The Potomac Aquifer Recharge Oversight Committee
Final Meeting Minutes
September 26, 2022

In attendance: Whitney Katchmark (Committee Chair), Jim Bennett (remote), Mark Bennett, Jay Bernas, Ryder Bunce, Marcia Degen (remote), KC Filippino, Lance Gregory (remote), Julie Henderson, Dan Holloway, Hadi Khatami (remote), Mark Kram (remote), Scott Kudlas (remote), William Mann (remote), Jamie Mitchell, Scott Morris (remote), Harry Post, Doug Powell (remote), Leila Rice (remote), Gary Schafran, Tony Singh (remote), Mark Widdowson, Chris Wilson, Lauren Zuravnsky

Ms. Katchmark called the meeting to order at 11:30 am.

The minutes of the previous meeting were approved as distributed.

Dr. Widdowson (PARML) presented the timeline and planning stages for the Potomac Aquifer Recharge Monitoring Laboratory (PARML). There was some discussion on the groundwater monitoring wells being installed at James River plant. Mr. Powell mentioned that James City County is doing monitoring and offered to coordinate with PARML efforts.

Funding was received and approved at both ODU and VA Tech for the next three years. The James River plant should be in full scale operation in 2026. PARML is interested in developing a strategic plan with stakeholder input from PAROC. Current studies are at laboratory scale, but with a full-scale plant, adjustments will need to be made for monitoring, infrastructure, and student involvement. The strategic planning process would benefit from having a facilitator and suggestions were provided from participants. A facilitator familiar with Hampton Roads, the technical importance of PARML, and with strong facilitation skills was recommended. Several options were thrown out including an HRSD employee, someone from UVA's Institute for Engagement and Negotiation (IEN), Division of Consolidated Laboratory Services (DCLS), or an academic. Ms. Katchmark asked if there were funds for facilitation, that isn't clear. The group will continue discussion on finding the appropriate candidate.

Mr. Holloway (HRSD) presented an overview of the new research well drilled at the SWIFT facility. It is performing much better than the old well and they will start recharge in October. Many lessons were learned from the old well about how to avoid clogging and loss of recharge capacity. The new well is larger in diameter, packed differently to prevent clogging (silica beads with gravel), and should last indefinitely. The new well is a similar design as what to expect for a full scale recharge well.

Ms. Zuravnsky (HRSD) presented on the James River SWIFT construction progress and the Advanced Nutrient Reduction Improvements (ANRI) planned there. They have transitioned from design to construction and the JR SWIFT plant should be complete by April 2026. One design build contractor was hired for ease in funding and transition. A combination of loans and grants from WIFIA, CWRLF, and WQIF were used to fund the $468M facility. The ANRI upgrades will improve water quality for SWIFT treatment and/or discharge. VDH asked if the diffusers would be moved so as not to impact any shellfish growing areas but there is no plan to move them and the current closures will stay in place. There is constant communication with James City County parks staff as construction progresses.

Ms. Zuravnsky then discussed the full-scale implementation update for all HRSD plants. By 2025, Boat Harbor's connection to Nansemond should be complete. Some of the land at Boat Harbor will be kept but HRSD will have a smaller footprint. The pump station will be moved to higher ground. The force main will go under the James River and environmental assessments still need to be made as the permit is acquired. Strategic Planning is ongoing for VIP, York, and Williamsburg plants. A full-scale Nansemond plant will be complete before VIP.

Dr. Schafran (PARML) presented on results of aquifer isotope ratio monitoring. Oxygen and hydrogen isotope ratios serve as groundwater tracers to track movement of recharge water. There is evidence of SWIFT recharge water in the Upper Potomac Aquifer layer but no linear trend in the middle or lower layers. Other organic compounds (1,4-dioxane, nitrosamines, PFAS) were measured at various stages of treatment in the SWIFT water and in the aquifer. Removal appears to be complete in SWIFT water (following UV treatment) for most compounds. PARML will continue to monitor isotope ratios as tracers of recharge water and they will continue to monitor for 1,4 dioxane and nitrosamines as well as other organic compounds.

There were no public comments.

The meeting adjourned at 2:00 p.m.

Approved: Date:

______________________________ __________________
Committee Chair

Committee Members:

- Mike Rolband, Director of Virginia DEQ
- Dr. Colin Greene, Virginia State Health Commissioner
- Dr. William Mann, Governor Appointee
- Doug Powell, Governor Appointee
- Whitney Katchmark, HRPDC
- Dr. Stanley Grant, Director Occoquan Watershed Monitoring Laboratory
- Dr. Mark Widdowson, Co-Director of the Potomac Aquifer Recharge Monitoring Lab
- Dr. Gary Schafran, Co-Director of the Potomac Aquifer Recharge Monitoring Lab

Non-voting members:

- Mark Bennett, Director of Virginia and West Virginia Water Science Center
- Leslie Gillespie-Marthaler, Deputy Director Water Division, US EPA Region 3

Potomac Aquifer Recharge Monitoring Laboratory (PARML)

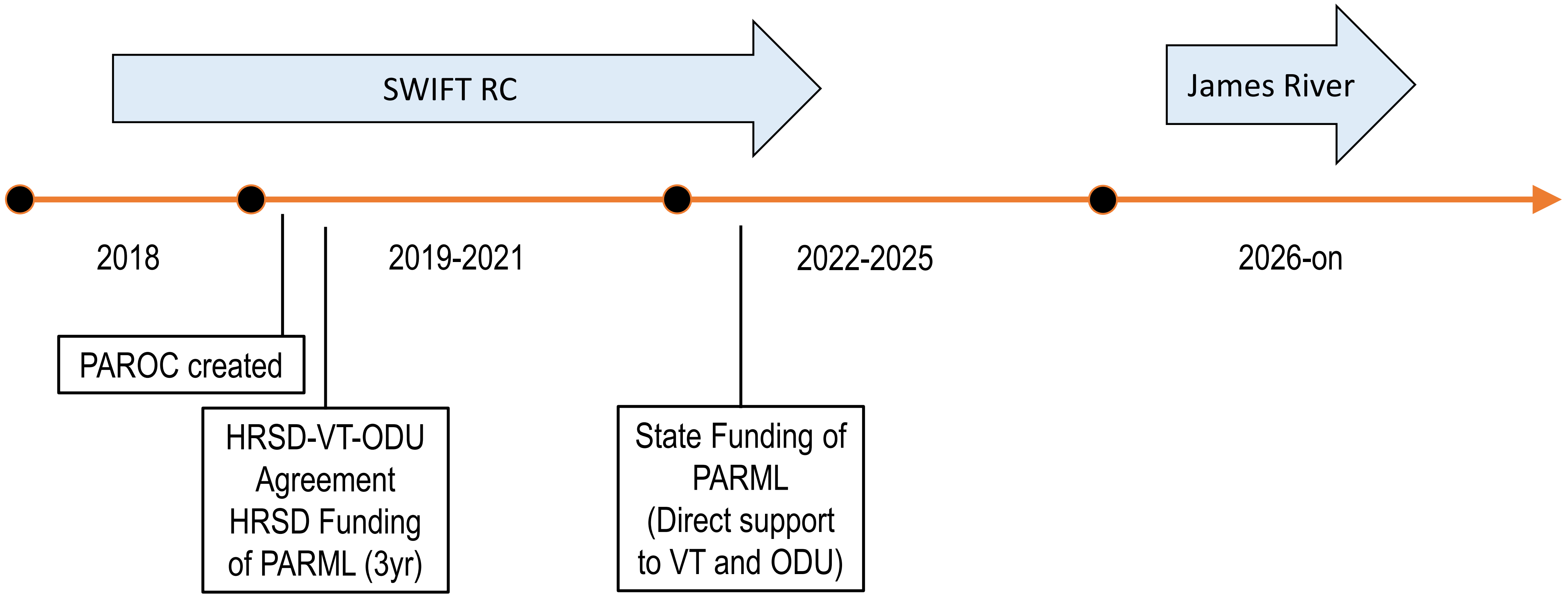
Mark Widdowson and Gary Schafran
PARML Co-Directors

September 26, 2022

PARML Updates

1. Groundwater Monitoring – James River
   - Public-Sector Partnerships
2. PARML Funding
3. Long-Term Planning
4. Groundwater Chemistry
   - Aquifer Monitoring
   - Analytical Method Development

PARML Planning Concepts

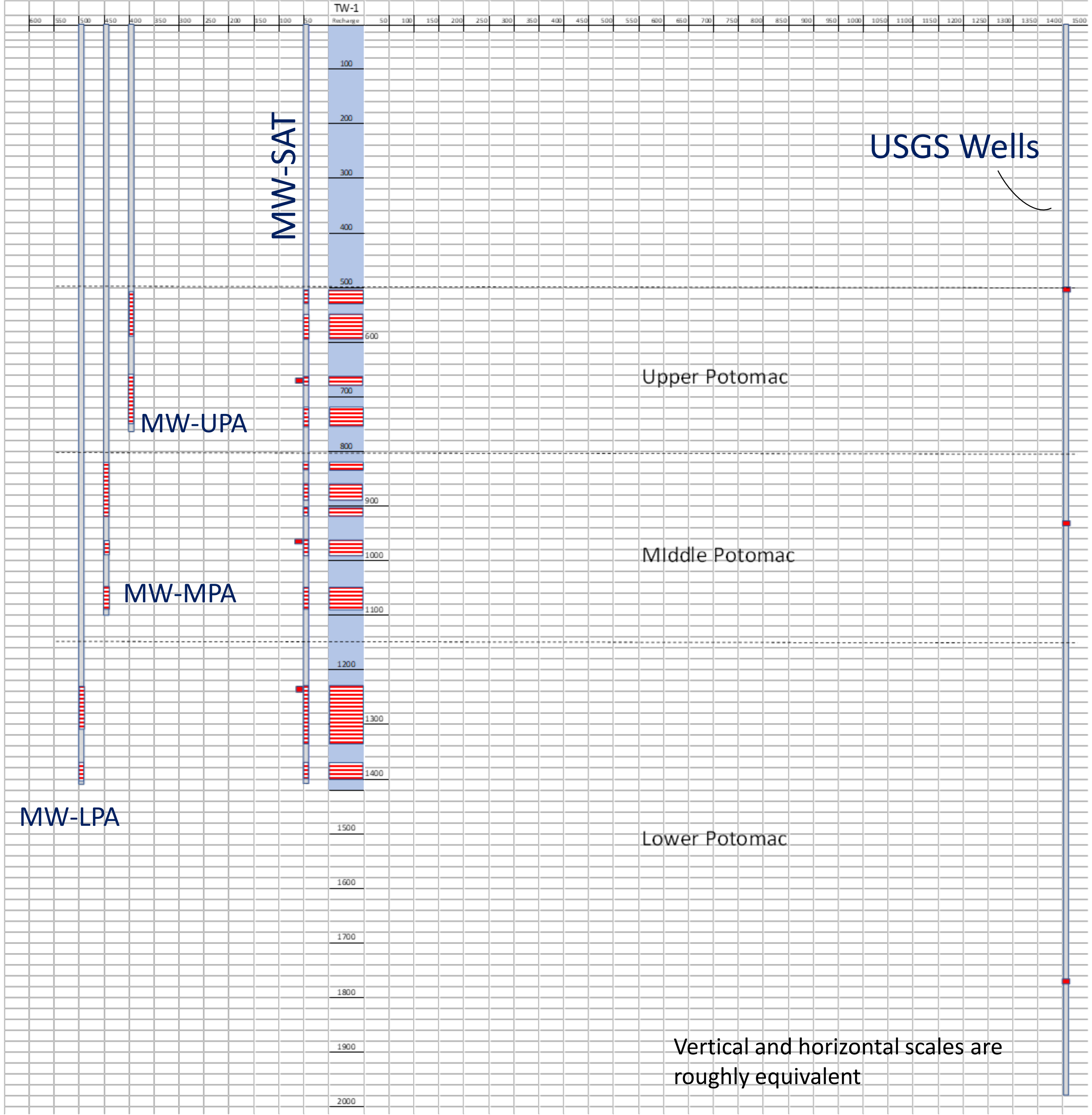


Aquifer Isotope Ratio Monitoring

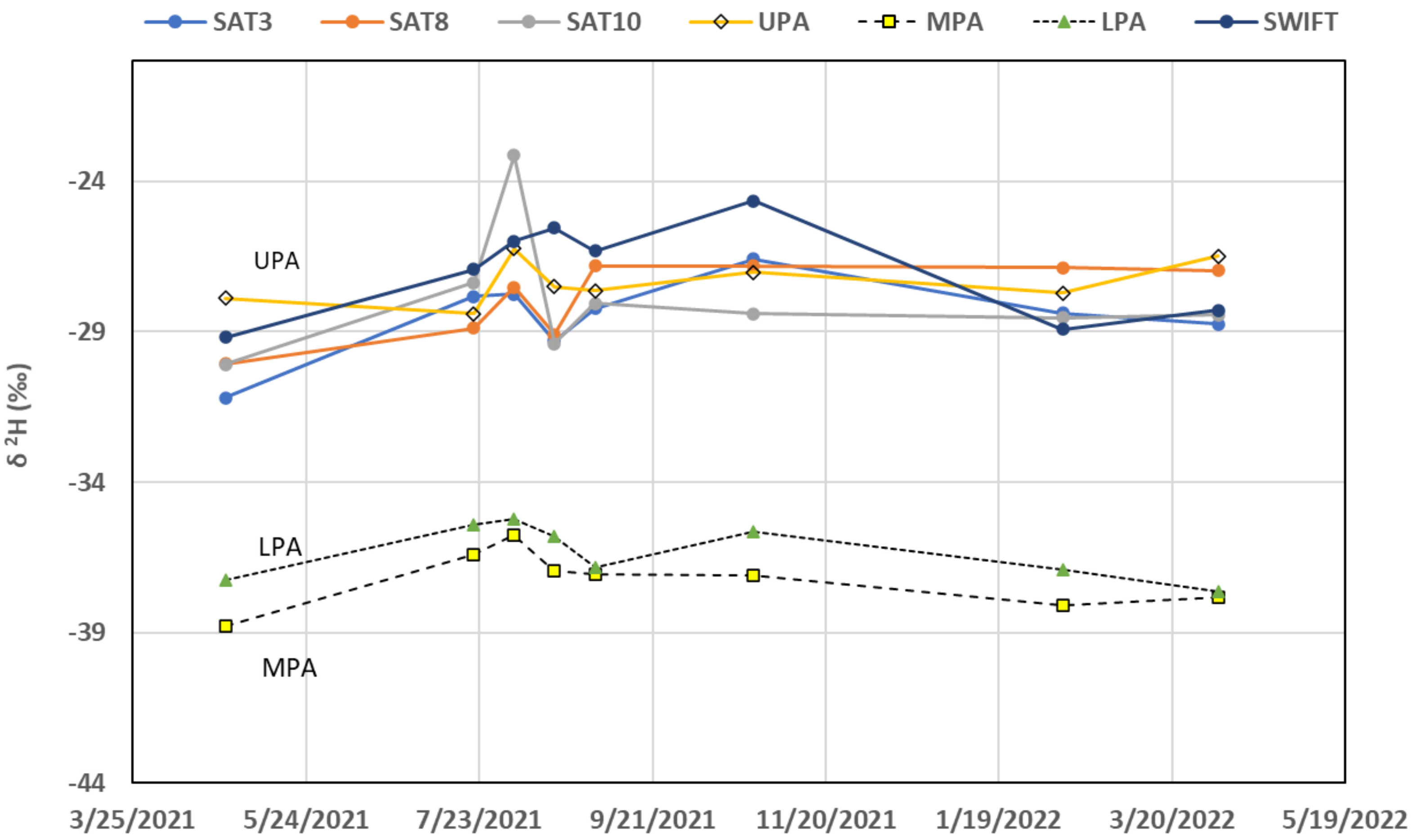
Oxygen ($^{18}O/^{16}O$) and Hydrogen ($^{2}H/^{1}H$) Isotope Ratios May Serve as a Groundwater Tracer Helping to Movement of Recharge Water

- Develop as a tool to monitor the movement of recharge water in the Potomac Aquifer
- Essentially unaffected by geochemical reactions

Recharge and Monitoring Wells at the SWIFT Research Center and USGS Wells



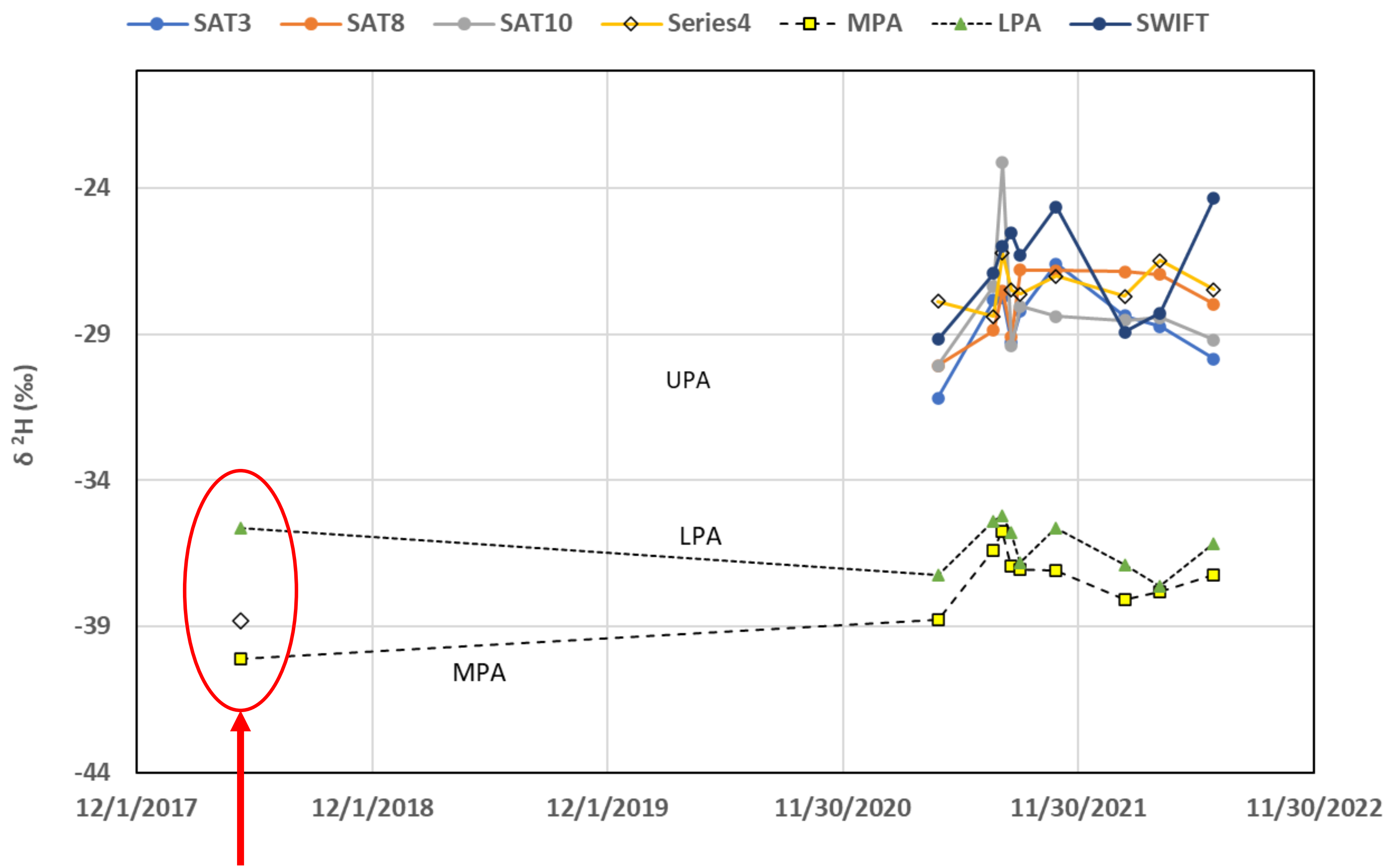
Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



At the previous PAROC meeting this figure was shown and it was interpreted as manifesting that UPA and MW SAT were fully influenced by recharge and LPA and MPA were not.

However, no pre recharge isotope data were available for comparison

Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells

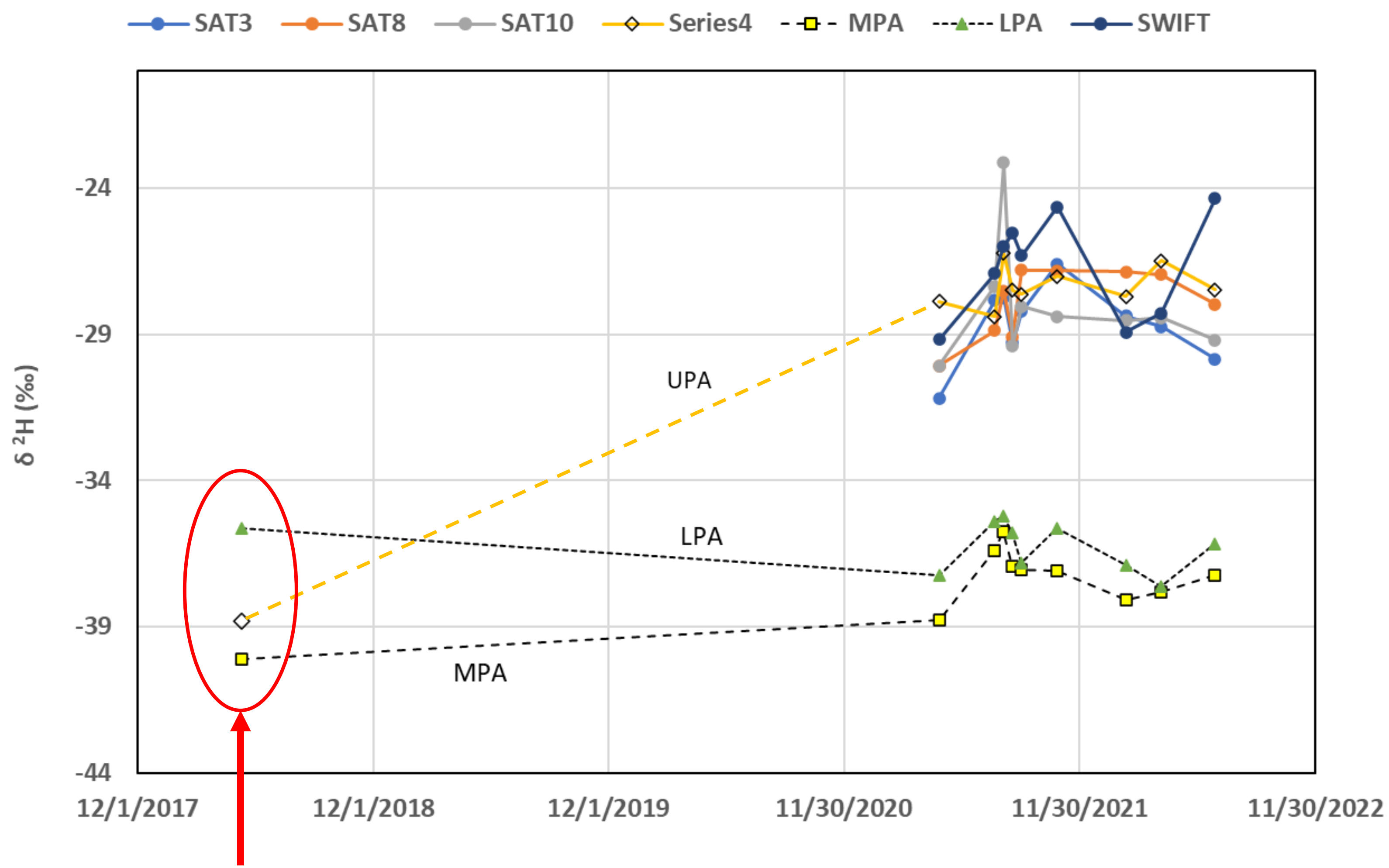


Isotope ratio vales of archived samples collected prior to recharge

Archived samples at SWIFT RC analyzed

Lack of significant influence of recharge on MPA and LPA

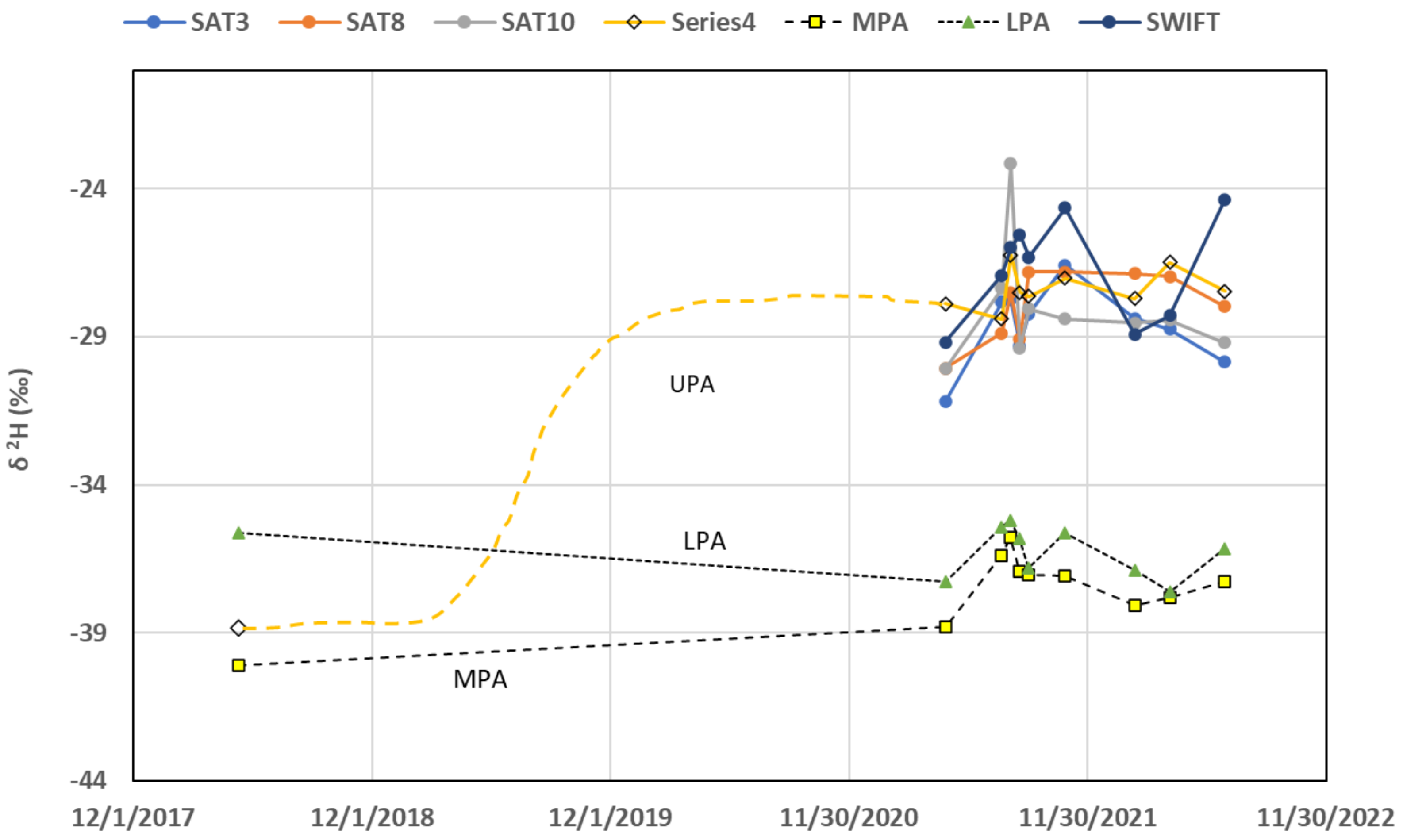
Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



Isotope ratio vales of archived samples collected prior to recharge

The influence of SWIFT recharge is clearly evident at UPA but not likely a linear trend

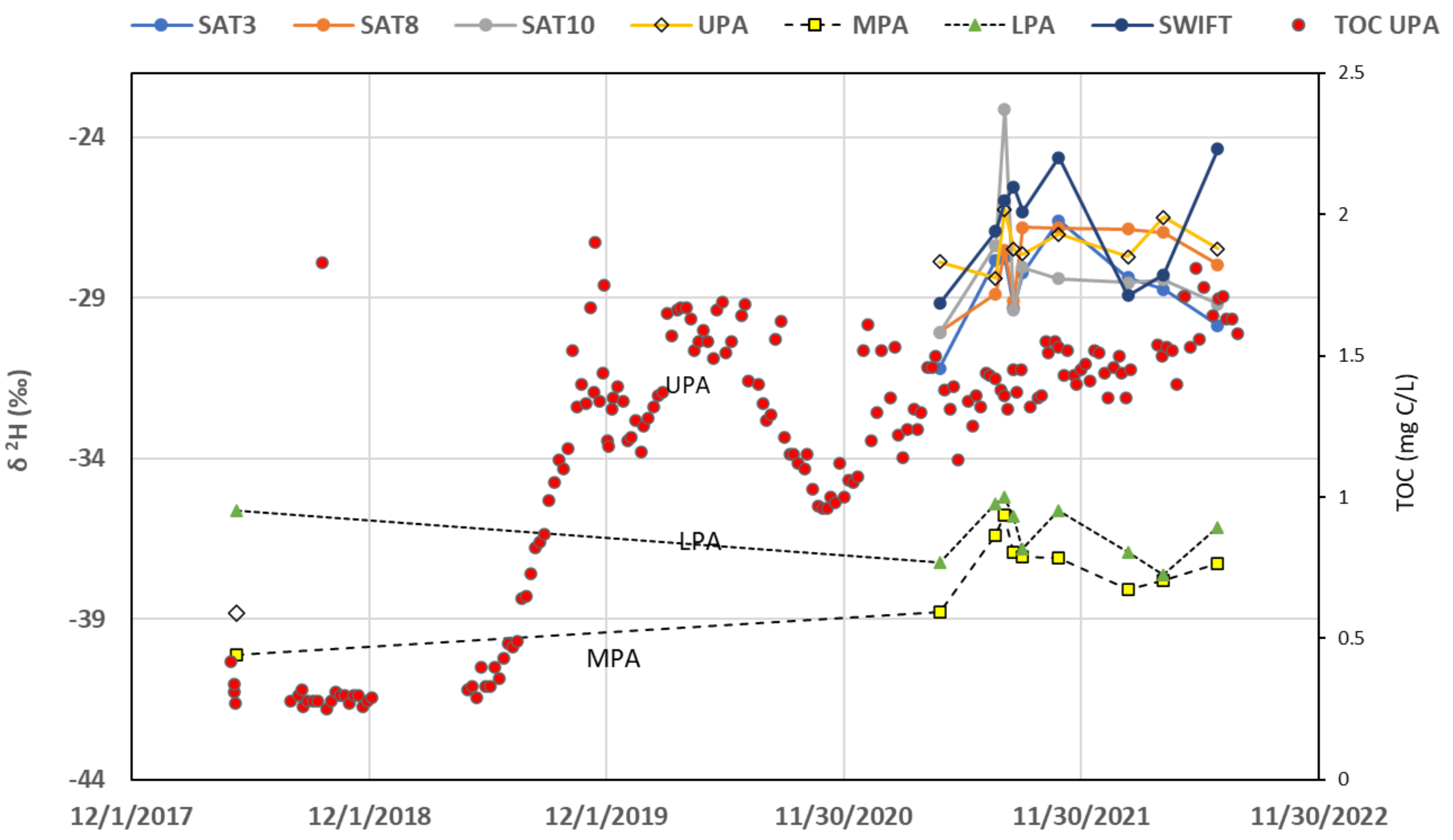
Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



Based on both computer modeling and chemical monitoring a rapid rise in isotope ratios would be expected.

