

DRAFT

REPORT ON

**WATER SYSTEM
DISTRIBUTION AND STORAGE
ANALYSIS**

**HANOVER WATER WORKS COMPANY
HANOVER, NEW HAMPSHIRE**

Jack Nelson, President

Michael Blayney, Vice-President

Cary Clark, Clerk

Marilyn Black, Treasurer

Julia Griffin, Town Manager

William Boyle, Jr.

**Submitted by
Dufresne-Henry, Inc.**

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SECTION 1

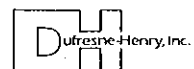
SUMMARY, CONCLUSION, RECOMMENDATIONS

Summary

The Hanover Water Works system operates in compliance with a filtration waiver to supply unfiltered surface water to the urban area of Hanover, New Hampshire. The system serves approximately 1,650 accounts. Fifty percent of the water used is consumed by Dartmouth College accounts. Contained within this report are the results of an evaluation of the water distribution system and water storage facilities using a computer model of the distribution system. The study also includes the results of a water audit, a comprehensive leak detection survey of the distribution mains and testing of selected large meters.

Water consumption has taken a downward trend since the relocation of the Mary Hitchcock Memorial Hospital. System water loss due to open blow-offs intended to maintain water quality was evaluated and reduced substantially as part of this study. Evaluation of water meters sized 2-inches and larger indicate the need for resizing many of these meters. The sampling of 3-inch and 4-inch meters that were tested found most to be inaccurate resulting in a revenue loss to the Company.

Despite the age of the distribution system, the water mains appear to be sound and free of major leaks. Evaluation of the delivery capacity of the water system identified inadequately sized transmission and distribution mains that should be replaced. The transmission mains receive a higher priority for replacement since they serve broad areas of users and also protect the health and



safety of the community in transmitting recommended fire flows for significant buildings, including the elementary and high schools.

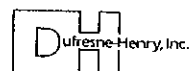
Water storage was evaluated and determined to be deficient within the main system. A verbal rules interpretation by an NHDES staff engineer confirms the requirement for treated water storage. Storage volume was evaluated and storage tank site regions were identified. The relationship between a water storage location and its proximity to the source is discussed. To maximize system hydraulics, water storage is recommended to be placed at two locations within the water system.

The total project cost of recommended improvements has been estimated to cost about \$8 million. The improvements have been prioritized and placed within a capital improvement schedule. The schedule presents improvements to be performed as part of a major project. Small transmission and distribution projects are also presented to be completed as part of the annual budget.

Conclusions

1. More than 71% of the water accounts service residential users, but only 30% of the water use is attributed to those users.
2. Dartmouth College holds 17% of the water accounts and uses about 50% of the water.
3. The projected average day water use for the year 2020 is 1.4 mgd. The projected maximum day demand is 1.9 mgd.
4. Total unaccounted for water is 14% including under-registration of water volume by larger commercial meters. Inaccuracy at the source meter indicates that unaccounted for water could be as high as twenty percent.

5. Tank and booster pump controls function adequately and do not appear to be a source of lost water due to tanks overflowing..
6. Components of the source meter(s) become clogged which under-registers the amount of water produced. The master source meter was found to under-register by 6% in August 1997 and has subsequently been repaired.
7. The source meters are over-sized for reliable low flow accuracy.
8. There are 90 user meters sized 2-inches or larger. These 90 locations account for about 50% of the metered usage.
9. More than half the meters 2-inches and larger need to be tested to comply with the frequency of meter testing requirements required by the Public Utilities Commission.
10. Nine of the meters 3-inches and larger were tested. Eight of the nine meters were determined to be outside the accuracy limits and require repair.
11. The estimated lost water revenue from the eight inaccurate meters is \$24,000 per year with \$20,000 per year of this amount lost from two of the eight locations.
12. Approximately thirty of the large meters appear to be oversized based on water use and should be evaluated for down-sizing.
13. Approximately fifteen of the large meters may be candidates for up-sizing.
14. The cost of water production for 1996 was \$0.207 per 100 cubic feet of water.
15. The estimated annualized unaccounted for water loss is estimated at approximately 9.6 million cubic feet. The production value of this water is approximately \$20,000 per year. Unaccounted for water represents potential revenue receipts of \$105,000 annually based on the current water rate of \$1.00/100 cubic foot.



