City of Alexandria, Virginia

Combined Sewer System Permit and Long-Term Control Plan Update

Public Meeting
April 21, 2016

Bill Skrabak, Deputy Director

Department of Transportation and Environmental Services

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ECO-CITY ALEXANDRIA

City of Alexandria, Virginia

AGENDA

- ❑ Process
- ❑ City's Combined Sewer System (CSS)
- ❑ Combined Sewer Overflow Strategies Evaluation
- ❑ Infrastructure Sizing Analysis
- ❑ Tunnel Alignments and Tank Sites
- ❑ Complementary Strategies
- ❑ CSO-001 Strategy
- ❑ Schedule and Cost

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City of Alexandria, Virginia

Process

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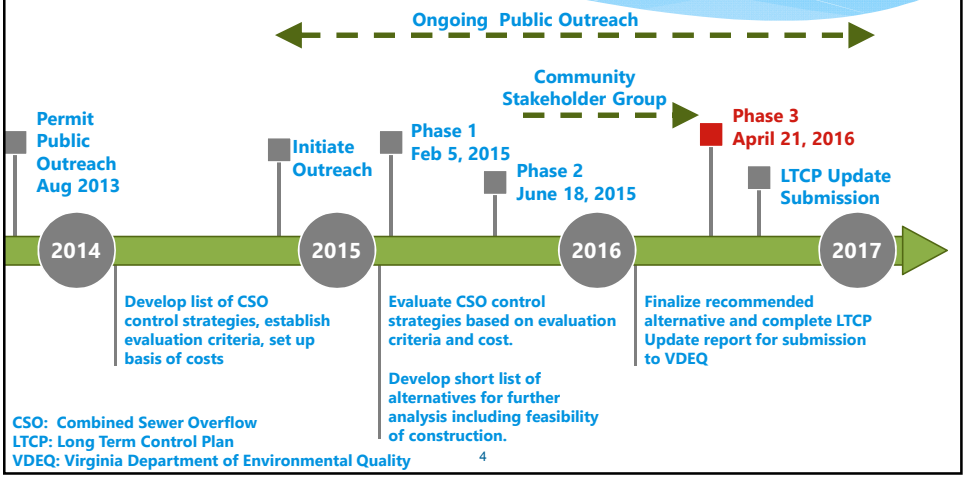
Planning Timeline



CSO: Combined Sewer Overflow
LTCP: Long Term Control Plan
VDEQ: Virginia Department of Environmental Quality

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Prior Outreach

Date	Audience	Date	Audience
8/5/2013	Public Meeting (through EPC)	2/11/2015	Old Town Civic Association
10/30/2013	Federation of Civic Associations	3/18/2015	NorthEast Citizens' Association
11/13/2013	Old Town Civic Association	5/18/2015	Environmental Policy Commission
11/14/2013	West Old Town Citizens Association	5/19/2015	Waterfront Commission
1/28/2014	City Council Work Session	**5/26/2015**	**City Council Work Session**
5/19/2014	Environmental Policy Commission	6/11/2015	West Old Town Citizens Association
9/18/2014	Porto Vecchio Condominium Association	**6/18/2015**	**LTCPU Phase II Public Meeting**
10/21/2014	AlexRenew Board	**10/7/2015**	**CSS Stakeholder Meeting #1**
10/27/2014	Agenda Alexandria	**11/2/2015**	**CSS Stakeholder Meeting #2**
1/27/2015	**City Council Legislative Session**	**1/7/2016**	**CSS Stakeholder Meeting #3**
1/28/2015	Federation of Civic Associations	**2/4/2016**	**CSS Stakeholder Meeting #4**
2/2/2015	Environmental Policy Commission	**3/3/2016**	**CSS Stakeholder Meeting #5**
2/5/2015	**LTCPU Phase I Public Meeting**	**4/7/2016**	**CSS Stakeholder Meeting #6**

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Collaboration

- Ad Hoc Combined Sewer System Plan Stakeholder Group
- Updates to Virginia Department of Environmental Quality
- Environmental Policy Commission
- Alexandria Renew Enterprises
- CSO Peer Review Panel
  - Independent check of the Long Term Control Plan Update progress
  - Panel includes Directors from DC Water and Cities of Lynchburg and Richmond, along with an independent consultant who has experience with large CSO programs
  - Panel meetings held May 2015 and March 2016

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Ad Hoc Combined Sewer System Plan Stakeholder Group

- Established by City Council in June 2015
- 13-members appointed by the City Manager
- Charged with advising Staff during development of Long Term Control Plan Update
  - Consideration of impacts to the community while meeting City's environmental goals
  - Consideration of regulatory issues, engineering and analysis of potential locations of future sewer infrastructure facilities
  - Consideration of implementation plan schedule and cost
  - Receive input from the public

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City of Alexandria, Virginia

City's Combined Sewer System (CSS)

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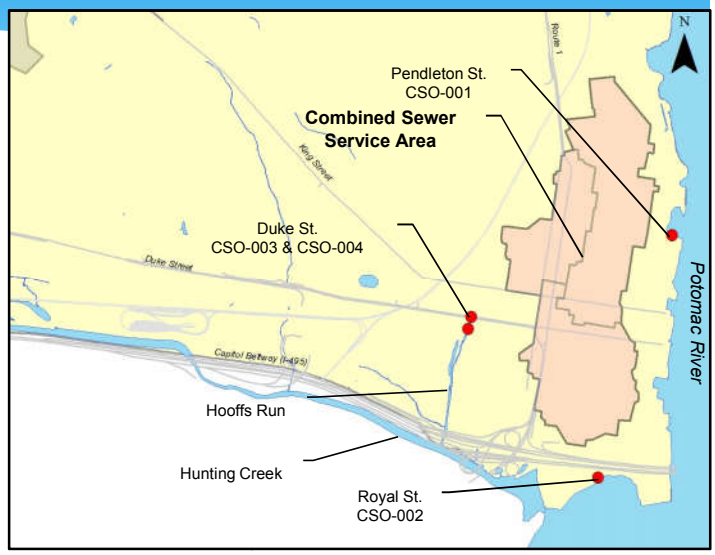
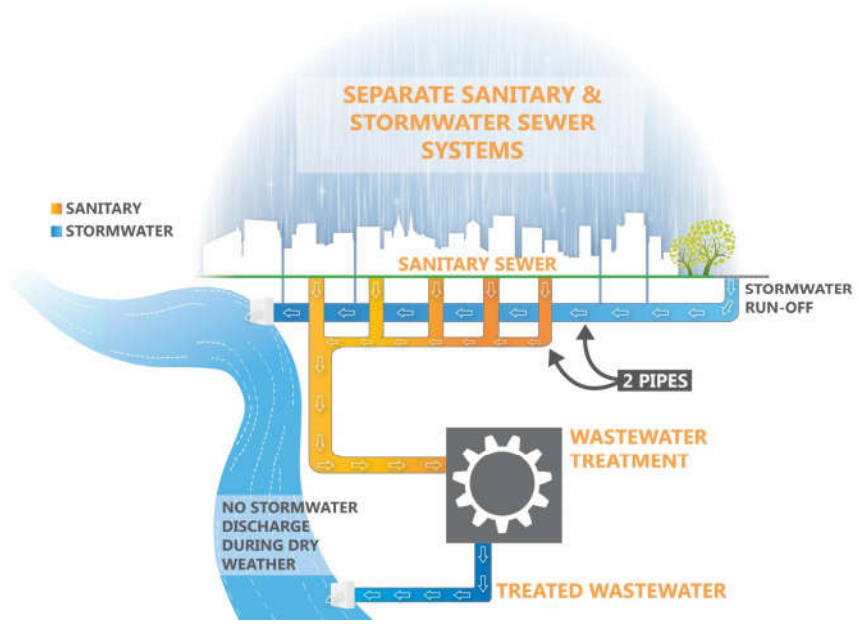
Combined Sewer System

