TATA & HOWARD

April 30, 2021

Mr. Thomas Holder, Director
Department of Public Works
Town of Wayland
66 River Road
Wayland, MA 01778

Subject: Happy Hollow PFAS Compliance Action Plan
T&H No. 6804

Dear Mr. Holder:

Tata & Howard (T&H) is presenting the following per- and polyfluoroalkyl substances (PFAS) Compliance Action Plan based on the levels of PFAS recently measured at the Happy Hollow Wellfield Point of Entry (POE) into the Wayland water distribution system. The Action Plan summarizes the PFAS sampling conducted by the Wayland Water Division (WWD), the immediate actions already implemented as a result of the levels of PFAS measured, and the potential short-term and long-term alternatives for the WWD to return the public water system (PWS) into compliance with the Massachusetts Department of Environmental Protection (MassDEP) PFAS regulations.

Background

On October 2, 2020, the MassDEP promulgated a new drinking water regulation and maximum contaminant level (MCL) of 20 nanograms per liter (ng/L) for the sum of six per- and polyfluoroalkyl substances (called PFAS6). A PFAS6 MCL violation occurs when the average of at least three monthly samples collected over a quarter exceeds the MCL of 20 ng/L. PFAS6 includes perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), perfluorodecanoic acid (PFDA) and perfluoroheptanoic acid (PFHpA). PFAS are man-made chemicals that have been used in manufacturing of certain fire-fighting foams, moisture and stain resistant products, and other industrial processes. According to information provided by the MassDEP, some people who drink water containing PFAS6 in excess of the MCL may experience certain adverse effects. These could include effects on the liver, blood, immune system, thyroid, and fetal development. PFAS6 may also elevate the risk of certain cancers.

Although the new standard required the WWD to begin sampling for PFAS6 in April 2021, the WWD began proactively sampling each water source POE in January 2020, prior to the MassDEP promulgating the new PFAS6 MCL. The POE sampling locations include the Baldwin Pond Water Treatment Plant (WTP), Happy Hollow Wellfield, Campbell Well, and

Tata & Howard
67 Forest Street | Marlborough, MA 01752
T: 508-303-9400 | F: 508-449-9400
www.tataandhoward.com

Other Offices
MA | NH | CT | ME | VT | AZ

Chamberlain Well. All PFAS6 sampling results collected by the WWD since January of 2020 are shown in Table No. 1.

Table No. 1
Wayland PFAS6 Sampling Results

Sample Location by Entry Point to Distribution System	Monitoring Period	Sample Collection Date	PFAS6 Result (ng/L)	Quarterly Average (ng/L)[3]	MCL (ng/L)
Baldwin Pond Treatment Plant	Pre-MCL	1/14/2020	2.2	N/A	20
Happy Hollow Wellfield	Pre-MCL	1/14/2020	15.7	N/A	20
Campbell Well	Offline	N/A	N/A	N/A	20
Chamberlain Well	Pre-MCL	1/14/2020	12.0	N/A	20
Baldwin Pond Treatment Plant	Pre-MCL	3/11/2020	2.4	N/A	20
Happy Hollow Wellfield	Pre-MCL	3/11/2020	18.7	N/A	20
Campbell Well	Pre-MCL	7/14/2020	2.7	N/A	20
Chamberlain Well	Pre-MCL	3/11/2020	10.7	N/A	20
Baldwin Pond Treatment Plant	Pre-MCL	11/2/2020	2.36	N/A	20
Happy Hollow Wellfield	Pre-MCL	11/2/2020	19.21	N/A	20
Campbell Well	Pre-MCL	11/2/2020	3.69	N/A	20
Chamberlain Well	Pre-MCL	11/2/2020	14.89	N/A	20
Baldwin Pond Treatment Plant	Pre-MCL	12/16/2020	2.55	N/A	20
Happy Hollow Wellfield	Pre-MCL	12/16/2020	Failed Q.C.[1]	N/A	20
Campbell Well	Pre-MCL	12/16/2020	Failed Q.C.[1]	N/A	20
Chamberlain Well	Pre-MCL	12/16/2020	Failed Q.C.[1]	N/A	20
Baldwin Pond Treatment Plant	Quarter 1 January	1/20/2021	3.13	N/A	20
Happy Hollow Wellfield	Quarter 1 January	1/20/2021	23.36	N/A	20
Campbell Well	Quarter 1 January	1/20/2021	3.62	N/A	20
Chamberlain Well	Quarter 1 January	1/20/2021	16.66	N/A	20
Baldwin Pond Treatment Plant[2]	Quarter 1 February	2/9/2021	2.79	N/A	20
Happy Hollow Wellfield[2]	Quarter 1 February	2/9/2021	22.64	N/A	20
Campbell Well[2]	Quarter 1 February	2/9/2021	3.72	N/A	20
Chamberlain Well[2]	Quarter 1 February	2/9/2021	14.89	N/A	20

Table No. 1 (Continued)
Wayland PFAS6 Sampling Results

Sample Location by Entry Point to Distribution System	Monitoring Period	Sample Collection Date	PFAS6 Result (ng/L)	Quarterly Average (ng/L)[3]	MCL (ng/L)
Baldwin Pond Treatment Plant[2]	Quarter 1 February	2/25/2021	5.47	N/A	20
Happy Hollow Wellfield[2]	Quarter 1 February	2/25/2021	29.18	N/A	20
Campbell Well[2]	Quarter 1 February	2/25/2021	8.07	N/A	20
Chamberlain Well[2]	Quarter 1 February	2/25/2021	18.0	N/A	20
Happy Hollow Wellfield	Quarter 1 March	3/16/2021	24.86	**24.71**	20
Chamberlain Well	Quarter 1 March	3/16/2021	15.79	16.30	20

[1]The December 2020 samples collected at the Happy Hollow Wellfield, Campbell Well, and Chamberlain Well failed independent quality control analysis so the results were not included.
[2]Two sets of samples were collected in February 2021. The first set collected on 2/9/21 was the required confirmatory sample set due to the detection of PFAS6 in the initial samples collected in January 2021 at the start of Quarter 1. The second set collected on 2/25/21 was the regulatory monthly sample required to be collected for February 2021.
[3]The Quarterly Average = (Initial Sample Result on 1/20/21 + ((Sample Result on 2/9/21 + Sample Result on 2/25/21) divided by 2) + Sample Result on 3/16/21) divided by 3.

