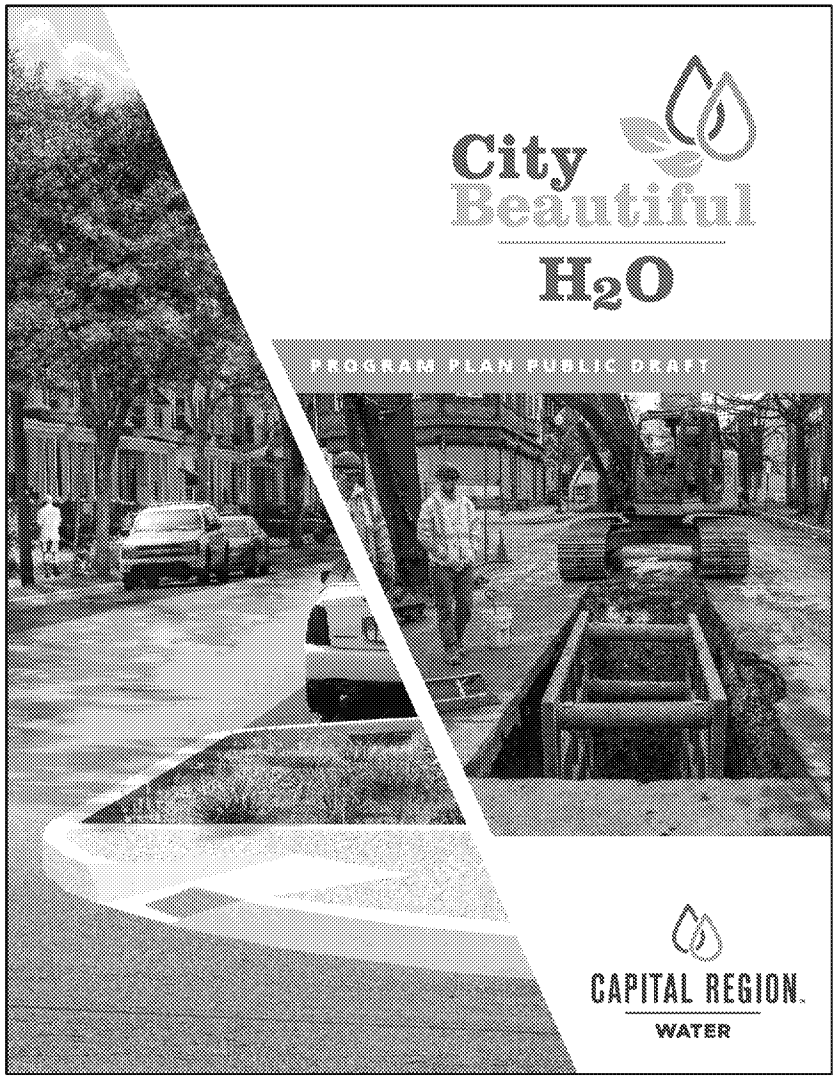
CAPITAL REGION™

WATER

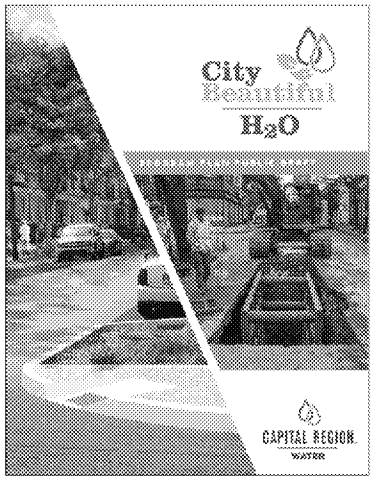
City Beautiful

H_2O

Program Plan Coordination Meeting
October 17, 2019



Discussion Topics Requested by EPA



- Plan needs to be based on the actual hydraulic needs not cost limitations
- The H/H model needs to reflect evolving system performance
- Continuous flow level sensing may be needed to design weir height modifications
- Localized storage needs to be evaluated to reduce smaller volume CSOs
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- The life cycle costs of GI alternatives and the expected reductions in CSO frequency and volume needs to be evaluated
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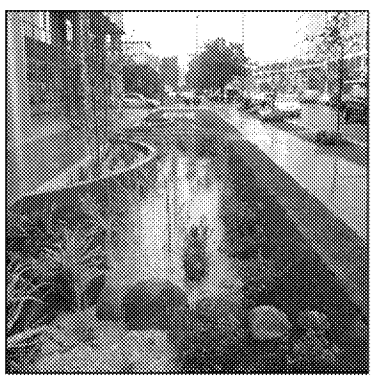
- Properly calculate the CSO capture percentage given high discharge frequencies



Topic 1. Hydraulic Capacity Assessments

EPA Discussion Point. *"It is critical that CRW plan ahead based on the **actual hydraulics needs** of its wastewater collection and treatment system when doing remedial work. Otherwise, implementation of supplemental CSO controls may cost more in the future. The current LTCP seems to reflect a relatively narrow view of alternative analysis that does not appear to maximize cost effectiveness since it does not consider the full gambit of alternatives that could be applied individually to each combined sewer basin".*

CRW Response. The Section 8 alternatives analysis evaluated the full range of alternatives, building upon the hydraulic capacities of the CRW interceptors, pump stations, and AWTF.

The Baseline Level of Control

The Baseline LOC is the optimal starting point for the CBH_2OPP

- Cost is $181 million in 2017 dollars and would be implemented over 8 to 10 years
  - Makes the CRW system reliable and resilient and maximizes initial wet weather control
  - Includes priority remedial repairs to the AWTF, the interceptor system, and the collection system
  - Increases hydraulic capacity of the AWTF, interceptors and pump stations to 80 MGD
  - Modernizes CSO regulators to increase wet weather capture and reduce river intrusion.
  - Addresses priority needs identified by the CCTV investigations within the collection system
- CSO capture would increase (from 53% to 78%), CSO frequency would be reduced (from 12 to 95 to a range from 0 to 57) CSO duration would decrease (from 700 to 225 hours/year)
- The backlog of deferred maintenance would be caught-up and a proactive O&M program would begin

