



Johnson County Wastewater Integrated Management Plan Phase 1

September 2019



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ACRONYMS AND ABBREVIATIONS

ATF	Auxiliary Treatment Facility
BNR	Biological Nutrient Removal
BOCC	Board of County Commission
BOD	Biochemical Oxygen Demand
BUPP	Backup Prevention Program
CAMP	Collection System Asset Management Plan
CCTV	Closed Circuit Television
CIPP	Cured In Place Pipe
CWA	Clean Water Act
DO	Dissolved Oxygen
ENR	Enhanced Nutrient Removal
EPA	Environmental Protection Agency
FAMP	Facility Asset Management Program
FIB	Fecal Indicator Bacteria
FOG	Fats, Oils and Grease
IMF	Interlocal Metering Facility
IMP	Integrated Management Plan
JCW	Johnson County Wastewater
KDHE	Kansas Department of Health and Environment
LM	Lake Monitoring
LOT	Limits of Technology
MCDA	Multiple Criteria Decision Analysis
MCL	Maximum Contaminant Level
MGD	Million gallons per day
NCAC	New Century Air Center
NPDES	National Pollution Discharge Elimination System
OIG	Office of Inspector General
PEFTF	Peak Excess Flow Treatment Facility
PFAS	Polyfluoroalkyl Substances
POTW	Publically Owned Treatment Works
R&R	Repair and Replacement
RWQC	Recreational Water Quality Criteria

SC	Stream Chemistry
SSO	Sanitary Sewer Overflow
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
WLA	Wasteload Allocation
WWTF	Wastewater Treatment Facility

1 Executive Summary

Johnson County Wastewater (JCW) is responsible for providing sanitary sewer services for over 500,000 people in Johnson County, KS. To effectively provide these services, JCW must manage many assets and numerous facilities. They have made, and continue to make, significant investments to improve and maintain their systems. However, aging infrastructure needs, increasingly complex water quality issues, system-wide wet weather capacity concerns, and growing service demands will continue to require major capital investments that will impact JCW's financial and management resources.

To continue to provide cost effective and reliable service, protect environmental quality, and enhance the surrounding communities, JCW understands that future program improvements will need to be prioritized to address the most critical environmental and public health issues first, while allowing adequate time to gather the information needed to address longer term infrastructure needs. In 2012, the US Environmental Protection Agency (EPA) recognized that municipalities require more flexibility to balance long-term system improvements with environmental needs, and developed the *Integrated Municipal Stormwater and Wastewater Planning Approach Framework* (Framework) to support communities in their planning efforts. The Framework includes six elements that outline a planning process, while acknowledging that integrated plans should be appropriately customized to the size and needs of the community. In January 2019, EPA's Framework was codified into Section 402(s) of the Clean Water Act (CWA).

Johnson County Wastewater Mission Statement

Protecting our environment
Serving our customers
Enhancing our communities

EPA's Framework provides a useful approach for developing a long-term investment strategy that addresses system-wide infrastructure needs, improves water quality, and improves regulatory certainty over time. JCW initiated this Integrated Management Plan (IMP) effort with the goal of developing a prioritized and balanced infrastructure investment strategy that addresses CWA requirements and meets programmatic and capital wastewater needs across the service area over the next 25 years. JCW is developing the IMP in an adaptive manner that features multiple phases to address near-term compliance needs while allowing sufficient time to complete more detailed planning studies on additional potential facilities. For Phase 1, JCW followed EPA's Framework in a streamlined manner to identify an initial 25-year investment schedule that will inform near-term regulatory agreements and actions. During Phase 1 JCW also identified data gaps and detailed studies needed to more precisely forecast future projects and costs. In Phase 2, JCW will combine the results of the detailed planning studies with a more comprehensive assessment of community-wide priorities to revise the Phase 1 investment schedule. This report outlines the results of the Phase 1 IMP assessment.

The Phase 1 IMP is tailored to address the known, existing utility and regulatory drivers expected to demand resources over the coming years. From a utility management perspective, aging infrastructure, community growth and redevelopment, wet-weather management, and an increasing focus on the beneficial reuse of waste products will continue to drive system-wide investments.

Additionally, a number of significant regulatory requirements will necessitate major collection system and treatment facility upgrades that must be prioritized through the IMP process. These regulatory drivers include the minimization of wet-weather discharges, particularly in the watersheds served by the Nelson Complex; achievement of more stringent ammonia criteria that will require upgrades at the Nelson Complex Wastewater Treatment Facility (WWTF) and Mill Creek Regional WWTF; and ongoing or anticipated nutrient reduction requirements that impact JCW's other four Wastewater Treatment Facilities (WWTFs). Projects and solutions to address these regulatory needs will be prioritized in the IMP, and resulting implementation schedules will inform future NPDES permit compliance schedules and other regulatory implementation agreements. The IMP also identifies future regulatory issues that may evolve and potentially impact JCW as the IMP is implemented over time. For this reason, the IMP is structured so that it is specific enough to effectively schedule infrastructure improvements to address the known, existing drivers described above, but flexible and adaptive enough to effectively anticipate and respond to evolving issues and requirements as they arise.

JCW has identified many near and long-term programmatic and capital improvement projects that will be needed to address the aforementioned utility and regulatory drivers. Solutions include ongoing programs and projects, WWTF upgrades, WWTF and collection system repair and replacement (R&R), capacity enhancement and wet-weather improvements, system expansion, asset management, and ongoing planning and support efforts. Through this effort, JCW has identified approximately \$3 billion (in 2018 dollars) in potential projects and solutions to address all currently forecasted system-wide capital and programmatic needs. Through this planning process, JCW selected approximately \$2.1 billion in priority projects and program investments to be completed in the next 25 years. These solutions and their projected costs were developed based on the results of previous planning efforts combined with the current level of system understanding. For several of the projects, these are standard planning level estimates that will evolve over time as additional information becomes available to more adequately characterize the required investments. As a result, some of the estimates will need to be reevaluated as part of the IMP adaptive management process to inform Phase 2 plan development.

JCW evaluated all of the potential projects using a multiple criteria decision analysis (MCDA) tool. The MCDA tool was used to score the relative anticipated environmental and community benefits produced by each individual project. The MCDA scoring system was based on JCW's community-supported mission statement and specific, weighted evaluation criteria. This approach was validated during meetings with the Board of County Commissioners.

Final ranked benefit scores for the individual projects reflected the importance of the utility drivers facing JCW. Treatment facility upgrade projects to meet nutrient reduction requirements along with collection system and facility R&R projects were generally expected to produce the greatest benefits when evaluated against the sub-objectives, which reflects the severity of system-wide aging infrastructure demands. Capacity and expansion projects also tended to rank in the upper half of projects, in particular as a result of their positive impacts on water quality and human health. Resource recovery, waste acceptance, and wet weather projects generally produced medium to low benefits. See Figure 1-1 for the results of the MCDA.

WEIGHTED BENEFIT SCORES BY SUBCRITERIA

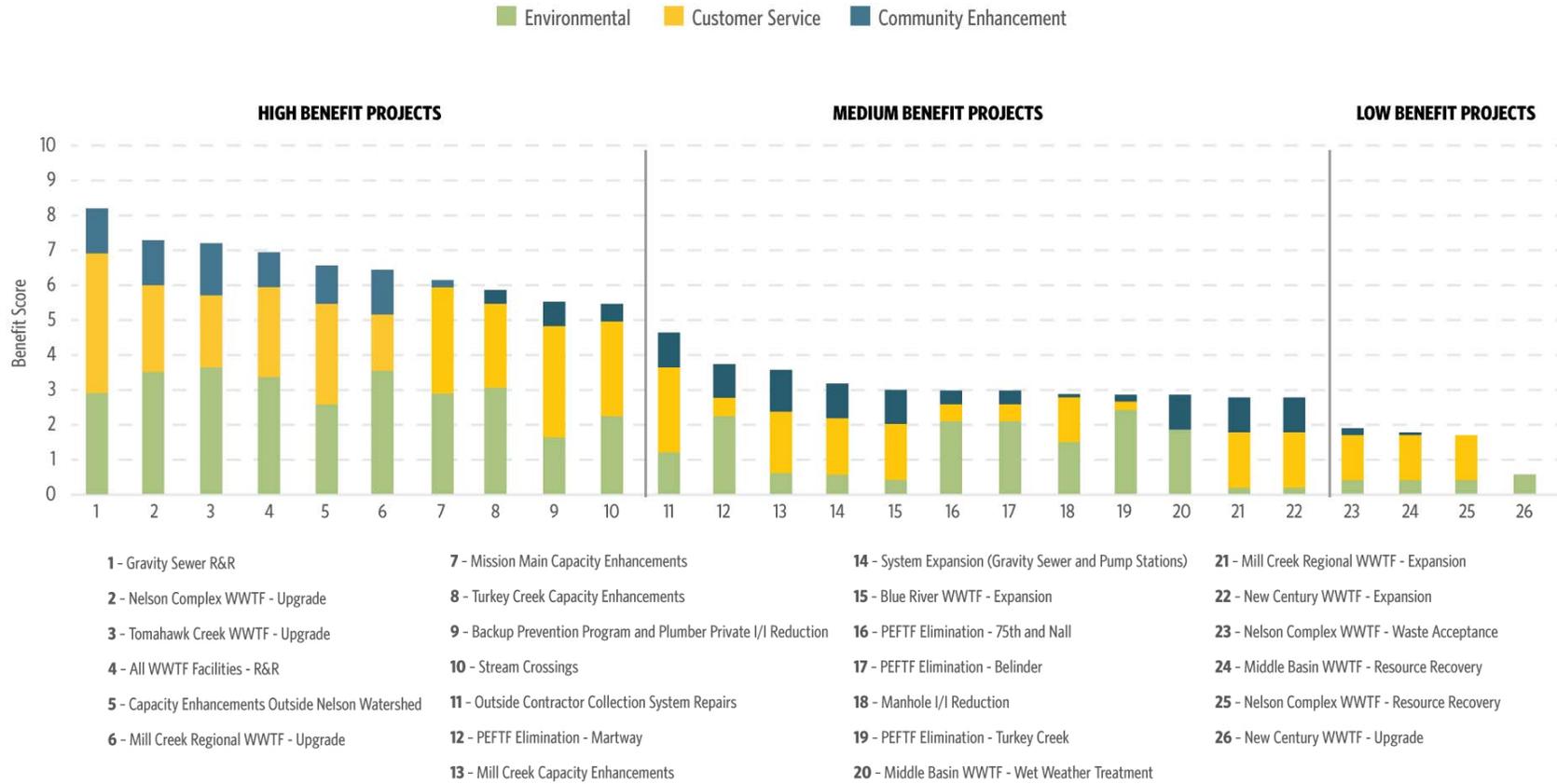
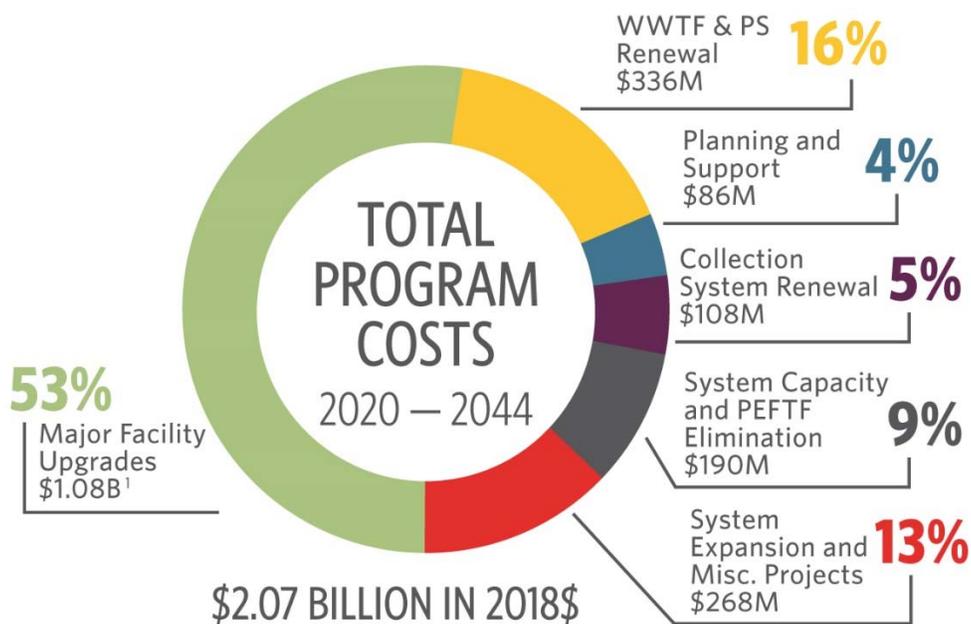


Figure 1-1: Final Phase 1 Benefit Scores for JCW IMP Wastewater Treatment and Collection Projects.

The MCDA evaluation was limited to evaluating the benefits of potential projects and did not assess the anticipated financial impacts, implementation complexities, or project interdependencies that must be considered when developing implementable schedules. To develop a final Phase 1 IMP project schedule, JCW's financial consultants evaluated the projected benefits with respect to overall costs using their existing internal financial model. Overall, results of the financial modeling suggest that approximately \$2.1 billion of the \$3 billion of identified needs can be funded and implemented over the next 25 years. This approach generally prioritizes the highest benefit projects within the first 10 years of the plan and defers the lower benefit projects to the end of the planning period. A majority (53%) of the 25-year program costs are related to major WWTF upgrades needed to meet existing or anticipated regulatory requirements or provide additional treatment capacity. These planned investments are dominated by large WWTF upgrade costs associated with the Nelson Complex WWTF (\$350 million), Tomahawk Creek WWTF (\$334 million), and Mill Creek WWTF upgrade (\$250 million). Collection system capacity, addressing peak excess flow treatment facilities (PEFTF) (Martway, Turkey Creek, and 75th and Nall facilities), and collection system renewal projects account for approximately \$300 million of the total program costs. The projected program costs for the Phase 1 Integrated Plan are shown below in Figure 1-2.



¹ Cost includes \$173 million expenditure for Tomahawk Creek WWTF prior to 2020.

Figure 1-2: Projected Program Costs for Phase 1 of the IMP Program

JCW developed a 25-year project schedule that addresses critical public health and environmental issues first, while appropriately balancing revenue requirements and ability to effectively and efficiently deliver these capital improvements. The implementation schedule is presented in Figure 1-3 on the following page.

Integrated Plan 25-Year Schedule

	CAPITAL COST (2018 \$ x Million)	YEARS 1 - 5 ¹ 2020 - 2024	YEARS 6 - 10 2025 - 2029	YEARS 11 - 15 2030 - 2034	YEARS 16 - 20 2035 - 2039	YEARS 21 - 25 2040 - 2044
Major Facility Upgrades						
Tomahawk WWTF Upgrade	\$334 ²					
Nelson Complex WWTF Upgrade	\$350					
Mill Creek WWTF Expansion and Upgrade	\$250					
Blue River WWTF Expansion	\$150					
Collection System Renewal with Public Sector I/I Reduction	\$108					
WWTF & PS Renewal						
PEFTF Interim Upgrades	\$6					
WWTF & PS Renewal	\$330					
System Capacity and PEFTF Elimination						
Turkey Creek Storage	\$24					
Brush Creek Storage	\$25					
Mill Creek Storage	\$25					
Collection System Upgrades	\$61					
I/I Reduction	\$18					
PEFTF Elimination - Martway	\$18					
PEFTF Elimination - Turkey Creek	\$19					
PEFTF Elimination - 75th and Nall	— ³					
PEFTF Elimination - Belinder	—					
Miscellaneous Projects/Expansion	\$268					
Planning and Support	\$86					
TOTAL	\$2.07 Billion					

¹ IMP schedules based on Mill Creek Regional and Nelson Complex WWTFs NPDES Permits and Consent Order issuance by December 31, 2019. Schedules will be extended accordingly if issuance is delayed.

² Cost includes \$173 million expenditure for Tomahawk Creek WWTF prior to 2020.

³ Addressed with Brush Creek Storage Project.

LEGEND	Major Facility Upgrades	WWTF & PS Renewal	Planning and Support	System Capacity and PEFTF Elimination	System Expansion and Misc. Projects	Collection System Renewal
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Figure 1-3: Phase 1 IMP Project Implementation Schedule

To implement early actions and gather additional information needed to direct informed capital improvement decisions, JCW will pursue a 5-Year IMP Action Plan focused on implementing near-term projects while pursuing additional planning studies to inform Phase 2 of the IMP. The 5-year Action Plan includes \$473 million of capital projects and planning studies that JCW intends to implement based on the Phase 1 planning results. Significant elements of the 5-Year Action Plan include the conclusion of the Tomahawk Creek WWTF expansion, design and start of construction of the Nelson Complex WWTF Upgrade, major collection system and facilities renewal efforts, capacity enhancement projects, and planning studies to gain a better understanding of project scope and costs for several major program components. All IMP schedules are based upon issuance of the renewed Mill Creek Regional and Nelson Complex WWTFs NPDES permits and entering into implementing the Consent Order with KDHE by December 31, 2019. If permit renewals and Consent Order execution are delayed beyond this date, then IMP implementation schedules will be extended to the same extent.

JCW intends to refine the Phase 1 estimates through Phase 2 integrated planning efforts which will incorporate additional studies and improved system understanding. JCW anticipates completing a draft of the Phase 2 IMP by December of 2021, with adoption of the Phase 2 program by December 2022. This planned schedule is dependent on successful study completion for incorporation into the Phase 2 IMP. Following the Phase 2 update, JCW will reevaluate and update the IMP at least every five years based on changing regulatory drivers, greater system understanding, lessons learned from program and project implementation, and updated benefit evaluations. Further, JCW will provide the Kansas Department of Health and Environment with annual progress reports.

2 Introduction

Johnson County Wastewater (JCW) is the utility responsible for providing sanitary sewer services for over 500,000 people in Johnson County, KS. To effectively provide these services, JCW must manage a significant number of assets. Collectively, JCW owns and operates six major wastewater treatment facilities (WWTFs) and 31 pump stations. JCW also manages and maintains more than 2,300 miles of gravity sanitary sewer lines, 58,000 manholes, 23 miles of low-pressure sewers, and 42 miles of forcemains (Figure 2-1).

JCW is committed to providing effective and affordable wastewater services that protect public health and the environment, meeting customer expectations, and facilitating long-term community planning efforts. To this end, JCW has made considerable investments to continually improve these assets. These investments include upgrading wastewater treatment capabilities, optimizing collection system maintenance and renewal efforts, implementing wet weather management strategies, and improving pumping facility performance.

Notwithstanding these significant efforts, JCW continues to face aging infrastructure needs, increasingly complex water quality issues, system-wide wet weather capacity concerns, and growing service demands. In particular, there are a number of current and future Clean Water Act (CWA) regulatory drivers that will require major capital investments and impact JCW's financial and management resources. JCW is concerned that potentially overlapping compliance timelines for multiple federal and state regulatory drivers will limit their ability to efficiently manage resources and make system improvements going forward.

In 2011, the US Environmental Protection Agency (EPA) recognized that when afforded the flexibility to balance wastewater and stormwater improvements, municipalities can more efficiently use their resources to make important, cost-effective environmental improvements that align with community priorities¹. To support communities in these efforts, EPA released the *Integrated Municipal Stormwater and Wastewater Planning Approach Framework*² (Framework). In January 2019, EPA's Framework was codified into law with the adoption of the Water Infrastructure Improvement Act of 2018.

EPA's Framework outlines a process that allows municipalities to meet human health and water quality objectives by using existing CWA flexibilities to appropriately prioritize and schedule wastewater and stormwater improvements according to a community's needs and financial capability. It also makes it clear that local governments may pursue integrated planning to prioritize wastewater and stormwater compliance obligations, as well as water reuse, water recycling, green infrastructure, and other innovative projects, over a long-term planning period.

¹ Stoner, N. and C. Giles. 2011. Achieving Water Quality through Integrated Municipal Stormwater and Wastewater Plans. October 27, 2011. Washington DC.

² Stoner, N. and C. Giles. 2012. Integrated Municipal Stormwater and Wastewater Planning Approach Framework. June 5, 2012. Washington DC.

In their Framework, EPA recognizes that integrated plans should be appropriately tailored to the size of the municipality and scope of the issues, but the Agency anticipates that integrated plans will address the following six planning elements:

- Element 1 – A description of the water quality, human health and regulatory issues to be addressed.
- Element 2 – A description of existing wastewater and stormwater systems under consideration and summary information describing the systems' current performance.
- Element 3 – A process which opens and maintains channels of communication with relevant community stakeholders in order to give full consideration of the views of others in the planning process and during implementation of the plan.
- Element 4 – A process for identifying, evaluating, and selecting alternatives and proposing implementation schedules.
- Element 5 – A process for evaluating the performance of projects identified in a plan.
- Element 6 – An adaptive management process for making improvements to the plan.

JCW recognizes that through the integrated planning process, they can better prioritize affordable and protective solutions to resolve the most critical environmental and public health issues first, while allowing adequate time to gather the information needed for thoughtful infrastructure planning. With this approach, the utility can effectively provide reliable and sustainable wastewater networks with the capacity to support the entire service area into the future. JCW developed this system-wide Integrated Management Plan (IMP) to create a prioritized and balanced infrastructure investment strategy that addresses CWA requirements and meets programmatic and capital wastewater needs across JCW's service area over the next 25 years.

JCW is developing the IMP in multiple phases to address existing compliance needs and allow sufficient time to complete more detailed planning studies on specific facilities. Phase 1 identified an initial 25-year investment schedule that will inform near-term regulatory agreements and actions. To develop the Phase 1 schedule, JCW followed the EPA's integrated planning Framework in a streamlined manner using known, near-term capital improvement projects and program expenditures and planning level estimates of future projects and costs. These planning level estimates were based on current understanding of system-wide service and regulatory needs. Phase 1 also identified the data gaps and detailed studies needed to more precisely forecast future project costs.

In Phase 2, JCW will combine the results of the detailed planning studies with a more comprehensive assessment of community-wide priorities to revise the Phase 1 investment schedule. JCW anticipates completing a draft of the Phase 2 IMP by December of 2021, with the Phase 2 IMP finalized by December of 2022, depending on successful study completion for incorporation into the Phase 2 IMP. Following Phase 2, the IMP will be updated at least every five years to address various dynamics including changes in community priorities, regulatory initiatives, economic conditions, technological developments, and system understanding. This adaptive management approach provides the opportunity for the reprioritization of projects and programs through informed decision-making to yield a dynamic and living long-range plan.

This report documents the results of the Phase 1 IMP evaluation. The sections and corresponding link to EPA's six Framework elements are as follows:

- **Section 3 – Utility Drivers** highlights the major infrastructure concerns that JCW is addressing through the IMP. This section addresses Element 1 of EPA's Framework.

- **Section 4 – Regulatory Drivers and Regional Water Quality** identifies the CWA regulatory drivers that will drive compliance obligations. This section addresses Element 1 and Element 2 of EPA's Framework.
- **Section 5 – Program Needs and Solutions** provides a broad review of the performance and condition of specific wastewater assets. It also outlines planning level projects and associated costs to address currently-forecasted needs. This section addresses Element 2 and Element 4 of EPA's Framework.
- **Section 6 – Community Engagement** describes the streamlined process used to identify community priorities for Phase 1. This section directly addresses Element 3 of EPA's Framework.
- **Section 7 – Project and Program Prioritization and Scheduling** outlines the multiple criteria decision analysis (MCDA) process used to assess the alternatives described in Section 5 with the community priorities identified in Section 6. This section addresses Element 4 of EPA's Framework.
- **Section 8 – Adaptive Management and 5-Year Action Plan** summarizes the adaptive management, performance reporting, additional studies, and near-term capital projects JCW will pursue to implement the IMP and evaluate progress. This section addresses Elements 5 and 6 of EPA's Framework.

3 Utility Drivers

The first step of EPA’s Framework includes identifying the water quality, human health, and regulatory issues that will be addressed by the plan. JCW has identified a number of utility and regulatory-related issues that will drive future system-wide investments aimed at improving overall system performance and CWA compliance. A broad overview of JCW’s utility drivers are discussed in this section. Regulatory drivers are addressed in Section 4. It is important to note that JCW has identified these issues based on their current system understanding, which may evolve as additional information is developed during future phases of the IMP.

3.1 Aging Infrastructure

The first sewers were installed in the northeastern portion of JCW’s service area in the 1940s. At that time, construction materials consisted primarily of clay pipe and brick manholes, both of which are subject to damage by expansive clay soils and tree roots. Over time, the service area expanded to the South and West, and new materials came into use such as reinforced concrete and plastic pipe and precast concrete manholes. In some areas, JCW took ownership of systems installed by others such as private developers that were not constructed to the same quality standards as JCW employed. JCW also took ownership of areas that were originally operated by individual cities and constructed to the cities’ standards. As a result of this evolution, JCW’s system exhibits a wide geographic variance in age and serviceability (Appendix A, Figure A.1), and the ongoing investment required to address aging assets and maintain JCW’s level of service will be significant (Figure 3-1). While these figures indicate age and physical life of gravity sewer infrastructure, the same holds true for the associated treatment and pumping facilities.

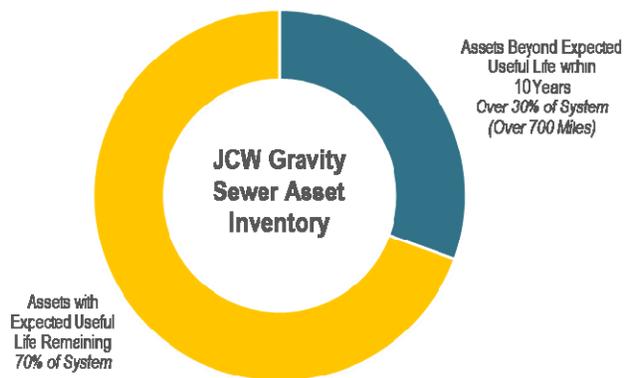


Figure 3-1: System-Wide Aging Gravity Assets

Similarly, JCW’s wastewater treatment and pumping facilities have evolved since the 1940s. While some treatment facilities have been upgraded to employ state-of-the-art technologies, others still employ obsolete technologies that not only struggle to meet current water quality requirements, but in some cases are inefficient to operate or require frequent repairs to remain in service. JCW has kept some facilities and components operable well beyond their design life. However, the annual investment required to maintain and operate antiquated systems through repair and replacement (R&R) projects continues to grow.

3.2 Community Growth and Redevelopment

The service areas of three of JCW’s six WWTFs are essentially fully developed, at current density levels. Most of the growth areas now lie in the southern and western portions of the service area (Figure 2-1). JCW must continue system expansion efforts to ensure that responsible and sustainable wastewater management services are provided as community growth occurs. These system expansion efforts include extending new sewer lines, upsizing existing sewer lines, and

expanding WWTFs to manage the additional flows. Redevelopment within existing built out areas has also resulted in the need for added capacity and upsizing, and will likely continue into the future.

3.3 Wet Weather Management

Over the years, JCW has become known as an industry leader in collection system management and performance due to their demonstrated success in reducing the frequency and impact of issues caused by wet weather events. Historical efforts have included a highly successful cleaning program implemented in the 1980's, a private inflow and infiltration (I/I) reduction program that resulted in the disconnection of thousands of I/I sources, and a backup prevention program that greatly reduced the risk of backups for many homeowners in older portions of the system. In recent years these foundational efforts have evolved into an industry leading asset management program focused on continuous improvement in JCW's collection system management strategies and a capacity enhancement program that incorporates cutting edge technologies to determine the optimum plan for addressing capacity enhancement needs.

Despite these efforts, wet weather management challenges remain in the older portions of the collection system. The systems within the Nelson Complex, Tomahawk Creek and Leawood service areas exhibit high rates of I/I that may result in flows exceeding the capacity of the collection system during major wet weather events. The Mill Creek basin currently meets JCW's level of service; however continued growth within this basin may require improvements to maintain this level of service. In the Nelson Complex collection system, Peak Excess Flow Treatment Facilities (PEFTFs) are utilized to relieve capacity restrictions by treating and discharging directly to adjacent waterways. The systems downstream were designed based on continued usage of the PEFTFs and lack the capacity to convey the additional flows currently discharged through the PEFTFs.

3.4 Resource Recovery and Waste Acceptance

JCW has increasingly focused on identifying opportunities to beneficially reuse waste byproducts to reduce overall environmental impacts, reduce operating costs, and more efficiently use resources. JCW currently land applies biosolids from two of its facilities, Middle Basin and Mill Creek. Land application of digested biosolids provides an agricultural benefit through return of nutrients to the soil. Digestion and land application are also planned for Tomahawk Creek once that facility, currently under construction, comes on line. Biosolids from Blue River and New Century are currently hauled to Nelson, and then taken along with the Nelson biosolids to disposal at the landfill. The feasibility of continued landfilling in the future is questionable due to public concerns about odors believed to be associated with the landfilled biosolids, as well as the limited hours when hauling may take place which is burdensome to plant operations. A project is currently under design to convert Nelson to digestion and land application.

