Louis Berger

Integrated Water Management in Maryland

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Senior Vice President

Discussion Topics

- State initiatives for water management
  - Stormwater management
  - Agriculture runoff
  - Enhanced Nutrient Removal
- Local initiatives for water management
- Federal initiatives for water management
  - Combined Sewer Overflow Systems - District of Columbia
  - Sanitary Sewer Overflow Systems - Baltimore County
  - Sanitary Sewer Overflow Systems—Baltimore City
  - Lessons learned

State Initiatives for Water Management

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Cold Spring Elementary School

Stormwater runoff biofiltration

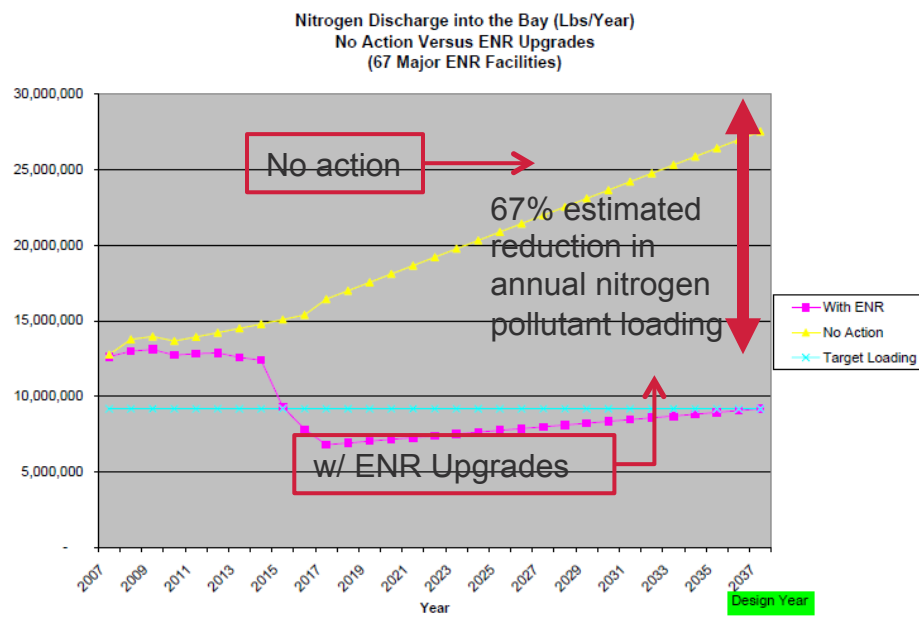
Stormwater Management

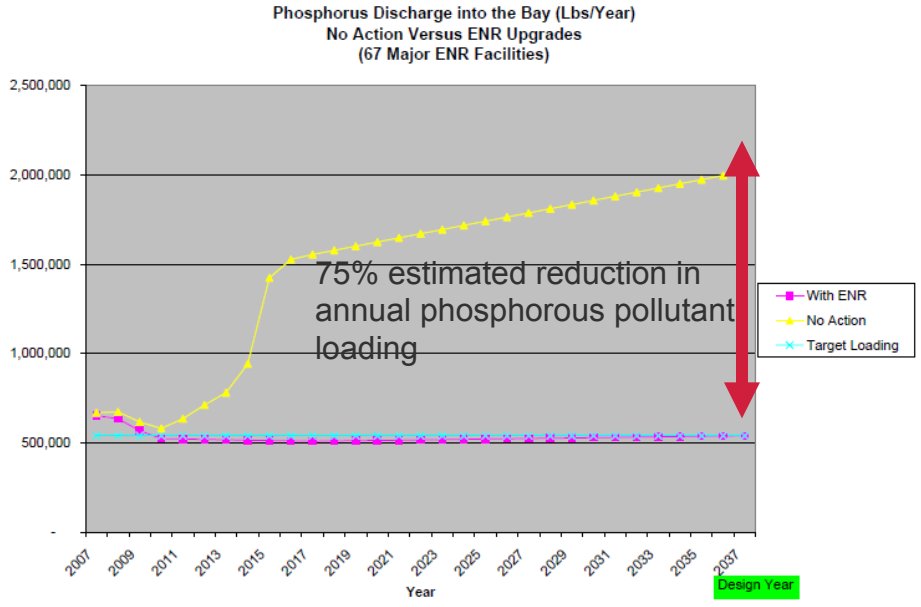
- Environmental permits issued by the Maryland require jurisdictions to develop plans to meet U.S. Clean Water Act requirements
- The goal of these plans is to reduce phosphorous, nitrogen and sediment pollutants to the Chesapeake Bay
- To fund these plans, the State of Maryland in April 2012 passed legislation that required 9 Maryland counties and the City of Baltimore to establish a Watershed Protection and Restoration Program
  - Program includes stormwater fee and watershed protection/restoration fund
  - Collected money is placed in dedicated fund and used to address pollutant reduction and maintain stormwater systems

