Department of the Environment

CSO Status in Maryland

Presented By:

Yen-Der Cheng

Wednesday, August 7, 2019

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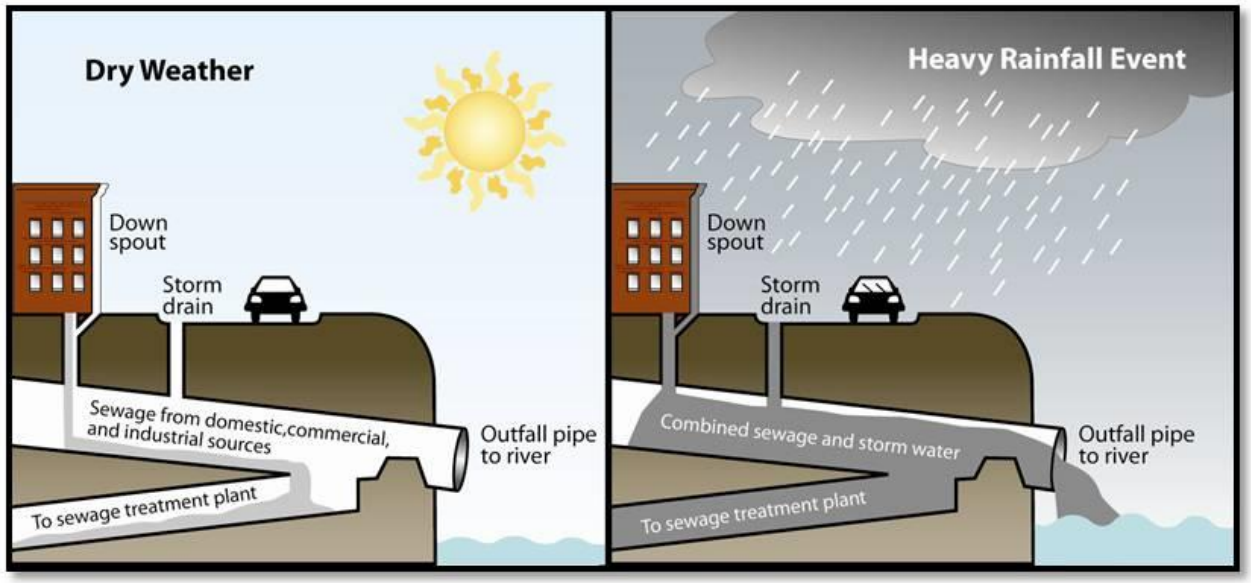
What is a CSO ?

A combined sewer system (CSS) is a wastewater collection system owned by a municipality that conveys sanitary domestic, commercial, industrial wastewater and stormwater through a single-pipe system to a public owned treatment works (POTW).

A CSO is the discharge from a CSS of untreated wastewater at a point prior to the POTW.

CSOs consist of mixtures of domestic sewage, industrial and commercial wastewaters, and storm runoff.



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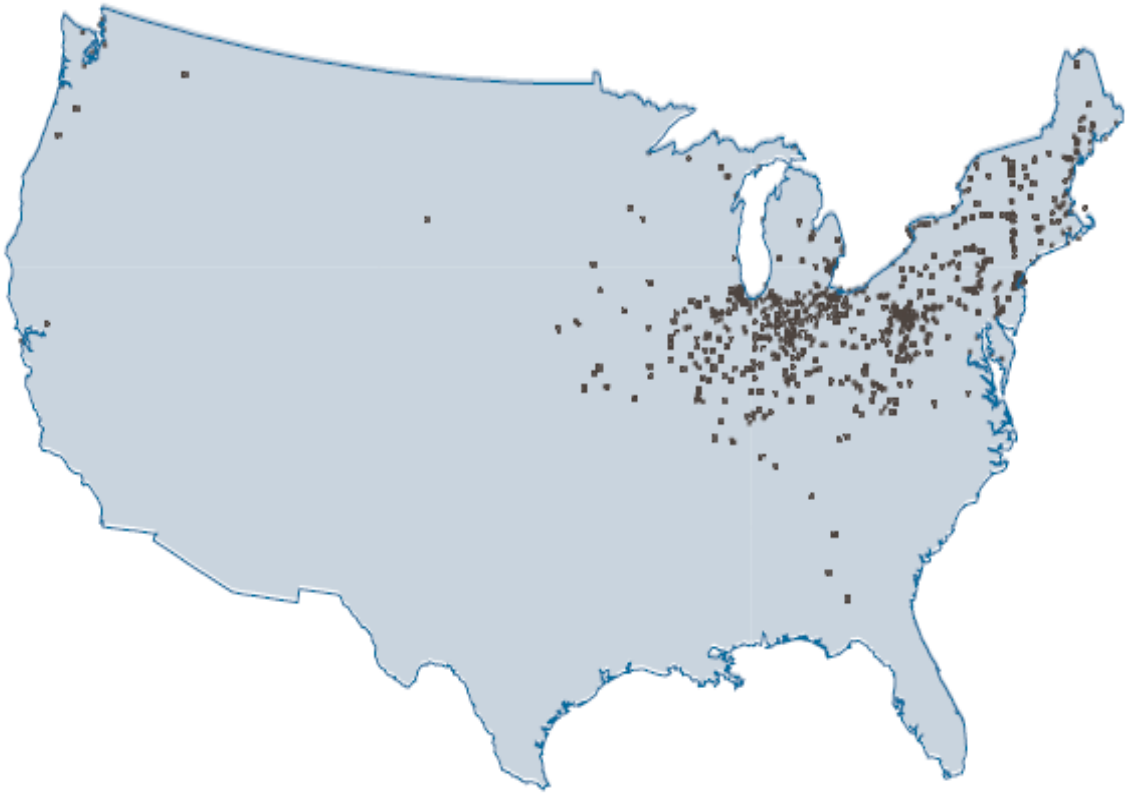
Locations of CSO Communities in U.S.



There are more than 700 CSO Communities within 32 states (including D.C.)
Mostly concentrated in older communities in the N.E. and Great Lake regions

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Locations of CSO Communities in Maryland (1)

CSS	Receiving Stream	Status
Cumberland WWTP	Potomac River	Operation
La Vale CSS	Potomac River	Operation
Allegany County CSS	Potomac River	Operation
Frostburg CSS	Potomac River	Operation
Western Port CSS	Potomac River	Operation

CSS	Receiving Stream	Status
Baltimore	Patapsco River	Separated 2006
Cambridge	Choptank River	Separated 2008
Salisbury	Wicomico River	Separated 2008

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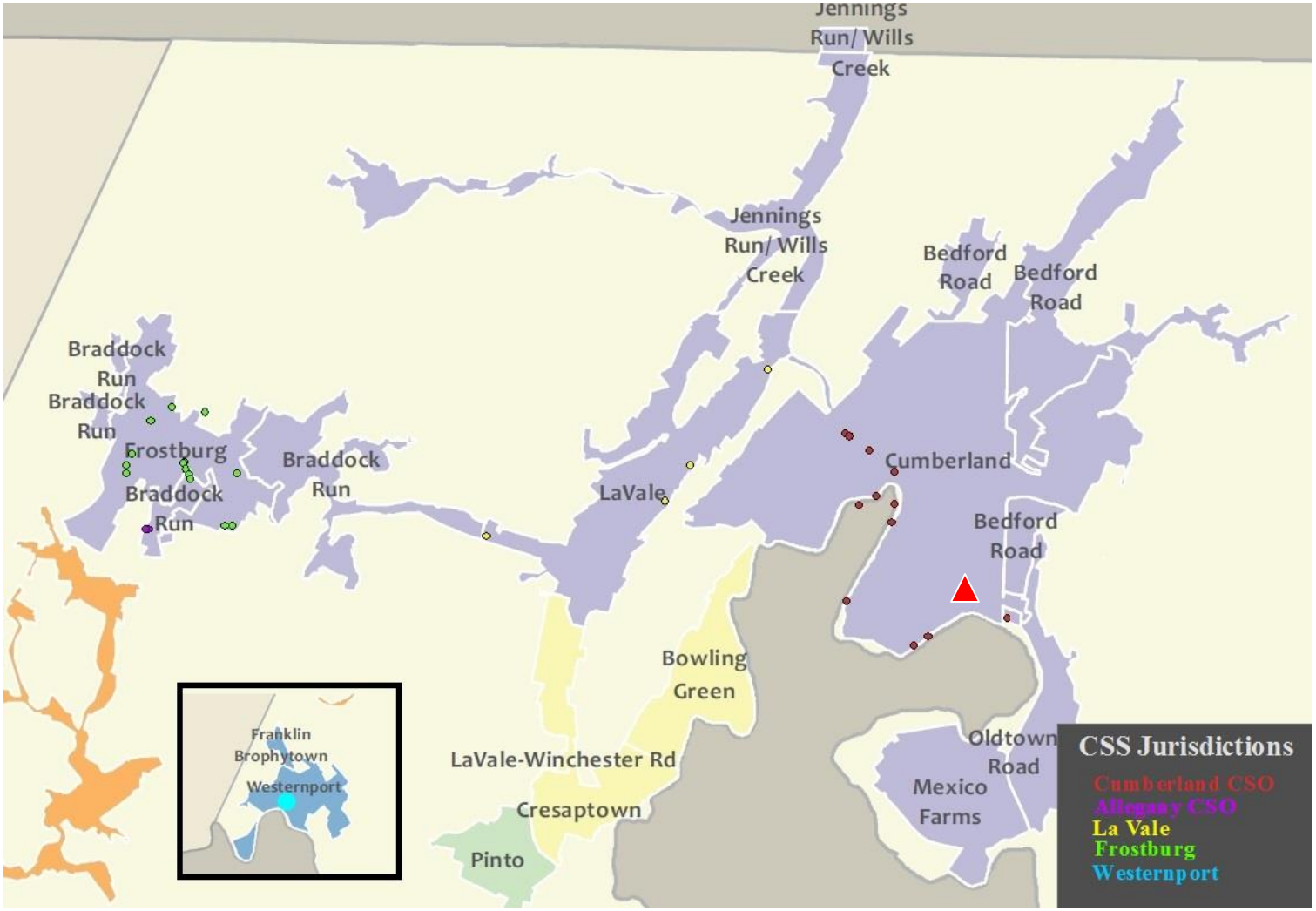
Locations of CSO Communities in Maryland (2)



CSS Jurisdiction	Outfall Number
Cumberland	11
Frostburg	14
LaVale	4
Allegany County	3
Westernport	1

