HRSD

Cleaning wastewater every day for a better Bay.

EPA Consent Decree Annual Informational Meeting Integrated Plan/Regional Wet Weather Management Plan

January 26, 2021

Agenda

- *Overview of Consent Decree and Progress to Date*
  - *Ted Henifin, General Manager, HRSD*
- *Detailed review of HRSD SSOs*
  - *Ryan Radspinner, Hydraulic Analysis Manager, HRSD*
- *Review of HRSD's Asset Management Program*
  - *Anas Malkawi, Chief of Asset Management, HRSD*
- *Questions and Answers*

Objective of the Consent Decree

"WHEREAS, the Consent Decree fulfills the objective of the Clean Water Act ("CWA") to minimize or eliminate the discharge of pollutants to navigable waters by requiring that the Hampton Roads Sanitation District ("HRSD") implement measures to ensure that the Regional Sanitary Sewer System and HRSD's Sewage Treatment Plants have Adequate Capacity to convey and treat wet weather sewer flows within the Hampton Roads' region;"

"Adequate Capacity" shall mean that capacity needed to collect and convey, within Operating Pressures defined in the RWWMP, peak hourly wet weather flows, without capacity-related SSOs or Backups … at the Level of Service selected in the Regional Wet Weather Management Plan pursuant to Section XI.C of this Decree.

Regionalized Approach

- Consent decree amended to permit a regional approach estimated to save the region $1 billion over original approach
- Localities and HRSD agreed in Memorandum of Agreement to Regionalized Approach
- HRSD will be responsible for capacity in the regional sanitary sewer system (Localities' systems and HRSD system) upon approval of the Integrated Plan

Major Change in Compliance Orders

- Special Order by Consent (SOC) modified in December 2014 focuses on Localities' Management, Operations and Maintenance (MOM) issues
  - Eliminates HRSD from SOC
  - Adds Norfolk to SOC and terminates prior Order

- Consent Decree Modification No. 4 references SWIFT and its relationship with the RWWMP. Requires that the approved RWWMP be a material modification to the CD subject to public comment and Court approval

Overall Regulatory Status

- HRSD continues to implement requirements of Federal Consent Decree, which was originally entered with the court on February 23, 2010, as modified
- **All Consent Decree required submittals have been on time**
- **HRSD waiting on final approvals to plan agreed to in principle with DEQ, EPA and DOJ and signed by HRSD on July 24, 2020**

Rehabilitation Action Plan

- Requires addressing specific features with condition defects identified in Consent Decree Condition Assessment Program (CAP)
- EPA/DEQ approved the plan in May 2015
- Addresses more than $183M of required improvements in gravity mains, force mains, pump stations, and associated system components
- Implementation Plan has three phases through May 2025 – Total over $255 million
  - **Phase 0 - Complete**
  - **Phase 1 (5/2021) – 43% complete – last 6 on schedule**
  - **Phase 2 (5/2025) – 8 % in construction or complete**

Interim System Improvements

- Consent Decree includes requirement to complete 45 CIP projects totaling approximately $ 400M.
- All are complete with the final project certification provided to EPA in December 2018.

COMPLETE

Management, Operations, and Maintenance (MOM) Program

- MOM Program approved by EPA/DEQ in 2011
- Updated in 2018
- Ongoing regular review and updates
- Performance measures are continuing to be tracked to evaluate the effectiveness of the programs

Consent Decree Performance Measures Review

Year-over-Year Performance Summary

Metric	Target	FY-12 Actual	FY-13 Actual	FY-14 Actual	FY-15 Actual	FY-16 Actual	FY-17 Actual	FY-18 Actual	FY-19 Actual	FY-20 Actual
Pump Station Annual PM	**82**	84	83	83	84	85	87	89	85	82
Back-up Generator Annual PM	**55**	112	81	121	129	129	121	89	85	112
Force Main Air Vent PM	**1,550**	3,096	3,274	3,304	3,486	3,327	3,940	1,881	3,771	3,856
Non-Invasive Force Main Inspection (LF)	**2,400**	15,098	2,800	2,562	4,355	2,562	6,375	5,000	3,300	2,400
Gravity Sewer Inspection (LF)	**39,600**	72,730	98,185	81,841	89,757	71,595	94,009	40,307	55,394	45,459
Gravity Sewer Cleaning (LF)	**29,400**	234,463	207,724	194,838	208,059	190,160	203,206	57,025	141,999	167,353

FY 20 - Conveyed 51.5 billion gallons
Total volume lost 0.00054%

HRSD SSOs

Year	# of SSOs	Volume (gal)	# of Unknown SSO Volumes (during wet weather)	Total Inches of Rain near ORF
CY2011	35	1,880,086	13	55
CY2012	40	22,850,543*	6	52
CY2013	14	722,237	2	50
CY2014	29	2,250,915	10	45
CY2015	18	516,704	3	53
CY2016	49**	6,148,239**	23**	69**
CY2017	21	259,057	4	42
FY2018	20	1,006,196	3	47
FY2019	14	1,366,725	2	53
FY2020	17	277,521	0	47

*Included single SSO at Wilroy Road of 18,352,000 gallons. Remaining volume ~4,500,000 gallons for 2012
**Included two major weather events in Hurricane Matthew and Tropical Storm Hermine

FY 20 - Conveyed 51.5 billion gallons
Total volume lost (capacity) 0.0000032%

Capacity Related SSOs

Calendar Year	Total # of SSOs	Total Volume Of SSOs (gal)	Volume for Capacity (Gals)	# of Capacity SSOs	Named Storm
2011	35	1,880,086	1,409,796	16	Hurricane Irene
2012	40	22,850,543	4,249,483	31	Hurricane Sandy
2013	14	722,237	584,784	5	Remnants of Hurricane Andrea (1)
2014	29	2,250,915	681,392	15	None
2015	18	516,704	207,177	15	None
2016	49	6,148,239	2,133,775	35	TS Julia & Hurricane Matthew
2017	21	259,057	145,221	13	None
2018	20	1,006,196	134,886	10	None
2019	14	1,366,725	72,775	8	None
2020	17	277,521	**16,530**	2	None

Submitted to EPA 9/2017

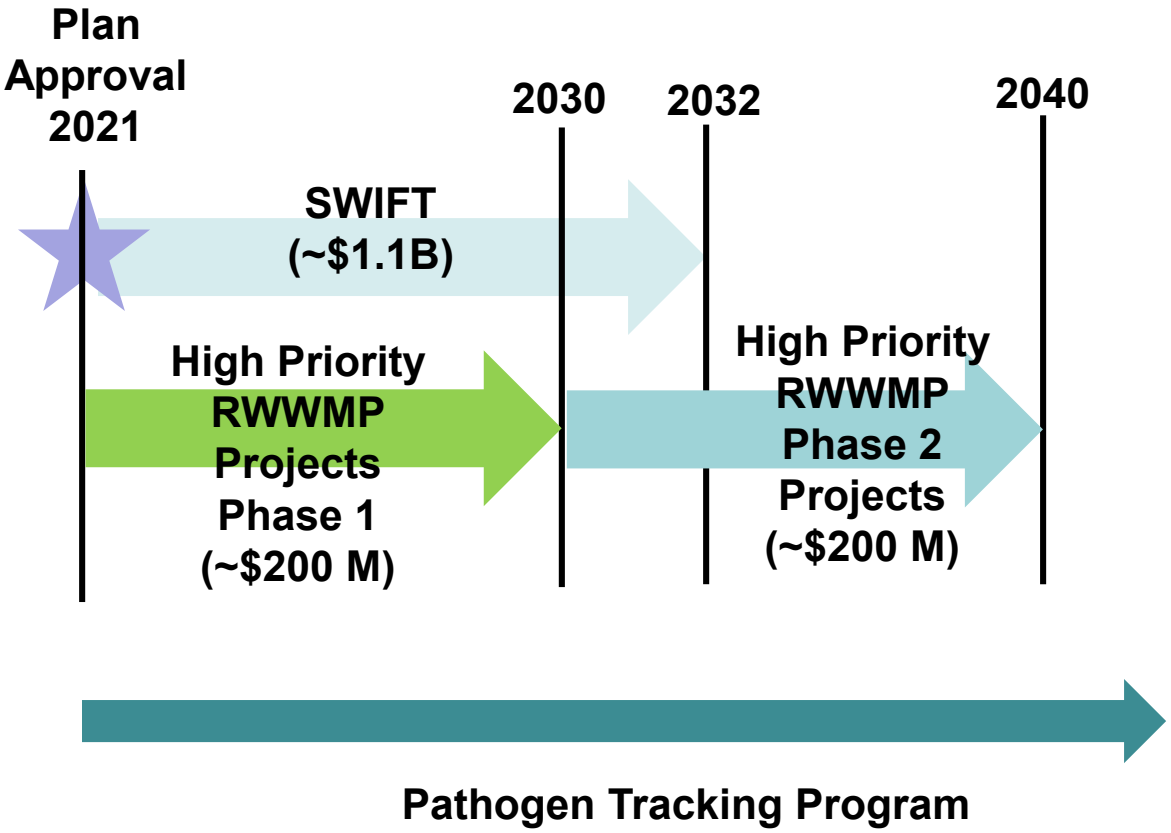
- Plan integrates HRSD obligations under federal consent decree to minimize wet weather overflows with SWIFT to prioritize projects that achieve greatest environmental benefits (i.e., SWIFT)

- HRSD and Localities have entered into nutrient trading agreements to apply SWIFT reductions to stormwater requirements
- Prioritize the projects that provide the highest benefit to human health and the environment
- Allows for appropriate sequencing of projects/programs

Regional Integrated Plan

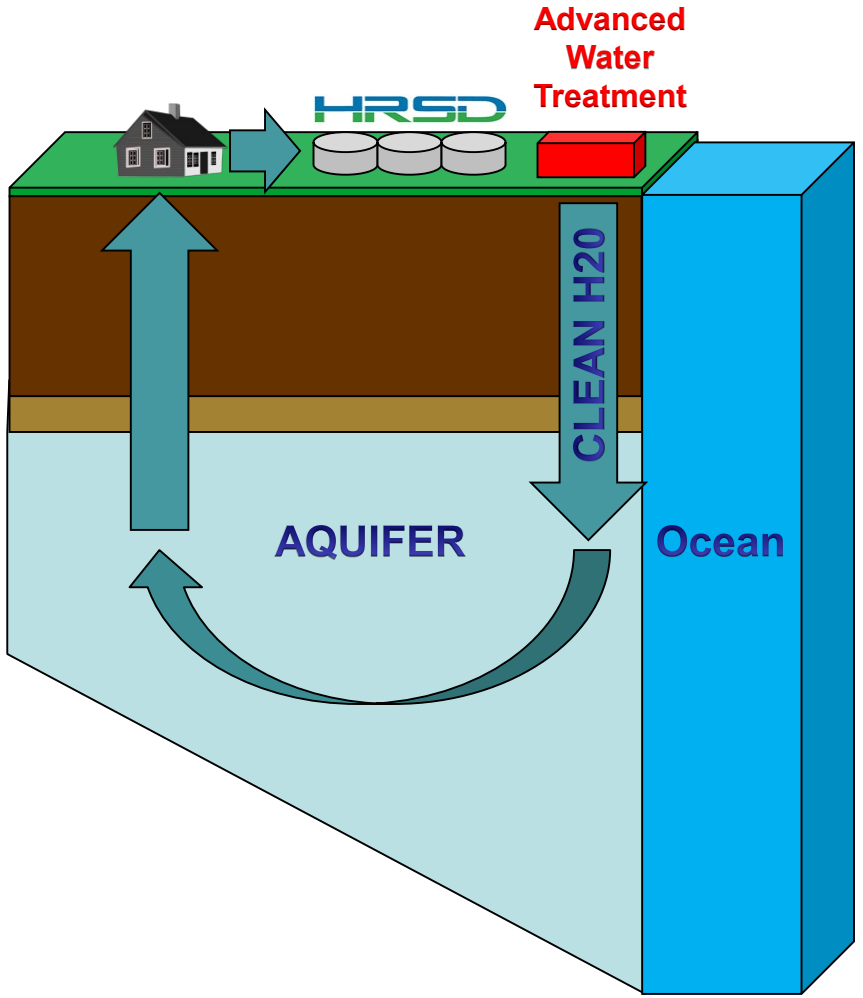
Phase	Activities	Cost	Schedule
1	Planning, Condition Assessment, Prompt Repairs, Interim System Improvements, Rehab Action Plan	$700M	2008 - 2025
2	SWIFT and High Priority Projects	$1.2B	2020 - 2032
3	High Priority Phase 2	$200M	2030 - 2040
4	Post Implementation Evaluation	$2M	2040