Four permitted outfalls:

- CSO-001 to Oronoco Bay
- CSO-002 to Hunting Creek
- CSO-003 to Hooffs Run
- CSO-004 to Hooffs Run
- Outfalls permitted by the Virginia Department of Environmental Quality (VDEQ)





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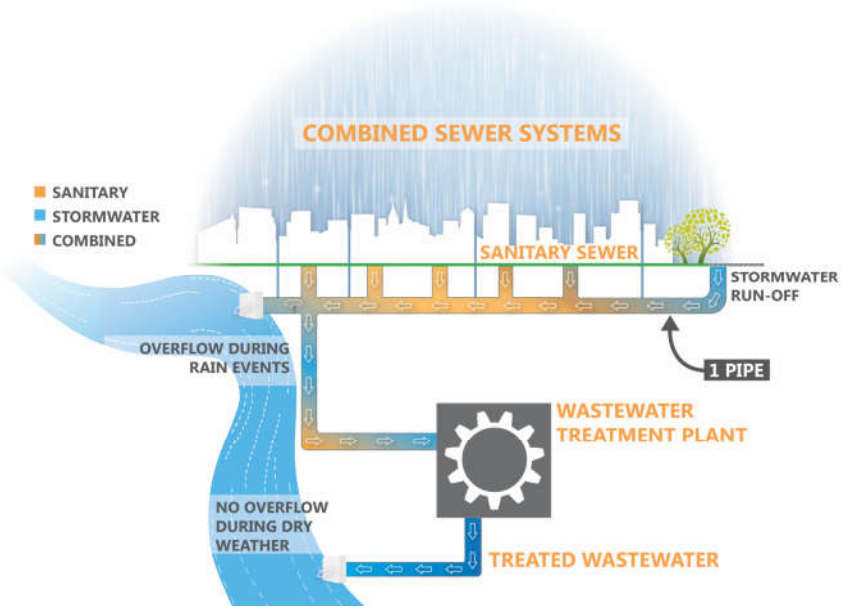

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Combined Sewer Overflow (CSO) Locations

Hunting Creek: CSO-002

Oronoco Bay: CSO-001

Hooffs Run: CSO-003 & 004

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Paradigm Shift

* Previous Combined Sewer System Permits (before 2013):
  - City's Long Term Control Plan based on best practices for operation and maintenance of combined systems
  - Proactive separation as part of Area Reduction Plan
  - Monitoring and modeling of combined sewer overflows
* Current and Future Combined Sewer System Permits:
  - Must address the Hunting Creek Total Maximum Daily Load

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Clean Water Act Goals
Total Maximum Daily Load

* Clean Water Act goal that all waters of the United States be "fishable" and "swimmable"
  - State develops impaired waters list and total maximum daily loads
* Hunting Creek listed as an impaired water for *E. coli* bacteria

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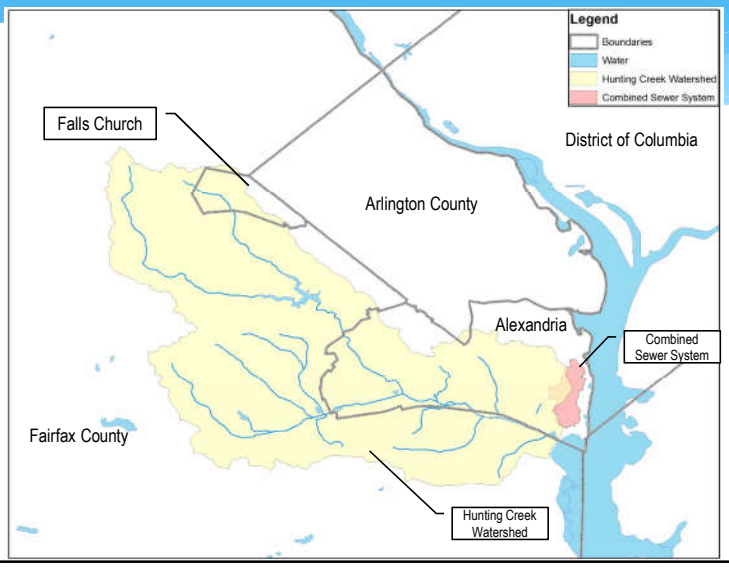
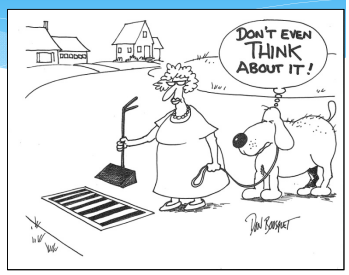
Hunting Creek Drainage Area



Sources of Bacteria in Hunting Creek TMDL



- Virginia Bacteria Water Quality Criteria
  - 126 *E.coli* counts per 100mL
- Sources of Bacteria:
  - Stormwater
    - Wildlife
    - Pets
  - Combined Sewer System
  - Septic Systems
  - Sanitary Sewer Overflows
  - AlexRenew Water Resource Recovery Facility
- TMDL Bacteria Reductions:
  - Stormwater (85-98% removal)
  - Wildlife (50% removal)
  - Combined Sewer System (80-99% removal)
  - Septic Systems (100% removal)