PFAS6 levels at the Happy Hollow Wellfield, one of the four POEs to the Wayland water system, were measured above 20 ng/L starting in January 2021. The quarterly average PFAS6 result at the Happy Hollow Wellfield for Quarter 1 of 2021 was 24.71 ng/L, which exceeded the MCL for PFAS6. Monthly sampling is required at the Happy Hollow Wellfield as it remains in service so that the WWD can meet the water demands of the distribution system. Upgrades to the existing membranes are ongoing at the Baldwin Pond WTP so the full capacity from the WTP is not available, increasing the current reliance on the Happy Hollow Wellfield to meet daily water demands.

PFAS6 levels were reported below the 20 ng/L MCL at the other three POE locations. Following the sampling conducted in February 2021, the MassDEP approved a reduced annual PFAS sampling plan for the Baldwin Pond WTP and Campbell Well as results were consistently below 10 ng/L. However, with results consistently exceeding 10 ng/L at the Chamberlain Well, monthly sampling continues to be required by the MassDEP so that additional data can be collected to confirm the levels will not increase over time and reach or exceed the MCL.

Public Education and Public Notice

In accordance with the PFAS6 regulations, the WWD prepared and issued a Public Education document to all water customers on April 2, 2021 when the average of the PFAS6

levels measured at the Happy Hollow Wellfield exceeded 20 ng/L in the initial Quarter 1 sample collected on January 20, 2021 and the confirmatory Quarter 1 sample collected on February 9, 2021.

Following the PFAS6 sampling at the Happy Hollow Wellfield for the monthly February sample collected on February 25, 2021 and the monthly sample collected on March 16, 2021, the Happy Hollow Wellfield exceeded the MCL and a Tier 2 Public Notice was required. The Tier 2 Public Notice has been prepared by the WWD and will be distributed to all water customers on May 4, 2021 in accordance with the timelines required by the PFAS regulations.

The WWD will continue to prepare and distribute a combined Public Notice and Public Education document to its water customers every quarter until the Happy Hollow Wellfield is removed from service or treated so that the PFAS6 levels are consistently and reliably below the PFAS6 MCL.

Immediate Actions

With PFAS6 sampling results at the Happy Hollow Wellfield exceeding 20 ng/L starting in January 2021, and with the MCL exceedance following the receipt of the results of the samples collected on March 16, 2021, the WWD took some immediate actions to begin the process of coming into compliance with the new PFAS6 regulations. Due to the water demands of the Wayland water system, removing the Happy Hollow Wellfield from service is not currently a viable alternative. Immediate actions taken by the Town of Wayland include the following:

- Engaged with the MassDEP toward fulfilling Wayland's regulatory obligations and understanding the requirements of a Compliance Action Plan to reduce PFAS6 levels and protect public health.
- Collected PFAS water quality samples from each of the three wells that make up the Happy Hollow Wellfield to understand the PFAS6 concentrations in each well.
- Contracted with its engineering consultant to begin an evaluation of available treatment processes and consideration of supplemental or alternative water supplies.
- To assist with the availability of public information, the Town developed a website dedicated to PFAS6 outreach.
- Bottled water was made available for pickup by customers identified in MassDEP's regulatory guidance as being in a sensitive subgroup (pregnant or nursing women, infants and people diagnosed by their health care provider to have a compromised immune system).
- Alternative to the bottled water pickup program, the Town is evaluating a Rebate Program that would provide financial assistance for those residents in the sensitive subgroup to purchase bottled water.

