Flat Rock Dam — Manayunk Canal Betterment Project

Water Quality | Safety | Ecological Integrity

AWWA PA Section | Fall 2023 Joint Technical Conference
Tuesday, October 24th, 2023 | 1:30 PM

PHILADELPHIA WATER DEPARTMENT

Rowan University
HENRY M. ROWAN
COLLEGE OF ENGINEERING

VILLANOVA UNIVERSITY
COLLEGE OF ENGINEERING

CENTER FOR RESILIENT
WATER SYSTEMS

Ian McKane, EIT

B.S. Civil Engineering

M.S. Civil Engineering

(Spatial and Temporal Trends in Infiltration, Soil Texture, and Nutrient Accumulation in Rain Gardens)

Construction Project Engineer for Flat Rock Dam

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Outline

1. Project Background and History
2. Water Quality Improvements
3. Construction Timeline & Community Impact

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Philadelphia County
Manayunk Canal
Schuylkill River
Montgomery County
Layers
3D
Google
100%
600 m
Camera: 5,043 m
40°01'56"N 75°14'09"W 15 m


Philadelphia County
Montgomery County
Schuylkill River
Manayunk Canal
Schuylkill River
Manayunk Canal
Elite Sports Factory
76
76
Layers
3D
Google
100%
Data attribution
6/6/2022
200 m
Camera: 1,630 m
40°02'16"N 75°14'49"W 13 m


INLET CANAL WALL
MANAYUNK INLET CANAL
FLAT ROCK DAM MAIN SPILLWAY
OWNED BY THE COMMONWEALTH OF PENNSYLVANIA
FISH LADDER OWNED BY THE COMMONWEALTH OF PENNSYLVANIA
SCHUYLKILL RIVER
(WATERS OF THE U.S.)
LOCK NO. 68
MANAYUNK CANAL
FEEDER STRUCTURE

1. Project Background

Mission Statement

Design Rationale and Sustainability

Historic Features: Past to Present

Environmental Impacts and Benefits

Construction Updates

Project Timeline

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1. Project Background

Project Mission

- To improve water quality in the Manayunk Canal
- To meet Dam safety compliance & regulations

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INLET CANAL WALL
MANAYUNK INLET CANAL
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(WATERS OF THE U.S.)
LOCK NO. 68
MANAYUNK CANAL
FEEDER STRUCTURE

Project background / Reasons for project

- Manayunk Canal has no connection to the Schuylkill River
- Canal is stagnant, leading to algae blooms and fish deaths
- Sediment, trash, and debris has accumulated upstream of the Gatehouse Structure
- Historic Gatehouse Structure has become unsafe
- Dam Repairs


Towpath
Bulkhead
Lock No. 68
Intake Channel
Accumulated Sediment
Manayunk Canal
Intake Channel Wall
Gatehouse Structure
Schuylkill River

Schuylkill Navigation Company
Port Carbon to Philadelphia, PA

Over 130 miles

Flat Rock Dam
Constructed 1815
Re-Constructed 1909

Historic Features in Manayunk Canal

- Feeder Gatehouse Structure
- Lock No. 68
- Towpath (Schuylkill River Trail)
- 1.75 mile long Manayunk Canal
- Lock No. 69, 70

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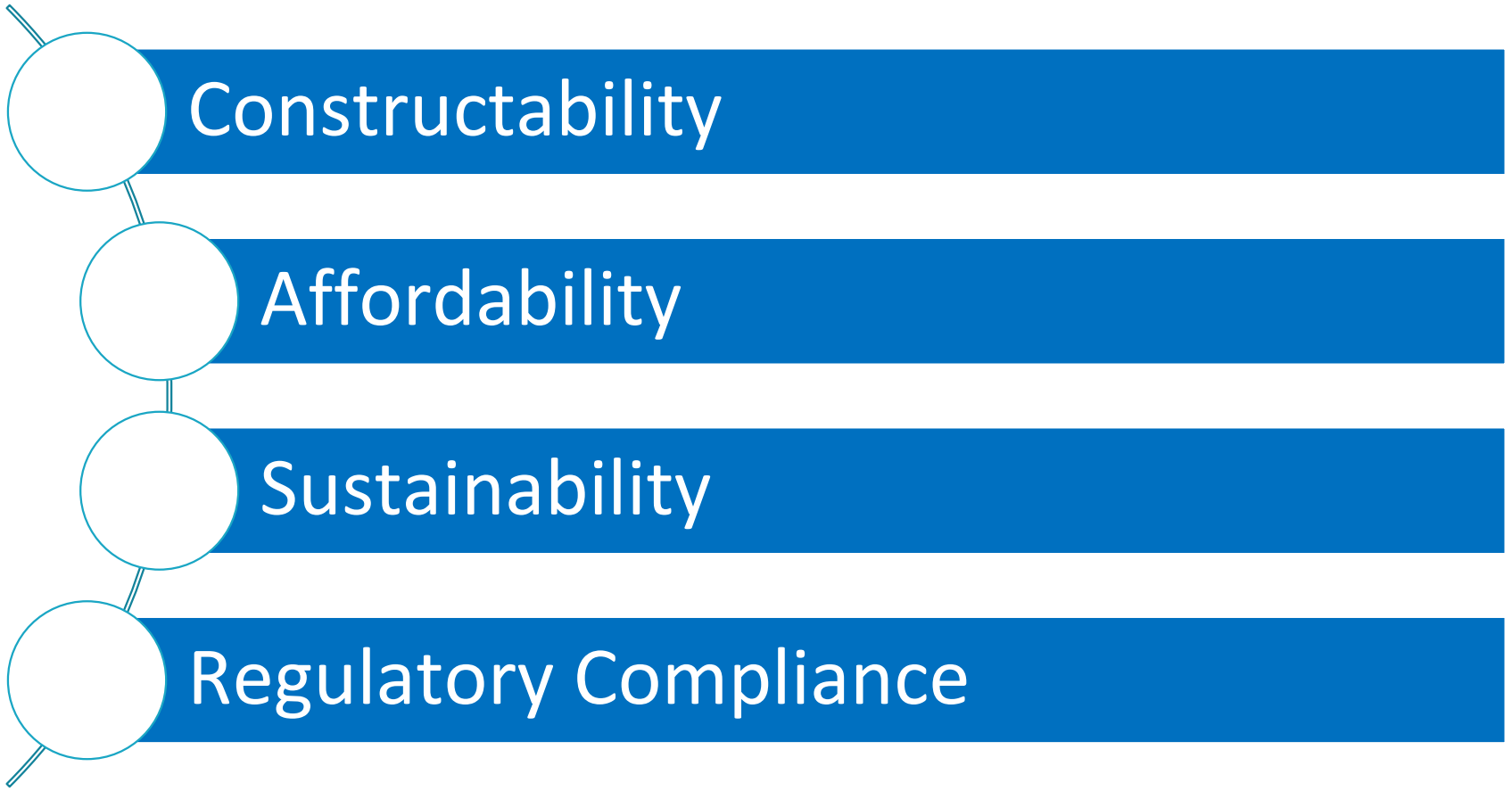
Lock 68 and Feeder Structure Prior to 1918

