Hampstead Area Water Company
DW 20-117

Date Request Received: 1/6/2022 **Date of Response: 1/21/2022**
Request No. OCA 1-4 **Witness: Karen Steele**

REQUEST:

4. Refer to Testimony of Karen S. Steele, page 4, lines 4-6. Kindly cite to or provide copies of any data of which you are aware concerning over-pumping at the Hampstead Area Water Company well in Hampstead.

RESPONSE:

Hampstead Water Advocates Report (OCA 1-4 -- Main Streat Area Wells Report-Final)

NH DES Report – attached (OCA 1-4 -- Hampstead Initial Findings Report DES April 2019)

Rockingham Superior Court Preliminary Injunction – attached (OCA 1-4 -- 1 25 21 Court Order)

Reference Exhibit KS-28, with pumping data from DES OneStop which was provided to DES by HAWC, as is required.

Hampstead Area Water Company
DW 20-117

Date Request Received: 1/6/2022 **Date of Response: 1/21/2022**
Request No. OCA 1-12 **Witness: Karen Steele**

REQUEST:

12. Refer to Testimony of Karen S. Steele, page 11, lines 8-10. Please state where the referenced "triple volume capacity" is going today and whether it is being sold.

RESPONSE:

- The company has not said where this water will go, through they have said they have no plans to expand the Atkinson-Hampstead Core which is the only portion of their network to be able to consume pipeline water.
- In response to discovery requests Steele TS 5-2 and Steele TS 5-3, HAWC had no quantifiable justification for their 10 year and 20 projected demands that they provided to Underwood Engineering for the design of the pipeline (attached).
- If you refer to Exhibit KS-27, there are not many options to gain customers/consumers other than the development plans at the Atkinson Country Club.

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 1 of 50

The State of New Hampshire

ROCKINGHAM COUNTY **SUPERIOR COURT**

Deanna Anthony, et al.

v.

Hampstead Area Water Company, Inc.
and
Lewis Builders Development, Inc.

Docket No.: 218-2019-CV-01361

ORDER ON PLAINTIFFS' REQUEST FOR A PRELIMINARY INJUNCTION

The plaintiffs,[1] a group of owners and tenants of single-family houses in Hampstead, brought suit against the defendants, Hampstead Area Water Company, Inc. ("HAWC") and Lewis Builders Development, Inc. ("Lewis Builders"). Compl. (Doc. 1). The suit arises out of the defendants' alleged interference with the plaintiffs' groundwater. The plaintiffs bring claims for negligence, nuisance, negligence per se, and unjust enrichment. Id. The plaintiffs also seek preliminary and permanent injunctive relief. Id. Currently before the Court is the plaintiffs' request for preliminary injunctive relief. The Court held a multi-day hearing on this request on February 7, March 13, August 20, and September 3, 2020. The parties also submitted pre-hearing and post-hearing memoranda and proposed orders to the Court. See Pls.' Pre-Hr'g Mem. (Doc. 15); Pls.' Post-Hr'g Mem. (Doc. 47); Pls.' Proposed Order (Doc. 48); Defs.' Pre-Hr'g Mem. (Doc. 14); Defs.' Post-Hr'g Mem. (Doc. 50); Defs.' Proposed Order (Doc.

[1] The plaintiffs in this case are Deana Anthony, David Anthony, Scott Skafas, Exacusti Skafas, Michael Hanides, Karen Hanides, the Hanides Family Revocable Trust, Thomas Farhadian, Carolyn Farhadian, the Thomas and Carolyn Farhadian Revocable Trust, Rachel Neri, Graig Neri, Deborah Fairchild, Kenneth Fairchild, Daniel MacDonald, Dennis Silva, Cindy Silva, and Howell Steadman.

51).[2] For the following reasons, the Court GRANTS in part and DENIES in part the plaintiffs' request for preliminary injunctive relief.

Facts

The court derives the following facts from the testimony and exhibits the parties presented at the multi-day hearing. The court will cite to the exhibits, but will not cite to hearing testimony. Given the significant amount of testimony and exhibits in this case, and the complicated issues involved, the Court will divide this section by topic.

A. HAWC and its operations.

HAWC is a privately owned public utility company that provides water services for residents, businesses, and municipalities in southern New Hampshire. The New Hampshire Public Utilities Commission (the "PUC") issued a tariff to HAWC that requires the company to provide an uninterrupted supply of clean drinking water to all of the customers within its service area. HAWC's service area includes Hampstead and parts of Atkinson. There are approximately 2,700 connections in Hampstead and Atkinson to HAWC's water system, and HAWC serves approximately 6,700 people through these connections. Defs.' Ex. A.

HAWC's water system has approximately fifteen sources of groundwater. One source is the Kent Farm Well Field ("Kent Farm") in Hamsptead. See Defs.' Ex. AA-1 (depicting Kent Farm's location and surroundings). HAWC has operated Kent Farm since the 1980s. Defs.' Ex. E at 14. HAWC withdraws groundwater from the bedrock aquifer beneath Kent Farm using wells. From the 1980s until the summer of 2017,

[2] The parties incorporated their motions on the defendants' two motions to dismiss, (Docs. 17, 18), into their post-hearing memoranda. See Doc. 47 at 27 n. 8; Doc. 50 ¶ 55. The Court issued an order resolving the defendants' motions to dismiss on December 29, 2020. See Court Order on Defs.' Mots. Dismiss (Doc. 54).

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 3 of 50

HAWC operated two wells on Kent Farm, known as BRW-1 and BRW-3. Id. at 14–15. Over time, the productivity of these wells significantly decreased. Id. at 15. In response to this decrease in productivity, HAWC drilled a new well, known as BRW-4, in 2016. Id. BRW-4 was a test well and HAWC did not originally connect the well to its system. In July 2017, the New Hampshire Department of Environmental Services (the "DES"), which regulates large groundwater withdrawals, issued HAWC temporary approval to withdraw groundwater from BRW-4 to meet summer demand within its customer area. Id. In August 2017, HAWC shut down BRW-1 and BRW-3 and began to exclusively use BRW-4 to extract water at Kent Farm. Id. During that summer, HAWC pumped BRW-4 at rates between 90 and 110 gallons per minute ("gpm"). BRW-4 has remained in operation since the summer of 2017 and HAWC has pumped the well at varying rates throughout its history. Prior to December 3, 2018, HAWC operated BRW-4 without a formal, long-term permit from the DES. On December 3, 2018, the DES issued a permit for HAWC to pump BRW-4 at a permitted production volume ("PPV") of 80 gpm. Pls.' Ex. 15 at 2.

According to the DES, since HAWC installed BRW-4 in January 2016, the average monthly water use from Kent Farm increased approximately forty percent over the average use from January 2010 to January 2016. Defs.' Ex. E at 16–17; see also Pls.' Ex. 33 (demonstrating that between 2004 and 2015, the combined extraction rate of BRW-1 and BRW-3 was approximately 45 gpm). Between August 2017 and February 2018, BRW-4's pumping rate ranged from 80 to 100 gpm. Defs.' Ex. E at 18. HAWC did not operate BRW-4 in early February 2018. Id. From June to August 2018, BRW-4's pumping rate was 107 gpm. Id. In September 2018, BRW-4's pumping rate

averaged 90 gpm. Per the DES' analysis, there was a strong correlation between reductions in pumping rates at BRW-4 and increases in groundwater levels. Id. at 18–19.

B. Issues with the plaintiffs' private wells in 2017 and 2018.

All of the plaintiffs either live in or own properties along Main Street in Hampstead and rely on private wells to supply their homes with water.[3] See Pls.' Ex. 35. The plaintiffs do not live within HAWC's existing service area. Main Street lies approximately 2,500 feet from Kent Farm. Defs.' Ex. E at 14. Deanna and David Anthony (the "Anthonys") are tenants at 414 Main Street, and moved into the residence in May 2018. Defs.' Ex. E at 5. At the time they moved in, there were four wells on or near the property.[4] Id.; see also Defs.' Ex. P (depicting the wells on or near 414 Main Street). The first well on the property was drilled in 1999 and provided water to the residence until it went dry, meaning it could no longer supply the home with water, in August 2017. Defs.' Ex. E at 6. Between August and October 2017, the then-owners of 414 Main Street drilled three new wells, with only the fourth well ("Well 4") able to provide water to the residence. Id. When the Anthonys first moved into their home, Well 4 provided them with sufficient water to meet their domestic needs and they did not notice any issues with the water's quality. In June 2018, the Anthonys noticed a significant change in water quality in the well, id. at 5; Deanna Anthony testified that on June 10, 2018, the water coming out of the faucets was "orange and smelly." In early

[3] Except for Deanna Anthony, David Anthony, and Howell Steadman, all of the plaintiffs both own and live in their homes. Steadman owns the property at 414 Main Street in Hampstead, while the Anthonys reside in the residence on the property as tenants.
[4] As the Court understands the record, one of these wells was located adjacent to, but not on, 414 Main Street.

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 5 of 50

July 2018, Well 4 went dry. Id. Well 4, and the other three wells on the property, remained dry until early December 2018. Id.

After the wells went dry, the Anthonys brought a temporary storage tank and booster pump to supply water to their home. Id. at 6. A company delivered water to fill the tank on a weekly basis. Id. Due to freezing temperatures in the fall of 2018, the Anthonys took the storage tank offline and had the water delivery company discharge the water into the (then dry) Well 4 on at least one occasion.[5] Id. The Anthonys could store approximately 450 gallons of water in Well 4. Id. By early December 2018, after HAWC reduced BRW-4's pumping rate to 80 gpm, Well 4 was able to supply at least fifty gallons of groundwater per day to the home. Id. Deanna Anthony testified that, since the water has returned, the Anthonys have been able to use their well water for non-consumptive purposes. However, Deanna Anthony also testified that the water, after returning in December 2018, smelled and stained fixtures and dishes. Deanna Anthony testified that, as of the February 7, 2020 hearing, the Anthonys have been unable to drink or make any use of the water that requires human contact because of its quality. See Pls.' Ex. 2 (images from the Anthonys' home taken on or around November 13, 2019, depicting staining of appliances, dishes, and fixtures).

Scott Skafas and Exacusti Skafas (the Skafases) have lived at 405 Main Street since 2012. The Skafases maintain a residence and farm animals on their property. Exacusti Skafas testified that the family did not experience any issues with water

[5] The plaintiffs objected to defense expert James Emery's testimony that water was added to Well 4 in the fall of 2018 on the grounds that he had no first-hand knowledge of this occurrence. For the same reason, the plaintiffs disputed Emery's testimony that water was injected into Well 4 on multiple occasions. In April 2019, the DES reported that "bulk water deliveries were discharged into" Well 4 "in late fall of 2018." Defs.' Ex. E at 6. From this evidence, the Court finds that the Anthonys added water to Well 4 at least once in the fall of 2018 but makes no conclusions as to how many times it occurred.

quantity or quality after purchasing the home until 2017. In November 2017, the primary well supplying water to the Skafases' property went dry. Id. The Skafases drilled a new, deeper well that same month. Id. This well currently supplies water to the property. Id. Exacusti Skafas testified that when the water originally returned, the water quality level was very low, and stained the family's dishes, faucets, and water-reliant appliances. See Pls.'s Ex. 3 (images from the Skafas' home depicting staining of dishes and fixtures). She further testified that, as of February 7, 2020, the current supply of water was sufficient to supply the home and farm animals, but remained of poor quality and thus her family did not drink it.

Karen Hanides and Michael Hanides live at 387 Main Street. There are two wells on this property. Id. at 7. The first well dates from 1991 and went dry in 2010. Id. The second well replaced the first well. Id. In order to encounter an adequate water volume to source the well, the driller was required to dig this well 400 feet deep. Id. at 8. In early October 2017, this well went dry. Id. The Hanideses then deepened this well to 600 feet, at which depth it was able to meet most of their domestic water needs. Id. The Hanideses, however, had lost water for approximately three months.

The Court will hereinafter refer to the plaintiffs who testified at this hearing as the Monitored Plaintiffs.

C. The DES' investigation and report.

In September 2018, the DES learned about the water issues at properties along Main Street and initiated an investigation. See Defs.' Ex. E at 1. This investigation included monitoring wells at 387, 405, and 414 Main Street (the "Monitored Wells"). Id. In April 2019, the DES released a report on its investigation. See Def.'s Ex. E. That

report indicated the DES "confirmed numerous water capacity issues" around Main Street. Id. at 25. Putting the water issues in context, the DES noted that "[t]he need to deepen an existing water supply well or install a replacement well is common in many areas in southern New Hampshire, especially where there is a relatively high density of private wells." Def.'s Ex. E at 12. In fact, the DES stated that, as Hampstead's population increased in the past thirty years, the average depth of wells approximately doubled. Id. at 13. The report also indicated that there are many natural and human impacts upon groundwater levels and well production. Id.

Nonetheless, the report found that the only large water user in close proximity to Main Street was Kent Farm. Id. It further observed that, although increasing population density and other factors contributed to issues with private wells over the previous thirty years, "a noted change in the groundwater system in 2017 . . . led to an increase in the number of water capacity issues in the area." Id. at 25. Based on data from the Monitored Wells, the DES concluded that there was a hydraulic connection between the Monitored Wells and Kent Farm, as the water levels in these wells fluctuated depending on the rate of withdrawal at BRW-4. See id. at 20–26. It further concluded that "[t]he primary cause for declining groundwater levels in the vicinity of 414 Main Street from July 2017 through December 2018 [was] the operation of [Kent Farm]." Id. at 1; see also id. at 26. The report noted that, prior to the release of the report, "[the DES] ha[d] coordinated with HAWC to reduce withdrawals from the wellfield and groundwater levels ha[d] consequently been recovering within the vicinity of 414 Main Street." Id. The

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 8 of 50

report concluded that "[o]ther water use activities in the area may also impact groundwater levels over the long term." Id.; see also id. at 26.

D. HAWC's operations since April 2019.

In addition to releasing this study, the DES revised BRW-4's PPV from 80 to 70 gpm in April 2019. Pls.' Ex. 24. In September 2019, the DES and HAWC reached an agreement wherein HAWC volunteered to pump BRW-4 at a rate of 35 gpm, half of its 70 gpm PPV. According to the testimony of Charles Lanza, HAWC's general manager, 35 gpm was an "arbitrary" figure that HAWC reached internally based solely on HAWC's water needs during the fall and winter months. After the initial hearing on the plaintiffs' request for a preliminary injunction, the Court ordered HAWC to maintain this pump rate while the request was pending. As a result, HAWC has been limited to pumping BRW-4 at an approximate rate of 35 gpm since September 2019.

In the spring of 2020, the DES issued a groundwater withdrawal permit to HAWC for a new source known as Angle Pond. The well at Angle Pond has a PPV of 113 gpm. Since it has been in operation, HAWC has pumped the Angle Pond well at a rate between 80 and 110 gpm. In addition, at the time of the August 20, 2020 hearing, there was another source of water which was "tentatively" set to connect to HAWC's system, known as the Southern New Hampshire Water Project. This source was set to provide a significant amount of water to HAWC's water system. At the same time, Lanza testified at the August 20, 2020 hearing that HAWC planned to remove several of its existing water stations over the next year. Lanza stated, however, that it was HAWC's

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 9 of 50

decision to remove these stations based on its business operations, and it could keep them online if it so chose.

In addition, Lanza testified as to HAWC's ability to provide water to its customers given the 35 gpm limit on BRW-4. As the Court understands Lanza's testimony, HAWC cannot set a precise withdrawal amount for BRW-4. Rather, its system allows it to set a general target, but minor fluctuations above and below this pumping target inevitably occur. For this reason, in order to ensure that its pumping rate does not exceed 35 gpm, HAWC must set its pumping rate at around 30 gpm. Data from HAWC for the spring and summer of 2020 demonstrate that, while there have been several minor deviations, HAWC has generally pumped BRW-4 at a rate below (and often significantly below) 35 gpm during this period. See Pls.' Exs. 52–53. Lanza testified that HAWC was forced to implement an "exterior water use ban" on its customers in the summer of 2020, due both to severe drought conditions and the Court's limitation on BRW-4's pump rate. Lanza testified that an exterior water ban did not apply to the use of water within homes, and it mostly served to limit its customers' abilities to water their lawns.

At the same time, Lanza testified that HAWC was concerned it would be unable to meet its customers' domestic water needs while pumping BRW-4 at 35 gpm. However, Lanza also testified that HAWC was able to meet those needs throughout the summer of 2020. The record does not indicate that HAWC has even been unable to meet its customers' domestic needs since HAWC began pumping BRW-4 at 35 gpm in September 2019.

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 10 of 50

E. Expert testimony on the hydraulic connection between the Monitored Wells and BRW-4.

At the multi-day hearing, the parties presented the conflicting expert testimony of Manu Sharma and James Emery on three issues relevant to this Order: (1) the hydraulic connection between BRW-4 and the three Monitored Wells; (2) the rate at which BRW-4's operation negatively affect the plaintiffs' water levels; and (3) the likely causes of the contamination of the water in Well 4.[6] For the purpose of this Order, the Court will discuss both experts' opinions as to each topic in turn.

The plaintiffs presented Manu Sharma as an expert in hydrology and engineering. Relying on historic pumping data and measurements of water levels in the Monitored Wells, Sharma testified that there was a strong correlation between the pumping of BRW-4 and all three of the Monitored Wells. The Court notes that there are multiple wells on each of the Monitored Plaintiffs' properties, and that the DES only monitored water levels in one well on each property—which are the wells the Court refers to by the term "Monitored Wells."[7] For the purposes of this Order, the Court will hereinafter refer to these monitored wells as 387 MW, 405 MW, and 414 MW, respectively. With respect to 414 MW, Sharma testified that data collected from July 2017 to December 2019 demonstrated that decreasing the pumping rate of BRW-4 resulted in corresponding increases in 414 MW's water levels. See Pls.' Ex. 28. In addition, Sharma testified that analogous data from 387 MW and 405 MW demonstrated

[6] The experts testified to a range of other issues, including whether HAWC properly permitted BRW-4. The Court does not need to resolve any issues relating to HAWC's permitting to rule on the plaintiffs' instant request, however, and thus will not recount this testimony.

[7] The Court notes that the Monitored Wells are not necessarily the wells that currently provide water to the Monitored Plaintiffs' residences. However, both the DES and the parties in this case treat the Monitored Wells as appropriate proxies for water levels in the other wells on the Monitored Plaintiffs' properties, and the Court will therefore do the same.

similar results. See Pls.' Exs. 30–31. Based on this evidence, and the DES' earlier conclusion in its April 2019 report, Sharma concluded that there was a strong correlation between BRW-4'a pump rate and the water levels in the Monitored Wells. In addition, Sharma testified that BRW-4's impacts on the Monitored Wells were relatively immediate, as increases and decreases in pumping rates were reflected quickly in water levels in the Monitored Wells. Finally, Sharma testified that these wells were representative of the other plaintiffs' wells in the area.

The defense introduced James Emery as an expert in hydrology and hydrogeology. Emery agreed with significant portions of Sharma's opinion, including that all three of the Monitored Wells were hydraulically connected to BRW-4 and that their water levels reacted relatively quickly to changes in BRW-4's pumping rate. However, Emery also testified that data from the Monitored Wells showed signs that additional, unidentified causes were affecting water levels. See Defs.' Exs. W, Z, AA-2, BB. In particular, Emery testified that data from 387 MW demonstrated that this well's connection to BRW-4 was different from 405 MW and 414 MW's connections to BRW-4, and was actually less responsive to pumping at BRW-4 than the other two wells. See Defs.' Ex. BB. For this reason, Emery opined that 387 MW was strongly affected by withdrawals from a source other than BRW-4. See Defs.' Ex. BB, Defs.' Ex. W (demonstrating a correlation between BRW-4 and the well at 387 Main Street but also showing fluctuations in the 387 MW's water levels even at times BRW-4 was not operational).

Emery testified that, in light of this data, there were likely other causes affecting water levels in all three Monitored Wells, including a recreational center and an

apartment complex in the vicinity. Emery conceded, however, that he did not have data showing that any of these other users actually had an impact on the Monitored Wells. Finally, Emery testified that, other than the Monitored Wells, there was no data available that demonstrated that any of the other plaintiffs' wells are hydraulically connected to BRW-4 and that, without such data, it would be impossible to offer an opinion as to whether these wells were connected to BRW-4.

Sharma disagreed with Emery about the relative strength of the connection between 387 MW and BRW-4 and the existence of another, unidentified user significantly contributing to the water level issues at the Monitored Wells. With respect to 387 MW, Sharma presented data demonstrating a strong correlation between the pumping rates at BRW-4 and the water levels at 387 MW. See Pls.' Ex. 50 (demonstrating that whenever BRW-4's pumping rate increased, the water levels at 387 MW decreased, and vice versa). In addition, Sharma opined it was unlikely the adjacent apartment complex, given its size, had a significant impact on any of the Monitored Wells. However, he also testified that he had no data on the apartment complex's pumping rate and its relative impact on groundwater levels.

F. Expert testimony on the appropriate pumping rate for BRW-4.[8]

Both parties testified as to the appropriate pumping rate for BRW-4 to ensure that water levels in the Monitored Wells were sufficient to provide for the residences' needs—which Sharma testified meant they must be capable of producing 400 gallons of

[8] Neither party introduced express evidence on how groundwater withdrawals affect groundwater levels, the relationship between groundwater levels and water levels within private wells, and other background information relevant to the BRW-4's effects on the Monitored Wells' ability to produce sufficient water to supply residential needs. For an overview of this information, the Court relied on the Restatement (Second) of Torts. See Restatement (Second) of Torts Ten 41 4 Intro. Note (1979).

water per day. Both experts relied on historical data comparing the pumping rate at BRW-4 to water levels in the Monitored Wells from November 2018 to December 2019. See Pls.' Exs.' 28, 30–31; Defs. Ex. D. This data is presented in the form of graphs and demonstrates that, after December 2018, HAWC pumped BRW-4 at varying rates in between 80 gpm and 35 gpm. Id. It also demonstrates that prior to September 2019, when HAWC began pumping BRW-4 at 35 gpm, the water levels at the Monitored Wells remained relatively low and showed only modest, if any, increases. Id. For example, when HAWC pumped BRW-4 at a rate of about 45 gpm around February 21, 2019, none of the Monitored Wells' water levels showed any signs of consistent increases, and the water levels in 405 MW actually decreased. Id.

That said, water levels in 405 MW and 414 MW did show signs of consistent increases between April 2019, when HAWC began pumping BRW-4 at a rate of 70 gpm, and June 2019. Pls.' Exs. 28, 31. Water levels in these wells decreased, however, between June and September 2019. Id. Water levels in 387 MW showed no consistent increases between April and September 2019. Pls.' Ex. 30. When BRW-4 began pumping at a rate of 35 gpm in September 2019, the water levels in all three Monitored Wells increased significantly. Pls.' Exs. 28, 30–31. The Court understands that water levels in all three Monitored Wells have remained consistently high—i.e., with several hundred feet of groundwater above the well's depth—since September 2019. See, e.g., Defs.' Ex. S (showing water levels remaining stable in 414 MW throughout the summer of 2020 while BRW-4 was being pumped).

The experts disagreed as to the meaning of this data. Sharma testified that high pumping rates in 2017 and 2018 had resulted in the Monitored Plaintiffs' wells going

dry. Sharma further testified that, although all of the Monitored Wells were producing water by the end of 2018, water levels within the Monitored Wells were insufficient to meet residenital water needs until the levels showed significant increases in September 2019. In particular, Sharma testified that, prior to September 2019, the water levels in the Monitored Wells were not adequate to provide sufficient water to the residences on a year-round basis, particularly during the summer months (when water levels become stressed). He testified that the data indicated that only at 35 gpm did the water levels in the Monitored Wells show signs of recovery, and that any increase in BRW-4's pump rate would therefore result in the water levels becoming depleted again. Based on this data, Sharma testified that 35 gpm "appear[ed]" to be the safe level for pumping BRW-4 with respect to ensuring the Monitored Wells have adequate water levels. He also testified, however, that many different factors affected water levels, including seasonal conditions, and the appropriate pumping rate may therefore change as well. He thus recommended continued monitoring the plaintiffs' wells to ensure water levels did not materially decrease as a result of BRW-4.