JCW's Middle Basin facility has a Fats, Oils, and Grease (FOG) Waste Receiving Facility. This benefits local FOG waste haulers and area industries by providing a disposal option. The Middle Basin digesters do not have the capacity to accept all area FOG plus the local industries, and JCW is contemplating adding a FOG Waste Receiving Facility at Nelson as part of a future project.

Another benefit of FOG receiving is its high heating value and resulting large quantity of methane produced as a byproduct of the digestion process. This has allowed JCW to implement cogeneration at Middle Basin. By operating the engine generators off of digester gas, JCW is able

to offset a significant portion of its plant electrical load. Although cogeneration is not currently planned for either Tomahawk Creek or Nelson, provisions are being made in the design so that it could be added in the future.

4 Regulatory Drivers and Regional Water Quality Issues

In addition to the utility drivers outlined in Section 3, there are a number of impactful regulatory and water quality issues that will drive future improvements across the service area. An overview of these drivers is presented in this section. It is important to note that the items discussed in this section and incorporated into Phase 1 of the IMP were identified based on JCW's current understanding of the magnitude and timing of known regulatory drivers. During future phases of the IMP, it may be necessary to reprioritize projects and implementation schedules based on new or changing regulations as they are developed and implemented at the state or federal level.

4.1 Permits

Understanding the National Pollutant Discharge Elimination System (NPDES) permit renewal schedules is important because it provides insight into the potential timing and impacts of future regulatory drivers and compliance requirements. JCW owns and operates six WWTFs and the collection systems that convey wastewater flows to these facilities. These facilities and current NPDES renewal schedules are summarized below.

- **Blue River Main Sewer District No. 1 (Federal Permit Number: KS0092738)** – The Blue River Main WWTF discharges to Negro Creek, a tributary of the Blue River. The plant is a biological nutrient removal activated sludge system with a design average flow of 10.5 MGD. The existing permit was issued in October 2017 and expires in September 2022. In addition to conventional pollutant limits, the permit includes annual average nutrient goals of 10 mg/L total nitrogen (TN) and 1.0 mg/L total phosphorus (TP).
- **Douglas L. Smith Middle Basin Wastewater Treatment Plant (WWTP) (Federal Permit Number: KS0119601)** – The Middle Basin WWTF discharges to Indian Creek approximately 5 miles upstream from Tomahawk Creek WWTF. The Middle Basin WWTF is a biological nutrient removal activated sludge system with a design average flow of 14.5 MGD. The existing permit was issued in March 2017 and expires in February 2022. During the last permit renewal, the WWTF's discrete wet weather discharge was removed as a permitted outfall. In addition to conventional pollutant limits, the permit includes an annual average nitrate limit of 10 mg/L and annual average nutrient goals of 8 mg/L for TN and 1.5 mg/L for TP.
- **Mill Creek Regional WWTF (Federal Permit Number: KS0088269)** – The Mill Creek Regional WWTF discharges directly to the Kansas River. The facility is an activated sludge system operated in parallel with a five cell aerated lagoon with a combined design average flow of 18.75 MGD. The existing permit was issued in January 2014 with an expiration date of December 31, 2018. The permit has been administratively extended and remains in effect until superceded by the next permit renewal. In addition to conventional pollutant limits, the permit includes annual average nutrient goals of 10 mg/L for TN and 1.0 mg/L for TP (alternatively TN = 8 mg/L and TP = 1.5 mg/L) from the activated sludge system. Extensive treatment upgrades are required to meet State discharge requirements including ammonia, nitrogen, and phosphorus removal.

- Nelson Complex WWTP (Federal Permit Number: KS0055492)** – The Nelson Complex WWTF consists of separate treatment trains servicing two main tributary sewersheds with a combined design average flow of 15 MGD. The sewersheds were originally serviced by two separated WWTFs, but have since been consolidated into a single facility with two distinct process trains that share dechlorination and solids facilities and a single permitted outfall that discharges to Turkey Creek. The existing permit expired on September 30, 2006, but due to objections from EPA the permit has been administratively extended and remains in effect until superseded by the next permit renewal. Extensive treatment upgrades are required to meet anticipated effluent discharge requirements including ammonia, nitrogen, and phosphorus removal. Capacity improvements are also required to address four PEFTFs within the facility’s collection system.
- New Century WWTF (Federal Permit Number: KS0119296)** – The New Century WWTF discharges to Little Bull Creek, which is tributary to Hillsdale Lake. The existing permit was issued in April 2015 and expires in October 2019. The plant is a biological nutrient removal activated sludge system with a design average flow of 1.65 MGD. However, JCW anticipates expanding the facility to 1.91 MGD in the future as flow and loads increase to provide for future growth in the tributary basin. In addition to conventional pollutant limits, the existing permit includes an annual average TN target of 8.0 mg/L and 127.6 pounds per day as goals. The existing permit also includes an annual average TP target of 0.5 mg/L as a goal and 8.0 pounds per day as a limit. During the next permit cycle, JCW anticipates that the current TN loading goal will become a limit. Reduced ammonia limits are also anticipated during the next permit cycle to address revised criteria for ammonia aquatic life criteria adopted by the Kansas Department of Health and the Environment (KDHE).
- Tomahawk Creek WWTF (Federal Permit Number: KS0100854)** – The Tomahawk Creek WWTF discharges to Indian Creek downstream from its confluence with Tomahawk Creek. The existing permit was issued in May 2016 and expires in April 2021. The permit includes goals of meeting 10 mg/L for TN and 0.5 mg/L for TP, as well as TP limits intended to meet the future Indian Creek total maximum daily load (TMDL) requirements (Section 4.2.3). The permit reflects conditions of a Consent Order signed April 26, 2016, that requires facility upgrade and expansion activities that will add nutrient controls and increase design average flow from 10 MGD to 19 MGD.

4.2 Existing Regulatory Drivers

There are several known, existing regulatory issues that will drive significant upgrades to JCW’s collection and treatment facilities and must be considered as projects and programs are prioritized through the IMP process. These include specific wet weather management concerns at the Nelson Complex WWTF, revised ammonia criteria, regional water quality impairments, and continued implementation of KDHE’s statewide Nutrient Reduction Plan. A review of these existing drivers is included below.

4.2.1 Wet Weather Discharges

As described in Section 4.1, EPA has objected to the latest draft Nelson Complex WWTF permit in part because it includes PEFTFs, which are listed as Outfalls 002, 003, 004, and 005. In order to satisfy the objection and obtain a final permit that will provide regulatory and investment certainty,

JCW is working to identify the optimal schedule for addressing the PEFTF discharges with respect to other system-wide needs and community priorities through the IMP process.

To support the identification and prioritization of PEFTF solutions, JCW recently evaluated wet weather water quality impacts from the Nelson Complex and its collection system using a watershed model. The study found that elevated levels of total residual chlorine and bacteria from some PEFTF discharges impact receiving waters, but may be mitigated through operational changes and facility improvements. Other wet weather discharges such as sanitary sewer overflows (SSO) may represent a significant source of bacteria loading during excessive wet weather events but are relatively infrequent and have little impact on the instream recreational season geometric mean concentrations. However, mitigation of these sources are considered higher priority than addressing PEFTFs. The study also found that ammonia toxicity and nutrient impacts from the Nelson Complex WWTF likely represents a higher priority water quality issue than wet weather discharges in the collection system.

The Tomahawk Creek WWTF and Leawood service areas also have wet weather capacity limitations that result in infrequent SSOs during major wet weather events. Addressing these unpermitted discharges also present additional regulatory obligations that JCW accounts for within the IMP. All of these water quality and regulatory issues were considered during project rating and prioritization efforts described in Section 7.

4.2.2 State Ammonia Criteria Updates

In 2013, EPA finalized new water quality criteria recommendations for ammonia. The updated criteria recommendations were based on new toxicity data which demonstrate that some organisms, particularly some species of gill-breathing snails and freshwater mussels, are more sensitive to ammonia than other organisms in the national toxicity dataset used in previous criteria recommendations. On April 11, 2018, the Kansas Department of Health and Environment (KDHE) adopted the revised criteria into the state water quality standards. As the revised ammonia criteria are implemented in upcoming permit renewals, ammonia limits will become more restrictive for JCW's facilities. These more restrictive requirements will have an impact on all plant operations and require major capital improvements at the Nelson Complex and Mill Creek WWTFs.

4.2.3 Impairments and Total Maximum Daily Loads

KDHE is required per Section 303(d) of the Clean Water Act (CWA) to identify waterbodies that do not meet water quality standards. Waterbodies that do not attain water quality standards are placed on the state's 303(d) List of impaired waters. KDHE's biennial 303(d) List categorizes impairment status for three types of waterbodies:

- Watershed – Impairment applies to the stream watershed monitored at the KDHE stream chemistry (SC) monitoring station indicated;
- Lake – Impairment applies to a lake waterbody as monitored at the KDHE lake monitoring (LM) station indicated; and
- Facility – Impairment has been linked to a NPDES permitted facility.

All three types of impairments occur within Johnson County (Figure 4-1, Appendix B.1, Appendix B.2).

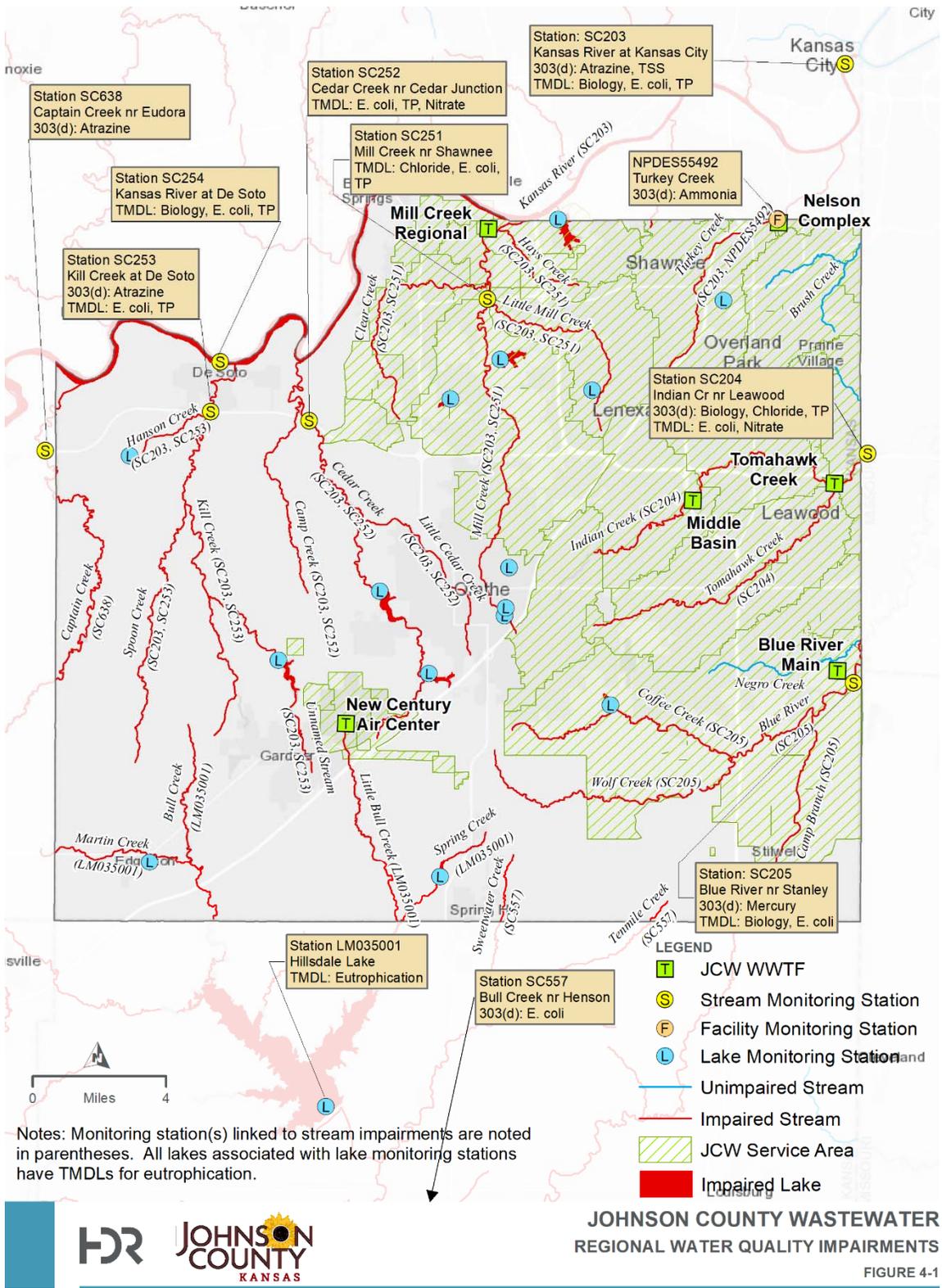


Figure 4-1: Regional Water Quality Impairments.

KDHE develops total maximum daily loads (TMDL) for impaired waters. A TMDL is a study that allocates pollutant loads to point and nonpoint sources with the goal of restoring water quality and maintaining acceptable pollutant levels that protect beneficial uses. Point source allocations, also known as wasteload allocations (WLAs), are implemented through NPDES permits. Nonpoint source allocations, also known as load allocations, are implemented through a combination of federal, state, and local programs which include regulatory requirements and voluntary efforts.

Table 4-1: Existing and Anticipated Total Maximum Daily Load Requirements Applicable to JCW's WWTFs.

Total Maximum Daily Load	Parameter	Units	Blue River Main WWTF	Middle Basin WWTP	Mill Creek Regional WWTF	Nelson Complex WWTF	New Century Air Center WWTF	Tomahawk Creek WWTF
Lower Kansas River (Biology), 2000	BOD ₅	mg/L			30	30		
Lower Kansas River (Phosphorus), 2017	TP (Phase I)*	mg/L			1.0	1.0		
		lbs/d			156.6	125.3		
	TP (Phase II)*	mg/L			0.5	0.5		
Lower Kansas River (Bacteria), 2008	Bacteria†				†	†		
Indian Creek (Nitrate), 2007	Nitrate	mg/L		10				10
Indian Creek (Bacteria), 2001	Bacteria†			†				†
Hillsdale Lake (Eutrophication), 2014	TP	mg/L					0.5	
		lbs/d					8	
	TN	mg/L					8	
		lbs/d					127.6	
Indian Creek (Phosphorus)	TP			‡			‡	
Turkey Creek (Ammonia)	Ammonia					‡		

*Phase I (2019-2039); Phase II (commences in 2040 if necessary).

†Value not explicitly specified in TMDL. TMDL requires that permits be conditioned such that discharges from the permitted facility do not cause violations of applicable bacteria criteria.

‡TMDL not yet completed. Values pending completion of TMDL or permit in-lieu of TMDL.

Existing and anticipated TMDL requirements that are applicable to JCW's WWTFs are summarized in Table 4-1. The individual TMDLs that drive those requirements are briefly summarized below.

- Lower Kansas River TMDL (Biology: Nutrient and Oxygen Demand Impact on Aquatic Life)** – This TMDL was approved by EPA in 2000 and addresses the Nelson Complex WWTF and Mill Creek Regional WWTF. The TMDL WLA is defined as “a reduction of [5-day biochemical oxygen demand (BOD)] loadings from point sources such that monthly average BOD concentrations are maintained below 30 mg/L, leading to instream concentrations of [dissolved oxygen (DO)] remaining above 5 mg/L at flows below 750 cfs.” WLAs were not assigned for nutrients.
- Lower Kansas River TMDL (Total Phosphorus)** - This TMDL was approved by EPA in 2017 and addresses the Nelson Complex and Mill Creek Regional WWTFs. The TMDL established a two phased approach for reducing phosphorus loadings and concentrations. Phase I targets an instream TP concentration of 0.200 mg/L with a TP WLA of 1.0 mg/L for mechanical treatment plants. Once the Kansas River approaches target concentrations, an intensive assessment of macroinvertebrate abundance and diversity will be made to determine compliance with the narrative nutrient criteria. Should biological endpoints fail to demonstrate achievement, Phase II will commence with a target instream concentration of

0.18 mg/L and a TP WLA of 0.5 mg/L. Phase I of this TMDL will occur from 2019 through 2039. If Phase II is necessary, implementation will commence in 2040.

- **Lower Kansas River TMDL (Bacteria)** – The revised version of this TMDL was approved by EPA in 2008 and addresses the Nelson Complex WWTF and Mill Creek Regional WWTF. The TMDL WLAs were set at bacteria limits applicable at the time the TMDL was developed. At that time, the Nelson Complex WWTF had fecal coliform limits of 200 cfu/100 mL year round. The Mill Creek Regional WWTF, which was provided a mixing zone, had fecal coliform limits of 1,316 cfu/100 mL during April through October and 2,468 cfu/100 mL during November through March. Since this time, KDHE has been converting historic fecal coliform limits into *E. coli* limits during permit renewal periods.
- **Indian Creek TMDL (Nitrate)** – This TMDL was approved by EPA in 2007 and addresses the Middle Basin and Tomahawk Creek WWTFs. The TMDL WLAs were established as the product of their anticipated design flow and a nitrate target concentration of 8 mg/L. However, KDHE currently implements this WLA as a 10 mg/L nitrate concentration limit expressed as an annual rolling average.
- **Indian Creek TMDL (Bacteria)** - This TMDL was approved by EPA in 2001 and addresses the Middle Basin and Tomahawk Creek WWTFs. The TMDL did not provide an explicit WLA, but specifies that any future NPDES and state permits will be conditioned such that discharges from permitted facility will not cause violations of the applicable fecal coliform criteria during flow conditions below 24 cfs. KDHE has since replaced the historic fecal coliform criteria with *E. coli* criteria.
- **Hillsdale Lake TMDL (Eutrophication)** – This TMDL was approved by EPA in 2014 and addresses the New Century WWTF. The TMDL applies nutrient WLA values to the New Century WWTF based on its anticipated future design average flow of 1.91 MGD. The TMDL WLA for TP is 8.00 pounds per day based on a TP concentration of 0.5 mg/L. The TMDL WLA for TN is 127.60 pounds per day based on a TN concentration of 8 mg/L.

In addition to the completed TMDLs discussed above, the following future TMDLs are expected to impact JCW's facilities.

- **Indian Creek Impairment (Phosphorus)** – According to the 2018 303(d) list, the TMDL for this impairment is currently scheduled for development in 2023. A use attainment evaluation is planned prior to TMDL development to account for the improved effluent quality that will be achieved by the new Tomahawk Creek WWTF. It is anticipated that the Indian Creek phosphorus TMDL, if needed, will include TP WLAs for Middle Basin and Tomahawk Creek WWTFs.
- **Turkey Creek Impairment (Ammonia)** - The Turkey Creek ammonia TMDL is currently prioritized for development in 2022, which will likely include an ammonia WLA for the Nelson Complex WWTF. However, KDHE could delay TMDL development or address the impairment through the NPDES permit based upon the anticipated facility improvements that are planned to address this impairment.

4.2.4 Nutrient Reduction Strategy

In addition to developing nutrient TMDLs, KDHE has been pursuing a statewide Nutrient Reduction Plan since 2004. The plan targeted a 30 percent reduction in nitrogen and phosphorus throughout the state by emphasizing actions that reduce nutrients over the development of nutrient criteria (KDHE 2004). The plan requires nutrient removal at all new treatment plants and upgrades to major facilities to achieve reductions of nitrogen and phosphorus. To support the Nutrient Reduction Plan, KDHE requires major facilities to assess the feasibility of meeting a range of nutrient goals as NPDES permits are renewed. The range is typified by the following three levels of nutrient removal technology:

- Biological Nutrient Removal (BNR): TN = 8 mg/L and TP = 1.5 mg/L (Alternatively, TN = 10 mg/L and TP = 1.0 mg/L);
- Enhanced Nutrient Removal (ENR): TN = 5 mg/L and TP = 0.5 mg/L; and
- Limits of Technology (LOT): TN = 3 mg/L and TP = 0.3 mg/L.

Currently, the Nelson Complex WWTF is the only JCW facility that does not include Kansas Nutrient Reduction Plan goals in the NPDES permit. However, goals (and limits to meet the Kansas River TMDL requirements) will likely be included in the next permit.

4.3 Evolving Regulatory Drivers

Future regulatory issues with potential to impact JCW will continue to develop and evolve as the IMP is implemented over time. For this reason, it is important that the IMP be specific enough to effectively schedule infrastructure improvements to address the known, existing drivers described above, but flexible and adaptive enough to effectively respond to new issues as they arise. Potential regulatory drivers with the potential to impact future IMP planning efforts are discussed below. The status of these drivers will be reevaluated during Phase 2.

4.3.1 Federal 304(a) Water Quality Criteria

Recent and potential future federal recommendations for Section 304(a) criteria could trigger revisions to Kansas Surface Water Quality Standards during upcoming triennial reviews. EPA periodically publishes and revises scientific guidance for water quality criteria to accurately reflect the latest scientific knowledge. Although EPA's 304(a) criteria recommendations do not impose legally binding requirements, EPA recommends that states consider the Agency's guidance when developing criteria. Recent updates to EPA's Section 304(a) criteria are shown below.

- New federal recommended Section 304(a) criteria for the protection of human health – In 2015, EPA updated water quality criteria intended to protect public health from 94 chemical pollutants. KDHE has indicated that they intend to adopt the new criteria in an upcoming rulemaking.
- New federal recommended Section 304(a) criteria for the protection of aquatic life - EPA has recently updated a number of aquatic life criteria recommendations including: aluminum, bacteria/pathogens, cyanide and hydrogen sulfide, sulfate and chloride, selenium, iron, and by petition chronic cadmium and lead.

In addition to recent updates, EPA is also working on revisions to other 304(a) criteria including the following:

- Recreational Water Quality Criteria (WRQC) for coliphages – Coliphages are viruses that infect *E. coli* and are considered a promising alternative to traditional fecal indicator bacteria (FIB) for predicting gastrointestinal illnesses. Treatment efficiency can significantly differ between FIB and coliphages depending on the treatment process. Further study and evaluation will be required to determine appropriate treatment processes if coliphages are adopted for RWQC.
- Human health recreational criteria and/or swimming advisories for cyanotoxins, microcystins and cylindrospermopsin – Cyanotoxins, such as microcystins or cylindrospermopsin, are produced by cyanobacteria and are typically associated with harmful algal blooms.

If EPA 304(a) criteria are adopted by KDHE, additional study would be required to determine necessary improvements on JCW's existing infrastructure design and treatment processes.

4.3.2 Biosolids Management

The CWA Amendments of 1987 required the EPA to develop new regulations pertaining to sewage sludge and biosolids. Biosolids are regulated in 40 CFR Part 503 (Part 503) published by EPA in 1993. The Part 503 regulation is a complex, risk-based assessment of potential environmental effects of pollutants that may be present in biosolids. These guidelines regulate pollutant and pathogen concentrations as well as vector attraction reduction. The guideline defines biosolids as Class A or Class B, depending on the potential level of pathogens. Biosolids in both classes must meet established vector attraction reduction and pollutant concentration requirements.

The United States Office of Inspector General (OIG) conducted an audit of EPA in relation to land application of sewage sludge and published a report in November 2018. The report concluded that “the EPA identified 352 pollutants in biosolids but cannot yet consider these pollutants for further regulation due to either lack of data or risk assessment tools.” While the EPA’s position is that it lacks the data and tools necessary to conduct health and environmental risk assessments of many of the pollutants identified in biosolids, the OIG report provided 13 recommendations to which EPA has responded. Estimated completion dates have been established for each of the recommendations over a period spanning from March 2019 to December 2022.

Environmental impacts of per- and polyfluoroalkyl substances (PFAS) is a growing concern in the US, including accumulation in municipal biosolids. PFAS are a group of man-made chemicals used in a variety of industries that are pervasive throughout the environment and represent a growing health concern. Early in 2019, EPA issued a PFAS Action Plan to address this issue, but took no specific regulatory action. However, the Agency is continuing to gather information and movement towards regulatory action is growing. In July 2019, the US House of Representatives approved an amendment to the defense authorization bill (H.R. 2500) that would require EPA to add PFAS to the CWA list of toxic pollutants and develop technology-based effluent limits within one year. The Senate is currently considering a separate bill (S. 1790) that would address PFAS through the Safe Drinking Water Act, Toxic Substances Control Act, and Toxic Release Inventory rather than the CWA. At this time, neither of these bills have been codified into law.

While potential federal regulatory initiatives are largely focused on developing Maximum Contaminant Levels (MCL) or technology-based effluent limits, some states environmental agencies are exploring biosolids regulations. In many instances, measured levels of PFAS in biosolids

significantly exceed proposed regulatory standards. For example, recent State regulatory initiatives in Maine effectively bans land application of biosolids due to PFAS unless monitoring data are available to alleviate environmental concerns. Should Kansas adopt similar regulatory standards for PFAS, it would have the potential to significantly disrupt JCW's biosolids management options.

Currently, the land application of biosolids in Kansas is based on agronomic rates of nitrogen (N) and risk-based loading rates of several trace elements. Phosphorus (P) concentrations in biosolids are such that agronomic application rates based on N loadings often result in an oversupply of P to the soil. In other states, concerns have been raised that a buildup of P in soils could result in a greater likelihood of P losses through runoff, erosion, and leaching. The Phosphorus Index (P-Index), a risk-based concept developed by the National Resources Conservation Service, has been implemented in a number of states as an approach toward agricultural P management. The P-Index greatly informs land application decisions rather than using simple loading rates based upon agronomic rates. Qualification for Farm Bill funding assistance programs may be predicated upon nutrient management plans that include the P-Index. If phosphorus-based land application requirements evolve, JCW's land application options could be greatly impacted as additional grower participation may be required and transportation costs could increase significantly.

4.3.3 Peak Flow Management Rule

In April 2018, EPA began a rulemaking process to provide nationwide regulatory certainty regarding the use of "blending" at wastewater treatment plants. Blending is the process of diverting some portion of wet weather flows around biological treatment units with treatment by physical and/or chemical processes prior to recombining before discharge through a common outfall. EPA's blending rule, which is anticipated in 2020, should provide clarity for all states regarding the appropriate regulatory requirements that will apply to blending. These are expected to include ensuring representative monitoring, proper collection system management, and effective disinfection performance.

Depending on how the rule is structured, it could have significant implications for peak flow management at JCW's major WWTFs. JCW, KHDE, and EPA recently worked together to evaluate the water quality and financial impacts associated with auxiliary treatment of internal wet weather diversions at the Tomahawk Creek WWTF and determined it was the preferred approach for peak flow management. Future plans for other facilities addressed in this plan assume that similar peak flow management approaches will continue to be approved and permitted into the future. If future federal or state peak flow regulatory requirements become more stringent than are currently anticipated, JCW's capital program could be significantly impacted and the projects and schedules identified in the IMP may require significant reprioritization.

5 Program Needs and Solutions

JCW has identified many near and long-term programmatic and capital improvement projects that will be needed to address the utility and regulatory drivers described previously. These solutions and their projected costs were developed based on the results of previous planning efforts and the current level of system understanding, and anticipated utility and regulatory drivers. For several of the projects, additional information is needed to more adequately characterize the required investments. Therefore, the solutions and projected costs of program improvements outlined in this section should be considered planning level estimates for use in Phase 1 of the IMP. The estimates will be reevaluated as part of the adaptive management process (Section 8) to inform Phase 2 plan development.

The solutions identified for Phase 1 include ongoing projects, as well as forecasted programmatic and capital improvement projects. All cost estimates are presented in 2018 dollars. The projects and associated costs are summarized in the sections that follow according to the following categories:

- **Facilities** – This category includes all WWTF improvement and R&R projects. “R&R projects” refers to projects that aren’t specifically driven by changes in permit requirements or capacity needs, but are focused on replacement and/or upgrade of existing facilities to prolong life and improve efficiency and/or functionality. This category also includes pump station, PEFTF, and forcemain R&R projects. Note that pump station and forcemain capacity improvement projects required to address wet weather capacity or eliminate PEFTFs are included under Collection System Capacity Enhancement and PEFTF Elimination.
- **Collection System**
 - **Capacity Enhancement and Addressing PEFTFs** – This category includes initiatives needed to address wet weather flows through increasing conveyance capacity, storage of wet weather flows, or the disconnection of private I/I sources.
 - **Collection System Asset Management** – This category includes collection system R&R and public sector I/I reduction programs.
 - **System Expansion** – This category identifies collection system projects required to address community growth or redevelopment within existing service areas.
- **Other Programs and Capital Expenses** – This category includes other necessary and ongoing capital programs and miscellaneous expenditures.
- **Program Planning and Support** – This category outlines the efforts and planning studies needed to refine existing cost estimates and enhance program development and support implementation.

