



Flat Rock Dam Betterment Project: Reconnecting the Manayunk Canal

PA AWWA Southeast District
Fall 2024 Joint Technical Conference



Friday, October 11th, 2024
1:25-2:25PM



Ian McKane, EIT

Resident Engineer

B.S. Civil Engineering, Rowan University

M.S. Civil Engineering, Villanova University



Agenda

- 1. Project Background and History**
- 2. Construction Sequence and Challenges**
- 3. Completion of Work**



Project Background and History





Schuylkill
River

Manayunk
Canal

Montgomery
County



Philadelphia
County





Schuylkill River

Manayunk Canal



Manayunk
Canal

Schuylkill
River

Manayunk
Canal

Schuylkill
River



Site Entrance:
Flat Rock Rd.



SEPTA

Manayunk
Canal



Schuylkill
River





Owner:

City of Philadelphia
Philadelphia Water Department

Designer Consultant:

Ramboll Engineering

General Contractor:

AP Construction Co.





Mission:

- To improve water quality in the Manayunk Canal and downstream in the Schuylkill River
- To meet PADEP Dam Safety compliance requirements for high hazard potential dams

Project background and 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 preventing flow
- Historic Gatehouse Structure has become unsafe
- Repair Concrete wall of existing dam structure

Schuylkill Navigation Company Port Carbon to Philadelphia, PA

Over 108 miles
72 Locks

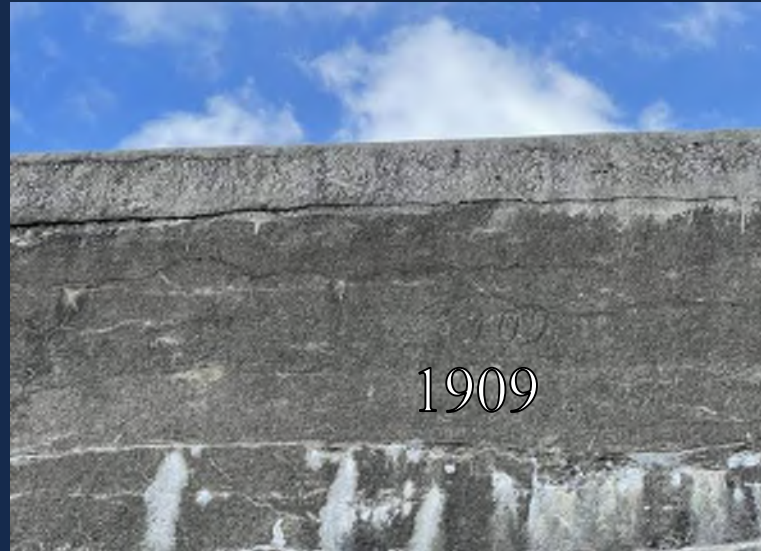


Flat Rock Dam
Constructed 1815
Re-Constructed 1909



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



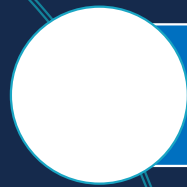
**Lock 68 and
Feeder Structure
Prior to 1909**



