

Evaluation of PFAS Treatment
Wells 2, 3, 7 & 8
Merrimack Village District

Underwood Engineers

February 25, 2019

Purpose of Report

- If Treatment Were Pursued:
 - How could it be done
 - How much will it cost
- Report issued December 14, 2018



25 Vaughan Mall
Portsmouth, NH, 03801-4012
Tel: 603-436-6192 Fax: 603-431-4733

Technical Memorandum

To: MVD Board of Commissioners
From: Mike Metcalf, Lynnette Carney, Billy Kitchens *[Signature]*
Date: December 14, 2018
Subject: Evaluation of PFAS Treatment for Wells 2, 3, 7 & 8
Merrimack Village District (MVD), Merrimack, NH

BACKGROUND

Merrimack's water distribution system serves an estimated 25,000 customers. The source for all of Merrimack's water is groundwater with the exception of emergency interconnections with Pennichuck Water Works (PWW) and Manchester Water Works (MWW). It is noted that the MWW connection would only be used in the case of an extreme emergency since MWW disinfects with chloramines. Merrimack has six (6) active and one (1) inactive gravel-packed well located in the towns of Merrimack and Hollis as follows:

Well	Location	Status
Well #2	Central Merrimack	On-line
Well #3	Central Merrimack	On-line (elevated Fe/Mn)
Well #4	Front Street in northern Merrimack; piped together with Well #5. Well is about 8,000 ft south of the Saint Gobain facility.	Off-line, due to PFOA concentrations exceeding NHDES AGQS.
Well #5	Front Street in northern Merrimack; piped together with Well #4. This well is about 8,000 ft south of the Saint Gobain facility.	Off-line, due to PFOA concentrations exceeding NHDES AGQS.
Well #6	Southern Merrimack	Inactive/removed from service; no longer permitted
Well #7	Northeastern Hollis; piped together with Well #8 to Fe/Mn WTP	On-line
Well #8	Northeastern Hollis; piped together with Well #7 to Fe/Mn WTP	On-line

MVD Wells

- Active MVD Wells
 - Well #2 - 1,500 gpm (1,100 pump)
 - Well #3 - 800 gpm
 - Well #7 & #8 - 1,250 gpm
- Off-Line Wells
 - Well #4 & #5 - 625 gpm