Near-Term Action Plan

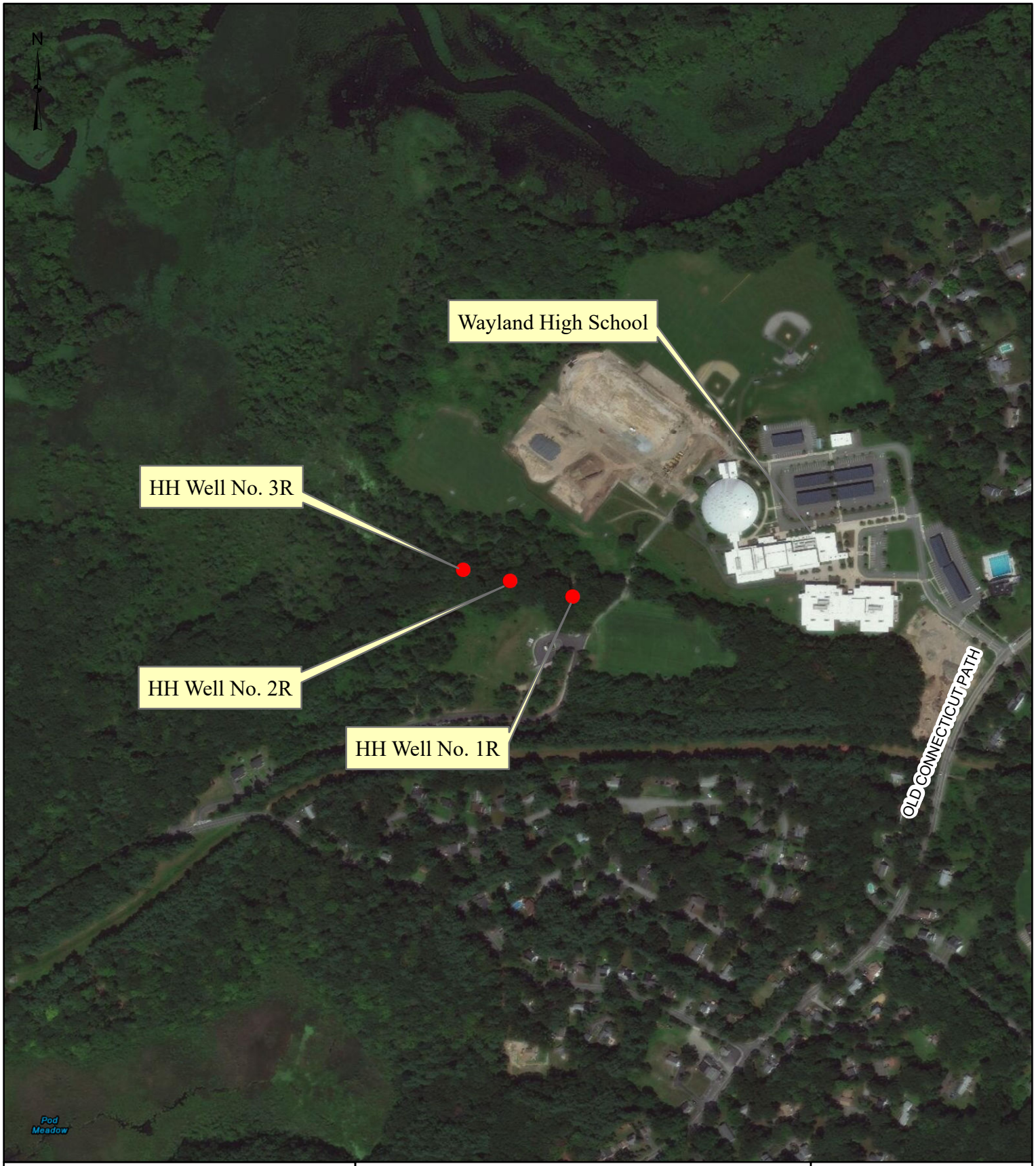
The location of the three wells at the Happy Hollow Wellfield is shown on the site map in Figure No. 1, including Happy Hollow (HH) Well Nos. 1R, 2R, and 3R. Each well is equipped with a submersible well pump, pitless adapter, and below grade site piping which manifolds together prior to the existing below grade chemical injection vault. A chemical feed facility nearby is used to store and pump water treatment chemicals including sodium hypochlorite for disinfection and sodium hydroxide for pH adjustment and corrosion control to the combined well pump discharge line that extends through the chemical injection vault. Following the chemical injection vault, the finished water piping splits in two directions to feed the water distribution system. The finished water piping in each direction is equipped with a remote chlorine analyzer which allows the WWD to continuously measure the free chlorine residual in the water main for 4-log virus inactivation compliance monitoring.

The WWD collected samples from each of the three individual Happy Hollow Wells that make up the wellfield including HH Well Nos. 1R, 2R, and 3R. The results of the individual well samples collected on March 17, 2021 are shown in Table No. 2. HH Well No. 1R located furthest to the east as shown in Figure No. 1 had the highest PFAS6 level at 30.11 ng/L, HH Well No. 2R had lower levels at 22.97 ng/L, and the HH Well No. 3R had the lowest PFAS6 results at 19.51 ng/L, below the MCL of 20 ng/L.

Table No. 2
Happy Hollow Wellfield PFAS Sampling Results (March 17, 2021)

Well Identification	PFAS6 Result (ng/L)
Happy Hollow Well No. 1R	30.11
Happy Hollow Well No. 2R	22.97
Happy Hollow Well No. 3R	19.51

Each of the three Happy Hollow Wells produces approximately 300 gallons per minute (gpm) for a total capacity of 900 gpm. The WWD is reliant upon a production of 700-900 gpm from the Happy Hollow Wellfield throughout the year to meet the demands of the water distribution system. Typical pump discharge pressure as measured by the pressure transmitter in the chemical injection vault ranges from 105-110 pounds per square inch (psi). Based on the results of the PFAS6 sampling conducted at each well, there is not a viable solution to optimize flows from the well sources to reliably produce a finished water with PFAS6 levels below the MCL. Shutting down Well No. 2R and Well No. 3R would only allow for the WWD to produce approximately 300 gpm, and the concentration of PFAS6 is just below the MCL of 20 ng/L in Well No. 3R so future samples may be at or above the MCL.



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Date: April 2021
Approximate Scale: 1" = 500'

Happy Hollow Site Map

PFAS Engineering Assistance

Wayland, MA

Figure No.

1

Temporary treatment will allow the WWD to return the Happy Hollow Wellfield into compliance with the PFAS6 regulations. Treatment using Granular Activated Carbon (GAC) or ion exchange (IX) resin within pressure treatment vessels are two technologies which have received approval for PFAS treatment in the State of Massachusetts under the MassDEP's New Technology Approval process. There are various IX resins available for PFAS treatment, but not all IX resins have been approved by the MassDEP for use in the State of Massachusetts. Temporary treatment vessels can be rented from a vendor, delivered and setup at the Happy Hollow Wellfield site, and operated for several months as a means for the WWD to produce water from the Happy Hollow Wellfield with PFAS6 levels below the MCL.

The near-term temporary treatment solution focuses on shutting down Well No. 1R which exhibits the highest PFAS6 levels and may be the most challenging to intercept and treat prior to the existing chemical injection vault due to the piping layout at the Happy Hollow Wellfield. Well No. 2R at a flow rate of approximately 300 gpm would be pumped and treated through the GAC or IX treatment system and blended with the untreated 300 gpm flow stream from Well No. 3R, which currently measures PFAS6 levels below the MCL. The combined pump discharge flow rate from the two wells would be approximately 600 gpm with a blended PFAS6 concentration of approximately 10 ng/L, in compliance with the PFAS6 MCL of 20 ng/L. Operational factors reviewed for the near-term temporary treatment alternative are summarized below:

Water Production

Overall production from the Happy Hollow Wellfield is reduced from 900 gpm to 600 gpm, but Well No. 1R remains available and active to use in an emergency situation.