Baseline Level of Control

Mapped Sewersheds

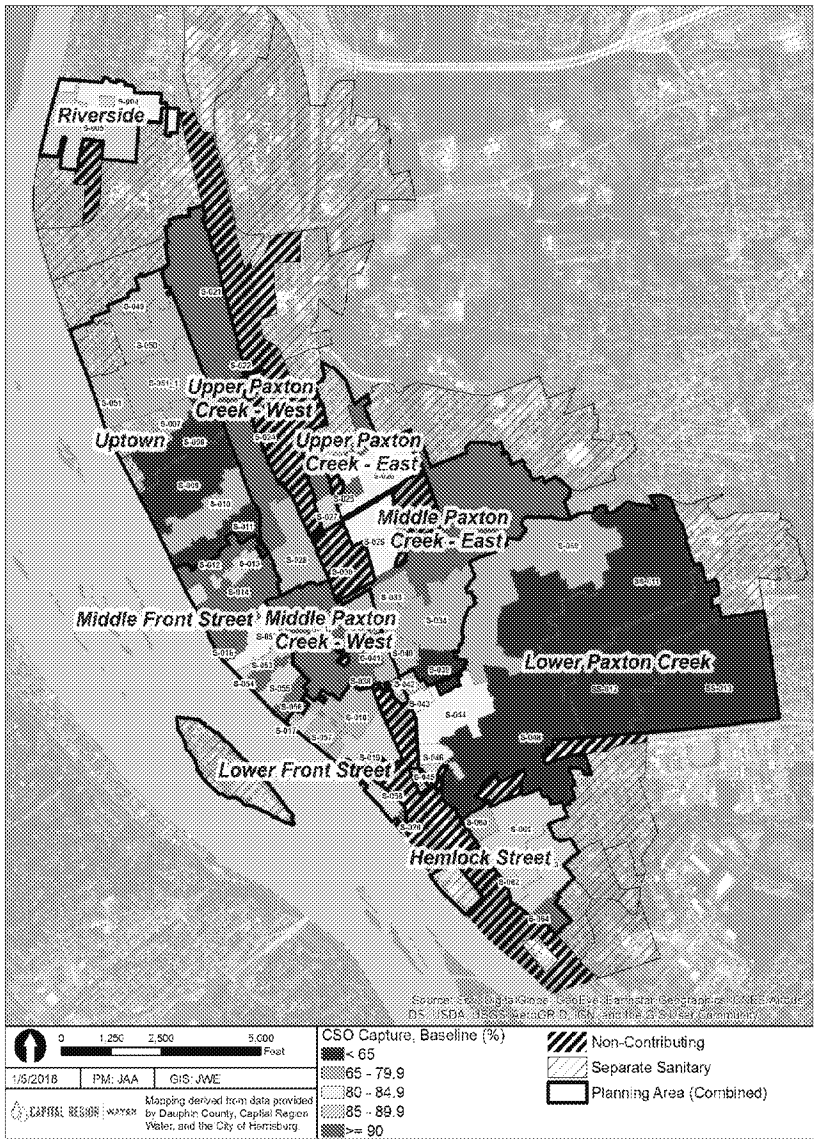
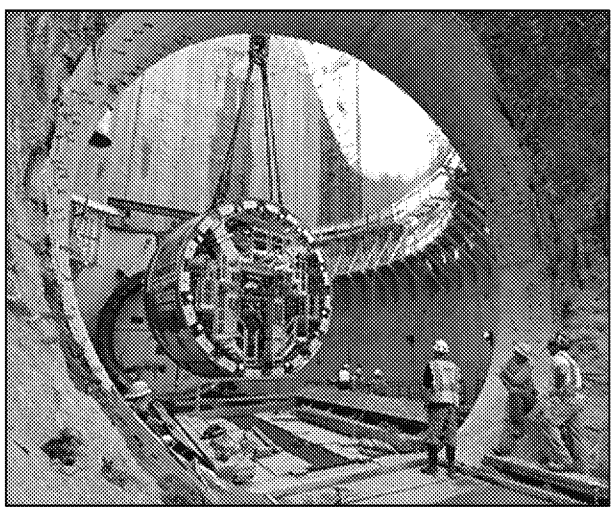
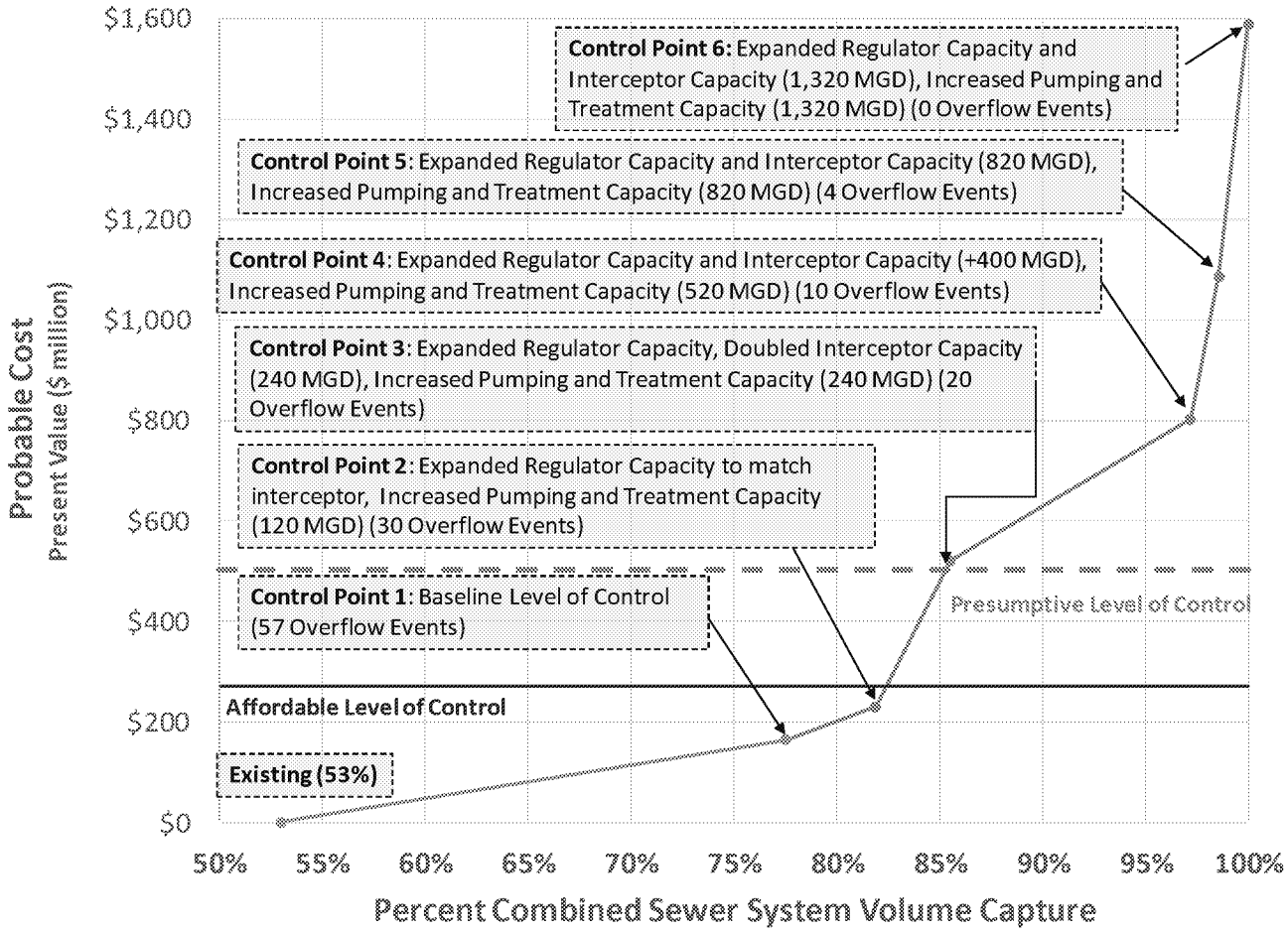