16. The Town of Hanover should be interested in optimizing metered revenue since sewer bills are derived from Water Company meter readings. Since the effective sewer rate is approximately 150% of the current water rate, the Town will recover about \$1.50 for every \$1.00 of lost revenue received by the Water Company.
17. The \$8,000 purchase price of a dual register flow data recorder and associated software used to optimize meter sizing appears warranted.
18. The comprehensive system leak detection survey indicates the absence of significant water main leakage.
19. Both existing booster pump stations are serviceable and operate adequately. Minor short-term improvements have been identified for each facility.
20. A check valve feature provided at each booster station would minimize potential back-feed from the boosted system to the main system.
21. There appear to be blockages, pipe restrictions or non-connected mains at five locations including North College Street, North Main Street, Lebanon Street, Route 120 and Maple Street. Water Department personnel investigated, but did not locate any partially closed, valves that might account for these restrictions.
22. Most of the local distribution mains are undersized, unlined 4-inch and 6-inch cast iron pipe. The presence of undersized mains makes it difficult to flush the water system in several locations.
23. The Insurance Services Organization (ISO) most recent fire flow rating was performed in 1984 and updated in 1988. At that time eleven of thirteen representative locations could not sustain the required fire flows.

24. Five deficient ISO locations were selected for evaluation using a computer model of the water system. Alternative improvements were also analyzed.
25. The transmission of water is adequate from Fletcher Reservoir to Main Street. Transmission capacity beyond Main Street to the north and south is often limited. Transmission capacity within the Greensboro booster system is limited.
26. About 1.8 million gallons of additional treated water storage is required for the system. Total storage should be divided between two geographical locations.
27. Water storage tank site locations were analyzed and two sites are recommended. Tank locations within the main system are limited due to the development of land within the Balch Hill boosted pressure zone.
28. The Lebanon system interconnection near Route 120 may be able to support the Greensboro and/or main system. As a result of this study the capabilities of this interconnection are being investigated. Meetings have been held and procedures and protocol are being developed between the Water Company and the Lebanon Water Department.
29. The Hanover main system, with a low zone gradeline of 705 feet, may be able to partially support the West Lebanon water system, at a gradeline of 695 feet, during an emergency.

Recommendations

1. Determine the low end accuracy of the two source meters and utilize the most accurate meter for source production records. Continue to use the downstream meter from the contract tank for calculation of disinfection "CT".



2. Replace the source meter with a smaller more accurate meter and associated small pipeline installation. This work should be scheduled as an immediate priority if source improvements are not being considered.
3. Establish a program for testing and/or replacement of all meters in accordance with the Public Utility Commission requirements or the American Water Works Association recommendations. The highest priority should be given to meters 2-inches or larger.
4. Resize and replace all large meters that were identified as candidates for down-sizing. Investigate resizing those meters that were identified as candidates for up-sizing and are needing replacement. The priority needs to be placed on the oldest meters and those with the largest flow.
5. Utilize a dual register flow meter data recorder to resize the meters and validate building owners concern over increased meter consumption. This equipment can be purchased by the Water Company or the company may wish to utilize a meter testing or installation firm qualified to optimally size water meters for maximum revenue.
6. Investigate cost sharing by the Town for costs associated with reading, repair, testing and replacement of water meters since the Town Sewer Department uses this meter data.
7. Update annually Section 3 - Water Audit and Leak Detection of this report to assess trends in metered, usage, blow-off, flushing and unmetered water use.
8. Investigate the pipe restriction along Lebanon Street and Route 120 through systematic line isolation, hydrant flow testing and/or polypig or interior video devices. Investigate other restrictions as the opportunity for pipe and interconnection inspection develop.



9. Construct water transmission and distribution main improvements as recommended in Sections 5 and 6.
10. Install an 800,000 gallon water storage tank for the main water system zone north of the Greensboro Road Pump Station. Another 1,000,000 gallon storage facility should be located and constructed in conjunction with future source improvements.
11. Install a check valve feature within the pump control valves at both booster pump stations.
12. Replace the instrumentation and control systems for the pump stations and storage tanks with a SCADA system unless source improvements are planned within the next five years..
13. Seal the interior of the PRV manholes or install a drain to prevent submersion of the pressure reducing valves.
14. Establish a capital reserve fund to the extent financially possible to enable distribution main improvements in conjunction with scheduled road reconstruction or overlay projects.
15. Submit this report to the NHDES for their review and comment.