Enhanced Nutrient Removal

Chesapeake Bay Fund

- On May 26, 2004 the Chesapeake Bay Fund was signed into law
  - Created dedicated fund to upgrade Maryland's WWTPs (> 0.5 MGD capacity) to enhanced nutrient removal (ENR) technology
  - Plant effluent quality to 3 mg/l total nitrogen and 0. 3mg/l total phosphorous
- On March 20, 2012, flush tax increased to $5/month
  - Additional funds used to upgrade the remaining wastewater treatment plants and funds stormwater and Agriculture runoff





Enhanced Nutrient Removal

Chesapeake Bay Fund Accomplishments

ENR Upgrade Status	Major Plants (> 0.5 MGD Capacity)	Minor Plants (< 0.5 MGD Capacity)
Completed	31	2
In Construction	20	2
In Design	11	3
Planning Phase	4	3

Enhanced Nutrient Removal

BayStat

- State developed BayStat to track and report the progress of the State's initiatives

Volume 1 Number 6

BAY STAT CHESAPEAKE

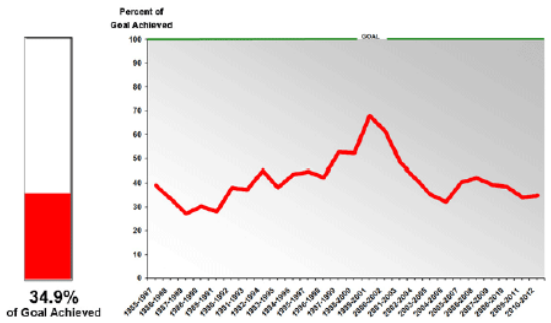
Bay Restoration Fund Targeted Wastewater Treatment Plants

Reporting Period: April 2014

	Basin	Nitrogen Est. Reduction (with vs. without Upgrade) lbs/year	Phosphorus Est. Reduction (with vs. without Upgrade) lbs/year	Start Date Construction	Target Da Constructi Complete
APG-Aberdeen	Upper Western	25,142	3,053	Complete	Complete
Hurlock	Lower Eastern	44,120	5,357	Complete	Complete
Celanese	Upper Potomac	63,465	7,707	Complete	Complete
Swan Point	Lower Potomac	5,021	610	Complete	Complete
Easton	Choptank	104,016	12,631	Complete	Complete
Kent Island	Upper Eastern	77,328	9,390	Complete	Complete
Mattawoman	Lower Potomac	462,296	0	Complete	Complete
Chestertown	Upper Eastern	30,715	3,730	Complete	Complete
Brunswick	Upper Potomac	16,498	2,003	Complete	Complete

Dissolved Oxygen Standards Attainment

Dissolved oxygen (DO) refers to the amount of oxygen that is present in the water. Just like humans, all of the Bay's living creatures, from worms to fish to crabs, need oxygen to survive.

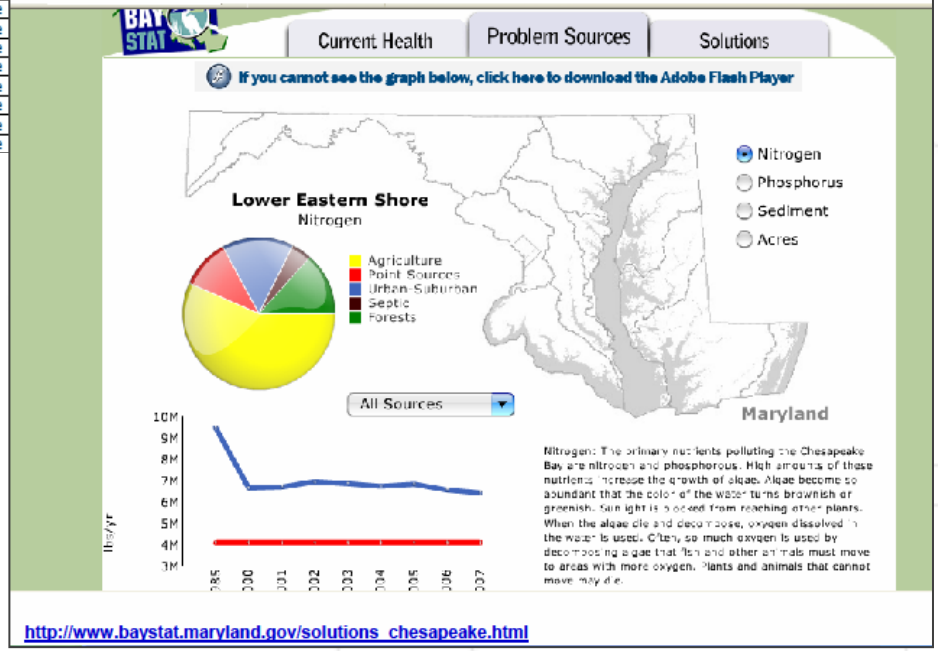


Status:

Water quality data gathered between 2010 and 2012 indicate that 34.9 percent of the combined volume of open-water, deep-water and deep-channel water of the Bay and its tidal tributaries met dissolved oxygen standards during the summer months. This is a slight increase from 34.1% in 2009 through 2011.