Sequence Places the Greatest Water Quality Benefits First

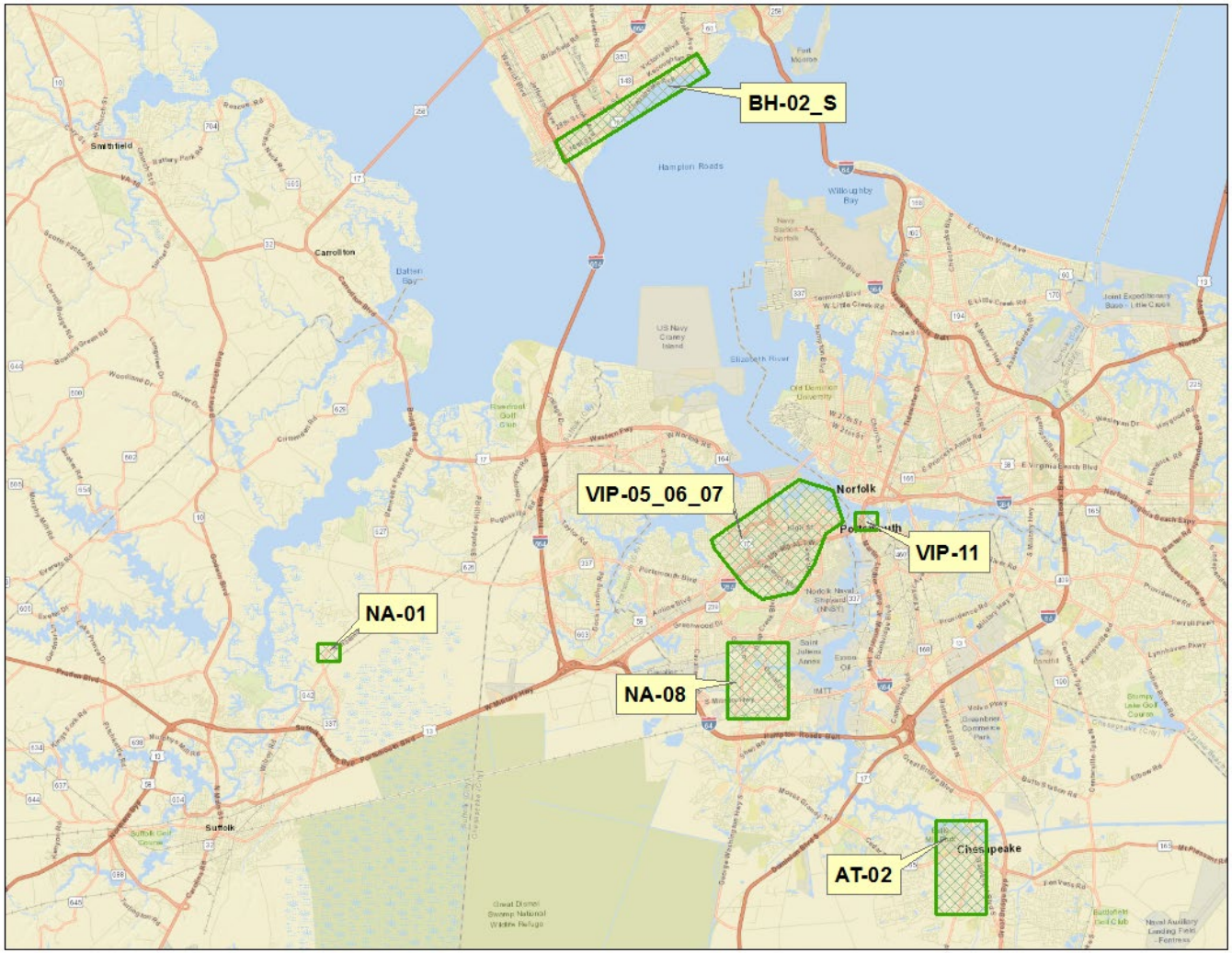


SWIFT – Sustainable Water Initiative for Tomorrow

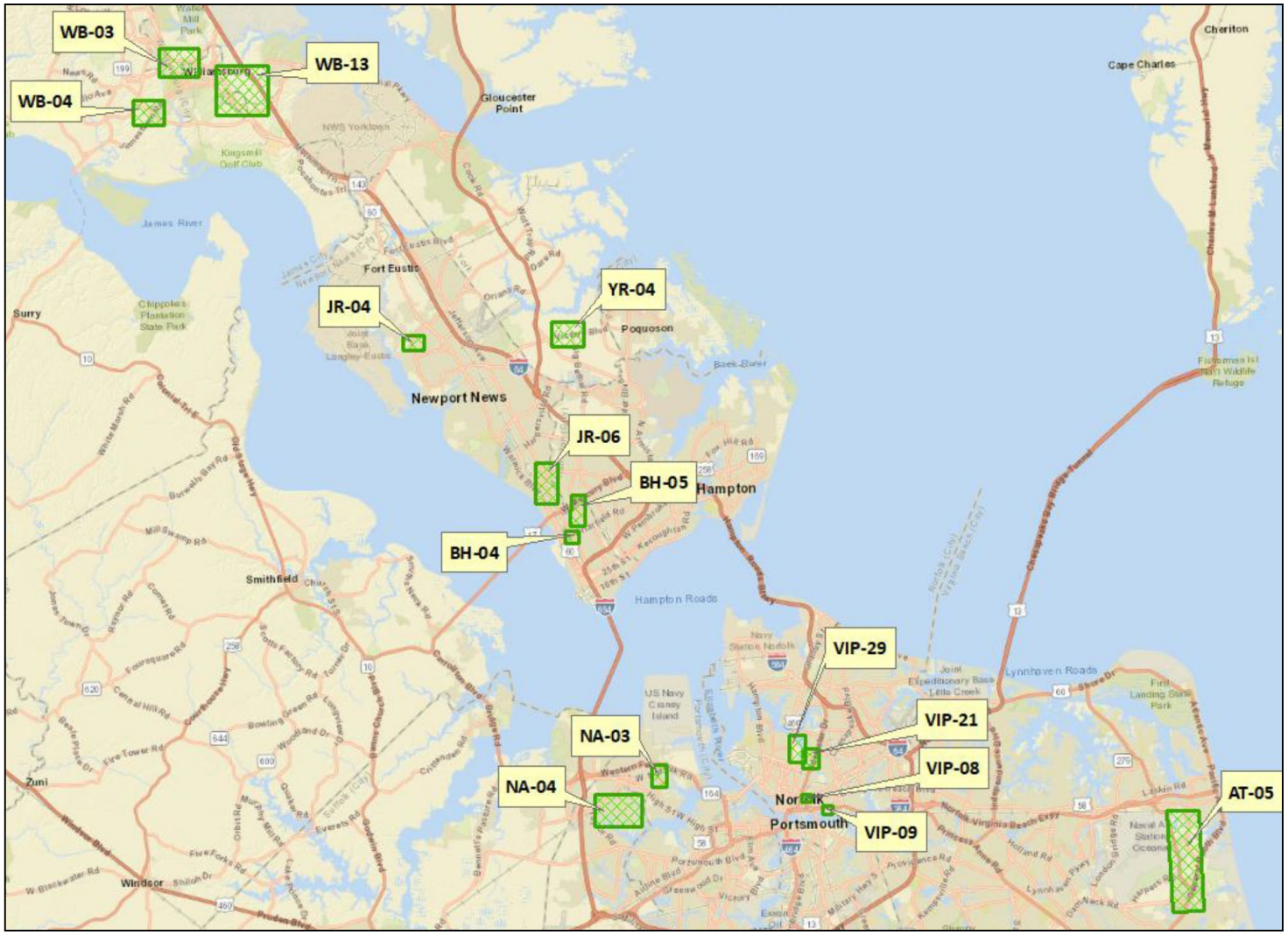
- Treat water to meet drinking water standards and replenish the aquifer with clean water to:
  - Provide regulatory stability for wastewater treatment
  - Reduce nutrient discharges to the Bay
  - Reduce the rate of land subsidence
  - Provide a sustainable supply of groundwater
  - Protect the groundwater from saltwater contamination



