Climate Change Vulnerability Assessment, Adaptation, and Mitigation Plan (CCVAAMP) Briefing

Metropolitan Washington Council of Governments

Water Resources Technical Committee, January 7, 2022

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Agenda

- CCVAAMP Contract Scope & Drivers
- Climate Analysis & Projections
- Facility Vulnerability Assessment & Adaptation Planning
- Linear Assets Vulnerability Screening
- Climate Change Design Guidelines
- Greenhouse Gas Inventory Progress (Mitigation)

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Contract Scope & Drivers

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Purpose of WSSC Water's CCVAAMP

- Purpose of study
  - Provide WSSC Water with understanding of future climate conditions, risks, and adaptation strategies.
  - Continue tracking greenhouse gas (GHG) emissions and developing GHG mitigation planning to achieve WSSC goals.
- Objectives/scope
  - Determine local climate change effects: *Sea level rise, rainfall, and temperature projections*
  - Identify vulnerabilities and risks: *Flooding, electrical supply*
  - Identify resilience and mitigation strategies: *Facility adaptations, design guide, GHG mitigation planning*

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Flood-Related Challenges Facing WSSC

Precipitation Driven Flooding

Stormwater/ Drainage

2- to 10-year storms

Localized flooding from overwhelmed drainage systems

Riverine

100-year storms

Regional flooding

Coastal Flooding

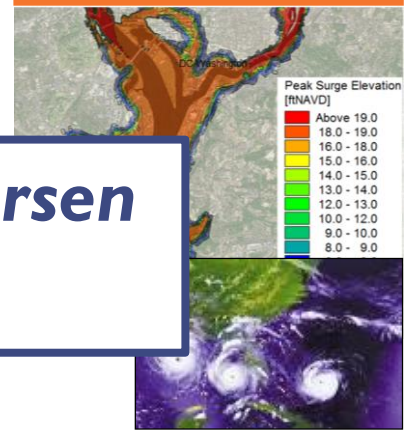
Sea Level Rise

Tidal Flooding

"Sunny day" flooding from increased tide levels

Storm Surge

Tropical Storms



Coastal flooding

These challenges are projected to worsen due to impact of climate change.

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Climate Analysis & Projections

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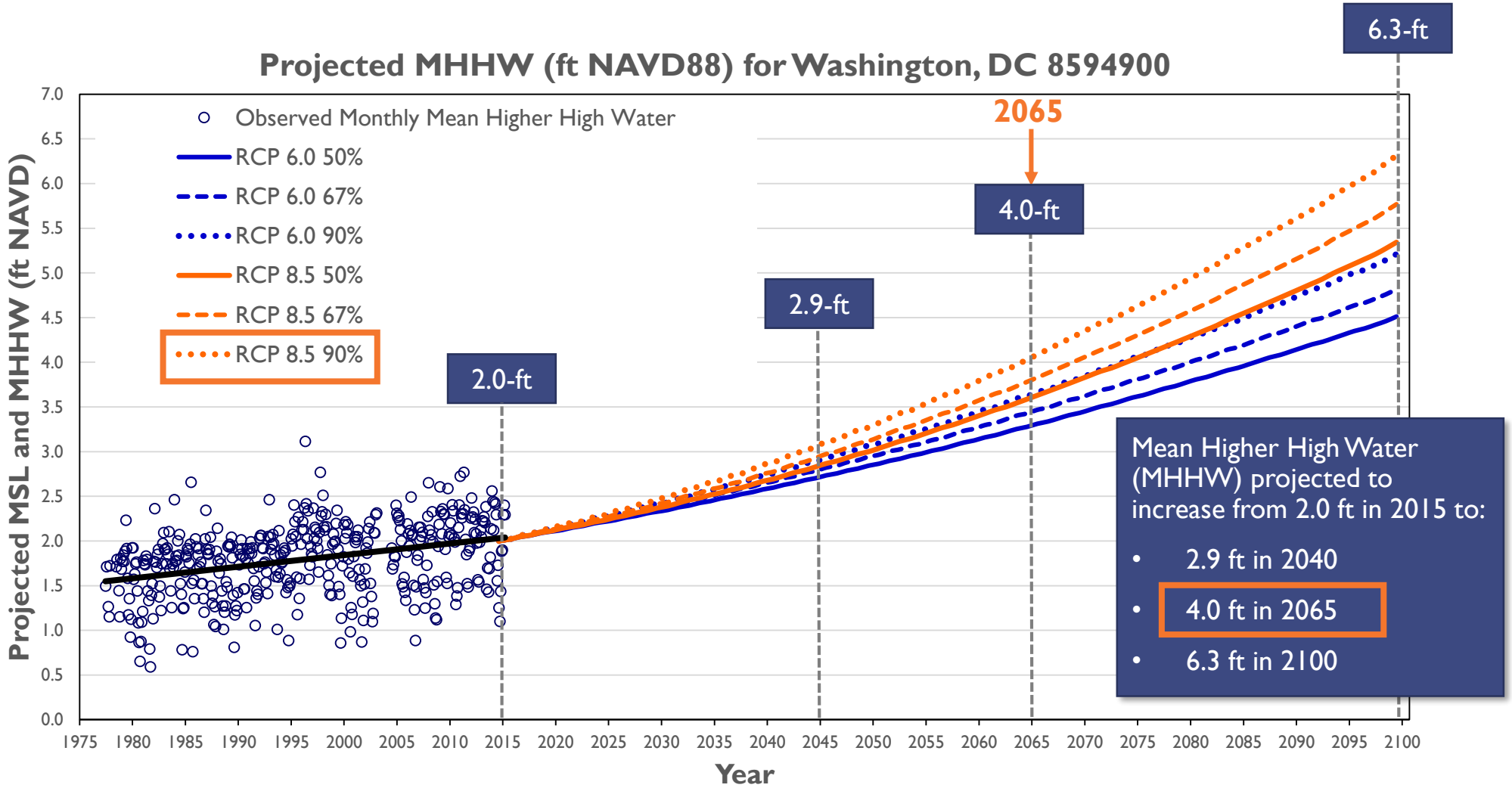
Sea-Level Rise Projections for Service Area:

