



VIA EMAIL: townmanager@fryeburgmaine.org
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March 30, 2020
Project No. 33.0083035.01

Katie Haley, Town Manager
Town of Fryeburg
16 Lovewell Pond Road
Fryeburg, Maine 04037

Re: 2019 Water Level Monitoring Report for the Wards Brook Aquifer

Dear Katie:

The Town of Fryeburg, Maine retained Emery & Garrett Groundwater Investigations (EGGI), a Division of GZA, to review total groundwater withdrawals from the Wards Brook Aquifer to ensure that such withdrawals are not exceeding the sustainable capacity of the Aquifer or detrimentally impacting surface water quality downstream of the Aquifer. This report summarizes and evaluates the data collected during 2019 by others, and therefore EGGI cannot testify as to the full accuracy of the data presented. The contents of this report and the conclusions and recommendations herein are subject to the Limitations in **Appendix A**.

Background

The Wards Brook Aquifer has been used as a community water source (the “Evergreen Spring”) by the Fryeburg Water Company (FWC) for decades. The FWC continues to withdraw groundwater to meet community supply needs from Production Wells FWC#2 and FWC#3, which are now operated and managed by the Maine Water Company (Maine Water) (**Figure 1**). Nestlé Waters North America Inc. (Nestlé), a bottled water company, processes and sells groundwater from Production Well FWC#1 (aka Pure Mountain Spring PMS-1 or, more recently, PBH-1). In addition, for several years, the WE Corporation (DBA Pequawket Water Company) withdrew water from another well (FWC#4 also known as the Pequawket Well) tapping the Wards Brook Aquifer, but that well is now also owned by Nestlé and has not been used to withdraw groundwater since 2017.

The Town of Fryeburg engaged Emery & Garrett Groundwater, Inc. (EGGI, as it was then known) to complete a hydrogeological analysis of the Aquifer using a numerical groundwater flow model. This model was used to generate a recommendation of what maximum withdrawals could be used from the Wards Brook Aquifer bearing in mind all local considerations, including the water demands of the Town and the preservation of adequate quantities of groundwater discharge to Wards Brook (**EGGI, 2005**). That study was prepared for the Fryeburg Planning Board and is the major reference that documents groundwater flow conditions in the Wards Brook Aquifer. It was recommended that groundwater withdrawals for non-public uses (shipping groundwater off site for bottled water or other purposes) should

not exceed 603,000 gallons per day (gpd) (EGGI, 2005). In 2018, EGGI recalibrated the existing numerical model using multiple years of groundwater level data that had been collected. As a result, the model was able to present various climate simulations that were assessed and presented to the Town (EGGI, 2018). *The updated numerical model confirmed that the maximum recommended daily withdrawal for non-potable use (bottled water) can safely remain at 603,000 gpd.*

This report reviews documentation of non-public withdrawals by Nestlé (Luetje Geological Services, LLC and McDonald Morrissey Associates, LLC (2020)) and community water supply withdrawals by Maine Water (the current manager of the Fryeburg Water Company).

Precipitation in 2019

Precipitation is measured both at the Fryeburg Eastern Slopes Airport (at a station known as KIZG) and at the Nestlé pumping station (on-site) close to Wells FWC#1 and FWC#2. Precipitation at the KIZG site is almost always slightly higher. Given that the Aquifer extends from the high ground near the airport, to the low ground in the vicinity of the springs flowing into the lower reaches of Wards Brook, it is reasonable to consider that these two gauges are reasonably representative of precipitation contributing to the Wards Brook Aquifer as a whole.

Precipitation for the period of January through December 2019 was slightly above average compared to the long-term period of record (Table 1).

Groundwater Withdrawal Rates

Groundwater was withdrawn from the three Production Wells in the Wards Brook Aquifer during every month of 2019 (Well FWC#1 serves non-public water needs and Wells FWC#2 and #3 serve the community water supply - Table 2). No groundwater was withdrawn from the former Pequawket Well (FWC#4) during 2019.

