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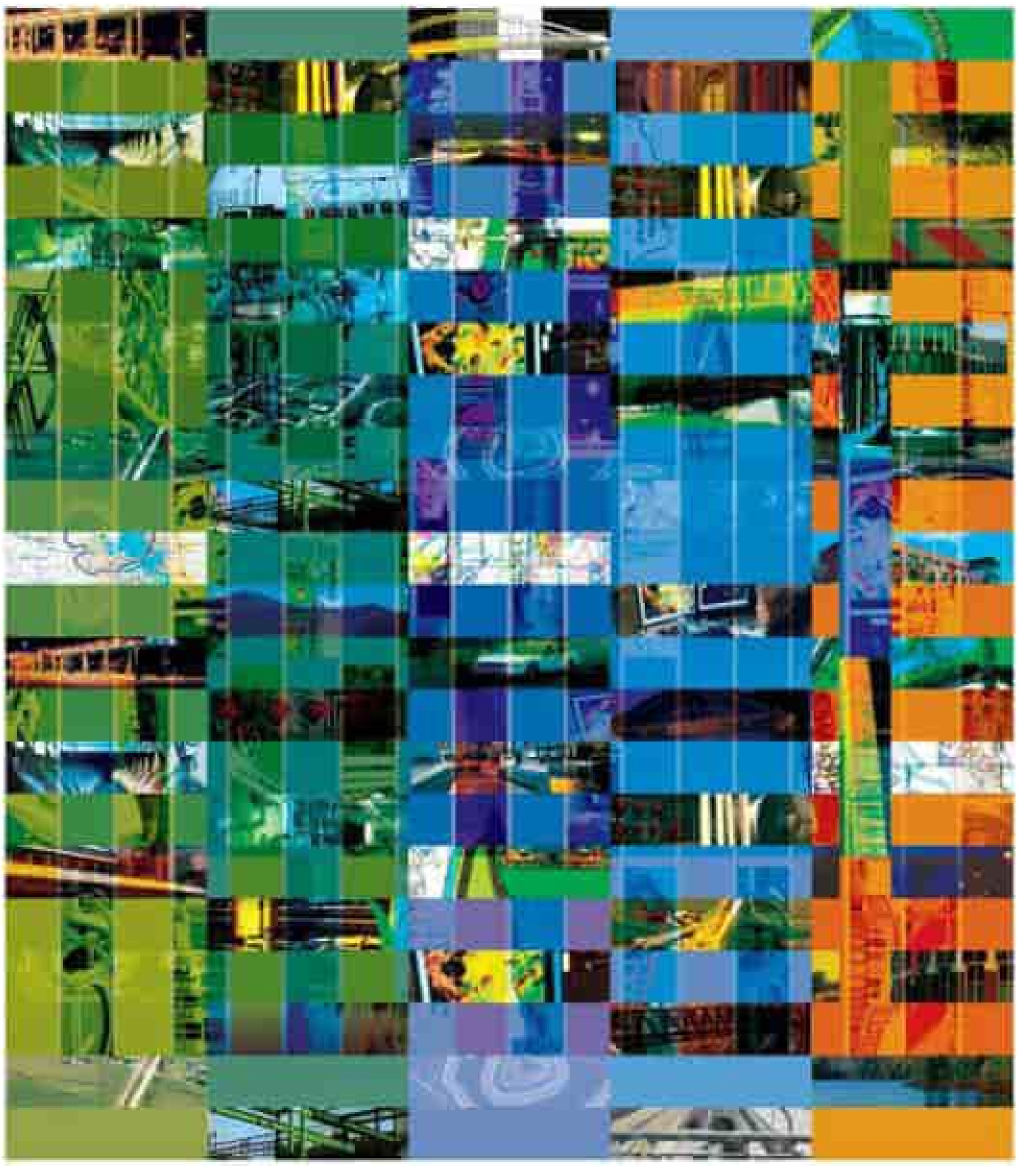
# Water System Capital Improvement Plan



## Report

**Ohio County Water District, KY**

**April 2023**

STRAND ASSOCIATES

Report for

# Ohio County Water District, Kentucky

## Water System Capital Improvement Plan

STATE OF KENTUCKY
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April 2023

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# EXECUTIVE SUMMARY

## INTRODUCTION

The purpose of this project is to evaluate the existing Ohio County Water District (OCWD) water system and develop a Capital Improvement Plan (CIP). This report will compare the identified alternatives and rank the projects based on ability to resolve identified capacity issues, cost, operation, reliability, and environmental impacts.

## EXISTING WATER SYSTEM

OCWD's existing water distribution system consists of a 4 million gallons per day (MGD) water treatment plant, approximately 646 miles of water main, six water storage facilities, and three booster pumping stations (BPS). The distribution system consists of three pressure zones that service the County with several smaller subzones. The total population served is approximately 20,000. The total service area is approximately 434 square miles. See Section 2 of this report for additional information on the existing systems and Section 5 of this report for a capacity evaluation for each pressure zone.

## HISTORIC AND PROJECTED WATER DEMANDS

The population of Ohio County is anticipated to increase over the next 20 years, according to historical population data obtained from the United States Census Bureau. It is thus assumed that the residential water demand across the system will grow as well in that time frame.

By analyzing the OCWD's historical water sales and pumpage data from 2017 to 2021, the 2042 average demand day was determined to be 2.3 MGD without Project Otter and 2.6 MGD with Project Otter. The 2042 maximum demand day was determined to be 3.72 MGD without Project Otter and 4.02 MGD with Project Otter. See Section 3 of this report for additional information on historic and projected demands.

## DISTRIBUTION SYSTEM EVALUATION

The water distribution system is evaluated using a computerized water distribution model. The model was provided to Strand Associates Inc.® (Strand) as a fully functioning model by OCWD. The project scope did not include calibration of the model. The model was provided as a KYPipe model, and Strand converted the model to use in WaterGEMS for the purposes of the CIP. Pressure zone boundaries, storage improvements, BPS replacements, and water main replacements are analyzed using the distributions system model. The average and maximum demand day conditions are used in these evaluations. Refer to Section 4 for additional information on the water distribution model and Section 5 for the distribution system evaluation.

## CIP

The CIP reviewed the water system and proposed several projects to help the system run more efficiently. The projects were ranked as high, medium, or low based on their cost and the effect they would have on the system. Table ES-1 summarizes the rankings and cost of each project, which can be found in more detail in Section 6 of this report.

| High Priority Projects | Total Cost |
|---|---|
| Hartford Interconnect | $4,645,000 |
| DMA Project | $1,031,000 |
| Hartford BPS Wall and HVAC Duct Repair | TBD |
| BPS Emergency Generator Installations | $397,000 |
| Replace or Rehabilitate Echols BPS Pump 2 | $20,000 |
| Rockport and McHenry Water Main Improvements | $903,000 |
| Echols BPS Elimination Project | $863,000 |
| Area 3 AC Water Main Replacements | $5,463,000 |
| **Medium Priority Projects** | |
| Satellite Leak Detection Initiative | $306,000 |
| Other BPS Improvements | TBD |
| Areas 1 and 2 AC Water Main Replacements | $6,518,000 |
| **Low Priority Projects** | |
| GCWD Emergency Interconnect | $1,644,000 |
| Northeast System Improvement Alternative | $923,000 |

Note: Costs to be determined (TBD) depend on the extent of Owner chosen improvements.
DMA=district metered area
HVAC=heating, ventilation, and air conditioning
AC=asbestos cement
GCWD=Grayson County Water District

**Table ES-1 Project Rankings and Cost**

As funding becomes available, it will be important to complete the projects that will have the most positive impact on the water distribution system. Using this report in conjunction with an asset management plan will enhance management of the water distribution system and allow financial planning for the future.

# SECTION 1
# INTRODUCTION

## 1.01 PURPOSE

The purpose of this project is to evaluate the existing Ohio County Water District (OCWD) water system and develop a Capital Improvement Plan (CIP). This report will compare the identified alternatives and rank the projects based on ability to resolve identified capacity issues, cost, operation, reliability, and environmental impacts.

## 1.02 SCOPE

The scope of this report includes the following:

A. Site Visit

An in-person site visit to kickoff the project and discuss information regarding the water distribution system that can be implemented into the CIP.

B. Prepare CIP

1. Provide an inventory of existing water supply components including historic demands, storage facilities, pumping equipment, water mains, and service areas.
2. Forecast the 20-year average and maximum day demands under steady state simulations.
3. Develop, prioritize, and review alternatives in areas of deficiencies.
4. Develop opinions of probable construction cost (OPCCs) for the proposed alternatives.
5. Develop a district metered area (DMA) alternative to improve tracking of water use and water loss within the distribution system.
6. Summarize potential benefits of conducting a satellite-based water leak detection process.
7. Review potential emergency interconnect opportunities with adjacent water utilities.

## 1.03 DEFINITIONS

| | |
|---|---|
| AC | asbestos cement |
| AMI | advanced metering infrastructure |
| AMR | automatic meter reading |
| BCBC | Bluegrass Crossing Business Centre |
| BOTG | boots-on-the-ground |
| BPS | booster pump station |
| CIP | Capital Improvement Plan |
| DBP | disinfection byproducts |
| DMA | district metered area |
| DCWD | Daviess County Water District |

| | |
|---|---|
| ft | feet |
| fps | feet per second |
| GAC | granular activated carbon |
| gal | gallon |
| GCWD | Grayson County Water District |
| GIS | geographical information system |
| gpd | gallons per day |
| gpm | gallons per minute |
| Hartford | City of Hartford, Kentucky |
| HGL | hydraulic grade line |
| HVAC | heating, ventilation, and air conditioning |
| KDOW | Kentucky Division of Water |
| KY 110 | Kentucky Route 110 |
| LF | linear foot |
| McHenry | City of McHenry |
| MCLs | maximum containment levels |
| MGD | million gallons per day |
| NRW | nonrevenue water |
| OCWD | Ohio County Water District |
| OPCC | opinion of probable construction cost |
| PFAS | per- and polyfluoroalkyl substances |
| POI | points of interest |
| PRV | pressure reducing valve |
| psi | pounds per square inch |
| PVC | polyvinyl chloride |
| Rockport | City of Rockport |
| SAR | synthetic aperture radar |
| Strand | Strand Associates, Inc.® |
| TDH | total dynamic head |
| US 62 | United States Route 62 |
| USEPA | United States Environmental Protection Agency |
| VFD | variable frequency drive |
| WTP | water treatment plant |
| WST | water storage tank |

## SECTION 2
## EXISTING WATER SYSTEM

## 2.01 SYSTEM SUMMARY

OCWD's existing water distribution system consists of a 4 million gallons per day (MGD) water treatment plant (WTP), approximately 646 miles of water main, six water storage facilities, three booster pumping stations (BPS), and serves a population greater than 20,000. The distribution system consists of three primary pressure zones that (for the purposes of this CIP) are named the Bluegrass Crossing Business Centre (BCBC) zone, Windy Hill zone, and the Hoover Hill zone (based on the name of the tank with the largest storage volume in the respective zone). There are smaller subzones within the primary zones that are supplied through either pressure reducing valves (PRV) or variable frequency drive (VFD) controlled BPSs. The total service area is approximately 434 square miles. Figure 2.01-1 shows the major system components and existing service area.

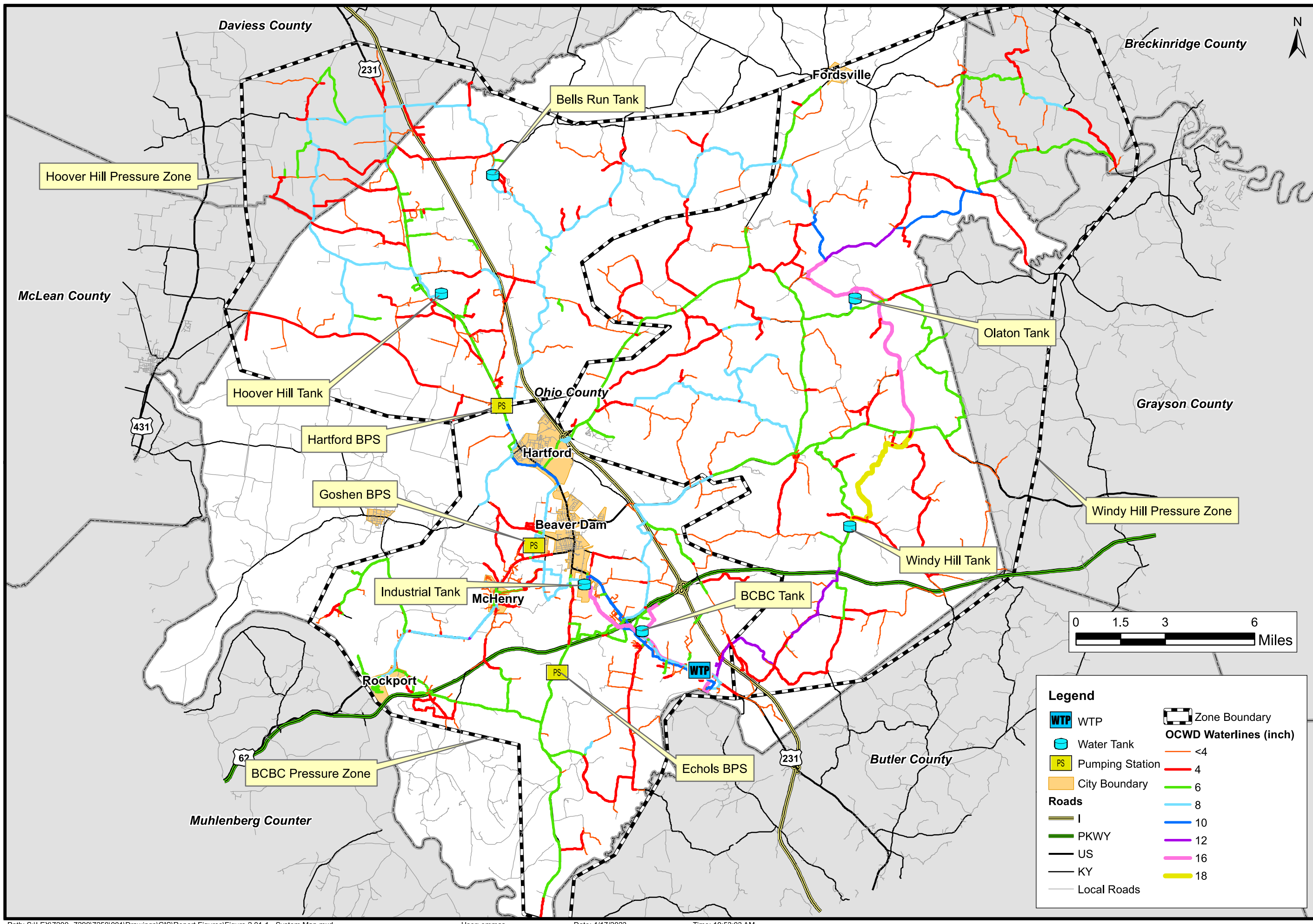
## 2.02 WTP

The existing WTP has a rated capacity of 4 MGD, supplying the OCWD distribution system and interconnects with several adjacent utilities. The WTP is a conventional surface water treatment facility that pulls water from the Green River. A detailed review of the WTP process was not conducted as part of this report, but a site visit and brief review of WTP design documentation was conducted. Based on information provided by OCWD, the WTP appears to have the necessary redundancy for a 4 MGD conventional surface WTP, with the exception of the Granular Activated Carbon (GAC) filters. The GAC filters are an optional treatment process and are rated for 2 MGD based on two installed filters with room in the existing building for a third vessel expansion. After filtration, operators have the option to convey flow to the clearwells for disinfection or divert a portion of the flow to the GAC filters.

GAC filters are particularly effective at removing organic chemicals from water that are often the cause of objectionable odors or taste. GAC filters are also one of a few treatment technologies that can effectively remove per- and polyfluoroalkyl substances (PFAS). PFAS are a group of chemicals used in products that resist heat, oil, stains, grease, and water; because they do not break down in the environment and have potential health concerns in humans. The United States Environmental Protection Agency (USEPA) recently released proposed Maximum Contaminant Levels (MCLs) for several PFAS compounds in March of 2023. At the time of this report, the MCLs were under a public comment period, and a virtual public meeting hosted by USEPA to discuss the MCLs is scheduled for May 4, 2023. Depending on the final MCLs and amount of PFAS in OCWD source water, already having GAC filters in place will provide a treatment advantage many other utilities currently do not have.

## 2.03 WATER STORAGE

OCWD's existing water distribution system contains six water storage tanks (WST). At the time the CIP work began, the Olaton WST was out of service, but OCWD noted it intends to bring it back into service in the near future. Strand Associates, Inc.® (Strand) agrees with bringing the Olaton WST back in service to increase storage volume and operational redundancy in the Windy Hills zone. Therefore, it is included in all storage summary information and modeling efforts described later in this report. Table 2.03-1 provides a summary of the WSTs in the distribution system.




**WATER DISTRIBUTION SYSTEM MAP**

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

FIGURE 2.01-1
7250.001

| WST | Pressure Zone | Overflow Elevation | Volume (gal) |
|---|---|---|---|
| Windy Hill WST | Windy Hills | 860 | 500,000 |
| Olaton WST | Windy Hills | 860 | 500,000 |
| | | **Windy Hills Zone Storage Subtotal** | **1,000,000** |
| Bells Run WST | Hoover Hill | 739.5 | 300,000 |
| Hoover Hill WST | Hoover Hill | 739.5 | 500,000 |
| | | **Hoover Hill Zone Storage Subtotal** | **800,000** |
| Industrial Park WST | BCBC | 685 | 500,000 |
| BCBC WST | BCBC | 685 | 1,000,000 |
| | | **BCBC Zone Storage Subtotal** | **1,500,000** |
| | | **System Storage Total** | **3,300,000** |

gal=gallons

**Table 2.03-1 WST Summary**

## 2.04 BPS

OCWD has three operational BPSs throughout the distribution system. Table 2.04-1 summarizes the BPS design information provided by OCWD.

| BPS | Number of Pumps | TDH Design Point (ft) | Flow Design Point (gpm) | Service Zone |
|---|---|---|---|---|
| Echols | 2 | 200 | 100 | BCBC |
| Goshen | 3 | 150 | 300 | BCBC |
| Hartford | 3 | 295 | 220 | Hoover Hill |

ft=feet
gpm=gallons per minute
TDH=total dynamic head

**Table 2.04-1 BPS Summary**

The Echols BPS is a VFD-controlled station that maintains a set discharge pressure. It services a small subzone within the BCBC zone on the south side of the water distribution system. The Goshen and Hartford BPSs operate simultaneously because they are located in a series within the distribution system. While the Hoover Hill and Bells Run WSTs are in the same zone, the Hartford BPS has a pump dedicated separately for each WST.

Table 2.04-2 presents a pump summary for the pumps within the existing WTP.

| Pump Station | Number of Pumps | TDH Design Point (ft) | Flow Design Point (gpm) |
|---|---|---|---|
| Raw Water | 2 | 163 | 2,920 |
| High-Service BCBC | 3 | 260 | 1,014 |
| High-Service Windy Hills | 2 | 500 | 750 |

**Table 2.04-2 WTP Pump Summary**

## 2.05 DISTRIBUTION SYSTEM

The existing distribution system contains approximately 646 miles of waterlines ranging from less than 3 to 18 inches in diameter. The system is comprised of three primary pressure zones served by BPSs and WSTs. Table 2.05-1 details the waterlines throughout the distribution system.

| Main Size (inches) | Length (ft) | Length (miles) |
|---|---|---|
| Under 3 | 1,033,385 | 196 |
| 4 | 879,531 | 167 |
| 6 | 696,163 | 132 |
| 8 | 511,717 | 97 |
| 10 | 96,754 | 18 |
| 12 | 69,133 | 13 |
| 16 | 93,438 | 18 |
| 18 | 28,372 | 5 |
| **Total** | **3,408,493** | **646** |

**Table 2.05-1 Water Main Summary**

# SECTION 3
# HISTORIC AND PROJECTED WATER DEMANDS

## 3.01 GENERAL

This section presents the current water demands in OCWD's system and projects future demands to the year 2042. Population projections for the service area are used with the current customer demands to simulate future water use in the water distribution system model.

Water demand rate terminology used in this report is defined as follows:

- Average day: The total volume of water pumped in a year divided by the number of days in the year.

- Maximum day: The historical high volume of water pumped based on data provided by OCWD from 2017 through 2021.

- Fire demand: The estimate of the amount of water required in a community to fight a fire. This demand is generally specified as a rate of flow, in gpm, for a given period of time, in hours. The calculated fire demand is added to the average domestic demand during the maximum day to obtain the demand on a day that a major fire occurs. Fire demand generally increases the volume of storage that must be available on the maximum day.