Pressure Evaluation

- The water pressure at 600 gpm at the chemical injection vault is between 105-110 psi when running two of the three Happy Hollow well pumps. Pressure rated treatment vessel stock is lower than normal with other communities facing similar PFAS challenges. There is an availability for 125 psi rated vessels with a lead time of 3-6 weeks, but vessels rated for 150 psi would require a lead time of at least 16 weeks for rental. The expected headloss through an IX treatment system at 300 gpm is approximately 10 psi, which means the pressure at the influent to the pressure vessels would approach 120 psi, which would be an acceptable pressure for using the 125 psi rated vessels. The pressure losses through a GAC treatment system at 300 gpm will be similar or less due to the larger size of the treatment units as summarized later in this report.
- To treat the total flow rate of 600 gpm from HH Well No. 2R and HH Well No. 3R, there will be additional headloss observed through the treatment system and associated piping meaning the pressure at the influent to the pressure vessels may exceed the 125-psi pressure rating. Larger treatment units and piping resulting in an expanded footprint

may reduce the headloss through the treatment system and allow for treatment of the full 600 gpm. The larger treatment vessels and expanded footprint would add costs to the near-term treatment solution, and space would need to be evaluated further as the availability of open, flat space adjacent to the wells is limited.

- In addition to the pressure rating of the vessels, consideration was given to the existing well pumps installed in each well. The pumps are sized with some extra capacity as the pumps' variable frequency drives (VFDs) typically operate between 70%-80% speed for normal production between 250-300 gpm from each well. The additional headloss through the treatment system will require the pump in Well No. 2R to operate at a greater speed to produce the same flowrate at a greater total dynamic head (TDH). Based on our review of the existing pump, it should have sufficient capacity to continue to produce 250-300 gpm at the greater TDH condition. The water pressure discharged from the Happy Hollow Wellfield will remain the same, and customers in the Wayland water system will not experience any changes to their typical water supply or pressure.

Empty Bed Contact Time and Bed Volumes

- The recommended empty bed contact time (EBCT) for PFAS treatment using IX resin is approximately 2.5 minutes compared to the recommended EBCT using GAC treatment of approximately 10 minutes. Treatment using GAC requires a bed volume that is approximately 4 times larger than the IX resin making the pressure vessels larger and requiring a greater footprint.
- IX can typically treat approximately 300,000 – 350,000 bed volumes (BVs) of drinking water with PFAS6 concentrations as reported at the Happy Hollow Wellfield before requiring a resin changeout. The GAC typically treats up to 50,000 BVs of water at similar PFAS6 concentrations. Based on these historical treatment values, the IX resin in each lead vessel (half the resin provided) is expected to operate for 18-30 months prior to needing a resin exchange. The GAC in each lead vessel (half the media provided) is expected to operate for 12-18 months prior to needing a GAC changeout.
- Both IX resin and GAC media can be replaced in the field when each has been exhausted. Depending on how long the temporary treatment system is operated will determine the number of resin or media changeouts that will be necessary. Although a pilot study is necessary to confirm the capacity of IX resin or GAC media for this specific application, based on systems with similar water quality, it is expected that IX resin changeouts would occur less frequently than the GAC media replacements.

Backwashing Requirements

- The GAC media typically requires an initial backwash to properly stratify the bed in the field prior to its use for treatment. The backwash water may have to be trucked to the site to use for initial backwashing if discharging water with PFAS to the ground will not be permitted by the MassDEP. The PFAS in the water, if Happy Hollow well water is used for the initial backwash, will not be properly removed at the high backwash rate through the vessels and will remain in the backwash effluent. Secondary water quality

contaminant levels, such as iron and manganese, are low at the Happy Hollow Wellfield, but periodic backwashing of the GAC media during normal operations may be required depending on any particulate buildup in the GAC media.

- The IX resin vessels will be prepared and delivered to the site and ready for connection and operation without the need for any backwashing or rinsing. The IX resin will not require backwashing during normal operations and will run continuously until the resin is exhausted and requires a full resin exchange.

The estimated initial costs received from vendors for GAC and IX resin treatment alternatives were similar, including the initial cost for the rental of treatment equipment, mobilization, equipment setup, training, demobilization of equipment, and media or resin disposal. With similar initial vendor costs, the operational factors discussed in this report for GAC and IX treatment and the smaller footprint requirements for the IX treatment alternative in the sensitive area around the wells made it a more advantageous alternative, especially when evaluating the options for a more immediate, short-term action to comply with the PFAS6 regulations. If treatment will be a long-term alternative, a pilot study to test and compare the various treatment alternatives is recommended. In addition to GAC and IX resin, other technologies such as closed-circuit reverse osmosis (CCRO) may be an approach worth evaluating as part of a pilot study, although some of the newer technologies like CCRO are not approved for use in the State of Massachusetts for PFAS treatment under the MassDEP's New Technology Approval program so that approval would be needed before a newer technology could be used for full-scale treatment. The specifics of the proposed near-term temporary IX treatment system are summarized below:

Site Layout

Figure No. 2 shows the site plan and conceptual layout for the proposed near-term temporary IX treatment system. The number of pre-filters and IX units can vary depending on the vendor, but the overall dimensions of the needed layouts, resin bed volumes, and other operational considerations are similar. For the near-term solution, temperatures and weather conditions are not a concern for temporary treatment equipment and piping. The existing 6-inch gate valve on the Well No. 2R pump discharge will be closed for temporary treatment. Water will be drawn from the Well No. 2R pump discharge, approximately 300 gpm, by connecting temporary above-ground piping to the existing hydrant. Temporary piping will extend to the proposed PFAS treatment area including pre-filters operating in parallel and one or multiple trains of IX units operating in series in a lead/lag configuration. IX units are operated in a lead/lag configuration in series so that when breakthrough of any PFAS6 occurs through the first unit, the second unit will remove the PFAS6 prior to being discharged to the distribution system. The temporary treatment equipment can be installed on a processed gravel or concrete pad constructed by the WWD prior to arrival of the equipment.