Photo Courtesy of Adam E. Levine, Historical Consultant, Philadelphia Water Department

Lock 68 and Feeder Structure Circa 1918

Photo Courtesy of Adam E. Levine, Historical Consultant, Philadelphia Water Department

Critical Drivers for Project Design



- Chapter 105 – PADEP Dams and Waterways
- Chapter 93 – PADEP Water Quality Standards
- PENNVEST Funding

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Sustainable Operations

- To be sustainable, the design solution must provide for:
  - Flow Control (Normal Operations and Flood Control) using manually operated gates
  - Debris collection and removal
  - Sediment management and removal
  - Regular inspections and maintenance

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Existing Conditions

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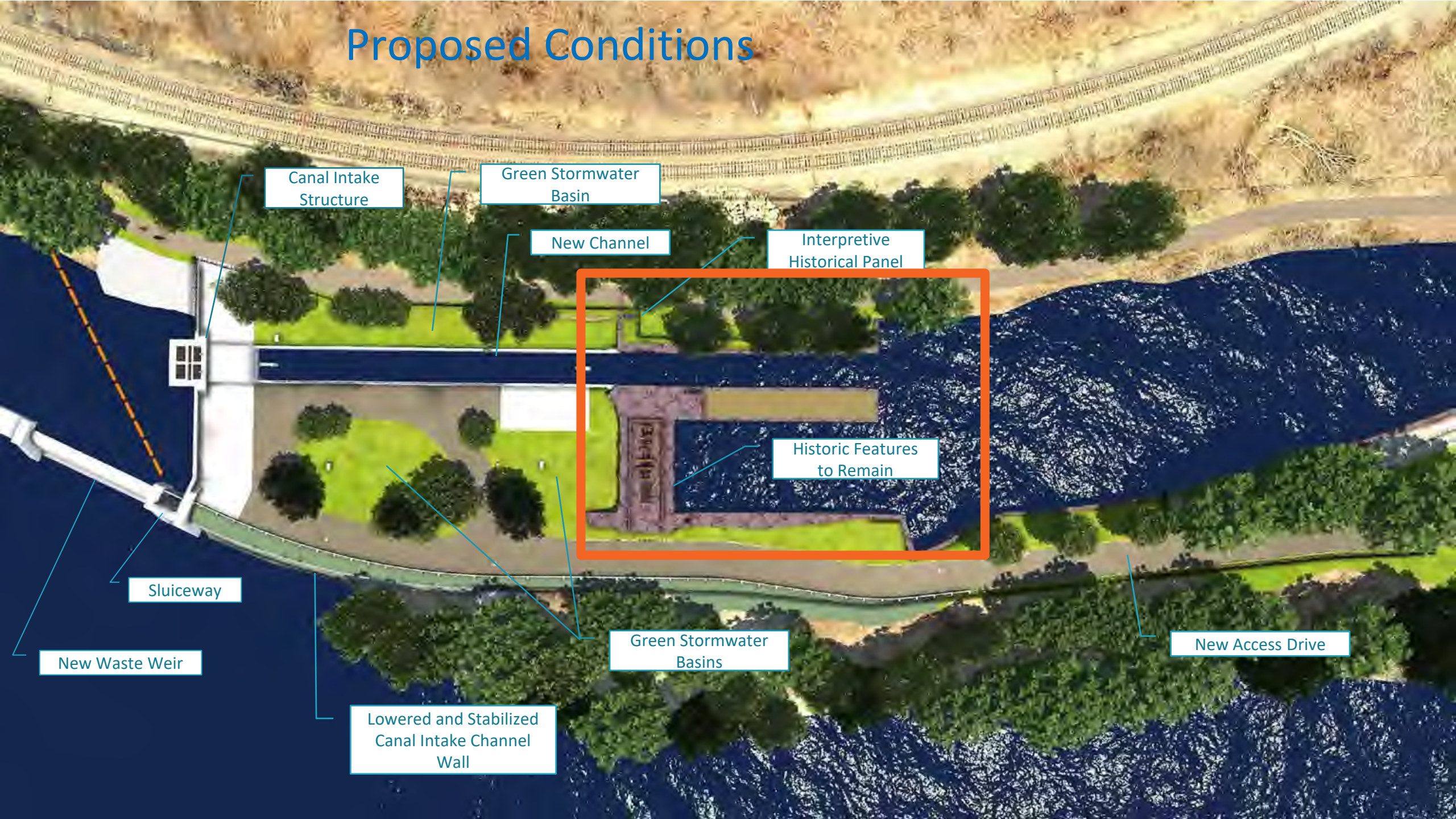
Proposed Conditions

Proposed Conditions



Prior to Construction
Abandonment of Historic Features

- Canal ceased operations in the 1940s
- Lock gates were removed, and Lock 68 was bulkheaded in the 1970s
- Outlet arches of Feeder Structure were plugged
- Maintenance dredging and collection of debris ceased
- Brick Feeder Gatehouse was boarded up and abandoned