The defendants' expert Emery disagreed that limiting BRW-4's pump rate to 35 gpm was necessary to protect the water levels in the Monitored Wells. Emery agreed that pumping rates above 70 gpm had resulted in the depletion of the water levels in the Monitored Wells. However, he testified that, starting in April 2019 when HAWC set BRW-4's pump rate to 70 gpm, the water levels in 405 MW and 414 MW showed signs of recovery until June 2019. See Defs.' Ex. D.[9] While Emery conceded that water

[9] Emery acknowledged that 387 MW did not show similar increases, but this testimony must be placed in the context of Emery's opinion that 387 MW is affected by unidentified water withdrawals and thus may experience impacts unrelated to BRW-4.

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 15 of 50

levels in these two wells declined between June and September 2019, he testified that water levels typically decline in the summer months.

At the same time, Emery agreed water levels in the Monitored Wells were low prior to September 2019, and that imposition of a 35 gpm limit on BRW-4 allowed these levels to increase significantly, with water levels rising by about 220 feet. Emery testified that, due to this increase, the water levels have since "recovered" and are sufficient to meet residential needs. In fact, Emery testified that water levels in at least one well, 414 MW, had over two hundred feet of available water to draw from. See Defs.' Ex. S. As the Court understands Emery's testimony, his opinion is that it may have been appropriate to reduce BRW-4's pumping rate below 70 gpm for a certain period of time to allow water levels in the underlying aquifer and in the Monitored Wells to recover from their low levels prior to September 2019. However, once those water levels had recovered, it was no longer necessary to limit BRW-4's pumping rate to promote such significant recovery. Instead, the appropriate goal was to find a pumping rate that maintained water levels in the Monitored Wells at levels sufficient to provide adequate amounts of water to the Monitored Plaintiffs. Emery testified that the current data did not indicate what this rate was, but that the bedrock aquifer and the Monitored Wells' water levels could handle pumping above 35 gpm. He testified that the best method for determining the appropriate rate would be to allow HAWC to slowly increase BRW-4's pump rate in month-long intervals, while continuing to monitor the Monitored

Plaintiffs' wells to determine the impacts of these increases and adjusting BRW-4's pumping rate accordingly.

G. Expert testimony on the contamination of Well 4.

Finally, the parties presented expert testimony on the potential causes of contamination of Well 4 at 414 Main Street.[10] As an initial matter, both experts agreed that the water within Well 4 has been significantly contaminated since January 2019 and is not safe for consumptive purposes, such as drinking, cooking and bathing. See Pls.' Ex. 29 (showing, in addition to other deviations, that the pH, iron, and manganese levels in the water from Well 4 have significantly deviated from safe drinking water standards since January 2019); see also Defs.' Ex. O. Further, both experts agreed that, prior to Well 4 going dry in the summer of 2018, the water it produced was safe for human consumption (at least after treatment). See Pls.' Ex. 29 (comparing water quality in Well 4 in October 2017 and April 2018 with water quality from January to November 2019). Although the water within Well 4 is contaminated in several ways, its major problem appears to be that it is highly acidic—i.e., that it has a low pH level.

The plaintiffs' expert Sharma testified that the water quality issues in Well 4 were a direct consequence of BRW-4's high extraction rates depleting water levels in the aquifer near Well 4. Sharma testified that the mineral pyrite is often found in bedrock formations in southeastern New Hampshire, where Hampstead is located. Sharma testified that, under normal conditions, when pyrite is submerged within water, it remains stable. However, he testified that when pyrite is exposed to air, it oxidizes and releases sulfuric acid. This acid, when released into water, causes the water itself to

[10] As the Court understands, Well 4 is the Anthonys' current service well—the well connected to their residence's plumbing—and is separate from 414 MW, the well which the DES is monitoring.

become acidic. In Sharma's opinion, this phenomenon explains the low pH levels in the water at Well 4 because the documented effects of pyrite on water are consistent with the data on Well 4's contamination. That said, Sharma testified that he did not know whether there was pyrite in the rock formation underneath Well 4. Rather, he testified that he knew from geological literature that pyrite was present in rock formations in southeastern New Hampshire, and that the problems in Well 4 were consistent with the oxidation of pyrite.

For his part, Emery disagreed that low water levels within the aquifer were the direct cause of the poor water quality in Well 4. Emery noted that Well 4's water was significantly worse than the water at any other well in the vicinity, including the water at 387 Main Street, 405 Main Street,[11] and the water drawn from BRW-4. See Defs.' Ex. G (results of water quality testing at BRW-4 from March 6, 2020). In addition, Emery presented water quality data from two other wells at 414 Main Street. Defs.' Ex. O. This data demonstrated that the water quality at all three wells failed to meet clean drinking water standards. Id. However, it also showed that Well 4's water quality was multitudes worse in every criterion than the other two wells. Id. Emery testified that he would not call the water in either of the other two wells "good quality water," but his opinion was that the water in either could be treated and made safe for consumption. Id. Significantly, Emery noted that all three of the wells at 414 Main Street, in addition to

[11] Exacusti Skafas testified that the quality of the water from her service well was poor and that she and her family did not drink it. However, the plaintiffs did not present data as to the quality of the water in this well.

the wells at 387 Main Street and 405 Main Street, went dry at some point in 2017 and 2018, but that only Well 4's water quality dramatically deteriorated.

Emery testified that, given the differences in water quality between Well 4 and the other wells in the area, Well 4's contamination was likely not caused by something affecting minerals in the bedrock of the aquifer, as the contamination would then have been more widespread. Further, while Emery testified that oxidation of pyrite could have caused the increased acidity in Well 4's water, his opinion was that this phenomenon would be unlikely to cause the extreme change in water quality in Well 4 within the six-month period of time Well 4 was dry. Moreover, he testified that if pyrite was the cause, the water quality should have improved after water levels increased, but that water levels in Well 4 have remained consistently poor since January 2019. Finally, he testified that because all of the Monitored Wells, in addition to the other two wells at 414 Main Street, are part of the same rock formation, pyrite would have been present in the bedrock underlying all other wells. For this reason, Emery opined that if the oxidation of pyrite was the cause, these wells would have seen similar effects on water quality.

In Emery's opinion, the problems at Well 4 were likely local to that well. He testified that the only significant difference between Well 4 and the other wells in the area was that the Anthonys discharged water from a water delivery company into the well in the fall of 2018. Emery testified that water delivery companies usually treat water with chlorine to disinfect it prior to delivery. Emery testified that this fact was significant because chlorine is an oxidizer. In Emery's opinion, if there were "sufficient bulk deliveries" of chlorinated water into Well 4, then the chlorine in this water could have

oxidized minerals present within Well 4 and increased the water's acidity. In Emery's opinion, the addition of this chlorinated water was the likely cause of the water quality issues in Well 4.[12] At the same time, he testified that he had no knowledge of whether the company in this case treated the water with chlorine prior to delivering it to the Anthonys or injecting it into their well.

For his part, Sharma strongly disagreed that the quality issues in Well 4 were caused by the injection of chlorinated water, rather than oxidation of pyrite. Moreover, Sharma disputed Emery's testimony that the differences in water quality in Well 4 and other wells in the area showed that pyrite, or the oxidation of minerals within the bedrock, was not the cause of Well 4's acidic water. Sharma testified that, even within relatively short distances, variations in the composition of bedrock are common. For this reason, pyrite might have been present, or more common, under the subsurface of Well 4, but not under the other wells in the area. Further, he testified that a hydraulic connection between two wells does not necessarily mean they were drilled into the same rock formation. In fact, he testified this situation would not be uncommon, as the only requirement for a hydraulic connection is that the wells draw from the same fracture. Sharma testified that it would not be unusual for wells drawing from the same fracture to have different water qualities because the minerals and conditions around each well could differ significantly. In response to questioning on cross-examination, Sharma conceded that he did not know what rock formation Well 4 was drilled into. He

[12] At the August 20, 2020, hearing, Emery testified that the presence of a perforated pipe in Well 4, which did not exist in the other wells on that property, could also have been the cause of water quality issues in Well 4. He appeared to abandon this theory, however, at the September 3, 2020, hearing. Moreover, Emery expressly discounted other potential causes of the low pH in Well 4, including the presence of liquid carbon dioxide and muriatic acid.

testified, however, that he did not need to know this information to form an expert opinion as to whether pyrite could have caused the contamination of Well 4 because he knew that pyrite was present in southeastern New Hampshire and the contamination in Well 4 was consistent with the effects of the oxidation of pyrite.

In terms of a solution to the contamination issues, Sharma testified it would take several decades for the water quality at 414 Main Street to improve even after water levels recovered. As a result, Sharma testified that 414 Main Street would need an alternative source of water. For the short-term, Sharma testified that a temporary storage tank should be set up at 414 Main Street with infrastructure to connect to the residence's water lines, so that water could be delivered on a regular basis and used within the residence. See Pls.' Ex. 39 (detailing components of this plan and explaining their costs). According to Sharma, the average household requires 400 gallons of water a day (or 100 gallons per person for a typical family of four), and thus any alternative source of water would need to supply this amount to the residence. Finally, he testified that, given New Hampshire's cold winters, any temporary storage tank would need to be stored in a shed to prevent it from becoming inoperable during the winter months.

Emery did not agree that this solution was necessary. Emery presented data showing that the other wells on 414 Main Street were capable of producing sufficient amounts of water to serve the needs of that residence. See Defs.' Exs. S, V. Emery testified that because these wells produced water that, upon treatment, would be safe for human consumption, the Anthonys could draw water from these wells in order to

supply their residence's needs. Emery did not present data as to how much this plan would cost.

H. The plaintiffs' request to supplement the record.

After the September 3, 2020, hearing, the plaintiffs attempted to supplement the record with evidence that the wells on the properties of Rachel Neri and Graig Neri (the "Neris") and Thomas Farhadian and Carolyn Farhadian (the "Farhadians") went dry after the hearing. See Pls.' Motion to Admit Further Evidence (Doc. 46). The Court denied this request. See Margin Order on Doc. 46 (dated Oct. 6, 2020).

Analysis

This Order concerns the plaintiffs' request for several forms of preliminary injunctive relief. "A preliminary injunction is a provisional remedy that preserves the status quo pending a final determination of the case on the merits." N.H. Dep't of Env. Servs. v. Mottolo, 155 N.H. 57, 63 (2007). "The issuance of injunctions, either temporary or permanent, has long been considered an extraordinary remedy." Id. "An injunction should not issue unless there is an immediate danger of irreparable harm to the party seeking injunctive relief, . . . there is no adequate remedy at law [and the] party seeking an injunction [is] likely [to] succeed on the merits." ATV Watch v. N.H. Dep't of Res. & Econ. Dev., 155 N.H. 434, 437–38 (2007) (quoting Mottolo, 155 N.H. at 63)). In addition, "[t]he trial court retains the discretion to decide whether to grant an injunction after consideration of the facts and established principles of equity." Pike v. Deutsche Bank Nat'l Trust Co., 168 N.H. 40, 45 (2015).

The plaintiffs request the Court issue injunctions: (1) preventing HAWC from pumping BRW-4 at a rate higher than 35 gpm for the remainder of this litigation; (2) requiring HAWC to supply water to the Anthonys, Farhadians, and Neris through

temporary storage tanks and weekly water deliveries for the remainder of this litigation, and requiring HAWC to provide this same relief to any of the plaintiffs who notify the company his or her well has gone dry; (3) requiring HAWC to install monitoring devices in all of the plaintiffs' wells that the DES is not currently monitoring and provide monthly data to the plaintiffs about the plaintiffs' water levels and BRW-4's pumping rates; and (4) preventing HAWC from adding new customers to HAWC's water system while this litigation is pending. Doc. 47 at 4–5. The Court will evaluate each request under the applicable standard.

I. The plaintiffs' request to limit HAWC's pumping *rate to 35 gpm.*

The plaintiffs first request that the Court limit HAWC's pumping rate to 35 gpm while this litigation is pending. Doc. 47 at 4.[13] The plaintiffs further request an order requiring HAWC, if it exceeds this limit, to report the incident to the Court and the plaintiffs within forty-eight hours and show cause as to why the Court should not hold the company in contempt. Id. Prior to analyzing this request, the Court notes that, although the plaintiffs direct this request toward both defendants, HAWC is the party in control of BRW-4, not Lewis Builders. For this reason, the Court will analyze this request only as it pertains to HAWC. In addition, the Court notes that one challenge the defendants make to this request is that the record only contains evidence as to wells the Monitored Plaintiffs own, and that there is therefore no basis to grant any relief to the other plaintiffs in this action. Doc. 50 ¶¶ 68–69. The Court does not need to make a finding on this issue, however. All of the plaintiffs request the same injunctive relief—a

[13] In response to this request, the defendants do not ask that the Court remove all Court-imposed limitations on BRW-4's pumping rate. Rather, they request that the Court sanction a procedure through which HAWC would be able to gradually raise its pumping rate above 35 gpm (up to 70 gpm) while monitoring the plaintiffs' wells to ensure no adverse impacts occur. See Doc. 50 ¶ 59; Doc. 51.

limitation on HAWC's pumping rate to 35 gpm. Thus, if the Court grants that relief on behalf of the Monitored Plaintiffs, the remaining plaintiffs will benefit as well. For this reason, the Court will analyze the plaintiffs' request only as to the Monitored Plaintiffs, and grant any merited relief in their name.

A. Likelihood of success on the merits

The plaintiffs argue they are likely to succeed on the merits of this request because the evidence in the record establishes that there is a hydraulic connection between BRW-4 and the Monitored Wells and that pumping BRW-4 at a rate above 35 gpm will have detrimental impacts on the Monitored Plaintiffs' well water levels. Doc. 47 at 9–13, 17–23.[14] For their part, the defendants do not dispute that HAWC's operation of BRW-4 has interfered with the Monitored Wells' water levels in the past and thus could interfere with the same in the future.[15] They do, however, argue that there is no evidence that limiting BRW-4's pump rate to 35 gpm is necessary to protect the Monitored Plaintiffs' water levels and ability to withdraw groundwater from their wells. Doc. 50 ¶¶ 61, 63–65.

Under New Hampshire law, landowners have "the right . . . to a reasonable use or management" of groundwater, "in view of the similar rights of others." In re Town of Nottingham, 153 N.H. 539, 548 (2006). "An unprivileged interference [with that right] is a tort[.]" Restatement (Second) of Torts Ten 41 Intro. Note (1979). Courts may protect

[14] The plaintiffs argue that they are entitled to this injunction because they are likely to succeed on their negligence, negligence per se, and nuisance claims. Doc. 47 at 24–25. In the Court's view, however, the plaintiffs do not have to show success on any one of these individual claims to obtain an injunction against an unreasonable interference with their common law right to a reasonable use of groundwater. Instead, they only have to show that they are likely to succeed in demonstrating that HAWC interfered with their reasonable use of groundwater.

[15] The Court is not stating that the defendants are conceding this issue. The Court is only stating that this argument is not the basis of the defendants' objection to the instant request.

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 24 of 50

against interferences with this right by issuing injunctions. Nottingham, 153 N.H. at 548.

According to the Restatement:

> A proprietor of land . . . who withdraws ground water from the land and uses it for a beneficial purpose is not subject to liability for interference with the use of water by another, unless
>
> (a) the withdrawal of ground water unreasonably causes harm to a proprietor of neighboring land through lowering the water table or reducing artesian pressure,
>
> (b) the withdrawal of ground water exceeds the proprietor's reasonable share of the annual supply or total store of ground water, or
>
> (c) the withdrawal of the ground water has a direct and substantial effect upon a watercourse or lake and unreasonably causes harm to a person entitled to the use of its water.

Restatement (Second) of Torts § 858 (1979) (emphasis added).

All groundwater withdrawals will have some effect on water levels in wells drawing from the same aquifer. Id. § 858, cmt. e. Thus, the law bases the "protection against loss of access to the water . . . on a consideration of whether, under all the circumstances, the harm done by lowering the water table or pressure is unreasonable." Id. In general, uses of water that interfere with other reasonable uses of groundwater are considered unreasonable, and the reasonableness of a particular use of groundwater is evaluated in relation to the purpose and extent of other uses. Id. § 858. For example, a landowner who uses her groundwater to supply a large farming operation will not be able to hold another farmer liable for reducing the groundwater levels by withdrawing groundwater for the same purpose. Id. However, a nearby homeowner who uses the groundwater for the sole purpose of supplying his home's

domestic water needs may be able to hold both farmers liable for interfering with his use. Id.

In this case, the Monitored Plaintiffs use their groundwater for their domestic needs.[16] This use is reasonable because it is necessary for their homes to be inhabitable. Therefore, if the plaintiffs can show that HAWC's pumping BRW-4 at a rate above 35 gpm prevented them from withdrawing groundwater for this purpose, the plaintiffs can obtain an injunction preventing HAWC from doing so. Although the defendants argue that the hydraulic connection to BRW-4 between the three Monitored Wells differs and that there are other outside sources that affect the water levels at the Monitored Wells, both parties agree that there is a hydraulic connection between BRW-4 and the Monitored Wells. In addition, both parties agree that BRW-4's pumping rate has an immediate impact on water levels within the Monitored Wells. Finally, both parties agree that HAWC's pumping of BRW-4 at higher rates resulted in the depletion of water levels in the Monitored Plaintiffs' wells in 2017 and 2018. For these reasons, there is no dispute that HAWC's operation of BRW-4 may interfere with the Monitored Wells' water levels if pumped at certain rates. Thus, the relevant question with respect to this criterion is whether the plaintiffs are likely to show that HAWC's pumping BRW-4 at a rate above 35 gpm will reduce water levels in the Monitored Plaintiffs' wells to the

[16] The Skafases also use their groundwater to support a significant number of farm animals. However, the record does not reflect that the Skafases have ever provided water to their animals at the expense of their own domestic needs.

extent they will not be able to use the wells to provide sufficient amounts of water to their homes.

The defendants contend the plaintiffs will not be able to succeed on this claim because there is insufficient evidence to demonstrate that harm would result if HAWC pumped BRW-4 at any rate between 35 and 70 gpm. Doc. 50 ¶ 61 (arguing that the data only shows that the Monitored Plaintiffs' wells went dry while HAWC was pumping at rates above 70 gpm in 2017 and 2018). The defendants acknowledge that pumping at higher rates than 70 gpm caused water levels in the aquifer and Monitored Plaintiffs' wells to decrease. Id. ¶¶ 61, 64. However, they contend that the water levels have since recovered, in part because HAWC has pumped BRW-4 at 35 gpm for such a long period of time. Id. The defendants note that the Monitored Wells in the summer of 2020 had water levels around 200 feet high. Id. ¶ 65. The defendants maintain that the recovery of the water levels in these wells "prove[s] that the BRW-4 pump rate can [now] be safely increased without negatively impacting the" Monitored Plaintiffs' wells. Id.[17]

In the Court's view, in order to protect the Monitored Plaintiffs' common law right to a reasonable use of water to supply their homes, their wells must consistently have water levels sufficient to meet their domestic water needs throughout the year. In

[17] In supporting this conclusion, the defendants note that the DES adjusted BRW-4's PPV to 70 gpm after concluding its April 2019 investigation, which the defendants contend demonstrates that the DES determined that pumping at 70 gpm was an appropriate long-term pumping rate. Doc. 50 ¶ 65. The Court does not find this fact dispositive evidence that 70 gpm is an appropriate pumping rate to protect the Monitored Plaintiffs' access to water. For one thing, neither expert testified that 70 gpm was an appropriate pumping rate, with Emery testifying that it was unclear what the appropriate pumping rate was, given the evidence available. Moreover, the DES approved BRW-4 for a pump rate of 107 gpm in the summer of 2017, which all parties agree resulted in wells running dry on the Monitored Plaintiffs' properties. For this reason, the Court concludes that the appropriate rate to protect the Monitored Plaintiffs' common law rights to groundwater may differ from the PPV the DES sets.

addition, the pumping rate must allow for water levels that can continuously provide adequate amounts of water in the face of reductions caused by external factors such as fluctuating seasonal rates of recovery, drought, and other users' effects on water levels. After reviewing the evidence, the Court concludes that the plaintiffs have established that they are likely to succeed on their claim that pumping BRW-4 at a rate above 35 gpm would result in water levels inconsistent with this standard.

According to data from the Monitored Wells, HAWC pumped BRW-4 at varying rates below 80 gpm between December 2018 and September 2019. See Pls.' Exs. 28, 30–31; Defs.' Ex. D. During this time period, HAWC occasionally pumped BRW-4 at relatively low rates, the lowest being approximately 45 gpm in late February 2019. Id. Despite these relatively low pumping rates, however, the water levels in the Monitored Wells either remained stagnant or decreased. Id.; see also Pls.' Ex. 31 (showing water levels decreasing in 405 MW while HAWC was pumping BRW-4 at approximately 45 gpm). In addition, while 405 MW and 414 MW showed increases in water levels between April and June 2019, when HAWC was pumping BRW-4 at a consistent rate of approximately 70 gpm, their water levels actually decreased between June 2019 and September 2019 when HAWC was pumping at the same rate. Pls.' Exs. 28, 31. 387 MW, meanwhile, showed decreases in its water levels even after the HAWC began pumping BRW-4 at a rate of 70 gpm. Pls.' Ex. 30. Sharma testified that, throughout this period, the water levels in the Monitored Wells were consistently insufficient to meet residential water needs.

However, all three Monitored Wells experienced immediate, substantial, and consistent increases in their water levels when HAWC began pumping BRW-4 at 35

gpm in September 2019. Id. The pumping rate has remained 35 gpm since that date, and the Court understands that all three Monitored Wells have had relatively consistent water levels since that time. See Defs.' Ex. S. Sharma testified that, in his expert opinion, if HAWC pumped BRW-4 at rates above 35 gpm, it is likely that the Monitored Wells' water levels would decrease as an immediate result, which would eventually prevent the wells from meeting residential needs. Sharma therefore concluded that 35 gpm was the appropriate pumping rate at BRW-4 to ensure that water levels remained at sufficient levels in the Monitored Wells. The Court credits Sharma's testimony, particularly as the data shows that water levels only began to rise and remain stable when HAWC pumped BRW-4 at 35 gpm. Accordingly, the Court concludes the plaintiffs are likely to succeed on their claim that a pumping rate in excess of 35 gpm will unreasonably interfere with the Monitored Plaintiffs' reasonable use of their groundwater by depleting the water levels in their wells.

The Court appreciates Emery's testimony that an appropriate pumping rate is not static. In particular, Emery testified that, because the water levels in the Monitored Wells (and presumably the aquifer as a whole) had recovered significantly since September 2019, BRW-4 could pump at rates above 35 gpm without having a detrimental impact on these wells' ability to produce sufficient quantities of water. Specifically, he testified that 414 MW's water levels were high enough that if they decreased or experienced relatively small fluctuations, they would still be sufficient to consistently meet domestic needs. See Defs.' Ex. S (showing water levels in 414 MW consistently about 200 feet above the well's depth throughout the summer of 2020). However, the data from the Monitored Wells shows that, at 45 gpm in February 2019,

water levels remained stagnant at 414 MW and decreased at 405 MW. Defs.' Ex. D. In addition, at rates between 60 and 70 gpm from June to September 2019, the water levels at all three Monitored Wells ultimately showed consistent decreases. Id. Regardless of how much the water levels in the Monitored Wells have recovered since September 2019, consistent decreases will eventually result in the depletion of water levels. Therefore, the data in the record reflects that the only pumping rate that has resulted in continuous or increased water levels is 35 gpm.

