Emery & Garrett Garrett A Division of GZA



2020 WATER LEVEL MONITORING REPORT WARDS BROOK AQUIFER

TOWN OF FRYEBURG, MAINE

April 16, 2021 33.0083035.02



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Emery & Garrett GROUNDWATER INVESTIGATIONS A Division of GZA

GEOTECHNICAL ENVIRONMENTAL ECOLOGICAL WATER CONSTRUCTION MANAGEMENT

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April 16, 2021 Project No.: 33.0083035.02

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

Re: 2020 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 GeoEnvironmental, Inc. (GZA), to review total groundwater withdrawals from the Wards Brook Aquifer to ensure that such withdrawals did not exceed the sustainable limit of the Aquifer or decrease surface water flow in Wards Brook during calendar year 2020 (**EGGI, 2018**). This report summarizes and evaluates the data collected during 2020 by the Maine Water Company (Maine Water) and Nestlé Waters North America Inc. (Nestlé) (see Background below), and therefore, EGGI cannot testify as to the completeness or the accuracy of the dataset provided to us and presented herein. 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 utilized as a community water resource (first as a surface water resource via the "Evergreen Spring" and later as a groundwater resource via extraction from nearby Production Wells) 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 (**Figure 1**). Withdrawal volumes from the two Production Wells are provided by Maine Water. In 2020, as during many years past, Nestlé withdrew and bottled groundwater from Production Well FWC#1 (aka Pure Mountain Spring PMS-1 or PBH-1) for commercial distribution and monthly withdrawal volumes were reported to the Town of Fryeburg. Nestlé also owns a fourth Production Well in the Wards Brook Aquifer known as Well FWC#4 (aka the Pequawket Well), but that well has not been used to withdraw groundwater since 2017.

In 2005, the Town of Fryeburg engaged EGGI to complete a hydrogeological analysis of the Aquifer using a numerical groundwater flow model. This model was used to generate a recommendation of the maximum withdrawals that could safely be obtained from the Wards Brook Aquifer while being protective of other local considerations, including the municipal water demands of the Town and the sustainability of adequate groundwater base flows to Wards Brook (EGGI, 2005) to maintain aquatic life. 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 (e.g., commercial bottled water production 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 expanded to present various climate simulations (EGGI, 2018). *The updated numerical model reaffirmed that the maximum recommended daily withdrawal for non-potable use (bottled water) should remain at 603,000 gpd.*

This report presents the findings of EGGI's review of documentation of the non-public groundwater withdrawals by Nestlé (as prepared by Luetje Geological Services, LLC and McDonald Morrissey Associates, LLC (**2021**) on behalf of Nestle) and other community water supply withdrawals by Maine Water (the current manager of the Fryeburg Water Company). EGGI used the data provided to us and did not independently verify the data quality.

Precipitation in 2020

Precipitation is measured both at the Fryeburg Eastern Slopes Airport (at a station known as KIZG) and at the Nestlé pumping station located close to Wells FWC#1 and FWC#2 (**Figure 1**). At the end of the year, the total annual rainfall measured at the Airport was 40.94 inches and at the Nestlé pumping station was 39.33 inches, a difference of 1.61 inches (**Table 1**).

Precipitation for the period of January 2020 through December 2020 was below average at the Airport compared to the longer-term historical database, with an annual cumulative rainfall deficit of 4.66 inches below the long-term average from 1998 to 2018 (**Table 1**).

Groundwater Withdrawal Rates During 2020

Groundwater was withdrawn from three Production Wells in the Wards Brook Aquifer (FWC#1, FWC#2, and FWC#3) during every month of 2020. 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 Nestlé Production Well FWC#4 during 2020.

The data show that groundwater withdrawals varied seasonally, as expected. The data also show 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 99,130,200 gallons and the total withdrawal by Nestlé was 131,128,607 gallons (**Table 2**). This equates to an average daily withdrawal rate for non-public usage of 358,275 gpd and an average daily withdrawal rate for public water supply usage of 270,848 gpd.

