An exposé of MassDEP's ineptitude, deception, and waste in oversight of Massachusetts' drinking water systems –

including the remarkable case studies of Chester, Housatonic, Millville, and Monroe

by Richard W. Gullick, PhD

May 1, 2022

WATER COMPLIANCE SOLUTIONS

"Simple solutions for complex problems"

This report provides my observations regarding the performance of the Massachusetts Department of Environmental Protection's Drinking Water Program (MassDEP) in their duties enforcing the Safe Drinking Water Act (SDWA) in Massachusetts, and in particular how that performance has impacted small systems and towns. I have witnessed an alarming and repeated lack of technical competence, common sense, and integrity in MassDEP's decisions and statements. Numerous examples are described of MassDEP rendering improper water treatment decisions, causing violations of public health regulations, deceiving the public regarding water quality, wasting extreme amounts of small systems' money, and retaliating against the water professionals and communities who question their statements and decisions.

Four case studies are presented that describe the debacles created by MassDEP for these small drinking water systems, including the Chester Water Department, Housatonic Water Works Company, Town of Millville's Elementary School, and the Monroe Water System. I supported each of these systems on their SDWA compliance issues as a technical assistance provider working for a USEPA-financed non-profit organization in 2019, and later worked as a contracted consultant for three of those systems through my own consulting firm Water Compliance Solutions, LLC beginning in 2020.

These four cases are all now legendary to me in my career – legendary for regulatory agency ineptitude beyond that witnessed even by the customers of Flint Michigan a few years ago. Unfortunately, the customers of these water systems are innocent bystanders of MassDEP's damaging actions.

This report is provided for those interested and concerned about drinking water quality in Massachusetts and the corresponding financial costs, for the customers of the affected water systems, as a lesson for drinking water operators and other water industry professionals, and as a treatise to draw recognition to far-reaching problems I have observed within the drinking water industry as a whole (see Appendices E and F). For example, far too many capital projects have been proposed or completed that actually weren't necessary. It is my hope to catalyze change within Massachusetts that will simplify and improve regulatory oversight of drinking water systems, as well as reduce unnecessary expenditures of funds by the regulated community, especially very small towns like those discussed here.

I have kept relatively silent for the past three years about what I've witnessed at MassDEP. But a recent petition for Governor Baker circulated by some Housatonic customers has convinced me it is now time to speak out.

Protecting drinking water is essential work, but needs to be done correctly and properly to not only protect public health but to also do so at a reasonably appropriate cost and without expending too much unnecessary time and effort. With small systems it is usually best to keep things simple. And customers should be able to expect their money is being spent prudently.

What is presented here is my own work and opinion as Water Compliance Solutions, LLC, and is a message I believe is needed. This is not a statement from any particular water system or municipality. While some data and materials previously prepared on behalf of clients are included, I did not charge anyone for the time used in preparation of this report.

I do not intend to insult anyone or hurt their feelings with my observations, but this all needs to be brought out into the open. It is often mentioned in ethics seminars for the drinking water industry (and other industries) that one shouldn't say anything or do anything that one wouldn't mind reading in the newspaper or seeing on television the next day (and I like to add "*or anything one wouldn't do in front of their mother*"). So I wrote in this report what I have observed happen, and will let the cards fall where they may, so to speak.

As a licensed drinking water operator in Massachusetts, I am required to adhere to the Professional Code of Ethics for Water System Operators, which includes:

> *"The water systems operator shall, at all times, recognize his or her primary obligation is to protect the safety, health, and welfare of the public in the performance of his or her duties. If his or her judgement is overruled under circumstances where the safety, health, and welfare of the public are endangered, he or she shall inform his or her employer of the possible consequences and notify such other proper authority of the situation, as may be appropriate."*

I bear witness here as to what I have observed MassDEP do that goes against the safety, health, and welfare of the public.

There are many good people at MassDEP who work hard to help protect public health and the environment, and I thank them sincerely for their efforts. This report is about the statements and decisions I have encountered from the MassDEP Drinking Water Program within the past 3+ years, and is not meant to be a criticism of any other MassDEP departments or of all staff within the Drinking Water Program. Also, my experience is limited to cases in three of the four MassDEP regions. I have no experience with clients or staff in MassDEP's Southeast Region, and the little I have heard were good things about how they communicate and interact well with engineering firms and their water system clients.

____ ____ ____

The serious mistakes I have observed be committed by MassDEP about drinking water quality are similar in principle to the mistakes made by the Michigan Department of Environmental Quality (MDEQ) in their oversight **of the Flint water system** which allowed that water quality crisis to happen. In each case the state regulatory staff did not exhibit adequate understanding of the relevant water chemistry principles, and then made basic mistakes in their orders and directives that shouldn't have happened and that caused a lot of harm.

In my opinion, MassDEP not only overreacted to the *"Flint"* water scare by increasing compliance enforcement to a very strict and counterproductive extent, but went in the totally wrong direction by decreasing water chemistry and treatment technical assistance for water systems. The key problem with

the *"Flint"* water crisis being allowed to happen was the state regulatory agency's lack of technical capability in water chemistry and treatment. One does not solve that problem by decreasing that capability.

MassDEP appears to have taken a doomed approach – enforcement over science – when the end result is supposed to be regulation based on science. **In trying to not be like Michigan DEQ and allow a "*Flint*" to happen, MassDEP evidently plotted a path that was designed to make them even worse** than Michigan DEQ and resulted in multiple serious mistakes. **That was an inexplicable strategy** – trying to prevent a problem from happening by deemphasizing their ability to address that same type of problem.

As brief examples, in both the Monroe and Chester cases I believe MassDEP themselves caused the disinfection byproduct (DBP) Maximum Contaminant Level (MCL) violations that occurred as a result of their mistaken directives that were in contradiction to standard chlorination practice for drinking water treatment. Then both of these water systems recently received a financial grant from MassDEP's *Assistance for Small and Disadvantaged Communities Drinking Water Grant Program*, and in both cases MassDEP cited as the reason for the grant a need to solve the same MCL violations that their own actions helped cause.

In another case, much has been said and written about the drinking water provided by the Housatonic Water Works Company (HWWC) in Great Barrington, and in particular the episodes of colored water that have occurred in recent summers. And now a petition to Governor Charlie Baker is circulating around Housatonic seeking relief to the customers' perceived problems with the water company and water quality (copy in Appendix D). Fortunately, much of what has been said is just plain wrong.

I believe that a public outcry exists in Housatonic as a result of misinformation proffered by the MassDEP over non-existent issues that are unrelated to the manganese that causes the color. So not only may Housatonic's customers be subjected to the yellow or brown water color during seasonal spikes of manganese, but also to additional unnecessary emotional angst over what some are wrongly insinuating is improper utility management, inadequate investment in distribution system pipes, and violations of drinking water regulations on the part of HWWC. There are claims of problems which need fixing where there really aren't any problems, and unnecessary solutions have been proposed that would costs lots of money – either the customers' money (through the water company) or other taxpayers' money through grants.

I believe HWWC's customers have been misled by MassDEP about the cause of the color episodes, and about what's needed to get it fixed. Not only has that already cost the customers and their town money on needless monitoring expenses and unnecessary consultant reports, but it led to a consultant recommendation to spend an absurdly exorbitant $31M to fix the water system's alleged problems. That corresponds to about $37,640 for each of the 825 customer accounts, and $22,181 per person (assuming 1,400 people). A staggering proposal.

Fortunately, that is absolutely not necessary. People should be aware of the false narrative propagated by MassDEP.

It is my intention to set the record straight in this report by providing important facts and perspective about the Housatonic situation. The misconceptions apparent in the Housatonic community (as evidenced by the petition to Governor Baker) indicate the community is a victim of the substandard work and misinformation provided by those whom the community should have been able to count on for sound evaluations and recommendations. The HWWC case study presented in this report provides critical information concerning the validity and veracity of that work.

Much of the misconception stems originally from a Sanitary Survey inspection report completed by MassDEP in November 2020. That MassDEP report requires numerous non-sensical, unnecessary, time-consuming,

costly, and potentially harmful directives for HWWC. That Sanitary Survey report was later used by a consultant hired by the Town of Great Barrington as part of the basis for an estimate of over $31 million dollars to fix the alleged problems.

That whole progression of analyses? It's malarkey. The amount of improper assumptions and superficial supposition in that work is alarming. As is the lack of questioning of those assumptions by others. But because the subjects involve a level of scientific, chemical, engineering, and regulatory knowledge, the faulty underlying assumptions and correspondingly inaccurate and unreliable results may not be apparent to the untrained eye such as water customers or volunteer town officials.

The complete story for the Housatonic Water Works Company situation is provided in the case study section.

____ ____ ____

Given how much I have observed by myself during my short time in Massachusetts (less than four years), **the damage caused statewide by MassDEP is likely enormous in terms of water quality and lost money and time.** That makes me wonder…

- → ***How much money is being wasted on unnecessary and excessive monitoring directives?***
- → ***How much of the clamor for new water system infrastructure is actually unnecessary?***
- → ***How much of that is merely a result of substandard engineering evaluations or regulatory overreach?***
- → ***How many "Flints" may MassDEP have caused in Massachusetts?***
- → ***And what may happen in the future with MassDEP so unprepared to respond to an incident with a serious acute health threat?***

This is a complicated story with lots of detail, and some may say this report – or treatise – is too long at 79 pages. But that's what the record company initially said about Queen's song *Bohemian Rhapsody*, and that became a classic. So here it goes…

Table of Contents

Dr. Gullick's Qualifications

As an introduction, I have worked as a drinking water industry executive, operations manager, water quality engineer, consultant, and research scientist. I have worked with many of the top professionals in the U.S. drinking water industry throughout my career, and have conducted water quality evaluations of numerous different utilities. My credentials and work experience include the following, and more details are included at *http://watercompliancesolutions.com/qualifications*.

- B.S. in Environmental Science from Lyman Briggs College at Michigan State University
- M.S. in Public Health degree from the University of North Carolina at Chapel Hill focusing on water chemistry and drinking water treatment
- PhD degree in environmental engineering from the University of Michigan specializing in water treatment and groundwater transport
- Licensed as a Class T-4 drinking water treatment operator in Massachusetts (#27363) and other states

I am also highly experienced with the different subjects involved here. For example:

- *Source water quality?* – I was the primary developer of the American Water Works Association's Standard for Source Water Protection (G300-14), and author of the accompanying guidebook (2017).
- *Distribution system pressures?* – My published research on the monitoring and modeling of negative transient pressures was groundbreaking and is still frequently referenced.
- *Disinfection byproducts?* – My DBP research is referenced in the U.S. Environmental Protection Agency (USEPA) guidance manual that MassDEP uses, and my previous successes in DBP control are outstanding. In Virginia I quickly discovered that a major consulting firm misinterpreted the water quality data and misapplied their models, and the utility wasn't doing the basic treatment correctly, which then led the utility into a totally unnecessary $25M treatment project at five treatment plants.
- *Regulations?* – I moved to Massachusetts in 2018 for a job serving as an expert instructor giving USEPA-sponsored training on drinking water regulatory compliance for operators and regulatory staff in Massachusetts, Connecticut and Rhode Island.
- *Reviewing technical reports?* – During the past 16 years I have served on the *Journal AWWA* Peer Review Editorial Board, *Journal AWWA* Editorial Board, and as an Associate Editor for *AWWA Water Science*. A water utility Executive Director once called me "*a consultant's worst nightmare*". I liked that compliment.
- *Mentors?* – I have worked as a direct report for five different AWWA A.P. Black Award recipients (Drs. Phil Singer, Fran DiGiano, Walt Weber, Jr., Mark LeChevallier, and Dave Cornwell… *Thanks to all!*).
- *General water industry knowledge?* – I was that guy in the audience at industry conferences shouting out corrections to the expert panel's answer key during operator quiz bowls.

MassDEP's Actions

I consider the Massachusetts Department of Environmental Protection to be the primary obstacle to successfully supplying safe and low-cost drinking water to small communities in western Massachusetts. Observations of MassDEP's actions from my ~3.5 years of experience in Massachusetts are provided in the lists on the following six pages. I have tried to include documenting examples for each of these observations in the four case studies presented.

MassDEP technical competency, common sense, and integrity:

I have witnessed an alarming and repeated lack of technical competence, common sense, and integrity in MassDEP's decisions and statements.

I believe the evidence suggests their actions have endangered the health and welfare of the people of the Commonwealth. It's so bad I personally don't think they deserve maintaining primacy status for implementing the Safe Drinking Water Act on behalf of the USEPA. To be even more blunt, from what I have seen they just don't have a clue as to how to properly lead oversight of public drinking water systems, and they don't seem to want to.

MassDEP is too often wrong. It's that simple. And obvious. I have witnessed too many statements, decisions, and requests from MassDEP that are simply incorrect from a scientific or regulatory perspective. I don't know how they can be so wrong so often. And this costs communities throughout the Commonwealth lots of money for ineffective or inappropriate projects and remedies. The drinking water state regulators I worked with in Virginia and New Jersey were much more knowledgeable, willing to learn, adjusted positions when appropriate, and were practical in their approaches. Same for those I have worked with more recently in Rhode Island and Connecticut. They were on our side.

Sometimes when MassDEP is wrong, water systems suffer from AND get blamed for those mistakes, and end up being required to spend money on unnecessary or inappropriate solutions. There is no way outside of that loop, other than expensive legal action against the state. And no small community can afford that, so against their better judgment they acquiesce to MassDEP's poor ideas.

In my experience, MassDEP too often doesn't properly identify the real cause of problems, only seems interested in capital projects, and denies the use of inexpensive, practical solutions. That's not what you should do with small systems. Or any system. You don't study them forever or collect countless samples like it's an academic study – just identify the problem, find a simple solution, apply it, and evaluate the results. We shouldn't need to spend customers' money on evaluations or monitoring if we already know the answer.

MassDEP requires large amounts of data collection that they apparently ignore or is otherwise irrelevant, needlessly costing communities lots of money. And then they often misinterpret the data they do review. They have tried to force expensive capital projects on small communities that just aren't needed. And they create emotional chaos for all kinds of drinking water professionals and water consumers.

And when MassDEP's statements and positions are countered by professional engineers and scientists using sound principles and evaluations, they typically don't budge. In my experience, MassDEP habitually maintains their position no matter how wrong or harmful or unnecessarily expensive it is. This continues until the consultants and operators are beaten into submission and just go along with MassDEP's requirements in order to stay in business. No matter how illogical or inappropriate those requirements may be. This frustrates engineers throughout the state who have learned this business and know better.

Observations of MassDEP Actions

Technical capability?

1. Important decisions are being made for public health protection by MassDEP that don't demonstrate adequate comprehension of some basic underlying concepts and principles of drinking water science and regulation, and in particular for misdirecting basic chlorine disinfection chemistry, disinfection byproduct (DBP) control, and corrosion control.
2. MassDEP's work has too often exhibited an apparent lack of understanding of basic physical, chemical, and microbiological principles and laws as well as the details and concepts of their own regulations.
3. This system is broken. You can't regulate well if you don't understand the underlying principles.
4. They have made directives and recommendations in chlorination practices that would endanger both public health and regulatory compliance.
5. There are times where what MassDEP says is a good thing is actually a bad thing. And vice versa – there are other times when what they say is a bad thing is actually a good thing.
6. Their level of work can be frustratingly simple and short sighted, unnecessarily costing small communities large sums of money in operational and capital expenses, and costing the Commonwealth's taxpayers through inefficient use of agency staff time chasing problems that aren't problems.
7. At times they like to follow their rules to a tee, and seem to have everything down to forms, checklists, flowcharts, and deadlines. Unfortunately that affects one's range of thought and conceptualization of relative risk, and they then miss the forest for the trees.
8. MassDEP seems to avoid discussions of a technical nature.
9. Peculiar use of industry terms and buzz words and Illogical lines of reasoning have suggested to me a concerning lack of understanding of the concepts being discussed. With some of the things they say and write, it seems they are from outside the drinking water industry.

Issues overseeing SDWA compliance?

10. MassDEP behaves as enforcement bullies, but are short on technical competence. That is an unfortunate combination.
11. MassDEP has issued violations (Notices of NonCompliance) that should not have been issued because there really was no violation.
12. They have imposed inappropriate operational decisions on water systems and licensed operators, followed by the occurrence of health-based water quality violations. Water quality data and other evidence suggest the violations would not have happened if standard industry practice had been followed. The system or operator then get blamed for the compliance violation. If MassDEP is making the operational decision, it's only fair they should take responsibility for the results. Fair is fair.
13. They don't seem to adequately consider potential secondary results of their decisions.
14. They don't seem to consider enough the potential for unintended consequences from their decisions.
15. MassDEP apparently likes to base decisions for optimal corrosion control treatment solely on strictly following the flowcharts in USEPA's guidance manual. That is a "plug and chug" solution that can have critical drawbacks. USEPA even included disclaimers for that. The flowcharts are not intended for strict regulatory use, and doing so may be poor science and may not adequately accomplish the needed goals. Each situation should be evaluated individually and wholly.
16. MassDEP has provided substandard and inadequate oversight of my clients' water systems. The things they have missed during inspections and in the submitted Monthly Operating Reports both astound and upset me as someone trained in the field, as do some of their treatment-related decisions. And that's happening at the same time they are scolding, punishing, fining, and taking legal action against the same small-town community water systems.
17. The regulations were written to grant vast authority to MassDEP under the assumption that the agency staff would be technically qualified enough to properly use that authority in their decisions about water chemistry and treatment and utility management. Unfortunately, in my experience with MassDEP that has frequently not been the case.

Observations of MassDEP Actions (cont.)

Problem-solving capability?

18. MassDEP is so poor at identifying the underlying cause of problems that they responded to the Flint water scare by decreasing technical assistance to water systems in water chemistry and treatment and increasing compliance enforcement. But the problem with Flint was the state agency's lack of technical capability in water chemistry and treatment. You do not solve that by decreasing that capability.
19. MassDEP has been unable to solve some simple drinking water compliance problems.
20. Sometimes MassDEP diagnoses problems where there really aren't any problems, and then create difficulties and impediments for the water systems and small communities
21. Their decisions and statements exhibit an apparent lack of experience with operating treatment and distribution systems, impacting their ability to develop and maintain an appropriate relative perspective of what's important for their mission, and to understand appropriate treatment adjustments and solutions.
22. At times MassDEP doesn't seem to understand the practical difference between the possibility a particular scenario "could" happen versus whether that scenario actually "will likely" happen, or the difference between whether a particular thing "could" be done versus whether it "should" be done.
23. Water system problems with very simple and obvious operational solutions available are being forced into unnecessary engineering studies and capital projects. Even when the best action plan is to do nothing, MassDEP wants a capital project. Even when an MCL violation was caused by something operational or a freak event of nature, MassDEP wants a capital project.
24. The operator for an elderly housing complex told me **they had been required by MassDEP to install pH adjustment for corrosion control based on results from a single lead sample.** All previous compliance samples had reportedly been relatively low in lead. The operator told MassDEP he recalled using his bare hands to handle some lead material shortly before collecting the guilty sample, which would significantly increase the **potential for sample contamination**. **Despite subsequent lead samples being relatively low, MassDEP forced installation** and subsequent monitoring and maintenance **of an additional chemical feed system.**

    In my view that's overreactive. I was taught not to construct anything based on only one sample – always confirm what one is acting on before taking action ("measure twice, cut once"). Especially if it is known to have possibly been contaminated. That pH adjustment system was not necessary.
25. They sometimes block the same progress they claim to want
26. MassDEP requires data be collected for them (at water system expense) and then don't use it.
27. MassDEP does not appear to have acceptable skill at interpreting or using water quality data.
28. MassDEP requires so many things that do not change the water chemistry or microbiology, and water quality does not change if the water chemistry or microbiology doesn't change.
29. MassDEP sometimes makes too much out of simple systems (making 'mountains out of molehills').
30. MassDEP seems overly focused on tiny things and irrelevant issues, at chasing triviality instead of using their time for more important purposes.
31. They make water systems do things that don't really help, taking time away from the tasks that do need to be done. They really slow down progress, especially for small systems with limited staff time and resources. Stricter is not necessarily better.

Over-reliance on crutches?

32. MassDEP over emphasizes capital project solutions instead of thinking through inexpensive operational solutions first.
33. MassDEP seems to over-rely on the concept of licensed certified operators for most operational duties and Professional Engineers for too many assessments, blindly assuming what they do will be correct. MassDEP also will block them from doing what they know is right. The contradiction is apparent.
34. MassDEP has knee-jerk reactions, and then other people make money (e.g., consultants)

Observations of MassDEP Actions (cont.)

Over-reliance on crutches (cont.)?

35. Upon an MCL exceedance, MassDEP routinely notifies water systems they are required to have an engineering study conducted and then will be required to implement whatever solutions the engineering firm recommends that MassDEP agrees with. This process is predisposed toward capital expense solutions. Engineers tend to recommend engineering solutions.
36. Doing that provides incentive – intentional or not – for the engineers to propose projects that involve more engineering work, and to not search for simple operational solutions that don't take any money (and thus don't make any money). It's only natural, and takes discipline to avoid that trap.
37. And sometimes poor work by engineering firms results in unnecessary recommendations that they may financially benefit from if the recommendations move forward through engineering design and construction.
38. There are civil engineers running water utilities, and then civil engineers working at the consulting firms who are required by MassDEP to develop a plan resembling a capital project, so of course they want to build something. It's what they do. More is said about this concept in Appendix E.

Perspective?

39. There is too much of an overzealous approach to MassDEP's advocacy and requirements. There is lots of overkill, where a simpler approach would be quicker, more effective, and less expensive. At times they overreact and cause unnecessary harm to treatment system operations. And they frequently require overstudy – continuing to ask for evaluations and reports when the answer is already staring them right in the face.
40. MassDEP put too much time and effort into addressing low probability/low impact events, and also into things that have no impact.
41. MassDEP spends time and resources creating and issuing legal documents that have no impact. They waste time on irrelevant trivialities instead of focusing on the only things that matter to water quality – water chemistry and microbiology.
42. If MassDEP leadership or staff believe they don't have enough time or employees, they need only to look at their own operation and the extremely inefficient manner they have approached compliance oversight for my small-system clients.
43. Drinking water is an easy subject to scare people with. MassDEP points to good water systems and says "*Look how bad they are!*", and that diverts possible attention away from how bad MassDEP has actually been doing with their work. That's what seems to have happened with the local press in Housatonic.

Attitudes?

44. Instead of trying to enforce with smarts MassDEP tries to enforce with harshness.
45. MassDEP seems to focus more on appearance than on substance.
46. It appears they act tough to give the impression they know what they are doing and are being strict in fulfilling their duties.
47. MassDEP's methods, attitude, and lack of necessary technical skill causes way too much personal stress, aggravation, and anxiety for the water industry professionals working with them. MassDEP's denial of science and facts is psychologically grueling for those who encounter it. For a scientist or any rational person there may be anxiety from having the real world – facts and data – denied by the government.
48. They act like they can say or do anything, and they do. Sometimes they say things and I wonder how they think they'll get away with it, but they do. The lack of checks and balances over MassDEP allows that.
49. MassDEP pushes away talented professionals and their practical ideas, further entrenching themselves into their mistaken positions. Having a closed mind like that prevents them from improving by learning from those in the industry who have more experience and knowledge. By not allowing their ideas to be challenged, MassDEP holds to a rigidity that prevents adequate learning and affects a "dumbing down" of their capabilities.
50. A widespread reputation of meanness is attributed to one particular MassDEP official in the western region's Drinking Water Program.

Observations of MassDEP Actions (cont.)

Retaliation?

51. MassDEP retaliates against individuals, water systems, and communities who disagree with them.
52. MassDEP uses Sanitary Survey inspections, unlimited monitoring requirements, and Administrative Consent Orders (ACOs) as tools for retaliation when water systems question MassDEP's statements and decisions. This wastes time and money, and causes lots of anguish.
53. I've seen good work by Professional Engineers for different water systems illogically blocked by MassDEP.
54. I couldn't get MassDEP to be honest about their data interpretation, or a water treatment plant classification, or even just the number of significant digits that are allowed by the rules to be used for values of total trihalomethanes (TTHM) and haloacetic acids (HAA5). It's like talking with a wall. And there's no recourse.
55. Many people have experienced MassDEP's ruthlessness, but few want to challenge the evil empire.

The cause and impact of serious mistakes made by state drinking water regulatory agencies:

56. The mistakes made by the state drinking water agencies in the cases of Flint (Michigan DEQ), Toledo (Ohio EPA), and as described here by MassDEP for Monroe, Chester, and Housatonic all have one thing in common. In each case the state regulatory staff did not exhibit adequate understanding of the relevant water chemistry principles, and made basic mistakes in their orders that shouldn't have happened and that caused a lot of harm.
57. The underlying problem that allowed the Flint water scare was that the state regulatory staff didn't understand the chemistry and treatment principles well enough, and permitted an improper change in source water and treatment. As a cost-saving measure in April 2014, an unelected Flint city manager appointed by the Governor of Michigan directed a switch from using Detroit Water and Sewerage Department water to treating their own water from the Flint River. That change resulted in colored and dirty water, was linked to over a dozen deaths from Legionella (as a result of low chlorine levels), and caused an exceedance of the lead Action Level for just one 6-month monitoring period (1st half of 2016).

    The problem in Flint was not so much with the regulations themselves, but instead was a lack of proper consideration for the effect of changing water chemistry and treatment. The water system, MDEQ, USEPA, and consulting firms all received substantial negative publicity, and some lawsuits too.
58. With the August 2014 Toledo, Ohio incident, the city's water supply was declared unusable for nearly three days even though there had been no confirmed detections via the LC/MS method of the algal toxin in the finished water. The Ohio EPA relied on an inexact ELISA screening method for its decision, and seemed to ignore that the microcystins would be rapidly degraded by the treatment plant's chlorine. That just didn't make sense, and was an overreactive decision. It was quite a shocking story once the facts came out. The city's water apparently did not need to be avoided.
59. The extensive publicity from the Flint case resulted in decreased consumer confidence in public drinking water supplies, a hypersensitivity for regulatory agencies and water systems, and an onerous revision of the Lead and Copper Rule. The industry has placed a big emphasis on the subjects of corrosion control and algal toxins since the Flint and Toledo events, and the consulting firms are glad to fill that need.

    While understandable, it is easy to go too far at the expense of taking time away from other important issues. Because of that perceived public sensitivity, lead and algal toxins were probably the two subjects I worked on the most as Director of Operations at a wholesale water system in Virginia from 2014 to 2018, even though we had no actual problem with either.

MassDEP's Post-Flint Strategy ("strictness over technical competency"):

60. It is said that **MassDEP's drinking water program changed after the Flint water scare**. The types of problems I have observed apparently existed before then, but that case sparked a damaging overreaction.
61. I recall attending a meeting of the Massachusetts Water Works Association (MWWA) on January 24, 2019, one-half year after I started working in Massachusetts. MassDEP Commissioner Martin Suuberg and the other officials who spoke all kept mentioning "*because of what happened in Flint*", "*after what happened in Flint*", "*because of Flint*", "*Flint*…". Mr. Suuberg acknowledged that perhaps MassDEP had reacted too much to "*Flint*".

Observations of MassDEP Actions (cont.)