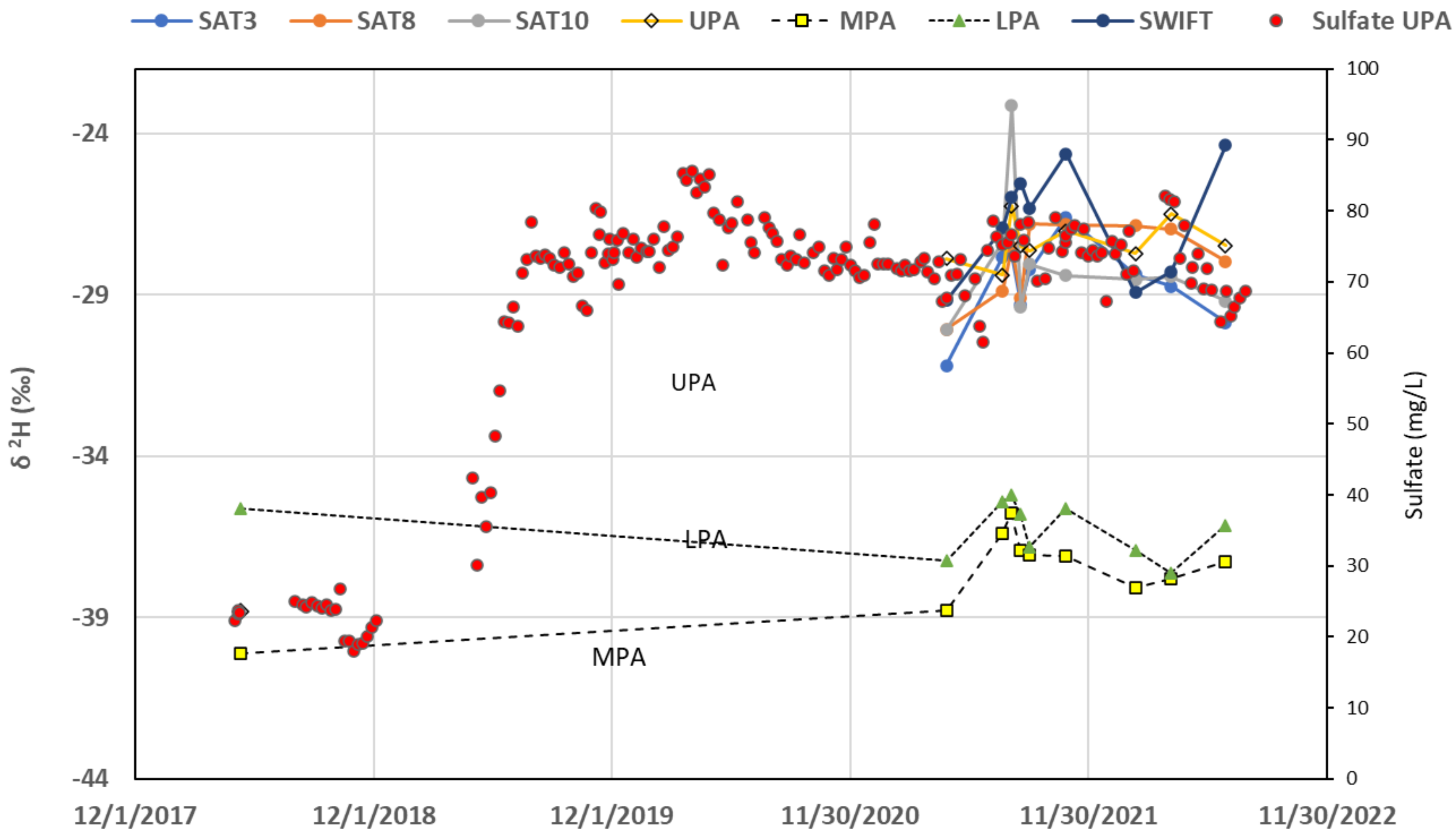
Chemical monitoring parameters to help assess recharge influence

Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



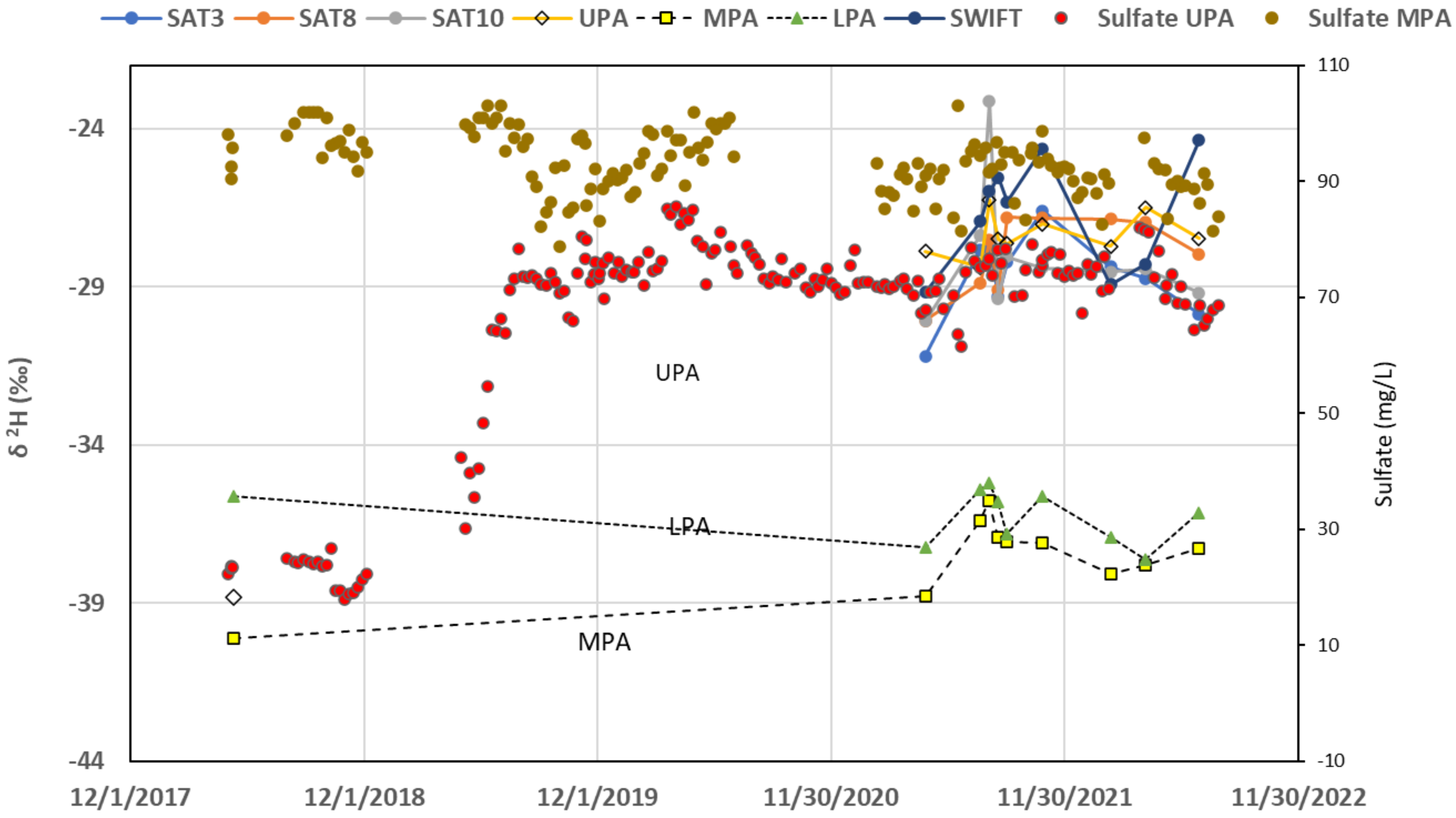
HRSD TOC UPA monitoring data illustrate the rapid rise expected

Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



Sulfate appeared an even better tracer

Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



In MPA, sulfate shows less variation consistent with MPA isotope values.

It can be seen that under full influence of SWIFT recharge, sulfate concentration change would be small compared to isotope ratio

Analytical Determination of 1,4-Dioxane and Nitrosamines in Water With a Single Method

Currently two separate methods are utilized to measure these constituents:

- USEPA Method 521 – Nitrosamines
- USEPA Method 522 – 1,4 Dioxane

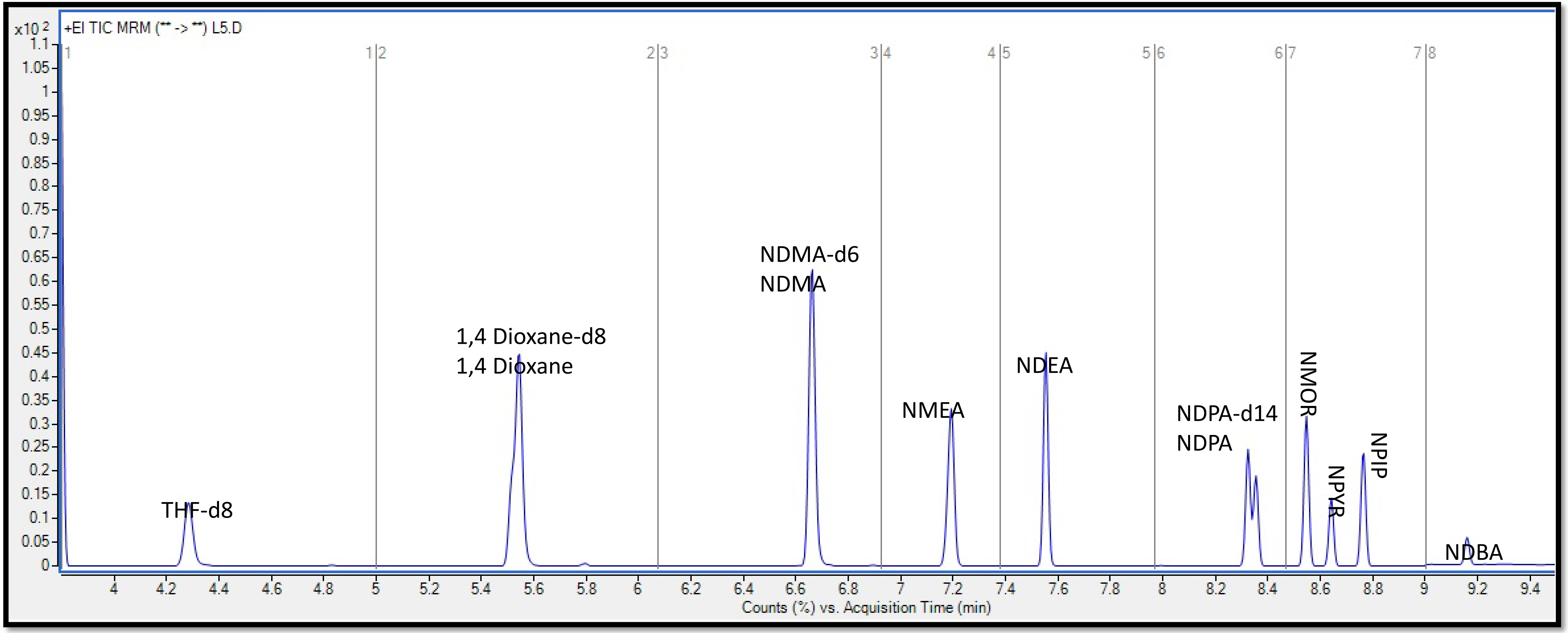
PARML Development of a Single (Combined) Method to Analyze both Nitrosamines and 1,4 Dioxane in a Single Analysis

Benefits:

- Greater number of analyses per time
- Greater number of samples per time
- Increased productivity
- Reduced solvent use (less hazardous waste generation)

New Method for Simultaneous Analysis of Organic Compounds Corresponding to EPA521/522

SWIFT Sample – September 20, 2022



Seyyedhadi Khatami

1,4 Dioxane

SWIFT Sample – September 20, 2022

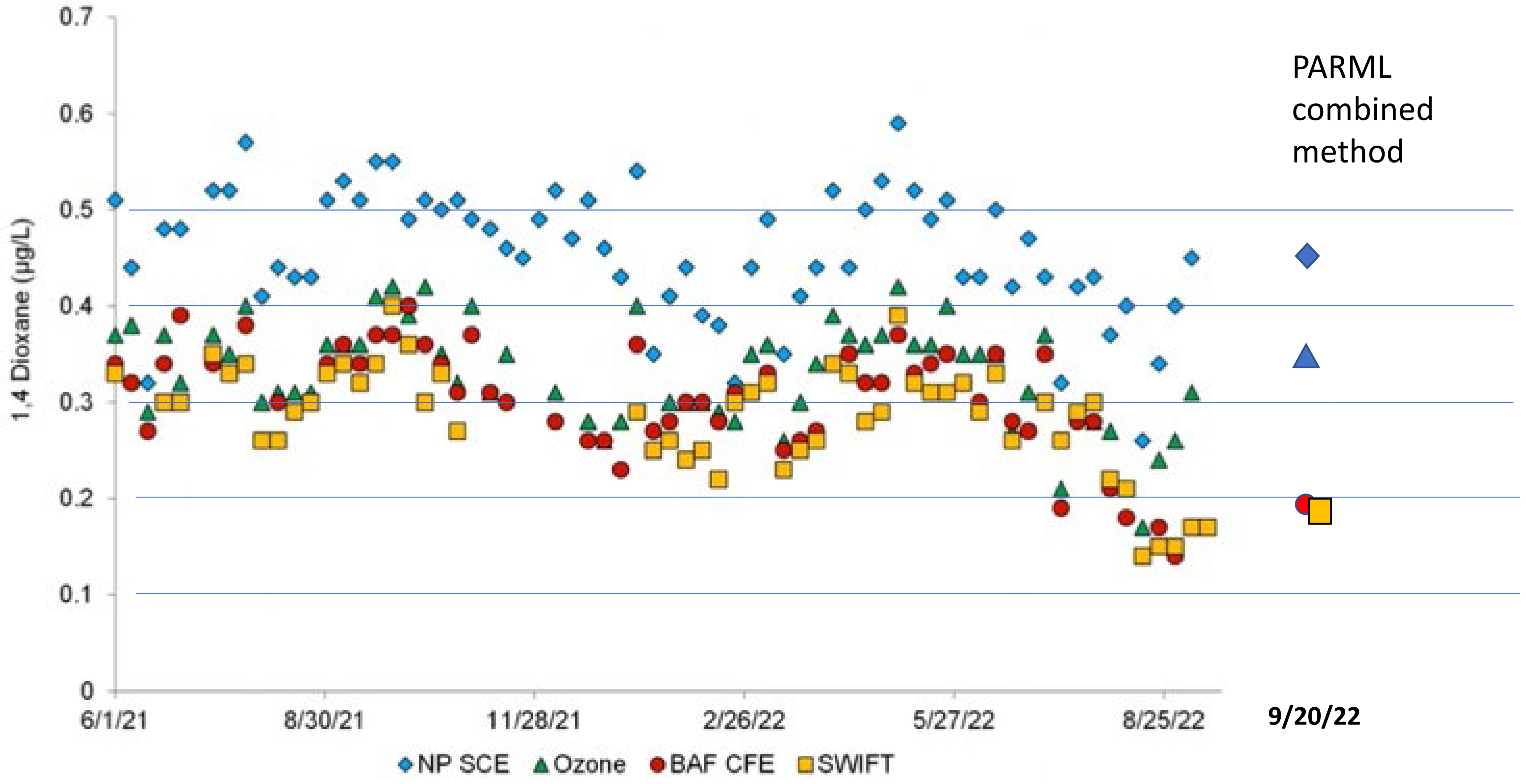
Compound name	Conc (ug/L)	Recovery % by 1,4 Dioxane-d8
(1,4 Dioxane) R2=0.991	LOQ= 0.008	
INF	0.45	86.5
FS	0.49	73.0
O3	0.34	92.2
BF	0.19	65.2
C GAC	0.18	85.8
SWIFT	0.19	88.3
UPA	0.35	82.3
MPA	0.11	75.5
LPA	0.01	77.3

NDMA

compound name	Conc (ng/L)	Recovery % by NDMA-d6
(NDMA) R2=0.992	LOQ = 2	
INF	2.28	83.7
FS	3.30	71.4
O3	114.96	89.4
BF	0.54	62.3
C GAC	0.38	82.9
SWIFT	0.72	82.7
UPA	1.02	79.6
MPA	0.50	72.7
LPA	0.24	72.3

Seyyedhadi Khatami

SRC 1,4-dioxane



NDEA

Compound name (NDEA) R2= 0.993	Conc (ng/L) LOQ = 2	Recovery % by NDMA-d6
InF	0.80	83.7
FS	0.72	71.4
O3	2.30	89.4
BF	0.42	62.3
C GAC	0	82.9
SWIFT	0.48	82.7
UPA	0.42	79.6
MPA	0	72.7
LPA	0	72.3

NMOR

Compound name (NMOR) R2= 0.992	Conc (ng/L) LOQ = 2	Recovery % by NDMA-d6
InF	5.82	83.7
FS	6.12	71.4
O3	5.16	89.4
BF	6.20	62.3
C GAC	6.98	82.9
SWIFT	0	82.7
UPA	0	79.6
MPA	0	72.7
LPA	0	72.3

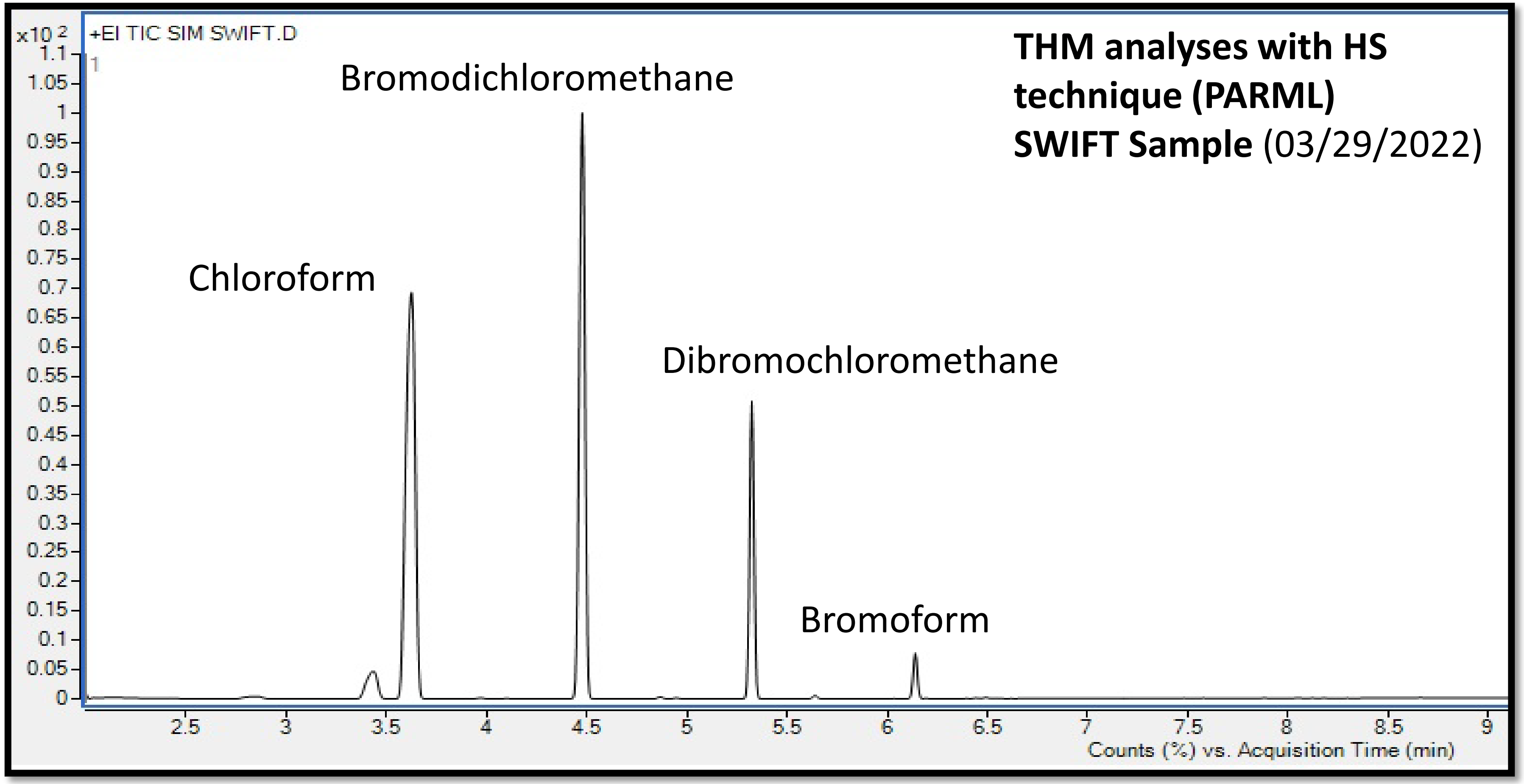
Removal appears fully to be associated with UV photolysis

Other nitrosamines are quantified too!

Seyyedhadi Khatami

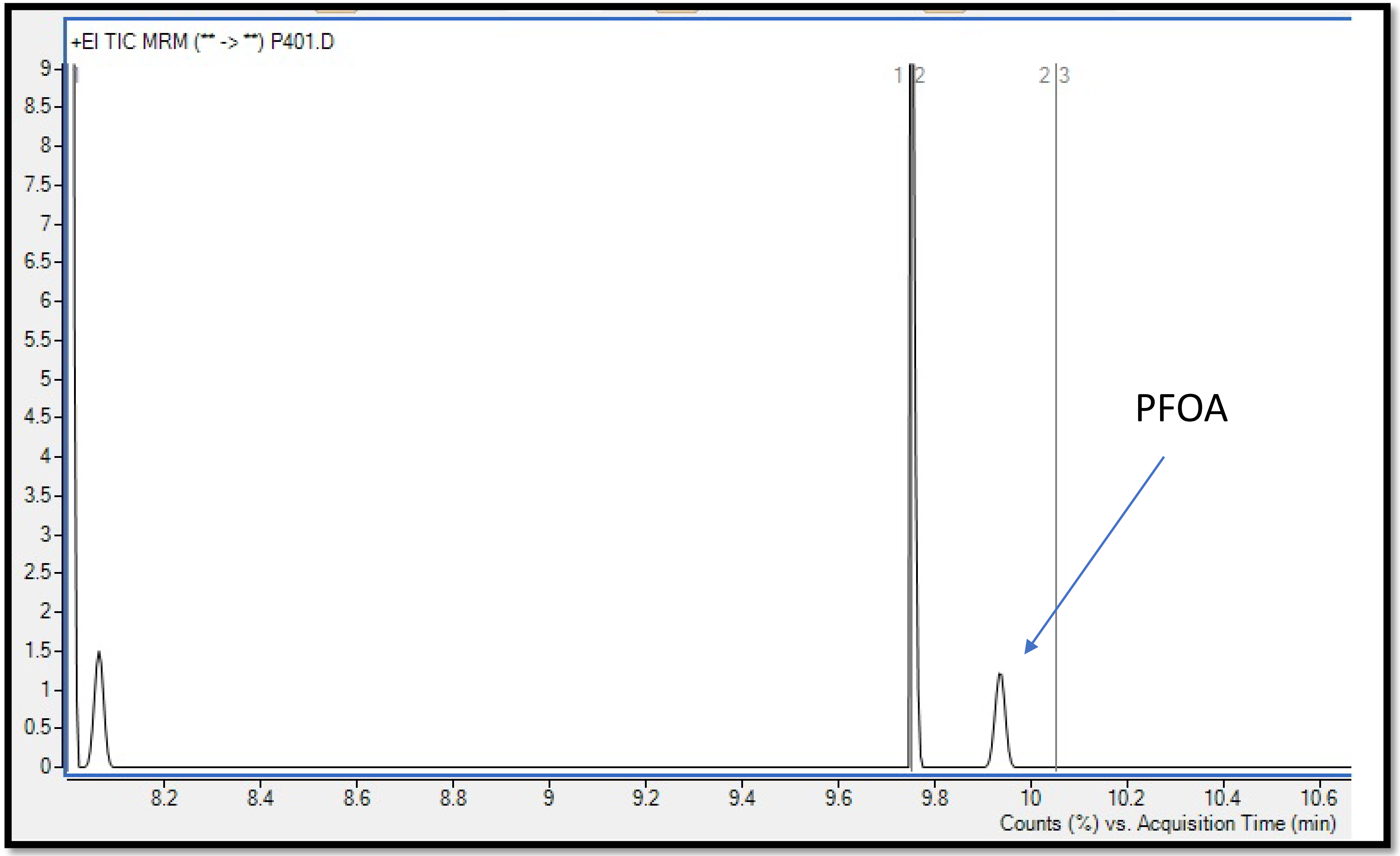
Application of EPA Method 524 (Volatile organic compounds, 54 analytes) by ITEX HS GC/MS.

Method is applicable to a wide range of organic compounds, with sufficient volatility to be analyzed by purge and trap. Includes four THMs regulated in drinking water (below).



Seyyedhadi Khatami

PARML Development of a New Method for Simultaneous Analysis of PFAS (PFCAs, PFOA) and HAAs by GC/MS



Seyyedhadi Khatami

Summary

Continuing to monitor isotope ratios in PAS to evaluate potential for use as a tracer to monitor movement of recharge water at Research Center and future SWIFT sites.

Continue monitoring of SWIFT RC for 1,4 dioxane and nitrosamines. Planned publication of this method after additional comparison efforts.

Continue application of other organics methods by GC MS and “challenge” the analyses with more complex waters of varying TOC concentrations and ionic content to assess any aqueous matrix affects

Questions?