Based on the data provided to EGGI, total groundwater withdrawals from Nestlé Well FWC#1 never exceeded the recommended daily limit for non-public withdrawal rates from the aquifer (603,000 gpd) (**Table 2**). The highest daily average groundwater withdrawal for non-potable uses was recorded in August 2020 at 537,416 gpd or approximately 89% of the recommended limit. Averaged throughout 2020, groundwater withdrawals from Nestlé Well FWC#1 accounted for 59% of the recommended maximum daily withdrawal for non-public uses.

Thus, the documented groundwater withdrawal for non-public use in 2020 was greater than the three previous calendar years, when withdrawals were 52% (2017), 56% (2018), and 54% (2019), respectively, of the recommended limit (**Table 3**). Annual groundwater withdrawals for non-public use from 2007 through 2020 have ranged from 35% (2011) to 68% (2015) of the 603,000 gpd limit.



Groundwater Elevations

The locations of the eleven wells included in the Nestlé monitoring well network are shown on **Figure 2**. Eight of the wells are distributed throughout the Wards Brook Aquifer, plus three wells located outside the Aquifer limits. Monthly groundwater elevation data for 2020, as well as for thirteen prior years are presented in **Figure 3**.

The annual variation in groundwater elevation is from four to eight feet. Despite the wide range of precipitation over the 13-year period of record, a qualitative analysis of the groundwater level data shows roughly the same range of elevation variations with no obvious trends indicative of long-term groundwater mining. Groundwater level declines during 2020 were among the greatest recorded within the available dataset, but not as great as those recorded during the 2016 drought (**Figure 3**). There has been a very subtle decrease in average water level elevations over the period of record, but it is not likely that those trends are specifically attributable to groundwater withdrawals only. The decreasing trends may more likely reflect a regional recovery from above average precipitation (and resulting groundwater recharge) from approximately 2008 through 2011, when average annual precipitation was 55.2 inches. By comparison, the average annual precipitation from 2012 through 2017 was 44.88 inches, and the total precipitation in 2020 was 40.94 inches, which are more reflective of long-term average precipitation for the area.

Surface Water Conditions

Surface water elevations recorded in 2020 were consistent with the historical data range for all four stations that are monitored by Nestlé (**Figure 4**). Two of the surface water stations, Lovewell Pond (LPSG-1) and the Saco River (SRMP-1), provide regional baseline conditions for the area (**Figure 2**). The other two stations, WPMP-1 and WPSG-2, both monitor surface water levels upstream of Evergreen Spring, so they are not situated appropriately to monitor the impact that groundwater withdrawals from the Wards Brook Aquifer may have on the flow in Wards Brook.

Beginning in 2020, Nestlé began monthly monitoring of surface water elevation and flow measurements in Wards Brook at two additional locations: location SG-2, located upstream of Evergreen Spring, and location SG-3, downstream of Evergreen Spring (**Figure 2**). The results of the expanded surface water monitoring program are shown in **Table 4**. Stream flow gaging in Wards Brook was initiated in June 2020 and continued monthly thereafter. The difference in flow rate between Stations SG-2 and SG-3 can be largely attributed to the flow from the Evergreen Spring and ranged between 804 and 1,257 gallons per minute (gpm) gpm. The lowest flow recorded during 2020 at Station SG-3 (862 gpm) was during the month of September and near the lowest point of the 2020 drought. Earlier investigations of the Wards Brook Aquifer established a flow of 400 gpm in Wards Brook downstream of Evergreen Spring as a minimum low flow threshold that should be maintained. Based on that criteria, groundwater withdrawals from the Wards Brook Aquifer during 2020 were well within the target flow to the surface water flow in Wards Brook.

The results of the biological monitoring of Wards Brook in 2019 were included in Nestlé's 2019 Annual Aquifer Monitoring Report (Luetje Geological Services and McDonald Morrissey Associates, 2020). Those results indicated 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. The biological survey is performed every other year, so the next anticipated survey is scheduled for 2021.



