Henderson County Water District
Qualified Infrastructure Improvement Plan
PSC Case #2023-00333

Purpose

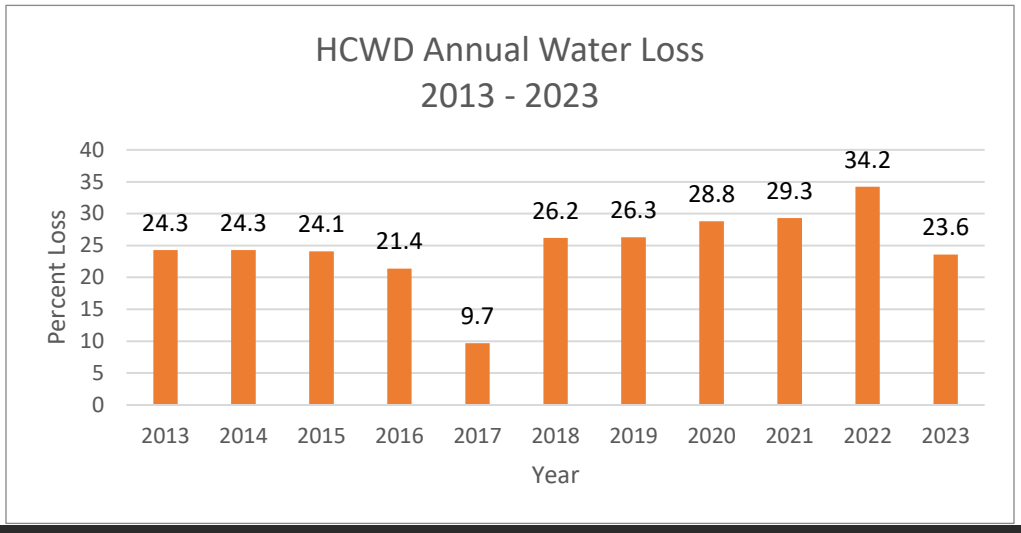
On December 13, 2023, the Public Service Commission of Kentucky issued an Order in Case No. 2023-00101 directing Henderson County Water District ("HCWD") to prepare a qualified infrastructure improvement plan that included a comprehensive unaccounted-for water (UFW) loss reduction plan that establishes priorities and a time schedule for eliminating each source of UFW and provide a detailed spending plan for the proceeds of the surcharge. This document is submitted to respond to that directive.

It is important to note that PSC Order #2023-00101 specified that the PSC would open a separate proceeding (Case # 2023-00333) to monitor the surcharge proceeds collection and expenses.

Background

Henderson County Water District (HCWD) was created October 24th 1964, as a single county district. The Board of Commissioners of the water district consists of five members. Three of which are appointed by the County Judge/Executive and approved by the Henderson County Fiscal Court. The other two members are appointed by the County Judge/Executive and approved by the Webster County Fiscal Court. The term of each commissioner is four (4) years. Its territory encompasses all of Henderson County, Kentucky, excluding the incorporated boundaries of the City of Henderson, and a portion of Webster county. As of December 13, 2023, it supplied water to 6,467 customers (6,017 residential customers, 448 commercial customers). HCWD purchases all their water from the City of Henderson (Henderson Water Utility) which operates two water systems, each with their own water treatment plant. Five of the six master meters are supplied by Henderson Water Utility's North plant and system, and the final purchase point is supplied by Henderson Water Utility's South plant and system. HCWD has an active contract with Henderson Water Utility that expires in 2029, which is priced based on the cost to produce water. HCWD provides no extra treatment to the water supply. Two emergency interconnections are also maintained by HCWD with Webster County Water District and Daviess County Water District. The System is split into five pressure zones. Finished water in Zone 1 is supplied by the 60 West pump station, which fills the Corydon and Midway elevated storage tanks. The 41A pump station supplies water to Zone 2, including the Rock Springs standpipe. The Rock Springs pump station pushes water from the Rock Springs standpipe to the Tunnel Hill elevated storage tank, also located in Zone 2. Water in Zone 3 is pumped from two different pump stations, 41 South and Robards pump stations. The Robards pump station is the only location that is supplied by the Henderson Water Utility South plant. This pump station fills the Robards elevated storage tank in Zone 3. Pressure Zone 4 is supplied by the Graham Hill pump station, which drives water to the Delaware elevated storage tank. Lastly, the 60 East pump station provides water to Zone 5, including the Ridgewood elevated storage tank. Each tank and corresponding pump station are linked via telemetry, which controls the empty and fill cycle of the tanks. The System has set the tanks to cycle from a high fill point to a low fill point in order to maintain adequate distribution system pressure and reduce the age of water in the tank. Pumps automatically alternate to ensure even wear on all pumps. The total storage capacity of the System is 1.55 million gallons, which can accommodate the average daily use of 1.26 million gallons per day (MGD). The infrastructure required to provide water service includes over 459 miles of water line, 7 storage tanks and 7 in-service pump stations. A generalized infrastructure map for all of Henderson County is provided on page 4.