Figure 8.2-1: CSO Volume Capture by Catchment under the Baseline Level of Control

Systemwide Control Strategy 1: Increased Conveyance/Treatment

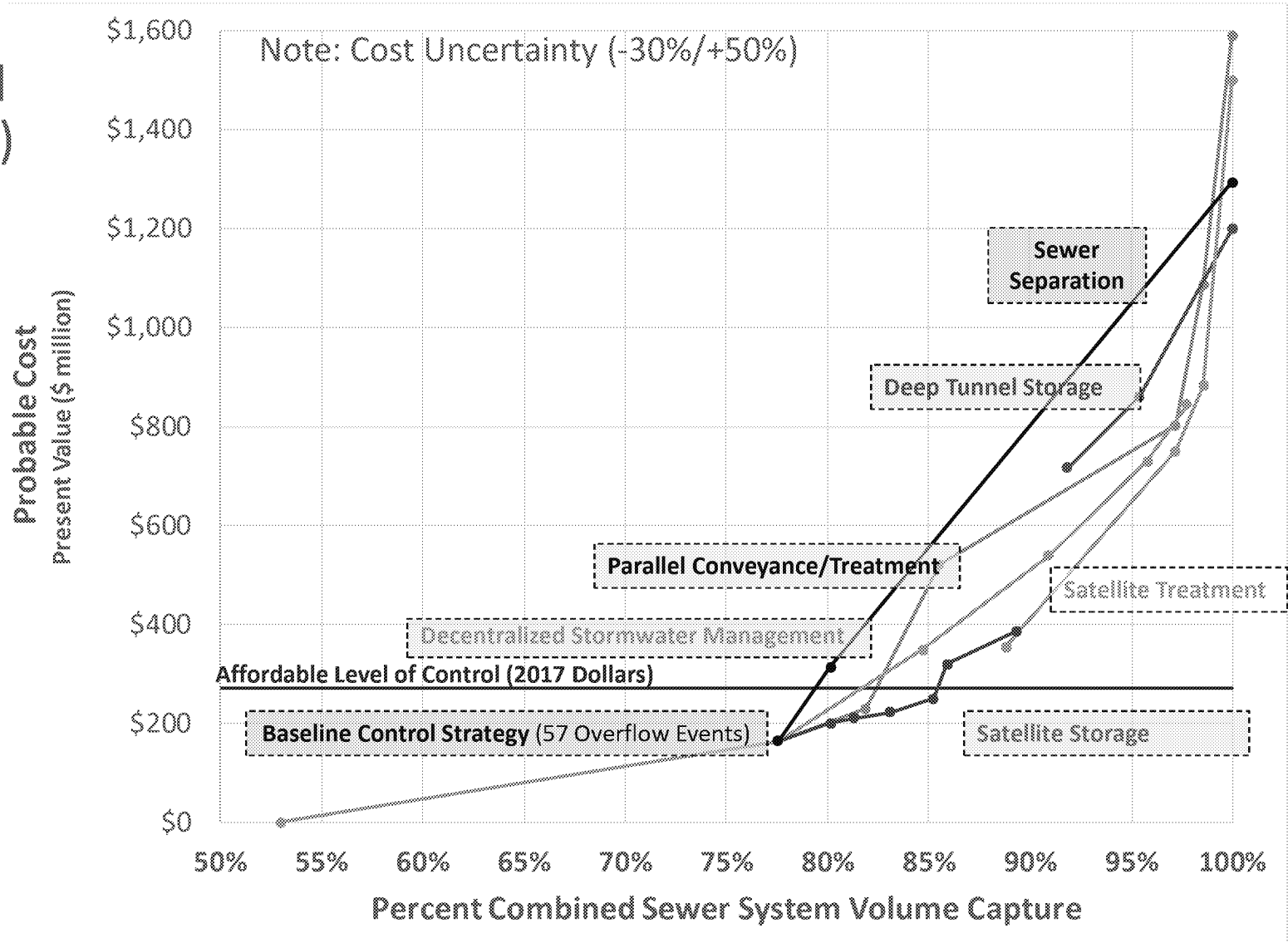
- The Plan evaluated the entire range of increased conveyance/ treatment hydraulic capacity from the Baseline LoC to 0 CSO discharges per typical year





Decentralized Control Strategy (Green/Grey)

- Increased Systemwide conveyance/treatment, systemwide separation, and deep tunnel storage were least cost effective
- Satellite storage/ treatment was most cost-effective for CSO control alone
- Decentralized stormwater management was most cost-effective for full wet weather control and maximizes triple bottom line benefits