## 3.02 POPULATION PROJECTIONS

Figure 3.02-1 shows a graphical representation of the historic and projected populations in Ohio County. The historical population data and population projections through 2040 can be found in Table 3.02-1. Historical population data was obtained through the United States Census Bureau and projections were prepared based on a review of population trends in the data collected. Since 1960, the population for Ohio County has historically seen gradual growth. This growth was assumed to continue for the purposes of the CIP and the associated 20-year projected water system demands.

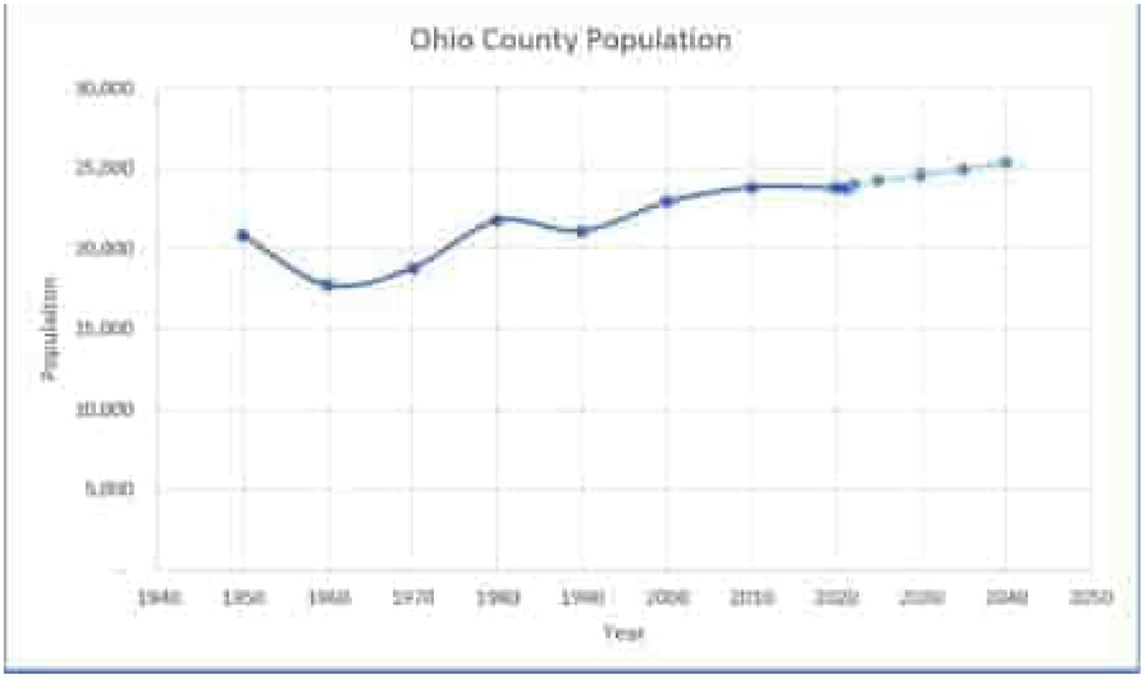



**Figure 3.02-1 Ohio County Population**

Using the historic population data taken, a linear trend was used to project 20-year populations. This process yielded an approximate 7 percent growth in population, as seen in Table 3.02-1. Therefore, for the purposes of this report, it is assumed that the demand for Ohio County will follow a similar trend.

| Year | Population |
|---|---|
| 1950 | 20,840 |
| 1960 | 17,725 |
| 1970 | 18,790 |
| 1980 | 21,765 |
| 1990 | 21,105 |
| 2000 | 22,916 |
| 2010 | 23,842 |
| 2020 | 23,772 |
| 2025 | 24,222 |
| 2030 | 24,586 |
| 2035 | 24,949 |
| 2040 | 25,313 |

**Table 3.02-1 Population Projections**

## 3.03 WATER SALES AND PUMPAGE

OCWD's historical water sales and pumpage data were obtained from OCWD's records for the years 2017 to 2021. Table 3.03-1 summarizes the historical finished water pumpage data.

| Year | Annual Pumpage (gal) | Average Day Pumpage (gpd) | Maximum Day Pumpage (gpd) | Annual Sales (gpd) | Sales to Pumpage Ratio | Maximum to Average Day Ratio |
|---|---|---|---|---|---|---|
| 2017 | 855,188,684 | 2,167,579 | 3,259,783 | 489,269,400 | 0.57 | 1.50 |
| 2018 | 894,900,939 | 2,273,753 | 3,480,589 | 511,584,700 | 0.57 | 1.53 |
| 2019 | 840,113,004 | 2,132,936 | 3,078,064 | 488,876,400 | 0.58 | 1.44 |
| 2020 | 792,123,544 | 1,983,326 | 2,710,287 | 495,530,500 | 0.63 | 1.37 |
| 2021 | 868,256,795 | 2,204,585 | 2,913,543 | 497,700,700 | 0.57 | 1.32 |
| **Average** | **850,116,593** | **2,152,436** | **3,088,453** | **495,496,850** | **0.58** | **1.43** |

gpd=gallons per day

**Table 3.03-1 Water Pumpage and Sales Data**

Based on the sales to pumpage ratio, nonrevenue water (NRW) accounted for 37 to 43 percent of pumped water from 2017 to 2021. NRW includes water that is pumped or produced but is lost before it reached the customer. NRW is often further divided into real losses (such as leaks or physical losses) and apparent losses (such as theft, unmetered usage, or metering inaccuracies). Water loss in Kentucky averages approximately 30 percent on a statewide basis according to the *2019 Kentucky ASCE Report Card*. Direct water loss is only a portion of NRW, but a NRW of 40 percent for OCWD indicates it is higher than the statewide average for water loss. A common goal for many utilities is to achieve a NRW percent of 15 or less. OCWD acknowledges it has above average water loss. As part of the CIP, OCWD directed Strand Associates, Inc.® to develop and review several proposed alternatives discussed later in this report to identify leaks and reduce NRW.

OCWD provided records of finished water that is sent throughout the distribution system to the various areas, BPS, and communities served. Table 3.03-2 summarizes this data in a daily context.

| Year | BCBC Total (gal) | Windy Hill Total (gal) | Hoover Hill Total (gal) | Bells Run Total (gal) | Rockport Total (gal) | Fordsville Total (gal) | Beaver Dam Total (gal) |
|---|---|---|---|---|---|---|---|
| 2017 | 1,449,018 | 677,304 | 370,375 | 168,119 | 15,917 | 115,274 | - |
| 2018 | 1,521,495 | 730,876 | 241,868 | 324,845 | 18,787 | 119,124 | - |
| 2019 | 1,360,378 | 719,406 | 182,701 | 320,663 | 17,454 | 113,631 | - |
| 2020 | 1,265,353 | 693,738 | 159,616 | 278,961 | 16,504 | 108,090 | 230,194 |
| 2021 | 1,393,039 | 762,734 | 192,828 | 296,101 | 27,274 | 121,485 | 244,129 |
| **Average** | **1,397,857** | **716,812** | **229,478** | **277,738** | **19,187** | **115,521** | **237,162** |

Note: Data is based on monthly average data.

**Table 3.03-2 Average Daily Distribution Data**

Table 3.03-3 summarizes the distribution data in an annual context.

| Year | BCBC Total (gal) | Windy Hill Total (gal) | Hoover Hill Total (gal) | Bells Run Total (gal) | Rockport Total (gal) | Fordsville Total (gal) | Beaver Dam Total (gal) |
|---|---|---|---|---|---|---|---|
| 2017 | 529,101,186 | 247,366,712 | 134,457,000 | 61,108,000 | 5,817,000 | 42,086,000 | - |
| 2018 | 555,488,949 | 266,975,187 | 88,132,000 | 118,775,000 | 6,863,000 | 43,461,000 | - |
| 2019 | 496,295,288 | 262,256,819 | 66,809,500 | 116,938,000 | 6,344,000 | 41,461,000 | - |
| 2020 | 459,980,309 | 253,867,181 | 58,492,000 | 102,127,000 | 6,042,000 | 39,553,000 | 7,136,000 |
| 2021 | 508,301,129 | 278,097,584 | 70,464,000 | 108,012,000 | 9,947,000 | 44,296,000 | 86,897,000 |
| **Average** | **509,833,372** | **261,712,697** | **83,670,900** | **101,392,000** | **7,002,600** | **42,171,400** | ***47,016,500** |

*Outlier because of Beaver Dam starting in December 2020.

**Table 3.03-3 Annual Distribution Data**

## 3.04 WATER DEMAND PROJECTIONS

As previously discussed and for the purposes of the CIP, the population of Ohio County is assumed to grow by approximately 7 percent over the next 20 years. Therefore, it is assumed that the change in water demand across the system will be increase by 7 percent in that time frame for both the average day demand and the maximum day demand.

In addition to the base demand increase from population growth, OCWD provided information on demands resulting from “Project Otter.” Project Otter is a proposed industrial user that will have a projected demand of 300,000 gpd with a peak hourly usage of 20,000 gallons per hour. Based on information provided by OCWD, the location of Project Otter is within the BCBC zone. OCWD noted that Project Otter is anticipated to come online in the latter half of 2023. Therefore, this demand is included in all alternative and modeling analyses discussed in the CIP. The current and projected demands can be seen in Table 3.04-1.

| | Current Demand (MGD) | Current Demand with Project Otter (MGD) | Projected 20-Year Demand (MGD) | Projected 20-Year Demand with Project Otter (MGD) |
|---|---|---|---|---|
| **Average** | 2.15 | 2.45 | 2.30 | 2.60 |
| **Maximum** | 3.48 | 3.78 | 3.72 | 4.02 |

**Table 3.04-1 Current and Projected Water Demands**

As part of the CIP, OCWD requested that Strand review the potential need for WTP improvements based on the projected 20-year demands. The WTP has a capacity of 4 MGD. The results of this analysis can be seen in Table 3.04-2.

| | Current Demand WTP Capacity | Projected 20-Year Demand WTP Capacity |
|---|---|---|
| **Average** | 61% | 65% |
| **Maximum** | 95% | 101% |
| **WTP Capacity** | 4 MGD | |

**Table 3.04-2 WTP Capacity Demand Comparison**

According to Kentucky Administrative Regulations Title 401, Chapter 008, Regulation 100, "A public water system that purchases water from another public water system shall submit a letter from the providing water system verifying the providing water system has the capacity and shall provide water service to the purchasing water system, including the proposed project if the project will result in: Demand for water exceeding eighty-five (85) percent of the purchasers current purchase contract." Although this does not directly apply to the OCWD WTP production capacity, the 85 percent benchmark is often used as an indicator that a plan should be in place to address increased demands. OCWD's average day demand is not expected to exceed 85 percent in 20 years, including Project Otter demands.

## 3.05 CAPACITY ANALYSIS

The following section evaluates the capacity of the three primary pressure zones. Note that the 20-year project demand scenarios include the Hartford Interconnect demands discussed in more detail in Sections 4 and 5.

Table 3.05-1 summarizes the capacity analysis for each pressure zone. The pumping capacity column is based on firm capacity of the pumping station, meaning the capacity with the largest unit out of service. Because each pump in a BPS is the same size as the others, firm capacity is defined as having one pump out of service.

| | Pressure Zone | Zone Demand (gpm) | Pumping Capacity (gpm) | Zone Storage Volume (gal) |
|---|---|---|---|---|
| **Current Average** | Windy Hill | 422 | 750 | 1,000,000 |
| | Hoover Hill | 394 | 600 | 800,000 |
| | BCBC | 875 | 2,028 | 1,500,000 |
| **Current Maximum** | Windy Hill | 684 | 750 | 1,000,000 |
| | Hoover Hill | 422 | 600 | 800,000 |
| | BCBC | 921 | 2,028 | 1,500,000 |
| **20-Year Average** | Windy Hill | 453 | 750 | 1,000,000 |
| | Hoover Hill | 415 | 600 | 800,000 |
| | BCBC | 1,353 | 2,028 | 1,500,000 |
| **20-Year Maximum** | Windy Hill | 739 | 750 | 1,000,000 |
| | Hoover Hill | 619 | 600 | 800,000 |
| | BCBC | 2,175 | 2,028 | 1,500,000 |

**Table 3.05-1 Capacity Analysis Summary**

Results from Table 3.05-1 indicate for the three main pressure zones, OCWD has the capacity to meet demands except for the 20-year projected maximum day demand scenario. In the 20-year maximum day demand scenario, all three primary zones have demands that are near to or exceed anticipated demands. In these instances, adequate storage can supplement pumping capacity to meet demands within the system.

An hour-by-hour capacity analysis was conducted for the three pressure zones using a 24-hour diurnal curve from the American Water Works Association Manual 32. Figures 3.05-1, 3.05-2 and 3.05-3 show the hour-by-hour capacity evaluation for the 20-year maximum day demand for the Windy Hill, Hoover Hill, and BCBC zone, respectively.

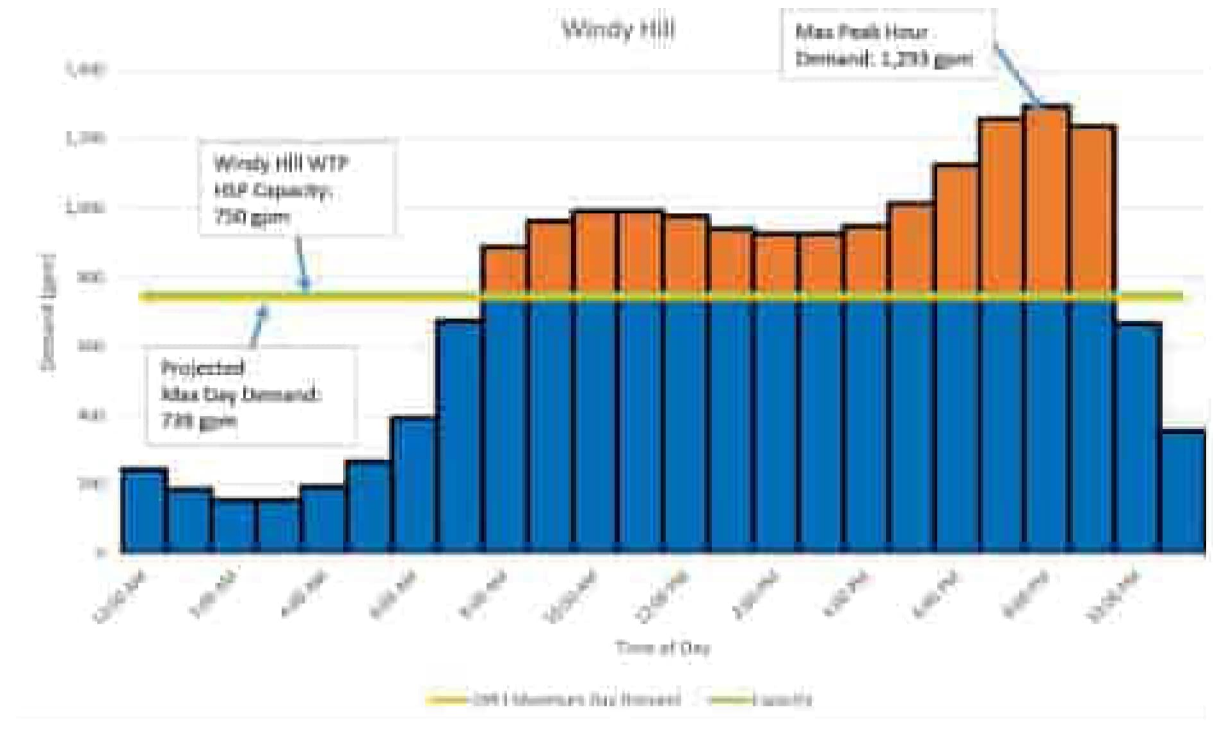



**Figure 3.05-1 Windy Hill Zone Capacity Analysis**


**Figure 3.05-2 Hoover Hill Zone Capacity Analysis**

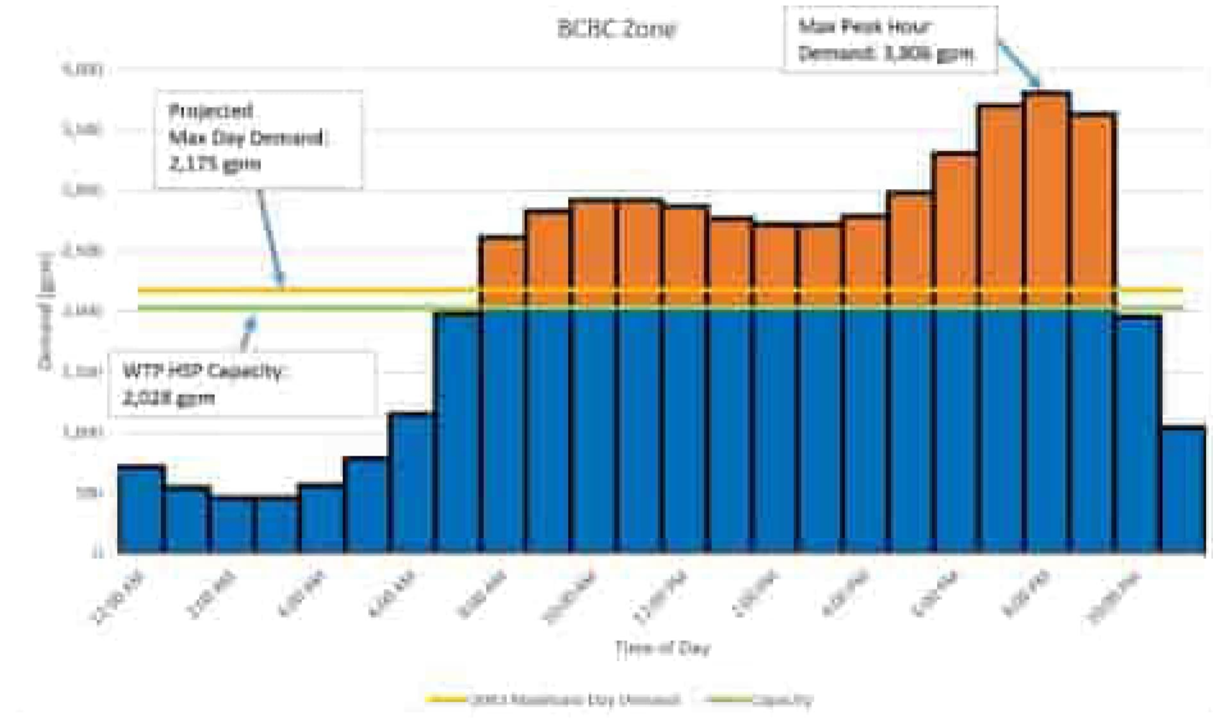



**Figure 3.05-3 BCBC Zone Capacity Analysis**

Based on the hour-by-hour calculations, approximately 240,000, 225,000, and 850,000 gallons of storage are required from elevated storage (as shown in the orange-colored bars) to meet projected peak demands in the Windy Hill, Hoover Hill, and BCBC zones, respectively. Table 3.05-2 summarizes the required storage, total storage, and available storage for the three pressure zones. Available storage assumes that 20 percent of the total storage in WSTs is needed for operational fluctuations.

| Pressure Zone | Required Storage Capacity to Meet Peak Demand (gallons) | Total Storage Capacity (gallons) | Available Storage Capacity (gallons) |
|---|---|---|---|
| Windy Hill | 240,000 | 1,000,000 | 800,000 |
| Hoover Hill | 225,000 | 800,000 | 640,000 |
| BCBC | 850,000 | 1,500,000 | 1,200,000 |

**Table 3.05-2 Hour-by-Hour Capacity Analysis Summary**

As shown in Table 3.05-2, each zone has enough available storage to offset projected peak demands. This indicates the OCWD system does not need any additional elevated storage or pumping capacity.

# SECTION 4
# EXISTING SYSTEM EVALUATION

## 4.01 GENERAL

This section presents information regarding the evaluation of the water distribution system using a calibrated computerized water distribution model provided by OCWD. This section will analyze current and future demand scenarios based on the existing system. Alternatives to address identified system deficiencies are discussed further in Section 5.

## 4.02 COMPUTERIZED WATER MODEL

OCWD provided Strand with a working computerized water model using the KYPipe software. The model was then converted to WaterGEMS software to analyze the existing system and investigate potential project alternatives.

System demands in the model were updated to represent current and projected future average and maximum demands discussed in Section 2. Base model demands were uniformly adjusted across the system to match the current and projected future average and maximum demands. The demand for Project Otter was placed individually in the model based on the location provided by OCWD. Refer to Table 3.04-1 for the current and projected system demands. These demands were used for the model simulations.

