RECLAIMING OUR RESOURCES

Building An Effective Conservation Strategy For Today And Tomorrow

Presented

by

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Submitted to the Naifeh Center for Effective Leadership
Institute for Public Service at the University of Tennessee

December 2021

Certified Public Manager Capstone Project

ACKNOWLEDGMENTS

This CPM program has proven to be a wonderful opportunity to expand my knowledge and understanding of leadership principles; to better examine and navigate personalities, conflicts, and solutions in the work place; and to have a greater awareness of my own personal tendencies when it comes to facilitating projects. The staff and the presenters, along with the friendship and input of fellow classmates, has made CPM a very memorable experience.

This opportunity would not have been possible without a City Council seeing the benefit of their mayor receiving this training, and without having a staff willing to work hard in order to ensure smooth operation during class time.

I am very grateful for the patience and encouragement of my wife while I worked through this program; and most of all, I am thankful for the kindness that my Lord Jesus Christ bestows on me daily.

This information has been provided in hopes that other communities can and will benefit.

~Mayor Mike Callis

ARPA STATEMENT

The 1.9 trillion-dollar American Recovery Plan Act, is creating an influx of federal monies flowing through states, counties, cities, and regulatory bodies such as TDEC; and much of this money is aimed at water and sewer projects. The push for regionalization and cooperative partnerships will have a direct impact on projects once deemed unfeasible; which may alter the planning direction for the city. The ability to remain open minded to new possibilities will be crucial to ensure that the City of Portland does not miss a once in a lifetime opportunity.

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GLOSSARY of DEFINITIONS

(Some are within the paper, and some are needed for the supplementary research links/material)

- Aqueduct – A pipe, conduit, or channel designed to transport water from a remote source, usually by gravity.
- Aquifer - A geological formation or structure that stores and/or transmits water, such as to wells and springs.
- Aquifer (confined) - Soil or rock below the land surface that is saturated with water. There are layers of impermeable material both above and below it, and it is under pressure so that when the aquifer is penetrated by a well, the water will rise above the top of the aquifer.
- Aquifer (unconfined) - An aquifer whose upper water surface (water table) is at atmospheric pressure, and thus is able to rise and fall.
- Artesian water - Groundwater that is under pressure when tapped by a well and is able to rise above the level at which it is first encountered. It may or may not flow out at ground level. The pressure in such an aquifer is commonly called artesian pressure, and the formation containing artesian water is an artesian aquifer or confined aquifer.
- Artificial recharge - A process where water is put back into groundwater storage from surface-water supplies such as irrigation, or induced infiltration from streams or wells.
- Cumberland Intake – Cumberland River/Old Hickory Lake raw water intake/withdrawal controlled by Army Corps of Engineers.
- Customer – A single point of service such as a water meter, or sewer tap; regardless of the number of individuals served at that location.
- Direct Potable Reuse - (DPR) Water is distributed directly into a potable water supply distribution system downstream of a water treatment plant or into the source water supply immediately upstream of the water treatment plant.

- Effluent – Treated water flowing out of a WTP or WWTP (WTP effluent is treated to safe drinking standards; WWTP effluent is treated to standards allowing its release into a stream).
- Evaporation - The process of liquid water becoming water vapor, including vaporization from water surfaces, land surfaces, and snow fields, but not from leaf surfaces.
- Evapotranspiration - The sum of evaporation and transpiration.
- Fit-For-Purpose - Fit-for-purpose specifications are the treatment requirements to bring water from a particular source to the quality needed, to ensure public health, environmental protection, or specific user needs.
- In-Direct Potable Reuse - (IPR) Water is blended with other environmental systems such as a river, reservoir, or groundwater basin before the water is reused.
- Inflow (connections) / Infiltration (breaks) – How ground water and/or storm water enters a sewer collection system.
- Influent – Water (source or sewage) flowing into a WTP or WWTP.
- Non-Potable Water – Water that is not suitable for human consumption and may not meet standards for certain agriculture or other uses.
- Potable Water – Water that meets or exceeds EPA safe drinking water standards.
- Purchase Water – Purchasing finished (potable/treated) water.
- Reverse Osmosis - An advanced method of water or wastewater treatment that relies on a semi-permeable membrane to separate waters from pollutants. An external force is used to reverse the normal osmotic process resulting in the solvent moving from a solution of higher concentration to one of lower concentration.
- Safe Drinking Water Standards- EPA sets legal limits on over 90 contaminants in drinking water. The legal limit for a contaminant reflects the level that protects human health, and that water

systems can achieve using the best available technology. EPA rules also set water-testing schedules and methods that water systems must follow.

- Sinkhole – A depression in the Earth's surface caused by dissolving of underlying limestone, salt, or gypsum. Drainage is provided through underground channels that may be enlarged by the collapse of a cavern roof.
- Tertiary Wastewater Treatment - Selected biological, physical, and chemical separation processes to remove organic and inorganic substances that resist conventional treatment practices; the additional treatment of effluent beyond that of primary and secondary treatment methods to obtain a very high quality of effluent.
- Transpiration - Process by which water that is absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface, such as leaf pores.
- Tributary - A smaller river or stream that flows into a larger river or stream. Usually, a number of smaller tributaries merge to form a river.
- Turbidity - The amount of solid particles that are suspended in water and that cause light rays shining through the water to scatter. Thus, turbidity makes the water cloudy or even opaque in extreme cases. Turbidity is measured in nephelometric turbidity units (NTU).
- Unplanned Potable Reuse - Occurs when water intakes draw raw water supplies downstream from other discharges such as a wastewater treatment plants. When used effluent water gets put back into a river or stream and is delivered downstream to another raw water intake, it becomes part of the drinking water supply after it receives treatment from the WTP.
- Water Reuse – A reclaimed water program whereby the sanitary sewer effluent, or commercial discharge process, is used to replace, or reduce, potable water requirements.
- Watershed - The land area that drains water to a particular stream, river, or lake. Large watersheds, like the Mississippi River basin, contain thousands of smaller watersheds.

GLOSSARY of TERMS

(Some are within the paper, and some are needed for the supplementary research links/material)

- ARAP - Aquatic Resource Alteration Permit
- CIP - Capital Improvements Program
- CWA - Clean Water Act
- D/DBP - Disinfectants/Disinfection Byproducts
- DO – Dissolved Oxygen
- EIS - Environmental Impact Statement
- EPA - US Environmental Protection Agency
- FDA – Food and Drug Administration
- fps - Feet per Second
- GIS – Geographic Information System
- gpm - Gallons per Minute
- HAAs - Haloacetic Acids
- IESWTR - Interim Enhanced Surface Water Treatment Rule
- I & I – Inflow and Infiltration
- L - Liter
- MCL - Maximum Contaminant Level
- MG - Million Gallons
- mgd - Million Gallons per Day
- mg/l - Milligrams per Liter
- NCTRWR Study – 2011 North Central Tennessee Regional Water Resources Planning Study
- NEPA - National Environmental Policy Act

- NPDES – National Pollutant Discharge Elimination System
- psi - Pounds per Square Inch
- SDWA - Safe Drinking Water Act
- SRF - State Revolving Fund
- SWTR - Surface Water Treatment Rule
- TDEC - Tennessee Department of Environment and Conservation
- THMs - Trihalomethanes
- TMDL – Total Maximum Daily Loads
- TNC - The Nature Conservancy
- TWRA - Tennessee Wildlife Resource Agency
- TVA - Tennessee Valley Authority
- ug/L - Micrograms per Liter
- USACE - US Army Corps of Engineers
- USDA - US Department of Agriculture
- USEDA - US Economic Development Administration
- USEPA - US Environmental Protection Agency
- USFWS - US Fish & Wildlife Service
- USGS - US Geological Survey
- WFDC Reservoir – West Fork Drakes Creek Interstate Dam and Reservoir Project (originally created in an effort to build a corporative raw supply reservoir for Franklin, KY and Portland, TN)
- WQS – Water Quality Standards
- WTP – Water Treatment Plant
- WWTP – Waste Water Treatment Plant

PROBLEM STATEMENT

The City of Portland faces two distinct, but inter-connected, infrastructure needs that place limitations on both its raw water supply and its waste water effluent; which in turn, inhibits future growth and makes the city vulnerable to drought.

DESIRED STATEMENT

To effectively communicate the need for implementing a comprehensive water and sewer plan that maximizes current resources in order to create a sustainable infrastructure within the City of Portland, Tennessee for generations to come.

CPM PROJECT SCOPE

Through project analysis, stakeholder feedback, and proven technology, this CPM Project looks to incorporate elements of learning from the last twelve months that will aid in leading others through change by offering tangible solutions and in integrating multiple departments and agencies for a common goal; all the while building an argument in favor of using reclaimed water so that a cost-effective and implementable plan can better position the Portland community as it responsibly plans for the future.

STAKEHOLDER ANALYSIS – PART 1
Summary of a Growing Community

Portland, Tennessee has grown from a stop on the L&N railroad in the 1800's, to a large industrial employer that causes its population to double each day. This once rural community has seen its population continue to grow; and according to Census data, the city had 579 people in 1910, 2424 in 1960, 8458 in 2000, and 13156 in 2020.

The city limits of Portland rest within both Sumner and Robertson counties near the Kentucky state line in the northern middle part of Tennessee. The City Hall sits in the heart of the community at an elevation of 807 feet above sea level and is one of eighteen municipal buildings within the city that oversees operations for its own water, sewer, and natural gas utilities; as well as its own sanitation, stormwater, parks, golf course, airport, fire, and police departments. The city employs over 160 full-time team members. The 2021-2022 budget estimates utility revenues at $12,548,000.00, general fund revenues at $11,137,049.00, and special revenues at $2,894,712.00; with a property tax rate currently set at $1.06.

Along with a newly opened interstate exit *(#121 on I-65)* that serves as the termini of the Hwy 109 connecting corridor for interstates I-40 and I-65, TDOT is preparing to construct a Portland by-pass to deal with the increasing flow of traffic and better provide industrial access.

STAKEHOLDER ANALYSIS – PART 2
Summary of the Current Water and Sewer Infrastructure

Portland produces approximately 2.3mgd of potable water from its 3mgd rated water treatment plant. The WWTP is permitted to discharge 1.9mgd, and is designed to treat 3.8mgd of sanitary sewer influent. Currently, the WWTP discharges about 1.5mgd of waste water effluent, and has preliminary approval for a 2.83mgd daily discharge once Phase 2 of the WWTP expansion is complete. Phase 1 of the WWTP expansion was completed in 2019.

As of September 16, 2021, the Water Distribution Department maintains 272.5 miles of water main, 1276 water valves, and 656 fire hydrants as it provides services to 7,920 customers. The Sewer Collections Department maintains 78.4 miles of gravity sewer line, 33.7 miles of low-pressure sewer line, 89 sewer lift stations, and 1648 manholes as it provides services to 4,266 customers.

West Fork Drakes Creek serves as the primary source for raw water and the City Lake serves as a secondary emergency source with a storage capacity between 88.6mg and 115.7mg according to Army Corps of Engineers and TDEC estimates. The system has eight water tanks with a total maximum capacity of 2.75mg; as well as cooperative connections with WHUD (White House Utility District), SCWD (Simpson County, KY Utility District), and the City of Westmoreland (Westmoreland purchases their water from the City of Gallatin).

Sumners Branch serves as a direct discharge point for the waste water effluent and is considered a low-flow stream. Discharge limits are based on EPA water quality standards and governed under TDEC (Tennessee Department of Environment and Conservation) for measurement of ammonia, dissolved oxygen, and in establishing total maximum daily loads to maintain levels suitable for human health and aquatic life.

PROBLEM ANALYSIS – PART 1

Summary of Raw Water Projects

In the late 1960's, Portland, TN and Franklin, KY researched the possibility of a cooperative lake and dam project, but in 1992 Franklin, KY withdrew and constructed its own dam causing Portland to pursue a separate project.

In 2000, Portland secured its first permits and loan to construct a reservoir; yet after suffering many engineering setbacks and spending almost 10 million dollars for the purchase of 125 acres and water plant upgrades, the original permit expired in 2005. The city was told in 2007 by TDEC, "that other viable alternatives were not explored thoroughly" and that biological concerns with the stream now exist due to possible degradation of high-quality waters.

Focus turned toward the possibility of building a new intake pumping station on the Cumberland River some 23 miles away, but the Army Corps of Engineers placed a moratorium on all new withdrawals from 2010 to May 13, 2021. The city has since been meeting with the USACE and other stakeholders to understand the feasibility of a pipeline project once again.

During a July 20, 2021 meeting with TDEC Deputy Commissioner Young *(see Appendix A & B)*, a plan for the future water needs of the city was mutually agreed upon, with a reclaimed water program being a priority. Since that meeting, the city and TDEC have collaborated on next steps in finalizing the Phase 2 WWTP design, as well as, including reuse into the new discharge permit.

After 50 plus years, failed projects, and much heartache, the City of Portland is still looking to supplement its water supply, provide drought protection, and ensure future growth. Now is the time for a fresh approach in solving this decades old problem.

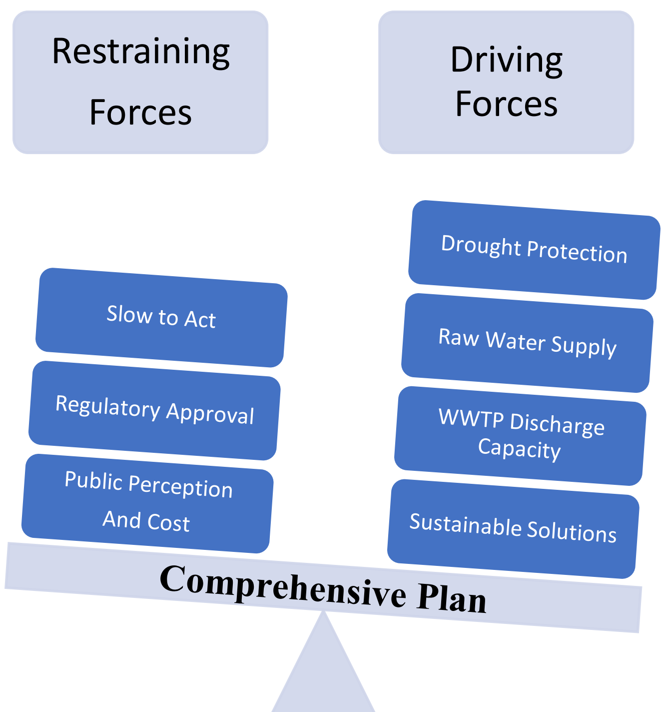
PROBLEM ANALYSIS – PART 2

The Need Is Not Going Away

According to the 2020 CENSUS data, the State of Tennessee grew 8.9%, Sumner County grew 22.2%, Robertson County grew 9.84%, and Portland grew 14.6%, in the last 10 years; completing this 50-year trend *(see Appendix C)*. The last decade has seen a large expansion of commercial and industrial growth in both counties that Portland services; and the increased daily workforce places further demands on the water and sewer infrastructure. Portland's WTP and WWTP are both currently operating about 80% of capacity. Many in Sumner and Robertson counties are looking to Portland to provide the needed water and sewer; and as long-term solutions are being formulated to meet the growing demand, Portland must look for sustainable alternatives that can be quickly implemented.