MARYLAND BAY STAT EIGHT WATERSHED SECTIONS REPORT CARD

Future CW Benefits Integration



http://www.baystat.maryland.gov/solutions_chesapeake.html

Local Initiatives for Water Management

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Water Reuse

- In 2016 Howard County will begin providing from the Little Patuxent Water Reclamation Plant up to 5 MGD of treated wastewater to cool the National Security Agency's (NSA) computer center
  - Treated wastewater would normally discharge into the Little Patuxent River
  - Provides reliable water source for NSA
  - Up to $2M in utility fee income for Howard County

Little Patuxent Water Reclamation Plant

Future site of NSA's High Performance Computing Center-2

Federal Initiatives for Water Management

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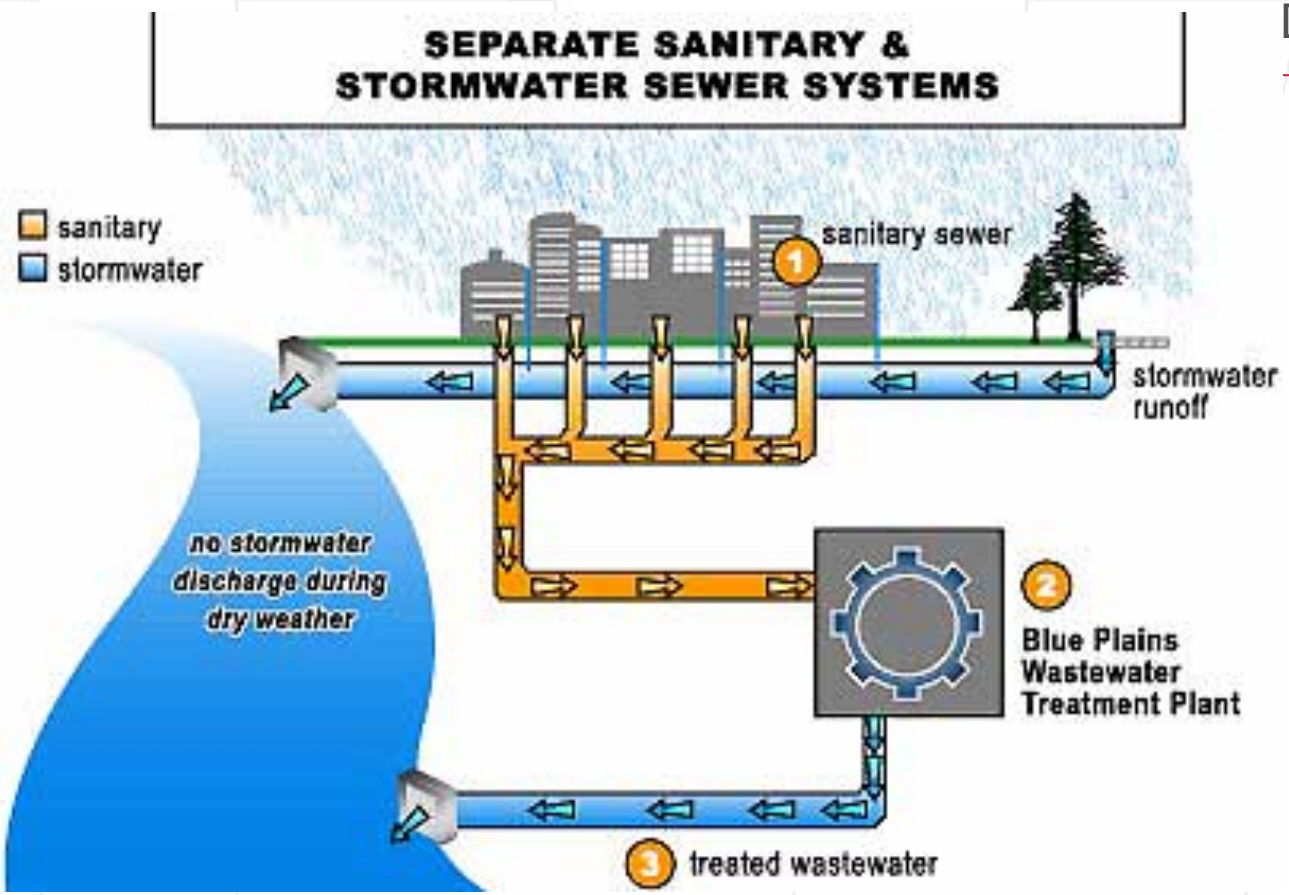
District of Columbia Water and Sewer Authority