High Priority Project Areas Phase 1

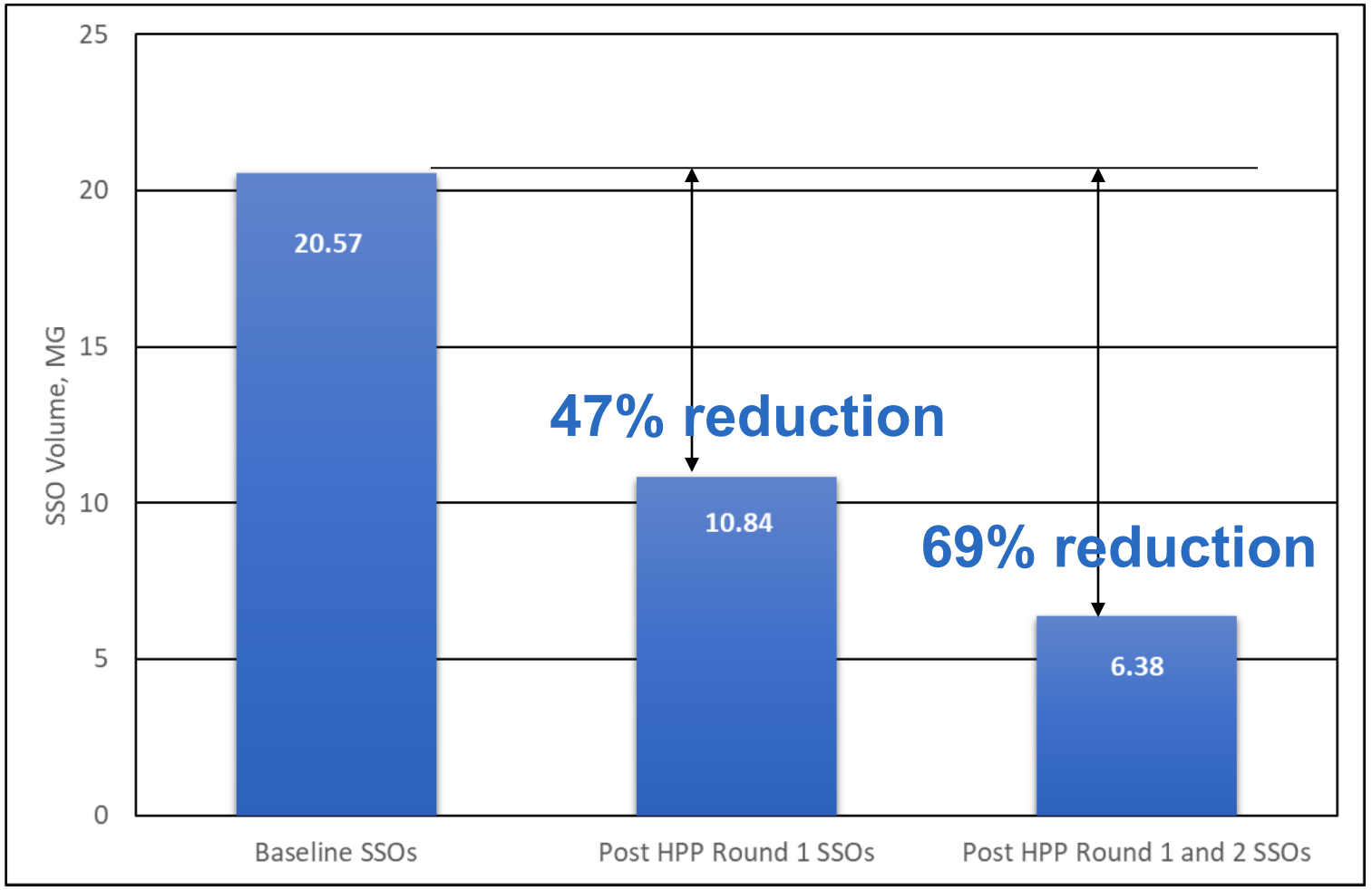


High Priority Project Areas Phase 2



Estimated High Priority Projects Reductions

Volume reduction as compared to RHM baseline simulation



Water Quality Impacts of SSOs

- Water quality impacts have proven to be short-lived for non-chronic spills (temporally and spatially diverse)
- Post-overflow monitoring consistently demonstrates rapid return to background conditions and compliance with recreational standard when applicable

Water Quality Impacts of SSOs - Examples

- Shingle Creek - 2011
  - Loss of >18 million gallons in headwater stream
  - Returned to background within 5 days of cessation of leak
- Linkhorn – 2016
  - Loss of > 2 million gallons in headwater stream
  - Sample results complied with recreational standard within 24 hours of cessation of leak

Coordination with Localities

- Periodic meetings of Capacity Team
- Monthly Directors of Utilities meetings
- HRSD providing GIS, flow, pressure and rainfall data to Localities
- Ad hoc coordination of bacteria source tracking program

Public Participation

- HRSD.com is maintained with all CD related documents
- Annual newsletter published in February of each year
- Annual public informational is held each January
- When SSOs occur, focused public outreach, news releases, etc.,…
- Project specific public meetings as each construction project is kicked off
  - Project specific construction progress details maintained on HRSD.com

Uncertainties

- Sea level rise and recurrent flooding
- Magnitude and spatial patterns of growth
- Future of numerous major DoD facilities
- Long term trend in I/I
- Regional economic vitality and household income and employment levels
- Regional environmental and public health priorities

Steps Citizens Can Take to Protect Receiving Waters

- Report Sanitary Sewer Overflows – Call your local utility department
- Inspect home, yard and sewer service pipes to ensure separation between storm and sanitary systems
- Reduce storm water runoff by using rain barrels, rain gardens and establishing a buffer

Steps Citizens Can Take to Protect Receiving Waters

- Pick up animal waste
- Avoid feeding wildlife
- Support “No Dumping” and use boater pump out facilities

Steps Citizens Can Take to Protect Receiving Waters

- Practice proper disposal of pharmaceuticals, household chemicals, food wastes and kitchen grease – minimize use of or eliminate garbage disposal

Steps Citizens Can Take to Protect Receiving Waters

- Improve water quality by raising oysters
- Plant native plants – minimize groomed turf – managed meadow concept
- Limit fertilizer and other lawn chemical applications – use natural products like compost

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EPA Briefing
Sanitary Sewer Overflow (SSO) Summary
January 26th, 2021

Overview

- HRSD At A Glance
- Fiscal Year Capacity- Wet Weather Related SSOs
  - (July 1, 2019 – June 30, 2020)
- Review Historical Trends
- Risk Discussion

- **Mission:**
  - ***We protect public health and the waters of Hampton Roads by treating wastewater effectively.***
- ~99.993% of wastewater over the last decade

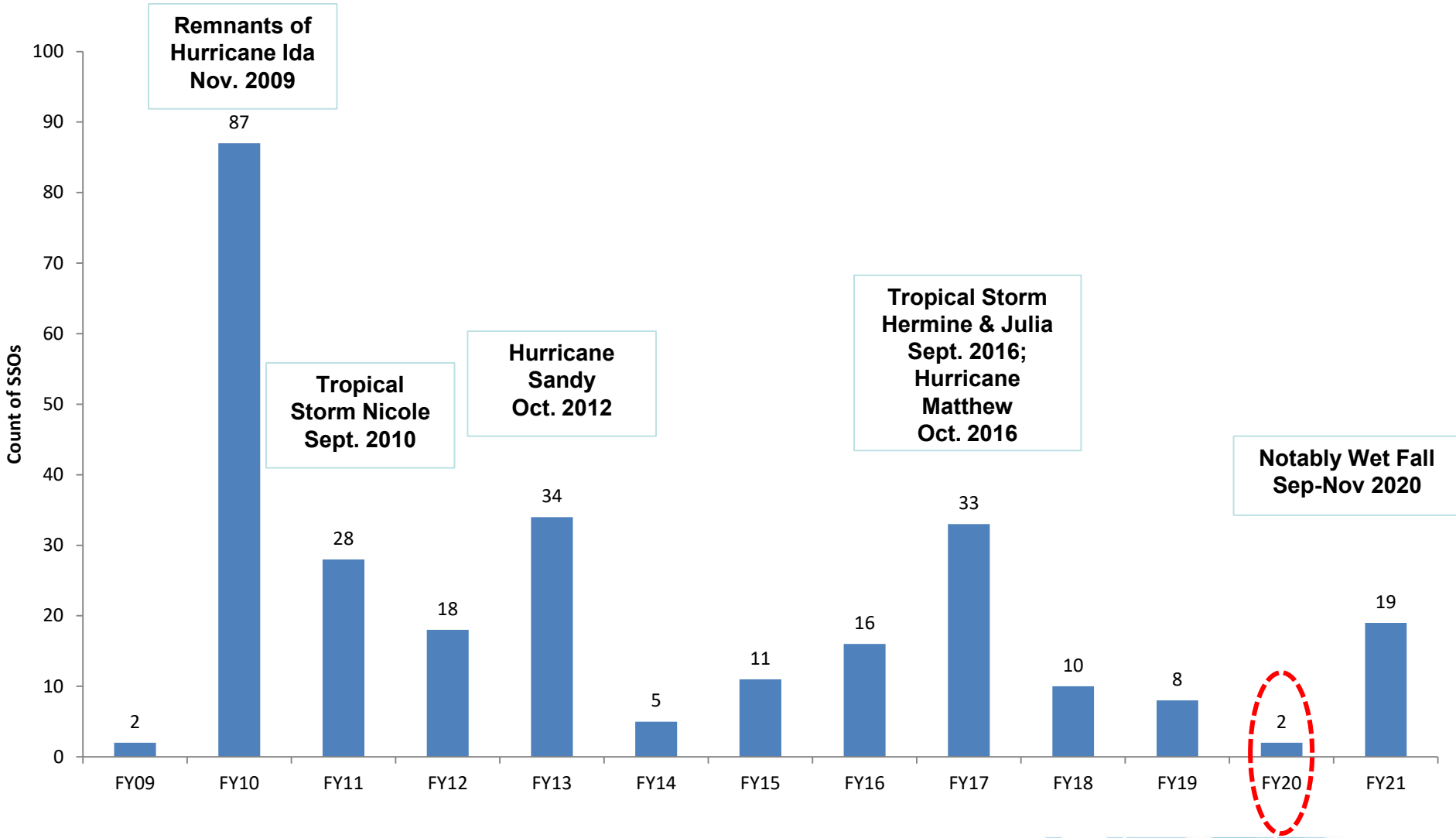
- Wastewater treatment for 18 Cities and Counties
- 500+ miles of wastewater Pipe, 100+ pump stations, and 9 major plants

FY 2020 Overview

- Over 51 billion gallons of wastewater treated
- 17 SSOs which released ~277k gallons of wastewater to state waters
  - **0.00054%**
- 2 SSOs were attributed to Wet Weather
- How does this past year compare?