High Tide (MHHW) projected to increase from 2.0 ft to 4.0 f in 2065



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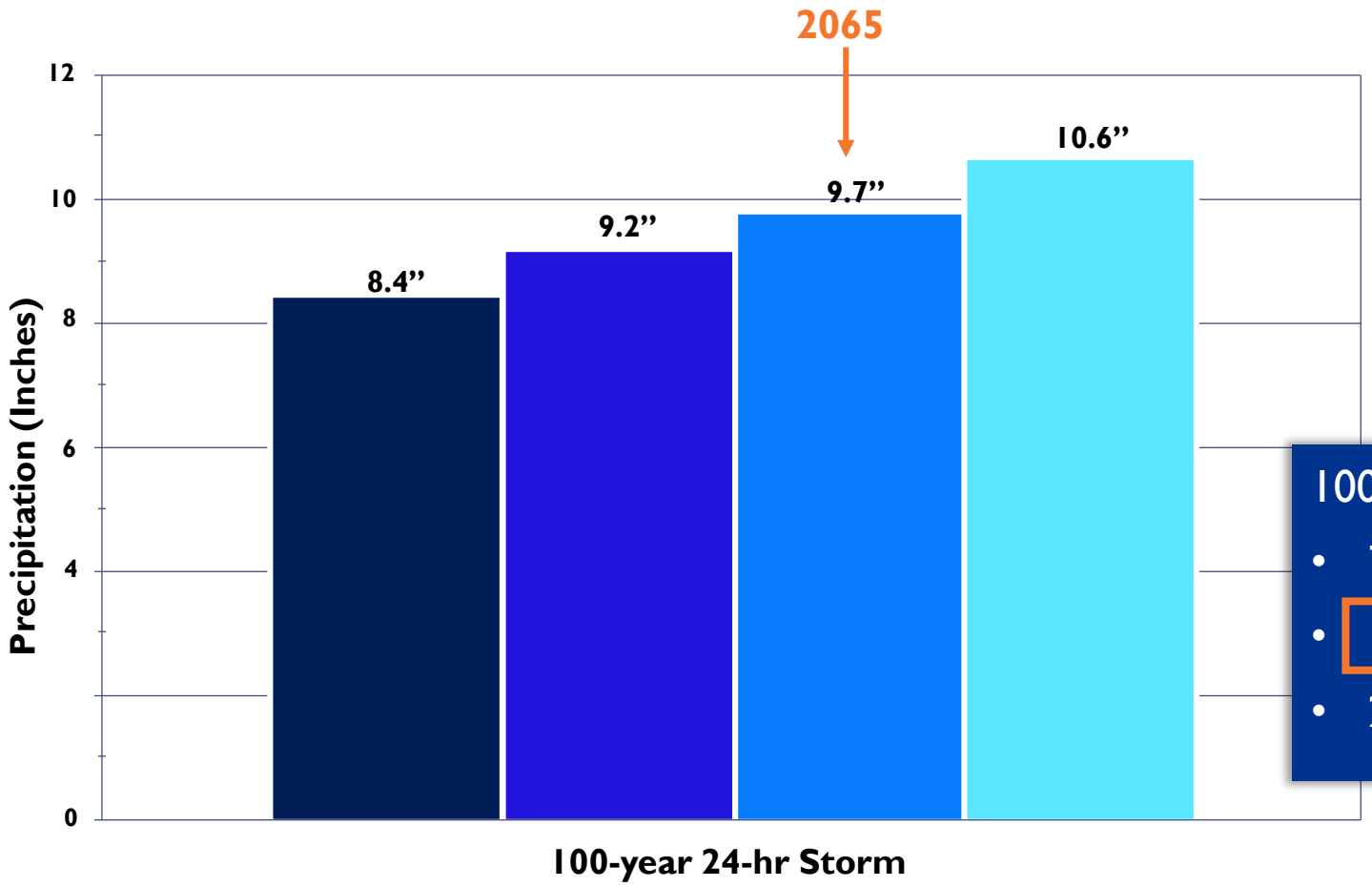
Rainfall Projections for Service Area

24-hour rainfall depth projected to increase 15% by 2065



100-year storm increases:

- 7 percent for 2040
- 15 percent for 2065
- 23 percent for 2100

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Facility Vulnerability Assessments & Adaptation Planning

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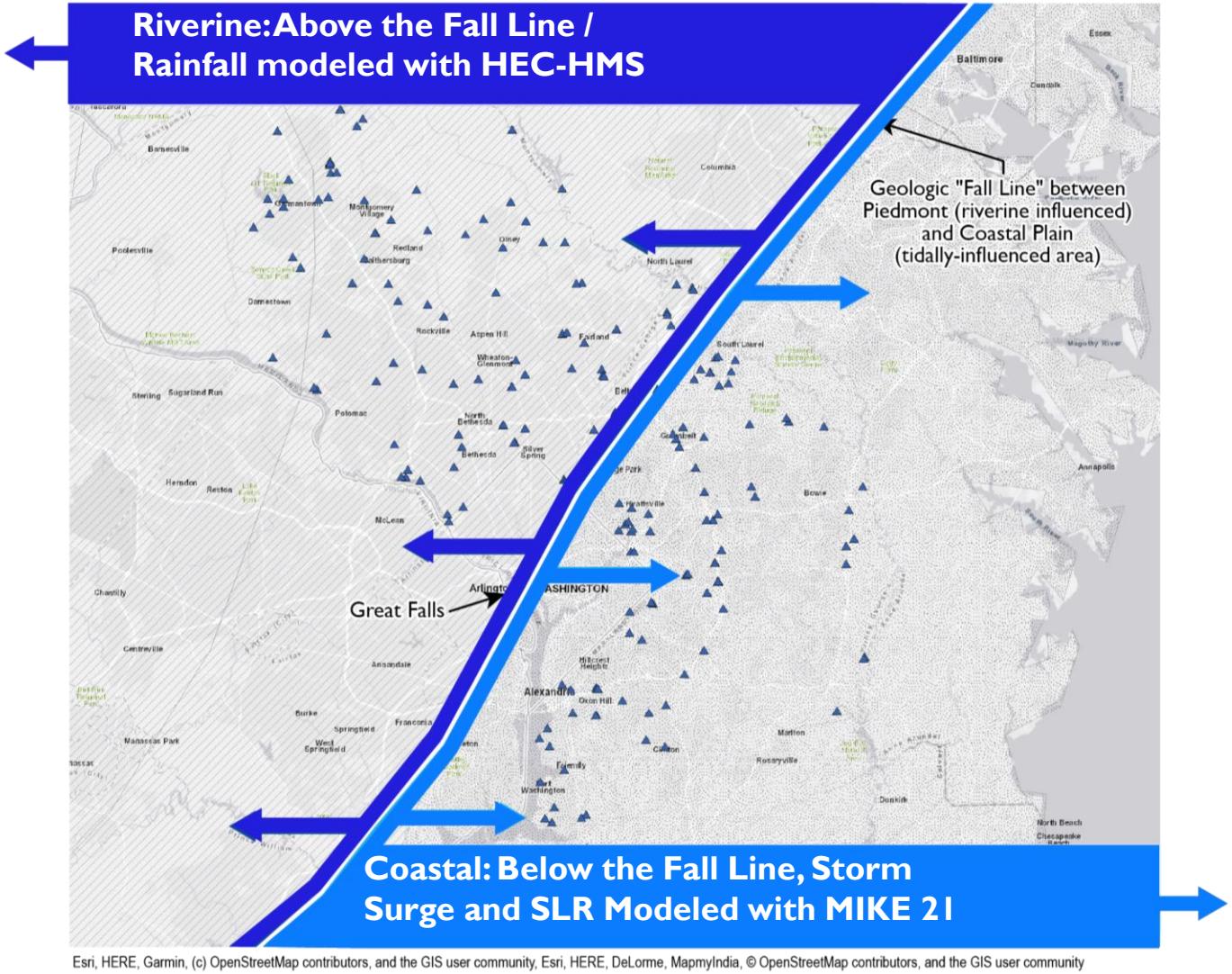
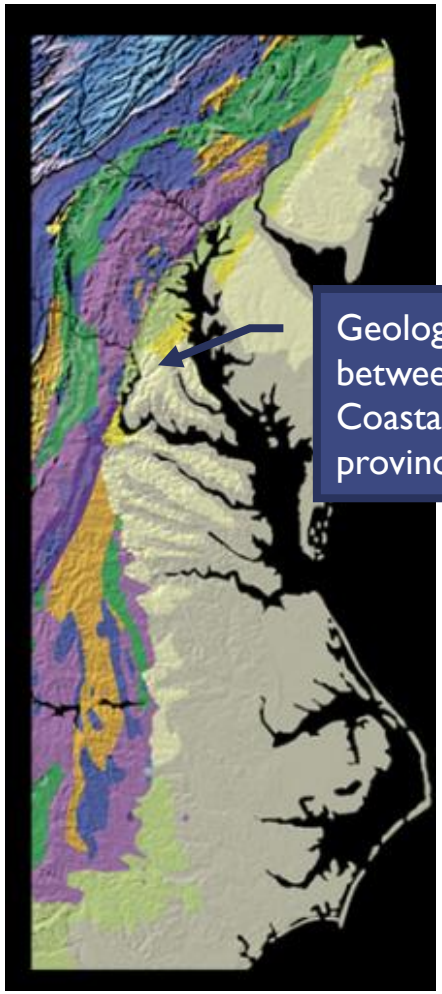
Flood modeling completed for riverine and coastal facilities using climate projections