The data show that groundwater withdrawals varied seasonally, as expected, being approximately twice the volume during summer months compared to winter months. The data also shows that groundwater withdrawals from the two wells used by the Fryeburg Water Company (FWC#2 and FWC#3) for consumption via the Town's Public Water System withdrew 93,619,220 gallons and the total withdrawal by Nestlé was 118,338,772 gallons (Table 2). This equates to non-public withdrawals in 2019 of 324,216 gpd and for public supply withdrawals of 256,491 gpd.

Total groundwater withdrawals from the Nestlé Well (FWC#1) never exceeded the recommended maximum non-public withdrawal rates from the aquifer at 603,000 gallons per day, as recommended by EGGI (EGGI, 2005 and EGGI, 2018) (Table 2). August 2019 had the highest daily average groundwater withdrawal for non-potable uses (504,000 gpd) or approximately 84% of the recommended maximum non-public groundwater allocation. Averaged throughout 2019, groundwater withdrawals from the Nestlé Well accounted for 54% of the recommended maximum daily withdrawal from Wards Brook Aquifer.

Annual groundwater withdrawals for non-public use (bottled water) from 2007 through 2019 have utilized a range from 35 to 68% of the 603,000 gpd maximum groundwater use allocation (Table 3).

There is a serious discrepancy that needs to be resolved in reported groundwater withdrawals from Well FWC#1 during 2019 between the records provided by Nestlé and those reported by Maine Water (Table 2). During just

five months of 2019, the records match between the two entities. Records from the other seven months are not consistent and show variations of up to 761,424 gallons per month (17.4 percent). The total annual groundwater withdrawal for non-public uses (Well FWC#1) was off by 2.47 million gallons between the two entities. This is not a great cause of concern during a year when only 54% of the recommended allocation (663,000 gpd) was withdrawn, but it might be in drier periods when demand is much greater. *Accurately monitoring groundwater withdrawal volumes is fundamental to the Wards Brook Aquifer monitoring program and steps should be taken to ensure accurate withdrawal volumes are recorded. EGGI recommends annual calibration of any flow meters used to monitor flow from Well FWC#1.*

Groundwater Elevation

Locations of the eleven wells monitored in the Nestlé monitoring well system are shown on **Figure 2**. Eight of the wells are distributed throughout the Wards Brook Aquifer, plus three wells located outside the Aquifer limits. Groundwater elevation data collected monthly is presented for twelve years, including the relatively wet years of 2008-2011 and the excessively dry period from 2016-2017 (**Figure 3**).

Groundwater elevations at most locations vary from four to eight feet depending on the season. Despite the wide range of precipitation over the 12-year period of record, groundwater level elevations have shown roughly the same range of elevations with no clear indications of long-term mining of the groundwater from the Wards Brook Aquifer. Groundwater level declines during the 2016 drought were the greatest throughout the monitoring period of record. There has been a very subtle decrease in average water level elevations over the period of record, but that minor change cannot be attributed to groundwater withdrawals only. Those changes more likely reflect the fact that precipitation was well above average during the years of 2008 through 2011 (average annual precipitation of 55.2 inches) whereas the average annual precipitation from 2012 through 2017 was 44.88 inches, which is more reflective of long-term average precipitation for the area.

Surface Water Conditions

Surface water elevations remained in a normal range of values for all four stations that are monitored by Nestlé in 2019. However, it must be noted that the most vulnerable surface water body with regard to groundwater withdrawals from the Wards Brook Aquifer is Wards Brook downstream of Evergreen Spring and this is not being monitored. Two of the surface water stations, Lovewell Pond and the Saco River, provide regional baseline conditions for the area. The other two stations, WPMP-1 and WPSG-2, both monitor surface water levels upstream of Evergreen Spring and most of the groundwater withdrawals from the Wards Brook Aquifer (Wells FWC#1 and FWC#2). Only withdrawals from Well FWC#3 (Fryeburg Water Company) could impact surface water levels at the two Ward Pond gaging stations (now that Well FWC#4 is not being used).