All model simulations conducted were steady-state evaluations of the distribution system. The following operational criteria was used for each steady-state simulation:

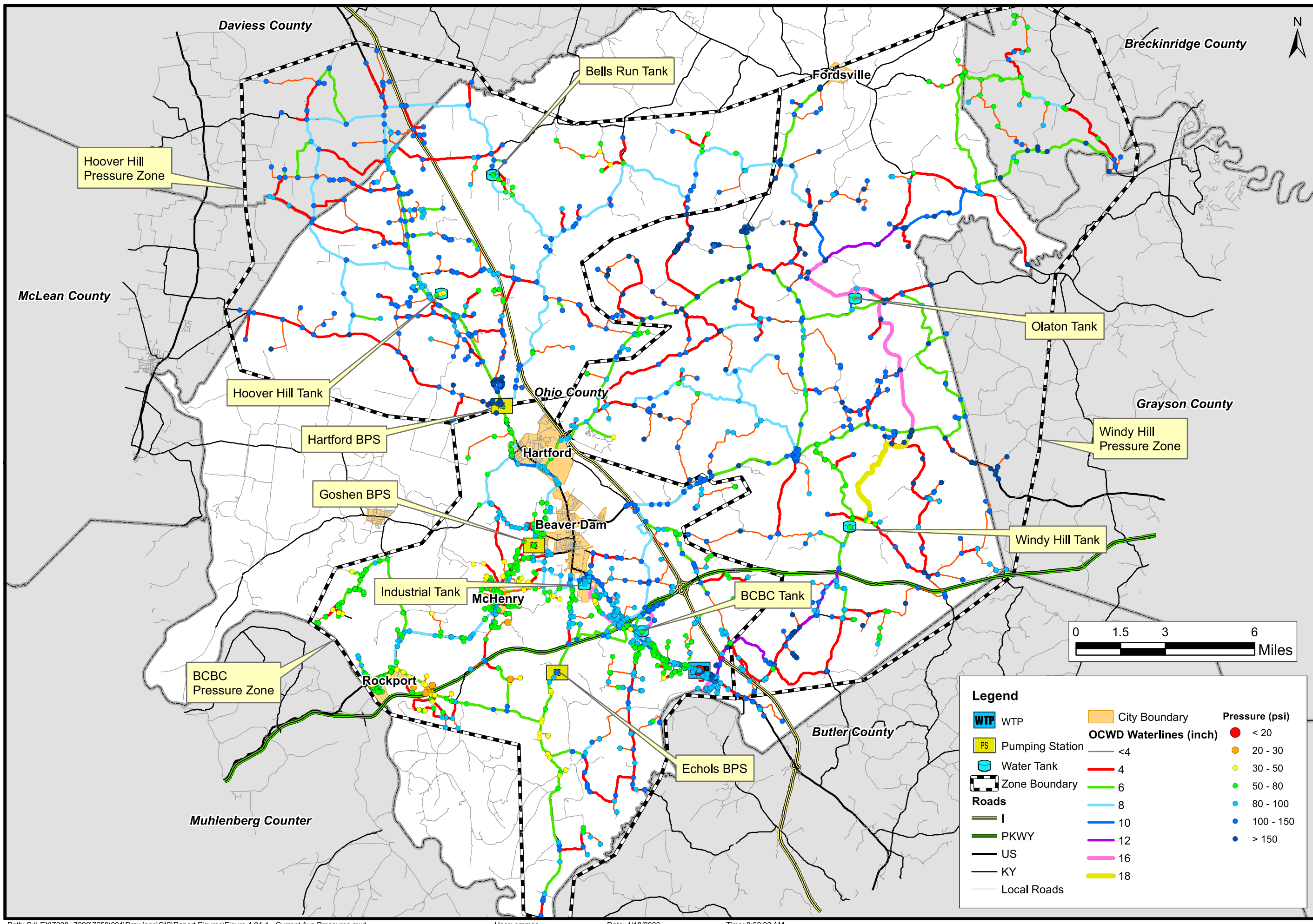
- One pump in the Goshen BPS is operating and set to maintain a flow of 300 gpm.
- One pump in the Hartford BPS is operating.
- Echols BPS is operating to maintain a discharge pressure of 100 pounds per square inch (psi).
- One high-service pump feeding the BCBC zone is operating.
- One high-service pump feeding the Windy Hill zone is operating.
- All initial water levels in tanks were set to 5 feet below overflow.
- Olaton WST is assumed to be in service.

## 4.03 CURRENT DEMAND SYSTEM EVALUATIONS

### A. Current Average Day Demand

A steady-state simulation was run for the current average day demands. Kentucky Division of Water (KDOW) requires system pressures shall be greater than 20 psi in all conditions. Recommended Standards for Water Works, also known as Ten States Standards, recommends a normal working pressure of at least 35 psi. Figure 4.03-1 shows the simulated working pressures for the system for the current average day demands.

All points within the system meet or exceed 20 psi. Select areas near the City of Rockport (Rockport) and the City of McHenry (McHenry) have working pressures in the 20 to 35 psi range. Figure 4.03-2 shows a screenshot of resulting model pressures in the Rockport and McHenry area.




**CURRENT AVERAGE DAY DEMAND**
**SIMULATED PRESSURES**

**WATER SYSTEM CAPITAL IMPROVEMENT PLAN**
**OHIO COUNTY WATER DISTRICT**
**OHIO COUNTY, KENTUCKY**

**FIGURE 4.03-1**
**7250.001**

Path: S:\LEX\7200--7299\7250\001\Drawings\GIS\Report Figures\Figure 4.04-1 - Current Avg Pressures.mxd User: emmas Date: 4/18/2023 Time: 8:52:02 AM

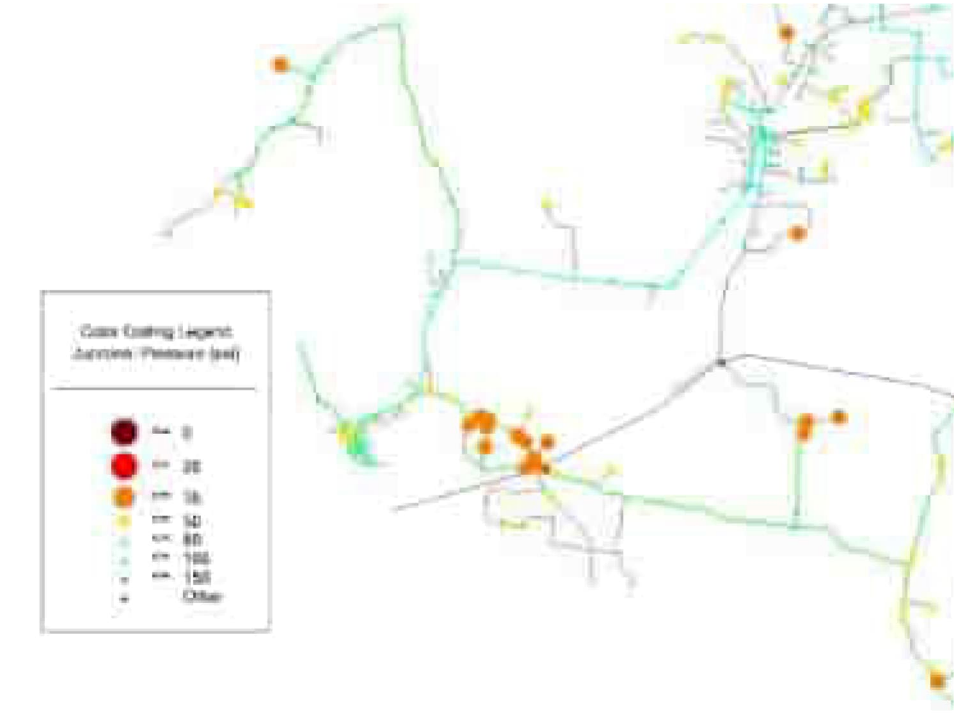


**Figure 4.03-2 Current Average Day Demand Rockport and McHenry Pressures**

B. <u>Current Maximum Day Demand</u>

A steady-state simulation was run for the current maximum day demands. Figure 4.03-3 shows the simulated working pressures for the system for the current maximum day demands. The majority of the system maintained required pressures with the exception of areas near and serving Rockport and McHenry. Figure 4.03-4 shows a screenshot of resulting model pressures in the Rockport and McHenry area.

## CURENT MAXIMUM DAY DEMAND
## SIMULATED PRESSURES

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

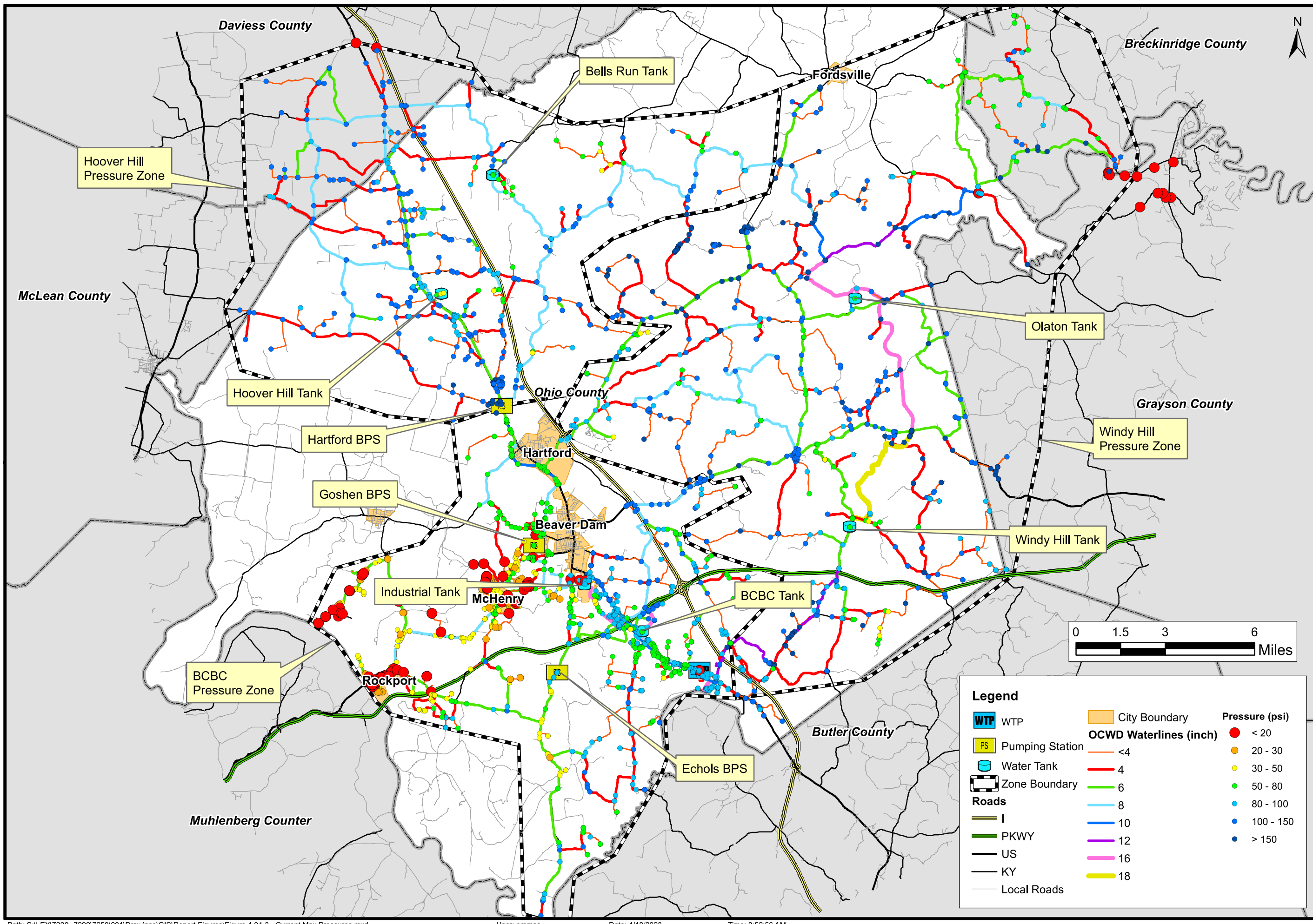



FIGURE 4.03-3
7250.001

Path: S:\LEX\7200--7299\7250\001\Drawings\GIS\Report Figures\Figure 4,04-3 - Current Max Pressures,mxd User: emmas Date: 4/18/2023 Time: 8:52:56 AM

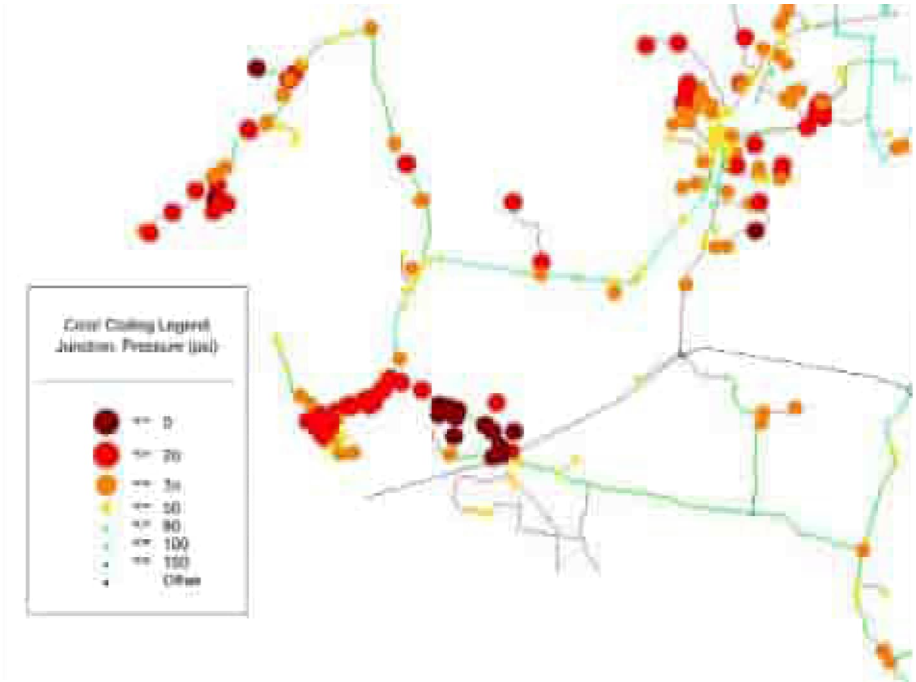


**Figure 4.03-4 Current Maximum Day Demand Rockport and McHenry Pressures**

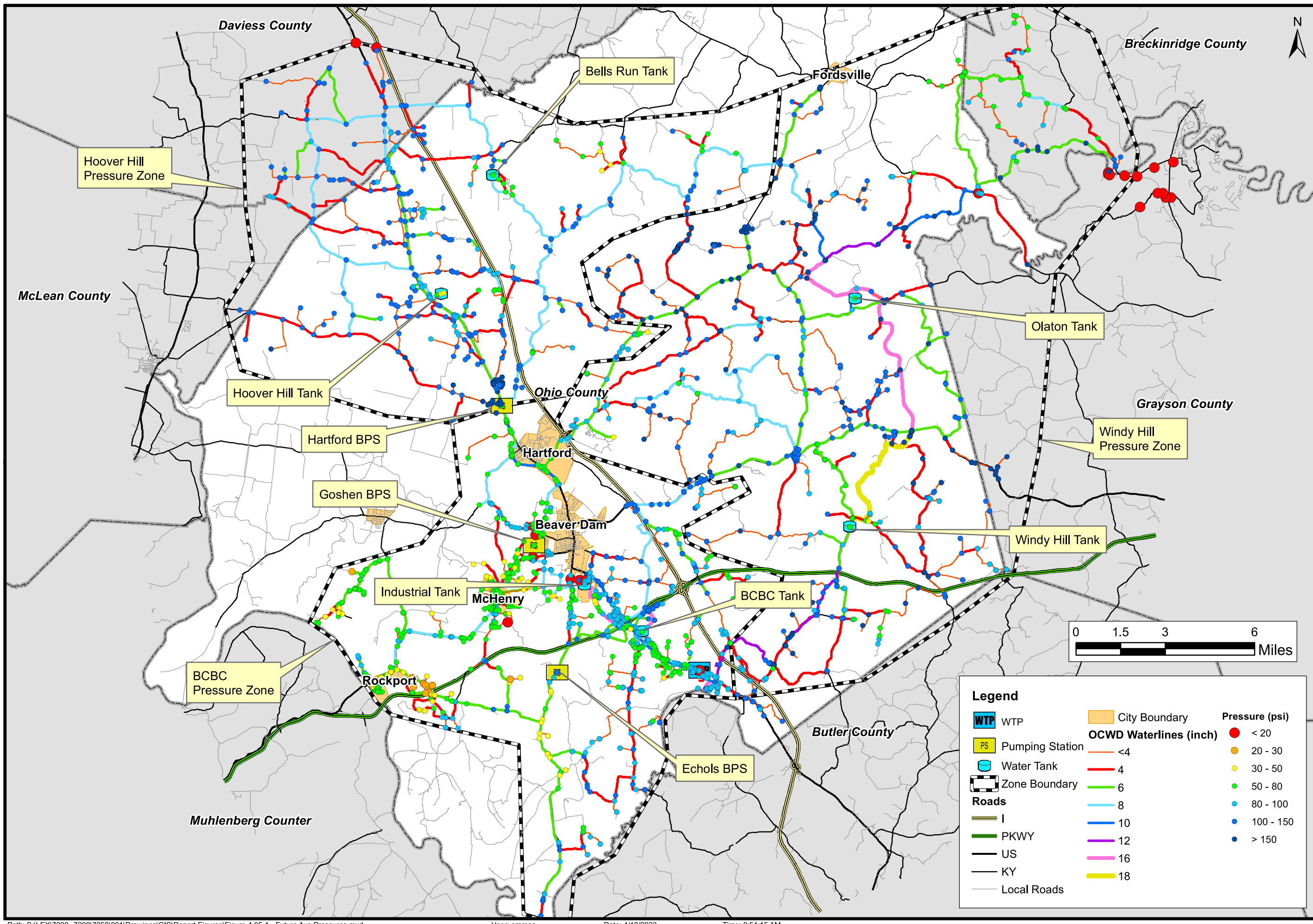
As shown in Figure 4.03-4, pressures in the area are below KDOW and Ten States Standards requirements. Select nodes also show pressures dropping below 0 psi. Pressures this low for a current day demand would result in numerous customer complaints and OCWD did not indicate any significant operational concerns in this area. This indicates the model provided does not accurately represent the system in the area. Steps should be taken to further calibrate the model and make corrections. Those steps were outside the scope of this report.

## 4.04 PROJECTED DEMAND SYSTEM EVALUATIONS

The existing distribution system model was also simulated under the projected 20-year future demand conditions to determine whether system improvements were needed to meet demands.

### A. 20-Year Projected Average Day Demand

A steady state simulation was run for the 20-year projected average day demands. Figure 4.04-1 shows the simulated working pressures for the system for the projected average day demands. The majority of the system maintained required pressures with the exception of areas near and serving Rockport and McHenry. Figure 4.04-2 shows a screenshot of resulting model pressures in the Rockport and McHenry areas.




