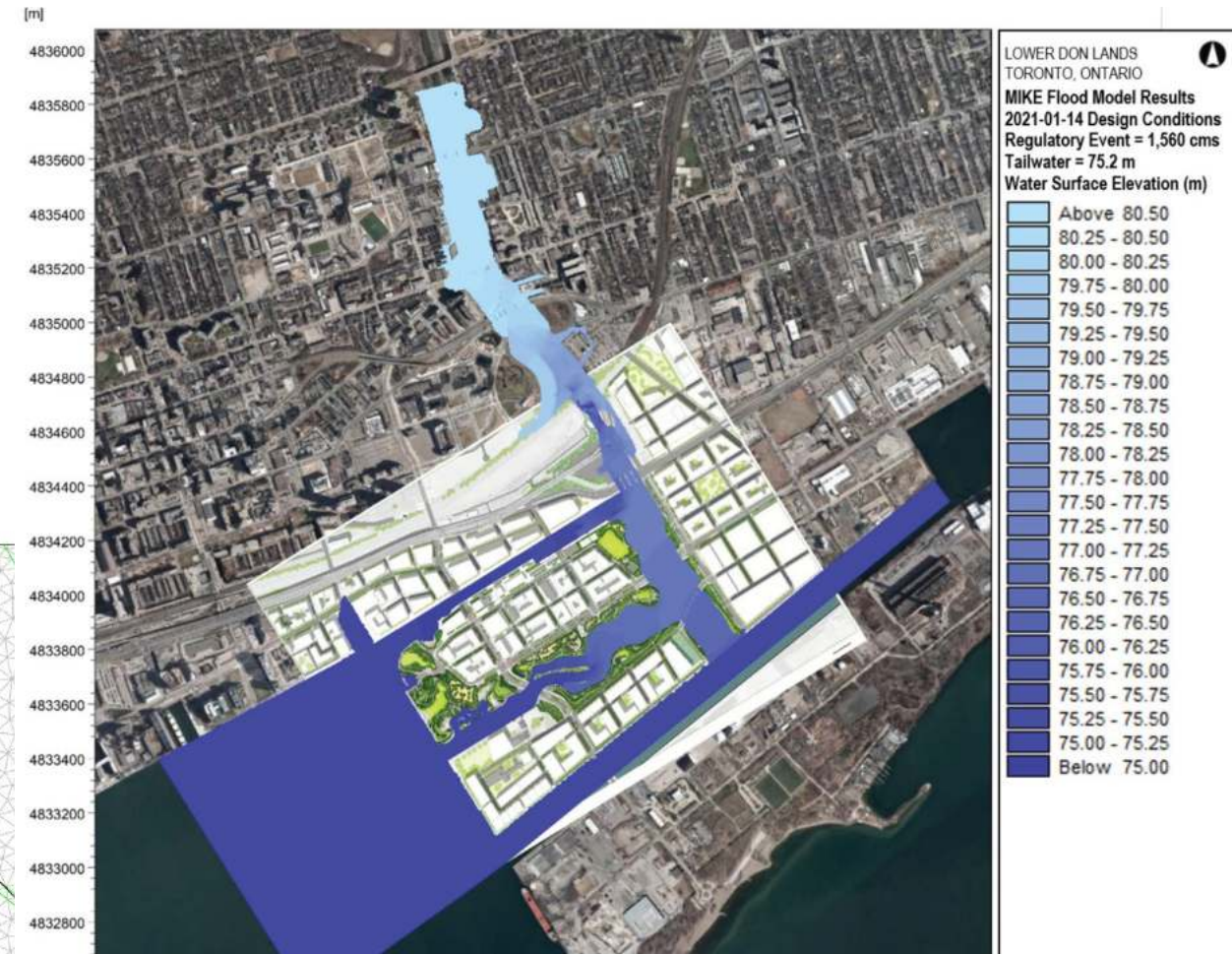
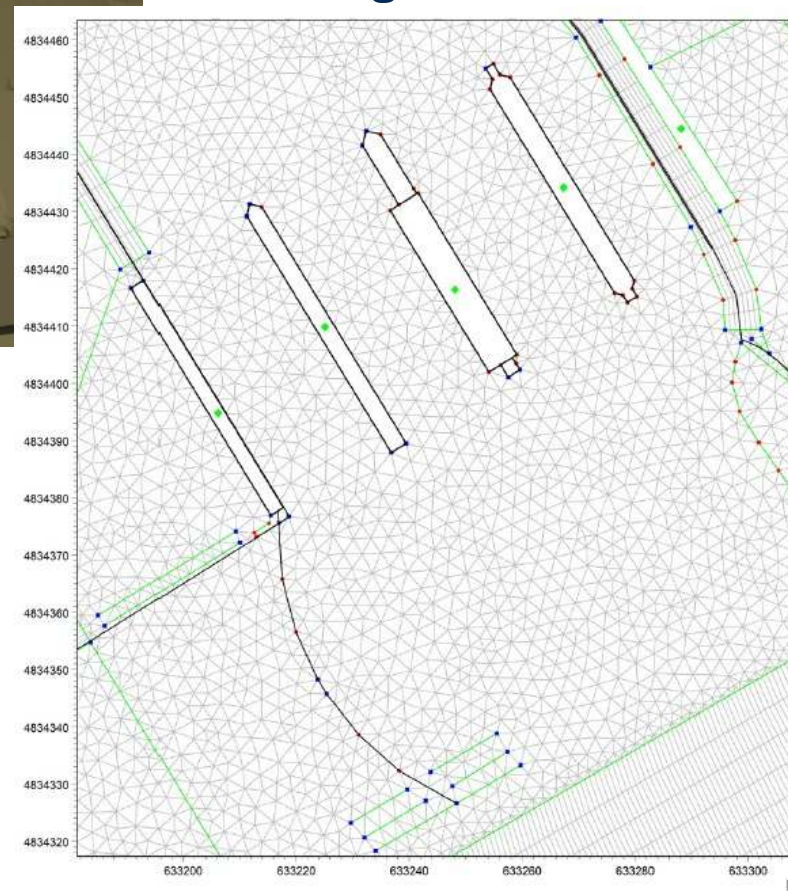


MIKE 21 Hydraulic Model – Confirming Conveyance



Detailed Digital Terrain Model

Building the Model



Model Output - Conveyance

MIKE 21 Hydraulic Model – Inform Ecological Design



Analogous River Mouth Site Visits



Jonathon Kusa,
Interfluve

Nick Nelson,
Interfluve

Brendan Cousino,
LimnoTech

Gord MacPherson, TRCA

Bill Norris,
Interfluve

Emily Alcott,
Interfluve

Tom Sciscione, TRCA

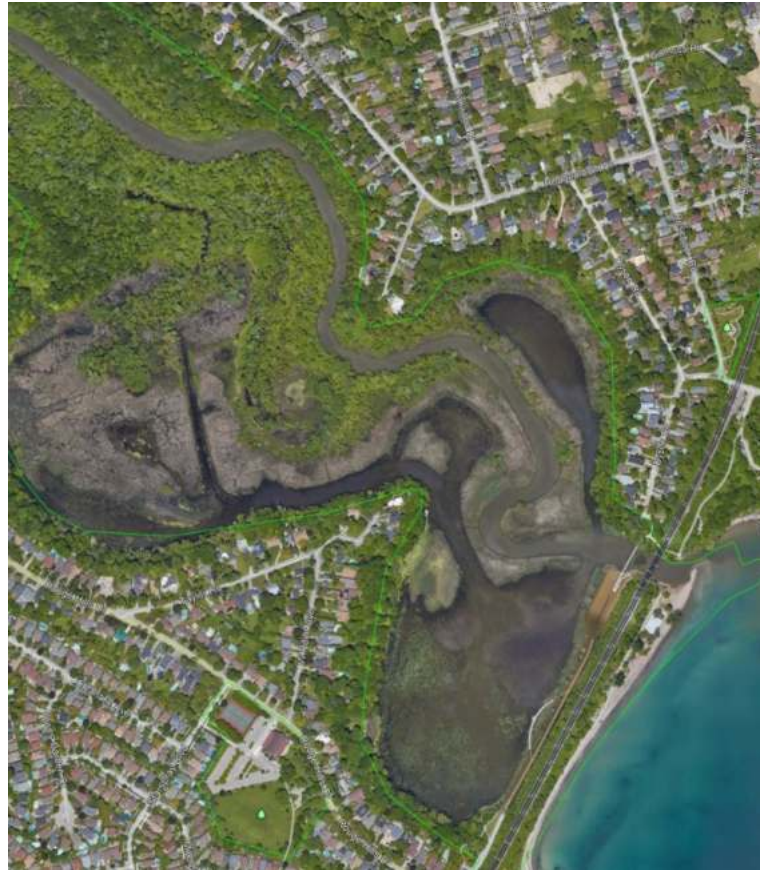
Rick Portiss, TRCA

Neil Budzinski,
MVVA

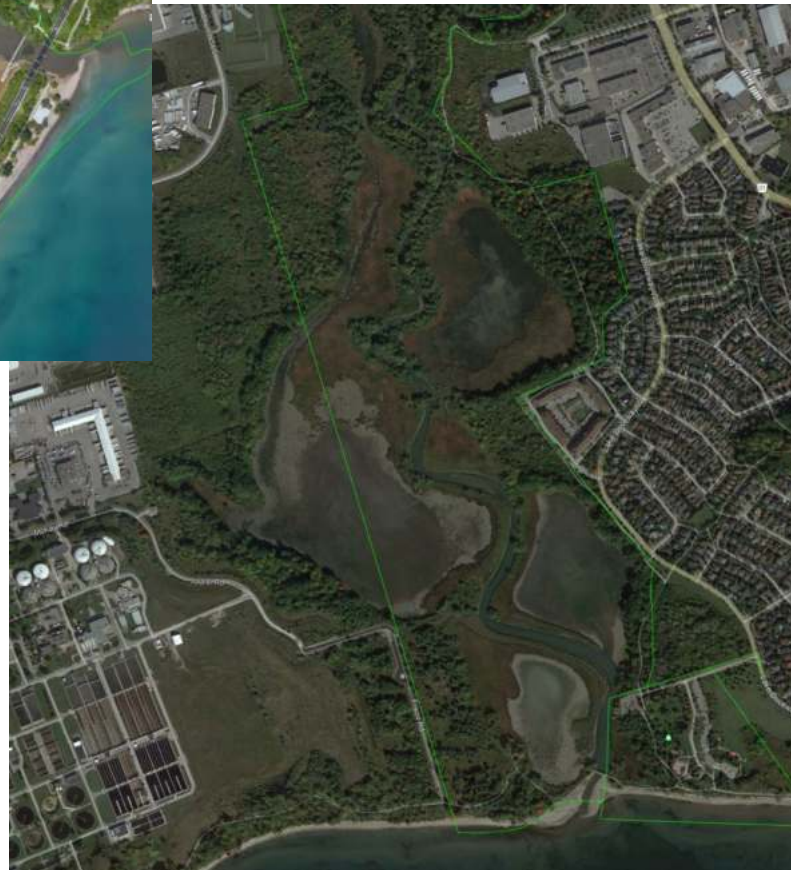
Observations



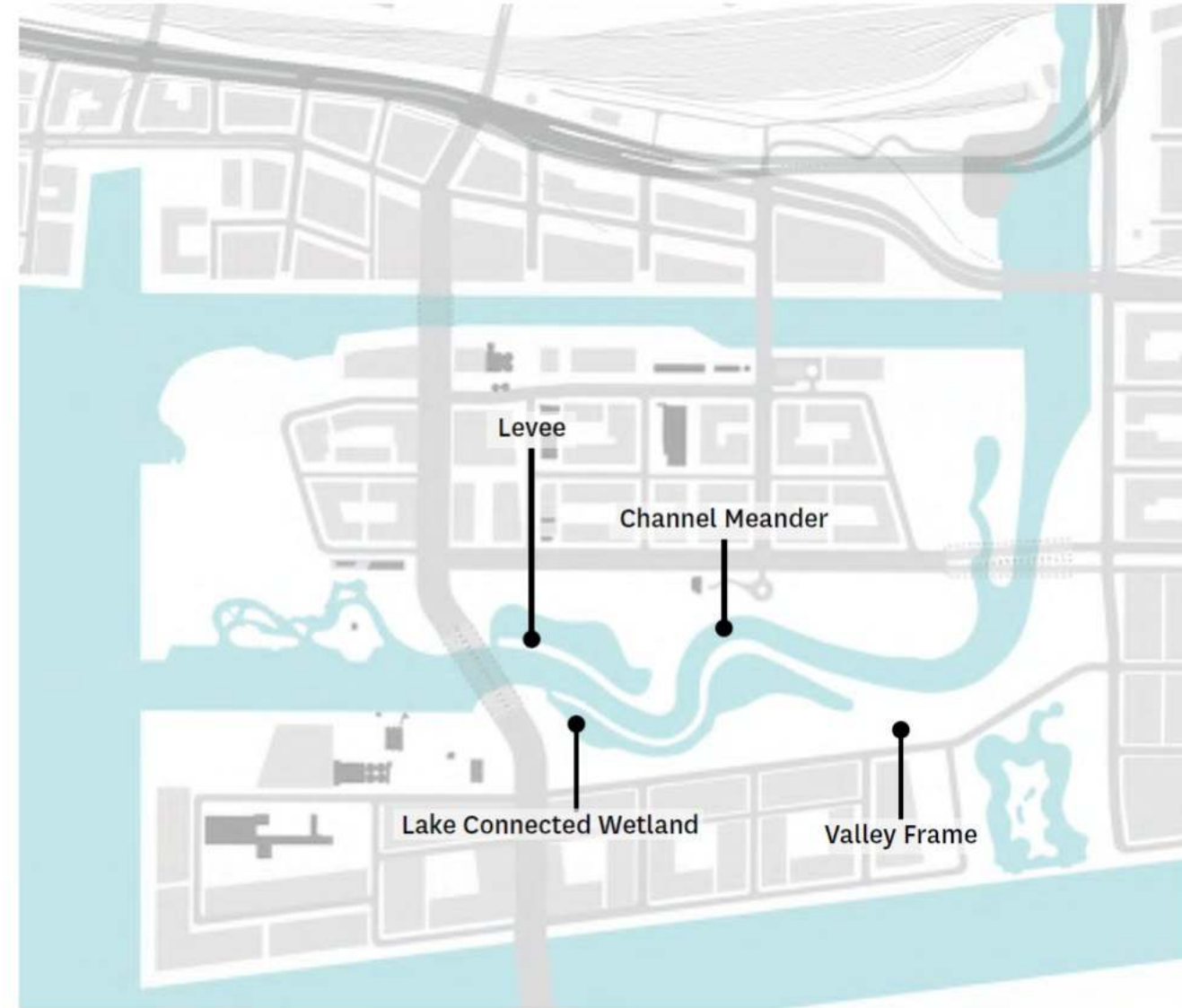
Morphological Studies of Analogous Local Rivers



