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CHAIRMAN
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Michael S. Giaimo

EXECUTIVE DIRECTOR
Debra A. Howland

PUBLIC UTILITIES COMMISSION
21 S. Fruit Street, Suite 10
Concord, N.H. 03301-2429

TDD Access: Relay NH
1-800-735-2964

Tel. (603) 271-2431

FAX (603) 271-3878

Website:
www.puc.nh.gov

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July 15, 2019

Debra A. Howland
Executive Director
New Hampshire Public Utilities Commission
22 South Fruit Street, Suite 10
Concord, New Hampshire 03301-2429

Re: DW 17-165 – Abenaki Water Company, Inc. / Rosebrook Water System – Step II Staff Recommendation

Dear Ms. Howland:

The purpose of this letter is to recommend the Commission authorize Abenaki Water Company, Inc. (Abenaki) to proceed with contracting Horizons Engineering, Inc. (Horizons) to create engineering designs for the resolution of a significant water pressure condition at its Rosebrook Water System (Rosebrook). Staff also recommends that the Commission require Abenaki to submit periodic reports regarding its efforts to obtain low cost financing for this project through programs administered by the New Hampshire Department of Environmental Services (NHDES). Staff further recommends that the Commission approve an alternative date of March 31, 2020 for Abenaki to submit its filing for a second step adjustment in this case.

Background

On December 27, 2018, the Commission issued Order No. 26,205 in DW 17-165 approving a Settlement Agreement (Agreement) resulting in a permanent rate increase and two step adjustments for Rosebrook. The second step adjustment (Step II) specifically relates to recovery of the cost of engineering designs by Horizons to resolve a significant water pressure issue present in the Rosebrook system. The Agreement further indicates that the recoverable cost of these designs should not exceed $100,000 and that the step adjustment request must be filed by September 30, 2019.

The Commission's order states that the Step II adjustment is contingent on Commission approval of the engineering designs, the scope of which would be litigated in the present proceeding. Therefore, the Commission required Abenaki to file a report,

within ten days of the issuance of Order No. 26,205, addressing certain issues concerning the Rosebrook system's water pressure situation. The specific issues to be addressed in Abenaki's report were; (1) the solutions considered by Abenaki before contracting with Horizons; (2) the other possible options available to address the water pressure issue; and (3) the reasons supporting the construction of a new water tank, as proposed by Horizons, as the best and most cost effective solution. The Commission Staff (Staff) and the other parties in the proceeding were further directed to develop a procedural schedule to conduct discovery and discussions pertaining to the scope of the engineering designs; the result of this review would form the basis for the Commission's consideration of the engineering design and subsequent Step II.

On January 8, 2019, Abenaki filed its report with the Commission. On January 9, a Secretarial Letter was issued scheduling a technical session on January 23, 2019. At the January 23 technical session, six entities participated: Abenaki; Omni Mount Washington, LLC (Omni); the Bretton Woods Property Owners Association (Bretton Woods POA); NHDES; the Office of the Consumer Advocate (OCA); and Staff. A procedural schedule for the remainder of the proceeding was agreed to by the participants and filed with the Commission by Staff on January 24. On January 30, a Secretarial Letter was issued approving the proposed procedural schedule.

The course of the proceeding included two rounds of discovery propounded by the parties on Abenaki and one further technical session held on March 20, 2019. Copies of Abenaki's discovery responses are attached to this correspondence. At the conclusion of the March 20 technical session, which also included representatives from Horizons, it was determined that Abenaki and Omni should conduct further discussions to resolve their differences regarding the scope of the engineering services provided by Horizons.

On May 10, 2019, Abenaki sent a letter to Staff and the other parties informing them that discussions with Omni were unsuccessful in reaching agreement regarding the scope of the engineering services to be provided by Horizons. A copy of Abenaki's letter is attached to this correspondence. Abenaki further encouraged Staff and the other parties to submit a recommendation to the Commission to authorize Abenaki to move forward with design completion and initial construction of the proposed project.

Subsequent to receipt of Abenaki's letter, Staff met with NHDES on May 23, 2019. Staff also reached out to Omni to better understand its position regarding Abenaki's engineering proposal. Omni's response to Staff in this regard includes an e-mail dated May 31, 2019 which is attached to this correspondence.

On June 7, 2019, the NHDES issued a letter to Abenaki containing the results of a recent Sanitary Survey of the Rosebrook system. In that letter, NHDES categorized the extreme pressure situation at Rosebrook as a "significant deficiency" requiring either immediate correction or the submission of a "corrective action plan" within 30 days. On June 14, Abenaki filed with the Commission copies of NHDES's Sanitary Survey report along with its response.

Positions of Abenaki, NHDES, and Omni

Abenaki

In its report to the Commission filed on January 8, 2019, Abenaki first provided a brief summary of the high pressure situation at the Rosebrook system and its resulting consequences. Abenaki stated that due to elevation differentials throughout the Rosebrook service area, system pressures vary between 35 pounds per square inch (psi) at higher elevations and 200 psi at lower elevations. Abenaki explained that the extreme pressures present in the Rosebrook system have previously resulted in significant damage to system assets as well as customer property, and has resulted in the temporary closure of commercial establishments, including the Mount Washington Hotel. In addition, Abenaki stated that the high system pressure constantly results in water loss, wear and tear on system equipment causing premature failure, and poses a constant hazard in the day-to-day operation of the water system. Abenaki is committed to reducing Rosebrook's maximum system pressure to approximately 100 psi.

In addressing the specific issues required by the Commission in Order No. 26,205, Abenaki provided the following responses:

1) With regard to other solutions the Company considered before contracting with Horizons, Abenaki described two possible options that it had previously considered. These solutions were eventually discounted, however, because they would not result in a comprehensive reduction in water pressures to acceptable levels throughout the Rosebrook system.

2) With regard to other possible solutions considered by Abenaki to address the water pressure issue, Abenaki stated that they have utilized a hydraulic model developed by Horizons to evaluate other pressure reduction alternatives. These included the installation of multiple pressure reduction valves and the looping of water mains.

3) With regard to the reasons supporting the construction of a new water tank as the best and most cost effective solution, Abenaki stated that while a new storage tank could help in addressing Rosebrook's pressure issues, it was necessary for non-pressure related reasons, as well. Abenaki further explained that the location of its existing tank actually contributes to the extremely high pressure present in the Rosebrook system. Abenaki also stated that the present tank is difficult to access, especially in winter, as it is located in the middle of intersecting ski trails. Abenaki concluded that a new tank, therefore, would be more accessible, accommodate future service expansion, and reduce water system pressures to acceptable levels.

Finally, Abenaki's report provided a narrative explaining the process by which the conceptual solution proposed by Horizons to resolve the Rosebrook pressure situation

was derived. Abenaki explained that Horizons has worked with the Rosebrook system since 1987. In 2016, Abenaki contracted with Horizons to develop conceptual improvements addressing Rosebrook's pressure situation for the Company's consideration. In July 2016, Horizons produced a report recommending consideration of a three-pump station approach relative to Rosebrook's pressure issues. In 2017, Horizons was contracted to further refine the three-pump station approach through the development of a hydraulic model. The resulting report issued by Horizons in March 2017 included further recommendations for system improvements to address the pressure issue. Subsequently, Abenaki determined that design, permitting, and other coordination requirements associated with Horizons' recommendations would be best handled by Horizons' engineers. In September 2018, Horizons further refined its previous recommendations through a four-phase approach to reduce the system pressures present in the Rosebrook system. Horizons also presented Abenaki with a proposal for the services it would provide as part of the overall project for an estimated cost of approximately $100,000.

In its May 10, 2019 letter sent to Staff and the other parties in the proceeding, Abenaki provided the following additional information:

- Discussions between Abenaki and Omni were unsuccessful in reaching agreement regarding the scope of the engineering services to be provided by Horizons.
- In order to effectively pace the financings necessary to complete the overall project and mitigate rate shock to customers, Abenaki proposes to pursue resolution of Rosebrook's pressure issues in the following phases:
    1. Complete engineering design of the planned system improvements (2019).
    2. Construct a new transmission main and one booster pump station (2019 – 2020).
    3. Construct two additional pump stations and install pressure reduction valves (2021 – 2022).
- Abenaki agreed to eliminate construction of a storage tank (formerly Phase 4) from the current engineering services contract with Horizons as it is not essential to the pressure reduction project.
- NHDES has reviewed and is supportive of Abenaki's phased approach to resolve the pressure situation at Rosebrook.
- Abenaki, with the assistance of Omni, intends to apply for grant funding from the Drinking Water and Groundwater Trust Fund (DWGTF) administered by NHDES.

In its June 14, 2019 response to the Sanitary Survey report issued by NHDES, Abenaki stated that its proposed corrective action plan relative to the extreme pressure finding is outlined in the instant docket before the Commission. Abenaki further stated, however, that it must receive Commission approval before proceeding with its proposed course of action.

NHDES

During Staff's meeting with representatives from NHDES on May 23, 2019, it was confirmed that NHDES fully supports resolution of the extreme pressure situation at the Rosebrook system as well as the phased approach proposed by Abenaki. NHDES further informed Staff that it soon would be concluding a Sanitary Survey of the Rosebrook system and that the extreme pressure present within that system was a serious concern that would be addressed in its report. A normal pressure range recommended by NHDES is between 60 and 80 psi, with a minimum and maximum of 35 and 100 psi, respectively. The extreme pressures present within the Rosebrook system creates concern relative to safety, increased water loss trough water main breaks or leaks, increased operating costs, and the necessity for installing pressure reducing valves in customer's homes and businesses. NHDES also provided Staff with further information regarding the application process for both State Revolving Fund (SRF) loans and DWGTF grants and loans. NHDES advises, however, that Abenaki should apply for SRF funding initially rather than DWGTF funds.

In its June 7, 2019 Sanitary Survey report, NHDES categorized the extreme high pressure present within the Rosebrook system as a "significant deficiency." The report more fully described NHDES's findings and the required actions by Abenaki as follows:

> "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 . . . 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 [Rosebrook] 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."

Omni

In its e-mail response to Staff dated May 31, 2019, Omni indicated that its engineering consultant agrees that a phased approach to addressing water pressure and other operation and maintenance issues makes sense. Omni, however, also indicated its belief that because Abenaki's proposals are so high level and that because the proposed phases have been subject to modification, it is not able to address the reasonableness of the phases or possible alternatives due to a lack of engineering detail and cost information. Omni further suggested a procedural solution to this proceeding whereby it would be open to discussions with Staff and the other parties to request that the Commission clarify or amend its previous order to ensure that the funds contemplated under Step II are spent prudently and result in the best engineering solution.

Staff Analysis and Recommendation

The extreme pressures found at the Rosebrook system, which oftentimes exceed 200 psi, are not only in violation of NHDES rules as stated in the June 7, 2019 Sanitary Survey report, they are also in violation of NHPUC rules. NH Code Admin. Rules Puc 604.03 (a) requires a water utility to maintain normal operating pressures of not less than 20 psi or more than 125 psi. Additionally, Puc 604.03 (c) further requires that utilities, such as Rosebrook, make every reasonable effort to deliver normal system operation pressures within the 30 to 100 psi range.

As detailed in Abenaki's recent filings with the Commission, the extreme pressures at Rosebrook result in constant wear and tear on system equipment and have resulted in significant water loss. Further, the extreme pressure has resulted in a number of incidents where substantial damage has resulted to both Company and customer property. Abenaki's May 10, 2019, letter related an incident that occurred as recently as this past Easter where a significant break occurred in an 8" service line. Coupled with a concern for future property damage, the extreme pressure situation at Rosebrook also results in safety concerns, making even routine system maintenance and repairs extremely hazardous. Abenaki's January 8, 2019 report to the Commission detailed a circumstance where a system operator refused to make repairs on a 16" pipe due to safety concerns associated with the extreme system pressure.

As stated previously, Abenaki is committed to reducing the maximum system pressure at the Rosebrook system to 100 psi. In order to effect such a reduction, Abenaki has been working with Horizons, which has provided engineering consulting services to the Rosebrook system as far back as 1987. Horizons performed several studies of the Rosebrook system, a number of which were included in Abenaki's report to the Commission as well as in follow-up discovery. Horizons' recent review of Rosebrook's pressure situation included the creation of a hydraulic model and report dated March 2017 leading to the development of a conceptual four-phase approach to resolve that system's pressure issues.

During the initial technical session that occurred on January 23, 2019, Abenaki provided a preliminary Gantt Chart containing the estimated timeline and cost for each of the four originally contemplated phases. See attached. The chart indicates an overall timeline for completion of the four phases from 2019 through 2024 at a combined cost of $2.6 million dollars. In its response to the OCA Data Request 1-1, however, Abenaki emphasized that these costs are very preliminary and will be subject to revision pending Horizons' more detailed designs as well as when the individual projects are actually placed out to bid. Further, Staff notes that the storage tank that is no longer under consideration was included in the overall estimate at a cost of $500,000.

With regard to the initial design phase that is the subject of Step II, the Horizons Agreement for Engineering Services (Settlement Agreement, Attachment D) indicates that within 65 days, a Basis of Design Report will be submitted to NHDES for its review.

Subsequently, Horizons will prepare final designs for the overall project, apply for necessary permits, prepare contract documents, and coordinate the bidding of those contracts. This will be done within an approximate five-month timeframe. The estimated cost of these services is approximately $100,000. Staff also notes, however, that at least $31,000 of this cost pertains to the storage tank that is no longer under consideration.

Based upon its review and analysis in this proceeding, Staff recommends that the Commission authorize Abenaki to proceed to contract with Horizons to create the necessary engineering designs to resolve the significant water pressure condition at Rosebrook. Staff bases its recommendation primarily on the recent Sanitary Survey report issued by NHDES that categorizes the Rosebrook water pressure situation as a "significant deficiency" which requires Abenaki to take immediate measures for the resolution of the matter. Staff also notes that per Abenaki's letter dated May 10, 2019, the new water tank that the Company was considering building as part of the overall pressure reduction project is no longer a part of the immediate plans for the Rosebrook system, the construction of which was of great concern for the Commission and all parties involved. Staff finally notes that NHDES has indicated its support of the phased approach proposed by Abenaki to resolve the pressure issues at Rosebrook.

Staff notes that Order No. 26,205, at 10, states the following:

> "that Step II should be contingent on the Commission's approval of the engineering design … [and that the Commission] will wait for the results of the discovery and discussions between Staff and the parties involving the scope of the engineering design to address the water pressure problem, including discussions regarding the investigation into alternative solutions and a demonstration that the proposed solution is the most cost effective means to address this problem."

Staff recognizes, however, that Abenaki is in a difficult position as only the conclusion of the engineering study can provide definitive proof of the solution as being the most cost effective means to address the problem. Staff furthermore argues that Abenaki's burden of proof regarding approval of Step II, pursuant to RSA 378:8, can only be met after the engineering study is complete. Staff, thus, contends that the results of the discussions with Abenaki regarding alternative solutions at this time, and the immediate need to address the water pressure problem, as recognized by NHDES and the Commission, are evidence that the "scope of the engineering design" has been sufficiently formulated, thus requiring Abenaki to proceed with contracting Horizons for the engineering study. Staff considers that especially true in light of Abenaki's current withdrawal of consideration to build an expensive water storage tank.

Staff is encouraged by Abenaki's willingness to apply for low cost financing from NHDES for the construction of the required infrastructure. Staff recommends that the Commission require Abenaki to periodically submit reports of its efforts in this regard for

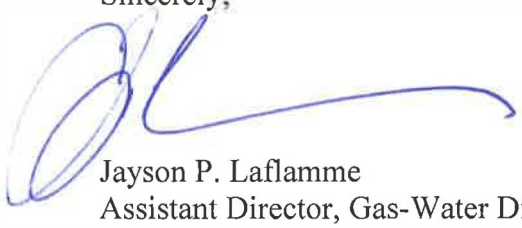
review by the Staff and the other parties in this proceeding. Further, Staff reiterates NHDES's recommendation that the Company first apply for SRF financing before applying for DWGTF financing.

Finally, Staff notes that the Settlement Agreement approved in Order No. 26,205 called for the Company to submit its filing for step recovery of the design costs by no later than September 30, 2019. Given that the estimated length of time indicated in the Horizons agreement for these activities was approximately seven months, it would appear that the original filing date is no longer a viable option. Therefore, Staff recommends that the Commission approve an alternative date for Abenaki to submit its Step II filing of March 31, 2020.

Before submitting this letter to the Commission, Staff contacted the other parties in this case in order to ascertain their respective positions to Staff's recommendations. In response, NHDES stated its assent to Staff's recommendations. The Bretton Woods POA and Forest Cottages Association indicated that they do not assent to Staff's recommendations and that they will provide a further written response within two weeks. The OCA indicated that it will file a prompt response to Staff's recommendations. Omni indicated that it takes a position similar to Bretton Woods POA and Forest Cottages as well as the OCA. Omni further stated that it has some concerns regarding Staff's recommendations that will be provided in a subsequent written response. Abenaki indicated that it generally agrees with Staff's recommendations but had concerns regarding Staff's recommendations regarding the periodic reporting requirement relative to NHDES administered financings and the Phase II filing date extension. Staff urged Abenaki to file a written response with the Commission regarding its concerns. In light of the forthcoming written responses from the parties, Staff urges the Commission to keep the record open for a two-week period following the filing of its letter.

Thank you for your assistance and attention to this matter. If you have any further questions, please do not hesitate to contact me.

Sincerely,



Jayson P. Laflamme
Assistant Director, Gas-Water Division

Attachments: A) Abenaki's Discovery Responses
B) Abenaki's May 10, 2019 Update Letter to the Parties
C) Omni's May 31, 2019 E-mail Response to Staff
D) Abenaki's Pressure Reduction Project Gantt Chart

cc: Service List

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Staff 1-1 Witness: T. Hansen/D. Vaughan

REQUEST:

The Mt Washington Hotel, Nordic center, ski lodge and other buildings are protected by sprinkler systems that rely on the Abenaki-Rosebrook system for supply. Since the fire suppression systems were originally designed based on existing system pressures, please provide the flow testing and hydraulic modeling results conducted to confirm the effect of reduced system pressures and whether adequate sprinkler flows, can be maintained.

RESPONSE:

The hydraulic modeling results and report dated March 20, 2017 were submitted pursuant to Order No. 26,205 in Docket DW 17-165 on January 8, 2019, Attachment 2. http://www.puc.state.nh.us/Regulatory/Docketbk/2017/17-165.html No flow testing was performed. The model was analyzed for a 1,000 gpm fire flow at the Mount Washington Hotel. Under this condition, the residual pressure at the Hotel was determined to be 34 psi. Typically, fire flow is more fully described as a specific flow at a residual pressure of 20 psi. Therefore, the above Hotel fire flow at 20 psi would be considerably higher.

As can be seen in the Horizons report, no fire flow design criteria could be found for the Hotel. They did find that the Spa/Conference Center had a maximum requirement of 880 gpm at 124 psi. The required fire flow for the Hotel will need to be determined by others.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Staff 1-2 Witness: T. Hansen/D. Vaughan

REQUEST:

There have been several severe leaks resulting from high distribution 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 time period. Many services are equipped with privately owned PRVs, which require maintenance or replacement. Please provide an inventory of existing equipment that requires replacement and the expected equipment maintenance schedule prepared consistent with N.H. Code Admin. Rule Env-DW 504.03 requirements.

Please provide copies of the most recent franchise maps. Please include a description of the metes and bounds.

RESPONSE:

The Company does not take inventory of privately-owned pressure reducing valves (PRVs) although they are required on each service in accordance with the related Terms and Conditions of service. Ideally, the proposed system modifications being considered will preclude the need for these PRVs.

Each of the six plant categories (Per ENV – DW 504.03) are maintained on a consistent basis by Rosebrook operators.

Although there is some indication of recommended improvements coming from the hydraulic model report, more specific replacements/up-sizing/looping will be derived from the final engineering plans and specifications. Furthermore, there are certain known valves indicated on the distribution maps that cannot be found, or have been determined to be inoperable. Additionally, the Company recognizes the absence of strategic valves necessary to provide greater control over the system and to minimize service disruption at the event of main repairs. Such system improvements will be further evaluated in the design phase and included in the Basis of Design Report.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Staff 1-3 Witness: T. Hansen/D. Vaughan

REQUEST:

Abenaki-Rosebrook indicated there are a number of valves in the system that either do not function at all, or are only partially operable due to high system pressures. Please provide an Asset Management Plan or similar tool indicating the evaluated priority of system upgrades. The evaluated priority should include a conditional assessment, expected remaining life, and criticality of the assets.

RESPONSE:

An Asset Management Plan is currently being developed by the Company. Valves that are found to be inoperable have been identified for replacement. It is the Company's intent to include new valves and/or replace valves under the various construction contracts associated with this project. System improvements, including a schedule for the installation and replacement of valves, will be included in the Basis of Design Report.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Staff 1-4 Witness: T. Hansen/D. Vaughan

REQUEST:

Abenaki-Rosebrook indicated the atmospheric storage consists of a single partially buried cast in place concrete tank with a metal truss roof, constructed in the early 1970s. Please provide observations from the most recent tank inspection conducted to comply with N.H. Code Admin. Rule Env-Dw 504.09 requirements.

RESPONSE:

The truss roof on the storage tank was replaced in 2015, and we presume that a full inspection was performed then. The Company will do a new inspection in 2020.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Staff 1-5 Witness: T. Hansen/D. Vaughan

REQUEST:

Has the information on existing pump capacity been evaluated alongside the estimated water leak rate and future capacity? Please provide this evaluation as part of the design submittal along with the design for the new well pumps and booster pumps. Additionally, are the existing well pump motors VFD rated and does Abenaki-Rosebrook anticipate using VFD's to reduce system pressure during the transition period between phase 1 and phase 4?

RESPONSE: Yes. See the following excerpt from page 2 of the hydraulic modeling report:

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.

The Basis of Design Report will summarize existing and future flow data for review.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Staff 1-6 Witness: T. Hansen/D. Vaughan

REQUEST:

Please provide potential locations for a new tank and indicate whether the existing tank can continue to be used for the foreseeable future. Please also provide a preliminary evaluation regarding the possible construction of a new tank including the potential purchase of property and/or necessary easements.

RESPONSE:

The Company has not identified the potential locations for a new or supplemental tank. A separate step in the design contract with Horizons is to identify and evaluate alternative locations for a new tank. However, part of the consideration for this aspect of the design, as detailed in the hydraulic model report (attached), has to do with the complicated controls required by the pump systems operating in series up to the existing storage tank as well as the degree of operator difficulty in managing such a system. Another consideration centers on the relative inaccessibility of the tank under winter conditions and the recreational and aesthetic impact of roadway access across ski trails. In an attempt to eliminate this problem, further consideration is to possibly locate a new tank on the northerly side of Route 302.

In any event, the Company is proceeding with the project under the assumption that the existing tank may be used in some fashion.

Finally, the issue of a new tank has arisen because the existing tank is not favorably located for future and planned growth.

If a new tank is located under this project, the location and potential purchase of property/easements will be addressed in the Basis of Design Report.

PRESSURE SURGE ASSESSMENT
ROSEBROOK WATER SYSTEM
Bretton Woods, New Hampshire

March 11, 2010
Horizons Engineering, LLC Project No. 09125

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APPENDICES

1.0 PURPOSE AND SCOPE

For over 10 years there have been noticeable pressure fluctuations within the system at the Mount Washington Hotel and Bretton Arms Hotel causing false alarms in the air-filled sprinkler system during periods of occupancy. There are suspicions that the new larger submersible pump installed in 2006 has the capacity to over pump the well and allow air into the pump intake. The air is then introduced into the distribution piping. Historically there have always been pressure surges (even before the Mount Washington Hotel was reopened in 2000) but the surges have increased in frequency over the years. A pressure relief valve was installed at the Mount Washington Hotel to help remedy the fire alarm activations and there have been no false alarms there since. In addition to the pressure surge issues, the system has experienced chronic unaccounted for water loss and has several non-functioning valves and corroded piping located within the pump station building.

The purpose of this assessment is to attempt to identify potential causes for the pressure surges experienced at the Mount Washington Hotel and Bretton Arms, and proposes both short- and long-term solutions for the problem. The report will also discuss documented water loss, contaminant risk to the Rosebrook Well Field, and other system deficiencies identified by either the water system operator or past work Horizons staff completed for the water system. In addition, this assessment will provide engineering opinions of cost for implementing the proposed improvements intended to address the pressure surges and other system deficiencies.

2.0 BACKGROUND INFORMATION

The Rosebrook Water system provides domestic water and fire protection for approximately 14 commercial and 403 residential service connections in the Village of Bretton Woods located in Carroll, New Hampshire. Water for the system is provided by two overburden water wells. These include Well #1, 43 foot deep 12" x 24" gravel packed well with an estimated yield of 322 gallons per minute and Well #2, a 12" x 24" gravel packed well with an estimated yield of 425 gallons per minute. Well #1 is located inside the Rosebrook pump house building and is equipped with a vertical turbine well pump. Well #2 is located approximately 100 feet north of the pump house and is equipped with a submersible well pump. The pump in Well #1 features a variable frequency drive and the Well #2 pump features a soft-start system. The pump house building houses equipment for injection of soda ash and sodium hypochlorite, water meters, and other equipment. The water system is equipped with a 600,000 gallon atmospheric storage tank located within the Bretton Woods ski area.

3.0 PRESSURE SURGE ASSESSMENT

3.1 Data Collection & Review

To better understand what causes pressure surges within the Rosebrook system, data sets were collected to determine possible causes. In 2008 pressure chart recorders were installed at the Mount Washington Hotel (MWH), Bretton Arms Hotel (BAH), Rosebrook Pump House, and Bretton Woods Ski Base Lodge. From 2008 to 2009 the pressures were recorded over time to see how the system behaved during a pressure surges large enough to cause fire alarm activation at the Bretton Arms. Occupancy records were obtained from the MWH and BAH for comparison of room occupancy and fire alarm activation using Daily Security Report records from January 2008 to April 2009. The submersible pump (Pump 2) activity was monitored, recorded, and compared to the fire alarm records to determine if there was any obvious correlation with the pump on and the fire alarm activation. Fire alarm activation, chart recorder, occupancy and Pump 2 activation records are summarized in **Appendix A**.

On June 24, 2009 a site visit to the MWH, the BAH, and the pump house was completed to observe normal operations and discuss possible sources of the pressure surges with operators and maintenance crews.

Pump House Site Visit
The pump house contains one well which had an observed output of 343 gallons per minute at 185 psi during the site visit in June, 24 2009. In 2006 the submersible pump (Pump 2) was installed and the pressure surges reportedly increased to as many as 3 per day capable of triggering false alarms. Around that time the groundwater well was reportedly overdrawn which caused possible air intrusion into the distribution system.

The Mount Washington Hotel
The Mount Washington Hotel recently installed a pressure relief valve. The maintenance crew has verified that the valve releases frequently and has reduced the pressure surges such that no sprinkler false alarms at the MWH have occurred since installation. The maintenance crew also indicated that surges occurred during a period of no occupancy prior to the hotel opening in 2000 and that the MWH could not be the source of the surges.

The Bretton Arms Hotel
The Bretton Arms Hotel air-filled fire suppression system requires a minimum of 40 pounds per square inch (psi) pressure that is maintained by an air compressor. The observed water pressure was 175 psi and the observed maximum pressure needle was

approximately 220 psi. This indicates at least one pressure spike 45 psi above observed static conditions.

On July 8, 2009 a site visit to the boiler house and laundry at MWH was completed to determine if the boiler or washing machines could draw enough water to cause a pressure surge when shutting off. Both have the potential of using a large amount of water during periods when there is occupancy at the hotel, and based on the long lengths and small diameter of pipe (2" copper), could contribute to the pressure surges.

3.2 Water Hammer Analysis

In order to better understand what caused the pressure surges (e.g. 45 psi change at the Bretton Arms), an investigation into how the volume of water needed to generate a pressure spike, or water hammer, of similar magnitude was calculated.

The amount of water hammer is directly related to the pressure wave velocity within the main from a closing valve (or stoppage in flow) and the atmospheric storage tank. The pressure wave velocity is calculated based on pipe type, geometry, and the mass of water within the pipe. Since there are numerous pipe sizes and loops within the distribution system, only the 16-inch and 8-inch mains from the MWH to the storage tank and the BAH to the tank were analyzed. The flow required to generate water hammer was calculated using the pressure wave velocity with and without two presumed air pockets at the Route 302 crossing and the MWH parking lot. Although pockets of air in the system can have a positive influence on water hammer by absorbing some of the velocity wave produced by a closing valve (i.e. design of surge tanks), the negative effect is the decrease in flow area within the main where the air pocket is suspended. The decrease in flow area increases the velocity to meet the demands within the system. Supporting calculations and system layout and profile can be found in **Appendix A**.

The pressure surges from usage at the MWH boiler house and laundry room were also modeled using maximum possible flow in the feed pipes under static conditions and observed flows during site visits.

Users within the high pressure zone have installed pressure reducing valves to reduce the water pressure to a usable pressure at the tap. It is possible to unknowingly create a pressure wave at a connection with high usage and a pressure reducing valve (such as MWH) since there is no noticeable change in pressure at the tap when the pressure wave is sent out to the distribution system (assuming the pressure wave is much faster than the time it takes to activate the valve), and the wave is blocked from the tap by the activated pressure reducing valve upon return from the storage tank.

3.3 Results & Discussion

Pressure Surge Frequency & Trends
The frequency of fire alarm activation using Daily Security Report records from January 2008 to April 2009 for the Bretton Arms was analyzed to observe trends or periods where

pressure surges were more likely. The number of surges large enough to activate the alarm was grouped by day and by time of day and is summarized in the following table:

Number of Surges by Day of Week and Time of Day Summary Table

Day	0:00-6:00	6:00-12:00	12:00-18:00	18:00-24:00	Total (%)
Monday	1	3	2	1	7 (13%)
Tuesday	0	1	3	4	8 (15%)
Wednesday	,0	3	4	2	9 (17%)
Thursday	1	3	0	0	4 (8%)
Friday	0	4	2	4	10 (19%)
Saturday	1	1	2	2	6 (11%)
Sunday	0	3	5	1	9 (17%)
Total (%)	3 (6%)	18 (34%)	18 (54%)	14 (26%)	53 (100%)

The table shows that the largest number of occurrences was on a Friday and the most frequent time of day was between noon and 6pm. The least likely day for an alarm activation was on Thursdays, and the least likely time was between the hours of midnight and 6am.

A second surge grouping was organized by day and by time of year in order to determine the most frequent alarm activation time of year. This grouping showed that the most frequent period was between January and March and the least frequent period was between July and September and is summarized in the following table:

Number of Surges by Day of Week and Time of Year Summary Table

Day	Jan-Mar	Apr-June	Jul-Sep	Oct-Dec	Total (%)
Monday	5	0	0	2	7 (13%)
Tuesday	5	2	1	0	8 (15%)
Wednesday	3	3	3	0	9 (17%)
Thursday	2	2	0	0	4 (8%)
Friday	1	2	0	7	10 (19%)
Saturday	1	3	0	2	6 (11%)
Sunday	4	4	0	1	9 (17%)
Total (%)	21 (40%)	16 (30%)	4 (8%)	12 (22%)	53 (100%)

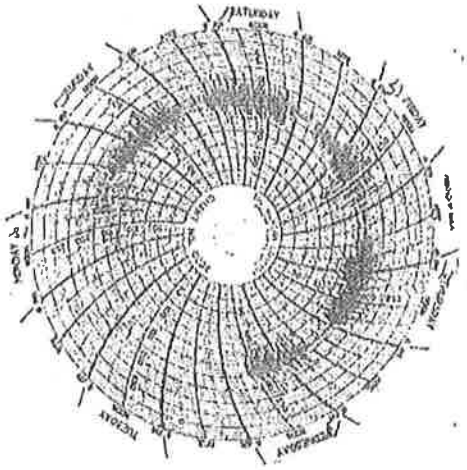
Pressure Surge Uniformity within Distribution System

The information gathered from the chart recorders indicated that the pressure fluctuations are noticeable within the distribution system. The only noticeable difference in fluctuations between each location (MWH, BAH, pump building, base lodge) is the magnitude of the pressure surge. The ability of a distribution system to reduce the pressure surges between two points of interest is dependent on the amount of looping, leaks and possible air within a distribution system. For instance, large spikes recorded at

the hotel may be reduced by the absorbing factors listed and can account for corresponding but low intensity pressure surges at the base lodge. Of the 53 fire activations at BAH, only four were recorded at all locations, and thirteen captured fire alarm activation surges at the BAH and MWH. The two charts below show the difference in magnitude of the pressure surges taken from BAH and MWH.

Data Recorder Charts from 2/13/08 to 2/18/08

Bretton Arms



Mount Washington Hotel

Not all recorded fire alarm activations caused by pressure surges were captured by the data recorders. Missing or mislabeled charts account for 21 of 53 of the fire alarm activations and there were instances where the chart was left on the recorder too long and analysis of pressure spikes wasn't possible.

Occupancy Influence

Occupancy records from the MWH and BAH show limited correlation between occupancy and the occurrence of a pressure surge large enough to activate the fire alarm at the BAH. The percent occupancy and fire alarm activation occurrence is summarized in the following table.

Room Occupancy and Fire Alarm Occurrence Comparison Table

Location	Percent Occupancy	Percent Occurrence
MWH	25%	40%
	50%	50%
	75%	25%
BAH	25%	67%
	50%	25%
	75%	14%

The average room occupancy during all fire alarm activation occurrences was around 10 (29%) for BAH and 95 (48%) for the MWH. There was only one occurrence (2/16/09)

when the both were near full capacity (BAII-33 and MWH-199) and there was fire alarm activation caused by a surge in pressure.

Pump Influence
The pump records showed only 3 of 53 (6%) instances when pump 2 was on during a pressure surge large enough to activate the sprinkler alarm at BAH. This suggests that pump start up or shut down isn't a primary cause of water hammer.

Air Intrusion Influence
Generally, high pressure air pockets within a distribution system can decrease the amount of flow necessary to create a similar pressure surge without air pockets. Upon review of distribution main layout and topographic maps, two possible locations for air pockets were identified. The first noticeable high point within the distribution system is in the 16-inch water main and starts near the intersection of Route 302 and the Cog Railway Base Road. From the intersection the main runs along the road for approximately 600 feet before dipping down. The elevation change along this 600' long run is approximately 7 feet, assuming uniform depth of cover. The second high point is on the 8-inch main feeding the hotel and runs approximately 300 feet under the parking lot before dipping down and serving the hotel. The elevation change along the run is around 10 feet. The effects of the two air pockets were calculated using the pressure wave velocity equation and can be found in **Appendix A**.

Pressure Surge Source of MWH Boiler House and Laundry Room
A high flow of 160 gallons per minute was calculated at the boiler house assuming static conditions and pipe size and lengths observed in the field. A 2-inch line downstream of the pressure reducing valve in the carpenters shop (reducing to around 80 psi) feeds a condensate tank in the boiler house. According to maintenance crews, the amount of flow into the tank is controlled by a 'slow closing' solenoid valve. Assuming the flow to the boiler was stopped instantly by closing of valve too fast (< 7 seconds) the change in pressure could be as shown in the table shown below. The recommended time to completely close the valve without causing a pressure surge is 1 minute 10 seconds (10 times the travel time of 7 seconds).

The high flow used at laundry room to calculate pressure surge potential, was 150 gallons per minute based on an observed flow for one washing machine. Assuming the flow to the laundry room was stopped instantly when the washer shut down, the change in pressure could be as high as presented in the following table.

Calculated Pressure Surges Using Calculated Peak Flows

Location	Flow Rate (gpm)	Pressure Surge without Air Pockets (psi)	Pressure Surge with Air Pockets (psi)
MWH Boiler House	160	41	43

MWH Laundry Room	150	28	29

Both the laundry room and the boiler house usage at the MWH could be high enough to contribute to the observed 45 psi pressure surge at the Bretton Arms, depending how much the demand fluctuates within the distribution system near the hotel.

High Demand Influence
Water usage data from MWH and BAH provided by Rosebrook Water Company was used to approximate the peak flow at the MWH and the BAH. The 2008 and 2009 usage was taken from flow meters at the MWH and BAH and the peak flow rates were calculated using a peaking factor of 4 and the highest quarterly usage. More information on usage can be found in **Appendix A.**

To compare the effect of peak demand at the MWH and the BAH the pressure surges from water hammer were calculated using the peak flow rate and compared. The following table shows the increase in pressure assuming the peak flow generated by the MWH and BAH was reduced fast enough to generate water hammer.

Calculated Pressure Surges Using Peak Demand Flow

Location	Peak Usage (gpm)	Pressure Surge without Air Pockets (psi)	Pressure Surge With Air Pockets (psi)
MWH	597	85	91
BAH	20	3.2	3.3

As the table shows, there is little change in pressure at the BAH, but extremely high at the MWH under the peak usage conditions. This suggests that the MWH demands under peak usage are high enough to generate observed surges shown by the data recorder charts in **Appendix A.** However, the likelihood that all occupants used water and stopped flow at the same time causing a pressure surge isn't promising due to occupants varying schedules and the data does not support a high number of alarm occurrences during periods when the hotel could experience peak usage (morning and evening). This idea suggests that the peak usage at the MWH could contribute, but there are other unaccounted usages with a high flow rates causing alarm activations.

The source of the pressure surge at the hotel prior to opening in 2000 is not known, but in order to generate a surge there needed to be high demand elsewhere in the system. A possible source is a fire hydrant used for fire protection, training or maintenance (flushing or pressure/flow recordings). Unfortunately there are no known accounts of hydrant use at this time.

3.4 Recommendations

Assuming that modifications to the sprinkler systems are not practical, the following actions are recommended to reduce pressure surges at the Bretton Arms Hotel causing false fire alarm activations:

Short Term - Pump Adjustments
Adjust pumping rates or alternate well pumps to reduce likelihood of over pumping of the submersible pump (Pump 2) and ongoing introduction of air into distribution system. This will reduce the amount of air in the system and reduce pipe velocities required to generate water hammer pressure surges.

Short Term - Pressure Relief Valve Installation
Install an adequately sized pressure relief valve outside the Bretton Arms in a vault or inside the Bretton Arms just before the sprinkler connection. A relief valve would relieve high pressures caused by irregular and uncontrollable surges within the system.

Short Term – Additional Hydrant Installation
Install additional hydrants at high points at the Rt 302/ Base Station Road Intersection and in the MWH parking lot to allow evacuation of trapped air. Prior to hydrant installation Horizons recommends non-invasive geophysical profiling of the water line. This profiling would confirm the location to minimize excavation damage to existing roadway and parking and would help to identify optimal hydrant placement.

Short Term - Maintenance & Fire Hydrant Use
An improved maintenance schedule and practice for flushing lines should be established. The occupancy trend indicated pressure surges large enough to activate the fire alarm are more likely to occur when there are less people staying at the hotel and may be during a period when the hotel is experience maintenance. Flushing lines should be performed to reduce the air pockets within the system.

Procedures for opening and closing hydrants should be established to limit the effect of water hammer within the system. Using the longest pressure wave velocity (3.5 seconds from MWH), the time for the compression wave to travel to the tank and the rarefraction wave to return to the source is 7 seconds. By increasing the travel time by a factor of 10, the total time to close the valve off the main should never be less than 1 minute and 10 seconds. This will gradually release the pressure surge at the hydrant while the valve is closing.

All valves connected to the water system with the ability to flow large quantities of water (>50 gallons per minute) should be closed slowly, especially if the service uses a pressure reducing valve. A pressure reducing valve will aggravate pressure surges because of its ability to block the high pressure surge instead of releasing energy at the end of the service during the return of the rarefraction wave. Activities generating such flows that could be rapidly shut off using a common ball valve, including snowmaking, irrigation,

and/or maintenance, should be properly managed to prevent instantaneous reduction in flow.

Long Term – Water Main Extension Option 1: Bretton Arms Main Extension
Connect the 16-inch main at Fairway Village to the 6-inch main at Bretton Arms to loop the system and distribute pressure surges. As in the case with the Mount Washington Hotel, by looping the system, the velocity in the 6-inch main servicing the Bretton Arms Hotel and the likelihood of pressure surges would be reduced.

Long Term – Water Main Extension Option 2: Mount Washington Hotel Main Extension
Extend the 16-inch water main from Fairway Village to Mount Washington Hotel. By looping the system, the velocity in the 8-inch main servicing the Mount Washington Hotel and the likelihood of water hammer at that end of the system would be reduced.

It should be noted that the proposed short and long term improvements assume that the configuration of the sprinkler systems require existing operating pressures and they cannot be modified to operate under lower static system pressure. However, Horizons strongly recommends additional dialog with the sprinkler system designer to confirm that system pressures cannot be lowered while still maintaining proper system function.

Opinions of cost for the proposed short and long-term improvements are included in **Appendix B**.

4.0 WATER LOSS REVIEW

Water use data appear to indicate that the Rosebrook system has an excessive amount of unaccounted water loss. For the 2008 operating year the water system operator reported that the system could not account for approximately 29% of the water pumped from the two system wells. In the first quarter of 2009 (the latest quarter for which Horizons has data) the system could not account for approximately 38% of the water pumped from the wells. New Hampshire Department of Environmental Services (NHDES) administrative rule Env-Wq 2101.05 (j) requires that systems with more than 15% unaccounted for water prepare and submit a response plan to address the loss. Horizons is currently unaware of any formal response program.

In discussions both Mark Fuller, the former water system operator, and Nancy Oleson, the current operator, indicated that several steps had been taking in an attempt to identify leaks. These include sampling several suspect surface water puddles for residual chlorine, and using leak detection equipment with the assistance of Granite State Rural Water.

Due to the high operating pressures the Rosebrook system is particularly susceptible to pressure induced leaks. There is potential opportunity to reduce pressure in some parts of the Rosebrook system through the use of zone pressure reducing valves. The area in the vicinity of the Mount Washington Hotel, Bretton Arms Inn and Fairway Village would be particularly well suited for a lower pressure zone. However, anecdotal

information indicates that sprinkler systems in the hotel complex buildings were designed for the existing operating pressures and would not be properly operational under lower pressures.

In order to address the excessive percentage of unaccounted for water Horizons recommends the following:

- Confirm that the sprinkler systems in the Mount Washington Hotel and surrounding buildings are in fact incompatible with lower system operating pressures.
- If one does not exist, develop a comprehensive response plan to address the water loss. This plan should include a leak detection survey strategy and schedule, and a scope for assessing potential un-metered water use.

5.0 WELL YIELD ASSESSMENT

5.1 Water Source Overview

The Rosebrook Water System currently sources water from two drilled sand and gravel wells located to the east of Route 302 and the west of the Ammonoosuc River. These include Well #1; 43 foot deep 12" x 24" gravel packed well with an estimated yield of 322 gallons per minute and Well #2, an approximately 50 foot deep 12" x 24" gravel packed well with an estimated yield of 425 gallons per minute. Well #1 is located inside the Rosebrook pump house building and is equipped with a vertical turbine well pump. Well #2 is located approximately 100 feet north of the pump house and is equipped with a submersible well pump.

5.2 Well Yield Assessment

In September of 2009 data loggers were installed in the two Rosebrook water supply wells and one nearby monitoring well to facilitate collection of pumping and non-pumping water level data. The data loggers were installed on September 10th, 2009 and removed on October 5th, 2009. During installation it was discovered that neither of the pumping wells were equipped with stilling tubes, and therefore it was not possible to install either data logger to a depth equivalent to that of the pump intake. The data loggers were programmed to collect water level data once per minute. During the period from September 10th through September 22nd Well #1 was operated on average of approximately 7-10 hours per day and Well #2 remained offline. On September 23rd operation of the wells was switched, and Well #2 was operated approximately 7-10 hours per day through the remainder of the monitoring period while Well #1 remained offline.

Data collected during the monitoring period for the three wells are presented in charts located in **Appendix C**. In general, pumping water level data indicated a moderate hydraulic connection between the two wells. Data also showed that water levels fell below both data loggers within one minute of the start of pumping. Because of this, it was not possible to measure maximum drawdown in

each of the wells during active pumping. However, using the available data, projected time/drawdown plots were estimated for both wells. These plots, also included in **Appendix C**, indicate that the present pumping rate of Well #1 is likely appropriate, and water level should remain well above the pump intake during the present pumping cycles. However, data suggest that the pumping rate in Well #2 is near or potentially above the capacity of the well based on the present pumping cycle. The estimated drawdown plot for Well #2 indicates that the pumping water level after a 10 hour pumping cycle may be within 2-3 feet of the pump intake. While data did not suggest pumping level dropped to the pump intake during the present pumping cycle, adequate data were not available to properly assess the actual pumping level. As such, it appears that reducing the pumping rate of Well #2 may be appropriate in order to reduce the probability of lowering the pumping water level to the pump intake, which would result in pump cavitation and the introduction of air into the water main. At the very least, additional water level monitoring in both production wells near the end of the pumping cycles to confirm that adequate water remains present above the pump intakes.

5.3 Potential Contamination Sources

Two potential contamination sources have been identified in the immediate vicinity of the well field. These include a documented petroleum release at the Mount Washington Trading Post, and potential road salt contamination associated with Route 302 and parking lots for the Mount Washington Trading Post, Fabayan's Restaurant, and Drummond's Ski Shop. These are summarized as follows:

- *Mount Washington Trading Post* – Petroleum contamination associated with retail gasoline sales was discovered on the Mount Washington Trading Post property in 1999. Subsequently, several phases of subsurface characterization work have been completed by Irving Oil, the responsible party. Most recently in January of 2010, Ransom Environmental Consultants completed a Contaminant Plume Delineation at the Mount Washington Trading Post. Results of the delineation indicated that groundwater flow and contaminant migration from the site was primarily to the west, and not to the south towards the Rosebrook well field. As such, under present conditions data suggest the cone of depression created by the Rosebrook well field has not captured the contaminant plume originating at the Mount Washington Trading Post. However, if the daily withdrawal rate at the Rosebrook well field were to increase significantly, the potential for the cone of depression intersecting with the contaminant plume would increase significantly. As such it is recommended that increased monitoring of the existing sentry wells be completed if the daily withdrawal from the well field increases significantly over the historic withdrawal.

- *Road Salt* – To date there have been no significant evidence of anthropogenic chloride or sodium contamination detected in the Rosebrook wells. However, road salt contamination from Route 302, Drummond's Ski Shop, and other nearby commercial properties does pose a potential risk to the well field, particularly if the daily withdrawal increases in the future. As such, it is recommended that Rosebrook Water initiate or continue public outreach in the area and encourage reduced road salt usage in the vicinity of the well field.

6.0 MISCELANEOUS IMPROVEMENTS

In addition to improvements associated with addressing the pressure surge issue, several additional needed improvements have been identified. These include:

- Replacement of the corroded elbow inside the Rosebrook Pump House
- Replacement of a failed valve (believed to be 16") adjacent to Route 302 that allows isolation of portions of the water system to the east of Route 302.
- Installation of a backup generator at the Rosebrook Pump House.
- Installation of power to the Rosebrook water tank to reduce lost signal errors with the tank level monitor.
- Installation of automated low water cutoffs in each of the two pumping wells.

Opinions of cost for the proposed improvements are included in **Appendix B.**

APPENDIX A:
PRESSURE SURGE ANALYSIS DOCUMENTATION

Rosebrook Water Company
Route 302
Bretton Woods, NH 03575

Order 24,243 in DW 01-253

Lost Water Explanation

2007 - Water Consumption vs. Water Production

Qtr	Consumption	Production	Difference
1st	9,336,750	21,267,800	11,931,050
2nd	6,264,750	11,425,900	5,161,150
3rd	9,972,250	16,787,000	6,814,750
4th	8,219,100	17,699,000	9,479,900
Total	33,792,850	67,179,700	33,386,850

Jan	5,000,000.00	Lost signal of tank overflow – Snowmaking
Feb	96,000.00	Tank overflow - lost signal
March	1,200.00	Drilling by Horizon Eng,
March	528,000.00	Overflow of storage tank
J.A.S	859,200.00	SIGNAL LOST
SEPT	78,000.00	FIRE FLOW TEST
O,N,D	2,230,000.00	SIGNAL LOST/TANK OVERFLOW
DEC	1,222,000.00	SNOW MAKING
	10,012,400.00	

PRODUCTION

JAN	11,350,000	APRIL	3138000	JULY	3867000	OCT	6603000
FEB	5,087,000	MAY	3959100	AUGUST	5635000	NOV	4458000
MARCH	5,684,000	JUNE	4328800	SEPT	5785000	DEC	6638000
	22,121,000		11425900		16787000		17699000
PATTI	21,268,700						
	852,300						

Rosebrook Water Company
Route 302
Bretton Woods, NH 03575

Order 24,243 in DW 01-253

2006 - Water Consumption vs. Water Production

Qtr	Consumption	Production	Difference
1st	9,250,250	13,473,000	4,222,750
2nd	8,099,950	11,246,000	3,146,050
3rd	9,216,300	14,914,000	5,697,700
4th	9,704,750	15,325,000	5,620,250
Total	36,271,250	54,958,000	18,686,750

Rosebrook Water Company
Route 302
Bretton Woods, NH 03575

Order 24,243 in DW 01-253

2008 - Water Consumption vs. Water Production

Qtr	Consumption	Production	Difference
1st	10,520,700	17,327,000	6,806,300
2nd	6,294,950	10,806,000	4,511,050
3rd	9,036,000	14,254,000	5,218,000
4th			
Total	25,851,650	42,387,000	16,535,350

Month	Lost Water Gallons	Lost Water Explantion
JAN	2,447,000	Signal loss
FEB	863,000	Signal loss
MAR	5,000	Flushing hydrants (air)
APRIL	22,000	Flushing hydrants (air)
MAY	7,000	Flushing hydrants (air)
JUNE	36,000	Flushing hydrants (air)
JULY	76,750	BIANNUAL FLUSHING
AUG	29,250	Hydrant flush
SEPT		all usage billed to Hutter Const.

Accounted Loss	Unaccounted Loss	Percentage
3,486,000.00	13,049,350.00	31%

PRODUCTION

JAN	5,682,000	APRIL	3,125,000	JULY	4,789,000	OCT	
FEB	6,223,000	MAY	3,750,000	AUGUST	5,174,000	NOV	
MARCH	4,442,000	JUNE	3,931,000	SEPT	4,291,000	DEC	
	17,327,000		10,806,000		14,254,000		0

ROSEBROOK WATER COMPANY
2008 Actual Consumption (Gallons)

	Number of Customers End of Period	Connected To Resort Waste	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Total 2008	Average Quarter	% of Total
Commercial									
Mt. Washington Hotel	1	No	6,665,000	4,110,000	5,790,000		16,565,000	4,141,250	52.90%
Bretton Arms	1	No	223,000	154,000	302,000		679,000	169,750	2.17%
Fabyans Restaurant	1	No	215,000	164,010	244,000		623,010	155,753	1.99%
MWH Administrative	1	No	34,000	3,000	25,000		63,000	15,750	0.20%
Manager's Home	1	No	68,000	165,000	199,000		432,000	108,000	1.37%
Total	5		7,205,000	4,600,010	6,560,000	0	18,362,010	4,590,503	58.66%
Irving Store	1	No	27,000	33,000	52,000		112,000	28,500	0.36%
Real Estate Sales Office	1	Yes	10,000	5,000	8,300		24,300	6,000	0.08%
Drum Hand Mt. Shop	1	Yes	5,000	0	9,000		14,500	3,500	0.04%
Stables	1	No	6,000	7,000	8,000		21,000	5,250	0.07%
Sports Club	1	Yes	150,050	185,000	194,000		529,000	132,250	1.69%
Ski Area/Maint.	9	YES/NO	540,700	12,190	109,000		661,890	165,473	2.10%
Golf/Nordic	1	No	110,000	165,000	140,000		415,000	103,750	1.32%
First Aid Bld	1	Yes	0	11,000	1,000		12,000	3,000	0.04%
Sprung Bld.(2 motors)	2	Yes	117,000	0	45,000		162,000	40,500	0.51%
Other Commercial	11		969,700	419,190	532,000	0	1,850,890	487,723	6.15%
Total Commercial	16		8,175,700	5,019,200	7,118,000	0	20,312,900	5,079,225	64.45%
Residential									
Rosebrook Townhomes	28	Yes	265,000	143,000	240,000		648,000	162,000	2.06%
Farm: Cottages	34	No	365,000	91,000	182,000		638,000	159,500	2.02%
Crawford Ridge	22	Yes	146,000	63,000	74,000		283,000	70,750	0.90%
Riverfront Homes	9	Yes	86,000	19,000	71,000		176,000	44,000	0.56%
MW Place	105	Yes	545,000	414,000	420,000		1,379,000	344,750	4.38%
Rickroy Circle/Private motors	50	Yes	363,000	89,750	287,000		739,750	184,938	2.35%
Fairway Village	30	Yes	195,000	171,000	279,000		645,000	161,250	2.05%
Dartmouth Ridge Homes	11	Yes	72,000	74,000	96,000		242,000	60,500	0.77%
Rosebrook Club/Mt View	15	Yes	89,000	29,000	35,000		153,000	38,250	0.49%
MW Homes	7	Yes	61,000	73,000	87,000		221,000	55,250	0.70%
Mt. Madison	10	Yes	128,000	27,000	62,000		217,000	54,250	0.69%
Pres. View	10	Yes	102,000	15,000	47,000		164,000	41,000	0.52%
Stone Hill	10	Yes	28,000	70,000	43,000		141,000	35,250	0.45%
Total Residential	381		2,345,000	1,275,750	1,889,000	0	5,509,750	1,377,438	17.48%
Unmetered Sales-Other									
Hutter Const-Fire Hydrants	0	No	0	0	29,000		29,000	7,250	0.09%
Total Unmetered Sales			0	0	29,000		29,000	7,250	0.09%
Total Rosebrook - 2008	397		10,520,700	6,294,950	9,036,000	0	25,851,650	5,462,913	82.02%

2007	9,335,750	6,264,750	9,972,250	8,219,100	33,792,850	8,448,213
2006	9,260,250	8,099,950	6,216,300	9,704,750	33,271,250	9,067,813
2005	7,763,550	5,533,800	11,993,850	8,782,400	34,074,000	8,473,750
2004	8,904,250	7,065,500	8,991,250	6,685,250	31,646,250	7,915,563
2003	8,856,270	8,224,600	10,327,800	8,172,500	35,580,170	9,148,043
2002	10,097,200	8,769,080	9,375,830	9,547,090	37,771,000	9,442,750
2001	8,929,730	5,503,742	8,731,800	7,352,800	31,517,372	7,879,393
2000	8,802,580	6,177,970	10,061,260	6,856,560	31,898,370	7,974,593
1999	4,668,760	11,316,970	20,969,760	10,717,090	48,804,170	11,666,043
1998	3,586,852	5,666,600	21,691,370	10,848,240	45,122,862	11,530,716
1997	3,633,423	9,362,349	17,534,252	4,900,000	35,430,024	8,857,506
1996	3,561,030	5,519,560	15,177,455	4,654,632	29,912,937	7,478,209
1995	2,236,074	7,357,518	14,653,400	1,943,150	26,222,542	6,555,636

ROSEBROOK WATER COMPANY
2008 Actual Consumption (Gallons)

	Number of Customers End of Period	Connected To Resort Waste	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Total 2008	Average/ Quarter	% of Total
Commercial									
Mt. Washington Hotel	1	No	5,772,000				5,772,000	1,443,000	18.31%
Bretton Arms	1	No	43,000				43,000	10,750	0.14%
Fabyans Restaurant	1	No	198,000				198,000	49,500	0.63%
MWH Administrative	1	No	11,000				11,000	2,750	0.03%
Manager's Home	1	No	65,000				65,000	16,250	0.21%
Total	5		6,089,000	0	0	0	6,089,000	1,522,250	19.32%
Irving Store	1	No	34,000				34,000	8,500	0.11%
Real Estate Sales Office	1	Yes	4,000				4,000	1,000	0.01%
Drummond Rd. Shop	1	Yes	8,000				8,000	2,000	0.03%
Stables	1	No	5,000				5,000	1,250	0.02%
Sports Club	1	Yes	305,000				305,000	76,250	0.97%
Ski Area/Maint.	2	YES/NO	524,000				524,000	131,000	1.66%
Golf/Nordic	1	No	57,000				57,000	14,250	0.18%
First Aid Bld	1	Yes	8,000				8,000	2,000	0.03%
Serving Bld.(2 meters)	2	Yes	62,000				62,000	15,500	0.20%
Other Commercial	17		1,007,000	0	0	0	1,007,000	251,750	3.20%
Total Commercial	16		7,096,000	0	0	0	7,096,000	1,774,000	22.51%
Residential									
Rosebrook Townhomes	28	Yes	296,000				296,000	74,000	0.94%
Forest Cottages	54	No	370,000				370,000	92,500	1.17%
Crawford Ridge	22	Yes	129,000				129,000	32,250	0.41%
Riverfront Homes	6	Yes	54,000				54,000	13,500	0.17%
MW Place	105	Yes	523,000				523,000	130,750	1.66%
Stickney Circle/Chauss mebins	50	Yes	220,000				220,000	55,000	0.70%
Fairway Village	59	Yes	247,000				247,000	61,750	0.78%
Dartmouth Ridge Homes	12	Yes	63,000				183,000	20,250	0.30%
Rosebrook Club/Mt View	15	Yes	99,000				99,000	24,750	0.31%
MW Homes	7	Yes	85,000				85,000	21,250	0.27%
Mt. Madison	10	Yes	70,000				70,000	17,500	0.22%
Pres. View	10	Yes	84,000				84,000	21,000	0.27%
Stone Hill	10	Yes	33,000				33,000	8,250	0.10%
Total Residential	392		2,303,000	0	0	0	2,303,000	575,750	7.31%
Other sales-metered & calc									
Hutter Const-Fire Hydrants	0	No					0	0	0.00%
Golf Course/Ice	0	No					0	0	0.00%
Skating Rink/calc	0	No	3,600				3,600	900	0.01%
Tubing Hill/metered & calc	0	No					0	0	0.00%
MWHC new construction/calc	0	No					0	0	0.00%
Total Other sales			3,600	0	0	0	3,600	900	0.01%
Total Rosebrook - 2009	398		9,402,600	0	0	0	9,402,600	2,350,650	29.83%

2006	10,920,700	8,284,550	9,035,000	6,836,580	34,688,230	8,672,058
2007	9,336,750	6,764,750	9,972,250	8,218,100	33,790,850	8,448,213
2006	9,250,250	8,099,650	9,216,300	9,734,750	36,271,250	9,067,813
2005	7,783,950	9,533,800	11,993,850	5,702,400	34,054,000	8,513,500
2004	8,904,200	7,665,550	8,991,299	6,085,250	31,646,299	7,911,575
2003	8,855,270	8,224,600	10,327,800	2,172,505	30,580,175	8,145,043
2002	10,987,200	8,760,880	9,375,830	9,547,090	37,771,000	9,442,750
2001	8,529,730	6,503,742	8,731,800	7,352,500	31,317,372	7,829,393
2000	8,802,560	8,177,670	10,051,200	5,856,540	31,888,370	7,974,593
1999	4,599,700	11,318,970	20,039,700	10,717,080	46,664,170	11,666,043
1998	-3,586,652	9,995,600	21,891,370	10,846,240	44,122,860	11,030,715
1997	3,639,420	9,969,040	17,594,200	4,666,000	35,480,024	8,857,560
1996	3,581,030	6,516,680	15,177,495	4,554,630	29,612,537	7,478,206
1995	2,238,074	7,057,918	14,883,400	1,543,150	26,222,542	6,555,636

APPENDIX B:
OPINIONS OF COST

OPINION OF PROBABLE PROJECT COST
Rosebrook Water System Improvements
Bretton Woods, New Hamsphire

Pump House Elbow, Valve Installation, Backup Power, and Low Water Cutoffs

Prepared by Horizons Engineering, L.L.C.
March 2010

ITEM	UNITS	NO. UNITS	UNIT COST	TOTAL COST
Mobilization	LS	1	$2,000.00	$2,000
16" Flanged Elbow with Mechancial Restraint	EA	2	$2,500.00	$5,000
16" x 12" Reducer	EA	1	$2,200.00	$2,200
Labor and Materials to Replace Elbow	EA	1	$10,000.00	$10,000
Backup Generator	LS	1	$65,000.00	$65,000
Low Water Cutoffs for Wells	EA	2	$6,000.00	$12,000
Sand	CY	30	$15.00	$450
Crushed Gravel	CY	20	$25.00	$500
Erosion Control	LS	1	$500.00	$500
				$97,650
			15% Contingency	$14,648
			Total Construction Cost	$112,298
			Total Project Cost	$112,298
			ROUNDED PROJECT COST	**$110,000**

OPINION OF PROBABLE PROJECT COST
Rosebrook Water System Improvements
Bretton Woods, New Hamsphire

Bretton Arms Pressure Relief Valve Installation

Prepared by Horizons Engineering, L.L.C.
September 2009

ITEM	UNITS	NO. UNITS	UNIT COST	TOTAL COST
Mobilization	LS	1	$1,500.00	$1,500
Loam & Seed	SY	20	$3.00	$60
Sand	CY	5	$15.00	$75
Crushed Gravel	CY	5	$25.00	$125
3" Bit Pavement	TON	1	$95.00	$95
Pressure Relief Valve	EA	1	$2,000.00	$2,000
Pressure Relief Drain	EA	1	$1,500.00	$1,500
6" Gate Valve	EA	2	$1,200.00	$2,400
Concrete Vault	EA	1	$3,500.00	$3,500
Erosion Control	LS	1	$200.00	$200
				$11,455
			15% Contingency	$1,718
			Total Construction Cost	$13,173
			10% Engineering	$1,317
			Total Project Cost	$14,491
			ROUNDED PROJECT COST	**$14,000**

OPINION OF PROBABLE PROJECT COST
Rosebrook Water System Improvements
Bretton Woods, New Hamsphire

Water Main Extension Option 1
16-Inch Main Extension from Fairway Village to Bretton Arms Hotel

Prepared by Horizons Engineering, L.L.C.
September 2009

ITEM	UNITS	NO. UNITS	UNIT COST	TOTAL COST
Mobilization	LS	1	$5,000.00	$5,000
Loam & Seed	SY	850	$3.00	$2,550
Sand	CY	225	$15.00	$3,375
Crushed Gravel	CY	150	$25.00	$3,750
3" Bit Pavement	TON	4	$95.00	$380
Trench Ledge Removal	CY	150	$120.00	$18,000
16" Water Main	LF	500	$100.00	$50,000
16" Gate Valve	EA	2	$3,000.00	$6,000
Hydrants	EA	1	$3,500.00	$3,500
6" Water Main	LF	25	$58.00	$1,450
Connect to Existing	EA	2	$2,000.00	$4,000
Erosion Control	LS	1	$1,000.00	$1,000
				$99,005
			15% Contingency	$14,851
			Total Construction Cost	$113,856
			10% Engineering	$11,386
			Total Project Cost	$125,241
			ROUNDED PROJECT COST	**$130,000**

OPINION OF PROBABLE PROJECT COST
Rosebrook Water System Improvements
Bretton Woods, New Hamsphire

Water Main Extension Option 2
16-Inch Main Extension from Fairway Village to Mount Washington Hotel

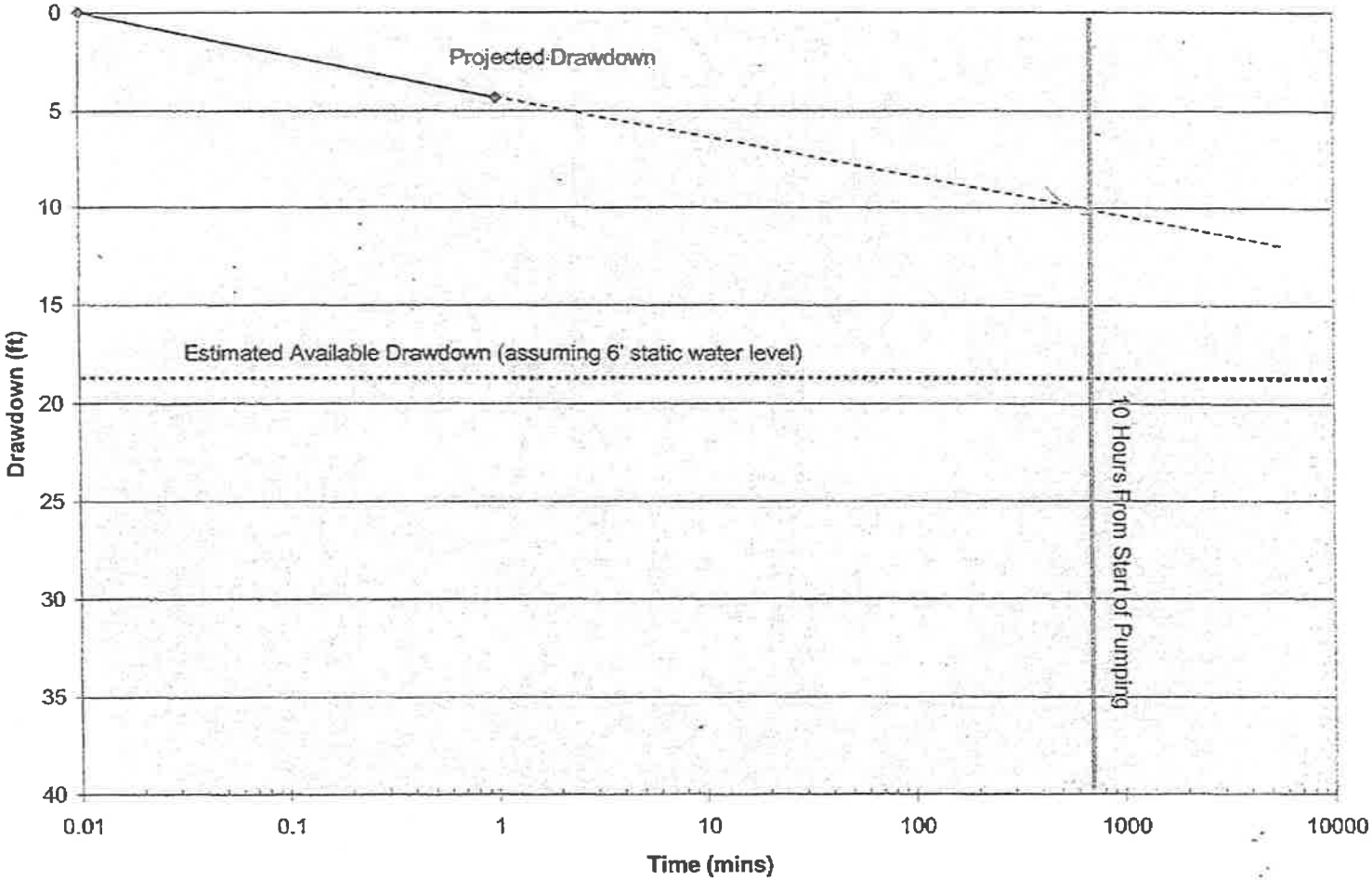
Prepared by Horizons Engineering, L.L.C.
September 2009

ITEM	UNITS	NO. UNITS	UNIT COST	TOTAL COST
Mobilization	LS	1	$5,000.00	$5,000
Loam & Seed	SY	3,400	$3.00	$10,200
Sand	CY	900	$15.00	$13,500
Crushed Gravel	CY	600	$25.00	$15,000
3" Bit Pavement	TON	4	$95.00	$380
Trench Ledge Removal	CY	600	$80.00	$48,000
16" Water Main	LF	2,000	$100.00	$200,000
Hydrants	EA	4	$3,500.00	$14,000
16" Gate Valve	EA	2	$3,000.00	$6,000
Connect to Existing	EA	2	$2,000.00	$4,000
Erosion Control	LS	1	$4,000.00	$4,000
				$320,080
			15% Contingency	$48,012
			Total Construction Cost	$368,092
			10% Engineering	$36,809
			Total Project Cost	$404,901
			ROUNDED PROJECT COST	**$400,000**

APPENDIX C:
WELL YIELD ASSESSMENT DOCUMENTATION

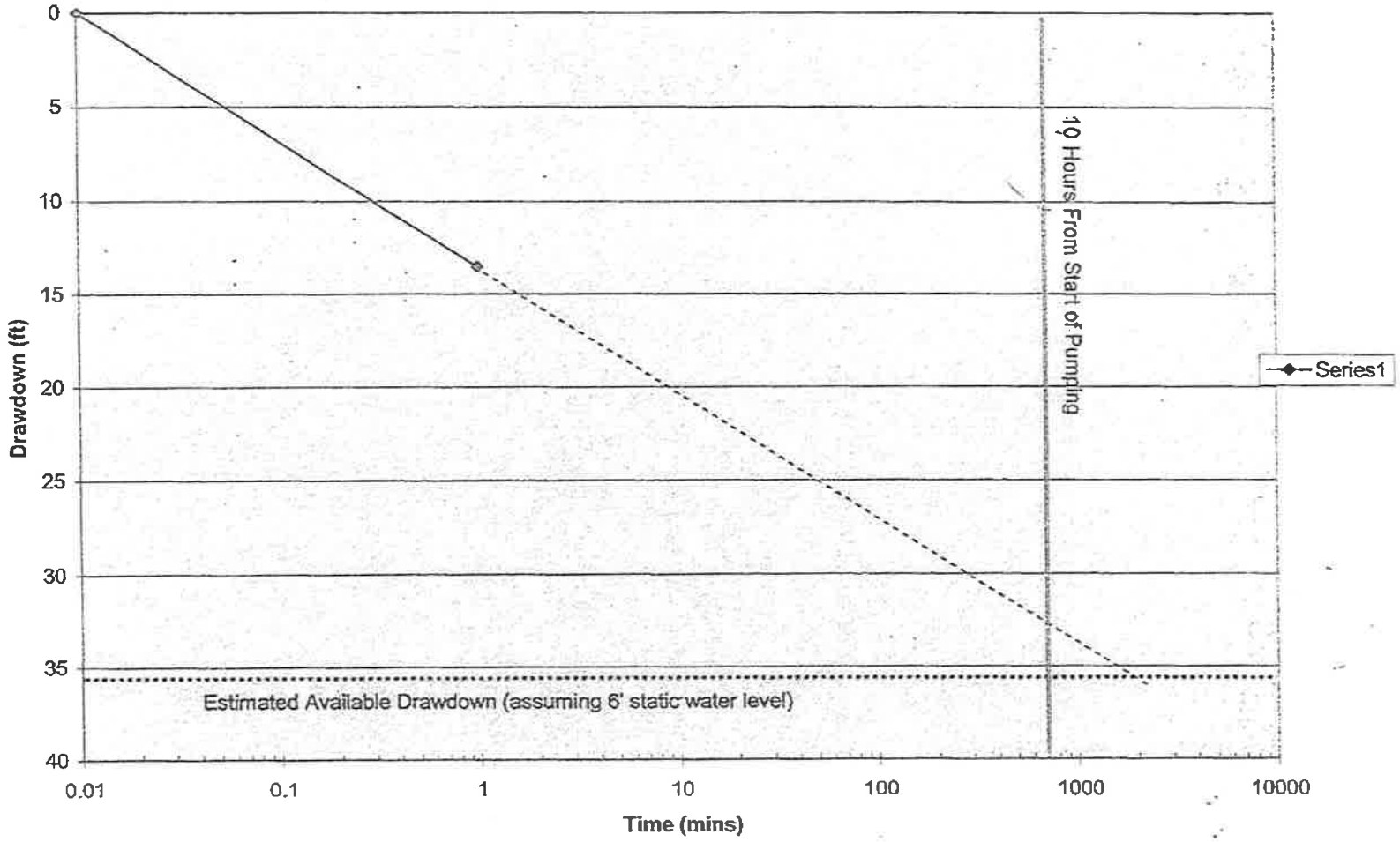
horizons Engineering Inc.

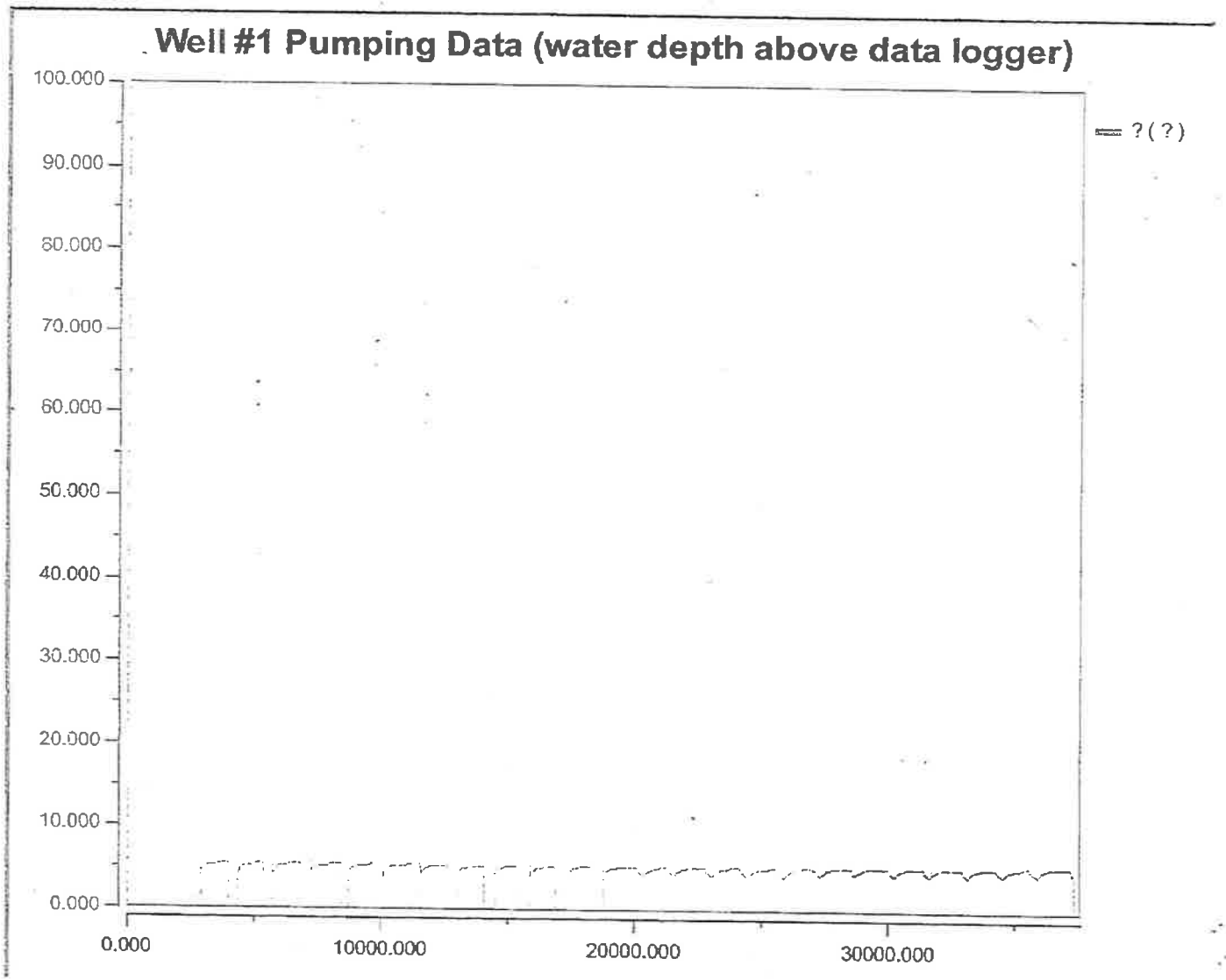
Rosebrook Well #1
Projected Pumping Drawdown

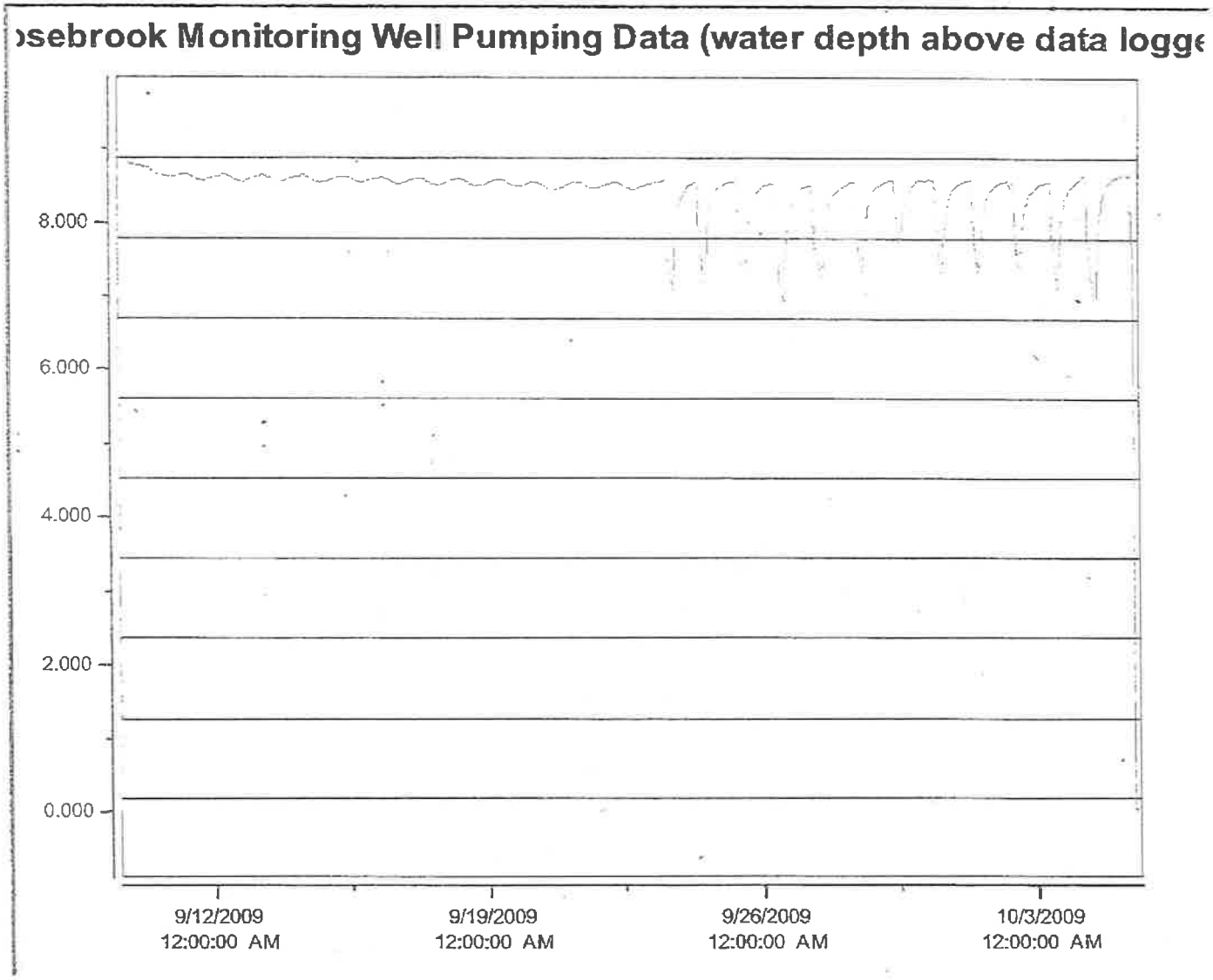


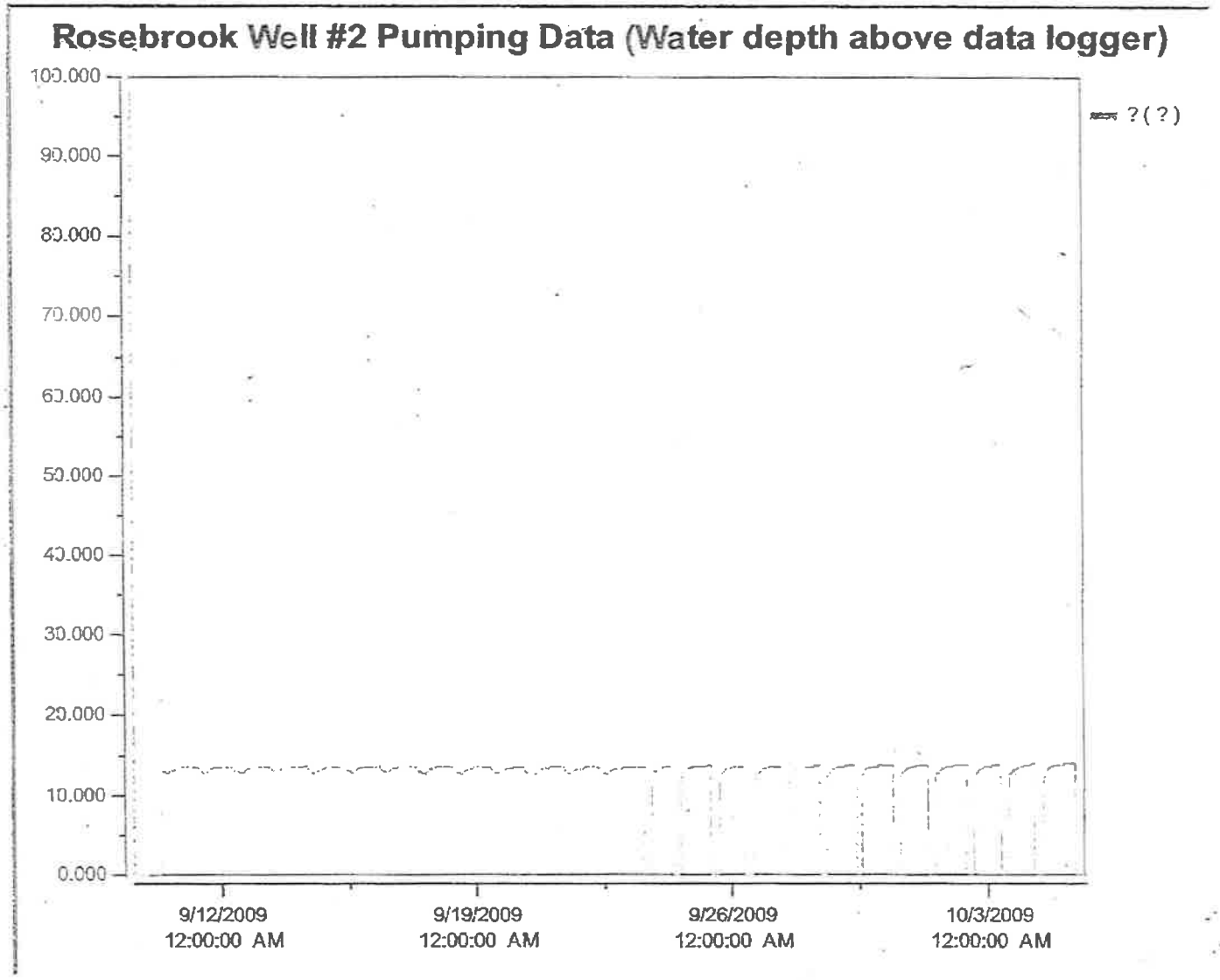
horizons Engineering

Rosebrook Well #2
Projected Pumping Drawdown




Well #1 Pumping Data (water depth above data logger)
100.000
90.000
80.000
70.000
60.000
50.000
40.000
30.000
20.000
10.000
0.000
0.000
10000.000
20000.000
30000.000
?(?)


ɔsebrook Monitoring Well Pumping Data (water depth above data logge
8.000
6.000
4.000
2.000
0.000
9/12/2009
12:00:00 AM
9/19/2009
12:00:00 AM
9/26/2009
12:00:00 AM
10/3/2009
12:00:00 AM

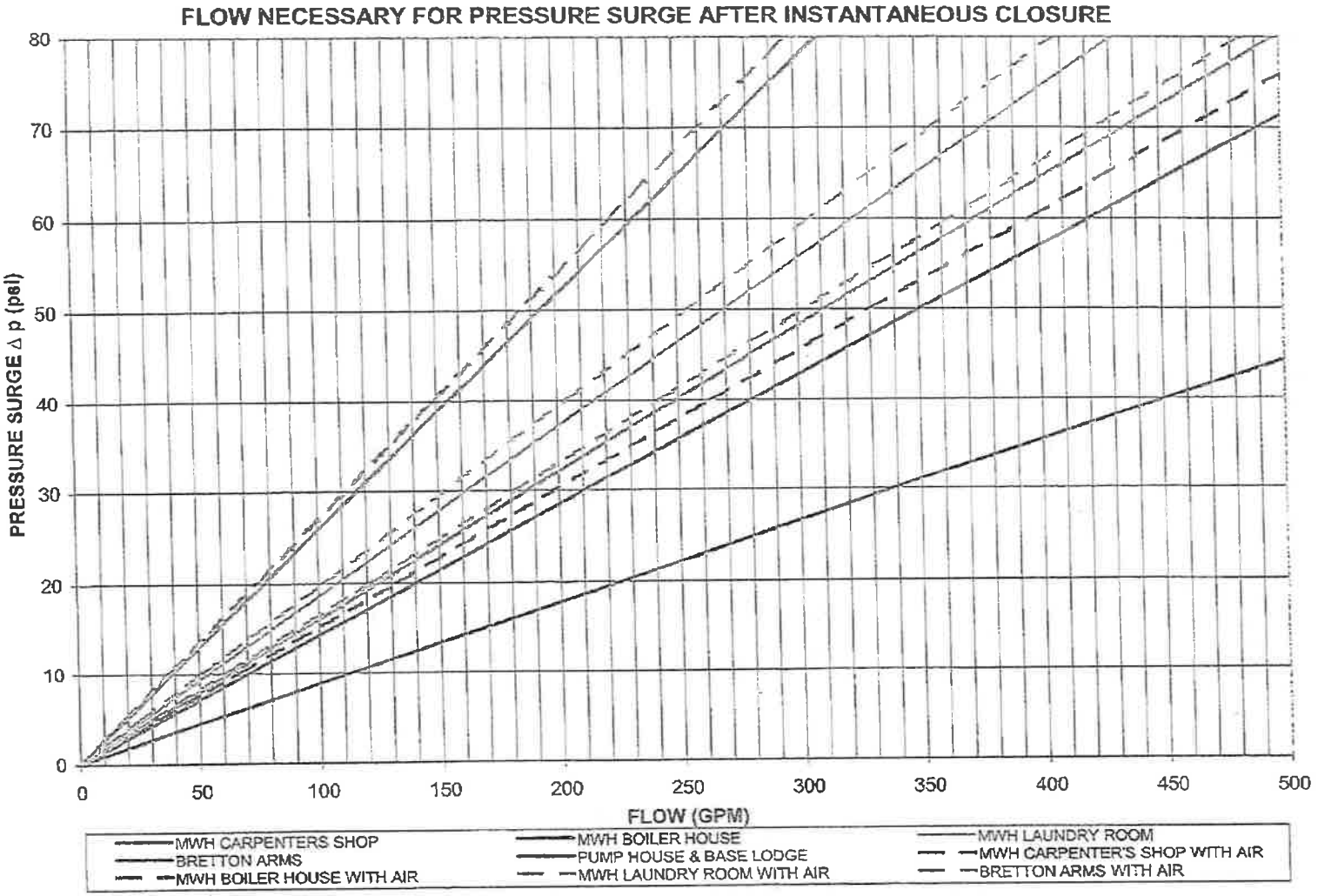

Rosebrook Well #2 Pumping Data (Water depth above data logger)
100.000
90.000
80.000
70.000
60.000
50.000
40.000
30.000
20.000
10.000
0.000
?(?)
9/12/2009
12:00:00 AM
9/19/2009
12:00:00 AM
9/26/2009
12:00:00 AM
10/3/2009
12:00:00 AM

Horizons Engineering

34 School Street
Littleton, New Hampshire 03561

Ph: (603) 444-4111
Fax: (603) 444-1343

www.horizonsengineering.com
email@horizonsengineering.com


FLOW NECESSARY FOR PRESSURE SURGE AFTER INSTANTANEOUS CLOSURE
PRESSURE SURGE Δ p (psi)
80
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
400
450
500
FLOW (GPM)
MWH CARPENTERS SHOP
MWH BOILER HOUSE
MWH LAUNDRY ROOM
BRETTON ARMS
PUMP HOUSE & BASE LODGE
MWH CARPENTER'S SHOP WITH AIR
MWH BOILER HOUSE WITH AIR
MWH LAUNDRY ROOM WITH AIR
BRETTON ARMS WITH AIR

WATER HAMMER CALCULATIONS FOR ROSEBROOK WATER SYSTEM

7/14/09 by JFM
Project #09125

PRESSURE WAVE VELOCITY (U) IN 16-INCH DI PIPE

E =	43,200,000	psf	
p =	1.94	lb sec2 / ft4	
D =	1.333	ft	
Ep =	30,500,000	psi	<< *Ductile Iron pipe*
	4,392,000,000	psf	
t =	0.042	ft	

U = 4118 fps

PRESSURE WAVE VELOCITY (U) IN 8-INCH PVC PIPE

E =	43,200,000	psf	
p =	1.94	lb sec2 / ft4	
D =	0.667	ft	
Ep =	400,000	psi	<< *PVC pipe*
	57,600,000	psf	
t =	0.042	ft	

U = 1312 fps

PRESSURE WAVE VELOCITY (U) IN 6-INCH PVC PIPE

E =	43,200,000	psf	
p =	1.94	lb sec2 / ft4	
D =	0.500	ft	
Ep =	400,000	psi	<< *PVC pipe*
	57,600,000	psf	
t =	0.032	ft	

U = 1322 fps

WATER HAMMER CALCULATIONS FOR ROSEBROOK WATER SYSTEM

7/14/09 by JFM
Project #09125

PRESSURE WAVE VELOCITY (U) IN 6-INCH DI PIPE

E =	43,200,000	psf	
p =	1.94	lb sec2 / ft4	
D =	0.500	ft	
Ep =	30,500,000	psi	<< *Ductile Iron Pipe*
	4,392,000,000	psf	
t =	0.032	ft	

U = 4393 fps

PRESSURE WAVE VELOCITY (U) IN 2-INCH COPPER PIPE

E =	43,200,000	psf	
p =	1.94	lb sec2 / ft4	
D =	0.167	ft	
Ep =	17,000,000	psi	<< *Copper pipe*
	2,448,000,000	psf	
t =	0.013	ft	

U = 4256 fps

PRESSURE WAVE VELOCITY (U) IN 1.5-INCH COPPER PIPE

E =	43,200,000	psf	
p =	1.94	lb sec2 / ft4	
D =	0.125	ft	
Ep =	17,000,000	psi	<< *Copper pipe*
	2,448,000,000	psf	
t =	0.012	ft	

U = 4339 fps

WATER HAMMER CALCULATIONS FOR ROSEBROOK WATER SYSTEM

7/14/09 by JFM
Project #09125

Pressure Wave Velocity (U) Equation:

$$U = \sqrt{\frac{E}{\rho}} \sqrt{\frac{1}{1 + ED/E_s t}} \quad (21\text{-}61)$$

where U = velocity of a pressure wave along a pipe, fps
E = modulus of elasticity of water, 43.2×10^6 psf
ρ = density of water, 1.94 lb sec^2 per ft^4 (specific weight divided by acceleration due to gravity)
D = diameter of pipe, ft
E_s = modulus of elasticity of pipe material, psf
t = thickness of pipe wall, ft

Standard Handbook for Civil Engineers by Frederick Merritt. 1968. McGraw-Hill Book Company.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Staff 1-7 Witness: T. Hansen/D. Vaughan

REQUEST:

Please provide a proposed construction sequence that includes the location and status of distribution system valves that will be used to isolate system segments as needed.

RESPONSE:

The design documents (drawings, plans and specifications) being produced for Step II, will include a construction sequencing plan for each phase. The sequencing plan will identify all valves used to isolate the system.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Office of the Consumer Advocate Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. OCA 1-1 Witness: T. Hansen/D. Vaughan

REQUEST:

Refer to the "Estimated Timeframe of Activities (January 2019) Revision No. 1" document that was discussed at the Tech Session on January 23, 2019.

a. Please succinctly discuss the differences between the proposed project as it stands now relative to what was proposed in July, 2016.
b. Per the response to part a., please provide cost estimates to explain how the differences increase the total cost for the project from $1.41 million to $2.6 million.
c. For differences identified in response to part a., please briefly explain why the Company requires the proposed alterations.
d. For each of the estimated costs in the "Estimated Cost" column, please provide an explanation of how those estimated costs were derived. To the extent those estimates are based on estimates from Horizon Engineering Inc., please furnish all documents that support their estimations. If the analysis relies on EXCEL worksheets, provide the live versions of those worksheets.

RESPONSE:

a) The 2016 plan was a conceptual plan to reduce water pressure to 100 psi throughout the system. It included three pump stations to service properties higher than 1730 feet. They would all draw from the distribution system. One of these pump stations (Rosebrook) would also fill the tank. The tank would back feed the system through pressure reducing valves (PRVs).

The difference from 2016 is that the dedicated line from the wells to the Rosebrook station was introduced as a possibility if we are unable to achieve a system wide pressure reduction. Under this scenario, only the well discharge pressure will be reduced to 100 psi and the wells will pump directly to the Rosebrook station. The Rosebrook station would then pump into the system. Note that this would keep the water pressure at close to 200 psi at the Hotel and other low points in the system. Under this new alternative, the other two pump stations would not be required. The Company does not accept this alternative as the best, long term solution because it leaves much of the distribution system with very high pressure.

A new or supplemental water storage tank has also been considered. The tank would be at a lower hydraulic grade line precluding the need for system PRVs. There would still be three pump stations and other system improvements. Other benefits of a new tank include

redundancy and better accessibility. Also, a second tank located on the north side of Route 302 would be better situated to service the expected growth area.

b) The Company anticipates additional costs such as easement acquisition, inflation due to phasing over a period of years, multiple petitions and rate hearings, contingencies and other factors. In any case, these estimates are very preliminary and subject to revision when projects are bid. New cost estimates will be submitted with the Basis of Design Report.

c) See response to a). These alterations are not necessarily required but are being considered as part of alternatives analysis. For example, the dedicated line would not be required if we can address the system pressures as a whole and not just focus on the wells.

d) The only detailed cost estimates are contained in the Horizon's report. The Company did obtain quotations from pump station suppliers but these have been incorporated into the Horizon numbers. The Basis of Design Report will refine the estimates.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Office of the Consumer Advocate Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. OCA 1-2 Witness: T. Hansen/D. Vaughan

REQUEST:

Refer "AWC Rosebrook Step II Report ... water pressure problem 1-7-19." End of Page 3 and the beginning of Page 4 discuss the need for a new tank.

a. Has the Company evaluated whether the access to the existing tank can be improved to allay concerns about inaccessibility in winter? If so, please provide that evaluation and its findings.
b. It is stated that "[p]resumably the original location was designed, as the resort was developed, to negate the need for construction of pump stations and related expense." Has the Company explored the reasons behind the choice of the original location more definitively rather simply relying on a presumption? If the answer is in the affirmative, please provide the Company's findings.
c. If the answer to the first part of a. is in the affirmative, please provide cost estimates of alternatives to improve winter accessibility to the existing tank.

RESPONSE:

a) Please refer to Staff 1-6 for more information about tank access. The Company has not performed a formal evaluation of how access to the existing tank can be improved and what the cost would be.
b) The Company has not been able to obtain any additional information as to why the tank is located at this site.
c) See a) above.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-1 Witness: T. Hansen/D. Vaughan

REQUEST:

In the steps leading up to this phase of the docket, Abenaki has focused on a water pressure reduction project. However, such a large and capital-intensive project would normally be the result of a comprehensive review of all system needs. That review would consider every aspect of the system, provide alternatives and estimated costs to address deficiencies, and rank projects according to need and cost. In Rosebrook's case, such an overview is lacking or incomplete. Some aspects of the pressure reduction proposal appear to have been introduced relatively late in the process (the concept of a new tank and, more recently, the fuller extent of the iterative process and evolution of alternatives considered to date). As will be evident in many of the questions that follow, there may be other issues with equally critical impacts on the system and customers. Also, of concern is that "final design" mean final detailed engineering of an alternative that has already been adequately evaluated, compared against other alternatives for addressing a particular need, and then selected to move forward to the last step (engineering design) prior to construction. With this background in mind:

Would the company be amenable to a two-step involvement by Horizons Engineering or another entity that would accomplish the two items below? (A significant portion of such a report could likely be based on work already done by Horizons and as such may require neither a great deal of time and cost nor the loss of an additional construction season.)

a) Assess and clearly compare in an understandable format all reasonable alternatives for pressure reduction including capital costs, pumping and other O&M costs, impacts of phasing, comparison of new tank to existing or some combination thereof, and pros and cons of each alternative; and

b) Evaluate the need for, and prioritize, improvements related to other system needs such as mains, valves, wells and system looping.

RESPONSE:

With respect to the opening narrative connected to this request, the company's operators and engineers have observed and assessed the system function and performance since the acquisition of Rosebrook in 2016. During the intervening period between then and now, while addressing several secondary issues such as evaluating hydrant function and improving metering and data collection, the company has identified the clear leading subject of concern as extreme pressure.

The company also acknowledges that the potential for water hammer, without doubt, is a directly related issue and is magnified by the existence of excessive pressure.

Plant issues of lesser priority, but still very significant are: 1) the lack of sufficient distribution system valving, 2) mains which are not looped, and 3) pipe lines which are in locations extremely difficult to access. These items will be considered and continuously evaluated throughout the design process.

From the inception of the Company's addressing pressure reduction, conceptual designs have been evaluated and advanced to a preliminary stage, primarily for further discussion. Alternate plans have been considered, including a new storage tank on the northerly side of route 302. Evolving plans subject to critiquing would be a typical engineering development process. Engineering ideas must be presented, incorporated, modified, or dismissed. This would explain on-going changes to *preliminary* engineering.

Ultimately, it is the responsibility of the Company's operations and engineering department, with the aid of outside consultants such as Horizons, to consider possibilities, make cost effective engineering decisions, review input of all, and produce plans and specifications with Step II requirements.

Certainly, the Company would be amenable to providing the information and functions expressed in parts a) and b) of this request contingent that such items are consistent with the purpose for and the Company expectations of the Horizons proposal dated September 18, 2018. As is known, the Company has a deadline of September 30, 2019 to submit a petition seeking recovery of a not to exceed sum of $100,000 for plans, specifications and services detailed in the above proposal. That said, the Company is under a very tight time line.

Furthermore, the Company would be concerned about adding additional requests of Horizons' causing their fee to increase without prior PUC approval.

Finally, any delay in exercising the September 18th proposal would reasonably jeopardize Horizon's ability to "hold the line" on the fee.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-2 Witness: Pauline Doucette

REQUEST:

Mr. Vaughan's testimony filed Dec 7, 2017 notes that over $25,000 had been spent on the pressure reduction project at that point (p. 7, line 11 and p. 9, line 15). In that regard please provide a breakdown of amounts spent on:

a) The Jul 15, 2016 Horizons report;
b) The Mar 20, 2017 Horizons report;
c) Other efforts by Horizons.

RESPONSE:

a) $3,490
b) $15,700
c) No additional charges at this time

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-3 Witness: T. Hansen/D. Vaughan

REQUEST:
The company has recently provided reports by Horizons evaluating a limited number of potential alternatives for reducing system pressures. Please indicate whether the company has performed or considered an engineering analysis of the following items:

a) Alternatives to dedicated mains (for example, well pump station to Rosebrook Booster Station) such as re-valving the existing 16-inch main in some way.
b) Specific costs associated with phasing, such as items that may be oversized or become obsolete or unnecessary upon completion of the final phase (dedicated mains, extra pressure reducing valves, oversized Rosebrook booster pumps, etc.).
c) General rate impacts of phasing v. not phasing.
d) A comparison of factors relating to construction of a new tank v. continued use of the existing (higher elevation, nearly 50-year old) tank, or any proposed combination thereof, including capital costs, remaining v. expected lives, difference in long term pumping costs, maintenance costs, required road construction or main extensions, relative siting pros and cons, the ability to accommodate present and future development and demands, and other impacts.

RESPONSE:

a) The dedicated water main to Rosebrook Booster Station was originally proposed only as an alternative to a system-wide pressure reduction project. It would only reduce the pressure at the well house. But as pointed out in Horizon's earlier report, it does have other operational advantages. Re-valving or otherwise modifying the existing 16" main to accomplish the same objective is certainly possible and has been discussed. We intend to look at that option.
b) The Rosebrook booster station is the only component that may have a different operational function after all phases are complete. Thus, design would consider re-purposing this station in a cost-effective manner.
c) With respect to rate impacts in the context of phasing, they will be lessened with an incrementally stepped plan that is further lengthened in time to allow for recovery of capital expenditures at each completion date through the regulatory process. Although phasing mitigates rate impacts, it does not take advantage of the economies inherent in one construction contract executed continuously over fewer construction seasons. In view of potential economic impacts, the company has suggested a contribution (CIAC) toward the project cost that would have the effect of reducing the revenue requirement related to cost recovery. The consequential benefits would be lower commodity costs to consumers going forward.

d) A tank study and evaluation will be done before any decision is made on a new tank.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-4 Witness: T. Hansen/D. Vaughan

REQUEST:

The July 15, 2016 Horizons report makes no mention of a new tank, and in fact indicates that "At the direction of the system owner, a conceptual plan has been developed … [that] maintains key components of the existing system such as …the 650,000 gallon atmospheric storage tank in the present locations to minimize disruption and project cost." (p. 5 at top). Similarly, the March 20, 2017 Horizons report assesses two alternatives for pressure reduction, both involving only the existing tank. However, Attachment 2, page 6 of the 2017 report indicates the 2016 report "proposed a new storage tank at a lower elevation". Page 14 of the same attachment refers to an item being "close to the [existing] tank or a new lower water storage tank (which was the intent of the 2016 preliminary report)". In this regard:

a) Please explain the apparent discrepancies in the above statements.
b) Please provide any separate 2016 report prepared by Horizons in relation to a new tank.
c) Please provide copies of any other engineering reports or studies by Horizons or others (including in-house reports or studies) relating to the evolution of the water pressure reduction project.
d) Please provide copies of any analysis of other operational or maintenance issues relative to providing safe and adequate service performed by Abenaki or others before or after Abenaki's acquisition of the system, including as part of the company's due diligence efforts.

RESPONSE:

a) The 2017 report refers to a "preliminary" 2016 report, not the final report. A preliminary version discussed a tank but this discussion was eliminated from the final.
b) There is no separate tank report.
c) We have provided all copies of Horizon reports. The Company does have in-house documents that it can provide. We request a meeting with your engineering consultant/staff to go through these documents with you to decide which are relevant.
d) There has been no analysis of other operational or maintenance issues to the Company's knowledge other than what has been submitted to date with the exception of the water hammer report referenced in OMNI Step II 1-5 c), and included with the data request.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-5 Witness: T. Hansen/D. Vaughan

REQUEST:

Water hammer problems persist in the system and continue to cause significant customer disruption. Six times in the last six weeks or so, all customers in the Bretton Arms Inn were forced to evacuate due to a sprinkler system fire alarm set off by water hammer. High system pressure alone does not cause (and may only contribute additively to) water hammer; the hammer must be initiated by some form of shock within the system. One potential reported source of shock is well pump cavitation resulting from running the pumps at higher output than the wells or aquifer can handle. An added result of such over-pumping can be air introduced into the system, causing other system complications and potentially exacerbating the water hammer problem. With these things in mind:

a) For the 5 or 6 year duration of the pressure reduction project as currently proposed, how will the company address the system's recurring water hammer problems?
b) Well outputs can diminish over time; the system's two wells are close together in the same aquifer; NHDES rules relate well capacity to present and future demand and sizing of storage; further development (and hence system demand) is clearly contemplated in the Bretton Woods area; over-pumping has already been expressed as a concern; and Horizons, with its substantial hydrogeological expertise, has proposed to perform a well yield assessment (albeit a very limited one) with a projected cost (including well pump design) of $8,500 (Sep 18, 2018 Agreement for Engineering Services). Given the relatively small cost compared to a proposed $3 million capital project, does the company plan to have at least that level of assessment of well capacity performed as part of Step II?
c) To the extent available, please provide the earlier Horizons water hammer report referenced in the memo from Don Vaughan to Stephen P. St. Cyr dated 1/4/19 (filed Jan 8, 2019; see p. 3, last sentence in 4th paragraph).

RESPONSE:

In response to the narrative preceding the data requests, the Company would respectfully clarify the claim that "...pressure alone does not cause (and may only contribute additively to) water hammer...". The Company would concur that water under high pressure in a static state is not the cause of hammer. That said, water at excessive pressure in a dynamic state has high potential to cause water hammer due to abrupt demand variations in the distribution system. This situation can occur when valves are closed too quickly causing multiple reversals of water direction.

Although entrained air can exacerbate the potential for water hammer, the Company has no reason to believe that well supplies are at the cause of the pressure surges or that they are being over pumped, the suggestion being that air has been introduced into the system.

a) The design of the pressure reduction project will address the potential for water hammer issues by significantly reducing the potential that they will occur by lowering pressure as well as strategically installing air relief valves, among other design tasks. Water hammer will be effectively addressed in the Horizons design.

b) The Company agrees that well production can and will diminish over time. However, when that trend is observed and reaches a certain tipping point, they are redeveloped to usually achieve their former output or even more.

   While there has been virtually no growth at Rosebrook over the past several years, given the relative similar demands, there has been no stressing impacts on wells.

   In any event, a well assessment is included in the Step II endeavor and will be analyzed on its own and in context with the pressure reduction initiative.

c) The Horizons' pressure surge report in included herein.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-6 Witness: T. Hansen/D. Vaughan

REQUEST:

Another serious concern is that there may be inordinately long stretches of primary 16-inch and/or other water main lacking operable isolation valves. Results of such a situation can range from inconvenient to catastrophic. In this regard:

a) Is the company willing to have an engineering assessment of overall system valve needs done as part of Step II?
b) Is the company willing to consider installing (or upgrading, repairing, etc.) the top several such identified valves in conjunction with, as opposed to only after completion of, the pressure reduction project?
c) Please provide an approximate cost to add a single 16-inch valve to the distribution system.

RESPONSE:

a) The Company would be willing to do an overall assessment of valve needs, but that can and will be done internally as it does with its other systems as a routine course of management
b) Yes
c) The present cost of a 16" valve is approximately $7,700 just to purchase. Installation of costs may be as high as $1000 depending on such considerations as existing soil conditions, potential rock excavation, pavement or ground/landscaping restoration, traffic control, service disruption expense etc.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-7 Witness: T. Hansen/D. Vaughan

REQUEST:

Horizons reports have recommended a number of water main extensions to complete or enhance system looping at specific locations. Please indicate which of the following the company is currently planning to construct as part of the pressure reduction project:

a) 350' of 8-inch main connecting Mt. Adams Lane to Dartmouth Ridge Lane (Jul 15, 2016 and subsequent Horizons reports).
b) 40' of 16-inch main connecting the existing 16-inch (12-inch?) main on Base Station Road to the Mount Washington Hotel's 8-inch main (Mar 20, 2017 report).
c) Additional 2,620' of 16-inch main involving further looping and main upgrades near the Hotel, as recommended by the Mar 20, 2017 report (consisting essentially of three segments - a short looping section from the Fairway Village 16-inch main, a cross-country connection to the Hotel's 8-inch main, and upgrade of the 8-inch main itself). The Hotel, which is by far the system's largest customer (accounting for roughly 2/3 of total system demand), lies at the far end of the system and is served by only the one long, small diameter (8-inch) line. Even with the 40' interconnection in part b) above in place, preliminary hydraulic modeling using a minimal (1,000 gpm) fire flow at the Hotel during peak conditions yielded essentially no remaining pressure at the Hotel's upper floors without further improvements to the distribution system.

RESPONSE:

a) b), and c): The Company will construct each of the mentioned pipe lines provided that they are essential to the pressure reduction project. Those that are not, but that would enhance the performance of the system, will be incorporated into the Company's Capital Improvement Plan.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-8 Witness: T. Hansen/D. Vaughan

REQUEST:

For any of the three water main extensions (or segments thereof) identified in the previous question that the company is not currently planning to construct as part of the pressure reduction project:

a) Please provide an estimated construction cost for that main or segment (Horizons has estimated a price of $64,250 for the 350' Mt. Adams Lane main in App. E of its 2016 report).
b) Please indicate whether the company is willing to have further engineering analysis done in Step II of this docket of the specific need for, and impacts of constructing or not constructing, the given main or segment.

RESPONSE:

a) The Company expects the cost would be similar to that provided by Horizons. If the segment is included in the pressure project, the issue becomes moot.
b) Certainly the Company is willing to provide further analysis within the project scope as appropriate.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-9 Witness: T. Hansen/D. Vaughan

REQUEST:

A 16-inch main currently runs directly beneath the Base Lodge. Any break or leak in that main could obviously have significant repercussions. In this regard:

a) Please provide an estimated cost to reroute the main around the Lodge.
b) Is the company willing to consider constructing the rerouted main as part of, instead of after completion of, the pressure reduction project?

RESPONSE:

a) The Company is reluctant to provide such an estimate due to unknowns such as length of main under the Lodge, depth of bury, etc. In any event, the Company will propose relocation within the project scope.
b) Please refer to a)

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-10 Witness: T. Hansen/D. Vaughan

REQUEST:

The larger diameter main in Base Station Road running eastward from the 16-inch main serving Fairway Village is described in item 3 on p. 3 of the Mar 20, 2017 Horizons report as 16-inch, but is shown on the accompanying map as 12-inch. Does the company know which is correct (and which was used in the hydraulic model)?

RESPONSE:

The Company cannot be definite as to main size, but can confirm it through an eventual test pit which will be included in the project. The Company cannot be sure which is correct as used in the model. In any event, the Company will be running a second hydraulic model upon completion of the project.

ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
DW 17-165
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 1

Date Request Received: 2/4/19 Date of Response: 2/11/19
Request No. Omni 1-11 Witness: T. Hansen/D. Vaughan

REQUEST:

Has the company considered whether to include in the final (or pre-final) design other elements, such as location of any future storage and other facilities, the need for model calibration by flow testing, assessment of well pump station flow meter accuracy, consideration of equipment to better monitor and record water hammer incidents, etc.?

RESPONSE:

Yes, the Company plans to include design of other elements including a tank if a suitable site can be identified. The station flow meter is regularly calibrated. We are not planning to do flow testing for model calibration at this time.

NH Brown Law

Environmental Law ▪ Utility Law

Marcia A. Brown
Attorney at Law

March 4, 2019

Christopher Tuomala
N.H. Public Utilities Commission
21 South Fruit Street, Suite 10
Concord, NH 03301

Re: DW 17-165 Abenaki Water Company, Inc. – Rosebrook Water Company
Step II Data Responses, Set 2

Dear Attorney Tuomala:

Attached please find Rosebrook Water Company, Inc's responses to Staff's data requests. If you have any questions, please do not hesitate to contact me. The Company will also be prepared to discuss any questions Staff has regarding these responses and this issue at the technical session scheduled for March 20, 2019.

Very Truly Yours,

Marcia A Brown

Marcia A. Brown

cc: DW 17-165 Discovery-Related Service List

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Staff 2-1 Witness: T. Hansen/D. Vaughan

REQUEST: System Assessment and Design

Is the Company aware that N.H. Code Admin. Rules Env-Dw 504.09 require storage tanks to be inspected at a minimum of every five years? An inspection of the tank condition should be performed in 2019, prior to finalizing the basis of design. Please provide an estimate of what anticipated inspection costs should be included if necessary, unless the design recommendation is to replace the tank.

RESPONSE:

The Company is aware of the requirement for a tank inspection every 5 years and estimates the cost to perform the service to be about $5,000. The Company will have this work done independently of the Horizons Engineering Project, but report the findings to them for consideration in the design. The Company expects to have the inspection done when snow disappears and ground conditions are such that vehicles and necessary equipment can reasonable access the tank.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Staff 2-2 Witness: Stephen St. Cyr

REQUEST: System Assessment and Design

The Drinking Water and Groundwater Trust Fund is a source of funding for water systems. Systems have been encouraged to come to the Trust Fund Advisory Commission as a final step in the funding process. Leveraged funding sources from the water system and developers, and supporting economic growth appear to be valuable precursors to receiving Trust Fund allocations. How will potential funding sources and interest rates impact the increase in customer rates?

RESPONSE:

Since the Company has yet to finalize its projected costs of the pressure reduction project (and any other related projects), and has yet to finalize the financing, the Company has not determined how the potential funding sources and interest rates will impact the increase in customer rates. Also, the Company has yet to finalize the number phases, the costs / financing related to each phase, but does anticipate phasing-in the rate increases.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Staff 2-3 Witness: T. Hansen/D. Vaughan

REQUEST: System Assessment and Design
A system Sanitary Survey is scheduled to be performed this year by the NHDES. The survey should be scheduled early enough for Horizons to incorporate any recommendations or deficiencies into the design. Will the budget estimate provide a contingency if an unrelated deficiency of significant cost is identified by NHDES?

RESPONSE:

If the sanitary survey identifies recommendations or deficiencies, the Company will perform the needed work. It is likely that the work will be completed independently of the pressure reduction project as it may affect the Company's day to day operations. But it is possible that certain improvements could also be included in Horizon's scope of services. If so, the Horizon's agreement will be adjusted accordingly.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Staff 2-4 Witness: T. Hansen/D. Vaughan

REQUEST: System Assessment and Design
Horizons indicated the production wells are not equipped with level transducers, but there are concerns raised in regard to air in the distribution system as a potential cause of water hammer. Why have well level transducers not been installed to date, to monitor pump intake and well drawdown levels?

RESPONSE:

The Company to date has had no reason to believe the wells have been over pumped nor that air has been introduced into the system. That said, and rather than do work subject to modification, the Company plans to incorporate transducers into the redesign of the wells 1 and 2 pumping systems.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Staff Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Staff 2-5 Witness: T. Hansen/D. Vaughan

REQUEST: System Assessment and Design:

What recommendations in the 2010 Horizons Engineering Report have been incorporated into the current distribution system and what remaining recommendations are anticipated to be addressed in the design?

RESPONSE:

The recommendations in the above referenced report are largely under section 6.0, MISCELLANEOUS IMPROVEMENTS and their status is as indicated below:

- Replacement of the corroded elbow inside the Rosebrook pump house
  - Status – The elbow in question has been replaced. Please refer to the second bullet point, 1st page, of Responses pursuant to DW 17-165, Order No 26,205, regarding Rosebrook pressure problem. Under separate cover letter to the commission, dated January 7, 2019.
- Replacement of failed valve (believed to be 16") adjacent to Route 302 that allows isolation of portions of the water system to the east of Route 302.
  - Status – This valve has not been replaced.
- Installation of a backup generator at the Rosebrook pump house.
  - Status – Installed
- Installation of power to the Rosebrook water tank to reduce lost signal errors with the tank level monitor.
  - Status – Installed
- Installation of automated low water cutoffs in each of the two pumping wells.
  - Status – Not Installed

Replacement of existing failed, as well as installation of strategically located new valves, will be incorporated into the Horizons design.

NH Brown Law

Environmental Law ▪ Utility Law

Marcia A. Brown
Attorney at Law

March 4, 2019

Thomas B. Getz
McLane Middleton
11 South Main Street, Suite 500
Concord, NH 03301

Re: DW 17-165 Abenaki Water Company, Inc. – Rosebrook Water Company
Step II Data Responses, Set 2

Dear Attorney Getz:

Attached please find Rosebrook Water Company, Inc's responses to Omni Mount Washington, LLC's data requests. If you have any questions, please do not hesitate to contact me. The Company will also be prepared to discuss any questions Omni has regarding these responses and this issue at the technical session scheduled for March 20, 2019.

Very Truly Yours,

Marcia A Brown

Marcia A. Brown

cc: DW 17-165 Discovery-Related Service List

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-1 Witness: T. Hansen/D. Vaughan

REQUEST:

What would the company consider a reasonable pressure range design goal to provide customers under the anticipated system conversion? For those customers accustomed to higher pressure, would 50 to 100 psi be a reasonable goal?

RESPONSE:

The Company considers 50 to 100 psi a reasonable and responsible range of water pressures. However, depending on the final design and location of proposed pump stations, that range may be somewhat modified.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-2 Witness: T. Hansen/D. Vaughan

REQUEST:

Is a map of the system (with building locations) available with more complete topo than is included in the Horizons 2016 and 2017 reports? If so, please provide.

RESPONSE:

No. The system map included in the Horizons reports are the most complete topo maps showing the system and buildings.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-3 Witness: T. Hansen/D. Vaughan

REQUEST:

Have there been any written communications to or from NHDES before or after the January 26, 2017 letter to the company? If so, please provide.

RESPONSE:

Other than routine correspondence during the course of operations, the Company has attached a letter dated April 12, 2017, Attachment Omni 2-3, DES letter 4.12.17. This is to the extent of the Company's knowledge during its ownership. All items contained in the aforementioned letter will be thoroughly evaluated in Horizons design phase.

DW 17-165 - Pressure Reduction
Attachment Omni 2-3

The State of New Hampshire
Department of Environmental Services

Clark B. Freise, Assistant Commissioner

April 12, 2017

Mark J. Nance, P.E.
Horizons Engineering
34 School Street
Littleton, NH 03561

Subject: Rosebrook Water Company PWS 0382010
Pressure Reduction Project
Design Review #170093

Dear Mr. Nance:

The Department of Environmental Services (DES) is in receipt of your report on the proposed alternatives for the pressure reduction project for the Rosewood Water System. It is unclear from the report how the project affects the other two systems mentioned, PWS 0388010 and PWS 0381020, if at all. I have the following comments after a review of the report, which should be addressed prior to or included with the final design:

1. The Recommended Standards for Water Works requires at least two pumping units with the remaining pump(s) with the capacity to supply the peak demand against the required system pressure. At a minimum, each pump should be able meet maximum day demand, calculated to be 311.6 gpm in the report. The future demand should also be considered when sizing the pumps.
2. The report mentions unaccounted-for-water (UAW) due to mismatched meter readings and master meter, but does not mention any specific value associated with UAW. This amount of water should be analyzed prior to making a final determination on pump sizes. If a leak detection program is warranted, DES offers a grant program that could be used. Water loss due to leaks should not only be considered a loss in revenue, but in increase in system operational costs, i.e. pumping costs, and in this case an increase in capital costs to purchase larger pumps which may not be necessary. A continual elevated pressure in the system in recent years has a significant impact on the probability of water main leaks.
3. Sufficient data should be collected on the existing pumping capacity prior to final design. The data presented in the report is incomplete.
4. The minimum fire flow for the Mount Washington Hotel should be calculated based on the State Insurance Services Office, Guide for Determination of Needed Fire Flow. This is for compliance with the Recommended Standards for Water Works.

We commend the water system for taking on this important project and look forward to reviewing design plans of the selected alternative. In the meantime, please let us know if you have any questions.

Sincerely,

Randal A. Suozzo, P.E.
Drinking Water and Groundwater Bureau

ec: Jon Warzocha, P.G., Horizons Engineering
Tom Hanson, New England Service Company
Alex Cranshaw, Abenaki Water Company
Don Vaughan, Abenaki Water Company

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-4 Witness: T. Hansen/D. Vaughan

REQUEST:

The response to Omni 1-4 a) indicates "A preliminary version [of the 2016 Horizons report] discussed a tank but this discussion was eliminated from the final." Please indicate why a new tank was not further considered or evaluated at that time.

RESPONSE:

The tank was not fully considered at that time as the Company believed it was premature and wanted to focus on modifying the system with the facilities in place at that time.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-5 Witness: T. Hansen/D. Vaughan

REQUEST:

Regarding the response to Staff 1-4:

a) Would the company agree the roof membrane was replaced in 2012 (not 2015) and that the underlying supports (beams, joists, decking) remain original to the tank (see, for example, top of p. 2 in Horizons 2016 report)?
b) Does the company have a copy of the November 23, 2010 Water Storage Tank Inspection Report by Stewart Structural Engineering and Horizons?
c) Has a full internal inspection been done of the tank concrete itself for cracking or other deficiencies?
d) Does the tank have a foundation drain with a visible outlet?
e) Has a leak test been done, for example, at night with the tank offline (and VFD well pump supplying the system)?
f) Is the 16-inch gate valve at the tank operable?
g) If the existing tank is kept in service, would the company consider installing a perimeter fence to keep large animals off the EPDM (HDPE?) membrane cover?
h) Has the heavily rusted framing around the access hatches been repaired or replaced?
i) Has the rusted vent pipe been repaired or replaced?
j) Does the company have an estimate of the tank's remaining life?

RESPONSE:

a) Yes.
b) No, the Company has not been able to locate a copy of the report.
c) A full internal inspection has not been performed since acquisition of the system.
d) The Company does not know the conditions of the foundation drain or if one exists.
e) No leak testing has been performed since acquisition.
f) Yes, the 16" valve is operable.
g) Yes, the Company would consider installing a fence to secure the site as long as it does not interfere with resort operations.
h) No hatch repairs have been made since acquisition.
i) No vent pipe repairs have been made since acquisition.
j) No, the Company does not have an estimate of the tank's remaining life.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-6 Witness: T. Hansen/D. Vaughan

REQUEST:

The response to Omni 1-3 d) states a "tank study and evaluation will be done before any decision is made on a new tank." Similarly, the response to Staff 1-6 indicates that a "separate step in the design contract with Horizons is to identify and evaluate alternative locations for a new tank." This step does not appear in the September 18, 2018 'Agreement for Engineering Services' with Horizons. Please explain. If a separate or revised agreement exists, please provide.

RESPONSE:

The tank evaluation will be performed under a separate contract, not yet developed. Horizons will need to identify tank locations under their contract in order to complete design task 5. Please refer to Horizons proposal of September 18, 2018, page 3 of 8.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-7 Witness: T. Hansen/D. Vaughan

REQUEST:
The September 18, 2018 'Agreement for Engineering Services' with Horizons indicates on pp. 1-2 that "Horizons will prepare a basis of design for the proposed improvements. This basis of design will be submitted to the State of New Hampshire Department of Environmental Services (NHDES) for review and approval prior to proceeding with final design of the individual system components." The Agreement itself incorporates both steps (basis of design and final design, with the latter including preparation of final plans and specifications). The responses to Omni 1-1 (3rd and 4th paras. from end) and Staff 1-7 appear to confirm completion of both steps in Step II. In this regard:

a) Please indicate which of the two steps (basis of design, final design) the company hopes to complete by Sep 30, 2019.
b) If the answer to the above is 'both', please indicate the time by which it anticipates completion of the Basis of Design Report (Agreement Scope of Services Item 1).
c) Has Horizons already begun work on the Basis of Design Report?
d) Does the company interpret the 140 days at the bottom of p. 4 of the Agreement to begin at the same point as the preceding 65 day period, or at completion of the 65 days?
e) Will the Basis of Design Report clearly spell out all reasonable alternatives for pressure reduction and system storage including relative costs, phasing and other pros and cons?
f) If the answer to the previous question is 'no' for reasons involving cost, how much additional cost would be required to include those items?

RESPONSE:
a) The basis of design report is scheduled for completion within 65 days of execution of the design services agreement. Both the report and final design are expected to be completed by 9/30/19.
b) Design scope items 2 through 9 are scheduled for completion within 140 days. See a).
c) No, Horizons has completed some preliminary work but has not started on any tasks included in the engineering agreement.
d) The schedule for completion of all scope items is 140 days from execution of the agreement and expected to start concurrently.
e) No, the basis of design report is not an alternatives analysis. It will present the design criteria and preliminary design of the pump stations and water main improvements to the NH DES. It will also identify a possible future tank location. It will include updated cost estimates for construction including phasing and other requirements.
f) The Company will review the need for additional effort related to design and amend the agreement accordingly.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-8 Witness: T. Hansen/D. Vaughan

REQUEST:

Regarding the response to Staff 1-5, will the Basis of Design Report also evaluate potential or proposed development at higher elevations?

RESPONSE:

Yes, the design will factor in the potential development at higher elevations.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-9 Witness: T. Hansen/D. Vaughan

REQUEST:

In response to Omni 1-5, the Company says:

a) It "has no reason to believe that well supplies are at the cause of the pressure surges or that they are being over pumped, the suggestion being that air has been introduced into the system." Please explain the basis for the Company's belief and describe what investigation, if any, helps form the basis for that belief?

b) "[W]ater at excessive pressure in a dynamic state has high potential to cause water hammer due to abrupt demand variations in the distribution system." Please explain what is meant by "high potential" and what would constitute an "abrupt demand variation" on the Rosebrook system. Also, are there other potential causes for water hammer, such as, equipment malfunction, operational error, or lack of maintenance?

RESPONSE:

a) The Company has seen no indication of air in the system.

b) "High potential" means that excessive pressure in a dynamic state is a likely cause of water hammer. An "abrupt demand variation" would be, for example, sudden valve closures. Yes, there are other potential causes.

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ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-10 Witness: T. Hansen/D. Vaughan

REQUEST:

Has the cost of, for example, running a water main to connect two high service areas been compared to the cost of eliminating the need for a second booster station?

RESPONSE:

The cost of running a water main to connect two high service areas has not specifically been developed as an option to eliminate one station. The stations were envisioned as part of a preliminary design step and their proposed locations did not suggest that such an interconnection would be cost effective. However, this will be revisited under the design step.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-11 Witness: T. Hansen/D. Vaughan

REQUEST:

What is the approximate installed cost per foot in the Bretton Woods area for:

a) 16-inch main.
b) 8-inch main.

RESPONSE:

a) A 16 – inch main, with a reasonable allowance for ledge removal, site restoration, etc., is $200/lf
b) An 8-inch main, with a reasonable allowance for ledge removal, site restoration, etc. $180/lf

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-12 Witness: T. Hansen/D. Vaughan

REQUEST:

In light of the discussion of fire flow requirements in the 2017 Horizons report, Att. 2, p. 5, first full para. at top:

a) What is the basis for an approximate 250 gpm fire flow from the proposed booster stations?
b) Has the Twin Mountain Fire Department provided any input regarding fire flow requirements in the proposed high service districts?
c) What percent of individual residential units in the Bretton Woods development are sprinklered?

RESPONSE:

a) The fire flow requirement of 250 gpm is a minimum flow requirement at peak demand. The Company believes it is a reasonable fire flow requirement. Higher flows can be achieved with bigger pumps. This can be considered during the design phase. The stations also have dual hydrants to allow firefighting equipment to pump around the station
b) No, the Twin Lakes Fire Department has not provided any input regarding required fire flows
c) The Company does not know if individual units are sprinklered.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-13 Witness: T. Hansen/D. Vaughan

REQUEST:

A core requirement of a pressure reduction effort is that it be compatible with existing fire protection sprinkler systems (see, for example, 2016 Horizons report, p. 4, 2nd full para.: "The effect of reduced system pressures should be evaluated to ensure that adequate sprinkler flows are maintained."). In regard to the response to Staff 1-1:

a) Does not the impact of a 34 psi fire flow residual suggest the current proposal is incompatible with the hotel's sprinkler system without further improvements to the water system?
b) Would not a higher fire flow yielding an even lower (20 psi) residual (for example, from simultaneous use of an external hydrant for a fire involving both building interior and exterior) allow the Hotel's sprinkler system to protect even fewer floors?

RESPONSE:

a) The Company does not know that the proposed fire flow is "incompatible". Sprinkler flow tests must be run and reviewed by underwriters.
b) Yes, but that possibility exists now. Most water systems do not provide pressure in excess of 100 psi so it should be a familiar situation for the fire protection consultant to make the analysis.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-14 Witness: T. Hansen/D. Vaughan

REQUEST:

The response to Omni 1-1, first page at bottom, references the company having evaluated hydrant functionality in the system. In this regard:

a) Please describe the results of this evaluation and any corrective actions taken.
b) Does the company believe the current number, type and operability of hydrants is adequate? Please explain.

RESPONSE:

a) The Company satisfactorily operated all hydrants during the fall 2018 flushing program.
b) Yes. However, additional hydrants could be added to enhance fire protection.

DW 17-165
ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-15 Witness: T. Hansen/D. Vaughan

REQUEST:

The Horizons 2010 Pressure Surge Assessment indicates concerns that well #2 could be drawn down below the pump intake, resulting in cavitation and introduction of air into the system (see p. 2 at top, p. 3 in middle, p. 9 at top, p. 12 at top). There are reports that well #1 has had to be throttled back in the past to avoid similar problems, and that flushing air out of the mains is the current short term cure for Bretton Arms sprinkler system alarms. There are concerns that water hammer remains a significant system liability (with spikes of 100 psi or more above baseline pressure reported); that reducing overall system pressure alone, while having some benefit by reducing the starting or baseline pressure, may under certain circumstances otherwise have no effect on the frequency of spikes or their amplitude above that baseline pressure; that system-wide pressure reduction will not occur for at least several more years as currently proposed; and that in general the company may not be giving adequate acknowledgment, weight, or priority to the issues of water hammer, potential well over-pumping and air in the system (see, for example, response to Omni 1-5). In this regard:

a) Please indicate any changes to the well #2 pump or controls since 2010 that would lessen the potential for over-pumping.
b) Please describe all investigation done by the company to date regarding the issues of water hammer, air in the system and potential over-pumping of wells, including prior to system acquisition.
c) Please list all pre-Abenaki operators of the Rosebrook system the company has interviewed regarding past operational issues and problems.
d) Is the company willing to consider implementing items that could affect water hammer, over-pumping and system air, such as the following (Please respond individually to each item. These are presumed to be in addition to efforts the company has already agreed to undertake such as the installation of hydrants, manual blowoffs or air reliefs at high points (Omni 1-5 a)) and a well assessment (Omni 1-5 b)):
    1) Automated low water cutoff in each well (identified as an 'additional needed improvement' on p. 13 of the Pressure Surge report, with a 2010 cost of $6,000 each as shown on the first page of Appendix B);
    2) Key water main extensions specifically related by the Pressure Surge report to water hammer (16-inch Fairway Village to Bretton Arms main, 16-inch Fairway Village to Mount Washington Hotel main - see top of p. 10; see App B pp. 3-4 for 2010 cost estimates);
    3) Pressure relief valve at Bretton Arms (3rd para. on p. 9 of Pressure Surge report; App B p. 2 indicates a 2010 cost of $14,000).

RESPONSE:

The Company has given priority to the issue of water hammer and the overall pressure reduction project is intended to address this problem. The Company has no evidence of air in the system that would account for the water hammer and no evidence that the wells are being over pumped. The high system pressure is the major issue both from the perspective of water hammer and the perspective of safe operation of the system.

a) Since acquisition of the system in 2016, the Company has not made any changes to the well No. 2 pump or controls.
b) The Company has not further investigated for presence of air in the system or over pumping of the wells based on the stated reasons in the above paragraph.
c) The pre-Abenaki operator of the Rosebrook system was Nancy Oleson. She did not provide any further insight into the water hammer problem.
d) Items that could affect water hammer:
    1) Yes, the Company will install low water cutoffs in each well.
    2) Yes, the water main extensions identified in the Pressure Surge report will be installed in accordance with the final design by Horizons.
    3) No, the Bretton Arms relief valve will not be installed by the Company.

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Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-16 Witness: T. Hansen/D. Vaughan

REQUEST:

The 2010 Pressure Surge report indicated well yield testing at that time was inhibited by the absence of stilling tubes in the wells (see pp. 11-12). The Horizons Sep 18, 2018 'Agreement for Engineering Services' Scope of Services Item 3 "assumes the Client will install stilling tubes in each of the two wells to allow installation of 1" diameter data loggers if such tubes are not already present." Is it the company's intent to install stilling tubes in both wells prior to the well assessment if they are not present?

RESPONSE:

Yes, the Company will install the stilling tubes as required to facilitate the installation of data loggers in both wells,

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Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-17 Witness: T. Hansen/D. Vaughan

REQUEST:

Concerning analysis of the need for potential water main upgrades, the response to Omni 1-8 b) states "Certainly the Company is willing to provide further analysis within the project scope as appropriate." The response to Staff 1-2 appears to indicate water main upgrades won't be known until final plans and specifications have been produced (i.e., at completion of final design). The response to Omni 1-10 appears to say determination of the size of a larger main in Base Station Road may not occur until the construction phase of the project. Please indicate the extent to which specific water main upgrades may be considered in the Basis of Design Report.

RESPONSE:

The engineering agreement includes the design of the Mt. Adams Lane water main extension. No other water main extensions are included. However, it is likely that additional improvements will become evident during the design and, to the extent that they need to be incorporated into the construction project, they will be included in the final design. Any and all water main improvements necessary to affect the pressure reduction project will be incorporated in the final design.

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ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-18 Witness: T. Hansen/D. Vaughan

REQUEST:

Regarding the response to Omni 1-7, please indicate:

a) How the company will determine which main extensions or upgrades are essential to the pressure reduction project.
b) When the company will determine which main extensions or upgrades are essential to the pressure reduction project.

RESPONSE:

a) Water main extensions or upgrades essential to the pressure reduction project will be identified in the basis of design report which will be provided by Horizons.
b) See a)

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ABENAKI WATER COMPANY, INC. – ROSEBROOK WATER SYSTEM
Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-19 Witness: T. Hansen/D. Vaughan

REQUEST:

The responses to Staff 1-2 and Staff 1-3 appear to indicate an assessment of system valve needs will be part of the design phase and as such be included in the Basis of Design Report. However, the response to Omni 1-6 a) appears to say such an analysis will only be done internally by the Company. Please clarify or explain.

RESPONSE:

System valve needs essential to the development of the pressure reduction project will be included in the basis of design report. Other valve needs, such as repair and replacement of inoperable or missing valves, will be identified by the Company as part of its ongoing operations. It may be possible to include some of these in the design of the project. Otherwise, they will be addressed under other maintenance and improvement operations.

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Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No: Omni 2-20 Witness: T. Hansen/D. Vaughan

REQUEST:

Does the company own a valve exerciser? If so, please indicate type and where it is normally located.

RESPONSE:

No.

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Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-21 Witness: T. Hansen/D. Vaughan

REQUEST:
Horizons reports reiterate the need for hydrant flow testing in conjunction with hydraulic modeling as indicated below:

> 2016 Report pp. 3-4: "This estimate is based simply on relative elevations and static pressure conditions and would need to be confirmed with flow testing and hydraulic modeling."
>
> 2016 Report p. 4: "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."
>
> 2016 Report p. 7: "Determine allowable system pressure reduction through hydrant testing and hydraulic modeling."
>
> 2017 Report Att. 2 p. 4: "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."

However, the company has provided the following responses regarding hydrant flow testing:

> Staff 1-1: "No flow testing was performed."
>
> Omni 1-11: "We are not planning to do flow testing for model calibration at this time."
>
> Omni 1-10: "… the Company will be running a second hydraulic model upon completion of the project."

Please provide further explanation of the company's intentions and reasoning regarding hydrant flow testing.

RESPONSE:
The Company agrees that testing and subsequent calibration of the hydraulic model is an important task. Therefore, the Company will require "C" factor testing and flow testing as a preliminary step in the design. Horizons will then be able to confirm or revise the recommendations of the hydraulic modeling report. A supplemental memorandum describing this effort will be included in the basis of design report. The design agreement with Horizons will be revised accordingly.

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Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-22 Witness: Pauline Doucette

REQUEST:

Please list the individual Rosebrook system operators employed by Abenaki from time of acquisition to present, including dates of service, where based, whether full or part time, and the number of other systems operated by that individual along with the Rosebrook system.

RESPONSE:

All operators are employed by New England Service Company

Employee	Dates of Service	Location	Full Time	Other Systems Operated
Nancy Oleson	10/16-2/18	Rosebrook	FT	2-Wastewater Systems
Alex Crawshaw	10/16-7/18	Gilford	FT	2 Abenaki Systems & other contracted Systems
Kenneth Goode	10/16-5/18	Rosebrook	FT	2-Wastewater Systems
Taylor deOgburn	10/18-Present	Gilford	FT	2 Abenaki Systems & other contracted Systems
Brian McCall	2/18-9/18	Gilford	FT	2 Abenaki Systems & other contracted Systems
Philip Sausville	2/18-Present	Gilford	FT	2 Abenaki Systems & other contracted Systems
Samuel Pitre	7/18-1/19	Rosebrook	FT	None

All individuals based in the Gilford location worked on a coordinated basis to provide daily operating and maintenance tasks to the Rosebrook system.

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Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-23 Witness: T. Hansen/D. Vaughan

REQUEST:

The 2017 Horizons report, Att. 2, p. 4 indicated that a disparity in pump outputs "suggests one or more of the following issues: the pump curve is incorrect, the [well pump station] flow meter is incorrect, or the pressure gauge is incorrect." There was some question during the December 14, 2018 water system tour whether the pump station meter was even working. Larger meters are typically required to be tested annually. The response to Omni 1-11 indicates the "station flow meter is regularly calibrated". In this regard:

a) Please indicate the date of last calibration of the meter.
b) Please indicate the diameter of the pipe the meter is installed in.

RESPONSE:

a) The production meter was calibrated in May 2018.
b) The diameter of the pipe is 12".

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Request for Change in Rates, Step II Scope of Engineering
Omni Mt. Washington Discovery Requests - Set 2

Date Request Received: 2/25/19 Date of Response: 3/4/19
Request No. Omni 2-24 Witness: Pauline Doucette

REQUEST:

Please provide water produced, consumed and unaccounted-for by month, for the most recent 12-month period for which it is available.

RESPONSE:

Please see Attachment Omni 2-14, UAW

DW 17-165 Pressure Reduction
Attachment Omni 2-24

		February-18	March-18	April-18	May-18	June-18	July-18	August-18	September-18	October-18	November-18	December-18	January-19
ROSEBROOK	Production (gals)	4,522,900	4,029,300	2,603,913	3,087,187	3,641,100	3,589,800	4,755,200	3,068,100	3,720,100	2,578,000	4,413,700	4,036,700
	Consumption (gals)	3,631,275	3,428,736	1,927,054	2,289,675	3,041,265	2,980,299	3,593,664	2,854,019	3,081,819	2,335,261	3,762,116	3,460,278
	Trailing 12 Month UAW	9.89%	11.68%	14.91%	19.32%	19.59%	15.35%	16.68%	22.24%	16.60%	16.52%	17.23%	17.39%
	AVG. Daily Prod	112,564	113,436	116,620	117,218	118,378	120,370	121,892	129,915	122,692	120,679	119,930	120,674
	AVG Daily Cons	101,381	102,329	100,310	99,283	100,316	99,561	100,487	101,338	102,323	100,746	99,264	99,686

NH Brown Law

Environmental Law ▪ Utility Law

Marcia A. Brown
Attorney at Law

May 10, 2019

VIA ELECTRONIC DELIVERY

Christopher R. Tuomala, Esq.
N.H. Public Utilities Commission
21 South Fruit Street, Suite 10
Concord, NH 03301

D. Maurice Kreis, Esq.
Office of the Consumer Advocate
21 South Fruit Street, Suite 18
Concord, NH 03301

Thomas B. Getz, Esq.
McLane Middleton, P.A.
11 South Main Street, Suite 500
Concord, NH 03301

Paul Mueller
Bretton Woods Property Owners Association
4 Tiffany Drive
Randolph, MA 02368

Lawrence Devito
Rosebrook Association
250 South St
Tewksbury MA 01876

Paul Luongo

Re: Docket No. DW 17-165
Abenaki-Rosebrook Summary of Discussions with Omni and
Abenaki Request for Concurrence on Scope of Engineering and Phase II

Dear Staff and parties:

This letter is to update Staff and the parties on Abenaki Water Company, Inc.-Rosebrook Water Company, Inc.'s ("Abenaki" or "Company") discussions with Omni Mount Washington, LLC ("Omni") and request your concurrence on moving forward so that we may report to the Commission and proceed with certain phases of Abenaki's proposal and close out this phase of the procedural schedule.

As you know, the Commission approved procedural schedule concerning Abenaki's Step II and concluded with a technical session on March 20, 2019. Since that technical session, Abenaki and Omni have met to discuss resolution of Omni's concerns with Abenaki's engineer's proposal to address the extreme, high pressure within the water system. Those discussions have not produced any changes to Abenaki's goal of reducing system pressure. The discussions have also not changed Omni's position, its objection is largely focused on the storage tank and demonstration that the recommended plan is the most cost-effective approach to the problem. Omni however, is supportive of the Company's plans to apply for grant funds.

Given that it is May and Abenaki's costs for its engineering plans are to be submitted in September and, importantly, that Abenaki not lose this construction season, Abenaki requests, pursuant to section D, paragraph 6 of the settlement agreement, to amend the procedural schedule to allow Staff and the parties to file a recommendation concurring on the scope of its engineering plans, by May 24th.

History of Evaluation

Since acquiring the Rosebrook water system in September 2016, Abenaki has reviewed the system's needs and priorities. These reviews are manifested in the January 7, 2019 compliance report filed by the Company in this docket as well as in Abenaki's responses to Staff 2-1, Tech 1-4 and Supplemental Tech 1-4. The first review (2016) was part of Abenaki's due diligence and Abenaki retained Horizons Engineering, Inc.'s ("Horizons") because of its ready historical understanding of the system. (Horizons had prepared a pressure reduction analyses in 2010 for the prior owner of the water system. See Abenaki's response to Staff 1-6.) Abenaki refined that analysis in 2017 and, most recently in 2018. See Horizons' Analysis and Recommendation Summary, dated September 5, 2018, submitted as Attachment 3 to Abenaki's January 7, 2019 compliance report.

Abenaki's assessment has not been done in isolation. Abenaki has been in regular contact with the New Hampshire Department of Environmental Services ("NHDES") over a number of years. The NHDES has made repeated requests that pressure be addressed, both before and after Abenaki acquired the system. The NHDES supports Abenaki's pressure reduction proposals, in particular, phases II, III, and IV. Abenaki and Horizons considered NHDES's comments in formulating the 2018 Analysis and Recommendation. This correspondence and support have been provided in the September 5, 2018 Horizons report and in response to Omni 2-3.

Plan Going Forward

As discussed in the January compliance report, data responses, and at the March technical session, Abenaki plans to address the high pressure over the course of four phases. The phases are necessary to pace financings and avoid rate shock. Abenaki believes it has addressed the Commission's questions, which were: that Abenaki detail the solutions it considered before contracting with Horizons, the other possible options available to address the water pressure problems, provide the reasoning supporting the construction of the new water tank, and demonstrate that the phases are the best and most cost-effective solutions. Importantly, the NHDES supports Abenaki's solutions and understands that engineering designs must be developed first in order to finalize additional details of the proposal.

Phase I involves completing engineering design of the system improvements (2019). Phase II involves construction of a new transmission main and one booster pump station (2019-2020). This project will reduce the pressure at the well to 100 psi and reduce safety concerns associated with operating the wells at 200 psi.[1]

[1] High pressure at the well pump house is of concern in light of the dangerous pipe break that occurred in 2011. See the Company's pressure reduction presentation filed with the

Phase III involves later construction of two additional pump stations and installation of pressure reduction valves (2021-2022). The phased approach is intended to build upon each other to address the high pressure in an integrated fashion. The Company has agreed to eliminate Phase IV (storage tank) from the current engineering services contract with Horizon's. The need or desire for a new tank can be revisited at some future time. The tank is not essential for the pressure reduction project.

Discussions with Omni

Abenaki and Omni met and corresponded multiple times after March 20th. Notwithstanding those meetings and exchange of information, Omni is not prepared to support Abenaki's proposal. Omni maintains that its questions have not been resolved. Omni is supportive, however, of Abenaki's application to the Drinking Water and Groundwater Trust Fund and will assist in the application, as appropriate.

Abenaki's Position

Abenaki still believes that the phases set forth in the 2018 Horizons report are the best solution to the pressure problem. Action must be taken now. The reality of delaying addressing the high-pressure problem was made real on Easter Sunday, April 21st, when Omni suffered a break in its 8-inch service line. Due to the holiday weekend, Omni urged the Company to delay shutting off the service until Monday when it could effectuate repair of the line. The Company remained on site to monitor the leak and the impact of the leak on its water system until the repair.

This break illustrates how significantly the extreme high pressure compromises the water system and adversely affects customers. At the March technical session, Horizons and NHDES stated that service lines are prone to leaking under high pressure. The pressure within Omni's service line that Sunday was between 180 and 195 psi. This is extremely high considering Puc 604.03 requires normal operating pressures of not less than 30 psi and not more than 100 psi. (For service connections made prior to 1997, pressures are allowed to be between 20 and 125 psi.) . The phases proposed by Abenaki will address the high-pressure problem and, importantly, improve safety, and operations and maintenance.[2]

Abenaki shares Omni's concern that the recommended plan be the most cost effective option. It is Abenaki's plan to collaborate with Omni during the design phase. The Company will pursue any and all opportunities to reduce the overall project cost. The design phase is where we will identify and adopt cost effective options.

Commission on June 20, 2018 as well as its response to Staff 2-1.

[2] The high pressure makes it difficult for Abenaki to conduct regular maintenance. As mentioned at the technical session, high pressure prevents regular exercise of valves and creates water hammer when hydrants are flushed. Many pumps for chemical injections won't operate above 150 psi.

The longer pressure reduction initiatives are delayed, the more Abenaki becomes increasingly concerned about damage liability, proper operation of the system and operator safety. Consequently, Abenaki will seek relief from liability due to high pressure in those parts of the system where pressure remains above 100 psi.

Conclusion

In order to maintain its construction window, Horizons needs to commence its design work now, at a minimum, on the phase II transmission main and booster pump station. Abenaki seeks Staff and the parties' concurrence on phases I and II so that we may advise the Commission and move forward. The Company appreciates Staff and the parties' attention to this very important issue and seeks your reply as soon as possible.

Very Truly Yours,

Marcia A. Brown

Marcia A. Brown

cc: Randal Suozzo, NHDES

Laflamme, Jayson

From: Tuomala, Christopher
Sent: Friday, May 31, 2019 8:26 AM
To: Laflamme, Jayson
Cc: Descoteau, Robyn; Vercellotti, Joseph
Subject: FW: Follow-up Question
Attachments: Reconciliation of Rosebrook (Abenaki Water Co.) Pressure Reduction Initi....docx

FYI – My response from Omni regarding their issues with Abenaki and if they have a proposed engineering solution.

From: Getz, Thomas <Thomas.Getz@MCLANE.com>
Sent: Thursday, May 30, 2019 11:18 AM
To: Tuomala, Christopher <Christopher.Tuomala@puc.nh.gov>
Subject: RE: Follow-up Question

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Chris,

You asked whether Omni, after reviewing Abenaki's high-level engineering proposals, could offer any alternative engineering solutions to the water pressure problem, specifically whether there are any alternatives that Omni is in a position to share with respect to Phases II and III. You also asked whether Omni objects to the possible costs or the proposed solutions themselves.

As you may be aware, Doug Brogan has spent considerable time going over Abenaki's proposals including as part of discovery last year. As a general matter, he agrees that a phased approach to addressing water pressure and other O&M issues pointed out by Chris Ellms makes sense but, because Abenaki's proposals are so high level, and because the phases have been subject to change as you can see from the attachment, neither Doug nor Omni can address the reasonableness of the phases or alternatives to them precisely due to the lack of engineering detail and cost information. As a consequence, Omni could not go along with Abenaki's recent request for concurrence and Omni objects to moving ahead with Step II under the Commission's Order because the costs are unknown and there is no proven solution, just a general approach that might eventually lead to a solution.

At the same time, Omni agrees that the Commission's Order has created constraints in respects that may be irreconcilable. Step II recovery of $100,000 in engineering costs appropriately puts on Abenaki the burden of demonstrating that it has developed the "best and most cost effective solution," which solution it points out will only be apparent when Horizons has prepared the final designs. Thus, Abenaki essentially admits that it does not currently have the information to make its case. Correspondingly, Omni and the other customers have no other recourse than to point out the inadequacy of Abenaki's January 7, 2019 report and subsequent information relative to the Commission's Order. Furthermore, Omni's concerns about Abenaki's plans have been heightened by the implications of Abenaki's recent assertion that it is not responsible for the 8-inch water main that serves the Mount Washington Hotel.

Omni appreciates that Staff is interested in finding a way forward but, unfortunately, at this stage Omni is not in a position to offer an engineering solution. As Omni noted at the last technical session, however, there may be a procedural solution to the impasse. Omni would be open to discussing with Staff, the OCA, Abenaki, and the

other parties, a request that the Commission clarify or amend its order to get over this hurdle in a way that could allow Abenaki to make the best use of engineering dollars contemplated under Step II without subjecting customers to the potential consequences of a premature and unsupported determination that Abenaki has developed the "best and most cost effective solution."

Please let me know if you have any questions or would like to discuss this further.
Thanks
Tom

From: Tuomala, Christopher <Christopher.Tuomala@puc.nh.gov>
Sent: Tuesday, May 21, 2019 11:28 AM
To: Getz, Thomas <Thomas.Getz@MCLANE.com>
Subject: Follow-up Question

CAUTION - EXTERNAL EMAIL

Dear Tom,

Thanks for taking the time to chat earlier.

After mulling it over, I did have some additional engineering questions.

As the subject matter for this "Step II" phase is dictated (or handcuffed) by the Commission's order to specifically address Rosebrook's water pressure problem, Staff would like to know if Omni, after reviewing the high-level engineering proposals from Abenaki, can offer any alternative engineering solutions to the water pressure problem? I understand Omni is hesitant to sign off on any of Abenaki's engineering proposals as the solutions do not have any concrete costs associated. Staff, however, would like to know if Omni specifically objects to the possible costs involved, or to the proposed engineering solutions themselves.

Staff would find it extremely helpful if Omni could offer any alternatives to the water pressure problem that Abenaki has not already offered. Specifically, are there any alternatives to following that Omni is in the position to share:
Phase II – Construction of a new transmission main and one booster pump station.
Phase III – Construction of two additional pump stations and installation of pressure reduction valves.

I appreciate your time and consideration into Staff's request.

Best,
Christopher R. Tuomala
Staff Attorney/Hearings Examiner
New Hampshire Public Utilities Commission
21 South Fruit Street
Concord, NH 03301
(603) 271.6011
Christopher.Tuomala@puc.nh.gov

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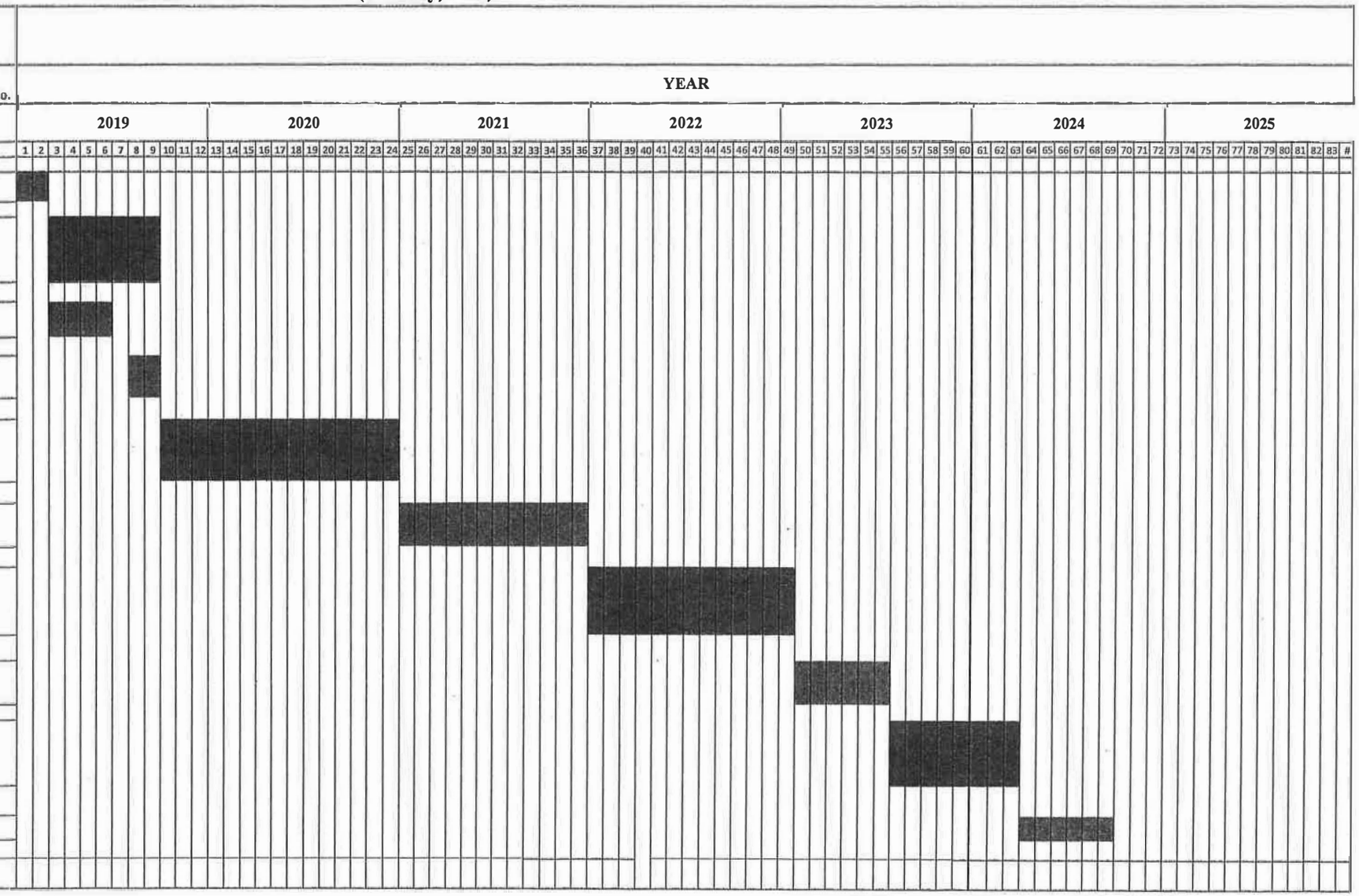
ABENAKI WATER COMPANY

Rosebrook Water System Pressure Reduction Project

Estimated Timeframe of Activities (January, 2019) Revision No. 1

ACTIVITY	Estimated Cost	Project Reference No.
PUC Procedural Schedule		
Phase I - DESIGN including Basis of Design Report and ongoing coordination with DES, OMNI and PUC	$100,000	16-09
Petition to Finance up to $3.0 MM.		
Petition for Recovery of $100,000 (Step 2) Due by 9/30/19		
Phase II -Bidding and construction of Contract 1 including the transmission line and booster pump station No. 1	$1,000,000	
General rate case or step increase recovering $1,000,000		
Phase III - Bidding and construction of Contract 2 including PRVs and two additional pump stations (Nos. 2 and 3)	$1,000,000	
Petition recovering step increase of $1,000,000		
Phase IV - Bidding and construction of Contract No. 3 including new water storage tank	$500,000	
Petition recovering step increase of $500,000		
Total Estimated Project Cost	$2,600,000	



Executive.Director@puc.nh.gov

amanda.noonan@puc.nh.gov

anthony.leone@puc.nh.gov

cellms@omnihotels.com

Christopher.tuomala@puc.nh.gov

david.goyette@puc.nh.gov

donald.kreis@oca.nh.gov

james.brennan@oca.nh.gov

jayson.laflamme@puc.nh.gov

joseph.vercellotti@puc.nh.gov

mab@nhbrownlaw.com

ocalitigation@oca.nh.gov

pdoucette@newenglandservicecompany.com

pluongo@plymouthrock.com

pmueller@comcast.net

pradip.chattopadhyay@oca.nh.gov

Randal.Suozzo@des.nh.gov

robyn.descoteau@puc.nh.gov

rosebrook.president@gmail.com

stacey.burgess@mclane.com

stephenpstcyr@yahoo.com

steve.frink@puc.nh.gov

thomas.getz@mclane.com

viggo.fish@mclane.com