- Capacity-Weather Related

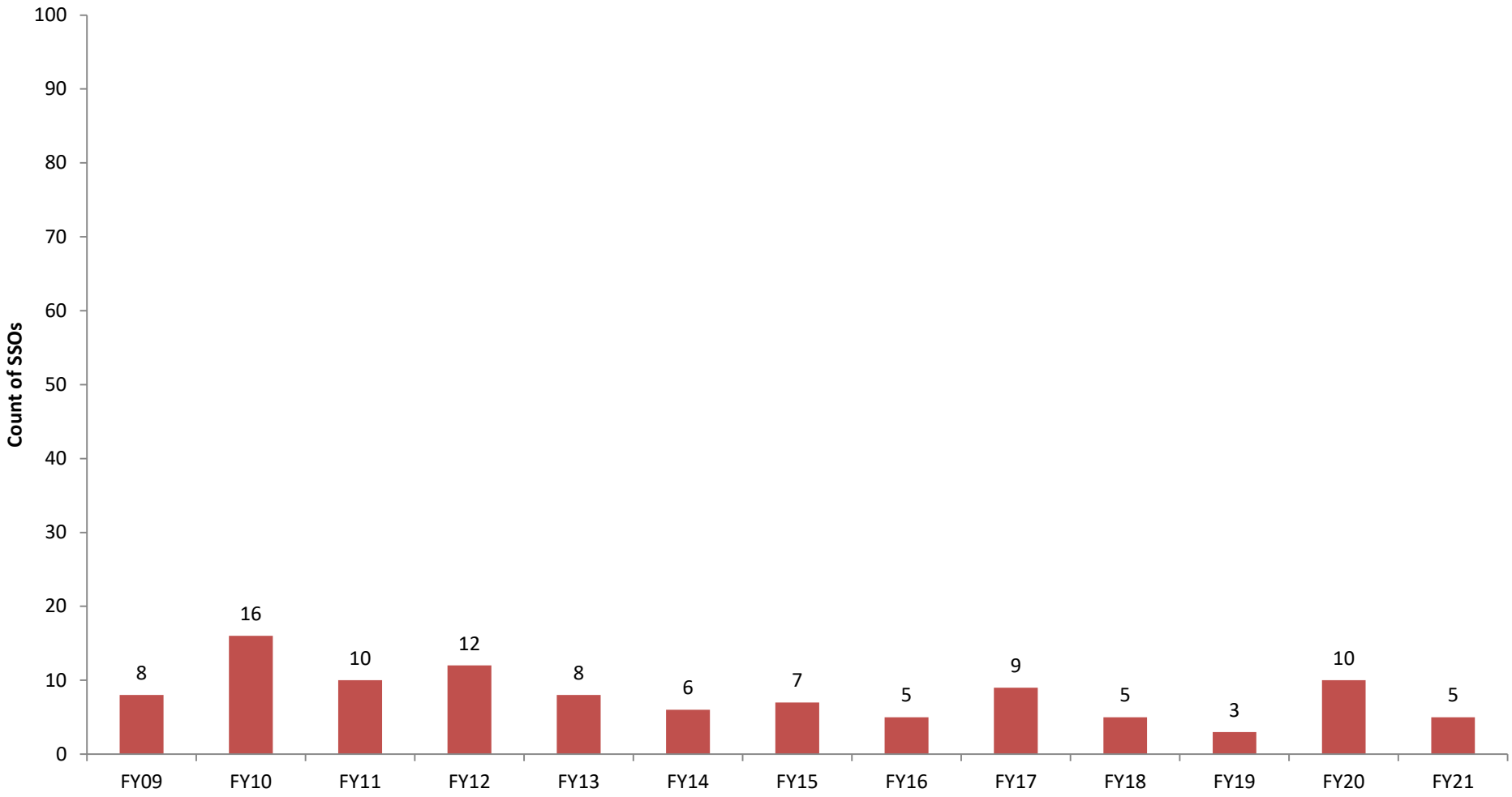
Capacity- Wet Weather SSOs (July 1, 2008 – Present)



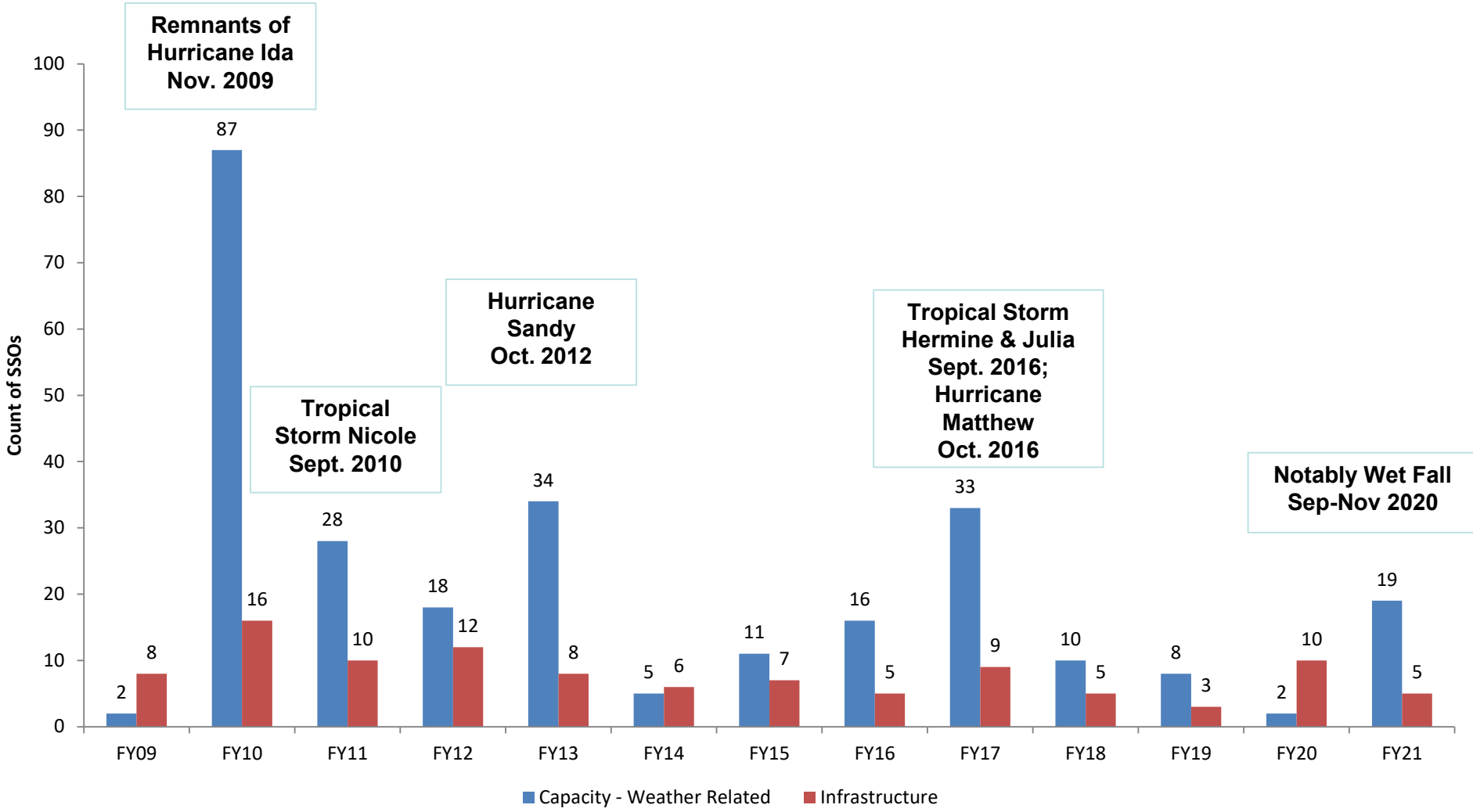
Definitions

- Infrastructure
  - e.g. force main break

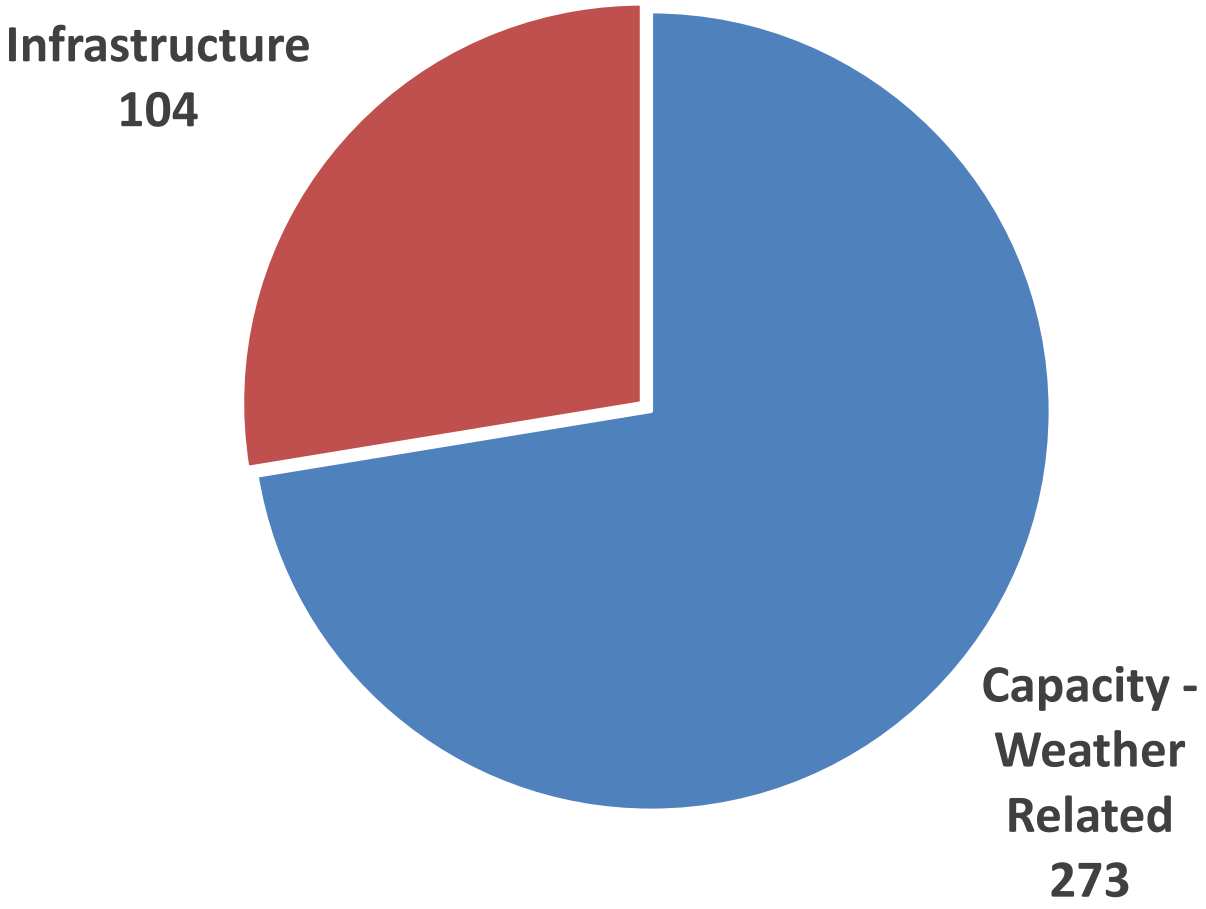
Infrastructure SSOs (July 1, 2008 – Present)