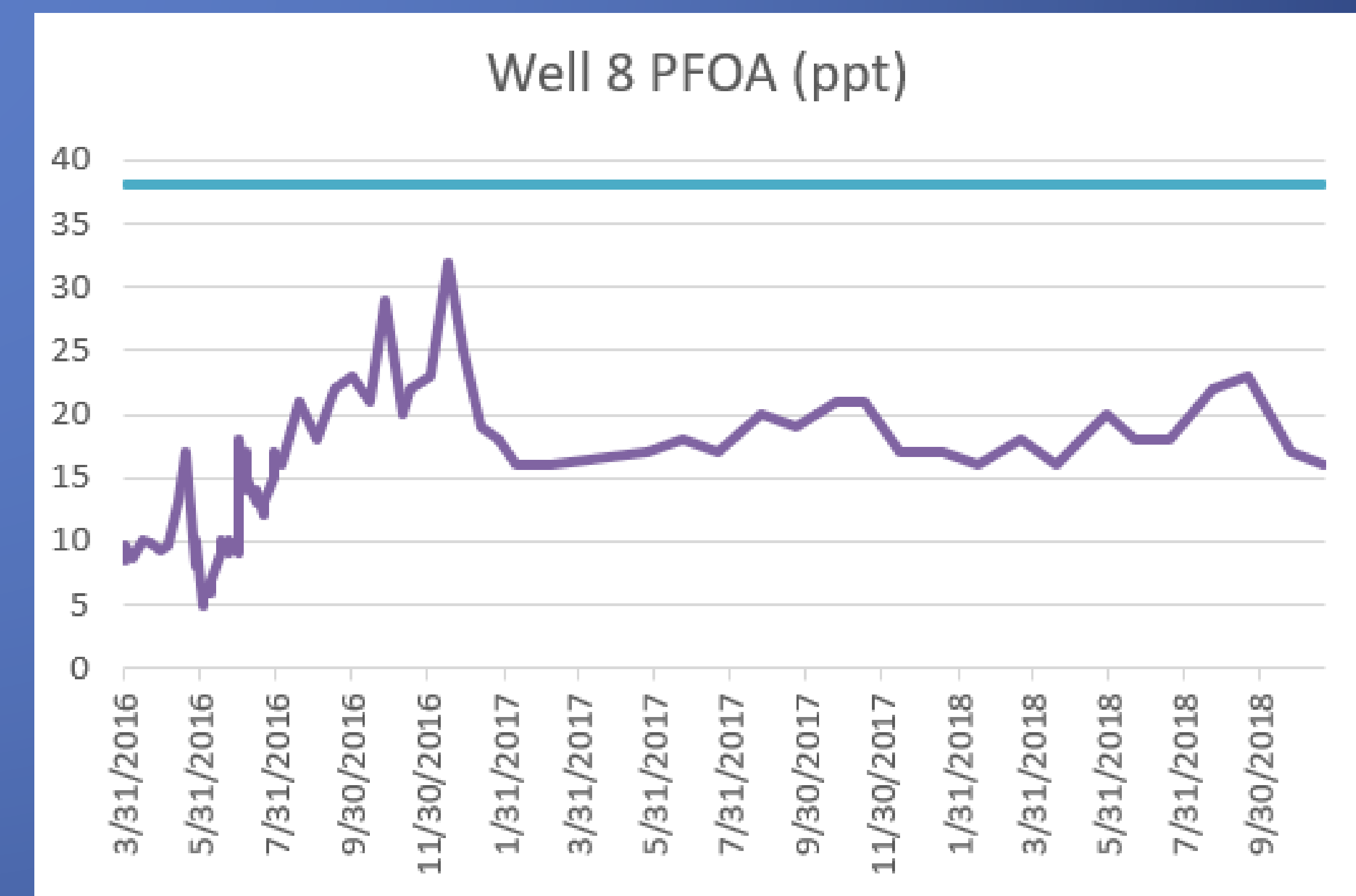
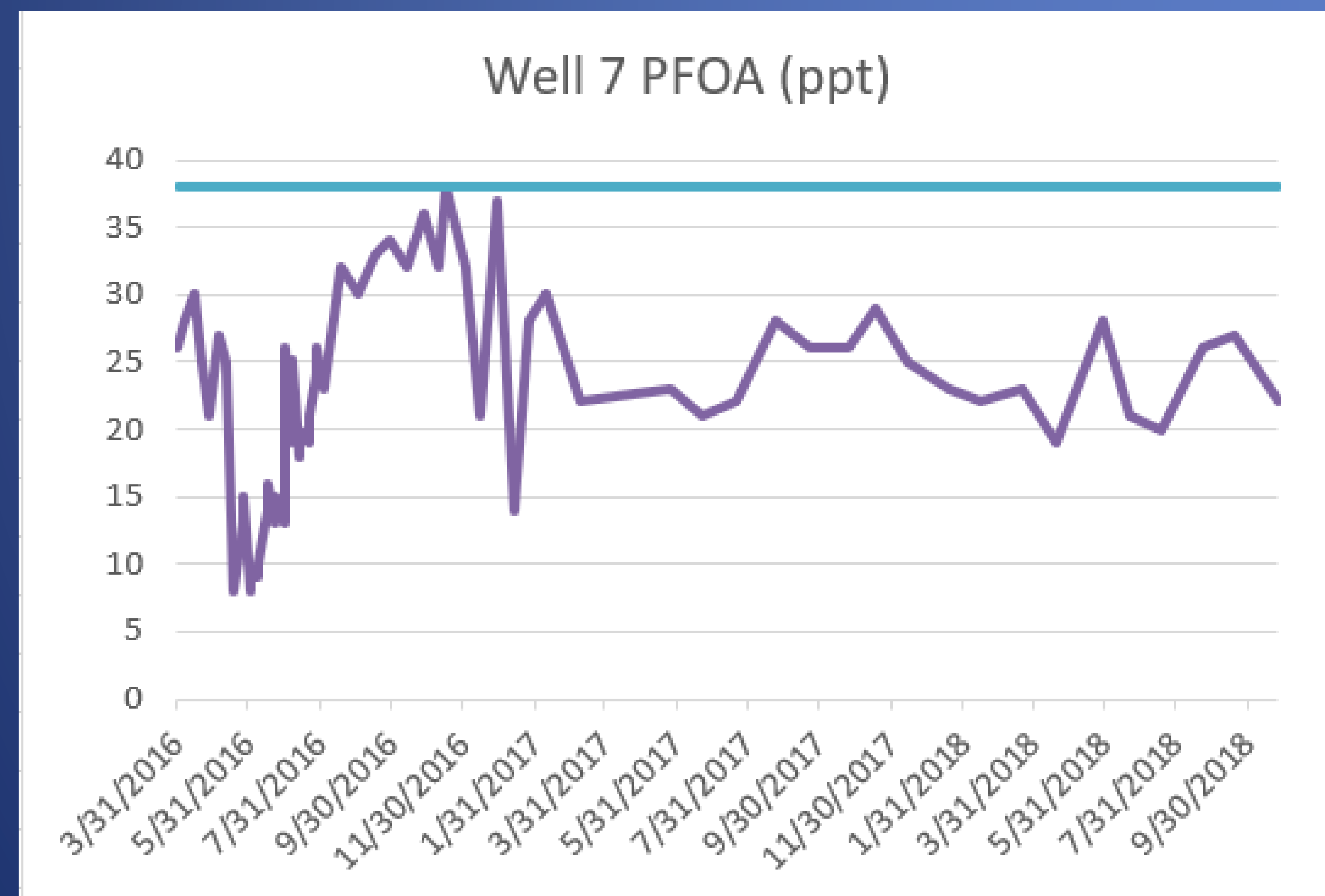
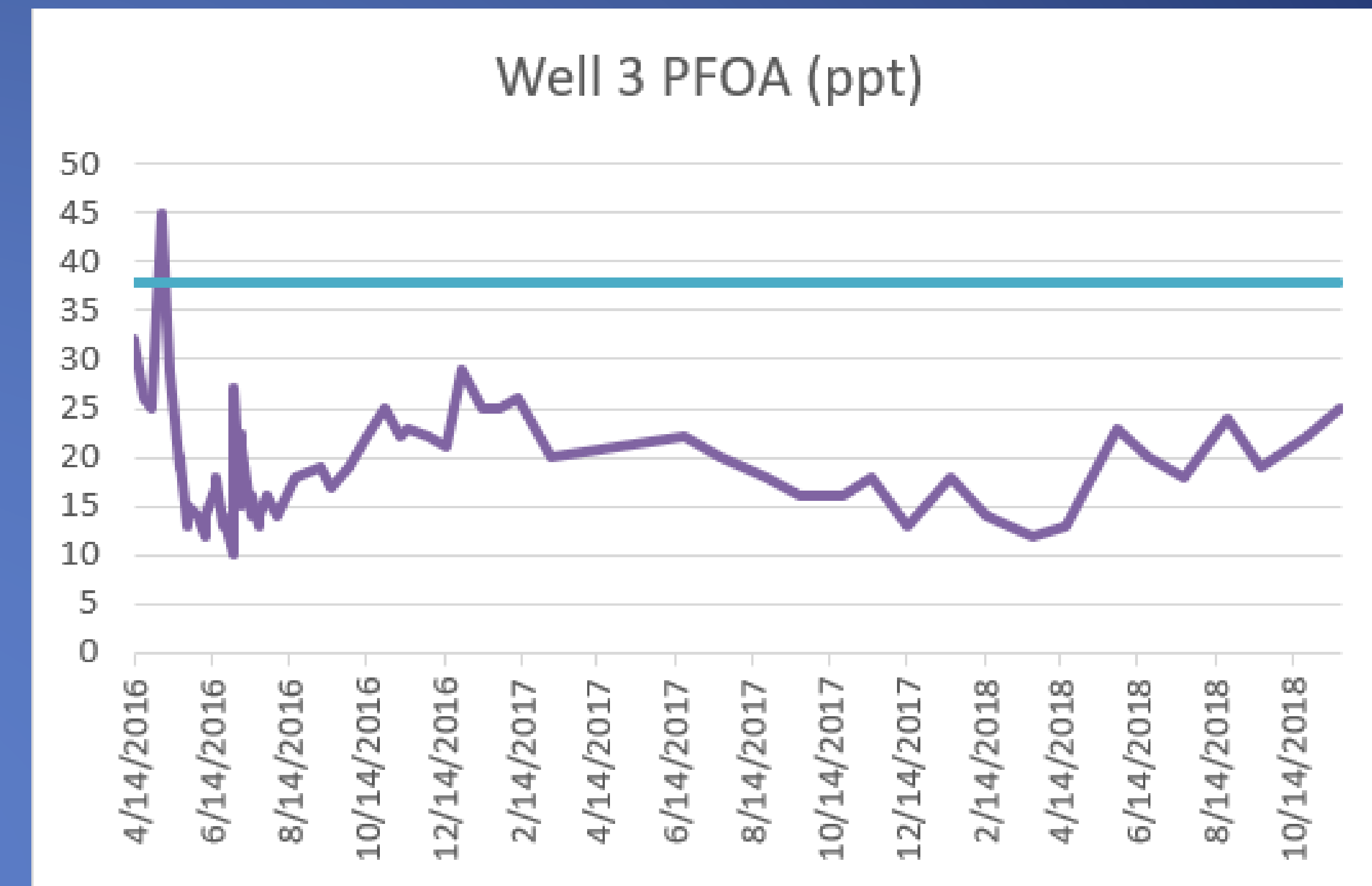
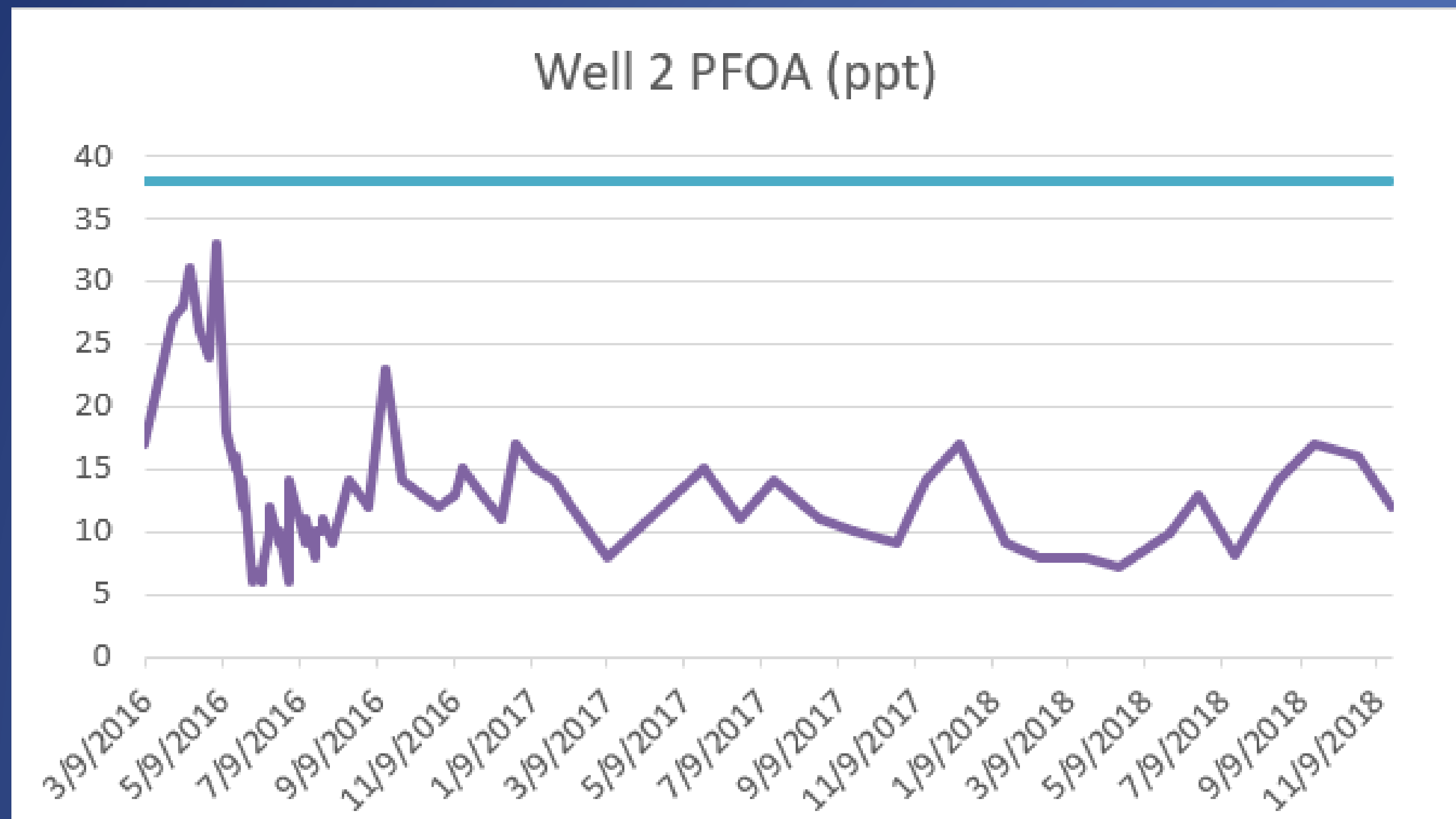
Current Standards PFOA and PFOS