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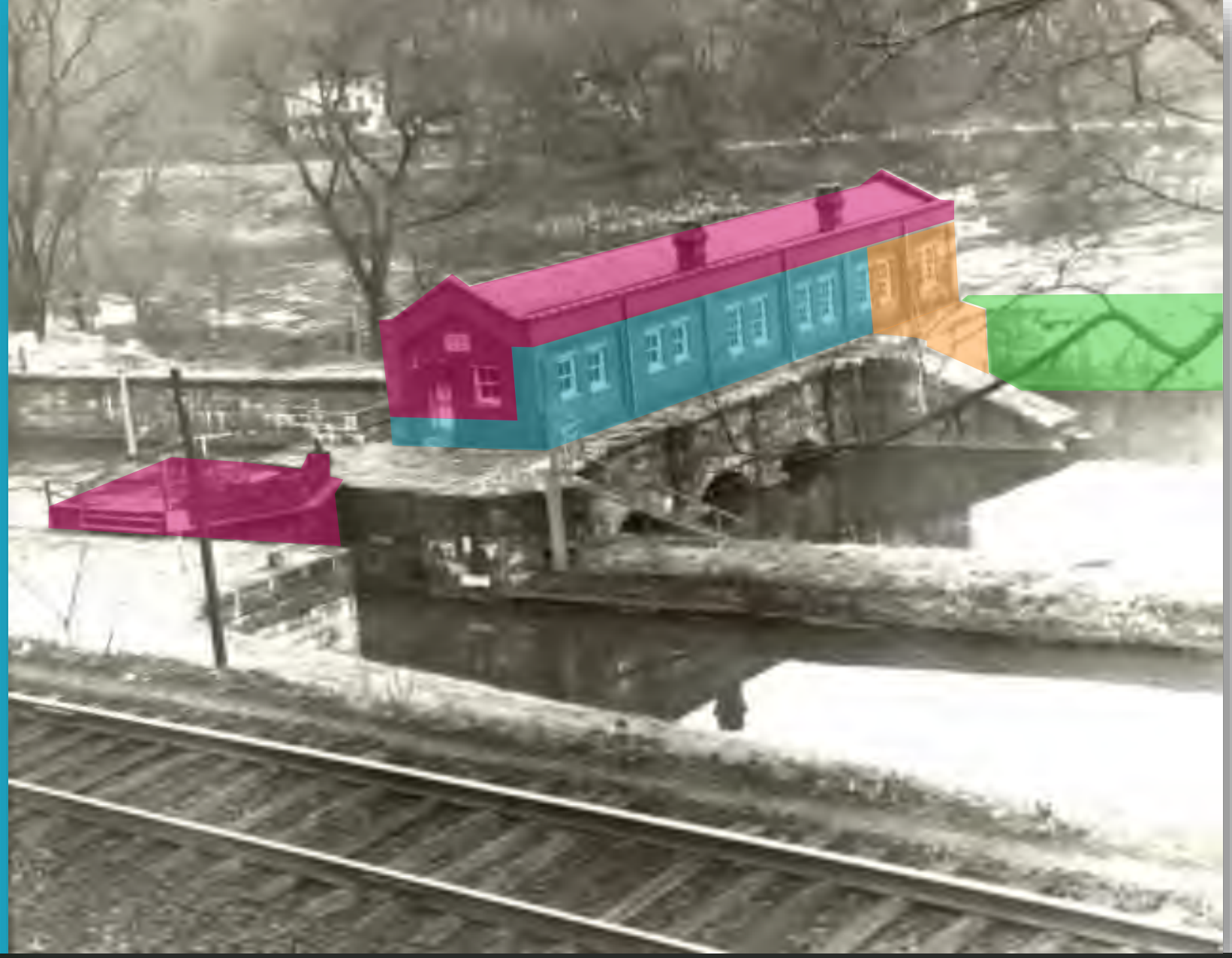
Existing Conditions and Adverse Effects



- No Longer Exists
- Extremely Deteriorated
- Conflicts With New Configuration
- Requires Stability Improvements

Photo Courtesy of Adam E. Levine, Historical Consultant, Philadelphia Water Department

Preservation and Mitigation

- Preserve what remains of pre-1918 structures - Lock 68 and Masonry Feeder Structure
- Cleaning (graffiti removal), Clearing of vegetation and Restoration of Preserved features
- Operating gears will be preserved in place to be seen from the towpath/trail
- Provide for interpretation of historic features from the towpath/trail
- Fencing to inhibit trespass