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BVW#48
BVW#47
BVW#46
BVW#45
BVW#44
WETLAND FLAG LIMITS
WF 330
WF 331
WF 332
WF 334
WF 335
WF 336
WF 337
WF 338
WF 329
WF 328
WF 327
WF 326
WF 325
WF 324
BORDERING VEGETATED WETLAND
12" D.I. WATER MAIN
(2) 12" 1/8 BEND
EXISTING 12" D.I. WATER MAIN FROM EXISTING VAULT
(1) 12"X6" TEE
(1) 8" GATE VALVE
(1) 8"X12" REDUCER
PROPOSED (1) 12"X6" TEE
(1) 6" GATE VALVE
(1) 6" HYDRANT
8" D.I. WATER MAIN
6" GATE VALVE (NORMALLY CLOSED
30' NO DISTURB BUFFER
PROPOSED 4" TEMPORARY ABOVE GROUND PIPING
(1) 12"X12" TEE
(2) 12" GATE VALVES
PROPOSED 28'X15' CONCRETE PAD PFAS TREATMENT AREA
(1) 6"X6" HYDRANT TEE
(2) 6" GATE VALVES
(1) 6" HYDRANT
(1) 6"X8" REDUCER
METER VAULT
(1) 6"X6" HYDRANT TEE
(1) 6" GATE VALVE
(1) 6" HYDRANT
3/4" CORPORATION STOP
ION EXCHANGE UNITS (SERIES)
BAG FILTERS (PARALLEL)
1-1/4" WATER SERVICE
1/2" SAMPLE LINE
6" D.I. WATER MAIN
6" FLEXIBLE COUPLING
(1) 8" 1/8 BEND
(1) 12"X8" REDUCER
WATER SAMPLING STATION (TYP. 1 OF 3)
EXISTING WELL NO. 2R AND PITLESS ADAPTER
EXISTING WELL NO. 3R AND PITLESS ADAPTER
EXISTING WELL NO. 1R AND PITLESS ADAPTER
8" GATE VALVE
(1) 8"X6" HYDRANT TEE
(1) 6" GATE VALVE
(1) 6" HYDRANT
8"X6" REDUCER
100' BUFFER ZONE
115
120
125
130
135

0 20' 40'

SCALE: 1" = 20'

Figure No. 2

HAPPY HOLLOW WELL FIELD
TEMPORARY TREATMENT SITE PLAN
PFAS ENGINEERING ASSISTANCE

WAYLAND, MA

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After the temporary treatment process, the above-ground effluent piping will extend to a new hydrant as shown in Figure No. 2 installed for the purpose of blending the treated water from Well No. 2R back into the untreated water, approximately 300 gpm, from the Well No. 3R pump discharge. The new hydrant tee, 6-inch gate valve, and hydrant can be installed by the WWD prior to the delivery of the temporary treatment equipment. A total blended flow stream of approximately 600 gpm will continue through the chemical injection vault to receive the normal chemical treatment prior to being discharged to the distribution system.

The pre-filters are bag filters used to remove any particulates in the raw water prior to the IX units. Vendors will furnish multiple replacement bag filters for operator use. As headloss across the bag filter increases per the pressure gauges installed at the unit, an operator can remove the old bag filter and replace it with a new bag. The bag filters can be disposed with normal municipal waste. No special disposal is necessary for the particulates removed by the bag filters.

After the IX units are set up in the field, the units will require minimal maintenance by the operators. Monitoring piping connections for leaks and routine PFAS6 sampling as required by the MassDEP will be conducted by the WWD operators. Sample ports will be available on the influent to the IX treatment units, following the first/lead IX unit in each treatment train, and after the second/lag IX unit prior to the water being discharged to the distribution system. The sample ports will allow operators to measure the PFAS concentrations in the raw water, post-lead IX unit, and post-treatment. The IX units can run until the resin is exhausted, but the units are not winterized in this near-term temporary treatment option so colder temperatures and inclement weather will limit the duration for use of the treatment equipment through November, well before the resin is exhausted. A photograph of a temporary IX treatment system rated for 150 gpm that was utilized for PFAS removal during a pilot study is shown in Figure No. 3. The system proposed for use in Wayland would include rigid piping and additional units or larger units to treat the 300 gpm rate.

Schedule and Installation

The lead time for a vendor to prepare and deliver the IX temporary treatment equipment rated for up to 125 psi to treat 300 gpm at the Happy Hollow Wellfield will range from 3-6 weeks. The lead time allows the vendors the necessary time to obtain the appropriate vessels, clean them, prepare the IX resin, load the vessels with the resin, rinse the resin at the factory, and coordinate and deliver the vessels to the site. The vendor will provide a field technician on the day of delivery to assist with the setup of the equipment on the site. The WWD will need to provide a loader or other vehicle to offload the bag filter units and IX vessels from the flat-bed truck on which the equipment will be delivered. The treatment units are not delivered in a pre-packaged container, but rather as loose units on a flat-bed truck. The loose units will provide some flexibility in how the treatment equipment is arranged on the site, but within certain limits since the vendor's field technician will have interconnecting piping between the bag filters and IX units already sized and prepared for the specific setup.

Figure No. 3
Temporary IX Pilot System Setup for 150 gpm Capacity PFAS Treatment

After the vendor and the WWD set the treatment units on the gravel or concrete pad constructed on the site in preparation for the treatment equipment, the interconnecting piping can be installed by the vendor. The WWD will be responsible for the temporary piping between the hydrants and the influent and effluent connections associated with the temporary treatment equipment. All interconnecting piping will be provided by the vendor. The 3-6 week lead time will allow the WWD the necessary time to prepare the gravel or concrete pad, install the new hydrant as shown in Figure No. 2 to receive the treated water, and procure the necessary influent and effluent piping to be connected from the hydrants to the treatment system.

The temporary treatment system can be operated through November, but without being winterized, the temporary treatment system would be shut down and demobilized from the site in December prior to the arrival of colder temperatures and winter weather. Vendors would be concerned about freezing and other damage to the treatment units if operated in unprotected conditions into and beyond December in New England.