Figure 1. Below: *HCWD Annual Water Loss 2013-2023*



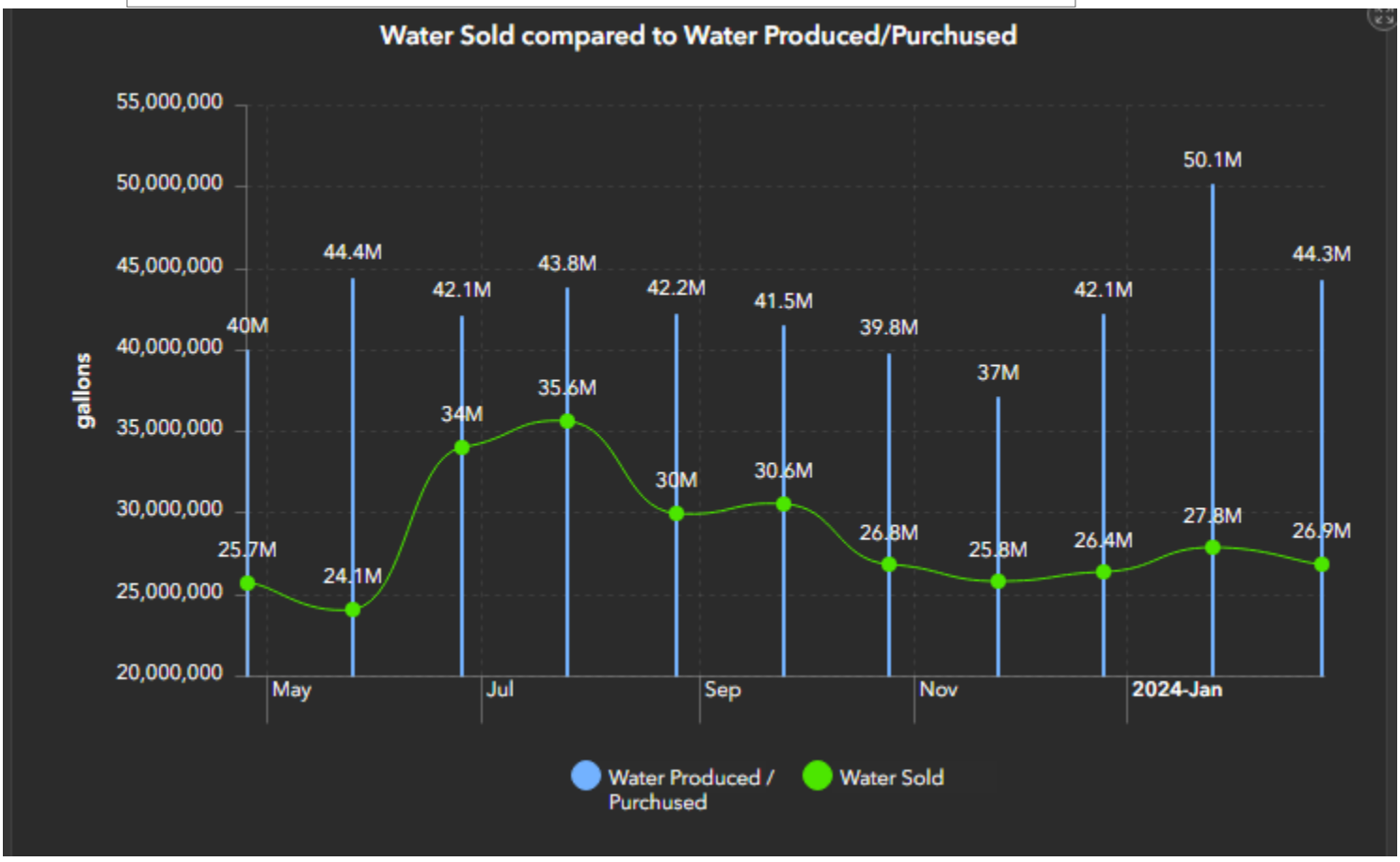


Figure 2. Above: Last 12 months Water Sold compared to Water Purchased

HCWD has maintained unaccounted for water loss below 15% once over the past ten years with 2021 and 2022 being the highest at 29.3% and 34.2%, respectively. District staff spends a considerable amount of time tracking leaks to minimize water loss and purchase water expense. Following the COVID restrictions/recommendations of 2020-2022 the utility staff

