TOWN OF BOW, NEW HAMPSHIRE

DRINKING WATER PROTECTION COMMITTEE

Brown Hill Road Area Water Quality Study

June 2016

APPENDICES

APPENDIX 1-1

Town Manager Report to Board of Selectmen
Re: Brown Hill Road Water
August 22, 2013

TOWN OF BOW

Office of the Town Manager

Municipal Office Building
10 Grandview Road
Bow, NH 03304

Tel: (603) 228-1187
Fax: (603) 224-6680
admin@bow-nh.gov

To: Board of Selectmen
From: David L. Stack, Town Manager
Date: August 22, 2013

Re: Brown Hill Road water

I have researched the contamination of private wells in the Brown Hill Road area.

In 1996, the Town engaged Stearns and Wheler, an environmental engineering firm, to conduct a study of the potential causes of chloride contamination in private drinking water wells in the Brown Hill Road area. Seven residents were identified as having chloride levels above the acceptable level as determined by the United States Environmental Protection Agency. A copy of the executive summary from the 1996 report is enclosed. Sterns and Wheler recommended that the best long term solution to the problem was a combination of installing/improving roadside drainage and altering the sanding/salting program.

Since the 1996 report was issued, the Town has taken steps to alleviate the problem:

1997: The Board of Selectmen adopted a Town-wide low salt policy. The Board also approved the use of magnesium chloride in the Brown Hill area in the hope that it would reduce the calcium chloride levels. The Town Meeting also voted to appropriate $20,000 for the repair and replacement of wells contaminated by salt intrusion on Brown Hill Road.

1998: The Town appropriated $316,104 to settle past claims, install twenty household treatment systems and the cost to maintain the household systems in the Brown Hill Road area. Several claims were filed with the Town and the Town Manager worked with property owners, Sterns and Wheler, and Secondwind Technologies, a water service company, to install new wells, seal existing wells, and install treatment systems. The Town chose not to fund future maintenance of the filtration systems and that responsibility was given to the individual property owners. The total number of wells that were replaced and systems installed still needs to be determined.

1999: The Town attempted to utilize an organic de-icing agent and eliminate the use of salt in the sand/salt mix. This was unsuccessful and the agent was found to not work. The Town reverted back to the use of a low salt mix and magnesium chloride.

The Town continues to utilize the services of Secondwind for the installation and replacement of equipment as needed. The responsibility for the maintenance costs of the filtration systems is still borne by the individual property owners.

EXECUTIVE SUMMARY

Stearns & Wheler, LLC was contracted by the Town of Bow to investigate the potential causes of chloride contamination in private drinking water wells in the Brown Hill Road area of Bow. The investigation included: the review of existing data on file with the Town of Bow; review of soils and geological maps prepared by government agencies; review of ground water quality data available through the New Hampshire Department of Environmental Services; review of water well records maintained by the New Hampshire Water Well Board; and collection of water samples from some residential wells. In addition, information was gained through interviews and site visits with some residents.

In the Brown Hill Road area seven residents were identified as having chloride levels above the Secondary Maximum Contaminant Level (SMCL) of 250 mg/L. The SMCL is established by the United States Environmental Protection Agency (EPA). Three residents in the area have already installed new drinking water wells, due to elevated chloride levels. Analytical data, collected by others, indicate an additional 25 residents in the area had levels of chloride below the SMCL.

From seven residents who had documented chloride levels above the SMCL and one resident whom has replaced their well water samples were collected for field screening and laboratory analyses. The analytical samples confirmed that the most probable source of chloride in these wells is from road salt.

Upon review of data collected by the New Hampshire Department of Environmental Services (NH-DES) and discussions with NH-DES staff the groundwater in the study area is of fair to poor quality. This is based on the natural presence of manganese and radon above guidance levels considered safe by the New Hampshire Department of Public Health. In addition, there are numerous samples with iron levels above the guidance values.

Upon review it appears that several factors are potentially contributing to chloride intrusion into residential supply wells. The residents with the highest levels of chloride are in locations with a thin layer of soil over the bedrock and near roadside drainage discharges. The majority of the wells with elevated chloride are older wells, greater then 20 years old. At the present time, it can not be ruled out that the well construction may be allowing the intrusion of road salt laden runoff. Some of these factors are beyond the Town's control (i.e., well placement, well construction, and overburden thickness). Other factors can be attributed to the Town's maintenance of the road, (i.e, quantity of deicing salt applied, and road side drainage).

