Appendix A

Public Participation Materials

A.1 Meeting Presentations

1. Supplemental CSO Team Meeting No. 1, June 9, 2017
2. Supplemental CSO Team Meeting No. 2, October 11, 2017
3. Supplemental CSO Team Meeting No. 3, January 29, 2018
4. Supplemental CSO Team Meeting No. 4, June 5, 2018
5. Supplemental CSO Team Meeting No. 5, October 26, 2018
6. Supplemental CSO Team Meeting No. 6, January 30, 2019
7. Supplemental CSO Team Meeting No. 7, April 11, 2019
8. Supplemental CSO Team Meeting No. 8, June 7, 2017
9. City Council Presentation, November 6, 2019
10. Public Meeting No. 1 / Supplemental CSO Team Meeting No. 9, January 23, 2020
11. Public Meeting No. 2 / Supplemental CSO Team Meeting No. 10, August 26, 2020

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Supplemental CSO Team

Meeting No. 1 – Project Introduction
Long-Term Control Plan Permit Compliance

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

June 9, 2017, 1 pm
Elizabeth City Hall Council Chambers

Supplemental CSO Team Meeting No. 1 Agenda

Important points to cover:

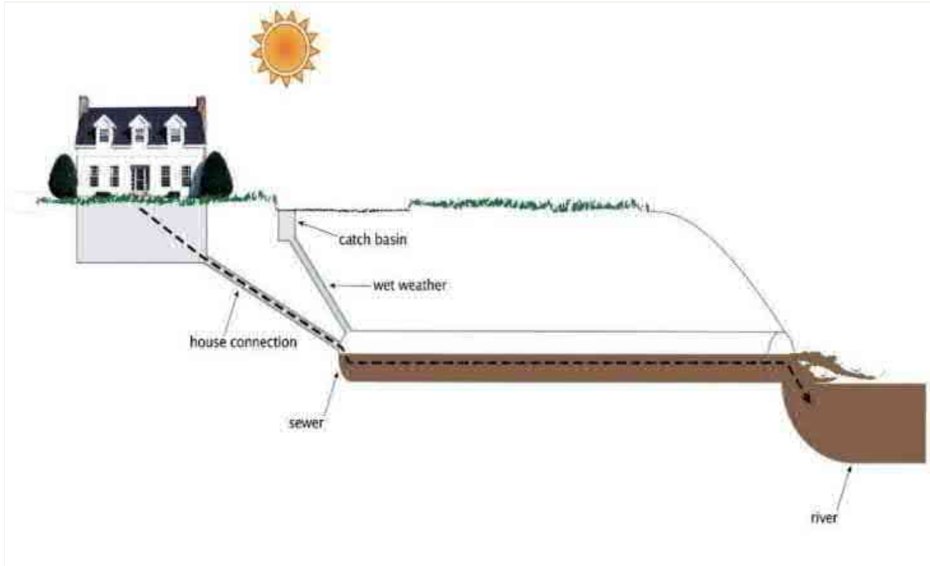
- Introductions
- What is a Combined Sewer System?
- What is a Combined Sewer Overflow?
- Why are the City and JMEUC undertaking this project?
- What are the regulatory requirements?
- What have the City and JMEUC done so far, and what's left?
- What is my role?

What is a Combined Sewer System?

Oldest Sewers in Country

In the mid 1800s, sewers and ditches were built in large cities to transport both sewage and stormwater to the river.

Is dilution the solution?

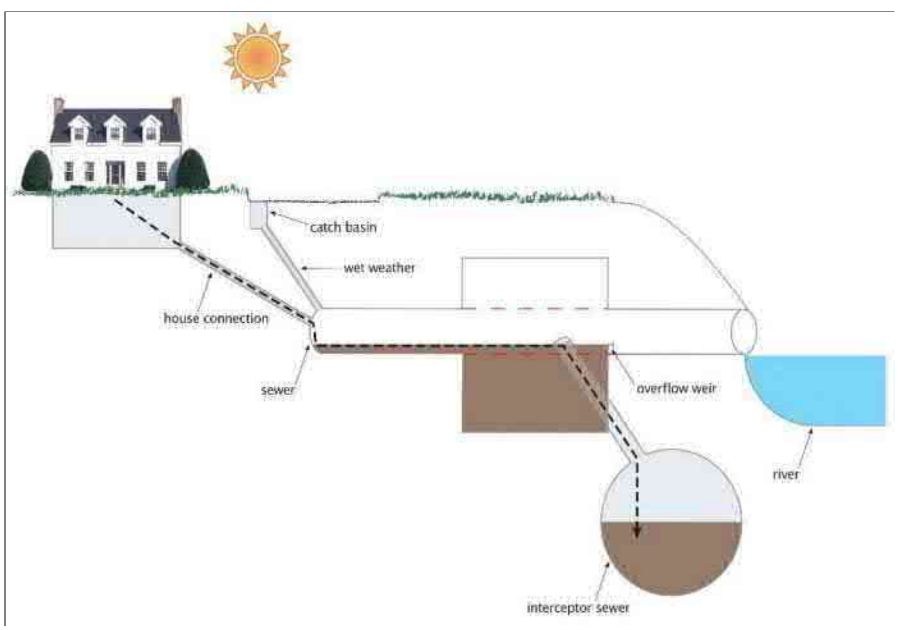


What is a Combined Sewer System?

Oldest Sewers in Country

By the turn of the century, our rivers turned to open sewers and new intercepting sewers were constructed to collect and treat wastewater.

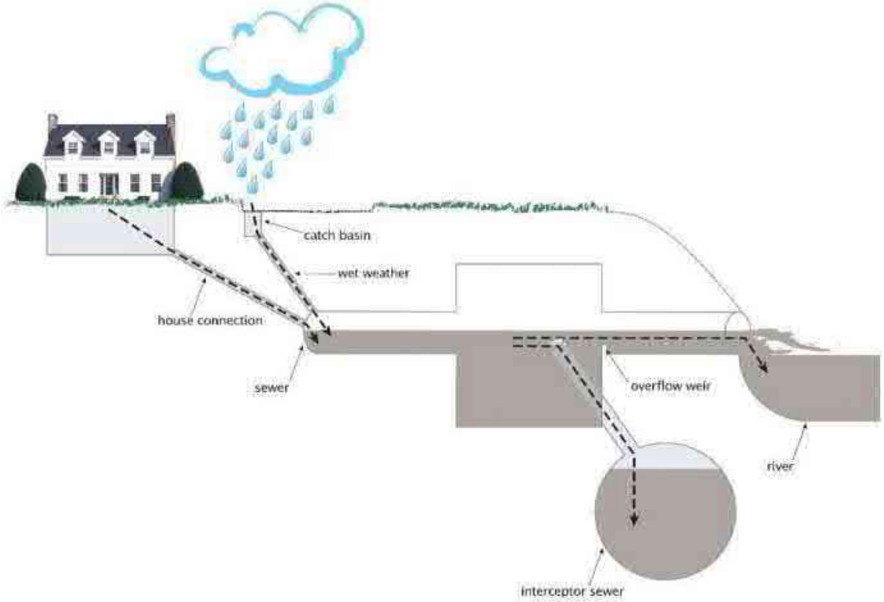
Dilution is not the solution!



What is a Combined Sewer Overflow?

Oldest Sewers in Country

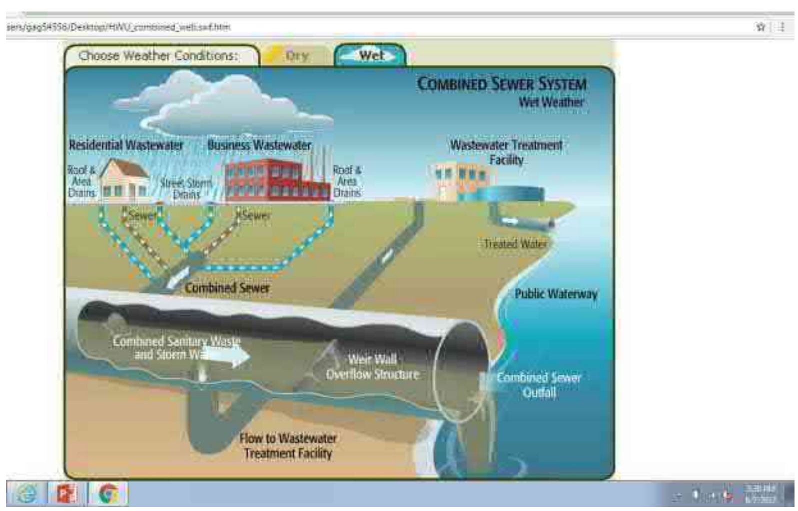
Dilution is not the solution, but hydraulic relief is needed in wet weather to limit the size and cost of Interceptor Sewers and Sewage Treatment Plants.



What is a Combined Sewer Overflow?

Combined Sewer Flow Animation File:

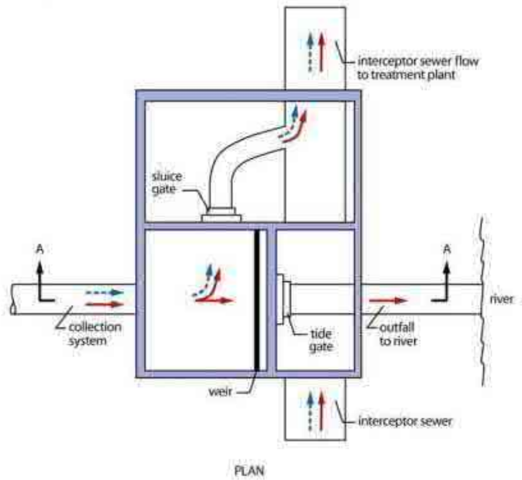
HWU_combined_web.swf



What is a Combined Sewer Overflow?

Oldest Sewers in Country

Wet weather flows to the Sewage Treatment Plant are controlled by CSO Control Facilities



Typical Automatic Regulator

What is a Combined Sewer Overflow?

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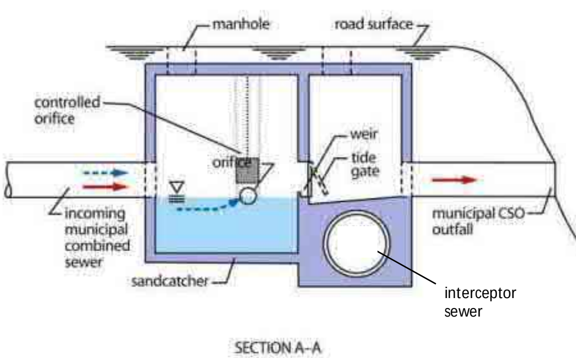
Typical Automatic Regulator

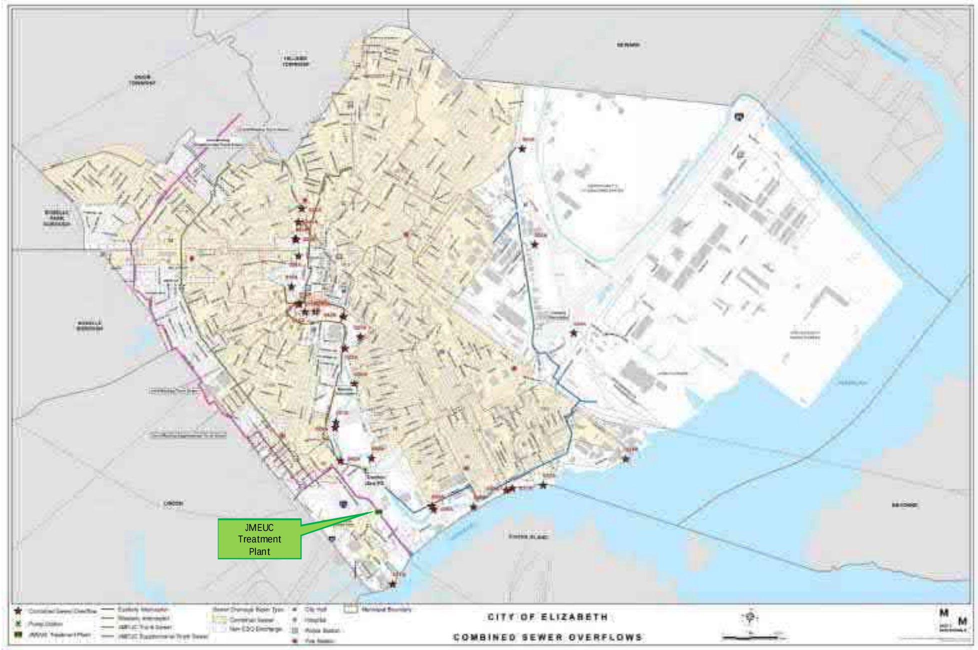


City of Elizabeth – CSO Locations

Population: 129,000

CSO Characteristics:
29 CSO Discharge Points

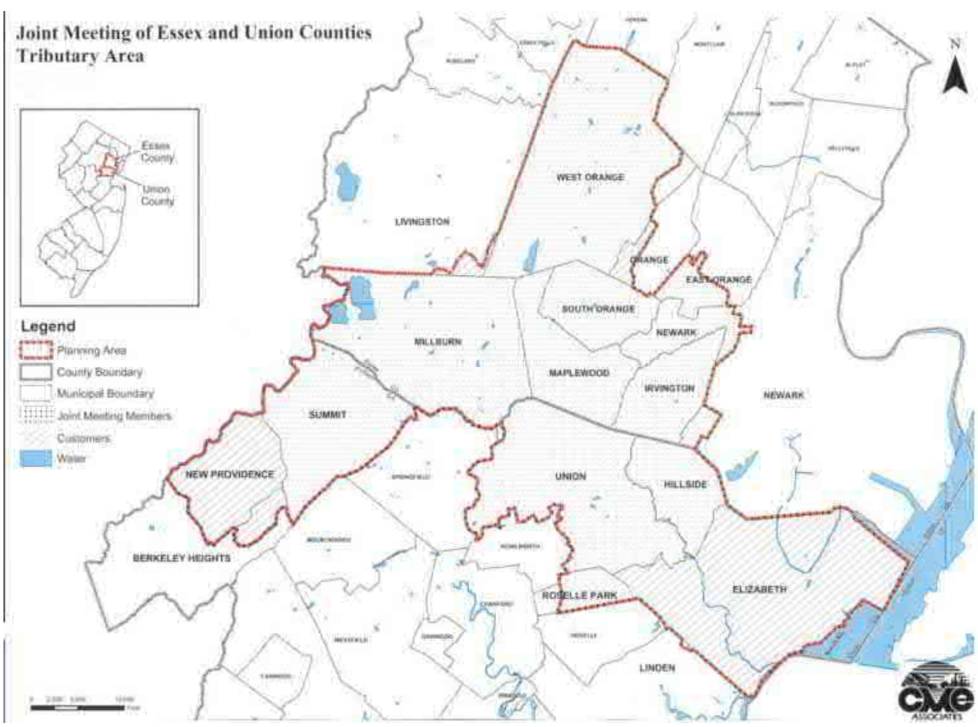
Receiving Waters:
Elizabeth River,
to the Arthur Kill



JMEUC Tributary Area

11 member communities:
- East Orange
- Hillside
- Irvington
- Maplewood
- Millburn
- Newark
- Roselle Park
- South Orange
- Summit
- Union
- West Orange

4 customer communities:
- City of Elizabeth
- Livingston
- Orange
- New Providence



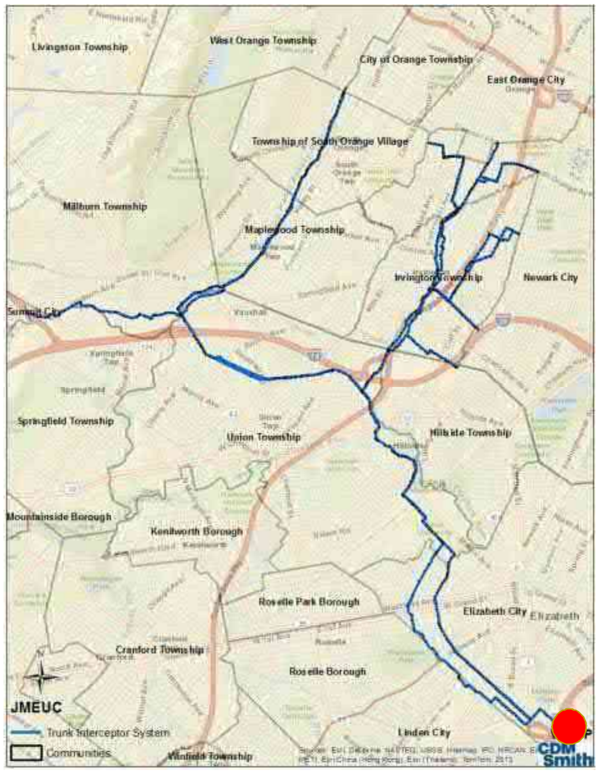
JMEUC Interceptor Sewer System

Total Service Area = 60 square miles

Gravity sewers ranging from 10-inches in diameter to the twin 67 x 68-inch rectangular sewers at WWTP

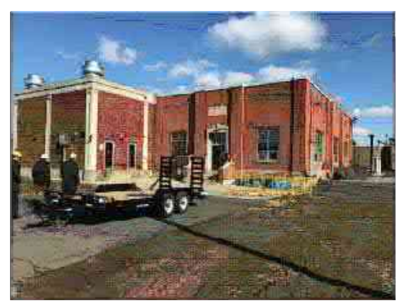
WWTP capacity:

- Design flow = 85 mgd
- Maximum capacity varies with tidal conditions: up to 225 mgd



JMEUC Wastewater Treatment Plant

JMEUC Wastewater Treatment Plant



Why are the City and JMEUC undertaking this work?

History of Regulations & Permits

- US EPA issued National CSO Control Policy in 1994
  - Remains the current national framework for CSO control and Long-Term Control Plan (LTCP) development
- NJPDES Permits for all CSO discharges first issued in 1995 under General Permits for Combined Sewer Systems
  - Nine Minimum Controls, incl. Solids/Floatable Control Facilities in 2001 to 2005
  - Initial System Characterizations & Cost and Performance Analysis Work for LTCP in 2007

Why are the City and JMEUC undertaking this work?

NJDEP Issues Individual NJPDES Permits

- Issued in March 2015, Amended in October 2015
- To develop Long-Term CSO Control Plans per EPA National Policy
- 25 Permittees Total – Fractured ownership of collection systems and treatment plants
  - With regional coordination and cooperation, LTCP anticipated to center around Treatment Plant and its associated CSO communities
    - JMEUC has the sewage treatment plant
    - Elizabeth has the combined sewer system

What are the regulatory requirements?

Nine elements of the Long-Term Control Plan:

1. Characterization, monitoring, and modeling of the combined sewer systems
2. Public participation (Supplemental CSO Team is a component)
3. Consideration of sensitive areas
4. Evaluation of alternatives
5. Cost/performance considerations
6. Operational plan
7. Maximizing treatment at the existing treatment plant
8. Implementation schedule
9. Compliance monitoring program

What are the regulatory requirements?

Long-Term Control Plan Submittal Schedule:

CSO Submittal Summary

Summary of Reports Required to be Submitted to the Department		
Permit Condition	**Abbreviated Description of Requirement**	**59 Month LTCP Due Date**
Part IV.D.3.b.ii	Submit System Characterization Report	July 1, 2018
Part IV.D.3.b.iii	Submit Public Participation Process Report	July 1, 2018
Part IV.D.3.d	Submit Compliance Monitoring Program Report	July 1, 2018
Part IV.D.3.b.iv	Submit Consideration of Sensitive Areas Plan	July 1, 2018
Part IV.D.3.b.v	Submit Development and Evaluation of Alternatives Report	July 1, 2019
Part IV.D.3.b.vi	Submit Selection and Implementation of Alternatives Report in the Final LTCP	June 1, 2020

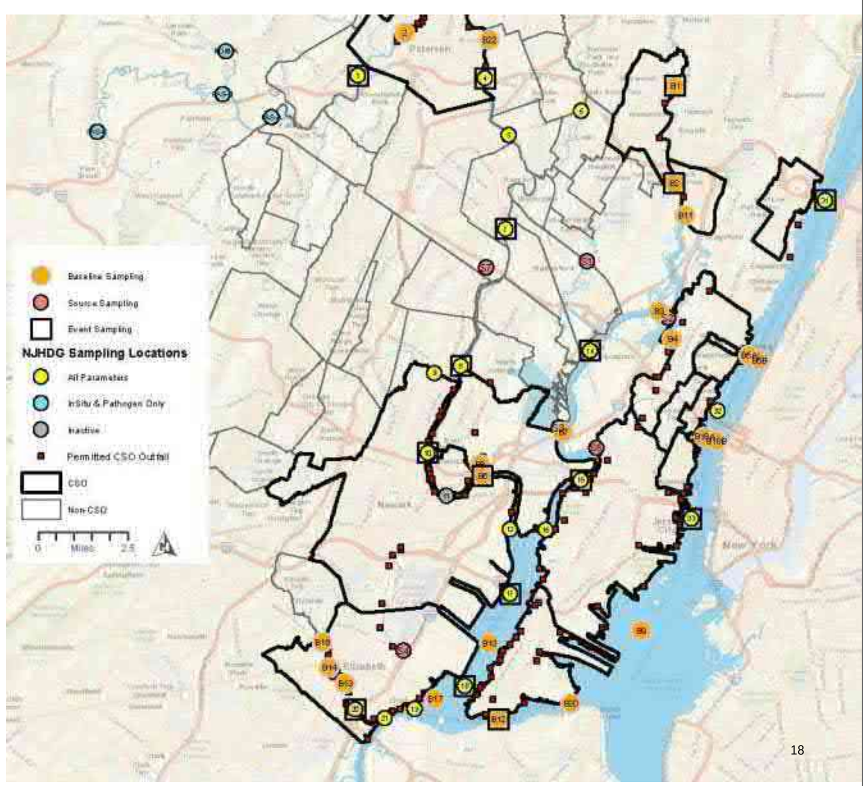
What are the regulatory requirements?

NJPDES Individual Permits include requirements other than LTCP development, such as:

- Install new outfall signs
- Create and maintain CSO hotline or website for public notification of CSO occurrences
- Update Operation and Maintenance Manual
- Update Standard Operational Procedures (SOPs)
- Develop Asset Management Plan
- Revise rules/ordinances on sewer use conditions
- Update information on component locations and mapping

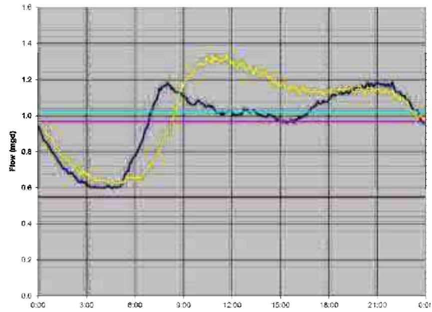
Working Together in NJ

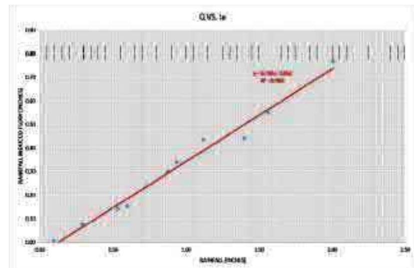
- There are nearly 200 CSO Outfalls in the Region not counting New York City!
- Elizabeth and JMEUC are coordinating with several other municipalities and sewage authorities as part of the NJ CSO Group.
- Keeps abreast of CSO issues and assists members with CSO compliance for interconnected waterways with CSO Outfalls.



City of Elizabeth - Work Performed to Date

- System Characterization Work Plan (submitted and approved)
- Baseline Compliance Monitoring Program Work Plan (submitted and approved in conjunction with NJ CSO Group shared services program)
- Combined and separate sewer system area mapping
- Sewer inventory and field surveys
- Sewer flow monitoring (40 sites for 4-month period)
- Sewer flow sampling and analysis for 3 wet weather events
- Sewer system model updating





City of Elizabeth – Upcoming Work Items

- Compile combined sewer flow sampling results and summary chapter
- Complete updated sewer system model calibration and validation
- Coordinate typical year precipitation record selection
- Follow-up on outside flows from adjoining towns

JMEUC - Work Performed to Date

- System Characterization Work Plan (submitted and approved)
- Baseline Compliance Monitoring Program Work Plan (submitted and approved in conjunction with NJ CSO Group shared services program)
- Interceptor sewer system model developed
- Flow and rainfall monitoring program in place
    - Flow monitoring: 32 sites – August 2013 to present
    - Rainfall: 4 sites – November 2014 to present
- Analysis of full record of flow and rainfall data completed

JMEUC – Upcoming Work Items

- Link City of Elizabeth combined sewer system model to JMEUC interceptor sewer model
- Refine interceptor sewer model representation of WWTP
- Update interceptor sewer system model calibration
- Coordinate selection of typical year precipitation record
- Apply updated model to characterize interceptor sewer system performance
- Characterize WWTP performance
- Prepare System Characterization Report

Public Participation Process

- Supplemental CSO Team is an essential part of this process!
- To seek to actively involve the affected public
  - Rate payers
  - Environmental groups
  - Economic Development Groups
  - Industrial, Institutional, and Educational Interests
  - Integration with Municipal Agencies
- NJDEP interested in assisting in the public participation efforts

Stakeholders Invited to Participate

Department of Engineering, Public Works and Facilities Management

Elizabeth River / Arthur Kill Watershed Association

Supplemental CSO Team

- Advisory role; two-way communications is key
- You are our link to the general public
- Will provide input on planning process
- Will provide input for consideration on
  - evaluation of sensitive areas
  - evaluation of CSO control alternatives
  - selection of CSO control alternatives
- Final selection and decision rests with permittees, with NJDEP approval

Public Participation Process

Supplemental CSO Team

- Quarterly meetings anticipated for:
  - permit process and requirements
  - system characterization and results
  - status and schedule for each process
  - sensitive area analysis
  - alternatives evaluation considerations
  - LTCP alternatives and costs
  - implementation schedule

System Characterization and Sensitive Areas

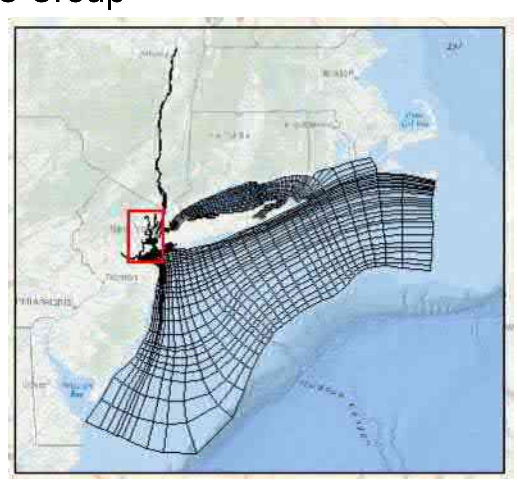
Deadline for submission July 1, 2018

- City of Elizabeth and JMEUC working cooperatively to develop independent reports
- Characterization of system performance
  - CSO performance statistics
  - System conveyance capacities/limitations vs. wet weather system flows
  - Identification of basement and surface flooding
- Identification of Sensitive Areas

Compliance Monitoring Program (CMP) Report

Deadline for submission July 1, 2018

- City of Elizabeth and JMEUC working with NJ CSO Group
- Report to establish baseline receiving water quality conditions
- Water quality model being developed to better evaluate:
  - WQ in the region
  - Existing WQ compliance
  - Impacts of CSO discharges
  - Impacts of separate storm sewer discharges
  - Impacts from NYC combined sewers



Development and Evaluation of Alternatives

Deadline for submission July 1, 2019

- Work will be presented to Supplemental CSO Team in future meetings
  - what are alternative controls?
  - space requirements for each
  - what are the costs associated with each?
    - construction costs
    - operation and maintenance costs
  - anticipated benefits

Selection and Implementation of Alternatives Report in the Final LTCP

Deadline for Submission June 1, 2020

- Work will be presented to Supplemental CSO Team in future meetings
  - what are alternative controls recommended?
  - what are the costs associated with the LTCP?
    - construction costs
    - operation and maintenance costs
  - implementation and funding schedule
  - anticipated benefits

Scheduling of Future Meetings

- Quarterly
- Next meeting: September 2017

Questions?

Thank you

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

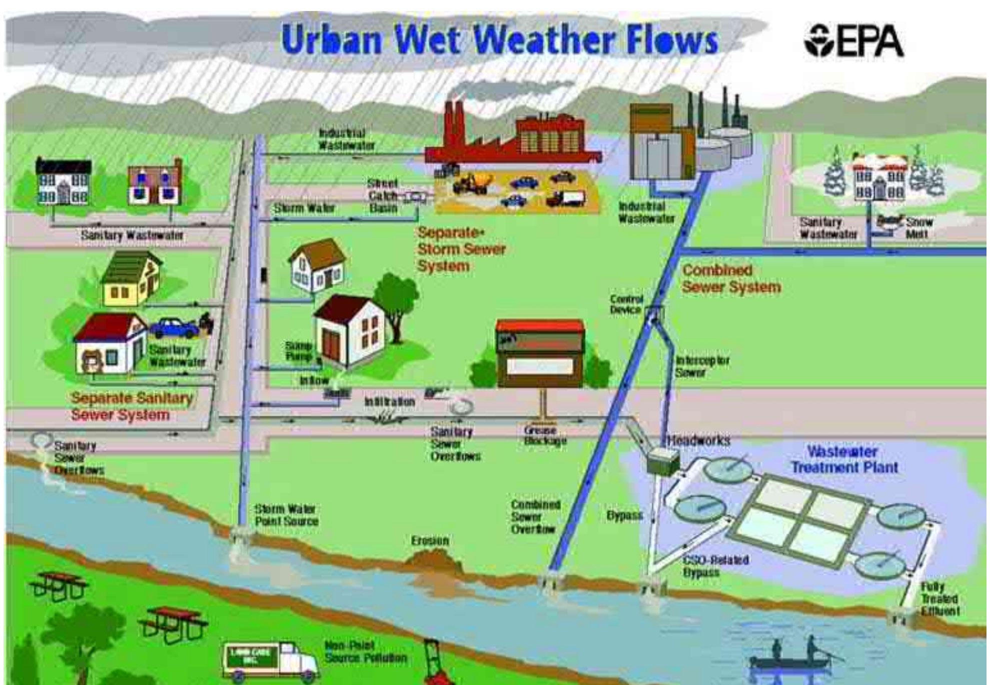
Supplemental CSO Team

Meeting No. 1 – Project Introduction
Long-Term Control Plan Permit Compliance

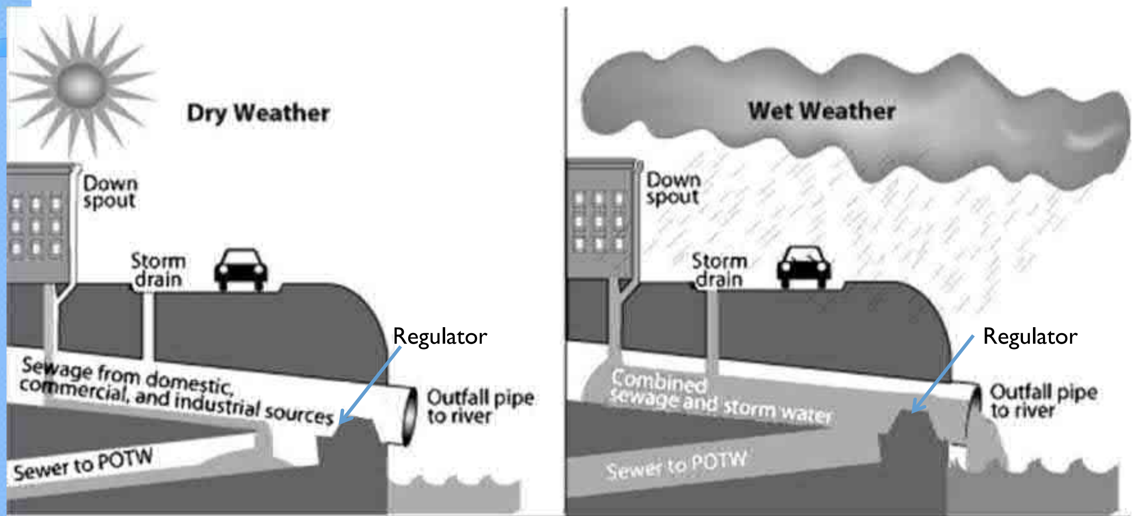
Combined Sewer Overflow Program Overview

Division of Water Quality

Sewer System Types



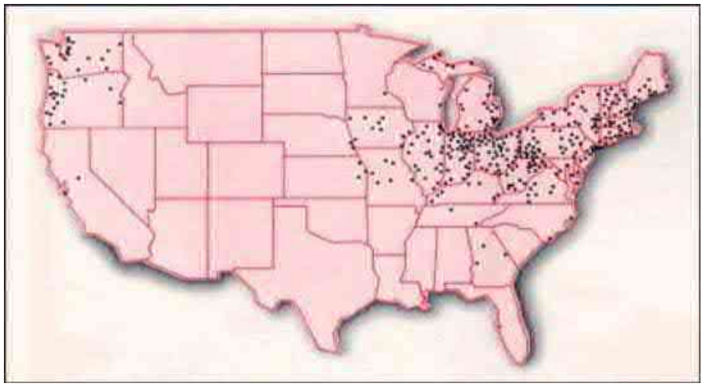
Combined Sewer System Operation



Combined Sewer Systems

- Combined Sewer Systems are remnants of our country's early infrastructure. They are outdated and in need of repair.

CSOs in the US

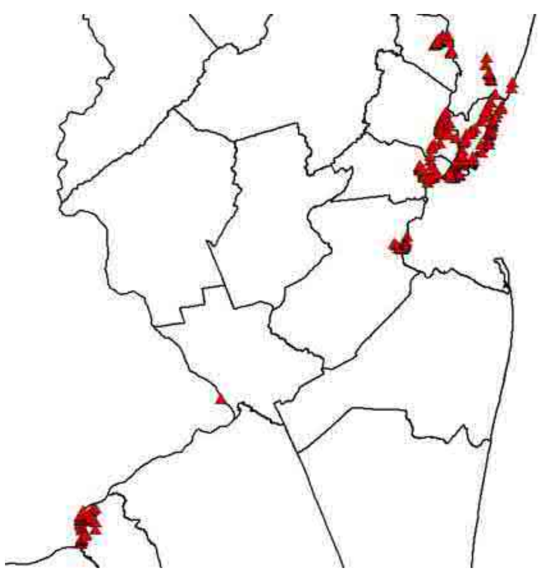


-<u>772 communities</u>

-9350 outfalls

-850 billion gallons discharged per year

CSOs in New Jersey



- 21 communities
- <u>210 permitted outfalls</u>
- 23 billion gallons discharged per year
- 9 POTWs
  - Northeast: 179 outfalls, 7 communities and 7 POTWs
  - Camden County: 30 outfalls, 3 communities and 1 POTW
  - Trenton: 1 outfall, 1 community and 1 POTW

CSO Permits - Two Components

- **Nine Minimum Controls (NMC)**
  - Simple, low cost measures
  - Mostly carried forward but with some enhancements
- **Long Term Control Plan (LTCP)**
  - Goal is to reduce or eliminate CSO discharges to comply with the CWA
  - Dictates a path to achieve that goal
  - Substantially new requirements
  - Due June 2020

Nine Minimum Controls (NMC)

- Proper operation and maintenance
- Maximize use of collection system for storage
- Review of pretreatment requirements
- Maximize flow to POTW for treatment
- Elimination of discharges during dry weather (SSO)
- **Control of solids/floatables**
- Pollution prevention
- **Public notification (signs & website)**
- Monitoring of impacts and efficacy of controls

CSO - Outfall

Nets Can Be Exposed

S/F Nets Under Stress

Nets Can Be Exposed

Nets Can Be Exposed

S/F Nets Can Be Hidden

S/F Nets Can Be Hidden

Public Notification – Two Signs

CSO Websites

11/29/16; 4:57 PM
http://www.nhudsonsa.com/Public/waterbody.html

Long Term Control Plan (LTCP)

- System characterization, monitoring and modeling
- **Public participation**
- **Consideration of sensitive areas**
- Evaluation of CSO control alternatives
- Cost/performance considerations
- Operational plan
- Maximization of treatment at the POTW
- Implementation schedule
- Post-construction compliance monitoring

Public Participation

- Permittees are required to seek public input throughout the LTCP process via the Supplemental CSO Team:

➢ Where is flooding?
➢ What abatement strategies should be considered?
➢ What should be the LTCP schedule?

- Permittees are not *required* to follow public input.

Consideration of Sensitive Areas

- Sensitive areas can include: ONR Waters, T&E species, Drinking Water Intakes and Primary Recreation (Bathing beaches)

- Sensitive Areas are given the highest priority

Questions?

Nancy Kempel
CSO Program
Division of Water Quality
Nancy.Kempel@dep.nj.gov
(609) 984-4428

Supplemental CSO Team

Meeting No. 2 – Project Update
Long-Term Control Plan Permit Compliance

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

October 11, 2017 – 1:00 pm
Elizabeth City Hall Council Chambers

Supplemental CSO Team Meeting No. 2 Agenda

- Previous meeting recap
- CSO outfall locations
- Sewer sampling summary
- Modeling updates (Elizabeth and JMEUC)
- Recent and pending sewer improvement projects
- Input on public outreach opportunities
- Input on potential sensitive areas
- 6-month look-ahead

Prior Meeting Recap:
City of Elizabeth Combined Sewer System

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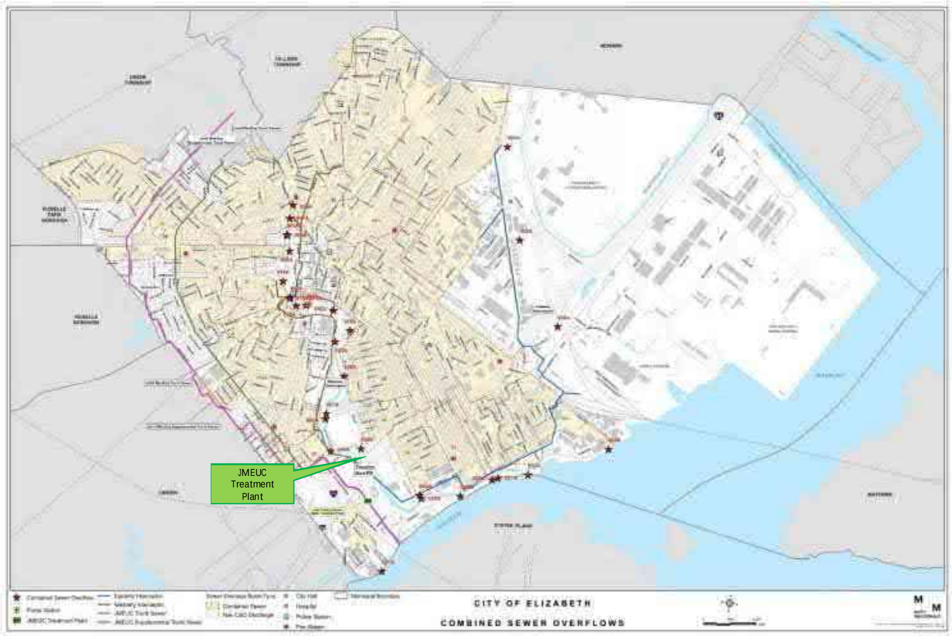

Prior Meeting Recap:
Why are the City and JMEUC undertaking this work?

- Long history of regulatory action on combined sewers
- Most recently, NJDEP issued Individual NJPDES Permits in March 2015, Amended in October 2015
- To develop Long-Term CSO Control Plans per EPA National Policy
- 25 Permittees Total – Fractured ownership of collection systems and treatment plants
  - With regional coordination and cooperation,
    LTCP anticipated to center around Treatment Plant and its associated CSO communities
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  - Integration with Municipal Agencies
- NJDEP willing to assist in the public participation efforts

Elizabeth River / Arthur Kill Watershed Association

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Supplemental CSO Team

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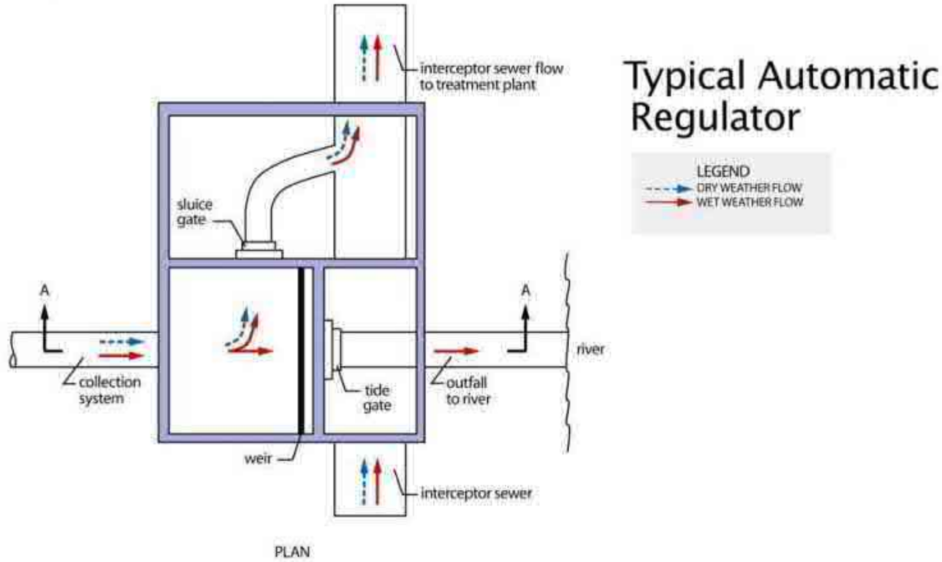

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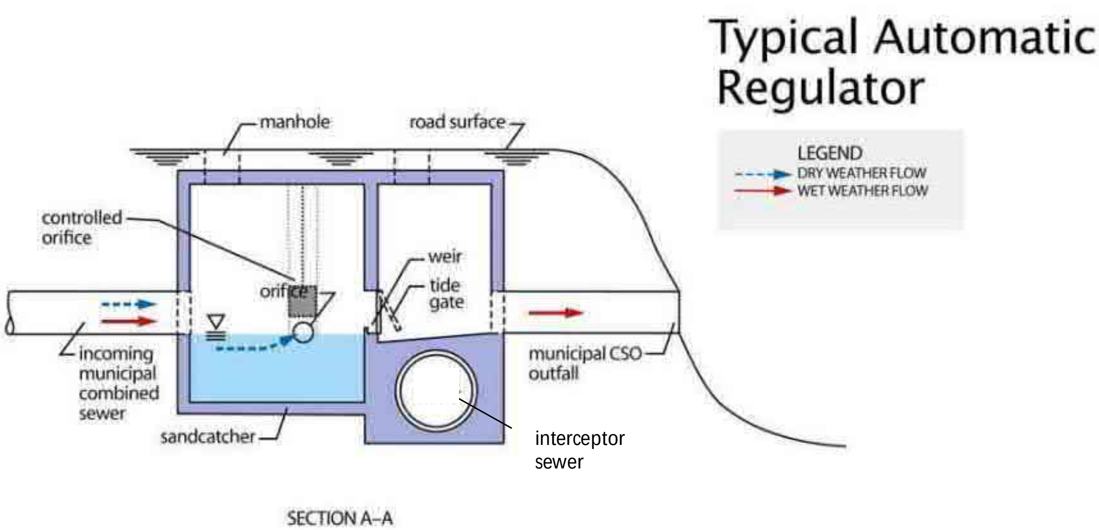

CSO Outfall Locations

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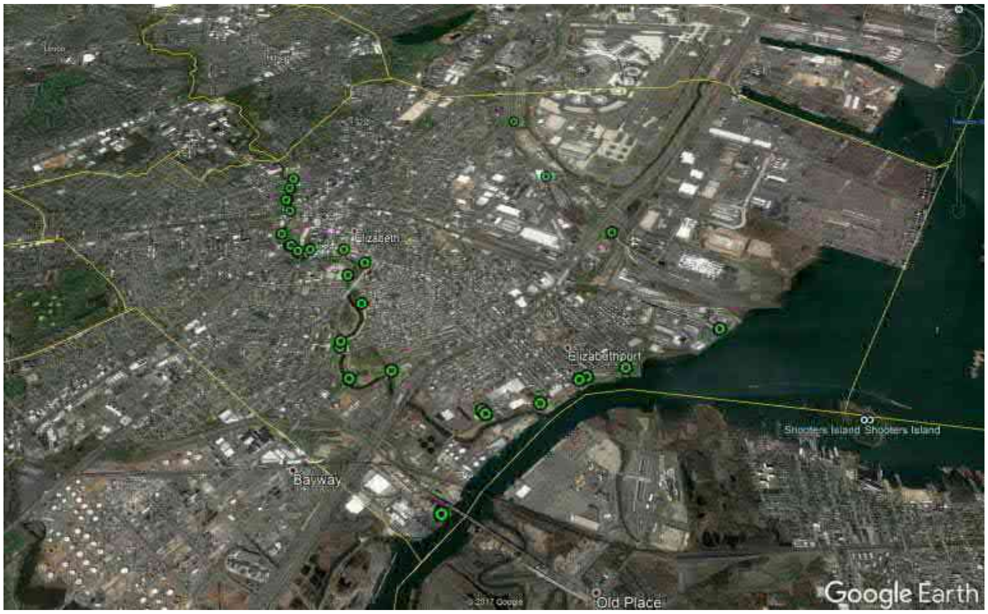

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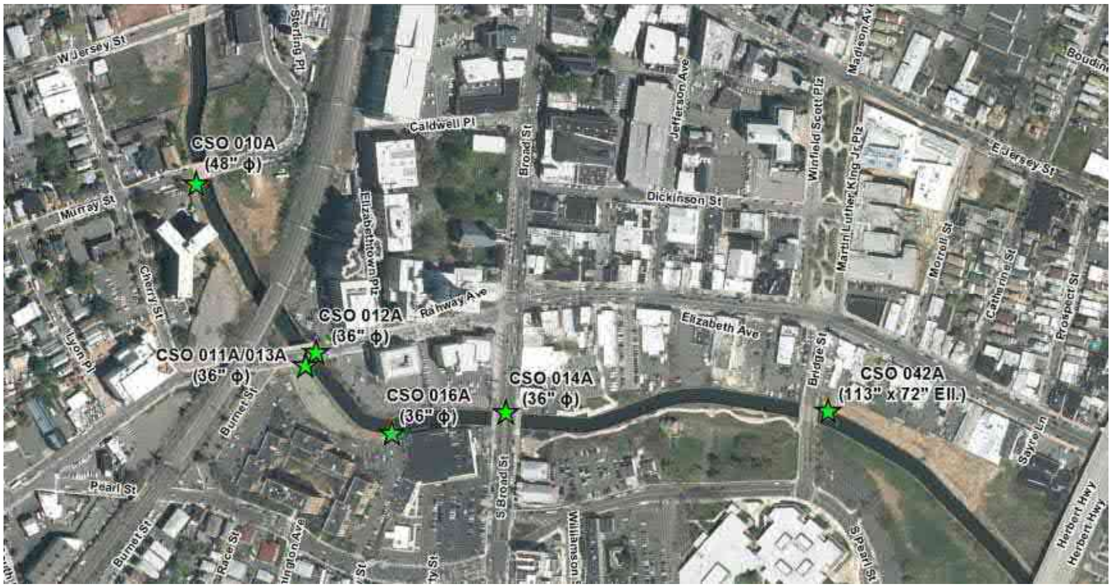

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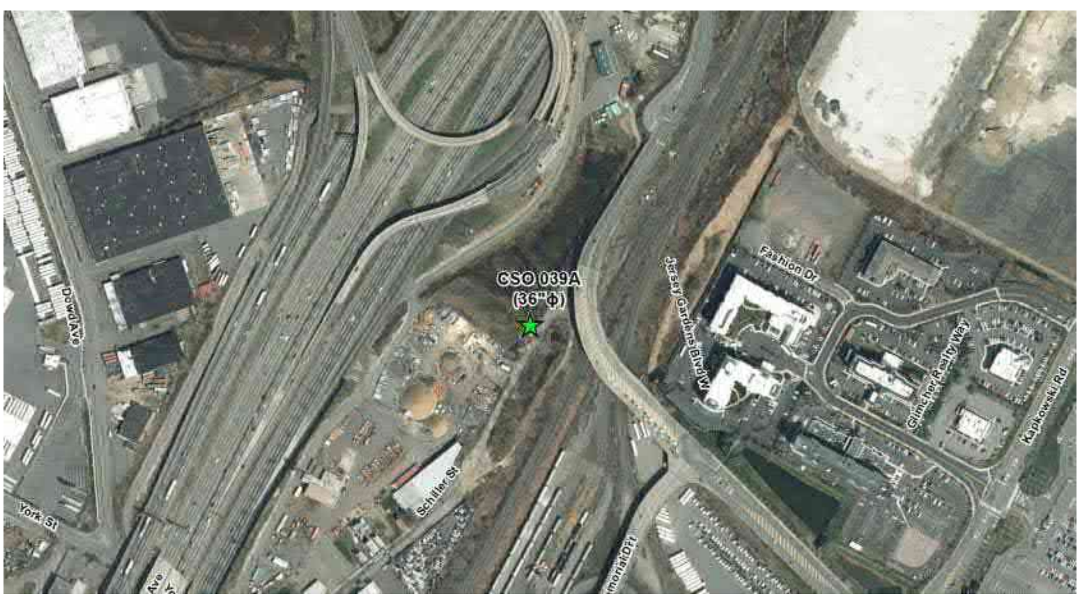

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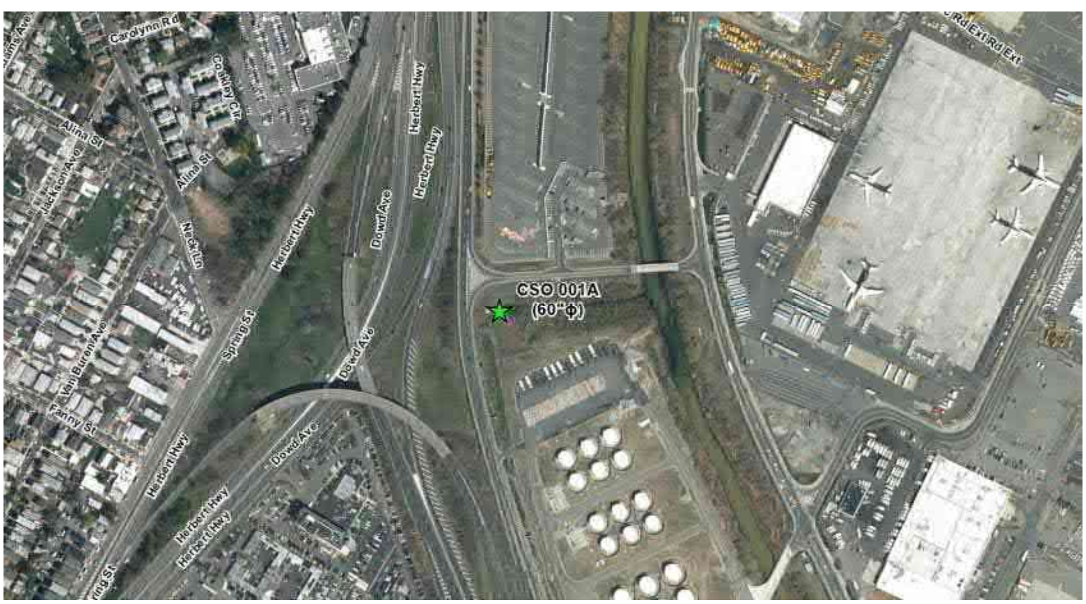
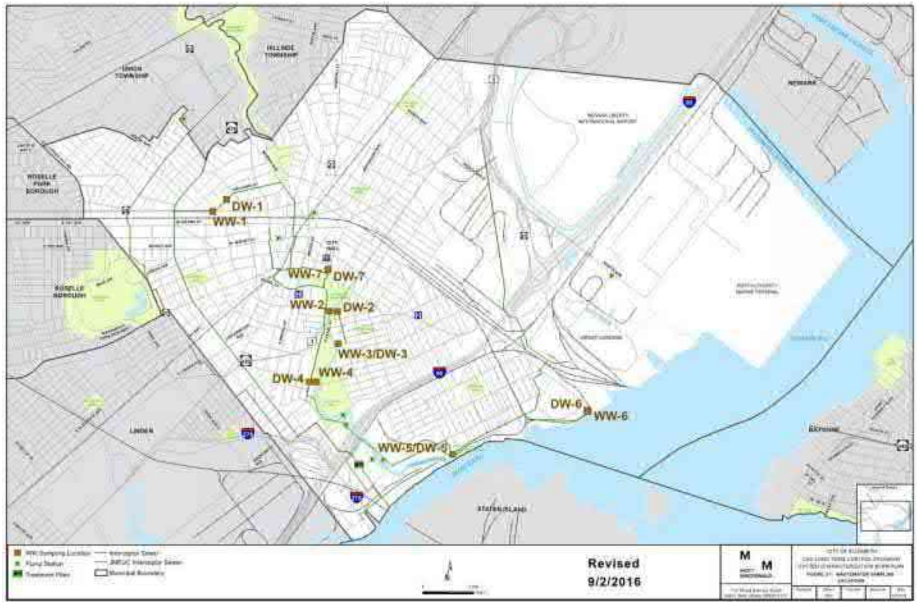


Sewer Sampling Program

- Seven locations across the city with varied upstream land-use characteristics
- Samples taken upstream of outfall
- Testing for Fecal coliforms, Enterococci and E. coli

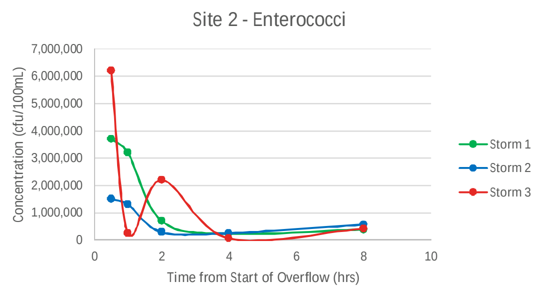


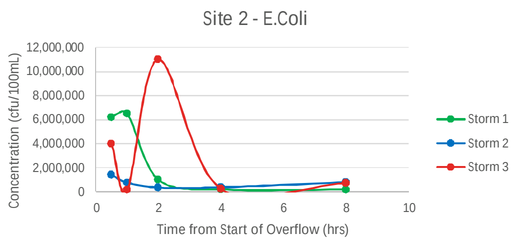
Sewer Sampling Program

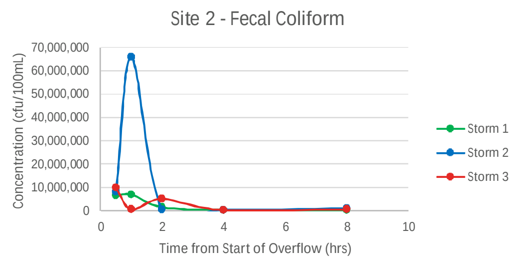
- Weather monitored between October 2016 and May 2017 for rainfall greater than 0.5”
- Three sampling events:
  - November 29, 2016 (2.02”)
  - April 25, 2017 (0.88”)
  - May 5, 2017 (3.05”)
- Dry weather samples taken the day before each rain event.
- Wet weather samples collected at 30mins, 1 hour, 2 hours, 4 hours and 8 hours from the beginning of overflow at each site.

Sewer Sampling Results

- Results fall within typical ranges and patterns
  - First flush
  - Concentrations generally decrease over the course of storm (dilution)

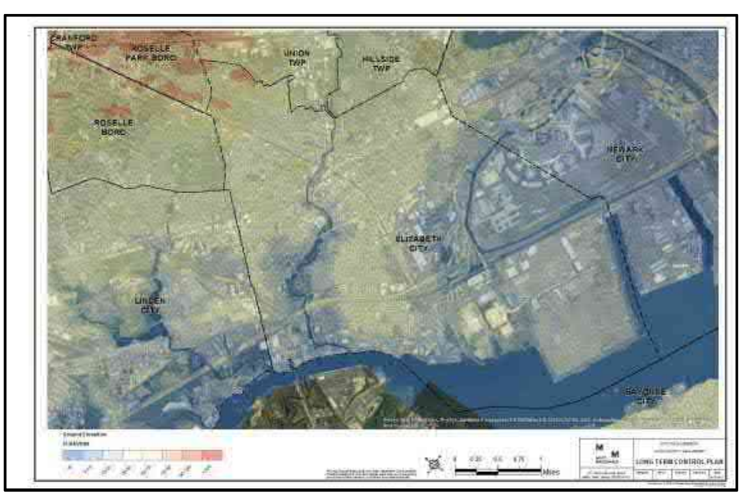






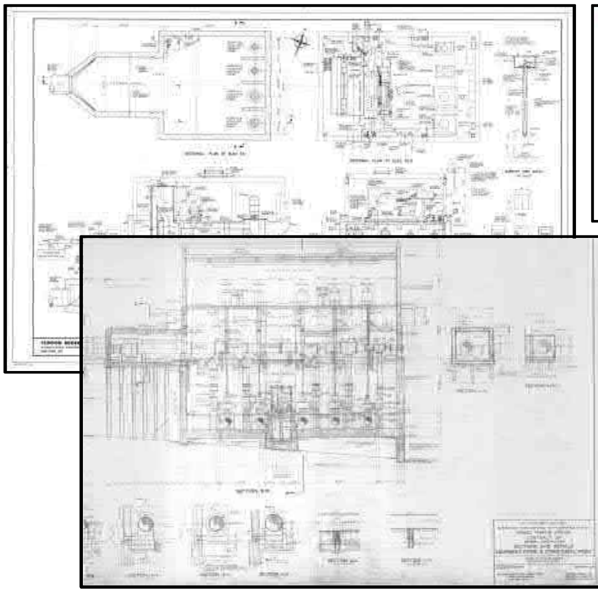
Elizabeth Combined Sewer System Model Update

- Lay of the Land



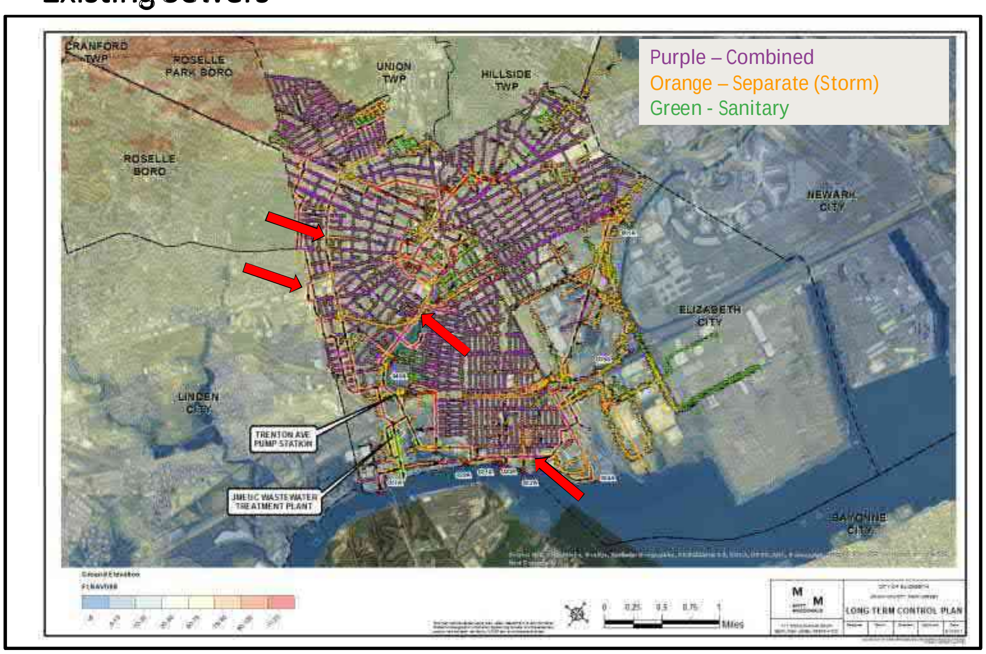
Sewer Data Collection

As-Built Drawings



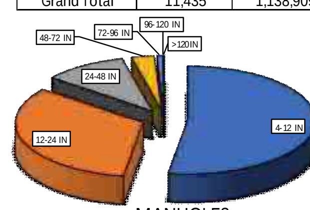
Field Data Collection

Existing Sewers



PIPES

TYPE	COUNT	LENGTH (LF)
Combined	6,352	766,035
Sewage	517	63,646
Storm	4,566	309,228
Grand Total	11,435	1,138,909



MANHOLES

TYPE	COUNT
Combined	5,858
Sewage	457
Storm	1,193
Grand Total	7,508

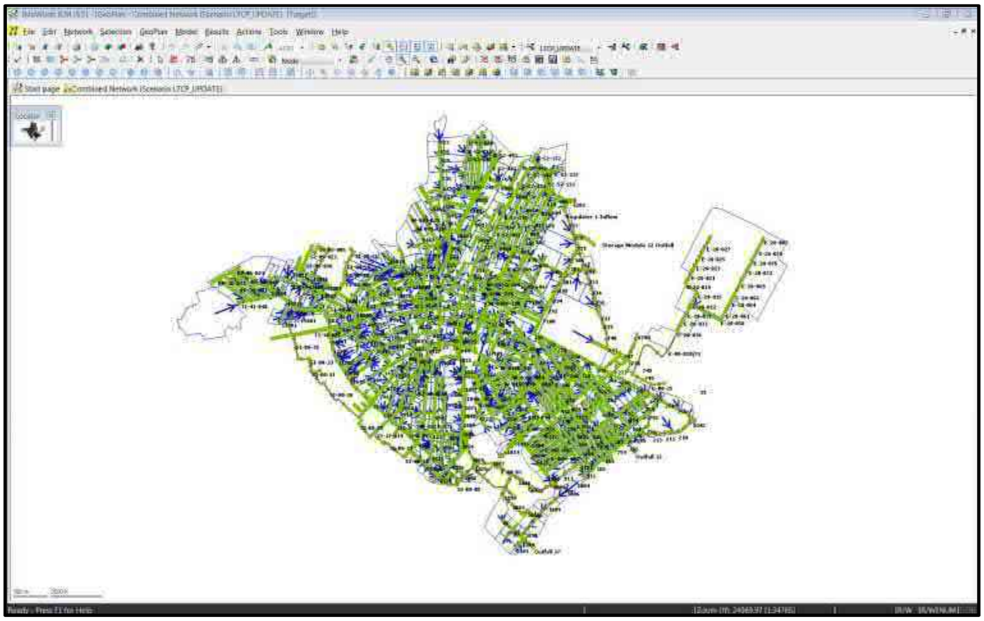
DRAINAGE

TYPE	COUNT
INLETS	4695

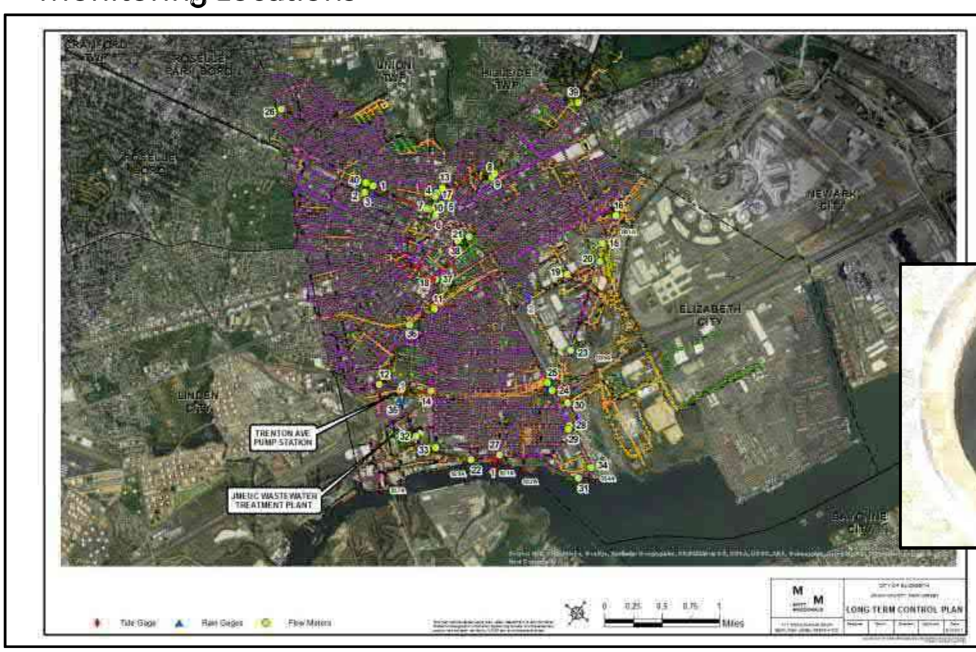
FACILITIES

FACILITY TYPE	COUNT
Treatment Plant	1
Pump Station	9
CSO Outfalls	29
Netting Chambers	28
Siphon Chambers	16
Regulators	39
Tide Gates	43
Sluice Gates	12

Hydraulic Model



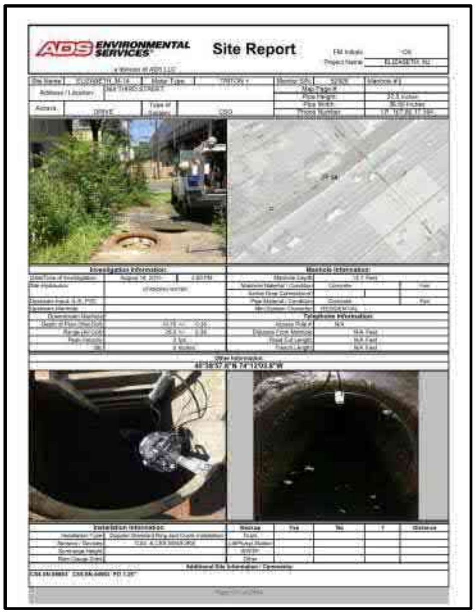
Monitoring Locations

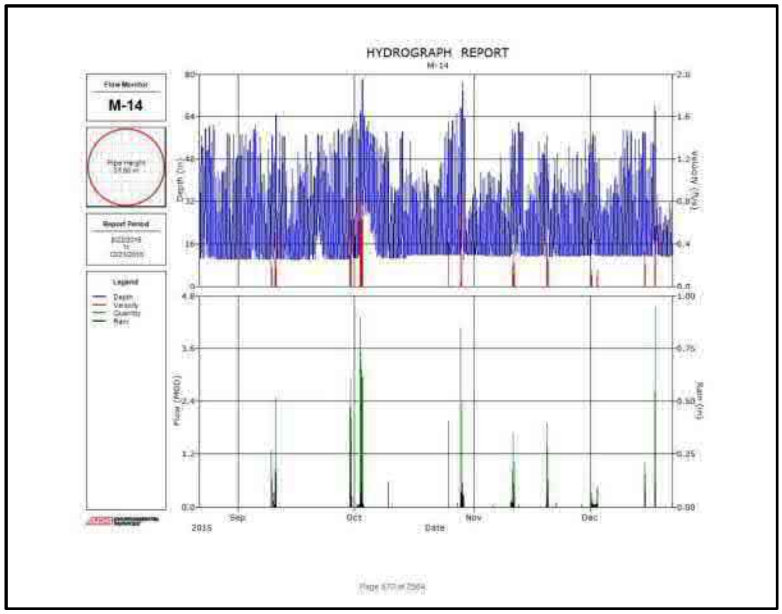


FLOW METERS

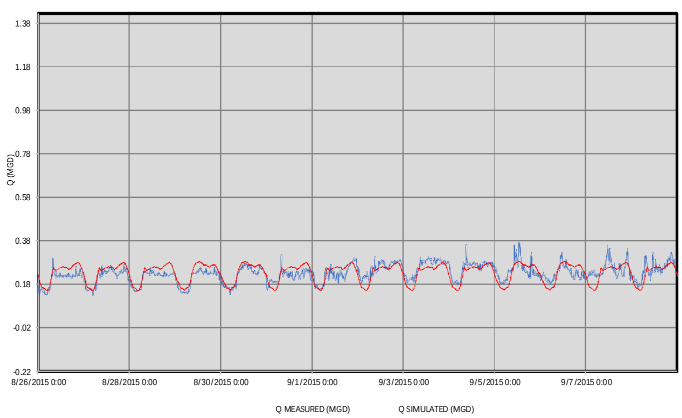
FLOW METER LOCATION	COUNT
DWF	14
EAST-INT	6
OVERFLOW	10
STORM	4
WEST-INT	6
Grand Total	40

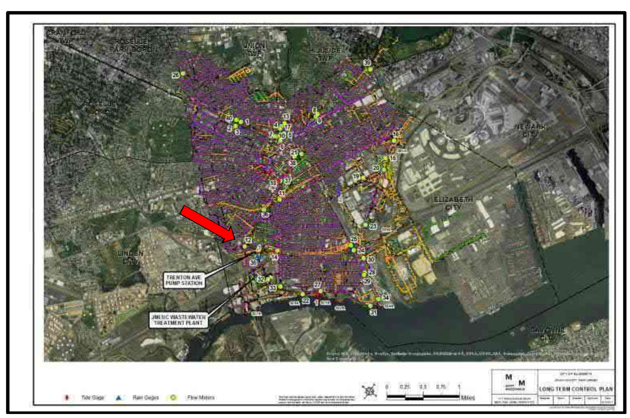
Flow Meter Data



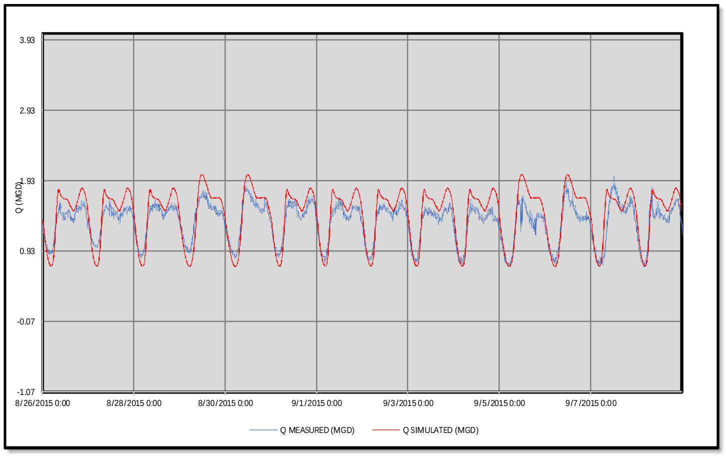


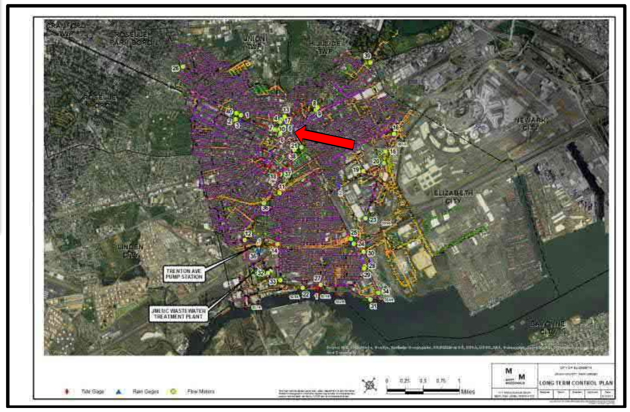
Meter vs. Model





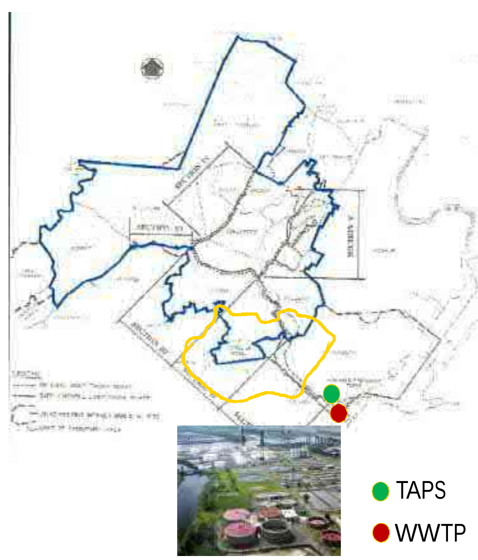
Meter vs. Model





Local CSO situation – physical system

- City of Elizabeth: 29 CSO outfalls discharging to Elizabeth River, Arthur Kill and other waterbodies
- Intercepted dry- and wet-weather flows conveyed to City of Elizabeth's Trenton Avenue Pump Station (TAPS)
- TAPS discharges to main sewer entering plant about 1500 feet above headworks
- Combined sewer flows from Elizabeth and separate sanitary sewer flows from JMEUC system all conveyed to and treated at JMEUC WWTP



Descriptions of current models

- City of Elizabeth and JMEUC have independently developed models of their respective sewer systems in InfoWorks ICM modeling software
  - Combined sewer system in Elizabeth to TAPS
  - JMEUC separate sanitary sewer system to WWTP
  - Independent models are being linked at common junction (TAPS connection to JMEUC system)
- JMEUC model:
  - Hydraulic model (does not route pollutants)
  - 43 miles of interceptor/trunk sewer conduits
  - No combined sewers or CSO outfalls

JMEUC Interceptor Model Sewer Network

Gravity sewers ranging from 10-inches in diameter to the twin 67 x 68-inch rectangular sewers at the wastewater treatment plant (WWTP)

WWTP capacity:
- Design flow = 85 mgd
- Maximum capacity varies with tidal conditions: up to 225 mgd

JMEUC Wastewater Treatment Plant

JMEUC Interceptor Model Sewersheds

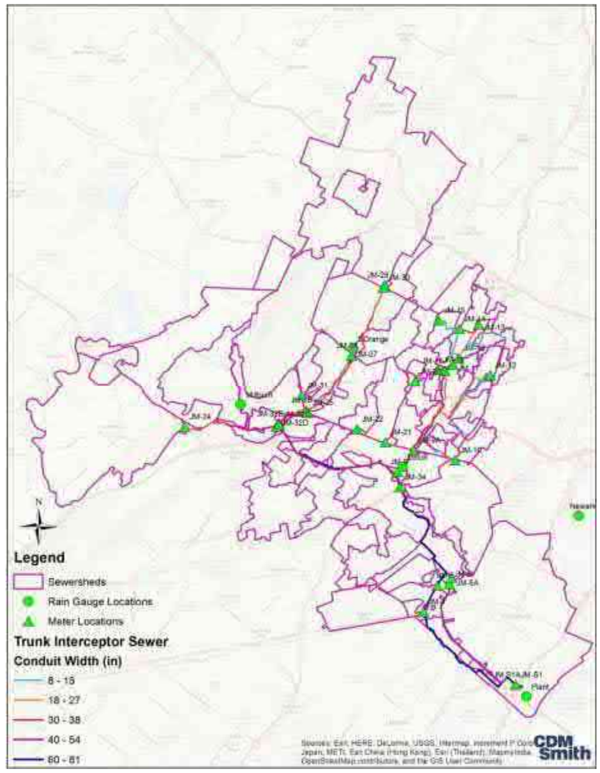
Total Service Area = 60 square miles

11 member communities:

East Orange	Roselle Park
Hillside	South Orange
Irvington	Summit
Maplewood	Union
Millburn	West Orange
Newark	

4 customer communities:
City of Elizabeth (inflow from TAPS)
Livingston
Orange
New Providence

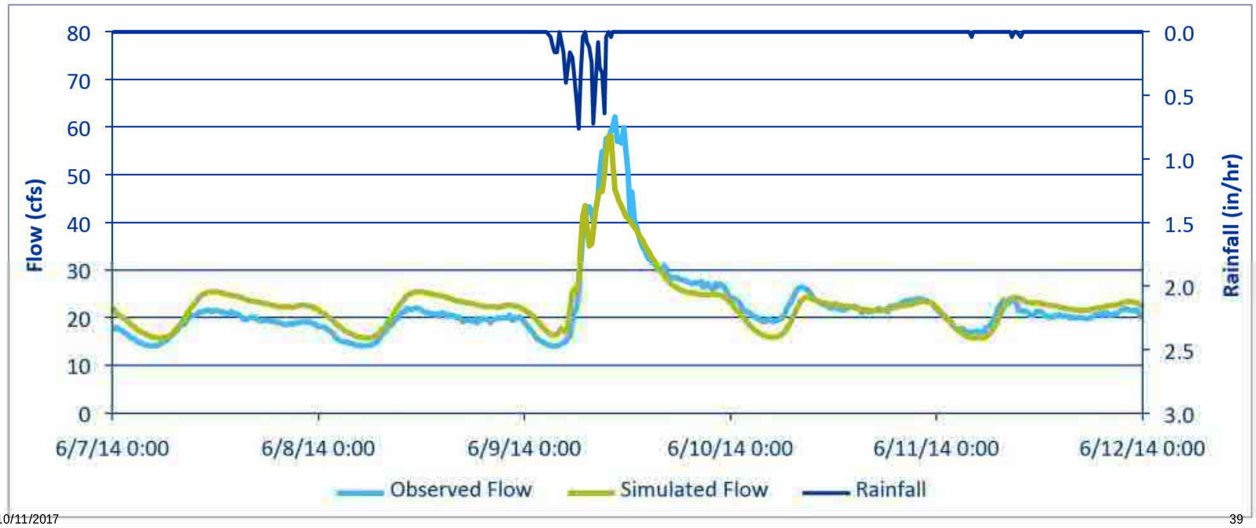
32 flow monitoring sites

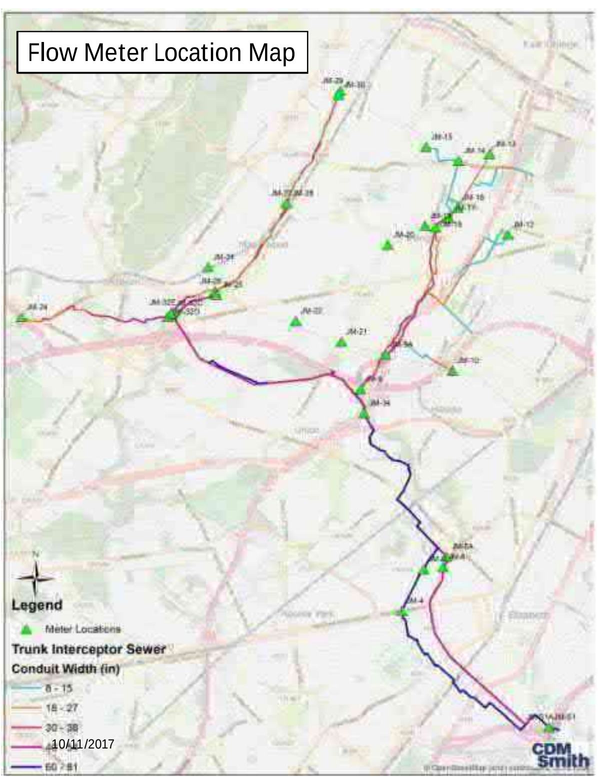


JMEUC modeling process

- Update previously developed model of system: newest software, improved level of detail in system representation (e.g. WWTP)
- Calibrate model – adjust parameters until model results agree with observed data at 32 meter sites for monitored rainfall events
- Complete linkage with City of Elizabeth model
- Initial simulations with combined JMEUC-Elizabeth model to characterize system performance during wet weather (the typical year precipitation record)

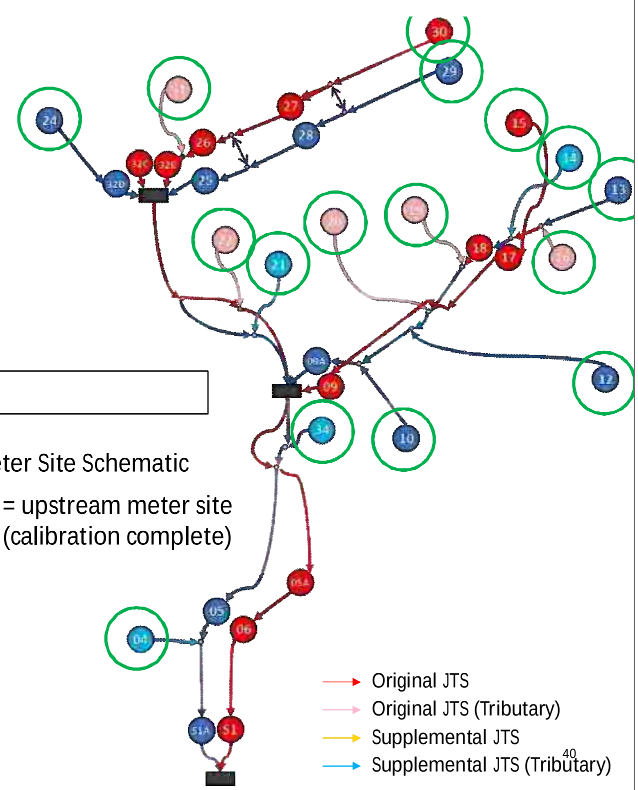
Calibration process – example calibration plot





Flow Meter Site Schematic

= upstream meter site (calibration complete)

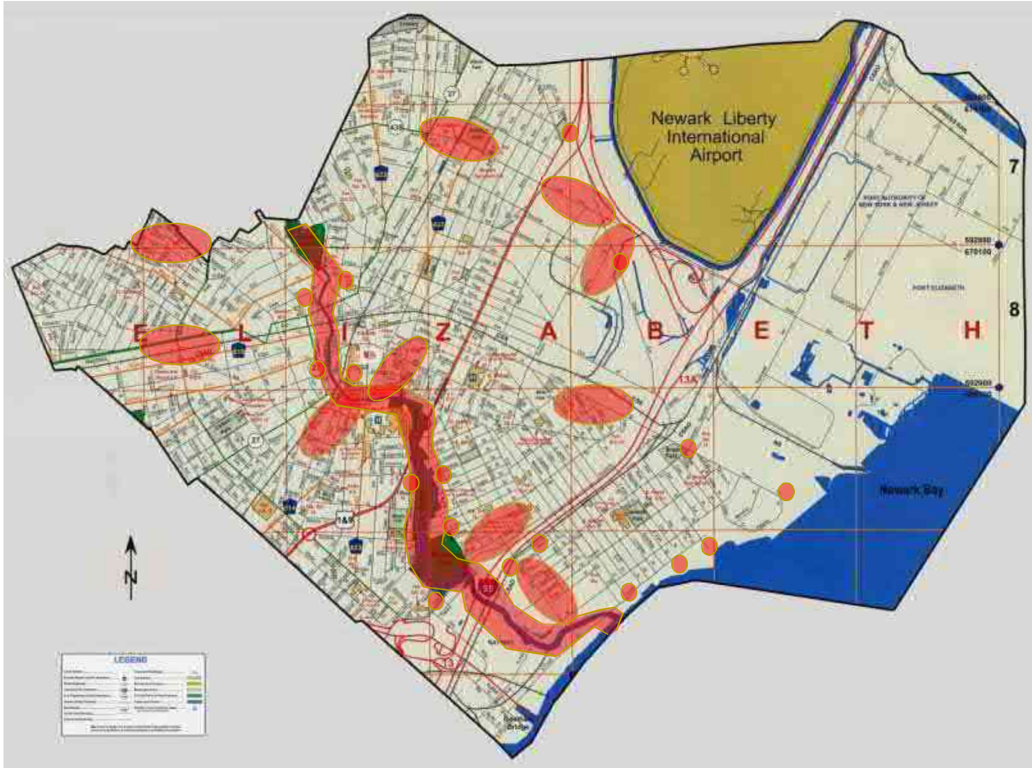


JMEUC model status and next steps

- Model updates substantially complete
  - Next steps: further refine WWTP elements in JMEUC model
- Model calibration complete at upstream sites
  - Next steps: complete calibration at downstream sites
- JMEUC sub-model linked with City of Elizabeth sub-model
  - Next steps: ensure both sub-models are fully consistent to finalize linkage with City of Elizabeth model
- Complete initial typical year simulations with combined JMEUC-Elizabeth model

Recent and Pending Improvement Projects: Partial Listing

- Progress Street Stormwater Control Project
- Verona Avenue/Gebhardt Avenue Storm Sewer Improvements Project
- Elizabeth River Flood Control Project - Levee and Drainage Structure Stabilization Work
- Midtown Infrastructure Improvements Project - CSO Abatement Work
- Westfield Avenue/Elmora Avenue Sewer Improvements Project
- South Street, North Avenue, & Third Avenue Flood Control Projects
- Westerly Interceptor Cleaning and Inspection Project
- Trumbull Street Stormwater Control Project



Recent Projects – Verona Gebhardt
Before

Recent Projects – Verona Gebhardt
During Construction

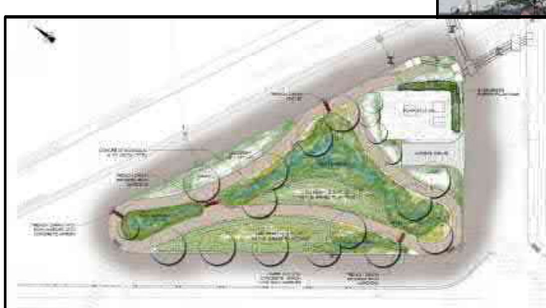
Recent Projects – Verona Gebhardt
After Construction

Recent Projects – Progress St Flood Control
During Construction

Recent Projects – Progress St Flood Control
After Construction

Recent Projects – Trumbull St Flood Control
Last Summer

Recent Projects – Trumbull St Flood Control
Construction to begin late 2017



Opportunities for Outreach

- Goal: Increase residents' understanding of environment and the connection to sewer infrastructure
- Environmental Day: April 28, 2017
- Estuary Day: October 6, 2017
- Press releases for upcoming projects: Trumbull Street

Other opportunities for engagement:

- Supplemental CSO members connection to community
- Other events?
- Information to share with constituents?