Therefore, the surface water monitoring program, although beneficial at its current locations, would greatly benefit from monitoring stream stage (level) in Wards Brook downstream of Evergreen Springs and up-gradient of the influence from Lovewell Pond. Currently, the only surface water monitoring performed along that reach of the brook is the biological monitoring now being performed by Nestlé every two years. Stantec of Topsham, Maine, is now conducting the surveys, whereas past biological surveys were performed by Normandeau Associates of Bedford, New Hampshire.

The results of the biological monitoring of Wards Brook in 2019 are included in Nestlé's 2019 Annual Aquifer Monitoring Report (Luetje Geological Services and McDonald Morrissey Associates, 2020). Those results indicate

that Wards Brook “maintains a community of macroinvertebrates that are consistent for small woodland stream communities in a suburban watershed” and its water quality is classified as Class A. Those are very favorable findings, however, it should be noted that biological monitoring results generally indicate that a problem has (or has not) occurred sometime in the past, whereas monitoring of long-term changes in surface water levels (that are easy to measure) may provide an indication that flows are decreasing long before a biological monitoring survey can observe those changes. This could provide an easy warning system to allow for some type of meaningful mitigation.

Conclusions and Recommendations

Nestlé withdrew 118.3 million gallons in 2019, an average daily withdrawal of 324,216 gallons or 54% of the 603,000 gallons per day that is allowable for non-public withdrawals from the Wards Brook Aquifer. The recommended withdrawal of 603,000 gallons per day was calculated assuming that a growing demand for water would occur in the public water supply system provided by the Fryeburg Water Company and that a minimum flow out of the springs must always occur into Wards Brook. Flow from the springs and into Wards Brook continues, given the combined withdrawals of both community supply and non-public wells.

EGGI recommends that the Town continue the long-term groundwater and surface water monitoring program as a means of monitoring the condition of the Wards Brook Aquifer. Two specific recommendations should be considered by the Town:

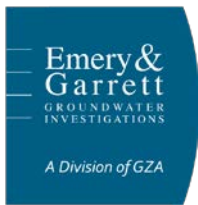
- Nestlé and Maine Water must establish an accurate means of measuring and reporting groundwater withdrawal volumes from the Production Wells (**Table 4**). Accurate withdrawal data is critical to this long-term effort to effectively monitor the Wards Brook Aquifer.
- EGGI recommends that surface water stage (level) be monitored in Wards Brook downstream of Evergreen Spring and upstream of the influence from Lovewell Pond. This can be accomplished easily by installing an automated water level recorder in a small stillings well beside the Brook. Ideally, such monitoring would be supplemented by actual streamflow gaging to measure the flow in Wards Brook during the driest times of each year. This will provide a greater level of assurance that low flows are being maintained at a reasonable level during periods of maximum stress on the hydrologic system.

References and Data Sources

Emery & Garrett Groundwater, Inc. (2005) Groundwater Flow Model, Wards Brook Aquifer, Fryeburg, Maine: Report to the Town of Fryeburg Planning Board.

Emery & Garrett Groundwater Investigations, A Division of GZA (2018) Recalibration and Application of the Numerical Model of the Wards Brook Aquifer, Fryeburg, Maine, presented to the Fryeburg Selectmen.

Luetje Geological Services and McDonald Morrissey Associates (2020) 2019 Annual Aquifer Monitoring Report, Evergreen Spring, Fryeburg, Maine: Prepared for Nestlé Waters North America Inc., Poland Spring, Maine.



Very truly yours,

EMERY & GARRETT GROUNDWATER INVESTIGATIONS, A DIVISION OF GZA

Daniel J. Tinkham
Senior Consulting Hydrogeologist

James M. Emery
Senior Hydrogeologist and Principal

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Attachments:

Figure 1: Location Map of Contributing Area to the Wards Brook Aquifer and Production Wells

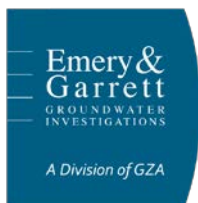
Figure 2: Monitoring Locations for Groundwater and Surface Water Level Monitoring Program

