

AGENDA
JAMES CITY SERVICE AUTHORITY BOARD OF DIRECTORS
RETREAT

JCSA OPERATIONS CENTER TRAINING ROOM
119 TEWNING ROAD, WILLIAMSBURG, VA 23188

January 24, 2025

12:00 PM

A. CALL TO ORDER

B. ROLL CALL

C. BOARD DISCUSSION/GUIDANCE

1. Rate Study
2. Water Supply Update
3. Sewer Capacity
4. Development Review

D. BOARD REQUESTS AND DIRECTIVES

E. CLOSED SESSION

F. ADJOURNMENT

1. Adjourn until 5 pm on February 11, 2025 for the Regular Meeting



James City Service Authority

Water & Sewer Rate Study

January 24, 2025





Agenda

- **Background and Summary of Prior Study**
- **Revenue Sufficiency & Rate Design**
- **Facility Fees**
- **Questions & Discussion**



Background & Summary of Prior Study





Summary of Historic Rate Increases

- **Structural Changes Implemented in FY 2021**
 - Based on results of FY 2020 Rate Study
 - Resulted in 4-tiered structure for water residential customers
- **Since then, modest increases to the water fixed and variable charges**
- **No increases to sewer charges**

Average Monthly Residential Bill	FY 2021	FY 2022	FY 2023	FY 2024
Water Bill (5,000 Gal/Mo)	\$ 26.29	\$ 27.22	\$ 28.16	\$ 29.16
Sewer Bill (5,000 Gal/Mo)	\$ 17.55	\$ 17.55	\$ 17.55	\$ 17.55
Total Bill (5,000 Gal/Mo)	\$ 43.84	\$ 44.77	\$ 45.71	\$ 46.71
\$ Change		\$ 0.93	\$ 0.94	\$ 1.00
% Change		2.12%	2.10%	2.19%

FY 2024 Revenue Sufficiency Study

Key Data Points & Policies:

- Develop a rate plan that recognized increases in capital and operating costs
- Maintain minimum reserve levels (Avg. of last 3 years exp.)
- Minimize rate increases to the greatest extent possible

Key Assumptions:

- Continued decreases in per capita water usage
- Modest system growth at around 1% annually
- System renewal and replacement fully cash funded
- Increased operational costs reflected in budget



Financial Pillars



Sustainable Funding From Rates
for Recurring Capital Needs



Increase Fiscal Stability &
Recovery of Fixed Costs



Maintaining Adequate Reserves
to Mitigate Risks & Plan Ahead

	TIC	All-In TIC	Arbitrage Yield
Par Value	139,035,000.00	139,035,000.00	139,035,000.00
+ Accrued Interest			
+ Premium (Discount)	6,637,303.05	6,637,303.05	6,637,303.05
- Underwriter's Discount	-493,387.01	-493,387.01	
- Cost of Issuance Expense		-733,671.87	
- Other Amounts			
Target Value	145,178,916.04	144,445,244.17	145,672,303.05
Target Date	10/19/2023	10/19/2023	10/19/2023
Yield	4.802478%	4.843685%	4.522296%





Summary of FY 2024 Study Results

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Water						
Average Single-Family Bill	\$29.16	\$31.94	\$34.90	\$38.09	\$40.36	\$41.56
Change (\$)		\$2.78	\$2.96	\$3.19	\$2.27	\$1.20
Change (%)		9.5%	9.3%	9.1%	6.0%	3.0%
Sewer						
Average Single-Family Bill	\$17.55	\$18.70	\$20.00	\$21.45	\$23.18	\$25.04
Change (\$)		\$1.15	\$1.30	\$1.45	\$1.73	\$1.86
Change (%)		6.6%	7.0%	7.3%	8.0%	8.0%
Combined						
Average Single-Family Bill	\$46.71	\$50.64	\$54.90	\$59.54	\$63.54	\$66.60
Change (\$)		\$3.93	\$4.26	\$4.64	\$4.00	\$3.06
Change (%)		8.4%	8.4%	8.5%	6.7%	4.8%

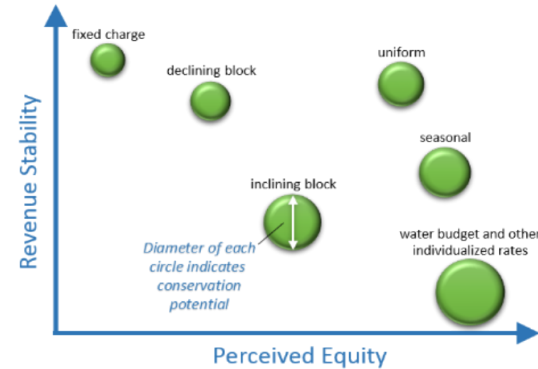
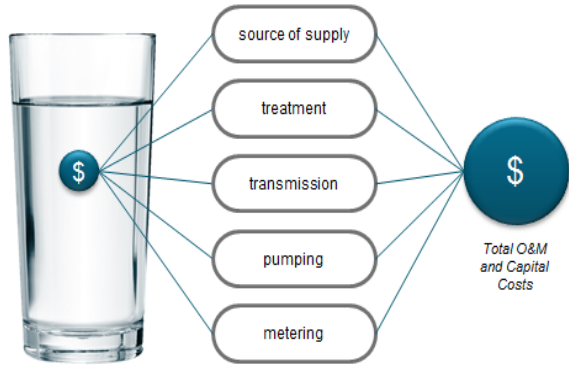


Current Rate Study





Elements of the Utility Rate Study Process



Revenue Sufficiency

How much total revenue is needed each year

Rate Structure

How to collect revenue from each customer class

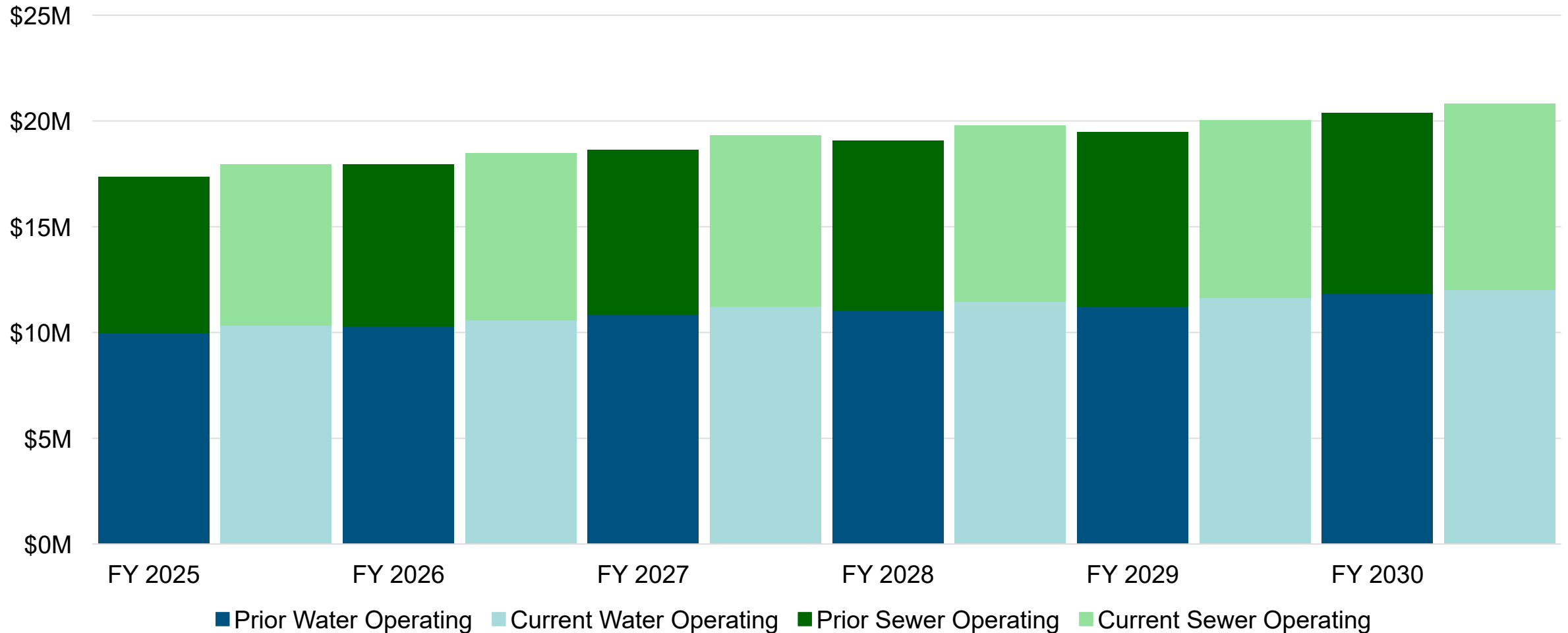
Facility Fees

How to recover **capacity costs** from development



Operating Costs Stabilizing

Comparison of FY 2024 and FY 2025 Rate Study Operating Costs





Examples of Increased Operational Costs

Chemicals

- Since 2022, has increased by 44.4%
- Hypo Unit Cost per Gallon increased 164.6% since 2020
- Caustic Soda cost per pound increased 90.0% since 2020

Electricity

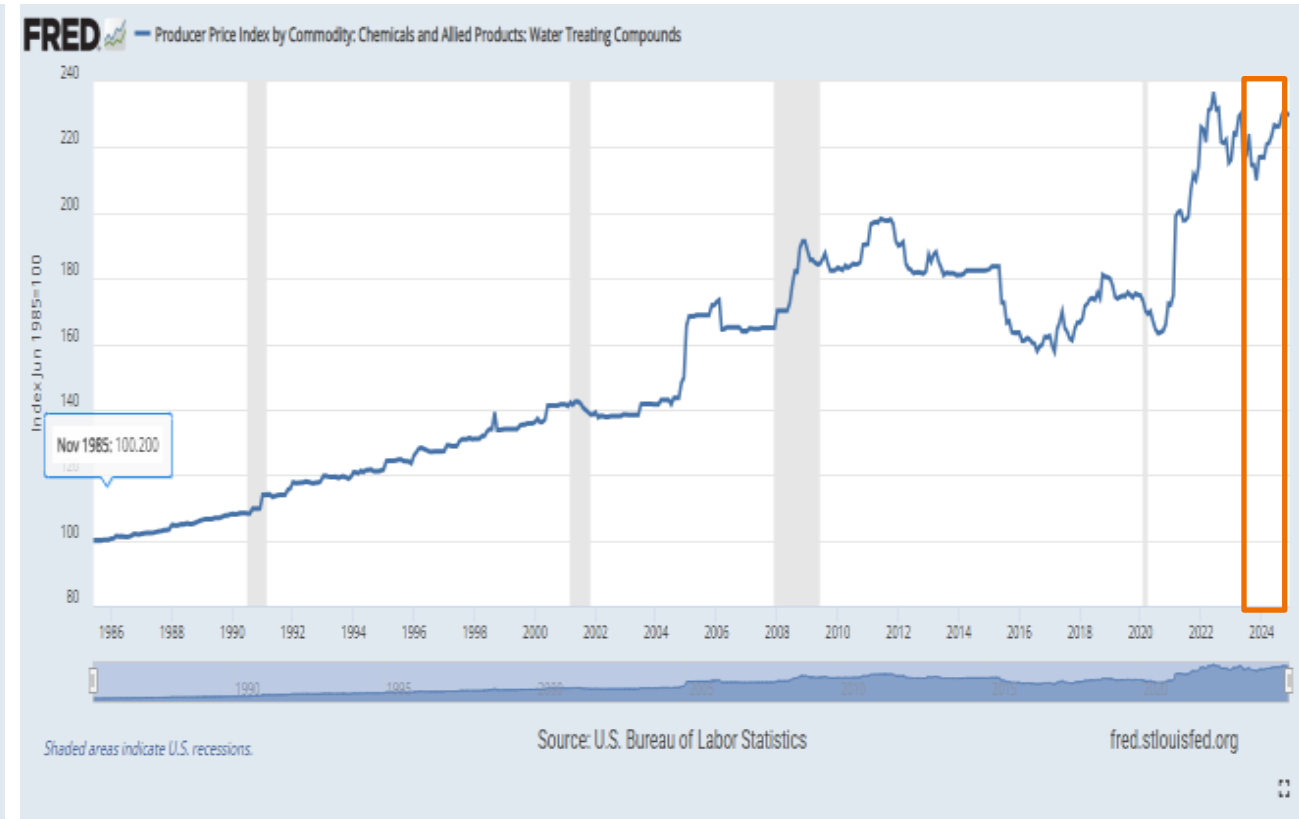
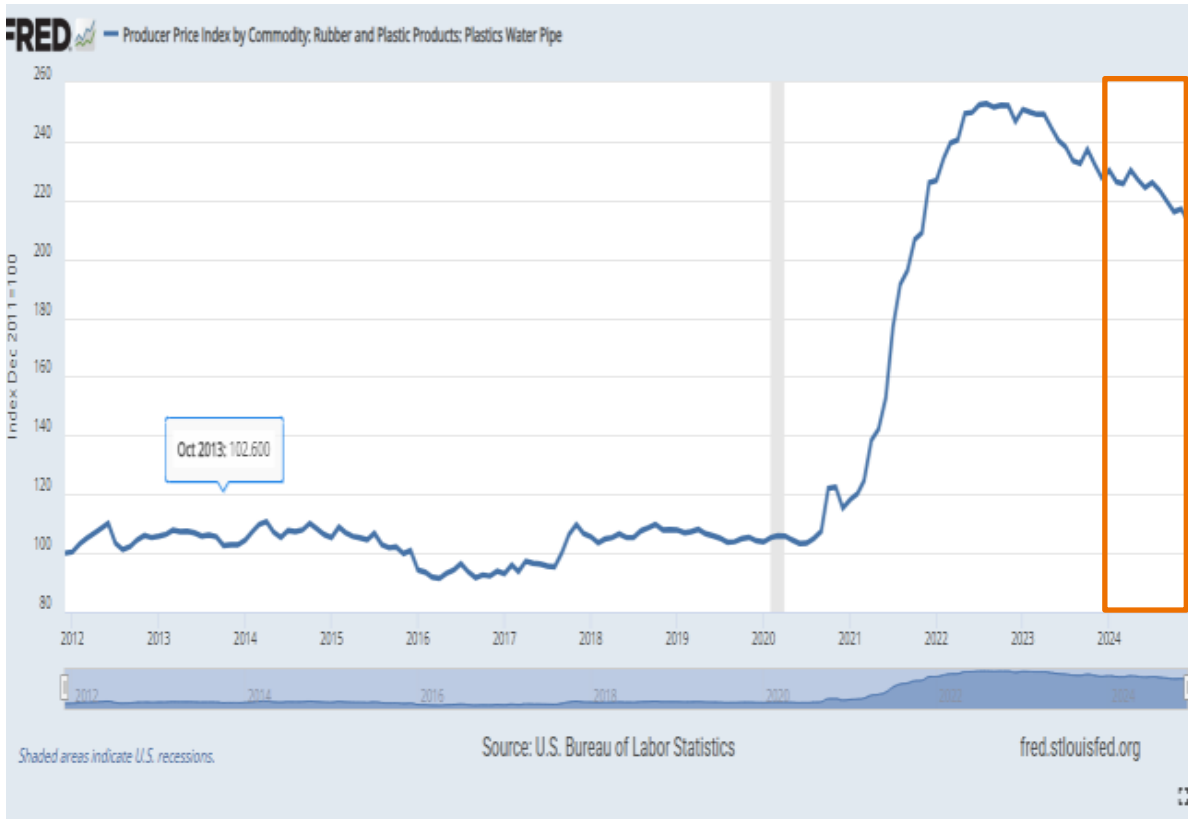
- Annual Water/Sewer Facility Expense
- 2024 increased 14.9% over 2023

Personnel

- Per ACFR:
 - 2023 increased 14.6% over 2022
 - 2024 increased 12.1% over 2023



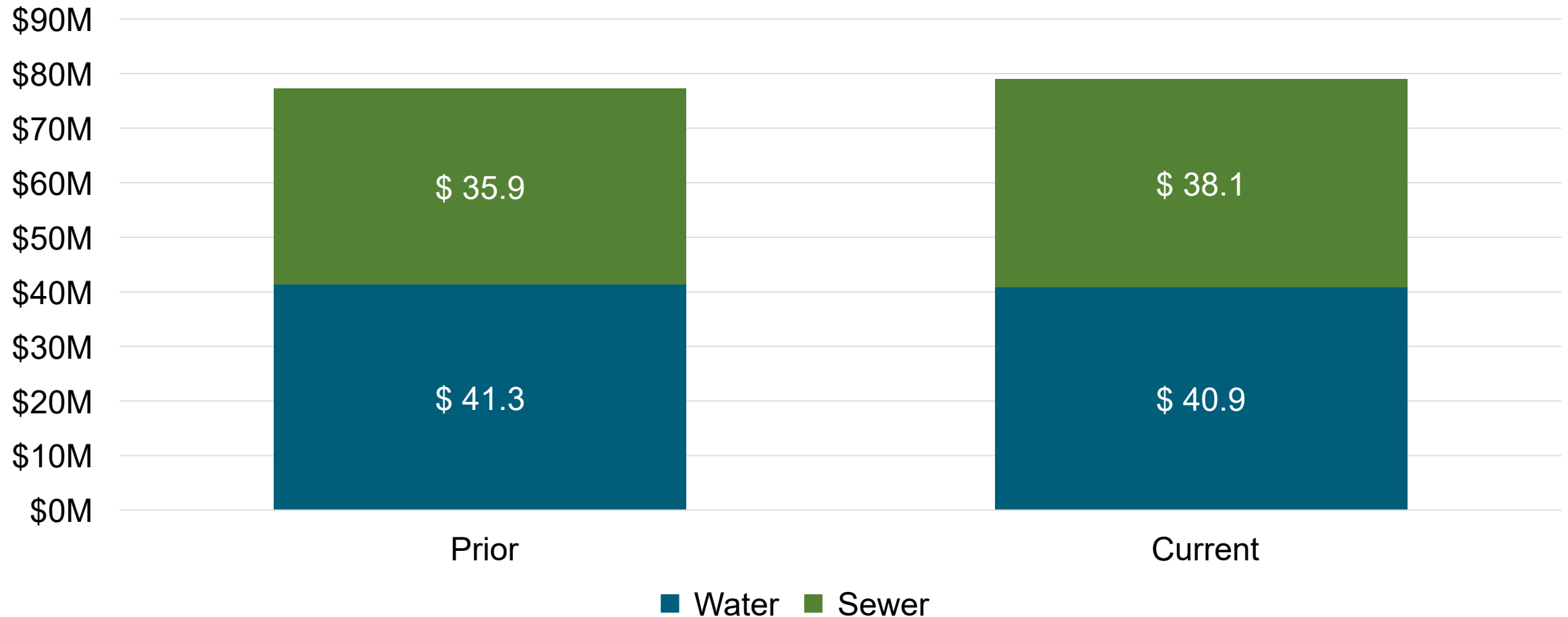
Operations/Material Cost Inflation





Capital Improvement Costs Still Major Driver

Current vs 10-Year CIP from FY 2024 Study





JCSA Examples of Increased Capital Costs

Cost Increases

- 2024 Five Forks Water Plant bid is 1.75X the 2021 estimate
- Liberty Ridge Water Main 2024 bid is 1.5X higher than the 2024 estimate
- Since 2020, PVC 8"x 20' increased 219% and 14' Push Joint sections increased 216%

Vehicle Challenges

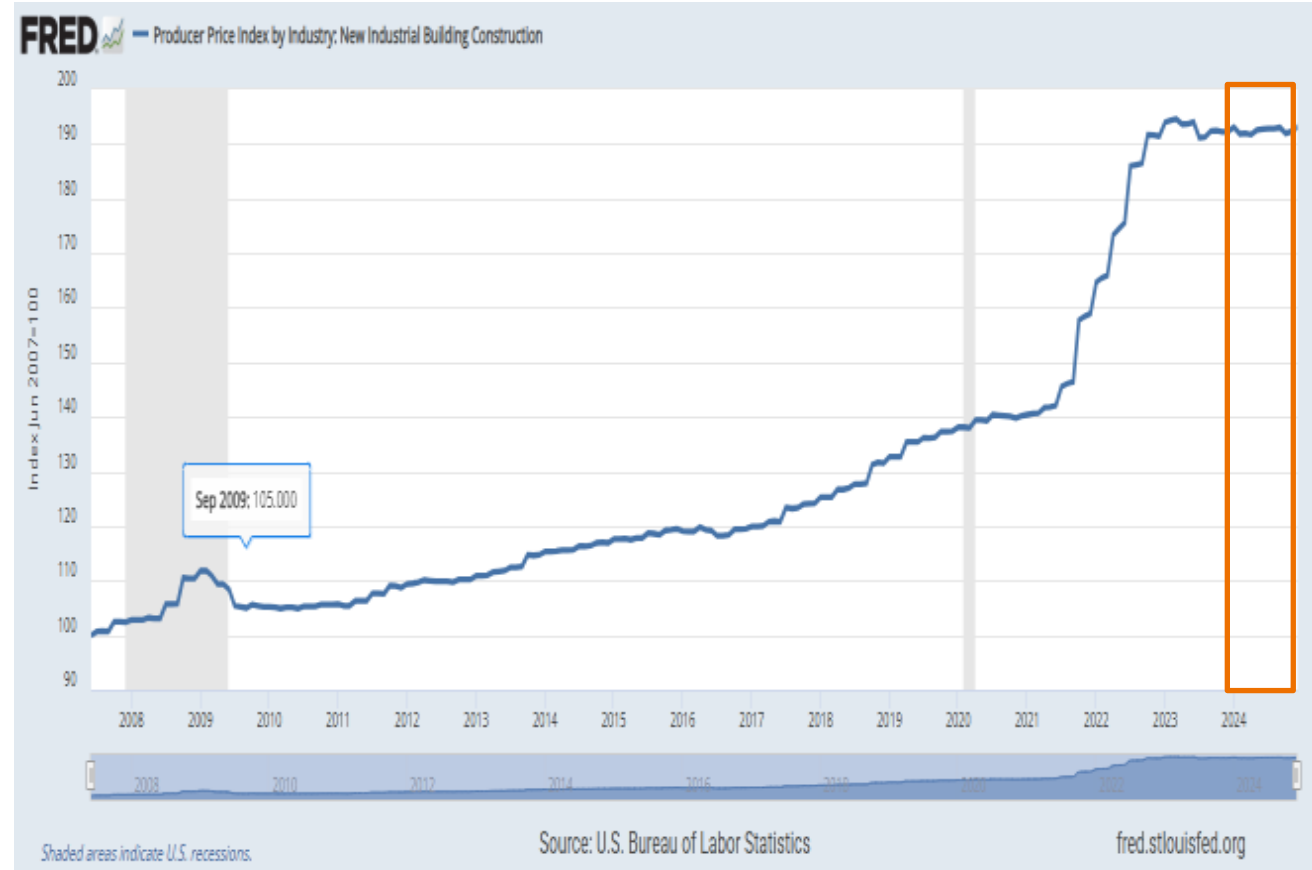
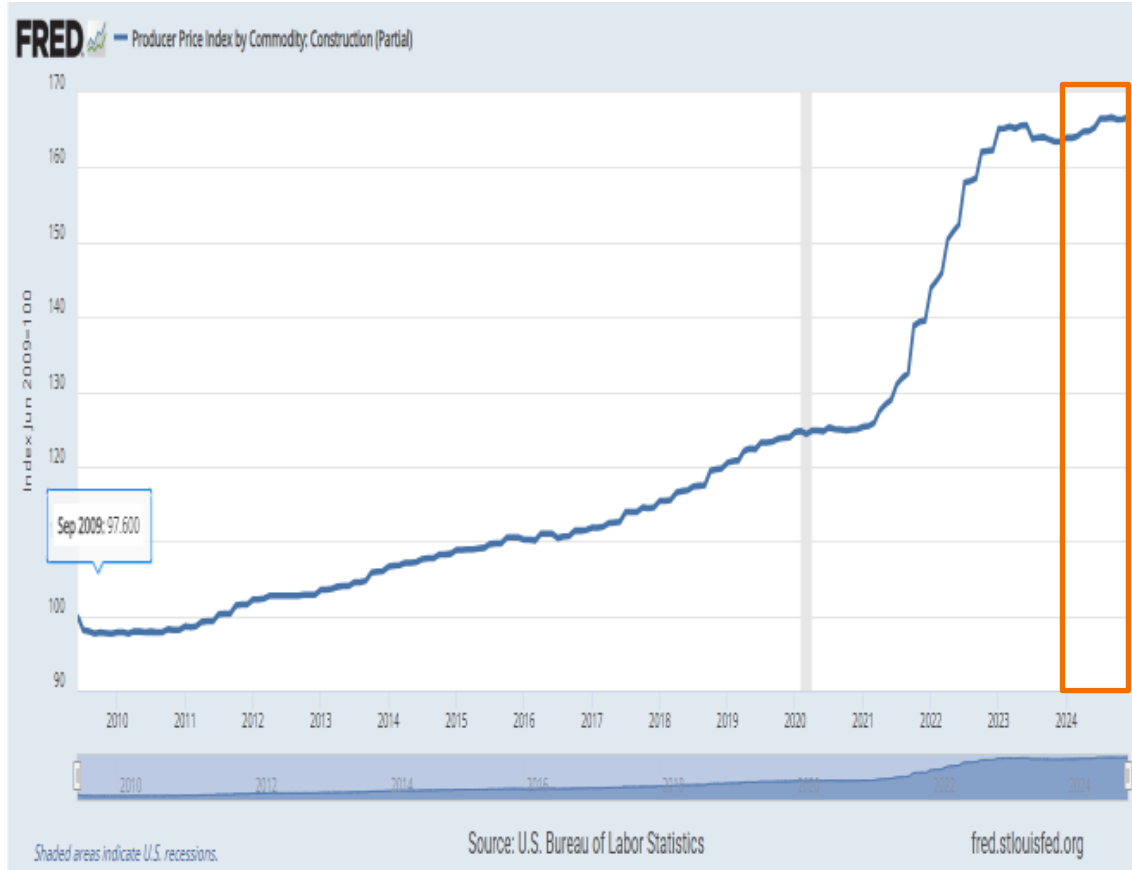
- Truck out of service in 2023; PO's were created in October 2023
- Trucks were delivered in October of 2024