Evaluating Control Alternatives

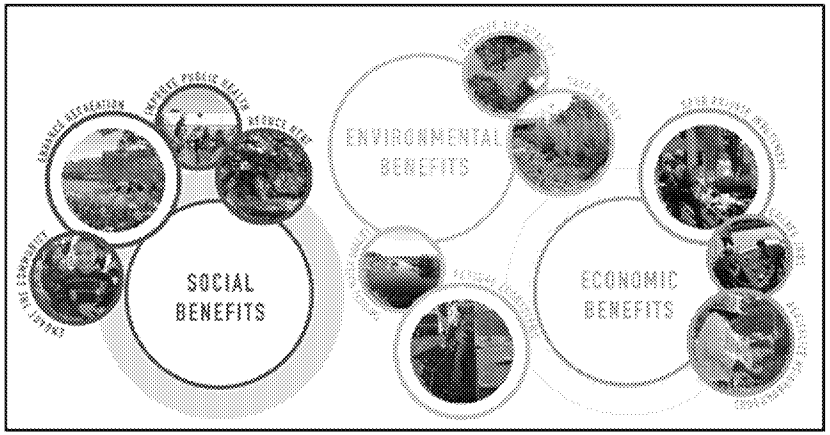
Comparing the Local - Decentralized Control Strategies

Decentralized End-of-Pipe

- Only controls CSOs
- No multi-objective community benefits
- Funded solely via sewer rates
- Inflexible large projects
- Beyond financial capability constraints

Local - Decentralized Green/Grey

- Controls CSOs and basement flooding
- Supports community revitalization
- Multiple funding sources available
- Flexible mix of small projects
- Integrates with collection system rehabilitation
- Fits financial capability constraints



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CRW Response. The Section 8 alternatives analysis evaluated the full range of alternatives, building upon the hydraulic capacities of the CRW interceptors, pump stations, and AWTF.

Action Items/Next Steps?

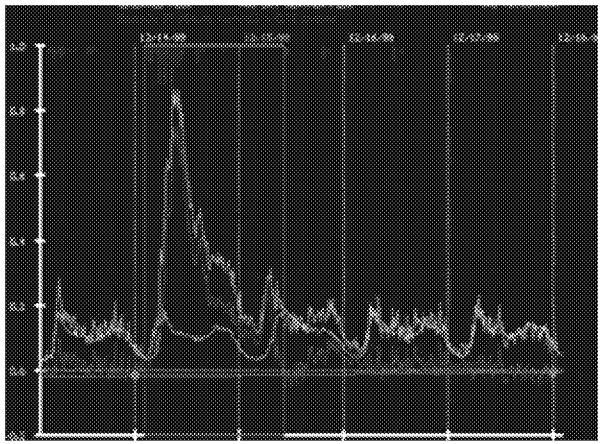
Topic 2. Verifying the H/H Model is Current

EPA Discussion Point. *"In order to be able to evaluate actual collection system hydraulic improvement needs, the model of the system needs to reflect system performance as it evolves. Regular updates of the model to reflect changes in the collection system are critical to effective implementation of adaptive management".*

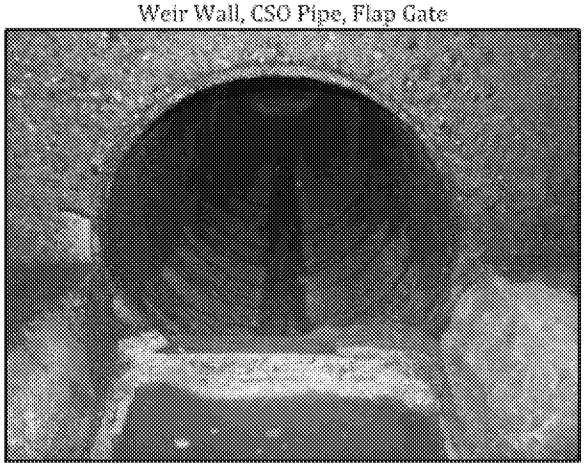
CRW Response. The H/H model is revalidated every 6 months for semi-annual reporting

- Simulated CSO discharge frequency and duration are compared to observations of the CRW field crews
- As revisions are made to the system corresponding revisions will be made to the model
- CBH_2OPP already includes post construction monitoring and model validation

Action Items?

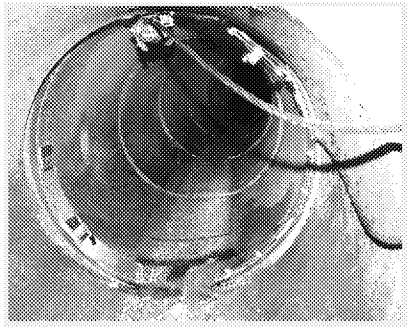


Weir Wall, CSO Pipe, Flap Gate



Topic 3. Continuous Flow Level Sensing

Potential for Real Time Control



<u>EPA Discussion Point</u>. *"Concurrent implementation of continuous flow in key combined sewers is required to determine the effects of weir height modifications and other modifications, and to begin baseline data collection in preparation for development of Real Time Control.*

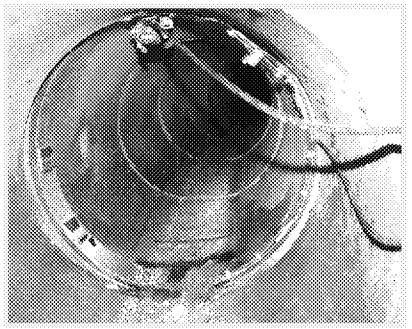
For example, "SmartCovers®" or similar low-cost technology. It appears that 50 to 100 initial installations may be needed in CRW's in trunk and larger upstream collector sewers. These could also be used to monitor CSO diversion chambers to track numbers and durations of activations."

<u>CRW Response</u>: CRW has and will continue to evaluate such approaches.

<u>Action Items/Next Steps?</u>

Continuous Flow Level Sensing

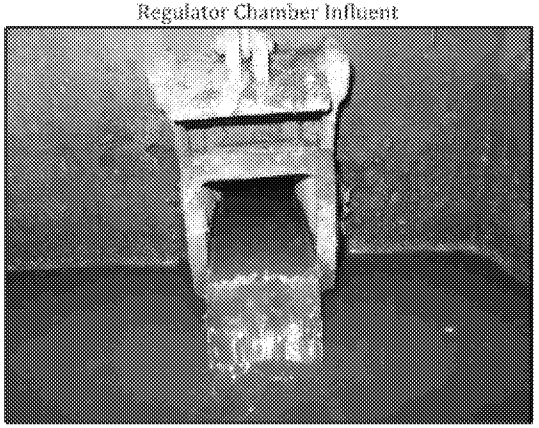
Potential for Real Time Control



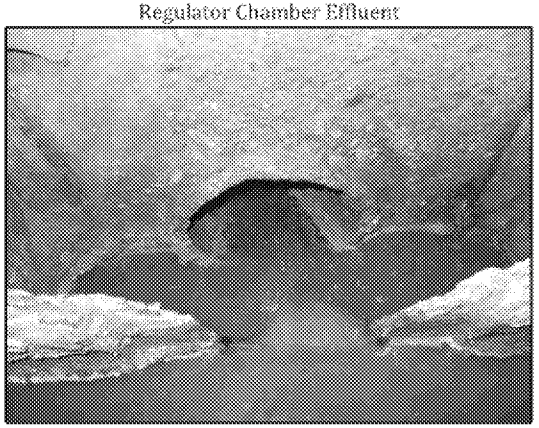
<u>CRW Response:</u> CRW has and will continue to evaluate such approaches.