The Court also appreciates Emery's testimony that Monitored Wells, and particularly 387 MW, all experience effects from outside forces, including from generally lower water levels in the summer, droughts, and other water users. As such, the water levels in the Monitored Wells may occasionally decrease at certain periods at a particular pumping rate, while they would remain consistent at the same rate during other periods. The Monitored Plaintiffs, however, cannot remove themselves from the effects of these external phenomena, and they require consistently sufficient supplies of water throughout the year. Moreover, whatever effects these other forces have on the Monitored Plaintiffs' well water levels, the DES concluded that BRW-4 was the only large withdrawer in the area and was the primary cause of the water issues at the Monitored Wells, Defs.' Ex. E at 1, and the data reflects that BRW-4's pumping rate has an immediate impact upon the water levels at these three wells.[18] Therefore, any appropriate pumping rate for BRW-4 must account for these inevitable fluctuations in

[18] Significantly, even if 387 MW's connection to BRW-4 differs from the other two wells, these two facts remain—387 MW is hydraulically connected to BRW-4, and high pumping rates at BRW-4 result in lower water levels in 387 MW.

water levels in order to ensure that all three Monitored Wells have consistent supplies of water for their domestic needs.

In light of the foregoing analysis, the Court concludes that the plaintiffs will likely succeed on the merits of their claim that pumping BRW-4 at a rate above 35 gpm will interfere with the Monitored Plaintiffs' reasonable use of their groundwater.

B. Immediate, irreparable harm

The plaintiffs argue they meet this criterion because allowing HAWC to pump BRW-4 at a rate above 35 gpm will result in the Monitored Plaintiffs' wells depleting and possibly running dry. Doc. 47 at 25. For their part, the defendants contend there is no evidence that pumping BRW-4 at a rate between 35 and 70 gpm will interfere with the Monitored Plaintiffs' ability to use the water in their homes for domestic purposes. Doc. 50 ¶¶ 61, 63–65. The defendants also argue that the Monitored Plaintiffs' concerns about their water levels are based on "mere possibility or fear," not on data or evidence about harms that actually will happen. Id. ¶ 62.[19]

In the Court's view, the plaintiffs have demonstrated that they are at risk of immediate, irreparable harm if HAWC raises BRW-4's pumping rate above 35 gpm. As an initial matter, the Court notes that HAWC and the Monitored Plaintiffs draw groundwater throughout the year, and any potential harm to the Monitored Plaintiffs must be evaluated in that context. With that note in mind, the Court has already concluded that the plaintiffs are likely to succeed in showing that the Monitored

[19] The defendants also argue that the Monitored Plaintiffs cannot show that their injuries are "irreparable" because, in the event their wells do run dry, the Monitored Plaintiffs can spend money to find new sources of water and be compensated in damages at the end of this litigation. Doc. 50 ¶ 66. As the defendants themselves acknowledge, id. ¶ 67, this factor is essentially the same as whether the Monitored Plaintiffs have an adequate remedy at law. The Court will therefore address the defendants' argument while analyzing that criterion.

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 31 of 50

Plaintiffs' water levels will decrease to levels insufficient to provide their homes with adequate amounts of water, and potentially run dry, if HAWC pumps BRW-4 at rates above 35 gpm throughout the year. According to Sharma's testimony, if groundwater levels were to consistently decrease back to levels in April 2019, the Monitored Plaintiffs would not have a sufficient amount of water to supply their homes with water for drinking, cooking, and bathing. The loss of a domestic water supply for these purposes would render the Monitored Plaintiffs' residences at least temporarily uninhabitable, pose potential health risks, and prevent them from using their property and exercising their common law rights over groundwater to the extent to which they are entitled. This loss, even if temporary, would be irreparable. See Charles C. Wilson & Son v. Harrisburg, 107 Me. 207 (1910) ("[A] continuing nuisance which prevents the comfortable use of one's property and the enjoyment of his property rights creates an irreparable injury . . . and inflict[s] damages which are incapable of measurement . . . ."); accord Craft v. Freeport Oil Co., 563 S.W.2d 866, 868 (Tex. Civ. App. 1978). In addition, given the strong correlation between BRW-4's pumping rates and water levels in the Monitored Wells, this harm is "immediate" in the sense that it will likely happen prior to the end of this litigation.

In reaching this conclusion, the Court notes that, contrary to the defendants' assertion, the Monitored Plaintiffs' fears about decreasing water levels are not mere conjecture, but based upon data in the record. The pumping of BRW-4 at certain rates has caused the Monitored Plaintiffs' wells to run dry in the past. Available data within the record reflects that pumping rates between 35 gpm and 70 gpm have resulted in decreases in the water levels in the Monitored Wells and water levels generally

insufficient to provide for the Monitored Plaintiffs' needs. Moreover, Sharma testified that, in his expert opinion based on this data, pumping rates above 35 gpm would result in a continual depletion of water levels in the Monitored Wells. Based on this evidence, the Court concludes the Monitored Plaintiffs' fears of the loss of their water supplies are supported by evidence as to what will likely happen if BRW-4's pumping rate increases.

In sum, the Court concludes that the plaintiffs have shown that the Monitored Plaintiffs will suffer an immediate, irreparable injury if BRW-4's pumping rate exceeds 35 gpm.

C. Adequacy of remedies at law

The plaintiffs do not directly address whether the Monitored Plaintiffs have an adequate remedy at law for their alleged injuries. The defendants argue that the Monitored Plaintiffs do have an adequate remedy at law because, if HAWC's pumping rate causes their wells to lose capacity, they can dig new wells or secure alternative sources of water while this litigation is pending. Doc. 50 ¶ 66. According to the defendants, "[c]osts associated with digging a new well or paying for water delivery are quantifiable monetary damages for which the [p]laintiffs would be compensated in the normal course of litigation . . . ." Id. As such, the defendants maintain that the Monitored Plaintiffs' potential injury in this case, the lack of well water, is not irreparable, and the plaintiffs therefore have an adequate remedy at law. In essence, the defendants contend that, if BRW-4 detrimentally impacts their water supplies during the course of this litigation, the Monitored Plaintiffs could pay money to find alternative

sources of water as a means of self-help and seek reimbursement for these costs at the end of the litigation.

The law encourages tort victims to engage in self-help in order to minimize their damages, and victims are generally only able to recover damages that reflect reasonable self-help measures. See Restatement (Second) of Torts § 919 (1979). In addition, the availability of self-help measures to remedy victims' harms may preclude injunctive relief against defendants. See Restatement (Second) of Torts §§ 944, cmt. e, 950 (1979). However, the availability of self-help measures does not necessarily preclude an injunction. See id. For example, "[a] remedy requiring an outlay of money in a substantial amount by the party desiring to exercise it is no remedy at all for a person who cannot command the money and is not a beneficial remedy for one whose resources would be strained by the outlay." Id. § 950. Further, if mitigating harm is particularly burdensome, it may be inappropriate to shift those burdens onto the plaintiff. Id. ("[I]f the defendant has deposited quantities of earth or rock on the plaintiff's land, the plaintiff should not be expected to assume the burden of responsibility for its proper removal and disposal.").

In the Court's view, the availability of self-help measures does not preclude the Monitored Plaintiffs from receiving preliminary injunctive relief. As an initial matter, the Court concludes that damages are generally not an adequate remedy for the loss of water, even if it is temporary. For individuals who rely upon private wells, a supply of safe groundwater is necessary for them to make full use of their homes. Houses without water are essentially uninhabitable, and subsequent awards of damages will not

allow individuals to recover for the lost period of time that their property was uninhabitable. See Harrisburg, 107 Me. at 207, supra.

In addition, the self-help the defendants reference is inadequate to prevent the Monitored Plaintiffs from suffering harm while this litigation is pending. Notably, under the defendants' plan, if the Monitored Plaintiffs lost access to water, they would be required to dig new wells or procure water deliveries, during which time their residences would lack water. The Court notes that, when the Skafases and Hanideses' wells ran dry in 2017, it took one and three months, respectively, for them to dig or deepen wells to supply their homes. Moreover, requiring the Monitored Plaintiffs to expend resources to dig new wells or find alternative sources of water to secure their own rights to groundwater would impose a burden on the Monitored Plaintiffs, as they would have to undertake the stress and financial burden of securing and maintaining alternative water supplies. Allowing them to subsequently recover damages for the cost of these expenses would not allow them to recover for the stress and hardship caused by the extended, albeit temporary, loss of water or the burden of securing new sources of water. See The Woods at Wayne Homeowners Ass'n v. Gambone Bros. Constr. Co., 893 A.2d 196, 206 (Pa. Commw. Ct. 2006) ("A negligence action is neither adequate nor complete in these circumstances . . . . It provides, at best, after-the-fact relief in monetary damages while, in the meantime, the threat from a dangerous wall remains unabated.").

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 35 of 50

In light of the foregoing analysis, the Court concludes that the Monitored Plaintiffs do not have an adequate remedy at law for harms caused by excessive pumping rates at BRW-4.

D. Public interest.

Finally, the Court must consider whether limiting BRW-4's pump rate to 35 gpm is in the public interest. The defendants contend that limiting BRW-4 to 35 gpm is not in the public interest because it could potentially interfere with HAWC's ability to provide water to its customers. Doc. 50 ¶ 70. In support of this position, the defendants note that HAWC issued an "exterior water ban" in the summer of 2020, in part because of the limitation on BRW-4's pump rate. See id. ("This ban was primarily due to the severe drought, but the limited pumping availability of BRW-4 . . . contributed to the ban."). The defendants contend that it was just "luck" that the 35 gpm limitation did not interfere with HAWC's ability to provide unlimited water for domestic purposes to its customers over the previous summer. Id.

In the Court's view, limiting HAWC's pump rate to 35 gpm is in the public interest. As an initial matter, the record reflects that allowing HAWC to pump at a rate above 35 gpm will likely result in decreases in the water levels in the Monitored Wells and thus impact the Monitored Plaintiffs' ability to access water in their homes. As there is a strong public interest in ensuring that New Hampshire residents have access to water in their homes, this conclusion weighs heavily in favor of granting the injunction.

On the other hand, the evidence in the record is that HAWC has been pumping BRW-4 at a rate of 35 gpm for more than a year. There is no evidence the company has not been able to supply sufficient amounts of water to meet its customers' domestic

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 36 of 50

needs—even during the apparently historic drought conditions in the summer of 2020. HAWC did have to implement an "exterior water ban" in the summer, which limited its customers' ability to use water for certain outdoor activities, such as watering their lawns. However, the public's interest in the Monitored Plaintiffs' access to water for household needs strongly outweighs the interest in HAWC's customers being able to water their lawns. The Court acknowledges that HAWC's general manager testified that the company was concerned about being able to meet customer demand without being able to pump BRW-4 at a higher rate. However, the record reflects that those concerns have never been realized.

In addition, Lanza testified that, since the spring of 2020, HAWC opened a new groundwater source, Angle Pond, with a PPV of 113 gpm. This PPV is higher than BRW-4's PPV of 70 gpm. In addition, at the August 20, 2020, hearing, HAWC was in the process of securing a new, large additional source of water from the Southern New Hampshire Water Project. While Lanza testified that HAWC was simultaneously planning on closing other sources of groundwater over the next year, he acknowledged that HAWC was choosing to close these stations and did not have to close them. For these reasons, the Court cannot conclude that limiting BRW-4's pump rate to 35 gpm will prevent HAWC from meeting its customers' domestic water requirements.

Balancing the equities in this case, the Court finds that granting the plaintiffs' requested injunctive relief is in the public interest.

E. Scope of relief

As the Court finds the plaintiffs have satisfied all requisite criteria for a preliminary injunction and that doing so would be in the public interest, the Court

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 37 of 50

GRANTS the plaintiffs' request for injunctive relief to the extent it is consistent with the following ruling: HAWC may not pump BRW-4 at a rate above 35 gpm until otherwise ordered by this Court. In imposing this requirement, the Court rejects the more flexible approach offered by the defendants in their proposed order. Doc. 51; see also Footnote 13, supra. The Court has already concluded that the Monitored Plaintiffs are likely to succeed on their claim that raising HAWC's pump rate above 35 gpm will result in detrimental decreases in their water levels. Relatedly, the Court has also concluded that HAWC does not need to pump BRW-4 at a rate higher than 35 gpm to provide water to meet its customers' domestic needs. As a result, the Court does not find it necessary to impose a complicated system that would be difficult for the Court to monitor and likely result in frequent disputes between the parties. Accordingly, the Court concludes that the general, easily enforceable limitation recommended by the plaintiffs is appropriate in this case.

However, the Court does not agree that the plaintiffs' related request that HAWC report all infractions of this limitation to the plaintiffs and to the Court and show cause why it should not be held in contempt for each violation is necessary to protect the Monitored Plaintiffs' water levels. The Court credits HAWC's general manager Lanza's testimony that HAWC is following its obligation in good faith. Moreover, data from the spring and summer of 2020 demonstrate that, while HAWC occasionally pumped BRW-4 at rates above 35 gpm during certain limited intervals of time, its daily pump rate was consistently at an approximate rate of 35 gpm and its average daily pumping rate remained well below 35 gpm. Pls.' Exs. 52–53. For these reasons, the Court concludes that HAWC has complied with the Court's limitations in good faith and that

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 38 of 50

additional reporting requirements and punitive enforcement measures are unnecessary. Therefore, the Court DENIES the plaintiffs' request for injunctive relief to the extent it includes such additional reporting requirements.

II. The plaintiffs' request for the defendants to provide alternative sources of water.

The plaintiffs second request is that the defendants, at their sole cost and expense, pay to establish a temporary water storage tank and periodic water deliveries to the Anthonys because the water in Well 4 is currently too contaminated to use for human consumption. Doc. 47 at 3; see also Pls.' Ex. 39.[20] The plaintiffs also request that, should any other plaintiffs' wells go dry while this litigation is pending, the defendants be required to provide the same remedy to those plaintiffs. Id. The Court makes two notes about this claim. First, the plaintiffs direct this request at both HAWC and Lewis Builders. However, while there was some testimony at trial as to the relationship between Lewis Builders and HAWC, the Court cannot conclude based on this limited testimony that the plaintiffs will likely show that Lewis Builders is liable for the pumping of BRW-4. For this reason, the Court will only address this request as it relates to HAWC.

Second, the Court notes that this requested relief requires HAWC to undertake actions, rather than precluding the company from taking action. "Even though preliminary injunctive relief is typically intended to preserve the status quo, the status

[20] The plaintiffs also seek this relief for the Neris and Farhadians, and attempted to supplement the record in this case with affidavits that the Neri and Farhadian wells went dry after the completion of the September 3, 2020 hearing. See Doc. 46. The Court denied this request to supplement the record. See Margin Order on Doc. 46 (dated Oct. 6, 2020). For this reason, there is no evidence in the record that these wells are currently incapable of producing water. There is thus no basis for the Court to conclude that HAWC's actions have resulted in these wells going dry. Therefore, the Court DENIES this injunctive relief as it applies to the Neris and Farhadians.

quo in cases of potential environmental contamination is not a 'condition of rest,' but one of action which, if allowed to continue or proceed unchecked and unrestrained, will inflict serious irreparable injury." Francisco Sanchez v. Esso Standard Oil Co., 572 F.3d 1, 20–21 (1st Cir. 2009). "Thus, the fact that an injunction may require the payment or expenditure of money does not foreclose the possibility of equitable relief." Id. at 21 (quotations omitted); see also id. (holding that "the funding of a diagnostic study, though it would require monetary payments, would be preventive rather than compensatory[,]" and courts may therefore issue such relief in a preliminary injunction (quotations, brackets, and ellipses omitted). In this case, the Court finds that the appropriate "status quo" is for the plaintiffs to have access to uncontaminated water. Accordingly, the Court concludes it can grant affirmative injunctive relief necessary to attain this status quo if the plaintiffs otherwise satisfy the criteria for a preliminary injunction.

A. Likelihood of success on the merits

The plaintiffs contend they are likely to succeed on the merits of this request because, in the opinion of their expert, Sharma, HAWC's excessive pumping of BRW-4 resulted in the contamination of Well 4 by reducing water levels in the aquifer and exposing minerals in the bedrock to air, which oxidized these minerals and ultimately led to increased acidity within the well water. Doc. 47 at 17–22. As a result, the plaintiffs contend that, even though Well 4 provides sufficient water, the water is not potable and thus HAWC has still interfered with the Anthonys' right to a reasonable use of their groundwater. Id. For their part, the defendants concede that the water in Well 4 is unsafe for consumption. Doc. 50 ¶ 79. The defendants argue, however, that the plaintiffs cannot show that HAWC's actions were the proximate cause of the contamination. Id. ¶¶ 79–80. Relying on the testimony of expert Emery, the defendants

contend that the cause of Well 4's contamination was the addition of chlorinated water into Well 4 in the fall of 2018, which Emery testified was not a normal or recognized practice. Id. ¶ 82. The defendants maintain that this act was the direct cause of contamination in Well 4 and that it was a superseding cause cutting off liability for whatever impact BRW-4's pumping had on Well 4's water levels because it was unforeseeable that the Anthonys would add chlorinated water to their well. Id. ¶ 82. As such, the defendants contend the plaintiffs cannot establish that BRW-4 proximately caused the water quality issues in Well 4. Id. In response, the plaintiffs argue that, even assuming adding chlorine to Well 4 was the cause of the contamination, it was not a superseding cause because the Anthonys only added water to Well 4 as a remedy for the well going dry. Doc. 47 at 20–22.[21]

In analyzing this dispute, the Court notes the Anthonys' common law right to be free from unreasonable interferences with their use of their groundwater extends to interferences in the quality of the groundwater caused by unreasonable withdrawals. See Restatement (Second) of Torts § 858, ill. 3 (1979) (city that installs a wellfield on coastal property and withdraws water at a rate that lowers the water table to the extent that nearby ocean water flows into the aquifer is liable to property owners for the presence of salt in their groundwater). Thus, the Anthonys may be entitled to a preliminary injunction if they can show likely success on their claim that HAWC's over pumping caused Well 4 to become contaminated. The Court concludes that the plaintiffs have met their burden to show that they are likely to succeed on the merits of

[21] The plaintiffs argue that adding outside sources of water to groundwater wells is a reasonable method and provided a website link they claimed was to a DES factsheet on safely doing so. See Doc. 47 at 21 n. 6. When the Court attempted to access that link, however, the Court was directed to a DES website page reading "Page Not Found."

this injunction request. As an initial matter, there is no dispute that, prior to the summer of 2018, Well 4 was producing water safe for consumption. In addition, there is no dispute that after Well 4 ran dry and water returned in December 2018, its water quality became unusually poor and unsafe for consumption. The only question in this case is thus what happened between the summer of 2018 and December 2018 that caused the water in Well 4 to become contaminated. Both of the parties have put forward conflicting, irreconcilable theories on this issue supported by expert opinion. See Facts Section, supra. Notably, both experts testified that their respective theories were the most likely causes of the contamination and discounted other potential causes of Well 4's contamination.

In the Court's view, it is not necessary to resolve which expert's theory is correct in order to rule on the plaintiffs' instant request because the Court concludes that, regardless of which theory is correct, the plaintiffs are likely to succeed on their claim that HAWC's depletion of the water levels was the proximate cause of Well 4's contamination. Proximate cause "involves both cause-in-fact and legal cause." Estate of Joshua T. v. State, 150 N.H. 405, 407 (2003) (quotations omitted). "Cause-in-fact requires the plaintiff to establish that the injury would not have occurred without the negligent conduct." Id. (quotations omitted). "The plaintiff must produce evidence sufficient to warrant a reasonable juror's conclusion that the causal link between the negligence and the injury probably existed." Id. at 407–08 (quotations omitted). "Further, legal cause requires a plaintiff to establish that the negligent conduct was a substantial factor in bringing about the harm." Id. at 408. "Although the negligent conduct need not be the sole cause of the injury, to establish proximate cause a plaintiff

must prove that the defendant's conduct caused or contributed to cause the harm." Id. "The question of proximate cause is generally for the trier of fact to resolve." Id.

The chain of causation between a defendant's act and the plaintiff's injury may be cut off, however, when an "intervening force" which contributes to the plaintiff's injury becomes a superseding cause. "An intervening force is one which actively operates in producing harm to another after the actor's negligent act or omission has been committed." Restatement (Second) of Torts § 441 (1965). "A superseding cause is an act of a third person or other force which by its intervention prevents the actor from being liable for harm to another which his antecedent negligence is a substantial factor in bringing about." Restatement (Second) of Torts § 440 (1965). "A superseding cause relieves the actor from liability, irrespective of whether his antecedent negligence was or was not a substantial factor in bringing about the harm." Id., cmt. b. Significantly, not all intervening forces are superseding causes. Id., cmt. a. In particular, "an independent intervening cause will not interfere with the connection between the original act and the injury if the intervention was probable or foreseeable." Marcotte v. Timberlane/Hampstead Sch. Dist., 143 N.H. 331, 348 (1999).

In this case, if Sharma's theory proves correct, the plaintiffs would likely prevail on their claim that HAWC's operation of BRW-4 was the proximate cause of Well 4's contamination because it would have directly resulted in that contamination. In addition, if Emery's theory is correct, the Court concludes the plaintiffs would still be likely to show that HAWC's actions were the proximate cause of Well 4's contamination. As an initial matter, HAWC's actions resulting in Well 4 running dry were the cause-in-fact of the contamination because the Anthonys would not have added water to Well 4 if the

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 43 of 50

well had not gone dry. Further, unless there was a superseding cause cutting off liability, it was also the legal cause because the dry state of Well 4 was a substantial factor in the Anthonys' decision to add water to Well 4.

Thus, the issue is whether the Anthonys' addition of water was a superseding cause. As a starting point in this analysis, the Court concludes it was foreseeable that individuals with dry wells would take actions to secure alternative sources of water while their wells were dry. In addition, based on the evidence in the record, the Court concludes the plaintiffs' will likely show that it was foreseeable that individuals in such a position might resort to adding water to their private wells. The Court acknowledges that evidence before this Court as to whether adding outside sources of water to private wells is safe or advisable is unclear. Emery testified that this practice was against the policy of the DES and was not safe. Deanna Anthony testified, however, that the DES approved adding potable water to Well 4 prior to the Anthonys doing so. Further, at the February 20, 2020, hearing, defense counsel noted that the EPA and the DES had certain requirements for adding outside water to private wells and asked Deanna Anthony if she followed those requirements. Deanna Anthony testified that she did not know of these requirements, and that her understanding was that the DES approved of adding water as long as it was potable. While defense counsel did not introduce evidence of either the DES or EPA's specific requirements, the Court gleaned from her questioning that both agencies have at least contemplated that individuals might attempt to add water to their wells to remedy water quantity issues. Finally, in the April 2019 DES report, the DES noted that the Anthonys added water to their wells and then discussed how effective this method would be in providing water to the Anthonys'

residence. Defs.' Ex. E at 6. Notably, the DES does not state that this action violated its policies or was dangerous to the Anthonys' well water quality. Id. At the very least, this record reflects that adding outside water to wells to remedy water quantity issues is a method individuals and government agencies have contemplated and, thus, even if unadvisable, is a foreseeable response to a private well running dry.

In light of this analysis, the Court cannot make any conclusions as to whether it was safe or consistent with DES policy for the Anthonys to add water to Well 4. At the same time, the Court concludes that the plaintiffs are likely to succeed in showing that it was reasonably foreseeable to HAWC that individuals, like the Anthonys, whose wells run dry, would take self-help measures including adding outside sources of water to their wells. As such, the plaintiffs are likely to show that the addition of water to Well 4 was not a superseding cause that cut off liability to HAWC. Therefore, the Court finds that, even assuming adding water to Well 4 resulted in the contamination, the plaintiffs are still likely to succeed in showing that HAWC's overpumping of BRW-4 was the proximate cause of the contamination. See Marcotte, 143 N.H. at 348.