Once data is reviewed and solutions are explored, action must be taken as indicated in the Force Field Analysis below, to advert a slow-down in growth and commerce, to build protection against drought, and to reduce treatment plant capacity restrictions. Our community deserves a plan that is agreeable, financially feasible, and realistic.

Force Field Analysis



The Need To Act Must Out Weigh The Resistance

Three-phase process for bringing about change:

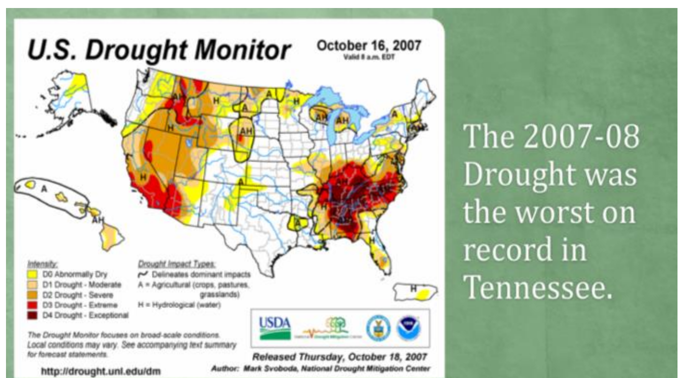
1. Unfreezing
2. Changing
3. Refreezing

"If you want truly to understand something, try to change it."
~ Kurt Lewin

- **Unfreezing** – Inaction, waiting on the possibility of regulatory reversals, and lack of a real plan, has led to the city wasting years and money as growth has strained the capacity of both the WTP and WWTP. This kind of behavior is unsuitable to the ever-changing needs in the area. Cost effective sustainability must be a driving force.

- **Changing** – A new tactic must be taken by seeing the possible solution as a multi-prong approach, instead of an all-or-nothing mindset. New ideas, new partnerships, and new technology must be considered, as new behaviors are formed to move us forward.
- **Refreezing** – Presenting a comprehensive plan that focuses both on capacity and conservation, will allow the city to not only sustain present service, but to provide for future growth as well. This will ensure that the community is adequately leveraged against both drought conditions and system failure, as redundancy and regional cooperatives are put into place.

According to the December 2011 North Central Tennessee Regional Water Resources Planning Study *(see Appendix D for excerpts)* prepared by the Water Resources Technical Advisory Committee, *"The drought of 2007 and 2008 was one of the most severe on record, and it was a harsh reminder that while the water supply in this state is abundant, it is not unlimited".* The study further stated that *"During the 2007-2008 drought, Portland was the only water system in the North Central study area that suffered serious shortages".*



Tennessee Advisory Commission on Intergovernmental Relations Water Supply Study May 2017

Vulnerability in Portland's current water and sewer infrastructure calls for an innovated plan that offers environmentally friendly renewable resources able to provide stability and resilience for the community and the local region.

RESEARCH - PART 1
Plan Considerations

Water and Sewer within the city can no longer be approached on separate tracks. The infrastructure issues faced by Portland are inter-connected and must be viewed in a cause-and-effect way, ensuring manageable and available services for the next generation *(see Appendix E).*

Rivers, lakes, artesian wells, and/or other water table wells are great water sources for raw water; but many communities across America do not have these readily available. The stream that seemed adequate only 30 years ago struggles to supply the water needed today, or offer protection during drought conditions; and similar struggles restrict sewer effluent limits. Unfortunately, these issues are not unique to Portland and cause great hardship for many communities.

Seeking viable options to meet increased demands requires a willingness to be open to change as a plan is formulated. Currently, Portland removes water from one stream and water shed and discharges it to another stream and water shed by means of the waste water treatment discharge outfall *(see Appendix F).* Even though this effluent water is treated and tested to meet acceptable environmental standards before being released, it is not being used to offset non-potable water needs or to replenish the watershed it was pulled from. The traditional approach places limitations on the current infrastructure; but with forward thinking and innovation, the following could be realized:

- Increase WWTP discharge capacity by using the effluent in non-traditional ways;
- Increase WTP capacity since potable water is no longer used in every process requiring water;
- Increase raw water supply through in-direct recharge of stream and lake;
- Preserve watershed integrity and offer drought protection;
- Reclaim lost capacity through system rehab.

As these inter-connected and inter-dependent systems are planned in unison, each individual system should become more robust and viable, as a holistic view of both is considered.

RESEARCH - PART 2

Non-traditional Alternative

NASA released a story in November of 2008 about the Space Shuttle Endeavour carrying two refrigerator-sized racks packed with a distiller and an assortment of filters designed to process astronauts’ urine and sweat into clean drinking water. Traditionally, crews have depended on water carried on a space shuttle or cargo rocket, but an operational water recycler was expected to cut that need by 65 percent by producing about 6,000 pounds of potable water each year. That’s enough fresh water to allow the station to host six crew members instead of three. As pictured, the Expedition 19 crew participated in a toast of reclaimed wastewater aboard the International Space Station; but the opportunity for reclaimed water far exceeds that of direct reuse for potable water needs.

Expedition 19 Crew

As stated on the USGS web-site, most of the uses of water reclamation are non-potable uses such as washing cars, flushing toilets, cooling water for power plants, concrete mixing, artificial lakes, and irrigation for golf courses and public parks. Many agricultural uses exist where effluent can be piped for pasture and seed crops, or trucked from filling stations to onsite locations for greenhouse production of flowers and landscape plantings. There is an abundance of data to support water reuse *(see Appendix G).*

According to the Gilbert, AZ government website, Gilbert has been using 100 percent of its reclaimed water since 1986. Nearly 17 million gallons of drinking water have been saved each day due to Gilbert using non-potable reclaimed water in everything from aesthetic fountains, to the recharging of their aquifer system for the raw water supply.

Florida, Texas, Georgia, Virginia, and California are all using reclaimed water as part of their conservation strategy, as well as, places like Belgium, Singapore, and Australia. When we begin to separate the need for potable drinking water from non-potable uses, we begin conserving capacity and reducing cost. Treating water to safe drinking standards and then using it to irrigate a ball field or to mix concrete, takes up valuable resources that are unnecessary. Pre-treated waste water effluent can successfully replace potable water in a multitude of applications, reserving capacity at both water and sewer treatment plants. Portland can greatly benefit from this proven technology; and at least three other cities in Tennessee are exploring reuse as TDEC considers rules for implementation.

PROJECT TEAM

(These members listened, collaborated, and/or supplied information)

- City Utility Director – Bryan Price
- City Finance Director – Rachel Slusser
- City Business Manager – Kristi Gibbs
- City GIS Manager – Chris Newton
- City Executive Assistant to the Mayor – Teresa Keen
- Engineering Consultants – OHM Advisors
- Regulatory Advisors – TDEC, Army Corps of Engineers
- Community Stakeholders – Chamber of Commerce, Leadership Portland Alumni, Rotary Club, Lions Club, and various small groups
- Elected Officials – City Council, State Representative William Lamberth, Sumner County Mayor Anthony Holt, Robertson County Mayor Bill Vogle, and regional directors for Congressman John Rose and Senator Bill Haggerty
- Regional Partners – Trousdale County, Sumner County, Robertson County, WHUD, and the cities of Westmoreland, Bethpage, Castalian Springs, Hartsville, and Lafayette

POTENTIAL SOLUTIONS

After reviewing past engineering studies, projects, and current options, several potential solutions to solve capacity needs at both the WTP and WWTP were considered for the comprehensive plan. One such document was the 2011 NCTRWR Study which identified the following four alternatives for supplying additional water: 1. Building a new water supply reservoir on Caney Fork Creek; 2. Drilling wells for groundwater; 3. Building a raw water pipeline to Old Hickory Lake; and 4. Purchasing finished water from White House Utility District. This study placed no focus on sewer discharge limits, nor did it connect the dots between the two.

Today, ten years after the 2011 study, other alternatives for sustainable infrastructure such as a reclaimed water program *(see Appendix H)*, water loss program, and a I & I point repair program are needed. In an effort to ensure that water and sewer systems are operating efficiently within the city, constant collaboration with staff, regulatory authorities, and regional partners will be needed to understand capacity demands; and the search for sustainability must focus on immediate drought protection measures, conservation of resources that impact both treatment plants, and controlling customer cost by preserving autonomy within the system.

ANALYSIS of POTENIAL SOLUTIONS

One of the biggest hurdles in formulating a comprehensive plan is the willingness to honestly access feasibility, regardless of emotion or preference. Having a plan that cannot be implemented will only waste time and resources; and unless long-term maintenance, depreciation cost, and regulatory burdens are considered, the plan will fail and remain dormant like so many do.

After many years of work, we now know that the reservoir project is no longer an option due to environmental concerns; and since no evidence of groundwater wells having sufficient flow have been presented, it should no longer be considered either.

The Cumberland River Pipeline Project has two possible considerations. First, building a cooperative regional utility where three to five partners share in cost for a withdrawal, pipeline, and regional treatment plant. The regional approach would require each partner to secure funding and permitting on a similar schedule; but at this time, there is no real consensus that this option is possible.

Secondly, Portland could build its own 23-mile raw water supply pipeline complete with an intake and pump system that could initially pump a minimum of 6mgd of raw water 400 feet higher in elevation than the intake. Recent engineering estimates for this project is around 76-million dollars. This does not include long-term maintenance, energy cost to operate pumps, and adequate staffing to maintain the 20 plus miles of infrastructure, which could easily see an annual cost in excess of $400,000.00. Depending on bond rating and interest rate, a 30-year note could need $3,470,000.00 of yearly debt service. When depreciation is calculated, this alternative could see a pass-thru cost on each customer that far exceeds their current billed amount for usage, which seems to make this option an unrealistic burden on the city and its customers.

Purchasing treated water from WHUD is an available alternative to supplement current supply and as a hedge against drought conditions, but it comes with cost concerns as well. Portland currently purchases water from WHUD on an emergency basis at a cost of $3.77 per 1000 gallons; which is $1.89 higher per 1000 gallons than what the city can produce *(see Appendix I).* If Portland chose to enter into a guaranteed supply contract with WHUD, pricing would likely improve; but upgrades to the WHUD system would be expected to be paid by Portland to guarantee availability. If Portland supplemented its potable water through WHUD at 250,000 gallons a day, that would equate to $172,462.50 yearly and have a monthly pass-thru rate of $1.81. Purchasing 1,000,000 gallons a day would create a yearly expense of $1,376,050.00 and a customer pass-thru rate of $14.48 each month. Portland would still have the expense of maintenance. This is an option that should be considered when developing the comprehensive plan; especially for drought protection.

A reclaimed water program can be a phased-in approach where immediate benefits to both the WTP and WWTP could be realized. This is the only feasible alternative that benefits both treatment plants, conserves watershed integrity, allows for stable pricing, provides for growth, and aids in drought management. While new non-potable washing and filling stations would help conserve potable water in the short-term, the biggest gains would be realized in lake and stream recharge, irrigation, and in industrial applications. The enhanced filtration needed at the WWTP for a reclaimed water program is already part of the Phase 2 design, and the other elements such as a 15,000-foot effluent supply line, new lake intake and weir system, filling/washing stations, and associated pumps, could possibly be constructed for less than 7-million dollars. A reclaimed water system would allow the city to produce another 1-million plus gallons of drinking water a day at a yearly cost of $686,200.00, saving $689,850.00 a year over purchasing water. This option would pay for the reclaimed system within ten years at that level of production; and should be a priority.

Two other programs with great impact on both the WTP and the WWTP are the water loss program and the point repair program. Implementing a fixed Wi-Fi network for flow data, installing master flow meters, and zoning off the water system *(see Appendix J)* allows for quicker leak response and reduces waste; as will ending flushing protocols by looping end of line water mains. Reducing water loss by 10% would free up another 1,616,691 gallons of treated water each month, which is enough for another 200 homes. Reducing stormwater infiltration and inflow (I&I) into the sewer collection system creates capacity and reduces overflows, which in turn, allows for more sewer taps. The city currently operates under a self-imposed moratorium; and for every two gallons of I & I removed, one gallon of new waste water is allowed. The current system averages 300-million gallons of stormwater each year. Reducing I & I by one third, could allow 500 more homes on the system, as we work to remove the moratorium. The city's I & I point repair program recently won the Tennessee's Outstanding Overflow Abatement Award, and is making a difference.

Without in-depth engineering, complete construction plans, and a formal bid process, assumptions on cost must be made; and while using some of the old engineering estimates along with current pricing can help in calculating cost, some factors such as land/easement acquisition, energy consumption, maintenance of equipment, and staffing will make these estimates uncertain.

Work is also underway to know the true capacity of the current WTP, and what upgrades and changes are needed to increase operation from 3mgd to 5mgd. Those expansion costs are being estimated at $6.5-million.