Reduced Bidding

- Five Forks Water Plant Addition & College Creek Waterline Replacement received one bid
- LS 1-9 Replacement received no bids



Construction Cost Inflation





Key Model Inputs & Assumptions - Water

Assumption	Details
Growth	380 new annual accounts $\approx$ 1.2%
Reserve Targets	At a minimum, unrestricted cash and liquid investment reserves will be maintained at the average of the last three fiscal years' operating and maintenance expenses less depreciation plus debt service.
Debt Service Coverage	Target: 1.5x Minimum: 1.20x
Base Operating Budget	FY 2025 Revised Budget
Cost Escalation Factors	Applied to FY26 Budget and on Ex. Salaries = Annual Cost of Living Increases, Utilities= 4.0%
CIP Escalation	3% Compounding Escalation beginning in FY 2027
Funding Sources	System & Local Facility Fees, Cash



Water System Updated Rate Plan

	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
Variable Rate Plan* (\$)	\$4.20	\$4.45	\$4.72	\$4.86	\$5.01	\$5.16
Variable Rate Plan (%)		6.00%	6.00%	3.00%	3.00%	3.00%
Fixed Rate Plan (\$)	\$7.52	\$9.52	\$11.52	11.87	\$12.23	\$12.60
Fixed Rate Plan (%)		26.60%	21.01%	3.00%	3.00%	3.00%
% Rev from Fixed Charge	19.64%	22.90%	25.65%	25.92%	26.20%	26.48%

*Represents Residential Tier 1 Rates

Fixed rate plan increases the Fixed Charge by \$2 from FY 2026 – FY 2027
Larger increases to Fixed Rate Plan improves revenue stability



Water System Forecast

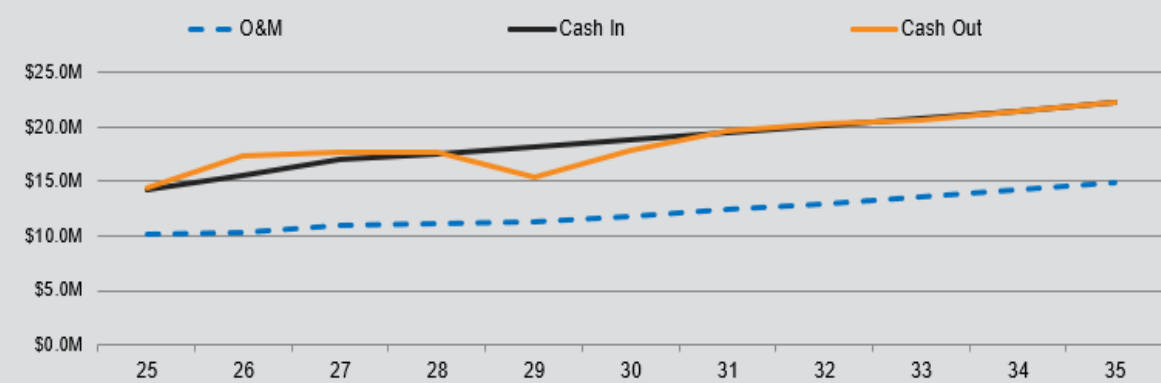
- Utility still experiencing impacts of increased costs, but appear to be stabilizing
- Higher short-term increases needed to increase fixed revenue recovery and meet targets
- Timing of capital spending will affect actual operating fund reserve balances

	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034	FY 2035
Variable Charges Rate Plan	5.50%	6.00%	6.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Last Plan	5.50%	6.00%	6.50%	6.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	0.00%
Fixed Charges Rate Plan	24.90%	26.60%	21.01%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Last Plan	24.90%	19.90%	16.60%	6.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	0.00%

Operating Fund



Revenues vs. Expenses



Last Plan (Green) shows results of FY 2024 study



Key Model Inputs & Assumptions - Sewer

Assumption	Details
Growth	394 new annual accounts $\approx$ 1.4%
Reserve Targets	At a minimum, unrestricted cash and liquid investment reserves will be maintained at the average of the last three fiscal years' operating and maintenance expenses less depreciation plus debt service.
Debt Service Coverage	Target: 1.5x Minimum: 1.20x
Base Operating Budget	FY 2025 Revised Budget
Cost Escalation Factors	Applied to FY26 Budget and on Ex. Ex. Salaries = Annual Cost of Living Increases, Utilities= 4.0%
CIP Escalation	3% Compounding Escalation beginning in FY 2027
Funding Sources	System & Local Facility Fees, Cash



Sewer System Updated Rate Plan

	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
Variable Rate Plan (\$)	\$3.14	\$3.14	\$3.27	\$3.47	\$3.68	\$3.90
Variable Rate Plan (%)		0.00%	4.00%	6.00%	6.00%	6.00%
Fixed Rate Plan (\$)	\$3.01	\$6.02	\$7.22	\$7.65	\$8.11	\$8.60
Fixed Rate Plan (%)		100.00%	20.00%	6.00%	6.00%	6.00%
% Rev from Fixed Charge	16.56%	28.67%	31.93%	32.23%	32.53%	32.83%

Fixed rate plan increases the Fixed Charge by \$3 in FY 2026

Larger increases to Fixed Rate Plan improves revenue stability

Sewer System Results

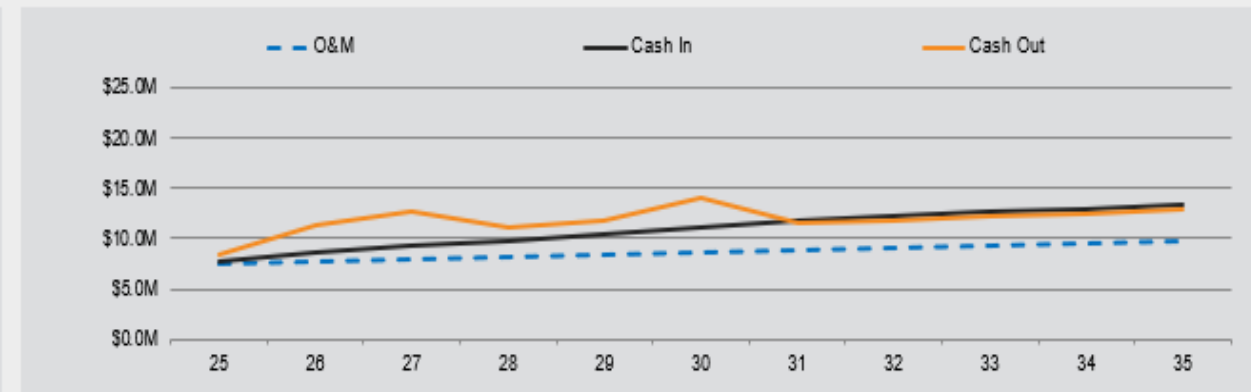
- Utility still experiencing impacts of increased costs
- Higher short-term increases needed to increase fixed revenue recovery and meet targets
- Timing of capital spending will affect actual operating fund reserve balances

	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034	FY 2035
Variable Charges Rate Plan	0.00%	0.00%	4.00%	6.00%	6.00%	6.00%	6.00%	3.00%	3.00%	3.00%	3.00%
Last Plan	1.00%	2.00%	4.00%	8.00%	8.00%	8.00%	8.00%	3.00%	3.00%	3.00%	3.00%
Fixed Charges Rate Plan	0.00%	100.00%	20.00%	6.00%	6.00%	6.00%	6.00%	3.00%	3.00%	3.00%	3.00%
Last Plan	50.00%	33.33%	20.00%	8.00%	8.00%	8.00%	8.00%	3.00%	3.00%	3.00%	3.00%

Operating Fund

Revenues vs. Expenses

Expenses by Type



Last Plan (Green) shows results of FY 2024 study



Summary

	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
Water						
Average Single-Family Bill	\$31.94	\$35.40	\$38.96	\$40.13	\$41.35	\$42.59
Change (\$)	\$2.78	\$3.46	\$3.56	\$1.17	\$1.22	\$1.24
Change (%)	9.5%	10.8%	10.1%	3.0%	3.0%	3.0%
Sewer						
Average Single-Family Bill	\$18.71	\$21.72	\$23.57	\$25.00	\$26.51	\$28.10
Change (\$)	\$1.16	\$3.01	\$1.85	\$1.43	\$1.51	\$1.59
Change (%)	6.6%	16.1%	8.5%	6.1%	6.0%	6.0%
Combined						
Average Single-Family Bill	\$50.65	\$57.12	\$62.53	\$65.13	\$67.86	\$70.69
Change (\$)	\$3.94	\$6.47	\$5.41	\$2.60	\$2.73	\$2.83
Change (%)	8.4%	12.8%	9.5%	4.2%	4.2%	4.2%

Expense of Potable Water

Comparing the cost of filling an average size swimming pool (10,000 gallons) with JCSA potable water against many other commodities in the marketplace

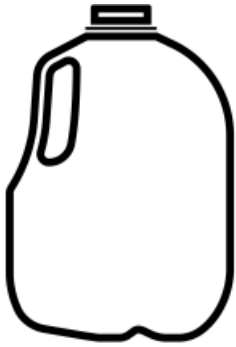
- \$85 to fill with JCSA Water
- \$10,000 to fill with Zephyrhills bottled water from the grocery store
- \$23,700 to fill with Coca-Cola or Pepsi from a 2L bottle
- \$30,000 to fill with milk
- \$40,000 to fill with gasoline
- \$100,000 to fill with bottled beer
- \$320,000 to fill with Starbucks coffee
- \$2,200 with topsoil from Home Depot in 40-pound bags



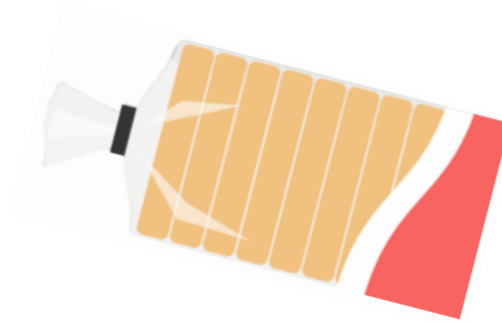
JCSA Potable Water is in fact cheaper than dirt



1,000 gallons = \$4.20 ... or ...



1 gallon of milk = \$3.98



1 loaf of bread = \$2.75



1 slice of pizza = \$3.50



Starbucks coffee = \$5.25



Box of cereal = \$ 3.25



Local Residential Water Bill Comparison

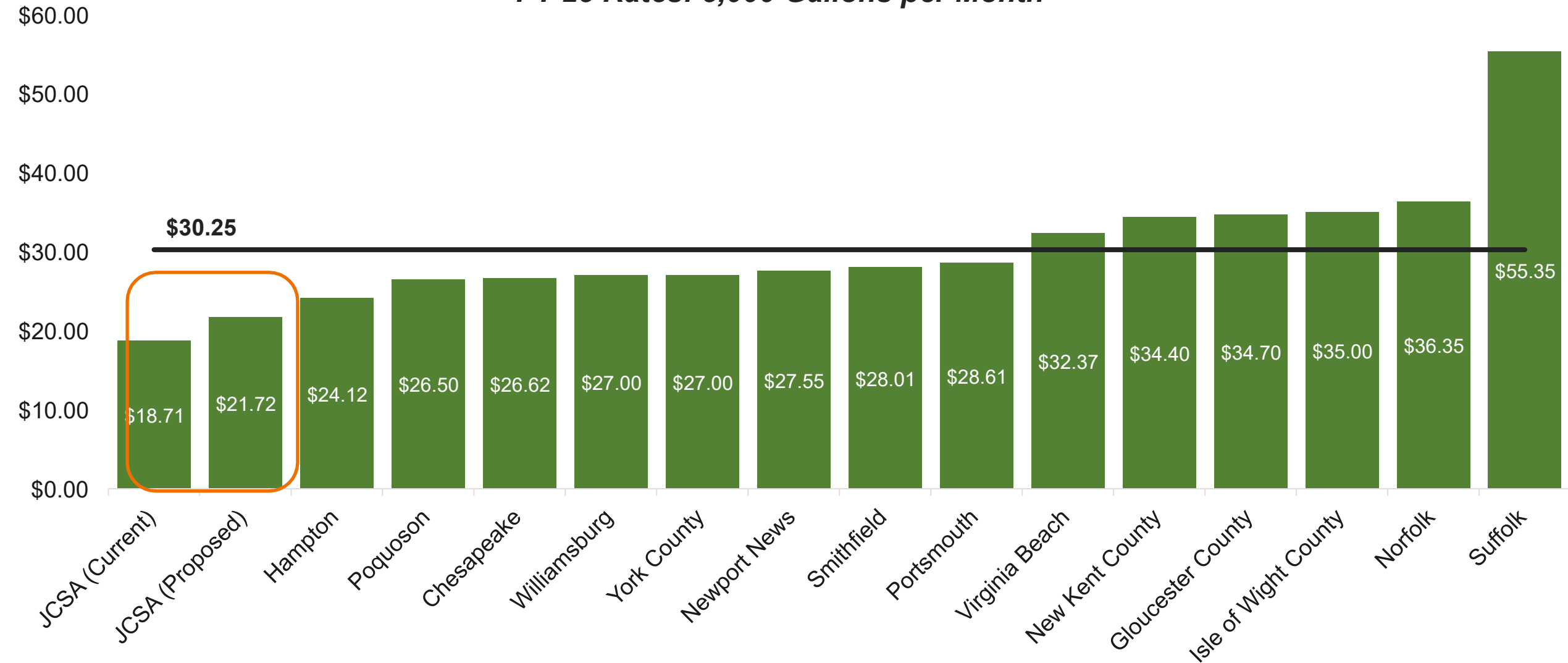
FY 25 Rates: 5,000 Gallons per Month





Local Residential Sewer Bill Comparison

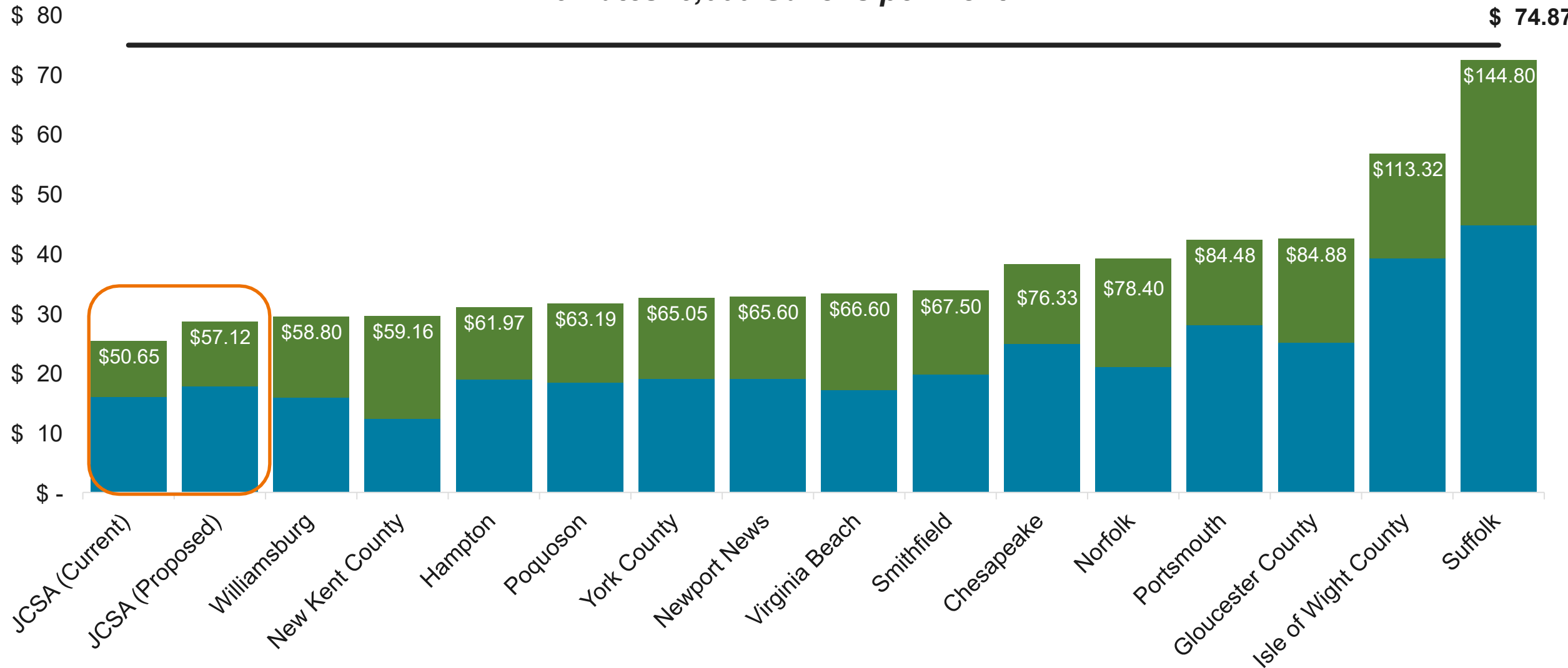
FY 25 Rates: 5,000 Gallons per Month



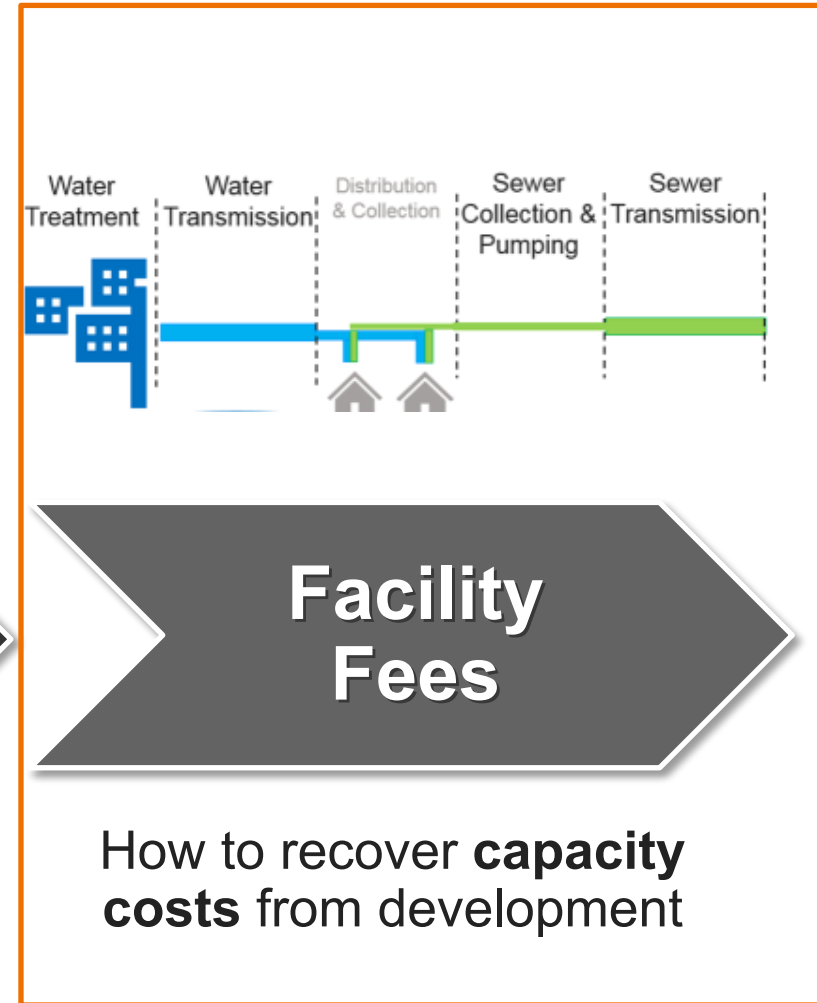
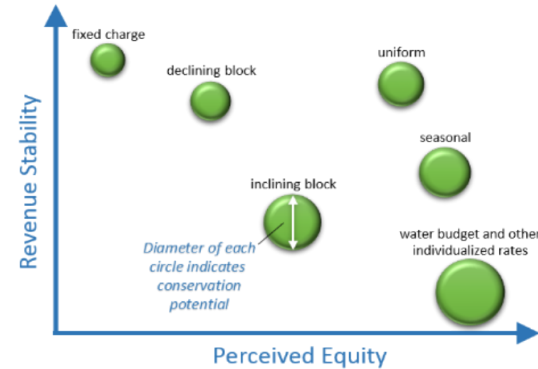
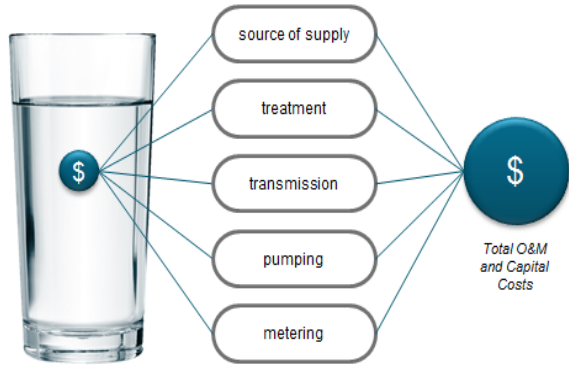


Local Residential Water & Sewer Bill Comparison

FY 25 Rates: 5,000 Gallons per Month



Elements of the Utility Rate Study Process



Revenue Sufficiency

How much total revenue is needed each year

Rate Structure

How to collect revenue from each customer class

Facility Fees

How to recover **capacity costs** from development



System Facility Fees

Overview & Observations

- System facility fees are levied against new growth in the service area in order to defray the cost of system expansion and have “growth pay for growth”
- The Authority currently assesses the system facility charge based on the meter size serving the connection
- Current Fees have not increased since 2020

Recommendations

- Update the fees to reflect the cost of the system infrastructure in current dollars



Methodologies

Equity Buy-In Approach

- Cost of existing major functional components as cost basis
- Appropriate when excess capacity in existing system

Marginal Cost Approach

- Capacity-adding projects in CIP as cost bases
- Appropriate when future capacity needed to serve growth

Hybrid Approach

- Appropriate when excess capacity in existing system, but additional capacity needed in near term
- CIP includes capacity-adding projects, but is not reflective of a total system



System Facility Fee Calculation

$$\text{System Facility Fee} = \frac{\text{System Value}}{\text{System Capacity}} - \text{Credits}$$

1) System Value:

- a) Existing system value + Expansion-related CIP
- b) Plus, associated borrowing costs
- c) Less, grant funded and contributed capital

2) System Capacity:

- Existing system capacity + Expansion-related capacity

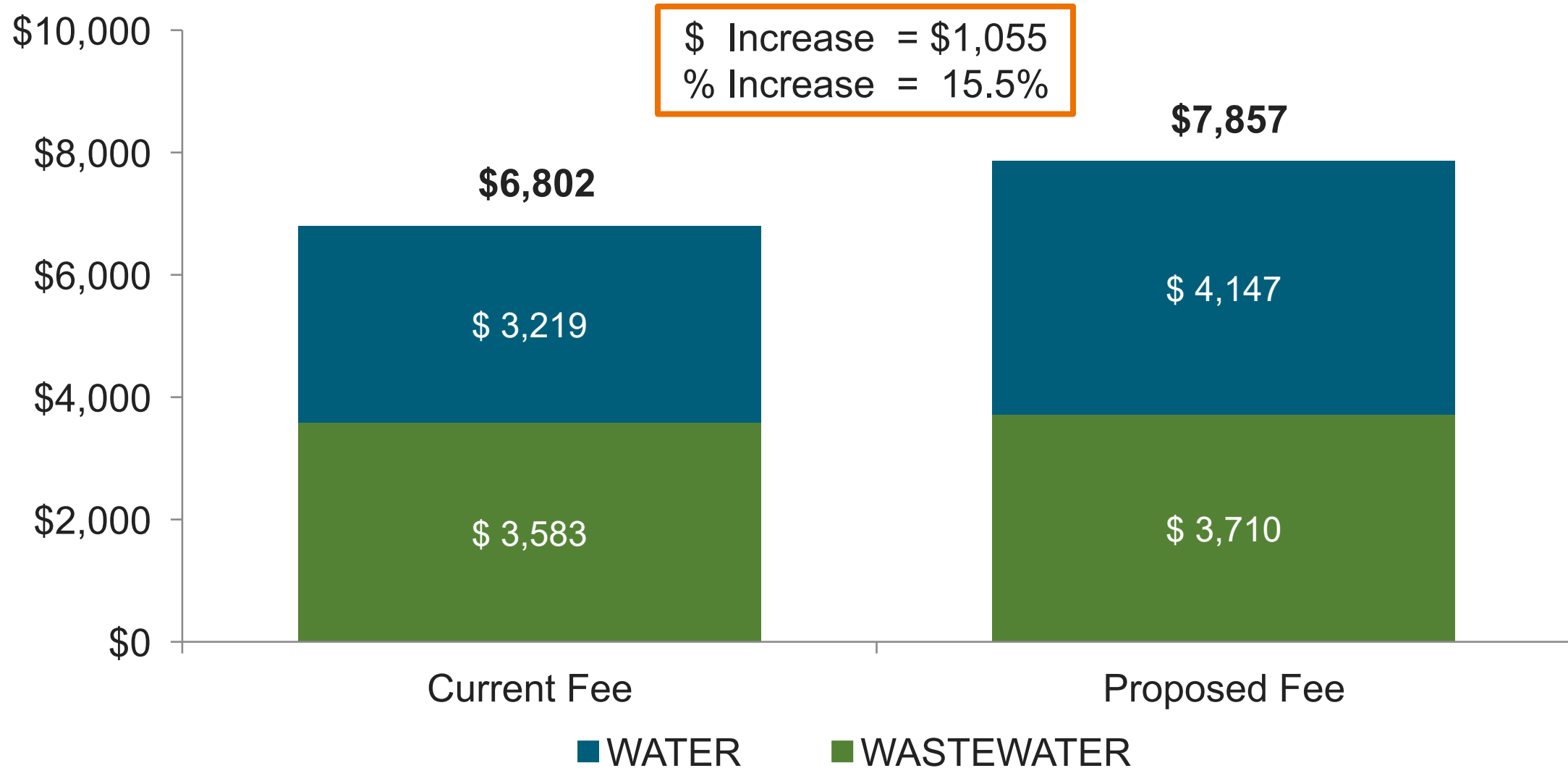
3) Credits:

- Avoids double-recovery of debt service from user charges

** Includes 3.84% inflation to FY25, based on 5-year ENR average*

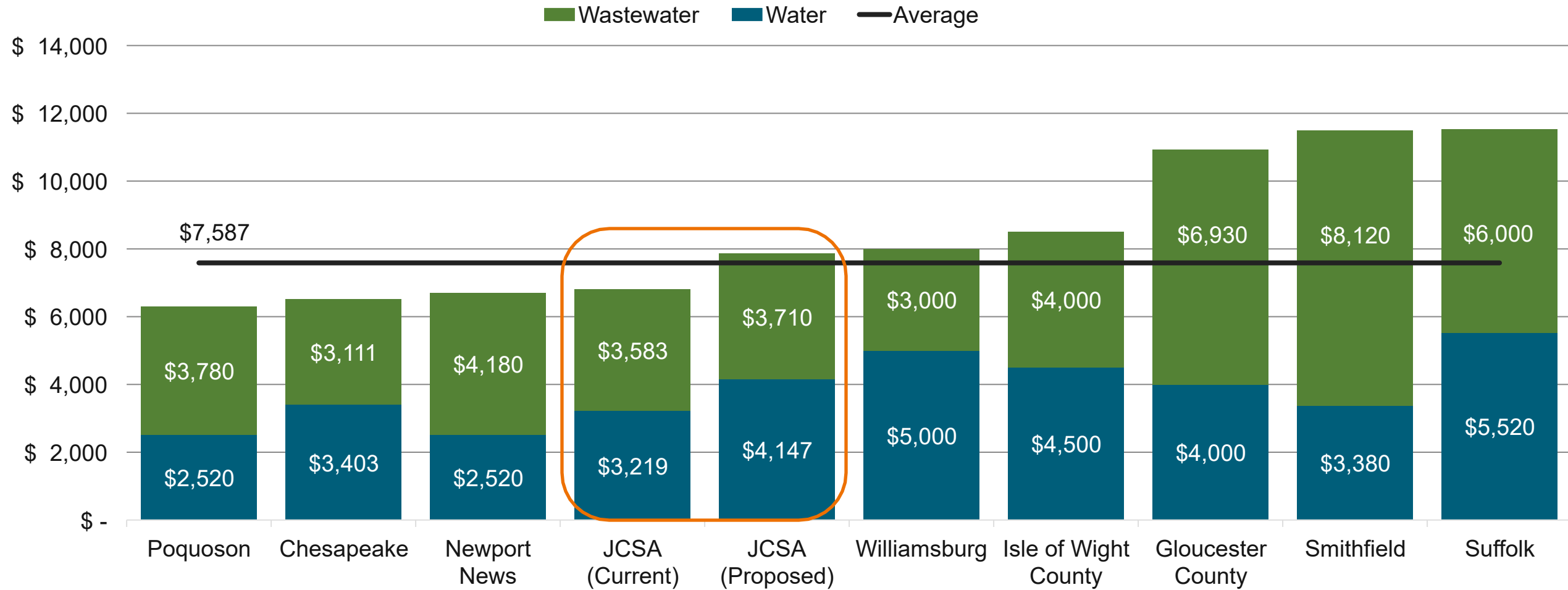


Facility Fee Results





Benchmarking





Summary of Recommendations

- **Recommend larger near-term rate increases for water and sewer fund to maintain fund balances and meet reserve targets**
- **Targeted increases on fixed charge promotes revenue stability**

Combined Water / Sewer	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
Average Single-Family Bill	\$50.65	\$57.12	\$62.53	\$65.13	\$67.86	\$70.69
Change (\$)		\$6.47	\$5.41	\$2.60	\$2.73	\$2.83
Change (%)		12.8%	9.5%	4.2%	4.2%	4.2%

- **Recommend updating system facility fees to reflect the cost of the system infrastructure in current dollars**

System Facility Fee	Current	Proposed	Change (\$)	Change (%)
Water	\$3,219	\$4,147	\$928	28.8%
Sewer	\$3,583	\$3,710	\$127	3.5%
Combined	\$6,802	\$7,857	\$1,055	15.5%

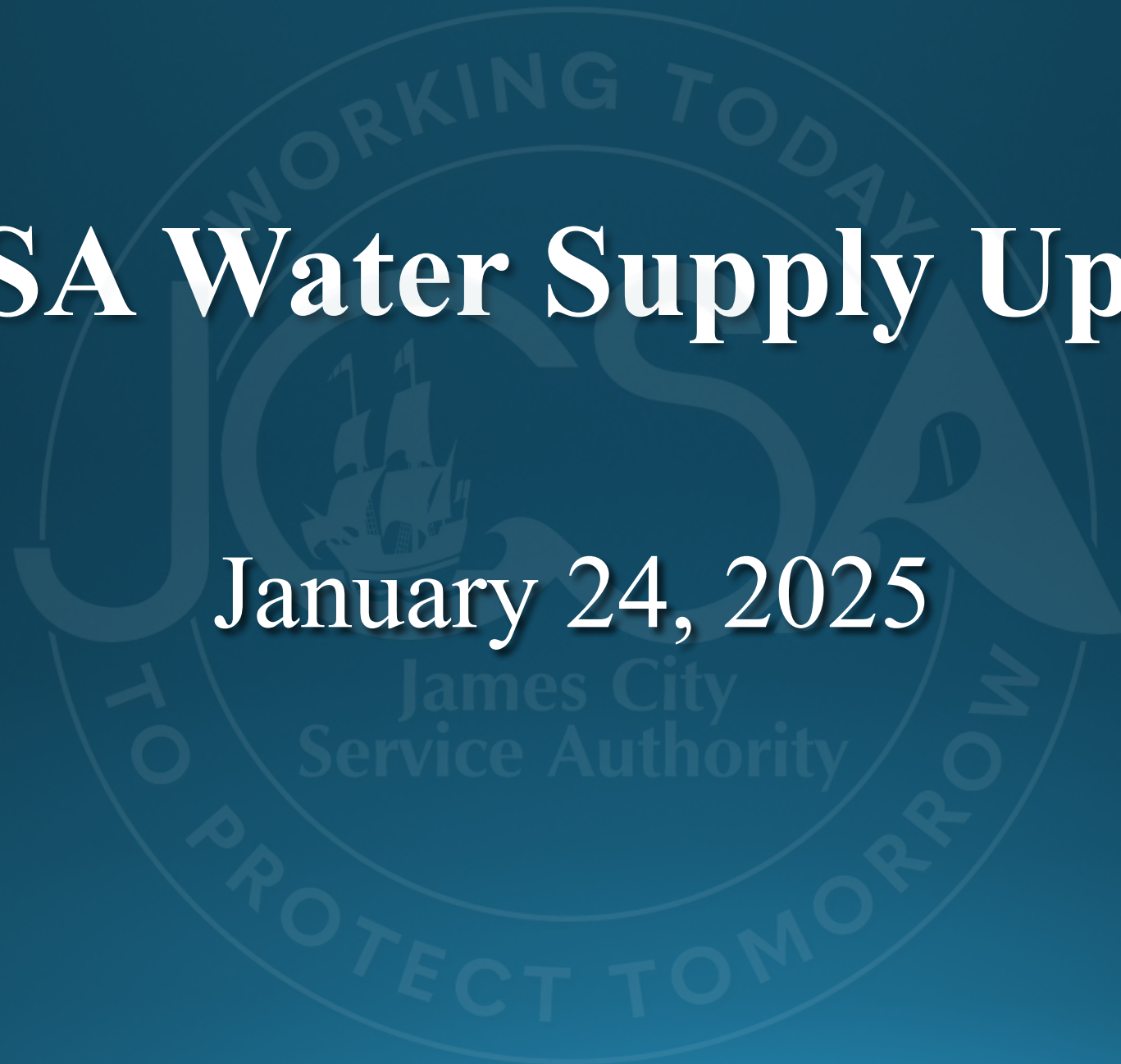
Questions & Discussion



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Vice President
andrew.burnham@stantec.com

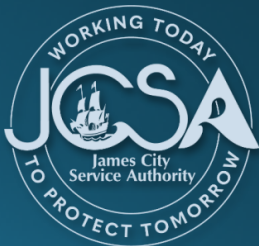
JCSA Water Supply Update

January 24, 2025

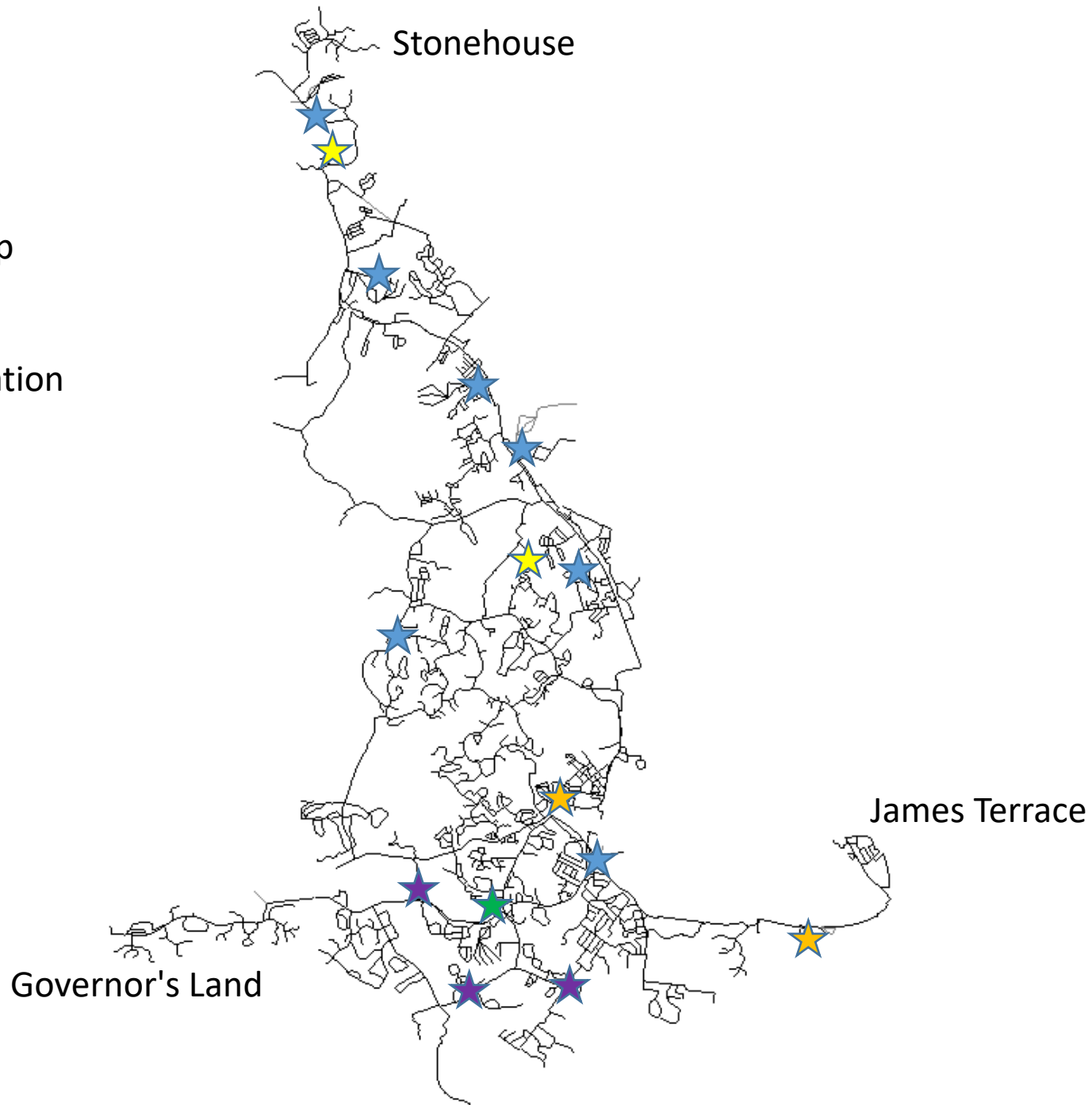


JCSA Central System – Sources of Supply

- Five Forks Water Treatment Plant – 5 MGD
 - 5 Wells – 3 Lower Potomac, 2 Middle Potomac
- Remote Facilities – 5 MGD
 - 7 Well Facilities (will be 8 once Liberty Ridge and Westport are connected and the Pottery well is abandoned).
 - 14 Wells – 3 Potomac, 11 Chickahominy/Piney Point
- Newport News Interconnect
 - 2 MGD Purchased Water Agreement

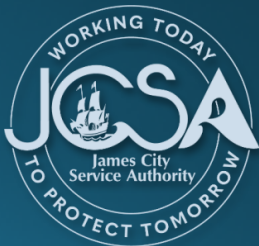


- ★ Well Facility
- ★ Elevated Storage
- ★ Storage/Booster Pump
- ★ Five Forks WTP
- ★ Pressure Reducing Station



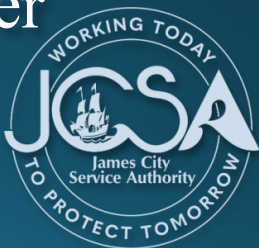
JCSA Central System - Current Status

- DEQ GW Withdrawal Permit Expires February 6, 2027
 - Tiered Limit: 8.4 mgd (annual avg.); 11.76 mgd (max month)
- VDH Permit
 - Design Capacity: 9.973 mgd (in process of updating)
- System Withdrawal (2020-2024)
 - Average: 5.30 mgd (63% of GW Permit Limit)
 - Max Month: 7.35 mgd (63% of GW Permit Limit)
- System Demand (2020-2024)
 - Average: 4.77 mgd
 - Max Month: 6.65 mgd



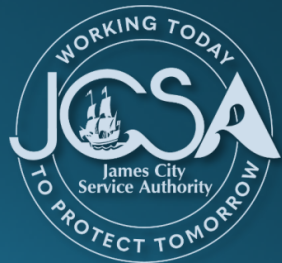
JCSA Central System - Current Status

- Growth continues at approximately 325 new connections per year.
- Declining usage trend continues and has offset increased demands associated with growth.
- Seasonal irrigation accounts for approximately 25% of water used annually.
- Projections indicate that JCSA can operate under its current GW Permit limits for 20+ years.
- As required by the DEQ GW Permit, JCSA submitted a report updating the activities associated with future water source alternates in December 2021, received no comments or response from DEQ.

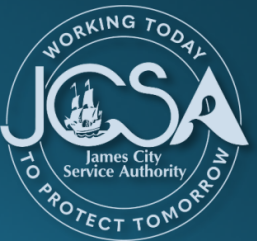
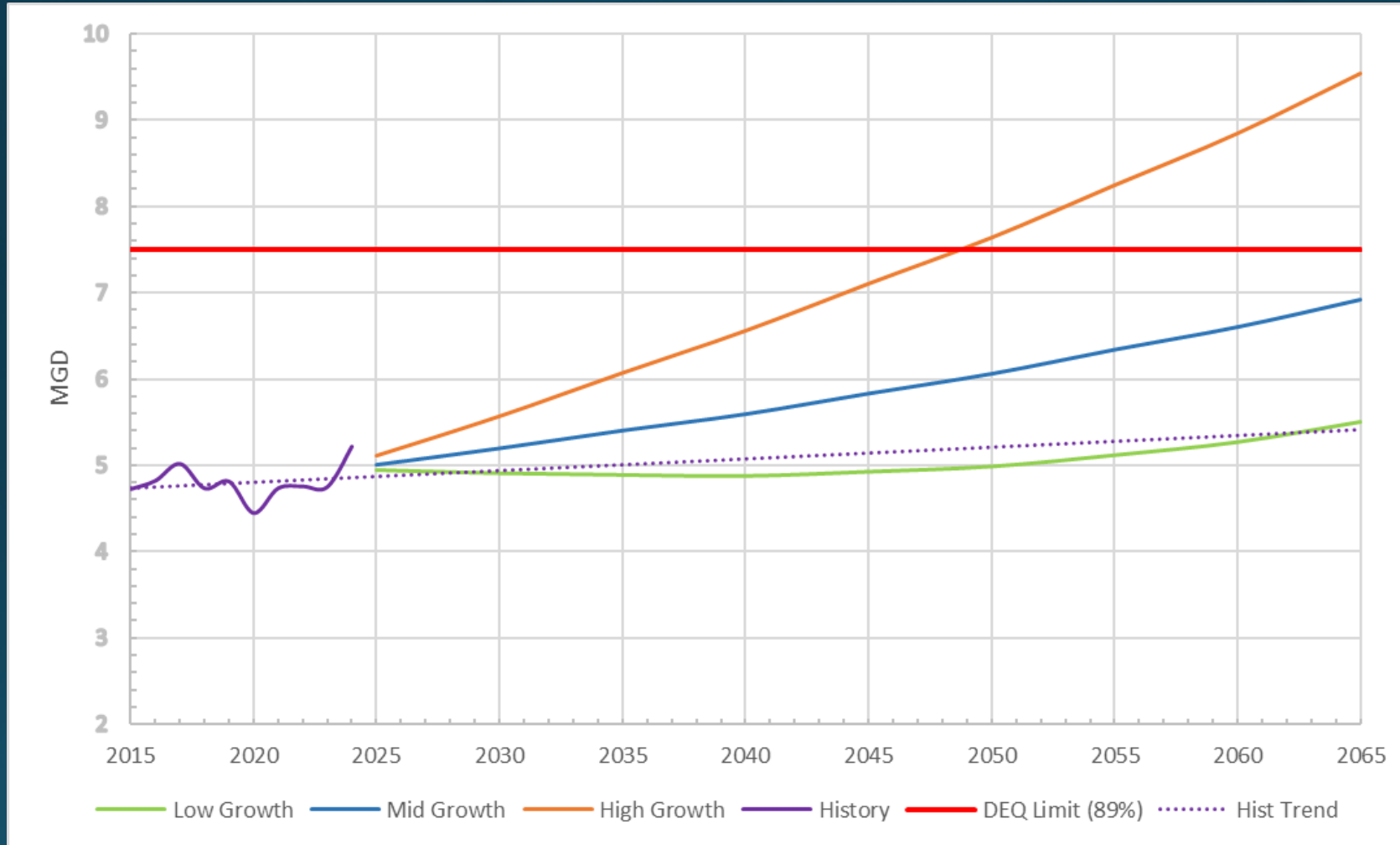


JCSA Central System - Current Status

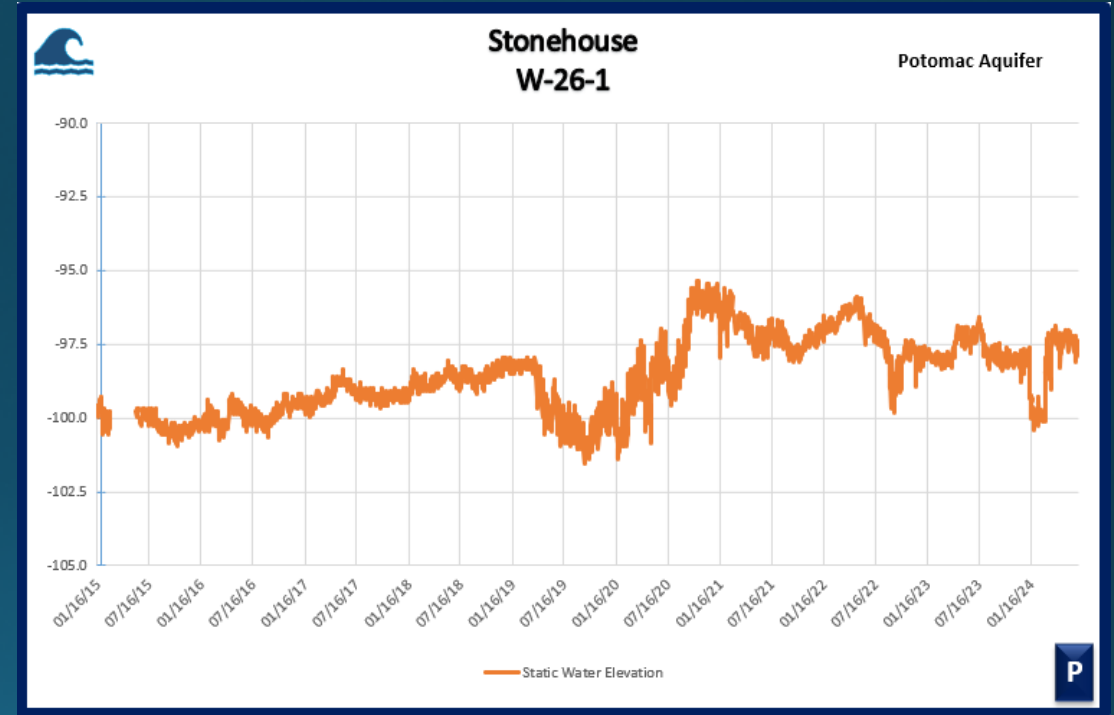
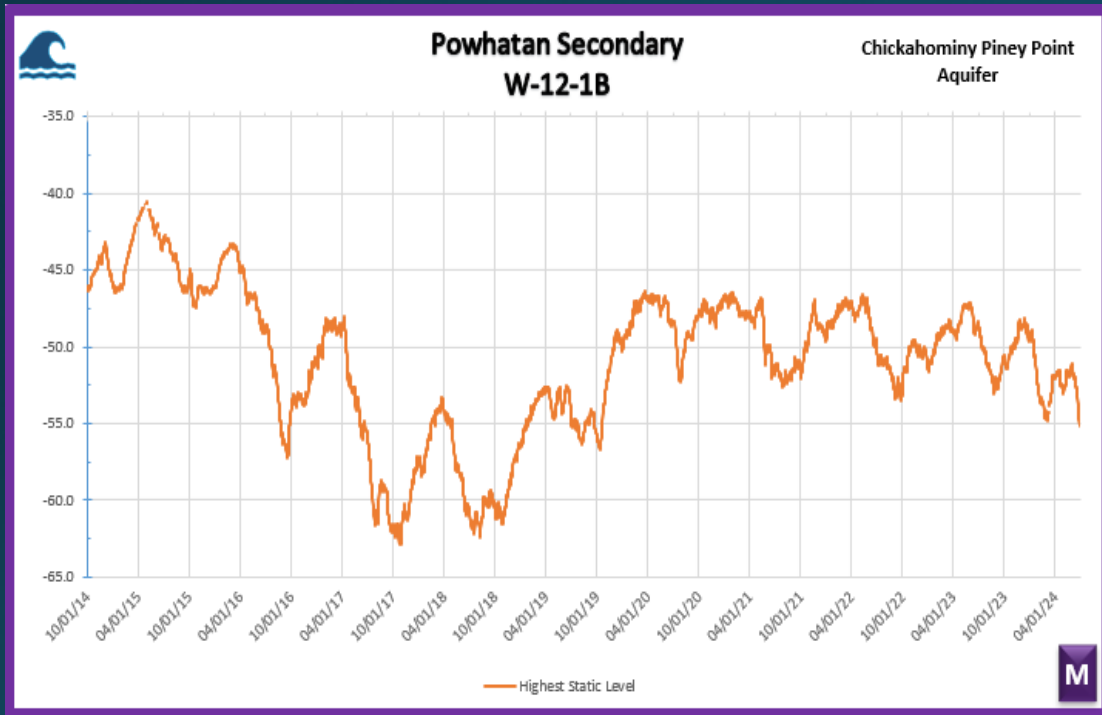
- Conclusions from update to DEQ
 - Several positive developments:
 - Continued trend of decreasing consumption.
 - Lower projections for future demands.
 - Indications that depletion of aquifers has slowed or slightly rebounded.
 - Implementation of the SWIFT project.
 - JCSA to defer significant capital investments until at least the next permitting cycle.
 - Will allow time to evaluate impacts of SWIFT and other factors influencing the long-term sustainability of groundwater sources.