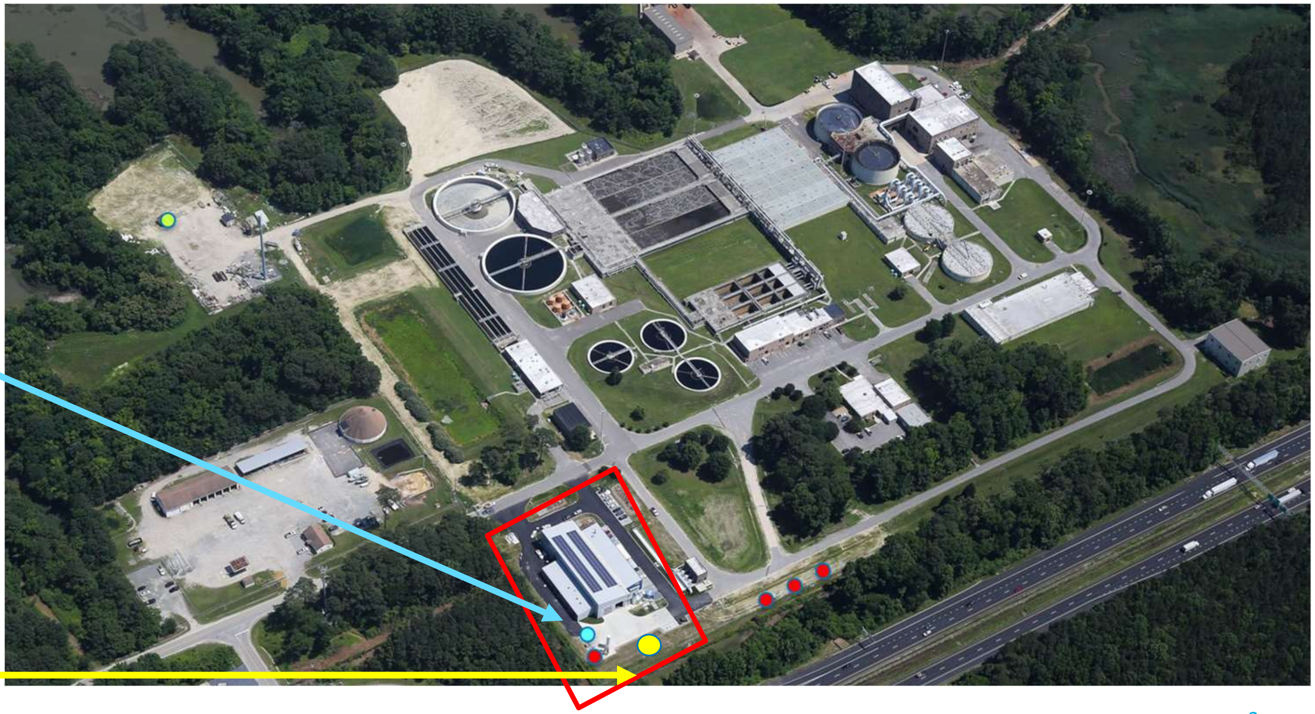
NP_MAR_01 Update

Potomac Aquifer Recharge
Oversight Committee
September 26, 2022

HRSD swift

SWIFT Research Center

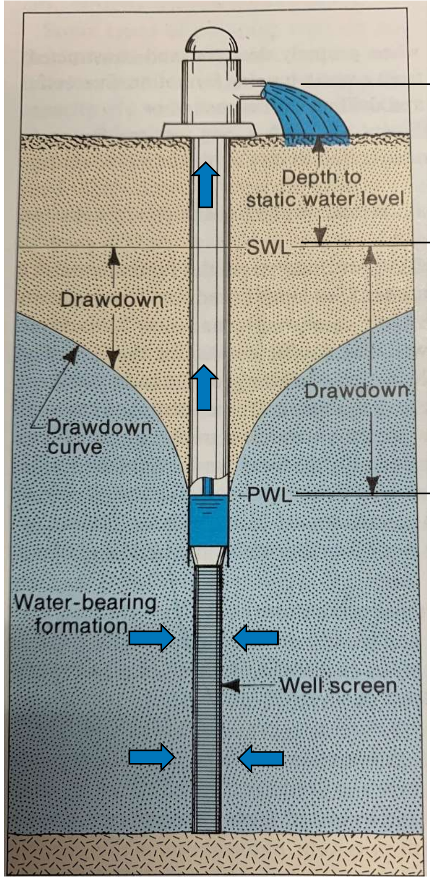
- 1 MGD demonstration facility
- Educational facility
- Research facility
- May 2018 start-up
- Recharge Well TW-1
- Recharge Well NP_MAR_01



Nansemond SWIFT Research Center Wells

Specific Capacity

- Specific capacity (SC) – yield per unit measure of drawdown = gpm/ft of **drawdown** during withdrawal
- Requires a steady pumping rate
- Calculated over a specific duration of pumping
- Typically,
  - longer the duration, the lower the SC
  - higher the pumping rate the lower the SC



Flow: 1200 gpm

Static Water Level: -95’

Pumping Water Level: -145’

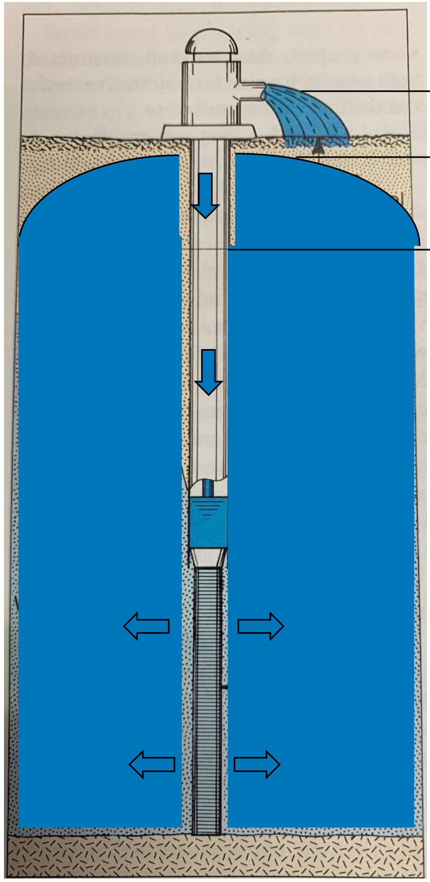
Specific Capacity = 1200 gpm/50ft = 24 gpm/ft

Duration = 24hrs

Modified from Driscoll, 1987

Well Injectivity

- Specific injectivity (SI) – yield per unit measure of draw-up = gpm/ft of **draw-up** on a recharging well
- Requires a steady recharge rate
- Calculated over a specific duration of recharging
- Typically,
  - longer the duration, the lower the SI
  - higher the recharge rate the lower the SI



Flow: 700 gpm

Recharge Water Level: -45’

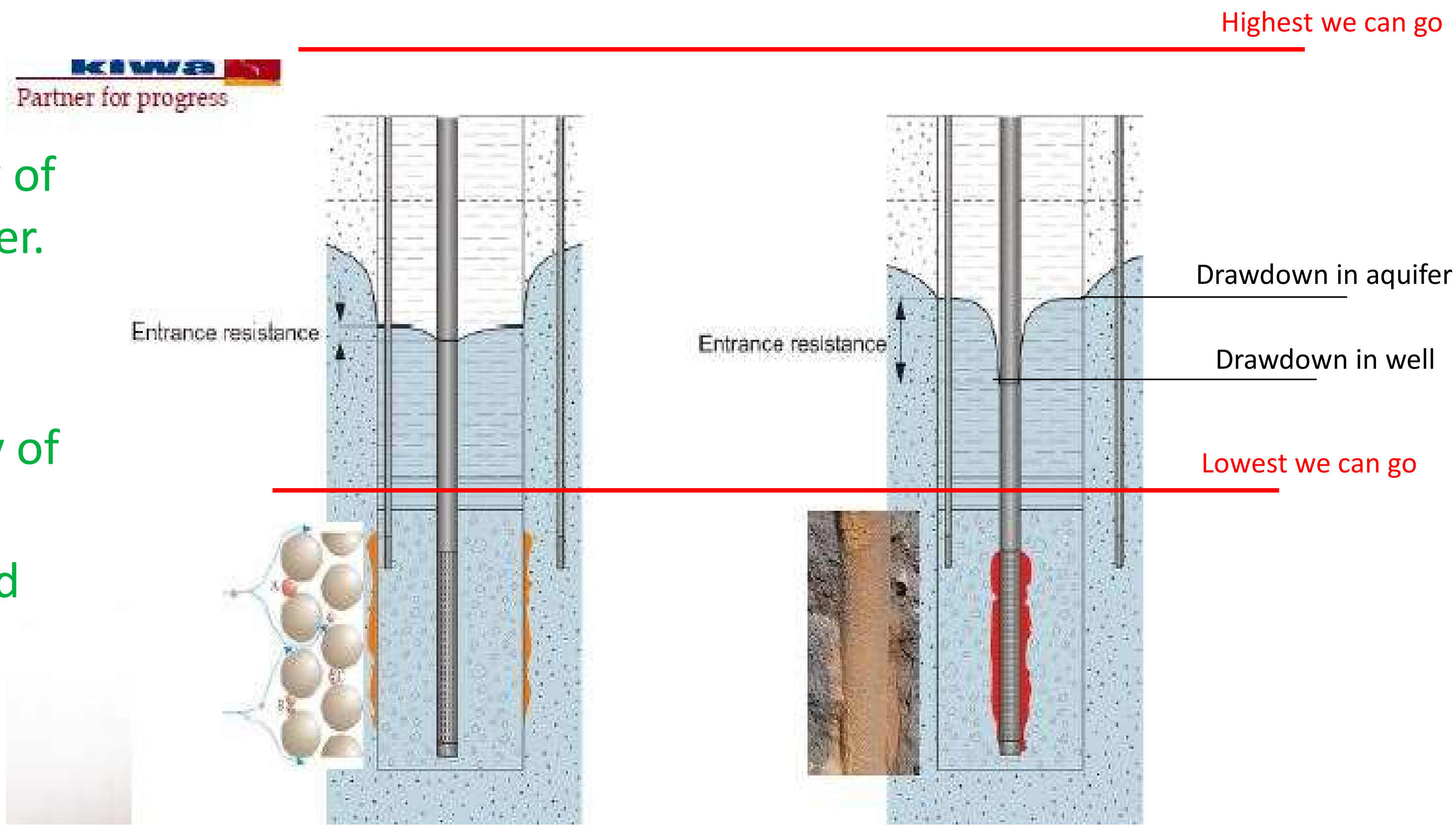
Static Water Level: -95’

Specific Injectivity = 700 gpm/50ft = 14 gpm/ft

Duration = 24hrs

Modified from Driscoll, 1987

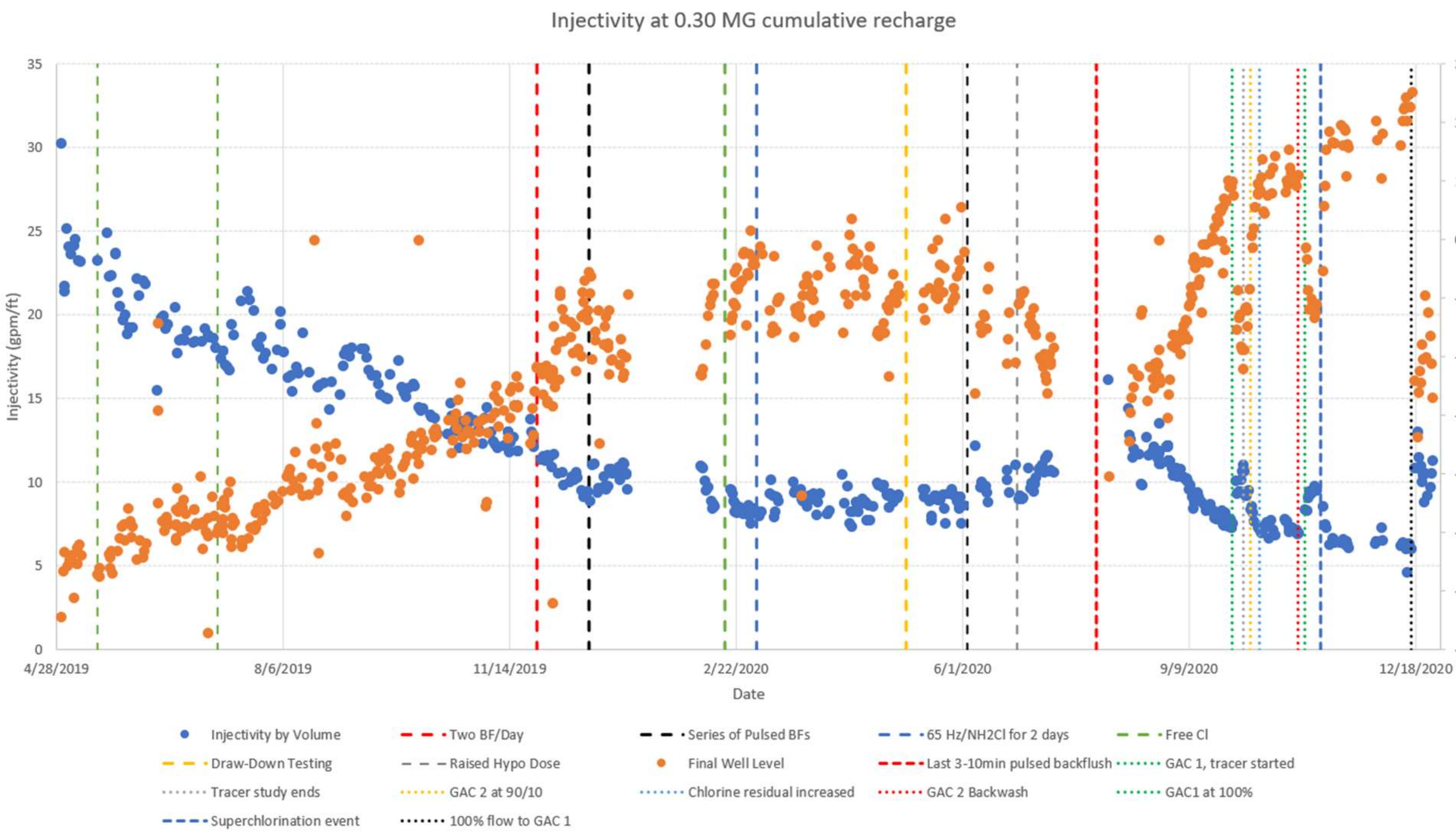
- SC and SI provide capacity of the well not just the aquifer.
  - Losses in the aquifer
  - Losses in the well (gravel pack/screens)
- Good for tracking capacity of a well over time
- Production production and recharge flow capacities



Recharge well TW-1

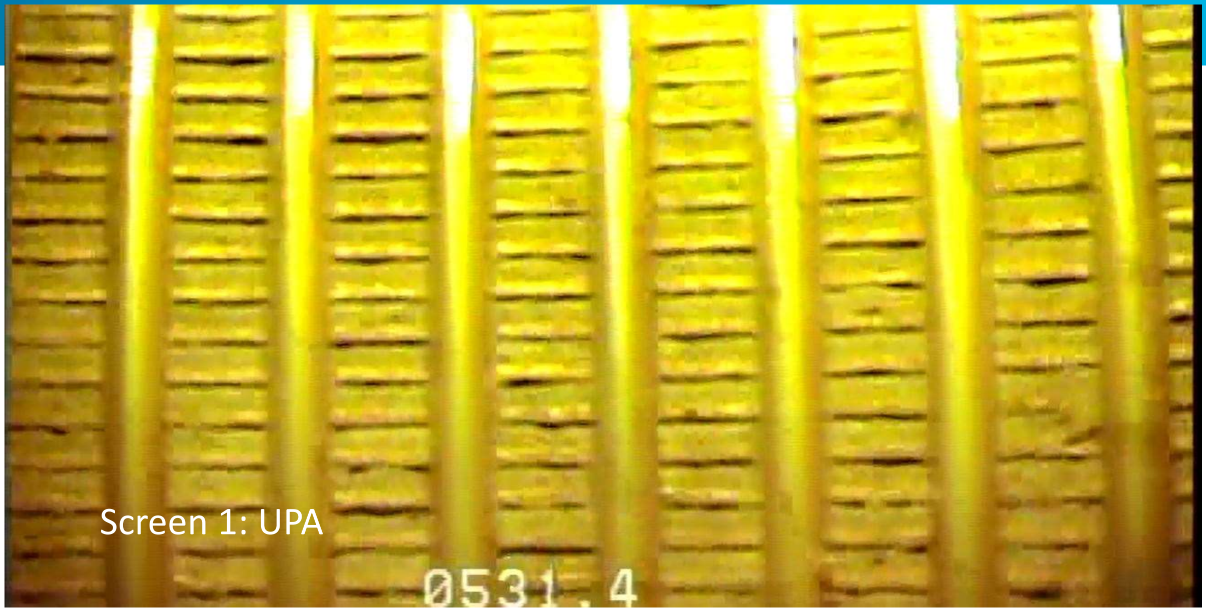
- TW-1 installed in Aug 2016
- Test well and recharge well
- 12” diameter, carbon steel
- Initial specific capacity (withdrawal) of 37 gpm/ft at 1,200 gpm
- Initial recharge specific injectivity (recharge) of 23 gpm/ft

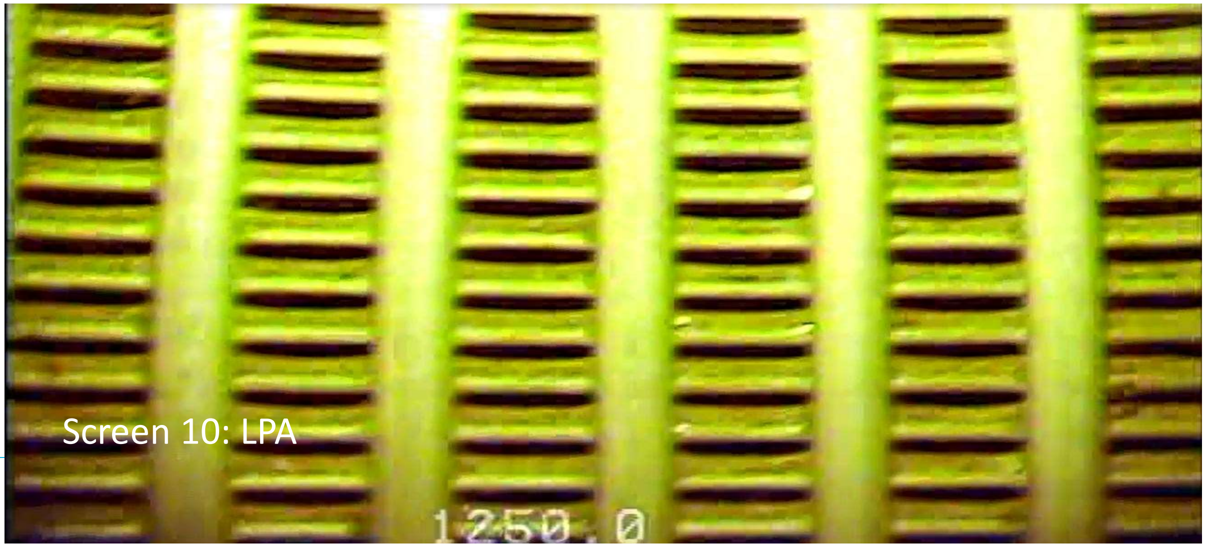
TW-1 specific capacity history



Pre-Rehab Video Log at TW-1

- Screen(s) exhibit clogging by siltation with fine- grained material filling screen slots.
- No visual evidence of biofilm or mineral incrustation appears on screen faces.
- Bottom of TW-1, contained 28 feet of sand accumulation compared to 83 feet in December 2018





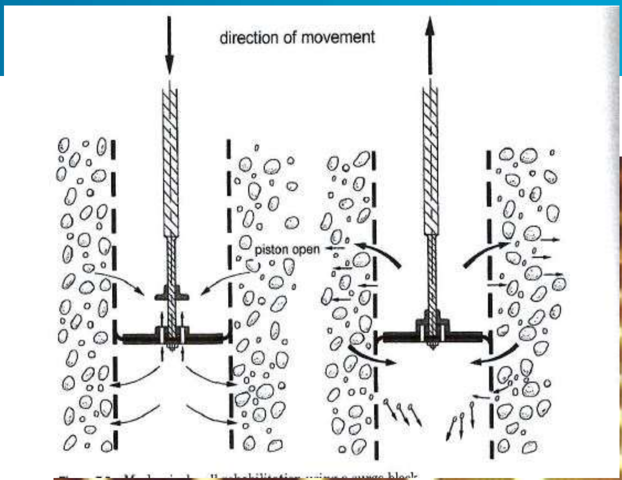
Percent of Screen Slots Clogged

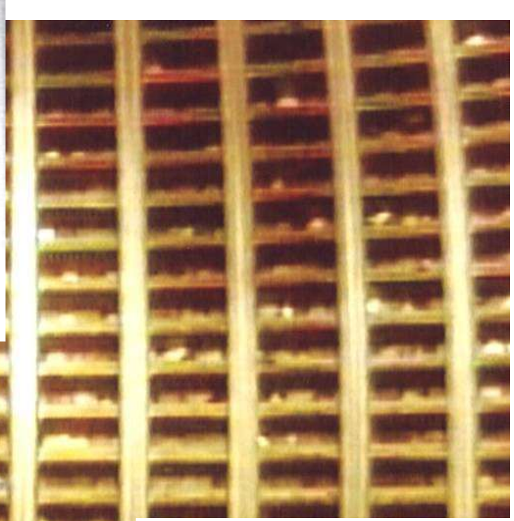
- Screens are between 15 and 83 percent clogged.
- Screens in UPA significantly more clogged than the MPA and LPA.
- **Injectivity @ 8 gpm/ft now 1/3 of original value**.
- From the perspective of transmissivity, clogging the screens set against the UPA drops the transmissivity by 2/3.

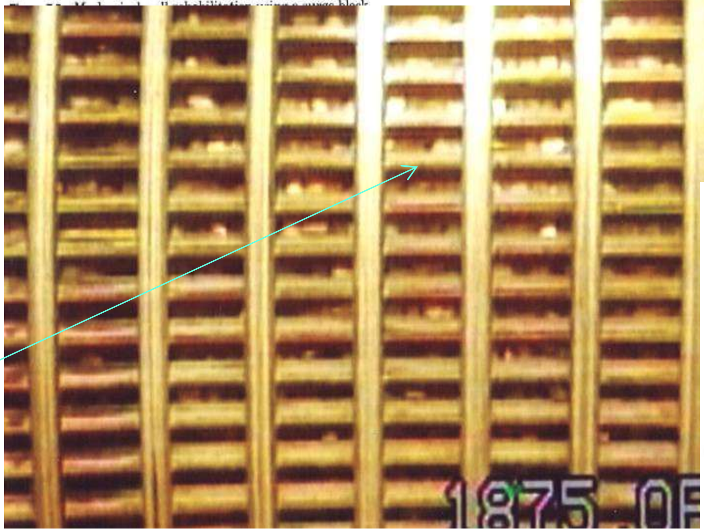
Depth (fbg)	Screen	Aquifer Zone	Visual average clogged for screen (%)
508 to 531	1	UPA	51
555 to 595	2		27
677 to 685	3		83
725 to 756	4		36
822 to 835	5	MPA	17
861 to 885	6		15
906 to 920	7		18
965 to 989	8		18
1050 to 1090	9		23
1230 to 1335	10	LPA	23
1375 to 1395	11		31

Rehab at TW-1

- Brush casing and screen
- Swabbing Pass #1
- Swabbing Pass #2 with chemical addition (acid/dispersant)
- Post swabbing video survey
- Over-pumping
- Re-swab & airlift Screen 4
- Airlift material 1,395 to 1,415 fbg
- Install new pump and shafting
- Backflush to raise pH
- Resume MAR operations
- Post rehab video of well screening Lower Zone of Potomac Aquifer







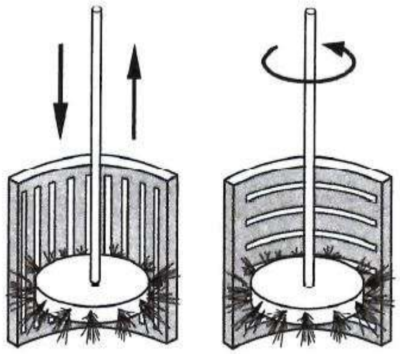
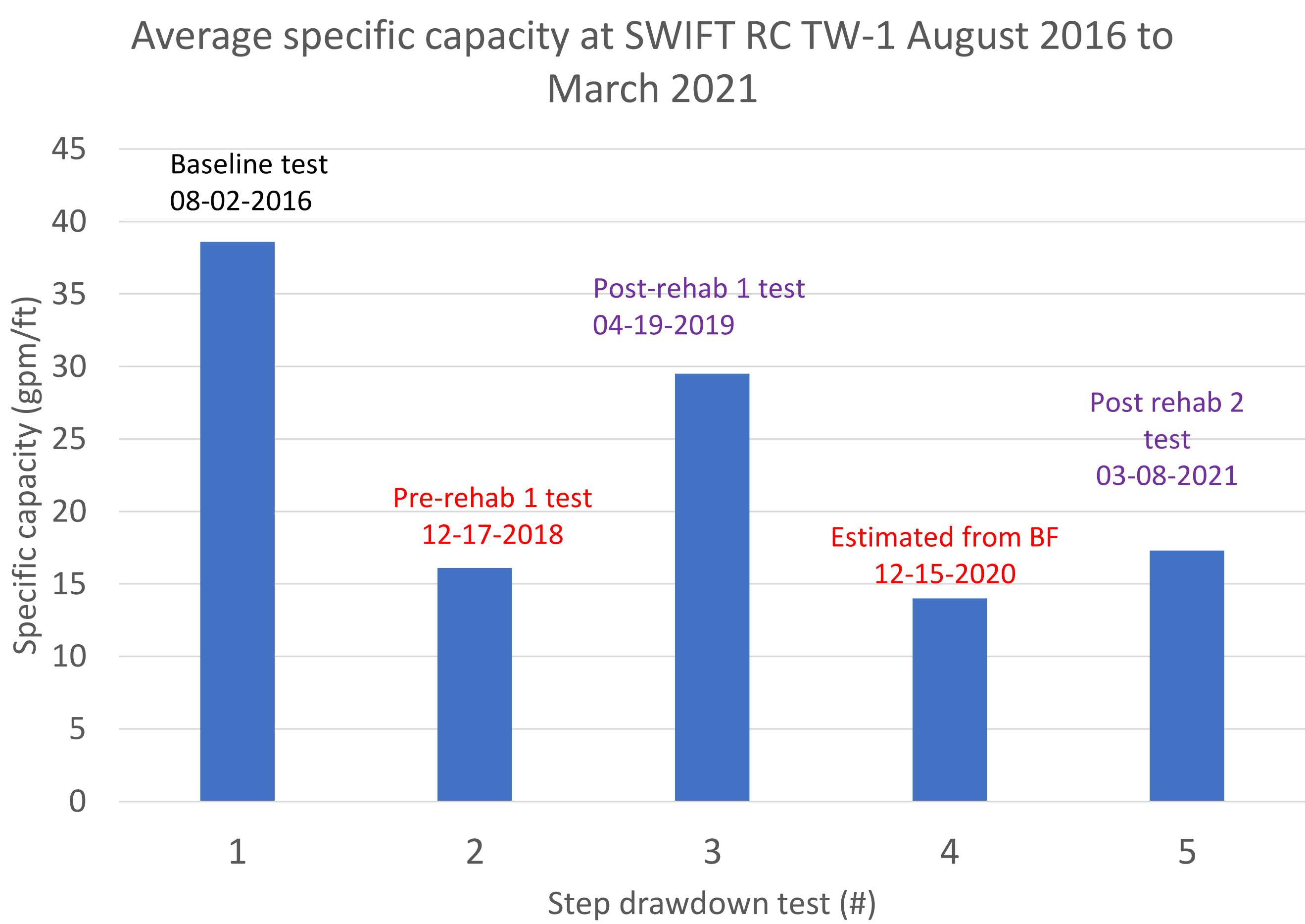


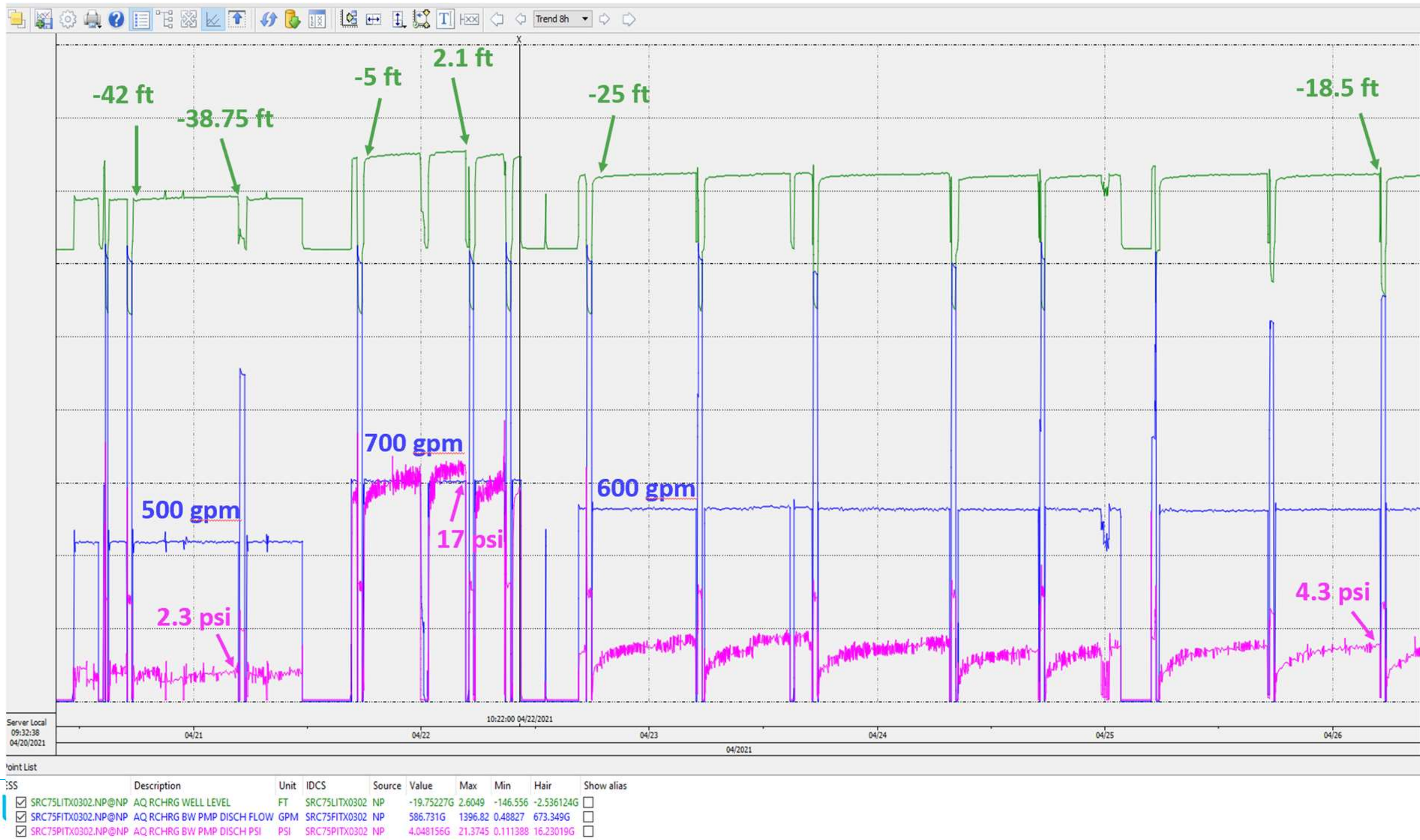
Figure 7.2 Brushing of wells with different screen slot arrangements. *Drawing: Schröder.*

