

## **HISTORY OF THE IDLEWOOD WELLFIELD WATER TREATMENT FACILITY, TTHMs EXCEEDANCE AND NEED FOR PRE-TREATMENT**

### **WATER SYSTEM BACKGROUND**

Based on the results of two pilot studies conducted in 1997, the Town commissioned the construction of the Idlewood Wellfield WTF in 2000 to treat the Town's Idlewood wellfield. The plant was designed around a high rate proprietary filtration technology offered by Filtronics, Inc. for the removal of iron and manganese. The use of this technology was recommended as part of the second study due to its smaller footprint and initial capital costs as compared to the previously recommended conventional filtration. In 2009, the plant began experiencing operational issues with the filters including excessive media loss. At about the same time, the Town also began observing increases in Total Trihalomethanes (TTHMs) within the distribution system, which are a byproduct of disinfection with sodium hypochlorite when natural organics are present in the raw water.

To address these on-going operational issues, it was recommended to replace the existing Filtronics proprietary media with greensand media, and install a new potassium permanganate feed system for oxidation in place of the using sodium hypochlorite to reduce chlorine dosages at the plant. Disinfection with sodium hypochlorite would still be required after filtration. These two upgrades were completed in 2010 along with operational modifications to the backwash process to accommodate the higher volumes of backwash water associated with greensand media. It should be noted that it was recommended to retrofit the existing filters with a new air scour system to improve the backwashing efficiency, however, this upgrade was never implemented.

Despite these upgrades to the plant, the issue with media loss from the filters continued along with an increase in sludge production within the backwash/decant tanks. Additionally, the performance of the filters diminished to a point where the plant could only be operated at about half of its original design capacity. Even at this reduced rate, the plant was still having difficulty meeting the secondary MCL for manganese of 0.05 mg/l. This performance issue prompted the Town to routinely implement water bans to help relieve the stress on the plant filters, and prevented the Town from conducting annual water system flushing programs. To address the continued media loss issue and lack of production capacity at the plant, a study was conducted to evaluate the existing plant conditions and develop possible solutions to improve the plant performance. Two feasible solutions were identified for consideration including: 1) converting the filter plant back to the original Filtronics media with sodium hypochlorite as the oxidant; or 2) constructing a new greensand or membrane filtration plant with appropriate chemical, backwash and pre-treatment processes.

The conversion of the plant back to the original Filtronics design was recommended as the most practical short-term approach for the Town to implement with the construction of a new filtration facility as a long-term solution based on the effectiveness of the first approach. One potential issue with the recommended approach was the increased formation of TTHMs within the distribution system given the change back to sodium hypochlorite as the oxidant. Several operational measures to alleviate this potential issue were identified including: more aggressive and routine flushing to reduce water age; improving the turnover rate for the Browns Hill Reservoir; adding an internal mixing system and/or TTHM aeration system for the Browns Hill Reservoir; replacing the existing Browns Hill Reservoir with a new tank equipped with an internal mixing and/or TTHM aeration system; and the use of chloramines for post-disinfection.

The upgrades of the existing plant to convert the filters back to the Filtronics media were completed along with a new floating decanter system for the backwash tanks, new SCADA system and work stations, new radio and communication systems, new PLCs at each of the well stations and storage tank, new filter flow meters and differential pressure transmitters. Since completing the upgrades, the plant has been operating well, removing iron and manganese as required to meet the MCL secondary standards, while producing finished water at the plant's normal rate of 650 gpm. Prior to the construction of the upgrades, the Town conducted a round of water quality sampling in April 2018 for TTHMs and Total Organic Carbons (TOCs) within the distribution system and at each well source to establish a baseline for evaluating the impacts of the upgrades to the water system. The results of this sampling showed that the Idlewood #1 and #2 wells had elevated levels of TOCs as compared to the other wells. The results of the 2<sup>nd</sup> quarter Stage 2 DBP sampling conducted in May 2018 prior to any treatment changes at the plant showed TTHMs at the Town's 28 Goodhue Street monitoring site to be 88 ppb, which is above the drinking water standard of 80 ppb. However, the calculated locational running annual average (LRAA) for the last four quarters was in compliance.