MassDEP's Post-Flint Strategy ("strictness over technical competency") (cont.):

62. Hearing "*Flint*" so much, I suspected that those speaking did not really know what had happened in the Flint case. As much as bad publicity came out of it for the state agency, the underlying issues were about water chemistry and not enforcement.
63. In response to the publicity from that case, MassDEP apparently didn't want to be accused of being an agency that didn't do their job enforcing the law, and so they became even stricter in their enforcement of the regulations and issuing compliance notices, and reduced their work in supporting water systems with chemistry and treatment guidance.
64. MassDEP will apparently take time to cite water systems for practically anything, even in circumstances where it doesn't seem to matter in any real sense. For example, they issued Notices of NonCompliance for such minor issues as a delivery certification being late to MassDEP (Chester) or the commercial laboratory's refrigerator and generator failing (Chester), and they even make up a regulation or two that don't exist.
65. MassDEP's emphasis on chasing even the slightest little compliance issue with legal notices does not help the big picture objective of making better water quality. Instead, it distracts time and attention, annoys and stresses the individual people involved, and costs money for both the MassDEP (oops… I mean the taxpayers of Massachusetts…) and the water rate payers. And if you are simultaneously both a taxpayer and a rate payer, you pay twice for silly nonsense that doesn't help one iota. And for HWWC customers who are residents of Great Barrington, their town also spent money on consultant evaluations and so they effectively paid money in three different ways for MassDEP's poor and misleading work. Ouch.
66. Instead of using that time, money and resources to help the water utilities improve water quality and compliance, MassDEP issues trivial and nonsensical violations and requirements.
67. And they do that with serious issues too… MassDEP staff and attorneys went through a lot of effort to draft and enforce the Administrative Consent Order for Chester, yet avoid and deny the simple solution of turning a valve to use the original and better quality source water to solve the DBP issue. Why?
68. MassDEP has recently repeated the regulation for daily operator time requirements in a Sanitary Survey and in an Administrative Consent Order for different systems. Why do they do that? That rule is already in the regulations. Is that supposed to be a double-sided hammer?
69. This all may help MassDEP appear stern and authoritarian, but it's inappropriate and counterproductive. Anything that takes time or money away from the main goal of producing quality water does not help, especially with small systems that are short on staff and resources.

Science and the regulations (MassDEP misses the point):

70. In response to a state agency making a big mistake (Flint) by their not understanding the water chemistry well enough, MassDEP deemphasizes their technical competency in and ability to oversee the same thing.
71. Because of the shift in their mission, some of their staff with treatment and water chemistry experience left MassDEP, making the agency even weaker in those areas.
72. In my experience science and the truth are the enemy of MassDEP's method. MassDEP tries to smother or push out good work done by engineers and scientists, otherwise their method of controlling through intimidation and abuse instead of through science will not work easily enough.
73. And since they don't know the chemistry well, they push capital projects to make it look like they are doing something and being strict. But at great financial cost to rate payers.
74. And by not knowing the chemistry well enough, MassDEP has issued Notices of Noncompliance when their own mistakes in how they interpret water chemistry and direct treatment operations actually caused those same violations.

What can be done?

75. MassDEP's regulations need to be applied with technical competency, common sense, and integrity, not just by the letter of the law. The regulations are designed that way.
76. MassDEP needs more science and less enforcement. Work smarter and oversee simpler, not harder and more forceful.
77. We need chemists to enforce chemistry laws and regulations, not lawyers and lay people.

Observations of MassDEP Actions (cont.)

What can be done? (cont.):

78. If MassDEP really wants drinking water chemistry to improve in the state, then they themselves should better learn water chemistry and treatment principles and put them to proper use. Be leaders in the subjects that are needed most. And do not count on consultants with P.E. licenses to necessarily be good water chemists.
79. If MassDEP wants improvement in both water quality and regulatory compliance, they should be led by people who understand both subjects, can appropriately prioritize agency efforts, and have a reasonable degree of common sense and emotional intelligence.

MassDEP retaliation (Monroe, Chester, HWWC, and Millville):

Making the situation even worse is that the communities I have worked for have incurred what appears to be repeated and costly retaliation from MassDEP. All too often, when I have provided informed and supported explanations to MassDEP about various water chemistry, treatment, and regulatory considerations that contradict what MassDEP had done or stated, strong adversarial action was promptly taken by MassDEP personnel against either my clients or against me personally. That has happened with each of my clients in Massachusetts.

With the Monroe Water System example, MassDEP personnel called my supervisor to angrily complain after a meeting in November 2018. My company interpreted that as a threat to their EPA funding, and made it clear I would be fired if I were to contradict MassDEP again. My investigation for RCAP Solutions happened to inform MassDEP they had wrongly declared an "*acute public health threat*" and issued a SDWA disinfection violation for February and March 2018 based on a mistaken understanding of the concept and definition of "peak hourly flow" for calculating disinfection compliance, and in a circumstance where it was obvious there couldn't be a Surface Water Treatment Rule disinfection violation (> 10 day contact time with > 0.6 ppm chlorine residual).

For the Chester Water Department, I completed evaluations that happened to observe various mistakes MassDEP had made about chlorine chemistry, DBP control, misclassifying the treatment plant (as 2T instead of 1T), and missed oversight of key yet simple operational issues including disinfection compliance determination and reporting, treatment system data management, and other important topics. Also, the existing GAC filter was shown to have no observable effectiveness for total organic carbon and disinfection byproduct removal.

Most importantly, literature citations and data I collected showed MassDEP's earlier directive to move much of the chlorination to after the clearwell when the pH is raised actually increases trihalomethanes (THMs) instead of decreasing them. I believe that mistake in chlorine feed location was likely enough to cause the relatively small MCL exceedances that had occurred at Chester. It also meant that fire hydrant flushing needed to be limited to just a few minutes, as most of the water stored in the clearwell was not regularly disinfected enough to be used at that fast a flow rate.

For lowering DBPs at Chester I recommended three simple and basically free operational solutions be applied before considering any capital projects, including (1) solving the chemical feed problems that result in excessive variation of pH and chlorine residuals, (2) moving the location of the second chlorine feed back into the clearwell prior to pH adjustment, and (3) switching back to the original source water which has much lower TOC levels and lower manganese also.

In turn, MassDEP declared my DBP evaluation from two years' previous to suddenly be invalid as Chester's submission due to a lack of recommendations for DBP control (actually, there were 11 of those…), forced the town into an Administrative Consent Order for the DBP problem that requires hiring another company to repeat my evaluation and essentially propose a capital project, and denied Chester's requests to switch back to their original source water or to correct MassDEP's mistaken directive by moving the chlorination back into the clearwell before pH adjustment to minimize THM formation.

In both the Monroe and Chester cases I believe MassDEP themselves caused the disinfection byproduct MCL violations with their directives that were in contradiction to standard chlorination practice for drinking water treatment. Both of these water systems recently received a financial grant from MassDEP's *Assistance for Small and Disadvantaged Communities Drinking Water Grant Program* (and were rated the top two priorities for that funding), and in both cases MassDEP cited as the reason for the grant a need to solve the same MCL violations that their own actions helped cause. MassDEP is providing a total of $50,000 to each water system, and then is claiming a total in-kind contribution of $118,417 for the staff time they spend processing the two grant applications and other administrative duties, for a combined total project cost of $218,417. For projects that probably would not be needed if MassDEP hadn't made those mistakes.

The taxpayers just can't win… MassDEP spends our money making bad decisions about treatment operations… which causes MCL violations… prompting MassDEP to spend more of our taxpayer money on staff time to process grants where they will give more taxpayer money to the water systems for projects that either should not otherwise be needed or are not likely to be successful. That's not funny. Not funny at all.

With Millville, MassDEP appeared to respond to some critical consultants' reports by conducting an inordinately extensive Sanitary Survey inspection, much more so than previous ones conducted by the same MassDEP office for the same water system. The excessive effort required by both MassDEP and the town's consultants wasted substantial time and money for little gain. In my opinion, MassDEP did not appear to be motivated to really help the water system, and instead appeared to be harassing and punishing them with unnecessary requirements in the Sanitary Survey, with excessive water quality monitoring requirements, and with numerous requests for written standard operating procedures.

In the case of the Housatonic Water Works Company, HWWC disagreed with some rather peculiar assertions from MassDEP. Key among those was MassDEP writing that HWWC's distribution system chlorine residuals of 0.3 – 0.5 mg/L (ppm) were too high, and combined with warm temperatures and iron pipes that was causing the color issues. That's an invalid theory which had been disproved by data that MassDEP themselves ordered be collected for their evaluation (the color is not from iron), and I consider their suggestion to lower distribution system chlorine residuals to between 0.05 and 0.2 mg/L to be both dangerously low and operationally impractical.

Two business days after HWWC sent an e-mail politely countering MassDEP's theory, MassDEP staff called to schedule a Sanitary Survey inspection. The resulting Sanitary Survey report then had numerous nonsensical claims and requirements, and was later used by a consultant as part of the basis for an estimate of over $31 million dollars to fix the alleged problems.

These examples involve what are generally considered simple concepts for basic water treatment operations – calculating chlorine contact time, the impact of pH on THM formation, treatment process and distribution system chlorine residual goals, impact (or lack thereof) of chlorine residual on water color, and using the best available source water. Yet MassDEP staff didn't seem to understand these concepts or even want to try to, nor were they willing to accept them. I always tried to be respectful in my approach, but

those technical subjects needed to be discussed and resolved in the water system's quest for protecting public health.

It's not personal, it's just water chemistry. So why would MassDEP retaliate against communities and drinking water professionals? And harm communities in the process? I don't know. I just know they do it. Kind of like that Geico commercial… it's just what they do.

There are no checks and balances on MassDEP, so they are immune to questioning of their own mistakes and harmful decisions. As the regulatory agency for public drinking water supplies, MassDEP sets the rules (along with USEPA), then serves as the policy makers, law enforcement agency, investigator, prosecutor, judge, jury, and appeals court all in one. Then completing the circle, they also give utilities detailed direction of how to operate the treatment systems, making decisions for the operators that may adversely impact compliance. That is a 360-degree conflict of interest. The only way to break the cycle is through expensive legal action that no small community is likely willing or able to use, especially since MassDEP has the power and resources of the state government behind them.

MassDEP's authority is basically unquestioned. And they are using it to harass small communities through unreasonable and inappropriate application of that authority, primarily through abuse of their power for Sanitary Survey inspections, Administrative Consent Orders, and requiring unlimited water quality monitoring and consultant reports. And in my experience they seem to pick on the smallest and most vulnerable… elementary schools, elderly housing, and very small towns like Housatonic and Monroe. And this is unnecessarily costing these small communities lots of money that they can't afford to needlessly throw away. Complain to MassDEP about it? They'll just hit you back harder and needlessly cost you more money. Someone needs to pull this agency back into our reality.

As another dimension of the harm they cause, the impact I have observed from the resulting emotional turmoil inflicted by MassDEP on individual water industry stakeholders is undeniably compelling. I well recall consoling one client many times over the phone at all hours of the night. They were terrified of the contact person at MassDEP, and often cried (literally) over what they perceived was abuse directed at them. They were always scared about the response they'd get if they changed something without MassDEP approval, no matter how minor, so there was usually great resistance to accept my guidance on how to make their treatment or compliance reporting better. I was providing this technical assistance through USEPA grants so that water systems could better comply with MassDEP regulations, yet the fear instilled by MassDEP personnel paralyzed the water system so much it often prevented them from accepting suggestions for even the most simple improvements.

I've seen grown engineers (… is there another kind?) nearly have a freakout meltdown over how frustrating these dealings with MassDEP can be. I've seen town officials frustrated and infuriated as they watch their budgets get bled dry by unnecessary monitoring and Sanitary Survey requirements. And I've heard several wild stories from operators about a regulatory official somewhere, and invariably it's about the same person at the Western Regional Office of MassDEP. And the whole situation has affected my life too given the stressful frustration of seeing great progress for small drinking water systems be repeatedly thwarted by an agency that just doesn't get it.

Monroe Water System Case Study

The Monroe Water System (PWSID #1190000) is the smallest community drinking water system in Massachusetts with only 26 connections. They have a pristine brook source water with slow-sand filtration, disinfection (sodium hypochlorite), and pH adjustment (soda ash). MassDEP seemed to go looking for problems, since Monroe had no licensed operator in 2018 after theirs retired. Town citizens long familiar with the system were doing a good job operating it, and one of them was granted an emergency license by MassDEP to make it legal.

My investigation in fall 2018 for RCAP Solutions informed MassDEP that they had wrongly declared an "*acute public health threat*" with associated required public notice, and incorrectly issued a Surface Water Treatment Rule (SWTR) disinfection violation for February and March 2018 based on a mistaken understanding of the concept and definition of peak hourly flow for calculating performance calculations, and in a circumstance where it was obvious that couldn't be the case. The chlorine contact time was over 10 days and the chlorine residual was > 0.6 ppm, which is literally off the compliance charts. That gives a CT of > 302 min-mg/L (using a baffling factor of 0.1, and peak hourly flow of 3.5 times higher than average flow). In contrast, the highest value in the CT charts is 184 min-mg/L for the required 1-log inactivation at the worst-case conditions of the lowest possible temperature and highest possible pH. [**CT** = chlorine residual **C**oncentration * chlorine contact **T**ime]

I shared the concept of that news with MassDEP staff during a meeting with Monroe representatives in November 2018. Shortly after that, my supervisor at RCAP Solutions and another company official met with me over lunch to explain that Deirdre Doherty, Chief of the MassDEP Western Regional Office's Drinking Water Program, had telephoned him to angrily complain that I had "demeaned" her, her staff, and the entire MassDEP. My company interpreted that as a threat to their EPA funding, and made it clear I would be fired if I were to contradict MassDEP again.

I had mistakenly thought my responsibility was to independently assess the causes of regulatory noncompliance however it was, not to just agree with MassDEP's mistakes. I had shared truthful and important good news about Monroe's water quality to MassDEP, and then was chastised and threatened for doing so. Something seemed really off for either MassDEP or RCAP Solutions to behave this way. I lost my appetite, didn't order lunch, and just left. Not surprisingly, my employment at RCAP Solutions lasted less than a year more.

MassDEP had been applying a wrong definition of peak hourly flow for over a decade, and had made the utility measure the maximum instantaneous flow possible in the system by opening numerous taps in town (it's a very small town with only ~26 service connections). The correct definition of peak hourly flow is provided on the monthly compliance reporting forms and in the regulations. Average flows are calculated for each of the 24 full hourly periods each day, and then the highest of those 24 hourly averages is called the peak hourly flow and is used for disinfection performance determinations. Lower peak hourly flows require less chlorine.

MassDEP also didn't seem to consider in their determination of a violation that the pH readings on those days were unrealistic outliers, and a slight change in those two values would bring the calculation into compliance even without adjusting for their peak hourly flow error. MassDEP continued to deny their mistake in subsequent correspondence – still claiming there was a SWTR violation – despite the clear explanation provided of how to properly calculate chlorine contact time and CT.

MassDEP also directed Monroe to increase the chlorine dose to address the alleged acute public health threat, as then the disinfection calculation would meet the compliance standard. They changed the chlorine target when the problem on paper was some outlying pH datum points (and their miscalculation of peak hourly flow). They did this despite the amount of chlorine residual and contact time already there, and with recognition the decision could have adverse impact on DBP compliance. Shortly after Monroe followed the directive to increase the chlorine, in 3rd quarter 2018 Monroe failed the total trihalomethane (TTHM) Maximum Contaminant Level (MCL) for the first time in the history of the DBP Rule after 56 quarters of monitoring over 14 years. Without MassDEP's series of mistakes, DBP compliance may not have been violated.

Recently, Monroe was given a $50,000 grant from MassDEP as the second community priority in their *Assistance for Small and Disadvantaged Communities Drinking Water Grant Program* to help solve the DBP compliance problem. As part of the project, MassDEP is claiming a $41,021 in-kind contribution for the staff time they spend processing the grant application and other administrative duties, for a total project cost of $91,021.

The grant was based on Monroe exceeding DBP limits in 3rd quarter 2018 and the two subsequent quarters, failures I believe may have been caused by MassDEP themselves with their misplaced directive for Monroe to increase the chlorine dose earlier in 2018, and as described above were the first MCL exceedances after 56 quarters of monitoring over 14 years.

Housatonic Water Works Company (HWWC) Case Study

I have been evaluating HWWC's water quality data at their request since April 2019, first as a water quality technical assistance provider working for an EPA-supported non-profit organization, and then with my own consulting firm Water Compliance Solutions, LLC hired as HWWC's water quality specialist. I support operations by personally processing and evaluating all of HWWC's water quality data and providing recommendations on treatment practices.

HWWC's water quality is discussed below, both the positives and negatives. Then some unfortunate misconceptions are exposed about the water and the water company, as exemplified by the recent customer petition to Governor Baker. That is followed by a description of the misleading manner in which those misconceptions came about, including MassDEP's Sanitary Survey for HWWC and the subsequent consultant reports that repeated and further compounded MassDEP's mistakes. The appendices include critical technical evaluations of MassDEP's requested corrosion control plan for HWWC (Appendix A) and of the Town of Great Barrington's two consultant reports about HWWC (Appendices B and C).

HWWC's water quality:

HWWC (PWSID #1113003) provides ~107,000 gallons per day (gpd) to ~825 service connections and ~1,400 people. The Long Pond source water is treated with slow sand filtration and chlorine disinfection. The treatment plant has been rated by MassDEP as a I-T facility.

HWWC's water has experienced episodes of yellow or brown color during summers of 2018, 2020, and 2021. **Extensive water quality data conclusively show these episodes were caused by seasonal spikes of naturally occurring manganese in the Long Pond source water.** In my professional opinion, manganese is the one and only cause of the colored water episodes.

Other than the periodic spikes in manganese, Housatonic's water is extremely high quality, one of the best I have seen in my career. Positive characteristics include the following:

- The Long Pond source water is an oligotrophic reservoir located in a small, mostly undeveloped watershed with minimal human activity near the pond ***– that's all very good…***
- The water is crystal clear throughout the reservoir, has a low nutrient loading that does not support algal blooms, and is low in hardness and iron **– again, all good…**
- There are no synthetic organic chemicals (SOCs), volatile organic chemicals (VOCs), toxic metals (e.g., arsenic, cadmium, chromium, mercury, etc.), or PFAS (newly regulated chemicals) ***– Great!***
- The water is naturally corrosion resistant because of its relatively high pH (~7.7 average in the distribution system), and there are no known lead service lines in the community, so adding chemicals for controlling lead corrosion is not necessary. ***– Extra bonus!***
- No lead was detected in 19 of 20 samples (95%) during the most recent round of monitoring (< 1.0 ppb), and the 20th sample was only 1.1 ppb, well below the lead Action Level of 15 ppb. ***– Awesome!***
- To our knowledge there has never been a detection of either total coliform bacteria or *E. coli* in the finished water or anywhere in the HWWC distribution system. I understand the Great Barrington Fire District cannot say the same, and neither can most utilities. ***– Wow!***

Disinfection treatment:

While there are some beaver huts and other wildlife around Long Pond, bacteria levels are relatively low, and Housatonic's slow sand filtration system is extremely reliable and effective at removing pathogens and particles. Life Magazine (1997) and the WHO and CDC (2007) declared that filtration with the use of chlorine for drinking water was probably the most significant public health advancement of the millennium.

Basically, the treatment system is an enclosed sand box followed by a chlorine feed pump. But this is great stuff – simple yet exceptional ideas – eliminating most of any potential health risk inherent in the high-quality natural water supply. The filter physically and microbiologically removes contaminants, basically anything that isn't dissolved and some things that are. There's really not much that can go wrong. And it provides outstanding treatment, going well beyond the government's rigorous regulatory requirements 100% of the time.

This is an excellent choice of treatment for a small community. Filter effluent turbidities are always low, and with the hydraulic harrowing cleaning method used by HWWC the filters don't need time after cleaning to ripen, further reducing any potential risk. The chlorine is applied continuously and is monitored at two locations before water leaves the treatment plant, so there is redundancy in confirming disinfection performance.

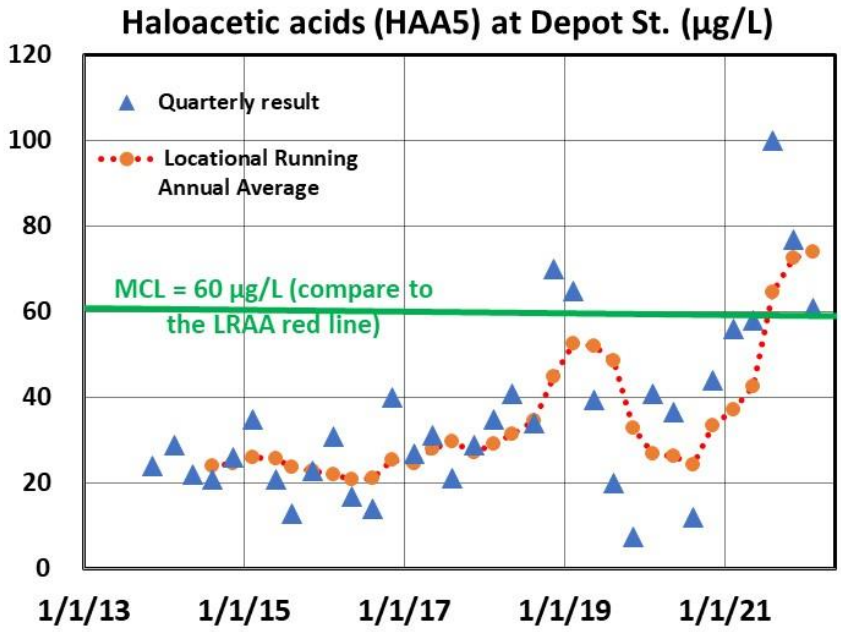
Disinfection byproducts:

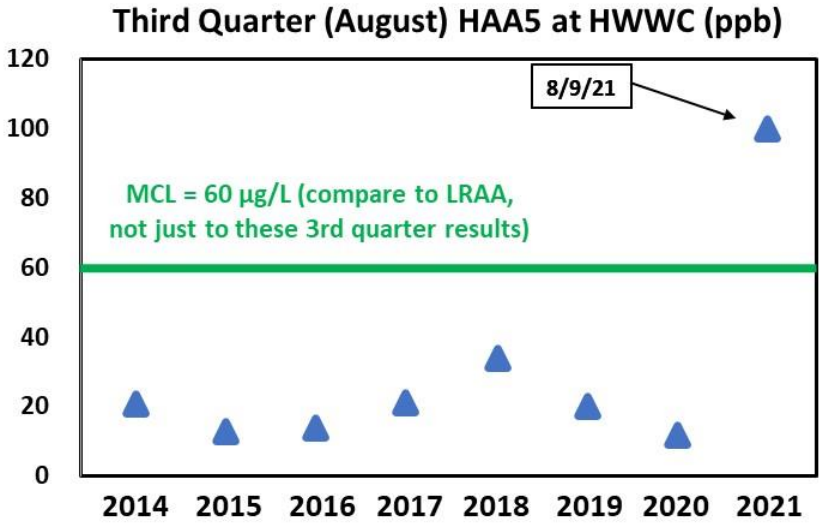
Although the chlorine disinfection is essential, unfortunately there are undesired disinfection byproducts (DBPs) that are formed when chlorine reacts with natural organic matter in the water. MassDEP regulates two classes of organic DBPs, total trihalomethanes (TTHM) and haloacetic acids (HAA5).

HWWC had never had a problem with the regulated TTHM or HAA5 prior to last August 2021 when the Maximum Contaminant Level (MCL) for HAA5 was exceeded. That event was – as far as I can tell – a fluke of nature caused by record rainfall in July.

The standard for HAA5 is 60 µg/L (or parts per billion, ppb) based on a locational running annual average over four 4 quarters. HAA5 levels vary some seasonally, so it's also good to look at one season at a time. HAA5 samples collected in August for all seven previous years from 2014 to 2020 ranged from 12 to 34 ppb, with an average of 19 ppb. Then in August 2021 the HAA5 result was an anomaly at 103 ppb. HWWC also observed more manganese and for a longer period of time in 2021 than had been previously seen, while lead results were at a record low. So apparently the July 2021 rains changed the water some, and in ways we will likely never know. Other utilities in western Massachusetts also experienced elevated DBPs during that time, and they too presumed the wet weather was the cause in their cases.

While the regulators may issue violations, the HAA5 concentrations do not concern me as either a public health professional or as a water treatment operator. These very low part per billion levels of HAA5 are reported to only have a potential health impact after decades of consumption, and that's just not the case here. So far, the increase in HAA5 seems to have been a temporary incursion caused by the exceptionally high period of rainfall last July, and should not have any health impact during this short-term period. HAA5 levels measured in November 2021 and then February 2022 have been decreasing closer to previous levels, and I expect that to continue.





In response to the HAA5 results, HWWC has lowered the chlorine residual level while maintaining more than enough to exceed all disinfection requirements, and will be conducting increased monitoring for total organic carbon in both the source water and treated water.

The wording in the Public Notice sent out by HWWC to its customers about the HAA5 situation is rather alarming, and is specifically required by MassDEP. It is signed and mailed by the water company, but most of it is MassDEP's wording. I think those menacing notices are grossly overstated, and while the intent to fully inform customers is admirable, the approach ends up misleading and unnecessarily scaring people. And suggesting bottled water be used is totally overkill since there is no health threat for short-term exposures such as this case. Remember, it's not just a question of whether toxic or carcinogenic chemicals are in our water or air (they are, everywhere…), it's a question of what levels and for how long and via what route of

exposure would cause any real noticeable adverse health impact. I believe this incidence just isn't an issue in any authentic sense beyond the regulatory requirement and the adverse impact on public perception.

HWWC's slow sand filters are very good at removing the natural organic matter that serves as precursors for forming chlorinated disinfection byproducts, and without the addition of coagulant chemicals. Recent data show 55% removal of total organic carbon (TOC) last September, and 34% removal in cold February, both of which are unexpectedly excellent results for slow sand filters which typically are expected to remove only ~15 to 20% of the TOC. Perhaps this success is partly due to the well-established age of the microbial population and HWWC's custom hydraulic rake filter cleaning system. Periodically cleaning the sand surface with water instead of physically removing the top layer of sand has allowed the sand to not be replaced for a very long time (≥ 25 years), providing better treatment while also saving money. That's good utility operations.
Despite the HAA MCL exceedance having no health impact, it being caused by a very rare weather event, and HWWC already having a good TOC removal system in the slow sand filters, MassDEP is still requiring a "corrective action" that will apparently involve a capital project to add further redundancy to the system.

MassDEP's standard wording was issued again in a letter dated April 4, 2022. That requires the water system to "*submit to MassDEP a report by a Massachusetts Registered Professional Engineer with expertise in Drinking Water compliance documenting the causes of the MCL violation and his or her recommendations for preventing future MCL violations in the water distribution system. The report shall include an alternatives analysis including a feasibility evaluation, effectiveness determination, cost estimate, and implementation schedule. The system will implement the recommended actions set forth in the report as approved by MassDEP in accordance with a schedule approved by MassDEP*."

I don't believe that's something HWWC's customers should be forced to spend money on at all, let alone when they haven't yet had manganese control installed to prevent the color episodes. The HAA5 violation was just this one period since August 2021, and the water has been returning toward normal. The water that existed when the HAAs were so high last August is no longer available to test and study. As shown in the table below, HAA5 levels vary seasonally, with HWWC's higher levels generally being in February (1st quarter) and lower levels in August (3rd quarter). That's part of why last August's high results were so unexpected.

The good news is that not only have the HAA5 sample results been decreasing since last August's atypically high value, but the difference compared to the historical average for their seasons has been decreasing, cutting in about half from August to November (from 81 ppb down to 44 ppb) and then again in half from November to February (from 44 ppb down to 21 ppb). **That suggests the water is returning to its more normal state in terms of the potential for formation of HAAs**, though it is still somewhat elevated. In the past, the recent February HAA5 result of 61 µg/L generally would not have put the LRAA over the MCL, given February was usually the highest result of the four quarters.

Table 1. Historical average HAA5 (2013 – 2021) vs. recent results (since August 2021) in µg/L (ppb)

Month	Historical average	Recent result	Recent difference from average	Recent sample date
August	22	103	+ 81	8/9/21
November	33	77	+ 44	11/10/21
February	40	61	+ 21	2/9/22
May	33	NA	NA	NA

This suggests the peculiar water quality that caused such uncharacteristically high HAAs last August is now basically gone and can't be replicated to study. Further, the quantity of total organic carbon is typically a controlling factor in DBP formation. But that does not appear to be the case here since raw water TOC levels from September 2021 (3.7 and 3.8 mg/L) and February 2022 (3.3 mg/L) were no different than the levels from October 2020 (2.9 – 4.2 mg/L). The finished water TOC level in September 2021 was 1.7 mg/L (55% removal by the filters), and in February 2022 was 2.3 mg/L (a 34% decrease).