Combined Sewer Overflow Systems

District of Columbia



- Combined stormwater/ wastewater collection system
- Cost to construct separate collection systems is higher than treating the stormwater and wastewater
- All flow is treated at the Blue Plains Advanced Wastewater Treatment Plant
- No room for plant expansion

Combined Sewer Overflow Systems

- In December 2004 the U.S. Environmental Protection Agency approved DC Water's Long Term Control Plan to reduce CSOs
- Plan included construction of CSO storage tunnels
  - Tunnels store wet weather flow for treatment after the storm has passed

CSO Overflow Reduction of Recommended CSO Plan (Average Year)

Item	*Anacostia River*	*Potomac River*	*Rock Creek*	*Total System*	*% Capture of Combined Sewage per CSO Policy*
CSO Overflow Volume (mg/yr)					
No Phase I Controls	2,142	1,063	49	3,254	76%
With Phase I Controls	1,485	953	52	2,490	82%
Recommended Plan	*54*	*79*	*5*	*138*	*99%*
% Reduction from No Phase I Controls	97.5%	92.5%	89.8%	95.8%	-
Number of Overflows/yr					
No Phase I Controls	82	74	30	-	-
With Phase I Controls	75	74	30	-	-
Recommended Plan	*2*	*4*	*1 / 4*[1]	-	-

Notes: 1. One at Piney Branch, four at the other Rock Creek CSOs.

Combined Sewer Overflow Systems

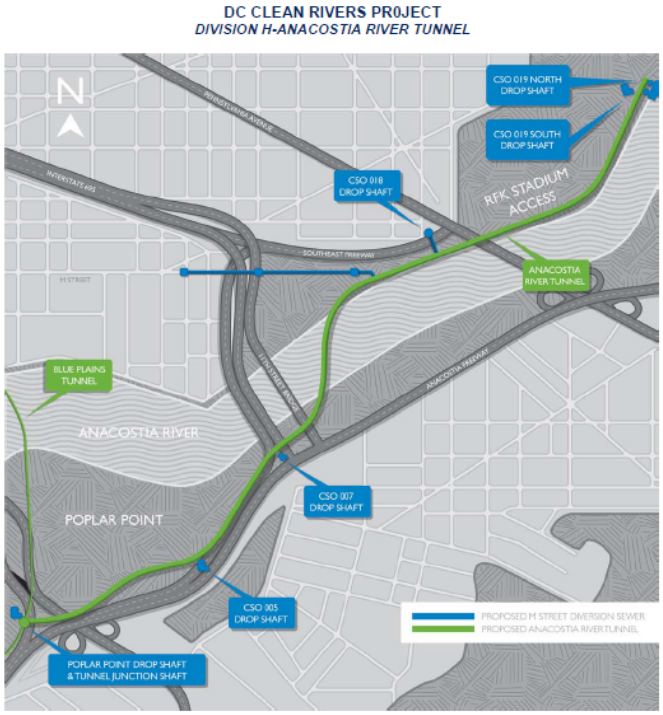
Blue Plains Tunnel: 7.4 km of 40 m diameter

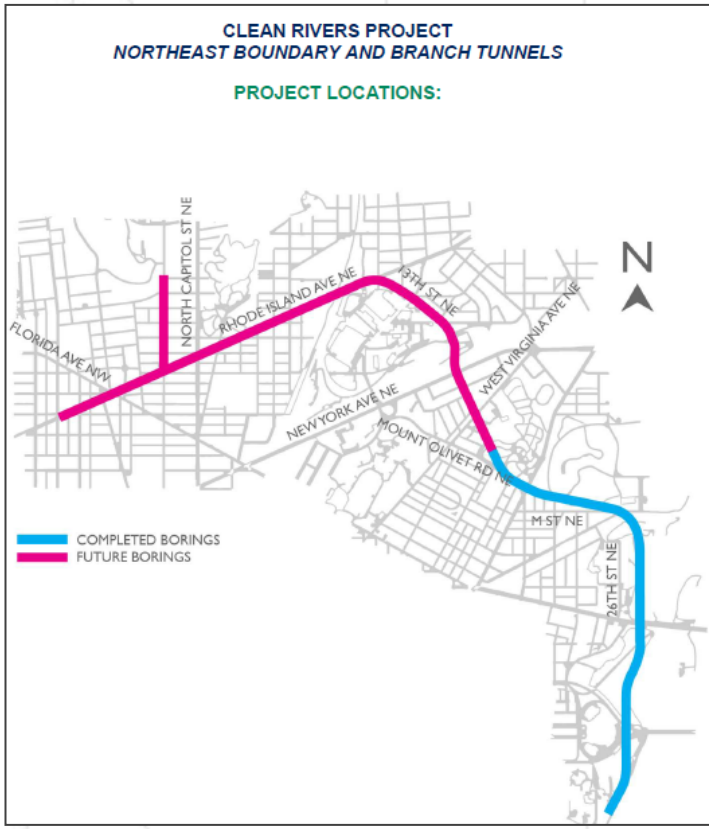
DC Water's Clean Rivers Project includes:

dc clean RIVERS PROJECT

Anacostia River Tunnel: 3.8 km of 7 m. diameter

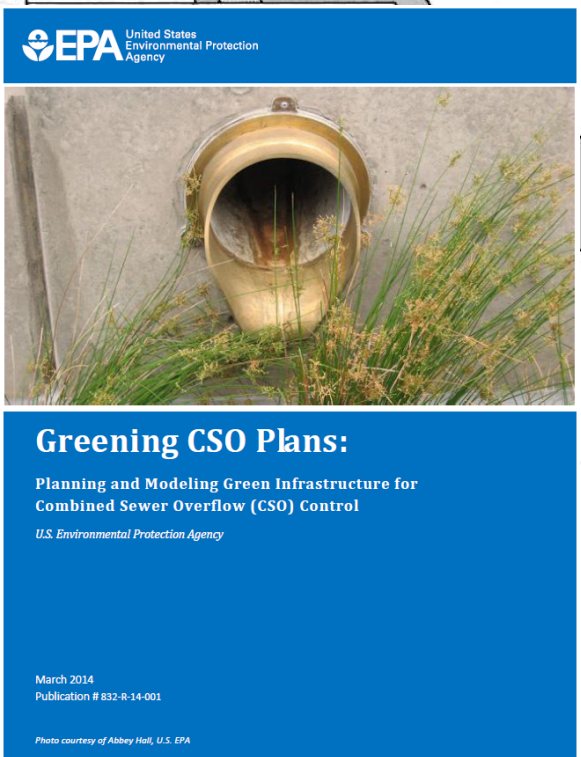
Northeast Boundary Tunnel: 8.2 km of 7 m. diameter





Combined Sewer Overflow Systems

- Municipality w/ green infrastructure projects
- Municipality w/ storage tunnel project



- Storage tunnels have been the prevalent solution to reducing CSOs
- Growing trend throughout the U.S. to construct green infrastructure to reduce peak wet weather flows
- Growing acceptance from EPA that green infrastructure is a viable alternative to storage tunnels

Sanitary Sewer Overflow Systems

Baltimore County

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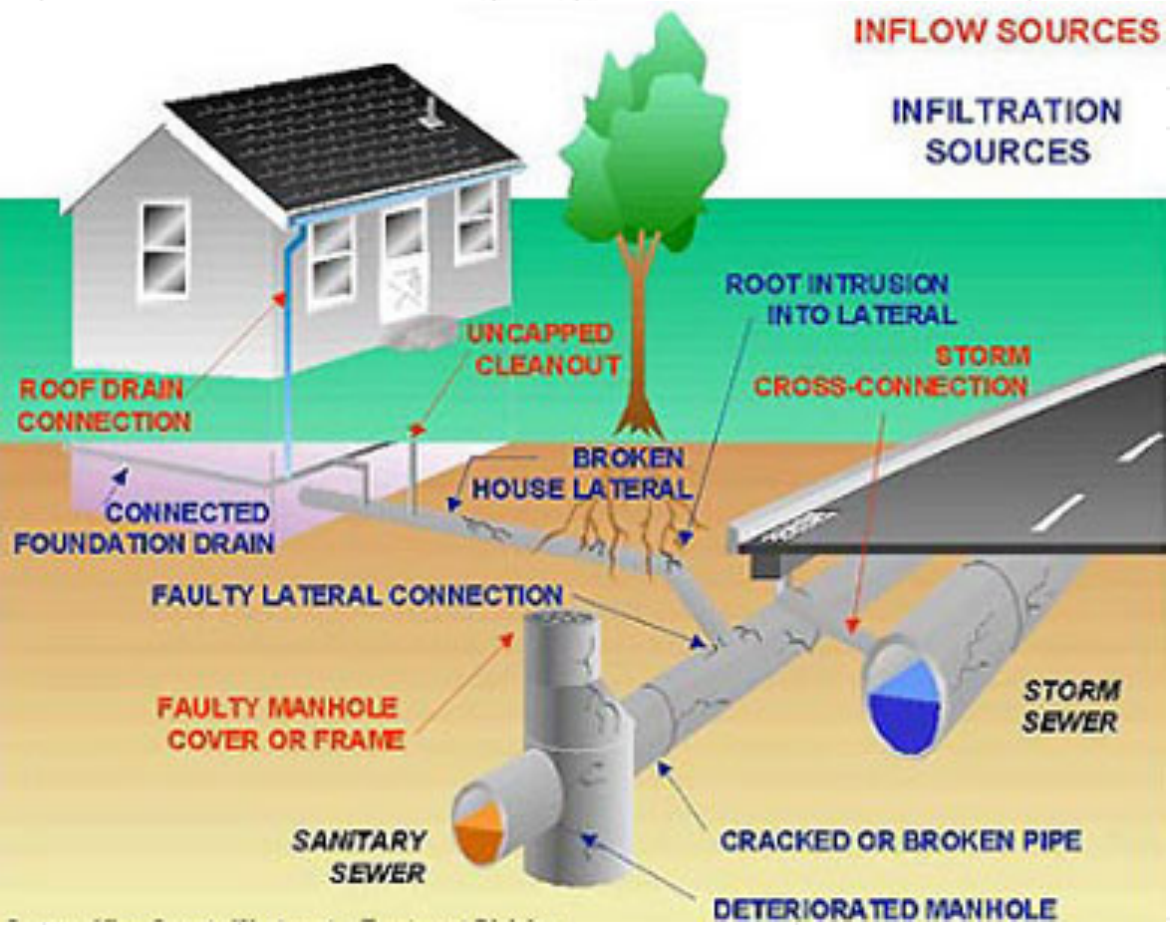
Sanitary Sewer Overflow Systems