B. Immediate, irreparable harm

The next question is whether the Anthonys will suffer immediate, irreparable harm if HAWC does not supply them with an alternative water source for the remainder of this litigation. Neither party expressly argues whether the Anthonys would suffer an immediate, irreparable harm in the absence of an alternative supply of water.[22] As the Court understands, the Anthonys do not have a permanent source of water safe for

[22] The defendants argue that the Anthonys' alleged injuries are not irreparable because the Anthonys themselves can find an alternative source of water and seek to recover these expenses in the form of damages at the end of this litigation. Doc. 50 ¶ 73. The Court will evaluate whether damages would "repair" the Anthonys' injuries in its analysis of whether the Anthonys have an adequate remedy at law.

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 45 of 50

human consumption within their home. All human beings need water for drinking, cooking, and bathing, and the Anthonys' ongoing lack of safe water renders their residence essentially uninhabitable. The Anthonys are thus currently being injured, and the injury will continue until they have a reliable source of safe water. Moreover, the Anthonys' lack of water is an irreparable injury because it prevents them from using their residence and groundwater to the extent they are legally entitled for an extended period of time. This continuing loss of property and riparian rights cannot be recovered through subsequent damages. As a result, the Court concludes the Anthonys will suffer immediate, irreparable harm if they are unable to secure alternative sources of water to their homes. See Harrisburg, 107 Me. at 207, supra.

C. Adequacy of remedies at law

The next question is whether the Anthonys have an adequate remedy at law. Similar to their argument as to the adequacy of damages vis-à-vis the plaintiffs' request to limit HAWC's pumping rate, the defendants argue that the Anthonys have an adequate remedy at law for their lack of safe water because the cost of a temporary storage tank and periodic water delivery is quantifiable and the Anthonys could therefore make these expenses on their own and seek damages at the end of trial. Doc. 50 ¶ 73 (referencing Plaintiffs' Exhibit 39, which details the costs of supplying a large water tank and paying for periodic water deliveries).

The Court reiterates that plaintiffs are generally encouraged to engage in self-help to minimize their damages. However, as noted above, requiring plaintiffs to engage in self-help and subsequently seek damages is not always an adequate remedy over preliminary injunctive relief because self-help measures may impose unreasonable financial and administrative burdens on plaintiffs. Restatement (Second) of Torts § 950

(1979). In this case, the Court concludes self-help would not be an adequate remedy for the plaintiffs. The costs of providing a long-term, temporary source of water for use for the Anthonys' residence are apparently very high. Pls. Ex. 39. Moreover, these costs are recurring and will be necessary until this litigation is over. Imposing such recurring costs on individual homeowners is highly burdensome. In addition, requiring the Anthonys in this case to undertake the long-term logistical and financial burden of maintaining a temporary source of water for their residence for an indefinite period of time is also highly burdensome, particularly as the Court has concluded that the Anthonys will likely succeed on their claim that HAWC is liable for the contamination of Well 4. For these reasons, the Court concludes that the Anthonys' ability to engage in self-help and subsequently seek reimbursement is not an adequate remedy for the current loss of drinking water at their residence. See Gambone Bros., 893 A.2d at 203, 206–07 (Pa. Commw. Ct. 2006) (upholding trial court's preliminary injunction requiring defendant to repair damaged retaining wall, and rejecting defendant's argument that that the plaintiffs had an adequate remedy at law because they could repair the wall themselves and seek damages).

D. Public interest

Finally, the Court concludes it is in the public interest for HAWC to supply the Anthonys with an alternative source of water. On the one hand, the public has a strong interest in both ensuring that individuals' rights to groundwater are respected and preserved and that individuals have access to safe water for use within their residences. Issuing injunctive relief requiring HAWC to provide water to the Anthonys will further both of these interests. On the other hand, there is no evidence that requiring HAWC to supply drinking water to the Anthonys will cause any harm to the public. For these

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 47 of 50

reasons, the Court concludes that the public interest supports granting this injunctive relief.

E. Scope of relief

As the Court has concluded that the plaintiffs have satisfied all the criteria for a preliminary injunction and that issuing one is in the public interest, the Court GRANTS the plaintiffs' request for a preliminary injunction requiring HAWC to provide water to the Anthonys. The Court notes, however, that it will not order HAWC provide the plaintiffs with the exact relief requested by the plaintiffs in Plaintiffs' Exhibit 39. See Pls.' Ex. 39. Rather, the Court orders HAWC, at its own expense, to provide an alternative source of water to the Anthonys' residence that is consistent with the following requirements:

1. HAWC must be able to ensure that the method will meet the Anthonys' needs within three weeks of the date of the Notice of Decision accompanying this Order;
2. The method must provide water that is safe for human consumption;
3. The method must provide water that is compatible with the existing plumbing in the Anthonys' residence, such that they could use the water for drinking, cooking, and bathing;
4. The method must provide an interrupted supply of water to the Anthonys for the duration of this litigation and its availability must not be affected by weather conditions; and
5. The method must provide at least 400 gallons of water a day to the Anthonys' residence.

The Court, however, cannot accept the plaintiffs' related request to require HAWC to provide identical relief to any plaintiff who notifies HAWC that their well has gone dry. The evidence in the record is that all of the Monitored Wells have been able to produce water while HAWC has pumped BRW-4 at 35 gpm for the past year. There is no evidence that any of the plaintiffs' wells have gone dry since that time. For these

reasons, there is no basis for the Court to conclude that any of the plaintiffs' wells will go dry given the Court's order limiting BRW-4's pump rate to 35 gpm. Thus, the plaintiffs have not shown that this requested relief is necessary, and the Court therefore DENIES the request for a preliminary injunction to the extent it requires HAWC to provide water to plaintiffs other than the Anthonys.

III. The plaintiffs' request for HAWC to install monitoring equipment in the plaintiffs' wells and provide data on water levels and BRW-4's pumping rate.

The plaintiffs next request that the Court order the defendants to "install, maintain[,] and operate water level monitoring equipment in the wells of each of the [p]laintiffs." Doc. 47 at 4. Relatedly, the plaintiffs request that the defendants provide them with "daily readouts" of this data on a monthly basis. Id. In addition, the plaintiffs request that the Court require HAWC to provide the plaintiffs monthly reports on BRW-4's pumping rates. Id. Assuming without deciding that the plaintiffs would be entitled to this relief if it was necessary to prevent unreasonable interferences with their groundwater, the Court concludes that the plaintiffs have not shown such relief is necessary to protect against these interferences. As to additional monitoring for the plaintiffs' wells, the available data and expert testimony establish that all of the Monitored Wells have maintained relatively stable water levels capable of producing sufficient amounts of water to supply the Monitored Plaintiffs' domestic needs since HAWC began pumping BRW-4 at 35 gpm. Moreover, there is no evidence that any of the other plaintiffs' wells have been impacted by BRW-4 being pumped at 35 gpm since September 2019. There is thus no basis for the Court to conclude that any of the plaintiffs' wells will go dry as long as HAWC is limited to pumping BRW-4 at 35 gpm. For this reason, the plaintiffs have not established that additional monitoring of all of the

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 49 of 50

plaintiffs' wells is necessary to prevent interferences with their groundwater. The Court therefore DENIES this request for preliminary injunctive relief.

As to requiring HAWC to provide data regarding BRW-4's pumping rates, the plaintiffs have made no argument as to why this relief is necessary to protect them while this litigation is pending, and the Court cannot think of a reason why it would be necessary. Moreover, the plaintiffs can request such information through the normal discovery process. For these reasons, the Court DENIES this request.

IV. The plaintiffs' request to prevent HAWC from adding new connections to its water system.

Finally, the plaintiffs request that the Court order the "[d]efendants [to] not add new connections or add new consumers who are serviced by any water derived from Kent Farm . . . [to HAWC's water] system without first demonstrating to the Court that such addition will not adversely affect the domestic water supply wells of the [plaintiffs]." Doc. 47 at 5. Beyond making this request, the plaintiffs do not make any express argument as to why they merit this relief based on the record before the Court. Assuming without deciding that such relief would be appropriate if it was necessary to protect against unreasonable interferences with the plaintiffs' well water, the Court concludes the plaintiffs have not shown such relief is necessary to prevent such harms. The Court has already limited BRW-4's pumping rate to 35 gpm and HAWC therefore cannot pump above this level regardless of how many customers it adds to its service. HAWC has the responsibility to determine whether it can sustain new customers given the water sources it has available. The Court does not understand why preventing

OCA 1-4 – January 25, 2021 Superior Court Preliminary Injunction, Page 50 of 50

HAWC from adding new customers would provide any relief to the plaintiffs. For this reason, the Court DENIES this request.

Conclusion

For the foregoing reasons, the Court GRANTS in part and DENIES in part the plaintiffs' request for preliminary injunctive relief, and issues the following injunctions:

A. HAWC may not pump BRW-4 at a rate above 35 gpm until otherwise ordered by this Court; and

B. HAWC must provide water safe for human consumption to the Anthonys for the remainder of this litigation in a manner consistent with the requirements the Court laid out in Section II(E) of this Order.

SO ORDERED.

January 25, 2021

Judge Daniel I. St. Hilaire

Clerk's Notice of Decision
Document Sent to Parties
on 01/25/2021

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 1 of 29

Water Well Capacity Investigation
Main Street, Hampstead, NH
Initial Findings

April 2019

New Hampshire Department of Environmental Services
Water Division
Drinking Water and Groundwater Bureau

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 2 of 29

Table of Contents

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 3 of 29

List of Figures

List of Tables

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 4 of 29

Executive Summary

In September 2018, the New Hampshire Department of Environmental Services (NHDES) initiated an assessment of groundwater level conditions in the vicinity of 414 Main Street in Hampstead, New Hampshire, in response to concerns about the capacity of private water supply wells. While the assessment is ongoing, sufficient information was available by March of 2019 to provide initial findings. The primary cause for declining groundwater levels in the vicinity of 414 Main Street from July 2017 through December 2018 is the operation of the Hampstead Area Water Company (HAWC) Kent Farm wellfield, which is located approximately 2,500 feet east of 414 Main Street. The wellfield predates the current state requirements for large groundwater withdrawal permitting. These requirements are designed to identify and mitigate adverse impacts associated with large groundwater withdrawals. NHDES has coordinated with HAWC to reduce withdrawals from the wellfield and groundwater levels have consequently been recovering within the vicinity of 414 Main Street. Other water use activities in the area may also impact groundwater levels over the long term. The information in this report documents the work completed by NHDES to date and the basis for the initial findings.

1.0 Introduction

In September 2018, NHDES became aware of a resident at 414 Main Street in Hampstead that had not been able to withdrawal water from any of the four wells constructed on the property, since July 2018, due to low groundwater levels. Additionally, NHDES became aware of other homeowners near 414 Main Street that experienced water capacity issues in the fall of 2017.

NHDES initiated a study to:

1. Document water capacity issues at and in the area of 414 Main Street;
2. Identify activities that may have contributed to water capacity issues; and
3. Identify measures that private well owners, municipalities, or the state can take to address water supply issues.

To date, NHDES has taken the following actions as part of the study:

1. Gathered information/personal accounts from residents, town officials, and well drillers.
2. Reviewed over 200 responses to an online private well survey administered by NHDES.
3. Reviewed data associated with groundwater withdrawals by two nearby community public water systems (HAWC's Kent Farm wellfield and Glenwood North apartment building).
4. Began monitoring groundwater levels in private wells located at 414, 405, and 387 Main Street.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 5 of 29

5. Reviewed information pertaining to the new housing development on Labrador Lane in Hampstead.
6. Reviewed well construction records for wells reportedly installed in Hampstead since 1984. RSA 482-B:, enacted in 1984, requires the submission of well construction records to NHDES.
7. Reviewed other pertinent data (geological maps, aerial imagery, historical maps, environmental sites, water use, and surface water levels) to aid in identifying possible factors or trends in local groundwater conditions near 414 Main Street.

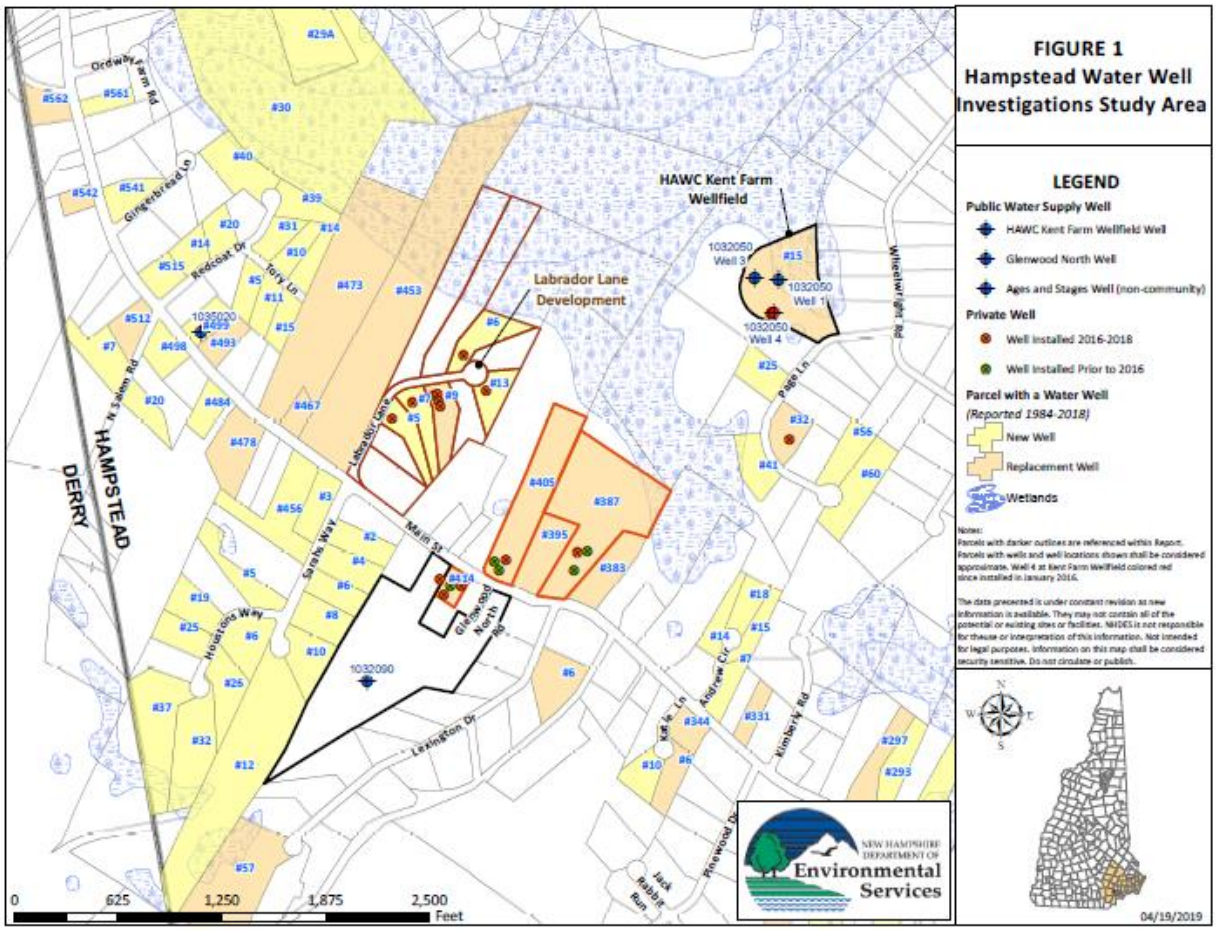
In accordance with state law, NHDES has limited regulatory authority to address factors related to the capacity of private wells. In general, homeowners have to mitigate problems with their wells using their own resources. There is no state program to financially assist private well owners that are dealing with a water supply issue. NHDES has authority to address impacts to private wells that may be associated with man-made groundwater contamination or that are protected under the permitting of large groundwater withdrawals. Large groundwater withdrawal permits are required for any withdrawal of water from a new well or wells sited after July 1998. Under RSA 485-C:21, NHDES has authority to require any entity that has a large groundwater withdrawal permit to mitigate adverse impacts that the permitted groundwater extractions have on private and public water supply wells. Per RSA 485-C:22, large groundwater withdrawals from new wells that replace a well or wells installed prior to August 1, 1998 are not subjected to the requirements of RSA-C:21.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 6 of 29

2.0 Assessment of Water Supply Capacity Problems

There has been growth in Hampstead, primarily residential, over the past 30 years with reports of water capacity and water quality issues spanning this time. Well construction records and personal accounts indicate that there was a change in the groundwater system in 2017 that led to an increase in the number of water capacity issues in private wells located on Main Street between the intersections with Lexington Drive and Sarah's Way. The study area for the investigation to support this assessment (Figure 1) encompasses approximately a 2,500-foot radius around 414 Main Street.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 7 of 29



OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 8 of 29

2.1 Water Well Capacity Case Studies at Homes on Main Street in Hampstead, NH

2.1.1 414 Main Street

The current residents of 414 Main Street moved into the house in May 2018. At the time of purchase, there were four wells on the property and water to the house was supplied by the fourth well (WRB# 104.1161, #4). By mid-June 2018, the resident observed a drastic change in water quality and by early July 2018, this well went dry – meaning it was unable to provide enough water to meet the domestic water demands of the home. This well and the other three wells on the property remained dry until early December 2018.

A summary of well construction records for wells installed at 414 Main Street is provided in Table 1. The first well was constructed on the property in 1999. It was reported to NHDES that prior to 1999, the home was serviced with water from a shared well located on a nearby lot.

Table 1: Wells installed at 414 Main Street

WRB # (informal designation in parentheses)	Date Installed	Total Depth (casing length)	Yield (Gallons Per Minute when installed)	Driller
104.0787 (#1)	05/03/1999	340 (20 ft cased)	100	Faxon Well
104.1160 (#2)	08/28/2017	500 (40 ft cased)	0	Skillings &Sons
104.1159 (#3)	09/08/2017	1500 (420 ft cased)	0	Skillings & Sons
104.1161 (#4)	10/17/2017	700 (20 ft cased, sleeved & screened at the bottom)	2	Skillings & Sons

In the fall of 2018, NHDES interviewed the driller that constructed the first well on the property. Lucy Faxon of Faxon Well (NH Water Well Contractor license # 1768) reported that the original well pump was set at 120 feet deep. However, the pump was lowered to 200 feet at some point between 2004-2007 in response to the homeowner experiencing air coming through the well line.

Between August and October 2017, after well #1 went dry, three new wells were constructed on the property by Skillings and Sons (NH Water Well Contractor license #1543). In a conversation with NHDES in the fall of 2018, Roger Skillings reported that all three wells installed encountered a fracture zone at depths around 350-400 feet. Unfortunately, this facture zone did not supply groundwater and was not stable – as evidenced by the collapsing of bedrock from the borehole wall. Mr. Skillings reported that the third well (WRB# 104.1159, #3),

was drilled to a depth of 1,500 feet in an unsuccessful attempt to encounter water. This well was completed with 420 feet of casing to seal over the dewatered fracture zone and to prevent future collapsing. Mr. Skillings reported that the fourth well is 700 feet deep and yielded 2 gallons per minute (gpm) at the time of installation. In order to avoid collapse at the known fracture zone, Skillings installed a 4-inch polyvinyl chloride (PVC) pipe in the well to the total depth of 700 feet. This pipe is solid for the majority of its length and perforated only at the bottom to allow water to enter. This well provided water to the home from late October 2017 to early July 2018. The residents at 414 Main Street reported that the well went dry on July 3, 2018. A temporary storage tank and booster pump were then set up to supply water to the house. On nearly a weekly basis, bulk water was delivered by truck to fill the tank. Due to freezing temperatures in the late fall of 2018, the temporary storage tank was taken offline and bulk water deliveries were discharged into the 700-foot well. Approximately 450 gallons of water could be stored in the borehole and used before another delivery was made.

On January 2, 2019, the residents at 414 Main Street notified NHDES that in early December the fourth well was able to supply at least 50 gallons of water per day to the home. The last bulk water delivery was reported by the resident to have occurred on December 5, 2018. Also on January 2, 2019, the resident reported that based on visual observations the water quality was unfavorable.

2.1.2 405 Main Street

405 Main Street is located across the street and one parcel south from 414 Main Street. Three wells have been identified on this property. Based on well reports and an interview with the well driller, Faxon Well constructed a well on the property in 2014 (WRB# 104.1164) in order to replace an existing 1998 well that went dry. While constructing the 2014 well, Ms. Faxon recalled the well yielded approximately 2.5 gpm until a significant water bearing fracture was encountered from 362-365 feet. Ms. Faxon noted that at 365 feet the drill rods dropped 10-12 feet, indicating a large fracture zone. The well was finished to 380 feet and had an initial yield of 20 gpm. This well lost all of its capacity in November 2017 (note: this occurred one month after the fourth well was installed at 414 Main Street). In response, a new well was drilled on the property in November 2017 (WRB# 104.1166). This well was completed to a depth of 320 feet, above the fracture zone, in an attempt to isolate any shallow groundwater that was encountered from being drained by the deeper fracture zone. The 2017 well currently supplies water to the home and barn on the property. A summary of well construction records for wells installed at 405 Main Street is provided in Table 2.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 10 of 29

Table 2: Wells installed at 405 Main Street				
WRB # (informal designation in parentheses)	Date Installed	Total Depth (casing length)	Yield (Gallons Per Minute when installed)	Driller
104.0708 (#1)	10/13/1998	370 (30 ft cased)	60	McKinney Artesian Wells
104.1164 (#2)	03/03/2014	380* (20 ft cased)	20	Faxon Well
104.1166 (#3)	11/21/2017	340 (20 ft cased)	2.5	Faxon Well

*= Well measured to be 370 feet deep in October 2018

During the fall of 2018, NHDES determined that water was flowing into the 2014 well at a depth around 70 feet, however, the borehole was not storing water. The water flowing into the borehole from shallow fractures was flowing out of the borehole through a fracture zone located near the bottom of the borehole.

In the fall of 2018, NHDES began monitoring groundwater levels in the 2014 well with a data logger and pressure transducer. Groundwater levels rose over 28 feet from December 2018 through early March 2019. Additional information on groundwater level monitoring is provided in Section 5 of this report.

2.1.3 408 Main Street

In September 2018, NHDES spoke with the homeowner of 408 Main Street which is the parcel located immediately south from 414 Main Street. The home located on 408 Main Street utilizes a 225-foot deep well for domestic water supply needs. The homeowner noted that the well has run dry a number of times over the past 10 or more years. In response, the homeowners are very conservative with their water use. Additionally, over the past couple of years the number of occupants in the home has declined which has resulted in even less water use. There were no notable issues with this well during the fall of 2017.

2.1.4 387 Main Street

387 Main Street is located across the street and three lots south of 414 Main Street. Two wells have been identified on this property. In 1991, a well was completed to a depth of 220 feet and was estimated to have a yield of 100 gpm (WRB# 104.0474, #1). This well lost all capacity in 2010. At which time, a replacement well was installed to a depth of 400 feet by Ms. Faxon. A well construction report for the 2010 well could not be located in NHDES' files. Ms. Faxon reported to NHDES that during the drilling of this well, the drill rods dropped approximately 10

feet at a depth of 230 feet – indicating a significant fracture zone exists. Unfortunately, no groundwater was encountered in the fracture zone. The well was then drilled to a total depth of 400 feet where an adequate volume of water was encountered to supply the home. In early October 2017, this second well went dry. In response, it was deepened to 600 feet (WRB# 104.1165, #2b) where enough water was encountered to meet the domestic water needs of the home. This 600-foot well presently provides water to the home.