JCSA Central System - Demand Projections

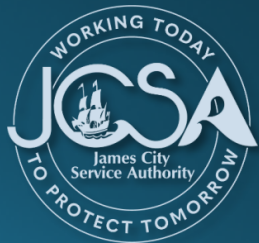


JCSA Groundwater Trends



Supply Alternative Summary

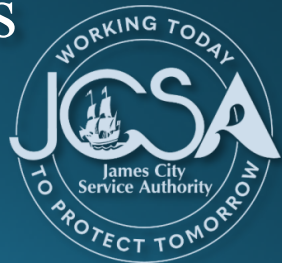
- Groundwater
 - Provided DEQ does not reduce GW withdrawal limits, this continues to be the most feasible option, even if JCSA is required to construct 2nd RO plant with deep wells.
- Newport News Purchased Water
 - JCSA limited to 2 mgd under terms of current agreement.
 - No water has been purchased from NN to date.
 - System improvements are necessary to use water since NN uses different treatment techniques.
- Chickahominy Riverfront Park Surface Water Plant
 - Likely not feasible due to cost (\$200M+) of the plant plus required distribution system improvements. Project has been put on hold.
- Surface Water Plant – Other Locations
 - May be options to locate a surface water plant in a more centralized location to minimize distribution system upgrades, but still a high-cost option.



Next Steps

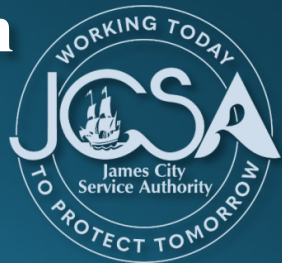
- Submit final Alternative Source Development Assessment Report to DEQ by December 31, 2025.
 - If Chickahominy RFP Plant is not developed, must include a list of actionable steps with timeframes that will be taken to reduce impacts on the groundwater system and proposed deadlines for each.
- Submit application for renewal of GW withdrawal permit at least 270 days prior to expiration, by May 12, 2026.

Note: New Kent County received permit in 2024, GW withdrawals reduced by 62% in year 15 (1.54 to .58 MGD)



What can we do in the meantime?

- Continue to monitor GW levels and impacts of SWIFT.
- Continue to focus on conservation, possible changes:
 - Move to 2-day per week outdoor water use schedule.
 - Remove sewer cap.
 - May encourage more private irrigation wells.
 - Install advanced metering infrastructure (AMI).
 - Update tiered rates as appropriate.
 - Continue to promote water conservation initiatives.
- **Managing system demands is the most effective means to defer or eliminate significant capital investments associated with additional source of supply. This is also a focus of DEQ to reduce impacts on GW system.**



A large, faint watermark of the James City Service Authority logo is centered in the background. The logo is circular with the text "WORKING TODAY" at the top and "TO PROTECT TOMORROW" at the bottom. In the center of the logo is a stylized illustration of a sailing ship on the left and a modern building on the right, with the letters "JCSA" overlaid in a large, serif font.

Questions?

James City
Service Authority



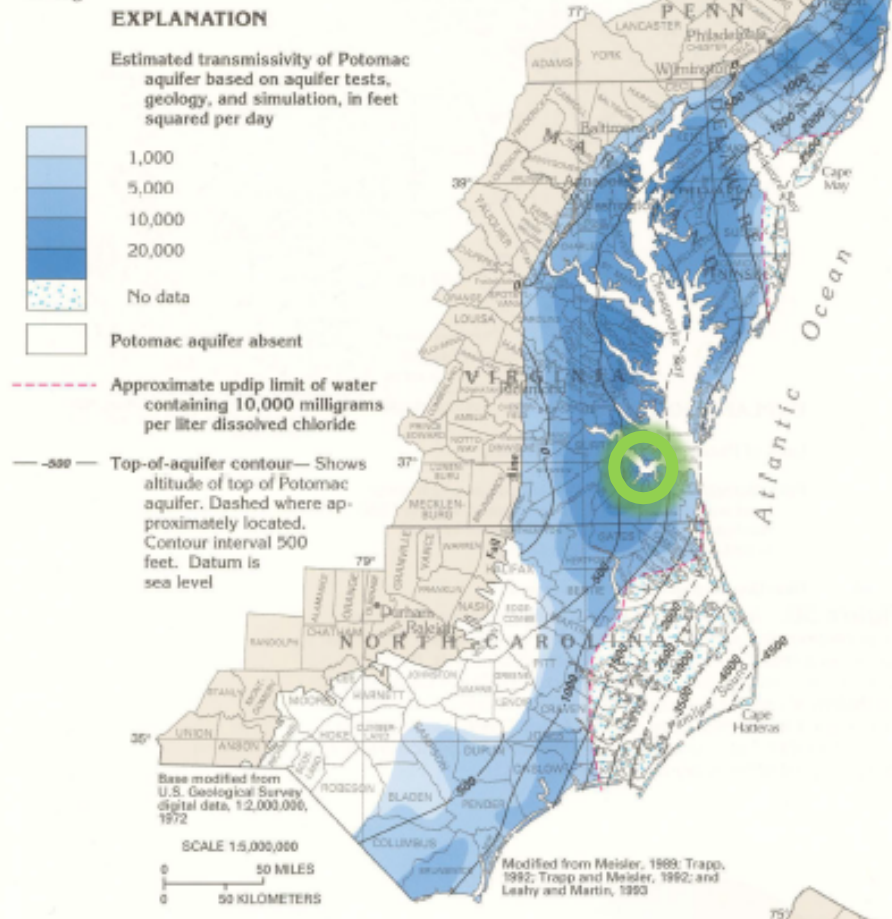
SWIFT Potential to Increase Groundwater Availability

Dan Holloway, P.G., HRSD Hydrogeologist
January 24, 2025

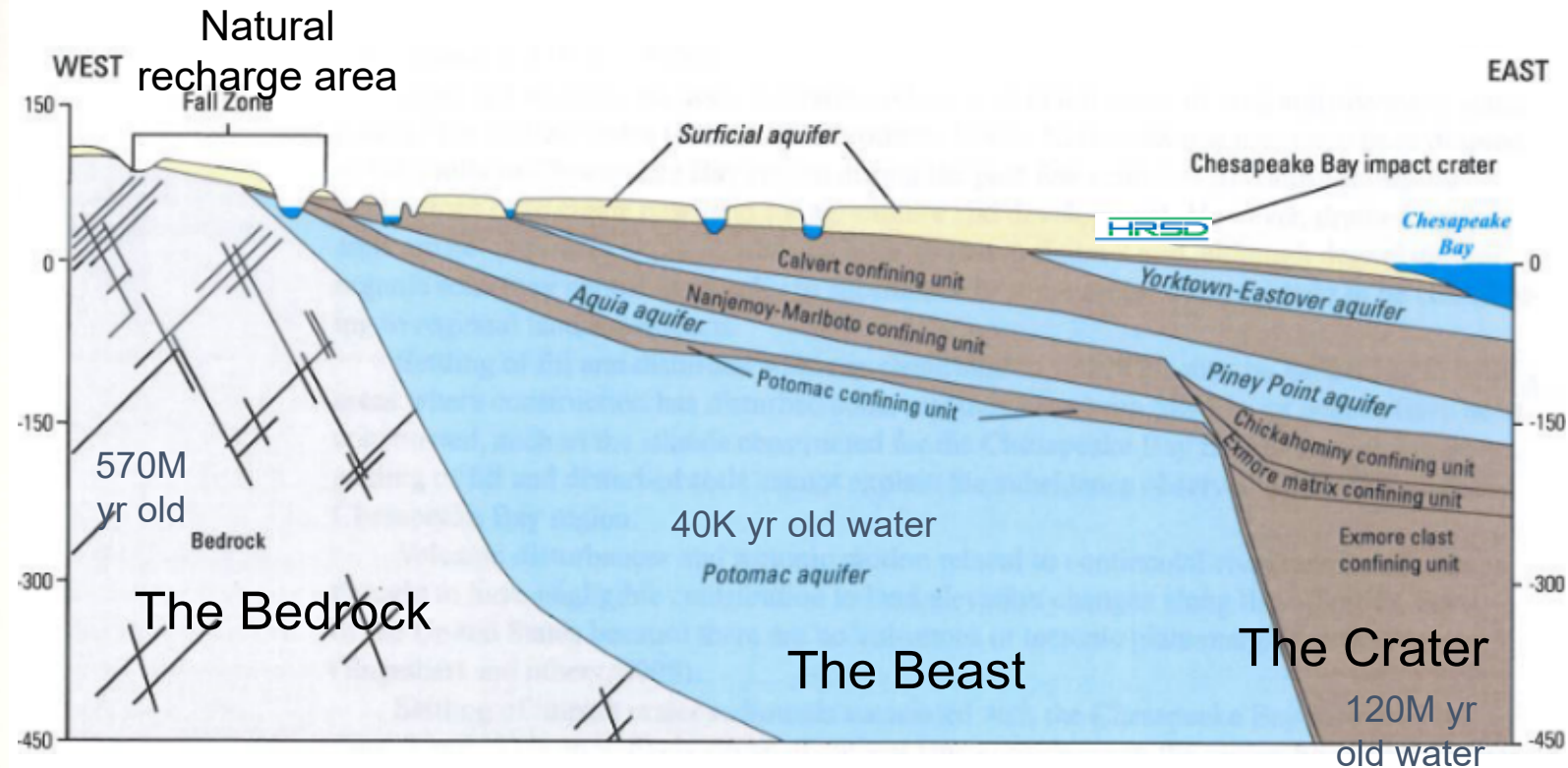
James City Service Authority Board of Supervisors Retreat

Coastal Plain Aquifer System Quick Primer

Figure 54. The top of the Potomac aquifer is above sea level along its western and northwestern limit from northernmost North Carolina to New Jersey but slopes to more than 2,500 feet below sea level along the coast of New Jersey and to more than 4,500 feet below sea level near Cape Hatteras in easternmost North Carolina. The transmissivity of the aquifer is highest near Chesapeake Bay and in central New Jersey.



Source: USGS Groundwater Atlas of the US

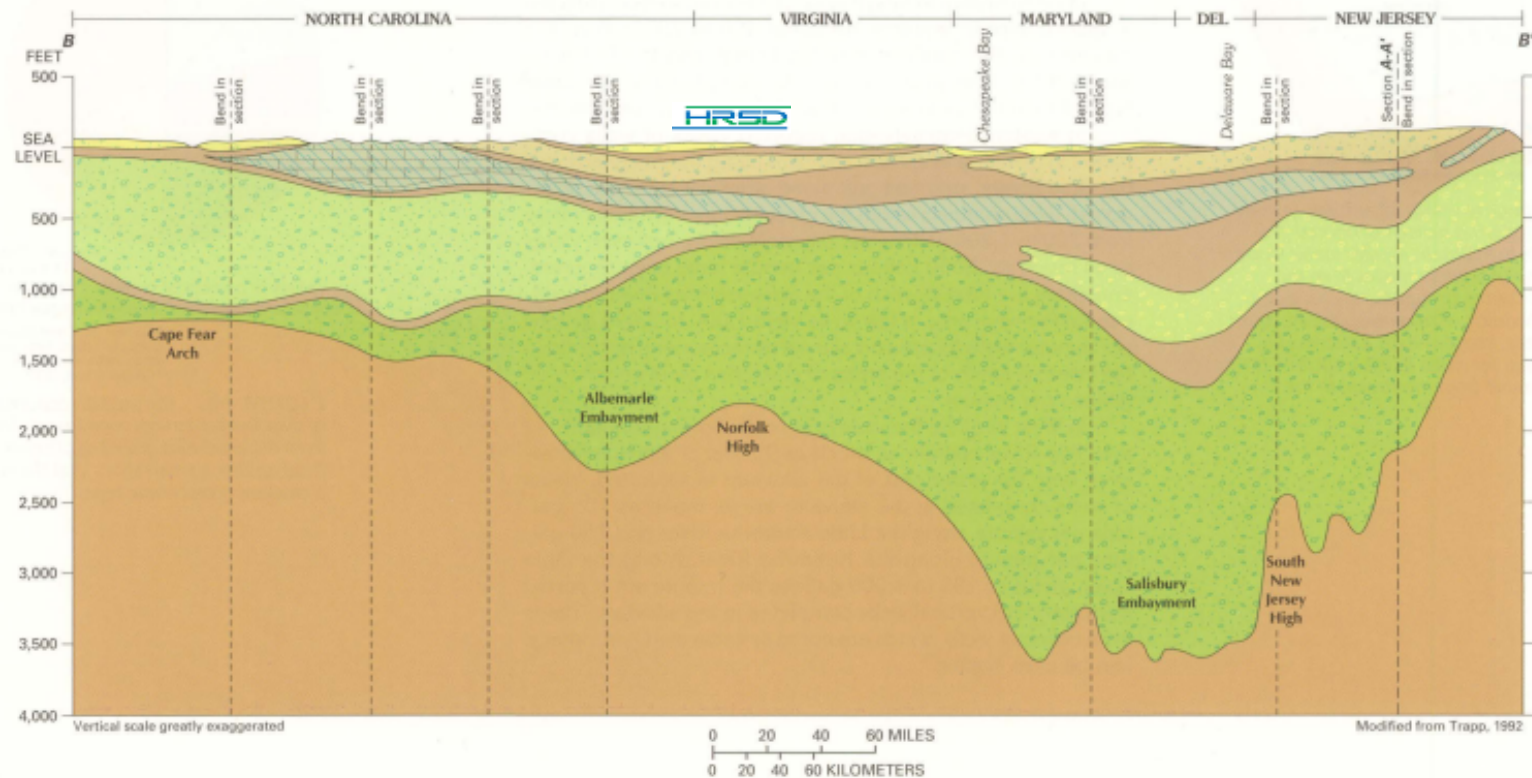
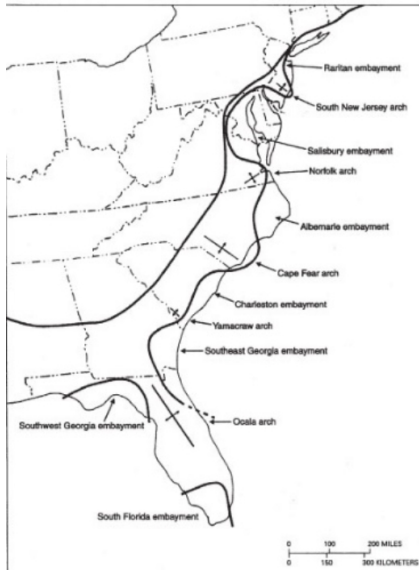
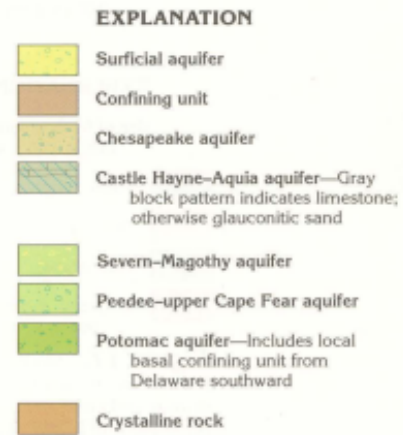


Source: USGS Professional Paper 1731, McFarland and Bruce 2006

Not quite parallel and uniform



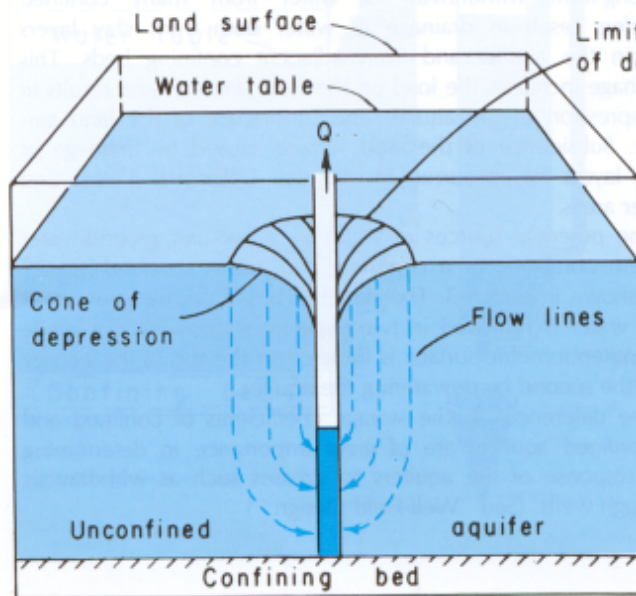
Figure 20. The aquifer system is thinner where parts of the underlying crystalline-rock surface have been upwarped and thicker where the crystalline rocks have been downwarped. The line of the hydrogeologic section is shown in figure 18.



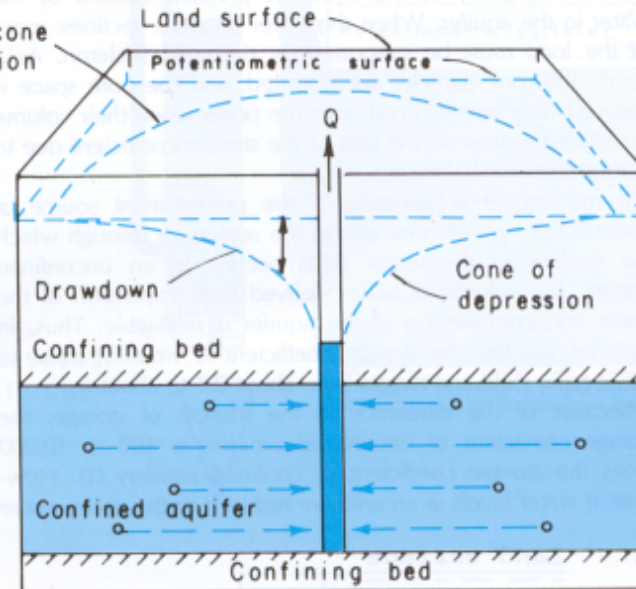
Source: USGS Groundwater Atlas of the US

A little bit about water levels and wells

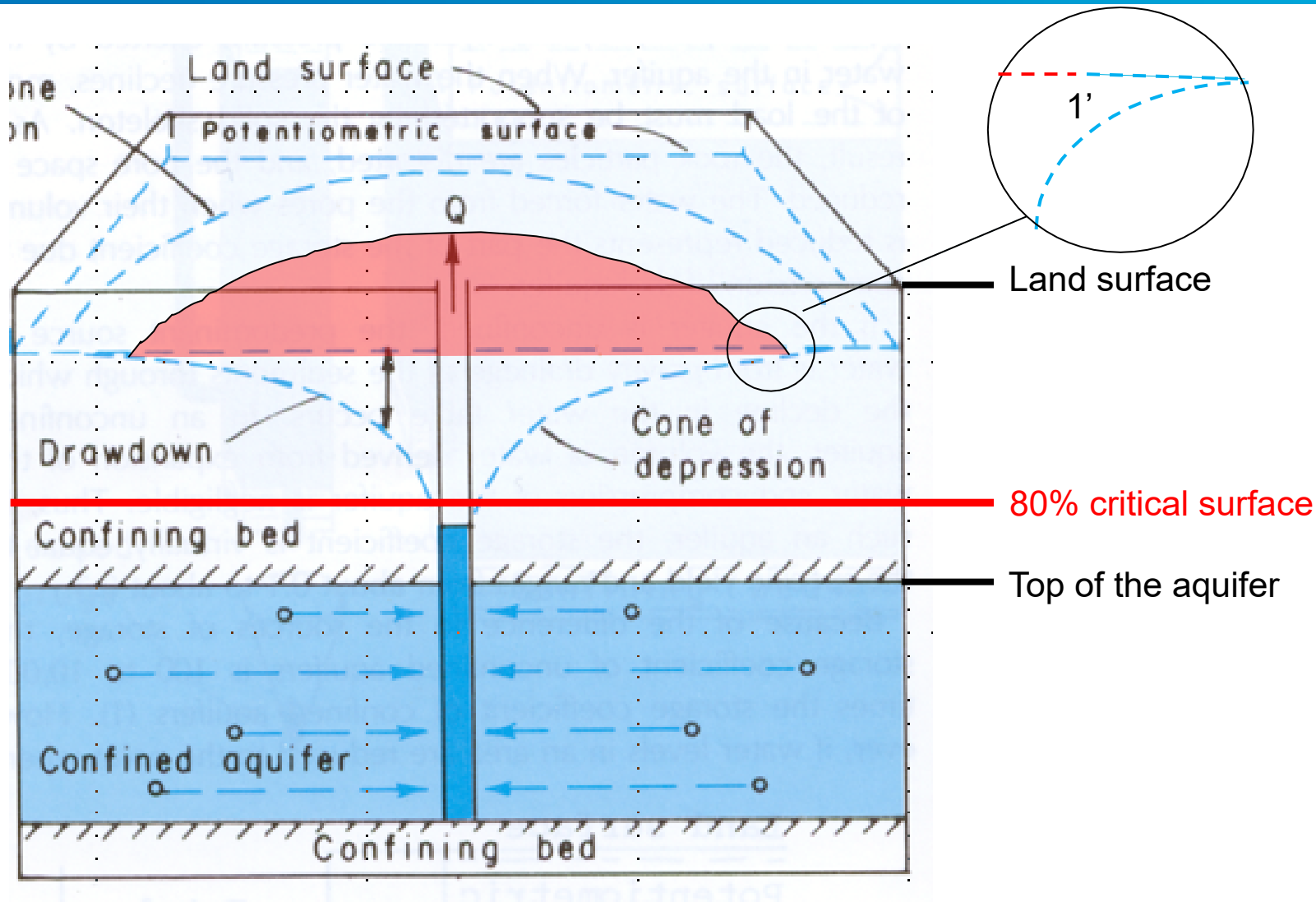
- Flowing well creates drawdown,
- Lower pressure or water level, around the well
- Cone of depression



USGS, Basic Groundwater Hydrology, 1982

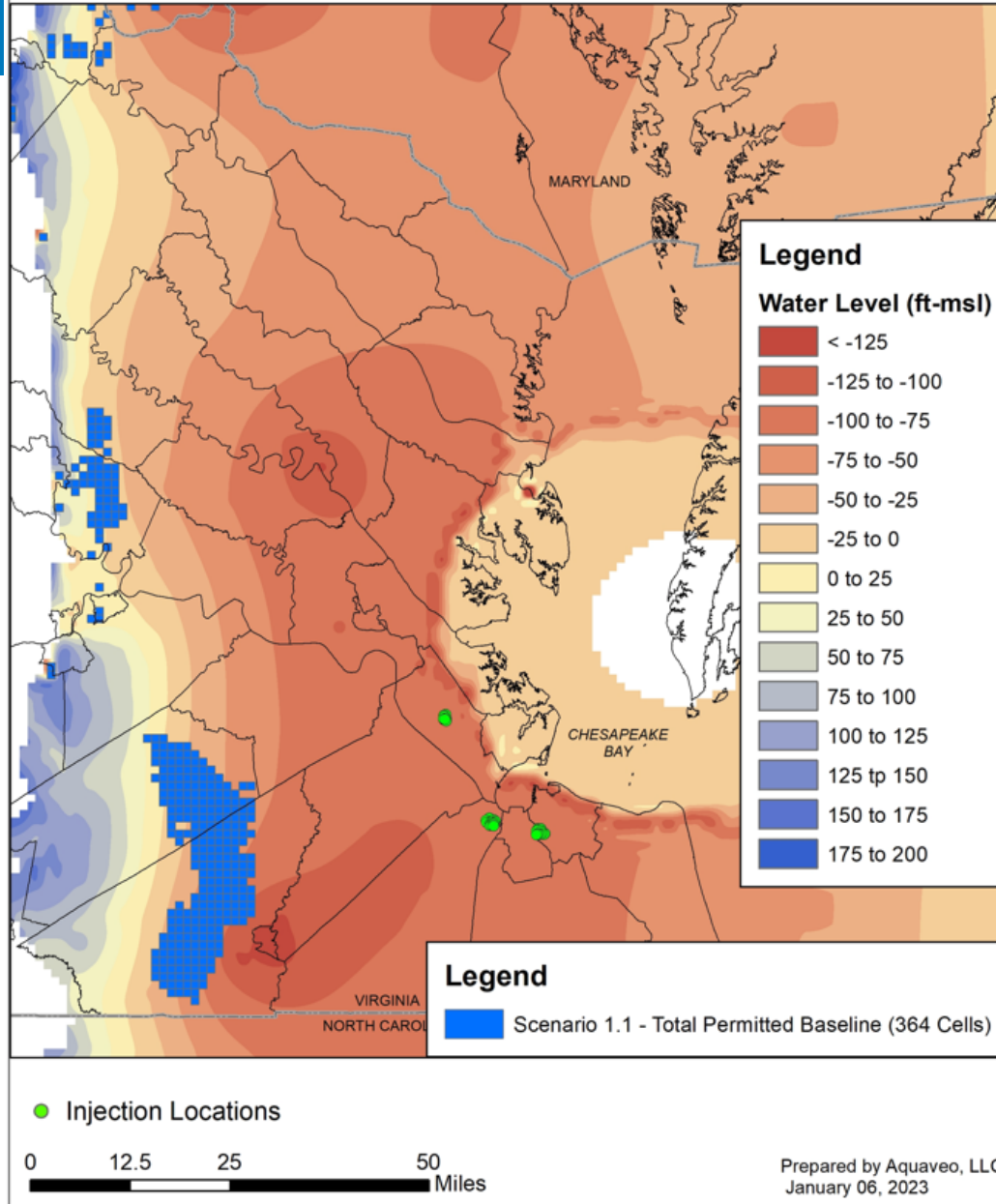


DEQ Groundwater Permitting Terminology



- **Area of Impact** – area within 1-foot of drawdown
- **Critical surface** – surface that exists 80% the distance from land surface to the top of the aquifer
- Calculated using model for each aquifer in the system