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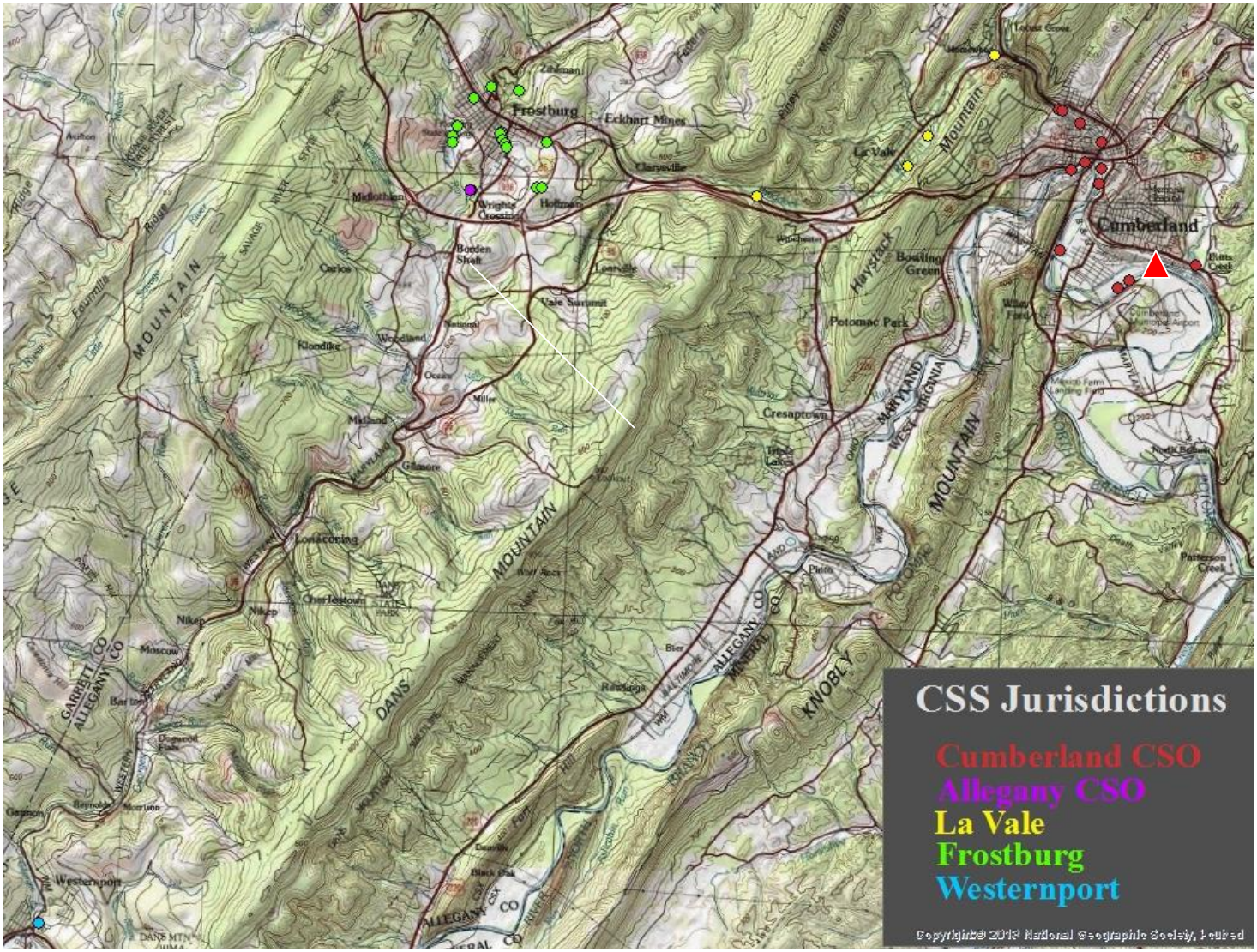
Locations of CSO Communities in Maryland (3)



CSS Jurisdiction	Outfall Number
Cumberland	11
Frostburg	14
LaVale	4
Allegany County	3
Westernport	1

0 10 miles

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City of Cumberland WWTP

The Cumberland WWTP is designed to treat an average of 15 MGD, and a peak flow of 30 MGD.

Current serving 45,000 MD residents with annual average flow of 11 MGD.

The plant currently has been upgraded to Enhanced Nutrient Removal (ENR) since 2011.

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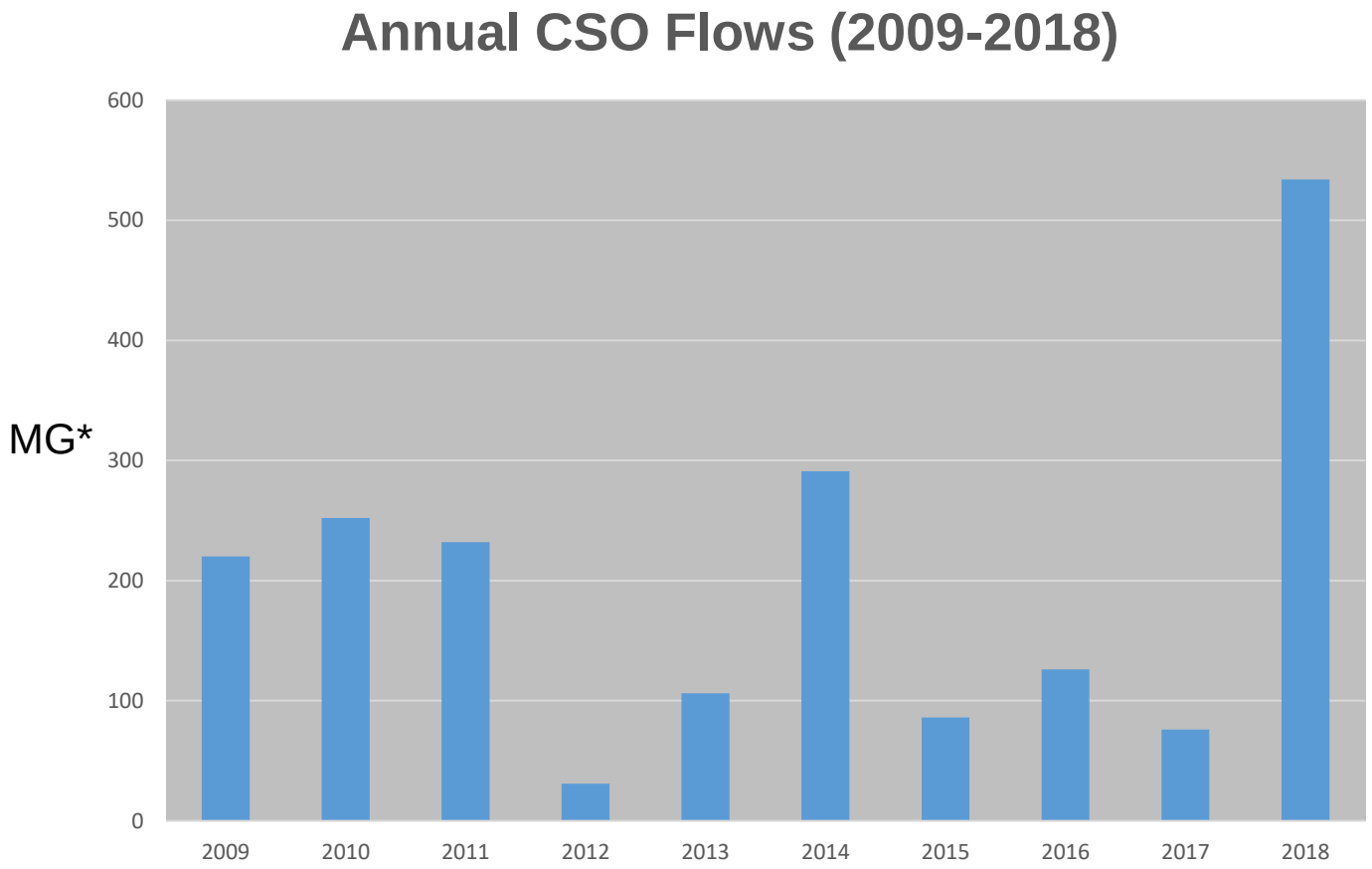
Total Annual CSO Flows in MD



*Million Gallons

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Impacts of CSOs (1)

1. Exceedance of Water Quality Standards
2. Human Health Risks
3. Threaten Aquatic Life and Habitats
4. Impair Designated Use of Waterways (i.e. beach closures, shellfish bed closures and contamination of drinking water supplies).

Pollutant	Consequence
Bacteria	Public health, beach/shellfish closures
Trash/Floatables	Aesthetics, beach closures
BOD	Reduced oxygen levels, fish kills
Solids	Deposition, habitat impairment
Nutrients	Algal blooms, aesthetic impairment
Metals, oil, toxics	Aquatic life impairment

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Federal Policies & Regulations

1989 -National CSO Control Strategy (54 FR 37370)

1.Ensure CSO occurrences are only results of wet weather
2.Bring all wet weather CSO discharges into compliance with technology-based & water quality-based requirements of the Clean Water Act(CWA).
3. Minimize the impacts of CSO on water quality and public health.
4. Request States to develop permitting strategies to reduce or eliminate CSOs.

1994 - CSO Control Policy (59 FR 18688)

1. EPA adopted a process to accelerate the implementation of the strategy and developed the policy in conjunction with stake holders.
2. Provide guidance to CSS permittees, NPDES permitting and enforcement authorities, and State's WQS authorities.
3. Contain four key principles to ensure CSO controls are cost-effective and meet the objectives of CWA.

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EPA CSO Control Policy - Key Principles

1994 - CSO Control Policy (59 FR 18688)

1) Provide clear levels of control
2) Provide sufficient flexibility
3) Allow a phased approach to implementation
4) Review and revise WQS if appropriate

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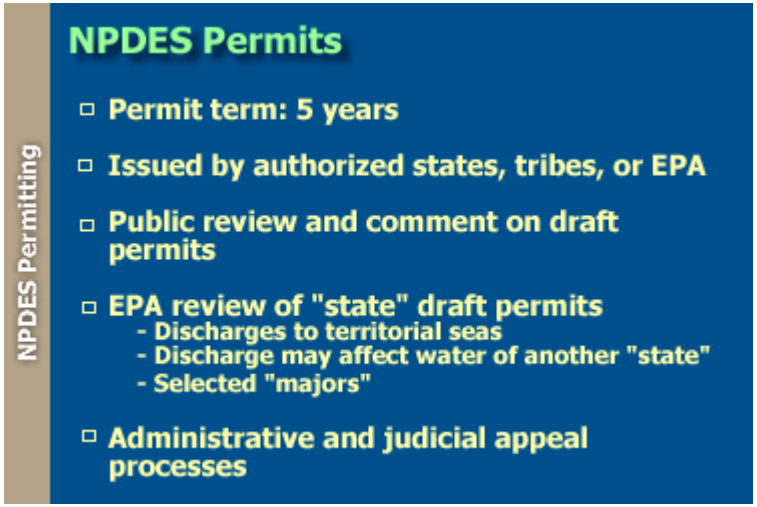
NPDES Permits Issued to MD CSS

CSS Jurisdiction	NPDES NUMBER	Expiration Date
Cumberland	MD0021598	3/31/2020
Frostburg	MD0067423	11/30/2023
LaVale	MD0067547	10/31/2023
Allegany County	MD0067407	10/31/2023
Westernport	MD0067384	11/30/2023



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Regulatory Approach

1. NPDES discharge permit issued to each CSS will set requirements consistent with the Key Principles. Monitoring and reporting of CSO events and volumes are mandatory.