5.1 Facilities

The following sections summarize the anticipated improvements and initiatives to address aging asset, capacity, and regulatory needs at each of JCW's facilities.

5.1.1 Tomahawk Creek WWTF

Until 2018, Tomahawk was a 10 million gallon per day (MGD) trickling filter plant. Of the 15 MGD generated in the tributary area, up to 11 MGD was conveyed past the WWTF through the Linking Interceptor to Kansas City, Missouri for treatment. The WWTF was limited to treating the remaining 5 MGD, which was the maximum capacity that could be processed while achieving ammonia effluent limits. The trickling filter plant has since been demolished and construction is underway on a 19 MGD enhanced biological nutrient removal (BNR) facility. This facility will treat all flow from the tributary area, a small allotment for future growth, and anticipated future pumped flows from existing Metered Interconnection Sites (MIS) from which flows are currently conveyed across State Line Road for treatment by Kansas City (Section 5.2.3). The facility will be capable of meeting stringent nitrogen and phosphorus limits derived through extensive dynamic water quality modeling of Indian Creek from the WWTF discharge point to the Blue River.

The facility will include an auxiliary treatment facility (ATF), cloth media disk filters, followed by chlorination and dechlorination, to allow the WWTF to treat up to 172 MGD of wet weather flows. The BNR train will treat up to 57 MGD (3Q), with the ATF handling the remaining 115 MGD. The two flow streams will be re-combined prior to disinfection and discharge.

The facility will include anaerobic digestion of biosolids, which will be land applied. The project does not include methane reuse, although provisions are being made to facilitate addition of cogeneration in the future. The new facility is scheduled to go on line in 2021. The total project cost is \$334 million.

5.1.2 Nelson Complex

The Nelson Complex is comprised of two separate treatment facilities, Mission Main and Turkey Creek. These two facilities are operated as separate treatment trains but are located on the same site and their effluent is combined prior to discharge. The total facility capacity is 15 MGD as a daily average flow and 52 MGD as total peak flow. Flow is conveyed to the WWTF from three major off site pump stations, Turkey Creek, Rock Creek, and Belinder. Each of these pump stations is associated with a PEFTF as follows:

- Turkey Creek Pump Station with Turkey Creek PEFTF
- Rock Creek Pump Station and Martway PEFTF
- Belinder Pump Station with Belinder PEFTF

Brush Creek is the fourth major pump station and is associated with 75th and Nall PEFTF. Brush Creek pumps flow to Rock Creek, where it is re-pumped to the WWTF. The PEFTFs operate in conjunction with the pump stations, treating and discharging wet weather flows that exceed the capacities of the pump stations (Appendix A, Figure A.2).

Planning is underway to upgrade the Nelson Complex to a 15 MGD BNR facility. The facility will be designed to achieve anticipated TN and TP targets and ammonia limits. The facility will initially

include an ATF sized to handle 7 MGD, which is the difference between the facility total peak flow capacity of 52 MGD and the 45 MGD (3Q) that will be treated in the BNR train. In the future, the ATF expansion will be needed as PEFTFs are addressed and their flows conveyed to the WWTF. In general, addressing each PEFTF will require a capacity upgrade of its associated pump station and forcemain system. PEFTF projects are explained in greater detail in Section 5.2.1.1. This most cost-effective approach to addressing the PEFTFs necessitates permitting of wet weather diversions with auxiliary treatment. If this regulatory solution is not achieved, costs of wet weather management and feasibility of addressing the PEFTF discharges will be dramatically impacted.

Currently design is underway to convert from the current practice of disposing of biosolids by landfilling to anaerobic digestion and land application. This conversion is being driven by a concern over the continued viability of landfilling and the desire to move toward beneficial resource recovery. Phase 1A consists of recommissioning the two previously abandoned digester tanks as primary and secondary digesters. This initial phase is projected to cost \$7.6 million. The remaining phases of digester conversion, two additional primary digesters, a FOG waste receiving facility, and provisions for future addition of methane reuse, are likely to be included in the BNR upgrade project. Note that the solids processed at Nelson include solids trucked from the Blue River Main WWTF and the New Century Air Center WWTF.

The estimated BNR upgrade cost is \$328 million. Concurrent with the WWTF project will be upgrades to the Turkey Creek, Rock Creek, and Belinder Pump Stations to account for the increase in pumping head resulting from the new headworks elevation. The estimated combined cost for these three stations is \$17.5 million.

In the interim, several R&R projects are needed to maintain serviceability of the WWTF, pump stations and PEFTFs until such time as the major improvements can be made. Notable among these are the addition of dechlorination at Turkey Creek and Belinder PEFTFs (Martway and 75th & Nall already have dechlorination), and the addition of disinfectant flow pacing capability at all four PEFTFs.

5.1.3 Mill Creek Regional WWTF

The Mill Creek Regional (MCR) WWTF was originally constructed in the 1990's as part of a regionalization effort that consolidated several smaller systems throughout this developing watershed. The facility is currently rated at 18.75 MGD. It consists of two parallel treatment trains, a 12.75 MGD activated sludge train and a 6 MGD aerated lagoon system. The total hydraulic capacity of the facility is 105 MGD. The facility does not currently have primary clarifiers or mechanical biosolids processing facilities. Biosolids are stored and digested in the lagoons, and these are periodically cleaned out and the biosolids land applied.

At the time of this writing, the facility's NPDES permit is in the process of being renewed. However, JCW anticipates that the MCR WWTF will be challenged to meet anticipated ammonia and nutrient limits and that a significant upgrade will be required. Improvements are likely to include replacement of the lagoon with mechanical facilities, primary clarifiers, BNR conversion, wet weather treatment, and anaerobic digestion. A preliminary cost estimate for this project is \$250 million. However, a facility plan for this upgrade has not been developed in detail. The facility plan for the MCR WWTF is planned to begin in 2019, and will provide a more reliable cost estimate for the Phase 2 IMP. This planning-level cost estimate is based upon using auxiliary treatment for peak wet weather flows that exceed biological treatment capacity. If this wet weather management solution is not approved,

costs of wet weather management within the service area will be dramatically impacted. The Mill Creek watershed is not fully built out and at some point the facility may also need to be expanded to provide regional wastewater treatment. Expansion costs are estimated to be in the \$200 million range.

5.1.4 Douglas L. Smith Middle Basin WWTF

The Middle Basin WWTF is a 14.5 MGD BNR facility with anaerobic digestion. It is designed to meet nitrogen and phosphorus limits, although at the present time these are goals and not actual limits. In many respects, it is currently JCW's most advanced facility. It includes full anaerobic digestion and a FOG waste receiving facility. Biogas from the digestion process is cleaned of impurities and utilized by cogeneration units which supply significant portions of the facility's electricity and heating needs.

Middle Basin has expanded over the years in phases. The first phase was completed in 1980 with the last (fourth) treatment train being added in 2009. As such, facilities vary in age and condition and it is anticipated that significant R&R improvements will be required over the 25 year planning period to maintain the facility's serviceability. Currently, several initiatives are underway to improve the reliability of the digestion process. The only major capital improvement project anticipated is the replacement of the existing wet weather lagoons with an ATF, and combining the discharges into a single outfall. The estimated cost for this improvement is \$21 million. If this wet weather management solution is not approved, costs of wet weather management within the service area will be dramatically impacted.

5.1.5 Blue River Main WWTF

The Blue River Main WWTF tributary area has the highest growth rate of any portion of the service area. The facility is rated at 10.5 MGD. It is capable of reducing nutrients consistent with its NPDES permit nutrient reduction goals. The plant is limited hydraulically to 34 MGD, with 16 MGD flowing to the BNR train and 18 MGD flowing to the wet weather lagoons. While the mechanical train is hydraulically limited to 16 MGD, a recent project increased the BNR process specific components of the plant to 24 MGD. The facility does not have primary clarifiers. Waste activated sludge is thickened in a dissolved air flotation unit and trucked to the Nelson Complex for dewatering and disposal.

Three future improvement projects will likely be needed at the Blue River Main WWTF. First, the wet weather capacity of the mechanical plant will need to be expanded to 31.5 MGD at an estimated cost of \$20 million. Another anticipated upgrade includes a capacity expansion from 10.5 to 15 MGD to accommodate growth, addition of primary clarifiers, and implementation of anaerobic digestion. This project has a preliminary estimated cost of \$150 million. Finally, an additional expansion will be needed in the future to accommodate the fully built out watershed capacity of 20 MGD. This project has a preliminary estimated cost of \$90 million.

5.1.6 New Century Air Center (NCAC) WWTF

The New Century Air Center (NCAC) WWTF primarily treats flows from the industries and business that comprise the air center. It is a 1.65 MGD activated sludge plant with a hydraulic capacity of 4.0 MGD. The non-residential nature of the facility's customer base is such that it is necessary to add nutrients to the influent to achieve the balance required to achieve the required degree of treatment. This practice must be optimized to improve nutrient reduction performance in accordance with existing and future permit requirements. Thickened waste activated sludge is hauled from the facility to the Nelson Complex for dewatering and disposal.

In the near term, the hydraulic capacity must be increased at an estimated cost of \$4.1 million. As residential customers are added and the influent becomes more typical of domestic waste in the future, enhancement of BNR capability will be required so the facility can continue to meet its discharge nutrient limits. This upgrade is projected to cost \$5 million.

5.1.7 Pump Stations

Periodic investment in R&R projects will be required to maintain serviceability, improve efficiency and reliability, and maintain code compliance. The most significant pump station expansions, excluding influent pump stations located at the WWTFs, are Turkey Creek, Rock Creek, and Belinder. As described previously, these pump stations will be upgraded in conjunction with the Nelson WWTF upgrades, and ultimately expanded when their associated PEFTFs are addressed.

Other significant pump station projects include:

- Lamar Pump Station – This station pumps to the Turkey Creek WWTF Headworks. When the Nelson Complex is upgraded, this station will be replaced with a new station capable of pumping to the higher gradient, estimated at \$0.7 million.
- Brush Creek – This station currently requires significant R&R, as well as a new dumpster room and separate electric room (\$3.6 million). In the future (concurrent with the Brush Creek Storage project) the station will be replaced with a new submersible pump station (\$3.3 million).
- Dyke's Branch – This station currently pumps dry and wet weather flows to the Tomahawk Creek WWTF. Station reliability and capacity improvements and a forcemain replacement project are currently underway. The future operating philosophy will be to pump only wet weather flows from Dyke's Branch to the Tomahawk Creek WWTF. Dry weather flows will be bypassed to the downstream collection system and conveyed to the state line where they will be intercepted by a proposed State Line Road Pump Station and pumped through a new forcemain to the Tomahawk Creek WWTF. During wet weather, all flows from the Dyke's Branch service area will continue to be pumped back to Tomahawk Creek. The total estimated cost for this project is estimated at \$5.75 million.
- State Line Road Pump Stations – Two pump stations are planned to intercept flows from Leawood which are currently conveyed across State Line for treatment by Kansas City. These projects are discussed in more detail in Section 5.2.3.

5.1.8 Forcemains

JCW's system contains approximately 42 miles of forcemain. These pipelines vary significantly in age, size, material, and operating conditions. Forcemain management strategies and project identification and planning efforts are implemented through the asset management program. Over the first five years of the program, JCW has allocated \$500,000 on even numbered years and \$200,000 on odd numbered years for undefined forcemain needs to be determined through the asset management program. After five years, these funds are assigned to the overall undefined facilities R&R funds detailed in Section 5.1.9 below.

One major identified forcemain R&R project included in the plan is the replacement of the Dyke's Branch Forcemain. This project includes construction of a 24-inch forcemain in the alignment of the existing dry weather forcemain to the high point, which is planned to address breaks and increase system reliability. This forcemain will serve as the primary forcemain and the existing wet weather forcemain will serve as a backup. The estimated costs for the project \$5.1 million. An additional \$1 million will likely be needed for rehabilitation of the pipeline beyond the extents of the replacement project.

5.1.9 Other Repair and Replacement (R&R)

In addition to the identified treatment and pump station renewal projects discussed previously, general R&R needs will need to be addressed over time. A baseline funding forecast model for R&R of JCW's treatment and pumping assets and associated site and building infrastructure has been developed through the Facilities Asset Management Program (FAMP). A deterministic forecast model was used to calculate projected R&R funding needs based on information such as asset age, condition, replacement value, and useful life expectancies.

The R&R forecast model indicates a funding demand for all pump stations and wastewater treatment facilities of approximately \$22 million annually over the next 10 years. These projections include a significant near-term demand for existing facilities, primarily due to assets at Middle Basin WWTF, Mill Creek WWTF, and older pump station facilities that are currently beyond their estimated useful life. After this initial spike, projections for existing facilities remain relatively consistent until projected needs begin to rise again during the latter part of the planning period, reflecting the installation of a large number of new assets at the Tomahawk Creek and Nelson WWTFs which will begin to require increased R&R investments as the new equipment ages.

The forecast model indicates a total anticipated funding need of over \$500 million for facilities R&R over the next 25 years. A dedicated facilities condition assessment program and other FAMP initiatives are being implemented to increase JCW's ability to proactively identify and package projects and increase confidence in long term R&R needs and budgeting.

5.2 Collection System

Collection system program needs are summarized in this section. These programs have been organized into three primary categories:

- Capacity Enhancement and PEFTF Elimination
- Collection System Asset Management
- System Expansion

5.2.1 Capacity Enhancement and PEFTF Elimination

This program category includes all wet weather conveyance and management improvements needed to address peak wet weather flows. These include gravity and pumping capacity improvements, remote storage facilities within the collection system, ATFs located at wastewater treatment facilities, and private I/I reduction efforts. Capacity enhancement needs are described below for each major service area basin within the system. These needs were identified to satisfy

JCW's aggressive system-wide wet weather level of service goals, which are based on a 5-year occurrence interval event. JCW also strives to achieve a 10-year level of service goal within the gravity collection system to minimize customer service impacts.

Inflow and infiltration (I/I) reduction is a major component of JCW's capacity enhancement and peak flow management strategy. The program includes major efforts to reduce I/I rates through ongoing public sector reduction efforts (included in Section 5.2.2) and private source disconnections. However, the system will continue to age and is subject to external influences that influence I/I rates. It is challenging to accurately project the results of I/I reduction efforts at the level of accuracy needed to size the corresponding future facility improvements. The costs for these improvements are based on projected future design flows using the best available estimates of I/I reduction to be achieved. Prior to design of all major facility upgrades, the effectiveness of I/I reduction will need to be assessed at each location in the system. The schedules for capacity enhancement programs take into account both the time required to achieve I/I reduction targets and the need for monitoring and validation of achieved I/I reduction levels prior to design.

5.2.1.1 NELSON COMPLEX (MISSION MAIN AND TURKEY CREEK BASINS)

The tributary area to the Nelson Complex consists of two watersheds with names corresponding to the two WWTF trains, Mission Main and Turkey Creek (Appendix A, Figure A.2). Flows from these watersheds are pumped to the WWTF via multiple pump stations. The watersheds also contain PEFTFs which either store wet weather flow and return it to the collection system after the storm passes, or discharge directly from the collection system to surface waters after providing screening, primary treatment, and disinfection. In the Mission Main watershed, the 75th and Nall PEFTF operates in conjunction with the Brush Creek Pump Station (PS), which pumps flows to the Rock Creek PS. The Martway PEFTF operates in conjunction with the Rock Creek PS, which pumps flow to the WWTF. Similarly, the Belinder PEFTF and PS operate in concert with the PS pumping to the WWTF. In the Turkey Creek watershed, the Turkey Creek PS pumps directly to the WWTF and excess wet weather flows are stored and/or treated at the PEFTF.

Addressing the PEFTFs will require extensive upgrades throughout the collection system. The Nelson Complex WWTF is currently capable of treating a total peak flow of 52 MGD. The PEFTFs are designed to provide wet weather treatment for an additional 104 MGD, resulting in a total peak flow treatment capacity of 154 MGD in the Nelson Complex service area. The collection system infrastructure downstream of PEFTFs lacks the capacity to convey the additional peak flows currently discharged through the PEFTFs. For example, eliminating the PEFTFs will require improvements beginning at each of the PEFTF sites, extending through the collection system to the Nelson WWTF where peak flow management improvements will be required to address the additional flows.

An extensive evaluation was completed in 2018 and 2019 to determine the preferred long-term management plan to address wet weather flows within the Turkey Creek and Mission Main watersheds. Several upgrade alternatives were evaluated, including conveyance upgrades (gravity mains, pump stations, and forcemains), collection system storage, and I/I reduction (public and private). An Optimization analysis was used to investigate a wide range of scenarios and sensitivities to identify the most cost effective set of improvements. These improvements were incorporated into a long-term plan to address the PEFTFs and alleviate capacity constraints throughout the collection system. Wet weather flows will be handled through a combination of I/I reduction, capacity upgrades, remote storage facilities, and auxiliary treatment at the Nelson Complex.

In order to address each PEFTF, preliminary improvements must be made to handle the increased wet weather flows currently treated and discharged. Generally, improvements include storage or pump station and forcemain capacity upgrades. The major improvements recommended for each basin are summarized below and depicted in Figure A.3.

Major projects in the Turkey Creek Basin include:

- Public sector I/I reduction throughout the service area
- Private I/I reduction in select sub-basins (ranging from 15%-30% total reduction)
- Turkey Creek interceptor improvements
- Remote Storage in the collection system (3.7 million gallons)
- Local pipe capacity improvements
- Turkey Creek PEFTF decommission
 - Turkey Creek Pump Station upgrade (43 MGD total capacity) and 36" parallel forcemain

Major projects in the Mission Main Basin include:

- Public sector I/I reduction throughout the service area
- Private I/I reduction in select sub-basins (ranging from 15%-30% total reduction)
- 75th/Nall PEFTF decommission
 - Storage near Brush Creek Pump Station (4.4 million gallons)
 - Brush Creek interceptor improvements
- Martway PEFTF decommission
 - Rock Creek Pump Station upgrade (24 MGD total capacity) and 24" parallel forcemain
- Belinder PEFTF decommission
 - Belinder interceptor improvements
 - Belinder Pump Station upgrade (52 MGD total capacity) and 48" parallel forcemain
- Local pipe capacity improvements

In order to further increase confidence in the major CIP expenditures recommended in the long-term plan, detailed planning level costs were developed for underground storage alternatives, major gravity interceptor project, and pump stations and associated forcemains. The total project costs for each category of improvements are provided in Table 5-1. The specific costs required to address each PEFTF and address corresponding collection system restrictions within each service area are described in the sections that follow.

Table 5-1: Nelson Complex PEFTF Elimination Project Costs

Improvement Items	Project Costs (\$M, 2018 Dollars)
Gravity Sewers	31.9
Pumping Station Upgrades ⁽¹⁾	39.2
Force Mains	26.3
Underground Storage Facilities	48.7
Baseline I/I Reduction	30.0
Additional I/I Reduction	13.9
Auxiliary Treatment Facilities Phases 1 - 3	37.5
Total Capital Costs	227.5

⁽¹⁾ Includes portion of new Rock Creek pump station (constructed with treatment plant) attributable to wet weather conveyance.

5.2.1.1.1 Turkey Creek PEFTF Elimination

The Turkey Creek PEFTF and wet weather PS operate in concert with the dry weather PS which pumps to the WWTF. Several projects are required prior to elimination of the Turkey Creek PEFTF. Gravity conveyance upgrades (approximately 16,000 LF) are needed to alleviate surcharge within the collection system. Construction of a 3.7 MG remote storage facility in the collection system that will allow peak flows to be detained within the system and reduce peak flows to downstream facilities. Public and private I/I reduction (approximately 17%) is also required to reduce peak wet weather flows to the Turkey Creek PS and the storage facility. Finally, eliminating the PEFTF will require repurposing the PEFTF into a wet weather PS capable of pumping to the WWTF, construction of a new parallel forcemain and the expansion of the auxiliary treatment facility (ATF) at the Nelson Complex to treat an additional 16 MGD. The total cost associated with these projects is estimated at approximately \$73 million and is allocated as follows:

- Public and Private I/I Reduction: \$20.4 million
- Gravity Conveyance Upgrades: \$9.6 million
- Remote Storage Facility: \$24.6 million
- Turkey Creek PS Expansion and Forcemain: \$11.6 million
- Auxiliary Treatment Facility Expansion: \$6.8 million

5.2.1.1.2 Martway PEFTF Elimination

The Martway PEFTF operates in conjunction with the Rock Creek PS, which pumps flow to the WWTF. Several projects are required prior to elimination of the Martway PEFTF, most notably expansion of the ATF. Gravity conveyance upgrades are needed to alleviate surcharge and convey flow to Rock Creek PS. Public and private I/I reduction (approximately 14%) is also required to reduce peak wet weather flows to Rock Creek PS. The Rock Creek PS must be expanded to a wet weather capacity of 24 MGD, a 24-inch parallel forcemain must be constructed, and the ATF at the Nelson Complex must be expanded to treat an additional 12 MGD. This forcemain will likely be

constructed on or near a major thoroughfare, Roe Avenue. The total cost associated with these projects is estimated at \$35.5 million and is allocated as follows:

- Public and Private I/I Reduction: \$5.4 million
- Gravity Conveyance Upgrades: \$1.4 million
- Rock Creek PS Upgrade, Parallel Forcemain, ATF Expansion: \$28.7 million

5.2.1.1.3 75th and Nall PEFTF Elimination

The 75th and Nall PEFTF operates in conjunction with the Brush Creek PS, which pumps flows to the Rock Creek PS. Several projects are required prior to elimination of the 75th and Nall PEFTF, including construction of a 4.4 million gallon (MG) remote storage facility near Brush Creek PS. Gravity conveyance upgrades (approximately 10,000 linear feet) are needed to alleviate surcharge and convey flow to either the Brush Creek pump station or the new storage facility. Most notably, prior to decommissioning the PEFTF a new 36" interceptor must be constructed between the 75th and Nall PEFTF and the future storage facility near the Brush Creek pump station to convey the increased flows. Public and private I/I reduction (approximately 12%) are also required to reduce peak wet weather flows to Brush Creek PS or the storage facility. The total cost associated with these projects is estimated at \$34.3 million and is allocated as follows:

- Public and Private I/I Reduction: \$4.3 million
- Gravity Conveyance Upgrades: \$5.9 million
- Remote Storage Facility: \$24.1 million

5.2.1.1.4 Belinder PEFTF Elimination

The Belinder PEFTF and pump station operate in concert with the pump station pumping to the WWTF. The Belinder PEFTF is the largest and most challenging to address, both in terms of cost and construction challenges. Gravity conveyance upgrades (approximately 32,000 linear feet) are needed to alleviate surcharge and convey flow to the Belinder Pump Station. Public and private I/I reduction (approximately 14%) is also required to reduce peak wet weather flows to Belinder pump station. The pump station must be upgraded to a wet weather capacity of 54 MGD, which will be very difficult to do at the existing site while maintaining operations. It will also require installation of 14,000 linear feet of 48-inch diameter forcemain through densely populated, narrow residential streets and crowded commercial areas. The next phase of ATF expansion at the Nelson Complex facility will then need to be completed to treat the additional 43 MGD pumped from the Belinder Pump Station. The total cost associated with these projects is estimated at \$85 million and is allocated as follows:

- Public and Private I/I Reduction: \$13.8 million
- Gravity Conveyance Upgrades: \$15.1 million
- Belinder PS Upgrade, Parallel Forcemain, ATF Expansion: \$56.1 million

Prior to designing the capacity improvements at Belinder, upstream work must be completed and system performance assessed. This includes I/I reduction throughout the service area, the projects

to eliminate the Martway and 75th and Nall PEFTFs, and the bulk of the upstream gravity conveyance improvements. Flow monitoring will then be required to confirm design flows and final facility sizing. An evaluation and pre-design study must then be completed to determine the scope of the preferred solution and costs for the final improvements to eliminate the Belinder PEFTF.

5.2.1.2 TOMAHAWK SERVICE AREA (LOWER INDIAN CREEK AND TOMAHAWK CREEK BASINS)

The Tomahawk WWTF service area is tributary to the confluence of the Tomahawk Creek and Indian Creek, and includes both the Lower Indian Creek and Tomahawk Creek basins (Appendix A, Figure A.4). The Indian Creek basin is the older of the two basins and contains higher levels of I/I than the newer Tomahawk Creek basin. Both basins are mostly built out; however there are some growth areas remaining and the potential for major redevelopment projects at locations within each basin.

While the WWTF project described in Section 5.1.1 will address management of peak wet weather flows at the facility, collection system improvements will also be required. A high level planning study completed in 2015 identified significant capacity enhancement needs throughout the service area. Capacity restrictions are present primarily within the Lower Indian Creek basin, where the Indian Creek Interceptor and several branch lines are under capacity. The study also identified potential capacity improvements to the Tomahawk Creek Interceptor. The study recommended a combination of I/I reduction, gravity sewer capacity improvements, and storage in order to contain and convey wet weather design flows to the expanded Tomahawk Creek WWTF.

The initial study identified over \$300 million in potential improvements required to address capacity within these basins. These basins will be evaluated through a more detailed planning and optimization study to define the preferred long term wet weather management strategy and level of investment required. This study is scheduled for 2020 and the results will be incorporated into the Phase 2 IMP update.

5.2.1.3 MILL CREEK BASIN

The Mill Creek basin, located in the northwest portion of JCW's service area, is approximately 60% developed (Appendix A, Figure A.5). While portions of the service area are new construction, some areas of the collection system which pre-date the Mill Creek WWTF are older. Under existing conditions, the Mill Creek Watershed collection system is able to meet JCW's level of service. However, significant growth is expected to continue to occur. This growth is expected to increase peak flows in portions of the collection system to beyond what the existing infrastructure can convey while still meeting JCW's level of service goals, including the Mill Creek Interceptor.

An extensive evaluation was completed in 2018 and 2019 to determine the preferred long term management plan to address future wet weather flows within the Mill Creek service area. Alternatives analysis and optimization were completed to identify the optimal combination of conveyance improvements, storage facilities, auxiliary wet weather treatment improvements and/or I/I reduction in specific areas within the basin for both interim and ultimate growth conditions (Figure A.6.). The study resulted in a long-term, phased improvement plan (Table 5-2) summarized as follows:

- Influent pumping capacity improvements and wet weather treatment improvements

- Storage facility (5 MG) near the confluence of the Mill Creek and Little Mill Creek interceptors, near Shawnee Mission Parkway
- Mill Creek Interceptor capacity improvements, and other local capacity improvements (approximately 18,000 linear feet total)
- Two linear pipe storage facilities at key locations
- Targeted public and private sector I/I reduction

Table 5-2: Mill Creek Long Term Wet Weather Improvement Plan

Improvement Item	Project Cost (\$M, 2018 Dollars)
Influent Pump Station (IPS) Capacity Upgrade	\$3.0
Storage Facility	\$23.1
Inflow / Infiltration Reduction	\$7.5
Linear Storage	\$4.6
Gravity Sewer	\$9.4
Forcemain (IPS to Lagoons)	\$0.3
WWTF Peak Flow Capacity Upgrade	\$1.0
Total Capital Costs	\$48.9

5.2.1.4 LEAWOOD BASIN

The Leawood service area is located in the easternmost portion of JCW's service area, flowing east across State Line Road to Kansas City, Missouri for treatment (Appendix A, Figure A.7). The Dyke's Branch service area naturally drains toward the Leawood system. Flow from this area is currently pumped back to Tomahawk Creek WWTF via the Dyke's Branch pump station.

JCW has evaluated pumping flow from Leawood back to Tomahawk Creek WWTF for treatment and plans to implement these improvements (these projects are described in Section 5.2.3). This will include construction of a pump station along State Line Road, near where Dyke's Branch creek crosses the state line. JCW has initiated a project to enable them to divert dry weather flows through the Leawood system to the future State Line Road Pump Station. Dyke's Branch will serve as a wet weather pump station, and all flow during wet weather will continue to be pumped back to the Tomahawk Creek WWTF. The required pump station and forcemain improvements include increased capacity and are discussed in further detail in Section 5.1. The total cost for these projects is \$12 million.

JCW took ownership of the system in the Leawood basin from the City of Leawood in 1999. Since then, JCW has made many improvements to address condition issues and improve the system. However, capacity deficiencies remain within the system as well as at the interconnect facilities with Kansas City, where downstream capacity constraints limit peak discharge from the system.

A high level planning study completed in 2012 identified approximately \$75 million in improvements required to address capacity within the Leawood system, consisting of gravity capacity improvements, storage, and public and private sector I/I reduction. This study is considered out of date and the methodologies and assumptions utilized do not align with JCW's current basin study approaches and I/I reduction strategies. Therefore, the Leawood basin will be evaluated with a more detailed planning and optimization study to define the preferred long term wet weather management strategy and level of investment required. This study is scheduled for 2021 and the results will be incorporated into Phase 2 of the IMP.