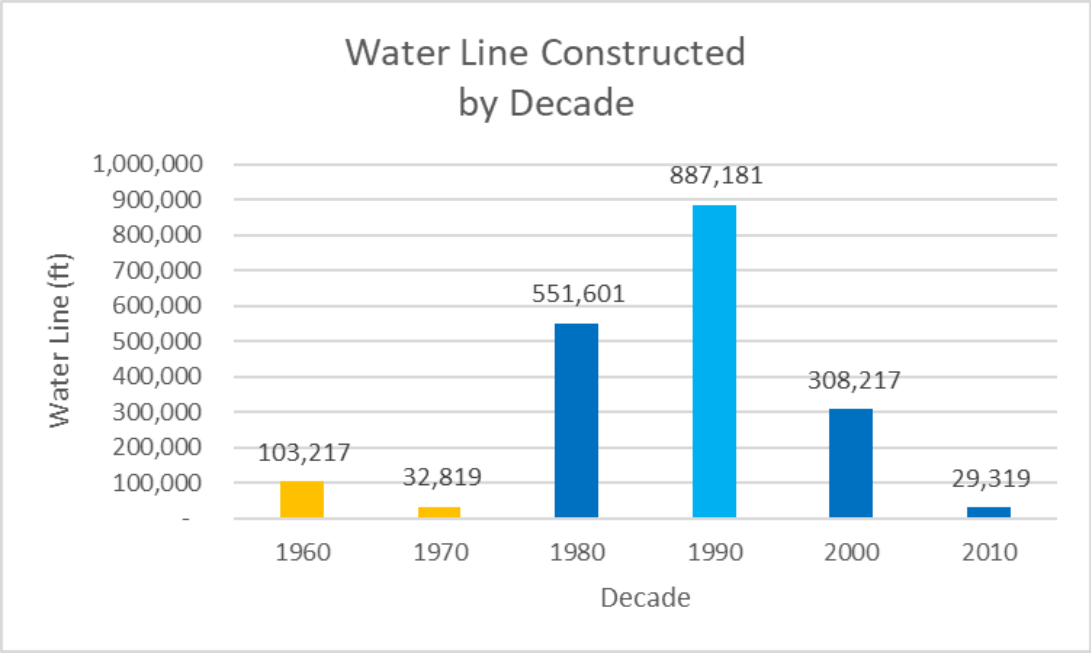
rarely worked together as a crew to facilitate social distancing. This upset in the workflow allowed smaller leaks to go unchecked until they grew large enough to warrant a repair. This event in addition to the severe cold weather of winter 2021 & 2022 revealed that the district needs to complement its staff with technology that offers early detection of leakage, effective management of its assets and promotes the efficient use of time to conduct repairs.

Water Infrastructure Inventory

Aging infrastructure is a significant source of water loss along with personnel and repair materials for the district. Specifically, the 1960's and 1970's asbestos-cement (AC) distribution lines (373,560 LF) that have exceeded their operational life. There are currently seven project profiles that will replace 205,308 LF

PNUM	Title	LF Replacing
WX21101105	US 60 West Main Replacement	23,756
WX21101107	US 41-A Main Replacement	19,002
WX21101108	US 41 South A/C Main Replacement	31,196
WX21101109	Hwy 416 W Main Replacement	38,232
WX21101110	Hwy 351 Main Replacement	51,759
WX21101111	Hwy 136 W Main Replacement	30,141
WX21101126	Henderson County Water District Improvements Project	11,222
	Total	205,308