A summary of well construction records for wells installed at 387 Main Street is provided in Table 3.

Table 3: Wells installed at 387 Main Street

WRB # (informal designation in parentheses)	Date Installed	Total Depth (casing length)	Yield (Gallons Per Minute when installed)	Driller
104.0474 (#1)	09/04/1991	220 (20 ft cased)	100	McKinney Artesian Wells
N/A (#2a)	2010	400	Unknown	Faxon Well
104.1165 (#2b)	10/06/2017	600	Unknown	Faxon Well

In the fall of 2018, NHDES gauged the 1991 (#1) well for the purpose of performing groundwater level monitoring. NHDES found groundwater to be entering this well at a depth[1] of 27 feet, but there was no water being stored in the borehole. This suggests that the groundwater is flowing from shallow fractures into the borehole and is exiting the borehole through a fracture near the bottom of the well. Further information on the groundwater level monitoring in the well at 387 Main Street is provided later in Section 5 of this report.

2.2 Labrador Lane Development

Approximately 1,200 feet north of 414 Main Street, a parcel of land was subdivided into 11 smaller parcels and new homes are being built on a new cul-de-sac designated as Labrador Lane. According to well completion reports on file with NHDES, the installation of wells for homes in this development initiated in the summer of 2017. As of November 2018, five homes and eight wells had been constructed on Labrador Lane.

Ms. Faxon reported to NHDES that during the construction of the well at 13 Labrador Lane in August 2018, a non-water bearing fracture was encountered at 340 feet. The well was drilled

[1] Depths to fractures, groundwater, and other features in a well are referenced to ground level or the top of the casing, rather than to a constant such as sea level.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 12 of 29

to a depth of 1,160 feet with a final yield of 8 gpm (WRB# 104.1192). The water level in this well stabilized at 246 feet deep, which is above the elevation of the non-water bearing fracture. After installation of this well, Ms. Faxon wanted to assess whether the connection of a deep (deeper than 1,000 feet) water bearing fracture to the shallower fracture zone (encountered at 340 feet) would raise the groundwater level in bedrock wells on properties located on Main Street. Ms. Faxon assessed this by measuring the water level in two wells located at 405 Main Street a couple weeks after the well at 13 Labrador Lane was installed. Ms. Faxon noted that the water levels in the 405 Main Street wells had not improved. Ms. Faxon also noted that the 350-400 foot fracture zone was not encountered in any other wells she drilled on Labrador Lane.

Well completion reports received to date for this subdivision are summarized in Table 4, below. Well records show that three wells installed at 9 Labrador Lane were dry (one was deepened and then yielded 40 gpm). Three other wells, installed at 6, 7, and 13 Labrador Lane, did not encounter water until reaching depths of at least 1,000 feet. Only the well installed at 5 Labrador Lane encountered groundwater at a depth above 1,000 feet.

Table 4: Wells installed on Labrador Lane

WRB#	Address	Date Installed	Depth (feet)	Casing Length (feet)	Yield (Gallons Per Minute when installed)	Static Water Level (feet)
104.1182	5 Labrador	10/7/2017	240	40	10	2
104.1180	6 Labrador	8/1/2017	1000	31	2	5
104.1181	7 Labrador	8/25/2017	1280	31	20	142
104.1192	13 Labrador	8/17/2018	1160	40	8	246
104.1176	9 Labrador	6/14/2017	1000	20	0	Not reported
104.1177	9 Labrador	6/23/2017	600	20	0	Not reported
104.1178	9 Labrador	7/28/2017	1100	20	0	Not reported
104.1163	9 Labrador (deepening of 104.1178)	8/3/2017	1145	20	40	Not reported

Note: All wells except 104.1163 were installed by Faxon Well.

It was reported to NHDES from the residents at 387, 405, 408, and 414 Main Street that blasting occurred on Labrador Lane in the summer of 2017 and 2018. This housing development was not required to get a state Alteration of Terrain permit nor develop a rock blasting program with NHDES. Typically, blasting at the surface is not expected to have an effect on well yields.

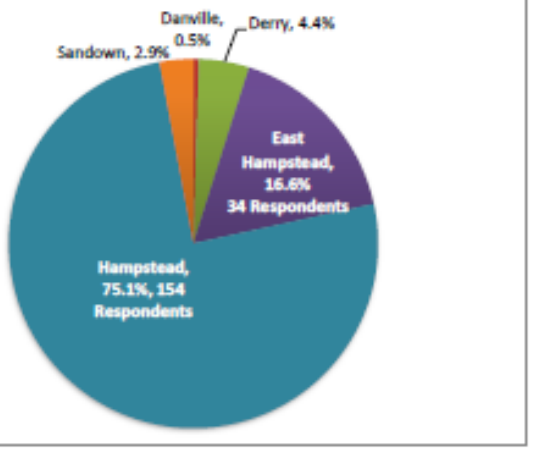
OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 13 of 29

2.3 Private Well Survey

In September 2018, NHDES sent postcards to homes within a 6,000-foot radius of 414 Main Street requesting homeowners with private wells complete an online survey in order to document where and when problems associated with private water wells have occurred. In addition to the postcard mailing, the resident at 414 Main Street distributed the survey through email and social media. The survey sought specific information about ongoing or historical experiences with water supply problems. The survey allowed for respondents to indicate if no water problems have occurred. The residents were asked to respond to the survey by November 1, 2018.

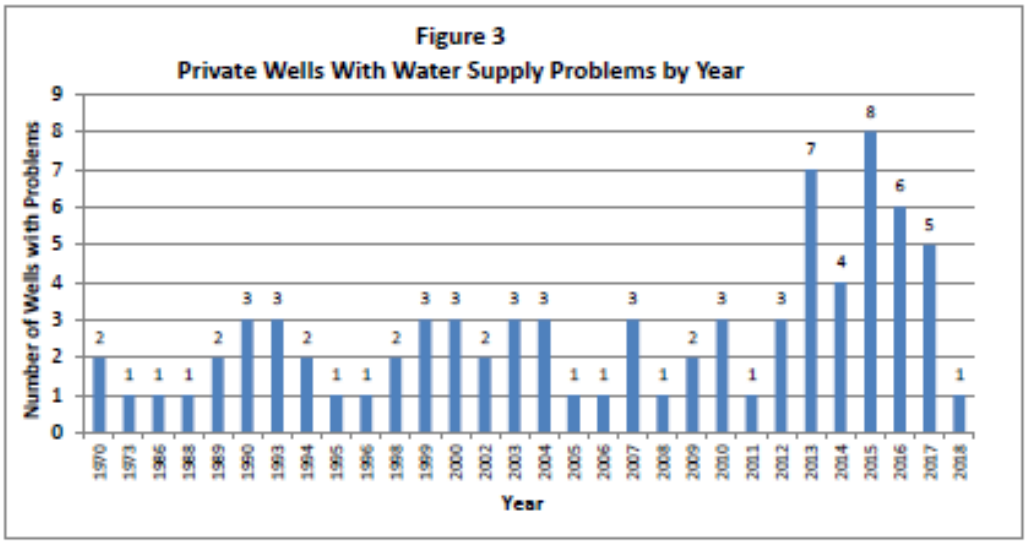
A total of 204 responses were received from residents in Sandown, Derry, Danville, East Hampstead, and Hampstead. East Hampstead is a subsection of the Town of Hampstead. Figure 2 shows the locations of properties associated with a response to the survey.

Figure 2
Respondents to the Private Well Survey



One hundred out of the 204 properties that submitted a response to the survey stated that there was no problem with the capacity of their private well. The survey requested that private well owners who experienced water problems greater than 12 months ago specify a year when water problems began. Seventy-nine responses to the survey provided a year in which their private well had experienced a water supply problem. Figure 3 depicts the reported date that private wells exhibited a problem.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 14 of 29



3.0 Well Completion Reports for Wells Constructed in Hampstead

Licensing of water well contractors and filing of well completion reports has been required since 1984 when the New Hampshire Water Well Board and its associated rules were established. The NHDES Water Well Program and the NH Geological Survey maintain the database of well completion records. Wells installed prior to 1984 were not reported to the state and there are some wells installed after 1984 that have not been reported to NHDES. For the Town of Hampstead, 1,189 well completion reports have been filed for wells installed from 1984 through 2018. Well completion reports include information on the location of the well, well construction details (e.g. total depth, depth to bedrock), well yield, the purpose of the well (e.g. domestic drinking water, public water, agricultural use, geothermal wells, and monitoring wells), and whether it was installed as a new source of water supply or installed to replace an existing source of water supply.

The well records on file for Hampstead indicate:

- 11 wells were installed for agricultural purposes;
- 24 wells were installed for either monitoring purposes or for geothermal systems; and
- 1,154 wells were installed as a source of supply to homes and businesses of which:
  - 1,076 were for domestic water use;
  - 37 were for public water use (community wells, schools, etc.); and
  - 41 were for commercial water use.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 15 of 29

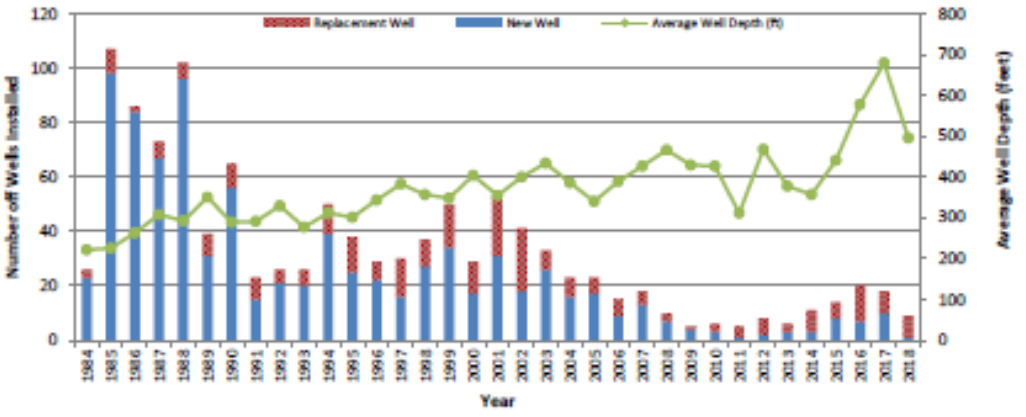
The well records identify whether a water supply well is a new well or a well installed to replace an existing water supply well. New wells are typically installed on lots that are being developed. Replacement wells are installed on lots previously developed where a well already existed, but another well was necessary or an existing well was deepened. A replacement well is commonly, but not always, installed to mitigate water capacity issues in an existing well.

Of the 1,154 wells installed as a source of supply to homes and businesses:

- 870 were installed as a new well; and
- 284 were installed as a replacement well.

Figure 4 depicts the distribution of the number of water supply wells constructed in Hampstead each year for homes or businesses and whether they were installed as new or replacement wells. Also shown in Figure 4 is the increasing trend in average well depth over time.

Figure 4
Hampstead Water Supply Well Installation and Average Well Depth Per Year



The number of replacement wells constructed each year has increased relative to the number of new wells that were constructed. The need to deepen an existing water supply well or install a replacement well is common in many areas in southern New Hampshire, especially where there is a relatively high density of private wells. Additionally, shallow bedrock wells located at relatively higher elevations on a hillside or where bedrock is close to the ground surface are often more susceptible to failure. Factors that can cause the capacity of a well to decline include clogging of borehole fractures with mineral deposits or bacteria matting, drought, other nearby water users, and increases in consumptive water uses such as lawn watering.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 16 of 29

The average depth of wells constructed in Hampstead increased from 221 feet in 1985 to 441 feet in 2015. This trend is similar to that observed statewide. Over time, wells have been constructed to deeper depths. This is partly due to an increase in demand on the shallow bedrock fractures associated with withdrawals from pre-existing shallow bedrock wells. In addition, evolving bedrock well construction practices have led to deeper well casings that are set more securely into competent rock, prohibiting shallower water from contributing to well yields. There is a significant increase in the average depth of the wells in 2016 (577 feet) and 2017 (679 feet), which is partly due to an increase in wells installed to 1,000 feet depth or deeper. Three wells in 2016 and six wells in 2017 were installed to a depth of at least 1,000 feet. Wells located on Labrador Lane account for five of the 1,000 foot (or greater) wells. The average depth of the wells reported in 2018 is 495 feet.

A review of well completion records, historical maps, aerial photographs, and a windshield survey indicates the only large water use near 414 Main Street is the Kent Farm wellfield operated by HAWC. There are no records on file with NHDES indicating that wells have been constructed for industrial, agricultural, or geothermal use near 414 Main Street. Historical maps, aerial photographs, and a windshield survey do not indicate a major change in the extent of surface waters or wetlands over time.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 17 of 29

4.0 Public Water System Withdrawals near 414 Main Street

There are two community public water systems in the area of 414 Main Street. They are:

1. Glenwood North (PWS 1032090) – A 20-unit apartment building fed by one bedrock well; and
2. Kent Farm wellfield (PWS 1031010, formerly PWS 1032050) – A bedrock wellfield owned and operated by HAWC that provides water to both homes in the area and to other customers of HAWC in the towns of Hampstead and Atkinson.

Public water system wells withdrawal a greater amount of water than a typical private well. Public water systems are entities that provides drinking water to at least 15 service connections or regularly serves an average of at least 25 individuals daily for at least 60 days out of the year and are regulated under the NH Safe Drinking Water Act, RSA 485.

4.1 Glenwood North

Ms. Faxon informed NHDES that her father-in-law drilled the well that feeds Glenwood North in the early 1980s. The well was drilled approximately 400 feet deep and it yielded 15-20 gpm at the time of installation. NHDES has a record of a short term pumping test performed on this well in the 1980s. The pumping test data indicated that the depth to groundwater in the 400-foot well while pumping at 19 gpm was approximately 339 feet.

In December 2018, the water system operator for Glenwood North stated that they were not aware of any recent issues with water supply capacity and that the apartment building uses approximately 1,200 gallons of water per day. In February 2019, after the water storage tank at the building was drained, NHDES was informed of a leak in the water line that feeds the garage building. In a phone call with the property owner in March 2019, NHDES learned that the February 2019 leak caused the well to run out of water within 6 hours, and the water level recovered within 24 hours after the leak was repaired. The owner stated that there have been no noticeable changes in the water quantity or quality since purchasing the property in 2016.

4.2 Kent Farm Wellfield

HAWC has operated the Kent Farm wellfield, located approximately 2,500 feet east of 414 Main Street, since the 1980s. Bedrock wells 1 and 3 were originally tested at a combined rate up to 160 gpm, although the actual production rates have generally been lower. Bedrock well 2 has not been in use for some time. The wells were constructed prior to 1984, so there are no well completion reports for these wells. HAWC has reported that both bedrock wells 1 and 3 are

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 18 of 29

approximately 500 feet deep. Due to declining yields, HAWC installed bedrock well 4 in January 2016 as a replacement well to bedrock wells 1 and 3.

Bedrock well 4 was constructed approximately 150 feet south of bedrock well 1 and was completed with 41 feet of grouted 8-inch diameter steel casing and finished with a 6-inch diameter borehole to a depth of 535 feet. The well was reported to yield 100 gpm (WRB # 104.1134). Due to collapsing rock in the borehole, bedrock well 4 was deepened and reamed out twice. In March 2017, the borehole was reamed out from a 6-inch to an 8-inch diameter from a depth of 42 feet to 452 feet (WRB # 104.1191). The yield log on the well completion report for WRB # 104.1191 indicated a yield of 100 gpm to 150 gpm at 300 feet and greater than 300 gpm at 452 feet. In March 2018, the borehole was cleaned out and reamed from a 6-inch to an 8-inch diameter from a depth of 450 feet to 530 feet (WRB # 104.1190). A summary of the data provided in well completion reports for bedrock well 4 is provided in Table 5.

Table 5: Kent Farm Wellfield Bedrock Well 4 Construction History

WRB #	Date Installed	Total Depth (feet)	Yield (Gallons Per Minute when installed)	Static Water Level (feet)	Notes	Driller
104.1134	1/28/2016	535	100	100	41 feet of 8-inch diameter steel casing. 6-inch diameter borehole to 535 feet.	E.M Young
104.1191	3/04/2016	550	300	20	Borehole (WRB# 104.1134) was reamed out from 6 to 8-inch diameter from 42 feet to 452 feet. Yield Log indicated 100 to 150 gpm at 300 feet and >300 gpm at 452 feet.	Viera Artesian Wells
104.1190	3/31/2018	530	150	300	Cleaned out and reamed borehole (WRB # 104.1134/104.1191) from 6 to 8-inch diameter from 450 feet to 530 feet.	Viera Artesian Wells

In July 2017, NHDES issued HAWC temporary approval to withdraw groundwater from bedrock well 4, after HAWC requested to use the well in order to meet summer water demands. In August 2017, HAWC shut down bedrock wells 1 and 3 and began withdrawing groundwater from bedrock well 4. In May 2018, HAWC performed a pumping test on bedrock well 4 to evaluate the capacity of the well in accordance with NHDES' community well siting rules for replacement wells. HAWC submitted the report of this pumping test data to NHDES in September 2018 and asked NHDES to approve a production volume for bedrock well 4 of

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 19 of 29

154,080 gallons per day, or 107 gpm, over a 24-hour period. In response to that request, NHDES made the following findings:

- NHDES water use records indicate that from 2005 to 2015, the average monthly water use for bedrock wells 1 and 3 was between approximately 43,200 and 115,200 gallons per day.
- Based on the run-time meter readings from August 2017 through October 2018, bedrock well 4 was pumped from 80 to 100% of the time each day. Due to this extended pumping, groundwater levels in the well since July 2018 have declined below the 180-day drawdown projection from the May 2018 pumping test.
- NHDES cannot approve the requested production volume of 154,080 gallons per day because the requested withdrawal rate exceeds bedrock well 4's sustainable capacity and the historic use volume from the wellfield.

On December 3, 2018, NHDES approved a permitted production volume for bedrock well 4 of 115,200 gallons over a 24-hour period. As a condition of approval, NHDES required HAWC to provide groundwater level measurements from the well on a semi-annual basis in order to verify that the approved production rate is sustainable and to ensure the well is not causing excessive drawdown in the bedrock aquifer. Groundwater level data for bedrock well 4 is presented with the private well monitoring data in Section 5 of the report.

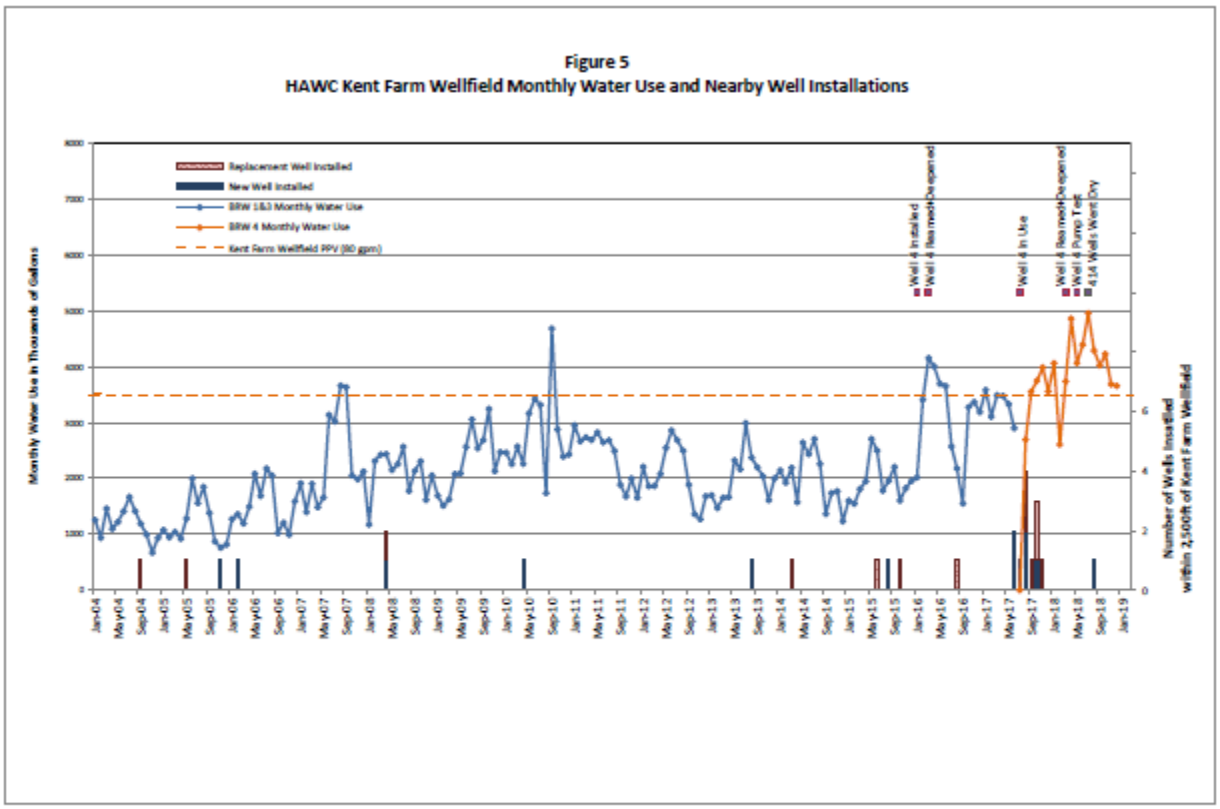
Figure 5 summarizes the volume of water withdrawn from the Kent Farm wellfield, activities associated with the construction and use of bedrock well 4, and the number of domestic wells installed per month within the study area since 2004. The wells installed are designated as either new wells or replacement wells. The well installation data shown in Figure 5 do not include the wells installed at the Kent Farm wellfield. Monthly water use data for the Kent Farm wellfield have been reported to the state since 2004. Figure 5 indicates the following:

- Since bedrock well 4 was installed in January 2016, the average monthly water use from the Kent Farm wellfield has increased approximately 40% over the average use from January 2010 to January 2016.
- A total of 14 domestic wells were installed between January 2016 and December 2018. The Labrador Lane development accounts for eight of these 14 wells. In August 2016, a well was installed at a property at 32 Page Lane.
- Between August and November 2017, five replacement wells were installed at 387, 405, and 414 Main Street.