Geologic "Fall Line" between Piedmont and Coastal Plain geologic provinces

Photo credit: NationalAltas.gov

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Facilities Investigated to Date

8 out of 18 found to be at risk from current or projected flooding

200 +	Facilities in GIS
49	Facilities located in or near floodplain
18	Facilities prioritized for future flood modeling
18	Vulnerability assessments completed to date

Coastal

- Anacostia WWPS #1
- Anacostia WWPS #2
- Broad Creek WWPS
- Western Branch WRRF
- Hyattsville WWPS
- Piscataway WRRF
- Anacostia Depot
- Colmar Manor WWPS
- Forest Heights WWPS
- Fort Foote WWPS

Riverine

- Air Park WPS
- Decatur Street WWPS
- Hyattstown WRRF
- Marlboro Meadows WWPS
- Parkway WRRF
- Reddy Branch WWPS
- Rocky Gorge WPS

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Risk Assessment / Alternatives Development

-Major assets located below new Design Flood Elevation

1. Identify all assets at risk below recommended design flood elevation (DFE).
2. Determine Level of Service (LOS) of all assets at risk.
3. For high LOS assets under the DFE, develop asset-level strategy.
4. For all buildings at risk, develop building-level strategies.
5. Calculate benefit of adaptation.
6. Compare benefits to cost of flood-proofing alternatives.
7. Develop project recommendations.

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Water and Wastewater Facility Level of Service

Wastewater Treatment Process Level-of-Service Designations

1	Maintenance of hydraulic capacity
2	Primary treatment liquid processes and disinfection
3	Secondary treatment liquid processes
4	Solids treatment processes

Water Treatment Process Level-of-Service Designations

1	Finished water pumping, distribution network sensors, disinfection
2	Liquid filtration and treatment processes
3	Solids treatment processes

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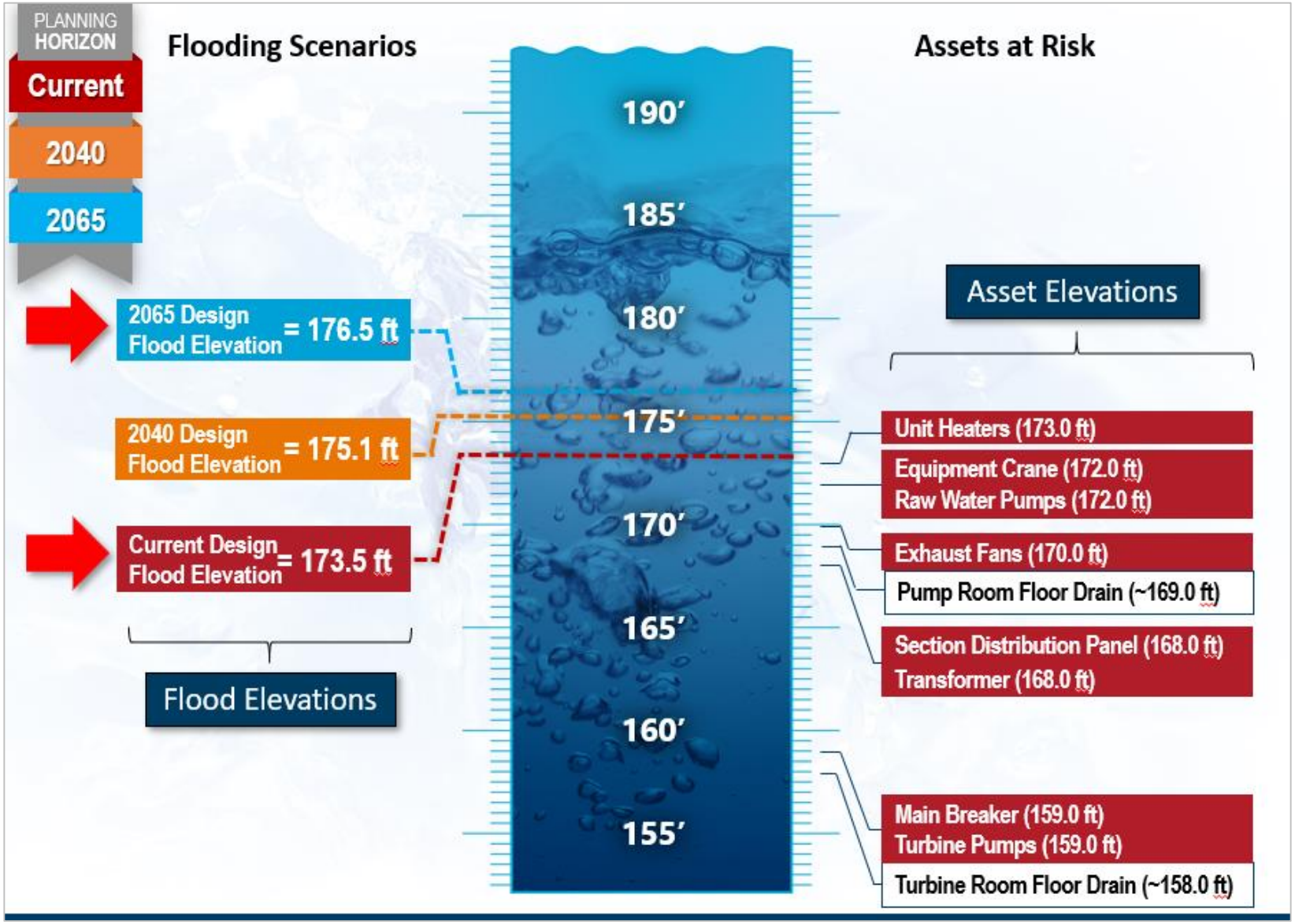
Sample Assessment: Rocky Gorge Water Pump Station



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Adaptation Strategies for Plants and Pump Stations

Strategy	Resiliency Level
No Action	No Protection
Sandbagging	Low
Temporary Barriers	Moderate
Seal Building/ Control Room	Moderate/ Medium
Construct Static Barrier	High
Flood-proof Equipment	High
Elevate Equipment	Very High

Photo credit: Presray, FEMA, Global Industrial, Dis-Tran

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Vulnerability and Adaptation Results (based on LOS 1 and LOS 2 assets at risk at 8 facilities found to be at risk of flooding)

Planning Horizon	LOS 1 and LOS 2 Assets at Risk*			
	Quantity	Cost of Replacement	Strategy Cost (Planning Level)	Benefit (Risk Avoided)
2065 100-year	71	$12,720,000	$1,104,000	$3,931,700

*Level of Service (LOS) 1 and (LOS) 2 include assets that maintain the safety and protection of site personnel, maintain plant hydraulic capacity, and perform primary treatment for liquid processes.