- Ambient Groundwater Quality Standard (AGQS)
 - Individually or combined = 70 ppt (parts per trillion)
- Current Levels in #2, #3, #7 & #8
 - All less than current 70 ppt AGQS
 - Combined concentration range 8 – 48 ppt

Pending Standards

- PFOA Maximum Contaminant Level (MCL) = 38 ppt
 - One initial test > 38 ppt in Well #3
 - All results since 2017 < 38 ppt
- PFHxS and PFNA (80 ppt and 23 ppt, respectively)
 - Both are consistently below laboratory detection limits (~4 ppt), but lab indicates presence.

PFOA Concentration History



Report Approach

- Below detection for all PFAS compounds
 - 24 PFAS chemicals being monitored by EPA
 - MVD monitoring 14 compounds based on what has been detected
- Only lead treatment vessel vs lead & lag vessels
 - No regulatory limit so no redundancy requirement
 - Room left for lag vessels if required in future

Treatment Alternatives - Considered

- **Granular Activated Carbon (GAC)**
 - Media of choice for most PFAS removal systems to date
- **Ion Exchange Resin**
 - Several selective resins developed for PFAS removal
- **Advanced Oxidation**
 - Minimal effectiveness for PFOA/PFOS removal
- **Reverse Osmosis**
 - Expensive & high reject volume
- **Zeolite**
 - In testing & development phase, full scale system not available

Treatment Alternatives - Considered

- **Granular Activated Carbon (GAC)**
 - Media of choice for most PFAS removal systems to date
- **Ion Exchange Resin**
 - Several selective resins developed for PFAS removal
- **Advanced Oxidation**
 - Minimal effectiveness for PFOA/PFOS removal
- **Reverse Osmosis**
 - Expensive & high reject volume
- **Zeolite**
 - In testing & development phase, full scale system not available

Treatment Selection

Granular Activated Carbon (GAC)

- Demonstrated removal for PFOA & PFOS (8 carbons)
- Reportedly less effective & faster breakthrough for shorter carbon chain compounds
- GAC adsorbs many contaminants (i.e. iron, manganese, etc.) so competition for adsorption sites
- Estimated life 1-2 years based on water chemistry
 - 1 year assumed for operation & maintenance (O&M) costs
- GAC media is less expensive than resin



Pease Demonstration WTP GAC Units



Hoosick Falls GAC Units

Well 7 & 8 PFAS Removal

- Existing Iron (Fe) & Manganese (Mn) removal WTP
- GAC process
 - Can handle chlorinated water from existing process
 - No bag vessels required
 - Two 12 ft diameter by 26 ft tall vessels (one per Fe/Mn removal train)
 - Space for subsequent GAC or resin vessels
- 34' x 48' building addition
- Opinion of Probable Cost - \$3.6 Million