5.2.1.5 MIDDLE BASIN SERVICE AREA (INDIAN CREEK MIDDLE BASIN)

The Middle Basin WWTF service area is located upstream of the Lower Indian Creek basin (Appendix, Figure A.8). This basin serves the Indian Creek Middle Basin and Indian Creek Olathe Contract Area portions of the Indian Creek watershed. In the past, a portion of the dry weather flow from these areas was diverted to Tomahawk Creek WWTF for treatment. However after WWTF improvements completed by JCW, all flow is now treated at Middle Basin. There are no capacity enhancement projects identified within the collection system. Wet weather flow management improvement at the WWTF were discussed in Section 5.1.4.

5.2.1.6 BLUE RIVER BASIN

The Blue River basin, located at the far south of JCW's service area (Figure A.9), is the overall youngest collection system within JCW's service area. The basin is partially built out and there are no known wet weather capacity issues within the collection system.

Although the vast majority of conveyance infrastructure within Blue River was designed for ultimate conditions, the Blue River Interceptor from Highway 69 to the Blue River WWTF was designed for partial growth. Ultimately, a parallel line or storage facility will be required to handle weather flows as the basin becomes more fully developed. Preliminary estimates indicate this improvement may cost up to \$50 to \$75 million

5.2.1.7 NEW CENTURY AIR CENTER WWTF SERVICE AREA

The NCAC WWTF is located at the far southwest corner of JCW's service area (Figure A.10), and serves three isolated basins. The basin is partially built out and there are no identified gravity capacity enhancement projects required within this area. Pump station capacity improvements will be required; these are included in the Little Bull Creek No. 1 Pump Station project included in Section 5.2.3 under System Expansion.

5.2.1.8 PLUMBER OUTREACH PRIVATE I/I REDUCTION PROGRAM

JCW has partnered with the local plumbing community in an effort to disconnect private I/I sources to reduce wet weather flows. Through this program, plumbers work with JCW and homeowners to educate homeowners on private I/I, identify these sources, and disconnect them whenever opportunities arise. This successful program resulted in over 200 I/I source disconnections in the past three years. JCW allocates \$100,000 annually for these disconnections. JCW has removed well over 16,000 sources throughout the system.

5.2.1.9 BACKUP PREVENTION PROGRAM

JCW administers a backup prevention program (BUPP) in order to help protect homeowners from basement backups during major wet weather events. Qualified homeowners will receive a backup prevention devices, with the cost of the equipment and installation provided by JCW. JCW allocates between \$50,000 and \$75,000 annually for this program. However, in 2017 there were multiple wet

weather events that led to increased near-term BUPP investments far beyond these budgeted levels.

5.2.2 Collection System Asset Management Program (CAMP)

The CAMP was originally developed in 2013, and includes a multi-year implementation plan of continuous improvement initiatives for collection system management and performance. This implementation plan is updated each year to focus and align the program initiatives with JCW's priorities.

JCW's system renewal and public sector I/I reduction program strategies are implemented through the CAMP. This includes JCW's pipe, manhole, and stream crossing inspection and renewal programs, along with operations and maintenance strategies and other collection system management tasks. Other program activities include strategic direction and planning support for the operations and maintenance program and other collection system management tasks.

5.2.2.1 PIPE INSPECTION AND RENEWAL PROGRAM

JCW has a dedicated pipe closed circuit television (CCTV) and renewal program. Inspections are completed by four in-house CCTV crews, who typically inspect 100 – 130 miles of unique pipe per year. JCW has established a goal to ultimately inspect all pipes before they reach 40 years in age and operations staff have worked diligently to finish inspections of the backlog of aging pipes. CCTV efforts are prioritized each year based on risk factors such as age, pipe material, I/I levels, and consequence of failure.

In the early years of the CAMP, JCW developed a rehabilitation prioritization and decision model. This automated model is utilized by JCW to efficiently prioritize pipes based on inspection findings and determine the preferred method of renewal. Inspection findings are prioritized by risk based on a Structural Risk Score that accounts for likelihood and consequence of failure factors along with I/I mitigation. Pipes that do not meet the risk threshold for renewal are scheduled for re-inspection on a 5, 10, or 20-year interval based on risk. Using this risk-based asset management framework, JCW will continue to systematically inspect and renew the collection system throughout the course of the IMP.

Pipe renewal and repair work identified through the program is executed through three mechanisms:

- Cured In-Place Pipe (CIPP) lining – The CIPP program renewal work is executed through a term and supply contract. JCW has lined over 160 miles of pipe, with the vast majority located within the older basins with capacity enhancement needs. Annual program funding needs vary based on inspection findings since the asset management program was implemented in 2013. JCW has increased investments in the CIPP program and typically line between 15 and 20 miles of pipe per year. The volume of CIPP work required is anticipated to decline over time as JCW completes the first inspection of all older VCP pipes. In the near term, JCW has budgeted approximately \$2.5 million annually for the CIPP program, with projected needs decreasing to \$1.5 million annually after the first 10 years of the planning period.
- In-house repairs – JCW has approximately a dozen operations staff members dedicated to collection system repairs. These in-house repairs consist of both open cut pipe repairs and trenchless pipe patch installations. Crews have typically complete 100 to 140 repairs per

year in recent years. Note that funding for these repairs comes from JCW's operations budget; therefore, there is no capital funding allocation for these efforts.

- Contracted repairs – Repairs identified through CCTV, or repairs that cannot be effectively completed by in-house crews are completed by an on-call contractor. JCW budgets \$750,000 annually for contracted pipe and manhole repairs.

JCW has inspected the majority of the pipes in the system within the older basins which have capacity enhancement needs. Inspection efforts over the next ten years will first be focused on completing first inspections of all the older pipes within these basins, and completing follow-up monitoring inspections of moderate risk pipes. Once the first inspections are completed, inspection efforts are anticipated to begin to transition to other areas of the system. Inspection efforts will continue to be prioritized based on risk, and pipe renewal resources will be prioritized against other collection system R&R needs.

5.2.2.2 MANHOLE INSPECTION AND RENEWAL PROGRAM

JCW has implemented a Tier 1 manhole inspection program in place for over a decade. Through this program, cleaning crews complete a high level condition assessment and document a quick rating for each manhole they open. This Tier 1 program is used to flag manholes that may have major structural or I/I source defects for further review by engineering staff.

In 2016, JCW initiated a Tier 2 Manhole inspection program. This program is focused on completing detailed interior manhole inspections utilizing the latest technologies (including a 360 degree internal camera) to identify manhole I/I sources and structural renewal needs. Similar to the pipe renewal program, an automated decision model was developed to efficiently assess the inspection results and identify which manholes have I/I sources which will be cost effective to address. This includes a dedicated process to assess and mitigate inflow sources through leaky covers and frames.

Program inspections will be focused in areas with capacity enhancement needs. Over 5,000 manholes have received Tier 2 inspections in the first three phases of this program. These inspections have been focused in areas with capacity enhancements needs within the Nelson Complex, Indian Creek, and Leawood service areas along with targeted inspections in Mill Creek to identify inflow sources on the main interceptor.

JCW has allocated \$1 million annually for the program through 2021 (emergency structural repairs may also be funded through the contracted repair allocation). After 2021 program funding is set to increase to approximately \$2 million annually for approximately 15 years. It is anticipated that program funding will decrease thereafter because inspections will have been completed in most areas with capacity enhancement needs. Program strategies will continue to be evaluated and adjusted as post-renewal flow monitoring is completed and information on I/I reduction performance is incorporated.

5.2.2.3 STREAM CROSSING PROGRAM

JCW's stream crossing program has been in place for nearly two decades. Through this program, JCW continuously inspects and protects infrastructure located near bodies of water that is at-risk from the erosive forces of the many streamways in the service area. Inspection frequencies are prioritized based on risk and the consequence of failure of the infrastructure at each area monitored.

The program has an annual budget of \$1.2 million (note that emergencies are often funded through the emergency repair allocation). Improvements identified through the program range from minor rehabilitation or stream bank protection projects to capital improvement projects such as realigning major interceptor sewers. When these projects take place in basins with capacity enhancement needs, JCW will typically increase capacity of the impacted segments in order to address both infrastructure protection and capacity needs.

In recent years, particularly in 2017 and 2019, the increase in frequency and intensity of major wet weather events has resulted in increased project needs. This trend will continue to be evaluated so these projects can be prioritized along with other system needs in Phase 2 of the IMP.

5.2.2.4 CONTRACTOR REPAIRS

Repairs identified through CCTV, or repairs that cannot be effectively completed by in-house crews are completed by an on-call contractor. JCW budgets \$750,000 annually for contracted pipe and manhole repairs. These repairs are typically identified through the programs described above, as well as needs identified by operations staff through system maintenance activities.

5.2.2.5 OPERATIONS AND MAINTENANCE CLEANING PROGRAM SUPPORT

JCW implemented a dedicated cleaning program in the 1980s. This program drastically reduced the amount of SSOs and basement backups due to blockages caused by roots, grease and debris. This successful operations and maintenance program has resulted in dry weather backup/overflow rates that are consistently below one per year per 100 miles of gravity sewer main. This high level of performance has established JCW as an industry leader in this key area of customer service on a national level.

JCW has focused on maintaining this high level of service as the system continues to grow and age. JCW currently completes approximately 500 miles of total gravity sewer cleaning per year, which will likely increase in the future as the system ages and continues to grow. Cleaning program strategies are implemented through the asset management program, including ongoing prioritization of resources between proactive CCTV inspection work and cleaning. This resource prioritization will continue in order to prioritize inspection, renewal, and maintenance resources where they will provide the most benefit to JCW's customers.

5.2.3 System Expansion

This program category encompasses the activities to provide efficient and sustainable wastewater service to future growth areas. This program primarily involves constructing sanitary sewer infrastructure to service new development areas on the boundaries of JCW's service area and redevelopment.

Economic conditions and housing demand significantly impact the magnitude of necessary system expansion investments. Costs for the system expansion program can fluctuate significantly based on these external drivers. In order to meet this need, JCW has budgeted \$5 million annually for future district expansion projects. JCW will continually evaluate growth patterns to better understand the timing and necessity of system expansion improvements.

Along with these growth driven district expansion projects, JCW has identified the following additional near term expansion projects that are necessary:

- Leawood Service Area Pump Stations and Forcemain - Two pump stations are planned to intercept flows from Leawood which are currently conveyed across State Line for treatment by Kansas City. One will be located at IMF Site 10/11 at approximately 90th and State Line Road. It will intercept the collection system flows as well as the dry weather Dyke's Branch flows as described above. The other will be located at IMF Site 13/13A at approximately 104th and State Line Road. The forcemain from the stations will parallel State Line, then turn and follow Indian Creek to the Tomahawk facility. The estimated cost for the pump stations and forcemain project is \$15.6 million.
- Little Bull Creek No. 1 Pump Station – This project involves replacement of the Lone Elm pump station, which is nearing the end of the useful life and may require relocation to serve new areas on the boundary of JCW's service area. It may allow for a single pump station to be built to handle flows that are currently being sent to two regional pump stations. The estimated costs for this project is \$5 million.
- New WWTF Evaluations – JCW will need to evaluate siting and design of a new facility or facilities to serve additional areas within the southern and/or western portions of JCW's service area. The estimated cost for these evaluations is \$5 million.

5.3 Other Programs and Capital Expenses

JCW's CIP includes ongoing expenditures for other programs and capital expenses that do not fit into the previous categories.

- City Street and Storm Program – JCW administers a dedicated program focused on partnering with local municipalities to ensure protection of infrastructure during street and storm improvement projects. This often includes constructing pipe and manhole protection and/or realignments to accommodate improvements. Through this program, JCW will also complete collection system improvements in conjunction with other projects when the opportunity arises in order to limit disruption to customers. JCW has planned to allocate \$700,000 annually for this program for the next ten years, decreasing to approximately \$3 million each five years thereafter.
- Customer Service Software Improvements – JCW projects they will invest \$150,000 bi-annually over the next ten years for continued improvements to customer service related software and programs.
- SCADA/Network Improvements – JCW projects investing \$200,000 annually in SCADA and network improvements over the next ten years, decreasing to \$250,000 every five years thereafter.
- Lab Equipment – JCW projects spending \$50,000 annually from the capital budget for lab equipment.
- O&M Vehicles – JCW projects spending \$3.2 million from the capital budget for large O&M vehicles (e.g. Cleaning, CCTV trucks) over the next five years. Beyond the 5 years, these type of expenses will be included in the operations budget.

5.4 Program Planning and Support

Consultant support will be required to complete the studies necessary to increase JCW's understanding of several specific program needs, prioritize them, and incorporate them into the Phase 2 of the IMP. Support will also be required to facilitate delivery of the ambitious improvements program JCW is committing to executing through the IMP. The estimated costs for these programmatic support items are described below.

- Studies to be completed to inform Phase 2 of the IMP – There are several major needs that require detailed engineering studies to determine the preferred long term plan and estimated project costs. In this Phase 1 report, high level preliminary cost estimates have been included for these items; however, a greater degree of confidence is needed prior to Phase 2 so that JCW can more accurately forecast the challenges and financial impact of these projects and schedule them accordingly. The most impactful studies to be completed include a facility planning study for Mill Creek WWTF, and collection system basin planning and optimization studies for the Lower Indian Creek, Tomahawk Creek and Leawood service areas. The estimated combined cost forecasts for these studies is \$5 million.
- Asset Management Program – Annual funding needed for ongoing support for the CAMP and FAMP is approximately \$500,000 based on historical expenditures.
- Integrated Management Plan Delivery Support – Based on the level of support required to successfully deliver programs of comparable magnitude, required funding forecast for IMP delivery support is \$3 million annually. This may include a variety of support tasks including staff augmentation, capital project delivery process improvements, preliminary design development, design consultant management, construction management, program reporting and controls, information technology improvements, plan updates, adaptive management and continued project prioritization, ongoing flow monitoring to assess I/I reduction effectiveness, and stakeholder and community outreach program support. Included in this category are studies that will be required throughout the program to confirm design sizing and update improvement plans or strategies and corresponding project costs. These studies include the following efforts which will be required prior to elimination of PEFTFs:
 - Nelson Complex collection system flow monitoring, hydraulic model update, and wet weather management strategy refinement – Following completion of the new WWTF and ongoing public sector I/I reduction efforts in 2029, flow monitoring will need to be completed to assess I/I reduction performance and update system performance. The hydraulic model will be updated and design flow sizing will be updated for the improvements required to eliminate the PEFTF facilities. Along with this basin wide update, individual studies will be required at different stages of the integrated plan to confirm final facility sizing.
 - Turkey Creek storage and Rock Creek Pump Station facility planning – Prior to construction of these improvements, the results of I/I reduction and other system improvements will be assessed to confirm sizing and final project costs.
 - Brush Creek Pump Station storage and Turkey Creek Pump Station facility planning - Prior to construction of these improvements, the results of I/I reduction and other system improvements will be assessed, along with the impacts of upstream storage

and the downstream improvements at Rock Creek Pump Station to confirm sizing and final project costs for the Turkey Creek Pump Station improvements and Brush Creek storage, respectively.

- Belinder Pump Station facility planning – After completion of upstream improvements in the service areas tributary to the Rock Creek and Brush Creek Pump Stations and basin wide I/I reduction efforts, a final Belinder planning study will need to be completed. This study will determine the preferred approach to eliminating the Belinder PEFTF, project costs and schedule for PEFTF elimination.

6 Community Engagement

JCW has a proven track record of providing high quality service to Johnson County customers and takes pride in providing transparent decision-making and keeping the community well-informed. For the Phase 1 IMP, JCW leveraged existing community engagement programs and methods to identify and prioritize the overall goals and investment plan. Since 2012, JCW has conducted biannual customer satisfaction surveys by randomly sampling over 400 individual customers and soliciting feedback on several topics, ranging from interactions with JCW personnel to customer impacts from odors and wet weather. Overall customer satisfaction is consistently greater than 90%, and routinely above 70% of customers feel well-informed about the utility's services. With this strong customer support, JCW's mission was selected to reflect the overarching IMP goals and provide a framework for decision-making. JCW's mission statement is the following:

- Protecting Our Environment
- Serving Our Customers
- Enhancing Our Communities

During IMP development, JCW relied on input from the Johnson County Board of County Commissioners (BOCC) to guide and affirm plan priorities. Because members of the BOCC are elected by the public, their input and priorities reflect the priorities of the communities they serve and are sufficient for the planning level prioritization and scheduling efforts needed for Phase 1. In addition, JCW presented the IMP framework and priorities during the April 18, 2019 BOCC Committee of the Whole to solicit feedback from the BOCC and general public. Feedback from this meeting was positive and JCW was charged with continuing IMP development. On May 20, 2019, JCW management and financial team presented to the BOCC and community the 10-year revenue requirements necessary to implement the projects and programs as scheduled and budgeted within this plan. After receiving BOCC feedback, JCW moved forward with finalizing this Phase 1 IMP. In the context of EPA's integrated planning framework, community outreach should be an ongoing process that informs goals and outcomes over time. Therefore, JCW plans to more deeply engage the broader community as Phase 2 of the IMP is prepared.

JCW recently demonstrated commitment to public outreach and stakeholder involvement as part of the Tomahawk Creek Wastewater Treatment Facility project. Initial efforts including outreach to the BOCC through a May 2013 Committee of the Whole presentation. JCW engaged the City of Leawood early in the project definition phase by holding a work session for the City Council members in February 2016. JCW held the first public meeting in March 2016 to explain the drivers for the project, reveal the recommended alternative, show the anticipated future revenue needs and long-term savings from implementing the recommended alternative. The response from attendees was positive, and public feedback was used to improve the construction traffic pattern to be less disruptive to the surrounding property owners. This meeting was closely followed by another Committee of the Whole presentation to the BOCC summarizing our project definition phase efforts and presenting the recommended alternative.

During detailed design, the JCW Tomahawk team continued our public outreach involvement through interactive meetings with the public, further meetings with elected and appointed officials at the City of Leawood and the Board of County Commissioners, and development of a project website.

This website, located at www.jcwtomahawk.com, has been instrumental in providing continuous project updates to the general public in a conveniently accessed format.

7 Project and Program Prioritization and Scheduling

To prioritize and schedule the investments identified in Section 5, JCW developed a decision analysis tool to measure the anticipated environmental and community benefits produced by each project. Projects and programs were then evaluated with JCW's existing financial model to develop an IMP schedule that is implementable, fundable, and prioritizes the highest benefit projects early in the planning period. A 25-year IMP planning period was used for this evaluation. Project prioritization will be refined as more information is developed during Phase 2 of the IMP.

7.1 Project Identification

JCW's review of wastewater management needs identified approximately \$3 Billion (in 2018 dollars) in potential projects and solutions to address all currently forecasted system-wide capital and programmatic needs (Table 7-1). Planning level costs associated with these projects include both capital costs and costs associated with conducting necessary planning activities. Operation and maintenance cost increases for major capital projects were also estimated within JCW's financial model.

Table 7-1: Summary of All Projects and Planning Level Costs (2018 \$, in millions) Considered in the Development of the IMP. Projects (\$3 Billion total) included in this table were prioritized with a decision analysis tool and scheduled using JCW's financial model to develop the final 25-year IMP project schedule (\$2.1 Billion).

Category	Project and Estimated Cost (in 2018\$)	
Major Facility Upgrades³	<ul style="list-style-type: none"> Tomahawk Creek WWTF Upgrade - \$334 M Nelson Complex WWTF Upgrade - \$350 M Mill Creek WWTF Upgrade - \$250 M 	<ul style="list-style-type: none"> Blue River WWTF Expansion - \$150 M Mill Creek WWTF Final Expansion - \$200 M Blue River WWTF Final Expansion - \$90 M
WWTF and PS Renewal^(1, 2, 3)	<ul style="list-style-type: none"> Nelson Complex WWTF Resource Recovery (Biosolids) Improvements - \$7.5 M Nelson Complex WWTF Renewal - \$ 4 M Turkey Creek Pump Station Renewal - \$4 M Belinder Pump Station Renewal - \$3 M Brush Creek Pump Station Near Term Renewal, and Long Term Replacement - \$7 M 	<ul style="list-style-type: none"> Dyke's Branch Forcemain Improvements - \$6 M Middle Basin WWTF Near Term Renewal - \$3 M Middle Basin WWTF Solids Improvements - \$15.5 M Mill Creek WWTF Near Renewal - \$2 M Additional Ongoing WWTF, Pump Station, and Forcemain R&R - \$450 M PEFTF Interim Upgrades - \$6 M
Collection System Renewal⁽¹⁾	<ul style="list-style-type: none"> Gravity Sewer R&R - \$60 M (CIPP Program and Outside Contractor Repairs) Stream Crossing Program - \$31 M 	<ul style="list-style-type: none"> Manhole I/I Reduction Program - \$22 M
System Capacity and PEFTF Elimination^(1,3)	<ul style="list-style-type: none"> Turkey Creek PEFTF Elimination and Capacity – \$73 M Martway PEFTF Elimination and Capacity – \$ 36 M 75th and Nail PEFTF Elimination and Capacity – \$34 M Belinder PEFTF Elimination – \$ 85 M Mill Creek Capacity Enhancements - \$49 M 	<ul style="list-style-type: none"> Tomahawk and Lower Indian Creek Capacity – up to \$300 M Leawood and Dyke's Branch Capacity – up to \$75 M Dykes Branch Pump Station Capacity – \$ 5 M BUPP and Plumber Private I/I Reduction Programs - \$3.4 M
System Expansion and Misc. Projects⁽¹⁾	<ul style="list-style-type: none"> Future Districts Expansion - \$136 M Leawood Service Area Pump Stations and Forcemain - \$16 M Little Bull Creek Pump Station - \$5 M Street and Storm Program - \$ 17 M Middle Basin WWTF Regulatory (Wet weather Treatment) - \$21 M Blue River WWTF Wet weather Capacity - \$20 M 	<ul style="list-style-type: none"> New Century WWTF Expansions - \$6 M New Century WWTF Upgrade - \$5 M SCADA and Network Improvements - \$3 M Near Term Large O&M Vehicle Purchases - \$ 3M Lab Equipment - \$1.5 M Other Misc. Needs – \$ 34 M
Planning and Support	<ul style="list-style-type: none"> Near Term Studies and Integrated Plan Development - \$ 5 M Asset Management Program Implementation Support - \$12 M 	<ul style="list-style-type: none"> Integrated Plan Delivery Support and Adaptive Management - \$70 M

(1) R&R cost forecasts and ongoing programs do not include projected needs outside 25-year planning period.

(2) Defined near term WWTF, Pump Station and Forcemain R&R projects are specifically listed. Future R&R projects and near term needs that have not been incorporated into specific projects are included in additional ongoing R&R needs.

(3) Includes projects scheduled to be completed outside the 25-year planning period.

7.2 Multiple Criteria Decision Analysis Tool Development

Multiple criteria decision analysis (MCDA) is a structured, quantitative technique used to solve planning problems that involve multiple decision criteria or objectives. When applied correctly, MCDA facilitates the critical thinking process in an open and transparent manner. Simplistically, a MCDA is conducted by scoring potential alternatives relative to a set of weighted criteria using a standardized rating system. After all alternatives are scored, the alternative with the highest total score should be the one that best addresses the overall planning goals. By coupling final benefit scores with costs, a prioritized implementation schedule can be developed.

A critical aspect of developing an MCDA tool is creating a decision framework that explicitly links the alternatives to evaluation criteria, which represent the interests or priorities of the community. Sub-objectives are critical to the decision framework because they provide an objective means of linking alternatives to the community objectives. Once established, the framework enables decision makers to understand how the overall goal is linked to the individual alternatives and helps facilitate the scoring process.

The MCDA tool incorporates four basic components:

1. **Goal** - The goal of the MCDA evaluation was to identify projects that provide the greatest community and environmental benefit.
2. **Projects and Programs** - The projects and programs were defined based on an assessment of forecasted needs through the year 2044.
3. **Weighted Evaluation Criteria** – Evaluation criteria represent the planning objectives that the projects are intended to address. The weighting reflects the relative importance of each criteria. In this MCDA, the evaluation criteria reflect JCW's Mission Statement. The IMP evaluation criteria are explained in greater detail below.
4. **Benefit Scores** – Benefit scores were developed to quantify how well each project address the planning objectives. The scoring process is described in more detail below.

The final MCDA tool, as well as project rankings and benefit scores, are included in Appendix C.1. More detailed information regarding the evaluation criteria, scoring process, and optimization analysis used to evaluate the IMP alternatives are described below.

7.2.1 Weighted Evaluation Criteria

A key element of EPA's Framework is ensuring that community needs and priorities are adequately considered in the integrated planning process. JCW's community-supported mission statement formed the basis for identifying community needs and priorities during initial stages of IMP. The selected criteria were validated during meetings with the BOCC. JCW chose evaluation criteria that align with JCW's mission statement, which is:

- Protecting Our Environment
- Serving Our Customers
- Enhancing Our Communities

These three primary objectives were then weighted on a 0 to 1 scale (with a sum of 1) based on a qualitative assessment of community values. After the three primary objectives were defined, JCW identified and weighted seven sub-objectives that more specifically characterized the primary

objectives. Descriptions of the scoring basis for each sub-objective are included in Appendix C.2. Objective and sub-objective weights were then multiplied together to develop a combined weight which reflects the relative importance of each sub-objective in the MCDA (Table 7-2).

Table 7-2: Final Community Objectives, Sub-Objectives, and Priority Weightings used in the MCDA Evaluation. Note that community objective weights must total 1.0. Similarly, the sub-objective weights must total 1.0 for each corresponding community objective. The combined weight is the product of the objective and sub-objective weights.

Community Objective (Weight)	Sub-Objective (Weight)	Combined Weight
Environmental Protection (0.4)	Improve Water Quality (0.4) Enhance or restore water quality in local, regional, and national waters.	0.16
	Meet Regulatory Obligations (0.5) Remain a key partner in implementing state federal laws and regulations by maintaining compliance.	0.20
	Efficiently Use and Protect Natural Resources (0.1) Promote a sustainable use of resources.	0.04
Customer Service (0.4)	Minimize Human Health and Property Impacts (0.6) Minimize health and property impacts related to capacity constraints or failing infrastructure.	0.24
	Achieve Financial Benefits (0.4) Yield a net positive financial benefit to JCW customers by improving overall efficiency, costs, or business performance.	0.16
Community Enhancement (0.2)	Be a Good Neighbor (0.5) Enhance community well-being and satisfaction by reducing the number and frequency of community disruptions (odors, noise, aesthetics, etc.).	0.10
	Foster Responsible Growth and Important Development (0.5) Provide necessary infrastructure improvements to new and redeveloping areas.	0.10

7.2.2 Project Rating and Benefit Score Calculation

Projects were assigned consensus-based ratings on a 0 to 10 scale to indicate how well each project addressed individual sub-objectives; a rating of 0 indicated that the project was not anticipated to benefit the sub-objective, whereas a rating of 10 indicated the highest benefit was expected. Project ratings were then multiplied by the combined weight and summed to develop final benefit scores (Appendix C.1).

Overall, the final ranked benefit scores reflected the importance of the utility drivers facing JCW (Figure 7-1). Collection and facility R&R and upgrade projects were generally expected to produce the greatest benefits when evaluated against the sub-objectives, which reflects the severity of system-wide aging infrastructure demands. Capacity and expansion projects also tended to rank in the upper half of projects, in particular as a result of their positive impacts on water quality and human health. Resource recovery, waste acceptance, and wet weather projects generally produced medium to low benefits.