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Hunting Creek Bacteria Total Maximum Daily Load

- Hunting Creek Bacteria TMDL and CSOs:
  - Total overall bacteria reduction from CSO discharges of 86%:
    - 99% reduction from Outfalls 003 and 004 (Hooffs Run)
    - 80% reduction from Outfall 002 (Hunting Creek)
  - Applicable to Outfalls 002, 003, and 004 only
- CSS Permit issued in August 2013 requires City to address TMDL through an update to its Long Term Control Plan to be submitted to VDEQ by August 23, 2016

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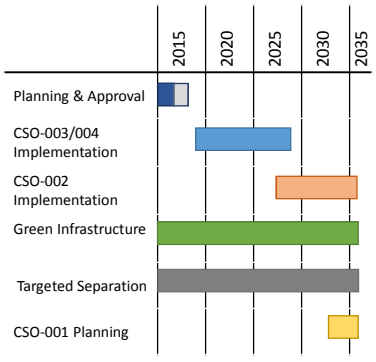
Long Term Control Plan Goals

- Comply with the new permit
- Develop a plan that best meets the unique needs of Alexandria
- Active participation by stakeholders
- Limit impacts to residents and businesses
- Preserve the historic character of the City
- Improve and address legacy infrastructure
- Remain fiscally responsible
- Approval by VDEQ
- Implement by 2035



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Combined Sewer Overflow Strategies Evaluation

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Combined Sewer Strategies Evaluated

- **Store and treat:** build CSO storage and send to wastewater treatment facility after CSO event for high level of treatment
  - Storage tanks (aboveground or underground)
  - Deep tunnels
- **Sewer separation:** build new sewers to separate all storm and sanitary sewers in Old Town
- **Green infrastructure:** Reduce stormwater runoff
- **Disinfection:** kill the bacteria in the overflow
- **Combination** of the above strategies

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Storage Tunnels

DC Water: Tunnel Boring Machine

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Storage Tanks

Toronto: Keelesdal-Hyde Ave
Underground CSO Storage Tank

Arlington: Water Pollution Control Plant

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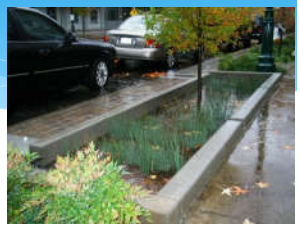
Sewer Separation

Alexandria: King & West Diversion Structure

Green Infrastructure

Bioswales

Rain Gardens



Planter Boxes

Permeable Pavement

Rainwater Harvesting

Green Roof

Disinfection

NYC: Spring Creek CSO Disinfection Facility

Detroit: Hubbell-Southfield CSO RTB

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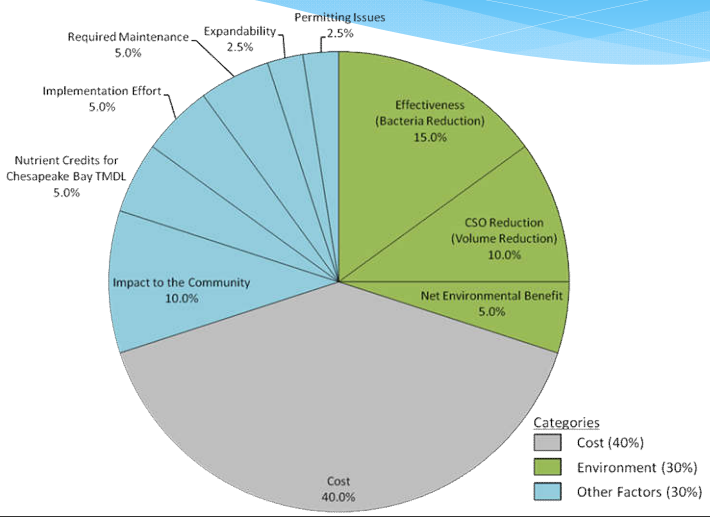
Evaluation Criteria Weightings



Combined Sewer Control Strategy Rankings

Rank	CSO Control Strategy	Score
1	**Separate Storage Tunnels**	**3.98**
2	**Storage Tunnel for Hooffs Run and Storage Tank at Royal Street**	**3.97**
3	**One Storage Tunnel**	**3.86**
4	Separate Storage Tanks	3.76
5	Storage Tunnel for Hooffs Run and Disinfection at Royal Street	3.69
6	One Storage Tunnel (relocate outfalls to the Potomac)	3.68
7	Separate Disinfection Facilities	3.34
8	Green Infrastructure	3.13
9	Complete Sewer Separation	2.10

Store and Treat Strategy

* Advantages:
  - Significant reduction in the number of combined sewer overflows
  - Reduces pollutant loadings (bacteria, nutrients, etc.)
  - Reduces floatables
  - Minimal aesthetic impact (underground facilities)
  - Generates credits for stormwater
  - Allows for complementary strategies to be implemented
* Disadvantages:
  - Complexity of construction and construction impacts
  - Easement acquisition
  - Does not eliminate combined sewer system

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Primary Strategy Recommendation

Primary Strategy

* Storage Tunnel for Hooffs Run and Storage Tank at Royal Street
  - Most cost effective alternative
  - Fewer construction impacts
  - Potential opportunities to improve embayment
  - Supported by members of the CSS Stakeholder Group

Complementary Strategies

1. Green Infrastructure
   - Implement Citywide
2. Targeted Sewer Separation
   - Area Reduction Plan
3. Other Potential Opportunities
   - Real Time Controls
   - Sewer Rehabilitation
   - Downspout Disconnection
   - Low Flow Fixtures

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Long Term Control Plan Update Overall Strategy

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City of Alexandria, Virginia

Infrastructure Sizing Analysis

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Basis for Storage Tunnels/Tanks

- EPA's Combined Sewer Overflow Control Policy
  - Presumption approach for combined sewer overflows, requires one of the following:
    - An average of 4-6 overflow events per year
    - The capture of 85% of the combined sewage for treatment
    - The removal of the mass of pollutants equal to 85% capture
- City has established a minimum target of 4-6 overflows per year during the typical year (1984)
  - Other requirements of presumptive approach are also met

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Infrastructure Sizing Evaluation