Figure 4 Below: *Water Lines Constructed by Decade*



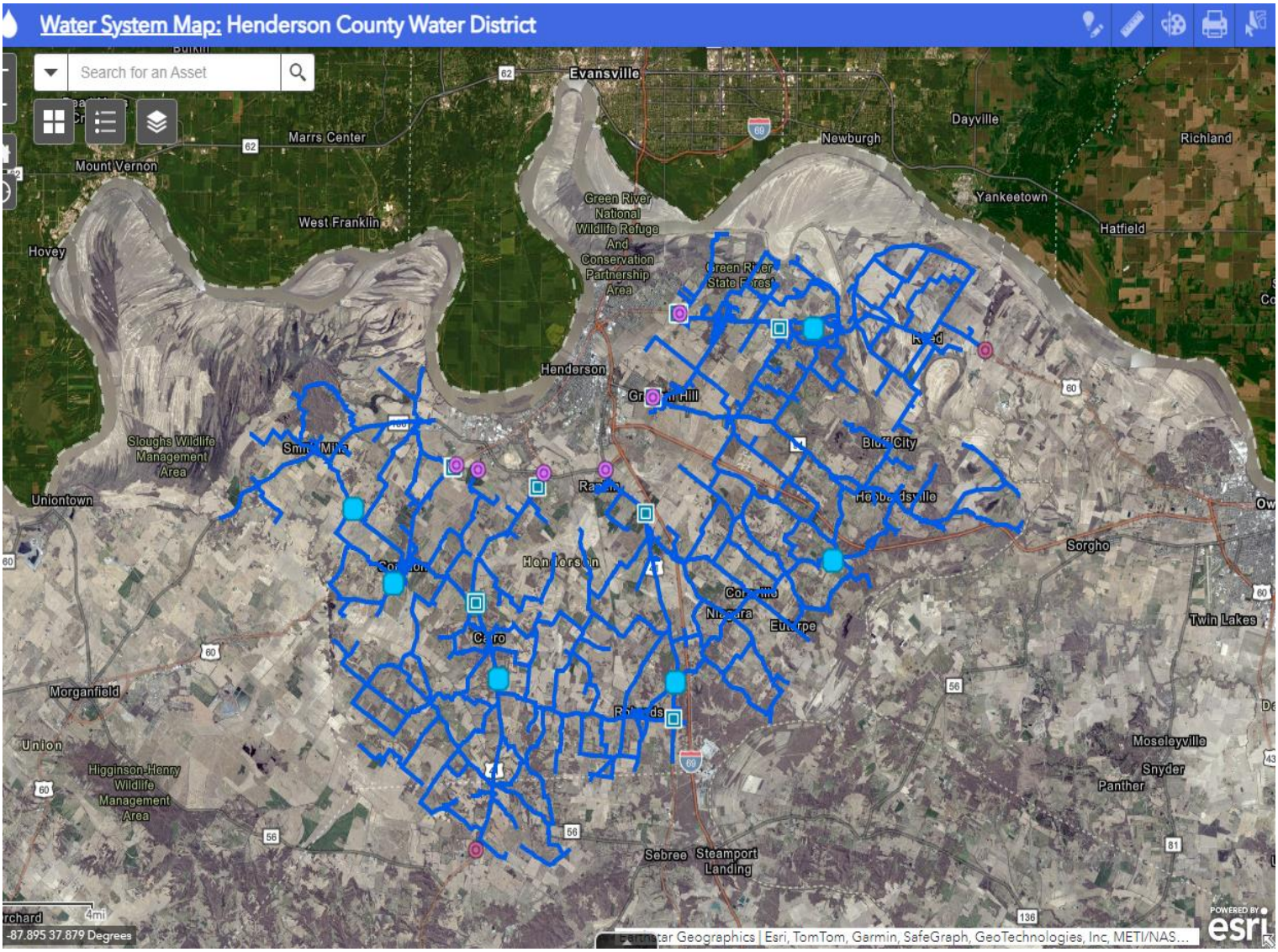


Figure 3 Above: *HCWD Generalized Infrastructure Map*

Continued on Page 5.

A listing of HCWDs primary capital assets is presented below. The inventory identifies their current condition and performance, the need or urgency to replace the asset, and the cost of replacement where indicated.

An asset's current condition is based upon the following scale that is accepted by state regulatory and funding agencies:

Water Line Assets:

Rating Code	Condition Rating	Performance Rating	Priority Rating
0			Not a priority
1	New or Excellent - None or minor defects.	Exceeds/Meets all performance targets.	It would be nice to have.
2	Good - Defects that have not begun to deteriorate.	Minor performance deficiencies.	Improved system operations & maintenance (O&M) efficiency.
3	Fair - Moderate defects that will continue to deteriorate.	Considerable performance deficiencies.	Internal safety concern or public nuisance.
4	Poor - Severe defects that will collapse/break in near future.	Major performance deficiencies.	Potential public health, safety, or environmental concern.
5	Inoperable - Defects need immediate attention.	Fails to meet performance targets.	Existing threat to public health, safety, or environment.