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Vulnerability and Adaptation Results (based on all assets at risk at 8 facilities found to be at risk of flooding)

Planning Horizon	All Assets at Risk			
	Quantity	Cost of Replacement	Strategy Cost (Planning Level)	Benefit (Risk Avoided)
2065 100-year	801	$113,790,000	$2,561,000	$27,321,700

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Linear Assets Vulnerability Screening

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Flood Vulnerability Screening of Linear Assets

- Objective: Assess vulnerabilities of WSSC Water collection and distribution system assets for a projected 2065 100-year flood event
- Electrical and Mechanical (E/M) Asset Damage Vulnerabilities
  - Damages can result in operational impacts and repair/replacement costs
  - The CCVAAMP FY21 screening identified location and flood depth in the vicinity of assets
- Rainfall Dependent Inflow and Infiltration (RDII) Vulnerabilities
  - Component of inflow directly due to rainfall entering the sewer system through manhole covers, structures, illegal connections or cross-connections
  - The CCVAAMP FY21 screening identifies location and flooding depth of manhole rims to provide a focus for potential RDII concern areas

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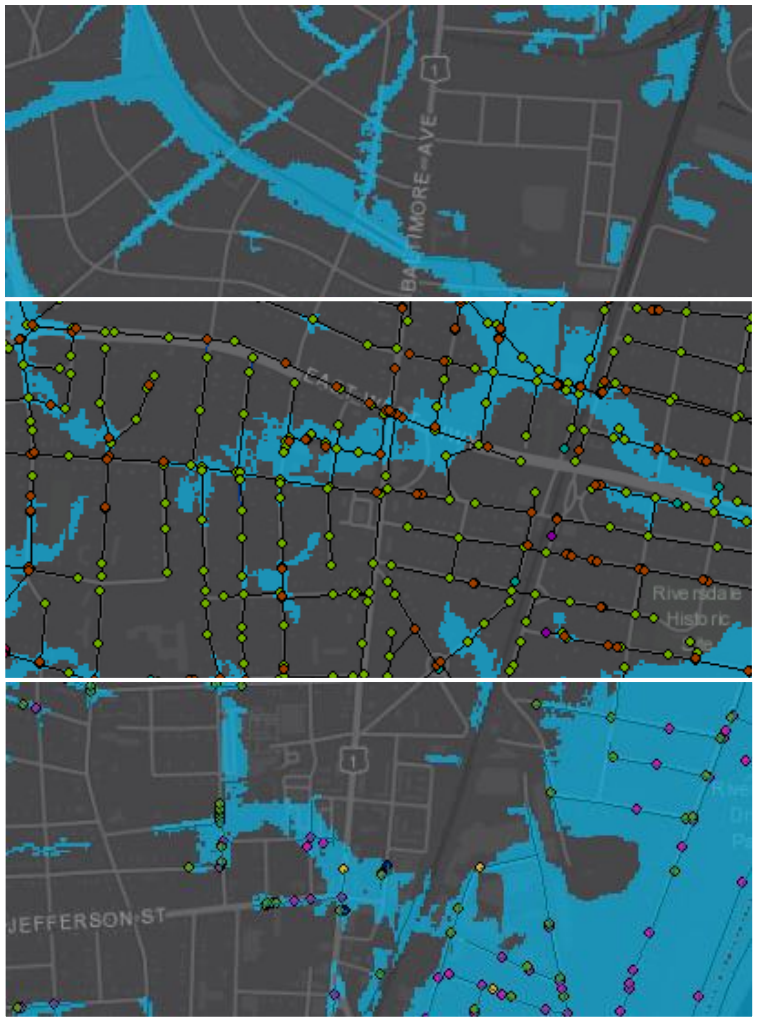
GIS-Based Vulnerability Assessment Screening



Screening Floodplain	**100-year 2065 Floodplain (RCP 8.5)** • *Existing CCVAAMP MIKE 21 coastal results* • *Jacobs Flood Modeller FAST ADI riverine results (developed FY21)*
+	
Asset Geodatabase	**Water & Sewer System GIS Asset Databases**
↓	
Assets Potentially at Risk	**Location & Number of Impacted Assets** **Approximate Flood Depths (Manholes Only)** • *Estimated flood depth above rim (via WSSC GIS attributes)*

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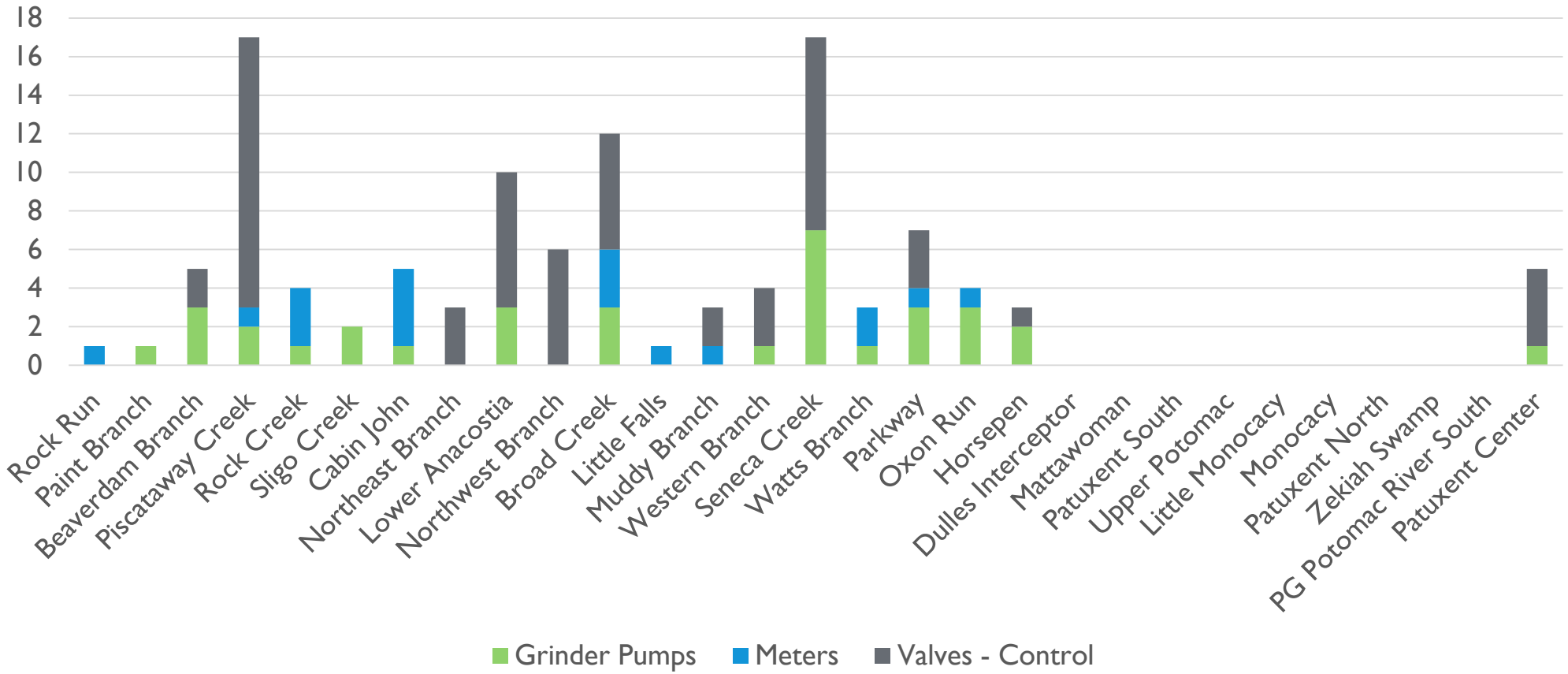
Sewer Screening – Total Number of Potentially Vulnerable Electrical and Mechanical (E/M) Assets (2065 100-year Event)