2. Each CSS will implement Nine Minimum Controls(NMC) to reduce CSO events and volumes. Documentation and reporting for NMC taken is required (**NPDES Permit Phase I** requirement).

3. Each CSS will develop Long Term Control Plan (LTCP), subjected to approval (by MDE), to set milestones and goals to eventually meet the Water Quality Standard (WQS). (**NPDES Permit Phase II** requirement).

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Nine Minimum Control (NMC)

The NMCs are minimum "technology-based controls" that can be used to address CSO problems -- without extensive engineering studies or significant costs -- prior to implementation of long-term control measures.

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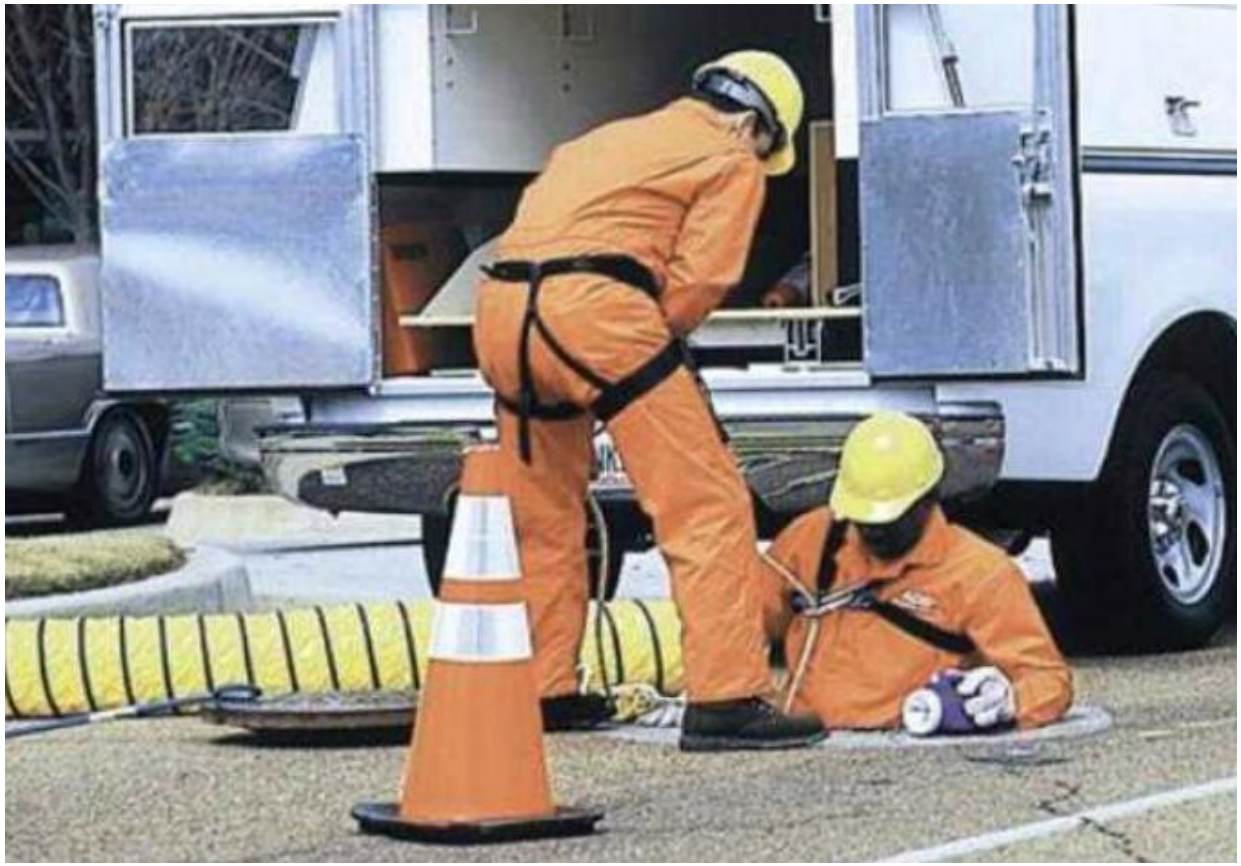
Nine Minimum Controls (1)

Proper operation and regular maintenance for the sewer system and the CSOs



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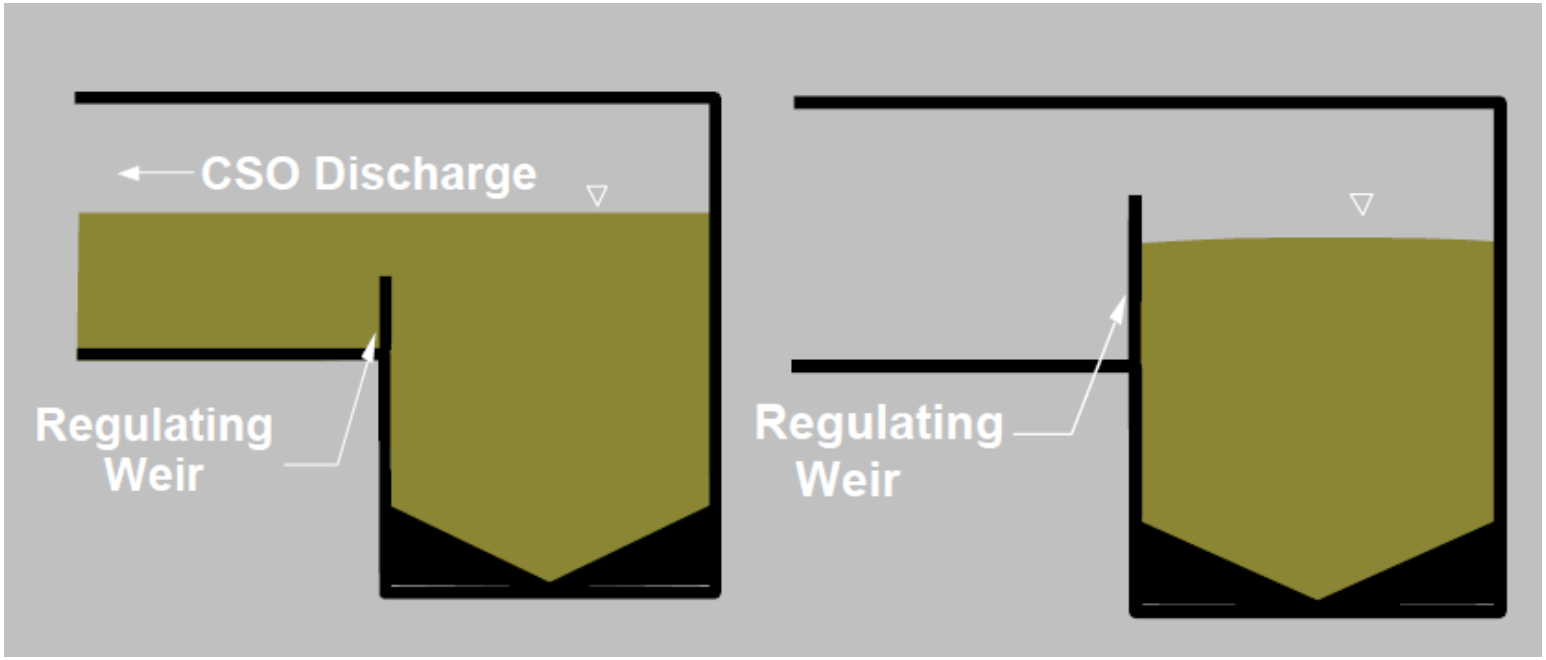
Nine Minimum Controls (2)

Maximize the collection system for storage



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Nine Minimum Controls (3)

Review and revise <u>pretreatment requirements</u> to minimize CSO impacts

Industrial Source

Commercial Source:

Hospitals, Automobile Services, Restaurants, Laundries, Dentist…..

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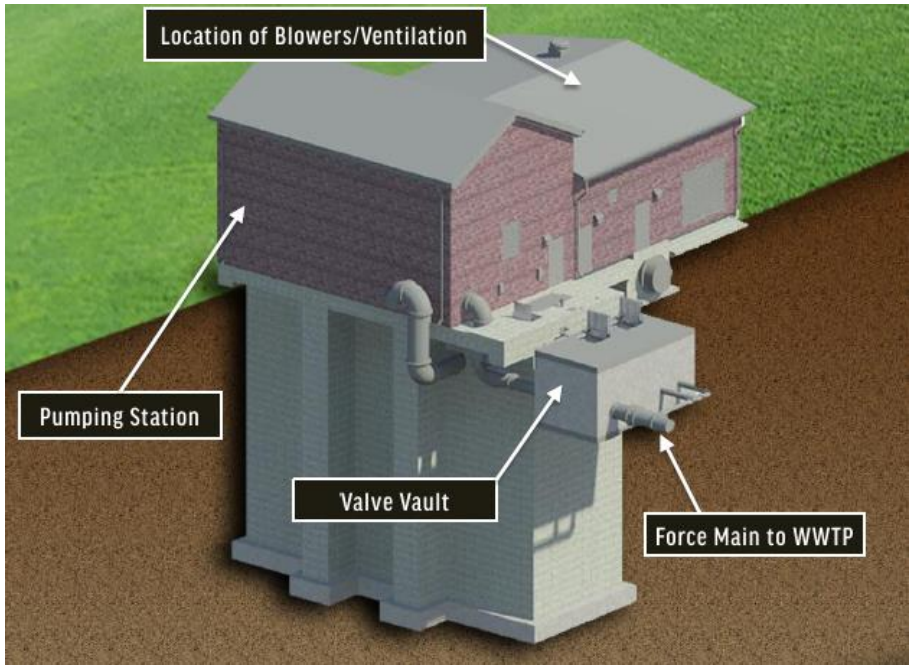
Nine Minimum Controls (4)

Maximizing flow to the POTW for treatment
By increasing conveyance and pumping capacity



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Nine Minimum Controls (5)

Prohibition of CSOs during dry weather

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Nine Minimum Controls (6)

Control of solids and floatable materials in CSOs

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Nine Minimum Controls (7)

Develop Pollution Prevention Programs

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Nine Minimum Controls (8)

Adequate public notification of CSO occurrences and CSO impacts

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Nine Minimum Controls (9)

Monitoring to effectively characterize CSO impacts and the efficacy of CSO control

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Long Term Control Plan (LTCP)

1. LTCP is Water Quality Base Control

2. Permittee with CSO is responsible to develop LTCP that will ultimately result in compliance with requirements of the CWA

3. Development and implementation of LTCP should be **coordinated** with NPDES permit authority and State authority responsible for reviewing and revising WQS.

4. The selected controls should allow cost-effective expansion or retrofitting should additional control is necessary to meet existing or designate use.