Water Line Assets							
Size (inches)	Material	Decade Constructed	Length (feet)	Condition ID	Performnce ID	Priority ID	WRIS PNum
Assessment Area: HCWD ZONE 1							
Up to 2	AC	1960	3,567	4	4	3	
Up to 2	PVC	1960	2,791	3	2	1	
Up to 2	PVC	1970	13,303	3	2	1	
Up to 2	PVC	1980	17,861	3	2	1	
3	PVC	1970	1,746	3	2	1	
3	PVC	1980	4,263	3	2	1	
3	PVC	1990	7,352	2	1	1	
3	PVC	2000	6,862	2	1	1	
4	AC	1980	4,067	4	4	3	
4	PVC	1970	3,001	3	2	1	
4	PVC	1980	10,469	3	2	1	
4	PVC	1990	3,526	2	1	1	
4	PVC	2000	6,151	2	1	1	
6	AC	1960	24,318	4	4	3	
6	AC	1980	3,544	4	4	3	
6	AC	1990	1,236	4	4	3	
6	AC	2000	8,150	4	4	3	
6	PVC	1960	5,276	3	2	1	
6	PVC	1970	28,144	3	2	1	
6	PVC	1980	50,111	3	2	1	
6	PVC	1990	40,537	2	1	1	
6	PVC	2000	14,675	2	1	1	
8	AC	1960	17,695	4	4	3	
8	AC	1970	11,503	4	4	3	
8	PVC	1970	10,323	3	2	1	
8	PVC	1980	31,473	3	2	1	

Assessment Area: HCWD ZONE 2							
Up to 2	PVC	1960	1,262	3	2	2	
Up to 2	PVC	1980	46,374	3	2	1	
Up to 2	PVC	1990	9,085	2	1	1	
3	PVC	1960	2,643	3	2	2	
3	PVC	1970	1,209	3	2	1	
3	PVC	1980	42,778	3	2	1	
3	PVC	1990	12,352	2	1	1	
3	PVC	2000	4,902	2	1	1	
4	AC	1980	6,184	4	4	3	
4	AC	1990	2,014	4	4	3	
4	PVC	1970	25,071	3	2	1	
4	PVC	1980	24,674	3	2	1	
4	PVC	1990	7,836	3	2	1	
4	PVC	2000	15,026	2	1	1	
6	AC	1960	29,428	3	2	1	
6	AC	1990	2,818	4	4	3	
6	PVC	1960	20,116	3	2	1	
6	PVC	1980	126,430	3	2	1	
6	PVC	1990	7,345	3	2	1	
6	PVC	2000	15,739	2	1	1	
8	AC	1960	14,070	3	2	1	
8	PVC	1960	2,920	3	2	1	
8	PVC	1970	7,986	3	2	1	
8	PVC	1980	113,052	3	2	1	
8	PVC	1990	21,321	3	2	1	
10	AC	1960	16,175	3	2	1	
10	AC	1980	7,384	4	4	3	
10	AC	1990	3,119	4	4	3	
10	DUCTILE IRON	1980	352	3	2	1	
10	PVC	1960	95	3	2	1	
10	PVC	1980	1,258	3	2	1	
Assessment Area: HCWD ZONE 3							
Up to 2	PVC	1960	7,798	3	2	1	
Up to 2	PVC	1980	5,878	3	2	1	
Up to 2	PVC	1990	10,890	3	2	1	
Up to 2	PVC	2000	1,210	2	1	1	
3	PVC	1960	9,373	3	2	1	
3	PVC	1970	8,593	3	2	1	
3	PVC	1980	8,247	3	2	1	
3	PVC	1990	24,349	3	2	1	
3	PVC	2000	18,925	2	1	1	
4	AC	1960	23,396	4	4	3	

4	AC	1980	7,379	4	3	3	
4	PVC	1960	17,706	3	2	1	
4	PVC	1980	16,235	3	2	1	
4	PVC	1990	4,337	3	2	1	
4	PVC	2000	24,859	2	1	1	
6	AC	2000	6,161	4	3	3	
6	PVC	1980	72,205	3	2	1	
6	PVC	1990	43,948	3	2	1	
6	PVC	2000	46,311	2	1	1	
8	AC	1960	24,467	4	4	2	
8	AC	1970	1,759	4	4	2	
8	AC	1990	12,304	4	3	3	
8	AC	2000	899	4	3	3	
8	PVC	1960	9,773	3	2	1	
8	PVC	1970	14,002	3	2	1	
8	PVC	1980	75,323	3	2	1	
8	PVC	1990	24,042	2	2	1	
10	AC	1980	11,262	4	3	3	
10	PVC	1990	5,789	3	2	1	
12	PVC	1960	1,063	3	2	1	
12	PVC	1980	14,296	3	2	1	
12	PVC	1990	76	3	2	1	
12	PVC	2000	8,220	3	1	1	
18	PVC	1960	4,214	3	1	1	
Assessment Area: HCWD ZONE 4							
Up to 2	AC	1960	859	4	3	3	
Up to 2	PVC	1960	5,204	3	2	1	
Up to 2	PVC	1980	25,774	3	2	1	
Up to 2	PVC	1990	4,943	3	2	1	
Up to 2	PVC	2000	1,269	2	1	1	
3	PVC	1960	1,849	3	2	1	
3	PVC	1970	12,981	3	2	2	
3	PVC	1980	11,134	3	2	1	
3	PVC	1990	5,346	3	2	1	
4	AC	1960	10,532	4	3	3	
4	AC	1980	14,694	3	3	2	
4	AC	1990	697	3	3	2	
4	PVC	1960	13,831	3	2	1	
4	PVC	1970	1,287	3	2	1	
4	PVC	1980	20,046	3	2	1	
4	PVC	1990	3,943	2	1	1	
4	PVC	2000	13,415	2	1	1	
6	AC	1960	21,331	4	4	3	
6	AC	1970	2,553	4	4	3	
6	PVC	1960	3,053	3	3	2	
6	PVC	1970	15,245	3	2	1	
6	PVC	1980	61,355	3	2	1	
6	PVC	1990	19,523	2	1	1	
6	PVC	2000	9,017	2	1	1	
6	PVC	2020	3,200	1	1	0	