Cost Summary

The budgetary cost for a 4-month rental of the temporary IX treatment equipment is $250,000. Each additional month of rental beyond the initial 4-month period will cost up to $10,000 per month. For the purpose of this near-term analysis, it was assumed the

temporary treatment equipment was ordered and delivered to the Happy Hollow Wellfield for the start of June 2021. The temporary treatment equipment will remain in place and in operation through November 2021, a 6-month rental duration. The costs associated with this alternative include the rental of treatment equipment, mobilization, the services of a field technician, equipment setup, training, demobilization of equipment, and IX resin disposal. The costs associated with the 6-month rental of temporary treatment equipment, construction of a gravel or concrete pad and water main improvements to facilitate the temporary treatment and blending scenario, and general engineering assistance during the 6-month near-term solution total $320,000 and are summarized in Table No. 3.

Table No. 3
Near-Term Happy Hollow Wellfield Temporary Treatment Cost Summary

Item	Cost
IX Treatment Equipment (300 gpm) Initial 4-Month Rental	$250,000
Monthly Rental Fees After Initial Rental Period ($10,000/Month)	$20,000
Equipment Pad and Water Main Improvements	$25,000
General Engineering Assistance	$25,000
Total	**$320,000**

The work associated with the placement of a gravel or concrete pad, furnishing and installation of a new hydrant, and furnishing and installation of temporary piping can be completed by the Wayland Department of Public Works personnel or a hired contractor. Table No. 3 includes the costs for a contractor to complete the pad construction, hydrant and water main improvements, and temporary piping construction. No resin exchanges will be needed during the 6-month duration, so resin exchange costs are not included for the near-term solution. Engineering assistance associated with the near-term temporary treatment process can be managed by an amendment under the ongoing PFAS Engineering Assistance Task Order between the Town and its engineering consultant. The engineer can provide PFAS sampling guidance, coordination with the MassDEP and other regulatory agencies such as the Wayland Conservation Commission if equipment will be installed, even on a temporary basis within the 100-foot buffer zone of the bordering vegetated wetlands, technical guidance during temporary treatment in regards to public notices or public education, and continued assistance with the development of the next stages of the PFAS Action Plan beyond the initial 6-month period of temporary treatment.

Near-Term Action Plan Conclusions

Temporary treatment will allow the WWD to return a portion of the Happy Hollow Wellfield into compliance with the PFAS6 regulations while the Town continues to evaluate future short-term and long-term alternatives for managing the PFAS levels at the Happy

Hollow Wellfield. The near-term temporary treatment approach and its associated factors, benefits, and costs are summarized below:

- Happy Hollow Wellfield will comply with the new PFAS6 regulations with effluent PFAS6 concentrations below the MCL of 20 ng/L.
- Upon complying the PFAS6 effluent limits at the Happy Hollow POE, the WWD can pause the distribution of bottled water and eliminate the need to prepare and distribute quarterly public notice and education documents to its customers.
- Total production from the Happy Hollow Wellfield will be 600 gpm by treating 300 gpm from HH Well No. 2R and blending it with 300 gpm from HH Well No. 3R. The additional flow lost by not operating Well No. 1R will have to be recovered by pushing operations of another source to maximize the output from the Baldwin Pond WTP or the Chamberlain Well.
- The existing submersible pump in Well No. 2R has additional available capacity to overcome the additional headloss through the temporary treatment equipment while still producing approximately 300 gpm.
- The EBCT for the IX resin vessels is approximately 2.5 minutes and each vessel will treat approximately 300,000-350,000 bed volumes before requiring a resin changeout. The low EBCT requirements minimizes the overall size of the vessels to control the footprint of the temporary treatment equipment within this sensitive area adjacent to the bordering vegetated wetlands.
- The lead time for preparation and delivery of the IX treatment equipment is 3-6 weeks from the vendor receiving an order.
- The IX resin vessels will be delivered to the site already prepared, rinsed, and ready for operations without the need for any initial backwashing prior to use. Treatment units can be delivered, installed, and placed in operation the same day or next day.
- The WWD or a hired contractor will have to construct a gravel or concrete pad, install a new hydrant and minor water main improvements, and provide temporary above ground piping between the hydrants and the influent and effluent connections to the treatment system as shown in Figure No. 2.
- Operator maintenance requirements will include replacing the bag filters when the headloss across the bag filter increases due to particulate buildup, brief daily monitoring of the equipment for leaks and proper functionality, and the collecting of water quality samples in accordance with a sampling plan that will be developed in consultation with the MassDEP. Operators can review the equipment during their normal daily rounds at the Happy Hollow Wellfield. Several spare bag filters will be furnished by the vendor for replacement on a weekly basis. The bag filters are simple to changeout and are easily removed and replaced by an operator within minutes. Bag filter replacements may extend longer depending on the particulate buildup and actual operation time of the Happy Hollow Wellfield. The bag filters and IX resin will not require backwashing.
- Treatment data can be collected during IX system operations to better analyze the effectiveness of IX for this application and the long-term treatment expectations for

the IX resin if the WWD elects to review permanent treatment as an extended short-term or long-term approach for compliance with the elevated PFAS6 levels.

- Under the 6-month near-term treatment scenario, the WWD will continue to sample and collect data on the PFAS6 levels in each of the three individual HH wells. The data collected may influence decisions made for the next stages of the action plan beyond this initial 6-month period. Stable PFAS6 results may indicate the Town can stick with the current treatment/blending approach, but if PFAS6 concentrations continue to increase over time, the approach may be to treat the water from Well No. 3R as well.
- The treatment equipment is not winterized and will be exposed to weather conditions. The equipment will have to be shut down at the end of November 2021 and removed from the site to prevent damage during low temperatures and inclement winter weather in New England.
- The initial 4-month rental cost is approximately $250,000 and each additional month can be rented for $10,000 making the total 6-month rental fee $270,000 for the temporary IX treatment equipment. Additional work for the construction of a gravel or concrete pad, hydrant and water main improvements, and the construction of temporary piping, and general engineering assistance during the 6-month near term solution period may result in additional costs totaling $50,000. The total estimated costs to implement the near-term solution is $320,000.