Input on Potential Sensitive Areas

- Sensitive Areas, as defined by the CSO Control Policy, include:
  - Outstanding National Resource Waters
  - National Marine Sanctuaries
  - Waters with threatened or endangered species and their habitat
  - Waters with primary contact recreation
  - Public drinking water intakes or their designated protection areas
  - Shellfish beds
- Are sensitive areas present and impacted by CSO discharges?

Sensitive Areas: Primary Contact Recreation Areas?

- N. J. A. C. 7:9B -1.4: “Primary contact recreation” means water related recreational activities that involve significant ingestion risks and includes, but is not limited to, wading, swimming, diving, surfing, and water skiing.
  - No bathing beaches
  - Channelized portion of Elizabeth River upstream of South Broad St, no existing primary contact use. No access, concrete base and walls, shallow water depth.
  - No existing primary contact use in downstream earthen channel of Elizabeth.
  - Arthur Kill and Newark Bay – industrial / commercial shipping waterway. No primary contact recreation use present. (Boat ramp access at Elizabeth Marina)

Six-month Look Ahead

- Next meeting: January 2018
- Link City of Elizabeth combined sewer system model to JMEUC interceptor sewer model
- Refine interceptor sewer model representation of WWTP
- Update interceptor sewer system model calibration
- Apply updated model to characterize interceptor sewer system performance
- Characterize WWTP performance
- Prepare System Characterization Report

Questions?

Thank you

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

Supplemental CSO Team

Meeting No. 2 – Project Update
Long-Term Control Plan Permit Compliance

Supplemental CSO Team

Meeting No. 3
Long-Term Control Plan Permit Compliance

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

January 29, 2018 – 1:00 pm
Elizabeth City Hall Council Chambers

Supplemental CSO Team

Meeting No. 3 Agenda

- Prior meeting recap
- Further input on public outreach opportunities
- Further input on potential sensitive areas
- System characterization and modeling updates
- NJ CSO Group coordination
- Green Infrastructure (GI) basics
- Upcoming deadlines

Meeting No. 2 Refresher

Material covered in the prior meeting (10/11/2017):

- CSO outfall locations
- Sewer sampling summary
- Modeling updates (Elizabeth and JMEUC)
- Recent and pending sewer improvement projects
- Input on public outreach opportunities
- Input on potential sensitive areas
- 6-month look-ahead

Any questions on previous topics?

Public Involvement Activities

Prior Meeting Comments

- Provide info on pending construction projects
- Send info to Elizabeth Chamber of Commerce for membership distribution
- Distribute info at Peterstown Community Center nature center and Phil Rizzuto Park outdoor pavilion
- Post info on City's social media pages
- Consult environmental planning commission and master planners

Opportunities for public engagement on CSO Long-Term Control Plan

- Upcoming Events?

Public Involvement Activities (cont.)

Community Interface Assistance

- Any feedback from your groups on the CSO issues?
- What info do Team members need to facilitate public input?
- What other resources are available?

Input on sewer system issues to be addressed

- Areas of flooding
- Sewer backups
- Sewer infrastructure age & deterioration
- Sewer bills

Sensitive Areas Consideration

- Sensitive Areas, as defined by the CSO Control Policy, include:
  - Outstanding National Resource Waters
  - National Marine Sanctuaries
  - Waters with threatened or endangered species and their habitat
  - Waters with primary contact recreation
  - Public drinking water intakes or their designated protection areas
  - Shellfish beds
- Are sensitive areas present and impacted by CSO discharges?

Sensitive Areas Consideration

Prior Meeting Comments

- Fishing at Slater Park and Waterfront Memorial Park has been observed.
- Jet skiing through the Arthur Kill has been observed.
  - Occasional and unusual use.
- No specific outfall appears to be of greater concern, higher priority, or exceptional quality

Outstanding National Resource Waters

- First and most protective tier of antidegradation protection;
- Applied to surface waters classified as freshwater 1 (FW1) waters, also known as non-degradation waters, and Pinelands (PL) waters;
- None present in City of Elizabeth

Nationwide Rivers Inventory (NRI)

- Listing maintained by the National Parks Service;
- Includes about 67 New Jersey river sections, at approximately 490 river miles;
- None present in the City of Elizabeth

National Marine Sanctuaries

- None located in New Jersey; closest is Stellwagen Bank, off the coast of Massachusetts
  - More information available on-line at: http://www.sanctuaries.nos.noaa.gov/

Waters with Threatened or Endangered Species and their Habitat

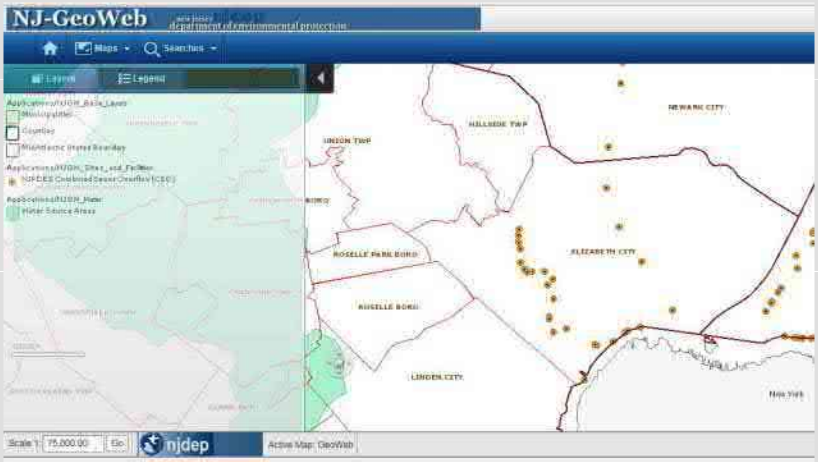
- Determine whether listed species are located in the area by checking the Endangered Species Act listings
- Review NJDEP Landscape Project critical wildlife habitat maps
- No presence of threatened or endangered species and critical habitat for specific outfall location anticipated

Are waters used for Primary Contact Recreation?

- N. J. A. C. 7:9B -1.4: “Primary contact recreation” means water related recreational activities that involve significant ingestion risks and includes, but is not limited to, wading, swimming, diving, surfing, and water skiing.
- Focus on existing uses, versus designated use.
  - No bathing beaches present.
  - Channelized portion of Elizabeth River upstream of South Broad Street designated FW2-NT(C2), but no existing primary contact use. No access, concrete base and walls, shallow water depth.
  - Downstream earthen channel of Elizabeth, SE3 (C2), no access, shallow depth.
  - Arthur Kill and Newark Bay – industrial / commercial shipping waterway.

Public Drinking Water Intakes

- No public drinking water source intake located within 1 mile upstream of City of Elizabeth CSO

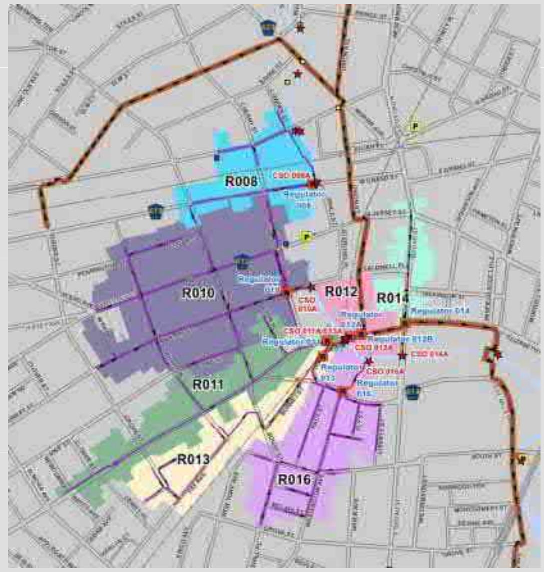


Shellfish Classification

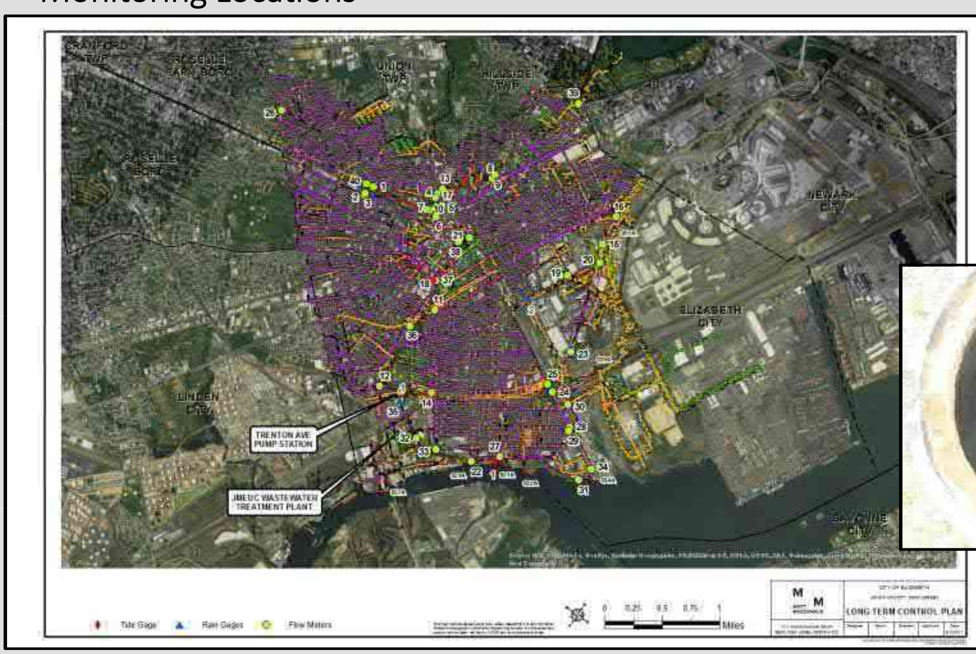
- Classification of the coastal waters for shellfish harvest in accordance with N.J.A.C. 7:12-1.3.
- None present in City of Elizabeth vicinity

System Characterization Status Update
City of Elizabeth

- Completed sewer data collection
- Confirmed and updated sewer shed and regulator details
- Expanded geographic information system
- Compiled sewer inventory data
- Calibrated and validated model
- Preparing characterization report sections



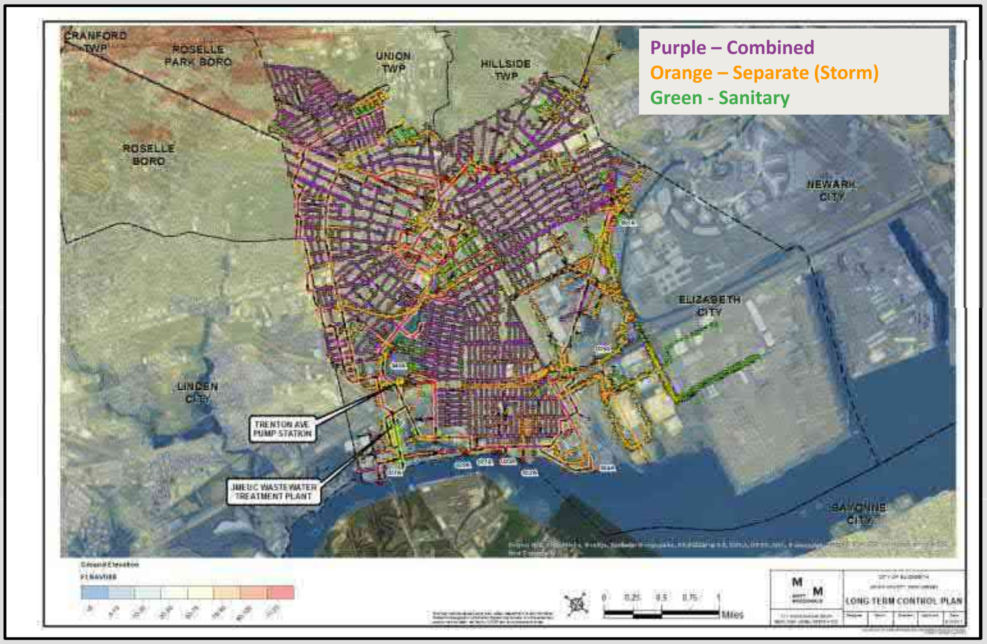
Monitoring Locations



FLOW METERS

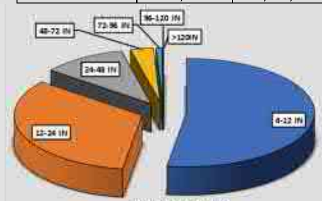
FLOW METER LOCATION	COUNT
DWF	14
EAST-INT	6
OVERFLOW	10
STORM	4
WEST-INT	6
Grand Total	**40**

Existing Sewers



PIPES

TYPE	COUNT	LENGTH (LF)
Combined	6,352	766,035
Sewage	517	63,646
Storm	4,566	309,228
Grand Total	11,435	1,138,909



MANHOLES

TYPE	COUNT
Combined	5,858
Sewage	457
Storm	1,193
Grand Total	7,508

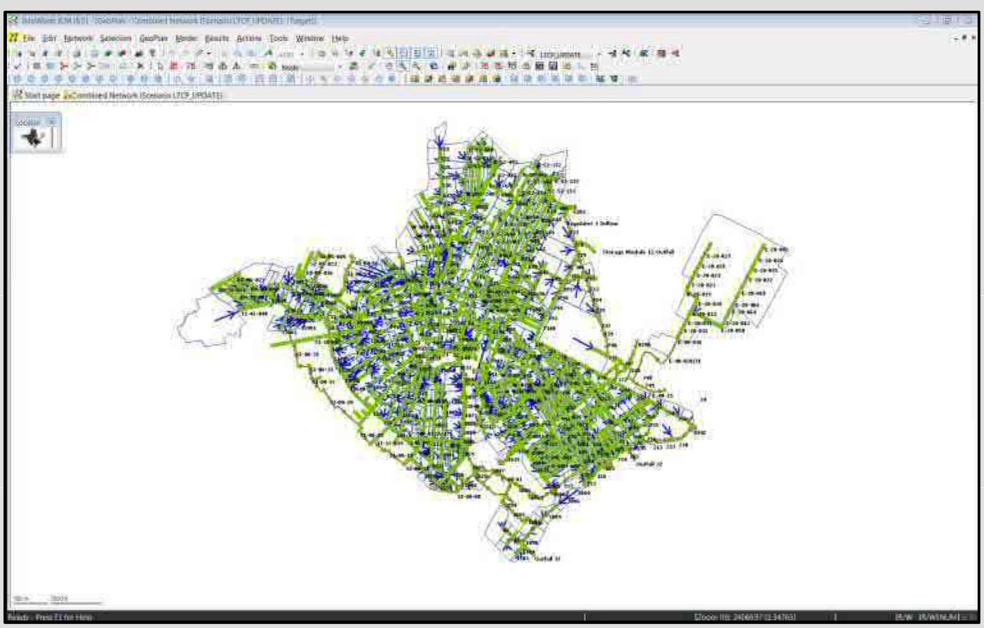
DRAINAGE

TYPE	COUNT
INLETS	4695

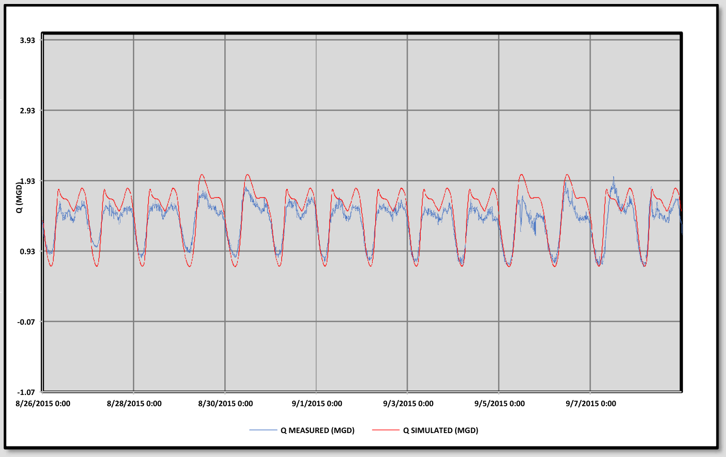
FACILITIES

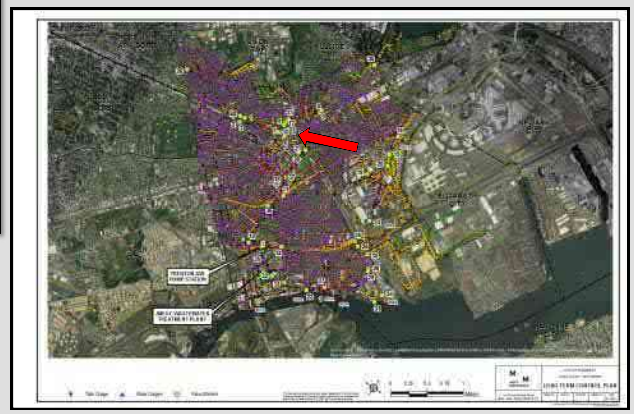
FACILITY TYPE	COUNT
Treatment Plant	1
Pump Station	9
CSO Outfalls	29
Netting Chambers	28
Siphon Chambers	16
Regulators	39
Tide Gates	43
Sluice Gates	12

Hydraulic Model

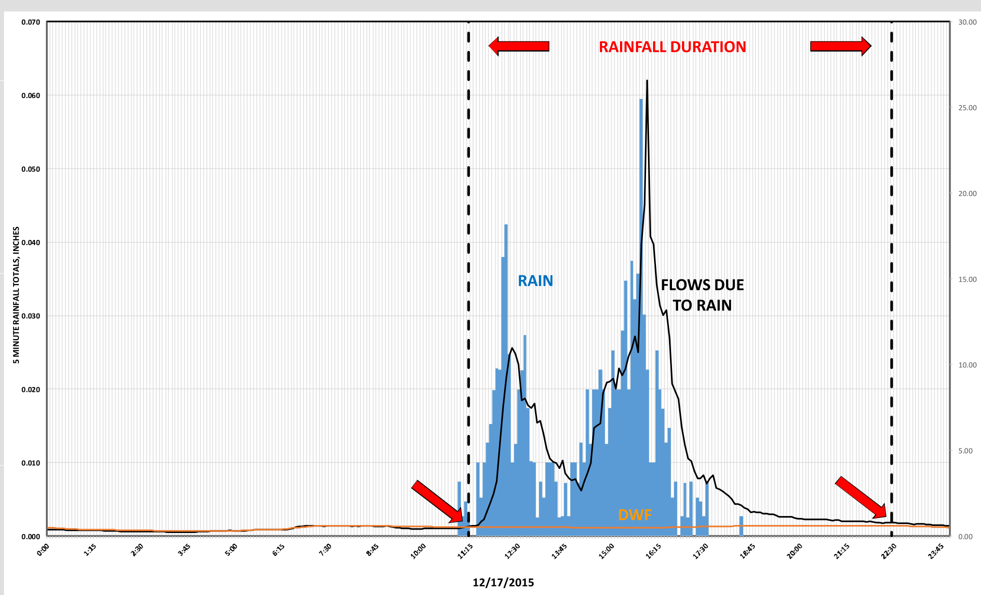


Meter vs. Model (Dry Weather Flows)





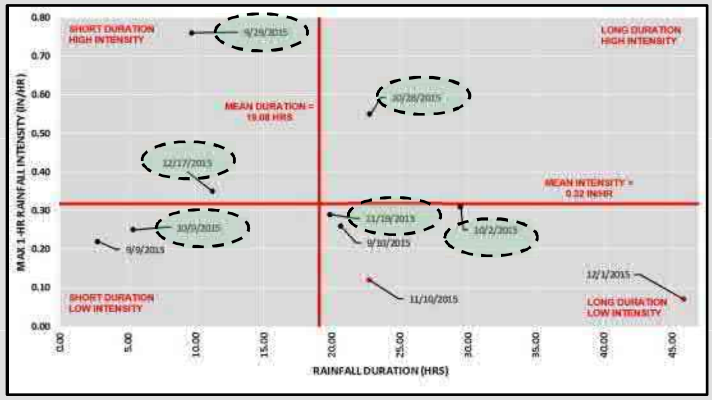
What Happens When it Rains?



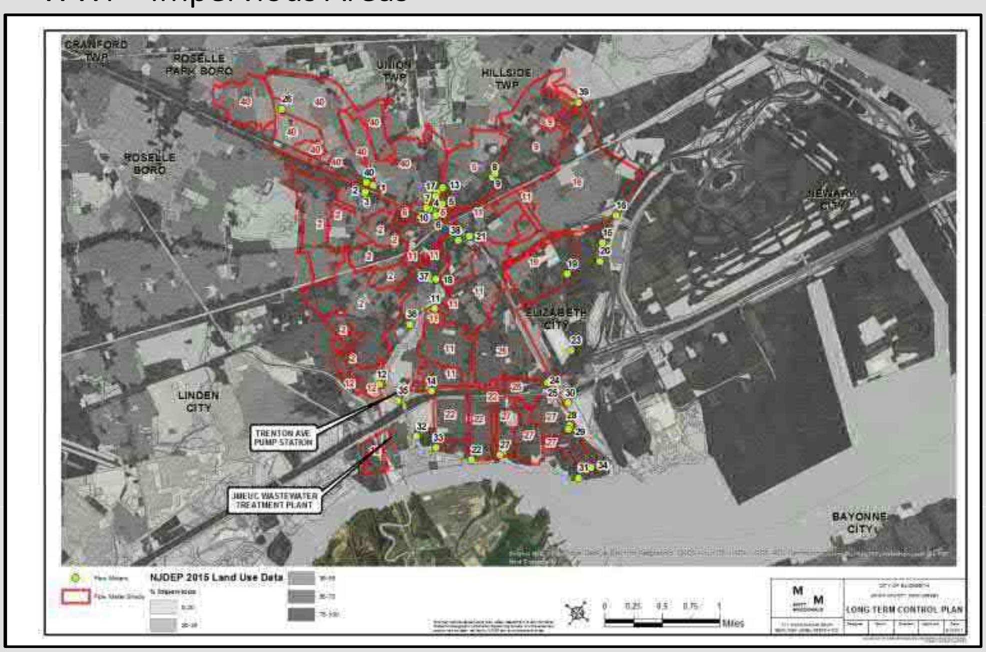
Step 1: Rainfall Selection

- **Calibration Storms**
  - 10/9/2015
  - 10/28/2015-10/29/2015
  - 11/19/2015-11/20/2015
  - 12/17/2015
- **Validation Storms**
  - 9/29/2015
  - 10/2/2015

Storm #	Start Date	End Date	Start Time	End Time	Rain Depth (In)	Rain Duration (Hrs)	Max 1-Hr Rainfall Intensity (In/Hr)
#1	9/9/2015	9/9/2015	15:40	18:30	0.11	2.83	0.22
#2	9/10/2015	9/10/2015	3:05	23:45	0.99	20.67	0.26
#3	9/29/2015	9/30/2015	23:00	8:45	1.39	9.75	0.76
#4	10/2/2015	10/3/2015	4:30	10:00	1.91	29.5	0.31
#5	10/9/2015	10/9/2015	17:25	22:50	0.32	5.42	0.25
#6	10/28/2015	10/29/2015	10:25	9:15	1.65	22.83	0.55
#7	11/10/2015	11/11/2015	8:30	7:15	0.57	22.75	0.12
#8	11/19/2015	11/20/2015	13:35	9:30	1	19.92	0.29
#9	12/1/2015	12/2/2015	1:35	23:30	0.6	45.92	0.07
#10	12/17/2015	12/17/2015	11:15	22:30	1.15	11.25	0.35

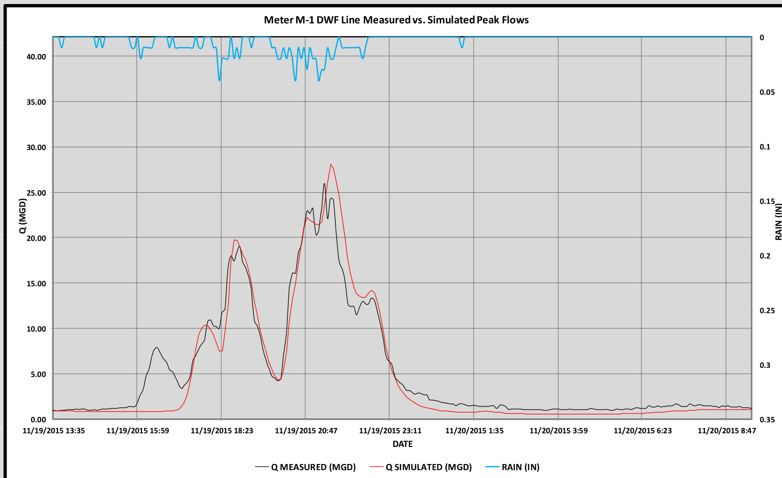


WWF - Impervious Areas



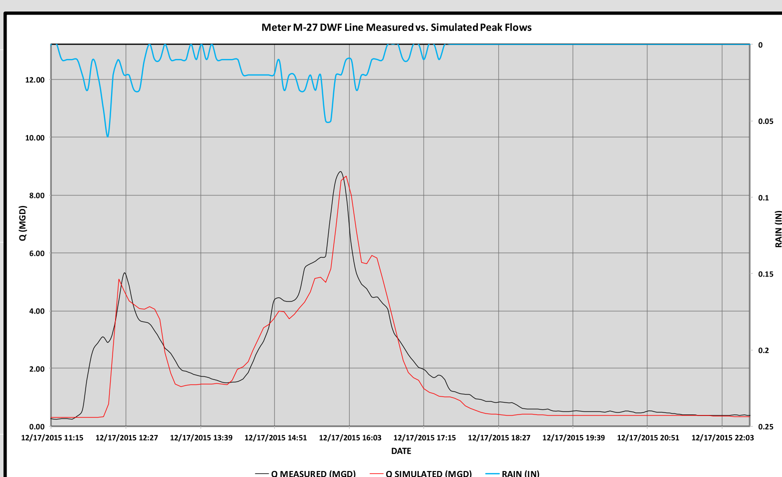
- NJDEP 2012 Land Use/ Land Cover Data (updated in 2015) used to calculate overall % impervious in flow meter sheds.

Meter vs. Model (Wet Weather Flows)



- **Calibration Storms**
  - 10/9/2015 (Low D, I)
  - 10/28/2015-10/29/2015 (High D, I)
  - **11/19/2015-11/20/2015 (High D, Low I)**
  - 12/17/2015 (High D, I)

WWF Calibration Results – Easterly Interceptor



- **Calibration Storms**
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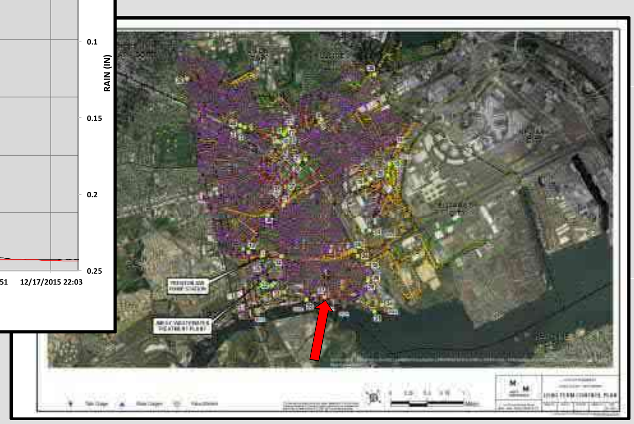
  - 11/19/2015-11/20/2015 (High D, Low I)
  - **12/17/2015 (High D, I)**



Meter vs. Model (Wet Weather Flows)

- **Calibration Storms**
  - 10/9/2015 (Low D, I)
  - **10/28/2015-10/29/2015 (High D, I)**
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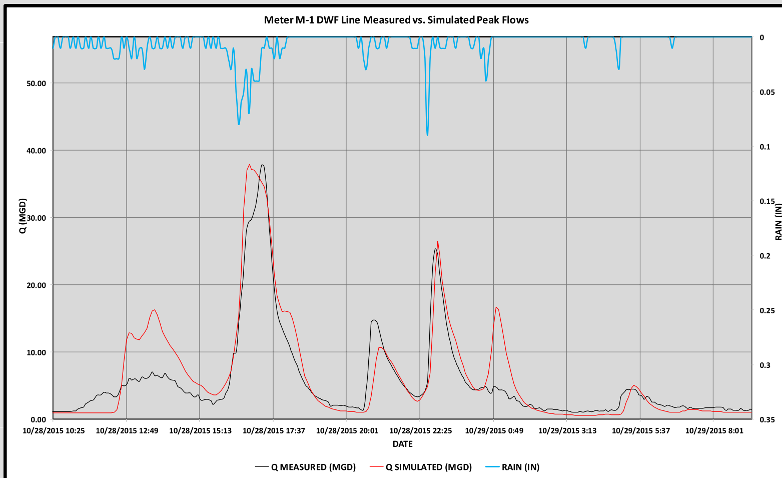

Meter vs. Model (Wet Weather Flows)

- **Calibration Storms**
  - 10/9/2015 (Low D, I)
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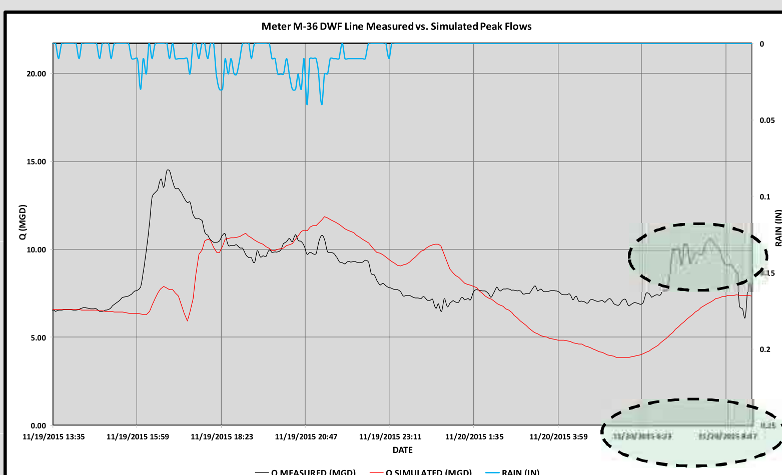
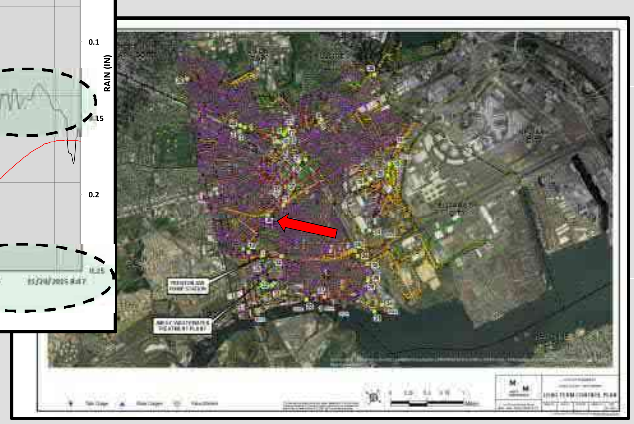
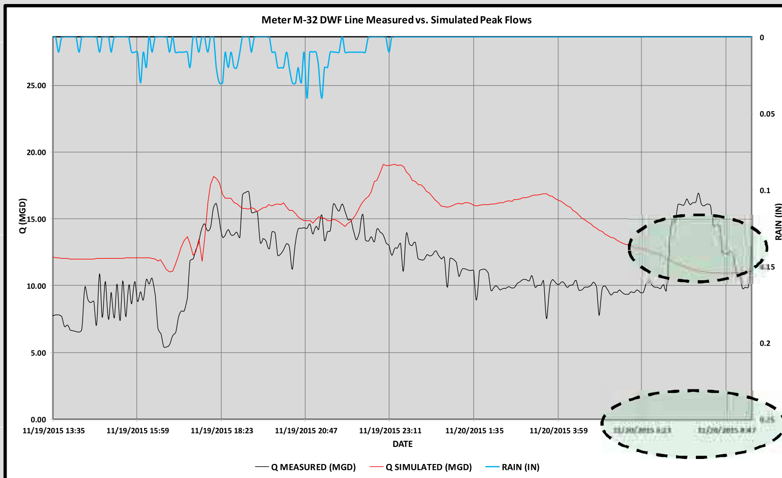
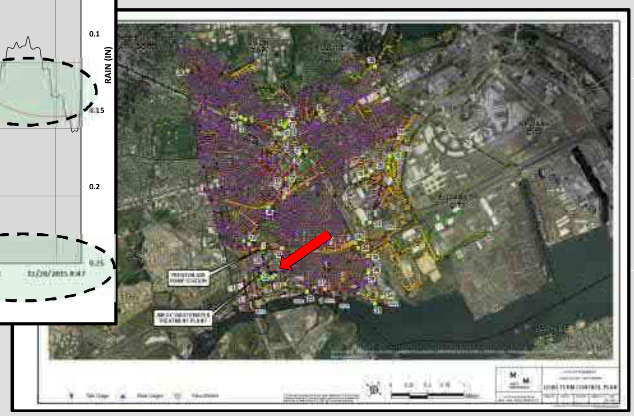




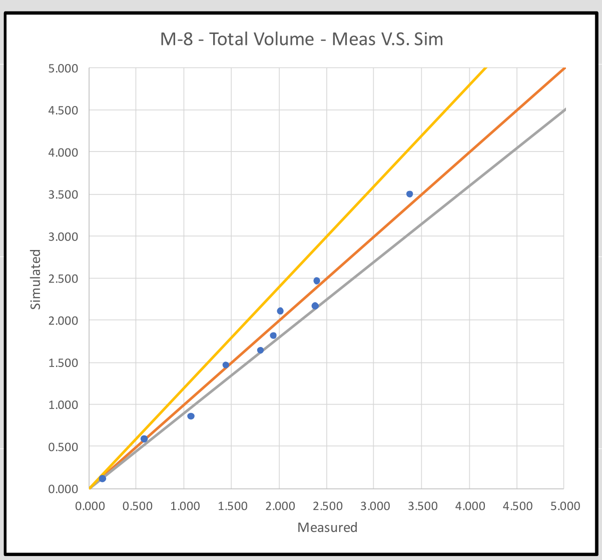
WWF Calibration Results – Easterly Interceptor

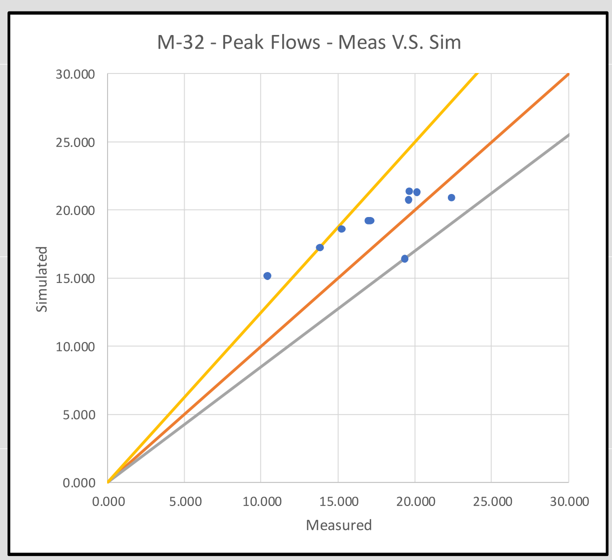
- **Calibration Storms**
  - 10/9/2015 (Low D, I)
  - 10/28/2015-10/29/2015 (High D, I)
  - **11/19/2015-11/20/2015 (High D, Low I)**
  - 12/17/2015 (High D, I)





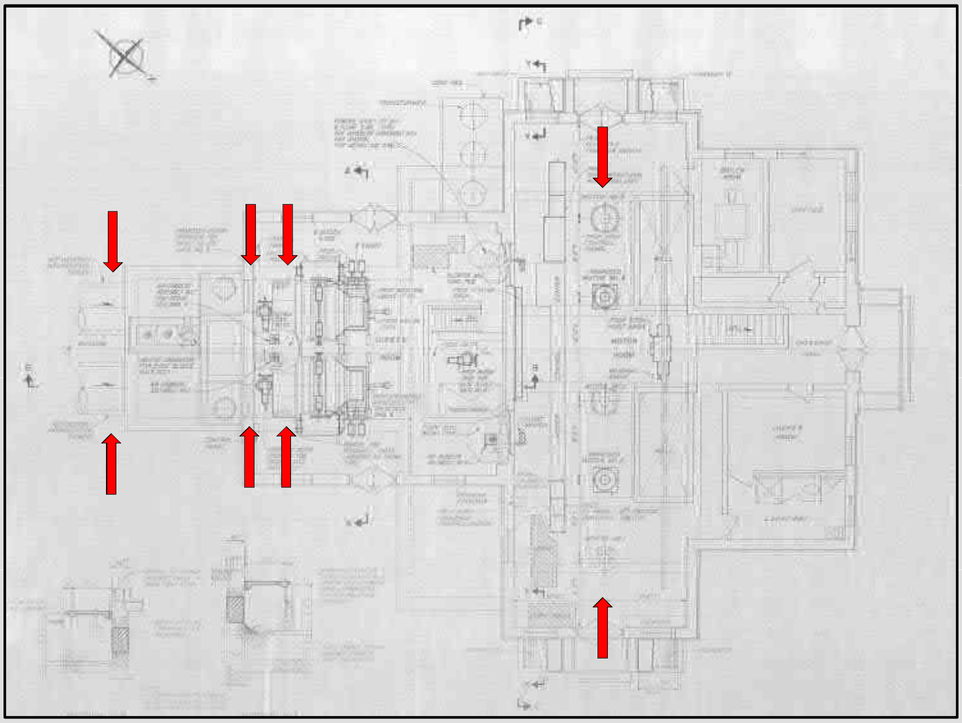
WWF Calibration Results – Overall Performance





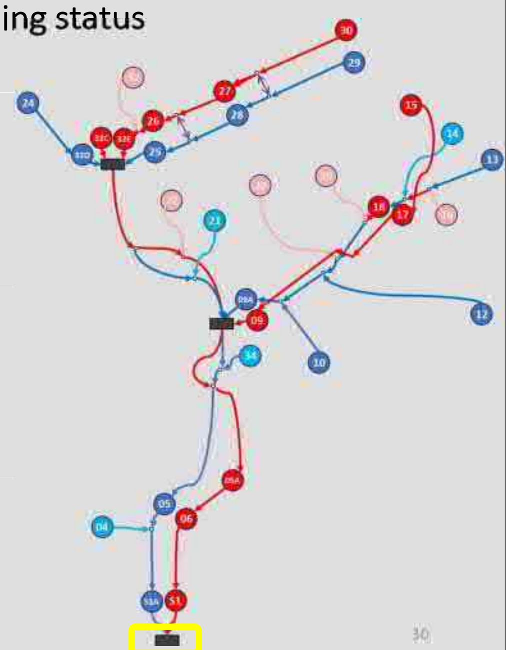
Trenton Ave PS

- Interceptors
- Sluice Gates
- Screens/ Bar Racks
- 5 VFD Pumps

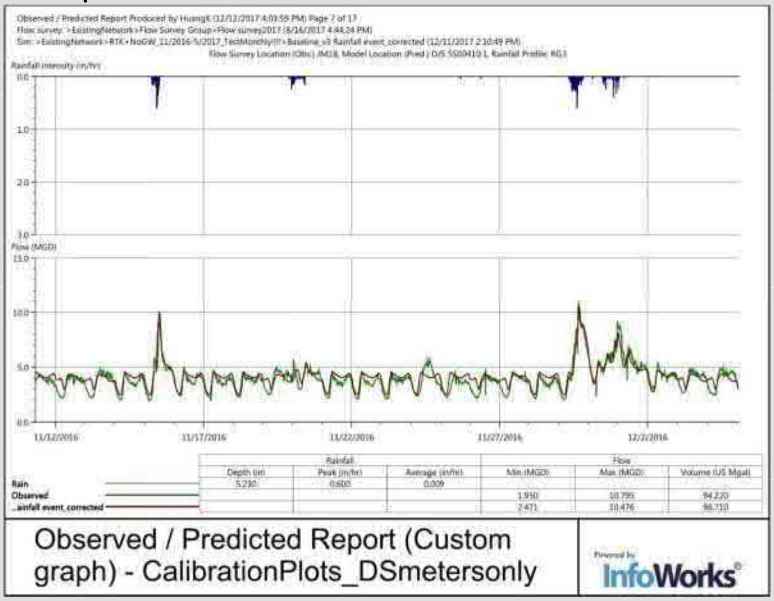


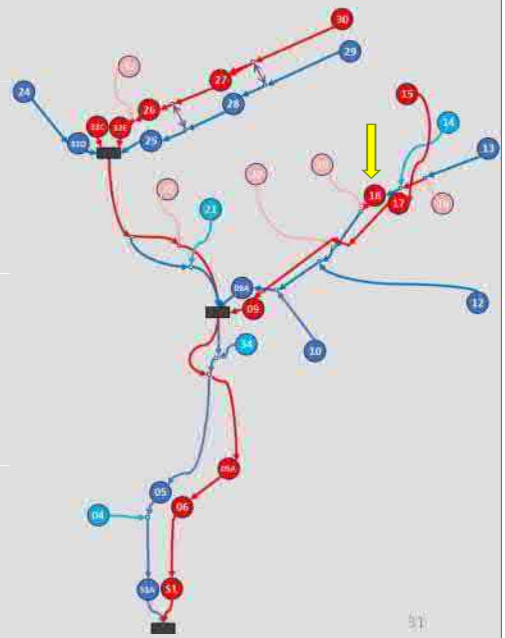
Project Status Updates
System Characterizations / Modeling – JMEUC modeling status

- Model calibration – flow monitoring sites for calibration:
  - 13 upstream sites: calibration complete
  - 11 middle trunk sites: calibration complete
  - 5 downstream trunk sites: final calibration adjustments in progress
- Coordination with City of Elizabeth combined sewer system model
- Coordination with NJ CSO Group ambient water quality model (plant effluent discharge)
- Integrate JMEUC wastewater treatment plant into collection system model

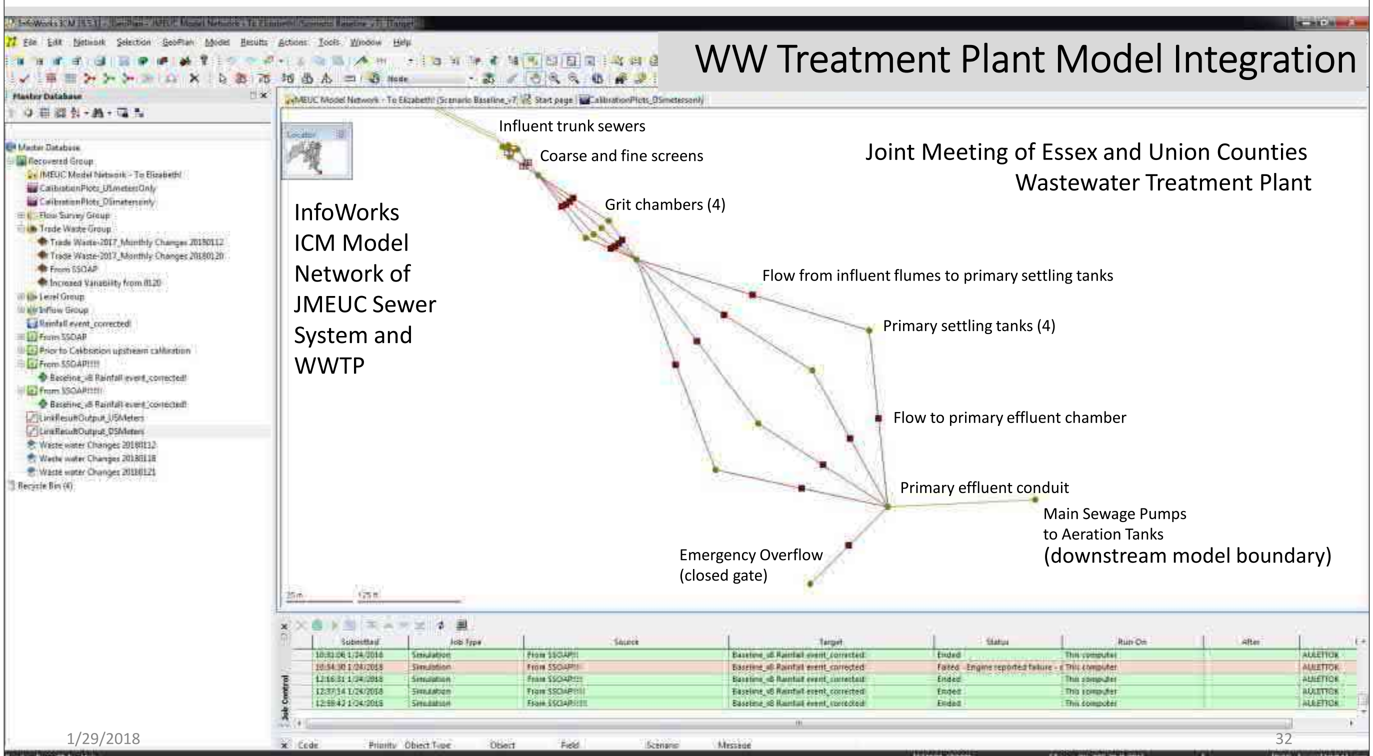


Example Model Calibration Plot – JMEUC Model





WW Treatment Plant Model Integration



NJ CSO Group coordination

- Baseline compliance monitoring program water quality testing and pathogen model
- CSO Notification System website operation
- Duration of discharge results for monthly reports
- Outfall signs, outreach materials and other collaborative works

Green Infrastructure Basics
Description

Presentation is taken from USEPA website.

Learn more by going to:

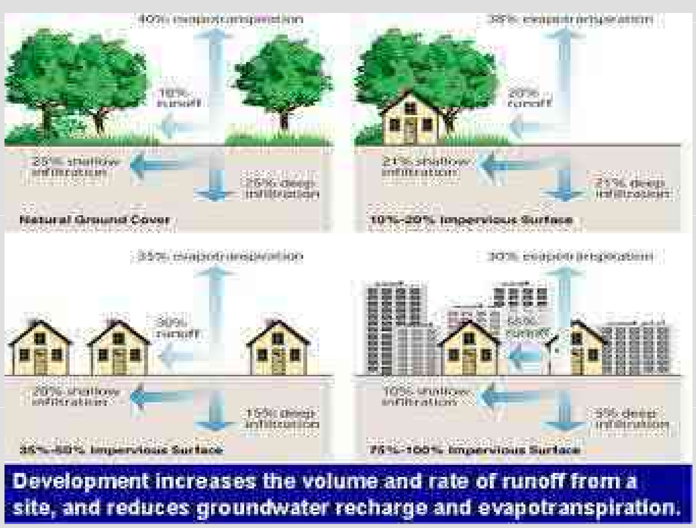
https://www.epa.gov/green-infrastructure/learn-about-green-infrastructure

Green Infrastructure Basics
Description

What is Green Infrastructure?

According to EPA: Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.

Green Infrastructure Basics
Description



Green Infrastructure Basics
Description

What is Green Infrastructure?

Changes the Way Stormwater Runoff in Handled from common methods of transport and discharge, including:
- Treat it
- Use it
- Store it, or
- Slow it Down

In a way that can be economical and/or beneficial to the community.

Green Infrastructure Basics
Description

What is Green Infrastructure?

- Downspout Disconnection
- Rainwater Harvesting
- Rain Gardens
- Planter Boxes
- Bioswales
- Permeable Pavements
- Green Streets and Alleys
- Green Parking
- Green Roofs
- Urban Tree Canopy
- Land Conservation

Green Infrastructure Basics
Examples

Downspout Disconnection

Reroute rooftop drains from curb drains or service laterals in combined sewers areas to dry wells, cisterns, or permeable areas.

Water from the roof flows from this disconnected downspout into the ground through a filter of pebbles.

Green Infrastructure Basics
Description

Downspout Disconnection

Only works where roof leaders and downspouts are currently directed to service connection and combined sewer system.

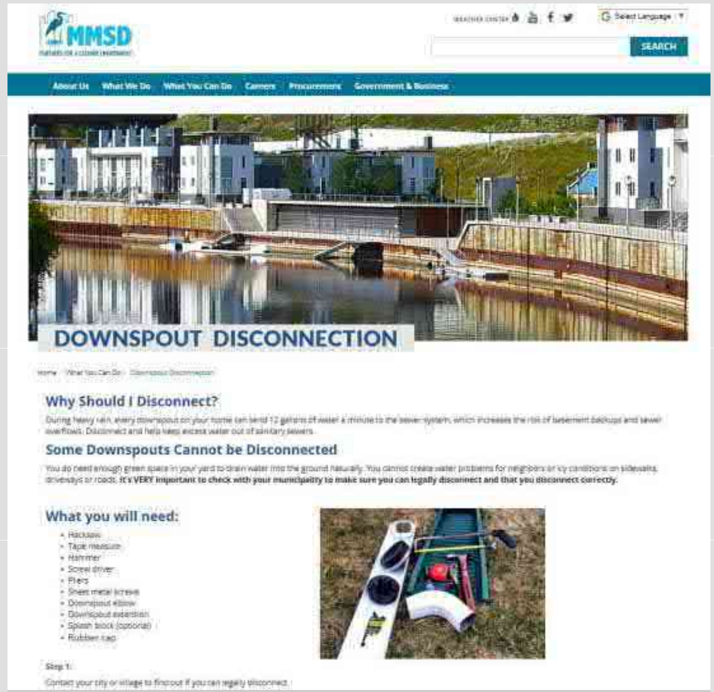
Caution:

a. Water cannot be directed to a neighbor
b. Do not direct water across a sidewalk (freeze potential).
c. Does your soil perc?
d. Check your local ordinances.

Green Infrastructure Basics

Example

Milwaukee Downspout Disconnection Program



Green Infrastructure Basics

Description

Rainwater Harvesting

Collect and Store Rainwater for Later Use on Landscaping or Gardens, i.e. rain barrels, or larger storage tanks. Particularly valuable in arid regions with limited water supplies.

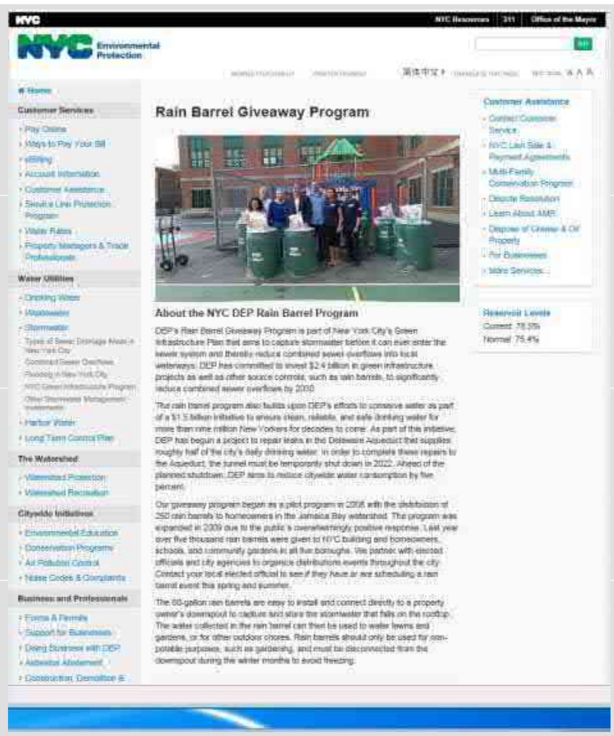
Green Infrastructure Basics
Description

Rainwater Harvesting

Limitations:
- Size of Container
- Only reuse during growing season.
- Manual maintenance needed to keep barrel empty to maximum harvesting.

Green Infrastructure Basics
Example

New York City
Rain Barrel Giveaway Program



Green Infrastructure Basics
Description

Rain Gardens

As per EPA, Rain gardens are versatile features that can be installed in almost any unpaved space. Also known as bioretention, or bioinfiltration, cells, they are shallow, vegetated basins that collect and absorb runoff from rooftops, sidewalks, and streets.

Green Infrastructure Basics
Description

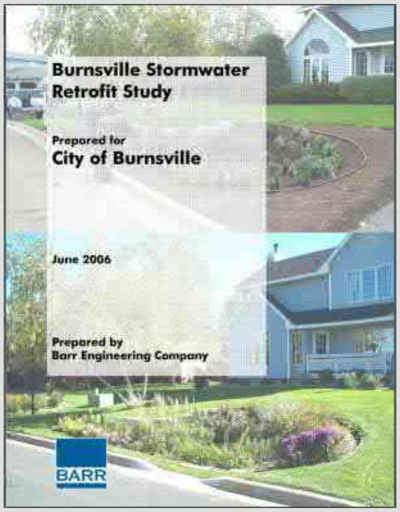
Rain Gardens

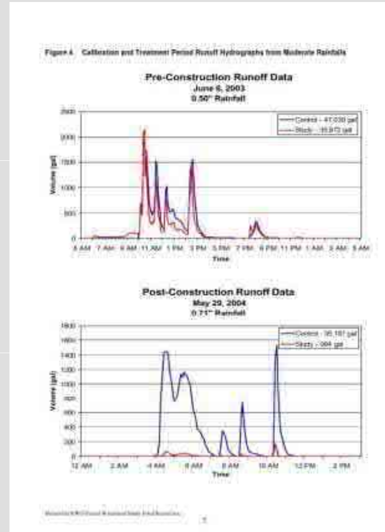
Limitation:
Needs permeable non-paved areas

Advantage:
Mimics natural hydrology of infiltration, evaporation, and transpiration.

Green Infrastructure Basics

Rain Gardens - Minnesota





Green Infrastructure Basics

Description

Planter Boxes

As per EPA, Planter boxes are urban rain gardens with vertical walls and either open or closed bottoms. They collect and absorb runoff from sidewalks, parking lots, and streets and are ideal for space-limited sites in dense urban areas and as a streetscaping element.

Green Infrastructure Basics
Description

Planter Boxes

Limitation:
Needs permeable non-paved areas and thus a decent right-of-way width between curbs and buildings.

Advantage:
Mimics natural hydrology of infiltration, evaporation, and transpiration.

Green Infrastructure Basics
Example

Philadelphia

Green Infrastructure Program

Green Infrastructure Basics
Description

Bioswales

As per EPA, Bioswales are vegetated, mulched, or xeriscaped channels that provide treatment and retention as they move stormwater from one place to another. Vegetated swales slow, infiltrate, and filter stormwater flows.

Green Infrastructure Basics
Description

Bioswales

Limitation:
Needs permeable non-paved areas and thus a decent right-of-way width between curbs and buildings.

Advantage:
Mimics natural hydrology of infiltration, evaporation, and transpiration.

Green Infrastructure Basics
Description

Permeable Pavements

As per EPA, Permeable pavements infiltrate, treat, and/or store rainwater where it falls. They can be made of pervious concrete, porous asphalt, or permeable interlocking pavers.

Green Infrastructure Basics
Description

Permeable Pavements

Limitation:
Needs permeable subsoils or high void volume subbase.
Require higher maintenance to limit plugging.

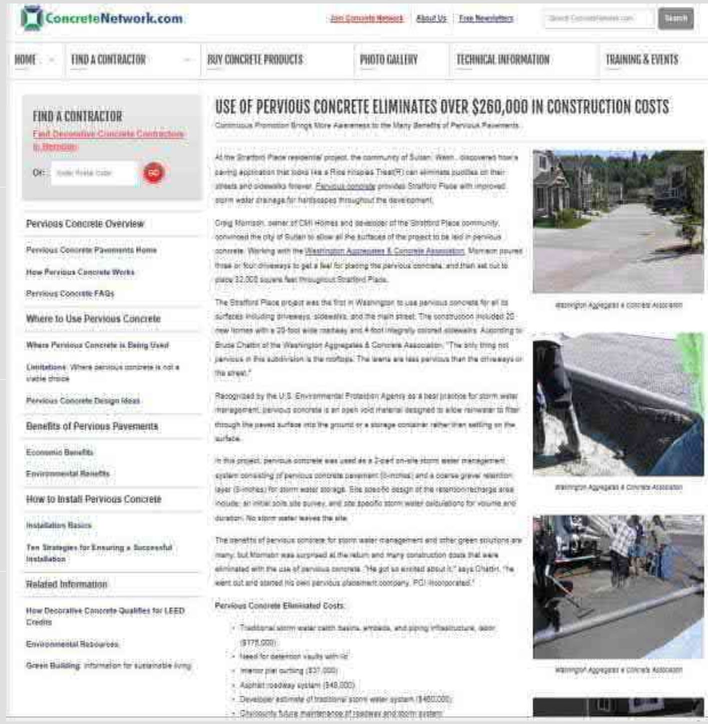
Advantage: Could be cost effective in areas with high land values and flooding or icing problems.

Green Infrastructure Basics
Example

Permeable Pavements

Sultan, Washington

Straford Place
Community Residential
Project


ConcreteNetwork.com

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FIND A CONTRACTOR

Pervious Concrete Overview

Pervious Concrete Pavements Home

How Pervious Concrete Works

Pervious Concrete FAQs

Where to Use Pervious Concrete

Where Pervious Concrete is Being Used

Pervious Concrete Design Ideas

Benefits of Pervious Pavements

How to Install Pervious Concrete

Related Information

USE OF PERVIOUS CONCRETE ELIMINATES OVER $260,000 IN CONSTRUCTION COSTS

Pervious Concrete Eliminated Costs:

Green Infrastructure Basics
Description

Green Streets and Alleys
As per EPA, “Green streets and alleys are created by integrating green infrastructure elements into their design to store, infiltrate, and evapotranspire stormwater. Permeable pavement, bioswales, planter boxes, and trees are among the elements that can be woven into street or alley design

Green Infrastructure Basics
Description

Green Streets and Alleys

EPA Region 3 Green Streets, Green Jobs, and Green Towns (G3) Program is meant to provide guidance with:

- Policy, Regulations, and Incentives
- Planning and Design
- Construction, Operation, and Maintenance
- Financing and Economic Benefits
- Green Jobs and Training

https://www.epa.gov/G3

Green Infrastructure Basics
Example

Green Streets and Alleys

Syracuse, NY
Green Street
Project

Save The Rain
Clean The Lake

Project:	Concord Place
GI Technology:	Infiltration Bed
Project Location:	Concord Place from Westcott St to Allen St
Project Owner:	City of Syracuse
Sewershed:	Erie
Capture Area:	35,000 square ft
Run-off Reduction:	955,000 gallons/yr
Year Completed:	2011
Construction Cost:	$78,900
Prime Contractor:	Cornerstone Paving

FACT SHEET
Green Street: Concord Place

Project Description: Concord Place is the first "green street" project in Syracuse. This project demonstrates a subtle approach to managing stormwater with the installation of infiltration trenches along the street corridor. Stormwater enters the system through the existing storm drain connections in the street. Instead of the collected water flowing to the sewer system, as was previously the case, the water is directed to an underground trench filled with a stone base. As the water enters the trench, it slowly filters through the compacted stone and soil, eventually releasing into the ground water. In addition to the underground infiltration system, Concord Place also received a new mill and pave application to the street surface, which was paid for by the City of Syracuse.

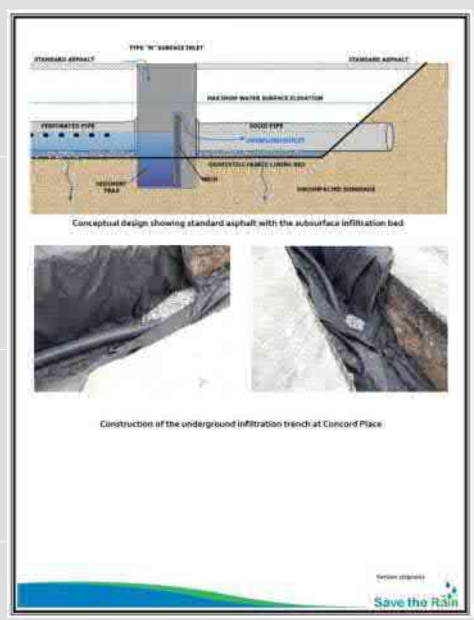
This type of project is unique among green infrastructure projects – although above the surface it appeared to be a traditional street paving process, below the street green infrastructure was installed to more effectively manage stormwater and protect our water resources.

The completion of the renovation of Concord Place is the first of several planned "green street" projects within the "Save the Rain" program.

Concord Place (looking south)

Concord Place (looking at center island)

Save the Rain



Conceptual design showing standard asphalt with the subsurface infiltration bed

Construction of the underground infiltration trench at Concord Place

Save the Rain

Green Infrastructure Basics

Description

Green Parking

Use of permeable pavements can be installed in sections of a lot (parking spaces) and rain gardens and bioswales can be included in medians and along the parking lot perimeter.

Green Infrastructure Basics

Description

Green Parking

Wilmington, MA

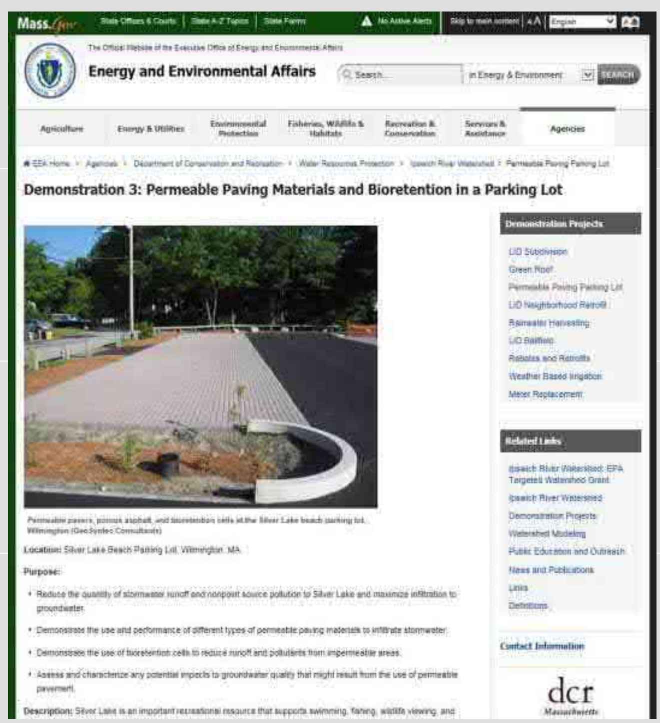
Silver Lake Beach Parking Lot

Key Results and Conclusions:

- Infiltration tests of the permeable paving materials, conducted after construction, indicated that infiltration rates met or exceeded specifications; the average observed infiltration rates were:

Porous Asphalt	Permeable Pavers	Flexi-Pave	Gravelpave
69 in./hr.	49 in./hr.	1,492 in./hr.	exceeds 5,000 in./hr

- Results of USGS monitoring show no indication of groundwater impairment beneath the areas with pervious paving.
- Reports from the town Board of Health show no closures of the swimming beach as a result of *E. coli* bacteria in the four years following installation of the LID features. For eight years prior to installation, beach closures due to *E. coli* occurred one or more times each summer.
- Since the installation of the LID features, the beach had one closure due to cyanobacteria, an algal bloom often associated with in influx of nutrients.



Green Infrastructure Basics

Description

Green Roofs

As per EPA, Green roofs are covered with growing media and vegetation that enable rainfall infiltration and evapotranspiration of stored water. They are particularly cost-effective in dense urban areas where land values are high and on large industrial or office buildings where stormwater management costs are likely to be high.

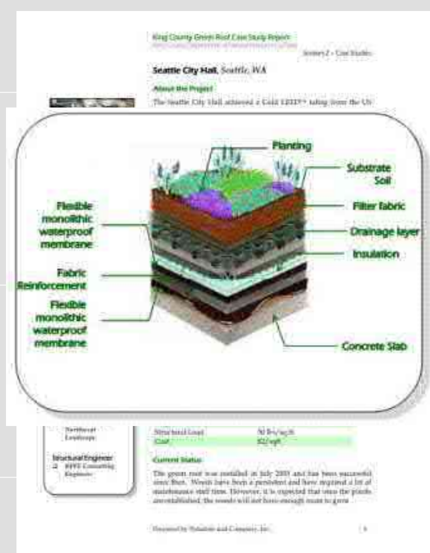
Green Infrastructure Basics

Example Washington State

King County Green Roof Case Study Report

Seminar II, Evergreen State College, Olympia, WA

About the Project



King County Green Roof Case Study Report

Seattle City Hall, Seattle, WA

About the Project

King County Green Roof Case Study Report

Justice Center, Seattle, WA

Green Infrastructure Basics

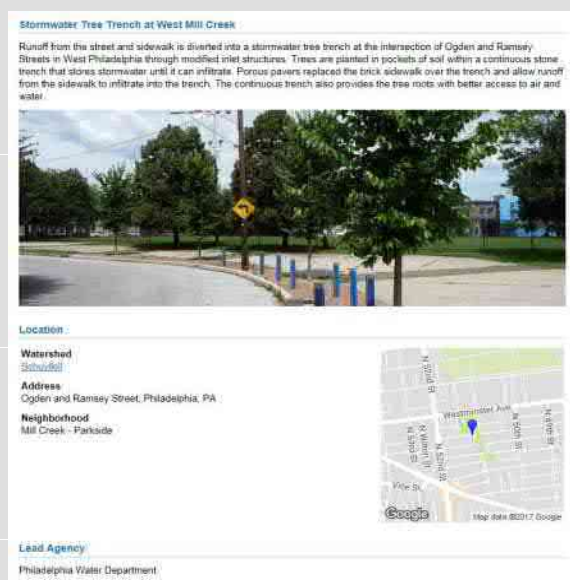
Description

Urban Tree Canopy

Trees reduce and slow stormwater by intercepting precipitation in their leaves and branches. They can also be integrated into green infrastructure such as tree trenches or bioswales.

Green Infrastructure Basics

Example – Tree Canopy



Green Infrastructure Basics

Description

Land Conservation

The water quality and flooding impacts of urban stormwater also can be addressed by protecting open spaces and sensitive natural areas within and adjacent to a city. Natural areas that should be a focus of this effort include riparian areas, wetlands, and steep hillsides.

Six-month look ahead

- Next meeting: late April – early May
- Submit reports with July 1, 2018 deadline:
  - System Characterization Reports
    - Separate reports for Elizabeth and Joint Meeting
    - Joint reviews and certifications
    - Drafts anticipated in April
  - Consideration of Sensitive Areas Plan
  - Public Participation Report
  - Compliance Monitoring Program Report
    - NJ CSO Group joint effort, draft results under review
- Develop and evaluate alternatives, with performance modelling

Questions?