- Impacts on Overflows
  - # of overflows
  - Volume of overflows
- Climate Periods Evaluated
  - 1984 – Typical Year
    - Determined based on several rainfall characteristics over the last 40 years of data
  - 2004-2013 – Recent Climate Period
    - Larger, more intense storms
- Why go larger?
  - Reduce the number of overflows and total overflow volume
  - Accommodate uncertainty in future weather patterns

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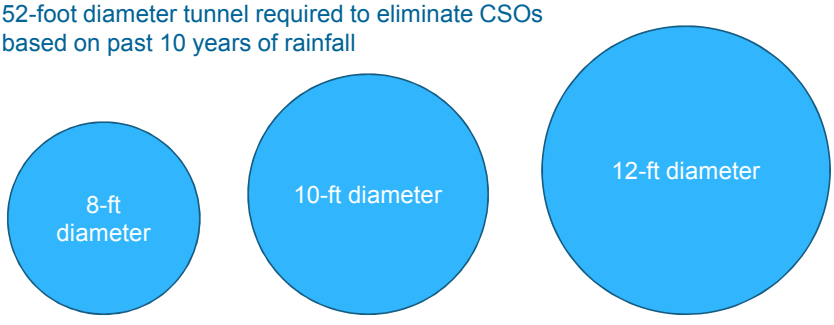
Tunnel Sizes (CSO-003/004)

- 8-foot (1.0 MG) diameter tunnel meets the regulatory requirement of 4-6 overflows/year (typical year)
- 52-foot diameter tunnel required to eliminate CSOs based on past 10 years of rainfall



CSO-003/004 - 1 MG | CSO-003/004 – 1.6 MG | CSO-003/004 – 2.25 MG

MG = million gallon

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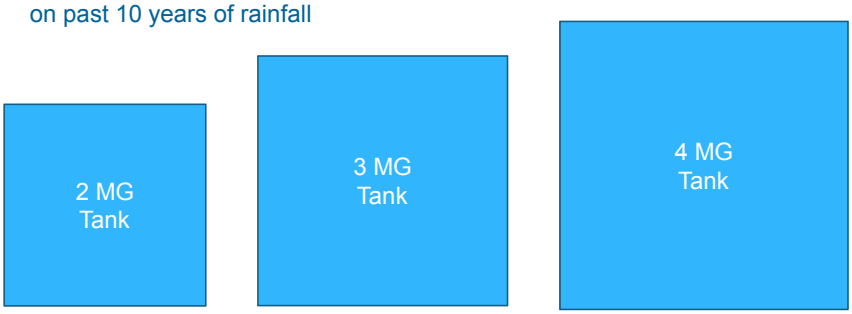
Tank Sizes (CSO-002 Only)

- 2 MG tank meets the regulatory requirement of 4-6 overflows/year (typical year)
- 44 MG tank required to eliminate CSOs based on past 10 years of rainfall



105'Lx105'Wx25'D | 130'Lx130'Wx25'D | 150'Lx150'Wx25'D

MG = million gallon; L = Length, W = Width, D - Depth

CSO-003/004 Tunnel Comparison

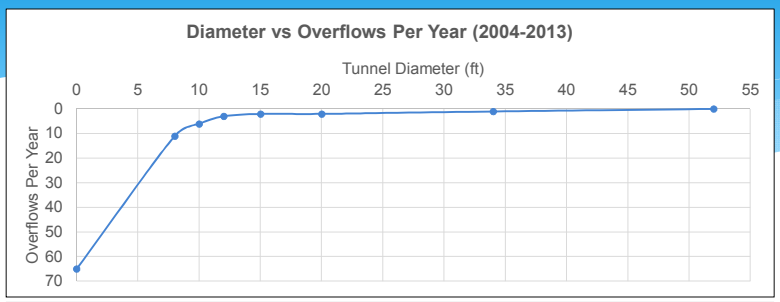
Tunnel Diameter	Typical Year (1984)[1]		Recent (2004-2013)[1]		Capital Cost ($M)	NPW Cost ($M)
	Number of Overflows	Volume of Overflows (MG)	Number of Overflows per year	Volume of Overflows (MG)		
Current Conditions (no tunnel)	67	29.1	65	52.4	-	-
8-foot (1.0 MG)	5	2.9	11	27.1	$72-$107	$82-$123
10-foot (1.6 MG)	3	1.1	6	22.7	$80-$120	$91-$137
12-foot (2.3 MG)	0	0	3	19.8	$88-$132	$100-$149
52-foot (43 MG)[2]	0	0	0	0	$241-$363	$258-$387

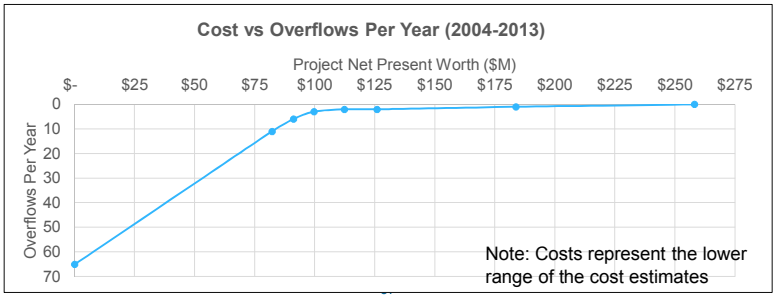
Notes:

1. Expected performance estimated for the years indicated. Actual overflows and volume will be more or less based on specific rainfall events each year.
2. For illustrative purposes only, not practical to construct.