Existing Treatment Plant - #7/#8



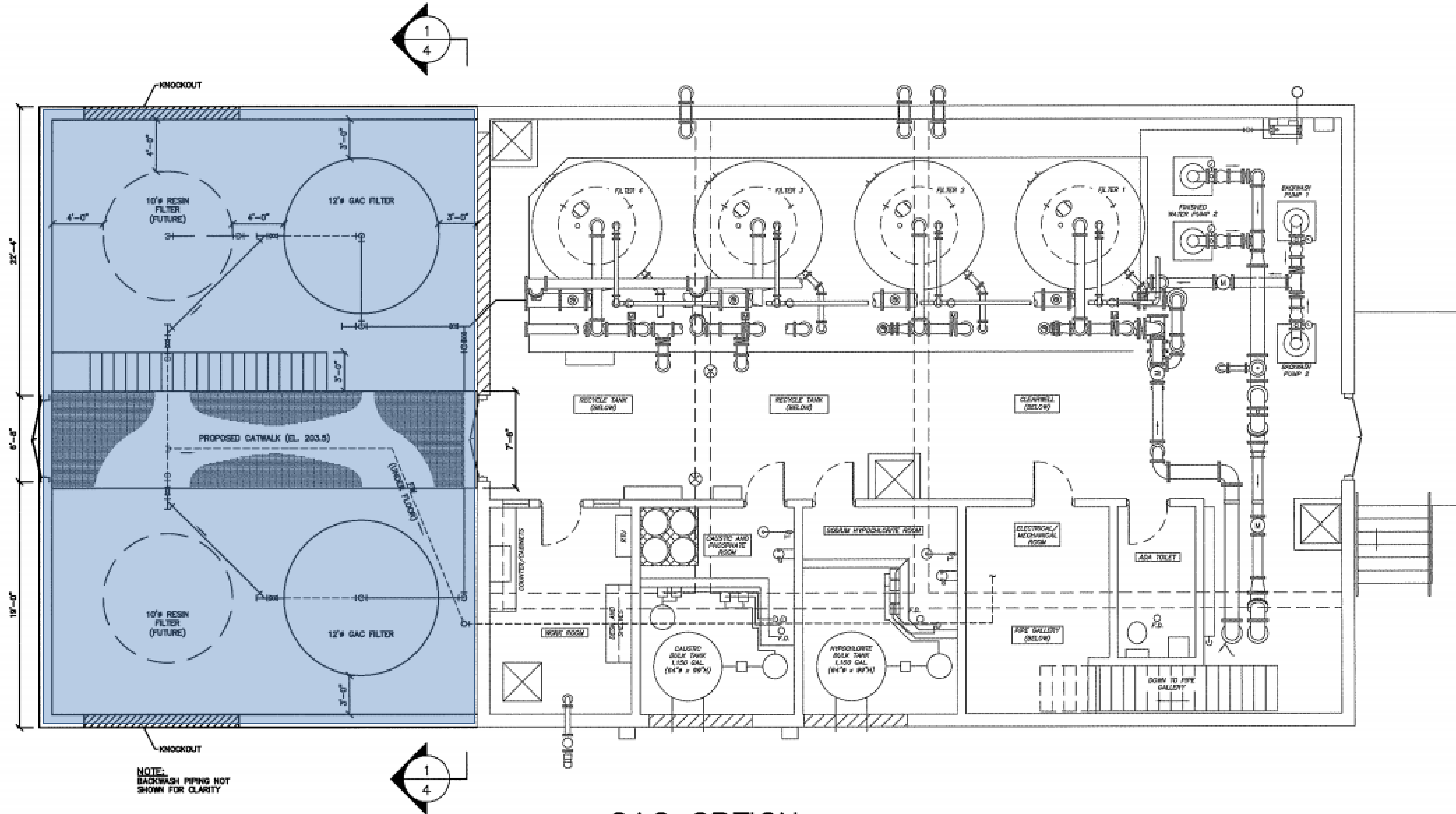
Existing Treatment Plant - #7/#8



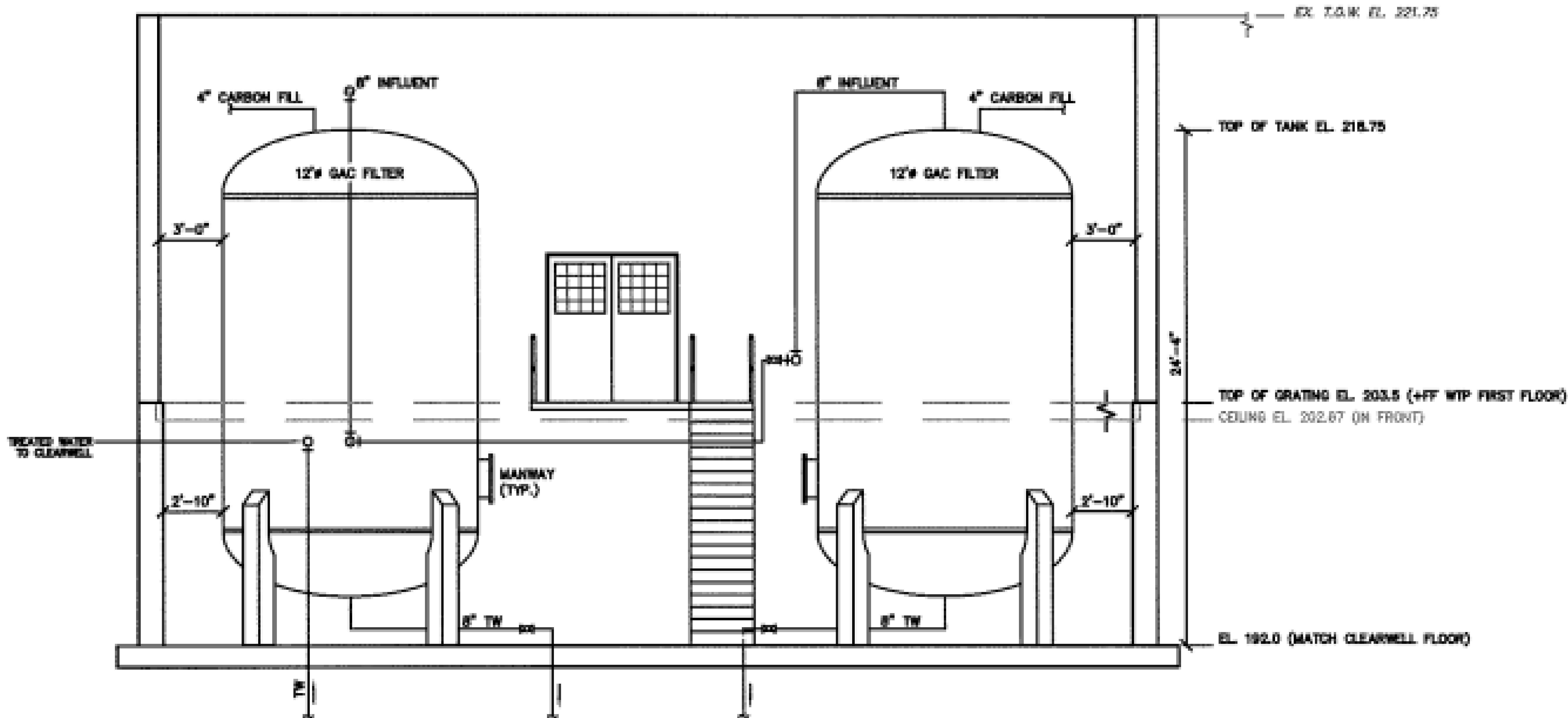
Existing Treatment Plant - #7/#8



Well 7 & 8 GAC Option