SELECTION of SOLUTIONS to IMPLEMENT

As the plan progresses other needs may arise; but for now, the following elements have been identified and should be incorporated into a comprehensive water and sewer infrastructure plan for the City of Portland, Tennessee:

Reclaimed water program	*Water purchase contracts*	*Cooperative agreements*	*Water loss program*
Point repair program	*WTP expansion*	*WWTP expansion*	*Survey of city lake*
Secondary outfall plan	*Water resource study*	*Water and Sewer rate study*	*Stream flow monitoring*
Fixed network meter reading/monitoring	*Master water meters*	*Main line looping*	*GIS mapping*
Water pressure and volume mapping	*Sewer overflow mapping*	*Policy documents*	*Wireless sewer lift station telemetry*

RESOURCE ESTIMATES

Calculating cost for this comprehensive study is difficult; but some of the work has already been done through research on this capstone, some will be incorporated from the ongoing engineering work on the Phase 2 WWTP expansion, and in an upcoming water resource study. Cost for a new rate study is $15,000.00 and that authorization to move forward was given mid-October of this year.

Other work such as water modeling is currently underway, and was used in creating the Sumner County Regional Water Plan that we presented to the county and to TDEC *(see Attachments)*. Survey of the City Lake has been authorized at a cost of $27,000.00 and more data and relevant information are being gathered through meetings with TDEC, USACE, and our regional partners.

The ever-growing city project list *(see Attachments)* proves the need for prioritization to ensure resources are available; yet, rising inflation is making cost estimates almost impossible. Just in the last few weeks of writing this paper we have seen pricing balloon. As ARPA funds pour into global market, these increases may cause some projects to be scaled back or even cancelled due to strict obligation and spending deadlines of federal money.

IMPLEMENTATION PLAN – PART 1

Perceived Obstacles

Communicating a non-traditional infrastructure plan begins with evaluation and listening. Since the reclaimed water program will hopefully serve as the anchor of this plan, a greater focus will be given to communicating this innovative technology.

Recognizing that most all projects face obstacles, it is important to try to define what issues could delay or collapse the plan. Based on preliminary research and historical knowledge of past projects, three major obstacles were perceived to be present.

- **Public Perception** – Educational opportunities are needed to help overcome the “yuck” factor through detailing differences between direct and in-direct use, presenting the need for conservation and drought management, and for creating confidence that neither public health nor water quality are in danger.
- **Regulatory Approval** – Permitting water reuse carries a special set of challenges since Tennessee currently has limited guidelines. Collaboration on WWTP effluent filtration, effects of pharmaceuticals and other chemicals, benefits of reduced discharge into a low-flow stream, and the possibility of being a TDEC pilot program are all being explored.
- **Financial Planning** – Depending on the scope of the project, and any potential phasing of the project, funding plans must begin early with an identified five-year and ten-year capital outlay

plan, proposed operation and maintenance cost, along with the methodology for creating future rate increases and building fund balances.

Project perceptions are opportunities for public engagement; and as more points of consideration are brought to light or learned, a clearer message of what, why, how, when, and who will develop as this process hopefully evolves into an adopted comprehensive plan that the City of Portland is able to follow as it provides legacy solutions and meets tomorrow's needs.

IMPLEMENTATION PLAN – PART 2

Focus Group

Perceived obstacles are a good starting point; but bringing in a varied group of community minded and engaged individuals to be briefed about the project allows for an opportunity to have your perceptions challenged by the perceptions of others. And since these real-life stakeholders live, work, shop, serve, and pay utility bills within the city, they are a valuable resource to not only hear from, but to have on your side as you work to promote non-traditional infrastructure projects.

While assembling and using a focus group may seem difficult at first, it becomes less challenging when you find partners that can help make the process easier; and Portland's local Chamber of Commerce is that community partner.

Focus Group touring the WTP

The Chamber reached out to alumni of the Leadership Portland program, and assembled 17 participants along with a tour bus for travel. The group toured both the WTP and the WWTP, were briefed on the history, current and future needs, and some possible solutions as it relates to the city's water and sewer program. Water quality test results that compared samples from the stream, the City Lake, the WWTP effluent, and the WTP effluent were presented *(see Appendix K).*


Focus Group touring the WWTP

Having physically seen the process and the data, the group was now better able to engage in discussion and generate questions. Not only did their feedback help shape future research, it brought encouragement to know that many could envision our city using non-potable water to replace certain processes where valuable drinking water was currently being used. The following points were compiled from the focus group:

- Need data and success stories from other States and/or facilities for similar projects;
- Educating the public will be key to understand that the water is safe;
- Explain the benefits for the future growth of the community;
- Share cost comparisons for other alternatives to raw water besides that of reuse;
- Communicate the plan's support by the regulatory body;
- Have a simple reason for the "Why" of the project.

Comparing the focus group's input to the perceived obstacles allows the messaging to be tailored, ensuring that items of most importance are communicated in a meaningful way. Since this type of plan needs effective communication that is able to resonate with a vast array of stakeholders, no single concern can, or should, be overlooked.

IMPLEMENTATION PLAN – PART 3
Forming A Consensus

Generational style infrastructure projects must have concrete agreements in place, or communities can waste years and valuable dollars chasing projects that neither the regulatory body, nor elected officials are willing to fight for. Through an on-going dialogue and a series of meetings with local officials, staff, permitting agencies, and other stakeholders, a plan is emerging as priorities and solutions are being identified more clearly. Securing an officially adopted plan will help future administrations continue the work with confidence.

In Council chambers around America, projects can live and die by public opinion; and many times, it was a lack of communication that stalled or derailed the issue. Buy-in from local stakeholders has been vital in helping create momentum on this project, and more educational opportunities are being planned in order to bring awareness and confidence.

IMPLEMENTATION PLAN – PART 4

Communication Strategy

Recommending unconventional methods involving drinking water requires a "change leadership" style mentality. The temptation to revert back to the "that's how we have always done it" approach, must be avoided. Communicating a reclaimed water program will face opposition; but the need for an effective conservation strategy that protects the community must be a priority. A 5-point communication strategy is being utilized to form a consensus for plan approval and implementation.

> *The most dangerous phrase in the language is "we've always done it this way".*
> ~ Rear Admiral Grace Hopper

- **Messaging *(The What)* -** One of the easiest ways to derail projects during the conceptual phase is to share too much, with too many, too early in the process. In this case, the narrative must be sensitive to the fact that not everyone understands utility infrastructure or reclaimed water. Presenting a plan on *"Reclaiming Our Resources"* verses *"Drinking From The Drain"*, allows for more in-depth education and conversation before minds are made up. Introducing *"the what"* (a complicated infrastructure plan), will need the why, the how, the when, and the who to be successful after *"the what"* is shared.

- **Stakeholders *(The Why)* –** While buy-in from elected officials and regulatory bodies is vital to the process, buy-in from engaged community and business leaders will help provide momentum to the project as well. The opportunity to share details with the Chamber of Commerce and local civic groups, provided an environment where messaging could be refined, and where needed data could be added. Stakeholders are often driven by *"the why"*; and as the reasoning for adopting a plan is communicated, project buy-in will hopefully begin to materialize as individuals unite in a common purpose.
- **Data *(The How)* -** Supporting data will always be needed to push a project forward; but data, like messaging, has to be carefully measured. Too much, and you lose your audience; too little, and you end up circling back in order to validate your point. Developing data from perceived obstacles, the focus group, past studies, and real-world operating conditions not only provides the proof that action is needed, it provides *"the how"* when it comes to solving *"the why"* of *"the what"*.
- **Approval *(The When)* -** Seeking a phased-in approach to communicating and implementing a comprehensive plan avoids the public perception that the plan is too big or too hard. Since the goal is to have a working and implementable plan, and not an all-or-nothing document, it must be broken down into bite-size components that can easily be understood, reviewed, approved, and applied. *"The when"* would happen in stages.
- **Implementation *(The Who)* –** Communication cannot stop once a plan is adopted. Ongoing evaluation of the plan's merits should lead to amendments as the infrastructure landscape changes. Each obstacle should cause the communication strategy to be reviewed, ensuring that each hurdle can actually be overcome. Constant engagement of *"the who"*, i.e., staff, Council, consultants, and regulatory agencies, will be crucial in bringing life to the planning document.

Water security and sustainability must be a priority for communities like Portland; and when waste water discharge restrictions are added to the formula, the sum of the solution hopefully equals a reclamation program as a conservation strategy emerges *(see Appendix L).*

Portland can no longer afford the uncertainty of future droughts as it seeks to solve the raw water supply issue. Steps should be taken immediately to enhance connections with WHUD, conserve capacity at both treatment plants through non-potable uses, continue I & I removal efforts, and install zoned metering to reduce water loss, as a resilient infrastructure plan focused on reclaiming our abundant resources is created. All of this is possible if we embrace the truth that what is currently unused and unrealized, is beneficial to our community.

PLAN EVALUATION

Measuring the success of this capstone will be realized in the answer of two very important questions as our community seeks viable solutions.

- Did this project help all the stakeholders realize that now is the time for action?
- Did the call for action actually lead to the creation of an infrastructure plan that is both realistic and reliable for today and tomorrow?

While the process of creating and adopting a comprehensive water and sewer plan is lengthy and labor intensive, it is a necessary guide for the community. Once a plan is formally adopted, the hard work and expense of plan implementation begins; yet, without this hard work, Portland will remain vulnerable to drought and no longer able to decide how and when growth takes place.

Personally, I already see this experience as successful. The conversations and possible solutions generated because of this project, will better position my community to make sound decisions; and it has given me a greater confidence that we can solve most of these issues by simply reclaiming the resources we already have.

APPENDIX

APPENDIX A

TDEC Letter #1

Office of the Mayor

100 South Russell Street

Portland, Tennessee 37148

Telephone 615/325-6776 Ext 242
Email Address: mikecallis@cityofportlandtn.gov

May 26, 2021

Mr. David Salyers, Commissioner
Tennessee Dept of Environment and Conservation
312 Rosa L. Parks Avenue
Nashville, Tennessee 37243

RE: City of Portland, TN
ARAP – Dam and Reservoir Project

Mr. Salyers:

I am unsure if you are familiar with the City of Portland's years-long pursuit of a supplemental water supply that would have included construction of a dam and reservoir; so, I wanted to take a moment and share our needs.

The concept dates back to the late 1960s but work officially began in the late 1980s, early 1990s. The necessary permits were issued by TDEC and the Corps of Engineers in 2000. But the project was stalled in 2003 when our project engineer admitted that the site chosen on Drakes Creek would not work and original plans must be modified. Due to many hindrances and difficulties, construction had not resumed by 2005, and unfortunately, TDEC did not reinstate the permit, citing our failure to pursue all other possibilities of

supplemental water as the reason; plus the fact that TWRA had raised some environmental concerns.

To spare you great detail of multiple obstacles and disappointments we have encountered, all the options we've had to explore with study after study, and the millions of dollars we've spent, we are in a position right now that we must decide how to move forward; therefore, I am asking for direction from TDEC.

Over the years different agency representatives have repeatedly pushed for regionalization and we attempted to pursue that, but the Corps of Engineers would not commit to allowing additional withdrawals from the Cumberland River. However, we have been notified that withdrawals will now be allowed. Utilities Director, Bryan Price and I met with TDEC and Corps of Engineers officials Friday, May 21, but it is doubtful that either the City of Portland, or any of the other small communities involved - Bethpage, Castalian Springs, Westmorland – will have the means to fund a regional group. The cost of necessary engineering studies, ROW purchases, and construction would make it necessary for funds from almost a fully funded grant, since the water rates needed to pay debt service on the bonds would be unsustainable for rate payers. Especially since a majority of the population of most of these areas would be low income.

As you know, the financial feasibility of projects is part of the selection process. That is why I have also been pursuing waste water reuse; and I am encouraged about this possibility. I have already spoken with TDEC staff on the requirements. In past studies it was determined that our community needs an adequate raw water source to supply an extra 1.5mgd, and currently our waste water treatment plant's effluent averages 1.5mgd in discharge. Since elected to this office I have instructed the lab at our Water Treatment Plant to test our City Lake and our withdrawal from Drakes Creek, to have a comparison for our WWTP effluent. As we enter into Phase 2 of our WWTP upgrades and the new discharge permit, we are looking for a secondary outfall and how best to implement reuse. Whether that is fire suppression, equipment washing stations, or sending it to the head of our City Lake, each gallon of reuse will create capacity both in our potable water supply and in our effluent discharge permit, all the while helping our community be environmentally friendly.

We've appeared before the House and Senate subcommittees multiple times to justify our continuation of the West Fork Drakes Creek Dam and Interstate Authority. We were asked for a plan, and I told them that I do not see a path forward with a reservoir. So, the City must make a decision about our raw water source based on economic impact to our community, and which permits that could possibly be available.

We would appreciate the opportunity to speak directly to you or a representative, about the direction that the City of Portland should move forward at your earliest convenience. If you and your team are in agreement, then the City will end the pursuit of a reservoir and begin the process of selling the property so that those proceeds could be applied to our water debt and future needs.

I am confident that if we work together, we will find an affordable and reasonable solution for the water needs of Portland; and that will place us in a position to supply even more water to those in rural parts of Sumner and Robertson counties.

You may reach me at 615/325-6776 ext. 242 should you wish to discuss this personally.

Thank you for your consideration.

Sincerely,

Mike Callis
Mayor

C: Bryan Price, Utilities Director

APPENDIX B

TDEC Letter #2

MAYOR:
Mike Callis

VICE MAYOR:
Andrew "Drew" Jennings

BOARD OF ALDERMEN:
Penny Barnes
Thomas Dillard
Mike Hall
Jody McDowell
Megann Thompson
Brian Woodall

Office of the Mayor

100 South Russell Street

Portland, Tennessee 37148

Telephone 615/325-6776 Ext 242
Email Address: mikecallis@cityofportlandtn.gov

August 2, 2021

Mr. David Salyers, Commissioner
Tennessee Dept of Environment and Conservation
312 Rosa L. Parks Avenue
Nashville, Tennessee 37243

RE: City of Portland, TN

Mr. Salyers:

It was good to meet with you and Deputy Commissioner Greg Young last week. We very much appreciate your willingness to listen to our ideas regarding Portland's water needs, and to mutually agree on a plan moving forward.