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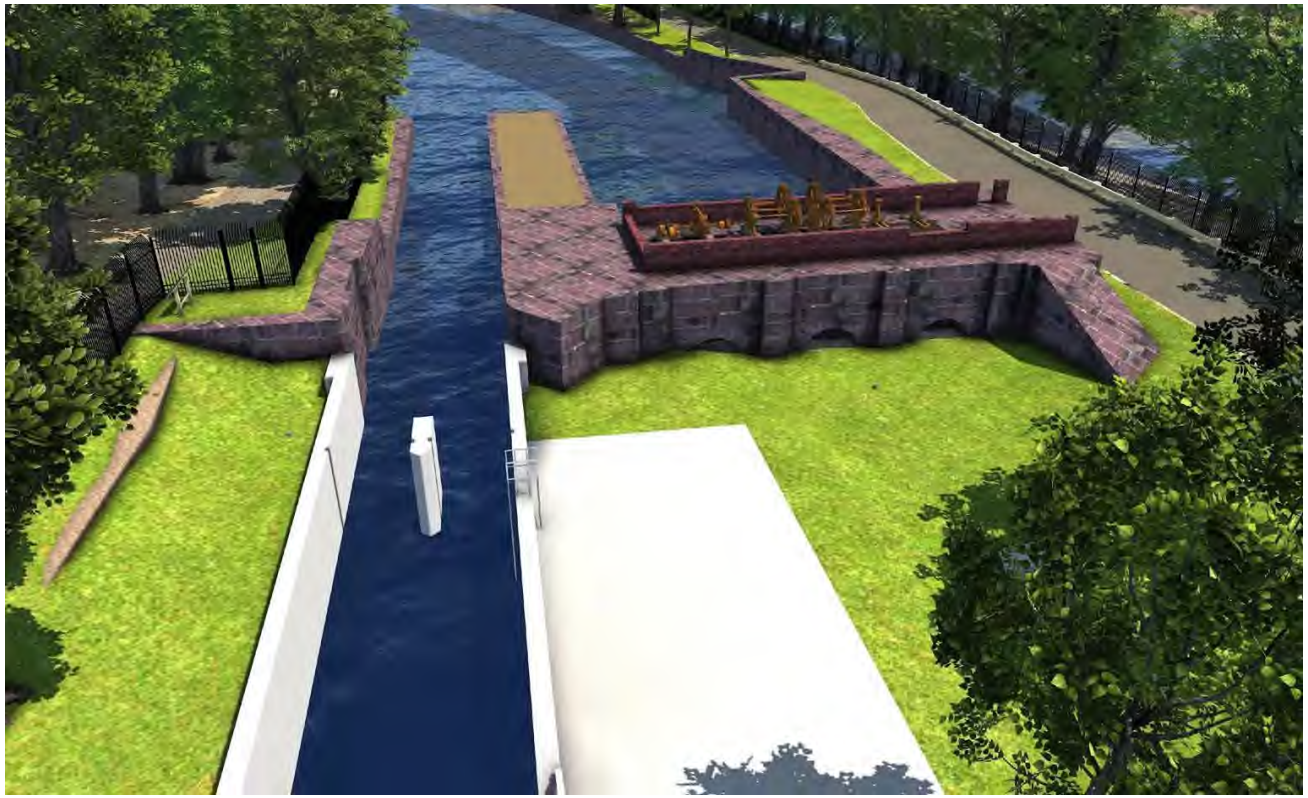
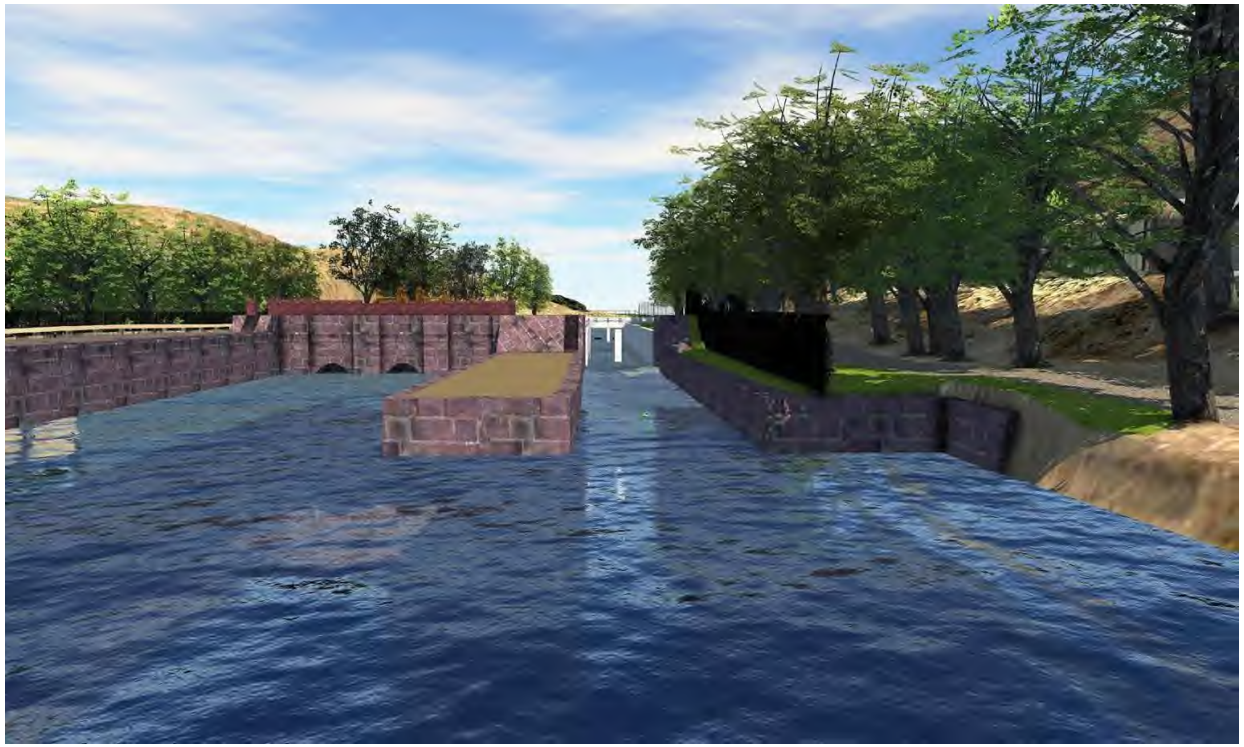
Upstream View from Sediment Area – Before and After



Downstream View of Lock – Before and After



View from Trail – Before and After

Above View - Pre- and Post-Construction

2. Water Quality Improvements

Flat Rock Dam - Manayunk Canal Improvements Project

Water Quality Concerns - *Algal Blooms*

- Frequent in Summer months
- Negative impact on water quality and aquatic organisms
- Taste and odor concerns for City's drinking water

Algal bloom during drought conditions in 1999 (Upstream view at Lock Street)

Floating mats of benthic algae at Lock Street bridge (2006)

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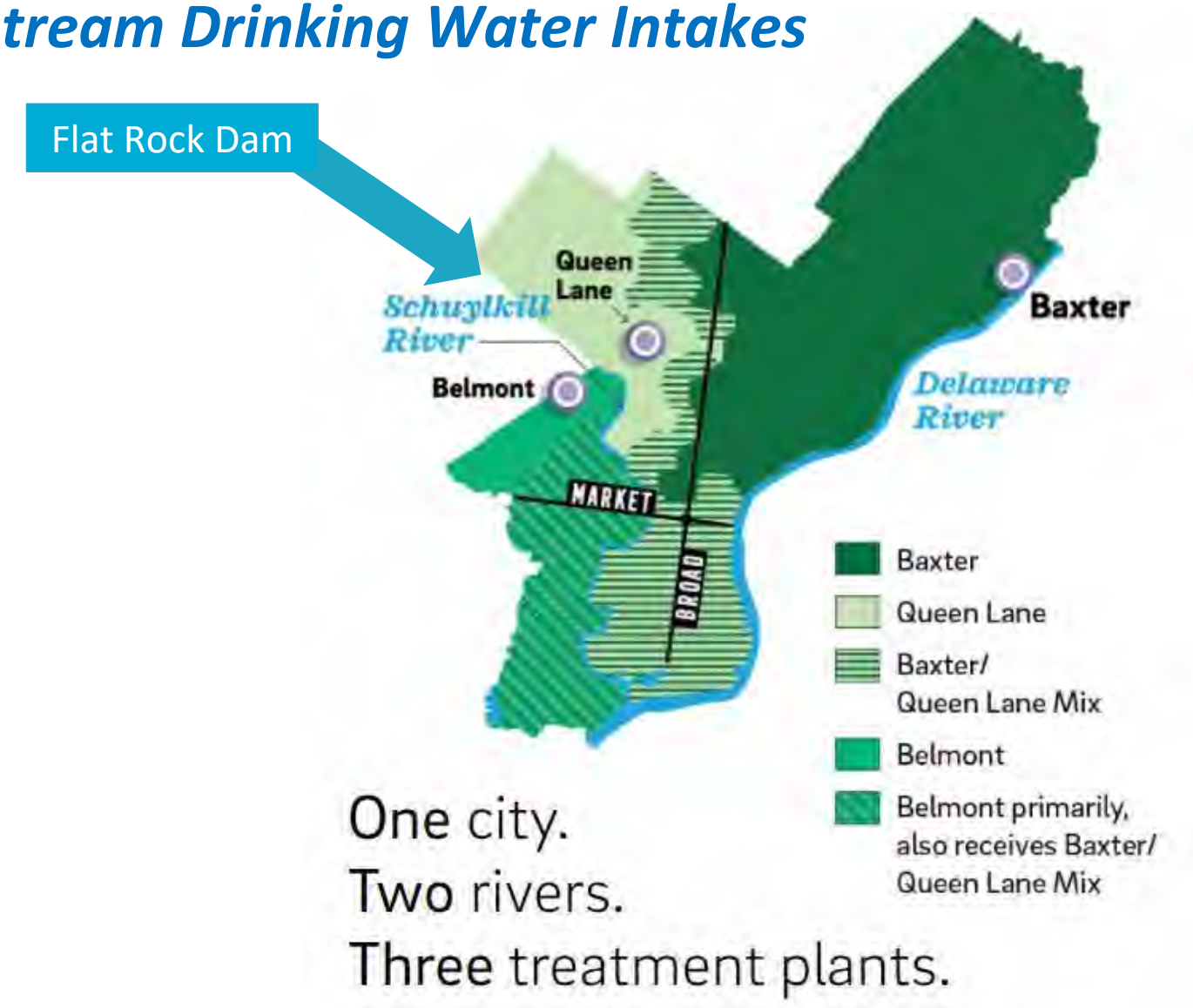
Water Quality Concerns -