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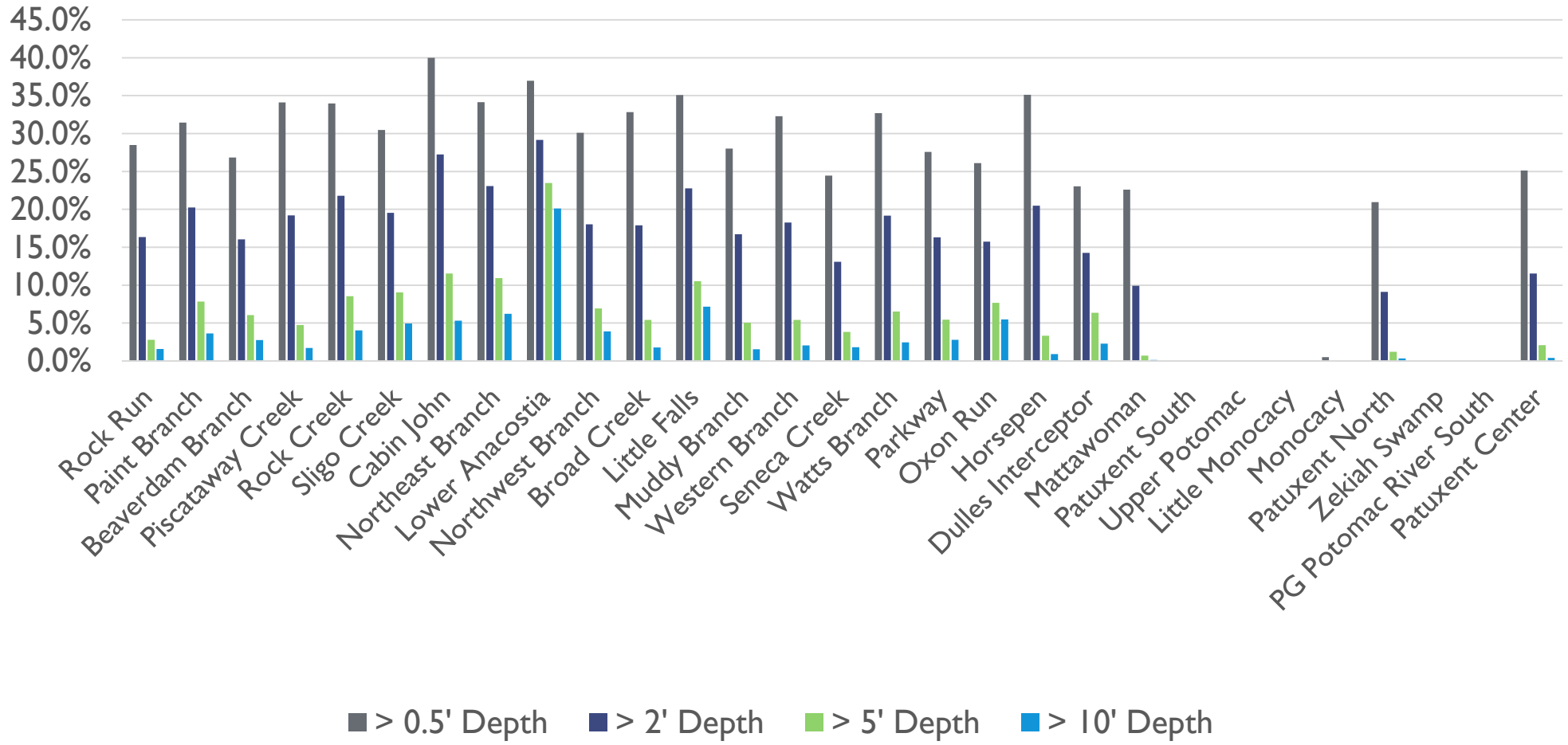
Sewer Screening – Percentage of Manholes Flooded (2065 100-year Event)



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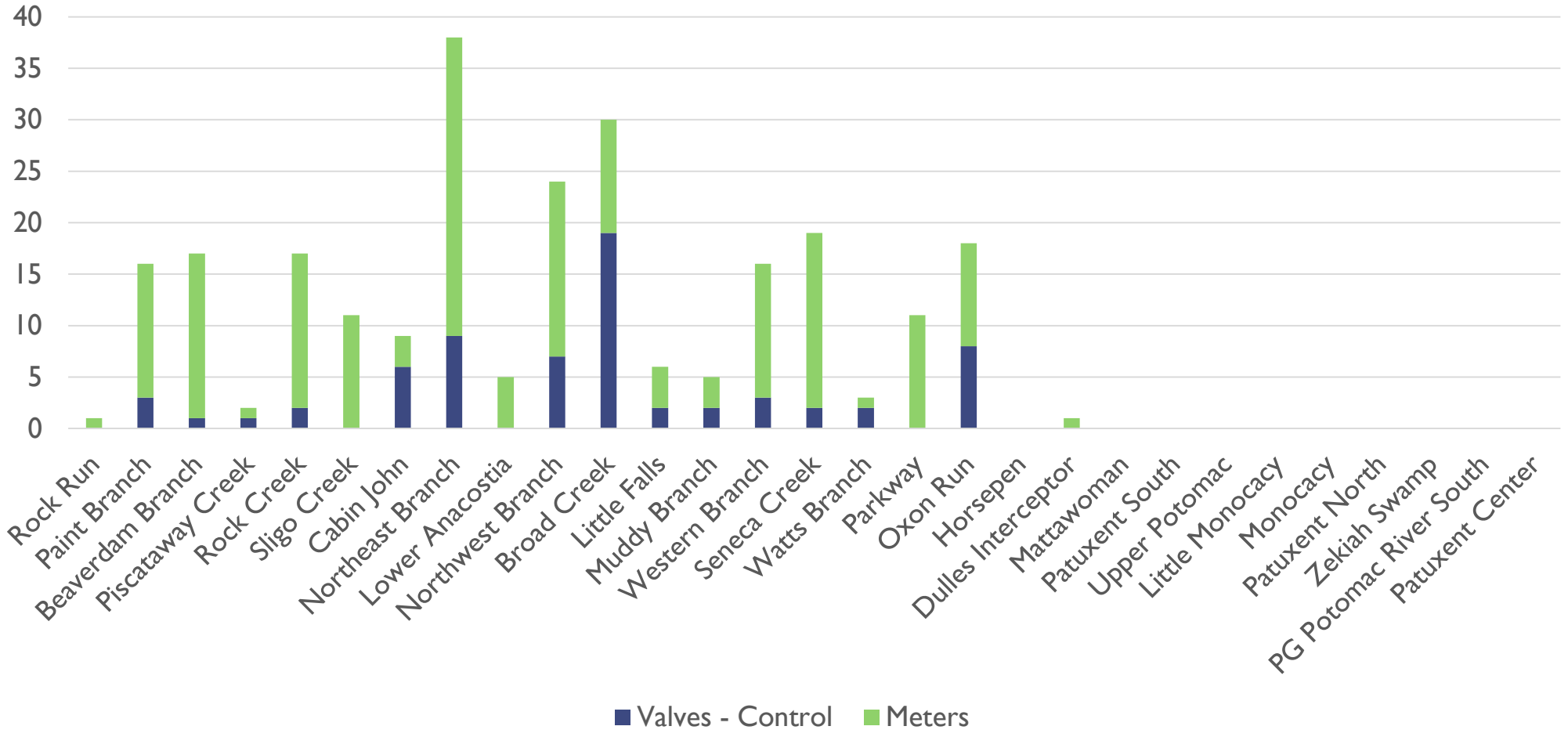
Water Screening – Total Number of Potentially Vulnerable Electrical and Mechanical (E/M) Assets (2065 100-year Event)