Winterizing Treatment Equipment for Extended Short-Term Operations

The near-term action plan provides a temporary treatment alternative to treat 300 gpm of water pumped from HH Well No. 2R to PFAS6 levels below the detectable limits and blend it with 300 gpm of water pumped from HH Well No. 3R. The near-term treatment plan utilizes above ground piping connections from hydrants to connect to the influent and effluent connections at the temporary treatment equipment. The equipment is proposed to be mounted on a gravel or concrete pad with the vessels and associated equipment exposed to the weather. The near-term treatment plan will return the WWD into compliance with the PFAS6 MCL, but only through the end of November since the treatment equipment is not enclosed or winterized for use during cold temperatures and inclement weather.

If the near-term temporary treatment solution operates as expected based on historical water quality of similar PFAS6 concentrations, the WWD may want to extend the use of the near-term temporary treatment system beyond November 2021 while it continues to evaluate other long-term alternatives for addressing the elevated PFAS6 levels at the Happy Hollow Wellfield. To extend the use of the near-term temporary treatment system, vendors recommend the construction of a small foundation surrounding the treatment equipment and the construction of a prefabricated or wood-framed, heated building to enclose the treatment equipment while leaving appropriate space around the equipment for operator access and maintenance. An enclosure with approximate dimensions of 30’ x 15’ x 15’ would be necessary around the treatment equipment and to cover the height of the vessels. Enclosure dimensions may vary depending on the vendor providing the treatment equipment.

The WWD will need to eliminate the temporary above grade piping connections between the hydrants and install buried piping which would be protected from the winter elements. A new 6" x 6" tee on the Well No. 2R pump discharge line could be installed with a 6" gate valve and ductile iron piping extending below the concrete pad and foundation of the proposed treatment enclosure. The piping would rise inside of the enclosure to connect to the treatment system influent piping. The discharge piping would drop below the concrete pad and foundation inside the enclosure and extend below grade to the location where the new hydrant is shown in Figure No. 2. The WWD can remove the proposed hydrant and connect the discharge piping to the 6" gate valve on the hydrant lateral. The piping work could be done by the Wayland Department of Public Works personnel or a hired contractor. The WWD could elect to combine the piping work, concrete pad and foundation work, and enclosure construction into one contract to bid, award, and construct while the temporary treatment equipment is in use between June 2021 and November 2021. If the cost estimate for construction is below $150,000, the contract is expected to be bid under Massachusetts General Law (MGL) Chapter 30, Section 39M, otherwise a Chapter 149 procurement will be required. The temporary treatment equipment would continue to operate while construction was completed around it, and the construction could be done with few interruptions to the treatment process and the water production at the Happy Hollow Wellfield.

The estimated probable construction costs to modify site piping, construct a foundation and building enclosure, and provide lighting, electric unit heaters, minor ventilation, and electrical conduit and wiring for power feeds, assuming an electrical service is available at the old buildings on the site, is approximately $150,000, including construction and a budgetary 30-percent markup for engineering and contingency. This is for the minimum features and essentials needed for a basic enclosure. Additional features in terms of aesthetics and Town preferences would result in an increase to the estimated costs. Enclosing the treatment system to winterize the near-term treatment solution is recommended by the vendors for protection of the treatment units as well as for the safety of the operators who may have to maintain the units and associated piping. Certain vendors may allow the treatment units to remain exposed during the winter or recommend heat tracing of piping and equipment. However, based on the critical need for the continued operation of the source, operators may face unnecessary challenges and hazardous conditions during the winter in situations where the equipment or piping needs minor repairs if the units remain exposed to winter conditions without a heated enclosure.

The winterizing of the near-term temporary treatment system would allow the process to be operated year-round and extend the near-term solution as needed by the WWD. Rental costs at $10,000 per month would continue as needed by the WWD. Vendors did indicate that if treatment units were going to be rented for an extended period of time, there may be an opportunity to negotiate a reduced monthly rental fee, at $5,000 per month for example, but in this early stage of conceptual design, a firm commitment to that reduced cost has not been confirmed.

With the continued use of the IX treatment system, a resin exchange/changeout will likely be necessary after approximately 18-24 months of operation. A typical resin exchange process can be done onsite leaving the vessels in place, vacuuming out the spent resin for disposal, and loading the new resin into the treatment vessels. Rinsing of the new resin would be required using water hauled onto the site and then collected in frac tanks and disposed off site preventing the discharge of any water in the sensitive areas adjacent to the bordering vegetated wetlands. The budgetary costs to fully replace the resin in all IX vessels included in the proposed temporary treatment solution is $80,000. This cost may be able to be reduced if only half the resin requires replacement at the 18-24 month point if the lag vessels can be rotated into the lead position and only the resin in the original lead vessels is replaced. The original lead vessels with the new resin would now operate in the lag position. Conservatively, the estimated costs for this winterized solution includes full resin replacement after 24-months of operation.

The costs associated with winterizing the temporary treatment solution and operating the solution for an additional 3.5-year period beyond the initial near-term 6-month period is shown in Table No. 4. The total additional cost as shown in Table No. 4 is estimated at $650,000. No changes to the current Wayland operations staffing plan will be necessary to accommodate the temporary treatment system. These costs in Table No. 4 would be in addition to the costs included in Table No. 3 as part of the initial 6-month temporary treatment rental period to extend the 6-month near-term solution to a 4-year short-term action plan. The total 4-year short term temporary treatment cost estimate is $970,000.