Conclusions and Recommendations

Nestlé withdrew approximately 131.1 million gallons of groundwater from the Ward's Brook aquifer in 2020, which results in an average daily withdrawal of 358,275 gallons or 59% of the applicable 603,000 gallons per day limit. Monthly streamflow measurements in Wards Brook both upstream and downstream of Evergreen Spring recorded since June 2020 indicate that actual stream flow rates in 2020 exceed the minimum threshold flow of 400 gallons per minute.

EGGI recommends that the Town continue the long-term groundwater and surface water monitoring program as a means of monitoring the valuable resource of the Wards Brook Aquifer.

Very truly yours,

EMERY & GARRETT GROUNDWATER INVESTIGATIONS, A DIVISION OF GZA

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Daniel J. Tinkham Senior Consultant/Hydrogeologist

James M. Emery Principal/District Office Manager Senior Hydrogeologist

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Attachments

Table 1 Precipitation in Fryeburg, Maine During 2020 Table 2 Groundwater Withdrawals from the Wards Brook Aguifer, 2020 Table 3 Annual Totals of Non-Public (Bottled Water) Withdrawals: 2007-2020 Table 4 Reported Streamflow and Stage in Wards Brook at Surface Water Stations SG-2 and SG-3 Figure 1 Wellhead Protection Area for Production Well in Wards Boork Aquifer Figure 2 Wards Brook Aquifer LiDAR Base Map with Monitoring Locations Figure 3 Groundwater Elevations at Monitoring Stations from 2008 Through 2020 Surface Water Elevations at Monitoring Stations from 2008 Through 2020 Figure 4



John R. Paquin, C.G. Associate Principal/Consultant Reviewer



Appendix A Limitations

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 (2021) 2020 Annual Aquifer Monitoring Report, Evergreen Spring, Fryeburg, Maine: Prepared for Nestlé Waters North America Inc., Poland Spring, Maine.



Tables

Table 1: Precipitation in Fryeburg, Maine During 2020 (Inches)							
at Eastern Slopes Airport (Station KIZG) and Evergreen Spring							
2020 Long-Term Monitoring Program Wards Brook Aquifer, Fryeburg, Maine							
Month	Long-Term Average*	On-Site at Evergreen Spring **	Eastern Slopes Airport (KIZG) **	Difference between Evergreen Spring and KIZG	KIZG - Departure from Long-Term Average		
January	3.23	3.44	3.15	-0.29	-0.08		
February	3.31	3.44	3.43	-0.01	0.12		
March	3.58	2.81	2.80	-0.01	-0.78		
April	3.98	5.77	5.76	-0.01	1.78		
Мау	3.90	3.05	3.17	0.12	-0.73		
June	3.82	3.32	3.36	0.04	-0.46		
July	3.66	3.42	3.99	0.57	0.33		
August	3.78	2.53	2.52	-0.01	-1.26		
September	3.31	0.67	0.72	0.05	-2.59		
October	3.98	5.15	4.30	-0.85	0.32		
November	4.80	3.52	4.49	0.97	-0.31		
December	4.25	2.21	3.25	1.04	-1.00		
Annual	45.6	39.33	40.94	1.61	-4.66		
% of Average		86%	90%				

* From Climate.Org (https://en.climate-data.org/north-america/united-states-of-america/maine/fryeburg-141320)