**20-YEAR FUTURE AVERAGE DAY DEMAND**
**SIMULATED PRESSURES**

**WATER SYSTEM CAPITAL IMPROVEMENT PLAN**
**OHIO COUNTY WATER DISTRICT**
**OHIO COUNTY, KENTUCKY**

**FIGURE 4.04-1**
**7250.001**

Path: S:\LEX\7200--7299\7250\001\Drawings\GIS\Report Figures\Figure 4.05-1 - Future Avg Pressures.mxd User: emmas Date: 4/18/2023 Time: 8:54:15 AM

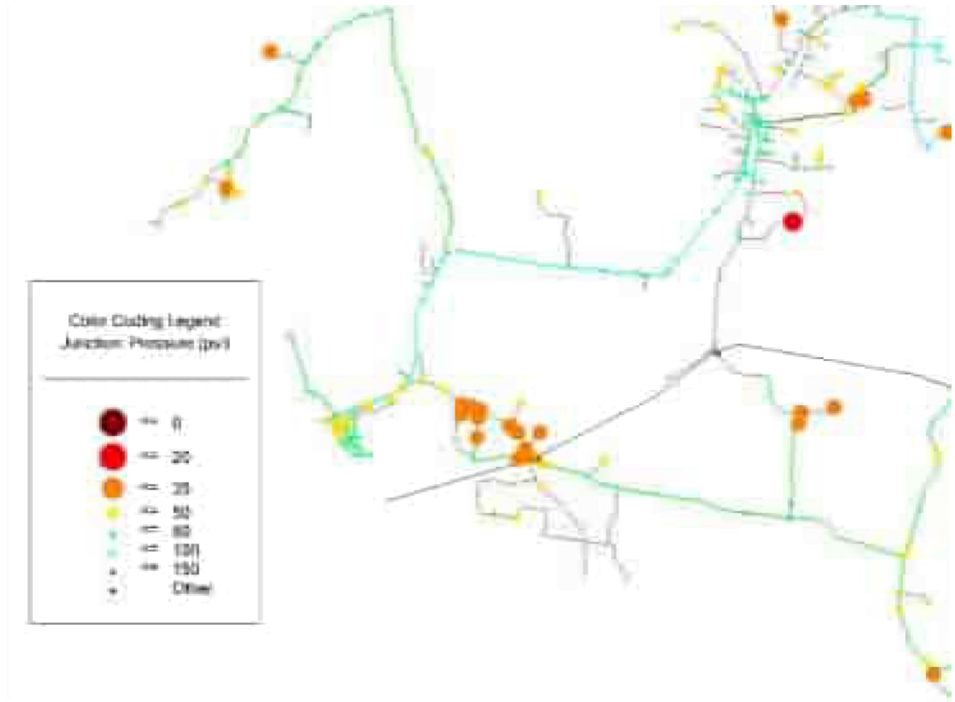
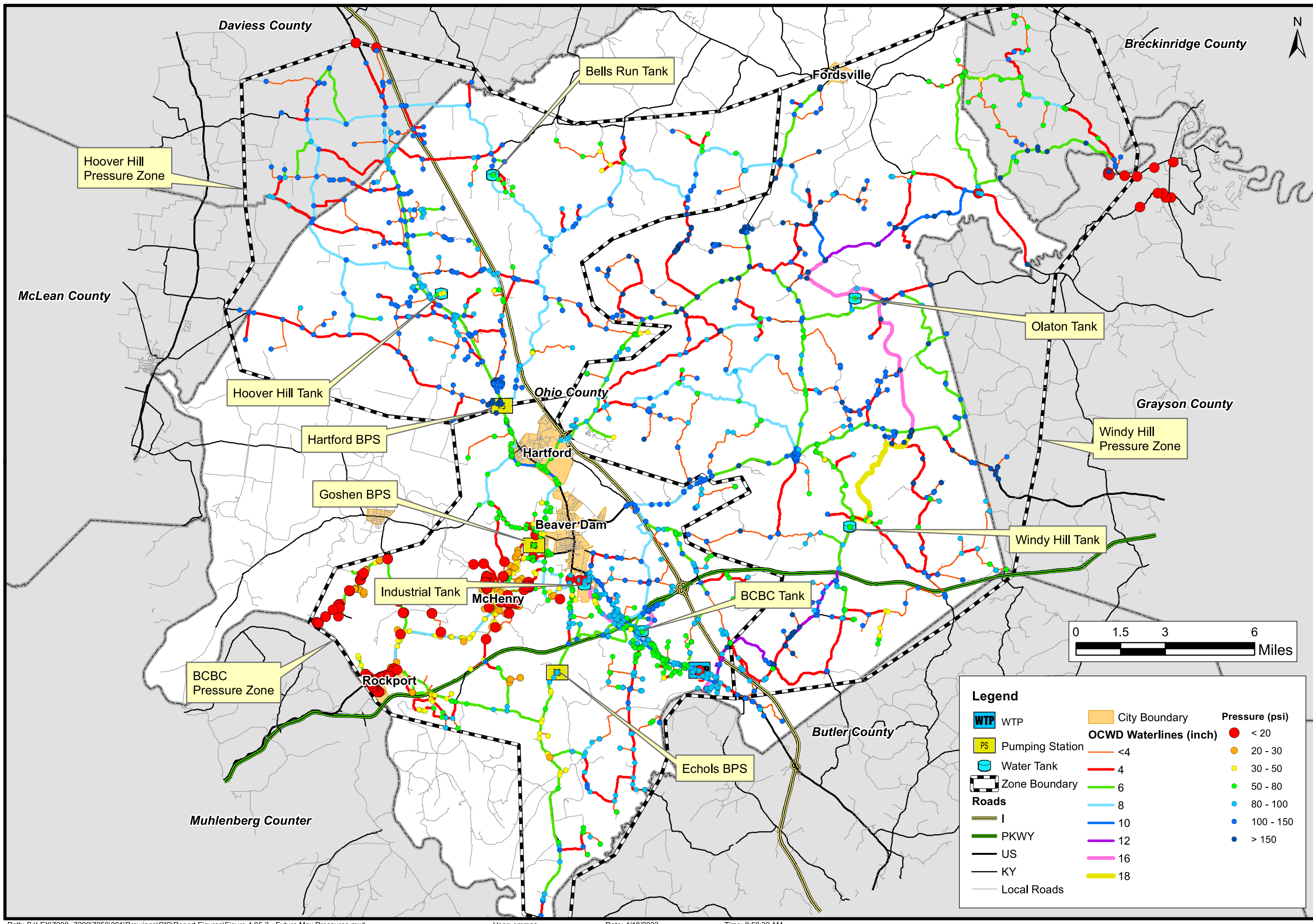



**Figure 4.04-2 Projected Average Day Demand Rockport and McHenry Pressures**

Results are similar to the current average day scenario system, with minor reductions in system pressures due to the project increase in demands.

B. <u>20-Year Projected Maximum Day Demand</u>

A steady-state simulation was run for the 20-year projected maximum day demands. Figure 4.04-3 shows the simulated working pressures for the system for the projected maximum day demands. The majority of the system maintained required pressures, with the exception of areas near and serving Rockport and McHenry. Figure 4.04-4 shows a screenshot of resulting model pressures in the Rockport and McHenry area.




**20-YEAR FUTURE MAXIMUM DAY DEMAND**
**SIMULATED PRESSURES**

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

**FIGURE 4.04-3**
**7250.001**

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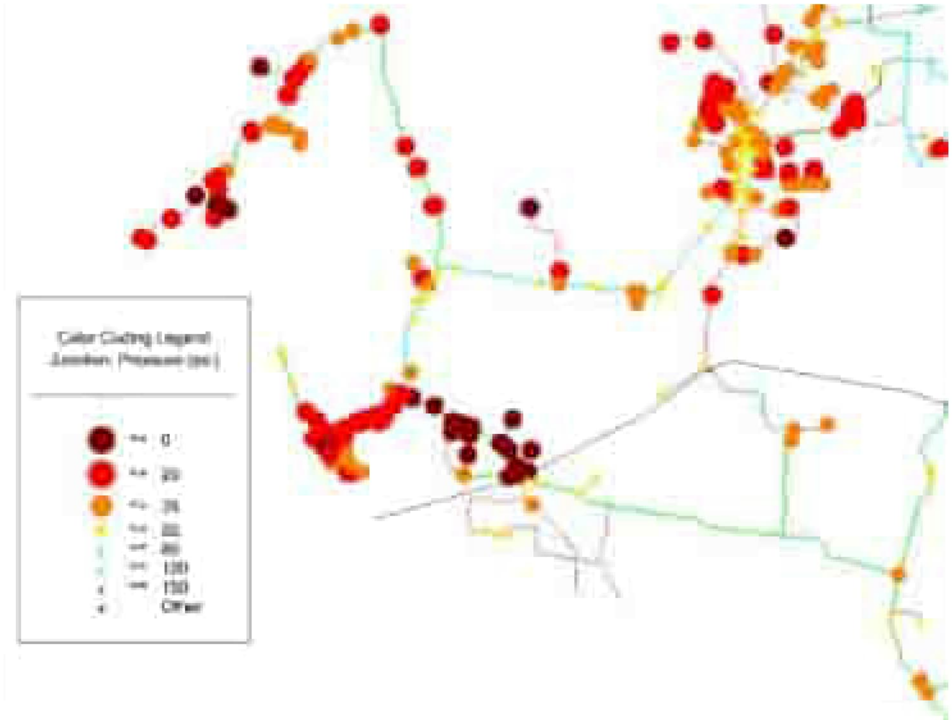


**Figure 4.04-4  Projected Maximum Day Demand Rockport and McHenry Pressures**

Results are similar to the current maximum day scenario system, with minor reductions in system pressures due to the project increase in demands.

## 4.05 DISTRIBUTION SYSTEM OVERVIEW COMMENTS

In general, most of the system does not have any anticipated hydraulic capacity issues for the projected system demands, with the exception of the Rockport and McHenry areas. The main contributing factors are hydraulic bottlenecks near the Industrial Park WST and leading to the Rockport and McHenry area.

There is an approximately 1.1 mile stretch of 8-inch water main from the Industrial Park WST that services the Rockport and McHenry area, Goshen BPS, Hartford BPS, and subsequent Hoover Hill zone. The 8-inch watermain branches off a 12-inch connection to the Industrial Park WST, runs west for approximately 1.1 miles, then splits into parallel 8-inch mains on Taylor Mine Road. This 8-inch main creates a hydraulic bottleneck in the system that also lacks redundancy. Current and future maximum demand conditions result in velocities exceeding 4.5 feet per second (fps) in the water main, which yields friction losses of over 60 feet in the 1.1-mile section.

The Rockport and McHenry area is primarily served by a 6-inch main on KY 2670. There is also a 4-inch main on US Route 62 (US 62) but it does not provide significant capacity. The 6-inch main is approximately 2-miles long, which branches off an 8-inch main that leads to the Goshen BPS and connects into an 8-inch main in McHenry, making it a hydraulic bottleneck to the area. Velocities exceed 2.5 fps during maximum demand scenarios, which yields more than 50 feet of head loss in the 2-mile section.

The areas of low pressure are higher elevation areas in the zone. The average model junction elevation in this area is approximately 450 to 475 feet. The low-pressure nodes have elevations generally between 525 to 560 feet. The operating hydraulic grade line (HGL) of the area is 685 feet based on the Industrial Park and BCBC WSTs.

# SECTION 5
# ALTERNATIVE EVALUATIONS

## 5.01 GENERAL

This section presents proposed water distribution system improvement alternatives based on model results from Section 4 and scenarios requested by OCWD.

## 5.02 SYSTEM INTERCONNECTS

OCWD requested Strand review interconnects to either serve adjacent utilities or provide interconnects to OCWD to be used during emergencies only. The following interconnect alternatives were reviewed:

- Daviess County Water District (DCWD) Emergency Interconnect to OCWD
- Grayson County Water District (GCWD) Emergency Interconnect to OCWD
- OCWD Interconnect to Fully Supply Hartford

### A. DCWD Emergency Interconnect

DCWD is located to the north of OCWD. OCWD requested Strand review an interconnect with DCWD along US 231 to service the Hoover Hill zone during an emergency. Strand has previously worked with DCWD and is familiar with the operation of their water distribution system. Figure 5.02-1 shows the existing and proposed water distribution system infrastructure for DCWD and OCWD for the proposed interconnect location.

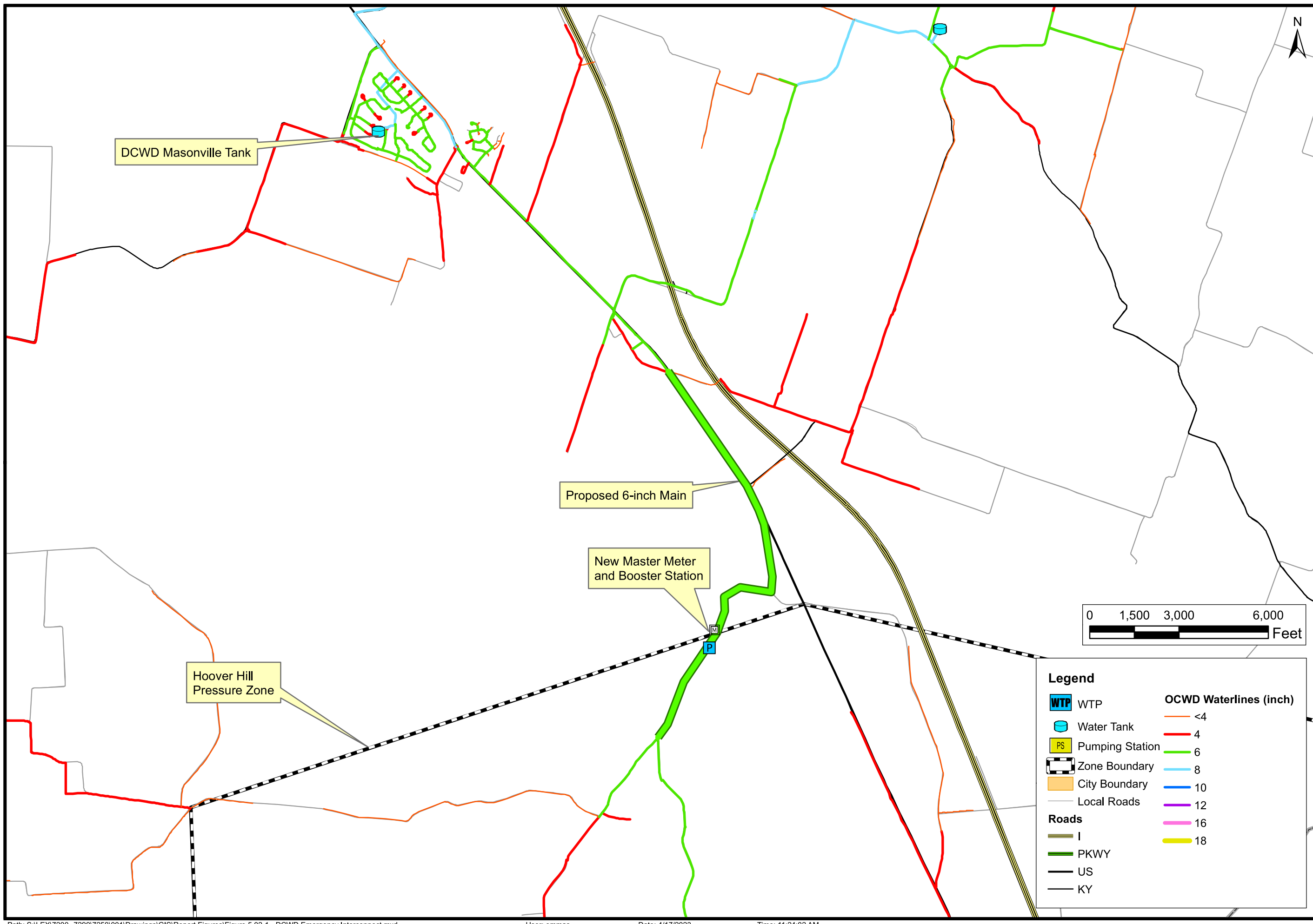
The nearest WST in the DCWD system is the Masonville WST, which is a steel multi-column elevated storage tank with an overflow of 620 feet, volume of 500,000 gallons, and is approximately 4 miles from the proposed interconnect point. The two WSTs in the Hoover Hill zone have an overflow of approximately 740 feet. Therefore, a BPS would be required with this interconnect. The existing 4-inch and smaller water mains in the DCWD are also not anticipated to be able to support more than 50 gpm without pressures dropping below acceptable levels. Therefore, approximately 3 miles of 6-inch water main improvements are also proposed. The proposed 6-inch water main would connect into the existing 6-inch water main at the intersection of US 231 and Taylor Road West in the DCWD system and connect into the existing 6-inch water main near Red Hill and Maxwell Road in the OCWD system.

After discussing the required improvements with this alternative, OCWD noted the anticipated cost did not outweigh the benefits provided and did not want to pursue this alternative further.

### B. GCWD Emergency Interconnect

GCWD is located to the east of OCWD. OCWD requested Strand review an interconnect with the Lone Hill tank in the GCWD system to service the Windy Hill zone during an emergency. Figure 5.02-2 shows the existing and proposed water distribution system infrastructure for GCWD and OCWD for the proposed interconnect location.

The Lone Hill tank is a ground storage tank in the GCWD system with an overflow of 902.5 feet and a volume of 500,000 gallons. The Windy Hill tank has an overflow of 860 feet; therefore the Lone Hill tank can supply the area to a certain extent without a BPS. Anticipated water main improvements include:




DCWD EMERGENCY INTERCONNECT

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

FIGURE 5.02-1
7250.001

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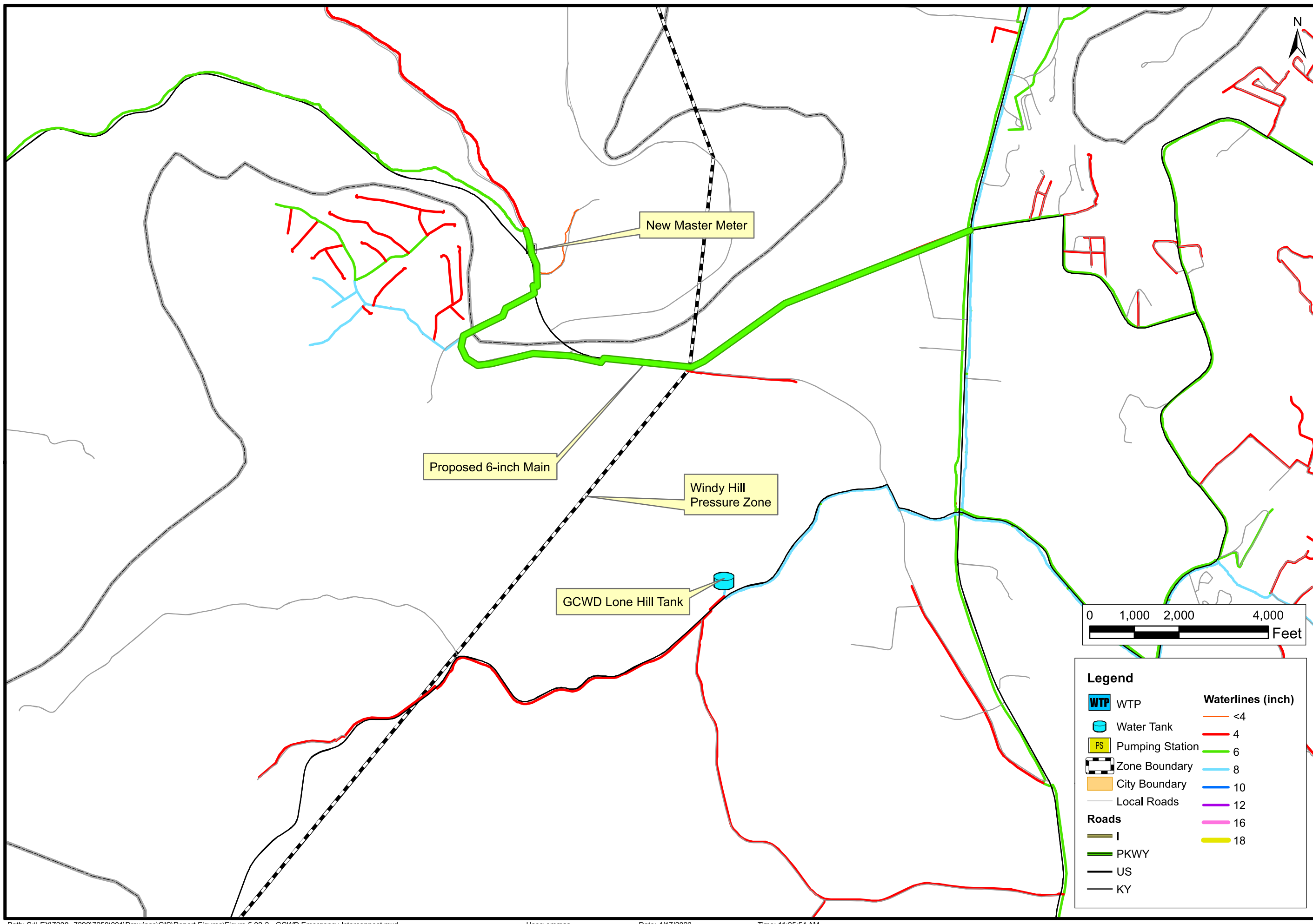


GCWD EMERGENCY INTERCONNECT

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

FIGURE 5.02-2
7250.001

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- Upsizing approximately 12,000 linear foot (LF) of 4-inch GCWD water main along Kentucky Route 110 (KY 110) to 6 inches.

- Adding approximately 3,500 LF of new 6-inch water main to connect the two systems. The new water main would require a crossing of the Rough River to connect the two systems.