Given the lack of correlation between the high levels of HAAs detected last year and the relatively steady quantity of TOC measured, installing additional treatment to remove more TOC cannot necessarily be expected to help prevent another MCL exceedance if a similar weather event happens again. Yet MassDEP is pushing for some kind of new treatment system… a solution where one is not needed.

The impact from last July's rains on surface water supplies was regional, with other water systems also suddenly experiencing jumps up in DBP levels that resulted in MCL and OEL (Operational Evaluation Level) exceedances. Since the impact from that weather event was regional, I don't believe it should be the responsibility of HWWC's customers – or any other water system's customers – to pay for a study to investigate what happened to the whole region.

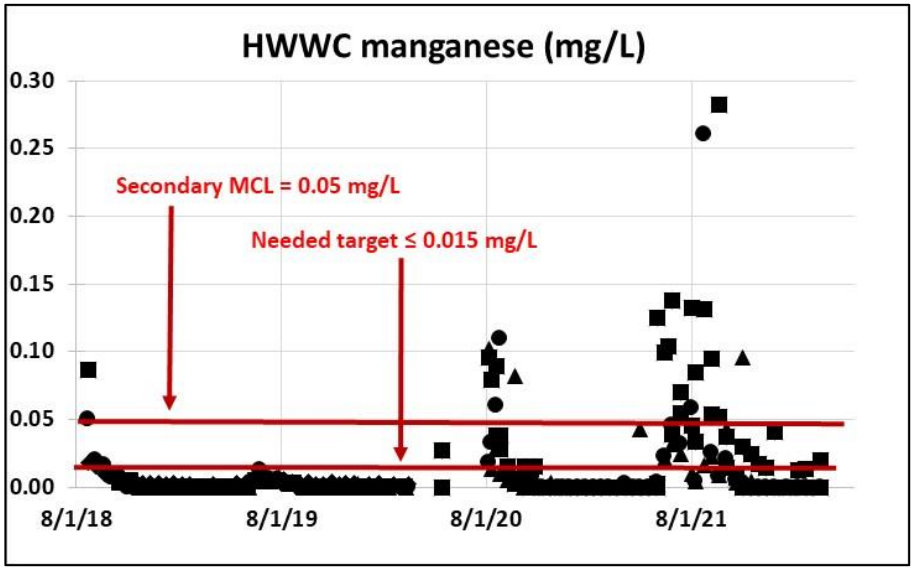
The prudent path would be to wait and see what data are in the next few quarters and years, and if the HAA situation raises its ugly head again sometime then perhaps consider action. But don't do it because a near once-in-a lifetime rain event (July 2021) changes the water quality for a short period of time and that has no health impact. I would consider that an unnecessary expense for the community. One shouldn't necessarily rush into capital projects as knee-jerk reactions to regulatory compliance issues like MassDEP is doing here. As is described further below, we used a common-sense approach with Lead and Copper Rule testing at HWWC and that worked out fine.

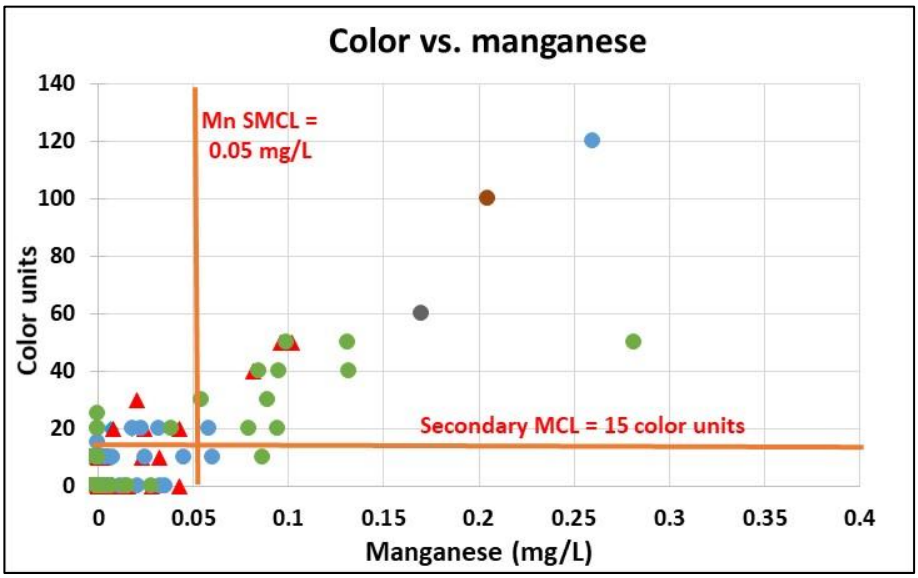
Manganese, iron, and water color:

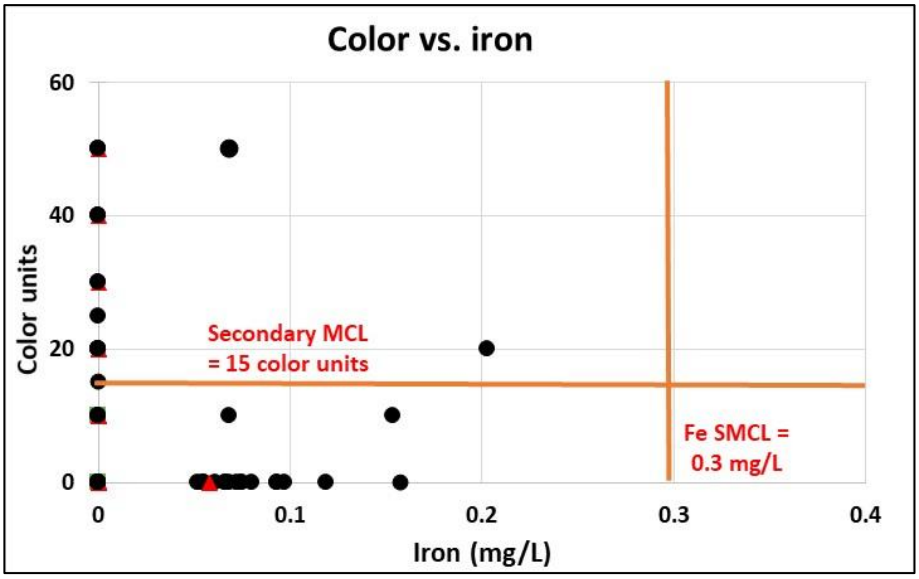
Manganese is naturally present in the environment, and is an essential nutrient for human health. The levels of manganese in HWWC's water are well below applicable health advisory levels, so there is no health hazard present from it. Manganese at these levels does not cause skin problems (if anyone blames a skin problem on this water, they are almost guaranteed to be wrong, so they should please consult a dermatologist if they haven't already).

Manganese release from lake sediments is primarily controlled by dissolved oxygen levels in the water. Anoxic conditions (no oxygen) cause particulate manganese to dissolve and be released from sediments into the water column, where it can then enter the intake and treatment plant. Dissolved manganese is colorless, but once it reacts with chlorine (used as a microbial disinfectant) it forms a precipitate that causes color in the water ranging from light yellow to dark brown to grey or black, and leaves a black or grey residue. I call it the horse of many colors. And manganese not only clouds the water, but can also cloud public perception.

Water quality data clearly show HWWC's colored water episodes are caused by seasonal spikes of naturally occurring manganese in the Long Pond source water. The below plot provides all of HWWC's manganese data (raw, finished, and distribution system water), showing spikes in summers of 2018, 2020, and 2021. That is followed by a plot illustrating the association between high manganese and high color.


HWWC manganese (mg/L)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Secondary MCL = 0.05 mg/L
Needed target ≤ 0.015 mg/L
8/1/18
8/1/19
8/1/20
8/1/21


Color vs. manganese
140
120
100
80
60
40
20
0
Color units
Mn SMCL =
0.05 mg/L
Secondary MCL = 15 color units
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
Manganese (mg/L)


Color vs. iron
60
40
20
0
Color units
Secondary MCL
= 15 color units
Fe SMCL =
0.3 mg/L
0
0.1
0.2
0.3
0.4
Iron (mg/L)

Manganese removal:

As good as HWWC's treatment system is, it is not a manganese removal system. And one is needed. Simple as that. It's an option for drinking water treatment that was not originally installed, and an option that was not paid for by the users.

As an analogy, this is like having a car without air conditioning, then complaining that it is too hot because the air conditioner isn't working. I certainly understand the complaining. I bought a car once without air conditioning, then drove around New Mexico and Texas during August. That was wayyyy too hot. So I then bought a car with air conditioning. The Housatonic community needs that air conditioner. Or in this case, a manganese removal system. And HWWC is working on installing one.

HWWC and the MassDEP:

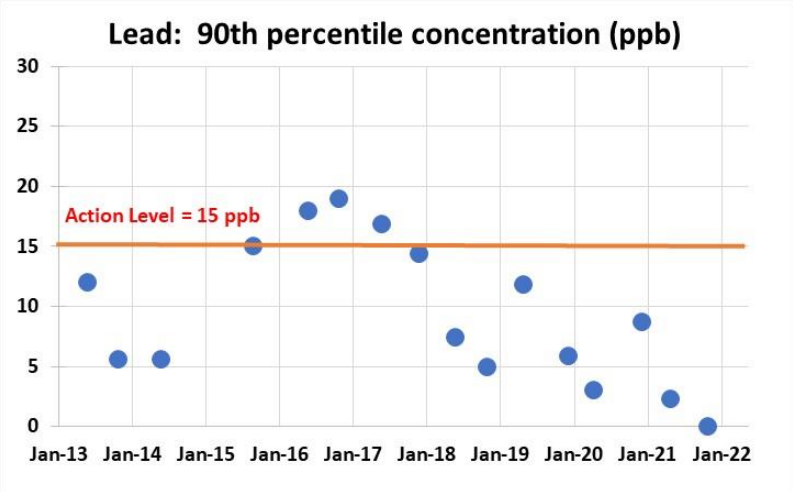
MassDEP has been very wrong about many aspects of the Housatonic case, from lead and copper control to disinfection procedures to the colored water problem. Perhaps their most damaging work was the Sanitary Survey inspection report issued on November 6, 2020. That will be addressed after first discussing interactions with MassDEP regarding corrosion control for the water system and then the colored water episodes.

Corrosion Control:

I was connected with HWWC in spring 2019 by a fellow water industry colleague who recognized similarities in our separate stories about concerns with MassDEP. HWWC reported they were uncomfortable with the corrosion control plan that was being required by MassDEP, and so I reviewed that as one of my short projects as a non-profit technical assistance provider. I still recall how horrified I was as a water scientist when I read the details… so many unwise, unnecessary, and potentially harmful requirements (see list in Appendix A). So much of the plan made no sense and would actually be harmful. They didn't even include the correct type of chemical. And they required a pH adjustment to levels already being experienced naturally, so it was unnecessary.

Review of the historical data suggested something was different with the lead and copper sampling during 2016-2017 (see plot on next page). Lead results had jumped up to above the Action Level, when usually they would stay the same or decrease over time as plumbing is further exposed to the water. And there are no known lead service lines in the community. HWWC had been informed by some of their customers conducting the sampling that they had inadvertently used faulty sampling procedures (water that was too old), which could explain the temporary increase in results.

Discounting those two sample sites (which haven't had high lead since correcting the sampling procedures), two of the three Action Level exceedances that had happened would not have occurred, and the remaining single lead Action Level exceedance would then be based on a single sample at one site having 17 ppb of lead instead of 15 ppb. That's two parts per billion in just one out of 200 samples over nine years. And the lead Action Level is not a Maximum Contaminant Level, is not even a health-based limit, and exceeding it is not a violation. So yes, that's technically going over the Action Level. But what's the clamor really about? Is that actually a real "problem" worth addressing? And is it really risk changing the water quality to solve that "problem"?



The Long Pond supply's natural pH and water chemistry is not very inducive to corrosion of piping and plumbing fixtures, and thus use of additional chemicals for corrosion control is not necessary. In the distribution system pH averages about 7.7, which is about ideal for corrosion control while maintaining chlorine disinfection effectiveness which is reduced at higher pH.

MassDEP's required corrosion control plan was going to be a case of doing something extremely badly that didn't need to be done at all. My plan was basically "*don't do something stupid and harmful when you don't need to do anything*". Though I didn't quite word it that way to MassDEP.

HWWC provided over 20 reasons to MassDEP why that particular corrosion control plan should not be implemented (list provided in Appendix A), but they disagreed with every single position made, writing *"MassDEP is not persuaded by any of the arguments put forth by HWW…"* (6/19/19).

When I discussed my conclusions with MassDEP staff, they emphasized "*it would be easier for us if nothing in the plan changed*", and they were still going to require it. I thought *"Really? That's the priority? Making things easier for them? Instead of simply not using their unnecessary and harmful plan?"* And that's not the last time I heard that from MassDEP.

MassDEP continued to insist HWWC do what they demanded. And what they were demanding would likely have been a big mistake for water quality, and indicated to me the MassDEP personnel simply do not understand corrosion control chemistry well enough to be designated with responsibility for overseeing it.

I advised HWWC to protect their customers and not implement MassDEP's required corrosion control plan. They agreed. That took courage, for there was sure to be backlash. I was proud of them. Looking back, resisting that horrible corrosion control plan was one of the better things I have done in my career.

MassDEP then fined the water company $5,000 as a result of not implementing their corrosion control plan (private water company or not, that was the customers' $5,000). Adding insult to injury, that $5,000 fine was in direct contradiction of the MassDEP regulation that says corrosion control treatment construction may be halted if a system doesn't exceed the lead and copper Action Levels for two consecutive monitoring periods. That regulation was intended to save customers money, as successful results are what count.

HWWC improved sample collection instructions, and now HWWC's results have been below the lead Action Level for nine consecutive 6-month monitoring periods (4.5 years). Per the regulations (310 CMR 22.06B(7)(d)4), those water quality results qualify HWWC not only for a reduced lead monitoring frequency

of annual sampling, but a reduced frequency of triennial sampling. HWWC also qualifies for a reduced number of samples for each sampling event. These regulations are in place to help save systems money.

Nonetheless, MassDEP denied HWWC's request to reduce the required monitoring frequency and number of samples based on their consideration of *"the system capacity, historic and current operations and historic and current water quality issues at HWWC"*, and the agency made that decision *"consistent with its authority under 310 CMR 22.00 and its implementation as a primacy agency, designated by the U.S. Environmental Protection Agency"* (letter dated 8/31/21) . So MassDEP creates imaginary issues, then uses them against the water system.

HWWC's latest monitoring results showed 19 of 20 sampling locations to be non-detect for lead. HWWC's inexpensive solution appears to have led to easily meeting the lead Action Level, and without adding additional chemicals or risking changes to water quality. And yet MassDEP continues to require much more monitoring than specified by the regulations, a decision inconsistent with how they treat some other water systems regarding the same issue of required monitoring frequency.

Investigating the colored-water episodes:

The first colored water episode that I heard about was from summer of 2018, and it drew plenty of attention from customers, the press, and MassDEP. I started working with HWWC in April 2019, and a serious color episode did not occur that summer. When the color water problem returned in July 2020, I was asked by HWWC to investigate.

I had suspected manganese as the culprit, and that seemed confirmed when HWWC's operator told me he'd seen yellow water coming out of the treatment plant, and the collected water quality data supported that. Sure enough – data from the first samples collected on August 22, 2018 had showed high manganese and low iron (plant effluent had 0.090 mg/L Mn compared to a target of ≤ 0.015 mg/L, while iron was not detected). After that August 2019 sample both the manganese and color were relatively low through the rest of 2019 and into early 2020. Sampling was then suspended during the early stages of the COVID-19 pandemic, and then resumed when the color episodes returned in summer 2020. Summer 2021 was particularly difficult for manganese in the water, as shown in the plot on page 24. The same data were available to both HWWC and MassDEP, and thus to the town's consultants if they requested.

Given the first data result from August 2018 combined with the nature of the water color, it should have been obvious to MassDEP right then that the problem was manganese and not iron. And all ensuing data for colored water samples have shown the same. So why have MassDEP and others been insisting that rusting iron pipes are causing the color problem? And why wasn't MassDEP paying attention to the very data they required to be collected biweekly ever since August 2018? Results that were "*expected to assist MassDEP in further understanding the system and any potential water quality issues*" (8/3/18 MassDEP e-mail).

Aside from identifying the problem as manganese, I also knew that MassDEP should have already known that. Normally I would gladly report the manganese conclusion to a state agency. But in this case, based on previous experience with MassDEP, I assumed they would likely deny what I said, and then HWWC's customers wouldn't get the manganese removal system that they so desperately need (recall MassDEP disagreed with every single one of my corrosion control ideas and positions…). Or at least that numerous and expensive unnecessary diversions would be required (as ended up happening anyway with the Sanitary Survey…).

So instead of submitting to MassDEP my conclusions about manganese causing the water color, I contacted my former colleagues at the Cornwell Engineering Group, who are highly regarded experts in water science and engineering. I figured it would be more difficult for MassDEP to question Cornwell given their national stature. HWWC was already interested in having Cornwell conduct an evaluation of corrosion chemistry, so they hired them to do that and to also present the manganese data to MassDEP. As expected, MassDEP accepted what Cornwell Engineering Group said in their 10/29/20 report about both manganese and corrosion control, as did the Town of Great Barrington's consultants. Now how about that.

And here's a bigger conundrum. MassDEP had various correspondences with HWWC about the colored water episodes in summer 2020, with the exchanges representing different views of the water chemistry and related factors, and MassDEP making some rather peculiar assertions.

- In response to customer complaints about the colored water, on 7/29/20 MassDEP requested responses from HWWC about the chlorine residual target range (and asked some rather peculiar questions), flushing protocol, and why HWWC hadn't yet installed pH adjustment to maintain a consistent pH and polyphosphate treatment to coat distribution system pipes.
- HWWC replied to MassDEP on 8/1/20 reminding of their position on corrosion control, defending the chlorine residuals, and questioning why MassDEP appeared to have contradicted themselves about the potential for chlorine to cause corrosion.
- On 8/12/20 MassDEP wrote to HWWC noting the recent distribution system chlorine residuals ranged from 0.24 to 0.41 mg/L, and that HWWC's stated target range was 0.2 to 0.5 mg/L. They wrote that *"Given the unlined iron piping and the current warm water temperatures, the upper range of the distribution chlorine residual goal: 0.3, 0.4, and 0.5 mg/L is too high. The high chlorine residuals are likely related to discolored water experienced by HWW customers."* They suggested HWWC try to maintain distribution system chlorine residuals between 0.05 and 0.2 mg/L.

  Not only is MassDEP's assertion an implausible theory that was contradicted by the available data, but it was a dangerous suggestion to lower the chlorine level any further, not only because of a potential lack of disinfection and getting positive bacteria results, but also because of the possibility of microbially-induced corrosion. Everyone in our industry knows to keep chlorine residuals in the distribution system ≥ 0.2 mg/L.

  MassDEP was wrongly trying to reduce disinfection protection in the distribution system in order to solve a problem (iron from pipes causing color) that they should have known didn't exist based on the very data they had required to be collected and for which the customers pay for. That's not good. Nonetheless, MassDEP required HWWC to again justify their chlorine residual goals.

- HWWC responded on 8/20/20, politely noting their target chlorine residual range is appropriate, is extremely common among U.S. water utilities, and should not be lowered, and questioned MassDEP's characterization that those chlorine residuals would cause discolored water.

We had dared to disagree… dared to be genuine. When sending that note on 8/20/20, HWWC staff and I wondered what kind of blowback we would get for it from MassDEP, given their history with us and with my other clients, and their reputation amongst the water industry. Apparently we would soon find out.

Two business days later MassDEP called HWWC to schedule the triennial Sanitary Survey inspection, several months ahead of schedule and during the COVID-19 pandemic (they weren't even working in their offices).

HWWC staff reported to me the first thing the inspectors said upon arriving was that "*it's going to be a harsh inspection*". Again, that's *before* they started inspecting anything on site.

MassDEP's Sanitary Survey inspection:

The Sanitary Survey inspection was conducted by MassDEP inspectors Douglas Paine and Michael McGrath on September 16, 2020, and the Sanitary Survey report was signed November 6, 2020 by Deirdre Doherty, Chief of the MassDEP Western Regional Office's Drinking Water Program. Ms. Doherty signed most of the correspondence from MassDEP discussed in this report.

I have been involved with quite a few Sanitary Surveys in different states during my career working at utilities and as a consultant. What follows is my evaluation of MassDEP's Sanitary Survey evaluation. I was taught what's good for the goose is good for the gander.

I always welcome and encourage a rigorous inspection that provides sound observations of current practices and helpful recommendations or requirements for improvement. Unfortunately, that is not what this Sanitary Survey report provided. Instead, I was both disappointed and troubled by how misguided and improper I found MassDEP's report to be.

In my opinion, the November 6, 2020 Sanitary Survey inspection report issued by MassDEP was one of the most unprofessional pieces of conjectural work I have encountered in my whole career. And, to make matters worse, this appears to have served as the primary source of misinformation about HWWC's situation, and I believe was conducted as an unwarranted act of retaliation by the MassDEP against the water company and me – and by extension by MassDEP against HWWC's customers.

The lack of subject matter proficiency apparent in MassDEP's work is startling for a regulatory agency overseeing public health protection. Key parts were based on sheer speculation, unsupported conclusions, and an inaccurate understanding of water science principles. Other parts were just flat-out wrong and contradicted what the inspectors were reportedly shown during the site visit. Furthermore, their approach to problem solving is both inefficient and wasteful, and included some unnecessary, ineffectual, and counterproductive requirements. Some of what they called "deficiencies" are actually good things, and some of what they directed to be done are actually bad things to do. There were also several examples of peculiarly shoddy observations about other more minor matters.

The Sanitary Survey's rating of HWWC's system as "*Conditional*" (not a good rating) was grossly unfair and unsubstantiated. At the time of the inspection there were no water quality issues at all other than manganese causing color. HWWC is up to date up on all the required planning documents, and has a top team providing independent professional assistance. Other than the manganese, which is not a health issue and which MassDEP is not regulating, there was really nothing legitimate for MassDEP to complain about HWWC or the water.

In my opinion, the Sanitary Survey included exaggerated and unfounded insults to HWWC's operations. The wording appears designed to disparage the water company's reputation by wrongly making them appear to be irresponsible and negligent, and to create angst amongst the water company customers.

Other MassDEP regional offices include regulatory reminders in a separate Reminder section of their Sanitary Surveys. This Sanitary Survey included some of those kind of reminders within the Requirements section, worded in a manner easily misconstrued as violations, making it look as though the water company hadn't been complying when it actually had been.

But my primary concern with the Sanitary Survey is that MassDEP suggested far too many different implausible causes of the colored water incidents, and required numerous actions that wouldn't have anything to do with the water color at all, and cost HWWC's customers money for minimal or no benefit. But it does help make MassDEP appear to be active in trying to fix the problem, and lays blame at the feet of the water company, giving a place for customers to direct their wrath about the water color.

After having been questioned in August 2020 by HWWC on their implausible position that the chlorine levels were causing the water color by corroding iron pipes, MassDEP speculated in the Sanitary Survey on ten other reasons they believed were causing the color. In my opinion those reasons were all conjecture by MassDEP that had nothing practically possible to do with the color. None of the reasons were based on any scientific data at all, and none of the required activities would actually be expected to help solve the color problems.

The many different theories postulated by MassDEP about the cause of the color and corresponding requirements for HWWC to implement are discussed in Table 2. Additional requirements that also really made no sense to be included in the Sanitary Survey are described in Table 3.

According to MassDEP, the occasional colored-water events in the distribution system may be caused by…

> *…"high" chlorine residuals of 0.3 to 0.5 ppm… or by aquatic vegetation in the source water… or by algae in the source water… or by elevated water temperatures… or the age of the treatment plant… or the operation of the treatment plant… or the filter cleaning method… or the age of the filter sand… or the storage tank… or the old distribution system pipes… or some pipe leaks...*

Whew! That's dizzying. That's not being thorough; that's just plain absurd. Not only are the corresponding action item requirements harassment and even abusive toward HWWC, but none of that would be effective at solving the colored water issues, and some of the requirements would likely cause new water quality problems.

In my opinion, this compilation of unsupported conjecture is a sign of an agency that doesn't understand some of the fundamental principles of the environmental processes they are regulating, and thus they don't know what's actually germane or important, and so they then request everything they can think of for HWWC to do, flailing around like a child trying to hit a piñata at a birthday party, instead of focusing on properly identifying the cause of the problem and implementing an appropriate solution. This suggests an agency that is trying to give an appearance of being active and authoritative in response to customers' complaints and the ensuing high-level political and public pressure, but that is not focusing on what's actually needed to solve the problem. And this suggests an agency deliberately trying to be aggressive and punitive toward a small community's water system, and ultimately toward its customers – the same customers they are supposed to be protecting.

MassDEP deliberately ignored all of the evidence about manganese being the cause of the color, and packed the Sanitary Survey with a long expensive list of pointless, harmful, and gratuitous requirements based on implausible theories and unsupported speculation about basically every step of the source to tap process. And the few of their required actions that do focus some on manganese (i.e., filter sand cleaning and storage tank cleaning for manganese) did not offer any likelihood of success based on the fundamental principles of those treatment processes.

Table 2. Comments on various MassDEP theories as to the cause of HWWC's colored water episodes, and corresponding requirements for HWWC per the 11/6/20 Sanitary Survey

#	MassDEP theory as to source of color episodes	Corresponding requirements from MassDEP (two are suggestions)	Will this solve the colored water issues?
1	Corrosion of cast iron pipe from "high" chlorine residuals of 0.3 to 0.5 ppm	Suggestion to reduce chlorine residuals to a range of 0.05 to 0.2 mg/L (from MassDEP letter 8/12/20)	*No*
	All the data collected show low iron, so that's not a factor. Further, this was a dangerous suggestion as those chlorine residuals are already low, and that is too tight and too low a range for full-scale practice.		
2	Vegetation or algae in the source water	Hire a consultant to conduct a study, or move the raw water intake further out into the pond to avoid color from plants	*No*
	Vegetation is minimal in this oligotrophic reservoir, and the low nutrient loading does not support algal blooms. *Moving the intake to a lower water level would likely result in lower dissolved oxygen levels and associated increases in dissolved manganese, thus worsening the color problem. That is common knowledge. There was a presentation 4/6/22 at the NEWWA conference in Worcester, MA about controlling color by modifying an intake to access shallower water for the higher levels of dissolved oxygen and corresponding less manganese.* *The required consultant's report was completed by Water Compliance Solutions, LLC.*		
3	"Coincides" with elevated temperatures	Suggestion to move the raw water intake further out into the pond for cooler water	*No*
	This would be harmful and not beneficial. Dissolved oxygen is the controlling variable for manganese fate and transport, not temperature (though temperature can affect D.O.). For example, summer 2019 was hot and there was no significant spike in manganese. *Moving the intake to a lower water level would likely result in lower dissolved oxygen levels and associated increases in dissolved manganese, thus worsening the color problem.*		
4	Treatment plant age	Not specified, but the repeated comments about age imply a suggestion to build a replacement treatment plant	*No*
	Treatment plant age has nothing to do with the colored water events. It's a concrete bunker with a sandbox.		
5	Treatment plant operation	Not specified, but may refer to filter sand cleaning methodology	*No*
	Slow sand filter systems do not have any operational controls, and this plant is not designed for manganese removal.		
6	Filter cleaning method	Replace hydraulic harrowing with traditional surface sand scraping method (since the filters "*may not be removing manganese or organics… which are then washed through the filters*") Assess hydraulic loading rates and filter-to-waste capability	*No* *No*
	This is not a helpful change, as the hydraulic harrowing method is better than the more traditional manual surface scraping. Slow sand filters are not capable of much dissolved manganese removal. Any manganese bound to the filter would be in oxidized particulate form (Mn^{4+}), as dissolved manganese (Mn^{2+}) would flow right through. The only way for the oxidized manganese to convert to dissolved manganese would be for the filter water to become anoxic (devoid of dissolved oxygen). Given the filter operates microbiologically, if that happened (which it won't), then there would be much bigger problems than a release of some manganese. *A filter evaluation was completed by Water Compliance Solutions, showing no problems at all.*		

Table 2 (cont.). Comments on various MassDEP theories as to the cause of HWWC's colored water episodes, and corresponding requirements for HWWC per the 11/6/20 Sanitary Survey

#	MassDEP theory as to source of color episodes	Requirements from MassDEP	Will this solve the colored water issues?
7	Filter sand	Replace the sand (since "*iron and manganese … may now be impeded in the filters*")	*No*
	Both theory and data disprove that claim, and thus replacing the sand is not necessary. In fact, no iron at all has been detected in the finished water, and manganese is usually not detected except for when it increases in the Long Pond source water. *More importantly, the slow sand filters operate primarily through microbial activity compared to physical straining by the sand. So removing the sand would be throwing away the existing, well-established (> 25 year) bacterial population living attached to the sand that are the real treatment system. This is not like a larger system's rapid sand filters that need to be backwashed. This sand stays in place and doesn't move, making it nearly a steady-state operation as far as filters go.* *Replacing the sand would result in worse filter operation, as a new bacterial population would need to be cultivated before the filter effluent could be used for drinking water, and even if the filters ripened well and turbidities settled down to previous levels there may not be as much organic matter removal for a long time, possibly resulting in increased formation of disinfection byproducts.*		
8	Storage tank	Inspect and clean the storage tank	*No*
	The tank is inspected regularly, but there hasn't been very much solids to remove from the bottom. The tank was inspected and cleaned again, which stirred up the Mn that had precipitated and settled harmlessly to the bottom of the tank, resulting in customer complaints about colored water.		
9	Pipe age and condition	Prioritize pipe replacement in the Capital Improvement Plan (CIP)	*No*
	Iron from pipes is definitely not the issue. The current CIP should instead prioritize the manganese removal system. Replacing pipes would remove any residual legacy manganese in those areas, but that's not the primary source of manganese, and pipe cleaning would be a much less expensive option if that is needed in the future after a treatment system is operational. *The pipes may be old, but they seem in good condition based on a low main break rate, low leak rate (unaccounted for water), and per visual inspection of pipes during repairs. So that's a good thing – the pipes are holding up well, and some could last for many more years to come. Pipes lasting longer than their expected life is a good thing, isn't it? Age alone is not necessarily a reason to replace pipes, and pipes are affected differently by different soil conditions. The expected life is just a prediction, and pipe replacement priorities should be based on data and evidence of problems.* *For the pipes, I'd recommend nothing more than a standard phased preplacement plan, and prioritizing improvements which potentially might be needed to improve pressures and hydrant flows during fires.*		
10	Water leaks	Conduct leak study	*No*
	HWWC's leak rate is very low at only ~2.8% unaccounted for water, which includes all flushing. Leaks would flush out water and thus could improve water quality.		