Baltimore County



- Separate stormwater and wastewater collection systems
- Dry weather SSOs occur due to lack of proper operation and maintenance
- Wet weather SSOs occur due to inadequate hydraulic capacity and/or inflow/ infiltration

Consent Decree Requirements

- Inspect collection system
- Identify and address defects found during the inspection phase
  - Regional preference to use NASSCO PACP guidelines
- Complete rainfall/flow monitoring program (usually 1 year)
- Complete inflow/infiltration analysis
- Develop hydraulic model

Sample Model Simulation

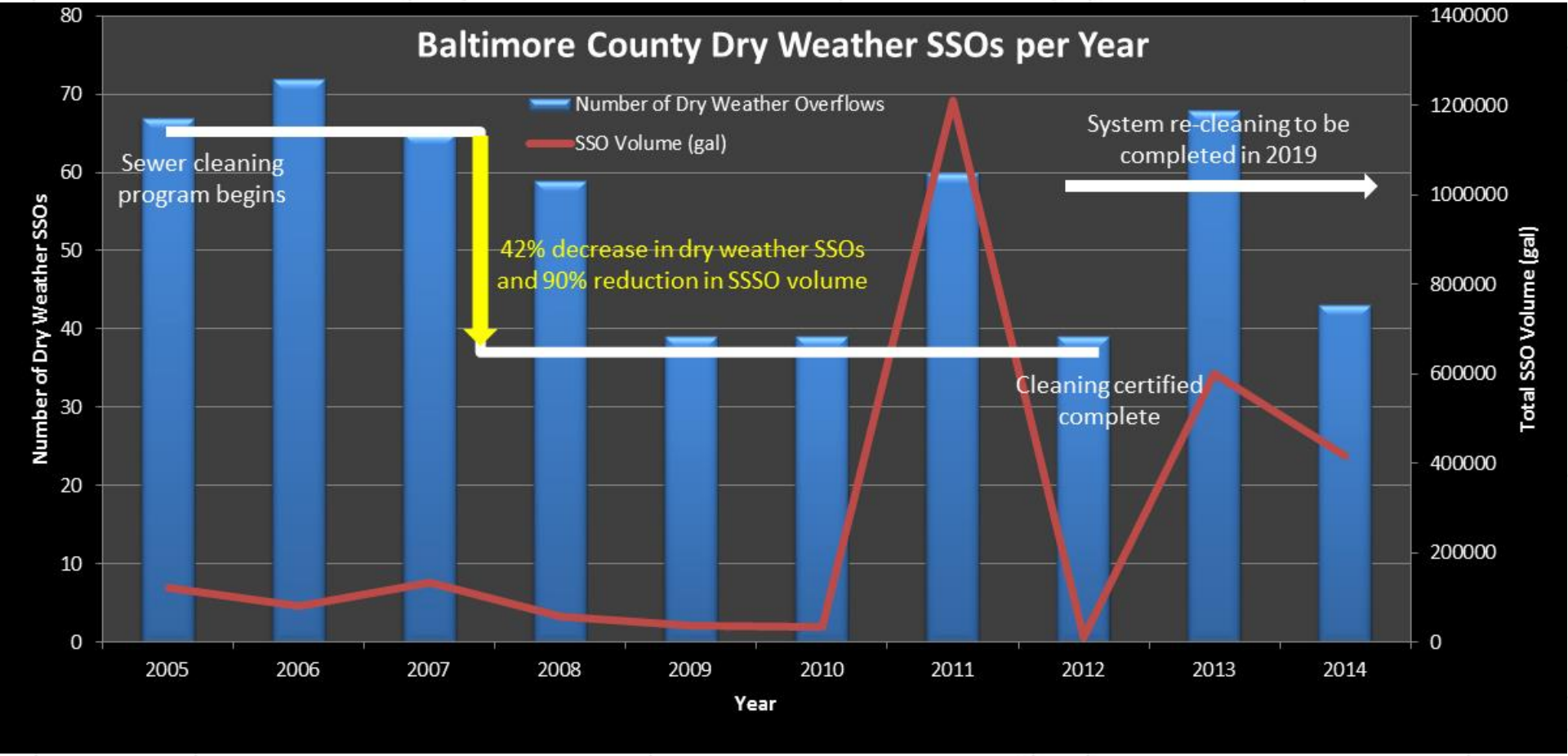
- Complete model simulations for 2, 10 and 20 year storm events
- Identify and address hydraulic restrictions
- EPA preference is to address restrictions resulting from a minimum 10-year storm event