Rouge River



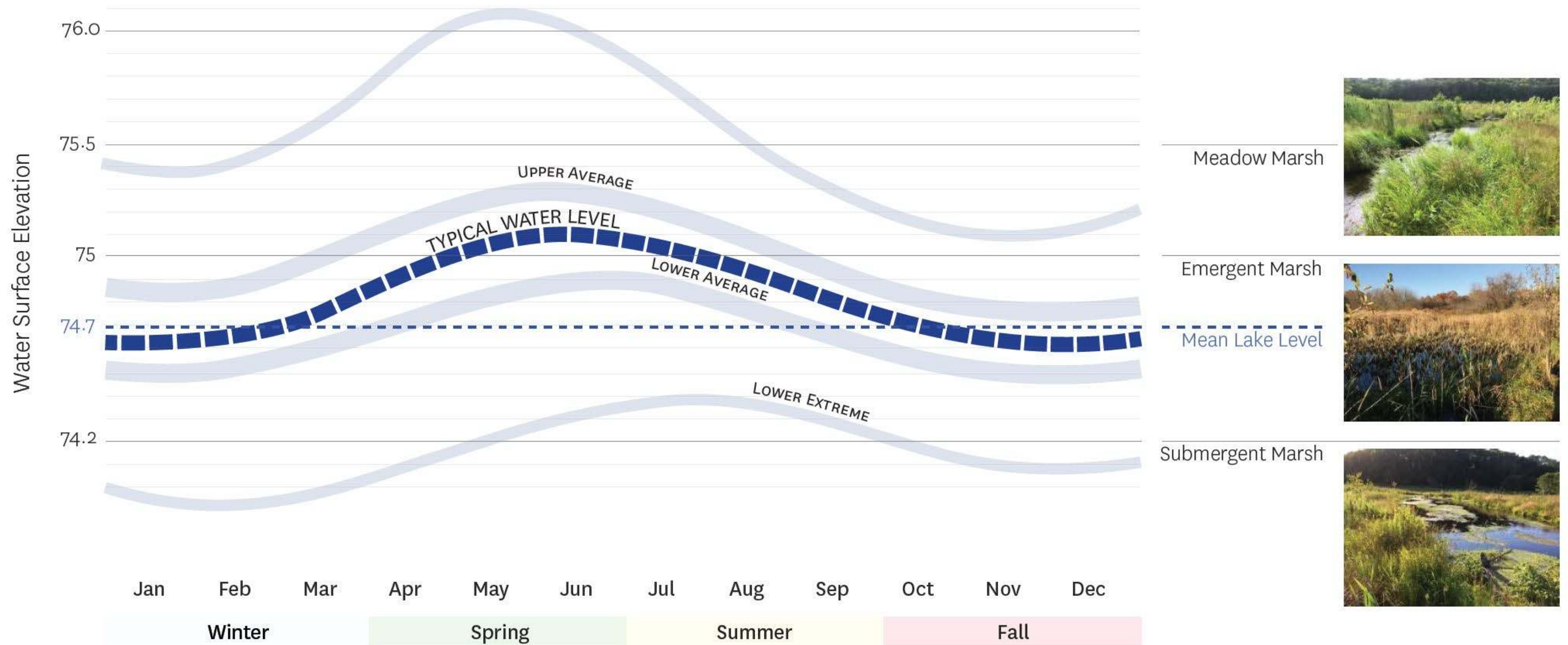
Duffins Creek



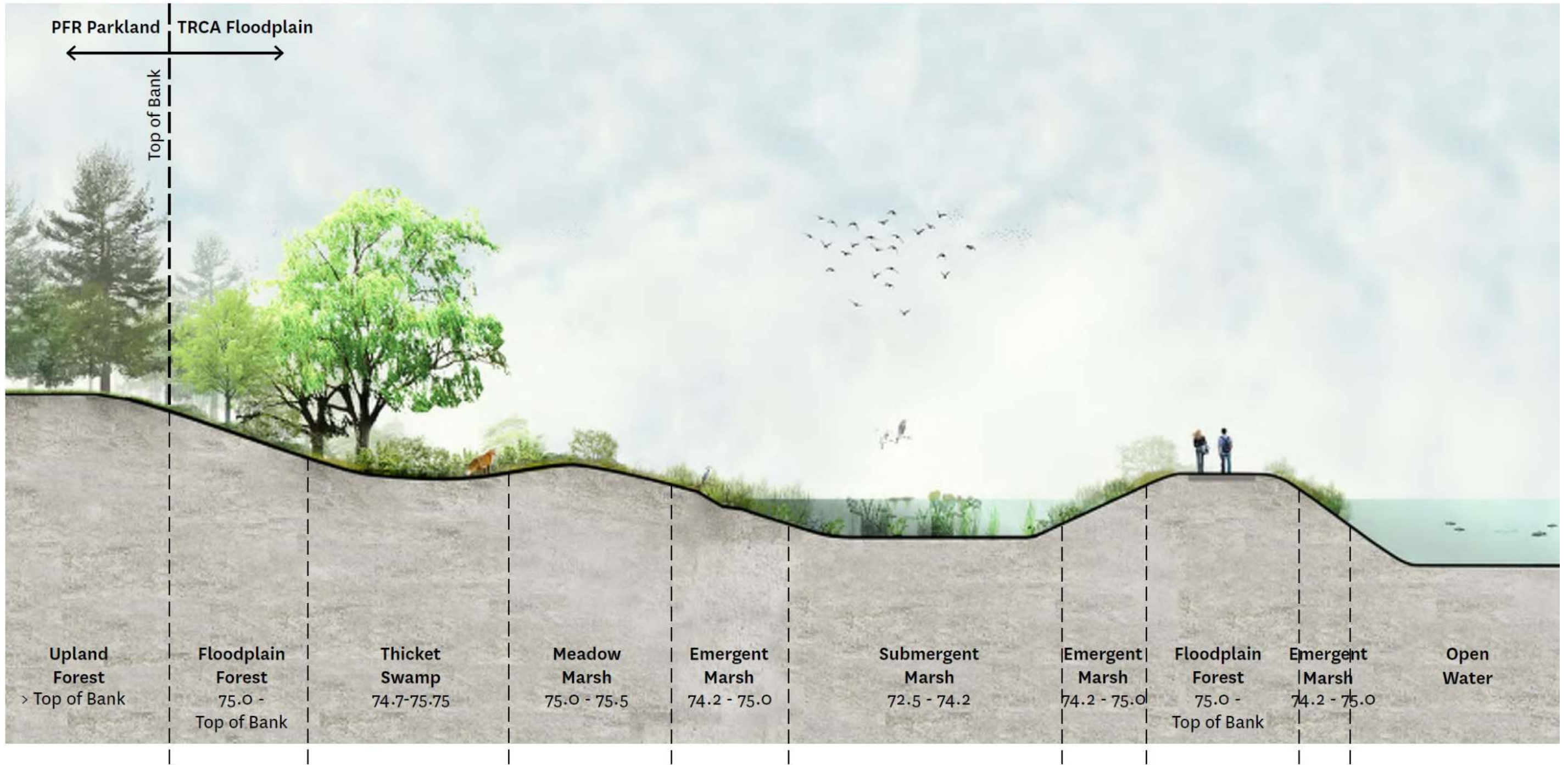
Lower Don River



Lake Ontario Hydrology – Ecological Design



Resulting Habitat Selection



River Ecology: Plant Communities and Habitat



- Submergent Marsh: 72.5 - 74.2
- Emergent Marsh: 74.2 - 75.0
- Meadow Marsh: 75 - 75.50
- Thicket Swamp: 74.7 - 75.75
- Floodplain Forest: 75.0 - TOB
- Upland Forest: >TOB
- Planted Armour Stone
- Vernal Pool
- Nest Boxes
- Turtle Bank Habitat
- Anchored Wood Habitat
- Nesting Platform
- Top of Bank (TOB)



