

Asset Inventory and Assessment Success Story: Oxford, North Carolina

A series of case studies on small water and wastewater utilities

May 2023



Acknowledgments

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Written by **Paul C. Ruback**

Editorial Assistance by **Andrew Waters, Elsemarie Mullins, and Christy Ihlo**

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Cover Image provided courtesy of City of Oxford

Background on Utility—Oxford, NC

Like many small-scale water and wastewater utilities, the Oxford Water and Sewer Department struggled to keep up with maintenance and infrastructure upgrades over the years, leading to a system that needed substantial investment by the 2010s. Since 2016, however, Oxford has successfully used the North Carolina Division of Water Infrastructure's Asset Inventory and Assessment (AIA) grant program to begin implementation of a long-term asset management program, inform other grant applications, and maximize construction dollars.



Aerial view of Oxford. Photo Credit: [WFAE News](#)

Oxford is a town of six square miles in Granville County, North Carolina, located approximately thirty miles from Durham and Wake Forest.

According to the U.S. Census, the population of Oxford was 8,628 persons in 2020.¹ A 2021 Division of Water Resources report stated there are 3,338 residential, 476 commercial, 43 industrial, and 79 institutional water connections in Oxford.² Oxford's water supply is the Kerr Lake Water Treatment plant, which supplies several water systems in the region. Oxford has maintained a small but consistent population growth of about 1% per year for the last 50 years. But Oxford is expanding. Almost 1,000 new homes have recently been approved, with three new residential subdivisions already under construction.

To accommodate the anticipated growth, the Kerr Lake Water Treatment Plant has been allocated a total of \$80 million for renovations. This funding includes a \$6 million contribution from Oxford, which owns 20% of the plant. The plant is set to undergo restoration efforts to improve portions of the 1973 structure and double its current capacity from 10 MGD to 20 million MGD. After renovation efforts, Kerr Lake Regional Water System will increase water allocation to Oxford from the current 2 MGD of water to 4 MGD per day. In terms of wastewater treatment, Oxford's plant is capable of processing 3.5 million gallons per day, and they currently average about a million gallons per day.

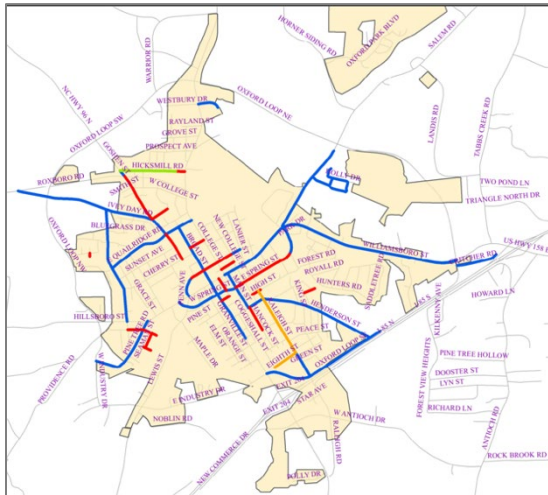


Image Courtesy of City of Oxford

Before 2015, Oxford did not have a regular program for refurbishment or replacement of its water and wastewater system infrastructure. Utility representatives described this as a reactive maintenance approach that often operated in crisis mode when infrastructure failed. "We wanted to start being proactive as a city to get ahead of the problems that faced us," said Oxford city engineer Amy Ratliff.

¹ "U.S. Census Bureau: Oxford City, North Carolina," 2021.

<https://www.census.gov/quickfacts/oxfordcitynorthcarolina>.

² "NC DEQ Division of Water Resources Local Water Supply Planning." DWR: Local Water Supply Planning, 2021.

<https://www.ncwater.org/WUDC/app/LWSP/report.php?pwsid=02-39-010&year=2021>.

This desire for a proactive approach was facilitated by an Asset Inventory and Assessment (AIA) grant award received by Oxford in 2016. The AIA grant is a program of the North Carolina Division of Water Infrastructure (DWI), a division of the N.C. Department of Environmental Quality, to encourage water and wastewater utilities to become more viable and proactive in the management and financing of their systems. Oxford used the AIA grant to complete an asset management plan for its water and wastewater systems, including an inventory and condition assessment of existing infrastructure. Oxford has used the information from the AIA grant to inform their applications for other grants and loans from DWI. This led to the development of a 10-year Capital Improvement Plan (CIP) to guide the restoration of the City's water and wastewater systems. Since then, Oxford has applied for and received additional AIA grants as they continue to refine and invest in their asset management program.

Infrastructure Needs

Sewer and Water Systems Mains

Before restoration initiatives, most of Oxford's newer water and sewer mains dated back to 1947, with some dating as far back as 1905. Since 2016, Oxford has undertaken a robust replacement program. Out of the approximately ninety miles of water and eighty miles of sewer mains, the city has so far replaced about twenty miles of water and about ten miles of sewer mains.

Sewer Overflow Issues

One of the most significant issues in the first AIA report was the wastewater treatment plant. Oxford struggles with sanitary sewer overflows (SSOs), typically caused by flushable wipes clogging sewer lines. While the plant sufficiently handles debris such as flushable wipes and clogging under normal circumstances, the system tends to fail when rainwater enters the plant's inflow and infiltration system, exacerbating the debris issue. This occurs during significant events like tropical storms or hurricanes when water inflow levels increase beyond the meter register. Despite the overflow, Oxford continues to treat minimally all water inflow with UV to ensure bacteria are dead before entering the outflow creek. The issue of flushable debris is being improved by public education, but the system needs capital improvements so that data on inflow and outflow can be precisely recorded to determine what percentage of wastewater was fully treated versus the amount receiving minimal treatment.