8	AC	1960	48,304	4	4	3	
8	AC	1980	761	3	2	2	
8	AC	1990	7,715	3	2	2	
8	PVC	1960	160	3	1	1	
8	PVC	1970	105	3	1	1	
8	PVC	1980	20,114	3	1	1	
8	PVC	1990	8,338	2	1	1	
8	PVC	2000	7,099	2	1	1	
10	PVC	1970	1,175	3	1	1	
12	PVC	1980	2,642	2	1	1	
12	PVC	1990	15,483	2	1	1	
12	PVC	2000	23,174	2	1	0	
16	PVC	1980	569	2	1	1	
Assessment Area: HCWD ZONE 5							
Up to 2	PVC	1970	4,861	3	2	1	
Up to 2	PVC	1980	50,756	3	1	1	
Up to 2	PVC	1990	21,246	2	1	1	
Up to 2	PVC	2000	4,896	2	1	1	
3	PVC	1980	12,531	2	1	1	
3	PVC	1990	23,327	2	1	1	
3	PVC	2000	2,471	2	1	1	
4	AC	1980	875	3	2	2	
4	PVC	1980	10,920	2	1	1	
4	PVC	1990	17,312	2	1	1	
4	PVC	2000	17,086	2	1	1	
6	PVC	1980	31,440	3	2	1	
6	PVC	1990	134,950	2	1	1	
6	PVC	2000	91,755	2	1	1	
8	AC	1970	4,815	4	3	3	
8	AC	1980	11,134	3	2	3	
8	AC	1990	6,391	3	2	3	
8	PVC	1980	8,872	2	1	1	
8	PVC	1990	24,516	2	1	1	
8	PVC	2000	9,248	2	1	0	
10	PVC	2010	31,975	1	1	0	

Pump Station Assets:

Pump Station Assets

Asset Name	Capacity (gpm)	HP	Pump Count	Motor Starter	SCADA	Condition ID	Performnce ID	Priority ID	WRIS PNum	Cost	Comments
Assessment Area HCWD Zone 1 - US 60 WEST CORYDON / MIDWAY											
60 WEST	350		2		Y	1	1	0			
OLD 60 WEST	OUT OF SVC		2		N	N/A	N/A	N/A	N/A	N/A	Not in service
Assessment Area: HCWD ZONE 2 US 41-A ROCK SPRINGS / TUNNEL HILL											
41 A	250		2		Y	4	3	3	WX21101126	$504,000	The cost provided here is just for replacing the PS
ROCK SPRINGS	350		2		Y	3	2	2			
Assessment Area: HCWD ZONE 3 - US 4 SOUTH / ROBARDS											
41 SOUTH ANTHOSTON	350		2		Y	3	1	2			
41 SOUTH ROBARDS	250		2		Y	3	1	2			
Assessment Area: HCWD ZONE 4 - GRAHAM HILL / DELAWARE											
GRAHAM HILL	350		2		Y	3	1	2			
Assessment Area: HCWD ZONE 5 - US 60 EAST - RIDGEWOOD											
60 EAST	650		3		Y	3	1	2			
KY 1078	OUT OF SVC		2		N	N/A	N/A	N/A	N/A	N/A	Not in service
OLD 60 EAST	OUT OF SVC		3		N	N/A	N/A	N/A	N/A	N/A	Not in service

Water Tank Assets:

Water Tank Assets								
Asset Name	Capacity (gallons)	Date Constructed	Date Inspected	SCADA	Condition ID	Performance ID	Priority ID	WRIS PNum
Assessment Area: HCWD ZONE 1								
CORYDON	150,000	10/01/1992	12/18/2023	Y	2	1	1	
MIDWAY	200,000	06/30/1987	12/18/2023	Y	2	1	1	
Assessment Area: HCWD ZONE 2								
ROCK SPRINGS	100,000	10/01/1966	12/19/2023	Y	3	2	2	
TUNNEL HILL	200,000	11/01/1987	12/18/2023	Y	2	1	1	
Assessment Area: HCWD ZONE 3								
ROBARDS	500,000	10/01/1998	12/18/2023	Y	3	2	2	
Assessment Area: HCWD ZONE 4								
DELAWARE	200,000	07/01/1987	12/19/2023	Y	2	1	1	
Assessment Area: HCWD ZONE 5								
RIDGEWOOD	200,000	07/01/1987	12/19/2023	Y	3	1	1	

The estimated $584,220 generated by the surcharge over 48 months is insufficient to replace the remaining AC pipe. The capital costs to replace the balance of the AC pipe after the proposed projects are completed is over $10,000,000.

Supervisory Control and Data Acquisition (SCADA) is another asset that is critical to water system operation and especially useful for leak detection. The HCWD storage tanks and pump stations are equipped with SCADA. The system only monitors/records tank level and pump station flow but lacks data analysis capability. Having the ability to analyze data gives the operator insight into system behavior, identify patterns, and implement proactive measures to prevent leaks and other issues.

Water Accountability Process

The goal of the water loss program is to reduce “unaccounted-for water” to below 15%. In doing so, real and apparent losses must be addressed. Real loss consists of physical water losses from leaks, line breaks, tank overflows, etc. that place a financial and operational burden on the utility. Apparent loss consists of unauthorized consumption, customer metering inaccuracies, and errors in the meter reading and billing processes. This can result in overtime and wasted hours testing for leaks that are not real.

Proper distribution management is the key to reducing water loss. The first step is to divide the system into distribution management areas (DMAs) which are manageable geographic regions within a pipe network where the flow of water can be controlled, measured, and analyzed separately. The main purposes of DMAs are to reduce water loss, improve water quality, and enhance overall network efficiency. Once the customer meters are validated within a DMA the demand factor will be assigned. The demand factor is a “theoretical” calculation of the expected flow in gallons per minute needed to satisfy customer demand. The objective is to obtain a baseline flow (gpm) within each zone to determine where real water loss occurs.

Once DMAs are created, an inventory and condition assessment of all infrastructure assets is conducted within the zone. Since HCWDs primary assets have been assessed the focus will be on secondary assets such as valves, hydrants and meters. Each of these secondary features plays a role in controlling water flow, identifying water loss and locating the leak.

Valves:

1. Gate valves are used on water lines either in an open or closed position that controls the flow of water. Gate valves that do not close increases the search area for leak detection. Gate valves that do not seal when closed obscure or prevent the location of leaks.
2. Control valves are used to modulate flow and pressure. These valves range from simplistic check valves to complex multi-stage systems. In either case, when they fail or operate erratically, they tend to make it appear that a line is leaking. Tank control valves when failing can allow the tank to overflow.
3. Valves should be assessed on age, ease of movement, number of turns to close and sealing ability.
4. Control valves should be assessed on age, size, use (application), last service date and functionality.

Hydrants:

1. Hydrants are installed for two main purposes: water quality and fire protection. Hydrants are access points to the distribution system used to flush water from the pipe network to remove debris that accumulates over time and to stabilize disinfectant residuals. As access points, hydrants are used to test the hydraulic capabilities (flow and pressure) of the distribution system. Pressure monitoring can be used as an early warning system to detect water loss.
2. Hydrants that can supply adequate flow and pressure to sustain fire protection are a bonus to a rural community.
3. Hydrants should be assessed on age, barrel size, ease of opening, and weep hole drainage.

Meters:

1. Meters measure the volume of water. The two most important factors to meter accuracy are installation and whether it is the proper type and size for the application.
2. Master / zone meters are typically full pipe size that measure the flow and volume of water entering a distribution system or sub-system through a DMA. The volume of water passed through the zone meter over a period of time should closely total that of the customer meters in that area.
3. Customer meters within HCWD range from 5/8”x3/4” residential up to 6” for customers.
4. Meters should be assessed by installation date, size, use (application) and last test date.
5. Additional meter information that should be recorded during the assessment is the account number, meter serial number, brand and model. These data are critical to validating the meter to the customer information system.

Water District Improvements

- Distribution Management Areas: HCWD with assistance of Kentucky Rural Water Association (KRWA) staff has identified five DMAs to correspond with the active storage tanks. To create these hydraulically isolated areas.

  Action: Prioritize the DMAs and install the isolation valves and the zone meter. The zone meters should be full pipe size magnetic flow meters with cellular data so that flow can be transmitted to the operator throughout the day and trended over time.