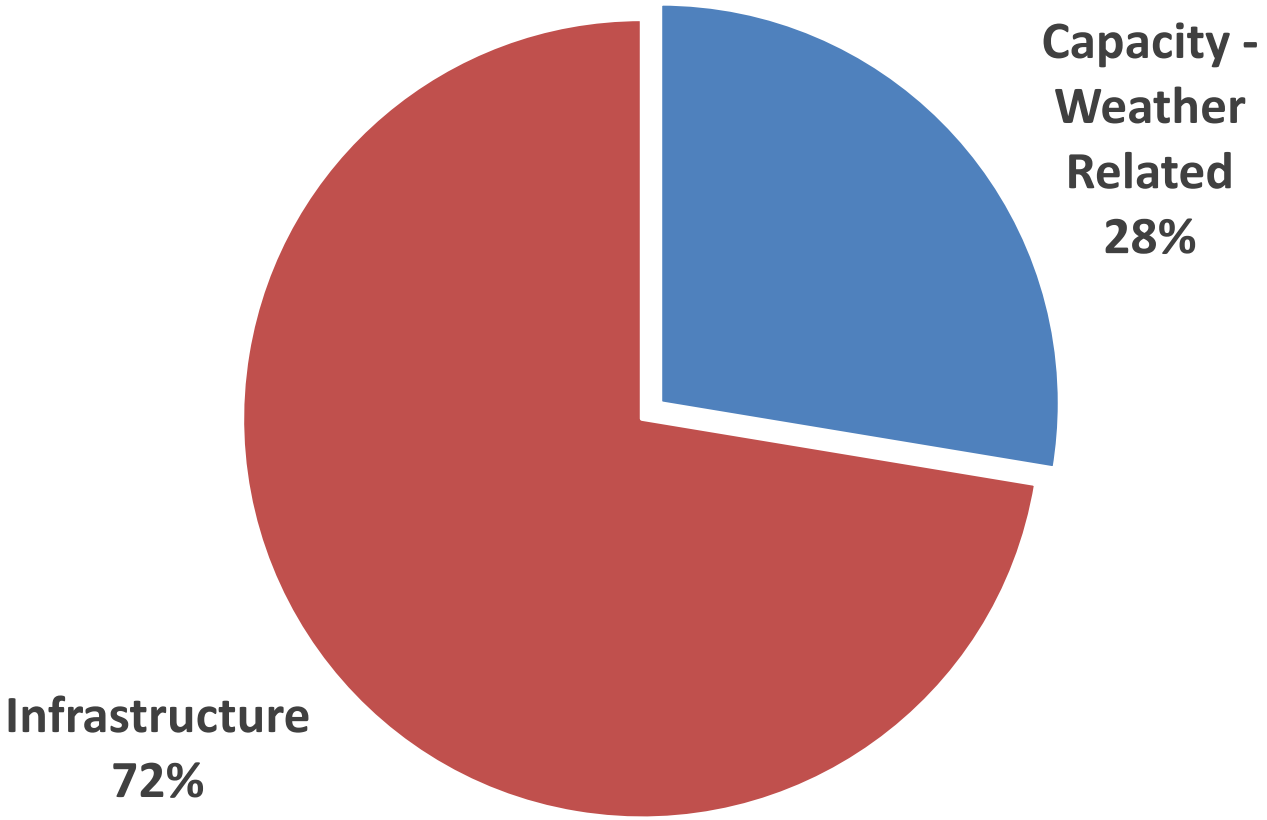
SSOs (July 1, 2008 – Present)



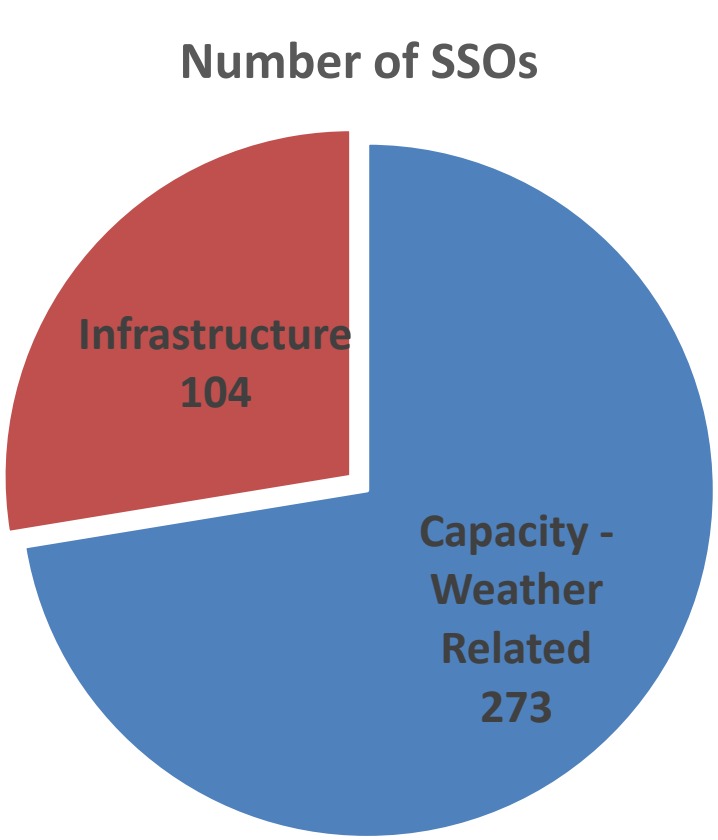
Number of SSOs (July 1, 2008 – Present)

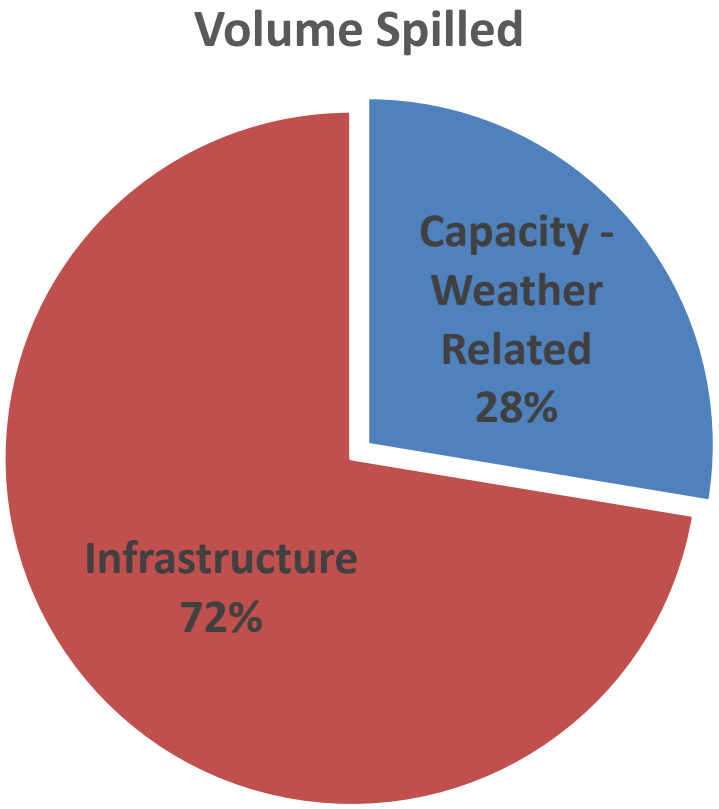


Volume Spilled (July 1, 2008 – Present)

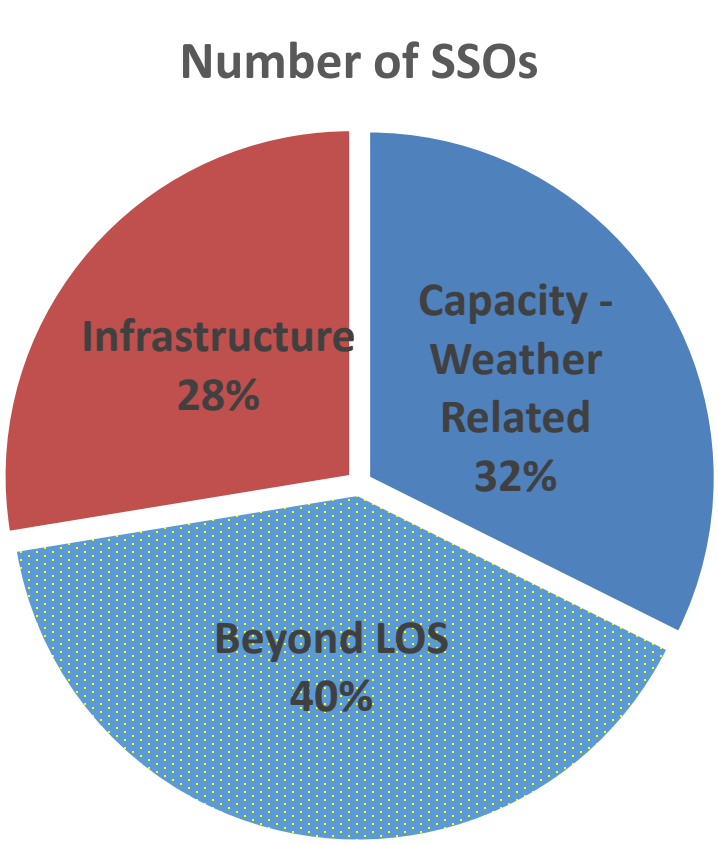


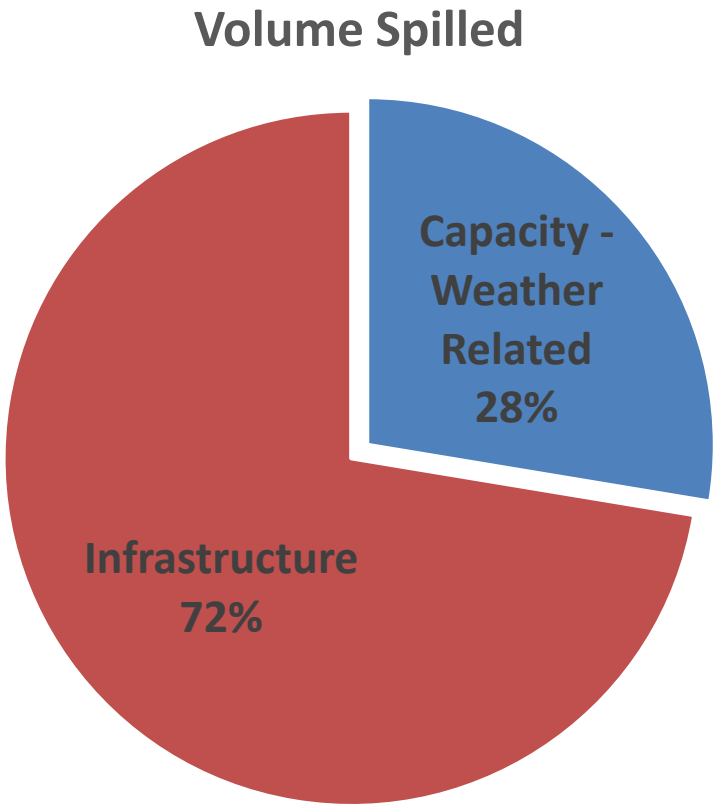
July 1, 2008 - Present





July 1, 2008 - Present





- Infrastructure SSO >>> Wet Weather Related SSO
  - Less frequent, but more consequential
  - Overflows resulting from infrastructure failures are mostly raw sewage while wet weather capacity overflows are ALWAYS diluted
- HRSD infrastructure is predominately pressurized
- Pipelines, pump stations, treatment plants are used continuously
- Wet weather capacity is used infrequently

What are we doing?