Table 3. Other select unnecessary MassDEP requirements from the 11/6/20 Sanitary Survey

1. MassDEP issued a violation, claiming regulations require installation of a combined filter effluent turbidimeter, and ordered one be installed.

The regulations do not require online monitoring of combined filter effluent turbidity at slow sand filtration plants, and I provided the specific regulatory reference to the inspector before the report was completed. A single daily grab sample is sufficient for slow sand filters, as is done at some other plants under MassDEP's jurisdiction. HWWC already monitors both individual filters continuously, and the filters are basically totally reliable since there is no backwashing. A CFE turbidimeter is just not needed and would be a waste of money.

2. Operator must spend at least two hours on site at the treatment plant.

This is a regulatory reminder worded in a manner that may imply to some readers the rule isn't followed, which I'm told it is. Adding injury to insult, this is a horrible rule that wastefully costs communities lots of money as it doesn't take nearly 2 hours each day to check the chlorine pump and instrumentation. And for automated plants where the requirement is 8 hours per day, the job may take only an hour or two at most, and then the rest of the operator time may be idle.

3. Update its Emergency Response Plan (ERP), and submit to MassDEP with a new Emergency Response Plan Compliance Checklist

The ERP was already up to date as required, and was updated again, as it is every year, as required. This is another regulatory reminder worded in a manner that may imply to some readers the rule isn't followed.

4. Install a chlorine residual SCADA alarm

This alarm was already in existence at the time of the MassDEP inspection, and was reportedly shown to the inspectors by the operator.

5. Provide written notice that the raw water and POE taps have either been replaced or adapted in a manner that results in a dedicated unthreaded tap for sample collection only

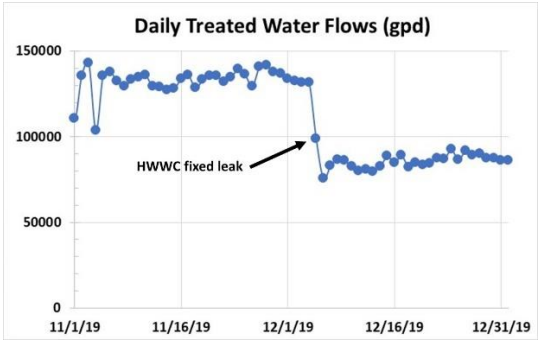
No action taken, as both sampling taps reportedly shown to the inspectors were already dedicated unthreaded taps, and that was visibly evident.

6. Install a raw water high turbidity SCADA alarm

There is no online raw water turbidimeter to have an alarm for, and one is not needed in terms of either regulatory requirements or operational need.

7. Reported unaccounted for water during the last three years was 35% - 42%. Submit a detailed action plan for unaccounted for water (UAW).

MassDEP ignored data provided to them that showed a major leak was fixed on 12/5/19 which reduced the 10-day average demand by 39 percent. Since then, unaccounted for water (unmetered water) has averaged a very low 2.8%, and that counts all flushing water. With water loss that low there is no need for a UAW plan, and water loss that low would be hard to find. MassDEP had been informed of the pipe repair and corresponding change in flow rates long before the Sanitary Survey, but neglected to incorporate that important information into their findings.



By using this blanket strategy, MassDEP diverted time, attention, effort, and funding away from implementing an effective solution for the colored water episodes, and directs blame on the water company. This approach is especially difficult for small water systems such as HWWC, who have a very limited customer base to share in the associated expenses, and very limited staff available to oversee or conduct the required tasks. It is neither appropriate nor practical to ask a small water system to do so much unnecessary work.

Those requirements unnecessarily cost the customers of HWWC money. I would know, as I earned some of that myself on work that was required by MassDEP but was neither necessary nor helpful. Frankly, I make a living from MassDEP's mistakes and harassment of small communities. But it's disturbing and stressful.

Problems such as the colored water episodes must be fixed right, so money isn't spent on unrelated hypotheses that won't solve the actual problem. Misdirection can be very costly in terms of money, time, effort, and emotions.

While MassDEP claimed that their Sanitary survey report was completed prior to them receiving the Cornwell Engineering Group report, the MassDEP report was dated November 6, 2020 while they received the Cornwell report earlier on November 3. Also, I spoke with one of the MassDEP inspectors on October 26, discussed the data and my conclusions about manganese causing the color, and told him the Cornwell report would be submitted to MassDEP soon and would confirm the same.

Why didn't MassDEP consider my perspective on the manganese, or consider the Cornwell report's results, prior to issuing their Sanitary Survey report? And why didn't they evaluate for themselves the data they had required to be collected biweekly for the previous two years? What were they collecting those data for?

I believe it appears MassDEP either didn't review or didn't understand the data collected for them, wanted to look like they were doing something, and wanted to appear tough to the community, officials, and the press. And so they threw all that nonsense into the Sanitary Survey.

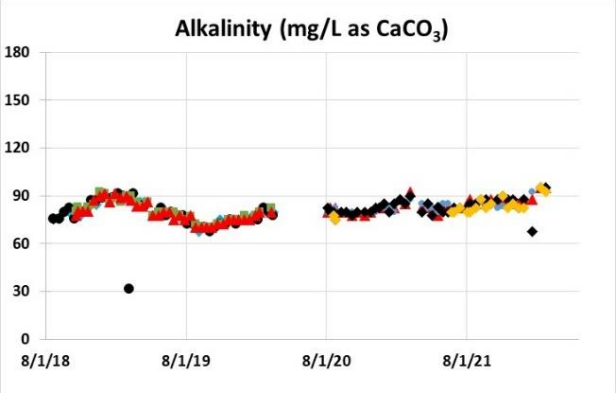
So HWWC made the observations, compiled data, and completed evaluations as MassDEP had requested in the Sanitary Survey, but without complying with those directives that would have harmed the treatment system or water quality, such as throwing away the perfectly good slow sand filter media. MassDEP accepted the conclusion that manganese was a cause of the color, but still required that an emphasis be placed on spending money to replace the iron pipes in the distribution system to solve the color issue.

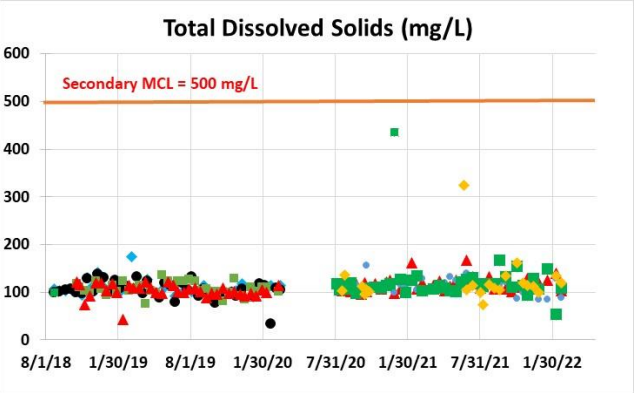
Wasteful data collection:

Does anyone have concerns about water rates? Check this out…

While some of the monitoring data required to be collected by MassDEP since August 2018 were definitely helpful for indicating the color was caused by manganese and not iron, that information could have been easily ascertained via substantially less monitoring by focusing on collecting data for the relevant parameters and for samples that have the objectionable color. With MassDEP, that monitoring program is still going on after nearly four years, extremely inefficiently, long after the need is over.

As one specific example, the requirement included laboratory analysis of alkalinity (acid neutralizing capability) and total dissolved solids (TDS) for each sampling event. While those can be important parameters for certain circumstances, neither alkalinity nor TDS would relate to the color. And yet the water company has now paid for (meaning the customers have now paid for…) a total of 284 TDS samples and 277 alkalinity samples.





At $20 each (2019 prices), that's a total of $11,220 to measure 561 samples for two parameters that have no bearing on the color issue, that never change substantially over time (see plots above), and that even if they did change there wouldn't be a response action to take no matter what the data results were (i.e., it's "nonactionable data").

Congratulations Housatonic customers! You are the proud owner of a multitude of expensive water quality data that are of no use to anyone at all! Please excuse the sarcasm, but I resent seeing small system customers' money being wasted away like that by MassDEP.

And that waste continues to this day. What does MassDEP gain from this? What do they expect to learn from the 285th analysis of total dissolved solids? Wouldn't it be better for that $20 to go toward a manganese removal system? An equally effective monitoring program could be implemented at a vastly lower cost if only MassDEP would agree.

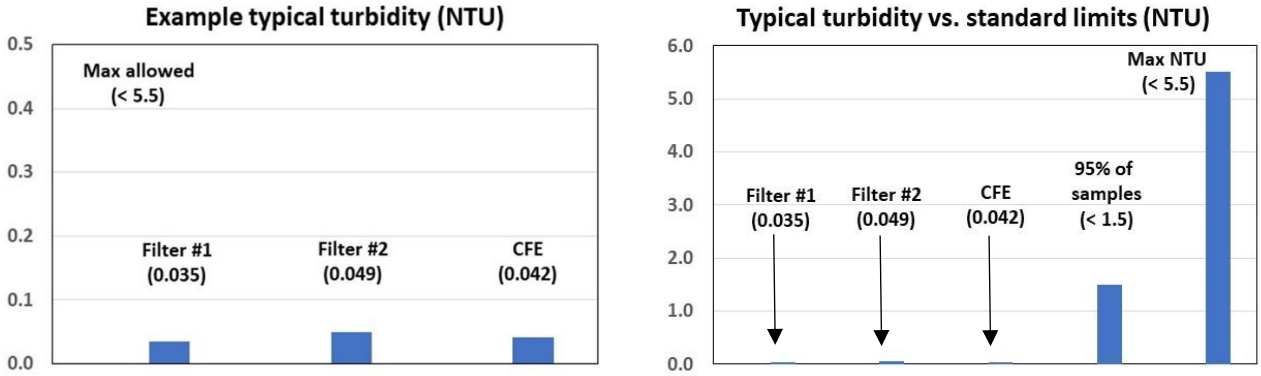
Another 'extra' cost for the customers is that whenever a customer complains to MassDEP about the water color, MassDEP requires HWWC to sample that water and write a report summarizing an investigation into the cause. If there was a different type of complaint I'd agree that should be investigated promptly. But for these ones I just want to shout out to MassDEP that "*It's the manganese! It's still the manganese! Tell them it's the darn manganese!"* every time they ask HWWC to spend more of the customers' money confirming what is already known. A phone call to the customer with the explanation would be an appropriate initial response prior to possibly incurring additional expense for sampling.

As a third example of MassDEP trying to squander the Housatonic community's money, it was disconcerting to see MassDEP claim in the Sanitary Survey that an online turbidity meter was required for the combined filter effluent (CFE). I spoke with one of the MassDEP inspectors on October 26, 2020, almost two weeks before the November 6, 2020 Sanitary Survey was completed. I reminded him about the specific MassDEP regulation that exempts slow sand filter systems from the CFE monitoring requirements. Yet MassDEP still went ahead and made that incorrect claim about their own regulations, and wrongly accused HWWC of a violation of the Safe Drinking Water Act.

While there are other systems with slow sand filters in MassDEP's jurisdiction that are allowed to take just one turbidity grab sample per day, HWWC has online instrumentation for each individual filter, which is better than just measuring the combined filter effluent, leaving that option redundant.

As a practical matter aside from the regulatory question, typical turbidity results for HWWC's two filters are about 0.035 and 0.049 NTU, and the regulatory limits are effectively at < 1.5 NTU for 95% of samples (i.e., limit of 1 NTU after rounding) and < 5.5 NTU at all times (i.e., limit of 5 NTU after rounding). The above plots show how these levels compare relatively.

Do they really need to buy a CFE Turbidimeter??



CFE = combined filter effluent (basically an average of both individual filters)

So do the customers really want or need to pay to install and maintain a third turbidity monitor to find the average of the two filters is 0.042 NTU? Do we really need to measure that? Especially given the results are so far below the standard limit? For a system that is not at all prone to upsets? And when it's not even actually required by the regulations??

HWWC and I resisted this unnecessary expenditure. That's what good water managers and operators do. They do what is necessary and appropriate to ensure the water is safe, and they don't waste money on things that really aren't helpful. It's knowing that difference where the skill lies in this business.

Impact of the MassDEP Sanitary Survey:

The substandard and misleading work presented in MassDEP's Sanitary Survey was then repeated by the Town of Great Barrington's consultants and assigned exorbitant price tags. The first consultant (AECOM) assumed MassDEP was correct, and the second consultant (DPC Engineering) assumed that both MassDEP and AECOM were correct. Poor assumptions piled on even worse assumptions. The Housatonic community and the drinking water industry deserve better than what was done here.

I consider neither of those consultant reports to be sufficiently valid for basing any decisions for actions or expenditures. My specific observations and critiques are presented in Appendix B for the AECOM report and Appendix C for the DPC Engineering report.

In my opinion, MassDEP's 11/6/20 Sanitary Survey was a misrepresentation of reality. It appears to have been written with the intent to make HWWC appear as bad as possible, when that is not at all the case. And then in 2021, with manganese levels spiking and producing the resulting color, the November 2020 Sanitary Survey took on a life of its own, being amplified and misrepresented by resident advocates and copied by the town's consultants and turned into a $31M recommendation, without even minimal vetting of MassDEP's statements and allegations or review of HWWC's comprehensive and rigorous responses.

And that's a large part of the reason for the misconceptions and angst in the Housatonic community about HWWC and its water.

Customer Petition to Governor Baker:

As an example of some of those misconceptions, a petition has recently been circulating Housatonic that requests Governor Baker provide relief for their perceived problems with the water company and water quality (a copy of the petition is provided in Appendix D). The petition called HWWC's situation "*a disastrous public health crisis that needs swift attention after being stalemated*", claimed there were MassDEP violations related to "*poor management processes, unremedied systems, and lack of investment over a long period of time*", noted "*the Town has spent an enormous amount of time, money and efforts to understand the issues*", and requested an "*eminent-domain takeover of HWWC"*, along with funding "*for relocating the four-foot deep lake draw, a new filtration system, and a staged pipe replacement"*.

Each part of that is either an inaccurate statement or an unwarranted action (except for needing a new filtration system for the color issue). Here's why…

1. The existing filtration system consistently provides excellent results for removing microorganisms, particles, and natural organic matter. While it does not need to be replaced, it is not designed for manganese (Mn) removal. So a new manganese removal system is definitely needed, whether it complements or replaces the current filters.
2. There is no public health crisis at all as defined by any sense of science or regulation. Some of the water is sometimes colored and ugly. That's an upsetting inconvenience, but not a health hazard. I understand the strong feelings, but it's just not factual to call it a health hazard and even MassDEP agrees on that.
3. The situation is not stalemated, as progress is being made on designing a new treatment system to remove the manganese.
4. The sole cause of the color (Mn) has been known since 2020, and HWWC has well publicized this fact. I believe the town's consultant reports were not necessary, as is explained below.
5. MassDEP issued two violations against HWWC in the most recent Sanitary Survey. One was not correct (the CFE turbidimeter; details on pages 35-36), and the other was for not reporting a change in the Secondary Operator (backup operator) within the required 7-day time frame for notifying MassDEP. A minor clerical error, that's all.
6. Changing the utility ownership will not change the water chemistry – and that is where the problem is. Changing ownership would only slow down the process of designing and constructing the needed new treatment system. As a private water supplier, HWWC is able to move much faster at getting this done than the Town of Great Barrington could do, and have teamed with top expert professionals to best resolve the issue.
7. Moving the intake to deeper water would likely result in lower dissolved oxygen concentrations and greater release of manganese from the sediment – thus INCREASING the color problem. And with a manganese removal system paid for and installed, it wouldn't matter where the intake was located since the manganese would be removed anyway. So with manganese removal treatment impending, there's no reason to spend customers' money studying lake chemistry dynamics or moving an intake.
8. Since iron is not causing the color, iron pipes do not need to be replaced for that purpose. Instead of solving the problem, that would instead misdirect limited customer funds. HWWC already has a staged pipe replacement program anyway, and will soon be updating the pipe replacement and related priorities based on results from hydraulic studies to best ensure adequate fire flows at all locations in town.

It seems apparent that whoever wrote this petition to Governor Baker is familiar with either the 11/6/20 MassDEP Sanitary Survey or the town consultant reports that summarized the Sanitary Survey, but did not consider HWWC's response to MassDEP. That response convincingly countered MassDEP's many unsupported speculations about the color. I have not seen any evidence that the local press reviewed and reported on that response either. The devil is in the details.

People are angry that the water sometimes has color – I get that. But to be true advocates one needs to think beyond the surficial commentary provided by MassDEP and the town's consultants because sometimes it's just plain unsupported nonsense.

Conclusions for Housatonic:

Other than the periodic spikes of manganese that cause episodes of colored water, all indications are that HWWC's water quality is excellent. The color is caused by oxidized manganese, and by nothing but manganese. Manganese is naturally present in the environment, and is an essential nutrient for human health. While the levels of manganese in HWWC's water are at times problematic from an aesthetic viewpoint, it is well below applicable health advisory levels.

Housatonic took a sound scientific and data-driven approach to identifying the cause of the colored water, and has received approval from MassDEP to conduct a pilot study of a proposed oxidation/filtration system for manganese removal which is expected to commence this coming summer (an alternative oxidation/ filtration technology is currently being considered). HWWC has provided good water other than the unavoidable manganese, and within a few years that problem will be solved with a new manganese removal system.

The water company continually fine tunes its operations, and they use independent professionals to support numerous data collection and evaluation activities. HWWC has insisted on independent expert assistance and evaluations for all technical aspects of their operations, and has followed sound advice. I know of no other small water system who has hired as good a group of independent experts as HWWC has. And yet HWWC has been continually harassed by MassDEP's actions, which have unnecessarily cost a lot of money with no or minimal benefit.

HWWC has for years invested in the water treatment plant, a new 1.1-MG storage tank, and pipe replacements, often against opposition from customers and the town. First it's "*don't spend our money!*", followed later by "*you didn't invest in our infrastructure!*" While that's just the way it is, it still leaves HWWC stuck between the proverbial rock and a hard place. It seems to me that HWWC is damned if they do and damned if they don't. Recall that the color issue has nothing to do with investing in the distribution system, as it's a new treatment system that's needed.

It will cost some money to design and build a manganese removal system for the community's water supply. And HWWC already has the financing to get that done. And it will likely cost some more money to install another elevated storage tank or some larger piping in select areas to help improve fire flows in the few areas of town where that is needed. This will be accomplished using a sound scientific and data-driven approach, and it won't cost anywhere near $31M, and perhaps less than a tenth of that. That's still a very large investment for a small community such as Housatonic, but at least it will be an appropriately targeted and effective investment.

The overriding obstacle to success here is neither technological nor financial, but instead is needing to persevere against a campaign of misinformation that has clouded the issue in the public's mind. And it's a campaign of misinformation that doesn't stand up to any degree of scrutiny. Switching ownership to people

who want to implement ineffective solutions without understanding the chemistry or even properly evaluating the available data would not be a helpful idea.

Don't people make phone calls anymore? If anyone had called me, I'd have been glad to provide the straight story and answer any questions about the water quality. I wasn't hiding anywhere. HWWC gave several public meetings over the past two years where I presented water quality data, discussed treatment goals and performance, and answered whatever questions I could that were asked.

The water company remains committed to keeping its customers informed about their water system and water quality. They have sent information notices to customers, and continue to hold public meetings where concerns and questions may be addressed in a public forum. Those meetings may be used by those interested to discuss the water chemistry, treatment approaches, regulatory compliance, and project scheduling.

If someone has a specific water quality question, I encourage them to contact the water company and inquire. Any HWWC customer who would like to discuss the water quality with me directly may simply let the water company know (413-528-1780; housatonicwater@gmail.com) and provide their contact information and I will get in contact with them. We can talk over the phone, or have an individual or group meeting via Zoom where we look at data together.

After hearing AECOM's presentation to the Great Barrington Selectboard on July 12, 2021, I telephoned in during the time the Selectboard said the public could ask questions, but once I mentioned working as the water quality consultant for HWWC the Chair changed the rule to allow only Great Barrington residents to speak that night instead of the general public and would not let me speak. That seemed odd, since in my role I should know more about HWWC's water quality than anyone. If they're investigating the water, you'd think they'd want to know what I was going to ask or say. HWWC subsequently held a public meeting in October 2021, and we discussed water quality and answered questions. And yet these misconceptions still exist.

So I am disappointed and frustrated at the misconception of these issues by some HWWC customers and by the leadership in Great Barrington. While the local press have at times covered some aspects of this situation fairly well, the lack of deeper investigative reporting has been disappointing, and an authentic description of the water quality and related issues has not yet emerged from their work and publications.

I do not believe there was any need for the Town of Great Barrington to hire the two consultants for this situation or to consider an eminent domain takeover of the water company, excepting for their faithful reliance on a perceived conclusive dependability on MassDEP's information and decisions. After all, MassDEP staff are supposed to be "the experts".

Too many people appear to assume that everything MassDEP says or writes should be believed, and that's just not the case. MassDEP's reputation about the issues I've described is widespread in the drinking water industry. One needs to dig deeper than the first level of superficial commentary from MassDEP or the town's consultants to find the real story about HWWC's water quality. Actually look at the data, and evaluate it based on proper water chemistry principles. The devil is in the details, so to speak.

It shouldn't be this difficult. Housatonic has a pristine source water, with a very simple but highly effective treatment system (a sandbox and bleach pump). Except that it doesn't remove dissolved manganese. Yet. That capability will be added in the near future, and should prevent the color episodes from happening.

Millville Elementary School case study

Millville is a small town with a nontransient noncommunity (NTNC) system that uses a single well to provide potable water for an elementary school. Treatment is focused on iron and manganese removal via greensand filters (with the necessary preoxidation using chlorine). The water also has high total organic carbon (TOC) and has had disinfection byproduct (DBP) issues when the chlorine dose for the greensand filter gets too high.

The school has premise plumbing in one building only, with no distribution system to any other customers, not even a small neighborhood. And, according to the school, the water has not even been used for drinking for several years. I'm told they got spooked by some of those scary-sounding DBP violation notices that MassDEP requires water systems to send out after an MCL exceedance, even though the situation was extremely short-lived (one high sample can result in four quarters of violations and required public notices).

Subsequent to a DBP violation (due to a short-term increase in the chlorine dose), MassDEP directed the town to lower the chlorine residual target and dose. Lower chlorine levels then led to failure of the greensand filter and corresponding breakthrough of manganese and iron (both of which would be expected if chlorine levels were too low). The better solution to the DBP spike increase would be to maintain the chlorine target for the greensand filter effluent at 0.5 mg/L to ensure its proper operation, while doing better operationally to prevent the chlorine level from getting too high out of the target range.

My first experience with the client involved discussing MassDEP's insistence that they should connect the school to another water system in a neighboring town a few miles away to solve the DBP problem, and the town was considering approving that night $50,000 from their budget for an engineering study to assess the practicality of such a connection. Then if the project were to go forward, it would cost a few million dollars to lay the new pipeline. All to solve a short-term increase in DBPs?

But even if treatment for DBPs was needed for the well water at the school, two canisters of granular activated carbon no bigger than the size of a person would do the job adequately for removing total organic carbon (TOC). That's basically something Culligan could install, and for less than $50,000, let alone millions of dollars. I recommended to the client that they withdraw their request to the Town Board for the $50,000, and that money was saved.

Water Compliance Solutions, LLC completed an evaluation of the DBP compliance plan and data, and provided Millville with a report on January 30, 2020. That report was forwarded to MassDEP, and followed several good reports from the contracted operations firm that had been supplied to MassDEP as part of an ongoing dialogue.

MassDEP conducted a scheduled Sanitary Survey inspection on February 19, 2020, and the Sanitary Survey report was issued July 30, 2020. The Sanitary Survey was unusually extensive – much more so than previous ones conducted by the same MassDEP office for the same water system – and I saw no valid reason why they made it so inordinately extensive.

In my opinion the excessive effort required by both MassDEP and the town's consultants wasted substantial time and money for little gain. MassDEP appeared misinformed about some of the treatment system dynamics, and included things they should know are not correct or true. **In my opinion, MassDEP did not appear to be motivated to really help the water system, and instead appeared to be harassing and punishing them with unnecessary requirements in the Sanitary Survey, with excessive water quality monitoring requirements, and with numerous requests for standard operating procedures (SOPs).**

Water Compliance Solutions, LLC recently reviewed the water quality monitoring program for the elementary school, and found **the laboratory analytical costs alone add up to an astonishing $36,138 per year.** And that does not include operator and consultant time to collect and process the samples, or to compile, manage, interpret, and report the resulting data.

Almost $32,000 of that cost (88%) can be attributed to having a number of redundant sampling locations and some excessive sampling frequencies for some very costly chemical analyses. Neither the water chemistry nor MassDEP regulations necessitate those extra monitoring requirements. A more appropriate sample schedule for this drinking water system should cost about $5,000 per year.

Water Compliance Solutions, LLC identified over $14,000 in annual analytical costs that could be saved by eliminating some non-regulatory samples the consulting operator was collecting, most of which were essentially duplicating other locations. **Over $17,000 of the remaining annual analytical costs are for data required by MassDEP for this specific system that goes beyond the standard monitoring requirements** specified in 310 CMR 22.0, and which I believe add no value for operational or regulatory compliance purposes.

With the over-the-top monitoring requirements, MassDEP is taking money away from the schoolchildren's programs for no good reason or real benefit. I recommended more focus be made on interpreting data and less on collecting samples. The town submitted a letter request from Water Compliance Solutions on March 14, 2022 to the MassDEP discussing the water quality data and requesting a decrease in the unnecessary monitoring costs. They subsequently received a phone call from the MassDEP Regional Director who said April 5, 2022 they would be sending a letter agreeing to an unspecified amount of reduction in the monitoring requirements. As of the date of publication of this case study (May 1, 2022), that letter has not been received by the town so I cannot yet report on what was decided.