Thank you

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

Supplemental CSO Team

Meeting No. 3
Long-Term Control Plan Permit Compliance

Supplemental CSO Team

Meeting No. 4

Long-Term Control Plan Permit Compliance

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

June 5, 2018 – 1:00 pm
Peterstown Community Center
408 Palmer Street, Elizabeth, NJ 07202

Meeting Agenda

- Prior meeting recap
- Upcoming submittal schedule
- Group survey – water quality concerns and responsibilities
- System Characterization Report
- Baseline Compliance Monitoring Program Report
- Consideration of Sensitive Areas Information
- Group survey – CSO control approaches and financial burdens
- Public Participation Process
- Alternatives Evaluation – Quick Look Ahead
- Next meeting

Meeting No. 3 Refresher

Material covered in prior meeting (1/29/2018):

- Public involvement activities
- Sensitive areas consideration
- Characterization and modeling updates
- NJ CSO Group coordination
- Green Infrastructure Basics

Upcoming Submissions

Reports with July 1, 2018 deadline:

1

System Characterization Reports

- Separate reports for Elizabeth and Joint Meeting
- Coordinated and joint certifications

2

Baseline Compliance Monitoring Program Report

- NJ CSO Group joint effort, draft results under review

3

Consideration of Sensitive Areas Information

- NJ CSO Group joint effort, draft results under review

4

Public Participation Process Report

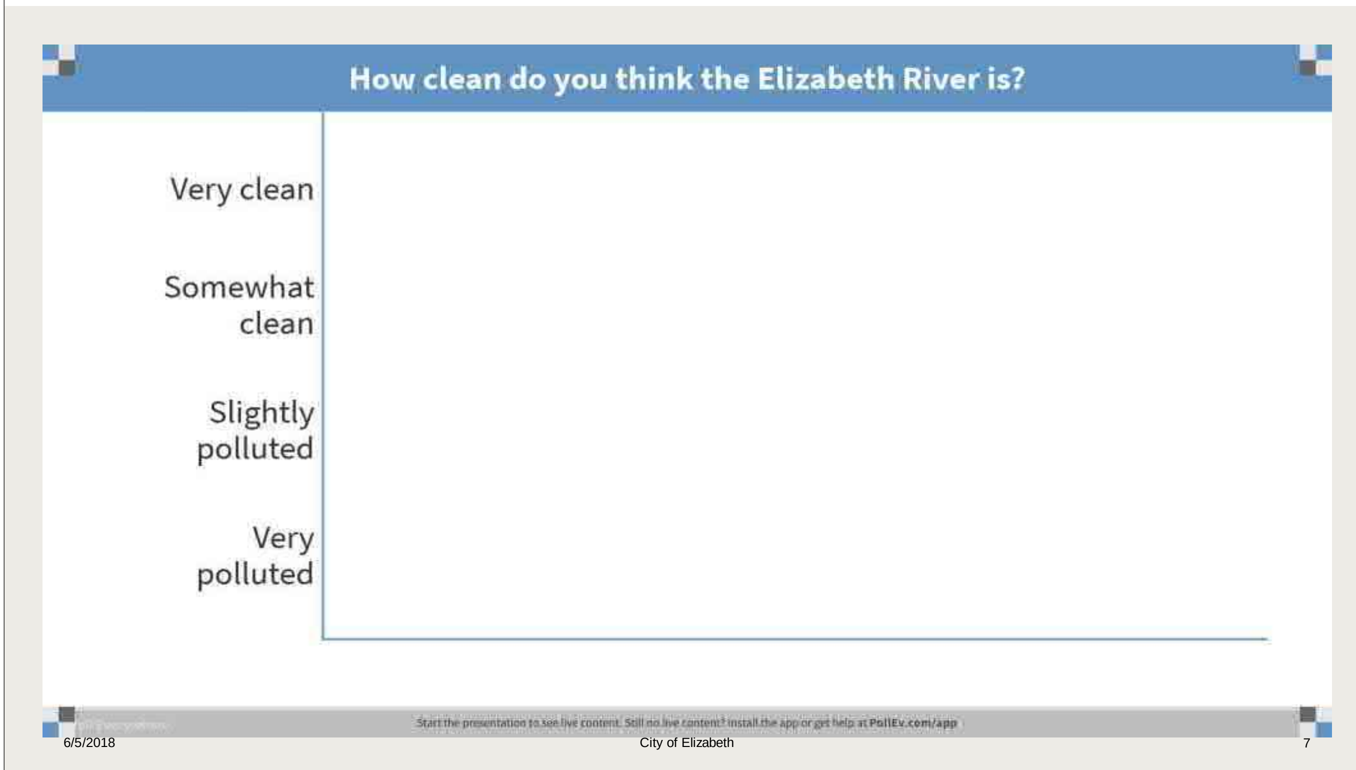
- Joint effort of Elizabeth and Joint Meeting

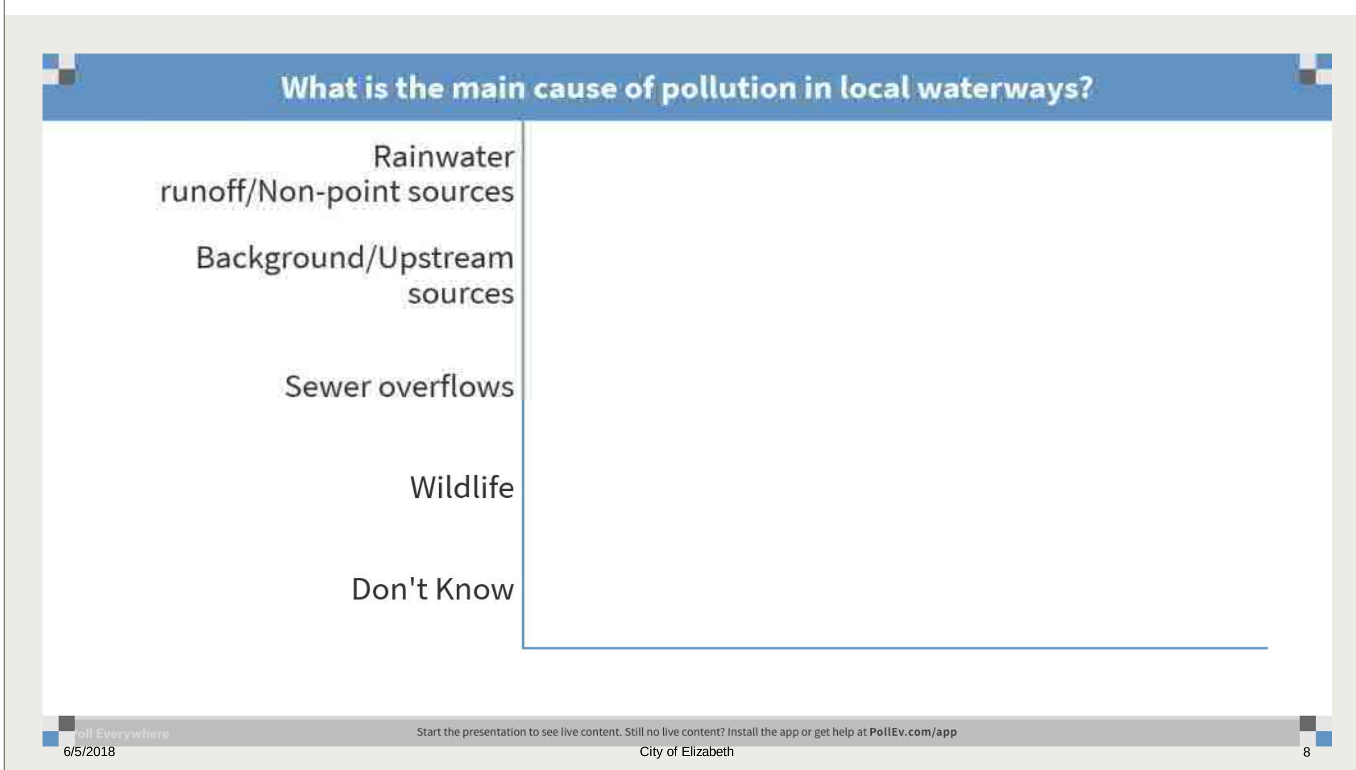
Interactive Surveys

We would like to obtain your feedback on items such as:

- Who you are / who you are representing
- Water pollution sources, issues, and concerns
- Public engagement methods
- Priorities for CSO alternatives
- Financing CSO controls

Please go to www.pollev.com/mottmac355 on your smartphone


How clean do you think the Elizabeth River is?
Very clean
Somewhat clean
Slightly polluted
Very polluted
Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app
6/5/2018
City of Elizabeth
7


What is the main cause of pollution in local waterways?
Rainwater runoff/Non-point sources
Background/Upstream sources
Sewer overflows
Wildlife
Don't Know
Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app
6/5/2018
City of Elizabeth
8

System Characterization Update – Report Organization

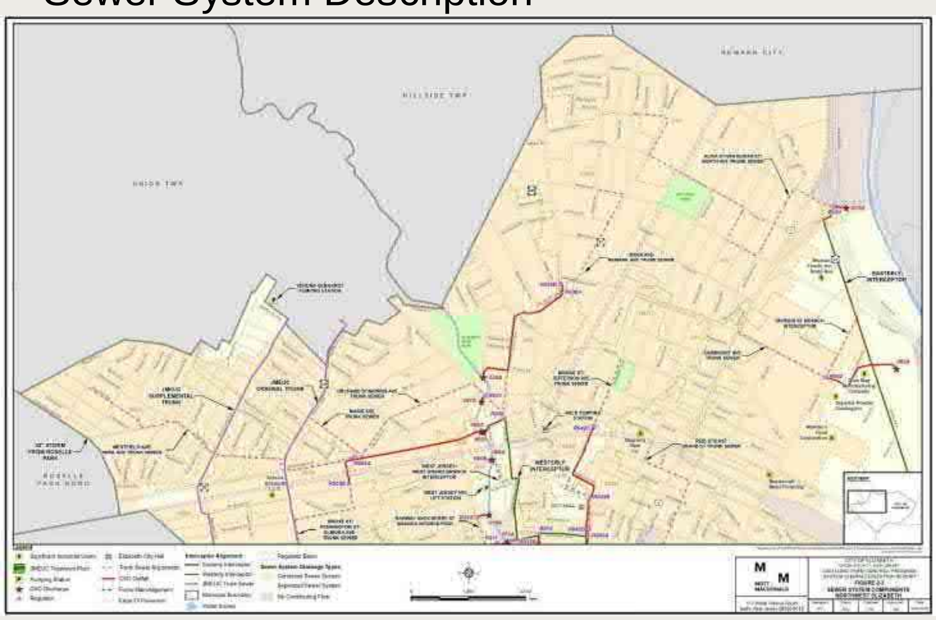
1. Introduction
2. Sewer system description
3. Hydraulic monitoring
4. Wastewater quality monitoring
5. Collection system model
6. Receiving water quality monitoring
7. Consideration of sensitive areas
8. Characterization of system performance – typical year simulation

Sewer System Description

Combined Sewer System

- Combined and separate sewer areas
- Hydraulically connected system
- Receiving waters
- Facilities inventory and descriptions
- Outfall and regulator control structure details
- Significant Indirect Users
- CSO drainage basins
- Facility assessments

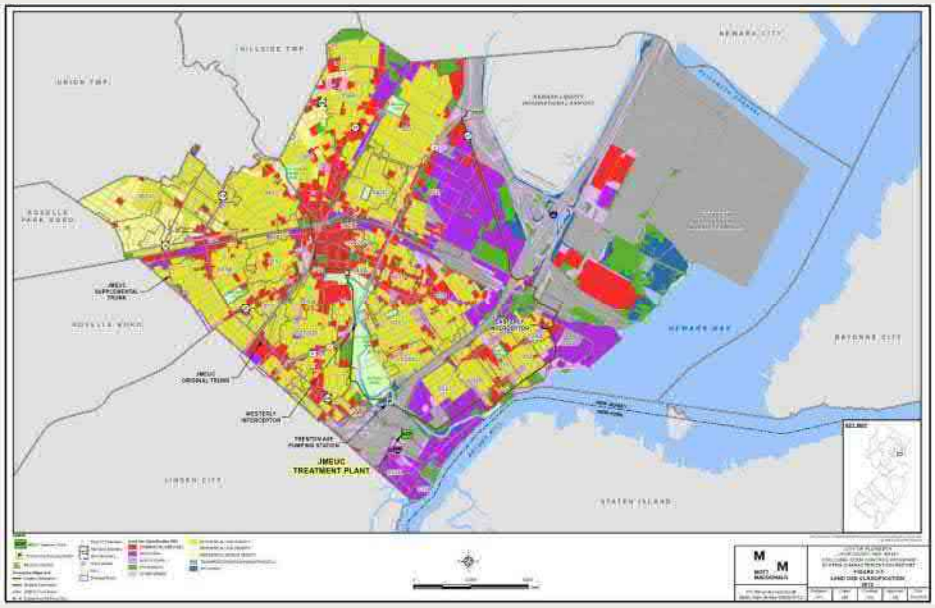
Sewer System Description



Combined Sewer System

- 29 CSO Outfalls
- 36 CSO Sub-basins, varying from 3 to 439 acres each
- 38 regulators and diversion chambers
- 166 miles of combined sewers, with 6,400 manholes & 3,300 inlets
- Complex network of interconnections
- 14.7 Mgal/day average flow, Trenton Ave PS
- Roselle Park storm sewer connection

Updated Land Use Analysis – 2012 NJDEP GIS Data



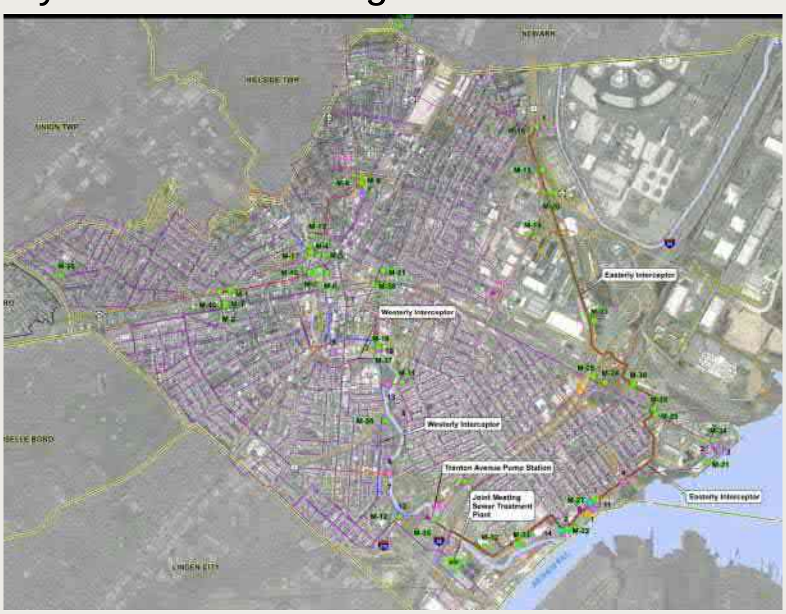
Land use overall CSO area – 3,832 acres

- 52.2% high-density resid.
- 8.2% med-density resid.
- 17.3% commercial
- 11.6% industrial
- 3.5% open areas
- 3.3% transportation
- 3.9% other uses

61.8% impervious cover

Little change from 2007

Hydraulic Monitoring



Continuous monitoring: 8/22/15 – 12/21/15 (4 months)

- 40 flow meters
  - 14 dry weather lines
  - 10 overflow lines
  - 6 along E. Interceptor
  - 5 along W. Interceptor
  - 4 storm sewers
- 2 tide gauges
- 14 tide gate monitors
- 2 groundwater level monitors
- 3 rain gauges

Hydraulic Monitoring – Rainfall Events

Storm	Start Date	End Date	Start Time	End Time	Depth (In)	Duration (Hrs)	Max Intensity (In/Hr)
1	9/9/2015	9/9/2015	15:40	18:30	0.11	2.83	0.22
2	9/10/2015	9/10/2015	3:05	23:45	0.99	20.67	0.26
3	9/29/2015	9/30/2015	23:00	8:45	1.39	9.75	0.76
4	10/2/2015	10/3/2015	4:30	10:00	1.91	29.50	0.31
5	10/9/2015	10/9/2015	17:25	22:50	0.32	5.42	0.25
6	10/28/2015	10/29/2015	10:25	9:15	1.65	22.83	0.55
7	11/10/2015	11/11/2015	8:30	7:15	0.57	22.75	0.12
8	11/19/2015	11/20/2015	13:35	9:30	1.00	19.92	0.29
9	12/1/2015	12/2/2015	1:35	23:30	0.60	45.92	0.07
10	12/17/2015	12/17/2015	11:15	22:30	1.15	11.25	0.35

Total 10 storms

- Durations varying from 2.8 to 46 hours
- Intensities varying from 0.07 to 0.76 inches/hour

Categorized as:

- Low duration, low intensity (2)
- Low duration, high intensity (2)
- High duration, low intensity (5, some close to the cutoff line)
- High duration, high intensity (1)

Various periods of dry weather flow data

Wastewater Quality Monitoring

- 7 sampling locations
- 3 event sampling surveys
  - Rainfall events > 0.5”
  - Dry weather samples day before
  - Wet weather sampling intervals: 30 mins, 1 hr, 2 hr, 4 hr and 8 hr
- 3 pathogen parameters
  - E. coli at 2 sites
  - Fecal coliform and enterococcus at 7 sites

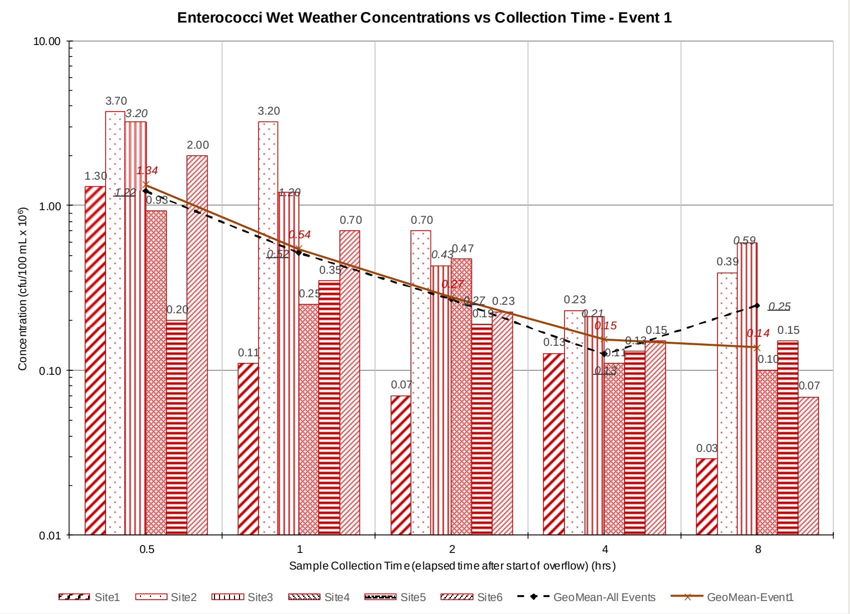
Dry Weather Pathogen Concentration Averages and Ranges by Sample Site, All Events

Parameter / Statistic	Concentrations in cfu/100 mL x 10^6							
Site No.	1	2	3	4	5	6	7	
Drainage Area	003A	022A	026A	028A	029A	034A	042A	All Sites
E. Coli								
Geometric Mean	2.08	3.34	NA	NA	NA	NA	NA	2.64
Minimum	1.40	1.70	NA	NA	NA	NA	NA	1.40
Maximum	3.20	5.00	NA	NA	NA	NA	NA	5.00
Fecal Coliform								
Geometric Mean	2.52	3.08	5.65	3.56	3.90	4.67	4.13	3.82
Minimum	2.20	2.40	4.20	3.40	3.00	1.10	3.20	1.10
Maximum	2.90	4.20	7.80	3.70	6.20	32.00	5.80	32.0
Enterococci								
Geometric Mean	1.41	1.23	2.22	2.25	1.40	1.92	0.86	0.89
Minimum	0.70	0.57	1.00	1.50	1.07	0.64	0.54	0.54
Maximum	2.00	2.20	5.00	3.60	1.70	5.50	1.30	5.5

Wet Weather Pathogen Concentration Averages and Ranges by Sample Site, All Events and Sample Times

Site No.	1	2	3	4	5	6	7	
Drainage Area	003A	022A	026A	028A	029A	034A	042A	All Sites
All Events								
E. Coli								
Geometric Mean	0.29	0.88	NA	NA	NA	NA	NA	0.50
Minimum	0.07	0.17	NA	NA	NA	NA	NA	0.07
Maximum	2.30	11.00	NA	NA	NA	NA	NA	11.00
Fecal Coliform								
Geometric Mean	0.46	1.57	2.45	0.65	0.36	0.47	1.98	0.87
Minimum	0.04	0.20	0.22	0.08	0.05	0.09	0.26	0.04
Maximum	9.30	66.00	108.00	4.10	1.80	2.40	38.00	108.00
Enterococci								
Geometric Mean	0.18	0.70	0.76	0.30	0.23	0.29	0.39	0.36
Minimum	0.03	0.06	0.07	0.03	0.04	0.02	0.03	0.02
Maximum	1.30	6.20	4.20	2.40	1.30	0.90	2.00	6.20

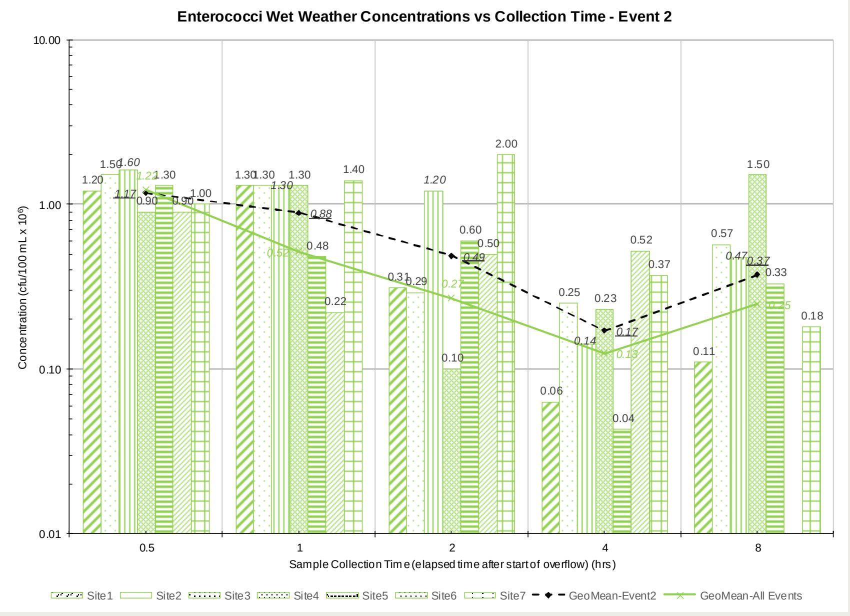
Wastewater Quality Monitoring



Pathogen Data

- Highly variable, but consistent with typical ranges.
- Average overflow content lower than dry weather.
- During storm, pathogens may stay high or increase during initial overflow period (first flush)
- Decreases during course of storm, with dilution
- Increases at end of overflow event.

Wastewater Quality Monitoring



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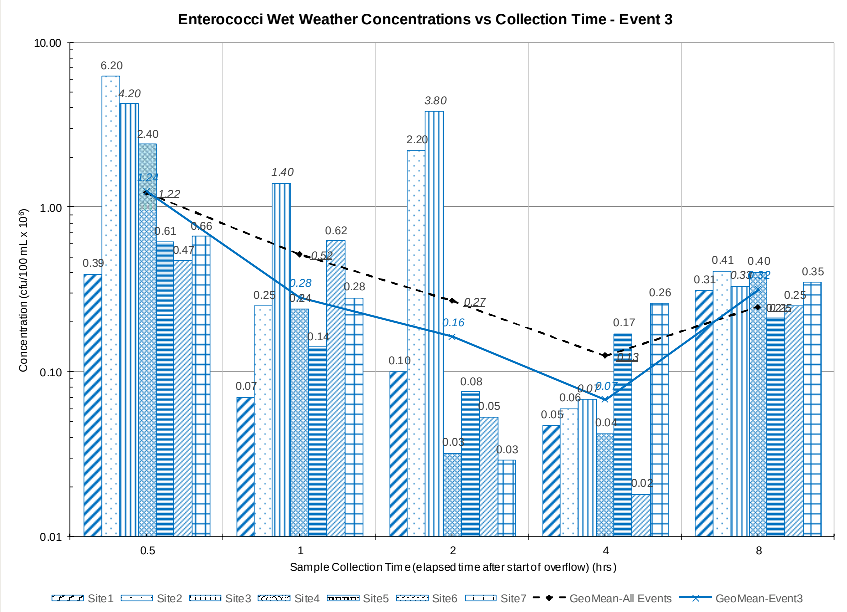

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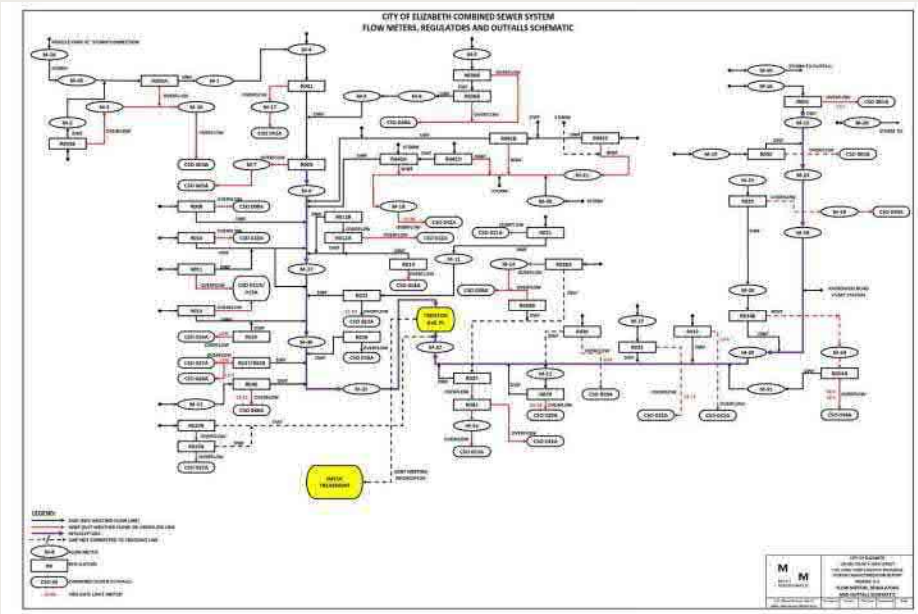
Collection System Modeling

- Computer model with extensive coverage of physical system
- Model geometry and representation based on existing system
- Complex network of interconnections represented



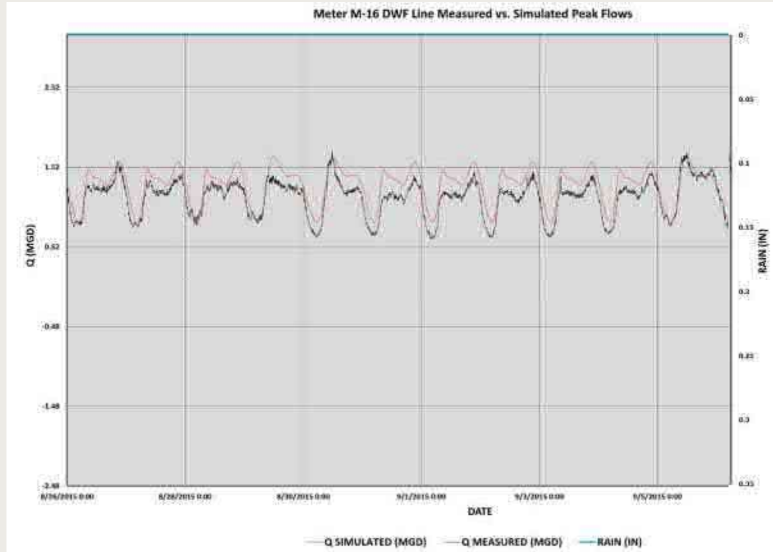
Collection System Modeling

Calibration and validation storm selection

- 4 calibration storms (#5, 6, 8 & 10)
- 2 validation storms (#3 & 4)

Dry weather flow (DWF) analysis

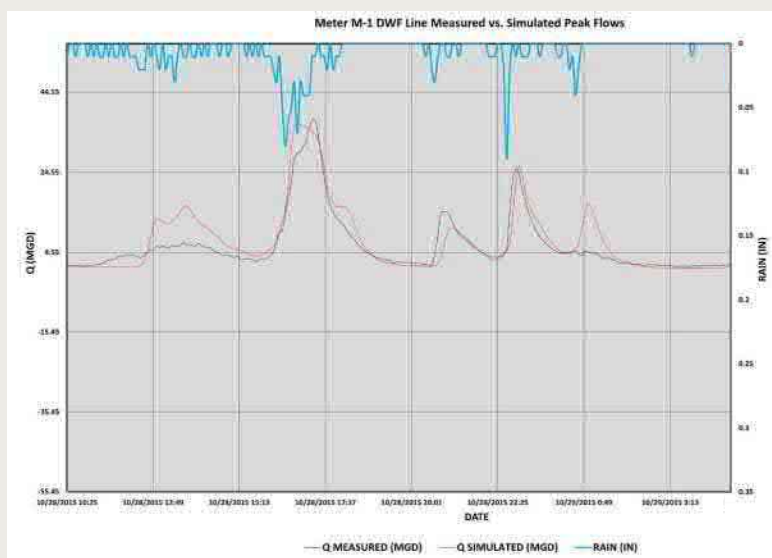
- Flow component estimation for each meter with DWF
  - Segregate dry weather weekday and weekend flows and diurnal peak factors
  - Population analysis for flow generation
  - Groundwater infiltration analysis
  - Correlate model calculations with monitoring data



Collection System Modeling

Wet weather flow (WWF) analysis

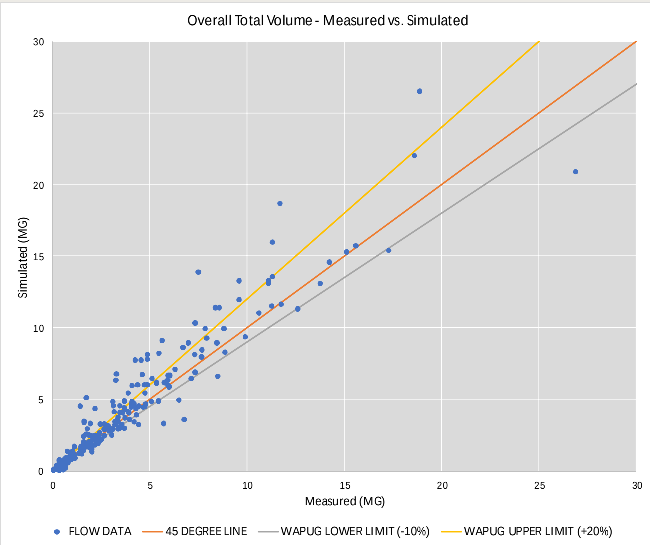
- For tributary area to each meter,
  - Estimated runoff generation characteristics, i.e., impervious area, initial abstraction and runoff coefficients
  - Generated peak flows and used coefficients as calibration parameters
- WWF calibration to accurately reflect system wet weather response relative to timing and hydrograph shape
- Similar analysis for validation storms to confirm fit

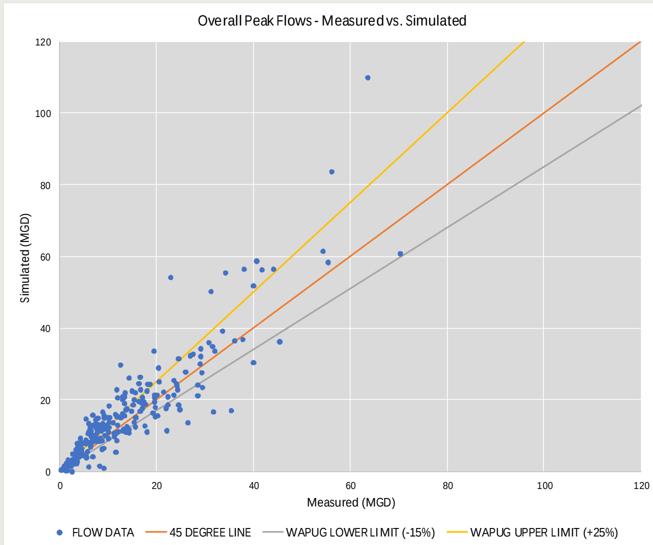


Collection System Modeling

Goodness-of-fit plots for WWF calibration results

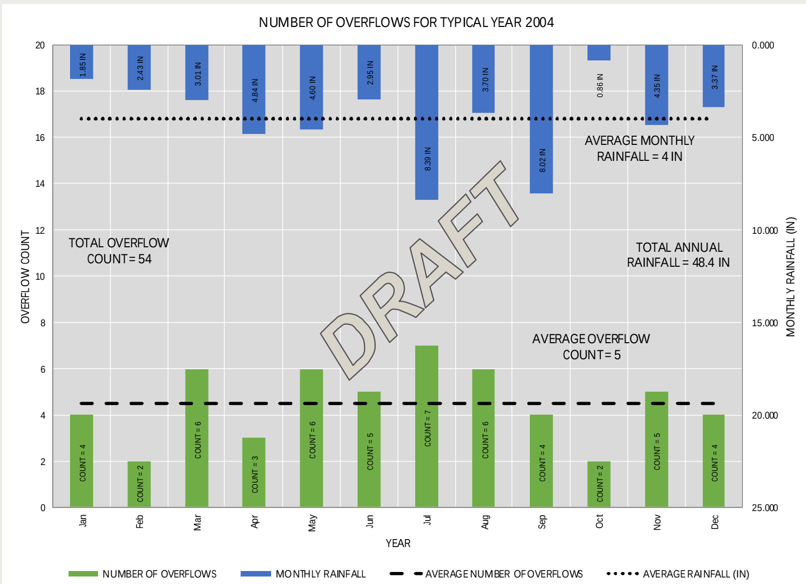
All storms and meters for monitoring period (400 data points)





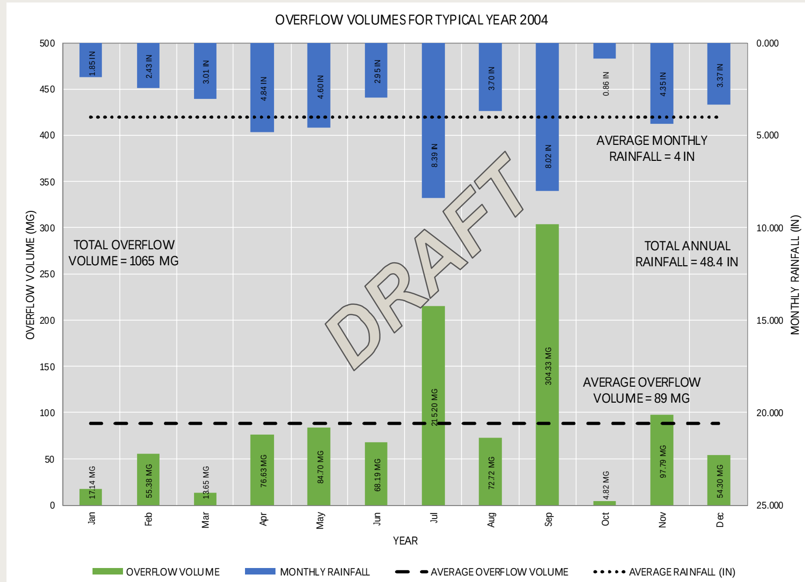
System Performance for Typical Year Rainfall Record

- Typical year to represent expected rainfall conditions to assess CSO controls on "system-wide, annual average basis"
- NJ CSO Group collaboration **2004** was selected & NJDEP accepted.
- Draft results from model simulations with 2004 rainfall record for CSO frequency, volume, and duration



System Performance for Typical Year Rainfall Record

- Draft results from existing system conditions model with 2004 rainfall record
  - Total annual rainfall = 48.4”
  - Total CSO frequency = 54/yr (preliminary)
  - Total CSO volume = 1,065 Mgal/yr (preliminary)
  - Average CSO Duration = 7 hours/overflow

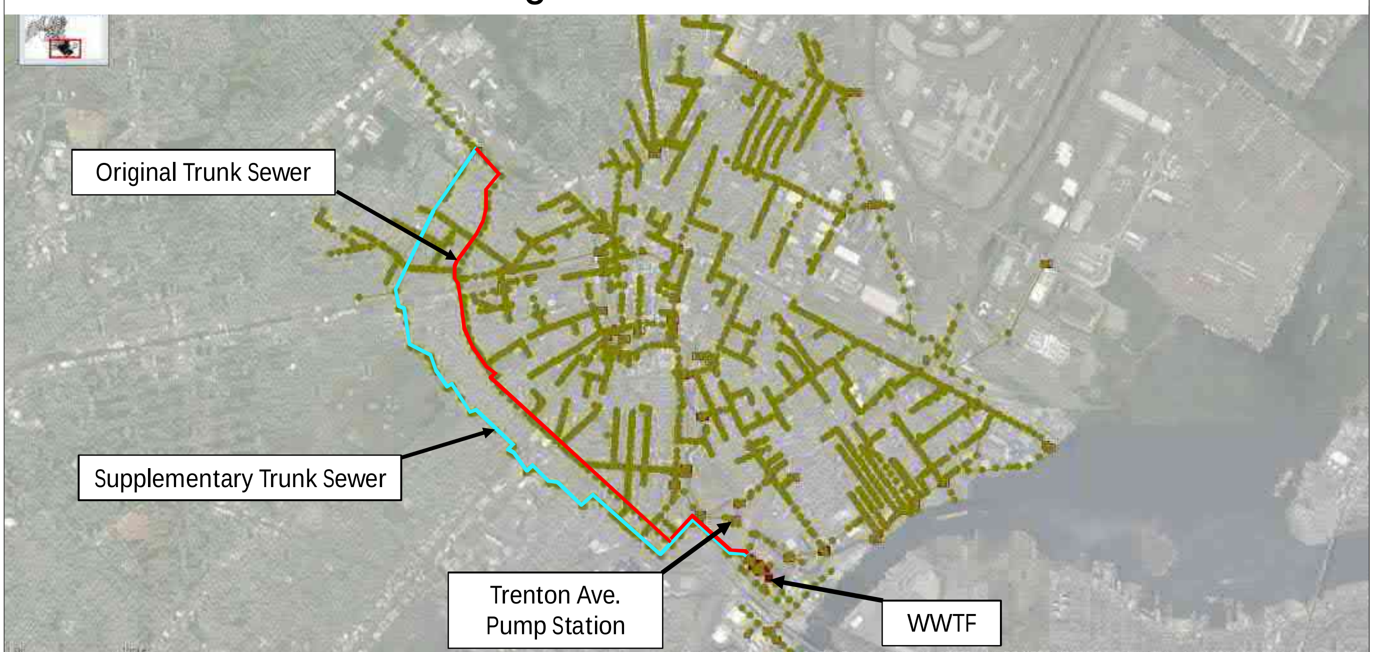


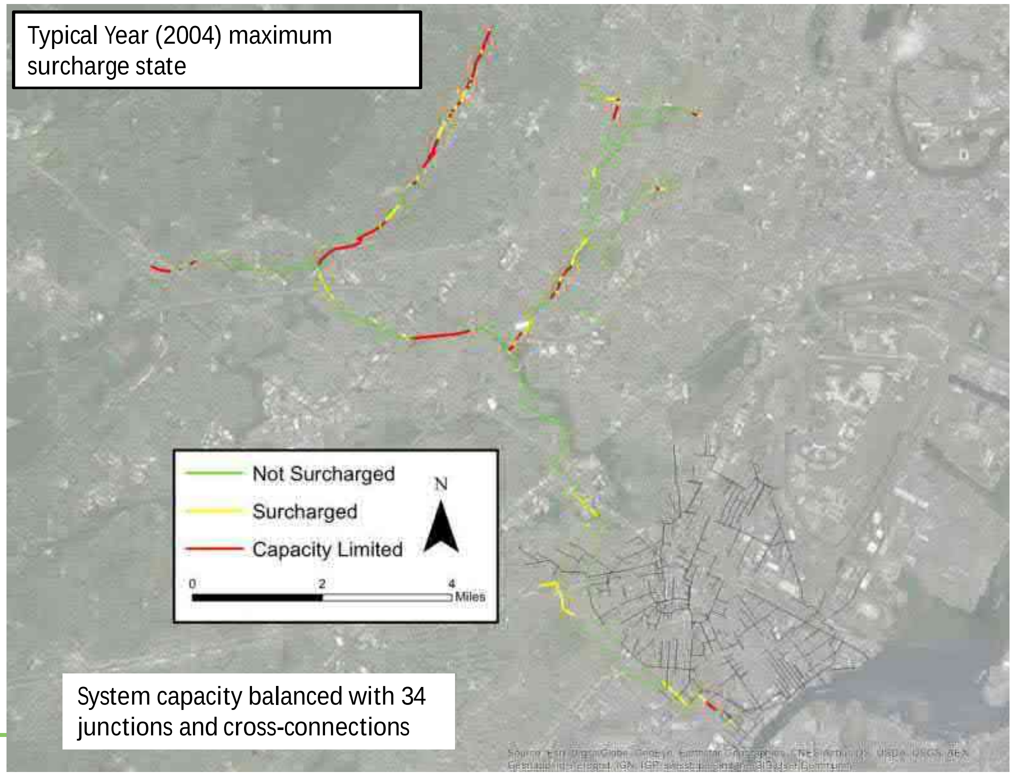
System Characterization Report Outline – JMEUC

Section	
1 Introduction	
2 Description of Combined and Separate Sewer Systems and Treatment Facilities	
3 Receiving Waterbodies	
4 Sewer System Monitoring and Modeling	
5 Receiving Waterbody Monitoring and Modeling	
6 Rainfall Analysis and Typical Hydrologic Record	
7 Characterization of System Performance – JMEUC Sewer System	
8 Characterization of System Performance – Wastewater Treatment Plant	
9 Institutional Arrangements	
10 Conclusions	

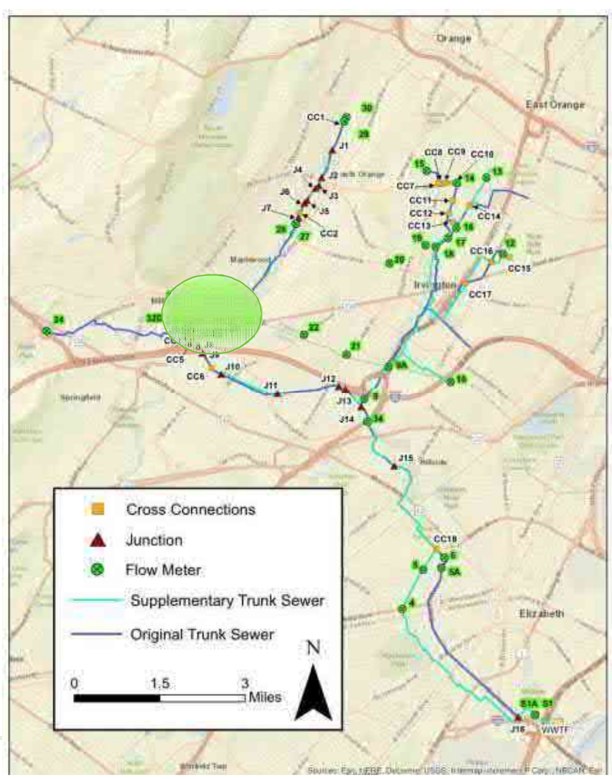
Merged Model Network

Merged Model Network

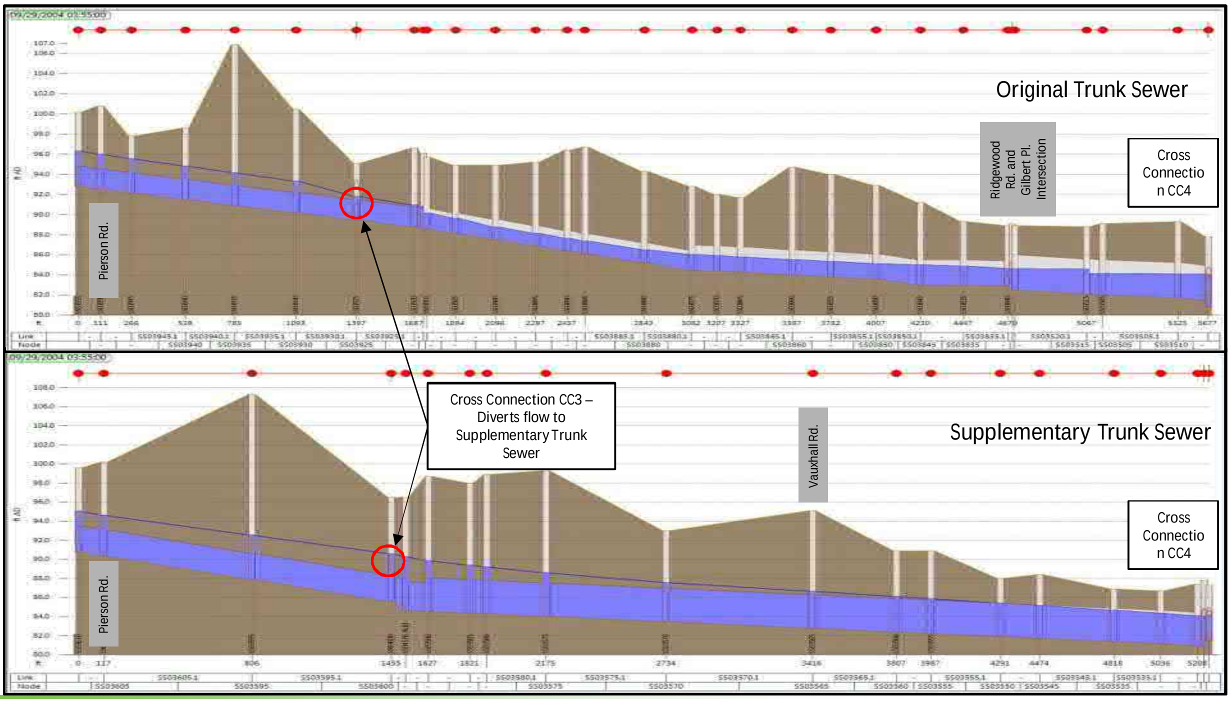




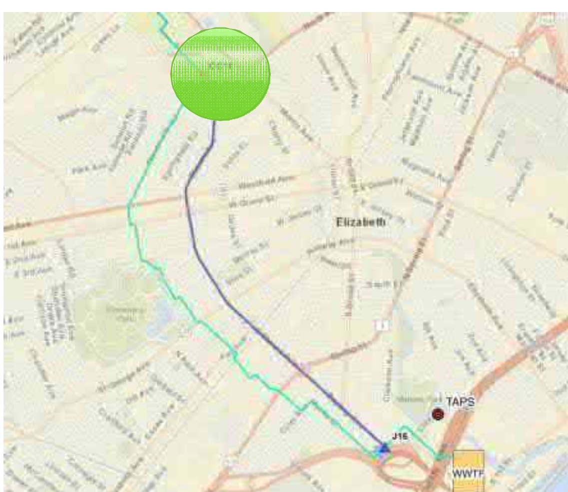
Junctions and Cross-Connections in JMEUC System

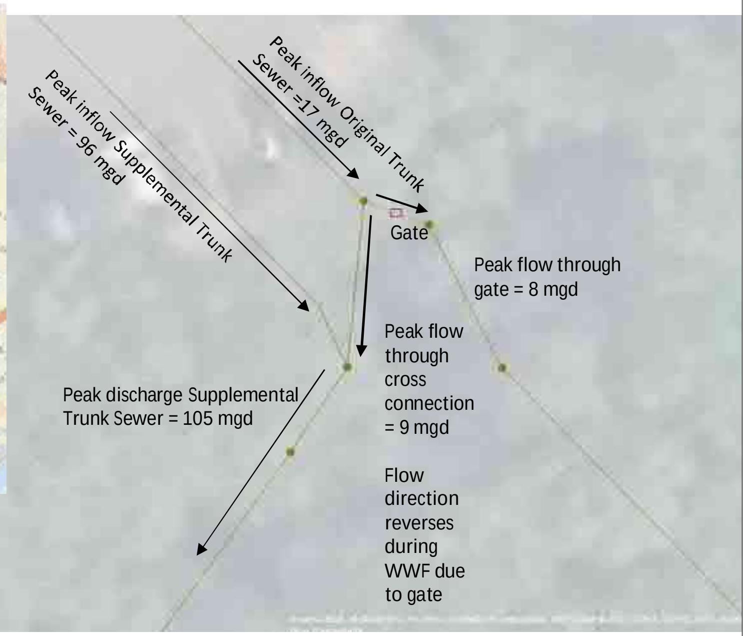


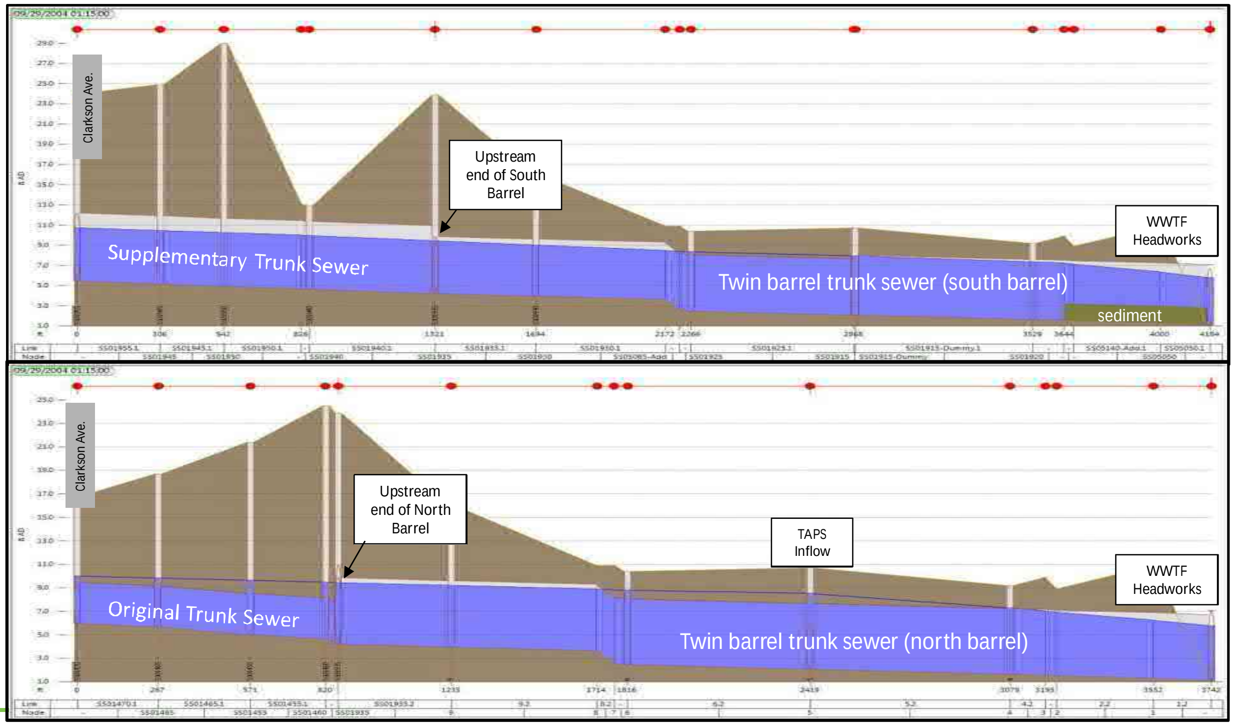
Profile 5



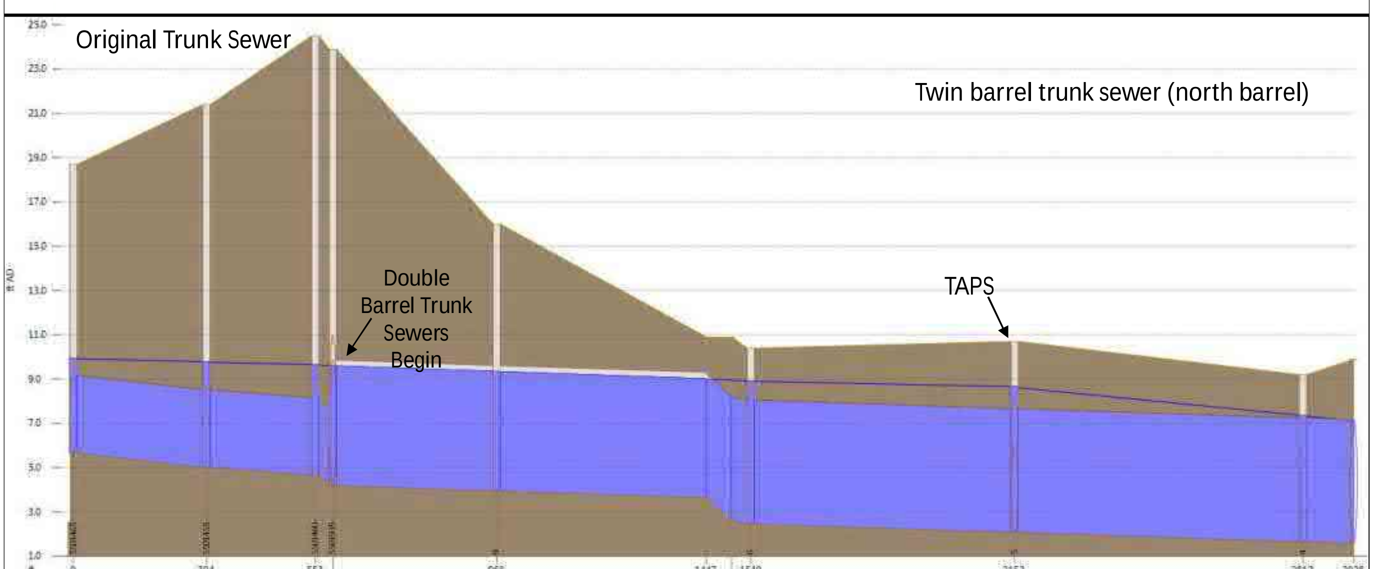
Kean University Cross Connection – 2/6/2004 Event



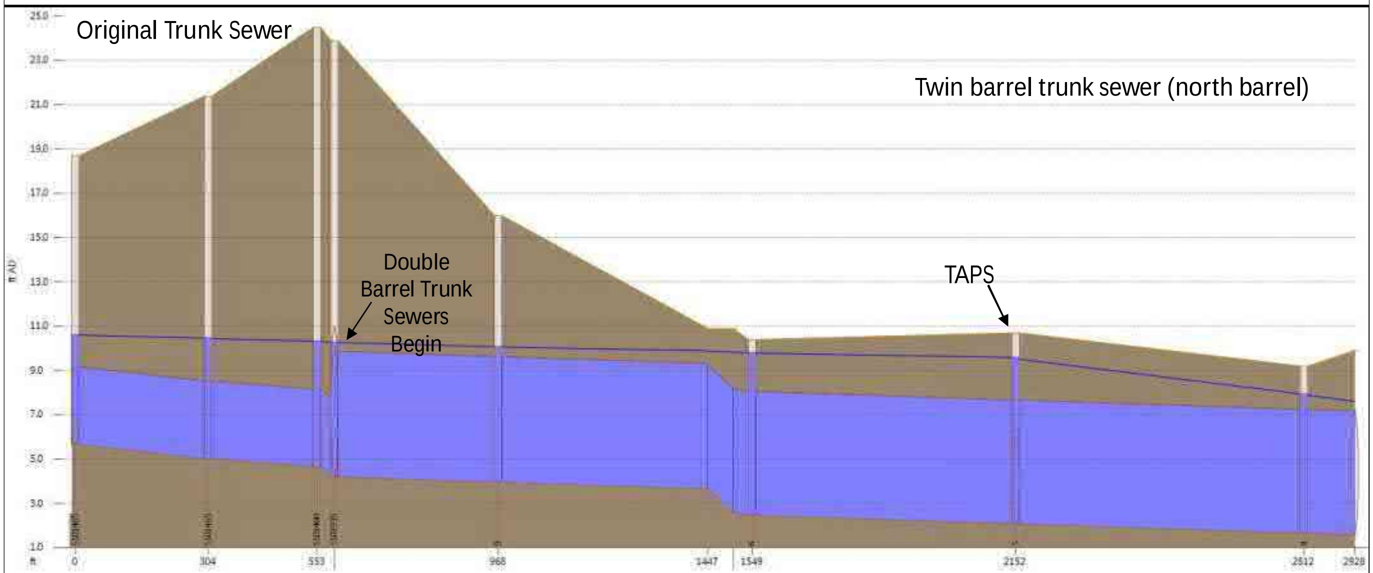




36 mgd Peak Inflow From TAPS – 2/6/2004 Event



55 mgd Peak Inflow From TAPS – 2/6/2004 Event



Baseline Compliance Monitoring Program (CMP) Report

- NJ CSO Group collaboration
- Field sampling and testing for existing ambient pathogen water quality conditions
- Data input for pathogen water quality model for the receiving waters

Baseline Sampling

Twice a month in May and June; weekly in July, August, and September; and monthly from October through April

Source Sampling

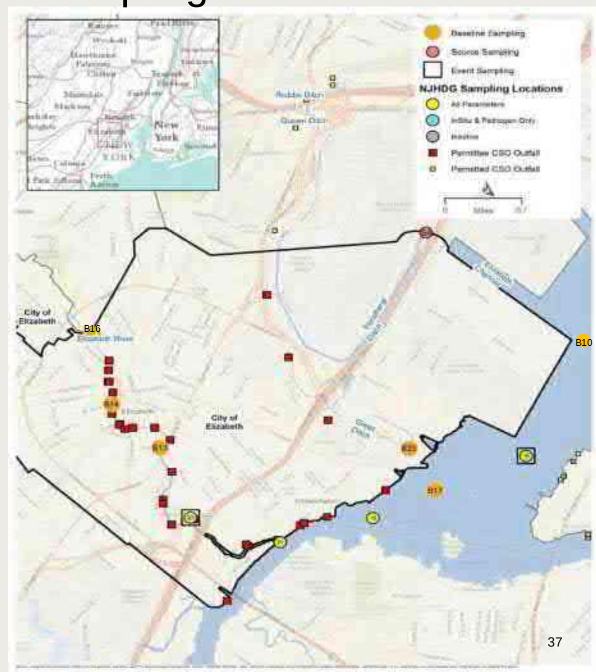
Establish non-CSO loadings at major influent streams, coincided with Baseline Sampling

Event Sampling

Coincided with rainfall to capture three discrete wet-weather events (>0.5”)

Baseline CMP Report - Elizabeth Area Sampling Locations

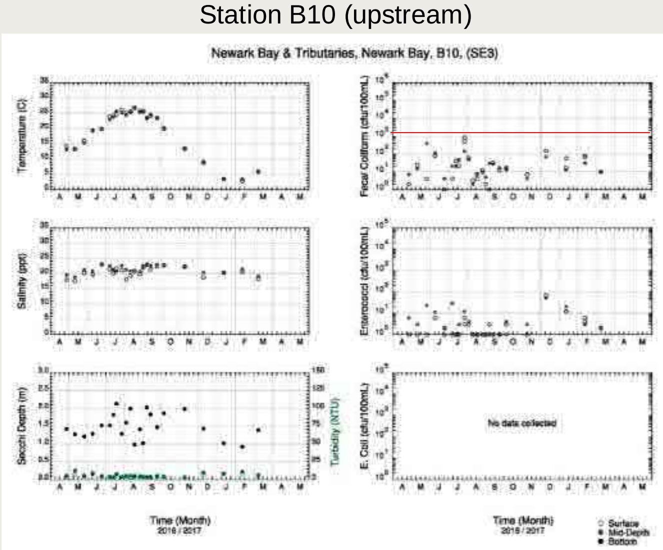
Station No.	Waterbody	Sampling Category	Surface WQS Class
B10	Newark Bay	Baseline	SE3
18	Newark Bay	NJHDG & Event	SE3
B17	Newark Bay	Baseline	SE3
19	Newark Bay	NJHDG	SE3
21	Arthur Kill	NJHDG	SE3
B16	Elizabeth River	Baseline	FW2-NT
B14	Elizabeth River	Baseline	FW2-NT
B13	Elizabeth River	Baseline	SE3
20	Elizabeth River	NJHDG & Event	SE3
S4	Peripheral Ditch	Source	SE3
B25	Great Ditch Outlet	Baseline	SE3



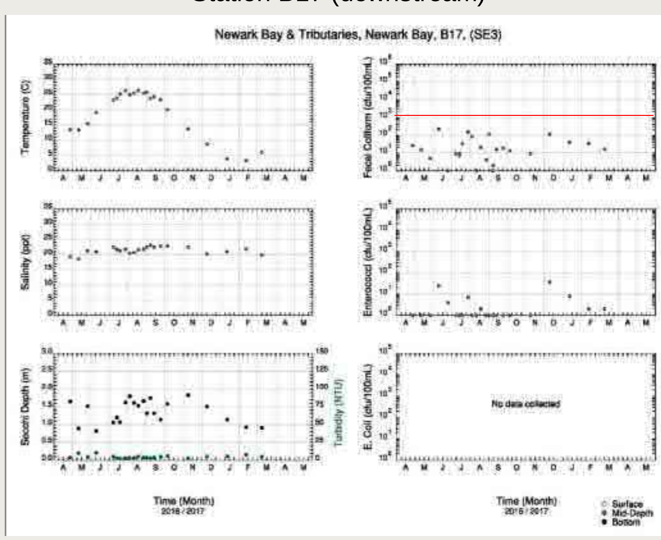
Baseline CMP Report – Data Results, Newark Bay (SE3)

WQS: Geo. Mean, coliform < 1,500 cfu/100 mL for SE3 (shown with red line)

Station B10 (upstream)



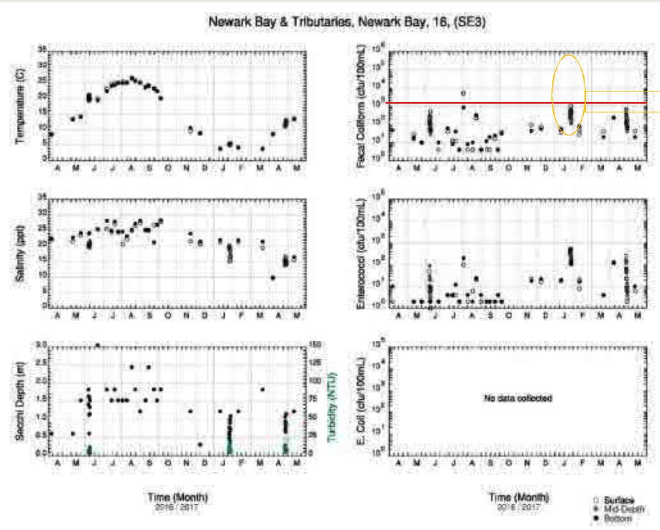
Station B17 (downstream)



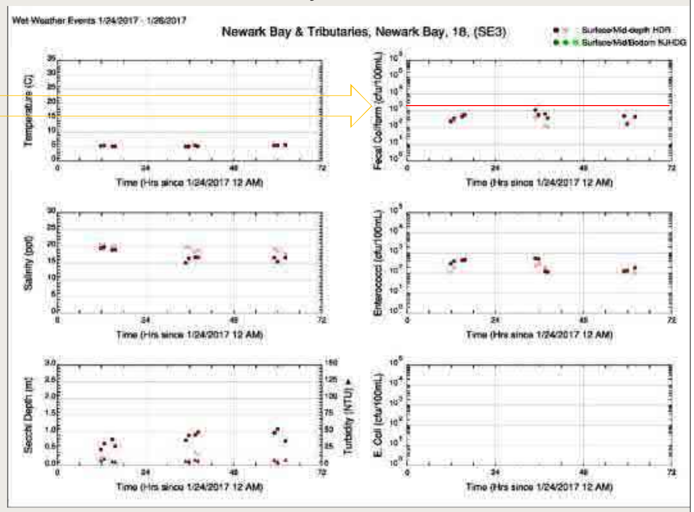
Baseline CMP Report – Newark Bay, Station 18 (SE3) (b/w B10 & B17)

WQS: Geo. Mean, coliform < 1,500 cfu/100 mL for SE3 (shown with red line)

Routine and Event Sampling



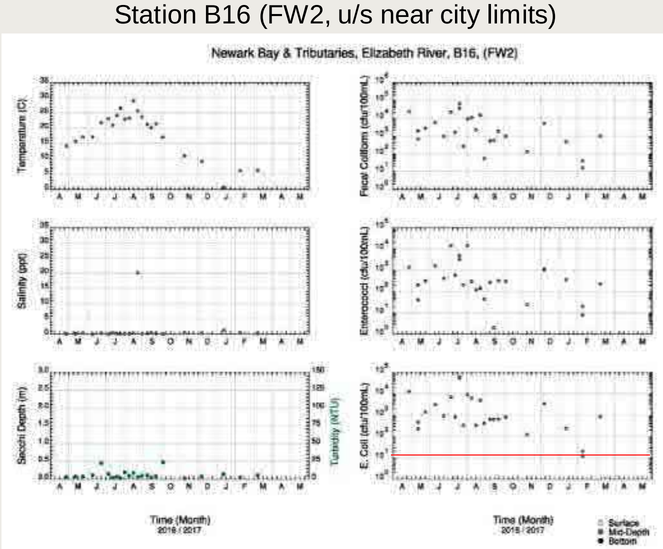
Wet Weather Sampling
January 24-26, 2017



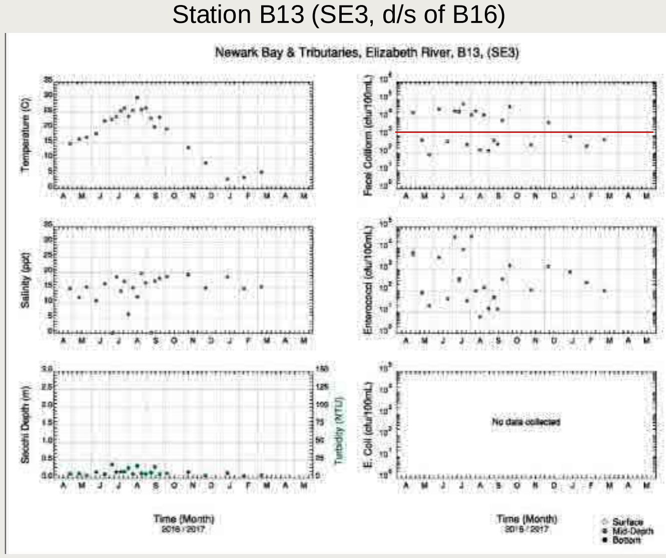
Baseline CMP Report – Data Results, Elizabeth River

WQS: Geo. Mean, E. coli < 126 cfu/100 mL for FW2, coliform < 1,500 cfu/100 mL for SE3

Station B16 (FW2, u/s near city limits)



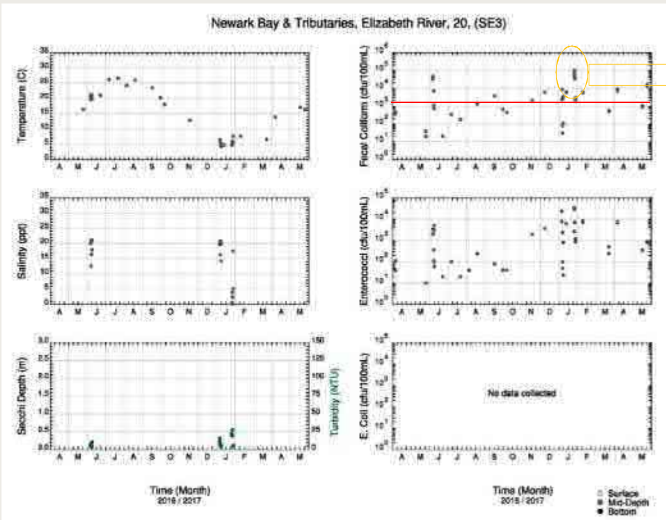
Station B13 (SE3, d/s of B16)



Baseline CMP Report –Elizabeth River (SE3) Station 20 (d/s B13)

WQS: Geo. Mean, coliform < 1,500 cfu/100 mL for SE3

Routine and Event Sampling



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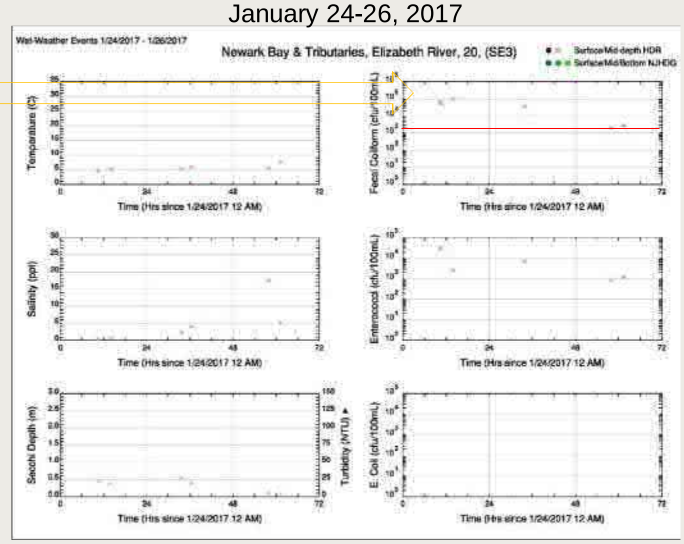


Baseline CMP Report –Findings

- Data sufficient for calibrating and validating Pathogen Water Quality Model
- Program not intended for assessing attainment of pathogen WQS (insufficient data points per month)

General observations:

- Newark Bay, Arthur Kill & Kill Van Kull may meet existing pathogen WQS for SE3 waters
- Smaller waterbodies, like Elizabeth, Rahway, Saddle, and Second River, unlikely to meet attainment
- Source sampling of tributary streams without CSOs have high bacteria loads. High background and other pathogen load sources.
- Elizabeth R. bacteria values entering city are very high, not meeting WQS and non CSO impacted
- Elizabeth R. bacteria values u/s and d/s of CSO outfalls are similar
- Wet weather event data fall at upper end of observed values. Influence of general wet weather bacteria sources.

Consideration of Sensitive Areas Information

- Are sensitive areas present and require highest priority for CSO control?
- Draft report under review

Criteria	Present?
Outstanding National Resource Waters	**None**
National Marine Sanctuaries	**None**
Waters with threatened or endangered species and their habitat	Sturgeon (federally listed endangered and state endangered) identified but not critically dependent on the water. Impact from CSO discharge likely insignificant given life cycle, migration behavior, waterway use, and impacts from other pollution sources and environmental threats. **No sensitivity for higher priority.**
Waters with primary contact recreation	Fishing at Slater Park and Waterfront Memorial Park, and jet skiing through Arthur Kill have been observed but occasional and unusual use. No bathing beaches or access to channelized parts of river. **No sensitivity for higher priority.**
Public drinking water intakes or their designated protection areas	**None**
Shellfish beds	**None**

Public Participation Process Report

Public Involvement Activities

Public outreach and education event – Future City Environmental Day 4/27/2018

Opportunities for public engagement on CSO Long-Term Control Plan

Prior Meeting Comments

- Provide info on pending construction projects
- Send info to Elizabeth Chamber of Commerce for membership distribution
- Distribute info at Peterstown Community Center nature center and Phil Rizzuto Park outdoor pavilion
- Post info on City's social media pages
- Consult environmental planning commission and master planners

Public Involvement Activities (cont.)

Community Interface Assistance

Any feedback from your groups on the CSO issues?
What info do Team members need to facilitate public input?
What other resources are available?

Input on sewer system issues to be addressed

Areas of flooding
Sewer backups
Sewer infrastructure age & deterioration
Sewer bills

What is the most effective way to engage with the public for CSO awareness?

- Mail / bill stuffers
- Community events
- Displays at public buildings
- Website / social media
- News media
- Facility tours

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

What is the most important criteria in developing CSO controls?

- Make waterway healthier for fish/wildlife
- Make waterway more usable by people
- Reduce overflows
- Keep rates as low as possible
- Green infrastructure / community spaces

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

What is your preferred level of CSO control?

Complete elimination

Prescribed minimums (4/yr or 85% capture)

Water quality-based cost/performance analysis

Start the presentation to see live content. Still no live content? Install the app or get help at **PollEv.com/app**

Would you/your group be willing to add green elements at home, like a rain garden?

Yes

No

Start the presentation to see live content. Still no live content? Install the app or get help at **PollEv.com/app**

Alternatives Evaluation – Quick Look Ahead

National CSO Situation

- LTCPs for other CSO areas have largely been completed already – especially for larger systems, often under federal consent decrees
- LTCPs have produced huge (multi-billion $) CSO programs in many large, older cities – affordability is a major element of these LTCPs
- CSO programs are typically 4-5 year planning efforts (LTCP), followed by 20+ year implementation schedules
- CSO discharges are being reduced, eliminated or controlled by:
  - Separating combined sewers into storm and sanitary lines
  - Capturing CSOs in large storage tanks or tunnels for later treatment at the WWTP
  - Treating CSOs at or near the point of discharge with special high-rate treatment processes
  - Reducing the rate of stormwater runoff using green infrastructure facilities to capture stormwater before it enters the sewer
  - Control structures and adjustments to improve capture in existing sewers

Alternatives Evaluation – Quick Look Ahead


Green Infrastructure


Collection System Storage


Sewage Treatment Plant (STP) Expansion & Storage


Infiltration / Inflow Reduction in entire connected system


Sewer Separation


CSO Discharge Treatment


CSO Related Bypass at STP (Blending)

Range of alternatives, different levels of control, numerous combinations

Alternatives Evaluation – Quick Look Ahead

Examples from other communities, green infrastructure


New York City


Philadelphia

Omaha, NE


Various Others

Alternatives Evaluation – Quick Look Ahead

Examples from other communities, conveyance and storage tunnels

Alternatives Evaluation – Quick Look Ahead

Examples from other communities, CSO storage basins

Alternatives Evaluation – Quick Look Ahead

Examples from other communities, High-Rate CSO Treatment Facility

Next Meeting

- Early September (?)
- Agenda:
  - Results of member survey
  - Evaluation of Alternatives Analysis
    - Alternative categories for Elizabeth-JMEUC LTCP
    - Modeling the performance of different alternatives
    - Preliminary cost analyses

MOTT MACDONALD

Questions?

MOTT MACDONALD

Thank you

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

Supplemental CSO Team

Meeting No. 4
Long-Term Control Plan Permit Compliance

Supplemental CSO Team

Meeting No. 5

Long-Term Control Plan Permit Compliance

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

October 26, 2018 – 10:00 am
Peterstown Community Center
408 Palmer Street, Elizabeth, NJ 07202

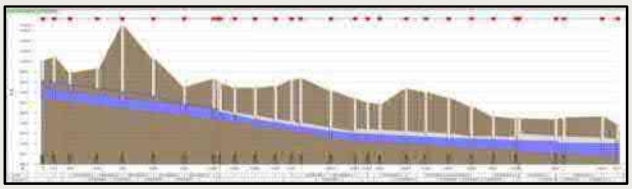
Meeting no. 5 agenda

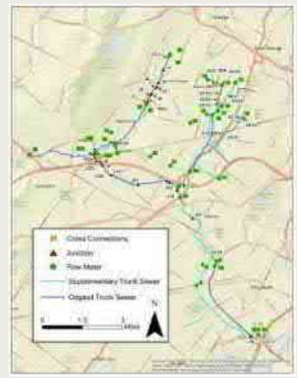
- Prior meeting recap
  - Results from member surveys
- Status of DEP review of July 1, 2018 submittals
  - *System Characterization Reports*, *Public Participation Process Report*, *Consideration of Sensitive Areas Report*, and *Baseline Compliance Monitoring Program Report*
- Public participation process update
- LTCP step 2 - development and evaluation of alternatives
  - Project team schedule and draft report outline
  - Grouping of CSO outfalls/basins for control objectives and planning
  - Initial discussion of CSO control objectives
  - Identification and screening of available CSO control technologies
  - Initial investigation of increasing combined sewer system flow from Elizabeth to JMEUC plant
- Bayonne Wet Weather Demonstration Project treatment technologies
- Next meeting lookahead

Meeting no. 4 refresher

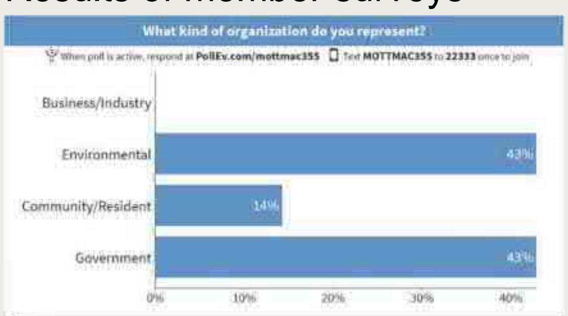
Material covered in prior meeting (6/5/2018):

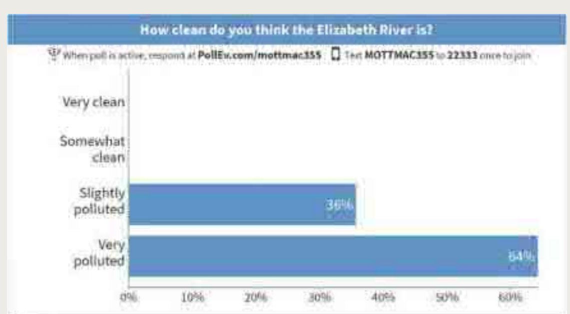
- Summaries of the July 1, 2018 submissions
- Interactive surveys
- Alternatives evaluation overview





Results of member surveys





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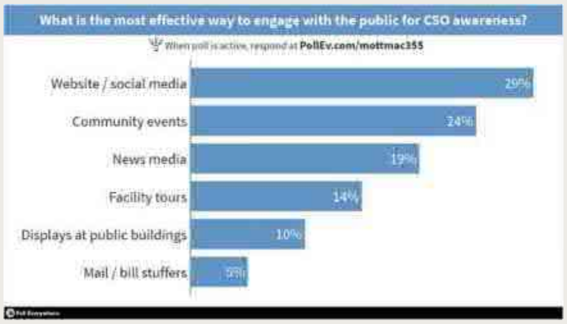

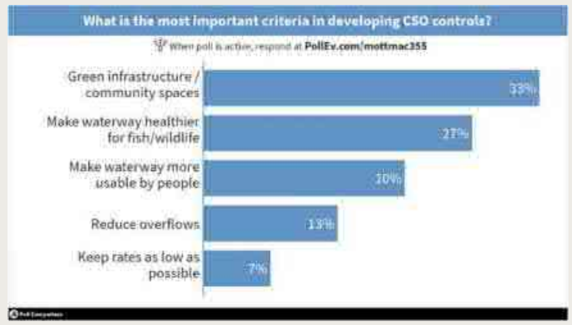

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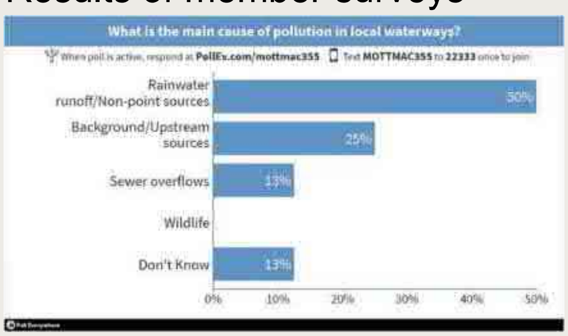

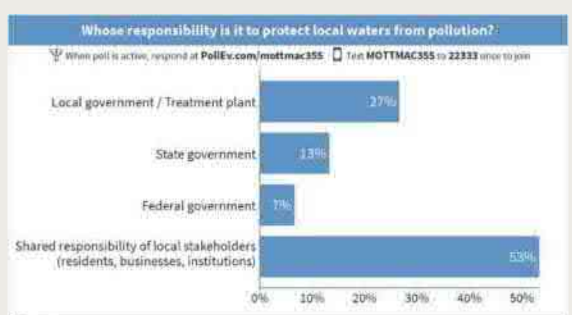

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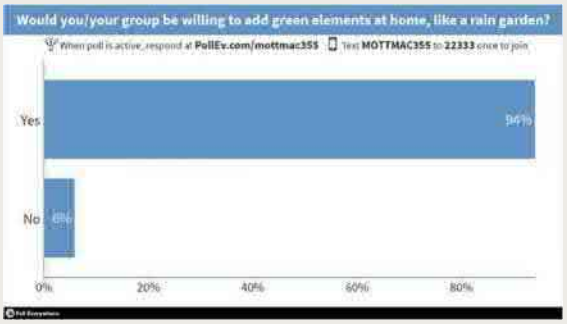
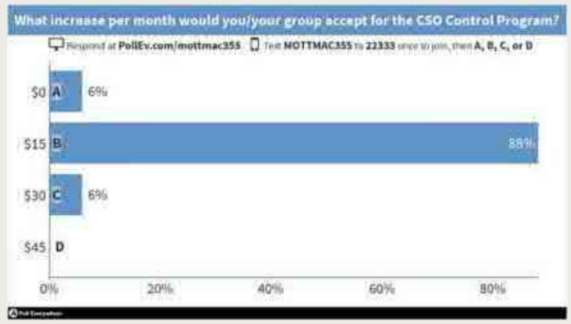
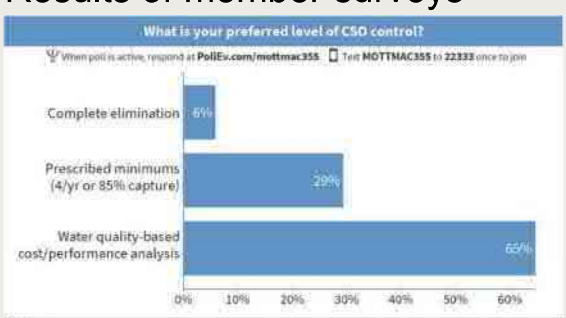




Results of member surveys



DEP review status – July 1, 2018 submittals

Quarterly progress meeting held on October 10, 2018

- **Consideration of Sensitive Areas Report**: NJ CSO Group report; DEP comment letter dated 9/20/2018; revised report submitted to DEP on 10/19/2018.
- **Baseline Compliance Monitoring Program Report**: NJ CSO Group report; DEP comment latter dated 9/7/2018; revised report submitted to DEP on 10/5/2018.
- **System Characterization Reports**: individual JMEUC and City of Elizabeth reports; positive verbal comments, awaiting written comments
- **Public Participation Process Report**: joint report from the City of Elizabeth and JMEUC; comment letter dated 10/12/2018; preparing response

Public Participation Report - Summary of NJDEP Comments

- Comment letter received October 12, 2018
- Spreadsheet format:
  1. Does the report include clear discussion of specific topics
  2. Summary of Findings
  3. Action Required
- Overview:
  - Comprehensive variety of outreach and engagement methods
  - Recognition of engagement with hydraulically connected municipalities such as Roselle Park
  - Documentation of entities invited to join Supplemental Team and responses
  - Quarterly Supplemental Team meetings, documentation of agendas and meeting materials
- Response will be provided to NJDEP by November 12, 2018

Action Items for Public Participation – DEP Comment Responses

Do	Measure	Identify	Continue	Consider
• Additional outreach to JMEUC separately sewered communities	• Number of attendees, social media posts, flyers distributed, etc.	• Specific affected organizations • If other languages needed • How updates will be provided to public (social media, council meetings, website, etc.)	• Surveys • Recording comments	• Public or Supplemental CSO Team review of key draft submittals

Public participation process update

Public outreach and education

Future City – Elizabeth Estuary Day

- October 5, 2018
- Over 250 students and 40 adults
- YouTube video at:

[Elizabeth Estuary Day 2018 – YouTube](https://www.youtube.com/watch?v=wbKlablTf9M&feature=youtu.be)
https://www.youtube.com/watch?v=wbKlablTf9M&feature=youtu.be

- Elizabeth Environmental Day, scheduled for April 26, 2019

Interactive Survey

- We would like your feedback:

Please go to www.pollev.com/mottmac355 on your smartphone

Development and evaluation of alternatives

Regulatory requirements

NJPDES Permit Section G.4.

- The permittees shall evaluate a reasonable range of CSO control alternatives that will meet the water quality-based requirements of the CWA
- The Development and Evaluation of Alternatives Report shall include a list of control alternative(s) evaluated for each CSO enabling the permittee, …to select the alternatives to ensure the CSO controls will meet the water quality-based requirements of the CWA
- The permittees shall select either the Demonstration or Presumption Approach
- The permittees shall evaluate the practical and technical feasibility of the proposed CSO control alternative(s), and water quality benefits and give the highest priority to controlling CSO discharges to sensitive areas

Which social media method would you suggest for effective LTCP messaging?

- A — City of Elizabeth Twitter feed
- B — New Elizabeth/JMEUC CSO LTCP Twitter feed
- C — Facebook
- D — LinkedIn
- E — City of Elizabeth & JMEUC website

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

How would you like to review key draft submittals?

- Content and summaries presented at CSO Supplemental Team meeting presentations
- Review full draft submittals
- Review draft Executive Summary

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

What are you most interested in discussing at upcoming meetings?

- CSO receiving water quality impacts
- Approach to financial capability assessment
- Green infrastructure analysis
- Presumption vs. Demonstration approach
- Other?

Development and evaluation of alternatives

Regulatory requirements

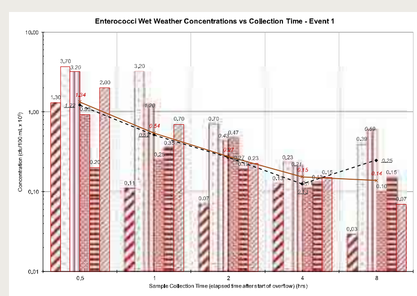
First, let's consider: "What are the pollutants of concern for CSOs?"

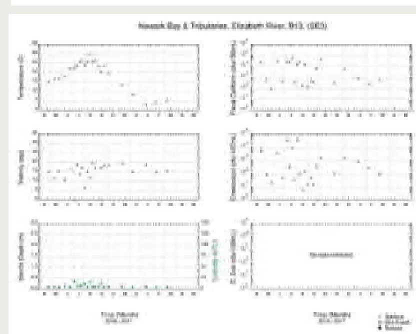
Pathogens & Floatables

In NJ, earlier DEP emphasis on floatables from CSOs has largely eliminated floatables through strategies such as City's netting and screening facilities. So in this LTCP, the focus is:

$\boxed{\text{Pathogens}}$

Other pollutants should be considered, but are not the focus of the LTCP.