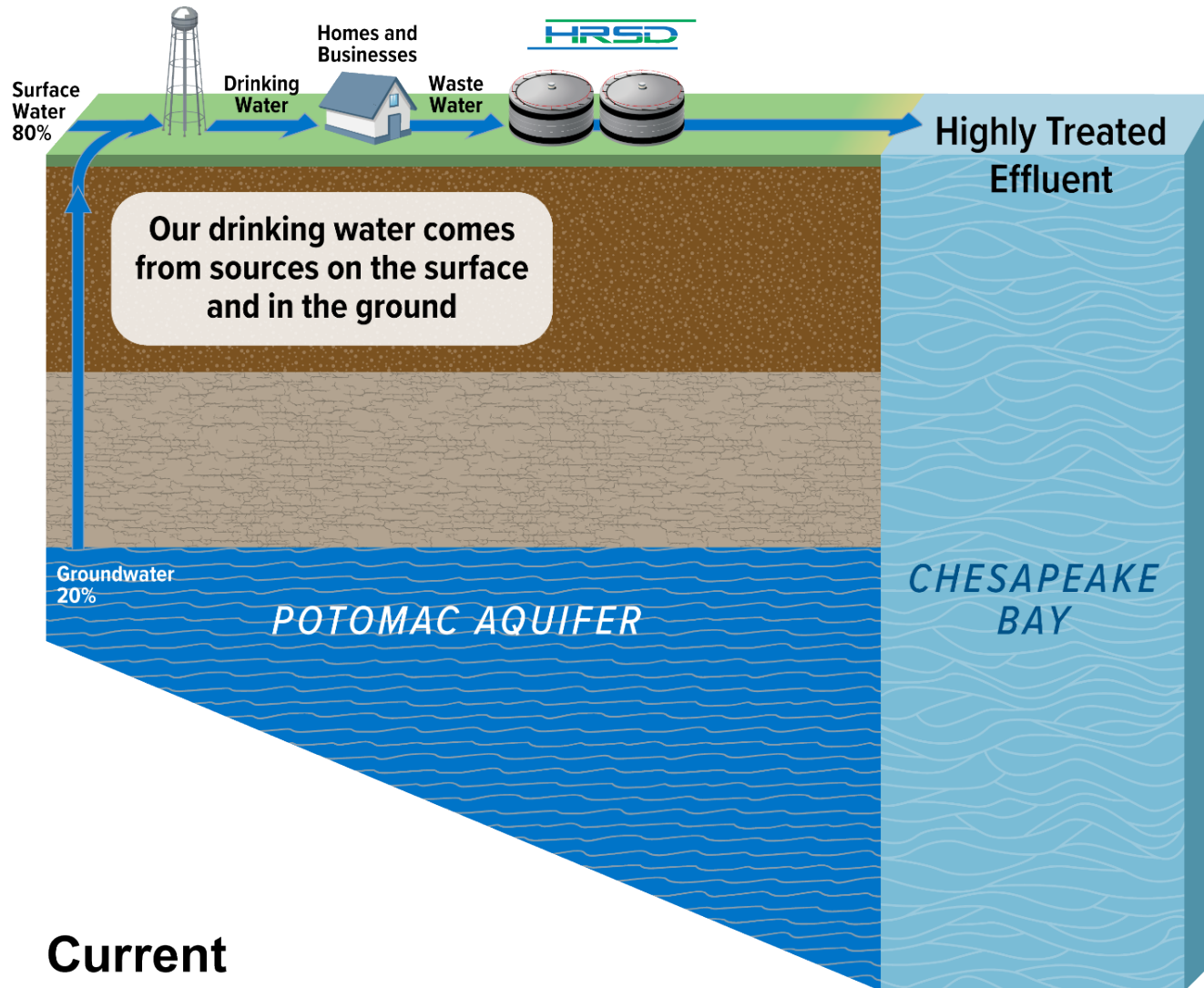
SWIFT Modeling Scenarios
Potomac Aquifer Water Levels - 2071 Results
Scenario 1.1 - Total Permitted Baseline



Technical Evaluation

- Critical cells in blue (364)
- If AOI includes critical cells = fail
- If proposed withdrawal adds any critical cells = fail

Business as usual for decades



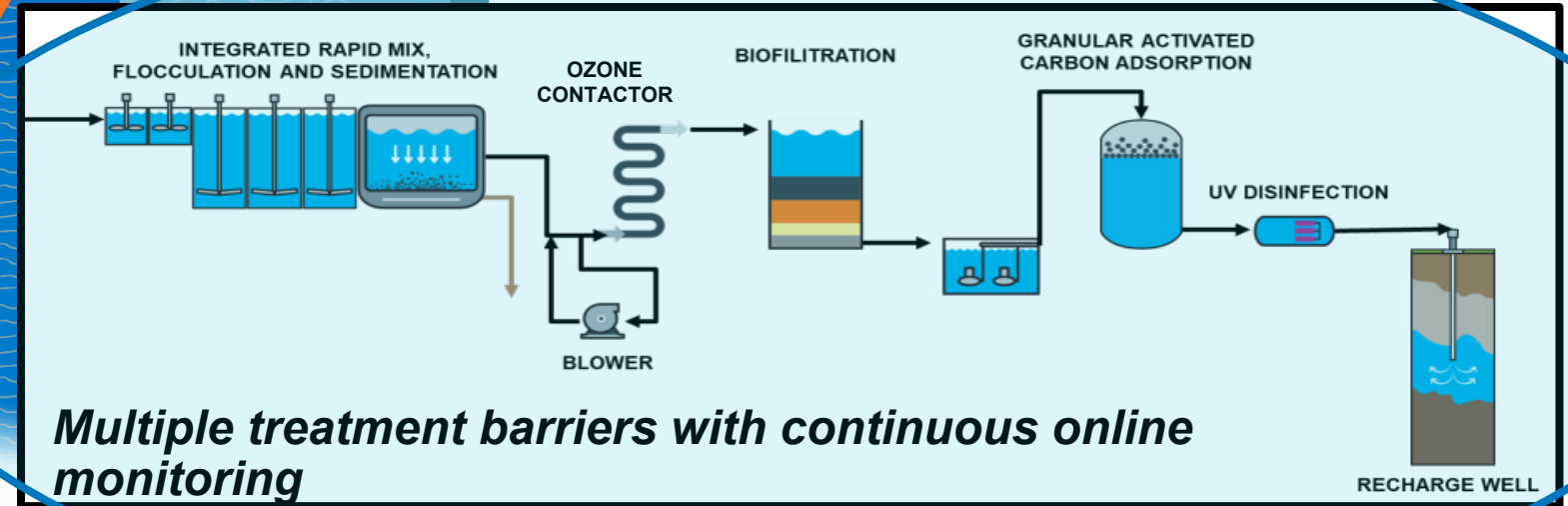
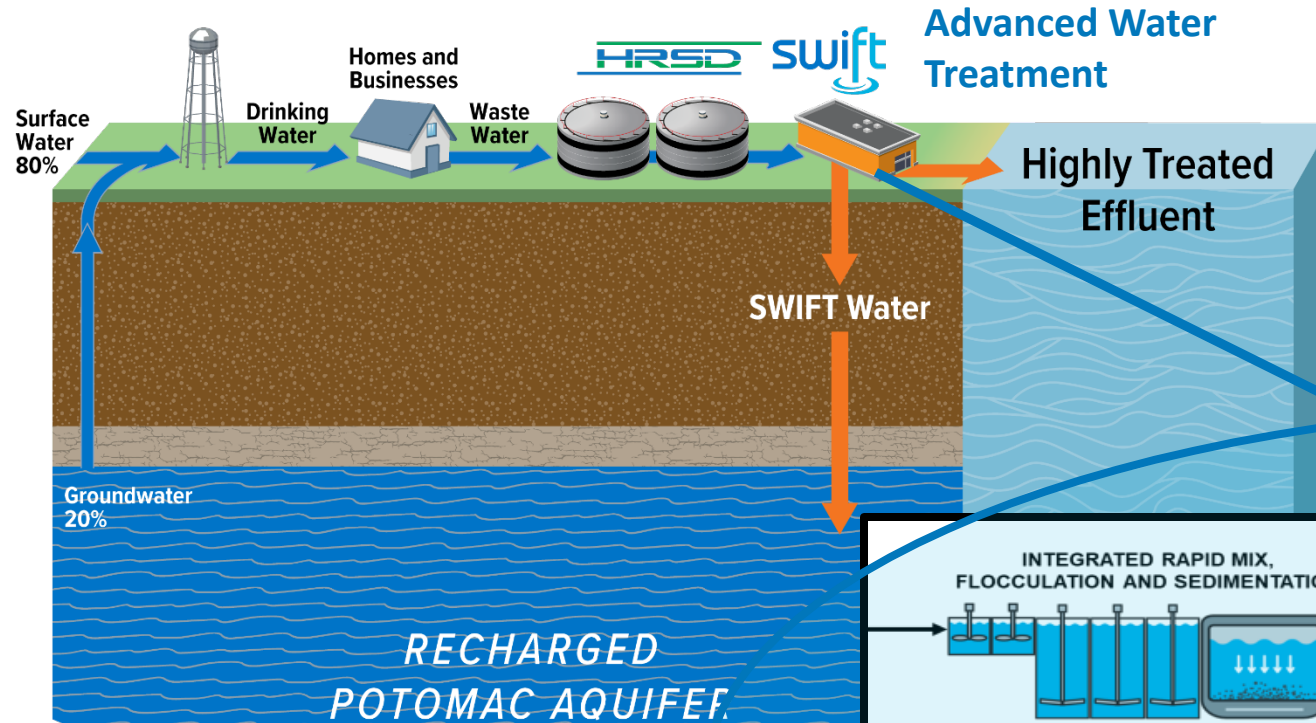
Current

- Withdraw ancient groundwater
- One pass use and discharge to surface water.
- Open loop system
- Not sustainable

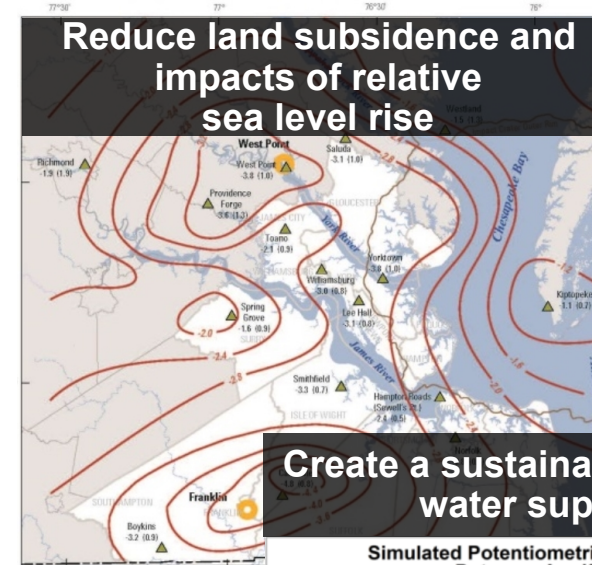
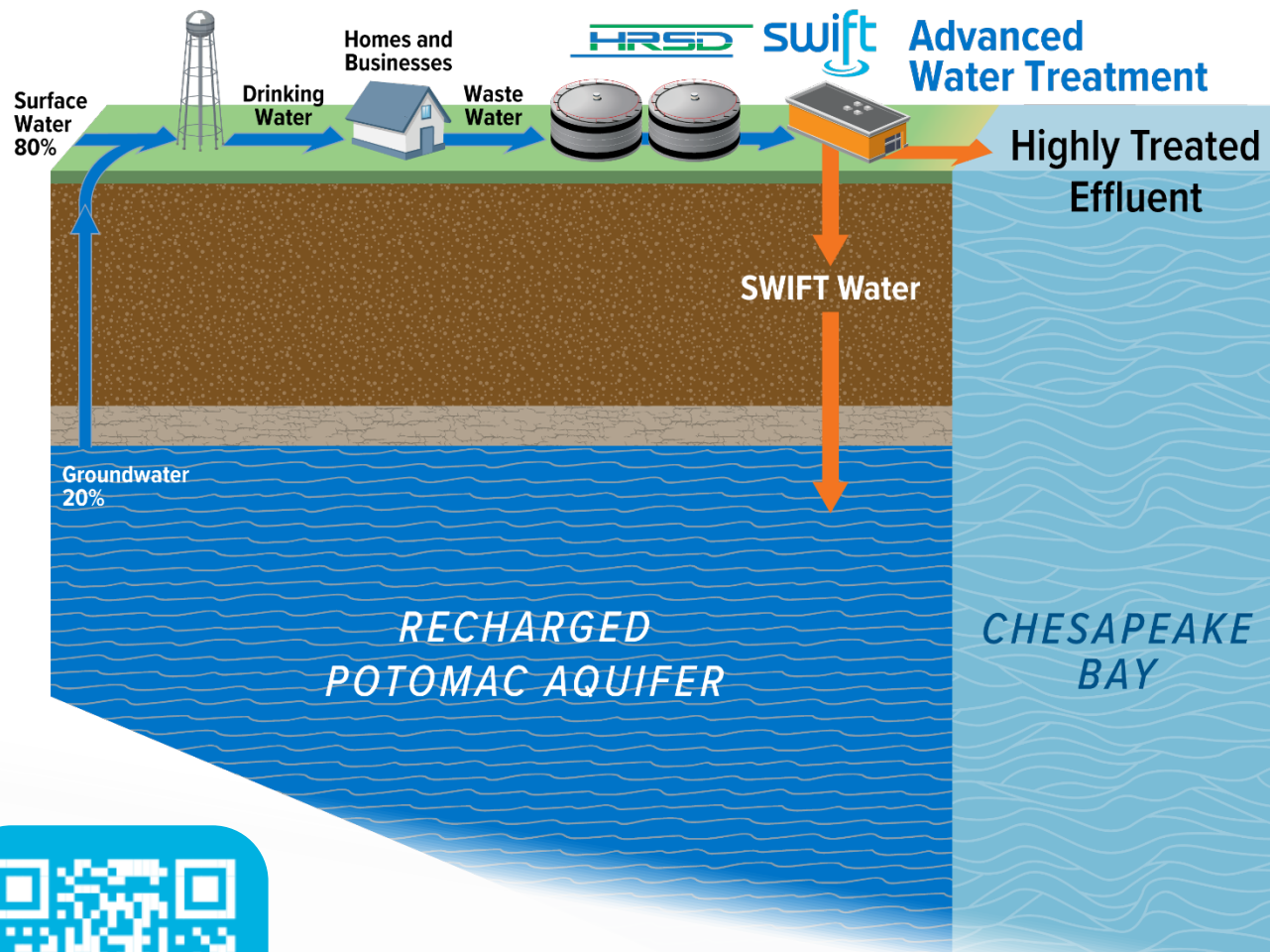
SWIFT applies multiple rounds of advanced water treatment....

... to produce **SWIFT Water** that

- ✓ meets drinking water quality standards
- ✓ make compatible with Potomac aquifer



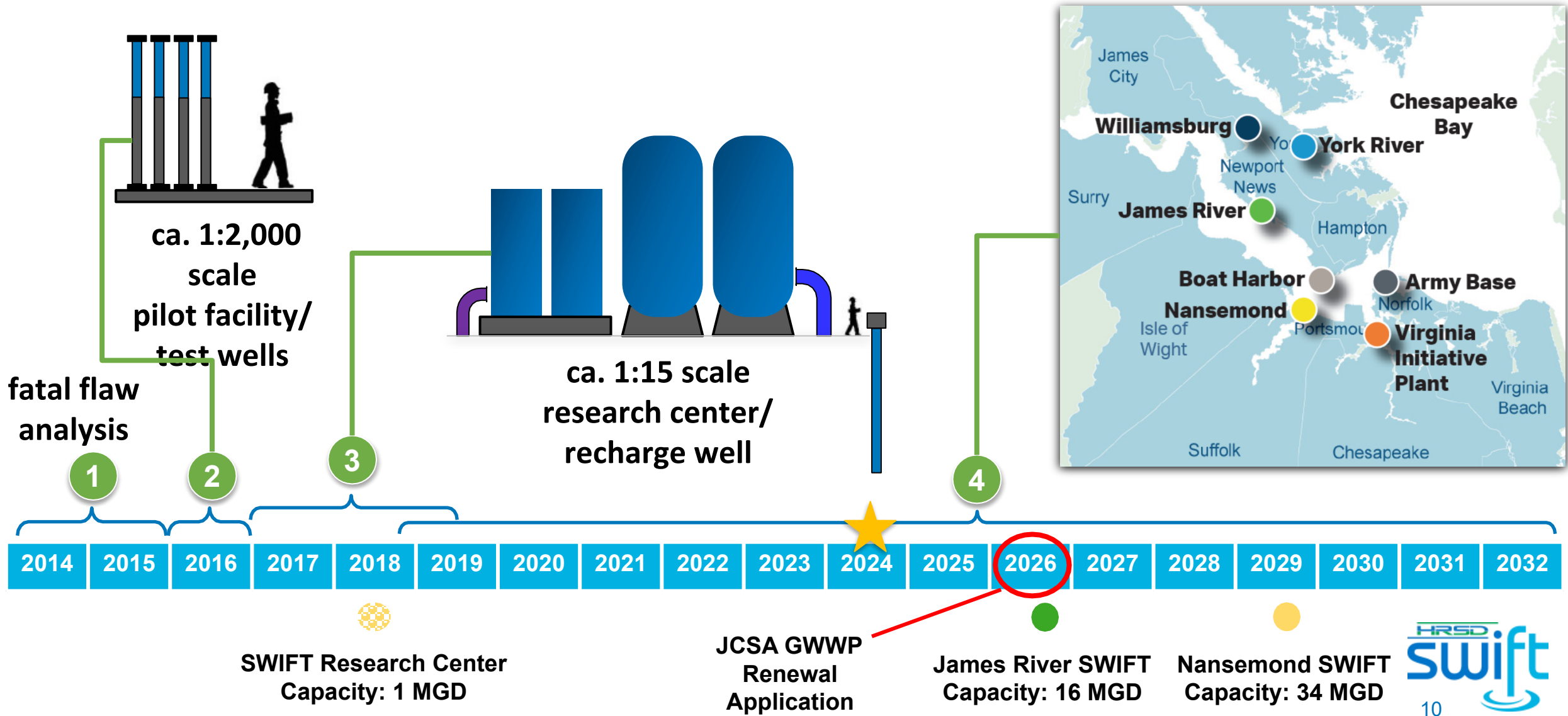
SWIFT provides multiple regional benefits



Scan the QR Code to watch
“Why SWIFT Matters”!



Initial phase of SWIFT full scale implementation will include AWT & MAR facilities at James River and Nansemond



SWIFT Strategy scenarios

SWIFT Facility	Anticipated SWIFT treatment recharge capacity (MGD)	SW31.9 Scenario Recharge Rates (MGD)	SW37.7 Scenario Recharge Rates (MGD)	SW41.6 Scenario Recharge Rates (MGD)	SW51.4 Scenario Recharge Rates (MGD)
James River	16	10.4 (65% capacity)	10.4 (65% capacity)	10.4 (65% capacity)	10.4 (65% capacity)
Nansemond	33	21.45 (65% capacity)	21.45 (65% capacity)	21.45 (65% capacity)	21.45 (65% capacity)
VIP	30	0	5.85*	9.75**	19.5***
Total	79 MGD	31.85 MGD	37.7 MGD	41.6 MGD	51.35 MGD

Notes:

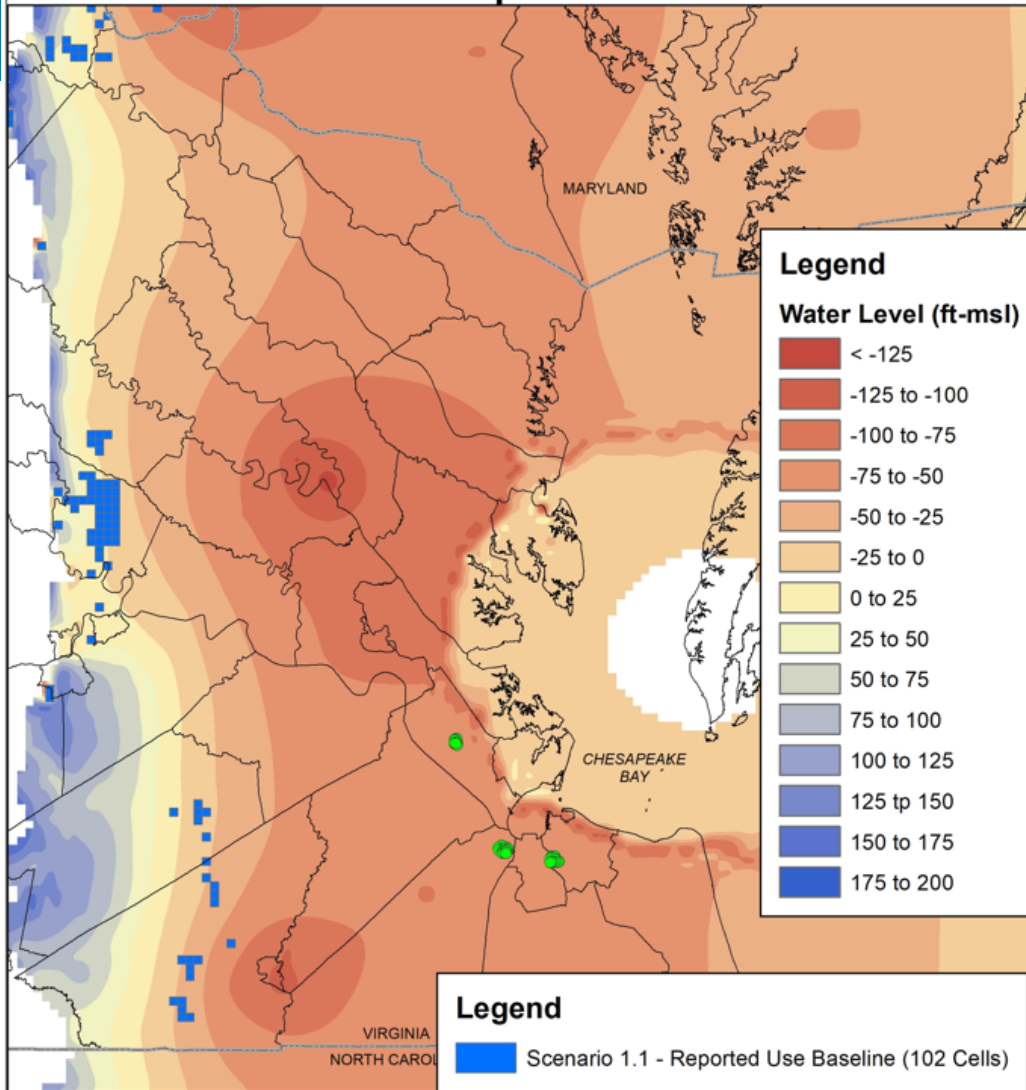
For each site distribute flows evenly across all the wells

*6 wells = 9 MGD * 65% = 5.85 MGD

**10 wells = 15 MGD * 65% = 9.75 MGD

***16 wells (@ VIP/PA) = 30 MGD * 65% = 19.5 MGD

SWIFT Modeling Scenarios Potomac Aquifer Water Levels - 2071 Results Scenario 1.1 - Reported Use Baseline