This is our official request that TDEC consider the City of Portland for a pilot program for using reclaimed water as discussed in our meeting; and for the funding to meet those objectives. Our collaboration led to the following four-point plan:

1. Begin a reclaimed water program – This plan would encompass many options for reclaimed water such as: Filling stations for fire trucks and construction tanks using non-potable water; A washing center for City equipment; Irrigation and farming alternatives; Fire lines for industry; Raw water to recharge the lake and/or the intake stream; and Filling our Jet-Vac truck for flushing sewer lines and hydro excavation.
2. Regional solution to expand Portland's connections to White House Utility District – This would include installing more metered connections and possibly upsizing lines and pumps within WHUD's infrastructure.
3. Continuation of communication with regional partners regarding the Army Corps of Engineers withdrawal expansion – Part of this plan includes seeking Congressional approval to have a multi-county region approved for Section 219 funding from the USACE. I have already begun this process, and met with local partners and the aids of differing elected officials.
4. Move forward from the dam and reservoir project previously pursued for supplemental water – As discussed, is highly unlikely that the City will ever be granted permit approval for this project. Plus, the City never acquired the last few but most-necessary tracts needed to make the project work. We have already approached the TN Comptroller's office to inquire about the necessary steps we must take to sell the 125 acres of land previously purchased for the project.

We appeared before the combined Senate and House Committee holding hearings dealing with sunset provisions the day after we met with you and I conveyed to them the plan we'd discussed. I explained that TDEC considered the plan we spoke of as "investment worthy". I further explained that the West Fork Drakes Creek Dam and Reservoir Interstate Authority is no longer needed since Franklin, KY has secured their water supply and we can no longer see a path forward for construction of a reservoir. The Senate and House Committee agreed and voted to sunset the legislation that allowed formation of the authority.

On Thursday July 22, two days after our meeting, I conducted a focus group on reuse. Through a partnership with the local Chamber of Commerce, we assembled a 17-member group with varied backgrounds to tour both the WWTP and the WTP, and then return to City Hall to discuss reuse. With the group's better understanding of the system, we were able to discuss any possible concerns. I provided the group with recent testing data from samples taken from the City Lake, from our intake stream, from WWTP effluent, and from the WTP effluent. We are currently looking at other tests to better understand which metrics are most critical, and look forward to TDEC's guidance in this process.

With 1.2 to 1.6 million gallons per day of unused effluent leaving our City, I am hopeful that we will work toward a solution that is meaningful for our community, provide a safety net for drought conditions, and be a model for an environmentally-friendly way to use reclaimed water; and ultimately, providing it as a source for potable water.

As we discussed, the City of Portland has worked hard over the last 2 years to make a culture change, and I am very pleased with our progress thus far. We have aggressively concentrated our efforts toward the system's I & I problems experienced in wastewater collection as we prepare for the construction of our Phase II wastewater plant expansion. We also have implemented more and newer strategies to reduce our water loss. And I know with TDEC's guidance, we will continue to make great strides.

We were very encouraged to hear that TDEC may be willing to help fund a water reuse program and any infrastructure improvements needed by White House Utility District to help with our current water needs as we build a reclaimed water system to carry us into the future, and I am very thankful for your time.

Interestingly enough, we were approached by another community the day after our meeting, and they shared their concerns in trying to overcome some regulatory hurdles. We encouraged them to personally reach out to your office, and we shared Deputy Commissioner Young's words that TDEC wants to be a resource. So, thank you for your encouragement and thank you for being a resource to the City of Portland.

I look forward to hearing from you soon.

Sincerely,

Mike Callis
Mayor

C: Greg Young, Deputy Commissioner

Bryan Price, Utilities Director

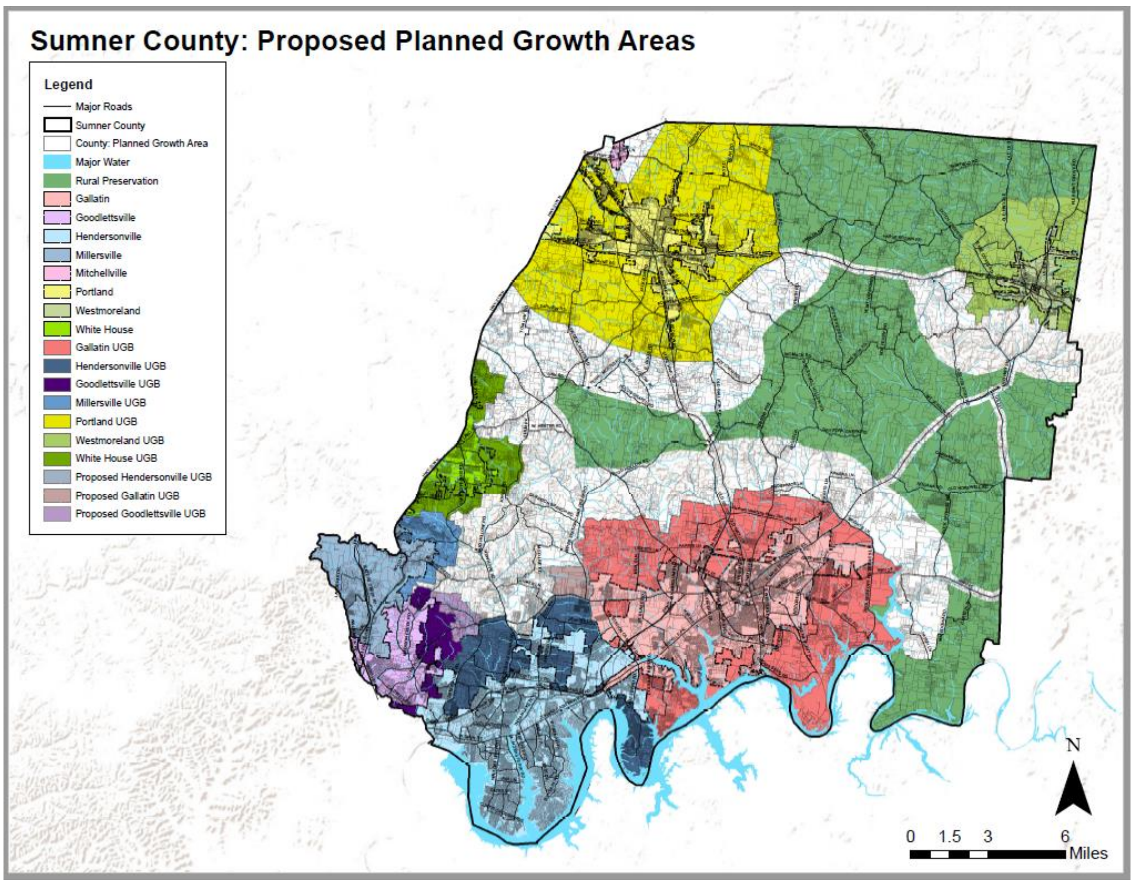
APPENDIX C

50 Year Growth Pattern

Table 1-1. Population Growth in Robertson and Sumner Counties 1960 to 2010

Place	1960	1970	1980	1990	2000	2010
Robertson	27,335	29,102	37,021	41,492	54,433	66,283
10-year Growth Rate	*1.2%*	*6.5%*	*27.2%*	*12.1%*	*31.2%*	*21.8%*
Sumner	36,217	56,256	85,790	103,281	130,449	160,645
10-year Growth Rate	*8.0%*	*55.4%*	*52.5%*	*20.4%*	*26.3%*	*23.1%*

Source: U.S. Bureau of the Census.



APPENDIX D

2011 NCTRWR Planning Study Excerpts

“The drought of 2007 and 2008 was one of the most severe on record, and it was a harsh reminder that while the water supply in this state is abundant, it is not unlimited. Many of Tennessee's 458 community public water systems were confronted by limits of their capacity to provide water to meet the demand.”

“Two study areas were chosen as pilots to support development of a regional water resource planning model: the southern end of the Cumberland Plateau and the northern part of Middle Tennessee. What follows is the second of these two pilots, the North Central Tennessee Regional Water Resource Planning Study. Most of the water utilities in the North Central study area rely on Old Hickory Lake as their source. Consequently, they weathered the 2007-2008 drought without too much difficulty. Portland, which relies on smaller, local sources was hit harder by the drought, but was able to manage by using existing interconnections with systems that draw their water from Old Hickory Lake. Those interconnections were adequate to manage that drought, but will not be sufficient in the future as the Portland area grows.”

“These pilot studies have made clear the complexity of regional water issues; the need for broad collaboration among local, state, and federal partners; and the need to include with regional water plans the tools needed to make adjustments as circumstances change. Although each of these pilots presented its own, distinct challenges, the same process was successfully applied by the study team. As we look to make water resource planning available to other regions across the state, it will be essential to recognize each region's unique set of issues, but the general principles and technical approaches used in these pilots are suited to the challenges of other regions across the state as well.”

“Situated between Nashville and the Kentucky state line, partly on the Highland Rim and partly in the Central Basin, the North Central Tennessee study area covers most of Sumner County and the eastern section of Robertson County. Its geography, ecology, population, land use and development patterns, and utilities are all important factors in assessing current and potential water sources to determine how best to project and meet the area's water supply needs.”

“Three major watersheds converge in the study area: the Barren River, the Red River, and Old Hickory Lake. The Barren River flows north to Kentucky and is part of the Ohio River watershed. The Red River originates in Tennessee, drains portions of southern Kentucky, then meets the Cumberland River near Clarksville. The portions of both the Barren River and the Red River watersheds that lie within the study area are the headwater areas where streams are relatively small. By contrast, Old Hickory Lake, a U.S. Army Corps of Engineers lock and dam project, lies on the main stem of the Cumberland River, well down river from the headwaters of the Cumberland River Basin. Because of its location downstream of several Corps dam and reservoir projects (Center Hill, Dale Hollow, and Lake Cumberland), Old Hickory Lake, though relatively shallow, is more than adequate to meet the region's water supply needs.”

“Portland is the only water utility in the study area that does not rely on Old Hickory Lake as its principal water supply source. Instead, Portland draws the majority of its water from West Fork Drakes Creek and supplements that source from Portland City Lake, located on a small, spring-fed tributary of West Fork Drakes Creek, when flow in the creek is too low to support withdrawals. Because these sources are small, headwater streams, there is some concern that water supply could become a factor for growth and development in the Portland area significant limiting. Sumner County is the 10th most densely populated county in Tennessee, having more than quadrupled in size since 1960. Robertson County has begun to grow nearly as rapidly and, in fact, grew more rapidly from 1990 to 2000. All governmental entities in the study area have active planning commissions

allowing them to plan for future population and development and to link the land-use and water supply planning processes. Sumner County's long-range plan specifically considers water supply."

"During the 2007-2008 drought, Portland was the only water system in the North Central study area that suffered serious shortages. The other utilities in the study area, both Gallatin and White House Utility District, as well as the smaller utilities that buy finished water wholesale, have a much more sustain- able water supply in Old Hickory Lake. Because drought is one of the biggest risks to Portland's water supply, and its potential for growth is consequently somewhat constrained, the study team focused mainly on alternatives to ensure that Portland can sustainably meet its water supply needs through the 2030 planning horizon. The study team estimates Portland's current withdrawal needs at 2.05 million gallons per day growing to 2.99 million gallons per day by 2030. Operated as a system, Portland's two water supply sources can provide a firm yield of only 2.28 million gallons per day. Reliable yield estimates, which are designed to reduce drought risk by preserving 20% of the total storage in City Lake even in the worst drought, are 2.02 million gallons per day with no drought mitigation measures enacted and 2.25 million gallons per day with such measures in place. Clearly, avoiding unacceptable shortages during severe drought or other water supply emergency will require access to more water. Four alternatives to supply additional water to the Portland area were evaluated by the study team:

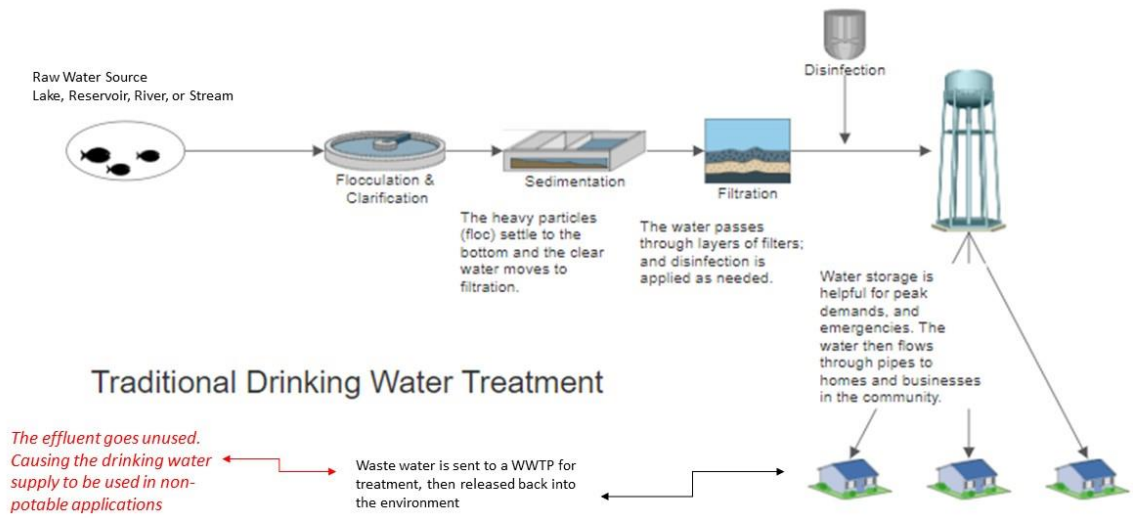
- *Building a new water supply reservoir on Caney Fork Creek*
- *Drilling wells for groundwater*
- *Building a raw water pipeline to Old Hickory Lake*
- *Purchasing finished water from White House Utility District"*

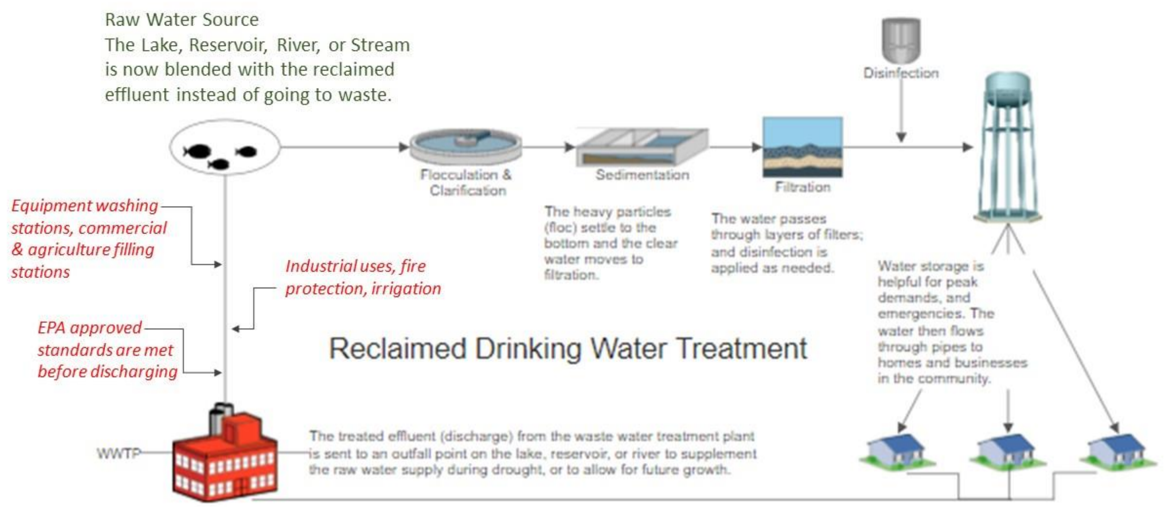
"These alternatives were evaluated against the criteria of sufficiency, cost, implementability, flexibility, raw and finished water quality, environmental benefits and impacts, and other relevant factors. Sufficiency is a threshold criterion. If an alternative does not have sufficient reliable yield to meet projected needs, then it should not be considered further. The groundwater alternative could not meet this test.
The remaining three alternatives were evaluated further through a two-tiered process. Tier One, in addition to sufficiency, considered general estimates of cost; implementability, considering the need for permits, public acceptance, property acquisition, and ease of construction; and flexibility, which is a matter of whether the project can be completed in phases with the costs spread over time to make it more affordable while still meeting the region's water supply needs, as well as its drought resistance. Tier Two scrutinized costs more closely and considered the remaining criteria of water quality, potential environmental benefits or impacts, and other relevant factors."