WEIGHTED BENEFIT SCORES BY SUBCRITERIA

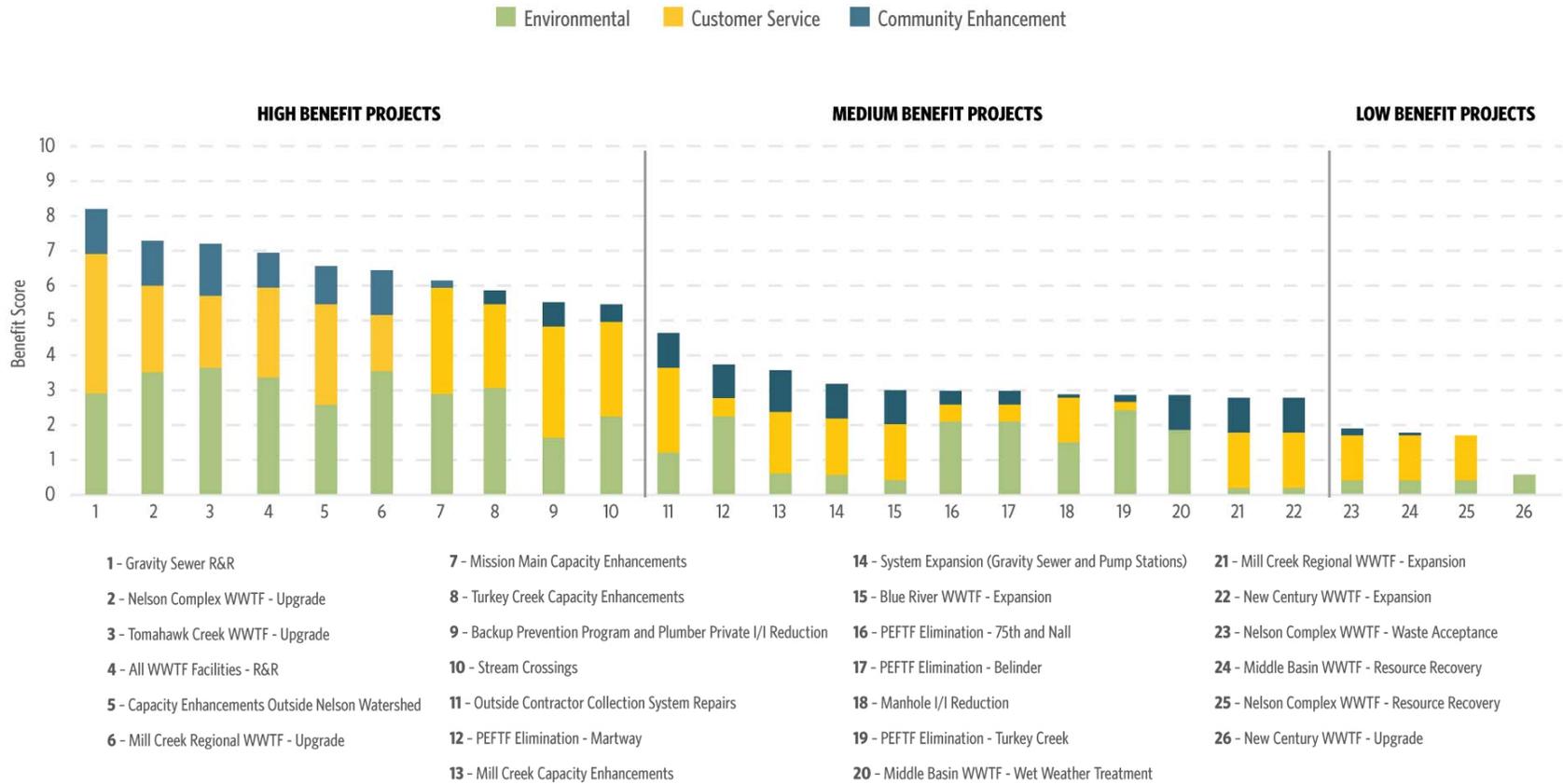


Figure 7-1: Final Phase 1 Benefit Scores for JCW IMP Wastewater Treatment and Collection Projects.

7.2.3 Benefit Score Sensitivity Analysis

Uncertainty is inherent to the MCDA process. JCW considered uncertainty in the benefit scores to better understand the potential ranking of projects that could result from the qualitative weighting and rating process. The evaluation was conducted with a Monte Carlo simulation (5,000 trials) by randomly adjusting the community objective weights using a normal distribution.

Rather than evaluate absolute scores that resulted from varying objective weights, JCW compared the ranking position of original scores in Figure 7-1 against the rank predicted by the Monte Carlo analysis using a qualitative demarcation of low, medium, and high benefit projects. If the majority of predicted ranks for each individual project fell within the same benefit range as the original benefit score, the two were considered similar. For example, Wastewater Facilities R&R (project 4 in Figure 7-1) originally scored 6.2 points and ranked within the high benefit category of projects. In the Monte Carlo analysis, absolute scores ranged from approximately 5.1 points to 7.8 points, but ranked within the highest category 87% of the time. Overall, about 80% of the original projects ranks were similar to the Monte Carlo analysis project ranks. Objective weightings, project ratings, and benefit scores will be evaluated in more detail in Phase 2. However, results of the uncertainty analysis demonstrate that the Phase 1 scores are sufficient for developing the initial IMP project schedule.

7.3 Project Scheduling and Delivery

The MCDA evaluation was limited to evaluating the benefits of potential projects and did not assess the anticipated financial impacts and implementation complexities that would result from delivering those projects. Project interdependencies are critically important in developing implementable schedules (e.g., project 1 must be operational prior to construction of project 2). JCW's financial consultant was also engaged to evaluate future project funding needs with respect to the existing and future customer base, operations, planned CIP projects, debt service requirements, and cash flow analyses. In addition, increasing JCW's capital project delivery will significantly increase in demands on JCW project managers and management staff and stress local demands on engineering and construction firms given the other large capital programs within the region. These internal and external demands and constraints are equally important to scheduling as the financial impacts to JCW customers.

Given these complexities, JCW identified a 25-year project schedule that addresses critical public health and environmental issues first, while appropriately balancing revenue requirements and ability to effectively and efficiently deliver these capital improvements. The resulting Phase 1 IMP project schedule is ambitious but considered sustainable, addressing approximately \$2.1 billion of the \$3 billion worth of needs over the next 25 years (Table 7-1 and Figure 7-2). While these improvements are presented in monetary terms, achieving the customer service enhancement, environmental benefits, and regulatory obligations associated with project and program implementation are the primary goals with IMP delivery. A detailed compendium of the anticipated investments is included within Appendix D; however, the timing and expenditures for individual projects may be modified by JCW during IMP implementation through adaptive management as these minor modifications will not significantly impact JCW's primary goals. JCW will pursue these actions to the extent possible but acknowledges that weather, staff availability, contractor performance, and other unanticipated constraints and needs may impede complete implementation on the proposed schedule.

To implement the planned projects, annual revenue requirements are projected to increase from approximately \$122 million in 2020 to \$340 million by the year 2040. This approach also generally prioritizes the highest benefit projects within the first 10 years and defers the lower benefit projects to the end of the planning period.

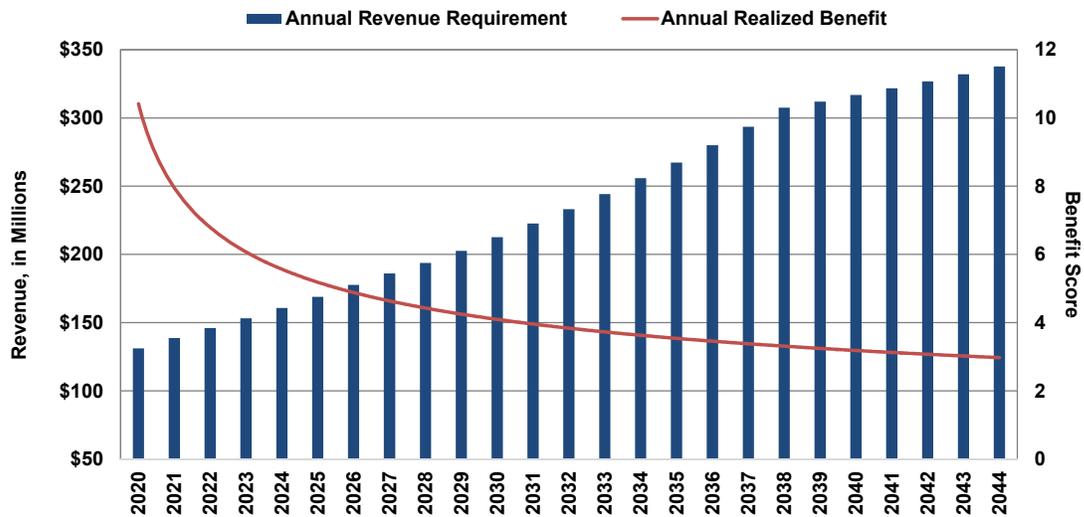


Figure 7-2: Projected Revenue Requirements (in Future Dollars) and Anticipated Annual Realized Benefits for the 25-Year IMP Planning Period. Note that the slope of the annual realized benefit line indicates that high value projects are prioritized early in the IMP planning period. Further, annual revenue values are presented in future dollars (include inflation estimates), rather than in 2018 dollars.

The Phase 1 IMP implementation schedule features approximately \$444 million worth of improvements including collection system (\$108 million) and WWTF (\$336 million) renewal projects to address system-wide aging infrastructure challenges (Figure 7-3, Figure 7-4). All IMP schedules are based upon issuance of the renewed Mill Creek Regional and Nelson Complex WWTFs NPDES permits and entering into implementing the Consent Order with KDHE by December 31, 2019. If permit renewals and Consent Order execution are delayed beyond this date, then IMP implementation schedules will be extended to the same extent. Collection system renewal and public sector I/I reduction programs strategies will continue to be implemented through the CAMP program and will address pipe, manhole, and stream crossing inspections, along with operations and maintenance strategies and other collection system management tasks.

The facility renewal estimates are based on JCW's preliminary R&R pump station and WWTF forecast model which currently indicates a funding need of over \$500 million for facilities R&R over the 25 year planning period. These estimates were reduced to \$336 million for purposes of Phase 1 IMP schedule development. JCW is implementing a dedicated facilities condition assessment program and other FAMP initiatives to more precisely define future project costs and increase confidence in long term R&R needs and budgeting during future IMP phases. The WWTF renewal estimates also include \$6 million for near-term PEFTF disinfection and dechlorination upgrades that will be completed within the first six years of the plan.

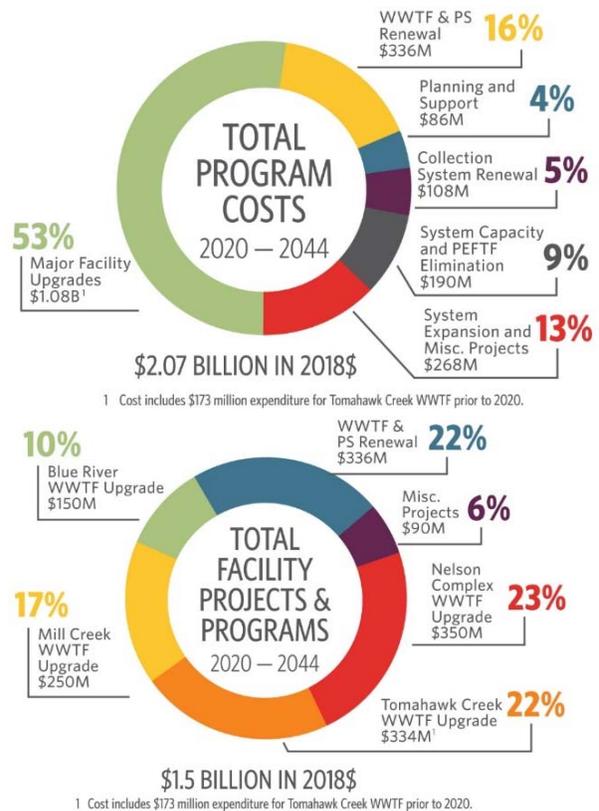


Figure 7-3: Final Phase 1 IMP Program Costs for the 25-Year (2020 – 2044) Planning Period.

Integrated Plan 25-Year Schedule

	CAPITAL COST (2018 \$ x Million)	YEARS 1 - 5 ¹ 2020 - 2024	YEARS 6 - 10 2025 - 2029	YEARS 11 - 15 2030 - 2034	YEARS 16 - 20 2035 - 2039	YEARS 21 - 25 2040 - 2044
Major Facility Upgrades						
Tomahawk WWTF Upgrade	\$334 ²					
Nelson Complex WWTF Upgrade	\$350					
Mill Creek WWTF Expansion and Upgrade	\$250					
Blue River WWTF Expansion	\$150					
Collection System Renewal with Public Sector I/I Reduction	\$108					
WWTF & PS Renewal						
PEFTF Interim Upgrades	\$6					
WWTF & PS Renewal	\$330					
System Capacity and PEFTF Elimination						
Turkey Creek Storage	\$24					
Brush Creek Storage	\$25					
Mill Creek Storage	\$25					
Collection System Upgrades	\$61					
I/I Reduction	\$18					
PEFTF Elimination - Martway	\$18					
PEFTF Elimination - Turkey Creek	\$19					
PEFTF Elimination - 75th and Nall	— ³					
PEFTF Elimination - Belinder	—					
Miscellaneous Projects/Expansion	\$268					
Planning and Support	\$86					
TOTAL	\$2.07 Billion					

1 IMP schedules based on Mill Creek Regional and Nelson Complex WWTFs NPDES Permits and Consent Order issuance by December 31, 2019. Schedules will be extended accordingly if issuance is delayed.

2 Cost includes \$173 million expenditure for Tomahawk Creek WWTF prior to 2020.

3 Addressed with Brush Creek Storage Project.

LEGEND	Major Facility Upgrades	WWTF & PS Renewal	Planning and Support	System Capacity and PEFTF Elimination	System Expansion and Misc. Projects	Collection System Renewal
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Figure 7-4: Final Phase 1 IMP Project Implementation Schedule.

A majority (53%) of the 25-year program costs are related to major WWTF upgrades needed to provide additional capacity and meet existing or anticipated regulatory requirements. These planned investments are dominated by large WWTF upgrade costs associated with the Nelson Complex WWTF (\$350 million), Tomahawk Creek WWTF (\$334 million), and Mill Creek WWTF upgrade (\$250 million) upgrade projects to meet regulatory requirements and replacement needs. These projects are staggered throughout the planning period (Figure 7-4) due to their extensive cost and the complexities associated with delivering these major upgrades. The funding outlay required to execute these WWTF upgrades comprises a substantial portion of the program costs over the first 15 years of the IMP (Figure 7-5).

Collection system capacity, addressing the PEFTFs, and renewal projects account for approximately \$300 million of the total program costs (Figure 7-3). Continuous projects include annual funding for BUPP and private I/I removal, as well as capacity improvements to address wet weather management issues throughout each of the major basins. Specific projects to eliminate the Martway, Turkey Creek, and 75th and Nall PEFTs through a combination of conveyance and storage are also included.

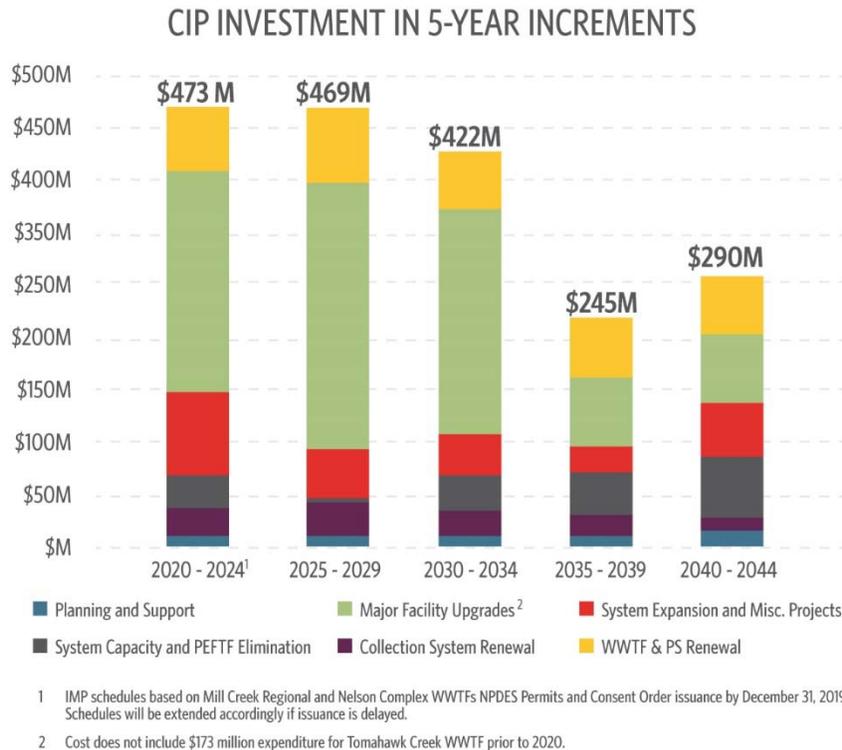


Figure 7-5: Final IMP Phase 1 Investment Schedule, in 5-Year Increments.

This IMP includes a major increase in capital project delivery, which results in significant increase in demands on JCW project managers and management staff. To address JCW’s internal resources to deliver this aggressive capital program, JCW will retain consultant support to assist with study efforts as well as support for IMP delivery. Therefore, the IMP includes approximately \$3 million annually for programmatic support to facilitate delivery of the ambitious improvements program JCW is committing to executing through this IMP. The final schedule also includes planning and studies to

better understand specific program needs and facilitate asset management program execution. The total cost for these programmatic support items is \$86 million over the 25-year planning period.

Due to the financial impacts and demands described above, some identified system needs are scheduled to be addressed outside the 25-year planning period. These include the following projects and program.

- JCW's preliminary facilities R&R forecast model indicated a funding need of over \$500 million over the planning period. The Phase 1 IMP 25-year schedule includes funding for approximately 2/3 of these R&R needs.
- Belinder PEFTF elimination is not included in the Phase 1 IMP schedule since the upstream PEFTF eliminations, conveyance improvements, and I/I reduction must first be completed to confirm the final sizing of improvements at Belinder. Approximately \$70 million in projects to eliminate this final PEFTF are preliminarily scheduled outside the 25-year planning period.
- Approximately \$150 million in capacity enhancements in the Lower Indian Creek, Tomahawk Creek, and Leawood service areas have been scheduled outside the 25-year planning period. Note that these investment needs are based on high level estimates and will be refined during Phase 2 IMP development.
- Major expansion projects at Mill Creek and Blue River WWTFs were assumed to occur outside the planning period, based on current growth rate projections.
- Construction of gas cleaning and utilization facilities at Nelson Complex were deferred until after the 25-year planning period.

8 Adaptive Management and 5-Year Action Plan

EPA's Integrated Planning Framework recognizes that adaptive management strategies are key to successful integrated planning. This means monitoring and evaluating projects and practices as work proceeds (Element 5), and adapting or revising plans and designs as new information is developed (Element 6). The IMP project schedule presented in the previous section reflects JCW's understanding of infrastructure needs and regulatory priorities over the next 25 years with respect to the information currently available. However, uncertainties exist which could impact these priorities as additional needs or regulatory requirements are identified. Therefore, adaptive management activities will be key to refining the forecasted timing and cost of program improvements as the IMP is implemented over time. As discussed in Section 7.3, JCW will pursue the proposed schedule of actions to the extent possible but acknowledges that weather, staff availability, contractor performance, and other unanticipated constraints and needs may impede complete implementation on the proposed schedule. Based on these factors and better understanding of resource needs, JCW may periodically adjust the timing and expenditures for individual projects during IMP implementation through adaptive management. JCW will provide KDHE annual reports detailing IMP progress, adjustments, and revised schedules.

As discussed in Section 2, JCW intends to develop and adopt Phase 2 of the IMP document by December 2022, depending upon the completion of additional studies to refine project cost estimates. Following the Phase 2 update, JCW will reevaluate and update the IMP at least every five years based on greater system understanding, results of program and project implementation, and updated benefit evaluations.

As part of the Phase 2 IMP development, JCW intends to implement a long-term performance monitoring approach that measures both the environmental and programmatic improvements that result from implementing the IMP. Specific performance metrics will be linked to the project evaluation criteria identified in Section 7.2 (or revised evaluation criteria identified through Phase 2 efforts) and results will be used to adjust or enhance the program, as necessary. Performance measures include tracking JCW's applicable Key Performance Indicators (KPIs) for the collection and treatment systems, reviewing effluent monitoring and other publicly available receiving stream data to characterize water quality improvements, and creating management controls to facilitate project execution and reliably achieve significant project milestones.

JCW currently has a robust KPI monitoring program for collection system performance and is continuing to develop and improve facilities KPI monitoring. JCW will continue to track system performance measures including dry and wet weather backups and overflows and the cause of each event. Along with these performance measures, JCW's KPI program diligently tracks inspection and maintenance productivity and uses these measures to prioritize resources to meet operational goals. JCW closely tracks system renewal efforts and prioritizes these efforts based on the risk associated with each pipe, in order to address the highest risk assets identified through inspection efforts. Pre and post-renewal flow monitoring is conducted to track the effectiveness of I/I reduction efforts and adjust program strategies accordingly.

Until specific IMP performance measures are identified in the Phase 2 IMP, Phase 1 IMP success will be measured through JCW's existing KPI monitoring program and through the achievement of milestones and actions outlined in the 5-Year IMP Action Plan outlined below. At the end of the first

five year period, JCW will evaluate progress to and make necessary changes and adjustments during future phases to ensure continuing progress towards satisfying infrastructure demands and meeting CWA obligations.

To implement early actions and gather additional information needed to direct future capital improvement decisions, JCW will pursue a 5-Year IMP Action Plan. This Action Plan is focused on implementing near-term projects while pursuing additional planning studies to inform Phase 2 of the IMP (Figure 8-1). All IMP schedules are based upon issuance of the renewed Mill Creek Regional and Nelson Complex WWTFs NPDES permits and entering into the implementing Consent Order with KDHE by December 31, 2019. If permit renewals and Consent Order execution are delayed beyond this date, then IMP implementation schedules will be extended to the same extent. The 5-year Action Plan includes \$473 million of capital projects and planning studies that JCW intends to implement based on the Phase 1 results (Figure 8-2). The action plan may be updated in Phase 2 based on new information that is developed.

Significant elements of the 5-Year Action Plan include the conclusion of the Tomahawk Creek WWTF expansion, design and initiation of construction of the Nelson Complex WWTF upgrade project, and planning studies to gain a better understanding of project scope and costs for several major program components (Figure 8-1). In this Phase 1 report, high level preliminary cost estimates have been included for these items and improvements have been scheduled based on current understanding. Prior to completion of Phase 2, the following detailed engineering studies will be required to determine the preferred long term plan and estimated project costs for these investments:

- Mill Creek WWTF Study – A significant update is anticipated for this facility in order to meet ammonia and nutrient effluent limits. In addition, the Mill Creek basin is approximately 60% built out and another facility expansion will be required. A preliminary estimate of \$250 million was included in the Phase 1 IMP for these improvements, scheduled in Years 11 – 15. Project costs and phasing will be defined through a facility planning study. Scoping of the study began in summer 2019, and the study completion is scheduled by the end of 2020.
- Tomahawk Creek Service Area (Lower Indian Creek and Tomahawk Creek Basins) Collection System Planning and Optimization – The IMP currently includes funding for the most beneficial capital investments in these basins. These basins will be evaluated through a more detailed planning and optimization study to define the preferred long term wet weather management strategy and level of investment required. This study is scheduled for 2020.

JOHNSON COUNTY WASTEWATER | INTEGRATED PLAN 5-YEAR ACTION PLAN

	CAPITAL COST ¹ (2018 \$ x Million)	YEAR 1 ² 2020	YEAR 2 2021	YEAR 3 2022	YEAR 4 2023	YEAR 5 2024
Tomahawk Creek WWTF Construction	\$162					
Nelson Complex WWTF Upgrade - Design/Begin Construction	\$76					
Nelson Biosolids Improvements and Renewal	\$10.1					
Blue River WWTF Wet Weather Capacity Improvements	\$20.1					
Middle Basin FOG Receiving, Biosolids Improvements, and Renewal	\$4.2					
New Century WWTF Wet Weather Capacity Improvements	\$4.1					
Mill Creek WWTF Planning Study	\$0.75					
PEFTF Disinfection and Pumping Upgrades	\$5.6					
Turkey Creek Pump Station Renewal	\$4.0					
Belinder Pump Station Renewal	\$2.8					
Collection System Renewal with Public Sector I/I Reduction	\$28.6					
Mill Creek Conveyance Improvements and Storage Facility	\$28.8					
Dykes Branch Pump Station and Forcemain Improvements	\$10.1					
Leawood Service Area Improvements	\$15.5					
Other WWTF and Pump Station Renewal	\$38					
Private I&I Source Disconnections	\$2.3					
Tomahawk Creek Service Area Planning/Optimization	\$0.5					
Leawood Service Area Planning/Optimization	\$0.5					
Collection System and Facilities Asset Management Programs	\$2.5					
Planning and Support	\$14.9					
Regional Service Enhancements	\$28.2					
Other Projects and Programs	\$13					
TOTAL	\$473					

1 Costs do not include project expenditures that occur prior to 2020 or 2024. The total capital costs for the Tomahawk WWTF Upgrade and Nelson WWTF Upgrade projects are \$334 Million and \$350 Million, respectively.

2 IMP schedules based on Mill Creek Regional and Nelson Complex WWTFs NPDES Permits and Consent Order issuance by December 31, 2019. Schedules will be extended accordingly if issuance is delayed.

LEGEND	Major Facility Upgrades	WWTF & PS Renewal	Planning and Support	Collection System Renewal
	System Capacity and PEFTF Elimination	System Expansion and Misc. Projects		



Figure 8-1: 5-Year Action Plan Project Schedule and Anticipated Costs.

- Leewood Service Area Collection System Planning/Optimization - The IMP currently includes allocation of funds for the most beneficial capital investments within this basin and/or the Tomahawk Creek service area. These basins will be evaluated through a more detailed planning and optimization study to define the preferred long term wet weather management strategy and level of investment required. This study is scheduled for 2021, with new flow meter data to be collected in 2020.
- Facilities R&R Needs Refinement – The IMP currently includes high level estimates of long term facilities R&R needs. These estimates were developed through FAMP work and adjusted based on historical needs. A condition assessment program and other FAMP initiatives are being implemented to increase JCW's ability to identify and package projects and increase confidence in long term R&R needs and budgeting.