- The existing AV meters along the interceptor are sufficient to quantify characterize existing and future flow along the interceptor
- The H/H model has proven to be fully capable to represent the impacts of the diversion weirs and Brown & Brown regulators and is sufficient to quantify the impacts of planned structural revisions to regulators as part of the CBH_2OPP
- CRW intends to modernize regulators and evaluate telemetry under baseline level of control

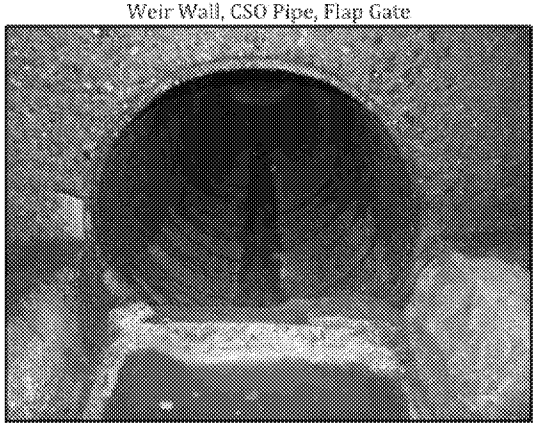
Regulator Chamber Influent



Regulator Chamber Effluent



Weir Wall, CSO Pipe, Flap Gate



Topic 4. Evaluation of Localized Storage

EPA Discussion Point. *"Evaluation of localized storage to reduce frequencies of smaller volume CSOs less than 250,000 gallons per event – this storage could be provided as green infrastructure or gray infrastructure, or more likely, a combination of both. Localized storage tends to be a cost-effective remedy where CSO event frequencies are high and CSO discharge volumes are low. Therefore, localized storage may be the most cost efficient CSO control alternative in some locations, but not in others. In order to yield most cost-effective overall CSO abatement program, the LTCP needs to integrate different mixes of CSO control alternatives for different combined sewer basins based upon the unique characteristics of those basins as revealed by system investigations, hydraulic modeling, and operational experience."*

CRW Response: Decentralized green-grey stormwater controls were determined to be most cost-effective, with specific facilities determined through adaptive management studies

Action Items/Next Steps?

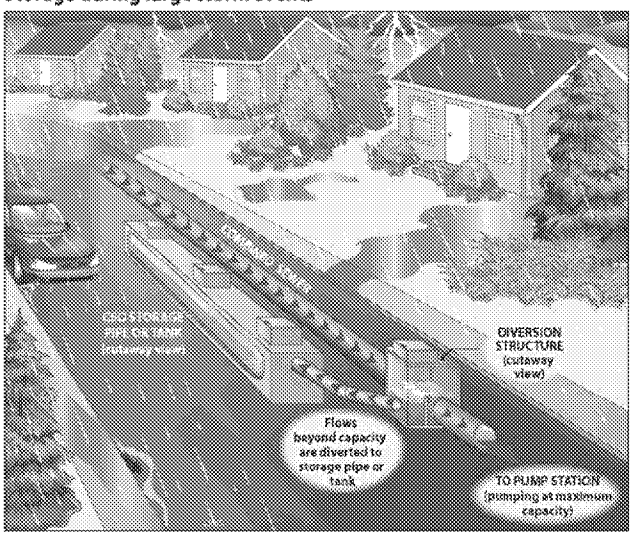
Evaluation of Localized Storage

Program Plan Sections 8.4.1 through 8.4.15

<u>CRW Response</u>: Decentralized green-grey stormwater controls were determined to be most cost-effective, with specific facilities determined through adaptive management studies

- CRW's community greening plan (shown in the CBH_2OPP for each planning area) identifies priority sites for implementing green-grey stormwater controls
- Detailed planning/preliminary design studies within the collection system will define specific project sites to control CSOs, resolve basement/street flooding, and capitalize on neighborhood reinvestment projects.
- Satellite storage/treatment and strategic sewer separation will be considered where site-specific cost-effectiveness is demonstrated.
- Adaptive management will present recommendations and report on level of control achieved

Storage during large storm events



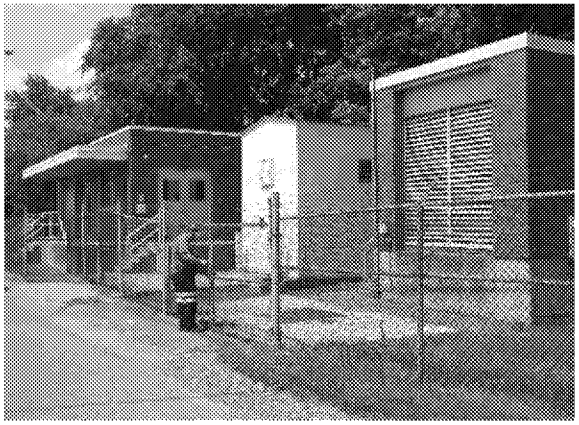
Topic 5. Evaluation of the Sizing of Pump Stations

EPA Discussion Point. *"Evaluate the sizing of the pump stations and the impact of pump station work on CSO reductions."*

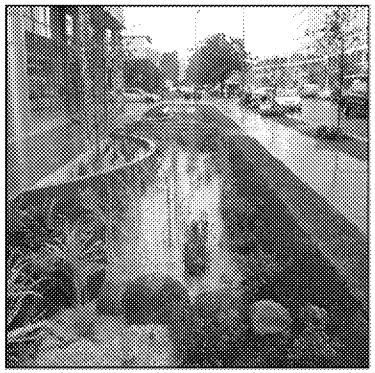
CRW Response: The requested evaluation was completed within Section 8.3.1:

- Baseline improvements were critical, limited by size of existing pump station building/wet well
  - Maximized increased pumping capacity of existing facilities
- A range of 6 increases in pump station hydraulic capacities were evaluated (see discussion, Topic 1):
  - 80 MGD (baseline), 120 MGD, 240 MGD, 400 MGD, 700 MGD and 1,300 MGD
- Corresponding increases in interceptor and treatment capacities were also required
- The corresponding levels of CSO control were determined

Action Items/Next Steps?