River Plantings



Port Lands Flood Protection – Historical Plant Species



meters above sea level



81.0

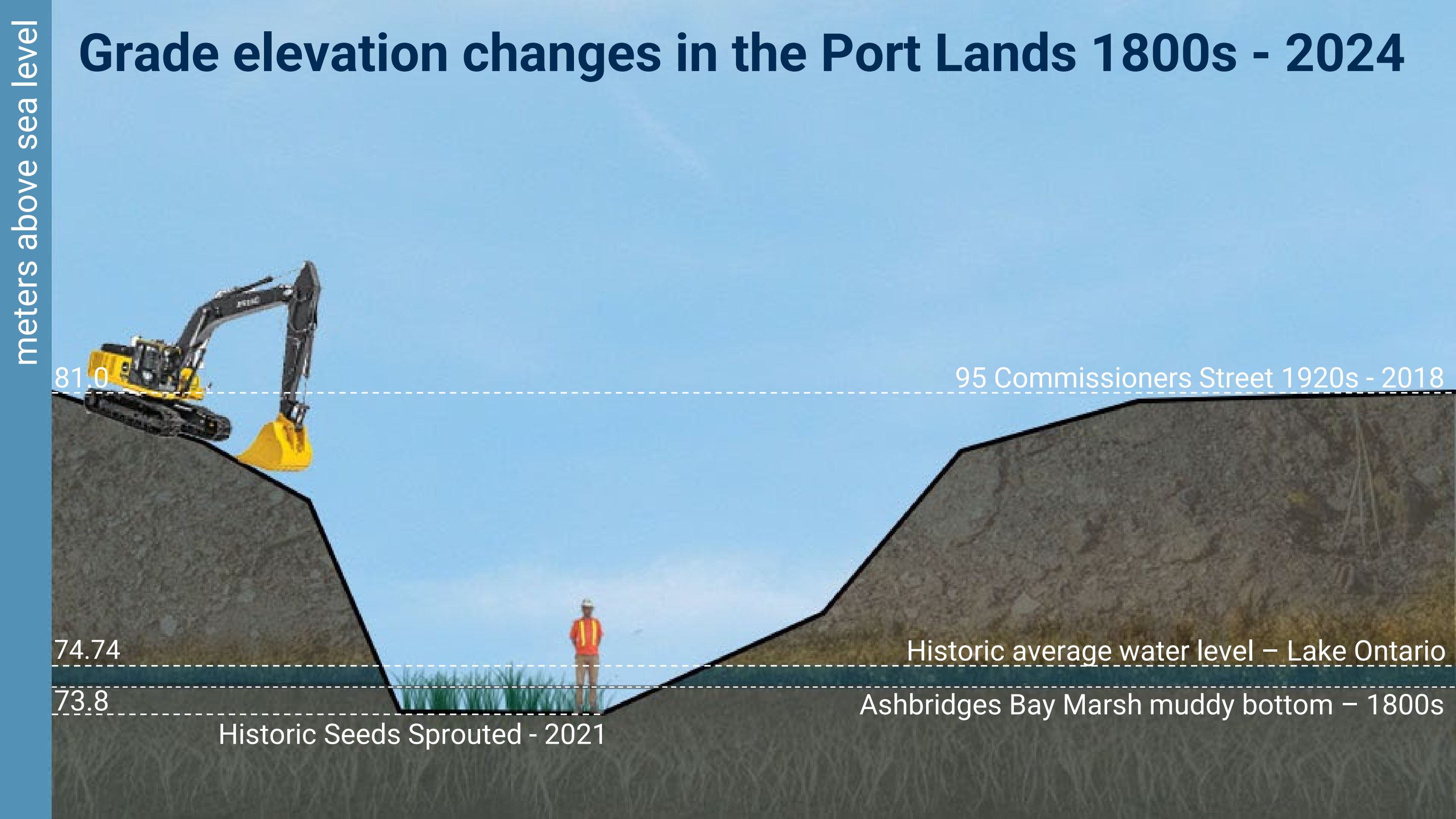
95 Commissioners Street 1920s - 2018

74.8

Historic average water level – Lake Ontario

Ashbridges Bay Marsh muddy bottom – 1800s

Grade elevation changes in the Port Lands 1800s - 2024



Habitat



WATERFRONT
Toronto

Aquatic



Submergent Marsh



Meadow Marsh



Floodplain Forest



Fauna

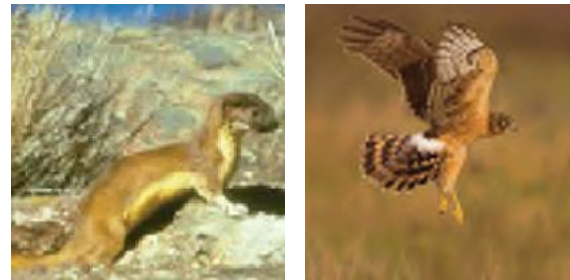
Aquatic



Submergent Marsh



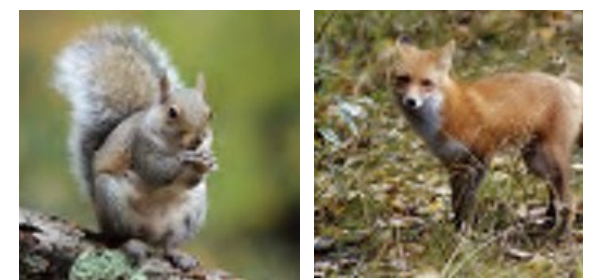
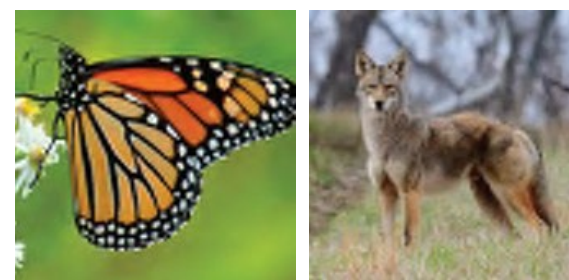
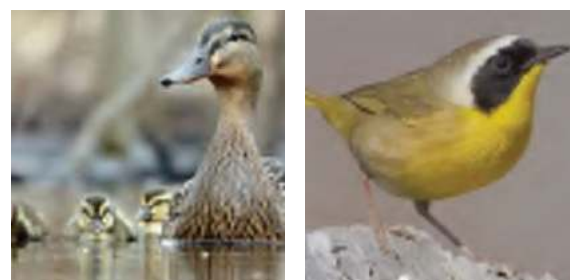
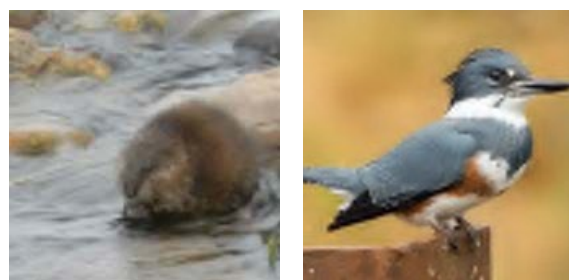
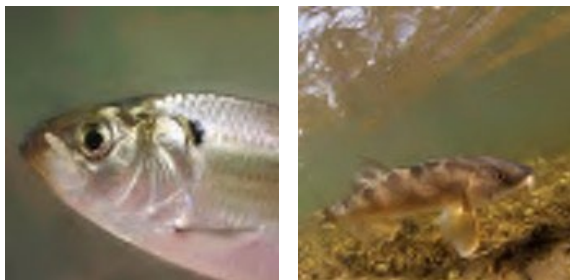
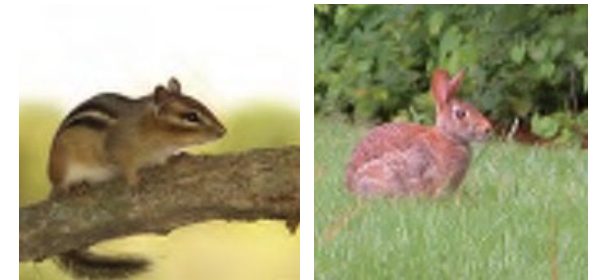
Emergent Marsh



Meadow Marsh



Floodplain Forest



River Ecology: Constructed Habitat



Bird Boxes



Anchored Wood



Osprey Platforms



Turtle Habitat

Urban Context: Designing a Downtown River

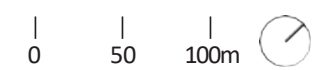
River Programming – Full Vision



- New Building
- Playscape
- Court Sports
- Dogs Off Leash Area
- Overlook
- Picnic Area
- Urban Promenade
- Plaza
- Event Lawn
- Passive Use Lawn
- Multi-use Field
- Rocky Harbour Edge
- Submergent Marsh
- Emergent Marsh
- Meadow Marsh
- Thicket Swamp
- Vernal Pool
- Planted Armour Stone
- Wooded Upland
- Floodplain Forest
- Gravel Beach



- Fishing Node
- Water Taxi Landing
- Nature Exploration
 - Nature Trail
 - Snowshoeing
 - Cross Country Skiing
- Canoe/Kayak Access
- Bird Watching
- Overlook
 - Eco Education / Interpretation



River Valley and Forest Frame



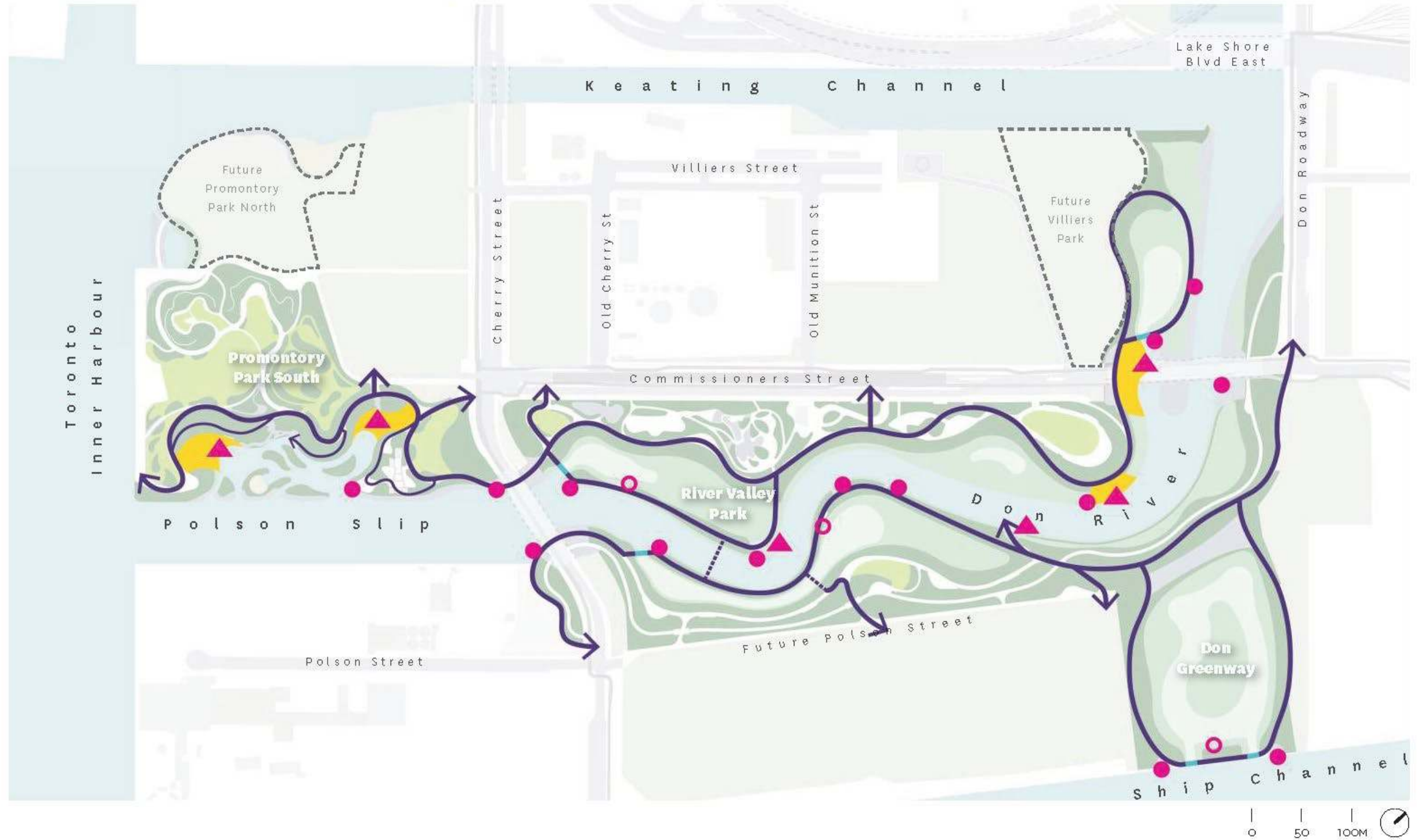
Creating a Park within the Forest Frame

- Mixed Forest
- Grove
- Glade
- Entry Garden
- Lawn
- Floodplain
- Hedgerow






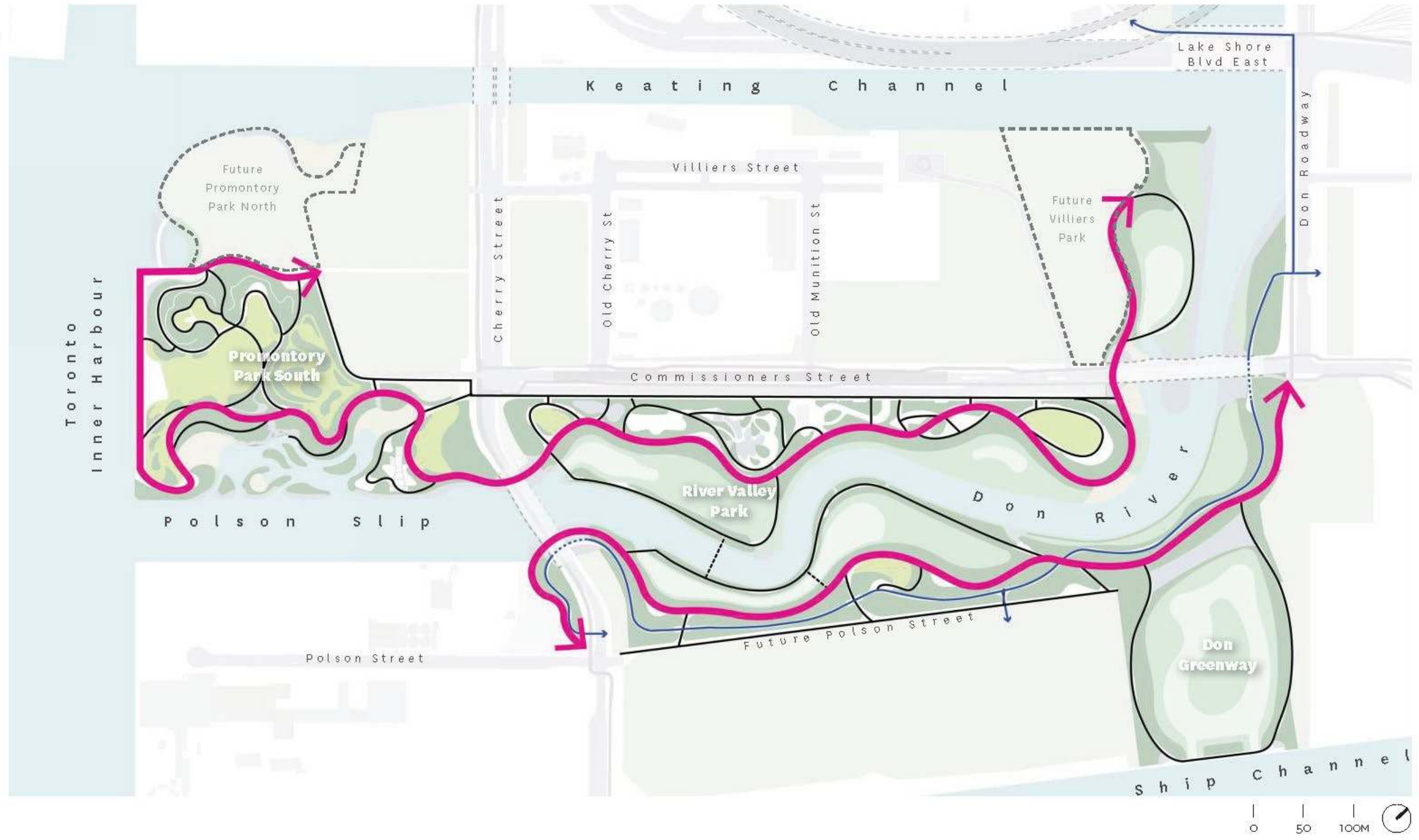
Providing Access to the Waters Edge

- ➔ Rivers Edge Path
- Boardwalk/Footbridge
- Fish Gate
- Gravel Beach
- ▲ Water Recreation Access Point
- Fishing Node
- Overlook



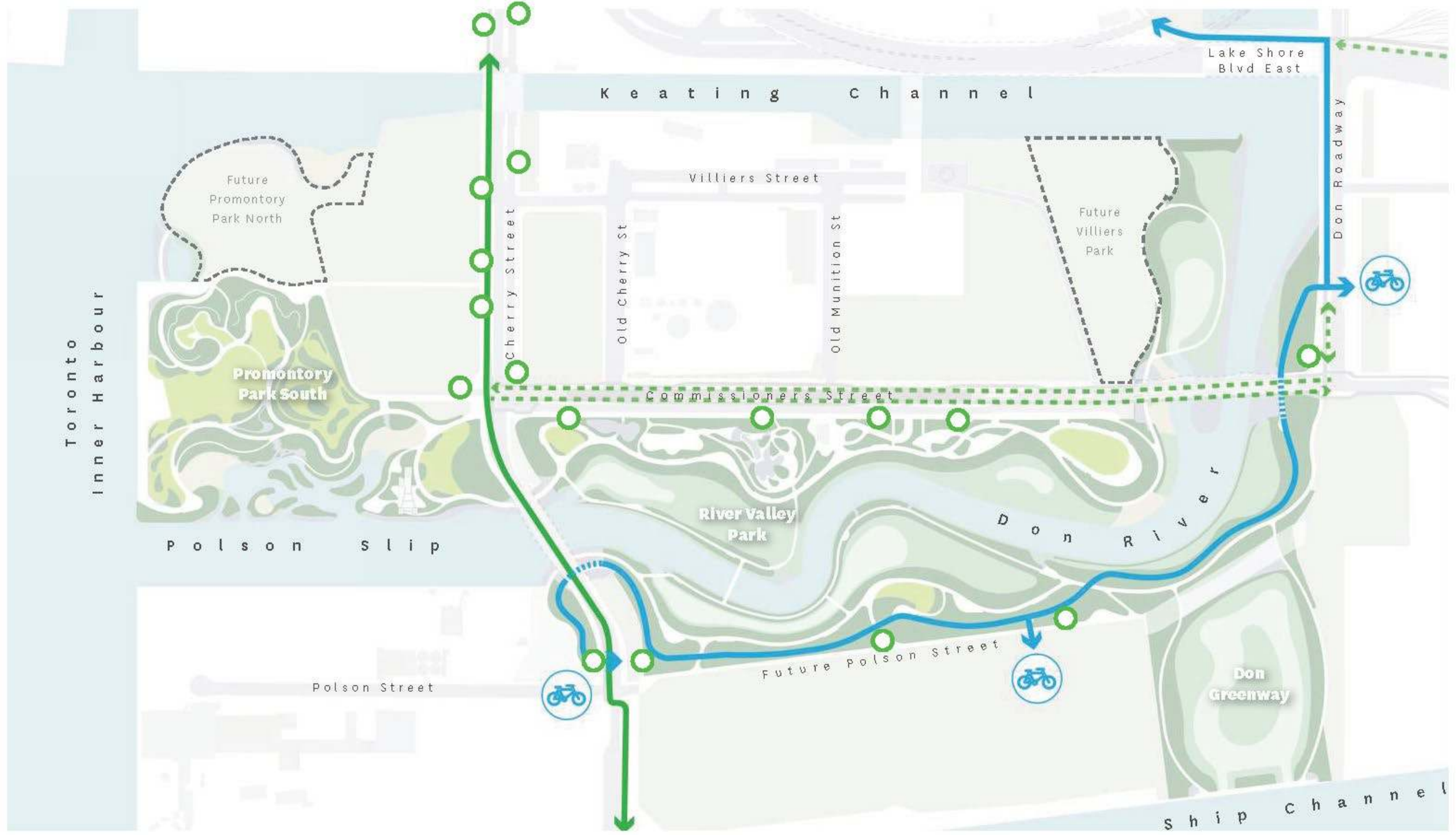
Two Primary Paths of Park Circulation

-  Main Path / Hallway 5-6m
-  Secondary Paths: 3-4m
-  Lower Don Trail: 3.6m



Connecting to the City through the Cycling Network

- Lower Don Trail
- Bicycle Entrance
- Martin Goodman Trail
- Commuter Bike Lane
- Proposed Bike Parking