In developing remedial alternatives a balance between the public safety and public health issues needs to be addressed. Residents and the Town need safe passage over the roads during the winter, which will require the application of deicers to the roadway. Residents need a *"safe"* water supply. Based on the information gathered during the investigation there are several alternatives available to elevate the chloride levels in residential wells. These include:

replacement or repair of existing wells; install either a point of use or point of entry reverse osmosis treatment system; install and improve roadside drainage; implement a "*Sensible Salting Program*"; use a substitute deicer; install a community water system.

Of the above options, the best long term solution is the combination of installing/improving roadside drainage, and implementing a *"Sensible Salting Program"*. This combination address the source of chloride intrusion and will help remediate the aquifer to provide a more suitable source of water. Installation of new wells will not guarantee a *"safe"* drinking water source due to the presence of natural constituents in the groundwater. Reverse osmosis treatment systems are generally only used as temporary solutions while other remedial actions are being implemented, i.e. installation of a community water system. Using a substitute deicer and installation of a community water system are extremely expensive solutions. Calcium - Magnesium Acetate (CMA), one of the more effective substitute deicers, is approximately 25 times more expensive per ton then salt, and requires a greater application rate to achieve the same effectiveness. Development of a community water system was not considered as a practical solution due to the long distance from an existing system and the high cost of developing a suitable supply system with in Bow.

APPENDIX 1-2

Stearns & Wheler Executive Summary and Figure of Study Area
August 1996

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Chloride Study
Brown Hill Road Area
Bow, New Hampshire

August 1996

Prepared for

Town of Bow
10 Grandview Drive
Bow, New Hampshire

Prepared by

Stearns & Wheler, LLC
2 Commerce Drive
Bedford, New Hampshire

S&W Job No. 67244

EXECUTIVE SUMMARY

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Upon review it appears that several factors are potentially contributing to chloride intrusion into residential supply wells. The residents with the highest levels of chloride are in locations with a thin layer of soil over the bedrock and near roadside drainage discharges. The majority of the wells with elevated chloride are older wells, greater then 20 years old. At the present time, it can not be ruled out that the well construction may be allowing the intrusion of road salt laden runoff. Some of these factors are beyond the Town's control (i.e., well placement, well construction, and overburden thickness). Other factors can be attributed to the Town's maintenance of the road, (i.e, quantity of deicing salt applied, and road side drainage).