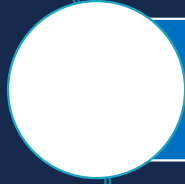
Lock 68 and Feeder Structure After 1909



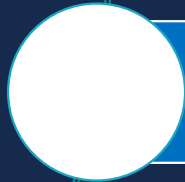
Critical Drivers for Project Design



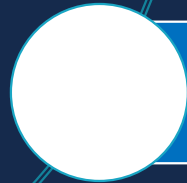
Constructability



Affordability



Sustainability



Regulatory Compliance

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

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

Existing Conditions



Towpath

Bulkhead

Lock No. 68

Intake Channel

Accumulated
Sediment

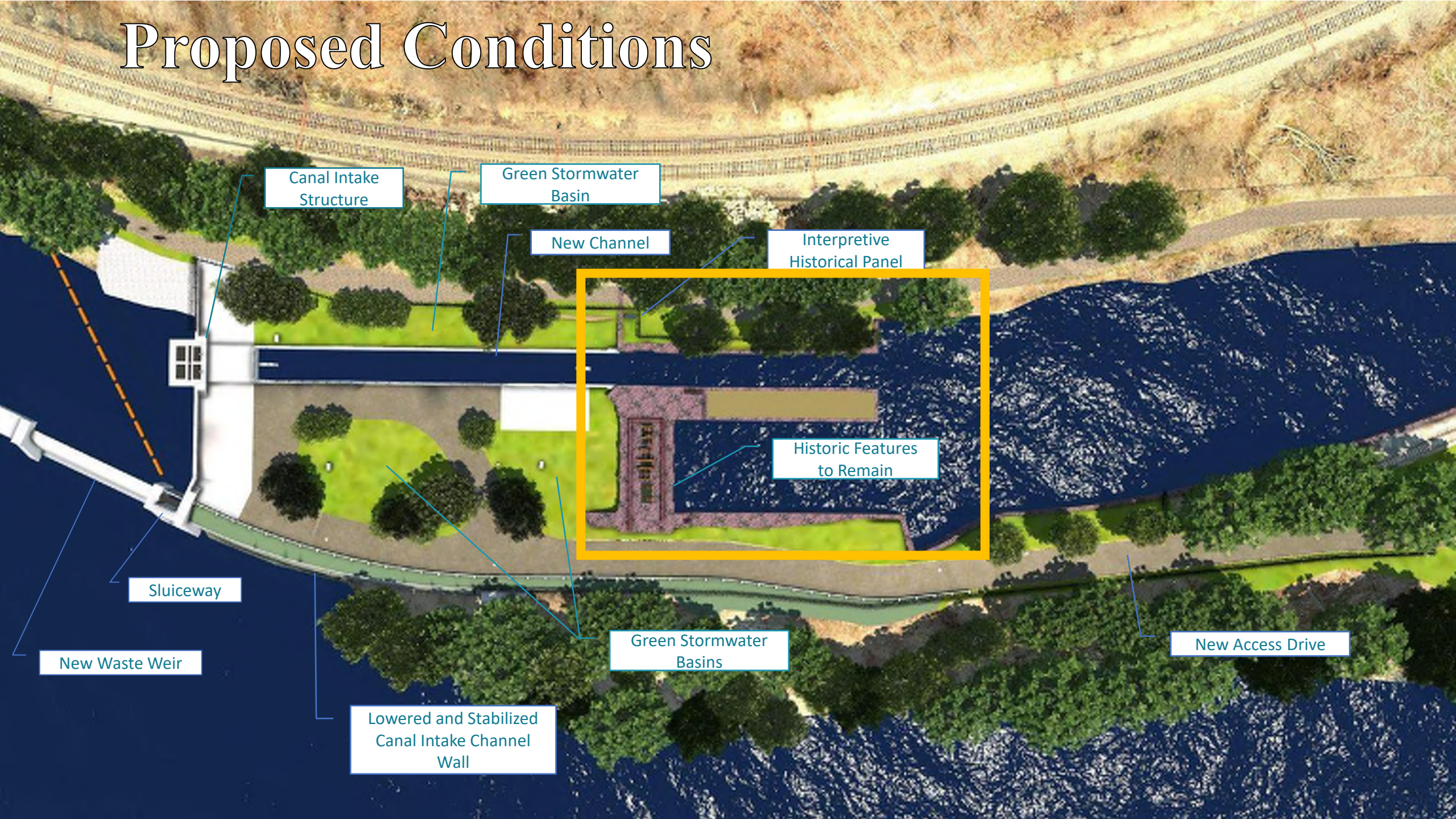
Manayunk Canal

Intake Channel
Wall

Gatehouse
Structure

Schuylkill River

Proposed Conditions



Canal Intake Structure

Green Stormwater Basin

New Channel

Interpretive Historical Panel



Historic Features to Remain

Sluiceway

New Waste Weir

Lowered and Stabilized Canal Intake Channel Wall

Green Stormwater Basins

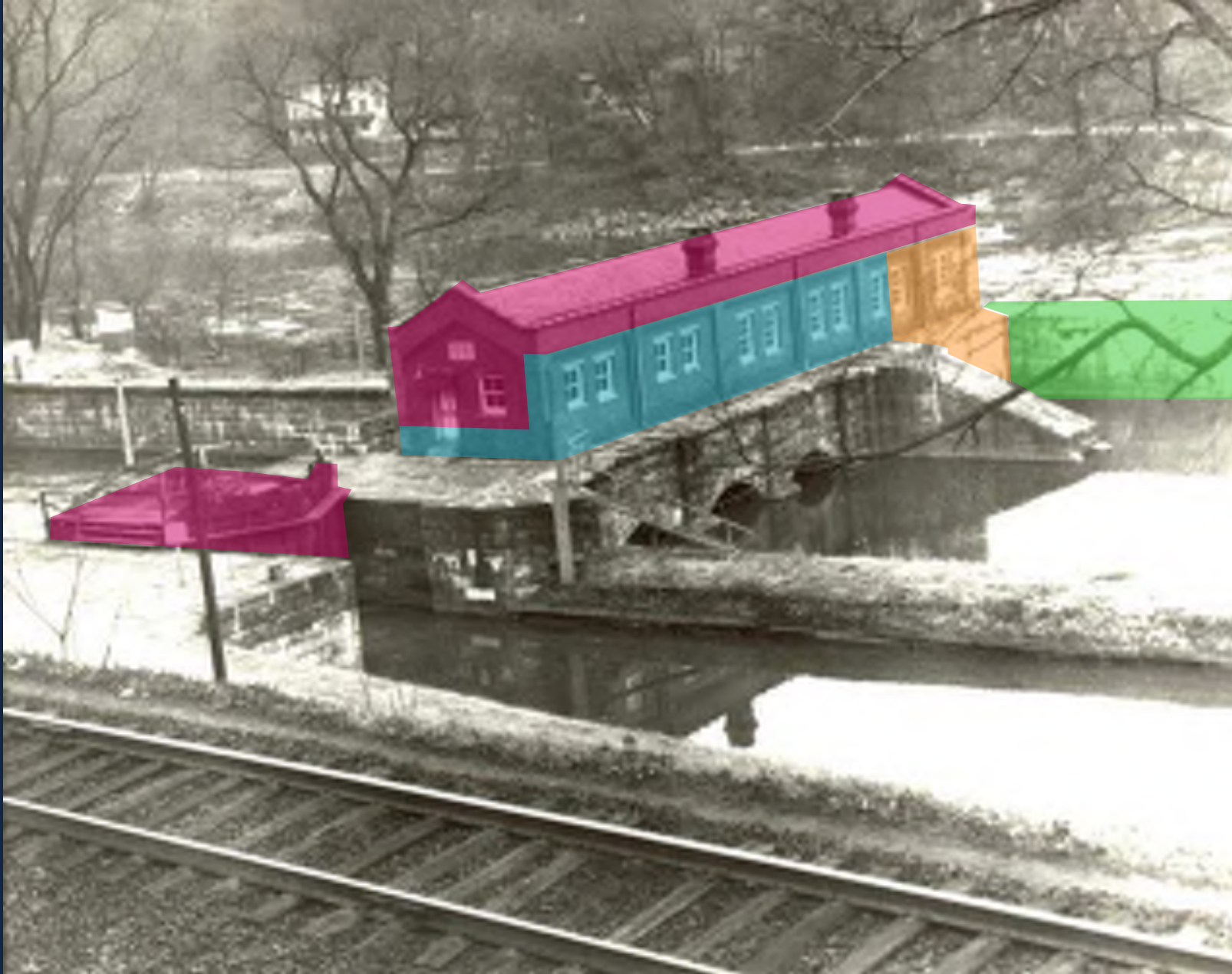
New Access Drive

Prior to Construction

Abandonment of Historic Features

- Canal ceased operations in the 1940s
- Lock gates were removed, and a steel bulkhead was installed on Lock 68 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