Downstream Drinking Water Intakes



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Water Quality Concerns - *Flow Conditions*

- **Present conditions:**
  - Spring flow ranges from 3 – 5 cfs
  - Summer flow ranges from 1 – 3 cfs
  - Average velocity of 0.03 ft/s
- **Post-construction conditions:**
  - Flow ranges between 50 – 110 cfs
  - Average velocity between 0.3 – 0.5 ft/s

2011 summer flows over Lock Street (~1 cfs)

"A molecule of water will flow through the canal in its entirety in 6 hours. . . .not 3 days."

Water Quality Concerns - *Improvement Benefits*

Water Quality & Source Water Protection

- Flow diversion will:
  - Increase velocities
  - Decrease hydraulic residence time
  - Improve dissolved oxygen concentrations
  - Improve biological health of fisheries and aquatic organisms (mussels)
  - Reduce potential of harmful algal blooms

Reintroduce Freshwater Mussels

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3. Construction Timeline & Community Impact

Project Timeline

- Design Drawings Completed – Winter 2020
- Bidding – Winter 2021
  - Contract Awarded to A.P. Construction Inc. for $16,301,250.00
- Notice to Proceed – March 2022

- Project Construction Period:
  - Estimated 900 calendar days of construction
  - March 2022 to September 2024

Gatehouse

March 2022 - Start of Work - Gatehouse

March 2022 - Start of Work – Upstream of Gatehouse

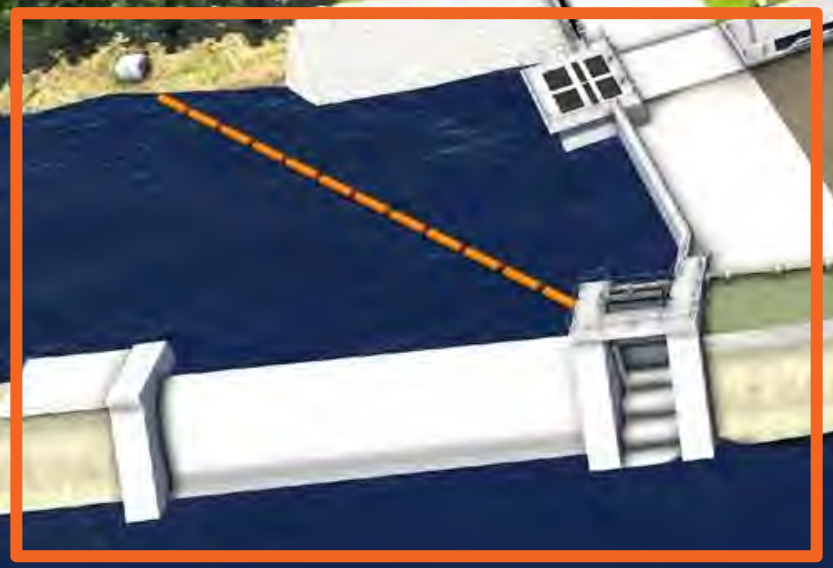
April 2022 - Start of Work – Gatehouse Downstream