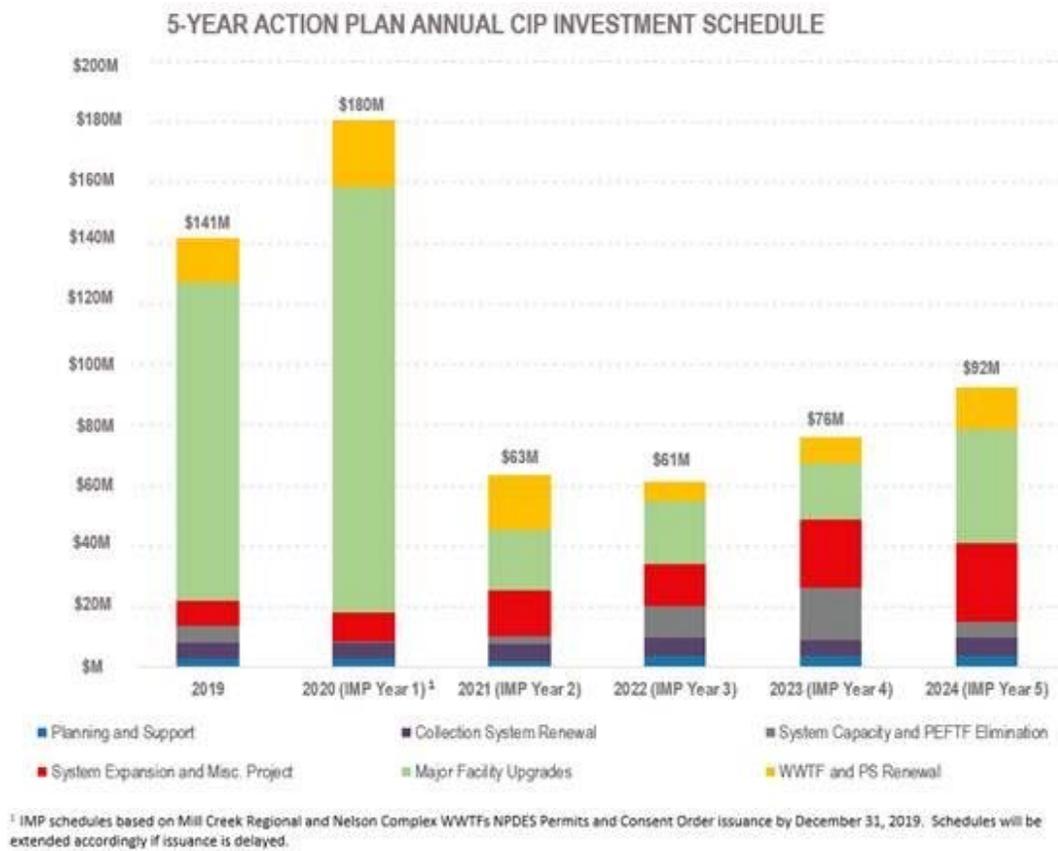
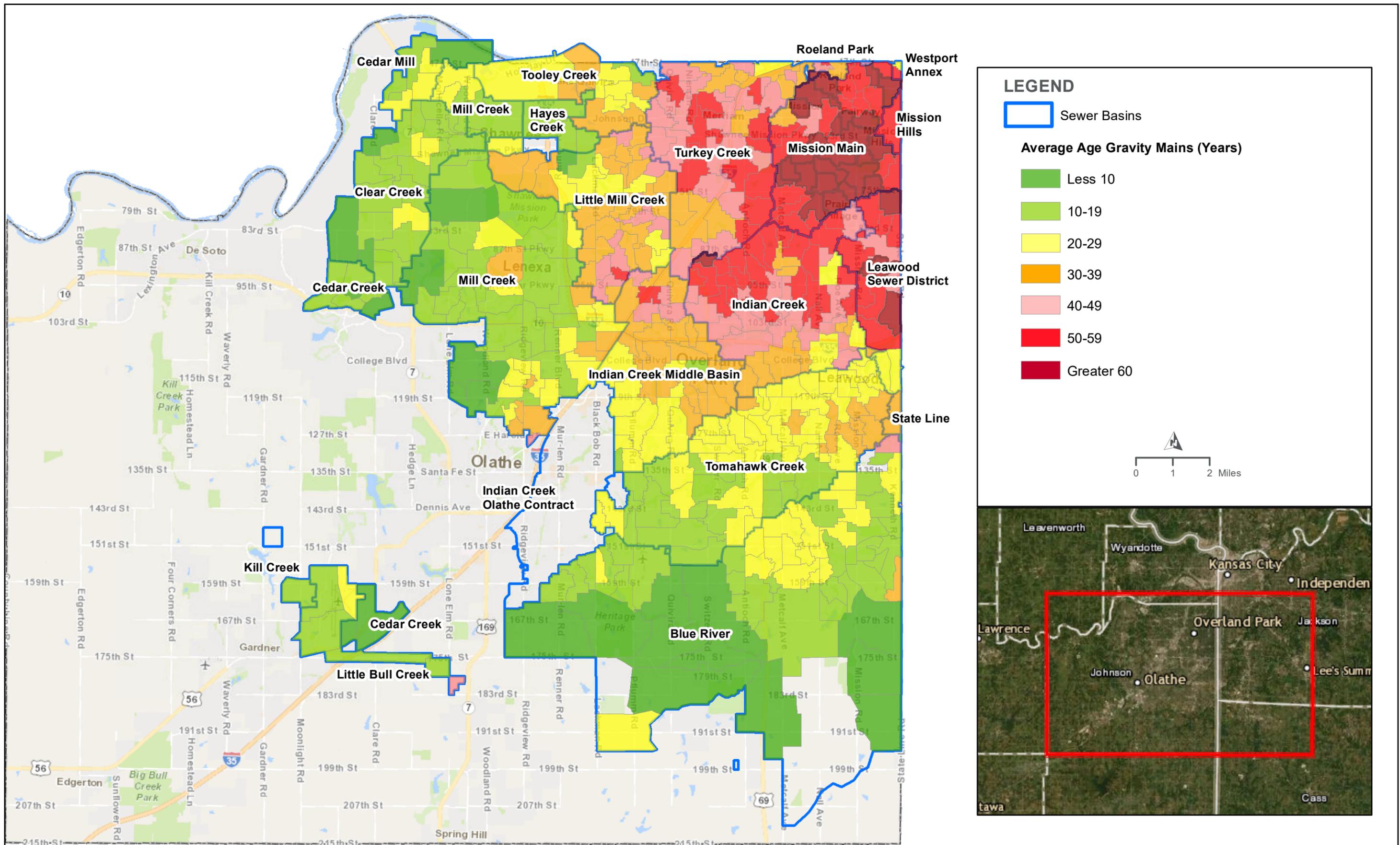


Figure 8-2: 5-Year Action Plan Annual CIP Investment Schedule.

Appendix A Figure Attachments



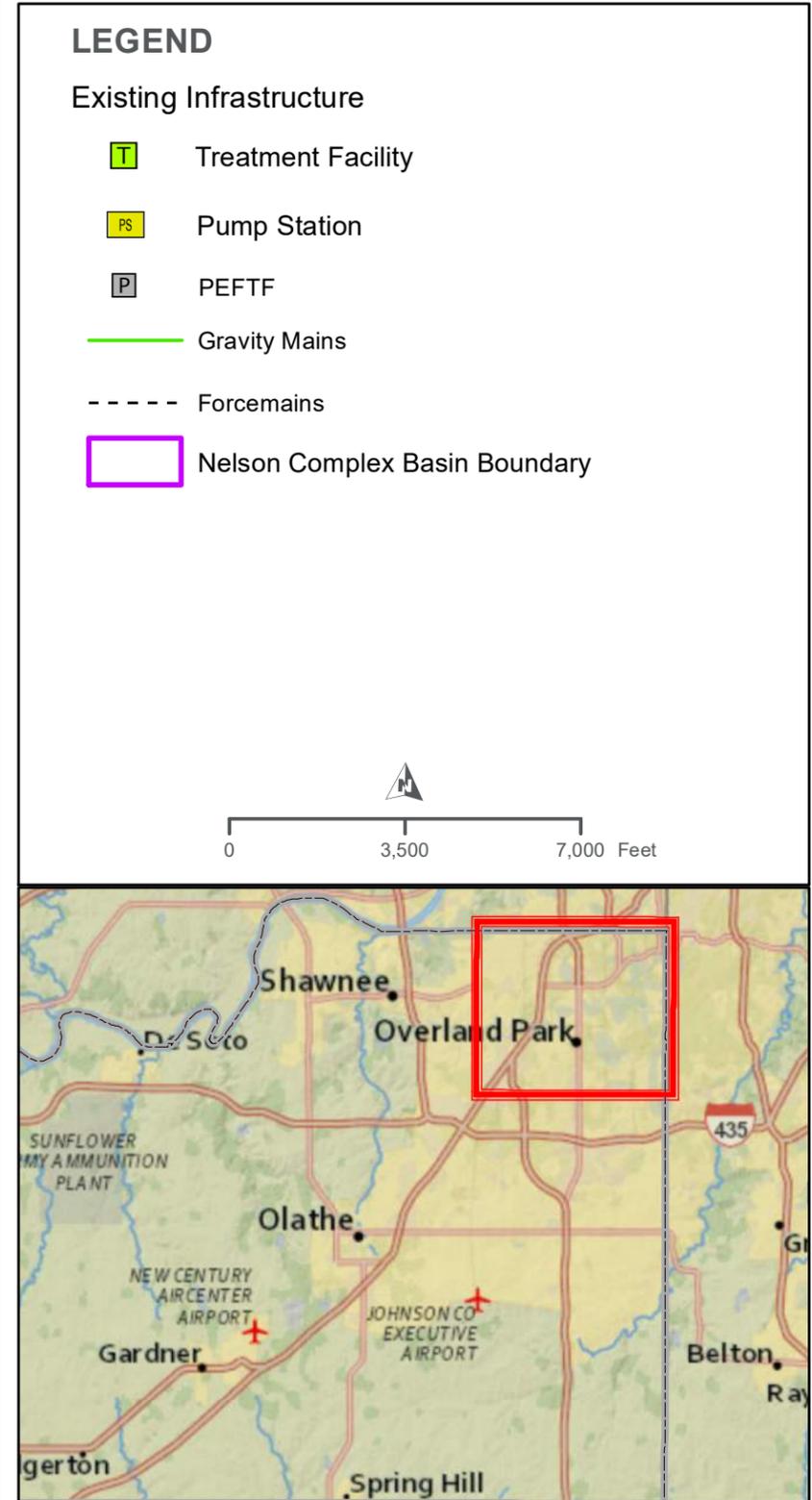
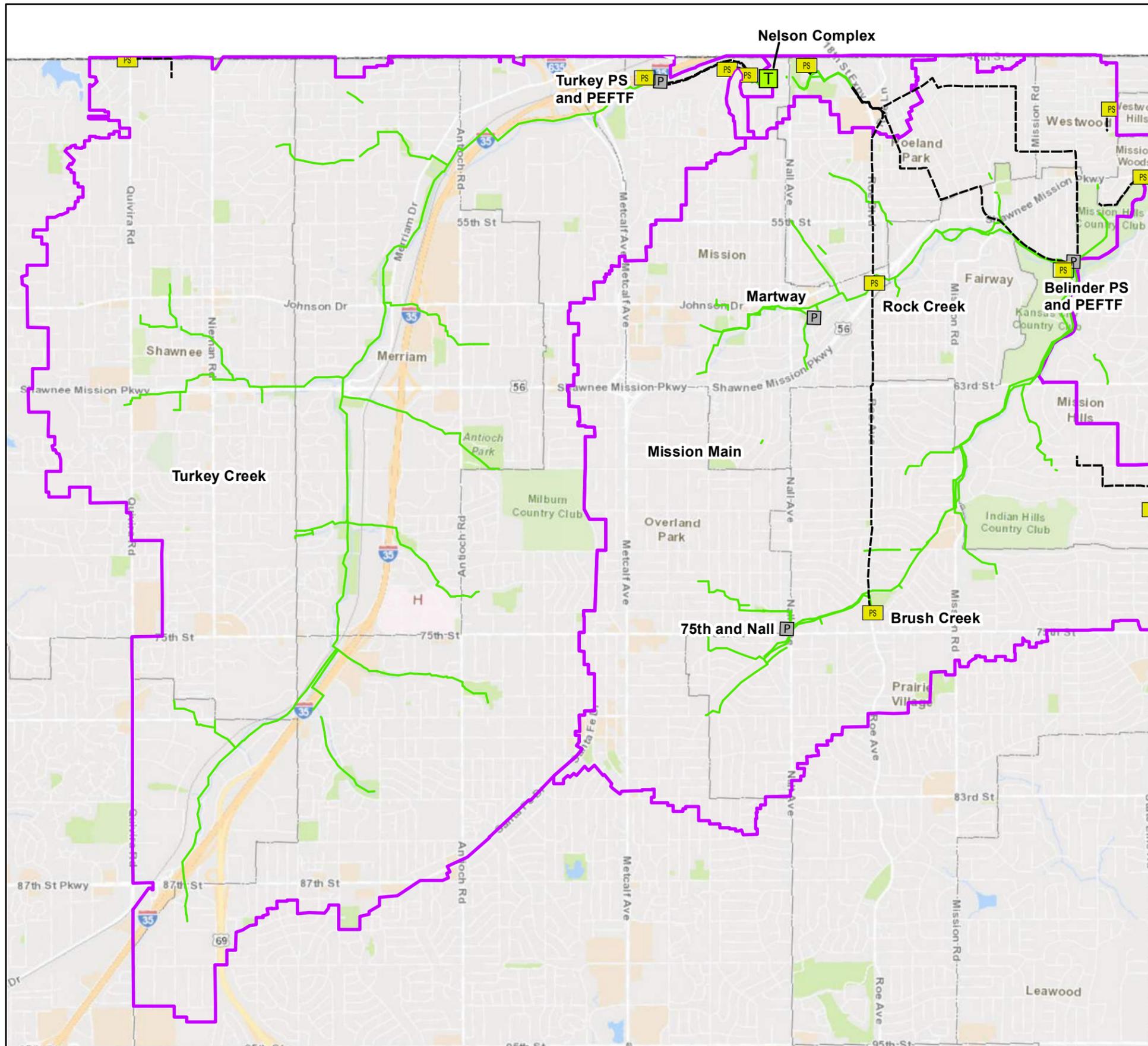
LEGEND

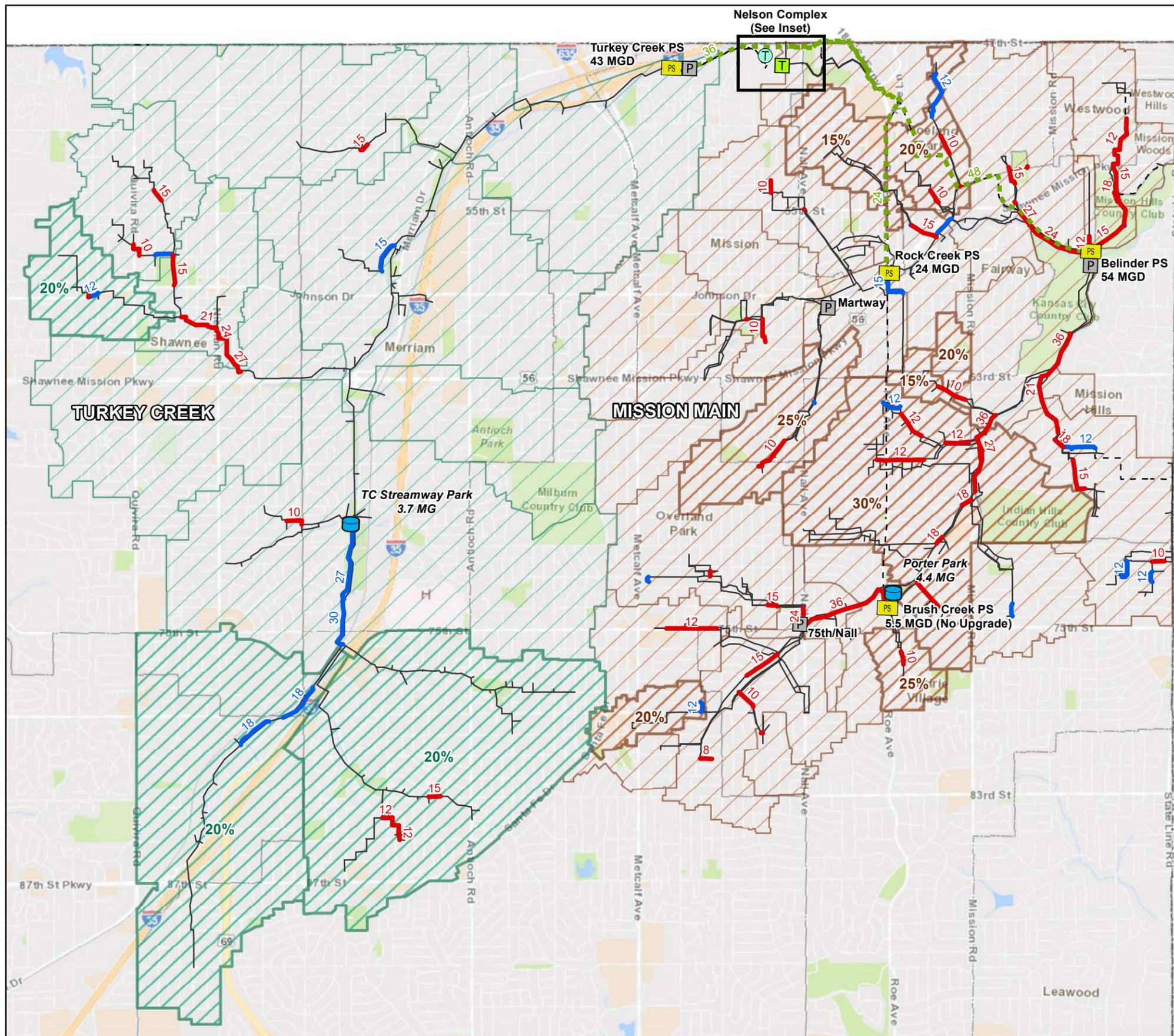
- Sewer Basins

Average Age Gravity Mains (Years)

- Less 10
- 10-19
- 20-29
- 30-39
- 40-49
- 50-59
- Greater 60

0 1 2 Miles





LEGEND

I/I Reduction

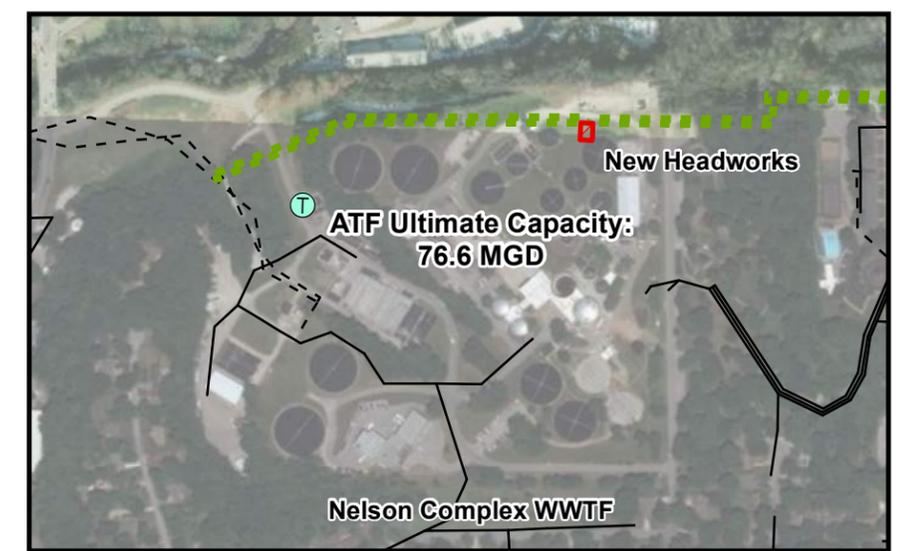
- Mission Main - 10% Reduction
- Mission Main - 15% to 30% Reduction
- Turkey Creek - 15% Reduction
- Turkey Creek - 20% Reduction

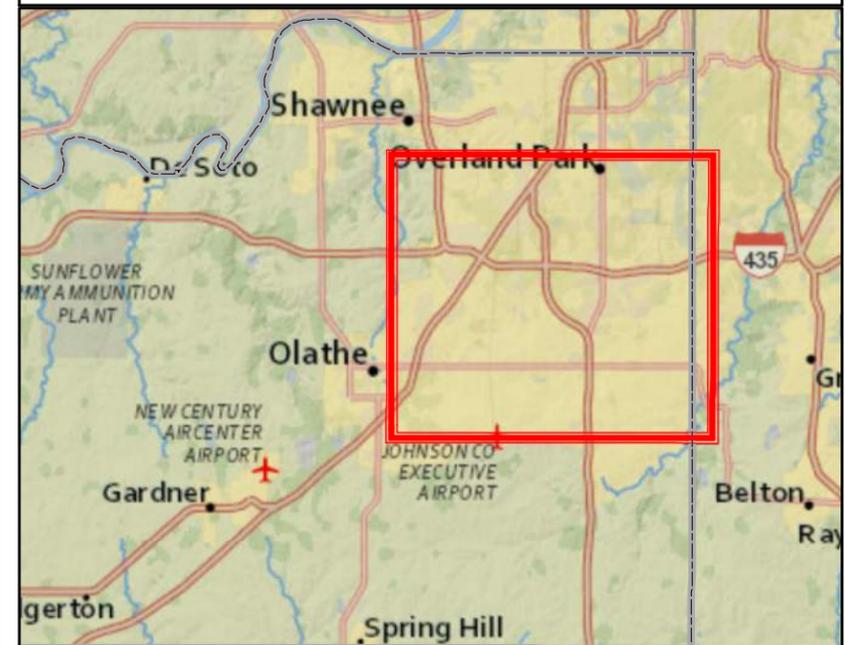
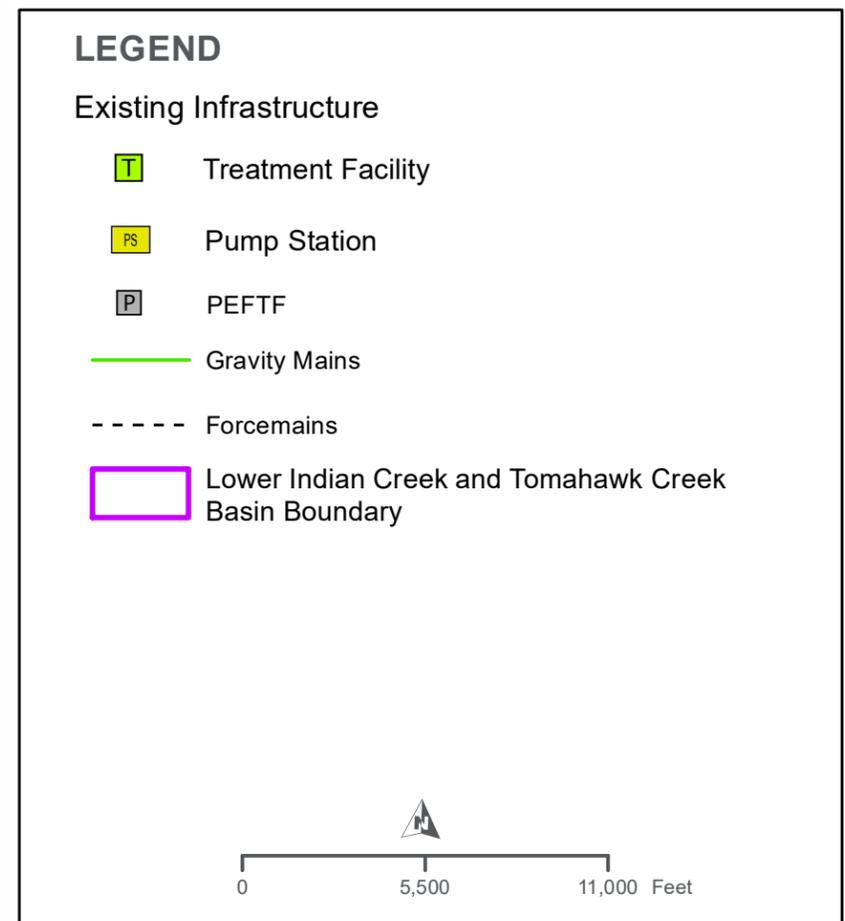
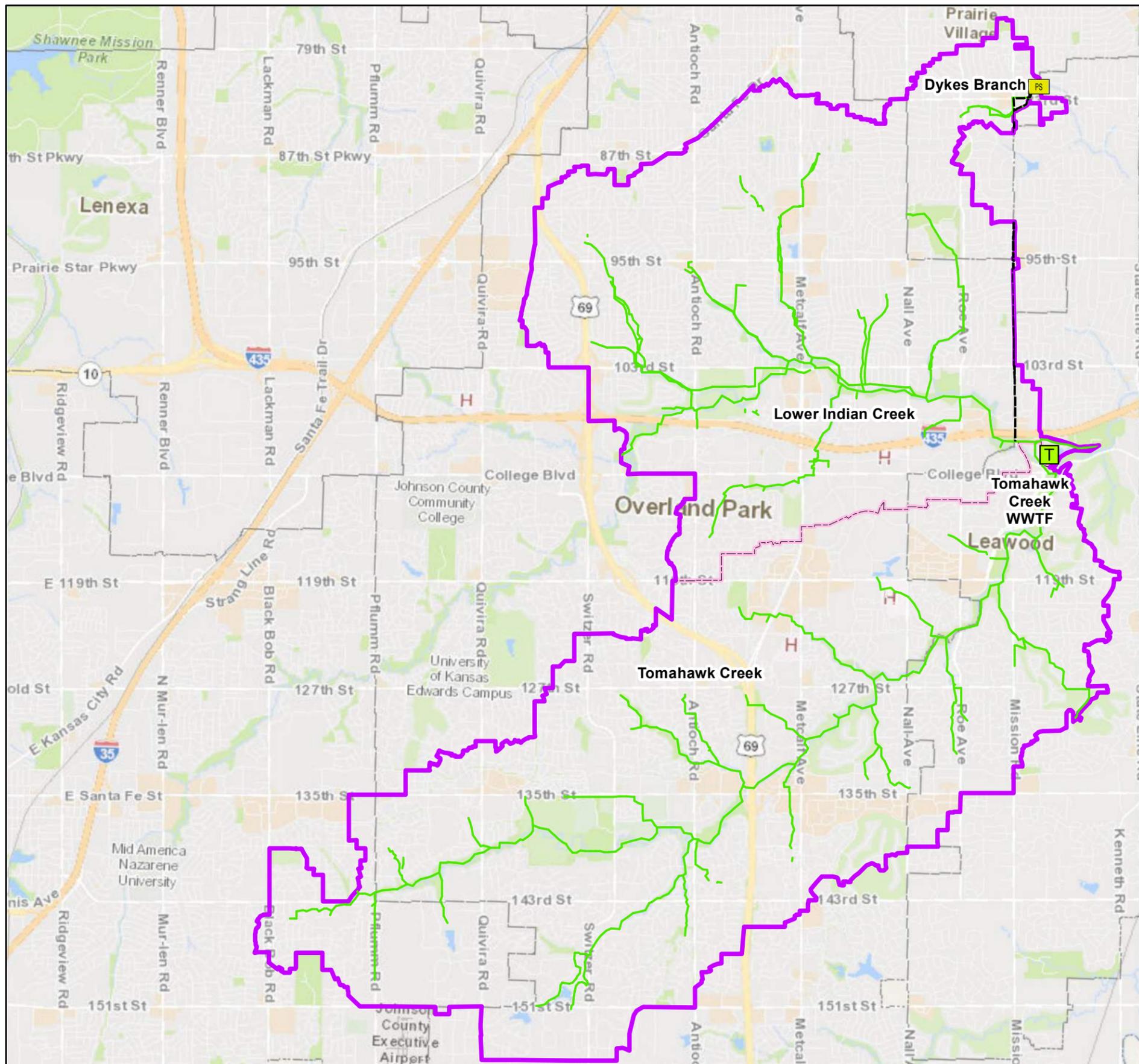
Proposed Infrastructure

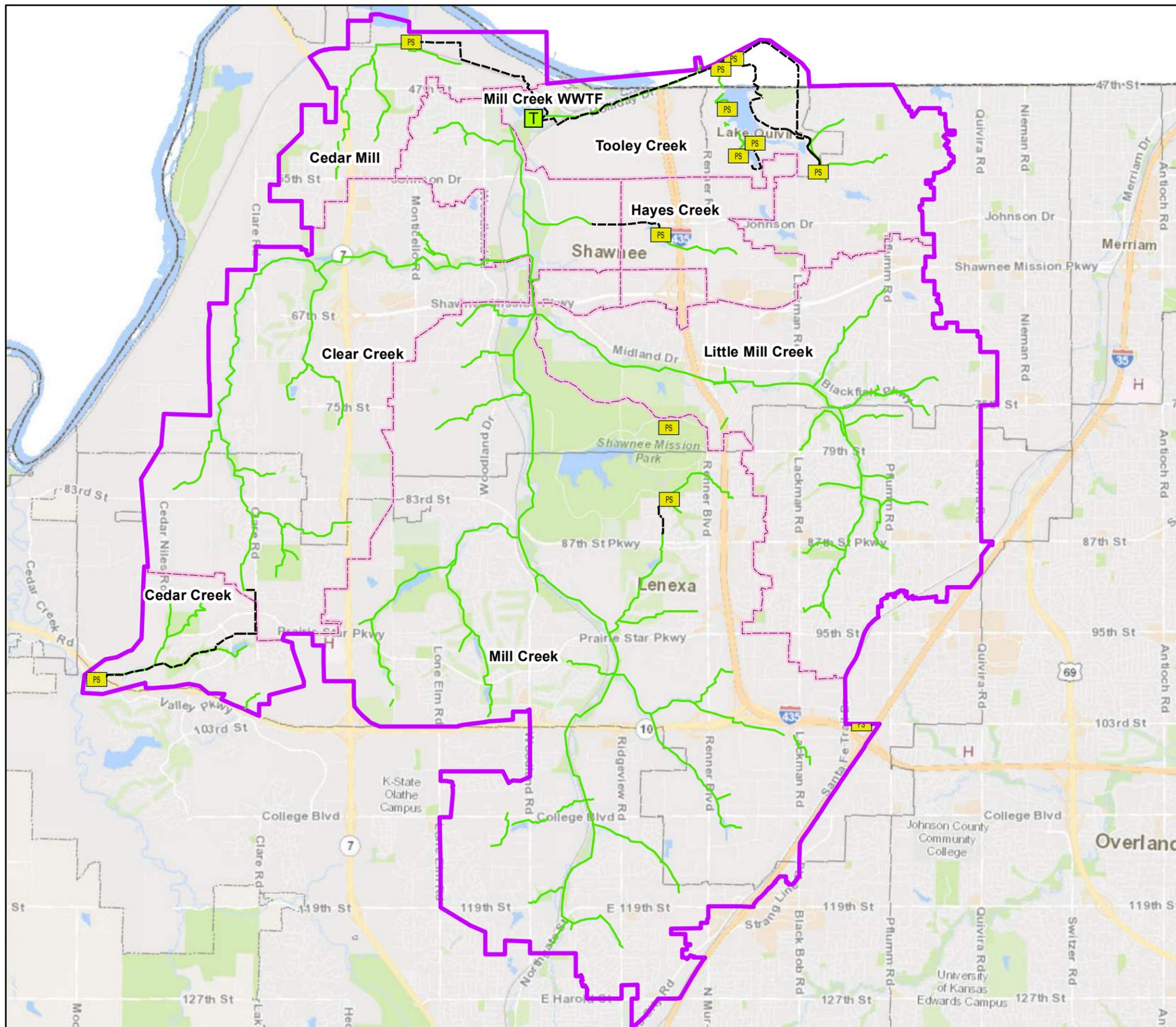
- Parallel Gravity Main
- Upsize Gravity Main
- Parallel Forcemain
- Underground Storage
- Auxiliary Treatment Facility