Existing Conditions



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

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

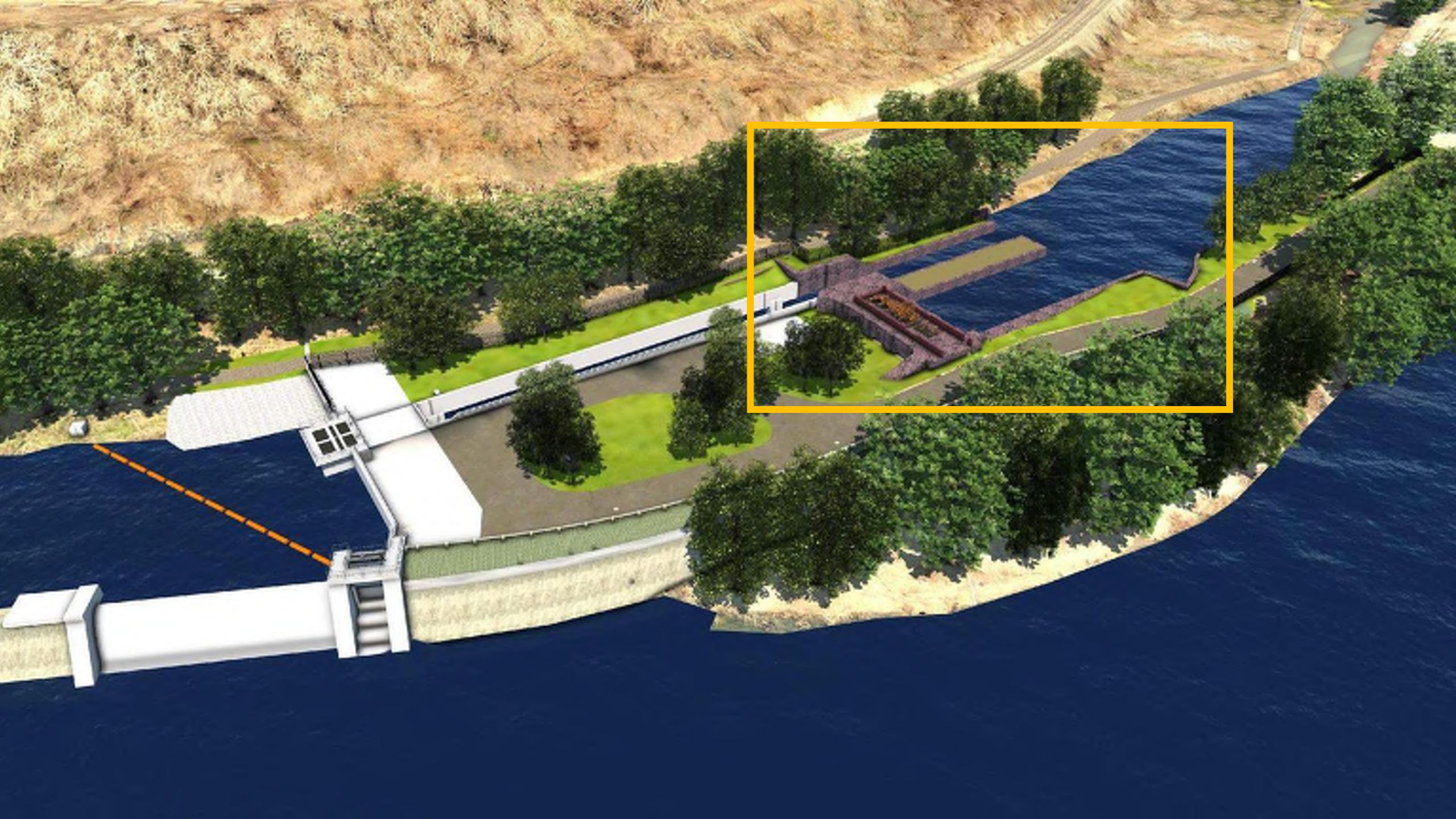
Preservation and Mitigation

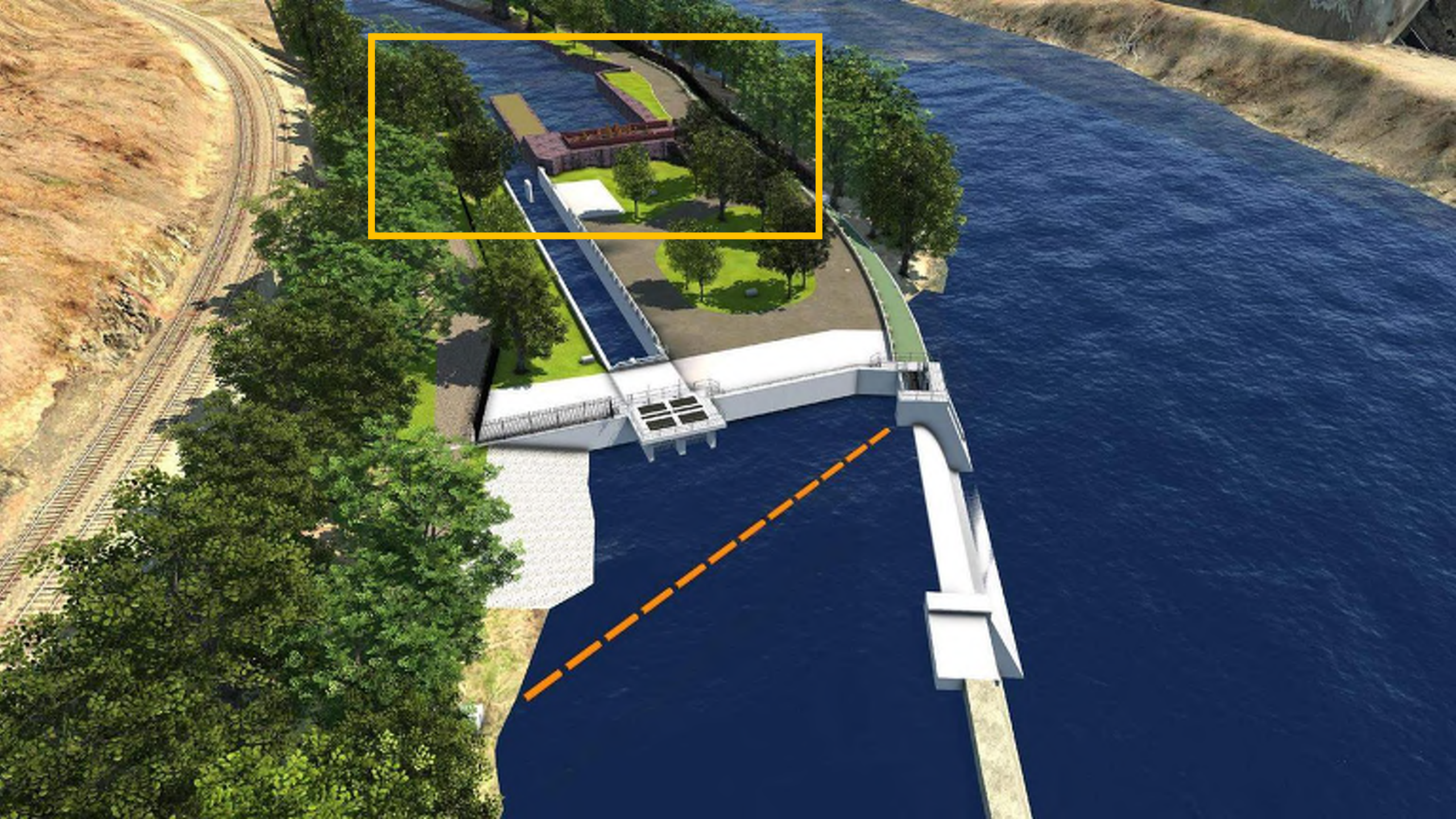
- Preserve what remains of pre-1909 structures - Lock 68 and Masonry Feeder Structure
- Clearing of vegetation and preservation of brick structure
- Operating gears will be preserved in place to be seen from the towpath/trail
- Informational signs showing historic features visible from the towpath/trail
- Fencing to inhibit trespass