Increased capacity required

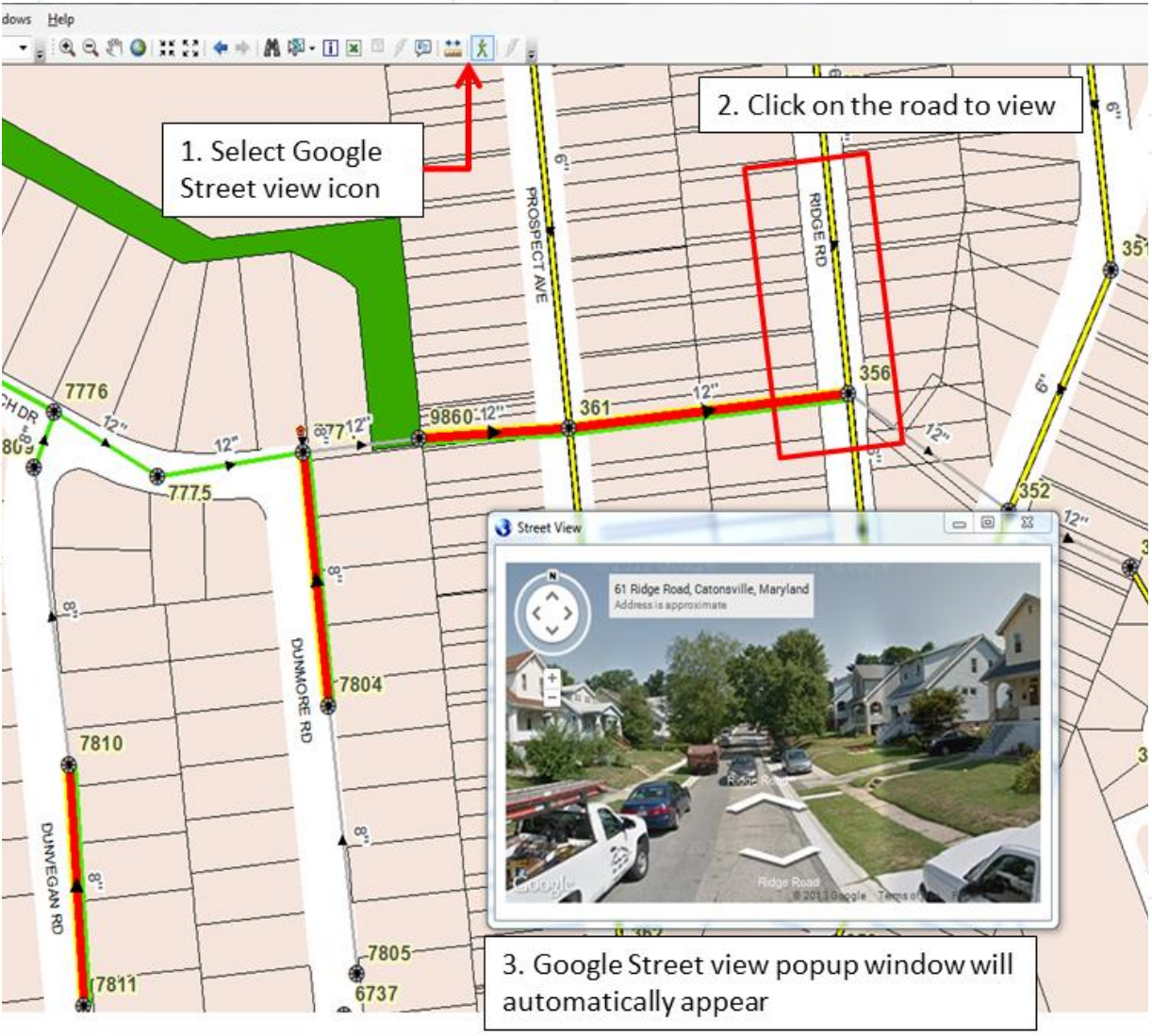
Modeled sewer

Sewer manhole

Results of an Effective O&M Program



Sample of Baltimore County's GIS-based corrective action planning system



Lessons Learned

Data Sharing

- How do we use/share all of the data that we've collected?
  - Develop comprehensive asset registry
  - Implement enterprise-wide data sharing and analyses tools