Table 1: Precipitation in Fryeburg, 2019

Table 2: Groundwater Withdrawals from the Wards Brook Aquifer, 2019

Table 3: Annual Totals of Non-Public (Bottled Water) Withdrawals: 2007-2019

Appendix A: Report Limitations



Tables

Table 1: Precipitation in Fryeburg, Maine - Station KIZG - 2019 (Inches)

Month	Long-Term Average*	On-Site at Evergreen Spring **	Eastern Slopes Airport (KIZG) **	Difference between On-site and KIZG	Difference KIZG from Long-Term Average
January	3.23	5.53	5.25	-0.28	2.02
February	3.31	3.11	2.77	-0.34	-0.54
March	3.58	2.35	2.23	-0.12	-1.35
April	3.98	4.70	5.00	0.30	1.02
May	3.90	4.32	4.16	-0.16	0.26
June	3.82	4.93	5.26	0.33	1.44
July	3.66	4.13	1.05	-3.08	-2.61
August	3.78	5.80	5.45	-0.35	1.67
September	3.31	1.14	1.14	0.00	-2.17
October	3.98	6.67	6.81	0.14	2.83
November	4.80	2.06	2.66	0.60	-2.14
December	4.25	4.96	4.79	-0.17	0.54
Annual	45.6	49.70	46.57	-3.13	0.97
% of Avg		109%	102%		

Table 2: Groundwater Withdrawals from the Wards Brook Aquifer, 2019, Fryeburg, Maine

Non-Public Groundwater Withdrawals						Fryeburg Water Company	
Month	Nestle FWC#1 (gallons)	Nestle FWC#4 (Pequawket)(gallons)	Total Withdrawal (gallons)	Average Daily Withdrawal (gallons)	Percent of Allocation (603,000 gpd)	Well FWC#2	Well FWC#3
January	6,000,434	0	6,000,434	193,562	32%	3,516,160	3,249,470
February	4,373,206	0	4,373,206	156,186	26%	2,376,880	3,509,340
March	11,051,979	0	11,051,979	356,515	59%	3,474,740	3,003,860
April	7,023,152	0	7,023,152	234,105	39%	2,524,250	4,254,960
May	10,544,651	0	10,544,651	340,150	56%	3,099,240	2,995,720
June	13,666,440	0	13,666,440	455,548	76%	4,781,000	5,048,000
July	15,599,850	0	15,599,850	503,221	83%	6,332,000	6,686,000
August	15,637,670	0	15,637,670	504,441	84%	6,055,000	5,493,000
September	11,444,795	0	11,444,795	381,493	63%	5,082,000	5,959,000
October	5,483,505	0	5,483,505	176,887	29%	3,597,900	3,978,800
November	5,770,640	0	5,770,640	192,355	32%	2,103,000	2,318,800
December	11,742,450	0	11,742,450	378,789	63%	2,033,900	2,146,200
Annual	118,338,772	0	118,338,772			44,976,070	48,643,150
Annual Average Withdrawal (gallons per day)				324,216			
Annual Average as percentage of 603,000 gallons per day				54%			
Total Withdrawals, Fryeburg Water Company (gallons)						93,619,220	
Annual Average Withdrawal, Fryeburg Water Company (gallons per day)						256,491	

Table 3: Annual Totals of Non-Public (Bottled Water) Withdrawals: 2007-2019

Year	Annual Withdrawal Nestle Well FWC#1	Annual Withdrawal Nestle Well FWC#4 (Pequawket)	Non-Public Annual Withdrawal (gallons)	Average Non-Public Daily Withdrawal (gpd)	Percent of Allocation (603,000 gpd)
2007	121,557,503	0	121,557,503	333,034	55%
2008	109,994,052	0	109,994,052	300,530	50%
2009	85,864,456	2,160,555	88,025,011	241,164	40%
2010	98,919,123	2,444,317	101,363,440	277,708	46%
2011	73,143,343	3,091,200	76,234,543	208,862	35%
2012	92,615,024	2,855,800	95,470,824	261,564	43%
2013	103,499,251	3,220,100	106,719,351	319,519	53%
2014	97,477,530	4,284,700	101,762,230	278,801	46%
2015	144,746,021	4,576,400	149,322,421	409,103	68%
2016	143,709,724	6,283,600	149,993,324	409,818	68%
2017	114,001,882	0	114,001,882	312,334	52%
2018	123,036,633	0	123,036,633	337,087	56%
2019	118,338,772	0	118,338,772	324,216	54%