Identifying and Addressing Sewer System Needs and Upgrades

The top three priorities identified for improving the sewer treatment system are: 1) to reduce sanitary sewer overflows, 2) to reduce inflow and infiltration to the City's wastewater treatment plant, and 3) to replace deteriorating sewers predominantly constructed of vitrified clay materials. McGill Associates, an engineering firm, proposed several projects in line with these recommendations as part of the AIA initiative, including flow monitoring to assess the capacity and daily flow within the City's wastewater collection system, smoke testing to identify locations where inflow and infiltration enter the system, video evaluations to inspect the storm and sanitary sewer lines for any issues, and manhole and lift station inspections. The AIA prioritized sewer line replacement and lift station improvements and listed the project names, costs, recommendations, and future tasks in the full assessment.

From the first round of AIA funding in 2016, Oxford successfully executed smoke testing of the sewer system to identify leaks and add flow monitors into manholes. After receiving a second AIA grant for water and sewer, Oxford was able to update the water model to evaluate where flows have improved with newly connected dead ends, increase pipe sizes, and enhance valve placement. Oxford also received funding from DWI and the USDA for a new 750,000-gallon water tank to meet storage needs, which has already been completed.

Water Mains Needing Replacement

The City's water system faces three major challenges: 1) Reducing non-revenue water in the distribution system, 2) replacing problematic aged water lines made of asbestos cement, galvanized iron, or cast iron, and 3) providing reliable high-quality water service to customers and critical users. To address these challenges, McGill Associates proposed several projects aligned with the AIA's objectives. These projects include conducting a water audit to identify the water distribution system's approximate usage and losses, performing a hydraulic distribution network modeling to update the City's hydraulic water and water quality model, and implementing an effective unidirectional flushing program to maintain drinking water quality. However, the City's water main flushing program's operability is unknown, which poses significant challenges. Therefore, the AIA prioritized a full-scale valve assessment and replacement program to ensure the distribution system's longevity and operability, and a routine valve exercising program to expand lifespan. The report listed the project names, costs, recommendations, and future tasks.

Reliable City Data & Metrics

To counteract the sewer overflow issues, Oxford is investing \$9 million in the wastewater treatment plant. They are replacing traditional filters with new disk filters and also updating the supervisory control and data acquisition (SCADA), which allows engineers and technicians to monitor the system remotely. Other examples of data quality improvements come in the form of replacing outdated and unreliable city records. Some of the older records have not been updated since 1930, including sewer schematics on linen and wooden scrolls.

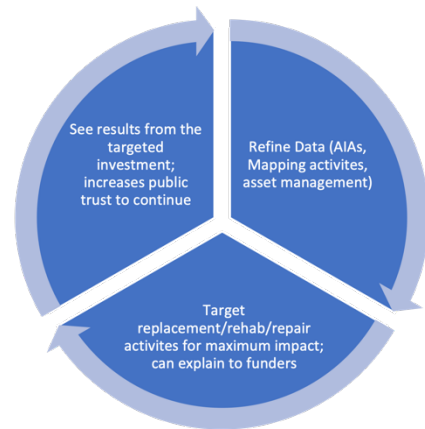
Staffing Inefficiency

Filling vacant roles is necessary to get big-budget projects started and completed, but Oxford is currently struggling with staffing efficiency. The engineering department consists of only two engineering technicians, and there are currently only nine technicians within the department for construction and maintenance. These staffing issues make it difficult to allocate a budget of approximately \$76 million to design and implement engineering and construction. Staff reports it is difficult to find candidates with the proper qualifications to fill these vacancies.

Lessons from Oxford

It is Never Too Late

Decades of neglect left Oxford's water and sewer systems facing a host of serious and expensive issues. However, Oxford was able to utilize the AIA grant program to clearly map out a feasible path forward. Furthermore, the refined data available through previous AIA grants has been instrumental in winning subsequent ones, institutionalizing a system of ongoing planning and infrastructure management. Although there is still much to do, Oxford's planning process has helped the City's staff and leaders address issues that previously seemed insurmountable.



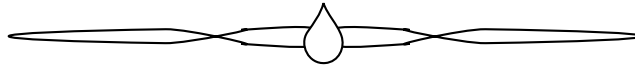
The continuous cycle of AIA

Invest in Human Infrastructure

With help from the AIA program, Oxford now has a capital improvement plan for the systematic improvement of its water and wastewater system. However, like many water and wastewater utilities around the United States, Oxford is struggling to find qualified engineers and technicians to implement these plans. While capital asset and infrastructure planning is a critical component of sustainable utility management in today's operating environment, these plans also require trained, talented, and motivated personnel. Utilities preparing for AIA processes shouldn't forget to prepare for these human needs as they plan for the fiscal ones through employee incentive and retention programs.

Stay Focused

Oxford continues to rely on its CIP for future projects, remaining vigilant to the City's highest priorities and maintaining accurate cost estimates to accomplish these objectives. This focused approach has not only helped improve the sustainability of Oxford's water and sewer systems, it has also enhanced public trust, officials report. As Oxford continues these improvements, this enhanced trust will prove a valuable asset of its own as officials justify ongoing infrastructure investments to concerned citizens.



If your town is thinking about upgrading existing water capacity: Apply for an Asset Inventory and Assessment Grant

An [*AIA grant*](#) gives towns the opportunity to identify real infrastructural needs.

AIA grant information hyperlink: <https://www.deq.nc.gov/about/divisions/water-infrastructure/i-need-funding/asset-inventory-and-assessment-grants>