"Based on these criteria, the alternative selected by the study team is contracting with White House Utility District to purchase finished water as needed and on a schedule amenable to both parties. This alternative can meet Portland's needs through the planning horizon of 2030, it is the least expensive by a significant margin, and it can be accomplished relatively quickly, which is an important factor given that Portland's current water sources are barely sufficient to meet today's reliability requirements. Although it was selected primarily because it can meet Portland's needs at the least cost, this alternative, as a form of regionalization, is also the most easily implemented and flexible alternative. It can grow as Portland grows, through and well beyond the 2030 planning horizon."

APPENDIX E

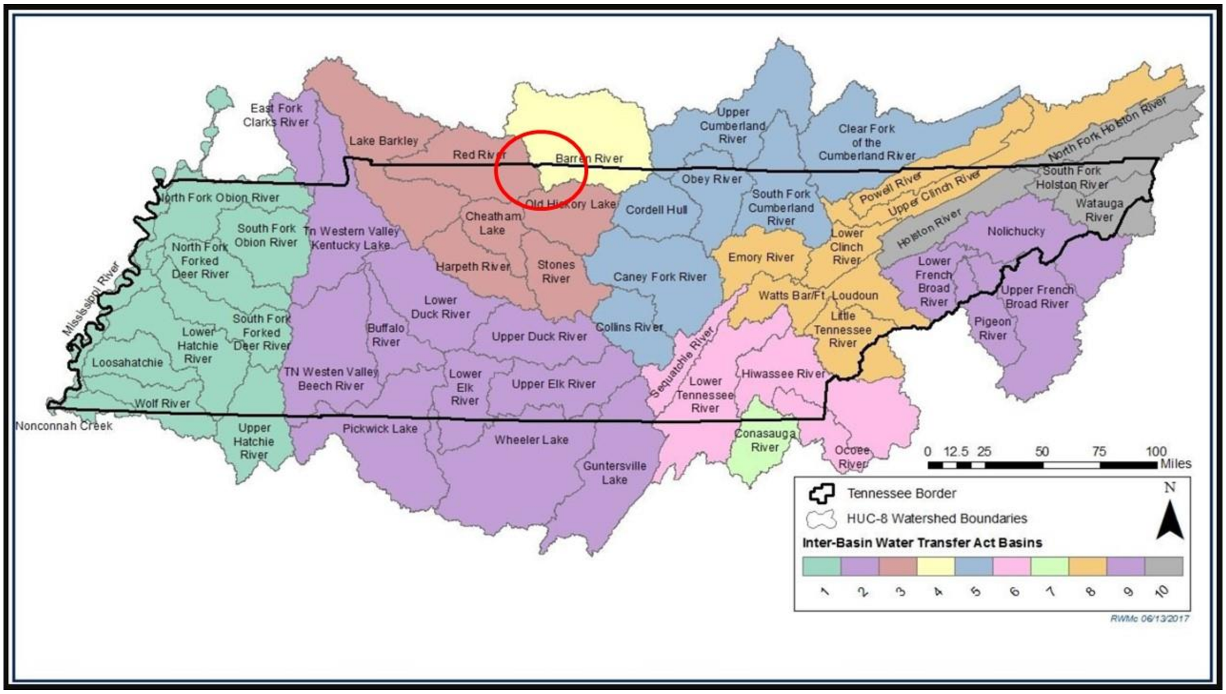
Connecting Water & Sewer Infrastructure



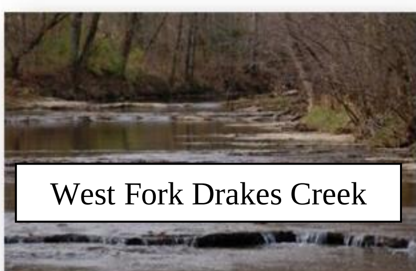


APPENDIX F

State Watershed Boundaries



The sewer effluent discharges into the Red River Watershed



The raw water is drawn from the Barren River Watershed

APPENDIX G

Research Links

(Both digital hyperlink title and web address is included for each)

- Water Reuse Action Plan | US EPA www.epa.gov/waterreuse/water-reuse-action-plan
- Pharmaceuticals in Water (usgs.gov) www.usgs.gov/special-topic/water-science-school/science/pharmaceuticals-water?qt-science_center_objects=0#qt-science_center_objects
- 2012 Guidelines for Water Reuse (epa.gov) www.epa.gov/sites/default/files/2019-08/documents/2012-guidelines-water-reuse.pdf
- Water Reuse Program | Florida Department of Environmental Protection www.floridadep.gov/water/domestic-wastewater/content/water-reuse-program
- Water Reuse 101 | WateReuse Association www.watereuse.org/educate/water-reuse-101/
- Reclaimed Water Study | LOTT Clean Water Alliance www.ottcleanwater.org/projects/reclaimed-water-infiltration-study/
- Layout 1 (tn.gov) www.tn.gov/content/dam/tn/environment/documents/ncrwrps2011.pdf
- Karst Map of the Conterminous United States - 2020 (usgs.gov) www.usgs.gov/media/images/karst-map-conterminous-united-states-2020
- River Basins Regulated by the Inter-Basin Transfer (tn.gov) www.tn.gov/environment/program-areas/wr-water-resources/water-quality/river-basins-regulated-by-the-inter-basin-transfer.html
- FY2015_TN_Annual_Report.pdf (usgs.gov) www.water.usgs.gov/wrri/AnnualReports/2015/FY2015_TN_Annual_Report.pdf
- USGS: Selected Water-Use Bibliography for the United States www.water.usgs.gov/watuse/biblio/
- 2020 Census Data Products | Tennessee State Data Center (utk.edu) www.tnsdc.utk.edu/data-and-tools/2020-census/

APPENDIX H

Project Viability Chart

Project Viability Metric for The City of Portland, TN *Project Ranking From 1 To 4 - Lowest Score Equals Most Viable*				
Cumberland	**Water Reuse**	**WFDC Reservoir**	**Purchase Water**	*Project Considerations*
TDEC does not recommend	*TDEC approves as a viable option*	*TDEC does not recommend*	*TDEC approves as a viable option*	
4	2	3	1	**Initial Project Cost**
3	2	4 (8)	1	**Long-Term Maintenance**
3	2	2	1	**Increased Operations Cost**
1	2 (9)	3 (6)	1 (4)	**Drought Protection**
4	2	4	1	**Initial Environmental Impact Of Project**
2 (1)	1	4 (3)	2 (1)	**Long-Term Environmental Impact**
4	1	4	4	**Creates WWTP Discharge Capacity**
4	1 (7)	4	1	**Creates WTP Capacity**
4	1	2	4	**Water Shed Transfer Conservation**
2	1 (5)	2	4	**Internal Control Water Quality**
4 (2)	1	1	4 (2)	**Internal Control Customer Cost**
35	16	33	24	*Total*
**Recommend using a combination of reuse and water purchase to supplement current supply* **Scoring is based on current information, previous studies, and conversations with TDEC*				

(1) Could be susceptible to contamination
(2) USACE has considered water purchase agreements
(3) TDEC said impoundment would degrade high quality waters
(4) Upgrades are needed to WHUD to deliver needed volume
(5) The city would be able to control both the source water and the finished water
(6) If the reservoir had the added capacity of WWTP effluent it would offer more protection
(7) Only option that conserves potable water
(8) Fissures could mandate a liner be used
(9) A water harvesting pond using effluent and/or stormwater could be an option

APPENDIX I

Production And Maintenance Cost For Portland Water

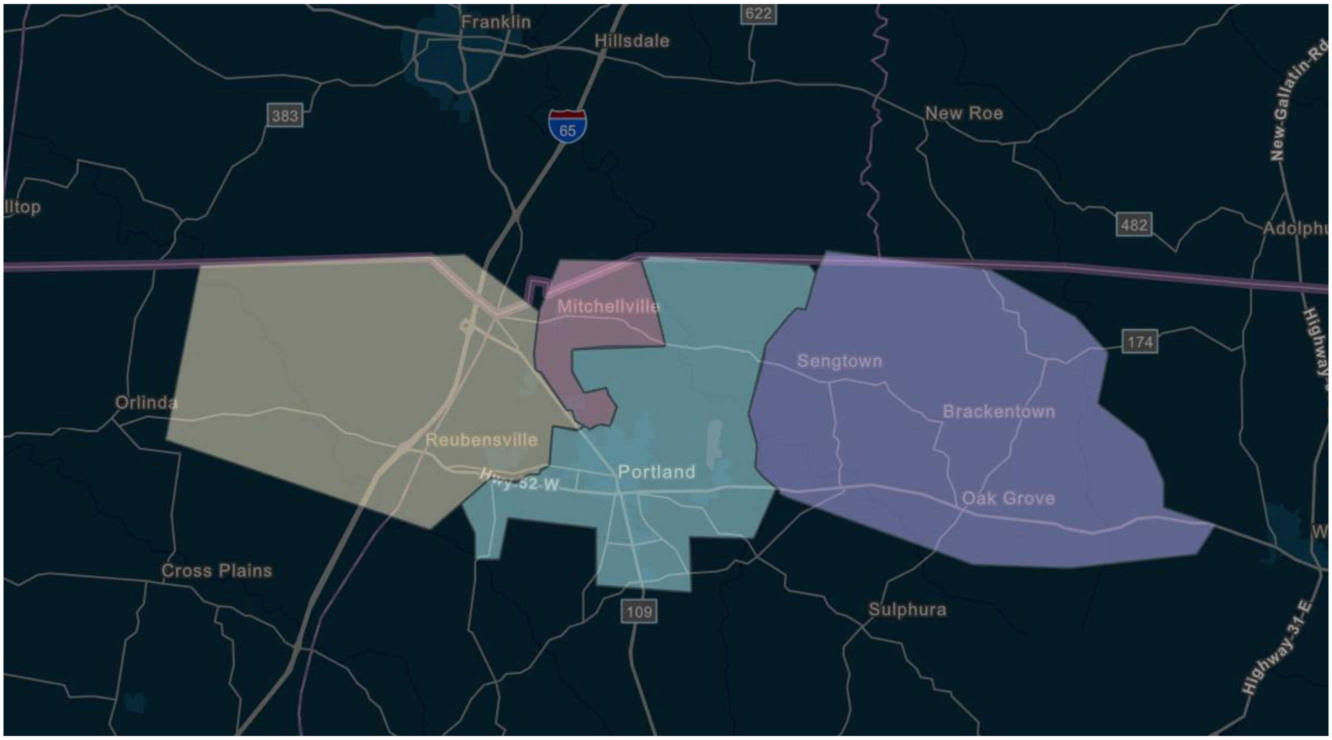
2018-2019 Budget Year			
Gallons Produced	***Cost to treat water per 1000 gallons***	***Cost to maintain system per 1000 gallons***	***Total cost per 1000 gallons of potable water***
765,805,000	$ 1.96	$ 2.78	$ 4.74
Total WTP Expenses	$ 1,498,609.00		
Total Distribution Expenses	$ 2,129,174.00		

2019-2020 Budget Year			
Gallons Produced	***Cost to treat water per 1000 gallons***	***Cost to maintain system per 1000 gallons***	***Total cost per 1000 gallons of potable water***
794,559,000	$ 1.85	$ 2.42	$ 4.27
Total WTP Expenses	$ 1,468,136.00		
Total Distribution Expenses	$ 1,919,146.00		

2020-2021 Budget Year			
Gallons Produced	***Cost to treat water per 1000 gallons***	***Cost to maintain system per 1000 gallons***	***Total cost per 1000 gallons of potable water***
829,567,000	$ 1.84	$ 2.81	$ 4.65
Total WTP Expenses	$ 1,529,076.00		
Total Distribution Expenses	$ 2,335,095.00		

APPENDIX J

Portland Water System Zone Map



Based on water models, transmission lines, water tanks, and valves, the system is broken into 4 master zones. Within the zones a series of master flow meters would be installed to measure the actual flow within a zone; and then compare that to customer usage.

With the fixed Wi-Fi network in place, flow data would undergo real-time monitoring allowing for quicker response to leaks, and to help identify problems that were once unknown; all in an effort to reduce the unaccounted-for treated water, so that capacity could be gained and reserved within the current system.