Chester Water Department case study

The Town of Chester Water Department (PWSID #1059000) provides ~44,000 gpd to ~245 service connections and ~750 people using one of two available surface water sources and a treatment system with slow sand filtration, chlorine disinfection, and pH adjustment with sodium hydroxide. Chester's treatment plant has been rated by MassDEP as a II-T facility.

Regulatory compliance:

Chester exceeded the total trihalomethane (TTHM) Operational Evaluation Level (OEL) limit for the 2nd quarter of 2018. In response to that, the Chester operator wrote to MassDEP on May 29, 2018 indicating he needed help with identifying the cause of the widely varying chlorine and pH levels, both of which can adversely affect THM formation. On June 5, 2018 Chester wrote to their elected officials complaining about the lack of technical support that their water department had been receiving from MassDEP compared to previous years. That did not go over well with MassDEP. MassDEP responded on July 6, 2018, defending their giving less technical help than before. MassDEP had made a visit to Chester's plant, but otherwise said no to giving the technical support they had done previously. The problem of the widely varying chlorine and pH levels still persists to this day.

In early July 2018, the new Town Administrator submitted the required annual Consumer Confidence Report (Annual Water Quality Report) and certification to MassDEP. Apparently, the Administrator had mailed out the certification by the due date when it needed to be received by MassDEP by the due date. For that 'rookie mistake', MassDEP's issued a violation (Notice of NonCompliance) that stated in part:

> *"If you, the supplier of water, fail to take any action MassDEP wants you to take by the prescribed deadline, or if you otherwise fail to remain in compliance in the future with the applicable requirements, you could be subject to legal action, including, but not limited to, criminal prosecution, court-imposed civil penalties, or civil administrative penalties assessed by MassDEP."*

That sure is overkill. The Administrator was understandably upset to be so accused and threatened when they were just trying to do their new job right.

Then, in the 3rd quarter of 2018, Chester exceeded the TTHM Maximum Contaminant Level (MCL), after six years of no MCL exceedances for either TTHM or HAA5 since the beginning of the Stage 2 D/DBP Rule.

The Chester operator sent MassDEP some notes about the DBP violation, but did not complete the necessary DBP compliance forms or evaluation. To complete the overdue DBP evaluation required for submittal to MassDEP, Deirdre Doherty of MassDEP recommended to Chester in December 2018 that they use me (as RCAP Solutions) for the evaluation, based on the good quality of the DBP evaluation I had done for Monroe. MassDEP often would allow RCAP Solutions to fulfill that role even though it wasn't completed by a licensed Professional Engineer.

I completed an evaluation on June 27, 2019 and provided four (4) low-cost recommendations related to operational control of DBPs, along with another seven (7) operational recommendation that could also help, all without needing a capital project. Chester submitted the report to MassDEP. Then not much was heard from MassDEP about my 6/27/19 report over the past two years until July 2021 (see below).

One extended disagreement between Chester and MassDEP was over the classification of Chester's water treatment plant, which determines staffing and licensed operator requirements. MassDEP misclassified the Austin Brook treatment plant's classification as a II-T facility when it should have been a I-T, and then when questioned about it refused to correct the classification. That situation is a story on its own, described separately in the last part of this case study.

On February 18, 2020, MassDEP completed a Sanitary Survey inspection report, which the operator did not satisfactorily reply to. In July 2020 Chester hired Water Compliance Solutions, LLC to complete the overdue compliance requirements related to the Sanitary Survey (including an asset management plan and distribution system operations and maintenance plan) and some DBP Operational Evaluation Level (OEL) forms, along with a Strategic Plan for the water system's near future and an evaluation of water quality and disinfection treatment. All of the required plans and forms were completed, bringing Chester into compliance with those issues, following some relatively minor follow-up.

Water Compliance Solutions' 3/31/21 treatment and DBP evaluation:

On March 31, 2021, Water Compliance Solutions, LLC completed a treatment system and DBP control evaluation that happened to observe various mistakes MassDEP had made about monitoring requirements, chlorine chemistry and DBP control. It also noted several key yet simple operational issues that MassDEP had missed in their oversight of the system, including disinfection compliance determination and reporting (e.g., minimum daily chlorine residuals not being reported), treatment system data management (e.g., no SCADA trends at all, and no storage of historical data), and several other topics.

It's very concerning how much MassDEP has missed at Chester. They get into picky and imagined details with inspections at some facilities, but then repeatedly missed or ignored very serious and readily obvious problems with Chester's operations.

The report also illustrated the wide variations in pH and chlorine levels that have been allowed at Chester for years. Also, the existing GAC filter was shown to have no observable effectiveness, and in theory would be expected to remove only ~6% of TOC with all three filters operating (~0.2 mg/L for an influent TOC of 4.0 mg/L).

Perhaps most importantly, literature citations and data I collected showed MassDEP's earlier directive to move much of the chlorination to after the clearwell when the pH is raised actually increases formation of THMs instead of decreasing them. That mistake in chlorine feed location was likely enough to cause the relatively minor DBP violations that had occurred. It also meant that fire hydrant flushing needed to be limited to just a few minutes, as most of the water stored in the clearwell was not regularly disinfected enough to be used at that flow rate.

For lowering DBPs at Chester I recommended in the 3/31/21 report three simple, obvious and basically free operational solutions be considered before any capital projects, including:

- **Solving the chemical feed problems** that result in excessive variation of pH and chlorine residuals.
- **Moving the location of the second chlorine feed** back into the clearwell.
- **Switching back to the original source water** (Austin Brook Reservoir).

Austin Brook Reservoir has better water quality than the reservoir currently being used (Horn Pond), Recent data suggest switching source would lower TOC (by ~50%) and manganese from levels that are problematic

to levels that should not be, thus likely solving both of Chester's two major water quality problems in one quick move that involves not much more than turning a valve and starting a pump.

Austin Brook Reservoir is located at the treatment plant, and is the water the plant's system was originally designed for and for which slow sand filtration was approved as the treatment. Horn Pond's primary advantage is that it is located at a higher elevation and the water can flow by gravity to the treatment plant, and it is a larger reservoir than Austin Brook Reservoir. Being located within a totally undeveloped reservoir, the Austin Brook water just can't change much. With the proposal to switch sources, I reminded MassDEP they had promised Chester if they requested the switch back it would be approved by MassDEP with ease in a simple e-mail (5/31/19 letter from D. Doherty).

My 3/31/21 treatment and DBP evaluation report was submitted on behalf of Chester to MassDEP on April 23, 2021, as was another request regarding the treatment plant classification. A specific request for switching source waters was submitted on June 10, 2021 to take advantage of the lower TOC level in Austin Brook Reservoir and quickly solve the DBP issue.

MassDEP's response to Water Compliance Solutions' treatment evaluation and Chester's requests:

After receiving Water Compliance Solutions' evaluation and Chester's requests, MassDEP proceeded to:

- **Wrongly** – and ridiculously so – **declare my DBP evaluation from two years' previous (6/27/19) to suddenly be invalid** as a submission for Chester due to a lack of recommendations for DBP control (actually, there were three (3) such recommendations specifically labeled as for "*DBP Control*" plus another eight (8) operational recommendations that could also help,… all apparently hidden in the "*Recommendations*" section). This demonstrates how little MassDEP seems to care about being truthful. It's worth noting the same staff member at MassDEP had recommended Chester use me for that DBP evaluation in the first place.

  If my 6/27/19 RCAP Solutions report wasn't sufficient and actually didn't contain any recommendations for DBP control, then why didn't MassDEP say anything about that when it was submitted in June 2019, or during their February 2020 Sanitary Survey report, or at any other time since then?
- **Wrongly claim** that my report dated June 27, 2019 was actually completed during their Sanitary Survey inspection on October 28, 2019. I don't know why they would fabricate this. My report dated 6/27/19 was completed and released on 6/27/19, and had been read by the MassDEP inspector prior to the Sanitary Survey inspection. Trivial perhaps, but that claim's just plain weird.
- **Not consider as a valid submission** my 3/31/21 treatment and DBP evaluation for the required report on DBP control, even though they agreed with almost all of the points in it and based numerous requirements for Chester on those points, including important items MassDEP had not observed as part of their long-term oversight of the water system.
- **Force the town into an Administrative Consent Order** for the DBP problem that requires hiring another company to repeat my evaluation and essentially propose a capital project
- **Deny Chester's request to switch back to their original source water**, and requested at least one new year of data be collected before considering to do so. They claimed *"Prior studies done at Chester indicate that Austin Brook Reservoir was deemed more flashy (susceptible to wet events) because of the fact that Austin Brook only holds 1.1 million gallons of the source water in the 0.6 square miles of the watershed area compared to Horn Pond holds 41 million gallons of the source water in its 1.25 square miles of the watershed"* (6/30/21 letter from Deirdre Doherty to Chester).

That explanation of the source water areas is not very applicable. Further, I believe no such report exists. As part of my work, I examined all of Chester's Water Department and treatment plant files, and found no such reports. In fact, the plant's operations and maintenance manual from July 1, 2015 noted that the maximum raw water turbidity previously observed was only 2.3 NTU. That *maximum* is well below the limit of 10 NTU for *average* raw water turbidity that MassDEP policy considers an appropriate water for use of slow sand filtration. Austin Brook Reservoir wasn't monitored anymore after November 11, 2015 when it stopped being used as a source (until Water Compliance Solutions started collecting samples in August 2020).

The manual does note that "*Horn Pond raw water is less influenced by rain events so that raw water turbidity is usually less than 1.0 NTU",* while Austin Brook Reservoir turbidity could potentially exceed 1.0 NTU. However, no specific data are provided to support this claim, and the difference in turbidity between the two sources could not be very significant since the maximum turbidity recorded was only 2.3 NTU. The Operator has verbally claimed to prefer Horn Pond because he says it is less "flashy" for turbidity during storm events, but the maximum reported raw water turbidity was only 2.3 NTU. With a maximum raw water turbidity as low as 2.3 NTU, there should be no concern about whether the turbidity is higher in Austin Brook Reservoir or Horn Pond, as both sources are satisfactory for slow sand filtration.

The manual further notes that Chester has achieved 0.05 to 0.3 NTU filtered water turbidity regularly, so there has been no problem regarding turbidity with either source. Subsequent data have shown Austin Brook Reservoir to consistently have the lower turbidity of the two sources, including during rain events, as well as significantly lower TOC and manganese levels.

- **Deny Chester's request** to correct MassDEP's mistaken directive, and move the second chlorine dose back to earlier in the plant at a lower pH where THM formation would be reduced.
- **Spent taxpayer money** for their staff time and legal support for preparing the Administrative Consent Order – probably more money and time than either of those solutions would cost
- Yet MassDEP still refuses both of Chester's proposed options, and the **residents are left needlessly exposed to elevated DBPs** while waiting for another study to be completed **at their expense**.
- In Chester, MassDEP seems to push all sorts of things <u>except for</u> solving the actual problems.

MassDEP's "Assistance for Small and Disadvantaged Communities Drinking Water Grant Program":

- During the same time period, MassDEP made a public announcement April 2, 2021 about **giving a $127,396 grant to Chester** as the top priority for their *Assistance for Small and Disadvantaged Communities Drinking Water Grant Program* (seven other systems also received grants in the announcement). The grant is for installing another GAC sandwich layer in one of the three filters, and was based on the idea that one had been installed in Chester previously and this would provide a second one. Numerous public officials heralded and praised the grant program in the announcement. I assume none of them were familiar with the details of either the Monroe or Chester cases.
- I expect MassDEP found my 3/31/21 report analysis inconvenient in that it showed how ineffective the existing GAC-layer filter had been for DBP control, with no observable impact, and how little TOC monitoring had been conducted by Chester's operator to monitor effectiveness of the filter. Further, my report explained the limited effectiveness that actually should be expected from installing a GAC layer. TOC removal can be expected to increase from about 15% up to ~30% by addition of a GAC layer into a slow sand filter. So adding a GAC layer into one of three slow sand

filters would be expected to reduce TOC by only ~6% with all three filters operating. That compares to an ~50% reduction in TOC for simply switching source waters – if MassDEP would approve it. MassDEP's concept was this grant would provide a "second" GAC filter to provide that "optimal treatment". This ignores the concept they have expressed previously that the GAC adsorption capacity would be exhausted in three to five years, while the GAC filter is already over eight years old. Further, TOC removal data shows minimal or no benefit from the GAC filter compared to the other filters.

- MassDEP did not discuss the grant with Chester to seek their input on the proposed technology before the grant was publicly announced. Instead, they kept it a 'surprise', claiming they didn't want to get Chester's hopes up and then possibly not award them the grant. Instead, MassDEP made the decision on what type of technology to use without inquiring what Chester's opinion was of the existing GAC filter and how they would like to see the grant money best spent on their system. Had MassDEP discussed any of this with Chester, they could have learned how ineffective the GAC filter had been. That seems to me like an unacceptable and unexplainable lack of communication on the part of MassDEP.
- While MassDEP publicly announced the grant value as $127,396, they telephoned Chester separately to let them know the actual amount they would receive only $50,000. The $50,000 was to be for the physical work (Chester needs to pay separately for an engineering firm's guidance and other support activities), while MassDEP is claiming the remaining **$77,396** as an **in-kind contribution for their staff time** for processing the grant application and other administrative duties. That's 516 hours of staff time, assuming a rate of $150 per hour. For administering a $50,000 grant. Something is fishy there.
- Claiming $77,396 for in-kind support for the grant seems to likely be either a deliberate gross overestimation of value, or the work of administering the grant took MassDEP way too much time to complete. Either way, that's not good.
- As part of the grant program announcement, MassDEP made several claims I disagree with, including:
  - MassDEP determined that an upgrade of the water treatment plant is warranted… *it's not, since easy and free operational solutions are available*
  - MassDEP claimed the GAC grant is necessary to comply with the SDWA… *it's not, since easy and free operational solutions are available*
  - MassDEP claimed the GAC grant is expected to improve DBP compliance… *That didn't happen with the first GAC filter at Chester (as shown to MassDEP in my 3/31/21 treatment report), the new GAC layer is expected to reduce TOC by only ~6% with the three filters operating, and therefore it won't provide nearly enough improvement to reliably solve Chester's DBP compliance issues*
  - MassDEP claimed there were multiple HAA5 and TTHM MCL and monitoring and reporting violations, with non-compliance since 2nd quarter 2018…
    - *Despite MassDEP claiming there had been MCL violations for HAA5, there actually have been no MCL exceedances for HAA5 at all throughout the Stage 2 D/DBPR Rule, and the MassDEP screenshots from the grant workplan do not show any alleged HAA5 MCL violations*
    - *MassDEP claimed Chester exceeded the operational evaluation level (OEL) for HAA5 results during the second quarter of 2017 and all four quarters in 2018. While the HAA5*

OEL was exceeded in the first quarter of 2018, it was not exceeded during any of those other quarters claimed.

- *There were no MCL violations for either TTHM or HAA5 in 2nd quarter 2018. It appears MassDEP applied the MCL to an individual result for TTHM instead of to the Locational Running Annual Average (LRAA) as required by the regulations. Individual test results that exceed the concentration of the LRAA MCL are not exceedances or violations of the MCL since the MCL only applies to the Locational Running Annual Average.*
- *The only reporting violation for HAA5 was for 3rd quarter 2018 when the contract lab's refrigerator (MicroBac) had a malfunction prior to analysis and the samples rose in temperature to 14 °C, above the maximum allowed temperature of 6 °C, and so the samples were collected again. MassDEP issued a violation for that, and wanted to know what Chester was going to do to prevent it from happening again. For real. And it wasn't even Chester's refrigerator.*
- *For monitoring violations, MassDEP screenshots from the grant workplan show alleged violations for not collecting DBP samples on time during three quarters. I believe one of those is inaccurate and the samples were obtained on time (2nd quarter 2019, sampled on 5/15/19), one was because of the lab refrigerator problem mentioned above required resampling for HAA5 (3rd quarter 2018), and one which appeared to have been sampled during the 4th week of the month instead of during the 3rd week (3rd quarter 2019).*

➢ MassDEP's screen shots allege TTHM violations for Chester from 2nd quarter of 2018 through 2nd quarter of 2020…

- That claim is absolutely incorrect. During that period Chester exceeded the MCL for TTHM during only three quarters (the 3rd and 4th quarters of 2018 and 1st quarter of 2019), and did not exceed the MCL for the other six quarters claimed. The text of the grant description got that right, but the screen shots at the end of the description did not.

- That means MassDEP incorrectly accused Chester of MCL violations for TTHM during six different quarters, and incorrectly accused Chester of MCL violations for HAA5 during an unspecified number of quarters that didn't happen.
- This is very disturbing… that MassDEP is giving out grant money without actually knowing the correct regulatory compliance status of the recipients. How do they know where there is actually a problem?
- In summary, both of the top two ranked grants in MassDEP's *Assistance for Small and Disadvantaged Communities Drinking Water Grant Program* were for DBP control (Chester and Monroe), and in both cases MassDEP themselves caused the violations of MCLs in the first place in full or in part with their unsound directives related to chlorine dosing, and where at least for the case of Chester easy and free solutions are already available but are being blocked by MassDEP. That is not good government.

Summary of MassDEP's approach to DBP control in Chester:

- If MassDEP already knew that a GAC filter layer would be the answer to the DBP problem, and they were willing to spend $127,396 of taxpayer money on that solution, then why are they still requiring Chester to conduct an engineering study to find what the right answer is for DBP control? Didn't MassDEP do any of their own due diligence investigating alternatives prior to their selection of this particular technology for the grant?

- MassDEP didn't even inform Chester or discuss with them the potential grant in advance of the decision, or contact me to discuss the water quality and potential DBP control alternatives, even though they knew I was working on that for Chester to fulfill several MassDEP requirements. Then when confronted with facts about the limited effectiveness of the GAC filters, MassDEP denied Chester's request to use the grant money for more efficient DBP solutions such as aeration of the volatile trihalomethanes.
- Seems odd… MassDEP gives Monroe a $50,000 grant for a study to search for a groundwater source in hopes of finding a water supply with get lower TOC, but won't let Chester switch to their well-known original source water reservoir located right next to the treatment plant that has both lower TOC and lower manganese?
- So to conclude about Chester, let's connect the dots… MassDEP rejected my evaluations for DBP control… then recently spent staff time and taxpayer money to develop an Administrative Consent Order requiring Chester to hire a licensed Professional Engineer to conduct another study on how to control DBPs… the same DBPs which MassDEP says will be solved by their $127,396 GAC filter grant project… yet without first implementing simple operational solutions such as fixing the chlorine feed variability problem… and while simultaneously denying Chester other free operational solutions that are standard industry practice by using their highest quality source water and returning chlorination back to the proper location prior to pH adjustment… and yet the people of Chester continue to be exposed to excessive levels of DBPs while they wait for another consultant evaluation to be completed, which they will need to pay for… ***What's wrong with this picture?***

Here is what MassDEP's 6/23/21 draft workplan stated about why Chester needed the grant. While they used the existence of one GAC filter in Chester as a reason to install another, they provided no data or other evaluation for the effectiveness of the first system. They complained about the lack of monitoring being conducted by Chester's operator for the GAC filter, but apparently didn't consider that a reason to not provide grant money for installing a second GAC filter.

"Chester Water Department

The Chester Water Department is a community PWS (ID #1059000) in Chester, Massachusetts that serves 750 residents drawing water from Horn Pond Reservoir (Austin Brook Reservoir is the backup). The Chester Water Department Treatment Plant utilizes a slow sand filtration process. The filtration component consists of three filters measuring 15 feet wide by 49 feet long and each containing up to 42 inches of filter sand. After filtration, the water is disinfected with sodium hypochlorite. Due to the level of organics in the reservoir water, Chester has had several trihalomethane MCL violations. In 2017, Chester exceeded the operational evaluation level (OEL) for HAA5 results during the second quarter of 2017 and all four quarters in 2018. In addition, Chester exceeded the TTHM MCL during the third quarter of 2018, fourth quarter of 2018, and first quarter of 2019. These violations have been entered into MassDEP's Water Quality Testing System (WQTS) as of October 2020 and will be uploaded into EPA's Safe Drinking Water Information System (SDWIS). See Appendix A for screenshots of the data entry into WQTS.

These violations have resulted in MassDEP issuing several Administrative Consent Orders that required Chester to investigate the problem and pursue corrective actions. Due to budgetary constraints, Chester has had to implement many of the corrective actions over the

course of many years. In addition to corrective actions, in 2011, Chester secured the assistance of the University of New Hampshire's Water Treatment Technology Assistance Center to study the possibility of using activated carbon at the treatment plant to remove organic matter in the water. The Study results led to the use of a carbon layer within the sand filter beds. Due to a limited budget, Chester installed the 'carbon sandwich' in only one of the three filter beds (Filter No. 1) and this filter bed only operates during the time periods when water organics are highest (May through October) in order to extend the life of the media beyond the typical 3-5 year period. In 2012, with MassDEP approval, Chester made this corrective action.

MassDEP recognizes that having only one filter with optimal treatment is not adequately serving Chester customers and has limited Chester's ability to comply with disinfection byproducts (DBPs) in a reliable and consistent manner. MassDEP has determined that an upgrade of the water treatment plant is warranted. To control DBPs, Chester would upgrade its Water Treatment Plant by installing a carbon layer in one or both of its other filters, so that the majority (2 out of 3) of the filters would be of an optimal design. Currently only one filter provides this optimal treatment. This is expected to improve compliance with the Disinfection Byproduct Rule (DBPR) and may improve aesthetic concerns of customers."

Chester's water treatment plant classification:

The Massachusetts Department of Environmental Protection (MassDEP) classifies drinking water treatment plants into different categories based on the complexity and size of the facility (310 CMR 22.11B), and stipulates a specific scoring system for determining treatment plant classifications, with a total of 30 points or less being classified I-T, and 31 to 55 points classifying as II-T (there are also higher classifications for larger facilities). The level of treatment plant classification then determines the level of license certification that the plant's Primary Operator must possess.

This is important for small, rural communities such as Chester since there are very few licensed operators available in western Massachusetts, making it extremely difficult to find staff, and a lower classification rating results in a larger pool of available operators. Without a licensed operator, a water system cannot legally provide drinking water to the community.

The Chair of Chester's Board of Selectmen told me he thought the rating used to be I-T, and asked Water Compliance Solutions to investigate. So I checked the scoring system in 310 CMR 22.11B and came up with a total of 27 points for Chester, which would be considered a I-T facility. I also met with an experienced contract licensed operator at Chester's plant, who said they worked with a basically identical system which is rated as I-T by the same region of MassDEP.

Chester's first request to MassDEP to reconsider the plant's classification was during an October 28, 2019 Sanitary Survey inspection, and that was not responded to by MassDEP. The next request was during a phone call with a MassDEP staff member, who said even if my scoring was correct, they most likely wouldn't want to change the classification from II-T to I-T and thus wouldn't do so. Instead, they would use their ability to add points in a category with a wide range of subjective scoring to increase the score above the threshold for the II-T classification, with that category being for the "*Average Raw Water Quality Variation*".

A written request was submitted July 30, 2020 by Water Compliance Solutions, LLC on behalf of Chester to MassDEP to reconsider the classification of Chester's Austin Brook Treatment Plant, and provided my count of the scoring at 27 points and a rating of I-T.

MassDEP denied the request for reclassification in an October 9, 2020 letter from Dierdre Doherty, Chief of the MassDEP Western Regional Office's Drinking Water Program. MassDEP agreed with all my scoring except for the category of "*Average Raw Water Quality Variation*", where they scored that a five (5) versus my score of one (1). Their total score was 31 points, just over the 30-point limit for I-T classification.

The regulation bases the scoring for the "*Average Raw Water Quality Variation*" category on how frequently treatment process changes are made at a treatment plant, as follows:

Points possible	**Average raw water quality variation (per 310 CMR 22.11B)**
0	Little of no variation – no treatment provided except disinfection
1	Minor variation – e.g., high quality surface sources appropriate for slow sand filtration
2, 3, 4	Moderate variation in chemical feed, with dosage changes made monthly (2 points), weekly (3), or daily (4)
5	Variation significant enough to require pronounced and/or very frequent changes
7	Severe variation – subject to non-point discharges, agricultural/urban runoff, and flooding
8	Subject to agricultural or municipal waste point source discharges
10	Subject to industrial waste pollution

I scored that category as a '1' since that's what the regulation said to do for a slow sand filtration facility, and the average variation in source water quality is minor. MassDEP claimed "*The effect on treatment process changes that would be necessary to achieve optimized performance was considered by MassDEP.*", and provided the following four irrelevant and specious excuses for their score of '5':

1. *"There is variation in water quality between Chester's two sources of supply, Austin Brook and Horn Pond, and the need to make treatment adjustments according to the source in use. Although Austin Brook is currently inactive, the Town has indicated that it intends to reactivate this source and to make it available for use."*

   Response: This point should not be applicable, as MassDEP has denied Chester's requests to use Austin Brook Reservoir anyway, despite the substantially lower TOC and manganese levels compared to the current source Horn Pond. **MassDEP actually uses the possibility of Chester sometimes switching sources for better water quality as a reason to rate classify the plant higher, and then denies Chester the right to switch sources. That's unreal to me.**

   Both of the source water reservoirs are located in similar small and largely undeveloped watersheds, and both are suitable for slow sand filtration. Any potential switch between the two similar raw water sources might happen at most once or twice per year (it hasn't happened since November 2015), and any chlorine or pH adjustment would be minor.

2. *"Chester's reports document variation in treated water pH, chlorine residual and chemical dosing values. These variations indicate that the operator is either making frequent treatment adjustments or should be making frequent treatment adjustments."*

Response: This point is not applicable, as the category is for variation in raw water quality, not treated water quality. The classification is about the treatment plant itself, not operator performance. The determination of plant classification is not meant as a place for MassDEP to criticize or penalize the quality of the operator's work.

MassDEP's conclusion about the operator's treatment adjustments is not correct – the problem there lies in the chemical feed system. The available data show a relatively consistent pH and alkalinity for the raw source water. And, according to the operator's reports, water flow, chlorine addition and sodium hydroxide addition are all constant. So the treated water should not vary much, yet it does significantly.

3. *Chester's recent non-compliance with the disinfection byproducts requirements, and the need to make seasonal treatment adjustments to address disinfection byproduct precursors. These operational decisions include when to use the filter that has a carbon layer.*

Response: This point is not applicable, as use of a GAC layer in a sand filter is so simple that the regulation distinctly specifies its use should not add any points to the total score.

At most that decision to use the GAC filter would be seasonal, such as using it during spring and summer and then off during fall and winter. This practice also ignores the damage done to a biological filter when it is turned off for extended periods, as the acclimated microbial population dies and needs to be repopulated when the filter is started back up.

4. *"Chester employs two points of disinfection. One application allows for compliance with the CT requirements of the Surface Water Treatment Rule while limiting the formation of disinfection byproducts under the Disinfection Byproducts Rule (DBPR). The second helps prevent the detection of coliform bacteria in the distribution system under the Total Coliform Rule. Although not unique, this balance of regulatory compliance results from source water which is prone to DPBR noncompliance."*

Response: This point is not applicable, as the regulation specifically states that *"Each unit process should have points assigned only once"*, and the chlorine and pH processes were already assigned their points elsewhere in the scoring. The scoring system does not include adding extra points for doing a certain process more than once or for having multiple components of the same type of treatment process.

Further, while all surface water systems use disinfectants to provide primary disinfection and a residual for secondary disinfection (as required by law), that concept does not have bearing on scoring for the category of *Average Raw Water Quality Variation*.

The "two-stage chlorination process" imposed by MassDEP is flawed, and is actually expected to increase THM formation and not decrease it since the second chlorine dose is delayed until after the pH is raised at the end of the treatment plant. Recent monitoring data confirmed excessive amounts of THMs can form rapidly in that final treatment stage (the pipe between the treatment plant and finished water building). It also decreases disinfection efficiency, and greatly restricts the volume of water available for flushing water mains. The process doses too little chlorine in the clearwell both in theory and practice, and the implementation lacked necessary data monitoring and oversight.