MG = million gallons
$M = cost in millions

CSO-003/004 Tunnel





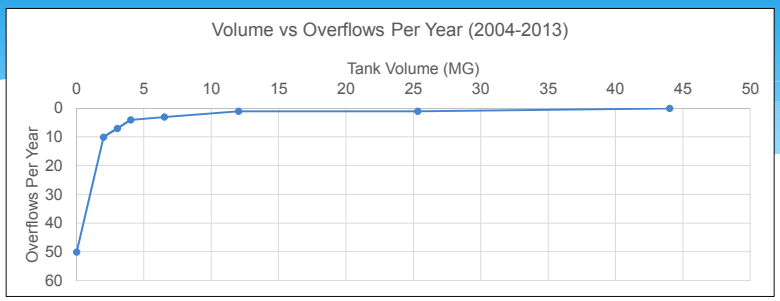
CSO-002 Tank Comparison

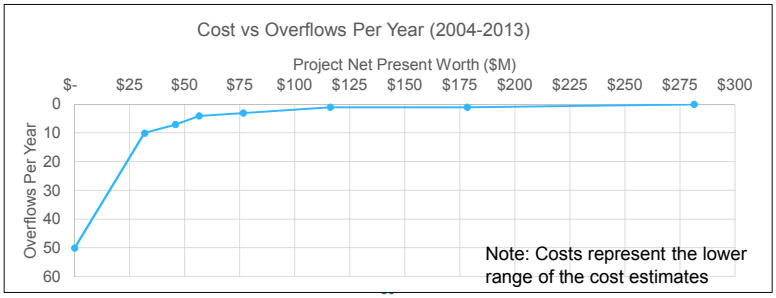
Tank Volume (MG)	Typical Year (1984)[1]		Recent (2004-2013)[1]		Capital Cost ($M)	NPW Cost ($M)
	Number of Overflows	Volume of Overflows (MG)	Number of Overflows per year	Volume of Overflows (MG)		
Current Conditions (no tank)	48	35.8	50	67.6	-	-
2.0	6	5.7	10	34.8	$23-$35	$32-$48
3.0	2	3.1	7	26.7	$35-$53	$46-$69
4.0	1	1.9	4	21.8	$44-$66	$57-$85
44.0[2]	0	0	0	0	$264-$396	$281-$422

Notes:

1. Expected performance estimated for the years indicated. Actual overflows and volume will be more or less based on specific rainfall events each year.
2. For illustrative purposes only, not practical to construct.

CSO-002 Tank





Infrastructure Sizing Recommendation

* **10-foot diameter tunnel for Hooffs Run and 3-million gallon tank for Royal Street**
  - More than the minimum (8-foot tunnel and 2-million gallon tank)
  - Less than 4-6 overflows per year during a typical (average) rainfall year (EPA CSO Policy)
  - Helps to mitigate future regulatory uncertainty
  - Helps to mitigate climate change
  - General support among the majority of the members of the Combined Sewer System Stakeholder Group

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Tunnel Alignments and Tank Sites

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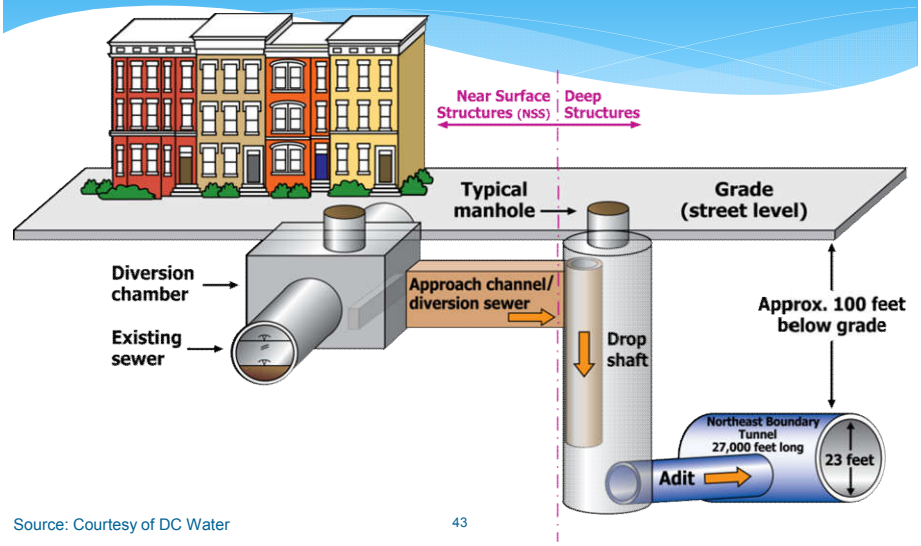
Tanks and Tunnels

Finished Tunnel



Source: Courtesy of DC Water

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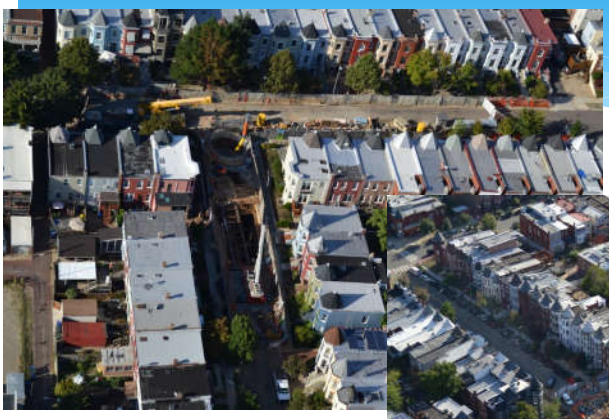
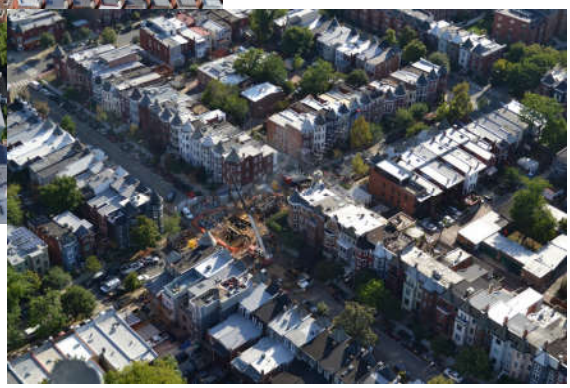
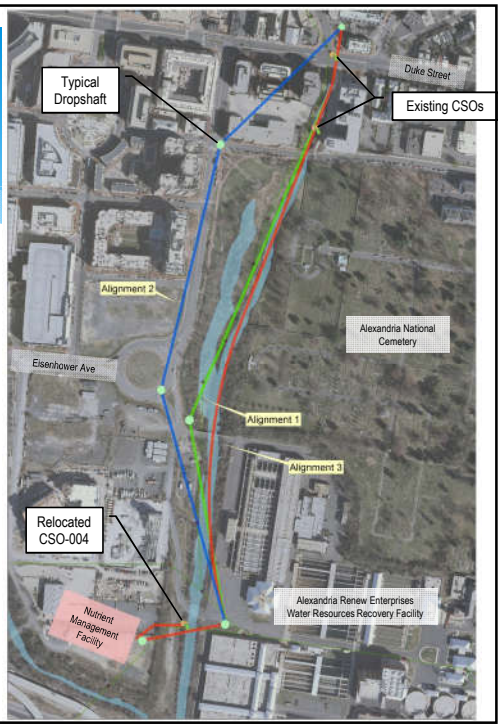
DC Shaft/Tunnel Construction