Topic 6. Evaluation of Life-Cycle Costs of GI Alternatives



EPA Discussion Point. *"Evaluate the cost of life cycle of GI alternatives and the expected reductions in volume and frequency of CSOs."*

CRW Response:

- The Costing Tool used for the CBH2OPP includes the life cycle costs for GSI
- The H/H Modeling analyses calculate resulting CSO control

Action Items/Next Steps?

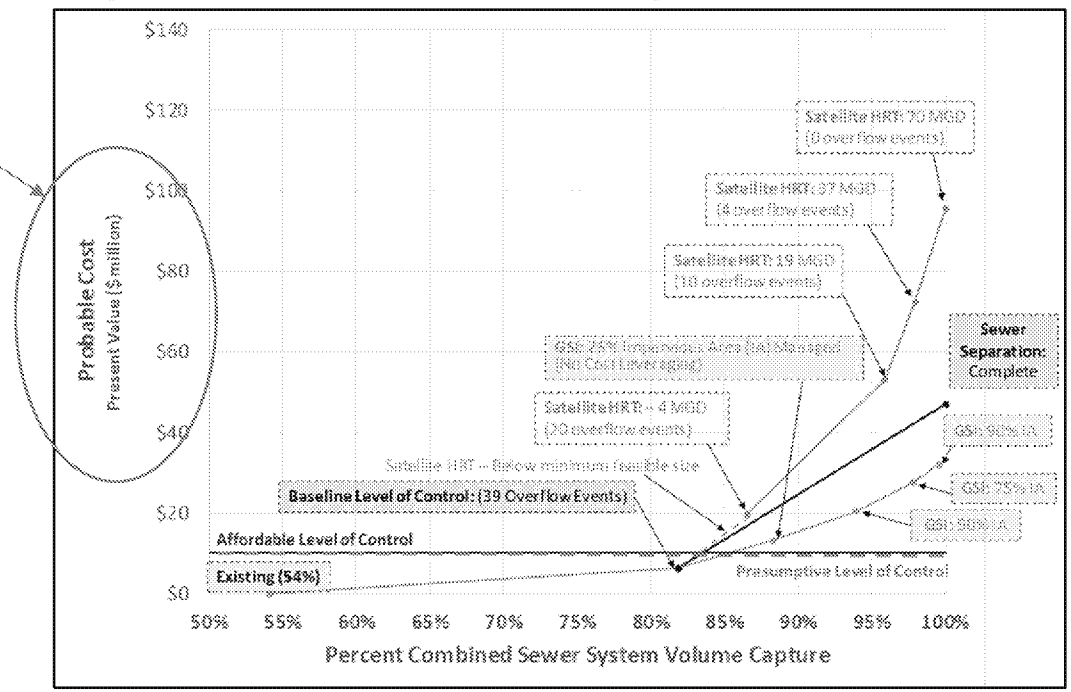
Green Stormwater Infrastructure Life Cycle Cost and Stormwater Management Performance

CRW Response:

- Life Cycle Cost
  - Included in Cost Performance Evaluation and Financial Capability Assessment
- Modeling Approach for GSI Stormwater Management Performance
  - CSO reduction impacts from individual GSI facilities is not feasible.
  - Best methodology is to monitor individual facilities to confirm that the performances meet or exceed the design assumptions.
  - Approach successfully used in Philadelphia.

Example Knee-of-the-Curve Assessment

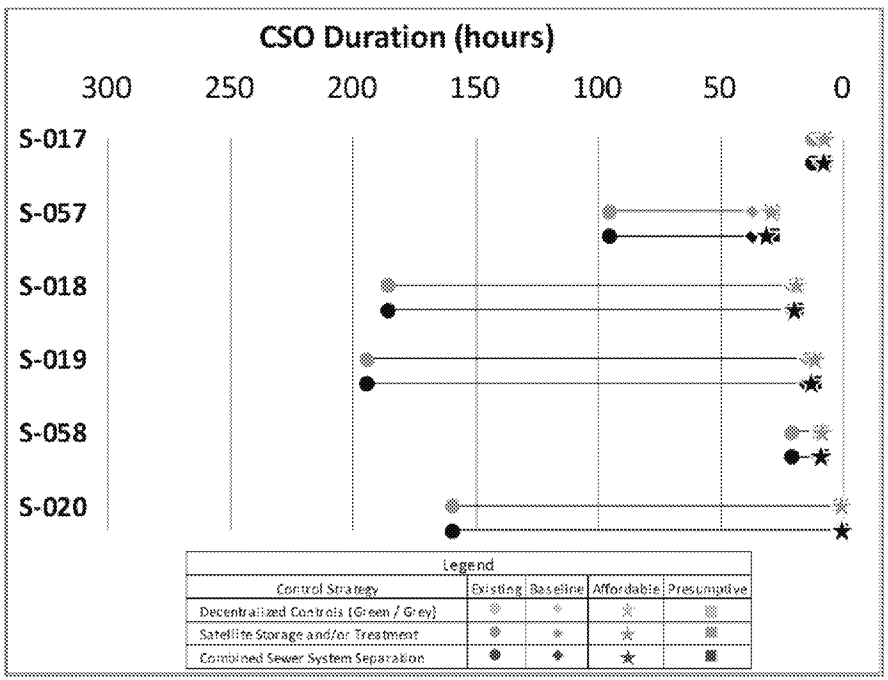
Program Plan Section 8.4.5: Lower Front Street Planning Area