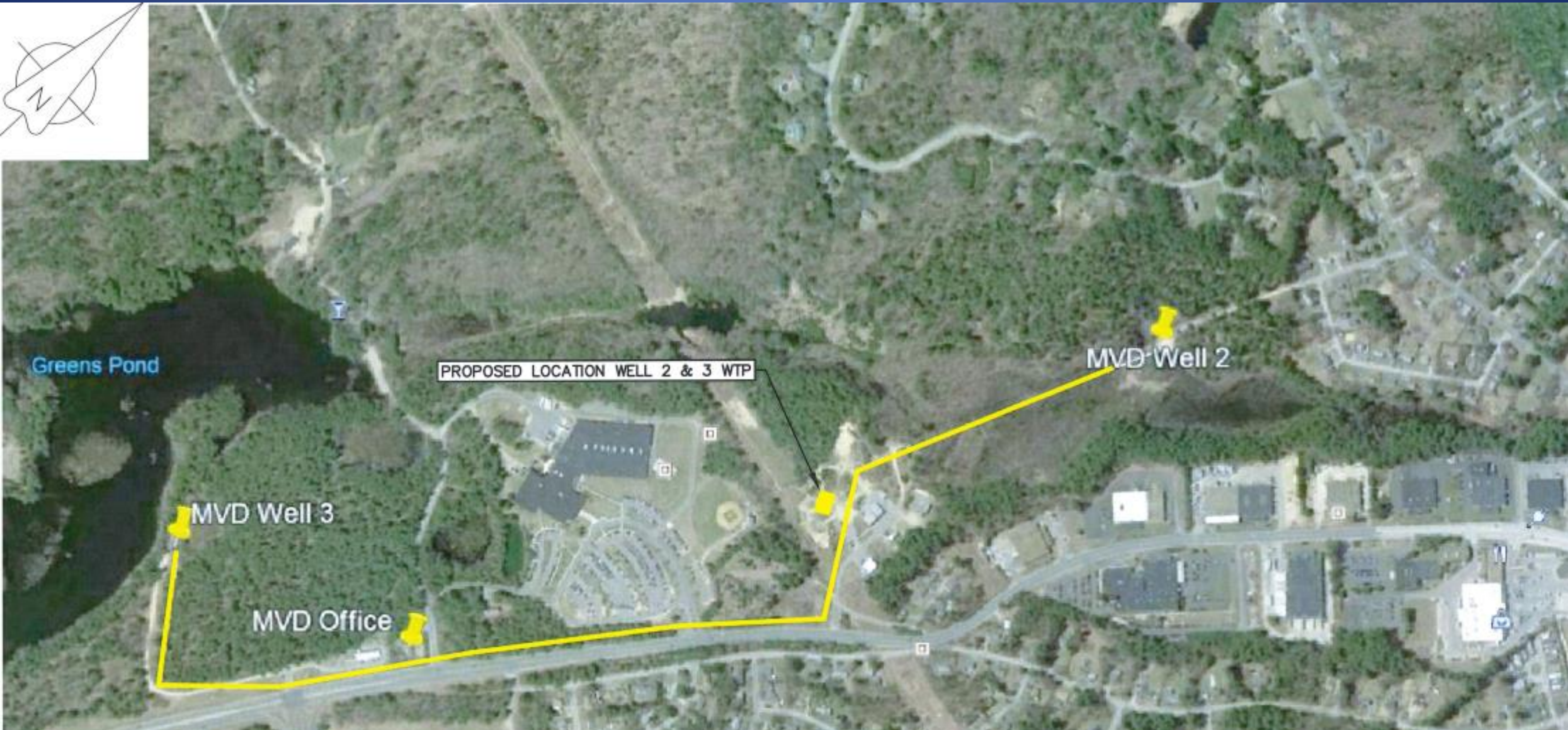
Well 7 & 8 GAC Option



① GAC PEAS TREATMENT OPTION

Well #2 & #3 PFAS Removal

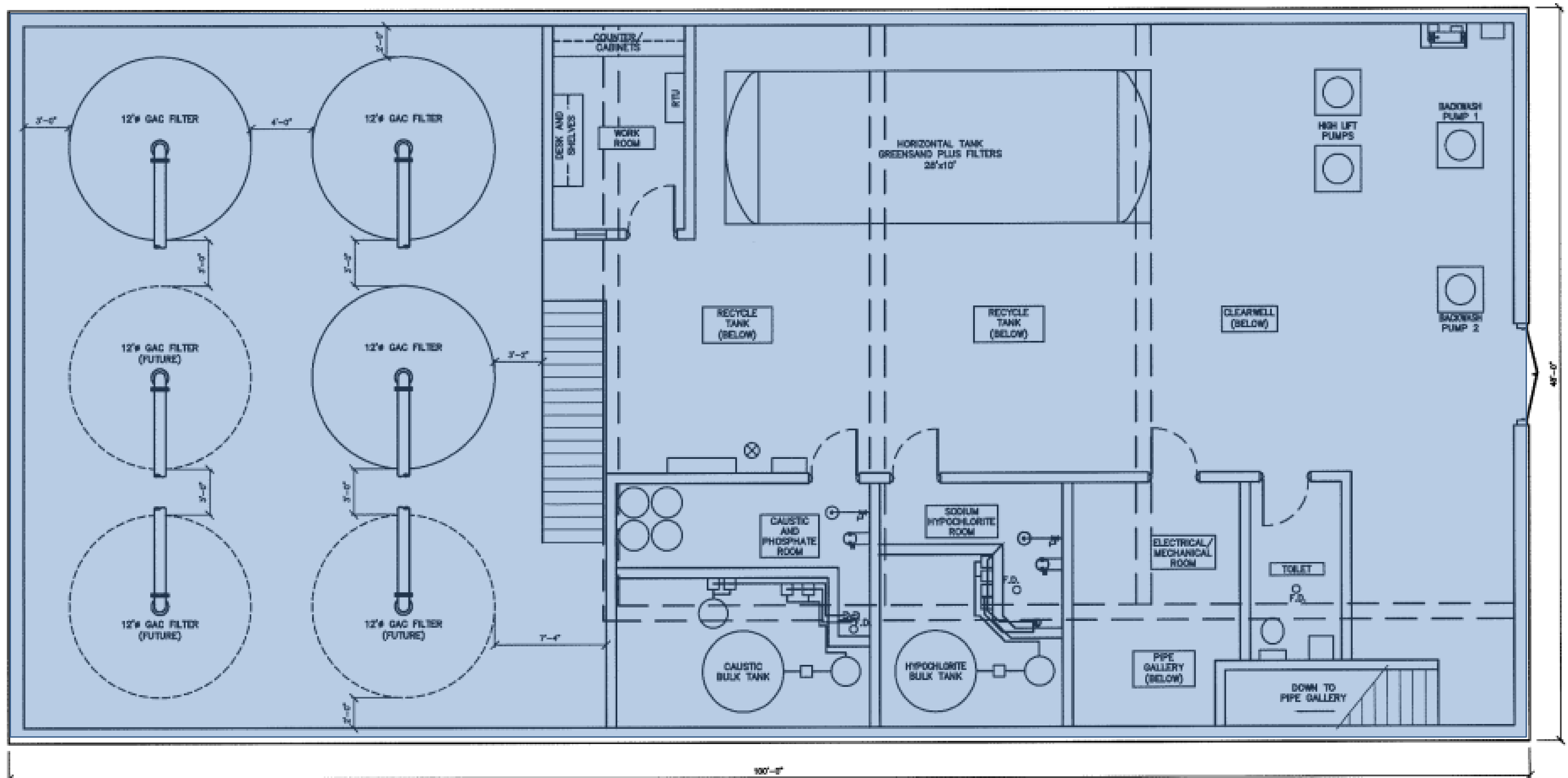
- Centrally located WTP for Well #3 Fe/Mn removal & PFAS removal from Wells #2 & #3