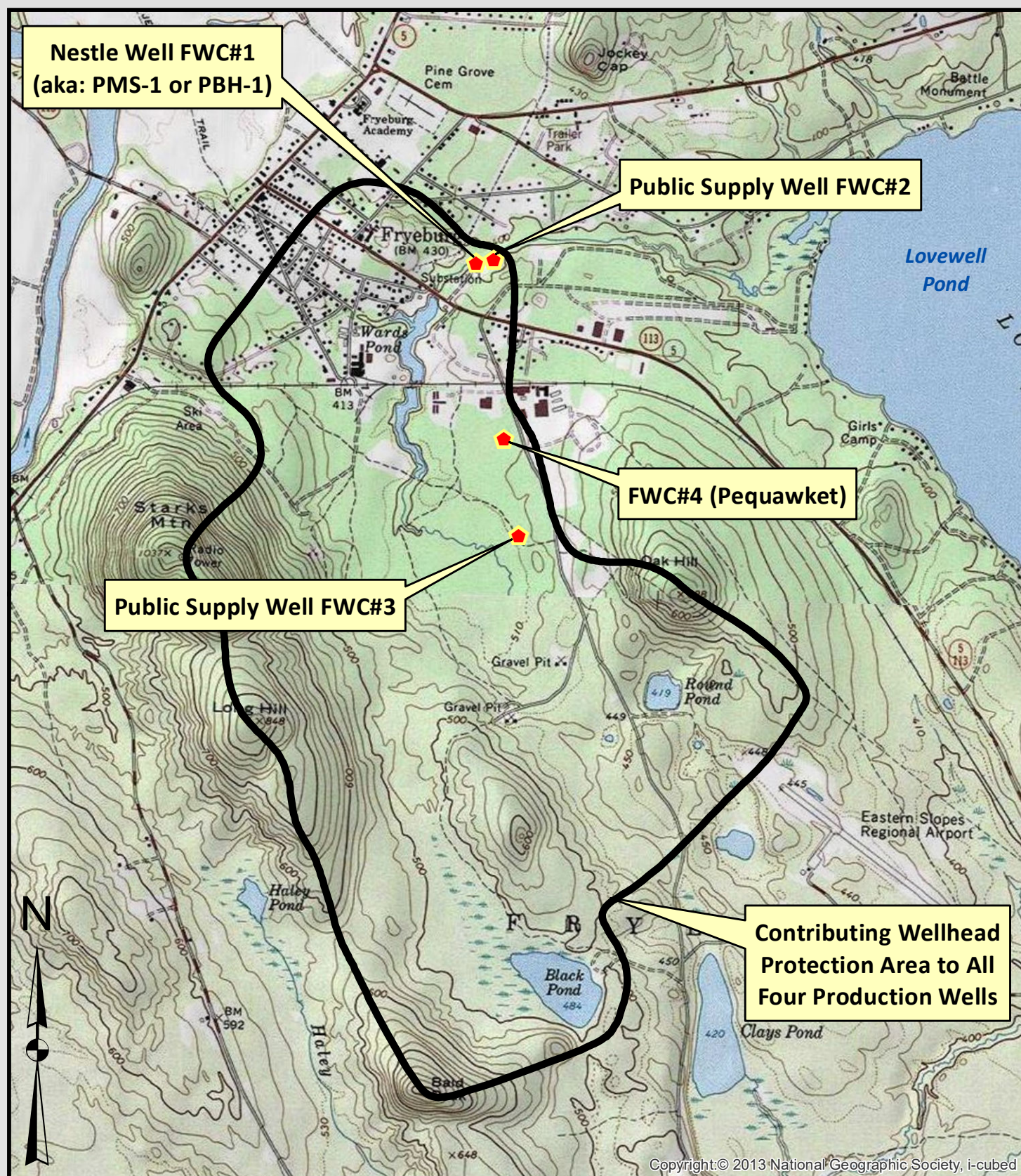
Table 4: Reported Groundwater Withdrawals for Non-Public Use from Well FWC-1 (aka PBH-1 and PMS-1)