Linear Asset Screening – Top Ranked Sewer Basin Level Summary

- Larger number of potential RDII* points located across the service area
  - Condition assessment information needed to characterize RDII vulnerability

Sewer Basin	# of Water E/M Assets	# of Sewer E/M Assets	# of Potential RDII Source Assets
Paint Branch	16	1	2,892
Beaverdam Branch	17	5	1,385
Piscataway Creek	2	17	4,134
Rock Creek	17	4	6,112
Sligo Creek	11	2	1,728
Cabin John	9	5	3,497
Northeast Branch	38	3	2,778
Lower Anacostia	14	10	733
Northwest Branch	24	6	3,343
Broad Creek	30	12	2,966
Western Branch	16	4	7,926
Seneca Creek	19	17	4,728
Parkway	11	7	1,294
Oxon Run	18	4	1,270

Rainfall Dependent Inflow & Infiltration

Highlighted sub-basins are top ranked for potential impact to water and sewer E/M assets and inflow sources.

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Climate Change Design Guidelines

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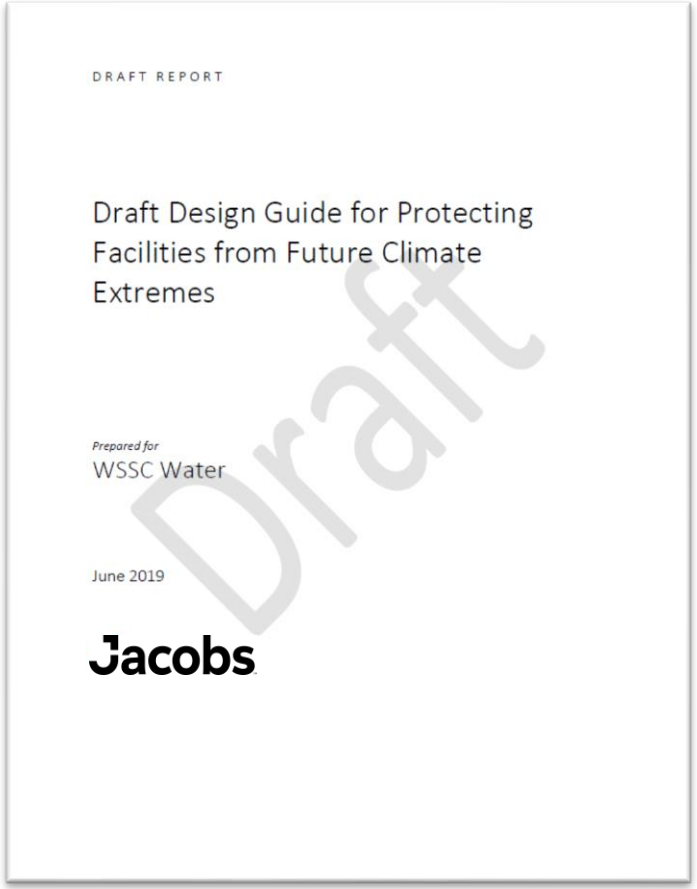
Design Guide for Protecting Facilities from Future Climate Extremes

- Guidance for flood protection criteria
  - Criteria for design of new facilities and protection of existing facilities
  - Outfall tailwater design elevations for treatment process
  - Site stormwater design guidance based on climate projections
- Guidance for resiliency of electrical and Instrumentation & Controls systems
- Greenhouse gas emissions reporting guidance for new projects



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Existing WSSC Water Flood Protection Guidance for Facilities

Facility Type	Guidance	Paragraph Reference
Drinking Water Facilities		
Water Supply & Treatment Plant Access Roads	Protect to at least the 100-year flood elevation or the maximum flood of record	2.20[a]
Water Pump Stations	Pumping station to be elevated to at least 3 feet above the 100-year flood level or highest known flood elevation, whichever is higher	6.1.1(a)[a]
Finished Water Storage	Lowest elevation of the floor and sump floor of ground level reservoirs shall be placed above the 100-year flood elevation or the highest flood of record, whichever is higher	7.0.2(a)[a]
Wastewater Facilities		
Wastewater Pump Stations	Protect from physical damage by the 100-year flood, should remain fully operational and accessible during the 25-year flood	41.1[b]
Wastewater Treatment Plants	Protect from physical damage by the 100-year flood, should remain fully operational and accessible during the 25-year flood	51.2[b]

[a] *Reference for water facility guidance is Recommended Standards for Water Works (10-States, 2012)*
[b] *Reference for wastewater facility guidance is Recommended Standards for Wastewater Facilities (10-States, 2014)*

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Basis of Recommended Standard

- ***Objective:*** *Protect WSSC assets for their entire service life*
  - *Resilience during flood events*
  - *Avoid costly equipment repairs/replacements*
- **Design Flood Elevation**
  - CCVAAMP Studied Facilities: 100-year 2065 water surface elevation + freeboard
  - Other Facilities: FEMA 100-year water surface elevation + freeboard + climate safety factor
- **Freeboard:**
  - American Society of Civil Engineers (ASCE) 24-14 Flood Resistant Design and Construction
  - Riverine = 1.0 foot, Coastal = 2.0 feet
- **Climate Safety Factor (S.F):**
  - Calculated based on comparison of existing to future water surface elevations in riverine and coastal areas
  - Riverine = 1.5 feet, Coastal = 2.0 feet

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Basis of Recommended Standard (contd.)

- *Objective: Protect WSSC assets for their entire service life*
- Design Flood Elevation

Facilities Studied in CCVAAMP	
Riverine	Modeled 2065 100-year WSEL + 1-foot freeboard
Coastal	Modeled 2065 100-year WSEL + 2-foot freeboard

Facilities Not Studied in CCVAAMP	
Zone A **(A, AE, A1-30, AH, AO, AR, A99)**	FEMA 100-year WSEL + 1.5-foot climate S.F. + 1-foot freeboard
Coastal Zone V & A **(V, VE, V1-30)**	FEMA 100-year WSEL + 2.0-foot climate S.F. + 2-foot freeboard

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Greenhouse Gas Reduction (Mitigation) Progress

