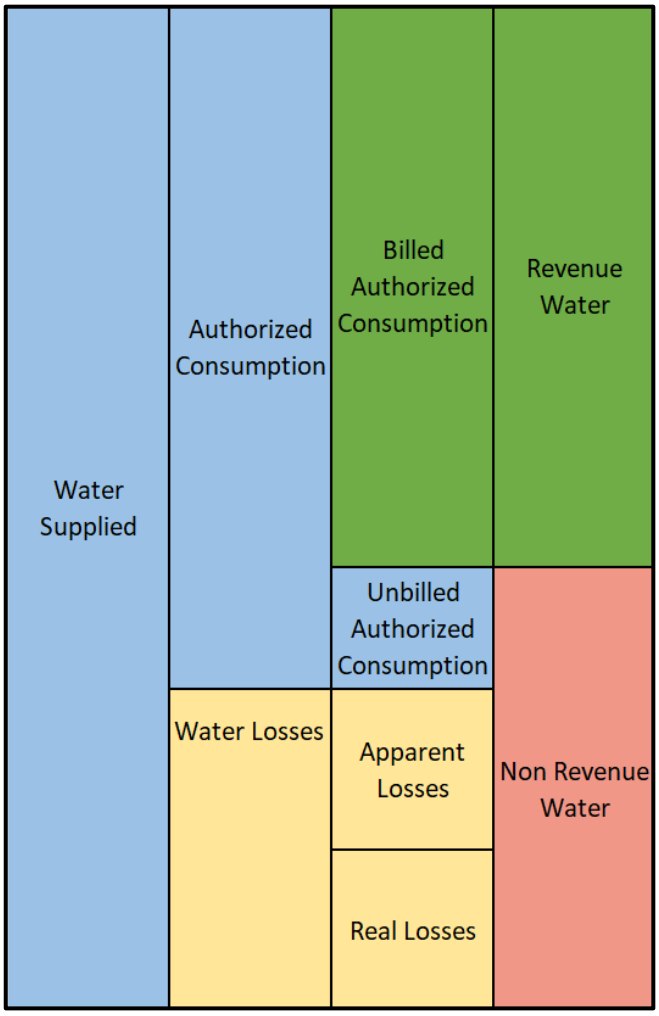
Water Loss Audit and Non-Revenue Water Reduction Strategy

Old pipes can develop leaks. Anyone who has worked to maintain the plumbing in an old building understands this reality. Now, imagine that you are responsible for maintaining not just the aging piping in one building, but hundreds of miles of water main that is buried below ground where it cannot be easily inspected. This is one of many challenges faced daily by water utility managers, superintendents, and operators. Yet while this challenge can seem daunting, the management of water loss within a system is critically important. Every gallon of water that is "lost" through leakage or accounting errors is a gallon of water that had to be treated and pumped, but which may not help to meet the needs of the utility's customers or produce the revenue required to cover the utility's costs.

Over the past few years, the City of Joliet has increased its efforts to understand and manage water loss as part of its overall strategy for effective utility management. Starting in 2018, the City initiated a program involving the performance of an annual Water Loss Audit and the identification and implementation of actions to reduce water loss in its system. A Water Loss Audit is a structured analysis based on an industry-standard methodology defined in the American Water Works Association (AWWA) Manual of Practice M36. The M36 methodology uses specific terms to define the disposition of all the water supplied to a given system.

- **Non-Revenue Water (NRW)** is the difference between the total amount of water supplied to a system and billed authorized water consumption. Components of Non-Revenue Water include:
    - **Unbilled Authorized Consumption** (fire hydrant flushing, water treatment plant process water, unbilled water used in public buildings, etc.)
    - **Apparent Losses** (non-physical losses due to water theft, metering inaccuracies, systematic data handling errors, etc.)
    - **Real Losses** (physical losses or leakage from the water distribution system or storage tanks up to customer meters).

Audits completed for 2016 through 2018 yielded estimates of NRW in the Joliet water system ranging from 29.7% to 34.8% of the total volume of water supplied to the system. 2018 audit results suggest that about 24% of the water supplied goes to Real Losses (leakage), about 10% is Apparent Losses, and less than 1% is unbilled authorized consumption.



Over the past several years, the City has taken specific actions to work toward reducing its current levels of NRW. Completed actions include:

- Appointment of a Water Loss Champion
- Implementation of an annual master meter testing program at points of supply into the Joliet distribution system and at points of water sale to wholesale water customers
- Testing of large meters used to measure water supply to major water users
- Annual leak detection and repair efforts
- Implementation of new procedures to reduce unmetered water use on City construction projects and approval of a new ordinance to eliminate unmetered water use at private construction sites
- Enhanced planning for water main replacement and continued replacement of aging water main with a goal of replacing 1% of the distribution system annually
- Development of new tools to improve tracking of water use and analysis of water meter and billing data

While these efforts represent positive steps toward the reduction of NRW in the Joliet system, City staff recognize that more aggressive actions are going to be required to support the effective implementation of its Alternative Water Source Program. Reductions in real losses within the system increase overall system efficiency and decrease the portion of new system capacity that is required to overcome leakage from the system, while reductions in apparent losses provide for improved billing and revenue generation from water sales. Given the increased cost associated with bringing Lake Michigan water to Joliet reduced levels of NRW will have real value to Joliet. In addition, the Illinois Department of Natural Resources requires that all Illinois water utilities using Lake Michigan water establish, submit, and implement a plan for reducing their levels of NRW to 10% or less of their total water supply as a condition of their water allocation permit. This requirement serves to demonstrate to other Great Lakes states and Canadian provinces that Illinois is working to efficiently manage the water that it diverts from Lake Michigan.

To meet this requirement, Joliet has formulated a comprehensive strategy for NRW reduction that includes short-term, mid-term, and long-term actions structured to achieve the City's goals in as cost-effective a manner as possible. Major actions being considered as key elements of this program include improvements in the overall accuracy of the City's metering and billing systems, increases in the effectiveness of annual leak detection and repair efforts, and replacement of approximately 1.6% of the City's aging water main annually. Estimates suggest that this aggressive program could enable the City to meet the IDNR 10% NRW water goal by about 2040. As the NRW reduction program is implemented, the City will monitor its progress and costs and make adjustments where appropriate to tailor the program to focus on high-value efforts that address the specific needs of the water system.