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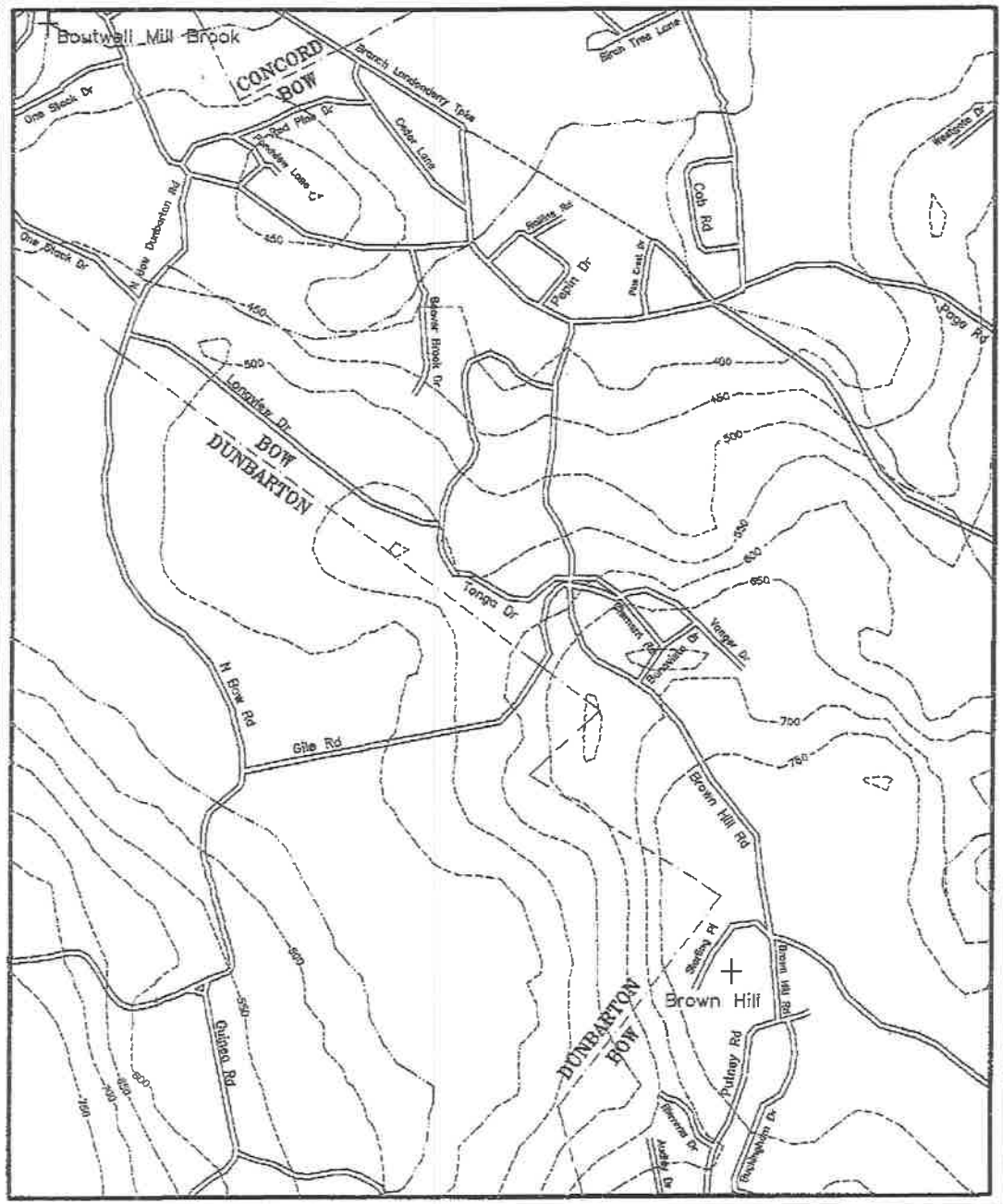
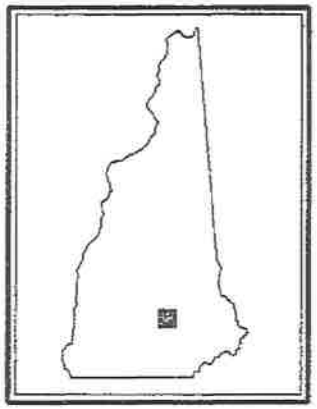


LEGEND:

- 50 FOOT CONTOUR
- ROAD
- TOWN BOUNDARY
- STREAM

N



NEW HAMPSHIRE
QUADRANGLE LOCATION

SOURCES:

CONCORD, NEW HAMPSHIRE
GOFFSTOWN, NEW HAMPSHIRE
TOPOGRAPHIC MAPS
PHOTOREVISED 1985

2000' 1000' 0 2000'

SCALE: 1" = 2000'

FIGURE 1.2.A

SITE LOCUS

CHLORIDE STUDY AREA
BROWN HILL ROAD

PREPARED FOR

TOWN OF BOW, NEW HAMPSHIRE

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: JULY, 1996 | JOB NO. 7244

APPENDIX 2-1

Sample Homeowner Cover Letter and Survey Form
Mailed June 2014

TOWN OF BOW

10 Grandview Road
Bow, New Hampshire 03304

June 2014

Dear Resident:

Since the 1990's, a number of residents in the Brown Hill Road area have reported to Bow Town officials that drinking water from their private wells has elevated concentrations of chloride. In 1996, the Town authorized a study to characterize the occurrence of chloride in drinking water in the Brown Hill Road area.

In response to more recent concerns expressed by area residents, the Town's Drinking Water Protection Committee (Committee), with the approval of the Board of Selectmen, is conducting an updated assessment of groundwater quality in the Brown Hill Road area. The objective of this study is to further characterize the distribution of chloride concentrations in drinking water. This information will help identify the extent of the problem and contribute to the development of recommendations for future steps.

The Committee is requesting your assistance and seeking your permission to conduct this assessment of groundwater quality in the Brown Hill Road area. Enclosed is a survey for you to complete and return by July 7, 2014 in the enclosed postage-paid envelope.

1. The survey asks for information about your well, any water treatment system, and problems you have or have not experienced.