CSO-003/004 Tunnel Alignments

- Shafts range in diameter from 20-ft to 30-ft
- Shafts and tunnel range in depth from 60-ft to 100-ft
- Alignment 2 eliminated from further consideration
- Alignments 1 and 3 retained
  - Alignment 3 preferred



CSO-002 Storage Tanks Alternatives

CSO-002 Tanks

CSO-002 Tank Alternative 1

CSO-002 Tank Alternative 3

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Complementary Strategies

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Long Term Control Plan Update Overall Strategy

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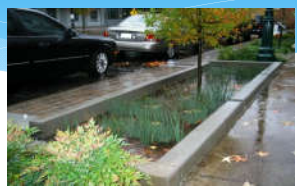
Examples of Green Infrastructure


Bioswales


Rain Gardens


Planter Boxes


Permeable Pavement


Rainwater Harvesting


Green Roof

Green Infrastructure: Benefits and Limitations

- Benefits:
  - Mimics natural systems
    - Reduces stormwater runoff volume, peak flows, and pollutants
    - Improves water quality and reduced nutrient loads discharged to the Chesapeake Bay
  - Community benefits:
    - Green spaces
    - Improves aesthetics
    - Reduces heat island effect
  - Environmental education
- Limitations:
  - Limited bacteria and stormwater volume reduction

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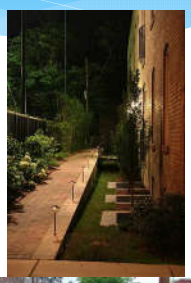
Green Infrastructure (Complementary Strategy)

- Implement the program citywide, not just combined sewer area
- **$1-2 million** for implementation of project in next permit cycle (2018-2023) in Capital Improvement Program
- Evaluate increasing number of street trees (tree canopy) in combined sewer system
- Assess effectiveness and based on assessment, consider establishing program and target goals for future permit cycles



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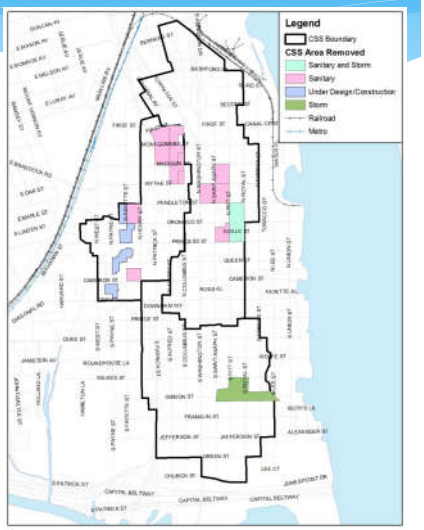
Targeted Sewer Separation (Complementary Strategy)

* Targeted Sewer Separation
  - Condition of redevelopment
  - Example: ABC/Giant project
    - Onsite sanitary separation
    - Offsite sanitary separation of 173-room hotel
  - Some City-led projects
* Other Potential Opportunities
  - Real time controls
  - Low flow fixtures
  - Downspout disconnects



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City of Alexandria, Virginia

CSO-001 Strategy

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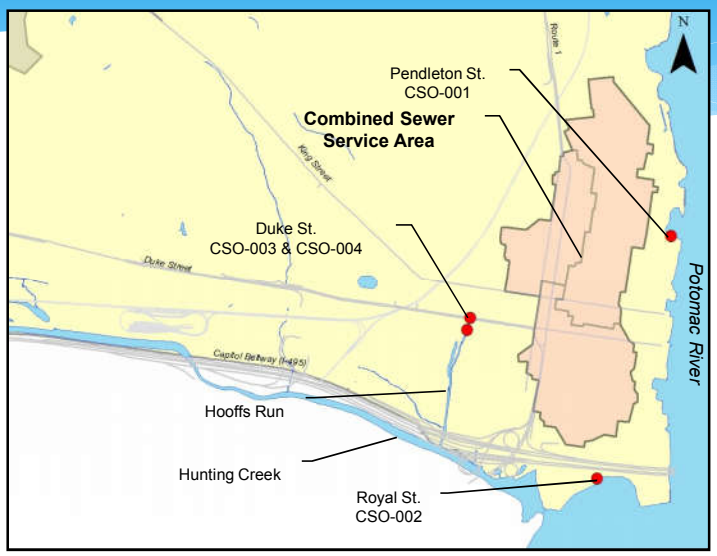
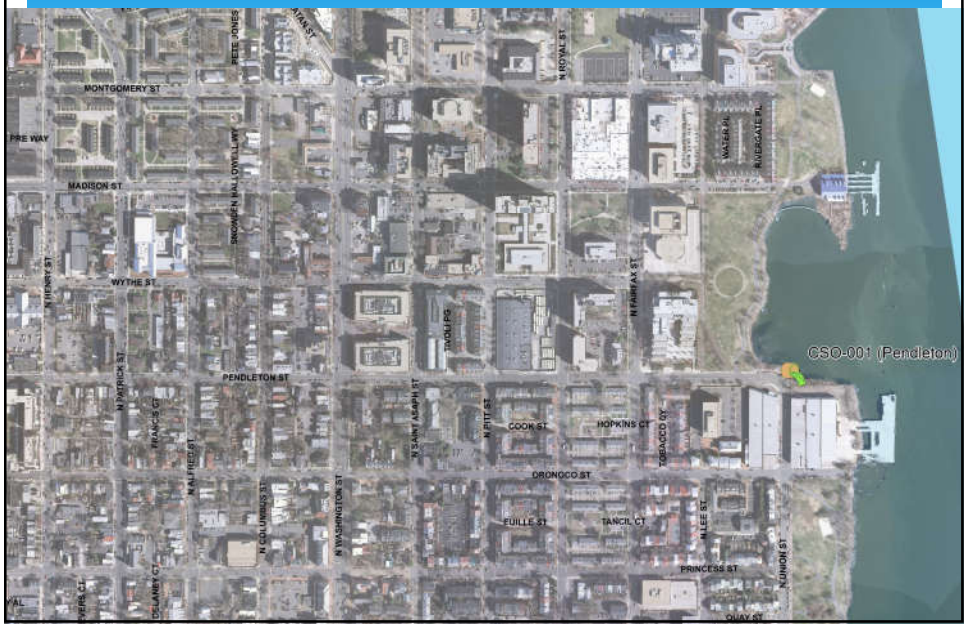
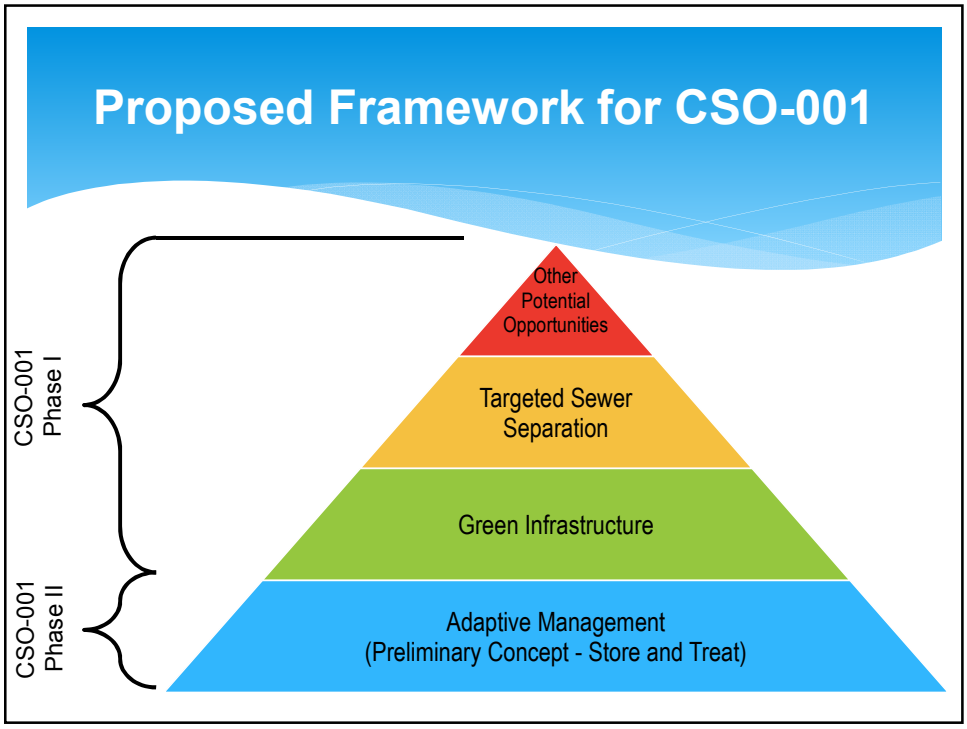
CSS Area



