IR 21-024
Department of Energy, Division of Enforcement

INVESTIGATION REPORT
OF
WATER PRESSURE REDUCTION MATTER
IN ROSEBROOK WATER SYSTEM
August 31, 2021
Abenaki Water Company, Inc – Carroll, New Hampshire

Table of Contents

Executive Summary

The following report presents the Department of Energy Division of Enforcement's investigation of the Rosebrook water system owned and operated by Abenaki Water Company (AWC, or the Company) in the 'Bretton Woods' area of Carroll, New Hampshire. Bretton Woods is located along New Hampshire Route 302 and includes the Omni Mount Washington Resort and Bretton Woods Ski Area owned by Omni Mount Washington, LLC.

The investigation focused on a system pressure design issue within the Rosebrook water system. The Division of Enforcement Safety Staff reviewed the root causes of the pressure issue identified in Docket DW 17-165, the Company's efforts to resolve that issue, and alternative engineering options considered by the Company to address pressure concerns. Staff reviewed prior Company filings, conducted in-person investigations of the system and interviews of Company personnel, evaluated system operations, analyzed the source of the pressure issue, and proposed options put forth by AWC to address the existing water pressure issues. Safety Staff's review noted a number of deficiencies in the Company's operation and maintenance of the Rosebrook system.

Conclusions and recommendations are provided in Element # 6 of the report.

Purpose and Scope of Investigative Report

In Order No. 26,426, issued in Docket DW 17-165 on November 25, 2020, the New Hampshire Public Utilities Commission (Commission) determined that it would open an investigation into a long-standing pressure problem in Abenaki Water Company's Rosebrook water system, located in Carroll, New Hampshire. The Commission subsequently opened Docket IR 21-024 through an Order of Notice issued on February 19, 2021. The Order of Notice directed the then-Commission's Safety Division, aided by the Gas and Water Division, to investigate the Rosebrook system pressure issue identified in Docket DW 17-165, including the Company's efforts to resolve that issue, and to produce an investigative report with recommendations to be considered by the Commission. The Order of Notice outlined the following elements to be included in the investigative review:

Element 1: Review of prior filings in related dockets

Element 2: Investigation of the safety and adequacy of the existing Rosebrook system

Element 3: Evaluation of proposed preferred remedies of the existing water pressure within the distribution system

Element 4: Evaluation of potential alternative solutions

Element 5: Provide results of field investigations as necessary

Element 6: Filing of findings and recommendations to the Commission.

This report presents the Department of Energy's Division of Enforcement investigation of the Rosebrook water system in the 'Bretton Woods' area of Carroll, New Hampshire. Bretton Woods is located along a section of New Hampshire Route 302 and includes the Omni Mount Washington Resort and Bretton Woods Ski Area owned by Omni Mount Washington, LLC.

The investigation spanned the time period in which the New Hampshire Legislature created a newly formed Department of Energy separate from the Commission. As a result, drawings, interviews, site inspections, and observations referenced throughout the following report may reference the Commission's Safety Division, which is now the Safety staff of the newly formed Department of Energy, Division of Enforcement (Safety Staff, or Safety).

Element #1: Prior Filings Reviewed

Safety Staff reviewed the following docket filings listed in Table #1-1 in preparation for this investigation:

ELEMENT #1 TABLE # 1-1 DOCUMENTS REVIEWED FOR REPORT

Docket	Tab/Exhibit#	Tab/Exhibit Description	Report Reference	Conf. Y/N
DW 17-165	Tab 3	Abenaki Water Company – Rosebrook Rate Filing		N
DW 17-165	Tab 53	Clerk Report		N
DW 17-165	Tab 63	Abenaki Water Company Pressure Problem Report	Element # 3 Element # 5	N
DW 17-165	Tab 75	Staff Recommendation		N
DW 17-165	Tab 93	Abenaki Water Company, Inc. Motion for Protective Order nunc pro tunc and Confidential Treatment of Facility Plans		N
DW 17-165	Tab 97	Order No. 26,300 Affirming and Clarifying Step II Adjustment		N
DW 17-165	Tab 132	Transcript of Hearing Held on 04/23/20		N
DW 17-165	Tab 145	Transcript of Hearing Held on 07/16/20		N
DW 17-165	Tab 148	Abenaki Water Company, Inc. Request for Approval of Step II Mechanism		N
DW 17-165	Tab 150	Omni Mount Washington, LLC Response to Abenaki Water Company, Inc. Request for Approval of Step II Mechanism		N
DW 17-165	Tab 151	Order No. 26,426 Denying Step II Deadline Extension	Purpose & Scope	N
DW 17-165	Exhibit 12	Direct Testimony of Donald J. E. Vaughan and Attachments		N
DW 17-165	Exhibit 20	Abenaki Water Company Pressure Problem Report	Element #2, Item 14 Element #3	N
DW 17-165	Exhibit 21	Staff Recommendation on Step II Pressure Reduction Project	Element # 2 Element # 5	N
DW 17-165	Exhibit 22	Abenaki Water Company Pressure Reduction Presentation		N
DW 17-165	Exhibit 23	Horizons September 18, 2018 Proposal	Element #3, Item 4	N
DW 17-165	Exhibit 25	New England Service Company Annual Report 2018		N
DW 17-165	Exhibit 26	NHDES 2019 Sanitary Survey Abenaki – Rosebrook Division	Appendix G, Element #5, Interview 1 Element #5, Interview 4	N
DW 17-165	Discovery	Discovery Responses Filed as Confidential	Element #2, Item 11	Y
DW 19-131	Tab 1	Complaint by Omni Mount Washington Hotel. LLC against Abenaki Water Company, Inc.		N
DW 19-131	Tab 6	Abenaki Water Company, Inc. Reply to Complaint		N
DW 19-131	Tab 7	Omni Mount Washington Hotel, LLC Response to Abenaki Reply		N
DW 19-131	Tab 9	Abenaki Water Company, Inc. Motion for Protective Order nunc pro tunc and Confidential Treatment of Facility Plans		N
DW 19-131	Tab 10	Order of Notice	Element # 2, Item 8	N
DW 19-131	Tab 16	Bretton Woods Property Owners Association Petition for Intervention and Comments		N
DW 19-131	Tab 19	Abenaki Water Company, Inc. Supplemental Reply to Omni Mount Washington, LLC Complaint		N
DW 19-131	Exhibit 23	As Built Utility Plans Filed in DR 89-031		N
DW 19-131	Discovery	Discovery Responses Filed as Confidential	Element #5	Y

The above document review allowed the Safety Staff to familiarize itself with the Rosebrook water system infrastructure, the design of the water system, and the pressure constraints/limitations of that system to better identify and clarify the scope of the pressure problem.

Element #2: Safety & Adequacy Evaluation

General Description

Organization Structure

Abenaki Water Company, Inc. (AWC) is a subsidiary of New England Service Company (NESC). NESC corporate headquarters are located at 37 Northwest Drive in Plainville, CT. AWC offices are located at 32 Artisan Court, Unit #2 in Gilford, New Hampshire.

NESC currently operates in three states - Connecticut, Massachusetts, and New Hampshire. NESC is managed by President Nicholas LaChance; Donald Vaughan is identified as the Vice President of Operations for NESC. NESC allocates its employees' time to each of its various subsidiaries. Three NESC employees work in the AWC Gilford home office – Teri Kucka, Office Manager; Taylor deOgburn, Operations Manager; and Eric Messier, Operator.

AWC is currently managed by President Robert Gallo. AWC operates five water utilities in New Hampshire serving an aggregate of approximately 725 customers.[1] Two water systems are located in Belmont (Tioga Drive and Lakeland Management); one system is located in Bow (White Rock); one system is located in Gilford (Gilford Village); and the largest system is located in Carroll (Rosebrook Water System). AWC does not have any employees in New Hampshire.

All employees who work on the AWC water systems are employed by NESC and are allocated to AWC's area systems. Table # 2-1 provides more detail regarding the AWC systems.

ELEMENT # 2 TABLE # 2-1 ABENAKI WATER SERVICE TERRITORY

Water Company Name	AWC Franchise Areas	Portions of Town Served in Franchise Area	Type	Customers (Meters)	Approx Miles of Mains
Rosebrook Water	Carroll	Limited areas of Carroll (storage tank in Bethlehem), Bethlehem	Water	414	9
White Rock	Bow	Limited areas of Bow (e.g., White Rock Road, Surrey Drive)	Water	95	1
Lakeland Mgmt	Belmont	Limited areas of Belmont (e.g., Randlett Street, Orchard Hill Road, Maple Hill Road, Darby Drive)	Water	160	2
Tioga River Water	Belmont	Limited areas of Belmont (e.g., Tioga Drive, Clark Street, Depot Street)	Water	22	1
Gilford Village	Gilford	Limited areas of Gilford (e.g.,Potter Hill Road, Belknap Mtn Road, Bacon Drive)	Water	39	1
5 Water Co.	*4 Towns*	*5 Franchise Areas*		*730*	*14*
Former Sewer Company	**AWC Franchise Name**	**Portions of Town Served in Franchise Area**	**Type**	**Customers (Meters)**	**Approx Miles of Mains**
Lakeland Sewer System	Belmont	Limited areas of Belmont (e.g. Randlett Street, Orchard Hill Road, Maple Hill Roadd, Darby Drive)	Sewer	158	2
1 Sewer Co.	*1 Town*	*1 Franchise Area*		*158*	*2*
TOTAL	**4 Towns**	**6 Franchise Areas**	**Water & Sewer**	**888**	**16**

[1] AWC's 2020 Annual Report filed with the Commission on May 25, 2021 lists 725 customers as of December 31, 2020. Safety Staff notes that the joint petition filed by AWC and Aquarion Company on April 30, 2021 in Docket DW 21-090 indicates approximately 720 AWC customers. *See* Joint Petition for Approval of the Acquisition of Abenaki Water Company by Aquarion Company at 2.

Rosebrook Water System (RWS)

Taylor deOgburn is RWS's Operator, spending most of each work week operating the Carroll area system but occasionally covering one of the other four AWC water systems in New Hampshire. RWS provides water service to approximately 414 customers in Carroll, including 394 residential customers and 20 commercial customers. Of the commercial customers, Omni Mount Washington, LLC uses more than 60% of the total annual water supplied by RWS in Carroll for its properties, including the Mount Washington Hotel and the Bretton Woods Ski area.

Approximate system piping consists of 9 miles or 46,725 feet comprised of ductile iron and polyvinyl chloride (PVC) piping ranging in size from 4-inch to 16-inch nominal diameters. In the course of its review, the Enforcement Division Safety Staff identified numerous instances of conflicting information and inaccuracies depicted in AWC's records of the Rosebrook water distribution system. AWC provided As Built plans revealing many discrepancies within AWC's records and conflicting mapping of fundamental information, including lengths and pipe diameters.

RWS is unique among other water systems in New Hampshire due to geographical terrain marked by the steep mountainous areas of the White Mountains. In effect, RWS operates in a deep bowl, in which the lowest point of the system runs along Route 302 and includes many of the company's commercial accounts, while the majority of residential customers are located at higher levels on both sides of the valley. The system terrain consists of an elevation gradient from the Route 302 area in the base of the valley at an approximate elevation of 1580 feet, while residential developments to the south reach approximately 1850 feet and residential developments to the north reach approximately 1750 feet in elevation. The gradients of 270 feet and 170 feet, respectively, from the water system source point are critical factors in determining design and pressure requirements for each part of the system. Please refer to Attachment 2 for further detail on this point.[2]

During April 2021, AWC indicated to Safety Staff that RWS produced a total of 2,165,300 gallons of water with a total demand of 1,781,254 gallons. Overall general water usage ranges from 100,000 gallons per day (gpd) during off-peak tourist seasons to as high as 150,000 gpd during peak winter and summer seasons. Water usage for both residential customers and commercial properties, including the Omni properties, tend to reflect tourist season patterns. System operating pressures vary throughout the year between 150 PSI to 200 PSI, depending on location within elevation gradients.[3]

Geographical highlights of the system layout include the Bretton Woods ski slopes located on Mount Stickney, Mount Rosebrook, and West Mountain to the south of Route 302, a main traffic artery to this region. From the west, Route 302 traverses southeast within the valley and separates the ski slopes to the south of the highway from the north and east areas, in which the historic Mount Washington Hotel is located.

[2] Attachment 2 is a drawing titled *"MAP 2 of Rosebrook Water System As Built Contour Elevations generated by PUC Safety Division".*

[3] Although AWS and its engineering consultant indicated that pressures ranged 150 -200 psi, Staff later observed pressures as high as 225 psi in the Mt Washington Hotel as shown in Element #5 Item 3 and photo #5-4.

The remainder of this report will describe the areas south of Route 302 as "South" and the area north of Route 302 as "North". Refer to Attachment 1 for more detail.[4]

To the South is the Bretton Woods Ski Area, which includes the Bretton Woods Base Lodge and all associated buildings, and the following residential developments: Riverfront Homes, Crawford Ridge Condominiums, and the Presidential Views to the west of the ski slopes; and Forest Cottages, Rosebrook Townhomes, and Mountain View Homes to the east of the ski slopes.

To the North are the Mount Washington Hotel and associated buildings, the Bretton Arms Hotel, the Stables, and the following residential developments: Fairway Village, Mount Washington Place, Stickney Circle, Dartmouth Ridge, and Mount Madison Homes.

Further geographical features within the system territory include an additional traffic artery identified as Base Station Road, which begins at the intersection of Route 302 adjacent to Fabyan's Station to the northwest and the Ammonoosuc River to the southeast of this intersection. With the exception of the Mount Washington Hotel Access Road, which is connected to Route 302, Base Station Road is the single traffic artery from Route 302 to the east, ultimately ending at the Cog Railway.

The primary water system components include:

- Two wells marking the source of water supply
- A single pump station with two water pumps
- An underground water storage tank
- Transmission mains
- Distribution mains with valves and hydrants
- Services to individual structures with individual pressure-reducing valves.

The system is configured beginning with two subsurface wells located to the south of Route 302 at an elevation of approximately 1,575 feet in the area identified as the Pump Station. This becomes a significant benchmark elevation as the active pump then pumps water from this elevation up through a 16-inch water transmission main south high up in the ski slopes area to fill a 650,000 gallon underground water storage tank. This early 1970s vintage single storage tank is located at an elevation of approximately 2,010 feet. The tank, which is connected to the 16-inch main, provides the water supply to branch connection mains along the area south of Route 302 with a single 16-inch transmission main that crosses Route 302. This single-source supply transmission main begins in the vicinity of the pump station location and then traverses north across Route 302 in the general area of the intersection of Route 302 and Base Station Road.

The transmission main crosses Route 302 and traverses eastward along Base Station Road to the Mount Washington Place development as well as to the Fairway Village area, where the main then traverses southeast into the Fairway Village development, where it ends. Distribution mains extend from the transmission main into the developments along Base Station Road. A water supply main also

[4] Attachment 1 is a drawing titled *"MAP 1 of Rosebrook Water System As Built including Neighborhood Areas generated by PUC Safety Division".*

connects to the transmission main in the area of Base Station Road and Hanna Loop to serve the Mount Washington Hotel further to the east.

This water system has been in use for approximately 50 years with the wells and the pumps located in the base of this geographic "bowl" region. Water is transferred from the wells, through the pumps, up into the storage tank to the South and simultaneously into the transmission and distribution systems to both the South and the North. Pump operation is limited to one pump at a time, with an alternate schedule of activation. Refer to Attachment 2 for a depiction of the components and transfer paths.

Elevation is a key factor when moving water uphill or downhill and becomes a consideration in all aspects of moving water throughout the system, especially with respect to operation of the pumps. To lift water one foot in elevation requires a pressure of 0.433 pounds per cubic foot of water. The fire protection industry uses a quick rule-of-thumb for pumping water: it takes 5 pounds of pressure (PSI) per cubic foot for every 10 feet in floor elevation within a building.

Taking the pressure and elevation factors into context with respect to the Rosebrook water system, for the active pump to pump water from the pump station elevation at 1,575 feet to the elevation of the water storage tank at 2,010 feet requires a pump discharge pressure of approximately 190 PSI[5]. Since this water system does not have any type of water distribution system pressure-reducing mechanism (other than the smaller service type pressure reducers installed within each structure), each time the pump activates at 190 PSI to fill the storage tank, the entire system becomes pressurized at the same discharge pressure. As a result, customers at the lower elevations not only receive the high pressure (or head pressure) of the water stored at a high elevation, they also experience the high discharge pump pressure as well.

Maintenance Activities and Records of the Rosebrook Water System

Safety Staff reviewed available maps of the AWC water system, including prior engineering As Built plans, as well as information collected during this investigation, including documents, interviews, and Safety Staff observations.

This water utility system consists of the Pump Station and the two wells noted above, from which water is pumped into the transmission and distribution system of piping, which consists of metallic ductile iron and non-metallic PVC piping. According to system maps, this piping system ranges from 4-inches to 16-inches nominal diameter. The system includes valves that can be activated to isolate water mains and the segments feeding customers, as well as fire hydrants for fire protection. There are numerous dead-end mains noted on system maps.

The As Built system maps depict piping materials used during construction made of either ductile iron or PVC. Interview information indicated that several developers over the years had constructed portions of the system, and that the newer areas have tended to utilize PVC piping within the past 25 years. Based on record reviews and discussions with Company personnel, it is very probable that much of this PVC piping does not have any metallic tracer wire installed above the PVC water mains,

[5] (2,010 – 1,575 = 435 feet X .434 = 189.79 PSI)

and the resulting difficulty in locating the piping to update and correct the As Built plans has contributed to a degree of inaccuracy in the As Built plans.

Safety Staff's examination of what are typically above-grade utility components included the pump station, fire hydrants, and grade level valve covers, as well as the water storage tank.

After extensive review of documentation provided by AWC along with in-person interviews, Safety Staff identified numerous conflicts with AWC's As Built water system maps. Please refer to Attachment 1 for a list of conflicts found. These As Built maps did not provide an adequate level of accuracy for conveying system materials and locations. Thus, further examination will be required to validate the true and correct As Built conditions of the Rosebrook Water System. Interview information further confirmed that due to identified conflicts, the As Built plans and maps could not be relied upon. Information found within these plans and maps and corresponding company documents revealed that minimal system maintenance was being performed with respect to critical water transmission and distribution system isolation valves. Plan notes indicated that many valves either did not function or could not be located. Although there appeared to be a general fire hydrant maintenance and flushing program in place, little documentation was found to confirm that operational maintenance activities are being sufficiently performed.

With the high system water pressures resulting from the water storage tank elevation and the gravity feed from this tank into the system, as well as the high pump discharge pressure required to fill the tank at the higher elevation, the importance of valve maintenance and proper functioning is critical. Key system isolation valves noted on the As Built plans were identified as "inoperable" in the only system valve inspection performed by AWC since its acquisition of the system in 2016, a factor that would make it extremely difficult to isolate the system and prevent significant loss of water in the event of any abnormal pressurization event. This inability to isolate could also render the system inoperable, as was evident when the Company noted in its inspection report that the 16-inch transmission main on the north side of the system has an isolation valve located near the pump station marked as "having no guts" inside it. AWC management has stated that replacement of valves would most likely occur during construction as part of a future, as yet undetermined, pressure reduction project. However, the Company's statement regarding valve replacement did not specify in which phase of a potential future project it might occur; nor was a targeted completion date identified. A management decision to wait to replace inoperable valves until some future construction might occur does not ensure a safe and functional water system, particularly in the event a need arises to isolate any part of the system.

As prescribed by the Puc 600 Rules for Water Service (Puc 600 Rules), Safety's investigation concludes that AWC has failed to adequately maintain the Rosebrook Water System, to maintain required water utility system documents, and to file said documents with the Commission, as detailed below.

Investigation Analysis of Compliance with Existing Puc 600 Rules

Prior to examining the pressure reduction issue, Safety Staff assessed the safety and adequacy of the existing Rosebrook system, as directed by the Commission in its February 19, 2021 Order of Notice. Safety's assessment focused on whether AWC is compliant with the Puc 600 Rules and whether it is

meeting the requirement under RSA 374:1 to provide service and facilities that are reasonably safe and adequate and in all other respects just and reasonable.

Safety Staff created a list of 14 safety-related requirements contained in the Puc 600 Rules applicable to RWS. Documentation was reviewed and informational requests were submitted to AWC to determine whether RWS is generally meeting Commission requirements and, if not, to quantify to what degree the Company is not in compliance and determine what may have prevented the Company from following applicable rules. Section titles and excerpted language of select Puc Rules are found in Appendix A.

Based on its review, it is the opinion of Safety Staff that AWC has failed to provide service and operate and maintain facilities that are reasonably safe and adequate in accordance with the Puc 600 Rules, based on the following factors:

1. Puc 604.05(g). AWC failed to maintain records pertaining to system pressure for at least 2 years. **AWC was unable to produce the requested required documentation since 2016, therefore the Company has not been in compliance Puc 604.05(g) within that timeframe.**[6]

2. Puc 604.05(h). AWC failed to maintain any reports of pressure complaints. In the event complaints are received by AWC, the Company is required to report such complaints to the Commission once a month on Form E-14 pursuant to Puc 609.07. The document review undertaken in this investigation confirmed that there is an excessive pressure issue in the Rosebrook system, as noted in direct testimony of Mr. Vaughan and other docket filings submitted by AWC. However, as discovered through this investigation, AWC failed to document or report known pressure complaints. For example, Mr. Vaughan asked AWC employees to seek information regarding pressure complaints directly from Omni Resorts because that customer had documented its own complaints more thoroughly than the Company had. Appendix B includes documentation of and correspondence regarding notifications from Omni to AWC addressing pressure complaints.

   AWC failed to maintain any reports of pressure complaints and as a result did not file E-14 reports as required by Puc 604.05(h) and Puc 609.07. Staff found numerous instances of documentation (see Appendix B) indicating that Omni notified AWC of pressure complaints and that AWC did not respond to the identified complaints. Therefore AWC was not in compliance with Puc 604.05(h) in the years 2016 and 2021, based on the complaint records maintained by Omni.

3. Puc 604.06(c). AWC failed to maintain records of service interruptions of over 30 minutes affecting any portion of its distribution system. Appendix B regarding Omni pressure complaints revealed service interruptions of more than 30 minutes on October 18, 2016, October 19, 2016, and December 16, 2018, each of which triggered notifications to AWC. **AWC was unable to produce the required documentation from its records, therefore the Company has not complied with Puc 604.06(c).**

4. Puc 604.06(i). AWC failed to file service interruption reports with the Commission on Form E-18, which is described in Puc 609.11. An example is the water main break that occurred on Omni

[6] Email correspondence from April 26, 2021 from NESC to K. Walsh, Safety Staff

property on Easter Sunday morning, April 21, 2019. In addition, Appendix B regarding Omni pressure complaints revealed service interruptions of more than 30 minutes on October 18, 2016, October 19, 2016, and December 16, 2018, as noted above, and Omni's notification in each instance to AWC. The Company did not file the required service interruption reports associated with those complaints. **AWC was unable to produce the required documentation; therefore, the Company is not in compliance with Puc 604.06(i).**

5. Puc 605.04(l). AWC failed to file annual periodic meter tests with the Commission on Form E-15 for 2018, 2019, and 2020. The last form filed with the Commission was for the year ending 2017. The 2017 form submitted by AWC lacked the required information. **AWC was unable to produce the required documentation; therefore the Company has not complied with Puc 605.04(l) since 2016.**

6. Puc 605.07. AWC failed to establish an Underground Utility Damage Prevention Program, commonly referred to as "Dig Safe". Safety Staff discovered a minimum of 97 probable Dig Safe violations within the Rosebrook Water Distribution system from October 2016 to May 3, 2021**.** This information was forwarded to the Safety Staff's Underground Damage Prevention Specialist and a separate investigation and finding will be issued. During a field site visit on April 14, 2021, Safety Staff observed a potential violation involving recent work scheduled for the Route 302 bridge crossing over the Ammonoosuc River, which mandated notification to all affected utilities. This work required the installation of utility poles along Route 302 and the intersection of Base Station Road. Examination of the scene during this investigation coincidentally revealed utility mark outs for all but the water utility. The noted wood utility poles and steel anchors were set within the immediate area of AWC's 16-inch transmission water main that feeds the north side of Route 302, which is the single-feed source for the Mt. Washington Hotel and all other residential and commercial structures.[7]

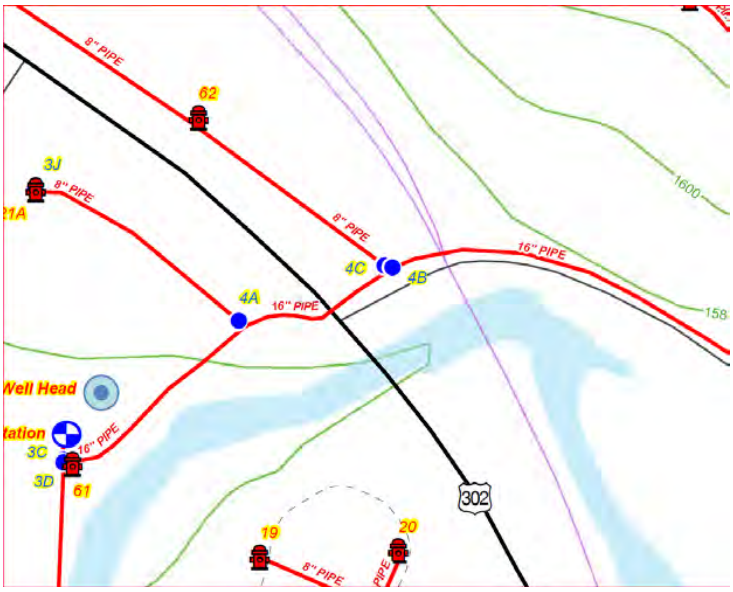


Figure 2-1 indicates an area in which excavation was performed near the 16-inch diameter water main between valves marked 4A and 4B but no markings by AWC were shown. Puc 800 rules require markings of any underground water mains within the tolerance zone or method of providing positive response that there are no such facilities within the tolerance zone. AWC did neither.

[7] See Element #5 - Observations from April 14, 2021 for more detail.

Photo 2-1 indicates an area in which excavation was performed to install a pole as indicated by the fresh dirt with Dig Safe pre-marks to show the tolerance zone in white with no blue markings by AWC. Puc 800 rules require markings of any underground water mains within the defined tolerance zone of an excavation area.

Photo 2-2 indicates an area in which excavation was performed but no markings by AWC are shown. Puc 800 rules require markings of any underground water mains within established tolerance zones or provide positive response that no water mains are present within the tolerance zone.

AWC was unable to produce the required documentation to demonstrate that they are compliant members of Dig Safe and that they supplied Dig Safe with the location of their Rosebrook Water System infrastructure and facilities so that Dig Safe would be properly notified; therefore the Company is not in compliance with Puc 605.07.

7. Puc 606.02(d) – records of the flushing of dead-end mains. AWC has many dead-end mains within the Rosebrook Water System.[8] **The Company was unable to produce the required documentation for any year from 2016 through 2021.[9] AWC therefore is not in compliance with Puc 606.02(d).**

8. Puc 606.03(c) – fire hydrants maintained by the utility shall be flushed and inspected at least once per year. AWC records indicate a maintenance program of fire hydrants for 2017 through 2020. No records were provided for the purchase year of 2016 when AWC assumed ownership.[10] The documents reviewed by Safety revealed fire hydrants listed as "Private" hydrants - specifically, the fire hydrants on the Omni Resort properties, which had been inspected and flushed from 2017 to 2019 by Rosebrook operators, but were not inspected and flushed in 2020. The 2020 Fire Hydrant Tracking Report entry noted "Private – 12 Omni Hydrants – not to test in 2020."[11] Safety concluded that there exists a serious safety concern regarding ownership and responsibility to inspect, maintain, and flush ALL fire hydrants; the identified deficiency was validated during this investigation. During recently scheduled fire hydrant flow testing coordinated by AWC personnel and their contractor Horizons Engineering, Inc. (Horizons Engineering) several fire hydrants located on the Mt. Washington Hotel (Omni Resorts) property were identified for flow testing. A fire hydrant on the east-side of the property located behind the new additions was operated and the gate valve to this fire hydrant was found to be partially opened, thereby producing effectively no water. Had the fire department connected hose lines to this fire hydrant for a fire emergency, they would not have known that this hydrant was out of service. Had this fire hydrant been inspected and maintained, this safety deficiency would have been identified and corrected. During this investigation and prior to the issuance of Commission Order No. 26,493 regarding ownership of the water mains and associated facility equipment, such as fire hydrants and valves, neither party was inspecting and maintaining these components. State fire codes mandate that private fire service water mains and associated facilities such as fire hydrants and valves be inspected on a regular basis. This responsibility typically lies with the property owner unless the water mains and associated facility components are the property of the water utility. Commission Order No. 26,493 determined that ownership of and responsibility for the water mains and associated facility components, the fire hydrants, and associated maintenance lie with AWC. Thus, duties associated with inspection, flushing, and

[8] Avalon Circle, Slope Side Lane, Rivers Edge, Rosebrook Farm Area, Hannah Loop (2 locations), Appleby Close, Stickney Way, Stickney Court, Dartmouth Road, Sand Trap Lane, Fairway Drive (2 locations), Mount Adams Lane, Car Barn Court are areas where dead-end mains occur.

[9] Email correspondence from April 26, 2021 from NESC to K. Walsh, Safety Staff

[10] Email correspondence from April 22, 2021 from NESC to K. Walsh, Safety Staff

[11] AWC opted not to perform maintenance during the period in which Docket DW 19-131 was not resolved (July 24, 2019 –June 30, 2021.)

operations not completed during the period in which Docket DW 19-131 was being adjudicated, presented a safety hazard. This condition continues as of the writing of this report. **AWC was unable to produce the required documentation for 2016 applicable to the entire system, including the segment of 8-inch water main and associated hydrants[12] on Omni property. Therefore, the Company is not in compliance with Puc 606.03(c).**

9. Puc 606.03(d) – records for each hydrant shall be maintained showing the size, type, location, date of inspection and flushing and the results thereof. Records produced and submitted by AWC personnel for the years 2017 through 2020 revealed six fire hydrants (5, 8, 26, 32, 33, 45) with noted deficiencies that continued without correction, and three hydrants (23, 55, 59) with noted deficiencies that continued for two years without correction.[13] 2020 fire hydrant inspection data noted that fire hydrants serving Omni properties were not inspected. No information was provided as to the scheduling of corrective actions for those fire hydrants. **AWC was unable to produce documentation showing corrective actions for inoperable components of defective hydrants for years 2017 through 2020. Therefore, the Company is not in compliance with Puc 606.03(d).**

10. Puc 606.03(e) – reports of annual inspection and flushing of hydrants shall be filed with the Commission on Form E-17 each year. The last form that appears to have been filed with the Commission was for the year 2017. The submitted form at that time lacked any of the required information. AWC failed to file the required documentation with the Commission in the years 2018, 2019, and 2020. AWC staff created these documents after the fact and subsequently submitted them to Safety Staff by request as part of this investigation. **AWC failed to submit the required annual documentation of inspections of hydrant flushing, therefore the Company is not in compliance with Puc 606.03(e).**

11. Puc 606.04(b) – A utility annually shall locate, operate and inspect valves which are: (1) larger than 12 inches in diameter, (2) located on major transmission lines, or (3) otherwise critical to system operation. Based on an examination of documents regarding Mr. Vaughan's responses to Staff when questioned about valve maintenance, as well as investigation interviews of Mr. Vaughan, Safety concluded that AWC had failed to properly maintain and inspect critical water transmission and distribution valves as required.[14] It appears from the evidence presented in Docket DW 17-165 that Mr. Vaughan was planning to maintain and/or replace water system valves as needed during an as yet unscheduled future construction project intended to address the water pressure issue. AWC failed to consider the risks of such a delay due to a number of existing factors, including: 1) the elevated water storage gravity-fed system, 2) inaccurate As Built distribution system plans and maps, 3) the emergency response time required for AWC staff to arrive on scene from the local Gilford office, and 4) the potential consequences to AWC's system that could result from AWC's decision to postpone standard basic maintenance to incorporate the required maintenance and equipment replacements into an as yet undetermined pressure reduction project. **Staff's review found that standard valve maintenance had not been**

[12] Hydrants 51-60, as shown on Attachment 1. Attachment 1 is a drawing titled *"MAP 1 of Rosebrook Water System As Built including Neighborhood Areas generated by PUC Safety Division".*
[13] Email correspondence from April 22, 2021 from NESC to K. Walsh, Safety Staff.
[14] See Confidential Discovery DW 17-165 Staff Set 1-2 and 1-3, and Set 2 (Step II) Staff requests and Company responses 2-3 and 2-5.

completed on any mains that were greater than 12 inches in diameter, on any transmission lines, or on other critical mains of the distribution system. Therefore, the Company is not in compliance with Puc 606.04(b).

12. Puc 606.04(c) – A utility shall keep a record of each valve showing the size, type, location, date of inspection, and the results of each inspection. AWC retained As Built plans from Provan & Lorber, Inc., identified as "Bretton Woods Utilities As Built Drawings" (As Built) with a revision date of "10/1999," but the drawings were not kept updated. Attachments 3A and 3B are compilations of those drawings.

    AWC's "Water Main and Valve Inventory" indicates 82 valves with 8 valves that are 16-inch in diameter.[15] Safety Staff created a summary of Rosebrook system valves with notes and comments and labeled it Table 2-1 in Appendix C. Staff noted that AWC kept separate record systems for valve information, but those records were inconsistent and resulted in conflicting information. The failure to integrate valve inspection historical data and water technician comments can lead to confusion especially during an emergency response.

    Staff found when reviewing 1999 Provan & Lorber As Built records that those records contained important valve information such as valve characteristics and prior inspection findings. The following discrepancies were found when reviewing valve inspection records associated with the 1999 Provan & Lorber As Built:

    - Sheet 2 depicts 15 valves with the following data entries: 2 valves did not operate, 6 valves had turning open issues, 3 valves could not be found, and 4 valves seemed ok.
    - Sheet 3 depicts 10 valves with the following data entries: 4 valves did not operate, 5 valves seemed ok, and 1 valve was full of gravel, which would suggest the valve nut was unable to be operated.
    - Sheet 4 depicts 17 valves with the following data entries: 4 valves did not operate, 11 valves seemed ok, and 2 valves were full of gravel and did not turn. Safety concluded that 6 valves did not operate, based on those entries.
    - Sheet 5 depicts 13 valves with the following data entries: 3 valves did not operate, 9 valves seemed ok, and 1 valve was full of gravel and could not be turned.
    - Sheet 6 provided no valve information.
    - Sheet 7 depicts 1 valve but included no inspection results.

    Although AWC did not acquire the Rosebrook Water System until the fall of 2016, records obtained from AWC revealed valve inspections conducted by AWC personnel only for the year 2018. Valve inspection records for 2016, 2017, 2019 and 2020 were missing or non-existent. AWC used Valve Tracking Spreadsheets (some containing photos), and information was inconsistent with the 1999 Provan & Lorber drawings. These inconsistencies are as follows:

    - Sheet 2 depicts 15 valves with the following data entries: 2 valves did not operate, and 12 valves were noted as good.

[15] The subsequent plan sheets included a valve table with headings labeled: Valve Numbers, Valve Locations, Valve Types and Sizes, with the following notations for certain valves: "turns to open 11/4/99", "turns to open 11/5/99", "turns to open (new)" , date, and comments.

- Sheet 3 depicts 13 valves (additional valves installed for new developments since 1999) with the following data entries: 4 valves did not operate, 1 valve could not be located, and 8 valves were noted as good.
- Sheet 4 depicts 18 valves (additional valves installed for new developments since 1999) with the following data entries: 3 valves did not operate, 1 valve could not be located, and 14 valves were noted as good.
- Sheet 5 depicts 14 valves (additional valves installed for new developments since 1999) with the following data entries: 3 valves did not operate, 1 valve could not be located, and 10 valves were noted as good.
- Sheet 5 also depicts 1 valve for map sheet 7 with no inspection results.

Analysis of the records obtained from AWC indicated that water main valves had been inspected in 1999, and that the next documented valve inspection occurred during the first week of November 2018. There has been no additional information provided to date to indicate any other valve inspections scheduled other than in 1999 and 2018. Based on these findings, AWC failed to inspect valves in 2016, 2017, 2019, and 2020. AWC also failed to maintain records of the required annual inspections for 2016, 2017, 2019, and 2020. Therefore the Company is not in compliance with Puc 606.04(c).

13. Puc 607.03(a) – Safety Staff was provided electronic copies of the 1999 Provan and Lorber As Built system maps. In Docket DW 19-131 AWC filed several sheets of system maps identified as "Rosebrook Water System – Water System Record Drawings Date 2019".[16] The filed sheets indicate there are 13 sheets to the original document, which clearly indicates the 2019 document to be the most recent system maps, separate from the current engineering proposal documents listed in Element 3 of this report. Other than the identified 1999 Provan & Lorber As Built plans, AWC did not readily have available what would be considered their most recent and up-to-date utility system maps and plans. However, AWC staff later provided documentation to include the 2019 Rosebrook Water System Record Drawings. A significant issue regarding all maps and plans obtained from AWC was and remains the accuracy of any maps and plans identified as As Built documents. Analysis of the interview information collected in Element 5 of this report led Safety Staff to conclude that the As Built water system distribution maps and plans depict numerous conflicts and therefore have questionable accuracy. Horizons Engineering personnel confirmed that although their company and their predecessor company Provan & Lorber, Inc. had been hired to produce design plans of the water and sewer distribution system, they were not hired to validate the completed construction of said systems or to provide accurate As Built plans. Horizons Engineering personnel also confirmed the As Built plans should not be relied upon for DigSafe or other uses.

    Inspections conducted of the Company's facilities and equipment continued to reveal and validate the inaccuracies of the provided Provan & Lorber, Inc. As Built plans.[17]

[16] Sheet 6 of 13, Sheet 9 of 13, and Sheet 10 of 13 are subject to a protective motion for confidentiality filed on 10/1/2019 by AWC. These were filed as data responses to Staff from AWC in DW-19-131 set 2, request 3.
[17] See Attachments 1 and 2. Attachment 1 is a drawing titled "MAP 1 of Rosebrook Water System As Built including Neighborhood Areas generated by PUC Safety Division;" Attachment 2 is a drawing titled "MAP 2 of Rosebrook Water System As Built Contour Elevations generated by PUC Safety Division".

Staff believes the intent of Puc 607.03(a) is to enable a water company to have reliable and useful information to readily conduct field operations and system planning. (*See* Puc 607.01: Station Records. Each utility shall keep sufficient records of the operation of its pumping, filtering, chlorinating and other units to show the characteristics and performance of each.) Safety concluded that the Company is not in compliance with Puc 607.03(a).

14. Puc 608.01 Safety Instructions – Each utility shall adopt comprehensive instructions for the safety of employees in regard to the operation, construction, and maintenance of its plant facilities, and shall require that such employees have been properly informed of safe practices and are cognizant of all hazards involved.

    During the course of this investigation and with the understanding that this investigation was a direct result of testimony and evidence provided by Mr. Vaughan of AWC to the Commission, Safety concluded that Company personnel are aware of serious safety issues associated with AWC's operation of a high pressure water distribution system.

    Throughout this investigation, Mr. Vaughan stated several times that he was concerned for *operator/consumer safety* and that he believed that, due to the pressure situation, the concern was more for *operator/consumer safety* than a *product safety* hazard.[18]

    Records were obtained from AWC regarding the Company's safety policy and procedures. A review of Appendix D - AWC Safety Policy revealed little if any substance to the one-page document titled "SAFETY POLICY." This undated written policy stated: *"Every employee of this organization, regardless of his or her position or length of service has the responsibility to follow safe work practices and to have a genuine concern for the safety and health of fellow workers."* In essence, the one-page policy provided to Safety describes a quarterly payment reward to an employee who works safely without injury, and mandates the use of safety shoes "for all employees who handle heavy objects or use heavy tools."

    Site inspections conducted during this investigation revealed numerous potential safety hazards to employees that at the most basic level should include the elements of hazard recognition as required by the U.S. Department of Labor Occupational Safety and Health Administration. AWC's "SAFETY POLICY" in Appendix D failed to include guidance regarding the following:

    - Hazard recognition – specific to the type of industry;
    - Lock out/tag out for energized electrical equipment;
    - Use of Personal Protective Equipment (PPE) to include for example, safety glasses, hard hats, hi-visibility clothing for vehicular hazards, etc.;
    - Traffic hazards and motor vehicle operations;
    - Associated water hazards such as drowning or impact from equipment under pressure;
    - Communications to others, especially when working alone or entering potentially dangerous environments;
    - Slips, trips, and falls; and
    - Material Safety Data Sheets (MSDS).

    AWC's safety policy is neither comprehensive nor does it explicitly discuss the safety of employees in regard to the operation, construction and maintenance of the Company's plant

[18] Docket DW 17-165, Exhibit 20, January 4, 2019, page 1.

facilities; neither does the policy require that Company employees have been properly informed of safe practices and are cognizant of all hazards involved. This is not in compliance with Puc 608.01.

Element #3: Staff Review of Historical AWC Proposed Pressure Solutions

Safety Staff's review of the various historical solutions proposed by AWC to resolve the current pressure issue is limited to the three engineering reports prepared by Horizons Engineering in 2016, 2017, and 2018, as well as the Horizons Engineering September 18, 2018 Agreement for Engineering Services. Please refer to Element #4 for an evaluation of the most recent potential alternative solutions, which embodies some of the components of the prior reports.

As previously indicated, the Rosebrook Water System has been in existence and operation for approximately 50 years. The water system has been owned and operated by several different business entities over the years, and numerous developers and property owners have been involved throughout that time frame.

In the past 50 years, engineering design regarding the Rosebrook water and sewer systems for the most part has been performed by engineering personnel from Provan & Lorber, Inc. Engineers and Planners, which has its main office in Contoocook, NH. Provan & Lorber engineering personnel designed the existing water and sewer systems in Carrol and, based on information gathered through interviews, revised their design documents to create the "Bretton Woods Utilities As Built Drawings, Bretton Woods, NH Water Main and Sanitary Sewer Plans". These plans identified Revision No. 5 - 10/99 as the last revision date.[19]

Subsequent to Provan & Lorber closing their firm after some thirty years, Horizons Engineering, Inc., which is located in Littleton, NH, became the primary engineering firm contracted by NH water system owners, including Abenaki. Safety Staff obtained useful historical and status information regarding the on-going water pressure reduction project from Horizons Engineering.

Under Abenaki Water Company's ownership of the Rosebrook system, Horizons Engineering produced three separate engineering reports between 2016 and 2018, prior to the 2021 report noted above.

The following information provides an evaluation of the three Horizons Engineering reports. Appendix F contains redacted copies of these reports taken from Exhibit 20 filed by the Company in Docket DW 17-165. The following highlights are based on the unredacted (public) sections of the reports.

1) Horizons Engineering, Inc. July 15, 2016 Report
System Evaluation for Pressure Reduction
Rosebrook Water Company Bretton Woods, New Hampshire
for Abenaki Water Company, Plainville, CT

System highlights are laid out on pages 1 and 2 of the July 15, 2016 report under the heading of "System Overview". In sum, the Rosebrook water system includes two wells (Production Well #1, with a 43-foot depth and a reported yield of 322 gallons per minute (GPM), located inside the

[19] Attachment 3A and 3B show the complete set of drawings.

existing pump station building, and Production Well #2 with a 52 foot depth and a reported yield of 450 GPM, located outside the existing pump station building approximately 90 feet to the southeast); a Pump Station (single-story metal framed building on a concrete slab rebuilt in 2008 after piping failure; no booster pumps or hydro-pneumatic storage; pumps operate based on water level in atmospheric storage tank with pumps as the sole source of head for system; building also houses well head and drive motor for Well #1 along with chemical feed pump, system controls and alarms for wells); a Tank (circa 1970s, 650,000 gallon, cast-in-place concrete that is partially buried, elevation of 2010 feet); Distribution System - primarily cement-lined ductile iron and C900 PVC mains with approx. 32,600 feet of main; service connections primarily "k" copper with brass fittings; system pressures range from 50 to 185 psi; service connections at lower elevations equipped with individual pressure reducing valves; fire hydrants; 16" gate valve at intersection of Route 302 and Base Road is inoperable.

Page 5 of the July 15, 2016 report describes the engineering conceptual improvements for the pressure reduction plan to reduce system pressures to a maximum of 100 PSI static pressure. In sum, this concept was designed to maintain certain existing components in their current locations, including wells, transmission and distribution mains, and the 650,000 storage tank; add three new booster pumps and three new system pressure reducing valves; and replace the two existing well pumps with two new pumps.

2) Horizons Engineering, Inc. March 20, 2017 Report Rosebrook Water Company Bretton Woods NH Hydraulic Modeling

Page 1 of the March 20, 2017 report states that "*At the request of New England Service Company (NESC), Horizons Engineering has collected data on the Bretton Woods water distribution infrastructure, performed a field visit, and completed hydraulic modeling of existing and proposed future conditions. The overall goal of these efforts was to finalize the proposed approach for implementing a system-wide reduction in operating pressures.*" This report summarized Horizon Engineering's work activities and modeling, noting that NESC's preferred design approach was to reduce system operating pressures to less than 120 PSI at the main system pump station.

Page 4 of this report notes that Horizons Engineering personnel identified challenges to their prior hydraulic modeling analysis that included assessments of well pump performance based on the pump curve data provided to them by Rosebrook staff. Engineering personnel commented in this report that the pump issue suggested the pump curve may be incorrect, the flow meter may be incorrect, or the pressure gauge may be incorrect. Horizons Engineering further indicated "*Despite the extensive data evaluation efforts and determining the most representative demand distribution, the information above does not provide adequate information to fully calibrate the model.*" Horizons Engineering further identified modeling performance challenges as they noted partially closed valves and that "RWC reports the main valves haven't been exercised in several years, possibly since 1999." Additionally, this report noted "*RWC reports the curb stops are exercised each year. Given the infrequency of main valve testing, this is a critical last-ditch program to minimize home flooding and should be continued*."

This report, as indicated and based on Horizons Engineering modeling efforts, assessed two alternatives. Alternative #1 is the basis for the July 15, 2016 Horizons Engineering report, which incorporated into its modeling analysis the existing water storage tank, modification of the well pumps, and the addition of three booster stations and three system pressure reducing valves.

Alternative #2 in this report incorporates the existing water storage tank with a new dedicated tank supply pipeline, adds two booster stations and pressure reducing valves to create four separate pressure zones. In this alternative, the approximately 4,300 foot dedicated tank supply pipeline would have no taps to this main and the pump station discharge pressure would remain high (at around 190 PSI) to fill the tank, but the distribution system would be fed by gravity from the tank while utilizing pressure-reducing valves to lower system pressures.

Horizons Engineering indicated in this report that NESC selected Alternative #1 as the preferred modification to reduce pressure on the system.

In this second report, Horizons Engineering provided "Table 5 - System Modifications Alternatives Comparison," identifying pros and cons for both alternatives. Although this preliminary comparison noted that Alternative #2 includes installation of approximately 4,300 feet of dedicated pipeline from existing well pumps to pump directly into the existing 650,000 gallon tank plus the installation of booster pumps and pressure reducing valves, Table 5 depicted more "Pros" than "Cons" for this alternative. Conversely, the only "Pros" noted in Alternative #1 included not requiring the installation of major pipelines; however, more "Cons" noted among other items higher operation and maintenance costs due to the additional booster pump station.

On page 61, In regards to water hammer, the report states "the system has experienced occasional issues with water hammer, the last occurring for approximately one month during summer of 2016…..however, no specific cause has yet been identified…..events can cause pressure gauges to lose their calibration, so readings from existing pressure gauges installed before water hammer events may be suspect."

3) Horizons Engineering, Inc. September 5, 2018 Report Analysis and Recommendations Summary – Abenaki Water Company Rosebrook Water System

In its third report, Horizons Engineering indicated its familiarity with the Rosebrook Water System since its staff had begun their initial design work on the system in 1987. AWC requested recommendations in this report on future capital improvements from Horizons Engineering.

As noted on pages 1 - 2 "The higher pressures in the system have reportedly caused problems with leakage and premature failure of valves, fittings, pumps and other appurtenances and operational and safety challenges in the day to day operation and maintenance of the system." Horizons Engineering further stated that "Since acquiring the System in September 2016, AWC has recognized the hazards associated with operating the water system at high pressures. Past incidents of pressure related issues have reportedly disrupted service." Other than a significant component failure within the pump station that occurred in 2010 and the water main break that occurred on Easter Sunday 2019 on the Omni Mount Washington property, no other "past incidents" of utility

component failures were identified during the course of this investigation. All parties involved in this investigation were offered multiple opportunities through interviews and requests for documentation to validate these statements, as noted in Horizons Engineering's reports and docket filings. AWC was also questioned on into investigation into reported events, yet nothing has been produced to date. In fact and as indicated in the interview element of this report, Mr. Vaughan stated that he did not believe the water pressure issue to be a product safety hazard.

In this third report, Horizons Engineering indicated on page 3 "At the request of the AWC, Horizons Engineering evaluated the System in July 2016 and recommended alternative methods to lower the maximum system pressure to 100 psi maximum. The recommendations include installing pressure reducing valves and constructing three new pump stations while maintaining the temporary use of the existing tank." The report then described a four-phase plan as requested by AWC to mitigate rate shock to customers.

The phasing outline as described appears to involve many new elements of concept designs, even beyond the alternatives described in Horizons Engineering's first and second reports. Phase I included a re-design of system improvements to include a new water storage tank at a lower elevation. Phase II included construction of a new water transmission main and one booster pump station. Phase III included construction of two additional pump stations and pressure reducing valves. System operating pressures would be reduced to 100 PSI through these phases. Phase IV included construction of a new storage tank designed to replace the existing tank. Horizons Engineering concludes with its recommendation to adopt this "multi-phased project."

4) Horizons Engineering, Inc. September 18, 2018 Agreement for Engineering Services

This written agreement is between NESC (Client) and Horizons Engineering Inc. (Engineer), as submitted to NESC by Horizons Engineering. The "Project Understanding" statement provides as follows: "To facilitate the pressure reduction the Client intends on ultimately constructing a new atmospheric storage tank at an elevation of approximately 1,810, which will reduce operating pressures in the system from approximately 185 PSI to approximately 100 PSI at the well field pump station." This design concept would ultimately include three new booster pump stations, a pressure reducing valve, reconfiguration of well pumps, and additional valves to isolate high pressure zones. Well yield assessment and well pump design is included within this agreement.

5) Summary of Staff Review of Historical AWC Proposed Pressure Solutions

Staff created Table 3-1 to emphasize the key elements reviewed and provided an overall summary that compared the three Engineering Reports and the 4th Agreement for Engineering Service that contained more information regarding the pressure production proposals.

Element #3: Staff Review of AWC Proposed Pressure Solution

ELEMENT #3 TABLE 3-1 SAFETY STAFF REVIEW OF HISTORICAL AWC PROPOSED SOLUTIONS				
	Horizons Engineering July 15, 2016 Report	**Horizons Engineering March 20, 2017 Report**	**Horizons Engineering Sept 5, 2018 Report**	**Horizons Engineering Sept 18, 2018 Contract Service Agreement**
EXISTING STORAGE TANK 650,000 GAL (Y/N)	Y	Y	Y	N
NEW STORAGE TANK 750,000 GAL S (Y/N)	N	N	Y [1]	Y [1]
NEW 10,000 GAL STORAGE TANK (Y/N)	N	N	N	N
RESOLVES CHEMICAL INJECTION PROCESS AT LOWER PSI (Y/N)	Not Discussed	Not Discussed	Not Discussed	Not Discussed
REDUCES PRESSURE (Y/N)	Y	Y	Y	Y
IF YES, TO WHAT PSI?	**100 psi**	**120 psi**	**100 psi (after all phases completed)**	**100 psi**
ALTERNATIVES CONSIDERED?	N	Y (2 BASIC ALTERNATIVES)	Y	Y
PHASES OF PROJECT	N	N	Y (4 PHASES)	Not Discussed
NEW BOOSTER PUMP STATIONS (Y/N)	Y	Y	Y	Y
NEW PRESSURE REDUCING VALVES (Y/N)	Y	Y	Y	Y
REQUIRES GENERATORS (Y/N)	Y	Y	Y	Y
REQUIRES EASEMENTS (Y/N)	Y	Y	Y	Y
MINIMIZES "OPERATOR/EMPLOYEE SAFETY"(Y/N)	Y	Y	N	Y
NEW WELL PUMPS AND STATION Y/N	Y	Y	Y	Y
PROJECT COST	**$1.4 M**	**Not Discussed**	**Not Discussed**	**Not Discussed**
1 Size and location were not selected				

Element #4: Evaluation of Potential Alternative Solutions.

Overview

During the course of its investigation, the Department of Energy's Enforcement Division Safety Staff identified what appears to be an impasse in a years-long ongoing need to address customer complaints and system issues due to water pressure concerns. To date, none of the proposed limited conceptual design options considered by the Company have been implemented. As noted in earlier sections of this investigation report, identified challenges to this process to address the pressure issue include topography, weather conditions, customer service, fire protection needs, water utility management decisions, water utility system maintenance, inaccurate utility system maps, project costs and funding, existing uncorrected New Hampshire Department of Environmental Services (NHDES) violations, property easement disputes, possible design alternatives, rate impacts, current customer needs of the existing water system, and, most recently, the proposed acquisition of NESC by Aquarion Water Company. Discussions regarding the noted issues regarding Abenaki Water Company's operations in Carroll appear to have been percolating with little to no resolution for years.

Nationally recognized fire protection codes require fire protection system designers to evaluate water supply sources for reliability, including adequacy of pressures and flows. Through the course of this investigation, the Safety Staff identified a number of fire safety issues that raise some concern. Several existing fire suppression systems located at the Mount Washington Hotel, for example, require residual pressures that exceed 125 PSI. Many of the existing systems have utilized 150 PSI or higher existing static pressures.

The complexities of designing a pressure reduction project such as the one Abenaki is undertaking, can have significant impacts on existing fire protection systems. Should the water utility system operating pressures be reduced as proposed by Abenaki through its engineering consultants, it is very likely that some, if not many, of the existing fire protection systems will not function as designed. This may require installation of on-site fire pumps, for example. If the flow in gallons per minute is reduced below existing fire protection system designs, then other water supply options need to be evaluated. Possible supply options could include looping existing dead-end water mains or constructing additional on-site water storage tanks to supplement the utility supply. Construction of a new water storage tank at a high elevation, for example, might be considered. However, winter weather conditions in the Bretton Woods area has already proven to be a serious challenge to AWC in accessing the existing storage tank at a high elevation.

The following information details the **project chronology and current status of the water pressure reduction project**.

On December 24, 2020, Abenaki Water Systems entered into an agreement with Horizons Engineering to provide design documents and specifications in AWC's efforts to achieve compliance with NHDES violations. In early 2021, NESC entered into a contract with Horizons Engineering to prepare and produce a Basis of Design Report for the pressure reduction project. In March 2021, AWC and engineering personnel from Horizons Engineering began virtual group meetings with stakeholders and

interested parties in an effort to inform as well as receive input from invitees. These web-based meetings included agenda items such as the presentation of engineering approaches and analyses of the system by Horizons Engineering. Additional agenda items included proposed locations of pump stations and related appurtenances, the need for performing fire hydrant flow tests, and the process of obtaining easements for the locations of the proposed pump stations.

On March 26, 2021, Horizons Engineering personnel presented in a project start-up meeting a "Conceptual System Improvements for Pressure Reduction Phase I Overall Plan" dated March 24, 2021.[20] The Safety Division was informed during its field investigations process that the Phase 1 Overall Plan was, in effect, an update of the 2016 Horizons Engineering report. The intent of the plan as presented was to design a system upgrade project that would build upon the 2016 report to reduce current system operating pressures of 190 PSI to approximately 100 PSI while maintaining a minimum of 35 PSI during all flow conditions. The 2021 conceptual plan still proposed three booster pump stations and two pressure reducing valves, and well pump upgrades, but with an option of constructing an approximately 2,000-foot "cross-country" water main in lieu of one of the booster pump stations. This cross-country main was proposed to cross the Bretton Woods Ski Slopes east to west. However, based on follow-up interviews conducted by the Safety Staff, AWC determined that this was not a good option. Horizons Engineering personnel agreed that the installation of the proposed cross-country main would be challenging due to the changes in elevation and the potential of hitting ledge during the installation process.

Additional items presented in the March 2021 start-up meeting included design upgrades to the chemical feed systems with containment and, as requested by NESC, the identification of a feasible location for a future water storage tank on the north side of Route 302, and the requirement to meet existing fire sprinkler system flow and pressure requirements.

Subsequent to this first start-up meeting, Omni Mount Washington, LLC, through its consultant, provided feedback considerations to all invitees upon the request of AWC.[21] Comments included, among other things, pros and cons of a new storage tank and location versus updating or replacing the existing tank, electrical power needs, fire flows, back-up generators for the new equipment, relocation of the existing 16-inch water transmission main currently located underneath the latest addition to the Bretton Woods Base Lodge, looping of mains, and the reduction of pressure to a minimum of 35 PSI.

On April 9, 2021, NESC and Horizons Engineering presented updates to invitees that included minor changes to the concept plan to include a designated property lot for a potential future water storage tank on the north side of Route 302. Other items presented included satellite views identifying potential locations for booster pump stations and pressure reducing valves, and lot-owner information.

On April 23, 2021, NESC and Horizons Engineering continued discussions with invitees to include design alternatives, future water storage tank locations, easements, fire suppression system demand requirements, booster pump station needs, generator needs, costs to create two separate pressure zones, and continuing updates to the base maps.

[20] Email correspondence dated March 24, 2021 from Horizons Engineering, Inc. to K. Walsh, Safety Staff and other parties.
[21] Email correspondence dated March 25, 2021 from Omni consultant to K. Walsh, Safety Staff and other parties.

On May 27, 2021, Mr. Vaughan of NESC communicated via email to invitees advising them that Horizons Engineering would be submitting a Basis of Design Report to NHDES within the week. Mr. Vaughan further commented that Horizons Engineering had completed an assessment of more definitive booster pump station locations to be utilized for discussions regarding easements.

Subsequent to this email communication from Mr. Vaughan, representatives from Omni Mount Washington, LLC communicated via email to Mr. Vaughan and the invitees their surprise regarding the new information contained in Mr. Vaughan's email. Omni personnel noted the numerous meetings held since March 2021 and expressed their frustration that, to date, no consensus had been reached regarding the water pressure project. Omni personnel further expressed surprise that AWC planned to submit a Basis of Design Report to DES within the week even though the filing deadline had been identified as August 2, 2021. Omni personnel reiterated their concerns as expressed for several years now that they still did not have any basis to judge whether all available design options had been considered and whether the best and most cost effective solution had been selected. A response email from Mr. Vaughan attempted to assure Omni and the other invitees that AWC intended to provide ample opportunity for all parties to review and comment, and that it was AWC's intent to mutually arrive at the most cost-effective solution. Mr. Vaughan further commented in his response email that "Abenaki is also dedicated to obtaining the least expensive and optimum engineered solution as well as one that complies with DES' Letter of Deficiency (LOD)."

Horizons Engineering, Inc. Updated System Evaluation for Rosebrook Pressure Reduction

On June 4, 2021, Horizons Engineering, as directed by AWC, presented to the invitees an "Updated System Evaluation for Pressure Reduction Rosebrook Water System Report" dated May 2021. This report included information on system components, water demands, pressures, system piping, and hydraulic modeling results, conceptual improvement options with construction cost estimates, summary findings, and concept plans. Appendix E contains the "Updated System Evaluation for Pressure Reduction Rosebrook Water System Report" dated May 2021.

General information provided in the May 2021 report indicates that the system contains approximately 32,600 feet of water mains with an average daily demand (based on calendar year 2015) at approximately 110,000 gallons per day (GPD) with a peak pumping day of 279,000 gallons in January 2015. Horizons provided average system demands for 2017 through March 2021 noting ranges from 91,430 GPD (in2020) to 115,810 GPD (in 2021). Elevation and pressure information was consistent with Route 302 at approximately 1,575 feet in elevation and the storage tank at approximately 2,010 feet with system static water pressures in excess of 200 PSI. Fire hydrant flow testing as performed in May, 2021, revealed available flows depending on elevations to range from 1990 gallons per minute (GPM) to over 9,000 GPM.

Within the section entitled "Conceptual Improvements Options for Pressure Reduction" of its May 2021 system evaluation report, Horizons Engineering described three overall design concepts for full and/or partial pressure reduction. The following provides a summary of those improvement concepts with various options presented:

Concept Improvement 1 – maintains use of the existing 650,000 gallon storage tank and replaces existing well pumps with two new well pumps. Three options are proposed under this concept improvement. Two options (1A and 1B) are proposed to reduce system pressures; option 1C does not address system pressures.

Option 1A – new pumps with the same flow rates in gallons per minute with system pressures reduced to 90 PSI. Requires three new booster pump stations with emergency generators and one new pressure reducing valve. The chemical injection process remains the same. Easements for pump station locations would be required. Estimated construction costs are $3.2 million.

Option 1B – similar to 1A, but adds a new 10,000 gallon storage tank at the well site for chemical injection at a lower pressure (20 PSI). System pressure is reduced to 90 PSI. Estimated construction costs are $4.1 million.

Option 1C – similar to 1B, but lowers pump discharge pressures only for chemical injection. Additional new pumps will not lower system pressures, which will remain at 190 PSI. Estimated construction costs are $1.2 million.

Concept Improvement 2 – replaces the existing 650,000 gallon storage tank located at high elevation site with a new 750,000 gallon storage tank to be installed at existing lower elevation well site, and replaces existing well pumps with two new pumps modified for chemical injection at lower water pressures. Two options (2A and 2B) are proposed to reduce system pressures.

Option 2A – requires three new booster pump stations with emergency generators, but no pressure reducing valve is required. Easements would be required. New pumps at current well station location would provide same flow rate in gallons per minute with system pressures reduced to 90 PSI. Estimated construction costs are $6.5 million.

Option 2B – new pumps at the pump station would provide same flow rate in gallons per minute with partial pressure reduction to 155 psi throughout the system. This option does not require additional booster pump stations with emergency generators, nor does it include pressure reducing devices or easements. Estimated construction costs are $3.3 million.

Concept Improvement 3 – includes replacement of existing 650,000 gallon storage tank at high elevation with new 750,000 gallon storage tank at a lower elevation site located north of Route 302. System pressure would be lowered, with new chemical injections at lower pressures.

Option 3A – in addition to replacement of the existing tank as noted, this option would require an additional 10,000 gallon tank at a new pump station located at the existing well site, along with three new booster pump stations with emergency generators, but no pressure reducing valve would be required. New well pumps would fill the new 10,000 gallon tank, and additional new pumps would fill a new 750,000 gallon tank north of Route 302 while providing same flow rate in gallons per minute with system pressures reduced to 90 PSI. Easements would be required. Estimated construction costs are $6.3 million.

Horizons Engineering, Inc. summarized its findings with several key items noted, as follows:

- Rosebrook Water System has operated under same pressure conditions in excess of regulatory recommended limits for approximately 50 years;

- Pressure reduction will significantly reduce existing fire flows in lower pressure zones that currently flow at lower elevation sites in excess of regulatory requirements (except for the Mount Washington Hotel); fire flows in gallons per minute are most likely compliant at the upper elevation sites;
- Pressure reduction will improve operator safety at the existing pump station;
- Pressure reduction will improve chemical injection operations;
- Above-grade piping in the existing pump station presents the greatest hazard potential to system operators;
- Existing pump station equipment will require upgrades to system components due to age and chemical exposure, which is currently accelerating component deterioration due to the existing corrosive system environment;
- Piping and appurtenances in the system appear to be appropriately rated for existing system pressures;
- Water hammer issues - especially within the north side of Route 302 - require attention. An option to correct this is to extend the existing 16-inch water main at the end of Fairway Village to the Mount Washington Hotel as previously identified;
- Six existing inoperable water main valves will not be fixed by pressure reduction measures, which do not alleviate the need for replacement of those six critical valves.

Regarding the most recent design concept information proposed for the reduction of higher system pressures to the Rosebrook Water System, Safety Staff is in agreement with the summary statements as presented by Horizons Engineering.

Safety Staff Review of June 4, 2021 Options 1A, 1B, 1C, 2A, 2B and 3A.

Evaluation and analysis by Safety Staff of the most recent design concept information from Horizons Engineering in its June 4, 2021 presentation, which listed six options in three categories. Safety Staff summarized the six options with key features denoted in Table 4-1, as follows:

ELEMENT #4 TABLE 4-1 SAFETY STAFF EVALUATION OF ALTERNATIVES SUMMARY						
	Option 1A	**Option 1B**	**Option 1C**	**Option 2A**	**Option 2B**	**Option 3A**
EXISTING STORAGE TANK 650,000 GAL (Y/N)	Y	Y	Y	N	N	N
NEW STORAGE TANK 750,000 GAL S (Y/N)	N	N	N	Y	Y	Y
NEW 10,000 GAL STORAGE TANK (Y/N)	N	Y	Y	N	N	Y
RESOLVES CHEMICAL INJECTION PROCESS AT LOWER PSI (Y/N)	N	Y	Y	Y	Y	Y
REDUCES PRESSURE (Y/N)	Y	Y	N	Y	Y	Y
IF YES, TO WHAT PSI?	**90 psi**	**90 psi**	**190 psi**	**90 psi**	**155 psi**	**90 psi**
NEW BOOSTER PUMP STATIONS (Y/N)	Y	Y	N	Y	N	Y
NEW PRESSURE REDUCING VALVES (Y/N)	Y	Y	N	N	N	N
REQUIRES GENERATORS (Y/N)	Y	Y	N	Y	N	Y
REQUIRES EASEMENTS (Y/N)	Y	Y	N [1]	Y	Y	Y
MINIMIZES "OPERATOR/EMPLOYEE SAFETY" (Y/N)	Y	Y	N	Y	Slightly	Y
ALTERS "PRODUCT SAFETY" (Y/N)	N	N	N	N	N	N
NEW WELL PUMPS AND STATION (Y/N)	Y	Y	Y	Y	Y	Y
PROJECT COST	**$3.3 M**	**$4.1 M**	**$1.3 M**	**$6.5 M**	**$3.3 M**	**$6.3 M**

1 Easements may be necessary for new 10 K storage.

The most expensive options and least expensive options vary significantly by factor of 5.4 (6.5/1.2) and are identified below:

- Most expensive is Option 2A at $6.5 million with two new tanks to replace the existing storage tank, new pumps, new booster pump stations with generators, and new equipment for chemical injection at lower PSI. This option reduces system pressure to 90 PSI, and would require easements, long-term maintenance of booster pumps, and additional equipment with higher maintenance and operating costs than other options.
- Least expensive is Option 1C at $1.2 million using the existing tank, adding a new, smaller tank primarily for chemical injection at lower PSI, and new booster pump stations with generators. This option does **not** lower system pressure.

The remaining options are ranked from higher to lower cost as follows:

- Option 3A at $6.3 million adds two new tanks while replacing the existing storage tank, adds new pumps, new booster pump stations with generators, and provides for chemical injection at lower PSI. This option would reduce system pressure to 90 PSI and require easements, long-term maintenance of booster pumps and additional equipment requiring higher maintenance and operating costs than other options.
- Option 1B at $4.1 million using the existing storage tank, adding a new, smaller tank primarily for chemical injection at lower PSI, new pumps, booster pumps with generators, and pressure reducing valves. This option would reduce system pressure to 90 PSI and require easements, long-term maintenance of booster pumps, and additional equipment requiring higher maintenance and operating costs than other options.
- Option 2B at $3.3 million adding one new storage tank to replace the existing storage tank, new pumps, and chemical injection at lower PSI. This option would reduce system pressure to 155 PSI. No additional booster pump stations or pressure reducing devices would be needed; therefore, no easements are required. This option would require far less maintenance and lower operational costs since there would be no new booster stations and generators added.
- Option 1A at $3.2 million using the existing storage tank, adding new pumps, booster pumps with generators, pressure reducing valves, and minimizing the chemical injection process, but only at existing high system water pressures. This option would reduce overall system pressure to 90 PSI, and would require easements, long-term maintenance of booster pumps, and additional equipment with higher maintenance and operating costs than other options.

Safety Staff General Evaluation and Findings Regarding Alternatives Considered

General Evaluation

Although the least-cost option, Option 1C does nothing to reduce system pressures, which is the primary goal of the project. Adding a smaller tank primarily allows for the chemical injection process to occur at a lower water pressure. System pumping equipment will remain at the current high pressures, so this option does little to address operator and employee safety concerns.

Options 1B, 2A, and 3A each come with higher costs, including more operational and maintenance costs, and the need to acquire property easements. All three options would reduce system pressure to 90 PSI. However, the proposed pressure reduction does not take into consideration the operational impacts to existing fire protection system design requirements of AWC's largest customer. This would likely result in significant increased costs to that customer, given its approximately 60 percent share of the overall system demand.

The remaining two alternative concepts, Options 1A and 2B, are close in cost estimates, but are based on different design concepts using components with long-term maintenance and operational cost impacts, as well as easement requirements.

Option 1A would continue to use the existing storage tank at its current high elevation, which is a known challenging locational issue, as stated in docket filings by AWC. This option would require new booster stations with generators that will cost more to operate and maintain over the long term, and property easements would be required. This option would reduce system pressure to 90 PSI.

Option 2B would replace the existing high-elevation storage tank with a new tank at a lower elevation and new pumping equipment. This option would not require additional booster pumps, generators, or easements. Therefore, operational and maintenance costs likely would be lower than Option 1A over the long term.

Unresolved Considerations Regarding Pressure Reduction Alternatives

AWC's engineering consultants have provided six options intended to lower pressures on the Rosebrook system. Four of the six options lower water pressures sufficiently to meet DES and PUC regulatory requirements; one option reduces system pressures but does not meet DES or PUC requirements; the remaining option does not reduce system pressures at all. Most of the proposed alternatives only ensure compliance with applicable requirements for the chemical injection process.

Safety Staff is reluctant to propose a "best" option based on the six alternatives provided, as those alternatives were not complete in presentation or substance, which left unresolved considerations regarding the proposed Pressure Reduction Alternatives.

After performing the general evaluation described above, Safety Staff determined 13 outstanding concerns[22] that remain regarding the alternatives presented by AWC or its engineering consultants:

1. Prior to proffering the six options presented as concepts requiring further design analysis, AWC did not exercise or exhaust any waiver request options available for regulatory agencies.[23]

2. The installation of additional localized pressure reducing valves (prvs) within the existing distribution system, including within each of the residential developments, was not included in Options 1A, 1B, 1C, 2A, 2B and 3A. This measure has also not been explored as a standalone alternative option. The benefits of localized prvs include the elimination of the need to add generators, the ability to operate the system within existing system pump discharge pressures, the possibility of strategically locating each valve, and potentially lowering overall costs to address pressure issues. This unexplored alternative would also leave higher pressures available for the existing fire suppression systems at the Mount Washington Hotel. This option would result in a scenario in which high pressures exist only in the limited portions of the system considered "transmission" and alleviate the current situation in which the remaining majority of the system's water distribution mains operate at high pressures.

3. Option 2B would reduce system pressures, but with a design concept of 155 PSI that would continue to exceed regulatory requirements for both DES and the PUC. One option might be to seek waivers from DES and the applicable regulatory authority (the PUC and/or Department of Energy, as applicable) while upgrading the system with option concepts that

[22] The 13 items listed are not shown in any particular order of priority.
[23] Maximum System Pressures are promulgated in DES Env-Dw 404.01(a), Design Standards for Large Public Water Systems (100 psi), and Puc 604.03 pressure requirements (125 psi).

include an improved chemical injection process and a new storage tank which ultimately would eliminate the high pressures as well as the need for any regulatory waivers.

4. AWC has neither separated nor established a clear line of demarcation between existing requirements and general duties regarding maintenance of existing equipment and pipeline components and new requirements that are necessary only for any newly selected pressure reduction project. In its evaluations, AWC has conflated consideration of the proposed pressure reduction alternatives with the correction of past maintenance and operational deficiencies.

5. AWC has not identified impacts associated with long term maintenance and operational expenses, such as costs associated with any proposed booster pump station, monthly electrical costs of new equipment, and higher operating expenses associated with each option considered. Annual inspections of any generators and related expenses was not discussed.

6. AWC has not identified any end of service life replacement costs for the three booster pump stations or the three associated generators contemplated in Options 1A, 1B, 2A, and 3A. Options 1C and 2A do not require any booster options.

7. Staff believes an Overall Evaluation Matrix for all six alternatives should have been provided with all elements considered that would allow for an "apples to apples" comparison to be made regarding each option. This would have enabled all stakeholders to better understand the concept designs and the considerations involved with each design. Similarly, Pros and Cons should be listed for each of the six presented conceptual designs.

8. AWC did not explicitly consider any impacts on the water system of customers' existing fire protection system designs in its consideration of proposed alternatives. While Omni initially was not responsive in providing its customer fire protection system information to AWC, this was a critical factor requiring consideration given the size of the Omni buildings and the complexities associated with multiple fire protection systems currently utilized within the historic properties. Both domestic water needs and fire protection needs must be considered individually as well as in totality. An improved alternative model analysis would potentially yield such impacts.

9. AWC did not consider contingencies regarding scenarios in which easements are not obtained. The potential impacts of easements and lack of easements were not considered in the calculation of costs for each option or in the assessment of basic design options. Specifically, Options 1A, 1B, 2A, 2B and 3A did not mention design impacts or what further options need to be considered if easements are not acquired. All options are based on design requirements predicated upon the attainment of easements.

10. AWC did not present any other potential options that may have been considered prior to the six identified options. Staff was not made aware of any alternatives that may have been considered but eliminated for various reasons prior to those listed in the three reports noted

in Element #3. Preliminary drafts of the three published Horizons reports, if they existed, were not provided to Safety Staff.

11. AWC's most recent Updated System Evaluation for Pressure Reduction report, shown in Appendix E, did not provide any modeling option that considered connecting the 16-inch nominal diameter existing water main at the end of Fairway Village to the existing 8-inch diameter main near Valve 7A, as shown on Attachment 1 Safety Staff approximates this to be an 1,800-foot extension using either a 16-inch diameter or a 12-inch diameter main. The benefit of this approach would be the creation of a looping of mains surrounding the Omni hotel, which would result in increased flows and increased reliability of domestic and fire protection services by providing the availability of more options during a disruption. This also would alleviate AWC's current reliance on mains that may enter and exit the Mount Washington Hotel, about which Omni has expressed uncertainty regarding the installation and construction methods used for the main that connects Hydrants 53 through 56, as shown on Attachment 1. The Safety Staff depicted this in Appendix H.

12. AWC proposed on March 20, 2017 and again in a presentation on April 23, 2021 a potential 40-foot main connection to Base Station Road from the 8-inch diameter dead-end main that currently feeds the Mt. Washington Hotel. Unfortunately, Safety Staff found that although this proposal offered a minor improvement with relatively little benefit, it highlighted the unreliability of the As Built plans when used for modeling, since there was no evidence a 12-inch main had ever been installed on Base Station Road for future development envisioned further east. This decreased the credibility of the inputs used in modeling, in Staff's opinion.

13. Neither AWC nor its engineering consultants appear to have incorporated or used any recognized formal process for refining estimated Project Level costs for the six options presented. Cost estimate classification systems were not used that typically identify estimated class or maturity levels of construction estimates with expected tolerance ranges and construction grade estimates. There are many project estimation classification processes available that could be used, such as ACEE International's Recommended Practice 18-R-97 and others. As a result, the resulting cost estimates vary for the six options by nearly 485% from $1.3 million to $6.5 million without identifying what level of estimate was used for each.

Element #5: Field Investigations Conducted

The Safety Staff completed six field inspections between March 2021 and May 2021 and employed numerous investigation methods during its assigned review. Methods included studying, observing, examining and collecting data regarding the pressure reduction proposals being considered as well as data regarding general operational and maintenance activities. In addition, interviews were conducted that revealed informative contributing factors in determining the conclusions and recommendations reached.

Methods

The methods used throughout Element #5 were:

- Analyze the specific local topography such as the elevations for fixed components such as the pump station and the water storage tank and the overall customer base location elevations;
- Study the utility observable components, such as locations of pump station, fire hydrants, water main valve covers, storage tank, etc.;
- Examine utility customer locations such as the Mt. Washington Hotel, Bretton Arms Hotel, and the residential homeowner associations and associated streets;
- Observe and collect data for Safety Staff GIS mapping on locations of verifiable utility components and equipment such as the pump station, fire hydrants, valve covers, elevations, etc.;
- Observe and collect data on AWC's scheduled fire hydrant flow testing with staff from AWC and Horizons Engineering;
- Observe and collect data on water utility customer fire protection system design requirements;
- Collect data during utility employee attempts to locate their facility components such as water mains and valves as identified on existing Provan & Lorber, Inc. Bretton Woods Utilities As Built Drawings, revised 10/1999 plans[24], Horizons Engineering , Inc. Rosebrook Water Company Existing Water System Assets, dated September, 2013[25], and Abenaki Water Company Rosebrook Water System Record Drawings, dated 2019[26];

Observations

Observations and field inspections by Safety personnel occurred on the following dates:

1) March 11, 2021
2) April 2, 2021
3) April 14, 2021
4) April 22, 2021
5) May 19, 2021

[24] Attachment 3A and 3B to this report
[25] Attachment 5 Rosebrook Water Company Existing Water System Assets, dated September, 2013 prepared by Horizons Engineering, Inc.
[26] Attachment 4 Abenaki Water Company Rosebrook Water System Record Drawings, dated 2019

6) May 24, 2021

1) Observations from March 11, 2021 first site investigation:

Safety personnel began the initial assessment "boots on the ground" inspection of the area and general facility equipment and locations. Snowpack was moderate, thereby limiting locating many facility components to include many fire hydrants as found buried in snow and inaccessible only to be generally identified by hydrant-attached marking location stakes. During this initial and unannounced site inspection, Safety Staff met with AWC operations personnel and Horizons Engineering personnel in the area of the pump station. Preliminary access was provided to Safety Staff after introductions and a detailed explanation as to the investigation assignment from the PUC Commission. This preliminary observation of the pump station revealed a pump discharge pressure at approximately 200 pounds per square inch (PSI) with the majority of piping fittings stamped or embossed at higher pressure ratings at 250 PSI.

Safety Staff then exited the pump station to observe the general area surrounding the pump station to include a fire hydrant, the emergency generator, and the second well head location. The generator and the second well head were found to the north of the pump station, both appearing to be intact.

Safety Staff continued this area assessment collecting data such as observable fire hydrants as found within the following developments: Crawford Ridge, Presidential Views, Forest Cottages, Rosebrook, Mountain Views, Mount Washington Place, Dartmouth Ridge, and Mount Adams. Safety Staff also began to assess the fire hydrant locations as found within the Mt. Washington Hotel property.

Photo #5-01 Depicts corrosion of pump station piping components.

Photo #5-02 Depicts main system shut off valve noting storage of corrosive chemicals.

2) Observations from April 2, 2021 second site investigation:

Safety Staff scheduled this second site visit as primarily an interview process with Omni Resorts personnel and their engineering consultant. This interview process continued with specific site examinations limited to the Mt. Washington Hotel property in order to gain a better understanding of the water distribution system as it relates to the hotel property and the fire protection system requirements.

Omni Resorts personnel provided their best information as to the locations of water service supply lines and fire hydrants located generally around the hotel. Safety Staff then preliminarily examined the internal fire protection system risers for data with the intent to return for a more in-depth focus and collection of available fire protection design data. Safety Staff understood from Omni personnel the hotel including the newer additions had approximately 15 or more fire protection risers with approximately 10 risers in the older hotel section (northern end of the structure). Preliminary observations revealed fire protection system risers had on average 160 PSI or more during this examination.

Overall observations on this first site visit provided a better understanding into the complexities of the fire protection system water supply needs as it relates to the overall water system pressure issue.

3) Observations from April 14, 2021 third site investigation:

This third site investigation provided continued opportunity to examine and locate AWC facility components as snow pack had melted with exception to the ski trails, which remained covered with snow. This prevented access at this time to the water storage tank located to the south of Route 302 in an elevation of approximately 2000 feet within Bretton Woods Ski Slopes. No AWC or engineering company personnel were present during this second investigation visit.

Beginning in the area of the pump station, Safety Staff observed piping, fittings, and valves located in areas adjacent to the pump station in what appeared to be general stock piles. Examination of these components revealed a mix of ductile iron pipe and plastic pipe, commonly known as PVC (polyvinyl chloride) pipe. Pipe valves were found to be rated for 250 PSI with 16-inch pipe fittings and valves scattered within a stock pile. The light-blue PVC piping found within this stockpile displayed severe weathering deterioration most likely resulting from years of exposure to sunlight and the environment. A prior discussion with AWC operations personnel revealed the stock piles had been there for some time and ownership of all the components was in question. Furthermore and although examination of these components revealed adequate pressure ratings for these products, there was and is no guarantee that any of these similar products were specifically used for the water utility.

Safety Staff then continued to the area beyond the pump station for further examination of the fire hydrant in the area south of Drummond's Ski Shop, located on Route 302. The location of this fire hydrant and a water valve was found to be extremely peculiar in that these components were found within a wooded area behind the ski shop essentially inaccessible for any fire department use. During examination of this fire hydrant location, the current owner of the ski shop approached Safety Staff and indicated this fire hydrant and water main was installed northward from the pump station area many years ago. This information conflicted with AWC's As Built water distribution system plans.

Safety Staff then continued observation of utility components in the area of Route 302 and Base Station Road adjacent to Fabyan's Station. While Safety Staff located a water main valve cover believed to be for the 16-inch transmission water main that crossed Route 302 from the pump station along Base Station Road, Safety Staff then observed colored mark-outs along the road surfaces. These painted mark-outs were found to be consistent with DigSafe requirements for locating and marking utility facilities and equipment. Further detailed examination of this area included Route 302, Base Station Road, and Fabyan's Station property. This examination revealed the following painted scheme as found on the noted roadways and properties and consistent with Puc 800 rules[27]:

- White painted mark-outs – these identified the proposed area for excavation, essentially the boundary of the proposed work zone;

[27] See Element #2 Item 6 for further discussion and photos of observation.

- Red painted mark-outs – these identified the existence or non-existence of electrical utilities;
- Orange painted mark-outs – these identified the existence or non-existence of communications utilities

Safety Staff examined this area along with AWC's provided As Built Water system maps, of which all documents clearly depicted the existence of the 16-inch water transmission main that extended northward from the pump station. This 16-inch water main depicted on all As Built plans was and remains the single source of water for all the developments including the Omni Resorts properties along Base Station Road and all streets connected to Base Station Road. Examination of the completed work in this area revealed numerous utility poles and steel cable pole anchors installed for traffic signal lighting equipment for work on the Route 302 bridge crossing the Ammonoosuc River. Even with questionable accuracies of the AWC As Built water system facilities, there was and is no doubt the water utility was required to be contacted in order for AWC to respond and appropriately mark-out their water system facilities. This investigation, which identified violations of the Puc 600 rules and the Puc 800 rules for underground utility damage prevention, revealed further serious water utility failures in that the 16-inch water main valve for this 16-inch transmission main was found to be inoperable for approximately 20 years. Had any of the installation of the utility poles and/or the steel anchors impacted the single source 16-inch transmission water main, there would have been no way to shut off and isolate the single feed transmission main to the entire north-side of Route 302. Location of other significant 16-inch transmission water main valves would have required water utility personnel to shut off valves farther up in the area of the Bretton Woods Base Station Ski Lodge. However, shutting off the closest water utility valves in this area in order to prevent draining the water storage tank up within the higher elevations, would have essentially shut down the entire system. The pumps would have to be shut down as well since the 16-inch valve to isolate the northern transmission main was inoperable as noted. This realistic scenario would have left the Rosebrook, Mountain View, and Forest Cottages developments as the only areas within the entire water utility system with a water supply had the valves been shut off quickly enough to prevent the water storage tank from draining. With the water supply pumps also being shut off, there would have been no way to fill the 650,000 gallon water storage tank located high up in the ski trails. Another significant and crucial element of this scenario is the response time for AWC operations personnel who indicated their response time was generally well over one hour from their New Hampshire home office in Gilford, assuming personnel were in the office during normal business hours.

Due to the nature and extend of the underground utility damage prevention violations, a separate investigation was subsequently opened within the Safety Staff's DigSafe program. Please refer to this separate investigation report.

Safety Staff continued this investigation and examination of water facility components in the area of the Mt. Washington Hotel. This examination included coordination with hotel security personnel to document existing fire protection system components while noting associated water pressures on the systems. Static or standing water pressures ranged from 160 PSI to over 225 PSI, assuming accuracy of gauges. Examination of a limited number of fire protection system riser's revealed hydraulic demands of over 110 PSI to 135 PSI residual (or remaining) pressures while flowing several

hundred to 880 gallons per minute for the design of the systems. Hotel personnel were questioned and advised to seek guidance from their fire protection companies and fire protection design teams in order to be able to properly determine the greatest water supply demand in pressure and flow in order for these code-required fire protection systems to properly operate as designed.

Photo #5-03 View of several fire sprinkler system risers at Mt. Washington Hotel.

Photo #5-04 View of a Mt. Washington hotel fire sprinkler system pressure gauge noting 225 psi.

Photo #5-05 View of hydraulic data plates on Mt. Washington hotel fire protection, noting a system demand of 135 psi.

Safety Staff then proceeded to examine further exterior fire hydrant and valve cover locations on the hotel property and later on the Bretton Arms Hotel site to update Safety Staff GIS mapping.

Additional areas examined included eastward along Base Station Road in the area identified as the extension of the 12-inch water main along this road to the farthest eastward future development phase. Valves and valve covers identified on the AWC As Built water distribution system maps were not located during this examination, but Safety Staff was able to locate two valve covers farther west along Base Station Road. These two valve covers were located in the area of the Horse Stable access road and both valves were identified on As Built maps as the valves controlling water to the Mt. Washington Hotel for an 8-inch water supply main and for the Bretton Arms Hotel for a 6-inch water main. These two water mains provided both domestic and fire protection system water supply.

4) Observations from April 22, 2021 fourth site investigation:

This fourth site investigation was scheduled with AWC operations personnel in an effort to locate and identify water utility facilities. Weather conditions on this visit had deteriorated with high sustained winds and blowing snow throughout the day. The specific goal was intended to further evaluate the AWC As Built water system distribution plans with the attempt to resolve plan inconsistencies and reported conflicts. Although the weather conditions proved difficult throughout the day, snowfall contributed to better observations of water utility employee mark-outs with the blue paint readily observable in the snow.

Safety Staff met with AWC operations personnel as we began the day in and around the pump station again observing the active pump discharge pressure at approximately 195 PSI. At this discharge pressure, customers located within a similar elevation of this pump station would receive similar pressures after accounting for pipe design friction losses as Safety Staff understood there were no pressure reducing valves downstream of this pump station. Two separate chemical feed pumps, located within the pump station building, were noted to be labeled for 250 PSI with 21 gallons per hour flow (GPH) and 350 PSI with 18.10 GPH. Aboveground piping within this pump station building displayed a range from newer valves and fittings to older, corroded valves and fittings including mechanical hardware bolts and nuts. Storage within this pump station building also included water treatment chemicals (corrosives), tools, equipment, and electrical panels and pump control equipment.

Examination of the pump station building revealed the area of greatest employee safety to be related to chemical injection equipment and water main control valves that displayed corrosion most likely resulting from equipment age, wear-and-tear, and the corrosive atmosphere from stored chemicals.

Photo #5-06 View of pump station components with stored corrosive chemicals, creating corrosive atmospheric environment.

Safety Staff then continued this scheduled examination with AWC personnel in an attempt to locate AWC utility facilities, such as the location of crucial water main isolation valves. AWC personnel used several locating tools during this process to locate components around the pump station with an average success rating. Of significance within this area was the importance in locating the 16-inch valve identified as "Valve 3D" add map and photos that isolates the entire north-side of Route 302 water supply. It is this valve that would have been the first valve for AWC operations employees to shut-off in the event of a water main break to the north downstream of this valve. The significance of this valve location and operation was further identified as a critical system component based on the DigSafe violations observed during the April 14th site investigation.

Safety Staff then proceeded to the area of Route 302 and the Base Station Road intersection whereupon the prior Safety Staff investigation inspection revealed the numerous issues related to the active installation of utility poles and steel anchors in and directly around the 16-inch transmission water main. According to the AWC As Built water system maps, this 16-inch water main extends northeast from the pump station crossing Route 302, then heading east-southeast along the northern side of Base Station Road. AWC operations personnel continued efforts to locate this 16-inch water main and any associated valves within this area with same personnel marking the general location of the 16-inch water main with blue painted streaks. The current snowfall

condition provided a white background for this blue paint mark-out process thereby aiding this investigation and the reader of this report.

Photo #5-07 Blue dotted line represents approximate location of 16" transmission main crossing US Route 302 toward Base Station Road. Recently erected utility poles were installed within immediate area of transmission main, as shown.

Results of this water utility mark-out process, which was not completed by AWC personnel as required prior to the bridge construction work in this area, resulted in the confirmation the installation of utility poles and anchoring systems clearly entered the water utility facility space. The significance of this issue cannot be understated as identified during this investigation.

Safety Staff and AWC personnel proceeded to further validate the existence of utility facilities eastward along Base Station Road in the area around the Bretton Wood Stables and farther eastward in what has been identified on AWC As Built documents as the 12-inch water main extension on Base Station Road. This 12-inch water main that was reportedly installed and connected to the 16-inch main in the area of Fairway Village and then extending eastward past Mount Adams Lane was not located. AWC personnel indicated they would continue efforts to locate this 12-inch main at a later date. Safety Staff then continued this day's site examination and data collection in and around the Mt. Washington Hotel, the Mount Washington Place development, and the Dartmouth Ridge development ending in and around the Mount Adams and Mount Madison developments.

Photo #5-08 View of Safety Staff personnel utilizing GPS data equipment to verify location of water infrastructure.

5) Observations from May 19, 2021 fifth site investigation:

Safety Staff observed AWC scheduled fire hydrant flow tests as conducted on this date by AWC and Horizons Engineering personnel as they continued to evaluate the water distribution system flow and pressures for their on-going design work. Hydrant flow tests performed on this date include areas in the Mount Washington development, the Dartmouth Ridge development, the Presidential Views development, and Mountainview development later ending on the Mt. Washington hotel property.

Photo 5-9 View of fire hydrant flow testing as conducted by AWC personnel and their engineering consultant Horizons Engineering.

During today's scheduled investigation, Safety Staff observed additional DigSafe violations located on Dartmouth Road at an active construction site. As previously identified during Safety Staff's site investigations, no AWC water utility mark-outs were observed for this site. Add photos

During the course of attempting to flow fire hydrants on the Mt. Washington property, a fire hydrant to the east of the hotel when initially opened, was found to have the hydrant water supply valve partially closed. This condition rendered this fire hydrant unusable in the event of a fire emergency. It was unknown at this time if any other fire hydrants were also in a similar inoperable condition due to use by on-site contractors. AWC personnel then contacted the hotel whereupon personnel responded for their notification. AWC personnel ultimately was able to operate the hydrant water supply valve leaving this valve in the fully open position with a fully functional fire hydrant. The fire hydrants on the Omni properties were confirmed to have no annual inspections and flow tests for the 2020 year and ongoing due to the outstanding complaint and docket filed with the PUC. Understanding the position of both AWC and Omni and until the complaint is resolved, the failure to inspect, maintain, and flush the fire hydrants on Omni property presents a serious life safety hazard.

Safety Staff then continued to examine the location of the 650,000 gallon water storage tank located up within the ski slopes of the Bretton Woods Ski Resort. Observation of this area revealed the grade-level structural roof of this underground storage tank. The roof covering appeared to be intact; however, there was no security fencing either around or protecting any element of this water storage supply tank.

Photo 5-10 View of underground storage tank located in area of Bretton Woods ski slope depicting lack of security fencing.

Safety Staff then proceeded to examine the location of 16-inch water transmission main valves as identified on the AWC As Built plans to the immediate west of the Bretton Woods Base Lodge. Observation of several valves revealed the 2003 era building addition constructed to the south of the Base Lodge was constructed directly over the 16-inch transmission water main and as confirmed by Omni staff during this inspection.

Safety Staff then returned to the Mount Adams area to again meet with AWC personnel to continue the location process of water main valves in this area finishing this day's examination.

6) Observations from May 24, 2021 sixth site investigation:

Examination by Safety Staff on this date was limited to the Bretton Woods Base Lodge area to locate additional water utility system components and valves in the Rosebrook development area.

Interviews

Safety Staff conducted interviews throughout the course of this investigation, which included interviewing personnel from:

1) Abenaki Water Company/ New England Service Company
2) Omni Resorts
3) Horizons Engineering, Inc.
4) New Hampshire Department of Environmental Services
5) Bretton Woods Property Owners Association

Interviews were conducted during the Field Site Visits when operating personnel were present but also conducted via conference calls on both a scheduled basis and impromptu follow ups throughout the investigation. Detailed information of each interview of the 5 organizations is provided below.

1) Interview Information of Abenaki Water Company-(Multiple Interviews):

Abenaki Water Company:

On March 26, 2021, Safety Staff initially phone-contacted AWC and spoke with Mr. Donald Vaughan. (Mr. Vaughan was previously identified in prior docket filings as the President of the New England Service Company and during the course of this investigation, he was later identified as the Vice President of Operations). This introductory call provided the opportunity for Safety Staff to advise Mr. Vaughan of this investigation assignment.

During this initial discussion, Mr. Vaughan questioned whether Safety Staff believed there was any doubt on safety concerns for their water system. Safety Staff responded indicating we did not know as we were recently assigned this task as part of the investigation order. Safety Staff indicated we would be seeking information as to the pressure ratings of water utility facility components such as piping, valves, and fittings. Safety Staff commented that separate from regulatory mandates for water pressure requirements, it was extremely important to identify if an imminent safety hazard existed such as piping and fittings that, as existing were not rated for the current reported pressures around 200 PSI. Mr. Vaughan commented he believed there were two safety paths – one for operator/employee safety and one for product safety and that all the product components were rated for 250 PSI or above. Mr. Vaughan stated he did not believe the water pressure issue to be a product safety hazard and that there was a lot of misrepresentation on the water distribution system As Built plans. Mr. Vaughan indicated he believed the non-metallic PVC (polyvinyl chloride) piping to be a “C900” classification pipe, but he was not certain of the dimensional ratios (wall thickness values).

Mr. Vaughan continued to discuss the safety element stating again the pressure situation was more of a hazard to their employees and to the consumer rather than a product safety hazard.

During this initial phone conference with Mr. Vaughan, Safety Staff scheduled a visit with AWC staff to meet on Thursday, April 1, 2021 at AWC’s Gilford, NH office. Mr. Vaughan was advised Safety Staff would need to review documentation such as water system maps and As Built plans.

As scheduled, on April 1, 2021, Safety Staff Mr. Joseph Vercellotti and Kenneth Walsh met with personnel at AWC's Gilford, NH office. In attendance for AWC were Mr. Vaughan, Office Manager Ms. Teri Kucka, and Operations Manager Mr. Taylor deOgburn. As previously indicated, AWC has no New Hampshire employees as the individuals are employed by the New England Service Company.

Safety Staff began by an overall review of our investigative tasks acknowledging our prior site meeting at AWC's pump station in Bretton Woods when we first met with Mr. deOgburn. Safety Staff explained to AWC personnel during this and subsequent meetings, we would be seeking information and documentation to include: water system As Built plans and maps, piping and system component specifications, maintenance reports for hydrants and valves, information on any specific events to the system, investigation or root-cause analysis by AWC or their vendors, and information regarding the pressure reduction design project.

Mr. Vaughan began by indicating there were no accurate maps provided from the prior water utility system owners when the Abenaki Water Company, which is a Subsidiary Division of the New England Service Company purchased the Rosebrook Water System (RWS) in 2016. As we began to discuss the system maps, Safety Staff observed AWC's other water systems noting distribution maps hanging from the office walls; however, no maps were noted at this time for the RWS region. After several lines of questioning from Safety Staff as to why we did not have any As Built system maps for the RWS, AWC personnel finally produced a weathered set of plans identified as the "Provan & Lorber, Inc. Engineering, Bretton Woods Utilities As Built Drawings" dated 10/99[28].

Safety Staff began to discuss the basic concepts of the three separate engineering reports as prepared by Horizons Engineering in 2016, 2017, and 2018 in an effort to better understand the history and why after many years and several reports, everyone is still waiting for the design options and associated project details. Mr. Vaughan then provided a general overview of the status of the pressure reduction project noting that Mr. deOgburn met with Horizons Engineering personnel the day prior for discussion on flagging and surveying sites for the proposed construction of booster pump stations so AWC could advise the homeowner associations.

Safety Staff questioned Mr. Vaughan as to the existence of any type of spreadsheet or document that has a basic alternatives analysis options. From Safety Staff's review of the engineering reports, there were few alternatives provided. Safety Staff referred to Horizons Engineering March, 2017, report that had at least provided a basic "Pros and Cons" table for only two options[29]. Safety Staff again questioned Mr. Vaughan as to why are we still here without options for the pressure reduction as this again is what the customers such as Omni Resorts and the various homeowner associations have been requesting. Mr. Vaughan explained that Mr. Jon Warzocha from Horizons Engineering, created this table on his own and that he was not paid for this task. Mr. Vaughan commented they were working with their engineering vendor to address the design as required to be submitted to the NH DES as noted in a December

[28] These plans are referenced in Attachments 3A and 3B were originally created in 1995 and last revised on 10/99.
[29] See Appendix F Exhibit 20 of DW 17-165 (Horizons Engineering Reports dated July 15, 2016, March 20, 2017, September 5, 2018, Table 5 System Modifications Alternatives Comparison – page 67 of 80.

1, 2020 letter sent to AWS[30]. Mr. Vaughan stated it was this DES deadline that pushed them to move on the Basis of Design Report, which will then generate the alternatives spreadsheet. Mr. Vaughan indicated the existing water storage tank was also an issue, especially due to the location up in the ski slopes with respect to the access and the seasonal weather conditions. Mr. deOgburn confirmed as access to this storage tank was generally not possible during the winter and if there was an emergency, it would be very difficult to get to the tank location. Mr. Vaughan commented this is why they were considering the installation of a new water storage tank located somewhere on a property lot on the north-side of Route 302.

Mr. Vaughan was questioned as to input from their customers such as the Omni folks regarding AWC's design basis. Mr. Vaughan stated that although AWC was seeking input from Omni, we can't get Omni to provide options as it is very convoluted.

Safety Staff questioned Mr. Vaughan on their due-diligence investigations and analysis of the Rosebrook Water System prior to their purchasing the company in 2016. Mr. Vaughan stated that prior to the purchase of the RWS, they researched the company and discussed incidents and thought they could fix the issues with the RWS. Mr. Vaughan indicated the prior system operator advised him they did not have time to flush fire hydrants, so they would call the local fire department and they did it. Mr. Vaughan believed some of the water hammer complaints most likely resulted from fire department hydrant flushing as he recalled a water hammer issue in the Stickney development area.

Safety Staff questioned AWC personnel about safety issues and their concerns if any. Mr. deOgburn indicated he was concerned as the RWS Operator when he entered the pump station building, describing it as "scary" when he entered the building. Mr. deOgburn stated he believed the exposed aboveground valves were stressed due to the higher system pressures. Mr. deOgburn indicated he had very limited prior historical knowledge of any issues as he had been with the AWC for only several years. No other specific safety concerns were offered at this time by AWC personnel.

Safety Staff questioned AWC personnel on maintenance of the system to include valves and hydrants. Mr. Vaughan indicated they were in the process of updating their system documentation to include computer software designs as there are valves that are either not accessible or the valve location is unknown. Mr. Vaughan commented the pressure reduction construction project will help root out the valve locations. Safety Staff continued to discuss the valve issues as detailed notes on the 10/99 revised As Built drawings indicated many valves were either inoperable or maintenance was required[31]. AWC did not provide any other information regarding valve maintenance as required, other than to acknowledge many valve locations were unknown.

Safety Staff questioned AWC personnel as to their subsurface work regardless of emergency or non-emergency timing on any of their system components, such as valve maintenance and replacement, repair of broken mains, etc. Mr. deOgburn indicated very little underground work

[30] See Appendix G DES Correspondence Regarding Letters of Deficiency for Sanitary Surveys of 2019 and 2010.
[31] See Attachment 3A 1999 Provan and Lorber As Built Drawings Sheets 1-4 and Attachment 3B 1999 Provan and Lorber As Built Drawings Sheets 5-9.

had been done, other than downstream of their curb valves for some copper service lines and new service connections in the area of Hartford Lane at which time he found some ductile iron piping.

Mr. Vaughan continued to discuss his concern for operator safety during any of their operations, but offered little substance regarding his concerns other than to state they would be the first to correct an identified safety concern.

Regarding further identification of their distribution system components as Safety Staff questioned identified conflicts as identified by Safety Staff review, Mr. Vaughan indicated they would need to dig test pits and perform analyses along with flow tests to update their system plans. Mr. Vaughan stated they would replace valves during the construction process.

Mr. Vaughan continued that he believed there were very limited options to correct the high system pressures with these options requiring booster pump stations. Mr. Vaughan again reiterated he was not concerned with the safety of the system products as he stated the safety relative to materials is minimal. Mr. Vaughan commented the material has stood the test of time referring to the length of time the piping and system components had been installed and in-use.

Safety Staff questioned AWC personnel on the maintenance of reported existing pressure reducing valves that were required by AWC for their customers and located on the customer's property. Mr. deOgburn indicated he believed the in-home pressure reducing valves were in rough shape and that Mr. Paul Mueller from the homeowners association contracts with a local plumber to check and test the pressure reducing valves. Both were questioned as to a count or list of who and where these pressure reducing valves are located with Mr. Vaughan and Mr. deOgburn indicating they were not really certain of the count and location as their Customer List of PRV's was not accurate. Safety Staff questioned AWC personnel as to customer complaints with AWC personnel indicating they were not aware of any specific complaints.

Safety Staff questioned Mr. Vaughan on company-provided safety training and any investigations processes for any type of event. Mr. Vaughan commented their company does provide training and with regard to any type of investigation process, he indicated that he and Mr. deOgburn would look at photographs and generally discuss the issue. Regarding the Easter Sunday, 2019 water main break on Mt. Washington Hotel's property, Mr. Vaughan indicated they believed after looking at photographs that a pipe saddle broke, which caused the damage.

Safety Staff questioned AWC personnel on their use of contractors with Mr. Vaughan and Mr. deOgburn indicating they contract with Excavator David Scalley and Excavator F.X. Lyons for some repair work when needed.

Safety Staff questioned AWC personnel on any reported water hammer issues and whether AWC planned on testing the two wells to determine overdrawing potential. Mr. Vaughan commented there were few water hammer issues as of late and that no testing had been performed to determine whether the wells were being overdrawn. Mr. Vaughan commented they will do this during construction. During the course of this investigation, Mr. Vaughan

stated “We don’t have time to flush fire hydrants, so we’ll call the fire department, they did it in the Stickney area and I think they caused the water hammer”.

Mr. Vaughan was questioned as to AWC’s policies and procedures for their investigation processes regarding any leaks or equipment failures. Mr. Vaughan stated he and his staff now review photographs if taken. AWC was unable to produce the required documentation, if taken, substantiating any investigations conducted.

As we concluded this scheduled interview process, Safety Staff questioned AWC personnel as to their next action item(s) for the pressure reduction engineering analysis. Mr. Vaughan indicated they were planning to schedule fire hydrant flow tests with Horizons Engineering for the end of April, weather permitting. Mr. Vaughan commented they were looking at two design options – the first one considered a cross country water main installation across the ski slopes from the Rosebrook development area to the Crawford Ridge development area, and the second option included the installation of three booster pump stations and pressure reducing valves while using the existing water storage tank. Mr. Vaughan stated though that the first option to install a new main across the ski slope was not a good option.

Prior to leaving this meeting, Safety Staff requested a copy of the full set of Provan & Lorber As Built plans for AWC’s water distribution system.

During the course of this investigation, Safety Staff continued to meet in April (15, 21, and 27) May (4, and 21) and June (3) 2021 with AWC personnel in an effort to collect documentation to include:

- Records pertaining to system pressure;
- Reports of pressure complaints and copies of required E-14 forms;
- Records of service interruptions and reports;
- Annual meter tests and copies of required E-15 forms;
- Copy of Underground Utility Damage Prevention Program;
- Records of flushing of dead-end mains;
- Annual fire hydrant maintenance and records along with copies of E-17 forms;
- Valve inspections and records;
- System distribution maps and AWC RWS System Record Drawings;
- Copy of AWC Safety Policy;
- Copies of accident reports, if any.

It is important to note that extensive time was required by AWC personnel to create systems and collect data for information and records that should have been readily available as the requested documentation is mandated by Chapter Puc 600 Rules for Water Service. Preservation of Records as described in Puc 607.05 and more specifically as required in Puc 607.05 (b) “The utility shall make such records available to the commission or its staff upon request at the utility’s office located in the state of New Hampshire.”

Safety Staff recognized and appreciated the efforts and cooperation by AWC personnel, specifically Office Manager Ms. Teri Kucka and Operations Manager Mr. Taylor deOgburn. As

identified during the course of this investigation, both individuals assisted Safety Staff to their best efforts in what appeared to be over-and-above their normal work responsibilities.

As identified by Safety Staff during this investigation, violations of the Underground Utility Damage Prevention Program referred to as "DigSafe," generated a separate investigative action by Safety Staff. Please refer to separate investigation report.

On April 15, 2021, Safety Staff met with AWC Office Manager Ms. Teri Kucka to review numerous sections of the Chapter Puc 600 Rules for Water Service. The intended purpose was to continue the collection of water utility-required data as noted above. Safety Staff provided education to Ms. Kucka as she indicated this was new to her as she had only been in the Office Manager position for less than one year. Safety Staff advised Ms. Kucka to work with AWC personnel in an effort to produce the required documentation, but if required tasks had not been performed, that needed to be documented as well.

Ms. Kucka was also questioned by Safety Staff of any requests to their company for DigSafe matters. Ms. Kucka commented Eversource Electric (ES) had contacted them the day prior to inquire as to whether ES could de-energize electrical power to their pump station. Ms. Kucka had another AWC Water Systems Operator Mr. Eric Messier speak with the ES contact to advise them of the significance of the loss of power to the pump station. According to Ms. Kucka, ES then determined they would not de-energize based on the concerns noted. Safety Staff believed this call to AWC from ES was based on the ongoing bridge repair project that generated the DigSafe violations as observed by Safety Staff during the April 14, 2021 site inspection.

On April 21, 2021, Safety Staff Mr. William Ruoff and Kenneth Walsh met with AWC Office Manager Ms. Teri Kucka to review the DigSafe rules and requirements as explained by Mr. Ruoff. Ms. Kucka was advised that of the five water systems owned and operated by AWC, DigSafe had only their Bow water system utility maps on file and none of the other four systems to include the Rosebrook Water System in Carroll (subject system of this investigation). Safety Staff questioned Ms. Kucka on her knowledge of any direct phone calls to AWC for mark-outs of their water systems. Ms. Kucka indicated it was possible that the Rosebrook Water System Operations Manager Mr. Taylor deOgburn may have been contacted directly for such requests. Ms. Kucka indicated that Mr. deOgburn had also been with the company for a short time as well starting sometime in 2018.

Safety Staff reviewed the AWC one-page Safety Policy and questioned Ms. Kucka as to the existence of anything else that provided substance as a written Safety Policy. Ms. Kucka then phone-contacted Mr. deOgburn on this request and they both acknowledged the creation of this Safety Policy was not within their abilities. During this phone call, Mr. deOgburn commented he supplied some of his own personal Safety Bulletins, but indicated nothing was provided to them as AWC employees. Mr. deOgburn also indicated he believed there may exist AWC job orders, wherein a contractor might have called them directly to perform water utility mark-outs, but he did not recall any specific calls nor was he contacted by the NH DOT for the ongoing bridge repair project. Mr. deOgburn commented he had recently observed the new utility pole sets in and around the Route 302 bridge repair project along with confirming he started employment with AWC in 2018. Safety Staff also reviewed with Mr. deOgburn the next day's (April 22, 2021) site inspection as scheduled with him and Safety Staff in an effort to continue to locate water

utility components. Mr. deOgburn indicated he was prepared with locating equipment and as we discussed reports of unaccounted for water (UAW) as noted in AWC information, Mr. deOgburn commented he believed some of this UAW was due to prior AWC employees failing to document fire hydrant flushing operations.

During this meeting at their office, Ms. Kucka indicated she located several different water system and system design documents, which she indicated she would submit copies to us as requested.

On April 27 and May 4, 2021, Safety Staff met with Ms. Kucka to continue the data collection efforts and to review what had been electronically submitted by Ms. Kucka. With regard to one of the requests for water pressure complaints to their company, Ms. Kucka commented that she was unable to locate any records and that AWC had no information as to pressure complaints. Ms. Kucka indicated that when she spoke with Mr. Vaughan about this issue, Mr. Vaughan advised her to contact the Omni folks to see if they had any records on pressure complaints. Safety Staff informed Ms. Kucka that it is the water utility's responsibility as per the rules to document such complaints.

On May 21, 2021, Safety Staff met with Mr. Vaughan at AWC's office. Safety Staff was questioned by Mr. Vaughan with regard to the context of this investigation. Safety Staff explained this investigation was ordered by the Commission based on much of his evidence and testimony in other dockets filed with the PUC. Mr. Vaughan indicated this was all related to the water pressure issue. However, Safety Staff advised him the filings also raised issues as to whether Abenaki is providing safe and adequate service and facilities and that this is a separate issue regardless of the pressure situation. Mr. Vaughan adamantly disagreed and again commented you can't separate the two. Safety Staff then provided several examples that did not have anything to do with the pressure issue, such as the failure to annually inspect, maintain, and operate water system valves as well as the failure to submit required annual documentation for fire hydrant maintenance and water meter testing. Safety Staff advised Mr. Vaughan after he questioned Safety Staff as to where we were getting the valve information from, whereupon Safety Staff informed him this information was found in their own company-provided records as requested during this investigation. Safety Staff informed Mr. Vaughan that their records regarding annual valve inspections, maintenance, and operations revealed that the only documentation to validate any valve inspections occurred in 1999 prior to their ownership, but then nothing until 2018. Safety Staff indicated AWC's 2018 valve tracking data identified numerous inoperable valves, such as one of the critical valves that would isolate the distribution system from the pump station for the single-source 16-inch main that crosses Route 302. Safety Staff informed Mr. Vaughan their data entries identified this 16-inch valve to have no guts inside it as described in AWC's documentation. Safety Staff informed Mr. Vaughan that his company was certainly responsible for annual valve inspections since their purchase of the Rosebrook Water System in the fall of 2016 and their records revealed again valves had only been inspected in 2018. Safety Staff commented that many of the same valve issues such as "inoperable" or "need to locate" as noted on the Provan & Lorber 10/99 plans was the same information as found in the AWC valve tracking information. Safety Staff advised Mr. Vaughan that it was clear from his own testimony and filings that it was his intent to repair or replace valves as part of the various construction projects for the pressure reduction project. Safety

Staff questioned Mr. Vaughan as to how then the failure by the water utility to annually inspect and test and operate valves could only be related to the pressure reduction project and not as a stand-alone requirement as mandated by laws and PUC rules to provide a safe and adequate utility service and facilities? Mr. Vaughan had little to offer as a response to this specific question[32].

Safety Staff continued to explain the criticalness of this issue, which was further revealed during Safety Staff's site investigation and inspections noting the DigSafe violations. Safety Staff again stated this failure to maintain and inspect and operate the water system valves was a totally separate issue from the pressure reduction issue and that this failure to maintain these valves was a direct responsibility of his utility to provide for safe and adequate service. Safety Staff questioned Mr. Vaughan as to his knowledge of the DigSafe program, which he indicated he was familiar with it and the similar program requirements in Connecticut as well as his many years of water utility experience.

Mr. Vaughan, when questioned by this investigator, was concerned why we are requesting this type of information, this investigator responded with the existing Dig Safe violation as previously stated as well as providing information to Mr. Vaughan regarding the failure to properly inspect and test valves annually as per water rules. Mr. Vaughan further questioned this investigator as to where my information regarding their lack of valve inspections came from, whereupon I informed him it was found in their provided records.

Mr. Vaughan questioned why the PUC had not addressed the same issues then with the prior water company owner. Safety Staff advised that these issues should be consistently enforced and that Safety Staff could not explain reasons as to why or why not. Mr. Vaughan commented after further discussion on similar annual maintenance issues such as the fire hydrants, that there were many water utilities that are probably similar. Safety Staff responded noting that for example, there should be no reason why a fire hydrant tracking document that revealed deficiencies, continues to identify the same deficiencies for years as this documents the failure to repair the components. Safety Staff indicated that a utility might identify an issue, but may set aside the capital expense and correct it in the next quarter or next year as an example; however, this was not the case as noted in AWC's records. Safety Staff advised Mr. Vaughan their company-provided records noted deficiencies for the same fire hydrants since their purchase of the water system in 2016 with the same deficiency noted in 2020 and therefore, there appears to be no valid reason as to why these fire hydrants were not repaired by his company. Safety Staff again stated this annual fire hydrant maintenance had nothing to do with the pressure situation.

Safety Staff then commented on another investigation component assigned to the PUC Safety Staff, which included the review of design options and alternatives for the pressure reduction project. Mr. Vaughan then commented that if this was the case, they should have just let PUC advise them or pick the option for corrections and they could then have saved a lot of money. Safety Staff advised Mr. Vaughan that it was absolutely not the responsibility of the PUC and Safety Staff to design the corrective action plan nor was it the responsibility of the PUC and

[32] See Confidential Discovery DW 17-165 Staff Set 1-3. See Element #2, Items 11 and 12 for more discussion.

Safety Staff to hand pick the options. Safety Staff commented the purpose was to evaluate the proposed and preferred remedies and to evaluate the potential alternative solutions. Safety Staff indicated this was essentially what their customers such as the Omni Resort representatives and the homeowners associations had been seeking to date and the Commission may certainly request the same information as part of any rate case review. Mr. Vaughan disagreed with this comment stating the PUC does not require this information for a rate increase case.

At this stage of todays' interview process, Mr. Vaughan commented he believed this investigation would result in his company going bankrupt as he further questioned Safety Staff whether it is a forgone conclusion of this investigation? Safety Staff advised Mr. Vaughan that although this investigation is almost completed, the "forgone" conclusion was not determined at this time.

On June 3, 2021, Safety Staff met with Office Manager Ms. Kucka to inquire about any updates for the DigSafe information as Safety Staff was in the area for unrelated inspections. During this visit to their office in Gilford, another AWC employee entered the building who introduced himself as Eric Messier. Mr. Messier indicated he was a Water Systems Operator for some of the other AWC water systems as Safety Staff recalled speaking with him on the phone one day as he was covering for Mr. deOgburn who was off duty.

Safety Staff questioned Ms. Kucka as to their progress in attempting to locate any AWC response information to the many DigSafe tickets as found by Safety personnel during the course of this investigation and the now separate investigation into the DigSafe violations. Ms. Kucka commented that although she had been diligently working on this research project, she was advised by Mr. Vaughan to put this project on the backburner now. Ms. Kucka was apologetic, but Safety Staff advised her she certainly needs to follow orders from her bosses.

As Mr. Messier then entered into the conversation, he began to ask questions about their responses to requests for mark-outs for the DigSafe program also indicating he, Ms. Kucka, and Mr. deOgburn were in the process of creating a database with documentation to enter specific fields. Safety Staff provided educational information and guidance to include their photographic documentation and recordkeeping of each request. During this discussion, Mr. Messier then began to discuss general safety concerns as he provided photographs of recent project that depicted a confined space entry believed to be in the Gilford area. Mr. Messier's photographic documentation revealed potential and serious safety concerns to include at the very least:

- entry into a confined space that was performed without monitoring the atmosphere (for flammable or combustible or toxic or oxygen-deficiency);
- inadequate safe ingress and egress (Mr. Messier stated another contractor was jumping into the underground vault, which Mr. Messier then used a company ladder for them);
- Lack of hazard recognition training;
- Potential electrical hazards as Mr. Messier indicated the contractors were working on pump equipment.

Safety Staff commented that the AWC was responsible for providing a Safety Policy, but this written policy could either be created by company personnel who were competent and qualified

or the company could choose to hire a Safety Consultant to design the policy and train employees as well. The written Safety Policy should include elements such as but not limited to the following:

- Employee hazard recognition;
- Use of Personal Protective Equipment (PPE);
- Electrical Safety;
- Water hazards;
- Lock-out/tag-out for energized electrical equipment;
- Confined space entry;
- Monitoring hazardous environments;
- Motor vehicle traffic hazards and traffic control;
- Use and storage of chemicals; and
- Material Safety Data Sheets.

This discussion continued as Ms. Kucka indicated that as she was attempting to locate any written AWC Safety Policies or Procedures of which AWC only provided a one-page document, she spoke with both Mr. deOgburn and Mr. Messier about figuring out how to create a policy. Ms. Kucka indicated that after her prior phone calls to New England Service Company (NESC) the parent company, in her quest to locate any safety policies, she was advised that since NESC had none, that she should then contact Aquarion Water Utility. Ms. Kucka was advised to speak with Aquarion Water as their company is in the process of acquiring the New England Service Company and their subsidiary companies to include Abenaki[33]. Ms. Kucka commented she followed directions from her bosses who advised her it would be simpler to use Aquarion's Safety Policy and just copy it and put Abenaki's name on it. Ms. Kucka subsequently contacted the Aquarion Water Company as she was instructed to do so and was ultimately provided a copy of their Safety Policy. Ms. Kucka indicated that after she and Mr. deOgburn and Mr. Messier began to review it, it now raised further safety concerns. Safety Staff did not take a copy of the Aquarion Safety Policy.

As Safety Staff began a cursory review of the Aquarion Safety Policy and taken into context of the safety-related questions posed by AWC employees during this meeting, Safety Staff utilized the Aquarion Safety Policy as an example to Mr. Messier with regard to the Confined Space Entry details. Safety Staff reviewed the same items as previously discussed noting a many safety components to be found in the Aquarion policy. Mr. Messier commented his company did not provide to them any of the instrumentation, nor training, nor personal protective equipment and questioned whether he should refuse to enter a confined space. Safety Staff advised him that he and any other employees need to recognize any potential hazards that could either injure or kill them and that they need to seek guidance from their employer and attorneys due to these serious safety issues. Mr. Messier then requested Safety Staff to accompany him to their storage area as he had additional safety-related questions.

[33] Joint petition filed by AWC and Aquarion Company on April 21, 2021 in Docket DW 21-090 for approval of the acquisition of Abenaki Water Company by Aquarion Company.

Safety Staff followed Mr. Messier to the lower level garage and storage area whereupon Mr. Messier had further questions regarding chemicals, equipment, and storage of flammable and combustible liquids to include gasoline and diesel fuels. After observing the overall storage conditions, Safety Staff provided further education to both Mr. Messier and Ms. Kucka. Safety Staff provided guidance on the proper type of fuel storage containers that were listed for storing flammable or combustible containers as Mr. Messier indicated the AWC policy was to use plastic fuel containers for both gasoline and diesel fuel. Safety Staff informed them of the hazards associated with static discharge when transferring flammable or combustible liquids especially with non-metallic plastic fuel storage containers. Mr. Messier indicated they were told to just use a blue plastic barrel to fill with diesel fuel when needed. This blue plastic barrel was not listed by any recognized agency and it appeared to be an approximately 35 gallon-type container and it was not clear what this container was originally used to store. Mr. Messier indicated they were told to then use a battery-type fuel pump to transfer the fuel to equipment when needed.

Safety Staff commented again about employees being properly trained on hazard recognition as we then discussed hazard warning labels on their stored corrosive chemicals. Safety Staff commented on the need for proper storage, use, and handling while wearing the appropriate type of PPE as well as the ventilation needs for their specific types of chemicals.

Mr. Messier continued to show Safety Staff their storage area whereupon a metallic tripod was observed stored in a corner. This tripod is consistent with equipment used for confined space entry and rescue. Safety Staff advised Mr. Messier that use of this tripod also requires typically a safety harness and a winch or hoisting mechanism at which time Mr. Messier looked around and then located two such items. Mr. Messier stated they were never trained or instructed in the use of this equipment and it appeared to be many years old. Safety Staff commented that such equipment needs to be inspected and maintained as well and the manufacturer should be contacted for information as to how to assess whether the web-belt harness could or should even be used anymore. Safety Staff further indicated it is important to follow the manufacturer specifications as these separate components collectively make up the approved system as listed and tested by the manufacturer.

Mr. Messier then discussed the general storage of aerosol paint cans as he then read the labels recognizing these to be labeled as highly flammable. Safety Staff again discussed the general fire safety and storage requirements suggesting the company may look into purchasing listed and labeled flammable storage cabinets due to the quantity of products stored in their garage storage area.

Safety Staff concluded by thanking Ms. Kucka and Mr. Messier for their assistance in this investigation.

2) Interview Information of Omni Resorts-(Multiple Interviews):

Omni Resorts:

On April 2, 2021, Safety Staff met with Omni Resorts Operations Manager Mr. Christopher Ellms and Consultant Mr. Douglas Brogan, P.E. This initial meeting as scheduled at the Bretton Woods

Base Lodge, was followed up by a visit to the Mt. Washington Hotel to later meet with Director of Loss Prevention Mr. Peter Eakley along with examining the site.

Mr. Ellms provided valuable historic perspectives regarding the chronological development and the relationship with the water utility throughout this period.

Mr. Ellms was questioned on Omni's initial meeting with AWC, more specifically with Mr. Vaughan. Mr. Ellms described this meeting, which occurred in 2016, as antagonistic with a request by Mr. Vaughan for funding of an unspecified amount.

According to Mr. Ellms' historical perspective, there existed years of developers coupled with a mix of Omni property owners. Mr. Ellms indicated to his knowledge, there also existed deferred water system maintenance from the owners of the water utility who also owned the hotel, which were essentially one and the same. Mr. Ellms commented over the time period, water utility employees and their operations of the water system also created water hammers as it was possible that water utility employees were over-pumping the well, which may have resulted in introducing air into the water distribution system. Mr. Ellms indicated the water utility was eventually sold by the owners of the hotel.

Mr. Ellms and Mr. Brogan were questioned on their review and understanding of the Provan & Lorber, Engineering and Horizons Engineering As Built plans along with the possibility the 16-inch water main that supplied the water storage tank was located underneath a building addition to the Base Lodge. Regarding this 16-inch main, Mr. Ellms confirmed an addition to the Base Lodge was constructed sometime between 2001 and 2003 and that this addition to the south of the Base Lodge was in-fact constructed over the existing 16-inch water main. As a matter of reference, this 16-inch water main is the single-source feed main from the pump station to supply the 650,000 gallon water storage tank located southeast in the ski slopes at an approximate elevation of 2010 feet. This 16-inch main is also the single feed line for essentially the entire water distribution system as we discussed during this interview process.

Safety Staff continued the discussion of reported conflicts Safety Staff identified with the As Built water system plans. Both Mr. Ellms and Mr. Brogan agreed there were conflicts to include questions on the existence of the 12-inch main on Base Station Road, which both indicated is proposed to be used for a portion of the pressure reduction project as a connection from the Mt. Washington Hotel to the existing water main.

Regarding the AWC engineering process review for the proposed pressure reduction project, Mr. Ellms and Mr. Brogan indicated they believed very little has been provided to this date with regard to design options and costs for any determinations at this time. Mr. Ellms indicated Omni has attempted to reach out to AWC with no success as it appeared AWC was moving forward with the single presented option of installing booster pump stations and pressure reducing valves, which may or may not be the best solution. Safety Staff questioned Mr. Ellms on the inclusion of an older design comment that identified the construction location of a new water storage tank located north of the Dartmouth Ridge development. Mr. Ellms indicated this would be very difficult, but that AWC has not even discussed this with Omni. Mr. Ellms indicated the various homeowner development associations would also need to provide comment as the lands identified in the most-recent AWC engineering concepts are properties

owned by the homeowner associations and not Omni Resorts. Mr. Ellms further commented this may be challenging as the various homeowner associations have a lack of trust in AWC.

Mr. Ellms commented other issues regarding water flows and pressures seemed to be related to water utility employees and pumping operations and at times, employees may have actually turned off the well pumps forgetting to turn them back on and this may have also been related to employee turn-over.

Mr. Ellms then coordinated a site visit and inspection of the Mt. Washington Hotel to meet with Director of Loss Prevention Mr. Peter Eackley. The preliminary focus of this initial site inspection was to assess the fire protection systems for water supply and basic design criteria if available. This inspection included a basic overview and analysis of the fire hydrants on the hotel property with an effort to identify the water supply to these hydrants.

Safety Staff met with Mr. Eakley to inquire about any documented water pressure complaints to AWC as his security department personnel would typically respond to these types of issues that often activated the fire sprinkler system alarms. Mr. Eakley indicated his personnel noted a water pressure issue within the last day or so and that he made several attempts to notify AWC including contact to AWC's 24-hour emergency contact phone number. Mr. Eakley indicated he was unsuccessful in all his attempts to either leave a message or speak with someone, but he documented this in their entry logs. Safety Staff requested any documentation from Omni personnel in reporting activities regarding water pressure issue complaints directed to AWC[34].

Mr. Eakley along with Mr. Ellms and Mr. Brogan provided access to the general areas of fire protection system risers starting in the northern end of the hotel by the carpentry shop. Examination of this area revealed a combination domestic and fire protection water supply line, which then separated for individual domestic and fire protection systems components. The fire protection feed main then supplied water to a dry alarm valve and ultimately to the fire sprinkler systems located in the older section of the hotel. This dry alarm valve was maintained with compressed air as designed to hold back or close the valve thereby preventing water from entering the fire sprinkler piping until a fire sprinkler fuses or opens. In essence, the fire protection system piping remains "dry" until the fire sprinklers then open thus allowing air to escape the dry piping system with the dry alarm valve then opening to allow water to enter the fire protection system piping. Observation of the water supply pressure below this dry alarm valve revealed a static or standing pressure of 150 to 160 PSI. Omni personnel indicated there were approximately ten (10) fire protection system risers within the older hotel building with perhaps another five (5) or more fire protection system risers in the southern newer building additions.

Although requested by Safety Staff, it did not appear at this time there was any fire protection system documentation for the older hotel systems, but Safety Staff was able to preliminarily review several fire protection system design plan sheets as located in a maintenance and engineering office at the hotel. These documents along with an examination of a limited number of fire protection system risers revealed hydraulic demands of over 110 PSI to 135 PSI residual (or remaining) pressures while flowing several hundred to 880 gallons per minute for

[34] See Appendix B OMNI Pressure Complaints.

the design of the systems. Static or standing water pressures ranged from 160 PSI to over 225 PSI, assuming accuracy of gauges.

Safety Staff then proceeded to inspect the location of several fire hydrants in and around the hotel while questioning Omni personnel as to their knowledge of water supply mains to these hydrants. Information provided by Omni personnel continued to support the single source 8-inch water main feeding the hotel property as connected to the water main on Base Station Road.

At the conclusion of this inspection and meeting, Safety Staff advised Omni personnel of the importance in their ability to identify the most demanding water supply requirements for their fire protection systems to include flow in gallons per minute and pressures. Safety Staff further indicated that depending on how the pressure is reduced by AWC based on their engineering design outcome, this could have a significant impact on Omni's existing fire protection systems as well as any other customer with a fire protection system.

3) Interview Information of Horizons Engineering (Multiple Interviews):

Horizons Engineering, Inc.

Safety Staff initially met on-site on March 11, 2021 with Horizons Engineering representative Mr. Michael Duffy, P.E. as he was working with AWC Operations Manager Mr. Taylor deOgburn. We met with both individuals who were located at the AWC pump station at the time of our arrival. Both individuals were informed by Safety Staff our meeting with them on this date was unintentional as we were performing our "boots on the ground" initial area assessment. Both individuals were also advised as to our presence for the purposes of the investigation assignment per Commission order.

Mr. Duffy indicated during this first meeting that he was planning to perform fire hydrant flow tests as part of their engineering evaluation and design plans intended to correct the water pressure issues. Mr. Duffy was questioned as to his knowledge of any water main breaks as a result of the reported high system pressures. Mr. Duffy commented other than a pipe component failure that occurred within the pump station building many years ago, he was not aware of any specific component failure resulting from the reported high water pressure. Mr. Duffy indicated it was his general understanding the piping and components were most likely rated for the existing pressures. Mr. Duffy then indicated their company was essentially reviewing their 2016 Horizons Engineering Report to determine how this 2016 design can be utilized for the corrections to address the high pressures due to the water storage tank location perhaps with the change from three booster pump stations to two with the installation of pressure reducing valves. Mr. Duffy was advised Safety Staff would coordinate further interviews at a later date during the course of this investigation.

On April 20, 2021, Safety Staff met with Horizons Engineering personnel PE Duffy and Engineer-In-Training Mr. Josh Davis at their Littleton, NH office. Mr. Stephen LaFrance, P.E. with Horizons Engineering attended this meeting via phone call-in. Mr. LaFrance was able to provide valuable

insight into the history of the Rosebrook Water System as he had worked for the former Provan & Lorber, Inc. Engineering Company over the many years of existence.

Mr. LaFrance indicated he had worked for a contractor many years ago installing water mains for this system and he noted the water storage tank was constructed in 1973. Mr. LaFrance stated this region experienced a period of multiple developers over the many years along with the bankruptcies from real estate market upswings and downswings. Mr. LaFrance commented that in 1973, the Mt. Washington Development Corporation constructed the water storage tank with the installation of a 16-inch water main from the single well pump along with the installation of a 16-inch water main to the Mt. Washington Place development along Base Station Road. Mr. LaFrance indicated that sometime around 1985, an 8-inch water C900 PVC water main was installed from Base Station Road to the Mt. Washington Hotel with additional water main installations sometime around 1987.

Mr. LaFrance commented the ductile iron water mains were rated to 300 PSI and the valves were rated to 250 PSI as both he and Mr. Duffy believed the water main system to be a robust system. Both Mr. LaFrance and Mr. Duffy were questioned on what they believed to be known issues with both responding the isolation valves installed in the early 1970's didn't work. Mr. LaFrance commented further work in 1989 included the extension of the 16-inch water main on Base Station Road past Fairway Village for the Sadder Development for an aggressive development concept plan.

Mr. LaFrance was questioned on his knowledge of the reported and identified 12-inch water main that extended eastward from the Fairway Village area connection to the 16-inch water main as this main was to extend services to the farthest-east developments along Base Station Road. Mr. LaFrance believed this 12-inch main to be installed and he was aware of the disputed existence of this 12-inch main. Mr. LaFrance commented there were several developers noting the BW Land Company and the Celebration Company Developers that had permits issued for the Dartmouth Brook Development site to the east along with the proposal to construct a water storage tank in this area. Mr. LaFrance believed these developers may have installed this 12-inch water main before going bankrupt sometime between 2005 and 2007. Mr. Davis commented he received a phone call from AWC Operations Manager Mr. Taylor deOgburn who also did not believe the 12-inch water main was installed on Base Station Road.

Both Mr. LaFrance and Mr. Duffy were questioned regarding their knowledge and understanding of the conflicts and disputed accuracy of the water system As Built plans from the former engineering company. Mr. LaFrance stated that although he was not certain why there existed plan inaccuracies, he did not believe there were any significant safety concerns as he typically designed the mains to be constructed with ductile iron. Mr. LaFrance indicated that the ductile iron mains have been installed for around 50 years of the existence of this water distribution system and the PVC non-metallic piping has been installed for at least 25 years.

Mr. LaFrance provided further insight into the possibility of As Built plan inaccuracies. He commented noting that although the Provan & Lorber Engineering Company provided an intended design of the water distribution system, and due to the multiple developers involved in the project, the engineering company was not contracted to field-inspect the completed work and provide true and correct As Built plans. Mr. LaFrance stated the engineering company was

also not contracted to perform an engineering review of shop drawings nor a review of the material specifications as created and typically supplied by the responsible contractors. Mr. LaFrance indicated as such, the engineering design company would receive a phone call from the contractors to inform the engineering design team of what was installed and where the components were installed. Mr. LaFrance commented that after engineering design personnel received the contractor phone calls, the design personnel would update their proposed design plans and this is the most likely scenario for the As Built plan inaccuracies again since the engineering company was not contracted to validate such reported contractor installations. Both Mr. LaFrance and Mr. Duffy also believe the contractors did not install a metallic tracer wire within the trench and above the PVC non-metallic pipe installations rendering it more difficult to locate the PVC pipe and verify installation.

Horizons Engineering personnel were advised by Safety Staff of the on-going investigation that also now involves extensive issues with the underground utility damage prevention program, commonly referred to as DigSafe. Horizons Engineering personnel all acknowledged their in-depth understanding of the requirements as we continued to discuss the inaccuracies and conflicts of the water distribution system maps for the Rosebrook Water System, which were never provided to DigSafe from AWC as required. Mr. LaFrance stated that due to the inaccuracies of the plans, the Provan & Lorber and Horizons Engineering As Built plans should not be relied upon based on his description of the creation of the As Built documents.

Safety Staff continued to question Horizons Engineering personnel on their concerns, if any, regarding safety of the water distribution system facilities. Both Mr. LaFrance and Mr. Duffy indicated they were not concerned with the safety of the water mains and the water storage tank; however, both had safety concerns with the pump station and piping components with some noting corrosion to components, which can be replaced. Regarding the overall system, Mr. LaFrance and Mr. Duffy believed there was very little maintenance of the water distribution system to include valve inspections. Mr. Duffy indicated there may have been some issues though with water main curb stops over the years. Safety Staff questioned Horizons Engineering personnel on their knowledge of the dimensional ratios (DR), or wall thickness compositions, of the non-metallic PVC installed piping as this has significance on the manufacturer pressure ratings. Both Mr. LaFrance and Mr. Duffy indicated they were not sure of the DR's as to verify this would require excavation and cutting a sample coupon from the plastic piping, which in-turn, might be more damaging than the fact this piping has been installed for well over 25 years.

Horizons Engineering personnel were questioned on their knowledge or involvement of any investigations or root cause analysis for any water distribution systems components that may have failed. All Horizons Engineering personnel indicated there were no investigations conducted to their understanding nor was there any well capability study performed either prior to or after the second well was installed in early 2000.

Safety Staff then proceeded to discuss the concerns if any regarding the proposed lowering of the water system pressures and the impact to existing customer built-in fire protection sprinklers and fire standpipes and whether or not the local fire department provided any comments. Mr. LaFrance indicated numerous requests for fire protection system design demand requirements and more specifically for the Mt. Washington Hotel, had been submitted

to the Omni folks over the years with no responses provided nor did they receive any comments from the local fire department. Safety Staff then provided limited residual fire suppression system design demand requirements as observed within the Mt. Washington Hotel on fire code-required hydraulic data plates as affixed to several of the fire suppression system piping risers. Safety Staff informed Horizons Engineering personnel that several fire suppression systems required well over 125 PSI residual (or remaining) water pressure with close to 900 gallons per minute (GPM) flow and that if the proposed design to address the higher system pressures results in much lower pressures in and around 50 PSI as indicated in past engineering reports, this would have significant consequences on the fire suppression systems' capabilities to either extinguish or contain a fire within the hotel. Horizons Engineering personnel commented they were not aware of these higher fire protection system design requirements as the needed fire flows would be required for design purposes.

Safety Staff continued to interview Horizons Engineering personnel on the status of the pressure reduction design project. Mr. LaFrance indicated they were looking at two design options and this was very complicated with many legal issues as well such as land ownership. Mr. Duffy commented he believed there really were not very many choices to create two water pressure zones and with an option to design a "cross country" water main across the ski slopes, this one option would eliminate one booster pump station. Both believed the design may be stuck with using the existing water storage tank and existing wells.

Safety Staff advised Horizons Engineering personnel that AWC Mr. Vaughan had been interviewed and questioned about the creation of any type of "alternatives analysis" for this pressure reduction project as it appeared that with three separate Horizons Engineering Reports generated in 2016, 2017, and 2018, very few options had been described[35]. Safety Staff indicated that the AWC customer base had essentially been asking this question as indicated in several dockets filed with the PUC, but yet, still await an answer. Safety Staff further commented that it is likely the PUC Commission may inquire in a rate case as to the available options to insure cost effective approaches to the corrective design options as Safety Staff has also been tasked with evaluating the proposed preferred remedies potential and evaluating the potential alternative solutions. Safety Staff indicated it was important to remember their guidance as to what to create and provide was at the direction of their client AWC and not Safety Staff. Horizons Engineering personnel indicated that if directed by AWC, this Alternatives Analysis could be done; however, they still believed there were very few options to correct the pressure issue.

4) Interview Information of NHDES (Single Interview):

<u>New Hampshire Department of Environmental Services:</u>

On April 13, 2021, Safety Staff conducted a telephone interview of New Hampshire Department of Environmental Services (DES), Drinking Water and Groundwater Bureau, Mr. Randal Suozzo,

[35] See Appendix F Exhibit 20 of DW 17-165 (Horizon Engineering Reports dated July 15, 2016, March 20, 2017, September 5, 2018).

P.E. Mr. Suozzo confirmed he performed the 2019 DES Sanitary Survey as identified in a letter dated June 7, 2019 as sent to AWC's Gilford NH office[36].

Safety Staff reviewed the overall context of this Sanitary Survey as compared to prior cyclical surveys noting his February 20, 2019 site visit identified four significant deficiencies. These deficiencies included the system pressures exceeding the regulatory limits as well as failure by the company to inspect the water storage tank, which at the time of his inspection, was three years past due. Two additional significant deficiencies included the lack of chemical containment and chemical feed systems, both located at the pump station building.

Safety Staff questioned Mr. Suozzo as to what changed over the years with respect to the DES Sanitary Survey results since prior survey letters did not identify the water pressure issue as a "Significant Deficiency", but rather a "Minor Deficiency". From a review of these documents, there did not appear to be any corrective actions performed by either the past or the current water utility owners. Mr. Suozzo indicated that he began his career with the DES in 2016 and after speaking with his supervisors about long-standing issues such as the AWC pressure issue, they took a new perspective review as to moving forward in order to gain compliance. Mr. Suozzo believed it was time to gain compliance through further enforcement actions[37].

Safety Staff questioned Mr. Suozzo as to whether there are other water systems in the state with high pressure issues and whether the utility can request a waiver. Mr. Suozzo commented they are becoming more aware of other systems with pressure issues as they request further information during their surveys. Mr. Suozzo stated DES does not typically issue waivers, but that he was not aware of any utility including AWC requesting a waiver from the water pressure regulatory requirements.

Mr. Suozzo commented DES struggled with the lack of progress as the improvements need to be completed. Mr. Suozzo stated their agency expected to see a Corrective Action Plan (CAP) that included a design to correct the water pressure issue and that their agency understandably does not select the ultimate correction plan nor do they render a decision or opinion as to the project cost. Mr. Suozzo commented their agency had directed AWC Mr. Vaughan to develop an "Asset Management Program" of which Mr. Vaughan claimed his company had such a plan. Mr. Suozzo stated he was disappointed in AWC's lack of this plan as he then directed Mr. Vaughan to seek out state funds in order to aid AWC in the creation of this Asset Management Program.

Mr. Suozzo indicated DES would like to see the design plan include a new water storage tank, but that their agency was not requiring this tank as part of the CAP. Mr. Suozzo further commented the prior concerns of "employees afraid" to work on the system also prompted their decision to further enforcement actions by their agency

5) Interview Information of Bretton Woods Property Owners Assoc. (Single Interview):

Bretton Woods Property Owners Association:

[36] See Appendix G DES Correspondence Regarding Letters of Deficiency for Sanitary Surveys of 2019 and 2010.
[37] See Appendix G DES Correspondence Regarding Letters of Deficiency for Sanitary Surveys of 2019 and 2010.

On April 12, 2021, Safety Staff conducted a telephone interview of Mr. Paul Mueller representing the Bretton Woods Property Owners Association (BWPOA). Mr. Mueller indicated the BWPOA is the umbrella association for all but four other homeowner's associations.

Safety Staff informed Mr. Mueller of the basis for this investigation. Mr. Mueller reiterated concerns as expressed in prior dockets filed with the PUC in that AWC never answered the question as to what is the best and most cost-effective solution to resolve the water pressure issue. Mr. Mueller further commented about homeowner concerns as to where water utility equipment is going to be located, such as the proposed booster pump stations and pressure reducing valves.

During this interview, Safety Staff informed Mr. Mueller of interview information from AWC personnel Mr. Vaughan and Operations Manager Mr. Taylor deOgburn regarding maintenance of homeowner-owned pressure reducing valves. Both individuals indicated maintenance on pressure reducing valves that were owned by the individual homeowner, was reportedly being conducted by a local plumbing contractor and coordinated by Mr. Mueller. Mr. Mueller stated this was absolutely not true and good luck as to anyone (homeowner) even knowing if they have a pressure reducing valve in their own home. Mr. Mueller commented he was not aware of any plumbing contractor performing service on the pressure reducing valves.

Element #6: Conclusions and Staff Recommendations

Conclusions

1. Safety Staff believes the identified **hazards to employees and to the operation of the water system** can be mitigated with the engineering and replacement of worn, corroded facility components that are designed and rated to current system operating pressures.

2. **Abenaki Water Company record keeping and documentation** regarding its water system infrastructure are inaccurate and inadequate.[38]
    a. Safety Staff identified approximately 15 fire hydrants not found plotted on any existing AWC utility maps or plans. This omission validates the inaccuracies of AWC's latest utility system As Built mapping.
    b. Engineering consultants for Omni Resorts have also confirmed the inaccuracy of the utility As Built documentation, specifically challenging the existence of a 12-inch water main as depicted on Base Station Road. This 12-inch water main, identified on the As Built maps and plans as being constructed of ductile iron, was reportedly installed and connected to the 16-inch water main in the area of Fairway Drive and Base Station Road. According to the As Built maps and plans, this 12-inch water main then traversed eastward, passing Mount Adams Lane and heading further eastward past the Mt. Washington Hotel toward an area identified for future development along the north side of Base Station Road. As of the time of the writing of this report, AWC personnel were unable to locate the identified 12-inch water main, but were able to locate two separate water main valves in the general areas of connections to this 12-inch main on Base Station Road and on Mount Adams Lane in the area of the Mount Madison development.[39]

3. **Abenaki Water Company Training Programs are inadequate.** In order to provide safe utility service, employees must first be safe in their work operations, properly **trained** to recognize hazards of the job, and **equipped** with appropriate safety equipment.

4. **The single page Safety Policy provided by Abenaki Water Company to its employees is inadequate.** The Company failed to d**evelop a Safety Policy** that at the most basic level should cover such safety elements such as hazard recognition, electrical hazards, use of personal protective equipment, water hazards, traffic control, and the use and storage of chemicals. Unsafe employee operations cannot ensure safe operation of the utility system without the above-noted elements and accompanying guidance.

[38] Data collected during the field inspection and investigation process was also used to establish the inaccuracies of utility system maps and plans as identified by Safety Staff, AWC personnel, and their vendor engineering team Horizons Engineering, Inc.
[39] AWC personnel found these two water main valves in the "OFF" position and believed these connections to be capped with no 12-inch main extending eastward along Base Station Road and Mount Adams Lane.

5. **Valves that are currently inoperable should be repaired as soon as practical.** Facility components such as water transmission and distribution system valves that have been specifically identified for years as either inoperable or in need of **maintenance,** must be repaired in order for the system to operate safely and adequately. Failure to maintain valves places the employees or contractors at risk, especially in the event of an emergency that requires immediate isolation of the system. Management decisions to wait until the proposed water pressure reduction project is under construction to replace and or find missing valves fails to provide for a safe and adequate system, and facts clearly show that this has been a long-standing issue for years with no resolution to date.

6. **Valve maintenance is not being routinely performed. Records** of the Rosebrook Water System produced by Abenaki Water Company to date since 2016 indicate that inspection of valves occurred only once in the 5 years since the Company assumed ownership of the system. The As Built plans provided by the Company to Safety Staff during this investigation noted the same valves that were noted in a 1999 valve inspection to be either inoperable or unable to be located.

7. In regards to water hammer occurrences, Safety Staff review of records within Element #1 indicated that at times employees improperly set pump discharge pressures too high, inadvertently introduced air into the pumping process from well draw-down thereby causing pump cavitation and water hammer events. Records also indicated fire hydrants may have been improperly opened during fire hydrant flow testing which may result in water hammer type symptoms.

8. Abenaki Water Company's **practice of not marking out water infrastructure** at Rosebrook and other water systems is unacceptable and undermines New Hampshire's One Call objective for notification systems such as Dig Safe. This poses a risk to the safety, adequacy, and reliability that has been further exacerbated by the Company's failure to **comply with the underground utility damage prevention program.** Had the Rosebrook Water System been damaged by any construction activities over the years, the safety and adequacy of the system could not be ensured, particularly in the event critical system valves are inoperable.

9. In the review of Element #1, Safety Staff found no evidence has been provided to date to indicate whether any type of root cause analysis validated pressure issues with the water utility equipment and components.

10. Examination of the pump station facility revealed the area of most immediate threat to employee safety to be related to chemical injection equipment and water main control valves. Inspection revealed wear-and-tear on all equipment within the facility, most likely due to equipment age, and corrosion resulting from the corrosive atmosphere accelerated by chemicals stored in proximity to the water pipeline and its components. This situation should be remedied immediately.

11. Safety Staff noted a general and persistent failure on the part of the Company to replace worn or deteriorated piping components resulting from corrosion, age, wear-and-tear, etc., within the pump station. It appears that the Company has conflated these basic, ongoing maintenance requirements with the pressure reduction project addressed in this investigation.

12. NH DES has suggested that AWC develop an Asset Management Program to aid the Company in achieving higher levels of service. The most recent Letter of Deficiency also requires chemical injection to be separated for each of the well supplies and spill containment to be incorporated for the chemicals. Safety Staff agrees with those requirements and believes the chemicals can be separately stored outside the pump house to further minimize corrosive atmospheres from forming. Fire resistant materials should be used for storage. These steps can be achieved with minimal expense.

From all information collected to date to include AWC documentation, interviews, and observations, other than the identified safety hazards to system operators as noted within the existing pump station, both AWC and their engineering vendor do not believe there exists product hazards to facility components as a result of the existing higher system pressures.

Safety Staff concludes, based on the totality of its investigation, which included a review of prior docket filings, in-person interviews, field investigations, observations, and evaluation of proposed system remedies of the existing water pressure issues, that as a public utility Abenaki Water Company has failed to furnish service and facilities that are reasonably safe and adequate as required by Commission rules.

As indicated above, management's decision to postpone the replacement or repair of critical system valves has perpetuated Abenaki Water Company's general failure to provide reasonably safe and adequate service and to ensure safe and adequate operations.

Safety Staff Recommendations

General Safety and Reliability

The following recommendations regarding general safety and reliability obligations exclusive of the pressure reduction project are provided for the Commission's consideration:

1. The Commission should consider appointing a qualified independent operations and management consultant to oversee day to day operations for a period of 6 months and report to the Department and/or Commission on a biweekly basis the status and results of findings regarding the items listed below in points 2 through 12. The determination of the role and duties of such a consultant may be assigned to the Department of Energy if the Commission finds that to be in the public interest.

2. AWC's emergency response plan should specifically address the 1.5 hours it currently takes company personnel or agents to respond to system emergencies from the Company's base in Gilford. Any mutual aid agreements should be explicitly cited and detailed if such agreements constitute a significant factor within the Company's emergency response plan.

3. A detailed comprehensive Safety Policy should be developed within 60 days of the acceptance of this report and its findings. Such Safety Policy should specifically address the Rosebrook Water System and the characteristics of its water operations and facilities. Copies shall be submitted to the Department of Energy.

4. Detailed comprehensive Safety Policies should be developed to address each of the other water systems in New Hampshire operated by NESC/AWC, with a focus on the specific characteristics of each water system in each policy. Copies shall be submitted to the Department of Energy no later than November 1, 2021.

5. The Department of Energy recommends that the Commission order Abenaki Water Company to conduct Safety Training within 90 days of the Commission's acceptance of this report. The training agenda, copies of any presentation materials, the names of persons attending, the dates and locations of each training session shall be reported to the Department of Energy within 10 business days of each training session.

6. AWC shall provide any necessary Personal Protective Equipment to any personnel that may be called to work in the field on the water system or at a local area work center. Such equipment shall be maintained at Company facilities and be easily accessible to employees and/or agents.

7. The Commission should consider ordering AWC to hire an engineering firm to validate, update, and correct, as needed, As Built infrastructure drawings that can be relied upon for system operations and planning. This may involve field investigations, excavations, and research of equipment and materials used, to ensure the accuracy and usefulness of such drawings. The Commission should also determine whether rate payers should bear the burden of this incremental cost.

8. The Commission should order compliance with annual system maintenance requirements including valve maintenance, hydrant flushing, pump house equipment, flushing dead end mains as discussed in Element #2, as well as all applicable requirements in Puc 600 rules, and pre-determine any potential civil penalties for consideration pursuant to RSA 365:41 if requirements are not met.

9. The Commission should order AWC to hire an engineering firm to inspect valves above and below ground for wear/tear/corrosion, valves inadequately rated for working pressures, non-functioning valves and related equipment, etc., and to provide a plan and schedule for replacement of identified components.

10. AWC should verify and produce an accurate accounting of system pipe sizes and lengths, and develop and maintain an accurate inventory of customer pressure relief valves associated with each water service.

11. The Commission should order AWC to complete repairs of inoperable valves and other non- or mal-functioning equipment, including fire hydrants and above-ground equipment within the

pump station. Safety Staff recommends that any such repairs be completed prior to any potential acquisition by Aquarion.[40]

12. Safety Staff recommends that associated maintenance records be required to be transferred to the new owners of the Rosebrook Water System in the event any acquisition is approved by the Commission.

Pressure Reduction Project

The following Safety Staff recommendations are provided with respect to the pressure reduction project. Many of these are discussed in Element #4.

13. AWC shall exercise or exhaust any waiver request options available from regulatory agencies prior to committing to any pressure reduction project.

14. AWC shall investigate what types of pressure reduction modifications would be supported by regulatory agencies to improve system pressures, but in no event to include complete reductions below levels of 100 psig or maintenance of system pressure levels at the regulatory maximum pressure level. Various scenarios should be presented along with cost estimates, consideration of customer impacts, and anticipated benefits of partial reduction. See Element #4, Item 2 and Item 3.

15. AWC shall evaluate and explore further the Pros and Cons of Element #4, Item 2 and Item 3, and present its findings to the Department of Energy and the Commission.

16. AWC shall clearly delineate any and all facility equipment and pipeline components that should have been either repaired and/or replaced to ensure safe and reliable service exclusive of the pressure reduction project. See Element #4, Item 4. Maintenance and replacement of valves shall neither be delayed nor subsumed into the proposed pressure reduction project, especially when these valves are critical to daily system safety and operation.

17. AWC shall include in any design proposals all cost estimates for long-term maintenance and operational expenses for proposed components such as new booster pump stations and generators. Examples may include monthly utility bills of electrical services to provide power for the booster pump stations, fuel supplies for emergency generators, and cyclical maintenance and inspection of booster pump stations, generators, and pressure reducing devices. This cost analysis process should also include the costs associated with the replacement of proposed equipment such as a booster pump or generator, along with the costs associated with snow removal to access these components. See Element #4, Item 5 and Item 6.

18. AWC shall provide an overall matrix that includes all option alternatives, pros and cons, projected annual operational costs, easement requirements and associated costs, and

[40] Order No. 26,493 does not explicitly require that any backlog of maintenance activities associated with the mains on Omni properties be rectified immediately or prior to any potential acquisition by Aquarion.

replacement costs for end-of-life equipment. The format of this matrix shall ensure a clear understanding of the apples to apples comparison for all input items. See Element #4, Item 7, Item 10, and Item 11.

19. AWC should set a deadline for existing customers to provide fire protection system design demands for pressure and flow in order for AWC and its design consultants to utilize the fire protection pressures and flows in the modeling and pressure reduction design alternatives. Those customers should work with AWC in an effort to ensure their existing fire protection needs will be satisfied with each pressure reduction design alternative considered. Fire protection demand data may suggest the need to incorporate geographical areas that will require higher pressures in order to satisfy existing fire protection system operational demands. See Element #4, Item 8.

20. AWC shall define the "next steps" to be taken and alternative design options in the event required easements are not granted and/or delayed due to legal proceedings. This process should be incorporated into the overall matrix as defined in Item 18 above. The most recent pressure reduction design concepts did not present contingencies that could cause further delays and possibly increased costs associated with concept design changes. See Element #4, Item 9.

21. AWC shall incorporate and utilize a formal project estimation classification process such as ACEE International's Recommended Practice 18-R-97 or equivalent for refining costs for all design concepts. These refined costs shall be incorporated into the overall matrix. See Element #4, Item 13.

APPENDIX A

LIST OF SELECTED APPLICABLE WATER RULES

NEW HAMPSHIRE CODE OF ADMINISTRATIVE RULES

CHAPTER Puc 600 RULES FOR WATER SERVICE

PART Puc 604 QUALITY OF WATER SERVICE

Puc 604.05 Pressure Surveys and Records

Puc 604.05(g) Each utility shall retain for at least 2 years and shall make available for inspection by the commission or its representative all pressure records obtained under this section.

Puc 604.05(h) Reports of pressure complaints shall be made to the commission on Form E-14, which is described at Puc 609.07, once a month, if any occur.

Puc 604.06 Interruptions of Service

Puc 604.06(c) Each utility shall keep a record of all interruptions to service of over 30 minutes duration affecting any portion of the distribution system.

Puc 604.06(i) Reports of service interruptions shall be made to the commission on Form E-18, which is described in Puc 609.11, once a month, if any occur.

PART Puc 605 METER ACCURACY AND TESTING

Puc 605.04 Test Schedules for Meters

Puc 605.04(l) Each utility shall report to the commission periodic tests of meters on Form E-15, which is described in Puc 609.08, once a year

Puc 605.07 Underground Utility Damage Prevention Program.

All utilities shall comply with Puc 800, the underground utility damage prevention program rules.

PART Puc 606 EQUIPMENT AND FACILITIES

Puc 606.02 Distribution System and Mains

Puc 606.02(d) Where dead ends are unavoidable the utility shall adhere to the following standards:

(1) Mains with dead ends shall be flushed as often as necessary to maintain the proper quality of the water;

(2) Records shall be kept of all flushings of mains, showing the date, place and duration; and

(3) Flushing records shall be used as a guide in determining the necessary frequency of flushing of the same mains thereafter.

Puc 606.03 Fire Protection and Hydrants

Puc 606.03(c) Hydrants maintained by the utility shall be inspected and flushed at least once each year, and shall be checked for freezing as often as necessary to insure that they are functioning properly.

Puc 606.03(d) A record of each hydrant shall be maintained showing the size, type, location, date of inspection and flushing and the results thereof.

Puc 606.03(e) Reports of periodic inspection of flushing of hydrants shall be reported to the commission on Form E-17, described at Puc 609.10 once a year.

Puc 606.04 Valves and Service Connections

Puc 606.04(b) A utility annually shall locate, operate and inspect valves which are:

(1) Larger than 12 inches in diameter;

(2) Located on major transmission lines; or

(3) Otherwise critical to system operation.

Puc 606.04(c) A utility shall keep a record of each valve showing the size, type, location, date of inspection and the results of each inspection.

PART Puc 607 RECORDS, REPORTS AND ACCOUNTING REQUIREMENTS

Puc 607.03 System Maps

Puc 607.03(a) Each utility shall have on file at its principal office located within New Hampshire a map, maps or drawings showing the following:

(1) The size, character and location of all mains including hydrants and valves;

(2) The size and location of each service connection, where practicable; and

(3) The layout of all principal pumping stations, filter and chlorinating plants to show size, location and character of all major equipment, pipe lines, connections, valves and other equipment used.

PART Puc 608 SAFETY, INSPECTIONS AND SHORT TERM DEBT

Puc 608.01 Safety Instructions

Puc 608.01 Safety Instructions. Each utility shall adopt comprehensive instructions for the safety of employees in regard to the operation, construction and maintenance of its plant facilities, and shall require that such employees have been properly informed of safe practices and are cognizant of all hazards involved.

OMNI HOTELS & RESORTS

Incident Report

Property: MountWashington
Report #: 190108-0004

☐ Supplement

Type of Incident	Location of Incident	Condition of Area	Routing ☐ Corporate Risk Management
Fire Alarm	Bretton Arms	See Report	

Date of Incident	Time of Incident	Date Reported	Time Reported
01/08/2019	0719	01/08/2019	0719

Subject

Subject Name (last)	(first)	(middle)	Subject Address (street)	(city)	(state)	(zip)
Bretton Arms Inn	Brettton Woods Brett	Woods	173 Mount Washington Hotel Rd	Bretton Woods	NH	03575

Age	Primary Phone	Secondary Phone	Subject Type
	(603)278-4610		

Speak directly with Subject?	Describe Subject Attitude/ Concerns

Property

Loss/Damage to Property	Subject Estimate of Loss/Damage

Describe (quantity, brand, style, color, model #, serial #, etc) **Attach separate Property Report Form as needed**

Injury

If injury, nature of injury	First Aid Offered	First Aid Accepted

Type of First Aid Administered	Administered by

Transported to Dr/Hospital (Name)	Transported by

Witness

Witness Name (last)	(first)	(middle)	Witness Address (street)	(city)	(state)	(zip)

Primary Phone	Secondary Phone	Witness Type

Speak directly with Witness?	Describe Witness Attitude/ Concerns

Police/Fire/EMS

Responding Agency
Twin Mountain Fire and Rescue

Notification Date/Time	Case #	Unit #	Badge #
01/08/2019 0719		Eng 1/ Cheif 1	

Additional Documentation

- ☐ Photos - Description
- ☐ Guest Folio - Description
- ☐ Police Report - Description
- ☐ Diagram - Description
- ☐ Room Access Log - Description
- ☐ Witness Statement - Description
- ☐ Other - Description

Narrative Summary

Please see Narrative Page for details

Prepared By	Date/Time Prepared
Peter Eakley	01/08/2019 0635
Reviewed By	**Date/Time Reviewed**
Peter Eakley	01/08/2019

Incident Report V1.1 Mar 2011

OMNI HOTELS & RESORTS

INCIDENT REPORT

☐ Supplement

REPORT #: 190108-0004

NARRATIVE

Assignment: Fire Alarm Activation

Narrative: On 8 January 2018, at approximately 0719, the undersigned and LPO Morales responded to an fire alarm activation at the Bretton Arms Inn.

On scene, the alarm was found to be caused by a water spike and filling the sprinkler system. This has been a recurring problem and determined to be caused by the water provider, Abenaki Water Company, with air and over pressured city water system / possible water hammer.

Under my orders, the system was silenced and the guests back into the building at 0724 hours, experiencing minimal impact.

Upon arrival of Twin Mountain Fire and Rescue, scene command was turned over to same and relinquished minutes later after confirmation of the water spike. MTWASH Engineering got the system back into complete service.

Note there was no water damage to the structure.

Group:
Transient:
Associate:
Patron:

Guest Information:
Name: Address:
Phone:
Email:
Check-in:
Check-out:

Guest Statement:

Voluntary Statement:

Prepared By	Date/Time Prepared	
Peter Eakley	01/08/2019	
Reviewed By	Date/Time Prepared	☐ Corporate Risk Management
Peter Eakley	01/08/2019	

REVISED 5/3/2007

OMNI HOTELS & RESORTS

INCIDENT REPORT

☐ Supplement

REPORT #: 190108-0004

NARRATIVE

Timeline:

Investigation: See above

Attachments: None

Notifications: Internal

Disposition: Closed

Prepared By	Date/Time Prepared	
Peter Eakley	01/08/2019	
Reviewed By	Date/Time Prepared	☐ Corporate Risk Management
Peter Eakley	01/08/2019	

REVISED 5/3/2007

OMNI HOTELS & RESORTS

Incident Report

Property: MountWashington

Report #: 181216-0030

☐ Supplement

Type of Incident	Location of Incident	Condition of Area	Routing
Fire Alarm	Bretton Arms	See report	☐ Corporate Risk Management

Date of Incident	Time of Incident	Date Reported	Time Reported
12/16/2018	1851	12/16/2018	1851

Subject

Subject Name (last) (first) (middle)	Subject Address (street) (city) (state) (zip)
Bretton Arms Inn	173 Mount Washington Hotel Rd Bretton Woods NH 03575

Age	Primary Phone	Secondary Phone	Subject Type
	(603)278-4610 Office		

Speak directly with Subject?	Describe Subject Attitude/ Concerns

Property

Loss/Damage to Property	Subject Estimate of Loss/Damage

Describe (quantity, brand, style, color, model #, serial #, etc) **Attach separate Property Report Form as needed**

Injury

If injury, nature of injury	First Aid Offered	First Aid Accepted

Type of First Aid Administered	Administered by

Transported to Dr/Hospital (Name)	Transported by

Witness

Witness Name (last) (first) (middle)	Witness Address (street) (city) (state) (zip)

Primary Phone	Secondary Phone	Witness Type

Speak directly with Witness?	Describe Witness Attitude/ Concerns

Police/Fire/EMS

Responding Agency
Twin Mountain Fire and Rescue Department

Notification Date/Time	Case #	Unit #	Badge #
12/16/2018 1851		Eng 1/ Cheif 1	

Additional Documentation

- ☐ Photos - Description
- ☐ Guest Folio - Description
- ☐ Police Report - Description
- ☐ Diagram - Description
- ☐ Room Access Log - Description
- ☐ Witness Statement - Description
- ☐ Other - Description

Narrative Summary

Please see Narrative Page for details

Prepared By	Date/Time Prepared
Jonathan McEntire	12/16/2018 1846
Reviewed By	Date/Time Reviewed
Peter Eakley	12/16/2018

Incident Report V1.1 Mar 2011

OMNI HOTELS & RESORTS

INCIDENT REPORT

☐ Supplement

REPORT #: 181216-0030

NARRATIVE

Assignment: Fire Alarm Activation

Narrative: On 16 December 2018, at approximately 1851, the undersigned responded to an fire alarm activation at the Bretton Arms Inn. On scene, the alarm was found to be caused by a water spike and filling the sprinkler system. This has been a recurring problem and determined to be caused by the water provider, Abenaki Water Company, with air and over pressured city water system.

Mr. Eakley - Director of Loss Prevention was in contact with the undersigned and authorized the system to be silenced and the guests back into the building at 1859 hours, experiencing minimal impact. Upon arrival of Twin Mountain Fire and Rescue, scene command was turned over to same and relinquished minutes later after confirmation of the water spike.

MTWASH Engineering got the system back into complete service and the alarm back on at 1945 hours. Note there was no water damage to the structure and only three occupied rooms.

Group:
Transient:
Associate:
Patron:

Guest Information:
Name:
Address:
Phone:
Email:
Check-in:
Check-out:
Guest Statement:

Voluntary Statement:

Timeline:
Investigation: See above.
Attachments:
Notifications: Director of Loss Prevention Mr. Peter T. Eakley
Disposition: Closed

Prepared By	Date/Time Prepared	
Jonathan McEntire	12/16/2018	
Reviewed By	Date/Time Prepared	☐ Corporate Risk Management
Peter Eakley	12/16/2018	

REVISED 5/3/2007

OMNI HOTELS & RESORTS

Incident Report

Property: MountWashington
Report #: 161107-0003

☐ Supplement

Type of Incident	Location of Incident	Condition of Area	Routing ☐ Corporate Risk Management
Fire Alarm	Bretton Arms Inn	Normal	

Date of Incident	Time of Incident	Date Reported	Time Reported
11/07/2016	0735	11/07/2016	0735

Subject

Subject Name (last) (first) (middle)	Subject Address (street) (city) (state) (zip)		
Bretton Arms Inn	173 Mount Washington Hotel Rd	Bretton Woods	NH 03575

Age	Primary Phone	Secondary Phone	Subject Type

Speak directly with Subject?	Describe Subject Attitude/ Concerns

Property

Loss/Damage to Property	Subject Estimate of Loss/Damage

Describe (quantity, brand, style, color, model #, serial #, etc) **Attach separate Property Report Form as needed**

Injury

If Injury, nature of injury	First Aid Offered	First Aid Accepted

Type of First Aid Administered	Administered by

Transported to Dr/Hospital (Name)	Transported by

Witness

Witness Name (last) (first) (middle)	Witness Address (street) (city) (state) (zip)	

Primary Phone	Secondary Phone	Witness Type

Speak directly with Witness?	Describe Witness Attitude/ Concerns

Police/Fire/EMS

Responding Agency
Twin Mountain Fire & Rescue

Notification Date/Time	Case #	Unit #	Badge #
11/07/2016 0736		Eng 1 / Chief 1	

Additional Documentation

- ☐ Photos - Description
- ☐ Guest Folio - Description
- ☐ Police Report - Description
- ☐ Diagram - Description
- ☐ Room Access Log - Description
- ☐ Witness Statement - Description
- ☐ Other - Description

Narrative Summary

Please see Narrative Page for details

Prepared By	Date/Time Prepared
Sean Schmidenberg	11/07/2016 0800
Reviewed By	**Date/Time Reviewed**
Peter Eakley	11/07/2016

Incident Report V1.1 Mar 2011

OMNI HOTELS & RESORTS

INCIDENT REPORT

☐ Supplement

REPORT #: 161107-0003

NARRATIVE

Assignment: Fire Alarm

Narrative:

On 7 November 2016 at approximately 0735 hours the undersigned received notification that the Bretton Arms Fire Alarm system was activated. The undersigned responded to the scene to find the sprinkler system in working order within the normal pressure ranges. There was no indication of a pressure spike. The alarm came from the wet side of the system.

Grafton County Sheriff's Office Dispatch was notified in order to update Twin Mountain Fire and Rescue. Director of Loss Prevention Mr. Peter Eakley was notified and updated of the situation. It is unclear at this time what caused the system to go into alarm. System was reset and is in working order.

Tristate Fire Protection LLC is already on property working on the sprinklers and will inspect the system today. MTWASH engineering also was notified.

Group:
Transient:
Associate:
Patron:

Guest Information:
Name:
Address:
Phone:
Email:
Check-in:
Check-out:

Guest Statement:

Voluntary Statement:

Timeline:
0735 Notified of Activation
0740 Arrived on Scene
0750 Twin Mountain Fire and Rescue arrived on scene
0755 Twin Mountain Fire and Rescue cleared scene

Investigation:

Attachments:

Notifications: Director of LP Mr. Peter T. Eakley

Disposition: closed

Prepared By	Date/Time Prepared	
Sean Schmidenberg	11/07/2016	
Reviewed By	Date/Time Prepared	☐ Corporate Risk Management
Peter Eakley	11/07/2016	

REVISED 5/3/2007

OMNI HOTELS & RESORTS

Incident Report

Property: MountWashington

Report #: 161027-0008

☐ Supplement

Type of Incident	Location of Incident	Condition of Area	Routing ☐ Corporate Risk Management
Fire Alarm	Bretton Arms	see report	

Date of Incident	Time of Incident	Date Reported	Time Reported
10/27/2016	0811	10/27/2016	0811

Subject

Subject Name (last) (first) (middle)	Subject Address (street) (city) (state) (zip)	
Bretton Arms Inn	173 Mount Washington Road	Bretton Woods NH 03575

Age	Primary Phone	Secondary Phone	Subject Type
	(603)278-4610		

Speak directly with Subject?	Describe Subject Attitude/ Concerns

Property

Loss/Damage to Property	Subject Estimate of Loss/Damage

Describe (quantity, brand, style, color, model #, serial #, etc) **Attach separate Property Report Form as needed**

Injury

If injury, nature of injury	First Aid Offered	First Aid Accepted

Type of First Aid Administered	Administered by

Transported to Dr/Hospital (Name)	Transported by

Witness

Witness Name (last) (first) (middle)	Witness Address (street) (city) (state) (zip)	

Primary Phone	Secondary Phone	Witness Type

Speak directly with Witness?	Describe Witness Attitude/ Concerns

Police/Fire/EMS

Responding Agency

Twin Mountain Fire and Rescue

Notification Date/Time	Case #	Unit #	Badge #
		Cheif	

Additional Documentation

- ☐ Photos - Description
- ☐ Guest Folio - Description
- ☐ Police Report - Description
- ☐ Diagram - Description
- ☐ Room Access Log - Description
- ☐ Witness Statement - Description
- ☐ Other - Description

Narrative Summary

Please see Narrative Page for details

Prepared By	Date/Time Prepared
Peter Eakley	10/27/2016 0915
Reviewed By	**Date/Time Reviewed**
Peter Eakley	10/27/2016

Incident Report V1.1 Mar 2011

OMNI HOTELS & RESORTS

INCIDENT REPORT

☐ Supplement

REPORT #: 161027-0008

NARRATIVE

Assignment: Fire Alarm Activation

Narrative:

The undersigned and LPO Gooden responded to the Bretton Arms on a fire alarm activation (flow alarm from the sprinkler system). On scene, we found the building evacuated by staff members (note this outlet is closed due to occupancy).

The investigation concluded that the alarm was set off by a water spike from the city water supply. (see attached pictures of gauges). This has been a recurring problem.

As per agreement between the Twin Mountain Fire and Rescue Department and the MTWASH, I gave the order to silence the alarm. Grafton County Sheriff's Office was updated of the situation.

In addition, MTWASH Engineering Department was notified to respond to the scene. Note that there was considerable water spraying, we were able to protect the buildings computer switch, electrical systems, and the fire alarm system.

Upon arrival, the scene was reviewed by the Twin Mountain Fire and Rescue Department who commented on the frequency of these event. They concurred that it appeared to be a water company issue and asked for names of the new owners, so they could facilitate a meeting. I assured them, that we fully agreed that this situation was not ideal and that we are also pressing for answers.

The undersigned also contacted the Rosebrook Water Company (Ms. Nancy Oleson) directly to discuss this issue. In addition a meeting was held, post event, with the MTWASH Managing Director - Mr. John Santaniello and Director of Engineering - Mr. Kolin Bailey on how to proceed with this ongoing problem.

Group:
Transient:
Associate:
Patron:
Guest Information:
Name
Address
Phone:
Email:
Check-in:
Check-out:

Guest Statement: n/a

Voluntary Statement: n/a

Timeline: Dispatched 0811

Investigation: See narrative

Prepared By	Date/Time Prepared	
Peter Eakley	10/27/2016	
Reviewed By	Date/Time Prepared	☐ Corporate Risk Management
Peter Eakley	10/27/2016	

REVISED 5/3/2007

OMNI HOTELS & RESORTS

INCIDENT REPORT

☐ Supplement

REPORT #: 161027-0008

NARRATIVE

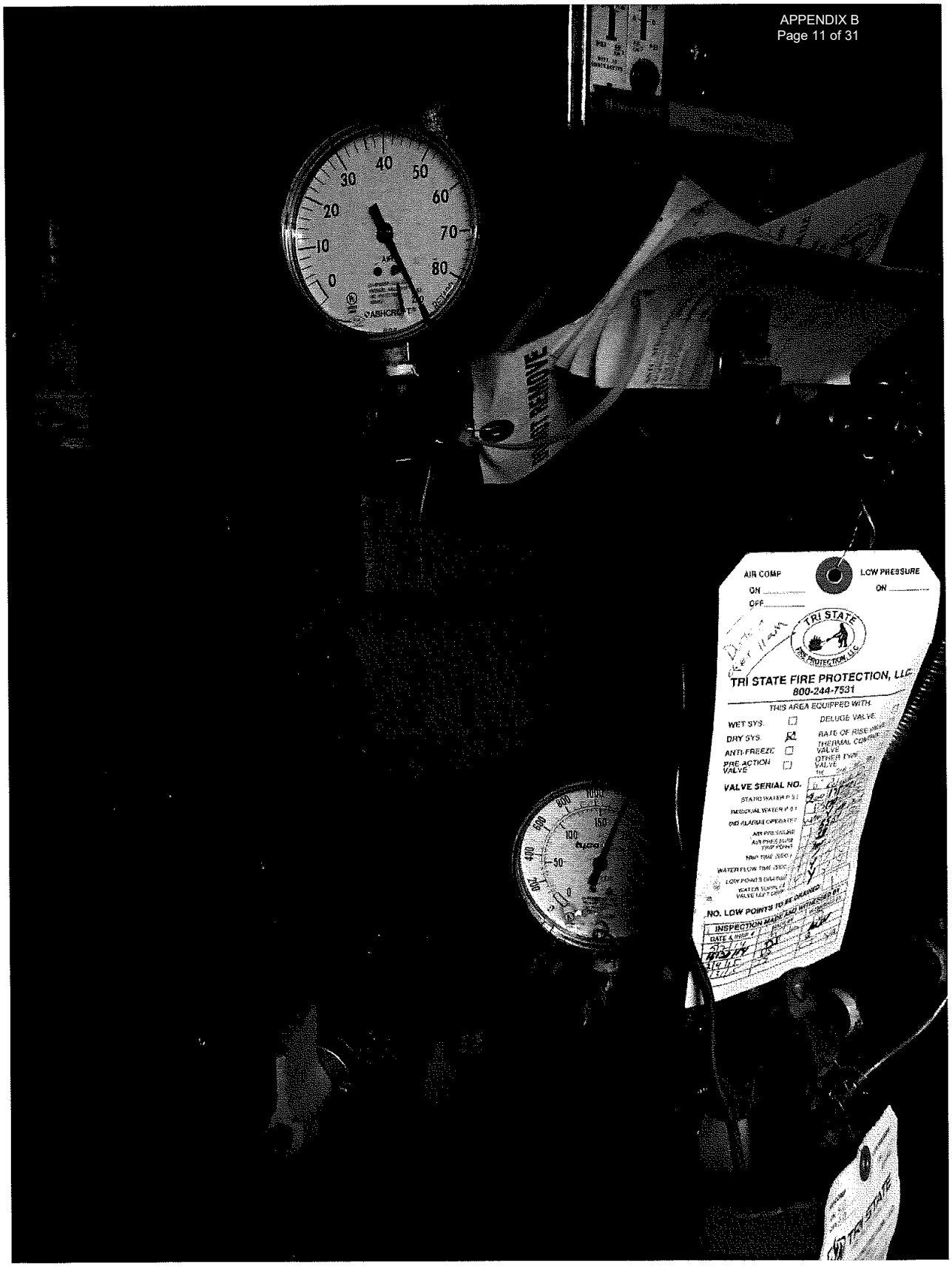
Attachments: pictures of various gauges

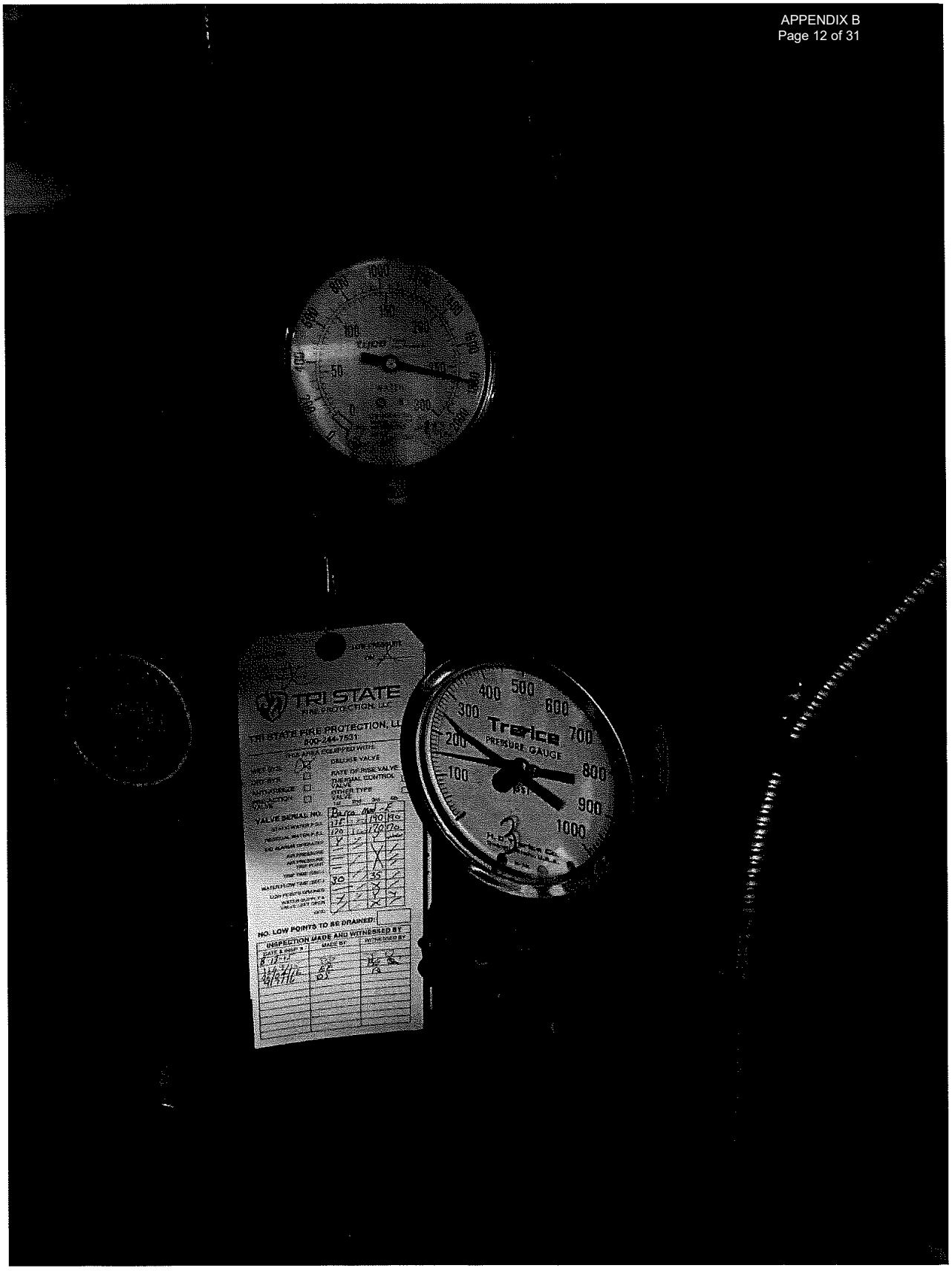
Notifications: Internal

Disposition: Open

Prepared By	Date/Time Prepared
Peter Eakley	10/27/2016
Reviewed By	**Date/Time Prepared** ☐ Corporate Risk Management
Peter Eakley	10/27/2016

REVISED 5/3/2007


AIR COMP
ON
OFF
LOW PRESSURE
ON
TRI STATE
TRI STATE FIRE PROTECTION, LLC
800-244-7531
THIS AREA EQUIPPED WITH
WET SYS.
DRY SYS.
ANTI-FREEZE
PRE-ACTION VALVE
DELUGE VALVE
VALVE SERIAL NO.
NO. LOW POINTS TO BE DRAINED
INSPECTION MADE AND WITNESSED BY
ASHCROFT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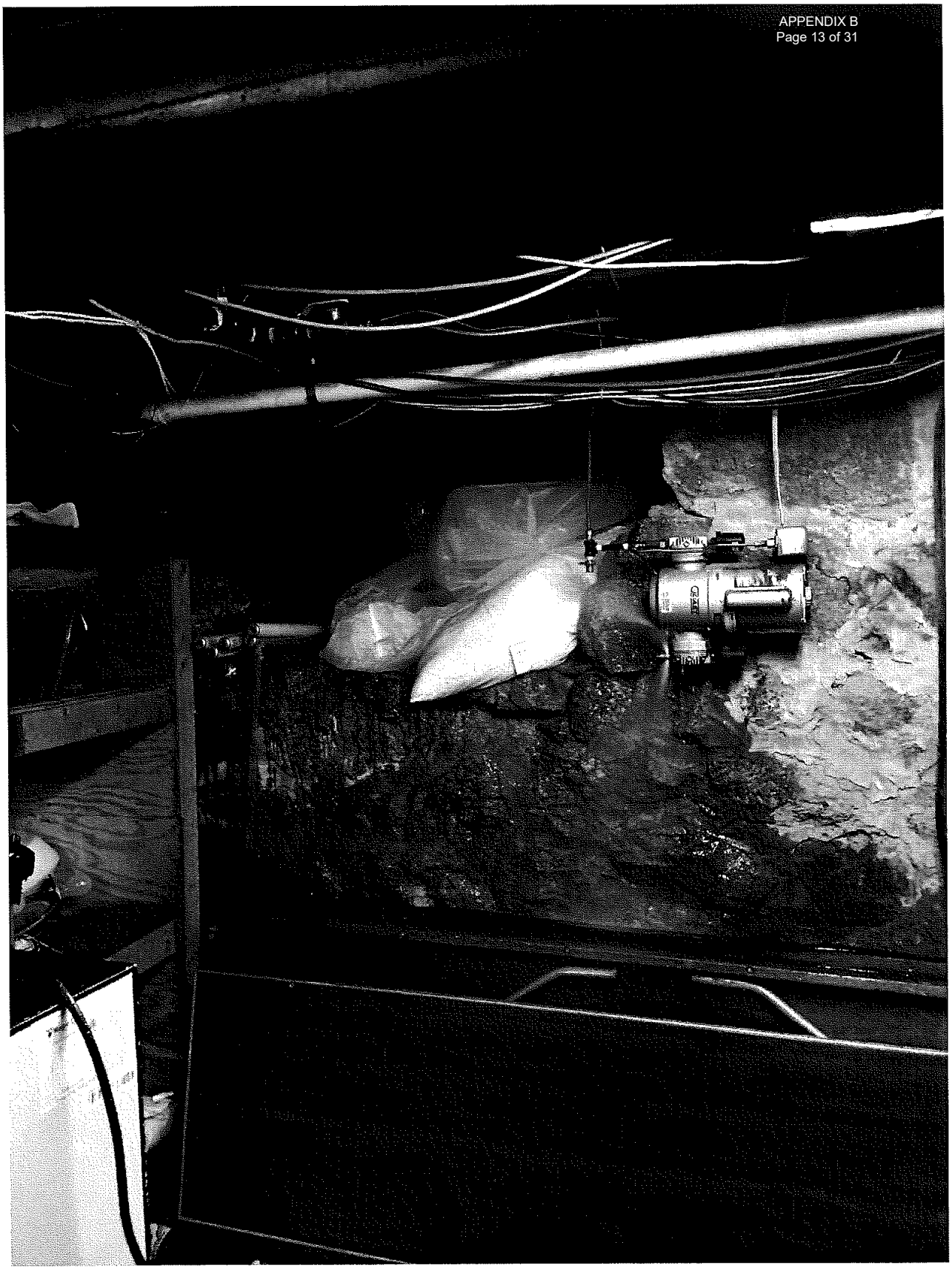
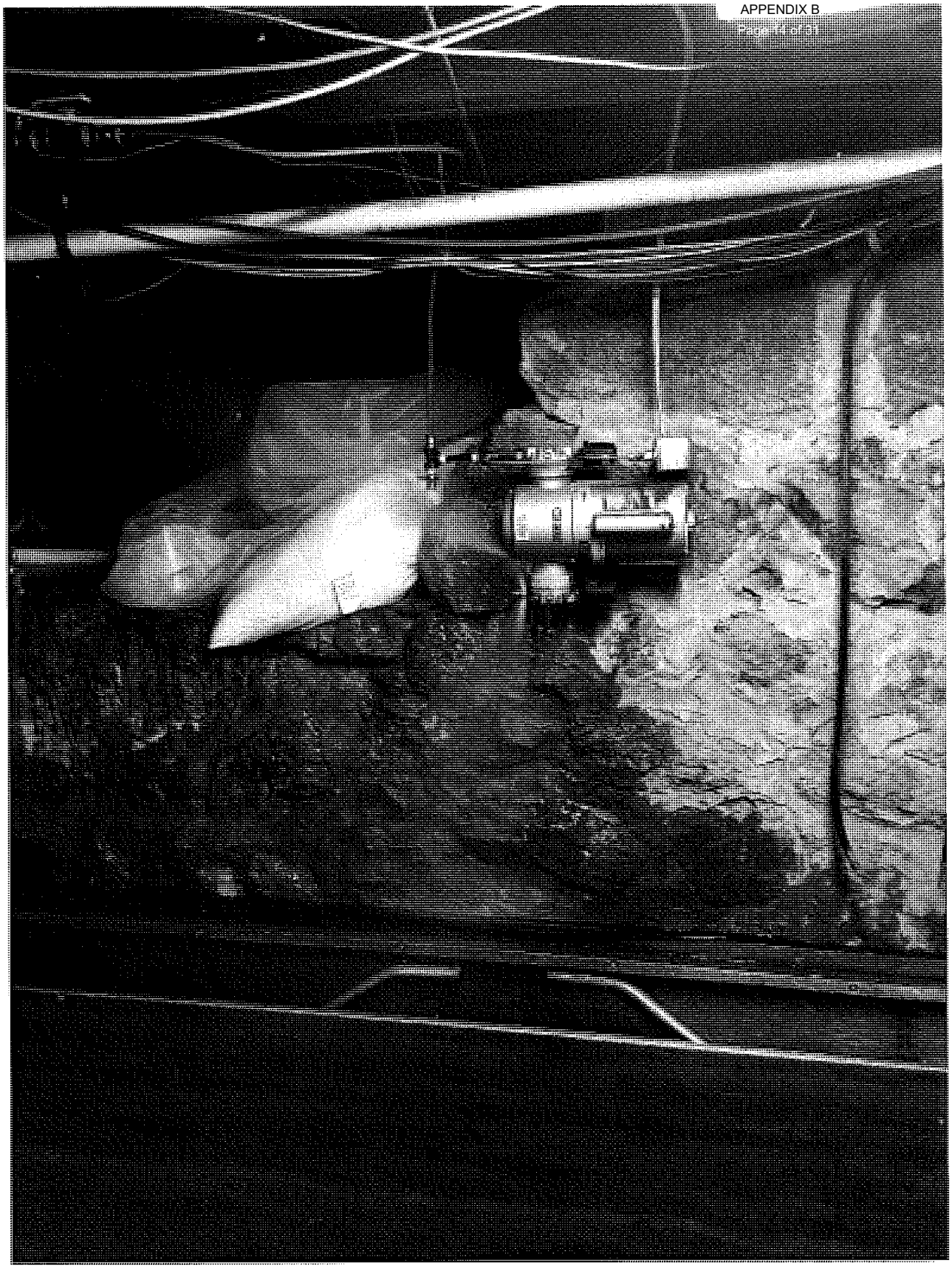
FIRE PROTECTION, LLC
TRI STATE FIRE PROTECTION, LL
800-244-7511
Trerice
PRESSURE GAUGE
NO. LOW POINTS TO BE DRAINED:
INSPECTION MADE AND WITNESSED BY:





OMNI HOTELS & RESORTS

Incident Report

Property: MountWashington

Report #: 161019-0010

☐ Supplement

Type of Incident	Location of Incident	Condition of Area	Routing ☐ Corporate Risk Management
Fire Alarm	Bretton Arms	Normal	

Date of Incident	Time of Incident	Date Reported	Time Reported
10/19/2016	0927	10/19/2016	0927

Subject

Subject Name (last) (first) (middle)	Subject Address (street) (city) (state) (zip)	
Bretton Arms Inn	173 Mt. Washington Road	Bretton Woods NH 03575

Age	Primary Phone	Secondary Phone	Subject Type
	(603)278-3000		

Speak directly with Subject?	Describe Subject Attitude/ Concerns

Property

Loss/Damage to Property	Subject Estimate of Loss/Damage

Describe (quantity, brand, style, color, model #, serial #, etc) **Attach separate Property Report Form as needed**

Injury

If injury, nature of injury	First Aid Offered	First Aid Accepted

Type of First Aid Administered	Administered by

Transported to Dr/Hospital (Name)	Transported by

Witness

Witness Name (last) (first) (middle)	Witness Address (street) (city) (state) (zip)	

Primary Phone	Secondary Phone	Witness Type

Speak directly with Witness?	Describe Witness Attitude/ Concerns

Police/Fire/EMS

Responding Agency
Twin Mountain Fire & Rescue

Notification Date/Time	Case #	Unit #	Badge #
10/19/2016 0927			

Additional Documentation

- ☒ Photos - Description: gages
- ☐ Guest Folio - Description:
- ☐ Police Report - Description:
- ☐ Diagram - Description:
- ☐ Room Access Log - Description:
- ☐ Witness Statement - Description:
- ☐ Other - Description:

Narrative Summary

Please see Narrative Page for details

Prepered By	Date/Time Prepared
Cody Gooden	10/19/2016 1002
Reviewed By	**Date/Time Reviewed**
Peter Eakley	10/19/2016

Incident Report V1.1 Mar 2011

OMNI HOTELS & RESORTS

INCIDENT REPORT

☐ Supplement

REPORT #: 161019-0010

NARRATIVE

Assignment:

Narrative: The Undersigned responded to a fire alarm activation at the Bretton Arms Inn at 0927 hours on 19 October 2016. On Scene (0932) I found that the alarm was caused by a water spike causing the alarm to trip. Mr. Peter T. Eakley- Director of LP was notified of this incident and ordered the undersigned to silence the alarm as per LSOP. At 0935 Twin Mountain Fire and Rescue was on scene along with MTWASH engineers. The engineers reset the system and was back into service by 1030 hours. The activation was caused by a water spike by the local water company. Mr. Eakley and Mr. Bailey - Director of Engineering notified Rosebrook Water Company.

Group:

Transient:

Associate:

Patron:

Guest Information:

Name:
Address:
Phone:
Email:
Check-in:
Check-out:

Guest Statement:

Voluntary Statement:

Timeline: Dispatched 0927 hours
On scene 0932 hours

Investigation: See above

Attachments: Photos of gauges

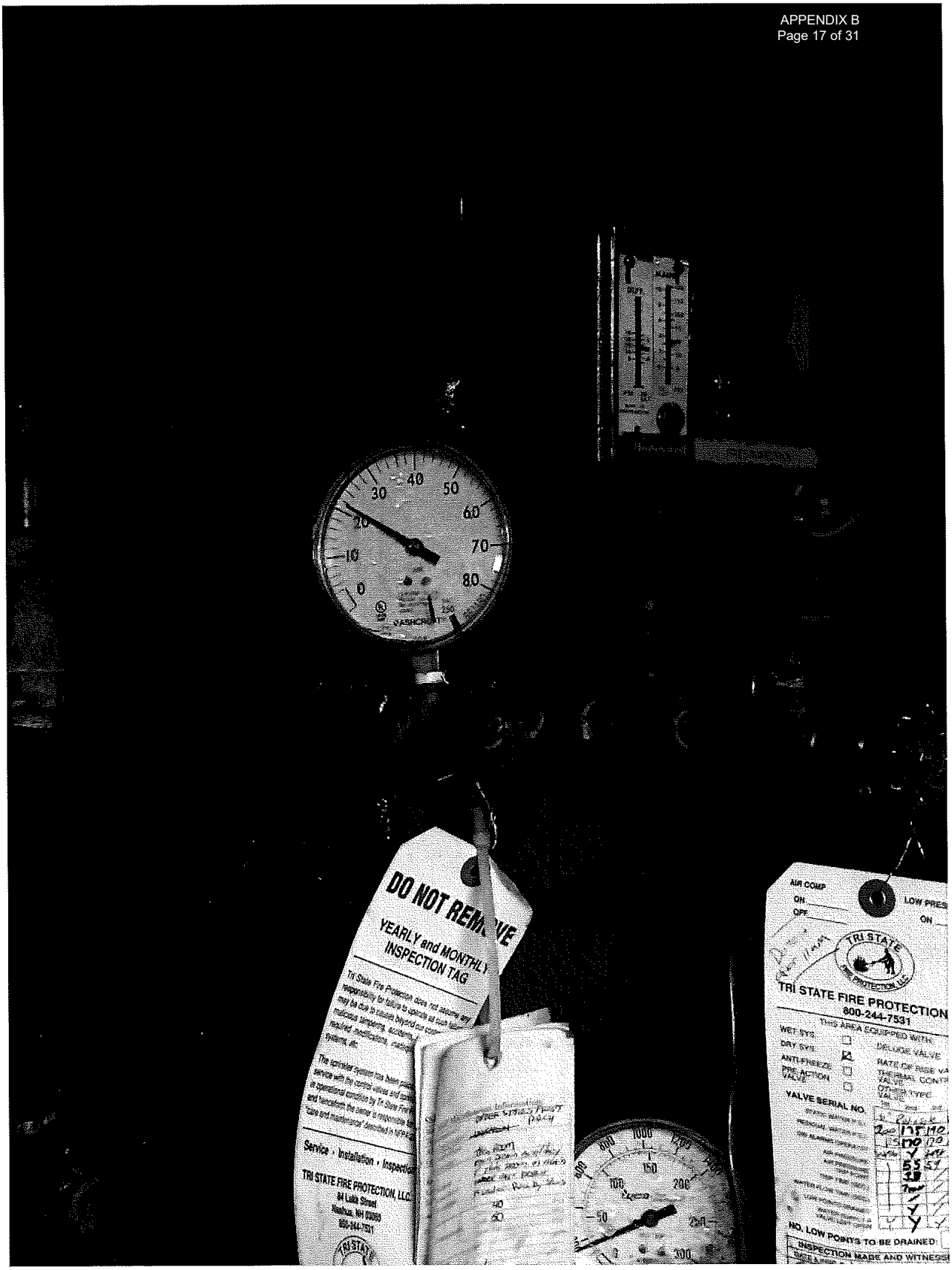
Notifications : Director of LP Mr. Peter T. Eakley

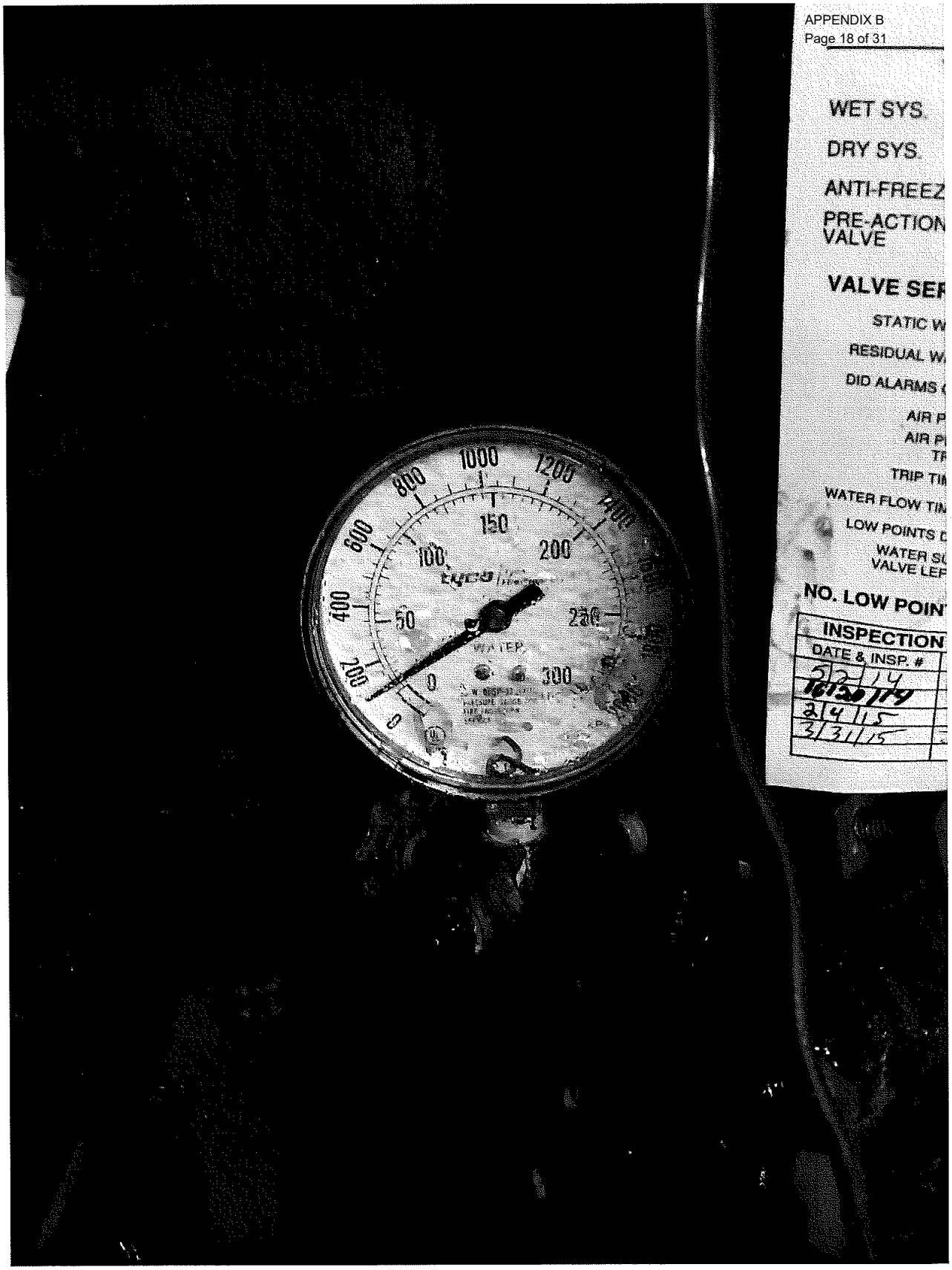
Disposition:

Closed

Prepared By	Date/Time Prepared	
Cody Gooden	10/19/2016	
Reviewed By	Date/Time Prepared	☐ Corporate Risk Management
Peter Eakley	10/19/2016	

REVISED 5/3/2007


DO NOT REMOVE
YEARLY and MONTHLY
INSPECTION TAG
Service • Installation • Inspection
TRI STATE FIRE PROTECTION, LLC
84 Lusk Street
Nashua, NH 03060
603-244-7531
TRI STATE
FIRE PROTECTION LLC
TRI STATE FIRE PROTECTION
800-244-7531
THIS AREA EQUIPPED WITH:
WET SYS
DRY SYS
ANTI-FREEZE
PRE ACTION
VALVE
VALVE SERIAL NO.
NO. LOW POINTS TO BE DRAINED:
INSPECTION MADE AND WITNESSED


APPENDIX B
Page 18 of 31
WET SYS.
DRY SYS.
ANTI-FREEZ
PRE-ACTION
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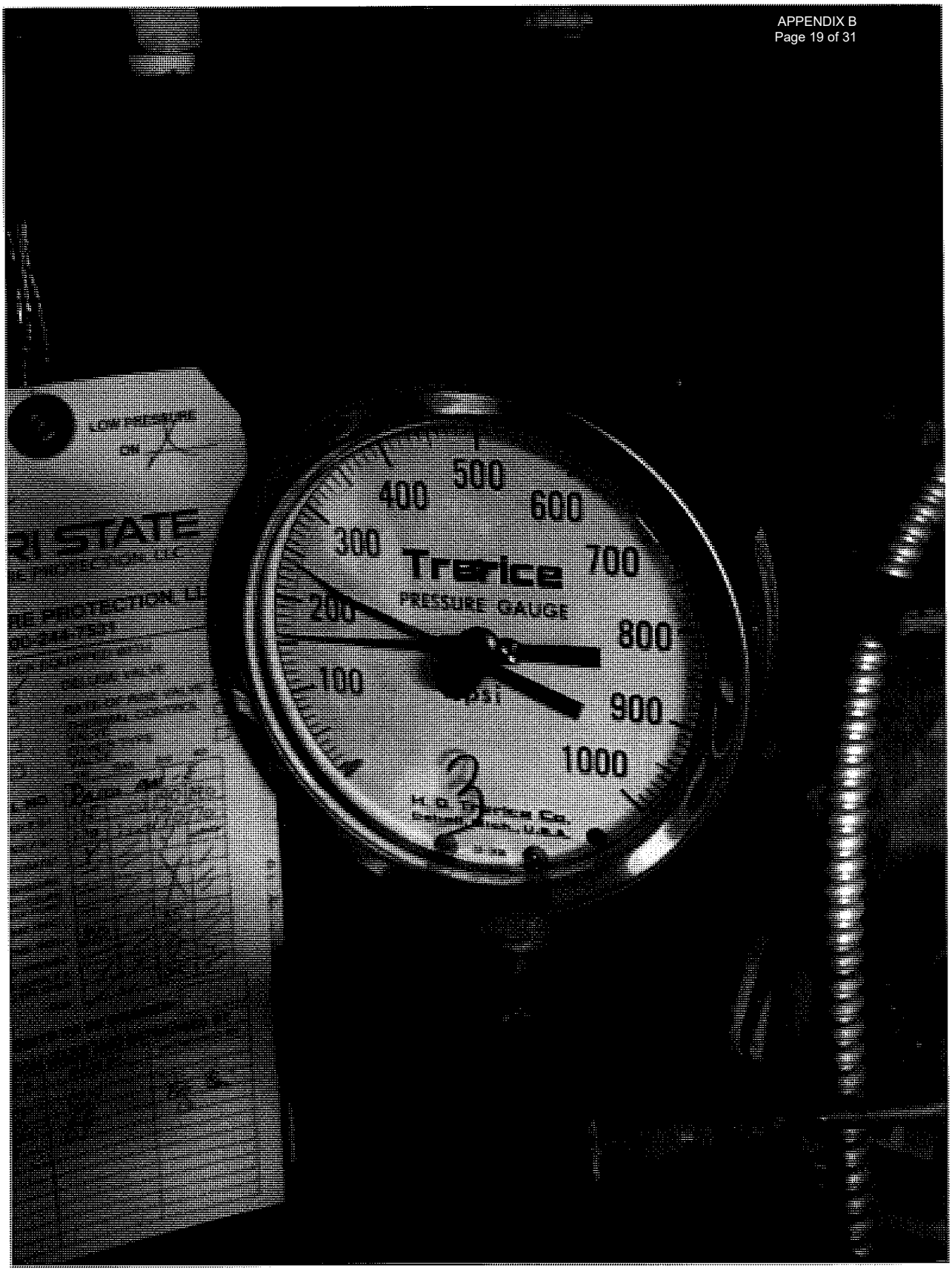
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Trerice
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OMNI HOTELS & RESORTS

Incident Report

Property: MountWashington
Report #: 161018-0006

☐ Supplement

Type of Incident	Location of Incident	Condition of Area	Routing ☐ Corporate Risk Management
Fire Alarm	Bretton Arms	Normal	

Date of Incident	Time of Incident	Date Reported	Time Reported
10/18/2016	1039	10/18/2016	1039

Subject

Subject Name (last) (first) (middle)	Subject Address (street) (city) (state) (zip)	
Bretton Arms Inn	173 Mt. Washington Road	Bretton Woods NH 03575

Age	Primary Phone	Secondary Phone	Subject Type
	(603)278-3000		

Speak directly with Subject?	Describe Subject Attitude/ Concerns

Property

Loss/Damage to Property	Subject Estimate of Loss/Damage

Describe (quantity, brand, style, color, model #, serial #, etc) **Attach separate Property Report Form as needed**

Injury

If injury, nature of injury	First Aid Offered	First Aid Accepted

Type of First Aid Administered	Administered by

Transported to Dr/Hospital (Name)	Transported by

Witness

Witness Name (last) (first) (middle)	Witness Address (street) (city) (state) (zip)	

Primary Phone	Secondary Phone	Witness Type

Speak directly with Witness?	Describe Witness Attitude/ Concerns

Police/Fire/EMS

Responding Agency
Twin Mountain Fire & Rescue

Notification Date/Time	Case #	Unit #	Badge #
10/18/2016 1039		Eng 1	

Additional Documentation

- ☒ Photos - Description: gages
- ☐ Guest Folio - Description:
- ☐ Police Report - Description:
- ☐ Diagram - Description:
- ☐ Room Access Log - Description:
- ☐ Witness Statement - Description:
- ☐ Other - Description:

Narrative Summary

Please see Narrative Page for details

Prepared By	Date/Time Prepared
Cody Gooden	10/18/2016 1121
Reviewed By	**Date/Time Reviewed**
Peter Eakley	10/18/2016

Incident Report V1.1 Mar 2011

OMNI HOTELS & RESORTS

INCIDENT REPORT

☐ Supplement

REPORT #: 161018-0006

NARRATIVE

Assignment: Fire Alarm Activation

Narrative: The undersigned and LPO Carpenter responded to a fire alarm activation at the Bretton Arms Inn at 1039 hours on 18 October 2016. On scene (1044) we found the alarm had been caused by a water spike causing the alarm to trip. Mr. Eakley - Director of LP arrived on scene and as per local SOP authorized the alarm to be silenced and allowed guests back into the building.

At 1055 Twin Mountain Fire and Rescue was on scene along with MTWASH plumber's . The plumbers reset the system and was back into service by 1209. Rosebrook Water Company was advised of this continuing problem.

Group:

Transient:

Associate:

Patron:

Guest Information:

Name:

Address:

Phone:

Email:

Check-in:

Check-out:

Guest Statement:

Voluntary Statement:

–

Timeline: Dispatched 1039 hours

On scene 1044 hours

Investigation: See above

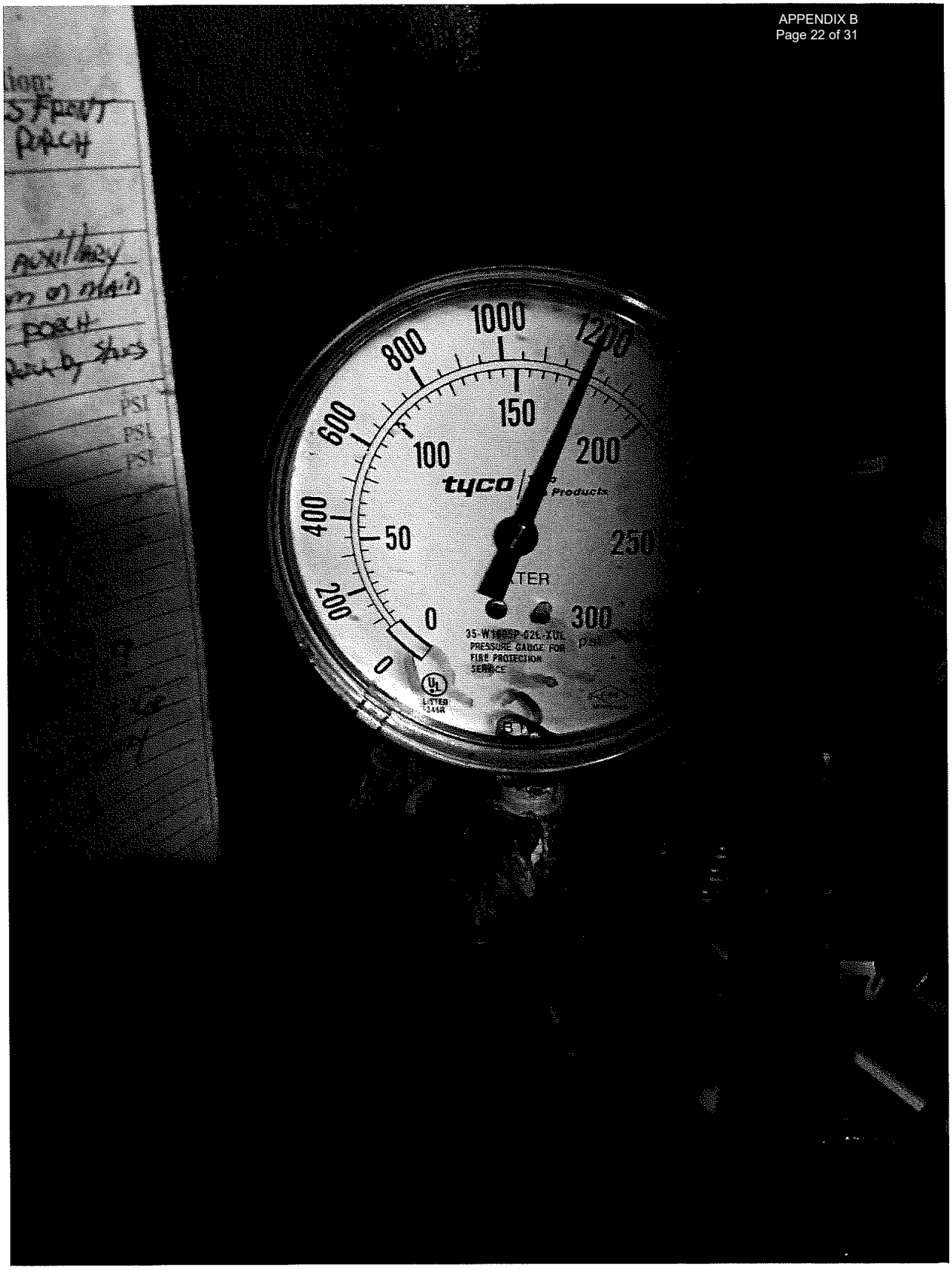
Attachments:

Notifications : Director of LP Mr. Peter T. Eakley

Disposition: Closed

Prepared By	Date/Time Prepared	
Cody Gooden	10/18/2016	
Reviewed By	Date/Time Prepared	☐ Corporate Risk Management
Peter Eakley	10/18/2016	

REVISED 5/3/2007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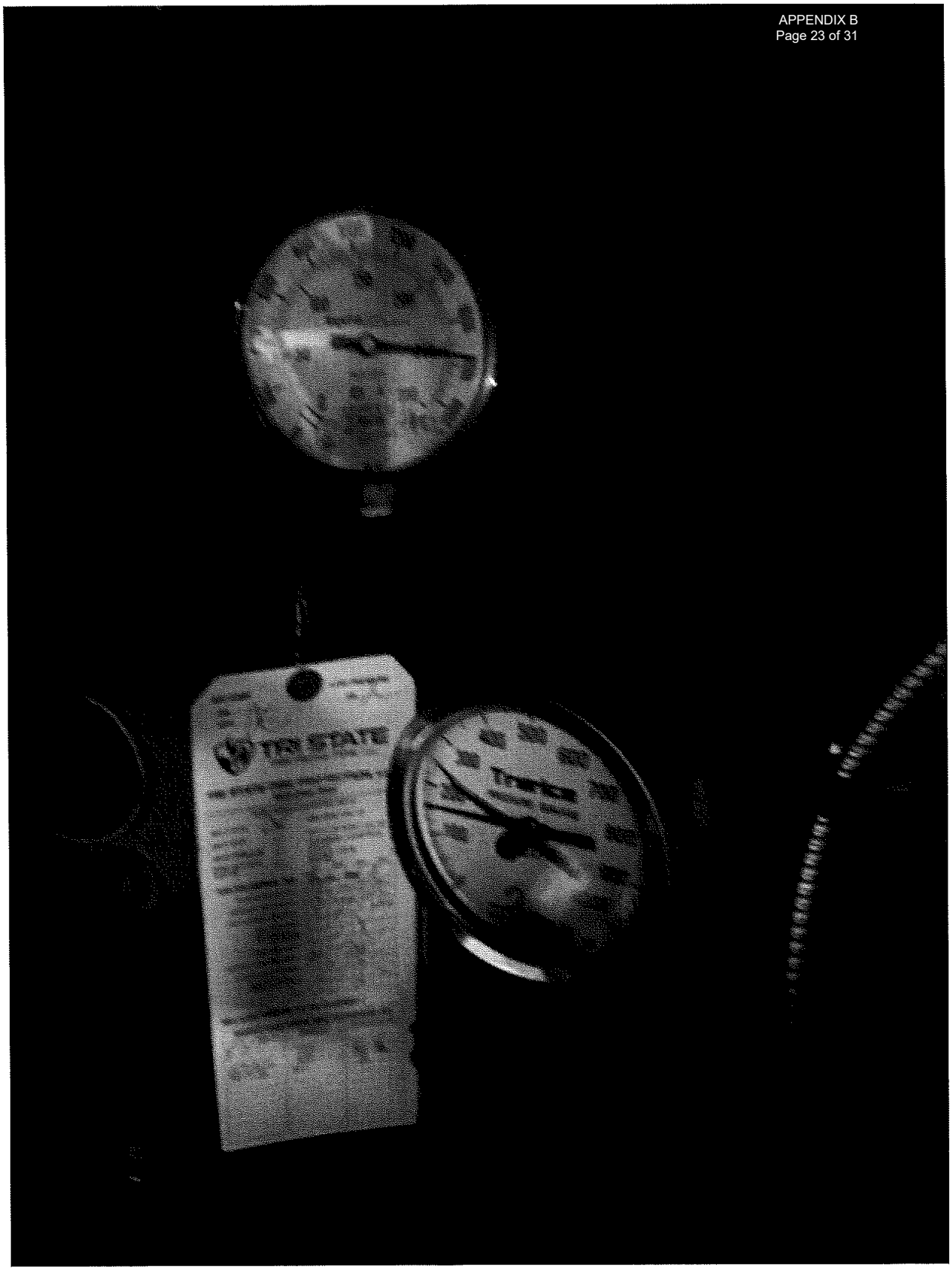
FIRE PROTECTION
SERVICE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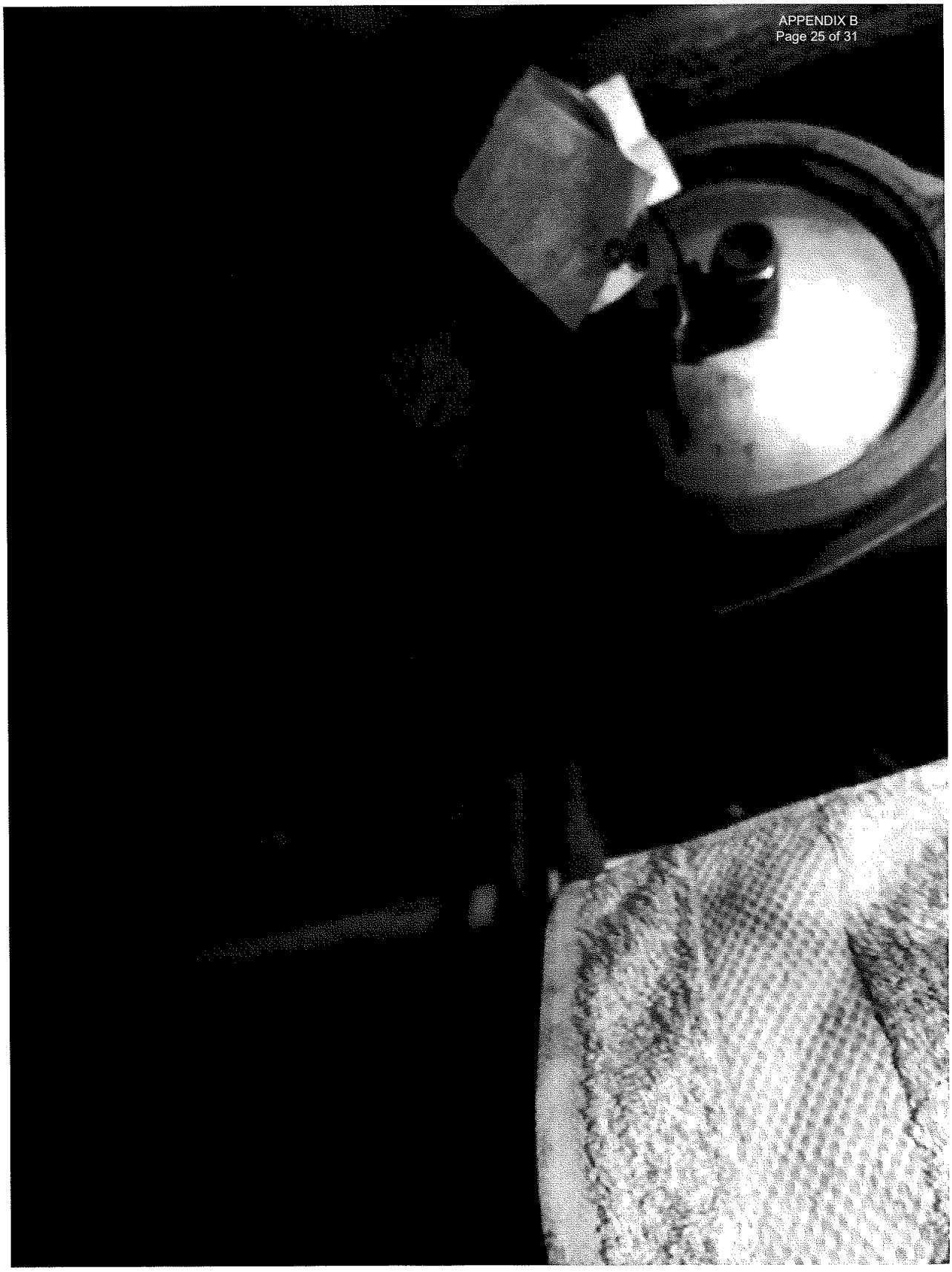


OMNI HOTELS & RESORTS

Incident Report

Property: MountWashington
Report #: 160726-0026

☐ Supplement

Type of Incident	Location of Incident	Condition of Area	Routing ☐ Corporate Risk Management
Fire Alarm	Bretton Arms Inn	See report	

Date of Incident	Time of Incident	Date Reported	Time Reported
07/26/2016	2103	07/26/2016	2103

Subject

Subject Name (last) (first) (middle)	Subject Address (street) (city) (state) (zip)
Bretton Arms Inn	173 Mount Washington Hotel Rd Bretton Woods NH 03575

Age	Primary Phone	Secondary Phone	Subject Type
	(603)278-4610 Office		

Speak directly with Subject?	Describe Subject Attitude/ Concerns

Property

Loss/Damage to Property	Subject Estimate of Loss/Damage
YES	TBD

Describe (quantity, brand, style, color, model #, serial #, etc) **Attach separate Property Report Form as needed**

see report - water damage and pipes

Injury

If injury, nature of injury	First Aid Offered	First Aid Accepted

Type of First Aid Administered	Administered by

Transported to Dr/Hospital (Name)	Transported by

Witness

Witness Name (last) (first) (middle)	Witness Address (street) (city) (state) (zip)

Primary Phone	Secondary Phone	Witness Type

Speak directly with Witness?	Describe Witness Attitude/ Concerns

Police/Fire/EMS

Responding Agency
Twin Mountain Fire and Rescue

Notification Date/Time	Case #	Unit #	Badge #
		Cheif 1 / Eng 1	

Additional Documentation

- ☒ Photos - Description
- ☐ Guest Folio - Description
- ☐ Police Report - Description
- ☐ Diagram - Description
- ☐ Room Access Log - Description
- ☐ Witness Statement - Description
- ☐ Other - Description

Narrative Summary

Please see Narrative Page for details

Prepared By	Date/Time Prepared
Peter Eakley	07/26/2016 2143
Reviewed By	**Date/Time Reviewed**
Peter Eakley	07/26/2016

Incident Report V1.1 Mar 2011

OMNI HOTELS & RESORTS

INCIDENT REPORT

☐ Supplement

REPORT #: 160726-0026

NARRATIVE

Assignment: Fire Alarm

Narrative:

At 2102 MTWASH LP Department was dispatched to the Bretton Arms on a fire alarm activation. LPO Ferri was on scene at 2103 . LPO Ferri found numerous sprinkler pipe failures in the basement alarm / sprinkler feed area.

Later it would be determined, by the fire department, that there was high pressure surge. This will be followed up with Bretton Woods Water Company in the morning. The pressure was in excess of 260 PSI over twice the normal pressure to the system.

The undersigned was immediately contacted (off-duty) and responded to the scene. Upon arrival of Twin Mountain Fire and Rescue, the scene was turned over to same. Engineering Department also responded to the scene.

Guests were allowed back into the building, but the sprinkler system was out of service and the alarms all in trouble. Tri-State Fire Protection was contacted to respond to fix the system. In addition, the undersigned setup a fire watch, to avoid the necessity of closing the building and moving the guests.

Group: N/A
Transient: N/A
Associate: N/A
Patron: N/A

Guest Information: N/A
Name
Address
Phone:
Email:
Check-in:
Check-out:

Guest Statement: N/A

Voluntary Statement: N/A

Timeline: Alarm activation 2102

Investigation: see above report

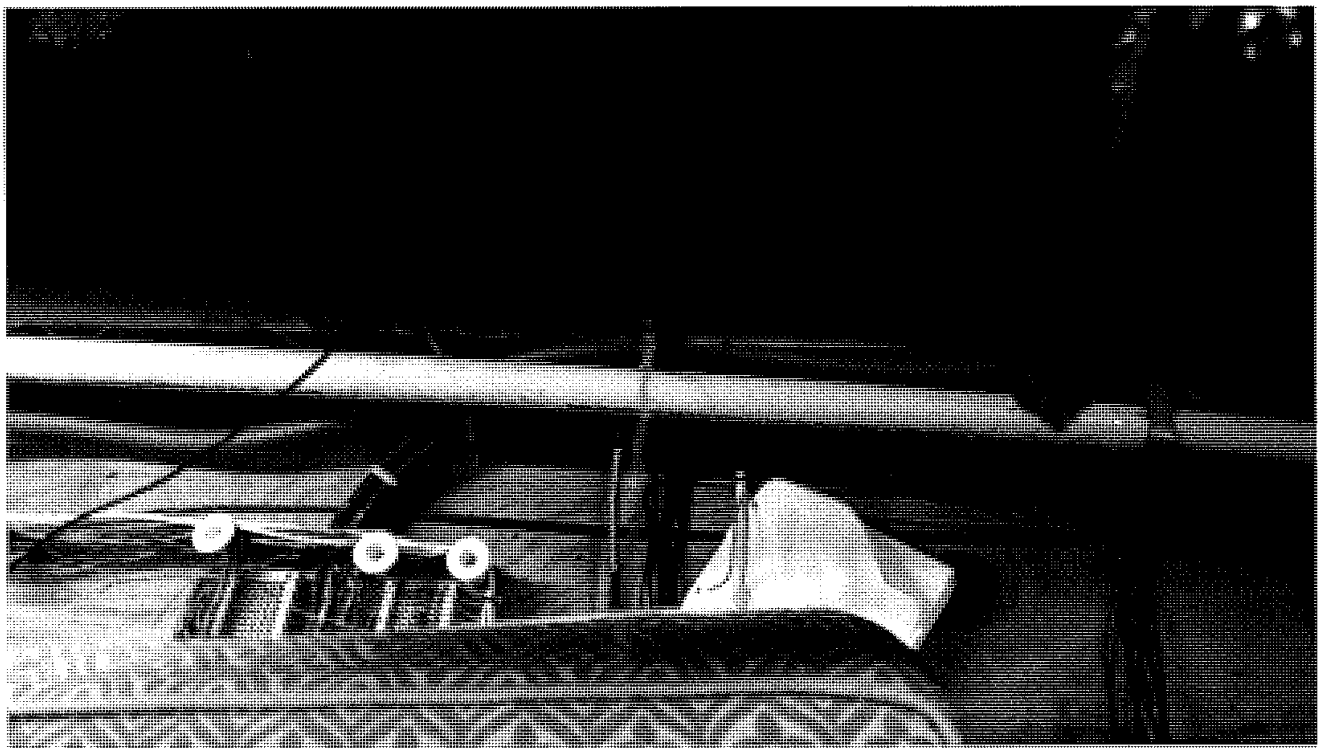
Attachments: None

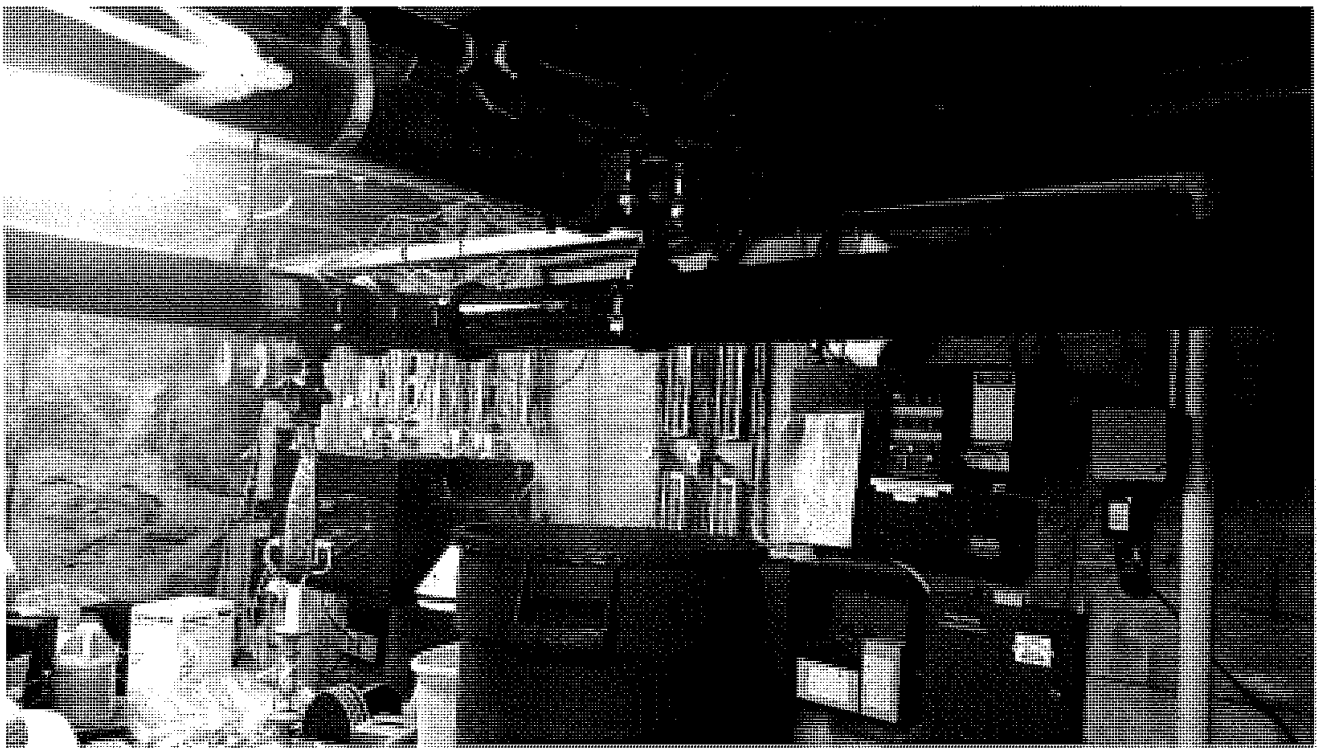
Notifications: Internal

Disposition: Open – follow up with water company

Prepared By	Date/Time Prepared	
Peter Eakley	07/26/2016	
Reviewed By	Date/Time Prepared	☐ Corporate Risk Management
Peter Eakley	07/26/2016	

REVISED 5/3/2007



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tyco
Fire Products
B10

Peter Eakley

From: Peter Eakley
Sent: Thursday, April 1, 2021 17:14
To: Kolin M. Bailey; Christopher Ellms; Jason Doyle; Josh DeBottis
Subject: Abenaki Water Company

Team:

Just and FYI on the water company side of the sprinkler systems we are having a 10 psi rise and fall at the Nordic / Golf Building.

I talked with Mr Doyle and don't believe it is anything the Resort is responsible for, so I have made several attempts to notify the water company, including their 24-hour emergency line.

All attempts to leave a message or speak to anyone was negative.

We have made entry of this incident in our logs.

LP and Engineering will continue to keep an eye on our system..

Mr. Ellms, I am not sure if this information will be helpful with your continuing saga with AWC.

Pete

PETER T. EAKLEY
Director of Loss Prevention

603-278-4610 direct
603-278-7943 facsimile
peter.eakley@omnihotels.com

OMNI MOUNT WASHINGTON RESORT
& BRETTON WOODS SKI AREA
310 Mount Washington Hotel Road
Bretton Woods, New Hampshire 03575

OMNIHOTELS.COM

Appendix C

APPENDIX C TABLE 2-1 ROSEBROOK WATER SYSTEM VALVES (not including hydrant shutoffs)

ATTACH 1 VALVE NO	AWC VALVE ID	TYPE	ESTIMATED INSTALLED	AWC POVIDED SOURCES	DOCKET	DESCRIPTION	ROSEBROOK WATER CO. COMMENTS as per 2018 VALVE INSPECTION	PUC DATA COLLECTION	PUC COMMENTS ON SOURCE DATA/INFORMATION
2A	#2A - Storage Tank	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	16" Gate Valve	Good	Verified	2018 Gate Valve Inspection
2B	#2B - Ski Slope	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	10" Gate Valve	Good	Verified	2018 Gate Valve Inspection
2C	#2C - Ski Slope	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	4" Gate Vale	Good	Verified	2018 Gate Valve Inspection
2D	#2D - Ski Slope	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	10" Gate Vale	Good	Verified	2018 Gate Valve Inspection
2E	#2E - Rosebrook	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	6" Gate Valve	Good	Verified	2018 Gate Valve Inspection
2F	#2F - Rosebrook	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	Unknown	Need to locate	Verified	Verified by Bing Maps & Site Vist 5/24/21
2G	#2G - Rosebrook	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	4" Gate Vale	Good	Verified	2018 Gate Valve Inspection
2H	#2H - Rosebrook	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	10" Gate Valve	Good	Verified	2018 Gate Valve Inspection
2I	#2I - Forest Cottages	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	8" Gate Vale	Good/BO	Verified	2018 Gate Valve Inspection
2J	#2J - Forest Cottages	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	10" Gate Valve	Need to Locate/not tested	Verified	Verified by Bing Maps & Site Vist 5/24/21
2K	#2K - Forest Cottages	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	10" Gate Vale	Good	Verified	2018 Gate Valve Inspection
2L	#2L - Forest Cottages	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	10" Gate Vale	Good	Verified	2018 Gate Valve Inspection
2M	#2M - Forest Cottages	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	Unknown	Good/size unknown	Verified	2018 Gate Valve Inspection
2N	#2N - Forest Cottages	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	Unknown	Good	Verified	2018 Gate Valve Inspection
2O	#2O - Forest Cottages	Gate Valve	Jan-95	19991001 P&L Asbuilts/2A-2O Gate Valve Tracker	IR 21-024	8" Gate Valve	Not Good/BO - Can't operate	Verified	2018 Gate Valve Inspection
3A1	#3A1 - Ski Lodge	Gate Valve	Jan-95	20210519 PUC Field Vist	IR 21-024	16" Gate Valve	-	Verified	Service Valve - See Area Inspection Photos 4 #1883
3A2	#3A2 - Ski Lodge	Gate Valve	Jan-95	20210519 PUC Field Vist	IR 21-024	16" Gate Valve	-	Verified	See Area Inspection Photos 4 #1882
3B	#3B - Ski Lodge	Gate Valve	Jan-95	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	12" Gate Valve	Good	Verified	2018 Gate Valve Inspection
3C	#3C - Pump Station	Gate Valve	Jan-95	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	16" Gate Valve	Not Good/BO - Need blow out	22-Apr-21	valve for 16 inch to pumphouse
3D	#3D - Pump Station	Gate Valve	Jan-95	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	16" Gate Valve	Valve has no nut or guts inside	22-Apr-21	possible 2nd valve 16 inch - Needs to be verified
3E	#3E - Crawford Ridge	Gate Valve	Jan-95	19991001 P&L Asbuilts/3A-3M Gate Vave Tracker	IR 21-024	8" Gate Valve	Good/BO - gate full of water/mud	Verified	2018 Gate Valve Inspection
3F	#3F - Crawford Ridge	Gate Valve	Jan-95	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	12" Gate Valve	Good/BO - gate tough to get free	Verified	2018 Gate Valve Inspection
3G	#3G - Crawford Ridge	Gate Valve	Jan-95	20210408 Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	12" Gate Valve	Good/BO - gate full of water	Verified	2018 Gate Valve Inspection
3H	#3H - Crawford Ridge	Gate Valve	Jan-95	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	4" Gate Valve	Not good/BO - Can't get to operating nut	Verified	2018 Gate Valve Inspection
3I	#3I - Crawford Ridge	Gate Valve	Jan-95	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	4" Gate Valve	Good - gate hard at first but got free	Verified	2018 Gate Valve Inspection
3J	#3J - Drummond	Gate Valve	Jan-95	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	8" Gate Valve	-	Verified	Gate labled wrong on 2018 inspection - need to verify
3J1	#3J1 - Crawford Ridge	Gate Valve	Unknown	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	12" Gate Valve	Needs to be verified	Verified	2018 Gate Valve Inspection
3K	#3K - Crawford Ridge	Gate Valve	Unknown	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	8" Gate Valve	Good	Verified	2018 Gate Valve inspection
3L	#3L - Crawford Ridge	Gate Valve	Unknown	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	Unknown	Good	Verified/Field Vist	2018 Gate Valve inspection
3M	#3M - Crawford Ridge	Gate Valve	Unknown	19991001 P&L Asbuilts/3A-3M Gate Valve Tracker	IR 21-024	Unknown	Good	Verified	2018 Gate Valve Inspection
4A	#4A - RT 302 West	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Need to Locate		Unknown location - need to verify
4B	#4B - 302/Cog Rd	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	16" Gate Valve	Good/BO	22-Apr-21	2018 Gate Valve Inspection
4C	#4C - 302/Cog Rd	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Good	22-Apr-21	2018 Gate Valve Inspection
4D	#4D - Cog Rd	Butterfly Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	16" Butterfy Valve	Not Good/BO - couln't get on nut	22-Apr-21	2018 Gate Valve Inspection
4E	#4E - Mt Washington Entrance	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Good	22-Apr-21	2018 Gate Valve Inspection
4F	#4F - Mt Washington PLace	Butterfly Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	16" Butterfy Valve	Good/BO	22-Apr-21	2018 Gate Valve Inspection
4G	#4G - Mt Washington Place	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Good/BO	22-Apr-21	2018 Gate Valve Inspection
4H	#4H - Mt Washington Place	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Not Good/BO	22-Apr-21	2018 Gate Valve Inspection
4I	#4I - Mt Washington Place	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Good/BO - Full of water	22-Apr-21	2018 Gate Valve Inspection
4J	#4J - Mt Washington Place	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Good/BO - Full of water	22-Apr-21	2018 Gate Valve Inspection
4K	#4K - Mt Washington Place	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	12" Gate Valve	Good/BO - Full of water	22-Apr-21	2018 Gate Valve Inspection
4L	#4L - L-2 Subdivision	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Not Good/BO	Verified	Verified
4M	#4M - Mt Washington Place	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Good/BO - Full of water	22-Apr-21	2018 Gate Valve Inspection
4N	#4N - Mt Washington Place	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Good/BO - Full of water	22-Apr-21	2018 Gate Valve Inspection
4O	#4O - Mt Washington Place	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Good	Verified	2018 Gate Valve Inspection
4P	#4P - Mt Washington Place	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve Tracker	IR 21-024	8" Gate Valve	Good	Verified	2018 Gate Valve Inspection
4Q	#4Q - Mt Washington Place	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve/5/19/21 Visit	IR 21-024	8" Gate Valve	Good - valve stays close	Verified	2018 Gate Valve Inspection
5A	#5A - Cog/Stickney	Gate Valve	Jan-95	19991001 P&L Asbuilts	IR 21-024	6" Gate Valve	Full of gravel - could not turn - as per 20210408 AWC Provided Asbuilts	Verified	2018 Gate Valve Inspection
5B	#5B - Fairway Village	Gate Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	8" Gate Valve	Good/BO - Gate full of water/mud	Verified	2018 Gate Valve Inspection
5C	#5C - Fairway Village	Gate Valve	Jan-95	19991001 P&L Asbuilts	IR 21-024	8" Gate Valve	Good/BO	Verified	Verified by Bing Maps/2018 Gate Valve Inspection
5D	#5D - Fairway Dr	Ball Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	16" Ball Valve	Good		2018 Gate Valve Inspection
5E	#5E - Fairway Village	Gate Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	8" Gate Valve	Not Good/BO - Full of sand	Verified	2018 Gate Valve inspection
5F	#5F - Cog Rd	Gate Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	8" Gate Valve	Good	22-Apr-21	2018 Gate Valve Inspection
5G	#5G - Cog Rd	Gate Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	6" Gate Valve	Good/BO	22-Apr-21	2018 Gate Valve Inspection
5H	#5H - Stickney Cir	Gate Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	6" Gate Valve	Good - Hard at first then broke free	Verified	2018 Gate Valve Inspection
5I	#5I - Stickney Cir	Gate Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	6" Gate Valve	Good	Verified	2018 Gate Valve Inspection
5J	#5J - Stickney Cir	Gate Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	6" Gate Valve	Need to locate	Needs to be verified	Need to verify location
5K	#5K - L-2 Subdivision	Gate Valve	Jul-16	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	8" Gate Valve	Good/BO - full of mud and water	Verified	Verified
5L	#5L - Cog Rd	Gate Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	8" Gate Valve	Did not operate - as per 20210408 AWC Provided Asbuilts	Needs to be verified	Unknown location - need to verify
5M	#5M - Cog Rd/FWV	Butterfly Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	16" Butterfy Valve	Not Good/BO - full of pavement/gravel		2018 Gate Valve Inspection
7A	#7A - Brett Arms	Gate Valve	Jan-95	19991001 P&L Asbuilts/5A-5N,7N Gate Valve Tracker	IR 21-024	16" Gate Valve	Needs to be verified		Needs to be verified
Z1	Gate Valve	Gate Valve	Jul-16	20210519 PUC Field Vist	IR 21-024	Unknown	Needs to be verified	Verified	See Area Inspection Photos 4 #1891
Z2	Gate Valve	Gate Valve	Jul-16	AWC-Rosebrook-Record-Drawings 2019	IR 21-024	Gate Valve	Needs to be verified	Verified	Verified by Bing Maps & Site Vist 5/24/21
Z3	Gate Valve	Gate Valve	Jan-95	20210408 AWC Provided Asbuilts	IR 21-024	2" Gate Valve	Needs to be verified		Needs to be verified
Z4	Gate Valve	Gate Valve	Jul-16	AWC-Rosebrook-Record-Drawings 2019	IR 21-024	4" Gate Valve	Needs to be verified	Verified	Verified by Bing Maps & Site Vist 5/24/21
Z5	Gate Valve	Gate Valve	Jul-16	AWC-Rosebrook-Record-Drawings 2019	IR 21-024	8" Gate Valve	Needs to be verified	Verified	Verified by Bing Maps & Site Vist 5/24/21
Z6	Gate Valve	Gate Valve	Jan-95	19991001 P&L Asbuilts	IR 21-024	Unknown	Needs to be verified	<Null>	Needs to be verified
Z7	Gate Valve	Gate Valve	Jan-95	AWC-Rosebrook-Record-Drawings 2019	IR 21-024	Unknown	Needs to be verified		Needs to be verified
Z8	Gate Valve	Gate Valve	Jul-16	Rosebrook Franchise Map 2016	IR 21-024	Unknown	Needs to be verified		Needs to be verified
Z9	Gate Valve	Gate Valve	Jul-16	Rosebrook Franchise Map 2016	IR 21-024	Unknown	Needs to be verified	Verified	Verified by Bing Maps & Site Vist 5/24/21
Z10	Gate Valve	Gate Valve	Jul-16	20210519 PUC Field Vist	IR 21-024	Unknown	Needs to be verified	Verified	See Area Inspection Photos 4 #1896 & 1897
Z11	Gate Valve	Gate Valve	Jan-95	AWC-Rosebrook-Record-Drawings 2019	IR 21-024	Unknown	Needs to be verified	Verified	Verified by Bing Maps
Z12	Gate Valve	Gate Valve	Jul-16	20210519 PUC Field Vist	IR 21-024	Unknown	Needs to be verified	Verified	See Area Inspection Photos 4 #1891 & 1892
Z13	Gate Valve	Gate Valve	Jul-16	Verified by Bing Maps StreetView 6/5/2015	IR 21-024	Unknown	Needs to be verified	Verified	Verified by Bing Maps
Z14	Gate Valve	Gate Valve	Jul-16	Rosebrook Franchise Map 2016	IR 21-024	Unknown	Needs to be verified	Verified	Verified by Bing Maps & Site Vist 5/24/21
Z15	Gate Valve	Gate Valve	Jan-95	20210524 PUC Field Vist	IR 21-024	Unknown	Needs to be verified		Need to verify location
Z16	Gate Valve	Gate Valve	Jul-16	Verified by Bing Maps StreetView 6/5/2015	IR 21-024	Unknown	Needs to be verified	Verified	Verified by Bing Maps
Z17	Gate Valve	Gate Valve	Jul-16	20210422 Field Vist	IR 21-024	Unknown	Needs to be verified	Verified	Needs to be verified
Z18	Gate Valve	Gate Valve	Jul-16	20210422 Field Vist / 20210414 Field Vist	IR 21-024	Unknown	Needs to be verified	22-Apr-21	Needs to be verified
Z19	Gate Valve	Gate Valve	Jul-16	AWC-Rosebrook-Record-Drawings 2019	IR 21-024	Unknown	Needs to be verified	22-Apr-21	Needs to be verified
Z20	Gate Valve	Gate Valve	Jul-16	AWC-Rosebrook-Record-Drawings 2019	IR 21-024	Unknown	Needs to be verified	22-Apr-21	Needs to be verified
Z21	Gate Valve	Gate Valve	Jul-16	20210422 Field Vist	IR 21-024	Unknown	Unknow valve - needs to be verified	22-Apr-21	Needs to be verified
Z22	Gate Valve	Gate Valve	Jul-16	20210422 Field Vist	IR 21-024	Unknown	Unknow valve - needs to be verified	22-Apr-21	Needs to be verified
Z23	Gate Valve	Gate Valve	Jul-16	20210422 Field Vist	IR 21-024	Unknown	Unknow valve - needs to be verified	22-Apr-21	Needs to be verified
Z24	Gate Valve	Gate Valve	Jul-16	20210422 Field Vist	IR 21-024	Unknown	Unknow valve - needs to be verified	22-Apr-21	Needs to be verified
Z25	Gate Valve	Gate Valve	Jul-16	AWC-Rosebrook-Record-Drawings 2019	IR 21-024	Unknown	Needs to be verified	Verified	Verified by Bing Maps
Z26	Gate Valve	Gate Valve	Jul-16	AWC-Rosebrook-Record-Drawings 2019	IR 21-024	Unknown	Needs to be verified	Verified	Verified by Bing Maps
Z27	Gate Valve	Gate Valve	Jan-95	19991001 P&L Asbuilts/4A-4R Gate Valve	IR 21-024	Unknown	Needs to be verified	Verified	2018 Gate Valve Inspection
Z28	Ball Valve	Ball Valve	Jan-95	19991001 P&L Asbuilts	IR 21-024	2" Ball Vale	Need to Locate		Unknown location - need to verify

	Valves that PUC found where records were inconsistent, wrong location or innacurate
	Valves that PUC found that were not recorded on AWC Tracker (no information, unlabeled)

Appendix D

SAFETY POLICY

The major objective of our company is to produce and market quality products and services at competitive prices with a commitment of integrity to employees, customers, vendors, and community. Our firm policy is to serve our markets in an efficient and safe manner. Safe and healthful conditions at our work sites are primary objectives.

It is our sincere belief that injuries and property damage resulting from accidents are preventable through the proper management of our human and physical resources. Accordingly, safety is a co-partner with productivity and quality.

Every employee of this organization, regardless of his or her position or length of service has the responsibility to follow safe work practices and to have a genuine concern for the safety and health of fellow workers.

In recognition of safety, each full-time non-exempt field employee will be rewarded with a $50.00 quarterly payment provided the following criteria have been satisfied during regular, overtime, and on-call hours of the corresponding period. These criteria are that all non-exempt employees measured as a group, by State, shall not have had any work related injuries that result in lost time of 8 hours or more for any quarter, nor shall any non-exempt employee have received a moving violation or been in an "at fault" vehicle accident in the applicable quarter while on duty. To be eligible, an employee must be employed for the entire quarter for which the bonus is being rewarded for.

Safety Shoes

The use of safety shoes is mandatory for all employees who handle heavy objects or use heavy tools. Therefore, the Company has adopted a program which will encourage use of safety shoes by those employees.

Our company will reimburse, as outlined in the uniform policy, for a pair of ANSI-approved safety shoes per year in the employee's size for the employee's personal use. **The employee is required to wear his/her safety shoes while on the job.**

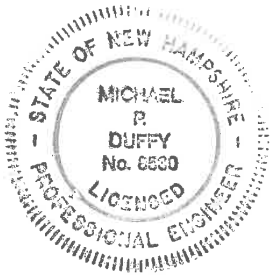
Employees **must** present a sales receipt indicating purchase of safety shoes from any safety shoe vendor to the Controller who will process the request for reimbursement to the employee.

UPDATED SYSTEM EVALUATION FOR PRESSURE REDUCTION
Rosebrook Water System
Bretton Woods, New Hampshire

34 SCHOOL STREET • LITTLETON, NH 03561 • PHONE 603-444-4111 • FAX 603-444-1343 • www.horizonsengineering.com

UPDATED SYSTEM EVALUATION FOR PRESSURE REDUCTION
ROSEBROOK WATER SYSTEM
BRETTON WOODS, NEW HAMPSHIRE
FOR
ABENAKI WATER COMPANY
PLAINVILLE, CT

MAY 2021



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System Overview/Components

The Abenaki Water Company, care of New England Service Company, operates the Rosebrook Water System (PWS ID 0382010) to provide domestic water supply and fire hydrant/sprinkler suppression to users in Bretton Woods, New Hampshire. The system serves the Mount Washington Hotel and Bretton Woods Ski Resort complex as well as single and multi-family residential and small commercial customers within the service area. The Rosebrook Water System is designated by the New Hampshire Department of Environmental Services (NHDES) as a Large Community Water System (a public water system serving a population greater than 1,000 or providing flow for fire suppression). NHDES records indicate the system serves a population of approximately 1,050 through 408 services connections. Major system components include two gravel packed production wells, a pump house, a 650,000-gallon atmospheric storage tank, and distribution piping and appurtenances.

Wells and Well Field

The system has two sand and gravel production wells located to the north of the Bretton Woods Base Lodge and to the south of Drummond Mountain Shop on Route 302.

Well #1 is a 43 foot deep gravel-packed production well with a reported yield of 322 gallons per minute and a static water level of approximately 6 feet below ground surface. Well #1 was installed in 1970 during the original construction of the water system and is located inside the pump station building. Currently Well #1 is equipped with an American Industrial 50 horsepower 10-stage vertical turbine pump. This pump has a reported pumping capacity of approximately 325 gallons per minute. As Well #1 was installed prior to adoption of NHDES Groundwater Withdrawal Rules Env-Ws 379 and 388, this well has not been assigned a permitted production volume.

Well #2 is a 52 foot deep gravel packed production well with a reported yield of 450 gallons per minute. The well is located approximately 90 feet to the southeast of the pump station. Well #2 was installed in the 1990s and received NHDES Conditional Approval in July of 2003. The well is currently equipped with a Goulds 60 horsepower, 480-volt, 3-phase pump set at 30 feet, with an estimated pumping capacity of 425 gallons per minute. NHDES has assigned Well #2 a daily permitted production volume of 540,000 gallons (375 gallons per minute based on continuous pumping).

Pump Station

The Rosebrook pump station consists of a single-story metal-framed building constructed on a concrete slab. The building is in fair condition, having been refurbished after a piping failure and flooding incident in 2008. The pump station does not contain any booster pumps or hydropneumatic storage. The well pumps are configured to operate based on water level in the atmospheric storage tank. These pumps provide the sole source of head for the system. The pump station building houses the Well #1 well head and drive motor along with a chemical feed pumps for water treatment, system controls and alarms for both wells, and various tools, spare parts, and supplies.

Atmospheric Storage Tank

Atmospheric storage consists of a single partially buried cast in place concrete storage tank with a metal truss roof, constructed in the early 1970s. The tank is ninety feet in diameter and has a capacity of 650,000 gallons. The tank is located within the Bretton Woods Ski Area at an approximate elevation of 2,010 feet. Within the last 15 years the tank has undergone repairs to address deterioration of the roof, including installation of a new roof covering system of polystyrene insulation and EPDM membrane in 2012.

Distribution System

The system consists primarily of cement-lined Ductile Iron and C900 PVC water mains. The system contains a total of approximately 32,600 feet of water main. Service connections consist primarily of type "K" copper with brass fittings. System pressures reportedly range from 50 to 190 pounds per square inch. Service connections at lower elevations are equipped with individual pressure reducing valves. The system is equipped with fire hydrants for fire suppression and water mains are adequately sized to provide fire flow. Some of the gate valves in the system are inoperable.

System Domestic Use Demands

Pumping records are maintained for the two water supply wells. Average daily demand over the 2015 calendar year was approximately 110,000 gallons. The peak month was January with an average daily demand of 131,616 gallons and a peak pumping day of 279,900 gallons on January 31, 2015. System demands for 2017 through March of 2021 are as follows:

2017	99,600 gallons per day
2018	119,800 gallons per day
2019	108,750 gallons per day
2020	91,430 gallons per day
2021	115,810 gallons per day

System Pressures

Due to the significant grade differential between the lower service areas and the operating level of the atmospheric storage tank, parts of the Rosebrook system have high static and working pressures. As noted earlier, the storage tank is located at elevation 2010+/-. Elevations along Route 302 and the Base Road near the intersection with Route 302 are approximately 1,575, resulting in static water system pressures in excess of 190 psi.

If system pressures can be effectively reduced, it may result in a system that is safer to operate, some operation and maintenance and pumping costs will be reduced, there will be less reliance on individual service pressure reducing valves (PRVs) for system control, and system leakage may be reduced.

Existing System Piping Flows/Hydraulic Modeling

On May 13, 2021 fire hydrant flow testing was performed in order to determine/confirm the flow characteristics of the existing system piping. Two different pressure gauges were used to confirm gauge accuracy before actual testing commenced. Three separate fire hydrant flow test diffusers were installed on the first hydrant in order to compare flow rates from each device. The newest flow test diffuser was selected for use as it provided a reasonable average of the three devices.

The hydrant flow testing showed that the existing piping network has a very high capacity to deliver water to all parts of the system, including the higher elevations of the system. This ability to deliver water is a function of the adequate size and interior condition of the water mains and the elevation of the exiting storage tank in relation to the hydrant locations. Based upon the hydrant flow testing, a pipe roughness coefficient C-value of 140 for cement lined Ductile Iron pipe and 150 for PVC pipe was determined to be appropriate and therefore utilized in the hydraulic modeling. Flow modeling assumed that a minimum residual pressure of 35 psi be maintained/provided at all locations in the system.

Available pipe water flows for the following locations are highlighted:

Hannah Loop (highest elevation, node J-64)	2,766 gpm
Dartmouth Ridge Homes (highest elevation, node J-66)	2,265 gpm
Crawford Ridge – Presidential Views (highest elevation, node J-19)	2,289 gpm
Rosebrook Townhomes (highest elevation, node J-31)	3,689 gpm
Mount Washington Hotel (node J-98)	1,990 gpm
Bretton Woods Base Lodge (node J-20)	9,070 gpm
Fairway Village (node J-88)	7,399 gpm

It is noted that water hammer was observed during fire flow testing on the north side of Route 302. Water hammer at the higher elevation locations was observed to be 10-12 psi and water hammer at the Mount Washington Hotel was observed to be 16 to 18 psi.

A copy of the modeling Plan and data output showing available flows at all junction nodes of the system can be found in Appendix B.

NHDES Letter of Deficiency DWGB 20-032

On December 1, 2020 the Abenaki Water Company received a Letter of Deficiency DWGB 20-032 (LOD) from the New Hampshire Department of Environmental Services. The LOD states that the Rosebrook Water System shall be modified such that the maximum normal working pressure is between 60 psi and 90 psi with a minimum working pressure of 35 psi at ground level under all conditions and a 100 psi maximum static pressure for the system. The LOD made reference to the "Recommended Standards for Water Works" as justification for the required pressure reduction.

Conceptual Improvements Options for Pressure Reduction

Three overall concepts have been considered for full and/or partial pressure reduction. The Overall Plan found in Appendix A generally shows the location of the proposed options infrastructure:

OPTION 1A assumes that the system will continue to utilize the existing 650,000 gallon water storage tank located at elevation 2,010 feet and that the existing pump station at the well site remains in use for chemical storage and injection. Under this option the well pumps will be replaced with pumps that provide the same outflow at a discharge pressure of 90 psi, and that new booster pump stations will be installed to fill the existing tank and provide service to the higher system users. A pressure reducing valve structure will be installed to allow water from the existing tank to flow back into the lower pressure zone.

OPTION 1B assumes that the system will continue to utilize the existing 650,000 gallon water storage tank located at elevation 2,010 feet and that a new pump station will be installed at the well site. Under this option the well pumps will provide the same outflow to the system but will pump into a 10,000 gallon +/- tank at the well site. Chemical injection will take place under low pressure when a well pump is filling the 10,000 gallon +/- tank. New booster pumps will draw water out of the 10,000 gallon +/- tank, pumping at the same rate of flow from the well pump(s) at a discharge pressure of 90 psi, and that new booster pump stations will be installed to fill the existing tank and provide service to the higher system users. A pressure reducing valve structure will be installed to allow water from the existing tank to flow back into the lower pressure zone.

OPTION 1C assumes that the system will continue to utilize the existing 650,000 gallon water storage tank located at elevation 2,010 feet and that a new pump station will be installed at the well site. Under this option the well pumps will provide the same flow to the system but will pump into a 10,000 gallon +/- tank at the well site. Chemical injection will take place under low pressure when a well pump is filling the 10,000 gallon +/- tank. New booster pumps will draw water out of the 10,000 gallon +/- tank, pumping at the same rate of flow from the well pump at a discharge pressure of approximately 190 psi to fill the existing storage tank without the need for new booster pump stations or pressure reducing valve structure (ie. pressure reduction to take place only for chemical injection piping).

OPTION 2A assumes that the existing water storage tank is replaced with a new 750,000 gallon water storage tank located at the existing well site. Under this option the well pumps will provide the same outflow to the system but will pump into the 750,000 gallon tank at the well site. Chemical injection will take place under low pressure when a well pump is filling the tank. New variable speed booster pumps at the well site will draw water out of the tank, pumping at the needed flow rate to serve the system at a discharge pressure of 90 psi, and new booster pump stations will be installed to service to the higher system users. A pressure reducing valve structure will not be needed under this option.

OPTION 2B assumes that the existing water storage tank is replaced with a new 750,000 gallon water storage tank located at the existing well site. Under this option the well pumps will provide the same outflow to the system but will pump into the 750,000 gallon tank at the well

site. Chemical injection will take place under low pressure when a well pump is filling the tank. New variable speed booster pumps at the well site will draw water out of the tank, pumping at the needed flow rate to serve the system at a discharge pressure of approximately 155 psi. Additional booster pump stations and pressure reducing valve structure will not be needed under this option.

OPTION 3A assumes that the existing water storage tank is replaced with a new 750,000 gallon water storage tank located on the north side of Route 302. Under this option the well pumps will be replaced with pumps that provide the same outflow at a discharge pressure of 90 psi to fill the new tank, and that new booster pump stations will be installed to service to the higher system users. A pressure reducing valve structure will not be needed under this option.

OPTION 1A

This Option maintains key components of the existing system such as the two gravel production wells, the existing pump station building, the transmission and distribution mains, and the 650,000 gallon atmospheric storage tank in the present locations. The key components of the improvements are outlined as follows:

- Replace existing well pumps in Well #1 and Well #2 with two new well pumps capable of the same flow rates (325 gpm for Well #1 and 425 gpm for Well #2) at a discharge pressure of 90 psi. This will reduce the system pressure at the pump station from approximately 190 psi to 90 psi. The well pumps will continue to be controlled by the water level(s) in the 650,000 gallon atmospheric storage tank.

- Install a new combined Rosebrook Booster Pump Station and Pressure Reducing Valve Structure in the vicinity of the existing 16 inch Ductile Iron pipe off of Rosebrook Lane on property owned by Omni/Rosebrook Townhomes Association. This pump station will be utilized to boost water flow/pressure from the well pump(s) to fill the existing storage tank. This pump station will have a slab elevation of approximately 1,700 feet. With an outlet pressure at the existing well pump(s) of 90 psi, this pump station will have an inlet pressure of approximately 35 psi and an outlet pressure of approximately 135 psi. This station will be outfitted with variable speed pumps that will operate in conjunction with the well pump to fill the tank with excess flow from the well pump in operation (pump outflow minus usage at the time of pump operation). This station will not need to provide fire flows, as fire flows for this area will continue to be delivered by the existing water storage tank. This pump station will have a maximum capacity of 425 gpm to match the design output of Well #2. Provisions for stand-by power (emergency generator) will need to be provided at this pump station. This pump station, as well as the well pump, would be controlled by water level in the existing atmospheric storage tank and would start and stop in conjunction with the well pump. The PRV structure will allow/throttle water flow from the existing tank back into the lower pressure zone. This PRV structure will need to operate under very low flow conditions and also high fire flow conditions. This PRV structure will need to be configured such that water hammer conditions are prevented/minimized. This PVR structure will have an inlet pressure of approximately 135 psi and an outlet pressure of approximately 35 psi.

- Install a new Crawford Ridge Booster Pump Station off of Crawford Ridge Drive on property owned by the Crawford Ridge Property Owners Association (at overflow parking area). This pump station will be utilized to boost water flow/pressure from the existing 12 inch water main on Crawford Ridge Drive. This booster pump station will have a slab elevation of approximately 1,670 feet. This pump station will have an inlet pressure of 50 psi and an outlet pressure 106 psi. This station will be outfitted with variable speed pumps drawing water from the storage tank and/or the existing well pump(s). This station will need to provide both domestic and fire hydrant flow to its service area. Provisions for stand-by power (emergency generator) will need to be provided at this pump station. This pump station will operate to maintain a constant outlet pressure of 35 psi minimum at ground level at the highest user in this area.

- Install a new Mount Washington Place Booster Pump Station off of Hartford Lane on property owned by the Mount Washington Place Owners Association (at intersection of Hartford Land and Hannah Loop). This pump station will be utilized to boost water flow/pressure from the existing 16 inch water main on Hannah Loop. This booster pump station will have a slab elevation of approximately 1,670 feet. This pump station will have an inlet pressure approximately of 50 psi and an outlet pressure of approximately 78 psi. This station will be outfitted with variable speed pumps drawing water from the storage tank and/or the existing well pump(s). This station will need to provide fire hydrant flows to its service area. Provisions for stand-by power (emergency generator) will need to be provided at this pump station. This pump station will operate to maintain a constant outlet pressure of 35 psi minimum at ground level at the highest user in this area.

Estimated Cost for OPTION 1A

Well Pump Replacement	$80,000
SCADA and Control Upgrade	$60,000
Chemical Feed/Storage Improvements	$30,000
Rosebrook Pump Station/PRV	$500,000
Crawford Ridge Booster Pump Station	$900,000
Mount Washington Booster Pump Station	$900,000
Subtotal – Construction Cost	$2,470,000
15% Contingency	$370,000
Subtotal – Construction Cost with Contingency	$2,840,000
Land/Easement	$200,000
Engineering @ 10% of Construction Cost	$247,000
Total	**$3,287,000**

OPTION 1B

This Option is similar to OPTION 1A except that the well pumps will pump into a 10,000 gallon +/- tank at the well site where chemical injection will take place and that a new pump station will be installed at the well site. Treated water will be pump into the system by new variable speed pumps in the new pump station drawing water from this 10,000 gallon +/- tank. The outlet pressure into the system from this pump station will 90 psi. The key components of the improvements are outlined as follows:

- Replace existing well pumps in Well #1 and Well #2 with two new well pumps capable of the same flow rates (325 gpm for Well #1 and 425 gpm for Well #2) at a discharge pressure of 20 psi. This will reduce the pressure for the chemical injection system from 190 psi to 20 psi. Install a 10,000 gallon +/- tank at the well site into which the treated well water will flow. Install a new pump station at the well site that will house the chemicals and chemical injection equipment as well as new variable speed pumps that will discharge into the system at 90 psi. The well pumps and booster pumps will continue to be controlled by the water level(s) in the 650,000 gallon atmospheric storage tank.

- Install a new combination Rosebrook Booster Pump Station and Pressure Reducing Valve Structure, a new Crawford Ridge Booster Pump Station, and a new Mount Washington Place Booster Pump Station as previously described.

Estimated Cost for OPTION 1B

Well Pump Replacement	$60,000
SCADA and Control Upgrade	$60,000
Well Site Pump Station	$700,000
Rosebrook Pump Station/PRV	$500,000
Crawford Ridge Booster Pump Station	$900,000
Mount Washington Booster Pump Station	$900,000
Subtotal – Construction Cost	$3,120,000
15% Contingency	$468,000
Subtotal – Construction Cost with Contingency	$3,588,000
Land/Easement	$200,000
Engineering @ 10% of Construction Cost	312,000
Total	**$4,100,000**

OPTION 1C

This Option is similar to OPTION 1B except that the treated water from the 10,000 gallon +/- tank will be pump into the system by variable speed pumps with an outlet pressure into the system of 190 psi to fill the existing storage tank without the need for new booster pump stations (ie. pressure reduction to take place only for chemical injection piping). This option includes a new pump station installed at the well site. The well pumps and booster pumps will continue to be controlled by the water level(s) in the 650,000 gallon atmospheric storage tank. The key components of the improvements are outlined as follows:

- Replace existing well pumps in Well #1 and Well #2 with two new well pumps capable of the same flow rates (325 gpm for Well #1 and 425 gpm for Well #2) at a discharge pressure of 20 psi. This will reduce the pressure for the chemical injection system from 190 psi to 20 psi. Install a 10,000 gallon +/- tank at the well site into which the treated well water will flow. Install a new pump station at the well site that will house the chemicals and chemical injection equipment as well as new variable speed pumps that will discharge into the system at 190 psi. The well pumps and booster pumps will continue to be controlled by the water level(s) in the 650,000 gallon atmospheric storage tank.

Estimated Cost for OPTION 1C

Well Pump Replacement	$60,000
SCADA and Control Upgrade	$60,000
Well Site Pump Station	$900,000
Subtotal – Construction Cost	$1,020,000
15% Contingency	$153,000
Subtotal – Construction Cost with Contingency	$1,173,000
Engineering @ 10% of Construction Cost	102,000
Total	**$1,275,000**

OPTION 2A

This option assumes that the existing water storage tank is replaced with a new 750,000 gallon water storage tank located at the existing well site and that a new pump station will also be installed at the well site.. Under this option the well pumps will provide the same outflow to the system but will pump into the 750,000 gallon tank at the well site. Chemical injection will take place under low pressure when a well pump is filling the tank. New variable speed booster pumps at the well site will draw water out of the tank, pumping at the needed flow rate to serve the system at a discharge pressure of 90 psi, and new booster pump stations will be installed to service to the higher system users. A pressure reducing valve structure will not be needed under this option. The Rosebrook Pump Station will need to provide fire flows under this option.

Estimated Cost for OPTION 2A

Well Pump Replacement	$60,000
SCADA and Control Upgrade	$60,000
Well Site Pump Station	$900,000
750,000 Gallon Water Storage Tank	$1,350,000
Rosebrook Pump Station	$900,000
Crawford Ridge Booster Pump Station	$900,000
Mount Washington Booster Pump Station	$900,000
Subtotal – Construction Cost	$5,070,000
15% Contingency	$760,000
Subtotal – Construction Cost with Contingency	$5,830,000
Land/Easement	$200,000
Engineering @ 10% of Construction Cost	$507,000
Total	**$6,537,000**

OPTION 2B

This option assumes that the existing water storage tank is replaced with a new 750,000 gallon water storage tank located at the existing well site and that a new pump station will be installed at the well site. Under this option the well pumps will provide the same outflow to the system but will pump into the 750,000 gallon tank at the well site. Chemical injection will take place under low pressure when a well pump is filling the tank. New variable speed booster pumps at the new well site pump station will draw water out of the tank, pumping at the needed flow rate to serve the system at a discharge pressure of approximately 155 psi. No additional booster pump stations or PRV structure will be needed. Under this option the outlet pressure of the well site pump station will be reduced from 190 psi to approximately 155 psi to service the highest user in the system with 35 psi minimum at the service elevation.

Estimated Cost for OPTION 2B

Well Pump Replacement	$60,000
SCADA and Control Upgrade	$60,000
Well Site Pump Station	$1,200,000
750,000 Gallon Water Storage Tank	$1,350,000
Subtotal – Construction Cost	$2,670,000
15% Contingency	$400,000
Subtotal – Construction Cost with Contingency	$3,070,000
Engineering @ 10% of Construction Cost	$267,000
Total	**$3,337,000**

OPTION 3A

This option assumes that the existing water storage tank is replaced with a new 750,000 gallon water storage tank located on the north side of Route 302 and that a new pump station will be installed at the well site. Under this option the well pumps will provide the same outflow to the system but will pump into a 10,000 gallon +/- tank at the well site. Chemical injection will take place under low pressure when a well pump is filling the 10,000 gallon +/- tank. New booster pumps will draw water out of the 10,000 gallon +/- tank, pumping at the same rate of flow from the well pump(s) at a discharge pressure of 90 psi to fill the new tank and new booster pump stations will be installed to service to the higher system users. A pressure reducing valve structure will not be needed under this option. The Rosebrook Booster Pump Station will need to provide fire flow for this option

Estimated Cost for OPTION 3A

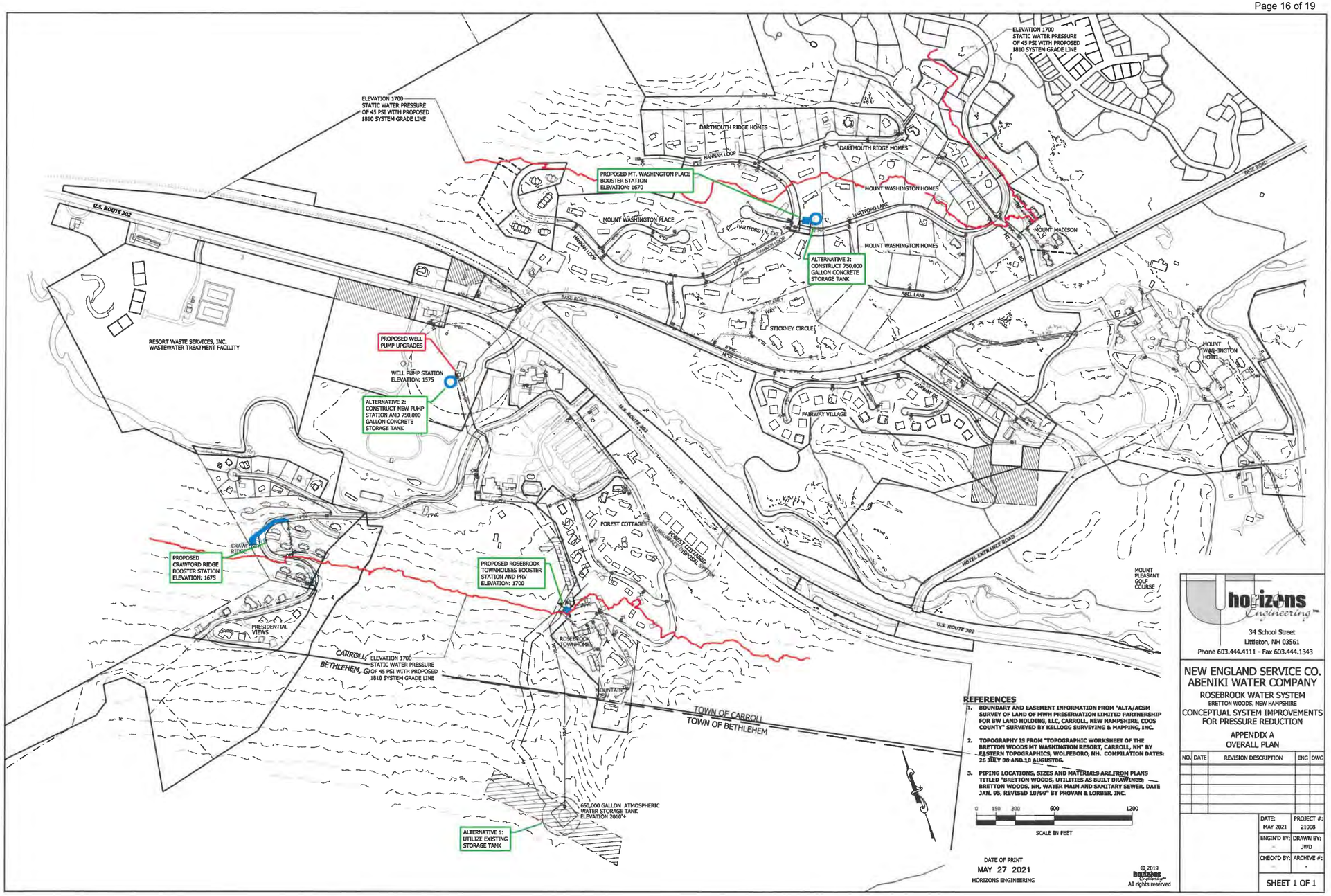
Well Pump Replacement	$60,000
SCADA and Control Upgrade	$60,000
Well Site Pump Station	$700,000
750,000 Gallon Water Storage Tank	$1,350,000
Rosebrook Pump Station	$900,000
Crawford Ridge Booster Pump Station	$900,000
Mount Washington Booster Pump Station	$900,000
Subtotal – Construction Cost	$4,870,000
15% Contingency	$730,000
Subtotal – Construction Cost with Contingency	$5,600,000
Land/Easement	$250,000
Engineering @ 10% of Construction Cost	$487,000
Total	**$6,337,000**

Summary Findings

- The Rosebrook Water System operates in excess of "recommended" pressure limits.
- The Rosebrook Water System has operated under these same conditions for approximately 50 years.
- Other public water systems in New Hampshire operate under similar pressure conditions.
- Pressure reduction will significantly reduce existing fire flows in the lower pressure zone.
- Existing fire flows in the lower elevation of the system are likely much greater than Needed Fire Flows (with the likely exception of the Mount Washington Hotel).
- Existing fire flows in the upper elevation of the system likely currently meet Needed Fire Flows.
- A Needed Fire Flow evaluation should be completed site wide for final design.
- Pressure reduction will reduce domestic water flow/pressure at properties at the higher system elevations. Some high value structures are up to 40 feet above the water service location at ground level and are three stories in height. A static pressure of 35 psi at the ground level of the service may not provide satisfactory pressure for the user.
- Pressure reduction may result in added liability to all parties involved in the project.
- Pressure reduction will improve operator safety at the existing pump station.
- Pressure reduction will improve operation and maintenance of the chemical injection system.
- Above grade piping within the existing pump station is believed to present the greatest hazard potential for the system operator.
- The existing pump station equipment is aged and will need to be upgraded within a relatively short period of time. The existing pump station was not designed for chemical storage and addition to the system.
- Chemical storage within the existing pump station creates a corrosive environment which will accelerate the deterioration of the existing equipment and piping within the building.
- Water hammer currently exists in the system on the north side of Route 302. This water hammer exasperates the high-pressure situation and should be addressed. One potential option to address this situation is the extension of the existing 16 inch water main at Fairway Village to the Mount Washington Hotel as has been previously identified.
- Piping and appurtenances in the system appear to be appropriately rated for the existing system pressures.
- Inoperable valves in the system will not be "fixed" by pressure reduction and should be replaced. Approximately 6 valves, in key system locations, are believed to be inoperable.

APPENDIX A

CONCEPTUAL IMPROVMENTS OPTIONS OVERALL PLAN



REFERENCES

1. BOUNDARY AND EASEMENT INFORMATION FROM "ALTA/ACSM SURVEY OF LAND OF MWH PRESERVATION LIMITED PARTNERSHIP FOR BW LAND HOLDING, LLC, CARROLL, NEW HAMPSHIRE, COOS COUNTY" SURVEYED BY KELLOGG SURVEYING & MAPPING, INC.
2. TOPOGRAPHY IS FROM "TOPOGRAPHIC WORKSHEET OF THE BRETTON WOODS MT WASHINGTON RESORT, CARROLL, NH" BY EASTERN TOPOGRAPHICS, WOLFEBORO, NH. COMPILATION DATES: 26 JULY 00 AND 10 AUGUST06.
3. PIPING LOCATIONS, SIZES AND MATERIALS ARE FROM PLANS TITLED "BRETTON WOODS, UTILITIES AS BUILT DRAWINGS, BRETTON WOODS, NH, WATER MAIN AND SANITARY SEWER, DATE JAN. 95, REVISED 10/99" BY PROVAN & LORBER, INC.

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DATE OF PRINT
MAY 27 2021
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NEW ENGLAND SERVICE CO.
ABENIKI WATER COMPANY
ROSEBROOK WATER SYSTEM
BRETTON WOODS, NEW HAMPSHIRE
CONCEPTUAL SYSTEM IMPROVEMENTS FOR PRESSURE REDUCTION
APPENDIX A
OVERALL PLAN

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: MAY 2021	PROJECT #: 21008
ENGINEER BY: -	DRAWN BY: JWD
CHECK'D BY: -	ARCHIVE #: -

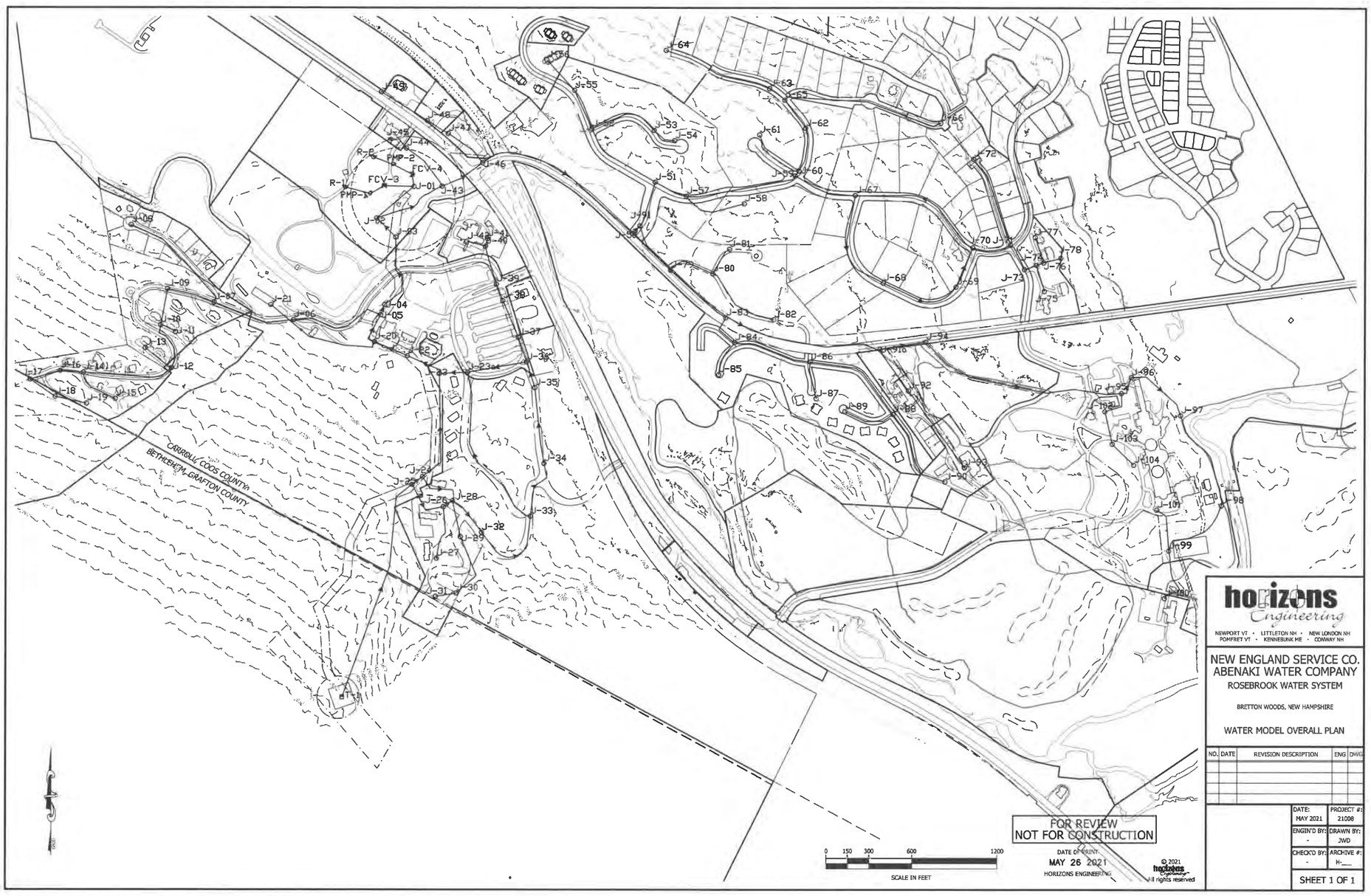
SHEET 1 OF 1

APPENDIX B

ROSEBROOK HYDRAULIC MODELING PLAN AND DATA OUTPUT

ROSEBROOK WATER SYSTEM
HYDRAULIC MODEL DATA
C-VALUES: DUCTILE IRON C=140, PVC C=150

Node Label	Available Flow (gpm)	Minimum Pressure (psi)	Calculated Pressure (psi)	Node Label	Available Flow (gpm)	Minimum Pressure (psi)	Calculated Pressure (psi)
J-01	4,135	35	35	J-55	4,271	35	48
J-02	8,672	35	131	J-56	3,771	35	35
J-03	8,672	35	145	J-57	7,029	35	119
J-04	8,672	35	141	J-59	6,609	35	87
J-05	8,672	35	142	J-60	6,525	35	85
J-06	6,105	35	140	J-61	3,088	35	35
J-07	5,068	35	127	J-62	4,241	35	70
J-08	4,943	35	35	J-63	3,489	35	49
J-09	4,657	35	118	J-64	2,766	35	35
J-10	4,430	35	94	J-65	3,489	35	59
J-12	4,162	35	75	J-66	2,265	35	35
J-14	3,734	35	51	J-67	6,609	35	76
J-15	3,306	35	35	J-68	5,621	35	64
J-16	3,643	35	47	J-69	5,046	35	58
J-17	3,001	35	35	J-70	4,775	35	57
J-18	2,408	35	35	J-71	3,987	35	55
J-19	2,289	35	35	J-72	3,001	35	35
J-20	9,070	35	138	J-73	3,987	35	44
J-22	9,552	35	136	J-74	3,927	35	35
J-23	10,000	35	134	J-75	3,726	35	35
J-23a	10,000	35	121	J-76	3,837	35	35
J-24	10,000	35	107	J-77	3,569	35	35
J-25	10,000	35	104	J-78	3,829	35	35
J-26	10,000	35	72	J-79	7,399	35	121
J-27	3,088	35	35	J-80	3,810	35	40
J-28	10,000	35	71	J-81	3,071	35	35
J-29	7,735	35	59	J-82	2,347	35	35
J-30	4,086	35	37	J-83	7,399	35	111
J-31	3,689	35	35	J-84	7,399	35	113
J-32	10,000	35	57	J-85	7,399	35	42
J-33	10,000	35	71	J-86	7,399	35	99
J-34	10,000	35	73	J-87	7,180	35	35
J-35	10,000	35	88	J-88	7,399	35	98
J-36	10,000	35	95	J-89	6,470	35	35
J-37	7,834	35	71	J-90	7,399	35	92
J-38	6,792	35	35	J-91	7,356	35	128
J-39	6,207	35	35	J-91a	3,159	35	50
J-40	5,264	35	35	J-92	2,618	35	35
J-41	5,119	35	35	J-93	1,989	35	35
J-42	4,179	35	35	J-94	2,939	35	41
J-43	8,672	35	133	J-95	2,300	35	38
J-44	7,559	35	37	J-96	2,277	35	35
J-45	6,606	35	35	J-97	2,150	35	46
J-46	8,419	35	126	J-98	1,990	35	46
J-47	7,834	35	47	J-99	1,892	35	50
J-48	7,048	35	35	J-100	1,892	35	48
J-49	5,569	35	35	J-101	1,838	35	35
J-50	7,399	35	128	J-102	2,236	35	37
J-51	7,172	35	124	J-103	2,173	35	37
J-52	5,048	35	50	J-104	2,120	35	35
J-53	4,131	35	35				



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NEW ENGLAND SERVICE CO.
ABENAKI WATER COMPANY
ROSEBROOK WATER SYSTEM

BRETTON WOODS, NEW HAMPSHIRE

WATER MODEL OVERALL PLAN

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: MAY 2021	PROJECT #: 21008
ENGIN'D BY: -	DRAWN BY: JWD
CHECK'D BY: -	ARCHIVE #: H-___

SHEET 1 OF 1

Stephen P. St. Cyr & Associates
17 Sky Oaks Drive
Biddeford, Me. 04005
207-423-0215
stephenpstcyr@yahoo.com

January 7, 2019

Debra A. Howland
Executive Director & Secretary
Public Utilities Commission
21 S. Fruit Street, Suite 10
Concord, N. H. 03301-2429

DW 17-165 Abenaki Water Company – Rosebrook Division – Step II Report … water pressure problems and supporting documentation

Dear Ms. Howland:

On December 27, 2018 the New Hampshire Public Utilities Commission ("NHPUC") issued Order # 26,205 approving change in rates. As part of its approval, the NHPUC "Further Ordered, that Abenaki-Rosebrook shall submit a report, and supporting documentation, with the Commission within 10 days of the date of this order, that address three issues concerning possible solutions to the system's water pressure problem: the solutions considered before contracting with Horizons; the other possible options available to address the water pressure problems; and the reasons supporting the construction of a new water tank, as proposed by Horizons, as the best and most cost effective solution."

In response to the NHPUC order, see attached report which provides Background, Solutions considered, Other possible options and Reasons for the construction of a new tank. Also, see Attachments 1 – 3, various Horizon reports.

If you, the Commissioners and/or its Staff have any questions about the report and / or attachments, please contact me at 207-423-0215 or stephenpstcyr@yahoo.com.

Sincerely,

Stephen P. St. Cyr

Cc: Don Vaughan
Pauline Doucette
Marcia A. Brown

To: Stephen P. St. Cyr

From: Don Vaughan

Date: 1/4/19

Subject: Responses pursuant to DW 17-165, order No. 26,205; Regarding Rosebrook Pressure Problem.

In accordance with the above subject, Abenaki Water Company (AWC) herewith responds to the following:

a. The solutions considered by the Company before contracting with Horizons
b. The other possible options available to address the water pressure problem; and
c. The reasons supporting the construction of a new water tank, as proposed by Horizons, as the best and most cost effective solution.

For a better understanding of the Rosebrook Water System and the nature of its attendant pressure problem, the following information should be helpful. Much of what appears in the following has been taken from testimony and responses to data requests previously provided in this docket.

The Rosebrook Water System beginnings date back to the early 1970s. Owing to significant elevation differentials throughout the service area, system static pressures vary from 35 pounds per square inch (psi) at the higher elevations and up to 200 psi along the valley, certain OMNI Hotel properties, other residential homes at lower elevations, as well as AWC's well house and source of supply. As described in the Company's filing of June 21, 2018, and detailed below, these higher (excessive) pressures in the system have led directly to problems associated with wear and tear, water loss, premature failure of valves, fittings, pumps, treatment equipment, and other appurtenances. Together the issues post operational and safety challenges in the day-to-day operation of the system. These higher pressures greatly exceed normally accepted limits and caused F.X. Lyons to refuse to work on the system in August 2018 (See Abenaki's response to Staff Tech 1-4a).

Background

Noteworthy information previously provided, consequential of extreme pressure ranges or directly related effects follow:

- Immediately prior to AWCs acquisition, Rosebrook Water Company was informed that its commercial package and property policy running from 6/23/15 through 6/23/16 would not be renewed. This non-renewal was triggered by an extensive damage claim by Rosebrook following a water hammer incident which flooded several townhouses during a hydrant flushing operation.
- In 2010, a high pressure event during a repair at Abenaki's well house caused major damage to that facility and forced the Mt. Washington Hotel to close for three days.

- In its Sanitary Survey report dated August 4, 2014 NHDES concluded "...pressure in the distribution system, as a result of storage tank elevation, is much higher than necessary for adequate water service and fire flow. This pressure presents serious questions about power consumption and about safety of the operation when making pipe repairs. We urge the system owner to consider alternate ways of using the existing tank and adopting a lower pressure gradient".
- In January 2017, NHDES stated in a letter to AWC "We are in support of and recommend system modifications which will reduce the public health risk and will maintain pressures within the recommended range. Not only will this provide for a safer and less costly system to operate, it also creates the ability for the company to take back ownership of system maintenance from home and commercial owners who are currently maintaining their own PRVs."
- The Twin Mountain Fire Department is also concerned about the high pressures. In February, 2017 the department sent a letter to AWC in support of the project to reduce system pressure to a maximum of 100 psi. The department stated that they believe such a project will "...improve safety and reliability of the system."
- Due to the issues raised by AWC and other parties as described above, the No Action alternative is not viable as a long-term solution.

In order to minimize the reoccurrence of any of the above incidents, the Company determined the optimal solution would result in a maximum system pressure of about 100 psi.

A. Solutions considered by the Company before contracting with Horizons

1. Install a single pressure reducing valve (PRV) on the fill/distribution water main to the existing storage tank.
   This solution would require a dedicated main, approximately one mile long from the wells to the storage tank. While reducing pressure to lower elevations, it would also have the same reducing effect or not provide service at all to homes in a higher elevation. Importantly, it would not relieve the excessive pressure at the well house which would remain at 190 – 200 psi. For these reasons, this was not an acceptable solution.

2. Address high pressure at the well house only. The company evaluated this solution aimed at reducing the pressure to about 100 psi at the well house only. Under this solution, a new pump station and a dedicated water main (about ½ the length as in No. 1) would be required. Excessive pressures would still exist at other lower elevations as before. This solution provides the desired relief for the well house but, importantly, ignores regulatory compliance and acceptable operating standards for other parts of the distribution system in addition to not correcting pressure at the lower elevations. Therefore, if mandated to accept this solution, the Company would disclaim responsibility for such incidents as main breaks in areas exceeding 100 psi.
   While still under consideration, this is not a recommended solution because of the problems noted.

Generally, the Company's engineers considered various configuration scenarios which would accomplish the goal of distributing water system wide pressures ranging between approximately 35 and 100 psi. Because neither of the preceding solutions were either acceptable or optimal, the Company began considering a three pump station solution which included a dedicated length of water main, PRVs, and other fittings as well as a future storage tank.

To that end, in 2016, AWC contacted Horizons Engineering to evaluate the Rosebrook system and develop conceptual improvements for pressure reduction for AWC's consideration. Their report, dated July 7, 2016 (Attachment 1), included a technical analysis and cost estimates for the three pump station solution.

In 2017, AWC contracted Horizons to develop a hydraulic model of the Rosebrook system in order to further refine the three pump station solution. Their report, dated March 20, 2017 (Attachment 2), includes recommendations for additional system improvements to accommodate the pressure reduction scenario.

As the design, contract drawings, specifications, coordination of permits, easements and other particulars were beyond the time available or the scope of resources the Company had at its disposal, Horizons Engineers was preferred to provide the above services. The proposal was preceded by Horizons' 9/5/18 Analysis and Recommendations Summary which was provided in response to Staff Tech 1-4a. (Attachment 3) Horizons has also prepared a previous narrative referencing water hammer and submitted it to the prior owners of the Rosebrook system.

Horizons has a long history of familiarity with Rosebrook since its initial work in 1987.

B. Other possible options available to address the water pressure problem

AWC has used the hydraulic model prepared by Horizons to evaluate various pressure reduction alternatives. This evaluation has been ongoing concurrent with the 3 pump station solution referenced earlier. The Company has considered:

- Installation of multiple PRVs at various locations in addition to a pump station(s)
- Looping water mains to potentially reduce the occurrence of water hammer (but not extreme pressure)
- Other engineering designs considering a cost/benefit perspective

C. Reasons for the construction of a new water storage tank, as proposed by Horizons, as the best and most cost-effective solution

Although the new water storage tank can help address the pressure problem, it is also needed for non-pressure related reasons.

- The tank is inappropriately located in the middle of intersecting ski trails, thereby making the tank virtually inaccessible by utility trucks and construction equipment in winter snow conditions.
- The tank access trail, under any weather conditions, is very difficult to traverse.

- The new tank would be sited on a designated lot and easily accessed by Company personnel and vehicles.
- The new tank will ensure scalability, accommodate OMNI expansion, and provide more service reliability.
- The existing tank elevation and location actually contribute to extremely high water pressure, thereby warranting relocation.
- Presumably the original location was designed, as the resort was developed, to negate the need for construction of pump stations and related expense. Water systems in nearby ski areas that the Company has observed, have multiple pressure gradients and supporting pump stations.
- A new tank constructed where no ski areas exist on the north side of route 302 (and closer to the OMNI Hotel) and at a lower elevation would immediately reduce pressure to acceptable levels. This would be the last phase of the proposed staged construction schedule.

As a final note, a site visit and inspection of the facilities was conducted on December 14, 2018 accompanied by an OMNI representative and consultant. Much of the above was discussed and a general understanding of the issues and solutions was accomplished.

Attachment 1

horizons Engineering Inc.

SYSTEM EVALUATION FOR PRESSURE REDUCTION
Rosebrook Water Company
Bretton Woods, New Hampshire

006

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SYSTEM EVALUATION FOR PRESSURE REDUCTION
ROSEBROOK WATER COMPANY
BRETTON WOODS, NEW HAMPSHIRE
FOR
ABENAKI WATER COMPANY
PLAINVILLE, CT

JULY 2016

Project No. 16134
Horizons Engineering, Inc.

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Project No. 16134
July 15, 2016

Messrs. Donald Vaughan and Thomas Hansen
Abenaki Water Company
7 Northwest Drive
Plainville, CT 06062
(860) 747-1665

Subject: Rosebrook Water Company – System Evaluation for Pressure Reduction

Dear Mr. Vaughan and Mr. Hansen:

In accordance with our agreement dated May 11, 2016 and your Purchase Order #1926, we have completed an evaluation for the reduction in system pressures in the Rosebrook Water system in Bretton Woods, New Hampshire. This effort was completed to address significant concerns related to high system pressures and the effect those pressures have had on the system, including premature material and equipment failures and lengthy losses in potable water service and fire protection. System pressure reduction is important to improve system reliability and reduce risk for system operators, users, and the public at large.

If you have any questions or need any additional information, please feel free to call. Thank you for the opportunity to be of service.

Sincerely,

Stephen M. LaFrance, P.E.
Principal Engineer
Horizons Engineering, Inc.

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TABLE OF CONTENTS

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APPENDICES

System Overview/Components

The Rosebrook Water Company, Inc. operates the Rosebrook Water System (PWS ID 0382010) to provide domestic water supply and fire suppression to users in Bretton Woods, New Hampshire. The system serves the Mount Washington Hotel and Bretton Woods Ski Resort complex as well as single and multi-family residential and small commercial customers within the service area. The Rosebrook Water System is designated by the New Hampshire Department of Environmental Services (NHDES) as a Large Community Water System (a public water system serving a population greater than 1,000 or providing flow for fire suppression). NHDES records indicate the system serves a population of 1,050 through 408 services connections. Major system components include two gravel packed production wells, a pump house, a 650,000 gallon atmospheric storage tank, and distribution piping and appurtenances.

Wells and Well Field

The system has two sand and gravel production wells located to the north of the Bretton Woods Base Lodge and to the south of Drummond Mountain Shop on Route 302.

Well #1 is a 43 foot deep gravel-packed production well with a reported yield of 322 gallons per minute and a static water level of approximately 6 feet below ground surface. Well #1 was installed in 1970 during the original construction of the water system and is located inside the pump station building. Currently Well #1 is equipped with an American Industrial 50 horsepower 10-stage vertical turbine pump. This pump has a reported pumping capacity of approximately 325 gallons per minute. As Well #1 was installed prior to adoption of NHDES Groundwater Withdrawal Rules Env-Ws 379 and 388, this well has not been assigned a permitted production volume.

Well #2 is a 52 foot deep gravel packed production well with a reported yield of 450 gallons per minute. The well is located approximately 90 feet to the southeast of the pump station. Well #2 was installed in the 1990s and received NHDES Conditional Approval in July of 2003. The well is currently equipped with a Goulds 60 horsepower, 480-volt, 3-phase pump set at 30 feet, with an estimated pumping capacity of 425 gallons per minute. NHDES has assigned Well #2 a daily permitted production volume of 540,000 gallons (375 gallons per minute based on continuous pumping)

Pump Station

The Rosebrook pump station consists of a single-story metal-framed building constructed on a concrete slab. The building is in good condition, having been rebuilt after a piping failure and flooding incident in 2008. The pump station does not contain any booster pumps or hydropneumatic storage. The well pumps are configured to operate based on water level in the atmospheric storage tank. These pumps provide the sole source of head for the system. The pump station building houses the Well #1 well head and drive motor along with a chemical feed pump for water treatment, system controls and alarms for both wells, and various tools, spare parts, and supplies.

Atmospheric Storage Tank

Atmospheric storage consists of a single partially buried cast in place concrete storage tank with a metal truss roof, constructed in the early 1970s. The tank is ninety feet in diameter and has a capacity of 650,000 gallons. The tank is located within the Bretton Woods Ski Area at an approximate elevation of 2,010 feet. Within the last 15 years the tank has undergone repairs to address deterioration of the roof, including installation of a new roof covering system of polystyrene insulation and EPDM membrane in 2012.

Distribution System

The system consists primarily of cement-lined ductile iron and C900 PVC water mains. The system contains a total of approximately 32,600 feet of water main. Service connections consist primarily of type "K" copper with brass fittings. System pressures reportedly range from 50 to 185 pounds per square inch. Service connections at lower elevations are equipped with individual pressure reducing valves. The system is equipped with fire hydrants for fire suppression and water mains appear to be adequately sized to provide fire flow. Some of the gate valves in the system (e.g. the 16 inch valve at the intersection of Route 302 and the Cog Railway Base Road) are inoperable.

System Demands

Pumping records are maintained for the two water supply wells and are provided in Appendix C. Average daily demand over the 2015 calendar year was approximately 110,000 gallons. The peak month was January with an average daily demand of 131,616 gallons and a peak pumping day of 279,900 gallons on January 31, 2015.

System Pressures

Due to the significant grade differential between the lower service areas and the operating level of the atmospheric storage tank, parts of the Rosebrook system have very high static and working pressures. As noted earlier, the storage tank is located at elevation 2010+/-. Elevations along Route 302 and the Base Road near the intersection with Route 302 are approximately 1,575, resulting in static water system pressures in excess of 180 psi. The elevation at the end of River's Edge Road, one of the lowest points on the system, is 1570, with static pressures of nearly 190 psi.

These high system pressures have caused issues in the past including failed hydrants, isolation valves, and service connections. Although there are design and operational considerations that must be addressed with any plan to reduce system pressures, there are legitimate concerns with current operations. The high pressures are a safety concern, result in excessive wear and tear on pumping equipment, piping, and appurtenances, and lead to premature equipment and material failures. There have been several severe leaks as a result of high system pressures, including a catastrophic failure of a fitting in the well pump station that resulted in loss of potable water and fire protection throughout the system for an extended period of time. The repairs were very costly (over $100,000) and not covered by insurance. There are also a number of valves in the

system that either do not function at all, or are only partially operable due to high system pressures.

These issues can be expected to continue and likely worsen as time goes on and system components age. These failures will at times lead to loss of potable water service and fire protection, which puts the users and residents at risk.

If system pressures can be effectively reduced, it will result in a system that is safer to operate, some operation and maintenance and pumping costs will be reduced, there will be less reliance on individual service pressure reducing valves (PRVs) for system control, and system leakage will be reduced.

Over the years there have been discussions about system modifications to reduce operating pressures. Assuming that the wells, pump station, atmospheric storage tank, and transmission main(s) remain in their present locations because of the large capital investment and cost to relocate, the installation of PRVs has been considered the most viable alternative. The installation of PRVs would require one or more booster stations to re-pressurize the system to reach existing higher elevation service connections.

The backbone of the system is the existing 16 inch diameter ductile iron transmission main the connects the well pump house on the north side of the Ammonoosuc River behind the Drummond Mountain Shop to the atmospheric storage tank to the south at the Bretton Woods Ski Area. There are a number of interconnections off this transmission main that act both as direct service connections (e.g. the Ski Lodge), as well as distribution mains to the Crawford Ridge/Presidential View/Riverfront developments, Rosebrook Townhomes, and Forest Cottages. Just outside the pump house, there is a tee to a 16 inch diameter ductile iron main the passes under Route 302 and along the Cog Railway Base Road and services the residential developments to the west as well as the Mt. Washington Hotel complex.

Concerns Related to Reduction in System Pressure

There are three primary concerns related to reducing system pressures; summarized as follows:

Impact on existing high elevation users

There are several existing residential developments at higher elevations on the system. The uppermost residential building at the Mountain View development is at a ground elevation of 1,810, which equates to a current static pressure of 85 psi. The uppermost residential building at Dartmouth Ridge Homes is at a ground elevation of 1,825, which equates to a current static pressure of 80 psi. The uppermost residential unit at Presidential Views is at a ground elevation of 1,845, which equates to a current static pressure of 70 psi.

New Hampshire Department of Environmental Services Drinking Water & Groundwater standards require a typical minimum residual pressure of 35 psi and an absolute minimum operating pressure of 20 psi (typically under rare fire flow conditions). Assuming at present that Presidential Views is the controlling development, system pressures could be lowered approximately 25 psi and still meet NHDES standards without the need to re-pump. This

estimate is based simply on relative elevations and static pressure conditions and would need to be confirmed with flow testing and hydraulic modeling.

Impact on existing fire flows and sprinkler flows

Reduction in operating pressure will reduce available fire flows throughout the system. Reductions will likely not be of consequence at lower elevations with high operating pressures, but will become more significant at the higher elevations at the ends of the system. Should the decision be made to further evaluate reductions in system pressure, hydrant flow testing and hydraulic modeling of the system at key locations such as at Presidential View, Dartmouth Ridge Homes and Stone Hill is recommended to ensure adequate fire flows are maintained. Given the high service pressures at present and the intent to provide a 100-120 psi ceiling pressure, maintenance of sufficient fire flows is not expected to be difficult.

The larger commercial buildings on the system such as the Mt. Washington Hotel, the Bretton Arms, the Golf/Nordic Center, the Bretton Woods Ski Area Base Lodge, etc. are protected by sprinkler systems that rely on the Rosebrook system for supply. These systems were originally designed based on existing system pressures. The effect of reduced system pressures should be evaluated to ensure that adequate sprinkler flows are maintained. Several calls have been placed to Mr. Kolin Bailey, Director of Engineering at Omni Hotels, for information regarding the system designs and operating parameters. A return call has not been received to date.

Impact on future development at high elevation

The Rosebrook water system was originally constructed to support development of the Bretton Woods Ski Area and associated residential and commercial development. Water main extensions and system upgrades have been made periodically to extend service to new developments and in some cases such as the extension to the Mt. Washington Hotel, to existing developments and structures that abandoned previous water supplies.

A significant amount of undeveloped land remains within the likely service area of the Rosebrook system. Plans have been developed to extend service on Crawford Ridge Road beyond the existing Presidential Views residences into the Town of Bethlehem. This development could extend up to elevation 1900, which would require all the system pressure currently provided by the system.

Plans have also been prepared for residential development to the north of the Base Road, above Dartmouth Ridge Homes. A copy of a subdivision and phasing plan prepared for Bretton Woods Land Co., LLC in 2009 can be found in Appendix B. This development extended to high elevations that also would need system pressures as they exist today. The uppermost and most northerly lot in the proposed development (DB-141) was identified as a future atmospheric storage tank location. The tank was intended to be set at the same elevation as the existing storage tank (2,010+/-) to provide additional storage and fire protection. The first phase of the development was fully designed and permitted but was not constructed due to a downturn in the economy, and remains a possibility in the future.

Conceptual Improvements for Pressure Reduction

At the direction of the system owner, a conceptual plan has been developed to reduce system pressures to a target maximum of 100 psi static. The plan maintains key components of the existing system such as the two gravel production wells, the transmission and distribution mains, and the 650,000 gallon atmospheric storage tank in the present locations to minimize disruption and project cost. The key components of the improvements are shown on the site plan in Appendix D and outlined as follows:

- Replace existing well pumps in Well #1 and Well #2 with two new well pumps capable of the same flow rates (325 gpm for Well #1 and 425 gpm for Well #2) at a discharge pressure of 100 psi. This will reduce the system pressure at the pump station from approximately 185 psi to 100 psi at a new system grade line of 1,810 +/-. The well pumps will continue to be controlled by the water level(s) in the 650,000 gallon atmospheric storage tank.

- Construct a new booster station on the existing 16 inch diameter transmission main from the pump station to the storage tank (see Storage Tank Booster Station on plan in Appendix D). This booster station is necessary to boost water from the proposed system grade line of 1,810 up to the existing storage tank elevation of 2,010 +/-. The booster station would be located adjacent to the Rosebrook Townhomes residential development at an elevation of 1,680 +/-. The station must be located below the distribution mains to Rosebrook Townhomes and Mountain Views to allow those developments to utilize the 2,010 storage tank grade line. The station would have duplex centrifugal pumps capable of 425 gallons per minute to match the output of Well #2. The booster station would be controlled by water level(s) in the atmospheric storage tank and would start and stop in conjunction with the well pumps.

- Install a bypass line and pressure reducing valve (PRV) in the Storage Tank Booster Station to allow water from the storage tank to back feed and supply the Rosebrook system. The valve would have an inlet pressure of approximately 140 psi and an outlet pressure of approximately 55 psi.

- Install a PRV (Rosebrook Townhomes PRV) on the existing 10 inch diameter PVC main on Rosebrook Lane to reduce system pressures from the 2,010 storage tank grade line to the 1,810 well pump station grade line. The valve would have an inlet pressure of approximately 120 psi and an outlet pressure of approximately 35 psi.

- Construct a new booster station (Crawford Ridge Booster Station) on the existing 12 inch diameter distribution main along Crawford Ridge Drive. This booster station is necessary to boost water from the proposed system grade line of 1,810 up to the highest user(s) in the Presidential Views development. A grade line of approximately 1,950 would be required to provide a static pressure of 45 psi at the highest user. The booster station would be located adjacent to Crawford Drive at an elevation of 1,710 +/-. The station would include multi-plex VFD centrifugal pumps and small hydropneumatic tank capable of maintaining system pressure and meeting the peak instantaneous demand of

the residential units at Presidential Views and the higher elevations of Crawford Ridge. Since there is no storage downstream of the proposed booster station, an emergency generator and automatic transfer switch is recommended to maintain water supply in the event of a power outage. The booster station would be capable of fire flows with adequately sized pumps, and would be fitted with fire hydrants upstream and downstream for bypass as an additional safety measure.

- Construct a new booster station (Mt. Washington Place Booster Station) on the existing 8 inch diameter distribution main along Hannah Loop. This booster station is necessary to boost water from the proposed system grade line of 1,810 up to the highest user(s) in the Dartmouth Ridge Homes development. A grade line of approximately 1,945 would be required to provide a static pressure of 45 psi at the highest user. The booster station would be located adjacent to Hannah Loop at an elevation of 1,680 +/-. The station would include multi-plex VFD centrifugal pumps and hydropneumatic tank capable of maintaining system pressure and meeting the peak instantaneous demand of the residential units at Dartmouth Ridge Homes and the higher elevations of Mt. Washington Place. Like the Crawford Ridge station, there is no storage downstream, so an emergency generator and automatic transfer switch is recommended to maintain water supply in the event of a power outage. The booster station would be capable of fire flows with adequately sized pumps, and would be fitted with fire hydrants upstream and downstream for bypass as an additional safety measure.

- Construct a 350 linear foot eight inch diameter water main extension from the end of Mt. Adams Lane cross country to Dartmouth Ridge Lane to connect two dead end mains. This connecting water main will provide pressure from the proposed Mt. Washington Place Booster Station to the higher users on Mt. Adams Lane and also improve water quality by removing dead ends.

- Install a new PRV at the intersection of Mt. Adams Lane and Hartford Lane to reduce system pressures from the 1,945 grade line to the 1,810 grade line. The valve would have an inlet pressure of approximately 105 psi and an outlet pressure of approximately 45 psi.

Opinion of Probable Project Cost for Improvement Options

An opinion of probable project cost has been prepared and included in Appendix E. The opinion includes an estimate of construction cost as well as a 15% contingency and an allowance for soft costs including land, legal fees, administration, and engineering.

Conclusions and Recommendations

The Rosebrook system currently operates with working pressures that are excessive. The working pressures pose a potential safety hazard and lead to premature wear and failure of equipment, piping, and appurtenances. System pressures can be reduced to a maximum of 100-120 psi with the installation of pressure reducing valves in key locations in the system. Due to

the broad elevation changes in the service area, pressure reductions must be countered with booster stations to continue to adequately serve higher elevation service connections.

The conceptual design that has been prepared envisions new well pumps and controls to reduce the system pressure at the well pump station from 185 psi to 100 psi. In addition, three booster stations and three pressure reducing valves are proposed to provide a minimum of approximately 45 psi static pressure to all existing users on the system. Finally, a 350 linear foot water main extension/connection is proposed to provide service to high elevation users in Dartmouth Brook. The total estimated cost for the proposed improvements is $1,410,000 including contingency and soft costs.

As Rosebrook Water Company, Inc. evaluates the proposed project further, we recommend the following:

- Conduct a review of existing sprinkler system flow requirements and hydrant fire flow requirements at key locations in the system.
- Confirm interpolated elevations for the existing storage tank and proposed booster station and PRV locations.
- Determine allowable system pressure reduction through hydrant testing and hydraulic modeling.
- Investigate options for booster station locations and required land purchases.
- Prepare preliminary design for the well pumps, pressure reducing valves, booster stations, water main connection, etc. to provide desired system pressures and flows.
- Revise opinions of probable project cost for the proposed improvements based on the refined designs.

Scheduling of Improvements

The proposed improvements are inextricably linked and must be completed together for the system to function properly. The booster pump stations (Storage Tank Booster Station, Mt. Washington Place Booster Station, and Crawford Ridge Booster Station) must be installed and operational before system pressures are reduced with a change in well pumps or the installation of the PRVs. Once the stations are installed, system pressures can be maintained at the higher elevations and lowered to the maximum target pressure of 100 +/- psi in the lower elevations.

Design and permitting can be expected to take approximately 90 days to complete. Construction of the booster stations would require an additional 90 days. Well pumps and pump station modifications, PRV vault installations, and the proposed eight inch diameter water main connection on Mt. Adams Lane could be accomplished in approximately 45 days.

APPENDIX A
Rosebrook Water Company, Inc.
Customer Meter Size and Type

10:08 AM
06/17/16

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Docket No. DW 17-165
Exh. 20

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type
COMMERCIAL:	200A BW Irving Store	Commercial	08664141	5/8"	Sensus
	201 Drummonds Ski Shop	Commercial	NO REMOTE	5/8"	Sensus-old
Total: 3	203 Real Estate Office/Peabody & Smith	Commercial	NO REMOTE	5/8"	Rockwell
HOTEL & ENTITIES:	202 Hotel-Omni Mt Wash Hotel	Hotel Entity	EBCS6EB	6"	Badger
	BW Admin Blg.	Hotel Entity	NO REMOTE	1"	Sensus
	BW Alpine Club-KITCHEN	Hotel Entity	NO REMOTE	1"	Sensus
	BW Apline Club-BATHRM TRAILER	Hotel Entity	73296636	5/8"	Sensus
	BW Arms	Hotel Entity	45862316	1"	Badger
	BW Caretakers Home	Hotel Entity	ANALOG	5/8"	
	BW Fabyans	Hotel Entity	NO REMOTE	5/8"	ICE?
	BW First Aid Blg	Hotel Entity	NO REMOTE	5/8"	Sensus
	BW Golf/Nordic Building	Hotel Entity	45862318	1"	Badger
	BW O/D Pool & Cabana	Hotel Entity	63408013	2"	Sensus
	BW Ski Area	Hotel Entity	NO REMOTE	2"	
	BW Ski Area-Maintenance Blg	Hotel Entity	35986259	5/8"	Badger
	BW Spa Building	Hotel Entity	02925660	3"	Sensus
	BW Sports Club/Rosebrook Rec Center	Blg. Closed removed meter			
	BW Stables	Hotel Entity	35986245	5/8"	Badger
	BW #337123 portable hydrant meter	Hotel Entity	337123	3"	Sportster
Total: 14 + 2 hydrant meters	BW #337124 portable hydrant meter	Hotel Entity	337124	3"	Sportster
CRAWFORD RIDGE:	CR01 Nelson, George & Kirsten	Active	51946552	5/8"	Sensus
	CR02 Banks, Clarence & Maria	Active	51946535	5/8"	Sensus
	CR03 Shumakin, Kosta & Helena	Active	51946534	5/8"	Sensus
	CR04 Revers, Daniel & Lise	Active	51946551	5/8"	Sensus
	CR05 Benoit, Michael & Donna	Active	51946537	5/8"	Sensus
	CR06 Smail, Peter & Maria	Active	51946554	5/8"	Sensus
	CR07 Milligan, Michael	Active	51946555	5/8"	Sensus
	CR08 Hanson, Michael & Janet	Active	51946550	5/8"	Sensus
	CR09 Relyea, Douglas & Kathleen	Active	57079494	5/8"	Sensus
	CR10 McGloin, Jonathan & Sherry	Active	ANALOG	5/8"	Sensus
	CR11 Foti, Alessandro	Active	63518471	5/8"	Sensus
	CR12 Thomas, Jo-Ellen	Active	06892404	5/8"	Sensus
	CR13 Potter, Brian & Robin	Active	55988888	5/8"	Sensus
	CR14 Baker, Scott	Active	55988889	5/8"	Sensus
	CR15 Southworth & Saisa	Active	13098704	5/8"	Sensus
	CR16 Toran, Richard & Ann	Active	13213198	5/8"	Sensus
	CR17 Falvey-Vantangoli, Karen	Active	09929294	5/8"	Sensus

Meter Count
5/8" = 361
1" = 45
2" = 2
3" = 3
6" = 1
Total: 412

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Association/Business+		Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
		CR18 McSherry, Stephen & Christine	Active	09980563	5/8"	Sensus	
		CR19 Farrell, Daniel & Sue	Active	63518475	5/8"	Sensus	
		CR20 Van Fleet, Bruce & Lisa	Active	09965987	5/8"	Sensus	
		CR21 Alphas Trust	Active	08635889	5/8"	Sensus	
	Total: **22**	CR22 Beauchesne, Bryan & Danielle	Active	08648465	5/8"	Sensus	
DARTMOUTH RIDGE:		DR01 Formisano, Ed & Mary Louise	Active	59616024	5/8"		
Single Family Homes		DR02 Birknes	Active	52214174	5/8"		
		DR03 Vaughan, Patrick & Kathleen L.	Active	52512379	5/8"		
		DR05 Oliver, Al & Connie	Active	09562834	5/8"		
		DR10 Perry & Gilmore	Active	09819852	5/8"		
		DR11 Schiess, Reed	Active	52862855	5/8"		
		DR12 Finn, Michael & Linda	Active	52214173	5/8"		
		DR13 Whitton, Richard & Barbara	Active	52214171	5/8"		
		DR16 Miller, Bode	Active	58207872	1"	Sensus	
		DR17 Manning, Robert & Donna	Active	52512383	5/8"		
		**DR17a Manning/2nd meter	Active	35986244	5/8"	Badger	
		DR20 Whalen, Charles	Active	35986241	5/8"	Badger	
		DR26 Infanti, James & Kathi	Active	62266802	1"	Sensus	
		DR27 Sullivan, Mark & Cheryl	Active	73296638	5/8"	Sensus	
	Total: **15**	DR29 Shea, Michael & Kathleen	Active	72933995	5/8"	Sensus	
FOREST COTTAGE:		FC01 Wirth, Cathy	Active	71003801	5/8"	Elster	
		FC02 Wirth, Theodore & Cathy	Active	ANALOG	5/8"		
		FC03 Hurley, David & Elaine	Active	57519013	5/8"		
		FC04 Torres & Foltz	Active	61135339	5/8"		
		FC05 Buras, Jennifer	Active	57519060	5/8"		
		FC06 Rose, Tony	Active	73296633	5/8"	Sensus	
		FC07 Grossman & Coyle	Active	ANALOG	5/8"		
		FC08 George, Philip & Denise	Active	7326632	5/8"	Sensus	
		FC09 Kloeblen, Steve	Active	ANALOG	5/8"		
		FC10 Luongo, Paul & Marilyn	Active	ANALOG	5/8"		
		FC11 Dunham, Donald & Joan	Active	ANALOG	5/8"		
		FC12 George, Philip & Denise	Active	ANALOG	5/8"		
		FC13 Crimmins & Robinson	Active	ANALOG	5/8"		
		FC14 George, Philip & Denise	Active	ANALOG	5/8"		
		FC15 Forrest, Michael & Janice	Active	ANALOG	5/8"		
		FC16 Dunham, Donald & Joan	Active	52512392	5/8"		
		FC17 Eland, Alan & Joanne	Active	ANALOG	5/8"		

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	FC18 Wilson, Robert & Joan	Active	ANALOG	5/8"		
	FC19 Johnson, Karl & Paulette	Active	71003785	5/8"	Elster	
	FC20 Barous, Frank	Active	ANALOG	5/8"		
	FC21 McMorrow, Daniel & Marianne	Active	7003921	5/8"		
	FC22 Remondi, Stephen & Kristen	Active	ANALOG	5/8"		
	FC23 Grayson, John & Lori	Active	57079497	5/8"		
	FC24 Molleur, Danielle	Active	ANALOG	5/8"		
	FC25 Stevenson & Brewer	Active	ANALOG	5/8"		
	FC26 Charette, George & Karen	Active	ANALOG	5/8"		
	FC27 Gill, Kevin & Rita	Active	08659844	5/8"		
	FC28 Jones, Jay & Debra	Active	ANALOG	5/8"		
	FC29 Fournier/"F Camp Family Trust"	Active	54968898	5/8"		
	FC30 Giannelli, Tom & Andrea	Active	ANALOG	5/8"		
	FC31 Johnson, Gary	Active	ANALOG	5/8"		
	FC32 Losordo, Peter & Karen	Active	ANALOG	5/8"		
	FC33 Penacho Family Trust	Active	54968901	5/8"		
	FC34 Botsivales, Greg	Active	ANALOG	5/8"		
	FC35 Ferguson, Paul & Amy	Active	ANALOG	5/8"		
	FC36 Lees, John & Pam	Active	ANALOG	5/8"		
	FC37 Quinlan, Kevin & Joanna	Active	ANALOG	5/8"		
	FC38 Graves, John & Suzanne	Active	ANALOG	5/8"		
	FC39 Ricciardi, Bernadette	Active	ANALOG	5/8"		
	FC40 JJZM Investment Co. LLC	Active	ANALOG	5/8"		
	FC41 San Antonio, Richard & Pamela	Active	62018055	5/8"		
	FC42 Dwyer, Lawrence	Active	62018058	5/8"		
	FC43 Rani Realty Trust	Active	54968899	5/8"		
	FC44 Osborn, Jason & Karen	Active	ANALOG	5/8"		
	FC45 Mongeau, Paul & Deborah	Active	ANALOG	5/8"		
	FC46 Schaier, Warren & Sandy	Active	ANALOG	5/8"		
	FC47 Blanchard, Ronald & Diane	Active	ANALOG	5/8"		
	FC48 Murphy, Henry & Mary	Active	ANALOG	5/8"		
	FC49 Barr, James & Jane	Active	ANALOG	5/8"		
	FC50 McQueeney, Owen & Sue	Active	ANALOG	5/8"		
	FC51 Penner, Terry & Michele	Active	72933994	5/8"	Sensus	
	FC52 Miller, Jeffery & Cynthia	Active	ANALOG	5/8"		
	FC53 Squires, Bob & Robin	Active	ANALOG	5/8"		
Total: 54	FC54 Hatch, William & Marguerite	Active	61135340	5/8"	Sensus	
FAIRWAY VILLAGE:	FV01 Monica & Horan	Active	07193974	5/8"	Sensus	

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	FV02 Keane, Brian & Theresa	Active	06894980	5/8"	Sensus	
	FV03 Apple, Leslie	Active	ANALOG	5/8"	Rockwell	
	FV04 Harmon, Robert & Rose Ellen	Active	ANALOG	5/8"	Rockwell	
	FV05 Keyser, Donald & Anne	Active	54949860	5/8"	Sensus	
	FV06 Dolan & Connly	Active	54949865	5/8"	Sensus	
	FV07 Mueller, Andreas & Birgit	Active	08907595	5/8"	Sensus	
	FV08 Gibson, Jay & Mary Pat	Active	07172591	5/8"	Sensus	
	FV09 Mordecai & Robbins	Active	54949862	5/8"	Sensus	
	FV10 Dirsa, Albert & Elise	Active	54949863	5/8"	Sensus	
	FV11 Seager, John S. & Linda	Active	07048024	5/8"	Sensus	
	FV12 Daft, Ed & Lisa	Active	07189359	5/8"	Sensus	
	FV13 St. Sauveur, Ronald & Susan	Active	ANALOG	5/8"	Rockwell	
	FV14 Ashe, Terry & Megan	Active	ANALOG	5/8"	Rockwell	
	FV15 Early, Jim & Jane	Active	55988881	5/8"	Sensus	
	FV16 Cox, Gregory & Alisha	Active	55323173	5/8"	Sensus	
	FV17 Cary, Lee B.	Active	07208121	5/8"	Sensus	
	FV18 Cary, Lee B.	Active	07212535	5/8"	Sensus	
	FV19 Pasalic, Sandi & Sener	Active	55323169	5/8"	Sensus	
	FV20 Sweeney, John & Dianne	Active	55322348	5/8"	Sensus	
	FV21 KIGS Enterprises/Kammann	Active	ANALOG	5/8"	Sensus	
	FV22 Molloy, Tracey	Active	ANALOG	5/8"	Sensus	
	FV23 Apple, Roy & Sharon	Active	62018057	5/8"	Sensus	
	FV24 Renner & Kirsch	Active	54968897	5/8"	Sensus	
	FV25 Bauchspies, Barbara	Active	55323174	5/8"	Sensus	
	FV26 Blanche, Jeremy & Julie	Active	09519611	5/8"	Sensus	
	FV27 Poche, Michael & Marjorie	Active	ANALOG	5/8"	Rockwell	
	FV28 O'Brien, Joseph	Active	ANALOG	5/8"	Rockwell	
	FV29 Apple, Fred & Jan	Active	57518568	5/8"	Sensus	
	FV30 Grondine, Leo & Maryann	Active	57518572	5/8"	Sensus	
	FV31 Urban, Steven & Maria	Active	57409106	5/8"	Sensus	
	FV32 Polinger, Shirley	Active	54968902	5/8"	Sensus	
	FV33 Hague & Hanley	Active	ANALOG	5/8"	Rockwell	
	FV34 Hahesy, Paul & Geralyn	Active	57409105	5/8"	Sensus	
	FV35 Elwell, Leon & Carol	Active	ANALOG	5/8"	Rockwell	
	FV36 Caterine, John & Melinda	Active	73296637	5/8"	Sensus	
	FV37 Roy, David & Jessica	Active	57409109	5/8"	Sensus	
	FV38 Bencivenga, Anthony & Lynn	Active	ANALOG	5/8"	Rockwell	
	FV39 Koplow, Meyer	Active	ANALOG	5/8"	Rockwell	
	FV40 Koplow, Meyer	Active	ANALOG	5/8"	Rockwell	

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	FV41 Trott, John & Tracey	Active	ANALOG	5/8"	Rockwell	
	FV42 Long & Brewer	Active	35975334	5/8"	Badger	
	FV43 Fusco, Theresa	Active	ANALOG	5/8"	Rockwell	
	FV44 Heath, Jack & Patty	Active	ANALOG	5/8"	Rockwell	
	FV45 Spinello, John A.	Active	ANALOG	5/8"	Rockwell	
	FV46 Lawson, Richard & Barbara	Active	ANALOG	5/8"	Rockwell	
	FV47 Corkery, Tim & Linda	Active	73296635	5/8"	Sensus	
	FV48 Gaudette, Eugene	Active	ANALOG	5/8"	Rockwell	
	FV49 St. Peter, Robert	Active	ANALOG	5/8"	Rockwell	
Total: 50	FV50 Latimer, Chris E. & Patricia	Active	ANALOG	5/8"	Rockwell	
MT. WASHINGTON HOMES:	MH01 Hegarty, Christopher & Joyce	Active	52862854	5/8"	Sensus	
Single Family Homes	MH03 Dopfel, Alan	Active	62266803	1"	Sensus	
	MH08 Rhodes, Matthew & Cindy	Active	62033392	1"	Sensus	
	MH12 Reynolds, Donald & Donna	Active	02623851	5/8"		
	MH14 Strasser, Allen	Active	56143451	1"	Sensus	
	MH16 Xue, Mei	Active	52862856	5/8"	Sensus	
	MH19 Woods, William & Lila	Active	52862859	5/8"	Sensus	
	MH20 Glendon, David	Active	52862857	5/8"		
Total: 9	MH21 Atkinson, Gaynor	Active	62033391	1"	Sensus	
MT. MADISON:	MM01 Griner, Gregg & Maria	Active	54884729	1"	Sensus	
	MM02 Gaton, Richard J.	Active	54884728	1"	Sensus	
	MM03 Cargill, William & Alicia	Active	54413057	1"	Sensus	
	MM04 Koplow, Meyer	Active	54413058	1"	Sensus	
	MM05 Weisman, Robert & Vanessa	Active	61116194	1"	Sensus	
	MM06 Berger, James & Lisa	Active	58207873	1"	Sensus	
	MM07 Tang & Kainz	Active	58207875	1"	Sensus	
	MM08 O'Shea, Timothy & Corinne	Active	58207876	1"	Sensus	
	MM09 Borek, Robert & Beth	Active	54884736	1"	Sensus	
Total: 10	MM10 Collins, Christoper & Sandra	Active	54884735	1"	Sensus	
MOUNTAIN VIEW:	MV101 Festa, Michael & Martha	Active	09658680	5/8"	Sensus	
fka: Rosebrook Club	MV102 Skilton, Brian & Deirdre	Active	09572422	5/8"	Sensus	
	MV103 Mueller, Paul & Deborah	Active	09572419	5/8"	Sensus	
	MV104 Atkinson, Gaynor	Active	09574445	5/8"	Sensus	
	MV201 Sullivan, Michael	Active	12949758	5/8"	Sensus	
	MV202 Ryan, Michele	Active	12811289	5/8"	Sensus	
	MV203 Donahue, John & Patricia	Active	12953265	5/8"	Sensus	

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	MV204 Waugh, Scott & Kimberly	Active	12877800	5/8"	Sensus	
	MV301 Alphas, John & Sharon	Active	30267357	5/8"	Sensus	
	MV302 Smith, Joseph & Mary Jo	Active	63518480	5/8"	Sensus	
	MV303 Morris, Peter & Heather	Active	63518479	5/8"	Sensus	
	MV304 Leeman & McLaughlin	Active	30267368	5/8"	Sensus	
	MV401 Pappalardo, Karen	Active	51946553	5/8"	Sensus	
	MV402 Casey, Mark	Active	51946532	5/8"	Sensus	
Total: 15	MV403 Page & Trahan	Active	51367085	5/8"	Sensus	
MT. WASHINGTON PLACE:	MW01 PiSierra & O'Connor	Active	55751688	5/8"		
	MW02 Falkenberry, Stephen & Allison	Active	08635770	5/8"		
	MW03 Coffman, David & Barbara	Active	57518666	5/8"		
	MW04 Korona, John & Kathleen	Active	ANALOG	5/8"		
	MW05 Scheidemantel & Boatwright	Active	ANALOG	5/8"		
	MW06 Taylor, Kim	Active	52512396	5/8"		
	MW07 Mullins, James & Eileen	Active	ANALOG	5/8"		
	MW08 McGoldrick, Neil & Amy	Active	ANALOG	5/8"		
	MW09 Rose, Matthew & Katherine	Active	57518665	5/8"		
	MW10 Toomey, William	Active	ANALOG	5/8"		
	MW100 Smith, Winthrop	Active	09027657	5/8"		
	MW101 Wyatt, Peter & Nancy	Active	07193086	5/8"		
	MW102 Alvarez, Austin & Carol	Active	07185267	5/8"	Sensus	
	MW103 Schwartz, James	Active	07048027	5/8"	Sensus	
	MW104 McCarthy, George & Nancy	Active	ANALOG	5/8"	Sensus	
	MW104A Viens, Arthur	Active	ANALOG	5/8"	Sensus	
	MW105 Roome, Ted & Cathy	Active	ANALOG	5/8"	Sensus	
	MW106 DePierro, Peter & Christine	Active	ANALOG/CUBIC	5/8"		
	MW11 Raouf, Firas	Active	52512393	5/8"		
	MW12 Vargas	Active	ANALOG	5/8"		
	MW13 Coache, Robert & Jane	Active	ANALOG	5/8"		
	MW14 Schiess, Reed	Active	35986255	5/8"	Badger	
	MW15 Strom, Judith	Active	ANALOG	5/8"		
	MW16 Berkowitz & Cote	Active	35975279	5/8"	Badger	
	MW17 Raposa & Rothenbuhler	Active	61135341	5/8"		
	MW18 Shapiro, Ken	Active	ANALOG	5/8"		
	MW19 Turcotte, Norman & Pat	Active	ANALOG	5/8"		
	MW20 Browne, Edward & Linda	Active	ANALOG	5/8"		
	MW21 Naylor, Robert & Patricia	Active	ANALOG	5/8"		
	MW22 Gray, John	Active	ANALOG	5/8"		

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	MW23 Lussier, Wayne & Karen	Active	61135342	5/8"		
	MW24 Gaff, Doug & Brenda	Active	ANALOG	5/8"		
	MW25 Keegan, Howard	Active	57518565	5/8"		
	MW26 Minahan, Madeline	Active	ANALOG	5/8"		
	MW27 Bracken, David & Katherine	Active	ANALOG	5/8"		
	MW28 Giglio Family	Active	ANALOG	5/8"		
	MW29 Barous, Dennis	Active	ANALOG	5/8"		
	MW30 Barrett, Richard & Nancy	Active	ANALOG	5/8"		
	MW31 DeChristoforo & Denictolis	Active	63518533	5/8"		
	MW32 Brownell, Thomas	Active	ANALOG	5/8"		
	MW33 Ewing, Thomas J./DEMT LLC	Active	ANALOG	5/8"		
	MW34 Camerlin, Larry & Ruth	Active	ANALOG	5/8"		
	MW35 Horrigan, James	Active	52512395	5/8"		
	MW36 Balliro-Speer, Daveen	Active	63518478	5/8"		
	MW37 Deveau, John & Loren	Active	ANALOG	5/8"		
	MW38 Hart, Sarah	Active	57519056	5/8"		
	MW39 Gagne, Roger & Deborah	Active	ANALOG	5/8"		
	MW40 Paquette, Victor & Amy	Active	ANALOG	5/8"		
	MW41 Dow & Tarter	Active	07010688	5/8"		
	MW42 Czekanski, Antoinette	Active	57519020	5/8"		
	MW43 Souza, David & Tatyana	Active	57519019	5/8"		
	MW44 Woo, Julianne	Active	ANALOG	5/8"		
	MW45 DiGregorio, John & Beverly	Active	ANALOG	5/8"		
	MW46 Churchill, Thomas	Active	ANALOG	5/8"		
	MW47 Everett, Robert & Eleanor	Active	ANALOG	5/8"		
	MW48 Formisano, Ed & Mary Louise	Active	ANALOG	5/8"		
	MW49 Sawyer, Rick & Ellen	Active	ANALOG	5/8"		
	MW50 Kendall, Kennett	Active	ANALOG	5/8"		
	MW50A Napoli & Bilotta	Active	57519016	5/8"		
	MW51 Grabeau, Ken & Ruth	Active	ANALOG	5/8"		
	MW52 Rastiello, Connie (James)	Active	ANALOG	5/8"		
	MW53 Bryant, Richard & Joanna	Active	57518570	5/8"		
	MW54 Kaufman & Kloos	Active	57518567	5/8"		
	MW55 Davies, Peter	Active	ANALOG	5/8"	Rockwell	
	MW56 Kammann & Sweeney	Active	ANALOG	5/8"		
	MW57 Towne, Leland & Judith	Active	ANALOG	5/8"		
	MW58 Yorke, Marilyn	Active	ANALOG	5/8"		
	MW59 Costello, Walter & Donna	Active	57518566	5/8"		
	MW60 Fischer, Robert & Sherry	Active	ANALOG	5/8"		

10:08 AM
06/17/16

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Docket No. DW 17-165
Exh. 20

APPENDIX F
Page 25 of 80

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	MW61 Ricci, Thomas	Active	ANALOG	5/8"		
	MW62 Warren, Zachary & Laura	Active	ANALOG	5/8"		
	MW63 Intriere, Lisa	Active	ANALOG	5/8"		
	MW64 Santosuosso, Lewis & Sharon	Active	ANALOG	5/8"		
	MW65 Griffin, Stephen & Susana	Active	ANALOG	5/8"		
	MW66 McCarthy, Paul & Janet	Active	ANALOG	5/8"		
	MW67 Presti, Richard & Audrey	Active	ANALOG	5/8"		
	MW68 Friedman, Lee & Helen	Active	ANALOG	5/8"		
	MW69 Lee, Kevin & Priscilla	Active	ANALOG	5/8"		
	MW70 Lowe, Donald	Active	ANALOG	5/8"		
	MW71 Twohig, Mike & Laurie	Active	ANALOG	5/8"		
	MW72 Tupper, Sherry	Active	ANALOG	5/8"		
	MW73 Rubin, Steven & Kerrie	Active	71003456	5/8"	Elster	
	MW74 Pothuru & Darulova	Active	71003759	5/8"	Elster	
	MW75 Knowles, Ann	Active	ANALOG	5/8"		
	MW76 Porreca, Gregory & Jamie	Active	35975336	5/8"	Badger	
	MW77 Lane, Peter & Victoria	Active	ANALOG	5/8"		
	MW78 Jacob, Daniel & Janice	Active	52512391	5/8"		
	MW79 Knowles, Jim & Jane	Active	07185266	5/8"		
	MW80 Weber, Peter & Karen	Active	ANALOG	5/8"		
	MW81 Gregory, Nicholas & Athena	Active	07774892	5/8"		
	MW81A Hornick, James	Active	07734579	5/8"		
	MW82 Thomas, Greg & Carra Elise	Active	07792996	5/8"		
	MW83 Walsh, Michael & Betty	Active	07766582	5/8"		
	MW88 Merrill & Rosenberg	Active	ANALOG	5/8"		
	MW89 Nicoll, Robert	Active	ANALOG	5/8"		
	MW90 Lyras, Gene & Tracey	Active	ANALOG	5/8"		
	MW91 Godfrey, Tom Linda	Active	ANALOG	5/8"		
	MW92 Weir, Robert & Georgann	Active	ANALOG	5/8"		
	MW93 Konsin, John P. & Barbara Ann	Active	ANALOG	5/8"		
	MW94 Grappel & Cohen	Active	ANALOG	5/8"		
	MW95 Johnston/Rann	Active	ANALOG	5/8"		
	MW96 Lyons, Richard	Active	57518674	5/8"		
	MW97 Russell, Bob & Laura	Active	57518669	5/8"		
	MW98 Knight, Michael	Active	57518672	5/8"		
Total: 105	MW99 Kavanaugh, Peter & Mary	Active	57518673	5/8"		
PRESIDENTIAL VIEW:	PV01 Goettler, Peter & Cynthia	Active	54884733	1"	Sensus	
	PV02 Neslusan, Dennis & Jane	Active	54884730	1"	Sensus	

10:08 AM
06/17/16

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Docket No. DW 17-165
Exh. 20

APPENDIX F
Page 26 of 80

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	PV03 PV3, LLC	Active	54884727	1"	Sensus	
	PV04 Murphy, Peter	Active	54884734	1"	Sensus	
	PV05 Pres View HOA	Active	65331928	1"	Sensus	
	PV06 Maldon, Jonathan & Andrea	Active	62033383	1"	Sensus	
	PV07 Donaghey, John & Cathy	Active	61116193	1"	Sensus	
	PV08 Falk, Alexander & Nora	Active	58207874	1"	Sensus	
	PV09 Spearman, Patrick & Jane	Active	58207877	1"	Sensus	
	PV10 Milligan & Ward	Active	59536752	1"	Sensus	
	PV11 Muise, Jason & Cristina	Active		1"	Sensus	
	PV12 Muise, Jason & Cristina	Active	71004447	1"	Elster	
	PV13 Allen, Derek & Cecilia	Active	62266804	1"	Sensus	
	PV14 Rose, Matthew & Katherine	Active	71438123	1"	Sensus	
Total: 15	PV15 Friel, Matthew & Lesli	Active	62033376	1"	Sensus	
ROSEBROOK TOWNHOMES:	RB01 O'Hearn, Shaun	Active	08659797	5/8"	Sensus	
	RB02 Caouette, Barry & Julie	Active	ANALOG	5/8"	Badger	
	RB03 Fuller, Peter & Mary	Active	ANALOG	5/8"	Badger	
	RB04 Jones, Mike & Linda	Active	ANALOG	5/8"	Badger	
	RB05 Van Hulle & Bunanta	Active	ANALOG	5/8"	Badger	
	RB06 Eldred, Todd & Kim	Active	10810759	5/8"	Sensus	
	RB07 Jones, Mike & Linda	Active	ANALOG	5/8"	Badger	
	RB08 Jones, Mike & Linda	Active	ANALOG	5/8"	Badger	
	RB09 Hausladen, Jennifer & Derek	Active	ANALOG	5/8"	Badger	
	RB10 Patel, Anit & Rebecca	Active	ANALOG	5/8"	Badger	
	RB11 Robie, Douglas & Dana	Active	ANALOG	5/8"	Sensus	
	RB12 DeVito, Lawrence	Active	07003922	5/8"	Sensus	
	RB13 Chung, Michael & Ava	Active	10793181	5/8"	Sensus	
	RB14 Irving, Mason & Ann	Active	ANALOG	5/8"	Badger	
	RB15 Roberts, Ernie & Paula	Active	07005133	5/8"		
	RB16 Spiller, Bert & Maria	Active	07010646	5/8"	Sensus	
	RB17 Schiller & Walrath	Active	07048029	5/8"	Sensus	
	RB18 McClenathan, Michael & Todd	Active	ANALOG	5/8"	Badger	
	RB19 Benz & Stan	Active	10798768	5/8"	Sensus	
	RB20 Jones, Mike & Linda	Active	71274465	5/8"	Badger	
	RB21 Morrow, Claudia	Active	ANALOG	5/8"	Badger	
	RB22 Rosenbaum, Brett & Heather	Active	10791994	5/8"	Sensus	
	RB23 McClenathan, Todd & Michael	Active	ANALOG	5/8"	Badger	
	RB24 Morton, David	Active	ANALOG	5/8"	Badger	
	RB25 Wilson, Tom & Vikki	Active	ANALOG	5/8"	Badger	

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

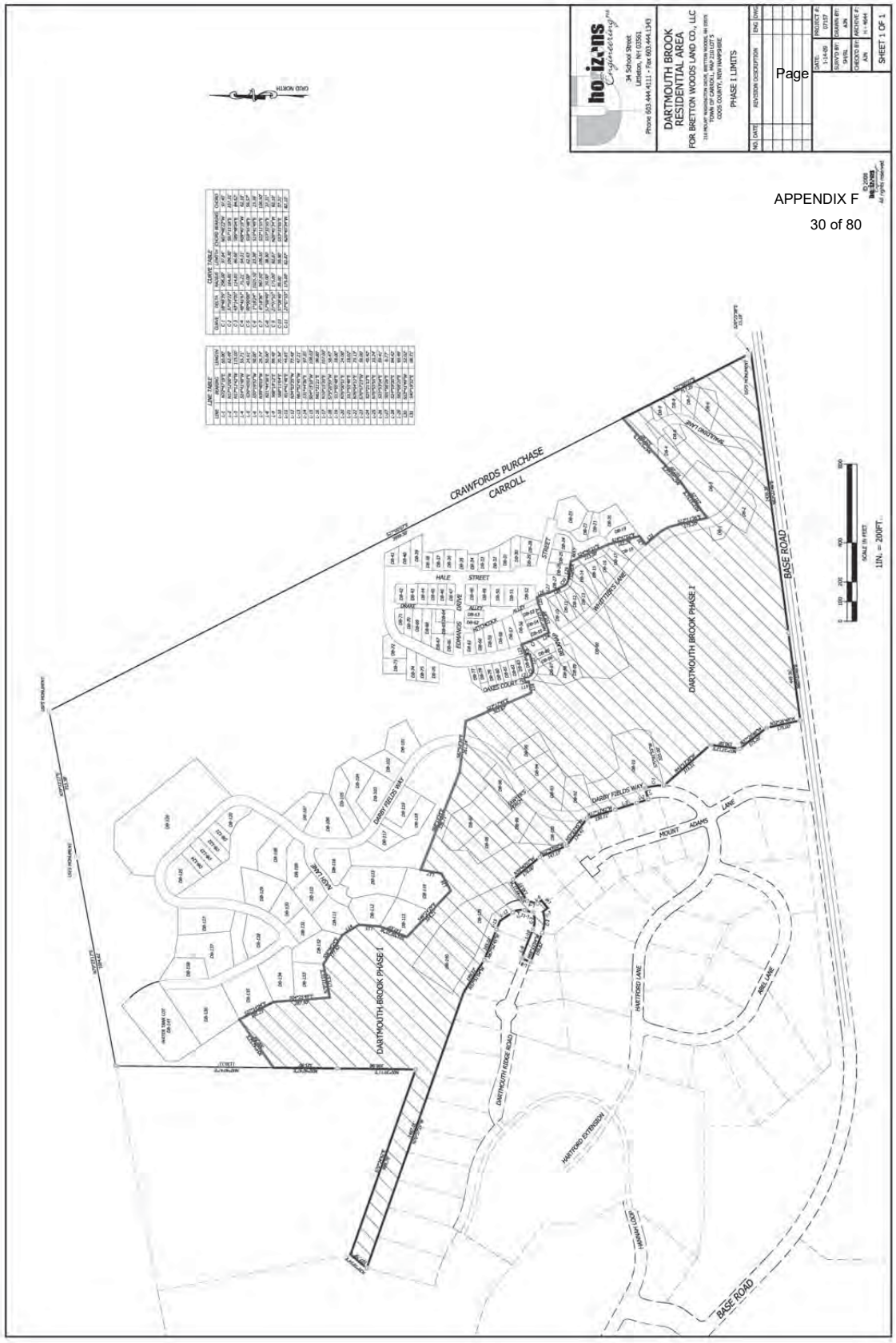
Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	RB26 Sousa, Joseph	Active	ANALOG	5/8"	Badger	
	RB27 Sylvestre, Sara	Active	ANALOG	5/8"	Badger	
Total: 28	RB28 Lane, Christopher & Deirdre w/Grace	Active	73296634	5/8"	Sensus	
RIVER FRONT:	RF01 Bergum, Erik & Leslie	Active	52862858	5/8"	Sensus	
Single Family Homes	RF02 Genimatas, Dale	Active	62018065	5/8"		
	RF03 Allen, Derek & Ceciilia	Active	ANALOG	5/8"	Sensus	
	RF04 Roper, James & Lynne	Active	08658755	5/8"		
	RF05 Hardaway & Peterson	Active	71103680	5/8"	Elster	
	RF06 Wolf, Margot	Active	09507351	5/8"	Sensus	
	RF07 Kraabel, Stephen & Susan	Active	07197279	5/8"	Sensus	
	RF11 McIntire, Heidi	Active	57518670	5/8"		
Total: 9	RF12 Martin, Steven & Elizabeth	Active	52512382	5/8"	Sensus	
STICKNEY CIRCLE:	SC01 Stevenson, Todd & Janel	Active	44780878	5/8"	Badger	
	SC02 Roy, David	Active	35975230	5/8"	Badger	
	SC03 Dinneen & McGuiggan	Active	35986252	5/8"	Badger	
	SC04 Rothery, Louise	Active	36986251	5/8"	Badger	
	SC05 Smith, Jim & Barbara	Active	73296639	5/8"	Sensus	
	SC06 Sheehan, Richard & Carole	Active	35975277	5/8"	Badger	
	SC07 Sheehan, Richard & Carole	Active	35975268	5/8"	Badger	
	SC08 Bungard, Donald & Jane	Active	35986262	5/8"	Badger	
	SC09 Abramovitch, Arlene	Active	ANALOG	5/8"	Sensus	
	SC10 Bruns, Michael & Amy	Active	ANALOG	5/8"	Sensus	
	SC11 11 Stickney Circle, LLC	Active	ANALOG	5/8"	Sensus	
	SC12 Miscione, Vincent & Elizabeth	Active	ANALOG	5/8"	Sensus	
	SC13 Blanco, Ramon & Sophie	Active	02645199	5/8"	Sensus	
	SC14 Hines, David & Deborah	Active	35986246	5/8"	Badger	
	SC15 Robie, Brad	Active	ANALOG	5/8"	Sensus	
	SC16 Yamajala, Sivaram	Active	35986249	5/8"	Badger	
	SC17 Louttit, Jonathan & Marion	Active	35975215	5/8"	Badger	
	SC18 Dolan, Jim & Joan	Active	37068849	5/8"	Sensus	
	SC19 Andriolo, Joseph & Dianne	Active	35986257	5/8"	Badger	
	SC20 Gamache & Lynch	Active	37068852	5/8"	Sensus	
	SC21 Hebert, Stephen M.	Active	35986261	5/8"	Badger	
	SC22 Neville, Kevin & Lisa	Active	63518535	5/8"	Sensus	
	SC23 Owen, William & Ann Marie	Active	35789417	5/8"	Badger	
	SC24 Kelley, Michael & Dianne	Active	13099136	5/8"	Sensus	
	SC25 Balmforth, Maxon	Active	09572087	5/8"	Sensus	

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	SC26 Guerin, Taylor & Carol	Active	10771404	5/8"	Sensus	
	SC27 Wright, Alan & Yoshiko	Active	10854546	5/8"	Sensus	
	SC28 Rosa, Ron & Kim	Active	35986260	5/8"	Badger	
	SC29 Coache, Robert	Active	10799097	5/8"	Sensus	
	SC30 McBunch, Bill & Jane	Active	10952311	5/8"	Sensus	
	SC31 Savini, John & Mary Kathleen	Active	35975338	5/8"	Badger	
	SC32 Chisholm, Claire	Active	35975236	5/8"	Badger	
	SC33 Juzwic, William & Mary Lou	Active	35986247	5/8"	Badger	
	SC34 Bartolini, Wilmin & Kathleen	Active	60896181	5/8"	Sensus	
	SC35 Michell, Patricia	Active	73296631	5/8"	Sensus	
	SC36 Wilson & Thompson	Active	35789415	5/8"	Badger	
	SC37 Doyle, Mary	Active	35986250	5/8"	Badger	
	SC38 Socransky, June	Active	63518476	5/8"	Sensus	
	SC39 Hartung, Kirk & Diane	Active	63518534	5/8"	Sensus	
	SC40 Stankiewicz, Jane	Active	71003716	5/8"	Elster	
	SC41 Walker, Donna	Active	35986253	5/8"	Badger	
	SC42 Raspuzzi, Christine	Active	35986243	5/8"	Badger	
	SC43 Osbahr, John & Carolyn	Active	63518477	5/8"	Sensus	
	SC44 Caterine, John & Melinda	Active	35986264	5/8"	Badger	
	SC45 Rizzolo, Anthony & Josephine	Active	35986256	5/8"	Badger	
	SC46 Costello, Matthew & Kathleen	Active	35986254	5/8"	Badger	
	SC47 Hart, Sarah	Active	35986248	5/8"	Badger	
	SC48 Yuan, Olive	Active	35986242	5/8"	Badger	
	SC BLG B WATER METER	HOA spigot	63518474	5/8"		
	SC BLG C WATER METER	HOA spigot	35975335	5/8"	Badger	
Total: 48 Cust + 3 spigots	SC BLG F WATER METER	HOA spigot	30267358	5/8"	Sensus	
STONE HILL:	SH01 Pinstein & Dassule	Active	56585496	1"	Sensus	
	SH02 Little, Brett & Cory	Active	56585495	1"	Sensus	
	SH03 Samtani & Leslie	Active	54851044	1"	Sensus	
	SH04 Smith, Tony & Chris	Active	54851043	1"	Sensus	
	SH05 Bajer Josephine	Active	54884726	1"	Sensus	
	SH06 Komari, Tony & Suzanne	Active	54884725	1"	Sensus	
	SH07 Burt, Larry & Joanna	Active	59536751	1"	Sensus	
	SH08 Oldroyd & Cronin	Active	59616023	1"	Sensus	
	SH09 Stone, Malcolm & Carol	Active	61116196	1"	Sensus	
Total: 10	SH10 Doherty, Dermot & Christine	Active	61116195	1"	Sensus	

TOTAL METERS 412 (410 CONNECTIONS & 2 PORTABLE)

APPENDIX B
Site Plan
Dartmouth Brook Residential Area
For
Bretton Woods Land Co., Inc.


horizons
Engineering
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343
DARTMOUTH BROOK
RESIDENTIAL AREA
FOR BRETTON WOODS LAND CO., LLC
PHASE I LIMITS
SHEET 1 OF 1
CRAWFORDS PURCHASE
CARROLL
DARTMOUTH BROOK PHASE I
BASE ROAD
HALE STREET
DARBY FIELDS WAY
MOUNT ADAMS
DARTMOUTH RIDGE ROAD
HARTFORD EXTENSION
HARTFORD LANE
ABEL LANE
HANNAH LOOP
1IN. = 200FT.

APPENDIX C
Well Pumping/Water Usage Records 2015/2016

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ROSEBROOK WATER SYSTEM MONTH January YEAR 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Thu	900	NO	10.74	5.28	106,000	3.37	90,100	196,100	200	-	-
2	Fri	900	NO	10.53	5.23	102,700	4.68	122,100	224,800	200	-	-
3	Sat	920	NO	10.78	4.34	86,700	2.63	70,100	156,800	190	-	-
4	Sun	915	NO	10.57	2.78	56,700	2.87	76,300	133,000	190	-	-
5	Mon	700	BS	11.24	0.79	16,600	1.9	50,400	66,000	190	-	-
6	Tue	700	BS	10.61	3.12	62,600	2.62	69,900	132,500	190	-	-
7	Wed	700	BS	11.08	3.04	60,900	0.38	10,200	71,100	190	-	-
8	Thu	700	BS	10.72	2.84	58,600	2.48	65,300	123,900	190	-	-
9	Fri	700	BS	11.07	1.05	19,900	4.06	107,900	127,800	190	-	-
10	Sat	730	BS	10.87	4.73	92,400	2.56	66,400	158,800	190	-	-
11	Sun	735	BS	10.65	4.8	93,000	2.29	61,800	154,800	190	-	-
12	Mon	700	BS	11.06	4.65	91,300	1.28	34,000	125,300	190	-	-
13	Tue	700	BS	11.42	2.58	51,500	0.7	17,900	69,400	190	4	12
14	Wed	700	BS	10.57	4.62	99,800	1.57	41,900	141,700	190	-	-
15	Thu	900	NO	10.78	2.79	57,300	2.44	64,900	122,200	190	-	-
16	Fri	700	BS	10.97	0.77	15,400	4.86	128,600	144,000	190	-	-
17	Sat	930	NO	10.58	6.33	131,500	3.29	87,200	218,700	190	-	-
18	Sun	940	NO	10.85	3.52	69,800	3.28	87,200	157,000	190	-	-
19	Mon	630	BS	10.59	7.2	146,800	0.46	12,300	159,100	190	-	-
20	Tue	700	BS	11.01	4.83	97,300	0.79	20,700	118,000	190	-	-
21	Wed	700	BS	11.35	3.06	62,000	0	-	62,000	190	-	-
22	Thu	700	BS	10.78	6.22	123,300	0	-	123,300	190	-	-
23	Fri	715	BS	11.22	3.66	72,200	2.17	57,600	129,800	190	-	-
24	Sat	700	BS	10.83	7.59	149,900	0.55	14,200	164,100	190	-	-
25	Sun	730	BS	10.74	6.19	123,500	0.97	25,600	149,100	190	-	-
26	Mon	735	BS	10.99	5.95	120,000	0	-	120,000	190	-	-
27	Tue	700	BS	11.26	3.36	63,200	0	-	63,200	190	5	12
28	Wed	630	BS	10.74	3.68	64,200	0	-	64,200	190	-	-
29	Thu	600	BS	10.68	5.57	102,000	0.86	22,500	124,500	190	-	-
30	Fri	840	NO	11.17	0	-	0	-	-	195	-	-
31	Sat	915	BS	8.4	14.56	279,900	0	-	279,900	195	-	-
											9	24
	Totals				135.13	2,675,000	52.94	1,405,100	4,080,100			24

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ROSEBROOK WATER SYSTEM MONTH February YEAR 2015

	DAY	TIME	INITIALS	REBERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Sun	920	NO	10.47	7.15	143,000	0	-	143,000	190	-	-
2	Mon	700	BS	11.25	3.01	59,000	0	-	59,000	190	-	-
3	Tue	700	BS	10.6	4.34	87,600	0	-	87,600	190	-	-
4	Wed	700	BS	10.8	4.95	98,100	0	-	98,100	190	-	-
5	Thu	700	BS	11.03	4.35	86,000	0	-	86,000	190	-	-
6	Fri	700	BS	11.11	8.24	149,300	0	-	149,300	190	-	-
7	Sat	730	BS	10.78	10.4	183,800	0	-	183,800	190	-	-
8	Sun	735	BS	11.01	4.89	91,100	0	-	91,100	190	-	-
9	Mon	700	BS	11.24	2.74	54,000	1.6	41,700	95,700	190	5	12
10	Tue	700	BS	11.24	2.82	56,500	1.44	38,400	94,900	190	-	-
11	Wed	700	BS	11.37	0	-	2.45	64,100	64,100	190	-	-
12	Thu	700	BS	10.87	3.38	65,000	2.08	54,900	119,900	190	-	-
13	Fri	840	NO	11.11	4	77,200	2.24	58,900	136,100	190	-	-
14	Sat	940	NO	10.88	4.53	89,800	2.77	73,200	163,000	190	-	-
15	Sun	925	NO	10.49	5.1	102,300	3.1	82,000	184,300	190	-	-
16	Mon	631	BS	10.65	5.36	109,700	3.06	80,500	190,200	190	-	-
17	Tue	730	BS	10.73	4.49	95,100	3.21	84,700	179,800	190	-	-
18	Wed	700	BS	10.63	5.2	105,000	3.11	82,300	187,300	190	-	-
19	Thu	700	BS	10.55	3.95	81,200	3.27	86,400	167,600	190	-	-
20	Fri	700	BS	10.64	8.41	164,700	3.53	82,000	246,700	190	5	12
21	Sat	730	BS	10.95	5.34	104,100	2.61	79,800	183,900	190	-	-
22	Sun	735	BS	10.91	2.61	52,800	2.47	65,100	117,900	190	-	-
23	Mon	700	BS	11.11	3.46	69,800	2.1	55,200	125,000	190	-	-
24	Tue	700	BS	11.11	3.17	66,400	2.07	54,600	121,000	190	-	-
25	Wed	700	BS	11.19	3.56	71,000	2.27	59,800	130,800	190	-	-
26	Thu	705	BS	11.42	3.64	74,900	1.82	42,800	117,700	190	-	-
27	Fri	830	NO	10.88	3.88	80,300	3.9	102,500	182,800	190	-	-
28	Sat	930	NO	11.06	4.16	90,100	3.58	93,900	184,000	195	-	-
	Totals				127.14	2,508,200	52.48	1,382,800	3,891,000		10	24

Jul.01.2016 09:30 AM

ROSEBROOK WATER SYSTEM MONTH March YEAR 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Sun	900	NO	10.9	2.72	58,100	2.46	64,800	120,900	195	-	-
2	Mon	700	BS	10.94	4.06	83,600	0	-	83,600	195	4	12
3	Tue	700	BS	10.65	2.79	57,200	2.64	69,600	126,800	195	-	-
4	Wed	700	BS	11.15	0.95	19,200	2.49	65,200	84,400	190	-	-
5	Thu	700	BS	10.76	2.65	53,300	2.42	63,500	116,800	190	-	-
6	Fri	700	BS	10.61	3.64	72,900	2.53	66,300	139,200	190	-	-
7	Sat	730	BS	10.93	4.97	99,100	3.09	81,000	180,100	190	-	-
8	Sun	900	BS	10.53	4.8	95,300	2.34	61,600	156,900	190	-	-
9	Mon	700	BS	11.09	3.17	65,100	0.5	13,000	78,100	190	-	-
10	Tue	825	BS	10.69	2.58	52,800	2.06	54,200	107,000	190	-	-
11	Wed	700	BS	11.27	0	-	2.33	60,900	60,900	190	-	-
12	Thu	700	BS	10.89	3.14	64,200	2.07	54,100	118,300	190	3	8
13	Fri	1015	NO	10.88	4.21	77,900	2.2	58,000	135,900	195	-	-

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ROSEBROOK WATER SYSTEM **MONTH** April **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 80 # BAGS
1	Wed	700	BS	10.72	2.87	58,400	2.33	60,300	118,700	190	-	-
2	Thu	850	NO	11.1	2.53	51,500	0	-	51,500	195	-	-
3	Fri	730	BS	11.38	0.87	17,900	2.51	66,100	84,000	190	-	-
4	Sat	730	BS	10.72	3.65	64,200	2.86	69,800	134,000	190	-	-
5	Sun	8700	BS	10.88	4.06	75,800	0	-	75,800	190	-	-
6	Mon	810	BS	10.52	3.37	54,600	2.48	64,600	119,200	190	4	12
7	Tue	850	NO	11.19	0.79	13,400	2.42	63,100	76,500	195	-	-
8	Wed	730	BS	11.17	3.89	62,900	0	-	62,900	190	-	-
9	Thu	700	BS	10.91	0.5	9,000	2.38	62,300	71,300	190	-	-
10	Fri	945	NO	10.63	4.39	71,500	2.62	42,200	113,700	190	-	-
11	Sat	850	NO	11.39	0.48	7,500	1.42	63,300	70,800	190	-	-
12	Sun	930	NO	10.53	4.45	72,900	0	-	72,900	190	-	-
13	Mon	700	BS	10.69	0	-	2.2	57,400	57,400	190	-	-
14	Tue	730	BS	10.73	3.49	60,100	0	-	60,100	190	-	-
15	Wed	840	NO	10.83	1	-	2.03	52,700	52,700	195	-	-
16	Thu	700	BS	11.11	2.3	54,300	0	-	54,300	190	-	-
17	Fri	660	BS	11.33	0	-	2.29	60,300	60,300	190	-	-
18	Sat	715	BS	11.21	3.54	67,100	0	-	67,100	190	-	-
19	Sun	620	BS	10.96	3.03	53,100	2.43	63,400	116,600	190	-	-
20	Mon	705	BS	11.38	0	-	2.33	60,900	60,900	190	-	-
21	Tue	730	BS	11.03	2.97	56,200	0	-	56,200	190	-	-
22	Wed	650	BS	11.03	0	-	2.34	61,300	61,300	190	-	-
23	Thu	644	BS	10.68	0.45	9,100	2.79	72,200	81,300	190	3	10
24	Fri	739	BS	10.69	3.64	62,200	0.89	23,200	85,400	190	-	-
25	Sat	1000	NO	10.85	3.12	54,100	1.5	39,200	93,300	190	-	-
26	Sun	1000	NO	11.01	0	-	2.26	59,000	59,000	195	-	-
27	Mon	715	BS	10.69	3.16	58,700	0	-	58,700	190	-	-
28	Tue	628	BS	10.81	0	-	1.96	51,300	51,300	190	-	-
29	Wed	655	BS	10.89	0.1	1,800	2.1	55,000	56,800	190	-	-
30	Thu	740	BS	10.95	3.62	61,900	0	-	61,900	190	-	-
	Totals				82.27	1,098,200	43.94	1,147,600	2,245,800		>	22

ROSEBROOK WATER SYSTEM MONTH May YEAR 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Fri	642	BS	10.79	0	-	2.27	59,000	59,000	190	-	-
2	Sat	700	BS	10.51	4.06	70,600	2.1	55,000	125,600	190	-	-
3	Sun	710	BS	11.27	3.18	59,200	0	-	59,200	190	-	-
4	Mon	700	BS	10.72	0	-	2.29	59,900	59,900	190	-	-
5	Tue	630	BS	11.4	2.74	56,500	2.24	58,100	114,600	190	-	-
6	Wed	650	BS	10.79	4.13	67,200	2.2	57,900	125,100	190	-	-
7	Thu	805	NO	11.38	2.72	56,200	0.27	7,100	63,300	195	-	-
8	Fri	700	BS	11.15	1.01	19,900	2.36	62,300	82,200	190	-	-
9	Sat	910	NO	10.75	3.41	60,800	1.93	50,500	111,300	190	-	-
10	Sun	910	NO	10.64	0	-	2.27	59,800	59,800	195	-	-
11	Mon	650	BS	10.67	3.42	63,500	0	-	63,500	190	-	-
12	Tue	620	BS	10.63	2.57	53,500	2.19	57,600	111,100	190	-	-
13	Wed	631	BS	11.39	0	-	2.37	62,500	62,500	190	-	-
14	Thu	615	BS	11.21	2.97	61,700	0	-	61,700	190	-	-
15	Fri	550	BS	10.83	2.16	44,700	2.44	63,900	108,600	190	4	11
16	Sat	630	BS	11.27	0.72	14,600	2.28	59,700	74,300	190	-	-
17	Sun	700	BS	10.95	4.16	65,300	0	-	65,300	190	-	-
18	Mon	700	BS	10.61	0	-	2.27	59,700	59,700	190	-	-
19	Tue	700	BS	10.69	3.91	62,900	0	-	62,900	190	-	-
20	Wed	650	BS	10.61	2.76	52,100	2.42	63,300	115,400	190	-	-
21	Thu	656	BS	11.25	0.71	12,300	2.39	62,500	74,800	190	-	-
22	Fri	820	NO	10.69	2.5	48,100	2.48	65,100	113,200	190	-	-
23	Sat	930	NO	10.53	3.43	69,300	2.5	65,300	134,600	190	-	-
24	Sun	945	NO	10.69	6.65	106,700	0.91	23,900	130,600	195	-	-
25	Mon	900	BS	10.89	1.33	24,900	2.2	57,300	82,200	195	-	-
26	Tue	640	BS	10.95	2.14	37,200	2.56	66,100	103,300	190	-	-
27	Wed	715	BS	10.51	3.11	61,200	2.23	58,300	119,500	190	-	-
28	Thu	700	BS	10.95	5.61	90,100	0	-	90,100	190	4	11
29	Fri	600	BS	10.56	2.86	58,400	2.53	66,400	124,800	190	-	-
30	Sat	730	BS	11.19	0	-	2.41	33,000	33,000	190	-	-
31	Sun	735	BS	10.53	4.93	76,000	2.07	84,000	160,000	190	-	-
	Totals				77.19	1,392,900	54.17	1,418,200	2,811,100		8	036 22

ROSEBROOK WATER SYSTEM **MONTH** June **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 60 # BAGS
1	Mon	700	BS	11.41	9.98	153,900	0	-	153,900	190	-	-
2	Tue	720	BS	11.07	3.59	66,000	1.71	44,700	110,700	190	-	-
3	Wed	900	NO	10.63	0	-	0	-	-	180	-	-
4	Thu	700	BS	9.51	8.45	144,600	0	-	144,600	190	-	-
5	Fri	700	BS	10.75	3.6	62,300	0	-	62,300	190	-	-
6	Sat	930	NO	10.06	10.19	176,700	0	-	176,700	195	-	-
7	Sun	1050	NO	11.46	3.28	56,200	0	-	56,200	190	-	-
8	Mon	700	BS	11.27	0	-	0	-	-	90	4	9
9	Tue	700	BS	9.67	6.46	121,900	0	-	121,900	190	-	-
10	Wed	630	BS	10.56	5.2	90,400	0	-	90,400	190	-	-
11	Thu	640	BS	10.88	4.28	73,400	0	-	73,400	190	-	-
12	Fri	700	BS	10.63	5.83	100,300	0	-	100,300	190	-	-
13	Sat	700	BS	10.73	6.82	127,200	0	-	127,200	190	-	-
14	Sun	630	BS	11.23	4.19	66,200	0	-	65,200	190	-	-
15	Mon	645	BS	10.77	3.47	65,700	0	-	65,700	190	-	-
16	Tue	655	BS	10.64	6.25	117,900	0	-	117,900	190	-	-
17	Wed	700	BS	11.24	3.93	64,300	0	-	64,300	190	-	-
18	Thu	745	BS	10.7	6.49	116,700	0	-	116,700	190	-	-
19	Fri	930	NO	11.1	4.61	85,600	0	-	85,600	195	-	-
20	Sat	730	BS	10.97	3.82	58,200	0	-	58,200	190	-	-
21	Sun	720	BS	10.57	7.08	137,600	0	-	137,600	190	-	-
22	Mon	700	BS	11.31	4.05	63,700	0	-	63,700	190	-	-
23	Tue	630	BS	11.26	3.65	64,400	0	-	64,400	190	-	-
24	Wed	740	BS	10.81	5.21	86,300	0	-	86,300	190	-	-
25	Thu	700	BS	10.75	2.94	52,400	0	-	52,400	190	5	12
26	Fri	645	BS	9.71	25.58	414,000	0	-	414,000	190	-	-
27	Sat	730	BS	13.41	0	-	0	-	-	195	-	-
28	Sun	730	BS	11.17	0	-	0	-	-	190	-	-
29	Mon	700	BS	9.04	11.29	182,200	0	-	182,200	190	-	-
30	Tue	630	BS	10.81	0	-	0	-	-	195	-	-
	Totals				160.24	2,747,100	1.71	44,700	2,791,800			21

Jul.01.2016 09:45 AM

Docket No. DW 17-165
Exh. 20

ROSEBROOK WATER SYSTEM MONTH July YEAR 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Wed	645	BS	8.96	3.28	68,500	0	-	68,500	190	-	-
2	Thu	700	BS	8.28	6.41	127,400	0	-	127,400	190	-	-
3	Fri	740	NO	8.62	8.34	154,300	0.43	-	154,300	195	-	-
4	Sat	840	NO	8.42	0	-	0	-	-	195	-	-
5	Sun	905	NO	5.44	6.8	119,700	0	-	119,700	190	-	-
6	Mon	700	BS	5.7	9.66	165,100	0	-	165,100	190	-	-
7	Tue	600	BS	9.18	0	-	0	-	-	190	-	-
8	Wed	700	BS	6	11.39	195,100	0	-	195,100	190	-	-
9	Thu	630	BS	7.24	2.44	44,900	3.45	73,200	118,100	190	-	-
10	Fri	630	BS	7.38	0.67	11,700	7.37	196,500	208,200	195	-	-
11	Sat	700	BS	9.1	4.64	83,500	2.68	71,000	154,500	190	-	-
12	Sun	725	BS	9.02	5.3	85,000	2.16	57,500	142,500	190	-	-
13	Mon	700	BS	9.98	4.51	71,600	0	-	71,600	190	-	-
14	Tue	700	BS	9.36	3.83	62,000	2.28	60,700	122,700	190	-	-
15	Wed	700	BS	9.8	0	-	2.55	68,000	68,000	190	-	-
16	Thu	640	BS	9.07	4.12	82,500	2.47	66,000	148,500	190	3	10
17	Fri	825	NO	9.35	5.19	74,400	2.19	58,500	132,900	190	-	-
18	Sat	930	NO	9.26	4.78	80,300	2.44	65,200	145,500	195	-	-
19	Sun	910	NO	9.08	5.03	85,700	2.11	56,300	142,000	190	-	-
20	Mon	700	BS	9.66	4.17	69,100	1.09	29,400	98,500	190	-	-
21	Tue	630	BS	9.35	0	-	4.54	121,400	121,400	190	-	-
22	Wed	700	BS	9.42	4.45	74,100	2.21	59,200	133,300	195	-	-
23	Thu	635	BS	9.75	4.74	76,800	2.36	63,500	140,300	195	-	-
24	Fri	700	BS	9.98	5.13	83,300	1.35	36,200	119,500	190	-	-
25	Sat	820	BS	9.46	5.28	85,400	3.21	86,000	171,400	190	-	-
26	Sun	830	BS	9.56	4.02	65,400	1.16	30,400	95,800	190	-	-
27	Mon	630	BS	9.8	3.86	62,600	2.32	62,500	125,000	190	4	12
28	Tue	645	BS	9.82	4.62	76,600	2.45	65,800	142,400	190	-	-
29	Wed	650	BS	9.65	3.9	62,900	2.69	71,900	134,800	190	-	-
30	Thu	650	BS	9.74	5.48	90,200	1.51	40,700	130,900	190	-	-
31	Fri	900	NO	9.52	5.83	94,300	1.34	35,800	130,100	195	-	-
	Totals				137.87	2,352,300	56.36	1,476,700	3,828,000		7	22

Jul.01.2016 09:49 AM

ROSEBROOK WATER SYSTEM MONTH August YEAR 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Sat	900	NO	9.02	1.47	24,900	4.88	131,100	156,000	190	-	-
2	Sun	915	NO	9.18	4.99	81,000	2.17	58,300	139,300	195	-	-
3	Mon	700	BS	9.63	4.9	80,300	2.1	57,300	137,600	190	-	-
4	Tue	655	BS	9.77	6.27	102,300	0	-	102,300	190	-	-
5	Wed	700	BS	9.1	6.3	100,700	2.79	74,300	175,000	190	-	-
6	Thu	630	BS	9.6	3.43	56,100	2.63	70,800	126,900	190	5	12
7	Fri	700	BS	9.85	4.05	66,400	3.92	105,600	172,000	190	-	-
8	Sat	930	BS	9.53	8.68	90,000	1.43	38,300	128,300	195	-	-
9	Sun	630	BS	9.82	2.01	80,900	2.7	72,500	153,400	190	-	-
10	Mon	700	BS	9.63	4.13	66,300	2.47	66,400	132,700	190	-	-
11	Tue	700	BS	9.76	4.24	68,900	2.53	68,200	137,100	190	-	-
12	Wed	832	BS	9.89	0	-	2.41	64,800	64,800	190	-	-
13	Thu	700	BS	9.26	5.18	84,900	2.62	70,800	155,700	190	2.5	6
14	Fri	835	NO	9.94	6.3	102,500	0.04	1,000	103,500	200	-	-
15	Sat	915	NO	9.8	6.55	108,400	2.76	74,400	182,800	195	-	-
16	Sun	930	NO	9	4.34	73,500	2.73	73,600	147,100	195	-	-
17	Mon	700	BS	9.62	4.23	72,300	2.39	64,200	136,500	190	-	-
18	Tue	700	BS	9.63	4.06	69,800	2.83	75,700	145,500	190	-	-
19	Wed	630	BS	9.6	3.82	64,500	2.88	78,200	142,700	190	-	-
20	Thu	730	BS	9.47	4.3	72,600	2.66	71,300	143,900	190	-	-
21	Fri	635	BS	9.7	4.63	78,200	2.69	72,500	150,700	190	-	-
22	Sat	730	BS	9.2	5.19	87,400	2.63	70,200	157,600	190	4	12
23	Sun	730	BS	9.18	4.5	76,200	2.56	69,300	145,500	190	-	-
24	Mon	700	BS	9.76	3.54	58,400	2.48	66,900	125,300	190	-	-
25	Tue	700	BS	9.82	0.93	16,100	2.4	65,200	81,300	190	-	-
26	Wed	650	BS	9.22	4.04	68,000	2.45	67,300	135,300	190	-	-
27	Thu	700	BS	9.51	4.35	72,500	2.34	62,600	135,100	190	-	-
28	Fri	900	NO	9.71	4.96	84,400	0.51	13,700	98,100	195	-	-
29	Sat	900	NO	9.16	4.74	81,200	2.09	56,600	137,800	195	-	-
30	Sun	910	NO	9.28	2.05	34,200	2.62	67,400	101,600	195	-	-
31	Mon	700	BS	9.56	6.35	105,900	0.02	3,800	109,700	195	-	-
	Totals				134.51	2,228,800	71.73	1,932,300	4,161,100		11.5	30

Jul.01.2016 09:49 AM

ROSEBROOK WATER SYSTEM

September 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP #1 HOURS	Pump #1 Gallons	PUMP #2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Tue	700	BS	9.76	0	-	2.22	60,200	60,200	190	5	12
2	Wed	700	BS	9.18	5.42	91,800	0	-	91,800	190	-	-
3	Thu	700	BS	9.26	3.68	62,700	2.6	70,500	133,200	190	-	-
4	Fri	700	BS	9.71	4.06	69,100	2.54	68,700	137,800	190	-	-
5	Sat	730	BS	9.63	3.96	66,900	2.95	79,600	146,500	190	-	-
6	Sun	735	BS	9.06	5.16	88,700	3.04	82,000	170,700	190	-	-
7	Mon	900	NO	9.26	0	-	2.66	72,300	72,300	195	-	-
8	Tue	600	BS	9.04	4.67	80,500	1.67	45,100	125,600	190	-	-
9	Wed	700	BS	9.7	3.69	62,800	0.86	23,200	86,000	190	-	-
10	Thu	700	BS	9.76	0.7	12,200	2.31	62,400	74,600	190	3	6
11	Fri	900	NO	9.16	3.54	61,000	2.08	56,200	117,200	190	-	-
12	Sat	915	NO	9.42	5.16	86,200	0.98	26,900	112,100	195	-	-
13	Sun	910	NO	9.34	3.44	57,500	1.6	43,100	100,600	195	-	-
14	Mon	700	BS	9.77	0.02	-	2.44	65,900	65,900	190	-	-
15	Tue	720	BS	9.33	4.3	72,000	0.87	23,500	95,500	190	-	-
16	Wed	700	BS	9.36	3.93	66,700	2.02	54,700	121,400	190	-	-
17	Thu	705	BS	9.58	3.96	66,300	0	-	66,300	190	-	-
18	Fri	1054	BS	9.06	3.63	61,300	4.71	126,600	187,900	190	-	-
19	Sat	730	BS	9.71	4.03	67,900	2.49	67,600	135,500	190	-	-
20	Sun	740	BS	9.37	0	-	2.4	64,800	64,800	190	-	-
21	Mon	700	BS	9.14	5.59	95,200	2.26	61,600	156,800	190	6	12
22	Tue	700	BS	9.6	17.46	88,000	0	-	88,000	190	-	-
23	Wed	700	BS	9.48	0.05	700	4.06	109,100	109,800	190	-	-
24	Thu	700	BS	9.77	4.21	75,900	1.4	38,200	114,100	195	-	-
25	Fri	1100	NO	9.56	3.89	66,000	1.11	29,800	95,800	195	-	-
26	Sat	1020	NO	9.2	3.84	65,900	2.42	65,600	131,500	195	-	-
27	Sun	910	NO	9.21	2.22	38,400	2.44	72,200	110,600	195	-	-
28	Mon	700	BS	9.53	2.48	41,600	2.23	54,500	96,100	190	-	-
29	Tue	700	BS	9.71	4.55	78,400	0	60,000	138,400	190	-	-
30	Wed	700	BS	9.21	0	-	2.36	4,000	4,000	190	-	-
	Average				3.58	54,090	1.96	52,943	107,033			
	Totals				107.51	1,622,700	59	1,588,300	3,211,000		13	32

ROSEBROOK WATER SYSTEM MONTH October YEAR 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Thu	700	BS	9.03	4.06	70,800	2.08	56,700	127,500	190	-	-
2	Fri	700	BS	9.71	4.4	76,600	2	53,700	129,300	190	-	-
3	Sat	750	BS	9.62	4.61	81,500	0.97	27,100	108,600	190	-	-
4	Sun	800	BS	9.08	3.57	59,800	2.57	70,000	129,800	190	-	-
5	Mon	700	BS	9.71	0	-	2.41	65,100	65,100	190	-	-
6	Tue	700	BS	9.03	4.67	78,800	2.09	56,600	135,400	190	-	-
7	Wed	700	BS	9.77	4.09	68,900	0	-	68,900	190	-	-
8	Thu	630	BS	9.31	3.34	57,700	2.26	61,000	118,700	190	-	-
9	Fri	830	NO	9.65	2.43	42,800	2.62	68,100	110,900	195	5	12
10	Sat	940	NO	9.31	4.88	83,300	2.73	73,500	156,800	190	-	-
11	Sun	915	NO	9.1	5.23	88,200	2.5	67,500	155,700	200	-	-
12	Mon	800	BS	9.42	4.66	78,900	2.12	57,100	136,000	195	-	-
13	Tue	700	BS	9.77	3.76	64,700	0	-	64,700	190	-	-
14	Wed	620	BS	9.26	3.44	58,200	2.38	64,100	122,300	190	-	-
15	Thu	700	BS	9.83	0	-	2.47	66,500	66,500	190	-	-
16	Fri	645	BS	9.27	4.58	77,100	2.14	57,800	134,900	190	-	-
17	Sat	700	BS	9.73	5.17	86,800	1.03	27,700	114,500	195	-	-
18	Sun	730	BS	9.35	4.2	71,000	1.96	52,300	123,300	190	-	-
19	Mon	700	BS	9.01	1.36	21,900	2.63	70,800	92,700	190	-	-
20	Tue	700	BS	9.33	4.24	71,300	0	-	71,300	190	-	-
21	Wed	700	BS	9.1	0.41	7,400	2.76	74,300	81,700	195	-	-
22	Thu	700	BS	9.12	4.46	74,400	2.18	58,900	133,300	190	-	-
23	Fri	830	NO	9.9	4.14	70,000	0.51	14,100	84,100	195	-	-
24	Sat	900	NO	9.43	2.15	36,900	2.81	76,400	113,300	190	-	-
25	Sun	910	NO	9.4	3.19	53,300	1.06	28,400	81,700	195	-	-
26	Mon	700	BS	9.463	3.83	64,200	1.67	45,300	109,500	190	-	-
27	Tue	700	BS	10	0.22	3,700	2.43	65,100	68,800	190	-	-
28	Wed	700	BS	9.63	4.15	68,800	0	-	68,800	190	-	-
29	Thu	700	BS	9.51	0	-	2.57	68,300	68,300	195	-	-
30	Fri	715	BS	9.73	4.49	76,700	0	-	76,700	195	-	-
31	Sat	730	BS	9.18	4.5	81,000	2.52	63,200	144,200	190	5	12
	Totals				104.21	1,773,700	65.37	1,489,600	3,263,300		10	041 24

Jul.01.2016 09:53 AM

ROSEBROOK WATER SYSTEM MONTH November YEAR 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Sun	1030	BS	9.98	0.3	5,300	2.42	64,300	69,600	190	-	-
2	Mon	700	BS	9.9	4.11	72,600	0	-	72,600	190	-	-
3	Tue	600	BS	9.76	0	-	2.64	69,500	69,500	195	-	-
4	Wed	700	BS	9.36	4.03	71,000	0.97	25,600	96,600	190	-	-
5	Thu	815	NO	9.37	0	-	1.76	46,400	46,400	195	-	-
6	Fri	700	BS	9.11	4.62	87,500	2.42	63,600	151,100	195	-	-
7	Sat	910	NO	9.6	3.85	74,800	1.87	49,600	124,400	190	-	-
8	Sun	910	NO	9.63	0	-	1.2	31,900	31,900	195	-	-
9	Mon	700	BS	9.08	4.34	58,600	0	-	58,600	190	-	-
10	Tue	925	BS	9.03	0	-	2.34	62,000	62,000	195	-	-
11	Wed	700	BS	9.33	3.88	76,200	0	-	76,200	190	-	-
12	Thu	700	BS	9.41	0	-	2.5	66,100	66,100	195	-	-
13	Fri	640	BS	9.53	4.22	81,400	0	-	81,400	195	-	-
14	Sat	730	BS	9.31	3.03	57,200	2.69	71,400	128,600	195	-	-
15	Sun	730	BS	9.56	1.68	34,600	0	-	34,600	195	-	-
16	Mon	700	BS	9.2	0	-	2.45	65,100	65,100	190	-	-
17	Tue	740	BS	9.37	4.04	81,300	0	-	81,300	195	-	-
18	Wed	700	BS	9.45	0	-	2.58	68,500	68,500	195	-	-
19	Thu	700	BS	9.35	4.07	66,400	0	-	65,400	195	3	9
20	Fri	840	NO	9.31	0.13	1,200	2.6	68,700	69,900	195	-	-
21	Sat	1000	NO	9.02	4.52	93,000	2.37	62,900	155,900	195	-	-
22	Sun	910	NO	9.66	4.11	86,100	0	-	86,100	190	-	-
23	Mon	700	BS	9.66	3.55	6,200	3.03	80,000	86,200	195	-	-
24	Tue	700	BS	9.69	1.95	11,800	2.95	78,200	90,000	190	-	-
25	Wed	700	BS	9.06	5.03	42,700	2.37	62,700	105,400	190	-	-
26	Thu	705	BS	9.65	5.55	106,400	0	-	106,400	190	-	-
27	Fri	700	BS	9.03	4.66	90,900	3.18	83,900	174,800	190	-	-
28	Sat	730	BS	9.46	4.11	72,100	3.26	85,600	157,700	190	-	-
29	Sun	630	BS	9.03	5.12	31,300	2.8	73,600	104,900	190	-	-
30	Mon	700	BS	9.49	4.93	14,400	2.56	67,100	81,500	190	-	-
	Totals				85.84	1,321,900	60.96	1,346,700	2,668,600		3	9

Jul.01.2016 09:54 AM

Docket No. DW 17-165
Exh. 20

ROSEBROOK WATER SYSTEM MONTH December YEAR 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Tue	730	BS	9.58	0	-	2.46	64,800	64,800	190	-	-
2	Wed	700	BS	9.5	3.87	77,200	0	-	77,200	190	-	-
3	Thu	700	BS	9.63	0	-	2.49	65,600	65,600	190	-	-
4	Fri	900	NO	9.56	5.15	102,700	0.2	5,400	108,100	195	-	-
5	Sat	1000	NO	9.1	4.1	82,900	2.58	67,800	150,700	195	-	-
6	Sun	950	NO	9.28	0	-	2.89	76,100	76,100	200	-	-
7	Mon	630	BS	9.21	4.01	73,000	0	-	73,000	190	-	-
8	Tue	700	BS	9.18	0	-	2.84	74,500	74,500	190	5	12
9	Wed	700	BS	9.01	4.52	80,300	2.36	61,800	142,100	190	-	-
10	Thu	700	BS	10.03	3.6	71,300	0	-	71,300	195	-	-
11	Fri	700	BS	10	0	-	2.69	70,500	70,500	195	-	-
12	Sat	640	BS	9.63	4.84	98,800	2.8	76,200	175,000	195	-	-
13	Sun	730	BS	9.98	4.15	80,700	0.06	400	81,100	190	-	-
14	Mon	700	BS	9.76	0	-	2.46	64,000	64,000	190	-	-
15	Tue	705	BS	9.58	3.67	74,600	0	-	74,600	195	-	-
16	Wed	730	BS	9.65	0	-	2.4	63,300	63,300	190	-	-
17	Thu	730	BS	9.69	3.81	79,900	0	-	79,900	190	-	-
18	Fri	900	NO	9.51	1.07	14,300	2.72	71,800	86,100	195	-	-
19	Sat	900	NO	9.09	9.75	183,200	2.93	77,500	260,700	190	-	-
20	Sun	925	NO	9.09	5.32	87,600	3.03	83,600	171,200	195	-	-
21	Mon	700	BS	9.26	4.98	76,100	2.06	58,500	134,600	190	-	-
22	Tue	730	BS	9.94	4.65	86,800	0	-	86,800	195	-	-
23	Wed	700	BS	9.51	3.7	67,700	3.74	90,500	158,200	190	-	-
24	Thu	700	BS	10.45	4	66,100	0.64	17,200	83,300	190	-	-
25	Fri	800	BS	9.05	8.31	164,700	3.06	80,600	245,300	190	-	-
26	Sat	930	BS	10.55	5	101,700	0	-	101,700	195	-	-
27	Sun	730	BS	10.01	4.81	95,200	4.58	120,300	215,500	190	5	12
28	Mon	630	BS	9.89	3.23	68,800	6.82	180,100	248,900	190	-	-
29	Tue	630	BS	9.66	7.5	152,800	3.75	98,800	251,600	190	-	-
30	Wed	635	BS	10.1	6.23	127,000	3.97	104,700	231,700	195	-	-
31	Thu	700	BS	10.09	7.04	139,800	4	104,900	244,700	195	-	-
	Totals				117.21	2,254,200	67.51	1,777,900	4,032,100		10	24

Jul.01.2016 09:19 AM

ROSEBROOK WATER SYSTEM MONTH January YEAR 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Fri	1000	NO	9.65	5.73	118,500	4.65	122,400	240,900	195	-	-
2	Sat	1000	NO	9.62	5.6	114,800	3.48	91,300	206,100	195	-	-
3	Sun	930	NO	9.69	5.49	114,900	3.39	89,000	203,900	190	-	-
4	Mon	815	NO	9.58	7.08	140,000	3.35	87,900	227,900	195	-	-
5	Tue	720	BS	9.51	6.96	138,000	3.58	94,200	232,200	195	-	-
6	Wed	700	BS	9.58	0	-	3.77	99,000	99,000	190	-	-
7	Thu	645	BS	9.74	0	-	5.2	137,300	137,300	190	-	-
8	Fri	700	BS	10.59	0	-	2.84	75,400	75,400	195	-	-
9	Sat	730	BS	9.51	0	-	7.19	190,300	190,300	195	-	-
10	Sun	730	BS	9.81	0	-	2.18	57,500	57,500	190	-	-
11	Mon	615	BS	9.6	0.07	1,000	8.53	225,600	226,600	195	5	12
12	Tue	700	BS	9.69	0	-	7.84	206,900	206,900	190	-	-
13	Wed	710	BS	10.49	0	-	2.49	65,900	65,900	190	-	-
14	Thu	700	BS	9.86	0	-	9.07	237,800	237,800	190	-	-
15	Fri	845	NO	10.31	0	-	5.27	138,200	138,200	195	-	-
16	Sat	930	NO	10.02	0	-	6.96	182,700	182,700	190	-	-
17	Sun	940	NO	9.71	0	-	6.14	160,200	160,200	190	-	-
18	Mon	700	BS	9.51	0	-	6.22	162,500	162,500	195	-	-
19	Tue	700	BS	9.94	0	-	4.4	123,000	123,000	195	-	-
20	Wed	700	BS	10.22	0	-	5.63	139,400	139,400	190	-	-
21	Thu	700	BS	10.36	0	-	2.63	68,900	68,900	190	-	-
22	Fri	725	BS	9.61	0	-	5.73	149,300	149,300	190	-	-
23	Sat	730	BS	9.54	0	-	9.04	214,800	214,800	190	-	-
24	Sun	740	BS	10.14	0	-	3.84	119,800	119,800	190	-	-
25	Mon	710	BS	9.83	0	-	4.91	127,500	127,500	190	5	12
26	Tue	530	BS	9.99	0	-	4.69	122,100	122,100	190	-	-
27	Wed	700	BS	10.37	0	-	3.02	80,500	60,500	195	-	-
28	Thu	705	BS	9.87	0	-	3.01	96,200	96,200	190	-	-
29	Fri	850	NO	10.06	0.07	1,000	5	129,900	130,900	195	-	-
30	Sat	910	NO	9.92	0	-	6.37	164,700	164,700	190	-	-
31	Sun	915	NO	9.81	0	-	4.91	127,100	127,100	195	-	-
	Average								151,468			
	Totals				31	628,200	155.33	4,067,300	4,695,600		10	24

ROSEBROOK WATER SYSTEM MONTH February YEAR 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Mon	710	BS	9.69	0	-	3.88	100,500	100,500	195	-	-
2	Tue	730	BS	10	0	-	3.68	95,800	95,800	190	-	-
3	Wed	650	NO	10.13	0	-	1.73	45,100	45,100	195	-	-
4	Thu	700	BS	10.01	0	-	1.9	49,400	49,400	195	-	-
5	Fri	630	BS	9.58	0	-	6.79	175,700	175,700	195	-	-
6	Sat	800	BS	10.08	0	-	6.32	163,300	163,300	190	-	-
7	Sun	740	BS	9.92	0	-	2.71	90,600	90,600	190	-	-
8	Mon	735	BS	9.53	0	-	4.91	106,400	106,400	190	-	-
9	Tue	700	BS	9.74	0	-	6.07	157,200	157,200	190	-	-
10	Wed	520	BS	9.9	0	-	1.22	45,300	45,300	190	-	-
11	Thu	700	BS	10.04	1.43	8,400	4.21	95,100	103,500	190	3	10
12	Fri	840	NO	9.74	0	-	5.04	130,300	130,300	190	-	-
13	Sat	900	NO	9.69	0	-	9.66	250,500	250,500	195	-	-
14	Sun	900	NO	9.71	0	-	7.39	190,200	190,200	195	-	-
15	Mon	700	BS	9.96	0	-	7.71	199,000	199,000	190	-	-
16	Tue	640	BS	10.05	0	-	7.21	186,600	186,600	190	-	-
17	Wed	635	BS	10.13	0	-	6.85	177,100	177,100	190	-	-
18	Thu	700	BS	10.37	0	-	6.15	158,400	158,400	190	-	-
19	Fri	700	BS	9.92	5.19	90,100	4.97	128,100	218,200	190	-	-
20	Sat	730	BS	9.71	10.69	186,900	2.68	68,700	255,600	190	-	-
21	Sun	720	BS	9.98	3	50,700	2.15	55,400	106,100	195	-	-
22	Mon	700	BS	10.29	5.39	90,700	0.62	16,000	106,700	195	-	-
23	Tue	700	BS	9.67	4.83	81,200	2.48	63,700	144,900	190	5	12
24	Wed	700	BS	9.85	3.81	64,500	2.11	67,400	131,900	190	-	-
25	Thu	700	BS	10.17	3.4	58,200	2.71	57,200	115,400	190	-	-
26	Fri	900	NO	10.06	3.21	55,200	0	-	55,200	195	-	-
27	Sat	910	NO	9.69	0	-	9.62	245,300	245,300	195	-	-
28	Sun	850	NO	9.65	0.44	7,600	6.26	135,500	143,100	190	-	-
29	Mon	700	BS	10.01	4.38	74,100	0.19	5,000	79,100	190	-	-
	Totals				45.97	769,600	126.01	3,256,800	4,026,400		8	22

ROSEBROOK WATER SYSTEM MONTH March YEAR 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Tue	700	BS	9.56	3.71	62,300	2.17	66,300	128,600	190	-	-
2	Wed	700	BS	10.22	0	-	2.47	64,100	64,100	195	-	-
3	Thu	700	BS	9.56	4.62	76,900	2.18	56,300	133,200	190	-	-
4	Fri	700	BS	10.14	5.29	88,600	2.54	66,000	154,600	190	-	-
5	Sat	730	BS	10.18	7.57	176,500	1.21	28,800	205,300	190	-	-
6	Sun	740	BS	9.78	3.47	24,700	2.24	60,400	85,100	190	-	-
7	Mon	700	BS	9.98	2.59	26,400	2.38	61,200	87,600	190	5	14
8	Tue	700	BS	9.85	3.02	50,100	2.17	56,100	106,200	190	-	-
9	Wed	700	BS	10.28	3.92	64,400	0	-	64,400	190	-	-
10	Thu	700	BS	10.03	0	-	2.41	62,200	62,200	190	-	-
11	Fri	810	NO	9.6	4.81	80,100	2.31	59,400	139,500	195	-	-
12	Sat	910	NO	9.66	5.44	89,100	2.5	64,300	153,400	190	-	-
13	Sun	950	NO	9.96	5.45	89,300	2.22	57,100	146,400	190	-	-
14	Mon	700	BS	10.44	4.46	73,000	0	-	73,000	195	-	-
15	Tue	700	BS	9.93	0	-	2.38	61,300	61,300	190	-	-
16	Wed	700	BS	9.62	4.48	73,000	0	-	73,000	190	-	-
17	Thu	520	BS	9.63	3.56	58,800	2.65	68,200	127,000	190	-	-
18	Fri	700	BS	10.44	0.26	4,000	2.64	65,300	69,300	190	-	-
19	Sat	730	BS	9.56	4.6	87,500	2.56	65,900	153,400	190	-	-
20	Sun	719	BS	9.63	5.58	77,400	2.25	58,100	135,500	190	-	-
21	Mon	655	BS	10.37	3.86	62,700	0	-	62,700	190	-	-
22	Tue	630	BS	10.15	0	-	2.2	56,400	56,400	190	-	-
23	Wed	700	BS	9.56	4.22	68,700	0	-	68,700	190	-	-
24	Thu	700	BS	9.67	3.77	61,300	2.41	61,800	123,100	190	5	12
25	Fri	900	NO	10.37	0.24	3,900	2.59	66,800	70,700	195	-	-
26	Sat	910	NO	9.63	5.49	89,300	2.24	57,500	146,800	195	-	-
27	Sun	930	NO	9.69	4.75	77,100	0	-	77,100	195	-	-
28	Mon	705	BS	9.66	1.45	24,100	2.27	58,700	82,800	190	-	-
29	Tue	910	NO	9.87	2.54	41,100	0	-	41,100	195	-	-
30	Wed	630	BS	9.51	0	-	2.43	62,200	62,200	190	-	-
31	Thu	630	BS	9.67	3.92	64,000	0	-	64,000	190	-	-
	Totals				103.07	1,694,300	53.32	1,384,400	3,078,700		10	046 26

ROSEBROOK WATER SYSTEM MONTH April YEAR 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Fri	700	BS	9.62	1.8	30,100	2.23	57,900	88,000	190	-	-
2	Sat	730	BS	9.96	2.31	37,500	2.22	57,000	94,500	190	-	-
3	Sun	735	BS	9.92	4.03	65,200	0	-	65,200	190	-	-
4	Mon	700	BS	10.03	0	-	2.15	55,300	55,300	190	-	-
5	Tue	700	BS	10.12	3.69	59,500	0	-	59,500	190	-	-
6	Wed	640	BS	9.99	0	-	2.02	52,400	52,400	190	-	-
7	Thu	700	BS	9.9	3.76	61,100	0	-	61,100	190	-	-
8	Fri	900	NO	9.92	0.05	700	2.29	59,300	60,000	195	-	-
9	Sat	1100	NO	9.49	3.8	61,600	2.38	60,900	122,500	195	-	-
10	Sun	900	NO	10.44	3.55	57,500	0.11	3,000	60,500	195	-	-
11	Mon	700	BS	10.45	0	-	1.02	26,100	26,100	190	-	-
12	Tue	630	BS	9.94	0	-	1.38	35,500	35,500	190	-	-
13	Wed	700	BS	9.83	0	-	2.15	55,600	55,600	190	-	-
14	Thu	700	BS	9.9	3.79	61,300	0	-	61,300	190	-	-
15	Fri	710	BS	10.17	0	-	2.28	58,600	58,600	190	-	-
16	Sat	730	BS	10.09	4.36	70,100	0	-	70,100	190	-	-
17	Sun	745	BS	9.67	0	-	3.46	89,200	89,200	190	5	14
18	Mon	900	NO	9.92	3.75	60,700	0	-	60,700	195	-	-
19	Tue	900	NO	10.01	0	-	2.15	55,200	55,200	190	-	-
20	Wed	900	NO	9.71	0	-	3.59	92,300	92,300	195	-	-
21	Thu	900	NO	10.06	0	-	3.01	77,600	77,600	195	-	-
22	Fri	930	NO	10.22	0	-	2.24	57,800	57,800	195	-	-
23	Sat	1010	NO	9.79	3.97	64,500	2.14	54,800	119,300	195	-	-
24	Sun	925	NO	10.37	3.54	56,600	0.35	9,000	65,600	195	-	-
25	Mon	900	NO	10.45	0.14	2,300	0	-	2,300	195	-	-
26	Tue	850	NO	9.58	0	-	2.28	58,200	58,200	195	-	-
27	Wed	850	NO	9.74	3.61	57,600	0	-	57,500	195	-	-
28	Thu	855	NO	9.83	0	-	2.15	54,900	54,900	190	-	-
29	Fri	900	NO	9.75	3.9	62,100	2.37	61,300	123,400	190	-	-
30	Sat	1010	NO	10.45	3.67	58,400	0.09	2,000	60,400	195	-	-
	Totals				53.72	866,700	44.04	1,133,900	2,000,600		5	14

Jul.01.2016 09:20 AM

ROSEBROOK WATER SYSTEM MONTH May YEAR 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Sun	1010	NO	9.91	0	-	2.27	58,400	58,400	195	-	-
2	Mon	855	NO	9.65	4.34	69,400	2.52	65,000	134,400	190	-	-
3	Tue	1050	NO	10.4	3.7	59,300	0	-	59,300	190	-	-
4	Wed	900	NO	10.47	0.11	1,600	2.22	57,100	58,700	190	-	-
5	Thu	900	NO	10.27	3.63	58,200	0	-	58,200	195	-	-
6	Fri	855	NO	10	0	-	2.19	56,500	56,500	190	-	-
7	Sat	1010	NO	9.53	3.86	62,200	1.68	43,400	105,600	190	-	12
8	Sun	1005	NO	9.99	0	-	2.36	61,300	61,300	190	-	-
9	Mon	925	NO	9.74	3.79	61,300	0	-	61,300	190	5	-
10	Tue	830	NO	9.85	0	-	2.21	57,100	57,100	190	-	-
11	Wed	900	NO	9.63	3.93	62,800	1.21	31,300	94,100	190	-	1
12	Thu	855	NO	10.03	3.85	61,300	1.1	28,400	89,700	195	-	-
13	Fri	915	NO	10.45	0	-	2.11	54,500	54,500	195	-	-
14	Sat	1005	NO	9.92	4.19	67,600	0	-	67,600	195	-	1
15	Sun	1010	NO	9.61	11.84	191,600	5.13	133,000	324,600	193	-	-
16	Mon	730	NO	10	0	-	4.61	119,100	119,100	195	-	-
17	Tue	825	NO	10.27	0	-	5.08	131,400	131,400	195	-	-
18	Wed	950	NO	10.13	0	-	3.43	89,000	89,000	195	-	-
19	Thu	950	NO	10.47	0	-	2.18	56,300	56,300	195	-	-
20	Fri	935	NO	9.98	3.84	61,600	0	-	61,600	193	-	-
21	Sat	950	NO	9.351	3.44	55,400	2.41	62,400	117,800	193	-	-
22	Sun	905	NO	10.03	0	-	2.3	59,500	59,500	193	-	13
23	Mon	900	NO	9.81	3.38	53,800	0	-	53,800	195	5	-
24	Tue	850	NO	9.81	0	-	2.18	56,300	56,300	193	-	-
25	Wed	900	AG	9.77	3.54	56,800	0	-	56,800	195	-	-
26	Thu	900	AG	9.65	0.35	5,800	2.26	59,200	65,000	195	-	-
27	Fri	915	AG	9.53	3.95	64,000	2.23	58,000	122,000	195	-	1
28	Sat	915	NO	9.67	4.73	76,600	2.21	57,500	134,100	190	-	-
29	Sun	940	NO	9.821	5.66	91,700	1.73	45,500	137,200	190	-	-
30	Mon	840	NO	10.13	3.75	61,500	1.02	26,400	87,900	190	-	-
31	Tue	830	AG	10.1	0.06	200	2.27	58,100	58,300	190	-	-
	Totals				75.94	1,222,700	58.91	1,524,700	2,747,400		10	28

APPENDIX D
Rosebrook Water Company, Inc. - Conceptual System Improvements for Pressure Reduction

APPENDIX E
Opinion of Probable Project Cost

OPINION OF PROBABLE PROJECT COST
Rosebrook Water Company
System Improvements For Pressure Reduction
Prepared by Horizons Engineering, Inc.
Jul-16

ITEM	UNITS	NO. UNITS	UNIT COST	TOTAL COST
General Conditions/Mobilization	LS	1	$5,000.00	$5,000
Well Pump Replacement				
Well #1 Vertical Turbine Pump	EA	1	$15,000.00	$15,000
Well #2 Submersible Pump	EA	1	$15,000.00	$15,000
Electrical/Controls	LS	1	$15,000.00	$15,000
Mechanical/Piping	LS	1	$5,000.00	$5,000
			Subtotal	$50,000
Storage Tank Booster Station				
Building (16 ft. x 18 ft.)	SF	288	$200.00	$57,600
Site Work/Grading	LS	1	$35,000.00	$35,000
Driveway/Access	LS	1	$20,000.00	$20,000
Electric Service	LS	1	$25,000.00	$25,000
Pumps/Mechanical	LS	1	$45,000.00	$45,000
Electrical	LS	1	$20,000.00	$20,000
Emergency Generator	LS	1	$35,000.00	$35,000
Piping/Valves	LS	1	$35,000.00	$35,000
Telemetry/Controls	LS	1	$20,000.00	$20,000
Connection to Existing	EA	2	$2,500.00	$5,000
Surface Restoration	LS	1	$7,500.00	$7,500
Erosion Control	LS	1	$1,000.00	$1,000
			Subtotal	$306,100
Crawford Ridge Booster Station				
Building (14 ft. x 16 ft.)	SF	224	$200.00	$44,800
Site Work/Grading	LS	1	$30,000.00	$30,000
Driveway/Access	LS	1	$10,000.00	$10,000
Electric Service	LS	1	$15,000.00	$15,000
Pumps/Mechanical	LS	1	$35,000.00	$35,000
Electrical	LS	1	$20,000.00	$20,000
Emergency Generator	LS	1	$35,000.00	$35,000
Piping/Valves	LS	1	$35,000.00	$35,000
Telemetry/Controls	LS	1	$15,000.00	$15,000
Connection to Existing	EA	2	$2,500.00	$5,000
Surface Restoration	LS	1	$5,000.00	$5,000
Erosion Control	LS	1	$1,000.00	$1,000
			Subtotal	$250,800
Mt. Washington Place Booster Station				
Building (14 ft. x 16 ft.)	SF	224	$200.00	$44,800
Site Work/Grading	LS	1	$20,000.00	$20,000
Driveway/Access	LS	1	$10,000.00	$10,000
Electric Service	LS	1	$15,000.00	$15,000
Pumps/Mechanical	LS	1	$35,000.00	$35,000
Electrical	LS	1	$20,000.00	$20,000
Emergency Generator	LS	1	$35,000.00	$35,000
Piping/Valves	LS	1	$35,000.00	$35,000
Telemetry/Controls	LS	1	$15,000.00	$15,000
Connection to Existing	EA	2	$2,500.00	$5,000
Surface Restoration	LS	1	$5,000.00	$5,000
Erosion Control	LS	1	$1,000.00	$1,000
			Subtotal	$240,800
Mt. Adams Lane Water Main Extension				
8 Inch Ductile Iron Water Main	LF	350	$90.00	$31,500

Ledge Removal	CY	75	$150.00	$11,250
8 Inch Gate Valves	EA	2	$2,500.00	$5,000
Connection to Existing	EA	2	$2,500.00	$5,000
Pavment Replacement	LS	1	$3,000.00	$3,000
Hydrant	EA	1	$5,000.00	$5,000
Surface Restoration	LS	1	$2,500.00	$2,500
Erosion Control	LS	1	$1,000.00	$1,000
			Subtotal	$64,250

Pressure Reducing Valves and Vaults (Rosebrook Lane, Mt. Adams Lane)

Pressure Reducing Valve Vaults	EA	2	$10,000.00	$20,000
Pressure Reducing Valves	EA	2	$7,500.00	$15,000
Gate Valves/Bypass Piping	EA	2	$15,000.00	$30,000
Connection to Existing	EA	2	$2,500.00	$5,000
Pavment Replacement	LS	1	$5,000.00	$5,000
Traffic Control	LS	1	$1,500.00	$1,500
Surface Restoration	LS	1	$1,500.00	$1,500
Erosion Control	LS	1	$500.00	$500
			Subtotal	$78,500

Subtotal Construction Cost	$995,450
15% Contingency	$149,000
Total Construction Cost	$1,144,450
Land/Easements	$30,000
Legal	$10,000
20% Engineering	$229,000
Total Project Cost	$1,413,450
ROUNDED PROJECT COST	**$1,410,000**

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March 20, 2017

Mr. Don Vaughan
President
New England Service Company
37 Northwest Drive
Plainville, CT 06062

Subject: Rosebrook Water Company Bretton Woods NH Hydraulic Modeling

Dear Mr. Vaughan,

At the request of New England Service Company, Horizons Engineering Inc. has collected data on the Bretton Woods water distribution infrastructure, performed a field visit, and completed hydraulic modeling of existing and proposed future conditions. The overall goal of these efforts was to finalize the proposed approach for implementing a system-wide reduction in operating pressures. This letter report summarizes the project's background, field visit findings, hydraulic modeling results, proposed modifications, anticipated easements, and next steps for implementing the project.

Background and Existing Conditions

The Bretton Woods water distribution infrastructure is managed by the Rosebrook Water Company under PWSIDs 0382010, 0388010, and 0388020. This project expanded on a hydraulic model prepared by Horizons in 2009 as well as a preliminary report by Horizons in 2016 for the System Evaluation for Pressure Reduction. Following completion of this study New England Service Company indicated that the preferred approach was to move forward with a project that allows reduction of operating pressures to less than 120 psi at the main system pump station. Additional pump stations are proposed to serve higher areas of the system that cannot be adequately served once pressures are reduced.

A map of the existing distribution system is provided in **Attachment 1.** System data for 2015 through 2016 indicate average system demand of 111,668 gallons per day (average flow of 77.6 gallons per minute). The existing system has a single pressure zone with a gravity water storage tank at elevation 2010. The current system configuration results in system pressures exceeding 180 psi in the lowest elevations the system. These high pressures are exacerbated by intermittent water-hammer events that occasionally cause instantaneous pressure surges in excess of 200 psi.

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Rosebrook Water Company staff provided extensive information on the infrastructure and operation of the existing system that substantially improved the accuracy of the effort, for which we are extremely grateful.

Field Visit

On Wednesday, February 15, 2017, Mark Nance of Horizons Engineering met with Ms. Nancy Oleson of Rosebrook Water Company to discuss the water system and to inspect the water pump station. The water system information provided critical operating information for the hydraulic modeling. The water pump station visit provided instantaneous operating data in addition to further detail on the system configuration.

Horizons also met with Omni Resorts Mount Washington staff Mr. John Santaniello, Mr. Kolin Bailey, Mr. Jason Doyle, and a staff plumber to attempt to determine the fire flow design requirements for various large facilities, including the Mount Washington Hotel and Spa/Conference Center. We inspected the Administration Building, Bretton Arms Inn, Bretton Woods Nordic Center, Mount Washington Hotel, and the Spa/Conference Center. We also visited the drawing archives room in the Mount Washington Hotel basement to search for fire flow design requirements on various construction projects' contract drawings. Fire flow requirements were located for the Spa/Conference Center, however none were identified for the hotel or other structures.

Horizons performed preliminary inspections of each potential booster station site to assess technical and aesthetic siting concerns. As a result of the inspections, each booster station location was adjusted from that generally shown in the 2016 report.

Hydraulic Modeling

The modeling effort updated an existing, eight-year-old Water Cad hydraulic model of the distribution system, which was then examined in the context of the 2016 evaluation recommendations for alternative options to reduce operating pressures. After reviewing the existing conditions model, Horizons completed modeling to assess two scenarios that reduce distribution system pressures to below approximately 130 psi. Based on some preliminary calculations and testing, two alternatives were modeled to assess their viability.

ALTERNATIVE 1 – EXISTING TANK, BOOSTER PUMP STATIONS/PRVS: Modify the existing well pumps to serve the lowest pressure zone (Zone 1) and install three booster stations to serve higher elevations (Zones 2CR, 2MWP, and 2RT). The well pump modifications would include a minimum of adding a variable frequency drive (VFD) to Pump 2 and replacing the Pump 2 motor with an inverter-duty motor to be compatible with a VFD. The wells would pump into Zone 1 based on storage tank elevation setpoints, and the water storage tank would be filled by the Rosebrook Townhomes booster station. Based on the modeling results, it might be possible to continue to use the two existing well pumps, however complete replacement might be necessary to adequately reduce their flow and pressure capacity.

ALTERNATIVE 2 – EXISTING TANK, NEW SUPPLY PIPELINE/PRVS: Use the existing well pumps to pump directly to the existing water storage tank via a new dedicated pipeline. The distribution system would then be fed by gravity off the existing storage tank and would require two booster stations to serve higher elevations. The distribution system would have four separate pressure zones: Zone 1 (lowest elevation), Zone 2CR (fed by a new booster station), Zone 2MWP (fed by a new booster station), and Zone 2RT (fed by gravity from the existing storage tank). The dedicated pipeline between the wells and the storage tank would have no supply taps, would generally follow existing water pipeline alignments, and would require high pressure (~190 psi) at the existing well pump house.

The hydraulic modeling was based on the available information. A detailed discussion of the modeling assumptions and results is provided in **Attachment 2**.

Proposed Modifications

After discussion of Horizons' initial findings, New England Service Company selected Alternative 1 as the preferred modification set to reduce operating pressures throughout the system. Alternative 1 consists of the following major improvements, which are shown on **Attachment 1**:

1. Install a variable frequency drive and inverter duty motor on existing well pump 2 as well as control communications with the new Rosebrook Townhomes booster station.
2. Install ~350 feet of 8-inch pipeline from the west end of Dartmouth Road to the north end of Mount Adams Lane.
3. Install ~40 feet of 16-inch pipeline from the 16-inch main in Base Station Road to the 8-inch hotel supply pipeline at a location north of the Stables.
    a. Based on the model results, an additional ~2,620 feet of 16-inch pipeline is recommended to loop together several buildings near the Mount Washington Hotel as well as to replace the existing 8-inch hotel supply pipeline which will be undersized for future demands.
4. Install one pressure reducing valve in the Rosebrook Townhomes development west of townhome 10.
5. Install one pressure reducing valve at the north corner of the intersection of Mount Adams Lane and Hartford Lane.
6. Install one booster pumping station in the Crawford Ridge development northwest of unit 22.
7. Install one booster pumping station in the Mount Washington Place development on the west side of Hannah Loop east of unit 100.
8. Install one booster pumping station in the Rosebrook Townhomes development on the south side of Rosebrook Lane south of unit 50.

Easements

The following summarize the locations of anticipated easements for each modification component and contact information.

1. ~350 feet of 8-inch pipeline. This pipeline would route along property lines between four parcels at the north end of Mount Adams Lane: 210-016, 210-017, 211-048, and 211-049.
    a. 210-016: Manning Realty Trust II, 13 Rockyledge Road, Swampscott, MA 01907
    b. 210-017: Robert and Donna Manning, Trustee Manning Realty Trust III, 15 Rockyledge Road, Swampscott, MA 01907
    c. 210-048: Robert Manning, Trustee Manning Realty Trust III, 13 Rockyledge Road, Swampscott, MA 01907
    d. 210-049: Robert and Donna Manning, Trustee Manning Realty Trust III, 13 Rockyledge Road, Swampscott, MA 01907
2. ~50 feet of 16-inch pipeline. This short interconnection would occur mostly in the right of way of Base Station Road with some possibility of incursion into parcel 210-008.
    a. 210-008: Omni Mount Washington, LLC, 4001 Maple Avenue, Suite 600, Dallas, TX 75219
3. PRV in Rosebrook Townhomes. This valve would be located in a new manhole in the ski area west of the Learning Center Quad unloading zone.
    a. 211-014: Omni Mount Washington, LLC, 4001 Maple Avenue, Suite 600, Dallas, TX 75219
4. PRV in Mount Adams Lane. This valve would be located in a new manhole in the Mount Adams Lane right of way.
5. Booster station in Crawford Ridge. This booster station would be located west of Crawford Ridge Road in parcel 211-015.
    a. 211-015: Crawford Ridge Homeowners Association, Route 302, Bretton Woods, NH 03575
6. Booster station in Mount Washington Place. This booster station would be located west of Hannah Loop in parcel 211-025.
    a. 211-025: Mount Washington Place Condo Association, Route 302, Bretton Woods, NH 03575
7. Booster station in Rosebrook Townhomes. This booster station would be located south of Rosebrook Lane either in the Rosebrook Lane right of way or in parcel 211-004.
    a. 211-004: Jack Sylvester 2012 Family Trust, P.O. Box 48, Orrs Island, ME 04066

Next Steps

Following are the next major steps to the pressure reduction project:

- Rosebrook Water Company to confirm the proposed Alternative 1 approach is acceptable.
- Confirm easements are available from the property owners.
- Perform a topographic and utility survey of each proposed improvement location.
- Perform final design and prepare construction documents, including determining final selection of booster station and pressure reducing valve criteria.

Thank you for the opportunity to be of service. We look forward to continuing to work with you toward the implementation of the desired improvements. If you have any questions, please contact me at my office phone number of 603-444-4111 extension 18.

Very truly yours,
Horizons Engineering, Inc.

Jon L. Warzocha, P.G.
CEO

Mark J. Nance, P.E.
Senior Project Manager

Attachments: Attachment 1 Overall Plan
Attachment 2 Hydraulic Model Evaluation

HEI Project 17002

There were two primary purposes for the modeling. The first was to determine the water supply capacity of the existing system to establish the baseline performance, including identifying its high pressure areas and any hydraulic restrictions. The second was to evaluate the optimal configuration and settings for planned system modifications that would reduce pressure in the lowest system areas.

Water distribution system modeling uses a computer program to simulate the flow of water through the distribution network under various conditions. The modeling was performed using the Bentley stand-alone WaterCAD version V8i computer program for both steady-state and extended period simulations.

EXISTING SYSTEM

The existing system has a single pressure zone with service connections at elevations from approximately 1560 to 1845 feet. Pump performance curves for the two supply wells were input into the model using curves provided by the Rosebrook Water Company (RWC) as summarized in the following table.

Table 1 Existing Well Pump Performance Characteristics at Full Speed

Pump	Shutoff Head, ft	Design Flow, gpm	Head, ft	Max Flow, gpm	Head, ft
Well Pump 1 (50 hp)	550	300	475	475	335
Well Pump 2 (60 hp)	693	350	495	500	290

Notes: 1. Well Pump 1 = Sulzer JTS-10AC, 10-stage, 1780 rpm, 7.36-inch impellers
2. Well Pump 2 = Xylem 7CLC, 6-stage, 3450 rpm, 5-inch impellers

Pump controls were based on water storage tank elevations reported by operations staff as follows. While the tank diameter was measured as part of a recent project, the tank depth and invert elevation are not available. The tank volume is reported by different documentation as 600,000 and 650,000 gallons. Operations staff reports the two well pumps are programmed with the same controls and an automatic alternator switches the active pump. Since Pump 1 has a lower pumping capability than Pump 2, Pump 2 was turned off in the model for a conservative assessment of pump supply.

Existing water storage tank: Base elevation = 1991 feet ASSUMED
Diameter = 90 feet → 47,586 gallons stored per foot of depth
Maximum water surface elevation = 2004.66 feet ASSUMED

Pump 1 controls: Turns on if tank water depth is less than 8.9 feet = elevation 1999.9
Turns off if tank water depth is equal to 9.3 feet = elevation 2000.3

Pump 2 controls: Turns on if tank water depth is less than 8.9 feet = elevation 1999.9
Turns off if tank water depth is equal to 9.3 feet = elevation 2000.3

Water production data from 2015 and 2016 is shown in the following figure.

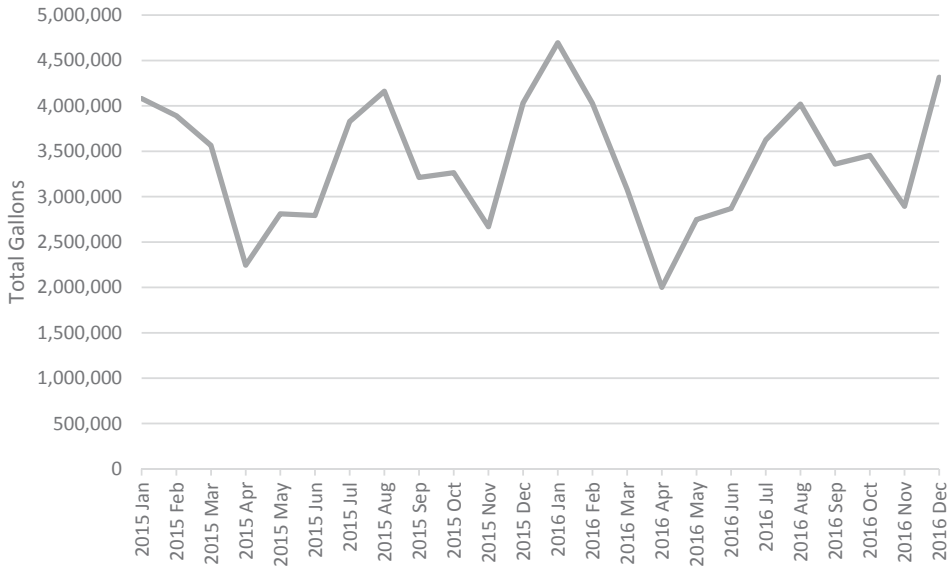


Figure 1 Rosebrook Water System Monthly Water Production

The average total gallons per day (gpd) were 111,086 in 2015 and 112,248 in 2016, which shows consistent water demands between the years. **Figure 1** shows peak demands occur in the winter and the late summer, which reflects the seasonal nature of the community. The peak months were December through March and July through October. During the peak months, the average total gallons per day were 123,070 in 2015 and 124,779 in 2016.

Based on this data, the following water demands were used for modeling the existing system:

- Average daily demand (ADD) (from 2016) = 112,248 gpd = 77.9 gpm
- Maximum day demand (MDD) (from June 26, 2015) = 414,000 gpd = 287.5 gpm = 3.69 x ADD
  - Used 4.0 x Average daily demand = 311.6 gpm
- Peak hour demand (PHD): no data, used 8.0 x Average daily demand = 623.2 gpm

Although the ratios used for MDD and PHD are higher than typical industry values and the New Hampshire Department of Environmental Services (NHDES) value in Eng-Wq 405.19, this seasonal community's peaking characteristics are expected to be higher due to vacation users compared to a full-time resident community. Due to the seasonal water demands, actual water distribution is expected to vary throughout the year as well as day to day. This is due to varying occupancy: some homes might have large taps but be unoccupied most of the year.

The distribution system has 393 residential taps and 19 commercial taps for a total of 412 service connections. The demands were distributed through the system by calculating the percentage of

flow for each tap or residential area based on the 2016 total meter readings as summarized in the following table.

Table 2 Existing Taps and Water Distribution

Area	Taps					Demand Distribution
	5/8"	1"	2"	3"	6"	
Residential						
Crawford Ridge	22					1.05%
Dartmouth Ridge	13	2				1.13%
Fairway Village	50					2.25%
Forest Cottages	54					2.30%
Mount Madison		10				0.45%
Mount Washington Homes	5	4				0.74%
Mount Washington Place	105					5.96%
Mountain View	15					0.81%
Presidential View		15				0.63%
River Front	9					0.50%
Rosebrook Townhomes	28					1.67%
Stickney Circle	51					2.13%
Stone Hill		10				0.48%
Commercial						
Administration Building		1				0.29%
Alpine Club Bathroom Trailer and Kitchen	1	1				0.22%
Arms Inn		1				2.93%
Caretakers Home	1					0.03%
Drummonds Ski Shop	1					0.08%
Fabyans	1					1.07%
First Aid Building	1					0.04%
Golf/Nordic Building		1				1.00%
Irving Store	1					0.27%
Mount Washington Hotel					1	67.23%
Outdoor Pool & Cabana			1			1.54%
Real Estate Office/Peabody & Smith	1					0.02%
Ski Area and Maintenance Building	1		1			3.58%
Spa Building				1		1.34%
Sports Club/Rosebrook Recreation Center						0.00%
Stables	1					0.28%

Notes: 1. The Sports Club/Rosebrook Recreation Center is currently not in use. Its meter was removed in February 2016.
2. Two portable meters are used for filling the ice rink, snowmaking for the tubing hill only, and testing the ski run snowmaking equipment.

The water pumped from the two well pumps is greater than the sum of all the taps' meter readings; this difference is categorized as unaccounted-for water. The distribution demands were

based on the well pump gallons per minute to include the unaccounted-for water. The water was distributed through the system using the taps' meter readings for percentages. This method distributes the unaccounted-for water evenly through the system.

In December 2016, Pump 2 averaged approximately 444 gallons per minute when it was running against a discharge head of approximately 195 psi. That performance exceeds the pump curve provided by RWC staff by approximately 54 gpm, which suggests one or more of the following issues: the pump curve is incorrect, the flow meter is incorrect, or the pressure gauge is incorrect. The model used the Pump 2 curve provided as it was the best available information.

Elevation information is critical in water modeling. Junction elevation information was taken from the previous model developed in 2009.

Despite the extensive data evaluation efforts and determining the most representative demand distribution, the information above does not provide adequate information to fully calibrate the model. Conventional model calibration involves measuring pressures and flows in the field and adjusting the model accordingly. Many issues can influence model performance, including:

- Groundwater table elevation
- Partially closed valves
    - RWC reports the main valves haven't been exercised in several years, possibly since 1999.
    - RWC reports the curb stops are exercised each year. Given the infrequency of main valve testing, this is a critical last-ditch program to minimize home flooding and should be continued.
- Air in pipelines
- Sediment in pipelines

The system has experienced occasional issues with water hammer, the last occurring for approximately one month during the summer of 2016. The water hammer events spike the pressure in various locations, however no specific cause has yet been identified. These events can cause pressure gauges to lose their calibration, so readings from existing pressure gauges installed before water hammer events may be suspect.

The NHDES adopted the 10 States Standards in Env-Dw 404.01(a), which requires the following pressures per section 8.2.1:

- Maintain a minimum pressure of 20 psi (140 kPa) at ground level at all points in the distribution system under all conditions of flow.
- The normal working pressure in the distribution system shall be at least 35 psi (240 kPa) and should be approximately 60 to 80 psi (410 - 550 kPa).

A reduction of operating system pressure will reduce the maximum available flow. A water demand during a fire is typically the highest instantaneous flow required from a distribution system. Horizons Engineering staff met with Omni Resorts Mount Washington staff to attempt to determine the design fire flow rates required for its structures, which are the largest in the

distribution system. After hours of searching through record documents and examining fire service entrances, only one complex' fire flow design criteria was found, which was for the Mount Washington Hotel's Spa/Conference center and had a maximum requirement of 880 gpm at 124 psi.

Fire flow rates vary depending on the local fire department. The Insurance Services Office (ISO) issues a Fire Suppression Rating Schedule that recommends fire flows for residential and commercial construction. The ISO fire flow range for residential buildings is typically from 500 to 1,500 gallons per minute (gpm). The Uniform Fire Code (UFC) requires a minimum of 1,000 gpm for residential buildings with areas up to 3,600 square feet. The National Fire Protection Association requires up to 8,000 gpm for up to 4 hours depending on the building fire flow area and construction type.

The modeling evaluated the system to supply a minimum of 1,000 gpm at the Mount Washington Hotel (MWH) at a minimum pressure of 20 psi because the MWH has a single, long, relatively small service pipeline that should represent the most difficult fire demand on the system.

EXISTING SYSTEM WATER MODELING RESULTS. The hydraulic modeling is based only on the system information entered into the system, which, while detailed, is not an exhaustive representation of system characteristics. It calculates a theoretical moment in time based on the stated assumptions and relatively evenly distributes the demands. Inaccuracies in the assumptions have varying degrees of impact on the system performance. Based on the information provided, the modeling results appear to be reasonable.

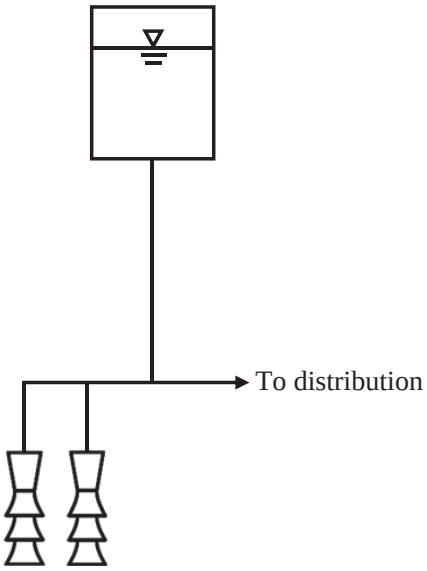
The following table lists average annual demand (AAD) and peak hour demand (PHD) results from the model. The modeling applied the fire flows to the peak hour demand.

Table 3 Existing System Hydraulic Modeling Results

Condition	Flow, gpm	Notes
AAD, NO fire flow	78	Low pressure at Dartmouth Ridge (node J-79) was 100 psi. Pressure at Crawford Ridge (node J-15) was 113 psi. Pressure at Rosebrook Townhomes (node J-22) was 121 psi. Pressure at the Mount Washington Hotel (node J-74) was 151 psi. High pressure 200' south of the water pump station (node J-3) was 190 psi.
PHD, NO fire flow	624	Low pressure at Dartmouth Ridge (node J-79) was 99 psi. Pressure at Crawford Ridge (node J-15) was 112 psi. Pressure at Rosebrook Townhomes (node J-22) was 121 psi. Pressure at the Mount Washington Hotel (node J-74) was 144 psi. High pressure 200' south of the water pump station (node J-3) was 190 psi.
PHD, 1,000 gpm fire flow at MWH	1,622	Low pressure at Dartmouth Ridge (node J-79) was 96 psi. Pressure at Crawford Ridge (node J-15) was 111 psi. Pressure at Rosebrook Townhomes (node J-22) was 120 psi. Pressure at the Mount Washington Hotel (node J-74) was 83 psi. High pressure 200' south of the water pump station (node J-3) was 189 psi.
PHD, 1,000 gpm fire flow at high point	1,622	Low pressure at Dartmouth Ridge (node J-79) was 81 psi. Pressure at Crawford Ridge (node J-15) was 111 psi. Pressure at Rosebrook Townhomes (node J-22) was 120 psi. Pressure at the Mount Washington Hotel (node J-74) was 141 psi. High pressure 200' south of the water pump station (node J-3) was 189 psi.

The hydraulic modeling of the existing system generally corroborated operations staff reports of system function. The goal of this project is to reduce the high pressures to no more than 120 psi if possible.

A schematic representation of the existing distribution system is provided in the following figure.



System Modifications

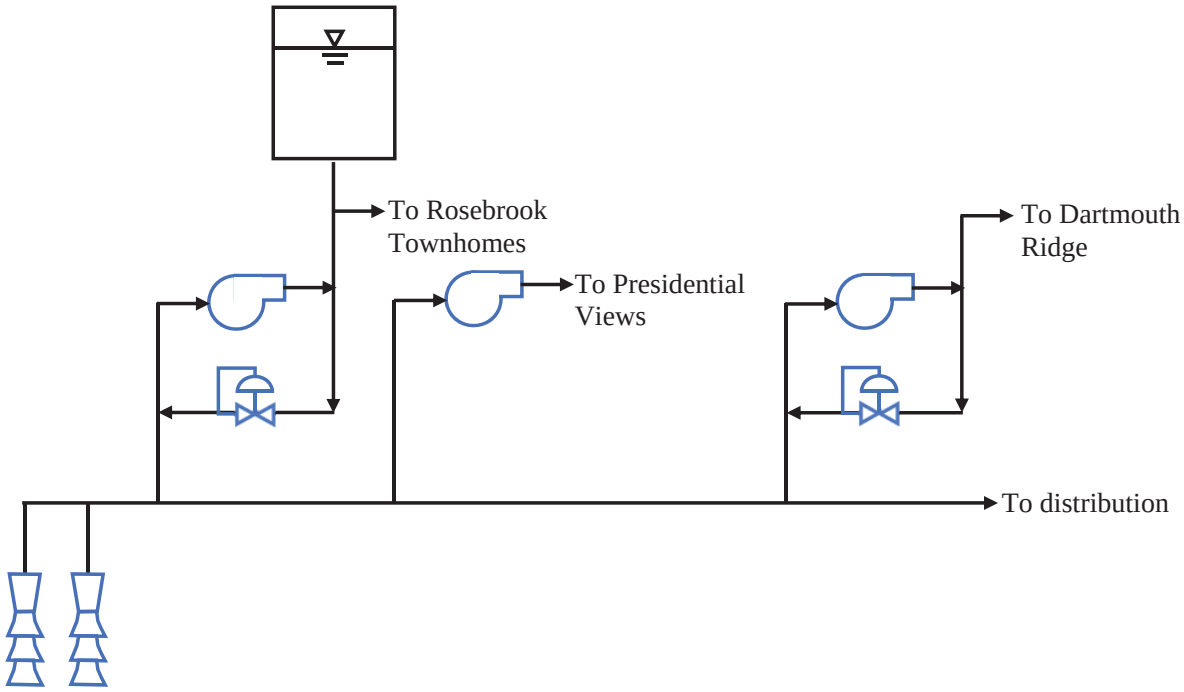
To reduce the maximum pressure in the lowest zone, multiple zones with booster stations are needed to supply water to the highest service areas. A 2016 preliminary report titled System Evaluation for Pressure Reduction by Horizons Engineering proposed a new storage tank at a lower elevation than the existing water storage tank as part of the distribution modifications. However, at the request of Rosebrook Water Company, the hydraulic model evaluation described herein relied on the existing storage tank and did not assume a new tank would be installed.

The basic operating criteria of the modified system are listed as follows:

- Zone 1 (lowest elevations) would serve elevations from approximately 1575 to 1700.
- Zone 2 (highest elevations) would serve elevations from approximately 1700 to 1845. Preliminary designation assumptions were as follows to match the booster station locations:
    - Zone 2CR for Crawford Ridge
    - Zone 2MWP for Mount Washington Place
    - Zone 2RT for Rosebrook Townhomes
- Minimum pressure during fire flow = 20 psi
- Minimum pressure during normal operation = 35 psi, try to maintain 45 psi = 104 feet
    - Zone 1: maintain a minimum hydraulic grade line of 1804 feet at the highest elevations
    - Zone 2: maintain a minimum hydraulic grade line of 1949 feet at the highest elevations

Two primary alternative configurations were considered to reduce the service pressures, which are summarized as follows and discussed further in the table below. Alternative 1 was the concept discussed in the 2016 System Evaluation for Pressure Reduction report. Both alternatives use the existing ~650,000-gallon water storage tank.

ALTERNATIVE 1 – EXISTING TANK, BOOSTER PUMP STATIONS/PRVS: Modify the existing well pumps to serve the lowest pressure zone (Zone 1) and install three booster stations to serve higher elevations (Zones 2CR, 2MWP, and 2RT). The well pump modifications would include a minimum of adding a variable frequency drive (VFD) to Pump 2 and replacing the Pump 2 motor with an inverter-duty motor to be compatible with a VFD. The wells would pump into Zone 1 based on storage tank elevation setpoints, and the water storage tank would be filled by the Rosebrook Townhomes booster station. Based on the modeling results, it might be possible to continue to use the two existing well pumps, however complete replacement might be necessary to adequately reduce their flow and pressure capacity. A schematic representation of this configuration is provided in the following figure.



Applying pump affinity laws to well pumps 1 and 2 and assuming the maximum turndown using a variable frequency drive would be 60 percent suggests the pumps' minimum performance would be approximately as listed in the following table.

Table 4 Existing Well Pump Performance Characteristics at 60 Percent Speed

Pump	Shutoff Head, ft	Design Flow, gpm	Head, ft	Max Flow, gpm	Head, ft
Well Pump 1 (50 hp)	330	180	285	285	201
Well Pump 2 (60 hp)	416	210	297	300	174

The performance listed above is theoretical and, if Alternative 1 will be pursued further, we recommend testing the existing Pump 1 by running its VFD at its minimum speed to confirm the limits of its capabilities if possible. Well pump 2 would require a variable speed drive and might require replacement of its pump with an inverter duty motor.

ALTERNATIVE 2 – EXISTING TANK, NEW SUPPLY PIPELINE/PRVS: Use the existing well pumps to pump directly to the existing water storage tank via a new dedicated pipeline. The distribution system would then be fed by gravity off the existing storage tank and would require two booster stations to serve higher elevations. The distribution system would have four separate pressure zones: Zone 1 (lowest elevation), Zone 2CR (fed by a new booster station), Zone 2MWP (fed by a new booster station), and Zone 2RT (fed by gravity from the existing storage tank). The dedicated pipeline between the wells and the storage tank would have no supply taps, would generally follow existing water pipeline alignments, and would require high pressure (~190 psi) at the existing well pump house. A schematic representation of this configuration is provided in the following figure.

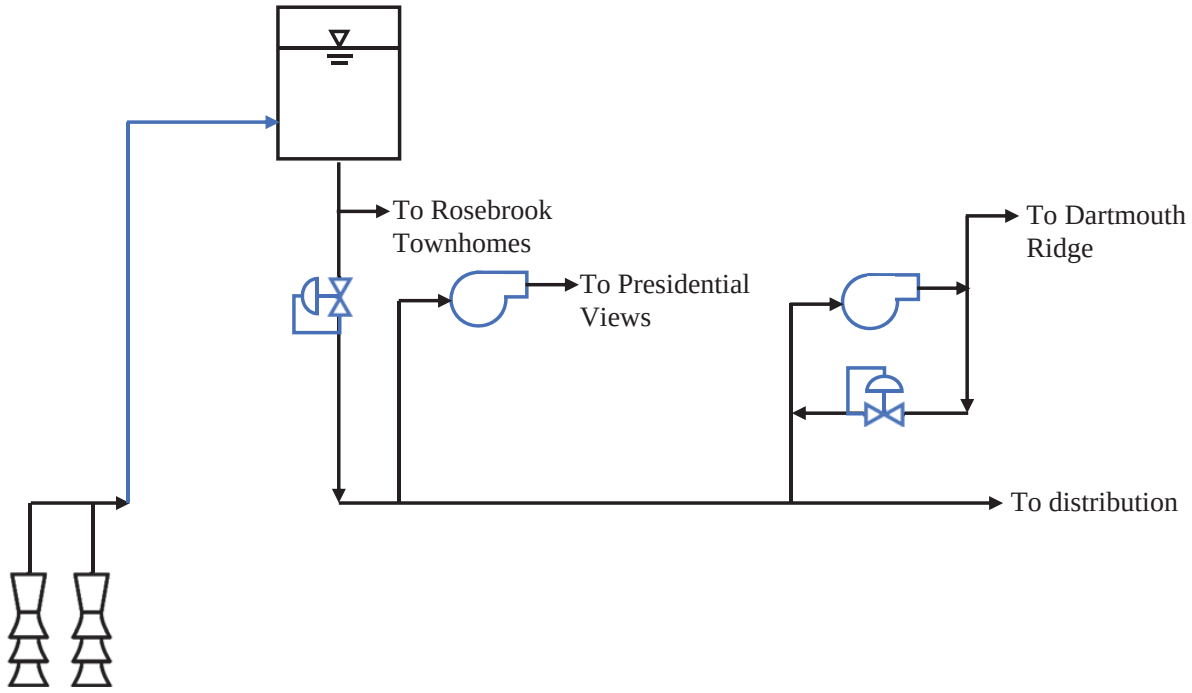


Table 5 System Modifications Alternatives Comparison

Description	Pros	Cons
ALTERNATIVE 1 – EXISTING TANK, BOOSTER PUMP STATIONS/PRVS		
Modify well Pump 2 and install 3 booster stations	• No major pipelines needed	• Pump 2 VFD required; replacement of both pumps may be required depending on actual maximum turndown • Higher operation and maintenance costs due to one additional booster pump station compared to Alternative 2 • The Rosebrook Townhomes booster station siting is expected to be particularly exposed to view and potential vehicle damage.
ALTERNATIVE 2 – EXISTING TANK, NEW SUPPLY PIPELINE/PRVS		
Install ~4,300 feet of 8" or 6" pipeline from wells to the existing storage tank and install 2 booster stations	• Only 2 booster pump stations needed (for Presidential Views and Mt. Wash. Pl.); Rosebrook Townhomes can be fed by gravity • Existing 2 well pumps can be used • Pipeline can be smaller than the current 16" tank connection • New pipeline connection opposite the existing connection would turn over water in the existing storage tank more often, which would improve tank water quality • Lower operation and maintenance costs due to one less booster pump station compared to Alternative 1	• Pipeline would need to cross the Ammonoosuc River • **High pressure (~190 psi) would be required in the existing pump house**

Regarding the booster stations and pressure reducing valves, the following criteria were assumed for each location:

Crawford Ridge Booster Station

- Floor elevation = 1710
- Serves buildings up to elevation = 1845
- Normal duty pump capacity = 0 to 40 gpm
- Features:
  - Variable frequency drive for each pump
  - Emergency power generator

Mount Washington Place Booster Station

- Floor elevation = 1680
- Serves buildings up to elevation = 1825
- Normal duty pump capacity = 0 to 80 gpm
- Features:
  - Variable frequency drive for each pump
  - Emergency power generator

Mount Adams Lane Pressure Reducing Valve

- Valve elevation = 1700
- Valve size = 6 inch
- Valve downstream setpoint = approximately 30 psi (1804 - 1700 = 104 feet = 45 psi is too high in the model as the Zone 2MWP booster station pumps in a loop during high flow rates)

Rosebrook Townhomes Booster Station

- Floor elevation = 1680
- Serves buildings up to elevation = 1810
- Normal duty pump capacity = 0 to 80 gpm
- Features:
  - Variable frequency drive for each pump
  - Emergency power generator

Rosebrook Townhomes Pressure Reducing Valve

- Valve elevation = 1725
- Valve size = 8 inch
- Valve downstream setpoint = approximately 86 psi (1804 - 1725 = 79 feet = 34 psi)

SYSTEM MODIFICATIONS WATER MODELING RESULTS. The hydraulic modeling revealed a critical problem with the system during fire flow conditions. The end of the Mount Washington Hotel water supply connection consists of approximately 4,300 feet of 8-inch piping, which connects to the main distribution system's 16-inch trunk pipeline. When a 1,000 gpm fire flow is supplied to the hotel during peak hour conditions, the total flow is over 1,600 gallons per minute, which has a velocity of over 9 feet per second in an 8-inch pipeline. This high velocity yields significant pressure loss – so much that the initial runs for both alternatives resulted in negative pressures at the hotel.

After considering several options, the most efficient solution would be to install a short interconnection between the 16-inch main pipeline in Base Station Road with the 8-inch hotel supply pipeline. This interconnection allows the water to flow through both the 8-inch and 16-inch pipelines to reach the hotel. The interconnection would likely be located just north of the Stables building. If additional flow or pressure becomes necessary at the hotel or other nearby buildings, the 8-inch supply pipeline could be upsized from this interconnection point towards the hotel. The short interconnection was necessary to make either alternative viable.

Modeling Alternatives 1 and 2 worked as a steady state analysis, however due to the complicated controls required by the pump systems operating in series up to the storage tank, it was necessary to model Alternative 1 as an extended period simulation to identify feedback problems with pump and pressure reducing valve setpoints. After many iterations using different infrastructure locations and control scenarios, a suitable and relatively simple configuration was identified.

Based on the evaluation findings, the following tables list the modeling results for both alternatives including the 16-inch pipeline interconnection. The modeling applied the fire flows to the peak hour demand. An example graphic output from the software is shown below.

Table 6 Alternative 1 Modified Well Pumps Hydraulic Modeling Results

Condition	Flow, gpm	Notes
AAD, NO fire flow	78	Low pressure at Dartmouth Ridge (node J-79) was 45 psi*. Pressure at Crawford Ridge (node J-15) was 56 psi*. Pressure at Rosebrook Townhomes (node J-22) was 121 psi. Pressure at the Mount Washington Hotel (node J-74) was 66 psi. High pressure 200' south of the water pump station (node J-3) was 105 psi.
PHD, NO fire flow	624	Low pressure at Dartmouth Ridge (node J-79) was 45 psi*. Pressure at Crawford Ridge (node J-15) was 56 psi*. Pressure at Rosebrook Townhomes (node J-22) was 121 psi. Pressure at the Mount Washington Hotel (node J-74) was 63 psi. High pressure 200' south of the water pump station (node J-3) was 105 psi.
PHD, 1,000 gpm fire flow at MWH	1,622	Low pressure at Dartmouth Ridge (node J-79) was 45 psi*. Pressure at Crawford Ridge (node J-15) was 56 psi*. Pressure at Rosebrook Townhomes (node J-22) was 120 psi. Pressure at the Mount Washington Hotel (node J-74) was 34 psi. High pressure 200' south of the water pump station (node J-3) was 104 psi.

Note: 1. Model run as an extended period simulation.
2. The system pressures in Dartmouth Ridge and Crawford Ridge would be controlled by the selected setpoints for their respective new booster stations. The exact setpoints would be determined during final design.

Both alternatives are viable. Alternative 1 appears to provide slightly higher pressure to the hotel during a fire flow and it keeps operating pressure at the well pump house relatively low (refer to results for node J-3). As expected, the pump controls were critical to the system's operation. The VFDs for the Crawford Ridge and Mount Washington Place booster stations were set to maintain a target discharge pressure, which would be operator-adjustable. The Rosebrook Townhomes booster station would serve to fill the storage tank, which would maintain the distribution pressure for the upper Rosebrook Townhomes and for the Mountain View homes. The well pumps would operate based on the storage tank level, as they do now. The Rosebrook booster station pumps would turn on and off in conjunction with the well pumps.

The upper Rosebrook zone (Zone 2RT) will still have pressures approaching 130 psi, which is unavoidable without an additional PRV close to the tank or a new lower water storage tank (which was the intent of the 2016 preliminary report) due to the ~310-foot maximum elevation difference between the storage tank and the homes (= 2010 – 1700).

Structures in Zones 2CR and 2MWP will have a maximum available flow based on their respective booster stations. Each booster station can provide a range of flows, and a higher maximum flow will increase the minimum flow capacity. At low flows such as in the middle of the night, the booster pumps are expected to cycle on and off frequently depending on the minimum flow capacity of the system. The maximum flow is currently expected to be approximately 300 gallons per minute.

Several of the modeling assumptions were conservative, including assuming peak hour demand rather than maximum day demand for the fire flow condition and assuming a peaking factor of eight rather than six. However, there are also unresolved factors that carry some risk and could be studied further, including the assumed water storage tank elevations, the identification of required fire flow rates for each sprinkled structure, and some operational discrepancies such as differences between pump performance curves and reported pumped water quantities.

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September 5, 2018

Mr. Tom Hansen
Abenaki Water Company
32 Artisan Court #2
Gilford, NH 03249

Subject: Analysis and Recommendations Summary - Abenaki Water Company Rosebrook Water System

Introduction

Abenaki Water Company ("AWC") has filed a petition with the New Hampshire Public Utilities Commission to support comprehensive water system improvement projects which, among other things will reduce extreme pressures in portions of the Rosebrook Water System ("System"). The Rosebrook system is part of the Abenaki Water Company, a subsidiary of New England Service Company ("NESC"). Horizons Engineering, Inc. ("Horizons") staff is familiar with the System since its initial work on the System in 1987. AWC has requested that Horizons analyze the System and provide recommendations on future capital improvements.

Background

The System dates back to the early 1970s and it is Horizon's understanding that it was initially constructed to serve the Bretton Woods Ski Area and appurtenant commercial and residential developments. The System relies on two overburden wells in the valley adjacent to the Ammonoosuc River, a 650,000 gallon concrete atmospheric storage tank on the ski slope to provide storage and maintain system pressure, and a network of distribution piping, mostly ductile iron ranging in size from 8 to 16 inches in diameter. The system serves 407 customers including the Mount Washington Hotel, several other commercial properties and a community of second homes and condominiums. The estimated serviced population is in excess of 1,100 people. The system has 63 fire hydrants and provides water for internal sprinkler systems. The System is routinely assessed by the New Hampshire Department of Environmental Services ("NHDES"). The NHDES has raised concerns that AWC address the System's high pressure.

Owing to significant topography within the service area, static pressures in the system vary from 35 pounds per square inch (psi) at the higher elevations to approximately 190 psi in the valley along the Ammonoosuc River. Intermittent pressure surges (water hammer) have reportedly increased this pressure significantly higher. The higher pressures in the system have reportedly caused problems with

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leakage and premature failure of valves, fittings, pumps and other appurtenances and pose operational and safety challenges in the day to day operation and maintenance of the system. These higher pressures exceed typical design operational ranges. Per the "Recommended Standards for Water Works" (aka Ten State Standards), PART 8 Distribution System Piping and Appurtenances, 8.2.1 Pressure, recommended system pressures"…should be approximately 60 to 80 psi…" These design standards have been adopted by the NHDES for large drinking water systems under Part Env Dw-404.

Since acquiring the System in September 2016, AWC has recognized the hazards associated with operating the water system at high pressures. Past incidents of pressure related issues have reportedly disrupted service. The following are examples of the difficulties of system operation reported by Abenaki:

- Rosebrook Water Company was informed that their commercial package and property policy, running from 6/23/15 through 6/23/16 could not be renewed. This event was triggered by an extensive damage claim by Rosebrook following a water hammer incident which flooded several townhouses during a hydrant flushing operation.
- In 2010, a high pressure event during a repair at the System's well house caused major damage to that facility and forced the Mt. Washington Hotel to close for three days.
- Recently, Abenaki has been unable to effect timely repair of two fire hydrants because the excessively high pressures posed a serious safety and construction concern for the contractor. (See Attached e-mail from of F.X. Lyons dated August 22, 2018).

NHDES has reportedly been aware of the high pressure situation for some time. In its Sanitary Survey report dated August 4, 2014 (attached) NHDES concluded "...pressure in the distribution system, as a result of storage tank elevation, is much higher than necessary for adequate water service and fire flow. This pressure presents serious questions about power consumption and about safety of the operation when making pipe repairs. We urge the system owner to consider alternate ways of using the existing tank and adopting a lower pressure gradient".

In January 2017, NHDES stated in a letter to AWC (attached), "We are in support of and recommend system modifications which will reduce the public health risk and will maintain pressures within the recommended range. Not only will this provide for a safer and less costly system to operate, it also creates the ability for the company to take back ownership of system maintenance from home and commercial owners who are currently maintaining their own PRVs."

The Town of Twin Mountain Fire Department is also concerned about the high pressures. In February, 2017 the department sent a letter to AWC (attached) in support of the project to reduce system pressure to a maximum of 100 psi. The department stated that they believe such a project will "...improve safety and reliability of the system."

Recommendations

The primary concern is that the System is presently operated at one pressure gradient despite the topography varying widely across the service area. Typically, a water service area with such varying terrain would be designed with multiple pressure zones served by booster pump stations as needed.

At the request of the AWC, Horizons evaluated the System in July 2016 and recommended alternative methods to lower the maximum system pressure to 100 psi maximum. The recommendations include installing pressure reducing valves and constructing three new pump stations while maintaining the temporary use of the existing tank.

To mitigate rate shock to customers, AWC recommends the plan be conducted over the following phases:

Phase 1. Design the System improvements, including the tank and pump stations. The plan would include constructing a new water storage tank at a lower elevation. This would preclude the need for pressure reducing valves. The new tank will enable Rosebrook to lower the maximum system pressure to a more reasonable 100 psi.

Phase II. Construct a new water transmission main and one booster pump station. The pressure at the well will be reduced to 100 psi. The overall system pressure will remain at 200 psi max. The Phase II improvements will become part of the overall pressure reduction project when it is completed. The phased construction approach will also reduce a safety concern associated with operating the wells at 200 psi.

Phase III. Construct two additional pump stations and install pressure reducing valves to lower the maximum service area pressure to 100 psi. The high elevations will be serviced by the pump stations which will have adequate fire flow capabilities and standby power.

Phase IV. Construct the new storage tank. The tank will replace the existing partially buried storage tank that is now on one of the resort ski slopes. Upon completion of Phase IV, the System will meet AWCs design and safety standards. The mitigation of unsafe pressure will allow for better maintenance, scalability, and less concern for damage and disruptions over the next 40 years.

In conclusion, Horizons recommends adoption of this multi-phased project. In addition to mitigating rate shock, Horizons believes the phased project components will ensure operational reliability and control, reduce the potential for increased water losses, and optimize scalability of the water system.

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Fax: 802-296-8301

Please feel free to contact me if you have any questions or if you need any additional information.

Sincerely,

Stephen LaFrance, P.E.
Principal Engineer
Horizons Engineering, Inc.

Enclosures

C:\Users\SysAdmin\Desktop\New England Water - Rosebrook Letter 2018-09-04.docx

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Don Vaughan

From: F. X. LYONS <fxlyons@hotmail.com>
Sent: Wednesday, August 22, 2018 3:05 PM
To: Don Vaughan
Subject: Re: Rosebrook Hydrants

Difficult undertaking with a high risk. In reviewing the P&L system prints page 3 shows a 16" valve adjacent to the broken hydrant. Their survey dated 11/3/99 labeled it as 3A, they apparently operated the valve, documented the turns and added a comment 'Seems OK'. This valve must still be in place. If a metal detector can not pick up the gate box that would lead me to believe that the gate box top section was removed following some event. That area can be excavated, 'carefully' , a new gate box installed and the valve tested. Without this valve being operational there is 4500+/- feet of 16" pipe between the tank and the north side of Rt 302 with out an operational valve. That is not a risk I am willing to take. Would you want us to attempt to locate that valve. We could schedule that next week. Thanks FX

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

August 4, 2014

Charles Adams
Rosebrook Water Co
123 E Main St 2nd Floor
Charlottesville VA 22902

Subject: Rosebrook Water; PWS ID 0382010; Carroll
Sanitary Survey

Dear Mr. Adams:

On 10/23/2013 I met with Nancy Oleson and Brian Sullivan to review facilities and management of the Rosebrook Water Company. The purpose of this survey is to review the capacity of the system's source, treatment, distribution and management to continuously produce safe drinking water. I thank Ms. Oleson and Mr. Sullivan for their assistance.

FACILITIES SUMMARY

The Rosebrook water system consists of two gravel packed wells, a single 650,000-gallon storage tank and a network of distribution piping, mostly ductile iron from 8 to 16 inches in diameter. The system serves 407 service connections, among which are the Mount Washington Hotel, several other commercial properties, and a community of second homes and condominiums. Estimated peak population served is in excess of 1,000 people. The system serves fire demand by way of some internal sprinkler systems and 63 exterior hydrants. There is also some limited outdoor water use, including minor snowmaking at the Nordic Center.

Water demand varies widely with the seasons and occupancy of the facilities served. Average year-round daily demand had been placed at about 154,000 gallons per day (gpd) historically. A 2007 report put estimated maximum daily demand as high as 500,000 gpd. Although construction is not moving forward at this time, residential and commercial construction is estimated to increase peak demand to about 740,000 gpd at full build-out.

The two gravel packed wells are summarized as follows:

Well	DES No.	Depth	Nominal well capacity (gpm)	Treatment
1	001	43'	350	Chlorine, soda ash
2	002	52'	450	Chlorine, soda ash

Well 1 is located within the pumping station, while well 2 is located 90 feet away. Well 1 is equipped with soft start to minimize hydraulic surges at startup. Injection of chlorine for disinfection and soda ash for corrosion control takes place within the pumphouse. Discharge pressure is normally about 185 psi, which is exceptionally high for residential water supplies.

A pipe break in the pump discharge main within the pumphouse in May 2010 did extensive damage to the pumphouse structure, electrical and instrumentation. The incident pointed out sub-standard piping and structural work at the facility. Repairs to the immediately affected infrastructure have since been completed. A generator has also been added to provide back-up power for the well pumps and pumphouse.

The 650,000-gallon tank is located adjacent to ski trails toward the south westerly side of the service area. Tank water level is now transmitted to the pumping station by way of line communication replacing the former battery-powered radio signal relay. Pump operating range is reportedly from 10 to 12 feet in tank depth, with a total tank depth of 13 feet.

The distribution system is primarily ductile iron. However maximum pressure is about 185 psi, significantly higher than the 100 psi allowed in state design standards. A backflow prevention program was adopted in 2013. There are a number of reduced-pressure zone devices and double-check valves in place, on high and low hazard classified service connections within the distribution system, which are tested routinely.

STAFFING AND CERTIFIED OPERATOR VERIFICATION

This water system is required to retain a primary certified operator certified at treatment grade 1 and distribution grade 2. The following certified operators are affiliated with Rosebrook Water and show adequate levels of certification:

Operator	Certificate No.	Treatment Level	Distribution Level
Nancy Oleson	2767	2	2
Brian Sullivan	3059	2	2

Significant Deficiencies

1. No significant deficiencies were noted during the site visit

Minor Deficiencies

Though less urgent than deficiencies noted above, the following deficiencies should be addressed in the course of system operation:

1. Pressure in the distribution system, as a result of storage tank elevation, is much higher than necessary for adequate water service and fire flow. This pressure presents serious questions about power consumption and about safety of the operator when making pipe repairs. We urge the system owner to consider alternate ways of using the existing tank and adopting a lower pressure gradient.

DES recommends developing an asset management plan to ensure that you get the most value from each of your assets and have the financial resources to rehabilitate and replace them when necessary. Asset management helps a system make critical decisions about how to achieve the desired level of service at the lowest appropriate cost to customers. For assistance contact Luis Adorno, by phone at (603) 271-2472, or email luis.adorno@des.nh.gov.

I can be reached at 271-2410 or wade.pelham@des.nh.gov if there are any questions regarding this letter.

Sincerely,

Wade Pelham
Drinking Water and Groundwater Bureau

cc. Nancy Oleson, Primary Operator
Michael Hahaj, Rosebrook Water Co

The State of New Hampshire
Department of Environmental Services

Clark B. Freise, Assistant Commissioner

January 26, 2017

Alex Cranshaw
Abenaki Water Co.
37 Northwest Drive
Plainville, CT 06062

Subject: Rosebrook Water (0382010)
Pressure Reduction Project

Dear Mr. Cranshaw:

We understand that you are in the process of presenting drinking water system upgrades to the community. The biggest issue that you plan to address is the high pressure areas throughout the system and in some locations are high enough to pose safety concerns. A normal system pressure range recommended by this department is 60 to 80 psi, with a minimum and maximum of 35 psi and 100 psi, respectively. It is our understanding that the existing water system owned by Rosebrook Water can exceed 200 psi in some locations. This extremely high pressure creates a safety risk, increased water loss through water main breaks or leaks, increased operating costs, and the necessity of home pressure reducing valves (PRVs). You have also indicated that the system lost insurance coverage because of numerous claims caused by the excessive pressure.

We are in support of and recommend system modifications which will reduce the public health risk and will maintain pressures within the recommended range. Not only will this provide for a safer and less costly system to operate, it also creates the ability for the operating company to take back ownership of system maintenance from home and commercial owners who are currently maintaining their own PRVs.

If you have any questions, please do not hesitate to reach out to me at Randal.Suozzo@des.nh.gov or 271-1746.

Sincerely,

Randal A. Suozzo, P.E.
NHDES Drinking Water & Groundwater Bureau

ec: Don Vaughan, Abenaki Water Company

DES Website: **www.des.nh.gov**
P.O. Box 95, 29 Hazen Drive, Concord, New Hampshire 03302-0095
Telephone: (603) 271-2513 • Fax: (603) 271-5171 • TDD Access: Relay NH 1-800-735-2964

Twin Mountain Fire Department

Twin Mountain. Fire Department
PO Box 119
104 Route 3 North.
Twin Mountain, NH 03595

Phone: 603-846-5545
FAX: 603-278-7944
email: twinmountainfirerescue@townofcarroll.org

February 25, 2017

Mr. Donald J. T. Vaughan
Abenaki Water Company
37 Northwest Drive
Plainville, CT 06062

Re: Rosebrook Water System

Dear Mr. Vaughan:

The Twin Mountain Fire Department is a municipal department providing fire protection services for Bretton Woods, served by the Rosebrook water system. As presently configured, the Rosebrook system has pressures as high as 200 psi in some areas. This pressure is excessively high and potentially dangerous from the perspective of operating fire hydrants and other equipment. Typically, municipal systems operate between 50 and 75 psi which is generally adequate for fire fighting purposes.

As the current owner and operator of the Rosebrook system, Abenaki has presented a plan for improvements to the system that would lower the maximum pressure to 100 psi while still maintaining adequate fire flows. The Twin Mountain Fire Department supports this project and believes that it would improve safety and reliability of the system.

Respectfully,

Jeremy Oleson
Fire Chief

Cc: TMFD - File

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Robert R. Scott, Commissioner

December 1, 2020

LETTER OF DEFICIENCY #DWGB 20-032
Certified Mail #7019 1120 0001 7107 7303

Donald Vaughan
Abenaki Water Co
32 Artisan Ct, Ut 2
Gilford, NH 03249
Also via email: dvaughan@newenglandservicecompany.com

Subject: Carroll - Public Water System: Rosebrook Water (PWS ID: 0382010)

Dear Mr. Vaughan.:

The records of the NH Department of Environmental Services ("NHDES") show that the Rosebrook Water water system (the "Water System") is classified as a public water system ("PWS"), as defined by RSA 485:1-a. A PWS is defined as any water system supplying 15 or more services, or 25 or more people for 60 or more days per year. The Water System serves approximately 408 connections and 1020 people on a year round basis. As owner of the Water System, Abenaki Water Company ("Abenaki") is required to comply with NH Administrative Rule Env-Dw 100-1200, *New Hampshire Drinking Water Rules*, for the purpose of providing safe and reliable drinking water.

Per Env-Dw 720, *Inspections; Significant Deficiencies*, PWS's with a public water supply source are subject to periodic inspections or sanitary surveys by NHDES staff to evaluate the adequacy of the source(s), storage facilities, equipment, operation, and maintenance for the protection of public health. In addition, Env-Dw 717, *Groundwater Monitoring and Treatment*, lists significant deficiencies applicable to PWS's served by groundwater. Env-Dw 720 and Env-Dw 717 require a PWS owner to correct significant deficiencies identified during a sanitary survey within 120 days of receiving notice from NHDES of a significant deficiency, unless a shorter deadline has been established.

On March 29, 2019, NHDES staff conducted a sanitary survey inspection of the Water System. The Sanitary Survey Deficiency Letter, sent to Abenaki by mail on June 7, 2019, identified four significant deficiencies and the required actions to correct the deficiencies. One of the four deficiencies was subsequently corrected.

The three following significant deficiencies have not been corrected according to NHDES records:

Significant Distribution Deficiency
The Water System's pressure exceeds the regulatory limit specified in Env-Dw 404.01(a), *Design Standards for Large Public Water Systems*. More specifically, the *Recommended Standards for Water Works* requires the working pressure to be between 60 to 80psi and for pressure reducing valves to be in place if the static pressure exceeds 100psi. *To correct the deficiency, permanently address the system's pressure exceedances to maintain a normal working pressure between 60 and 90psi, with a minimum working pressure of 35 psi and a maximum static pressure of 100 psi.*

Significant Treatment Deficiency
During the inspection, there was no chemical containment at the well station for the storage of chemicals or at the bulk mixing tank. Chemical containment is required for operator safety and for preventing potential groundwater contamination should a spill occur. *The Recommended Standards for Water Works*, as referenced in Env-Dw 404.01(a), requires that chemical containment be provided for 100% of the volume of the largest container. *To correct the deficiency, install containment for all tanks used for storing or mixing chemicals and chemical pumps.*

Operation and Maintenance Inadequate
Both of the chemicals used for treatment at the Water System, soda ash and NaOCl, are mixed in the same tank. Due to the chemical mixing, the recording of the daily quantities for NaOCl, required per Env-Dw 503.10, *Public Water System Operational Requirements,* are more of an estimate than an accurate quantity. Additionally, the mixing tank makes it difficult to hold a consistent chlorine residual. *To correct the deficiency, each chemical feed system should operate on its own to allow for accurate chemical recordings and should have separate storage, piping and pumping equipment, in addition to separate injection points.*

In the Sanitary Survey Deficiency Letter, NHDES noted that correction of the deficiencies or submission of a Corrective Action Plan ("CAP") was required within 30 days, and also noted the requirement that NHDES be notified in writing when the deficiencies had been corrected.

On June 21, 2019, NHDES staff sent an email to representatives of the Water System with an outline of information needed for a CAP to correct the deficiencies. The Water System responded by email on June 23, 2019 with dates for anticipated correction contingent on decisions pending with the NH Public Utility Commission ("PUC"). On August 26, 2020 and September 9, 2020, NHDES sent emails to representatives to establish proposed deadlines for the submission of design plans and project bidding for correction of the deficiencies, barring any other approved deadlines. On September 1, 2020 and September 18, 2020, NHDES received emails from representatives regarding Abenaki's inability to commit to the proposed deadlines with the lack of decisions from the PUC. On November 17, 2020, NHDES spoke with you to explain that PUC's review cannot prolong correction of the significant deficiencies to protect public health and safety. To date, NHDES has not received a proposed CAP for correction of the deficiencies.

Per Env-Dw 717.22(d) and Env-Dw 720.14(a)(1), the failure to correct the deficiencies within 120 days of being notified of the deficiencies, or be in compliance with an approved CAP, has resulted in the Water System incurring a treatment technique violation requiring public notice of the violation. **This Letter of Deficiency shall serve as formal notice of this violation**.

NHDES believes the violations can be corrected and future violations prevented by taking the following actions:

DEADLINE	ACTION
January 11, 2021	Provide public notice to consumers for the **failure to correct the noted significant deficiencies** within 120 days from the date of the sanitary survey and provide proof of public notice to NHDES, per the instructions on the template at *www.des.nh.gov*. Click on "A to Z List", and select "Public Notice (for Public Water Systems)", "Sanitary Survey" heading, "Sanitary Survey Significant Deficiency."
Continue to perform public notice every 3 months* for as long as the deficiency is unresolved and submit proof of public notice to NHDES, in accordance with the instructions provided on the public notice template available as indicated above.	
August 2, 2021	Submit completed design plans for modifications/improvements of the Water System in order to correct the significant deficiencies noted during the sanitary survey as detailed above.
By the NHDES-approved correction date	Correct the significant deficiencies and submit documentation, including photographs, to NHDES confirming that the deficiencies have been corrected.

*Water system owners may request an alternate repeat notice frequency in accordance with Env-Dw 801.10 and 801.13, *Alternate Frequency for Repeat Standard Public Notice*. NHDES will review and approve the request for modification of the repeat notice frequency if the proposal adequately protects human health and the

environment and meets all applicable federal requirements. In no event shall repeat notice be given less frequently than once per year.

Please note that NHDES may initiate formal action for this violation, including issuing an order requiring the deficiencies to be corrected, proposing an administrative fine of up to $4,000 per violation, and/or referring the matter to the NH Department of Justice for imposition of appropriate penalties.

All information as requested above should be addressed as follows or emailed to *dwgbenforcement@des.nh.gov*:

Kim Bourgouin
Enforcement Section
Department of Environmental Services
Drinking Water and Groundwater Bureau
29 Hazen Drive, PO Box 95
Concord, NH 03302-0095

NHDES records indicate that the Water System currently holds an SOC chemical monitoring waiver, which expires December 31, 2021. Please note that systems with unresolved significant deficiencies identified by NHDES will be denied requests for an SOC monitoring waiver, per Env-Dw 712.20(c).

Please contact Randy Suozzo at (603) 271-1746 or by email at *randal.a.suozzo@des.nh.gov*, if you have any questions regarding the noted sanitary survey deficiencies. If you have any other questions regarding this letter, please contact Kim Bourgouin by email at *kim.c.bourgouin@des.nh.gov* or *dwgbenforcement@des.nh.gov*, or by phone at (603) 271-0713.

Sincerely,

Brandon Kernen, P.G., Administrator
Drinking Water and Groundwater Bureau

cc: NHDES Legal Unit
File

ec: Taylor Deogburn, Primary Operator, *tdeogburn@newenglandservicecompany.com*
Health Officer, Town of Carroll, *twinmountainfireambulance@gmail.com*
Randy Suozzo, NHDES/DWGB, Sanitary Surveyor
EPA, Region 1

The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

June 7, 2019

Pauline Doucette
Abenaki Water Co Inc.
32 Artisan CT Unit 2
Gilford, NH 03249

Subject: Rosebrook Water (0382010)
Sanitary Survey 2019

Dear Ms. Doucette:

On February 20, 2019, I was onsite and initiated a sanitary survey on the Rosebrook Water system (RW). I subsequently revisited the RW on May 29, 2019. The purpose of the survey was to review the capacity of the water system's sources, treatment, distribution, and management to continually produce safe drinking water. I would like to thank Phil Sausville, primary operator, Taylor deOgburn, operator, and Don Vaughn for their time and assistance in conducting this survey.

SUMMARY

The RW is operated in a professional manner. The most recent water quality monitoring records show that the system is currently in compliance with water quality standards including lead and copper. However, this sanitary survey identified several significant deficiencies related to the existing infrastructure. We understand that the RW has applied for a rate increase from the Public Utilities Commission (PUC) to begin to address these deficiencies. The New Hampshire Department of Environmental Services (NHDES) fully supports the authorization of any funding to make improvements in accordance with the deficiencies and recommendations listed in this report and commend any effort to move forward.

The following **significant deficiencies** are described in more detail at the end of this report and must either be corrected or have a 'corrective action plan' (CAP) provided to this office within 30 days of this letter:

1. System pressures exceed the regulatory limit and need to be addressed.
2. The storage tank requires regular inspections and is three (3) years past due.

The well station requires significant upgrades, the following are the most significant and more are listed below under recommendations:

3. There is currently no chemical containment at the well station, as required.
4. There are two chemical feed systems at the well station. These systems should be completely separate and stand-alone.

In addition, the following is a list of issues that we recommend the managers of the water system consider to maintain compliance, and continue to provide an acceptable level of service to the system's customers:

1. Consider additional source water protection measures.
2. Make a permanent repair of the GPW2 electrical conduit.
3. Install well level transducers to monitor water levels.
4. Install a pH analyzer and residual chlorine analyzer at the well station and connect to an automated alarm system.
5. Install a flow switch on the emergency eyewash station and alarm to notify external parties in the event of activation.

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6. Place the electrical panel in the well station on a concrete pad and protect it from water or move it to a separate room/building.
7. Install an intrusion switch on the water storage tank hatch and/or security fence around the tank.
8. Consider the construction of a second water storage tank on the other side of the valley.
9. Locate the water storage tank overflow and inspect regularly to make sure access is screened/blocked from rodents or other small animals.
10. Investigate the location of and reduce system leaks.
11. Develop an Asset Management Program (AMP) for achieving and maintaining the desired level of service at the lowest appropriate cost to customers.
12. Develop a plan for addressing the 16-inch water main located under the ski resort either separately or included in an AMP.

A more descriptive discussion on each of these issues is included below under "Recommendations".

SYSTEM DESCRIPTION

General

The RW provides domestic water and fire protection to approximately 408 service connections, and a total estimated population served of 1020 people. The average reported daily water usage is less than 100,000 gallons per day (gpd) during the slow seasons in the spring and fall, and as high as 150,000 gpd during peak winter and summer seasons. The maximum daily demand can be as high as approximately 250,000 gpd in the winter.

In general, the water system is comprised of two gravel packed wells (GPW), one well station, one storage tank, and associated piping and appurtenances.

Water Sources

The water sources are summarized as follows:

Source	DES Data Base 0382010-	Well Type	Well Depth (feet)	Safe Yield (gpm / gpd)
GPW 1	001	Gravel well	43	350 / 504,000
GPW 2	002	Gravel well	45	450 / 648,000

GPW 1 is located within the well station with a turbine pump and 40 feet of 12 inch diameter steel well casing. GPW 2 is located 90 feet east, southeast of the well station with a submersible pump and 45 feet of 12 inch diameter steel well casing. The Ammonoosuc River flows nearby the wells.

The two wells are not operated simultaneous and alternate regularly. A sample tap is located on the common manifold line for the wells. There is currently no well level transducer in either well to determine the water level.

Treatment / Pumps, Pumping Facilities, and Controls

Water from the wells is treated with soda ash for corrosion control and sodium hypochlorite (NaOCl) for disinfection. A chemical mixture of dry soda ash, water, and liquid NaOCl is batched into a 625 gallon bulk storage tank approximately every two weeks. The mixture is injected and a combined source totalizing meter is in place on the manifolded well line.

There is no pH meter or chlorine residual monitor, but the pH and chlorine levels are manually checked whenever operators are onsite (three times per week). The wells start and stop automatically via a signal from

the storage tank level. Alarms for power and tank level call out and send texts to the operators. A standby generator is located at the well station to provide backup power when necessary.

Finished Water Storage

Water from the wells flows into a 16-inch distribution line and up to the 650,000 gallon atmospheric storage tank located slope side of the Bretton Woods Ski Area. The level transducer in the tank is connected to an adjacent radio panel.

The tank's roof has been reconstructed and/or upgraded since originally installed. It is an aluminum decking roof covered in an HDPE liner and supported by galvanized steel bar joists. The previous inspections of the tank, dating back to 1994, recommended replacement of the liner and additional upgrades to the tank. A fence around the tank has also been recommended previously.

The water storage tank is summarized as follows:

Storage Tank	Type	Capacity (gal)	Installed	Last Inspected
Bretton Woods	Buried Concrete	650,000	1974	2010

Distribution

Distribution piping is mostly ductile iron ranging from 8 inches to 16 inches in diameter. Water gravity feeds the distribution from the atmospheric storage tank. Because of the hydraulic grade line, this creates excessive pressure throughout the system in order to maintain minimum pressures in the upper areas. Pressure can be as high as 200 psi in some areas and as low as 35 psi in others. Some of the service connections include the Mount Washington Hotel and several other commercial properties as well as a community of second homes and condominiums.

The system serves fire demand by way of some internal sprinkler systems and approximately 64 exterior hydrants. The distribution system is reportedly flushed twice per year and valves are exercised periodically so that all valves are checked once per year. Residential meter reads are performed via radio read on a monthly basis and the system has all new meters as of 2017.

Monitoring, Reporting, and Data Verification / Water System Management and Operation

Water quality monitoring records show that the system is in compliance with current standards. However, the RW does not currently have an AMP and the excessive system pressures have not been addressed as previously recommended. The excessive pressures put a hindrance on operations as well as causing costly failures and repairs.

Staffing and Operator Certification

The RW is required to retain an operator certified at the grade 1 treatment level and the grade 1 distribution level. The following certified operators are listed as operators for this system:

Operator	Certificate No.	Treatment Level	Distribution Level
Philip Sausville	3692	1	1

Operators are reported to be onsite three days per week to check on the system.

ACKNOWLEDGEMENTS

1. The RW is operated in a professional manner and the system is in compliance with water quality standards.

2. We commend management for installing new radio read meters in 2017 and going to monthly billing. This provides management with more accurate non-revenue water calculations and the consumer with better information about water use and cost.

RECOMMENDATIONS

Significant Deficiency

There were four deficiencies noted during this inspection which are termed 'significant' as it has the potential to affect environmental safety and/or reliability. A significant deficiency must be corrected within 30 days. Alternately, for a deficiency which cannot be corrected within that time period, a 'corrective action plan' (CAP), identifying the action proposed to be taken, and timeline for the corrective action, shall be forwarded to this office within 30 days. The CAP submitted by the system owner shall identify any interim measures that will be taken in order to provide sufficient protection pending final action. Note that the owner shall not make any modifications to an approved CAP without first obtaining approval for the modifications from DES.

The following **significant deficiencies** were noted:

1. System pressures exceed the maximum allowable per New Hampshire Rules and Regulations, specifically the Recommended Standards for Water Works as referenced in Env-Dw 404.01. These rules state that when static pressures exceed 100 psi, pressure reducing valves shall be provided and the normal working pressure should be approximately 60 to 80 psi (410 - 550 kPa). The issue of elevated system pressures has been raised by NHDES in the past and needs to be addressed to bring the system in compliance with our rules. We understand that the RW has applied for a rate increase from the PUC to specifically address this deficiency and ask that the plan of action be submitted to NHDES as soon as possible, and at a minimum a schedule be submitted within the next 30 days.

2. Records indicate that the finished water storage tank was last inspected in 2011. Env-Dw 504.09 requires that tanks be inspected every five (5) years. These inspections should take place as soon as possible to confirm the extent of work that is required to properly maintain the tank. Previous inspections have recommended improvements, some of which have not been performed. In addition, this survey noticed some gaps between the sidewall and tank cover and NHDES would like confirmation that these areas are not a potential access points to the tank interior for insects and rodents. The overall condition of the tank is also important to determine prior to any work be planned on the system.

3. The well station does not have any chemical containment for storage of chemicals, or for the bulk mixing tank. Containment is required for hazardous chemicals for operator safety and in this instance, for protecting the surrounding building soils from contamination. There cannot be any drains in the containment area that are sent outside of the contained area. All of the bulk storage tanks, day storage tank, and chemical pumps must be contained. The Recommended Standards for Water Works requires that chemical containment is provided for 100% of the volume of the largest container.

4. Both chemicals, soda ash and NaOCl are mixed into the same tank. This tank makes it difficult to hold a consistent chlorine residual level, making the system's chlorine residual difficult to maintain. This tank also makes recording daily quantities of NaOCl more of an estimate than an accurate quantity. In accordance with Env-Dw 503.10, operators should maintain accurate recordings of the daily quantity of each chemical used. Each chemical feed system should operate on its own. Separate storage, piping, and pumping equipment are required for the injection of NaOCl. In addition, the installation of a second injection point is necessary.

Below are areas where improvements or operating adjustments are recommended, some of which could lead to significant deficiencies in the future if not addressed:

Water Sources

1. Wellhead protection is an important responsibility for every public water system. According to our records there is fuel storage (potential contamination source) within your wellhead protection area. As discussed during this survey, preventing contamination in the wellfield is the most prudent and cost-effective approach to protecting sources of drinking water used by public water systems. NHDES recommends that you consider additional wellhead protection measures such as expanded public education and installing fencing around the well site. If interested, source water protection grant applications are due to NHDES in November each year. Please contact Andrew Madison at andrew.madison@des.nh.gov or 271-2950 if you are interested in applying for this grant.
2. GPW 1 has a broken electrical conduit that has been fixed with tape. This is not a permanent solution. The conduit should be repaired properly to avoid contamination of the well.

3. There are concerns that the wells may potentially be over-pumping. This cannot be determined without knowing the water level in the well. NHDES highly recommends the installation of well level transducers for each well. In addition to determining if the wells are over-pumping, this will also allow operators to more effectively monitor the health the wells.

Treatment

4. Anytime there is addition of chemical treatment to a water supply, the risk to public health is increased. The RW manually samples for pH and chlorine residual in the system more than once per week, the minimum requirement under The New Hampshire code of administrative rules. However, DES recommends that a more conservative approach to protect against both high and low target pH and chlorine residual levels is implemented through the installation of online instrumentation. The instrumentation should also connect into the existing alarm system.

5. NHDES recommends that the eyewash station have a flow switch installed so that an alarm can be communicated in the event of activation. This is a great safety feature for operators in the event of a chemical spill.

Pumps, Pumping Facilities, and Controls

6. The well station is a single room structure that houses electrical equipment, pumping equipment, emergency showers, and chemicals. The electrical equipment is not on an equipment pad and although is away from the pumping equipment and emergency shower, the floor can get wet, and the equipment could also get sprayed in a situation of a leak. This is a safety issue for the operators and should be addressed.

7. There is no intrusion alarm on the water storage tank hatch and no fence protecting the area from passersby. The RW is a system with the entirety of the drinking water storage in one tank. The tank, and its contents, should be better protected to prevent contamination of the system's drinking water supply.

Finish Water Storage

8. The system has only one storage tank up the mountain side but also serves water to the other side of the valley. The pressure reduction project proposes a number of pressure reducing valves and booster stations for the system, but a second tank on the other side of the valley would also provide better reliability to the overall system. This could be done conjunction or separate from the pressure reduction project.

9. The location of the outlet to the tank overflow was not determined or inspected during this survey. Operators should locate the overflow outlet, inspect it, and report back to NHDES on the condition of screening or other protective measures to prevent access to the tank through this overflow outlet.

Distribution

10. Non-revenue water is reported between 15%-20%. We recommend RW consider applying for a Leak Detection Grant from DES so an investigation into the leaks can be performed professionally. Once located, the leaks should be repaired or pipes replaced, which can be done as part of an AMP.

Water System Management and Operation

11. NHDES recommends developing an AMP to help you get the most value from each of your assets and have the financial resources to rehabilitate and replace them when necessary. This program offers a matching grant up to $20,000 for water systems to perform a system assessment and begin asset management initiatives. Asset management helps a system make critical decisions about how to achieve and maintain the desired level of service at the lowest appropriate cost to customers. We highly recommend the RW consider applying for this grant. Contact Luis Adorno at 271-2472 or Luis.Adorno@des.nh.gov for more information about our Asset Management program.

12. At some previous time, management allowed (knowingly or unknowingly) the construction of a building expansion at the ski resort that was erected over the dedicated 16-inch main that serves the water tank. The contractor on that project should have been required to move that water main at that time to maintain proper access to this underground asset. NHDES recommends a plan be put in place to have that water main looped or a new water main constructed and that line abandoned. The urgency on this work should be part of an AMP.

As a general reminder, RSA 485:8 states that no new construction, addition, or alteration involving the source, treatment, distribution, or storage of water in any public water system or privately owned redistribution system shall be commenced until the plans and specifications have been submitted to and approved in accordance with rules adopted by the department; except, if such construction, addition, or alteration is exempted by the department because it will have no effect on public health or welfare, then such submission and approval is not required.

If you have any questions please contact me at Randal.Suozzo@des.nh.gov or 271-1746.

Sincerely,

Randal A. Suozzo, P.E.
Drinking Water and Groundwater Bureau

cc: Phillip Sausville, Primary Operator

ABENAKI
Water Company

Randal A. Suozzo, P.E.
Drinking Water and Groundwater Bureau
P.O. Box 95
Concord, N.H. 03302

June 13, 2019

Dear Mr. Suozzo:

This is to confirm receipt of your comprehensive and detailed sanitary survey report for the Abenaki Water Company Rosebrook system. The report is constructive and presents a framework from which Abenaki can utilize to place the Rosebrook system into a position of compliance.

The itemized **significant deficiencies** enumerated in the report are of paramount importance to the Company (Abenaki), its operations, customers and management. The following responses to address the specific significant deficiencies are presented in the order as listed in the report.

Significant Deficiencies

1. System pressures exceed the regulatory limit and need to be addressed.

   Response – The company is acutely aware of the excessive/extreme system pressure in the Rosebrook system. Since its acquisition in 2016, Abenaki has focused on the problem and solution and has expended a great amount of resources dedicated to laying the foundation for the Rosebrook system to reach full operating compliance in accordance with Env-Dw 404.01. However, the scope of the solution is significantly beyond Abenaki's financial capability to fund and therefore it is in unquestioned need of regulatory support to execute the solution as detailed in PUC docket DW 17-165.

   Engineering plans/specifications estimated at approximately $100,000 and identified as step II in the above docket, as well as consecutive construction phases punctuated by PUC investment recovery filings are all necessary parts of the solution to reduce system pressures to compliance levels. Further, and not the least of all, are the important enhancements to operator safety, system reliability, expected reduction of property liability, wear and tear, and energy consumption.

   Rosebrook's excessive pressure condition has been in existence since its 650,000-gallon storage tank was unfortunately located at its present location. Consequently, because of all the factors involved in addressing the issue, pressure reduction cannot be accomplished in the next 30 days and therefore forward remedies must be detailed in a **corrective action plan (CAP).** The CAP is outlined in DW 17-165.

Abenaki is fully cognizant of DES communication and approvals; however, it must receive PUC concurrence to proceed with its initiative as contained in the previously mentioned PUC docket.

2. The storage tank requires regular inspections and is three (3) years past due.
   Response – The company has executed an agreement with an experienced tank inspection contractor to perform the work. The inspection is anticipated to take place within the next 30 days.

3. There is currently no chemical containment at the well station, as required.
   Response – The well station which houses chemical supplies and treatment equipment, remains configured as it was when originally constructed and placed into operation. It is Abenaki's proposal to install chemical containment as part of the pressure reduction plan outlined in the response to significant deficiency No.1. Therefore, the company suggests this be included in that CAP.

4. There are two chemical feed systems on the well. These systems should be completely separate and stand alone.
   Response – The company recognizes this situation and agrees the systems should be separated. This operating condition has been long standing and is a result of the difficulties associated with chemical injection into excessive pressures. The company proposes correction to the condition be included in the CAP of significant deficiency No.1.

Regarding the recommended improvements and/or operating adjustments, Abenaki acknowledges that most can be accomplished though the pressure reduction plan. Others can be implemented within day to day operations.

We hope this letter is responsive to the sanitary survey. Please do not hesitate to advise if you have questions or comments.

Very truly yours,

Donald J.C. Vaughan
Chairman
Abenaki Water Co.

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

October 22, 2010

Michael Brunetti
Rosebrook Water Company
Mt. Washington Hotel
310 Mt. Washington Hotel Drive
Bretton Woods, NH 03575

Subject: MWS Carroll, Rosebrook Water Company (0382010)
Sanitary Survey 10/20/10

Dear Mr. Brunetti:

On October 20, 2010, I met with Nancy Oleson and Brian Sullivan to review facilities and management of the Rosebrook Water Company. The purpose of this survey, normally performed every three years, is to review the capacity of the system's source, treatment, distribution and management to continuously produce safe drinking water. I thank Ms. Oleson and Mr. Sullivan for their assistance.

FACILITIES SUMMARY

The Rosebrook water system consists of two gravel packed wells, a single 650,000-gallon storage tank and a network of distribution piping, mostly ductile iron from 8 to 16 inches in diameter. The system serves 402 service connections, among which are the Mount Washington Hotel, several other commercial properties, and a community of second homes and condominiums. Estimated peak population served is in excess of 1,000 people. The system serves fire demand by way of some internal sprinkle systems and 63 exterior hydrants. There is also some limited outdoor water use, including for snowmaking on the tubing hill at the Nordic Center.

Water demand varies widely with the seasons and occupancy of the facilities served. Average year-round daily demand in 2008 and 2009 was about 154,000 gallons per day (gpd). Maximum daily demand is estimated to be as high as 500,000 gpd. Although construction is not moving forward at this time, currently planned residential and commercial construction is estimated to increase peak demand to about 740,000 gpd at full build-out.

The two gravel packed wells are summarized as follows:

Well	DES No.	Depth	Nominal well capacity (gpm)	Treatment
1	001	43'	350	Chlorine, soda ash
2	002	52'	450	Chlorine, soda ash

Well 1 is located within the pumping station, while well 2 is located 90 feet away. Well 1 is equipped with soft start to minimize hydraulic surges at startup. Injection of chlorine for disinfection and soda ash for corrosion control takes place within the pumphouse. Discharge pressure is normally about 185 psi, which is exceptionally high for residential water supplies.

As of our last survey in 2007, a replacement well field was planned and the current wells and pumphouse were scheduled for abandonment. Those plans have reportedly been put on hold with the current pace of development in the service area. A pipe break in the pump discharge main within the pumphouse in May 2010 did extensive damage the pumphouse structure, electrical and instrumentation. The incident pointed out sub-standard piping and structural work at the facility.

The 650,000-gallon tank is located adjacent to ski trails toward the westerly side of the service area. The flat tank cover, noted as structurally defective in past inspections, is covered with a synthetic membrane and cannot be inspected from the exterior. Steel members around the access hatch opening show serious corrosion. Tank water level is transmitted to the pumping station by way of a battery-powered radio signal pack with solar recharge. Pump operating range is currently from 10 to 12 feet in tank depth, with a total tank depth of 13 feet. Batteries are reportedly changed out weekly to maintain tank/pumping station communications until line power installation can be completed.

The distribution system is primarily ductile iron supplies an estimated 1500 to 1800 gpm can reportedly be supplied throughout the service area. However, maximum pressure is about 185 psi, significantly higher than the 100 psi allowed in state design standards. There are reportedly a total of six testable double check valves associated with fire loops in the system. Frequency of testing of these valves is questionable.

STAFFING AND CERTIFIED OPERATOR VERIFICATION

This water system is required to retain a primary certified operator certified at treatment grade 1 and distribution grade 2. The following are certified operators according to our files:

Operator	Cerificate No.	Treatment Level	Distribution Level
Nancy Oleson	2767	2	2
Brian Sullivan	3059	2	2

ISSUES AND RECOMMENDATIONS

Acknowledgments

The following are among the positive features which were noted during this survey:

1. System staff interviewed as part of this survey are knowledgeable about the water system and approach their jobs in a professional manner.
2. The water system analyzes 2 samples each month for coliform bacteria. There have been no recorded violations of bacterial water quality standards since 1998.
3. Water quality monitoring records show that the Rosebrook water system is in compliance with all current primary water quality standards. The system was not in compliance with action levels for lead and copper in 2006, but chemical treatment and modified sample collection has brought the system into compliance.

Significant Deficiencies

There were deficiencies noted during this inspection which are termed 'significant' deficiencies as they have the potential to affect system safety and reliability. Although certain of these deficiencies are relatively simple, others may be more complex and subject to engineering evaluation. The significant deficiencies must be corrected within 30 days. Alternately, for deficiencies which cannot be corrected within that time period, a 'corrective action plan' (CAP), identifying the action proposed to be taken, shall be forwarded to this office within 30 days. If any of the significant deficiencies cannot be corrected within 120 days, the CAP submitted by the system owner shall identify interim measures that will be taken in order to protect the health and safety of persons served by the system pending final action. Note that the owner shall not make any modifications to the approved CAP without first obtaining approval for the modifications from DES. Also note you are required to notify this office within 30 days of completing actions to address the deficiencies.

The following significant deficiencies were noted:

1. The storage tank roof slab is seriously deflected, indicating possible structural failure. Collapse of the cover would have serious consequences in system operation. A structural evaluation has reportedly been performed in the past. We recommend a structural evaluation and follow-up action as soon as possible.
2. The area around the pumping station needs to be cleared of discarded items and debris which appear to have been left from past station reconstruction.
3. The pumping station, which saw major damage during the pipe breakage of April 2010, needs to be repaired before cold weather, including insulation, electrical work and instrumentation.
4. As the system has increased in size over time, a formal, enforceable cross-connection control program, involving installation and testing of backflow devices, needs to be adopted. Because of the governance and type of service provided by this system, the appropriate form of this program needs to be discussed with you further. Inclusion of construction standards and operator authority into a more comprehensive ordinance will be required as noted below.

Minor Deficiencies

Rosebrook Water Company
October 22, 2010
Page 4 of 4

Though less urgent than the deficiencies noted above, the following lesser deficiencies should be addressed in the course of system operation:

1. Pressure in the distribution system, as a result of storage tank elevation, is much higher than necessary for adequate water service and fire flow. This pressure presents serious questions about power consumption and about safety of the operator when making pipe repairs. We urge the system owner to consider alternate ways of using the existing tank and adopting a lower pressure gradient as part of the major expansion which is currently envisioned.
2. Pump cycles are difficult to control given the unreliable communication between the storage tank and the pumping station. Line power to the tank site replacing the existing battery-powered system will be more reliable. We urge the owner to consider a SCADA system as part of planned improvements to further improve system reliability, operator efficiency and emergency response.
3. Although an emergency generator is available from the ski area, there is currently no permanent backup power at the well site. An extended power outage would cause serious disruption, especially at times of peak water use. As it now appears that the existing wells will remain in service for the foreseeable future, we urge the owner to make this improvement at the pumping station.
4. We urge the owner and primary operator to review the respective requirements appearing in state administrative rules regarding the duties of each. The operator is responsible for oversight or supervision over all maintenance and repair of the system, including main repairs, pressure testing, and disinfection. Ordinances and bylaws, appropriate to the business structure of the Rosebrook Water Company, must reflect these responsibilities. A copy of Administrative Rules Env-Dw 502.21 and 502.22 is enclosed.

I can be reached at 271-2953 or rmann@des.state.nh.us if there are any questions regarding this letter.

Sincerely,

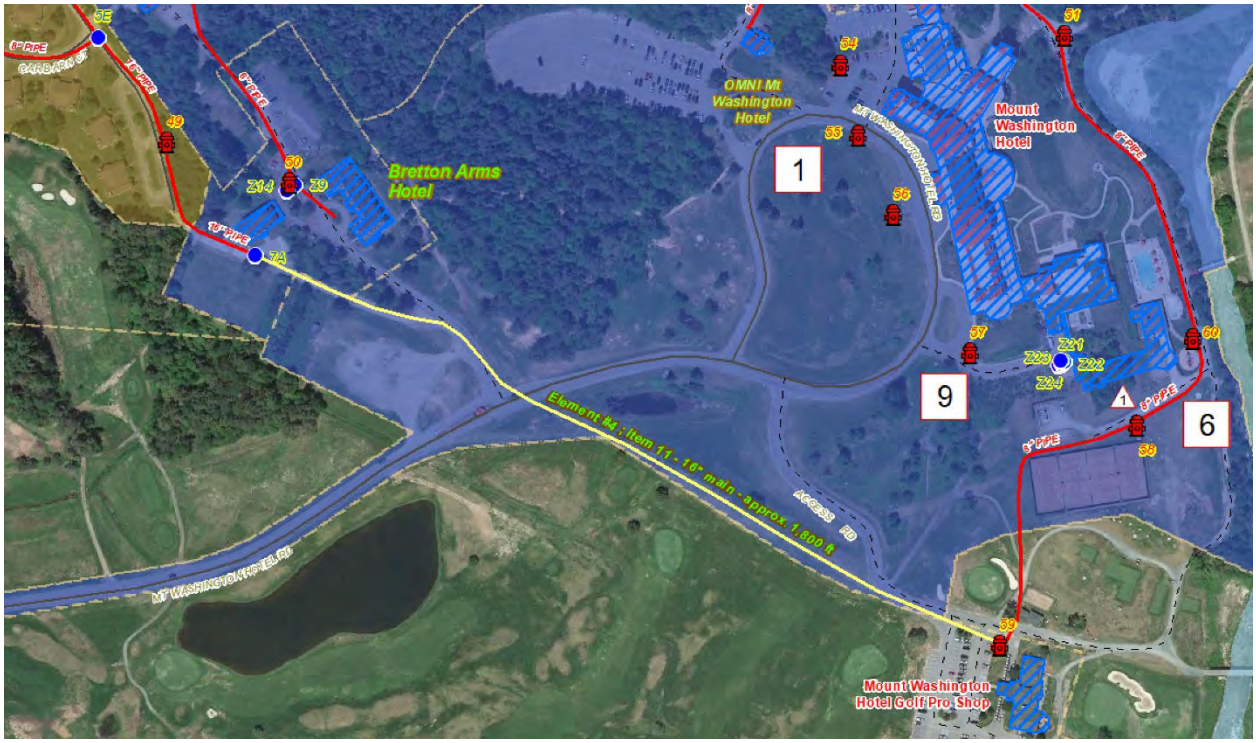
Robert Mann

Robert Mann, P.E.
Drinking Water and Groundwater Bureau

cc. Nancy Oleson, Certified Operator

Appendix H

Potential 1800 foot main 16” diameter water main extension from Fairway Village end of main to 8” diameter main on south side of OMNI hotel. This is based on Safety Staff’s Attachment 1 Drawing with possible main extension shown in light yellow.



List of Attachments Files

Attachment 1 MAP 1 of Rosebrook Water System As Built including Neighborhood Areas generated by PUC Safety Division on file at the Department of Energy, Division of Enforcement.

Attachment 2 MAP 2 of Rosebrook Water System As Built Contour Elevations generated by PUC Safety Division on file at the Department of Energy, Division of Enforcement.

Attachment 3A 1999 Provan and Lorber As Built Drawings Sheets 1-4 on file at the Department of Energy, Division of Enforcement.

Attachment 3B 1999 Provan and Lorber As Built Drawings Sheets 5-9 on file at the Department of Energy, Division of Enforcement.

Attachment 4 Rosebrook Water System Water System Record Drawings Date 2019 on file at the Department of Energy, Division of Enforcement.

Attachment 5 Rosebrook Water Company Existing Water System Assets 2013 on file at the Department of Energy, Division of Enforcement.

Docket #: 21-024 **SERVICE LIST - DOCKET RELATED - Email Addresses** Printed : 8/31/2021

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