	As Reported by Nestle (Well PBH-1)	As Reported by Maine Water (Well PMS-1)	Difference
Jan-19	6,000,434	6,754,630	754,196
Feb-19	4,373,206	5,134,630	761,424
Mar-19	11,051,979	10,678,815	-373,164
Apr-19	7,023,152	7,003,730	-19,422
May-19	10,544,651	10,855,570	310,919
Jun-19	13,666,440	13,666,440	0
Jul-19	15,599,850	15,599,850	0
Aug-19	15,637,670	15,637,670	0
Sep-19	11,444,795	11,444,795	0
Oct-19	5,483,505	5,891,350	407,845
Nov-19	5,770,640	5,770,640	0
Dec-19	11742450	12,371,050	628,600
2019 Totals	118,338,772	120,809,170	2,470,398

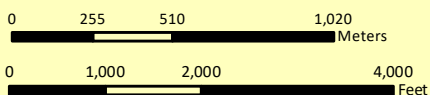


Figures

**Figure 1: Wellhead Protection Area for Production Wells
in the Wards Brook Aquifer - Fryeburg, Maine**

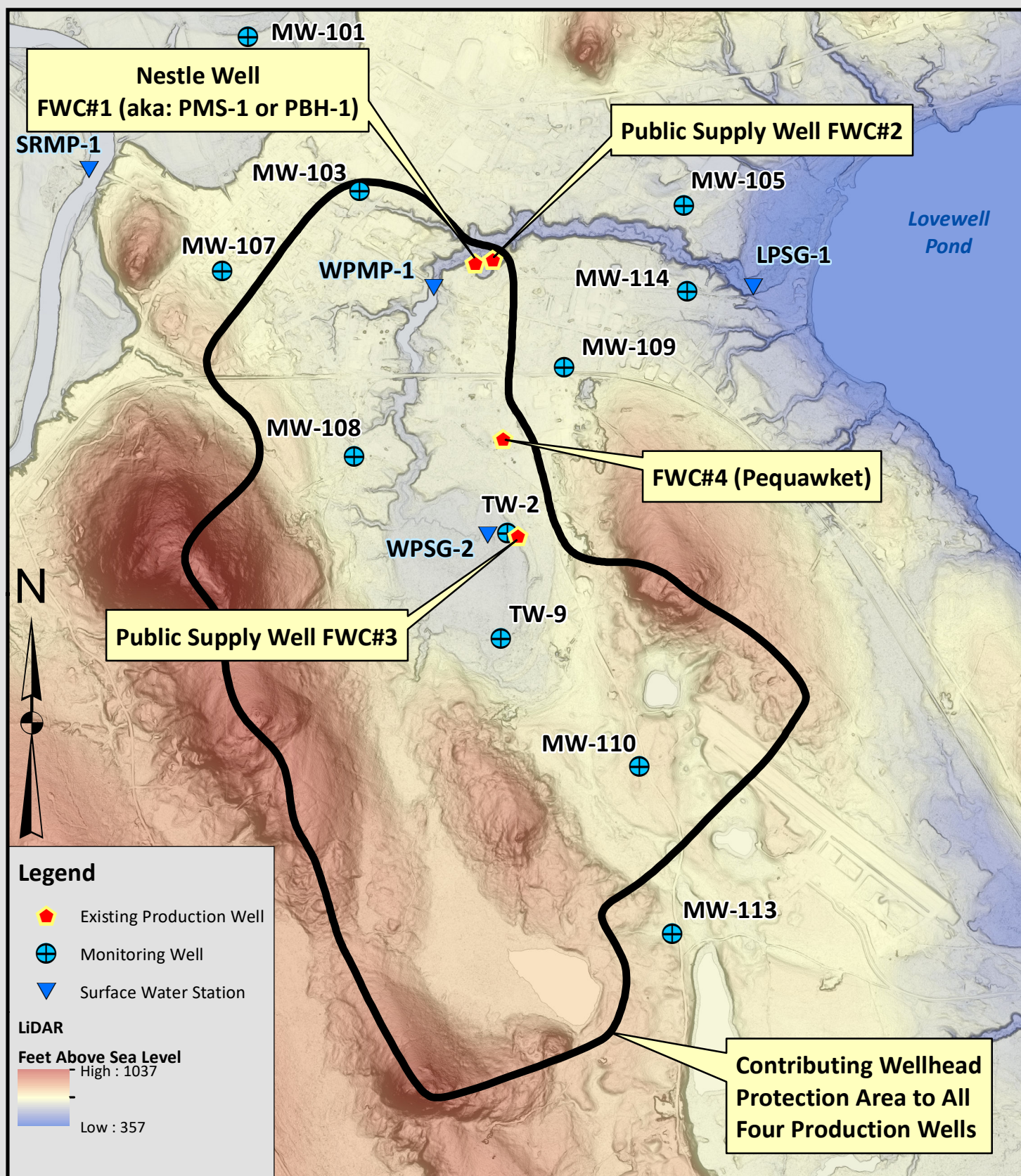


Scale is 1:24,000
1 inch = 2,000 feet

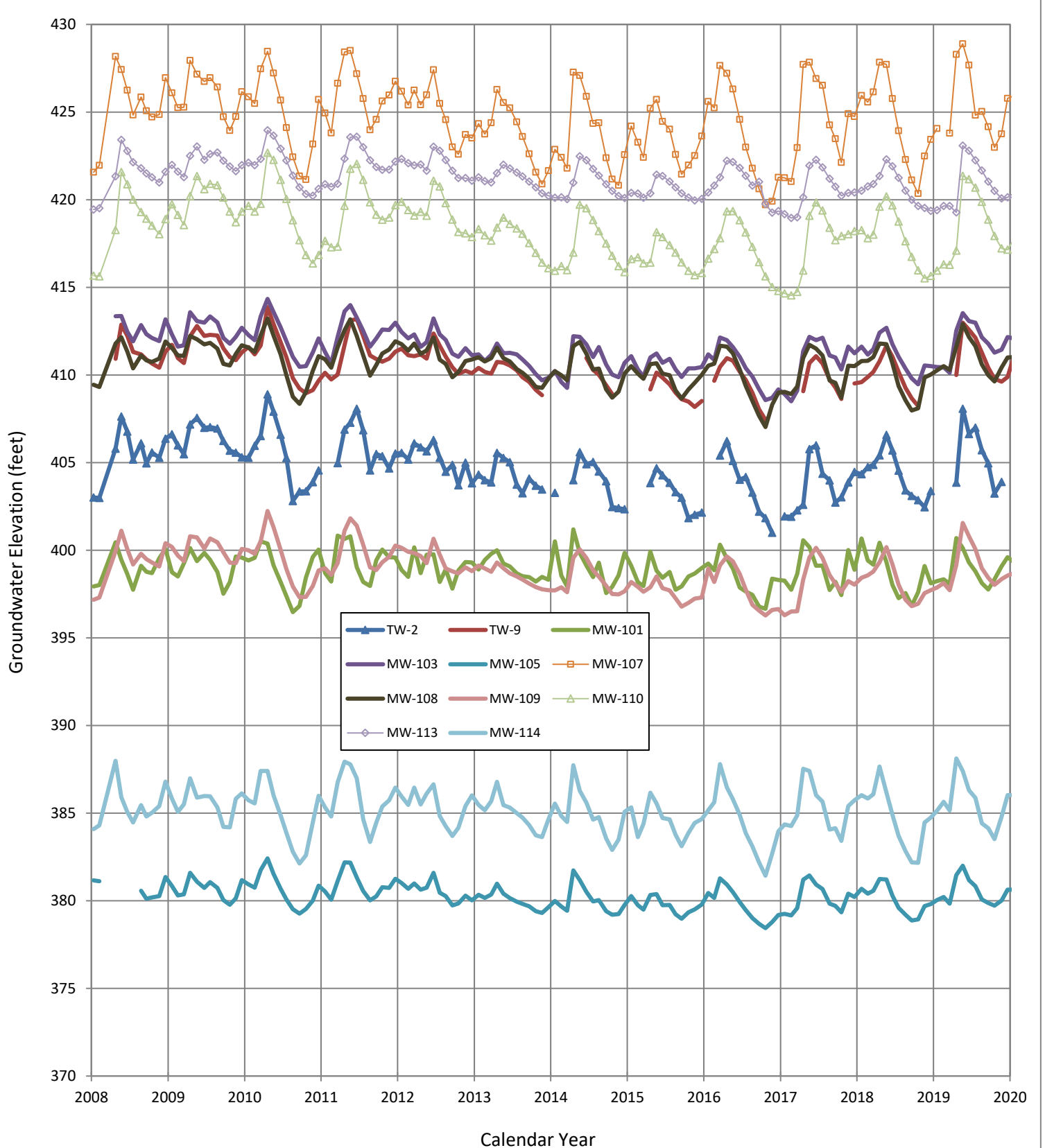


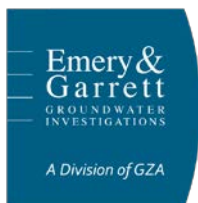
**Emery & Garrett Groundwater
Investigations, A Division of GZA**

**Figure 2: Wards Brook Aquifer
LiDAR Base Map with Monitoring Locations - Fryeburg, Maine**



**Figure 3: Groundwater Elevations at Monitoring Stations
from 2008 Through 2019
Wards Brook Aquifer, Fryeburg, Maine**





Appendix A - Limitations

USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Proposal for Services and/or Report and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. Conditions other than described in this report may be found at the subject location(s).