Existing Infrastructure (Modeled)

- Treatment Facility
- Pump Station
- PEFTF (Decommissioned)
- Modeled Gravity Mains
- Modeled Forcemains





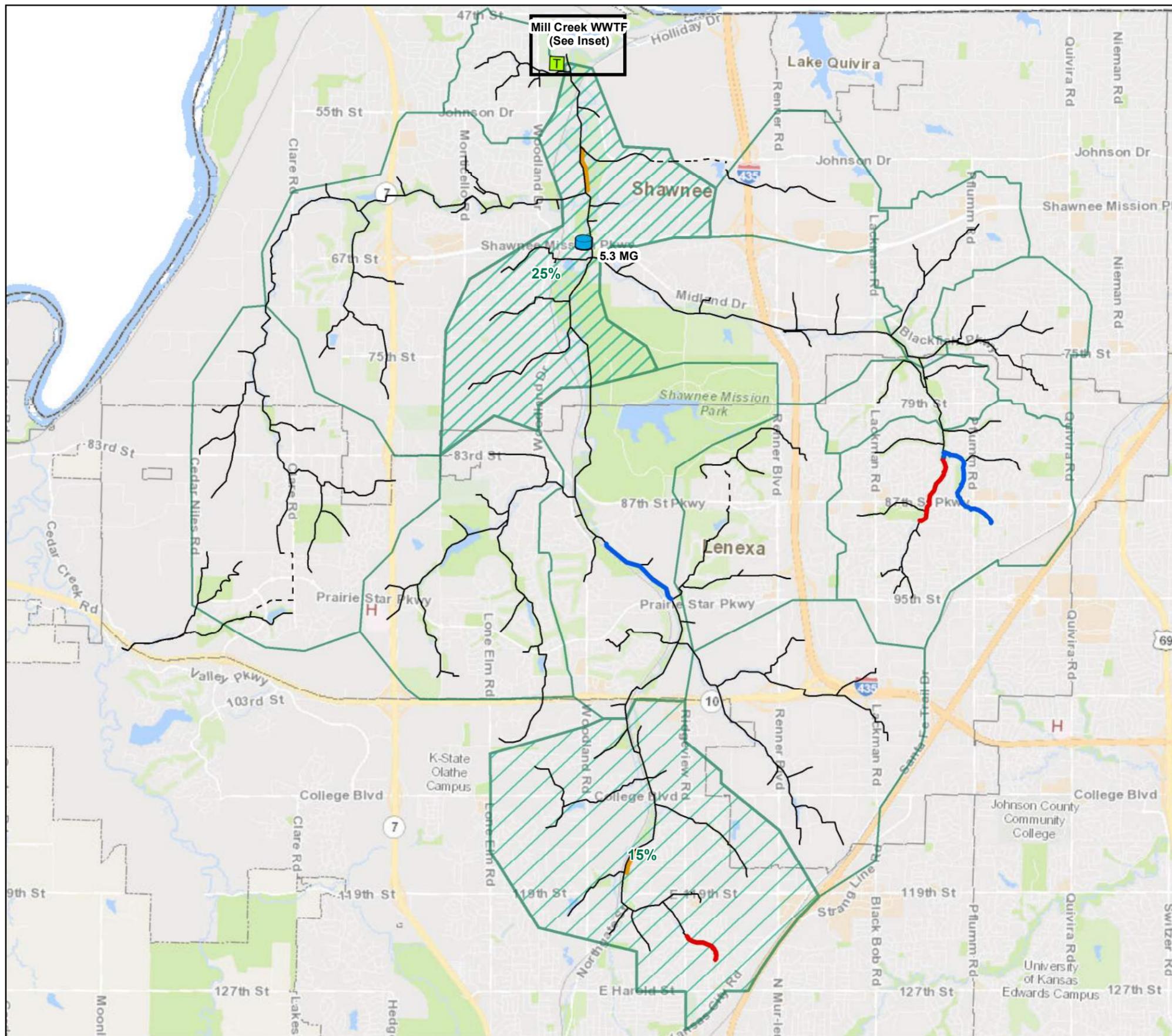


LEGEND

Existing Infrastructure

- T Treatment Facility
- PS Pump Station
- P PEFTF
- Gravity Mains
- - - - Forcemains
- ▭ Mill Creek Basin Boundary





LEGEND

I/I Reduction

-  15% Reduction
-  25% Reduction
-  No I/I Reduction

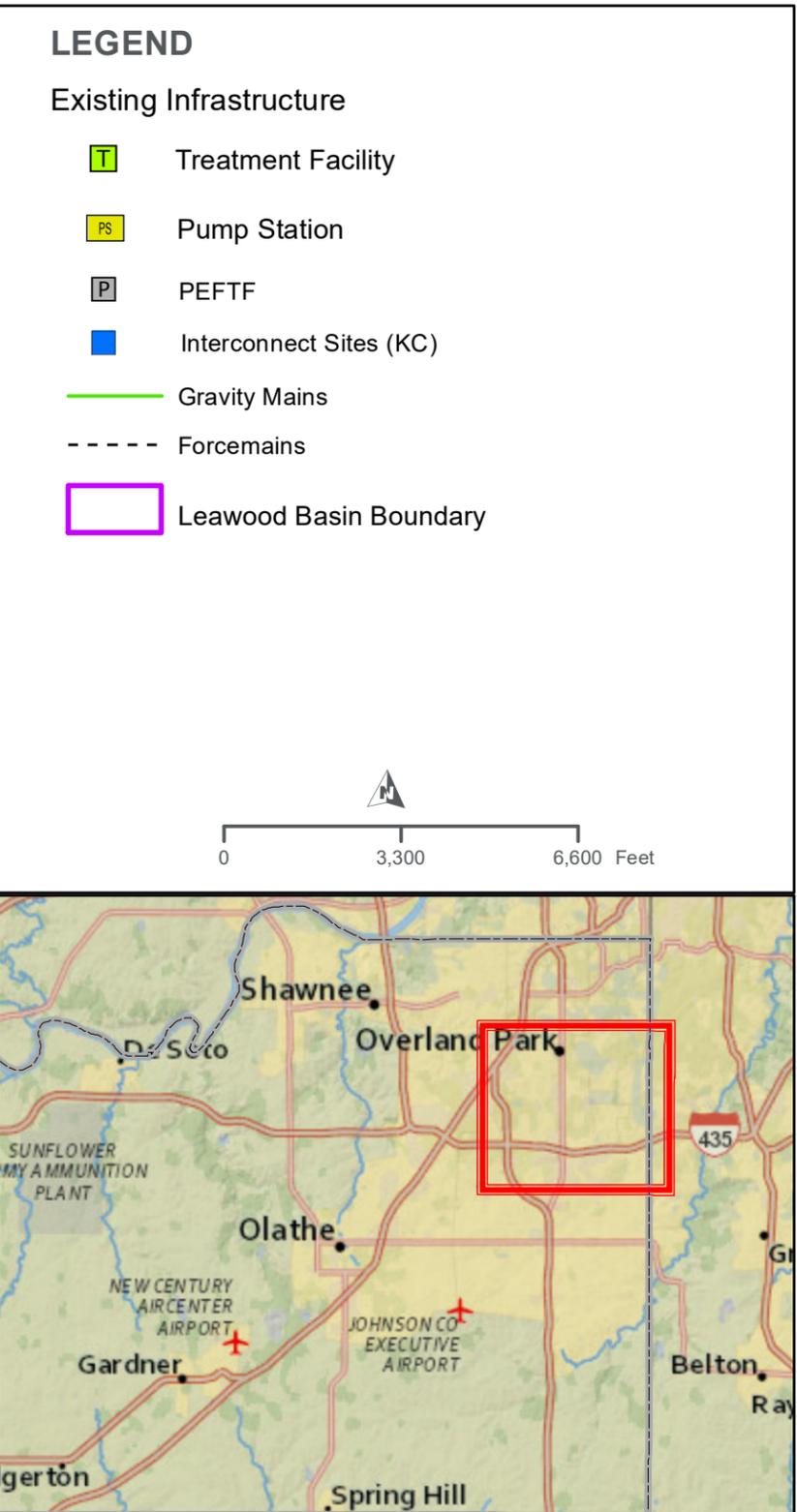
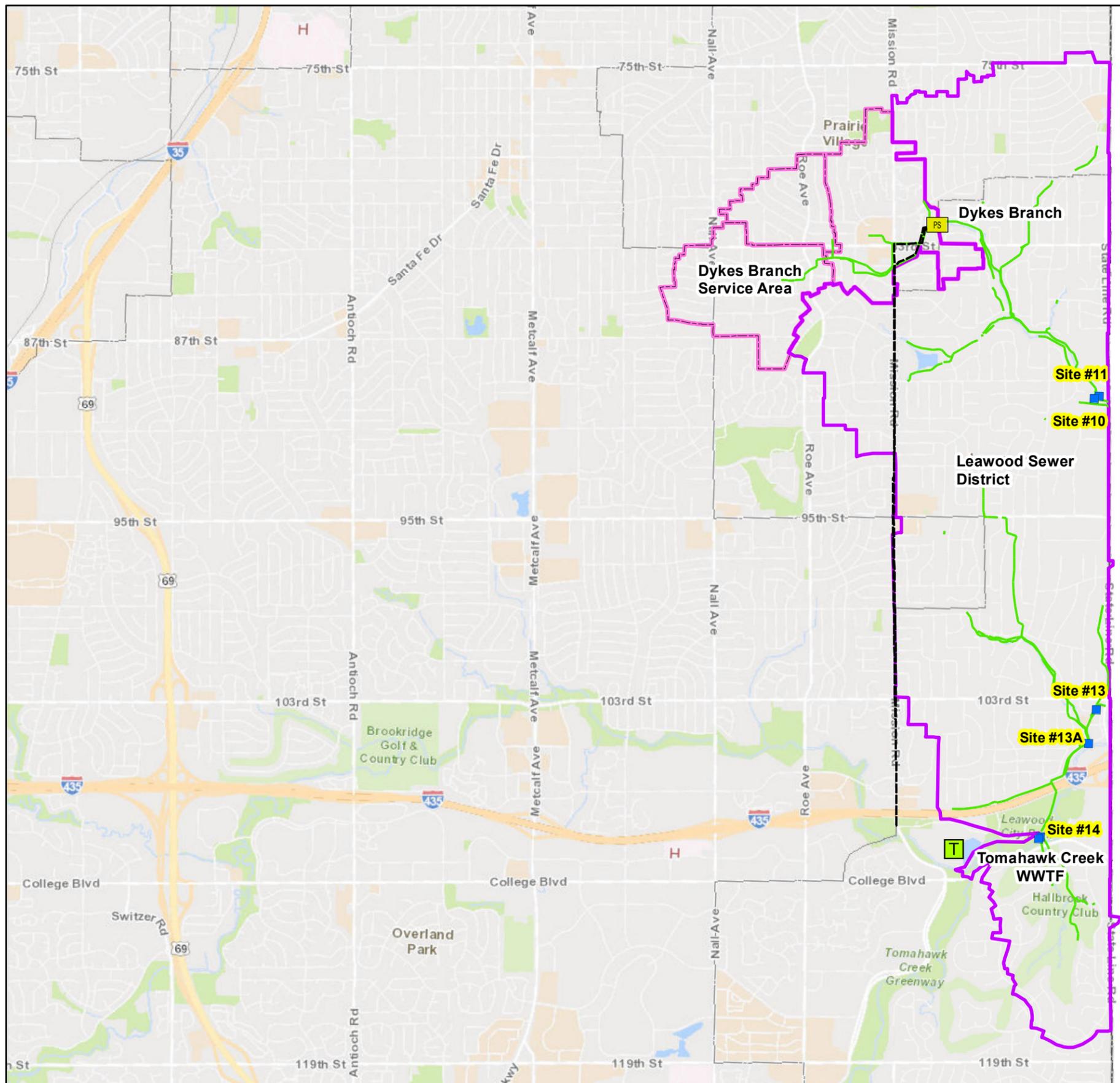
Proposed Infrastructure

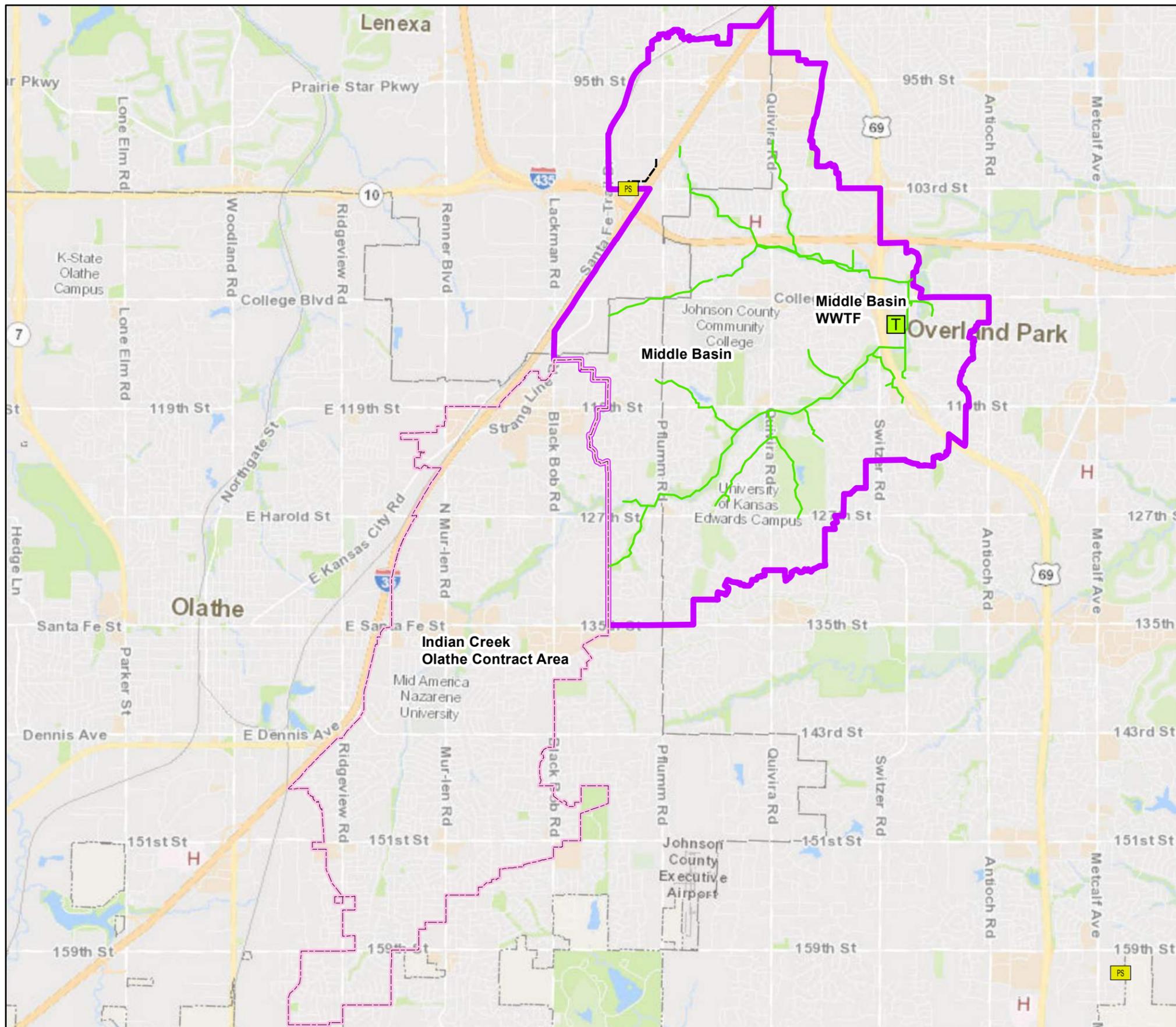
-  Parallel Gravity Main
-  Upsize Gravity Main
-  Linear Storage
-  Underground Storage

Existing Infrastructure (Modeled)

-  Modeled Gravity Mains
-  Modeled Forcemains
-  Influent Pump Station



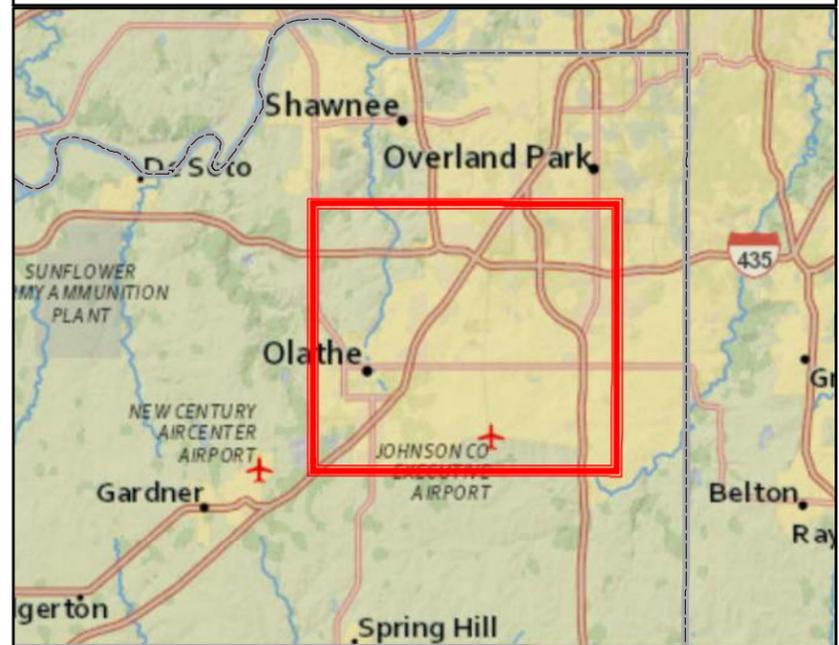


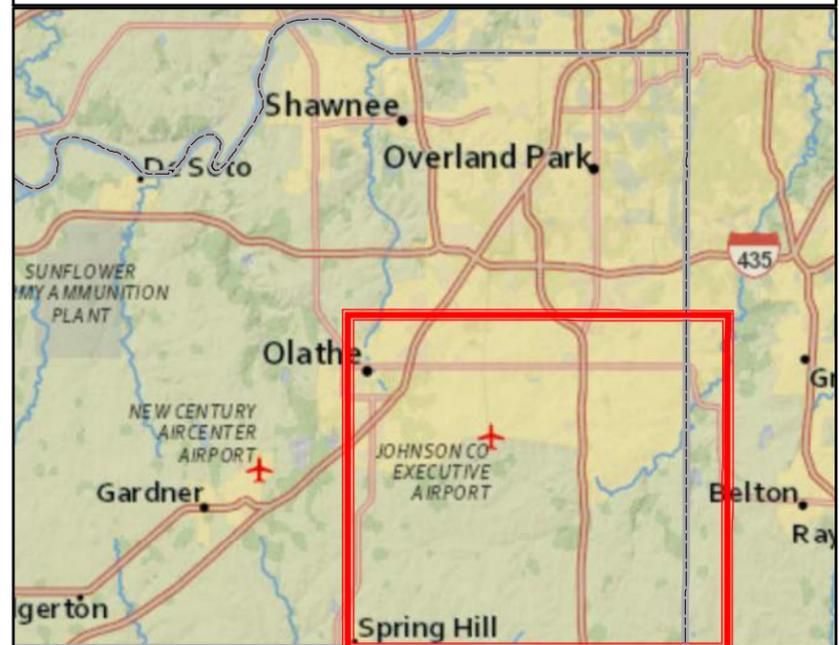
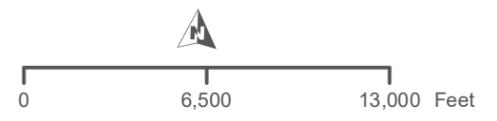
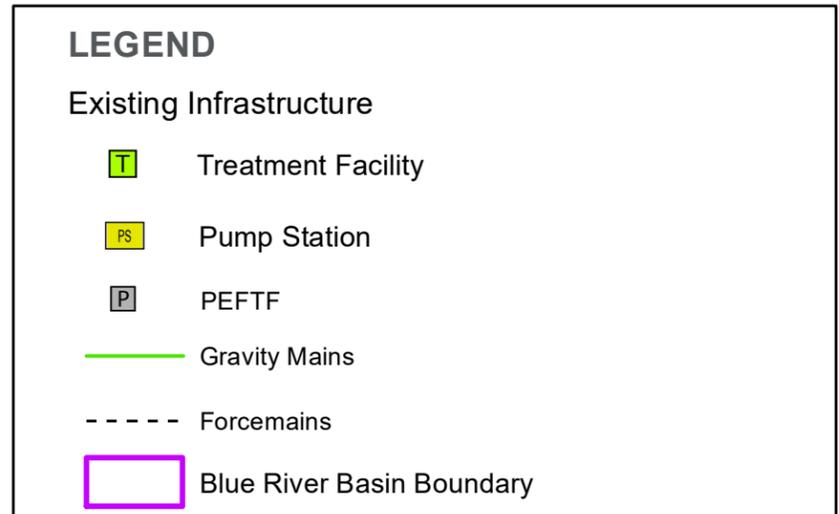
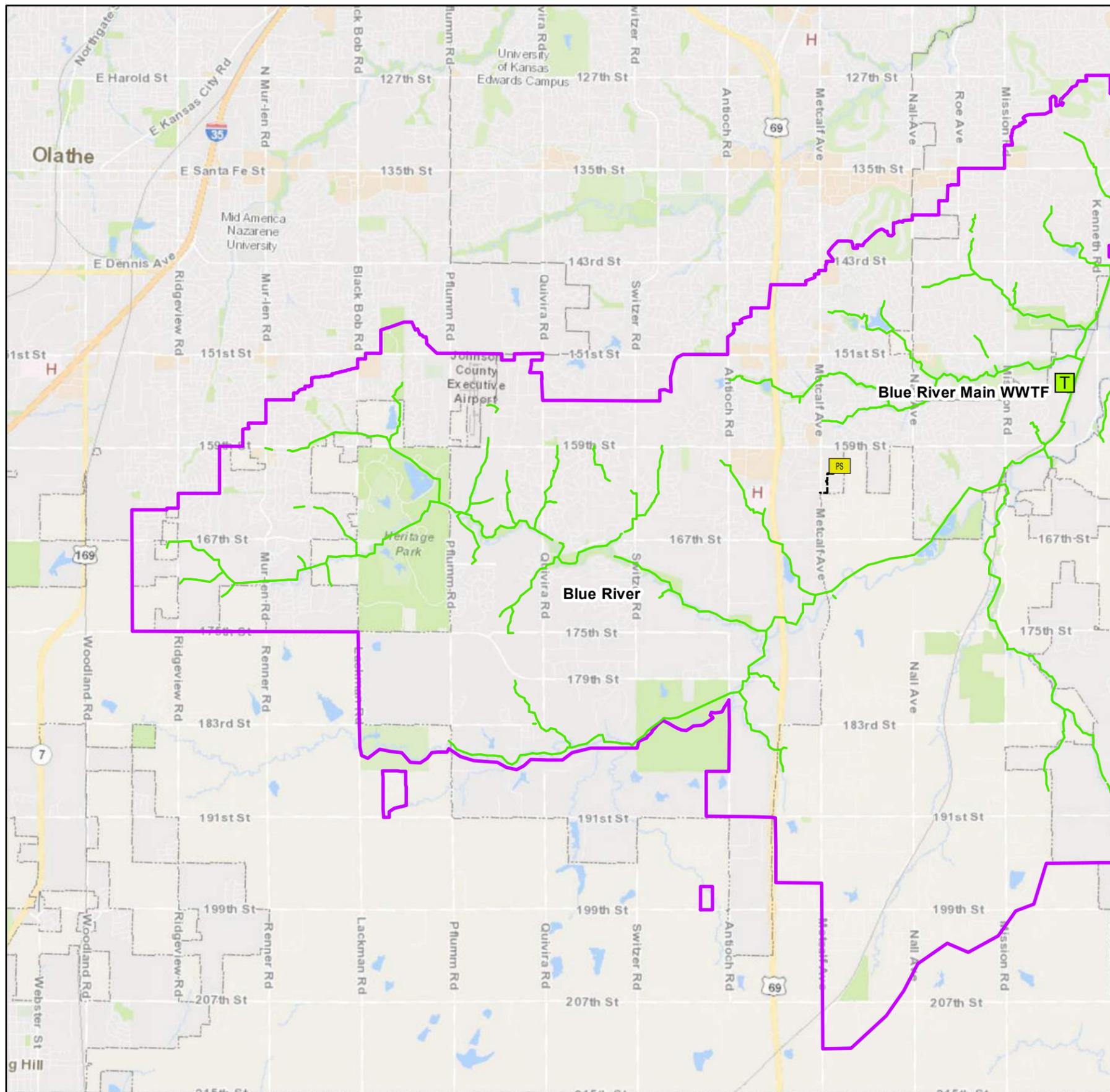


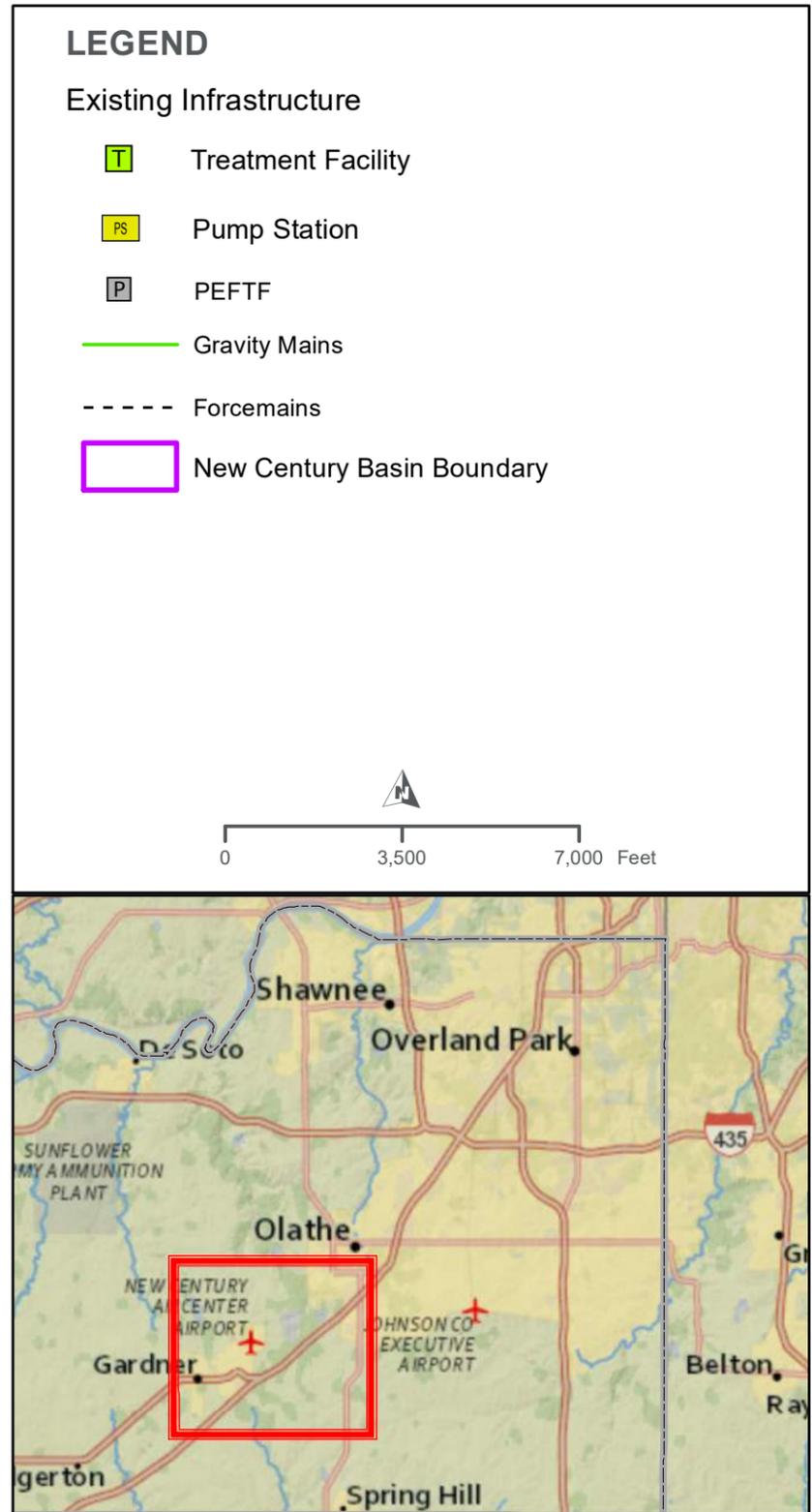
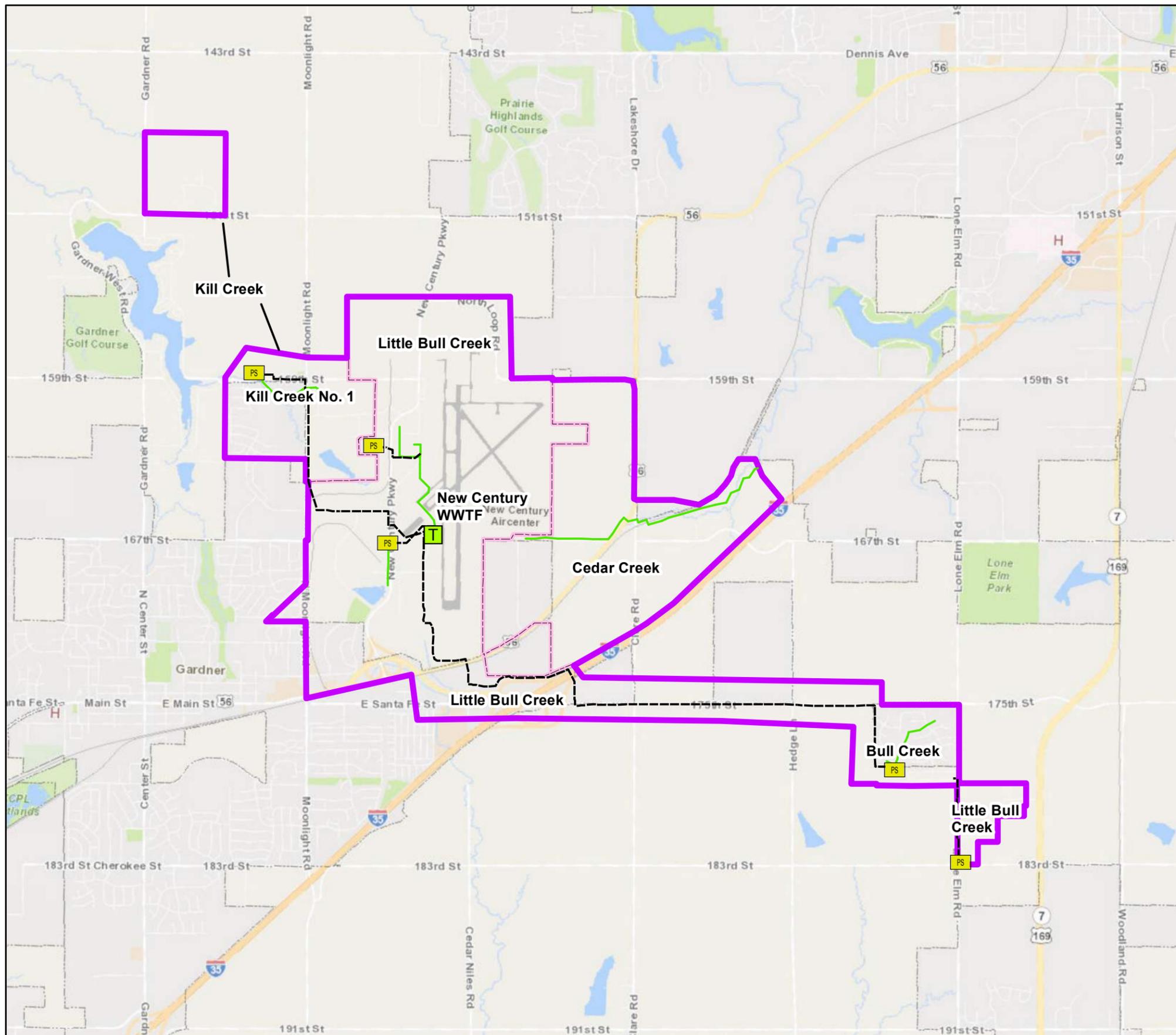
LEGEND

Existing Infrastructure

- T Treatment Facility
- PS Pump Station
- P PEFTF
- Gravity Mains
- - - - Forcemains
- Middle Basin Basin Boundary







Appendix B Impaired Waterbodies and Approved TMDLs in Johnson County

Appendix B.1. Impaired Waterbodies in Johnson County.