As the city works to ensure that the calculations for unsold/accounted-for water, unsold/unaccounted-for water, and sold water is accurate as it fixes leaks in a timely manner, it will have a truer measure of system demand.

APPENDIX K

Focus Group Test Results

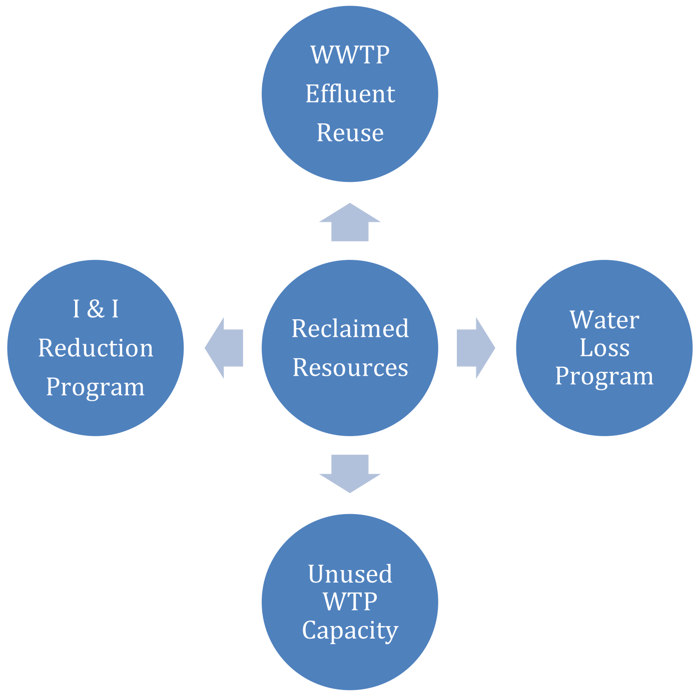
Source water testing

Collection Site	Creek		City Lake (Drawdown)		WWTP effluent		WTP effluent	
Date & Time	7/14/2021	12:20	7/14/2021	12:25	7/14/2021	12:10	7/14/2021	12:30
Temp (C)	25	Celcius	23	Celcius	27	Celcius	23	Celcius
Turbidity	10	NTU	7.8	NTU	0.85	NTU	0.02	NTU
pH	7.96		7.32		7.48		7.51	
Alkalinity	105	mg/L	145	mg/L	175	mg/L	89	mg/L
Hardness	148	mg/L	200	mg/L	214	mg/L	110	mg/L
Iron	0.11	mg/L	0.6	mg/L	0.03	mg/L	0.01	mg/L
Manganese	0.047	mg/L	1.905	mg/L	0.049	mg/L	0.02	mg/L
Fluoride	0.0981	mg/L	0.0858	mg/L	0.724	mg/L	0.54	mg/L
Phosphate	0.15	mg/L	0.09	mg/L	5.85	mg/L	0.31	mg/L
Nitrite	0.002	mg/L	0.002	mg/L	0.008	mg/L	0	mg/L
Chlorides	3.8	mg/L	6.9	mg/L	90	mg/L	14.3	mg/L
Sulfides	N/A	mg/L	N/A	mg/L	N/A	mg/L	N/A	mg/L
TOC	3.1	mg/L	3.1	mg/L	6.7	mg/L	1.5	mg/L
QuantiTray	1,046.20	e-coli	1,732.90	e-coli	14.6	e-coli	Neg	e-coli
Notes:								

APPENDIX L

CONSERVATION STRATEGY

Finding Capacity Within Current Resources



- ***1.5 million gallons of treated WWTP effluent goes unused each day***
  - Instead of using this resource to recharge the raw water supply, and to replace potable water in non-potable uses, it is being discharged into a separate watershed without benefit to the system.
- ***400,000 plus gallons of drinking water is unaccounted for each day***
  - Implementing a zoned master meter system with a fixed WiFi network to isolate leaks, along with a rehab/repair program, will conserve thousands of gallons each day and build capacity back into the system.
- ***300 million gallons of rain water takes up capacity at the WWTP each year***
  - O & M cost, plant capacity, and permit limits are all being stretched trying to treat the inflow and infiltraion of rain water into the system. Increasing point repair efforts allows for growth and moritorium relief.
- ***Capacity to treat thousands of gallons of raw water goes unused each day***
  - Pump and filter performance at the WTP, along with main line retrictions, keep the plant from pushing out more supply. Output measurements, impeller maintenance, and a stream flow guage are all currently in the process of being completed.

ATTACHMENTS

WATER & SEWER PROJECT LIST

(ESTIMATES AS OF OCTOBER 2021)

Wastewater Treatment Plant Reclaimed Water Outfall				
Item	Unit	Quantity	Unit Cost	Total Cost
12” Non-potable Water Line	LF	15,000	$165	$2,475,000
Engineering	EA	1	$195,000	$195,000
Contingency	EA	1	10%	$270,000
TOTAL				***$2,940,000***

*I & I Sewer Point Repair Program				
Item	Unit	Quantity	Unit Cost	Total Cost
Lift Station Telemetry	EA	74	$4,200	$310,800
Repair customer laterals, main lines, & manholes	EA	1	$2,500,000	$2,500,000
Engineering	EA	1	$250,000	$250,000
Contingency	EA	1	10%	$281,000
TOTAL				***$3,341,800***

*Mason Tank 12” Transmission Line				
Item	Unit	Quantity	Unit Cost	Total Cost
12” Water Line	LF	11,500	$165	$1,897,500
8” Water Line	LF	500	$100	$50,000
6” Water Line	LF	500	$75	$37,500
Engineering	EA	1	$215,000	$215,000
Contingency	EA	1	10%	$220,000
TOTAL				***$2,420,000***

*Oak Hill Tank & Transmission Lines				
Item	Unit	Quantity	Unit Cost	Total Cost
12” Water Line	LF	17,600	$165	$2,904,000
8” Water Line	LF	6,000	$100	$600,000
500,000 Tank	EA	1	$1,700,00	$1,700,000
Engineering	EA	1	$265,000	$265,000
Contingency	EA	1	10%	$547,000
TOTAL				***$6,016,000***

*Phase 2 Waste Water Treatment Plant Expansion				
Item	Unit	Quantity	Unit Cost	Total Cost
Plant Upgrade	EA	1	$10,500,000	$10,500,000
Engineering	EA	1	$395,000	$395,000
Contingency	EA	1	10%	$1,105,000
TOTAL				***$12,000,000***

*Water Quality Projects / Water Loss Program				
Item	Unit	Quantity	Unit Cost	Total Cost
Looping of dead-end lines	EA	1	$1,500,000	$1,500,000
Fixed Network Monitoring	EA	1	$150,000	$150,000
Ultrasonic Master Meters	EA	12	$15,000	$180,000
Water Modeling	EA	1	$35,000	$35,000
Kamstrup Meters replacement	EA	8,000	$500	$4,000,000
Contingency	EA	1	10%	$585,000
TOTAL				***$6,450,000***

TN/KY Industrial Park Water Line Upgrade				
Item	Unit	Quantity	Unit Cost	Total Cost
12” Water Line Upgrade	LF	13,200	$165	$2,178,000
Engineering	EA	1	$140,000	$140,000
Contingency	EA	1	10%	$231,000
TOTAL				***$2,549,000***

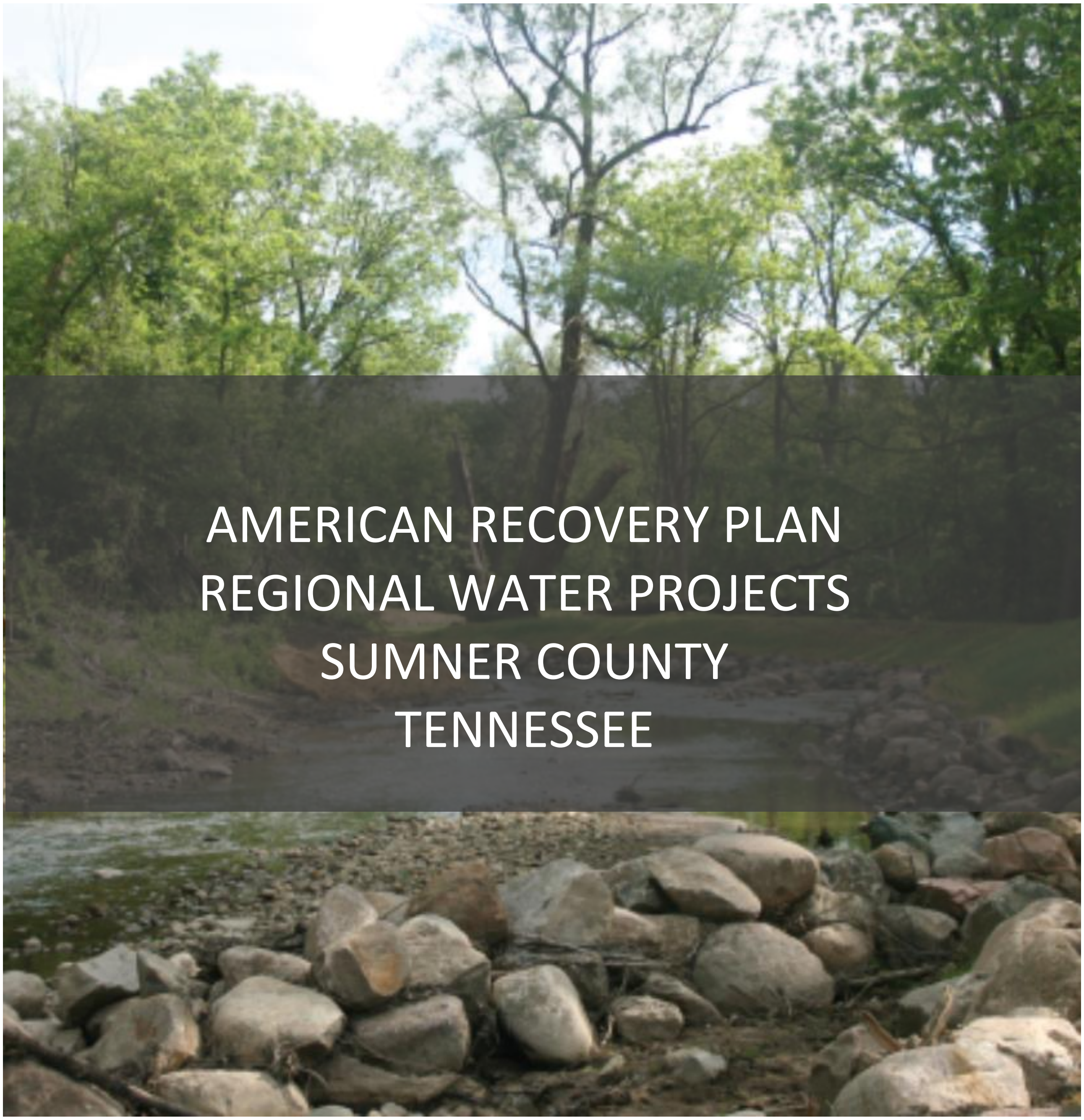
Water Treatment Plant Upgrade to 5mgd				
Item	Unit	Quantity	Unit Cost	Total Cost
Plant Upgrade	EA	1	$5,750,000	$5,570,000
Reconstruct Lake Intake	EA	1	$1,500,000	$2,500,000
Engineering	EA	1	$265,000	$265,000
Contingency	EA	1	10%	$835,000
TOTAL				***$9,170,000***

Payne Road Water Line				
Item	Unit	Quantity	Unit Cost	Total Cost
6” Water Line	LF	22,100	$75.00	$1,657,500.00
Engineering	EA	1	$110,000.00	$110,000.00
Contingency	EA	1	10%	$176,750.00
TOTAL				***$1,944,250.00***

New Deal Potts Road Water Line				
Item	Unit	Quantity	Unit Cost	Total Cost
12” Water Line	LF	11,500	$165.00	$1,897,500.00
Engineering	EA	1	$192,000.00	$192,000.00
Contingency	EA	1	10%	$208,950.00
TOTAL				***$2,298,450.00***

***Denotes projects already under design, pending funding.**

***** Not included is the $5,000,000.00 Sewer Interceptor Line that the city just awarded, with construction set to begin soon.***



OHM Advancing Communities®

In 2007-2008, Tennessee as well as the southeast region of the United States, experienced one of the most severe droughts on record. As a response to the water shortages that arose from this drought, the State of Tennessee initiated two pilot studies in 2009 to develop a model for regional water resource planning across the state. One of these, the North Central Tennessee Regional Water Resources Planning Study, focused on water supply to the Western Highland Rim which includes the northern

half of Sumner County. After 2 years of collaboration between TDEC, TACIR, TDECD, TWRA, USGS, COE, TAUD, The Nature Conservancy, and the utility providers of the region, a report was issued which can be found at the following link:
https://www.tn.gov/content/dam/tn/environment/documents/ncrwrps2011.pdf

Briefly highlighting the findings of that report, the primary source of water for the region, Old Hickory Lake, has more than enough capacity even during the worst droughts and substantial future growth. The City of Portland is the exception, which draws its water from West Fork Drakes Creek and during drought conditions, their emergency supply City Lake.

The drainage area upstream of Portland's intake is relatively small making it vulnerable to droughts when flows drop below the City's daily demand. There is ample supply available most of the time but as demands have increased due to growth within the City and surrounding county service areas, the impact of an extreme drought will be more difficult to mitigate. Figure 2-1 of the State report depicts this issue.

Hydrologic modeling of all historical rainfall data, 1928-2009, was completed and found the combined water sources for Portland have a reliable yield of 2.02 million gallons per day (mgd) during the worst droughts on record. Daily demands in excess of 2.02 mgd would potentially go unmet during a repeat historic drought if no other sources of water are available, or demand reduction mitigation measures imposed. At the time of the study, the City's demand was 2.05 mgd. Today, the peak summer demands is 2.56 mgd. The reality is the higher the demands get, the more vulnerable the water supply is to drought.