Development and evaluation of alternatives report

Preliminary project schedule

Milestone	Target Date
Project start-up	
Identify logical CSO outfall groups for planning purposes	September 14, 2018 (complete)
Define CSO control objectives for each outfall group	November 2, 2018
Status meeting (Q3-2018) with NJDEP Supplemental CSO Team meeting	October 10, 2018 October 26, 2018
Alternatives screening	
Coordinate with NJ CSO Group on adoption/use of PVSC manual with CSO control technology descriptions and unit costs	Confirmed at September 6, 2018 meeting of the NJ CSO Group
Complete initial screening to identify viable alternatives	Mid- to Late November 2018
Status meeting (Q4-2018) with NJDEP Supplemental CSO Team meeting	Early December 2018 Early to mid-December 2018
Alternatives evaluation – initial presentation	
Substantially complete detailed evaluation of viable alternatives: ▪ Sizing of facilities for a range of control targets ▪ Characterize and quantify benefits ▪ Develop cost estimates Status meeting (Q1-2019) with NJDEP Supplemental CSO Team meeting	Mid March 2019 Late-March 2019 ASAP after DEP meeting
Alternatives refinement	
Complete any additional evaluations based on stakeholder (Board, DEP, Team) feedback from presentations of preliminary results	Mid-April 2019
Status meeting (if needed) with NJDEP Supplemental CSO Team meeting (if needed)	Mid- to Late April 2019 ASAP after DEP meeting
Finalization of alternatives and report submittal	
Complete any final evaluations based on stakeholder feedback. Complete preparation of Draft Report with final results.	Mid-May 2019
Status meeting (Q2-2019) with NJDEP Supplemental CSO Team meeting	Mid-May 2019 ASAP after DEP meeting
Complete all revisions to Draft Report based on stakeholder feedback and submit to NJDEP	Week of June 24, 2019

Development and evaluation of alternatives report

Draft report outline

1. **Introduction**
   1. Regulatory Context and Report Objectives
   2. Combined Sewer System and Service Area Overview
   3. Previous Studies
   4. Organization of Report
   5. Certification
2. **Overview of Combined Sewer Overflow Locations and Impacts on Receiving Waterbodies**
3. **CSO Control Objectives**

   [sub-sections for CSO outfall groups as appropriate]
4. **Identification and Screening of Alternative CSO Control Approaches**

   [sub-sections for CSO outfall groups as appropriate]
5. **Basis for Cost/Performance Considerations**
   1. Levels of Control
   2. Estimating Costs of Controls [application of PVSC *Technical Guidance Manual*]
6. **Development and Evaluation of Alternative Approaches for CSO Control**

   [sub-sections for CSO outfall groups as appropriate]
7. **Conclusions**

   Appendices

Development and evaluation of alternatives

Groupings of CSO outfalls/basins for control objectives and planning

By waterbody classification

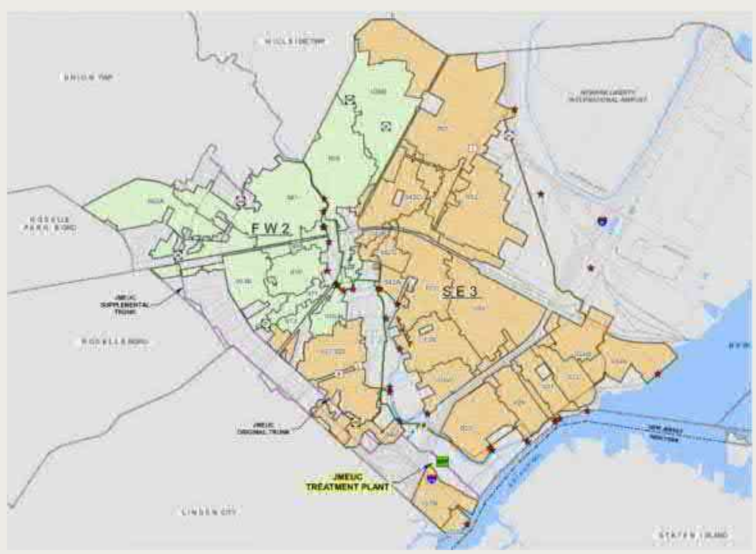
By hydraulic connectivity, size, & proximity

Development and evaluation of alternatives

CSO outfalls grouping

By waterbody classification

- FW2-NT Waters
  - Outfalls 003A, 005A, 008A, 010A, 012A, 013A, 014A, 016A, 036A,& 041A
- SE3 Waters
  - Outfalls 001A, 002A, 021A, 022A, 026A, 027A, 028A, 029A, 030A, 031A, 032A, 034A, 035A, 037A, 038A, 039A, 040A, 042A, & 043A

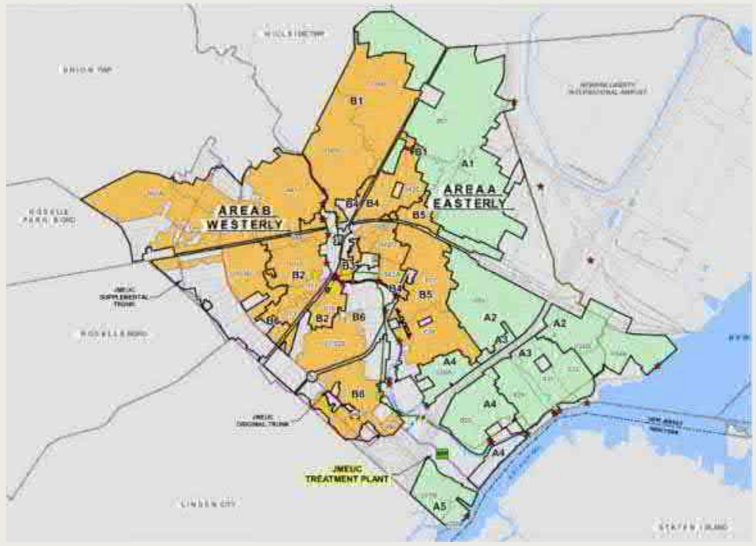


Development and evaluation of alternatives

CSO outfalls grouping

By hydraulic connectivity, size, & proximity

- Area A - Easterly Interceptor
  - A1 – 001A & 002A
  - A2 – 034A & 039A
  - A3 – 029A, 030A, 031A, 032A
  - A4 – 035A /043A & 038A
  - A5 – 037A
- Area B – Westerly Interceptor
  - B1 – 003A, 005A, 036A & 041A
  - B2 – 008A, 010A, 013A, & 016A
  - B3 – 012A & 014A
  - B4 – 042
  - B5 – 021A, 022A, & 026A
  - B6 – 027A, 028A, & 040A



Development and evaluation of alternatives

Initial discussion of CSO control objectives

Presumption vs. Demonstration Approach

- Alternative methods for developing a water quality-based control program in the LTCP
  - Presumption approach (performance based)
  - Demonstration approach (water quality based)
  - Combination of both

Presumption Approach

- Presumes that implementation of controls needed to meet defined performance criteria (e.g., controlling CSOs to no more than an average of four overflow events per year) will provide an adequate level of protection to meet the WQ-based objectives of the CWA.

Demonstration Approach

- Requires municipality to demonstrate that:
  - The LTCP is adequate to meet WQ standards
  - Remaining CSO discharges will not preclude attainment of WQ standards
  - LTCP provides maximum pollutant reduction benefits reasonably attainable
- Water quality data and modeling to obtain sufficient information to identify the appropriate level of CSO control
- Post-construction compliance monitoring

Development and evaluation of alternatives

Initial discussion of CSO control objectives

Presumption Approach: Performance Criteria

- Reduction of CSO frequency to an average of 4 overflows per year (with discretion to add 2 additional overflows)
- Elimination or capture for treatment of 85% of the volume of combined sewage in CSS during precipitation events on an "average annual basis."
- Elimination or capture for treatment of the mass of pollutants in CSS equal to 85% control by volume.
- Still requires post-construction compliance monitoring

Development and evaluation of alternatives

Initial discussion of CSO control objectives

Coordination with NJ CSO Group

- September 6 meeting of NJ CSO Group with DEP
- Water quality modeling of harbor
  - Baseline CSO and plant effluent flows and concentrations provided to PVSC
  - Model runs for baseline and full CSO removal scenarios to set boundaries on CSO impacts (by October 31)
- Objectives and approach may vary by receiving water and CSO outfall groups

Development and evaluation of alternatives

CSO control technology screening

Logical decision-making process: Screen different control technologies before detailed evaluations

Screening based on:

- Predicted effectiveness
  - Bacteria reduction
  - Volume reduction
  - Basement / street flooding control
- Implementation and operation factors
  - Land requirements
  - Suitable site locations
  - Maintenance intensity and reliability
- Cost and performance data

NJPDES CSO Permit list of alternatives

- Green Infrastructure
- Collection System Storage
- Sewage Treatment Plant (STP) Expansion & Storage
- Infiltration / Inflow Reduction in entire connected system
- Sewer Separation
- CSO Discharge Treatment
- CSO Related Bypass at STP (Blending)

Development and evaluation of alternatives

CSO control technology screening

Collection System Technologies

Combined Sewer Optimization

- Additional Conveyance
- Regulator Modifications
- Outfall Consolidation/Relocation
- Real Time Control

Combined Sewer Separation

- Roof Leader Disconnection
- Sump Pump Disconnection
- Combined Sewer Separation

Operation and Maintenance

- I/I Reduction
- Advanced System Inspection & Maintenance
- Combined Sewer Flushing
- Catch Basin Cleaning

Storage Technologies

Linear Storage

- Pipeline
- Tunnel

Point Storage

- Tank (Above or Below Ground)
- Industrial Discharge Detention

Treatment Technologies

Satellite / End-of-Pipe Facility

- Vortex Separators
- Screens and Trash Racks
- Netting
- Contaminant Booms
- Baffles
- Disinfection & Satellite Treatment
- High Rate Physical/Chemical Treatment (High Rate Clarification Process - ActiFlo)
- High Rate Physical (Fuzzy Filters)

Treatment Plant

- Additional Treatment Capacity
- Wet Weather Blending

Industrial Pretreatment Program

Development and evaluation of alternatives

CSO control technology screening

Green Infrastructure

Buildings
- Green Roofs
- Blue Roofs
- Rainwater Harvesting

Impervious Areas
- Permeable Pavements
- Planter Boxes

Pervious Areas
- Bioswales
- Free-Form Rain Gardens

Source Control Technologies

Stormwater Management
- Street/Parking Lot Storage (Catch Basin Control)
- Catch Basin Modification (for Floatables Control)
- Catch Basin Modification (Leaching)

Public Education and Outreach
- Water Conservation
- Catch Basin Stenciling
- Community Cleanup Programs
- Public Outreach Programs
- FOG Program
- Garbage Disposal Restriction
- Pet Waste Management
- Lawn and Garden Maintenance
- Hazardous Waste Collection

Source Control (cont.)

Ordinance Enforcement
- Construction Site Erosion & Sediment Control
- Illegal Dumping Control
- Pet Waste Control
- Litter Control
- Illicit Connection Control

Good Housekeeping
- Street Sweeping/Flushing
- Leaf Collection
- Recycling Programs
- Storage/Loading/Unloading Areas
- Industrial Spill Control

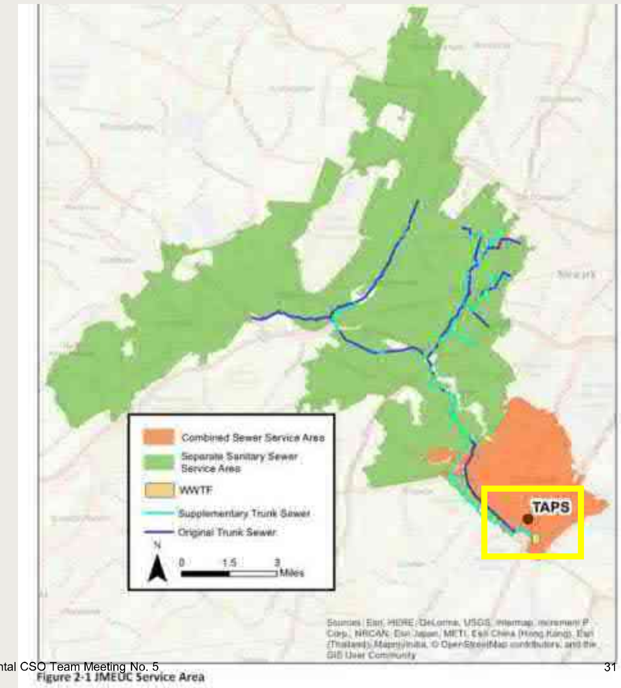
Development and evaluation of alternatives

Increase conveyance and treatment

Initial investigation of increasing combined sewer system flow from Elizabeth to JMEUC plant

- TAPS pumping station location
- TAPS pumping rate
- Peak timing of TAPS flow versus sanitary sewer system flows from JMEUC service area
- Impacts on hydraulic grade line in trunk sewers

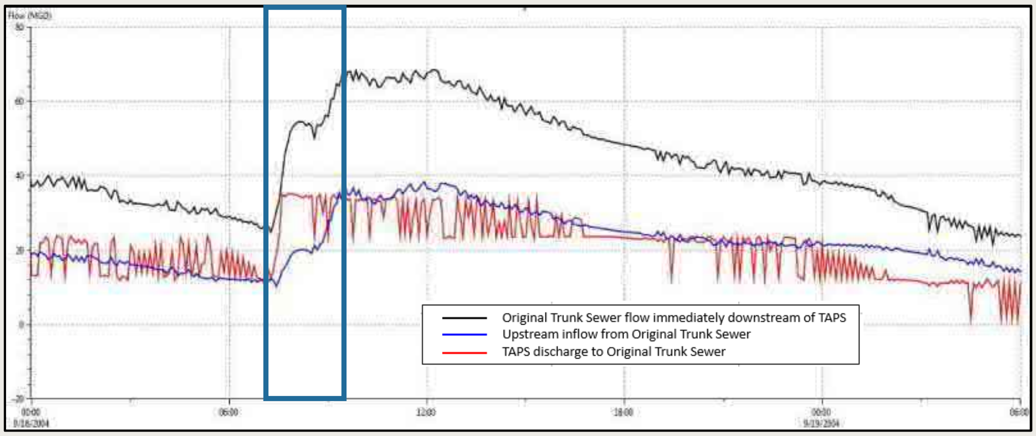
Location of Trenton Avenue Pump Station



Location of Trenton Avenue Pump Station

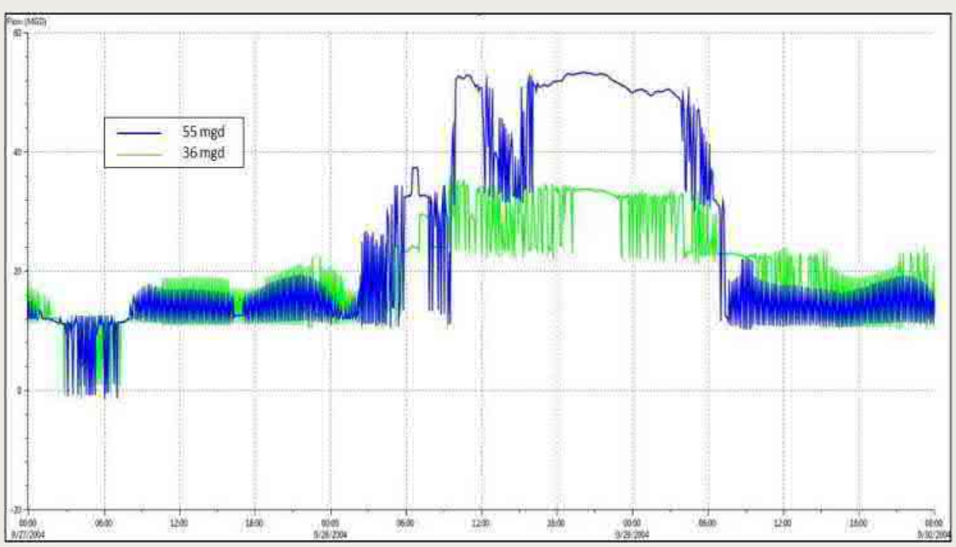
(from Figure 2-2 in JMEUC SCR; source: City of Elizabeth SCR; both June 2018)

Peak flow timing for the Elizabeth combined sewer system and for the upstream sanitary sewer portions of the JMEUC trunk sewer system

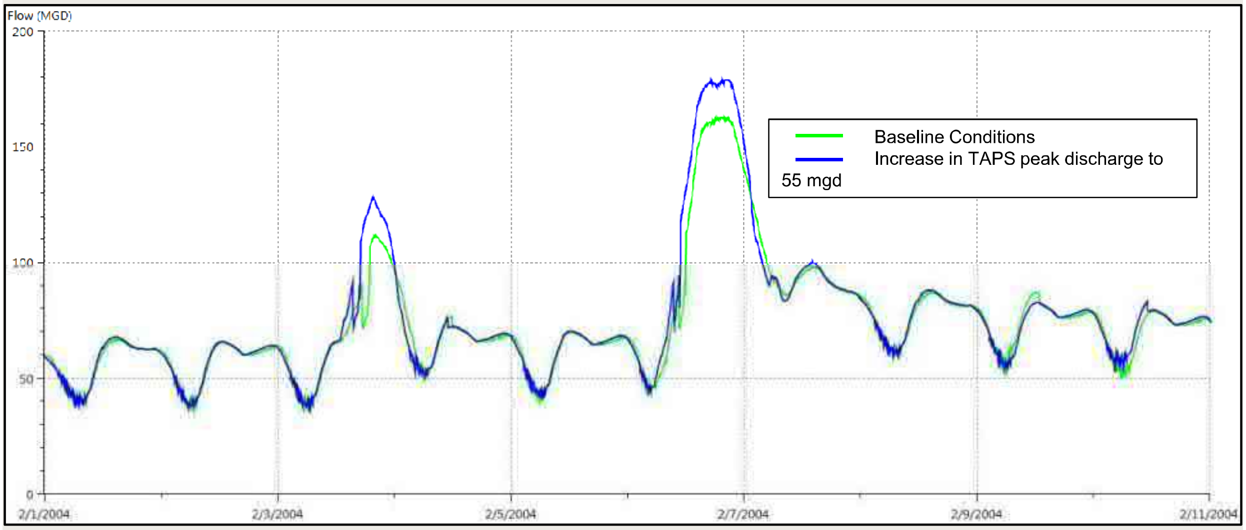


Modeled Flow from TAPS to JMEUC WWTF

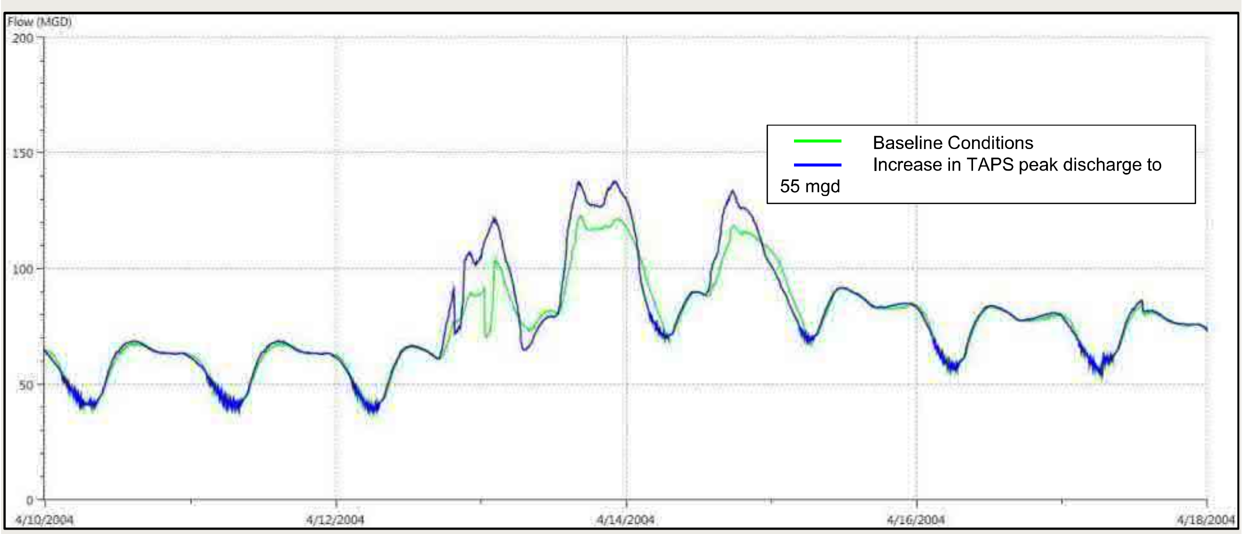
- 36 mgd – current max rate per contractual limit
- 55 mgd – potential future max rate per physical limit of pumping facilities



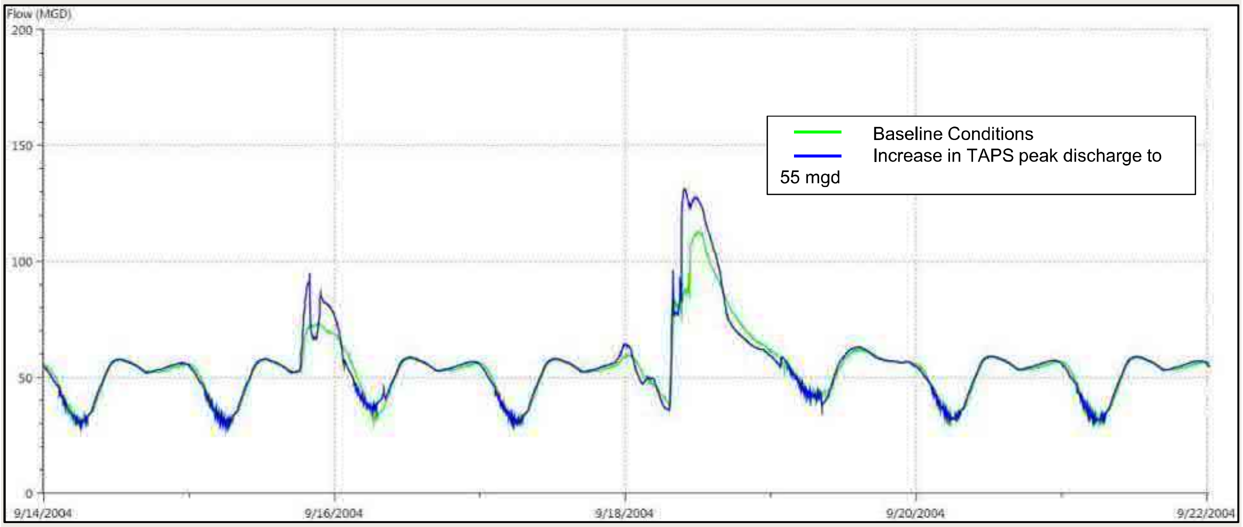
Simulated flow at WWTF – 2/6/2004 Event



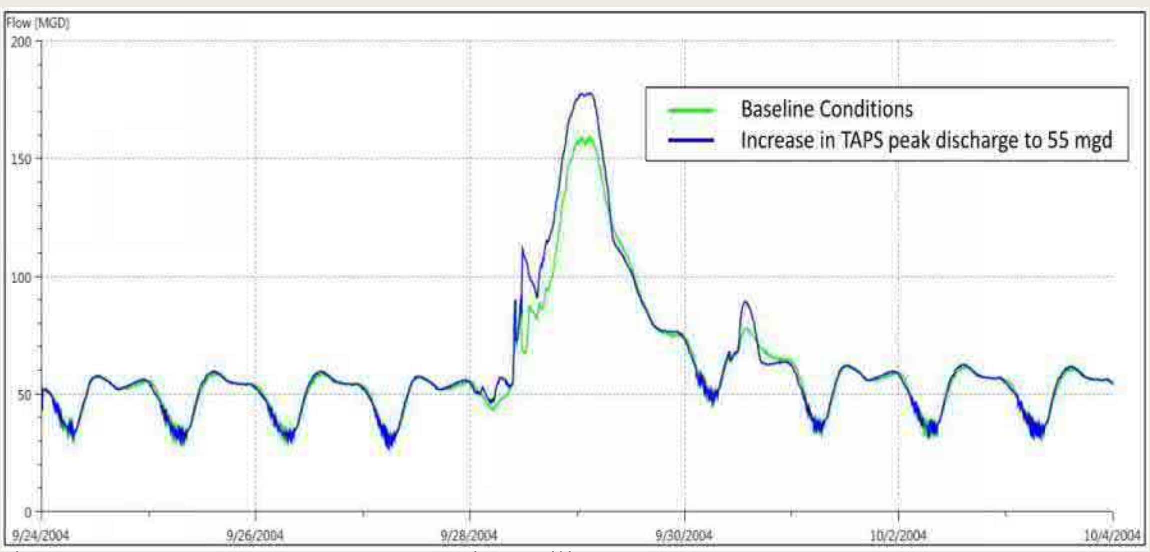
Simulated flow at WWTF – 4/12/2004 Event



Simulated flow at WWTF – 9/17/2004 Event

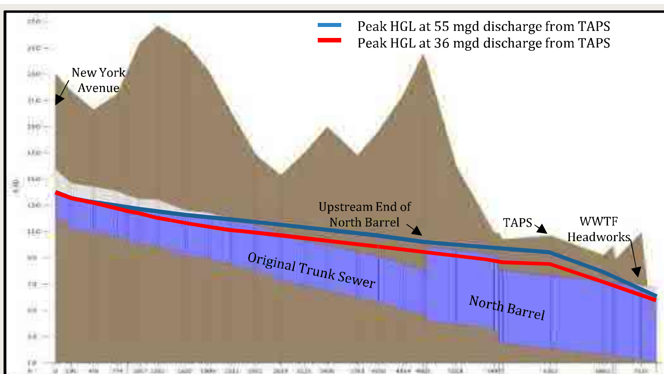


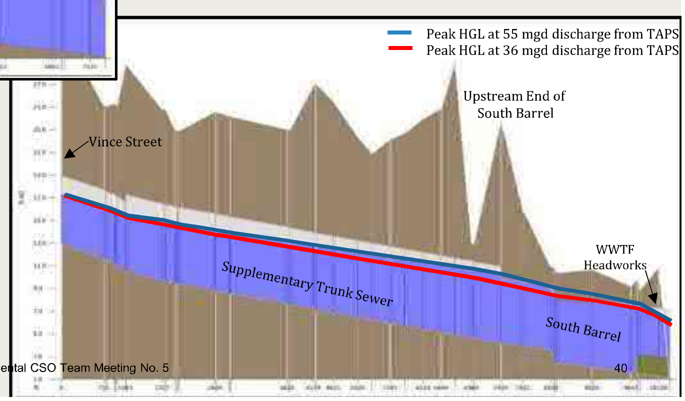
Simulated flow at WWTF – 9/28/2004 Event



Upstream extent of hydraulic grade line impacts of increased TAPS flow

Comparison of Peak HGL along the Trunk Sewers (September 28, 2004 Storm)





Preliminary findings on typical year CSO performance

Increasing Trenton Avenue PS maximum discharge to 55 Mgal/day, with existing collection and treatment system, predicted to result in:

- 17.6% reduction in annual total overflow volume, from 1065 to 878 Mgal.
- 12.5% reduction in the number of overflow events per year, from 56 to 49 Mgal.
- 10.1% reduction in the overflow volume for the 5th largest event, from approximately 56.7 to 51 Mgal.
- Much more pronounced impacts nearer to the pump station, with an estimated 71.4% reduction in total annual overflow volume at CSO Outfall 035A, from 81.3 to 23.2 Mgal.

Bayonne Wet Weather Treatment Demonstration Project: treatment technologies

Project objectives

- Gather performance data & evaluate the effectiveness of CSO treatment technologies
  - Under field conditions
  - For solids removal & disinfection
  - At remote satellite locations
- Gain improved understanding of their potential use for satellite wet weather treatment, including CSOs
  - Reliability
  - Scalability
  - Anticipated capital and O&M costs

Source: NJDEP, https://www.nj.gov/dep/dwq/pdf/WWFTDDP_Presentation.pptx

Bayonne Wet Weather Treatment Demonstration Project

Six (6) pilot technologies tested

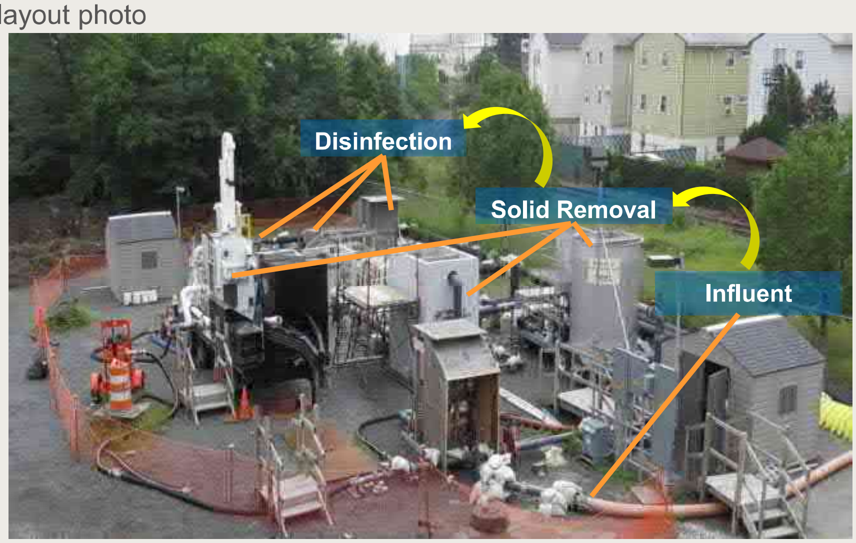
Function	Type	Technology
Solid removal	Vortex	Storm King
Solid removal	Plate settler unit	Terre Kleen
Enhanced solid removal	Compressed media filter	Flex Filter
Disinfection	Low pressure UV	Trojan
Disinfection	Medium pressure UV	Aquionics
Disinfection	Peracetic acid (PAA)	Injexx/Verdent

Selected based on:

- Suitability for satellite facilities
- Promising data on CSO performance
- Simple operation / low maintenance
- Small footprint
- Cost

Bayonne Wet Weather Treatment Demonstration Project

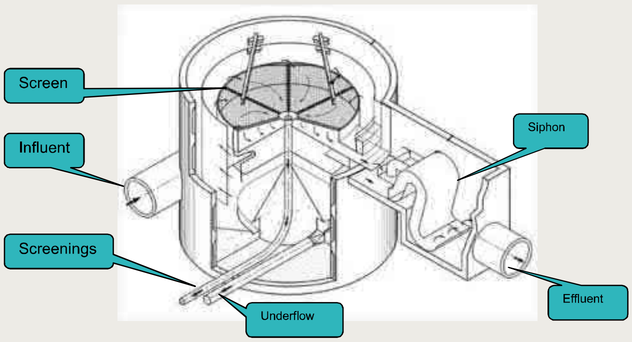
Project site layout photo



Bayonne Wet Weather Treatment Demonstration Project

High rate solids removal

Storm King



Schematic

Typical full scale installation

Bayonne Wet Weather Treatment Demonstration Project

Enhanced high rate solids removal

Flex Filter (WesTech WWETCO)

- High rate filtration system
- Uses synthetic compressible media
- Incoming flow applies hydrostatic force to the compression bladder causing tapered compression
- Densely compressed media at the bottom, expanded bed toward the surface
- Filter requires backwash: stop feed, which decompresses media; apply air scour and backwash water

Bayonne Wet Weather Treatment Demonstration Project

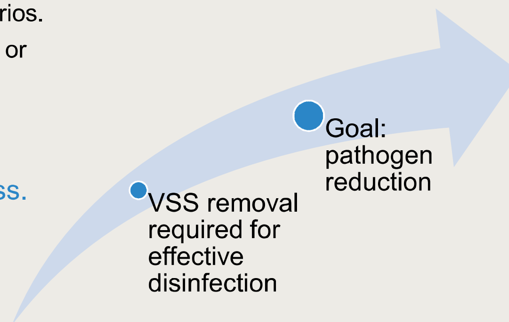
General findings / observations

Course solids must be controlled!

- Course screening should precede any treatment scenarios.
- CSO Permit requires solids/floatables removal equal to or greater than ½ inch; primary screening must meet this requirement.

Substantial prior volatile suspended solids (VSS) removal required for an effective disinfection process.

- Total suspended solids (TSS) have 2 components
  - Fixed suspended solids (FSS): primarily grit and sediment material
  - Volatile suspended solids (VSS): primarily organic material



Bayonne Wet Weather Treatment Demonstration Project

Summary of results

High-rate solids removal (Storm King & Terre Kleen)

- Effective for grit removal (heavier solids)
- Unable to reduce solids loadings for UV disinfection
- Low volatile suspended solids (VSS) removal overall
- Low organic removal rates

Enhanced high-rate solids removal (Flex Filter)

- Filter was effective, but required shorter run time and frequent backwash.
- Average TSS (FSS + VSS) removal in most runs: close to 90%.
- Effective on its own for UV pretreatment.
- Effective for removal of other pollutants.

UV Disinfection

- UV transmittance (UVT) decreases as TSS, COD, & CBOD increases
- Lower UVT requires higher UV output (more bulbs)
- Both low & medium pressure units capable of achieving water quality objectives for pathogen reduction, but only if preceded by compressed media filter (Flex Filter)

Peracetic Acid (PAA) Chemical Disinfection

- Effective disinfectant at comparable or lower dosages to chlorination.
- PAA contact time of 3 to 6 minutes were effective, compared to typical 30 minutes for chlorine.
- Less toxic than chlorine disinfection (no by products) and no dechlorination requirements.
- More corrosive and costly.

Next Steps – Timeline

Mid-Late November 2018: Complete initial screening to identify viable alternatives

Mid-March 2019: Detailed evaluation of viable alternatives (cost, sizing, benefits)

Mid-April 2019: Refine alternatives based on feedback

Mid-May 2019: Finalize alternatives, draft report submission

June 2019: Submit final report to NJDEP

Supplemental CSO Team Meeting

Supplemental CSO Team Meeting

Supplemental CSO Team Meeting (if necessary)

Next meeting lookahead

Next Supplemental CSO Team meetings

Mid December 2018 – Early January 2019

March – April 2019

Focusing on development and evaluation of alternatives report

- List of alternatives
- Screening for viable alternatives
- Sizing and costing of viable alternatives
- Modeling for CSO performance
- Draft report sections

Questions?

Thank you

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

Supplemental CSO Team

Meeting No. 5
Long-Term Control Plan Permit Compliance

Supplemental CSO Team

Meeting No. 6
Long-Term Control Plan Permit Compliance

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

January 30, 2019 – 10:00 am
Peterstown Community Center
408 Palmer Street, Elizabeth, NJ 07202

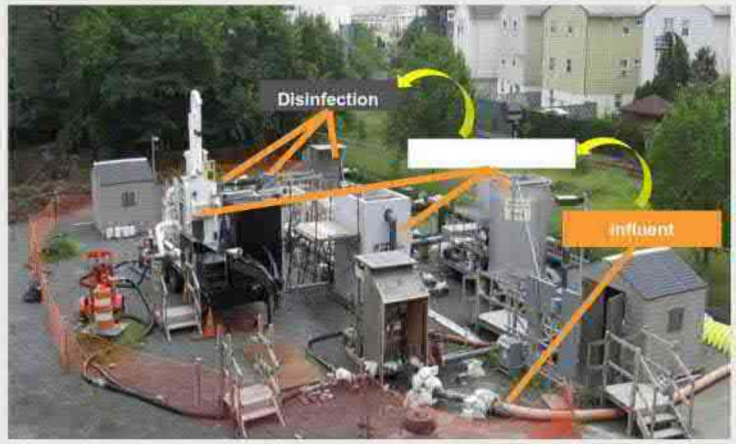
Meeting No. 6 agenda

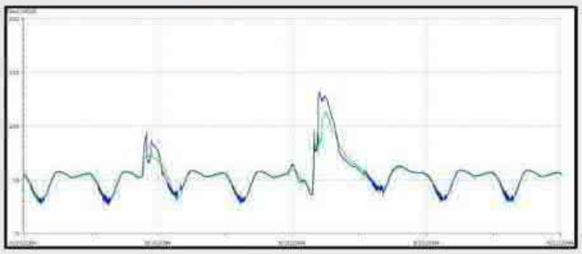
- Prior meeting recap
- Public participation process update
- Groundwork Elizabeth – Climate Safe Neighborhoods grant
- Status of NJDEP review of LTCP submittals
- Pathogen water quality model baseline estimates
- Alternatives analysis
  - Maximizing wet weather treatment at the JMEUC WWTF
  - Siting Alternatives Analysis
  - Green Infrastructure Analysis
- Next meeting lookahead

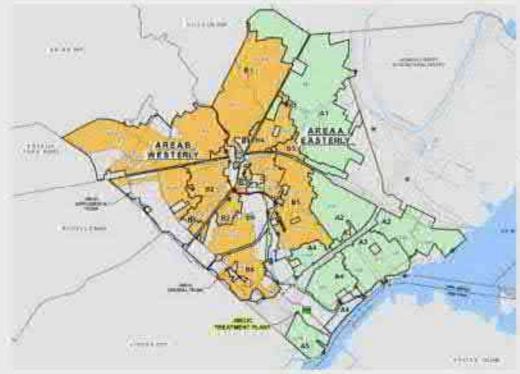
Meeting No. 5 refresher

Material covered in prior meeting (10/26/2018):

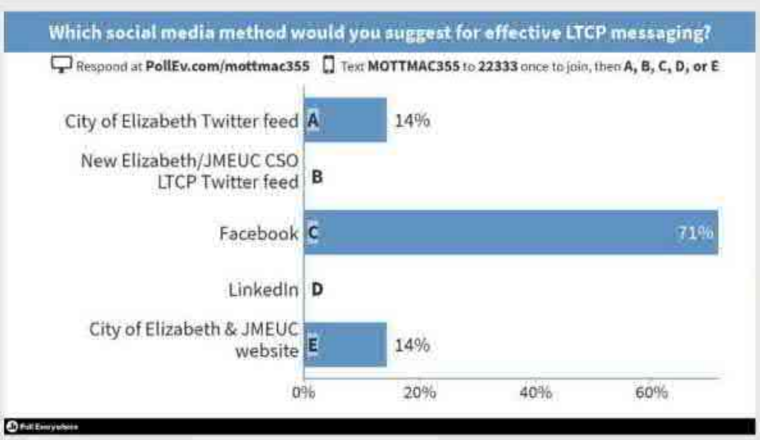
- July 1, 2018 submission status review
- Interactive surveys
- Alternatives evaluation overview
- Bayonne Wet Weather Demonstration Project treatment technologies

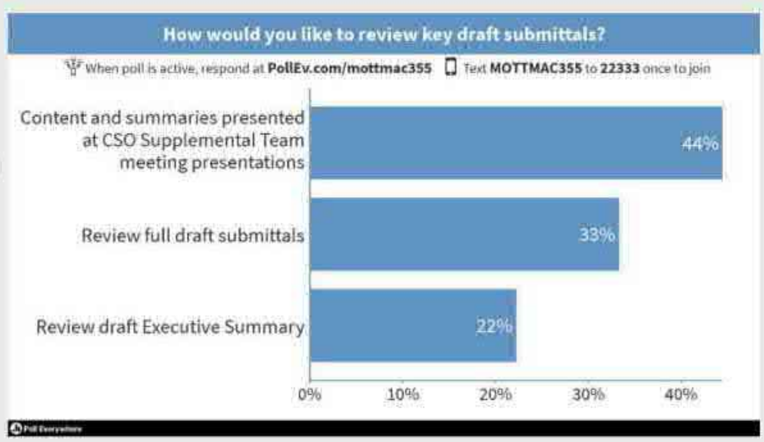




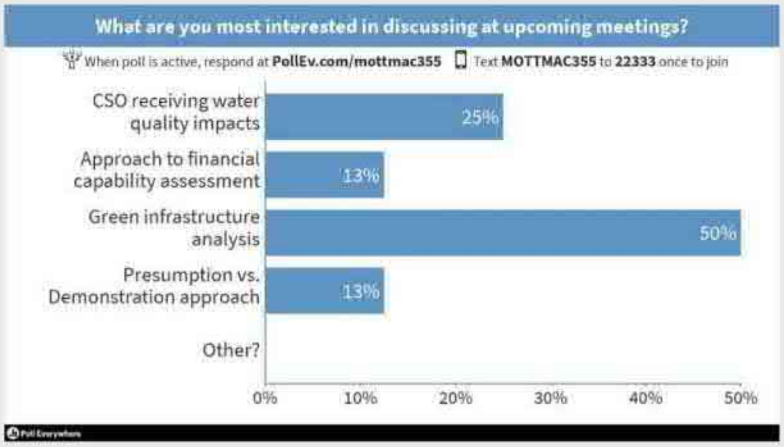


Results of member surveys





Results of member surveys



Public Participation Process Update

Public outreach and education

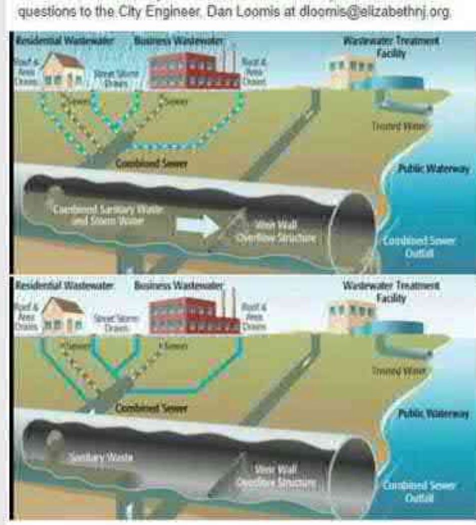
- Developed and circulated new informational flyer
  - Posted on City of Elizabeth's Twitter and Facebook
  - Distributing at City Hall
  - Emailed to Supplemental CSO Team
    - Did you circulate the informational flyer to your group? If so, to how many recipients?

City of Elizabeth NJ @CityofElizabeth · 20 Dec 2018
The City is working with @NewJerseyDEP to improve the quality of our waterways by reducing combined sewer overflows (CSOs). To learn more visit: elizabethnj.org/pdfs/engineer/... and send feedback to the City Engineer at dloomis@elizabethnj.org.

City of Elizabeth NJ - City Hall
December 20, 2018 at 12:22 PM

The City of Elizabeth is working with @State of NJ Department of Environmental Protection to improve the quality of our waterways by reducing combined sewer overflows (CSOs). Interested in learning more about CSOs and the City's engineering projects? Check out the City website here: http://www.elizabethnj.org/.../engi.../CSO/ElizabethCSOFlyer.pdf.

We would love to hear your feedback! Please send your comments and questions to the City Engineer, Dan Loomis at dloomis@elizabethnj.org.



City of Elizabeth NJ - City Hall
Government Organization
Send Message
11
5 Shares

Public Participation Process Update

Public outreach and education

Upcoming Events

- February 6 - NJDEP Public Participation Workshop
  - Organized by NJDEP to gather Supplemental Team members and CSO Permittees from across the State.
  - Here at Peterstown Community Center, 1 pm – 4 pm
  - Open to Supplemental CSO Team Members, CSO Permittees, and interested municipal officials
- May 3 – Future City Environmental Day school presentations
- June – Union County BioBlitz
- Others?

Outside Groups

- Jersey Water Works, Rutgers Cooperative Extension, and NJ Sea Grant Consortium
  - February 1 - “How to Identify Green Infrastructure Projects in Your Town” workshop (Bordentown, NJ)
  - February 15 - “Moving from planning to implementation of green infrastructure” (Bordentown, NJ)

Stakeholder Presentation – Groundwork Elizabeth

Climate Safe Neighborhoods Grant

Groundwork Elizabeth's 2019 - 2021 Overview of:

The Climate Safe Neighborhoods Partnership

GROUNDWORK
CHANGING PLACES
CHANGING LIVES

GROUNDWORK
Elizabeth

Groundwork Elizabeth's Mission is to bring about the sustained regeneration, improvement and management of the physical environment by developing community-based partnerships which empower people, businesses and organizations to promote environmental, economic and social well-being.

GROUNDWORK
Elizabeth

CHANGING PLACES
CHANGING LIVES

**In short - Groundwork Elizabeth is a people-focused environmental non-profit whose mission it to
Change Places by Changing Lives.**

Our Focus Areas:

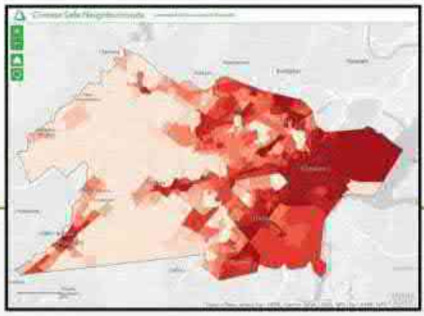
Urban Agriculture
Green Infrastructure + Sustainability
Youth Development
Rivers + Trails

GROUNDWORK
USA

CHANGING PLACES
CHANGING LIVES

In 2018 Groundwork USA selected Groundwork Elizabeth as one of five cities to receive funding to participate in the Climate Safe Neighborhood Partnership.

The other cities chosen are Denver, Rhode Island (Pawtucket, RI), Richmond (CA) and Richmond (VA) - along with our GIS lead Groundwork Milwaukee.



GROUNDWORK Elizabeth

Groundwork's Climate Safe Neighborhood Partnership seeks to:

1. Develop community-based plans to address the climate safety needs of vulnerable neighborhoods, with maps that show the origins and distribution of vulnerability and solutions;

GROUNDWORK Elizabeth

Groundwork's Climate Safe Neighborhood Partnership seeks to:

2. implement solutions through expanded community engagement, neighborhood improvement, and training/employment programs;

GROUNDWORK Elizabeth

Groundwork's Climate Safe Neighborhood Partnership seeks to:

3. organize + advocate for municipal policy + investment to address vulnerability in a systematic way.

GROUNDWORK Elizabeth

Maps included:

- HOLC Neighborhood Grades (1939)
- Population per Square Mile - Block Group (ACS 2016 5 YR Est.)
- % Black or African American - Block Group (ACS 2016 5 YR Est.)
- % Latino - Block Group (ACS 2016 5 YR Est.)
- % Households in Poverty - Block Group (ACS 2016 5 YR Est.)

GROUNDWORK Elizabeth

Maps included:

- Median Household Income - Block Group (ACS 2016 5 YR Est.)
- Pop less than 5y/o & Greater than 65 y/o - - Block Group (ACS 2016 5 YR Est.)
- % Impervious Surfaces - Block Group (NLCD)
- % Tree Canopy Covered

GROUNDWORK Elizabeth

An Overview or the Vulnerability Index - as conducted in Richmond, VA.

Data Sets:

- Measures of Heat
  NLCD Impervious Surface 2011 (NLCD 2016 is coming out soon)
  NLCD Tree Canopy Cover 2011
  LANDSAT 8 Land Surface Temperature for summer days with satellite imagery over past two years (<10% cloud cover)
- Measure of Adaptive Capacity*
  ACS 2016 5 year estimate - %Households living in poverty (block group) *There is discussion about including other demographic indicators of adaptive capacity such as race.

GROUNDWORK Elizabeth

Vulnerability Index as conducted in Richmond, VA

Index Methods:

1. Summarize the raster imagery to the block group level by converting raster to points then conducting a spatial join w/ summary statistics for each.
2. Use feature scaling to but the four indicators of heat vulnerability on a scale from -1 to 1 where -1 represents the least vulnerable value in each attribute field and one represents the most vulnerable score in each attribute.
3. Sum the score from the four attribute fields. The closer to four, the more vulnerable the block group, the closer to -4 the less vulnerable. In other words, a score of four would mean that hypothetical block group had the highest value on all four scales.

GROUNDWORK Elizabeth

After analyzing the maps, what will Groundwork Elizabeth do?

- Organize community meetings and surveys
- Create educational materials for distribution
- Build Green Infrastructure Demonstration Areas
- Lead Community Engagement
- Introduce a Green Corp - a community partnership to identify green infrastructure maintenance jobs and provide related trainings
- Expand GWE's Green Team to provide summer green jobs for Elizabeth High School students with an interest in the environmental sciences

HOW CAN YOU HELP?

DONT LITTER!
Garbage on streets clogs storm drains which causes flooding. If it's washed through a storm drain, it can go directly to our rivers.

REFRAIN DURING RAIN!
Help Newark reduce the amount of water entering the CSS during heavy rain by postponing laundry, taking a shower, or running the dishwasher.

REDUCE, REUSE, RECYCLE!
Shopping bags, bottles, and other plastic items are choking our waterways. Reducing the amount of plastic we use each day goes a long way. If you use plastic, re-use or recycle it!

GET THAT OIL LEAK FIXED!
Engine oil leaking from a car will be washed into our storm drains when it rains. When you notice a leak, get it taken care of ASAP.

SCOOP YOUR DOG'S POOP!
Not only is it mandatory in Newark, but picking up after your dog and disposing in the garbage helps reduce bacteria entering our waterways.

TAKE ACTION!

FREE RAINBARREL!
We are currently offering FREE Rain Barrels to Newark citizens and recruiting volunteers to help install rain barrels in their neigh-borhood.

ADOPT A CATCH BASIN!
Sign up now to adopt a catch ba-sin. Volunteers will be provided with a FREE "catch basin care kit".

CITY MAKE IT GREEN

HOME ABOUT EDUCATION ACTION RESOURCES

HOW TO CARE FOR YOUR CATCH BASIN

1. Using a dust pan, sweep litter and debris from the top of the catch basin on a regular basis. Throw this in the nearest trash receptacle.
2. During rain events, check to make sure that nothing is blocking the catch basin.
3. Clear the catch basin after any snowfall.
4. If you feel as though your catch basin needs more attention than you can give, call the Municipal Utilities Authority for a cleaning at (201) 432-1150.
5. Tweet pictures of your clean catch basin to @innovatejc, and use the hashtags #adoptacatchbasin and #yearofwater

left image: door hanger; right image: sample painting design

GROUNDWORK Elizabeth

CHANGING PLACES CHANGING LIVES

"The ultimate goal is to make sure that our communities are safe from hotter and wetter weather."



Steve Burrington
Executive Director
Groundwork USA

GROUNDWORK Elizabeth

CHANGING PLACES CHANGING LIVES

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DEP review status – LTCP submittals

Quarterly progress meeting held on December 11, 2018

- **System Characterization Reports:** comments received on both individual JMEUC and Elizabeth reports on 11/8/2018; JMEUC revised report submitted 12/6/2018; Elizabeth revised report submitted 1/4/2019; **NJDEP approval on 1/17/2019 for both.**
- **Public Participation Process Report**: joint report from Elizabeth and JMEUC; comment letter dated 10/12/2018; revised report submitted 11/12/2018.
- **Consideration of Sensitive Areas Report**: NJ CSO Group report; DEP comment letter dated 9/20/2018; revised report submitted to DEP on 10/19/2018.
- **Baseline Compliance Monitoring Program Report**: NJ CSO Group report; DEP comment letter dated 9/7/2018; revised report submitted to DEP on 10/5/2018.

System Characterization Report - Elizabeth

- Comment letter received November 8, 2018

Commendations
- Recognition of sewer monitoring and data generation completed for update of system characterization
- Sufficient number of wet weather sampling events were conducted representing variety of land use types.
- Dry weather calibration efforts are comprehensive and appropriate efforts were made to ensure accurate results.

System Characteristics
- Department considers the Peripheral Ditch and the Great Ditch waters of the state.
- Address any flooding related to sewage overflows or backups and any hot spots for CSO related flooding.
- Address TAPS capacity in alternatives report: peak daily flow of 36 MGD from Elizabeth vs. maximum pumping capacity of 55 MGD.

Connections
- Significant Indirect Users (SIUs) must be considered when evaluating CSO control alternatives.
- Provide update on Roselle Park storm sewer connection coordination.
- Department to work with City to address interconnections of stormwater and CSO outfalls.

Figures
- Table with all sub-catchment input parameters for the modeled areas.
- Pie chart depicting the total runoff generated from the combined sewer area and assumed water loss.

Action Items Completed – Comment Responses

1. Peripheral Ditch and Great Ditch noted as waters of the State
2. Additional discussion on SIU impacts provided
3. Additional discussion of flooding related to sewer system backups/overflows included
4. NJDEP to work with City for monitoring storm sewers on CSO outfalls
5. Update on Roselle Park storm sewer connection coordination
6. Commitment to evaluate maximizing flow to STP as a CSO control alternative
7. Appendix M – subcatchment characteristics table added
8. Figure added with overall water budget chart for total runoff from combined sewer area

- Revised report submitted 1/4/2019 and NJDEP approval received 1/17/2019.

System Characterization Report - JMEUC

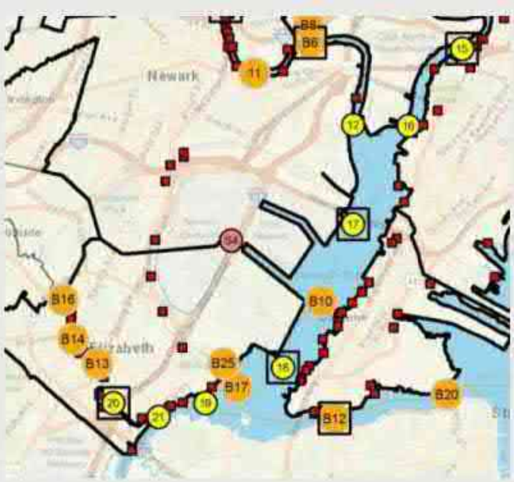
Submitted June, 27, 2018

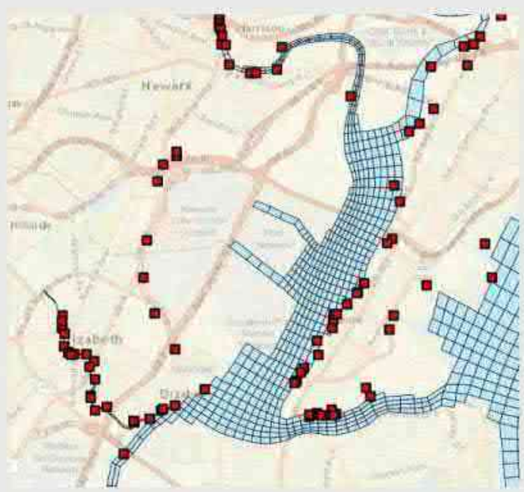
- Minor comments received from NJDEP on November 8, 2018
- Revised report submitted on December 6, 2018
- NJDEP approval letter received on January 17, 2019

Demonstration Approach: Application to Peripheral Ditch and Great Ditch

Water Quality Monitoring and Modeling

- Peripheral Ditch and Great Ditch water quality monitoring and modeling addressed in approved Baseline Compliance Monitoring and Pathogen Water Quality Model programs.
- Monitoring locations and model extents documented in QAPP and Report.





Pathogen Water Quality Modeling Update

Preliminary Baseline Results

Baseline Conditions

- 2004 Meteorological Conditions
- 2015 Infrastructure
- Existing River Concentrations and Dry Weather Loadings

New Jersey Pathogen Criteria

- N. J. A. C. 7:9B - Surface Water Quality Standards
- Use geometric mean to assess compliance with the bacterial quality indicators. Minimum of 5 samples collected over a 30-day period.

New Jersey Pathogen Criteria

- Newark Bay, Arthur Kill, and Lower Elizabeth River (SE3 waters)
  - Fecal coliform levels shall not exceed a geometric mean of **1500/100 ml**
- Upper Elizabeth River (FW2 waters)
  - E. coli levels shall not exceed a geometric mean of **126/100 ml** or a single sample maximum of **235/100 ml**

Pathogen Water Quality Modeling Update

Preliminary Baseline Results

Water Quality Attainment Estimates

- Specific sampling point basis, 30-day rolling geometric mean
- Estimate of % of the time pathogen WQ standard for receiving body is met

Preliminary Baseline Findings

- For Newark Bay stations, the model estimates 100% WQ attainment with or without existing CSOs
- For Elizabeth River SE3 section, the model estimates 34.1%, 93.3%, and 100% WQ attainment at Stations B13, 20, and 21
- For Elizabeth River FW2 section, the model estimates 0% WQ attainment at Stations B16 and B14 with or without existing CSOs

Next Steps

- Provide hydraulic model outputs for different CSO control levels as input to pathogen WQ model
- Evaluate potential water quality impacts with the corresponding CSO control levels

Interactive Survey

- We would like your feedback:

Please go to www.pollev.com/mottmac355 on your smartphone

What do you consider the primary benefit of green infrastructure practices?

Water quality improvements

Reduced flooding

Water harvesting / conservation

Aesthetic, green community spaces

Increased property values

Job creation for operations & maintenance

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

What do you consider the primary barrier to green infrastructure implementation in public right-of-ways and open space areas?

Project site identification

Operations & maintenance requirements

Cost effectiveness relative to storage (relative to other technologies)

Lack of funding/acceptance due to newer technology

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

What do you consider the primary benefit of grey infrastructure practices?

Reduced flooding

Lower maintenance than green infrastructure

Lower cost per gallon captured vs. green infrastructure

Less visible

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

What do you consider the primary barrier to grey infrastructure implementation?

- Capital cost
- Large site disruption during construction
- Does not create long term jobs (less maintenance required)
- Does not contribute to community aesthetics/green spaces

What do you consider more appropriate in selecting CSO control alternatives?

- Low capital costs, higher long-term maintenance cost
- High capital costs, lower long-term maintenance cost

Please select the indicator most important to your stakeholders in considering the financial capability of the community.

Median household income

Current cost of wastewater/water usage

Unemployment rate

Cost of living (available disposable income)

% of homes owned vs. rented in the City

% of population receiving social security benefits

% of population below the poverty line

Other?

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

Development and evaluation of alternatives report

Draft report outline

1. **Introduction**
   1. Regulatory Context and Report Objectives
   2. Combined Sewer System and Service Area Overview
   3. Previous Studies
   4. Organization of Report
   5. Certification
2. **Overview of Combined Sewer Overflow Locations and Impacts on Receiving Waterbodies**
3. **CSO Control Objectives**

   [sub-sections for CSO outfall groups as appropriate]
4. **Identification and Screening of Alternative CSO Control Approaches**

   [sub-sections for CSO outfall groups as appropriate]
5. **Basis for Cost/Performance Considerations**
   1. Levels of Control
   2. Estimating Costs of Controls [application of PVSC *Technical Guidance Manual*]
6. **Development and Evaluation of Alternative Approaches for CSO Control**

   [sub-sections for CSO outfall groups as appropriate]
7. **Conclusions**

Appendices

Alternatives Evaluation - JMEUC

- Treat increased wet weather flow at JMEUC WWTF pumped from Elizabeth combined sewer system:
  - Interim increase from current maximum rate (36 mgd) to 55 mgd with advanced pumping controls (no increase in peak flow rate at WWTF)
  - Long-term plan to increase to 140 mgd+ with plant improvements
- Evaluate potential to increase available wet weather capacity at JMEUC WWTF with additional I/I reduction in sanitary sewer areas

Alternatives Evaluation

Control Objectives – Presumption vs. Demonstration Approaches

Presumption Approach (performance based)

- Presumes controls needed to meet **defined performance criteria** will provide adequate level of protection to meet WQ-based objectives of Clean Water Act
  - Reduction of CSO frequency to an average of 4 overflows per year (with discretion to add 2 additional overflows)
  - Elimination or capture for treatment of 85% of the volume of combined sewage in CSS during precipitation events on an "average annual basis."
  - Elimination or capture for treatment of the mass of pollutants in CSS equal to 85% control by volume.
  - Still requires post-construction compliance monitoring

Demonstration Approach (WQ based)

- Requires permittees to demonstrate that:
  - The LTCP is adequate to meet WQ standards
  - Remaining CSO discharges will not preclude attainment of WQ standards
  - LTCP provides maximum pollutant reduction benefits **reasonably attainable**
- Water quality data and modeling to obtain sufficient information to identify the appropriate level of CSO control
- Post-construction compliance monitoring

Alternatives Evaluation

Evaluation Criteria

Alternatives will be evaluated based on criteria including:

- Potential reduction of overflows
- Available area
- Cost
  - Capital
  - Financial capability analysis
- Operational & maintenance considerations
- Traffic disruptions / existing infrastructure
- Community impacts / benefits

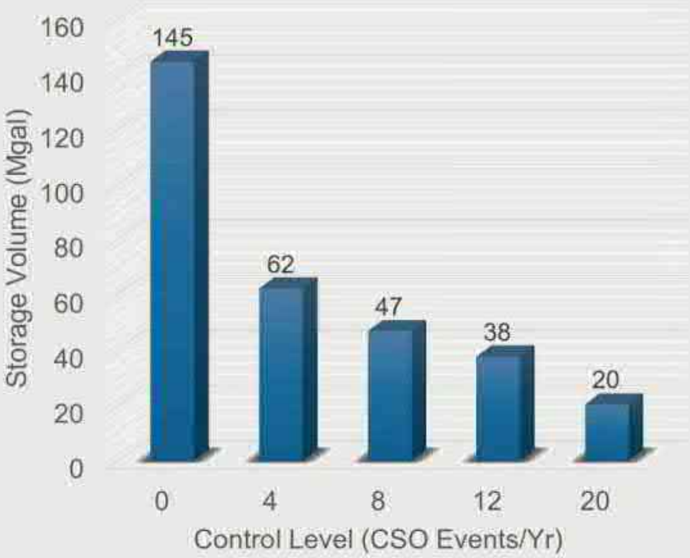
Alternatives Evaluation

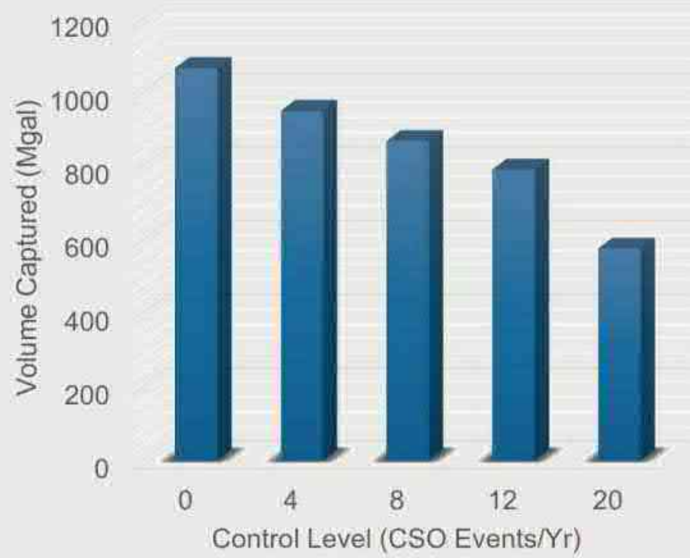
Top 20 Events – Existing Conditions 2004 Typical Year

Rank	Event	Total CSO (MG)	Start	End
1	45	145.61	9/28/2004 9:15	9/29/2004 5:09
2	42	89.27	9/8/2004 4:36	9/9/2004 20:26
3	44	64.23	9/18/2004 7:10	9/18/2004 13:47
4	32	61.07	7/18/2004 16:31	7/18/2004 23:44
5	27	56.73	6/25/2004 17:05	6/25/2004 23:23
6	52	54.39	11/28/2004 7:00	11/28/2004 15:29
7	30	44.49	7/12/2004 11:36	7/13/2004 6:53
8	19	44.09	5/12/2004 15:30	5/12/2004 20:40
9	33	39.91	7/23/2004 11:45	7/23/2004 23:33
10	6	39.12	2/6/2004 8:05	2/6/2004 23:21
11	14	38.59	4/12/2004 18:35	4/14/2004 18:40
12	34	33.40	7/27/2004 16:18	7/28/2004 1:47
13	39	30.81	8/14/2004 22:50	8/16/2004 9:16
14	15	30.34	4/26/2004 2:32	4/27/2004 1:58
15	40	29.89	8/21/2004 13:20	8/21/2004 17:45
16	29	29.38	7/5/2004 2:50	7/5/2004 15:08
17	48	22.75	11/4/2004 14:25	11/4/2004 23:51
18	53	21.63	12/1/2004 4:45	12/1/2004 14:36
19	18	18.78	5/10/2004 23:55	5/11/2004 3:24
20	49	18.37	11/12/2004 9:29	11/13/2004 5:27

Alternatives Evaluation

Preliminary Storage Volume Sizing by Control Level
System-Wide Total Storage Volume and CSO Volume Captured

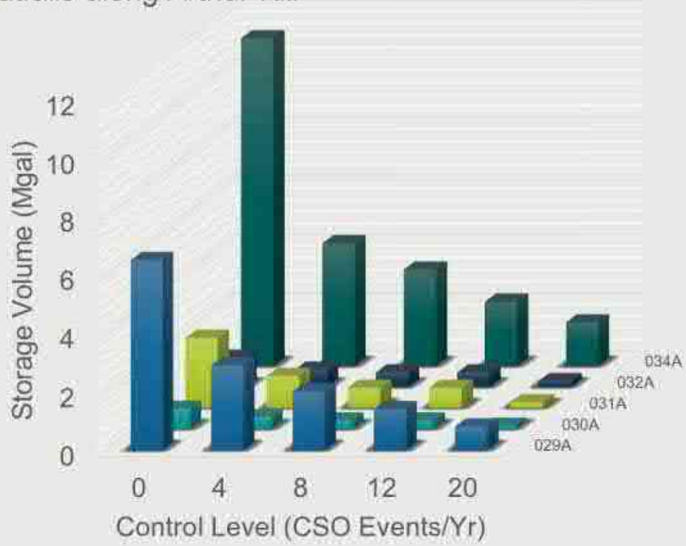




Alternatives Evaluation

Preliminary Storage Volume Sizing by Control Level
Breakdown by Outfalls

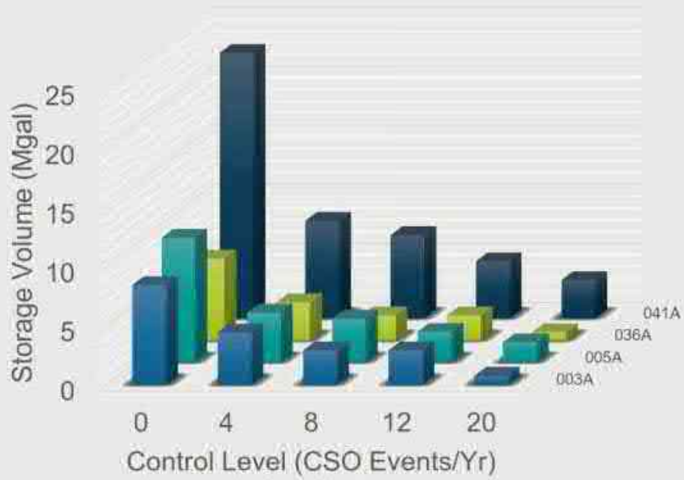
Outfalls along Arthur Kill



Alternatives Evaluation

Preliminary Storage Volume Sizing by Control Level
Breakdown by Outfalls

Northern Elizabeth R. Outfalls

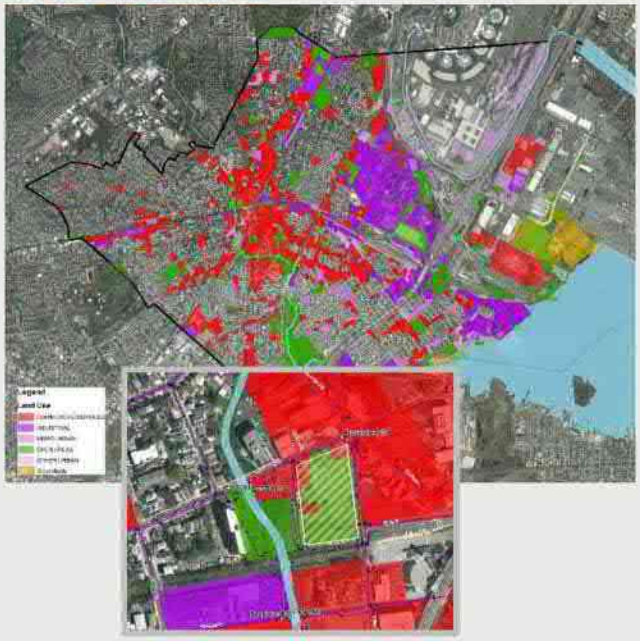


Alternatives Evaluation: Siting Analysis

Objective: To identify potential sites for storage or end-of-pipe treatment.

Analysis using GIS (mapping) data, including:

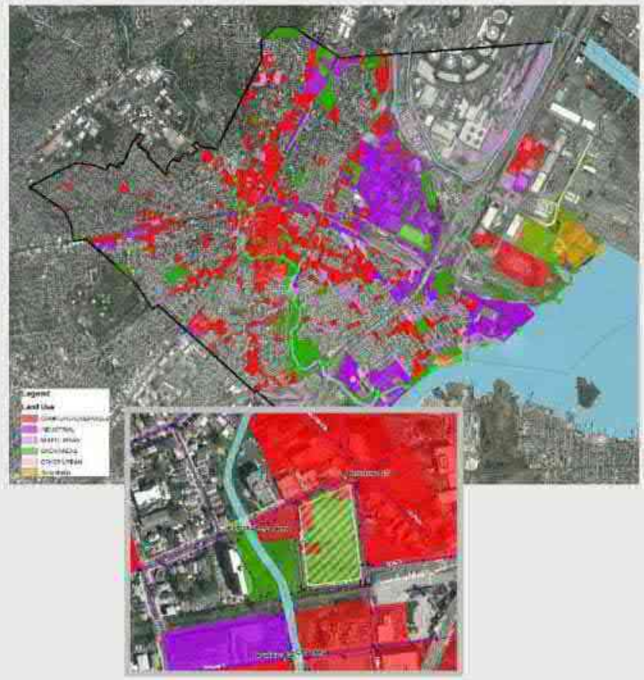
- Aerial photography
- Land Use / Land Cover
- Property data (vacant land, land ownership, property value)
- Open Space / Green Acres
- Soil Type
- Topography
- Contaminated Sites
- Brownfields



Alternatives Evaluation: Siting Analysis

Initial Screening:

- Subtract residential areas, transportation corridors and water bodies
- Analyze parcels surrounding outfalls for:
  - Parcel size and open space area
  - Distance from outfall, regulator, and S/F control facility
  - Parcel ownership (City, other public, and private)
  - Land use and density
  - Existing infrastructure
  - Existing re-development commitments
  - Public acceptance and improvement opportunity



Examples of Potential Sites

Example 1: CSO-032A

Area available:

- 2.8 acres in Arthur Kill Park open space adjacent to Outfall 032A (Court St. & Waterfront)

Ownership:

- City of Elizabeth

Land use considerations:

- Abandoned, buried railroad that cuts through the property.
- Site listed on NJDEP Recreation and Open Space Inventory (ROSI) database as a Green Acres property. Only green infrastructure alternatives allowed?
- Site is in concept design for park expansion likely in the next 3 years and may not align with CSO LTCP.

Examples of Potential Sites

Example 2: CSO-029A

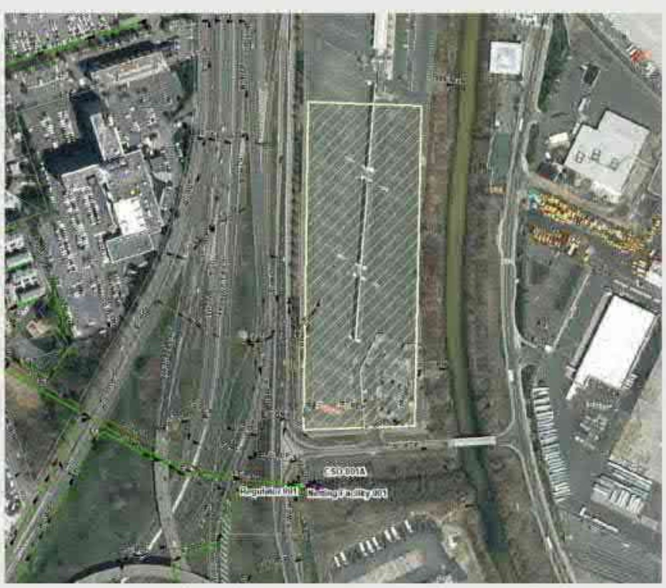
Area available:
- 4.1 acres at Elizabeth Ave. & S. 1st St.
- Underutilized Industrial parking and open space (vacant land) northwest of Outfall 029A

Ownership:
- MASH Realty Company

Land use considerations:
- Abandoned, buried railroad that cuts through the property.

Examples of Potential Sites

Example 3: CSO-001A



Area available:
- 9.2 acres at Parking Lot P1 for Newark Liberty International Airport
- 200 feet north of Outfall 001A

Ownership:
- Port Authority of NY & NJ

Land use considerations:
- Coordination with and approval from Port Authority of NY & NJ required

Examples of Potential Sites

Example 4: CSO-013A

Area available:

- 0.55+0.33 acres of underutilized parking lot at Bumet St. and Rahway Ave.
- Adjacent to Outfall 013A

Ownership:

- Elizabeth Center Apartments, Union County

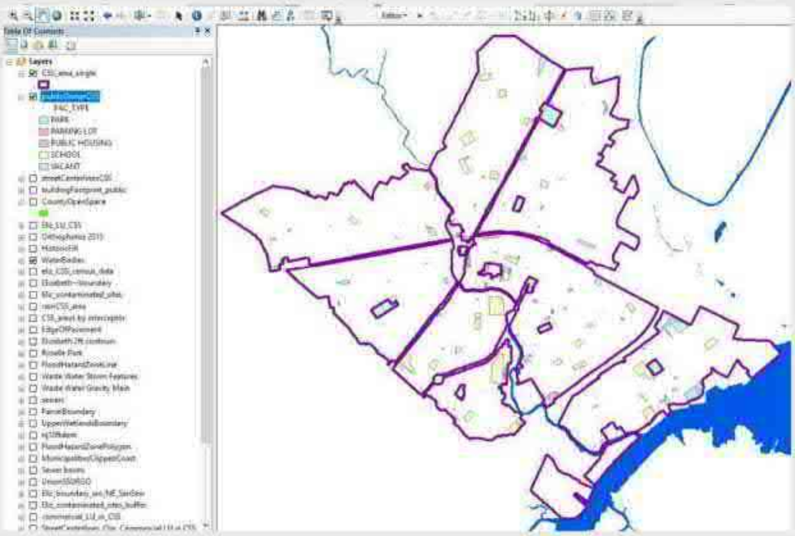
Land use considerations:

- Could also be used for Outfall 016A

Alternatives Evaluation: Green Infrastructure Screening

Green infrastructure (GI) = practices which reduce stormwater volume or flow rate by allowing the stormwater to infiltrate, to be treated by vegetation or by soils, or to be stored for reuse

- Desktop, planning-level study
- Estimate upper bound on impervious acres that could be feasibly managed by GI practices
- Following Chapter 2 “Locating and Assessing the Feasibility of Green Infrastructure” from NJDEP guidance document *Evaluating Green Infrastructure: A Combined Sewer Overflow Control Alternative for Long Term Control Plans*



Green Infrastructure Siting Evaluation

Analysis using GIS (mapping) data, including:

- Boundary of combined sewer area
- Aerial photography
- Land Use / Land Cover
- Tax parcels including area and ownership
- Building footprints
- Impervious area
- Streets
- Soil Type / Depth to Water (limited info on soil infiltration potential b/c urban land)
- Contaminated Sites

Green Infrastructure Siting Evaluation

Strategies considered:

- Bioretention (raingardens, bioswales, etc.)
- Pervious pavement
- Dry wells

Potential locations considered:

- City right-of-way – curb strip
- City right-of-way – shoulder in non-parking locations
- City public and school properties
- Parking lanes
- Parking lots
- Roofs – dry wells

Alternatives Evaluation

Green Infrastructure (GI) Screening

Key assumptions and parameters

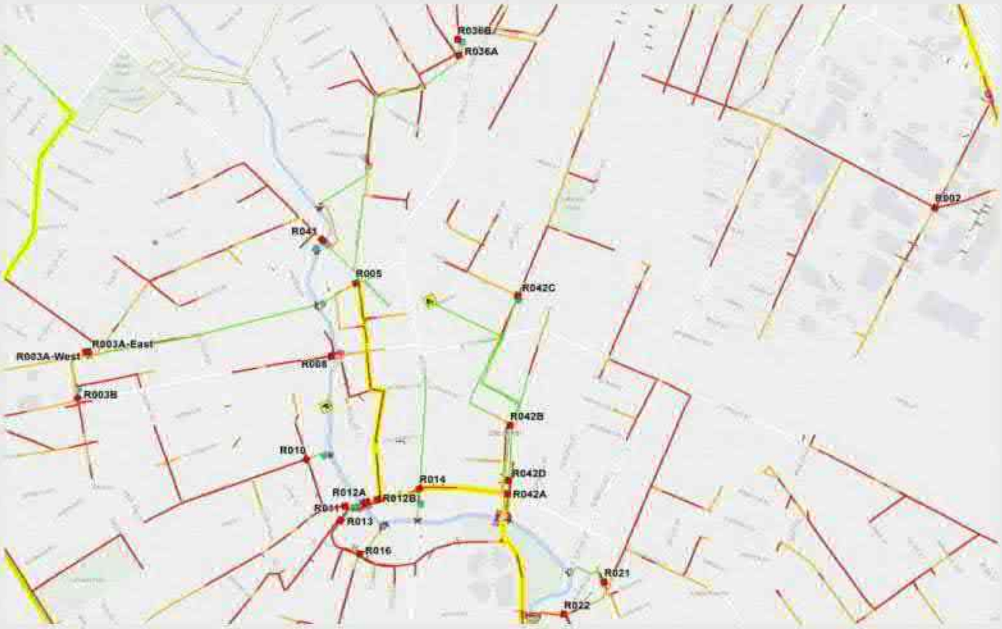
- Drainage-area-to-practice-area ratios
- Installation numbers per street segment
- Installation dimensions

Basic input parameters

Area of Elizabeth (ac & sq mi)	8,842	13.8
Combined sewer service area, CSSA (ac & sq mi)	4,100	6.4
Percent of Elizabeth in CSSA	46%	
Percent impervious in CSSA	62%	
Impervious area in CSSA (ac & sq mi)	2,542	4.0
County and local street segments in CSSA (each spans one linear block)		
Number of segments	1750	
Total length, mi	130.1	
Average segment length, ft:	393	

Alternatives Evaluation

Inline Storage Screening



- Over typical year, many upstream sewers reach pipe full capacity.
- Limited application for static weir raising

Next Steps – Timeline

Mid-March 2019:
Detailed evaluation of viable alternatives (cost, sizing, benefits)

Mid-April 2019:
Refine alternatives based on feedback

Mid-May 2019:
Finalize alternatives, draft report submission

June 2019:
Submit final report to NJDEP

Supplemental CSO Team Meeting

Supplemental CSO Team Meeting (pending team input)

Next meeting lookahead

Next Supplemental CSO Team meeting

March – April 2019

Focusing on development and evaluation of alternatives report

- List of alternatives
- Screening for viable alternatives
- Sizing and costing of viable alternatives
- Modeling for CSO performance
- Draft report sections

Questions?