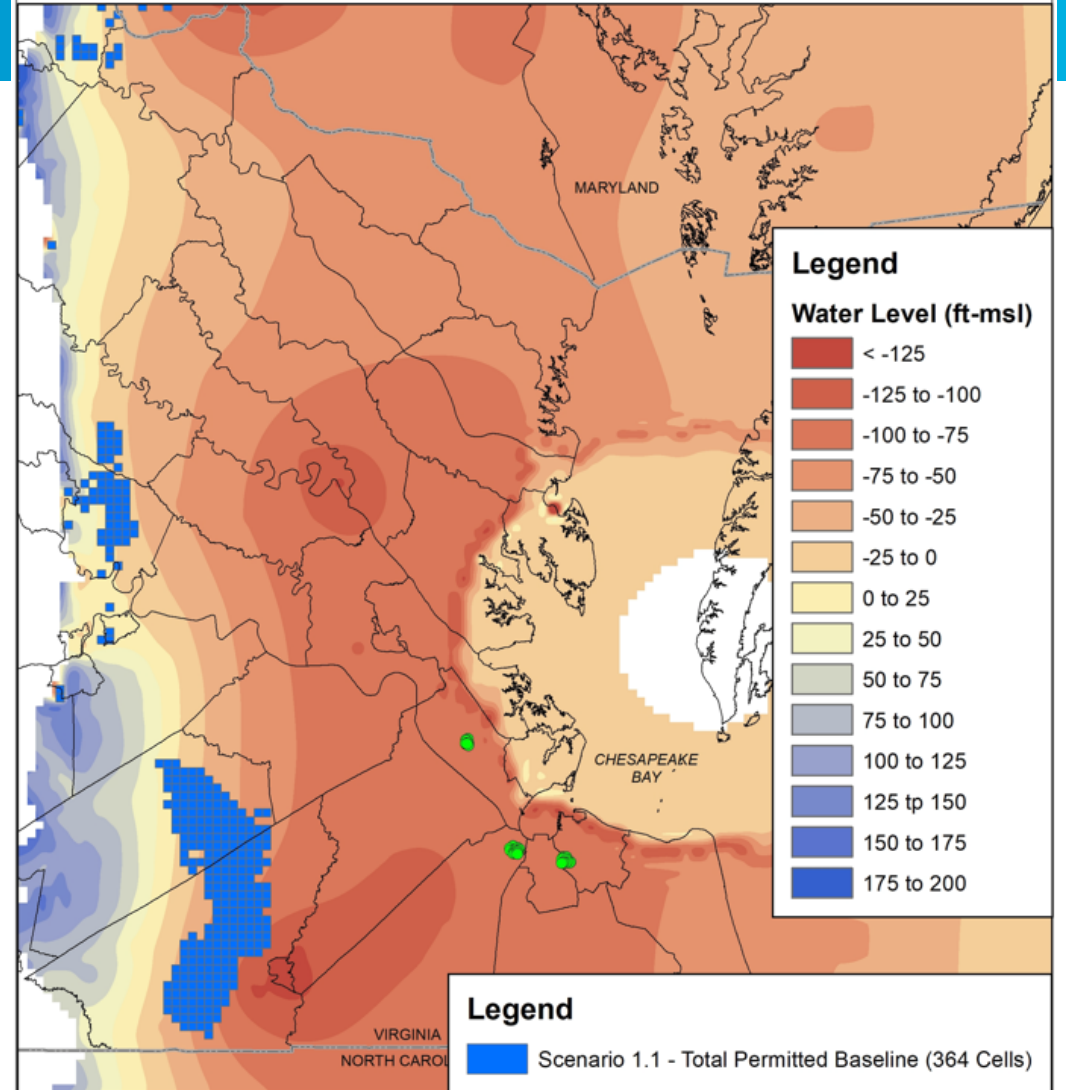


● Injection Locations

0 12.5 25 50
Miles

Prepared by Aquaveo, LLC
January 06, 2023

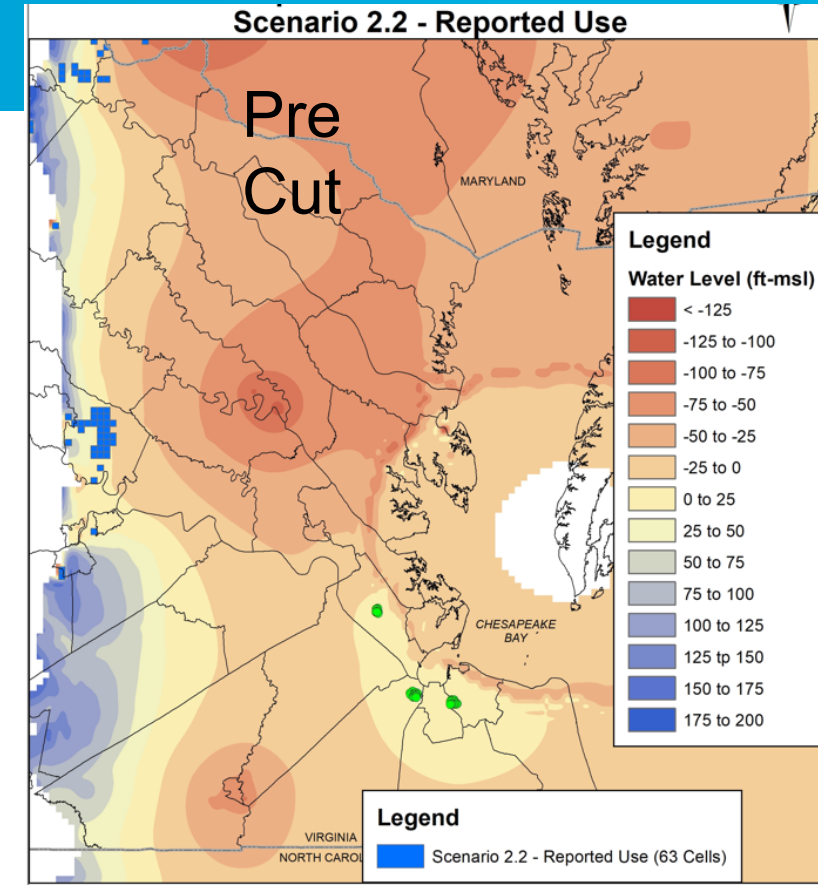
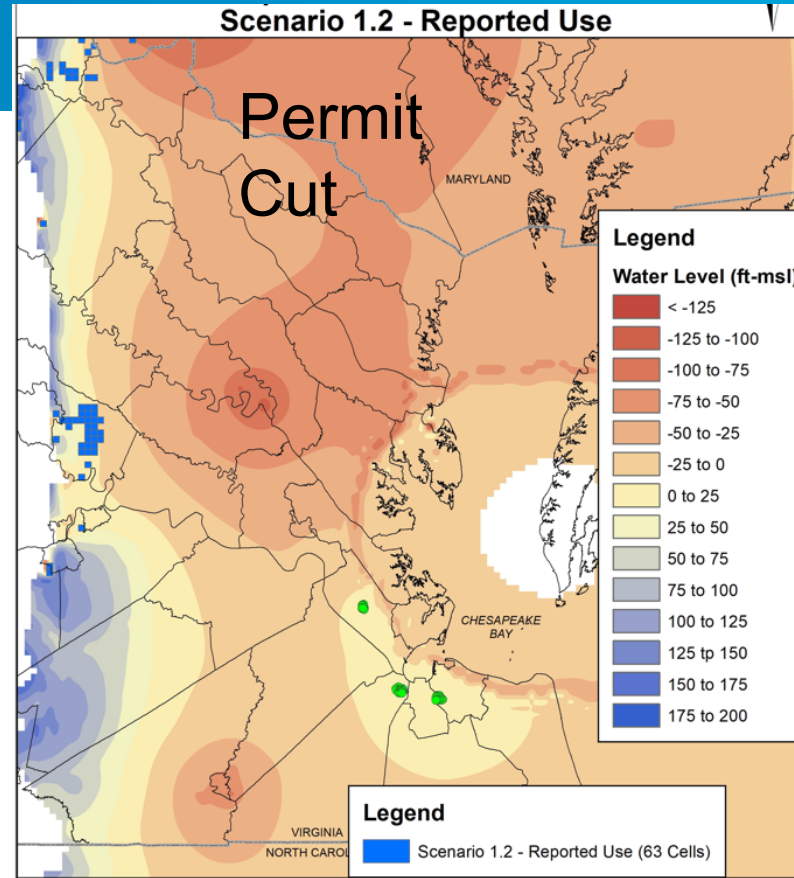
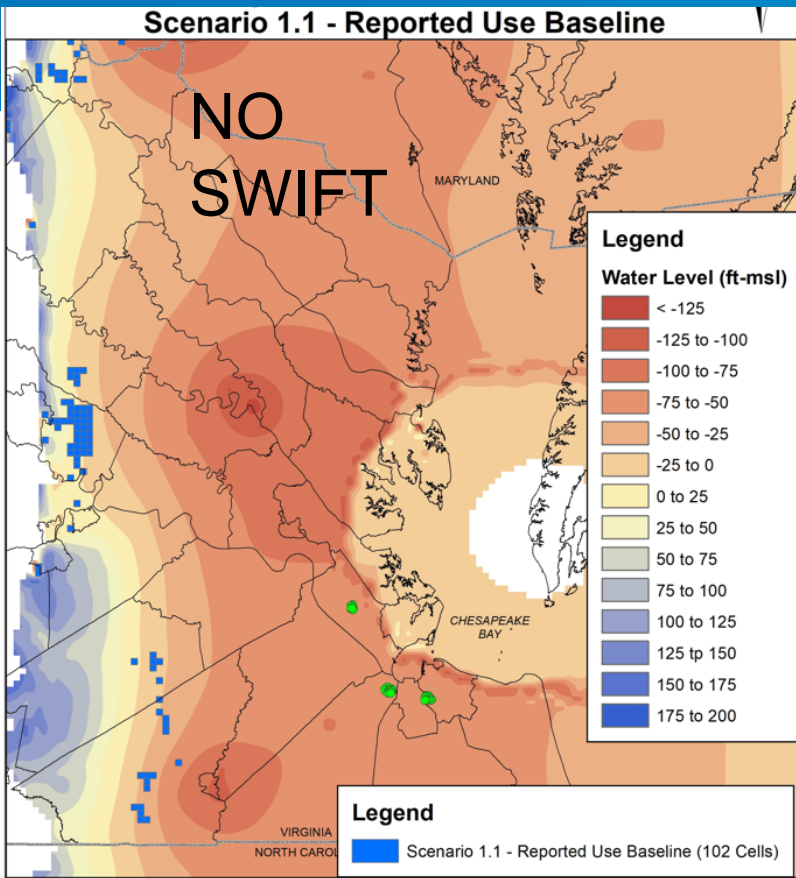
SWIFT Modeling Scenarios Potomac Aquifer Water Levels - 2071 Results Scenario 1.1 - Total Permitted Baseline



● Injection Locations

0 12.5 25 50
Miles

Prepared by Aquaveo, LLC
January 06, 2023



REPORTED USE critical cells

SWIFT at 31.9 MGD

JR at 10.4 MGD

NP at 21.45 MGD

Critical cell failures

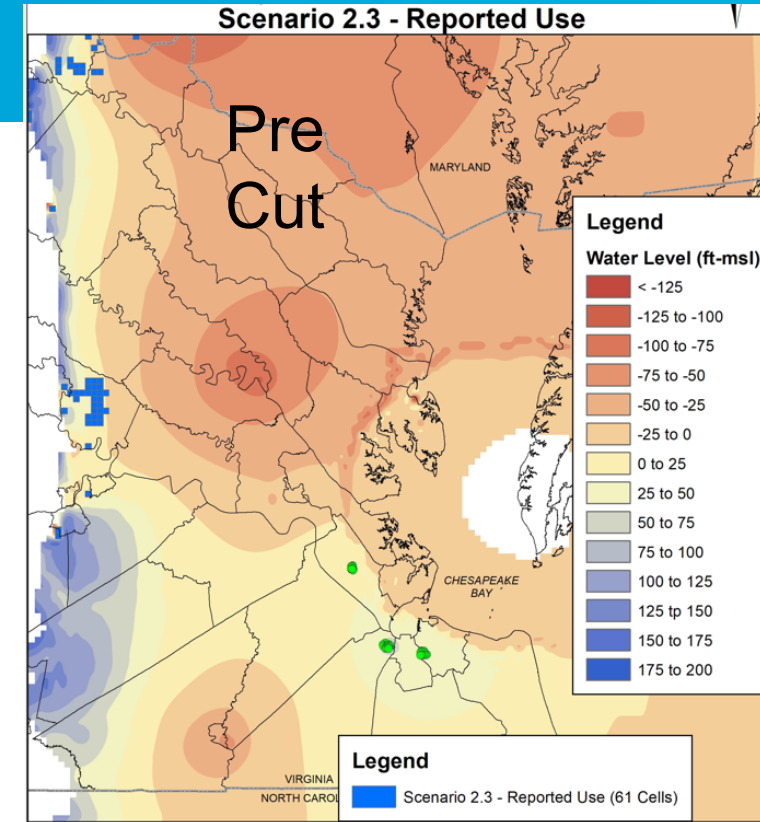
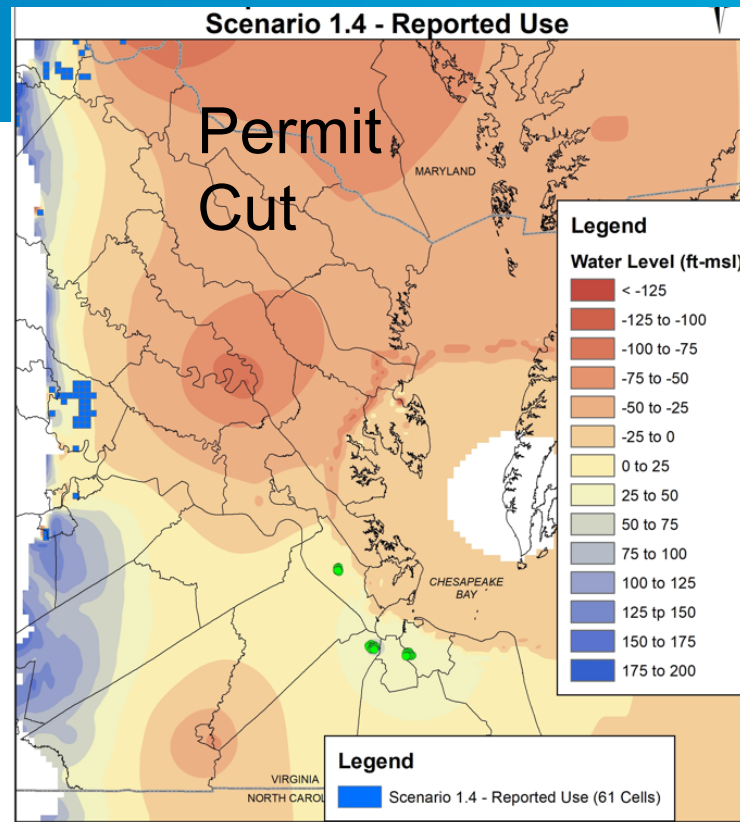
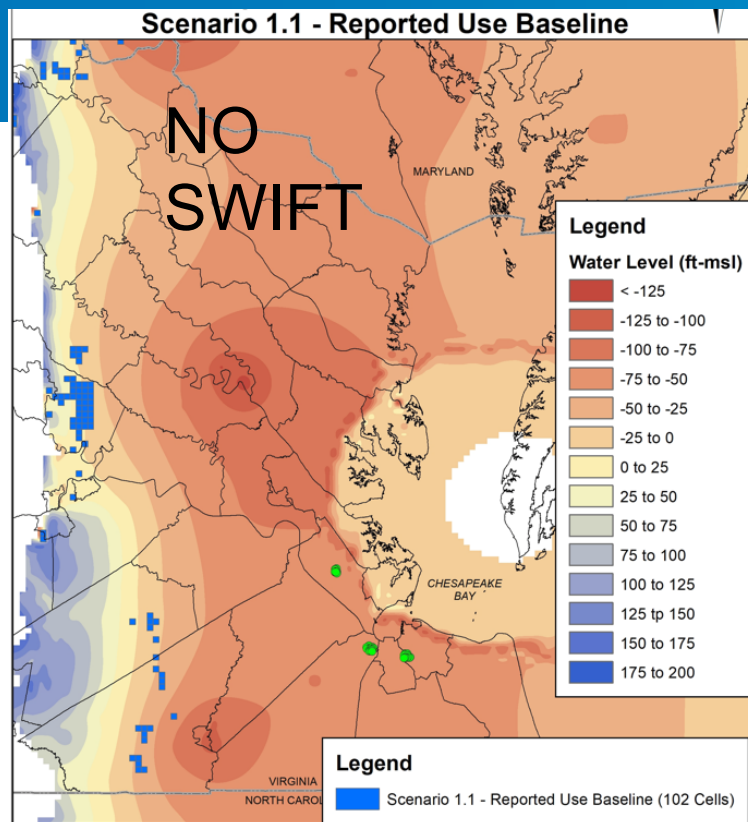
Baseline – 102

Scenario 1.2 – 63

Scenario 2.2 – 63

Aquaveo Modeling



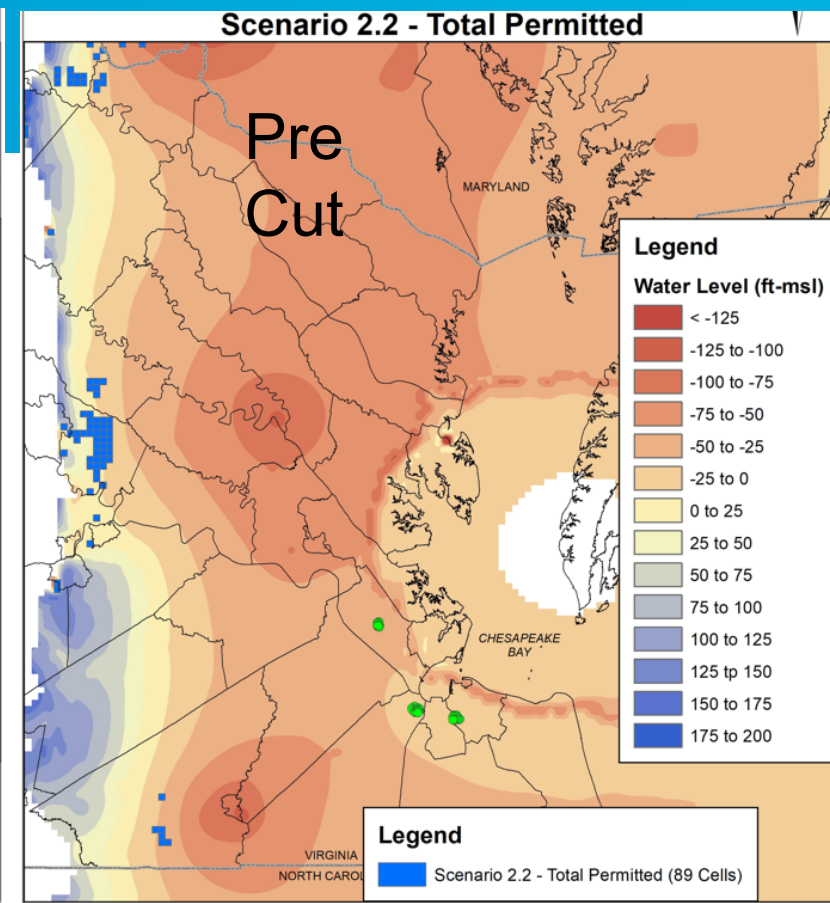
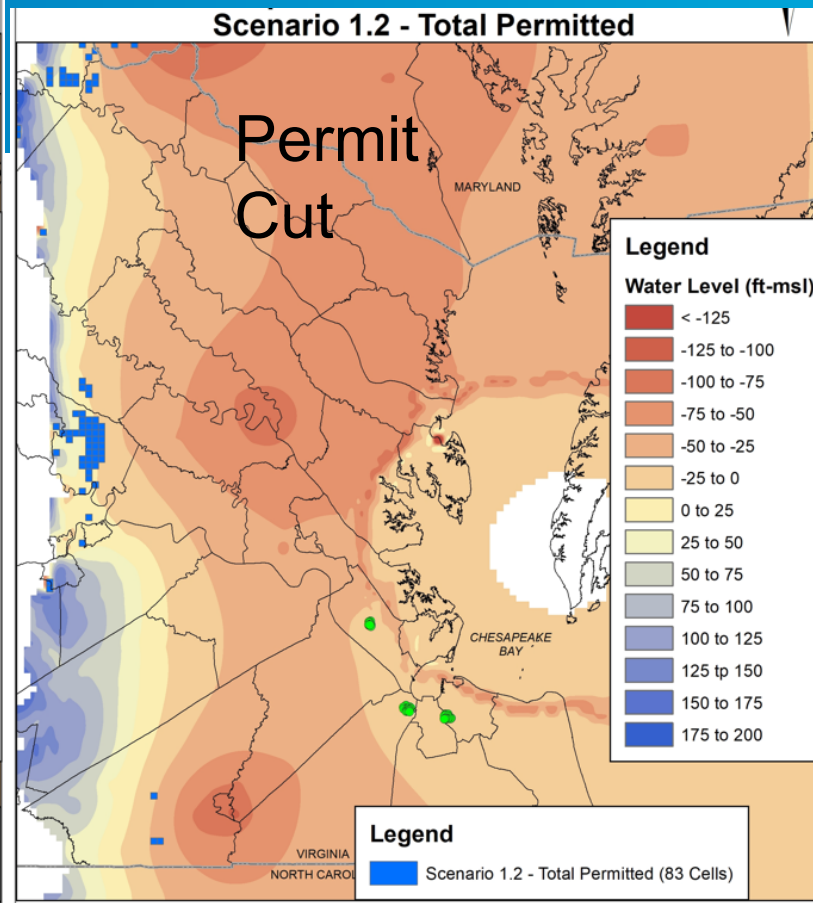
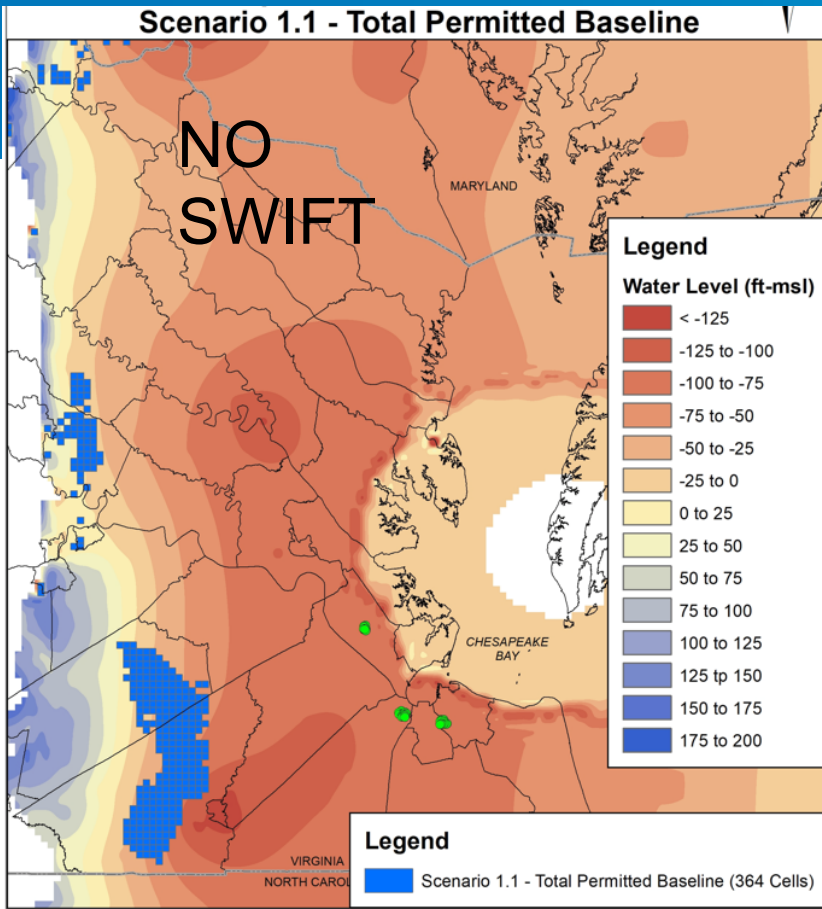


Aquaveo Modeling

REPORTED USE
critical cells
SWIFT at 41.6 MGD
JR at 10.4 MGD
NP at 21.45 MGD
VIP at 9.75 MGD