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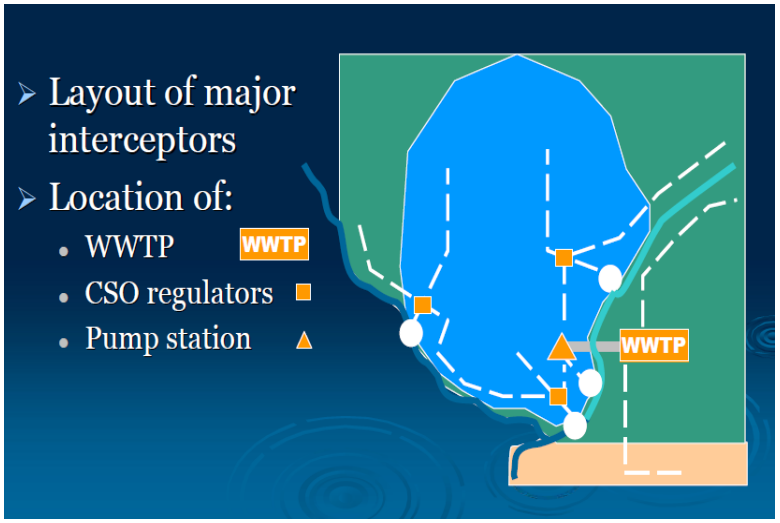
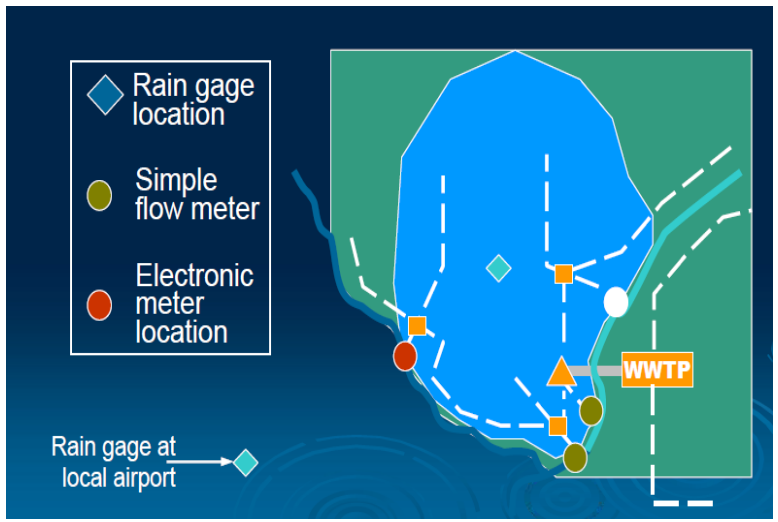
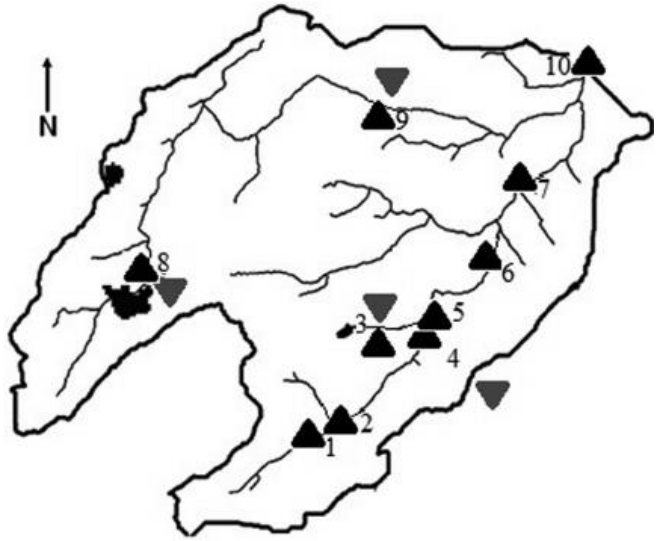
Element of LTCP (1)

Characterization, Monitoring, and Modeling of the CSS







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Element of LTCP (2)

Public Participation with stake holders

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Element of LTCP (3)

Consideration of sensitive areas

waters with primary contact recreation designation,
endangered species and their habitat,
public drinking water intake

Eliminate or relocate CSOs discharging to the sensitive area.
Prioritizing the CSO reduction or elimination projects in the area.

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Element of LTCP (4)

Two options to provide CSO communities with targets for CSO control to meet the WQ based requirements of CWA.

Presumption Approach:

Achieve 85% CSS flow capture or limit CSO event to less than 4 per year

Demonstrative Approach:

Demonstrate that CSO controls attain water quality standards

- Remaining CSO discharges will not preclude WQS attainment
- Maximum reasonable pollution reduction
- Provisions for cost-effective expansion should WQS not be met

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Element of LTCP (5)

Maximization of Treatment at the POTW

Minimize the CSO by maximizing the conveyance of flow to the POTW and utilize the existing treatment works.

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Element of LTCP (6)

CSO Controls: O&M Practices

- Sewer inspection and testing
  - Manual vs. remote
- Sewer cleaning
  - Hydraulic, mechanical, chemical
- Pollution prevention
  - Source control
- Water quality monitoring and public notification
  - To minimize exposure

Note: Many elements of NMC are source controls

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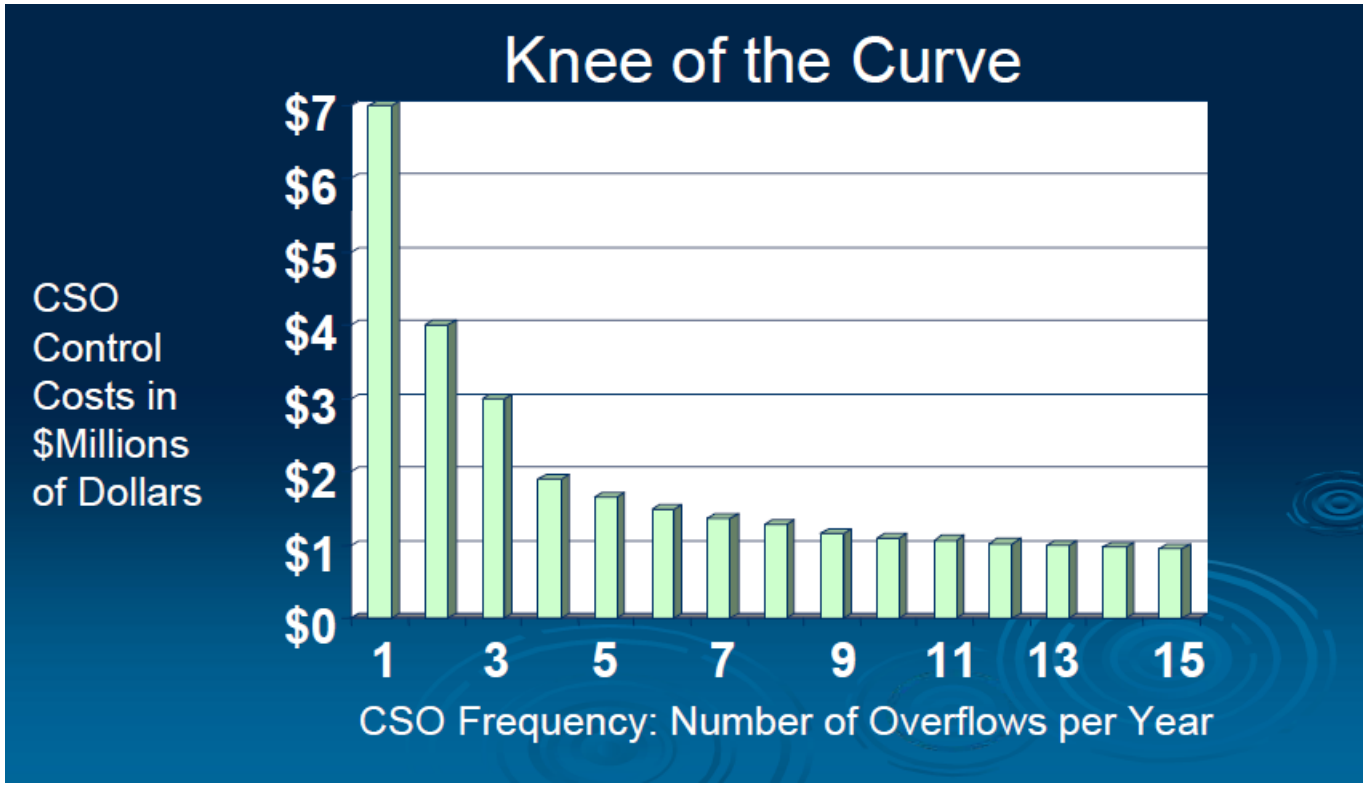
Element of LTCP (7)

Cost/Performance Considerations



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Element of LTCP (8)

LTCP: Operational Plan

- General O&M for entire CSS including POTW
- Individual O&M plans for CSO facilities:
  - Operating instructions
  - Maintenance activities
  - Staffing, training and safety
  - Monitoring

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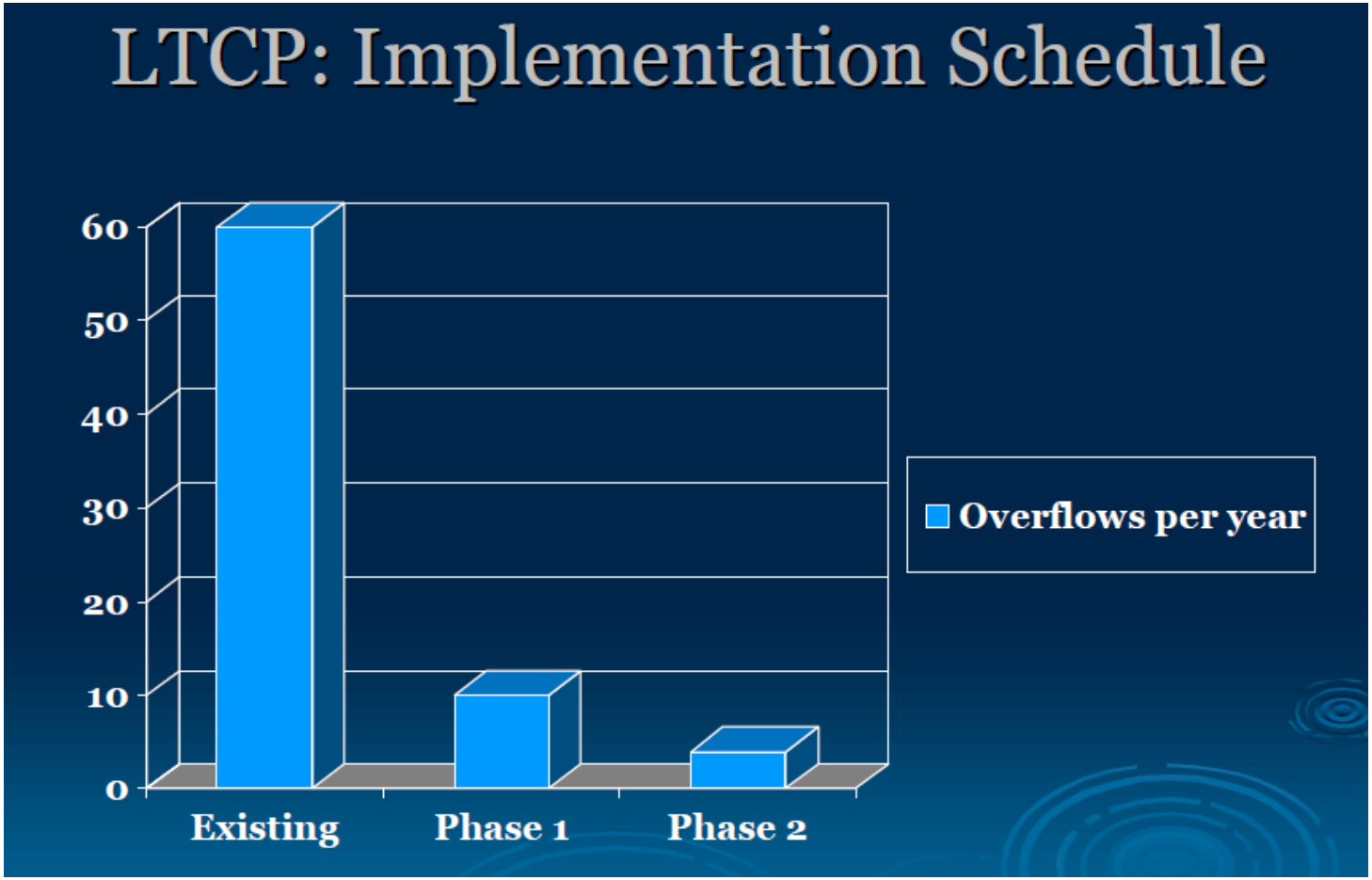
Element of LTCP (9)