Well #2 & #3 PFAS Removal

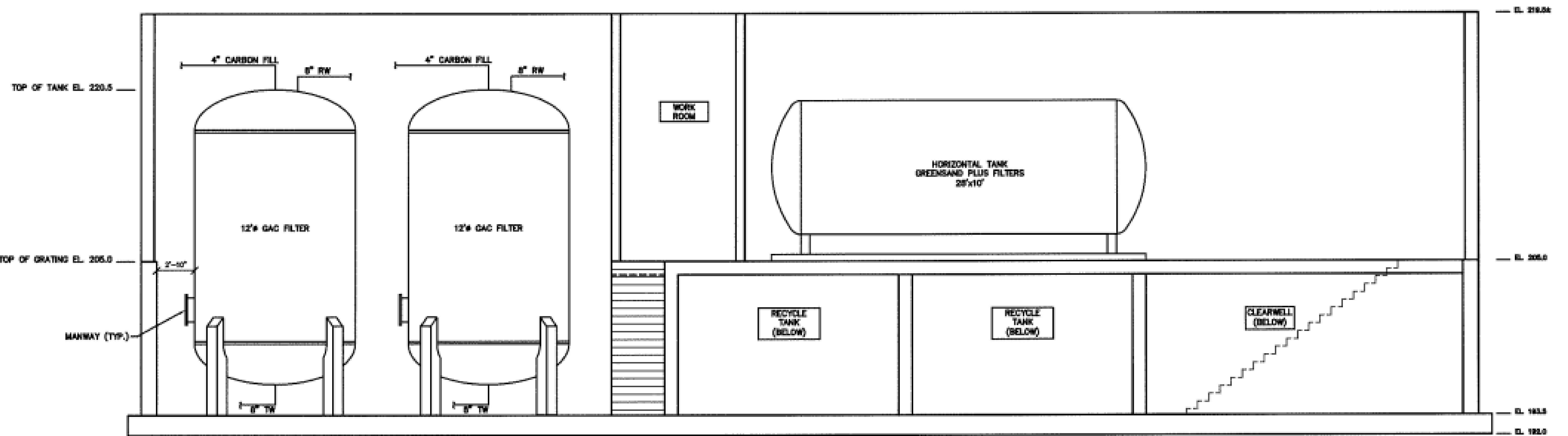
- 800 gpm Greensand Plus system to remove Fe & Mn from Well #3
- 2,300 gpm GAC removal system for Wells #2 & #3
- New raw water mains from each well to WTP
- Three 12 ft diameter x 26 ft tall GAC vessels (3 trains)
- New 48 ft x 100 ft building on MVD land
- Space for three more GAC or resin vessels
- Opinion of probable cost - \$10.9 Million

Well #2 & #3 Fe/Mn & PFAS Removal



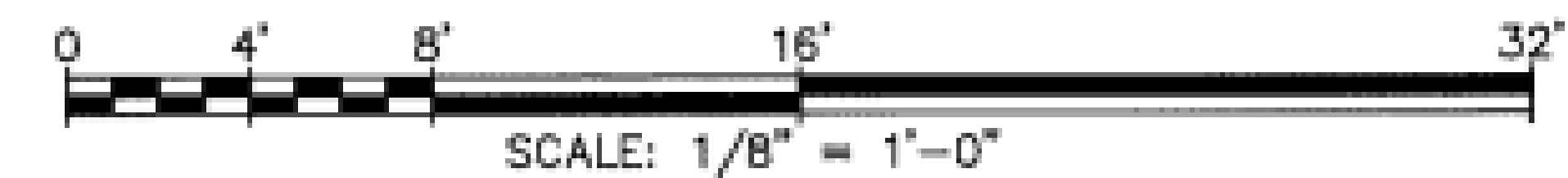
GAC PFAS TREATMENT OPTION

Well #2 & #3 Fe/Mn & PFAS Removal



GAC PFAS TREATMENT OPTION

SCALE: 1/8" = 1'-0"



GAC Verification Column Tests

- Well #4/#5 Water was brought to the lab
- Column tests conducted
 - bench scale
 - 3 carbons
- February 21 Update –
 - 80,000 bed volumes (18 months) and still going.

Opinion of Cost

- Wells #7 and #8
 - Capital - \$3.6 Million
 - O&M - \$192,500/year (1-year GAC life)

- Wells #2 and #3
 - Capital - \$10.9 Million
 - O&M - \$382,500/year (1-year GAC life)

If Passed - Next Steps

- Refine Design - preliminary and final design phase
- Schedule
 - Design: 12 months (min)
 - Piloting: 3 months
 - Construction: 18-24 months (min)
 - Online: 2022

QUESTIONS?

Water Rate Update Merrimack Village District

Underwood Engineers

February 25, 2019

Background

- Underwood Engineers (UE) developed a Water Rate model for MVD in 2006. This model assists MVD in:
 - Estimating district expenditures based on operations, administration, capital improvements, debt
 - Estimating rate increases to match revenue & expenditures
- Model is periodically updated by UE
- Underwood Engineers (UE) began most recent update in 2017

Background

- At this time, MVD and UE were exploring options for PFAS treatment
 - Project specifics were unknown, as well as costs, so the rate model was postponed
- UE performed engineering evaluation to propose PFAS treatment options and develop cost estimates
- The model was revisited in 2018 to include these potential projects

Rate Model Scenarios

- Four scenarios were included in the rate model:
Rate increases needed to support:
 - 1.) Current budget only
 - 2.) 1. + PFAS treatment at Wells #7 & #8
 - 3.) 2. + Iron & Manganese treatment at Well #3
 - 4.) 3. + PFAS treatment at Wells #2 & #3

Rate Model Scenarios

- Four scenarios were included in the rate model:
Rate increases needed to support:

1.) Current budget only

Includes CIP and Turkey Hill Booster Station debt

2.) 1. + PFAS treatment at Wells #7 & #8

Petitioned Warrant Article for \$3.6M

3.) 2. + Iron & Manganese treatment at Well #3

4.) 3. + PFAS treatment at Wells #2 & #3

Petitioned Warrant Article for \$10.9M

Estimated Rate Impacts

- Rate Increase needed to support current budget only
- FY 2020: 13%
 - FY 2021: 13%
 - FY 2022: 0%
 - Overall: 28%