In August 2018, upon completing the 3<sup>rd</sup> quarter Stage 2 DBP sampling, the Town was notified by MassDEP in a letter dated 08/16/18 that they exceeded the Operational Evaluation Level of 0.080 mg/l (80 ppb) for TTHMs at the 28 Goodhue Street monitoring site. The TTHMs at this site were 100 ppb, however the calculated LRAA for the last four quarters was in compliance. In response to this exceedance, the Town purchased and deployed several automatic flushing units at several locations within the system to improve the water age and residence times along the dead end main that fed this site. The Town also conducted a comprehensive system-wide flushing program to further reduce the water age and potential for the formation of TTHMs. In November 2018, the Town completed its 4<sup>th</sup> quarter round of Stage 2 DBP sampling. The Town also collected samples from each of the well sources and the water treatment plant to test for TOCs, which was required as part of the plant upgrade approval issued by MassDEP.

In December 2018, upon completing a supplemental round of 4<sup>th</sup> quarter Stage 2 DBP sampling, the Town was notified by MassDEP in a letter dated 12/28/18 that they exceeded the Operational Evaluation Level of 0.080 mg/l (80 ppb) for TTHMs at the 28 Goodhue Street monitoring site. The TTHMs at this site were 90.5 ppb, as averaged from the November and December sampling, however the calculated LRAA for the last four quarters was still in compliance. Given the results of the 4<sup>th</sup> quarter sampling, the Town was required by MassDEP to begin conducting monthly rounds of sampling for TOCs at all of the well sources, TOC and TTHMs on the plant's finished water, and TTHMs at the 28 Goodhue Street site.

In evaluating the cause of the November 2018 OEL exceedance, the Town identified two mechanical issues that occurred at the plant which likely contributed to the TTHM spike for the 4<sup>th</sup> quarter sampling. The first issue was discovered when one of the two backwash tanks at the plant was taking off-line for routine cleaning and maintenance. Upon entering the tank, Town staff found that a number of bolts on the flanges of the interior recycling pipe were corroded and/or missing, and the flanges were pulled apart. These faulty flanges allowed a portion of the settled solids from the bottom of the backwash tank to be drawn to the head of the plant and onto the filters for a few days until the tank was put offline. As these solids contain concentrated levels of iron, manganese and TOCs, it is believed that this had an impact on the filter performance and the OEL exceedance. Within two days of repairing the bolts, the water quality out of the filters improved. The other issue was the raw water quality of the Idlewood#2 well.

Prior to conducting the 4<sup>th</sup> quarter sampling, the Town began to use the Idlewood#2 well, which hadn't been used in a while, and has historically been known to have higher color and manganese than the other well sources. The results of the November sampling showed that this well had a TOC level of 6.94 mg/l, the highest of all the well sources, and higher than what was measured back in April 2018. Upon receiving the results of the November 2018 sampling, the Town turned the Idlewood #2 well off-line and has kept it off-line since. Based on the results of the follow-up December sampling, these two operational corrections seemed to improve the water quality at the plant as the TTHMs within the plant's finished water were noted to reduce from 90 ppb to 41 ppb.

The results of the monthly sampling being conducted by the Town at the 28 Goodhue Street have showed improvement since the spike that occurred in November 2018 with TTHM levels for December and January measured to be 61 ppb and 74 ppb, respectively. The Town has kept Idlewood#2 off-line and has been performing routine flushing of the affected areas to mitigate the formation of TTHMs. The 1<sup>st</sup> quarter Stage 2 DBP sampling conducted in February and March, 2019, also showed similar improvements with an average TTHM of level of 64.5 ppb at the 28 Goodhue Street site. However, the calculated LRAA for the last four quarters which includes the spike that occurred back in November 2018 exceeded the drinking water standard for TTHMs. Per the EPA requirements, the Town has prepared and issued a public notification informing residents of the violation and the steps that will be taken to remedy the issue.