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Element of LTCP (10)

LTCP: Post-construction Compliance Monitoring

- Intended to determine the effectiveness of LTCP in meeting CWA requirements and local goals
- Focus on operation of CSO controls as described in the LTCP, and attainment of WQS
- Required condition under NPDES permits

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MDE Consent Decree for CSS Communities

(01-C-00-18342L, 2001) : Cumberland, LaVale, Frostburg & Allegany County
Requires the completion of CSO eliminations or controls as stated in the approved LTCP by 2023

(01-C-00-18487L, 2002) : Westernport
Requires the completion of CSO eliminations or controls as stated in the approved LTCP by 2022.

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Summary – CSO Reduction and Elimination Efforts

Jurisdiction	Main Activities
Cumberland	1.Sewer system rehabilitation 2.Storage facility (5 million Gallon underground facility) 3.Enlarge and enhance conveyance capacity 4.Working modeling on demonstrative approach through water quality monitoring
Frostburg	Separation of combined sewer system (50% completed). Sewer system rehabilitation
LaVale	1. Rehabilitation of manholes and relining the interceptors 2. Enlarge the capacity of pumping station and a new gravity sewer line to Cumberland
Allegany County	1. Flows to pump station are maximized by regulating baffles in the manholes. Regulating baffles are being inspected regularly during dry and wet weather. 2. Pump stations are regularly maintained and inspected at least once per year.
Westernport	1. Construct treatment structure from WTP to eliminate CSO caused by backwash 2. Separation of combined sewer system from the main streets.

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Example:

City of Cumberland

CSO Control Approach

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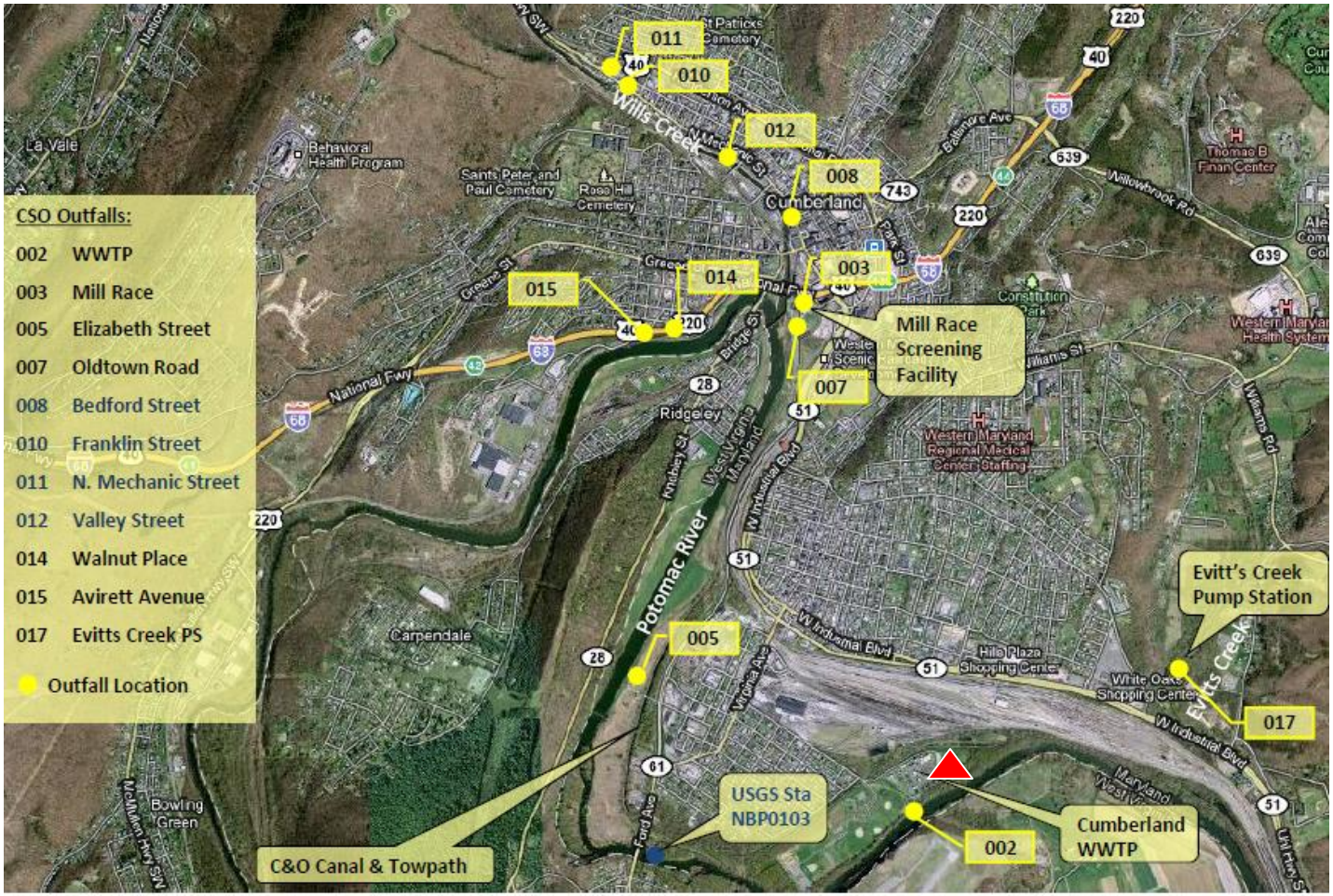
City of Cumberland CSO Outfalls



Historically, combined flow from outfall #2 (WWTP) & outfall #3 (Mill Race) represent more than **80%** of total CSO volumes from Cumberland

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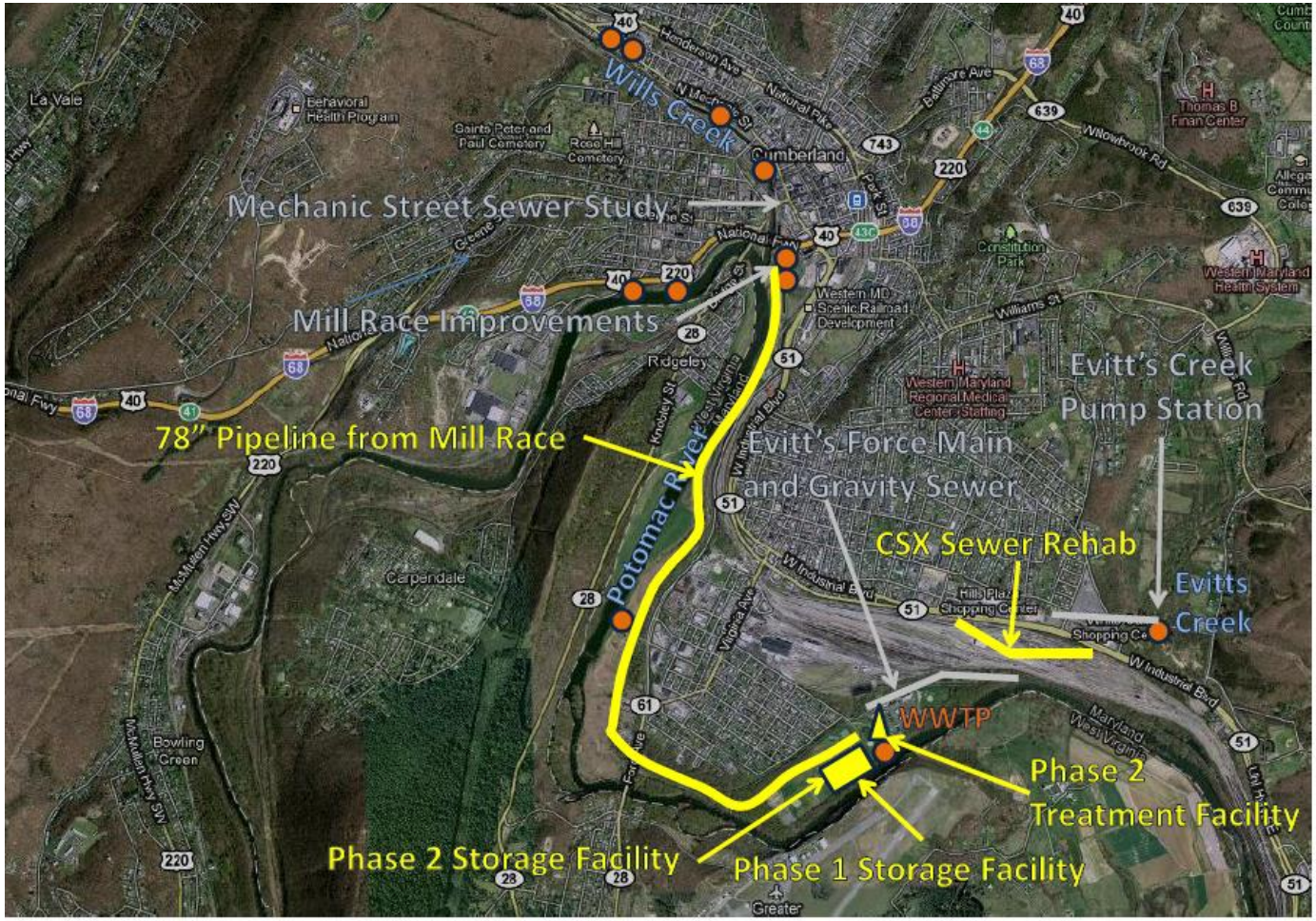
City of Cumberland CSO Reduction Projects