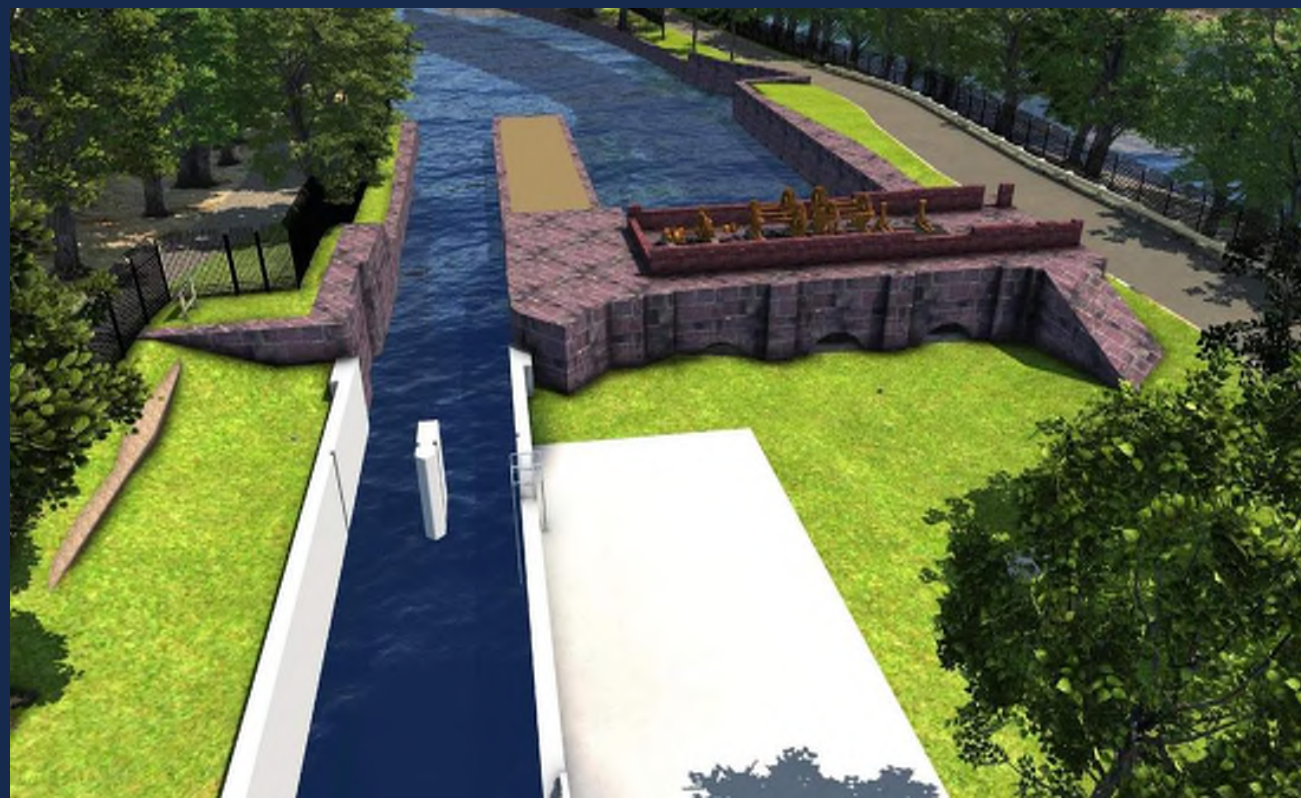




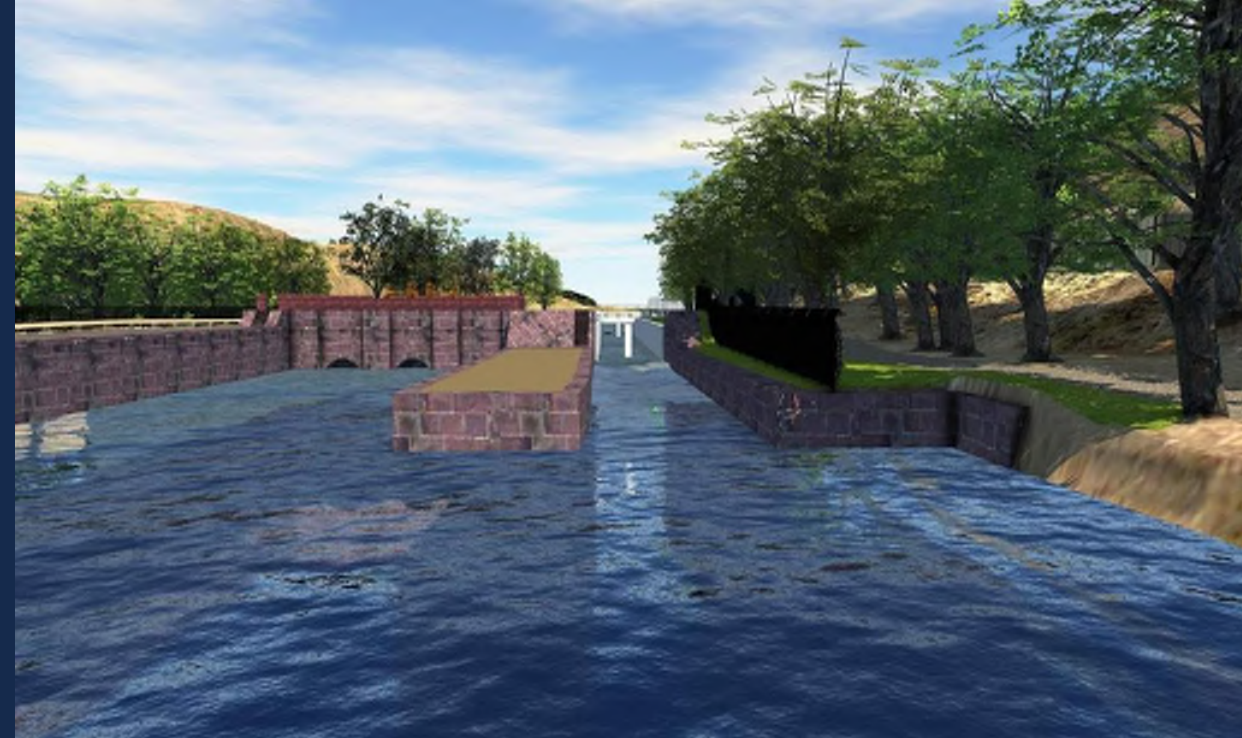




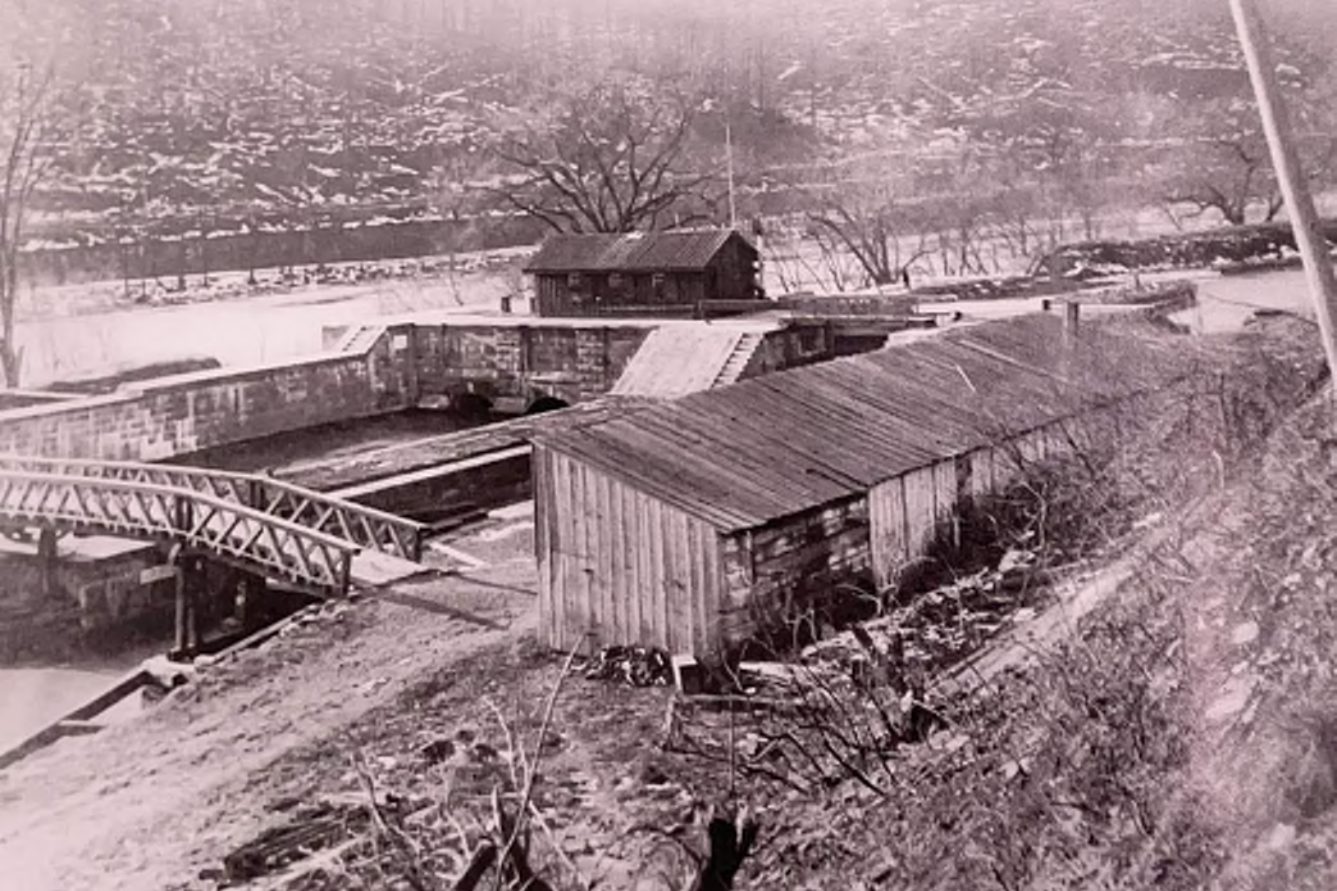
Upstream View from Sediment Area – Before and After



Downstream View of Lock – Before and After



View from Trail – Before and After



Before 1909

View from Trail – Before and After



Above View - Pre- and Post-Construction



2018



1918

Above View - Pre- and Post-Construction



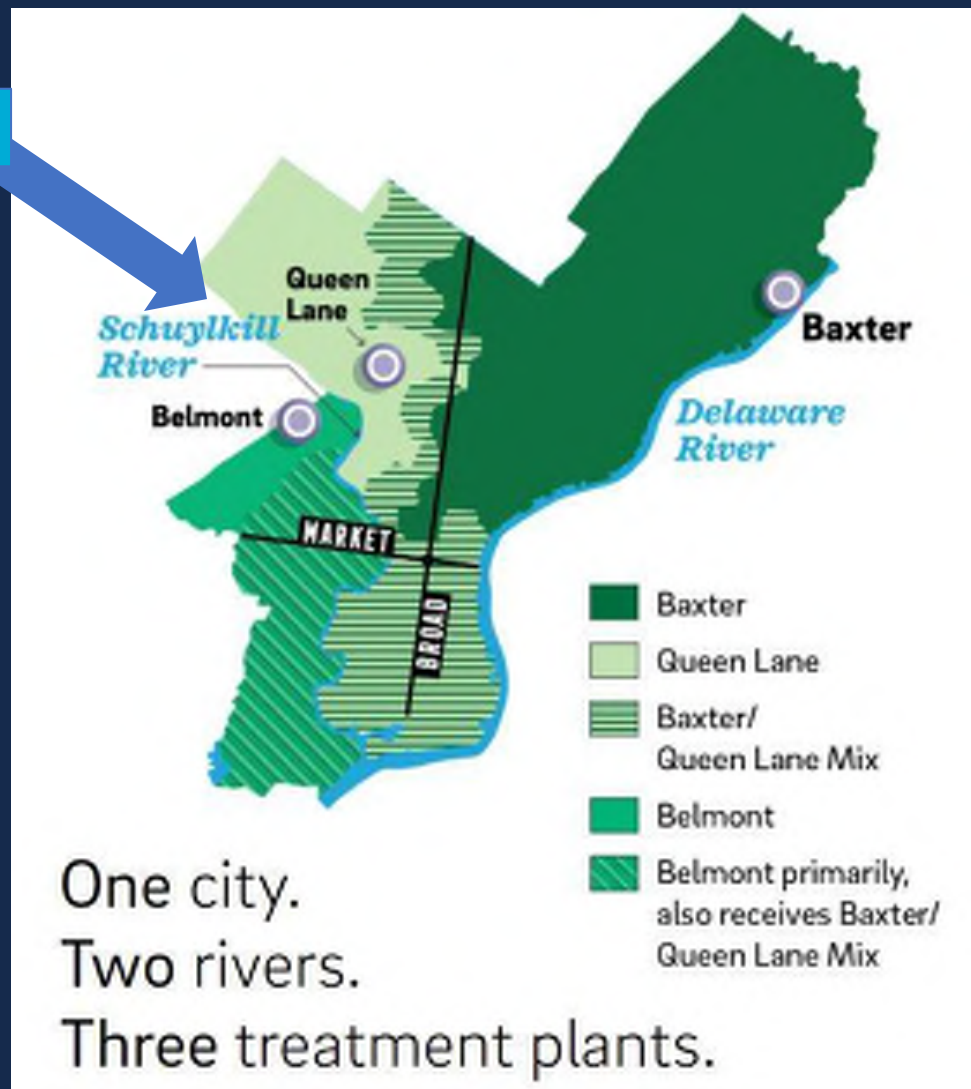
Water Quality – *Algal Blooms*

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



Water Quality - *Drinking Water Intakes*

Flat Rock Dam



Water Quality - *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



Water Quality - *Improvements*

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





Construction Sequence and Challenges

Project Timeline

- Design Drawings Completed – Winter 2020
Design Consultant: Ramboll Engineering
- 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