The dashed line on Figure 5 represents the December 2018 approved permitted production volume for the wellfield.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 20 of 29

Figure 5
HAWC Kent Farm Wellfield Monthly Water Use and Nearby Well Installations

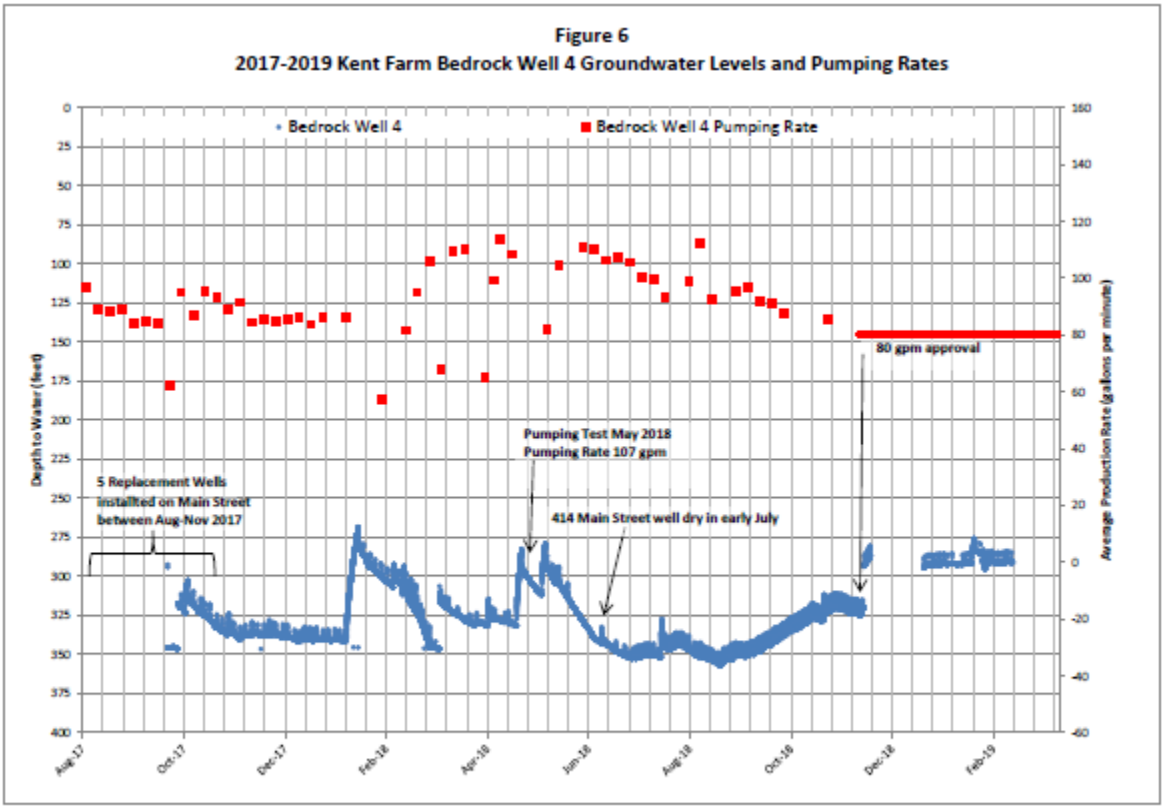


OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 21 of 29

HAWC has provided NHDES with available groundwater level data and pumping rate data associated with bedrock well 4 for the period from October 2017 through February 2019. Bedrock well 4 groundwater level data and the pumping rates (volume of water pumped averaged over a 24-hour period) are shown in Figure 6.

HAWC began pumping groundwater from bedrock well 4 in August 2017. In late 2017, the groundwater level under pumping conditions ranged from 307 feet to 338 feet deep from the top of the well casing. The pumping rate at this time ranged between 80 and 100 gpm. The groundwater level data indicate the well was not operated in early February 2018, which allowed the groundwater level to recover. The well was then in use for a couple of months and redeveloped at the end of March 2018. The pumping test was performed in May 2018. There was a rise in water levels prior to the pumping test period. After the pumping test, the groundwater data indicate the well was pumped steadily at around 107 gpm throughout June, July and August 2018. In September 2018, the pumping rate was decreased to near 90 gpm. The groundwater level through the summer months of 2018 ranged between 300 feet and 353 feet deep. In December 2018, the pumping rate was reduced to 80 gpm. Since December 6, 2018, the groundwater level under pumping conditions in bedrock well 4 has been above 300 feet deep. There was a rapid increase in the groundwater levels in early February 2019 when the well was shut down briefly for equipment maintenance.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 22 of 29



19

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 23 of 29

5.0 Groundwater Level Monitoring of Private Wells on Main Street

Depth to groundwater in wells naturally fluctuates due to precipitation trends, changes in the vegetative growing season, and drawdown associated with local and regional groundwater withdrawals. In the fall of 2018, staff from NHDES installed groundwater monitoring devices in wells at 414, 405, and 387 Main Street. The monitoring devices (pressure transducers) were programmed to measure and record groundwater levels every hour. A summary of the monitoring locations is provided in Table 6.

Table 6: Private Well Groundwater Level Monitoring Locations

Location (WRB #)	Well Depth (feet)	Transducer Depth (feet)	Notes
414 Main Street (WRB 104.1160)	350 feet (measured on 10/17/2018)	350 feet	Well was initially installed to 500 feet, a dry fracture was encountered around 350 feet; the well collapsed at this fracture. A yield of 0 gpm was reported. This well intercepts the same fracture as the 1999 well on the property that once yielded 100 gpm, as an interconnection was observed during drilling.
414 Main Street (WRB 104.1159)	1,500 feet	500 feet	Well was installed with 420 feet of casing. A yield of 0 gpm was reported. Well removed from monitoring program in January 2019.
405 Main Street (WRB 104.1164)	370 feet (measured on 10/17/2018)	370 feet	Well reported to have gone dry in fall of 2017. The well was originally reported to be 380 feet deep and yield 20 gpm.
387 Main Street (WRB 104.0474)	220 feet (measured on 10/17/2018)	220 feet	Original yield was reported to be 100 gpm.

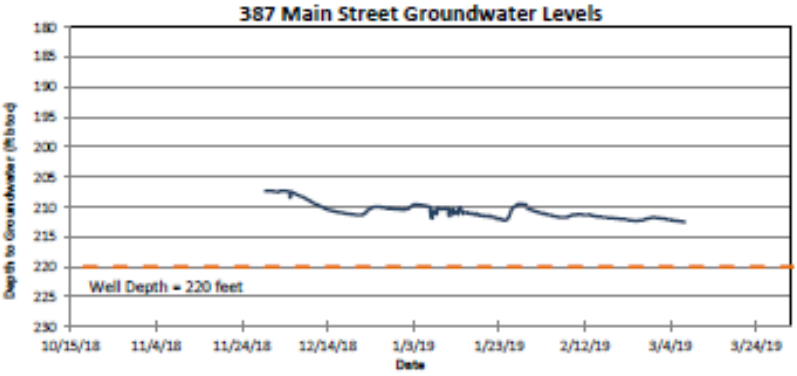
Except for the well that is 1,500 feet deep located at 414 Main Street, the wells selected for the monitoring programed were known to have produced water from fractures above a depth of 400 feet, but have since gone dry. The 1,500-foot deep well was monitored in an attempt to observe fluctuation of groundwater levels in the deeper bedrock.

5.1 387 Main Street

The 220-foot deep bedrock well installed at 387 Main Street in 1991 is being monitored. During site visits, water was flowing into the well from fractures above the groundwater level in the

well as evidenced by the sound of cascading water. Water was measured to be flowing in at 27 feet deep on October 17, 2018. The transducer is set at the bottom of the well, which was measured to be 220 feet deep on October 17. Water level measurements are shown in Figure 7.

Figure 7
387 Main Street Groundwater Levels



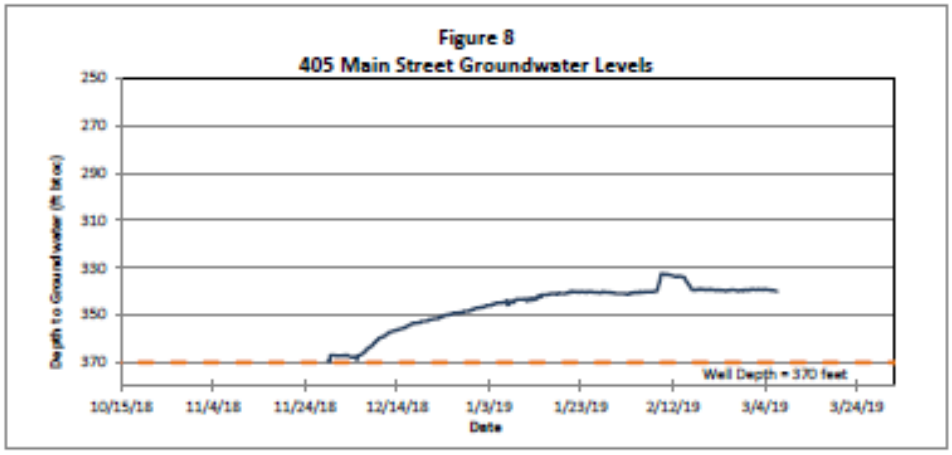
From the end of November 2018 to early March 2019, the groundwater level has been relatively stable and observed to fluctuate up to 5 feet between approximately 212 and 207 feet deep. Based on the spikes in the measured groundwater levels and the fact that water is not extracted from this well, the groundwater in this well appears to be influenced by a nearby groundwater withdrawal.

The groundwater level dropped in December 2018 and early January 2019. Between January 7 and 14, 2019 the fluctuations became more frequent. The groundwater level began to rise a few feet between January 24 and 28, 2019. Since January 28, 2019, the groundwater level has been fairly steady with a slight decline.

5.2 405 Main Street

The bedrock well installed at 405 Main Street in 2014 is being monitored. During site visits, water was flowing into the well from fractures above the groundwater level as evidenced by the sound of cascading water. On October 17, 2018, water was measured to be flowing into the well around 70 feet below the top of the casing. The transducer is set to the bottom of the well, which was measured to be 370 feet deep. The original depth of this well was reported to be 380 feet and a fracture zone was encountered near the bottom of the well. It is possible that the well has collapsed near the bottom causing rock from the borehole walls to collect in the bottom of the well. The groundwater level data measured from this well are included in Figure 8 below.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 25 of 29

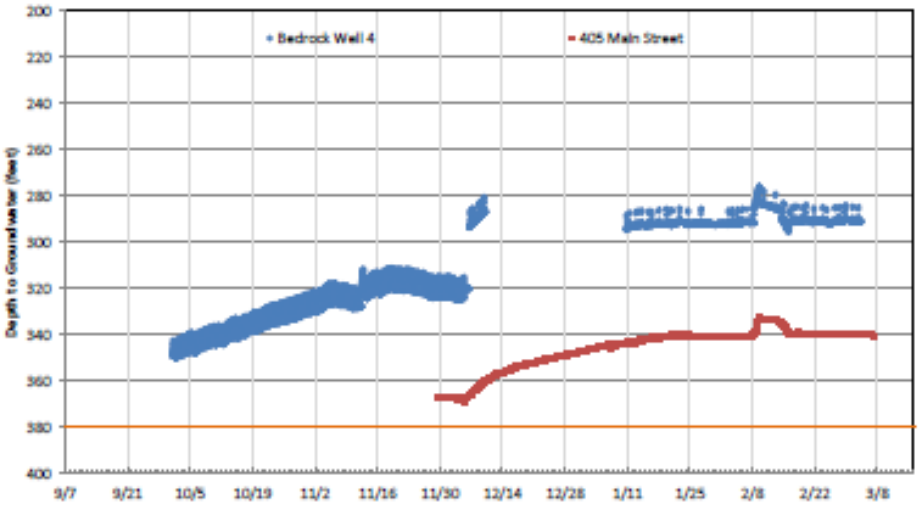


There was very little water in the 370 foot well at 405 Main Street from November 28 to December 6, 2018. On December 7, 2018, the groundwater level began to rise and rose steadily by approximately 28 feet through the middle of January 2019. From mid-January 2019 to early March 2019, the groundwater level remained steady, with the exception of the period of February 8 to 16, 2019. Between February 8 and 9, 2019, the groundwater level rose sharply by 7 feet (from 339 feet deep to 332 feet deep) then declined back to 339 feet between February 14 and 16, 2019.

The observed fluctuations in the groundwater level in the well at 405 Main Street correlates to the groundwater level measured in HAWC Kent Farm bedrock well 4 and is suggestive of a strong hydraulic connection between the two wells. Figure 9 depicts the correlation between groundwater level trends in both of these wells. The depth to groundwater in the 405 Main Street well is approximately 50 feet deeper than the depth to groundwater in bedrock well 4 at the Kent Farm wellfield. Based on topography maps, the ground elevation difference between the 405 Main Street well and Kent Farm bedrock well 4 is approximately 50 feet. This means the groundwater elevation at each location is similar.

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 26 of 29

Figure 9
Depth to Groundwater Levels in HAWC Kent Farm Bedrock Well 4 and 405 Main Street



On December 6, 2018, HAWC reduced the pumping rate in Kent Farm bedrock well 4 from 90 gpm to 80 gpm and groundwater levels in both this well and the 405 Main Street well began to rise. On February 8, 2019 HAWC ceased pumping from bedrock well 4 for a few days to make repairs to the electronic monitoring equipment. A response to this shutdown is observed in a rise in groundwater levels of both bedrock well 4 and the well at 405 Main Street.

In addition to a correlation between groundwater level trends with water levels measured in bedrock well 4, the groundwater level data observed at 405 Main Street between January 8 and 13, 2019, depicts a similar pattern of fluctuations that were also observed in the well located at 387 Main Street. The groundwater levels in both wells (387 and 450 Main Street) fluctuated up and down by a few feet at a frequent intervals over those few days in January 2019. This data indicates a hydraulic connection between these wells. However, what occurred to cause the fluctuation between those dates is unknown. The groundwater level data from 387 Main Street does not directly correlate to the groundwater level trends observed in bedrock well 4.

5.3 414 Main Street

NHDES is monitoring a bedrock well installed at 414 Main Street. This well was initially installed to 500 feet and intercepted the fracture zone that exists somewhere between 350 and 400 feet deep. After the well was drilled, the borehole collapsed at this fracture zone. During site visits, water was flowing into the well from a shallow fracture as evidenced by the sound of cascading

water. On October 17, 2018, this water was measured to be flowing into the well between a depth of 150 and 200 feet deep. The water flowing into the well is exiting the bottom of the well and the depth to groundwater remains below the depth of the well at this time.

The fourth well installed on the property, which is currently connected to supply water to the house, showed signs of recovery in early December 2018. Since December 5, 2018, the well has produced enough water to supply the home. However, the residents follow strict water conservation measures. In addition, based on visual descriptions provided by the resident, the water quality is vastly different from the water quality observed in May 2018. As part of the NHDES MtBE (methyl tertiary-butyl ether) Remediation Bureau well sampling program, a raw water sample was collected from this well on January 16, 2019. The water test results reported the concentration of iron at 36.9 parts per million (ppm), manganese at 5.78 ppm, hardness at 1240 ppm, and a pH of 3.63. These results have been confirmed by the laboratory; they represent unusually poor water quality. NHDES will collect water samples for laboratory analysis to assess whether water quality improves as the well recovers.

NHDES continues to monitor groundwater levels in wells located at 387, 405, and 414 Main Street. Additional monitoring is needed to provide insights to seasonal variation and longer-term trends in water levels in these wells.

6.0 Local Authority

NHDES has limited regulatory authority to address impacts to the water quality or capacity of private wells. NHDES has authority to address impacts to private wells that are protected under the large withdrawal permitting process (i.e. impacted by a withdrawal of greater than 57,600 gallons per day from a well installed after 1998). Municipalities have the authority to address the adequacy of the quality and quantity of water associated with a private well through local subdivision and site plan review regulations and through the administration of a clear potable water standard as defined within local building codes. For instance, local regulatory requirements could be incorporated into the following:

- Subdivision regulations that address:
  - Connecting to public water where there is a demonstrated quantity issue;
  - Requiring private well(s) to be installed before building new homes; and
  - Requiring a monitoring plan for potential or anticipated rock blasting.
- Irrigation Ordinances (new or existing parcels).
- Drought Management Plan – private and public wells.
- Town Well Permitting Program (inventory of local wells, use, etc.).

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 28 of 29

- Local Private Well Ordinance:
  - Adopt NHDES guidance on water quality and quantity prior to Occupancy Permit (this could be overseen by the Health Officer or Local Code Enforcement official);
  - Follow the example of towns with similar private well testing requirements, such as: Wakefield, Bedford, Kingston, Windham, Litchfield, Pelham, Derry, and Salem.
- Develop a Long-Term Growth Management Plan for the Town.

NHDES has provided example ordinances and guidance documents to officials in the Town of Hampstead for review.

7.0 Summary of Findings

NHDES initiated a study in September 2018 to investigate private well water capacity issues around 414 Main Street in Hampstead. The purpose of the study was to document the issues, identify activities that may have contributed to the issues, and identify actions that private well owners, local official, and NHDES can take to improve water supply problems.

NHDES has confirmed numerous water capacity issues at and in the area of 414 Main Street. There has been growth within the area over the past 30 years with reports of water issues spanning this time. However, well construction records, personal accounts, and groundwater levels indicate that there was a noted change in the groundwater system in 2017 that led to an increase in the number of water capacity issues in the area.

The decline in water capacities at and near 414 Main Street is, in part, a result of growth and an increase in water use across the area over time. In 2017, private wells were installed and rock blasting occurred on Labrador Lane. However, based on the depths, yields, and drillers accounts of the wells installed on Labrador Lane, it is not probable that the Labrador Lane wells had a direct negative influence on the groundwater conditions near 414 Main Street. The blasting on Labrador Lane is also not considered as a major factor in affecting groundwater levels based on NHDES' experience at sites that have undergone rock blasting.

Glenwood North the public water supply located directly west of 414 Main Street, is not considered a major factor in affecting groundwater levels. This is based on historical use and the wells' recovery after a recent leak in the system.

Information provided by water well contractors and groundwater level data measured in private wells along Main Street indicate there is a fracture zone underling the area allowing for a hydraulic connection between the wells at 387, 405, and 414 Main Street. The fracture zones

OCA 1-4 – NH DES Initial Findings Report - Hampstead, Page 29 of 29

encountered in the wells at 414 Main Street are at relatively the same depths as those encountered in the wells at 405 Main Street which is less than 400 feet away. At the same time that water levels began to rise in 405 Main Street, the well currently feeding 414 Main Street began to produce water. Also, fluctuations in groundwater data indicate a hydraulic connection between the well at 405 Main Street and 387 Main Street.

In 2017, HAWC began withdrawing groundwater from bedrock well 4 at the Kent Farm wellfield off Page Lane. Bedrock well 4 is a replacement well to bedrock wells 1 and 3, which have been in use since the 1980's and pre-date the large groundwater withdrawal statute. The groundwater level data collected to date indicates there is a hydrogeologic connection between the bedrock aquifer supplying groundwater to bedrock well 4 and the bedrock aquifer supplying groundwater to 405 Main Street, approximately 2,250 feet away.

The water capacity issues, installation of replacement wells, and deepening of wells along Main Street in 2017 occurred at the time bedrock well 4 began withdrawing water. In early December 2018, the reduction of pumping rates and rise in groundwater levels in bedrock well 4 correlates to the rise in groundwater levels at 405 Main Street and reported capacity increase in the well at 414 Main Street.

A cause for the decline in well yields at 414 Main Street and neighboring properties in recent years appears to be associated with groundwater withdrawals from bedrock well 4 at the HAWC Kent Farm wellfield. NHDES is coordinating with HAWC to adjust the operation of the Kent Farm wellfield to maintain adequate groundwater levels and prevent adverse impacts to private wells in the region.

There may be other unknown causes for the decline in groundwater levels. There is a need for continued and potentially expanded groundwater level monitoring to assess fluctuations in groundwater levels in the study area as withdrawals from public water supply wells change, seasonal groundwater fluctuations occur, seasonal water use patterns occur and further development occurs in the area. Additionally, drilling deep bedrock wells that contain shallow water bearing fractures that drain into deep fractures could impact the stability of the groundwater level in wells completed in the shallow portion of the bedrock aquifer.

NHDES encourages the Town of Hampstead to monitor groundwater use to assess long-term conditions and evaluate corrective actions that can be taken, if warranted.

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 1 of 25

Assessment of Adverse Effects on Residential Wells
North Main Street Area
Hampstead, New Hampshire

Prepared by:

The Hampstead Water Advocates

March 2019

Final

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 2 of 25

Table of Contents

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 3 of 25

Executive Summary

New Hampshire's bedrock groundwater aquifers are complex. Unlike the state's highly-productive glacial stratified drift aquifers, located in valleys and consisting of permeable and relatively uniform "sandy" materials, bedrock aquifers have significant vertical and lateral variability. For example, a 500-foot-deep well may have only 3 or 4 horizontal water-bearing zones, with the balance of the rock essentially being non-water-bearing. In addition, lateral groundwater flow is highly influenced by vertical fractures zones, commonly referred to as lineaments. These characteristics make bedrock aquifers vulnerable to impacts from larger volume production wells, which can cause significant drawdown and/or aquifer depletion at a sizable distance, and in an irregular pattern, from the production well. Impacts are more pronounced in bedrock aquifers as compared to stratified drift aquifers due to the limited amount of recharge, on average 9-12" per year, to bedrock aquifers.

The bedrock aquifers underlying Hampstead have been adversely affected by increased commercial and private groundwater withdrawal over time. For example, the average depth of a new private well in Hampstead has increased from 211 feet in 1984 to 643 feet in 2017. While these effects are occurring across the town, they are seen more acutely near higher volume production wells.

The Kent Farm Well field has operated as one of the highest, or the highest, production site in Hampstead from 2010 to present, with average annual pumping rates from 64,000 to 137,000 gallons per day (gpd), or 23-50 million gallons per year. During a 2018 pump test for a "replacement" production well, drawdown of 305 feet from the top of the well was observed, and greater drawdown was likely if pumping were to have continued, indicating the magnitude of impact high volume pumping can have on this aquifer.

Information was obtained defining significant adverse impacts to private wells in the north Main Street area in 2010, 2017, and 2018. While more challenging to collect information from all of the study area for 2010, in that year three private wells reported experiencing dry well problems. In 2017, nine residences experienced significant problems. Although remedial measures were taken by home owners to address these problems, in 2018 three residences experienced dry well problems, and other previously affected residences reported reduced flow or water quality in their wells. The Kent Farm well field operated at peak rates in these same years, with maximum reported monthly pumping rates exceeding 130,000 gpd in all three of these years. A review of data dating back to 2004 indicated a strong correlation between these high pumping rate periods and adverse impacts to adverse impacts experienced in north Main Street area wells.

Geologic bedrock lineament information was also reviewed to assess the hydrologic connection between the Kent Farm well field and adversely affected private wells in the north Main Street study area. Remarkably, the most significant bedrock fracture lineament coincides with a transect from the well field to the most highly-affected Main Street area, and the broader

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 4 of 25

affected area is bracketed by the primary, secondary and tertiary lineaments. These data demonstrate a highly likely hydrologic connection between the Kent Farm well field and the adversely affected wells in the study area, that is, when pumping in the well field is at elevated rates, impacts will arise in affected wells in the study area.

It is the Hampstead Water Advocates' objective to arrive at a conclusion for the root cause of adverse effects on private wells in the North Main Street study area. The assessment of the timeline of adverse impacts to private wells in the north Main Street study area, pumping rate data and operational information for the Kent Farm well field, and hydrogeologic information for the study area have conclusively demonstrated that operation of the Kent Farm well field at an excessive (i.e., non-sustainable) rate has caused and is causing adverse effects in these private wells. It is our conclusion that a pumping rate has not yet been established for the well field that will be sustainable for the town of Hampstead, the private wells in the study area, and the Kent Farm well field.

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 5 of 25

Main Street Area Wells Assessment

Hampstead, New Hampshire

Introduction

According to the NH Department of Environmental Services (NH DES), up to 60% of NH residents rely on groundwater as their source of water. For this reason, it is considered a critical resource for the health and wellbeing of the state's residents and businesses. Over 30 years ago, NH DES, who oversees groundwater for the State of NH, began to recognize threats to the state's groundwater, and thereafter began developing regulations, policies and technical guidance to protect and better manage this resource. In 1991, the New Hampshire Legislature passed The NH Groundwater Protection Act: RSA 485-C. This law, in combination with NH DES regulations which have evolved over time, provide the current legal framework for management of groundwater in the state.

Overview of NH Groundwater Aquifers

Groundwater supply sources, or aquifers, are to a great degree defined by their geology. In broad terms, there are two types of water-bearing geologic "units"; soil (known as overburden) and bedrock. In NH, two types of soil units are most important in terms of affecting water supply; glacial stratified drift, and glacial till.