Completed project

Ongoing and future project

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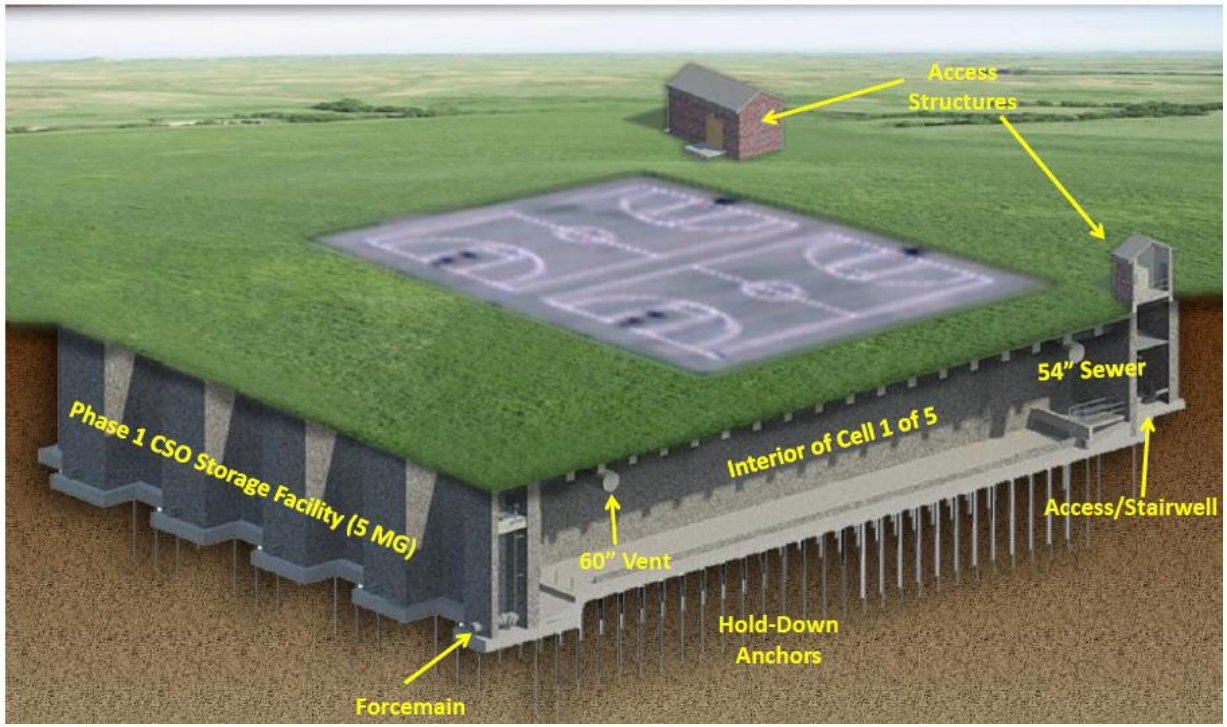
Phase I CSO Storage 5 MG at WWTP



The 5 MG facility will hold excess stormwater until treatment capacity is available at the Cumberland WWTP, thereby significantly reducing the quantity of untreated wastewater entering the North Branch Potomac River. The storage can be expanded to 20 MG if necessary.

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CSO Storage Facility – Construction Progress

Projected Completion Date: 09/2019

Cost : $31 Million

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78-inch from Mill Race

- 14,000 LF OF 78-inch pipeline
- Capture 3 largest remaining overflows (Mill Race, Oldtown Road, Elizabeth Street)
- In-line storage of up to 2.5 MG
- Maximizing storage at 5 MG facility and subsequent treatment

Projected Completion Date: 10/2021
Estimated Cost : $28 Million

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Presumption Approach (Storage Facility) – Projected Reduction of CSO Events

YEAR	Number of Overflows at WWTP	Number of Overflows at WWTP with CSO Storage
2005	15	1
2006	19	0
2007	16	0
2008	23	1
2009	19	3
2010	27	5
2011	27	8
2012	9	2
2013	27	3
2014	21	6
2015	24	3
2016	22	3
2017	30	1
2018	58	11

337

47

86% Reduction in # of Occurrences

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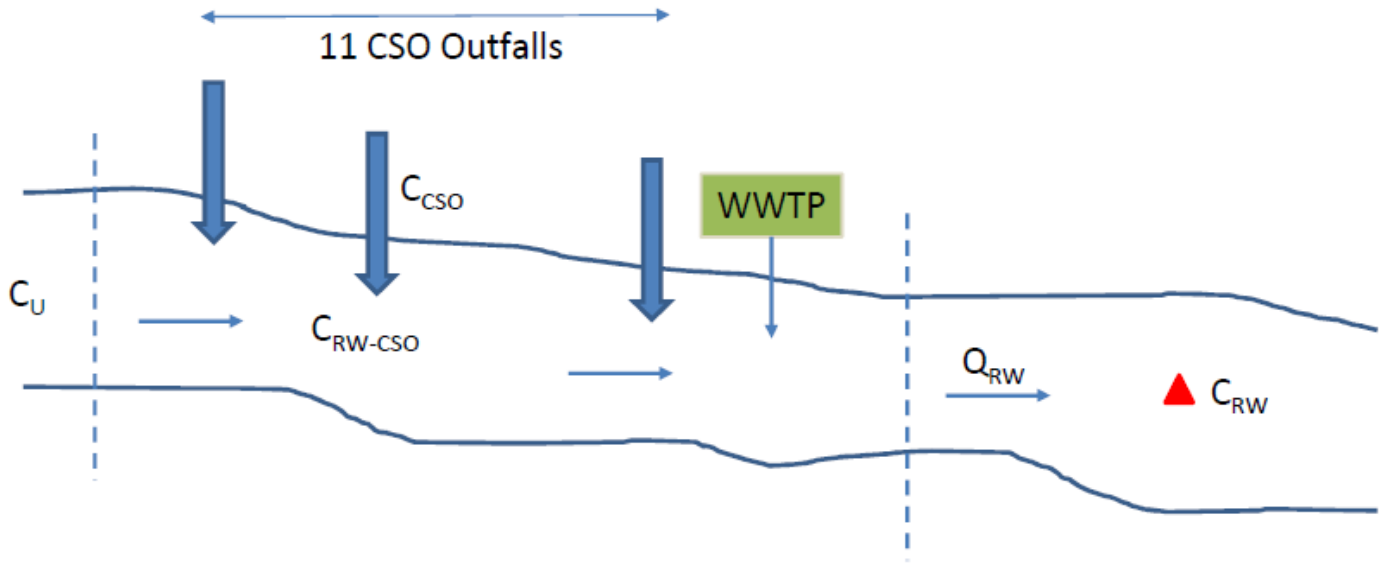
Demonstration Approach – Cumberland CSO Reduction (1)



C_u = background (upstream) bacteria concentration (non-CSO) (CFU/100mL)
C_{CSO} = bacteria concentration in CSO discharge (CFU/100mL)
Q_{RW} = LNB Potomac stream flow (cfs)
C_{RW} = bacteria concentration in receiving water (LNB Potomac River)

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Demonstration Approach – Cumberland CSO Reduction (2)

- For days with recorded CSO events:
  - Calculate total daily CSO bacteria load (CFU/day):
    - CSO bacteria concentration (2×10^6 CFU/100mL)*
    - CSO total volume (MG)
  - Calculate bacteria concentration in River based on stream flow:

Dilution mass-balance: $C_{RW} = \left[\frac{C_{CSO} * V_{CSO}}{V_{RW}} \right]$

- For days without CSO events ("dry weather"):
  - Background bacteria concentration in River (C_u)

- Calculate monthly geometric mean and compare to WQS

Recorded CSO volumes/duration (2005 - 2015) (City)
- CSO sampling/characteristics (2009 / 2015) (City)
- Stream bacteria sampling (1999 - 2003) (DNR Stations)
- Stream discharge data (2000 – 2015) (NBP USGS)

* Assumption based on CSO sample data and literature values

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City of Cumberland CSO Program - Bacteria Sample Locations at the LNB Potomac River and Wills Creek

△ Bacteria sampling locations

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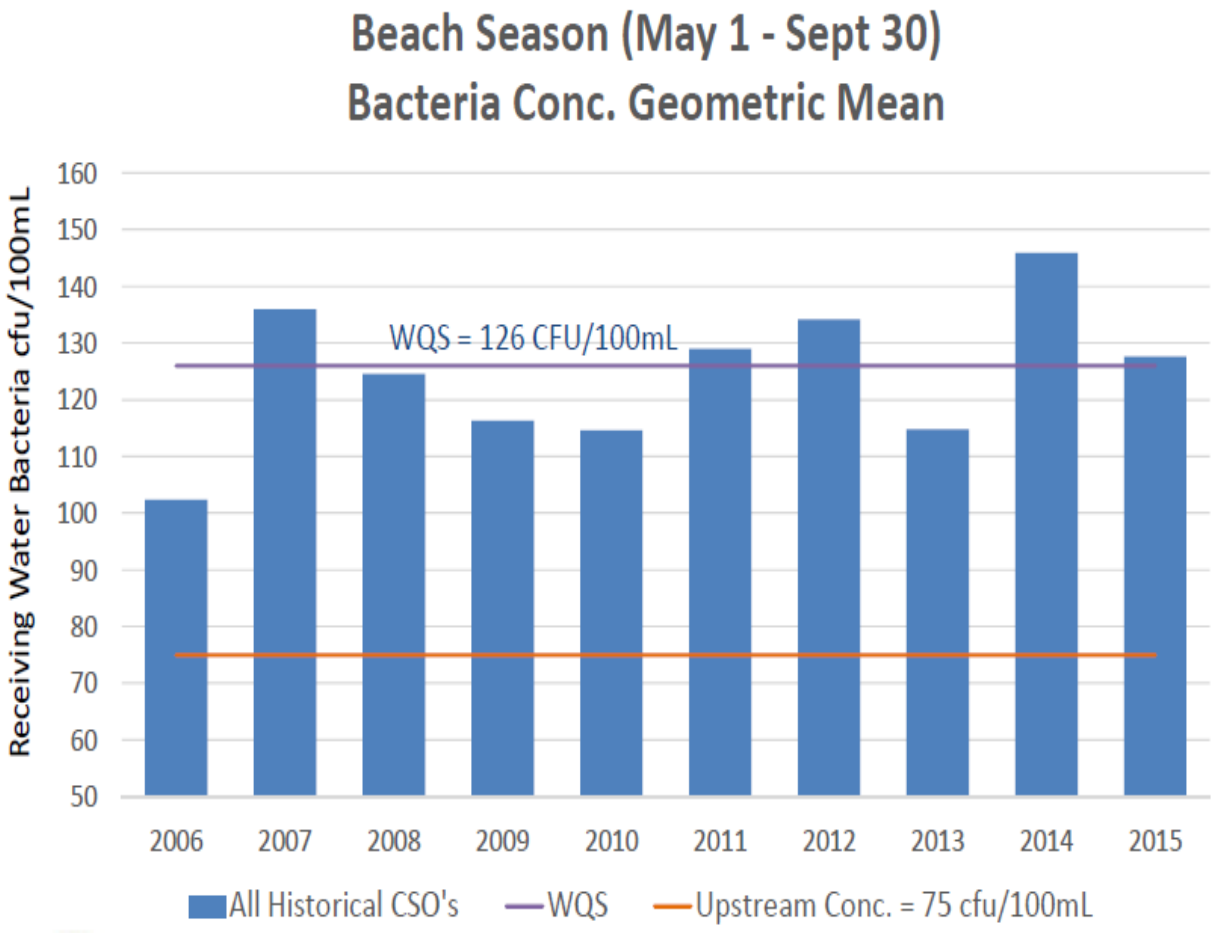
Demonstration Approach – Cumberland CSO Reduction (3)