CSO-001 Orientation





Proposed Framework for CSO-001

- **CSO-001 Phase I**
  - **Enhanced sewer separation and green infrastructure opportunities**
    - Coordinate with North Old Town Small Area Plan implementation
- **CSO-001 Phase II**
  - Assess following CSO-001 Phase I and CSO-002/003/004 Projects
  - Implement a plan consistent with the current regulatory requirements (potentially a store and treat strategy)

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Old Town North Small Area Plan / Eco-City District

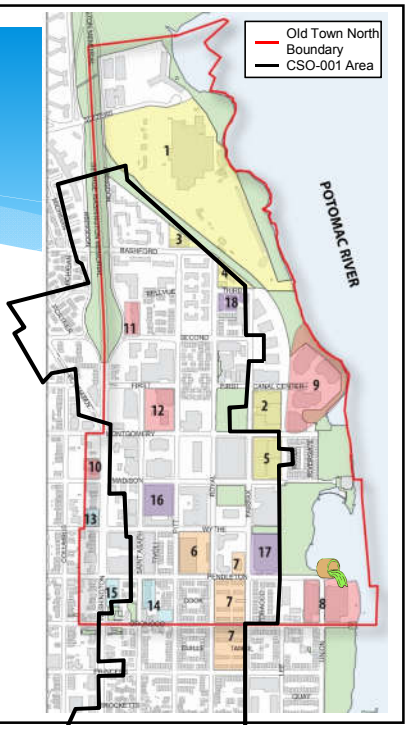
FUTURE POTENTIAL SITES
1. NRG-PRGS
2. Crowne Plaza Hotel
3. Foreign Car Service
4. Metro Stage
5. 801 N. Fairfax/209 Madison

REQUESTS FOR PROPOSALS
6. WMATA Bus Barn
7. ARHA Properties

PENDING APPLICATIONS
8. Robinson Terminal North
9. Canal Center - Public Improvements/Flood proofing
10. 800 - 802 N. Washington (Towne Motel)
11. Old Colony Inn
12. ABC/Giant

APPROVED & UNDER CONSTRUCTION
13. 700 N. Washington
14. Health Department
15. Cotton Factory (The Mill)

RECENTLY CONSTRUCTED
16. Harris Teeter/ The Kingsley
17. The Oronoco
18. Printers Row



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City of Alexandria, Virginia

Schedule and Cost

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Long Term Control Plan Update Framework through 2035

- CSO 003/004 tunnel to be implemented first (approximate timeframe 2019-2025)
- CSO 002 tank to be implemented following completion of CSO 003/004 tunnel (2027-2032)
- Green infrastructure and targeted sewer separation between 2016-2035
- Assessment for CSO-001 by 2035

Preliminary Capital Costs

Project	Capital Cost[1]
CSO 003/004 Tunnel	$80-120 million
CSO 002 Tank	$35-53 million
Green Infrastructure	$5-7.5 million
Targeted Sewer Separation	$5-7.5 million
TOTAL	**$125 - 188 million**

[1]Capital Costs in 2015 dollars

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Phasing of LTCPU Projects

- Major infrastructure projects to be implemented sequentially
- Sequential implementation allows for
  - Smaller increases to sanitary sewer rates
  - Confirmation of performance of constructed projects
  - Time to assess effectiveness of complementary strategies
    - Green infrastructure
    - Sewer separation