Program Opportunities at Don River Valley



Nature Trails



Boardwalks



Gravel Beaches



Fishing



Picnics and Fire Pits



Cross Country Skiing



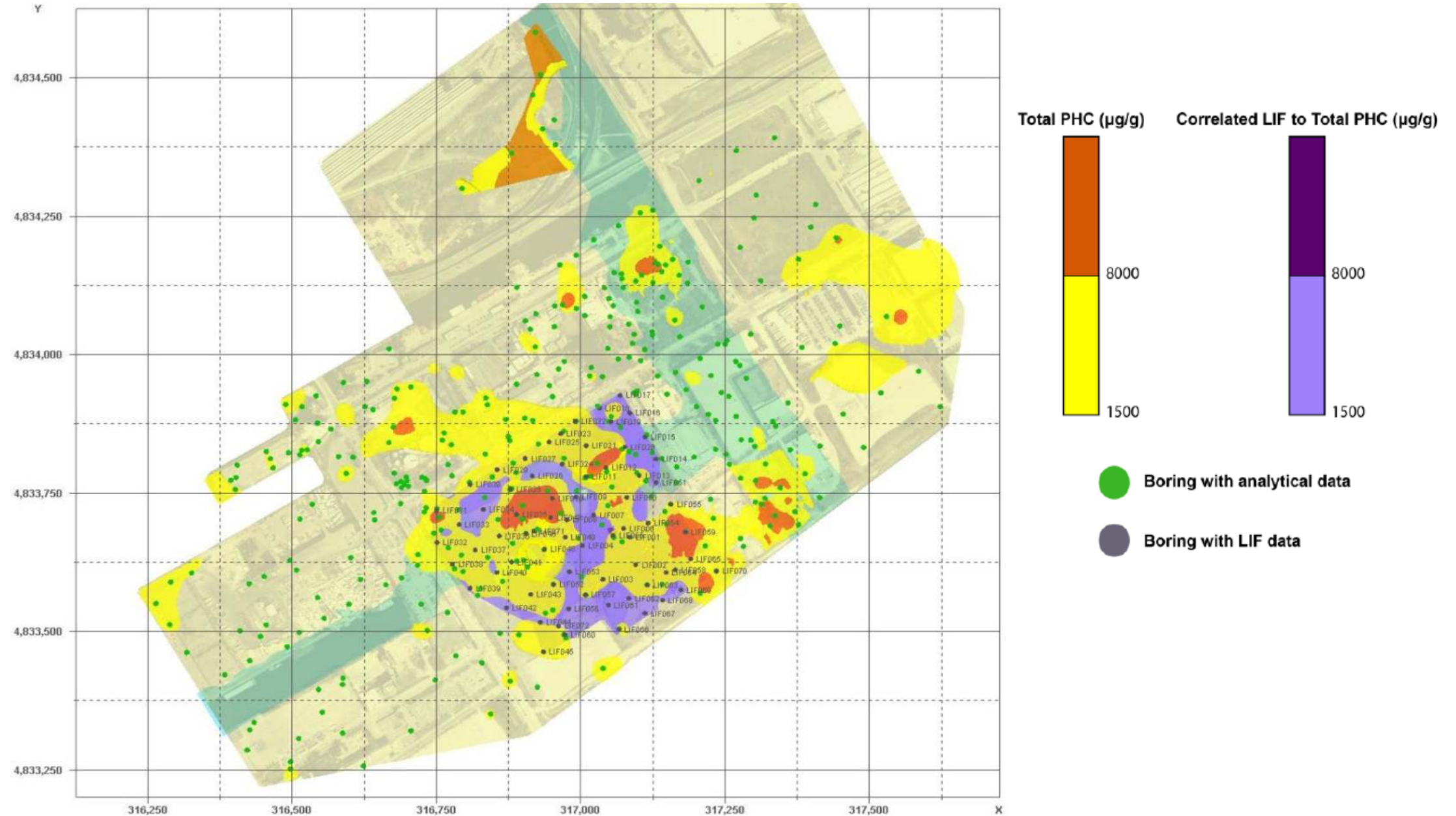
Aquatic Research



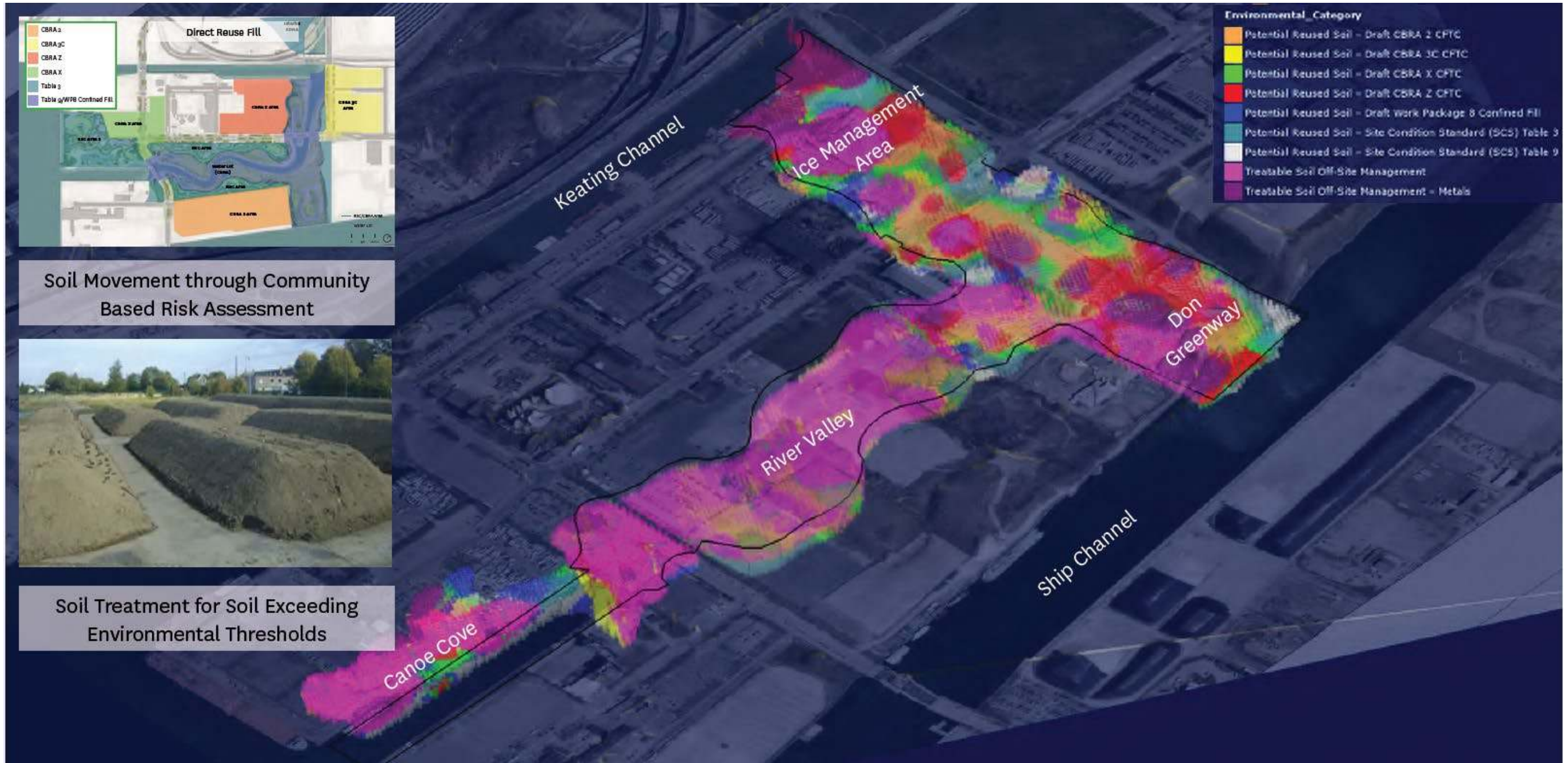
Canoe/Kayak Access

Sustainable Design - Environmental






Intensive Subsurface Environmental and Hydrogeological Studies

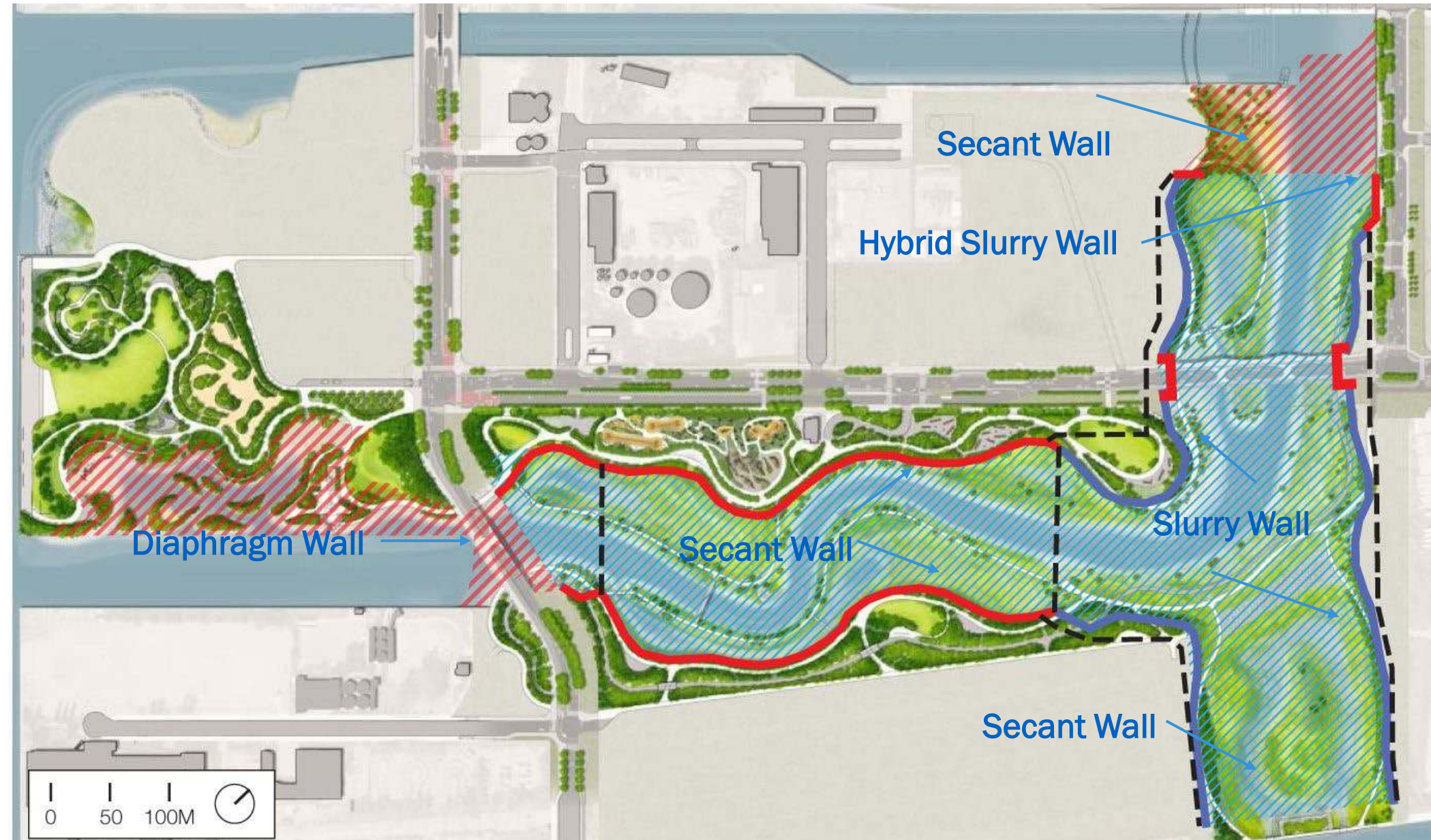


Community Based Risk Assessment (CBRA)



Cut Off Walls - Overview

-  Structural Cut Off Wall/
Vertical Barrier
-  Clay Plug Wall
Vertical Barrier
-  Non-Structural
Cut-Off Wall
-  Subaqueous Horizontal
Barrier
-  Geosynthetic Clay Liner
Horizontal Barrier