Stratified drift deposits exist primarily in valleys, are uniform and permeable in nature, and can be excellent aquifers. Historically, 79% of NH's high-volume production wells were located in stratified drift deposits. (NH DES Water Resources Primer)

Glacial till, which overlies most of NH's bedrock, is very different in nature. It is composed of highly variable materials, will bear little groundwater, and because it was compacted by past glaciers, is very dense. The density and particle size of glacial till makes it relatively impermeable, which limits the amount of recharge to the underlying bedrock aquifers.

NH bedrock aquifers consist of crystalline rock, with fractures and planes that can hold water. Bedrock aquifers are less productive and more susceptible to depletion, explaining why only 21% of the state's high-volume production wells are bedrock wells. Bedrock groundwater aquifers tend to be complex and non-uniform. Conditions which are encountered in one bedrock well may vary significantly from another well a short distance away. Unlike overburden aquifers, bedrock aquifers are composed of a great deal of material that cannot hold or provide water (solid rock); the water must come from fractures and planes in the rock, and there must be interconnection for water from one area to supply, or recharge, another. For bedrock to

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 6 of 25

serve as an aquifer, it must contain a sufficient amount of fracturing to hold water, the fractures must be interconnected so water can move within the rock, and there must be an adequate source of groundwater recharge to fill, and regenerate, the fracture network.

Bedrock aquifer complexity is three-dimensional in nature, due to the non-uniformity of lateral fractures, and the varying attributes of horizontal water bearing zones. Vertical fractures tend to have prominent "orientations" described as compass bearings.

Significant vertical discontinuities typically exist, resulting in only limited horizontal zones being capable of providing meaningful sources of water. For a well 500 feet deep, there may be only 3 or 4 horizontal water-bearing zones/depths. Those vertical zones may be limited in thickness, on the order of 1-10 feet, with the rock above and below essentially being non-water-bearing. In NH, the greatest water bearing fracture zones have historically been within the upper 400 feet of bedrock (NH DES Water Resources Primer). As will be discussed later in this report, these zones are now being depleted in some areas, and deeper wells are being installed to find deeper water-bearing zones, to provide "water storage" in the well hole itself, or both.

As reported by the NH DES, "The nature of New Hampshire aquifers differs significantly from many other parts of the country where aquifers are more uniform and much deeper. Unlike these places, the amount of water that can be stored as groundwater in New Hampshire is limited naturally by the state's climate and geology." (NH DES Water Resources Primer). Recognizing this fact, bedrock aquifers should be managed as a limited resource to assure that withdrawal rates do not exceed replenishment rates.

For reasons discussed below, recharge/replenishment of bedrock aquifers is much slower than overburden aquifers. While rainfall can reach and recharge an overburden aquifer in days, it can take months, even years, to reach bedrock zones.

Groundwater is recharged from a fraction of precipitation which falls. Some precipitation directly evaporates at the ground surface or runs off to streams and rivers, and never enters the ground. At certain times of the year, when there is frost in the ground, the frozen ground significantly limits recharge, so melting snow or rain is discharged as surface run off. Some water enters the ground, and is then used by plants and lost to evapotranspiration. The balance of infiltrating precipitation can recharge aquifers. On an average year, NH receives about 45" of precipitation, some of which recharges overburden aquifers. Due to the processes previously described, because of the presence of glacial till over bedrock, and the physical characteristics of bedrock, only about 9-12" of the 45" of precipitation is available as bedrock recharge on a regional basis.

Recharge rates are affected by the amount of development in an area. According to the NH DES, "the amount of precipitation that enters the ground to replenish groundwater can be significantly reduced as impervious cover increases." (NH DES Water Resources Primer). In addition, as areas are developed and as storm water systems are installed, more precipitation is

removed from an area as surface water run off rather than being allowed to recharge the ground. These two factors can result in substantial reduction of the amount of effective groundwater recharge. Over the past 30 years, southeastern NH has experienced significant growth and development, which have resulted in more effective storm water routing/removal and higher amounts of surface water runoff as compared to recharge. Fifteen years ago, it was noted that, "Moderate to high rates of land conversion are now found throughout the southeastern third, if not half, of New Hampshire." (Society for the Protection of New Hampshire Forests, 2005), and these land conversion rates have continued. Accordingly, the 9-12" of annual bedrock recharge should be seen as an upper-end estimate as compared to an average rate.

Recharge rates can also be diminished by other human actions. According to the NH DES, "Groundwater recharge can also be diminished if the groundwater withdrawn from an area for domestic purposes leaves the area where it is used" (NH DES Water Resources Primer). For most individual or small community wells in NH, the groundwater extracted from a well is used by the local residents, and then returned to the ground in septic systems, where it can be naturally treated and recharge the groundwater. While not fully effective in offsetting withdrawals, this type of recharge plays a roll along with precipitation in maintaining a local area's aquifer. However, if water is removed from the local system, being conveyed, used and discharged in another geographic area, the local system can experience a recharge shortfall. The significance of this shortfall is commensurate with the size of the well and its withdrawal; the larger the withdrawal, the greater the recharge shortfall and the greater the adverse impact to that local aquifer system.

Summary of Aquifer Characteristics

In summary, bedrock aquifers in NH are three dimensional and complex in nature. Water bearing zones exist in limited horizontal planes, with the majority of the rock being essentially impermeable. Precipitation recharge to bedrock aquifers is limited under optimal conditions. With the development which has occurred in southeastern NH, those recharge rates have been diminished due to more impermeable surfaces and greater surface water runoff. The viability of bedrock aquifers can be degraded by large volume water supply wells which export water from the area without providing commensurate recharge. In southeastern NH, bedrock aquifers can be highly sensitive to overuse and development if sufficient recharge is not provided.

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 8 of 25

Overview of Water Use, Demand and Development

In 1980, the population of NH was 921,000; in 2017 it had increased to 1,343,000. Much of this growth has been concentrated in the southeastern portion of the state. For towns like Hampstead, populations have nearly tripled and business presence has significantly increased during this same time period. This increase in population and commercial activity has been accompanied with a comparable increase in water demand and use.

Thirty years ago, it was possible to drill a well almost anywhere in the state, and find a good supply of clean water. In 2008, NH DES stated, "Generally, a bedrock water supply well that is capable of supplying a single household can be developed anywhere in the state." (NH DES Water Resources Primer) Today, that is no longer the case, and for southeastern NH, where more of NH's growth has occurred, the issue is getting more serious. In past years, most towns, including the Town of Hampstead, had significant amounts of undeveloped land which served as recharge areas, and water use from private wells was offset by precipitation recharge and septic system recharge. The occurrence of a bedrock well of any depth going dry was rare. As development has proceeded, water use has increased, and what was once undeveloped land supporting groundwater recharge became essentially impermeable surfaces with little effective recharge. This change was evidenced in terms of increased aquifer stress due to lower amounts of recharge, along with increased localized flooding due to faster/greater surface water runoff. Instances of this have occurred in Hampstead, including past localized flood of NH Route 111 attributed to increased runoff resulting from development of former recharge areas.

In addition to the stress placed on local bedrock aquifers from increased residential and commercial water use, and from surface development reducing precipitation recharge, localized effects can arise from operation of large volume supply wells. According to the NH DES, high volume bedrock water supply wells could be developed in the state, "but identifying networks of fractures that can yield large quantities of water often requires the expertise of hydrogeologists and the use of sophisticated technology." (NH DES Primer).

For large volume wells drilled after July 1998, this complexity must be overlaid with siting of the well in a location and at depths that would not cause adverse effects, as defined in RSA 485-C: 21 V-c. Such effects include impacts to private water supplies, public water supplies, surface waters, wetlands, and the "long-term replenishment of the aquifer." For wells installed prior to August 1998, and for replacement wells installed for pre-August 1998 wells, NH DES approval is based upon not causing additional impacts as compared to those which existed prior to the replacement well installation. Under this framework, it is significant to note that NH DES can apparently permit and allow large volume wells regulated under the "pre-August 1998" provisions to operate with known adverse impacts to private and public well owners and the environment, leaving management of adverse impacts between the large volume well operator and the impacted parties. In past years, NH DES had offered a "Well Owner Response Policy" to assist in such cases, and provided a means to address and mitigate adverse impacts to private well owners arising as a result of operation of large volume water supply wells, but this policy no longer appears to be active.

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 9 of 25

Hampstead Bedrock Aquifer Use and Characteristics

NH bedrock geology has been studied for decades by many groups, and is relatively well understood. Significant regional information is available to describe the bedrock underlying Hampstead. Emery & Garrett (E&G) recently compiled a geologic summary for Hampstead in their "Preliminary Hydrogeologic Investigation" report, dated August 2018, prepared in support of the development of a new large volume bedrock water supply well near Angle Pond. Should readers wish to better understand Hampstead bedrock lithology, the related sources identified in the E&G report provide an excellent starting point for that information. In their report, E&G presents the results of several geologic assessments, including a "lineament analysis" to define significant vertical fractures likely to hold and carry bedrock groundwater flow. Such fracture patterns and orientations are important, because they describe the existence and location of fracture zones, as well as preferred directions of groundwater horizontal flow within the bedrock.

Fracture lineaments are defined by a compass bearing from due north (e.g., a 90-degree lineament would run east-west). For the Hampstead area, 6 major fracture lineaments were reported by E&G, and the top 4, in order of decreasing significance are 39 degrees, 97 degrees, 63 degrees, and 170 degrees. The significance of the prominent lineament at 39 degrees is re-enforced by the bedrock fracture fabric analysis presented in the E&G report, noting a significant fracture set at 42 degrees. A review of the "Lineament area map 1 of New Hampshire bedrock aquifer assessment, southeastern New Hampshire" prepared by Ferguson, Clark and Moore (1997) showed consistent lineaments in the Kent Farm well field area. The significance of these lineaments relative to issues which have arisen in wells in the Hampstead Main Street area will be discussed later.

Unlike bedrock geology, bedrock hydrogeology is much less studied and resolved, making it a more complex aspect. The NH DES and United States Geologic Survey (USGS) have both acknowledged this shortcoming. In response to this need, they have begun collecting bedrock groundwater data using "nested wells" (multiple wells at one location screened in different vertical zones). Unfortunately, single or nested monitoring points included in the NH DES network within Hampstead were not identified. This lesser level of understanding of local bedrock hydrogeology is also reflected in E&G's August 2018 hydrogeologic investigation report, which discussed the geologic attributes to a fair extent, but provided little discussion regarding the hydrology of the aquifer(s).

According to "Geophysical Investigations of Well Fields to Characterize Fractured-Bedrock Aquifers in Southern New Hampshire", a 2001 report prepared in collaboration between the USGS and NH DES (James R. Degnan, Richard Bridge Moore, and Thomas J. Mack), "The average bedrock well yield in New Hampshire is about 6 gal/min." Accordingly, siting a well capable of supporting a household was a relative certainty, while siting one capable of supporting commercial supply levels was not. Based upon data collected from their study area which abuts Hampstead, the authors concluded that the probability of drilling a 400-foot-deep well (a typical production well depth at that time) capable of yielding > 40

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 10 of 25

gpm in Windham was only 8-15%, in Pelham only 12-19%. From these results, one can infer that at the time of the study the regional bedrock aquifer was able to reliably support residential wells; however it was difficult to install productive large volume commercial wells. Due to the limited nature of significant water-bearing bedrock zones, it would not be unusual to experience adverse draw down impacts to the aquifer from the operation of a large volume well.

Recognizing the paucity of bedrock hydrogeologic data, surrogate information can be used as an indicator of the status of, and trends within, Hampstead' bedrock aquifers. All of Hampstead relies on wells for its water, either individual wells at homes and businesses, small community wells, or commercial well fields of varying sizes operated by the Hampstead Area Water Company (HAWC), Hampstead's sole town-wide water franchise. Area well drillers are experts in their field, drilling wells to provide a safe and reliable water source. Through the installation of 100's of bedrock water supply wells, they have gained first-hand knowledge of Hampstead's geology, the likely location of water-bearing zones in the bedrock, and the depth of a well needed to provide a reliable yield. During the installation process, well drillers measure the expected yield or output of a well, so they have real-time data to decide whether to drill a well deeper to obtain adequate water. Well drillers are commissioned to install wells capable of meeting a location's needs, and not deeper (and more expensive) than needed. There are many licensed well drillers in the area, making well installation a competitive environment; a well drilling company cannot afford to drill wells deeper than needed, and more expensive than planned, and maintain a viable business. For these reasons, the depths of wells installed by licensed well drillers can be used as a surrogate indicator of the depth of reliable ground water in the town's bedrock aquifer(s).

The average depths of new bedrock wells in Hampstead are presented below:

Year	Average Depth (feet)
1984	211
1985	252
1990	278
2000	403
2010	426
2016	523
2017	643

The year 1984 was selected as a period in time prior to Hampstead's significant growth beginning in the 1980's. The year 1985 was included due to the large number of wells installed that year (107). The years 1990, 2000, and 2010 were included as decade transition years. The

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 11 of 25

years 2016 and 2017 were included in the later 2010's as it was during this time that public awareness of more widespread water issues began to emerge.

As seen from these data, the average depth of a new bedrock water supply well in Hampstead has more than tripled. In addition to well depth, information from the NH DES regarding the reason for new well installation was reviewed. In the 1984-85 time frame, less than 10% of new wells were installed as replacement wells. In the 2014-2017 time frame, the percentages of replacement wells ranged from 40-60%. Well replacement can occur for different reasons; reduced or no water yield, or reduction in quality. Both of these adverse changes can result from aquifer depletion. Prior to installing a new well, well drillers will typically offer to redevelop a well, to "clean it out", or hydro-fracture a well to re-open fractures, as both of these options are far less expensive that installation of another, deeper well. If redevelopment or hydro-fracturing is successful, a replacement well would not be needed. In cases where an adequate supply of clean water does not return to a redeveloped or hydro-fractured well, the most likely cause is aquifer depletion, that is loss of water flow to the well, and a well driller would propose to install a deeper replacement well.

Absent historic bedrock groundwater monitoring data, these data demonstrate that water levels in Hampstead have declined, and continue to decline; some of the historically viable shallower water-bearing zones have gone dry or can no longer produce water of a suitable quality. In other words, some bedrock zones, both laterally and vertically, are now depleted due to water extraction greater than the recharge rates for those zones.

There are not comprehensive records for the amount of water extracted from Hampstead's aquifers. However, in general terms, use as compared to recharge can be summarized for the town. The vast majority of wells in town are private wells serving individual homes. Individual home water use is relatively modest, and homes in Hampstead have septic systems, such that much of the water used for internal/domestic purposes is discharged back to the ground. For homes that use an irrigation system, less of that water recharges the ground due to losses from evaporation, evapotranspiration, and surface runoff. In addition, there are also a number of small community wells, which serve small residential developments. While bigger than individual home wells, the flows from these wells are generally not considered large. Because they serve homes near the well, the water used in these homes is discharged back to the area in their septic systems in a manner generally comparable to an individual home well.

There are also commercial water supply wells operated in Hampstead by HAWC; in 2017 there were 17 active water supply wells reported in HAWC's Hampstead supply well network. The withdrawal rates from these wells varies, some are similar to small community wells while others are considered large. Although small in number, because of the commercial nature of these wells, their cumulative withdrawals can be significant. In total, the HAWC Hampstead well network withdrew over 100,000,000 gallons of water from the bedrock aquifer in 2017. Of its multiple well fields located throughout Hampstead, the Kent Farm well field, located off Page Lane had the largest reported and permitted flows; during 2017, the well field was reported to operate at average rates between 90,000 gallons per day (gpd) or 63 gallons per minute (gpm)

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 12 of 25

(i.e., an annualized rate of 33,000,000 gallons per year) to 130,000 gpd or 90 gpm (i.e., an annualized rate of 47,000,000 gallons per year). During 2018 (January-September), the well field was reported to operate at average rates between 90,000 gpd to a high of 160,000 gpd or 110 gpm (i.e., an annualized rate of 58,000,000 gallons per year). This well field was the largest contributor of water to the HAWC Hampstead network in 2017 and 2018.

Kent Farm Well Field

The HAWC Kent Farm well field has been in operation for many years. Records describing monthly pumping rates dating back to 2004 can be found in the NH DES Onestop data base, and information regarding the nature and production of the well field in annual reports filed by HAWC with the NH Public Utilities Commission (NH PUC) can be found on the NH PUC web site. Based upon these records, the well field was placed in service in 1987. Well names vary between documents and data bases, as well as the number of wells present in the well field. Because these wells were installed prior to 1998, they apparently did not have permitted pumping rates assigned by the NH DES. However, based upon annual reports filed by HAWC with the NH PUC, the wells were assigned approved pumping rates, although the source of the approval was not identified. One well had an approved pumping rate of 8 gpm and one well had an approved pumping rate of 60 gpm; the aggregate approved pumping rate of 68 gpm equates to 98,000 gpd.

At the recent request of NH DES, HAWC conducted a review of their files to locate historic records regarding the two initial wells installed in the Kent Farm well field. While such records are limited, HAWC was able to locate the pumping test record for Kent Farm Well #3, a 2-day test performed in 1988. Based upon the test data sheet, the test was performed at a rate of 66-60 gpm, the rate being reduced during the course of the test. At the start of the test, the water level was 30′ below top of casing (TOC); 20 hours later the water level was 215′ below TOC (185′ of drawdown), where it remained for the balance of the test.

Adopting the names used in the Onestop data base, well production information for Kent Farm Bedrock Wells (BRWs) 1 and 3 is available from 2004 (the earliest data in this data base through 2017; the data base indicates that use of both of these wells was suspended in June 2017. Because no data was entered for these wells in 2018, it was assumed that the wells were not operated that year. The Onestop data base was used to determine monthly average and maximum production rates for BRW 1 and 3 from 2004 to present. During this time period, annualized average monthly production rates for the well field (including withdrawal from well BRW 4 discussed below) ranged from 39,000 gpd (2004) to 137,000 gpd (2018). The annual monthly average pumping rate exceeded 80,000 gpd in four of these fifteen years; 2010 (92,000 gpd), 2016 (101,000 gpd), 2017 (113,000 gpd) and 2018 (137,000 gpd).

In December 2016, a new well was drilled at the Kent Farm well field, BRW 4, with a reported depth of 535 feet. In March 16, 2017 e-mail correspondence from HAWC to NH DES, HAWC reported that this well was installed due to lost capacity, and that the two active wells at that

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 13 of 25

time had a combined production volume of 65 gpm (94,000 gpd). The correspondence also references a "permitted production volume" (PPV) of 100 gpm (144,000 gpd). In subsequent correspondence from NH DES to HAWC, also dated March 16, 2017, NHDES notes that a "permitted pump volume" (aka PPV) greater than 100 gpm would be allowed if other data higher than that amount could be provided.

NH DES files, with the exception of the Onestop data base, contain little additional information regarding well BR 4 for the balance of 2017. In an April 5, 2018 letter from NH DES to HAWC, NH DES notes that in July 2017 NH DES granted HAWC a temporary emergency approval for the use of well BRW 4, with a PPV of 160 gpm (234,000 gpd). The 160 gpm PPV was based upon information provided to NH DES by HAWC referencing "existing wells EPA 17 and 18", with prior yields of 100 gpm and 60 gpm. In July 3, 2017 correspondence, NH DES requested a schedule for the required pump test of well BRW 4; HAWC responded that they wished to conduct the test in October 2017, to avoid the higher summer demand period, and NH DES agreed to this schedule.

Not having received a pump test plan from HAWC, NH DES notified HAWC on February 1, 2018 that the agreed upon pump test had not been conducted, and that HAWC was out of compliance with their (emergency) approval.

In response to this notification, on March 20, 2018, having operated BRW 4 on an emergency basis since NH DES' July 2017 approval, HAWC submitted an application for operation of well BRW 4 with a requested rate of 168 gpm. On April 5, 2018, NH DES responded to this request with a proposed PPV of 160 gpm, calling for certain conditions including a 7-day pumping test of the well. That pump test was performed in May 2018, and results were presented to NHDES in a Lewis Engineering September 2018 report. Review of this pump test report was difficult, in that data did not appear consistent, some data were contrary to expected results, and supporting text or field notes were not identified to resolve apparent discrepancies.

In their review of the test report, NH DES also identified discrepancies, and also drew initial observations/conclusions regarding the test which were not discussed in the report. Some of these included:

- The drawdown in well BRW 4 while pumping at a rate of 107 gpm was 305 feet below top of casing (TOC)
- The water level in well BRW 4 was 335 feet below TOC prior to the pre-test rest period, 20 feet more than the drawdown reported at the end of the pumping test
- Drawdown in well BRW 4 exceeded the depth of the uppermost water bearing zone, and was approaching the lower water bearing zone at 420 feet below TOC
- Based upon this initial assessment, the pumping test rate may not be sustainable.

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 14 of 25

As a result of questions raised by NH DES, additional information was provided to NH DES in November 8 and November 23, 2018 correspondence. HAWC subsequently reduced the requested PPV to 154,080 gpd (107 gpm) as a result of their exchanges with NH DES. As part of this ongoing exchange, some of the apparent discrepancies of the pumping test were confirmed, and on November 15, 2018, NH DES informed HAWC that they would not be able to approve the (reduced) requested pumping rate of 107 gpm.

According to the Onestop data base, operation of BRW 4 began in August 2017, with no wells in the Kent Farm well field operating in the month of July, which is typically a high-demand month. The average monthly production rate for 2017 was 117,000 gpd (81 gpm annualizing to 43,000,000 gallons in a year), and for the first nine months of 2018 it was 137,000 gpd (95 gpm annualizing to 50,000,000 gallons in a year). The average monthly production rate for January-September 2018 was 137,00 gpd (95 gpm), and the peak use in those months (July) was 165,000 gpd (115 gpm). As will be discussed below, the PPV for well BRW 4 was reduced from its initial PPV by NH DES in December 2018; well production data for this well for October-December were not yet available at the time of report preparation.

On December 3, 2018, NH DES formally responded to the submissions provided by HAWC related to well BRW 4, and approved a PPV of 115,200 gpd (80 gpm). As discussed in this letter, the reasons for the approved rate being much less (50% of the initially approved rate) was related to the adverse effects observed during the pumping test. Some of the conclusions reached by the NH DES in this letter, and in earlier related letters, include:

- During the pumping test, drawdown of "305 feet btoc [below top of casing]" was observed and stabilization was not achieved, indicating further drawdown was likely if pumping continued
- Well BRW 4 drawdown at a pumping rate of 107 gpm exceeded the uppermost [bedrock] water bearing zone and approached the lower water bearing zone
- Based upon BRW 4 meter readings from August 2017 through October 2018, water levels in the well decreased below (i.e., were more severe than) the 180-day projection from the May 2018 pumping test
- The revised/reduced requested 154,080 gpd PPV exceeded the well's sustainable capacity (i.e., operation at this rate would result in aquifer depletion)

From the NH DES review, it is clear that at certain pumping rates, the Kent Farm well field is capable of causing significant adverse impacts to the surrounding bedrock aquifer. Although the reports prepared for the well field did not contain details regarding a zone of influence (ZOI) for the well field at these elevated pumping rates, it would be reasonable to conclude that they would extend thousands of feet from the production wells.

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 15 of 25

Impacts to North Main Street Area Wells

Identifying and understanding adverse impacts to wells in the north Main Street area involved a variety of activities. Information from several sources was used for the wells assessment, including; NH DES files related to their investigation of Hampstead wells and the associated NH DES survey results: information in the NH DES Onestop data base describing new well installation, production well operation and production well withdrawal rates: reports/ information regarding well installation and well issues provided directly by Hampstead residents: and real estate disclosures containing information regarding problems with wells.