Table No. 4
Happy Hollow Wellfield Winterized Treatment Cost Summary (3.5-Year Operation)

Item	Cost
IX Treatment Equipment Winterized Enclosure Construction	$150,000
Monthly Rental Fees for 42-Month Duration ($10,000/Month)	$420,000
Full Resin Exchange After 24-Months of Operation	$80,000
Total	**$650,000**

Chamberlain Well Considerations

The focus of this near-term action plan and extended short-term action plan has been temporary treatment at the Happy Hollow Wellfield since recent water quality sampling has resulted in an exceedance of the PFAS6 MCL. Although the PFAS6 levels at the Chamberlain Well are below the MCL of 20 ng/L, water quality sampling results for PFAS6 have ranged from 10.7-18.0 ng/L since the WWD began sampling in January 2020 as shown in Table No. 1. If PFAS6 levels increase at the Chamberlain Well, temporary treatment scenarios and costs will have to be replicated at the Chamberlain Well site to maintain

compliance with the PFAS6 regulations. The Chamberlain Well will continue to be sampled for PFAS on a monthly basis in accordance with the PFAS6 regulations so that the WWD can continue to collect PFAS6 data and monitor for any trends or changes in the PFAS6 concentrations.

Massachusetts Water Resources Authority Emergency Connection

As an alternative to the short-term, winterized temporary treatment approach at the Happy Hollow Wellfield, discussions are ongoing with the Massachusetts Water Resources Authority (MWRA) regarding a potential emergency connection to the MWRA's Hultman Aqueduct where it crosses Route 27 in Wayland. There is an existing valved and stubbed water main tap at the Route 27 crossing which could be used to connect the MWRA Hultman Aqueduct to the existing 12-inch water main in the Wayland water distribution system along Route 27. A booster pump station would be required near the MWRA connection along Route 27 with a pumping capacity to meet the full water demands of the Wayland system. The MWRA uses monochloramine for secondary disinfection in its distribution system compared to the Wayland system which utilizes free chlorine. Blending chloraminated water with free chlorine water can present water quality challenges. If the emergency MWRA connection was established, the MWRA water supply would be utilized to meet the full demands of the water system, and the WWD would shut down its existing local sources of water supply to avoid blending and the water quality concerns.

The emergency MWRA connection requires additional review and evaluation but it should be considered as a potential alternative to the short-term winterized temporary treatment alternative at the Happy Hollow Wellfield for a similar overall 4-year planning period. A long-term, permanent MWRA connection would be planned and considered at a different location outside of the Town of Wayland to optimize how the MWRA could supply water to the Town from both the Hultman Aqueduct and the MetroWest Tunnel. The emergency connection along Route 27 would be considered for the short-term, temporary planning period only. The intent is to review the potential emergency connection further with the MWRA in the immediate future and provide detailed information in this section to properly present this alternative.

However, for immediate planning purposes, we offer the following preliminary cost summary in Table No. 5 for the potential emergency connection to the Hultman Aqueduct at the Route 27 crossing for a 3.5-year short term planning period to supplement the near-term 6-month treatment alternative. The costs would include the MWRA administrative fees associated with the emergency connection in accordance with the MWRA's Emergency Water Supply Withdrawals Policy No. OP.05, the design and construction of a booster pump station and associated water main improvements along Route 27 on MWRA property, and the costs associated with the purchase of the water from the MWRA based on the MWRA's rate of $4,300 per million gallons (mg) and an average day demand in Wayland of 1.2 million gallons per day (mgd). The MWRA counts each 6-month emergency water supply agreement as one "period". Subsequent emergency water supply "periods" require

additional administrative charges. The MWRA is currently evaluating the administrative costs for a 3.5-year emergency connection for the Town. The booster pump station estimate of probable construction cost includes the design and construction of a booster pump station and a 30-percent budgetary markup for engineering and contingency.

If a full conversion is made to the MWRA water supply and the Town's existing water sources and treatment facilities are shut down, direct operations costs associated with the pumping and treatment of water using the Town's sources will be eliminated. There will be a new operational cost primarily associated with the electrical costs to pump the water at the MWRA booster pump station. In addition, much of the laboratory sampling done by the Town using its own sources would now be covered under the MWRA's annual fees. The annual net savings in direct operational costs for electricity, chemical supplies, and laboratory sampling with a full conversion from Town sources and treatment to the MWRA water supply is estimated at $550,000. The net savings in operational costs for a 3.5-year planning period of $1,925,000 are factored into the overall cost analysis for the MWRA alternative as shown in Table No. 5.

The costs included in Table No. 5 can be compared to the costs included in Table No. 4 for the temporary treatment alternative for the 3.5-year (42-month) period following the initial 6-months included in the near-term treatment alternative. The costs in Table No. 5 for the MWRA emergency connection would be additional costs to the near-term temporary treatment costs included in Table No. 3 to provide a combined 4-year solution for compliance with the PFAS6 regulations. The costs included in Table No. 5 will need to be refined as the MWRA emergency connection alternative is evaluated further and after the MWRA provides its expected emergency connection fees for the 3.5-year emergency operation period.

Table No. 5
Preliminary MWRA Emergency Connection Cost Summary (3.5-Year Operation)

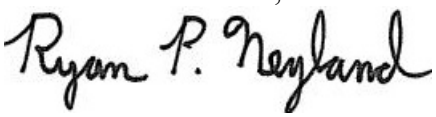
Item	Cost
MWRA Emergency Connection Administrative Fees for 42-Month Duration	Under Review By MWRA
Route 27 Booster Pump Station and Water Main Design and Construction	$975,000
MWRA Water Assessment Fees for 42-Month Duration[1]	$6,592,000
Net Operational Cost Savings with Full MWRA Supply for 42-Month Duration	($1,925,000)
Total	**$5,642,000**

[1]MWRA Assessment fees are based on a rate of $4,300/MG for the duration of the 42-month emergency supply period, but the MWRA reserves the right to increase water rates in accordance with annual increases to its normal rate structure.

We appreciate the opportunity to assist the Wayland Water Division on this important matter. Please contact the undersigned with any questions, comments, or concerns.

Sincerely,

TATA & HOWARD, INC.



Ryan P. Neyland, P.E.
Vice President