Comparing Average SC's from step tests at TW-1

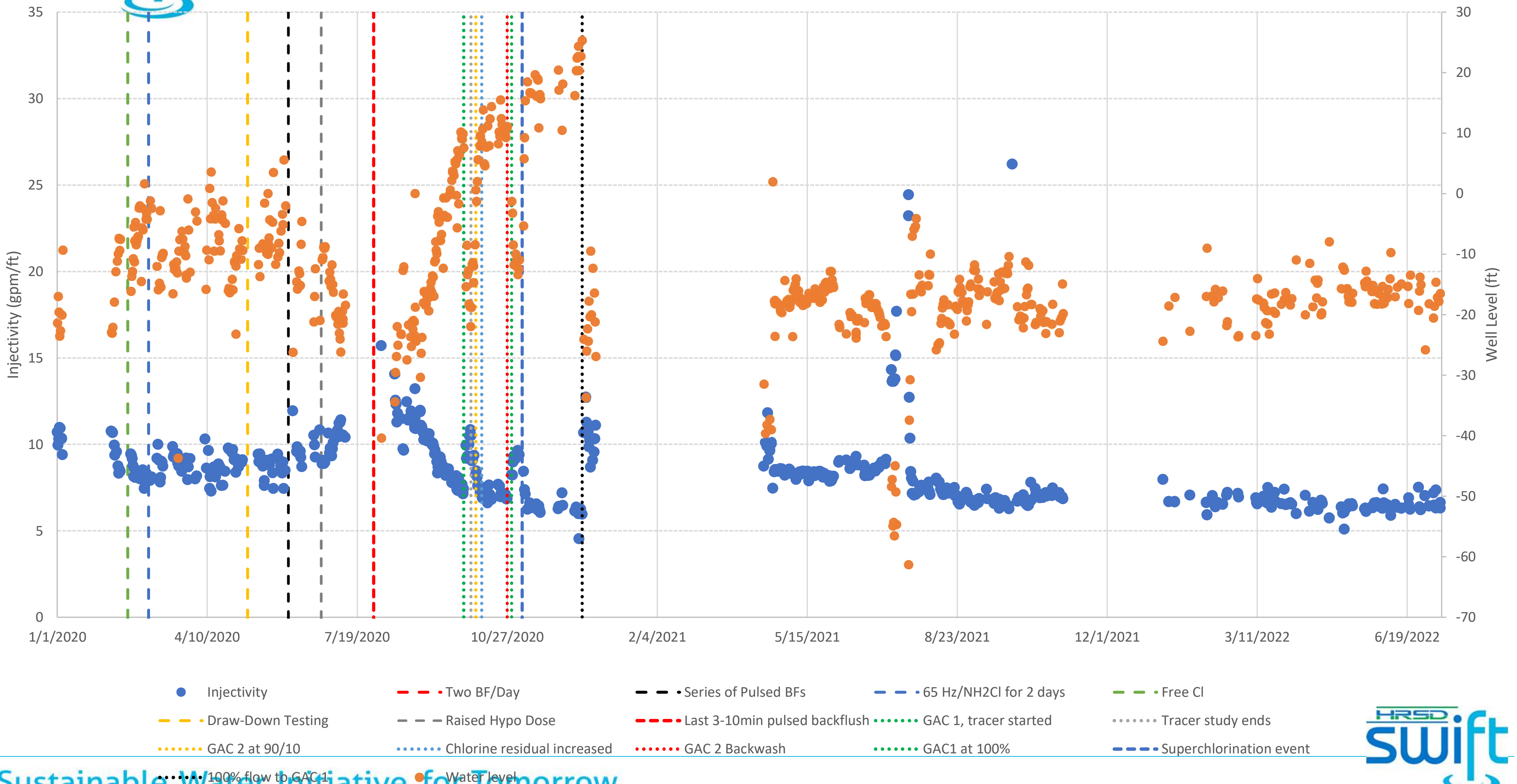


- Goal is to preserve capacity, NP_MAR_01 online end of 2021
- Operate at lower recharge rate @ TW-1~ 500 - 600 gpm.
- Backflush twice/day

Post Rehabilitation Operations at TW-1

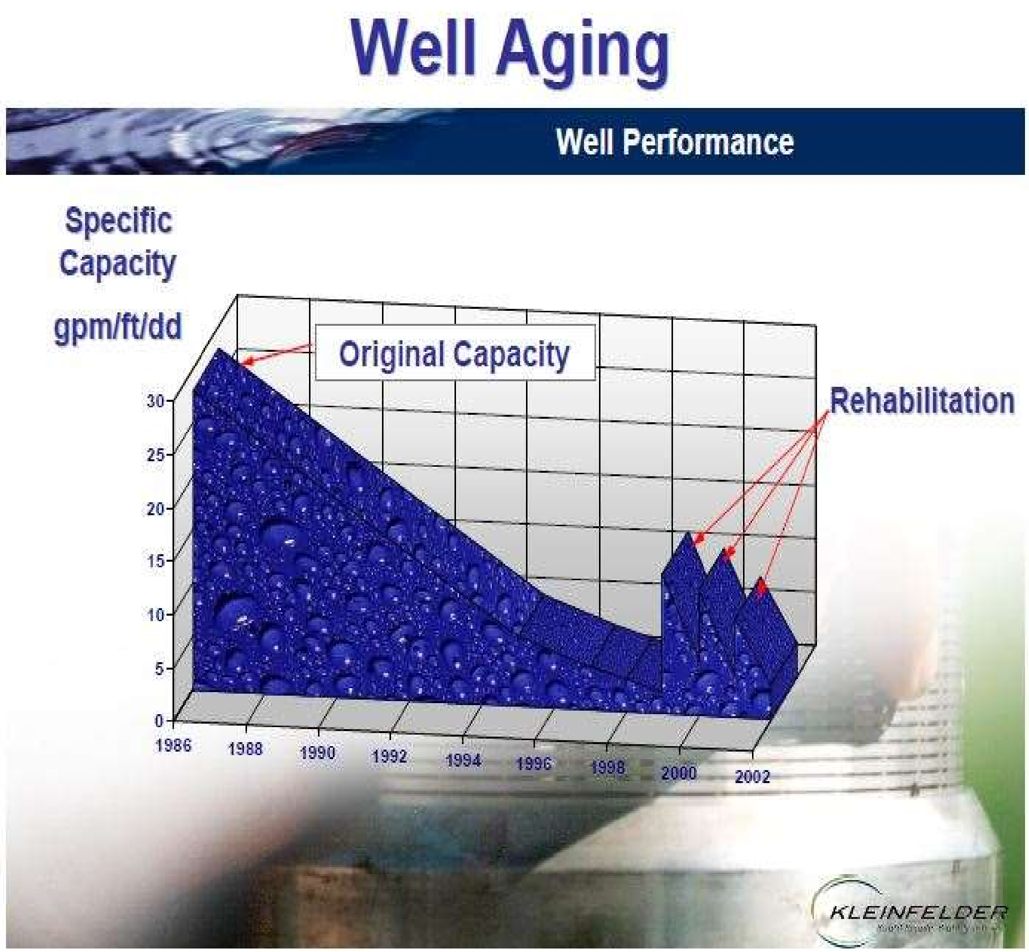


Injectivity at 0.30 MG cumulative recharge



Why New Full Scale Well at Nansemond – NP_MAR_01?

- Recharge well TW-1
  - Initial rehab after 6 months
  - Second rehab after ~3 yrs
  - Limited success
- **Shows signs of an aged well**
- Compromised from clogging, difficult to resuscitate
- TW-1 pumping sand
- Provides HRSD run time with a full scale well and unique features
- Incorporated into Nansemond SWIFT



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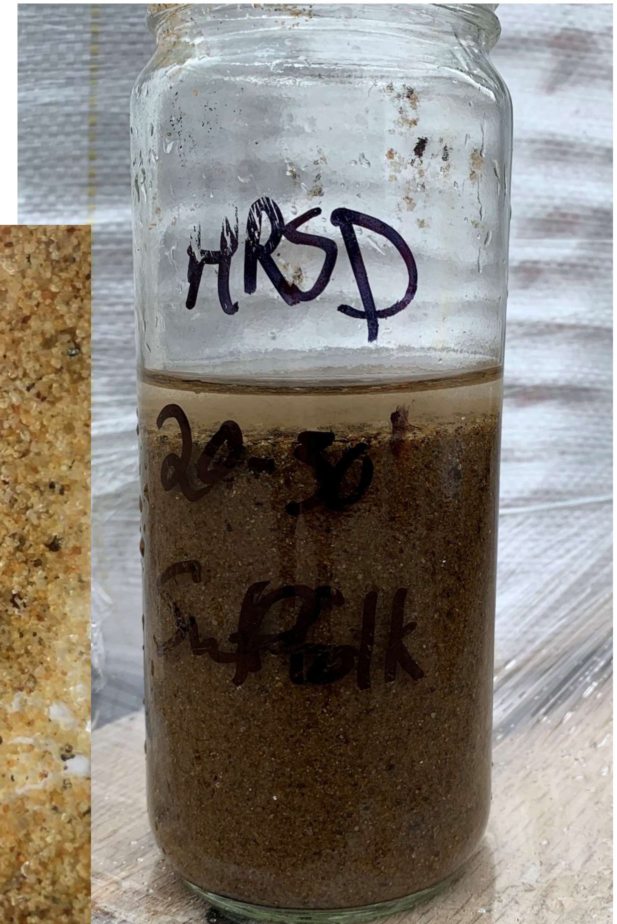
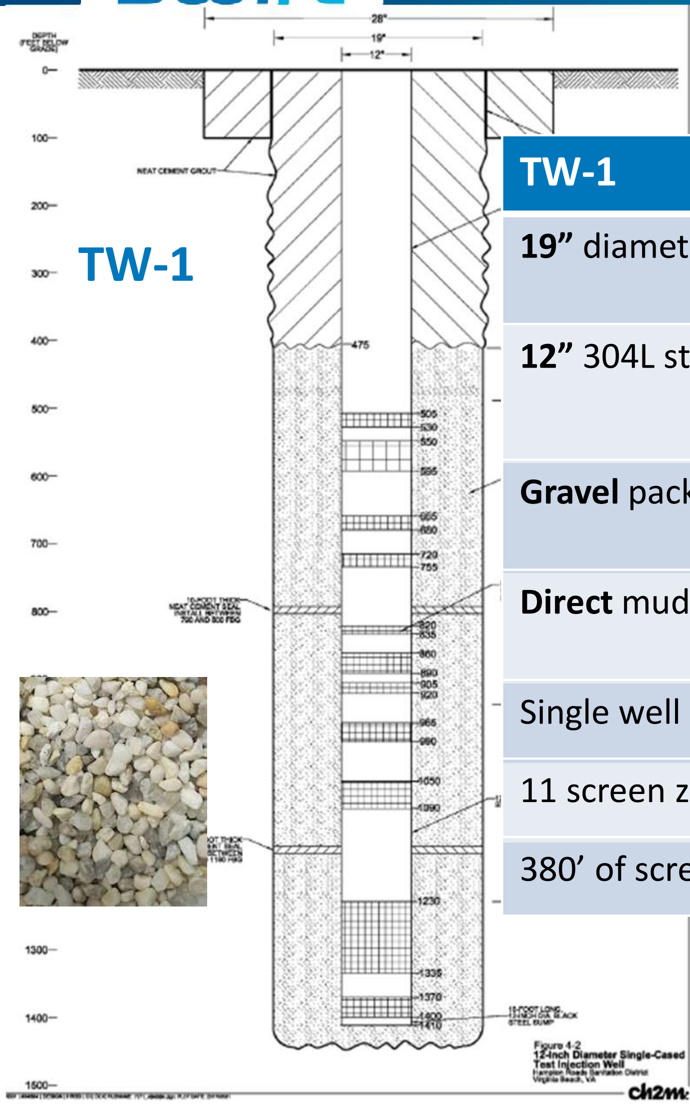
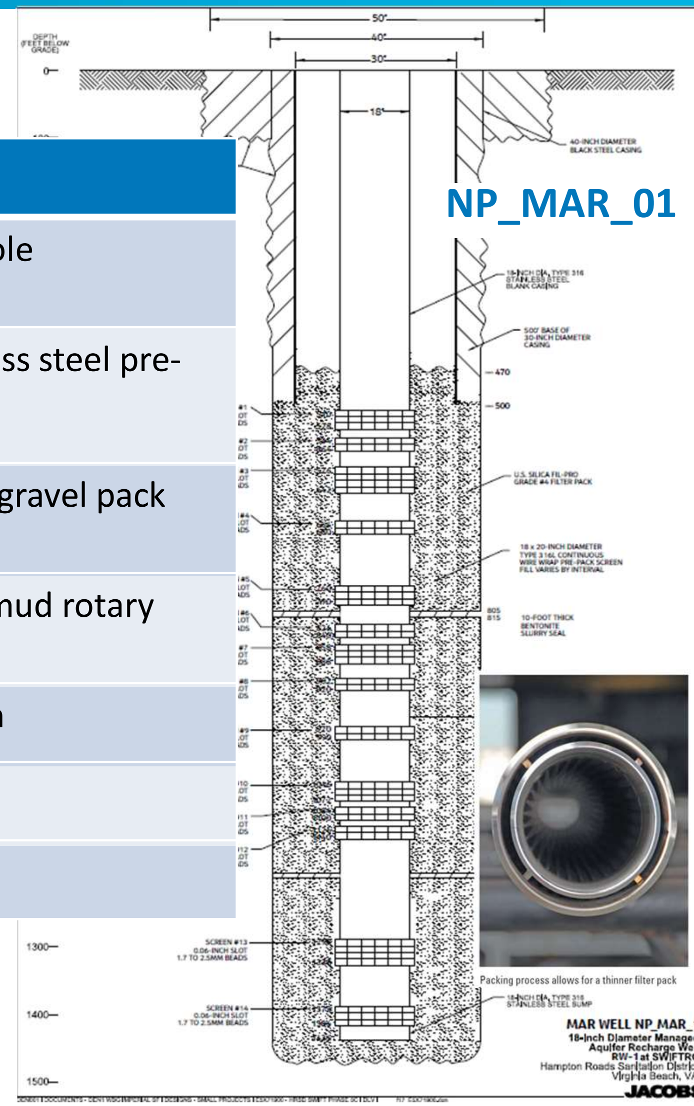


HRSD swift

TW-1 vs NP_MAR_01

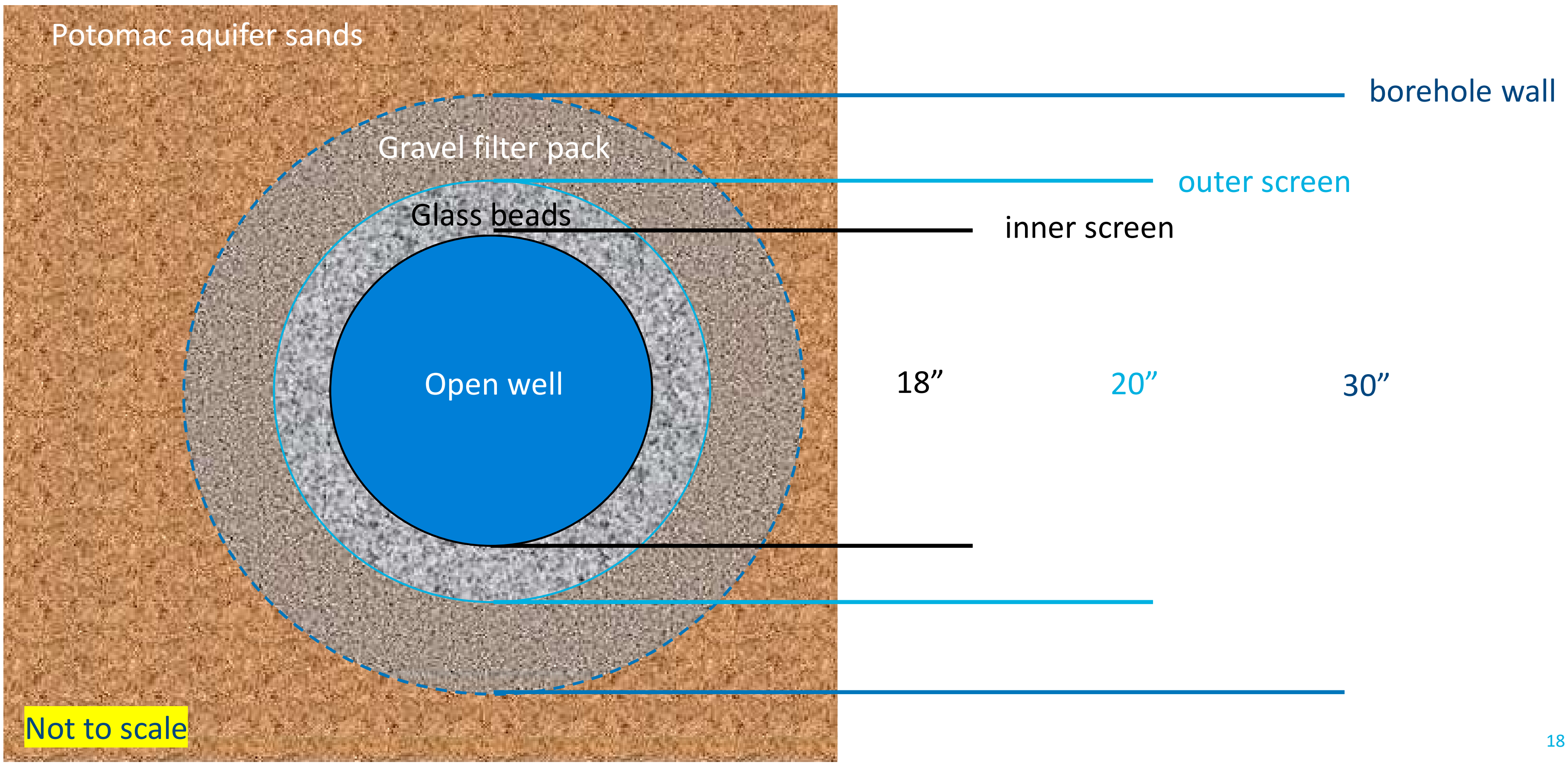


TW-1	NP_MAR_01
19” diameter borehole	**30”** diameter borehole
12” 304L stainless steel screen	**18”x20”** 316L stainless steel pre-packed screen
Gravel pack only	Si **spherical beads** + gravel pack
Direct mud rotary drilling	**Reverse** circulation mud rotary drilling
Single well casing/screen	Overlap construction
11 screen zones	14 screen zones
380’ of screen	342’ of screen



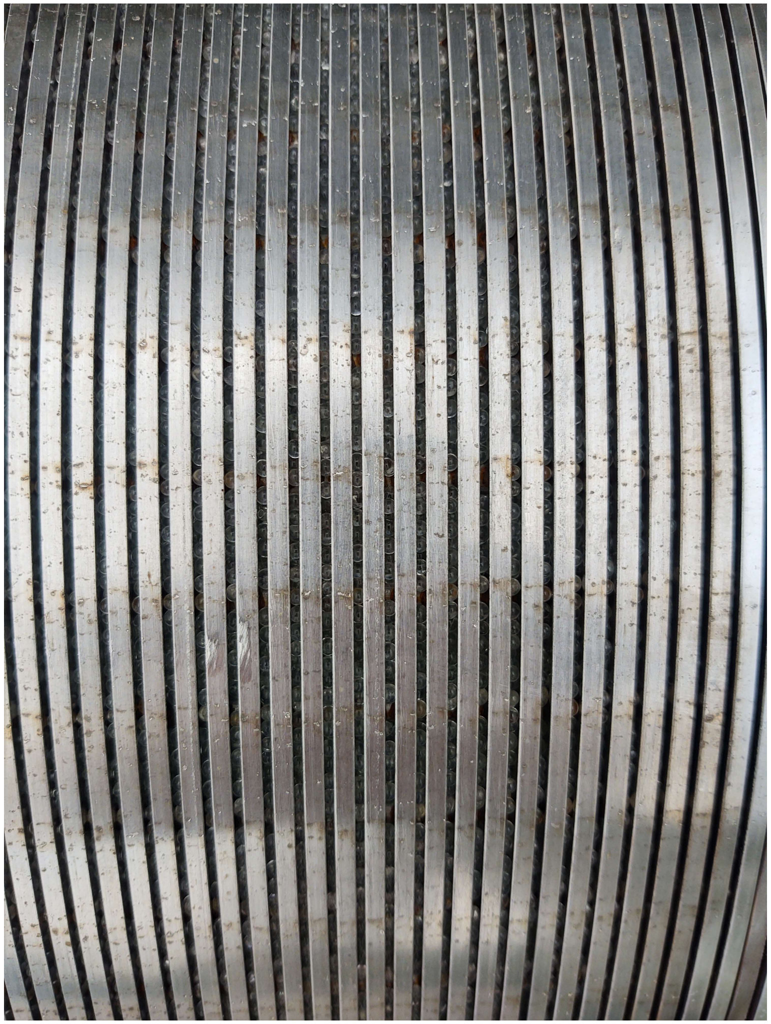
Packing process allows for a thinner filter pack

Pre-packed well screen, gravel pack borehole cross-section



316 Stainless Steel Pre-packed well screen

- Almost perfect spheres
- Uniform and consistent bead size
- Can custom size per sand lens
- Stronger crush strength
- No bridging of filter pack
- Less loss of capacity from bio-fouling and mineral scaling
- Easy to clean and chemical resistance



NP_MAR_01 Performance

- Pumped topped out at 2,813 gpm (4 MGD!)
- Specific Capacity @ 2,700 gpm = **69 gpm/ft**
- TW-1 SC @ 1,100 gpm = 37 gpm/ft
- NP_MAR_01 @ 1,220 gpm = 83 gpm/ft

Post ACH treatment Specific Capacity

TW-1 SC @ 1,100 gpm = 37 gpm/ft
NP_MAR_O1 SC @ 1220 gpm = 68.7 gpm/ft

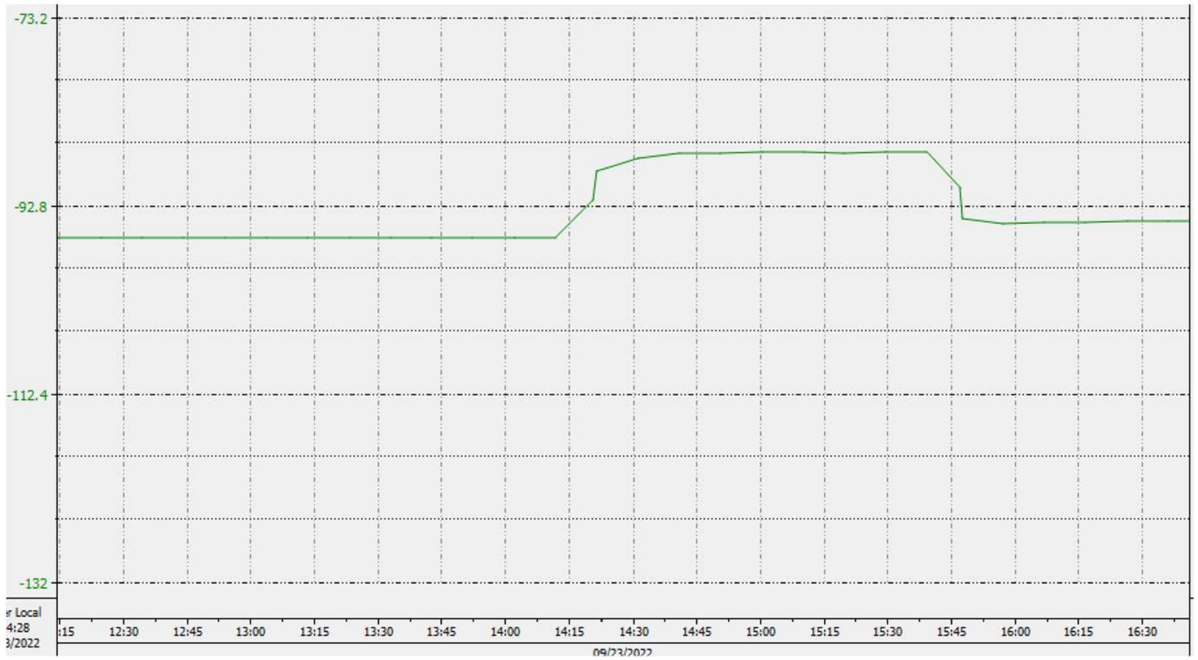
Static Water Level 100.5 feet below grade

Step No.	Pumping Rate (gpm)	Pumping Level (feet)	Drawdown (feet)	Specific Capacity (gpm/ft)	Specific Discharge (ft/gpm)	Skin Coefficient BQ (feet)	Well Loss CQ^2 (feet)	Caused by Laminar Flow (%)	Post Conditioning Diff (gpm/ft)	(%)
1	1220	118.3	17.8	68.7	0.0145	15.74	2.98	88.66	14.8	17.7
2	1494	123.7	23.2	64.4	0.0155	19.27	4.46	83.11	12.3	16.0
3	1795	130.2	29.7	60.4	0.0165	23.16	6.44	77.96	9.8	14.0
4	2112	136.0	35.5	59.6	0.0168	27.24	8.92	76.85	9.8	14.1
5	2414	142.6	42.1	57.3	0.0174	31.14	11.65	73.97	11.6	16.8
6	2704	146.7	46.2	58.6	0.0171	34.88	14.62	75.57	9.6	14.1
C	2.00E-06					Diff		Avergage	11.3	15.5
B	0.0129		average	61.51 gpm/ft			10.40 gpm/ft	14.46	(%)	

NP_MAR_01 Recharge testing complete

- Recharge cycle
  - ~ 450 gpm
  - ~ 2 hrs
- Static -96 ft below ground
- Recharge -87 ft below ground
- Recharge rate = 490 gpm
- Resulting specific injectivity (SI) = 54 gpm/ft

- Recharge at 700 gpm?