Cofferdams



June 2022 - Install Upstream Channel Cofferddam



July 2022 - Install Upstream Channel Cofferdam



July 2022 - Install Upstream and River Cofferdam at Weir



August 2022 - Install Upstream Channel Cofferddam



August 2022- Install Upstream Channel Cofferdam



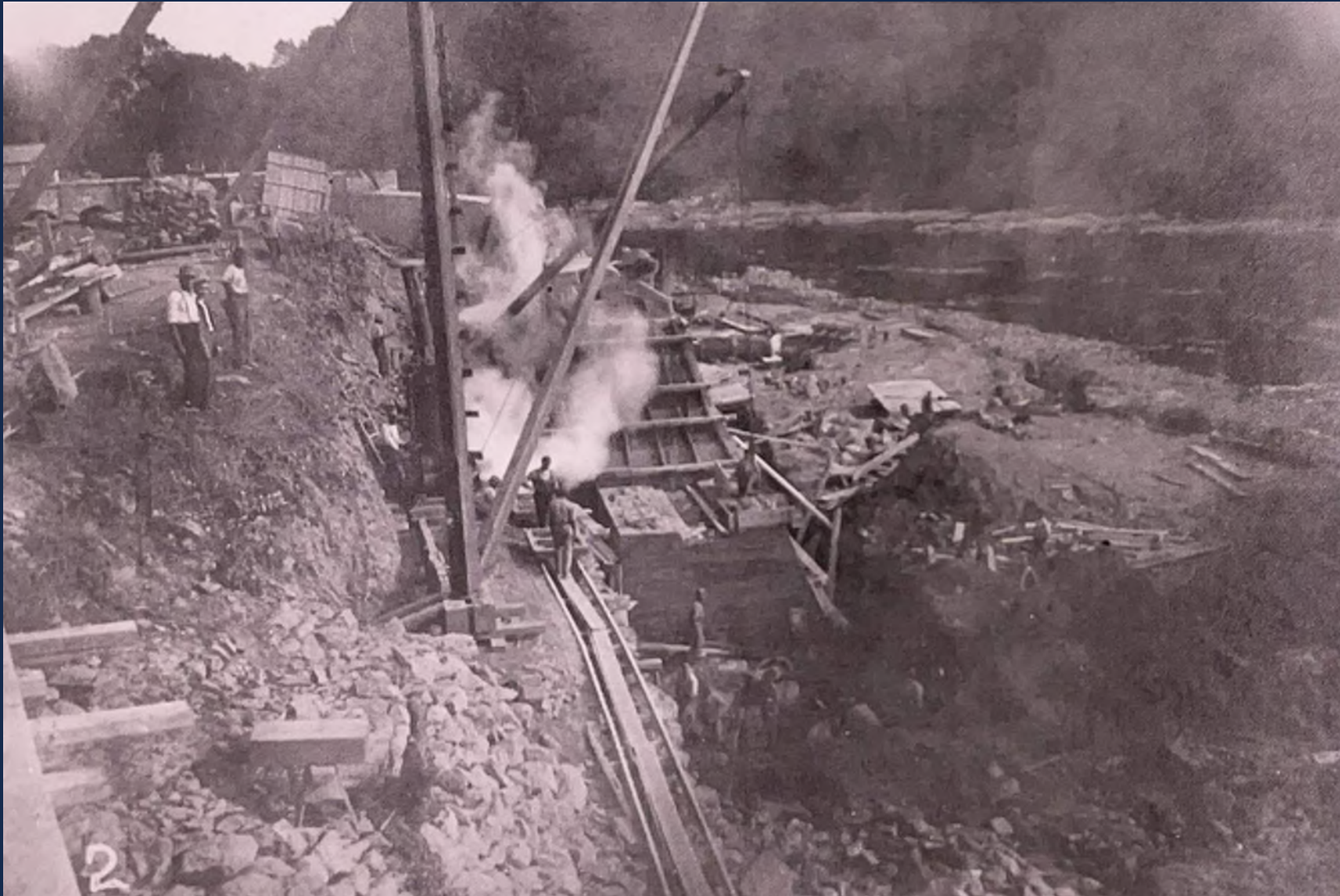
September 2022 - Install River Cofferddam at Weir



September 2022 - Concrete Conditions of Existing Weir



1909 - Construction of Canal Intake Wall near Current Weir



September 2022 - Dewatering and Excavation, Turtle and Fish removal



September 2022 - Bedrock Excavation for Weir



September 2022 - Excavation of Site



September 2022

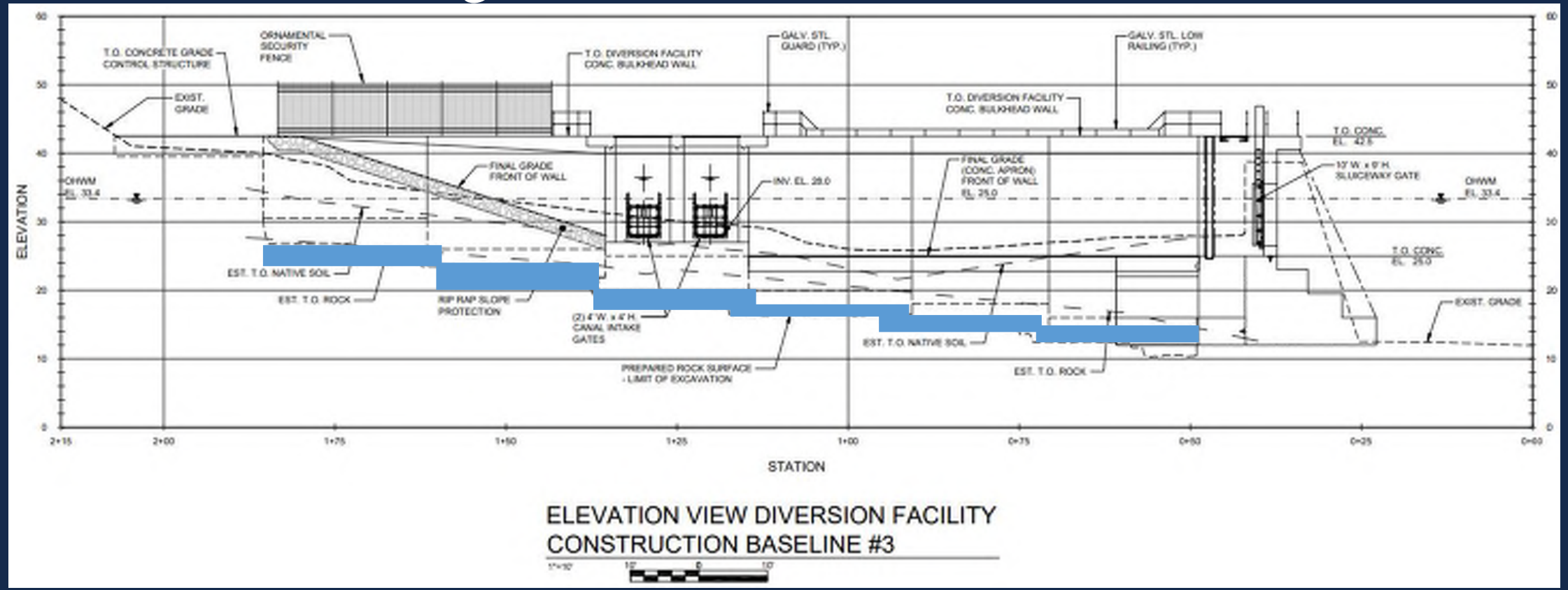
- contractor raised concerns when beginning excavation of accumulated sediment on site
- Characterized soil following PADEP Management of Fill Policy
 - 3 ft. layer of accumulated sediment upstream of Lock 68
 - Clean Fill Concentration Limit exceeded for Arsenic and Cyanide
 - Mass Removed: Approx. 3000 tons
- This discovery resulted in additional costs for disposal of Regulated Fill