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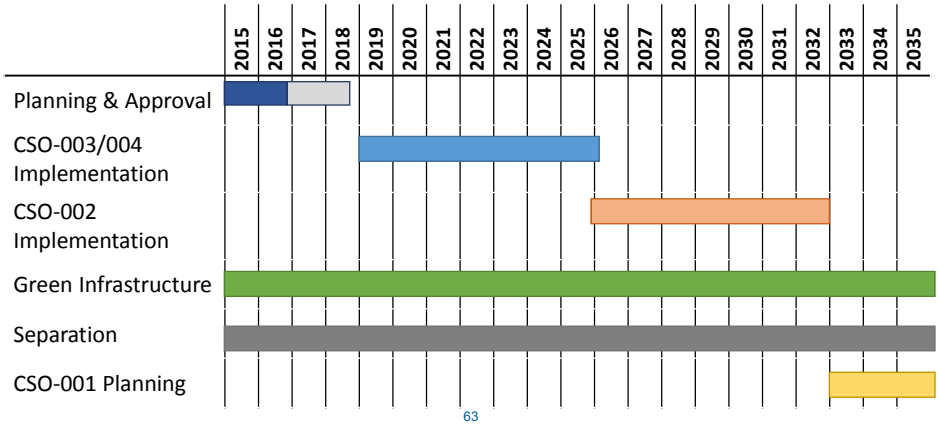
Preliminary Schedule



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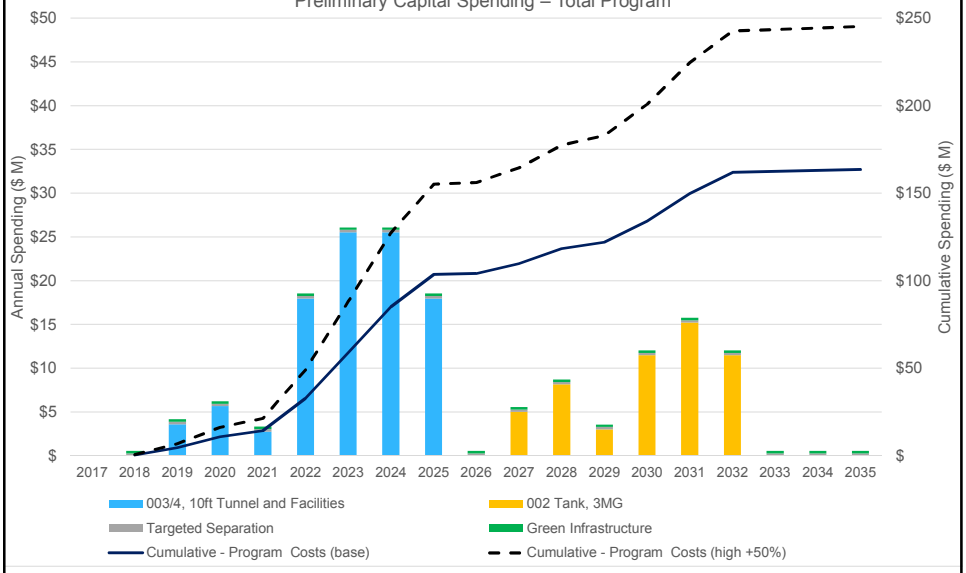
City of Alexandria, LTCPU
Preliminary Capital Spending – Total Program



Notes:
1. Includes capital costs for a tunnel for CSO 003/4, a tank for CSO 002, and allowances for GI and targeted separation in 2015 dollars.
2. Costs are preliminary (+50%) and developed to provide context. Additional analysis of the financing and impact on the sewer rate is on-going.

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Monthly Sewer Bill

Items	Value
AlexRenew Monthly Base Charge - Residential	$8.38
AlexRenew Monthly Base Charge – Commercial	Varies based on connection size
AlexRenew Flow Charge	$6.44/1,000 gallons
City of Alexandria Flow Charge	$1.25/1,000 gallons

	Additional Monthly Cost[1]	Total Monthly Bill[2]
Existing Sewer Bill	---	$48.48
Long Term Control Plan Update Implementation	$10-15	~$60

Notes:
1. Annual rate increases to be implemented over time and provided in the Sanitary Sewer Master Plan Update (2017-2018)
2. Based on usage of 5,000 gallons per month

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Long Term Control Plan Update Framework

- For the typical rainfall year
  - Reduce number of overflows by over 95%
  - Reduce volume of overflows by over 90%
  - Capture and treatment of over 95% of the total combined sewage
- Substantial water quality improvements other than bacteria
  - Reduction of nitrogen, phosphorous and sediment into the Chesapeake Bay
  - Reduction in floatables
- Phased approach – facilitates sequential implementation while managing rate increases
- Consistent with Eco-City goals
- Addresses regulatory requirements for approval by VDEQ
- Supported by the CSS Stakeholder Group

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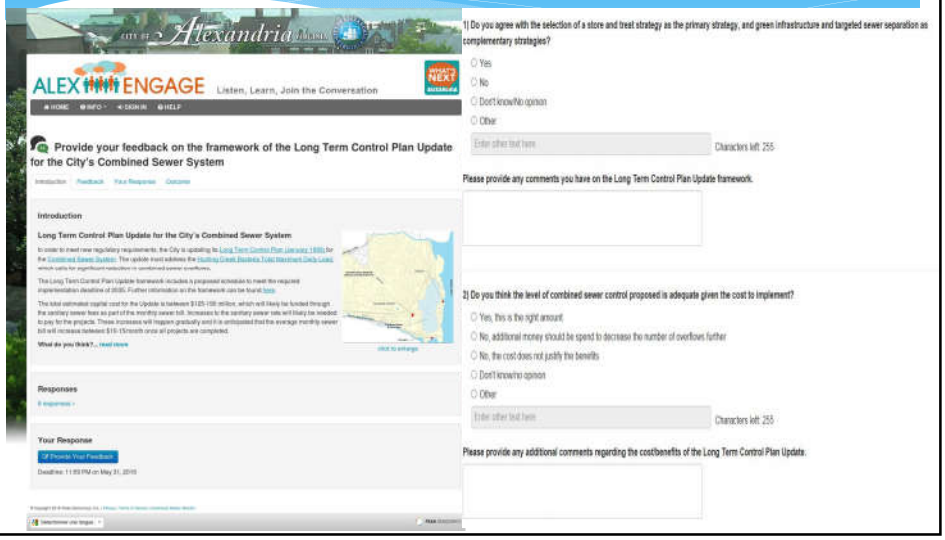
For More Information and How to Provide Input

* Planned City Council Public Hearing – Saturday May 14, 2016 9:30AM

* For more information and to provide feedback, please visit www.alexandriava.gov/sewers or provide comments in writing to:

Erin Bevis-Carver, P.E.
Sanitary Section Lead
Transportation and Environmental Services
2900-B Business Center Drive
Alexandria, Virginia 22314
erin.beviscarver@alexandriava.gov

AlexEngage Feedback



City of Alexandria, Virginia

Thank You

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