Thank you

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

Supplemental CSO Team

Meeting No. 6
Long-Term Control Plan Permit Compliance

Supplemental CSO Team

Meeting No. 7
Long-Term Control Plan Permit Compliance

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

April 11, 2019 – 10:00 am
Peterstown Community Center
408 Palmer Street, Elizabeth, NJ 07202

Meeting no. 7 agenda

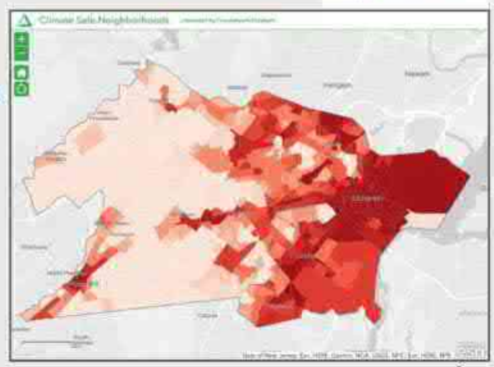
- Prior meeting recap
- Public participation process update
- Long term control plan submission and NJDEP review status
- Background and existing conditions refresher
- Development and evaluation of alternatives
  - Increased conveyance to treatment
  - Sewer separation
  - Increased sewer system storage
  - Green infrastructure
  - Expanded treatment at the JMEUC wastewater treatment facility
  - Infiltration reduction
- Next meeting lookahead

Meeting no. 6 refresher

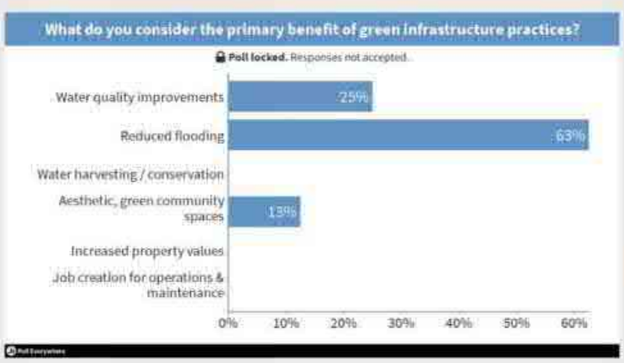
Material covered in prior meeting (1/30/2019):

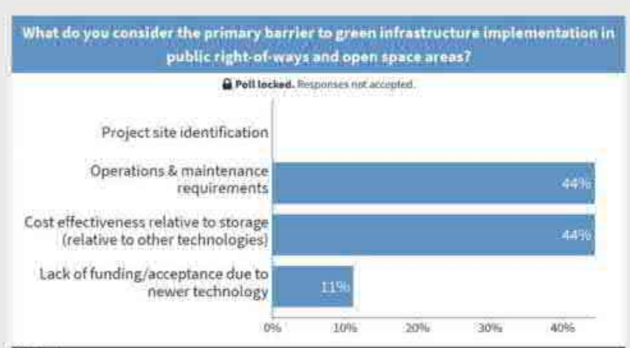
- Interactive surveys
- Groundwork Elizabeth – Climate Safe Neighborhoods presentation
- NJDEP review of LTCP submittals
- Pathogen water quality model baseline estimates
- Alternatives analysis
  - Maximizing wet weather treatment at the JMEUC WWTF
  - Siting Alternatives Analysis
  - Green Infrastructure Analysis

GROUNDWORK Elizabeth



Results of member surveys





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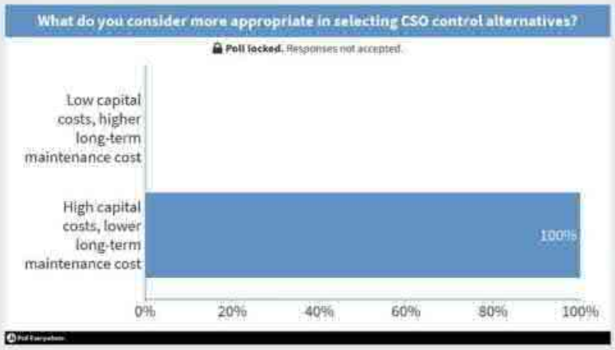

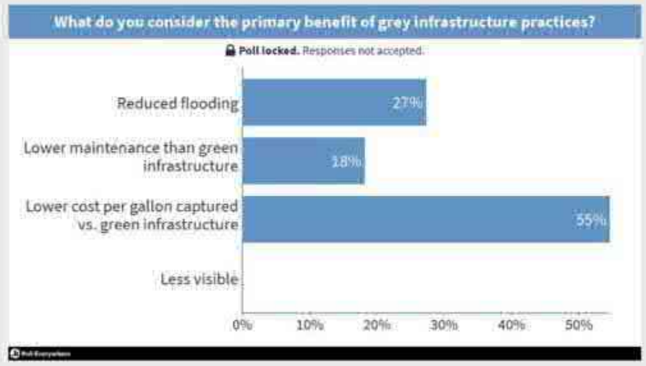

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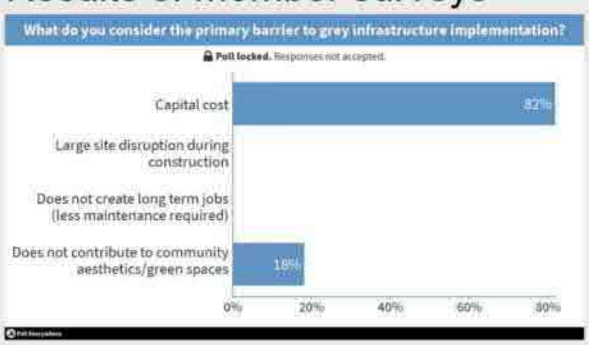
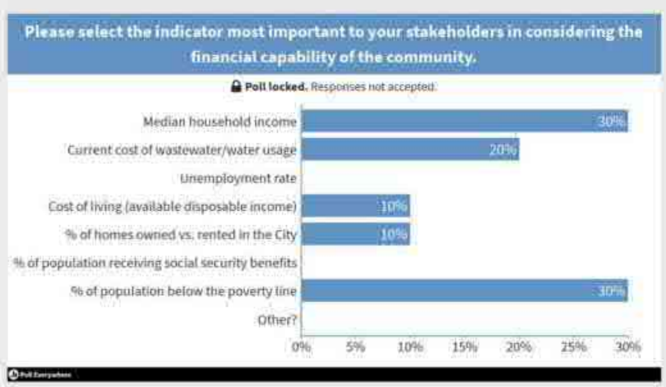




Public Participation Process Update

Public outreach and education

Recent Events

- March 6 - NJDEP Public Participation Workshop
  - Organized by NJDEP to gather Supplemental Team members and CSO Permittees from across the State.
  - Conducted here at Peterstown Community Center!
  - Discussed methods of identifying and effectively engaging with stakeholders
- City of Elizabeth Tree Planting Initiative
  - 15,000 copies of mailer sent in final week of March
  - Spread the word!
- Drone footage of Trumbull Street construction
  - Can be used for future public awareness videos

Upcoming Events

- May 3 – Future City Environmental Day school presentations
- June – Union County BioBlitz
- Others?

Long term control plan submission and NJDEP review status

Step 1.

- ✓ System Characterization Report – NJDEP Approval on 1/17/2019
- ✓ Baseline Compliance Monitoring Program Report – NJDEP Approval on 3/1/2019
- ✓ Consideration of Sensitive Areas Report – NJDEP Approval on 4/8/2019
- ✓ Public Participation Process Report – NJDEP Approval on 2/7/2019

Step 2.

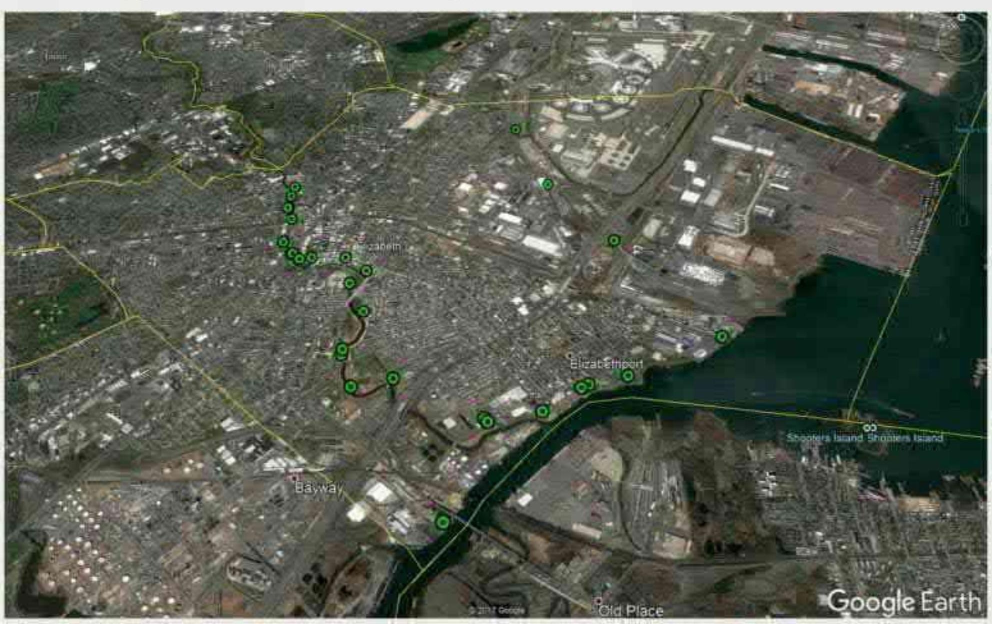
- Development and Evaluation of Alternatives – Due on 7/1/2019

Step 3.

- Selection and Implementation of Alternatives Report
- Final LTCP – Due on 6/1/2020

Background and existing conditions refresher

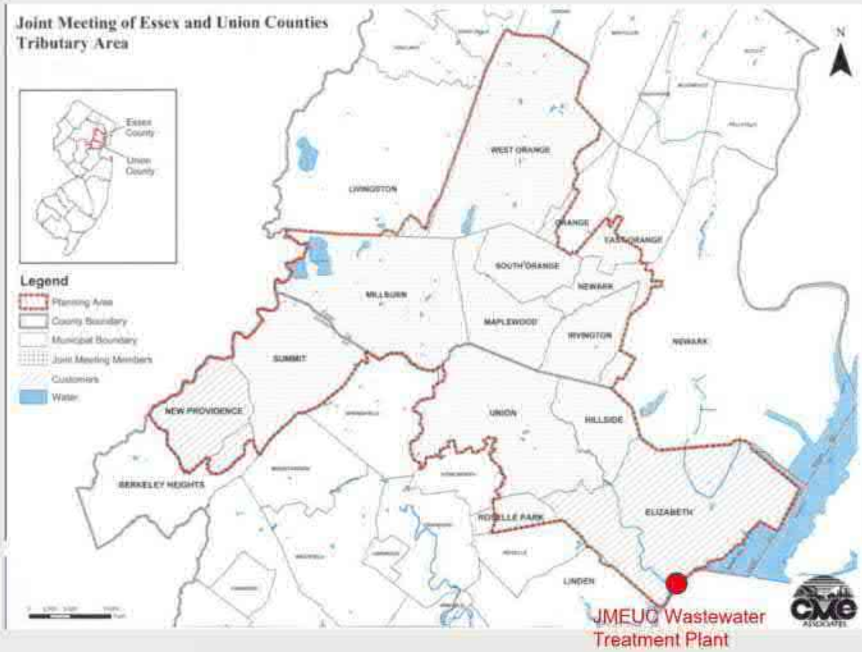
Background and existing conditions refresher



Combined Sewer System
- 29 outfalls
- 36 sub-basin; 3,500 acres
- 38 regulators and diversion chambers
- 166 miles of combined sewers, with 6,400 manholes & 3,300 inlets
- Complex network of interconnections
- 14.7 Mgal/day average flow, Trenton Ave PS
- Roselle Park storm sewer connection

JMEUC Tributary Area

- 11 member communities, 4 customer communities
- Total Service Area = 60 square miles
- Gravity sewers ranging from 10-inches in diameter to the twin 67 x 68-inch rectangular sewers at WWTP
- WWTP capacity:
  - Design flow = 85 mgd
  - Maximum capacity varies with tidal conditions: up to 225 mgd



System Characterization - Typical Year Highlights

73
Rain events

48.4"
Total rainfall

026
Most Active Outfall (at John Street)

3,490
Acres of combined sewered area.

1,065
Million gallons of total CSO volume

56
Total overflow events

Largest overflow volume = 176 million gallons

- At 041 (Morris Ave)

Peak discharge rate = 190 million gallons/day

- At 003 (Westfield & Magie)

Control Objectives

What are the regulatory requirements?

Presumption Approach (performance based)

- No more than 4 to 6 overflows per year
- No less than 85% capture of annual overflow volume

Demonstration Approach (water quality based)

- Control level that will not prevent the attainment of water quality in the future

Receiving waters and water quality standards

- Elizabeth River – Fresh Water FW2 and Saline Estuary SE3
- Newark Bay, Arthur Kill, Peripheral Ditch and Great Ditch – Saline Estuary SE3

Class	Bacterial Standards	Monthly Mean	Single Sample Max	Designated Uses
SE3	Fecal	1500	NA	Secondary Contact
FW2	E-coli	126	235	Primary Contact Public Water Supply

Alternatives Evaluation

Main CSO Control Strategies Evaluated – Part IV G 4 e

1. Increased conveyance to treatment
2. Sewer separation
3. Increased Sewer System Storage
4. Treatment of CSO discharges
5. Green infrastructure
6. Treatment plant expansion
7. Inflow / infiltration reduction
8. CSO operating protocol at treatment plant

Alternatives Evaluation

Preliminary Steps

Future Baseline Conditions

Anticipated 30-Year Project Duration – 2050 Future Baseline

Population Growth – City of Elizabeth

- North Jersey Transportation Planning Authority 2045 ->2050 population=165,000
- New Jersey Department of Labor ->2050 Population 155,000
- US Census extrapolation -> 2050 Population 144,000

Non-Residential Flow Projection (Commercial, Industrial etc.)

- Not significant in combined areas

Current Construction and Planned Capital Projects

- Trumbull Street Stormwater Control Project
- South Street Flood Control Project
- Atlantic Street Stormwater Control Project
- Lincoln Avenue Storm Drainage Improvements Project

Siting Analysis

Identify potential open or under-utilized sites for CSO control facilities

Preliminary assessment

- Reviewed area surrounding each outfall and regulator
- Identified multiple potential sites for each basin
- Generous consideration of possible locations with large paved areas
  - Objective of minimizing need to acquire real estate with existing building and structures

86 initial sites identified

- Reviewed by City for suitability

Favorable	Unfavorable
Open paved or grass areas, vacant land	Buildings / Structures
Industrial, Commercial, Open Space	Green Acres, Residential, Transportation Corridors
Publicly owned	Privately owned
Small elevation change to outfall or regulator	Large elevation change to outfall or regulator
Close to outfall or regulator	Far from outfall and regulator
No soil or groundwater contamination	Known contaminated site or brownfield site

Siting Analysis

Identify potential open or under-utilized sites for CSO control facilities

City review of potential sites identified several restrictions due to:

- Existing use and ownership
- Easement requirements
- Redevelopment plans and recent construction
- Potential business and community disruptions
- Open space / Green Acres

Most sites rated poor and very poor as suitable locations

Very limited amount of open and under-utilized space; significant land acquisition will likely be required

Storm Event Consistency

System-wide evaluation for control levels

Establish consistent list of storms

- Across outfalls
- Across control methodology

Impacts conveyance, storage, and treatment unit sizes

- Time of maximum discharge rate and overflow volume varies by outfall

Grouping of outfalls by water body to be investigated further

Top 2004 Storm Events by System-wide Volume			
1 thru 4	5 thru 8	9 thru 12	13 thru 20
7/18/2004	5/12/2004	2/6/2004	4/26/2004
9/8/2004	6/25/2004	4/12/2004	5/10/2004
9/18/2004	7/12/2004	7/23/2004	7/5/2004
9/28/2004	11/28/2004	7/27/2004	8/14/2004
			8/21/2004
			11/4/2004
			11/12/2004
			12/1/2004

Increased Conveyance to Treatment

Increased Wet Weather Flow from Existing Facilities

Trenton Avenue Pump Station

Existing System Components

(2) 60" incoming sewers (i.e., Easterly and Westerly Interceptors), with influent flow control gates

(2) mechanical bar screens

(5) extended vertical shaft dry pit centrifugal pumps, original pump casings from late 1950s

(1) 48" force main, approximately 930 LF

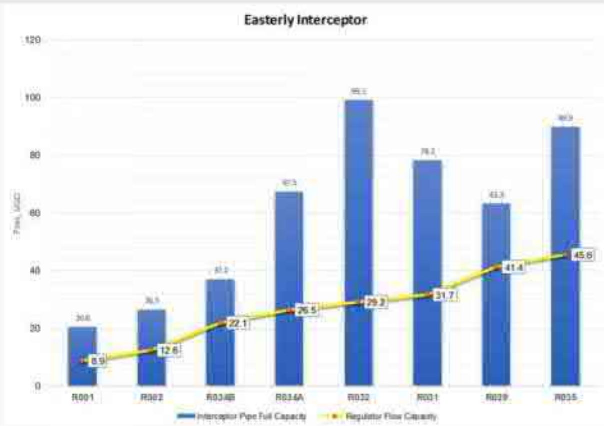
Estimated Maximum Pumping Capacity of 55 mgd

Estimated Force Main Capacity of ~ 65 mgd

1. 2. 3. 4. 5. 6. 7. 8.

Increased Conveyance to Treatment

Existing Regulator and Interceptor Capacities



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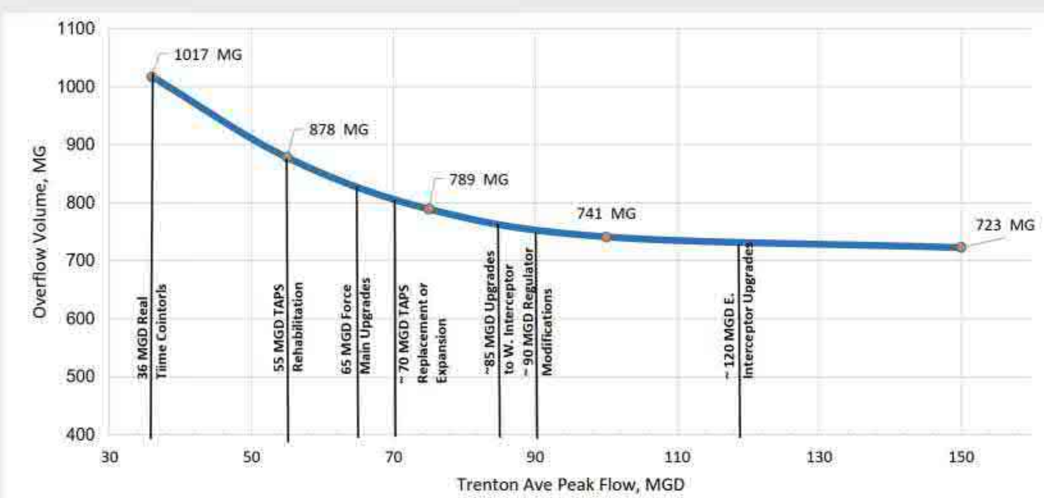
Increased Conveyance to Treatment

Pump Station Flows, System Modifications, and Est. Overflow Reductions



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Sewer Separation

Full Separation: Sanitary in one sewer, Stormwater in another

Install new sanitary sewer ⟶ Existing combined sewer becomes a storm sewer

- Work remains in public right-of-way, no new land required
- Opportunity for system renewal, reconstruction
- Highly disruptive
  - Over 100 miles of new sewers required
  - Need to redirect every service connection on each street
  - Over 30 year planning period, about 110 acres, 3.5 miles or 50 blocks need to be addressed each year
- Stormwater contributes to pollution of the receiving waters and will eventually need to be treated or controlled

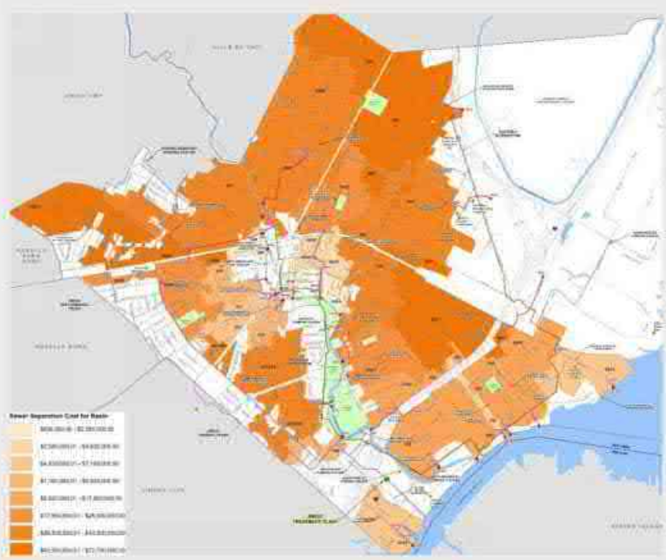
1. 2. 3. 4. 5. 6. 7. 8.

Sewer Separation

Construction Cost Estimate

- Cost estimated for each basin based on basin area (acres), average daily flow (gallons per day), feet of sewers
- Total cost for all basins ~ $660 million
- Corresponds to about $0.62 per gallon of overflow eliminated per year
- Costs vary by basin

Upper range	Lower range
Basin 001: $72.7 million	Basin 042A: $0.64 million
Basin 039: $57.8 million	Basin 012: $0.89 million
Basin 003A: $57.3 million	Basin 014: $1.61 million



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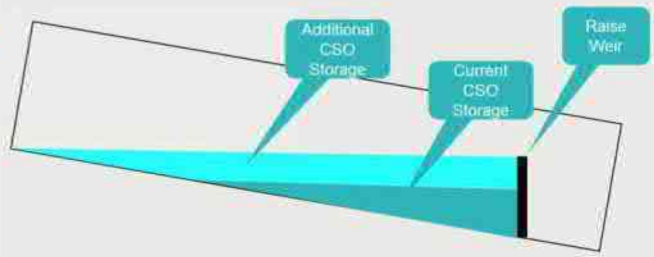
Increased Sewer System Storage

In-line Storage

- Uses available volume in existing sewer or new larger sewers in the same location
- Effectiveness driven by pipe size and slope
- Findings:
  - Larger trunk sewers reach full pipe condition during 2004 model run
  - Minimal additional storage volume is available
  - No reduction in number of overflows per year predicted
  - Very high cost per gallon stored



Storage Tanks

Tanks Located at Individual Outfalls

- Redirect outfall to off-line underground storage tank
- Flow stored up to tank volume
- Flow in excess of tank capacity discharged as overflow
- Select tank volume for targeted level of control
- Tank dewatered to interceptor
- Additional interceptor capacity and TAPS pumping may also be required.

Example: CSO-001 Tank Siting

Storage Tanks

Sizing and Construction Cost Estimates

- Estimated for each basin for:
  - Control levels: 0, 4, 8, 12, and 20 overflows per year
  - System-wide storm event ranking
  - 15' deep tanks, with factors for dewatering pumps, screens, and connecting pipes
- Total Construction Cost – All Basins

Control Level Overflows per year	0	4	8	12	20
Storage Volume Required (Mgal)	145.0	62.4	46.9	37.7	20.4
Construction Cost ($ million)	$738.0	$374.0	$297.0	$253.0	$159.0
Overflow Volume Captured (Mgal)	1065	950	867	790	576
Cost per Gallon Captured ($/gal)	$0.69	$0.39	$0.34	$0.32	$0.28

Storage Tank Siting Review

Example 1: CSO-001

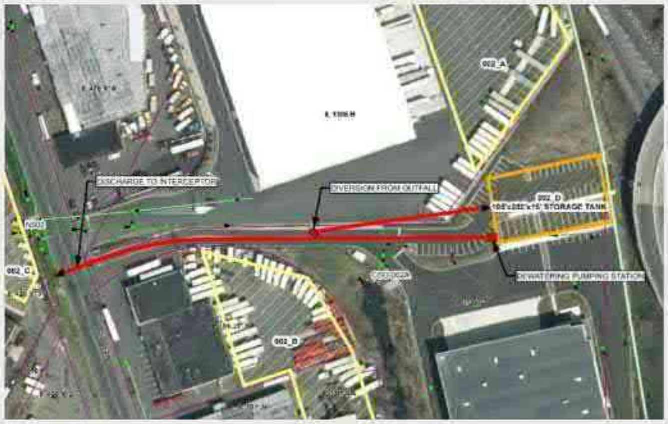
Area available:
- 1.1 acres near Newark Airport between Spring Street and U.S. Highway 1
- 550 feet west of Outfall 001A

Ownership:
- NJDOT

Site considerations:
- Diversion and return pipes must cross several major highways (outfall on other side of US 1-9 and Route 81)
- NJDOT approvals and easement grants required
- Potential traffic disruption for site access during construction and for tank maintenance

Storage Tank Siting Review

Example: CSO-002



Area available:
- 0.67 acres in parking area of warehouse distribution center
- Adjacent to Outfall 002A
- Possible use of triangular grass area

Ownership:
- Private

Site considerations:
- Potential interferences with existing infrastructure
- Disruption to business operations during construction and with final arrangement
- Loss of parking spaces.
- Easement requirements for site access and permanent facilities

1. 2. 3. 4. 5. 6. 7. 8.

Deep Tunnel Storage

General System Components

- Diversion structure / regulator
- Consolidation conduits
- Coarse screening
- Drop shafts
  - Approach channel
  - Inlet chamber
  - Vertical shaft
  - De-aeration chamber
  - Air vent shafts, recirculation, and odor control
- Main tunnel
- Dewatering pump station
- Overflow relief points

Source: DigIndy, citizens energy group, 2017

1. 2. 3. 4. 5. 6. 7. 8.

Deep Tunnel Storage

East Tunnel

Primary / south section

- Storage for 8 CSO basins
- South First Street and First Street
- 4 drop shafts, including launch & receiving
- Length: ~9,200 linear feet
- Diameter by control level

	Control Level (overflows/yr)				
	0	4	8	12	20
Vol, Mgal	30.5	13.6	10.5	7.7	4.4
Dia, ft	**24**	**16**	**14**	**12**	**10**

Deep Tunnel Storage

East Tunnel

Northern extension to Basins 001 & 002

- Adds 11,100 feet (120% increase)
- 2 more sites for drop shafts needed
- Excessive additional costs for remote outfall locations
- Tunnel extension – Not recommended

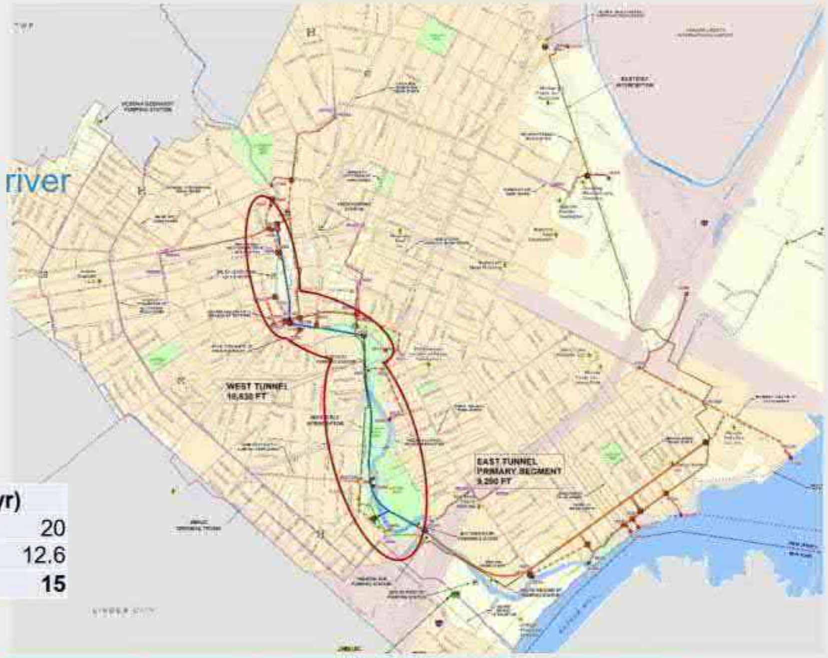
Deep Tunnel Storage

West Tunnel

Extends north, generally along river

- Storage for 17 CSO basins
- 4 additional drop shafts
- Large consolidation conduits
- Multiple river crossings
- Length: ~10,600 linear feet
- Diameter by control level

	Control Level (overflows/yr)				
	0	4	8	12	20
Vol, Mgal	89.6	38.1	29.1	23.7	12.6
Dia, ft	**38**	**25**	**22**	**20**	**15**



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Deep Tunnel Storage

Combined East and West Tunnels

Statistics for both sections

- Length: ~19,800 linear feet
- Diameter by control level

	Control Level (overflows/yr)				
	0	4	8	12	20
Vol, Mgal	120	51.7	39.6	31.4	17
Dia, ft	**32**	**21**	**19**	**16**	**12**

1. 2. 3. 4. 5. 6. 7. 8.

Deep Tunnel Storage

Shaft Siting Considerations

Tunneling operations

1. 2. 3. 4. 5. 6. 7. 8.

Deep Tunnel Storage

Shaft Siting Considerations

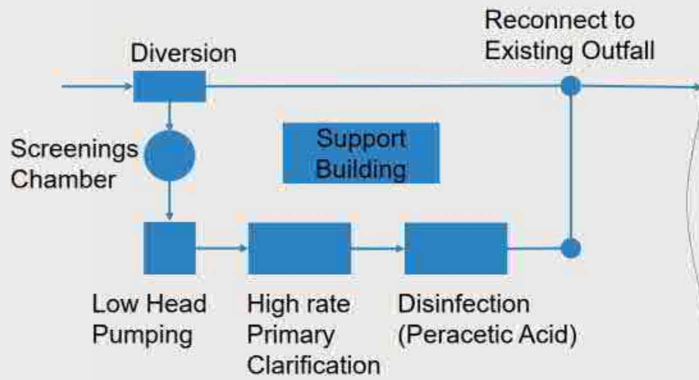
Drop shaft construction

1. 2. 3. 4. 5. 6. 7. 8.

Treatment of CSO Discharges

Primary Clarification and Disinfection

- Permit requirements for CSO discharge minimum treatment
  - Solids and floatables disposal
  - Primary clarification
  - Disinfection of effluent
- Considers disinfection with peracetic acid at 6 min contact time
- Pilot Testing Required



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Treatment of CSO Discharges

Peracetic Acid (PAA)

Acetic Acid and Hydrogen Peroxide solution

- Common Elements
  - 275 gallon totes or 55 gallon drums
  - Feed pumps
  - Mixers / diffusers
  - Instrumentation (flow, TSS)
  - Sampling equipment
  - Pressure relief
  - Heat monitoring

1. 2. 3. 4. 5. 6. 7. 8.

Treatment of CSO Discharges

Preliminary Sizing Calculations

Input requirements

- Peak flow rates
- Operating times
- Treatment volumes

Example: CSO-001
Peak Flow = 75.1 MGD

Item	Footprint (sf)
Screening	120
Pump Station	2,500
Primary Clarification (Actiflo)	5,000
Disinfection Chamber	10,000
Support Building	1,600

Rough Construction Cost = $38 million

Green Infrastructure

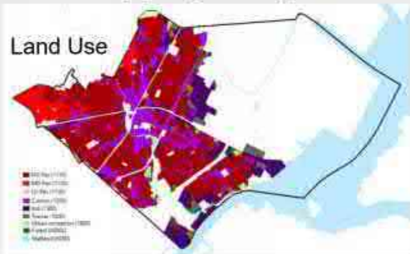
Background

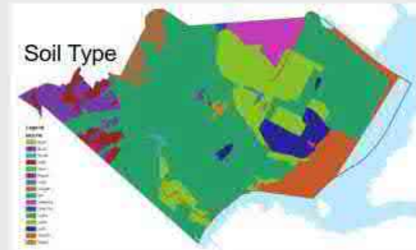
Green infrastructure (GI) = practices which reduce stormwater volume or flow rate by allowing the stormwater to infiltrate, be stored, or be treated by vegetation or soils

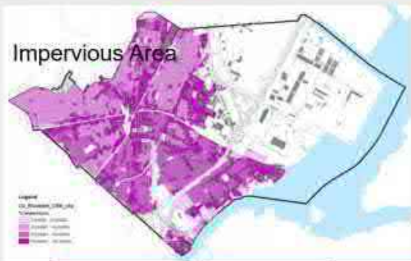
1. Estimate upper bound on impervious acres that could be feasibly managed by GI practices
2. Review GI practices for practical application citywide
3. Estimate potential number and size of units
4. Input GI areas into hydraulic model for performance simulation

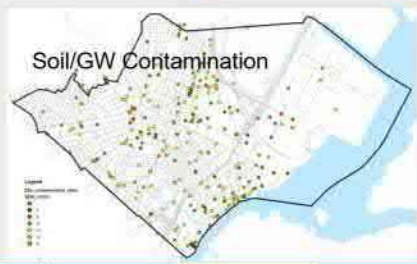
Green Infrastructure

GIS Mapping Analysis









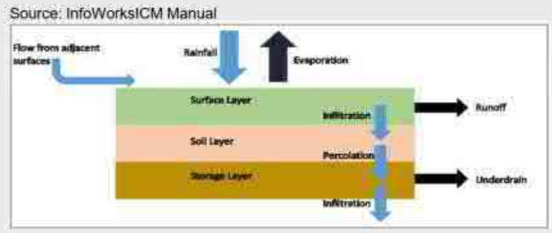
Green Infrastructure

Model Implementation

Representative Bioswale

- 3' W x 20' Long
- 18" Soil Depth
- 3.5' Storage layer (Crushed Stone)
- Loading Ratio of 15:1
- Treated Impervious Area 900sf
- Mimic NJ SW BMP Manual

Source: InfoWorksICM Manual



Results: Maximum of 2.6% of City impervious area can practically be directed to GI

- Will manage runoff from 2.9 million SF of impervious area
- 3,150 bioswales across Elizabeth
- Requires 18 additional staff for O&M (1 hr/month per bioswale, EPA)

Green Infrastructure

Model Impact

- Minimal Impact on Peak Flow
- Minimal Impact on Volume

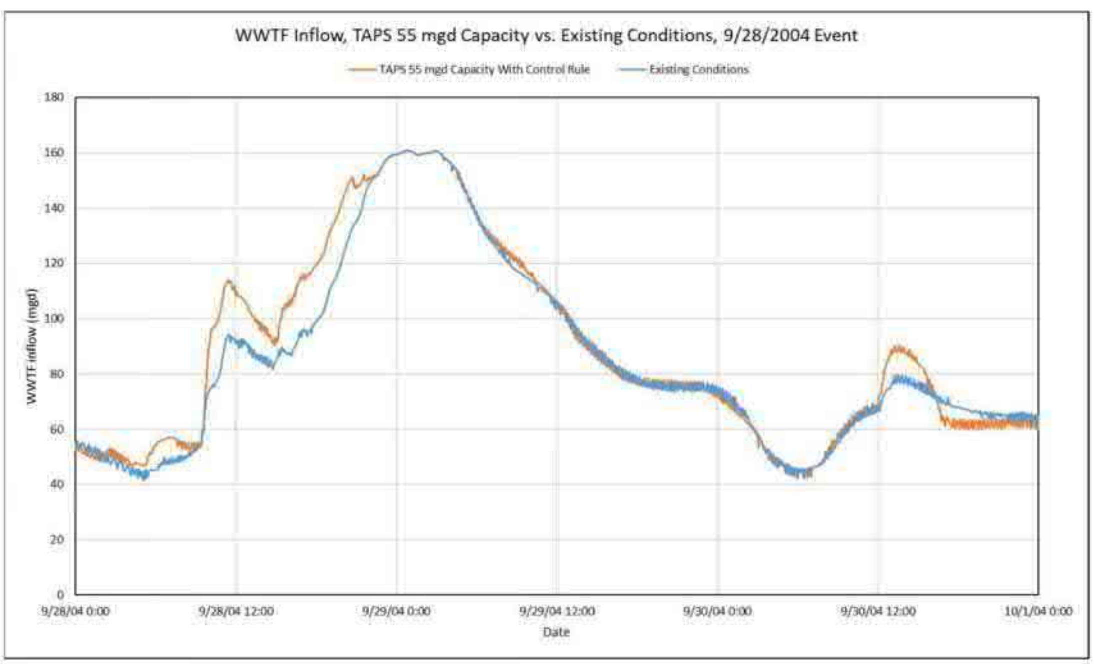
1. 2. 3. 4. 5. 6. 7. 8.

JMEUC Alternatives Evaluations

- Evaluation of expanded treatment of combined sewer flow from Elizabeth at the JMEUC Wastewater Treatment Facility (WWTF)
- Evaluation of costs and benefits of I/I reduction

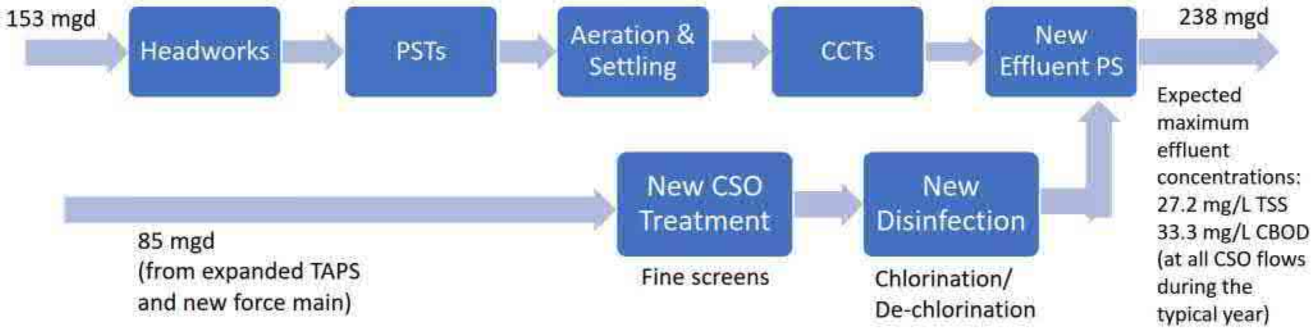
WWTF Expansion Objectives

- Core objective: Increase the capture and treatment of combined sewer flow during wet weather from the City of Elizabeth
- Interim plan to increase peak flow from TAPS to 55 mgd
- Long-term plan to increase peak flow from TAPS to 140 mgd
- Key elements of long-term plan:
  - Disinfection improvements required to accept additional CSO flows
  - Solids removal required for additional CSO flows prior to disinfection
  - Blending of treated CSO flows with normal wet weather plant effluent



Treatment of CSO Flows at JMEUC WWTP

- 153 mgd through existing facility (capacity ≥ 180 mgd)
- 85 mgd through new CSO treatment and new disinfection



Weekly average permit limits:
45 mg/L TSS
40 mg/L CBOD

Three treatment strategies evaluated:
A: All additional flow to a new treatment train **[SELECTED]**
B: Minimize capacity of new treatment train (maximize use of existing capacity)
C: Maximize use of secondary capacity (minimize additional pumping)

CSO Treatment Options

Treatment Option	Benefits	Limitations	TSS Removal, %	CBOD Removal, %
Mechanical Bar Screens	Small footprint (approx. 8 ft x 11 ft)	Need container to hold screenings and odor control	5	0
Fine Screens	Small footprint (approx. 20 ft x 5 ft)	Need regulators (weirs)	10	0
Vortex/Swirl Units	Easy to operate, TSS removal	Larger footprint (approx. 42 ft x 51 ft), Need ancillary tank to hold screenings (and odor control)	35	15
Ballasted Flocculation	Good TSS and BOD removal	Larger footprint than others (approx. 78 ft x 64 ft), Need ancillary tank, Start-up time	80	50

- Options Eliminated:
  - Band and belt screens: low Technical Guidance Manual matrix rating; primarily due to complexity and land required
  - Drum screens: low Technical Guidance Manual matrix rating; primarily due to complexity and land required
  - Modified vortex: higher level treatment not required for this system
  - Polishing ("Fuzzy") filter: higher level treatment not required for this system

Disinfection Options

- Chlorination
- Peracetic Acid
- Ultraviolet (UV) Disinfection

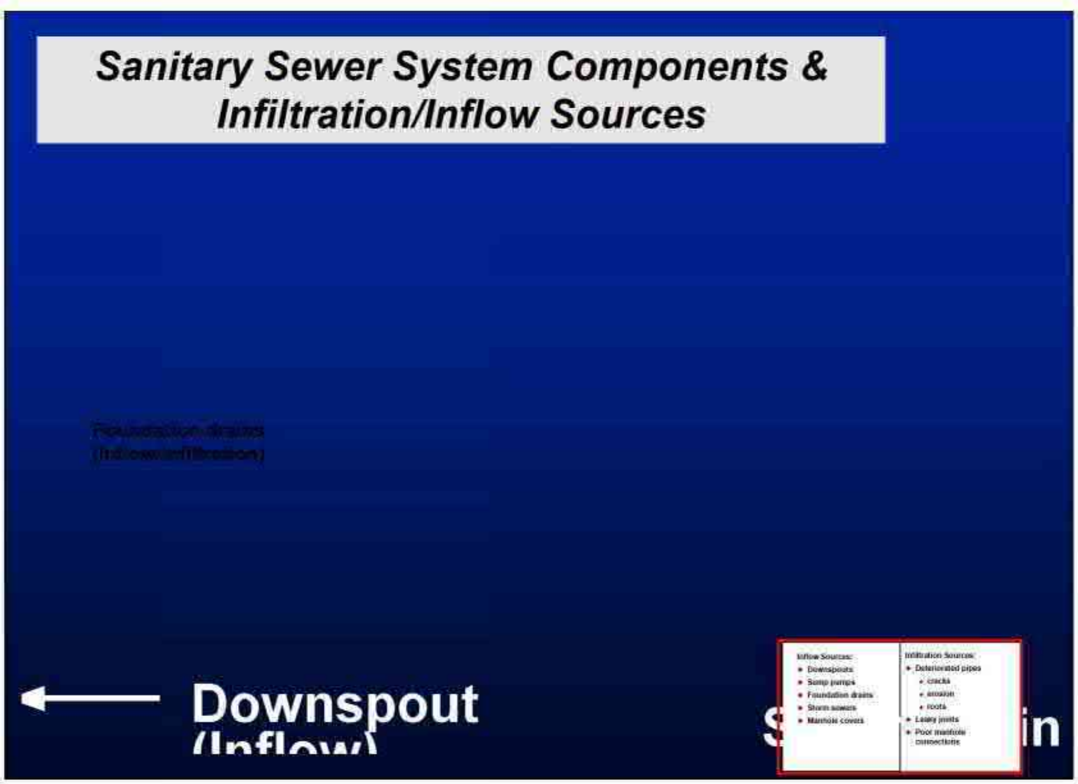
- Since the JMEUC WWTF already has a chlorination facility on site, CDM Smith recommends using **chlorination (and dechlorination)** as the disinfection technology for the proposed CSO flows.
- New chlorine contact tank with de-chlorination required

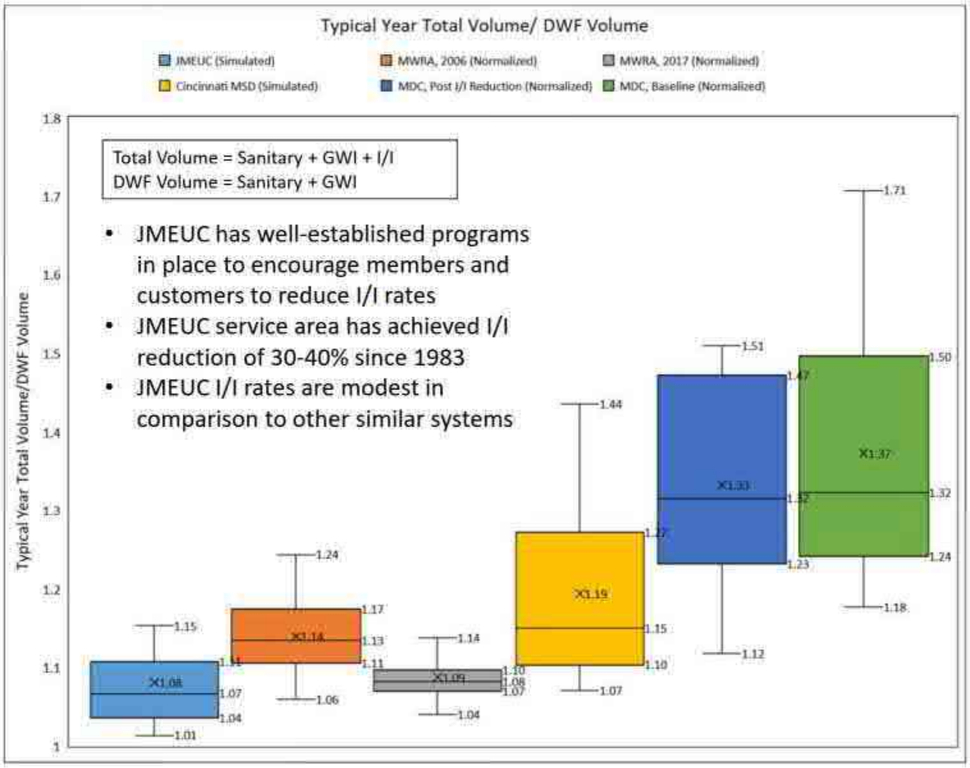
Conclusions and Next Steps – WWTF expansion

- Initial planning-level cost for additional CSO treatment (fine screens) is $14M (capital cost) and $450K annual operating cost
- Potential additional costs for TAPS expansion and new force main costs not yet included
- Evaluate WWTF expansion vs. other controls:
  - Compare these costs/benefits with those of other CSO control alternatives and select CSO controls based on all relevant decision criteria
  - I/I reduction evaluated as a means to reduce plant improvement costs

I/I Reduction Evaluation Approach - Overview

- Establish the maximum attainable I/I reduction for each sewershed
- Estimate potential I/I reduction costs for each sewershed
- Rank sewersheds by potential I/I volume removed per rehab $
- Develop cost effectiveness curve as plot of ranked sewershed removal vs. cost
- Evaluate potential benefits of I/I reduction
- Compare I/I costs and benefits





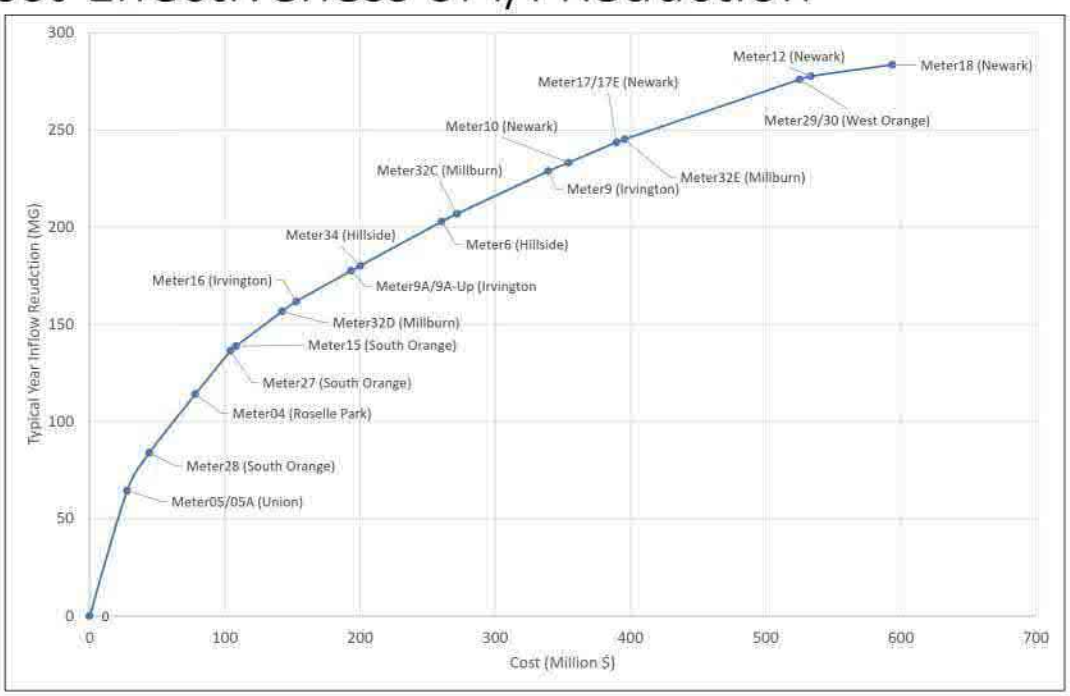
Potential I/I Reduction Targets by Sewershed

	Sewershed	Municipality	Estimated Typical Year Inflow (MG)	Estimated Attainable Inflow Reduction During Typical Year (MG; **50% maximum**)	Incremental Inflow Reduction Target (%)
No I/I reduction achieved to date	Meter16	Irvington	10.15	5.08	50.00%
	Meter04	Roselle Park	60.30	30.15	50.00%
	Meter27	South Orange	44.83	22.41	50.00%
	Meter9	Irvington	43.98	21.99	50.00%
	Meter10	Newark	8.79	4.39	50.00%
	Meter17/17E	Newark	20.89	10.44	50.00%
	Meter12	Newark	3.43	1.72	50.00%
	Meter06	Hillside	45.43	22.72	50.00%
	Meter34	Hillside	5.19	2.60	50.00%
	Meter32D	Millburn	35.73	17.86	50.00%
Partial I/I reduction achieved to date	Meter18	Newark	12.73	5.89	46.30%
	Meter29/30	West Orange	69.06	30.69	44.44%
	Meter28	South Orange	57.43	19.44	33.85%
	Meter15	South Orange	6.84	2.32	33.85%
	Meter32C	Millburn	14.99	3.93	26.25%
	Meter32E	Millburn	6.12	1.61	26.25%
	Meter9A/9A-Up	Irvington	62.77	15.85	25.25%
	Meter05/05A	Union	524.91	64.46	12.28%
Full I/I reduction achieved to date	Meter13	East Orange	12.86	0.00	0.00%
	Meter22	Maplewood	12.01	0.00	0.00%
	Meter21	Maplewood	18.32	0.00	0.00%
	Meter26/31	Maplewood	18.93	0.00	0.00%
	Meter14	East Orange	6.48	0.00	0.00%
	Meter25	Maplewood	8.02	0.00	0.00%
	Meter24	Summit	107.24	0.00	0.00%

I/I Reduction – Ranked List of Sewersheds with Feasible Reduction Opportunities

Subcatchment	Municipality	% Reduction in R values for modeling	% of subcatchment to undergo comprehensive I/I reduction to achieve calculated % Reduction in Inflow	Estimated Dwelling Count	Pipe Length (mi)	Estimated Dwellings with laterals in need of lining	Estimated Cost of CIPP Lining Laterals ($)	Estimated pipe length in need of CIPP lining (ft)	Estimated Cost of CIPP Lining Main Lines ($)	Total Estimated Rehabilitation Cost ($)	Estimated Existing Inflow During Typical Year (MG)	Estimated Attainable Inflow Reduction During Typical Year (MG)	Estimated gallons of I/I removed per $ spent
Meter05/05A	Union	12.28%	14.00%	25,109	122.05	3,515	24,605,217	90,213	$3,157,443	$27,762,660	524.906	64.459	2.322
Meter28	South Orange	33.85%	51.17%	3,940	24.95	2,016	14,113,118	67,422	$2,359,775	$16,472,893	57.428	19.439	1.180
Meter04	Roselle Park	50.00%	100.00%	4,752	3.45	4,752	33,264,000	18,237	$638,295	$33,902,295	60.300	30.150	0.889
Meter27	South Orange	50.00%	100.00%	3,400	12.85	3,400	23,798,412	67,823	$2,373,805	$26,172,217	44.827	22.413	0.856
Meter15	South Orange	33.85%	51.17%	972	4.41	498	3,482,531	11,912	$416,910	$3,899,441	6.841	2.316	0.594
Meter32D	Millburn	50.00%	100.00%	3,966	34.95	3,966	27,762,427	184,553	$6,459,355	$34,221,782	35.725	17.863	0.522
Meter16	Irvington	50.00%	100.00%	1,398	2.98	1,398	9,788,630	15,722	$550,270	$10,338,900	10.153	5.077	0.491
Meter9A/9A-Up	Irvington	25.25%	33.78%	16,459	28.44	5,560	38,918,335	50,728	$1,775,469	$40,693,804	62.772	15.850	0.389
Meter34	Hillside	50.00%	100.00%	865	3.69	865	6,055,070	19,475	$681,625	$6,736,695	5.192	2.596	0.385
Meter06	Hillside	50.00%	100.00%	7,700	34.41	7,700	53,899,930	181,685	$6,358,975	$60,258,905	45.432	22.716	0.377
Meter32C	Millburn	26.25%	35.59%	3,755	25.72	1,336	9,355,270	48,340	$1,691,895	$11,047,165	14.989	3.935	0.356
Meter9	Irvington	50.00%	100.00%	9,039	24.74	9,039	63,269,685	130,642	$4,572,470	$67,842,155	43.983	21.992	0.324
Meter10	Newark	50.00%	100.00%	1,991	5.20	1,991	13,934,851	27,454	$960,890	$14,895,741	8.785	4.393	0.295
Meter17/17E	Newark	50.00%	100.00%	4,706	13.45	4,706	32,943,284	71,028	$2,485,980	$35,429,264	20.886	10.443	0.295
Meter32E	Millburn	26.25%	35.59%	2,114	12.49	752	5,267,341	23,464	$821,244	$6,088,585	6.118	1.606	0.264
Meter29/30	West Orange	44.44%	79.99%	20,179	111.53	16,140	112,982,061	471,021	$16,485,728	$129,467,789	69.056	30.689	0.237
Meter12	Newark	50.00%	100.00%	1,104	2.40	1,104	7,731,462	12,652	$442,820	$8,174,282	3.431	1.715	0.210
Meter18	Newark	46.30%	86.22%	9,626	14.12	8,299	58,094,346	64,258	$2,249,025	$60,343,371	12.725	5.892	0.098
Total				121,075	481.83	77,038	$539,265,968	1,556,628	$54,481,973	$593,747,942			

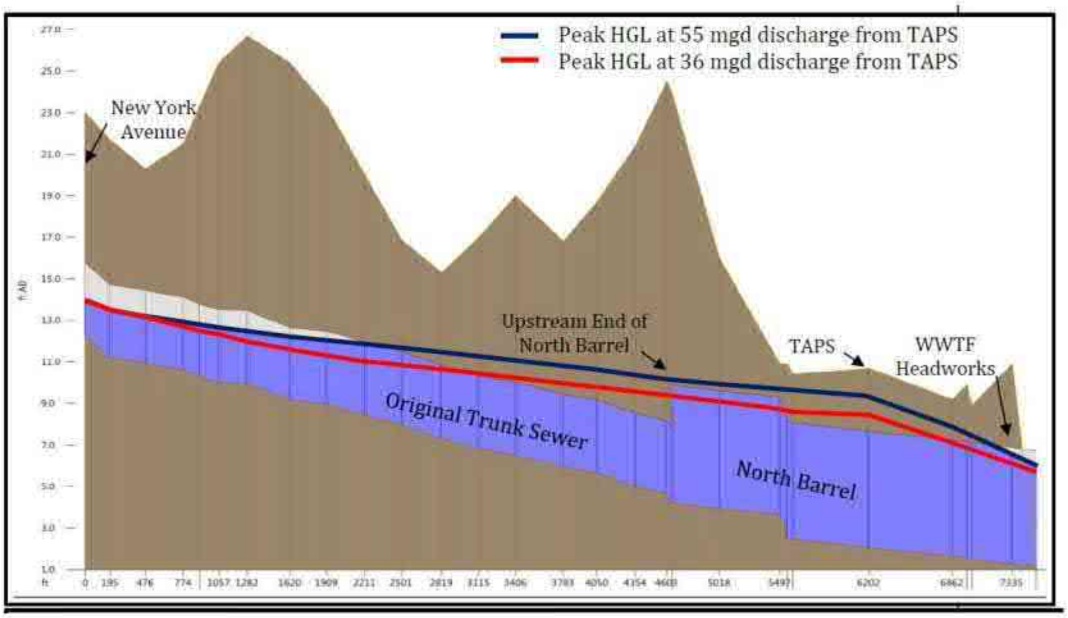
Cost-Effectiveness of I/I Reduction

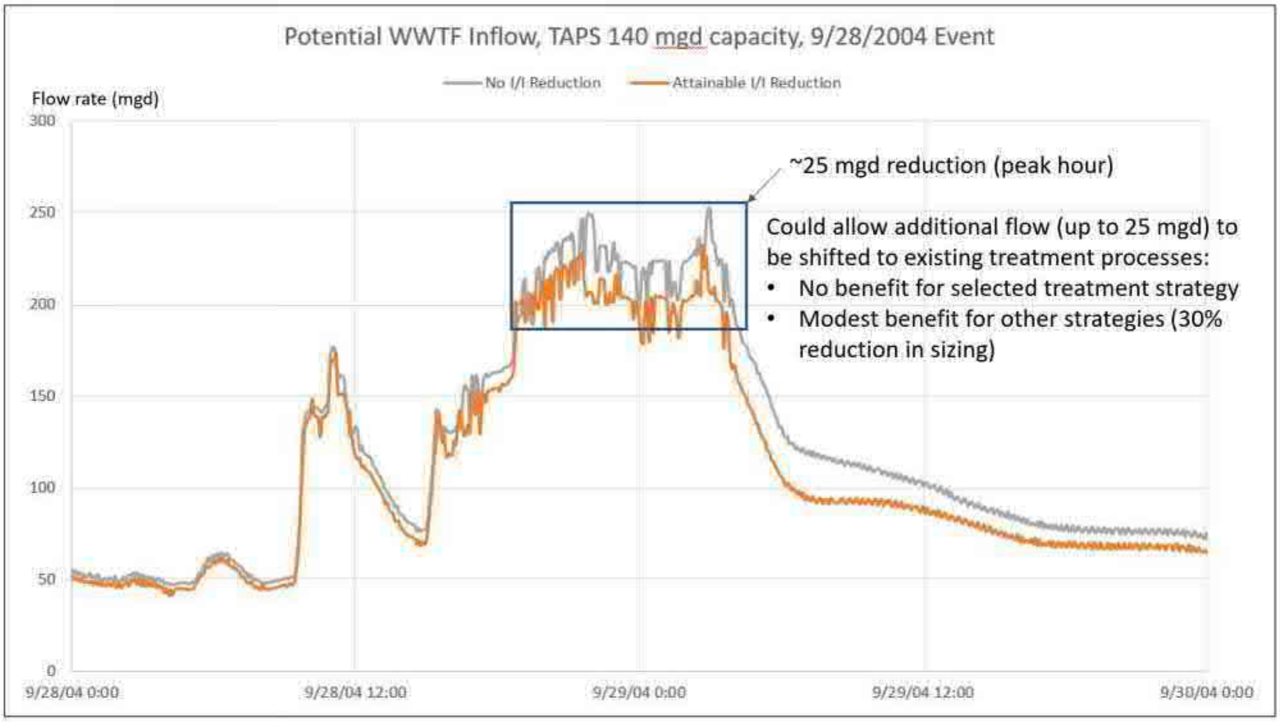


I/I Reduction Benefits – Key Factors

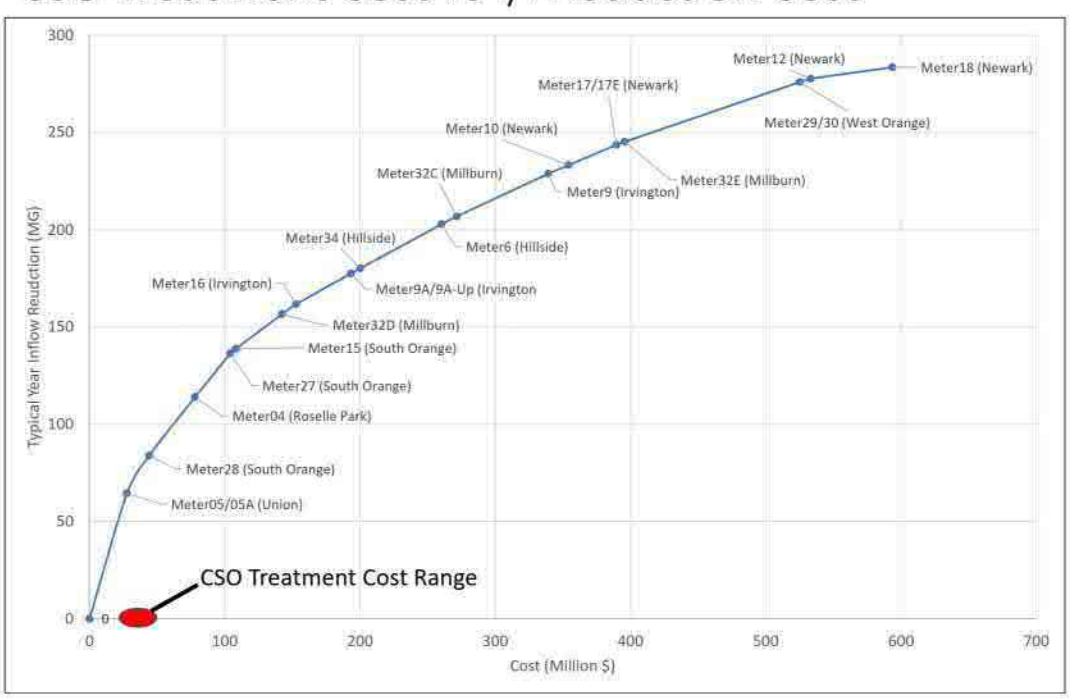
- System Characterization Report demonstrated that all wet weather flow in the typical year from member & customer communities (including TAPS at 55 mgd) can be delivered by JMEUC trunk sewers to the WWTF and fully treated
- Additional combined sewer flow at 140 mgd from Elizabeth/TAPS would require additional conveyance and treatment:
  - 55 mgd thru existing TAPS and JMEUC trunk sewers
  - 85 mgd thru expanded TAPS and new force main requires new CSO treatment train to provide the equivalent of primary treatment
  - **Only I/I reduction benefit for CSO LTCP** is reduction in capacity of the new CSO treatment train (for Options B & C) by 25 mgd (~30%)

I/I does not limit current or future capture of CSO flow





CSO Treatment Cost vs I/I Reduction Cost



Conclusions – I/I Reduction

- I/I reduction costs much higher than CSO treatment train costs:
  - ~$600M in I/I rehab costs ➡ ~$6M in CSO treatment cost savings
- Reducing I/I rates to reduce required CSO treatment train capacity is not cost-effective
- JMEUC will continue to encourage I/I reduction in the sanitary sewer service areas but I/I reduction will <u>not</u> be included as an element of the CSO LTCP

Next Steps – Alternatives Report Timeline

March 2019: Detailed evaluation of viable alternatives (cost, sizing, benefits)

Supplemental CSO Team Meeting

Mid-April 2019: Refine alternatives based on feedback

Mid-May 2019: Finalize alternatives, draft report submission

Supplemental CSO Team Meeting (pending team input)

June 2019: Submit final report to NJDEP

Next meeting lookahead

Next Supplemental CSO Team meeting

June 2019

Timing of meeting – weekday, weeknight, weekend?

Focusing on Development and Evaluation of Alternatives report

- Sizing and costing of viable alternatives
- Modeling for CSO performance
- Draft report sections

Questions?

Thank you

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

Supplemental CSO Team

Meeting No. 7
Long-Term Control Plan Permit Compliance

Supplemental CSO Team

Meeting No. 8
Long-Term Control Plan Permit Compliance

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

June 7, 2019 – 10:00 am
Elizabeth City Hall, Room 307
50 Winfield Scott Plaza, Elizabeth, NJ 07201

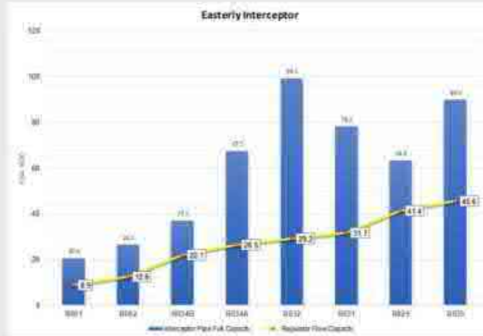
Meeting Agenda

1. Prior meeting recap
2. Public participation process update
3. Project background
4. Development and Evaluation of Alternatives Report (DEAR)
   - Report objectives
   - CSO control goals and approaches
   - Technology screening summary
   - Control program evaluation
5. Schedule for next meeting

Meeting no. 7 Recap

Material covered in prior meeting (04/11/2019):

- Initial presentation of alternatives
  - Increased conveyance to treatment
  - Sewer separation
  - Increased sewer system storage
  - Green infrastructure
  - Expanded treatment at the JMEUC wastewater treatment facility
  - Infiltration and inflow reduction



Public Participation Process Update

Public outreach and education

Recent Events

- Future City Environmental Day (May 3rd)
  - 200 students
  - Interactive presentation on stormwater runoff, impervious surfaces and impact to CSOs
- City of Elizabeth Tree Planting Initiative
  - Community greening and runoff reduction

Upcoming Events?

- Hold open public meetings for alternatives review and selection
- City summer camp education outreach

Long term control plan submission and NJDEP review status

Step 1.

- ✓ System Characterization Report – NJDEP Approval on 1/17/2019
- ✓ Baseline Compliance Monitoring Program Report – NJDEP Approval on 3/1/2019
- ✓ Consideration of Sensitive Areas Report – NJDEP Approval on 4/8/2019
- ✓ Public Participation Process Report – NJDEP Approval on 2/7/2019

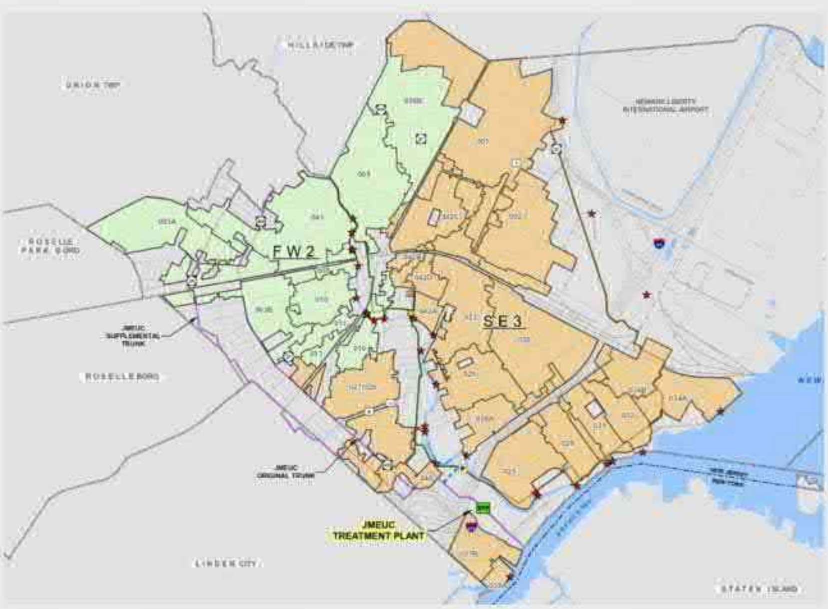
Step 2.

- Development and Evaluation of Alternatives – Due on 7/1/2019

Step 3.

- Selection and Implementation of Alternatives Report
- Final LTCP – Due on 6/1/2020

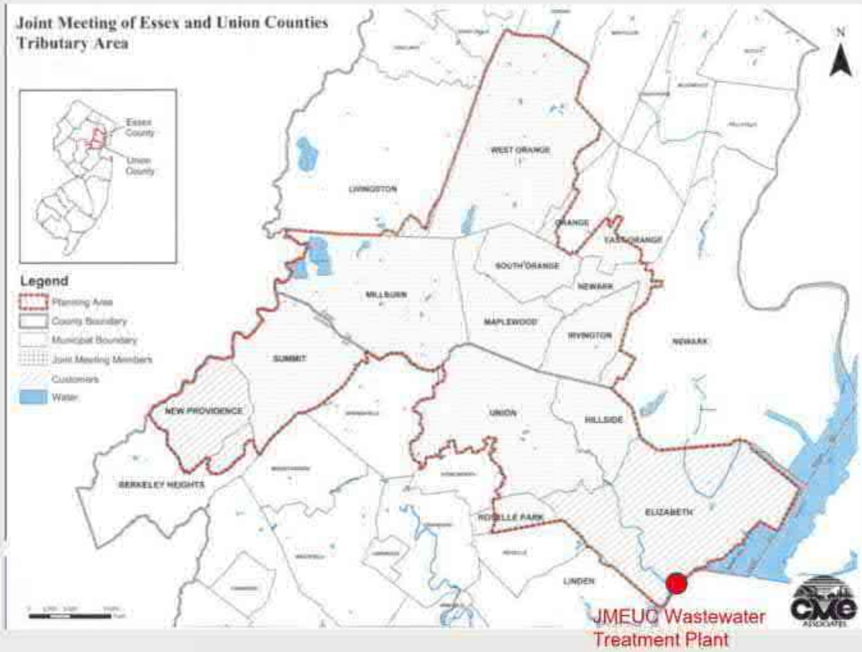
Elizabeth Combined Sewer System



- 29 outfalls
- 3,500 acres
- 166 miles of combined sewers
- Complex network of interconnections
- 14.7 Mgal/day average flow at Trenton Ave Pump Station
- Roselle Park storm sewer connection

JMEUC Tributary Area

- 11 member communities, 4 customer communities
- Total Service Area = 60 square miles
- Gravity sewers ranging from 10-inches in diameter to the twin 67 x 68-inch rectangular sewers at WWTP
- WWTP capacity:
  - Design flow = 85 mgd
  - Maximum capacity varies with tidal conditions: up to 225 mgd



Existing Conditions – CSO Performance

Typical Year (i.e., Annual Average) Highlights

1,065 million gallons/yr total CSO Overflow

- 48.4” total rainfall
- 56 overflow events/yr
- 145 million gallons – largest event overflow volume system-wide
- 19.4 million gallons – average event overflow volume system-wide
- 48 million gallon/day – average peak discharge per outfall (190 max)

CSO Program Objectives

Primary CSO Control Goal = Pathogen and CSO volume reduction

Water Body	Class	Designated Uses
▪ Newark Bay ▪ Arthur Kill ▪ Elizabeth River, south Broad St. bridge	Saline Estuary SE3	1. Secondary contact recreation; 2. Maintenance and migration of fish populations; 3. Maintenance of wildlife; 4. Any other reasonable use
▪ Elizabeth River, north of Broad St. bridge	Freshwaters FW2-NT	1. Primary contact recreation; 2. Maintenance, migration and propagation of the natural and established biota; 3. Industrial and agricultural water supply; 4. Public potable water supply after conventional filtration treatment

- What impact do CSO have on water quality?
- Preliminary indications from water quality modeling

CSO Control Goals and Approaches

Selection of CSO Control Approach

- Use either Presumption or Demonstration Approach for alternatives evaluation
  - **Presumption Approach** (performance based)
    - No more than 4 to 6 overflows per year
    - No less than 85% capture of annual overflow volume
  - **Demonstration Approach** (water quality based)
    - Use receiving water model to identify control level needed to meet WQ-based requirements shown on previous slide
- Evaluate broad range of control strategies to meet water quality standards
  - Range of CSO control levels studied: 0, 4, 8, 12, 20 overflows/year
  - NJ CSO Group water quality modeling results will indicate which level of control is needed for each receiving waterbody

Sensitive Areas Consideration

Clarifications on Approval Letter

- "Identification of Sensitive Areas Report" submitted by NJ CSO Group
- Approval letter of April 8, 2019 indicates some outfalls discharge to potential habitat for Atlantic sturgeon and Shortnose sturgeon
  - Five (5) Elizabeth CSO outfalls to Newark Bay and Arthur Kill listed: 029A, 031A, 032A, 034A, and 037A.
- Understanding per subsequent discussions that NJDEP may agree that the possibility of migrating sturgeon does not require prioritization or increased level of control
  - NJ CSO Group writing letter requesting clarification for NJDEP response.
- **No prioritization of outfalls at this time.**

Future Baseline Conditions

City of Elizabeth

Future Population: Extrapolated US Census projection to Year 2050: 144,240 persons (City)

- Additional Population (from 2015 to 2050) = 15,532 persons
- Additional Base Sanitary Flow (for combined sewer areas) = 0.997 MGD

Current Construction and Planned Capital Projects

- Trumbull Street Stormwater Control Project (CSO Basin 039)
- South Street Flood Control Project (CSO Basin 022)
- Atlantic Street Stormwater Control Project (CSO Basin 038)
- Lincoln Avenue Storm Drainage Improvements Project (existing separated storm sewer)

Future Baseline Conditions

JMEUC

Separate sanitary sewer service area population projected to decrease by 2050:

- Existing Population (modeled 2017): 342,032 persons
- Future Population: Extrapolated US Census projection to Year 2050: 333,520 persons
- Projected decrease of -8,512 (-2.5%)
- Assume no change in population of this portion of service area

Future Baseline Conditions

Typical Year Model Simulations

Comparison to Existing Conditions

- Largest increase in future condition annual overflow volume at Outfall 041 (estimated increase of to 7.7 MG)
- 2050 baseline model accounts for planned projects / projects under construction
  - e.g. Atlantic Street CSO storage facility will decrease annual overflow volume at Outfall 038 by 8.6 MG

Parameter	Existing Baseline 2015	Future Baseline 2050	Change
Overflow Volume (MG/yr)	1068	1072	3.3 (+0.3%)
No. Events per year	55	55	No change
Overflow Duration (hrs)	645	655	10 (+1.6%)

CSO Control Goals and Approaches

Percent Capture Calculations

- Future conditions baseline model results, typical year:

Item	Elizabeth, TAPS	JMEUC Trunk (with upstream systems)
Total Wet Weather Flow (MG)	3,190	6,330
Wet Weather Flow Captured (MG)	2,118	5,258
CSO Volume (MG)	1,072	1,072
% Capture	66.4	83.1
Additional Volume Needed for 85% Capture (MG)	594	123

CSO Control Goals and Approaches

Percent Capture Calculations

- Control Level Comparison, future conditions baseline model
  - System-wide annual average performance
  - Estimated additional capture volume required and % capture

No. Events / Yr	Additional Capture Volume (MG)	% Capture, TAPS Inflow	% Capture, JMEUC Inflow
0	1,072	100.0	100.0
4	953	96.3	98.1
8	884	94.1	97.0
12	808	91.7	95.8
20	589	84.9	92.4

CSO Control Technologies Screening

Screening Process

Pathogen reduction and CSO volume reduction – primary considerations!

Practicality – impacts to surrounding community (aesthetic, traffic, visibility), level of CSO control relative to cost

Technical feasibility – based on current state of the practice, operational needs, environmental considerations

Existing practice? Continue implementation but considered primary CSO control alternative

Stand-alone alternative, or possible **combination** with other alternatives?

CSO Control Technologies Screening

Screening Process

3 Main Groupings

Source Control | Collection System | Storage and Treatment

Technology Groups

Practices

Rating on Primary CSO Control Goals

Bacteria Reduction | Volume Reduction

Implementation & Operation Factors

Consider Combining with Other Technologies?

Being Implemented?