#### **NEED FOR PRE-TREATMENT SYSTEM AT PLANT**

In addition to sampling for TTHMs at the 28 Goodhue Street monitoring site, the Town has also been sampling for TTHMs in the plant's finished water along with TOCs at each of the Idlewood wells. In August 2018, the TTHMs in the plant's finished water were 55 ppb, whereas the TTHMs at the 28 Goodhue Street monitoring site were 84 ppb. In November 2018, when the Town experienced the high spike due to the operational issues noted above, the TTHMs at the plant were 90 ppb, whereas the TTHMs at the 28 Goodhue Street site were 120 ppb. During these two noted sampling rounds, the Town was operating both the Idlewood #1 and #2 wells, which have elevated levels of TOCs. In December 2018, when the Town turned off the Idlewood#2 well and began to aggressively flush the system on a more routine basis, the TTHMs at the plant were 41 ppb, whereas the TTHMs at the 28 Goodhue Street monitoring site were 61 ppb. In February and March 2019, the TTHMs at the plant were 57 ppb and 45 ppb, respectively, whereas the TTHMs at the 28 Goodhue Street site were 64 ppb and 65 ppb, respectively.

Based on the results of the collected sampling data performed to date, it seems that the majority of the TTHM formation is occurring at the plant, with about an additional increase of 30% occurring at the 28 Goodhue Street monitoring site due to high water age and residence time. Although water age within the distribution is clearly contributing to the TTHM formation issue, it is not the main cause as initially believed prior to performing the plant upgrades and associated water quality sampling. The TTHM formation at the plant is due to the moderate levels of raw water TOCs present in the Town's Idlewood #1 and #2 wells. As these two wells are large producers for the Town's water system, the future use of these wells will be necessary to meet system demands, particular during the higher peak periods in the summer. With the use of sodium hypochlorite at the water treatment for oxidizing iron and manganese, and for chlorinating the filtered water, there will always be TTHMs present within the finished water leaving the plant given the level of TOCs in the Idlewood wells.

Considering the fact that the existing distribution system will always have inherently high water age and residence times, the Town will always be at risk for exceeding the EPA drinking water standard for TTHMs. As such, the most feasible approach to continue with the operation of the existing plant and

Idlewood wells would be to remove the TOCs within the raw water as much as possible to reduce the formation of TTHMs at the plant. Since the plant processes are not designed to remove TOCs from the raw water, the Town is considering the addition of a new pre-treatment system to remove/reduce the TOCs within the wells prior to injecting sodium hypochlorite for pre-oxidizing iron and manganese. The system being evaluated is a packaged MIEX pre-treatment process which uses ion exchange resin technology to remove TOCs from the water. There is no chemical addition required. The resins are regenerated with a brine solution as needed to maintain their performance. These systems come pre-assembled on a skid that can readily be installed within a building.

The conceptual plan is to construct a new 30' x 25' addition on the back side of the existing plant to house the pre-treatment system and associated electrical, process and mechanical equipment. Raw water from the wells will be directed to the new pre-treatment system for removal of the TOCs, and then conveyed back to the head of the plant where the existing treatment for iron and manganese will be performed. There will be minimal disruption to the current plant operation and processes during the construction of this new pre-treatment system. The Town has provided raw water samples to the manufacturer so that a desk top pilot study can be completed to confirm the percent removal of TOCs expected upon operating the system.

As the permitting, design and construction of this new pre-treatment system and addition could likely take over a year to complete, the Town will continue to perform the following measures to mitigate the risk of future TTHM exceedances:

- Routinely flush areas within the distribution system including the dead end main in Highland Avenue to reduce water age and residence times.
- Deploy portable hydrant flushing units near the TTHM exceedance site and other high water age areas to provide automatic and/or continuous flushing of the system.
- Conduct monthly sampling rounds of TTHMs, HAA5s and TOCs at the plant and at the DBP compliance locations to monitor system conditions.
- Keep Idlewood #2 well off-line to minimize TOC levels entering the plant.
- Modify operation of the plant to allow the Browns Hill Reservoir to fluctuate over a wider range to improve water quality and age.
- Modify the operational range of the clear well to reduce the excessive contact time currently experienced at the plant to help reduce TTHM formation.

If you have any further questions regarding the TTHMs exceedance violation or the Town's long term plan to remove TOCs from the source water please call Hamilton's Water Department at 978-626-5226.

Thank you

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Town of Hamilton