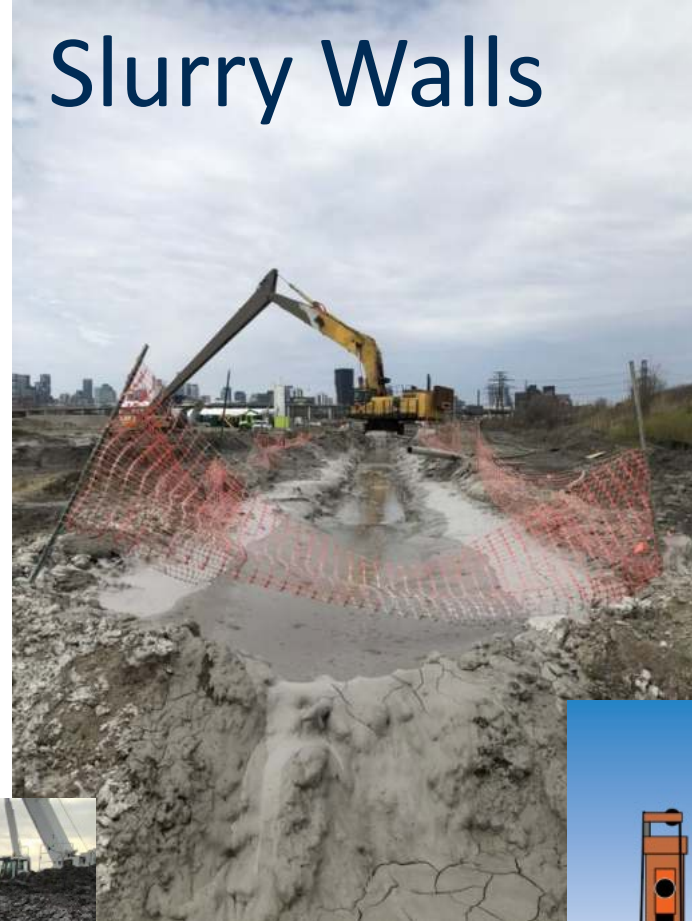


Cut Off Walls

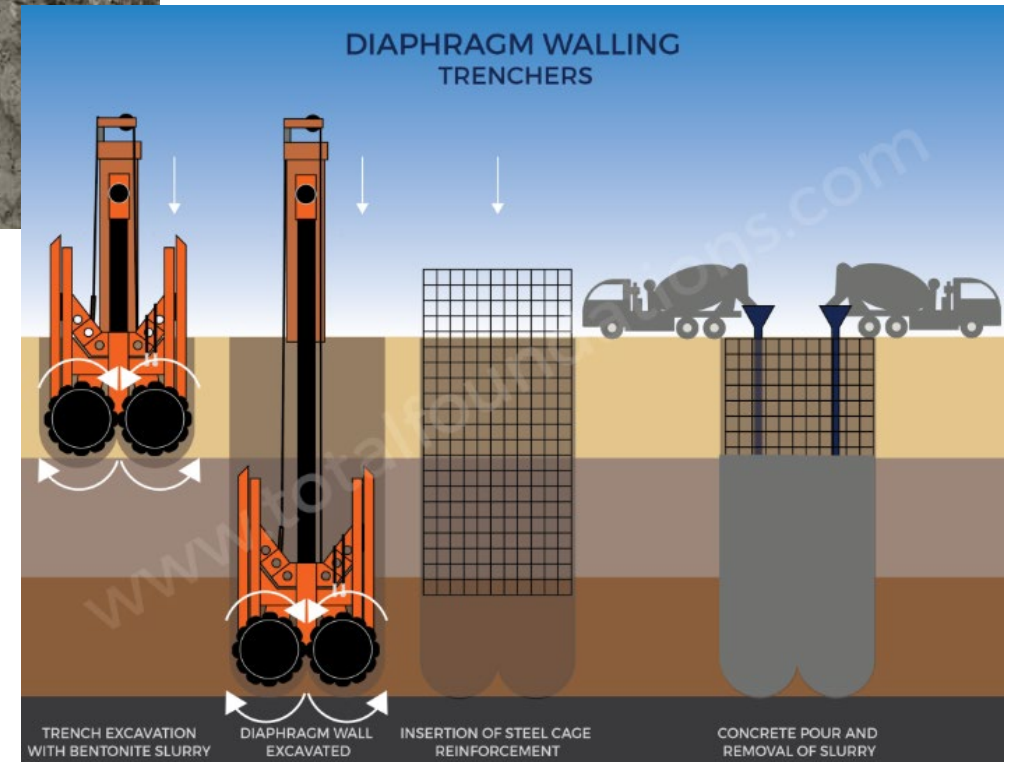
Secant Piles



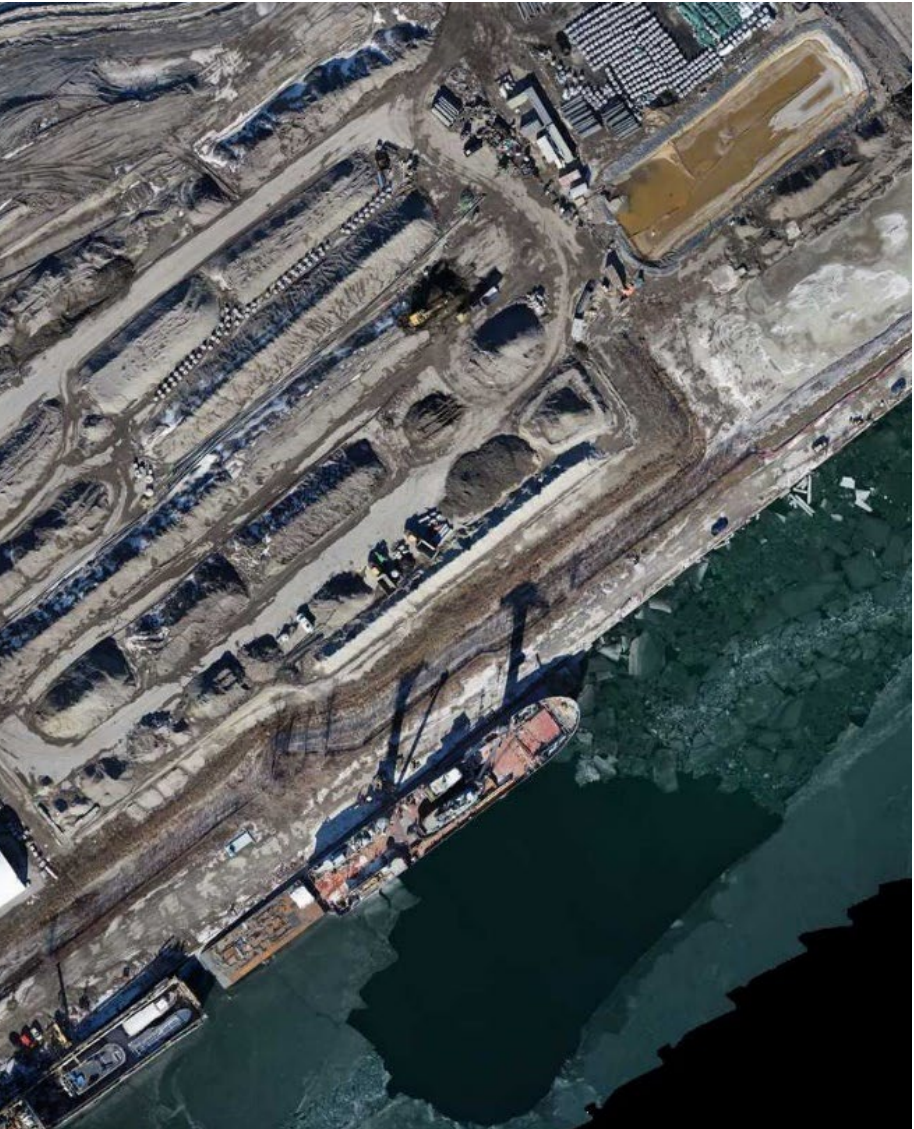
Slurry Walls



Hybrid Slurry Walls



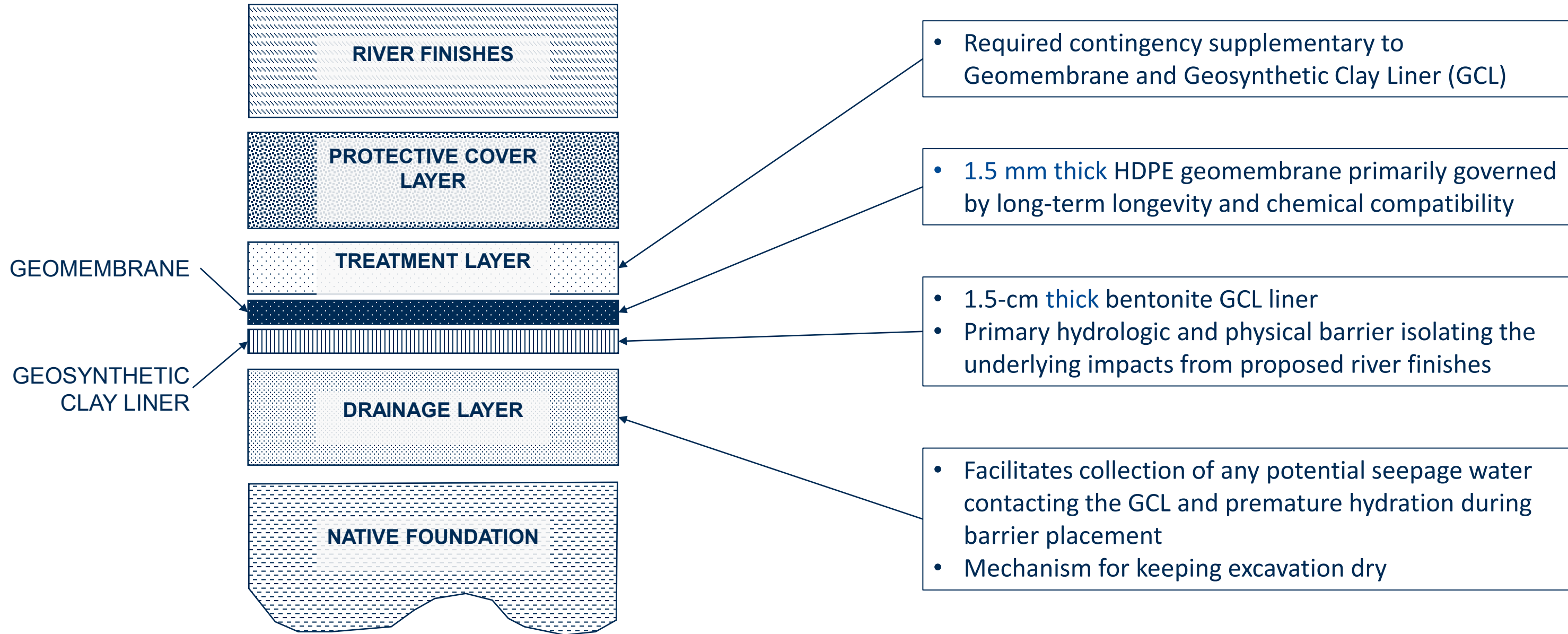
Soil Remediation – Bioremediation



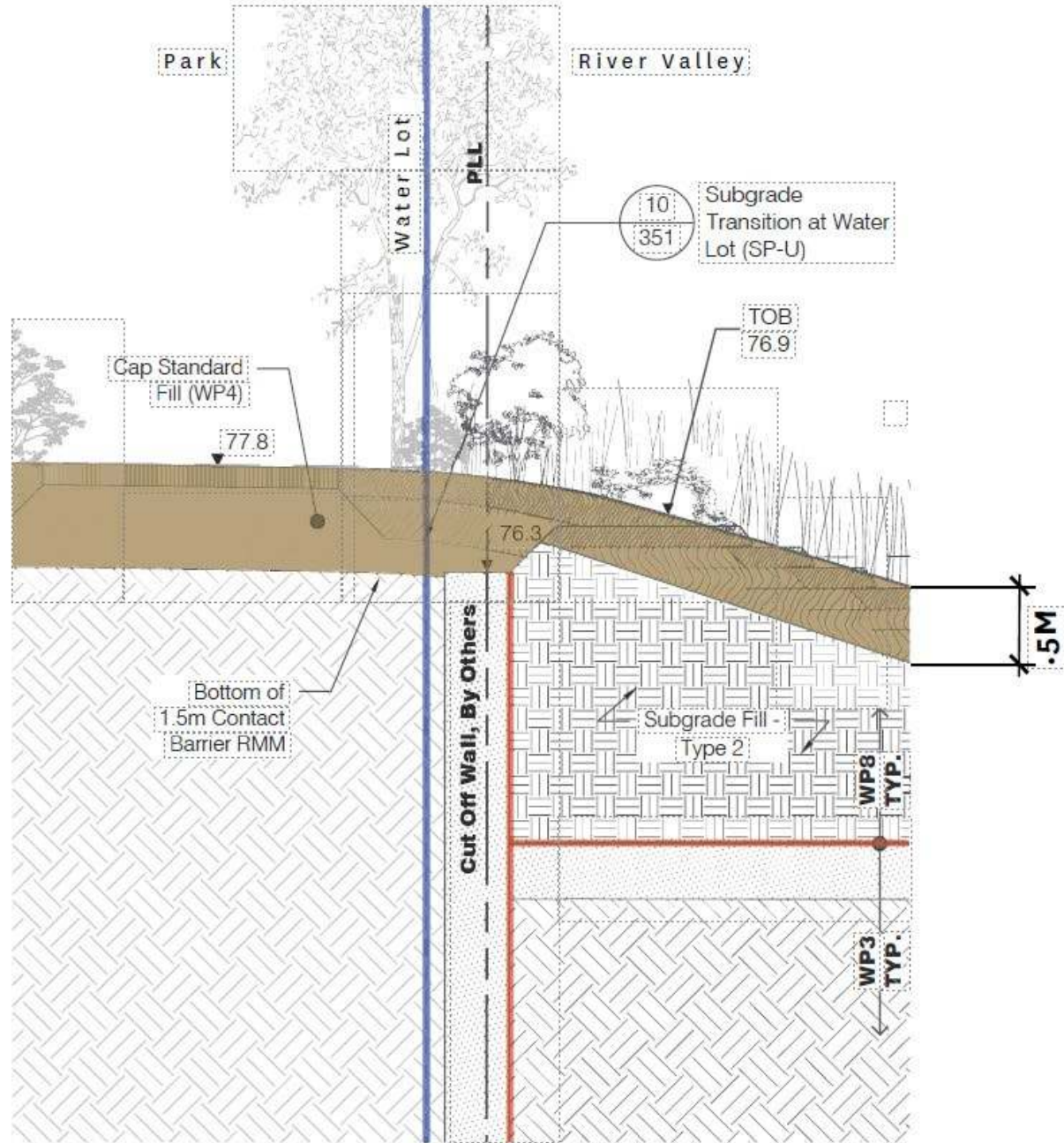
Water Management – Water Treatment System