October 2022 - Installation of Post-tensioned Rock Anchors



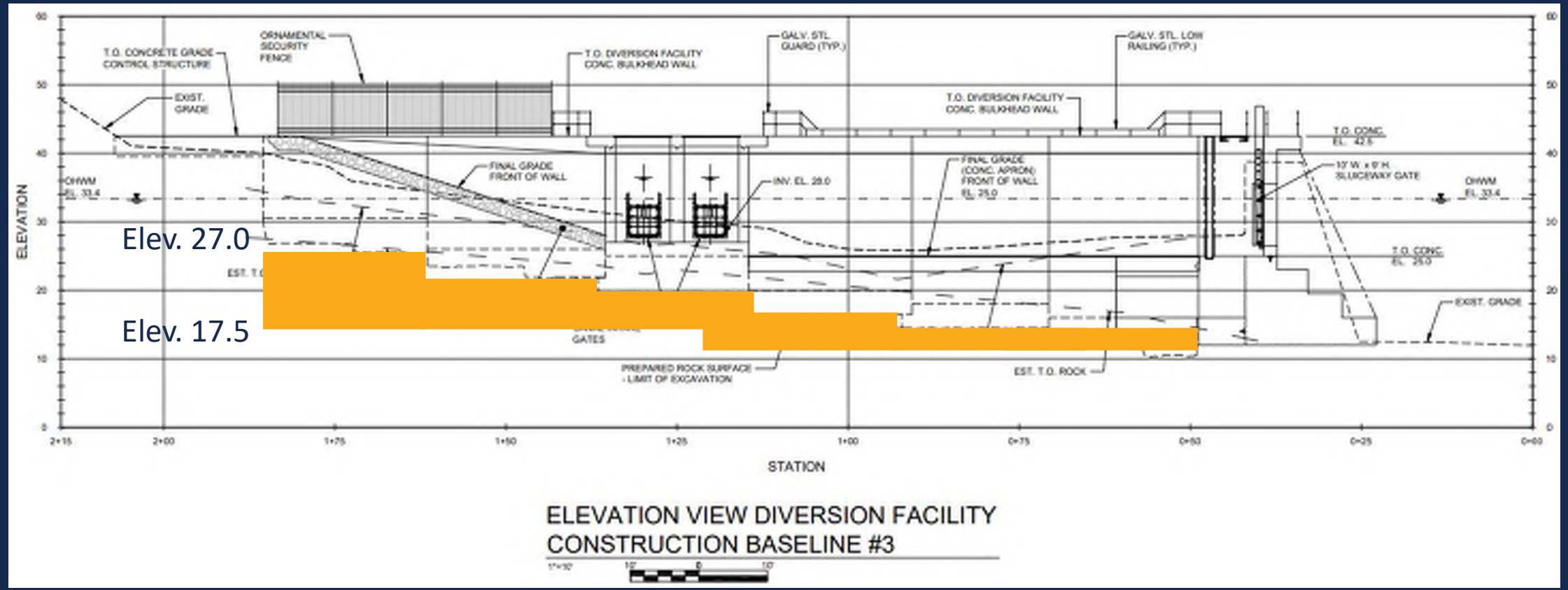
October 2022

- Bedrock Elevation slope did not rise like shown in pre-construction borings



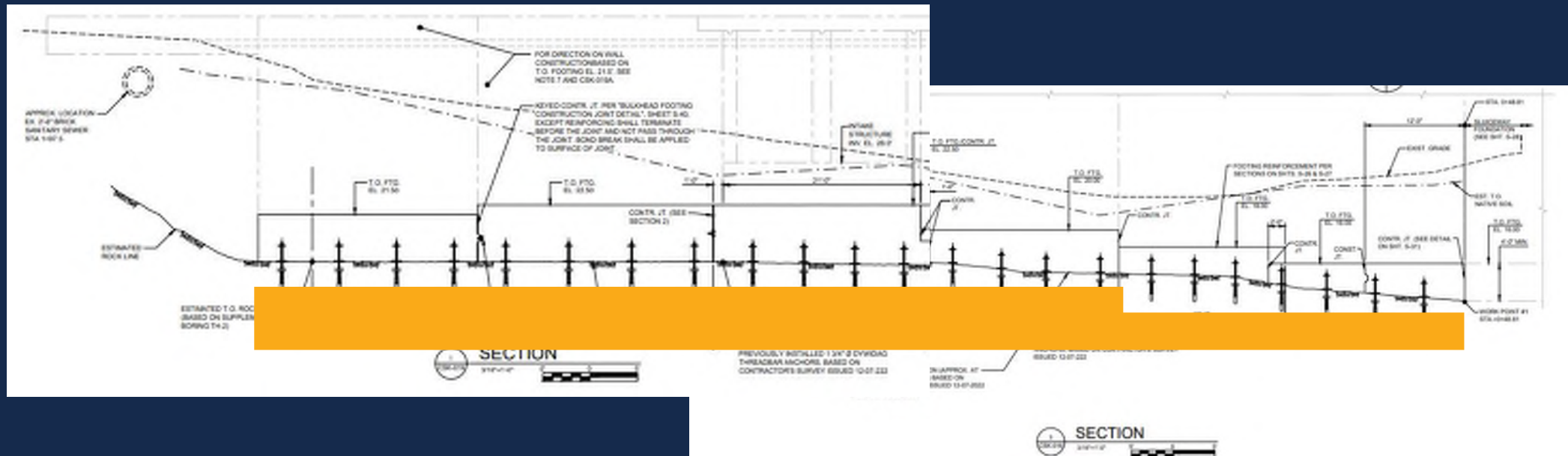
October 2022

- Resulting in as much as a 10 ft. change in Bulkhead Wall Foundations and Shoring needs for excavation



October 2022

- To combat the lack of rise in Bedrock Elevation sections of the wall were redesigned to be taller in height. This change resulted in cost increases for rebar, concrete, and support of excavation needs.