Recommendation for Alternatives Evaluation

Notes

Summary of Screening Results

Source Control Technologies

Green Infrastructure		Green Roofs
		Blue Roofs
		Rainwater Harvesting
	✓	Permeable Pavements
	✓	Planter Boxes
	✓	Bioswales
	✓	Free-Form Rain Gardens
Stormwater Management		Street/Parking Lot Storage (Catch Basin Control)
		Catch Basin Modification (for Floatables Control)
		Catch Basin Modification (Leaching)
Public Education and Outreach		Water Conservation
		Catch Basin Stenciling
		Community Cleanup Programs
		Public Outreach Programs

Public Education and Outreach	FOG Program
	Garbage Disposal Restriction
	Pet Waste Management
	Lawn and Garden Maintenance
	Hazardous Waste Collection
Ordinance Enforcement	Construction Site Erosion & Sediment Control
	Illegal Dumping Control
	Pet Waste Control
	Litter Control
	Illicit Connection Control
Good Housekeeping	Street Sweeping/Flushing
	Leaf Collection
	Recycling Programs
	Storage/Loading/Unloading Areas
	Industrial Spill Control

Summary of Screening Results

Collection System Technologies

Operation and Maintenance	✓	I/I Reduction
		Advanced System Inspection & Maintenance
		Combined Sewer Flushing
		Catch Basin Cleaning
Combined Sewer Separation		Roof Leader Disconnection
		Sump Pump Disconnection
	✓	Combined Sewer Separation
Combined Sewer Optimization	✓	Additional Conveyance
	✓	Regulator Modifications
	✓	Outfall Consolidation/Relocation
	✓	Real Time Control

Summary of Screening Results

Collection System Technologies

Linear Storage		Pipeline
	✓	Tunnel
Point Storage	✓	Tank (Above or Below Ground)
		Industrial Discharge Detention
Treatment-WWTP	✓	Additional Treatment Capacity
	✓	Wet Weather Blending
Treatment-Industrial		Industrial Pretreatment Program

Treatment-CSO Facility		Vortex Separators
	✓	Screens and Trash Racks
		Netting
		Contaminant Booms
		Baffles
	✓	Disinfection & Satellite Treatment
	✓	High Rate Physical/Chemical Treatment
		High Rate Physical

Control Program Evaluation

Range of Alternatives

1. Complete Sewer Separation
2. Satellite Treatment at Individual Outfalls
3. Pump Station and Treatment Plant Expansion
4. Satellite Storage at Individual Outfalls
5. Tunnel Storage and Secondary Controls
6. Green Infrastructure
7. Infiltration / Inflow Reduction

Control Program Evaluation

Evaluation Approach

Description	• Description of alternative and overall analysis
Institutional	• Permitting requirements (waterfront development, flood hazard area, stormwater management, USACE, treatment works approval, Tidelands, Green Acres, local permits)
Implementability	• Site access, site ownership, land area available, environmental (groundwater, soil), compatibility with existing infrastructure
Public acceptance	• Construction disturbance, traffic, visibility, cultural/community resources
Performance Summary	• Modelling results – improvements in volume reduction
Cost Summary	• Capital, O&M, Net Present Worth

Basis of Cost Estimates

Cost Considerations and Assumptions

Construction Costs

- Includes contractor's overhead, profit, and general conditions
- October 2017 dollars, Engineering News Record Cost Index: 10817.
- Accuracy Range: -50% to +100%
- Estimate contingency of 50%

Other Project Costs

- Land and easement acquisition: $80/SF, or ~$3.5 million/acre
- Planning, permitting and design: 10%
- Legal and administrative expenses: 5%
- Construction phase engineering services: 10%

Operation and Maintenance Costs

- Annual costs for O&M labor, power (at $0.14/KW-hr), chemicals, and equipment overhauls
- Percent of construction costs for tanks, tunnels, and pump stations

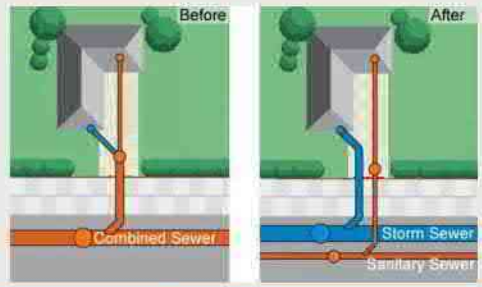
Net Present Value

- Annual interest rate of 2.75% per annum
- 20-year period
- Factor = 15.23 of annual costs

Control Program 1 – Complete Sewer Separation

Overview

- Construct new sanitary sewer system and convert existing combined sewer into a storm sewer
  - Apply to each CSO outfall basin (3,500 acres)
  - 100% CSO elimination/capture
    - Effectively remove City from being a CSO community
  - Separated areas transition to MS4 permitting
  - Requires over 100 miles of new sewers
    - Additional maintenance costs
  - Requires about 110 acres, 3.5 miles or 50 blocks to be addressed each year over 30 years
  - Requires private inflow/infiltration source control and separation



Benefits	Challenges
• Work remains in public right-of-way, no land acquisition required	• Highly disruptive to roads and traffic, affecting residents and businesses
• Opportunity for renewal of other utilities and reconstruction of roads	• Need to reconnect every sanitary service connection on each street
• Elimination of combined sewer outfalls	• Need for stormwater controls and treatment

Control Program 1 – Complete Sewer Separation

Cost Estimate Breakdown ($ million) DRAFT – Subject to Change

Control Level Overflows per year	0	4	8	12	20
Construction Cost ($M)	$996.0	-	-	-	-
Land/Easement Costs ($M)	$0.0	-	-	-	-
Other Project Costs ($M)	$249.0	-	-	-	-
Total Project Cost ($M)	*$1,245.0*	-	-	-	-
Annual O&M Costs ($M)	$10.0	-	-	-	-
20-Yr Present Value ($M)	$152.0	-	-	-	-
Total Present Value ($M)	**$1,397.0**	-	-	-	-
Overflow Volume Captured (MG)	1,072	-	-	-	-
Cost per Gallon Treated ($/gal)	$1.30	-	-	-	-

Control Program 1 – Complete Sewer Separation

Potential Future Stormwater Treatment Requirements

Unclear what treatment may be required for the separated stormwater discharge

- Urban stormwater runoff is a source of various pollutants of concern
- Current regulations require treatment if Land Use Permit from NJDEP is triggered (e.g., construction near waterfront)
- **Significant additional costs** may apply for end-of-pipe facilities to treat separated stormwater

Control Program 2 – Satellite Treatment at Individual Outfalls

Overview

- End-of-pipe treatment of CSO discharges
  - Apply to each CSO outfall; sizing for 28 locations; Outfalls 035A and 043A at same location
  - Significant siting challenges; very limited open and under-utilized sites available
    - Large sites required for storage tanks
    - Extensive land acquisition
  - Representative technologies used for analysis
    - Screening: ROMAG fine screens
    - Primary treatment: Actiflo ballasted flocculation, high rate clarification process
    - Disinfection: Peracetic Acid, 6-minute contact time
  - Intermediate low head pumping required for each satellite treatment facility
  - Treated flow returned to existing outfall

Control Program 2 – Satellite Treatment at Individual Outfalls

Systemwide Summary

DRAFT – Subject to Change

Control Level Overflows per year (equivalent)	0	4	8	12	20
Treatment Capacity (mgd)	1,338	1,186	980	980	472
Facility Footprint Area (acres)	11.2	10.2	8.96	8.96	5.77
Overflow Volume Treated (MG)	1,072	1,065	1,053	1,053	938
Reduction from 2015 Base (%)	100	99.4	98.2	98.2	87.5
Construction Cost ($M)	$653.3	$606.3	$540.0	$540.0	$370.7
Land/Easement Costs ($M)	$38.9	$35.7	$31.2	$31.2	$20.1
Other Project Costs ($M)	$173.0	$161.0	$143.0	$143.0	$98.0
Total Project Cost ($M)	*$865.2*	*$803.0*	*$714.2*	*$714.2*	*$488.8*
Annual O&M Costs ($M)	$6.4	$6.1	$5.7	$5.7	$4.6
20-Yr Present Value	$98.0	$93.0	$87.0	$87.0	$70.0
Total Present Value ($M)	***$963.2***	***$896.0***	***$801.2***	***$801.2***	***$558.8***
Cost per Gallon Treated ($/gal)	$0.90	$0.84	$0.76	$0.76	$0.60

Control Program 3 - Pump Station and Treatment Plant Expansion

Description

- Provide increase conveyance from Trenton Avenue Pump Station (TAPS) and WW treatment at JMEUC plant
  - Remove existing contractual limits on TAPS peak rates
  - Evaluate existing plant unit processes for additional treatment capacity
  - Upgrade TAPS for increased flows
  - Expand WW treatment and implement CSO-related operating protocol
- Control Program 3A - Interim plan for increase to 55 mgd
  - TAPS Upgrade
    - Replacement of 5 existing pumps for
    - Replacement of 2 existing mechanical bar screens
    - Modify screenings handling system
    - Add real time control system

Control Program 3 - Pump Station and Treatment Plant Expansion

Description

- Control Program 3A - Interim plan: Expand TAPS pumping to 55 mgd
  - Pump station control strategy developed to maintain current peak flow rates at WWTF
  - No trunk sewer or treatment plant modifications necessary
- Control Program 3B - Long-term plan: Expand TAPS pumping up to 140 mgd
  - CSO treatment train sized for up to 85 mgd flow with fine screens and chlorination/dechlorination facilities
  - Discharge CSO treatment train effluent at proposed new effluent pump station (blend with normal treatment train effluent for discharge to Arthur Kill in common outfall)
  - Estimated capital cost of new CSO treatment train (85 mgd): $16.3M

Control Program 3 - Pump Station and Treatment Plant Expansion

Cost Estimate Breakdown

Scenario No.	3A	3B
Construction Costs ($M)		
TAPS Upgrade	$7.2	$7.2
Treatment Plant Facility	$0.0	$16.3
Subtotal	$7.2	$23.5
Land/Easement Costs ($M)	$0.0	$0.0
Other Project Costs ($M)	$1.8	$5.9
Total Project Cost ($M)	*$9.0*	*$29.4*
Annual O&M Costs ($M)	$0.1	$0.5
20-Yr Present Value	$1.5	$7.6
Total Present Value ($M)	***$10.5***	***$37.0***
CSO Volume (MG)	893	851
Overflow Volume Captured (MG)	179	221
Cost per Gallon Treated ($/gal)	$0.06	$0.17

Reduces CSO volumes, equates to percent capture control level

- Scenario 3A: increase percent capture from 66.4% to 72.0% (based on TAPS inflow)
- Scenario 3B: increase percent capture from 66.4% to 73.3% (based on TAPS inflow)

Control Program 4 – Satellite Storage at Individual Outfalls

Overview

- Capture and hold overflow volumes until capacity is available in interceptor system
  - Apply to each CSO outfall; sizing for 28 locations; Outfalls 035A and 043A at same location
  - Significant siting challenges; very limited open and under-utilized sites available
    - Large sites required for storage tanks
    - Extensive land acquisition
  - 15-foot tank side water depths; additional areas for pump-back
  - Tank dewatering back to collection system by pumping
  - Increased wet weather pumping and treatment needed
    - Assume 65 MGD Trenton Avenue PS capacity

Control Program 4 – Satellite Storage at Individual Outfalls

Systemwide Summary

DRAFT – Subject to Change

Control Level Overflows per year	**0**	**4**	**8**	**12**	**20**
Construction Cost ($M)	*$817.0*	*$447.0*	*$343.0*	*$311.0*	*$213.0*
Satellite Storage Tanks	$793.3	$423.0	$319.5	$287.7	$189.4
Treatment Plant Facility	$16.3	$16.3	$16.3	$16.3	$16.3
TAPS Upgrade	$7.2	$7.2	$7.2	$7.2	$7.2
Land/Easement Costs ($M)	$88.9	$40.1	$28.6	$24.7	$15.0
Other Project Costs ($M)	$226.0	$122.0	$93.0	$84.0	$57.0
Total Project Cost ($M)	*$1,131.7*	*$608.6*	*$464.7*	*$420.0*	*$284.9*
Annual O&M Costs ($M)	$8.2	$4.5	$3.4	$3.1	$2.1
20-Yr Present Value	$125.0	$69.0	$52.0	$47.0	$32.0
Total Present Value ($M)	**$1,256.7**	**$677.6**	**$516.7**	**$467.0**	**$316.9**

Control Program 4 – Satellite Storage at Individual Outfalls

Systemwide Summary

DRAFT – Subject to Change

Control Level Overflows per year	0	4	8	12	20
Total Present Value ($M)	**$1,256.7**	**$677.6**	**$516.7**	**$467.0**	**$316.9**
Storage Volume Required (MG)	125	56.3	39.7	34.4	21
Total Tank Area (acres)	25.5	11.5	8.2	7.1	4.3
Overflow Volume Remaining (MG)	0	108	201	246	407
Overflow Volume Captured (MG)	1072	960	867	822	661
Reduction from 2050 Base (%)	100	89.6	80.9	76.7	61.7
Cost per Gallon Treated ($/gal)	$1.17	$0.71	$0.60	$0.57	$0.48

Control Program 5 - Tunnel Storage and Secondary Controls

Control Program Components

- Deep tunnel storage for 25 CSO outfalls
  - Consolidation piping and drop shafts for 7 outfall groups
- Satellite storage for Outfalls 001 and 002
- Sewer separation for Outfall 037
- Tunnel dewatering pump station
- Expanded wet weather treatment
- Increased pumping from existing Trenton Avenue PS

Control Program 5 - Tunnel Storage and Secondary Controls

Systemwide Summary

DRAFT – Subject to Change

Control Level Overflows per year	0	4	8	12	20
Total Storage Volume (MG)	*95.9*	*44.7*	*26.4*	*23.1*	*10.9*
Deep Tunnel Storage	78.8	37.8	22.8	19.7	9.4
Outfall 001 Tank	12.5	4.93	2.35	2.15	1.03
Outfall 002 Tank	4.67	1.96	1.21	1.21	0.50
Tunnel Diameter (ft)	26	18	14	11	9
Construction Cost ($M)	*$694.0*	*$527.0*	*$443.0*	*$401.0*	*$351.0*
Deep Tunnel Storage	$546.0	$433.0	$367.0	$326.0	$288.0
Treatment Plant Facility	$16.3	$16.3	$16.3	$16.3	$16.3
TAPS Upgrade	$7.2	$7.2	$7.2	$7.2	$7.2
Storage Tank Outfall 001	$69.9	$31.5	$17.3	$16.2	$9.7
Storage Tank Outfall 002	$30.1	$15.0	$10.8	$10.8	$5.3
Basin 037 Separation	$24.4	$24.4	$24.4	$24.4	$24.4

Control Program 5 - Tunnel Storage and Secondary Controls

Systemwide Summary

DRAFT – Subject to Change

Control Level Overflows per year	0	4	8	12	20
Land Required (acres)	*8.01*	*5.91*	*5.23*	*5.19*	*4.81*
Deep Tunnel Storage	4.50	4.50	4.50	4.50	4.50
Outfall 001 Tank	2.55	1.01	0.48	0.44	0.21
Outfall 002 Tank	0.96	0.40	0.25	0.25	0.10
Land/Easement Costs ($M)	$27.9	$20.6	$18.2	$18.1	$16.8
Other Project Costs ($M)	$180.0	$137.0	$115.0	$105.0	$92.0
Total Project Cost ($M)	*$901.9*	*$684.6*	*$576.2*	*$524.1*	*$459.8*
Annual O&M Costs ($M)	*$4.0*	*$3.0*	*$2.4*	*$2.2*	*$1.9*
20-Yr Present Value	$61.0	$46.0	$37.0	$34.0	$29.0
Total Present Value ($M)	***$962.9***	***$730.6***	***$613.2***	***$558.1***	***$488.8***
Overflow Volume Captured (MG)	1,072	960	867	822	661
Cost per Gallon Treated ($/gal)	$0.90	$0.76	$0.71	$0.68	$0.74

Control Program 6 - Green Stormwater Infrastructure (GSI)

Evaluation of Control Program

Provide storage or detention with GSI to contribute to meeting overflow requirements

- Range of implementation considered:
  - Direct 2.5%, 5%, 7.5% and 10% of runoff from impervious area within the combined sewer area to GSI
- For this stage, bioswales used as representative GSI unit in model
  - To be further refined if this alternative is selected
  - Cost estimate based on both bioswales and permeable pavement (most likely GSI for Elizabeth)

Kenah Field Park

Control Program 6 - Green Stormwater Infrastructure (GSI)

Evaluation of Control Program

1. Determine **total area** of CSS
2. Determine **total impervious area** within CSS
3. Determine **effective impervious area** in CSS (based on connectivity/CN)
4. **Model GSI** as bioswales for each control level to determine % runoff reduction
5. **Divide modeled GSI area** between bioswales and permeable pavement
6. Determine **number of units** of bioswales and acres of permeable pavement
7. **Cost estimate** based on acres of permeable pavement and # of bioswales

Control Program 6 - Green Stormwater Infrastructure (GSI)

Systemwide Summary

DRAFT – Subject to Change

% of Impervious Area Managed	2.50%	5%	7.50%	10%	15%
Total Area of GSI (ac)	3.54	6.91	10.39	13.82	20.73
Area of Bioswales (ac)	1.42	2.76	4.15	5.53	8.29
# of Bioswales	1028	2006	3016	4012	6019
Area of Permeable Pavement (ac)	7.96	15.54	23.37	31.09	46.63
Bioswale Cost ($M)	$51.40	$100.3	$150.8	$200.6	$301.0
Permeable Pavement Cost ($M)	$4.34	$8.47	$12.7	$16.9	$25.4
Construction cost ($M)	**$55.7**	**$108.8**	**$163.5**	**$217.5**	**$326.4**
Construction contingency ($M)	$27.9	$54.4	$81.8	$108.8	$163.2
Other contingencies ($M)	$13.9	$27.2	$40.9	$54.4	$81.6
Total Capital Cost ($M)	**$97.5**	**$190.4**	**$286.2**	**$380.7**	**$571.1**
O&M Cost per year ($M)	**$0.08**	**$0.15**	**$0.22**	**$0.29**	**$0.44**
Net Present Worth ($M)	***$98.7***	***$192.6***	***$289.5***	***$385.2***	***$577.8***
Cost per Gallon Treated ($/gal)	TBD	TBD	TBD	TBD	TBD

Control Program 7 - Inflow/Infiltration Reduction

Description and Analysis

- Reduction in JMEUC separate sanitary sewer area I/I rates/volumes evaluated as a CSO control option:
  - Existing trunk sewers and WWTF can capture and treat all flows during typical year (up to 55 mgd at TAPS)
  - Potential reduction in costs for CSO treatment train option at WWTF

- Extensive I/I reduction already achieved in JMEUC service area:
  - 30-40% reductions versus baseline 1983 I/I rates
  - Current I/I levels found to be low relative to other similar sewer systems

Control Program 7 - Inflow/Infiltration Reduction

Summary

- Incremental sewer system rehabilitation requirements, costs and benefits estimated to reach maximum achievable I/I reduction of 50% by volume:
  - CIPP lining of 1.5M feet of sewer main and 77,000 sewer laterals at a cost of $594M
  - Reduction in peak flow rate at WWTF of 22 mgd (modeled peak hour in typical year)
  - Cost to achieve ~25% reduction in CSO treatment train peak flow rate clearly not cost-effective

Control Program Evaluation

Comparison

DRAFT – Subject to Change

Total Present Values ($M)

Control Program	By Overflows per Year				
	0	4	8	12	20
1) Sewer Separation	$1,397.0	-	-	-	-
2) Satellite Treatment at Individual Outfalls	$963.2	$896.0	$801.2	$801.2	$558.8
4) Satellite Storage at Individual Outfalls	$1,256.7	$677.6	$516.7	$467.0	$316.9
5) Tunnel Storage and Secondary Controls	$962.9	$730.6	$613.2	$558.1	$488.8
	By % Impervious Area Managed				
	2.5%	5%	7.5%	10%	15%
6) Green Infrastructure	$98.7	$192.6	$289.5	$385.2	$577.8

Control Program Evaluation

Comparison DRAFT – Subject to Change

Total Present Value Cost per Gallon CSO Reduction

Control Program	By Overflows per Year				
	0	4	8	12	20
1) Sewer Separation	$1.30	-	-	-	-
2) Satellite Treatment at Individual Outfalls	$0.90	$0.84	$0.76	$0.76	$0.60
4) Satellite Storage at Individual Outfalls	$1.17	$0.71	$0.60	$0.57	$0.48
5) Tunnel Storage and Secondary Controls	$0.90	$0.76	$0.71	$0.68	$0.74
	By % Impervious Area Managed				
	2.5%	5%	7.5%	10%	15%
6) Green Infrastructure	TBD	TBD	TBD	TBD	TBD

Interactive Survey

- We would like your feedback:

Please go to www.pollev.com/mottmac355 on your smartphone

What are the most important priorities for the community related to wet weather?

- Address basement flooding
- Community greening (tree planting, green infrastructure, etc.)
- Community employment
- Affordability

How would your constituents feel about the acquisition of private property for siting CSO facilities?

- Acceptable
- Maybe, if considered the best CSO management strategy
- Maybe, if well-screened or incorporated into existing landscape/architecture
- Not in favor - disruption to community, displace residents, etc.

What factor would be most important to your constituents in forming a stormwater utility for financing of CSO controls?

Establish rates that are fair and equitable

Credits to rate-payers for reducing runoff through green infrastructure, etc.

Constituents would not be open to establishing a stormwater utility

Other

What would be the preference of your constituents in approach to siting CSO controls?

Centralized solution - longer-term disruption to streets, fewer locations

Satellite sites - smaller, shorter term disruption, several locations

LTCP Timeline

June 2019:
Finalize alternatives, draft report submission

End of June 2019:
Submit final report to NJDEP

July 2019 – June 2020:
Selection of Alternatives

Final Long Term Control Plan due June 2020

Next Supplemental CSO Team Meeting Fall 2019

Questions?

Thank you

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

Supplemental CSO Team

Meeting No. 8
Long-Term Control Plan Permit Compliance

Combined Sewer Overflow (CSO) Long Term Control Plan

City Council Presentation

City of Elizabeth
Union County, NJ

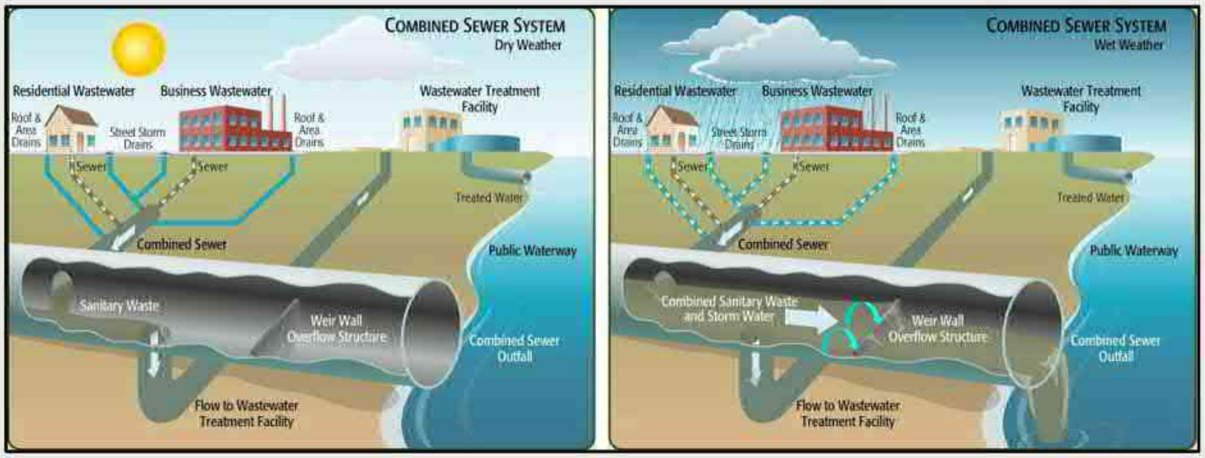
November 6, 2019 – 6:30 pm
Elizabeth City Hall
50 Winfield Scott Plaza, Elizabeth, NJ 07201

Program Background

- City of Elizabeth has a sanitary and stormwater collection system called a "Combined Sewer System."
- Outfalls from combined sewers are sources of water pollution when it rains.
- New Jersey Department of Environmental Protection (NJDEP) has issued permits requiring that this pollution be addressed.
- Regulatory Goal: Meet water quality-based requirements of federal Clean Water Act.
- Due to scale and costs of combined sewer overflow control programs, public participation and input is key factor.

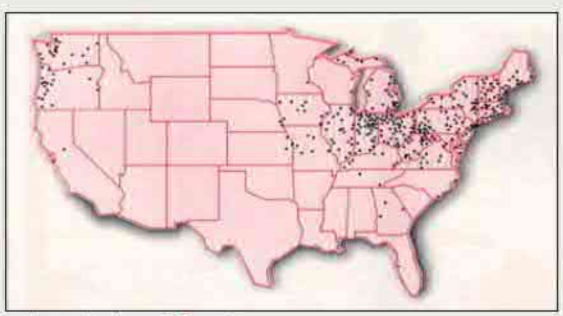
What is a Combined Sewer Overflow (CSO)?

- First type of sewers built, stormwater and sewage in one pipe
- Combined sewer overflow provides hydraulic relief during wet weather



Location of Combined Sewer System Communities

Across the United States and in NJ



- **USA:** Most combined sewer system communities located in Northeast and the Great Lakes regions (early municipal development locations)
  - 770 communities in 32 states and DC, with 9,350 outfalls
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Fort Lee (2)	Kearny (5)	Union (1)
Gloucester City (7)	Newark (18)	Weehawken (3)
Guttenberg (1)	North Bergen (1)	West New York (1)

Elizabeth Combined Sewer System

Combined Sewer System

- **29 outfalls**
  - Pipe size up to 120" by 120"
- Receiving waters:
  - Elizabeth River (21 outfalls)
  - Arthur Kill (4 outfalls)
  - Newark Bay & ditches (4 outfalls)
- 166 miles of sewers
- CSO area: 5.5 square miles
- Treatment at JMEUC Plant

Combined Sewer Overflow Existing Conditions Typical Year Performance

2004
NJDEP approved Typical Hydrologic Year

48.4"
Total rainfall depth in 2004 Typical Year

1.07
Billion gallons per year Total combined sewer overflow volume system-wide

190
Million gallon per day Maximum peak overflow rate from an outfall

73
Storm events in 2004 Typical Year with greater than 0.1" of rainfall

54
Total number of overflow events system-wide

145
Million gallons Total overflow volume system-wide for largest storm event

12
Hours Average overflow event duration

Regulatory Background

1994: US EPA issues *National CSO Control Policy*

1995: NJDEP regulates all CSO discharges under General Permit for combined sewer systems

2001-2005: City addresses Solids/Floatables Control Facilities and Nine Minimum Controls

2007: Initial System Characterizations & Cost and Performance Analysis Work for LTCP

2015: NJDEP issues Individual NJPDES permits

2020: LTCPs must be submitted to NJDEP

- Development of **Long Term Control Plans (LTCP)** per EPA National CSO Control Policy
- Regional coordination: JMEUC has sewage treatment plant, Elizabeth has combined sewer system
- Other permit conditions for system operation and maintenance and reporting
- 5-year permit cycle

Regulatory Requirements

What is a Long Term Control Plan (LTCP)?

- Comprehensive plan of **water quality** based control measures that are:
  - Technically feasible
  - Location and waterbody specific
  - Consistent with National CSO Control Policy
- Given scale of the combined sewer systems, control projects are typically extensive and costly

Many programs around the US are mandated under consent decrees, but New Jersey permits provide some flexibility in developing LTCPs

Water Quality Compliance Requirements

Primary CSO goals: pathogens and CSO volume reduction

- Upper Elizabeth River (FW2 waters)
  - Primary contact recreation so more stringent requirements
  - E. coli levels shall not exceed a geometric mean of **126/100 ml**; or a single sample maximum of **235/100 ml**
- Newark Bay, Arthur Kill, and Lower Elizabeth River (SE3 waters)
  - Secondary contact recreation (fishing, boating)
  - Fecal coliform levels shall not exceed a geometric mean of **1500/100 ml**

Control Approach Options for Permit Compliance

Option 1
Presumption Approach

a) Reduce number of overflows system-wide to no more than 4 per year
b) Capture no less than 85% of annual overflow volume
c) Remove pollutant mass equivalent to 85% volume capture

Option 2
Demonstration Approach

a) Show that control level will meet or not prevent attainment of water quality criteria
b) Uses water quality modeling data

- Evaluated range of control levels for demonstration approach (0, 4, 8, 12, and 20 overflows per year)
- Analysis based on 2004 precipitation record as typical year

Alternatives Evaluation

Control Programs Evaluated

- 1. Pump Station and Treatment Plant Expansion
- 2. Complete Sewer Separation
- 3. Satellite Storage Facilities
- 4. Tunnel Storage and Secondary Controls
- 5. Satellite CSO Treatment Facilities
- 6. Green Infrastructure
- 7. Infiltration / Inflow Reduction

Range of alternatives, different levels of control and combinations

Alternatives Evaluation

Siting Analysis for CSO Control Facilities

Preliminary assessment

- Reviewed area surrounding each outfall and regulator
- 86 initial sites identified

Sites reviewed with City for suitability

- Based on existing use, ownership, redevelopment plans, community disruption, open space / Green Acres, etc.
- Most sites rated as low and very low suitability
- Very limited open and under-utilized space; significant land acquisition likely required

Alternatives Evaluation

Pump Station and Treatment Plant Expansion

- Early action plan: Increase Trenton Ave Pump Station flow up to 55 mgd
  - Remove or revise existing contract limits on peak flow to Joint Meeting
  - Install control system to maintain current peak flow at Joint Meeting treatment plant (no plant modifications)
  - Upgrade pump station for reliable operation at higher flows
  - Estimated 20-year present worth: $10 million
- Long term alternative: Expand Pump Station and provide CSO treatment at Joint Meeting
  - Expand or construct new pump station for increased conveyance to Joint Meeting
  - Construct new CSO treatment facility at Joint Meeting for up to 85 mgd additional flow
  - Combine with normal treatment plant effluent for discharge to Arthur Kill in common outfall
  - May require new relief interceptor sewers
  - Estimated 20-year present worth : $101 million

Improvements to interceptors required to maximize flow to pump station. Extent of additional conveyance and treatment to be confirmed.

Alternatives Evaluation

Complete Sewer Separation

Install new sanitary sewer ⟶ Existing combined sewer becomes a storm sewer

- Work in public right-of-way, no new land required
- Opportunity for system renewal, reconstruction
- Highly disruptive
  - Over 100 miles of new sewers required
  - Need to redirect every service connection on each street
  - Over 30 year planning period, about 110 acres or 50 blocks each year
- Stormwater contributes to water pollution will eventually need to be treated or controlled

Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)
Sewer Separation	0 events/yr	$1,396

Alternatives Evaluation

Satellite Storage Facilities

- Redirect outfall to off-line underground storage tank (assume 15' deep)
- Flow stored up to tank volume, excess discharged as overflow
- Select tank volume for targeted level of control
- Tank dewatered to interceptor
- Additional interceptor capacity and TAPS pumping may also be required.

Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)	Acres of Land Required
Satellite Storage Facilities	0 events/yr	$1,306	25.5
	4 events/yr	$709.5	11.5
	8 events/yr	$541.3	8.1
	12 events/yr	$490.0	7.0
	20 events/yr	$332.2	4.3

Example: Westfield Ave at Grove St. (Outfall 003A) - ~1 acre parking lot, sufficient for 4 overflows but not 0 overflows

Example: Tank at Trumbull Street

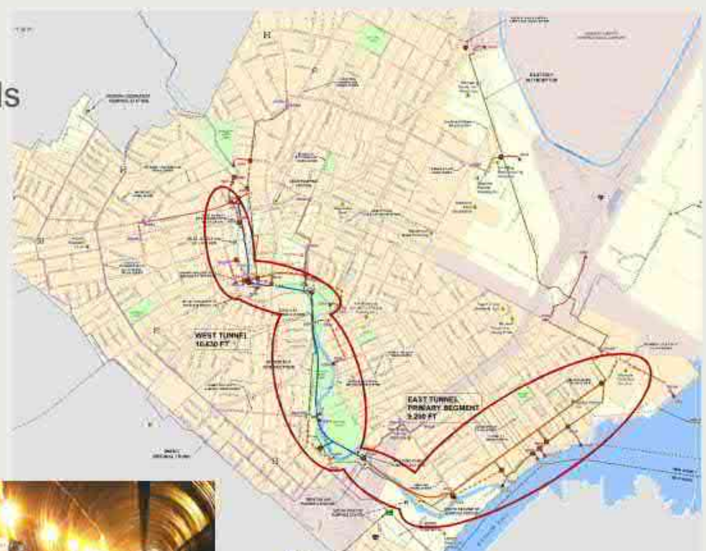
Alternatives Evaluation

Tunnel Storage and Secondary Controls

- Length: ~19,800 linear feet
- Multiple river crossings
- Launch & Drop shafts (smaller than tank sites)
- Dewatering pump station
- Diameter by control level

	Control Level (overflows/yr)				
Tunnel	**0**	**4**	**8**	**12**	**20**
Vol, Mgal	79	38	23	20	9.4
Dia, ft	26	18	14	11	9

Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)
Deep Tunnel Storage	0 events/yr	$962.9
	4 events/yr	$730.6
	8 events/yr	$613.2
	12 events/yr	$558.1
	20 events/yr	$488.8

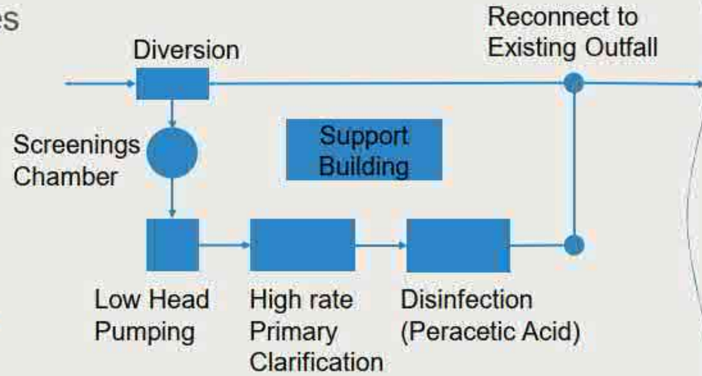


Example: Narragansett Bay Commission

Alternatives Evaluation

Satellite CSO Treatment Facilities

- Permit requirements for CSO discharge minimum treatment
  - Solids and floatables disposal
  - Primary clarification
  - Disinfection of effluent
- Considers disinfection with peracetic acid at 6 min contact time
- Pilot Testing Required



Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)
Satellite Treatment Facilities	0 events/yr	$963.2
	4 events/yr	$896.0
	8 events/yr	$801.2
	12 events/yr	$801.2
	20 events/yr	$558.8

Example: High-Rate CSO Treatment Facility in Bremerton, WA

Alternatives Evaluation

Green Infrastructure (GI)

- Reduces runoff volume or flow rate by allowing the rain water to infiltrate, be stored, or be treated by vegetation or soils
  - Assumed to be distributed throughout the City, consisting of bioswales or permeable pavement along roadways or at publicly owned land
- Site suitability identified as major issue
  - Soils with very low infiltration rates, provides minimal improvement on overflow performances
- Evaluated controlling 2.5% to 15% of City impervious area
  - Requires 1,000 to 6,000 bioswale installations (1.4 to 8.3 acres)
  - Excessive capital and maintenance costs and ineffective overflow reductions ($6.50 to $17.20 per gallon removed)
- Consider using GI where feasible to complement grey infrastructure controls

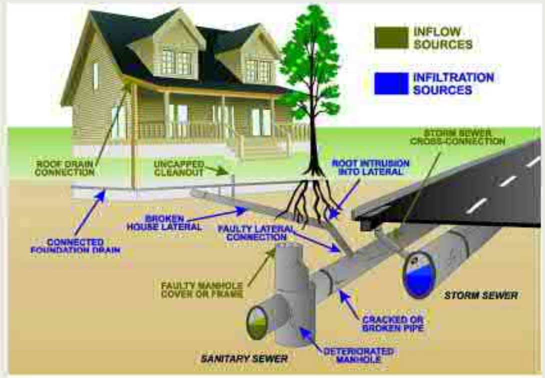
Bioswale Illustration

Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)
Green Infrastructure (% impervious area managed)	2.5%	$105.6
	5.0%	$206.2
	7.5%	$309.4
	10.0%	$412.4
	15.0%	$618.6

Alternatives Evaluation

Inflow/Infiltration (I/I) Reduction

- I/I reduction in Joint Meeting separate sanitary sewer areas evaluated as a CSO control program
  - Would reduce the wet weather flow at the treatment plant and make existing capacity available for additional flow from Elizabeth combined sewers
  - Current I/I levels reflect significant reductions over the past 30 years; found to be low relative or other similar sewer systems
  - $594M for 50% reduction from current I/I levels (maximum achievable level)
  - Minimal peak flow reduction at treatment plant
  - Cost prohibitive when compared with increased CSO treatment train capacity
- Joint Meeting to encourage continued I/I reduction, but I/I removal will not be relied on for CSO long term control plan



Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)
I/I Reduction	50% I/I volume reduction	$594.0

Cost Summary: Comparison of Alternatives

Total Present Worth ($ millions)

Control Program	By Overflows per Year				
	0	4	8	12	20
Complete Sewer Separation	$1,396.0	-	-	-	-
Satellite CSO Treatment Facilities	$963.2	$896.0	$801.2	$801.2	$558.8
Satellite Storage Facilities	$1,306.0	$709.5	$541.3	$490.0	$332.2
Tunnel Storage and Secondary Controls	$962.9	$730.6	$613.2	$558.1	$488.8
	55 mgd-Real Time Control		140 mgd-Real Time Control		
Pump Station and Treatment Plant Expansion (not sufficient on its own)	$10.2		$101.1		
	By % Impervious Area Managed				
Green Infrastructure (not sufficient on its own)	2.5%	5%	7.5%	10%	15%
	$105.6	$206.2	$309.4	$412.4	$618.6
	50% I/I volume reduction				
Inflow/Infiltration Reduction (JMEUC system-wide)	$594.0				

Note: GSI, additional conveyance, and I/I reduction are all partial solutions.

Cost Summary: Comparison of Alternatives

Total Present Value Cost per Gallon CSO Reduction

Control Program	By Overflows per Year				
	0	4	8	12	20
Complete Sewer Separation	$1.31	-	-	-	-
Satellite CSO Treatment Facilities	$0.90	$0.84	$0.76	$0.76	$0.58
Satellite Storage Facilities	$1.22	$0.74	$0.62	$0.60	$0.50
Tunnel Storage and Secondary Controls	$0.90	$0.73	$0.68	$0.66	$0.66
	55 mgd-Real Time Control		140 mgd-Real Time Control		
Pump Station and Treatment Plant Expansion (not sufficient on its own)	$0.06		$0.27		
	By % Impervious Area Managed				
Green Infrastructure (not sufficient on its own)	2.5%	5%	7.5%	10%	15%
	$6.52	$9.13	$11.63	$13.18	$17.18
	50% I/I volume reduction				
Inflow/Infiltration Reduction (JMEUC system-wide)	$594 M for 22 mgd of wet weather treatment				

Note: GSI, additional conveyance, and I/I reduction are all partial solutions.

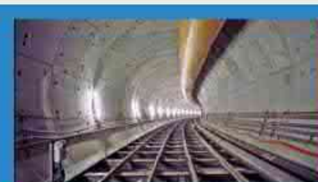
Pros and Cons of the Possible Primary Control Options

Storage Tanks

Pros:
- ✓ Less expensive for lower levels of control
- ✓ More flexibility for timing

Cons:
- ✗ More expensive for higher levels of control
- ✗ Will be very difficult to find the land for sites – space available, land acquisition (community impacts, cost, delays)
- ✗ Potential odor considerations

Storage Tunnel



Pros:
- ✓ Less expensive for higher levels of control
- ✓ Mainly subsurface - less land acquisition required, less disturbance to community
- ✓ Consolidates multiple outfalls to single location

Cons:
- ✗ More expensive for lower levels of control
- ✗ Less flexibility for timing

Public Participation

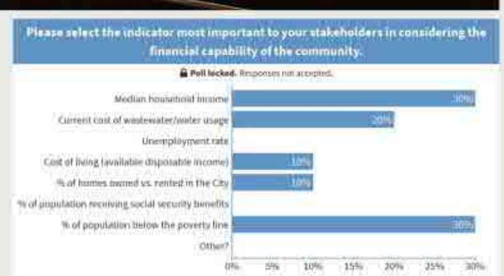
Outreach, education and feedback:

- Quarterly Supplemental CSO Team Meetings
  - Representatives from community, environmental, business, government, academia invited
  - Project progress and feedback through interactive surveys and Q&A
- Presence at Future City Environmental and Estuary Days (over 200 students each event)
- Hosted “Connecting with Stakeholders on Water Infrastructure” regional workshop
- Hosted NJDEP Public Participation Workshop
- Tree planting initiative

Public Participation

Next Steps

- Open Public Meetings
  - December/January and April/May
  - Obtain feedback on the selected CSO control program and obtain input on community concerns/priorities
- Continued education/outreach at community events
  - Future City Environmental Day
  - Groundwork Elizabeth – launch of Climate Safe Task Force



Timeline for Plan Selection

June 2019: Detailed evaluation of viable alternatives

Fall 2019: Review and select primary CSO control programs

March 2020: Finalize selected CSO control plan

June 1, 2020: Selection and Implementation Report due to NJDEP

Presentation to City Council and Open Public Meeting

Open Public Meeting

Questions?

Thank you

City of Elizabeth
Union County, NJ

City Council Presentation

Combined Sewer Overflow (CSO)
Long-Term Control Plan

Combined Sewer Overflow (CSO) Long Term Control Plan

Public Meeting No. 1
Supplemental CSO Team Meeting No. 9

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

January 23, 2020 – 7:00 pm
Elizabeth City Hall
50 Winfield Scott Plaza, Elizabeth, NJ 07201

Agenda

1. Introduction
2. Interactive survey setup
3. Background on combined sewer overflows
4. Regulatory requirements
5. Public participation process
6. Alternatives evaluation
7. Affordability factors
8. Next steps and schedule

Introduction

City of Elizabeth has a sanitary and stormwater collection system called a "Combined Sewer System."

Overflows from combined sewers are sources of water pollution when it rains.

New Jersey Department of Environmental Protection (NJDEP) has issued permits requiring that this pollution be addressed.

Regulatory Goal: Meet water quality-based requirements of federal Clean Water Act.

Due to scale and costs of combined sewer overflow control programs, public participation and input is key factor.

Interactive Survey

- Feedback from the community is an essential part of this process!
- Please feel free to ask questions or provide input at any time during the meeting
- An online survey will be used throughout the meeting to ask for input
- Surveys responses are anonymous with no personal information required, and responses will be shown in real-time on the presentation screen

Please go to www.pollev.com/mottmac355 on your smartphone

Which best describes you?

- Resident
- Business Owner/Industry Advocate
- Community/Environmental Advocate
- Government
- Other

Start the presentation to see live content. Still no live content? Install the app or get help at **PollEv.com/app**

What is your primary concern related to the sewer system?

- Polluted waterways
- Deteriorating sewer pipes
- Street flooding
- Rising sewer bills
- Other

Start the presentation to see live content. Still no live content? Install the app or get help at **PollEv.com/app**

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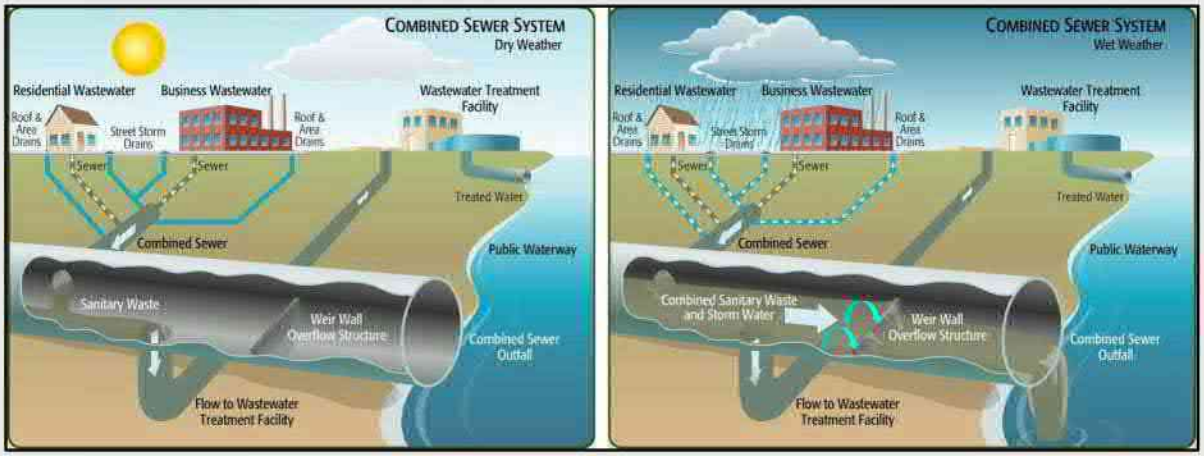

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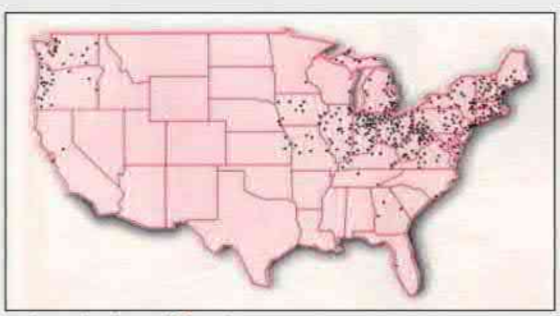

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Elizabeth Combined Sewer System

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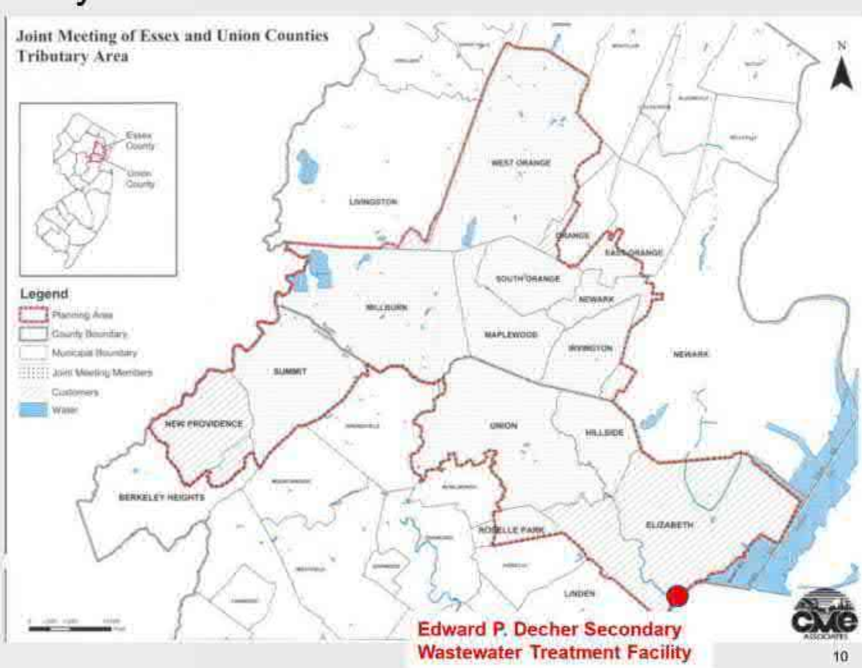
  - Arthur Kill (4 outfalls)
  - Newark Bay & ditches (4 outfalls)
- 166 miles of sewers
- CSO area: 5.5 square miles
- Treatment at JMEUC Plant

JMEUC Wastewater Conveyance and Treatment Facilities

- 11 member communities, 4 customer communities
- Total Service Area = 60 square miles
- Gravity sewers ranging from 10-inches in diameter to the twin 67 x 68-inch rectangular sewers at the WWTF
- WWTF capacity:
  - Design flow = 85 mgd
  - Maximum capacity varies with tidal conditions: up to 225 mgd



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Total number of overflow events system-wide

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Hours Average overflow event duration

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1995: NJDEP regulates all CSO discharges under General Permit for combined sewer systems

2001-2005: City addresses Solids/Floatables Control Facilities and Nine Minimum Controls

2007: Initial System Characterizations & Cost and Performance Analysis Work for LTCP

2015: NJDEP issues Individual NJPDES permits

2020: LTCPs must be submitted to NJDEP

- Development of **Long Term Control Plans (LTCP)** per EPA National CSO Control Policy
- Regional coordination: JMEUC has sewage treatment plant, Elizabeth has combined sewer system
- Other permit conditions for system operation and maintenance and reporting
- 5-year permit cycle

Regulatory Requirements

What is a Long Term Control Plan (LTCP)?

- Comprehensive plan of **water quality** based control measures that are:
  - Technically feasible
  - Location and waterbody specific
  - Consistent with National CSO Control Policy
- Given scale of the combined sewer systems, control projects are typically extensive and costly

Many programs around the US are mandated under consent decrees, but New Jersey permits provide some flexibility in developing LTCPs

Long term control plan submission and NJDEP review status

Step 1.	Step 2.	Step 3.
✓ System Characterization Report – NJDEP Approval on 1/17/2019	✓ Development and Evaluation of Alternatives Report – NJDEP Approval on 12/13/2019	Selection and Implementation of Alternatives Final LTCP – Due on 6/1/2020
✓ Baseline Compliance Monitoring Program Report – NJDEP Approval on 3/1/2019		
✓ Consideration of Sensitive Areas Report – NJDEP Approval on 4/8/2019		
✓ Public Participation Process Report – NJDEP Approval on 2/7/2019		

Public Outreach to-date

Outreach, education and feedback:

- Quarterly Supplemental CSO Team Meetings
  - Representatives from community, environmental, business, government, academia invited
  - Project progress and feedback through interactive surveys and Q&A
  - Members include:

Department of Engineering, Public Works and Facilities Management

Special Improvement District for Historic Midtown Elizabeth

Public Outreach to-date

Outreach, education and feedback:

- Presence at Future City Environmental and Estuary Days (over 200 students each event)
- Hosted “Connecting with Stakeholders on Water Infrastructure” regional workshop
- Hosted NJDEP Public Participation Workshop
- Tree planting initiative

Timeline for Plan Selection

June 2019:
Detailed evaluation of viable alternatives

Fall 2019:
Review and select primary CSO control programs

March 2020:
Finalize selected CSO control plan

June 1, 2020:
Selection and Implementation Report due to NJDEP

Presentation to City Council

Open Public Meeting

Open Public Meeting

How do CSOs Impact Water Quality?

Pathogens

Solids

Floatables

- High concentration
- From sanitary flow (about 10% of CSO flow)

- From stormwater flow (about 90% of CSO flow)
- Solids (litter, sediment, etc.)
- Floatables (bottles, cups, etc.)

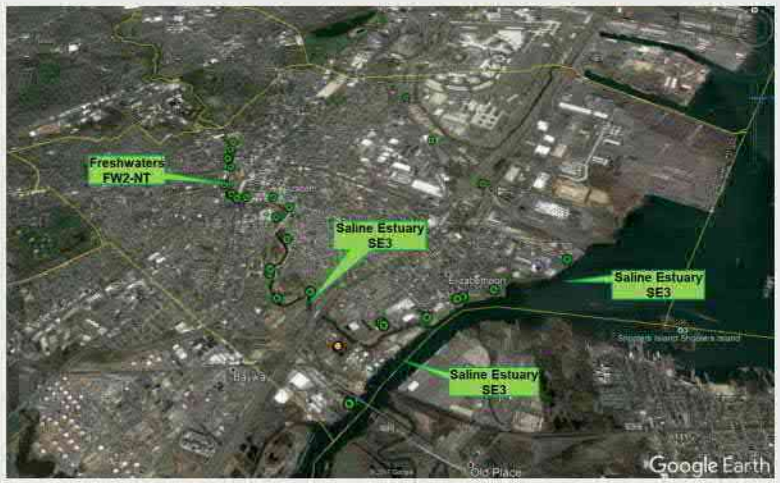
**CSO water quality does not include chemical, industrial waste, Superfund discharges, etc.

A complex water quality model has been developed with regional communities to determine the water quality characteristics of receiving waters.

Water Quality Compliance Requirements

Primary CSO goals: pathogens and CSO volume reduction

Receiving Water	# of Outfalls	Characterization	Meets WQ Req'ts?
Upper Elizabeth River	10	• FW2 • Primary contact (swimming, kayaking)	✗
Lower Elizabeth River	11	• SE3 • Secondary contact (boating, fishing)	✓
Arthur Kill	4	• SE3 • Secondary contact (boating, fishing)	✓
Newark Bay and ditches	4	• SE3 • Secondary contact (boating, fishing)	✓



Options to Demonstrate Water Quality Compliance

Option 1
Presumption Approach

- No more than 4 overflows per year
- Capture at least 85% of annual CSO volume or 85% pollutant volume removal

or

Option 2
Demonstration Approach

- Demonstrate that system meets water quality criteria through water quality modeling

→

A range of control levels has been evaluated:

- 0, 4, 8, 12, and 20 overflows in typical year
- 85% removal falls within this range

Do you think the water quality in the local waterways is:

Getting better

Staying the same

Getting worse

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

What would you like to see as the primary future use of local waterbodies?

Swimming

Fishing

Kayaking/Boating

Improved urban drainage

Public waterfront access (e.g. Riverwalk)

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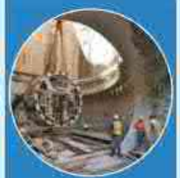
Alternatives Evaluation

Control Programs Evaluated

						
1. Pump Station and Treatment Plant Expansion	2. Complete Sewer Separation	3. Satellite Storage Facilities	4. Tunnel Storage and Secondary Controls	5. Satellite CSO Treatment Facilities	6. Green Infrastructure	7. Infiltration / Inflow Reduction

Range of alternatives, different levels of control and combinations

Alternatives Evaluation

Siting Analysis for CSO Control Facilities

Preliminary assessment

- Reviewed area surrounding each outfall and regulator
- 86 initial sites identified

Sites reviewed with City for suitability

- Based on existing use, ownership, redevelopment plans, community disruption, open space / Green Acres, etc.
- Most sites rated as low and very low suitability
- Very limited open and under-utilized space; significant land acquisition likely required

Which is your greatest concern in siting of CSO control facilities?

Size of required property

Private property acquisition / resident displacement

Traffic impacts

Odor / environmental issues

Losing green space

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

How do you feel about the acquisition of private property for siting CSO facilities?

Acceptable

Maybe, if considered the best CSO management strategy

Maybe, if well-screened or incorporated into existing landscape/architecture

Not in favor - disruptive to community, displace residents, etc.

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

Alternatives Evaluation

Pump Station and Treatment Plant Expansion

- Early action plan: Increase Trenton Ave Pump Station flow up to 55 mgd
  - Revise existing contract limits (36 MGD) on peak flow to Joint Meeting
  - Install control system to maintain current peak flow at Joint Meeting treatment plant (no plant modifications)
  - Upgrade pump station for reliable operation at higher flows
  - Estimated 20-year present worth: $10 million
- Long term alternative: Expand Pump Station and provide CSO treatment at Joint Meeting
  - Expand or construct new pump station for increased conveyance to Joint Meeting
  - Construct new CSO treatment facility at Joint Meeting for up to 85 mgd additional flow
  - Combine with normal treatment plant effluent for discharge to Arthur Kill in common outfall
  - May require new relief interceptor sewers
  - Estimated 20-year present worth: $101 million

Improvements to interceptors required to maximize flow to pump station. Extent of additional conveyance and treatment to be confirmed.

Alternatives Evaluation

Complete Sewer Separation

Install new sanitary sewer ⟶ Existing combined sewer becomes a storm sewer

- Work in public right-of-way, no new land required
- Opportunity for system renewal, reconstruction
- Highly disruptive
  - Over 100 miles of new sewers required
  - Need to redirect every service connection on each street
  - Over 30 year planning period, about 110 acres or 50 blocks each year
- Stormwater contributes to water pollution will eventually need to be treated or controlled

Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)
Sewer Separation	0 events/yr	$1,396

Alternatives Evaluation

Satellite Storage Facilities

- Redirect outfall to off-line underground storage tank (assume 15' deep)
- Flow stored up to tank volume, excess discharged as overflow
- Select tank volume for targeted level of control
- Tank dewatered to interceptor
- Additional interceptor capacity and TAPS pumping may also be required.

Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)	Acres of Land Required
Satellite Storage Facilities	0 events/yr	$1,306	25.5
	4 events/yr	$709.5	11.5
	8 events/yr	$541.3	8.1
	12 events/yr	$490.0	7.0
	20 events/yr	$332.2	4.3

Example: Westfield Ave at Grove St. (Outfall 003A) -
~1 acre parking lot, sufficient for 4 overflows but not 0 overflows

Example: Tank at Trumbull Street

Alternatives Evaluation

Tunnel Storage and Secondary Controls

- Length: ~19,800 linear feet
- Multiple river crossings
- Launch & Drop shafts (smaller than tank sites)
- Dewatering pump station
- Diameter by control level

	Control Level (overflows/yr)				
Tunnel	**0**	**4**	**8**	**12**	**20**
Vol, Mgal	79	38	23	20	9.4
Dia, ft	26	18	14	11	9

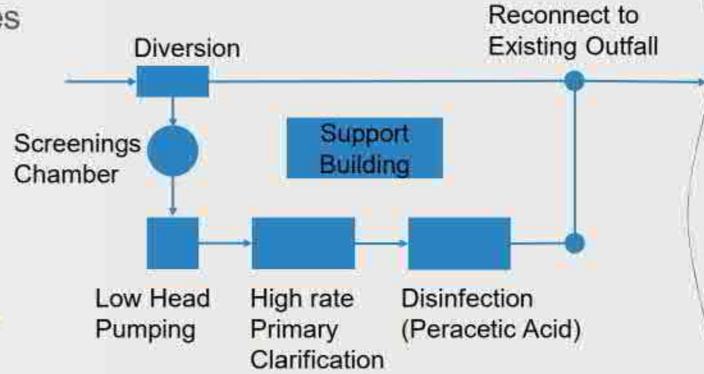
Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)
Deep Tunnel Storage	0 events/yr	$962.9
	4 events/yr	$730.6
	8 events/yr	$613.2
	12 events/yr	$558.1
	20 events/yr	$488.8

Example: Narragansett Bay Commission

Alternatives Evaluation

Satellite CSO Treatment Facilities

- Permit requirements for CSO discharge minimum treatment
  - Solids and floatables disposal
  - Primary clarification
  - Disinfection of effluent
- Considers disinfection with peracetic acid at 6 min contact time
- Pilot Testing Required



Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)
Satellite Treatment Facilities	0 events/yr	$963.2
	4 events/yr	$896.0
	8 events/yr	$801.2
	12 events/yr	$801.2
	20 events/yr	$558.8

Example: High-Rate CSO Treatment Facility in Bremerton, WA

Alternatives Evaluation

Green Infrastructure (GI)

- Reduces runoff volume or flow rate by allowing the rain water to infiltrate, be stored, or be treated by vegetation or soils
  - Assumed to be distributed throughout the City, consisting of bioswales or permeable pavement along roadways or at publicly owned land
- Site suitability identified as major issue
  - Soils with very low infiltration rates, provides minimal improvement on overflow performances
- Evaluated controlling 2.5% to 15% of City impervious area
  - Requires 1,000 to 6,000 bioswale installations (1.4 to 8.3 acres)
  - Excessive capital and maintenance costs and ineffective overflow reductions ($6.50 to $17.20 per gallon removed)
- Consider using GI where feasible to complement grey infrastructure controls

Bioswale Illustration

Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)
Green Infrastructure (% impervious area managed)	2.5%	$105.6
	5.0%	$206.2
	7.5%	$309.4
	10.0%	$412.4
	15.0%	$618.6

Alternatives Evaluation

Inflow/Infiltration (I/I) Reduction

- I/I reduction in Joint Meeting separate sanitary sewer areas evaluated as a CSO control program
  - Would reduce the wet weather flow at the treatment plant and make existing capacity available for additional flow from Elizabeth combined sewers
  - Current I/I levels reflect significant reductions over the past 30 years; found to be low relative or other similar sewer systems
  - $594M for 50% reduction from baseline (1983) I/I levels (maximum achievable level)
  - Minimal peak flow reduction at treatment plant
  - Cost prohibitive when compared with increased CSO treatment train capacity
- Joint Meeting to encourage continued I/I reduction, but I/I removal will not be relied on for CSO long term control plan

Control Alternative	Control Level or Extent of Implementation	20-Year Total Present Worth ($ Millions)
I/I Reduction	50% I/I volume reduction	$594.0

Cost Summary: Comparison of Alternatives

Total Present Worth ($ millions)

Control Program	By Overflows per Year				
	0	4	8	12	20
Complete Sewer Separation	$1,396.0	-	-	-	-
Satellite CSO Treatment Facilities	$963.2	$896.0	$801.2	$801.2	$558.8
Satellite Storage Facilities	$1,306.0	$709.5	$541.3	$490.0	$332.2
Tunnel Storage and Secondary Controls	$962.9	$730.6	$613.2	$558.1	$488.8
	55 mgd-Real Time Control		140 mgd-Real Time Control		
Pump Station and Treatment Plant Expansion (not sufficient on its own)	$10.2		$101.1		
	By % Impervious Area Managed				
Green Infrastructure (not sufficient on its own)	2.5%	5%	7.5%	10%	15%
	$105.6	$206.2	$309.4	$412.4	$618.6
	50% I/I volume reduction				
Inflow/Infiltration Reduction (JMEUC system-wide)	$594.0				

Note: GSI, additional conveyance, and I/I reduction are all partial solutions.

Cost Summary: Comparison of Alternatives

Total Present Value Cost per Gallon CSO Reduction

Control Program	By Overflows per Year: 0	4	8	12	20
Complete Sewer Separation	$1.31	-	-	-	-
Satellite CSO Treatment Facilities	$0.90	$0.84	$0.76	$0.76	$0.58
Satellite Storage Facilities	$1.22	$0.74	$0.62	$0.60	$0.50
Tunnel Storage and Secondary Controls	$0.90	$0.73	$0.68	$0.66	$0.66
	55 mgd-Real Time Control		140 mgd-Real Time Control		
Pump Station and Treatment Plant Expansion (not sufficient on its own)	$0.06		$0.27		
	By % Impervious Area Managed				
Green Infrastructure (not sufficient on its own)	2.5%	5%	7.5%	10%	15%
	$6.52	$9.13	$11.63	$13.18	$17.18
	50% I/I volume reduction				
Inflow/Infiltration Reduction (JMEUC system-wide)	$594 M for 22 mgd of wet weather treatment				

Note: GSI, additional conveyance, and I/I reduction are all partial solutions.

What is your primary consideration in selecting a preferred alternative?

Water quality improvements

Cost

Improved street drainage

Integrated green community spaces

Job creation potential

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

Keeping cost in mind, please select your preferred CSO control alternative:

- Pump station and treatment plant expansion
- Complete sewer separation
- Satellite storage facilities
- Tunnel storage and secondary controls
- Satellite CSO treatment facilities
- Green infrastructure
- Inflow/infiltration

Start the presentation to see live content. Still no live content? Install the app or get help at **PollEv.com/app**

Based on water quality benefit, please select your preferred CSO control alternative:

- Pump station and treatment plant expansion
- Complete sewer separation
- Satellite storage facilities
- Tunnel storage and secondary controls
- Satellite CSO treatment facilities
- Green infrastructure
- Inflow/infiltration

Start the presentation to see live content. Still no live content? Install the app or get help at **PollEv.com/app**

Long Term Control Plan Affordability

Regulatory Compliance Funded through Residential Sewer Bills

- EPA affordability criteria based on the community's:
- Total Sewer System Spending
  - Sanitary, combined, and stormwater
  - Current and proposed
- Residential Share (Average Cost per Household)
- Median Household Income
- **EPA High Financial Burden Criteria = 2% of Median Household Income**

Long Term Control Plan Affordability

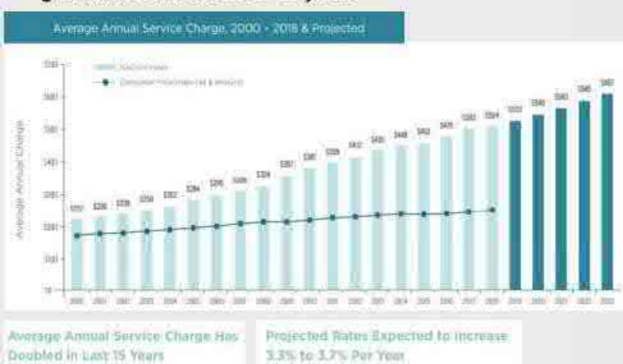
City of Elizabeth Preliminary Financial Estimates (DRAFT)

- Current sewer system costs
  approx. $30 million per year
  - Existing wastewater treatment costs, sewer staff and contract operations
  - Existing debt costs for previous capital investments
- Percent residential share:
  approx. 75% based on water consumption
- Number of households:
  approx. 40,390
- Current sewer cost per household (CPH)
  approx. **$560 per year**, or **$46.67 per month**
- Current median household income (MHI):
  approx. $47,000 per year
- Sewer costs per household / median household income:
  approx. **1.2%**

Long Term Control Plan Affordability

City of Elizabeth Preliminary Financial Estimates (DRAFT)

- Potential additional capital costs to reach EPA defined affordability criteria
  - Must consider sewer costs rising faster than income growth over next 20 to 30 years



Source: NACWA, 2018 Cost of Clean Water Index, https://www.nacwa.org/docs/default-source/news-publications/pub-5-index-1-web-final.pdf

- Financial model for differing cost and income inflation rates
- Estimated capital costs to reach EPA affordability criteria of 2% MHI (2019 $):
  - ~ **$95 to $145 million** over 20 to 30 years
- Projected cost per household in 20 yrs: $1,266 per year, or $106 per month
- Other considerations:
  - Current poverty rate: 18.4% (2018 Census estimate)
  - Cost burden on poorer households

What is a reasonable maximum monthly sewer bill?

$10-$30

$31-$50

$51-$70

$71-$90

over $90

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

How difficult would it be on your household if your sewer bill increased by $50 per month?

Very difficult

Difficult

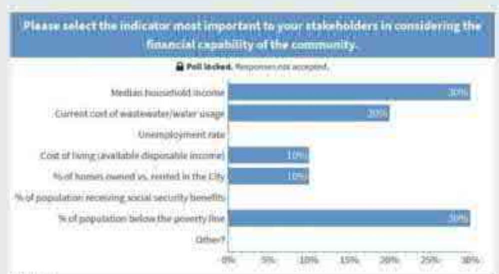
Manageable

Not an issue

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

Next Steps

- Balance CSO program scale and affordability
- Focus on development of the “Pump Station and Treatment Plant Expansion” alternative
- Conduct public meeting in April/May:
  - Obtain feedback on the selected CSO control program and input on community concerns/priorities
- Continue education/outreach at community events:
  - Climate-Ready Combined Sewer Overflow Solutions Forum – January 28 at 6pm, Elizabeth Public Library (main branch) – hosted by New Jersey Future
  - Future City Environmental Day
  - Groundwork Elizabeth – launch of Climate Safe Task Force
  - Partnering with EPA on CREAT water utility climate change risk assessment tool



Questions?

Thank you

Public Meeting No. 1
Supplemental CSO Team Meeting No. 9

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

Combined Sewer Overflow (CSO) Long Term Control Plan

Public Meeting No. 2
Supplemental CSO Team Meeting No. 10

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

August 26, 2020 – 6:30 pm
Virtual Meeting

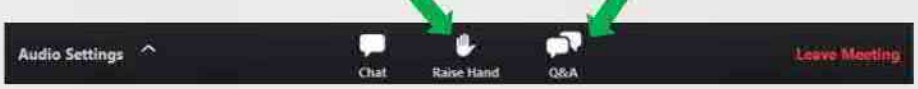
Zoom Instructions

- Attendees are muted by default at start of meeting
- Feedback from the community is an essential part of the LTCP process!
- Please feel free to ask questions or provide input at any time during the meeting
- Polling will be used throughout the meeting to ask for input (responses are anonymous)

Click "Raise hand" icon if you would like to be unmuted for discussion

If joining by phone, dial *9 to raise hand

Ask questions through the Q&A box



Agenda

1. Introduction
2. Background on combined sewer overflows
3. Regulatory requirements
4. Public participation process
5. Water quality considerations
6. Recommended CSO control plan
7. Costs and implementation schedule
8. Next steps and discussion

Polling Questions

Introduction

City of Elizabeth has a sanitary and stormwater collection system called a "Combined Sewer System."

Overflows from combined sewers (CSOs) are sources of water pollution when it rains.

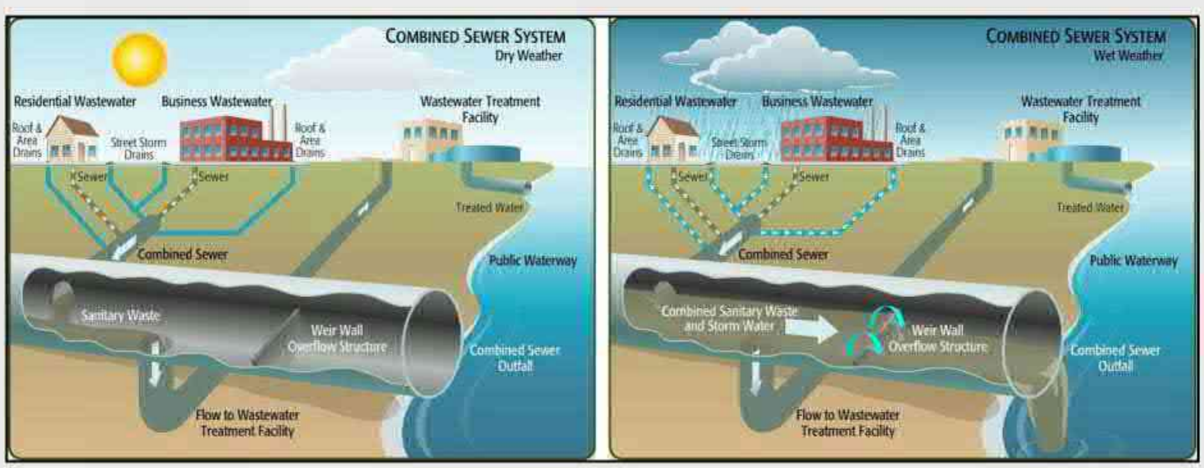
New Jersey Department of Environmental Protection (NJDEP) has issued permits requiring that this pollution be addressed.

Regulatory Goal: Meet water quality-based requirements of federal Clean Water Act.

Due to scale and costs of combined sewer overflow control programs, public participation and input is key factor.

What is a Combined Sewer Overflow (CSO)?

- First type of sewers built, stormwater and sewage in one pipe
- Combined sewer overflow provides hydraulic relief during wet weather



Source: hkywater.org

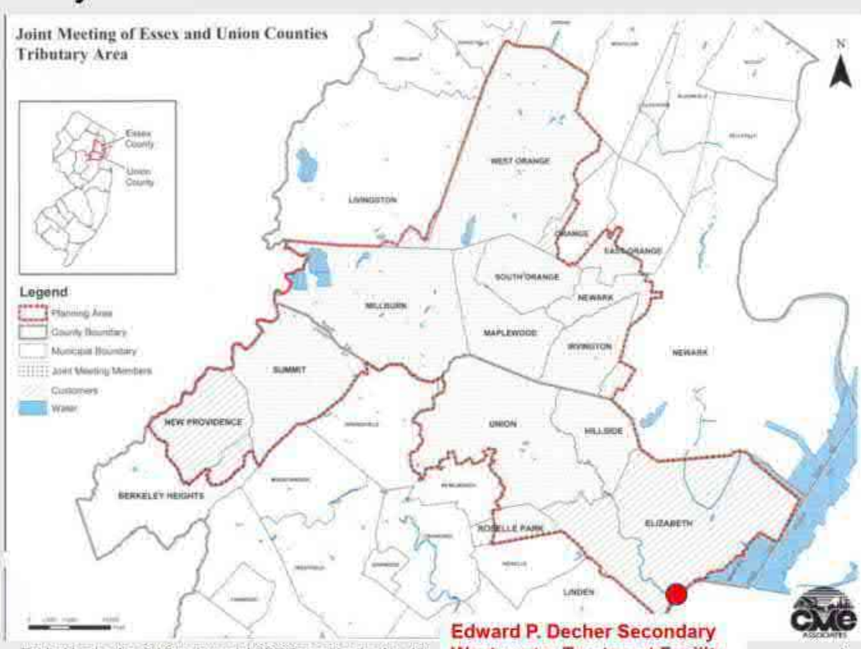
Elizabeth Combined Sewer System

Combined Sewer System

- **29 outfalls**
  - Pipe size up to 120" by 120"
- Receiving waters:
  - Elizabeth River (21 outfalls)
  - Arthur Kill (4 outfalls)
  - Newark Bay & ditches (4 outfalls)
- 166 miles of sewers
- CSO area: 5.5 square miles
- Treatment at JMEUC Plant

JMEUC Wastewater Conveyance and Treatment Facilities

- 11 member communities, 4 customer communities
- Total Service Area = 65 square miles
- Gravity sewers ranging from 10-inches in diameter to the twin 67 x 68-inch rectangular sewers at the WWTF
- WWTF capacity:
  - Design flow = 85 mgd
  - Maximum capacity varies with tidal conditions: up to 225 mgd



Combined Sewer Overflow Existing Conditions Typical Year Performance

2004
NJDEP approved Typical Hydrologic Year

48.4"
Total rainfall depth in 2004 Typical Year

866
Million gallons per year Total combined sewer overflow volume system-wide

190
Million gallon per day Maximum peak overflow rate from an outfall

73
Storm events in 2004 Typical Year with greater than 0.1" of rainfall

54
Total number of overflow events system-wide

145
Million gallons Total overflow volume system-wide for largest storm event

< 12
Hours Average overflow event duration

Regulatory Requirements

What is a Long Term Control Plan (LTCP)?

- Required under NJPDES permits issued by NJDEP for compliance with the Clean Water Act
- Comprehensive plan of water quality-based control measures that are:
  - Technically feasible
  - Location and waterbody specific
  - Consistent with National CSO Control Policy
- Regional coordination: JMEUC has sewage treatment plant, Elizabeth has combined sewer system
- Given scale of the combined sewer systems, control projects are typically extensive and costly

Many programs around the US are mandated under consent decrees, but New Jersey permits provide some flexibility in developing LTCPs

Public Outreach To-Date

- Supplemental CSO Team Meetings
  - Meeting quarterly since June 2017
  - Representatives from community, environmental, business, government, academia invited
  - Project progress updates
  - Feedback through interactive surveys and Q&A
  - Members include:

Department of Engineering, Public Works and Facilities Management

Special Improvement District for Historic Midtown Elizabeth

Project Schedule

Phase 1.

Supplemental CSO Team Meeting #1 – June 9 2017
Supplemental CSO Team Meeting #2 – October 11 2017
Supplemental CSO Team Meeting #3 – January 29 2018
Supplemental CSO Team Meeting #4 – June 5 2018

System Characterization Report
Baseline Compliance Monitoring Program Report
Consideration of Sensitive Areas Report
Public Participation Process Report
Submitted on July 1 2018

Phase 2.

Supplemental CSO Team Meeting #5 – October 26 2018
Supplemental CSO Team Meeting #6 – January 30 2019
Supplemental CSO Team Meeting #7 – April 11 2019
Supplemental CSO Team Meeting #8 – June 7 2019

Development and Evaluation of Alternatives Report
Submitted on July 1 2019

Phase 3.

City Council Meeting – November 6 2019

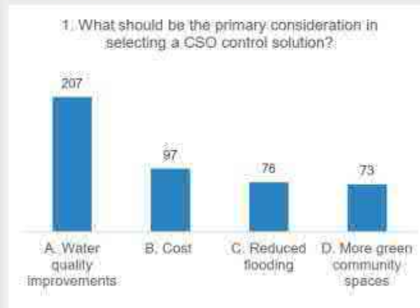
Public Meeting #1 – January 23 2020
Public Meeting #2 – August 26 2020

Selection and Implementation of Alternatives
Final LTCP – Due on October 1 2020

Public Outreach To-Date

Outreach, education and feedback:

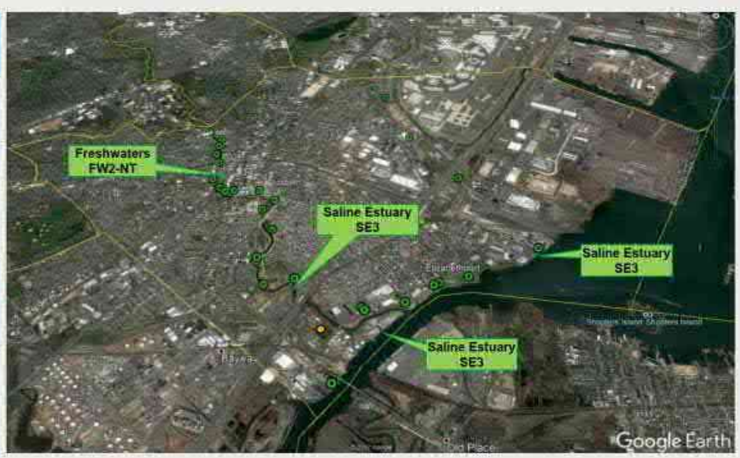
- Presented at Future City Environmental and Estuary Days (over 200 students each event)
  - Two presentations provided for remote event on May 1: CSO Basics & CSO Solutions
  - Included survey questions - over 450 responses received
- Hosted "Connecting with Stakeholders on Water Infrastructure" regional workshop
- Hosted "Climate-Ready Combined Sewer Overflow Solutions Forum" in January, organized by New Jersey Future
- Hosted NJDEP Public Participation Workshop
- Collaborated with Hudson River Foundation and EPA on CREAT water utility climate change risk assessment tool case study



Water Quality Compliance Requirements

Primary CSO goals: pathogens and CSO volume reduction

Receiving Water	# of Outfalls	Meets WQ Requirements? (based on model) Baseline Condition	With 100% CSO Control
Upper Elizabeth River	10	✗	✗
Lower Elizabeth River	11	✓	✓
Arthur Kill	4	✓	✓
Newark Bay and ditches	4	✓	✓



Consideration of Sensitive Areas

- No primary contact recreation observed or reported within the study area and no sensitive areas related to primary contact recreation identified.
- No Outstanding Natural Resource Waters, National Marine Sanctuaries, public drinking water intakes, or shellfish beds in the study area.
- Newark Bay and Arthur Kill considered potential habitat for Atlantic sturgeon and Shortnose sturgeon. However, species is currently stabilizing and sufficiently protected.
- **No outfall discharge area considered to be more critical or of greater concern than others**

Control Approach Selection

Presumption Approach Targeting 85 Percent Capture

Presumption Approach (performance based)	**Demonstration Approach** (water quality based)
• No more than 4 to 6 overflows per year, or • No less than 85 percent capture of wet weather volume annually	• Use receiving water model to identify control level needed to meet WQ-based requirements

SELECTED as best balance between water quality benefit and program affordability

Alternatives Evaluation

Control Programs Evaluated

Cost Summary: Comparison of Preliminary Alternatives

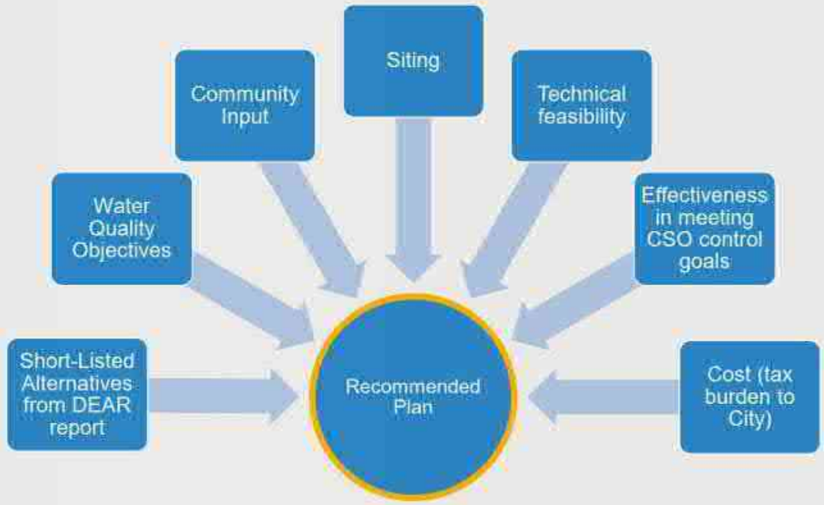
Total Present Worth ($ millions)

	By Overflows per Year				
Control Program	**0**	**4**	**8**	**12**	**20**
Complete Sewer Separation	$1,400	-	-	-	-
Satellite CSO Treatment Facilities	$963	$896	$801	$801	$559
Satellite Storage Facilities	$1,310	$710	$541	$490	$332
Tunnel Storage and Secondary Controls	$963	$731	$613	$558	$489
	Upgrade to Force Main Capacity		**Upgrade to Interceptor Capacity**		
Additional Conveyance and Treatment	$10.2		$101		
	By % Impervious Area Managed				
Green Infrastructure (not sufficient on its own)	**2.5%**	**5%**	**7.5%**	**10%**	**15%**
	$106	$206	$309	$412	$619
	50% I/I volume reduction				
Inflow/Infiltration Reduction (JMEUC system-wide)	$594				

Note: GSI, additional conveyance, and I/I reduction are all partial solutions.