2. The survey provides a place to obtain your permission for the *field* survey being conducted by the Committee. This field survey will include walking on your property and taking readings using a non-intrusive device used above the ground to estimate the concentration of chloride in groundwater.

3. If you provide additional permission to do so, a water sample may be collected from your well for analysis. The water sampling can occur from an outdoor faucet. Otherwise, the collection of water samples will need to be coordinated with a homeowner from a faucet near the pressure tank prior to any treatment system. All results from the sampling will be shared with the homeowner. There are no costs to the homeowner for this sampling and analysis.

Weather permitting, it is anticipated that the field work associated with the project will occur between July 17-31.

Your participation in this study is optional but important so that the extent of the chloride in drinking water in the area can be more fully understood. Should you have any questions, please contact Sandy Crystall, Committee Chair at bowdrinkingwater@gmail.com.

Thank you in advance for your participation in this important effort.

Sincerely,

David Stack
Town Manager

Town of Bow Survey of Private Well Water Quality

Brown Hill Road Area

In response to a number of public inquiries regarding water quality issues in this neighborhood, the Bow Drinking Water Protection Committee is collecting information.

- Please complete the survey below to the best of your knowledge and return it in the enclosed postage-paid envelope by July 7, 2014.
- Contact Sandy Crystall, Committee Chair bowdrinkingwater@gmail.com with questions.

Owner Name: _____ Telephone #: _____

Street Address: _____ Email: _____

Well information:

Well Type: Bedrock / Dug / Point (circle one) Date Well Constructed: _____

Depth of Well: _____ feet Depth to Bedrock: _____ feet

Length of Casing: _____ feet Depth of Pump: _____ feet

Do you have a water treatment system installed? **Yes / No**

What type of chemicals do you use to maintain your water treatment system? *(e.g., salt, potassium)*

_____

Please describe any taste or odor problems you have experienced with water from your well?

_____

Please describe any plumbing or well pump problems you have experienced.

_____

Permission from homeowner:

Please sign *one or more* of the lines below granting permission (or not).

I give permission for access to my property for the field survey. _____

I give permission for access to take a water sample outside. _____

I *do not* give permission for access or a water sample. _____

I am willing to share copies of water quality testing results or well construction record. ☐
Check the box if you want to share information you have.

If you have provided your signature for permission to conduct the field survey, on the enclosed map of your property, **please mark** the approximate **location of your Well** with the letter **"W"**, location of the **Leach field** with the letter **"L"**, and **Septic tank** with the letter **"S"**, and return the map with this completed questionnaire in the enclosed postage-paid envelope.

Please return the completed survey in the enclosed postage-paid envelope by July 7, 2014.

Thank You!

APPENDIX 2-2

Sample Homeowner Notification Letter, Laboratory Report, and Interpretive Document

TOWN OF BOW

Municipal Office Building
10 Grandview Road
Bow, NH 03304

Tel: (603) 228-1187
Fax: (603) 224-6680
admin@bow-nh.gov

December 2014

RE: **Well Water Test Results / Brown Hill Road Area Well Water Quality Study**

Dear Resident:

On behalf of the Bow Drinking Water Protection Committee (DWPC) and the Town of Bow, we thank you for your participation in the groundwater quality assessment for the Brown Hill Road area. Enclosed please find the following information pertaining to your test results:

- Well water test summary, including comparison to current health and aesthetic standards;
- Water quality parameter factsheet, to assist with interpretation of the results; and
- US Environmental Protection Agency, Chelmsford, MA laboratory report.

Overall findings and recommendations from this study will be presented at a public outreach meeting to be scheduled in March or April 2015. Individual homeowner results will only be shared with each property owner. Please note that most of the water samples were collected from an *exterior* hose tap, which may not be reflective of any water treatment equipment installed in your home.

The DWPC recommends you perform additional testing for other important health parameters that could not be included in this study. The additional testing should include BACTERIA, RADON, and "first flush" or stagnant LEAD AND COPPER. To take the sample for stagnant lead and copper, collect the water from a common tap that has not been used for a while (such as first thing in the morning); this will allow you to determine the maximum levels of these metals in your water.

Please contact the DWPC members at bowdrinkingwater@gmail.com with any questions or concerns. We look forward to seeing you at the outreach meeting next year.