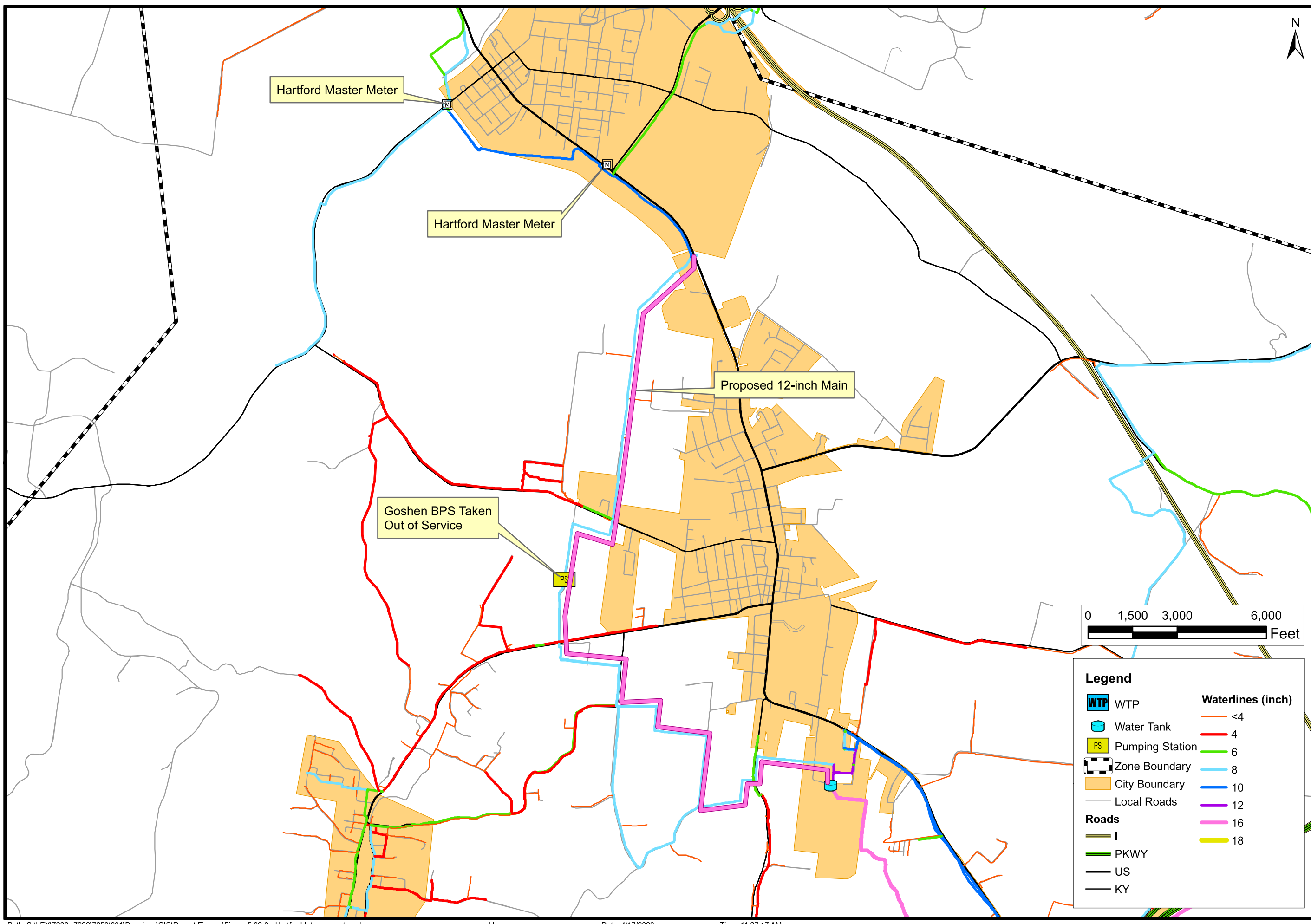
Based on modeling the proposed improvements from the Lone Hill tank to the Windy Hill zone connection point for the 20-year maximum day demand, it is anticipated that the interconnect could provide a maximum of approximately 100 gpm to OCWD. Information provided by OCWD indicates the average demand in the Windy Hill zone is approximately 500 gpm. Therefore, the emergency interconnect would supply 20 percent of average demands in the zone. The introduction of a BPS or additional water main improvements would increase the capacity of the interconnect. Further discussions with GCWD would be required to determine the anticipated capacity it could provide without significantly impacting the operation of its system.

C. Hartford Interconnect

OCWD requested Strand review a permanent connection to supply Hartford. Currently, OCWD has two emergency interconnects already with Hartford, one near the intersection of US 231 and KY 69 and the other near the intersection of KY 69 and Barnes Street. This places the interconnect locations within the BCBC zone between the Goshen and Hartford BPSs. It was noted by OCWD staff that Hartford would use up to 250 gpm total demand through these interconnects. In addition to the Hartford interconnect, OCWD was interested in providing enough hydraulic capacity to the interconnect point so the Goshen BPS could be taken out of service.

As noted in Section 4, the current and projected 20-year maximum day demands were already causing pressure issues in the area. The Hartford demand would further compound the pressure issue. Figure 5.02-3 shows the proposed improvements for the Hartford interconnect, which includes approximately 6.4 miles of new 12-inch transmission main. The proposed transmission main either parallels or replaces existing 8-inch mains between the Industrial Park WST and the 10-inch main that runs adjacent to Hartford.

It should also be noted that the addition of the Hartford interconnect puts further strain on the overall system and WTP. Table 5.02-1 shows a revision of Table 3.04-1 with the inclusion of the Hartford interconnect demand of 250 gpm, which indicates demands will exceed the 4-MGD WTP capacity on maximum day demands. This could create operational issues if there are two high-demand days back-to-back where OCWD's system storage cannot make up the difference between the water demanded in the system and water produced at the WTP.




HARTFORD INTERCONNECT IMPROVEMENTS

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

FIGURE 5.02-3
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| Demand Scenario | Current Demand with Hartford (MGD) | Projected 20-Year Demand with Hartford (MGD) |
|---|---|---|
| Average | 2.81 | 2.96 |
| Maximum | 4.14 | 4.38 |

**Table 5.02-1 Projected Water Demands with Hartford**

If OCWD does not proceed with a permanent connection to supply Hartford, a portion of the previously listed improvements is still recommended. As noted in Section 4.05, there is a stretch of 8-inch water main from Industrial Park WST that services the Rockport and McHenry areas, Goshen BPS, Hartford BPS, and subsequent Hoover Hill zone. This stretch of 8-inch water main was identified as a hydraulic bottleneck that lacks redundancy. In the scenario OCWD does not provide a permanent connection to Hartford, it is recommended to install a parallel 12-inch water main for this 1.1 mile stretch to eliminate the hydraulic bottleneck near the Industrial Park WST and improve service redundancy to the west portion of the OCWD distribution system. Figure 5.02-4 shows the proposed improvements near the Industrial Park WST.

## 5.03 WINDY HILLS ZONE ALTERNATIVES

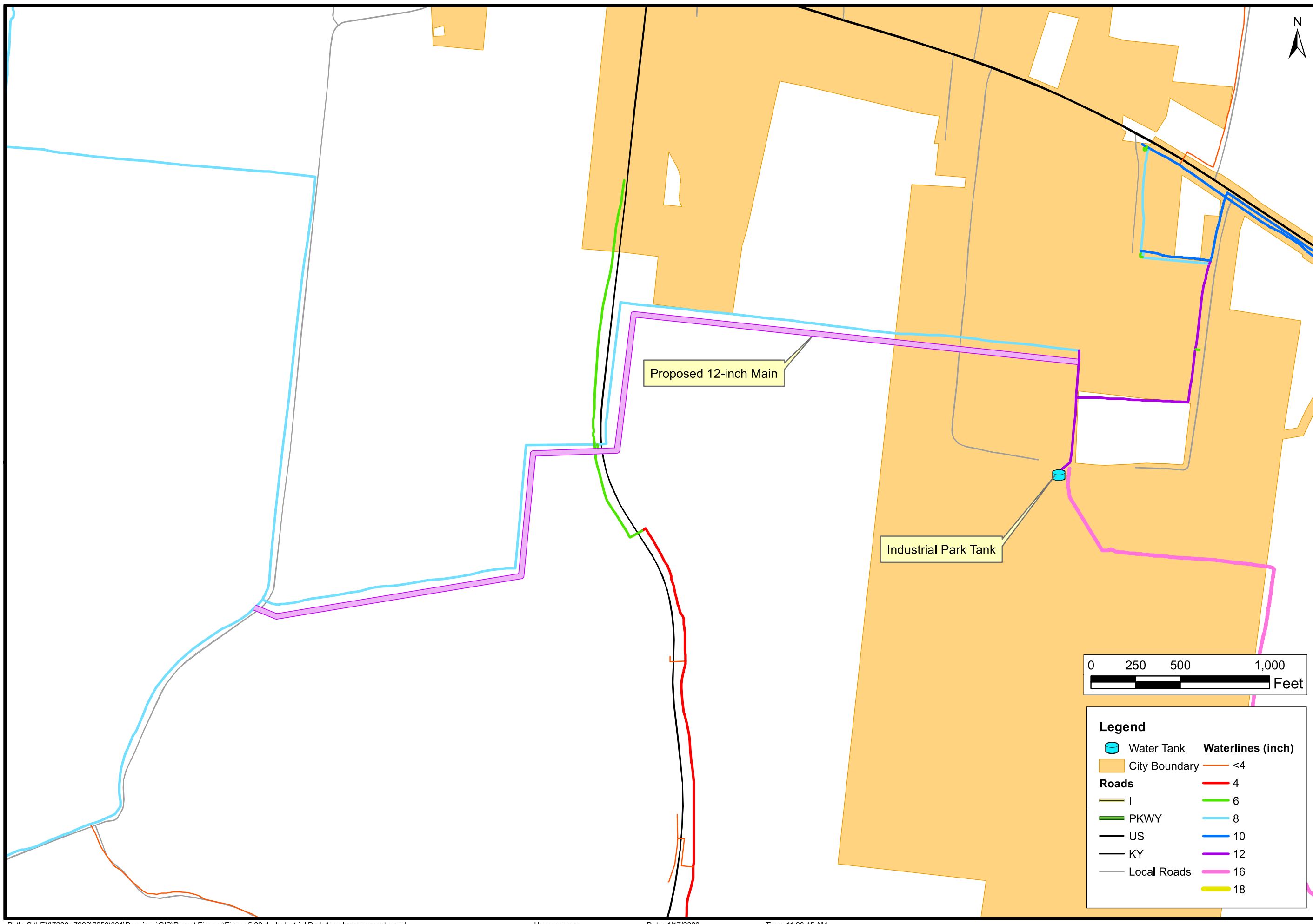
### A. Northeast Area Improvements

OCWD noted a concern in the northeast portion of the system in the Windy Hill zone along KY 54, KY 110, Askins Road, KY 629, and Tick Ridge Road. This area has a current average day demand of approximately 40,000 gpd and has higher elevations than the rest of the Windy Hill zone. OCWD noted it is prone to low pressures if there is a leak or operational issue in the Windy Hill zone. It should be noted that one option to resolve this issue is the GCWD interconnect. The interconnect would have the HGL and capacity to supply this area if it were isolated from the system during an emergency.

Other alternatives include the installation of a VFD-controlled BPS to maintain system pressures or a new BPS and tank. A new BPS and tank would offer more system redundancy as the tank could supply the area during critical emergencies, whereas the VFD-controlled BPS still depends on the Windy Hill zone to supply the area.

Based on the average daily demands of approximately 40,000 gpd and that no significant growth is anticipated in this area, a 100-gpm BPS with a 50,000-gallon elevated storage tank at an overflow elevation of 830 feet is proposed for this alternative. Figure 5.03-1 shows the location of the proposed BPS and tank. The VFD-controlled BPS would be located in the same area as the option with the BPS and tank. Controls would be set up for the BPS to maintain a discharge HGL of 830 feet.

Adding the tank discussed in this option would add to the excess capacity and storage issues described in the following section: Windy Hills Zone Boundary Modifications.




INDUSTRIAL PARK TANK AREA IMPROVEMENTS

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

FIGURE 5.02-4
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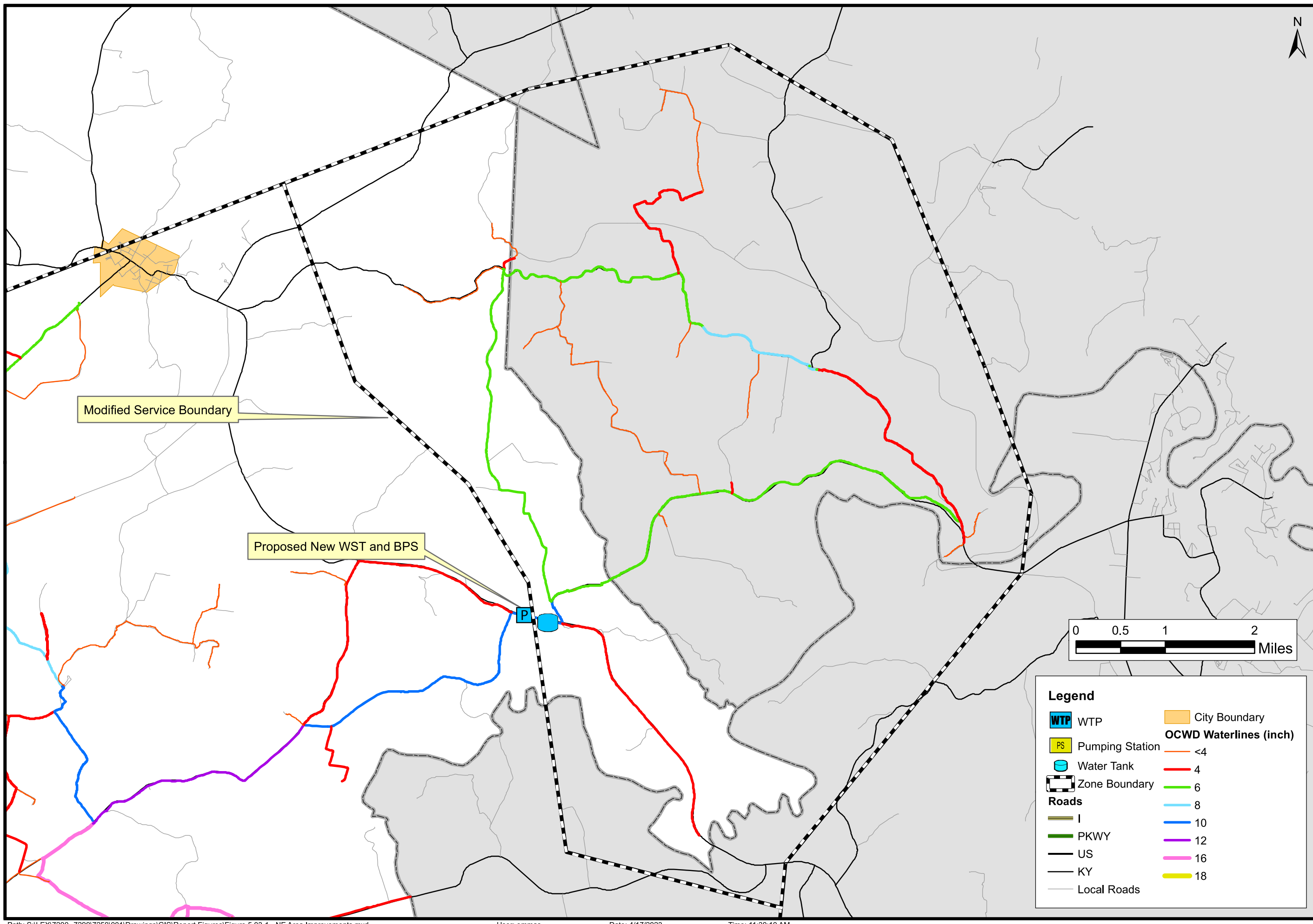


**NORTHEAST SYSTEM IMPROVEMENTS**

**WATER SYSTEM CAPITAL IMPROVEMENT PLAN**
**OHIO COUNTY WATER DISTRICT**
**OHIO COUNTY, KENTUCKY**

**FIGURE 5.03-1**
**7250.001**

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B. Windy Hill Zone Boundary Modifications

The Windy Hills zone is the largest zone by area in the OCWD distribution system. OCWD also noted it has several oversized transmission mains and, based on storage capacity analyses in Section 3, also has an overall surplus in elevated storage. Excess capacity and storage can cause water quality issues within a distribution system because the formation of some disinfection byproducts (DBPs) are directly related to residence time. Therefore, opportunities to expand the Windy Hills zone were reviewed. Expanding the Windy Hills zone would add more demand into the zone and potentially reduce overall residence time of water within the zone.

It should be noted that the Windy Hills zone is the highest HGL zone in the OCWD distribution system at 860 feet, with the BCBC and Hoover Hill zones at 685 feet and 740 feet, respectively. It is recommended to install PRVs with these zone boundary modifications to maintain system pressures close to current values.

Figure 5.03-2 shows the three potential zone boundary modifications that were reviewed. Following is a discussion of the modifications:

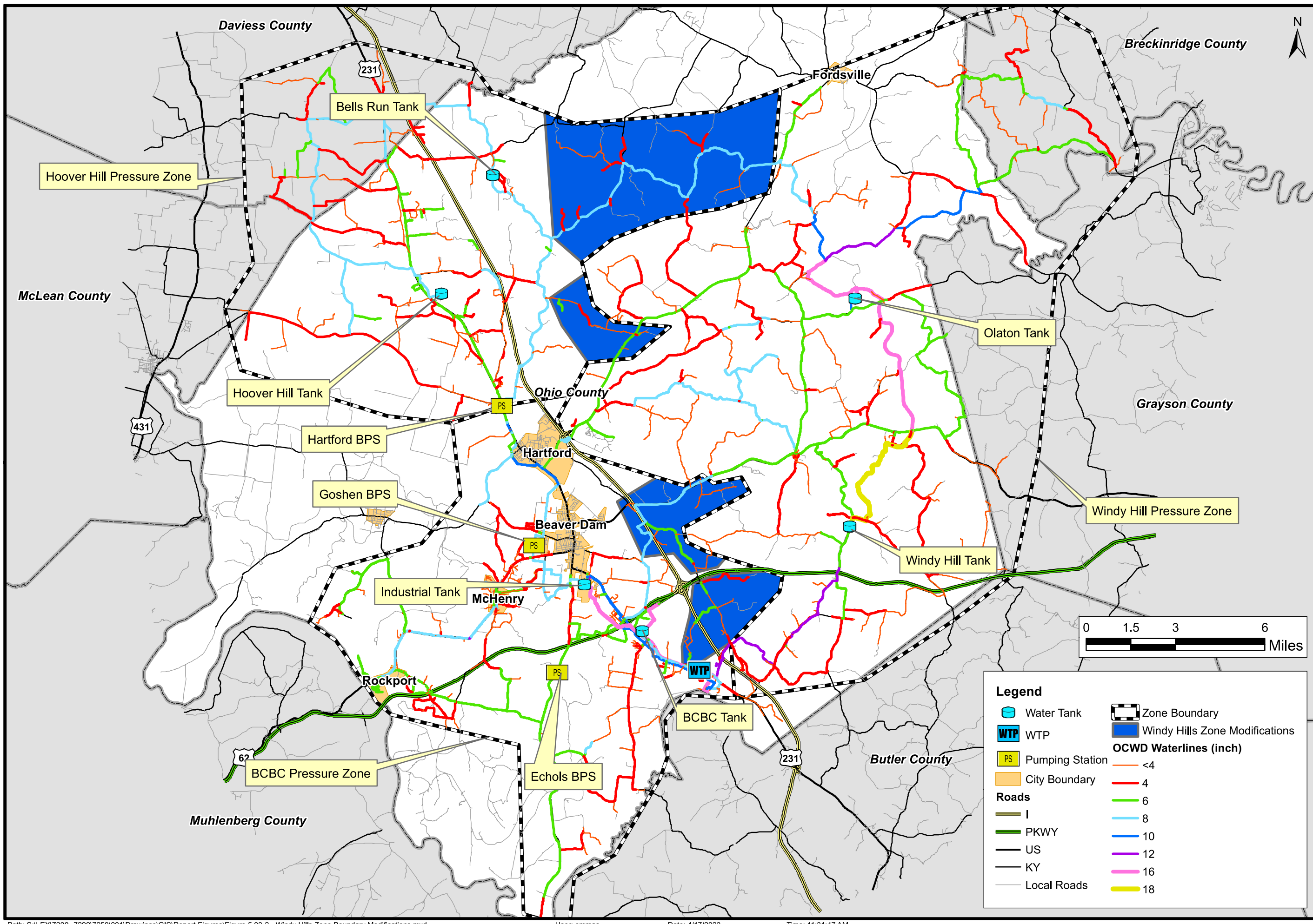
1. KY 1414 and Park Ridge Road

Modifications would involve opening currently closed boundary valves on Denton Slack Road, Sunnydale Road, and KY 69. Valve closures will depend on how OCWD wants to operate the system in the future. Valves could be closed at the end of Park Ridge near KY 1414 and on KY 1414, just east of Taffy Road. This would add more demand to the Windy Hills zone and keep the Bells Run WST in the Hoover Hills zone operating similar to how it is today, but with less demand in its service area. It is estimated that making this change would move approximately 50 to 70 gpm demand from the Hoover Hills zone to the Windy Hills zone during maximum demand conditions.

OCWD also discussed potentially removing Bells Run WST or filling the Bells Run WST with this zone boundary modification. A more detailed review of this scenario is recommended before proceeding with this option. Model results indicate the Bells Run WST supports approximately 220 gpm demand in the area during maximum demand scenarios. Demands in the Windy Hill zone during maximum demands are estimated to be around 650 to 700 gpm. The Windy Hill pumps at the WTP have a firm capacity of 750 gpm, resulting in maximum demands exceeding the flow capacity to the area. This may not be an issue during isolated maximum demand conditions when elevated storage can make up the difference in flow. Consecutive high-demand days could stress this area of the system in this scenario.