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



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



Weir

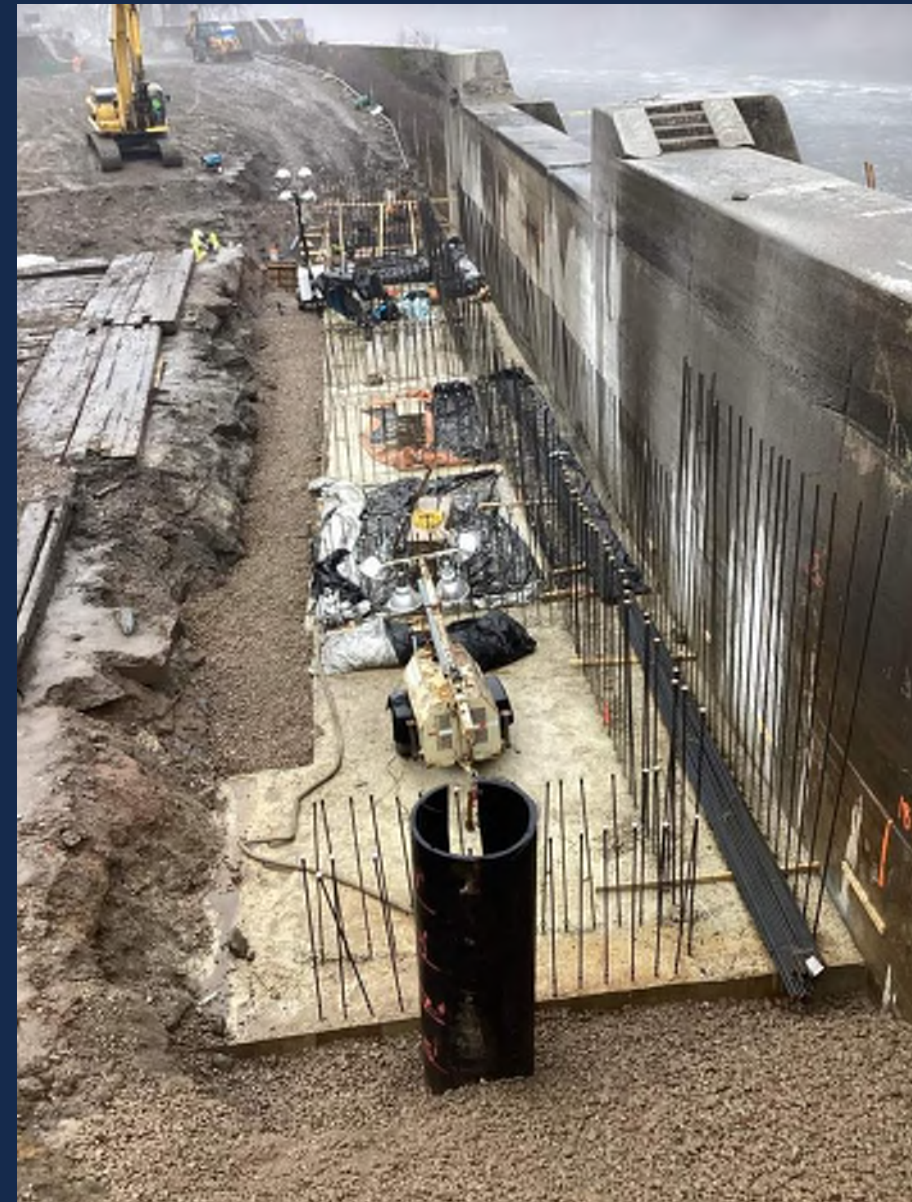


November 2022 - First Concrete Pour for Weir foundation behind Existing Weir



December 2022

- Constructing new concrete weir behind existing weir



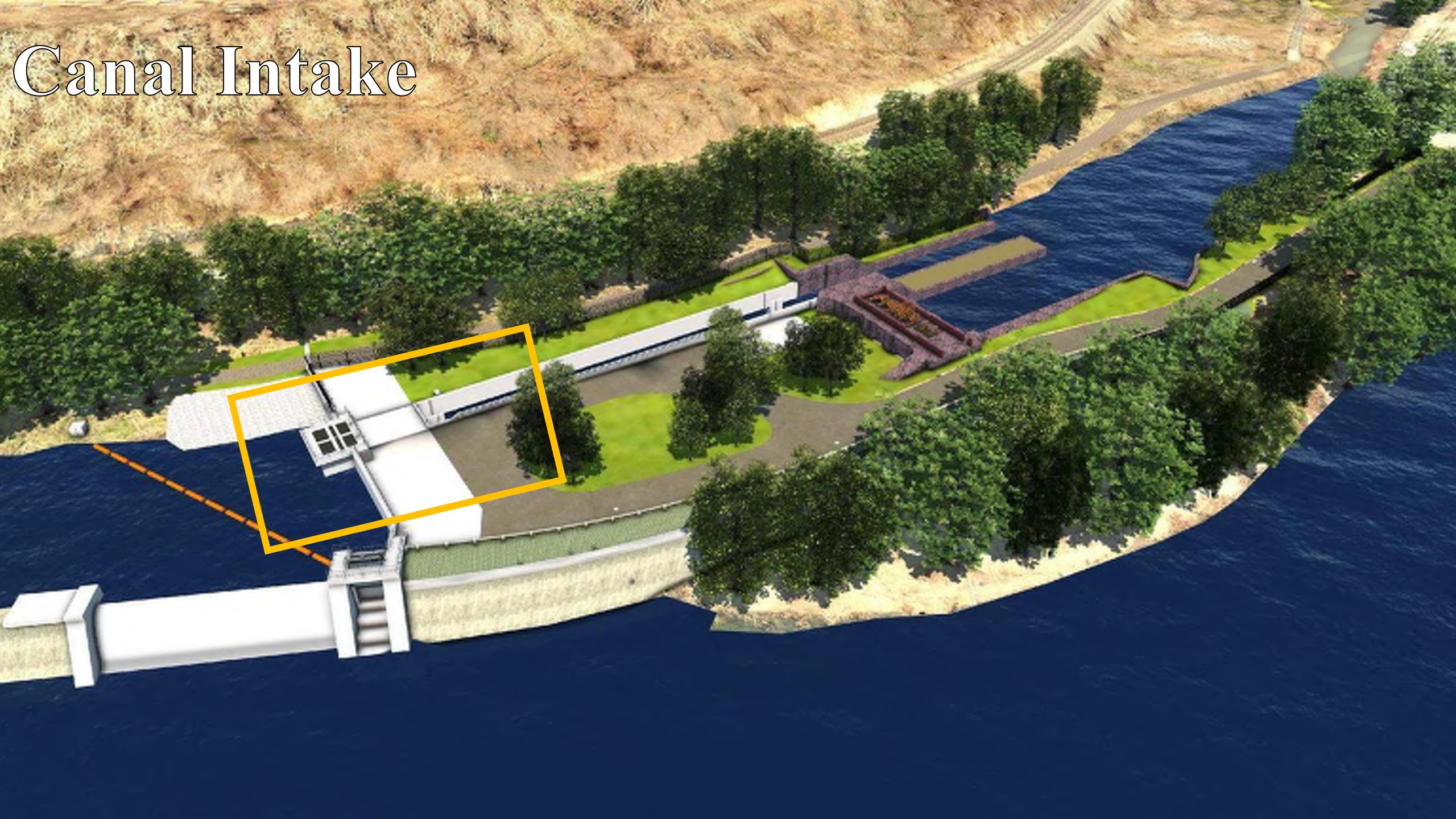
December 2022 - Sign facing Schuylkill River Trail



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 canal 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



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



September 2023 - Schuylkill River Trail Closure



September 2023 - Installation of Shoring for Bulkhead Wall



October 2023 - Shoring and Tieback Anchor Installation



October 2023 - Excavation and Shoring Installation



November 2023 - Topping off the concrete weir



December 2023 - Storms change site conditions in an instant



December 2023 - Storms change site conditions in an instant



December 2023 - Storms change site conditions in an instant



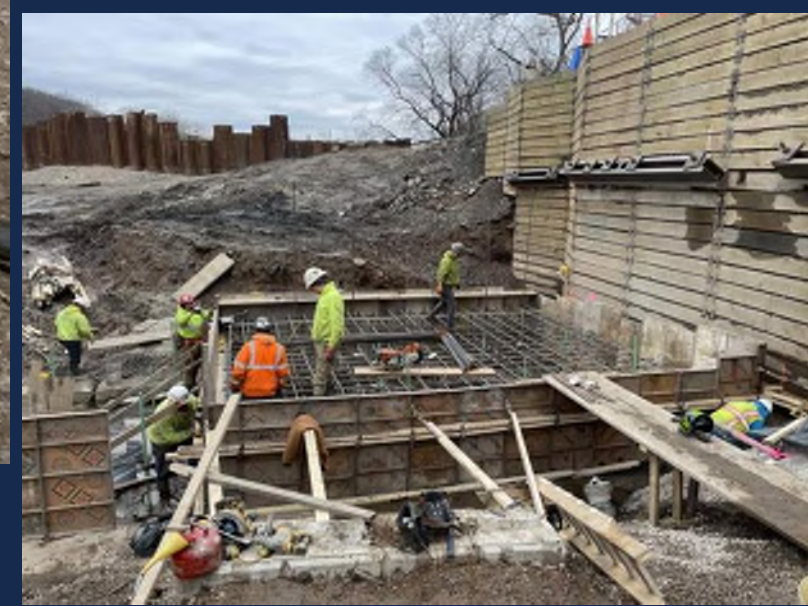
December 2023 - Stormflow recedes quickly revealing erosion around cofferdam



January 2024 - Shoring and Tieback Anchor Installation



January 2024 - Rock Anchors, Rebar, and Formwork for Bulkhead Wall



January 2024 - Formwork and Rebar at Sluiceway Gate



February 2024 - Bulkhead Wall Foundation, Rebar and Formwork Installation



February 2024 - Bulkhead Wall Foundation Concrete Pours



February 2024 - Bulkhead Wall Rebar and Formwork



March 2024 - Backfill on both sides of Bulkhead Wall



March 2024 - Concrete work crossing Schuylkill River Trail and resurfacing prior to reopening



March 2024 - Community Impact

Schuylkill River Trail Closure Concludes

- September 2023 to January 2024
- Delays extended trail closure
- Trail reopened in March 2024



April 2024 - River Flooding



April 2024 - Concrete Pours for Canal Intake and Foundations



May 2024 - Completion of Concrete Bulkhead Wall and Backfill



May 2024 - Old Canal Wall Cap and Curb Rock Anchors and Formwork and Rebar Work



June 2024 - Testing of Gates and Stop Logs for Canal Intake and Sluiceway Gates



June 2024 - Formwork and Rebar Installation for Canal



July 2024 - Ongoing Canal Concrete Pours



August 2024 - Completion of Canal Walls



August 2024 - Installation of Ladders and Trash Racks



September 2024 - Lock 69/ 70 Work to create splash pool



September 2024 - Project Site Tours



Pre-1900 - Dam Tour?



September 2024 - Progress towards cofferdam removal



October 2024 - PWD Operations Install Flow/ Level Sensors



October 2024 - Removal of Lock 68 Cofferddam





Completion of Work

October 2024

- Testing of Intake and Sluiceway Gates
- Installation of Debris Boom in forebay
- Removal of Cofferdam and flooding of Site Upstream

November 2024

- Opening of Canal Intake Gates and Introduce flow into the Mananyunk Canal

December 2024 to March 2025

- Construction of Green Stormwater Basins
- Installation of stormwater drainage piping
- Completion of asphalt and concrete access roadways

Spring 2025

- Planting of Green Stormwater Basins
- Ribbon Cutting Ceremony



Completion of Work

Timeline

May 2022

Historic Gatehouse

Weir



November 2022

Historic Gatehouse

Weir

March 2023

Historic Gatehouse

Weir



September 2023



Historic Gatehouse



Weir



February 2024

Historic Gatehouse

Weir



March 2024

Historic Gatehouse

Weir



September 2024

Historic Gatehouse

Weir



Completed

Historic Gatehouse

Weir



Project updates:
water.phila.gov/flat-rock





Ian McKane

Resident Engineer

ian.mckane@phila.gov

267-250-1816

[linkedin.com/in/ianmckane](https://www.linkedin.com/in/ianmckane)

Project updates:

water.phila.gov/flat-rock



Construction Contacts

Ian McKane, Resident Engineer
ian.mckane@phila.gov, 267-250-1816

Peter Reilly, Construction Division Engineer
peter.reilly@phila.gov, 215-200-1539

Amy Hopf, Public Relations Construction Liaison
amy.hopf@phila.gov, 215-809-7201

Project updates: water.phila.gov/flat-rock



Disclaimer: This Presentation is provided as of October 4, 2024. If you are viewing this Presentation after that date, there may have been events that occurred subsequently that could have a material effect on the information that was presented. By presenting this information, PWD has not undertaken any obligation to update the information beyond the date of the presentation. Data and other information provided are not warranted as to completeness or accuracy and are subject to change without notice. This Presentation is provided for your information and convenience only.