- Rehab Action Plan Projects (RWWMP Consent Decree)
- High Priority Projects (RWWMP Consent Decree)
  - ~$400 M
- Federal Facility I&I Orders
- Partnering with Localities to Eliminate Inflow
- Smart Sewer

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Infrastructure Risk Analysis and Condition Assessment

1/26/2021

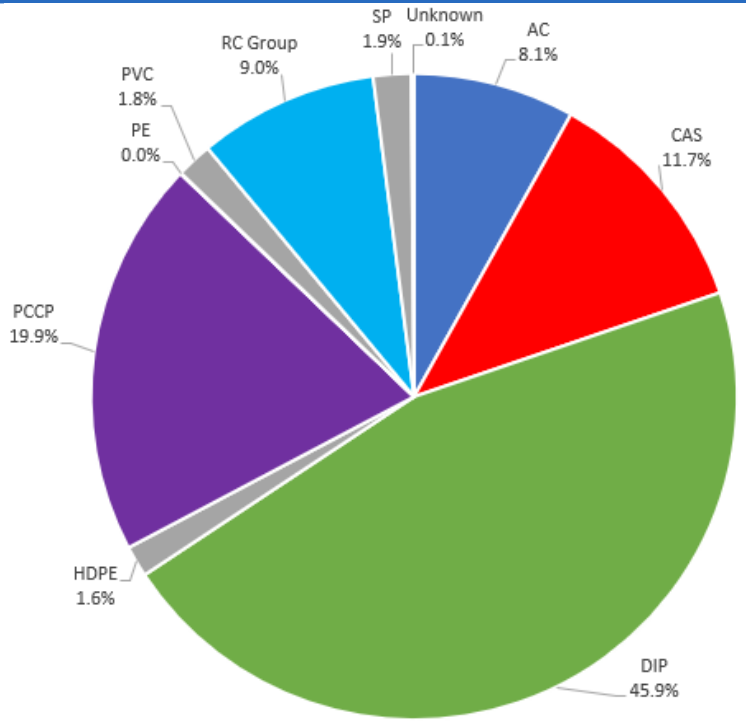
Agenda

- Infrastructure Failure Analysis
- Replacement Planning Model
- Infrastructure Risk Analysis
- Condition Assessment
- Other ongoing efforts to reduce risk

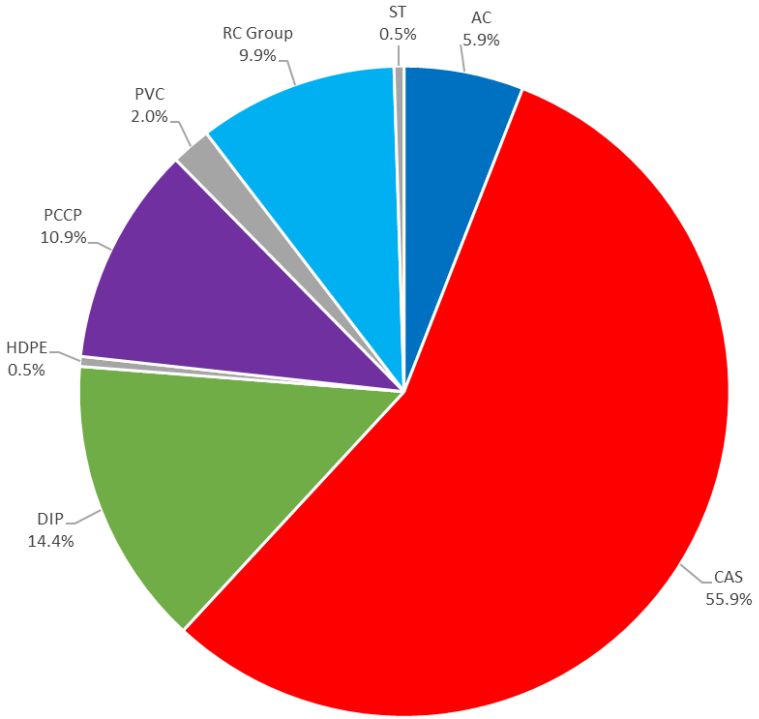
Pipeline Failure Analysis

- Purpose:
  - Identify patterns indicating potential risk of failure
  - Determine the root cause of failure
  - Identify other pipe segments that may be vulnerable to the same failure mode
  - Select pipe materials, corrosion control, and construction practices that would prevent the failure mode
- Approach
  - Visual
  - CCTV
  - Elevation surveys
  - Lab analysis (soil, metallurgy, micro fractures, strength, chemistry, etc)