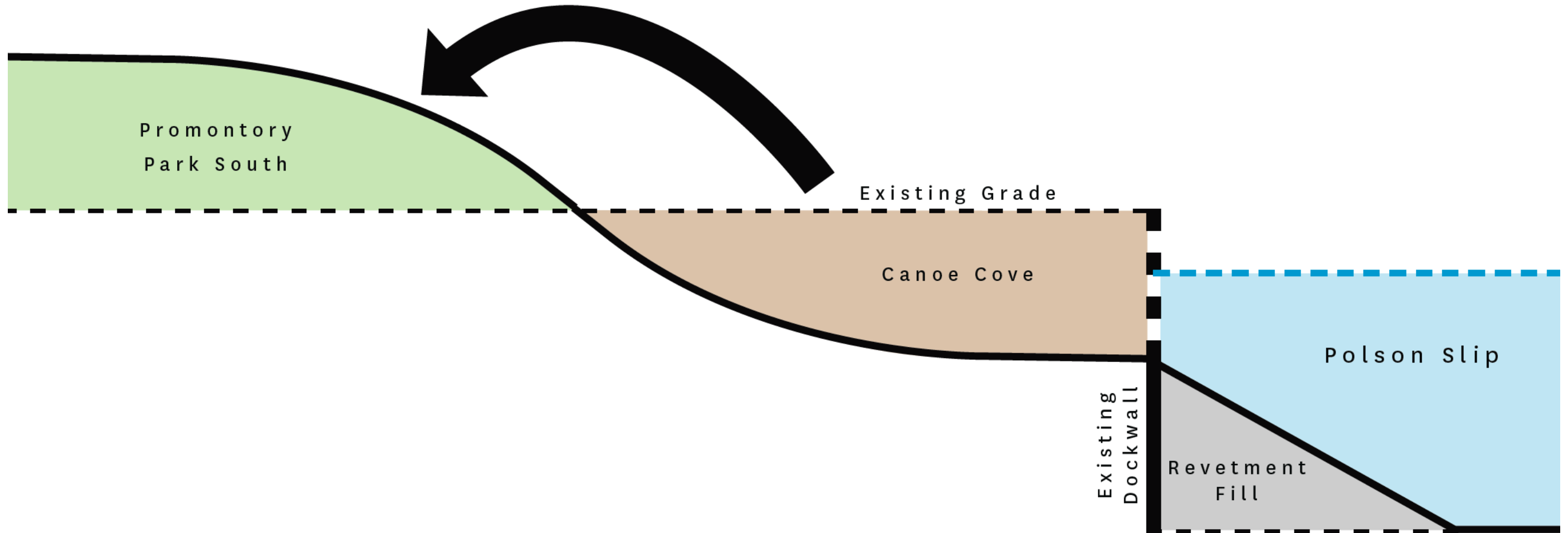
Horizontal RMM – Layer Configuration



Layering the Cake



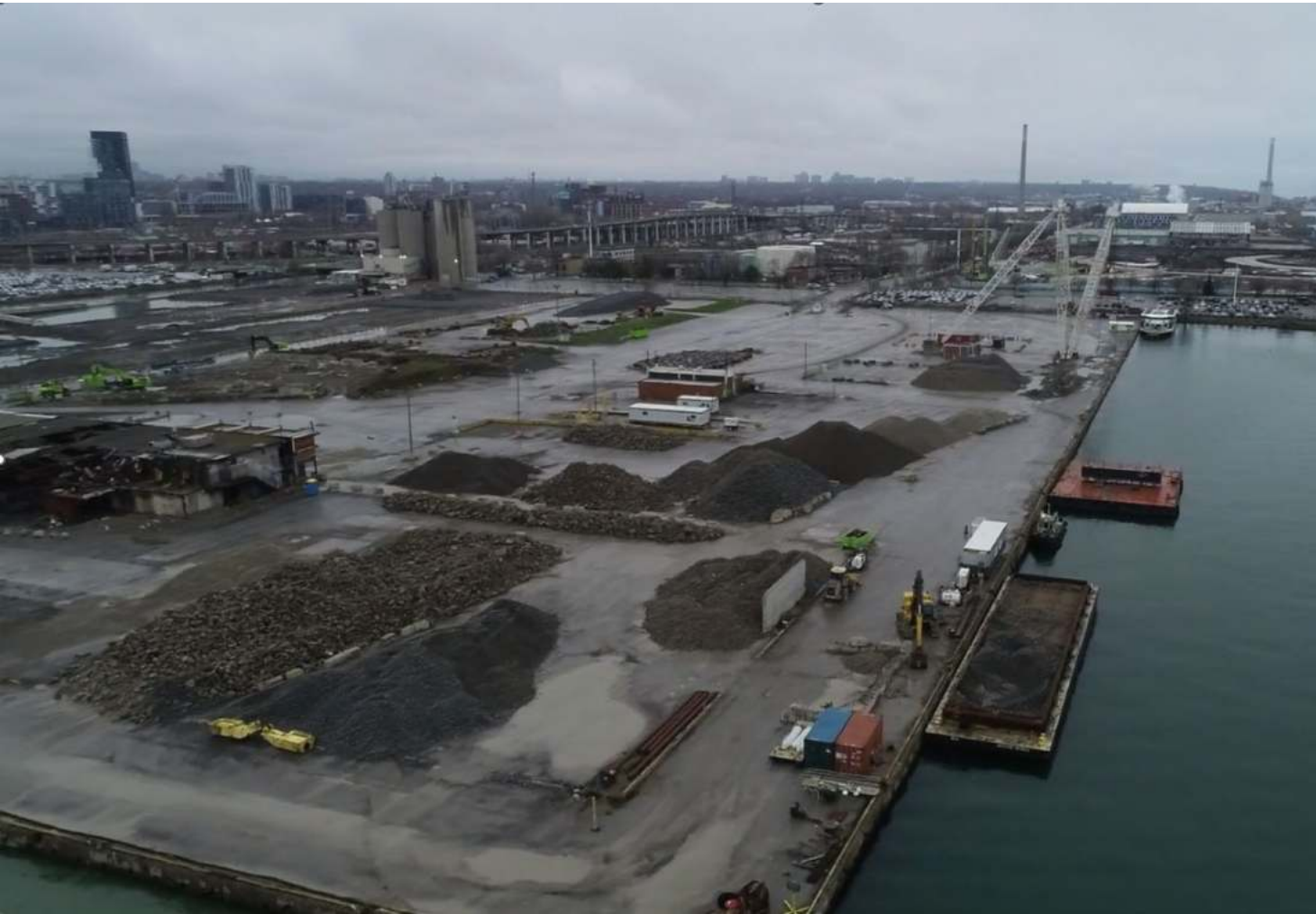
Direct Reuse of Available Soils



Conceptual Grading for Promontory Park



Canoe Cove



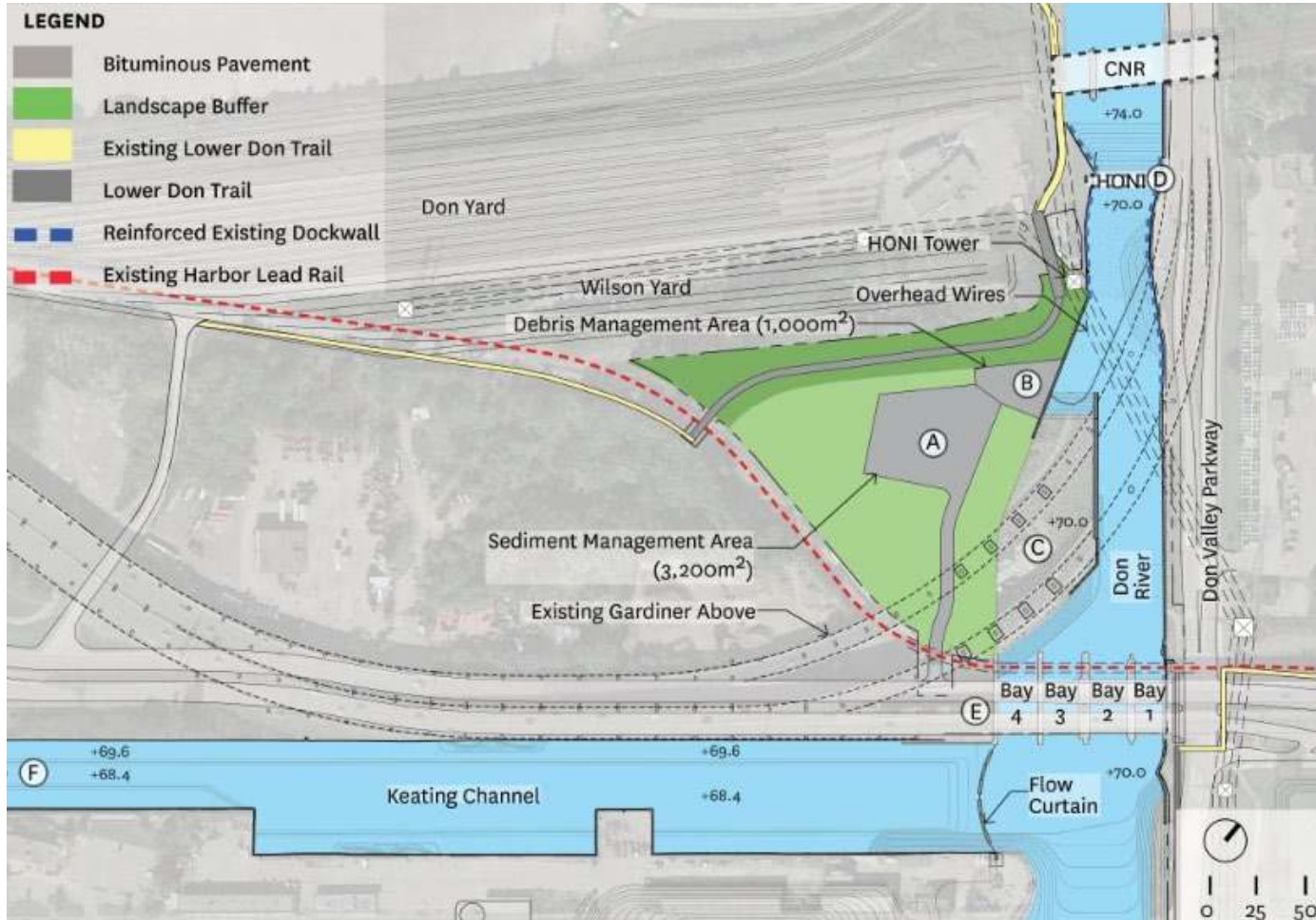
2019



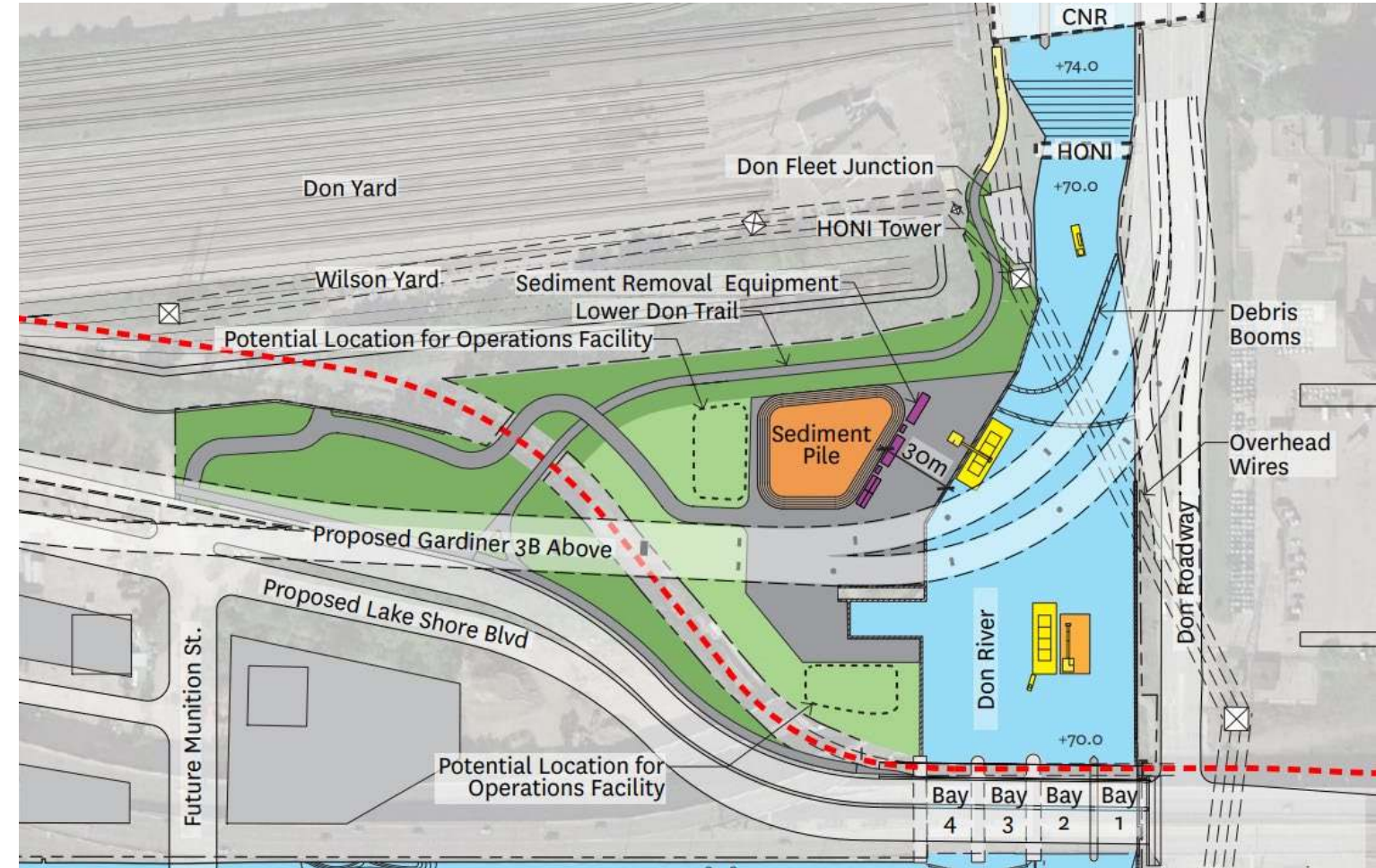
2024

Sediment Management

Sediment and Debris Management Area

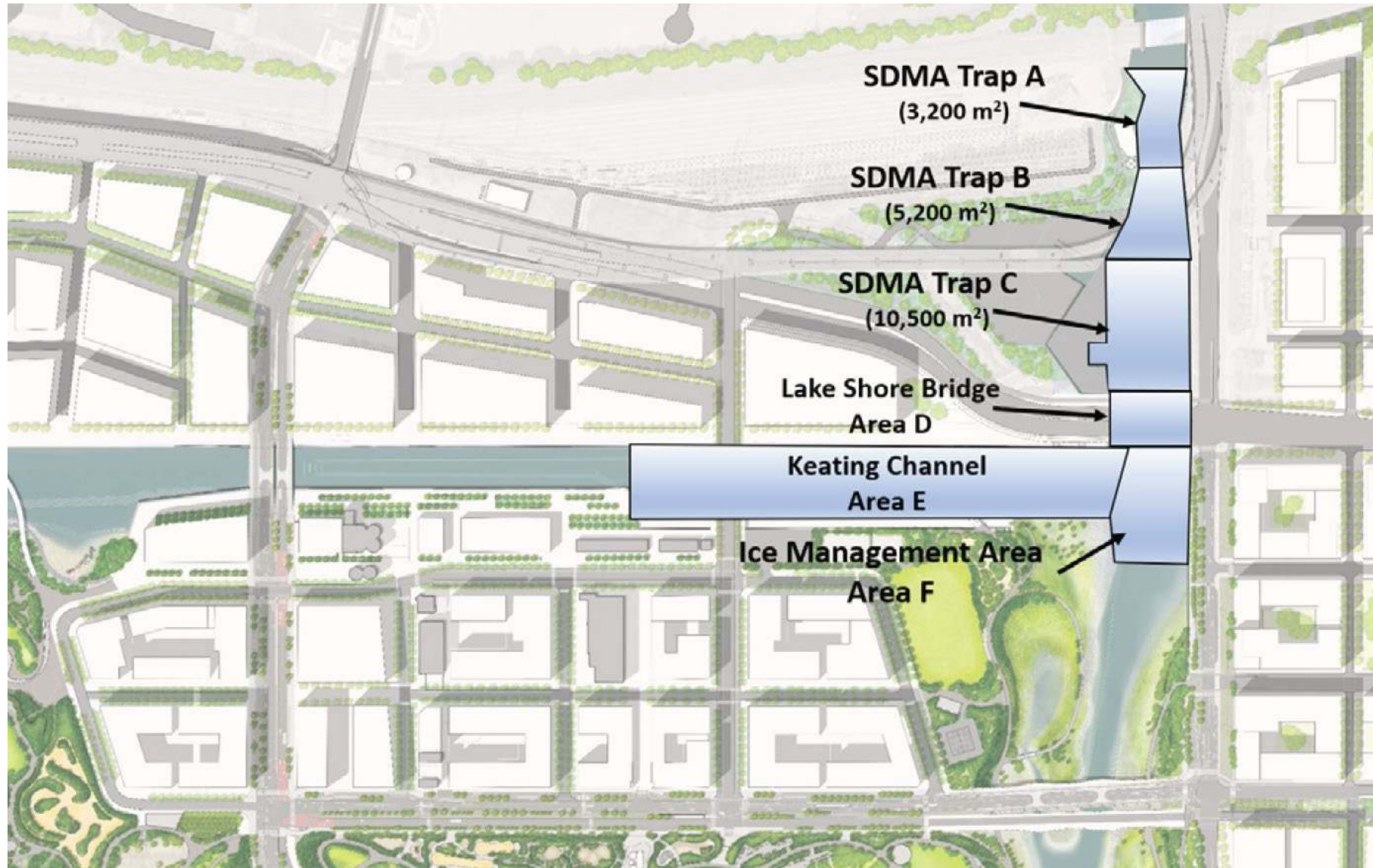