2. US 62 and Rob Roy Road

Modifications would involve opening a valve on US 62 near Vine Hill Road and closing a valve on Davis Road. This change would shift approximately 40 gpm from the BCBC zone to the Windy Hills zone during maximum demand conditions.




# WINDY HILL POTENTIAL ZONE MODIFICATIONS

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

FIGURE 5.03-2
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Path: S:\LEX\7200--7299\7250\001\Drawings\GIS\Report Figures\Figure 5.03-2 - Windy Hills Zone Boundary Modifications.mxd User: emmas Date: 4/17/2023 Time: 11:31:47 AM

3. Bald Knob Road and Cromwell Road

Modifications would involve opening a valve on Rob Roy Road near Bald Knob Road and closing a valve on Bald Knob Road near US 231. This change would shift approximately 25 gpm from the BCBC zone to the Windy Hills zone during maximum demand conditions.

## 5.04 BPS VISUAL EVALUATION

Strand conducted site visits of the Hartford, Goshen, and Echols BPSs with OCWD to perform visual inspections of their condition. In general, the exterior brick, roof, and overall BPS building for all sites appear to be in good to fair condition and do not need major improvements. The following discusses miscellaneous proposed improvements for each BPS.

A. Hartford BPS

1. Install new access drive. The previous gravel access drive appears to have been washed away and is now primarily grass. OCWD staff often park at an adjacent property and walk to the BPS.

2. Repair roof ventilation. There is a hole in the ceiling where it appears a vent used to be. This area should be repaired and filled.

3. Repair wall around heating ventilation and air conditioning (HVAC) ducts. When a new exterior HVAC unit was installed, a large square opening was created in the wall for the ducts. This opening was not sealed and is causing HVAC operational inefficiencies and a possible point of intrusion to the BPS for rodents.

4. Install permanent generator. OCWD noted an interest to provide backup power to its BPSs, which currently do not have emergency power.

B. Goshen BPS

1. Install new access drive. The existing access drive is in poor condition and is in need of replacement.

2. Repair roof ventilation. There is a hole in the ceiling where it appears a vent used to be. This area should be repaired and filled.

3. Replace or rehabilitate Pump 2. Pump 2 is in poor condition and currently not in service. It should be replaced or rehabilitated so it can be operated as needed.

4. Install permanent generator. OCWD noted an interest to provide backup power to its BPSs, which currently do not have emergency power.

5. Repaint piping. Several instances of rust and paint spalling were noted within the BPS. It is recommended to clean and repaint all piping and valves within the BPS.

6. Install VFDs. Pumps in the BPS currently do not run on VFDs. Installation of VFDs is recommended for better pump control, longevity, and potential energy cost savings.

C. Echols BPS

1. Replace or rehabilitate Pump 2. Pump 2 is in poor condition and currently not in service. There are only two pumps in the Echols BPS. Therefore, it currently lacks redundancy. Replacement or rehabilitation of Pump 2 is recommended.

2. Install permanent generator. OCWD noted an interest to provide backup power to its BPSs, which currently do not have emergency power.

3. Access bridge evaluation. A detailed evaluation of the integrity of the access bridge to the Echols BPS was not performed as part of the CIP. The BPS and bridge are many decades old and a detailed review of the bridge is recommended.

## 5.05 WATER MAIN IMPROVEMENT ALTERNATIVES

A. Water Main Looping Options

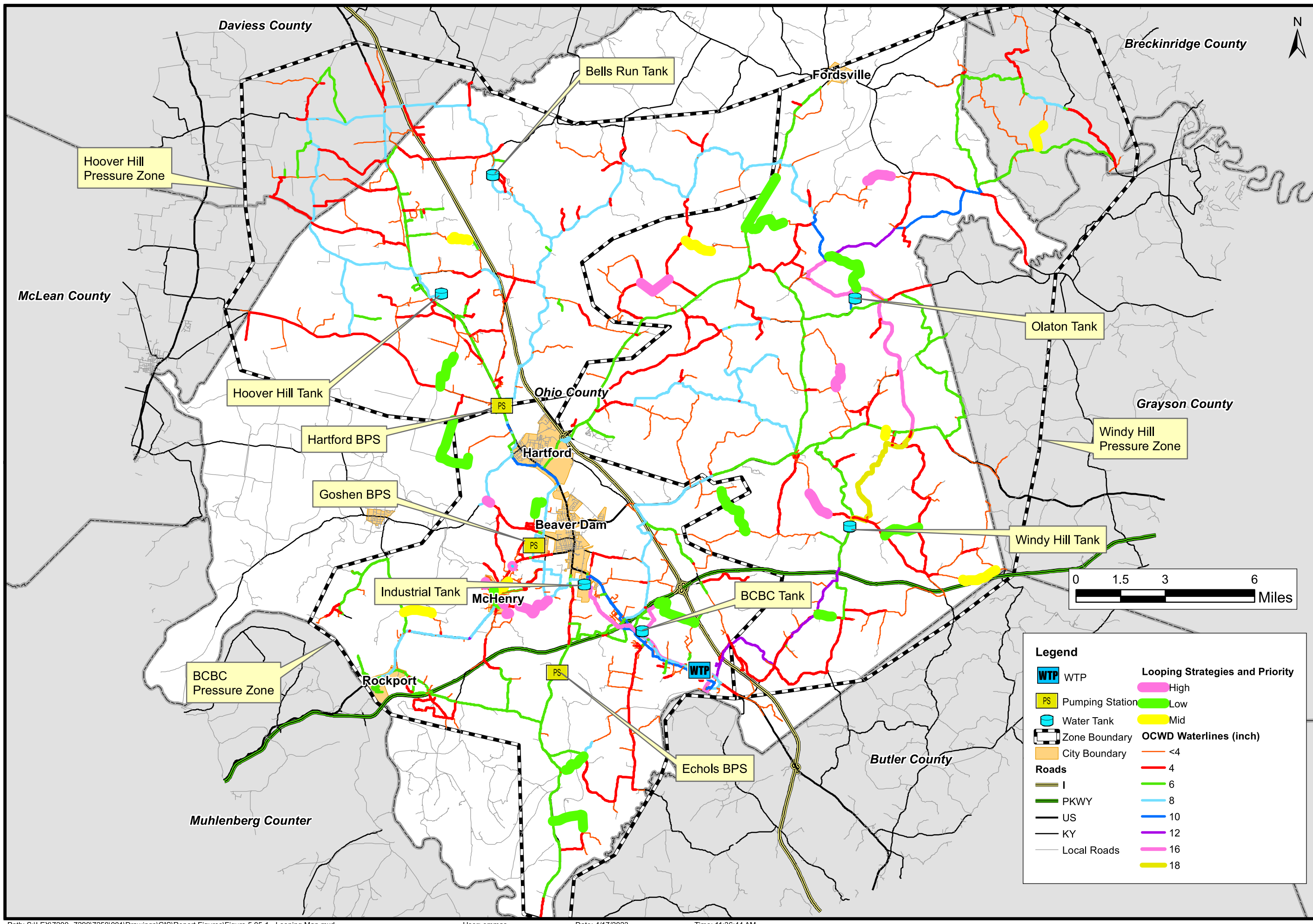
OCWD requested Strand review looping possibilities throughout the distribution system. Looping water mains can reduce water age by eliminating dead ends and allowing the water to be spread throughout the system to more users. Strand used water main shapefiles provided by OCWD, as well as geographical information system (GIS) mapping capabilities and aerial imagery, to determine possible areas of looping. Figure 5.05-1 shows the potential looping areas and their priority rating.

Priority rating was based on several factors, including:

1. Potential hydraulic benefit from providing a looped water main in the area.
2. Potential water quality benefit from elimination of dead-end mains.
3. Opinions of probable construction cost (OPCC). GIS and aerial imagery were used to see if the loop included stream crossings or other issues that may result in a high OPCC. Longer water mains may also be a lower priority as they would have a higher OPCC.

B. Echols BPS Elimination

Strand reviewed improvement alternatives to eliminate the Echols BPS. The Echols BPS is a VFD-controlled station that maintains a pressure of 100 psi to a small portion of the BCBC zone. At the time of the BPS site visits, the Echols pump was operating at a suction pressure of 94 psi, discharge pressure of 100 psi, and a pump speed of 40 percent. The pump is operating at a very low speed and is adding minimal head to the system, indicating there is an opportunity to eliminate the station with water main improvements.




**POTENTIAL LOOPING IMPROVEMENTS**

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

STRAND

FIGURE 5.05-1
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A steady-state simulation using the 20-year projected maximum day demands was run in the model with the following changes, which are also shown in Figure 5.05-2:

1. Echols BPS was not operating.
2. A 6-inch bypass of the Echols BPS was included in the model.
3. Approximately 8,900 LF of 6-inch water main was upsized to 8-inch water main along Apple House Road.

In this scenario, the system pressure at the Echols BPS location was 99 psi. This indicates that with the proposed improvements, the Echols BPS could be eliminated, while maintaining the same level of service to the area.

C. Rockport and McHenry Water Main Improvements

As previously noted, the water distribution system model indicated pressure issues in the Rockport and McHenry area during maximum demand conditions. This is due to demands and the 6-inch hydraulic bottleneck serving the area.

This improvement alternative includes approximately 9,300 LF of new 8-inch watermain along US 62 from Goshen Church Road to Third Street in McHenry. The new water main improves pressures in the Rockport and McHenry area and provides a redundant flow path to supply the area in the event the existing 6-inch on KY 2670 is out of service. Figure 5.05-3 shows the improvement alternative.

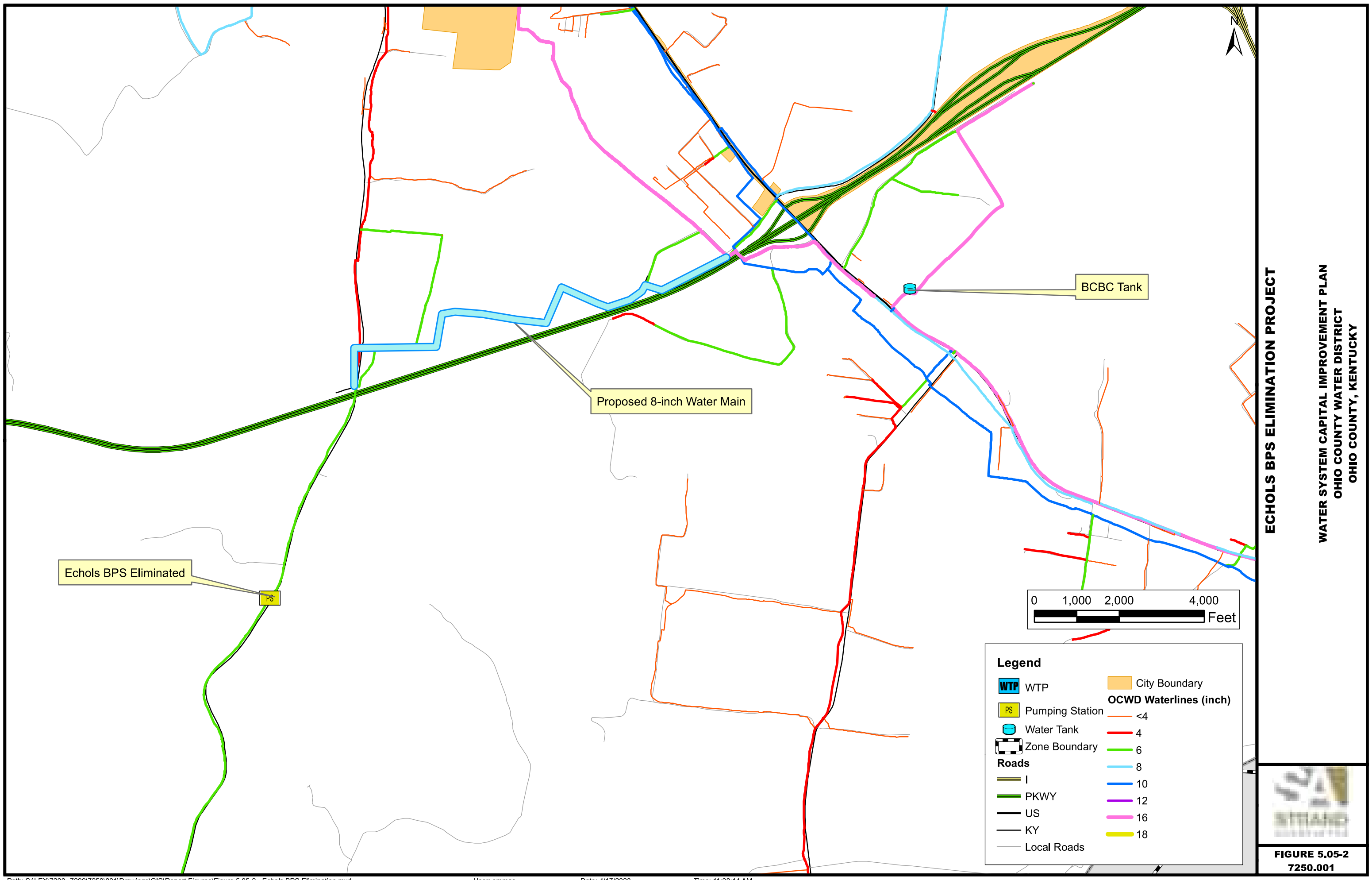
D. Replacement of Asbestos Cement (AC) Water Mains

As part of the CIP, OCWD also requested a 20-year replacement plan for AC water mains within the distribution system. Figure 5.05-4 shows the location of AC water mains in the distribution system based on GIS information provided by OCWD.

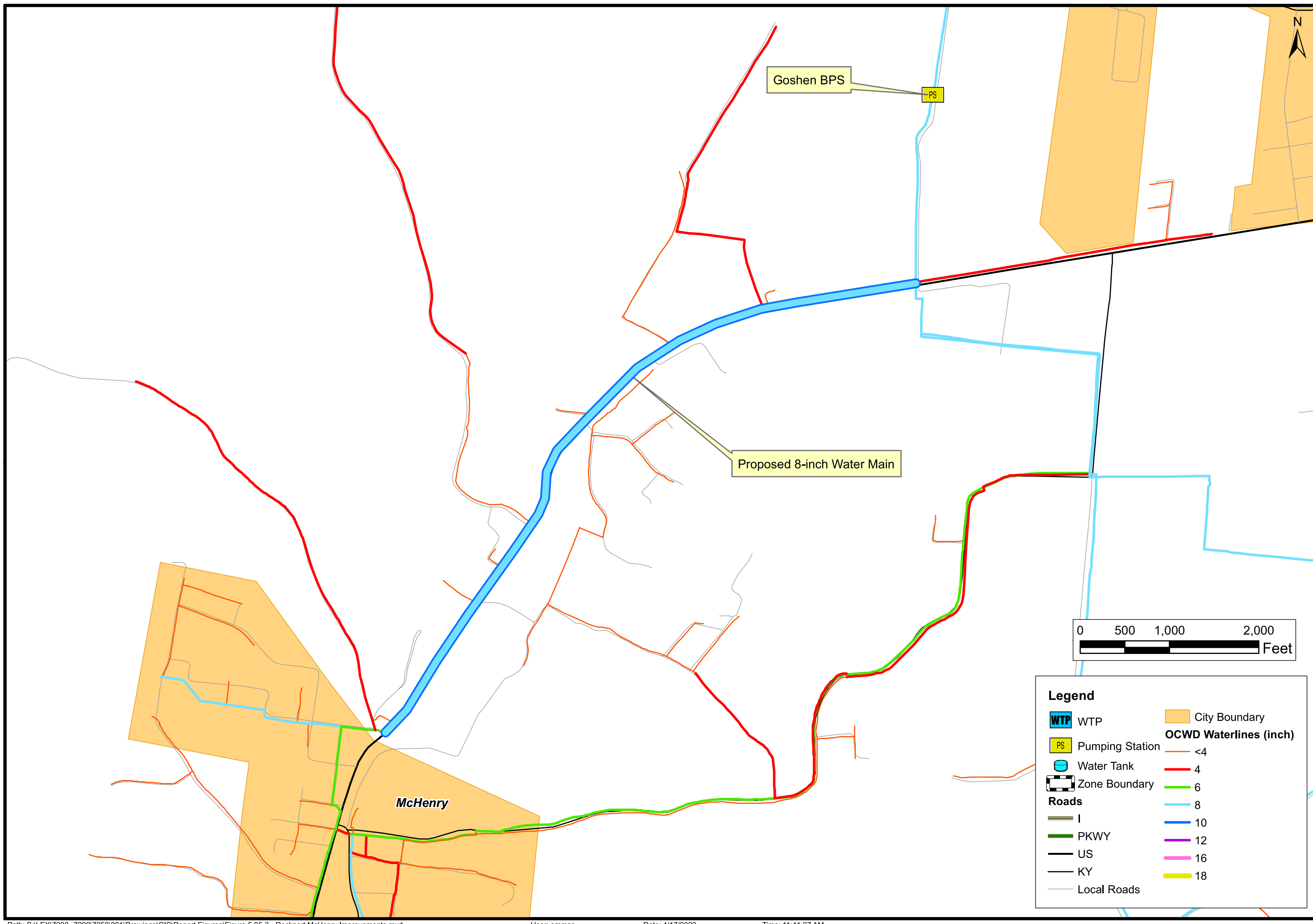
As shown on Figure 5.05-4, AC water mains are generally located in three areas of the distribution system, which are:

1. North of the Hartford BPS along US 231.
2. West of Beaver Dam along US 62 and within McHenry.
3. Along US 231 generally between the Industrial Park WST and the WTP.

Table 5.05-1 summarizes the size and length of AC water mains in each of the identified areas. It should be noted some of these AC water mains are already included for replacement in other projects, such as the AC water mains around Maple Leaf Lake in Area 1 and Rockport and McHenry proposed improvements in Area 2. These water main lengths have been excluded from Table 5.05-1 so they are not double counted for cost purposes in Section 6.



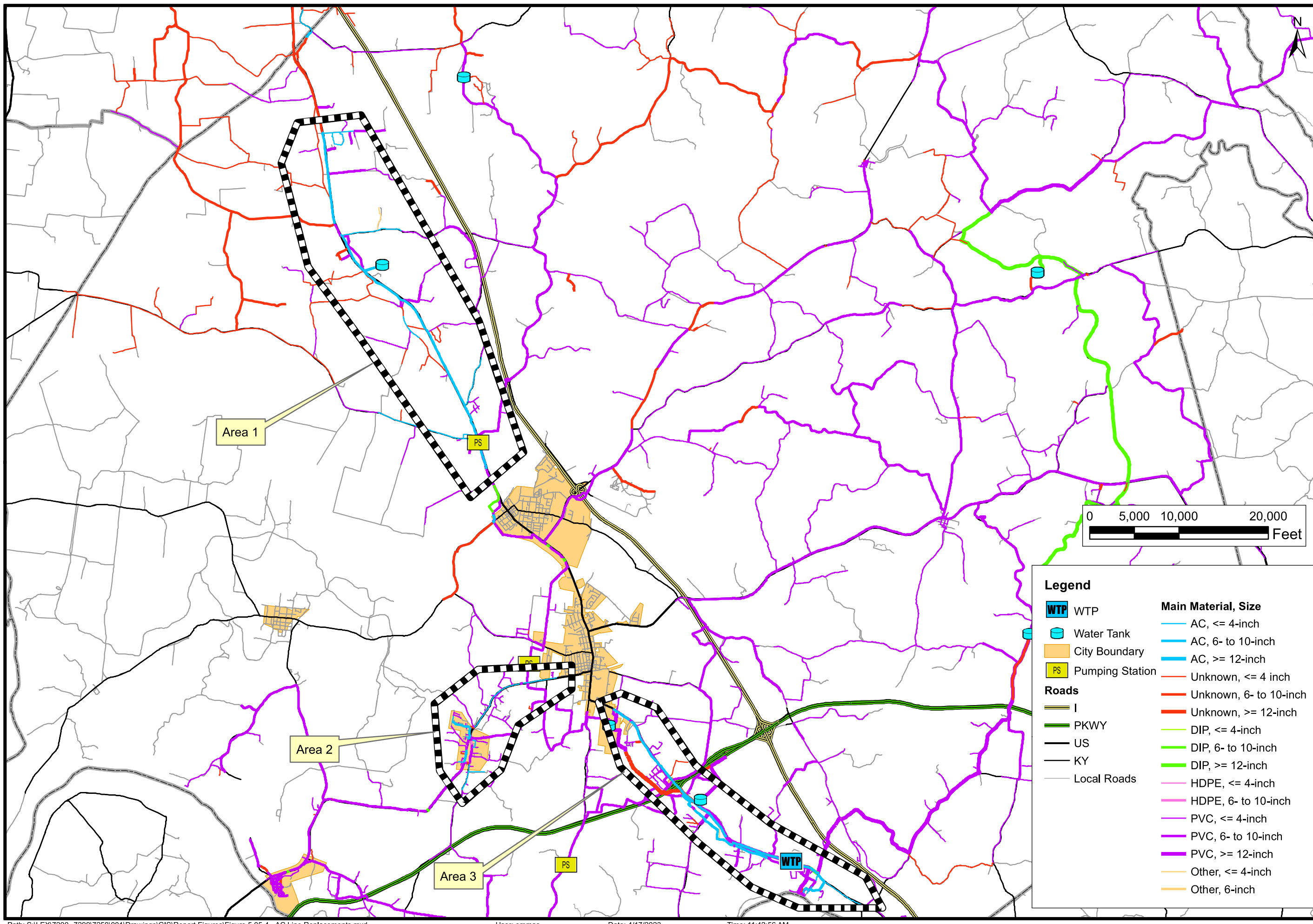

Path: S:\LEX\7200--7299\7250\001\Drawings\GIS\Report Figures\Figure 5.05-2 - Echols BPS Elimination.mxd User: emmas Date: 4/17/2023 Time: 11:38:14 AM




**ROCKPORT AND MCHENRY AREA IMPROVEMENTS**

**WATER SYSTEM CAPITAL IMPROVEMENT PLAN**
**OHIO COUNTY WATER DISTRICT**
**OHIO COUNTY, KENTUCKY**

**FIGURE 5.05-3**
**7250.001**




ASBESTOS CEMENT WATER MAINS

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

FIGURE 5.05-4
7250.001

| Diameter (inch) | AC Water Main Length (miles) | | |
|---|---|---|---|
| | Area 1 | Area 2 | Area 3 |
| 3 | 5.5 | 1.1 | 0.4 |
| 4 | 0.4 | 0.9 | 0.7 |
| 6 | 8.1 | 0.7 | 0.0 |
| 8 | 0.4 | 0.4 | 4.1 |
| 10 | 0.0 | 0.0 | 4.7 |
| **Total** | **14.4** | **3.1** | **9.9** |

**Table 5.05-1 AC Water Main Summary**

E. Previously Planned System Improvements

OCWD provided information about two additional water main improvement projects that are anticipated to proceed into design and construction within the next 5 years. These projects include the Maple Leaf Lake Improvements and the Goshen Road and Knob Hill Road Improvements.