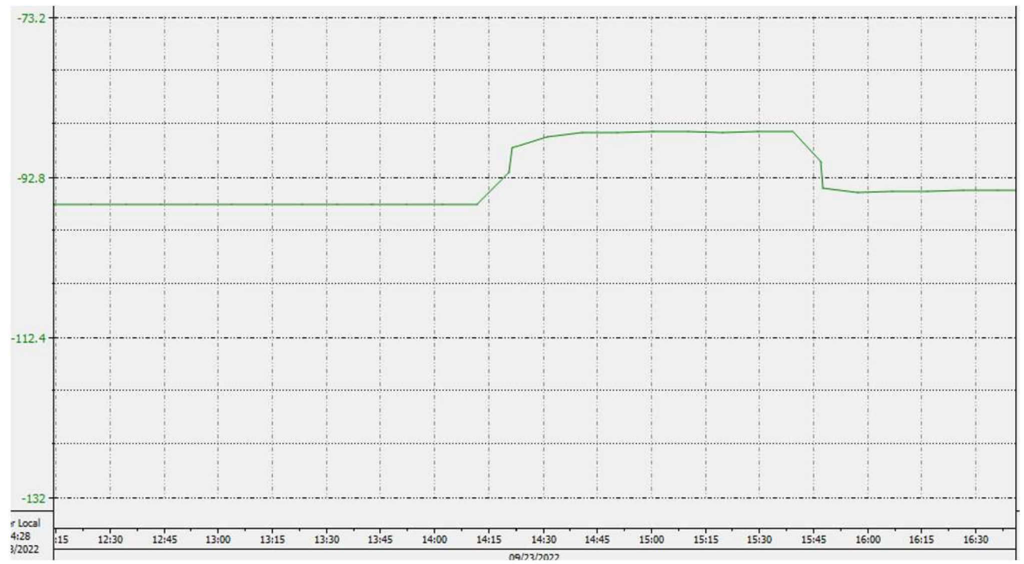


NP_MAR_01 performance compared to TW-1

- TW-1 Initial
  - Withdrawal @ 1,300 gpm **SC 37 gpm/ft**
  - Recharge @ 700 gpm SI **23 gpm/ft**

- TW-1 current
  - Recharge @ 450 gpm **SI 8 gpm/ft**

- NP_MAR_01 (post ACH treatment)
  - Withdrawal @ 1,300 gpm **SC 69 gpm/ft**
  - Recharge @ 490 gpm SI **54 gpm/ft**

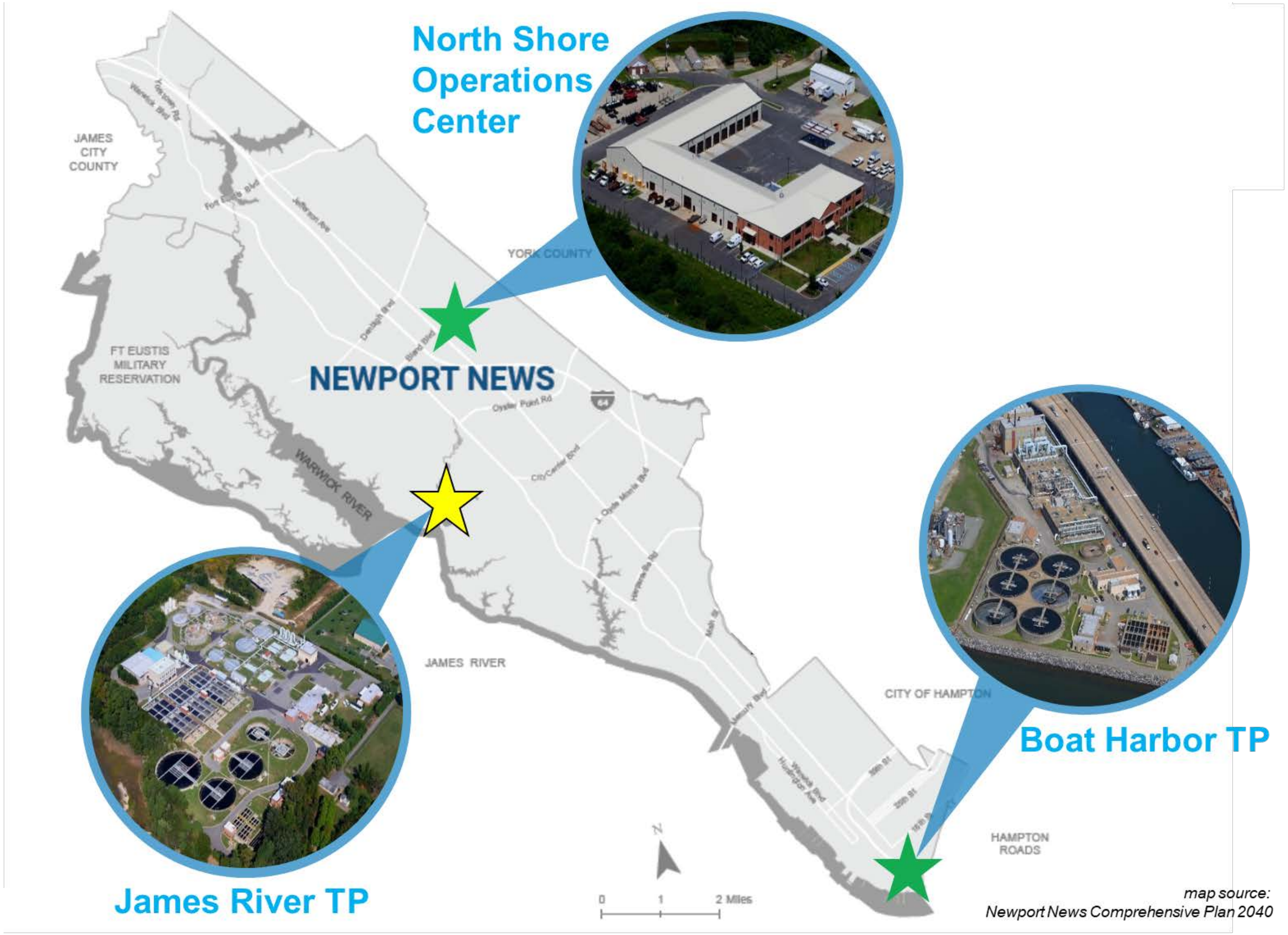


Questions?

James River SWIFT and ANRI Project Update

Potomac Aquifer Recharge
Oversight Committee
September 26, 2022

Lauren Zuravnsky, P.E.
Chief of Design & Construction - SWIFT



map source:
Newport News Comprehensive Plan 2040

Current Projects

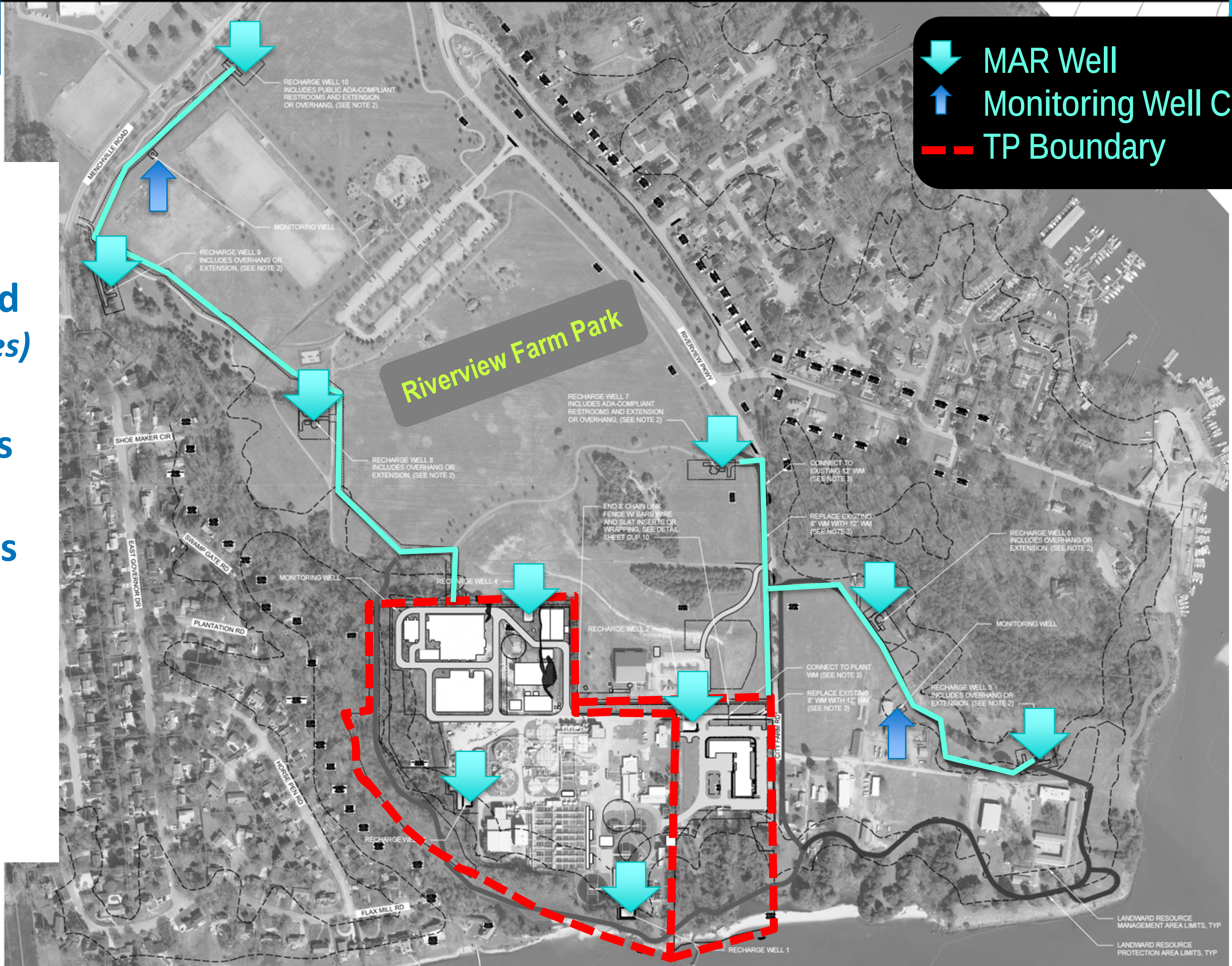
$534 M Design Build

(SWIFT + ANRI Upgrades)

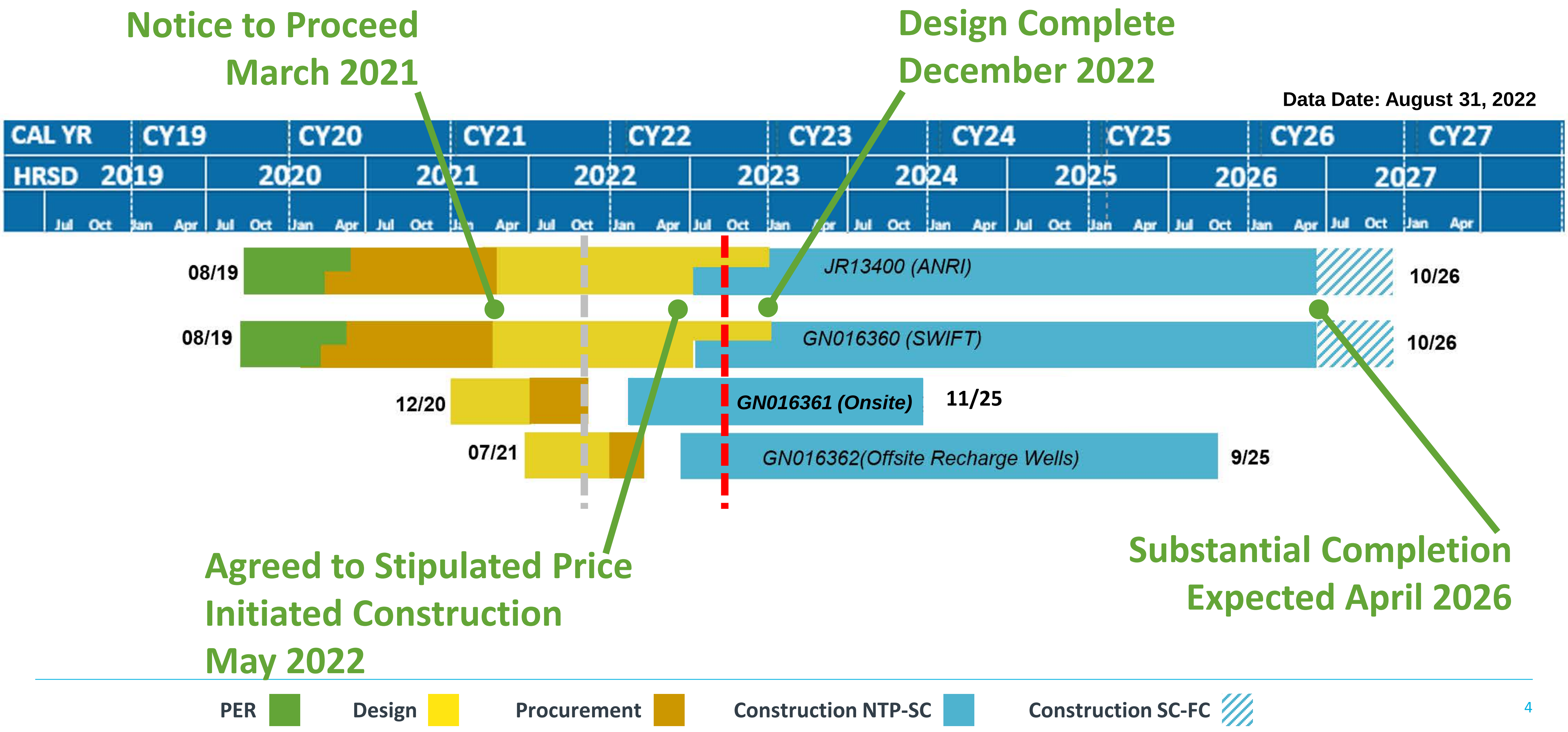
$14 M On Site Wells

$40 M Off Site Wells

**other capital projects*

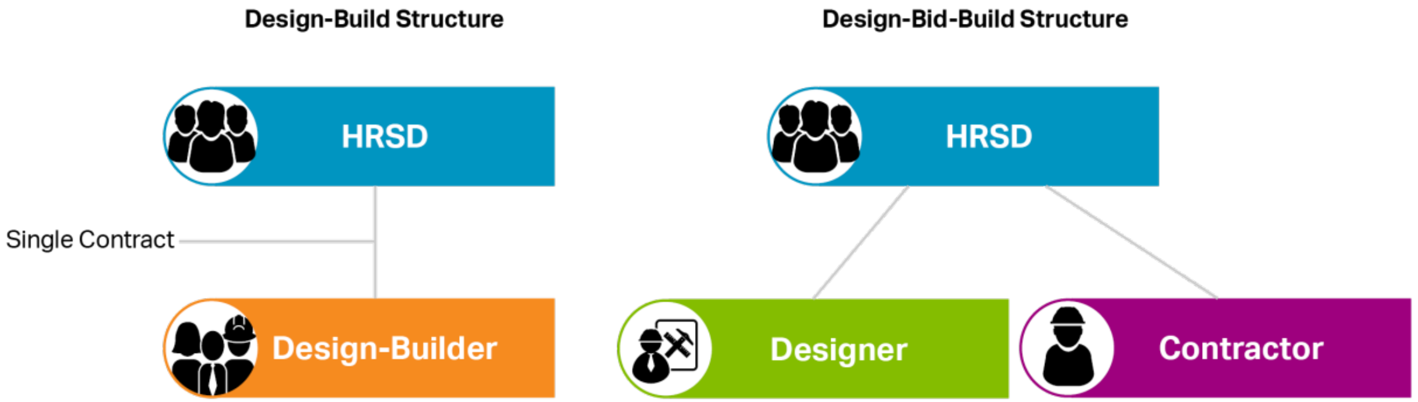


Projects have transitioned from design to construction

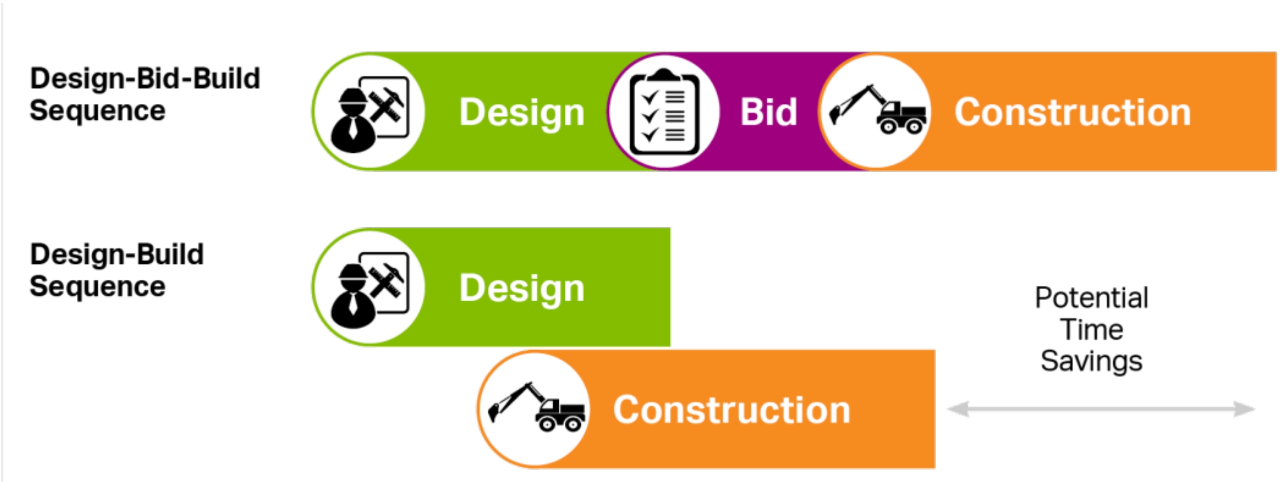


Design-Build project delivery

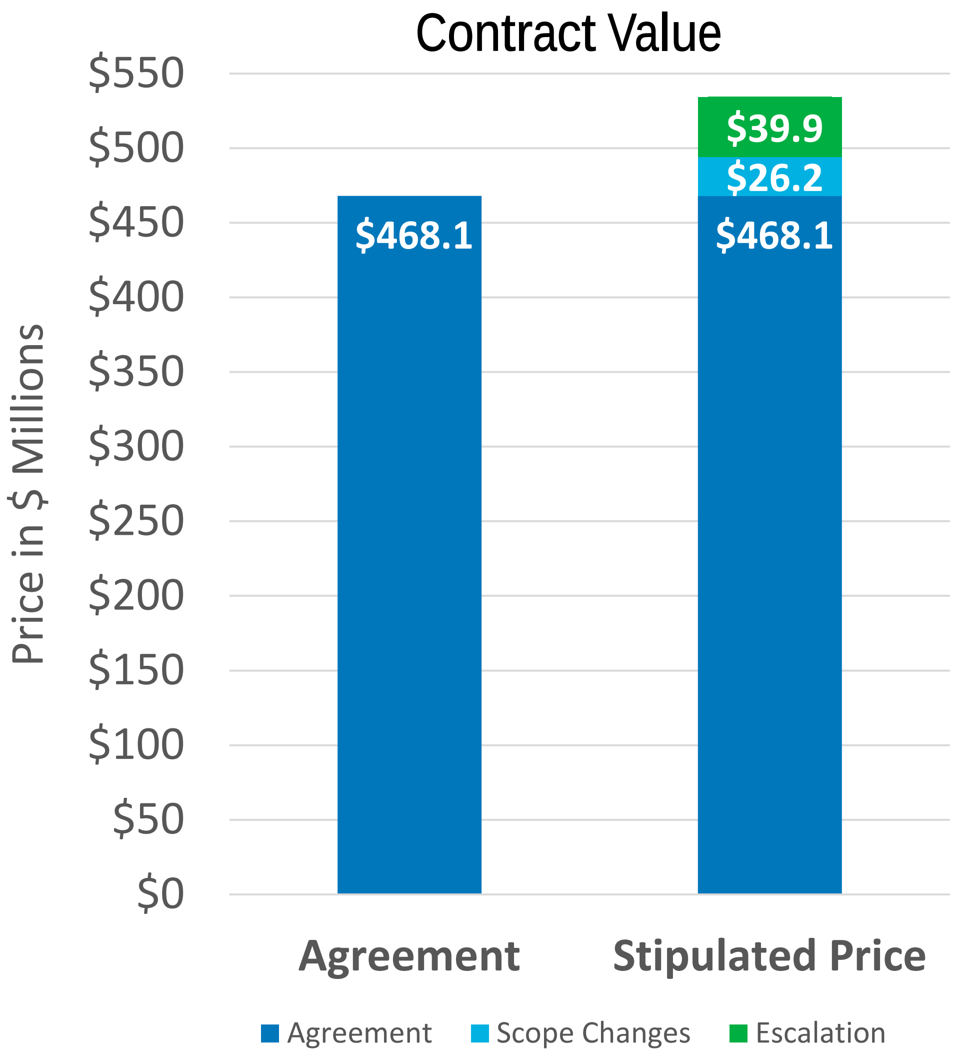
Single point of accountability (Design-Builder) for this large and complex project.



Shortened schedule by overlapping the design and construction phases.



Stipulated Price reflects a total cost increase of 14 percent.



Requested Escalation (8.5%)

Scope Changes (5.6%)

Scope Included in Agreement

Project funding sources include WIFIA and CWRLF loans; team will apply for WQIF grant funding.

Programmatic loan

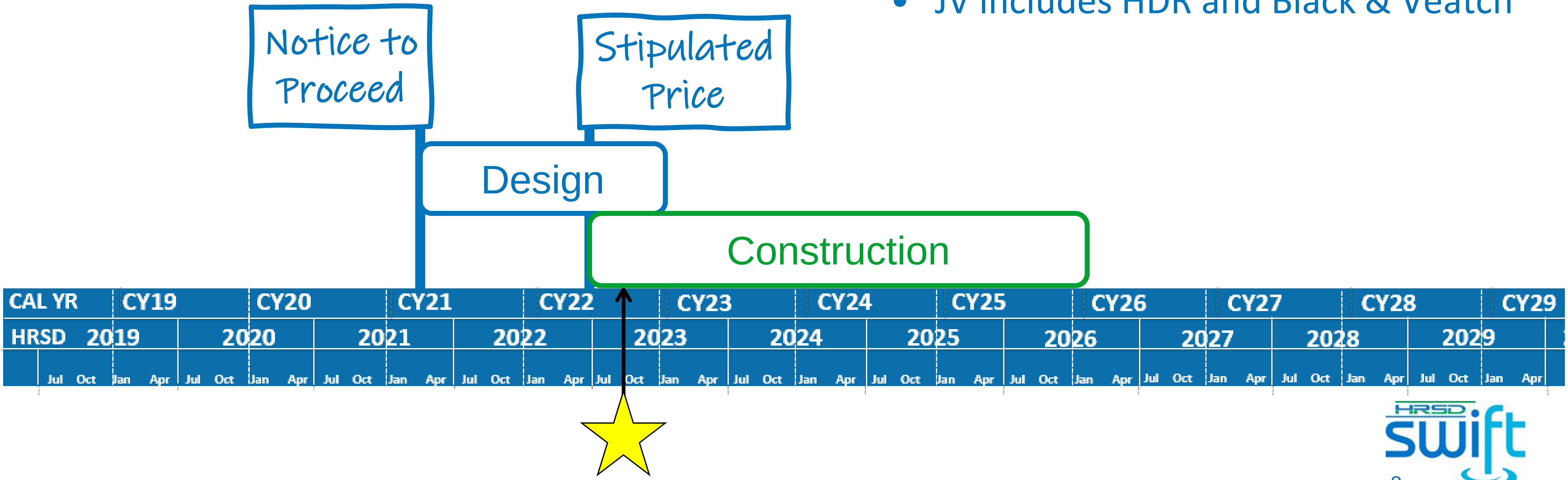
Programmatic loan

Will apply for grant

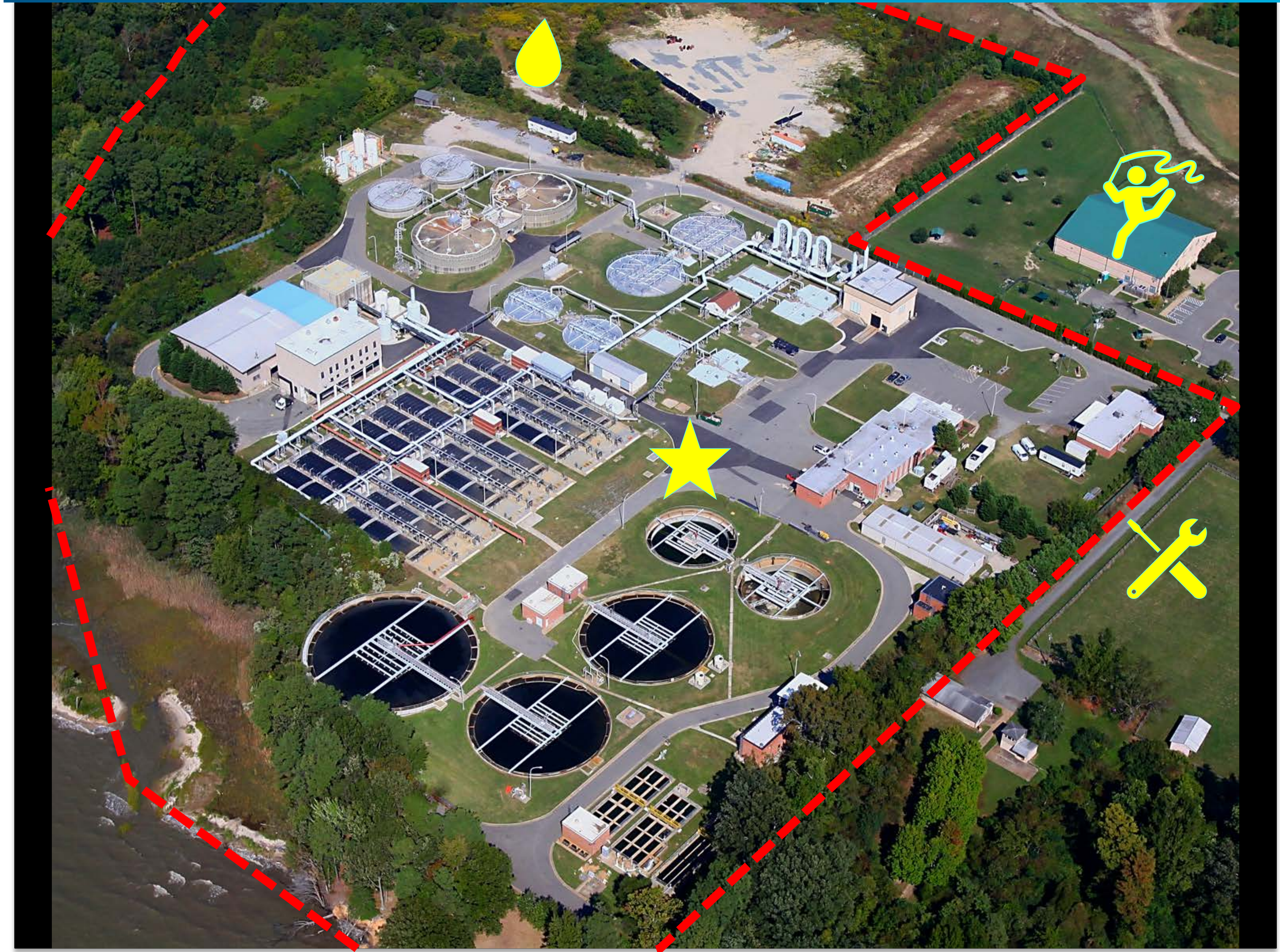
James River Design Build Project Status

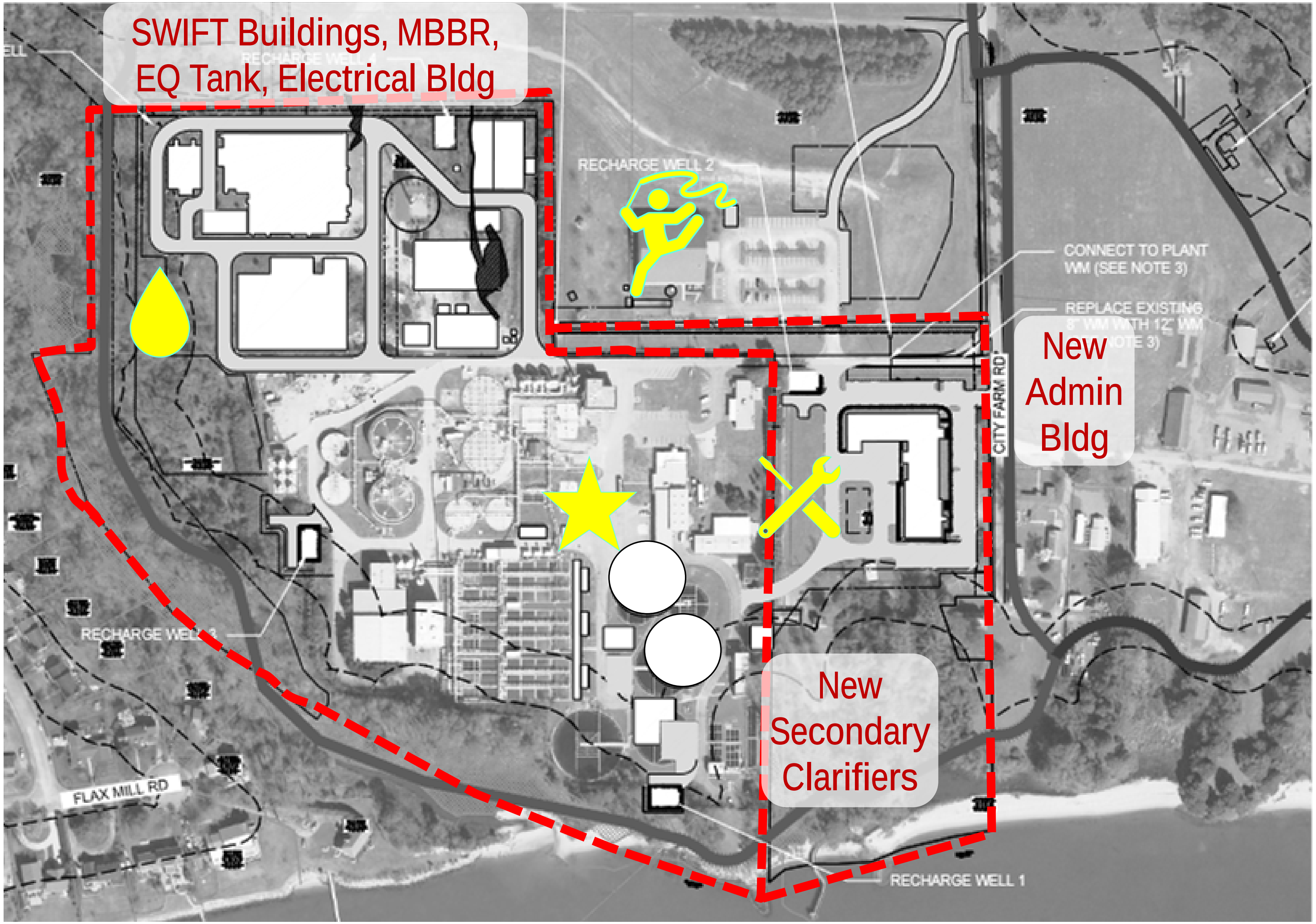
US-A
Ulliman Schutte – Alberici Joint Venture