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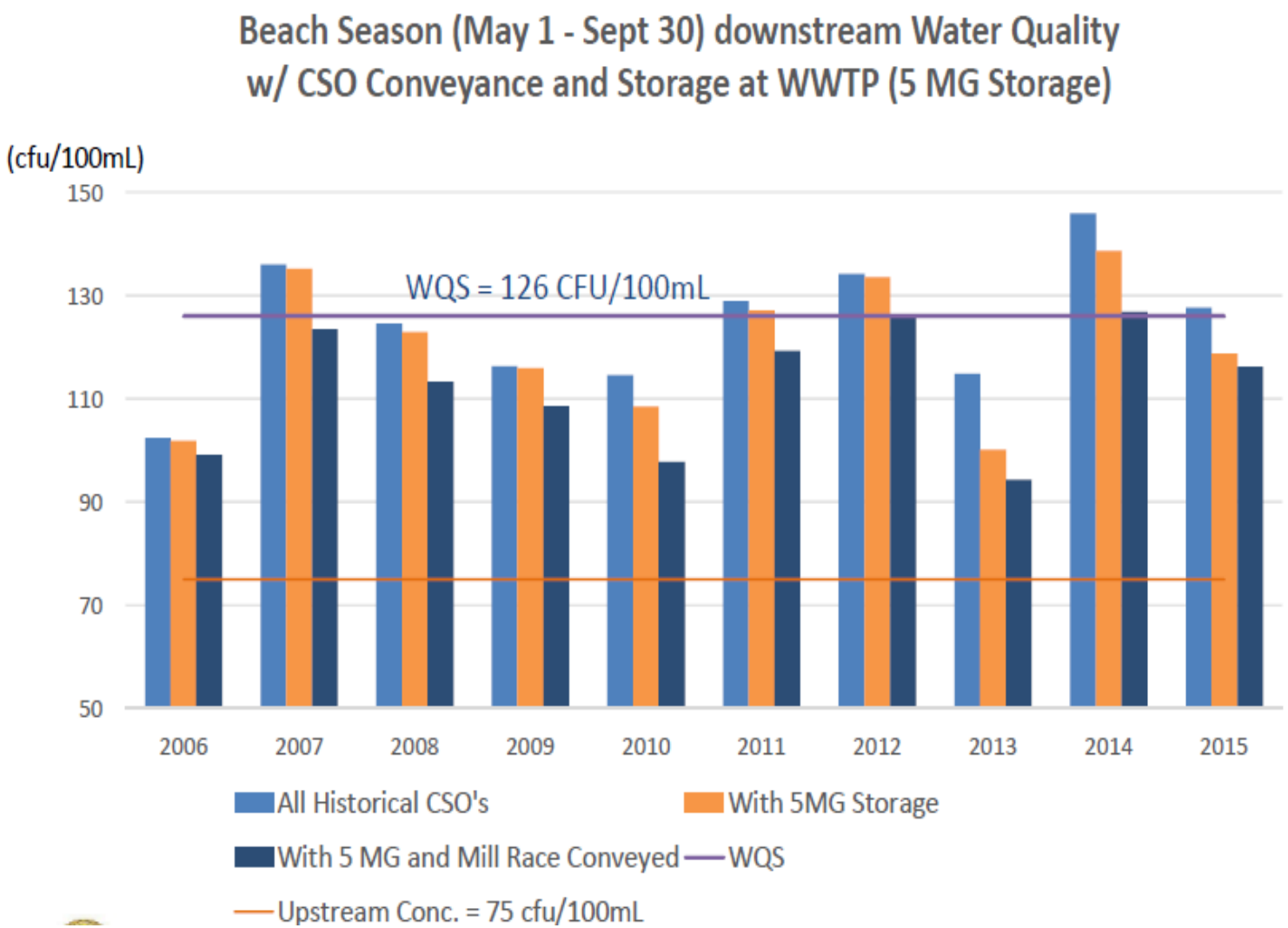
Demonstration Approach – Cumberland CSO Reduction (4)



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Questions?

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Contact Information

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Wastewater Permits Program

Maryland Department of the Environment

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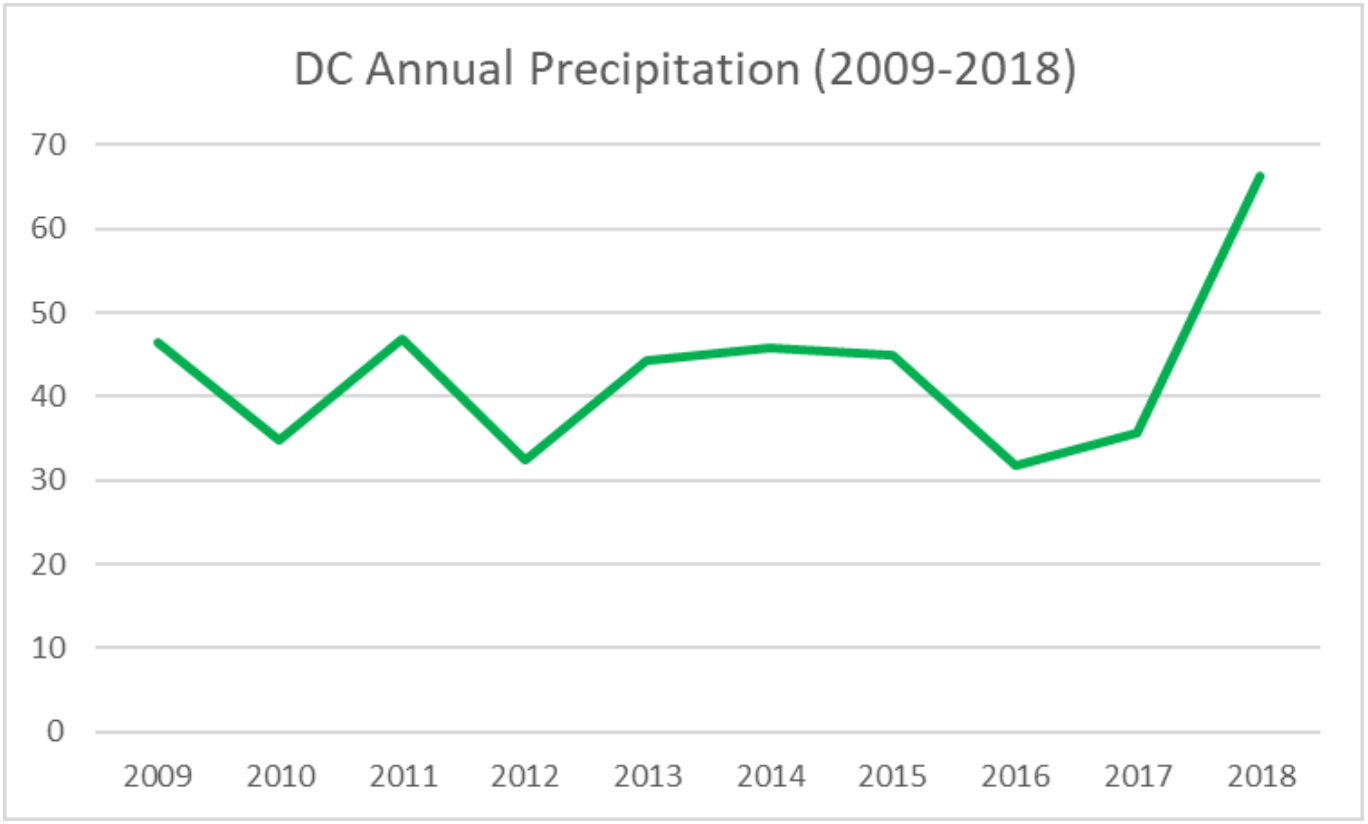
Inches


DC Annual Precipitation (2009-2018)
70
60
50
40
30
20
10
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

CSO Effluent Data

Pollutant	Median Concentration*
BOD	48
TSS (mg/L)	58
TN (mg/L)	6.2
TP (mg/L)	1.3
E.Coli (#/100ml)	> 2400

* Based on quarterly data (2012 -2016) reported by Allegany County, Frostburg and LaVale

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Cumberland WWTP Influent Data

Pollutant	Med. Conc. (non-CSO day)*	Med. Conc. (CSO day)*
BOD (mg/L)	108	31
TSS (mg/L)	134	41
TN (mg/L)	13	8
TP (mg/L)	4.6	1.8