The final recommendation of the TDEC report is a regional approach in which Portland purchases water from the White House Utility District (WHUD) to supplement water supply and mitigate future droughts. Proactively, WHUD and the City of Portland have already been coordinating on new purchase points and testing the capacity of the existing infrastructure with daily and intermittent water transfers from WHUD to Portland. Recent wholesale purchase testing shows the existing WHUD infrastructure can support about 150,000 gallons per day (gpd) extra to the northeastern Sumner County region before the existing level of service starts to be negatively impacted. This includes the WHUD service area.

With the issuance of the American Recovery Plan and the initiative of Sumner County to focus funding on the known water supply issues of the northern region of the County, the discussion expanded beyond WHUD and Portland to include Castalian Springs Bethpage Utility District (CSBUD) and Westmoreland. The resulting collaboration was fruitful and revealed the complexity of each utility's water supply and/or distribution challenges. For example, while Westmoreland has a direct connection to the City of Gallatin, the water supply line was installed in the 1970's, will reach the end of its useful life in the not-too-distant future and will need to be replaced. This future need could potentially be resolved with regional solution now.

CSBUD, Portland, and Westmoreland already had a list of capital projects which either targeted water loss or capacity issues and are included in the proposed projects as a base request. However, the ultimate goal of the discussions was to develop a regional solution that would improve the water availability to the region.

The premise was if Portland intends to purchase water from WHUD, how can the current and future supply needs of CSBUD and Westmoreland also be met as part of the solution. As the TDEC report alluded to, the distance required to move water from Old Hickory Lake to the upper parts of the county are extreme, improvements expensive, and the design capacity of the improvements should be adequately sized well into the future. As such, the upfront capital cost is higher than would be required to meet current or near future needs.

Option 1 was developed with the assumption WHUD would supply water to the region in the following amounts:

- CSBUD – 2 mgd
- Portland – 1 mgd
- Westmoreland – 1 mgd
- WHUD – 1 mgd

WHUD performed a hydraulic analysis and determined the infrastructure improvements required to supply 5 mgd to the northern region. These improvements included enhanced connections to Portland and CSBUD. Flows to Westmoreland would pass through Portland and/or CSBUD. Under Option 1, CSBUD's water system would be supplied on the ridge and then gravity down into the valley which is the opposite of how it operates now. A new tank would be required near the WHUD connection which regionally is a good location and could function as a regional tank for all utilities depending on size.

WHUD then allocated the resulting cost for improvements within their system respectively to each entity based on their percentage of the capacity they use of the proposed improvement. Assuming ARP grant funds are utilized exclusively for these improvements, depreciation is the primary expense (easements are not depreciated) and in the case of WHUD would need to be reimbursed through their wholesale rate which is directly related to the volume of water purchased. The first table on the project summary sheet lists the individual project, who's system it is in, and the Opinion of Probable Cost (OPC). The second table shows the cost of the WHUD improvements allocated to each utility followed by that value plus each utilities own internal projects to depict their total fiscal liability. Note that that total is not the depreciation total that must be shown as an expense on their audit. That will only be equal to the cost for the improvements within their system. The project locations are depicted on the accompanying map and are related by the project number (example 1-13 for Option 1).

Option 2 was developed with the assumption WHUD would supply 1 mgd to Portland, CSBUD and Westmoreland would continue to purchase water from the City of Gallatin. Under this Option, CSBUD would proceed with existing plans to install a new transmission main booster station and tank to supply water to the top of the ridge. Portland and Westmoreland still have the same base projects. See the project summary sheet and map results for this option.

Option 3 was developed assuming funding would be limited to $30 million dollars. This scenario was identical to Option 2 except the funding to WHUD would be less than was required to provide 1 mgd to Portland. Time was insufficient to perform this additional modeling analysis but if the results find the flow WHUD can provide Portland is not substantial enough to warrant the cost, then the remaining ARP funds would be disbursed among the utilities as agreed upon for other uses.

Based on the County's obligation of ARP funds toward water/sewer infrastructure, the regional water utility providers will continue to collaborate until a final plan is in place.

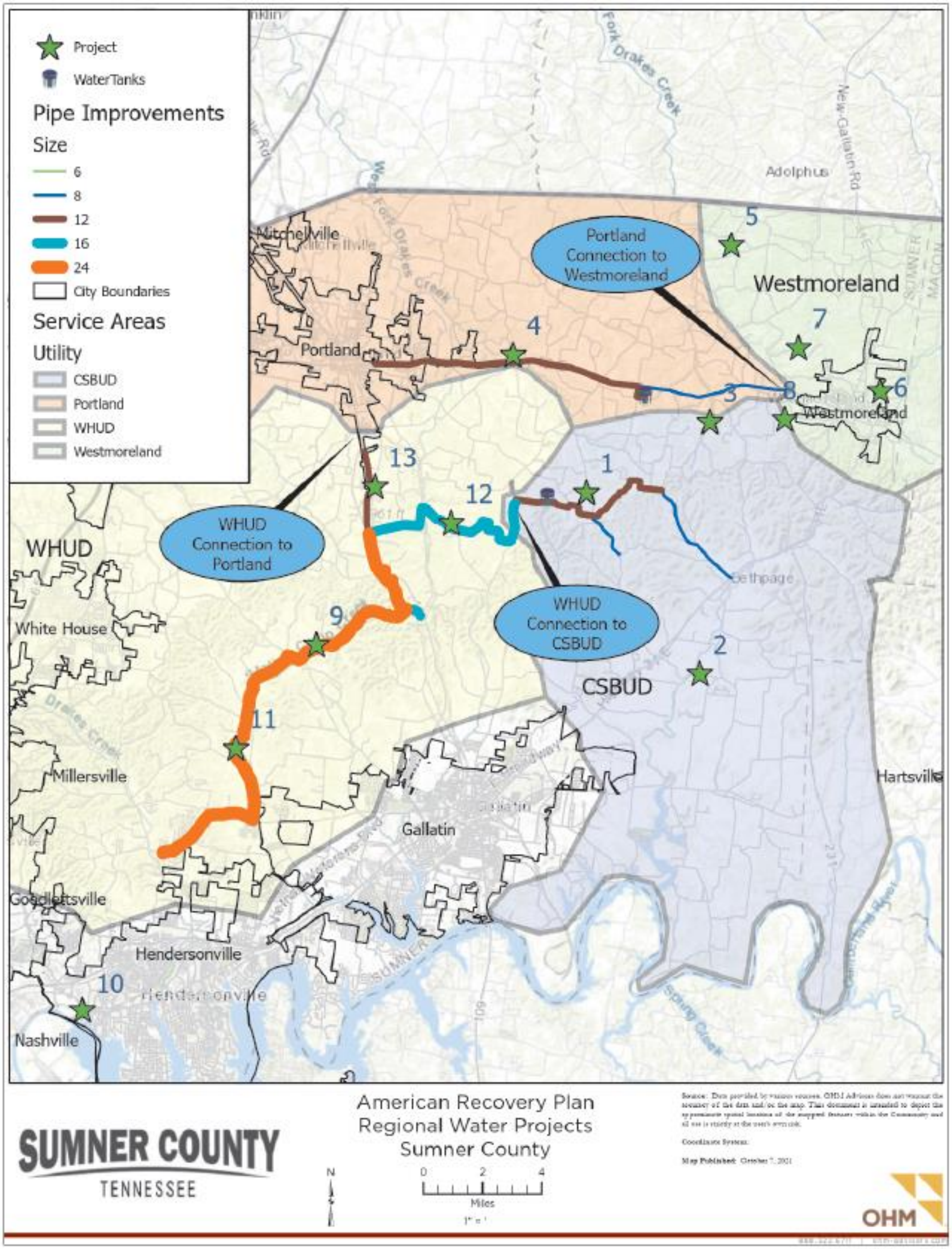
American Recovery Plan
Regional Water Projects
Sumner County
Option 1
Flow Supplied by WHUD in Million Gallons per Day (MGD)

2 CSBUD
1 Portland
1 Westmoreland

Project	CSBUD - 2 MGD supplied by WHUD	Opinion Of Probable Cost	
1	TM, Water Tank, Booster Station	$	3,600,000
2	Rogana Rd WL	$	600,000
3	Reese Road WL	$	300,000
	Total	$	4,500,000
	Portland - 1 MGD supplied by WHUD		
4	Hwy 52 TM, Water Tank, Booster Station	$	11,500,000
	Total	$	11,500,000
	Westmoreland - 1 MGD supplied by WHUD		
5	Bill Henson WL	$	195,000
6	Lake Westmoreland WL	$	380,000
7	Bishop Trout WL	$	90,000
8	Dewey Carr WL	$	650,000
	Total	$	1,315,000
	WHUD		
9	Bugg Hollow Booster Station (5MGD)	$	3,105,000
10	WTP Upgrades	$	35,425,000
11	24" TM (Regional)	$	50,475,000
12	16" TM (Hwy 109-CSBUD)	$	18,165,000
13	12" TM (Hwy 109-Portland)	$	4,591,000
	Easements	$	3,033,000
	Total	$	114,794,000
Regional Total		$	132,109,000

	Share of WHUD Depreciable Construction Costs/Reimbursed Through Rates		Total Fiscal Libabiliy	
CSBUD	$	41,653,256	$	46,153,256
Portland	$	19,784,370	$	31,284,370
Westmoreland	$	20,826,628	$	22,141,628
WHUD	$	29,392,108	$	29,392,108
Total	$	111,656,362	$	128,971,362

TM=Transmission Main
WTP=Water Treatment Plant
WHUD=White House Utility District
CSBUD=Castalian Springs Bethpage Utility District



Project
WaterTanks
Pipe Improvements
Size
6
8
12
16
24
City Boundaries
Service Areas
Utility
CSBUD
Portland
WHUD
Westmoreland
Portland Connection to Westmoreland
WHUD Connection to Portland
WHUD Connection to CSBUD
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10
11
12
13
Westmoreland
WHUD
CSBUD
Mitchellville
Portland
Adolphus
Bethpage
White House
Millersville
Gallatin
Hartsville
Goodlettsville
Hendersonville
Nashville
Fork Drakes Creek
West Fork Drakes Creek
Drakes Creek
New Gallatin Rd
Spring Creek
SUMNER COUNTY
TENNESSEE
American Recovery Plan
Regional Water Projects
Sumner County
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Miles
Source: Data provided by various sources. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.
Coordinate System:
Map Published: October 7, 2021
OHM

American Recovery Plan
Regional Water Projects
Sumner County
Option 2

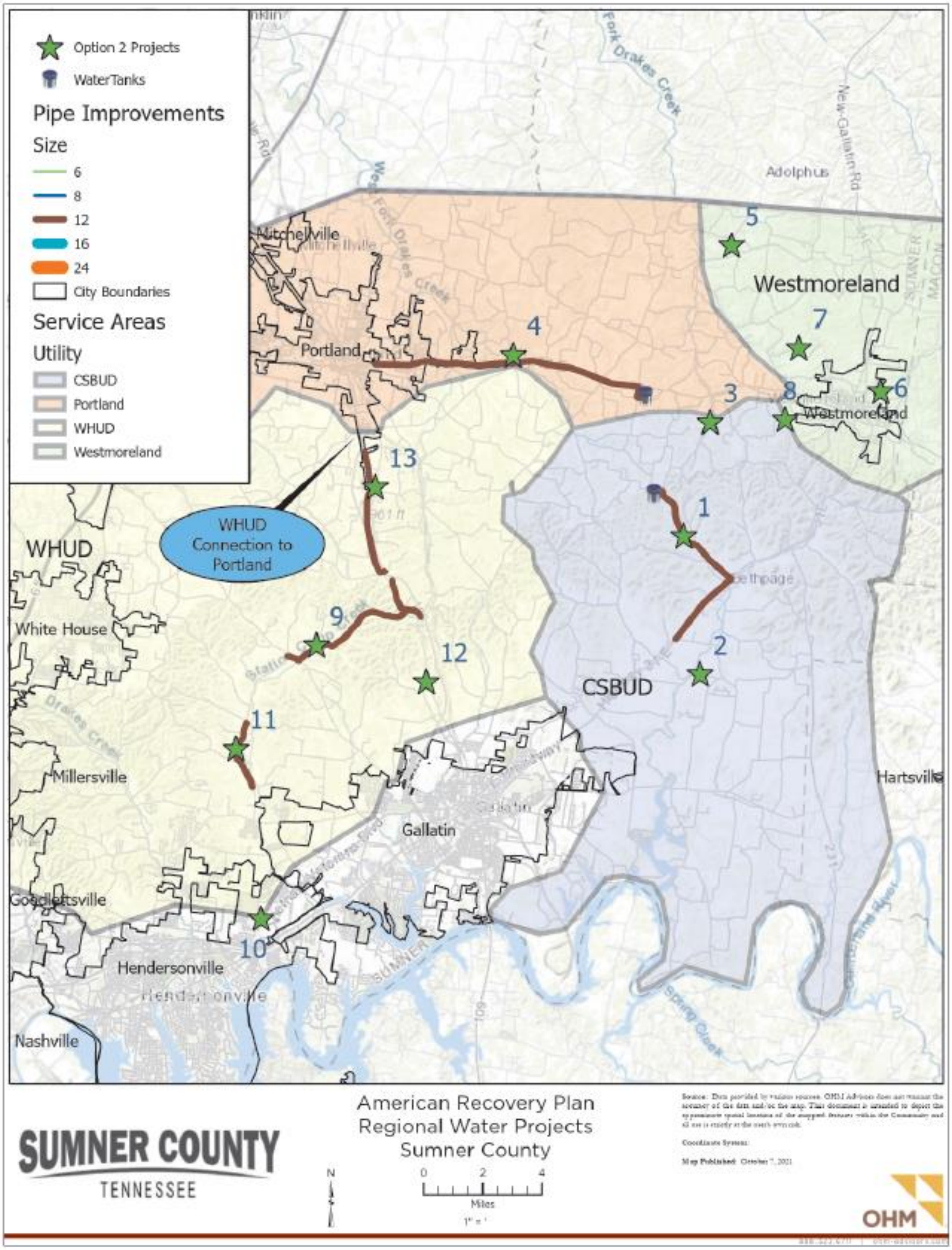
Flow Supplied by WHUD in Million Gallons per Day (MGD)