- SWIFT + Nutrient Improvements project has started construction
- Recharge expected in 2026
- JV includes HDR and Black & Veatch



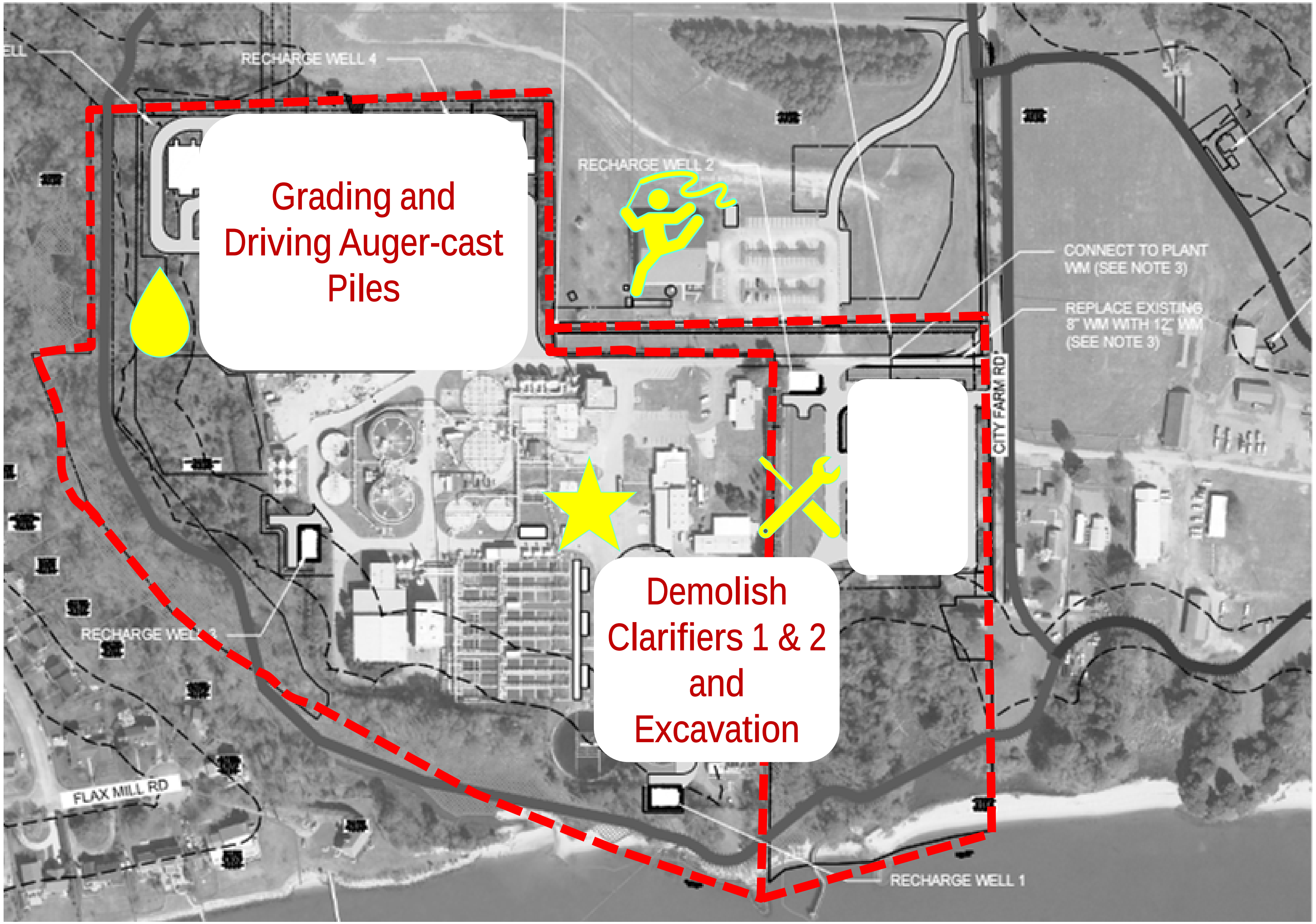
Existing James River TP Site



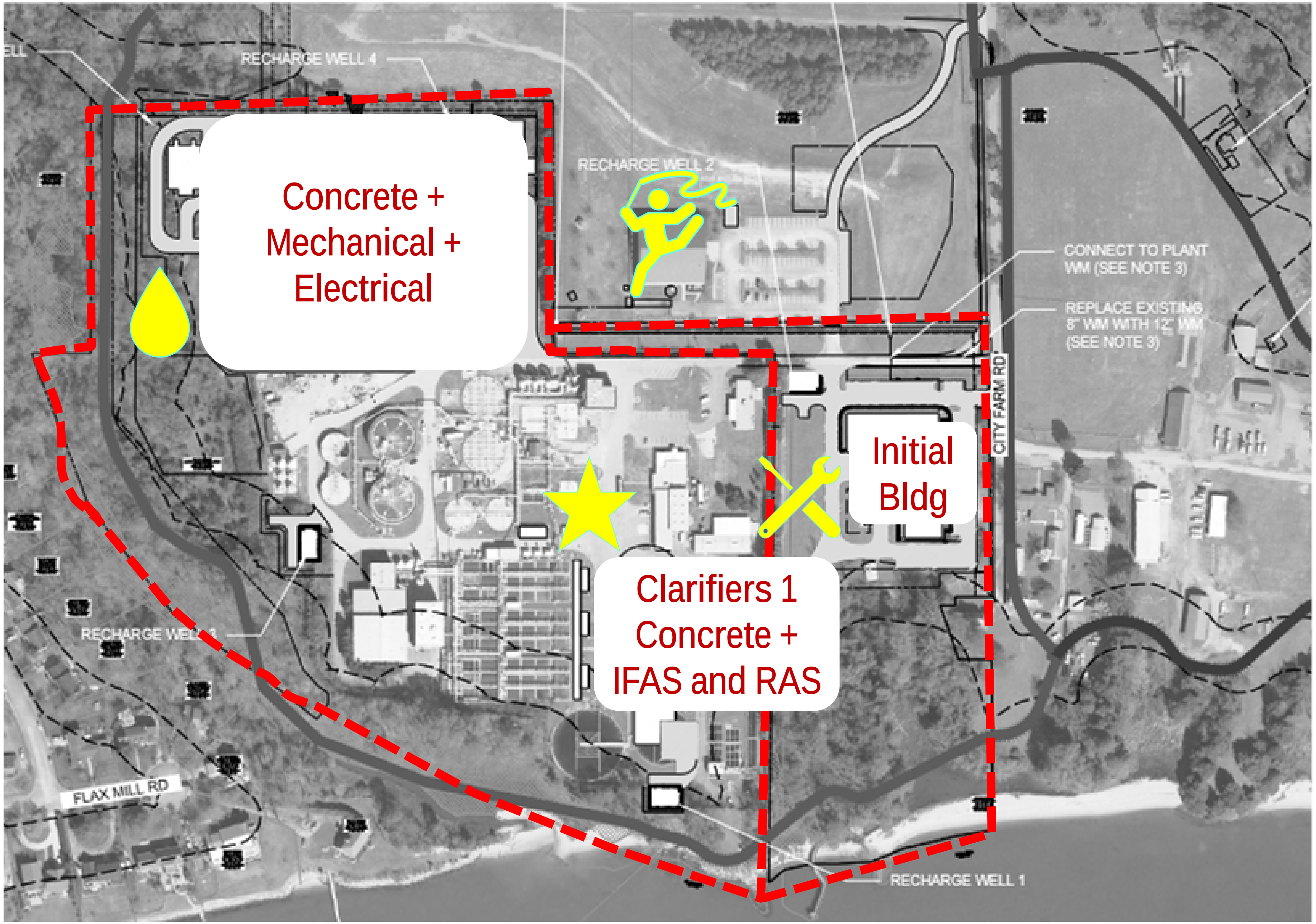


SWIFT Buildings, MBBR, EQ Tank, Electrical Bldg
New Admin Bldg
New Secondary Clarifiers
RECHARGE WELL 2
RECHARGE WELL 3
RECHARGE WELL 1
CONNECT TO PLANT WM (SEE NOTE 3)
CITY FARM RD
FLAX MILL RD

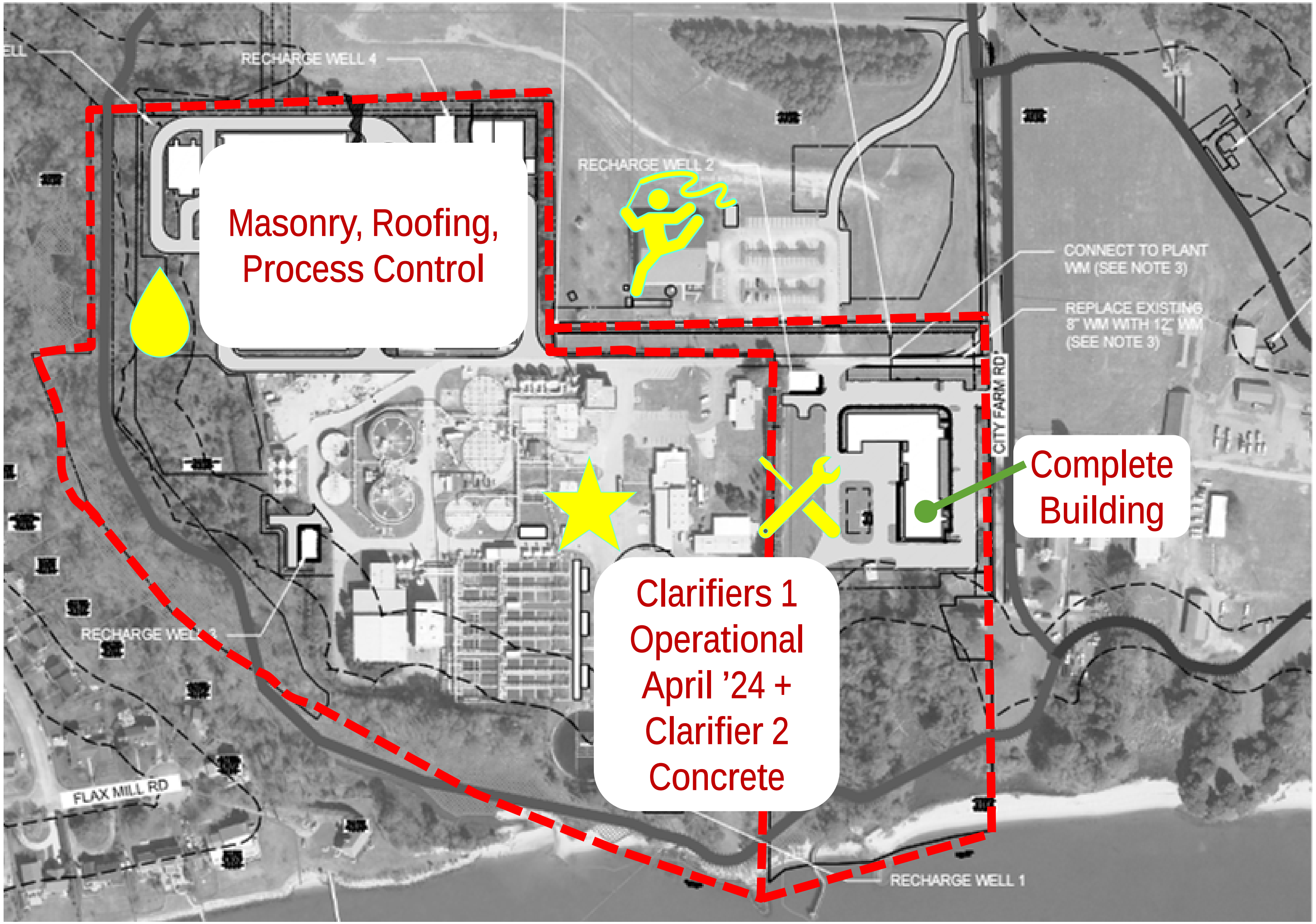
Construction Activity through the end of 2022



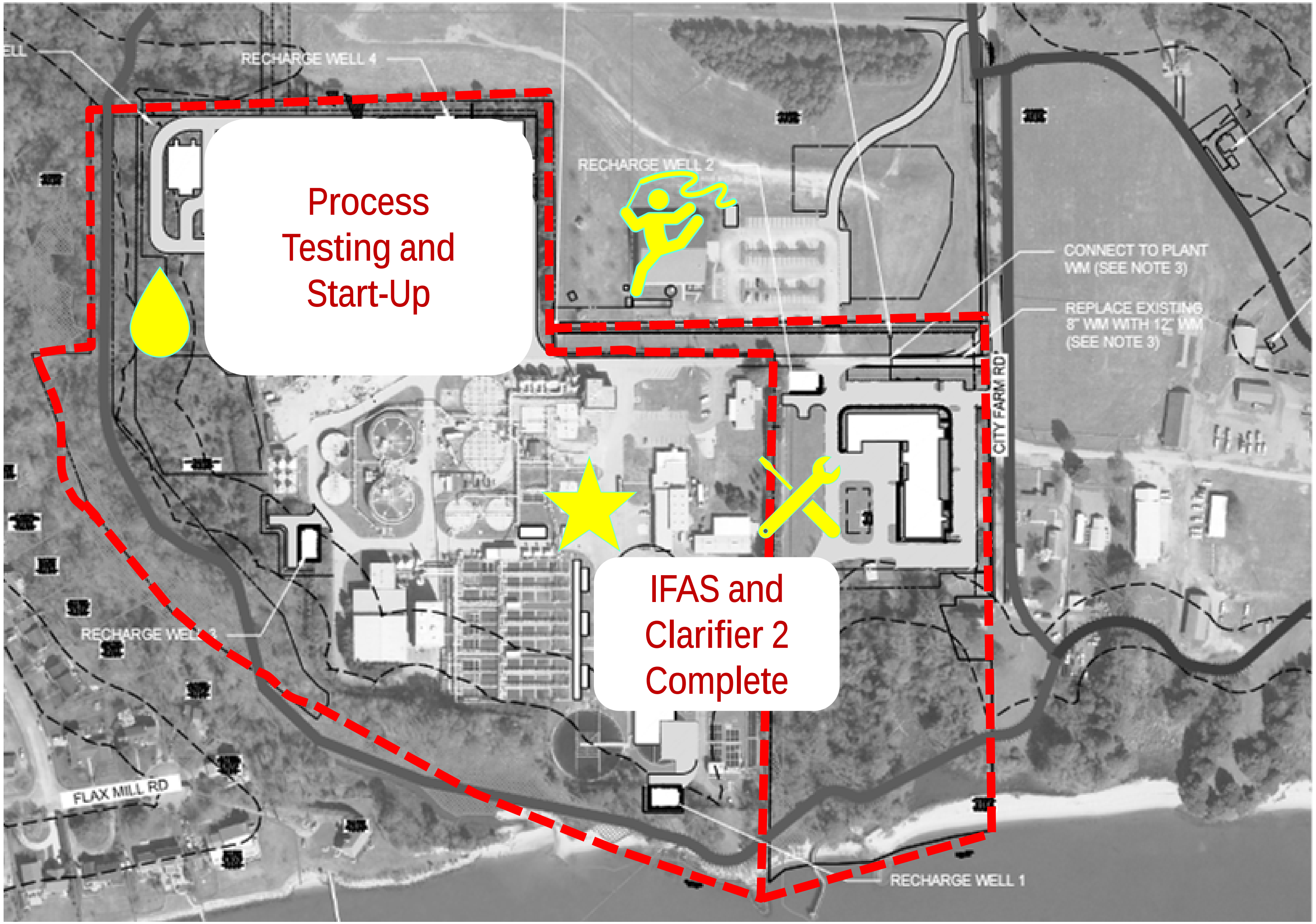
Construction Activity through the end of 2023



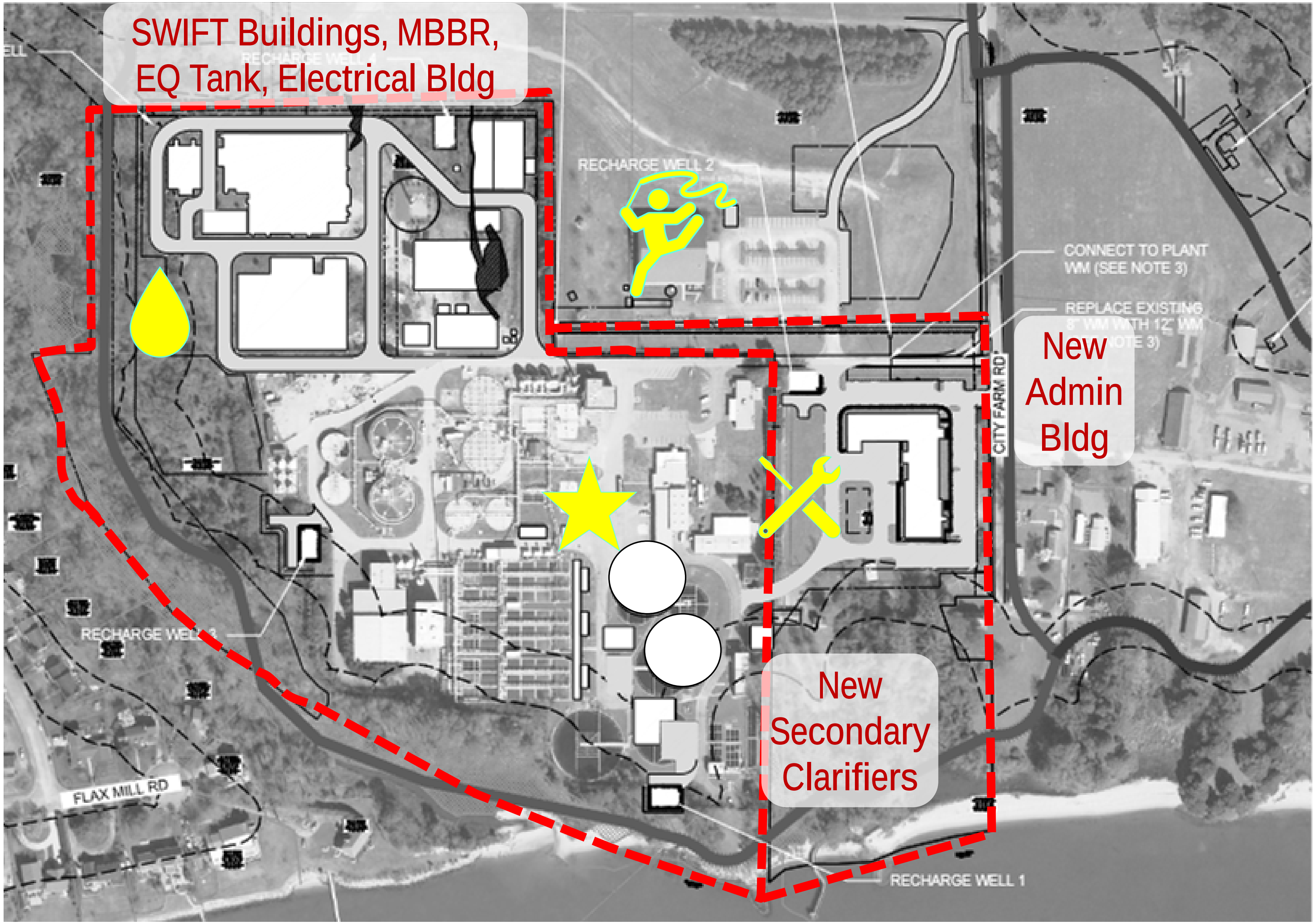
Construction Activity through the end of 2024



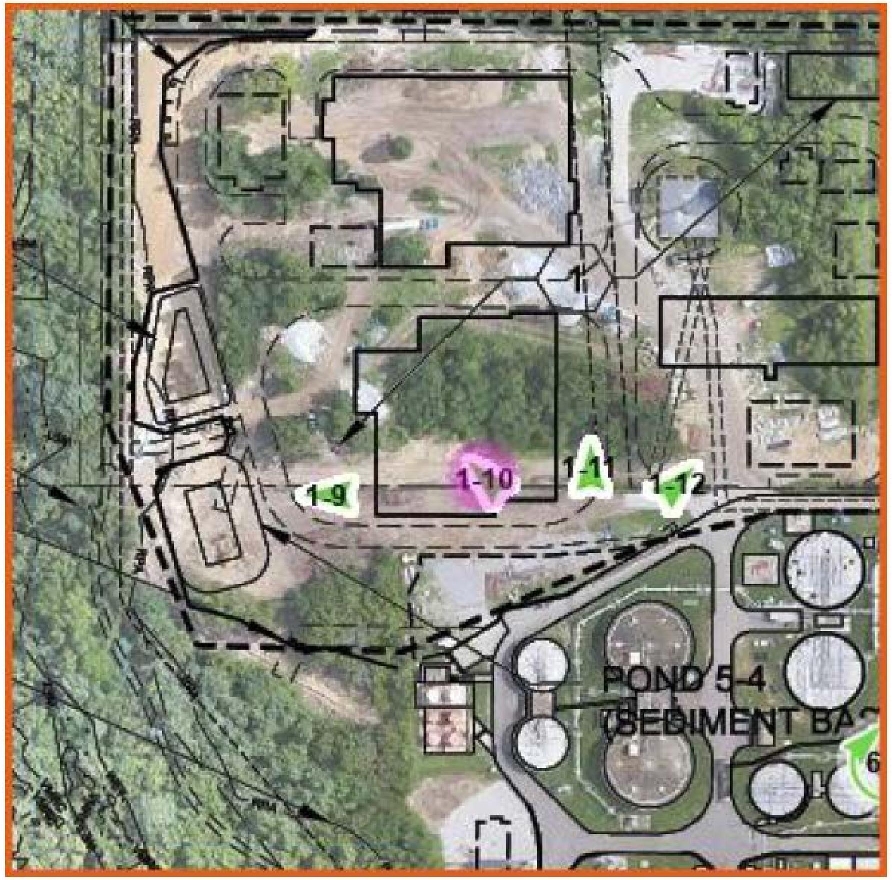
Construction Activity through the end of 2025



Performance Testing in 2026



Site work is on-going in the SWIFT area.



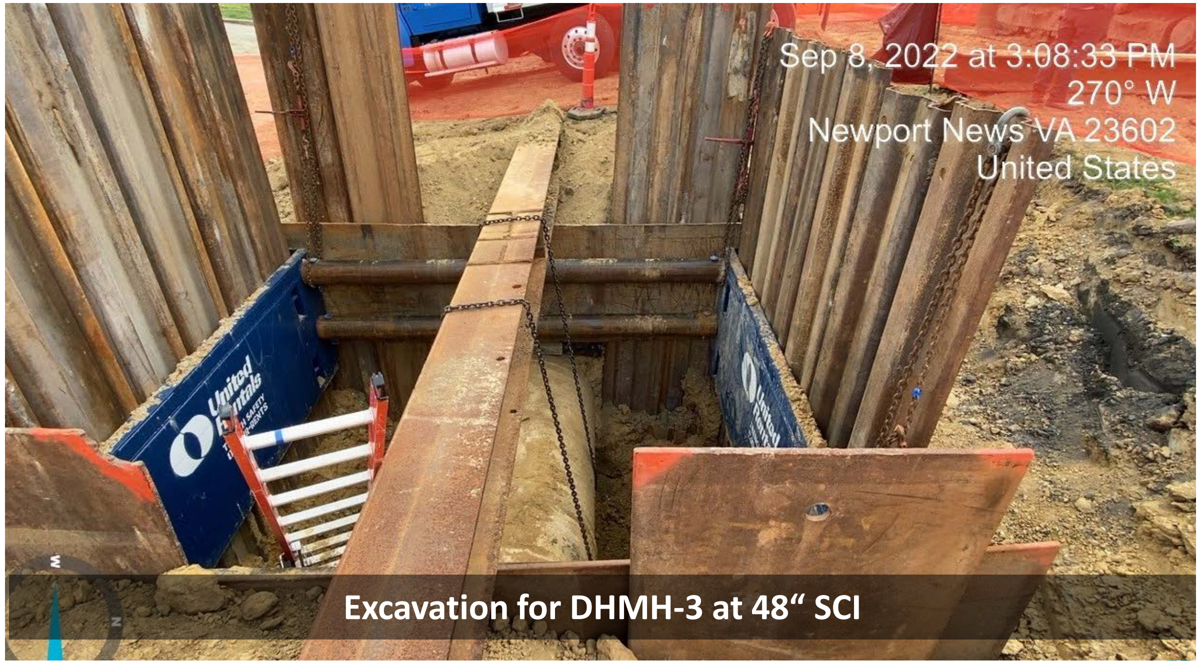

Sep 8, 2022 at 3:15:22 PM
44° NE
Newport News VA 23602
United States
C4


CAT
CAT
330F

Excavation for MH-4 at 48" SCE

Excavation for MH's 3 & 4

New Manholes

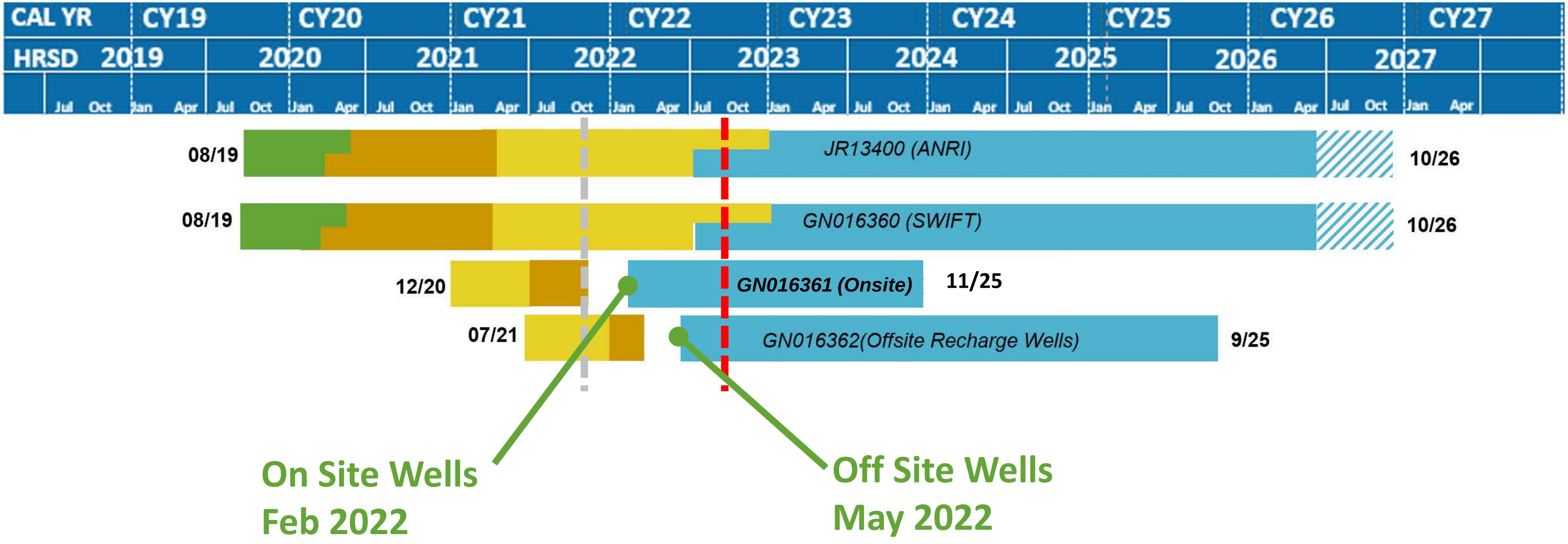


Excavation for DHMH-3 at 48" SCI


SULLAIR
800-UR-RENTS
185

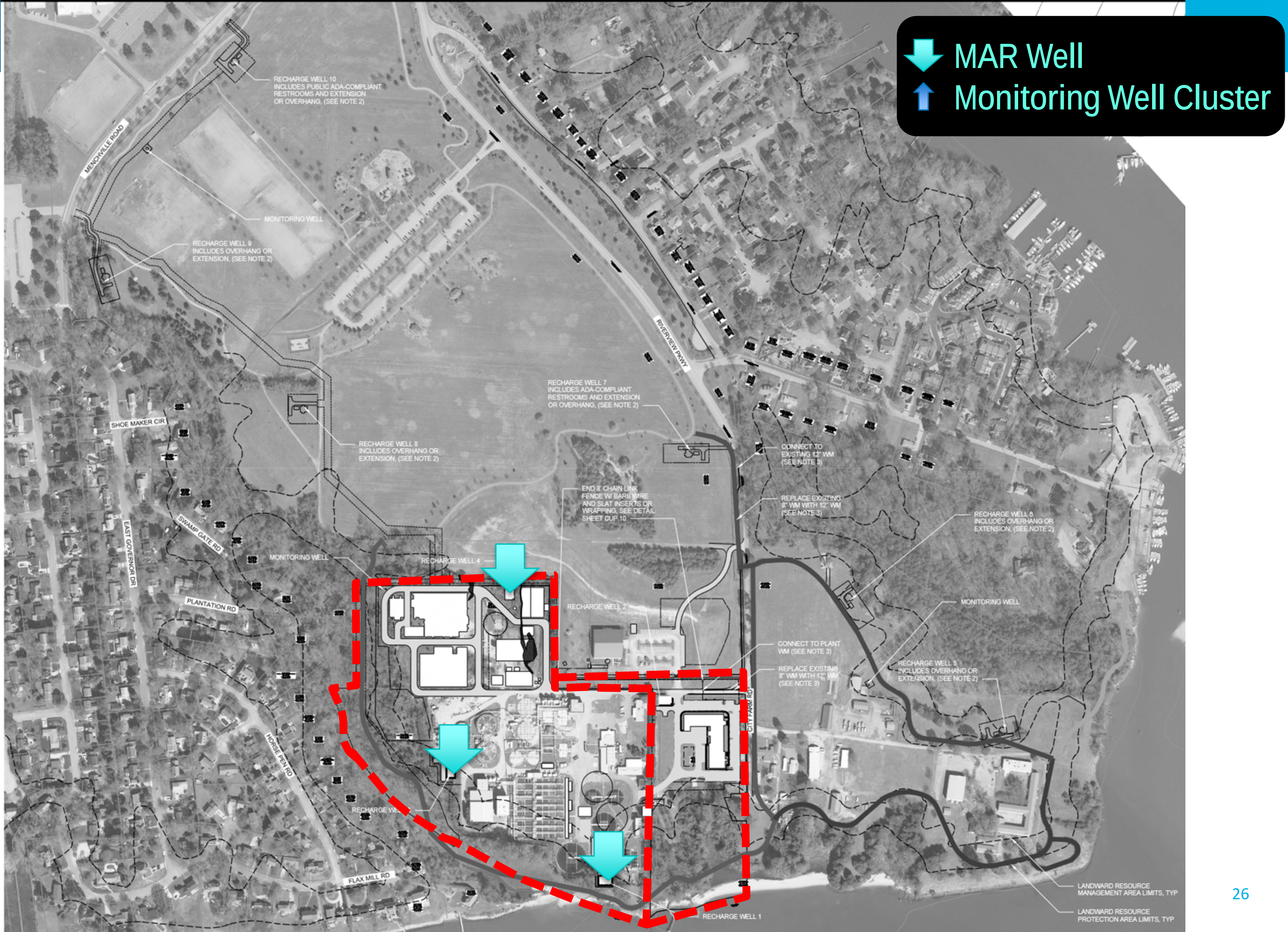
Both drilling contracts are underway.