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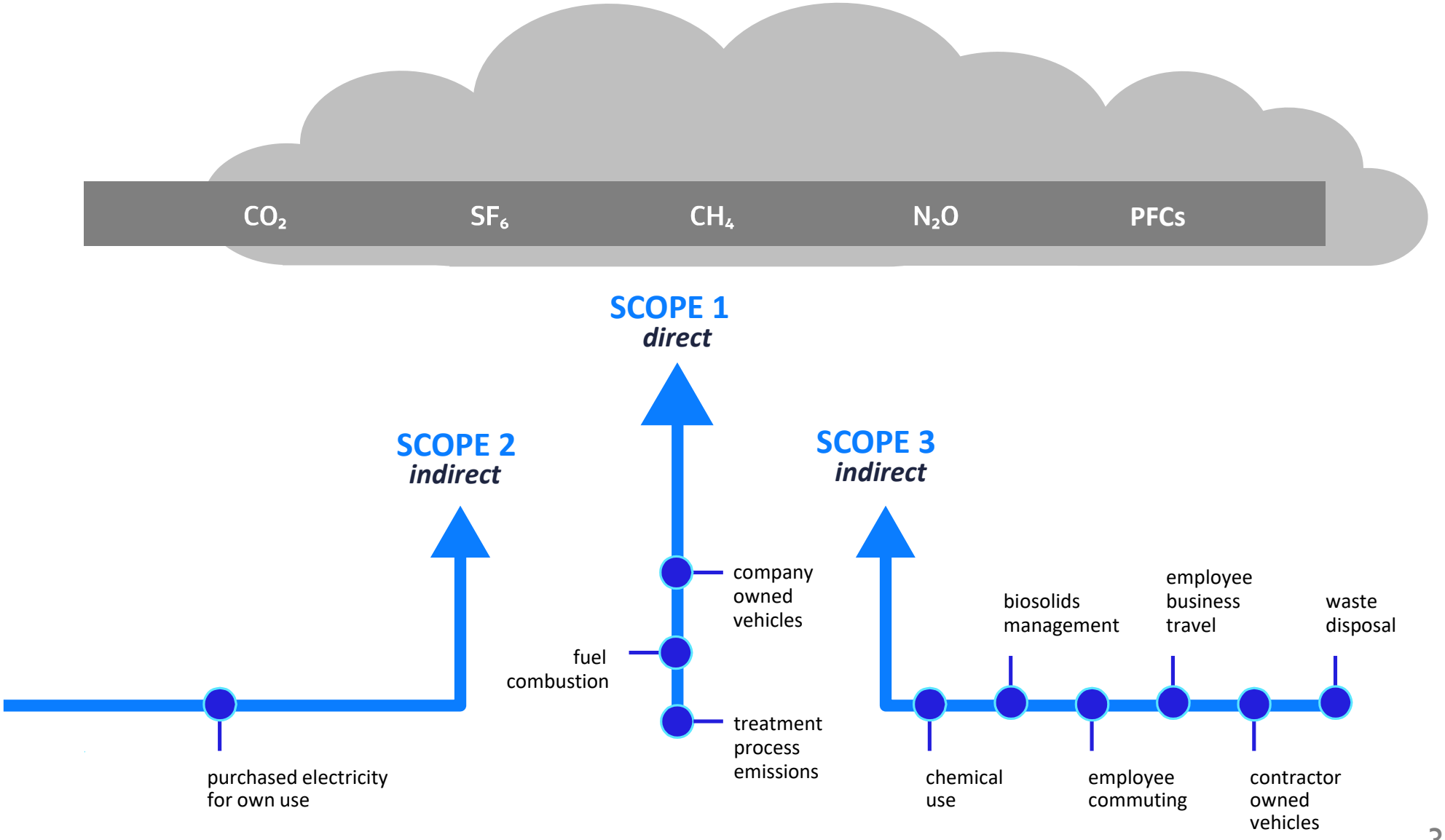
What the GHG inventory includes…



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WSSC Water GHG Reduction Goals

- WSSC's current GHG Reduction Goal:
  - 10% reduction every 5 years
  - 60% reduction from 2005 levels by 2035
  - 90% reduction from 2005 levels by 2050

- May be updated pending current legislation proposed in MD

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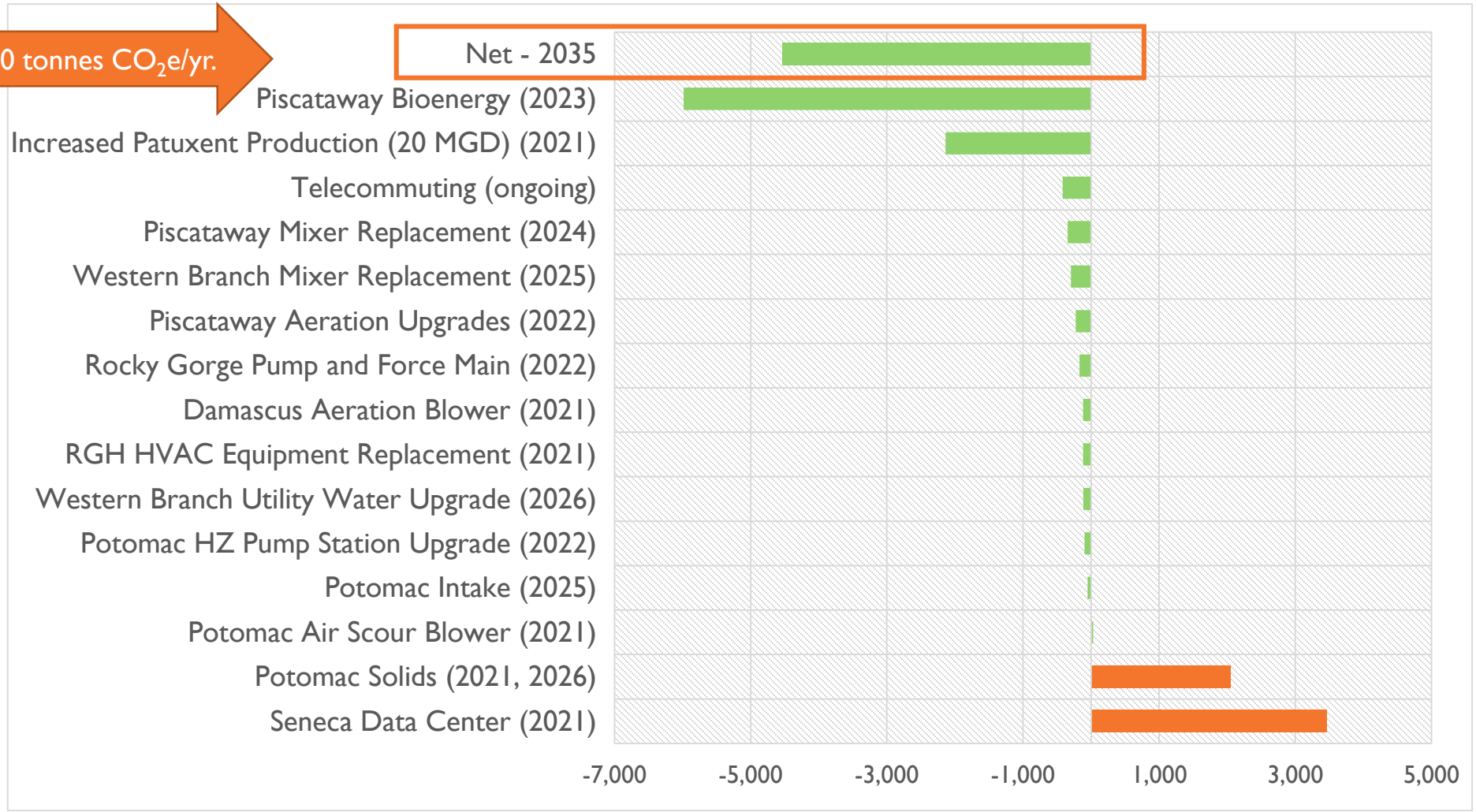
Emissions Impacts of Current Projects in 2035 (tonnes CO_2e/Yr)

Net: 4,530 tonnes CO_2e/yr.