Rate Increase FY 2020	Rate Increase FY 2021	Rate Increase FY 2022	Overall Rate Increase
13%	13%	0%	28%

Estimated Rate Impacts

- Additional Rate Increase needed to support the \$3.6M Petitioned Warrant Article and O&M for PFAS treatment at Wells #7 & #8
 - FY 2022: 12%
 - Overall: 43%

Rate Increase FY 2020	Rate Increase FY 2021	Rate Increase FY 2022	Overall Rate Increase
13%	13%	12%	43%

Estimated Rate Impacts

- Additional Rate Increase needed to support the \$10.9M Petitioned Warrant Article and O&M for PFAS treatment at Wells #2 & #3 and Iron and Manganese treatment at Well #3
 - FY 2022: 40%
 - Overall: 79%

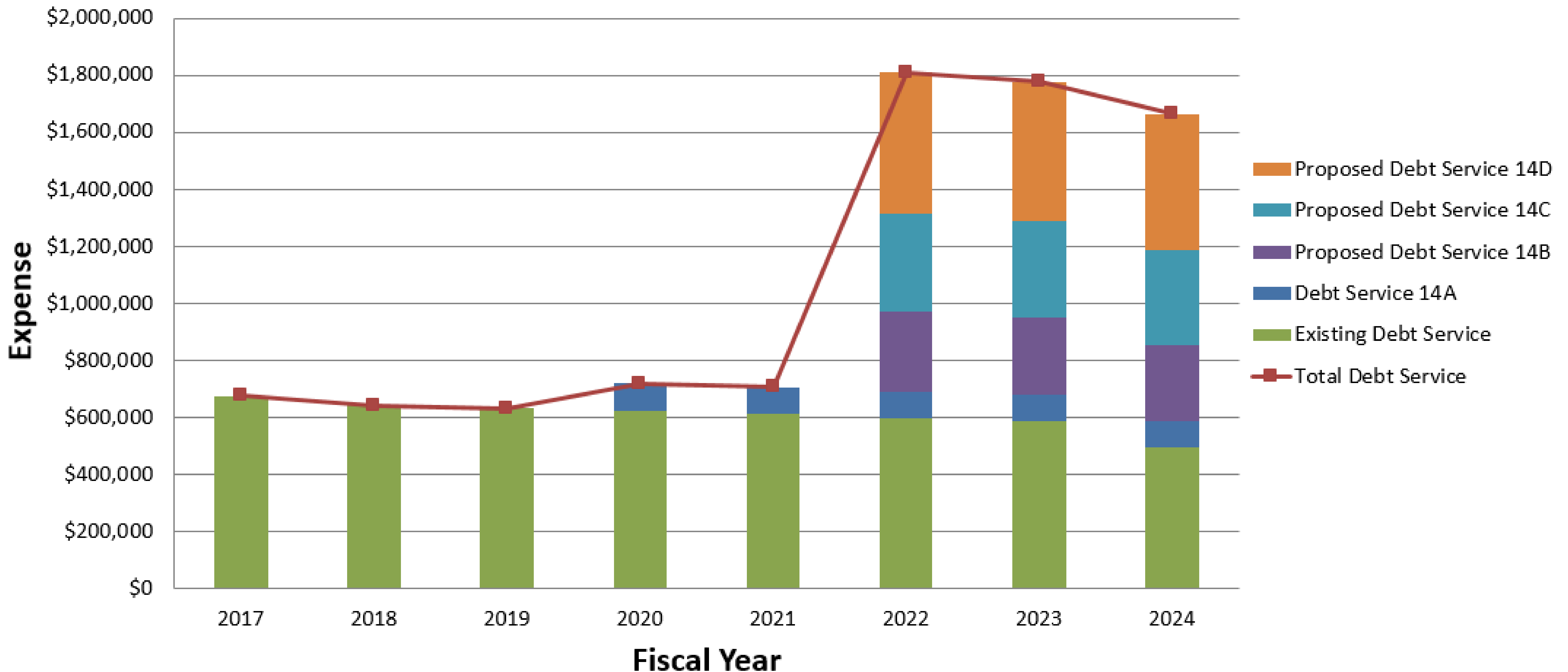
Rate Increase FY 2020	Rate Increase FY 2021	Rate Increase FY 2022	Overall Rate Increase
13%	13%	40%	79%

Budget Impacts

Expenditures	FY2019	FY2020	FY2021	FY2022
Current Budget Only	\$3,602,322	\$4,064,843	\$4,439,805	\$4,462,286
Petitioned Warrant Article Wells #7 & #8				
Debt				\$277,344
O&M				\$192,500
Petitioned Warrant Article Wells #2 & #3				
Debt				\$839,736
O&M				\$382,500