** Data from Luetje 2020 Annual Report (Luetje and Morrissey, 2021).

Table 2: Groundwater Withdrawals from the Wards Brook Aquifer, 2020, 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	15,077,190	0	15,077,190	486,361	81%	2,216,500	2,773,700	
February	9,552,805	0	9,552,805	341,172	57%	2,420,000	2,037,600	
March	14,136,570	0	14,136,570	456,018	76%	2,149,100	2,248,100	
April	3,037,760	0	3,037,760	101,259	17%	2,101,200	2,302,800	
May	3,301,895	0	3,301,895	106,513	18%	3,856,200	5,081,500	
June	10,709,460	0	10,709,460	356,982	59%	9,413,700	7,918,400	
July	16,570,000	0	16,570,000	534,516	89%	6,694,600	6,693,900	
August	16,659,907	0	16,659,907	537,416	89%	7,233,900	7,206,000	
September	15,580,850	0	15,580,850	519,362	86%	5,061,800	5,247,100	
October	11,276,810	0	11,276,810	363,768	60%	1,942,900	4,634,700	
November	7,080,990	0	7,080,990	236,033	39%	1,136,800	4,137,900	
December	8,144,370	0	8,144,370	262,722	44%	2,310,900	2,310,900	
Annual	131,128,607	0	131,128,607			46,537,600	52,592,600	
Annual Averag	ge Withdrawal (g							
Annual Avera	ge as percentage	59%						
Total Withdrawals, Fryeburg Water Company (gallons) 99.130.20							99,130,200	
Annual Average Withdrawal, Fryeburg Water Company (gallons per day) 270,84							270,848	

Table 3: Annual Totals of Non-Public (Bottled Water) Withdrawals: 2007-2020 2020 Long-Term Monitoring Program Wards Brook Aquifer, Fryeburg, Maine **Annual Withrawal Average Non-Public Percent of Allocation Annual Withrawal Nestle Well FWC#4 Daily Withdrawal Non-Public Annual Nestle Well FWC#1** (Pequawket) Withrawal (gallons) (gpd) (603,000 gpd) Year 121.557.503 333.034 2007 121.557.503 0 55% 2008 109,994,052 109,994,052 300.530 50% 0 2009 2,160,555 85,864,456 88,025,011 241,164 40% 277,708 2010 98,919,123 2,444,317 101,363,440 46% 73,143,343 3,091,200 76,234,543 208,862 2011 35% 2012 92,615,024 2,855,800 261,564 95.470.824 43% 2013 103,499,251 3,220,100 106,719,351 319,519 53% 2014 278,801 46% 97,477,530 4,284,700 101,762,230 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% 52% 2017 114,001,882 114,001,882 312,334 0 2018 123,036,633 0 123,036,633 337,087 56% 2019 54% 118,338,772 0 118,338,772 324,216 2020 131,128,607 0 131,128,607 358,275 59%

Table 4: Reported Streamflow and Stage in Wards Brook								
at Surface Water Stations SG-2 and SG-3								
2020 Long-Term Monitoring Program Wards Brook Aquifer, Fryeburg, Maine								
					Gain in Streamflow			
Location	SG-2 (Upstream of Evergreen Spring)		SG-3 (Downstream of Evergreen Spring)		Between SG-2 and SG-3			
Date	Stage (NAVD 29)	Flow (gpm)	Stage (NAVD 29)	Flow (gpm)	(gpm)			
1/23/20	387.10	No Data	367.81	No Data	No Data			
2/21/20	386.91	No Data	367.72	No Data	No Data			
3/18/20	387.20	No Data	367.87	No Data	No Data			
4/21/20	387.09	No Data	367.87	No Data	No Data			
5/19/20	386.95	No Data	367.80	No Data	No Data			
6/19/20	386.64	409	367.57	1666	1257			
7/22/20	386.64	332	367.51	1347	1015			
8/20/20	386.49	36	367.47	983	947			
9/24/20	386.54	58	367.46	862	804			
10/21/20	386.89	745	367.67	1760	1015			
11/18/20	386.95	1006	367.71	2083	1078			
12/21/20	386.86	822	367.66	1783	961			
2020 Average	386.86	487	367.68	1498	1011			

NGVD = National Geodetic Vertical Datum

gpm = gallons per minute; to convert to cubic feet per second, divide by 449.



Figures





Figure 3: Groundwater Elevations at Monitoring Stations from 2008 Through 2020 Wards Brook Aquifer, Fryeburg, Maine

Figure 4: Surface Water Elevations at Monitoring Stations from 2008 Through 2020 Wards Brook Aquifer, Fryeburg, Maine

Year

Appendix A - Limitations

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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 findingsand/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.

Emery & Garrett Groundwater Investigations A Division of GZA GeoEnvironmental, Inc.