On the surface that statement from MassDEP may sound plausible, but it leaves out some important practical considerations, and is only effective on paper if those considerations are ignored. The two-stage chlorination approach considers primary and secondary disinfection separately - on paper - in a regulatory framework, without real-world considerations for water chemistry. This approach ignores the basic principle of needing to meet the initial chlorine demand and achieve a consistent residual prior to raising the pH to avoid production of excessive THMs. This description was included in Water Compliance Solutions' 3/31/21 report that was sent to MassDEP.

By relying on low chlorine residuals for primary disinfection, the initial kill of microbes may be weak. By not satisfying the bulk of the chlorine demand prior to the end of the clearwell, the chlorine residuals would be difficult to maintain consistently in the distribution system. And by using a second feed of chlorine located after the pH is raised, THMs would be expected to increase instead of decrease.

Subsequent to implementation of this two-stage chlorination strategy, it would have been beneficial to evaluate the impact on both disinfection performance and formation of DBPs, especially considering the chlorine residual levels were deliberately pushing lower limits. To the best of my knowledge, no such evaluation was conducted by MassDEP prior to them insisting on this faulty practice nor was one conducted after it started. But MassDEP is now insisting on a study being conducted by Chester before they will allow Chester to stop the faulty procedure. To me that seems hypocritical, or at least contradictory.

In addition to review of the disinfection results and chlorine residuals, samples should have been obtained for THM and HAA analysis from the end of both Segment #1 and Segment #2 and compared to the results in the distribution system. That was not done by MassDEP. Samples collected by Water Compliance Solutions in 2020 and 2021 confirmed excessive THMs were being formed in the second disinfection segment after the increase in pH.

Chester again requested MassDEP reconsider their decision about the plant classification in a letter dated October 29, 2020, and pointed out that a score of '4' for that category applies to circumstances where treatment adjustments are needed to be made up to once per day, and a score of '5' or above applies if treatment adjustments are needed to be made two or more times per day. The latter situation simply does not happen at Chester, as the Operator makes only one visit per day to the treatment plant, and thus doesn't make any more than one treatment adjustment per day, at most. Therefore, the score for this category should not be greater than a '4', which would result in a classification as a I-T facility.

It should also be recognized that the average hydraulic retention time of the chlorine contact basin clearwell is over two days, and thus it would not be prudent for the Operator to make those chlorine feed adjustments as frequently as daily since the result of the adjustment (a change in chlorine concentration at the clearwell effluent) wouldn't be observed for two or more days.

In response, MassDEP again denied Chester's request for reclassification of their treatment plant, stating the following (2/8/21 e-mail from Doug Paine):

> *"Based on its review of submitted water quality reports (SWTR and chem add reports), MassDEP has determined that Chester's treatment systems continue to produce water with wide variability in both pH, chlorine residual, and CT. This variability was demonstrated to be both throughout the month, and from day-to-day. Raw water variability may partially*

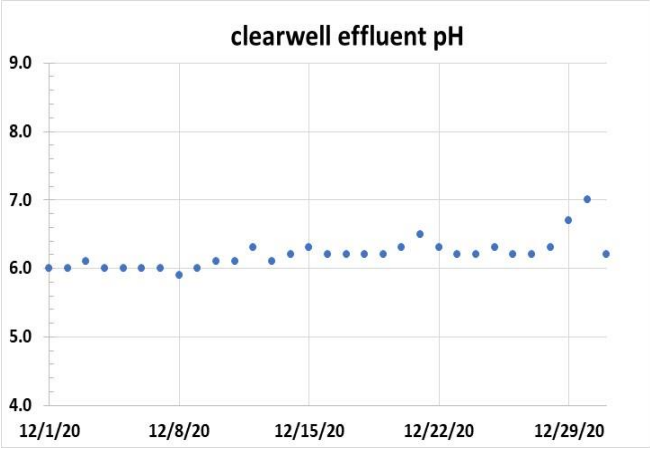
be responsible, as may treatment challenges that are inherent to the Chester system. MassDEP has therefore determined that it will not, now, make a change in the required level of certification of Chester's primary Treatment Operator. In support of this determination, MassDEP notes the following from December (2020):

- *Raw water pH varied between 5.9 – 7.0 throughout the month.*
- *Chlorine residual concentration following the 1st disinfection segment varied between 0.07 – 1.3 mg/l*
- *Inactivation ratio within the 1st disinfection segment varied between 1.2 – 8.0.*
- *Treated water pH varied between 7.0 – 8.4*
- *Chlorine residual concentration following the 2nd disinfection segment varied between 0.3 – 2.5 mg/l*
- *Inactivation ratio within the 2nd disinfection segment varied between 1.0 – 5.6*
- *Total inactivation ratio varied between 2.7 – 19.3"*

Note that all of the Inactivation Ratio values are calculated from chlorine residual and pH values, and so variation in their values is redundant to the issue of variation in chlorine and pH levels.

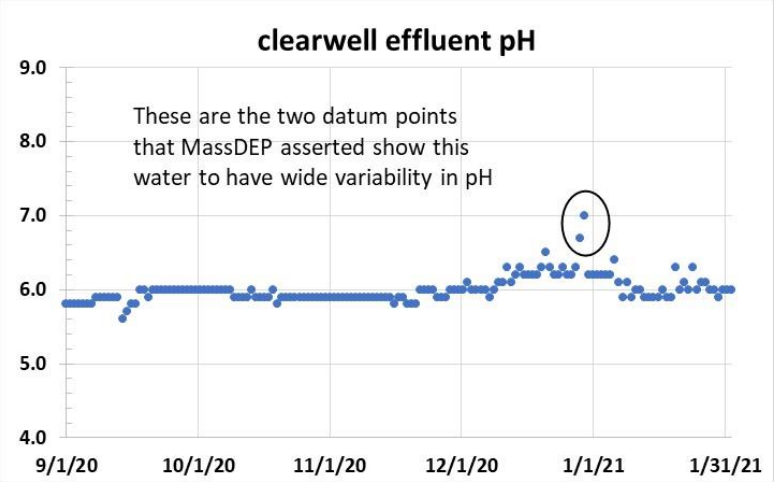
Water Compliance Solutions' reply for Chester to MassDEP's 2/8/21 decision was sent to MassDEP on April 23, 2021, and to the best of my knowledge nothing else was heard back from MassDEP on the subject. The reply again reminded MassDEP that the variation observed in treated water quality is not part of the regulatory scoring system for the category of *Average Raw Water Quality Variation*. It also noted the Surface Water Treatment Rule (SWTR) and Chemical Addition reports submitted to MassDEP do not include raw water pH data, and instead are for the clearwell effluent after slow sand filtration and the first segment of chlorination. So additional variability in pH may be expected beyond that natural for the raw water pH.

Water Compliance Solutions' response – and the data – also contradicted MassDEP's claim that "*Raw water pH varied between 5.9 – 7.0 throughout the month*" of December 2020. While the measured pH did range from 5.9 to 7.0 (for clearwell effluent), the pH was actually very steady throughout most of the month, with perceptible variation in the measured value occurring for only a day or two around December 29–30, as shown below.



December 2020 pH results

To look at a longer time period, the following plot shows additional pH data for before and after December 2020. These data were obtained from the monthly operating reports submitted by HWWC to MassDEP.



September 2020 through January 2021 pH results

MassDEP says these two datum points at the end of December 2020 show the water has wide variability in pH, and based the treatment plant classification in part on that. **How does one argue with something like this???**

MassDEP's statement not only over-interprets the accuracy and precision of those pH results, but "cherry picks" those two datum points out of months of steady data. It then misleads by claiming the pH varied like that "*throughout the month*", when the two outliers were only two days at the end of the month. The early November data are so constant that one might question if the pH meter was even still operating or was frozen. Given the notorious variability of pH measurements, those two datum points are not likely valid outliers (i.e., not reflective of a true change in pH). And that is really not all that wide a pH range anyway.

On a side note, the Chem-ADD forms that MassDEP "reviewed" for December 2020 included an impossible density for sodium hydroxide, and chlorine residual concentrations over 10 times higher than the doses, which just isn't possible. MassDEP has not noticed these and other similar ongoing errors for years.

One by one MassDEP's positions were knocked down, but then more kept popping up, like that Whack-a-Mole arcade game at the State Fair. In the end, MassDEP's decision for the II-T scoring was based on some variability observed in finished water quality, which is not part of the scoring system, and an alleged variability in source water quality that just isn't happening.

I believe MassDEP's scoring decision (as stated in their 10/9/20 letter and 2/8/21 e-mail) does not properly follow the applicable regulation, inappropriately double counted scoring for some treatment practices, and otherwise contained unsupported and specious arguments that do not hold up to scrutiny. I believe MassDEP originally miscalculated the treatment plant classification, and then when questioned on it wouldn't make the correction. Instead, they dug into their position that Chester's plant should be rated as II-T despite the clear evidence it is a I-T facility.

MassDEP's reasons for scoring as they did are so deficient in substance that it appears to me they decided on a score first, and then made up that wording as excuses to justify their decision. In doing so, they basically cheated on the scoring by creating a new category of points, and via a misleading claim about cherry-picked data for raw water pH. They are effectively including a scoring category for *"whatever MassDEP wants to add"*, which is not within the wording of the law.

Chester's treatment plant should be rated as a I-T facility.

Epilogue

I worked hard during my career and schooling to understand well the proper principles of water treatment and supply. When I moved to Massachusetts in 2018 I was looking forward to using my experience to help small communities and water systems. But what MassDEP does is so frustrating I find it difficult to continue working in the field. It's just too disturbing to basically be dealing in a different Twilight Zone reality. I lose too much sleep wondering why MassDEP won't let these small communities apply simple, low-cost effective solutions. Things would be so much better if MassDEP would just stop resisting sound and inexpensive approaches to drinking water supply.

This has all been so needless and frustrating. I am tired of all the misinformation and find it personally stressful. And I really don't like bullies. Never have.

Drinking water should be a simple business. We're supposed to be on the same team.

Respectfully submitted,

Richard W. Gullick, PhD
Founder/Owner
Water Compliance Solutions, LLC
e-mail: wcs.llc@comcast.net
web: watercompliancesolutions.com

Proverbs 3:5-6

Thus the task is,
not so much to see
what no one has seen yet,
but to think
what nobody has thought yet,
about that –
what everybody sees.

Schoppenhauer

Appendix A.

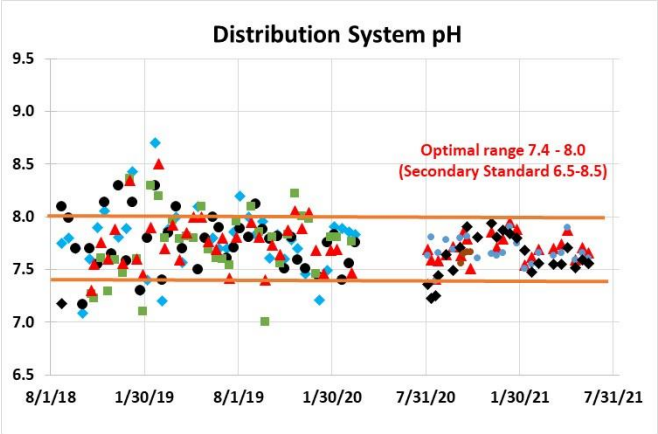
Assessment of MassDEP's 11/1/18 corrosion control plan for the Housatonic Water Works Company (thoughts of why it should not be implemented)

Richard W. Gullick, PhD
Water Compliance Solutions, LLC
May 1, 2022

IS THERE REALLY A NEED FOR THIS?

Natural pH:

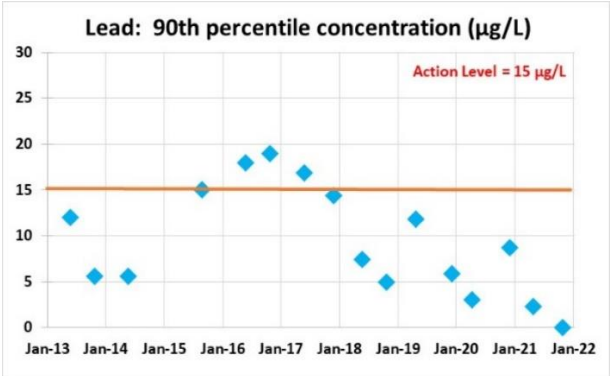
1. The natural pH of the Long Pond supply is already high enough for good corrosion control (median pH ~7.7 in distribution system; median ~7.5 as raw water)



2. Consideration of adding two new chemicals warrants more scrutiny. *"First do no harm"* and *"Keep it simple please".*

Lead and Copper Rule monitoring results and sampling errors:

3. The 2016-17 lead results were close to meeting the Action Levels, and results were relatively low not long before then.



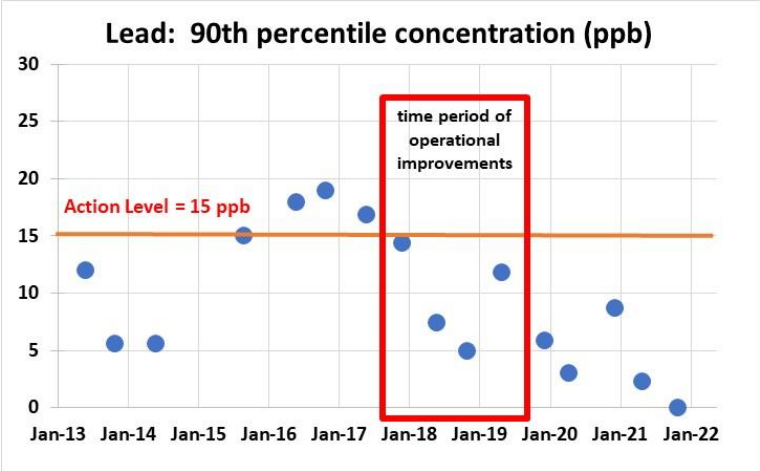
4. Some of the high lead samples were known to have been obtained from stagnant pipes (improper sampling procedure by residents). Those two residences were responsible for two of the three lead

Action Level exceedances, and the third exceedance would have been decided by only 2 µg/L (ppb) in one sample (17 vs. 15 µg/L)

5. As of Spring 2019, the 90th percentile lead results had dropped for four consecutive sampling periods (and have remained fairly low since)

IS THIS THE RIGHT PLAN?

6. Before considering a capital project one should first wait and evaluate the impact of recent operational controls and resulting new steady-state condition. HWWC had changed the plant piping arrangement in 2017 to direct all water through the storage tank, followed by improving lead and copper sampling procedures, and then correcting the calculation of peak hour flow in 2019 (thus requiring less chlorine for primary disinfection).



7. Steady control of pH via addition of a strong base (NaOH) is not easy, and can result in wider swings of pH than the natural water source exhibits.

8. The plan was to raise pH to a minimum of 7.8 (the existing median pH at that time), even though MassDEP uses a lower target pH range of 7.3 to 7.5 for some other water systems.

9. The original decision was based on using faulty low pH data.

10. 11/1/18 Conditional Approval letter from MassDEP for the corrosion control system included contradictory references to adding polyphosphate, orthophosphate, and a blend of both.

11. MassDEP was directing HWWC to raise the pH to levels above what is optimum for control of lead (for Carus 8600, optimum pH is 7 to 8) and based only on 90th percentile sampling results. That's too much reliance on the statistical relevance of using the 90th percentile value.

12. MassDEP required HWWC to *"continuously raise the pH by sodium hydroxide injection even when the raw water pH is higher than a pH of 7.8, and maintain a pH of 0.2 units above the raw water pH, unless that pH target will cause a shutdown alarm condition (pH ≥ 10.0)."* **(Yikes! Raise the pH no matter what? What's if it's too high already?)**

13. MassDEP required HWWC to *"begin raising the pH, beginning at 7.8 and increase by 0.5 units until Action Level exceedances are not occurring"* (maximum of 10.0). **(What if the Action Level exceedances are being caused by a factor other than pH?)**

WHAT ABOUT KNOWN AND POTENTIAL ADVERSE CONSEQUENCES?

14. Major changes to water quality can have unintended adverse consequences (e.g., lead in Washington, D.C. and Flint, MI), and should not be implemented unless really necessary or desired, and potential implications have been identified
15. Increasing pH results in decreased chlorine disinfection efficiency
16. Increasing pH results in increased trihalomethane formation (THMs)
17. Increasing pH results in increased hardness scaling (calcium and magnesium salts) in boilers, hot water heaters, and plumbing fixtures
18. Increasing pH results in increased deposition of iron and other metals on plumbing fixtures
19. Increased demands on operator time.
20. Increased costs for personnel, engineering services, chemical feed systems, chemicals, electricity, maintenance, monitoring instrumentation, water quality parameter sampling in the distribution system, etc.
21. Addition of a phosphorus-based corrosion inhibitor would increase the phosphorus loading to the wastewater treatment plant.
22. There are risks associated with the manufacture, transportation, storage, and use of the proposed hazardous water treatment chemicals, as well as with construction and operation of the chemical feed systems.

HWWC's 5/9/19 letter to MassDEP on their corrosion control strategy included the above considerations. MassDEP's 6/19/19 response included the following:

"MassDEP is not persuaded by any of the arguments put forth by HWW…"
'And you owe us $5,000…'

And that fine was in direct contradiction of the regulation that says corrosion control treatment construction may be halted if a system doesn't exceed the lead and copper Action Levels for two consecutive monitoring periods.

Additional considerations include:

ARE THERE OTHER KNOWN OR POTENTIAL ADVERSE CONSEQUENCES?

23. Addition of polyphosphate could increase lead corrosion (it's the wrong chemical to use).
24. It had been thought that the yellow color was due to rusting iron pipes, but HWWC's monitoring results suggest the color comes from manganese in the treated water, not rust deposits in the distribution system. So a polyphosphate would have been added to stop an iron problem that wasn't really a problem, and in so doing potentially may have increased lead levels.

HOW DOES MASSDEP'S PLAN GRADE FOR TECHNICAL COMPETENCY, COMMON SENSE, AND INTEGRITY?

25. It's bad chemistry, bad science, bad public health protection, bad regulatory compliance, bad for trust in MassDEP, and bad economics for the HWWC ratepayers. All unnecessary. What a waste.

26. MassDEP said it would be “easier” for them if HWWC stuck to the original plan instead of trying to change it with new information

27. Effectively, the only reason to install corrosion control was because MassDEP said to, and (correcting for the two sites with sampling errors) that was based on a single one of ~120 (now ~300) lead sample analyses being 17 µg/L instead of ≤ 15 µg/L.

28. Seriously?!? All this for a 2 µg/L difference in one sample out of 120, and comparing to a non health-based Action Level? Why? Because Flint, Michigan exceeded the lead Action Level for one six-month monitoring period, and MassDEP feels a need to overreact?

29. It would be betraying our trust to the community to allow that corrosion control plan to come to fruition, and against my oath as a Certified Operator in the Commonwealth of Massachusetts. Not on my watch.

Appendix B.

Technical evaluation of AECOM's consultant report to the Town of Great Barrington about HWWC (6/29/21 written report and 7/12/21 meeting presentation)

Richard W. Gullick, PhD
Water Compliance Solutions, LLC
May 1, 2022

Water Compliance Solutions, LLC completed a technical review of the report titled *Housatonic Water Works Company – Water System Evaluation*, which was prepared by AECOM for the Town of Great Barrington and is dated June 29, 2021. The report contained 55 pages plus appendices, for a total of 218 total pages. The appendices include supporting AECOM memoranda, copies of three HWWC consultants' reports, and manufacturers' information. The version available online was not signed or sealed (stamped) by a licensed Professional Engineer.

This memorandum provides a summary of the technical review. It also includes commentary regarding some of the statements made by AECOM staff during the July 12, 2021 meeting of the Great Barrington Selectboard.

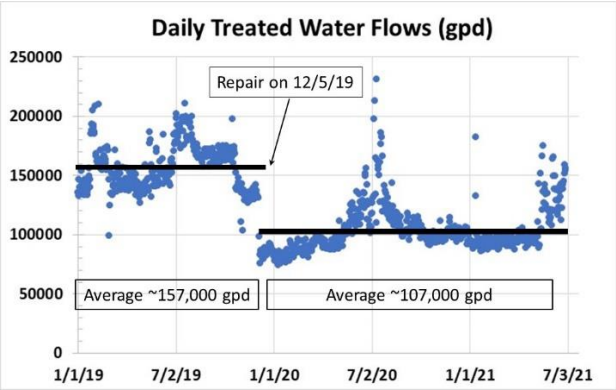
Comments are provided below for each subject area reviewed, and conclusions are provided at the end. As a brief summary, the AECOM report contains methodology that is gravely flawed, misinterprets both water quality data and regulatory compliance limits, and provides unnecessary, inappropriate, and astonishingly expensive recommendations totaling $31,053,000 for this small system of 825 service connections (~1,400 people). Based on those flaws and many others, I recommend that the 6/29/21 AECOM report be disregarded as a whole.

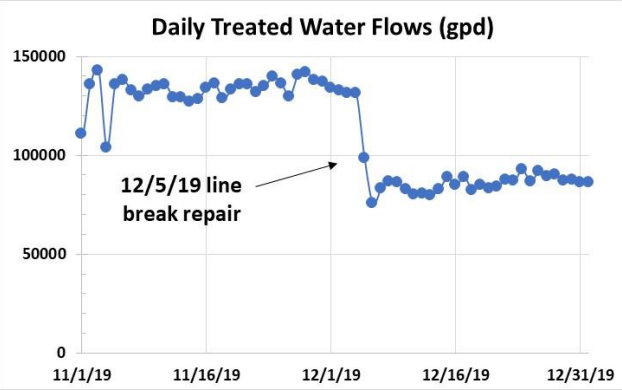
AECOM report methodology:

- I consider the data and information review conducted to be insufficient, especially for purposes of capital planning
- AECOM relied on information available online and from the Town of Great Barrington (per 7/12/21 presentation).
- They did not appear to have reviewed the data contained within the HWWC Monthly Operating Reports (MORs) that are submitted to MassDEP and serve as the utility's regular report on water quality to the public
- AECOM staff barely interviewed HWWC staff, and did not interview HWWC's water quality consultant (Water Compliance Solutions) or their design engineer (Lenard Engineering)
- The report did not appear to include anything from HWWC's response to the MassDEP Sanitary Survey (12/4/20), Lenard Engineering's feasibility study for manganese removal (March 2021), or much correspondence between MassDEP and HWWC
- For some evaluations they did not use appropriately current data sets (e.g., water demand)
- Some of the data used were not well scrutinized (e.g., chlorine disinfection)
- The report lacked important scientific reference citations for statements of fact
- The on-site inspection (1/21/21) was insufficient, as it was more like a short tour or a drive-by windshield survey. They didn't even enter the treatment building. They could have returned later with no snow cover and after vaccination for COVID-19.
- HWWC reports that AECOM would not sign a confidentiality agreement for security concerns regarding sensitive information, so they were limited as to what they were allowed to see and take photos of

Historical Water Production and Demand:

- AECOM based their analysis on the reported average annual production for each year from 2015 through 2019 (average 0.17 mgd)
- They did not consider any production data for any part of 2020 or the first half of 2021 (either daily flow data, annual average, or other)
- On 12/5/19 a major pipe leak was repaired, dropping the average demand by ~50,000 gpd. Since then, production has averaged 107,000 gpd.
- That change in production flow is readily evident from review of any flow data from December 2019 onward, either daily, monthly or annual values (data are available in the Monthly Operating Reports)
- AECOM apparently did not observe this change in demand as a result of not observing trends in daily or monthly data from December 2019 and not including any data from 2020 or 2021.





Projected Water Demand:

- *"For planning purposes, this reports uses the allowable 0.27 mgd withdrawal volume as the projected average daily demand"*
  - No effort was made to actually predict future demand.
  - No evidence was provided to show that the 0.27 mgd value used was at all practical, nor any explanation provided for what changes in the community would cause the demand to increase from the current 0.107 mgd up to 0.27 mgd.
  - *"The evaluation for the treatment plant was based on 0.30 mgd which was the 2018 maximum daily demand."* Note that the 2018 data are out of date, and current maximum daily demand is lower. Also, with the 1.1-million gallon tank having a ~10-day storage capacity, the treatment plant size doesn't need to be based on the full maximum daily demand.

Long Pond Reservoir Yield:

- AECOM did not evaluate the reservoir safe yield, and provided no new information

Long Pond Dam:

- AECOM repeated some of Lenard Engineering's 10/15/20 dam inspection report, but added no other information or evaluation (per Lenard, the dam is in satisfactory condition)
- The estimated costs for the recommendations from the Lenard Engineering report were increased by AECOM from $20,000 to $43,500, with no explanation

Long Pond Intake and Temperature Changes:

- *"Relatively high temperatures in summer… temperature fluctuations are likely due to shallow depth of intake… customer complaints are during summer when the water is warmer… complaints could be linked to seasonal manganese spike or eutrophication in reservoir, both of which could be reduced in severity if the intake was lower…So… use the deeper intake that is further out and close the closer, shallower intake... The deeper intake should reduce temperature swings and reduce worsening water quality conditions associated with seasonal turnover of surface water source"*
- *"It has been suggested in correspondence with MassDEP that the depth of the shallow intake could be the cause of water quality issues due to the dramatic temperature swings and risk of increased organics"*
    - MassDEP said that, but Water Compliance Solutions strongly disagrees (manganese is causing the color and not organics, and dissolved oxygen is the controlling factor for manganese and not temperature).
    - No independent assessment was provided to confirm MassDEP's claim.
    - Neither the report nor MassDEP explain how the risk for organics increases, nor how much of an increase in TOC would be expected from the upper temperatures, nor whether that would affect DBP levels and compliance, nor how much of an effect.
    - Seasonal manganese spikes do not appear correlated to seasonal lake turnover (manganese spikes are occurring mostly in July and August)
    - There is no eutrophication affecting water color (Long Pond is mostly oligotrophic)
    - A deeper intake would likely result in water with lower oxygen levels. If anoxic conditions exist at depth then manganese in sediments could dissolve and resuspend in the water, thus increasing the color problems and not decreasing them.
    - After the manganese removal system is installed, any impacts on manganese from intake location or temperature will be irrelevant . This is important – why pay for two solutions if only one is needed?
    - The aquatic plants near the current intake can help stabilize sediment, filter water, and contribute oxygen (which helps to keep manganese in particulate form and settled on the pond floor instead of being dissolved and entering the intake)
    - AECOM's report notably does not mention the expected positive benefits from increased temperature on filter microbial activity and disinfection performance.

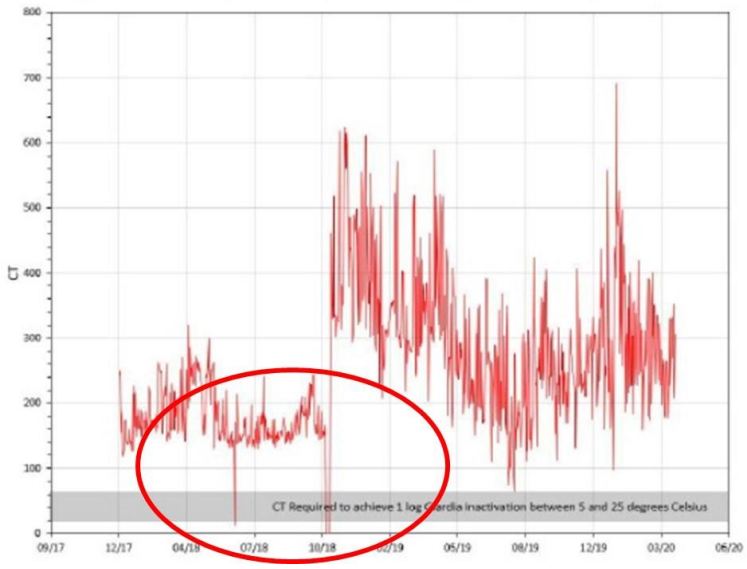
Filtration:

- Table 4-2 lists incorrect regulatory limits for the 95% of turbidity samples standard, and also the standard limit for all turbidity samples
- The report wrongly repeats MassDEP's claim that a combined filter effluent turbidity meter is required for the treatment plant. Not only is it not required (the regulations specifically exempt slow sand filtration plants from the CFE requirements), but would be unnecessary and redundant of the existing online continuous turbidimeters for each of the two individual filters. MassDEP regulations provide an option for collecting just one single grab sample for turbidity each day from slow sand filtration plants (online turbidimeters are not specifically required).
- The report estimates a cost of $21,000 for a turbidimeter. A more appropriate estimate would be $5,000.
- The report recommends installation of a raw water turbidity alarm, even though there is no raw water turbidimeter to connect one to, and there is neither a need nor a requirement for a raw water turbidimeter in the first place.