Critical cell failures
Baseline – 102
Scenario 1.2 – 61
Scenario 2.2 – 61



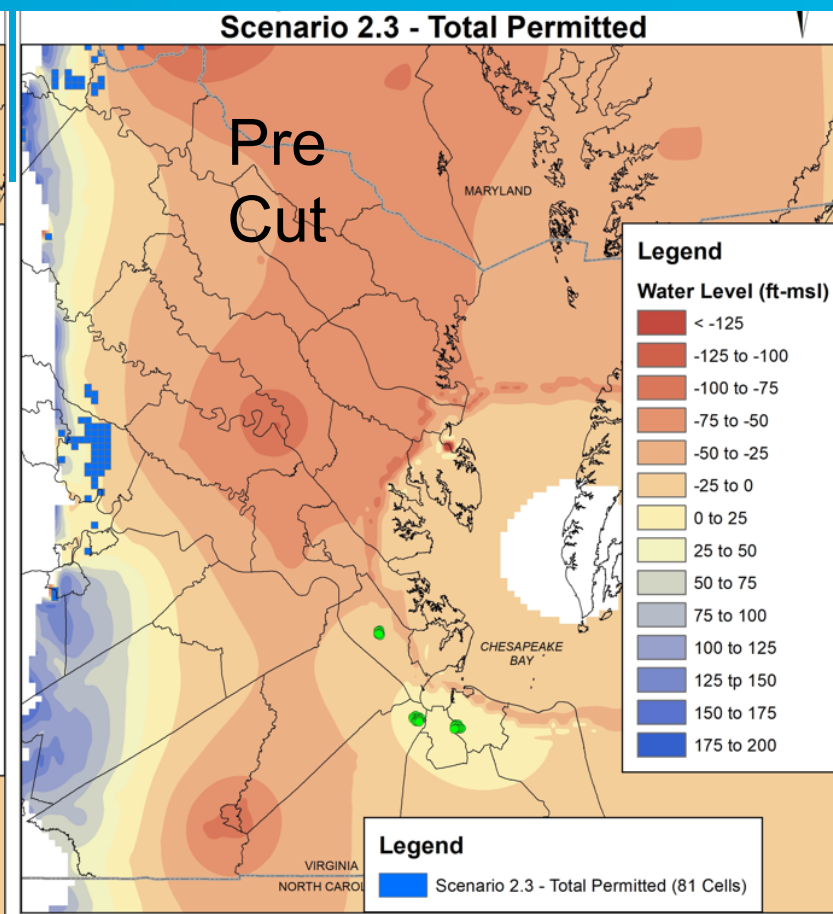
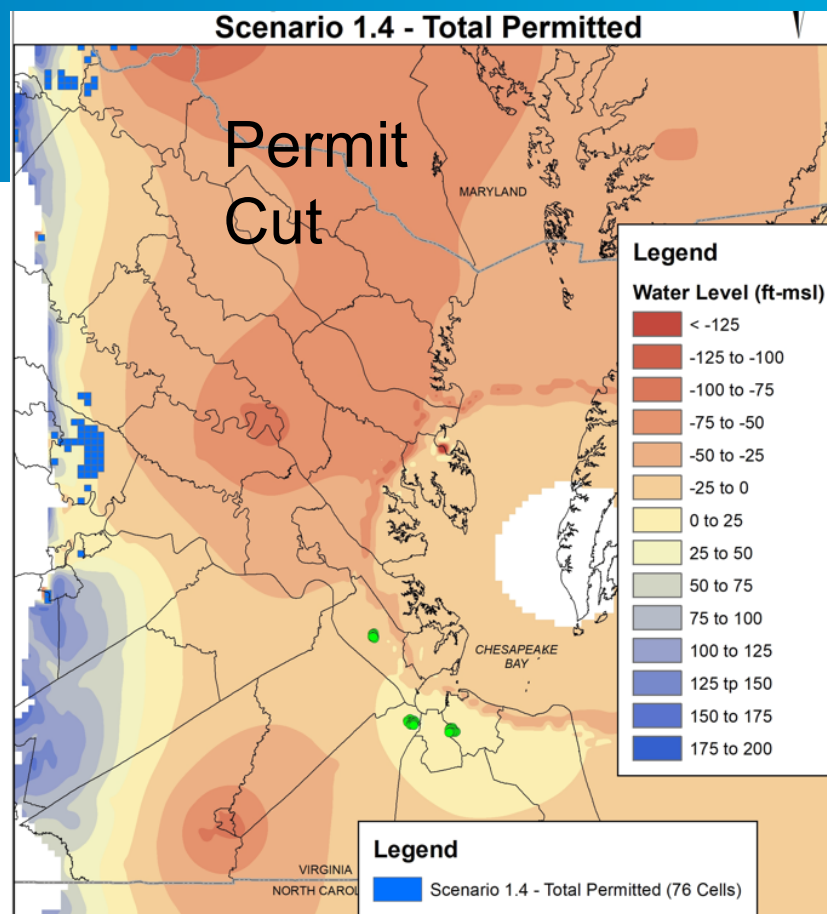
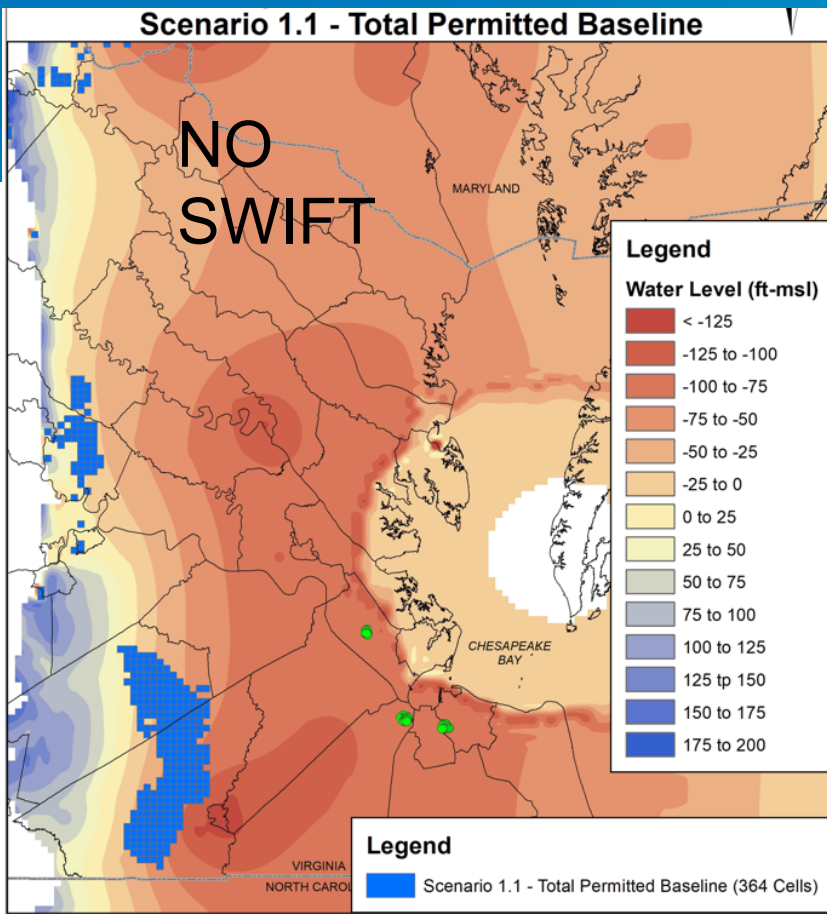


Aquaveo Modeling

Total Permitted
SWIFT at 31.9 MGD
JR at 10.4 MGD
NP at 21.45 MGD

Critical cell failures
Baseline – 364
Scenario 1.2 – 83
Scenario 2.2 – 89





Aquaveo Modeling

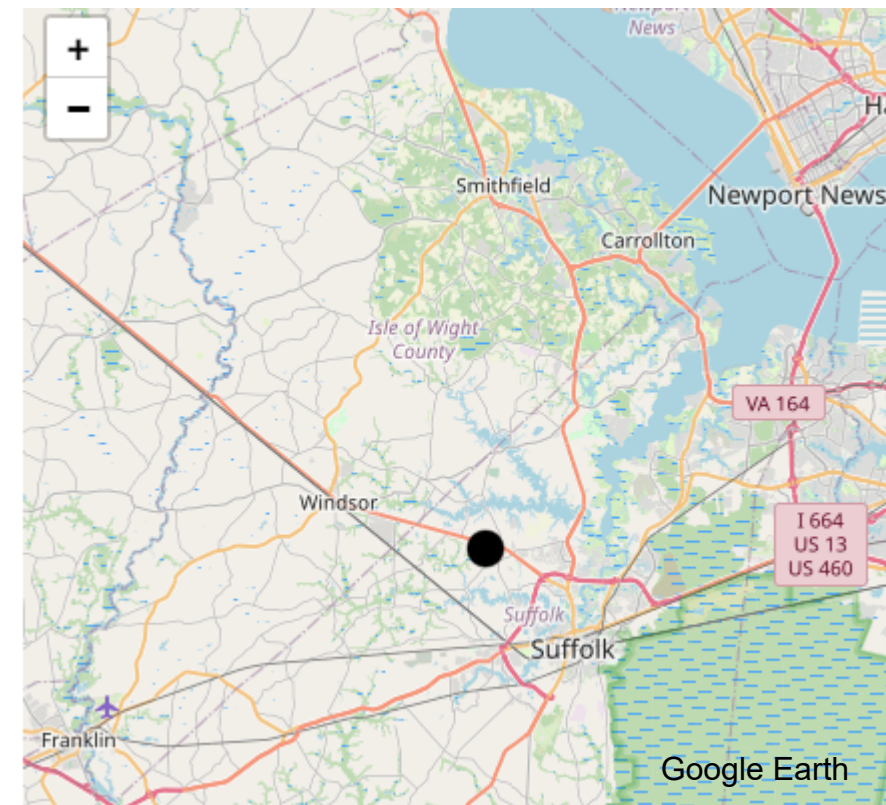
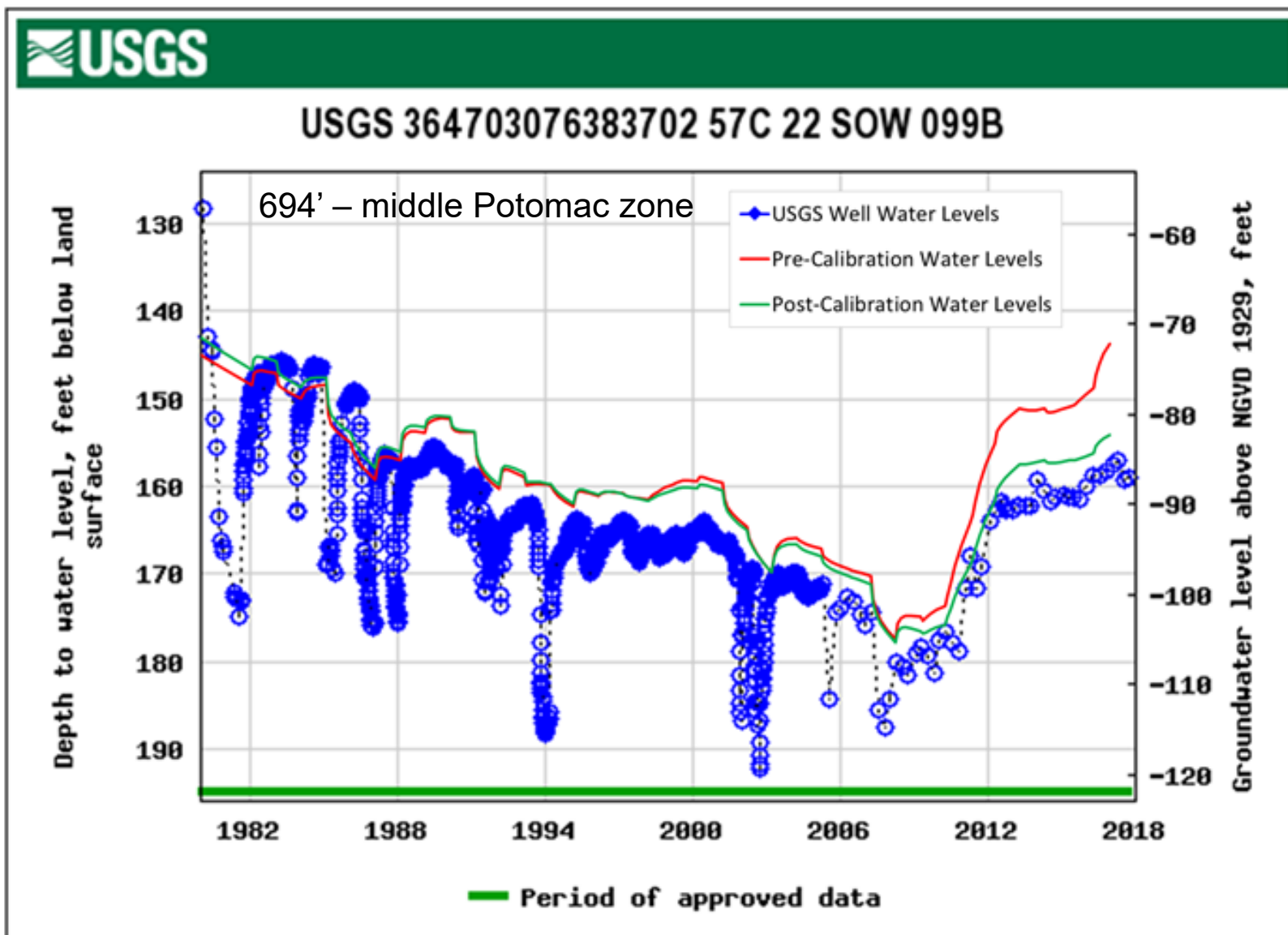
Total Permitted
SWIFT at 41.6 MGD

JR at 10.4 MGD
NP at 21.45 MGD

Critical cell failures
Baseline – 364
Scenario 1.2 – 61
Scenario 2.2 – 61

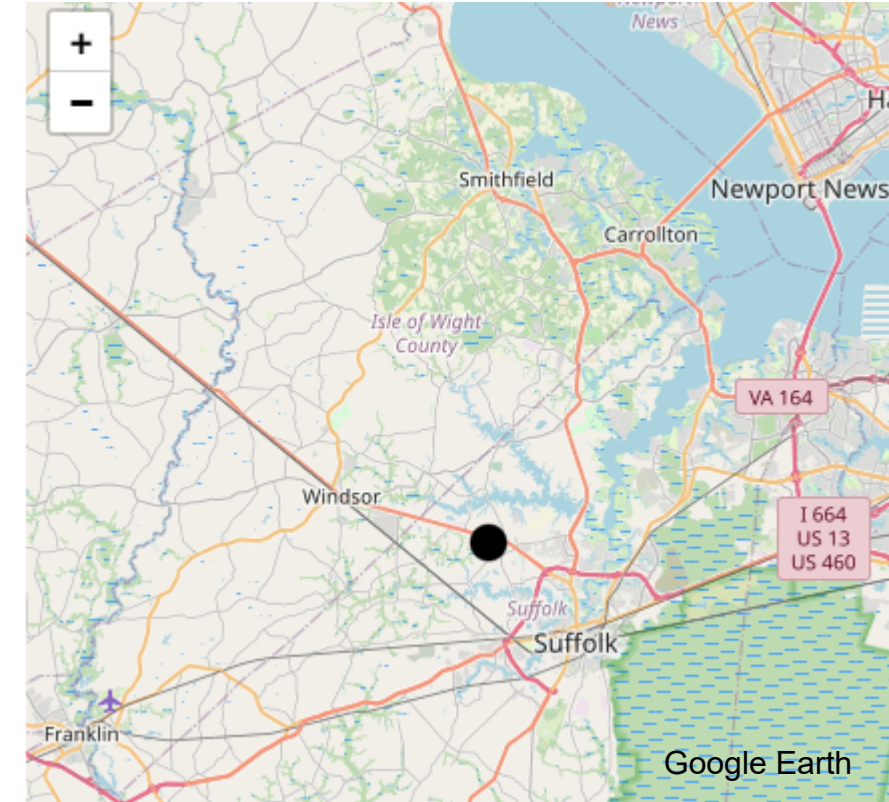
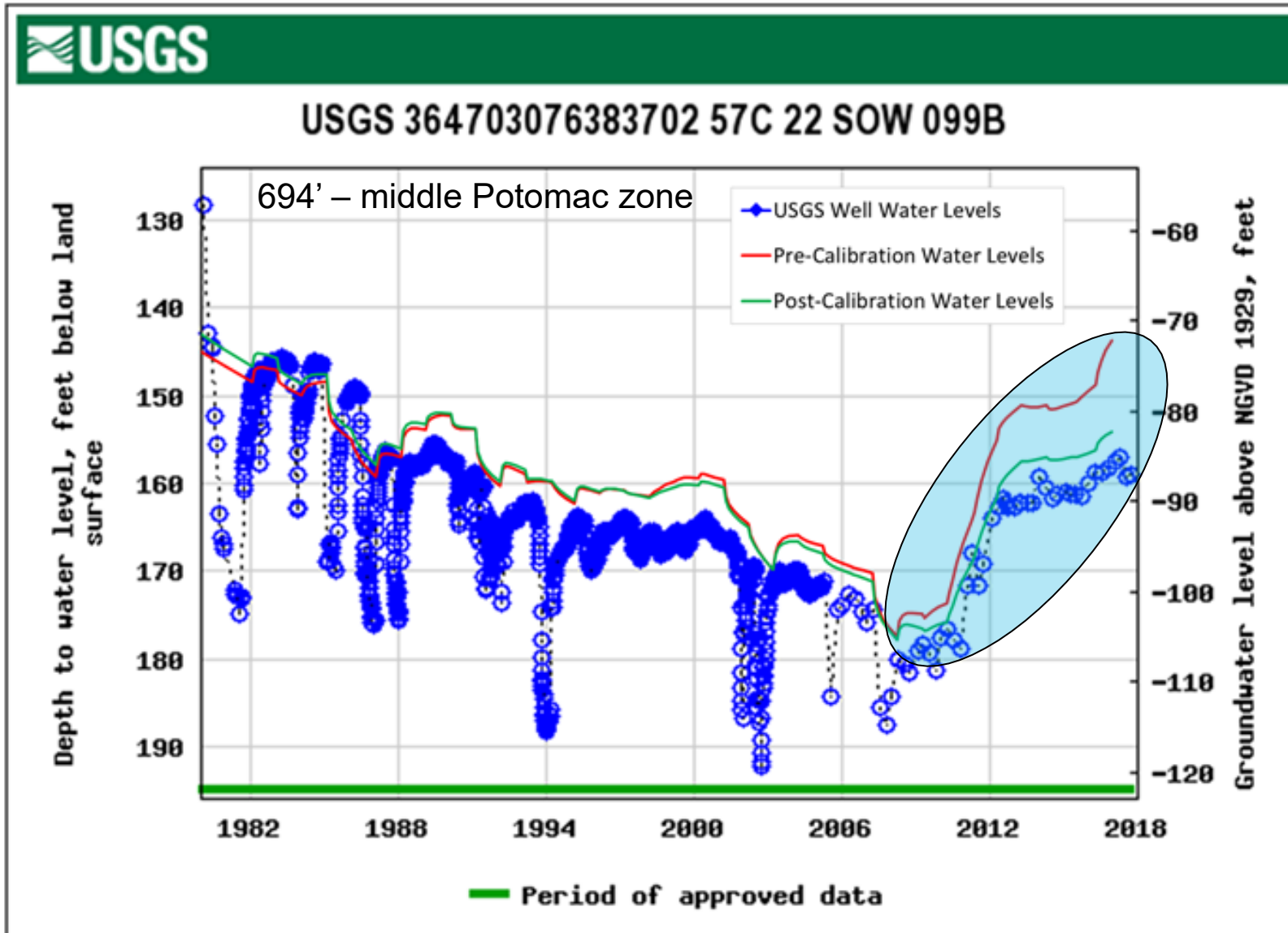


Example hydrograph, modeled vs observed



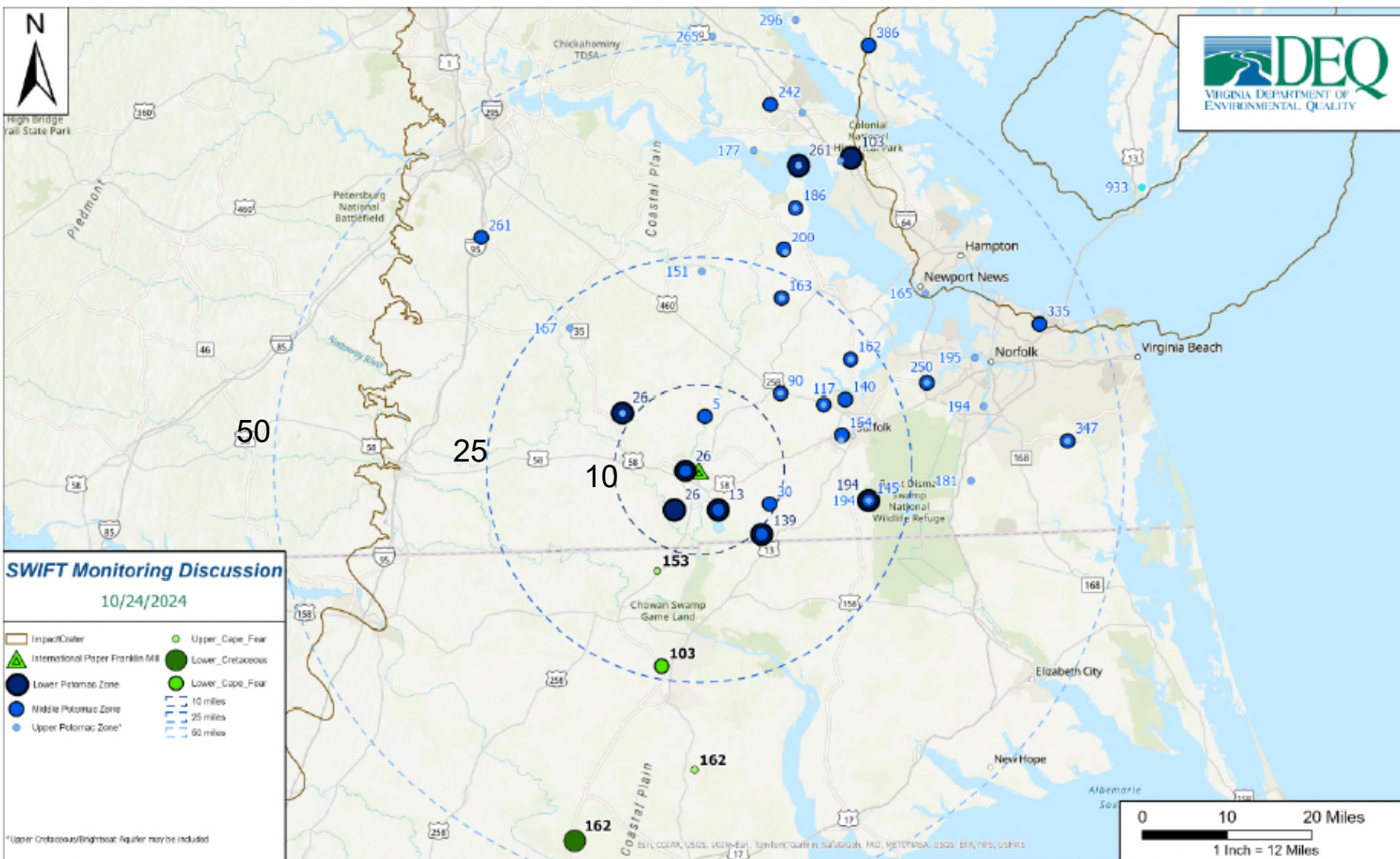
Credit: VDEQ Groundwater
Characterization

What happened in 2010?