Sincerely,

David Stack
Town Manager

Sandra Crystall
Chair, DWPC

Enclosures

Well Water Testing Summary

12/15/2014

[redacted]

Bow, New Hampshire 03304

PULL DOWN MENU IN CELL A2 TO CHANGE ADDRESS

Date Sampled 7/28/2014

Analyzed by US Environmental Protection Agency

Chelmsford, Massachusetts

Sampler: Bow Drinking Water Protection Committee

The concentration of the contaminant is less than half of the health based drinking water limit.

The concentration of the contaminant was detected in the sample at a level that is more than half of the health based drinking water limit, but is below the limit.

The concentration of the contaminant was detected in the sample above the health based drinking water limit.

The concentration of the contaminant was detected below the aesthetic based drinking water limit.

The concentration of the contaminant was detected above the aesthetic based drinking water limit.

µg/L = micrograms per liter = parts-per-billion (ppb)

mg/L = milligrams per liter = parts-per-million (ppm)

Health Status	Aesthetic Status	Chemical	Result	Units	Health Limit*	Aesthetic Limit*
		Aluminum	12	µg/L		500
		Ammonium	Not Detected	mg/L		
		Antimony	0.67	µg/L	6	
		Arsenic	1.6	µg/L	10	
		Barium	16	µg/L	2000	
		Beryllium	0.32	µg/L	4	
		Bromide	0.26	mg/L		
		Cadmium	0.76	µg/L	5	
		Calcium	24	mg/L		
		Chloride	400	mg/L		250
		Chromium	0.8	µg/L	100	
		Cobalt	Not Detected	µg/L		
		Copper	2900	µg/L		1000
		Fluoride	Not Detected	mg/L	4	2
		Hardness by Ion Chromatography	89	mg CaCO3/L		
		Iron	520	µg/L		300
		Lead	5200	µg/L	15	
		Lithium	Not Detected	mg/L		
		Magnesium	7	mg/L		
		Manganese	34	µg/L		50
		Molybdenum	Not Detected	µg/L		
		Nickel	7	µg/L		
		Nitrate as Nitrogen	0.97	mg/L	10	
		Nitrite as Nitrogen	Not Detected	mg/L	1	
		Potassium	2.6	mg/L		
		Selenium	Not Detected	µg/L	50	
		Silver	Not Detected	µg/L		
		Sodium	220	mg/L		
		Sulfate	19	mg/L		250
		Thallium	Not Detected	µg/L	2	
		Uranium	10	µg/L	30	
		Vanadium	Not Detected	µg/L		
		Zinc	360	µg/L		5000

Field measurements made by the Bow Drinking Water Protection Committee at the time of sampling:

pH	5.26	
Conductivity	1358	Microsiemens Per Centimeter (µS/cm)
Temperature	18.4	Degrees Celsius (C)

Note: * If the value is left blank, no limit has been established by Federal or State agencies

Water Quality Parameter Factsheet

This factsheet was compiled by the Town of Bow Drinking Water Protection Committee (DWPC) to assist participants in the Brown Hill Road Area Well Water Quality study to interpret their testing results. Please contact the DWPC at bowdrinkingwater@gmail.com with any questions or concerns regarding this study or your test results.

ACRONYMS

mg/L = milligrams per liter or parts per million (ppm)
µg/L = micrograms per liter or parts per billion (ppb)
MCL = health-based maximum contaminant level
MCLG = maximum contaminant level goal
SMCL = secondary or aesthetic based maximum contaminant level

ARSENIC MCL 10 µg/L MCLG Zero	**Health Effects**: Repeated daily (chronic) ingestion of arsenic is associated with increased risk of cancer (skin, bladder, kidney, liver, prostate) and non-cancerous (diabetes, immunological, cardiovascular, neurological) health effects. **Sources:** Naturally occurring in about 20% of the bedrock wells in New Hampshire. **Mitigation:** Treatment of water used for drinking and cooking. Washing and bathing are not a concern as there is no significant absorption through the skin. **Treatment:** Point of Use Arsenic Filter Cartridge or Reverse Osmosis (RO). **More Information:** Web search for "DWGB Factsheet 3-2" and "ARD-EHP Factsheet 1"
CHLORIDE SMCL 250 mg/L	**Health Effects**: None. Aesthetic (taste and corrosion) effects only. **Sources:** Road salt, water softener discharge, septic systems. **Mitigation:** Direct road and driveway drainage away from well. Reduce backwash frequency of softeners, consider non-salt treatment alternatives. **Treatment:** Point of Use Reverse Osmosis (RO). **More Information:** Web search for "DWGB Factsheet 3-17"
COPPER Action Level 1.3 mg/L	**Health Effects**: Stomach distress. **Sources:** Lead and/or copper originate from the water's corrosivity to household plumbing and fixtures. **Mitigation:** Flush tap thoroughly prior to collecting water for drinking or cooking. Treatment to reduce water corrosiveness. Replace fixtures and plumbing. **Treatment:** Whole-house neutralizer or calcite filter. **More Information:** Web search for "DWGB Factsheet 3-4" and "ARD-EHP Factsheet 9"
FLUORIDE MCL 4 mg/L SMCL 2 mg/L Optimum level 0.6 – 0.8 mg/L	**Health Effects**: Fluoride between 0.6 and 0.8 mg/L are optimal for protection against tooth decay for all ages, and especially for children and the elderly. Levels between 2 and 4 mg/L should be discussed with your dentist in order to balance your fluoride exposure. Levels of 4 mg/L and greater can cause dental fluorosis. **Sources:** Naturally occurring in New Hampshire bedrock. **Mitigation:** Treatment of water for drinking and cooking for levels above 4 mg/L. **Treatment:** Point of use Activated Alumina or Reverse Osmosis. **More Information:** Web search for "DWGB Factsheet 3-5" and "ARD-EHP Factsheet 14"
HARDNESS High > 150 mg/L Moderate 80 to 150 mg/L Low < 80 mg/L	**Health Effects**: None. Non-health aesthetic effects at high hardness levels include white scaling on household plumbing. **Sources:** Naturally occurring. **Mitigation:** None unless scaling is a nuisance, apply partial or whole-house treatment. **Treatment:** Cation exchange softening. **More Information:** Web search for "DWGB Factsheet 3-6"
IRON SMCL 0.3 mg/L	**Health Effects**: None. Non-health aesthetic effects include orange or brown staining and sometimes objectionable taste. **Sources:** Naturally occurring. **Mitigation:** None unless objectionable taste or staining, use whole-house treatment. **Treatment:** Cation exchange softening or oxidation / filtration with Birm or Greensand. **More Information:** Web search for "DWGB Factsheet 3-8"

LEAD Action Level 15 µg/L	**Health Effects**: Brain and nervous system disorders, kidney toxicity, reductions in IQ and other serious health effects especially to children. **Sources:** Lead and/or copper originate from the water's corrosivity to household plumbing and fixtures. **Mitigation:** Flush tap water thoroughly prior to collecting water for drinking or cooking. Treatment to reduce water corrosiveness. Replace fixtures and plumbing. **Treatment:** Whole-house neutralizer or calcite filter. **More Information:** Web search for "DWGB Factsheet 3-4" and "ARD-EHP Factsheet 10"
MANGANESE SMCL 0.05 mg/L Health Advisory Infants 0.3 mg/L	**Health Effects**: 0.3 mg/L acute hazard for infants up to 6 months due to inability to process. No health concerns for older children or adults. Non-health aesthetic effects include black particulates and metallic taste. **Sources:** Naturally occurring. **Mitigation:** Use bottled water for infants. If aesthetic effects are objectionable, apply whole-house treatment. **Treatment:** Cation exchange softening or oxidation / filtration with Greensand. **More Information:** Web search for "DWGB Factsheet 3-8" and "ARD-EHP Factsheet 15"
NITRATE NITROGEN MCL 10 mg/L **NITRITE NITROGEN** MCL 1 mg/L	**Health Effects**: Ingestion of nitrate or nitrite above the standard presents an immediate (acute) concern for *infants up to 6 months of age and to pregnant women*, causing severe illness and sometimes death, due to interference with the oxygen-carrying capacity of blood in infants. **Sources:** Fertilizers, animal waste, septic systems and blasting activities. **Mitigation:** Find and remove the contaminant sources and treat water for drinking and cooking. **Treatment:** Point of Use Reverse Osmosis (RO). **More Information:** Web search for "DWGB Factsheet 3-9" and "ARD-EHP Factsheet 16"
SODIUM Health Advisory 20 to 60 mg/L for individuals on sodium-restricted diets	**Health Effects**: Drinking water does not play a significant role in sodium exposure; however, individuals on sodium-restricted diets should consult with their doctor. **Sources:** Road salt, water softener discharge, septic systems. **Mitigation:** Direct road and driveway drainage away from well. Reduce backwash frequency of softeners, consider non-salt treatment alternatives. **Treatment:** Point of Use Reverse Osmosis (RO). **More Information:** Web search for "EPA Sodium Health Advisory" and "ARD-EHP Factsheet 21"
URANIUM MCL 30 µg/L	**Health Effects**: Repeated daily (chronic) ingestion of uranium is associated with increased risk of bone cancer, though cancer of other organs is also possible. **Sources:** Naturally occurring in about 5% of the bedrock wells in New Hampshire. **Mitigation:** Treatment of water used for drinking and cooking. Washing and bathing are not a concern as there is no significant absorption through the skin. **Treatment:** Point of Use Reverse Osmosis (RO). **More Information:** Web search for "DWGB Factsheet 3-11" and "ARD-EHP Factsheet 22"
pH SMCL 6.5 to 8.5	**Health Effects**: No direct health effects. However, pH levels below 7 contribute to water corrosiveness which can leach lead and/or copper from household plumbing. Lead and copper present health concerns ranging from stomach distress (copper) to brain and nervous system disorders, kidney toxicity, reductions in IQ and other serious health effects (lead). **Sources:** Naturally occurring. **Mitigation:** Flush tap thoroughly prior to collecting water for drinking or cooking. Treatment to reduce water corrosiveness, replace fixtures and plumbing. **Treatment:** Whole-house neutralizer or calcite filter. **More Information:** Web search for "DWGB Factsheet 3-4"

APPENDIX 3-1

Analytical Results Worksheets

Summary Worksheet of Select Parameters
2014 BDWPC Brown Hill Road Area Study

Sample Number	Specific Conductance uS/cm	Chloride mg/L	pH s.u.	Sodium mg/L	Hardness mg/L		Arsenic	Uranium
1	276	56	6.14	25	58		4.1	5
2	256	24	6.65	45	24		2.6	5.1
3	279.8	58	5.9	13	84		2.2	5.8
4	360	72	6.35	16	110		1.6	2.8
5	355	81	6.75	22	96		2.3	7.6
6	575	150	6.36	54	120		0	3.7
7	547	120	6.9	41	150		7.3	2.9
8	83.5	12	5.58	8.6	14		0	2.3
9	512	100	7.03	19	180		11	3.7
10	578	150	5.1	90	46		1	17
11	380	78	6.7	15	130		64	31
12	226.8	65	5.76	42	19		0	1.9
13	348.8	76	5.57	32	65		4.2	5.5
14	230.8	16	7.26	7.2	87		8.1	3.6
15	367	64	6.65	18	120		18	7.9
16	177.3	65	7.21	7.4	67		39	20
17	300	44	6.65	15	100		2.3	3.3
18	422	23	7.22	19	150		20	5.1
19	640	160	6.54	82	97		14	8
20	537	130	5.66	70	76		10	13
21	328.2	23	7.16	14	130		8.2	56
22	248	7.4	7.26	14	87		29	16
23	232.9	33	7.26	10	73		5.5	5.4
24	230.9	9.5	7.37	12	82		27	73
25	184	3.8	7.2	10	66		36	8.7
26	221.7	8	7.27	10	81		29	63
27	149	1.3	7.1	11	47		28	13
28	167.2	5.2	7.25	11	50		140	25
29	116.7	7.3	6.66	7.6	32		51	5.4
30	427.4	95	6.15	51	65		0	0
31	234.2	50	5.98	33	21		15	46
32	193.6	13	6.72	11	67		41	68
33	206.9	16	6.49	14	64		30	160
34	168.2	16	6.27	11	48		4.5	25
35	762	150	7	66	190		0	53
36	661	160	7	130	NC		0	3.5
37	319	56	7.6	65	3		13	5.8
38	559	140	6.4	110	NC		0	0
39	1145	320	6.6	230	NC		11	4.9
40	601	120	6.75	39	180		62	55
41	179	34	5.7	35	NC		0	0
42	432	99	5.88	55	64		1.8	2.7
43	585	130	6.48	120	NC		5.8	18
44	452	57	6.77	21	173		17	170
45	225	20	6.79	10	81		0	0
46	100	5.2	6.35	4.6	34		7.6	2.3
47	539	120	6	64	100		0	0
48	155.7	6	7.02	7.9	58		12	35
49	126	0.85	6.74	13	30		8.2	4.9
50	1098	330	5.16	146	140		3	13
51	984	280	6	120	140		1.4	4.3
52	473	120	6	57	63		1.5	3.2
53	490.6	107	6.21	47	104		13	12
54	1722	520	6.05	120	480		0	0
55	1390	430	5.77	160	280		0	4.6

Sample Number	Specific Conductance uS/cm	Chloride mg/L	pH s.u.	Sodium mg/L	Hardness mg/L		Arsenic	Uranium
56	378.5	37	8.09	26	120		2.1	25
57	508	130	5.75	53	88		8.4	24
58	490	100	5.92	58	84		9.2	48
59	1352	360	6.7	130	300		7.5	2.5
60	690	190	5.5	130	NC		0	0
61	1076	310	5.39	170	74		2.1	6.4
62	354.6	83	6.06	66	NC		1.3	0
63	175	30	5.4	22	20		1.9	2.4
64	400.5	73	6.59	81	3		0	0
65	306.2	65	5.38	31	55		8.2	8.4
66	1211	380	5.17	210	59		0	1.3
67	1277	410	4.63	240	36		0	2
68	561	150	5.5	96	29		8	10
69	1358	400	5.26	220	89		1.6	10
70	1159	320	5.64	190	74		0	0
71	1473	420	5.8	200	180		5.8	14
72	687	190	5.12	120	29		0	1.2
73	1039	310	5.23	170	68		1.1	1.8
74	284	43	6.49	14	91		12	21
75	712	180	6.27	76	140		2.5	19
76	511	110	7.11	38	140		0	0
77	760	160	7.08	61	210		31	22
78	335	32	7.18	76	NC		6.5	70
79	478.3	69	6.97	29	160		17	260

PARAMETER SUMMARY	SpecCond	chloride	pH	sodium	hardness	Raw hardness (homes with softeners)	arsenic	uranium
Number of Samples	79	79	79	79	71	12	79	79
Average	521	121	6.36	63	97	116	11.89113924	21.02405063
Median	422	78	6.48	41	81	81.5	5.5	5.8
Range	84-1722	<1-520	4.63-8.09	4.6-240	3-480	29-300	nd-140	nd-260

Age of Wells vs Chloride and pH

Pre-1985		*Post-1985*	
Chloride	**pH**	**Chloride**	**pH**
56	6.14	58	5.9
24	6.65	72	6.35
100	7.03	81	6.75
150	5.1	78	6.7
76	5.57	65	5.76
160	6.54	16	7.26
95	6.15	64	6.65
150	7	44	6.5
320	6.6	23	7.22
120	6.75	23	7.16
130	6.48	7.4	7.26
330	5.16	33	7.26
280	6	9.5	7.37
130	5.75	3.8	7.2
360	6.7	8	7.27
190	5.5	1.3	7.1
83	6.06	5.2	7.25
30	5.4	7.3	6.66
73	6.59	50	5.98
65	5.38	13	6.72
380	5.17	10	6.49
400	5.26	16	6.27
190	5.12	160	7
310	5.23	56	7.6
		140	6.4
		34	5.7
		99	5.88
		57	6.77
		20	6.79
		5.2	6.35
		6	7.02
		0.85	6.74
		120	6
		107	6.21
		430	5.77
		37	8.09
		100	5.92
		150	5.5
		180	6.27
		110	7.11
		69	6.97

SUMMARY

	Pre-1985		*Post-1985*	
	Chloride	pH	Chloride	pH
Number	24	24	41	41
Mean	175	6.0	63	6.7
Median	140	6.03	44	6.72
Range	24-400	5.1-7.03	0.85-430	5.5-8.09
Homes >250	7 of 24		1 of 41	

Chloride Comparison 1996 vs 2014

No	Chloride pre-1996, mg/L	Highest Cl pre 1996	Lowest Cl pre 1996	Chloride 2014
1	20	20	20	78
2	3	3	3	56
3	213	281	213	120
4	281	120	84	107
5	250	41	41	37
6	84	1014	300	190
7	92	380	368	310
8	120	198	93.6	83
9	41			
10	1014			
11	338			
12	310			
13	387			
14	761			
15	300			
16	368			
17	380			
18	93.6			
19	198			

Number	19	8	8	8
Average	277	257	140	123
Median	250	159	88.8	95
Range	3 to 1014	3 to 1014	3 to 368	37 to 310