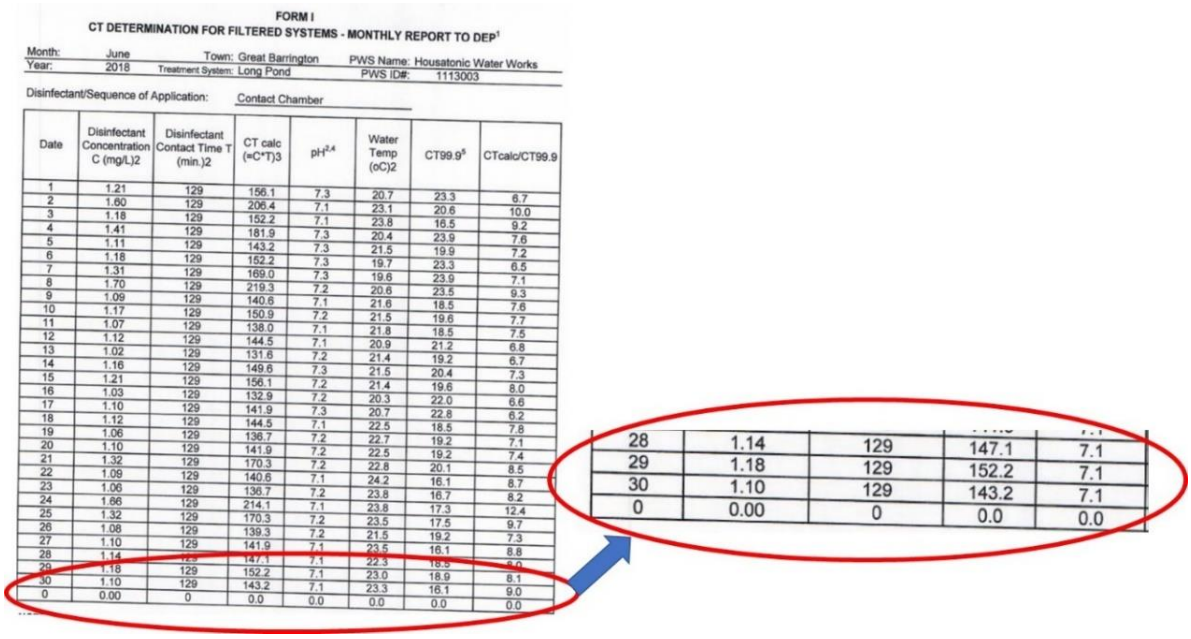
Disinfection:

- The AECOM report states that *"Figure 4-8 shows, with the exceptions of June and October 2018, the CT achieved in the chlorine contact basin has been well over the required CT for 1-log removal of Giardia."*
  - This statement suggests that disinfection compliance was not achieved in June and October 2018, which is not correct. "CT" represents chlorine residual concentration multiplied by chlorine contact time.
  - The report had earlier mentioned there are two sections of disinfection (chlorine contact tank followed by the storage tank), but then didn't mention that in this section where they provided data for only the chlorine contact tank, which is less than 25% of the total disinfection (storage tank is over 75%).

Figure 4-8: CT Required Compared to CT Required for 1-log Giardia Removal



- **For the case of June 2018, the AECOM report appears to have plotted a CT value of 0.0 min-mg/L for June 31st – a day that, of course, does not exist. Here is a copy of the June 2018 monthly operating report for Disinfection Segment #1:**



FORM I

CT DETERMINATION FOR FILTERED SYSTEMS - MONTHLY REPORT TO DEP[1]

Month: June Town: Great Barrington PWS Name: Housatonic Water Works

Year: 2018 Treatment System: Long Pond PWS ID#: 1113003

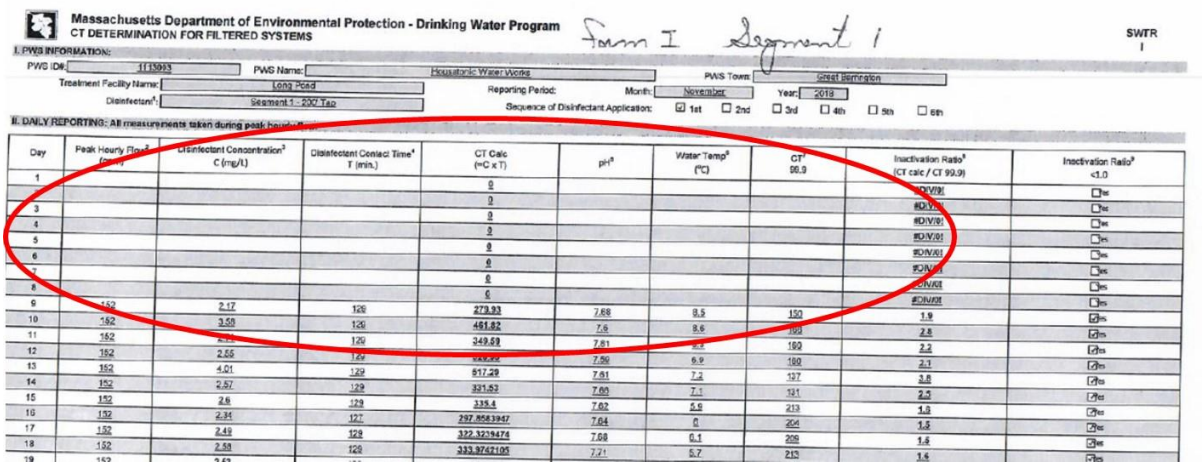
Disinfectant/Sequence of Application: Contact Chamber

Date	Disinfectant Concentration C (mg/L)2	Disinfectant Contact Time T (min.)2	CT calc (=C*T)3	pH2,4	Water Temp (oC)2	CT99.9[5]	CTcalc/CT99.9
1	1.21	129	156.1	7.3	20.7	23.3	6.7
2	1.60	129	206.4	7.1	23.1	20.6	10.0
3	1.18	129	152.2	7.1	23.8	16.5	9.2
4	1.41	129	181.9	7.3	20.4	23.9	7.6
5	1.11	129	143.2	7.3	21.5	19.9	7.2
6	1.18	129	152.2	7.3	19.7	23.3	6.5
7	1.31	129	169.0	7.3	19.6	23.9	7.1
8	1.70	129	219.3	7.2	20.6	23.5	9.3
9	1.09	129	140.6	7.1	21.6	18.5	7.6
10	1.17	129	150.9	7.2	21.5	19.6	7.7
11	1.07	129	138.0	7.1	21.8	18.5	7.5
12	1.12	129	144.5	7.1	20.9	21.2	6.8
13	1.02	129	131.6	7.2	21.4	19.2	6.7
14	1.16	129	149.6	7.3	21.5	20.4	7.3
15	1.21	129	156.1	7.2	21.4	19.6	8.0
16	1.03	129	132.9	7.2	20.3	22.0	6.6
17	1.10	129	141.9	7.3	20.7	22.8	6.2
18	1.12	129	144.5	7.1	22.5	18.5	7.8
19	1.06	129	136.7	7.2	22.7	19.2	7.1
20	1.10	129	141.9	7.2	22.5	19.2	7.4
21	1.32	129	170.3	7.2	22.8	20.1	8.5
22	1.09	129	140.6	7.1	24.2	16.1	8.7
23	1.06	129	136.7	7.2	23.8	16.7	8.2
24	1.66	129	214.1	7.1	23.8	17.3	12.4
25	1.32	129	170.3	7.2	23.5	17.5	9.7
26	1.08	129	139.3	7.2	21.5	19.2	7.3
27	1.10	129	141.9	7.1	23.5	16.1	8.8
28	1.14	129	147.1	7.1	22.3	18.5	8.0
29	1.18	129	152.2	7.1	23.0	18.9	8.1
30	1.10	129	143.2	7.1	23.3	16.1	9.0
0	0.00	0	0.0	0.0	0.0	0.0	0.0

28	1.14	129	147.1	7.1
29	1.18	129	152.2	7.1
30	1.10	129	143.2	7.1
0	0.00	0	0.0	0.0

- Regarding October 2018, there was no indication in the data of any issues with CT. However, during the first eight (8) days of November 2018 there was an analytical instrumentation issue for the chlorine contact basin effluent, and no data were reported during that period. However, the chlorine contact basin was just the first of two segments used for calculating disinfection credit, and compliance was easily met for all days in November 2018 using the data from the second disinfection segment. The AECOM report did not include these important facts in the text.

Segment #1 (chlorine contact tank) disinfection report for November 2018 (data are missing for the first 8 days due to instrument failure):



Massachusetts Department of Environmental Protection - Drinking Water Program
CT DETERMINATION FOR FILTERED SYSTEMS

Form I Segment 1

SWTR 1

I. PWS INFORMATION:

PWS ID#: 1113003 PWS Name: Housatonic Water Works PWS Town: Great Barrington

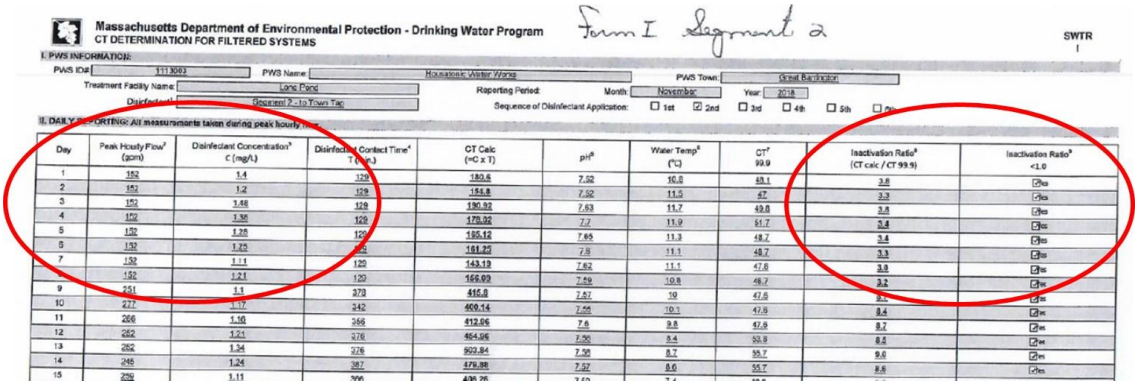
Treatment Facility Name: Long Pond Reporting Period: Month: November Year: 2018

Disinfectant[1]: Segment 1 - 200' Tap Sequence of Disinfectant Application: ☑ 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th ☐ 6th

II. DAILY REPORTING: All measurements taken during peak hourly

Day	Peak Hourly Flow[2] (gpm)	Disinfectant Concentration[3] C (mg/L)	Disinfectant Contact Time[4] T (min.)	CT Calc (=C x T)	pH[5]	Water Temp[6] (°C)	CT[7] 99.9	Inactivation Ratio[8] (CT calc / CT 99.9)	Inactivation Ratio[9] <1.0
1				0				#DIV/0!	☐Yes
2				0				#DIV/0!	☐Yes
3				0				#DIV/0!	☐Yes
4				0				#DIV/0!	☐Yes
5				0				#DIV/0!	☐Yes
6				0				#DIV/0!	☐Yes
7				0				#DIV/0!	☐Yes
8				0				#DIV/0!	☐Yes
9	152	2.17	126	273.93	7.68	8.5	150	1.9	☑Yes
10	152	3.58	126	451.02	7.6	8.6	160	2.8	☑Yes
11	152	2.77	126	349.02	7.61	8.2	160	2.2	☑Yes
12	152	2.66	126	335.16	7.56	6.9	160	2.1	☑Yes
13	152	4.01	129	517.29	7.61	7.2	157	3.3	☑Yes
14	152	2.57	129	331.53	7.60	7.1	151	2.2	☑Yes
15	152	2.6	129	335.4	7.62	5.9	213	1.6	☑Yes
16	152	2.34	127	297.8583947	7.64	6	204	1.5	☑Yes
17	152	2.49	129	322.3219474	7.68	6.1	209	1.5	☑Yes
18	152	2.58	129	333.9742105	7.71	5.7	213	1.6	☑Yes

Segment #2 (1.1-MG storage tank) disinfection report for November 2018 showing plenty of disinfection:



Massachusetts Department of Environmental Protection - Drinking Water Program
CT DETERMINATION FOR FILTERED SYSTEMS

Form I Segment 2

SWTR 1

I. PWS INFORMATION:

PWS ID#: 1113003 PWS Name: Housatonic Water Works PWS Town: Great Barrington

Treatment Facility Name: Long Pond Reporting Period: Month: November Year: 2018

Disinfectant[1]: Segment 2 - to Town Tap Sequence of Disinfectant Application: ☐ 1st ☑ 2nd ☐ 3rd ☐ 4th ☐ 5th ☐ 6th

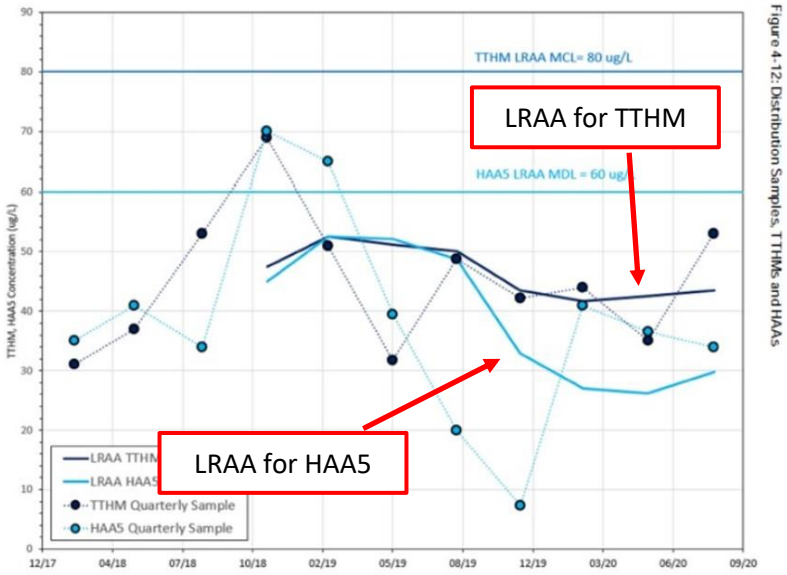
II. DAILY REPORTING: All measurements taken during peak hourly

Day	Peak Hourly Flow[2] (gpm)	Disinfectant Concentration[3] C (mg/L)	Disinfectant Contact Time[4] T (min.)	CT Calc (=C x T)	pH[5]	Water Temp[6] (°C)	CT[7] 99.9	Inactivation Ratio[8] (CT calc / CT 99.9)	Inactivation Ratio[9] <1.0
1	152	1.4	129	180.6	7.92	10.8	48.1	3.8	☑Yes
2	152	1.2	129	154.8	7.92	11.5	47	3.3	☑Yes
3	152	1.48	129	190.92	7.63	11.7	49.8	3.8	☑Yes
4	152	1.36	129	175.32	7.7	11.9	51.7	3.4	☑Yes
5	152	1.26	129	162.54	7.65	11.3	48.7	3.4	☑Yes
6	152	1.25	129	161.25	7.8	11.1	48.7	3.3	☑Yes
7	152	1.11	129	143.19	7.62	11.1	47.8	3.0	☑Yes
8	152	1.21	129	156.09	7.59	10.8	48.7	3.2	☑Yes
9	251	1.1	378	415.8	7.57	10	47.6	8.7	☑Yes
10	277	1.17	342	400.14	7.66	10.1	47.8	8.4	☑Yes
11	266	1.16	366	424.56	7.6	9.8	47.8	8.7	☑Yes
12	252	1.21	378	457.38	7.56	9.4	50.8	9.0	☑Yes
13	252	1.34	378	506.52	7.56	8.7	55.7	9.0	☑Yes
14	246	1.24	387	479.88	7.57	8.6	55.7	8.6	☑Yes
15	256	1.11	396	439.56	7.6	8.4	55.7	7.9	☑Yes

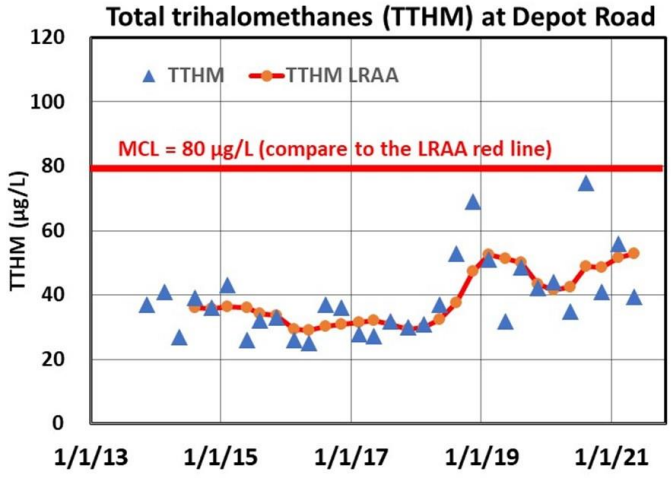
- These apparent data anomalies reported by AECOM (which are not actually there) should have been investigated before publishing, and before implying disinfection CT compliance was not met. That is a serious charge against HWWC that was not at all verified.

Disinfection Byproducts (DBPs):

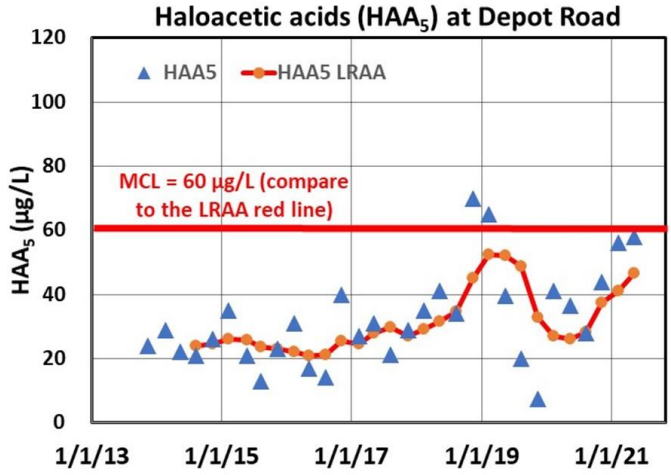
- While AECOM's 6/29/21 report correctly notes there have been no MCL violations for DBPs, AECOM staff wrongly claimed during their 7/12/21 presentation that there were exceedances of the MCLs for TTHM and HAA_5 in 2018, and in 2019 for HAA_5
  - That claim is not correct, for as of that time there had never been an exceedance of the MCL for either TTHM or HAA5 at HWWC (later HAA5 was exceeded in August 2021 after record rains in July). In fact, AECOM's plot of HAA5 and TTHM data did not show any exceedance of the MCLs.
  - There is no discussion of why treatment would be needed to reduce DBPs, yet the report proposes design and construction of an ion exchange system to reduce DBPs by removing natural organic matter.



6/29/21 AECOM report's TTHM and HAA5 data plot



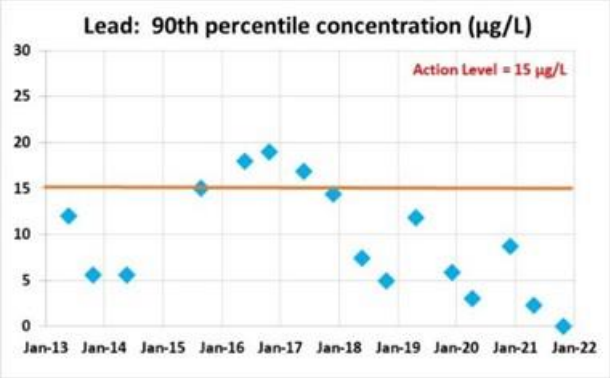
TTHM data through 2nd Quarter 2021 (before 6/29/21 AECOM report)



HAA5 data through 2nd Quarter 2021 (before 6/29/21 AECOM report)

Lead and Copper:

- AECOM claimed during their 7/12/21 presentation that the Lead and Copper Rule (LCR) Action Levels *"are MCLs – they are enforceable"*.
  - That statement is not accurate. The Action Levels are not MCLs, and the lead Action Level is not health based. The Action Levels are a limit at which a water system must "act" on the information – which HWWC did and did well.
- *"At the time of this report, there is no corrosion control plan in place*." (page 4-23)
  - That statement is not accurate. The May 9, 2019 memo from HWWC to MassDEP clearly outlined a logical and appropriate plan for lowering the measured lead concentrations, and that plan proved successful. In addition, the Cornwell Engineering Group's report further extensively discussed corrosion control, and concluded that pH adjustment and/or addition of an orthophosphate corrosion inhibitor are not warranted under the present conditions. The corrosion control plan that MassDEP pushed for was extremely flawed, likely would do more harm than good, and ~29 reasons not to use that plan were identified (see Appendix A). AECOM did not address any of those reasons in their report, and simply copied what MassDEP had said.
  - AECOM did not appear to look at the lead and copper data beyond the simple 90th percentile readings and whether those exceeded the Action Levels or not
  - The Lead and Copper Rule compliance data show that corrosion control is not presently a problem for HWWC. The most recent monitoring data showed 19 of 20 samples had no lead detected, and thus the 90th percentile was 0 µg/L.

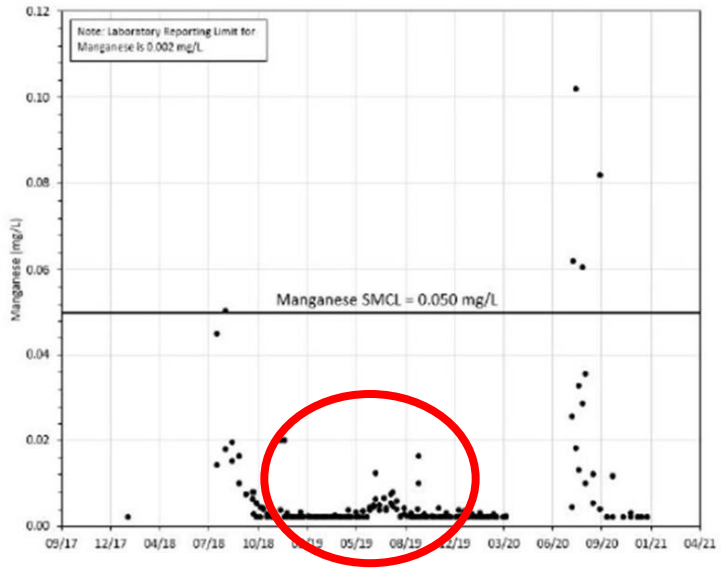


  - The natural pH of the Long Pond source water is regularly already high enough for corrosion control (median pH in Long Pond is 7.5, and in the distribution system where it counts the water's median pH is 7.7), so addition of chemicals is not needed for that. The AECOM report did not discuss this aspect of the water chemistry.

Iron, manganese, and water color:

- Table 4-2 and the subsequent discussion of manganese lists the SMCL of 0.05 mg/L for a target, but a lower limit is actually needed to avoid customer complaints (≤ 0.015 mg/L)
- *Manganese seems to spike in summer 2018 and 2020."* – that is correct, and it is associated with high color and low iron
- *"There also appears to be a slight increase in manganese concentration above the detection limit in summer of 2019. The data however is incomplete and does not show the complete extent of the manganese spike." (Figure 4-5)*

Figure 4-5: Distribution Samples, Manganese



- That is an improper assumption and poor data interpretation. There were two samples collected each week throughout the summer of 2019, so there are plenty of data. There were no high color results in summer 2019 because there was no significant manganese spike, just a little rise in the concentration. Given that summer 2019 was quite hot, the lack of a manganese spike or significant color that summer confirms that temperature is not the primary controlling factor for occurrence of manganese spikes (dissolved oxygen should be the controlling factor).

➢ While agreeing with HWWC that manganese is an issue, AECOM also attributed the colored water to rusting iron pipes.

- That assumption is in contradiction to the available analytical data showing low or non-detected iron levels and high manganese during periods of colored water. Expensive replacements of iron pipes were then proposed to help solve the color problem. Water Compliance Solutions, LLC is opposed to that approach. While specific pipes may need replacement for other reasons, a global pipe replacement strategy is unnecessary, inappropriate, and simply too expensive for such a small community.

Distribution System:

➢ *"HWWC has an average UAW (unaccounted for water) of 36.7%"*

- AECOM's data review did not observe the large decrease in demand resulting from the pipe leak repair on 12/5/19, when average flow went down from ~157,000 gpd to ~107,000 (a 32% decrease)
- Current unaccounted for water is only ~2.8%, and that includes all water used for flushing

➢ *"The existing piping seems to be susceptible to any kind of fluctuation in flow or water chemistry."*

- There is no basis at all provided by AECOM for this claim

➢ AECOM recommended a system interconnection be established with the Great Barrington Fire District

- HWWC already has a letter agreement to connect with GBFD at Christian Hill

Calibration of Distribution System Hydraulic Model:

- The hydrant flow and pressure data used for calibration (from Insurance Services Organization, ISO, dated 9/13/04) did not appear to be valid, and legitimate field data should be used:
  - ✓ Static pressures from the ISO dataset were higher than possible (in excess of hydraulic grade line, with maximum pressure ~110 psi), and thus couldn't be used

- ✓ Five of the six sites for the 9/13/04 dataset had the same data for measured flow, static pressure, and residual pressure. So apparently a copying mistake was made at some point, and these data should not be used.

Table 2. ISO Fire Flow Information

Location	Model Junction	Measured Flow, gpm	Static Pressure psi	Residual Pressure psi	Available Flow at 20 psi, gpm	Needed Fire Flow, gpm
Front St @ Depot St	155	380	120	55	500	4500
Main St. @ Oak St.	168	380	120	55	500	1750
Highland St. @ South St.	138	380	120	55	500	750
Park St. North of Mountain View	249	380	120	55	500	1750
Park St. @ North of Division St.	523	380	120	55	500	2000
N. Plain Rd. @ 2nd hydrant North of Division St.	331	1030	83	42	1300	1250

??

The static pressures of 120 psi represent HGLs of 75-110 feet above the current HGL of the tank at the Long Pond WTP, so these values were not used. The residual pressures were used as a reference to roughly calibrate the model in terms of pipe roughness.

- ✓ That left data for only one site, which should of course be suspect also, and one shouldn't calibrate a model with data for only one location. For that site, the calibration data indicated 1030 gpm flow at 43 psi, while the model predicted 1300 gpm at 20 psi (21% more flow at less than half the pressure?)
- ✓ AECOM noted *"this information is dated with no accompanying information regarding system operations and is thus not considered a conclusive representation of the system"* and the data are "*suspicious"*, but used the dataset for model calibration anyway.

- There was no mention of how AECOM modeled the allegedly large unaccounted for water. Total customer demand should have been much different than data for the volume produced.
- The model calibration was not verified using a separate data set (part of standard model calibration procedure)
- Available fire flow was evaluated using excessively high regular demands (range of 0.21 to 0.39 mgd, compared to the actual current average of 0.107 mgd)
- Given the lack of satisfactory model calibration and verification, Water Compliance Solutions recommends the hydraulic modeling effort and all associated expenditures be disregarded.