Data Date: August 31, 2022

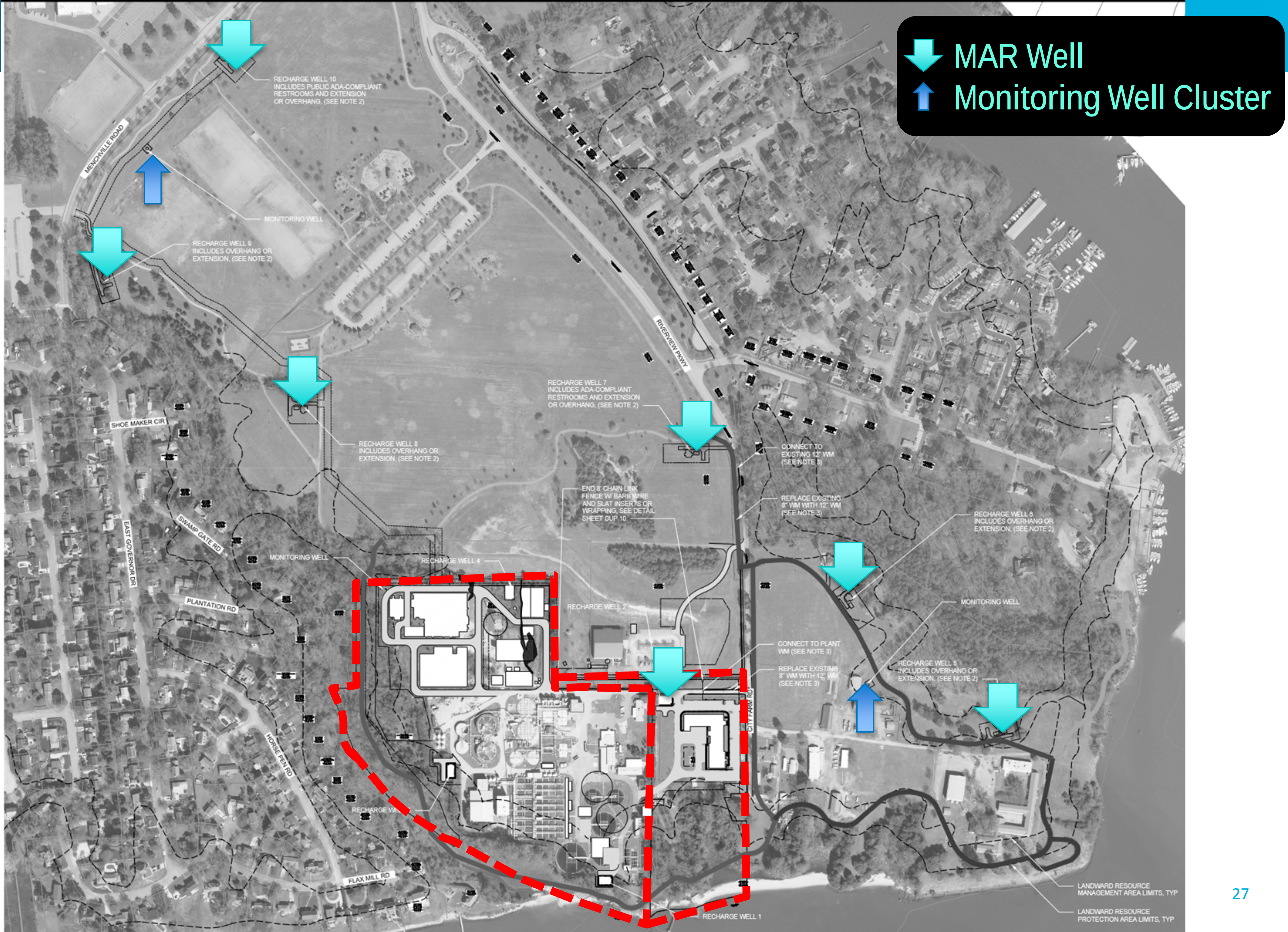


PER | Design | Procurement | Construction NTP-SC | Construction SC-FC

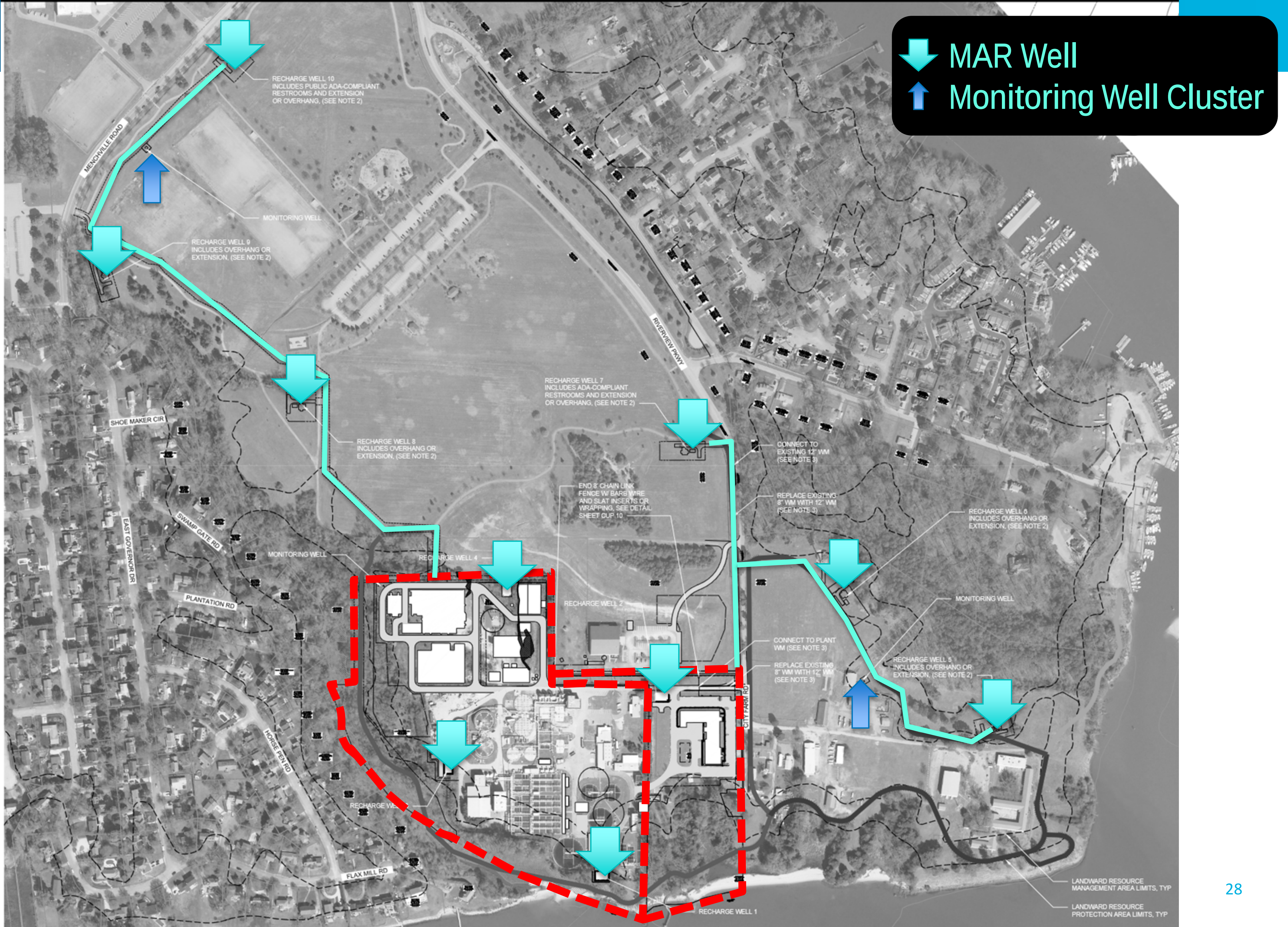
On Site MAR Wells



Off Site MAR Wells and Monitoring Wells

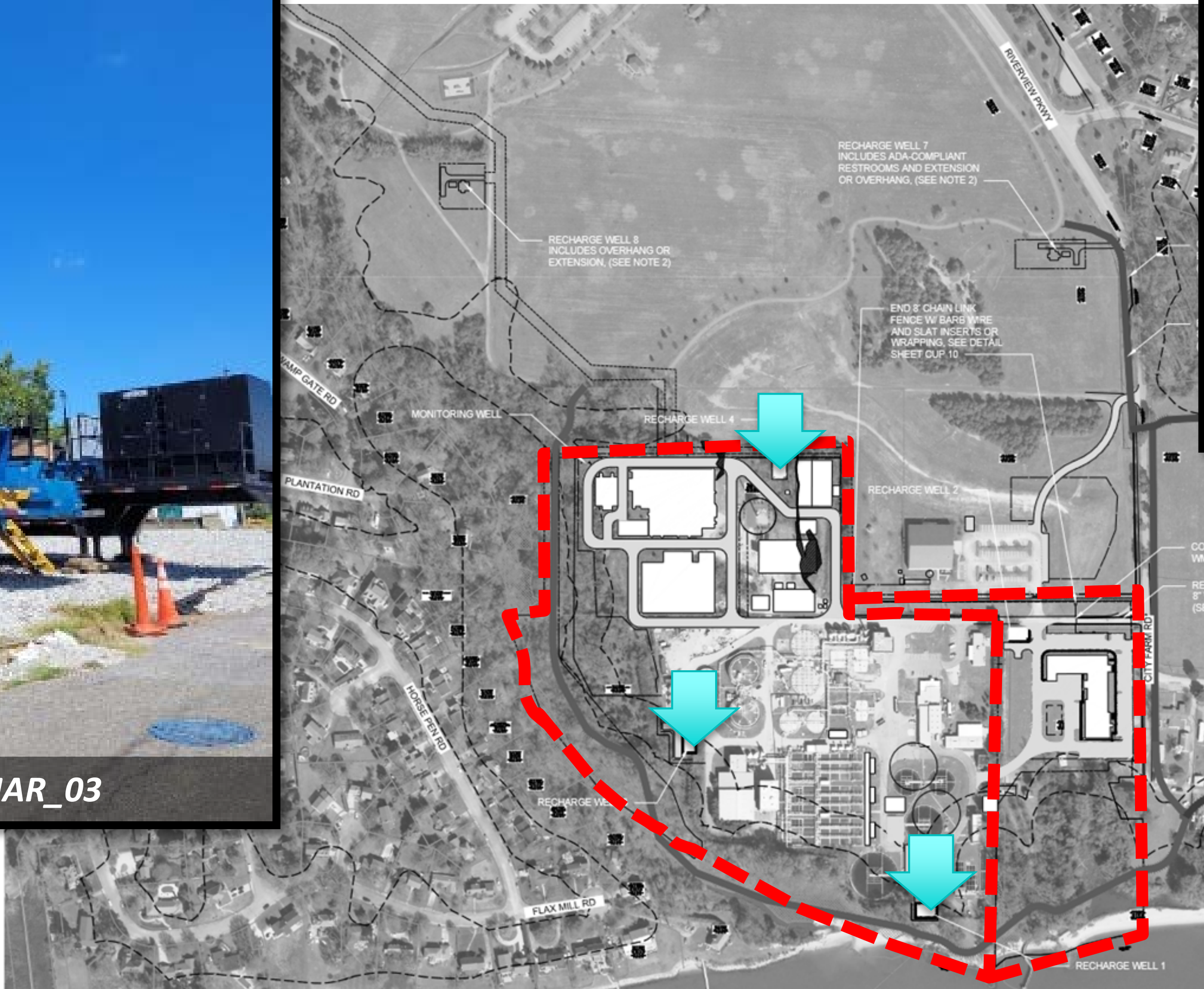


SWIFT Water Pipe Routes



All three on-site wells have been initiated.
Screens for the first well are expected on site in October 2022.

2[nd] rig set up at JR_MAR_03



Silt fence at JR_MAR_10

Construction entrance at JR_MAR_09

Off-site wells are starting with geophysical borings at Well 9 & 10.

Drilling at JR_MAR_01


Clean Drill Bit

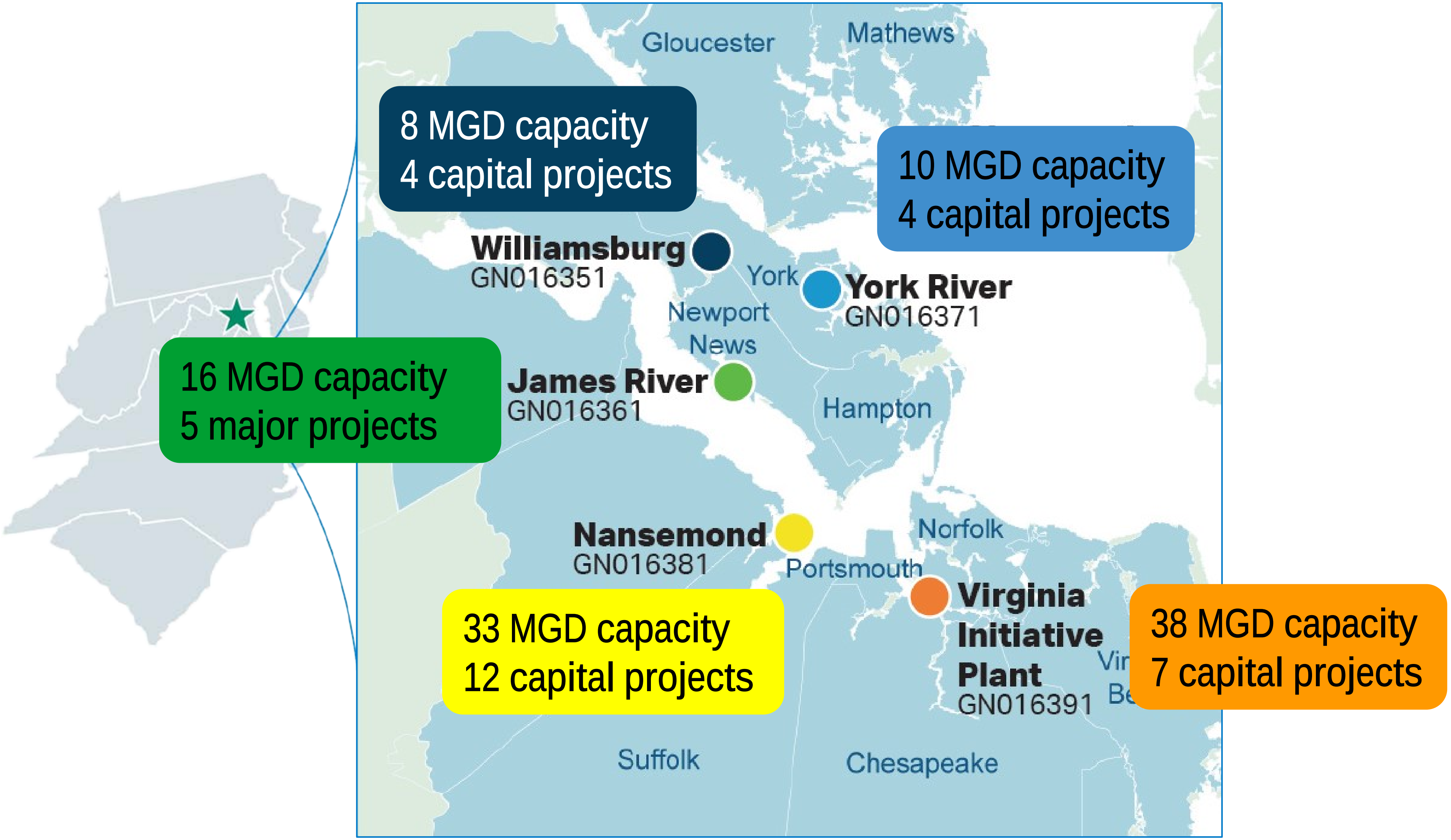

Dirty Drill Bit

Full Scale Implementation Program (FSIP) Update

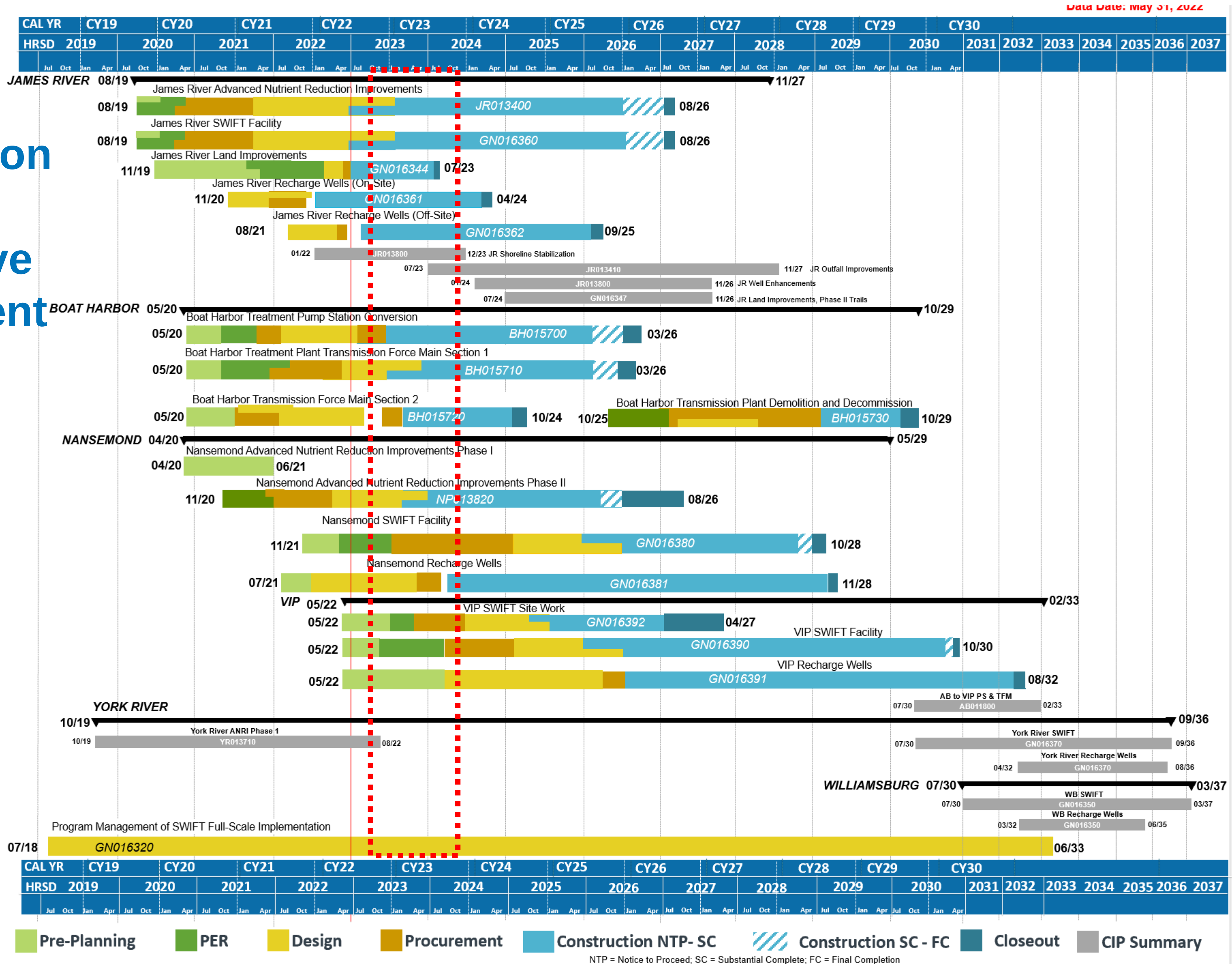
Potomac Aquifer Recharge
Oversight Committee
September 26, 2022

Lauren Zuravnsky, P.E.
Chief of Design & Construction - SWIFT

General Location of SWIFT Treatment and Recharge Facilities



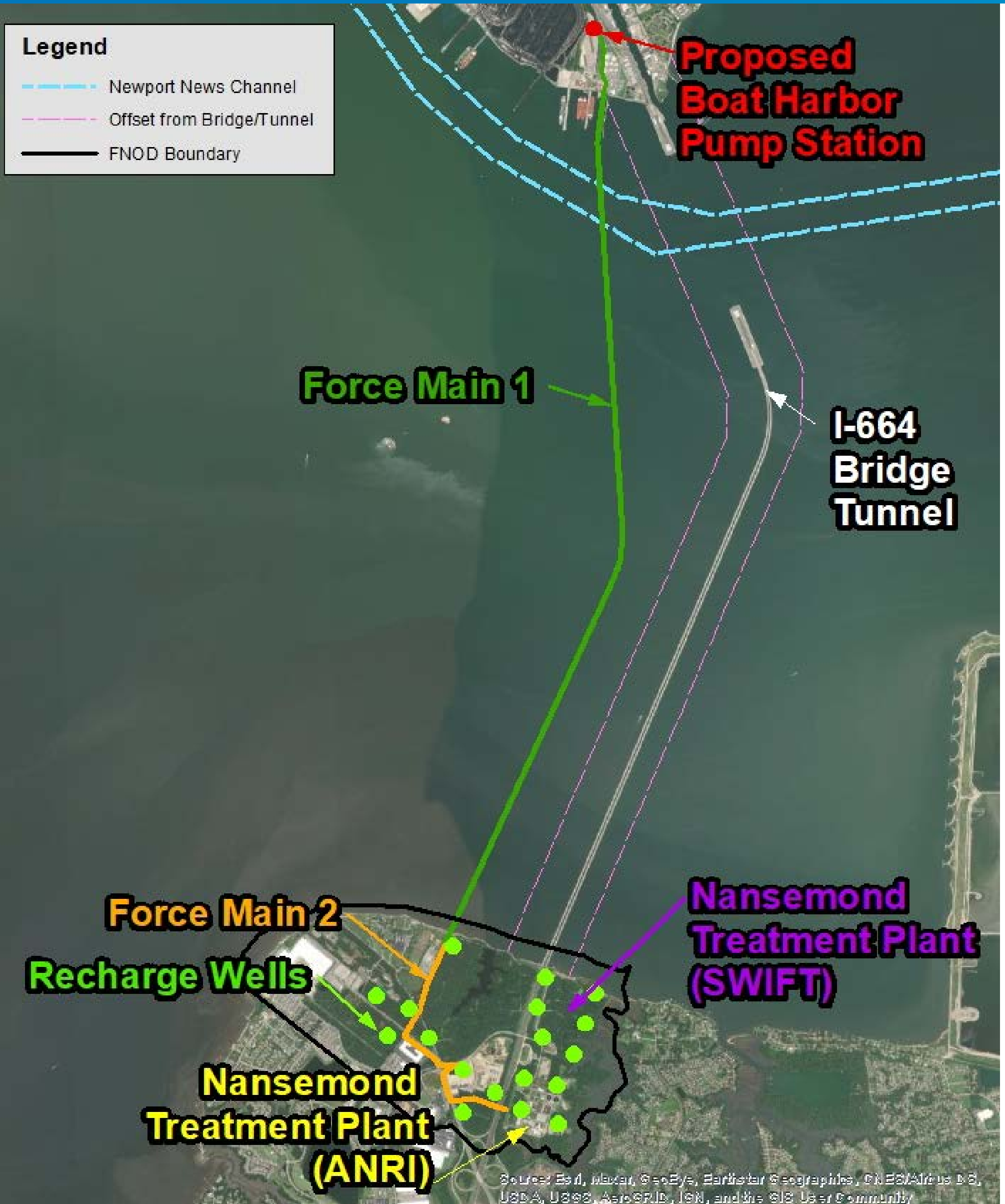
SWIFT Full Scale Implementation Program has multiple active and concurrent projects.