0 CSBUD
1 Portland
0 Westmoreland

Project	CSBUD - Supplied by Gallatin	OPC
1	TM, Water Tank, Booster Station	$ 3,600,000
2	Rogana Rd WL	$ 600,000
3	Reese Road WL	$ 300,000
	Total	$ 4,500,000
	Portland - 1 MGD supplied by WHUD	
4	Hwy 52 TM, Water Tank, Booster Station	$ 11,500,000
	Total	$ 11,500,000
	Westmoreland - Supplied by Gallatin	
5	Bill Henson WL	$ 195,000
6	Lake Westmoreland WL	$ 380,000
7	Bishop Trout WL	$ 90,000
8	Dewey Carr WL	$ 650,000
	Total	$ 1,315,000
	WHUD	
9	Bugg Hollow Booster Station (1.3MGD)	$ 855,000
10	HUD Transfer Booster Station (1MGD)	$ 1,000,000
11	12" TM (Portland)	$ 22,183,000
12	Saundersville Booster Station (1MGD)	$ 855,000
	Easements	$ 1,621,000
	Total	$ 26,514,000
Regional Total		$ 43,829,000

	Share of WHUD Depreciable Construction Costs/Reimbursed Through Rates	Total Fiscal Libabiliy
CSBUD	$ -	$ 4,500,000
Portland	$ 18,847,433	$ 30,347,433
Westmoreland	$ -	$ 1,315,000
WHUD	$ 5,865,745	$ 5,865,745
Total	$ 24,713,179	$ 42,028,179

TM=Transmission Main
WTP=Water Treatment Plant
WHUD=White House Utility District
CSBUD=Castalian Springs Bethpage Utility District



Option 2 Projects
WaterTanks
Pipe Improvements
Size
6
8
12
16
24
City Boundaries
Service Areas
Utility
CSBUD
Portland
WHUD
Westmoreland
WHUD Connection to Portland
Fork Drakes Creek
Adolphus
New Gallatin Rd
Mitchellville
Portland
Westmoreland
WHUD
White House
CSBUD
Millersville
Goodlettsville
Hendersonville
Nashville
Gallatin
Hartsville
Spring Creek
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SUMNER COUNTY
TENNESSEE
American Recovery Plan
Regional Water Projects
Sumner County
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Coordinate System:
Map Published: October 7, 2021
OHM

American Recovery Plan
Regional Water Projects
Sumner County
Option 3

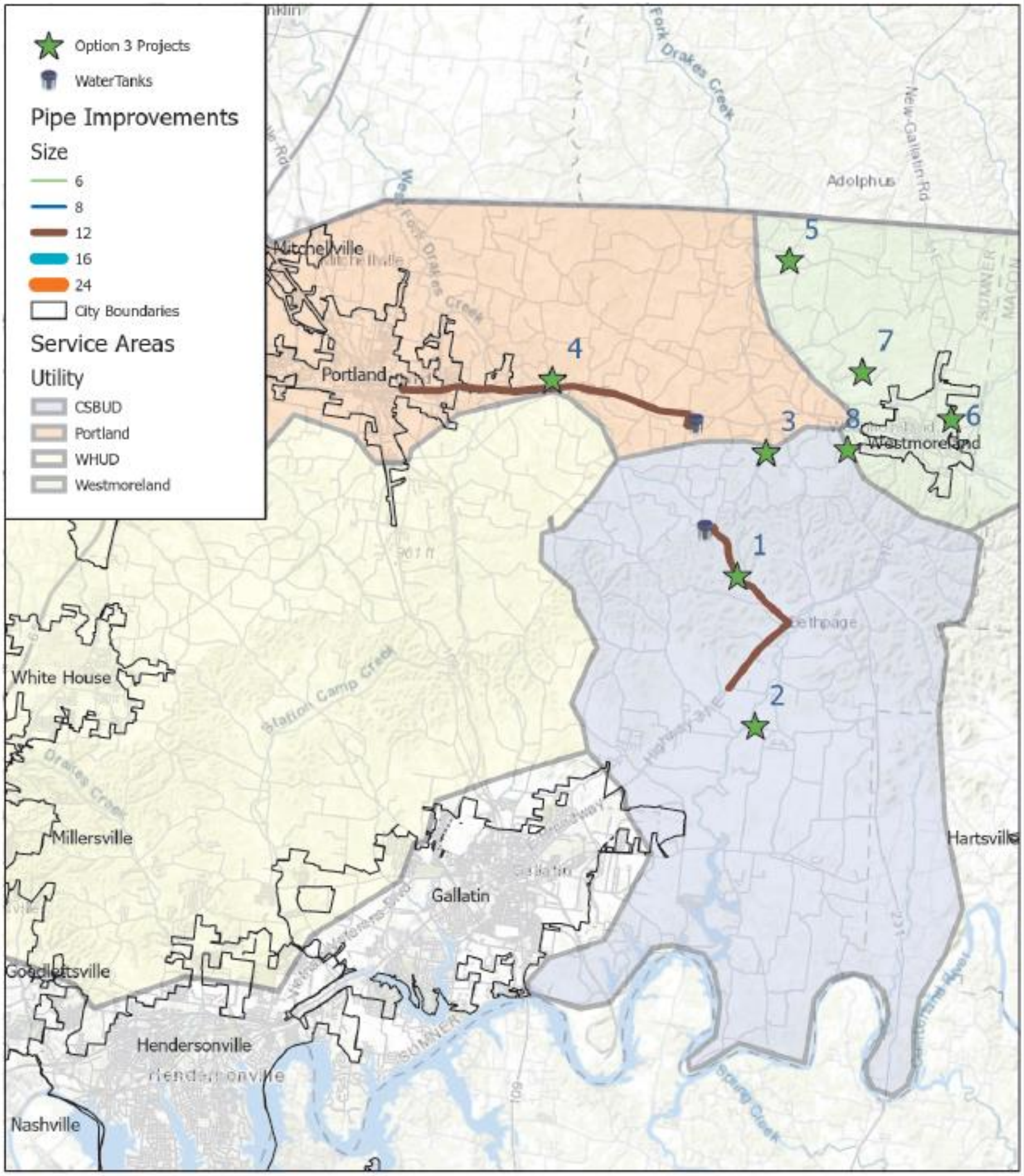
Flow Supplied by WHUD in Million Gallons per Day (MGD)

0 CSBUD
1 Portland
0 Westmoreland

Project	CSBUD - Supplied by Gallatin	OPC
1	TM, Water Tank, Booster Station	$ 3,600,000
2	Rogana Rd WL	$ 600,000
3	Reese Road WL	$ 300,000
	Total	**$ 4,500,000**
	Portland - 1 MGD supplied by WHUD	
4	Hwy 52 TM, Water Tank, Booster Station	$ 11,500,000
	Total	**$ 11,500,000**
	Westmoreland - Supplied by Gallatin	
5	Bill Henson WL	$ 195,000
6	Lake Westmoreland WL	$ 380,000
7	Bishop Trout WL	$ 90,000
8	Dewey Carr WL	$ 650,000
	Total	**$ 1,315,000**
	WHUD	
	Unknown projects	
	Total	**$ 12,685,000**

Regional Total		$ 30,000,000

TM=Transmission Main
WTP=Water Treatment Plant
WHUD=White House Utility District
CSBUD=Castalian Springs Bethpage Utility District



SUMNER COUNTY
TENNESSEE

American Recovery Plan
Regional Water Projects
Sumner County

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Coordinate System:

Map Published: October 7, 2021

OHM

Depreciation Schedule

Rate increase required per customer per month

	40-YR				50-YR			
Customer Count	5,300	7,920	1,400	39,000	5,300	7,920	1,400	39,000
Grant Amount	CSBUD	Portland	Westmoreland	WHUD	CSBUD	Portland	Westmoreland	WHUD
$ 1,000,000	$ 0.39	$ 0.26	$ 1.49	$ 0.05	$ 0.31	$ 0.21	$ 1.19	$ 0.04
$ 2,000,000	$ 0.79	$ 0.53	$ 2.98	$ 0.11	$ 0.63	$ 0.42	$ 2.38	$ 0.09
$ 3,000,000	$ 1.18	$ 0.79	$ 4.46	$ 0.16	$ 0.94	$ 0.63	$ 3.57	$ 0.13
$ 4,000,000	$ 1.57	$ 1.05	$ 5.95	$ 0.21	$ 1.26	$ 0.84	$ 4.76	$ 0.17
$ 5,000,000	$ 1.97	$ 1.32	$ 7.44	$ 0.27	$ 1.57	$ 1.05	$ 5.95	$ 0.21
$ 6,000,000	$ 2.36	$ 1.58	$ 8.93	$ 0.32	$ 1.89	$ 1.26	$ 7.14	$ 0.26
$ 7,000,000	$ 2.75	$ 1.84	$ 10.42	$ 0.37	$ 2.20	$ 1.47	$ 8.33	$ 0.30
$ 8,000,000	$ 3.14	$ 2.10	$ 11.90	$ 0.43	$ 2.52	$ 1.68	$ 9.52	$ 0.34
$ 9,000,000	$ 3.54	$ 2.37	$ 13.39	$ 0.48	$ 2.83	$ 1.89	$ 10.71	$ 0.38
$ 10,000,000	$ 3.93	$ 2.63	$ 14.88	$ 0.53	$ 3.14	$ 2.10	$ 11.90	$ 0.43
$ 11,000,000	$ 4.32	$ 2.89	$ 16.37	$ 0.59	$ 3.46	$ 2.31	$ 13.10	$ 0.47
$ 12,000,000	$ 4.72	$ 3.16	$ 17.86	$ 0.64	$ 3.77	$ 2.53	$ 14.29	$ 0.51
$ 13,000,000	$ 5.11	$ 3.42	$ 19.35	$ 0.69	$ 4.09	$ 2.74	$ 15.48	$ 0.56
$ 14,000,000	$ 5.50	$ 3.68	$ 20.83	$ 0.75	$ 4.40	$ 2.95	$ 16.67	$ 0.60
$ 15,000,000	$ 5.90	$ 3.95	$ 22.32	$ 0.80	$ 4.72	$ 3.16	$ 17.86	$ 0.64
$ 16,000,000	$ 6.29	$ 4.21	$ 23.81	$ 0.85	$ 5.03	$ 3.37	$ 19.05	$ 0.68
$ 17,000,000	$ 6.68	$ 4.47	$ 25.30	$ 0.91	$ 5.35	$ 3.58	$ 20.24	$ 0.73
$ 18,000,000	$ 7.08	$ 4.73	$ 26.79	$ 0.96	$ 5.66	$ 3.79	$ 21.43	$ 0.77
$ 19,000,000	$ 7.47	$ 5.00	$ 28.27	$ 1.01	$ 5.97	$ 4.00	$ 22.62	$ 0.81
$ 20,000,000	$ 7.86	$ 5.26	$ 29.76	$ 1.07	$ 6.29	$ 4.21	$ 23.81	$ 0.85
$ 21,000,000	$ 8.25	$ 5.52	$ 31.25	$ 1.12	$ 6.60	$ 4.42	$ 25.00	$ 0.90
$ 22,000,000	$ 8.65	$ 5.79	$ 32.74	$ 1.18	$ 6.92	$ 4.63	$ 26.19	$ 0.94
$ 23,000,000	$ 9.04	$ 6.05	$ 34.23	$ 1.23	$ 7.23	$ 4.84	$ 27.38	$ 0.98
$ 24,000,000	$ 9.43	$ 6.31	$ 35.71	$ 1.28	$ 7.55	$ 5.05	$ 28.57	$ 1.03
$ 25,000,000	$ 9.83	$ 6.58	$ 37.20	$ 1.34	$ 7.86	$ 5.26	$ 29.76	$ 1.07
$ 26,000,000	$ 10.22	$ 6.84	$ 38.69	$ 1.39	$ 8.18	$ 5.47	$ 30.95	$ 1.11
$ 27,000,000	$ 10.61	$ 7.10	$ 40.18	$ 1.44	$ 8.49	$ 5.68	$ 32.14	$ 1.15
$ 28,000,000	$ 11.01	$ 7.37	$ 41.67	$ 1.50	$ 8.81	$ 5.89	$ 33.33	$ 1.20
$ 29,000,000	$ 11.40	$ 7.63	$ 43.15	$ 1.55	$ 9.12	$ 6.10	$ 34.52	$ 1.24
$ 30,000,000	$ 11.79	$ 7.89	$ 44.64	$ 1.60	$ 9.43	$ 6.31	$ 35.71	$ 1.28

Capstone Project Summary Sheet

1. ***What benefits do you hope to achieve by engaging in this project?***
   Not only do I hope to have a comprehensive plan for our community, I am looking forward to expanding my knowledge of our current infrastructure, as I develop personal skills in working through this important Capstone Project.
2. ***How will you know if your project is successful?***
   Having a document formally adopted by the Council is the goal; but the research thus far has been instrumental in shaping the conversations with all stakeholders.
3. ***Was your project implemented?***
   Parts of this project are already underway as we wait for engineering reports. I have tried to avoid the all-or-nothing approach in an effort to remain flexible in this complex plan; and that has led to a new rate study, stream monitoring, and a focus on water loss.
4. ***Please state any cost savings or increased revenue that has occurred as a result of your project.***
   Saving potentially wasted dollars is one of the goals, seeing that our community knows what it means to spend millions on a project that failed. A reduction as small as ten percent in current water loss is estimated to produce about $98,000.00 per year; and with a yearly production of 800,000,000 gallons in treated drinking water, efficiency is a must. The city would also save $1.89 for every 1000 gallons of drinking water it produces instead of purchasing. For example: at a million gallons of increased capacity a day, the city would save $689,850.00 yearly. Removing a third of the stormwater flow each year from sewer collections, would save on energy cost and chemicals by not having to treat another 100,000,000 gallons of influent. And as more residential and commercial is developed due to available infrastructure, the city will benefit from increased revenue.
5. ***Was your project aligned with the Strategic Plan of your organization?***
   Yes. The City of Portland has been trying to solve its raw water needs for more than 50 years, and its waste water discharge problem for more than 20 years.

FINAL STATEMENT

In-direct and direct waste water reuse provides an environmentally friendly, cost effective, and proven alternative for supplying, and/or supplementing, a raw water supply while preserving capacity in both the water treatment plant, and in the waste water treatment discharge permit.
I encourage all communities to consider this conservation alternative.
~Mayor Mike Callis