Pipe Material / Failure Relationship

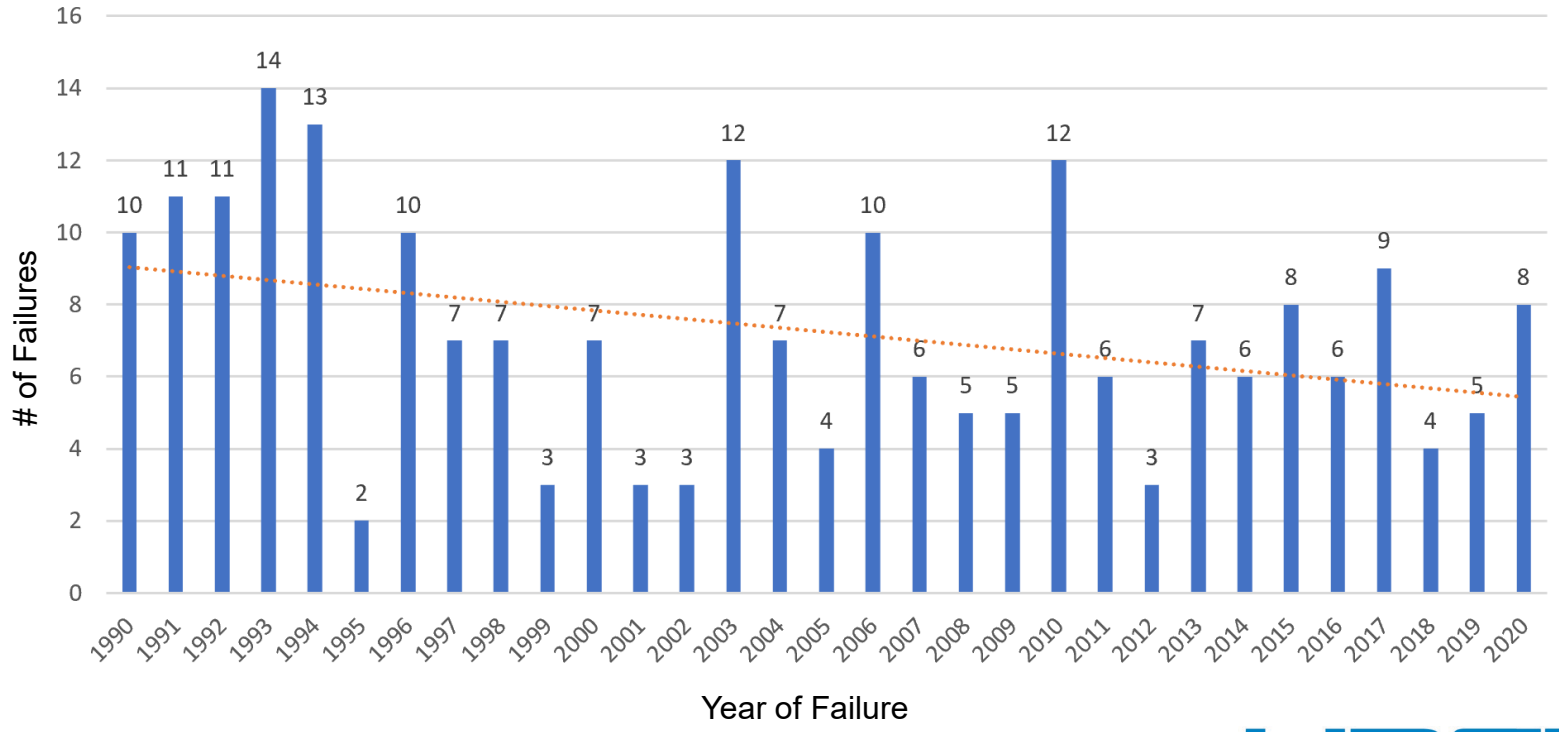


INTERCEPTOR SYSTEM

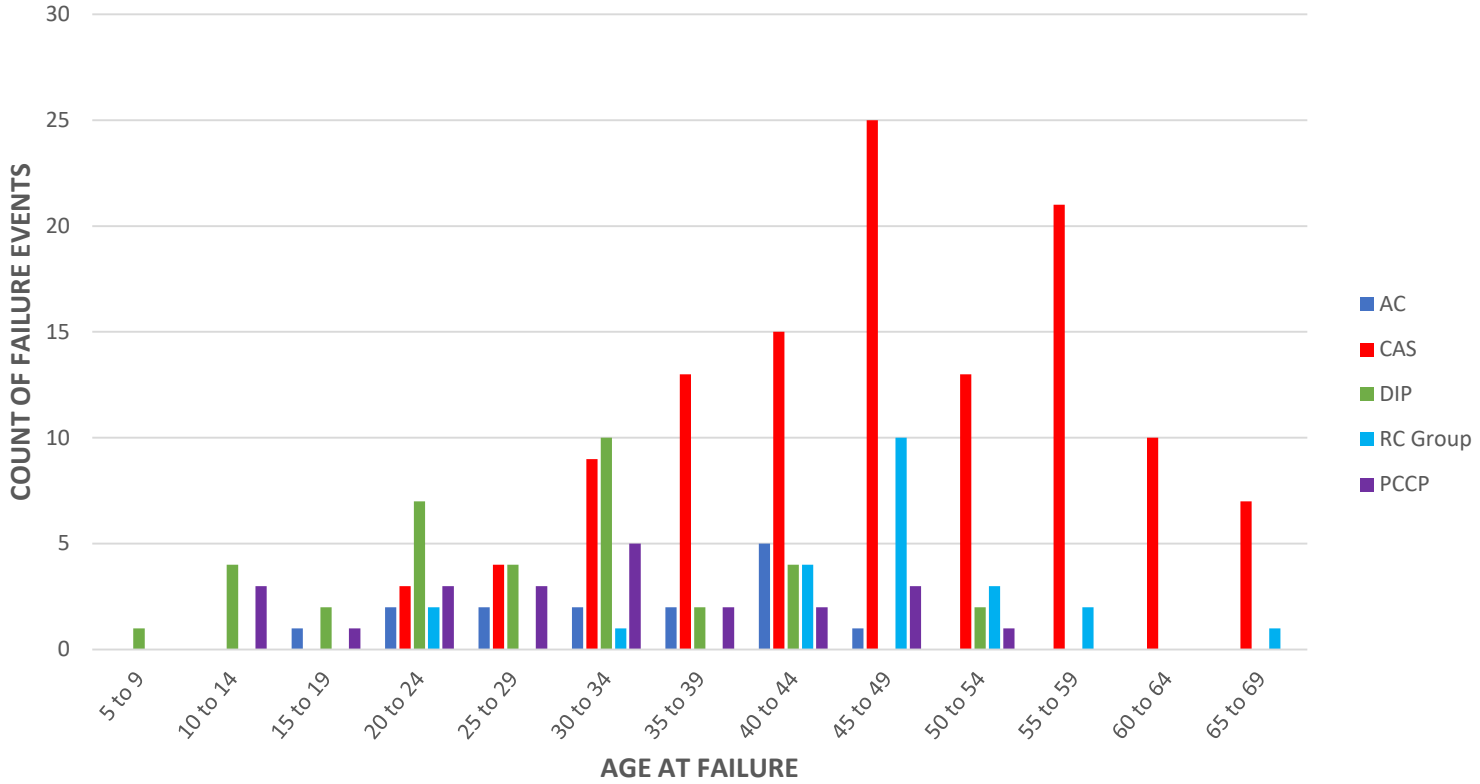


FAILURE EVENTS

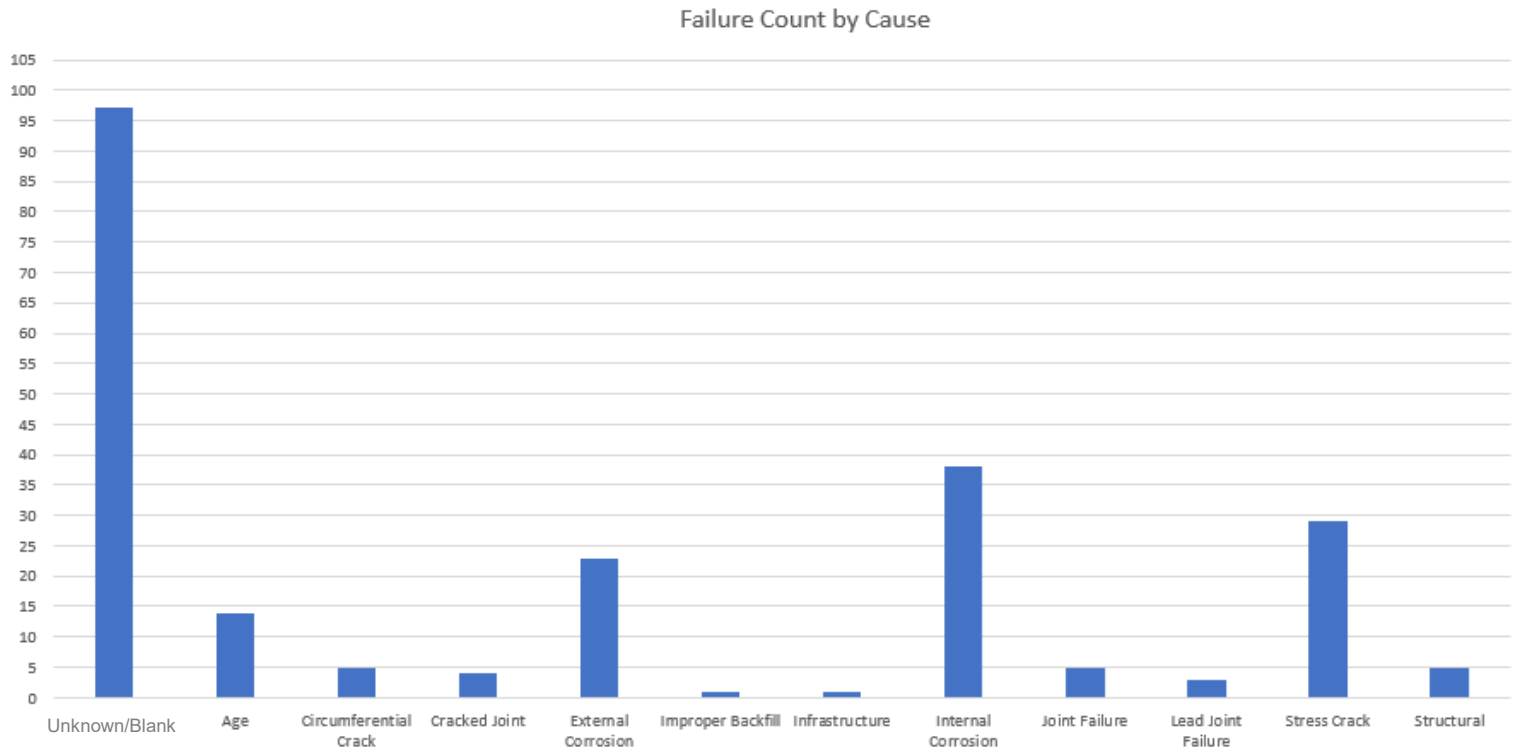
Failures per year



Failure Age (By Material)



Failure Cause

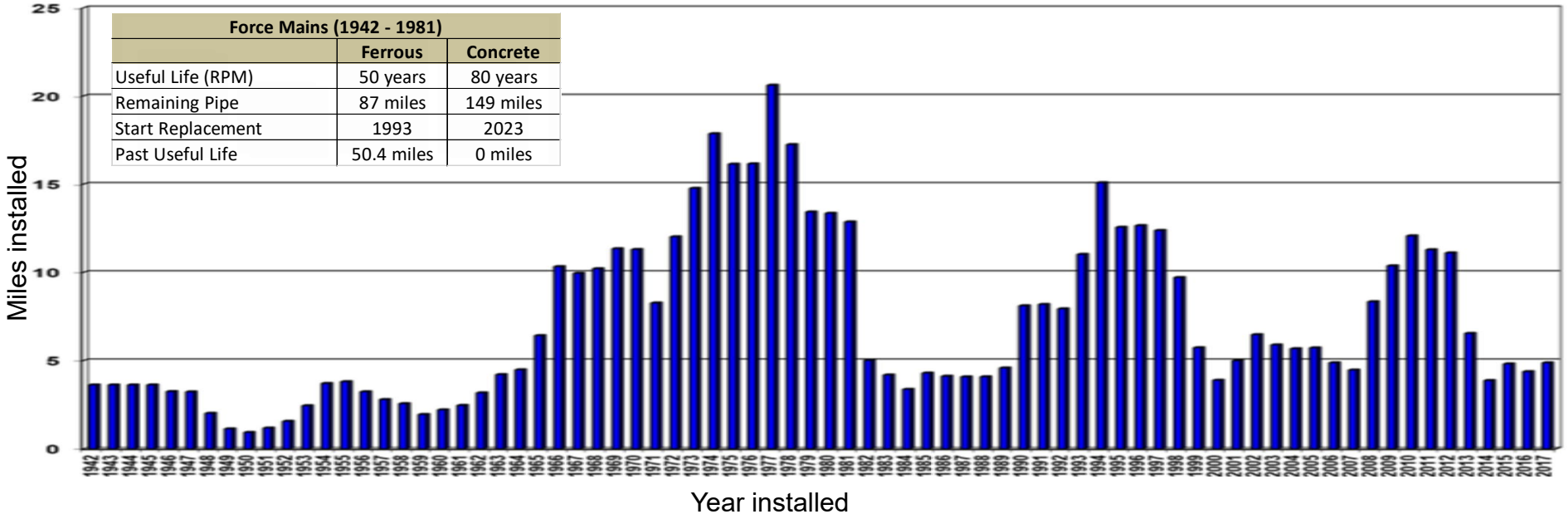


Replacement Planning Model

- Purpose:
  - Proactive pipeline replacement planning
  - Financial forecasting to address aging infrastructure
- Approach
  - Previous Model: Age and material based
    - Ferrous: 50-year useful life
    - Concrete: 80-year useful life
  - New Model: Risk based
    - Likelihood of Failure
    - Consequence of Failure

Pipeline Inventory

Force Mains (1942 - 1981)		
	Ferrous	Concrete
Useful Life (RPM)	50 years	80 years
Remaining Pipe	87 miles	149 miles
Start Replacement	1993	2023
Past Useful Life	50.4 miles	0 miles



Replacement Planning Model

- The table below indicates the number of miles/year needed to replace pipes prior to the end of “useful life”
- The current rate of replacement is approx. 3 miles/year (approx. $5M/mile)
- The current rate of new pipe installed is approx. 7 miles/year
  - New Developments / Service Areas
  - Divertability (redundancy)

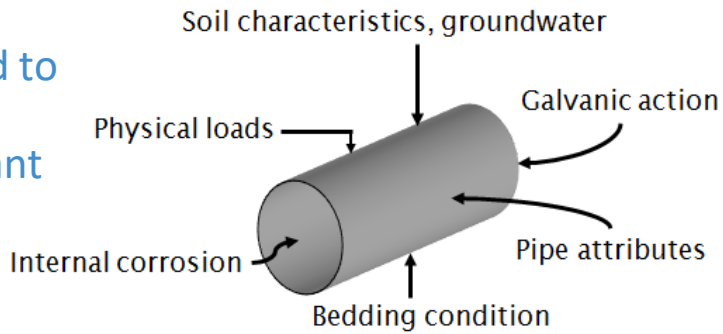
Replace Plan	Miles / Yr.	Cost / Yr.
50 Years	9.4	$47,200,000
60 Years	7.9	$39,400,000
70 Years	6.7	$33,800,000
80 Years	5.9	$29,500,000
90 Years	5.2	$26,300,000
100 Years	4.7	$23,600,000

Asset Management and Risk Analysis

- Asset Management: Extending the life of assets at the lowest life cycle cost
- Asset Management Vision: “Making the right investment at the right time”
- Risk = Likelihood of Failure X Consequence of Failure
- Likelihood of Failure: The probability that an asset would fail
- Consequence of Failure: The environmental, social, and financial impacts of an asset failure

Likelihood of Failure

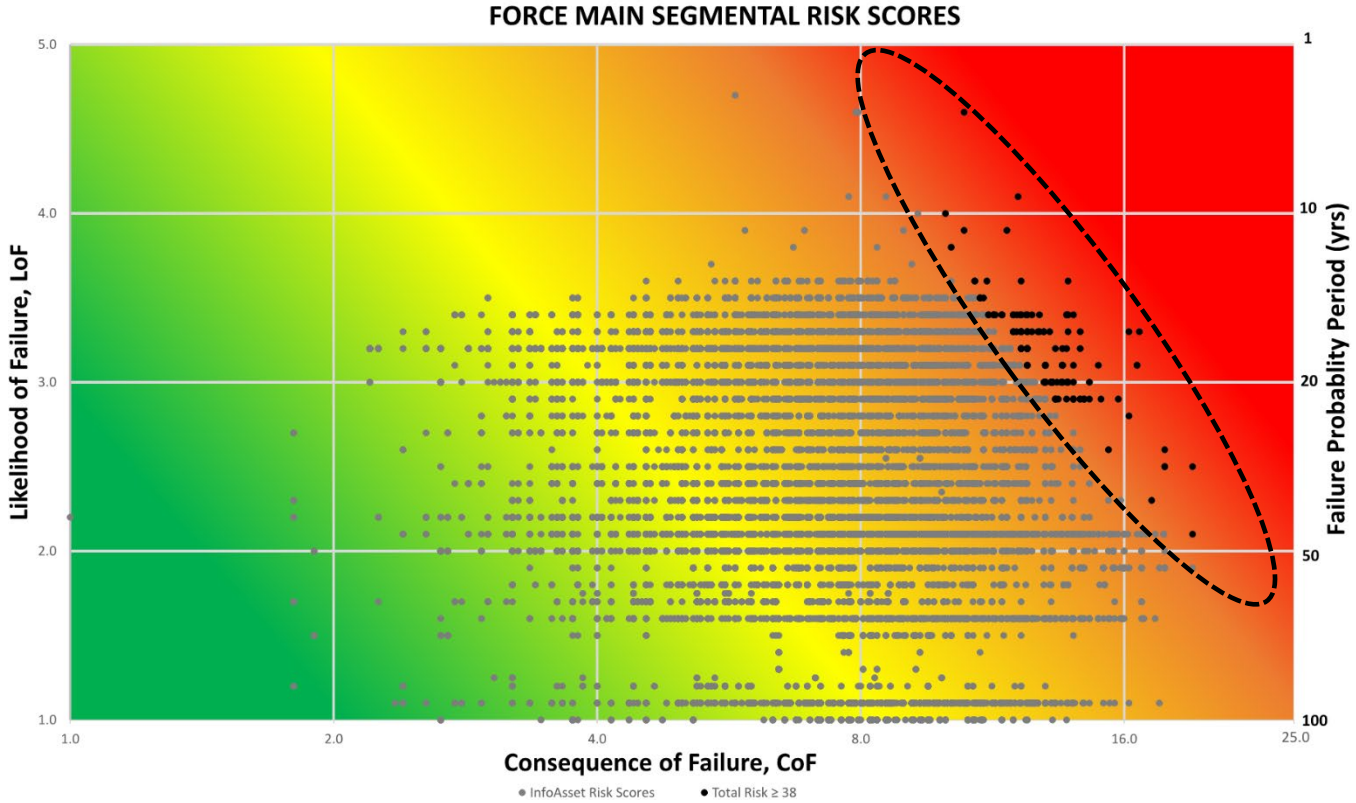
- Environmental Characteristics (20%)
  - Pipe material vulnerability to exterior corrosion
  - Proximity to corrosive soils or potential stray currents
  - Exterior Corrosion protection methods currently in place
- Operational / Pipeline Characteristics (45%)
  - Pipe material vulnerability to failure (H2S Corrosion, manufacturing/installation defects)
  - Proximity to active connections (air introduced to system)
  - Interior Corrosion protection (corrosive resistant materials, interior linings, etc.)
- Failure History (35%)
  - # of failures in the last 10-years