Dam Facts

- 6200+ cy Concrete Poured
 - 3900+ cy of Mass Concrete mix (Greater than 3ft deep pours)
- 165 Post-Tensioned Rock Anchors in Bedrock (45kip and 120kip design loads)
- Bulkhead Wall up to 30 ft. tall
- Weir Crest to Toe is 17.5 ft. tall



Flat Rock Dam

References:

- **Ramboll Engineering, (Previously: O'Brien & Gere Engineers, Inc.):
Artistic Renderings, Kevin Grim Drone Progress Photos**
- **Ian McKane, PWD: Photos**
- **Tom McIntyre, JBC Associates as PWD Inspector: Photos**

Book References:

- **Inland: The Abandoned Canals of the Schuylkill Navigation by Sandy Sorlien**
- **Images of America: The Schuylkill Canal by Karen Rodemich Roman**



Project Website

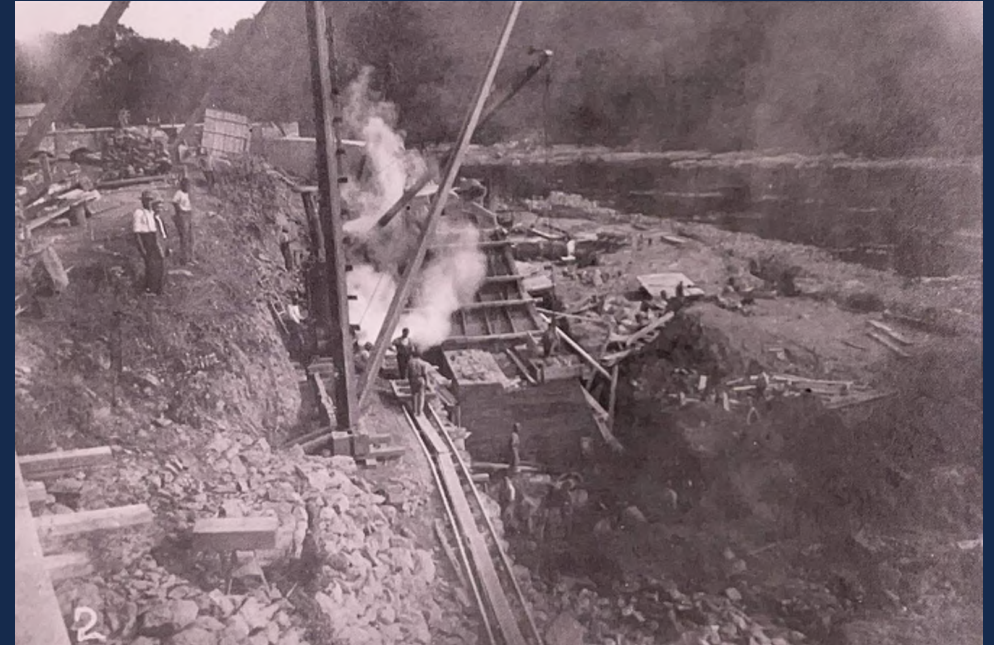
water.phila.gov/flat-rock

The screenshot shows the Philadelphia Water Department website for the Flat Rock Dam Betterment project. The header includes the department logo and navigation links for Water Utility, Sustainability, Education & Outreach, and About Us. The main navigation bar features 'Projects & Construction', 'Browse Projects', 'Construction Map', and 'Water Revitalization Plan'. The project title is 'MANAYUNK, NORTHWEST PHILADELPHIA Flat Rock Dam Betterment'. A progress bar indicates the current phase is 'Construction', with other phases being Planning, Design, Pre-Construction, and Complete. The start date is 'Spring 2022' and the completion is 'Estimated Fall 2024'. A map shows the project location on the Schuylkill River with callouts for various features like 'Manayunk Clearing', 'Green Stormwater Basin', 'New Access Road', 'Duckweed Management', 'Water Wall', 'Footing Deck to Support Dam Structure', 'Canal Intake Structure', and 'Canal'. A 'Project Details' sidebar lists: Project Type: Green; Watershed: Schuylkill; ZIP Code: 19127; Council District: District 4 - Curtis Jones, Jr.; Partner: Philadelphia Parks & Recreation. A 'Project Files' section contains a document titled 'Flat Rock Dam Betterment Project SRT Closure - updated'. A 'March 2024 SRT Reopening Update' section states: 'The closed trail section between the Manayunk Towpath and Shawmont will officially reopen on Saturday, March 30, 2024.'

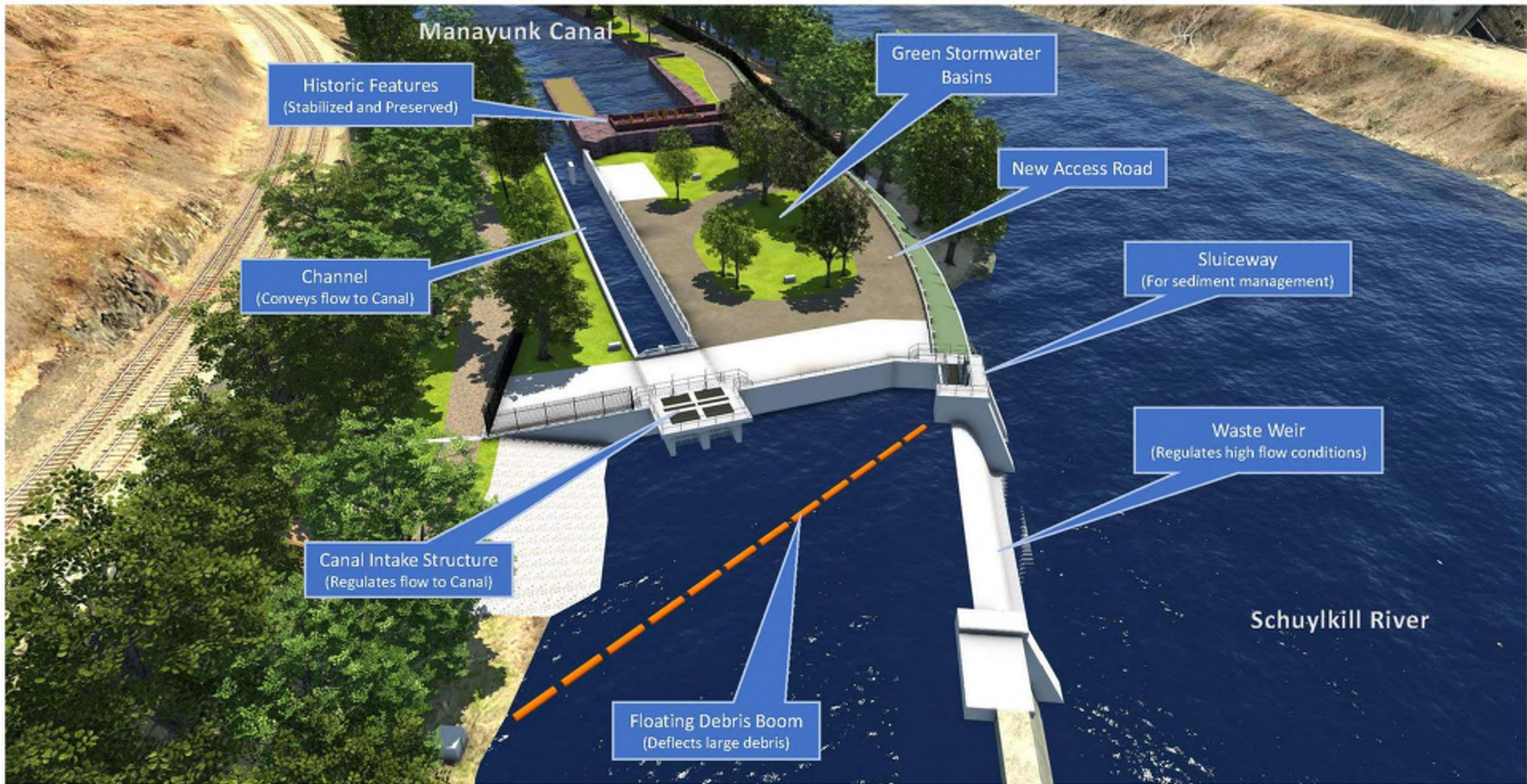
Flat Rock Dam

Project Stakeholders / Partners:

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



1909 – Canal Intake Wall





Canal Intake Structure

Green Stormwater Basin

New Channel

Interpretive Historical Panel

Historic Features to Remain

Sluiceway

New Waste Weir

Green Stormwater Basins

New Access Drive

Lowered and Stabilized Canal Intake Channel Wall



FLAT ROCK DAM MAIN SPILLWAY
OWNED BY THE COMMONWEALTH OF PENNSYLVANIA

INLET CANAL WALL

MANAYUNK INLET CANAL

MANAYUNK CANAL

LOCK NO. 58

FEEDER STRUCTURE

SCHUYLKILL RIVER
(WATERS OF THE U.S.)

FISH LADDER OWNED BY THE
COMMONWEALTH OF
PENNSYLVANIA



Ian McKane

Resident Engineer

ian.mckane@phila.gov

267-250-1816

[linkedin.com/in/ianmckane](https://www.linkedin.com/in/ianmckane)

Project updates:

water.phila.gov/flat-rock