Recommended Plan

Selection Process

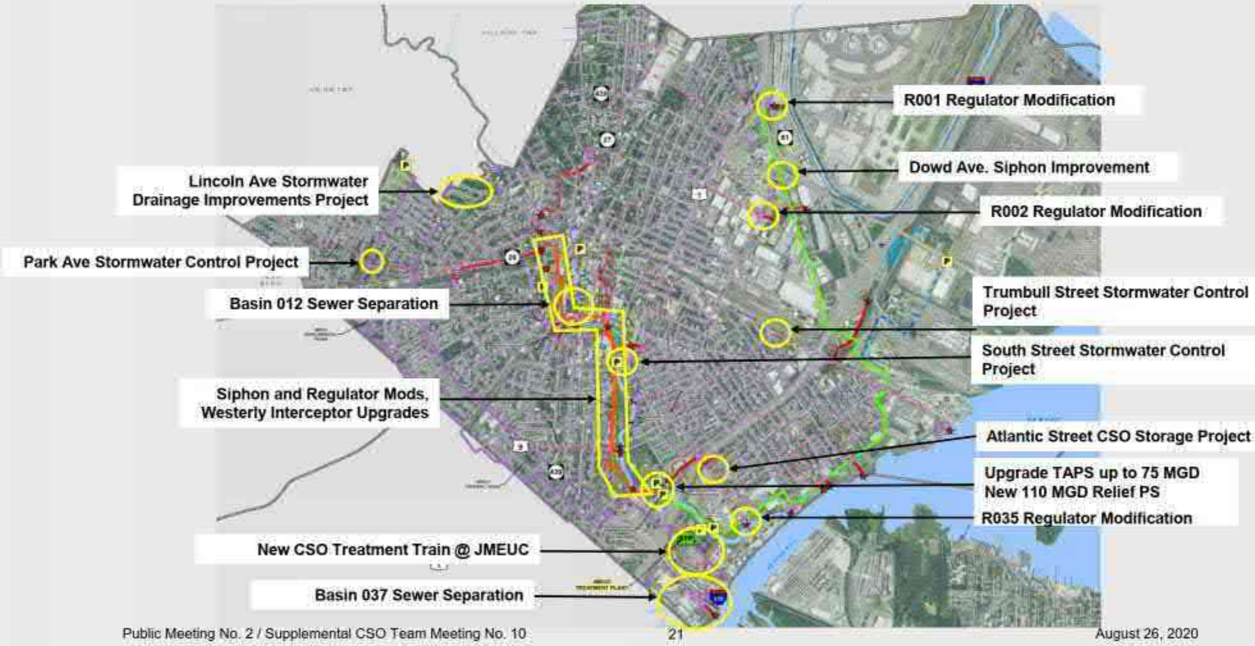


Recommended CSO Control Plan: Major Components

- Targeting 85% capture for Elizabeth system, achieves higher capture for entire system
- Applies a broad range of CSO control technologies
- Focus on increased conveyance and treatment

Storage	Conveyance	Treatment	Sewer Separation	Green Infrastructure
• Completion of approved projects (Trumbull St, Progress St, etc.)	• Upgrade Trenton Ave PS capacity up to 75 MGD • Siphon and regulator upgrades • Westerly Interceptor upgrades • New 110 MGD relief PS and force main	• New CSO Treatment Facility at JMEUC plant site	• Basins 012 and 037 to eliminate CSO outfalls	• Pilot program (not accounted for in % capture calcs, will provide additional CSO reduction)

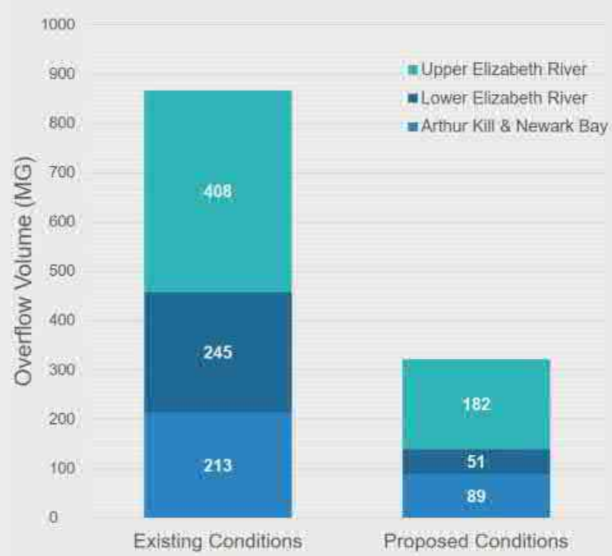
Locations of Recommended CSO Control Improvements



CSO Outfall Overflow Volumes – Existing vs. Proposed

- Approx. 545 MG reduction
- Note: Some outfalls have very large reductions, other less so
- Number of overflows remaining system-wide reduced, but not extensively
- Meets requirement to capture at least 85% CSO volume

	Overflow Volume (MG)	Elizabeth System – Percent Capture
Existing	866	58.3%
Future	322	85.1%



Recommended CSO Control Plan

Storage	Conveyance	Treatment	Sewer Separation	Green Infrastructure

Recently completed by the City:

- Progress Street Stormwater Control Project
- Trumbull Street Stormwater Control Project
- South Street Flood Control Project

Currently in progress:

- South Second Street Stormwater Control
- Atlantic Street CSO Storage Facility
- Lincoln Avenue Stormwater Drainage Improvements
- Park Avenue Stormwater Control

Recommended CSO Control Plan

Storage	Conveyance	Treatment	Sewer Separation	Green Infrastructure

- **Sending more flow to the treatment plant is the main strategy for CSO reduction**
- Phase 1 Trenton Avenue Pump Station
  - Increase peak flow from 36 mgd to 55 mgd to maximize capacity of existing facility
  - Installation of level sensors in North Trunk Sewer Barrel linked to TAPS pump controls with monitoring at JMEUC WWTF;
- Phase 2 Trenton Avenue Pump Station
  - Pump station upgrades to maximize flow through existing force main
  - Increase peak flow from Phase 1 level up to 75 mgd
  - Install inter-connection between North and South Interceptor Barrels to balance flows and hydraulic grade lines between the two barrels, to maximize flow to plant

Recommended CSO Control Plan

Storage | **Conveyance** | Treatment | Sewer Separation | Green Infrastructure

- New additional 110 MGD relief Pump Station at Trenton Avenue (total up to 185 MGD capacity)
- New force main to convey increased flow from pump station and interceptor upgrades to JMEUC treatment plant
- Easterly Interceptor upgrades (siphon and regulators)
- Westerly Interceptor upgrades (siphons, regulators, sewer upsizing)

Potential Pump Station Site Layout

Preliminary New Force Main Alignment

Recommended CSO Control Plan

Storage | Conveyance | **Treatment** | Sewer Separation | Green Infrastructure

New CSO Treatment Train at JMEUC WWTF Site

Two treatment alternatives evaluated:

1. Fine Screens with chlorine contact basin for disinfection.
2. Vortex Separators with chlorine contact within the vortex units (no separate basin required).
   - Both options include coarse screens ahead of primary solids removal, use sodium hypochlorite for disinfection and sodium bisulfate for dechlorination, and discharge effluent by blending with the normal WWTF effluent.
   - Both options provide sufficient pollutant removal for blended effluent to meet effluent quality requirements in NJPDES permit.

Treatment Alternative	Capital Cost ($M)	Present Worth Cost ($M)
Option 1	21	27
Option 2	29	34

Proposed Selection: Fine Screens (Option 1) – provides sufficient wet weather treatment to meet WWTF effluent quality requirements at lower cost.

- Proven technology with full-scale applications in service well over 10 years in Detroit
- Selected treatment approach to be re-evaluated later in implementation schedule to consider any new or emerging technology and other information available at that time.

Recommended CSO Control Plan

Storage | Conveyance | **Treatment** | Sewer Separation | Green Infrastructure

General Site Layout for New CSO Treatment Train at JMEUC WWTF

Recommended CSO Control Plan

Storage | Conveyance | Treatment | **Sewer Separation** | Green Infrastructure

Basin 012

- Eliminate CSO outfall by redirecting flows from storm inlets to an existing separate storm sewer outfall, and abandon an existing 8" sanitary sewer

Basin 037

- Eliminate CSO outfall by constructing 3,200 feet of new 12-inch and 15-inch sanitary sewers, parallel the existing combined sewers.

Recommended CSO Control Plan

Storage | Conveyance | Treatment | Sewer Separation | Green Infrastructure

Green Infrastructure Pilot Project

- Select 10 rain garden testing sites
- Monitor pilot sites for performance
- Report after first five years on construction, aesthetics, public education, performance, permitting requirements, and installation and maintenance costs.
- City to determine suitability for scaling up program with more green infrastructure.
- Note: Green infrastructure is not quantified in CSO LTCP volume reduction targets – however if pilot program is successful, it can be scaled up and incorporated into LTCP update

Benefits of Recommended Plan

Environmental

- Reduced CSO volume to receiving waterbodies, improved water quality

Community

- Community spaces and aesthetic benefits of green infrastructure

Reduced Localized Street Flooding

- Stormwater control projects

Technical Resilience

- Increased conveyance and treatment capacity in system
- Partial sewer separation

Recommended CSO Control Program Costs (DRAFT)

Project Name	Capital Cost (2020 $ in millions)
South Second Street Stormwater Control	$2.81
Lincoln Avenue Stormwater Drainage Improvements	$2.82
Trenton Avenue Pump Station - Phase 1 Upgrade	$0.610
Basin 012 Sewer Separation	$0.270
Atlantic Street CSO Storage Facility	$8.21
Park Avenue Stormwater Control	$8.58
Green Infrastructure Pilot Program	$1.28
Trenton Avenue Pump Station - Phase 2 Upgrade	$9.25
Basin 037 Sewer Separation	$4.59
Easterly Interceptor Upgrade	$2.53
New Wet Weather Pump Station Force Main to JMEUC	$11.9
New 110 MGD Wet Weather Pump Station	$41.4
New CSO WWTF	$20.9
Bridge Street Siphon Upgrade	$2.63
Palmer Street Branch Interceptor Upgrade	$4.28
Palmer Street Siphon Upgrade	$2.53
Lower Westerly Interceptor Improvements	$36.2
Pearl Street Branch Interceptor Upgrade	$5.48
Regulator Modifications (027/028 and 040)	$1.00
Upper Westerly Interceptor Improvements	$21.5
Morris Avenue Siphon Upgrade	$2.14
Total	**$191**

- Costs include planning, design, construction, admin and 25% contingency.

Long Term Control Plan Affordability

Regulatory Compliance Funded through Residential Sewer Bills

- EPA affordability criteria based on the community's:
- Total Sewer System Spending
  - Sanitary, combined, and stormwater
  - Current and proposed
- Residential Share (Average Cost per Household)
- Median Household Income
- **EPA High Financial Burden Criteria = 2% of Median Household Income**

Financial Assumptions

Overall financial assumptions/considerations:

- Existing operating expenses increase at 3.5% per year, new O&M increases at 2.75%
- Existing debt service escalation rate of 1.5%
- Construction cost inflation rate of 3.0%
- Annual income growth rate of 1.5%
- Also consider other factors affecting affordability e.g. poverty rate, burden on lower income households

Financing through low-interest State loans for wastewater projects

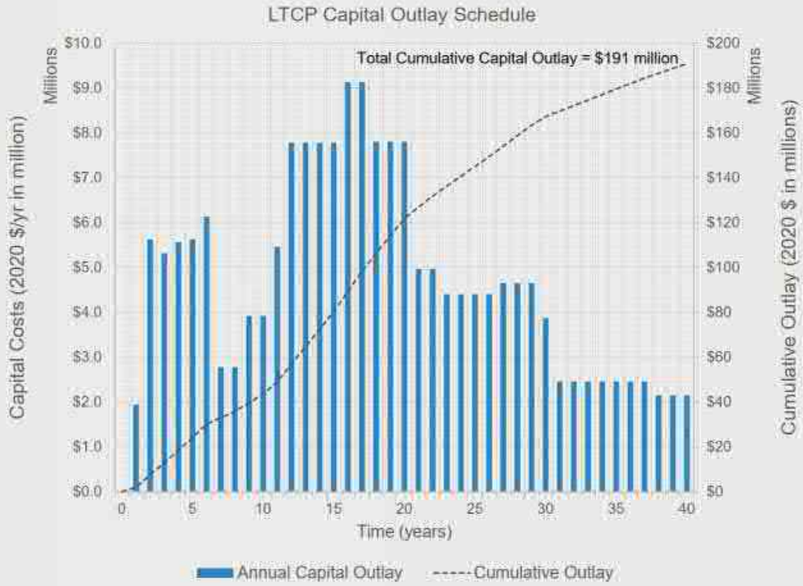
- Loan term of 20 years
- 25% at market rate and 75% at 0% rate

CSO LTCP total costs exceed the high financial burden threshold of 2% of MHI, therefore a longer implementation schedule of 40 years is proposed.

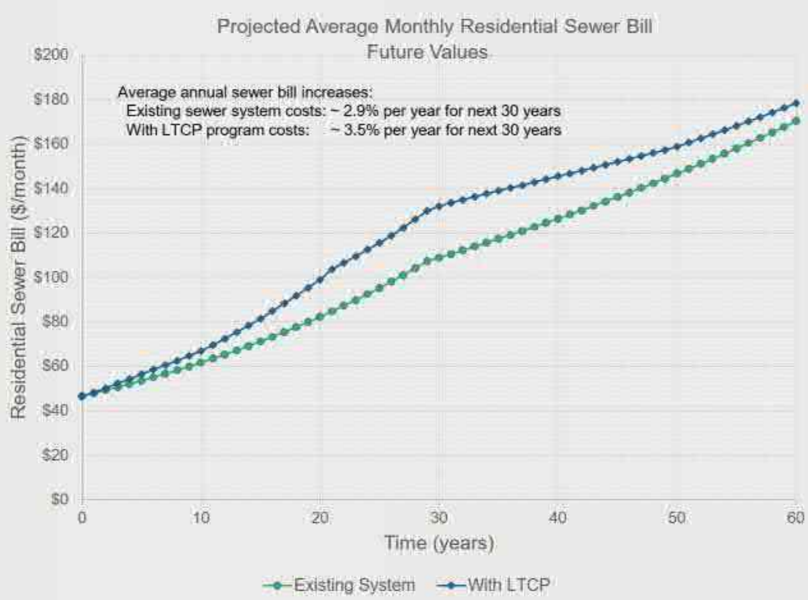
Project Implementation Schedule (DRAFT)

Project Name	Previously Completed	Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 21-25	Years 26-30	Years 31-35	Years 35-40
Progress Street Stormwater Control Project	■								
Trumbull Street Stormwater Control Project	■								
South Street Flood Control Project	■								
South Second Street Stormwater Control		■							
Lincoln Avenue Stormwater Drainage Improvements		■							
Trenton Avenue Pump Station - Phase 1 Upgrade		■							
Basin 012 Sewer Separation		■							
Atlantic Street CSO Storage Facility		■	■						
Park Avenue Stormwater Control		■	■						
Green Infrastructure Pilot Program		■	■						
Trenton Avenue Pump Station - Phase 2 Upgrade		■	■						
Basin 037 Sewer Separation		■	■						
Easterly Interceptor Upgrade			■						
New Wet Weather Pump Station Force Main to JMEUC			■	■	■				
New 110 MGD Wet Weather Pump Station				■	■				
New CSO WWTF				■	■				
Bridge Street Siphon Upgrade					■	■			
Palmer Street Branch Interceptor Upgrade					■	■			
Palmer Street Siphon Upgrade					■	■			
Lower Westerly Interceptor Improvements						■	■		
Pearl Street Branch Interceptor Upgrade						■	■		
R0278/028 Regulator Modifications							■		
R040 Regulator Modifications							■		
Upper Westerly Interceptor Improvements								■	■
Morris Avenue Siphon Upgrade								■	■

Proposed LTCP Spending Plan

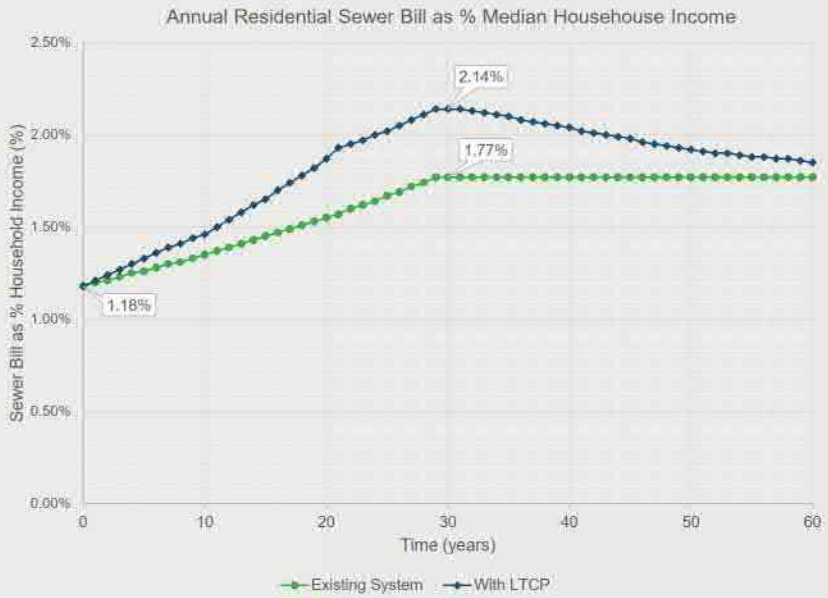


Average Residential Sewer Cost Impact

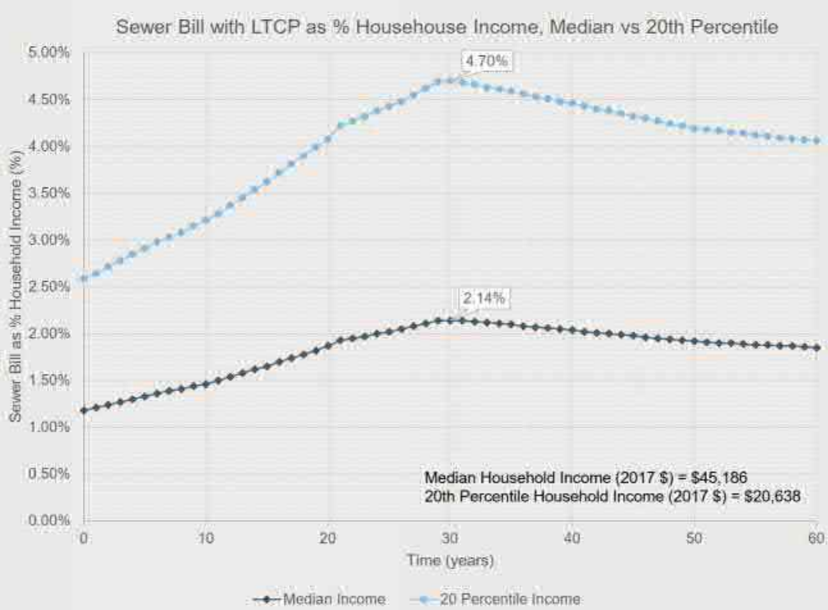


Average Residential Sewer Cost Impact, Relative to Median Household Income

- EPA High Financial Burden Criteria = 2% of Median Household Income

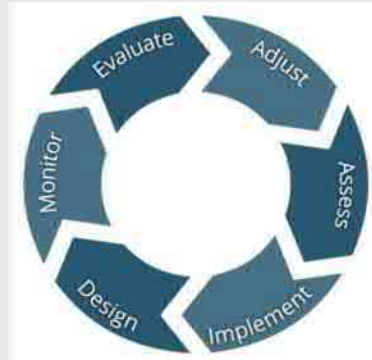


Impact on Lower Income Households



Adaptive Management

- Re-assess affordability throughout implementation schedule, based on emergent economic conditions beyond permittees' control
- Include provisions to re-evaluate, revise and/or reschedule CSO controls as appropriate to reflect new technologies, new conditions and potential new funding sources



Financial Impacts of COVID-19 Pandemic on LTCP Program

- The COVID-19 pandemic will likely impact affordability and implementation schedule for CSO LTCP projects
- Potentially reduced household incomes and sewer utility revenues.
- Preliminary FCA was based on 2019 financial info, which may no longer be accurate for the first 10 years of implementation.

CSO LTCP Schedule for Completion

July 2020:
Tentative selection of CSO control plan

August 2020:
Refine selected CSO control plan and regional coordination

September 2020:
Incorporate/address comments and finalize selected CSO control plan

October 2020:
Selection and Implementation Report due to NJDEP

Open Public Meeting

Early Sept: Review draft LTCP with NJDEP

October 1st: Submit LTCP to NJDEP

Polling Questions

Next Steps

- Refine CSO program implementation schedule to address affordability challenges
- Over the next two weeks, receive feedback on the recommended CSO control program and input on community concerns/priorities
- Refine CSO program to consider any input received

Thank you!
Questions / Comments?

A copy of this presentation as well as previously presented LTCP information can be found at : https://www.elizabethnj.org/182/CSO

If you have any further questions or would like to provide additional feedback, please contact:

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City Engineer
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Email: dloomis@elizabethnj.org

Anthony Gagliostro, PE
Mott MacDonald
Tel: 973-912-2442
Email: anthony.gagliostro@mottmac.com

Appendix A

Public Participation Materials

A.2 Public Outreach and Education Documents

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City Map (PDF)
Hazard Mitigation
CSO
Municipal Stormwater Plan (PDF)
Sewer Maps
Stormwater Ordinances
Stormwater Pollution Prevention Plan (PDF)
Tax Maps (PDF)
Tax Map Books

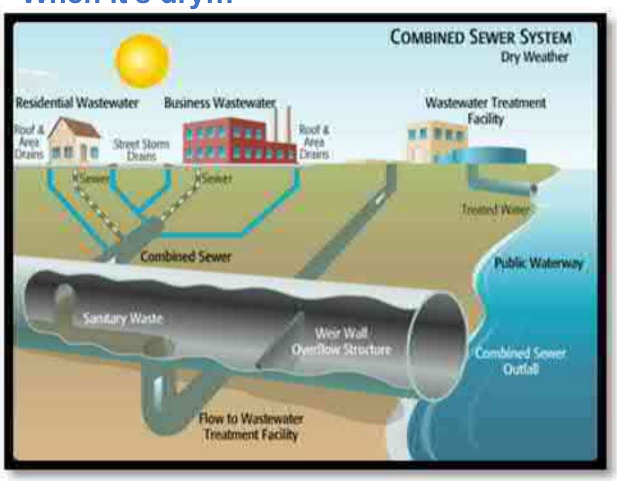
CSO

- 6-21-2016 Overall System Map (PDF)
- 06-09-2017 CSO Team Meeting One (PDF)
- 10-11-2017 CSO Team Meeting Two (PDF)
- 1-29-2018 CSO Team Meeting Three (PDF)
- 6-05-2018 CSO Team Meeting Four (PDF)
- 10-26-2018 CSO Team Meeting Five
- 1-30-2019 CSO Team Meeting Six
- 4-11-2019 CSO Team Meeting Seven
- 6-07-2019 CSO Team Meeting Eight
- 11-06-2019 CSO City Council Presentation No.1
- 1-23-2020 CSO Public Meeting No.1
- SupplementalTeam_Part1_CSOBasicsV2 (Preliminary) (5.08.20)
- SupplementalTeam_Part2_CSOSolutionsV2 (Preliminary) (5.08.20)
- CSO LTCP Public Meeting Notice-2020-08-26
- 8-26-2020 CSO Public Meeting No. 2
- ASSESSING COMBINED SEWER SYSTEMS VULNERABILITY TO SEA LEVEL RISE

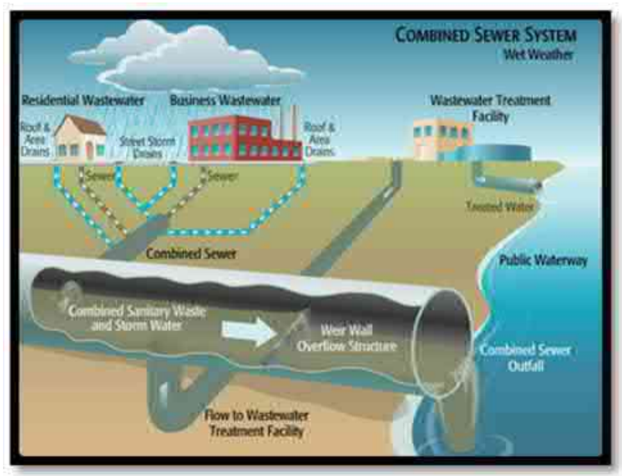
Did you know that the City of Elizabeth, like many older urban areas, has a Combined Sewer System that discharges into local waters during heavy rainfall?

Combined Sewer Systems (CSS) are typically located in older urban areas and were constructed to provide for the transportation of sanitary sewage, industrial discharges and stormwater within the same pipe. The combined sewer system in the City of Elizabeth is designed to transport all sewage flows and some wet weather flows for treatment at the Joint Meeting of Essex & Union Counties (JMEUC) Wastewater Treatment Plant. The system is also designed to discharge excess flows from the CSS as a Combined Sewer Overflow (CSO) discharge into the adjacent waterways. The City of Elizabeth has 29 combined sewer outfalls, which discharge to the Elizabeth River, Arthur Kill and Newark Bay. The wastewater treatment systems have limited capacity, and if CSSs were not permitted to overflow, the community would flood. The City of Elizabeth is working with the New Jersey Department of Environmental Protection (NJDEP) and the US Environmental Protection Agency (EPA) to reduce the number of CSO events that take place every year to improve water quality in Elizabeth's receiving streams.

When it's dry…



When it's wet…



What can you do to help? SLOW the FLOW

As a community and as an individual you can help reduce the amount of water that enters the CSS. In the past, homeowners have attempted to divert stormwater off their property as quickly as possible. This has resulted in flows in the combined sewer system that can exceed the treatment plant's capacity.

By taking a few simple and inexpensive steps, such as using rain barrels and planting rain gardens, you can hold some of the rainwater on your property during the storm. The water you retain can be used on your property for watering plants or released to the sewer system gradually during dry weather.

The Clean Water Act Establishes Water Quality Requirements

The Clean Water Act established the goal of making all rivers fishable and swimmable. The Act established water quality criteria for receiving waters as well as a permit system regulating discharges. The Clean Water Act was primarily directed at upgrading wastewater treatment plants. New treatment plants and upgrades to existing plants helped, but it was not enough. In 1995, all Combined Sewer Overflow (CSO) discharges were also brought into the discharge permit system under the General New Jersey Pollutant Discharge Elimination System (NJPDES) Permit for Combined Sewer Systems. The purpose of the permit was to reduce the pollutant loadings of CSOs on the receiving waters.

The City of Elizabeth has been evaluating options to meet the requirements of the permit. Members of the community have been providing feedback and input into the planning process. More information will be provided as the plans are finalized.

For more information on the City of Elizabeth's CSO Long Term Control Plan, contact
dloomis@elizabethnj.org

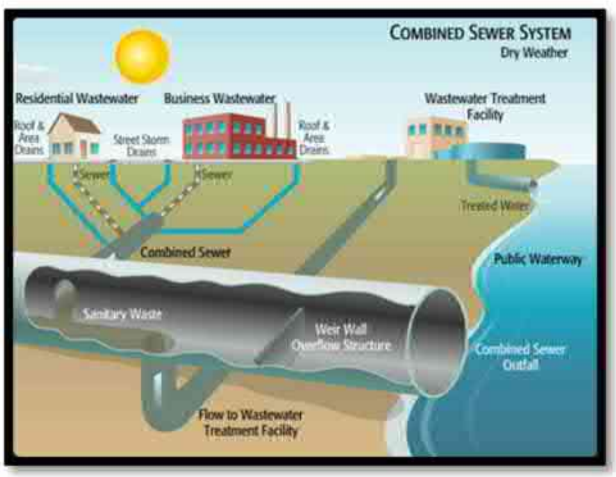
Ciudad de Elizabeth

El futuro de nuestros canales

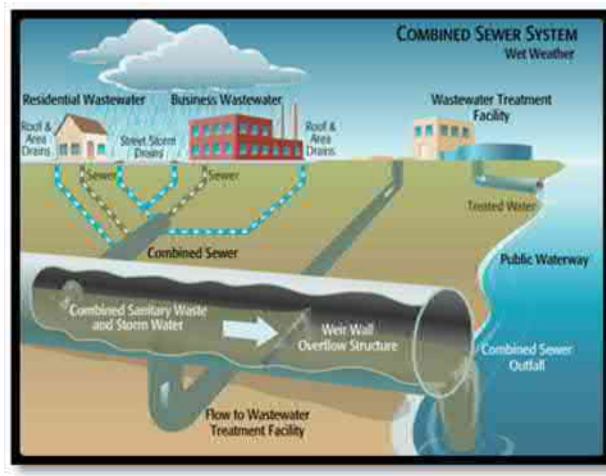
¿Sabía que la ciudad de Elizabeth, como muchas áreas urbanas más antiguas, tiene un sistema combinado de alcantarillado que se descarga en las aguas locales durante las fuertes lluvias?

Los sistemas combinados de alcantarillado (CSS) generalmente se encuentran en áreas urbanas más antiguas y se construyeron para proporcionar el transporte de aguas residuales sanitarias, descargas industriales y aguas pluviales dentro de la misma tubería. El sistema de alcantarillado combinado en la Ciudad de Elizabeth está diseñado para transportar todos los flujos de aguas residuales y algunos flujos de clima húmedo para su tratamiento en la Reunión Conjunta de la Planta de Tratamiento de Aguas Residuales de los Condados de Essex y Union (JMEUC). El sistema también está diseñado para descargar flujos excesivos del CSS como una descarga combinada de desagüe de alcantarillado (CSO) en las vías fluviales adyacentes. La ciudad de Elizabeth tiene 29 desagües de alcantarillado combinados, que desembocan en el río Elizabeth, Arthur Kill y Newark Bay. Los sistemas de tratamiento de aguas residuales tienen una capacidad limitada, y si no se permitiera que los CSS se desbordaran, la comunidad se inundaría. La Ciudad de Elizabeth está trabajando con el Departamento de Protección Ambiental de Nueva Jersey (NJDEP) y la Agencia de Protección Ambiental de EE. UU. (EPA) para reducir la cantidad de eventos de OSC que tienen lugar cada año para mejorar la calidad del agua en las corrientes receptoras de Elizabeth.

Cuando esta seco …



Cuando esta mojado...



¿Qué puedes hacer para ayudar?
LENTO el FLUJO

Como comunidad y como individuo, puede ayudar a reducir la cantidad de agua que ingresa al CSS. En el pasado, los propietarios intentaron desviar el agua de lluvia de su propiedad lo más rápido posible. Esto ha dado como resultado flujos en el sistema de alcantarillado combinado que pueden exceder la capacidad de la planta de tratamiento.

Al tomar algunos pasos simples y económicos, como usar barriles de lluvia y plantar jardines de lluvia, puede retener parte del agua de lluvia en su propiedad durante la tormenta. El agua que retiene puede usarse en su propiedad para regar plantas o liberarse al sistema de alcantarillado gradualmente durante el clima seco.

La Ley de Agua Limpia establece los requisitos de calidad del agua

La Ley de Agua Limpia estableció el objetivo de hacer que todos los ríos sean fluidos y nadables. La Ley estableció criterios de calidad del agua para recibir aguas, así como un sistema de permisos que regula las descargas. La Ley de Agua Limpia se dirigió principalmente a mejorar las plantas de tratamiento de aguas residuales. Las nuevas plantas de tratamiento y las actualizaciones a las plantas existentes ayudaron, pero no fueron suficientes. En 1995, todas las descargas de Desbordamiento de Alcantarillado Combinado (CSO) también se incorporaron al sistema de permisos de descarga bajo el Permiso del Sistema General de Eliminación de Descargas de Contaminantes de Nueva Jersey (NJPDES) para Sistemas de Alcantarillado Combinados. El propósito del permiso era reducir las cargas contaminantes de las OSC en las aguas receptoras.

La ciudad de Elizabeth ha estado evaluando opciones para cumplir con los requisitos del permiso. Los miembros de la comunidad han estado proporcionando retroalimentación y aportes al proceso de planificación. Se proporcionará más información a medida que se finalicen los planes.

Para más información sobre el plan de CSO control de la ciudad de Elizabeth, contacte
dloomis@elizabethnj.org

Pollution seeps into the ground and is carried by stormwater (rain and snow) directly to our drinking water, streams, lakes and oceans. Contaminated stormwater is the #1 cause of water pollution in New Jersey. Simple things, like proper clean-up after oneself and careful use of chemicals in the home, office, and yard are helpful ways for businesses and residents to protect the water.

What You Can Do

Pick It Up and Pitch It

- Always carry poop bags with you whenever you are out and about with your dog. Take more than you think you will need…you never know.
- Pick it up! Every. Single. Time.
- Tie the bag closed and toss it in the garbage. Dog poop CANNOT go in compost or yard waste bins.

Be Car Smart

- Take your car to a commercial car wash, where the dirty water is sent to the wastewater treatment plant.
- Don't DRIP and drive. Fix the LEAK.

Do Not Litter

- Do Not Litter! Surface waters are sources of drinking water, so we need to do our part to clean up pollution and to educate others not to litter.
- Don't overfill trash cans as litter can blow into the street on windy days.

Dispose Properly

- Properly dispose of used oil, paints and cleaning supplies —never pour them down any part of the storm sewer system and report anyone who does.

No Dumping

- Dumping of any waste material or causing pollution is an unlawful and punishable offense under the City code.
- If you see it report it.
- **City Hotline: (855) 772-7066**

CITY ORDINANCES

The City has ordinances aimed at reducing stormwater pollution from litter, fertilizer, oil, pesticides, detergents, animal waste, grass clippings and other debris.

Pet Waste Ordinance (§13.20.040)

Pet owners are required to dispose of their pet's solid waste properly.

Wildlife Feeding Ordinance (§13.20.020C)

Wildlife feeding is prohibited in any public parks or on any other property owned or operated by the City of Elizabeth.

Litter Control Ordinance (§8.32)

It is unlawful to litter any street, sidewalk or public place in the City with any material, papers, dirt, dust, sand, cinders, ashes or any other product

Improper Disposal of Waste Ordinance (§8.24.010)

Dumping of any waste materials in un-designated areas or without the express permission of property owners is prohibited.

Yard Waste Ordinance (§13.20.020.D)

Yard waste and clipping should be containerized in paper bags. Un-containerized yard waste is only allowed on certain specified days in a year.

Illicit Connections Ordinance (§13.20.020.B)

Any discharge (sanitary wastewater, effluent from septic tanks, Improper oil disposal, car wash, etc.) to the City's separate storm sewer system that is not entirely composed of stormwater is considered an illicit connection and is prohibited.

Private Storm Inlet Retrofitting Ordinance (§17.44.060)

Private property owners are required to retrofit storm drains to City standards when repaving, resurfacing or altering any pavement that is in direct contact with an existing storm drain inlet.

For details, see
https://library.municode.com/nj/elizabeth
OR
https://www.elizabethnj.org/176/Stormwater-Ordinances

Ciudad de Elizabeth

¡Ayúdanos a mantener tus aguas limpias!

La contaminación se filtra al suelo y es arrastrada por las aguas pluviales (lluvia y nieve) directamente a nuestro agua potable, arroyos, lagos y océanos. Las aguas pluviales contaminadas son la causa número 1 de contaminación del agua en Nueva Jersey. Las cosas simples, como la limpieza adecuada después de uno mismo y el uso cuidadoso de productos químicos en el hogar, la oficina y el patio, son formas útiles para que las empresas y los residentes protejan el agua.

Lo que puedes hacer

Recógelo y tíralo

- Siempre lleve bolsas de caca con usted cuando esté fuera de casa con su perro. Toma más de lo que crees que necesitarás… nunca se sabe.
- ¡Recógelo! Cada vez!
- Ate la bolsa cerrada y tírela a la basura. La caca de perro NO PUEDE entrar en el compost o en los contenedores de basura.

Ser inteligente con el auto

- Lleve su automóvil a un lavado de autos comercial, donde el agua sucia se envía a la planta de tratamiento de aguas residuales.
- No gotee y conduzca. Arregle la fuga.

No hagas basura

- No hagas basura! Las aguas superficiales son fuentes de agua potable, por lo que debemos hacer nuestra parte para limpiar la contaminación y educar a otros para que no tiren basura.
- No sobrecargue los botes de basura, ya que la basura puede caer a la calle en días ventosos.

Disponer adecuadamente

- Deseche adecuadamente el aceite usado, las pinturas y los productos de limpieza; nunca los vierta por ninguna parte del sistema de alcantarillado pluvial e informe a cualquiera que lo haga.

Sin Dumping

- El vertido de cualquier material de desecho o causar contaminación es un delito ilegal y punible según el código de la Ciudad.
- Si lo ves, repórtalo.
- **Línea directa: (855) 772-7066**

ORDENANZAS DE LA CIUDAD

La ciudad tiene ordenanzas destinadas a reducir la contaminación de las aguas pluviales de basura, fertilizantes, aceite, pesticidas, detergentes, desechos de animales, recortes de césped y otros desechos.

Ordenanza sobre desechos de mascotas(§13.20.040)

Los dueños de mascotas deben eliminar los desechos sólidos de sus mascotas de manera adecuada.

Ordenanza de alimentación de vida silvestre (§13.20.020C)

La alimentación de la vida silvestre está prohibida en cualquier parque público o en cualquier otra propiedad propiedad u operada por la Ciudad de Elizabeth.

Ordenanza de control de basura (§8.32)

Es ilegal tirar basura en cualquier calle, acera o lugar público de la ciudad con cualquier material, papeles, tierra, polvo, arena, cenizas, cenizas o cualquier otro producto.

Ordenanza de eliminación inadecuada de residuos(§8.24.010)

Se prohíbe el vertido de cualquier material de desecho en áreas no designadas o sin el permiso expreso de los propietarios.

Ordenanza de residuos de jardín (§13.20.020.D)

El desperdicio de jardín y el recorte deben colocarse en bolsas de papel. Los desechos de jardín sin contenedores solo se permiten en ciertos días específicos en un año.

Ordenanza sobre conexiones ilícitas (§13.20.020.B)

Cualquier descarga (aguas residuales sanitarias, efluentes de fosas sépticas, eliminación inadecuada de aceite, lavado de autos, etc.) al sistema de alcantarillado pluvial separado de la Ciudad que no está completamente compuesto de aguas pluviales se considera una conexión ilegal y está prohibida.

Ordenanza de actualización de entrada de tormenta privada (§17.44.060)

Los propietarios de propiedades privadas deben adaptar los desagües pluviales a los estándares de la Ciudad al repavimentar, revestir o alterar cualquier pavimento que esté en contacto directo con una entrada de drenaje pluvial existente.

Para detalles, vea
https://library.municode.com/nj/elizabeth
O
https://www.elizabethnj.org/176/Stormwater-Ordinances

STORMWATER POLLUTION

Pollution seeps into the ground and is carried by stormwater (rain and snow) directly to our drinking water, streams, lakes and oceans. Contaminated stormwater is the #1 cause of water pollution in New Jersey. Simple things, like proper clean-up after oneself and careful use of chemicals in the home, office and yard, are helpful ways for businesses and residents to protect the water.

The City of Elizabeth has ordinances aimed at reducing pollution from litter, fertilizer, oil, pesticides, detergents, animal waste, grass clippings and other debris.

Causing pollution of City waters by illicit discharges and illegal dumping is unlawful, and is subject to penalties and fines under the Section §1.12.010 of the City of Elizabeth Code of Ordinances.

Reporting of these incidents relies on participation from the public. Report any Illegal dumping or suspicious discharges to

City's reporting hotline
Phone: (855) 772-7066

CITY's STORMWATER POLLUTION PREVENTION ORDINANCES

Pet Waste Ordinance (§13.20.040)
Pet owners are required to dispose of their pet's solid waste properly.

Wildlife Feeding Ordinance (§13.20.020)
Wildlife feeding is prohibited in any public parks or on any other property owned or operated by the City of Elizabeth.

Litter Control Ordinance (§8.32)
It is unlawful to litter any street, sidewalk or public place in the City with any material, papers, dirt, dust, sand, cinders, ashes or any other product

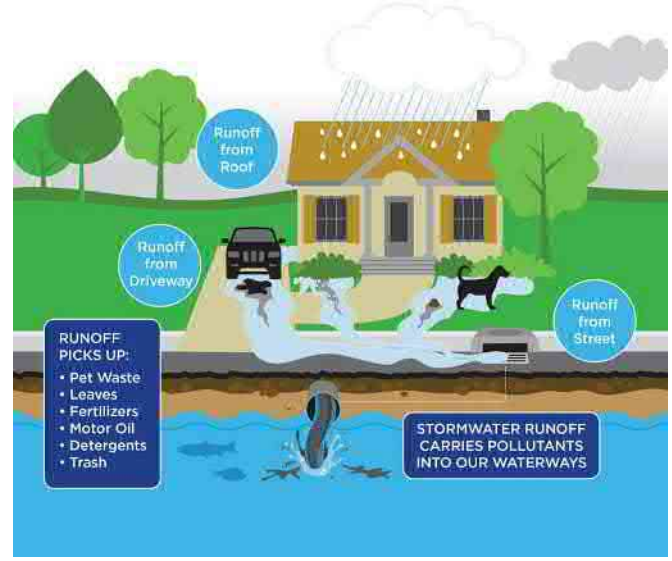
Improper Disposal of Waste Ordinance (§8.24.010)
Dumping of any waste materials in undesignated areas or without the express permission of property owners is prohibited.

Yard Waste Ordinance (§13.20.020.D)
Yard waste and clipping should be containerized in paper bags. Un-containerized yard waste is only allowed on certain specified days in a year.

Illicit Connections Ordinance (§13.20.020.B)
Any discharge (sanitary wastewater, effluent from septic tanks, Improper oil disposal, car wash, etc.) to the City's separate storm sewer system that is not entirely composed of stormwater is considered an illicit connection and is prohibited.

Private Storm Inlet Retrofitting Ordinance (§17.44.060)
Private property owners are required to retrofit storm drains to City standards when repaving, resurfacing or altering any pavement that is in direct contact with an existing storm drain inlet.

For details, see
https://library.municode.com/nj/elizabeth



Preventing Polluted Runoff is

Everyone's Business!

Do Your Part to Help!

PET WASTE DISPOSAL

When pet waste is left on the ground, rainwater or melting snow washes the pet waste into our storm drains or directly into our local creeks. In addition to contaminating waterways with disease-carrying bacteria, pet waste acts like a fertilizer in the water, just as it does on land. This promotes excessive aquatic plant growth that can choke waterways and promote algae blooms, robbing the water of vital oxygen.

What You Can Do:

- Always carry poop bags with you whenever you are out and about with your dog. Take more than you think you will need…you never know.
- Pick it up! Every. Single. Time.
- Tie the bag closed and toss it in the garbage. Dog poop CANNOT go in compost or yard waste bins.
- Pick up poops in your yard weekly (more often is better and definitely before a big rain).

LITTER AND FLOATABLES CONTROL

When trash (plastic bags, bottles, cans, leaves, etc.) is discarded onto the ground, it washes into storm drains and directly into waterways. Trash negatively impacts wildlife and migratory birds poses hazards for fisherman and boaters and is an eye-sore along streets, parks, and waterways in our community.

What You Can Do:

- Do Not Litter! Surface waters are sources of drinking water, so we need to do our part to clean up pollution and to educate others not to litter.
- Follow the 3R's—Reduce, Reuse and Recycle wherever possible
- Use reusable shopping bags instead of single-use plastic bags at the store and recycle plastic bags.
- Don't overfill trash cans as litter can blow into the street on windy days.
- When leaves and grass clippings end up in city streets and storm drain, it eventually makes its way to our waterways. Sweep up grass clipping and leaves and dispose of properly.

ILLICIT DISCHARGES

Some of the pollutants that fall into this broad category are:

- Car wash wastewater
- Gas and motor oil
- Household cleansers
- Paints
- Pesticides
- Weed killer

Once these pollutants are in the storm drainage system, they are carried by rain into streams and rivers. This can harm our water quality, wildlife, and human health

What You Can Do:

- Properly dispose of used oil, paints and cleaning supplies—never pour them down any part of the storm sewer system and report anyone who does.
- Take your car to a commercial car wash, where the dirty water is sent to the wastewater treatment plant
- Never connect sanitary sewer to storm drains.
- Store materials that could pollute stormwater indoors and use containers for outdoor storage that do not rust or leak.

What's Going On Under Your Streets?

Follow Your Flush!

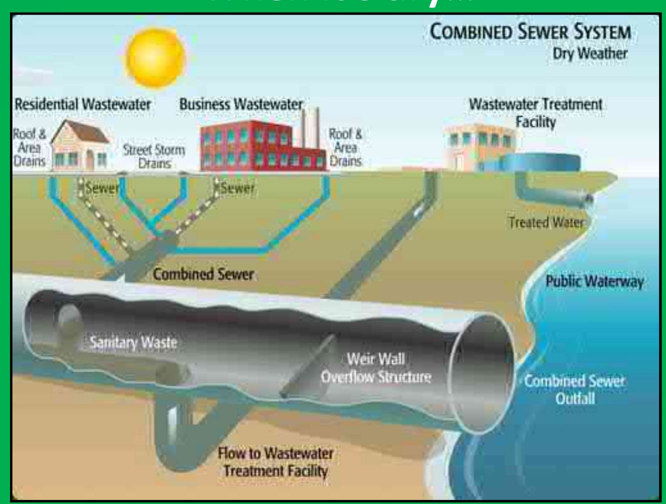
Source: SD1

1. Wet Weather Event (Rainfall)
2. Wastewater from your home (toilets, sinks, shower drains)
3. Combined Sewer Network = Sanitary + Storm Water
4. JMEUC Wastewater Treatment Plant
5. Combined Sewer Overflow (CSO) to Arthur Kill

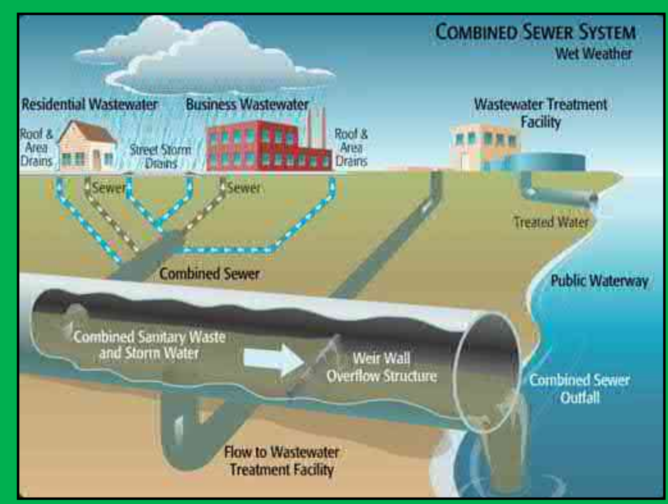
What is a Combined Sewer?

Most of Elizabeth's sewers are **combined sewers**, which means that they carry both sanitary sewage and stormwater in one piping system. When it rains, to prevent flooding at storm drains and in basements, the sewers fill up and release excess flow to nearby water bodies, called **Combined Sewer Overflows (CSOs)**. Elizabeth has **29 locations** where CSOs discharge, called **CSO outfalls**. During wet weather, untreated wastewater can be discharged to receiving streams including contaminants such as pathogens, oxygen-demanding pollutants, suspended solids, nutrients, toxics and floatable matter. **Nets** along the outfalls catch floatables as a control measure. The City of Elizabeth is working with the New Jersey Department of Environmental Protection (NJDEP) and the US Environmental Protection Agency (EPA) to reduce the number of CSO events that take place every year to improve **water quality** in Elizabeth's receiving streams.

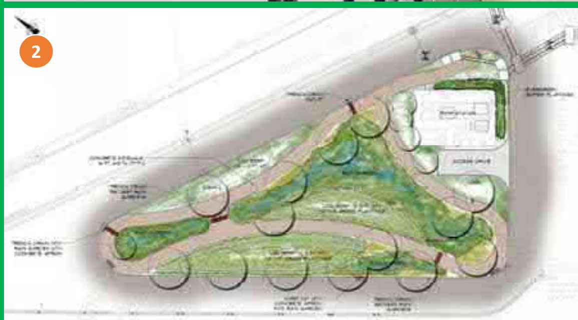
When it's dry…

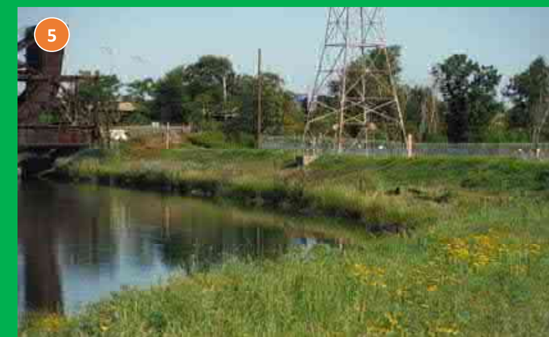


When it's wet…



The City of Elizabeth,
Keeping Your Community Green & Clean





1. Trumbull Street Green Infrastructure (under construction)
2. Trumbull Street Green Infrastructure (architectural rendering)
3. Solids/Floatables Control Facilities – netting frame being lowered
4. Verona Gebhardt Pumping Station – box culvert
5. Levee along Elizabeth River
6. Headwall for Elizabeth River Levee
7. Verona Gebhardt Pumping Station – precast concrete structure

From: Martyn, Sabina
Sent: Thursday, May 7, 2020 9:34 AM
To:

Cc:

Subject: Elizabeth-Joint Meeting CSO Long Term Control Plan Update
Attachments: SupplementalTeam_Part1_CSOBasics.pdf; SupplementalTeam_Part2_CSOSolutions.pdf

Dear Supplemental CSO Team,

We hope that you are keeping well. We would like to provide you with an update on recent developments on the City of Elizabeth and Joint Meeting of Essex and Union Counties (JMEUC) Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP).

The NJDEP has approved an extension to the deadline for submission of the CSO LTCP to October 1, 2020 (from the original date of June 1, 2020). This is in direct response to the COVID-19 pandemic, which has impacted the ability of permittees to coordinate with the public in sharing LTCP developments and obtaining feedback, as well as to coordinate with municipal and elected officials to gain input and obtain the required approvals in the selection of the recommended CSO control plan.

In response to this change in the submission timeline, as well as based on current understanding of the COVID-19 situation, we are tentatively planning to shift the next Open Public Meeting / Supplemental CSO Team Meeting to late Summer 2020 (subject to any relevant government restrictions in place at that time). This meeting will provide an opportunity for the City and JMEUC to share the analysis and tentative recommendations for the selection of the CSO control program, and for the City and JMEUC to solicit input from community members and Supplemental CSO Team members on this program before we prepare and submit the CSO LTCP to NJDEP.

In the meantime, we invite you to review and share the attached two presentation packages providing information about the CSO Long Term Control process to-date. Part 1 provides a review of background information about CSOs and water quality in Elizabeth, and Part 2 presents the range of CSO control solutions evaluated by the City and JMEUC as well as the current thinking on the selection of the preferred CSO control plan. We request that you could please review and circulate these slides among your constituents, cc'ing City Engineer Dan Loomis (dloomis@elizabethnj.org) on these messages, and also please let us know of any feedback you receive.

Thank you for your continued support and participation.

Regards,

Sabina Martyn, PE, P.Eng.
Senior Project Engineer

City of Elizabeth: What is a CSO?

Future City Environmental Day 2020

Remote Learning Presentation

Introduction

- The City of Elizabeth Public Works Department is responsible for all of the City's infrastructure, including:
  - Engineering services for roads, utilities, and public buildings and facilities owned or operated by the City
  - The City's **sewer system**

Future City Environmental Day 2019 - with Dan Loomis, City Engineer

- The goals of this workshop are to:
  1. Provide information about combined sewer overflows (CSOs) and the Elizabeth sewer system
  2. Obtain input on ways the City can reduce overflows and other water pollution

What is a Combined Sewer Overflow (CSO)?

- Most of Elizabeth's sewers are **combined sewers,** which means that they carry both sanitary sewage and stormwater in one piping system.
- Combined sewers were the first types of sewers and can be found in most older cities.
- When it rains, to prevent flooding at storm drains and in basements, the sewers fill up and release excess flow to nearby water bodies, called **Combined Sewer Overflows (CSOs)**.
- During wet weather, untreated wastewater can be discharged to receiving streams including contaminants such as pathogens, oxygen-demanding pollutants, suspended solids, nutrients, and floatable matter. **Nets** along the outfalls catch floatables as a control measure.

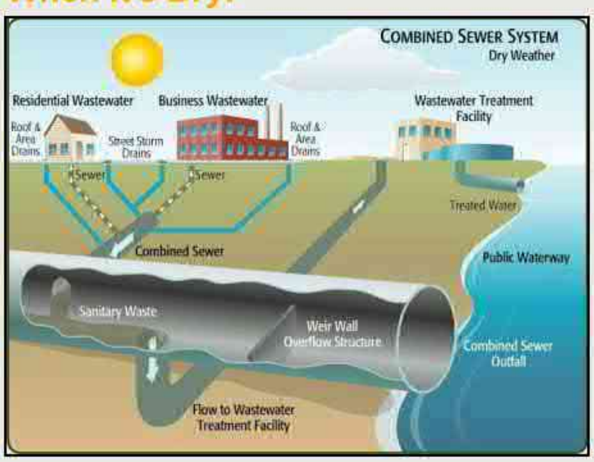
Typical CSO Outfall

CSO Sign

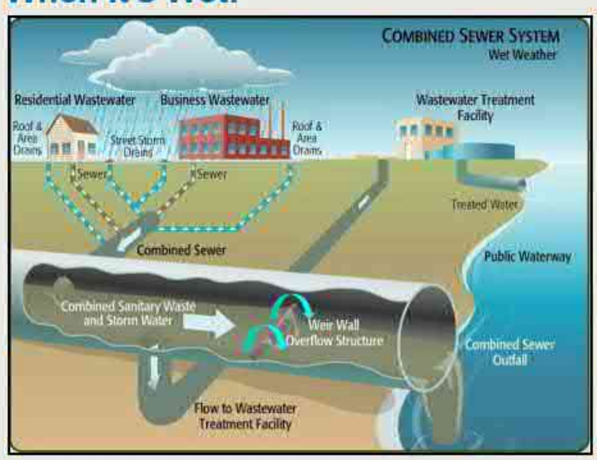
Nets at CSO Outfall

How does a CSO Work?

When it's Dry:



When it's Wet:



Animation and video links
HWU_combined_web.swf

https://www.youtube.com/watch?v=ev64xXDYmaw

Wastewater Treatment Plant

- Sanitary flow from the City of Elizabeth is treated at a regional wastewater treatment plant (the Joint Meeting of Essex and Union Counties, or JMEUC, plant)
- During wet weather, the treatment plant does not have the capacity to treat all of the sanitary flow and stormwater, so the excess is released untreated to Elizabeth's waterbodies.

CSOs in the City of Elizabeth

- Elizabeth has **29 locations** where CSOs discharge, called **CSO outfalls**.
- CSOs in Elizabeth discharge to:
  - Elizabeth River
  - Arthur Kill
  - Newark Bay
- The City of Elizabeth is working with the New Jersey Department of Environmental Protection (NJDEP) and the US Environmental Protection Agency (EPA) to reduce the number of CSO events that take place every year to improve **water quality** in Elizabeth's receiving streams.

City of Elizabeth Current CSO Numbers

Average Values for a Typical Year

48.4"
Average annual total rainfall

55
Total number of overflow events system-wide

870
Million gallons per year Total combined sewer overflow volume system-wide

130
Million gallon per day Maximum peak overflow rate from an outfall

73
Storm events with greater than 0.1" of rainfall in typical year

15.8
Million gallons Average overflow event volume

120
Million gallons Total overflow volume system-wide for largest storm event

16
Hours Average overflow event duration

What's Going on Under Your Streets? Follow Your Flush!

1. Wet Weather Event (Rainfall)
2. Wastewater from your home (toilets, sinks, shower drains)
3. Combined Sewer Network = Sanitary + Storm Water
4. JMEUC Wastewater Treatment Plant, OR
5. Combined Sewer Overflow (CSO) to Elizabeth River, Arthur Kill, or Newark Bay

What is the City Doing to Reduce CSOs?

- The City of Elizabeth is working hard to keeping your community **Green & Clean**
- The City is currently preparing a Long Term Control Plan strategy for CSO reduction
- Current projects include:

Trumbull Street Green Infrastructure (under construction)

Solids/Floatables Control Facilities – netting frame being lowered

Verona Gebhardt Pumping Station – precast concrete structure

Levee along Elizabeth River

Stormwater Management

Pollution seeps into the ground and is carried by stormwater (rain and snow) directly to our drinking water, streams, lakes and oceans. Contaminated stormwater is the #1 cause of water pollution in New Jersey. Simple things, like proper clean-up after oneself and careful use of chemicals in the home, office, and yard are helpful ways for businesses and residents to protect the water.

Help us keep our waters clean!

Pick It Up and Pitch It

- Carry pet waste bags whenever you are out with your dog, and always pick up after your pet!
- Tie the bag and toss it in the garbage. Dog poop CANNOT go in compost or yard waste bins.

Be Car Smart

- Take your car to a commercial car wash, where the dirty water is sent to the wastewater treatment plant.
- Don't DRIP and drive. Fix the LEAK.

Do Not Litter

- Surface waters are sources of drinking water, so we need to do our part to clean up pollution and to educate others not to litter.
- Don't overfill trash cans as litter can blow into the street on windy days.

Dispose Properly

- Properly dispose of used oil, paints and cleaning supplies - never pour them down the storm drain, and report anyone who does.

No Dumping

- Dumping of any waste material or causing pollution is an unlawful and punishable offense under the City code.
- If you see it, report it: City Hotline: (855) 772-7066

Discussion Questions:

(there are no wrong answers)

1. How clean do you think the Elizabeth River is?

A. Very clean

B. Somewhat clean

C. Slightly polluted

D. Very polluted

Discussion Questions:

(there are no wrong answers)

2. What do you think is the main source of pollution in Elizabeth's waterways?

A. Street and ground runoff

B. Sewer overflows

C. Sources outside the City

D. Other? (Name other sources)

Discussion Questions:

(there are no wrong answers)

3. What is the best way the public can help protect local waterways from pollution?

A. Support construction of new stormwater storage and treatment tanks

B. Organize and participate in local waterway cleanups

C. Install rain barrels and store rainwater at their homes

D. Plant more trees and vegetation at their homes to absorb more rainwater

Discussion Questions:

(there are no wrong answers)

4. What is the most effective way to communicate information about CSOs to you and your families?

A. Mail

B. Community events / school presentations

C. Website / social media

D. Other (Name other methods of communication)

City of Elizabeth: CSO Solutions

Future City Environmental Day 2020

Remote Learning Presentation

Introduction

- The City of Elizabeth Public Works Department is responsible for all of the City's infrastructure, including:
  - Engineering services for roads, utilities, and public buildings and facilities owned or operated by the City
  - The City's **sewer system**

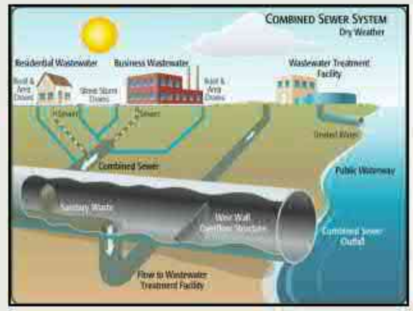
Future City Environmental Day 2019 - with Dan Loomis, City Engineer

- The goals of this workshop are to:
  1. Provide information about combined sewer overflows (CSOs) and the Elizabeth sewer system
  2. Obtain input on the City's plans to reduce CSOs

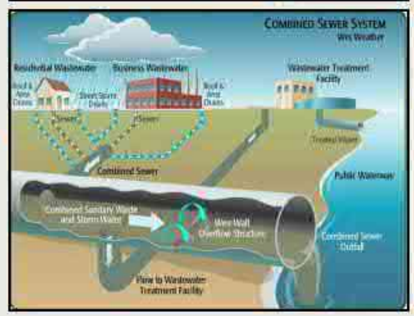
What is a Combined Sewer Overflow (CSO)?

- Most of Elizabeth's sewers are **combined sewers,** which means that they carry both sanitary sewage and stormwater in one piping system.
- When it rains, to prevent flooding in streets and basements, sewers fill up and release excess flow to nearby water bodies. This is called a **Combined Sewer Overflow (CSO)**.
- CSOs can result in contaminants entering the Elizabeth River, Arthur Kill and Newark Bay.
- Elizabeth has **29 locations** where CSOs discharge.
- The City evaluated a range of alternatives to reduce CSOs to improve water quality → **we want your input on the selected program!**

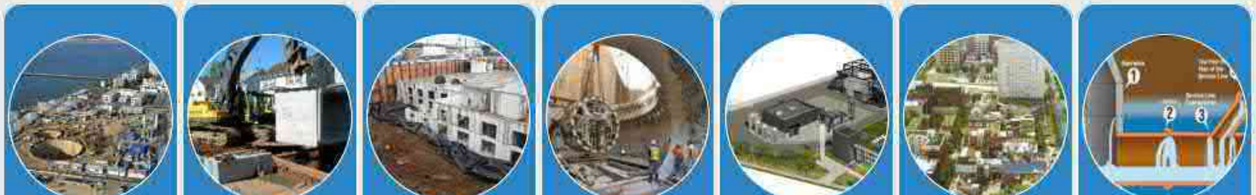
When it's Dry:



When it's Wet:



Alternatives Considered for CSO Control



1. Expand Treatment Plant and Send More Flow to It
2. Build Separate Sewers (one sanitary and one storm)
3. Build Underground Storage Tanks
4. Build a Tunnel to Store and Send Flow to Treatment Plant
5. Treat Overflows at Each Outfall
6. Build Rain Gardens and Other Natural / Green Systems
7. Reduce Leaks into the Sewers

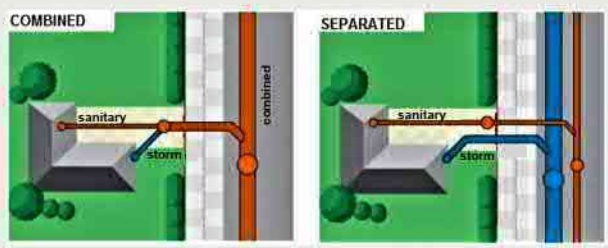
Range of alternatives

1. Expand Treatment Plant and Send More Flow to It

- Upgrade the Trenton Avenue Pumping Station, so that more flow can be sent to the JMEUC Treatment Plant
- Upgrade the JMEUC Treatment Plant so that it can treat (clean) more flow coming from the City during rain events

2. Build Separate Sewers

- Right now, one sewer pipe carries both sanitary and storm flows
- This alternative involves installing a parallel sewer system so there will be one for storm flow and one for sanitary flow
- During rain events, the storm sewer may still overflow, but it no longer has sanitary contaminants in it – CSOs are eliminated!
- May not be suitable for the entire City because of the traffic disturbance to dig up roads to install sewer, but may be suitable for some parts of the City.



3. Build Underground Storage Tanks

- CSO flows would be redirected to an underground storage tank at each outfall
- No overflows would occur until tank is full
- After the rain event is over, the contents of the tank are pumped back into the sewer pipe and sent to the treatment plant
- Requires a large amount of land to be purchased across the City for the tanks. Could require demolition of existing buildings and preventing new developments.

Example: Tank at Trumbull Street

4. Tunnel Storage through City

- Construct a 20,000 ft long tunnel under the City (as long as 55 football fields!)
- The tunnel will store CSO flows instead of sending them to the river. After the rain event is over, the contents of the tunnel are pumped to the treatment plant
- Must cross under the river multiple times
- Excavation is very costly but might be less disruptive to the City than some of the other alternatives.

Example: Narragansett Bay Commission

5. Treat the Overflows at the Outfalls

- CSO flows would be redirected to a treatment facility at each outfall location
- The facility would treat the water to remove solids and disinfect it
- Testing at a few locations would need to be done first to confirm the effectiveness of the treatment

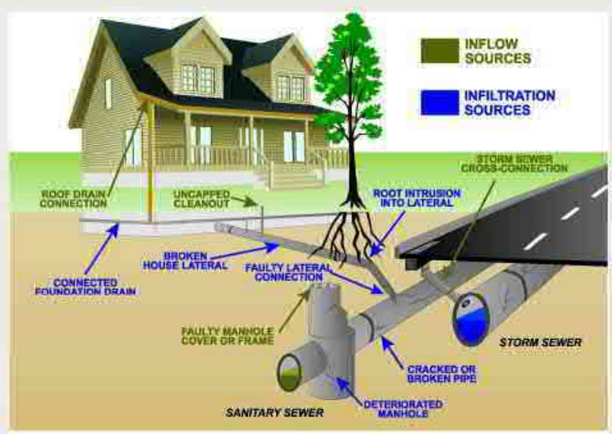
Example: High-Rate CSO Treatment Facility in Bremerton, WA

6. Reduce Leaks into the Sewers

Inflow/Infiltration:

When groundwater and stormwater seep into the sewer system through defects like cracked pipes, faulty manholes or illegal connections.

- Inflow/infiltration can reduced by lining all of the pipes to reduce leaks into them.
- However, this is very expensive compared to other alternatives.



7. Build Rain Gardens and Other Natural / Green Systems

The City of Elizabeth is working to identify locations around the city where **green infrastructure** would be a good fit.

A **rain garden** is a type of green infrastructure that allows rain to be naturally absorbed into the ground instead of flowing into the sewer system.

Kenah Field Park Rain Garden

Trumbull Street Green Infrastructure (under construction)

What's Inside A Rain Garden?

CSO Control Approach

The City wants to select a CSO control approach that balances:

- The plan should meet water quality objectives
- The plan should be cost effective
- The plan should be acceptable to City residents: traffic impacts, disturbance, noise, appearance, etc.

CSO Plan Elements

- The City is proposing a CSO control plan that incorporates several different approaches
- The objective is to capture at least **85% of the CSO volume** in an average year
- The proposed plan includes:

Storage	Conveyance	Treatment	Sewer Separation	Green Infrastructure
• Completion of City-approved projects that provide storage in tanks and pipes	• Sewer and pumping station upgrades to send more flow to the Treatment Plant	• Expand JMEUC Treatment Plant to treat more flow	• Separate existing sewer into two separate sewers (sanitary and storm) in two areas	• Pilot program starting with a few rain gardens around the City, add more if successful

Locations of Proposed CSO Control Improvements

What Can You Do at Home to Reduce CSOs?

Some ideas to consider for your home are:

- **Rain barrels:** Can hold up to 50 gallons of stormwater runoff which would otherwise flow into the sewer. This water is not drinkable but can be used for watering or washing outdoors.
- **Rain garden:** A garden specially designed to absorb stormwater run-off from roads, parking lots, and sidewalks, instead of sending it to the sewer.
- **Porous pavement:** Permeable surface that allows stormwater to absorb back into the ground instead of running off into storm drains.
- **Downspout disconnection:** Reroute rooftop drains from sewers to rain barrel or to soak into the ground.

Rain Barrel

Rain Garden

Porous Pavement

Downspout Disconnection

Discussion Questions:

(there are no wrong answers)

1. What should be the primary consideration in selecting a CSO control solution?

A. Water quality improvements

B. Cost

C. Reduced flooding

D. More green community spaces

Discussion Questions:

(there are no wrong answers)

2. What would be your preference in selecting locations for CSO control facilities?

A. CSO controls that you can see (treatment plant, green infrastructure, etc.)

B. CSO controls that are hidden (tunnel, underground storage tank, etc.)

Discussion Questions:

(there are no wrong answers)

3. What would be your preference in selecting locations for CSO control facilities?

A. Centralized solution – longer-term disruption to streets, but fewer locations around the City

B. Satellite sites – smaller, shorter-term disruption, but several locations around the City

Discussion Questions:

(there are no wrong answers)

4. What would be your greatest concern in selecting sites for CSO control facilities?

A. Size of required property / change in community

B. Acquiring private property / requiring residents to move

C. Traffic impacts

D. Odor / Environmental issues

E. Losing green space

Discussion Questions:

(there are no wrong answers)

5. What do you consider the primary benefit of green infrastructure?

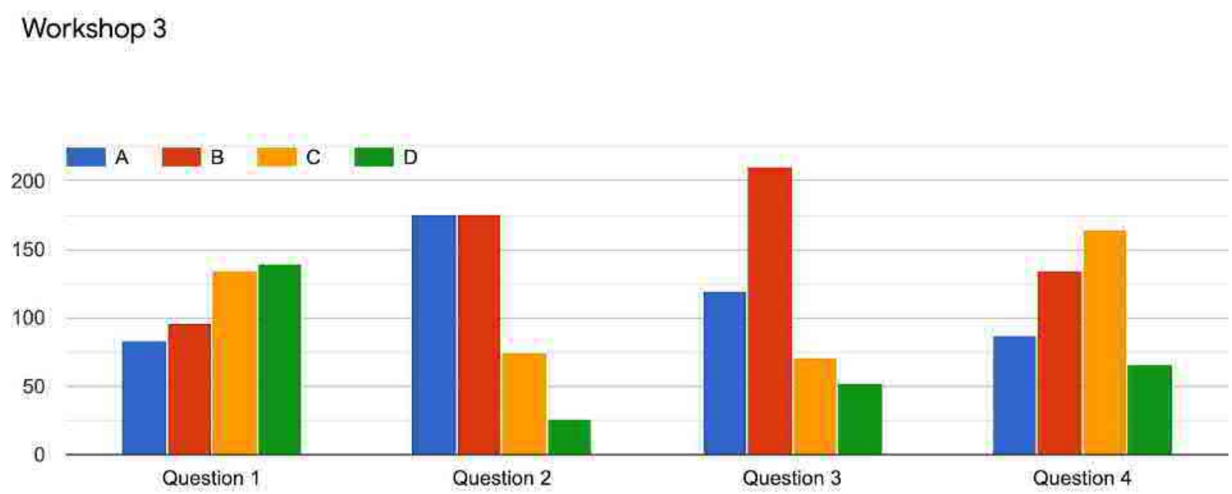
A. Water quality improvements

B. Reduced flooding

C. Aesthetic, green community spaces

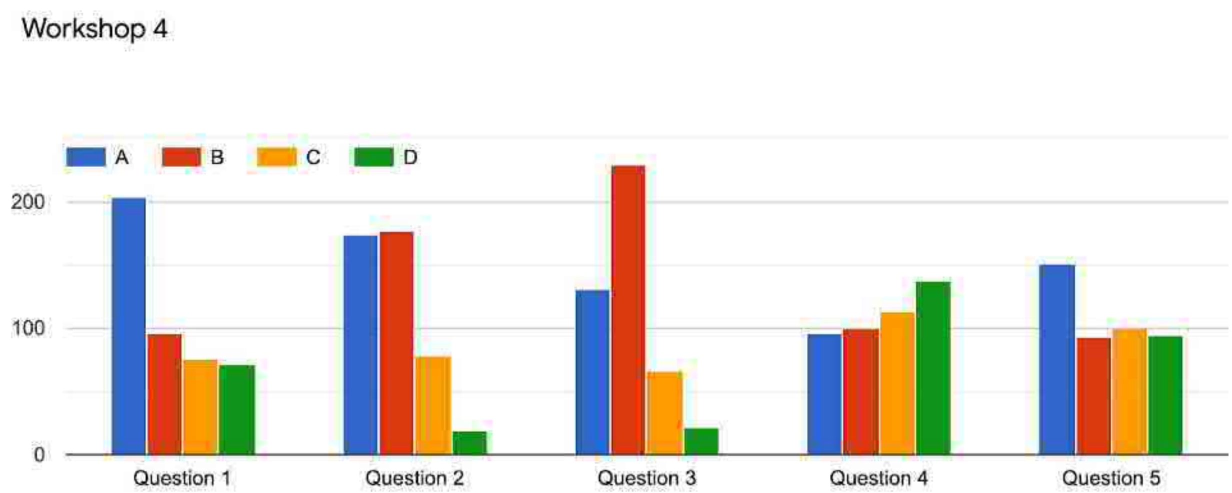
D. Job creation for green infrastructure operations and maintenance

Workshop #3: City of Elizabeth: What is a CSO?



Question 1:	Question 2:	Question 3:	Question 4:
A - 83	A - 176	A - 119	A - 87
B - 96	B - 176	B - 211	B - 135
C - 135	C - 75	C - 71	C - 165
D - 139	D - 26	D - 52	D - 66

Workshop #4: City of Elizabeth: CSO Solutions



Question 1:	Question 2:	Question 3:	Question 4:	Question 5:
A - 207	A - 176	A - 132	A - 98	A - 151
B - 97	B - 177	B - 231	B - 101	B - 94
C - 76	C - 81	C - 67	C - 115	C - 101
D - 73	D - 19	D - 23	D - 138	D - 98

SEWAGE FREE STREETS AND RIVERS

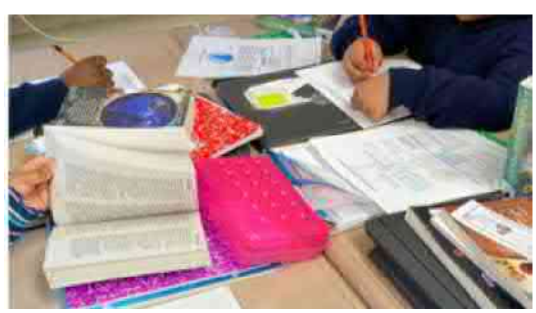
MENU

FEBRUARY 12, 2020 STAFF

Educating Youth On Combined Sewer Overflows

By Michelle Doran-McBean, CEO, Future City Inc.

Students from Winfield Scott School #2 in Elizabeth learned about combined sewer overflows, as part of a new education and outreach program implemented by Future City Inc. The program provided 88 students from third, seventh, and eighth grades with Rotary International dictionaries as a vehicle to for information about Combined Sewer Systems and the Sewage Free Streets and Rivers campaign. Most students, like most adults, did not know about CSOs until Future City Inc.'s presentation.



Each student received a dictionary and used it to complete crossword puzzles with words relating to CSOs. Students discussed the challenges of CSOs and

brought home flyers in English, Spanish, and Kreol to continue the discussion with their families. During these discussions, students explored what they can do to keep their streets clean. Students left the program reporting that they gained new understanding and appreciation of the importance of keeping litter out of their streets, and pledged to help prevent overflows.

This outreach and education program was supported by a capacity building grant from the Sewage-Free Streets and Rivers campaign.

Leave a Reply

Your email address will not be published. Required fields are marked *

Comment

Name *

Email *

Website

☐ Notify me of follow-up comments by email.

☐ Notify me of new posts by email.

POST COMMENT

← CLIMATE-READY CSO SOLUTIONS FORUM

Follow us on Twitter

My Tweets

Join us on Facebook

Sewage-Free Stree…
209 likes

SEWAGE FREE STREETS AND RIVERS
Your Waterways, Your Neighborhood, Your Money, Your Voice

Like Page Share

Be the first of your friends to like this

Sewage-Free Streets and Rivers
2 hours ago

It's Official! NJDEP's Stormwater Rule changes have been published in the New Jersey Register. See what that means for new development. http://ow.ly/Ocbz50yGIVF

NJFUTURE.ORG
It's Official: NJDEP's Stor…
On March 2, important changes t…

Sewage-Free Streets and Rivers is organized by its partners and an advisory board, with the support of New Jersey Future.

For more information, please send an email to info@sewagefreenj.org

The Sewage-Free Streets and Rivers campaign is funded by a generous grant from The Kresge Foundation.

SEARCH

Search …

January 7, 2020

Sewage Free Streets and Rivers Project Report

On January 6, 2020, and January 7, 2020, Future City Inc implemented a new educational outreach program to a group of 88 students consisting of third, seventh, and eighth-graders at Winfield Scott School #2 in Elizabeth, NJ. The goal for this program was to provide the students with Rotary International dictionaries, utilizing the dictionaries as a vehicle to educate students about Combined Sewer Systems and inform them about the Sewage Free Streets and Rivers campaign. During this event, Future City Inc distributed one dictionary to each student. The students interacted with the dictionaries by completing a crossword puzzle and stickers with vocabulary related to Combined Sewage Systems and Overflows. The students were presented with a bilingual Combined Sewage Systems flyer and encouraged to discuss the flyer as a group and talk about their personal experience with keeping the streets of their town clean.

Between late December 2019 and January 5, 2020, Future City Inc engaged in project development and preparation.

On January 6, 2020, Future City Inc met with Winnfield Scott School #2's seventh and eighth grade and gave them an interactive 15-minute presentation on Combined Sewage Systems, overflow, and their community. Later that day Future City Inc familiarized them with flyers and the Combined Sewer Overflow crossword puzzle so that they would be able to assist the third graders on January 7, 2020.

On January 7, 2020, Future City Inc visited four classrooms which included one Spanish/English speaking bilingual classroom and one Kreol/English speaking bilingual classroom. In each of the classrooms, presenters gave an overview of CSOs and initiated conversation amongst the third graders about their experiences with littering. With the assistance of School #2's Junior Honor Society, Future City Inc distributed dictionaries and all worksheets. After the dictionaries and worksheets were completed by the third graders. Future City Inc had a debriefing with the seventh and eighth graders about the impact of the activities that had participated in for the last two days. Several of the children reported not knowing what a CSO was before their interaction with Future City Inc and during the debriefing expressed that they had acquired new knowledge and pledged to keep their neighborhood streets clean in efforts to help prevent overflows.

<u>Attached are the following:</u>

- Combined Sewage Overflow bilingual flyer
- Combined Sewage Overflow crossword puzzle
- Screenshots of Twitter and Instagram posts from January 6, 2020 and January 7,2020
- Photos of the events from January 6, 2020 and January 7, 2020

Combined Sewer Overflow

A Combined Sewer System is where storm water and sanitary waste meet and are mixed together in the sewers. In Elizabeth, NJ, we run a CSS system. An overflow happens when there is heavy rainfall and the water treatment plant cannot treat the volume of water it is receiving. When this happens, untreated contaminated water flows in the Elizabeth waterways, polluting the water.

YOU and your family can help our sewers stay clean by doing four simple things:

- Don’t flush ANYTHING but toilet paper down the toilet.
- Do not litter ANYWHERE.
- Clean up after your pets.
- NEVER throw anything into a sewer drain.

**For your own safety, never walk in a flooded area. The water can be deeper than you think and it can be contaminated with sewage which can cause sickness.*

SEWAGE FREE
STREETS AND RIVERS
Your Waterways, Your Neighborhood, Your Money, Your Voice

Join the Campaign: https://sewagefreenj.org/join/

Derrame de Alcantarillado Combinado

Un Sistema (SCA) es donde agua lluvia y desechos sanitarios son mezclados en las alcantarillas. En Elizabeth, NJ, tenemos un sistema CSS. Un Derrame de Alcantarillado Combinado sucede cuando hay Fuertes lluvias y la planta de tratamiento no puede tratar el volumen de agua que esta recibiendo. Cuando esto pasa, agua contaminada que en ha sido tratada fluye a las vías fluviales de Elizabeth, contaminando el agua.

USTED y su familia pueden ayudar a que nuestro alcantarillado se mantenga limpio con estas cuatro simple acciones:

- No tire nada más que papel higiénico por el inodoro.
- No tire basura EN NINGÚN LUGAR.
- Recoja los desechos de sus mascotas.
- NUNCA arroje nada a las alcantarillas.

**Por su propia seguridad, nunca camine en zonas inundadas. El agua puede ser mas profunda de lo que usted piensa y puede estar contaminada, lo cual puede causar enfermedades.*

SEWAGE FREE STREETS AND RIVERS
Your Waterways, Your Neighborhood, Your Money, Your Voice

Unete a la Campaña : https://sewagefreenj.org/join/

Name:___________________

Combined Sewage Overflow Systems

Complete the crossword puzzle below

Litter | Waterway | Contaminate | Rainfall | Pollution | Flood | Overflow | Recycle | Drain

Sewage

Across

3. To throw trash on the ground, not in a garbage can.

5. To pour over the edge of a container when filled/to flood.

6. A body of water that ships can use.

7. The amount of water falling within a given time or area,

9. Substance in the air, in the water and on land that contaminate the Earth.

10. A pipe used to transport water into a sewer.

Down

1. Liquid waste from homes and businesses transported away by sewers.

2. To process material so they can be made into new products,

4. To soil, to stain or corrupt by contact, to pollute, to infect.

8. Water that stays on land that is normally dry.

Join the Campaign: https://sewagefreenj.org/join/

Instagram

Search

Log In Sign Up

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futurecityinc Future City Inc had a great time with the 3rd graders at Winfield Scott School #2 today ! The students learned how to navigate dictionaries, CSO and the importance of not littering! Special Thanks to NJFuture and the Elizabeth Rotary Club. Join the campaign: sewagefreenj.org/join/

10m

10 MINUTES AGO

Log in to like or comment.

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10m

10 MINUTES AGO

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futurecityinc • Follow

futurecityinc Learning about CSOs! Our members are training 7th graders to help with tomorrow's Dictionary Project with the Elizabeth Rotary Club and New Jersey Future.

Please join the Sewage-Free Streets and Rivers at: sewagefreenj.org/join/

16h

4 likes

16 HOURS AGO

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16h

4 likes

16 HOURS AGO

Log in to like or comment.

Future City Inc.
@FutureCityInc

Follow

Learning about CSOs! Our members are training 7th graders to help with tomorrow's Dictionary Project with the Elizabeth Rotary Club and New Jersey Future.

Please join the Sewage-Free Streets and Rivers at: sewagefreenj.org/join/

4:47 PM - 6 Jan 2020

1 Like

Future City Inc.
@FutureCityInc

Follow

Future City Inc had a great time with the 3rd graders at Winfield Scott School #2 today ! The students learned how to navigate dictionaries, CSO and the importance of not littering! Thank you to @sewagefreenj and @ElizabethRotary. Join the campaign: sewagefreenj.org/join/

8:41 AM - 7 Jan 2020


Rigby
Rigby
Rigby

Assessing Combined Sewer Systems Vulnerability to Sea Level Rise

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Sea level in the Harbor Estuary is expected to rise between 0.9 and 2.1 feet by 2050, with a worst-case projection of up to 6 feet by 2100. The functioning of combined sewer systems will be directly affected, as many outfalls are already underwater during high tides. This looming issue will compound the existing challenge of reducing the number and volume of discharges from combined sewers, which occur when sewage treatment plants reach capacity during storms, a pollution source that will increase in the future given anticipated changes in precipitation changes.