Interim (End of PLFP)



Full SDMA – Post Gardiner Relocation

Sediment Trap Analysis



Future SDMA Management Considerations

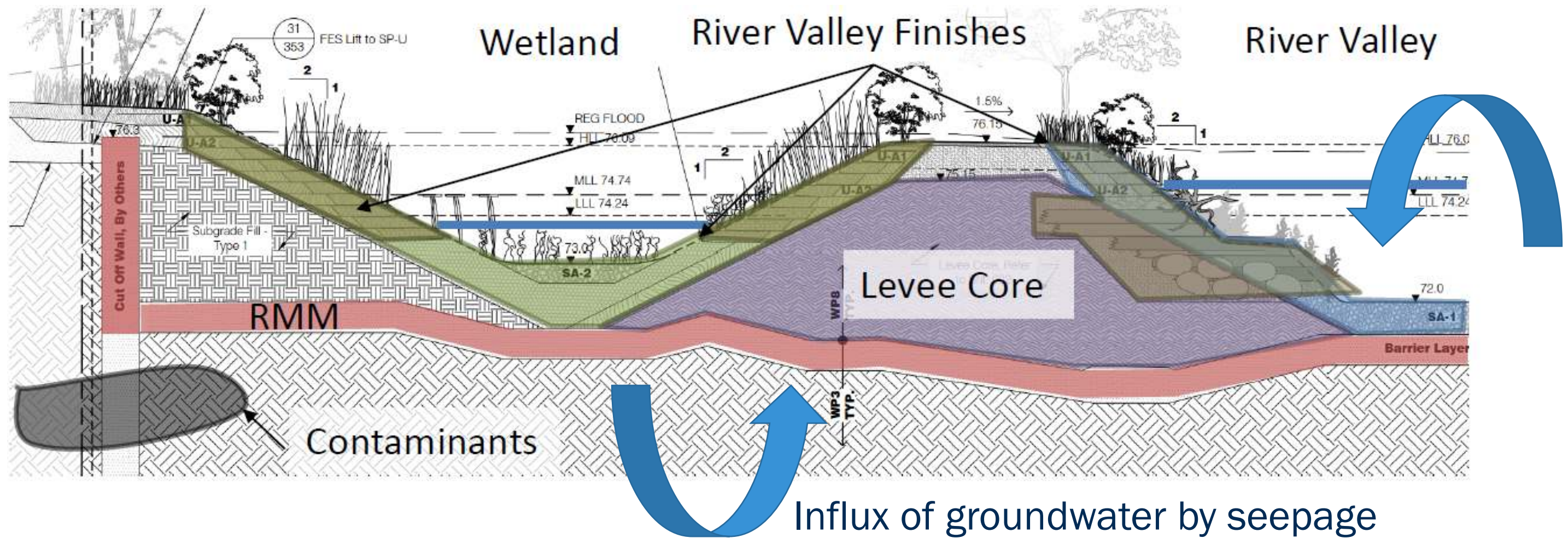


- Hydraulic dredging, dewatering, sorting and reuse
- Manual dredging, dewatering, stabilization (in the form of bricks and blocks) and reuse
- Hydraulic or manual dredging and pumping (submerged pipes) to Tommy Thompson Park Cell 3
- Bedload interceptor system