Since forming in 2018, the Hampstead Water Advocates (HWA) has become the recognized entity to provide information regarding past and new well issues. Information is reported to the HWA in various forms, and the HWA has followed up with residents providing information to assure it is correct and properly understood. The vast majority of the residents providing information have done so openly; in one instance, information was provided on a confidential basis, as that resident was concerned about adverse impacts to the value of their property. In aggregate, this process has provided a more complete means of reliably identifying locations and time periods of well issues. Never-the-less, while also recognizing that this process has resulted in identifying more adversely affected wells, it is also highly likely that there are other well issues which remain unreported (i.e., the existence of false negative data). One reason shared by an affected resident and discussed by local realtors is that the values of homes with or near wells with little or inadequate water supply will decline, making some residents more cautious about disclosing well problem information.

The period for this assessment was set from 2010 through 2018, in part based upon the ability to recover historic reliable information. During this 9-year time period, reports of significant adverse impacts were identified for an area on and around north Main Street, including Main Street, Labrador Lane, Houston's Way and Sarah's Way, and on Page Lane, the road adjacent to the Kent Farm well field; this has been termed the "study area". Because of the significance of impacts to wells at 414 Main Street, that property has been used as the reference point for reporting. Well problems related to loss of well yield or loss of water, and for some of these same wells significant changes in water quality, were reported in 2010 in the Main Street area, to a limited extent in 2016 on Page Lane, and in 2017-2018 in the North Main Street area and on Page Lane.

In June of 2010, three properties at or near to 414 Main Street experienced dry well problems; the locations of those wells are shown on Figure 1. The problems were addressed by: installing a new, deeper well; hydro-fracking an existing well; and installing a new pump, to replace a burned-out pump, deeper in an existing well. Because of home ownership changes and the number of years which have passed since 2010, it is expected that the full number of well problems is under-reported. Never-the-less, the occurrence of three wells within 0.1 miles of 414 Main Street all experiencing water loss problems in the same month constitutes a significant event.

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 16 of 25

In 2017, the number of reported well water supply problems in the area grew. In the period of June through November, wells of nine (9) properties in the north Main Street area were reported to go dry. On some of the properties, up to three additional wells (for a total of four wells) were installed to find water. Figure 2 shows the locations of these nine properties. The three properties which experienced problems in 2010 are among the nine with problems in 2017, that is to say, that the efforts made in 2010 to remedy loss of water at that time were not effective in 2017. By the end of the year, some level of flow had returned to at least one of the wells on these nine properties. It is also worth noting that because of the recognized difficulties in finding a reliable water source on Labrador Lane, new wells on that road were typically drilled to 1,000 feet or greater to either find a water-bearing zone or to provide storage in the well hole to offset lower than average yields. On some properties, up to 4 wells were drilled to find one able to provide an adequate source of water. These results in aggregate indicate a significant and more wide-spread adverse impact as compared to that occurring in 2010.

In the summer of 2018, wells on two properties at or <0.1 miles from 414 Main Street were reported to go dry, in addition to a well on Page Lane. Other properties in the vicinity reported reduced well flow rates or diminished water quality, but because of prior efforts made to restore water supply, did not lose water. In November 2018, the well on a property approximately 1 mile south of 414 Main Street was reported to go dry, and connected to the HAWC network rather than installing another well. In December 2018, some properties with affected wells near north Main Street reported an increase in flow to their wells, and some improvement in quality. The one viable well at 414 Main Street was also reported to have some return of flow, but not to an extent to support normal water use, and with a much diminished quality.

Correlation of Well Impacts to Kent Farm Well Field Operation

As summarized above, periods of significant adverse impacts to wells in the study area occurred in 2010, 2017 and 2018.

Figure 3 shows the average monthly production of the Kent Farm well field from 2004-2018. During that time, the average annualized production rate of 80,000 gpd was exceeded in 4 years; 2010, 2016, 2017, and 2018. Figure 3 shows the maximum monthly average pumping rate of the well field from 2004-2018. During those same 15 years, the maximum monthly pumping rate exceeded 130,000 gpd in 3 years; 2010, 2017 and 2018. The fact that the years of 3 of the 4 highest annual average pumping rates, and the years of the 3 highest maximum monthly pumping rates are the same years during which significant adverse well impacts occurred in the study area is significant, and not coincidental.

Additionally, in December 2018, the NH DES reduced the PPV for well BRW 4 (the only active well in the well field) to half of the initial PPV. In December 2018, residents with adversely affected wells reported increased well flows and/or improved water quality. That occurrence is also significant in that it demonstrates that a reduced pumping rate at the well field can and did

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 17 of 25

result in a reduction in adverse impacts to residential wells, and that there is a direct relationship between the viability of private home water supply wells in the vicinity of the Kent Farm well field and the pumping rate of the well field.

Looking more closely at water production records for the Kent Farm well field, the 2010 average pumping rate increased 21% to 92,000 gpd as compared to the average 2009 pumping rate of 76,000 gpd, and was 166% higher than the 2004 average pumping rate of 39,000 gpd (the earliest year with reliable records. The average pumping rate for each month in 2010 is presented in Figure 5. As shown on Figure 5, pumping rates began at levels comparable to 2009, approximately 70,000-80-000 gpd, increased sharply in May, and then remained in the range of 100,000-110,000 gpd through September. This marked increase in pumping directly coincided with the June adverse impacts to north Main Street area wells. Pumping rates declined in the fourth quarter of the year to 2009 levels, and average pumping rates remained at or below those levels from 2011 through 2015. During these 5 years, information was not identified regarding multiple wells experiencing yield problems within close time periods in the Main Street area. These data further indicate a direct hydraulic connection between the north Main Street area wells and the Kent Farm well field, and the ability of the well field to pose acute adverse effects on these wells when operating at high withdrawal rates.

Average monthly pumping rates were also reviewed for 2015, 2016, 2017 and 2018 to assess potential relationships between operation of the Kent Farm well field and adverse impacts to wells in the study area. In 2015, the well field average pumping rate was 64,000 gpd, comparable to average rates for 2011-2014. In 2016, the average monthly withdrawal rate increased to 101,000 gpd, a 58% increase. One well was reported to go dry in 2016 on Page Lane, adjacent to the well field, while reports of significant well impacts were not found for the Main Street area. In 2017, well field pumping rates remained at comparable levels for January and February, and then increased to approximately 134,000 gpd in March and April. In the following months, residential wells on 9 properties in the study area reported either significant yield reductions, or going dry. While not as immediate as the effects observed in 2010, the 2017 effects are still striking and correlate well with the higher pumping rates of the Kent Farm well field. There are possible reasons for the apparent delayed impacts in the 9 wells, some of which are: some of the wells may have been initially receiving benefits from past remedial measures undertaken in response to earlier well problems, until some change in hydrologic conditions reduced or eliminated the effectiveness of those remedies; and the effects associated with the now higher and sustained well field production may have become chronic in nature, more related to aquifer or water-bearing zone depletion as compared to immediate drawdown impacts.

In 2018, average monthly pumping in the well field continued at rates comparable to 2017 until April, when it increased to 161,000 gpd, the highest rate reported through that date, and remained relatively high through the balance of the reported year (rates for October-December 2018 are not yet available in the Onestop data base). New adverse impacts were reported for wells in the study area beginning in June and continuing for much of the balance of the year. The 2018 results are remarkably similar in nature to those of 2017, further showing the inter-

relationship between operation of the Kent Farm well field and the viability of certain wells in the study area.

Impacts this distance from a bedrock production well are not uncommon. As an example, in 2018 HAWC commissioned a pump test for a new large volume production well, HWT-1, in Atkinson, NH. While hydrogeologic differences exist between the Atkinson HWT-1 well field area and the Kent Farm well field area, the results from that pump test are presented as illustrative for large volume well impacts in this relatively proximal, adjoining town area. During the initial 2-day pump test, which began at 61 gpm and was reduced to 55 gpm during the test, drawdown was sufficient to cause dewatering of the uppermost bedrock water-bearing fracture zone. Based upon this initial adverse result, it was decided that the 7-day pump test would be performed at a lower pumping rate, 46 gpm, in an attempt to not dewater the upper portion of the aquifer. At this reduced rate, the results of the 7-day test indicated that drawdown effects could extend 2,500 feet from the production well, and that a drawdown in excess of 100 feet would exist in the production well.

To provide perspective to the north Main Street area, the initial PPV of Kent Farm well BRW 4 was more than three times the pumping rate during the well HWT-1 7-day test, and the adversely affected wells in the study area are on the order of 2,000 feet from the Kent Farm well field, a distance shorter that the well HWT-1 zone of impact. Based upon this information, it is reasonable to conclude that significant impacts could arise from a high pumping rate at the Kent Farm well field, and that the likelihood of occurrence would increase if other contributing factors existed.

In addition to hydrologic information, geologic information was also reviewed to assess potential relationships between operation of the Kent Farm well field and wells which have been adversely affected in the north Main Street area. As previously discussed in the aquifer characteristics section of this report, bedrock lineaments provide a reliable indication of preferred groundwater horizontal/lateral flow directions. For Hampstead, the top 4 lineaments are, in order of decreasing significance are 39 degrees, 97 degrees, 63 degrees, and 170 degrees. Figure 7 shows the orientation of these 4 lineaments, along with the location of the Kent Farm well field, the immediate 414 Main Street area, and the Labrador Lane area. Remarkably, the most significant lineament of 39 degrees coincides with a transect from the well field to a portion of the Main Street area with adversely affected wells, and the expanded area of affected wells is bracketed by the 39 degree and the 63 degree lineaments. The affected area of Labrador Lane is bracketed by the second and third most significant lineaments of 97 degrees and 63 degrees. The proximity of these lineament locations to areas with affected wells demonstrates a highly likely hydrogeologic connection between the affected north Main Street wells and Labrador Lane wells, and the Kent Farm well field.

The noted occurrence of adverse localized private residence well impacts coincidental with the highest periods of Kent Farm well field operation, the positive response in affected wells coincidental to the reduced pumping rate of the well field in late/December 2018, and the hydrogeologic pathway connections between the well field to the localized impacted areas

based upon the two most prominent lineaments demonstrate conclusively that operation of the well field at an excessive (i.e., non-sustainable) rate has caused and is causing adverse effects in these private wells.

Summary and Conclusion

It is the Hampstead Water Advocates' objective to arrive at a conclusion on the root cause of adverse effects on private wells in the North Main Street study area. It is our conclusion that a pumping rate has not yet been established for the well field that will be sustainable for the town of Hampstead, the private wells in the study area, and the Kent Farm well field.

Based upon the information provided in this report, there is little doubt that the Kent Farm well field is hydraulically connected to wells in the north Main Street study area and along Page Lane, and that operation of the well field has caused adverse impacts to wells in these areas. When the well field has operated at the upper end of its operating range, the effects have been more severe and wide-spread; when pumping rates have been reduced, effects have abated. In all likelihood, the well field could be operated at a sustainable rate, lower than its current PPV, to the benefit of both its own longevity and the viability of surrounding private wells. From the assessment presented in this report, it is fair to conclude that a sustainable pumping rate is well below the current PPV for well BRW 4.

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 20 of 25

List of Acronyms and Terms

btoc: below top of casing

BRW: bedrock well

E&G: Emery & Garrett

evapotranspiration: the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants.

gpd: gallons per day

gpm: gallons per minute

HAWC: Hampstead Area Water Company

HWA: Hampstead Water Advocates

lineaments: linear feature in the bedrock, such as a fault or fracture zone

NH DES: New Hampshire Department of Environmental Services

NH PUC: New Hampshire Public Utility Commission

PPV: permitted production volume

TOC: top of casing

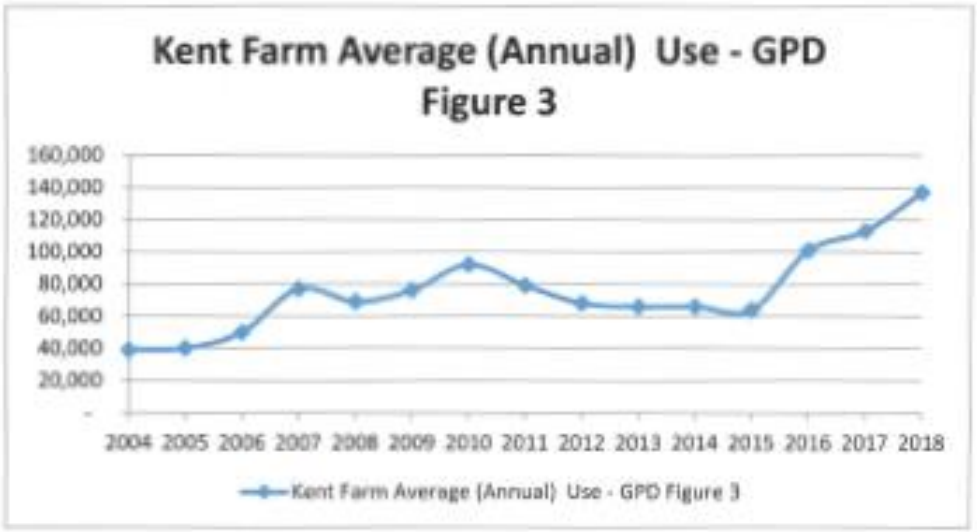
USGS: United States Geologic Service

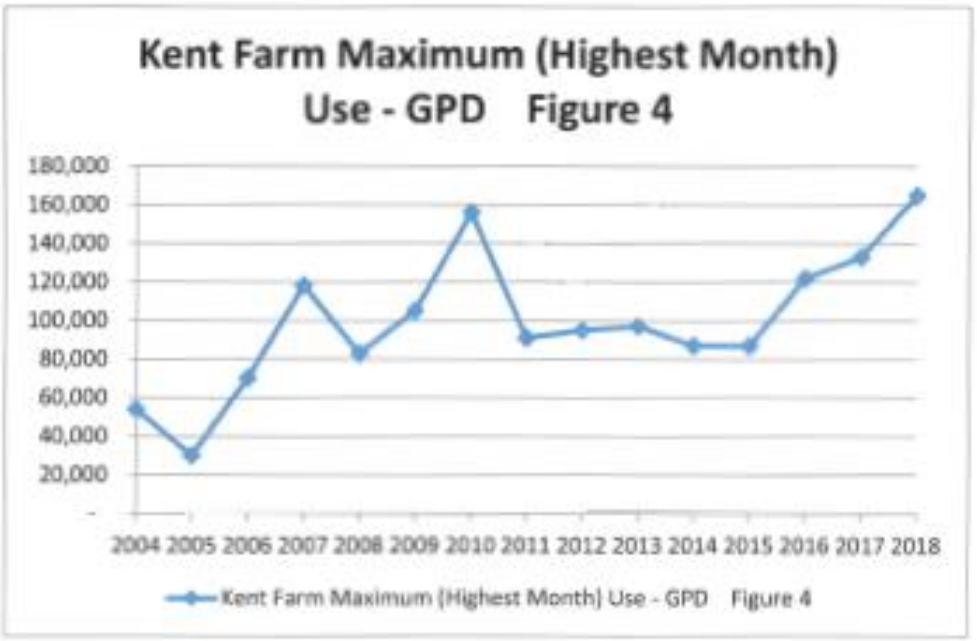
ZOI: zone of influence – the area affected by drawdown from a production well

OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 21 of 25

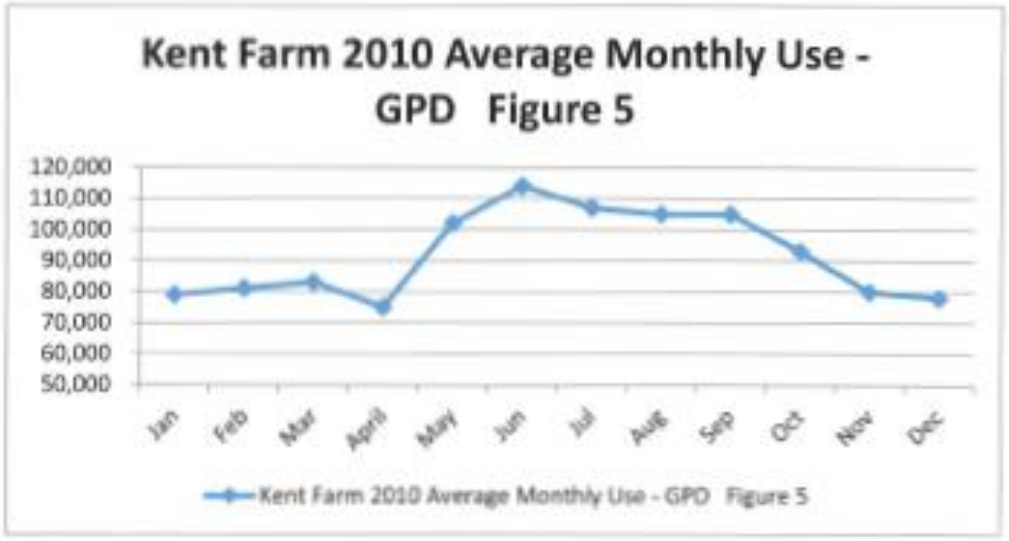
OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 22 of 25

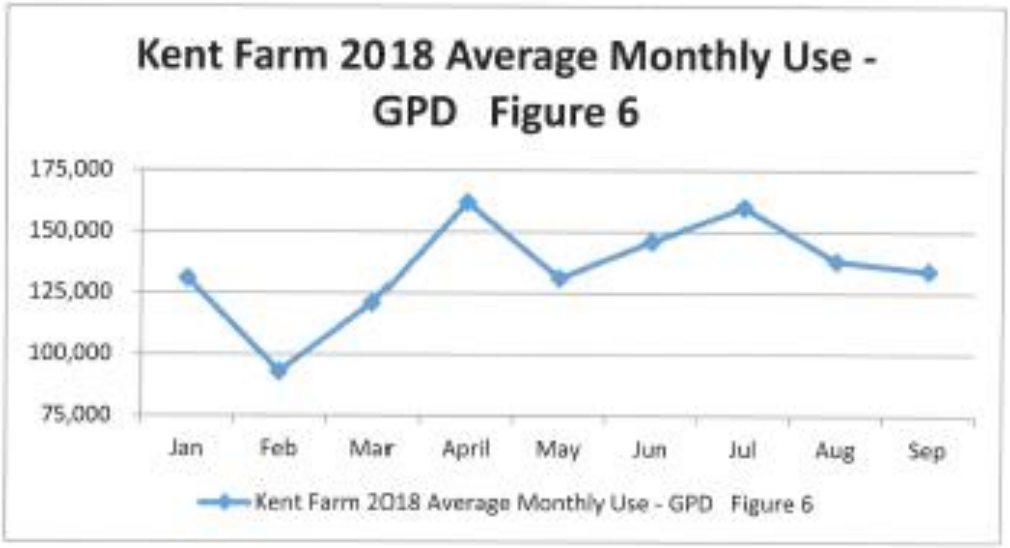
OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 23 of 25





OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 24 of 25





OCA 1-4 – Hampstead Water Advocates N. Main Street, Page 25 of 25

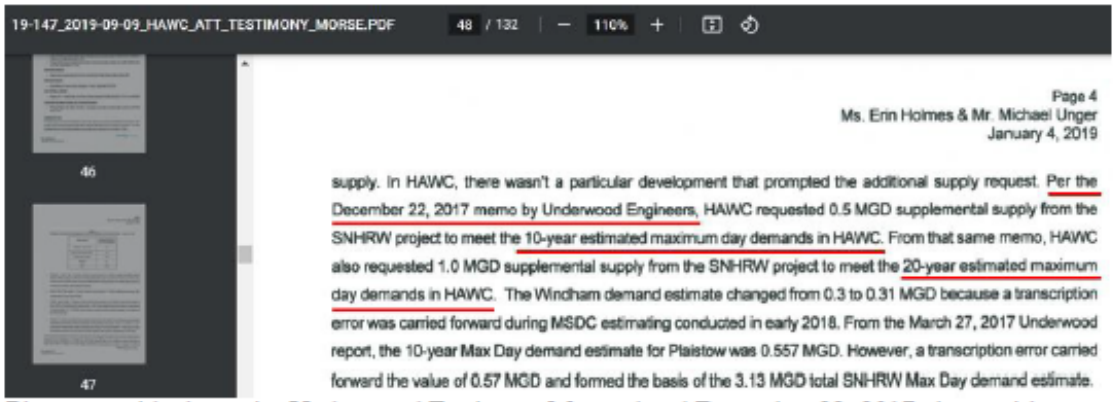
OCA 1-12 – 10 and 20 year plan for HAWC Water Needs, page 1 of 5

THE HAMPSTEAD AREA WATER COMPANY, INC.'S RESPONSES TO KAREN STEELE'S DATA REQUESTS – SET TECHNICAL SESSION 5

The Hampstead Area Water Company, Inc.
DW 20-117

Date Request Received: 12/16/21 Date of Response: 1/6/2022
Request No. Steele TS 5-1 Witness: Charlie Lanza

Page 48 of the document in the link here, provided by Chris Tuomala today, references a memo from Underwood Engineers. https://www.puc.nh.gov/Regulatory/Docketbk/2019/19-147/INITIAL%20FILING%20-%20PETITION/19-147_2019-09-09_HAWC_ATT_TESTIMONY_MORSE.PDF



Please provide the entire Underwood Engineers Memo dated December 22, 2017 along with any attachments and supporting documentation.

RESPONSE STEELE TS 5-1:

The requested memo was provided in response to Staff 3-24b. A copy is also being sent in response to this request.

OCA 1-12 – 10 and 20 year plan for HAWC Water Needs, page 2 of 5

The Hampstead Area Water Company, Inc.
DW 20-117

Date Request Received: 12/16/21 Date of Response: 1/6/2022
Request No. Steele TS 5-2 Witness: Charlie Lanza

Please provide the documentation and details as to how you arrived at your 10-year maximum as referenced in the Underwood Engineers memo dated December 22, 2017.

RESPONSE STEELE TS 5-2:

The 10-year maximum estimate was a preliminary estimate by the Company very early on during the Southern NH Regional Water Project. There is no documentation or details to provide related to this number.

OCA 1-12 – 10 and 20 year plan for HAWC Water Needs, page 3 of 5

The Hampstead Area Water Company, Inc.
DW 20-117

Date Request Received: 12/16/21 Date of Response: 1/6/2022
Request No. Steele TS 5-3 Witness: Charlie Lanza

Please provide the documentation and details as to how you arrived at your 20-year maximum as referenced in the Underwood Engineers memo dated December 22, 2017.

RESPONSE STEELE TS 5-3:

The 20-year maximum estimate was a preliminary estimate by the Company very early on during the Southern NH Regional Water Project. There is no documentation or details to provide related to this number.

OCA 1-12 – 10 and 20 year plan for HAWC Water Needs, page 4 of 5

The Hampstead Area Water Company, Inc.
DW 20-117

Date Request Received: 12/16/21 Date of Response: 1/6/2022
Request No. Steele TS 5-4 Witness: John Sullivan

Given the response to previous discovery that HAWC had no plans to expand the Atkinson-Hampstead Core to other towns, what % of the Phase 1 water (250,000 gallons per day) is going to Hampstead and what percent is staying in Atkinson?

RESPONSE STEELE TS 5-4:

There is no way to track where the water goes once it is received from Manchester. The water is combined with water from the Company's wells and is used wherever required on any particular day. That could be in Atkinson, in Hampstead, or stored in any of HAWC's water storage tanks.

OCA 1-12 – 10 and 20 year plan for HAWC Water Needs, page 5 of 5

The Hampstead Area Water Company, Inc.
DW 20-117

Date Request Received: 12/16/21 Date of Response: 1/6/2022
Request No. Steele TS 5-5 Witness: John Sullivan

Given the response to previous discovery that HAWC had no plans to expand the Atkinson-Hampstead Core to other towns, what % of the Phase 2 water (additional 500,000 gallons per day) is anticipated going to Hampstead and what percent will stay in Atkinson?

RESPONSE STEELE TS 5-5:

Phase 2 is not included in this rate case. Phase 2 is only a concept that may or may not happen sometime in the future. In addition, please see response to TS 5-4.