In New Jersey, the 17 municipalities and 4 utilities with active Combined Sewer Overflow (CSO) permits for estuary waters are addressing their Long-Term Control Plan (LTCP) requirements. The current requirements do not explicitly require permittees to address impacts associated with climate change. To understand the magnitude of these issues and better prepare for the future, HEP partnered with two New Jersey municipalities, the City of Elizabeth and the Village of Ridgefield Park, to assess the risk of sea level rise impacts to their respective CSO outfalls.

HEP worked with both municipalities and the EPA using EPA's Climate Resilience Evaluation and Awareness Tool (CREAT). CREAT is a risk assessment application that helps municipalities and utilities adapt to extreme weather events by better understanding current and long-term weather conditions. The final report and recorded webinars below provides important examples and guidance for managers and engineering professionals seeking to create climate-ready water systems.

Webinars and Reports

ASSESSING COMBINED SEWER SYSTEMS VULNERABILITY TO SEA LEVEL RISE: A NEW JERSEY CASE STUDY FINAL REPORT (COMING SOON)

HEP'S CREAT EXERCISE WEBINAR PART 1: SEA LEVEL RISE AND LESSONS LEARNED FROM ELIZABETH AND RIDGEFIELD PARK

HEP'S CREAT EXERCISE WEBINAR PART 2: DIVING INTO USING CREAT

Related Resources

PUBLICATION

Water and Wastewater Utilities Planning for Resilience

Elizabeth and Ridgefield Park's use of CREAT and how they were able to evaluate the costs of several potential management strategies.

TOOL

CREAT Risk Assessment Application for Water Utilities

EPA’s CREAT is a risk assessment application or tool that helps utilities to better understanding current and long-term weather conditions.

ACCESS THE APPLICATION

REPORT

NJ’s Rising Seas and Changing Coastal Storms

The report, published in 2019 by Rutgers University, highlights the most recent climate science needed to inform efforts to increase the resilience in NJ.

DOWNLOAD THE REPORT

MAP

NJ Flood Mapper

Developed by Rutgers University, this interactive mapping website helps generate map visuals regrading flooding hazards and sea level rise in the state of NJ.

VIEW THE MAP

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New York, NY 10004

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Keep Informed

Sign up with your email address and stay up to date on the latest Hudson River Foundation news.

Appendix B

Project Capital Cost Estimates

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City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
South Second Street Stormwater Control

Date: 8/12/2020

CAPITAL COST ESTIMATE

Estimate Class: 4 — Expected Accuracy: L: -15% to -30%
Use: Study or feasibility — H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Traffic control	LS	1.0	$30,000.00	$30,000.00
2	Demolition	LS	1.0	$30,000.00	$30,000.00
3	Site clearing and utilities coordination	LS	1.0	$10,000.00	$10,000.00
4	Preconstruction audio/video documentation	LS	1.0	$3,000.00	$3,000.00
5	Soil erosion and sediment control	LS	1.0	$15,000.00	$15,000.00
6	Test pits	LS	1.0	$3,500.00	$3,500.00
7	Mobilization	LS	1.0	$60,000.00	$60,000.00
8	Construction layout	LS	1.0	$20,000.00	$20,000.00
9	Sewer Rerout 24" PVC	LF	35.0	$32.00	$1,120.00
10	For 19" x 30" ERCP	LF	550.0	$60.00	$33,000.00
11	For 24" x 38" ERCP	LF	705.0	$70.00	$49,350.00
12	Inlets, headwall, lining of ditch	LS	1.0	$125,500.00	$125,500.00
13	Earth Excavation (0-8 ft)	CY	1150.0	$30.00	$34,500.00
14	Earth Excavation (8-14 ft)	CY	150.0	$35.00	$5,250.00
15	Earth Excavation (greater than 14 ft)	CY	15.0	$60.00	$900.00
16	Backfill	CY	969.0	$30.00	$29,070.00
17	Uncontaminated soil disposal	CY	428.0	$10.00	$4,280.00
18	Pump station improvements	LS	1.0	$698,660.00	$698,660.00
19	Temporary Pavement Replacement	SY	708.0	$70.00	$49,560.00
20	Permanent Pavement Replacement	SY	5194.0	$40.00	$207,760.00
21	Furnishing / Placing DGA	CY	1085.0	$12.00	$13,020.00
22	Furnishing / Placing 3/4" Crushed Stone	CY	350.0	$12.00	$4,200.00
23	Backfill Compaction	LF	1255.0	$2.25	$2,824.00
24	Concrete Curbing Restoration	LF	1200.0	$30.00	$36,000.00
25	Sidewalk Restoration	SF	20.0	$5.00	$100.00
26	Driveway Restoration	SF	1300.0	$5.00	$6,500.00
27	Allowance for analysis				
28	Allowance for analysis, transportation and disposal of contaminated soils	LS	1.0	$200,000.00	$200,000.00
29	Allowance for off-duty police officer	LS	1.0	$50,000.00	$50,000.00
30	Allowance for asphalt price adjustment	LS	1.0	$40,000.00	$40,000.00
31	Allowance for fuel price adjustment	LS	1.0	$20,000.00	$20,000.00
32	Allowance for utility relocations	LS	1.0	$100,000.00	$100,000.00
33	Allowance for Township defined work	LS	1.0	$50,000.00	$50,000.00

Item	Description	Unit	Qty	Unit Price	Total Cost
	Summary				
	Estimated construction cost, including overhead and profit				$1,933,100.00
	Cost contingency @ 18%				$348,000.00
	Sub total				$2,281,100.00
	Total Construction Cost				**$2,281,100.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$68,400.00
	Planning and design costs @ 10%				$228,100.00
	Construction phase services @ 10%				$228,100.00
	Sub total				$524,600.00
	Total Project Cost				**$2,805,700.00**
				say,	**$2,810,000.00**

City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Atlantic Street CSO Storage Facility

Date: 8/12/2020

CAPITAL COST ESTIMATE

Estimate Class: 4
Use: Study or feasibility
Definition Level: 0 to 15% of complete development

Expected Accuracy: L: -15% to -30%
H: +20% to +50%

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Traffic control	LS	1.0	$10,000.00	$10,000.00
2	Demolition	LS	1.0	$50,000.00	$50,000.00
3	Site clearing and utilities coordination	LS	1.0	$10,000.00	$10,000.00
4	Preconstruction audio/video documentation	LS	1.0	$3,000.00	$3,000.00
5	Soil erosion and sediment control	LS	1.0	$5,000.00	$5,000.00
6	Test pits	LS	3.0	$3,500.00	$10,500.00
7	Mobilization	LS	1.0	$30,000.00	$30,000.00
8	Construction layout	LS	1.0	$10,000.00	$10,000.00
9	8" DIP force main	LF	298.0	$80.00	$23,840.00
10	36" RCP pipe	LF	128.0	$75.00	$9,600.00
11	48" x 48" RCP box pipe	LF	18.0	$400.00	$7,200.00
12	15" RCP pipe	LF	14.0	$20.00	$280.00
13	Manholes, inlets, chambers, odor control	LS	1.0	$538,750.00	$538,750.00
14	CSO storage tank	LS	1.0	$3,000,000.00	$3,000,000.00
15	Earth Excavation (0-8 ft)	CY	245.0	$30.00	$7,350.00
16	Earth Excavation (8-14 ft)	CY	284.0	$35.00	$9,940.00
17	Earth Excavation (greater than 14 ft)	CY	11940.0	$60.00	$716,400.00
18	Backfill	CY	941.0	$30.00	$28,230.00
19	Uncontaminated soil disposal	CY	11529.0	$10.00	$115,290.00
20	Pump station and pump station utilities	LS	1.0	$396,800.00	$396,800.00
21	Temporary Pavement Replacement	SY	33.0	$70.00	$2,310.00
22	Permanent Pavement Replacement	SY	444.0	$20.00	$8,880.00
23	Furnishing / Placing DGA	CY	114.0	$12.00	$1,368.00
24	Furnishing / Placing 3/4" Crushed Stone	CY	52.0	$12.00	$624.00
25	Backfill Compaction	LF	663.0	$2.25	$1,492.00
26	Concrete Curbing Restoration	LF	398.0	$30.00	$11,940.00
27	Sidewalk Restoration	SF	3044.0	$5.00	$15,220.00
28	Site work	LS	1.0	$505,500.00	$505,500.00
29	Allowance for analysis, transportation and disposal of contaminated soils	LS	1.0	$250,000.00	$250,000.00
30	Allowance for off-duty police officer	LS	1.0	$25,000.00	$25,000.00
31	Allowance for asphalt price adjustment	LS	1.0	$15,000.00	$15,000.00
32	Allowance for fuel price adjustment	LS	1.0	$10,000.00	$10,000.00
33	Allowance for utility relocations	LS	1.0	$50,000.00	$50,000.00
34	Allowance for Township defined work	LS	1.0	$20,000.00	$20,000.00

Item	Description	Unit	Qty	Unit Price	Total Cost
	Summary				
	Estimated construction cost, including overhead and profit				$5,899,500.00
	Cost contingency @ 18%				$1,061,900.00
	Sub total				$6,961,400.00
	Total Construction Cost				**$6,961,400.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$208,800.00
	Planning and design costs @ 7.5%				$522,100.00
	Construction phase services @ 7.5%				$522,100.00
	Sub total				$1,253,000.00
	Total Project Cost				**$8,214,400.00**
				say,	**$8,210,000.00**

City of Elizabeth Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Lincoln Avenue Drainage Improvements Project

CAPITAL COST ESTIMATE

Estimate Class: 4 Expected Accuracy: L: -15% to -30%
Use: Study or feasibility H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Mobilization of equipment, materials and labor	EA	1.0	$327,818.00	$327,818.00
2	12" RCP pipe	LF	20.0	$55.00	$1,100.00
3	18" RCP pipe	LF	30.0	$98.00	$2,940.00
4	24" RCP pipe	LF	265.0	$109.00	$28,885.00
5	36" RCP pipe	LF	1270.0	$175.00	$222,250.00
6	42" RCP pipe	LF	1090.0	$186.00	$202,740.00
7	Excavation	CY	4295.0	$11.00	$47,245.00
8	Furnishing and placing backfill from excavation	CY	3540.0	$55.00	$194,700.00
9	Installation of new manholes	EA	16.0	$10,927.00	$174,832.00
10	Pavement Restoration	SY	1360.0	$82.00	$111,520.00
11	Site Restoration	EA	1.0	$10,927.00	$10,927.00
12	Disposal of waste materials	CY	900.0	$33.00	$29,700.00
13	Traffic control on Cherry, Lincoln, Melrose, Decker, Wilson	DAY	60.0	$1,093.00	$65,580.00
	Summary				
	Estimated construction cost, including overhead and profit				$1,420,200.00
	Hazardous soils allowance (10%)				$142,000.00
	Utility relocation (10%)				$142,000.00
	Cost contingency @ 25%				$355,100.00
	Sub total				$2,059,300.00
	Total Construction Cost				**$2,059,300.00**
	Other Project Costs	Per NJ I-Bank Loan Application Form			
	Engineering Contract				$351,100.00
	Contingencies @ 5%				$103,000.00
	Planning and design costs @ 12%				$247,100.00
	Legal and administrative expenses @ 3%				$61,800.00
	Sub total				$763,000.00
	Total Project Cost				**$2,822,300.00**
				say,	**$2,820,000.00**

City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Park Avenue Stormwater Control Project

Date: 8/12/2020

CAPITAL COST ESTIMATE

Estimate Class: 4 — Expected Accuracy: L: -15% to -30%
Use: Study or feasibility — H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Trench excavation, up to 16 feet deep	CY	10780.0	$45.00	$485,100.00
2	Support excavation system	LS	1.0	$415,400.00	$415,400.00
3	Backfill, imported granular material	CY	8107.0	$30.00	$243,210.00
4	Sewer pipe, 48-inch diameter	LF	3200.0	$420.00	$1,344,000.00
5	Precast manhole structures	EA	13.0	$20,000.00	$260,000.00
6	Service lateral connections	EA	64.0	$1,700.00	$108,800.00
7	Temporary pavement replacement	SY	3556.0	$75.00	$266,700.00
8	Permanent pavement restoration	SY	11733.0	$60.00	$703,980.00
9	Concrete curb replacement	LF	800.0	$50.00	$40,000.00
10	Concrete sidewalk replacement	SY	711.0	$80.00	$56,880.00
11	Soil removal off-site, uncontaminated	CY	9700.0	$30.00	$291,000.00
12	Soil removal off-site, contaminated	TN	1720.0	$75.00	$129,000.00
13	Utility relocations	LS	1.0	$217,200.00	$217,200.00
14	Dewatering	LS	1.0	$217,200.00	$217,200.00
15	Bypass pumping and existing pipe removal	LS	1.0	$320,000.00	$320,000.00
16	Traffic control	LS	1.0	$192,000.00	$192,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$5,290,500.00
	General requirements @ 10%				$529,100.00
	Sub total				$5,819,600.00
	Cost contingency @ 25%				$1,454,900.00
	Sub total				$7,274,500.00
	Total Construction Cost				**$7,274,500.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$218,200.00
	Planning and design costs @ 7.5%				$545,600.00
	Construction phase services @ 7.5%				$545,600.00
	Sub total				$1,309,400.00
	Total Project Cost				**$8,583,900.00**
				say,	**$8,580,000.00**

City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
CSO Basin 012 Sewer Separation Project

Date: 8/12/2020

CAPITAL COST ESTIMATE

Estimate Class: 4 | Expected Accuracy: L: -15% to -30%
Use: Study or feasibility | H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Trench excavation	CY	105.0	$45.00	$4,725.00
2	Support excavation system	LS	1.0	$30,700.00	$30,700.00
3	Backfill, imported granular material	CY	89.0	$40.00	$3,560.00
4	Sewer pipe, 15-inch diameter	LF	70.0	$210.00	$14,700.00
5	Plug outlet pipes	EA	2.0	$5,000.00	$10,000.00
6	Redirect existing storm inlets	EA	4.0	$5,000.00	$20,000.00
7	Temporary pavement replacement	SY	56.0	$75.00	$4,200.00
8	Permanent pavement restoration	SY	257.0	$60.00	$15,420.00
9	Concrete curb replacement	LF	18.0	$50.00	$900.00
10	Concrete sidewalk replacement	SY	16.0	$80.00	$1,280.00
11	Soil removal off-site, uncontaminated	CY	90.0	$30.00	$2,700.00
12	Soil removal off-site, contaminated	TN	20.0	$75.00	$1,500.00
13	Utility relocations	LS	1.0	$5,500.00	$5,500.00
14	Dewatering	LS	1.0	$5,500.00	$5,500.00
15	Bypass pumping and existing pipe removal	LS	1.0	$7,000.00	$7,000.00
16	Traffic control	LS	1.0	$15,000.00	$15,000.00
17	Smoke testing and video inspections	LS	1.0	$15,000.00	$15,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$157,700.00
	General requirements @ 10%				$15,800.00
	Sub total				$173,500.00
	Cost contingency @ 25%				$43,400.00
	Sub total				$216,900.00
	Total Construction Cost				**$216,900.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$6,500.00
	Planning and design costs @ 10%				$21,700.00
	Construction phase services @ 10%				$21,700.00
	Sub total				$49,900.00
	Total Project Cost				**$266,800.00**
				say,	**$270,000.00**

City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
CSO Basin 037 Sewer Separation Project

Date: 8/12/2020

CAPITAL COST ESTIMATE

Estimate Class: 4
Use: Study or feasibility
Definition Level: 0 to 15% of complete development

Expected Accuracy: L: -15% to -30%
H: +20% to +50%

Item	Description	Unit	Qty	Unit Price	Total Cost
A	**12" PVC Sanitary Sewer, 8' to 10'**				
1	Pavement removal	SY	1050.0	$40.00	$42,000.00
2	Trench excavation	CY	3500.0	$30.00	$105,000.00
3	Soil removal off-site	CY	3500.0	$50.00	$175,000.00
4	Backfill, imported granular material	CY	3421.46	$50.00	$171,073.00
5	12" PVC sewer pipe	LF	2700.0	$35.00	$94,500.00
6	Precast manhole, 4' diameter	EA	11.0	$8,000.00	$88,000.00
7	Service lateral connections, redirection, and modifications	EA	14.0	$5,000.00	$70,000.00
8	Temporary pavement replacement	TN	630.0	$115.00	$72,450.00
9	Permanent pavement restoration	TN	1080.0	$100.00	$108,000.00
10	Traffic marking lines and symbols	LS	1.0	$10,000.00	$10,000.00
11	Concrete curb replacement	LF	400.0	$60.00	$24,000.00
12	Concrete sidewalk replacement	SY	222.222	$125.00	$27,778.00
13	Utility relocations	EA	4.0	$40,000.00	$160,000.00
14	Storm drain cleaning and repairs	LF	2700.0	$15.00	$40,500.00
15	Drainage structure cleaning	EA	10.0	$350.00	$3,500.00
16	Sheeting left in place	SF	8000.0	$15.00	$120,000.00
	Sub total			$1,311,801.00	
B	**12" PVC Sanitary Sewer, 10' to 12' Deep**				
1	Pavement removal	SY	77.778	$40.00	$3,111.00
2	Trench excavation	CY	311.111	$30.00	$9,333.00
3	Soil removal off-site	CY	311.111	$50.00	$15,556.00
4	Backfill, imported granular material	CY	305.293	$50.00	$15,265.00
5	12" PVC sewer pipe	LF	200.0	$35.00	$7,000.00
6	Precast manhole, 4' diameter	EA	2.0	$8,000.00	$16,000.00
7	Service lateral connections, redirection, and modifications	EA	2.0	$5,000.00	$10,000.00
8	Temporary pavement replacement	TN	46.667	$115.00	$5,367.00
9	Permanent pavement restoration	TN	80.0	$100.00	$8,000.00
10	Traffic marking lines and symbols	LS	1.0	$1,000.00	$1,000.00
11	Concrete curb replacement	LF	50.0	$60.00	$3,000.00
12	Concrete sidewalk replacement	SY	27.778	$125.00	$3,472.00
13	Utility relocations	EA	1.0	$40,000.00	$40,000.00
14	Storm drain cleaning and repairs	LF	200.0	$15.00	$3,000.00
15	Drainage structure cleaning	EA	2.0	$350.00	$700.00
16	Sheeting left in place	SF	600.0	$15.00	$9,000.00
	Sub total			$149,804.00	

Item	Description	Unit	Qty	Unit Price	Total Cost
C	**15" PVC Sanitary Sewer, 10' to 12' Deep**				
1	Pavement removal	SY	194.444	$40.00	$7,778.00
2	Trench excavation	CY	777.778	$30.00	$23,333.00
3	Soil removal off-site	CY	777.778	$50.00	$38,889.00
4	Backfill, imported granular material	CY	755.052	$50.00	$37,753.00
5	15" PVC sewer pipe	LF	500.0	$35.00	$17,500.00
6	Precast manhole, 4' diameter	EA	2.0	$8,000.00	$16,000.00
7	Service lateral connections, redirection, and modifications	EA	2.0	$5,000.00	$10,000.00
8	Temporary pavement replacement	TN	116.667	$115.00	$13,417.00
9	Permanent pavement restoration	TN	200.0	$100.00	$20,000.00
10	Traffic marking lines and symbols	LS	1.0	$1,000.00	$1,000.00
11	Concrete curb replacement	LF	100.0	$60.00	$6,000.00
12	Concrete sidewalk replacement	SY	55.556	$125.00	$6,944.00
13	Utility relocations	EA	1.0	$40,000.00	$40,000.00
14	Storm drain cleaning and repairs	LF	500.0	$15.00	$7,500.00
15	Drainage structure cleaning	EA	2.0	$350.00	$700.00
16	Sheeting left in place	SF	1200.0	$15.00	$18,000.00
	Sub total			$264,814.00	
D	**Miscellaneous Items**				
1	Jack and bore pipe installation under existing trunk sewer	LS	1.0	$350,000.00	$350,000.00
2	Connection to existing branch interceptor sewer	LS	1.0	$40,000.00	$40,000.00
3	Modifications to regulator and netting chambers	EA	2.0	$25,000.00	$50,000.00
4	Dewatering	LS	1.0	$150,000.00	$150,000.00
5	Maintenance and protection of traffic	LS	1.0	$100,000.00	$100,000.00
6	Environmental testing and additional disposal cost contingency	LS	1.0	$300,000.00	$300,000.00
	Sub total			$990,000.00	
	Summary				
	Estimated construction cost, including overhead and profit				$2,716,400.00
	General requirements @ 10%				$271,600.00
	Sub total				$2,988,000.00
	Cost contingency @ 25%				$747,000.00
	Sub total				$3,735,000.00
	Total Construction Cost				**$3,735,000.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$112,100.00
	Planning and design costs @ 10%				$373,500.00
	Construction phase services @10%				$373,500.00
	Sub total				$859,100.00
	Total Project Cost				**$4,594,100.00**
				say,	**$4,590,000.00**

City of Elizabeth Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Green Stormwater Infrastructure Pilot Program

CAPITAL COST ESTIMATE

Estimate Class: 4 Expected Accuracy: L: -15% to -30%
Use: Study or feasibility H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Rain gardens	EA	10.0	$50,000.00	$500,000.00
2	Other pilot costs (site selection, monitoring, education)	EA	10.0	$33,000.00	$330,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$830,000.00
	Cost contingency @ 25%				$207,500.00
	Sub total				$1,037,500.00
	Total Construction Cost				**$1,037,500.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$31,100.00
	Planning and design costs @ 10%				$103,800.00
	Construction phase services @ 10%				$103,800.00
	Sub total				$238,700.00
	Total Project Cost				**$1,276,200.00**
				say,	**$1,280,000.00**

City of Elizabeth Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Trenton Avenue Pump Station
Phase 1 Upgrade for Integrated Controls to Increase Pump Station Discharge

CAPITAL COST ESTIMATE

Estimate Class: 4 Expected Accuracy: L: -15% to -30%
Use: Study or feasibility H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
A	**Trunk Sewer Level Sensor Site No. 1**				
1	Remove pavement	SY	33.333	$40.00	$1,333.00
2	Remove concrete curbs	LF	20.0	$20.00	$400.00
3	Remove concrete sidewalks	SY	22.222	$40.00	$889.00
4	Trench excavation	CY	44.444	$30.00	$1,333.00
5	Soil removal off-site	CY	44.444	$50.00	$2,222.00
6	Backfill, imported granular material	CY	44.444	$50.00	$2,222.00
7	Duct bank, concrete encased conduits	LF	100.0	$100.00	$10,000.00
8	Pavement replacement	SY	166.667	$40.00	$6,667.00
9	Pavement striping	LS	1.0	$1,000.00	$1,000.00
10	Concrete curb replacement	LF	20.0	$175.00	$3,500.00
11	Concrete sidewalk replacement	SY	22.222	$125.00	$2,778.00
12	Concrete base, control equipment enclosure	CY	6.481	$1,400.00	$9,074.00
13	Control equipment enclosure, stainless steel, with electrical service, PLC, and cell modem	EA	1.0	$35,000.00	$35,000.00
14	Level transmitter, installed in existing manhole structure	EA	1.0	$10,000.00	$10,000.00
15	Electrical work, cables, conduits, terminations, electrical service	LS	1.0	$25,000.00	$25,000.00
	Sub total			$111,418.00	
B	**Trunk Sewer Level Sensor Site No. 2**				
1	Remove pavement	SY	33.333	$40.00	$1,333.00
2	Remove concrete curbs	LF	20.0	$20.00	$400.00
3	Remove concrete sidewalks	SY	22.222	$40.00	$889.00
4	Trench excavation	CY	44.444	$30.00	$1,333.00
5	Soil removal off-site	CY	44.444	$50.00	$2,222.00
6	Backfill, imported granular material	CY	44.444	$50.00	$2,222.00
7	Duct bank, concrete encased conduits	LF	100.0	$100.00	$10,000.00
8	Pavement replacement	SY	166.667	$40.00	$6,667.00
9	Pavement striping	LS	1.0	$1,000.00	$1,000.00
10	Concrete curb replacement	LF	20.0	$175.00	$3,500.00
11	Concrete sidewalk replacement	SY	22.222	$125.00	$2,778.00
12	Concrete base, control equipment enclosure	CY	6.481	$1,400.00	$9,074.00

Item	Description	Unit	Qty	Unit Price	Total Cost
13	Control equipment enclosure, stainless steel, with electrical service, PLC, and cell modem	EA	1.0	$35,000.00	$35,000.00
14	Level transmitter, installed in existing manhole structure	EA	1.0	$10,000.00	$10,000.00
15	Electrical work, cables, conduits, terminations, electrical service	LS	1.0	$25,000.00	$25,000.00
	Sub total			$111,418.00	
C	**Trenton Avenue Pump Station Control Integration**				
1	Electrical enclosure, with PLC, operator interface terminal (OIT) and cell modems	LS	1.0	$25,000.00	$25,000.00
2	Installation	LS	1.0	$10,000.00	$10,000.00
3	Cable and conduit / termination	LS	1.0	$5,000.00	$5,000.00
4	Existing pump station control panel modifications	LS	1.0	$5,000.00	$5,000.00
5	PLC/OIT programming	LS	1.0	$25,000.00	$25,000.00
	Sub total			$70,000.00	
D	**JMEUC Control Room System for Monitoring**				
1	Electrical enclosure, with PLC, operator interface terminal (OIT) and cell modems	LS	1.0	$25,000.00	$25,000.00
2	Installation	LS	1.0	$10,000.00	$10,000.00
3	Cable and conduit / termination	LS	1.0	$5,000.00	$5,000.00
4	PLC/OIT programming	LS	1.0	$25,000.00	$25,000.00
	Sub total			$65,000.00	
	Summary				
	Estimated construction cost, including overhead and profit				$357,800.00
	General requirements @ 10%				$35,800.00
	Sub total				$393,600.00
	Cost contingency @ 25%				$98,400.00
	Sub total				$492,000.00
	Total Construction Cost				**$492,000.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$14,800.00
	Planning and design costs @ 10%				$49,200.00
	Construction phase services @ 10%				$49,200.00
	Sub total				$113,200.00
	Total Project Cost				**$605,200.00**
				say,	**$610,000.00**

City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Trenton Avenue Pump Station
Phase 2 Upgrade for Additional Pumping Capacity

Date: 8/12/2020

CAPITAL COST ESTIMATE

Estimate Class: 4
Use: Study or feasibility
Definition Level: 0 to 15% of complete development

Expected Accuracy: L: -15% to -30%
H: +20% to +50%

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Replace two (2) bar screens	EA	2.0	$700,000.00	$1,400,000.00
2	Install new screenings washer/compactor units	LS	1.0	$450,000.00	$450,000.00
3	Structural repairs and modifications	LS	1.0	$600,000.00	$600,000.00
4	Replace five (5) pumps (pumps, drive shafts & motors)	EA	5.0	$550,000.00	$2,750,000.00
5	Electrical and control system improvements	LS	1.0	$500,000.00	$500,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$5,700,000.00
	General requirements @ 10%				$570,000.00
	Sub total				$6,270,000.00
	Cost contingency @ 25%				$1,567,500.00
	Sub total				$7,837,500.00
	Total Construction Cost				**$7,837,500.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$235,100.00
	Planning and design costs @ 7.5%				$587,800.00
	Construction phase services @ 7.5%				$587,800.00
	Sub total				$1,410,700.00
	Total Project Cost				**$9,248,200.00**
				say,	**$9,250,000.00**

City of Elizabeth Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
New Wet Weather Pump Station

CONSTRUCTION COST ESTIMATE

Estimate Class: 4 Expected Accuracy: L: -15% to -30%
Use: Study or feasibility H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Site demolition and preparation	SF	30000.0	$3.00	$90,000.00
2	Existing building demolition, animal shelter	SF	3840.0	$15.00	$57,600.00
3	Foundation demolition	CY	170.0	$350.00	$59,500.00
4	Hauling and disposal	CY	310.0	$45.00	$13,950.00
5	New diversion chamber				
6	Excavation	CY	580.0	$25.00	$14,500.00
7	Sheeting	SF	2592.0	$50.00	$129,600.00
8	Structural fill	CY	205.0	$40.00	$8,200.00
9	Concrete work	CY	157.0	$1,400.00	$219,800.00
10	Isolation gates	LS	1.0	$50,000.00	$50,000.00
11	Metal fabrications and appurtenances	LS	1.0	$40,000.00	$40,000.00
12	Subtotal			$462,100.00	
13	Flow diversion channel and piping	LF	300.0	$2,500.00	$750,000.00
14	New screening facility				
15	Excavation	CY	4350.0	$25.00	$108,750.00
16	Sheeting	SF	7290.0	$50.00	$364,500.00
17	Structural fill	CY	1971.0	$40.00	$78,840.00
18	Concrete work	CY	1000.0	$1,400.00	$1,400,000.00
19	Isolation gates	LS	1.0	$75,000.00	$75,000.00
20	Mechanically cleaned bar screens	EA	2.0	$700,000.00	$1,400,000.00
21	Structure/capony	SF	2400.0	$250.00	$600,000.00
22	Metal fabrications and appurtenances	LS	1.0	$40,000.00	$40,000.00
23	Subtotal			$4,067,090.00	
24	New submersible wet weather pump station, parametric cost curve, 110 MGD	LS	1.0	$18,942,000.00	$18,942,000.00
25	New meter chamber				
26	Excavation	CY	205.0	$25.00	$5,125.00
27	Sheeting	SF	960.0	$50.00	$48,000.00
28	Pile foundation	LS	1.0	$25,000.00	$25,000.00
29	Structural fill	CY	85.0	$40.00	$3,400.00
30	Concrete work	CY	74.0	$1,400.00	$103,600.00
31	Process equipment and piping	LS	1.0	$100,000.00	$100,000.00
32	Metal fabrications and appurtenances	LS	1.0	$28,510.00	$28,510.00
33	Subtotal			$313,635.00	
34	Additional electrical facilities	LS	1.0	$495,100.00	$495,100.00
35	Miscellaneous site work	LS	1.0	$247,600.00	$247,600.00

Item	Description	Unit	Qty	Unit Price	Total Cost
	Summary				
	Estimated construction cost, including overhead and profit				$25,498,600.00
	General requirements @ 10%				$2,549,900.00
	Sub total				$28,048,500.00
	Cost contingency @ 25%				$7,012,100.00
	Sub total				$35,060,600.00
	Total Construction Cost				**$35,060,600.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$1,051,800.00
	Planning and design costs @ 7.5%				$2,629,500.00
	Construction phase services @ 7.5%				$2,629,500.00
	Sub total				$6,310,800.00
	Total Project Cost				**$41,371,400.00**
				say,	**$41,370,000.00**

City of Elizabeth Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
New Wet Weather Pump Station Force Main to Treatment Plant

CAPITAL COST ESTIMATE

Estimate Class: 4 Expected Accuracy: L: -15% to -30%
Use: Study or feasibility H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
A	**Open Cut Installation**				
1	Trench excavation, up to 10 feet deep	CY	7255.0	$35.00	$253,925.00
2	Support excavation system	LS	1.0	$280,100.00	$280,100.00
3	Backfill, imported granular material	CY	4728.0	$40.00	$189,120.00
4	Sewer force main, 60-inch diameter	LF	2100.0	$570.00	$1,197,000.00
5	Air release and blowoff chambers	EA	3.0	$45,000.00	$135,000.00
6	Temporary pavement replacement	SY	2800.0	$75.00	$210,000.00
7	Permanent pavement restoration	SY	7700.0	$60.00	$462,000.00
8	Concrete curb replacement	LF	525.0	$50.00	$26,250.00
9	Concrete sidewalk replacement	SY	467.0	$80.00	$37,360.00
10	Soil removal off-site, uncontaminated	CY	6530.0	$30.00	$195,900.00
11	Soil removal off-site, contaminated	TN	1160.0	$75.00	$87,000.00
12	Utility relocations	LS	1.0	$153,700.00	$153,700.00
13	Dewatering	LS	1.0	$153,700.00	$153,700.00
14	Traffic control	LS	1.0	$126,000.00	$126,000.00
	Subtotal			$3,507,055.00	
B	**Microtunneling, Interstate I-95 Crossing**				
1	Jacking and receiving pit excavations	CY	300.0	$350.00	$105,000.00
2	Microtunneling mobilization and setups	LS	1.0	$300,000.00	$300,000.00
3	Casing pipe installation, microtunnel	LF	700.0	$3,300.00	$2,310,000.00
4	Carrier pipe installation, 60-inch	LF	700.0	$600.00	$420,000.00
5	Chamber structures and transitions	EA	2.0	$125,000.00	$250,000.00
6	Vents and chamber appurtenances	LS	1.0	$20,000.00	$20,000.00
7	Site work	LS	1.0	$102,200.00	$102,200.00
8	Soil removal off-site, uncontaminated	CY	270.0	$30.00	$8,100.00
9	Soil removal off-site, contaminated	TN	48.0	$100.00	$4,800.00
10	Utility relocations	LS	1.0	$176,000.00	$176,000.00
11	Traffic control	LS	1.0	$150,000.00	$150,000.00
	Subtotal			$3,846,100.00	
	Summary				
	Estimated construction cost, including overhead and profit				$7,353,200.00
	General requirements @ 10%				$735,300.00
	Sub total				$8,088,500.00
	Cost contingency @ 25%				$2,022,100.00
	Sub total				$10,110,600.00
	Total Construction Cost				**$10,110,600.00**
	Other Project Costs				

Item	Description	Unit	Qty	Unit Price	Total Cost
	Legal and administrative expenses @ 3%				$303,300.00
	Planning and design costs @ 7.5%				$758,300.00
	Construction phase services @ 7.5%				$758,300.00
	Sub total				$1,819,900.00
	Total Project Cost				**$11,930,500.00**
				say,	**$11,930,000.00**

CSO Treatment Process at JMEUC WWTF					
Capital Estimate - Screens and Chlorine Contant Tank (CCT)					
CAPITAL COSTS					
Category	Item	Quantity	Unit	Unit Cost	Total Cost
Civil					
Meter Vault	Piles	8	ea	$3,100	$24,800
	clearing/stripping	432	sq ft	$4	$1,700
	Excavation	224	cu yd	$12.00	$2,700
	Backfill	101	cu yd	$27.00	$2,700
	Sheeting	1,008	sq ft	$52.00	$52,400
Screening Bldg	Piles	55	ea	$3,100	$170,500
	clearing/stripping	4,050	sq ft	$4	$16,200
	Excavation	1,650	cu yd	$12.00	$19,800
	Backfill	857	cu yd	$27.00	$23,100
	Sheeting	2,430	sq ft	$52.00	$126,400
Chlorine Contact Tank	Piles	110	ea	$3,100	$341,000
	clearing/stripping	7,900	sq ft	$4	$31,600
	Excavation	3,511	cu yd	$12.00	$42,100
	Backfill	1671	cu yd	$27.00	$45,100
	Sheeting	4,160	sq ft	$52.00	$216,300
Piping/Utilities	60" influent to meter vault (Steel)	200	lin ft	$1,500.00	$300,000
	60" effluent from Screen Bldge to CCT	20	lin ft	$1,500.00	$30,000
	60" effluent from CCT to PST eff	447.5	lin ft	$4,000.00	$1,790,000
	4" Non-Potable Water Service	200	lin ft	$200.00	$40,000
	1.5" Hypo, dbl contained	300	lin ft	$100.00	$30,000
	0.5" bisulfite, dbl contained	214	lin ft	$100.00	$21,400
	Dewatering	1	allow	$150,000.00	$150,000
	Tunnel Under Pri Eff Conduit	40	lin ft	$2,000.00	$80,000
	Jacking and Receiving pits	2	ea	$10,000.00	$20,000
	60" tie in to PST overflow chamb.	1	ea	$250,000.00	$250,000
	New Asphalt Paved Drive	5700	sq ft	$25	$142,500
	Relocate sewer piping	200	lin ft	$240.00	$48,000
	Existing Road Replacement	6000	sq ft	$25.00	$150,000
	Civil Subtotal				$4,168,300
Mechanical/Process					
Meter Vault	60-inch RW Isolation BFV	1	ea	$72,000.00	$72,000
	60-inch Meter Vault Internal Piping	30	lin ft	$600.00	$18,000
	Hatches and ladders	1	allow	$50,000.00	$50,000
	sump pumps and piping	1	ea	$30,000.00	$30,000
	supports and ancillarys	1	lot	$20,000.00	$20,000
Screen Bldg	5/8-inch Mechanical Screens	1	lot	$518,000.00	$518,000
	1/8-inch Mechanical Screens	1	lot	$658,000.00	$658,000
	Screening washer/compactor	2	ea	$101,500.00	$203,000
	Isolation gates	4	ea	$18,500.00	$74,000
	Process Piping	80	lf	$300.00	$24,000
	supports and ancillarys	1	lot	$40,000.00	$40,000
CCT	Chemical Mixer	2	ea	$69,700.00	$139,400

CSO Treatment Process at JMEUC WWTF					
Capital Estimate - Screens and Chlorine Contant Tank (CCT)					
CAPITAL COSTS					
Category	Item	Quantity	Unit	Unit Cost	Total Cost
	sump pumps and piping	2	ea	$30,000.00	$60,000
	Hatches and ladders	1	allow	$50,000.00	$50,000
	supports and ancillarys	1	lot	$40,000.00	$40,000
Existing Facilities	metering pumps	4	ea	$40,000.00	$160,000
	Tanks	0	ea	$30,000.00	$0
	supports and ancillarys	1	lot	$40,000.00	$40,000
	Mech equipment Subtotal				$2,196,400
	Installation of Mechanical Equipment	25	%		$549,100
			lin ft		$0
			lin ft		$0
			lin ft		$0
Structural/Architectural					
Meter Vault	Concrete Foundation	22	cu. yd	$1,000.00	$21,500
	Concrete Walls	44	cu. yd	$1,200.00	$52,900
	Concrete Top Slab	10	cu. yd	$1,400.00	$14,400
	Wall Pipes	2	ea	$5,000.00	$10,000
Screen Building	Concrete Foundation	151	cu. yd	$1,000.00	$150,800
	Concrete Walls	384	cu. yd	$1,200.00	$461,000
	Concrete Fill		cu. yd	$800.00	$0
	Concrete Top Slab	88	cu. yd	$1,400.00	$123,400
	Stairs and Platforms	1	ea	$100,000.00	$100,000
	Wall Pipes	2	ea	$5,000.00	$10,000
	Superstructure	2,379	sq ft	$370.00	$880,200
Chlorine Contact Tank	Concrete Foundation	431	cu. yd	$1,000.00	$430,700
	Concrete Walls	524	cu. yd	$1,200.00	$628,400
	Concrete Fill		cu. yd	$800.00	$0
	Stairs and Platforms	1	ea	$100,000.00	$100,000
	Structural Subtotal				$2,983,300
Electrical	Lighting	1	allow	$70,000.00	$70,000
	wiring of mech equip and instruments	10	%		$184,200
	MCCS	1	allow	$200,000.00	$200,000
	Feeders from substation	300	lin ft	$1,200.00	$360,000
	Electrical Subtotal				$814,200
Instrumentation	Programming	7	%		$137,400
	influent meter	60	in	$1,000.00	$60,000
	chlorine analyzers	2	ea	$30,000.00	$60,000
	miscellaneous	1	allow	$40,000.00	$40,000
	Instrumentation Subtotal				$297,400
	Total				$11,008,700

CSO Treatment Process at JMEUC WWTF					
Capital Estimate - Screens and Chlorine Contant Tank (CCT)					
CAPITAL COSTS					
Category	Item	Quantity	Unit	Unit Cost	Total Cost
	General Requirements			10%	$12,109,600
	Contractor O&P			20%	$14,531,500
	Construction Contingency			25%	$18,164,400
	Total Opinion of Probable Construction Cost				$18,164,400
	Engineering and Implementation			15%	$20,889,100
	Total Opinion of Probable Project Cost				$20,890,000

City of Elizabeth | Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Easterly Interceptor Improvements

CAPITAL COST ESTIMATE

Estimate Class: 4 | Expected Accuracy: L: -15% to -30%
Use: Study or feasibility | H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Regulator R001 Modification	LS	1.0	$300,000.00	$300,000.00
2	Regulator R002 Modification	LS	1.0	$300,000.00	$300,000.00
3	Regulator R035 Modification	LS	1.0	$300,000.00	$300,000.00
4	Dowd Avenue Siphon Upgrade				
	Connections to existing system	EA	2.0	$15,000.00	$30,000.00
	Sewer pipe, 18-inch diameter	LF	150.0	$300.00	$45,000.00
	Jacking and receiving pit excavations	CY	330.0	$250.00	$82,500.00
	Casing pipe installation, jack and bore	LF	100.0	$2,000.00	$200,000.00
	Backfill, imported granular material	CY	450.0	$40.00	$18,000.00
	Chamber structures and transitions	EA	2.0	$25,000.00	$50,000.00
	Temporary pavement replacement	SY	133.0	$75.00	$9,975.00
	Permanent pavement restoration	SY	550.0	$60.00	$33,000.00
	Concrete curb replacement	LF	38.0	$50.00	$1,900.00
	Concrete sidewalk replacement	SY	33.0	$80.00	$2,640.00
	Soil removal off-site, uncontaminated	CY	400.0	$30.00	$12,000.00
	Soil removal off-site, contaminated	TN	100.0	$100.00	$10,000.00
	Utility relocations	LS	1.0	$24,800.00	$24,800.00
	Dewatering	LS	1.0	$24,800.00	$24,800.00
	Bypass pumping and existing pipe removal	LS	1.0	$25,000.00	$25,000.00
	Traffic control	LS	1.0	$25,000.00	$25,000.00
	Subtotal			$594,615.00	
	Summary				
	Estimated construction cost, including overhead and profit				$1,494,600.00
	General requirements @ 10%				$149,500.00
	Sub total				$1,644,100.00
	Cost contingency @ 25%				$411,000.00
	Sub total				$2,055,100.00
	Total Construction Cost				**$2,055,100.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$61,700.00
	Planning and design costs @ 10%				$205,500.00
	Construction phase services @ 10%				$205,500.00
	Sub total				$472,700.00
	Total Project Cost				**$2,527,800.00**
				say,	**$2,530,000.00**

City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Bridge Street Siphon Upgrade

Date: 8/12/2020

CAPITAL COST ESTIMATE

Estimate Class: 4 — Expected Accuracy: L: -15% to -30%
Use: Study or feasibility — H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Connections to existing system	EA	2.0	$25,000.00	$50,000.00
2	Flow diversion piping, 42-inch, incl. excavation, install and backfill	LF	100.0	$1,400.00	$140,000.00
3	Jacking and receiving pit excavations	CY	670.0	$250.00	$167,500.00
4	Casing pipe installation, jack and bore	LF	150.0	$3,000.00	$450,000.00
5	Carrier pipe installtion	LF	150.0	$600.00	$90,000.00
6	Backfill, imported granular material	CY	640.0	$40.00	$25,600.00
7	Chamber structures and transitions	EA	2.0	$100,000.00	$200,000.00
8	Vents and appurtenances	LS	1.0	$20,000.00	$20,000.00
9	Temporary pavement replacement	SY	150.0	$75.00	$11,250.00
10	Permanent pavement restoration	SY	550.0	$60.00	$33,000.00
11	Concrete curb replacement	LF	100.0	$50.00	$5,000.00
12	Concrete sidewalk replacement	SY	100.0	$80.00	$8,000.00
13	Site restoration work	LS	1.0	$25,000.00	$25,000.00
14	Soil removal off-site, uncontaminated	CY	600.0	$30.00	$18,000.00
15	Soil removal off-site, contaminated	TN	100.0	$100.00	$10,000.00
16	Utility relocations	LS	1.0	$62,700.00	$62,700.00
17	Dewatering	LS	1.0	$62,700.00	$62,700.00
18	Bypass pumping	LS	1.0	$50,000.00	$50,000.00
19	Traffic control	LS	1.0	$125,000.00	$125,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$1,553,800.00
	General requirements @ 10%				$155,400.00
	Sub total				$1,709,200.00
	Cost contingency @ 25%				$427,300.00
	Sub total				$2,136,500.00
	Total Construction Cost				**$2,136,500.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$64,100.00
	Planning and design costs @ 10%				$213,700.00
	Construction phase services @ 10%				$213,700.00
	Sub total				$491,500.00
	Total Project Cost				**$2,628,000.00**
				say,	**$2,630,000.00**

City of Elizabeth Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Lower Westerly Interceptor Upgrade

CAPITAL COST ESTIMATE

Estimate Class: 4 Expected Accuracy: L: -15% to -30%
Use: Study or feasibility H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Trench excavation, up to 24 feet deep	CY	49409.0	$55.00	$2,717,495.00
2	Support excavation system	LS	1.0	$3,972,300.00	$3,972,300.00
3	Backfill, imported granular material	CY	39579.0	$40.00	$1,583,160.00
4	Sewer pipe, 60-inch diameter	LF	3265.0	$670.00	$2,187,550.00
5	Sewer pipe, 72-inch diameter	LF	3697.0	$790.00	$2,920,630.00
6	Precast manhole structures	EA	28.0	$45,000.00	$1,260,000.00
7	Service lateral connections	EA	139.0	$1,700.00	$236,300.00
8	Temporary pavement replacement	SY	9693.0	$75.00	$726,975.00
9	Permanent pavement restoration	SY	25527.0	$60.00	$1,531,620.00
10	Concrete curb replacement	LF	1741.0	$50.00	$87,050.00
11	Concrete sidewalk replacement	SY	1547.0	$80.00	$123,760.00
12	Soil removal off-site, uncontaminated	CY	44470.0	$30.00	$1,334,100.00
13	Soil removal off-site, contaminated	TN	7910.0	$75.00	$593,250.00
14	Utility relocations	LS	1.0	$963,700.00	$963,700.00
15	Dewatering	LS	1.0	$963,700.00	$963,700.00
16	Bypass pumping and existing pipe removal	LS	1.0	$696,200.00	$696,200.00
17	Traffic control	LS	1.0	$417,700.00	$417,700.00
	Summary				
	Estimated construction cost, including overhead and profit				$22,315,500.00
	General requirements @ 10%				$2,231,600.00
	Sub total				$24,547,100.00
	Cost contingency @ 25%				$6,136,800.00
	Sub total				$30,683,900.00
	Total Construction Cost				**$30,683,900.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$920,500.00
	Planning and design costs @ 7.5%				$2,301,300.00
	Construction phase services @ 7.5%				$2,301,300.00
	Sub total				$5,523,100.00
	Total Project Cost				**$36,207,000.00**
				say,	**$36,210,000.00**

City of Elizabeth | Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Palmer Street Branch Interceptor Upgrade

CAPITAL COST ESTIMATE

Estimate Class: 4 | Expected Accuracy: L: -15% to -30%
Use: Study or feasibility | H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Trench excavation, up to 16 feet deep	CY	4671.0	$45.00	$210,195.00
2	Support excavation system	LS	1.0	$183,500.00	$183,500.00
3	Backfill, imported granular material	CY	3865.0	$40.00	$154,600.00
4	Sewer pipe, 30-inch diameter	LF	720.0	$378.00	$272,160.00
5	Sewer pipe, 36-inch diameter	LF	780.0	$390.00	$304,200.00
6	Precast manhole structures	EA	9.0	$25,000.00	$225,000.00
7	Service lateral connections	EA	30.0	$1,700.00	$51,000.00
8	Temporary pavement replacement	SY	1627.0	$75.00	$122,025.00
9	Permanent pavement restoration	SY	5500.0	$60.00	$330,000.00
10	Concrete curb replacement	LF	375.0	$50.00	$18,750.00
11	Concrete sidewalk replacement	SY	333.0	$80.00	$26,640.00
12	Soil removal off-site, uncontaminated	CY	4200.0	$30.00	$126,000.00
13	Soil removal off-site, contaminated	TN	750.0	$75.00	$56,250.00
14	Utility relocations	LS	1.0	$104,000.00	$104,000.00
15	Dewatering	LS	1.0	$104,000.00	$104,000.00
16	Bypass pumping and existing pipe removal	LS	1.0	$150,000.00	$150,000.00
17	Traffic control	LS	1.0	$90,000.00	$90,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$2,528,300.00
	General requirements @ 10%				$252,800.00
	Sub total				$2,781,100.00
	Cost contingency @ 25%				$695,300.00
	Sub total				$3,476,400.00
	Total Construction Cost				**$3,476,400.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$104,300.00
	Planning and design costs @ 10%				$347,600.00
	Construction phase services @ 10%				$347,600.00
	Sub total				$799,500.00
	Total Project Cost				**$4,275,900.00**
				say,	**$4,280,000.00**

City of Elizabeth — Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Palmer Street Siphon Upgrade

CAPITAL COST ESTIMATE

Estimate Class: 4 — Expected Accuracy: L: -15% to -30%
Use: Study or feasibility — H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Connections to existing system	EA	2.0	$25,000.00	$50,000.00
2	Flow diversion piping, 30-inch, incl. excavation, install and backfill	LF	100.0	$1,200.00	$120,000.00
3	Jacking and receiving pit excavations	CY	670.0	$250.00	$167,500.00
4	Casing pipe installation, jack and bore	LF	170.0	$2,500.00	$425,000.00
5	Carrier pipe installtion	LF	170.0	$500.00	$85,000.00
6	Backfill, imported granular material	CY	640.0	$40.00	$25,600.00
7	Chamber structures and transitions	EA	2.0	$100,000.00	$200,000.00
8	Vents and appurtenances	LS	1.0	$20,000.00	$20,000.00
9	Temporary pavement replacement	SY	150.0	$75.00	$11,250.00
10	Permanent pavement restoration	SY	550.0	$60.00	$33,000.00
11	Concrete curb replacement	LF	100.0	$50.00	$5,000.00
12	Concrete sidewalk replacement	SY	100.0	$80.00	$8,000.00
13	Site restoration work	LS	1.0	$25,000.00	$25,000.00
14	Soil removal off-site, uncontaminated	CY	600.0	$30.00	$18,000.00
15	Soil removal off-site, contaminated	TN	100.0	$100.00	$10,000.00
16	Utility relocations	LS	1.0	$60,200.00	$60,200.00
17	Dewatering	LS	1.0	$60,200.00	$60,200.00
18	Bypass pumping	LS	1.0	$50,000.00	$50,000.00
19	Traffic control	LS	1.0	$125,000.00	$125,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$1,498,800.00
	General requirements @ 10%				$149,900.00
	Sub total				$1,648,700.00
	Cost contingency @ 25%				$412,200.00
	Sub total				$2,060,900.00
	Total Construction Cost				**$2,060,900.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$61,800.00
	Planning and design costs @ 10%				$206,100.00
	Construction phase services @ 10%				$206,100.00
	Sub total				$474,000.00
	Total Project Cost				**$2,534,900.00**
				say,	**$2,530,000.00**

City of Elizabeth Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Pearl Street Branch Interceptor Upgrade

CAPITAL COST ESTIMATE

Estimate Class: 4 Expected Accuracy: L: -15% to -30%
Use: Study or feasibility H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Trench excavation, up to 20 feet deep	CY	7392.0	$45.00	$332,640.00
2	Support excavation system	LS	1.0	$289,800.00	$289,800.00
3	Backfill, imported granular material	CY	6533.0	$40.00	$261,320.00
4	Sewer pipe, 30-inch diameter	LF	1800.0	$378.00	$680,400.00
5	Precast manhole structures	EA	7.0	$25,000.00	$175,000.00
6	Service lateral connections	EA	36.0	$1,700.00	$61,200.00
7	Temporary pavement replacement	SY	1900.0	$75.00	$142,500.00
8	Permanent pavement restoration	SY	6600.0	$60.00	$396,000.00
9	Concrete curb replacement	LF	450.0	$50.00	$22,500.00
10	Concrete sidewalk replacement	SY	400.0	$80.00	$32,000.00
11	Soil removal off-site, uncontaminated	CY	6650.0	$30.00	$199,500.00
12	Soil removal off-site, contaminated	TN	1180.0	$75.00	$88,500.00
13	Utility relocations	LS	1.0	$134,100.00	$134,100.00
14	Dewatering	LS	1.0	$134,100.00	$134,100.00
15	Bypass pumping and existing pipe removal	LS	1.0	$180,000.00	$180,000.00
16	Traffic control	LS	1.0	$108,000.00	$108,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$3,237,600.00
	General requirements @ 10%				$323,800.00
	Sub total				$3,561,400.00
	Cost contingency @ 25%				$890,400.00
	Sub total				$4,451,800.00
	Total Construction Cost				**$4,451,800.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$133,600.00
	Planning and design costs @ 10%				$445,200.00
	Construction phase services @ 10%				$445,200.00
	Sub total				$1,024,000.00
	Total Project Cost				**$5,475,800.00**
				say,	**$5,480,000.00**

City of Elizabeth Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Typical Regulator Modification

CAPITAL COST ESTIMATE

Estimate Class: 4 Expected Accuracy: L: -15% to -30%
Use: Study or feasibility H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Trench excavation	CY	142.0	$45.00	$6,390.00
2	Support excavation system	LS	1.0	$24,700.00	$24,700.00
3	Backfill, imported granular material	CY	125.0	$40.00	$5,000.00
4	Sewer pipe, 24-inch diameter	LF	50.0	$330.00	$16,500.00
5	Temporary pavement replacement	SY	44.0	$75.00	$3,300.00
6	Permanent pavement restoration	SY	183.0	$60.00	$10,980.00
7	Concrete curb replacement	LF	13.0	$50.00	$650.00
8	Concrete sidewalk replacement	SY	11.0	$80.00	$880.00
9	Soil removal off-site, uncontaminated	CY	130.0	$30.00	$3,900.00
10	Soil removal off-site, contaminated	TN	20.0	$75.00	$1,500.00
11	Structural modifications	LS	1.0	$150,000.00	$150,000.00
12	Hatches and appurtenances	LS	1.0	$10,000.00	$10,000.00
13	Utility relocations	LS	1.0	$11,700.00	$11,700.00
14	Dewatering	LS	1.0	$11,700.00	$11,700.00
15	Bypass pumping and existing pipe removal	LS	1.0	$25,000.00	$25,000.00
16	Traffic control	LS	1.0	$15,000.00	$15,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$297,200.00
	General requirements @ 10%				$29,700.00
	Sub total				$326,900.00
	Cost contingency @ 25%				$81,700.00
	Sub total				$408,600.00
	Total Construction Cost				**$408,600.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$12,300.00
	Planning and design costs @ 10%				$40,900.00
	Construction phase services @ 10%				$40,900.00
	Sub total				$94,100.00
	Total Project Cost				**$502,700.00**
				say,	**$500,000.00**

City of Elizabeth Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Upper Westerly Interceptor Upgrade

CAPITAL COST ESTIMATE

Estimate Class: 4 Expected Accuracy: L: -15% to -30%
Use: Study or feasibility H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Trench excavation, up to 20 feet deep	CY	27599.0	$45.00	$1,241,955.00
2	Support excavation system	LS	1.0	$2,462,900.00	$2,462,900.00
3	Backfill, imported granular material	CY	22675.0	$40.00	$907,000.00
4	Sewer pipe, 54-inch diameter	LF	4200.0	$624.00	$2,620,800.00
5	Sewer pipe, 60-inch diameter	LF	500.0	$670.00	$335,000.00
6	Precast manhole structures	EA	19.0	$35,000.00	$665,000.00
7	Service lateral connections	EA	94.0	$1,700.00	$159,800.00
8	Temporary pavement replacement	SY	6033.0	$75.00	$452,475.00
9	Permanent pavement restoration	SY	17233.0	$60.00	$1,033,980.00
10	Concrete curb replacement	LF	1175.0	$50.00	$58,750.00
11	Concrete sidewalk replacement	SY	1044.0	$80.00	$83,520.00
12	Soil removal off-site, uncontaminated	CY	24840.0	$30.00	$745,200.00
13	Soil removal off-site, contaminated	TN	4420.0	$75.00	$331,500.00
14	Connection and modifications to Regulator 005	LS	1.0	$300,000.00	$300,000.00
15	Utility relocations	LS	1.0	$554,900.00	$554,900.00
16	Dewatering	LS	1.0	$554,900.00	$554,900.00
17	Bypass pumping and existing pipe removal	LS	1.0	$470,000.00	$470,000.00
18	Traffic control	LS	1.0	$282,000.00	$282,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$13,259,700.00
	General requirements @ 10%				$1,326,000.00
	Sub total				$14,585,700.00
	Cost contingency @ 25%				$3,646,400.00
	Sub total				$18,232,100.00
	Total Construction Cost				**$18,232,100.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$547,000.00
	Planning and design costs @ 7.5%				$1,367,400.00
	Construction phase services @ 7.5%				$1,367,400.00
	Sub total				$3,281,800.00
	Total Project Cost				**$21,513,900.00**
				say,	**$21,510,000.00**

City of Elizabeth Date: 8/12/2020
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Morris Avenue Siphon Upgrade

CAPITAL COST ESTIMATE

Estimate Class: 4 Expected Accuracy: L: -15% to -30%
Use: Study or feasibility H: +20% to +50%
Definition Level: 0 to 15% of complete development

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Connections to existing system	EA	2.0	$25,000.00	$50,000.00
2	Flow diversion piping, 30-inch, incl. excavation, install and backfill	LF	100.0	$1,200.00	$120,000.00
3	Jacking and receiving pit excavations	CY	670.0	$250.00	$167,500.00
4	Casing pipe installation, jack and bore	LF	100.0	$2,500.00	$250,000.00
5	Carrier pipe installtion	LF	100.0	$500.00	$50,000.00
6	Backfill, imported granular material	CY	640.0	$40.00	$25,600.00
7	Chamber structures and transitions	EA	2.0	$100,000.00	$200,000.00
8	Vents and appurtenances	LS	1.0	$20,000.00	$20,000.00
9	Temporary pavement replacement	SY	150.0	$75.00	$11,250.00
10	Permanent pavement restoration	SY	550.0	$60.00	$33,000.00
11	Concrete curb replacement	LF	100.0	$50.00	$5,000.00
12	Concrete sidewalk replacement	SY	100.0	$80.00	$8,000.00
13	Site restoration work	LS	1.0	$25,000.00	$25,000.00
14	Soil removal off-site, uncontaminated	CY	600.0	$30.00	$18,000.00
15	Soil removal off-site, contaminated	TN	100.0	$100.00	$10,000.00
16	Utility relocations	LS	1.0	$49,700.00	$49,700.00
17	Dewatering	LS	1.0	$49,700.00	$49,700.00
18	Bypass pumping	LS	1.0	$50,000.00	$50,000.00
19	Traffic control	LS	1.0	$125,000.00	$125,000.00
	Summary				
	Estimated construction cost, including overhead and profit				$1,267,800.00
	General requirements @ 10%				$126,800.00
	Sub total				$1,394,600.00
	Cost contingency @ 25%				$348,700.00
	Sub total				$1,743,300.00
	Total Construction Cost				**$1,743,300.00**
	Other Project Costs				
	Legal and administrative expenses @ 3%				$52,300.00
	Planning and design costs @ 10%				$174,300.00
	Construction phase services @ 10%				$174,300.00
	Sub total				$400,900.00
	Total Project Cost				**$2,144,200.00**
				say,	**$2,140,000.00**

Appendix C

Financial Capability Assessment Details

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City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Financial Capability Assessment Details

Time-Based Financial Model
Input Parameters, Sources, and Assumptions

October 2020

Item	Value	Notes/Sources
Residential Share of Billed Wastewater Infrastructure Costs	75.00%	2018 Metered Water Consumption. City of Elizabeth.
Demographics		
Population	129,363	Census - American Community Survey, 2017 Estimate
Occupied housing units	40,219	Census - American Community Survey, 2017 Estimate
Owner-occupied housing units	9,951	Census - American Community Survey, 2017 Estimate
Renter-occupied housing units	30,268	Census - American Community Survey, 2017 Estimate
Median Household Income (MHI)		
Base Year MHI	$45,186	Census - American Community Survey, 2017 Estimate
Base Year	2017	Income adjustment base point
Income Growth Rate	1.50%	Annualized rate, 2000-2017.
Existing Sewer System Costs		
Existing Sewer O&M Cost Escalation Rate (/yr)	3.50%	National Association of Clean Water Agencies, 2018 Cost of Clean Water
No. Years Applied	30	Reverts to income growth rate after given number of years
Existing Debt Service Escalation Rate (/yr)	1.50%	Equal to income growth rate
CSO Construction Cost Inflation Rate (/yr)	3.00%	2000-2019 ENR Construction Cost Index
New O&M Cost Escalation Rate (/yr)	2.75%	Natural Resources Conservation Service (NRCS) 2018 Federal Water Projects discount rate
Financing for Future Capital Costs		
Bond Interest Rate		
Market	6.00%	Average interest rate 1986 - 2015, revenue bonds, Bond Buyer
NJDEP	0.00%	NJ I Bank - Smart Growth financing 25% at market rate and 75% at 0% rate, 20 year term
Interest Rate Blend		
Market	25%	NJ I Bank - Smart Growth financing 25% at market rate and 75% at 0% rate, 20 year term
NJDEP	75%	NJ I Bank - Smart Growth financing 25% at market rate and 75% at 0% rate, 20 year term
Blended Interest Rate	1.500%	NJ I Bank - Smart Growth financing 25% at market rate and 75% at 0% rate, 20 year term
Bond Term (years)	20	NJ I Bank - Smart Growth financing 25% at market rate and 75% at 0% rate, 20 year term

City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Financial Capability Assessment Details

Time-Based Financial Model Summary Data

Cost Per Household and Residential Indicator Worksheet 1 and 2 Calculations

October 2020

	Existing Sewer System Cost			CSO Control Program Costs				
Year	O&M Costs	Debt Service	Subtotal	Additional O&M Costs	Capital Outlay & Loan Amount	Additional Debt Service	Other Add'l Costs	Subtotal
0	$20,175,000	$10,665,000	$30,840,000	$0	$0	$0	$0	$0
1	$20,881,000	$10,825,000	$31,706,000	$68,000	$1,948,000	$113,000	$50,000	$2,179,000
2	$21,612,000	$10,987,000	$32,599,000	$69,000	$5,792,000	$451,000	$51,000	$6,363,000
3	$22,368,000	$11,152,000	$33,520,000	$247,000	$5,642,000	$779,000	$53,000	$6,721,000
4	$23,151,000	$11,319,000	$34,470,000	$253,000	$6,081,000	$1,134,000	$54,000	$7,522,000
5	$23,961,000	$11,489,000	$35,450,000	$260,000	$6,334,000	$1,503,000	$56,000	$8,153,000
6	$24,800,000	$11,662,000	$36,462,000	$267,000	$7,110,000	$1,917,000	$57,000	$9,351,000
7	$25,668,000	$11,836,000	$37,504,000	$354,000	$3,314,000	$2,110,000	$59,000	$5,837,000
8	$26,566,000	$12,014,000	$38,580,000	$364,000	$3,413,000	$2,308,000	$60,000	$6,145,000
9	$27,496,000	$12,194,000	$39,690,000	$404,000	$4,963,000	$2,598,000	$62,000	$8,027,000
10	$28,459,000	$12,377,000	$40,836,000	$415,000	$5,112,000	$2,895,000	$64,000	$8,486,000
11	$29,455,000	$12,563,000	$42,018,000	$541,000	$7,341,000	$3,323,000	$66,000	$11,271,000
12	$30,486,000	$12,751,000	$43,237,000	$556,000	$10,774,000	$3,950,000	$67,000	$15,347,000
13	$31,553,000	$12,943,000	$44,496,000	$571,000	$11,098,000	$4,597,000	$69,000	$16,335,000
14	$32,657,000	$13,137,000	$45,794,000	$587,000	$11,431,000	$5,263,000	$71,000	$17,352,000
15	$33,800,000	$13,334,000	$47,134,000	$603,000	$11,773,000	$5,948,000	$73,000	$18,397,000
16	$34,983,000	$13,534,000	$48,517,000	$620,000	$14,228,000	$6,777,000	$75,000	$21,700,000
17	$36,207,000	$13,737,000	$49,944,000	$637,000	$14,655,000	$7,631,000	$77,000	$23,000,000
18	$37,475,000	$13,943,000	$51,418,000	$654,000	$12,903,000	$8,382,000	$79,000	$22,018,000
19	$38,786,000	$14,152,000	$52,938,000	$672,000	$13,290,000	$9,156,000	$81,000	$23,199,000
20	$40,144,000	$14,364,000	$54,508,000	$691,000	$13,689,000	$9,954,000	$84,000	$24,418,000
21	$41,549,000	$14,580,000	$56,129,000	$1,650,000	$8,976,000	$10,363,000	$172,000	$21,161,000
22	$43,003,000	$14,798,000	$57,801,000	$1,695,000	$9,245,000	$10,564,000	$177,000	$21,681,000
23	$44,508,000	$15,020,000	$59,528,000	$1,742,000	$8,438,000	$10,727,000	$182,000	$21,089,000
24	$46,066,000	$15,246,000	$61,312,000	$1,789,000	$8,691,000	$10,879,000	$187,000	$21,546,000
25	$47,678,000	$15,474,000	$63,152,000	$1,839,000	$8,952,000	$11,032,000	$192,000	$22,015,000
26	$49,347,000	$15,706,000	$65,053,000	$1,889,000	$9,221,000	$11,155,000	$197,000	$22,462,000
27	$51,074,000	$15,942,000	$67,016,000	$1,941,000	$10,036,000	$11,546,000	$202,000	$23,725,000
28	$52,862,000	$16,181,000	$69,043,000	$1,995,000	$10,338,000	$11,949,000	$208,000	$24,490,000
29	$54,712,000	$16,424,000	$71,136,000	$2,049,000	$10,648,000	$12,280,000	$214,000	$25,191,000
30	$55,532,000	$16,670,000	$72,202,000	$2,106,000	$9,122,000	$12,514,000	$220,000	$23,962,000

City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Financial Capability Assessment Details

Time-Based Financial Model Summary Data

Cost Per Household and Residential Indicator Worksheet 1 and 2 Calculations

October 2020

	Existing Sewer System Cost			CSO Control Program Costs				
Year	O&M Costs	Debt Service	Subtotal	Additional O&M Costs	Capital Outlay & Loan Amount	Additional Debt Service	Other Add'l Costs	Subtotal
31	$56,365,000	$16,920,000	$73,285,000	$2,164,000	$5,963,000	$12,434,000	$226,000	$20,787,000
32	$57,211,000	$17,174,000	$74,385,000	$2,223,000	$6,142,000	$12,164,000	$232,000	$20,761,000
33	$58,069,000	$17,432,000	$75,501,000	$2,284,000	$6,326,000	$11,886,000	$238,000	$20,734,000
34	$58,940,000	$17,693,000	$76,633,000	$2,347,000	$6,516,000	$11,600,000	$245,000	$20,708,000
35	$59,824,000	$17,959,000	$77,783,000	$2,412,000	$6,712,000	$11,305,000	$252,000	$20,681,000
36	$60,722,000	$18,228,000	$78,950,000	$2,478,000	$6,913,000	$10,879,000	$258,000	$20,528,000
37	$61,632,000	$18,501,000	$80,133,000	$2,546,000	$7,120,000	$10,440,000	$266,000	$20,372,000
38	$62,557,000	$18,779,000	$81,336,000	$2,616,000	$6,421,000	$10,063,000	$273,000	$19,373,000
39	$63,495,000	$19,061,000	$82,556,000	$2,688,000	$6,614,000	$9,674,000	$280,000	$19,256,000
40	$64,448,000	$19,346,000	$83,794,000	$2,762,000	$6,812,000	$9,273,000	$288,000	$19,135,000
41	$65,414,000	$19,637,000	$85,051,000	$2,838,000	$0	$8,750,000	$296,000	$11,884,000
42	$66,396,000	$19,931,000	$86,327,000	$2,916,000	$0	$8,212,000	$304,000	$11,432,000
43	$67,392,000	$20,230,000	$87,622,000	$2,996,000	$0	$7,720,000	$312,000	$11,028,000
44	$68,402,000	$20,534,000	$88,936,000	$3,079,000	$0	$7,214,000	$321,000	$10,614,000
45	$69,428,000	$20,842,000	$90,270,000	$3,163,000	$0	$6,693,000	$330,000	$10,186,000
46	$70,470,000	$21,154,000	$91,624,000	$3,250,000	$0	$6,156,000	$339,000	$9,745,000
47	$71,527,000	$21,472,000	$92,999,000	$3,340,000	$0	$5,571,000	$348,000	$9,259,000
48	$72,600,000	$21,794,000	$94,394,000	$3,431,000	$0	$4,969,000	$358,000	$8,758,000
49	$73,689,000	$22,121,000	$95,810,000	$3,526,000	$0	$4,349,000	$368,000	$8,243,000
50	$74,794,000	$22,452,000	$97,246,000	$3,623,000	$0	$3,817,000	$378,000	$7,818,000
51	$75,916,000	$22,789,000	$98,705,000	$3,722,000	$0	$3,470,000	$388,000	$7,580,000
52	$77,055,000	$23,131,000	$100,186,000	$3,825,000	$0	$3,112,000	$399,000	$7,336,000
53	$78,211,000	$23,478,000	$101,689,000	$3,930,000	$0	$2,744,000	$410,000	$7,084,000
54	$79,384,000	$23,830,000	$103,214,000	$4,038,000	$0	$2,364,000	$421,000	$6,823,000
55	$80,575,000	$24,188,000	$104,763,000	$4,149,000	$0	$1,973,000	$433,000	$6,555,000
56	$81,783,000	$24,550,000	$106,333,000	$4,263,000	$0	$1,571,000	$445,000	$6,279,000
57	$83,010,000	$24,919,000	$107,929,000	$4,380,000	$0	$1,156,000	$457,000	$5,993,000
58	$84,255,000	$25,292,000	$109,547,000	$4,501,000	$0	$782,000	$469,000	$5,752,000
59	$85,519,000	$25,672,000	$111,191,000	$4,625,000	$0	$397,000	$482,000	$5,504,000
60	$86,802,000	$26,057,000	$112,859,000	$4,752,000	$0	$0	$496,000	$5,248,000

City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Financial Capability Assessment Details

Time-Based Financial Model Summary Data

Cost Per Household and Residential Indicator Worksheet 1 and 2 Calculations

October 2020

	Current and Projected WWT and CSO Costs					Residential
Year	Total Cost	Residential Share	No. Households	Cost Per Household	Median Household Income	Indicator CPH As % MHI
0	$30,840,000	$23,130,000	40,219	$575	$47,250	1.22%
1	$33,885,000	$23,953,000	40,219	$596	$47,959	1.24%
2	$38,962,000	$24,878,000	40,219	$619	$48,678	1.27%
3	$40,241,000	$25,949,000	40,219	$645	$49,408	1.31%
4	$41,992,000	$26,934,000	40,219	$670	$50,149	1.34%
5	$43,603,000	$27,952,000	40,219	$695	$50,901	1.37%
6	$45,813,000	$29,027,000	40,219	$722	$51,665	1.40%
7	$43,341,000	$30,020,000	40,219	$746	$52,440	1.42%
8	$44,725,000	$30,985,000	40,219	$770	$53,227	1.45%
9	$47,717,000	$32,065,000	40,219	$797	$54,025	1.48%
10	$49,322,000	$33,157,000	40,219	$824	$54,835	1.50%
11	$53,289,000	$34,460,000	40,219	$857	$55,658	1.54%
12	$58,584,000	$35,858,000	40,219	$892	$56,493	1.58%
13	$60,831,000	$37,299,000	40,219	$927	$57,340	1.62%
14	$63,146,000	$38,786,000	40,219	$964	$58,200	1.66%
15	$65,531,000	$40,319,000	40,219	$1,002	$59,073	1.70%
16	$70,217,000	$41,991,000	40,219	$1,044	$59,959	1.74%
17	$72,944,000	$43,716,000	40,219	$1,087	$60,858	1.79%
18	$73,436,000	$45,400,000	40,219	$1,129	$61,771	1.83%
19	$76,137,000	$47,136,000	40,219	$1,172	$62,698	1.87%
20	$78,926,000	$48,927,000	40,219	$1,217	$63,638	1.91%
21	$77,290,000	$51,235,000	40,219	$1,274	$64,593	1.97%
22	$79,482,000	$52,678,000	40,219	$1,310	$65,562	2.00%
23	$80,617,000	$54,134,000	40,219	$1,346	$66,545	2.02%
24	$82,858,000	$55,625,000	40,219	$1,383	$67,543	2.05%
25	$85,167,000	$57,161,000	40,219	$1,421	$68,556	2.07%
26	$87,515,000	$58,721,000	40,219	$1,460	$69,584	2.10%
27	$90,741,000	$60,529,000	40,219	$1,505	$70,628	2.13%
28	$93,533,000	$62,396,000	40,219	$1,551	$71,687	2.16%
29	$96,327,000	$64,259,000	40,219	$1,598	$72,762	2.20%
30	$96,164,000	$65,282,000	40,219	$1,623	$73,853	2.20%

City of Elizabeth
Union County, New Jersey
Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP)
Financial Capability Assessment Details

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Cost Per Household and Residential Indicator Worksheet 1 and 2 Calculations

October 2020

	Current and Projected WWT and CSO Costs					Residential
		Residential	No.	Cost Per	Median House-	Indicator
Year	Total Cost	Share	Households	Household	hold Income	CPH As % MHI
31	$94,072,000	$66,082,000	40,219	$1,643	$74,961	2.19%
32	$95,146,000	$66,753,000	40,219	$1,660	$76,085	2.18%
33	$96,235,000	$67,432,000	40,219	$1,677	$77,226	2.17%
34	$97,341,000	$68,119,000	40,219	$1,694	$78,384	2.16%
35	$98,464,000	$68,813,000	40,219	$1,711	$79,560	2.15%
36	$99,478,000	$69,424,000	40,219	$1,726	$80,753	2.14%
37	$100,505,000	$70,039,000	40,219	$1,741	$81,964	2.12%
38	$100,709,000	$70,715,000	40,219	$1,758	$83,193	2.11%
39	$101,812,000	$71,398,000	40,219	$1,775	$84,441	2.10%
40	$102,929,000	$72,088,000	40,219	$1,792	$85,708	2.09%
41	$96,935,000	$72,701,000	40,219	$1,808	$86,994	2.08%
42	$97,759,000	$73,319,000	40,219	$1,823	$88,299	2.06%
43	$98,650,000	$73,988,000	40,219	$1,840	$89,623	2.05%
44	$99,550,000	$74,662,000	40,219	$1,856	$90,967	2.04%
45	$100,456,000	$75,342,000	40,219	$1,873	$92,332	2.03%
46	$101,369,000	$76,027,000	40,219	$1,890	$93,717	2.02%
47	$102,258,000	$76,693,000	40,219	$1,907	$95,123	2.00%
48	$103,152,000	$77,364,000	40,219	$1,924	$96,550	1.99%
49	$104,053,000	$78,039,000	40,219	$1,940	$97,998	1.98%
50	$105,064,000	$78,798,000	40,219	$1,959	$99,468	1.97%
51	$106,285,000	$79,714,000	40,219	$1,982	$100,960	1.96%
52	$107,522,000	$80,641,000	40,219	$2,005	$102,474	1.96%
53	$108,773,000	$81,579,000	40,219	$2,028	$104,011	1.95%
54	$110,037,000	$82,528,000	40,219	$2,052	$105,571	1.94%
55	$111,318,000	$83,488,000	40,219	$2,076	$107,155	1.94%
56	$112,612,000	$84,459,000	40,219	$2,100	$108,762	1.93%
57	$113,922,000	$85,441,000	40,219	$2,124	$110,393	1.92%
58	$115,299,000	$86,475,000	40,219	$2,150	$112,049	1.92%
59	$116,695,000	$87,521,000	40,219	$2,176	$113,730	1.91%
60	$118,107,000	$88,579,000	40,219	$2,202	$115,436	1.91%

BOND RATING

Worksheet 3

		Line Number
• Most Recent General Obligation Bond Rating		
Date:	6 March 2020	
Rating Agency:	Moody's	
Rating:	AA2	301
• Most Recent Revenue		
(Water/Sewer or Sewer) Bond		
Date:	6 March 2020	
Rating Agency:	Moody's	
Bond Insurance (Yes/No)	N/A	
Rating:	AA2	302
Summary Bond Rating:	AA2	303

OVERALL NET DEBT AS A PERCENT OF FULL MARKET PROPERTY VALUE

Worksheet 4

		Line Number
• Direct Net Debt (G.O. Bonds Excluding Double-Barreled Bonds)	$146,839,895.87	401
• Debt of Overlapping Entities (Proportionate Share of Multijurisdictional Debt)	N/A	402
• Overall Net Debt (Lines 401 + 402)	$146,839,895.87	403
• Market Value of Property	$6,648,357,183.67	404
• Overall Net Debt as a Percent of Full Market Property Value (Line 403 divided by Line 404 x 100)	2.21%	405

UNEMPLOYMENT RATE

Worksheet 5

		Line Number
• Unemployment Rate – Permittee	8.7	501
Source: US Census - American Community Survey, 2017 Estimate		
• Unemployment Rate – County (use if permittee's rate is unavailable)	N/A	502
Source:	N/A	

Benchmark:

• Average National Unemployment Rate:	6.6	503
Source: US Census - American Community Survey, 2017 Estimate		

MEDIAN HOUSEHOLD INCOME

Worksheet 6

		Line Number
• Median Household Income – Permittee (Line 203)	$45,186	601

Source: US Census - American Community Survey, 2017 Estimate

Benchmark:

• Census Year National MHI	$57,652	602
• MHI Adjustment Factor (line 202)	1	603
• Adjusted National MHI (line 602 x line 603)	$57,652	604

Source: US Census - American Community Survey, 2017 Estimate

PROPERTY TAX REVENUES AS A PERCENT OF FULL MARKET PROPERTY VALUE

Worksheet 7

		Line Number
• Full Market Value of Real Property (Line 404)	$6,648,357,183.67	701
• Property Tax Revenues	$251,239,196.54	702
• Property Tax Revenue as a Percent of Full Market Property Value (702 ÷ 701 x 100)	3.78%	703

PROPERTY TAX REVENUE COLLECTION RATE

Worksheet 8

		Line Number
• Property Tax Revenue Collected (Line 702)	$251,239,196.54	801
• Property Taxes Levied	N/A	802
• Property Tax Revenue Collection Rate (Line 801 ÷ Line 802 x 100)	97.02	803

SUMMARY OF PERMITTEE FINANCIAL CAPABILITY INDICATORS

Worksheet 9

Indicator	Column A: Actual Value	Column B: Score	Line Number
Bond Rating (Line 303)	AA2	3	901
Overall Net Debt as a Percent of Full Market Property Value (line 405)	2.21%	2	902
Unemployment Rate (Line 501)	8.7%	1	903
Median Household Income (Line 601)	$45,186	2	904
Property Tax Revenues as A Percent of Full Market Property Value (Line 703)	4%	2	905
Property Tax Revenue Collection Rate (Line 803)	97.02%	2	906
Permittee Indicators Score (Sum of Column B ÷ Number of Entries)		2.00	907

FINANCIAL CAPABILITY MATRIX SCORE

Worksheet 10

		Line Number
• Residential Indicator Score (Line 205)	2.20%	1001
• Permittee Financial Capability Indicators Score (Line 907)	2.00	1002
• Financial Capability Matrix Category (see matrix next page)	High Burden	1003

FINANCIAL CAPABILITY MATRIX

Table 3

Permittee Financial Capability Indicators Score (Socioeconomic, Debt and Financial Indicators)	**Residential Indicator** (Cost Per Household as a % of MHI)		
	Low (Below 1.0%)	Mid-Range (Between 1.0 and 2.0%)	High (Above 2.0%)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	**High Burden**
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden