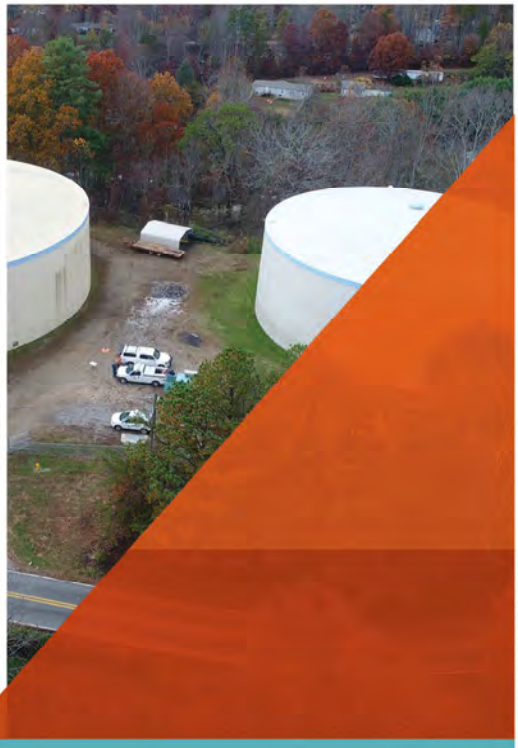










Independent Review Committee

Christmas 2022 Water Outage Incident Action Report

June 6, 2023

City of Asheville

mcgill Shaping Communities Together®

Table of Contents **Page**

Transmittal 1

Abbreviations 2

Executive Summary 3

Section I - Independent Review Committee 7

Section II - Christmas 2022 Water Outage Incident 11

Section III - System Overview Asheville Water Production and Distribution System 13

Section IV- Independent Review Committee – Emergency Response Subcommittee 16

A. Independent Review Committee – Water System/Operations Subcommittee 16

B. Independent Review Committee – Communications Subcommittee 17

C. Independent Review Committee – Emergency Response Subcommittee 18

Appendix I - Independent Review Committee Resolution No. 23-7 19

Appendix II - IRC - Water System/Operations Subcommittee Report IRC - 21

Appendix III - IRC - Communications Subcommittee Report 40

Appendix IV - Emergency Response Subcommittee Report 52

Appendix V - Hazen Hydraulic Modeling Executive Summary – Final May 15, 2023 59

Appendix VI - Hazen Hydraulic Modeling Report – Final May 15, 2023 62

Appendix VII - Hazen Hydraulic Modeling Report Executive Summary – Draft May 10, 2023 98

Appendix VIII - Hazen Hydraulic Modeling Report – Draft May 10, 2023 101

Transmittal

This Action Report is submitted on behalf of the active Independent Review Committee (IRC) members who were appointed by the Asheville City Council and the Buncombe County Board of Commissioners in January and February 2023 in response to the water outage event that occurred over the Christmas Holidays of 2022. This report summarizes the findings of the IRC following almost three (3) months of work. All time and efforts provided by the IRC have been volunteer in nature and at no costs to the City of Asheville, Buncombe County Board of Commissioners or the Asheville Water Resources Department (WRD).

The IRC work has resulted in a number of findings as to the potential cause of the events and how the WRD and City of Asheville responded to the emergency and communicated the event to the water customers and the service area. The IRC recommendations are summarized in the report and the IRC believes that adoption of the recommendations will maximize the prevention of similar disruption to the ability to provide safe drinking water to the customers of the service area, improve emergency response actions and facilitate a communication plan to keep the customers and public clearly informed in the event of a future disruption of water service.

M. Keith Webb, P.E.
McGill Associates, P.A.
55 Broad Street
Asheville, NC. 28802

NC Firm License # C-0459



Abbreviations

AMI	Advanced Metering Infrastructure
CAPE	Communication & Public Engagement Department – City of Asheville
CIP	Capital Improvement Plan
CoA	City of Asheville
COMMS	Communications
EABPS	East Asheville Booster Pump Station
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
gpm	Gallons per minute
ICS	Incident Command System
IRC	Independent Review Committee
MGD	Million Gallons per Day
mph	Miles Per Hour
MRWTP	Mills River Water Treatment Plant
NFWTP	North Fork Water Treatment Plant
SBBPS	South Buncombe Booster Pump Station
SCADA	Supervisory Control and Data Acquisition
TTX	Tabletop Exercises
WDWTP	William DeBruhl Water Treatment Plant (Bee Tree)
WRD	Water Resources Department
WTP	Water Treatment Plant

Executive Summary

This report summarizes the findings and actions of the Independent Review Committee (IRC) over the past three (3) months of research, review, and deliberations. The IRC was appointed by the Asheville City Council and the Buncombe County Board of Commissioners and began work in late February as directed by the City of Asheville.

Section I of the report contains a description of the IRC including the resolution to appoint the committee and the members who have volunteered their time and efforts to provide the findings to complete this report.

Section II contains a brief description of the Christmas Holiday 2022 water outage event.

Section III provides a brief overview of the Asheville Water System, its service area, capacities and customer base.

Section IV summarizes the IRC and describes the three (3) subcommittees formed by the IRC to expedite the work effort. The subcommittees are:

- Water System/Operations
- Communications
- Emergency Response

Each of the subcommittee reports are contained in Appendix II, III and IV.

The recommendation of the subcommittees are as follows:

Water System/Operations Subcommittee

Immediate Recommendations

- Implement a regular large-diameter distribution system valve assessment and operation program.
- Enable Supervisory Control and Data Acquisition (SCADA) control of the [redacted] control valve for full range of flow.
- Enable Supervisory Control and Data Acquisition (SCADA) control of other key distribution system control valves that maybe identified in the future.

Short-Term & Long-Term Recommendations

- Evaluate the existing pumps at the East Asheville Booster Pump Station (EABS), by inspection and with pump tests, for the purpose of producing a EABPS Preliminary Engineering Report (PER), detailing what will be needed to refurbish the EABPS and

return it to useful service for system redundancy during emergency events and future demand.

- Create a function, tool, or program within WRD's SCADA Historian that derives Total Daily Demand at the end of each midnight-to-midnight period. This will allow WRD staff to compare each day's Total Supply Input versus Total Demand.

- Expedite the implementation of AMI throughout the water system.

- Re-evaluate the overall role of the Engineering Division within the WRD. Consideration should be given to adding a Production Engineer position. The goal should be to hire or groom a knowledgeable, experienced Engineer who is engaged in the day-to-day operations and decision-making of the water utility.

- Conduct an overall assessment of how well the WRD has managed the ongoing challenge of knowledge retention. Identify knowledge gaps and develop strategies to address them as quickly as possible.

- At least semi-annually, plan and conduct table-top exercises (TTX's) to enhance the effectiveness of the department's and the community's overall emergency response capabilities.

- Accelerate the installation of additional district or zone meters in the distribution system.

- Consideration should be given to the creation of a Water Utility Advisory Panel. The Panel would be of assistance to the City Manager, City Council and the Mayor in their oversight responsibilities related to the WRD. Done correctly, such a Board could be a tremendous resource for the WRD Leadership, City leadership, community, and the region as a whole.

Communications Subcomittee

- Develop an updated crisis communications plan.

- Replace the "operational approach" to public communications with a system where communication (COMMS) professionals are elevated in importance and can have not just influence, but direct oversight of the crisis communications planning and implementation.

- Hire a Public Information Officer dedicated to the Water Resources Department (WRD).

- Require crisis COMMS training for ALL Communication and Public Engagement Department (CAPE) staff, based on the Incident Command System (ICS) training program, to provide redundancy and ICS shift flexibility.

- Institute the COMMS portion of the ICS under the National Incident Management System (NIMS).

- Require crisis COMMS training for WRD staff and elected officials to ensure everyone is on the same page before the next crisis. NIMS/ICS training and certifications for City staff responsible for crisis COMMS.

- Offer media training for all COMMS-related staff and department leaders.

- Engage regularly with Buncombe County COMMS staff.

- Elevate the importance of the design and implementation of Advanced Metering Infrastructure (AMI) to address the most pressing public communication issues that hampered the operational response.

- Hold off-the-record sit-down sessions with top local media outlets to air grievances and differences that influence the public communication process. While it was clearly stated the press has nothing but respect for their direct liaison, it is clear some issues need to be discussed. These discussions will only help both Asheville and the news media do their jobs on behalf of their citizens and readers.

- Ahead of next winter, COMMS should conduct proactive outreach in November (before Thanksgiving) that lays out all of the lessons learned from this event and the resulting actions taken. Proactive break repair demonstrations, the unveiling of a new outage map, instructions on how to prepare for the winter, and information on how to be best informed during an emergency can all be incorporated into this effort.

Emergency Response Subcommittee

The use of the Incident Command System (ICS) was not implemented as outlined in the National Incident Management System guide, as directed by Homeland Security Presidential Directive five, or as specified in the 2010, City of Asheville Emergency Operations Plan.

- Update both the Emergence Response Plan and Emergency Operations Plan for the City of Asheville. Plan updates and revisions shall include discussions with the Buncombe County Emergency Management director and other applicable parties. Both plans should be updated on the required five-year period as recommended by Federal Guideline.

- Clarify policy as to the establishment of an Incident Command System for similar events.

- Form a joint Incident Management Team to establish minimum training for the EOP and Incident Command staffing.

- Schedule, establish and implement an exercise schedule to include the opening of an Emergency Operations Center (EOC) and Unified Command/Multi Agency Coordination Group Structure to include all affected populations regardless of municipal limits.

- Provide training for elected officials to understand and operate within established parameters during a crisis. A method of communication to keep elected officials informed while meeting general statue requirements should be established.

Section I - Independent Review Committee

The Asheville City Council unanimously voted and passed Resolution No. 23-7 on January 10, 2023, to create an Independent Review Committee (IRC) to focus on reviewing the water outage in order to assess infrastructure needs and the City's response and to determine what actions and steps can be done to maximize prevention and improve response efforts for future similar events. A copy of the approved resolution is included in Appendix I.

The resolution acknowledged the role of the water system and its impact on the community's wellbeing, the impacts the water outage had on City residents, their families and businesses. The IRC was to be a multidisciplinary group and to act independently.

In recognition of the fact that the Asheville water system serves customers who live outside the Asheville City limits the resolution stipulated that the IRC would include appointees by Buncombe County.

The IRC was to be composed of nine (9) members; seven (7) appointed by the City and two (2) appointed by the Buncombe County Commission. The IRC members were to have multidisciplinary backgrounds and was to include the following:

- Two (2) residential water customers.
- One (1) commercial water customer.
- One (1) Emergency Response/Disaster Preparedness professional.
- Two (2) communications professionals.
- Three (3) subject matter experts in public water systems.

The Asheville City Council reviewed a list of candidates who had expressed an interest in serving. At the January 24, 2023, meeting the Asheville City Council appointed the following IRC members:

Committee Member	Title	Company	Representing
John W. McLaughlin, P.E.	Director Of Internal Development	Highfill Infrastructure Engineering	Public Water Supply Expert
Ted B. Tyree, P.E	Engineer	Knoxville Utilities Board	Public Water Supply Expert
Michael L. Holcombe, Sr.	Former Director (Retired)	City of Asheville – Water Resources Department	Public Water Supply Expert
Mike McGill	President	WaterPIO	Communications

Rob Brisley	Public Affairs Specialist	North Carolina Incident Management Team	Communications
Michele Ashley	Owner	Coeur Consulting LLC	Residential Representative
Carolyn Roy	Owner	Biscuit Head Restaurants	Commercial Representative

At the same meeting the City Council approved the services of an independent facilitator and professional to prepare the final report. These two positions were approved as follows:

Name	Company	Role
Kelley O'Brien	Owner KTO Strategy and Communications, Professor of Practice, Kenan-Flagler Business School, Adjunct UNC School of Government instructor	Independent Facilitator
Keith Webb, P.E.	McGill Associates – Vice President	Report Writer

The Buncombe County Commission appointed their two IRC representatives at the February 7, 2023, meeting. Those appointed were:

Committee Member	**Title**	**Company**	**Representing**
Dennis Fagnant, Jr.	Fire Chief	West Buncombe County Fire Department	Emergency Response Professional
Kim "Dirt" Murphy	Co-Owner/Farm Manager	Rainbow Path Wellness, LLC	Residential Representative

The resolution described the following scope of work for the IRC:

- Review the water outage and provide a comprehensive account of the event.
- Perform an assessment of the City's operational efforts.
- Perform an assessment of the City's communications efforts.
- Perform an assessment of the City's emergency response efforts.

- Perform an analysis of needed infrastructure changes and upgrades.
- Perform an analysis of needed communications policy changes and modifications.
- Perform an analysis of the Emergency Response plan and recommended changes.

The Asheville City Council requested that the IRC provide an update 30 days after project kick-off, and a final report by the end of May 2023. This deadline for the final report was later extended to June 6, 2023.

The IRC held a kick-off meeting on February 20, 2023. The scope of work and efforts required by the IRC were discussed along with the responsibility of each IRC member. To facilitate the work and make the IRC more efficient the decision was made to form three (3) subcommittees to accomplish the scope of work. All members were allowed to participate in more than one subcommittee if so desired. The three (3) subcommittees were:

Water System/Operations		
Ted B. Tyree, P.E	Knoxville Utilities Board - Engineer	Co-Chair
John W. McLaughlin, P.E.	Highfill Infrastructure – Director Internal Development	Co-Chair
Michael L. Holcombe, Sr.	Retired – City of Asheville – Water Resources Department	Co-Chair
Mike McGill	WaterPIO - President	
Carolyn Roy	Biscuit Head Restaurant - Owner	
Kim “Dirt” Murphy	Rainbow Path Wellness, LLC - Co-Owner/Farm Manager	
Michele Ashley *	Resident – Water Customer	
Keith Webb, P.E.	McGill Associates - Engineer	

* Participated in the February kick-off and signed up for subcommittees but unable to participate in subsequent subcommittee or committee meetings, including report review.

Communications		
Mike McGill	WaterPIO - President	Co-Chair
Rob Brisley	North Carolina Incident Management Team	Co-Chair
Kim “Dirt” Murphy	Rainbow Path Wellness, LLC - Co-Owner/Farm Manager	
Michele Ashley *	Resident – Water Customer	

* Participated in the February kick-off and signed up for subcommittees but unable to participate in subsequent subcommittee or committee meetings, including report review.

Emergency Response		
Dennis Fagnant, Jr.	West Buncombe Fire Department - Chief	Chair
Rob Brisley	North Carolina Incident Management Team	
Kim “Dirt” Murphy	Rainbow Path Wellness, LLC - Co-Owner/Farm Manager	
Mike McGill	WaterPIO - President	

Each of the subcommittee tasks and actions are summarized in the following sections. The full subcommittee report for each is included in Appendix II, III, and IV.

As requested by the Asheville City Council an update of the IRC work was presented to the Asheville City Council on March 28, 2023.

Section II - Christmas 2022 Water Outage Incident

Over the Christmas Holiday of 2022, the City of Asheville experienced a major disruption of water service to a large number of system customers. Water outages were the result of an extended period of low temperature, which began on December 23, 2022, and continued through December 26, 2022, before temperatures rose to above 33^0 F. These cold temperatures and the extreme weather event resulted in a number of system breaks, which increased system demands and requirement to take one of the three (3) water production facilities (WTP) offline for several days due to the inability of that facility (WTP) to meet safe drinking water standards.

On Friday December 23, 2022, the temperature in Asheville was 40^0 F at 4:00 a.m. As the cold weather front moved into the Asheville region temperatures began plummeting and reached 14^0 F by noon and continuing to fall before reaching 3^0 F at 12:00 a.m. on Saturday, December 24, 2022. Temperatures reached 0^0 F by 4:00 a.m. on the 24th and stayed there for approximately 5 to 6 hours, Temperatures then rose to 23^0 F on the 24th during the day. Over the 81-hour period beginning on December 23, 2022, temperatures remained below freezing. Temperatures finally rose above freezing (32^0 F) on Monday, December 26, 2022. While these low temperatures were not record-setting, the plunge in temperature to 0^0 F was the coldest since January 2014.

These freezing temperatures were combined with windy conditions with wind speeds of 15 to 20 mph, which made the impact of the freezing temperatures worse.

The freezing temperatures created a number of water line breaks that began on December 24, 2022. Over the next several days the City would experience and repair a total of 27 water line breaks, many on larger distribution system lines. Added to these system line breaks were numerous water line breaks on the customer side of the meter. The line breaks combined with customers allowing water to run at their faucets to prevent water line freezing resulted in higher than normal demands.

On December 24, 2022, the 7.50 MGD Mills River Water Treatment Plant began to experience problems and was unable to meet required water quality standards. The main cause of this event was frozen chemical feed lines that reduced the effectiveness of the coagulation/sedimentation process prior to filtration. To protect water quality for all system customers, the Mills River WTP was taken offline on December 24, 2022. This action required that all water for the South Buncombe storage tank area be supplied from the North Fork and William DeBruhl (Bee Tree) WTPs. The Mills River WTP remained out of service until December 28, 2022.

In response to the Mills River facility being taken off-line, water production at the NF and WD plants was increased. These two plants have a combined capacity of 36 MGD and are gravity-fed inputs to the water distribution system. The increases in system demand typically can be met from the North Fork and DeBruhl WTP. However, the total supply of water entering the system from the two plants was insufficient to maintain full service in the southern portion and parts of the western portion of the system as a result of the number of system breaks. Key water storage tanks were depleted, and by Monday, December 26, 2022, thousands of customers had no potable water, creating a public health hazard.

The increased system demands resulted in depletion for storage volume in many of the system tanks, most notably the three main storage tanks which provide storage for the main pressure zone,

South Buncombe (5.0 million gallon) and the two Candler Knob tanks (5.0 million gallons and 3.0 million gallons). These main storage tanks supply water for pumping stations that fill the storage tanks serving customers at higher elevations and above the standard pressure zone.

The disruption of water service and the ensuing outages disrupted the lives of many of the system's residential, commercial, industrial and institutional customers. To protect public health a Boil Water Order was put in place for the customers within the western part of the distribution system.

Crews worked tirelessly to restore service to all customers of the system and continued to identify and repair water line breaks, monitor and adjust system valves to allow the storage tanks to refill. A large portable pump was put in place on December 30, 2022, to increase system flows to the Candler Knob tanks. Finally on January 4, 2023, all storage tanks were refilled, all three (3) WTPS were on-line and operating at capacity needed to meet system demands and full service to all customers was restored. The Boil Water Notice was lifted on January 4, 2023.

In response to the Mills River WTP facility being taken off-line, water production at the NF and WD plants was increased. Given that those two plants are gravity-fed inputs to the water system, increases in system demand should have resulted in an increased supply of finished water flowing into the system, which it did. However, the total supply of water entering the system from the two plants was insufficient to maintain full service in the southern portion and parts of the western portion of the system.

At approximately 7:00 p.m., on Monday, December 26, 2022, the decision was made to isolate most of the southern part of the water system in order to maintain pressure and service in the remaining portions. This increased the number of customers who lost water service. Parts of the western portion of the system were next affected, as numerous service outages were reported.

During the event, WRD crews responded to repair a total of 27 main breaks/leaks throughout the system. In addition, there were many confirmed leaks/breaks on private property caused by the frigid weather. All of the leakage, combined with increased customer consumption, resulted in a sharp increase in Total System Demand to levels not previously experienced on Asheville's water system.

The Mills River facility was brought back on-line on Wednesday, December 28, 2022. The plant was off-line and not producing water for a total of 104 hours, or a little over four (4) days. Production at the Mills River plant ramped up slowly and the southern portion of the system began to gradually restore service. With all three (3) plants functioning again, full service restoration still eluded the Candler Knob, western portion of the distribution system. During the course of valve operations on Monday, January 2, 2023, WRD realized there must be a valve closed on a major transmission line feeding the Candler Knob tanks, western portion. At 6:45 p.m. on January 2, 2023, WRD valve crews found a closed 24-inch valve in the River Arts District on the east side of the French Broad River. The valve was immediately opened, at which time the Candler Knob tanks began to fill much more quickly which expedited full service restoration.

The final Boil Water Advisory was lifted on Wednesday, January 4, 2023. Full water system service was reported by January 6, 2023, and all water conservation requests were lifted.

Section III - System Overview Asheville Water Production and Distribution System

The City of Asheville water system is critical to not only the public health of the City of Asheville but also Buncombe County and the northern portion of Henderson County. Not only does the water system provide clean potable water, to protect public health, the water system is a key component to the economic health of the region. The Asheville water system is permitted by the North Carolina Department of Water Resources, Public Water Supply Section and is identified with public water supply ID number (PWSID#) 01-11-010. Based upon the most recent local water supply plan, the system has 59,984 metered connections (1-inch and smaller), 11 industrial meters, 4,431 commercial and 264 institutional meters. The Asheville water system not only provides water service to these connections but has interconnections with the towns of Biltmore Forest, Black Mountain, Weaverville, Woodfin Sanitary Water & Sewer District within Buncombe County, and serves customers in northern part of Henderson County. The water system also has an interconnection with the City of Hendersonville.

The following table shows the average daily water demand for 3 of the water interconnections which depend upon the City of Asheville for water supply.

WATER SYSTEMS SUPPLIED BY CITY OF ASHEVILLE

Water System	Average Daily Purchase (GPD)
Town of Biltmore Forest	153,400
Town of Black Mountain	498,300
Woodfin Sanitary Water & Sewer District	360,000

Asheville has three (3) water treatment plants that provide the treated potable water. The system is unique in that, unlike most water systems in North Carolina, more than 75% of the raw water to meet the average daily water demands is provided by the City owned 22,000-acre watershed located in the northeast part of Buncombe County near Black Mountain. The Asheville watershed is protected as a WS-I supply under North Carolina regulations, is fully owned by the City and has no development. This watershed provides a pristine raw water supply.

Two water treatment plants (WTP) obtain their raw water supply from the watershed. The North Fork WTP has a design capacity of 31.0 MGD with the Burnette Reservoir, which has a drainage area of 25 square miles, supplying the raw water. Under normal operating conditions when the reservoir is at or near full pool water flows by gravity to the WTP and no pumping is required to transmit finished drinking water into the distribution system. The North Fork WTP is one of two direct filtration WTP permitted in North Carolina (William DeBruhl [Bee Tree] is the second). Direct filtration indicates that there are no sedimentation basins in the treatment flow scheme upstream of the filters. Chemical addition is used for coagulation of fine particles in the raw water prior to filtration. Treated water flows by gravity to the finished water storage tank (clearwell)

which supplies the distribution system. The finished water clearwell (tank) has an overflow elevation of 2560 mean sea level (MSL).

The smaller William DeBruhl (Bee Tree) WTP has a design capacity of 5.0 MGD with the Bee Tree Reservoir, which has a drainage area of 8.2 square miles supplying the raw water. Like the North Fork plant, under normal operating conditions when the reservoir is at or near full pool water flows by gravity to the WTP and no pumping is required. The DeBruhl WTP is also a direct filtration plant. Treated water flows by gravity to the finished water storage tank which supplies the distribution system. The finished water clearwell (tank) has an overflow elevation of 2585 mean sea level (MSL).

The City has a third WTP located in Henderson County, south of Asheville, and uses the Mills River as the raw water source. The raw water intake is located at the confluence of the Mills River and the French Broad River and under certain conditions raw water can by withdrawn from the French Broad River if required to meet system demands. The Mills River WTP raw water supply has a drainage area of 429 square miles.

The Mills River WTP is a conventional plant configuration with chemical addition, coagulation, sedimentation, filtration, disinfection using Ozone prior to finished water being pumped into the system. Unlike the North Fork and DeBruhl WTP, which feed the distribution by gravity flow, the Mills River WTP has high service pumps that convey finished water to the distribution system and the South Buncombe tank.

The following table summarizes the three (3) water plants' capacity.

CITY OF ASHEVILLE WATER TREATMENT PLANTS

Facility	**Rated Capacity (MGD)**
North Fork WTP (Burnette Reservoir)	31.0
William DeBruhl WTP (Bee Tree Reservoir)	5.0
Mills River WTP (Mills River and French Broad River)	7.5
TOTAL	**43.5**

Given the high elevation of the North Fork and DeBruhl WTP in comparison to the main portion of the water distribution system, these two treatment facilities supply finished water via gravity, without pumps into the main distribution system. The water distribution system contains over 1,700 miles of pipes ranging in size from 2 inches up to 36 inches in diameter. Water from the North Fork and DeBruhl WTP is supplied to the main pressure zone (hydraulic gradient) through 36-inch, 24-inch, and 16-inch diameter water mains.

The main pressure zone, or hydraulic gradient, is at elevation 2440 feet above mean sea level (msl). This hydraulic gradient provides adequate pressure to a large portion of the distribution system and customers in those areas. The 2440 pressure zone was originally established around 1920 to provide adequate system pressures to the Battery Park Hotel area. The pressure zone is adequate to supply pressure to the Mission Hospital campus at elevation 2200 msl and the Grove

Park Inn area at elevation 2340 msl. Finished water storage for the pressure zone is provided by three large water storage tanks**,** South Buncombe (5.0 million gallons) and two Candler Knob tanks (5.0 million gallons and 3.0 million gallons). Each of these tanks has an overflow elevation of 2440.

The WTP and distribution system are located as shown on the simplified schematic graphic below and are connected via transmission pipes that provide the backbone of the water system.



Graphic Provided By Hazen and Sawyer

A large number of customers live above the main 2440 pressure zone enjoying the mountainous terrain which blesses Asheville. In order to provide adequate service to these customers the water system contains 41 booster pump stations and 36 water storage facilities. The total volume of system storage is approximately 21 million gallons.

Section IV- Independent Review Committee

As previously mentioned the IRC made the decision to divide into three (3) subcommittees to more efficiently complete the task and scope of work as directed by City Council. These three subcommittees are described below.

A. Independent Review Committee – Water System/Operations Subcommittee

The water system/operations subcommittee was charged with looking at the operation of the water supply and distribution system during the event to identify potential operational deficiencies and/or infrastructure components which failed or need improvements. The subcommittee as previously identified is:

Water System/ Operations		
Ted B. Tyree, P.E	Knoxville Utilities Board - Engineer	Co-Chair
John W. McLaughlin, P.E.	Highfill Infrastructure – Director Internal Development	Co-Chair
Michael L. Holcombe, Sr.	Retired – Former Director City of Asheville – Water Resources Department	Co-Chair
Carolyn Roy	Biscuit Head Restaurant - Owner	
Kim “Dirt” Murphy	Rainbow Path Wellness, LLC - Co-Owner/Farm Manager	
Keith Webb, P.E.	McGill Associates - Engineer	

The subcommittee submitted a large list of Request for Information (RFI) to the Asheville Water Resources Department for operational data recorded before, during and after the event. These RFIs included SCADA information for the WTP and storage tanks along with previous Water System Master Plans, system component and staffing information. The WRD provided information on facilities and staffing for the department which was very helpful.

The water system/operations subcommittee conducted interviews with a large number of key WRD staff including the Director, Water Production, Water Distribution and Engineering Staff. Each of these interviews provided valuable information.

Finally, to confirm and verify some concerns associated with the distribution system and the ability to deliver the higher than normal peak system flows the subcommittee requested additional hydraulic modeling of the system to simulate the events experienced. The City retained the engineering firm, Hazen which had prepared the current system hydraulic model to perform this work. Hazen has an open on-call services agreement with the City and presented a proposal and Task Order for the additional modeling. The value of this Task Order was in excess of $70,000 and was approved by the City.

The additional modeling enabled the subcommittee to more fully understand the impacts of the freezing temperature and high demands on the system and the impact of water system infrastructure failures or improper use which contributed to the event. The subcommittee wishes to express appreciation to the City and to Hazen for their efforts to accomplish the additional hydraulic modeling on an extremely short time frame. Without the additional work the subcommittee would not have been able to complete the thorough investigation accomplished and to develop the recommended action plan.

A copy of the Hazen hydraulic modeling reports along with their executive summaries are included in the Appendix. The reader will note that there is a draft report completed based upon some assumptions as to the operation of the East Asheville Booster Pump Station (EABPS) and a final report reflecting additional modeling with operation of the EABPS under a scenario to maintain a set system pressure at a specific location in the distribution system.

The Water System/Operations Subcommittee full report is located in Appendix II. The reader should refer to that report for a full summary of recommendations.

B. Independent Review Committee – Communications Subcommittee

The Communications subcommittee was charged with looking at how the City of Asheville Water Resources Department WRD) and other City leadership and staff handled communications during the event. The subcommittee was charged with the evaluation of the effectiveness of communications and to identify areas which failed or could have been improved. Active members of the subcommittee are:

Communications		
Mike McGill	WaterPIO - President	Co-Chair
Rob Brisley	North Carolina Incident Management Team	Co-Chair
Kim “Dirt” Murphy	Rainbow Path Wellness, LLC - Co-Owner/Farm Manager	

To gain a perspective on the event the subcommittee reviewed the “City of Asheville Water Resources Christmas 2022 Water Outage Incident Report” and previous media publications. The subcommittee also interviewed the City Manager, Assistant City Manager, Asheville City mayor and other Council members, the WRD Director and Water Production Supervisor along with a number of local media staff and writers. Each interview and request for information was made on the condition of respect for information shared until such time as the IRC final report is presented to Asheville City Council. Each of these interviews provided valuable information.

A number of Request for Information (RFI) were submitted to the Asheville Water Resources Department and the City for existing ordinances, policy, staffing list and support information. The City and the WRD provided information in a timely manner which was very helpful.

The Communications Subcommittee full report is located in Appendix III. The reader should refer to that report for a full summary of recommendations.

C. Independent Review Committee – Emergency Response Subcommittee

The Emergency Response subcommittee was charged with looking at emergency response implemented during the event and to identify a plan of action for modifications and improvements to be implemented, changes in current adopted ordinances and policies and guidelines to share information with other public officials and improve Emergency Preparedness. Active members of the subcommittee are:

Emergency Response	
Dennis Fagnant, Jr.	West Buncombe Fire Department - Chief
Rob Brisley	North Carolina Incident Management Team
Kim "Dirt" Murphy	Rainbow Path Wellness, LLC - Co-Owner/Farm Manager
Mike McGill	WaterPIO - President
Carolyn Roy	Biscuit Head Restaurant - Owner

The subcommittee reviewed the "City of Asheville Water Resources Christmas 2022 Water Outage Incident Report" and previous media publications. A number of Request for Information (RFI) were submitted to the Asheville Water Resources Department and the City for existing ordinances, policy, staffing list and support information. The City and the WRD provided information in a timely manner which was very helpful.

The emergency response subcommittee conducted interviews with a large number of key City of Asheville, Buncombe County, WRD staff and stakeholders. Interviews included the WRD Director and the Asheville Fire Chief. Each of these interviews provided valuable information.

The Emergency Response Subcommittee full report is located in Appendix IV. The reader should refer to that report for a full summary of recommendations.

APPENDIX I – Independent Review Committee Resolution No. 23-7

RESOLUTION NO. 23-7

RESOLUTION ESTABLISHING AN INDEPENDENT REVIEW COMMITTEE FOCUSED ON REVIEWING THE WATER OUTAGE IN ORDER TO ASSESS INFRASTRUCTURE NEEDS AND THE CITY'S RESPONSE; AND TO DETERMINE WHAT CAN BE DONE TO MAXIMIZE PREVENTION AND IMPROVE RESPONSE EFFORTS FOR FUTURE EVENTS

WHEREAS, in December of 2022, the City of Asheville experienced several days of extraordinarily low temperatures, causing water pipes to freeze and break and related infrastructure to fail; and

WHEREAS, the damage to this system resulted in numerous customers of the City's Water Department to go without water for extended periods of time; and

WHEREAS, the City of Asheville initially devoted all available resources, as well as coordinating assistance from community and local government partners, to fully restore service to all people and businesses; and

WHEREAS, upon completing these restoration efforts, and because the City of Asheville cares deeply about our community's well being and the impacts this outage has had on our residents, their families and businesses, City Council now desires to establish a multidisciplinary and independent review committee to review the water outage in order to assess infrastructure needs and the City's response; and to determine what can be done to maximize prevention and improve response and communication efforts in the case of future events; and

WHEREAS, because this water outage also impacted customers who do not reside in the City limits, the independent review committee will include appointees from Buncombe County;

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF ASHEVILLE THAT:

City Council hereby establishes an independent review committee to analyze the events and circumstances leading up to, and throughout the duration of, the recent prolonged water outage. This committee shall review the water outage in order to provide a comprehensive account of the event, an assessment of the City's operational and emergency response and communication efforts, and an analysis of needed infrastructure and process and policy changes that, if implemented, would maximize prevention of future events and improve communication, emergency response, and mitigation processes.

The committee shall be composed of nine members with multidisciplinary backgrounds to include the following position classifications: Two Residential Water Customers, One Commercial Water Customer, One Emergency Response/Disaster Preparedness Professional, Two Communications Professionals, and Three Subject Matter Experts in Public Water Systems. Two appointments shall be made by the Buncombe County Commission, and the remaining appointments shall be made by the Asheville City Council.

The committee shall engage an expert to prepare an initial report regarding the findings and recommendations of the committee, with updates on this process being shared with the City Council within 30 days of the committee being established.

The Committee shall provide a final report, including the written report of the committee's contracted expert, with the City Council within 90 days of the committee being established.

Thereafter, upon completion of the assigned review, presentation of its report, and fulfillment of any related tasks assigned by the City Council, the commission shall dissolve.

Read, approved and adopted this 10th day of January, 2023.

Magdalena Bouleson
City Clerk

Edna E. Mae
Mayor

Approved as to form:

City Attorney

Appendix II - IRC - Water System/Operations Report



Water Outage Independent Review Committee

Water Systems/Operations Subcommittee Report – FINAL

May 2023

Table of Contents **Page**

Executive Summary 23

Abbreviations 24

Introduction 25

Weather / Temperature During the Outage Event 26

Asheville Water System Overview 27

Normal Operation of the Water System 28

Event Description – What happened? 29

Independent Review Committee's Process 30

System Operations during the Outage Event 30

The Key Question 32

IRC Water Systems/Operations Subcommittee Analysis 32

Network Modeling by Hazen 34

Conclusions 35

Recommendations 39

Executive Summary

On Friday, December 23rd, 2022, a series of events initiated by sub-freezing temperatures resulted in water outages for thousands of water customers in the southern and western portions of the City of Asheville's water system for an extended period of time. A total of 27 water main breaks and high customer consumption and on-property leakage resulted in record high demands on the water system. The ensuing outages disrupted the lives of many of the region's residential, institutional, and business customers.

Within one week after the water system was restored and the Boil Water Advisory lifted, Asheville's City Council on January 10, 2023, unanimously voted to create an Independent Review Committee (IRC) to:

1. Review all available information and provide a comprehensive account of the water outage.
2. Assess the City of Asheville's Operational, Emergency Response, and Communication efforts during the event.
3. Identify any needed Infrastructure and Procedural enhancements.

The IRC conducted their work through three subcommittees.

1. Communications
2. Emergency Response
3. Water System/Operations (WS/OS)

This report outlines the work, findings, and recommendations of the WS/OS.

Over the course of the 90-day investigation period, the WS/OS analyzed large amounts of operational data collected during the event, spoke with selected employees of the Water Resources Department, toured various WRD facilities, and worked with two of WRD's engineering consultants to determine factors that contributed to the event, and make recommendations that would minimize the likelihood of a similar event occurring again.

The WS/OS concluded that the cause of the event was the inability to supply enough water into the system to meet the high demands. A 24" transmission valve in the River Arts District was closed for most of the event, and the [redacted] Control Valve was only open a maximum of 10% during the event. The two valves restricted the free flow of water to the western and southern portions of the system, respectively. In essence, the closed/throttled valves limited the full capacity (36 MGD) available from the North Fork and William DeBruhl Treatment Facilities from flowing into the system. In addition, Hazen's modeling illustrated that "By using the East Asheville Booster Pump Station, system pressures improved significantly," both with the valve limitations and even more so without them. (See attached Hazen Final Report, May 15, 2023, page 98.)

The WS/OS also identified other factors that contributed indirectly to the occurrence and duration of the event, and made recommendations accordingly. This includes the lack of a SCADA-based tool that derives Total_Daily_Demand each 24-hour period, the lack of system-wide Advanced Metering Infrastructure (AMI), the lack of a robust Engineering Division within the WRD, the ongoing challenge of Knowledge Retention within the WRD, the need for more multi-agency Table-top Exercises, the need for more District or Zone Meters within the system, and the need for the creation of a Water Utility Advisory Panel to assist both the WRD and City Council.

Abbreviations

CIP	Capital Improvement Plan
CoA	City of Asheville
EABPS	East Asheville Booster Pump Station
gpm	Gallons per minute
IRC	Independent Review Committee
MGD	Million Gallons per Day
MRWTP	Mills River Water Treatment Plant
NFWTP	North Fork Water Treatment Plant
SBBPS	South Buncombe Booster Pump Station
SCADA	Supervisory Control and Data Acquisition
TTX	Tabletop Exercises
WDWTP	William DeBruhl Water Treatment Plant
WRD	Water Resources Department
WS/OS	Water System/Operations Subcommittee

Introduction

In December of 2022, a series of events initiated by sub-freezing temperatures resulted in water outages in the southern and western portions of the City of Asheville's water system for an extended period of time. The outages disrupted the lives of many of the region's residential, institutional, and business customers.

Within one week after the water system was restored and the Boil Water Advisory lifted, Asheville's City Council on January 10, 2023, unanimously voted to create an Independent Review Committee (IRC) to:

1. Review all available information and provide a comprehensive account of the water outage.
2. Assess the City of Asheville's Operational, Emergency Response, and Communication efforts during the event.
3. Identify any needed Infrastructure and Procedural enhancements.

The IRC consists of nine members, seven appointed by Asheville City Council and two appointed by the Buncombe County Commissioners. At the~~ir~~ January 24, 2023, meeting, City Council appointed the following members:

Committee Member	Title	Company	Representing
✔ John McLaughlin	Director Of Internal Development	Highfill Infrastructure Engineering	Public Water Supply Expert
✔ Ted B. Tyree	Engineer	Knoxville Utilities Board	Public Water Supply Expert
✔ Michael L. Holcombe, Sr.	Former Director (Retired)	City of Asheville – Water Resources Department	Public Water Supply Expert
✔ Mike McGill	President	WaterPIO	Communications
Rob Brisley	Public Affairs Specialist	U.S. Customs and Border Protection	Communications
✔ Michele Ashley	Owner	Coeur Consulting LLC	Residential representative
✔ Carolyn Roy	Owner	Biscuit Head restaurants	Commercial representative

* Volunteered to serve on the subcommittee but did not participate in any committee meetings, research, or report review.

On February 7, 2023, Buncombe County Commission appointed the following members:

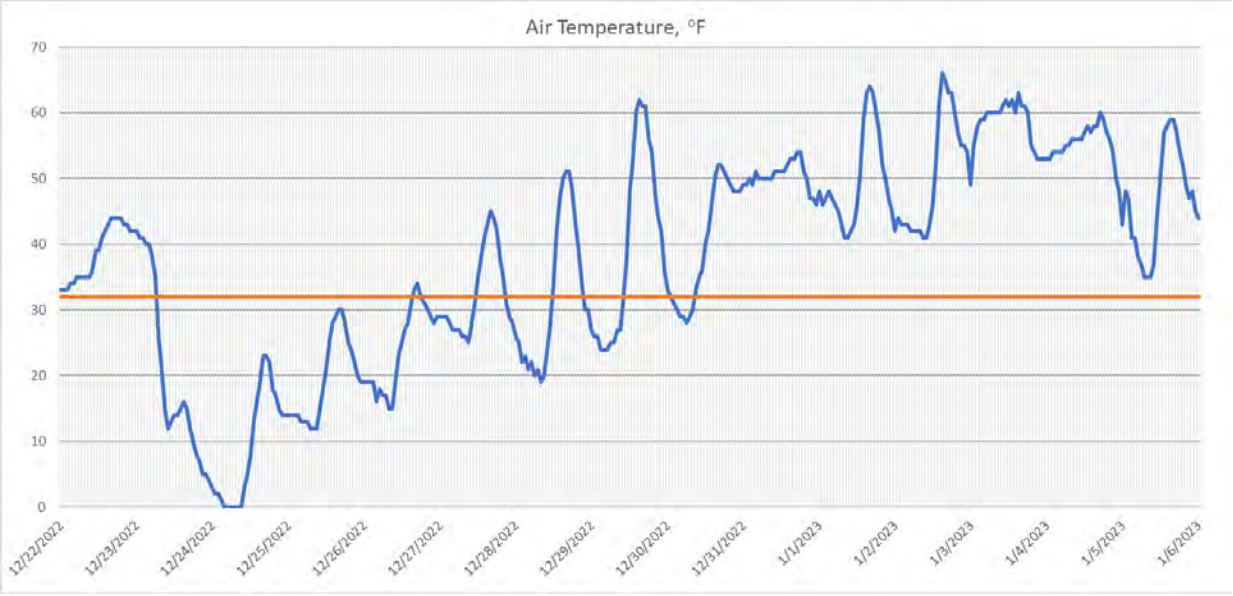
Committee Member	Title	Company	Representing
Dennis Fagnant, Jr.	Fire Chief	West Buncombe County Fire Department	Emergency Response Professional
✔ Kim “Dirt” Murphy	Co-Owner/Farm Manager	Rainbow Path Wellness, LLC	Residential representative

✔ Member of the IRC Water Systems/Operations Subcommittee

City Council requested that the IRC provide an update 30 days after Project Kick-Off, and a Final Report by the end of May 2023. The deadline was later extended to June 6, 2023. The IRC held a Kick-Off Meeting in Asheville on February 20, 2023. An update was presented to City Council on March 28, 2023.

Weather / Temperature During the Event

A cold front swept through western North Carolina in the early morning hours of Friday, December 23, 2022. The temperature in Asheville was 40 °F at 4:00 AM before plummeting, reaching 14 °F by noon, and continuing to fall before reaching 3 °F at 12:00 AM on Saturday, December 24th. By 4:00 AM on the 24th, the temperature had reached a low of 0 °F where it stayed for approximately 5-6 hours until shortly after 9:00 AM. The temperature then rose to a high of 23 °F on Saturday, the 24th. In total, temperatures remained below 32 °F for approximately 81 consecutive hours, finally reaching 33 °F at 3:30 PM on Monday, December 26th.



In addition to the frigid temperatures, windy conditions prevailed for much of the time period when temperatures were below freezing. Wind speeds averaged between 15-20 mph, with gusts reaching as high as 32 mph.

Asheville Water System Overview

The City of Asheville has three water treatment plants that supply water to its water distribution system. The distribution system has customers in the city, the towns of Black Mountain, Woodfin, and Biltmore Forest within Buncombe County, and customers in Henderson County.

Facility	**Rated Capacity (MGD)**
North Fork WTP	31.0
William DeBruhl WTP	5.0
Mills River WTP	7.5
TOTAL	**43.5**

The North Fork (NF) and DeBruhl (WD) facilities draw their source water from the Burnett Reservoir and Bee Tree Reservoir respectively and are located in the mountains in the northeast sector of the system. Given their high elevation in comparison to the main portion of the water distribution system, these two treatment facilities supply finished water via gravity, meaning they do not have to pump finished water into the system. It simply flows into the system by gravity.

The Mills River (MR) facility is capable of pulling its source water from either the Mills River or the French Broad River and is located in Henderson County, in the southwest area of the system. Unlike the NF and WD plants, Mills River is a pumped input plant meaning it must pump its finished water into the system. The plants are located as shown on the simplified schematic graphic below and are connected via transmission pipes that provide the backbone of the water system. In total, the distribution system contains over 1,700 miles of pipes ranging in size from 2” up to 36” in diameter.

Given the mountainous terrain, Asheville’s water system contains 41 booster pump stations and 36 water storage facilities. The total volume of storage is approximately 21 million gallons.



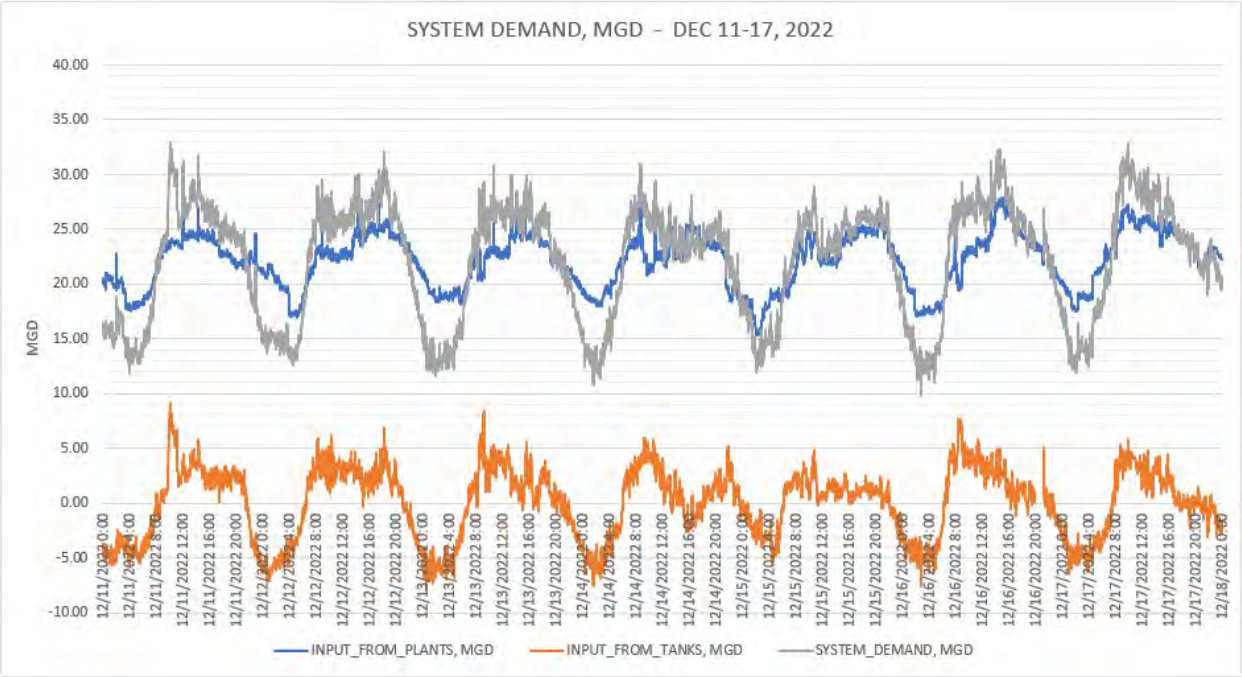
Normal Operation of Water System

Using Asheville water system operational data for the time period December 1, 2022, through January 31, 2023, provided to the IRC, the IRC Water System/Operations subcommittee was able to derive an approximate Demand curve for the time period. Doing so allowed the IRC members to compare the outage event period to a "normal" week of System Demand.

SYSTEM_DEMAND is a term used to represent how much water is being called for at any given time in a water system. This is the sum of how much water is being "Supplied" into the system, both from the Treatment Plants (INPUT_FROM_PLANTS) and the system's water storage tanks (INPUT_FROM_TANKS). Units are commonly expressed as MGD, or Million Gallons per Day.

During Peak Demand periods, SYSTEM_DEMAND typically exceeds INPUT_FROM_PLANTS, so the "deficit" is made up by INPUT_FROM_TANKS. During off-peak periods, INPUT_FROM_PLANTS typically exceeds SYSTEM_DEMAND. The excess water being put into the system allows the water storage tanks to recover/refill as they get ready for the next peak demand period. This cycle is often referred to as a system's "diurnal demand curve."

The 7-day (Sunday-Saturday) graph below shows the SYSTEM_DEMAND (blue line) curve for the week of December 11-17, 2022. Whenever the orange line (INPUT_FROM_TANKS) is above zero, the tanks are collectively "drafting," meaning their levels are dropping, Whenever the line is below zero, the tanks are collectively "filling," meaning their levels are rising. This is commonly referred to as the tanks 'Draft-Fill cycle.



Event Description – What Happened?

As stated earlier, by the evening of Friday, December 23, 2022, the City of Asheville and Buncombe and Henderson Counties were in the grip of a brutal cold snap of wintry weather. While not record-setting, the plunge in temperature to 0 ^{o}F was the coldest since January 2014.

The frigid weather caused water treatment issues at the Mills River Water Treatment Facility in Henderson County. Asheville's two other water production facilities in the eastern part of the water system in Buncombe County, the North Fork and William DeBruhl Water Treatment Plants, were not materially affected by the cold.

By 8:00 am on Friday, December 24, 2022, the Mills River plant had to be taken off-line due to the issues it was experiencing. Finished water turbidity levels were approaching the State of North Carolina regulatory limits so the decision was made to take the plant off-line. Plant staff quickly determined the treatment problems were the result of a clogged aluminum sulfate (Alum) line and frozen caustic chemical feed lines. Once the plant was shut down, filter valve actuators were discovered to be frozen and air valves on the filters were also discovered to be non-functioning. All of these problems necessitated time-consuming corrections.

In response to the Mills River facility being taken off-line, water production at the NF and WD plants was increased. Given that those two plants are gravity-fed inputs to the water system, increases in system demand should have resulted in increased supply of finished water flowing into the system, which it did. However, the total supply of water entering the system from the two plants was insufficient to maintain full service in the southern portion and parts of the western portion of the system. Key water storage tanks were depleted, and by Monday, December 26, 2022, thousands of customers had no potable water, creating a public health hazard.

At approximately 7:00 pm on Monday, December 26th, the decision was made to isolate most of the southern part of the water system in order to maintain pressure and service in the remaining portions. This increased the number of customers who lost water service. Parts of the western portion of the system were next affected, as numerous service outages were reported.

During the event, WRD crews responded daily to repair a total of 27 main breaks/leaks throughout the system. In addition, there were many confirmed leaks/breaks on private property caused by the frigid weather. All of the leakage combined with increased customer consumption resulted in a sharp increase in Total System Demand to levels not previously experienced on Asheville's water system.

The Mills River facility was brought back on-line on Wednesday, December 28th. The plant was off-line and not producing water for a total of 104 hours, or a little over four days. Production at the Mills River plant ramped up slowly and the southern portion of the system began to gradually restore service. With all three plants functioning again, full service restoration still eluded the western portion of the system. During the course of valve operations on Monday, January 2nd, WRD realized there must be a valve closed on a major transmission line feeding the western portion. At 6:45 am on the 2nd, WRD valve crews found a closed 24" valve near the intersection of [redacted]. The valve was immediately opened, at which time the Candler Knob tanks began to fill much more quickly which hastened full service restoration. The final Boil Water Advisory was lifted on Wednesday, January 4th. Full water system service was reported by January 6, 2023, and all water conservation requests were lifted.

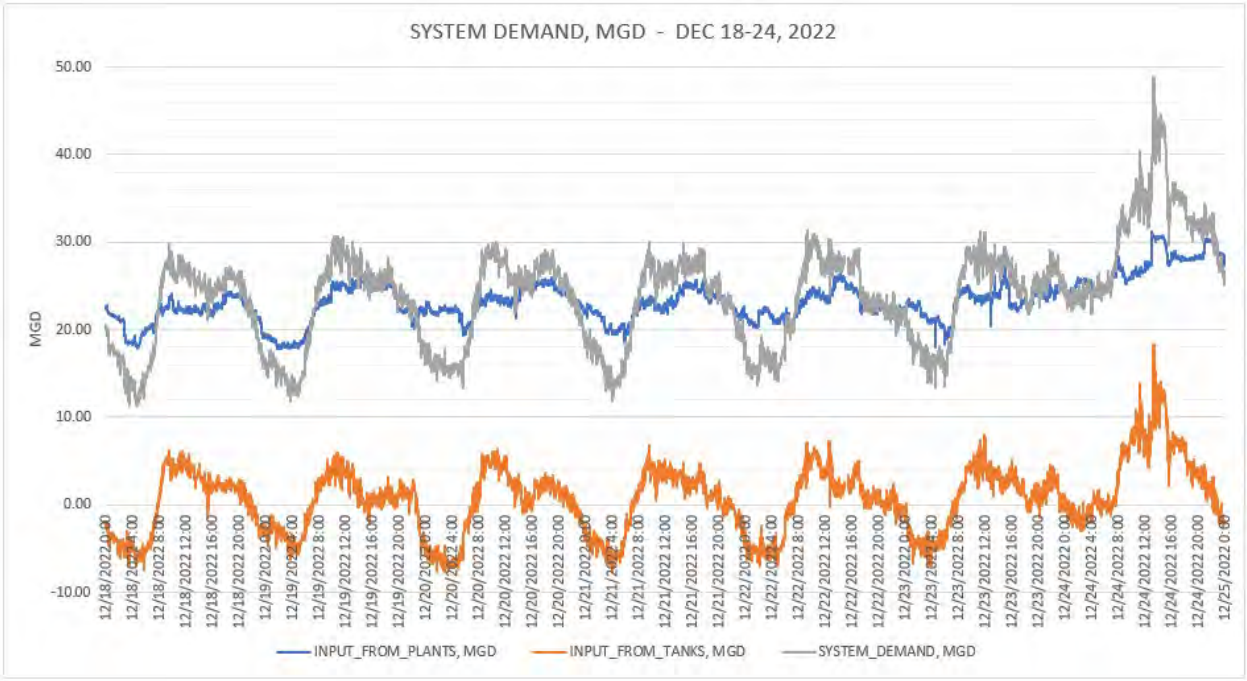
Independent Review Committee's (IRC) Process

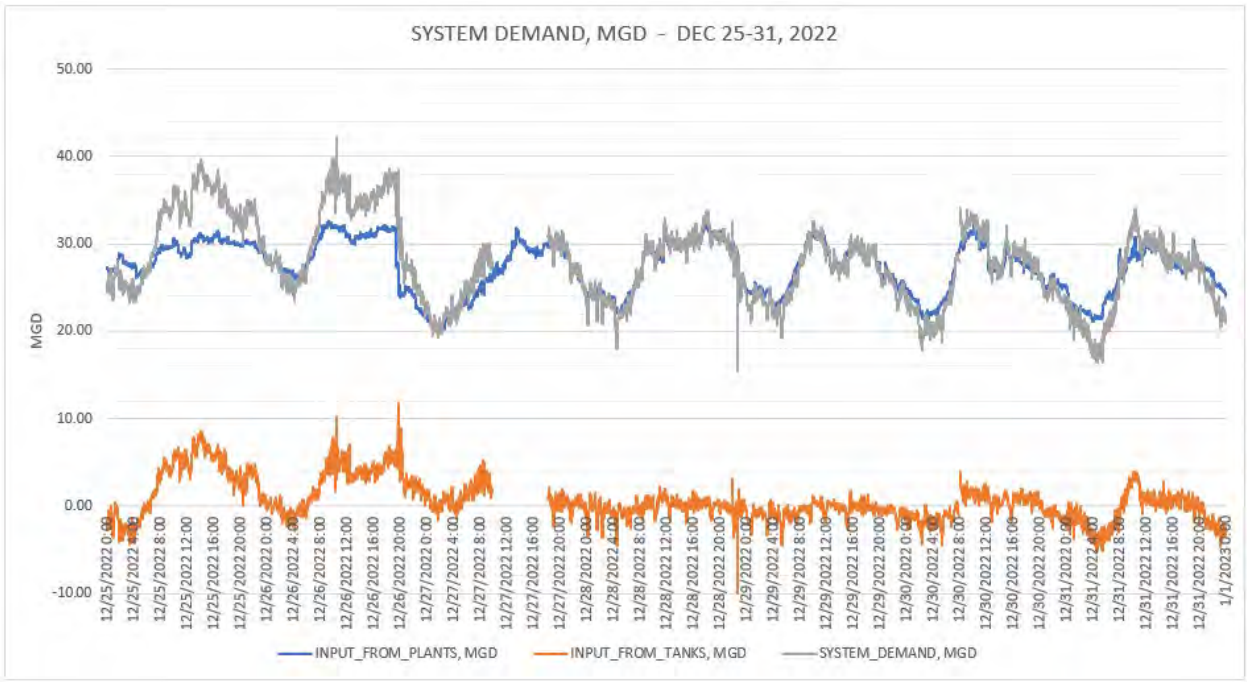
During the course of the IRC's investigation, more than 90 *Requests for Information (RFI s)* were submitted by the IRC to the City of Asheville. All of the requests were fulfilled by City staff in a timely and comprehensive manner. In addition, the IRC Water Systems/Operations Subcommittee conducted interviews with selected City staff members. Those interviews were productive and enlightening. On April 14, 2022, several members of the subcommittee participated in tours of Asheville's three water treatment facilities and the East Asheville Booster Pump Station (EABPS). At each of the four facilities, subcommittee members were able to meet and talk with additional WRD employees and ask relevant questions. City staff members were very professional, engaging, forthright, and consistently attempted to be as helpful as possible.

Throughout the process, subcommittee members met numerous times and spent countless hours analyzing, deliberating, negotiating, and contemplating its final Conclusions and Recommendations.

System Operation during the Outage Event

In comparison to the previous "normal" week's SYSTEM_DEMAND graph, similar graphs for the weeks of December 18-24, 2022, and December 25-31, 2022, illustrate what began to occur with the Total Supply-Demand relationship late on Friday, December 23, 2022.





SYSTEM_DEMAND began to rise, tanks drafted significantly, and very little recovery/refill was realized overnight leading into the morning demand period on Saturday, December 25th. SYSTEM_DEMAND spiked on the 25th, tank levels plummeted, and conditions became critical. Again, virtually no recovery/refill occurred overnight on Sunday, December 25th, leading into Monday the 26th. Demand spiked again on the 26th and most of the water system's largest, key water storage tanks either became critically low or completely emptied and were valved out of service.

The IRC spent considerable time analyzing the event's operational data. The data "paints the picture" of exactly what took place with the Supply / Demand relationship. With SYSTEM_DEMAND reaching the 30

MGD range during the event, the data illustrates that Asheville's water system struggled to supply enough water from the two remaining plants into the system.

The Key Question

Through its analysis, the IRC's Water System/Operations subcommittee eventually focused its efforts on trying to answer one central question:

> ➢ **What limited Asheville's ability to supply water into its system?**
>
> **Even though the combined capacity of the North Fork and William DeBruhl plants is 36 MGD, why were flows into the system from those two plants seemingly limited to less than that, resulting in key water storage tanks draining so quickly and unable to recover during off-peak demand periods?**

IRC Water Systems/Operations Subcommittee Analysis

Based on their review of all available operational data, interviews with WRD staff members, and tours of WRD facilities, the IRC Water Systems/Operations subcommittee suspected that the answer to the above key question may be two-fold:

1. The 36 MGD East Asheville Booster Pump Station had essentially been decommissioned and removed from service by the WRD more than ten years ago, having been deemed "no longer necessary."
2. A valve on the critical 24" West Asheville Connector transmission main just east of the French Broad River near the intersection of [redacted] was CLOSED.

<u>CLOSED 24" Valve</u>

A critical valve on a major 24" water transmission line serving the western part of the water system was discovered to be closed on January 2, 2023. The main line (called the "West Asheville Connector") was installed in the mid-1990's and was a companion to the East Asheville Booster Pump Station and the expansion of the North Fork facility from 25 MGD to 31 MGD. The transmission line runs from [redacted]. Once the 24" valve was opened at 6:45 pm on Monday, January 2, 2023, the Candler Knob tanks and the South Buncombe tank began to recover quickly.

WRD personnel had apparently suspected in 2021 or earlier, that a system anomaly (closed valve?) may have existed due to problems filling Candler Knob tanks during periods of high demand. The IRC learned the issues with Candler Knob tanks may have been first noticed in June and July of 2019, with the onset of typical "summertime demands." WRD personnel requested in 2021 that Hazen run some computer network modeling scenarios to determine what might be causing the problems with Candler Knob tanks.

On January 10, 2022, Hazen met with WRD representatives and presented their modeling findings via an online, virtual PowerPoint presentation. In the course of their modeling scenarios, the only way Hazen could get the model to emulate what was actually occurring with the Candler Knob tanks during periods of high demand was to close a 24" valve in the model. Based on that finding, Hazen's modeler strongly suspected a closed 24" valve may exist in the River Arts District just east of the French Broad River. The presentation went as far as to recommend WRD staff look in the vicinity of [redacted] for a suspected closed 24" valve.

IRC members asked WRD staff about this information and what was done after receiving the information. WRD staff said they looked for a closed valve after receiving the information from Hazen in January 2022, but did not find any such closed valve.

On Day 9 (January 2nd) of the Water Outage Event, WRD was conducting valving operations to hasten system recovery. When they closed a valve elsewhere in the system, they unknowingly shut off water service to an area in the western portion of the system that had been previously unaffected. The only way that could happen was for another unknown closed 24" valve to exist somewhere along the West Asheville Connector. WRD personnel began checking valves before finally finding the closed 24" valve in the River Arts District at 6:45 pm on Monday, January 2nd.

Under normal demands (~21-22 MGD), the system could function adequately even with the closed 24" valve. However, under higher demands (>25 MGD and approaching 30 MGD), not enough water from NF and WD plants could flow into the system to allow it to maintain normal tank levels. The tanks would begin experiencing deficits each day and would not refill enough during off-demand periods in preparation for the next high-demand period. During the outage event, the tanks were rapidly depleted and eventually needed to be valved out of service.

<u>Unavailability of the East Asheville Booster Pump Station</u>

The East Asheville Booster Pump Station (EABPS) was constructed and placed into service in the 1992-93 timeframe. The station enables the full combined capacity (36 MGD) of the NF and WD plants to flow into the water system. Without the station, frictional head loss that occurs as the water travels south and west prevents the full 36 MGD capacity from flowing into the system. The station's expressed purpose was to overcome that excessive head loss and restore the needed hydraulic gradient in the western and southern parts of the system. (Note: The expansion of the NF plant from 25 MGD to 31 MGD AND the construction of the EABPS both predated the Mills River WTP being built. Thus, the EABPS was a necessary component when flows need to be maximized out of NF and WD facilities.)

The continued operation of the EABPS is referenced in both the 2009 Water System Master Plan by Jordan, Jones & Goulding and the 2019 Water System Master Plan Update by Hazen. The Hazen plan states that the station would be needed *"….when system demand approaches 30 MGD."*

The WRD essentially decommissioned the EABPS and removed it from available service more than ten years ago. The IRC asked WRD staff if, in their opinions, having the station available during the water outage event would have made a difference. The collective response was "No, we don't think so."

During the April 14, 2023, tour of the EABPS, IRC members learned that due to a previous main break event on the station property but outside the station, the discharge line exiting the station has been flanged off with a blind flange. As it currently exists, the pumps are no longer connected to the system.

The EABPS was last utilized in 2009 or 2010. WRD staff described the pumps and their electrical equipment/controls as being obsolete. Since being placed into service almost thirty years ago, the station has been used very little and the pumps accrued very little run time. Other IRC discussions with WRD Staff indicate the station is considered to be no longer necessary for operation of the water system, given the addition of the Mills River treatment facility and the reductions in demand achieved through the department's reduction in Non-Revenue Water (leakage).

During the water outage event, system demands approached and exceeded 30 MGD at times. Sustained, lower system pressures in the southern and western portions of the system eventually led to the decision to isolate most of the southern portion on December 26th. Even when the Mills River plant was brought back on-line on December 28th, the NF/WD-supplied system struggled with maintaining pressures adequate to refill the western storage reservoirs. WRD staff rented and deployed portable pumps in an attempt to raise the hydraulic gradient in the western part of the system.

Network Modeling by Hazen

To evaluate the two factors identified above, the IRC Water Systems/Operations subcommittee requested the City of Asheville engage Hazen Engineering to update the computer model of Asheville's water system and run various scenarios to assess the relative impacts of the unavailability of the EABPS, and the closed 24" valve, both individually and in combination.

The subcommittee received Hazen's first draft of modeling results and analysis on May 10, 2023 and met with Hazen on May 12th to discuss. In these initial modeling scenarios, Hazen used a "trigger" for starting the EABPS's pumps in the model whenever Candler Knob tanks' water levels fell to 15 feet.

Hazen's findings from the initial model runs (Candler Knob tanks at 15 feet) indicated the 24" closed valve in the River Arts District and the [redacted] Control Valve being limited to only 10% open were significant factors that limited supply of water to the western and southern portions of the system. Hazen's report further concluded that…..

> *".....by using the East Asheville Pump Station (assuming one 18 mgd pump at 126 feet of total dynamic head running at reduced speed), the water levels in Candler Knob and South Buncombe tanks did not drop as significantly, and the number of model nodes with pressures less than 20 psi decreased by more than 49% (assuming [redacted] valve closed). With the [redacted] valve open, the water level in the Candler Knob tanks never reached the setpoint to operate the East Asheville Pump Station. Therefore, the pump station had minimal benefit with the [redacted] valve open. Using the pump station in combination with increased [redacted] Control Valve flow had a marginal increase in pressures compared to the alternatives individually."*

After meeting with Hazen on May 12th, the subcommittee was concerned about the appropriateness of using the Candler Knob tank level 15-foot "trigger." When the EABPS was previously operated (from 1993-2010), Candler Knob levels were never used as the trigger for activation of the pumps. The subcommittee requested Hazen run additional modeling scenarios using the same "trigger" that was used when the station was operational, i.e., system pressure at Haw Creek Junction falling to 200 psi. Hazen agreed to conduct the additional modeling. The results from the second round of modeling were received on May 15, 2023.

Hazen's findings from the second round of modeling results similarly confirmed the significant role the two valves played in the outage. Hazen also concluded that….

> *"By using the East Asheville Pump Station (assuming 18 mgd pumps at 126 feet of total dynamic head with variable frequency drives), system pressures improved significantly. The number of model nodes with pressures less than 20 psi decreased by 53% (with [redacted] valve closed). The pressure at Haw Creek Junction was used in the model to control the pumps, and pressures near that location were especially improved (including the Grove Park Inn area). Water levels in Candler Knob tanks improved by several feet, but South Buncombe tank levels did not improve significantly. With the [redacted] valve open and the pump station operational, water levels in all three tanks improve significantly, and the number of model nodes with pressures less than 20 psi decreased by an additional 5%."*

Note: Both Hazen reports, dated May 10 and May 15, 2023, are included at the end of this report for reference. Each report includes its own *Executive Summary* and *PowerPoint presentation*.

Conclusions

In the collective opinion of the members of the IRC Water Systems/Operations subcommittee, Asheville's Water Outage Event of December 24, 2022-January 6, 2023, should not have been as widespread nor impacted as many customers nor lasted as long as it did. The extreme, sustained cold temperatures certainly led to the loss of the Mills River facility and indirectly caused main breaks and the resulting record demands on the water system. However, the widescale nature and duration of the outage event was largely avoidable and preventable.

Closed 24" Valve: The failure to locate the suspected closed 24" transmission valve in the River Arts District, possibly closed since April 2018, proved to be a major contributor to the event. This subcommittee acknowledges that unknown closed valves are a constant challenge for water utilities. They are difficult to find and often don't become known except when high demand situations occur. Having said that, the IRC, through the course of its work, could not determine a reasonable explanation for why the closed 24" valve was not found between January 10, 2022, and January 2, 2023. Hazen's modeling that led to the January 10, 2022, presentation to WRD staff strongly suspected a closed valve and went so far as to provide a probable location, i.e., [redacted] The IRC suspects WRD staff perhaps wasn't convinced that a closed valve actually existed. And, there was definitely an unfortunate breakdown in communication internally that resulted in the Hazen information not reaching the WRD employees that could have immediately acted upon it and likely found the closed valve. On January 2, 2023, when a portion of the West Asheville system lost service inadvertently through another valve closure, WRD staff immediately became convinced that a valve must be closed on the 24" line. At that point, it was less than an hour before the long-closed 24" valve was found and re-opened. As soon as that occurred, the system began to quickly return to normal.

This subcommittee echoes what Hazen Engineering recommended in its January 10, 2022, presentation, that the WRD needs to invest in an effective Valve Assessment Program, especially for their water transmission line valves (larger than 16"). There are outside contract companies (Wachs, Hydromax, etc.) that specialize in inspecting, assessing, and even repairing water transmission and distribution valves. Even though WRD has about 20,000 valves in the system, there are only a few hundred transmission valves, so an assessment program should be manageable and affordable, in terms of work and resources.

[redacted] *Control Valve Limited to 10% OPEN*: Hazen's modeling work and analysis determined that another valve in the system, commonly known as the [redacted] Control Valve (STCV), also played a significant role in the outage event. The valve is actuated and can be remotely controlled by Operators at the North Fork treatment facility. However, to ensure the valve is not inadvertently opened fully to 100%, the WRD's SCADA system is set up such that the 0-100% scale within SCADA actually represents only 0-10% open on the valve itself. In other words, if an Operator designates within SCADA for the valve to be "open" 100%, the valve will only open to "10%" of its full range. At 10% open, the valve is limited to a maximum flow rate of about 1,800 gpm, or about 2.6 MGD. WRD staff can, if necessary, manually open the valve to fully 100% open but doing so requires a technician physically going to the valve in the field.

Hazen confirmed that the STCV limited to 10% and the unknown closed 24" valve in the River Arts District- restricted the system's ability to flow water from NF and WD plants to the south and west parts of the system. When Mills River was taken offline and system demands spiked, the full effect of the two valves took a toll on the south and west parts of the system.

Other conclusions reached by this IRC subcommittee are described below. While not necessarily direct causes of the outage event, these factors are deemed important enough to require follow-up action:

East Asheville Booster Pump Station: Hazen's modeling work and analysis determined that had the EABPS been available for use during the outage event, system pressures would have been improved, especially in the area of Haw Creek Junction. The unprecedented demands seen during the outage event combined with the need for more resiliency within the system warrant reconsideration by WRD of their timeline for refurbishing the EABPS. Hazen's Master Plan projections for Max Day demands approaching 30 MGD was not anticipated until 2028 or later. The fact that Asheville's system experienced demands at or above 30 MGD on three successive days in December 2022 was unexpected. Fortunately, the EABPS is already built and would enhance resiliency within the water system's ability to withstand high demands during future emergency events.

Derive Daily_System_Demand within SCADA: Asheville's water system has a very robust SCADA system that allows them to remotely monitor flows, pressures, tank levels, pump status, etc., at multiple points in the system. The WRD would benefit by adding an aggregation step within the SCADA Historian that derives what Total System Demand is each 24-hour period. This can easily be done since nearly all of the storage tanks within the system are equipped with level measurement instrumentation. The SCADA instrumentation already measures continuously how much water is being supplied to the system from the plants. The tank level data written to the Historian database can be used to derive how much water is being supplied to the system from the tanks. Adding the two totals together will allow WRD Operators to compare their Total Input from Plants to the calculated Total Demand each 24-hour period.

Advanced Metering Infrastructure (AMI): During the water outage event, the WRD struggled to know at any given time which water customers had water service and which did not. This is not uncommon for most water utilities, with the exception of those utilities that have fully implemented AMI throughout their system. The Asheville City Council approved $30M in funding in July 2022 for a WRD AMI Project. Replacement of the current Automated Meter Reading (AMR) system is underway, but when the December 2022 water outage event occurred, only a few thousand water customers had been converted to AMI. The IRC subcommittee recommends accelerating this effort if at all possible.

Engineering Role within WRD: In most water utilities, the role of Engineering staff is prominent given that a water system as a whole is a Hydraulic Engineering System. It is designed, constructed, and

operated based on engineering principles of closed-conduit, pressurized pipe flow. As such, the IRC questions the overall role of the small Engineering Division within the WRD. Only one member of the WRD Leadership staff that participated in the multiple interviews with members of the IRC Water Systems/Operations subcommittee is an engineer, and no Engineering Division personnel seem to be involved in the department's day-to-day operations of the system. Furthermore, none of the Engineering Division personnel were involved in the actual water outage event. The IRC does not imply that one must be an engineer to lead a water utility. But there is usually an Engineer involved somewhere in the leadership team to ensure that someone understands and fully appreciates the information presented to them by their outside consulting engineers.

For example, the modeling work conducted by Hazen's hydraulic modeler prior to the January 10, 2022, presentation was thorough. Hazen concluded that the only plausible explanation for how the Candler Knob tanks were behaving during elevated demand in the summer of 2019 was likely a closed valve along the 24" transmission line. WRD staff should have treated this information with a greater sense of urgency. The IRC is of the opinion that no one within the WRD fully appreciated how impactful such a closed valve could be to the system. That would have required someone fully understanding how the system is to be operated in high-demand situations. Unfortunately, the valve was not found ahead of time and ultimately proved catastrophic as demands quickly increased on December 24-26, 2022.

Knowledge Retention: During the course of the IRC's work, it became evident to this subcommittee that Asheville's WRD has likely been impacted by a phenomenon that has affected nearly all water utilities over the past decade or so. That challenge is commonly referred to in the water industry as *Knowledge Retention*. Water utilities continue to experience the loss of subject matter experts to retirements and/or higher-paying jobs in the private sector. The resulting potential loss of institutional knowledge can be impactful if not managed well. The *Water Research Foundation* is an excellent resource for many research reports and case studies that document what other utilities have done to combat the *Knowledge Retention* challenge.

Tabletop Exercises: The IRC understands that WRD Staff are in the early stages of developing and participating in Tabletop Exercises aimed at enhancing the department's overall emergency response capabilities. Those exercises and the WRD's participation should continue and increase in frequency and scope. Tabletop Exercises (TTX's) are just what the name implies. They are emergency preparedness and response type exercises based on various emergency scenarios that are conducted while in a controlled setting, i.e., over a tabletop.

TTX's provide a cost effective means of determining the current level of preparedness and the areas that need improvement relative to a variety of threat scenarios, without huge expense or danger to the system or staff.

Primary Objectives of TTX's

- To test the WRD's preparedness and response capabilities to a variety of threats to the water system.
- Determine areas of preparedness and response needing improvement.
- Begin (or continue) the process of continual improvement in preparedness and response. As a result, establish a regular schedule of increasingly difficult scenarios.
- Determine what new relationships to form, or what existing relationships to strengthen both internal to the WRD and with and between critical outside agencies.

District or Zone Meters: The IRC learned that the WRD has begun to install a few district or zone meters that provide flow and pressure data at key points within the distribution system. The IRC applauds these efforts, and fully confirms the need for additional meters to be installed as soon as possible. While these types of meters don't necessarily prevent anomalies from occurring with the distribution system, the near real-time information they provide is invaluable in helping Staff diagnose and understand what is happening within the system.

Water Utility Advisory Panel: This IRC subcommittee concludes that the WRD and the City of Asheville would benefit from the creation of a Water Utility Advisory Panel. It seems apparent that with everything else that the City of Asheville Mayor, City Manager, and City Council oversee, it is challenging at times to provide consistent, effective communication to a city department as critically important as the WRD. A Water Utility Advisory Panel could be a great resource in that it could advise both the WRD and the City Council on needs and issues related to the water utility in the region it serves. A Water Utility Advisory Panel would not possess oversight authority nor would they get involved in any operational decisions. Its role would simply be to represent the larger community served by the WRD's water system and advise on needs and issues related to the system. Such a panel can be effective as another means of connectivity between the utility and City Council members and the community as a whole. Other public water utilities have created and benefited from these Panels such as Charlotte NC, Knoxville TN, Hendersonville NC, Austin TX, and Boulder CO among others.

Recommendations Based on its Analysis and Conclusions, the IRC Water System/Operations subcommittee submits the following Immediate and Short-Term & Long-Term Recommendations.

Immediate Recommendations

- Begin Regular large-diameter valve assessment (contract with HydroMax or Wachs for relatively quick schedule)
- Enable SCADA control of the [redacted] Control Valve for full range of flow.

Short-Term & Long-Term Recommendations

1. Evaluate the existing pumps at the East Asheville Booster Pump Station, by inspection and with pump tests, for the purpose of producing a EABPS Preliminary Engineering Report (PER), detailing what will be needed to refurbish the EABPS and return it to useful service for system redundancy during emergency events and future demand.
2. Create a function or tool within WRD's SCADA Historian that derives Total Daily Demand at the end of each midnight-to-midnight period. This will allow WRD staff to compare each day's Total_Supply_Input versus Total_Demand.
3. Expedite the implementation of Advanced Metering Infrastructure (AMI) throughout the water system. AMI technology and the inherent benefits it provides would have been invaluable to the WRD during the December 2023 event. Many of the communication and operational miscues that hampered WRD's response during the recent event could possibly have been avoided.
4. Re-evaluate the overall Role of the Engineering Division within the Water Resources Department. Consideration should be given to adding a "Production Engineer" position. The goal should be to hire or groom a knowledgeable, experienced Engineer who is engaged in the day-to-day operations and decision-making of the water utility.
5. Conduct an overall assessment of how well the Water Resources Department has managed the ongoing challenge of Knowledge Retention. Identify knowledge gaps and develop strategies to address them as quickly as possible.
6. At least semi-annually, plan and conduct Table-top Exercises (TTX's) to enhance the effectiveness of the department's and the community's overall emergency response capabilities.
7. Accelerate the installation of additional District or Zone Meters in the distribution system. WRD has already installed a limited number of district meters and has seen firsthand the benefits derived from flow and pressure data they provide.
8. Consideration should be given to the creation of a Water Utility Advisory Panel. The Panel would be of assistance to the City Manager, City Council and the Mayor in their oversight responsibilities related to the Water Resources Department. Done correctly, such a Board could be a tremendous resource for the WRD Leadership, City leadership, community, and region as a whole.

Appendix III - IRC - Communications Subcommittee Report

Communications Committee:

- Mike McGill, President, WaterPIO, Co-Chair. The firm handles customer, media, & crisis COMMS for water & wastewater utilities nationwide. Conducted a similar after-action report for Austin, Texas.
- Rob Brisley, Co-Chair, North Carolina Incident Management Team
- Kim "Dirt" Murphy, Co-Owner/Farm Manager, Rainbow Path Wellness, LLC
- Michele Ashley – Did not participate in any meetings, interviews, email discussions, or drafts of this report.

Overall Committee Scope:

- Review the recent prolonged water outage to provide a comprehensive account of the event.
- Assess the City's operational and emergency response and communication efforts.
- Review and analyze infrastructure needs, processes, and policy changes to be implemented to maximize the prevention of future events and improve communication, emergency response, and mitigation processes.

Communications Committee Scope:

- Review, evaluate, & report on the internal & external crisis communications (COMMS) structures, processes, actions, & messages that dictated the City's COMMS before, during, & after the event.
- Provide short and long-term recommendations for improvements.

DISCOVERY PROCESS:

- First, all credit to City staff for facilitation and response to inquiries. Leading off with Jade Dundas, but extending throughout the COMMS and Administration staff, all City staff tasked with making the discovery/RFI process did their jobs extremely well.
- The process involved more than 50 hours of one-on-one interviews with representatives of the following groups:
    - City staff
    - Elected officials
    - News media
    - Community leaders
    - Business leaders
    - Impacted customers
    - IRC committee members

- Interviews were conducted using a process proven protective of participants to achieve candor.
- The process also involved RFI and document reviews, including COMMS and emergency response plans, as well as the CAPE after-action report.

City of Asheville's COMMS Team

Communication & Public Engagement Department (CAPE):
Responsible for the city's strategic communications and coordination of public engagement efforts.

10 FT/PT staff. Variety of COMMS duties, most assigned to specific staff. Some role overlap, especially on-call.

Internal & External Communications
Media Relations
Neighborhood Services
On-Demand City Council Recordings
Public Engagement Efforts

For the purposes of this report, the term "COMMS Team" is used on several occasions because CAPE was not solely in charge of the public communications structure or process. The phrase "COMMS team" refers to everyone who was involved in making public communications decisions.

Findings

- The CAPE team is more than capable of fulfilling crisis duties.
- Many were relatively new to the department. 1st crisis event. 1st water event.
- Across the board, staff had little knowledge of the water system.
- Good segmentation of duties during the event.
- The sheer amount of COMMS delivered to the public was not an issue.
- The quality of COMMS delivered to the public was an issue.
- Quality issues were rooted in the flawed structure and processes more than the staff's performance of duties.
- On-call duties properly managed. Logical rotation of staff.
- Holiday on-call duties were assigned as they normally would, by seniority.
- The on-call process was proper and included procedures to handle escalation.
- Holiday timing impacted the initial stage of response. Staff not together, or able to quickly come together, as during a typical work week. Unfair to treat the review as if the event happened on a regular Tuesday afternoon.

Pre-Event Public COMMS Findings

- A review of the public COMMS before the event shows CAPE staff used appropriate messaging at appropriate times to prep customers in advance of the cold weather. Asheville Fire Department also conducted advance COMMS.
- There was little indication that this particular weather event would cause major impacts on the water system yet "winter preps" messaging was given.
- The timing of the "preps" messages coincided with the last days before Christmas, naturally reducing their effectiveness.
- Direct contact with the press to help push out the word to the public was not used. The general approach continued throughout the emergency response.
- The release of public information was mostly passive. Not uncommon, however, especially given City's COMMS approach and reliance on AVL Alerts. This, however, would continue throughout the response.

Findings: First 24 hours

- CAPE staff is not trained on the water system. Not trained in emergency communications. No dedicated COMMS staff within the Water Department.
- Proper crisis communications plans and procedures for water emergencies are not in place.
- Water Resources Department (WRD) in charge of everyday, water-related COMMS through AVL Alerts.
- On-call CAPE staff were viewed as “producers” who got the word out about water-related incidents as determined by WRD.
- Holiday timing. Staff and public at home/away with families enjoying the holiday.
- Cold weather was predicted, but not at historic levels that would’ve created emergency preparations.
- Once the incident got underway, there was an initial belief from WRD Team that breaks were the main cause of the supply and pressure issues. If breaks were found and resolved, the entire situation would be quickly resolved.
- Public communications shifted to conservation messages, despite the view that the combination of the loss of water plant and reaching maximum capacity constituted a “major emergency.”
- Voluntary conservation messages usually do not work unless they are given several times over several days. Messaging given on Christmas Day was not followed, as is understandable. Only mandatory restriction messages tend to be successful with the public, especially during a crisis.
- Direct contact with the press was not used. Given the situation, preparatory outreach to the news media describing the event and the actions being taken by WRD to address the situation should’ve taken place.
- However, the loss of the water plant due to freezing issues was NOT treated as an emergency requiring public attention due to the plant being offline for months in the recent past.

Key Finding: “Operational Approach” to Public Communications

An "operational approach" to public communications took hold from the very first moments of the event, setting up the City’s COMMS efforts for significant challenges when the situation worsened.

An “operational approach” to public communications prioritizes operational objectives – finding and fixing the problems within its systems – over public communications. This is often used by the nation’s water providers because if the issues are quickly found and fixed, the need for significant “emergency” messaging is reduced, public panic is prevented, and, yes, pressure on the utility over what happened is reduced.

An "operational approach" holds onto information that should be released to the public longer than what is considered best practice. The COMMS are almost always handled this way. An initial message is sent that an event has taken place but is being addressed by staff, then when the situation is controlled, more detailed communications are made. For example, “We had a water main break at 1st and Main that caused water pressure issues in the area, but we were able to repair it and return people to water. People in X area are under a precautionary boil water advisory…”

The ”operational approach” is usually dictated/led by the “Water Operations” leader, not COMMS staff, and is quite common when COMMS staff do not know the water system. This is not unusual, and unfortunately, the case with thousands of water systems. Many are left to work with city or county public information staff that does not know the water system. As a result of the lack of knowledge, the COMMS staff that work the event has to serve in a subservient role to “Water Operations” leaders, with a reduced ability to influence the overall COMMS strategies and moderate influence on what the communications are and when they are released. Public information is often only released when it was completely confirmed – and approved – by multiple operations personnel.

As a result, water providers using the “operational approach” have a slower release of helpful information to customers, elected officials, the news media, and employees. While this doesn’t matter much if the incident is quickly addressed, it is almost always harmful whenever an incident escalates. Not only are Water Operations staff dealing with a worsening situation operationally, but their COMMS efforts must also catch up FAST.

When an emergency escalates while using the “operational approach,” gaps in communications are harshly revealed, trust is instantly placed at risk, and extra COMMS work is required to keep public confidence. Unfortunately, it’s not as easy as flipping a switch.

This is where a lack of a well-designed crisis communications plan and public information structure, such as the one found as part of the Incident Command System under the National Incident Command System, puts the entire response at risk. Without such a structure, COMMS become haphazard, creating random information streams and the potential for inaccurate information to be relayed to the public, frustrating the

press, the public, and key stakeholders in local government and the community, and costing essential trust in the overall response. (We will go into greater detail about the negative impacts that Asheville experienced in our next section.)

The lack of a functioning crisis communications plan is revealed in actual public communications that took place during the first 24 hours. While WRD internally declared a "major emergency" on Christmas Day, the City's public communication did not relay that such an emergency was taking place, or even that preparations for a possible emergency should begin. Early messages focused on relatively benign conservation messaging, effectively downplaying the seriousness of the matter. Meanwhile, the news media, elected officials, and community leaders were getting calls from the public about their water being out.

AVL Alerts was used as the primary way to get information out to the public, despite its lack of reach to the entire customer base, and no effort was made to directly inform the press, which found out about the severity of the situation from viewers calling into their newsrooms. Needless to say, there was also no effort made to get the press on a schedule for a regular release of information as soon as possible, another basic best practice for crisis communication.

Incident Response: First 72 Hours

This is not presented in a tick-tock format because the sheer number of communications was significant. The issue was the effectiveness of the communications. This section focused more on the strategies, actions, and messages used for the initial section of the event and the issues that led to their lack of effectiveness.

Findings

- "Operational approach" to public communications kept CAPE staff in a "producer" role process deep into the event.
- Difficulty relaying basic facts of the outage – "How many?" "Where?" "Why?" "How is it all being addressed?"
- Water-only emergency led to Water-only COMMS without other departments being included. Definition of an emergency – three or more departments need to be affected – kept WRD in full control of the crisis response and only practitioner of public communications. Asheville Fire Department was not notified until well after the event was underway (26th). AFD did not employ the Incident Command System for City; its responsibility stayed with WRD. The information flow to the County was not adequate and incomplete.
- Communications with critical customers like, for example, the hospital were handled properly with repeated updates that protected public health.
- Overemphasis on DHS security concerns caused unnecessarily confusing COMMS regarding the loss of the water plant. Mills River was not named when it had been previously named during a months-long lack of service. It is a best practice to name a specific plant when it goes down because public health is placed at additional risk.

- CAPE staff was not experienced with the water system. Not in a position to fully advise WRD, even though they asked proper COMMS-related questions. The job was to produce the information provided by the WRD.
- WRD control over AVL Alert usage led to decisions to use AVL Alerts as a primary delivery system for public notifications. Notification systems should not be the primary vehicle for emergency alerts. They are secondary, due to the lack of its ability to inform the entire population. When operating as a primary vehicle, the alert system creates a system of “have and have nots” regarding public information during a crisis. This simply cannot happen.
- Distrust of news media factored into the COMMS process. Mass media is the #1 outlet for crisis COMMS but was not properly informed of the situation. Instead, the City reverted to using press conferences to fill in the gaps created by the “operational approach.” The press conferences, especially the first one, relayed information confusingly and incompletely. Several key questions asked by the news media were unanswered.
- Attempts to use press releases to fill in gaps were made. However, the press releases did not follow the proper crisis COMMS schedule – early morning, mid-morning, mid-afternoon, mid-evening – that works with mass media schedules for the greatest impact. Also, the press releases – again, because of the need to catch up on COMMS – became “kitchen sink” documents, with every possible piece of information included, weighing down the essential facts.
- Best practices for incident crisis COMMS not in place. No PIO/Unified PIO in charge of COMMS only responsive to Incident Commander.
- Multiple leaders without any crisis COMMS training or experience in any situation resembling this event inserted themselves in COMMS decisions, exerting outsized influence when properly developed procedures would've greatly reduced their COMMS role.
- In an effort to give SOME estimate of the number of people affected, inaccurate information was provided to the public. The “About 38,000 people are affected” was not based on actual outage data; it is the number of people signed up to receive AVL Alerts. COMMS’s ability to tell leaders that it was okay to say, “I don’t know” instead of giving a false number was diminished because of the “producer” role. We do not find this misinformation to have been harmful to the public but it overestimated the impacts of the event. If anything, it helped relay how serious the situation was becoming. However, that number should never have been given and should not be used today.
- City Manager properly carried out her role, with one exception she noted. The City Manager took on a great deal of criticism for her actions for not being a public face of the event. Facts reveal she was engaged early in the response and appropriately handled her role. City Managers are not COMMS leaders during incidents. One area where the City Manager stated actions could’ve been better was in her interactions with elected officials, who insisted they be directly in both the overall response and the public communications. She stated, and we agree, that a stronger structure to keep elected officials out of the response and COMMS processes would’ve been beneficial. This situation, however, was created by the lack of a proper crisis COMMS plan and structure in place. Without it, the City Manager didn’t have guardrails to support any efforts to keep elected officials out of the COMMS process.

- Asheville's infrastructure limitations created a situation where basic information could not be reported. The “radio read” meters simply cannot provide the information that was demanded by elected officials, the press, and the public during the event. All information on who was without service and for how long was, at best, a longshot estimate. This lack of data set up situations where – because elected officials believed outage information had to be given – incorrect information was issued; a map with confusing and inaccurate information was produced; and estimates on restoration of service were given that had no basis in fact, potentially impacting public safety.
- The 211 system for service requests worked as designed.

Elected Official Impacts on COMMS Response

Elected officials are force multipliers for public information during a crisis. To accomplish this, however, elected officials are not involved in the operational response and are to be updated regularly either by the COMMS staff or through personal contact with the Incident Commander. Then they help push out the agreed-upon messaging from Incident and COMMS leaders to their constituents.

Elected officials are not to be on hand in the “room where it happens” because it can create questions about a possible public meeting in the middle of a crisis response/COMMS meeting. Injecting that dynamic into the mix can be extremely detrimental to the overall response and COMMS efforts.

As stated repeatedly, elected officials, in part because they viewed both the operational response and the public COMMS as failing, injected themselves into both processes, despite lacking proper training.

When it comes to their outsized influence on the overall response that we discovered, we relayed our fact-finding to other committees. We will focus on how the lack of a COMMS structure and process contributed to elected officials taking over key aspects of the public information process, even to the point of having the final say on what information would be relayed to the public, including information that had no business being stated because it put public health at risk.

Information was relayed to electeds in a manner such that the electeds who handled themselves properly during the crisis – according to proper crisis COMMS procedures – were the ones essentially left out of the loop. To her credit, the City Manager noted that this is one area where she felt she could’ve done better, both in informing all equally and preventing those with the information from exerting outsized influence.

In the case of this event, most elected officials found out about the severity of the event from their friends and constituents. In some cases, their being out of town for the holidays added to their lack of direct information. As the response developed, two elected officials, the Mayor and Council Member Ullman, began using the information they gathered from being at the location of the Incident Command to inject themselves into taking more of an active role in both the response and the public COMMS. Some other elected officials felt they were not being informed to the same degree and

understandably went to the Incident Command location. The remaining elected officials were left to largely find out information for themselves.

This reaction by the Mayor and Council Members is understandable; it is clear the Mayor and other elected officials had significant issues with how the situation was being handled, the lack of clarity and success surrounding the operational response, and the lack of adequate public communications, especially the inability to estimate how many people were without service, exactly where they were, and when service would be restored. This is a perfectly acceptable reaction. However, this reaction would become the driving force behind the most significant public COMMS mistakes.

The Erroneous "24 to 48 Hour" Service Restoration Message

The second area of focus for this report was the decision to tell the public that service would be restored within "24 to 48 hours" on December 27th. Before signing onto this effort, it was the area that drew the strongest reaction for people on the committee because it was a) a message no water operations leader should say; b) a message no one trained in crisis communications would say; and c) a message that placed public health at risk because it set an expectation the situation would be resolved days before full restoration took place.

Because of the seriousness of what is contained in this section, it should be stated that what is written here is confirmed by multiple sources, from multiple entities and departments who were in the room where the decision-making took place. Key moments are confirmed by all participants.

Frustration over the inability to both resolve the situation, and properly communicate about it, led to direct pressure by the Mayor and, to a lesser extent, Council Member Ullman to provide questionable, "best case" information to the public over the significant objections of WRD and CAPE staff. The reasons given were that the public demanded and deserved to know when they would get their water back in service.

While this is a perfectly reasonable request by elected officials, it did not remain a request. When CAPE and WRD staff stated their objections to providing such an estimate because they simply did not know when service would be restored – at the moment the drained tanks had not even started refilling – their concerns were overruled by the Mayor.

What was described by several people as "significant," "major," and "extreme" pressure was brought to bear on staff to come up with some estimate that could be given, and one that would relay service would be restored with some speed. Multiple people from multiple groups both directly and indirectly involved in the decision stated that if a public message was not immediately developed giving an estimate, the strong insinuation from the Mayor was that the jobs of the people stating objections were on the line.

We directly asked the Mayor about this moment. She stated what we confirmed in our report, that there were high levels of frustration about the response and the public COMMS process. She added this had been a long-standing issue with COMMS, that

she has more of a mind to inform the public fully and rapidly during everyday matters, let alone a crisis, while the COMMS staff took a more measured, administrative view of public COMMS.

The Mayor was asked about her crisis COMMS training and experience. She stated she had not had crisis COMMS training but that her work during the George Floyd protests provided some experience in dealing with a crisis. The Mayor was careful not to overstate this experience; her answer was in response to a direct question.

The Mayor confirmed she brought significant pressure on staff to change their assessment and put out a public message giving an estimate on the restoration of service. She stated that the public demanded a timeframe. Multiple people confirmed that, under this pressure, David Melton stated that a “goal of 24-48 hours” could be given, despite the situation with the tanks. Melton stressed the use of the word “goal” and it was relayed to all that it was truly a best-case scenario.

This is the message that was sent to the public via various communications vehicles on the evening of the 27th. As is usually the case when specific measures of time are given during crisis communications, caveats, like the use of the word “goal” are often lost in translation; when a person hears “24 to 48 hours,” they think is when they WILL get their service back, not that is a GOAL. That is why conservative timeframes are always given. Not only do they tend to be more accurate, but they also reduce pressure on the operational response to meet overly optimistic expectations.

Also, when exceedingly optimistic estimates are not met, the press, the public, elected officials, community leaders, and most importantly, a water provider’s customers lose complete trust in both the operational response and the truthfulness of the public communications. They simply tune out any information that follows the error.

And, as discovered in Asheville, when the press is told information that ends up being false, they immediately turn from newsgathering operations whose lead responsibility is to serve as a public information provider during a crisis to entities that feel the need to immediately conduct oversight, investigating why they were given information that turned out not to be true. This change in approach automatically changes the tone of the coverage with even more of a focus on the operational response and its failure to meet its own stated goals regarding the restoration of service.

But the greatest issue with giving such an optimistic and, as it turned out, wildly inaccurate estimate in a water supply-related crisis is that it changes the calculations people make when it comes to protecting their health and safety.

A scenario was provided to all who were involved in the “24-48” messaging during the questioning. If a customer who is taking care of an elderly family member is told they will be without water for one to two days, the calculation can be made that – if they can get a modest amount of water – they can remain in their home and not seek other facilities that have water service to protect the health and safety of the family member. However, if they are told the event could last longer, that changes the calculation for a caregiver. To be without water for more than two days, as it turns out for some it was

much longer, places public health and safety at risk. Actions can be taken to protect a person who cannot go without a reliable supply of water for three or more days. There was universal agreement about the seriousness of the mistake.

Above all, this is why the inaccurate message that service could be restored within “24 to 48 hours” should never have been given. The strenuous objections from WRD and CAPE staff should have held sway over the Mayor’s insistence that such a message be released to the public. This is yet another example of how the lack of a proper crisis COMMS plan and structure could’ve prevented a significant mistake that put public health and safety at risk.

Suggestion/Demand for an “Outage Map”

While not as significant as the push for the “24 to 48 Hour” communication, the creation of an inaccurate outage map – while viewed as a good idea at the time – also hampered the operational response and the COMMS effort. As stated earlier, Asheville uses old, “radio read” technology with its water meters. This is not unusual across the country; massive meter changeout efforts, even when funded, take a significant amount of time to craft and successfully implement.

“Radio read” meters simply don’t provide information in real-time to the water provider; staff would have to go out and get usage information, which is impossible to do in a crisis. As a result, utilities using these meters are largely flying blind when it comes to outage events, especially larger ones. During smaller breaks, crews can more easily estimate on the scene who is without water. During larger system impacts, especially a system as complicated with pressure zones as Asheville’s, the lack of more advanced metering technology prevents the provider from truly knowing how many people are without service. While pressure zones help provide some clues, there can even be variations within pressure zones. As stated by some we interviewed, people had water when they were told they wouldn’t and vice-versa.

Finally, and not least importantly, there is an expectation in this “Instant Information Age” about the need for service providers to instantly provide real-time outage information. This is an expectation set by another utility sector, the energy industry. If you have a smartphone or a computer, you can find out exactly who is without service and get an estimate on when service will return.

This same level of service is simply not available yet in the Water World; only systems with the finest Advanced Metering Infrastructure can even come close.

As stated earlier, there was significant frustration over the lack of information that was being given to the public about who was without water and when water would be restored. This led to the “About 38,000” message based, not on actual outage information, but on the number of people signed up for AVL Alerts.

Even though the information was relayed about the capabilities of the Asheville system to provide outage information, pressure was brought to bear from elected officials, led by Council Member Ullman, for an outage map to be produced as soon as possible.

There is some disagreement about whether Ullman's idea was a strong suggestion or a demand. It was also viewed by WRD staff as a good idea at the time. However, it negatively impacted both the operational response and the COMMS effort.

When asked why the suggestion/demand was made, Council Member Ullman stated it was based on the deepening frustrations over the response and the public communications. This is where the lack of a crisis COMMS plan and structure again harmed Asheville's efforts. Not only would the possibility of a map likely have been addressed before an emergency – we believe a "Zones" that provides a caveated outage estimate based on homes in each zone could be developed – but the lack of a map could've also been proactively explained so a rushed effort filled with understandable inaccuracies could be avoided. A proper COMMS structure also would've governed the influence of elected officials to ensure suggestions and ideas could not be viewed as demands or commands.

It must be stated that Asheville staff did a commendable job trying to get a map up; they were just starting with two strikes against them: lack of time and quality information. As discovered by other utilities attempting to create an outage map in the middle of a crisis, the middle of a crisis is not the time to try and create an outage map. Not only does it divert resources away from other efforts in the middle of the response, it's likely the information being relayed will be inaccurate, and not just in say, one community, but throughout the entire system. Any inaccuracy found or experienced by customers creates doubt, not only about the map but the entire utility's response.

Other jurisdictions have found that, while their mapping effort was truly conducted in good faith to provide as much information as possible, creating one for the first time in the middle of the crisis harmed the utility as much as helped it. Based on our findings, this was the case in Asheville as well.

RECOMMENDATIONS

While there are several recommendations weaved in with the findings, the top recommendations are as follows:

- The "operational approach" to public communications needs to be replaced with a system where COMMS professionals are elevated in importance and can have not just influence, but direct oversight of the crisis communications planning and implementation. This can be accomplished in several ways:
    - The hiring of a Public Information Officer dedicated to the WRD. (This is already in motion.)
    - Crisis COMMS training for ALL CAPE staff, based on the Incident Command training program, to provide redundancy and ICS shift flexibility.
    - The institution of the COMMS portion of the Incident Command System under the National Incident Management System. This can be used by COMMS, even if Asheville does not incorporate NIMS and ICS into emergency response plans. (All indications are these steps are being recommended by other committees.)

Using the COMMS portion of ICS places the COMMS responsibility with the Incident Commander and the Public Information Officer. No one else is responsible for leadership over COMMS decisions or staffing.
    - Crisis COMMS training for WRD staff and elected officials to ensure everyone is on the same page before the next crisis.
    - Media training for all COMMS-related staff and Department leaders.
    - NIMS/ICS training and certifications for City staff responsible for crisis COMMS. Certifications include NIMS/ICS 29, 42, 100, 200, 700, 800, and FEMA Basic PIO L105. (FEMA class is already being given with numerous COA and Buncombe County members participating.)
    - Regular engagement with Buncombe County COMMS staff.
- The development of updated crisis communications plans that will, among other impacts:
    - Incorporate any ICS/NIMS-related changes.
    - Incorporate staffing changes.
    - Develop a system for more consistent public communications using best practices, including the use of mass media and social media streams to handle citywide communications.
    - Shift passive information streams like AVL Alerts to secondary roles. Helpful, but not to be considered a primary path to the public.
    - More effective and structured use of elected officials, who would serve in their proper public information roles.
- The elevated importance of the design and implementation of AMI to address the most pressing public communication issues that hampered the operational response; harmed the credibility of the communications response; and created an environment where inaccurate information was relayed to the public on multiple occasions to fill in the gap information caused by the “radio read” meters.
- Off-the-record “sitdown sessions” with top local media outlets to air grievances and differences that influence the public communication process. While it was clearly stated the press has nothing but respect for their direct liaison, it is clear some issues need to be discussed. These discussions will only help both Asheville and the news media do their jobs on behalf of their citizens and readers.
- Ahead of next winter, COMMS should conduct proactive outreach in November, before Thanksgiving, that lays out all of the lessons learned from this event and the resulting actions taken. Proactive “break repair” demonstrations, an unveiling of a new outage map, instructions on how to prep for the winter, and information on how to be best informed during an emergency can all be incorporated into this effort. It is a tried-and-true for Asheville to get significant trust back, both regarding its operational response and its COMMS, before the next winter sets in.

Appendix IV - IRC - Emergency Response Subcommittee Report

<u>FINDING.</u> The use of the Incident Command System was not implemented as outlined in the National Incident Management System guide, as directed by Homeland Security Presidential Directive five, or as specified in the 2010, City of Asheville Emergency Operations Plan.

<u>SUPPORTING FACTS/TESTIMONY TO THE FINDING.</u>

- The CoA Emergency Manager staffed within the Fire Department was not utilized in that role (or to his potential) and was identified in interviews as being prevented from performing his duties.
    - Two individuals accounted for a Fire Department Employee becoming so frustrated and visibly upset (throwing a laptop on the tailgate of a truck) it required the employee to pause and regain composure. This detail is important because of the reputation, professionalism, demeanor, and expert knowledge this employee is known for.

- No incident documentation of the crisis was maintained throughout the duration of the incident. The reasoning provided by the WRD: “There was not an anticipated FEMA reimbursement”. *While incident documentation is critical for Federal reimbursement, it is not primarily why documentation is completed.*

- City leaders and elected officials were consistently unable to identify who was in charge (two identified themselves as the Incident Commander).
    - The only individual the Emergency Response sub-committee spoke with who was adamant that Mr. Melton was the IC was Chief Burnette.
    - One member in City Leadership described the situation as “leading by consensus.”
    - A common response received was leading “within silos.”

- Identified as a Type III incident by the Fire Department but an incident of this size, duration, and complexity lacked formal sections under the ICS. (Planning, Operations, PIO/JIC, Logistics)

- Lack of a coordinated, interdepartmental, and intergovernmental Emergency Operations Center.
    - Fire Department Leadership (with hindsight) would have opened an EOC for “optics.”
    - WRD set up its own “internal EOC” however, this EOC lacked trained personnel, no components in the ICS system were filled (Planning, Operations, Logistics, PIO, etc.), and there was no one to coordinate the multiple agencies involved in the response.

    - Because there was no “EOC” the Incident Commanders (Mr. Melton, Mayor Manheimer, and [eventually] Mrs. Campbell) found themselves in front of

cameras and media which is not an appropriate role of an Incident Commander for a response of this size and magnitude. *The sub-committee recognizes Mrs. Campbell was compelled to conduct an interview after community criticism of her absence which was unfounded and incorrect. The sub-committee understands and recognizes her need to conduct the interviews she did.*

Recommendation

"NIMS guides all levels of government, nongovernmental organizations (NGO), and the private sector to work together to prevent, protect against, mitigate, respond to, and recover from incidents. NIMS provides stakeholders across the whole community with the shared vocabulary, systems, and processes to successfully deliver the capabilities described in the National Preparedness System. NIMS defines operational systems, including the Incident Command System (ICS), Emergency Operations Center (EOC) structures, and Multiagency Coordination Groups (MAC Groups) that guide how personnel work together during incidents. NIMS applies to all incidents, from traffic accidents to major disasters."

(National Incident Management System, FEMA, 2017)

Driving the following recommendations, it is also important to highlight the three guiding principles of NIMS:

Flexibility. NIMS components are adaptable to any situation, from planned special events to routine local incidents to incidents involving interstate mutual aid or Federal assistance. Some incidents need multiagency, multijurisdictional, and/or multidisciplinary coordination. Flexibility allows NIMS to be scalable and, therefore, applicable for incidents that vary widely in terms of hazard, geography, demographics, climate, cultural, and organizational authorities.

Standardization is essential to interoperability among multiple organizations in incident response. NIMS defines standard organizational structures that improve integration and connectivity among jurisdictions and organizations. NIMS defines standard practices that allow incident personnel to work together effectively and foster cohesion among the various organizations involved. NIMS also includes common terminology, which enables effective communication.

Unity of effort means coordinating activities among various organizations to achieve common objectives. Unity of effort enables organizations with specific jurisdictional responsibilities to support each other while maintaining their own authorities.

- **To effectively manage incidents of all scopes and sizes, the design and implementation of one Incident Command System (ICS) should be established, trained, and exercised throughout the City of Asheville. The ICS system should incorporate the components of command and management, preparedness, resource management, communications and information management, supporting technologies, and ongoing management and maintenance as outlined in the National Incident Management System.**

- **Preplan (train and exercise) who will fill critical ICS Command and General Staff positions. For example, for a citywide or large-scale incident such as this, it is plausible that a City Manager would be best suited for the Incident Commander role due to the decision-making requirements, approvals needed, involvement of elected officials, and the implementation of a Unified Command. These three officials should then attend training and participate in exercises often. Operating within the ICS becomes overly cumbersome and often abandoned because of a lack of training and experience operating within it.**

FINDING. Inconsistent or complete lack of training for elected officials, city management, and operational staff surrounding emergency management/response.

SUPPORTING FACTS/TESTIMONY TO THE FINDING.

- A newly elected officials' workshop is offered by the CoA where Fire Department operations (to include emergency management) is briefed but no Fire Department personnel attend this session nor does anyone from the Fire Department present it.

- All levels of CoA personnel identified the response to this crisis as "needing improvement". The absence of training is derived as a root cause.

- Elected officials inserted themselves into operational areas which were the responsibility of departmental staff. This led to an emergency response which was described as "murky", "inappropriate", "unwieldy", and "cumbersome".

Recommendation.

- **Establish minimum training for Incident Command:**
    - **Mayor and Vice Mayor: ICS 100, 200, 300, 700, 800 (Coursework recommendation based on the roles assigned within the EOP and duties to declare a local disaster declaration under NCGS.)**
    - **Elected Body: Local Elected and Appointed Officials Course (Roles and Resources in Emergency Management)**
    - **City Manager(s) and Department Heads: ICS 100, 200, 300, 400, 700, 800 (Coursework recommendation based on the major roles these individuals would hold in an ICS command structure.)**
    - **Supervisors in customer forward departments: ICS 100, 200, 700, 800**

- **Establish training surrounding the EOP and COOP.**
    - **Roles and responsibility of elected officials during an emergency.**

- **Establish and implement an exercise schedule to include the opening of an EOC and Unified Command/Multi Agency Coordination Group Structure.**

FINDING. **There was no consideration for the implementation of a Unified Command although the incident extended beyond the municipal borders of Asheville.**

SUPPORTING FACTS/TESTIMONY TO THE FINDING.

- **Collaboration with and input from key Stakeholders (City/County Manager, Fire Department/BCEM) was through informal colleague discussions.**

- **Asheville City, Buncombe County, and Henderson County residents lost water service. Normally an incident affecting multiple jurisdictions is incorporated under a unified command to allow for joint ownership and responsibility and have full access to the resources each stakeholder has. While Buncombe County leadership was informally consulted during the incident, Henderson County leadership was not "brought into the loop" per WRD leadership. Woodfin Sanitary and Water District does not recall any conversation about the water outage.**

- **Buncombe County Emergency Management initially sat idle "a city problem" until the Buncombe County Emergency Services Director was contacted and briefed by his staff.**

- **Interviews conclude that information sharing between BC Emergency Management and Asheville Fire Department was difficult. It was described as information pulling compared to open transparent sharing of information.**

- **Interviews with Buncombe County residents conclude the level of service to those outside the CoA municipal limits lacked consistency and needs in the County were not met.**

    - **It was not understood by many that water was available to non-city residents. (The sub-committee does acknowledge that communication from the CoA was clear on water availability however, this point was heard consistently.)**

    - **Rural community needs not considered: water for livestock, horses, and farms.**

Recommendation.

- **An incident extending beyond the boundaries of a municipality affects populations which have no voice within the City of Asheville government. Future impacts which affect populations outside of the municipal limits should formally include professional representatives of those areas (Emergency Management, Fire Departments, etc.)**

- **Buncombe County Emergency Management should actively pursue involvement during incidents that affect its residents.**

- **Buncombe County and the CoA should form a joint Incident Management overhead Team to assist the operation of an EOC or to staff and function within an EOC.**

- **The COVID pandemic response was and is a successful model for what a Unified Command structure looks and operates like. The City of Asheville and Buncombe County should plan to exercise joint EOC activations bringing together critical ICS components to include the operation of a JIC.**

<u>FINDING.</u> The Emergency Response approach was appropriately guided by FEMA Community Lifelines but failed to acknowledge the community perception and reaction to the crisis. Communication with community partners was either absent, lacked consistency, and/or was inaccurate.

<u>SUPPORTING FACTS/TESTIMONY TO THE FINDING.</u>

- **Fire Department leadership maintained the response was adequate even with the benefit of hindsight. Key terminology used was "all community lifelines were green". While true, the community overwhelmingly voiced during and in the crisis aftermath that this was a significant community event.**

- **Elected officials did recognize the community impact and the lines of policy and operations became overly blurred. Elected Officials articulated that they "were not happy with the response".**

- **County officials (Emergency Services Director and Emergency Management) were briefed by Asheville Fire Department leadership that "there were no unmet needs" and [non-potable water distribution by the county] "would make the city look bad". The mayor articulated she felt there was a "rift" between Chief Burnette and the County.**

- **Asheville Fire Department leadership acknowledged an EOC should have been activated for "optics."**

- **Asheville Fire Department leadership stated an email was sent to all Buncombe Fire Chiefs however, numerous Chiefs deny receiving any email(s) about the event. No formal briefing was provided to Buncombe County Fire Chiefs throughout the incident nor was there any formal conversation with all County Chiefs about the need for tankers in the event of a fire in the outage area.**

- **The outage map distributed by the WRD did not accurately reflect who had and did not have water. This map was being used by critical water users (Fire Departments) to make decisions on the need to respond a water tanker in what would normally be a hydrated area. In interviews, the WRD articulated that this map was demanded by an elected official who was advised at the time that they did not have the technology or information in place to create the outage map that was being requested.**

- **The mayor found it very difficult to get information out to all elected officials because of the requirements under NCGS regarding open meetings. This difficulty potentially left**

some officials feeling underinformed which resulted in their actions to insert themselves into the response as a means of gaining information.

Recommendation.

- **The approach and response to the incident by Asheville Fire Department was appropriate but lacked sensitivity to what the community was feeling and coping with. The perceived insensitivity is a management prerogative, and the recommendation would be for a lessons learned after action.**

- **Elected officials require the necessary training to understand and operate within established parameters during a crisis. A method of communication to keep elected officials informed while meeting general statue requirements should be established.**

- **The Emergency Response sub-committee respectfully disagrees with the Fire Department leadership in that the activation of a formal EOC was needed. The size, complexity, and duration of the incident alone call for its activation however, the lack of an ICS system, planning, operations, documentation, and communications could have all been assisted with key positions meeting and working within an ICS system and EOC. EOC activation benchmarks should be established.**

- **Community partners and critical water users require accurate and timely situational reports. The implementation of a Unified Command/MAC and an EOC activation would likely have positively impacted this need. Email should be a tertiary method of communication.**

FINDING. Outdated and vague Emergency Operations and Continuity of Operations Plans.

SUPPORTING FACTS/TESTIMONY TO THE FINDING.

- **The existing 2010, Emergency Operations Plan and continuity of operations plan is outdated and beyond its 5-year revision cycle.**

- **The current EOP:**
    - **Lists a water system failure as a "Likely Occurrence"**
    - **Calls for the employment of the ICS, an integral part of the NIMS, in managing emergencies.**
    - **"Many emergencies are preceded by predications or warning signs which allow for mobilization of resources and notification of the public. Declaration of "level 3" will generally require the initiation of the "increased readiness" activities identified in the annexes to the EOP.**
    - **Vague. "Mayor will monitor the emergency response during disaster situations and provide direction where appropriate."**

Recommendation.

- **Both plans are currently under revision and recommend abiding to the five-year revision period.**
    - **Important note: The current draft fails to list a long duration of freezing temperatures related to water distribution as a potential threat.**

- **The EOP wording is vague to be used by those without formal emergency response training. For example, the wording regarding the duties of the Executive Group states that the mayor will "monitor the emergency response during disaster situations and provide direction where appropriate." Without formal emergency response training, it is unlikely that the appropriateness of direction can be accurately gauged, particularly since the severity of this incident was perceived differently by the members of the Executive Group.**

Appendix V - Hazen Hydraulic Modeling Executive Summary – Final May 15, 2023

Hazen *Executive Summary* May 15, 2023

Water System Resilience Modeling

Winter 2022 Water Main Break Analysis

In late December 2022, Asheville experienced frigid winter weather with sub-zero temperatures. Water demand increased dramatically due to numerous water main breaks, premise plumbing leaks and customers running faucets to prevent freezing in premise plumbing. The extreme cold also froze equipment at the Mills River Water Treatment Plant (WTP), resulting in an outage lasting several days. The combination of unusually high water demand and limited supply caused low pressures, loss of service, and subsequent boil water advisories for thousands of customers lasting several days.

The purpose of this study is to determine what water distribution system infrastructure and/or operations are necessary to maintain service in the future if main breaks and water plant outages of a similar magnitude occur. The technical details of this analysis were presented to the Independent Review Committee (IRC) for this study on May 12, 2023 during a virtual meeting. The presented slide deck is enclosed.

The first task of this study was to simulate the water distribution system events and operations in the hydraulic model. The model is owned and maintained by the city's Water Resources Department and was calibrated during a master plan completed in 2019.

The hydraulic model was updated to replicate the operation of the system between December 23, 2022, the day before main breaks started occurring, and January 4, 2023, when the boil water advisory was lifted. Predicted operation was compared with recorded performance from the city's Supervisory Control and Data Acquisition (SCADA) system to calibrate the model and verify its accuracy in the city's main pressure zone, called the 2440 zone. Locations of known pipe breaks, and estimates of water lost, were provided by the city. The location of a known closed valve was also provided, a 24-inch valve that was found closed at [redacted] near the intersection of [redacted]. The valve was opened by city staff on January 2, 2023. The model was able to predict recorded flows and tank levels within reasonable tolerances.

The model was then used to test three scenarios assuming the same water main breaks and outage at Mills River WTP:

1) [redacted] 24-inch valve open
2) Increased flow from the [redacted] Control valve
3) Operation of the decommissioned East Asheville Pump Station (with and without the [redacted] 24-inch valve open)

Improvements to the East Asheville Pump Station were recommended as part of the 2019 master plan to accommodate future demands. A demand-trigger for this improvement was a maximum day demand of 30 million gallons per day (mgd). Under typical current operations and customer usage, the city does not experience demands this high, but demand projections in the master plan exceeded 30 mgd between the years 2025 and 2030. Therefore, the master plan recommended recommissioning the East Asheville Pump Station when the demand approaches 30 mgd, around the year 2028.

Job no 32419-008

The modeling analysis showed the following results for each scenario:

1) Opening the 24-inch valve on [redacted] greatly improved hydraulic performance in the 2440 zone with normal operations of the [redacted] Control Valve without the East Asheville Pump Station. With the 24-inch valve open, the water level in Candler Knob Tanks did not drop as significantly and the number of model nodes with pressures less than 20 psi decreased by more than 51 percent.

2) The [redacted] Control valve helps to regulate the water levels in the Candler Knob and South Buncombe tanks. It is limited in the city's SCADA system to open no more than 10 percent (approximately 2.6 mgd). Opening the valve more than 10% requires manual operation. The model showed that completely opening the valve during the break event increased the flow to between 6 and 8 mgd. This operation caused the water level in South Buncombe Tank to not drop as significantly, and the number of model nodes with pressures less than 20 psi decreased by more than 49 percent.

3) By using the East Asheville Pump Station (assuming 18 mgd pumps at 126 feet of total dynamic head with variable frequency drives), system pressures improved significantly. The number of model nodes with pressures less than 20 psi decreased by 53% (with [redacted] valve closed). The pressure at Haw Creek Junction was used in the model to control the pumps, and pressures near that location were especially improved (including the Grove Park Inn area). Water levels in Candler Knob tanks improved by several feet, but South Buncombe tank levels did not improve significantly. With the [redacted] valve open and the pump station operational, water levels in all three tanks improve significantly, and the number of model nodes with pressures less than 20 psi decreased by an additional 5%.

Based on this analysis, we recommend the following:

1) **An independent valve assessment on all large diameter (16-inch and larger) transmission mains.** This process will document valve coordinates and any valves that are partially or fully closed, inoperable, or cannot be located. Independent contractors can also exercise the valves to bring some back into working order. The city can use this assessment to plan for valve replacements and other maintenance where needed.

2) **Enable SCADA control of the [redacted] Control Valve for full range of flow.** Safety features can be added into the programming to prevent accidental operation of this valve outside of its normal range, but the ability to rapidly respond to break events with full control of this valve will help distribution system operators maintain system pressures. When the South Buncombe Tank level drops below 17 feet, due to main breaks, plant outage, or other emergency conditions, we recommend increasing flow through the valve (up to 8 mgd) until South Buncombe Tank levels recover.

3) **Evaluate the existing pumps at East Asheville Pump Station, by inspection and with pump tests.** Also evaluate the working order of all the instrumentation and programming and develop a preliminary engineering report for recommissioning the pump station. While valve improvements alone improved a large portion of the system pressures, East Asheville Pump Station had a larger impact on critical customer pressures near Haw Creek Junction. Additionally, the possibility of a more extensive or sensitive break event in the future warrants returning this pump station to operation for added distribution system resiliency.

Appendix VI - Hazen Hydraulic Modeling Report – Final May 15, 2023

Summary and Recommendations

Summary

- Two major valve limitations were identified:
  - Closed [redacted] 24-inch valve
  - Limited flow through [redacted] Control Valve
- The status of the [redacted] 24-inch valve significantly impacts system pressures during high demand
- The flow through the [redacted] Control Valve significantly impacts pressures on the south side of the system, especially when Mills River WTP is offline
- During the winter 2022 break events, refurbishing and running East Asheville Pump Station would have improved system pressures, especially near Haw Creek Junction.
  - East Asheville PS has more significant improvements to pressure and tank levels WITHOUT above valve limitations

Recommendations

- Regular large-diameter valve assessment (contract with HydroMax or Wachs for relatively quick schedule)
- Enable SCADA control of the [redacted] Control Valve for full range of flow
- Evaluate the existing pumps at East Asheville Pump Station and recommission station for redundancy during emergency events and future demand

Appendix VII - Hazen Hydraulic Modeling Report Executive Summary – Draft May 10, 2023

Hazen *Executive Summary*

DRAFT – May 10, 2023

Water System Resilience Modeling

Winter 2022 Water Main Break Analysis

In late December 2022, Asheville experienced frigid winter weather with sub-zero temperatures. Water demand increased dramatically due to numerous water main breaks, premise plumbing leaks and customers running faucets to prevent freezing in premise plumbing. The extreme cold also froze equipment at the Mills River Water Treatment Plant (WTP), resulting in an outage lasting several days. The combination of unusually high water demand and limited supply caused low pressures, loss of service, and subsequent boil water advisories for thousands of customers lasting several days.

The purpose of this study is to determine what water distribution system infrastructure and/or operations are necessary to maintain service in the future if main breaks and water plant outages of a similar magnitude occur. The technical details of this analysis were presented to the Independent Review Committee (IRC) for this study on May __, 2023 during a virtual meeting. The presented slide deck is enclosed.

The first task of this study was to simulate the water distribution system events and operations in the hydraulic model. The model is owned and maintained by the city's Water Resources Department and was calibrated during a master plan completed in 2019.

The hydraulic model was updated to replicate the operation of the system between December 23, 2022, the day before main breaks started occurring, and January 4, 2023, when the boil water advisory was lifted. Predicted operation was compared with recorded performance from the city's Supervisory Control and Data Acquisition (SCADA) system to calibrate the model and verify its accuracy in the city's main pressure zone, called the 2440 zone. Locations of known pipe breaks, and estimates of water lost, were provided by the city. The location of a known closed valve was also provided, a 24-inch valve that was found closed at [redacted] near the intersection of [redacted]. The valve was opened by city staff on January 2, 2023. The model was able to predict recorded flows and tank levels within reasonable tolerances.

The model was then used to test three scenarios assuming the same water main breaks and outage at Mills River WTP:

1) [redacted] 24-inch valve open
2) Increased flow from the [redacted] Control valve
3) Operation of the decommissioned East Asheville Pump Station (with and without the [redacted] 24-inch valve open)

Improvements to the East Asheville Pump Station were recommended as part of the 2019 master plan to accommodate future demands. A demand-trigger for this improvement was a maximum day demand of 30 million gallons per day (mgd). Under typical current operations and customer usage, the city does not experience demands this high, but demand projections in the master plan exceeded 30 mgd between the years 2025 and 2030. Therefore, the master plan recommended recommissioning the East Asheville Pump Station when the demand approaches 30 mgd, around the year 2028.

Job no

The modeling analysis showed the following results for each scenario:

1) Opening the 24-inch valve on [redacted] greatly improved hydraulic performance in the 2440 zone with normal operations of the [redacted] Control Valve without the East Asheville Pump Station. With the 24-inch valve open, the water level in Candler Knob Tanks did not drop as significantly and the number of model nodes with pressures less than 20 psi decreased by more than 51 percent.

2) The [redacted] Control valve helps to regulate the water levels in the Candler Knob and South Buncombe tanks. It is limited in the city's SCADA system to open no more than 10 percent (approximately 2.6 mgd). Opening the valve more than 10% requires manual operation. The model showed that completely opening the valve during the break event increased the flow to between 6 and 8 mgd. This operation caused the water level in South Buncombe Tank to not drop as significantly, and the number of model nodes with pressures less than 20 psi decreased by more than 49 percent.

3) Demand in the system, including breaks and leakage, was nearly 30 mgd during the winter 2022 events. However, by using the East Asheville Pump Station (assuming one 18 mgd pump at 126 feet of total dynamic head running at reduced speed), the water levels in Candler Knob and South Buncombe tanks did not drop as significantly, and the number of model nodes with pressures less than 20 psi decreased by more than 49% (assuming [redacted] valve closed). With the [redacted] valve open, the water level in the Candler Knob tanks never reached the setpoint to operate the East Asheville Pump Station. Therefore, the pump station had minimal benefit with the [redacted] valve open. Using the pump station in combination with increased [redacted] Control Valve flow had a marginal increase in pressures compared to the alternatives individually.

Based on this analysis, we recommend the following:

1) **An independent valve assessment on all large diameter (16-inch and larger) transmission mains.** This process will document valve coordinates and any valves that are partially or fully closed, inoperable, or cannot be located. Independent contractors can also exercise the valves to bring some back into working order. The city can use this assessment to plan for valve replacements and other maintenance where needed.

2) **Enable SCADA control of the [redacted] Control Valve for full range of flow.** Safety features can be added into the programming to prevent accidental operation of this valve outside of its normal range, but the ability to rapidly respond to break events with full control of this valve will help distribution system operators maintain system pressures. When the South Buncombe Tank level drops below 17 feet, due to main breaks, plant outage, or other emergency conditions, we recommend increasing flow through the valve (up to 8 mgd) until South Buncombe Tank levels recover.

3) **Evaluate the existing pumps at East Asheville Pump Station, by inspection and with pump tests.** Also evaluate the working order of all the instrumentation and programming and develop a preliminary engineering report for recommissioning the pump station. While it would not have added much value to the winter 2022 break events, beyond what the other measures could have achieved, a more extensive or sensitive break event in the future may warrant returning this pump station to operation sooner than needed to supply growth in system demand.

Appendix VIII - Hazen Hydraulic Modeling Report – Draft May 10, 2023

Summary and Recommendations

Summary

- Two major valve limitations were identified:
  - Closed [redacted] 24-inch valve
  - Limited flow through [redacted] Control Valve
- The status of the [redacted] 24-inch valve significantly impacts system pressures during high demand
- The flow through the [redacted] Control Valve significantly impacts pressures on the south side of the distribution, especially when Mills River WTP is offline
- During the winter 2022 break events, refurbishing and running East Asheville Pump Station would have improved system pressures (and tank levels) WITH the valve limitations, however….
  - Pump station has minimal benefits WITHOUT valve limitations

Recommendations

- Regular large-diameter valve assessment (contract with HydroMax or Wachs for relatively quick schedule)
- Enable SCADA control of the [redacted] Control Valve for full range of flow
- Evaluate the existing pumps at East Asheville Pump Station and recommission station for redundancy during emergency events and future demand