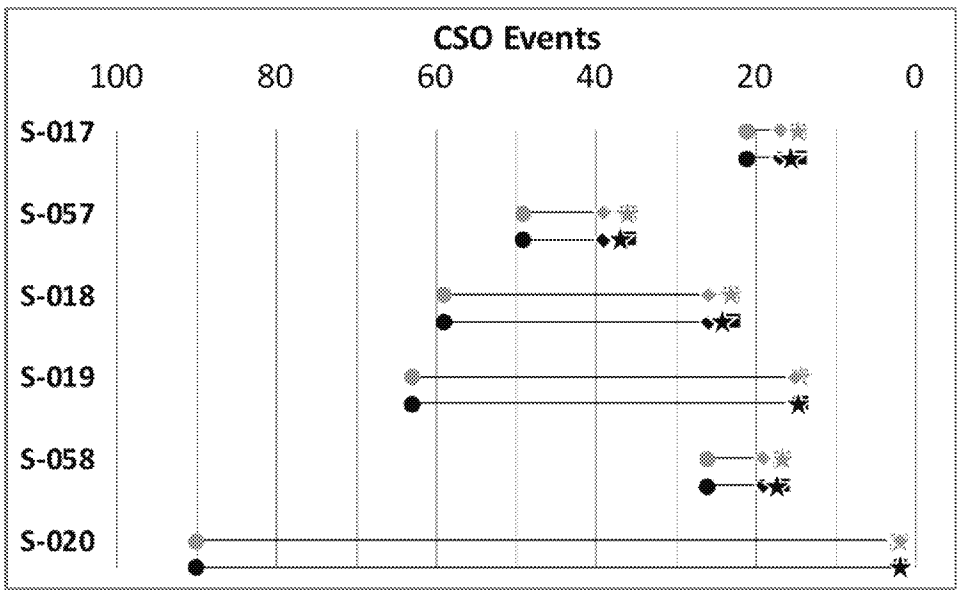


Example Graphics for CSO Control Benefits

Program Plan Section 8.4.5: Lower Front Street Planning Area

Existing and controlled CSO discharge frequency and duration values are also provided for each outfall





Existing and controlled condition CSO discharge durations tend to be short and flashy

Topic 7. Reduction of Satellite Community RDII

EPA Discussion Point. *"Reduction of satellite community wet-weather I/I: While satellite I/I reduction is not a specific combined sewer area improvement, for every gallon of wet-weather of separate sewer I/I that can be eliminated, an additional gallon of combined wastewater can be captured. Implement initial level sensing in key separate sewers to track wet-weather I/I impacts from satellite communities."*

CRW Response:

- All the major points of connection from satellite systems are continuously monitored
- The RDII components of the suburban community have been analyzed, quantified, and represented in the H/H model

Action Items/Next Steps?

Satellite Community Monitoring

Wet-Weather Flows

- All of the major points of connection from suburban community systems are continuously monitored
- The RDII components of the flow have been fully analyzed
- Relative "leakiness" of these collections systems is relatively low, and flow reduction potential may be low

Table 3-20: Summary RDII Analysis Results for Suburban Separate Sanitary Sewer Catchment Areas

Monitoring Site	R1	R2	R3	Total R	GWI Ratio
POC M9	0.0018	0.0018	0.0051	0.0087	0.63
POC M13	0.0018	0.0023	0.0068	0.0109	0.54
POC M32	0.0022	0.0022	0.0094	0.0138	0.72
POOC M167	0.0039	0.0039	0.0138	0.0216	0.78

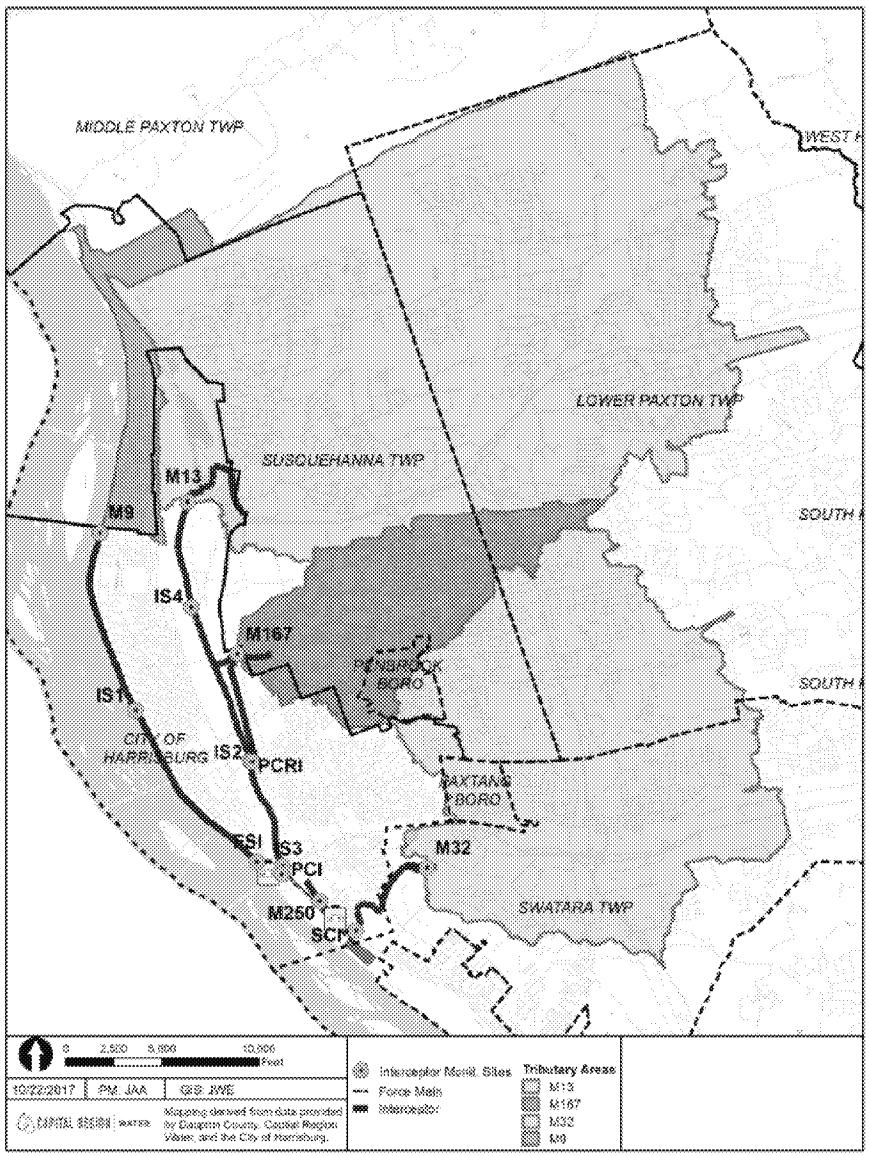


Figure 3-21: Interceptor and Suburban Community Point of Connection Monitoring Sites

Topic 8. Monitoring Water Quality

EPA Discussion Point. *"Monitor water quality to establish baseline info for POCs (including TSS), to determine the effectiveness of CSO abatement alternatives and demonstrating compliance with WQ objectives."*

CRW Response: PA-DEP's water quality sampling program along the Susquehanna River established and documented baseline conditions.