Credit: VDEQ Groundwater
Characterization

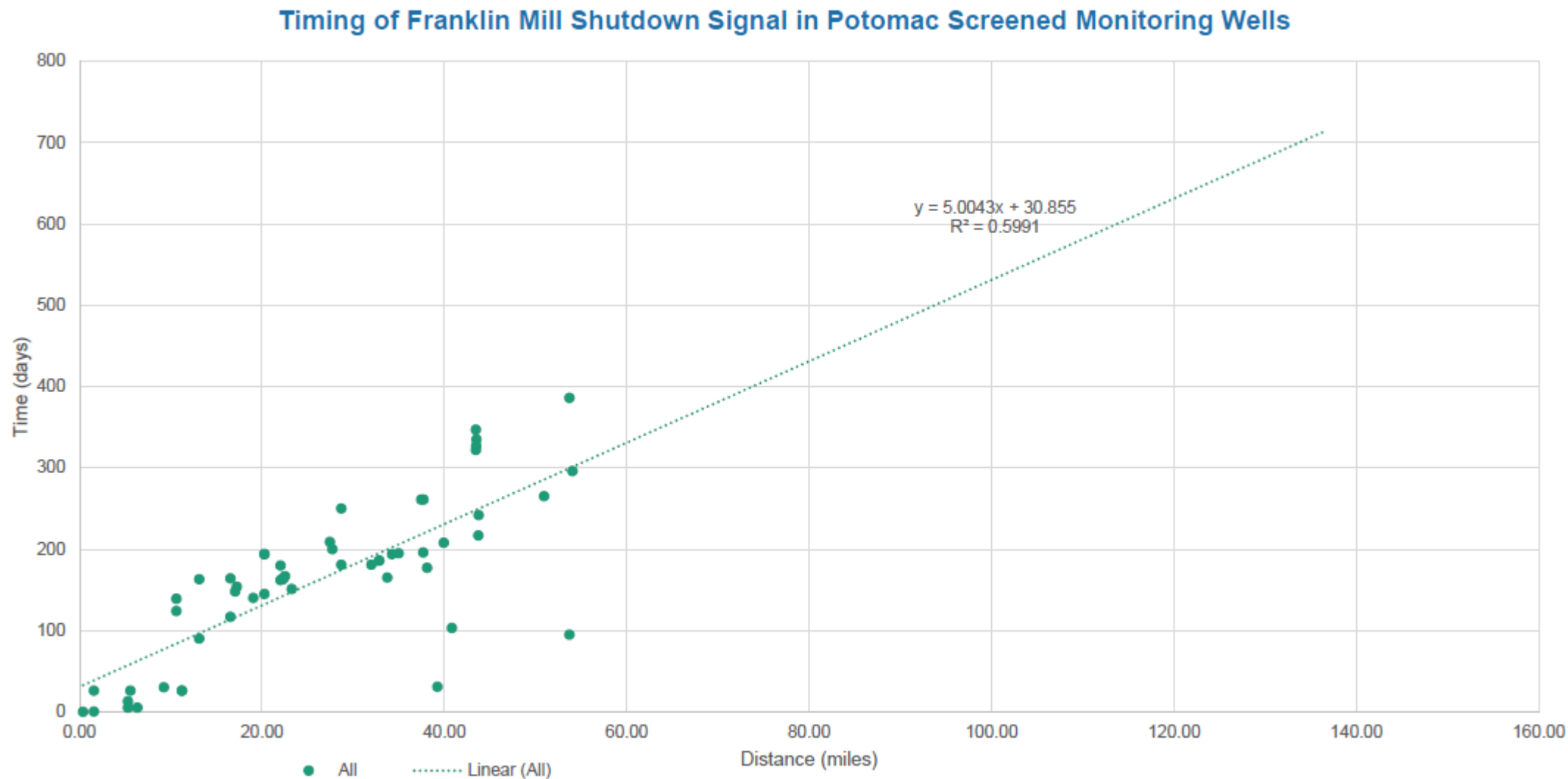
Franklin Mill Shutdown Response Time in Days



- Response travel time (days) vs distance (miles) from mill
- Limited time resolution
- Response was noted in NC wells also

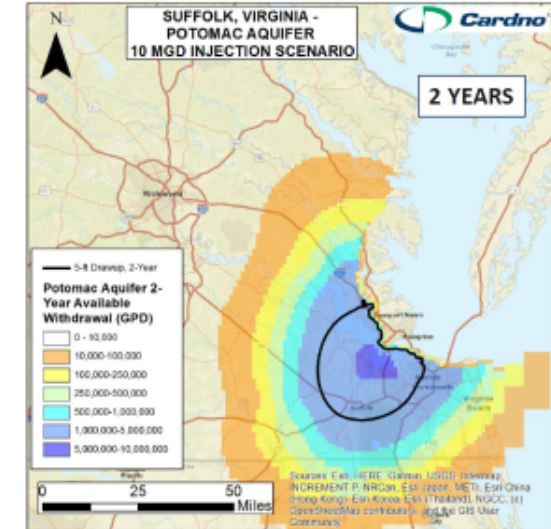
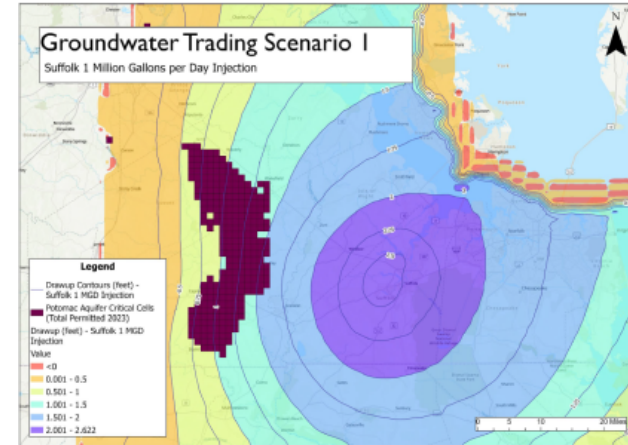
Credit: VDEQ Groundwater Characterization

Recovery Propagation: Time (days) vs Distance (miles)



Future Modeling Efforts

- Stantec conducted modeling to demonstrate the additional groundwater availability based on hypothetical managed aquifer recharge
 - HRSD is engaging Stantec to perform similar modeling with JCSA as a real case example
 - Model anticipated SWIFT Phase 1 recharge capacity and JCSA pre-permit cut withdrawal capacity
- Further vetting of the IP Paper Mill recovery data to support the model
 - Examine model versus observed hydrographs at other key areas (e.g., critical cell locations)
 - Perform linear regression on modeled results at mw locations and compare to observed graph



SCENARIO	GALLONS RECHARGED	CRITICAL CELLS ELIMINATED	AVERAGE HEAD INCREASE (FT)
Hanover County 1-MGD	18.3 Billion	29	0.5
Hanover County 10-MGD	183 Billion	88	5
Suffolk 1-MGD	18.3 Billion	19	0.5
Suffolk 10-MGD	183 Billion	109	5

Critical Cell = model cell where aquifer head is predicted to be below the surface representing 80% of the distance between land surface and the aquifer top after 50 years

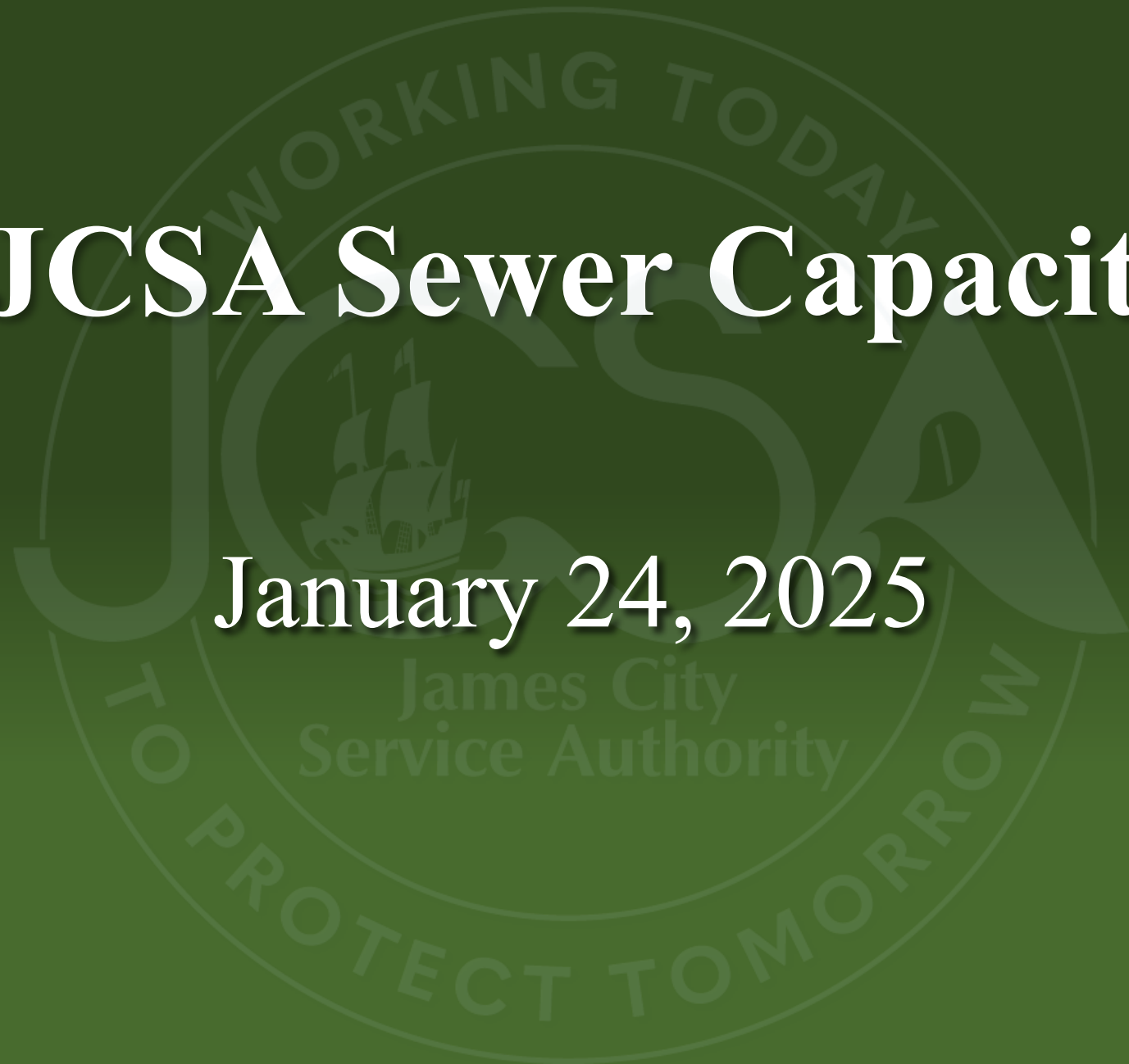
Credit: Jason Early, Bryant Mountjoy, Stantec

Thank you!



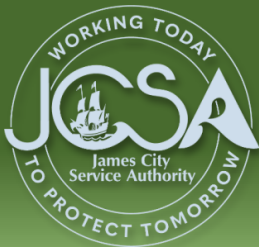
JCSA Sewer Capacity

January 24, 2025

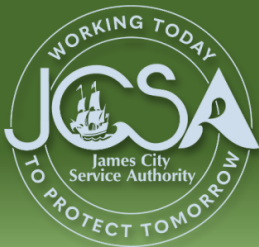


JCSA Collection System

- 78 Pump Stations
 - 23 directly connected to HRSD's Force main
- All stations monitored since 2008
 - Flows
 - Pressures
 - Wet Well Levels
 - Pump Run times/status
 - Communications
 - Emergency power

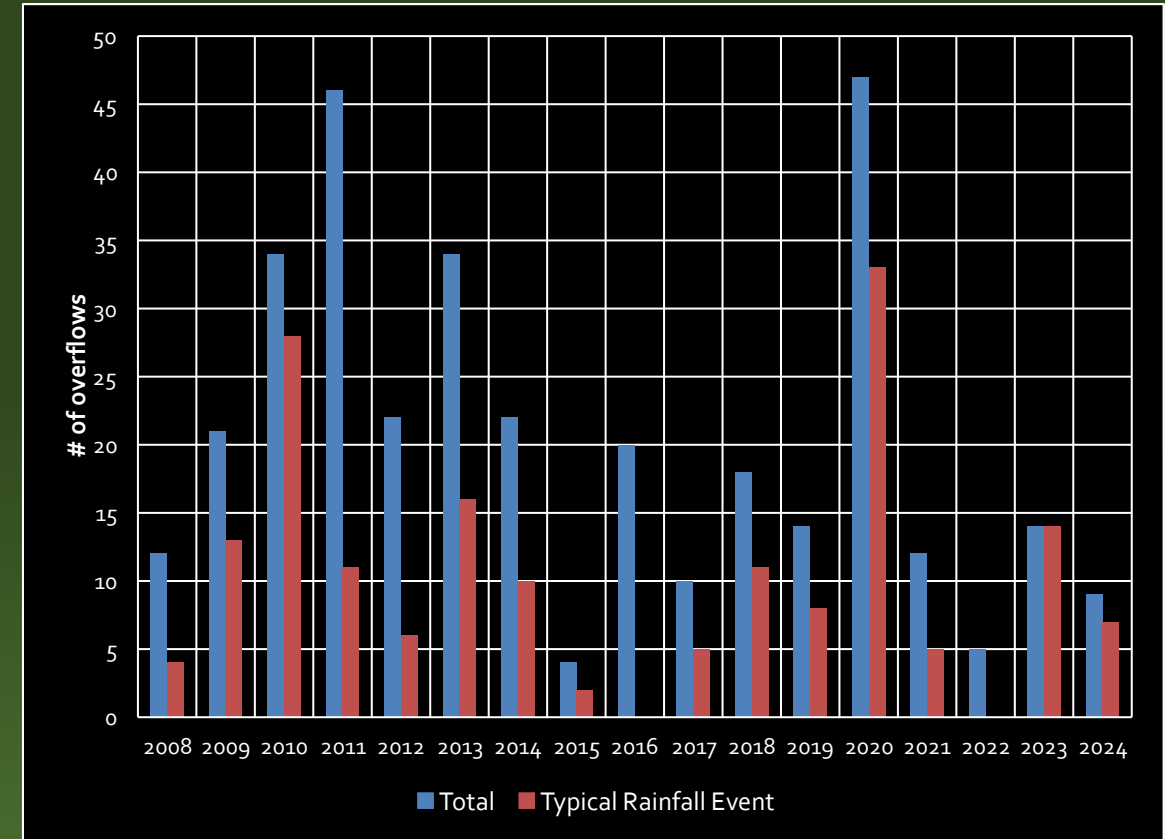


JCSA Collection System Overview



Overflows

Year	Total	Volume	Typical Rainfall Event	Volume	Hurricane Tropical Storm	# caused by high pressures	Other
2008	12	12,700	4		0	2	8
2009	21	9,580	13		0	5	8
2010	34	3,700	28		0	17	6
2011	46	9,667	11		20	16	15
2012	22	5,310	6		8	8	8
2013	34	7,770	16		12	17	6
2014	22	18,652	10		0	5	12
2015	4	292	2		0	1	2
2016	20	878,085	0		13	8	7
2017	10	151,145	5		0	5	5
2018	18	15,270	11	466	0	5	7
2019	14	109,000	8	102,750	0	5	6
2020	47	593,446	33	490,626	6	24	8
2021	12	70,987	5	43,217	0	3	7
2022	5	5,841	0	0	0	0	5
2023	14	88,219	14	88,219	0	14	0
2024	9	90,227	7	51,609	0	7	2
Grand Total	344	2,069,891	173	776,887	59	142	112



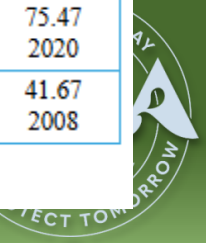
Overflows compared to annual rainfall

Year	Total	Rainfall	Hurricane/Tropical Storm	Other
2008	12	4	0	8
2009	21	13	0	8
2010	34	28	0	6
2011	46	11	20	15
2012	22	6	8	8
2013	34	16	12	6
2014	22	10	0	12
2015	4	2	0	2
2016	20	0	13	7
2017	10	5	0	5
2018	18	11	0	7
2019	14	8	0	6
2020	47	33	6	8
2021	12	5	0	7
2022	5	0	0	5
2023	14	14	0	0
2024	9	7	0	2
Total	344	173	59	112

Monthly Total Precipitation for WILLIAMSBURG 2 N, VA

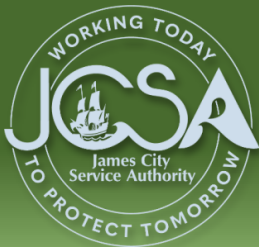
Click column heading to sort ascending, click again to sort descending.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2008	1.53	3.58	4.68	6.74	3.27	2.10	1.92	1.76	6.14	1.31	4.54	4.10	41.67
2009	1.70	1.05	4.97	3.59	5.31	3.54	7.54	3.94	6.77	3.01	7.68	6.95	56.05
2010	4.97	3.39	6.14	1.44	2.90	1.84	3.20	2.34	14.19	1.93	0.81	3.15	46.30
2011	2.01	1.69	3.25	2.29	2.16	4.07	10.69	12.29	8.61	4.24	3.58	1.63	56.51
2012	2.29	3.47	3.09	3.48	3.17	3.93	5.96	5.14	2.97	7.64	0.55	2.84	44.53
2013	6.44	4.27	3.91	3.96	5.62	11.08	7.07	5.32	0.86	3.18	2.66	6.58	60.95
2014	3.66	2.50	4.09	8.66	3.46	4.25	5.81	3.57	5.04	1.82	3.61	3.65	50.12
2015	3.60	2.81	4.99	5.42	2.53	10.50	4.41	4.30	4.10	4.99	4.41	4.28	56.34
2016	3.31	4.93	2.33	3.03	10.17	4.97	3.63	1.96	7.26	5.67	1.26	2.54	51.06
2017	4.39	1.36	5.15	3.53	5.32	4.96	2.10	8.83	2.03	4.02	1.47	2.42	45.58
2018	4.55	2.43	2.89	2.64	6.44	3.56	10.24	3.41	5.01	5.72	7.00	4.94	58.83
2019	3.29	4.61	4.34	4.59	2.62	6.18	4.51	4.69	1.03	5.36	3.12	3.53	47.87
2020	3.37	5.12	3.71	5.03	3.62	5.79	4.99	16.05	10.09	6.96	4.05	6.69	75.47
2021	4.00	5.84	4.32	1.56	1.75	7.23	8.19	8.45	2.96	5.30	0.81	1.70	52.11
2022	5.98	1.37	5.32	3.72	4.31	4.33	5.70	2.90	4.83	3.24	4.05	4.31	50.06
2023	2.94	2.21	2.48	6.32	3.33	5.00	3.40	5.96	5.84	1.44	2.90	6.23	48.05
2024	5.33	2.78	8.23	1.50	6.32	2.89	10.82	3.51	4.88	0.14	4.03	3.01	53.44
2025	M	M	M	M	M	M	M	M	M	M	M	M	M
Mean	3.73	3.14	4.35	3.97	4.25	5.07	5.89	5.55	5.45	3.88	3.33	4.03	52.64
Max	6.44 2013	5.84 2021	8.23 2024	8.66 2014	10.17 2016	11.08 2013	10.82 2024	16.05 2020	14.19 2010	7.64 2012	7.68 2009	6.95 2009	75.47 2020
Min	1.53 2008	1.05 2009	2.33 2016	1.44 2010	1.75 2021	1.84 2010	1.92 2008	1.76 2008	0.86 2013	0.14 2024	0.55 2012	1.63 2011	41.67 2008

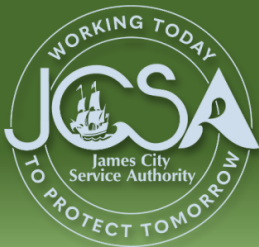


DEQ Warning letters

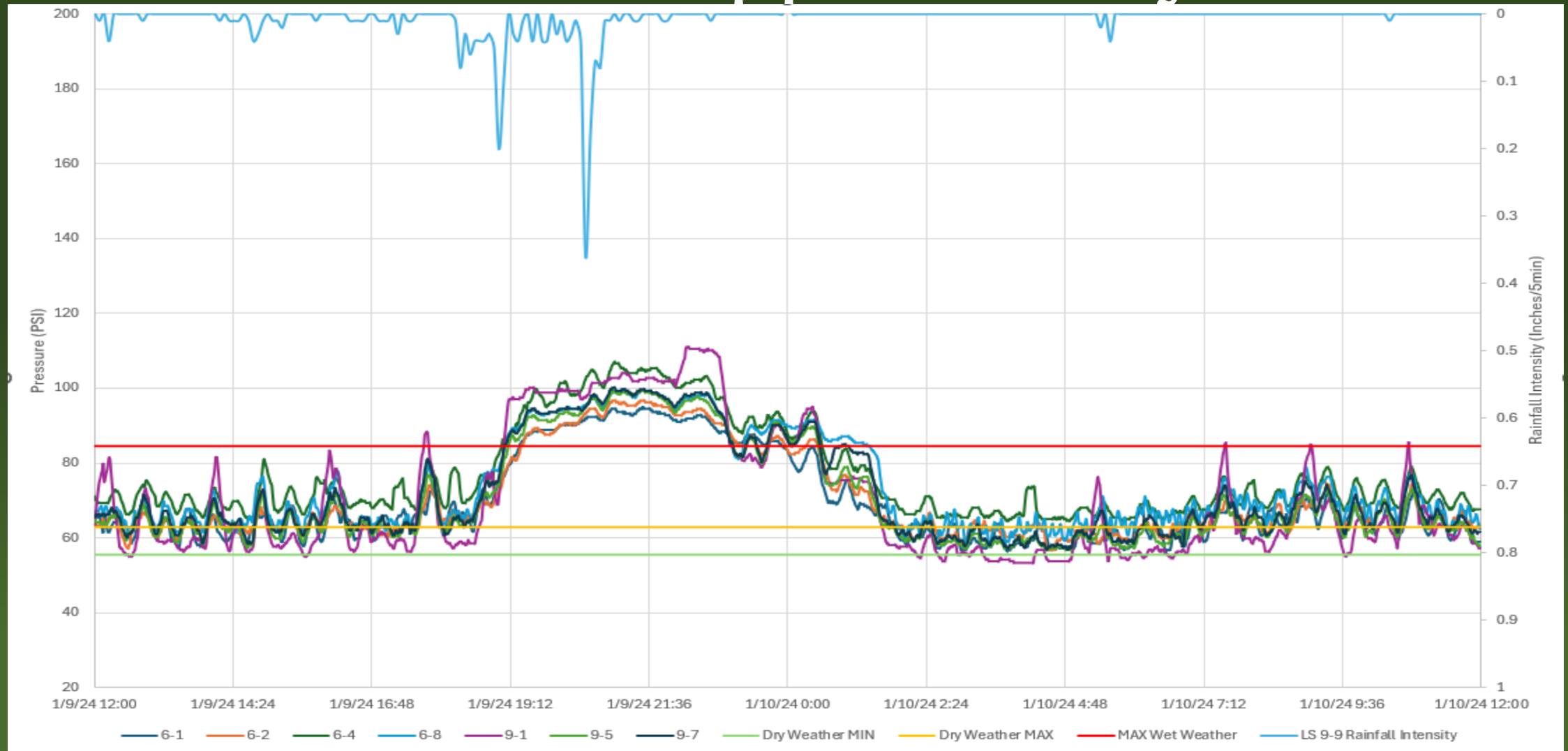
- DEQ started issuing letters to localities with reported spills
- To date we've received 6 warning letters as of 6/2/2023



- Recent overflows have been due to high pressures along the northern part of the forcemain.
 - [Sanitary Sewer Overflow location map](#)



Pressures in the upper county



Consent decree Memorandum

3.0 Guiding Principles

HRSD is responsible for ensuring there is adequate capacity in the Regional Interceptor System and treatment works to support current and future development activity within the HRSD Service Area. HRSD is also responsible for adequate wet weather capacity consistent with the 5th Amendment to the Federal Consent Decree entered on February 8th, 2022 and the Locality Memorandum of Agreement (MOA) executed on February 26th, 2014, as amended. Localities in the Metro Area are responsible for implementing approved sanitary sewer MOM Programs consistent with the Locality MOA and in accordance with the State Order by Consent effective December 19th, 2014.

Localities are responsible for defining sewer collection service areas within their communities and for constructing collection systems to convey sanitary waste from individual properties to the Regional Interceptor System. Direct and effective communication and collaboration with the localities regarding development planning, land use, population estimates and other factors that have the potential

COMMISSION ADOPTED POLICY *Regional Wet Weather Capacity*

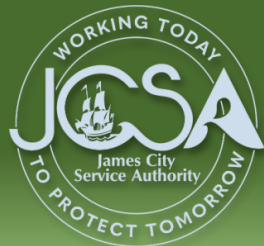


Adopted: November 22, 2022

Revised: N/A

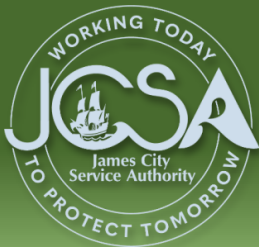
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to impact regional wastewater infrastructure is required for HRSD to adequately plan and size the Regional Interceptor System and treatment works. HRSD does not subsidize development and growth driven capacity upgrades are independent from wet weather capacity.



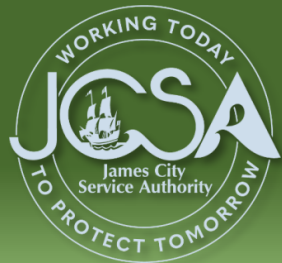
New & Potential Developments that would affect the Northern Pressures

- Stonehouse Area
 - Land Bay 5 – 75% complete (LS 9-1)
 - Tract 10A & B - clearing (LS 10-3)
 - Tract 2, 11A & S – Clearing & under construction (New LS 10-6 pumps to LS 10-5)
 - Tract 11B – Approved masterplan, no site plans submitted (proposed New LS 10-#)
 - Hazelwood/Lovett– site plan approved (New LS 10-7)
 - Hazelwood North of 64 – economic development
- Colonial Heritage
 - Fawn Crest (Deer Lake) Estates – under construction
- Conceptual
 - Whitehall neighborhood expansion – denied
 - Kiskiack Presidents Heads
 - Williamsburg Pottery
 - 6799 Richmond Road Colonial Heritage property (possible Assisted living care facility)



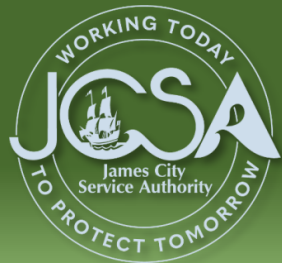
Immediate Steps to prevent spills

- HRSD
 - Upgrading SCADA to automate valving to relieve pressures during high pressure events
 - Use caustic to clean/scour force main and prevent air pockets from forming
 - Better communication between JCSA & HRSD operations
- JCSA perform an independent Wastewater Collection System Capacity Study
 - Primary focus of the study:
 - Evaluate future development and estimate future wastewater flows.
 - Identify capacity limitations with future wastewater
 - Prepare a report documenting the capacity evaluation through the year 2030
 - Hot spot map as a deliverable



HRSD next steps

- Performing a study to evaluate capacity issues in the older leaky collection systems such as LS 5-4 James Terrace area. Right now, there are only 3 of 78 JCSA sewer basins they are focusing on.
- Updating the regional hydraulic model to reflect current capacity and pressure issues
- Evaluating Capital Improvement Projects from modeling efforts



The background features a large, faint, circular logo for the James City Service Authority. The logo contains a sailing ship in the center, with the text "WORKING TODAY" at the top and "PROTECT TOMORROW" at the bottom. The words "James City Service Authority" are written in the center of the logo, below the ship.

Questions?