Recommended new water treatment plant:

AECOM recommendation for new WTP	Water Compliance Solutions' comment
Flow capacity 0.6 mgd	Oversized (current average demand = 0.107 mgd)
Greensand pressure filtration	Could do that while keeping the slow sand filters (which HWWC is considering)
Ion exchange	Not needed (no historical issue w/DBPs, other than from a temporary watershed rain event in summer 2021)

Other recommended projects for the water treatment plant:

AECOM recommendation	Water Compliance Solutions' comment
Chlorine day tank improvements (repeated from Sanitary Survey)	• Already completed
Install mixer in 1-MG storage tank	• Disagree. Prefer flow in at the top, and out at bottom. This is a chlorine contact tank, and so we'd want to maintain plug flow as much as possible (not mixed). • If there are stagnant areas, that decreases the effective volume, which decreases the water age through the tank.
Consider installing THM removal system	• This is not needed since the THM levels are now and always have been below the MCL.
Install raw water turbidity alarm and chlorine level alarms	• This is not a capital project (adding an alarm is a simple procedure on the SCADA screen) • There is no online raw water turbidity meter to set an alarm for, and one is not needed. The source water quality doesn't change enough to warrant that. • The chlorine alarms were already in place during the MassDEP Sanitary Survey inspection.

AECOM recommendations for replacement of distribution system piping:

- AECOM recommended $27.3 million in pipe replacements and lining.
- The recommendation was based in part on hydraulic modeling that did not involve satisfactory calibration, and thus those results are highly questionable.
- The recommendation was based in part on the assumption that the unlined iron mains are a cause of the color problems, in contradiction to field observations and analytical data obtained during colored water episodes
- The proposal and cost are overreach, and not practically possible for a small community with limited resources

Recommendations from Water Compliance Solutions, LLC regarding piping include the following:

- ✓ It would be appropriate to think more first, then act (‘measure twice, cut once’ - especially when it’s for $27.3M).
- ✓ Identify and assess critical flow control points (restrictive bottlenecks)
- ✓ Develop a strategic, prioritized plan for pipe replacement based on scientific evaluation and not just on pipe age, type, or diameter
- ✓ Do not replace pipes as a means of solving the colored water issue
- ✓ Address the manganese problem first, then reassess the color issue before determining any further course of action related to that

SUMMARY:

In conclusion, AECOM’s 6/29/21 report was not based on sufficient review of available information and data, grossly overestimated average daily water demand and projected future water demand, misleads as to whether there have been violations of the health-based Maximum Contaminant Levels, and wrongly claims there is no current corrosion control plan.

AECOM attributed the colored water to rusting iron pipes in addition to manganese, in contradiction to the available analytical data. The hydraulic model used was not calibrated with a valid data set of field conditions (flow and pressure), and it also was not verified using a separate set of data (the second step of model calibration). As such, results from the model should not be used to make any predictions about distribution system behavior for the purpose of developing any proposals for capital projects, and especially not expensive ones such as replacing about two thirds of the pipes in the distribution system.

Recommendations are made by AECOM that are not necessary, such as for a 0.6-mgd capacity treatment plant (that’s too large), and for an ion exchange treatment system to reduce disinfection byproducts (DBPs). At the time of the 6/29/21 AECOM report there had never been an exceedance of the Maximum Contaminant Level (MCL) for either class of chlorinated DBPs, so the ion exchange system shouldn’t have been considered necessary.

I detected some bias in the writing, based not only on what was mentioned, but how and where it was mentioned. Further, some important characteristics of the water quality were not even discussed. For example, no bacteria have been detected in the finished water or distribution system, and the raw water’s natural pH is already at a good level for corrosion control. Neither of those very important features was mentioned in the AECOM report.

It seemed at times as though the AECOM report was looking for problems to solve, not trying to determine what the real problems were to address. I found the evaluation to be technically surficial, and devoid of any in-depth independent analysis. The evaluation offered little original thought or evaluation, and often merely repeated unfounded claims made by MassDEP.

Based on the seriously flawed methodology, conclusion, and recommendations, I recommend that the 6/29/21 AECOM report be disregarded in its whole.

Appendix C.

Technical evaluation of DPC Engineering's consultant report to the Town of Great Barrington about HWWC (8/9/21 presentation report)

Richard W. Gullick, PhD
Water Compliance Solutions, LLC
May 1, 2022

Introduction:

- Titled *"Opinion of Value, Costs & Capital Implementation Alternatives for the Housatonic Water Works"* by Dave Prickett, P.E. and Justin Skelly, P.E. of DPC Engineering, LLC
- Presented at Great Barrington Selectboard meeting on August 9, 2021
- No report was provided on 8/9/21, just presentation slides
- The report purported to provide a financial estimate of the value of the Housatonic Water Works Company
- The authors cautioned that *"This Project is comprised of Engineering opinions, and is NOT a formal appraisal of value"*
- There was no mention of whether the evaluation followed the standards set by the American Society of Appraisers or by The Appraisal Foundation
- The evaluation did not include any discussion with HWWC or HWWC's consultants, nor was any information obtained from them by DPC Engineering

Methods for valuing water utilities

There are three primary methods for evaluating water utility value (per Mastracchio, et al., Aug. 2020 *Journal AWWA*):

1. *Income Approach* – the value estimated reflects the present value of future economic benefits of owning the property
2. *Market Approach* – the value is estimated by comparing to the price of similar systems that have been previously sold
3. *Cost Approach* – the value estimate reflects the cost of reproducing the system, adjusting for its estimated remaining useful life and obsolescence

DPC Engineering used only the 'Cost Approach', and wholly ignored the other two methods. They did not give consideration the income stream that ownership receives - whether it's private or public (income approach), and they made no comparisons to value of similar systems previously sold (market approach).

DPC Engineering used a four-step process to determine the value of HWWC.

1. First, estimated the current cost to build the system new today would be ~$55.0 million
2. Second, converted the $55M (in 2021 dollars) to what that amount would be at the times when the primary parts of the system were built (1939, 1958, and 1997) = $17.1M

3. Third, depreciated the $17.1M asset value over time down to an estimated current value of $5.8M
4. Lastly, compared the estimated depreciated value of $5.8M to the $31M needed for AECOM's capital investment plan, resulting in an estimated net value of minus $25.2M

Water Compliance Solution, LLC's comments

- DPC Engineering's evaluation process is **extremely flawed** in that it did not include any consideration for the water system's income stream, thus underestimating the financial value of the utility. As an example of the shortsightedness of that, let's say you're considering buying a hot dog stand. You inspect the building, and determine there are some repairs needed. Before deciding the overall value and making your offer, shouldn't you find out how many hot dogs are likely to be sold?
- DPC Engineering's evaluation process is **extremely flawed** in that it wrongly assumed all of AECOM's estimate of $31 million needed for capital projects was sound, apparently without independently questioning or verifying the validity of that analysis, and then used that overestimate of needed system improvements to devalue HWWC.
- DPC referred to the AECOM report as *"really, really well done"* with *"an extensive amount of computer modeling and water quality discussion".* In my opinion, for DPC Engineering to make such an unsound conclusion about the AECOM report generates further doubt about the validity of DPC's own report. In my opinion, the AECOM report readily accepted MassDEP's many mistakes and added some their own, and DPC Engineering then assumed all of that was correct and added their own set of deficient assumptions and analyses.
- DPC Engineering's evaluation process is flawed in that it proposes, without any supporting data, a global (universal) solution of replacing the majority of the pipes but without first considering the potential that the alleged fire flow issues may be caused by just a few local bottlenecks that might require only smaller, local solutions, or that a single modification to the distribution system (such as an additional elevated storage tank downtown) could solve the fire flow issues.
- DPC Engineering's evaluation process is flawed in that the accounting depreciation procedure used underestimates the real current value of HWWC's assets at only $5.8M. The depreciated values determined are too low to be realistic, do not include condition assessments for the assets, and are the result of a paper accounting exercise – where older assets may be considered to have little or no value, even if those assets are totally functional and in good condition, and even if they would cost a lot to replace. As one example, valuing the supply and treatment systems at only $500,000 is ridiculous – the value of Long Pond and the surrounding HWWC property alone is clearly worth much more than that, not to mention there is a fairly new 1.1 million gallon storage tank (installed in 1996) as well as a well-functioning water treatment plant.

Conclusion:

In my opinion, the analysis and "engineering opinions" presented by DPC Engineering are exceedingly flawed, and the results and conclusions should not be relied upon for any capital improvement planning purposes.

Appendix D.

Copy of 2022 Housatonic customer petition to Governor Baker

PETITION TO GOVERNOR CHARLIE BAKER TO MOBILIZE DPU ACTION TO PROTECT PUBLIC HEALTH IN GREAT BARRINGTON

We, petitioners, are calling on Governor Baker to take responsibility for a disastrous public health crisis that needs swift attention after being stalemated.

Housatonic WaterWorks (HWW), a private utility, was purchased by the current owners in 1984. HWW serves the township of Housatonic within the Town of Great Barrington has been under surveillance and in violation of the MA DEP. The violations relate to poor management processes, unremedied systems, and lack of investment over a long period of time. As a result, the water puts the health of Housatonic residents at risk. In contrast, the Great Barrington Fire District serves residents in other parts of town. It has an excellent track record and users of that public utility would never have accepted the unhealthy water being sold by HWW. The Town has spent an enormous amount of time, money and efforts to understand the issues of HWW over the past two years. But the Town of Great Barrington does not have oversight over this private utility.

The Chair of the Great Barrington Select Board has sent the attached letter in an effort to mobilize MA Dept. of Public Utilities (DPU) to act and has addressed MA DPU to no avail. We need:

- HWW to be taken over by eminent domain, converting it to a quasi-governmental organization with an independent board and oversight.
- Rejection of approval for additional funding for HWW, whether by MA or through higher fees, as nearly 50% of every dollar goes into the pocket of the two private owners.
- If GBFD were to take over HWW, it would need infrastructure funding to remedy the immediate situation (relocation of the four-foot lake draw, a new filtration system, and a staged pipe replacement program).

Our Select Board has commissioned independent consulting studies in the past three years which have recommended costly remedies. We are pressing for action and resolution from MA DPU. We recommend the State Auditor study the finances of HWW and its lack of adequate investment as a privately-owned utility that is endangering public health.

See addendum of the last annual report of HWW from MA DEP, which enumerates deficiencies and the latest violation in the January 2022 DEP finding showing a substance which can cause cancer.

SIGNED PETITIONERS:	PRINTED NAME	TOWNSHIP (GB/HOUSY)
1_____	_____	_____
2_____	_____	_____
3_____	_____	_____
4_____	_____	_____
5_____	_____	_____
6_____	_____	_____
7_____	_____	_____
8_____	_____	_____
9_____	_____	_____
10_____	_____	_____ P. ____

Appendix E.

Problems with MassDEP's system for licensed drinking water operator work requirements

Richard W. Gullick, PhD
Water Compliance Solutions, LLC
May 1, 2022

Some of MassDEP's treatment plant and distribution system operational requirements greatly limit the success of small systems. Some of the regulations for operator staffing, responsibilities, daily work time, and living distance from work are outdated, inefficient, and create staffing issues. Basically all activities are required to be conducted by a certified licensed operator, even as simple as writing down a temperature reading.

Current paradigm:

The current system wants everything from the operator – from treatment process knowledge to ordering chemicals to cleaning the buildings. To do the job the best way possible, the operator's work involves a lot of highly technical subject matter as well as more basic labor, including water chemistry, analytical chemistry, microbiology, hydraulics, chemical handling and safety, regulatory compliance, environmental protection, computer skills, recordkeeping, mechanical and instrument repair, building and yard maintenance, general housekeeping, and much more. These systems are best overseen by people or a group of people with this full skill set.

As an analogy, the medical field uses a chain of personnel to take care of patients, from nursing assistants to nurses to nurse practitioners to general physicians to specialist doctors. No one person is expected to take care of all aspects of the patient, from designing the care plan to conducting surgery to changing dirty underwear. Yet for drinking water, the relatively low-paid operators are supposed to do almost everything. Those people just don't exist. There are some real good operators, but in general that's too much to ask of a single person.

Staffing time requirements:

Each water treatment plant and distribution system is required to have a licensed certified operator who is present working on the system for a certain amount of time each day, depending on the classification of the treatment plant and distribution system. For some systems, MassDEP requires the licensed Primary Operator to be present at the treatment plant seven hours for five days each week (or 35 hours over four days), other than temporary absences when the Secondary Operator must fill in. With slow sand filtration facilities such as in Housatonic, Chester, and Monroe the daily requirement for the Primary Operator is two hours at the treatment facility, plus two hours for the distribution system (which can be a different operator). The Primary Operator is also required to be "*available to respond in person to emergencies at the treatment facility within one hour at all times when not present at the treatment facility.*"

In many cases the time requirements for daily licensed operator work far exceed the tasks involved, leaving water systems to either have employees or contractors sit there basically doing nothing to meet the time requirements (often in a cramped treatment building with chemicals), or they simply don't put in the time and then falsify timesheets or lie to MassDEP if they ask. I've seen both.

What work is an operator supposed to do for two hours each day with a buried pipe system in a small community? Most days would involve no needed distribution system work at all. That time requirement is

just plain bizarre. And that's after being at the treatment plant for two hours each day? Visiting and inspecting each day is good, but one probably doesn't need more than 20 to 30 minutes at most. There really isn't much to see or do. And seven hours a day is required for some small highly automated treatment plants. And for goodness' sake, according to the regulations, you must be a licensed operator to even record a simple temperature reading for a water plant. There are better ways to do this.

For HWWC's treatment system, there is not much that can go wrong. The slow sand filtration system is enclosed, and there is no backwashing – just occasional surface washing. So the base of the sand stays in the same place all the time. The chlorine pump could potentially malfunction, but the SCADA computer alarms would notify the operator. The company has spare pumps and parts available on site, and there is a 10-day supply of treated water at all times in the 1.1-MG storage tank to serve as a reserve supply in the event the treatment plant needed to be shut down for a few minutes while a chlorine pump was replaced.

The operator's daily visit would involve inspecting the facility (vision, sound, and smell), evaluating online instrumentation data and trends, verifying the online instrumentation is working well by conducting grab sample bench-top analysis of turbidity, pH, and chlorine residual, fill the chlorine tank if needed, maybe do some small equipment maintenance or facility upkeep, and record some notes.

That's it. Done by someone every day, they get quite efficient at it. So you get it done, do it well, and then go on about your day. There is no reason to sit in cramped quarters with nothing to do for around 90 minutes each day simply because MassDEP says to. That rule is financially irresponsible.

Availability of operators and required living distance from work:

There are not enough licensed operators available, especially in rural areas such as western Massachusetts. Given the requirements that the Primary Operator must do most of the work and also must be "*available to respond in person within one hour at all times*" greatly reduces the available pool of operators for a given system. It's an illusion that all of the above skill sets and all of these requirements be met by the same person, or that there are enough to staff all the facilities in western Massachusetts.

Water Compliance Solutions and RCAP Solutions collaborated to contact all licensed operators within the required distance of Chester, and found no one available or willing to take the job. The only person available is the current Primary Operator with a II-T license, backed up by his spouse the Secondary Operator who is licensed as I-T. Chester has had numerous issues with this particular arrangement, but MassDEP's rules and requirements leave them no other options. And Chester is left with the same operator, same unexplained variations in pH and chlorine residual, and repeated DBP MCL violations.

Alternative options:

A more efficient and effective system could be implemented that involved skilled, licensed operators overseeing operations and being responsible for activities and results, but allowing other qualified staff to conduct the simple daily checks. Some other states allow licensed operators to take responsibility and supervise systems, while other personnel (including operators-in-training) conduct many of the simple daily activities. With modern SCADA computer systems, alarms can be sent to operators and supervisors, and data can be accessed remotely 24/7/365.

Appendix F.

General concerns about the drinking water industry

Richard W. Gullick, PhD
Water Compliance Solutions, LLC
May 1, 2022

According to the American Water Works Association's 2021 State of the Water Industry survey, the top two issues facing the industry are (1) renewal and replacement of aging water and wastewater infrastructure, and (2) financing for capital improvements. Based on my experiences I have a different perception, and suggest that an inability to properly identify the real need for capital projects may be the biggest challenge the industry faces. Adding to that problem is the fact it's always difficult to argue against improvements for water supply and protecting the health of children. One might as well try to argue against mom, apple pie, and the American way. Discussions of how limited resources could be best used to reduce health risks in society that otherwise would be appropriate tend to not happen when advocates for a project can bring up the specter of the fear of something bad being in our drinking water.

Here are some of my concerns:

1. While there are unlimited examples of great people doing great things for drinking water utilities all around the country, I have witnessed much too often a damaging lack of technical competency, common sense, and integrity in the industry leading to excessive waste of funds and resources. That has included utilities, regulators, and engineering consultants.

2. I have seen too many unnecessary and expensive capital projects be proposed or completed based on invalid assumptions; insufficient and flawed data analyses and technical evaluations resulting in a lack of accurate verification of the problems; substandard modeling efforts; relying poorly on regulatory limits or guidance as a crutch instead of conducting a sound evaluation; and succumbing to political pressure or influence from officials in power to implement unnecessary projects.

3. I have seen too many cases of poor engineering consulting work in New Jersey, Virginia, and Massachusetts, poor regulatory oversight by MassDEP, and elected officials driven by personal motivations. That has all led to substantial waste in planning unnecessary capital projects. I expect these problems may be quite widespread in the U.S., yet hidden or unseen.

4. For public water systems the Individual elected officials involved with leadership can insert personnel motivations into system operations and planning. Nepotism hiring was rampant at a public utility in New Jersey I worked for, and substantially limited service quality. At a public utility in Virginia, I encountered capital projects worth $1M, $25M, and $82M that were not technically needed, but were implemented, scheduled or proposed based on inadequate operational control, faulty data interpretation, misapplied model projections, and/or political influence from a couple key Board members.

   The $25M granular activated carbon (GAC) project to comply with the Stage 2 D/DBP Rule really wasn't needed and was a scientific, engineering, and public relations boondoggle. The DBP data were misinterpreted and a need was identified that wasn't there, the utility thought they were using enhanced coagulation for TOC removal but really weren't, and they got pressured into a sudden decision for installing GAC at a utility meeting where public opposition to a consultant's

recommendation to use chloramines for secondary disinfection to reduce DBPs overwhelmed the Board. Subsequent improved operations had the DBP levels at ~50% of the MCLs prior to installation of the GAC.

The $1M and $82M projects were politically driven despite scientific, engineering, and economic evaluations showing no need. In 2018 I resigned my position as Director of Operations in protest over ethical concerns regarding the $82M project (see www.cvillesensiblewaterplan.org).

5. In MassDEP's case, the lack of technical competency, common sense, and integrity in some of their statements and decisions has resulted in unnecessary and considerably adverse operational, economic, and emotional impacts on numerous communities and individuals, along with lost time through unnecessary distractions and lost opportunities.

6. How much of the clamor for new water system infrastructure is actually unnecessary? How much is merely a result of substandard engineering evaluations, regulatory ineptitude or overreach, or political meddling?

7. Though there are certainly real issues in some places, in other places the problem may be not so much the drinking water supplies as it is MassDEP's approaches, decisions, and certain parts of their regulations.

8. How can the current paradigm for identifying the need for and planning capital projects be improved to reduce the number and cost of unnecessary projects?

9. How can we instill more common sense into regulatory interpretation and enforcement? One way would be to put more emphasis on relative risk assessments guiding enforcement priorities. So much in the water industry these days is taken out of perspective or blown out of proportion. In most cases, once the water is microbiologically safe the remaining risk is relatively negligible compared to the other risks in life.

10. How can the current paradigm for operating and regulating small rural water systems be improved by changing responsibility and oversight structure, along with modifying licensed operator requirements?

11. How can we improve data interpretation skills, problem identification methods, and big-picture perspective in water system planning and compliance enforcement?

12. Is MassDEP's current concept of restricting the completion of evaluations of MCL violations and identification of possible solutions to being conducted only by licensed Professional Engineers really appropriate? Who's really qualified for what roles? In my experience, colleges tend to teach engineers more about solving problems than about diagnosing them. Engineering homework assignments and exam questions typically provide a specific problem to solve, but don't get much into how that problem was identified and vetted. Designing something to build – that's what they were trained to do.

    I regularly see the implications of this educational approach in the work of environmental engineering consulting firms. As generalizations, engineers too often don't recognize important and revealing patterns in data. They don't often enough ask the "why?" of data trends and anomalies, or the next few needed levels of "why?", as that does not appear to be in their comfort zone. And that's if they see the trends and anomalies in the first place. Data are too often overinterpreted, and without consideration for the values' margins of error. And forget about proper use of significant digits – something taught in chemistry labs. In one way or another they seem to miss on part of the scientific method in their evaluations. The solutions become ones by engineers and for engineers. And by following regulations as their design goals the minimum standards become standard minimums. In my

experience someone being a P.E. does not necessarily provide the right set of skills for evaluating water chemistry and treatment problems, especially civil engineers who often end up in environmental work. I believe the engineers' lack of school or work experience as analytical chemists and in chemistry labs and gaining experience interpreting data with good mentors is one root of this problem. Chemical engineers learn chemistry very well along with reactor dynamics principles and typically are very good at data interpretation and problem solving.

There is a psychological factor as well. Engineers can understandably get excited about the challenge of the problem solving – it's a chase or sport. But they too often don't first pay good attention to actually vetting the alleged problem. Their mission was to evaluate different solutions – same as their school homeworks – not whether one was needed. Just because you can do something doesn't mean you should do it. I believe it's harder to teach problem identification than teaching how to solve the identified problems.

The management expert Peter Drucker said it best… ***"There is nothing quite so useless as doing with great efficiency something that should not be done at all."*** I call it gonzo engineering. Or robot engineering – follow the dots to the engineering solution. Plug and chug away.

13. If you have an electrical problem, call an electrician. If you have a plumbing problem, call a plumber. If you have a water chemistry problem, call a water chemist. If the solution identified by the water chemist involves needing to design and construct something, then call an engineer. That approach would likely save lots and lots of money, time, and effort. Some P.E.s have the necessary chemical training, but many do not.

14. Operators and managers should know "why" they are doing what they are doing at all times. There are three answers that should not be allowed when asked "*why are you doing that?"*– (1) *"because we've always done it that way"*; (2) *"because someone told me to"* (including their boss or a regulator); and (3) *"it's on the checklist"*. None of those answers demonstrate real understanding of a situation. More mistakes happen when those answers are allowed to be the extent of the employees' knowledge.

15. What can we do to educate and develop problem-identifiers and not just problem-solvers… in undergraduate and graduate engineering programs, operator training programs, regulatory agencies, consultants, environmental advocacy groups, and taxpayer advocacy groups?

16. What can we do to prevent another town or customer base from having to pay for one consultant's report and then for another consultant's report to refute the first consultant's report, only to really end up no further ahead and some dollars, time, and energy behind?

17. So much of the angst in Housatonic could have been prevented with a single phone call… what does that say?

18. What can we do to prevent state regulatory agencies from making such mistakes? Ohio EPA overreacted in 2014 with shutting down Toledo's water supply when no algal toxins had been confirmed in the treated water (just in Lake Erie), and the chlorine used as disinfectant would be expected to oxidize the microcystins present. And the Michigan Department of Environmental Quality made a mess of Flint's drinking water situation.

19. MassDEP's so many issues… what can be done?

20. *"Flint"* was a very bad mistake in one place at basically one time, but they learned and corrected things. MassDEP makes bad mistakes in different communities around the state and does so continuously, and too often doesn't correct mistakes or want to learn from them. That's really scary.

21. The objectionable behavior I have witnessed from MassDEP matched the reputation that I had heard from other water operators, scientists and engineers in Massachusetts. Is this type of behavior too systematically embedded and ingrained in the organization to change?

22. How can MassDEP improve their emotional intelligence, to lessen the creation of unnecessary angst, frustration, and anger in their human stakeholders?

23. MassDEP's Safe Drinking Water Act regulations really aren't too bad overall, but require a few important yet small changes. It's the manner of application of some of the regulations that is more problematic.

24. Could MassDEP improve the readability and understandability of their drinking water regulations? It's such a nightmare to follow. Perhaps they could at least put hotlinks in the online versions of regulations wherever a different section is referenced so that the user could quickly click to that section to review it and then go back to where they were. That's a simple intern-level task, but would really help stakeholders better understand and navigate the regulations.

25. Someone needs to pull MassDEP's Drinking Water Program back into an honest reality. Their reign of terror needs to end. Will that be the USEPA? Governor Baker? Our senators and representatives? Or perhaps MassDEP themselves??

26. For the U.S. Environmental Protection Agency –

    - What level of technical competency, common sense, and integrity is required for a state agency to serve as the Primacy Agency for enforcement of the SDWA?
    - Do the decisions I have observed been made by MassDEP meet the level required?
    - What does USEPA do to ensure MassDEP adequately oversees disinfection processes?
    - How can we get better QA/QC review for assessing the real need for capital projects?
    - Can USEPA implement a means for stakeholders to bring to USEPA's attention these kind of issues with primacy agencies?
    - Would USEPA be able to infuse some fairness and technical proficiency into the decisions?

27. For Senator Markey – is USEPA doing a good enough job of overseeing the primacy agencies for the Safe Drinking Water Act, particularly in Massachusetts? Are they really getting at what's important?

28. For Governor Baker –

How can I help the people of the state if the state won't let me?

The manganese issue in Housatonic is already in the process of being addressed, MassDEP has agreed with the concept of installing a manganese removal system, and pilot testing is planned for this summer. I respectfully suggest that your time and efforts are not needed there despite the assertions of the recent customer petition. However, your attention toward the many issues with MassDEP's Drinking Water Program could be very beneficial and would be greatly appreciated.

I respectfully recommend further inquiry be made into the nature of these types of decisions made by MassDEP, and the resulting adverse impacts on communities small and large. I also recommend a new paradigm of regulatory and operational oversight be developed and implemented at MassDEP, including the following:

a. A strategic plan for addressing the institutional problems that have been identified by Water Compliance Solutions, LLC and other drinking water professionals, including a specific vision,

goals, success metrics, and an evaluation and oversight mechanism to ensure the mission of the strategic plan is reached.

b. A new vision for MassDEP's role with water systems, including more and better assistance to help water systems comply with the regulations, and more selective enforcement (think "serve and protect")

c. A new system for independent stakeholder vetting of any drinking water capital projects required by MassDEP or any violations (Notices of NonCompliance) issued by MassDEP

d. New training for MassDEP drinking water staff on the important underlying scientific and regulatory principles that apply to their oversight of Massachusetts' public drinking water systems, including using appropriate relative real-life risk assessments to prioritize assistance and enforcement efforts. Also induce improvements in emotional intelligence to lessen the creation of unnecessary angst, frustration, and anger in human stakeholders.

e. A new system for how water systems are operated and managed in terms of licensed operator requirements is definitely needed. A new system is also needed regarding treatment plant and distribution system operational requirements for operator staffing, daily work time, and living distance from work. The regulations are outdated, inefficient, create staffing issues, and greatly limit the success of small systems.

The current system especially does not work well in rural areas where there just aren't enough licensed operators available. The Town of Chester is a prime example of where the operator license requirements have affected a water system by restricting the available personnel to one single person.

Regulatory requirements should be modified to allow alternate approaches to managing water systems using Licensed Operators as responsible agents, but not requiring specific activities to be performed by a licensed operator or for the Primary Operator to live within only one hour of the water system. This approach could be both more effective and more efficient than the current system. Modern automated systems do not require much direct attention, provide alarms when something does need attention, and can provide remote access to data. Systems like that do not require excessive babysitting at high cost to small-system customers. And with improved effectiveness by MassDEP in their inspections and oversight of treatment systems, the need for licensed operators to be required for all daily activities would be substantially reduced.

f. In my experience, drinking water systems are very resistant to appeal MassDEP's decisions due to potential legal costs and the fear of expensive retaliation. The existing MassDEP Office of Appeals and Dispute Resolution (OADR) is responsible for receiving all adjudicatory appeals of MassDEP's permitting and enforcement decisions. That office is staffed with attorneys, so going that route to settle a dispute over water chemistry or treatment principles should not necessarily be expected to be fruitful or efficient.

Perhaps there could be a new ombudsman office in MassDEP to review appeals for help from communities and water systems about their drinking water or MassDEP's actions, and to ensure those appeals may be made without fear of retribution from anywhere in MassDEP. This service could also be overseen by a separate ethics office, or be a part of the OADR. This would need to include participation by experts in water chemistry and treatment, and so perhaps an independent stakeholder group of water industry professionals could be tapped (pun intended) to help ensure any decisions made are supported by facts and sound science.