1. Maple Leaf Lake Improvements

The Maple Leaf Lake Improvements include approximately 7,900 LF of 6-inch and 3,700 LF of 4-inch water main improvements in the Maple Leaf Lake area. Figure 5.05-5 shows the Maple Leaf Lake improvements. The water mains being replaced have a history of high frequency leaks, putting up to 60 customers out of water.

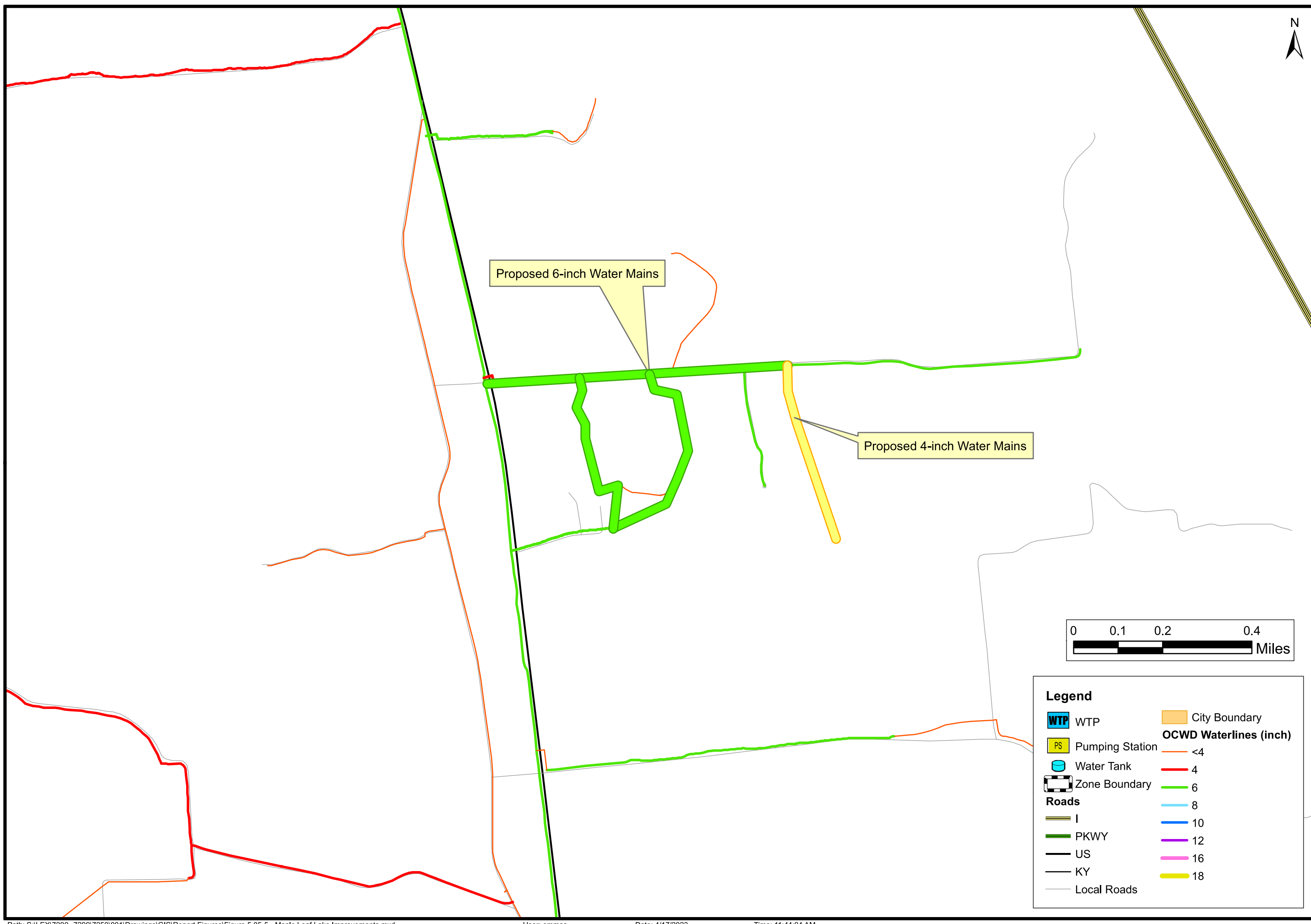
2. Goshen Road and Knob Hill Road Improvements

The Goshen Road and Knob Hill Road Improvements include approximately 12,400 LF of 8-inch water main on Goshen Road and 9,700 LF of 8-inch water main on Knob Hill Road. Figure 5.05-6 shows the Goshen Road and Knob Hill Road improvements.

The new water mains will improve service to the area and improve the hydraulic capacity supplying Hartford. The water main on Knob Hill Road is also prone to leaks in a low lying, swampy area. This makes locating and repairing leaks difficult for OCWD staff. It should be noted that Knob Hill Road Improvements are essentially a section of the overall Hartford Interconnect Improvements. Therefore, the OPCC for the Hartford Interconnect Improvements in Section 6 incorporates the cost for the Knob Hill Road Improvements.

## 5.06 DISTRICT METERING AREAS

OCWD staff noted one of the issues with reducing NRW from leaks is the size of the distribution system. A leak within a zone can be identified quickly based on changes in demand and operation in

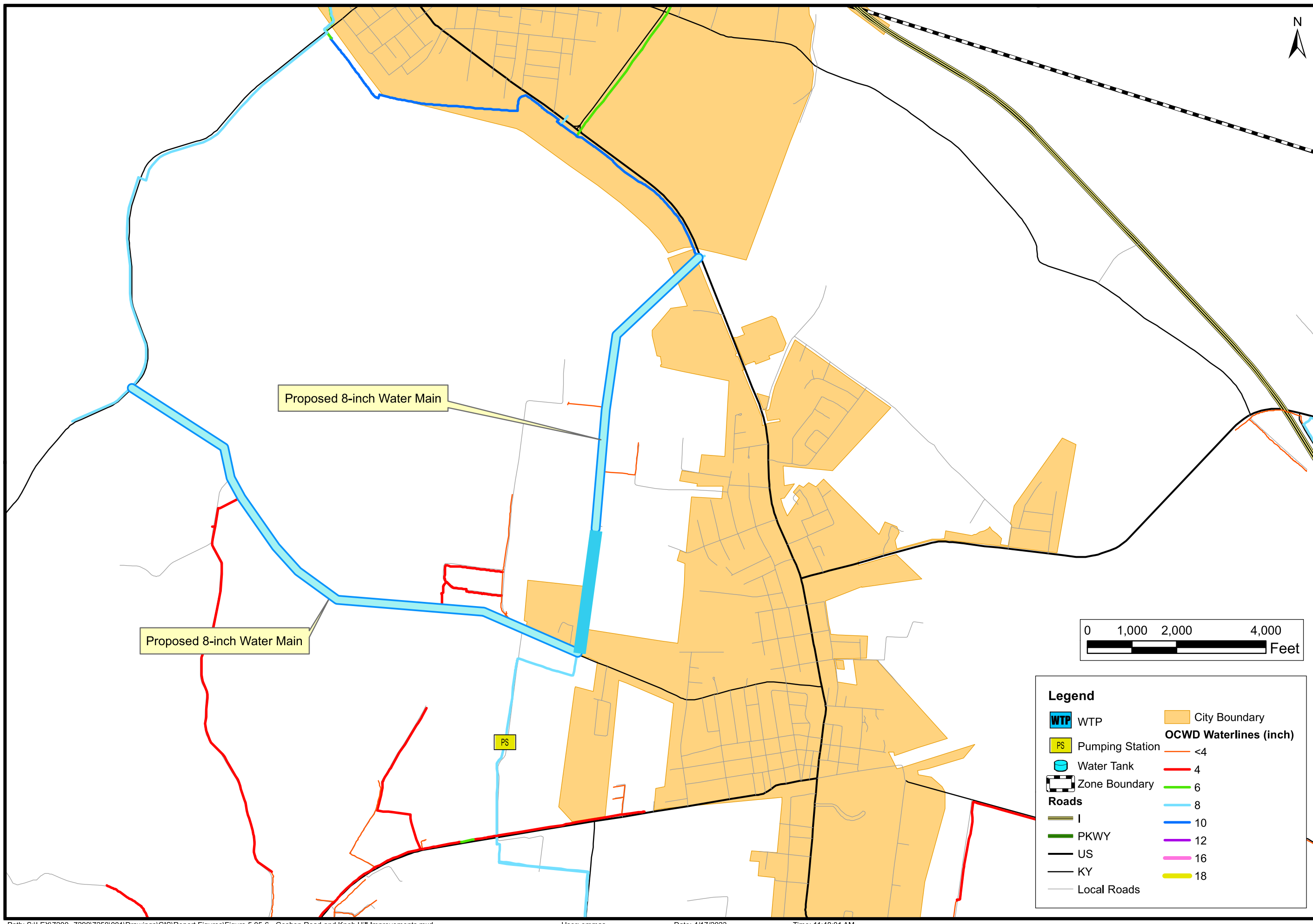



# MAPLE LEAF LAKE IMPROVEMENTS

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

FIGURE 5.05-5
7250.001

Path: S:\LEX\7200--7299\7250\001\Drawings\GIS\Report Figures\Figure 5.05-5 - Maple Leaf Lake Improvements.mxd User: emmas Date: 4/17/2023 Time: 11:44:04 AM




GOSHEN ROAD AND KNOB HILL IMPROVEMENTS

WATER SYSTEM CAPITAL IMPROVEMENT PLAN
OHIO COUNTY WATER DISTRICT
OHIO COUNTY, KENTUCKY

FIGURE 5.05-6
7250.001

Path: S:\LEX\7200--7299\7250\001\Drawings\GIS\Report Figures\Figure 5.05-6 - Goshen Road and Knob Hill Improvements.mxd User: emmas Date: 4/17/2023 Time: 11:48:01 AM the zone, but identifying the specific location of the leak is an issue due to the size of OCWD's distribution system. It takes a considerable amount of field investigation for staff to identify the specific location of a leak. Creating district metering areas (DMAs) through the installation of new meters within the distribution system will allow OCWD to track billed consumption versus metered flow and see abnormal increases in flows to areas within the distribution system. This will significantly narrow down areas where potential leaks are occurring. DMAs should also be reviewed regularly to determine NRW on a zone-by-zone basis. This can help prioritize replacement and rehabilitation of water mains in the distribution system where it is most needed.

Figure 5.06-1 shows the proposed DMA areas. The DMA areas were created based on the installation of 17 proposed meters to track flows within each existing pressure zone. It is recommended to use insertion-style magnetic flow meters for the DMA zones, which provide the following benefits for DMA application:

- Available in battery- and solar-powered options for remote sites without easy access to power.
- Bidirectional flow sensors.
- Accurate to within 2 percent.
- Insertion design installed similar to a hot tap installation, allowing the meter to be installed without interrupting service or cutting pipe.
- Options to connect to advanced metering infrastructure (AMI) and automatic meter reading (AMR) systems.

## 5.07 SATELLITE LEAK DETECTION

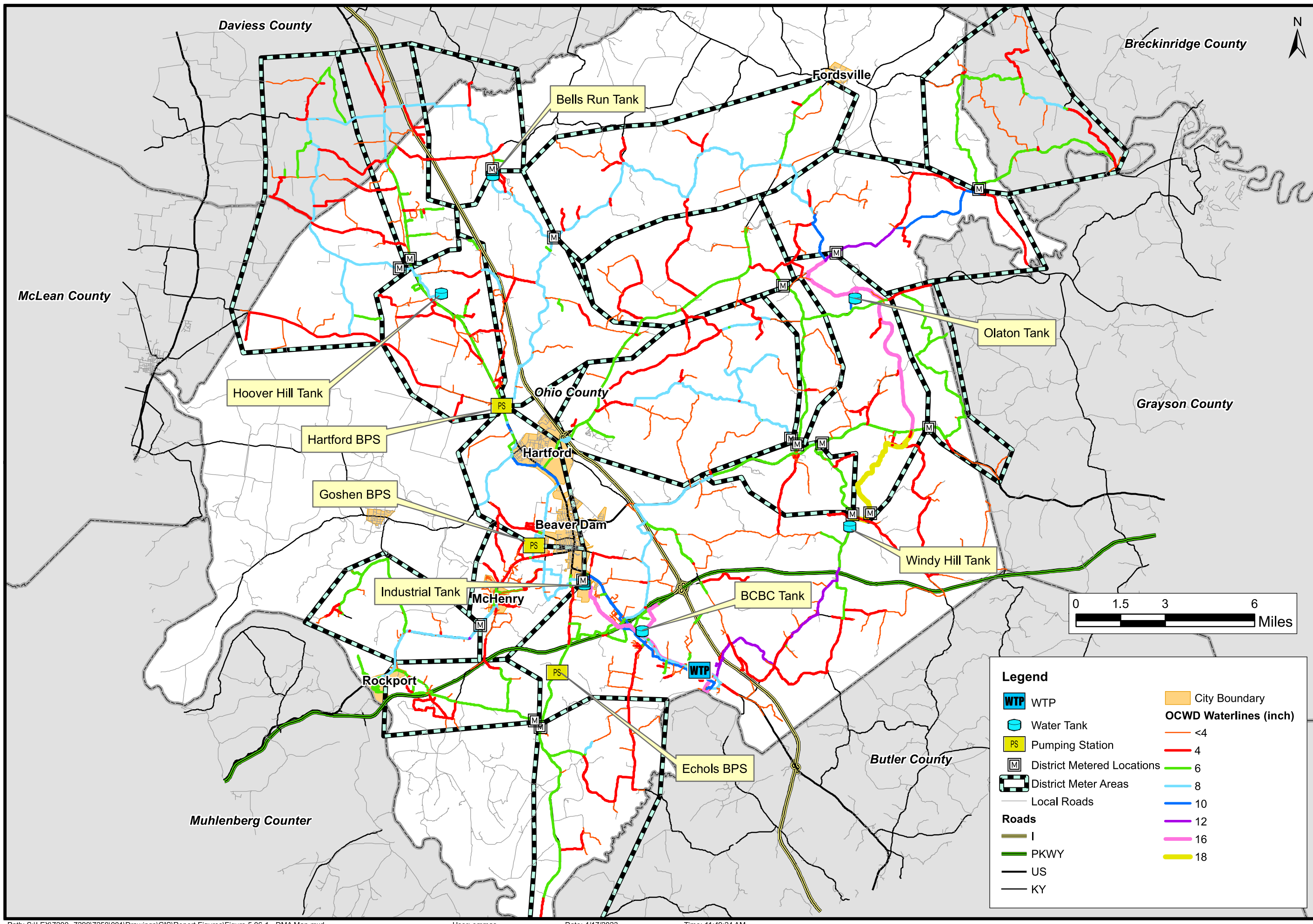
A. General Information

OCWD also requested Strand investigate satellite leak detection in an effort to reduce NRW throughout the distribution system. ASTERRA uses L-band synthetic aperture radar (SAR) mounted on a satellite for infrastructure condition assessment, pipe replacement modeling, and leak detection in water and sewage networks. Water leaks are identified by a proprietary algorithm that detects soil moisture resulting from treated water leaks through the analysis of SAR data. Signatures of moisture caused by potable water is correlated with the pipe system map to pinpoint and repair leaks.

An ASTERRA satellite image is capable of covering up to 14,000 square miles in a single image and SAR sensors can detect 10-foot-deep leaks on average. The system is capable of collecting data during all weather conditions. SAR sensors are only unable to detect leaks when covered by metal (e.g., a water leak covered by an automobile will not be detected). As a result, multiple passes are recommended to ensure all leaks are detected.

ASTERRA offers two relevant subscription packages: Recover and MasterPlan.

The Recover package monitors and detects leaks for entire drinking water systems. ASTERRA reduces the leak location to a 300-foot radius and an acoustic boots-on-the-ground (BOTG) leak investigation crew is then deployed to pinpoint the leak in the reduced radius to dig and repair.




**PROPOSED DISTRICT METERED AREAS**

**WATER SYSTEM CAPITAL IMPROVEMENT PLAN**
**OHIO COUNTY WATER DISTRICT**
**OHIO COUNTY, KENTUCKY**

**FIGURE 5.06-1**
**7250.001**

Path: S:\LEX\7200--7299\7250\001\Drawings\GIS\Report Figures\Figure 5.06-1 - DMA Map.mxd User: emmas Date: 4/17/2023 Time: 11:49:24 AM

The MasterPlan is an extension of the Recover package. This package detects leaks in the system but also monitors the system overtime using statistical analysis. MasterPlan is able to score pipe segments from 1 to 5, signifying the level of deficiency observed. With MasterPlan, critical areas are identified so pipeline rehabilitation and replacement efforts can be focused.

B. Leak Detection Process

Raw images of the area of interest are taken by the SAR and are then prepared by ASTERRA for analysis by filtering out interferences (e.g., manmade objects, vegetation, and water bodies). ASTERRA's algorithm targets the signature of treated water within the soil to detect leaks. When the drinking water signature is detected, a point of interest (POI) is recorded, signifying that a system leak is present within a 300-foot radius. A BOTG acoustic team is then deployed to the POI to pinpoint the exact leak location, dig, and repair the pipe segment.

In addition to leak detection, the MasterPlan package delivers a GIS dataset scoring pipe segments from 1 (low deficiency observed) to 5 (high deficiency observed). This program is based on the Recover program to detect leaks but extends its deliverable to monitor the system over time. The general process takes all POIs identified in two consecutive satellite passes and identifies: 1) clusters of leaks within one image on a single date, 2) which pipe segment sees POIs in the two satellite passes on different dates, or 3) which pipe segments see both clustering and repeat issues. The algorithm processes these results and is used to assign pipes a score from 1 to 5.

The Earth Observation Discover client portal provides the collected data in the form of GIS files and a dashboard with individual product and field performance metrics. Also within the portal is a U-Collect and U-View field application, which allows field technicians to collect and view data in the field. With the MasterPlan subscription, the pipe deficiency report detailing the pipe condition of the system is also available through the client portal.

# SECTION 6
# OPCC AND RECOMMENDED CIP

## 6.01 GENERAL

This section presents recommend water distribution system improvements in ranked order of importance. An OPCC for each recommended improvement will also be presented in this section.

## 6.02 OPCCs

OPCCs for water main improvements do not account for any new customer meters or customer meter reconnections associated with the project.