May 2022 - Start of Work – Gatehouse Downstream

May 2022 - Start of Work – Site Clearing

May 2022 - Start of Work – Accessway Clearing One road in and out

Cofferdams



June 2022 - Install Upstream Channel Cofferdam

July 2022 - Install Upstream Channel Cofferdam

July 2022 - Install Upstream and River Cofferdam at Weir

August 2022- Install Upstream Channel Cofferdam

August 2022- Install Upstream Channel Cofferdam

September 2022 - Install River Cofferdam at Weir

September 2022 - Dewatering and Excavation, Turtle and Fish removal

September 2022 - Bedrock Excavation for Weir

September 2022 - Bedrock Excavation for Weir

October 2022 - Installation of Post-tensioned Rock Anchors

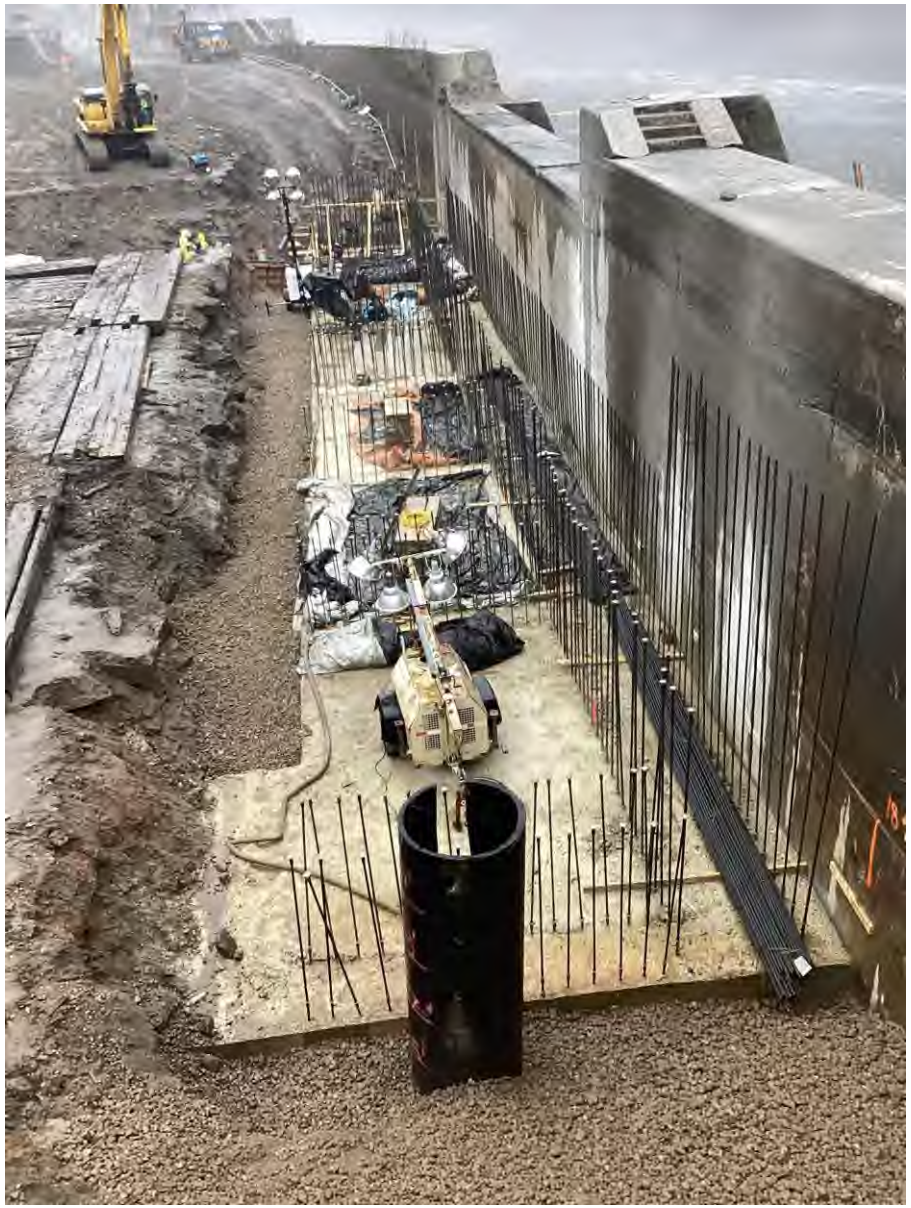
October 2022 - Excavation and Anchors at Bulkhead Wall and Canal Intake

November 2022 - Beginning of Rebar and Formwork Installation, Impact or Storm Events

Weir

November 2022 - First Concrete Pour for Weir foundation behind Existing Weir

December 2022 - Constructing new concrete weir behind existing weir



December 2022 - Sign facing Schuylkill River Trail

January 2023 - Continuing Weir Concrete Work

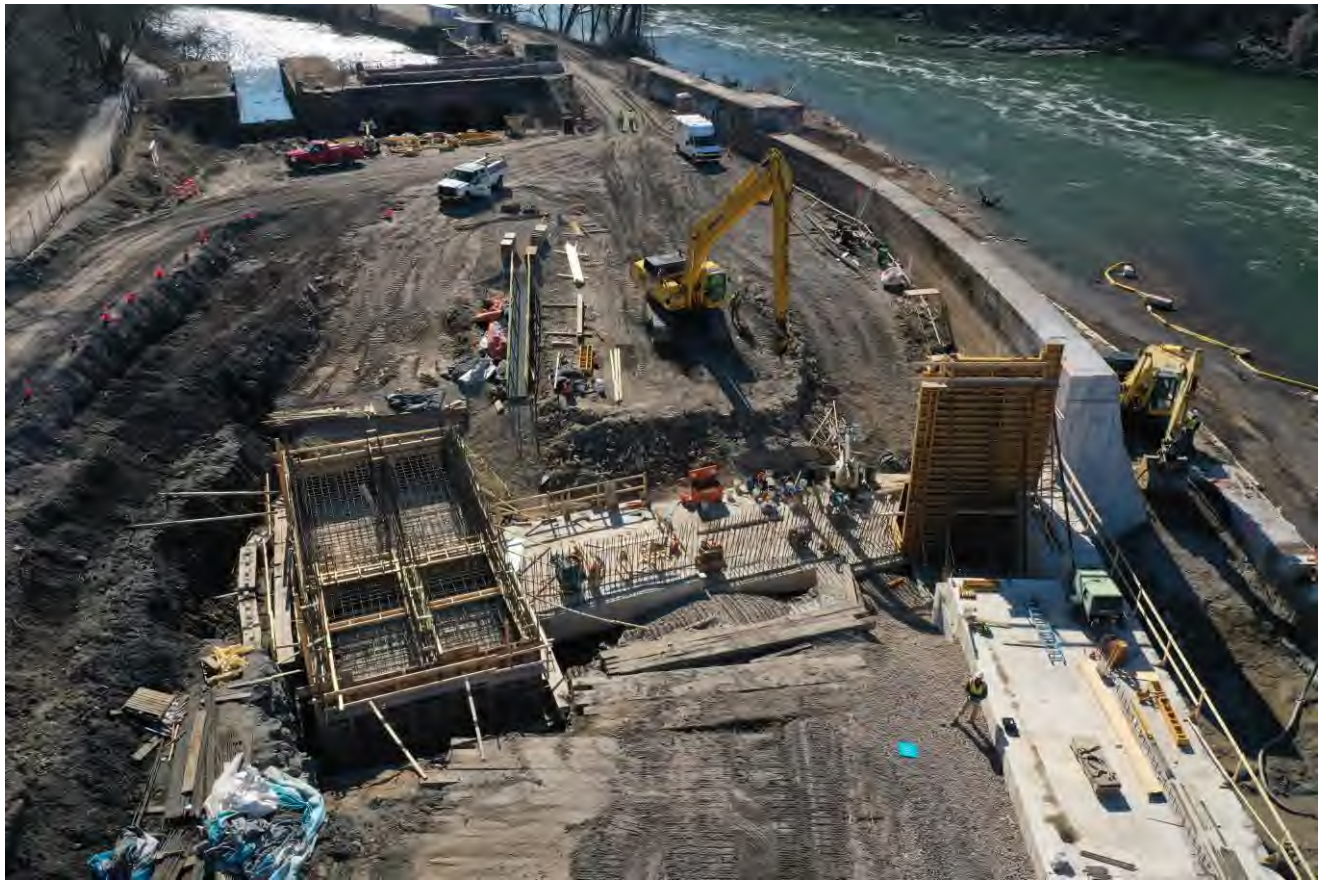
Canal Intake

February 2023 - Rebar, Formwork, and Concrete at Canal Intake Structure Foundation