* Based on 2018-2019 data collected by Cumberland WWTP

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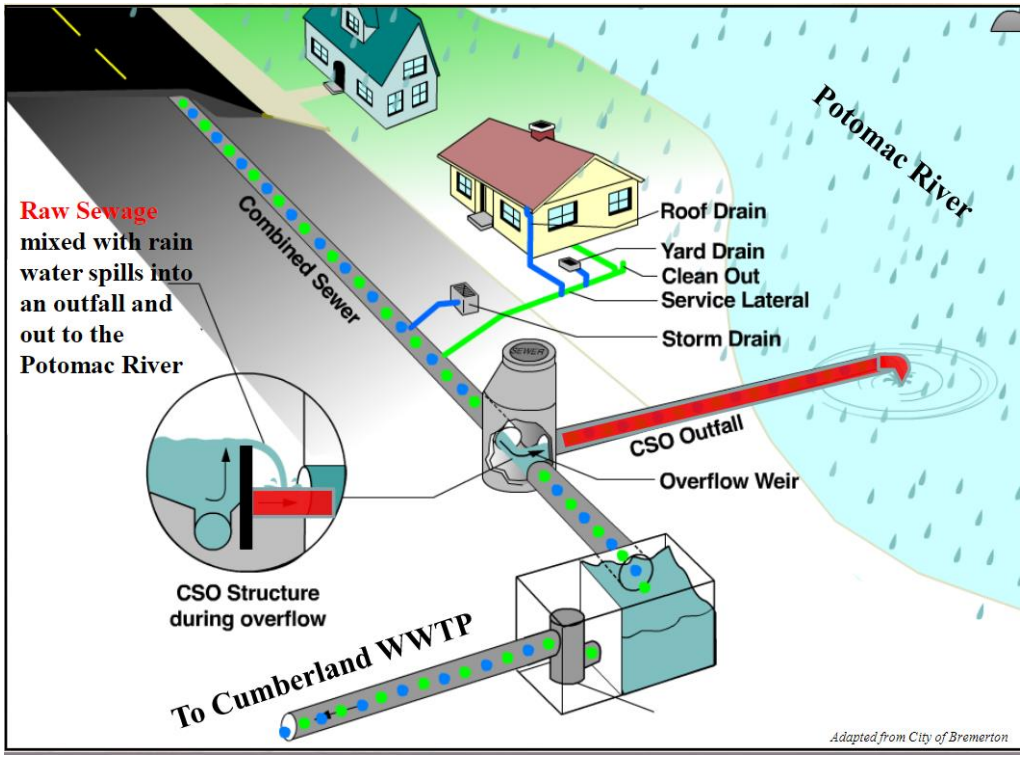
Raw Sewage
mixed with rain
water spills into
an outfall and
out to the
Potomac River
Combined Sewer
Potomac River
Roof Drain
Yard Drain
Clean Out
Service Lateral
Storm Drain
CSO Outfall
Overflow Weir
CSO Structure
during overflow
To Cumberland WWTP
Adapted from City of Bremerton

Determination of CSS Separation – Dye Test

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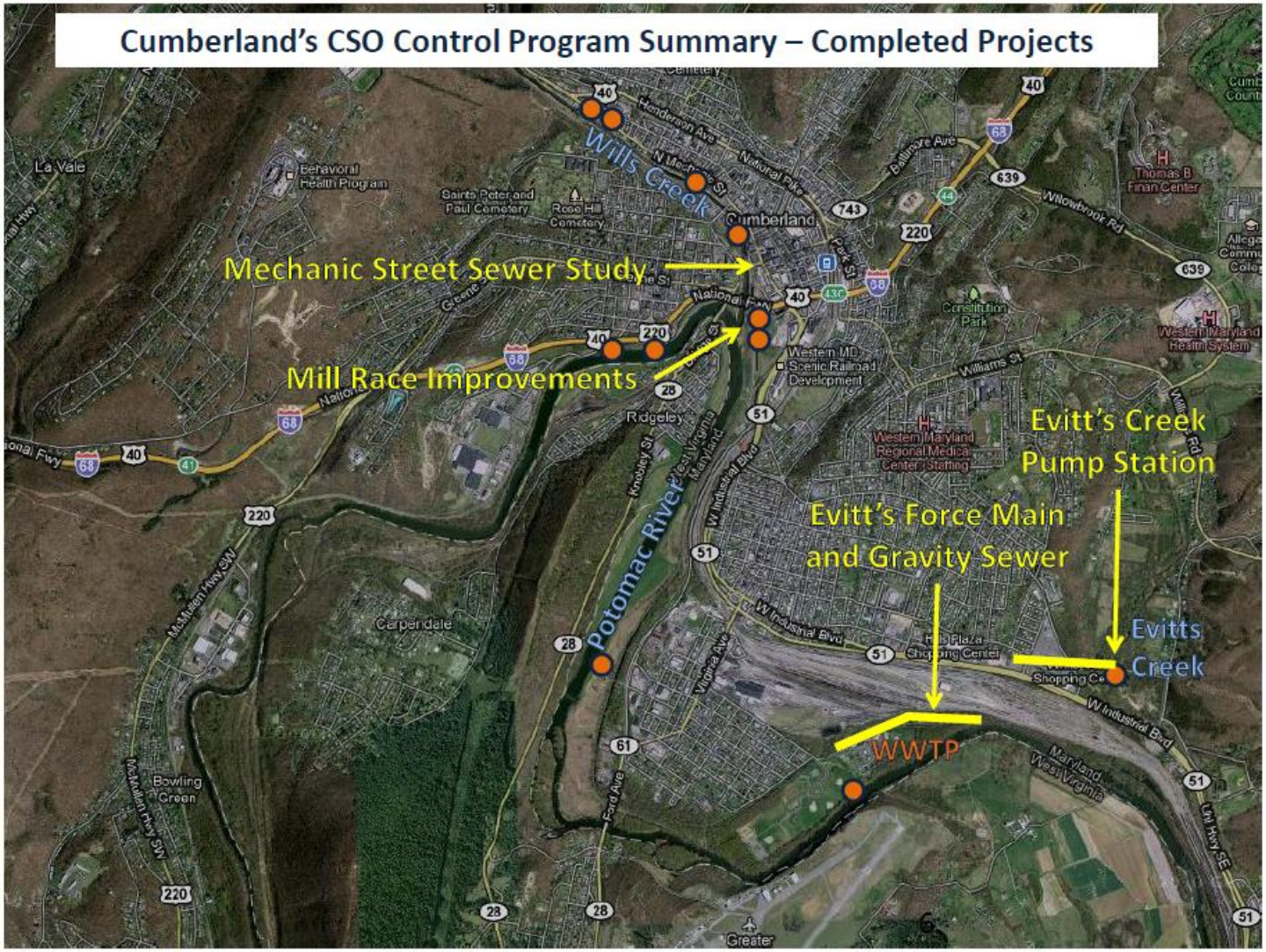

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Potomac River LNB WQ Impairment Listing

- Low pH (1996 impairment listing – EPA approved WQA),
- Cadmium (1996 listing – EPA approved WQA),
- Nutrients (P) (1996 listing – EPA approved WQA in 2012),
- Sediment (TSS) (1996 listing – EPA approved WQA in 2012),
- Methyl Mercury (2002 listing),
- Fecal bacteria (2002 listing) – placed in Category 3 (2008) – "waters with insufficient information to determine if water quality standards are attained").
- Impacts to biological communities (2002 listing – refined to 1st to 4th order streams – Biological Stressor Identification Analysis (BSID) submitted in 2013 – No biological stressors were identified).

Washington DC Precipitation

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	WINTER	SPRING	SUMMER	AUTUMN	1ST HALF	2ND HALF	
1998	5.43	5.23	5.40	3.96	4.05	4.42	1.79	0.59	1.83	0.59	0.91	1.74	35.94	12.40	13.41	6.80	3.33	28.49	7.45	
1999	5.42	2.54	3.87	2.09	1.28	2.26	1.01	5.02	10.27	2.16	1.82	2.49	40.23	9.70	7.24	8.29	14.25	17.46	22.77	
2000	3.66	2.06	3.98	5.13	3.08	4.93	5.51	3.77	4.91	0.02	1.60	2.01	40.66	8.21	12.19	14.21	6.53	22.84	17.82	
2001	2.22	1.83	3.88	1.68	3.71	4.69	4.78	2.98	1.41	0.69	0.55	1.53	29.95	6.06	9.27	12.45	2.65	18.01	11.94	
2002	1.32	0.47	3.37	3.47	2.17	3.81	2.20	1.63	2.10	5.00	4.34	4.45	34.33	3.32	9.01	7.64	11.44	14.61	19.72	
2003	2.41	6.98	4.20	2.55	7.06	7.87	5.76	4.65	6.87	3.93	4.23	4.32	60.83	13.84	13.81	18.28	15.03	31.07	29.76	
2004	1.35	2.28	2.09	3.84	2.98	4.60	6.98	5.09	3.99	1.74	4.50	3.05	42.49	7.95	8.91	16.67	10.23	17.14	25.35	
2005	3.31	1.63	4.46	4.33	4.61	2.87	6.06	2.33	0.11	9.41	1.92	3.34	44.38	7.99	13.40	11.26	11.44	21.21	23.17	
2006	3.25	2.46	0.05	3.10	2.21	14.02	3.56	1.03	6.31	5.06	5.16	1.56	47.77	9.05	5.36	18.61	16.53	25.09	22.68	
2007	2.46	2.22	3.19	4.17	1.75	1.38	2.40	3.47	0.60	6.55	1.46	3.28	32.93	6.24	9.11	7.25	8.61	15.17	17.76	
2008	1.37	4.17	2.80	4.92	10.66	4.80	3.60	1.23	6.41	1.13	2.43	2.97	46.49	8.82	18.38	9.63	9.97	28.72	17.77	
2009	2.68	0.35	1.97	4.22	8.05	5.86	1.07	2.46	3.31	5.71	4.43	6.79	46.90	6.00	14.24	9.39	13.45	23.13	23.77	
2010	1.56	2.72	3.55	1.50	2.40	1.87	5.17	2.59	6.02	3.40	2.22	1.78	34.78	11.07	7.45	9.63	11.64	13.60	21.18	
2011	2.25	2.12	4.40	3.20	1.70	1.68	3.03	8.92	8.84	3.91	1.94	4.90	46.89	6.15	9.30	13.63	14.69	15.35	31.54	
2012	2.19	2.33	1.02	1.92	3.28	2.38	2.81	2.78	4.29	5.82	0.60	3.03	32.45	9.42	6.22	7.97	10.71	13.12	19.33	
2013	2.53	1.67	2.80	2.76	2.82	9.97	4.43	1.34	1.22	6.25	2.92	5.53	44.24	7.23	8.38	15.74	10.39	22.55	21.69	
2014	2.58	4.02	4.26	6.47	4.96	4.68	4.68	3.39	1.11	3.49	2.64	3.50	45.78	12.13	15.69	12.75	7.24	26.97	18.81	
2015	3.73	1.68	4.04	3.41	1.92	11.94	5.01	1.16	2.15	3.04	2.10	4.84	45.02	8.91	9.37	18.11	7.29	26.72	18.30	
2016	2.68	3.79	1.16	2.05	5.65	3.68	3.13	2.79	2.50	0.90	0.76	2.61	31.70	11.31	8.86	9.60	4.16	19.01	12.69	
2017	2.75	0.68	3.19	2.62	5.55	1.13	9.15	4.58	1.43	2.02	2.00	0.50	35.60	3.43	11.36	14.86	5.45	15.92	19.68	
2018	0.94	4.79	1.92	3.59	8.73	5.21	9.73	5.19	9.73	3.06	7.57	5.82	66.28	8.34	14.24	20.13	20.36	25.18	41.10	
2019	3.30	3.52	4.00	2.24	4.97	4.27	6.49						28.79	7.32	11.21	10.76	0.00	22.30	6.49	
																				1981-2010
NORM	2.81	2.62	3.48	3.06	3.99	3.78	3.73	2.93	3.72	3.40	3.17	3.05	39.74	8.48	10.53	10.44	10.29	19.74	20.00	
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	WINTER	SPRING	SUMMER	AUTUMN	1ST HALF	2ND HALF	