- Data Management: HCWD is in the process of creating and updating their GIS base map. The GIS will help with tracking leak repairs, water loss, asset management, service line inventory, and valve & hydrant inspections. The point features (valves, meters, etc.) will be located with high accuracy GPS eventually when the equipment is purchased. HCWD has completed the condition assessment within the WRIS, however, once the mapping is complete, HCWD will be updating the digital base map. The water lines on the other hand have condition codes but the locations of the lines are digitized relative to the valve locations. Presently staff is receiving training on using handheld mobile devices to add features such as meters, and valves to the GIS.

  Action: HCWD will take advantage of the GIS based Asset Management (GIS-AM) program that is offered through the Division of Water's Small Disadvantaged Underserved Communities through a partnership with KRWA. With this GIS-AM program KRWA will convert the districts GIS data into a framework that promotes a sustainable system of data analytics to support operations, management and capital planning. The completed project will provide the district with an iPad to begin tracking system repairs and condition coding assets. This system should be integrated with high resolution GPS so that the operators can continue to improve the location of assets, especially the pipe network. The greatest impact the GIS-AM will have on water accountability is two-fold: 1) the meters can be validated monthly to the customer allowing the water usage within each DMA to be compared to the zone meter and 2) the demand factor calculation for each DMA is continuously refined.

- Infrastructure Improvements: Pump station motor control, SCADA and sub-zone metering points.

  Action: Upgrade the pump station motor controls to reduced voltage soft starters. They provide a gentle ramp up to full speed and are used to start and stop AC motors. Ramping up the initial voltage to the motor produces this gradual start/ stop that extends the life of the motor, reduces pressure spikes and decreases the stress on the pipe network. Professional installation will ensure that the soft start is properly sized and installed with surge protection.

  The SCADA system needs to be upgraded with data analysis capability to detect variations in flow rates, tank level, pressure, and other parameters. This early detection capability allows operators to identify leaks at their initial stages before they become major issues.

  Constructing sub-zone metering points within a DMA are useful for leak location and for data collection prior to placing a zone meter. These points are constructed meter boxes or small vaults that allow access to the water main to attach an ultrasonic flow meter. These meters are extremely responsive to changes in flow when conducting valve isolation to pinpoint water leaks.

- Leak Detection and Repair Equipment: The DMAs, zone metering and SCADA monitoring provide the operator with a birds-eye view of system performance and the ability to detect leakage within a specific area. Once the zone is identified for leakage the operator assembles a team to pinpoint the leak for repair.

  Action: Pinpointing a leak is aided by flow metering and acoustic listening devices. Leak repair is augmented by non-destructive excavation such as hydro-excavating. This reduces the damage to fragile infrastructure such as the AC pipelines and decreases the repair time since hydro-excavating is exempt from KY 811 notification. These units should be purchased with the optional integrated valve exercise machine. With this combination, the valve boxes can easily be cleaned and the valves properly exercised to remain functional.

Project Timeline

Short Term Goals (0-6 months) – 3% UAW reduction

1. Purchase leak detection equipment and with the assistance of Kentucky Rural Water, conduct a water audit and train district staff to utilize the leak detection tools.
2. Authorize KRWA to update the districts GIS data through the WIIN Grant Asset Management Program. HCWD will purchase a sub-foot grade GPS receiver and accessories to continue capturing assets.
3. Conduct an inspection of all meters and document the results with GIS.
4. Purchase and install soft starters for the Hwy 41-A, Rock Springs, Graham Hill, Hwy 41 S Anthoston & Hwy 41 S Robards pump stations.

Medium Range Goals (0-18 months) – 3% UAW reduction

1. HCWD will prioritize the sequence for creating the first five DMAs and schedule the material purchase and installation of the valves and zone meters.
2. Continue with valve and hydrant condition assessments.
3. Implement SCADA upgrades to tanks and pump stations.

Long Range Goals (0-60 months) – 5% UAW reduction

1. Develop a capital asset plan for replacing the remaining AC pipe.
2. Schedule the material purchase and installation of the valves and zone meters for the last three DMAs.
3. Purchase towable hydro-excavator with integrated valve exerciser.

Project Costs on Page 13

Project Cost

Estimated Project Cost	
Item	**Cost**
Leak detection equipment	$ 10,000.00
Sub-foot grade GPS / accessories	$ 12,000.00
Pump Station soft starter and installation	$ 100,000.00
SCADA upgrade	$ 75,000.00
Mag-flow meters & zone meters	$ 350,000.00
Valves and installation	$ 75,000.00
Towable Hydro-vac	$ 65,000.00
Total	$ 687,000.00