February 2023 - Demolition of old concrete weir

February 2023 - Community Meeting

March 2023 - Constructing bulkhead wall sections



March 2023 - Rock preparation and anchor installation for weir

March 2023 - Constructing bulkhead wall sections

April 2023 - Demolition of old Dam portion wall for new wall cap

April 2023 - Concrete pour for canal channel intake structure

May 2023 - Impact of Storm Events on in river work

June 2023 - Rebar, Formwork, and Concrete work for Weir

June 2023 - Rebar, Formwork, and Concrete work for Weir

June – July 2023 - Rebar, Formwork, and Concrete for Weir

July 2023 - Rebar, Formwork, and Concrete work on Canal Channel Foundations

July 2023 - Rebar, and Formwork Installation for Canal Intake

August 2023 - Rebar, Formwork, and Concrete work on Weir

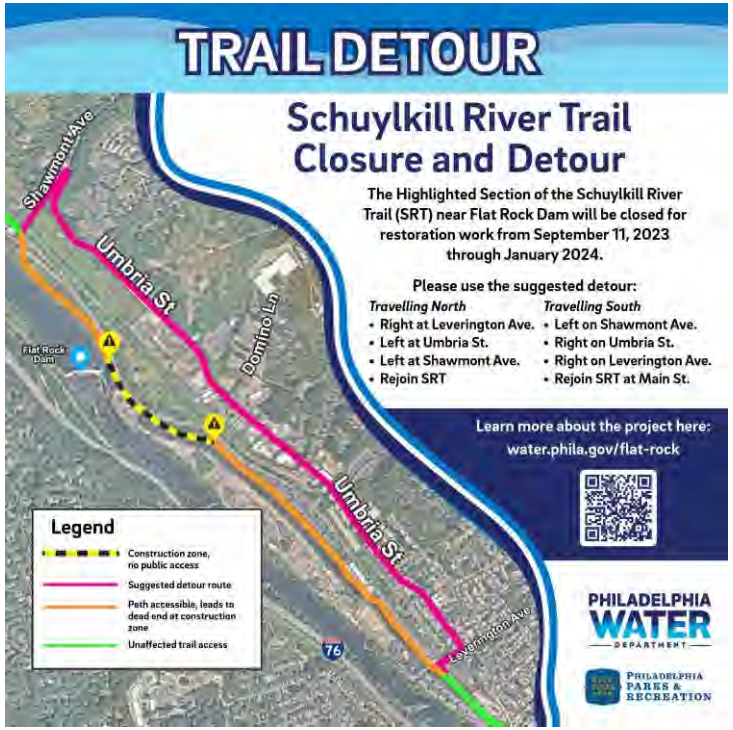
August 2023 - Rebar, Formwork, and Concrete work on Canal Intake Structure, Gate Thimble Installation