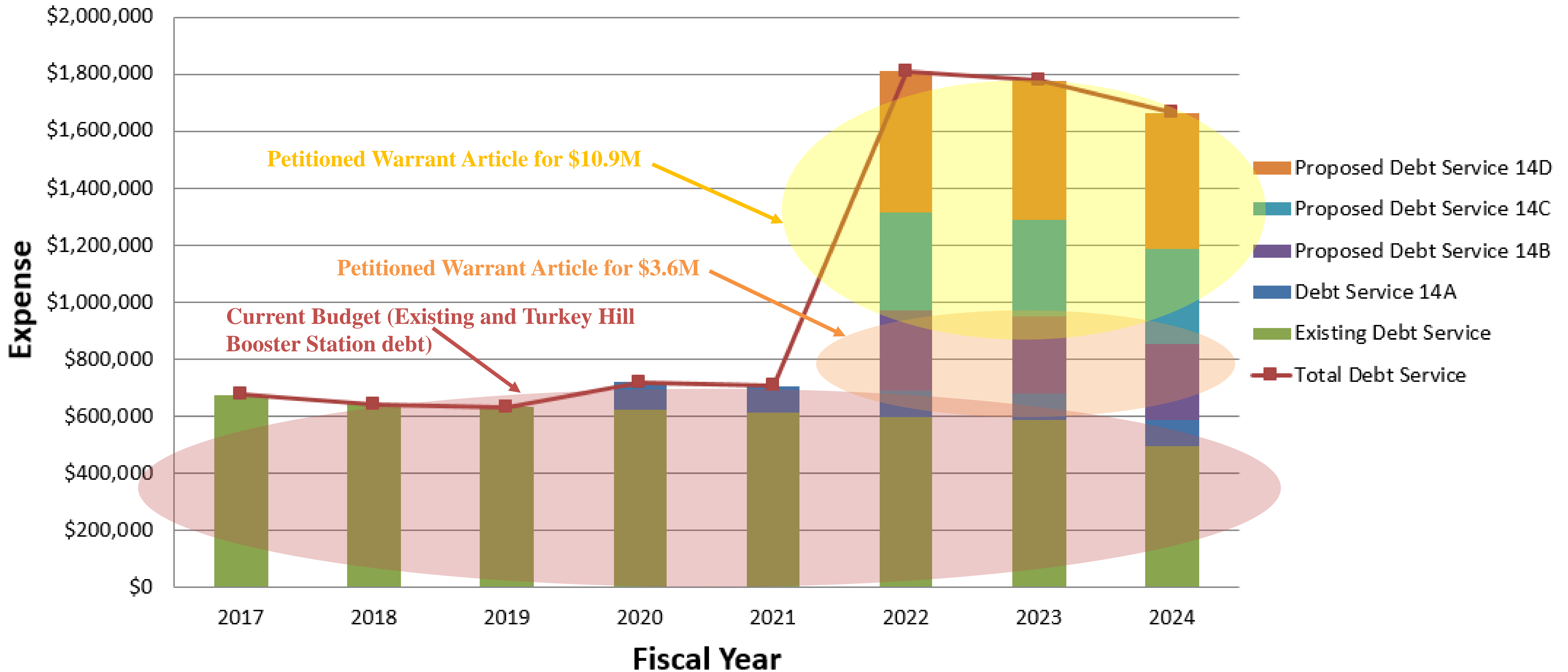
Debt Service Impacts

Proposed Debt Service MVD Rate Evaluation



Debt Service Impacts

Proposed Debt Service MVD Rate Evaluation



Sample Bills

- For an average residential user using 206 gpd:

Rate Scenario	Estimated Annual Bill in 2022	Associated Increase
Existing Rates	\$315	\$0
Current Budget Only	\$402	\$87
Additional \$3.6M Petitioned Warrant Article	\$451	\$49
Additional \$10.9M Petitioned Warrant Article	\$563	\$112

Note: Current NH statewide average annual water bill is \$577 using 206 gpd

QUESTIONS?

Update

Wells 4 & 5 PFAS Removal Facility Design
Merrimack Village District

Underwood Engineers

February 25, 2019

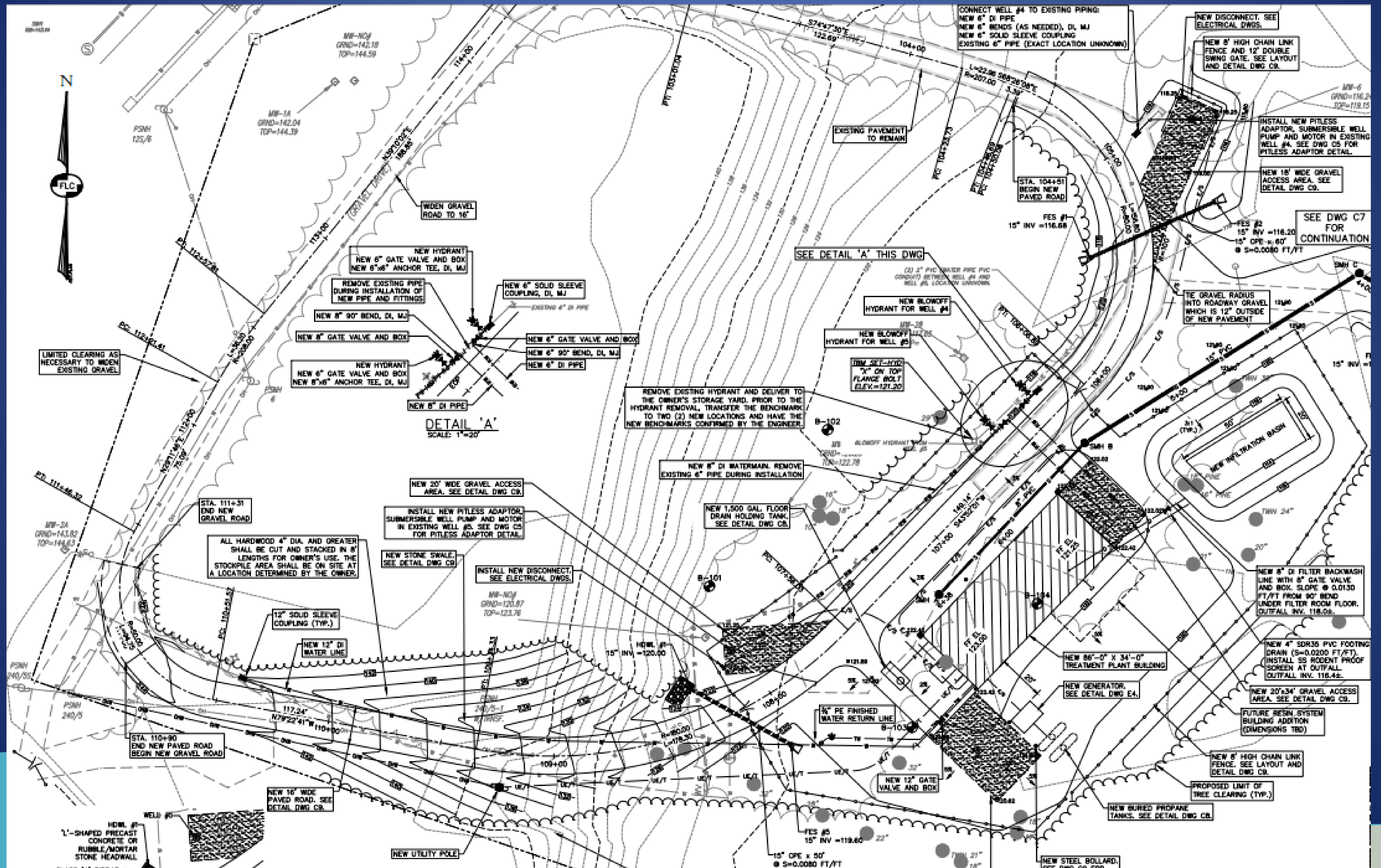
Well 4/5 PFAS WTP

- Peak Capacity: 870 gpm (1.25 MGD)
- Average Capacity: 625 gpm (0.9 MGD)
- Process
 - 2 – 12 ft diameter, 26 ft tall GAC vessels (40,000 lbs GAC per vessel)
 - Sodium hydroxide for pH adjustment & corrosion control
 - Poly/ortho phosphate for sequestering & corrosion control
 - Calcium hypochlorite for disinfection

Well 4/5 PFAS WTP

- WTP Room layout (building = 34 ft. x 86 ft.)
 - GAC vessel room
 - Sodium hydroxide room
 - Phosphate/Chlorine room
 - Mechanical room
 - Electrical room
 - Control/work room
 - ADA bathroom

Proposed Well 4 & 5 Site



Carbon Change-Out



Design Status & Schedule

<u>Milestone</u>		<u>Week Ending</u>
• 90% design submittal to MVD	-	Feb 23, 2019
• Final plans to NHDES	-	Mar 16, 2019
• Advertise for Bids	-	Apr 20, 2019
• Bid Opening	-	May 18, 2019
• Contract Award	-	June 15, 2019
• Begin Construction	-	July 13, 2019
• Complete Construction	-	July 2020

QUESTIONS?