James River

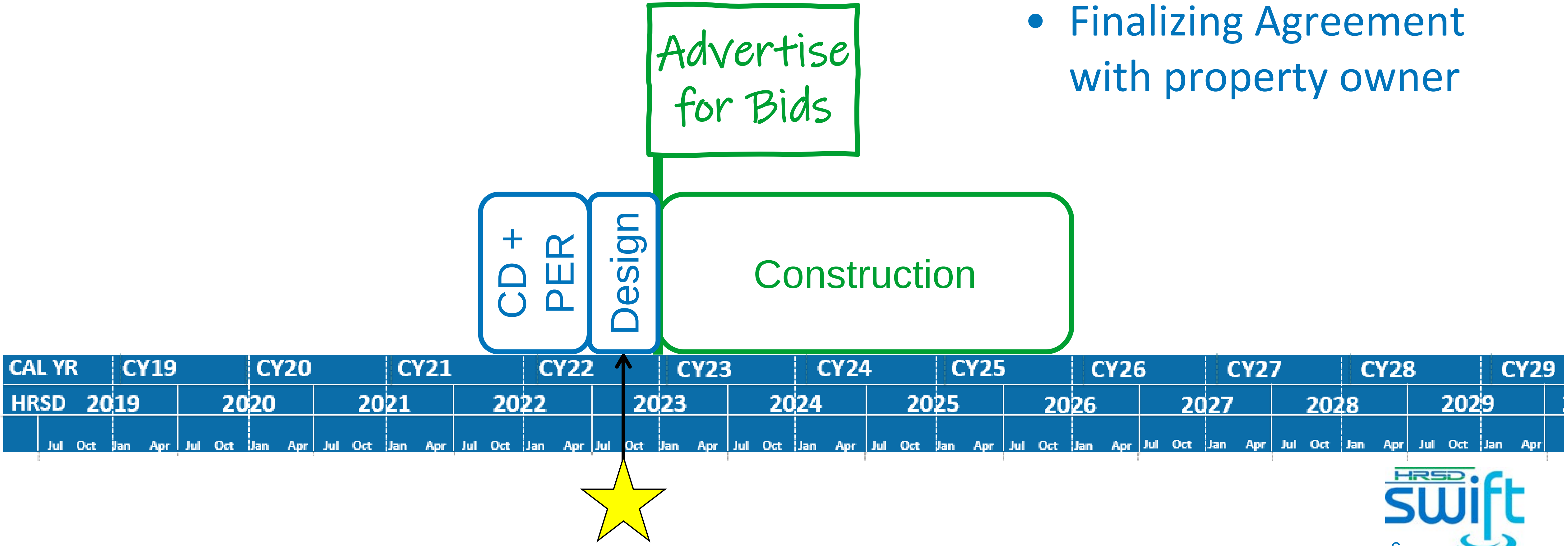
- SWIFT + Nutrient Improvements (design build) project has started construction
- Two well drilling contracts under way
- UIC Permit
- Recharge expected in 2026
- Multiple project efforts related to City park enhancements

Boat Harbor Transition and Nansemond Improvements



- Construct new equalization and pumping facility in Newport News
- Convey screened and de-gritted wastewater in a new transmission force main
- Expand hydraulic and treatment capacity at Nansemond in Suffolk
- All 4 projects must be operational by 2025 to meet strategy and program goals
- SWIFT improvements following wastewater improvements
- Install recharge wells and monitoring wells

Boat Harbor Pump Station Project Status



- Design-Bid-Build
- Design by RK&K
- Finalizing Agreement with property owner

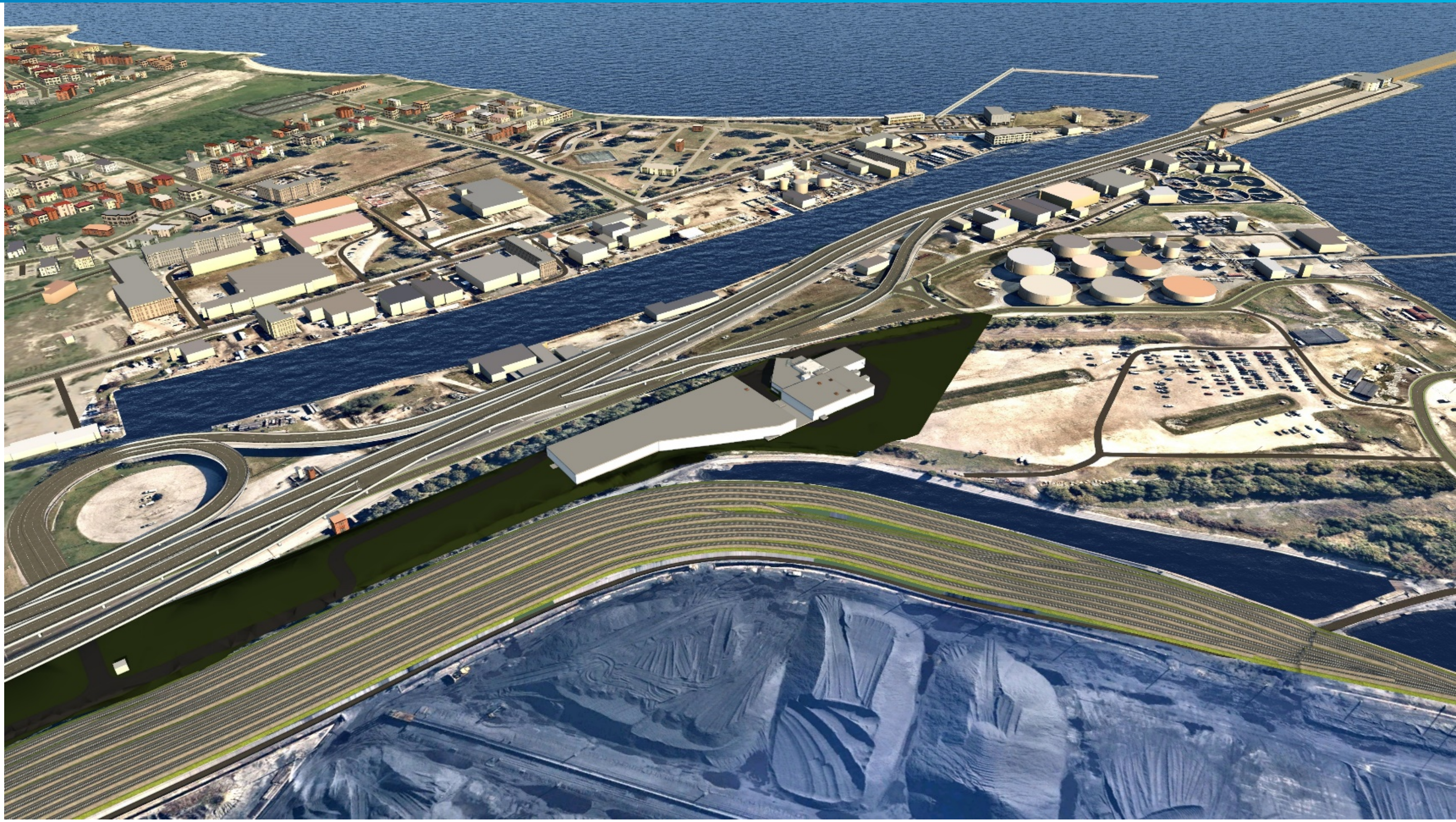
Boat Harbor Pump Station Location

- Higher elevation

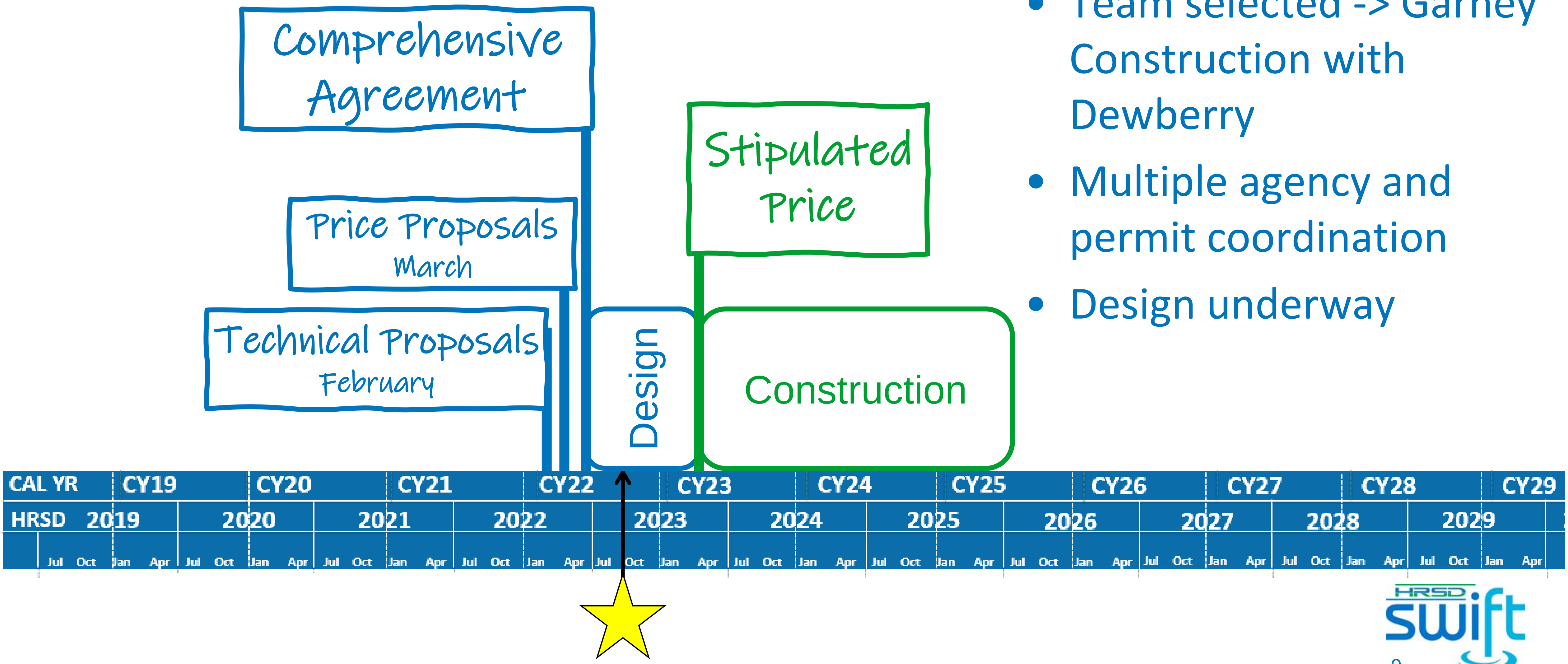
Boat Harbor Pump Station

- 14.5 MGD average flow
- 36.5 MGD peak flow

- Screening
- Grit removal
- 1.5 MG daily equalization
- 12 MG wet weather equalization

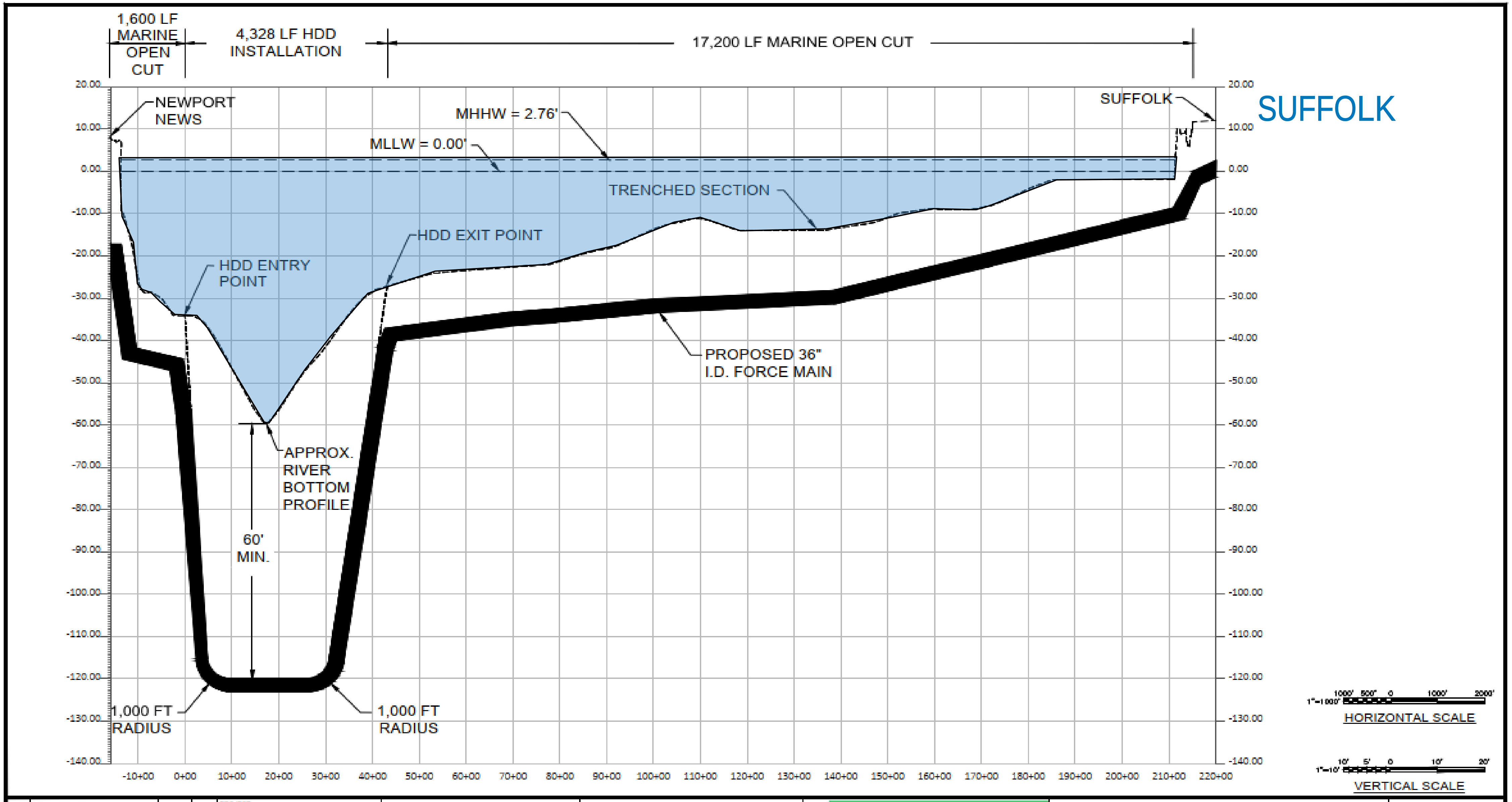


Boat Harbor Transmission Force Main (Aqueous-1) Design Build Project Status



- Team selected -> Garney Construction with Dewberry
- Multiple agency and permit coordination
- Design underway

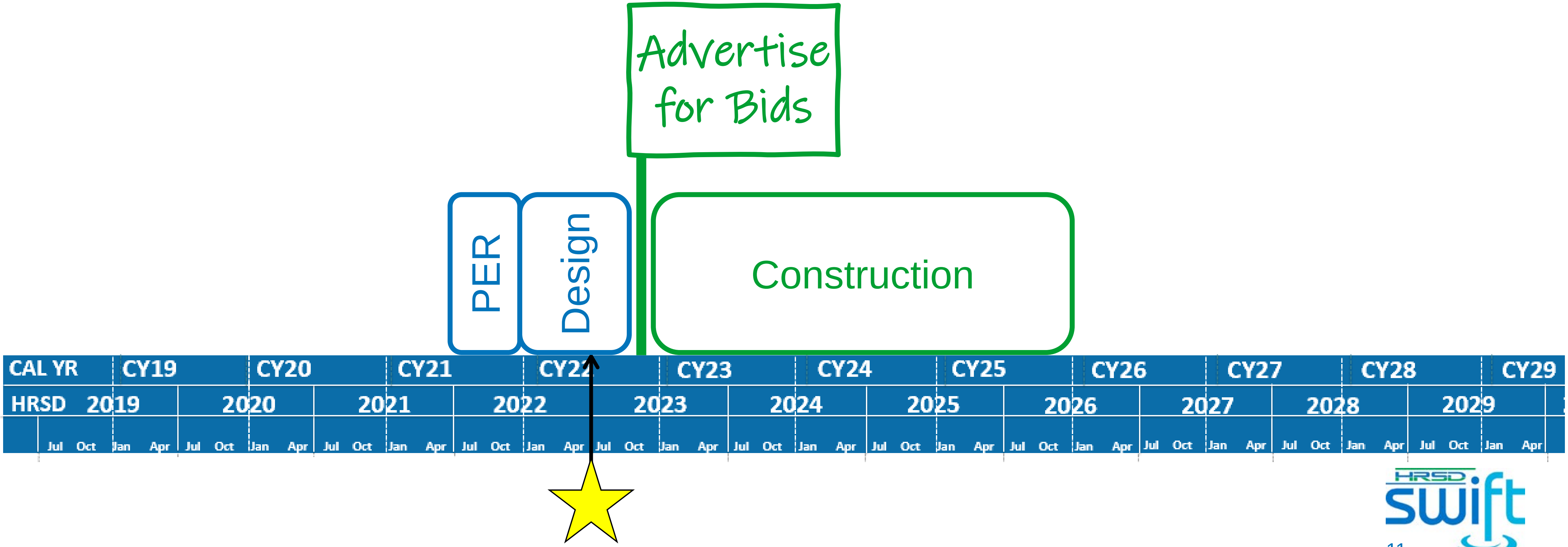
Proposed profile of Force Main under the James River



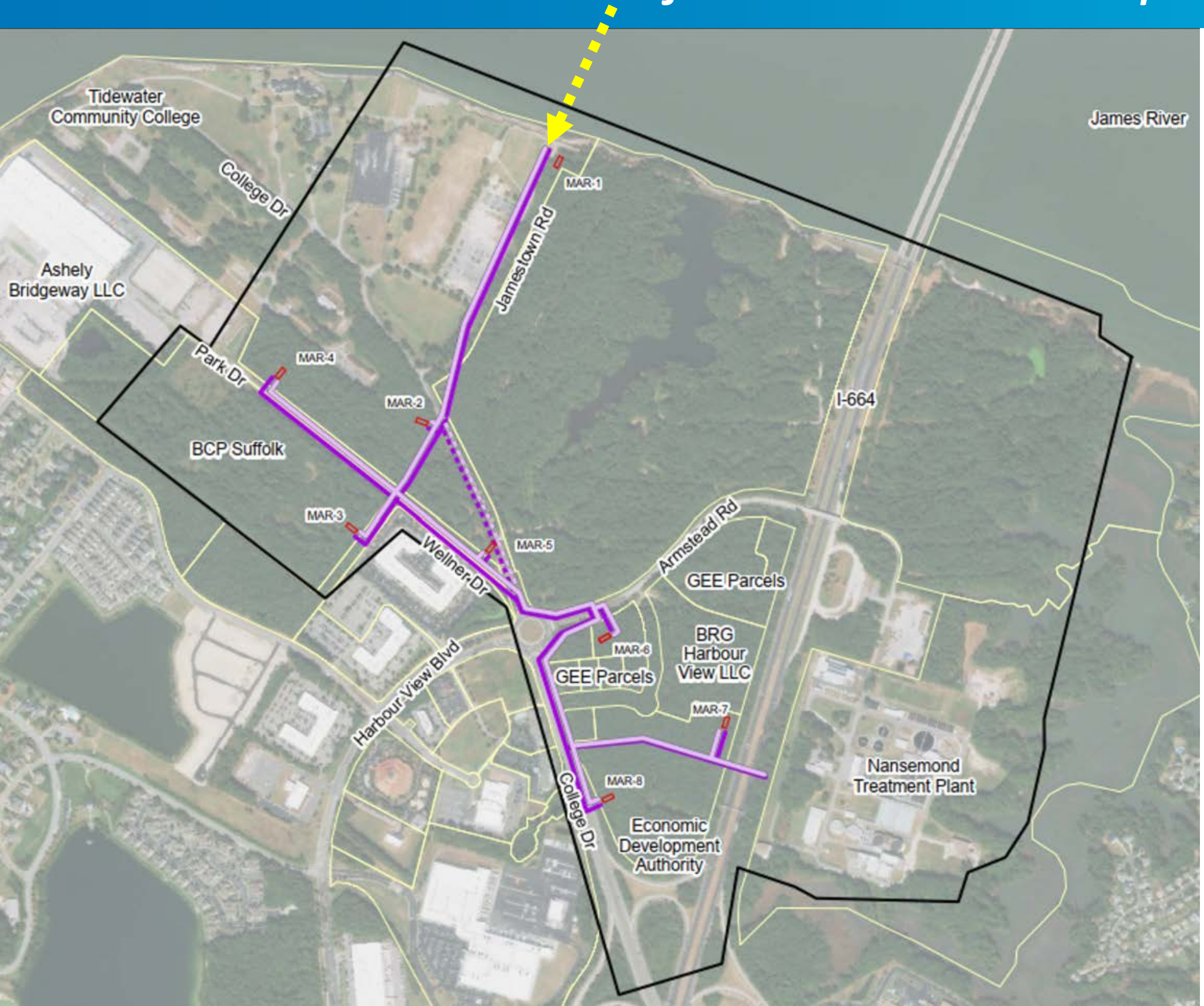
SUFFOLK

Boat Harbor Transmission Force Main (Land-2)
Project Status

- Design by CDM Smith



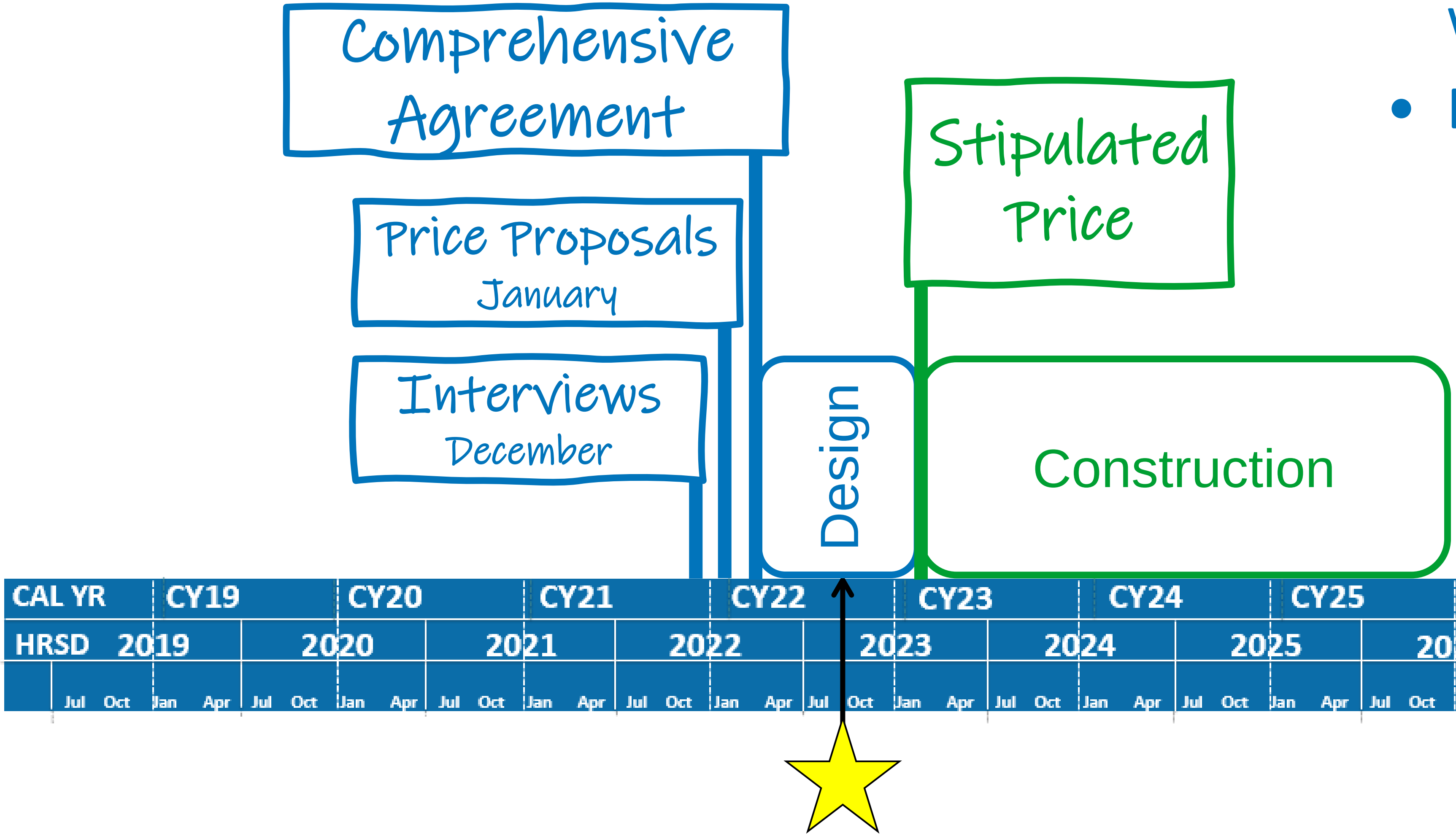
Boat Harbor Transmission Force Main (Land-2) Project Status – *site plan have been superseded*



- Interface with FM1 and Nansemond TP
- Coordinate with multiple private properties
- 48" HDPE Force Main
- Micro-tunnel under I-664

- Coordinate with managed aquifer recharge wells
- 30"-12" SWIFT Water pipe
- 16" Backwash pipe

Nansemond Wastewater Upgrade (ANRI) Design Build Project Status



- Team selected -> Garney with Tetra Tech
- Design is underway

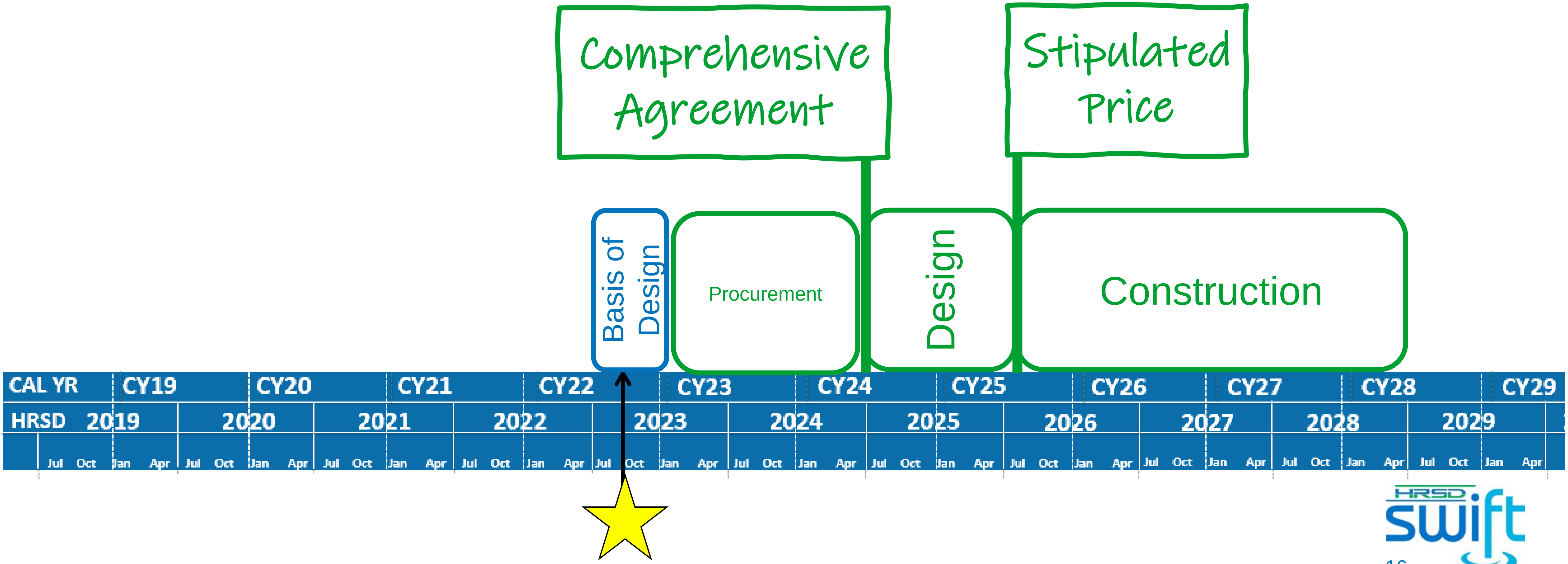
Wastewater Upgrades
Advanced Nutrient Reduction Improvements

- **Increase plant capacity - 50 MGD**
- **Major new infrastructure**
- **Improve nutrient reduction**
- **Treat to SWIFT influent quality**

Future Nansemond Facility

Nansemond SWIFT
Design Build Project Status

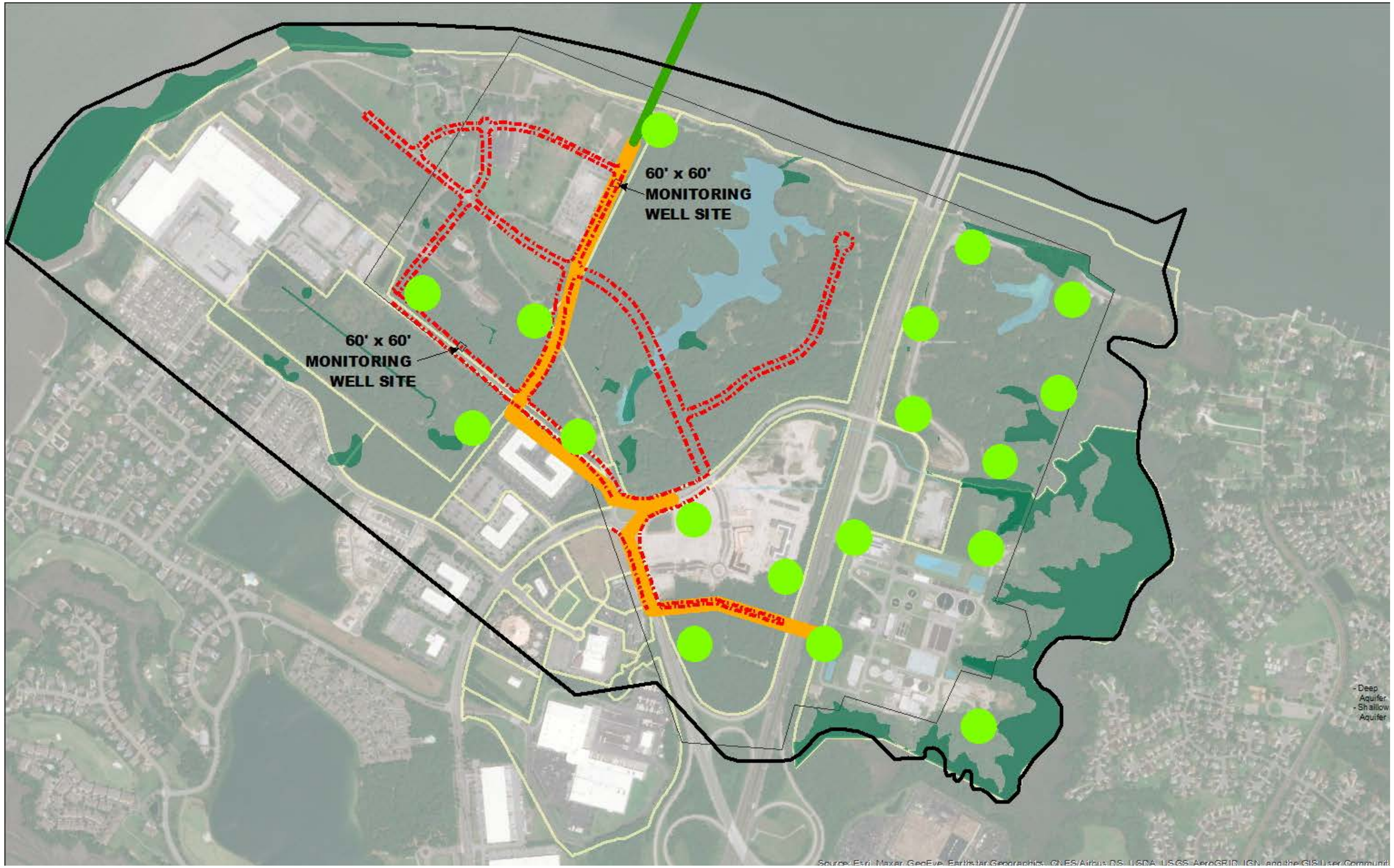
- Developing basis of design



Full-Scale SWIFT Facility

- **33 MGD capacity recharge**
- **Multi-barrier Advanced Water Treatment**
- **Piping distribution network to all Wells**

Nansemond Managed Aquifer Recharge Wells



2.5 MGD per well

SWIFT FSIP Update: VIP

- Strategic planning

SWIFT FSIP Update: YR, WB

- After VIP planning