September 2023 - Concrete pours at Sluiceway and Weir

September 2023 - Weir, Sluiceway, and Canal Intake Work Continues

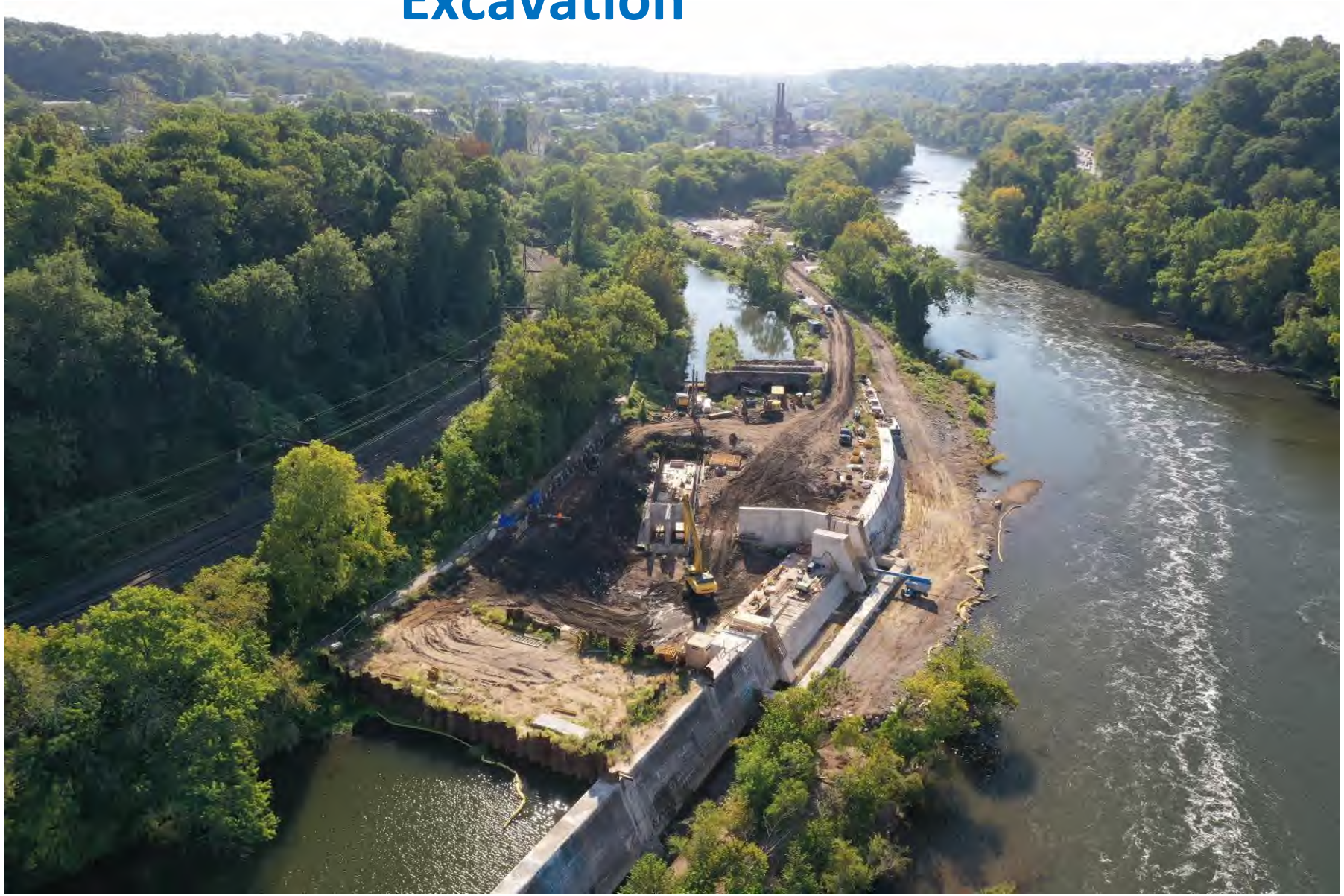
Community Impact

- Schuylkill River Trail Closure Required
  - September 2023 to January 2024



September 2023 - Schuylkill River Trail Closure Signs

September 2023 - Installation of Shoring for Bulkhead Wall Excavation



October 2023 - Shoring and Tieback Anchor Installation

October 2023 - Excavation, Shoring and Tieback Anchor Installation

November 2023

- Upcoming Work Progress
    - Finish shoring Installation and Excavation
    - Install and Test Post-tensioned Rock Anchors in bulkhead wall footings
    - Bulkhead Wall Concrete foundations

Community Impact

- Expected Project Completion:
  - September 2024


May 2022
Historic Gatehouse
Weir

September 2023

Completed

Flat Rock Dam — Manayunk Canal Betterment Project

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***Project Updates*: water.phila.gov/flat-rock**

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Flat Rock Dam — Manayunk Canal Betterment Project

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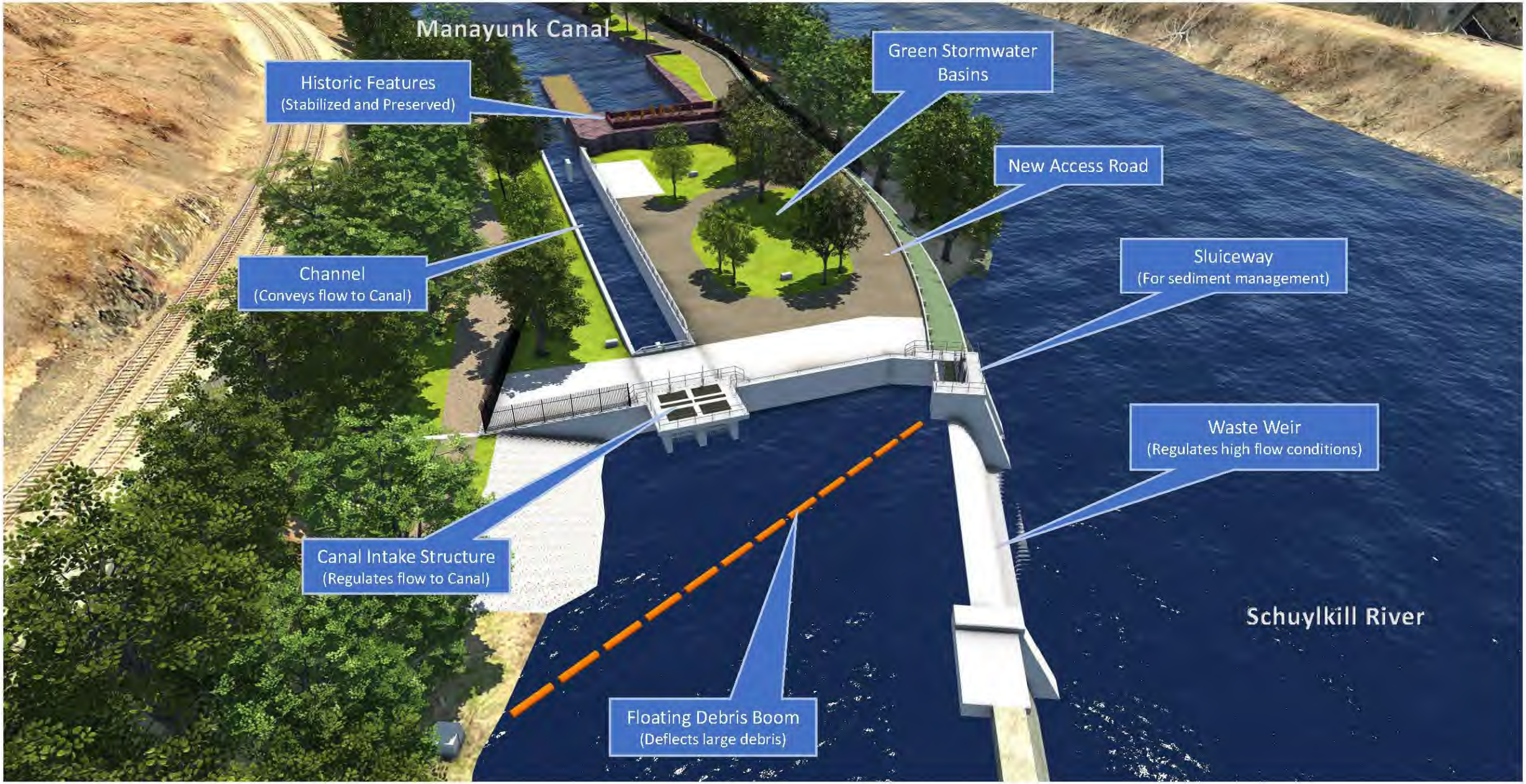
Proposed Conditions


Manayunk Canal
Historic Features
(Stabilized and Preserved)
Green Stormwater
Basins
New Access Road
Channel
(Conveys flow to Canal)
Sluiceway
(For sediment management)
Waste Weir
(Regulates high flow conditions)
Canal Intake Structure
(Regulates flow to Canal)
Floating Debris Boom
(Deflects large debris)
Schuylkill River

December 2023 – September 2024

- Upcoming Work Progress
    - Complete Bulkhead Wall
    - Remove Upstream Channel Cofferdam
    - Complete Canal Channel

Thank you!

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***Project page for updates*: water.phila.gov/flat-rock**

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Flat Rock Dam

Overview: to inform the community about the Flat Rock Dam Betterment Project, share best contact information, and answer questions

Project Stakeholders / Partners:

- Philadelphia Parks and Recreation
- Army Corps Engineers
- PA DEP
- PA Historical Museum Commission (PHMC)
- Manayunk Development Corporation
- National Marine Fisheries Service
- Fish and Wildlife
- Art Commission
- PENNVEST

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Flat Rock Dam

References:

- Ramboll, O'brien & Gere Engineers, Inc.: Drone Photos
- Ian McKane, PWD: Photos
- Tom McIntyre, JBC Associates as PWD Inspector: Photos