- Modeling of the system will confirm performance of the implemented control measures.
- Water quality compliance is a long term issue and will be assessed after all measures are implemented.
- Merits further discussion at that time.

Action Items/Next Steps?

Topic 9. CSO Capture Methodology

EPA Discussion Point. *"Properly calculate CSO capture percentage. The unusually high CSO frequencies remaining after supposedly achieving 80+ percent capture in the CRW combined system suggest inherent errors in CRW's combined flow capture calculation formula/process. Also, please note that the 85% minimum capture requirement in the 1994 CSO Policy is NOT a finite compliance criterion. The cost-benefit analysis process should still be considered as presented in the CSO Policy to determine the required compliance criterion, whether measured by number of overflow events or percent capture. The compliance capture percentage and event frequency are the products of cost-benefit analysis, not final criteria."*

CRW Response:

- Verify that the proper methodology was used by CRW to calculate percent capture.
- Discuss final compliance criteria for the CBH_2OPP

Action Items/Next Steps?

Characteristics Causing Frequent/Low Volume CSOs

CRW Response:

- Small CSO catchments: CRW system size is similar to Lancaster but 12X as many regulators and outfalls, leading to short times of concentration, high peaks, and minimal flow attenuation/storage
- In existing conditions, Brown & Brown regulators and small orifice plates limit capture of small intense events
- In planned Baseline Condition, more flow reaches the interceptor after regulator improvements but many CSO regulators are close to the crown of the interceptor so when interceptor reaches capacity CSOs are activated because of backflow prevention devices activating
- The periods are often brief (<2 hours) as the peak works its way through the system and volumes are small because of the small catchments

60% of CSO Regulator Orifice Openings < 6 in x 6 in

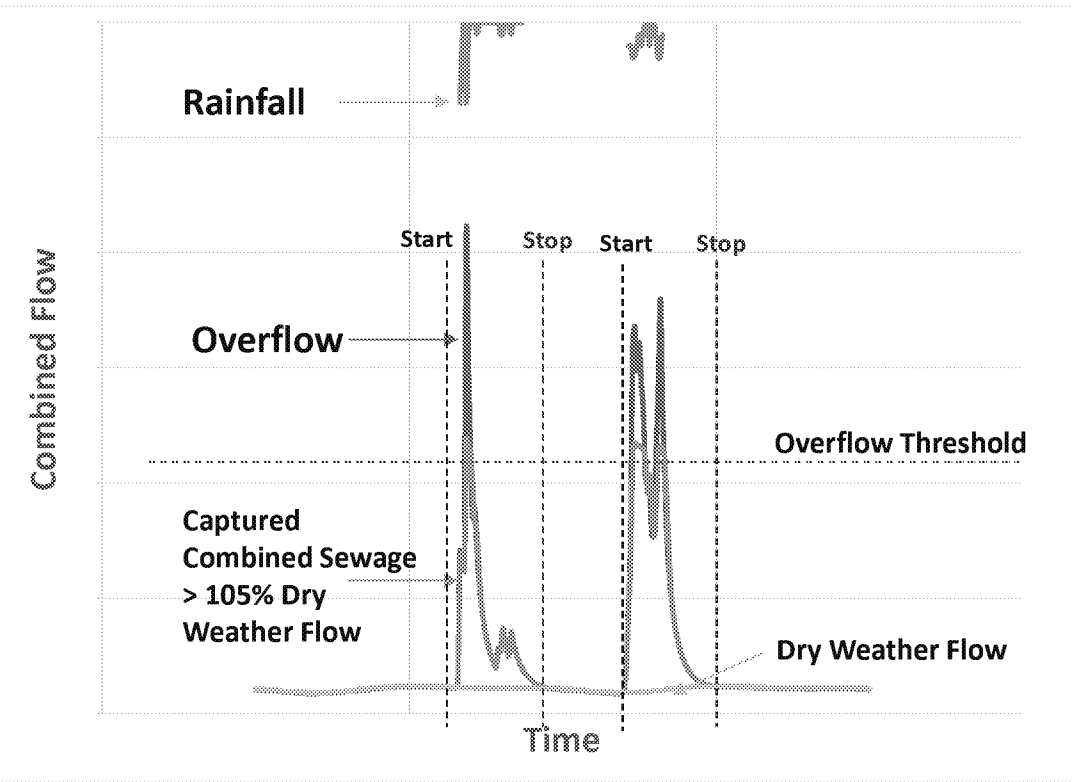
Equal to or Smaller than 1 Stormwater Inlet Pipe Connection to Trunk Sewer

50% of CSO Regulator Connector Pipes to Interceptor < 9 inches

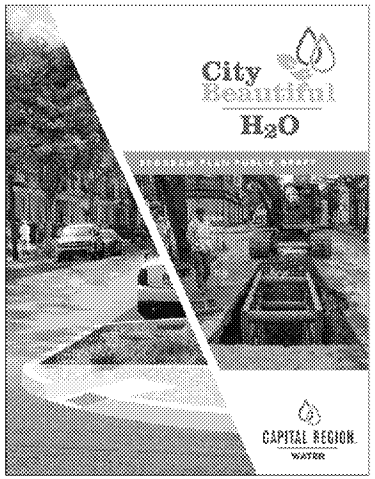
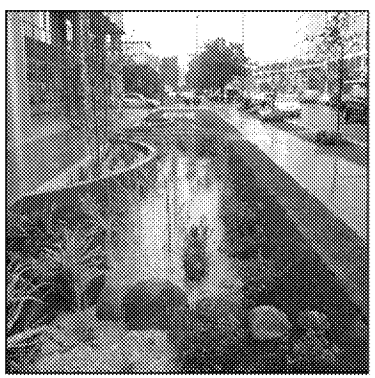
Combined Sewage Capture Methodology

CRW Response:

- Capture Methodology
  - Performed at each CSO regulator
  - Start when trunk sewer flow > 105% of Dry Weather at each time step (accounts for diurnal, daily, and seasonal variability)
  - Stop when CSO ceases or flow < 105%



Discussion Topics Requested by EPA

Summary of Action Items/Next Steps

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