River Inundation Process

River Inundation – Sequenced Flooding

Filling of river valley with lake water



River Inundation – Sequenced Flooding

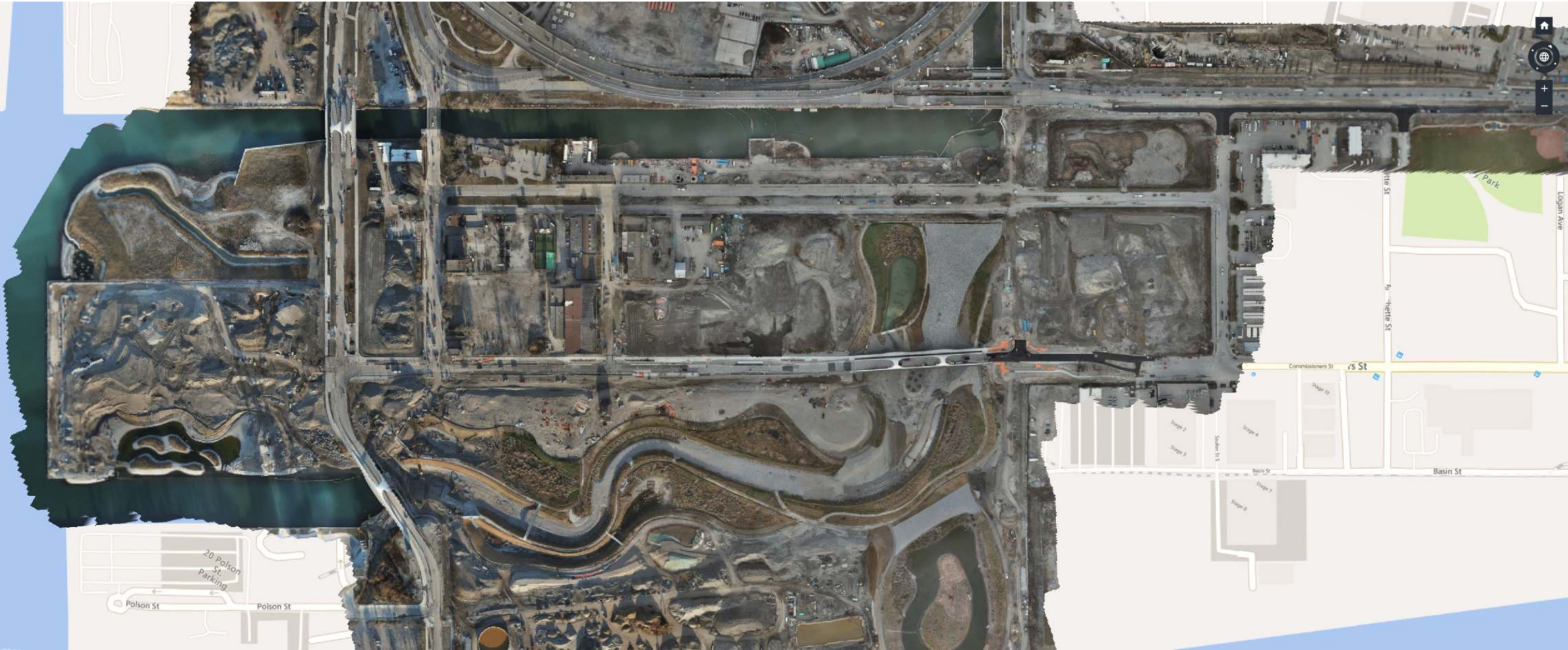


Project team not totally sure
if water was flowing yet



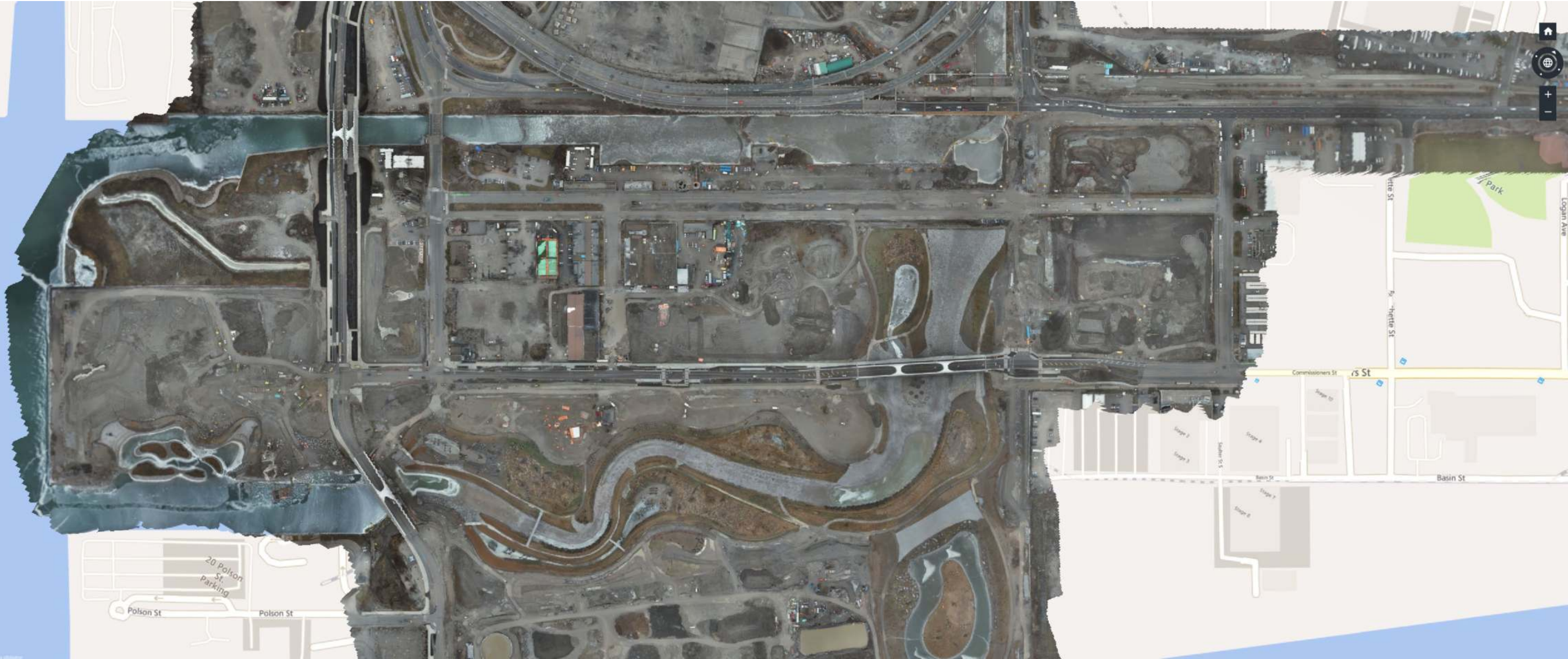
Water trickling into the
new river

River Inundation – Sequenced Flooding



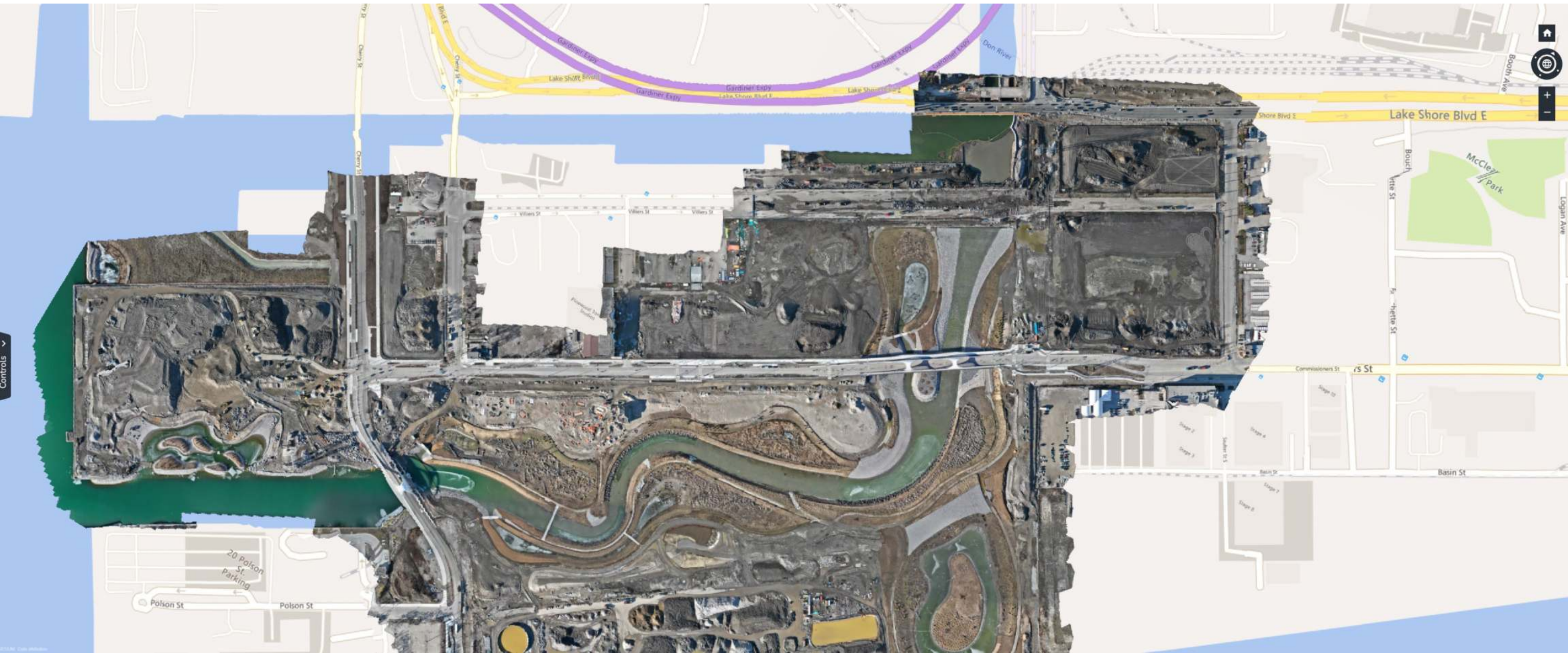
December 14, 2023

River Inundation – Sequenced Flooding



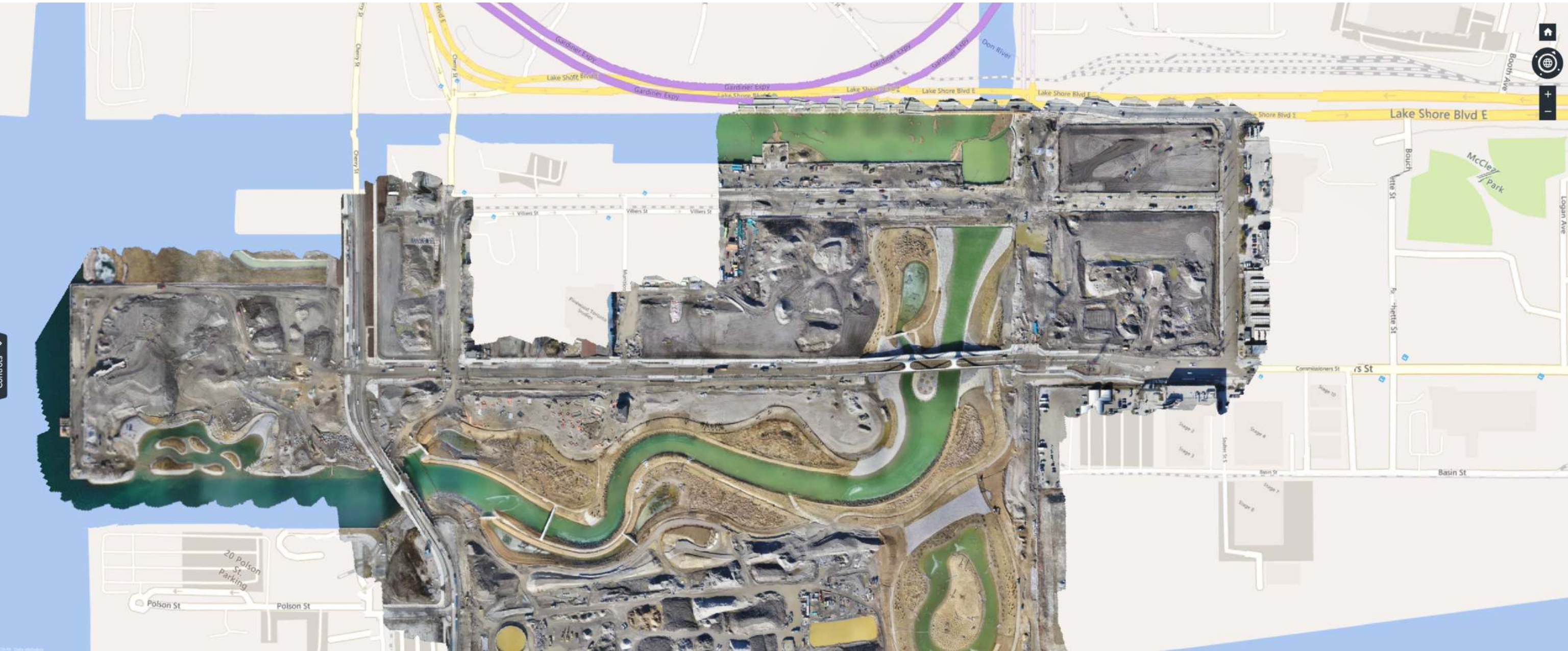
January 25, 2024

River Inundation – Sequenced Flooding



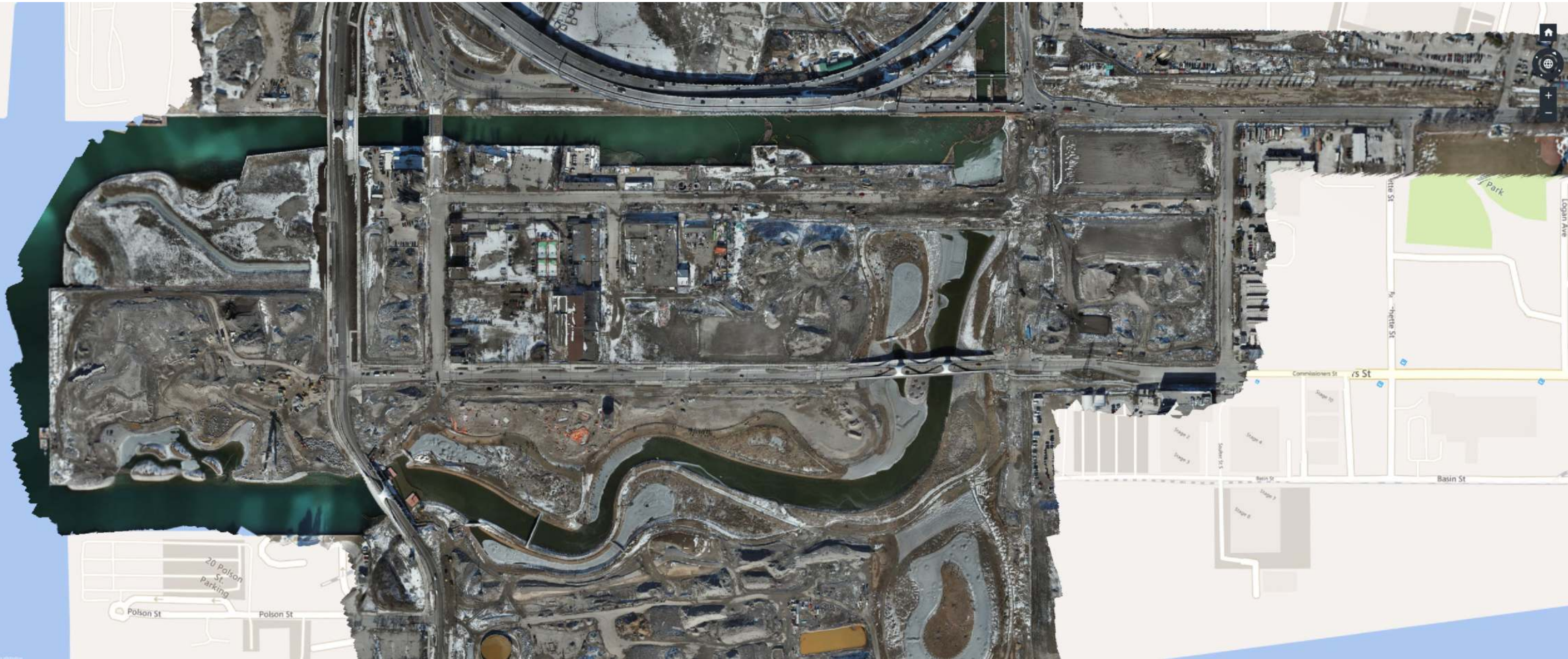
February 5, 2024

River Inundation – Sequenced Flooding



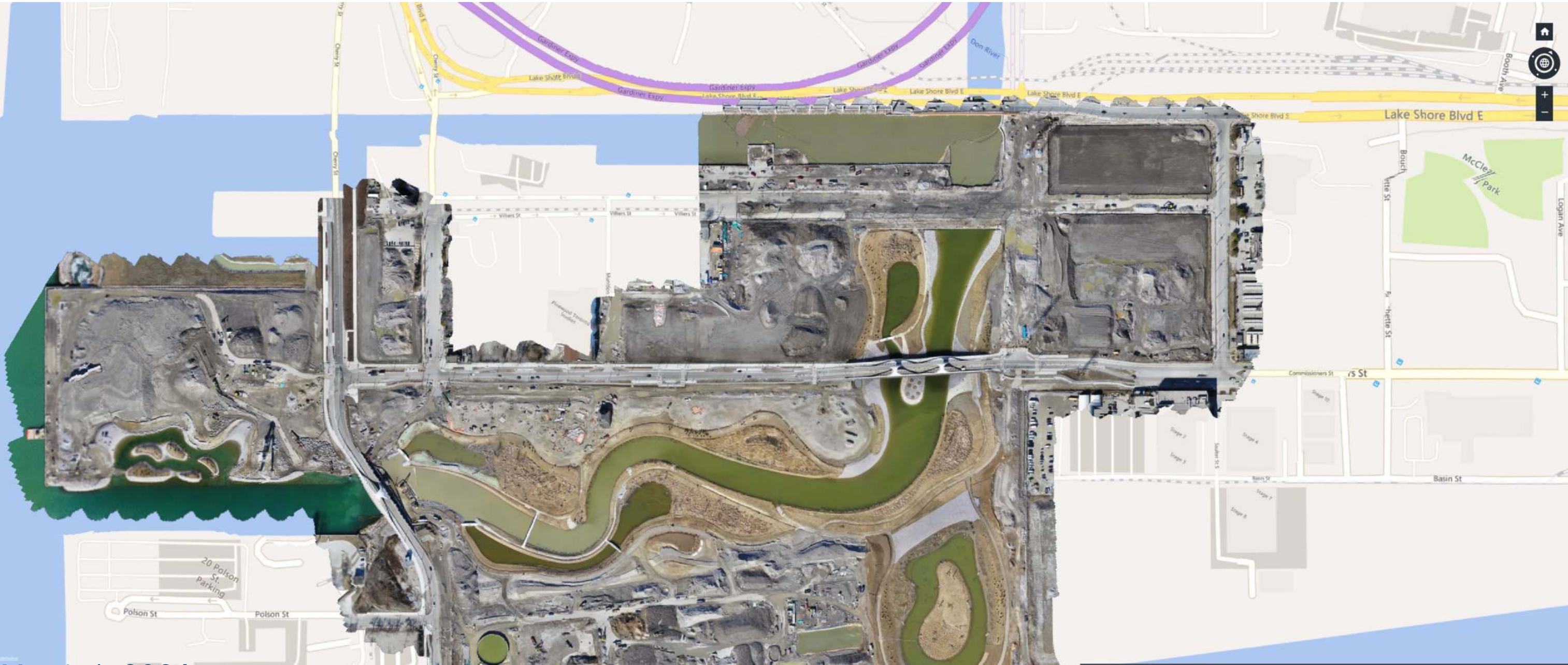
February 9, 2024

River Inundation – Sequenced Flooding



February 20, 2024

River Inundation – Sequenced Flooding



March 1, 2024

Current Conditions and Remaining Project Schedule



Remaining Schedule



Milestone	Approximate Date
Inundate main river valley	Early 2024
Remove South Plug	Early 2024
Remove West Plug	Spring 2024
Excavation Complete	Spring 2024
Play Equipment Installation Complete	Spring 2024
Remove North Plug	Winter 2024
Flood Protection Achieved	Winter 2024
River Park North & South Complete	Winter 2024/25
Open Parks to the public	Spring/Summer 2025



Thank you.

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