### A. System Interconnects

Table 6.02-1 shows the OPCC for the GCWD Emergency Interconnect. Tables 6.02-2 and 6.02-3 show the OPCC for the Hartford Interconnect (permanent connection) and the reduced Industrial Park WST Improvements, respectively.

| Description | Unit | Quantity | Unit Cost | Total |
|---|---|---|---|---|
| 6-inch PVC water main | LF | 15,600 | $60 | $936,000 |
| 6-inch tie-in | each | 3 | $2,800 | $8,400 |
| Directional drill under Rough River | LF | 500 | $500 | $250,000 |
| | | | Subtotal (Rounded) | $1,194,000 |
| | | | Erosion and Sediment Control (2%, Rounded) | $24,000 |
| | | | Construction Subtotal (Rounded) | $1,218,000 |
| | | | Construction Contingency and Engineering (35%, Rounded) | $426,000 |
| | | | **Total OPCC** | **$1,644,000** |

pvc=polyvinyl chloride

**Table 6.02-1 GCWD Emergency Interconnect OPCC**

| Description | Unit | Quantity | Unit Cost | Total |
|---|---|---|---|---|
| Abandon and bypass Goshen BPS | each | 1 | $10,000 | $10,000 |
| 12-inch PVC water main | LF | 34,000 | $95 | $3,230,000 |
| 12-inch tie-in | each | 7 | $6,000 | $42,000 |
| 12-inch MJ gate valve | each | 15 | $5,500 | $82,500 |
| Cut and cap existing main | each | 5 | $1,800 | $9,000 |
| | | | Subtotal (Rounded) | $3,374,000 |
| | | | Erosion and Sediment Control (2%, Rounded) | $67,000 |
| | | | Construction Subtotal (Rounded) | $3,441,000 |
| | | | Construction Contingency and Engineering (35%, Rounded) | $1,204,000 |
| | | | **Total OPCC** | **$4,645,000** |

**Table 6.02-2 Hartford Interconnect Improvements OPCC**

| Description | Unit | Quantity | Unit Cost | Total |
|---|---|---|---|---|
| 12-inch PVC water main | LF | 5,800 | $95 | $551,000 |
| 12-inch tie-in | each | 2 | $6,000 | $12,000 |
| 12-inch MJ gate valve | each | 2 | $5,500 | $11,000 |
| | | | Subtotal (Rounded) | $574,000 |
| | | | Erosion and Sediment Control (2%, Rounded) | $12,000 |
| | | | Construction Subtotal (Rounded) | $586,000 |
| | | | Construction Contingency and Engineering (35%, Rounded) | $205,000 |
| | | | **Total OPCC** | **$791,000** |

**Table 6.02-3 Industrial Park WST Improvements OPCC**

B. Windy Hills Zone Alternatives

Tables 6.02-4 and 6.02-5 show the OPCC for the Northeast Area Improvements and the Windy Hill zone boundary modifications alternatives, respectively.

| Description | Unit | Quantity | Unit Cost | Total Cost |
|---|---|---|---|---|
| 10-inch PVC water main | LF | 150 | $80 | $12,000 |
| 10-inch tie-in | LS | 3 | $6,000 | $18,000 |
| New 75,000-gallon WST | LS | 1 | $300,000 | $300,000 |
| New BPS, 100 gpm at 115 feet TDH | LS | 1 | $275,000 | $275,000 |
| Tank and BPS site work | LS | 1 | $96,250 | $96,300 |
| | | | Subtotal (Rounded) | $671,000 |
| | | | Erosion and Sediment Control (2%, Rounded) | $13,000 |
| | | | Construction Subtotal (Rounded) | $684,000 |
| | | | Construction Contingency and Engineering (35%, Rounded) | $239,000 |
| | | | **Total OPCC** | **$923,000** |

**Table 6.02-4 Northeast Area Improvements OPCC**

| Description | Unit | Quantity | Unit Cost | Total Cost |
|---|---|---|---|---|
| PRV valve vault | each | 7 | $60,000 | $420,000 |
| | | | Subtotal (Rounded) | $420,000 |
| | | | Erosion and Sediment Control (2%, Rounded) | $8,000 |
| | | | Construction Subtotal (Rounded) | $428,000 |
| | | | Construction Contingency and Engineering (35%, Rounded) | $150,000 |
| | | | **Total OPCC** | **$578,000** |

**Table 6.02-5 Windy Hills Zone Boundary Modifications OPCC**

C. Water Main Improvement Alternatives

Tables 6.02-6, 6.02-7, and 6.02-8 show the OPCC for the water main looping options, Echols BPS elimination, and Rockport and McHenry water main improvements, respectively. Costs for water main looping include a 2 percent factor for erosion and sediment control and 35 percent for construction contingency and engineering.

| Loop Location | Main Diameter (inches) | Water Main Length (LF) | Priority | OPCC |
|---|---|---|---|---|
| Windy Hill Lane | 4 | 5,085 | High | $257,000 |
| Salem Road | 4 | 3,976 | High | $203,000 |
| Marvins Chapel Road | 4 | 2,587 | High | $137,000 |
| Jesse Smith Bridge Road | 4 | 3,635 | High | $187,000 |
| Taylor Mine Road | 8 | 7,056 | High | $685,000 |
| Independence Loop | 3 | 732 | High | $46,000 |
| Render Street | 4 | 690 | High | $45,000 |
| Goshen Road | 4 | 748 | High | $47,000 |
| McIntyre Lane | 4 | 4,739 | High | $241,000 |
| Hillard Mosely Street | 4 | 472 | High | $33,000 |
| Tipple Lane | 4 | 142 | High | $17,000 |
| | | | **High Priority Subtotal** | **$1,898,000** |
| Neafus Road | 3 | 6,544 | Medium | $317,000 |
| Bufton-Huff Road | 4 | 4,916 | Medium | $249,000 |
| Boswell Road | 4 | 5,206 | Medium | $262,000 |
| Barnetts Creek Road | 4 | 3,777 | Medium | $194,000 |
| Renfrow Road | 4 | 1,162 | Medium | $67,000 |
| Pearl Lane | 4 | 2,844 | Medium | $149,000 |
| M2 Road | 4 | 5,244 | Medium | $264,000 |
| | | | **Medium Priority Subtotal** | **$1,502,000** |
| Old Liberty Church Road | 6 | 8,891 | Low | $771,000 |
| Fox Hunters Road | 4 | 6,584 | Low | $330,000 |
| Dundee Narrows Road | 3 | 7,139 | Low | $343,000 |
| Old Mill Cemetery Road | 4 | 6,787 | Low | $340,000 |
| Jane Street | 4 | 375 | Low | $28,000 |
| W H Luce Lane | 4 | 3,059 | Low | $159,000 |
| Union Hill Road | 4 | 7,673 | Low | $383,000 |
| Cool Springs Road | 4 | 4,411 | Low | $224,000 |
| Underwood Road | 8 | 10,609 | Low | $1,007,000 |
| State Route 505 South | 4 | 2,527 | Low | $134,000 |
| State Road 69 North | 6 | 10,374 | Low | $896,000 |
| Johnson School Road | 4 | 13,348 | Low | $657,000 |
| Sawyer Street | 4 | 261 | Low | $23,000 |
| Mt Zion Road | 4 | 9,356 | Low | $463,000 |
| | | | **Low Priority Subtotal** | **$5,758,000** |
| | | | **Overall Total** | **$9,158,000** |

**Table 6.02-6 Looping Alternative OPCC**

| Description | Unit | Quantity | Unit Cost | Total Cost |
|---|---|---|---|---|
| 8-inch PVC water main | LF | 8,900 | $65 | $578,500 |
| 16-inch tie-in | each | 1 | $6,000 | $10,000 |
| 6-inch tie-in | each | 3 | $4,000 | $12,000 |
| 8-inch MJ gate valve | each | 4 | $5,500 | $22,000 |
| Cut and cap existing main | each | 2 | $1,800 | $3,600 |
| | | | Subtotal (Rounded) | $626,000 |
| | | | Erosion and Sediment Control (2%, Rounded) | $13,000 |
| | | | Construction Subtotal (Rounded) | $639,000 |
| | | | Construction Contingency and Engineering (35%, Rounded) | $224,000 |
| | | | **Total OPCC** | **$863,000** |

**Table 6.02-7 Echols BPS Elimination Alternative OPCC**

| Description | Unit | Quantity | Unit Cost | Total Cost |
|---|---|---|---|---|
| 8-inch PVC water main | LF | 9,300 | $65 | $604,500 |
| 8-inch tie-in | each | 1 | $6,000 | $10,000 |
| 6-inch tie-in | each | 1 | $4,000 | $4,000 |
| 4-inch tie-in | each | 2 | $2,000 | $4,000 |
| 3-inch tie-in | each | 5 | $1,500 | $7,500 |
| 8-inch MJ gate valve | each | 4 | $5,500 | $22,000 |
| Cut and cap existing main | each | 2 | $1,800 | $3,600 |
| | | | Subtotal (Rounded) | $656,000 |
| | | | Erosion and Sediment Control (2%, Rounded) | $13,000 |
| | | | Construction Subtotal (Rounded) | $669,000 |
| | | | Construction Contingency and Engineering (35%, Rounded) | $234,000 |
| | | | **Total OPCC** | **$903,000** |

**Table 6.02-8 Rockport and McHenry Improvements Alternative OPCC**

Tables 6.02-9, 6.02-10, and 6.02-11 show the proposed AC water main replacements for Area 1, Area 2, and Area 3 over the 20-year CIP study period, respectively. The replacement of AC water mains uses the following LF OPCCs, which have been increased and averaged from other OPCCs in this CIP to account for valves, tie-ins, contingencies, and engineering. The replacement of AC water mains is also broken down into proposed 5-year replacement increments based on area priority and maintaining a similar OPCC for each 5-year period.

- 3-inch PVC Water Main Replacement–$50 per LF
- 4-inch PVC Water Main Replacement–$60 per LF

- 6-inch PVC Water Main Replacement–$85 per LF
- 8-inch PVC Water Main Replacement–$100 per LF
- 10-inch PVC Water Main Replacement–$120 per LF

| Diameter (Inch) | Year 0 to 5 | | Year 5 to 10 | | Year 10 to 15 | | Year 15 to 20 | |
|---|---|---|---|---|---|---|---|---|
| | Water Main Length (LF) | OPCC | Water Main Length (LF) | OPCC | Water Main Length (LF) | OPCC | Water Main Length (LF) | OPCC |
| 3 | 0 | $0 | 0 | $0 | 0 | $0 | 29,000 | $1,450,000 |
| 4 | 0 | $0 | 0 | $0 | 0 | $0 | 2,100 | $126,000 |
| 6 | 0 | $0 | 0 | $0 | 30,600 | $2,601,000 | 12,100 | $1,028,500 |
| 8 | 0 | $0 | 0 | $0 | 0 | $0 | 2,100 | $210,000 |
| 10 | 0 | $0 | 0 | $0 | 0 | $0 | 0 | $0 |
| **Totals** | **0** | **$0** | **0** | **$0** | **30,600** | **$2,601,000** | **45,300** | **$2,814,500** |

**Table 6.02-9 Area 1 AC Water Main 20-Year Replacement Summary**

| Diameter (Inch) | Year 0 to 5 | | Year 5 to 10 | | Year 10 to 15 | | Year 15 to 20 | |
|---|---|---|---|---|---|---|---|---|
| | Water Main Length (LF) | OPCC | Water Main Length (LF) | OPCC | Water Main Length (LF) | OPCC | Water Main Length (LF) | OPCC |
| 3 | 0 | $0 | 0 | $0 | 5,800 | $290,000 | 0 | $0 |
| 4 | 0 | $0 | 0 | $0 | 4,800 | $288,000 | 0 | $0 |
| 6 | 0 | $0 | 3,700 | $314,500 | 0 | $0 | 0 | $0 |
| 8 | 0 | $0 | 2,100 | $210,000 | 0 | $0 | 0 | $0 |
| 10 | 0 | $0 | 0 | $0 | 0 | $0 | 0 | $0 |
| **Totals** | **0** | **$0** | **5,800** | **$524,500** | **10,600** | **$578,000** | **0** | **$0** |

**Table 6.02-10 Area 2 AC Water Main 20-Year Replacement Summary**

| Diameter (Inch) | Year 0 to 5 Water Main Length (LF) | Year 0 to 5 OPCC | Year 5 to 10 Water Main Length (LF) | Year 5 to 10 OPCC | Year 10 to 15 Water Main Length (LF) | Year 10 to 15 OPCC | Year 15 to 20 Water Main Length (LF) | Year 15 to 20 OPCC |
|---|---|---|---|---|---|---|---|---|
| 3 | 0 | $0 | 2,100 | $105,000 | 0 | $0 | 0 | $0 |
| 4 | 0 | $0 | 3,700 | $222,000 | 0 | $0 | 0 | $0 |
| 6 | 0 | $0 | 0 | $0 | 0 | $0 | 0 | $0 |
| 8 | 0 | $0 | 21,600 | $2,160,000 | 0 | $0 | 0 | $0 |
| 10 | 24,800 | $2,976,000 | 0 | $0 | 0 | $0 | 0 | $0 |
| **Totals** | **24,800** | **$2,976,000** | **27,400** | **$2,487,000** | **0** | **$0** | **0** | **$0** |

**Table 6.02-11 Area 3 AC Water Main 20-Year Replacement Summary**

OCWD provided OPCCs for the previously planned water main improvement projects. Those OPCCs are noted as follows:

- Maple Leaf Lake Improvements–$820,000
- Goshen Road Improvements–$760,000
- Knob Hill Drive Improvements–$860,000

D. DMAs

Table 6.02-12 shows the OPCC for the DMA alternative.

| Description | Unit | Quantity | Unit Cost | Total |
|---|---|---|---|---|
| Insertion meter for 6-inch water main | each | 8 | $9,000 | $72,000 |
| Insertion meter for 8-inch water main | each | 6 | $11,000 | $66,000 |
| Insertion meter for 10-inch water main | each | 1 | $12,000 | $12,000 |
| Insertion meter for 12-inch water main | each | 1 | $16,000 | $16,000 |
| Insertion meter for 18-inch water main | each | 1 | $22,000 | $22,000 |
| SCADA and power | each | 17 | $25,000 | $425,000 |
| Manholes for access | each | 17 | $8,000 | $136,000 |
| Subtotal (Rounded) | | | | $749,000 |
| Erosion and Sediment Control (2%, Rounded) | | | | $15,000 |
| Construction Subtotal (Rounded) | | | | $764,000 |
| Construction Contingency and Engineering (35%, Rounded) | | | | $267,000 |
| **Total OPCC** | | | | **$1,031,000** |

SCADA=supervisory control and data acquisition

**Table 6.02-12 DMA OPCC**

E. Satellite Leak Detection

Table 6.02-13 shows the OPCC for the satellite leak detection alternative. A package price discount of 15 and 20 percent is also offered when purchasing a 24- or 36-month subscription, respectively.

| | Recover Package | MasterPlan Package |
|---|---|---|
| Yearly Subscription | $163,000 | $252,000 |
| Optional Subcontracted BOTG (40 hours/5 days) | $27,000 | $54,000 |
| **Total** | **$190,000** | **$306,000** |

**Table 6.02-13 ASTERRA Proposed Costing**

F. Emergency Generator

Permanent emergency generators provide backup power to the BPSs without staff needing to move portable generators into place during emergencies. Table 6.02-14 shows the OPCC for the emergency generators.

| Description | Total |
|---|---|
| Echols BPS Generator | $80,000 |
| Goshen BPS Generator | $94,000 |
| Hartford BPS Generator | $120,000 |
| Construction Subtotal | $294,000 |
| Construction Contingency and Engineering (35% Rounded) | $103,000 |
| **Total OPCC** | **$397,000** |

**Table 6.02-14 OPCC for Emergency Generators**

## 6.03 RECOMMENDED ALTERNATIVES

The following ranks the proposed improvements discussed in Section 5 in a high, medium, or low priority with a brief description of why. Priority rating is based on a combination of OPCC and potential positive impacts on the system based on operation, maintenance, cost savings, or other factors. Rankings within each priority are not in a particular order. Further discussions with OCWD staff should be conducted to finalize which projects to proceed with first, based on funding availability.

The water main looping alternatives are ranked by level of priority in Table 6.02-6.

A. High Priority

1. Hartford Interconnect Project

OCWD noted it is anticipated that Hartford will eventually move to purchase from OCWD on a permanent basis. To continue to reliably support Hartford, these improvements are needed. These improvements have the added benefit of eliminating the Goshen BPS and improving system redundancy.

If Hartford is not supplied on a permanent basis, the Industrial Park WST area improvement project is still recommended as a high priority. As previously noted, the 8-inch water main west of the Industrial Park WST serves the entire western portion of the OCWD distribution system but is a hydraulic bottleneck and has no redundancy, both of which are resolved by the installation of the parallel 12-inch water main.

2. DMA Project

Water loss was noted as a high priority for OCWD. This project will assist in monitoring changes in water use, areas of high water loss, and isolating areas where leaks are occurring. Depending on funding, DMA can also be added in phases to make installation costs manageable.

3. Hartford BPS Wall and HVAC Duct Repair

While a minor project compared to the others, this puts the BPS at risk for intrusion and results in significant inefficiencies in running the HVAC equipment.

4. BPS Emergency Generator Installations

Generators are recommended as a high priority to maintain operation of the BPS in case of power outages or other emergencies. Currently, no BPS has emergency power.

5. Replace or Rehabilitation Echols BPS Pump 2

At the time of the report, the Echols BPS only had one operational pump. Therefore, the BPS has no redundancy and would be out of operation completely if an issue arose with the existing pump. A new pump should be installed to have a proper backup in place.

6. Rockport and McHenry Water Main Improvements

The Rockport and McHenry areas show low pressures during current maximum and future demand conditions. The proposed improvements will alleviate the pressure issues and provide a redundant flow path to the Rockport and McHenry communities.

7. Echols BPS Elimination Project

Eliminating the Echols BPS will reduce energy and maintenance costs for OCWD by replacing it with an upsized water main. OCWD staff also noted the portion of the 6-inch existing water main between Apple House Road and KY 369 before crossing the Western Kentucky Parkway is located in a low-lying area prone to flooding. This stretch of water main has also needed repairs that were dangerous and difficult to complete due to its location. This portion of the main would be relocated as part of the project to also alleviate this maintenance issue in the future.

8. Area 3 AC Water Main Replacements

OCWD has noted that the replacement of AC mains throughout the system is a priority. Area 3 includes water mains near the WTP, which are considered more critical to system operation and should be prioritized for replacement over AC water mains in Areas 1 and 2. It should be noted that this prioritization is based solely on the water mains proximity to the WTP. Leak and break history data for the AC water mains was not provided as part of the CIP. If leak and break history data is available, it should be reviewed to see if other areas have high frequencies of these events, which may change the priority.

B. Medium Priority

1. Satellite Leak Detection Initiative

Similar to the DMA project, this project focuses on identifying leaks and reducing water loss throughout the distribution system, which is a priority for OCWD. The annual packages are a considerable monetary investment. If OCWD proceeds with satellite leak detection, it is recommended to proceed with 1 to 2 years, at the end of which the cost and leak reductions should be evaluated to determine the cost-effectiveness of the approach.

2. Other BPS Improvements

Section 5 lists a number of other miscellaneous recommedations for the BPSs within OCWD's system. These improvements are mostly for general site maintenance and aesthetics and do not impact the operation of the BPS. For this reason, they are considered a medium priority. The improvements will improve the ease with which operators can access and maintain the BPSs, but do not directly impact the function of the BPS for the distribution system operation.

3. Areas 1 and 2 AC Water Main Replacements

Areas 1 and 2 AC water main replacements are considered medium priority after the Area 3 mains near the WTP are replaced. As previously noted, this priority should change based on historical leak or breakage data. AC water mains with high frequencies of leaks or breaks should be prioritized first, regardless of the area in which they are located.

C. Low Priority

1. DCWD Emergency Interconnect

The DWCD emergency interconnect cannot provide sufficient flow to the OCWD without major improvements, including upsizing water mains and a new BPS. In addition, further investigation would need to be performed in coordination with DWCD to see the capacity DCWD has available for purchase through a master meter. The cost of this alternative requiring a new BPS was noted by OCWD to not be worth the benefit and is, therefore, listed as a low priority and not assigned and OPCC.

2. GCWD Emergency Interconnect

Similar to the DWCD emergency interconnect, the GCWD comes at a high cost and would require approximately 3 miles of line improvements, including a river crossing. Further discussions with GCWD would also be required to verify the capacity it could support through an emergency interconnect without negatively impacting its system.

3. Northeast System Improvement Alternative

While the Northeast System improvements would provide some redundancy to the northeast portion of the system, it would come at a high cost for a small portion of the system. It will also introduce more system volume in an area that is already on the extents of the system, increasing residence time of the water in the area. In addition, OCWD noted it planned to bring the Olaton WST back into service. Bringing the Olaton WST back into service will help support and maintain pressures in this area.

## 6.04 CONCLUSION

The recommended improvements presented in this report should be addressed in a timely manner as funding becomes available. OCWD should prepare and perpetually maintain an asset management plan in conjunction with this CIP to enhance management of the water distribution system infrastructure and to minimize the total cost of maintenance and operation for OCWD. Many recommended improvements can further be completed together with potential cost savings for OCWD.

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