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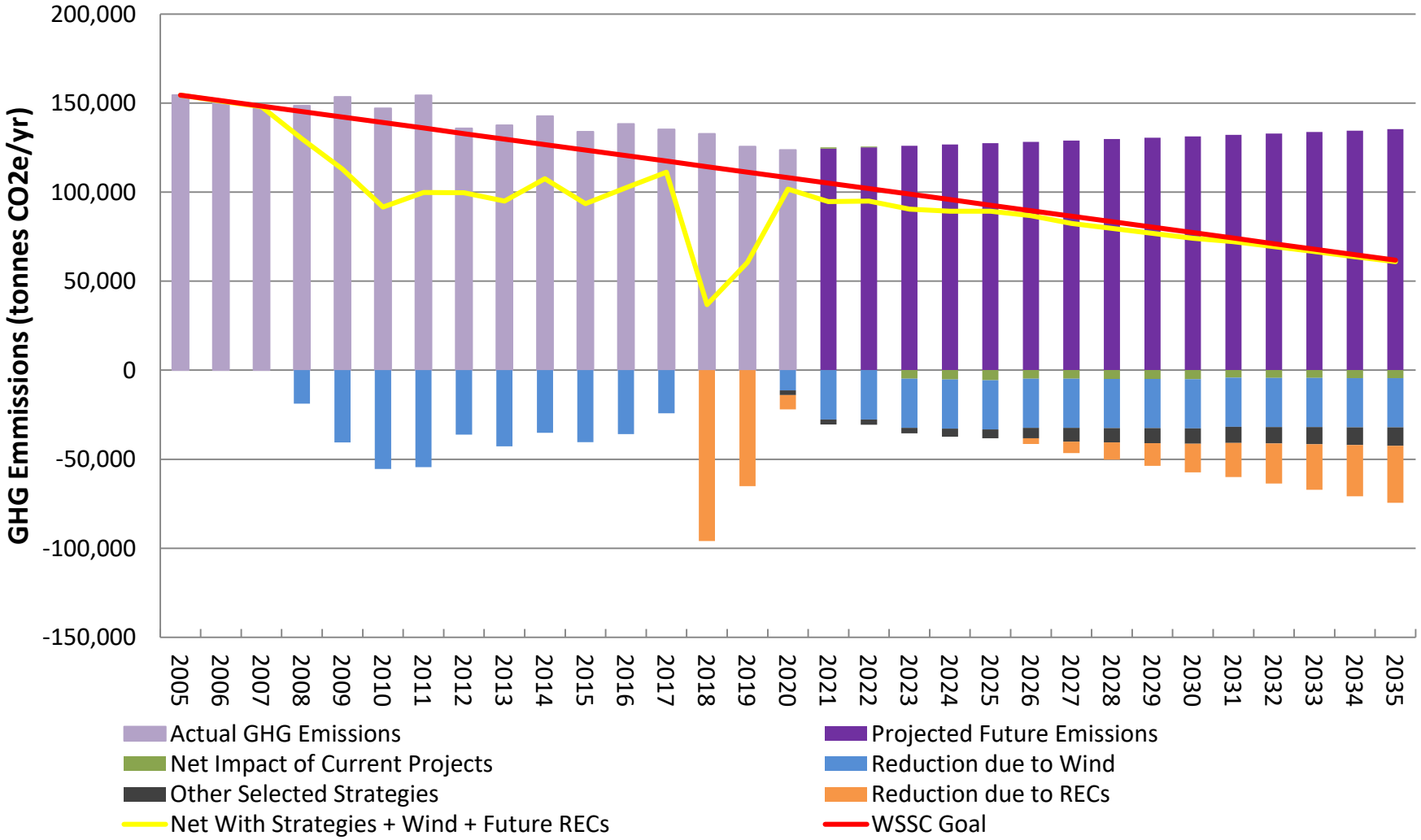
Projected Future Emissions, CIP Projects, and Wind/REC Purchase versus WSSC Reduction Goal



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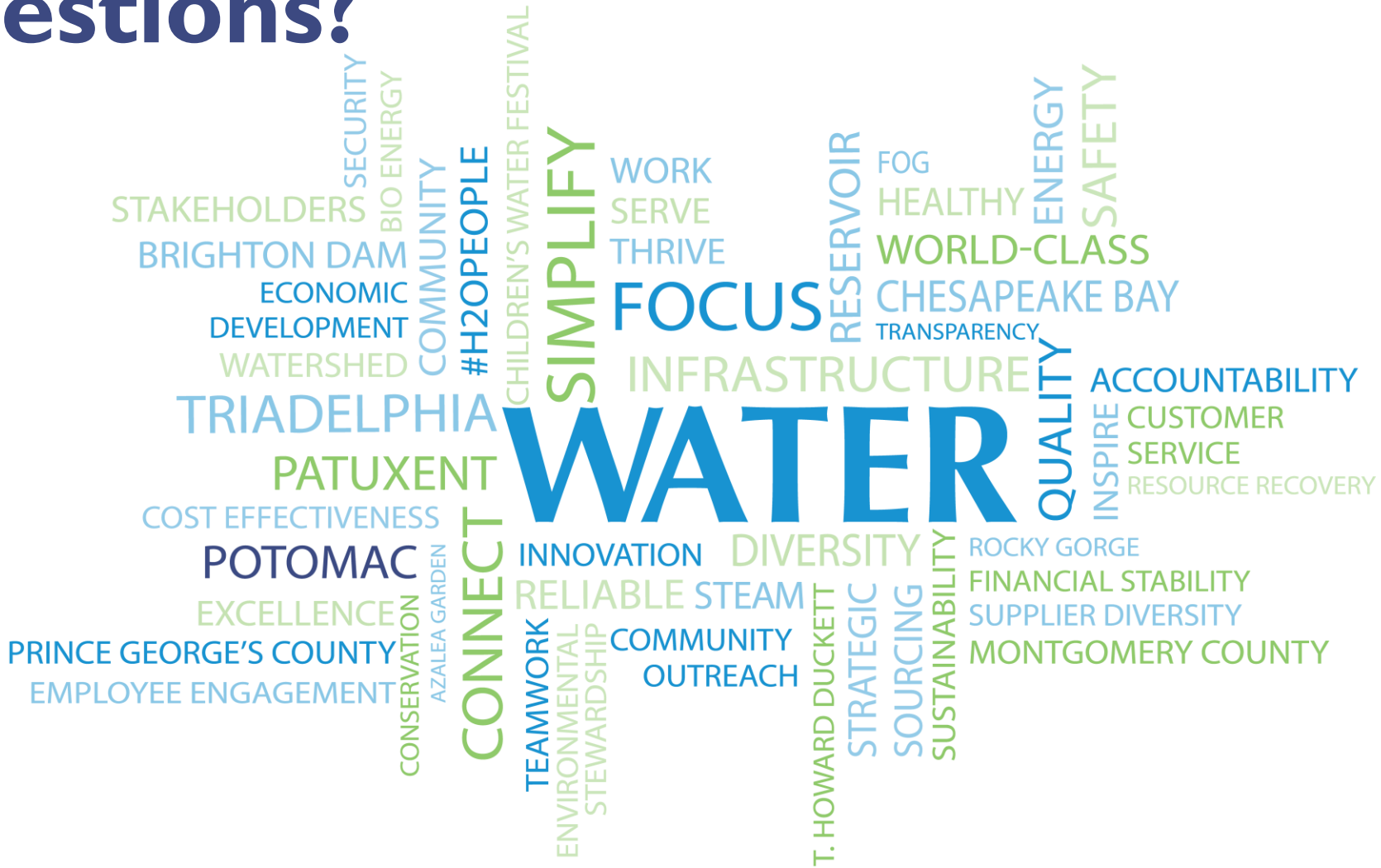
Questions?



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