3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.. Additionally, GZA makes no warranty that any response action or recommended action will achieve all of its objectives or that the findings of this study will be upheld by a local, state or federal agency.
4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of all information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

SUBSURFACE CONDITIONS

5. Water level readings have been made, as described in this Report, in monitoring wells at the specified times and under the stated conditions. These data were in some cases provided by others and cannot be independently confirmed by EGGI/GZA; interpretations made in this report are dependent on the accuracy of data presented by others. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, , and/or natural or artificially induced perturbations.

COMPLIANCE WITH CODES AND REGULATIONS

6. We used reasonable care in identifying and interpreting applicable codes and regulations necessary to execute our scope of work. These codes and regulations are subject to various, and possibly contradictory, interpretations. Interpretations and compliance with codes and regulations by other parties is beyond our control.

INTERPRETATION OF DATA

7. Our opinions are based on available information as described in the Report, and on our professional judgment. Additional observations made over time, and/or space, may not support the opinions provided in the Report.

ADDITIONAL INFORMATION

8. In the event that the Client or others authorized to use this report obtain additional information on environmental or hazardous waste issues at the Site not contained in this report, such information shall be brought to GZA's attention

forthwith. GZA will evaluate such information and, on the basis of this evaluation, may modify the conclusions stated in this report.

ADDITIONAL SERVICES

9. GZA recommends that we be retained to provide services during any future investigations. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our monitoring program as needed; and iv) assess the consequences of changes in findings and/or regulations.

CONCEPTUAL SITE MODEL

10. Our opinions were developed, in part, based upon a comparison of site data to conditions anticipated within our Conceptual Site Model (CSM). The CSM is based on available information, and professional judgment. There are rarely sufficient data to develop a unique CSM. Therefore observations over time, and/or space, may vary from those depicted in the CSM provided in this report. In addition, the CSM should be evaluated and refined (as appropriate) whenever significant new information and/or data is obtained.