Lessons Learned

Level of Service

- What is our level of service?
  - What is management's expectations?
    - How many dry weather SSOs are acceptable?
    - What is an acceptable response time to a customer complaint?
    - How much staff and money will these expectations require?
  - What is the customer's expectations?
    - How much is the customer willing to pay?

Sample Definition of Level of Service

Level of Service	Description
A	Meets City's design criteria under peak wet weather flow.
B	Meets City's design criteria under peak dry weather flow and no more than 100 percent of full pipe capacity under peak wet weather flow.
C	No more than 80 percent of full pipe capacity under peak dry weather flow and no more than 100 percent of full pipe capacity under peak wet weather flow.
D	No more than 90 percent of full pipe capacity under peak dry weather flow and no more than 110 percent of full pipe capacity under peak wet weather flow.
E	No more than 110 percent of full pipe capacity under peak dry weather flow and no more than moderate surcharge under peak wet weather flow.
F	More than moderate surcharge under peak dry weather flow or significant surcharge or predicted overflow under peak wet weather flow.

Lessons Learned

Prioritization

- How do we justify future costs to maintain our level of service?
  - What is our municipalities financial capacity?
  - What do we own and what is the condition of our assets?
  - What is the remaining life of our assets?
- How do we prioritize system repairs/upgrades?
  - What is the condition of each asset and what is the risk if no repair/upgrade is made?
  - Can we maintain our level of service if we don't repair/upgrade our assets?

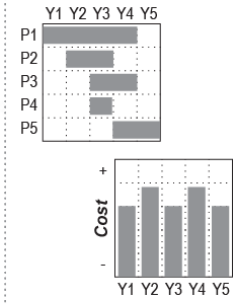
Risk Assessment Matrix

Criticality of Failure Rating	Risk of Failure Rating		
	0.1 to 6.42	≥ 6.43 and < 7.92	≥ 7.93
0.1 to 4.19	Low Priority		High Priority
≥ 4.20 and < 4.79		Moderate Priority	
≥ 4.80			

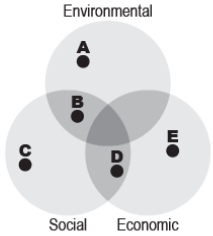
Sample of Baltimore County's force main condition/criticality prioritization matrix

Baltimore IPF Process

Step 1
Project List



Step 2
Prioritization Criteria



Step 3
Project Scores

Criteria

	Env. A	Env. B	Soc. C	Eco. D	Eco. E
P1	#	#	#	#	#
P2	#	#	#	#	#
P3	#	#	#	#	#
P4	#	#	#	#	#
P5	#	#	#	#	#

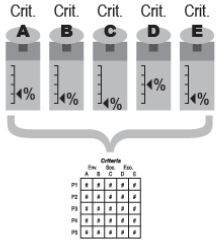
Step 4
Scenario Development

Consent Decree

EPA's IPF with SW & WW only

Baltimore's IPF with DW, SW & WW

Step 5
Importance Weighting



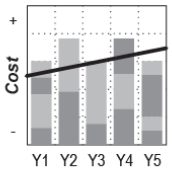
Step 6
Weighted Total Scores

Criteria

	Env. A	Env. B	Soc. C	Eco. D	Eco. E	
P5	#	#	#	#	#	**#**
P1	#	#	#	#	#	**#**
P3	#	#	#	#	#	**#**
P4	#	#	#	#	#	**#**
P2	#	#	#	#	#	**#**

Output:
Prioritized List

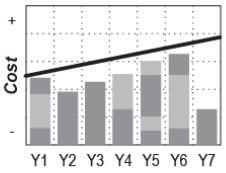
Step 7
Cost/Benefit & Full Financial Analysis



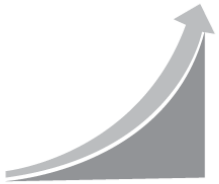
Step 8
Involve Stakeholders

Step 9
Select Final Scenario

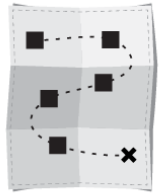
Step 10
Finalized Integration Plan



Step 11
Monitoring Success



Step 12
Revised Analysis As-needed



Questions?

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