Consequence of Failure

- Compliance (15%)
  - Violations/Enforcement action
- Environmental (15%)
  - Flow and spill duration
  - Proximity to any surface waters.
- Public Health (30%)
  - Flow and spill duration
  - Population density
  - Proximity to drinking water reservoirs, swimming, fishing, recreational activities, etc.
- Reputation, Customer Perception & Community Impact (5%)
  - Impact to Community (Extent of Services Impacted / Upstream Terminal PSs)
- Safety (30%)
  - Force Main Characteristics (size / depth)
  - Location where the travelling public may be greatly impacted
- Financial (5%)
  - Cumulative cost of repair and restoration

Risk Matrix

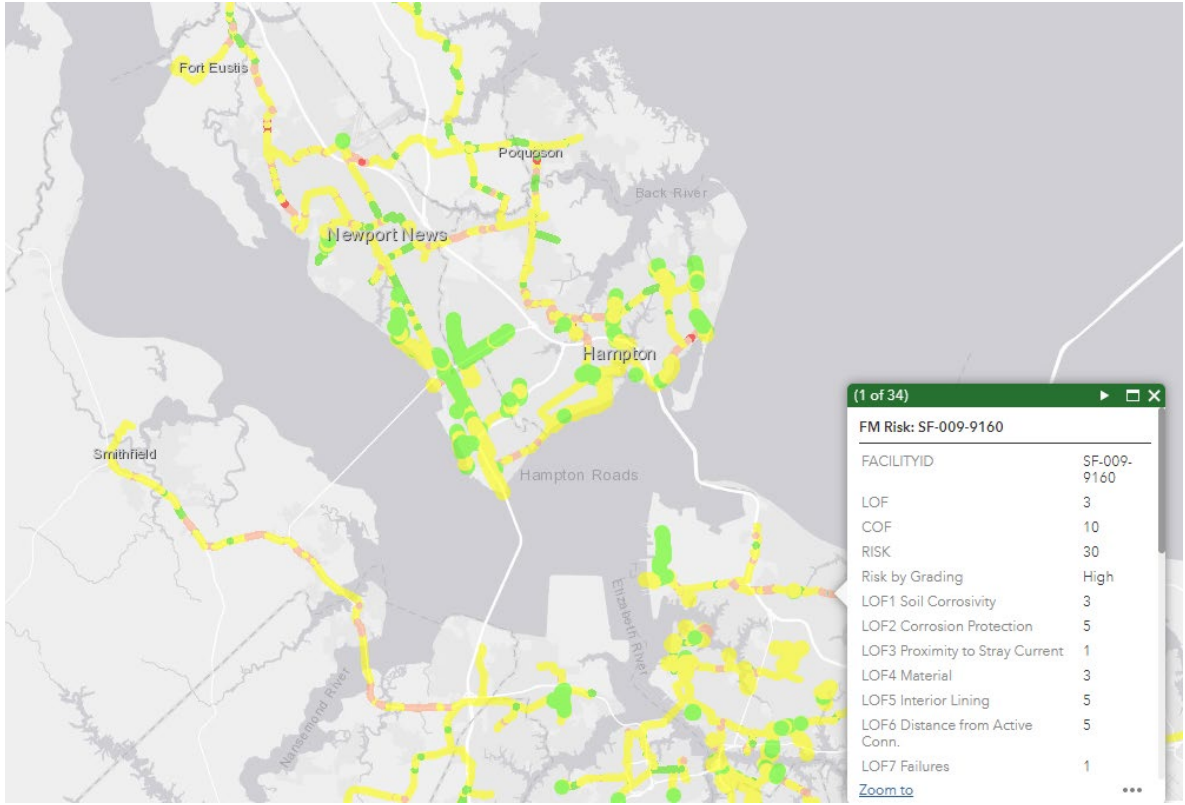


16,159 FM segments

Segment delineation:

- Material
- Size
- Between fittings
- Between appurtenances
- Max: 2000 ft

Risk Map


Fort Eustis
Poquoson
Back River
Newport News
Hampton
Smithfield
Hampton Roads
Elizabeth River
Nansemond River
(1 of 34)
FM Risk: SF-009-9160
FACILITYID SF-009-9160
LOF 3
COF 10
RISK 30
Risk by Grading High
LOF1 Soil Corrosivity 3
LOF2 Corrosion Protection 5
LOF3 Proximity to Stray Current 1
LOF4 Material 3
LOF5 Interior Lining 5
LOF6 Distance from Active Conn. 5
LOF7 Failures 1
Zoom to

Condition Assessment

- Purpose:
  - Identify the material risk of failure
  - Quantify the likelihood of failure
  - Calibrate the risk model
  - Enhance the industry's CA technology portfolio by testing on complex force mains (R&D/Innovation)
- Approach:
  - Technology selection based on size, material, divertability, cost, and other criteria
  - Target localized and/or higher risk segments to reduce cost
  - CA cost / Replacement cost ratio (<20%-25%)
- Challenges:
  - Isolating a segment while maintaining level of service
  - Augmenting flow to maintain a specific velocity or pressure
  - Insertion and extraction points
  - Precleaning
  - Cost (~$2M/year budget – Average $300k/segment)
  - Inconclusive results

HRSD

Technology Scan

	TECHNOLOGY CATEGORY	PRIMARY OBJECTIVE	INTERNAL / EXTERNAL	DIAMETERS (INCHES)	FERROUS	CONCRETE (NON-CYLINDER)	CONCRETE (CYLINDER)	ASBESTOS CEMENT	PLASTIC	AVAILABLE VENDOR PLATFORMS	MINIMUM ACCESS REQUIRED	SEGMENT DATA RESOLUTION	PIPE IN SERVICE	VELOCITY REQUIREMENTS	PRESSURE (PSI)
SCREENING	Acoustic Gas Pocket / Leaks Detection (combo) [1]	Internal Corrosion Risk / Failure Detection	Internal	4 to 78	X	X	X	X	X	Aquam: Bullet Hydromax: Nautilus PICA: Nautilus / Phyton Pure: SmartBall	Vendor specific. 2" or 4" tap.	Continuous	Yes	0.1 to 6 ft/s (Bullet: 32 ft/s)	15 to 200
	Acoustic Leak Detection	Failure Detection	External	Any	X	X	X	-	X	Echologics: EchoWave	External contact with pipe wall	Variable	Yes	< 5 ft/s	
PIPE WALL INTEGRITY	Transient Pressure Wave	Wall Thickness	External	8 to 36	X	X	X	X	-	Hydromax: p-CAT	Pressure port (e.g. air vent/valve)	30 ft	Yes	-	-
	Broadband Electromagnetic (BEM)	Wall / Cylinder Thickness	External	> 4	X	-	X	X	-	Echologics: RSG licensee Rock Solid Group (RSG): FAST, CAP, PAT, HSK, RAT	Excavate/expose	Continuous over exposed area	Yes	-	-
	Near Field Electromagnetic (NEM)	Wall Thickness	External	> 6	X	-	-	-	-	PICA: Bracelet Probe	Excavate/expose	Continuous over exposed area	Yes	-	-
	Remote Field Technology (RFT)	Wall / Cylinder Thickness Broken wires / bars	Internal	3 to 78	X	X	X	-	-	Pure: PipeDiver (16"-36") PICA: SeeSnake, Chimera, RAFT, EMIT (3"-78")	Wye sized for tool entry	Continuous	No	-	Depressurized
	Magnetic Flux Leakage (MFL)	Wall / Cylinder Thickness	External or Internal	External: Any	X	-	-	-	-	Hydromax: Smart-CAT	Excavate/expose	Continuous over exposed area	Yes	-	-
	Pipe Penetrating Radar (PPR)	Wall Thickness	External or Internal	External: Any Internal: > 10	-	X	-	X	X	SewerVue: Surveyor, AC Pipe Scanner	Ext: Excavate/expose Int: Open pipe end	Continuous or Point	Ext: Yes Int: No	-	Ext: N/A Int: Zero
	Guided Wave Technology (GWT)	Wall Thickness	External	All	X	-	X	X	-	Echologics: ePulse	Pressure port (e.g. air vent/valve)	30 ft	Yes	-	> 15 psi and steady
	Acoustically Sensitive Fiber Optic	Wire break detection	Internal	> 16	-	-	X	-	-	Pure: SoundPrint	Installed in pipe	Continuous	Yes	-	< 250 psi
PHYSICAL	Ultrasonic Thickness (UST)	Wall Thickness	External or Internal	External: All	X	-	-	-	-	Common handheld equipment	Excavate/expose	Point	Yes	-	-
VISUAL	Sonar	Defect / blockage detection	Internal	> 16	X	X	X	X	-	Pure: PureRobotics SewerVue: Surveyor	Excavate / Open pipe end	Continuous	No	-	Depressurized
	Laser profiling	Pipe shape / Wall surface	Internal	> 8	X	X	X	X	X	Hydromax: MaxSense Pure: PureRobotics SewerVue: Surveyor	Excavate / Open pipe end	Continuous	No	-	Depressurized
	Closed Circuit Television (CCTV)	Defect / blockage detection	Internal	> 8	-	X	X	X	-	Hydromax: IntelliSpan 360 Pure: PureRobotics SewerVue: Surveyor	Excavate / Open pipe end	Continuous	No	-	Depressurized
	Phenolphthalein	Wall Integrity	Cross-Section	Any	-	-	-	X	-	Common field / lab procedure	Removed section	Point	No	-	-

Other Ongoing efforts

- Unvented High Point Analysis
  - Purpose: prevent internal corrosion (especially near connection points)
  - Approach: survey pipe elevations to identify the high point and installing air vents
- Soil Corrosivity Study
  - Purpose: Reduce the rate of external corrosion
  - Approach: soil testing and stray current analysis
- Valve Assessments
  - Purpose: Enhance isolation capability to reduce spill volume
  - Approach: assess the condition of critical isolation valves and prioritize repair, replacement, or installation of new valves

Questions?

- Consent Decree
- SSOs
- Asset Management/Condition Assessment