Impairment	Impaired Use	Stream/Lake	Station	Tributaries	Priority
Ammonia	Aquatic Life	Turkey Creek*	NPDES55492		2022
Atrazine	Aquatic Life	Lower Kansas River*	SC203	Turkey Creek*, Mill Creek (Hays Creek, Clear Creek), Cedar Creek (Camp Creek), Kill Creek (Hanson Creek, Spoon Creek, Unnamed stream), Captain Creek	2023
Biology	Aquatic Life	Indian Creek*	SC204	Tomahawk Creek	2023
Chloride	Water Supply	Indian Creek*	SC204	Tomahawk Creek	2023
<i>E. coli</i>	Recreation	Bull Creek	SC557	Tenmile Creek (Sweetwater Creek)	2023
Eutrophication	Aquatic Life	Antioch Park Lake	LM067701		2023
Eutrophication	Aquatic Life	Heritage Park Lake	LM062401		2023
Eutrophication	Aquatic Life	Spring Hill City Lake	LM073501		2023
Eutrophication	Aquatic Life	Lenexa City Lake	LM022601		2022
Eutrophication	Aquatic Life	Mahaffie Farmstead Lake	LM020401		2023
Eutrophication	Aquatic Life	Lake Quivera	LM022701		2023
Eutrophication	Aquatic Life	Rose's Lake	LM062501		2022
Mercury	Food Procurement	Blue River	SC205	Coffee Creek, Wolf Creek, Camp Branch	2023
Total Phosphorus	Aquatic Life	Indian Creek*	SC204	Tomahawk Creek	2023
Total Suspended Solids	Aquatic Life	Lower Kansas River*	SC203	Turkey Creek*, Mill Creek* (Hays Creek, Clear Creek), Cedar Creek (Camp Creek)	2023

Notes:

*Receiving stream to at least one of six of JCW's wastewater treatment facilities.

Sources: KDHE 2018 303(d) List of All Impaired & Potentially Impaired Waters and KDHE's TMDL/303(d) Interactive Map (accessed June 2019).

Appendix B.2. Approved TMDLs in Johnson County.

Impairment	Impaired Use	Stream/Lake	Station	Tributaries	Approval Date
Atrazine	Aquatic Life	Edgerton City Lake	LM065001		2001
Biology (Nutrients and DO)	Aquatic Life	Lower Kansas River*	SC203, SC254	Turkey Creek*, Mill Creek* (Hays Creek, Little Mill Creek, Clear Creek), Cedar Creek (Camp Creek)	2000
Biology (Nutrients and DO)	Aquatic Life	Blue River	SC205	Camp Branch, Coffee Creek, Wolf Creek	2001
Biology (Sediment)	Aquatic Life	Lower Kansas River*	SC203, SC254	Turkey Creek*, Mill Creek* (Hays Creek, Little Mill Creek, Clear Creek), Cedar Creek (Camp Creek)	2000
Chlordane	Food Procurement	Antioch Park Lake	LM067701		2001
Chloride	Water Supply	Mill Creek*	SC251	Little Mill Creek	2000
Dissolved Oxygen	Aquatic Life	Gardner City Lake	LM040401		2000
Dissolved Oxygen	Aquatic Life	Sunflower Park Lake	LM073601		2000
<i>E. coli</i>	Recreation	Lower Kansas River*	SC203, SC254	Turkey Creek*, Mill Creek*, Cedar Creek, Kill Creek	2007
<i>E. coli</i>	Recreation	Mill Creek	SC251	Hays Creek, Clear Creek, Little Mill Creek	2000
<i>E. coli</i>	Recreation	Cedar Creek	SC252	Camp Creek, Little Cedar Creek	2000
<i>E. coli</i>	Recreation	Kill Creek	SC253	Hanson Creek, Spoon Creek, Unnamed Stream	2000
<i>E. coli</i>	Recreation	Indian Creek*	SC253	Tomahawk Creek	2001
<i>E. coli</i>	Recreation	Blue River	SC205	Camp Branch, Coffee Creek, Wolf Creek	2001
Eutrophication	Aquatic Life	South Park Lake	LM067501		2002
Eutrophication	Aquatic Life	Hillsdale Lake*	LM035001	Spring Creek* (Little Bull Creek*), Bull Creek (Martin Creek)	2014
Eutrophication	Aquatic Life	Edgerton City Lake	LM065001		2001
Eutrophication	Aquatic Life	Gardner City Lake	LM040401		2000
Eutrophication	Aquatic Life	Sunflower Park Lake	LM073601		2000
Eutrophication	Aquatic Life	New Olathe Lake	LM061301		2007
Eutrophication	Aquatic Life	Cedar Lake	LM061601		2007
Eutrophication	Aquatic Life	Frisco Lake	LM065201		2000
Eutrophication	Aquatic Life	Olathe Waterworks Lakes	LM062201		2000
Nitrate	Water Supply	Indian Creek*	SC204	Tomahawk Creek	2007
Nitrate	Aquatic Life and Water Supply	Cedar Creek	SC252	Camp Creek, Little Cedar Creek	2007
Total Phosphorus	Aquatic Life	Lower Kansas River*	SC203, SC251, SC252, SC253	Turkey Creek*, Mill Creek* (Little Mill Creek, Clear Creek, Hays Creek), Cedar Creek (Little Cedar Creek, Camp Creek), Kill Creek (Hanson Creek, Spoon Creek, Unnamed Stream)	2017

Notes:

*Receiving stream to at least one of six of JCW's wastewater treatment facilities.

Sources: KDHE 2018 303(d) List of All Impaired & Potentially Impaired Waters and KDHE's TMDL/303(d) Interactive Map (accessed June 2019).

Appendix C Multi-Criteria Decision Analysis Scoring

Appendix C.1. MCDA Tool and Final Benefit Scores Developed for the JCW IMP. (Integrated Plan Phase 1)

Community Objective (Weight)	Environmental Protection (0.4)			Customer Service (0.4)		Community Enhancement (0.2)		Total Benefit Score
	Sub-Objective (Weight)	Improve Water Quality (0.4)	Maintain Regulatory Compliance (0.5)	Efficiently Use Natural Resources (0.1)	Minimize Human Health and Property Impacts (0.6)	Achieve Financial Benefits (0.4)	Be a Good Neighbor (0.5)	
Combined Weight	0.16	0.2	0.04	0.24	0.16	0.1	0.1	1.0
Gravity Sewer R&R	5	10	2	10	10	10	3	8.18
Nelson Complex WWTF Upgrade	10	10	0	3	10	10	3	7.22
Tomahawk Creek WWTF Upgrade	10	10	0	2	10	10	5	7.18
Pump Stations R&R	6	10	4	8	4	7	3	6.68
PEFTF R&R	7	10	1	8	4	7	1	6.52
Mill Creek Regional WWTF Upgrade	8	10	6	0	10	10	3	6.42
Mission Main Capacity Enhancements	5	10	2	10	4	1	1	6.12
Tomahawk and L. Indian Cr. Capacity Enhancements	3	10	2	10	2	3	5	6.08
Forcemain R&R	4	10	0	7	4	7	3	5.96
Turkey Creek Capacity Enhancements	6	10	2	8	3	1	3	5.84
Backup Prevention Program and Plumber Private I/I Reduction	1	7	1	10	5	7	0	5.5
Dykes Branch Capacity Enhancements	3	10	1	8	2	6	1	5.46
Stream Crossings	7	5	2	6	8	5	0	5.42
Leawood Capacity Enhancements	3	6	2	10	3	3	1	5.04
Outside Contractor Collection System Repairs	5	2	0	10	0	10	0	4.6
All WWTF Facilities - R&R	3	8	6	1	4	5	3	4
PEFTF Elimination - Martway	4	8	0	2	0	7	3	3.72
Mill Creek Capacity Enhancements	1	2	1	6	2	2	10	3.56
System Expansion (Gravity Sewers and Pump Stations)	1	2	0	0	10	0	10	3.16
Blue River WWTF Expansion	1	0	6	0	10	0	10	3
PEFTF Elimination - 75th and Nall	3	8	0	2	0	3	1	2.96
PEFTF Elimination - Belinder	3	8	0	2	0	3	1	2.96
Manhole I/I Reduction	0	7	2	2	5	1	0	2.86
PEFTF Elimination - Turkey Creek	5	8	0	1	0	1	1	2.84
Middle Basin WWTF Wet Weather Treatment	2	7	3	0	0	10	0	2.84
Mill Creek Regional WWTF Expansion	1	0	0	0	10	0	10	2.76
New Century WWTF Expansion	1	0	0	0	10	0	10	2.76
Nelson Complex WWTF Waste Acceptance	0	0	10	0	8	0	2	1.88
Middle Basin WWTF Resource Recovery	0	0	10	0	8	0	1	1.78
Nelson Complex WWTF Resource Recovery	0	0	10	0	8	0	0	1.68
Blue River Capacity Enhancements	0	0	1	2	1	0	10	1.68
New Century WWTF Upgrade	1	2	0	0	0	0	0	0.56

Notes:

Red values are the benefit scores that resulted from the rating and scoring process described in Section 7.2.2.

Community objective weights must total 1.0. Similarly, sub-objective weights must total 1.0 for each objective.

The combined objective weight is the product of the objective and sub-objective weights.

Total benefit scores are the summed product project ratings and combined weights.

Appendix C.2. Sub-Objective Scoring Basis. (Integrated Plan Phase 1)

Criterion	Subcriterion	Ranking	Scoring Basis
Environmental Protection	Improve Water Quality Enhance or restore water quality in local, regional, and national waters.	10	Project provides frequent improvements for multiple parameters in multiple waterbodies.
		9	
		8	
		7	Project provides frequent improvements for at least one parameter in multiple waterbodies.
		6	
		5	Project provides significant, infrequent localized improvements for at least one parameter.
		4	
		3	Project provides moderate, infrequent localized improvements for at least one parameter.
		2	
		1	
		0	Project is not necessary for water quality improvements.
Environmental Protection	Meet Regulatory Obligations Remain a key partner in implementing state federal laws and regulations by maintaining compliance.	10	Address regulatory obligations that present significant risk (Example - control the discharge of untreated wastewater)
		9	
		8	
		7	Address regulatory obligations that present substantial risk (Example - existing TMDL requirements)
		6	
		5	Address regulatory obligations that present moderate risk (Example - future TMDL requirements)
		4	
		3	Address regulatory obligations that present limited risk (Example - meet nutrient reduction goals)
		2	
		1	
		0	Project does not needed for regulatory compliance.
Environmental Protection	Efficiently Use and Protect Natural Resources Promote a sustainable use of resources.	10	Project significantly increases energy and chemical efficiency.
		9	
		8	
		7	Project moderately increases energy and chemical efficiency.
		6	

Criterion	Subcriterion	Ranking	Scoring Basis
		5	Project provides a foundation for future sustainability efforts.
		4	
		3	Project is necessary to maintain existing resource use.
		2	
		1	
		0	Project does not have a sustainability component.
Customer Service	Minimize Human Health and Property Impacts Minimize health and property impacts related to capacity constraints or failing infrastructure.	10	Project significantly reduces potential for direct human exposure to pathogens and the number and frequency of infrastructure failures that damage public and private property.
		9	
		8	
		7	Project substantially reduces potential for direct human exposure to pathogens and the number and frequency of infrastructure failures that damage public and private property.
		6	
		5	Project moderately reduces potential for direct human exposure to pathogens and the number and frequency of infrastructure failures that damage public and private property.
		4	
		3	Project moderately reduces potential for direct human exposure to pathogens or the number and frequency of infrastructure failures that damage public and private property.
		2	
		1	
		0	Project does not reduce human health or property impacts.
Customer Service	Achieve Financial Benefits Yield a net positive financial benefit to JCW customers by improving overall efficiency, costs, or business performance.	10	Project results in a positive ROI in less than 5 years, provides major long-term financial savings, or avoids more than \$10 million in sunk capital investments.
		9	
		8	
		7	
		6	
		5	Project results in a positive ROI in less than 10 years, provides substantial long-term financial savings, or avoids more than \$5 million in sunk capital investments.
		4	
		3	
		2	
		1	Project results in a positive ROI in less than 20 years, provides minimal long-term financial savings, or avoids more than \$1 million in sunk capital investments.

Criterion	Subcriterion	Ranking	Scoring Basis
		0	Project does not increase financial benefits
Community Enhancement	Be a Good Neighbor Enhance community well-being and satisfaction by reducing the number and frequency of community disruptions (odors, noise, aesthetics, etc.).	10	Project reduces the number, frequency, and magnitude of significant disruptions in more than one area of the community.
		9	
		8	Project reduces the number, frequency, and magnitude of significant disruptions in a localized area of the community.
		7	
		6	
		5	Project reduces the number, frequency, or magnitude of moderate disruptions in more than one area of the community.
		4	
		3	Project reduces the number, frequency, or magnitude of minor disruptions in a localized area of the community.
		2	
		1	
		0	Project does not reduce disruptions.
Community Enhancement	Foster Responsible Growth and Important Development Provide necessary infrastructure improvements to new and redeveloping areas.	10	Project provides new services to newly developing areas.
		9	
		8	
		7	Project significantly improves capacity for development.
		6	
		5	Project moderately improves capacity for development.
		4	
		3	Project provides limited capacity for development.
		2	
		1	
		0	Project maintains existing level of service.

Appendix D Program Budget Projections

JCW Integrated Plan Investment Opportunities	Integrated Plan Phase I Program Budget Projections (2018 Dollars)													
	2019 (Locked in)	Years 1 - 5					Years 6 - 10					Years 11 - 15	Years 16 - 20	Years 20 - 25
Category		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 - 2034	2035 - 2039	2040 - 2044
Collection System Renewal and Public Sector I/I Reduction	\$5,400,000	\$5,400,000	\$5,400,000	\$6,400,000	\$5,500,000	\$6,100,000	\$6,200,000	\$6,200,000	\$6,200,000	\$6,200,000	\$5,300,000	\$19,300,000	\$15,900,000	\$14,200,000
Facilities	\$122,100,000	\$166,600,000	\$42,000,000	\$28,100,000	\$39,300,000	\$66,000,000	\$83,400,000	\$112,600,000	\$99,900,000	\$48,700,000	\$35,500,000	\$325,000,000	\$137,500,000	\$165,300,000
Watershed Capacity Enhancement and Expansion	\$9,900,000	\$4,500,000	\$12,000,000	\$21,700,000	\$26,000,000	\$15,400,000	\$6,200,000	\$5,200,000	\$9,200,000	\$6,200,000	\$9,200,000	\$57,800,000	\$70,500,000	\$89,300,000
Other Items	\$1,600,000	\$1,200,000	\$1,900,000	\$1,700,000	\$1,600,000	\$1,500,000	\$1,100,000	\$1,000,000	\$1,100,000	\$1,000,000	\$1,100,000	\$3,500,000	\$3,500,000	\$3,500,000
Programmatic Planning and Support	\$3,000,000	\$2,900,000	\$2,200,000	\$3,600,000	\$3,600,000	\$3,600,000	\$3,500,000	\$3,500,000	\$3,500,000	\$3,500,000	\$3,500,000	\$17,500,000	\$17,500,000	\$17,500,000
Grand Total	\$142,000,000	\$180,600,000	\$63,500,000	\$61,500,000	\$76,000,000	\$92,600,000	\$100,400,000	\$128,500,000	\$119,900,000	\$65,600,000	\$54,600,000	\$423,100,000	\$244,900,000	\$289,800,000

JCW Integrated Plan Investment Opportunities	Integrated Plan Phase I Program Budget Projections (Escalated Dollars) ¹													
	2019 (Locked in)	Years 1 - 5					Years 6 - 10					Years 11 - 15	Years 16 - 20	Years 20 - 25
Category		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 - 2034	2035 - 2039	2040 - 2044
Collection System Renewal and Public Sector I/I Reduction	\$5,400,000	\$5,400,000	\$5,400,000	\$6,400,000	\$5,500,000	\$6,100,000	\$7,600,000	\$7,800,000	\$8,000,000	\$8,300,000	\$7,300,000	\$29,200,000	\$27,800,000	\$28,800,000
Facilities	\$122,100,000	\$166,600,000	\$42,000,000	\$28,100,000	\$39,300,000	\$66,000,000	\$102,800,000	\$142,600,000	\$130,400,000	\$65,400,000	\$49,100,000	\$491,600,000	\$241,100,000	\$336,000,000
Watershed Capacity Enhancement and Expansion	\$9,900,000	\$4,500,000	\$12,000,000	\$21,700,000	\$26,000,000	\$15,400,000	\$7,600,000	\$6,600,000	\$12,000,000	\$8,300,000	\$12,700,000	\$87,400,000	\$123,600,000	\$181,500,000
Other Items	\$1,600,000	\$1,200,000	\$1,900,000	\$1,700,000	\$1,600,000	\$1,500,000	\$1,400,000	\$1,200,000	\$1,400,000	\$1,300,000	\$1,500,000	\$5,300,000	\$6,100,000	\$7,100,000
Programmatic Planning and Support	\$3,000,000	\$2,900,000	\$2,200,000	\$3,600,000	\$3,600,000	\$3,600,000	\$4,300,000	\$4,400,000	\$4,600,000	\$4,700,000	\$4,800,000	\$26,500,000	\$30,700,000	\$42,600,000
Grand Total	\$142,000,000	\$180,600,000	\$63,500,000	\$61,500,000	\$76,000,000	\$92,600,000	\$123,700,000	\$162,600,000	\$156,400,000	\$88,000,000	\$75,400,000	\$640,000,000	\$429,300,000	\$596,000,000

¹Costs Escalated using a 3% annual inflation rate

JCW Integrated Plan Investment Opportunities	Collection System Renewal and Public Sector I/I Reduction Projections (2018 Dollars)														
		Years 1 - 5					Years 6 - 10					Years 11 - 15	Years 16 - 20	Years 20 - 25	Total
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 - 2034	2035 - 2039	2040 - 2044	
Total, Collections Renewal and Public Sector I/I Reduction	\$5,355,000	\$5,355,000	\$5,355,000	\$6,355,000	\$5,455,000	\$6,055,000	\$6,155,000	\$6,155,000	\$6,155,000	\$6,155,000	\$5,305,000	\$19,275,000	\$15,875,000	\$14,150,000	\$113,155,000
CIPP Program	\$2,405,000	\$2,405,000	\$2,405,000	\$2,405,000	\$1,505,000	\$2,105,000	\$2,205,000	\$2,205,000	\$2,205,000	\$2,205,000	\$1,355,000	\$7,550,000	\$5,000,000	\$4,000,000	\$39,955,000
Stream Crossing Program	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$1,200,000	\$6,000,000	\$6,000,000	\$6,000,000	\$31,200,000
Manhole Program	\$1,000,000	\$1,000,000	\$1,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$1,975,000	\$1,125,000	\$400,000	\$22,500,000
Contracted Repairs	\$750,000	\$750,000	\$750,000	\$750,000	\$750,000	\$750,000	\$750,000	\$750,000	\$750,000	\$750,000	\$750,000	\$3,750,000	\$3,750,000	\$3,750,000	\$19,500,000

JCW Integrated Plan Investment Opportunities		Watershed Capacity Enhancement and Expansion Projections (2018 Dollars)															
		Years 1 - 5					Years 6 - 10					Years 11 - 15	Years 16 - 20	Years 21 - 25	Total		
		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 - 2034	2035 - 2039		2040 - 2044	
Mission Main - Brush Creek	Total	\$0	\$0	\$0	\$0	\$0	\$0	\$1,000,000	\$0	\$0	\$0	\$0	\$0	\$0	\$29,950,000	\$30,950,000	
Private I/I Upstream of Rock Creek Pump Station	Private I/I Reduction							\$1,000,000								\$1,000,000	
Brush Creek Interceptor Capacity Improvements	Conveyance Capacity														\$3,750,000	\$3,750,000	
Brush Creek Various Local Capacity Improvements	Conveyance Capacity														\$2,100,000	\$2,100,000	
Porter Park Storage Facility	Storage														\$24,100,000	\$24,100,000	
Mission Main - Rock Creek	Total	\$0	\$0	\$0	\$875,000	\$875,000	\$0	\$0	\$0	\$4,000,000	\$0	\$0	\$7,336,000	\$0	\$0	\$13,086,000	
Private I/I Upstream of Rock Creek Pump Station	Private I/I Reduction				\$875,000	\$875,000										\$1,750,000	
Rock Creek Pump Station Replacement and Capacity Improvements, and Wet Weather Forcemain	Conveyance Capacity									\$4,000,000			\$7,336,000			\$11,336,000	
Mission Main - Belinder	Total	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$7,000,000	\$1,100,000	\$8,100,000		
Private I/I Reduction	Private I/I Reduction												\$7,000,000	\$1,100,000	\$8,100,000		
Turkey Creek	Total	\$3,300,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$24,600,000	\$3,100,000	\$19,100,000	\$50,100,000	
Private I/I in Turkey Creek Basin	Private I/I Reduction													\$3,100,000	\$3,100,000		
Turkey Creek Wet Weather Pump Station and Forcemain	Conveyance Capacity														\$11,660,000	\$11,660,000	
Turkey Creek Interceptor Capacity Improvements	Conveyance Capacity														\$5,100,000	\$5,100,000	
Nieman Road Trunk Sewer Capacity Improvements	Conveyance Capacity														\$2,340,000	\$2,340,000	
Turkey Creek Interceptor Improvements	Conveyance Capacity	\$3,300,000														\$3,300,000	
Streamway Park Storage Facility	Storage													\$24,600,000		\$24,600,000	
Mill Creek	Total	\$0	\$100,000	\$530,000	\$6,590,000	\$16,200,000	\$5,400,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$8,750,000	\$37,570,000	
Private I/I Reduction in Mill Creek Basin	I/I Reduction														\$1,750,000	\$1,750,000	
Influent Pumping Capacity	Conveyance Capacity		\$100,000	\$530,000	\$3,590,000	\$16,200,000	\$5,400,000								\$3,810,000	\$8,030,000	
Mill Creek Storage Facility	Storage				\$3,000,000	\$16,200,000	\$5,400,000								\$3,190,000	\$27,790,000	
Tomahawk and Lower Indian Creek	Total	\$100,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$35,000,000	\$0	\$35,100,000	
Capacity Enhancements (Project not Defined)	Conveyance Capacity	\$100,000												\$35,000,000		\$35,100,000	
Leewood	Total	\$200,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$200,000	
Capacity Enhancements (Project not Defined)	Conveyance Capacity	\$200,000														\$200,000	
Dykes Branch	Total	\$1,750,000	\$0	\$2,000,000	\$2,500,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$6,250,000	
Dyke's Branch Pump Station Improvements	R&R/Conveyance Capacity	\$1,250,000		\$2,000,000	\$2,500,000											\$5,750,000	
Dyke's Branch Dry Weather Connection to Leewood System	Conveyance Capacity	\$500,000														\$500,000	
System Wide Categories	Total	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$175,000	\$175,000	\$175,000	\$175,000	\$175,000	\$175,000	\$875,000	\$375,000	\$375,000	\$3,400,000
Backup Prevention Program	BUPP	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$75,000	\$75,000	\$75,000	\$75,000	\$75,000	\$75,000	\$375,000	\$375,000	\$375,000	\$1,800,000
Plumber Private I/I Program	Plumber Outreach Private I/I	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$500,000			\$1,600,000
System Expansion (Lines & PS)	Total	\$4,396,000	\$4,265,000	\$9,300,000	\$11,600,000	\$8,800,000	\$9,800,000	\$5,000,000	\$5,000,000	\$5,000,000	\$6,000,000	\$9,000,000	\$25,000,000	\$25,000,000	\$30,000,000	\$158,161,000	
Undefined District Expansion	Future District Expansion	\$0	\$1,000,000	\$3,800,000	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$25,000,000	\$25,000,000	\$30,000,000	\$124,800,000	
Blue River 16, Contract 4	Future District Expansion	\$2,231,000														\$2,231,000	
Blue River 28	Future District Expansion	\$200,000	\$1,000,000	\$1,100,000												\$2,300,000	
Little Bull Creek No. 1 Pump Station	Future District Expansion	\$0			\$200,000	\$4,800,000										\$5,000,000	
Mill Creek 1, Contract 2	Future District Expansion	\$1,943,000	\$1,200,000													\$3,143,000	
Sewer Development Studies	Future District Expansion	\$22,000		\$100,000												\$122,000	
Leewood Service Area Pump Station and Forcemains	Leewood Pump Stations & Forcemains		\$1,065,000	\$4,300,000	\$6,600,000	\$3,600,000										\$15,565,000	
New WWTF Evaluations	Future District Expansion									\$1,000,000	\$4,000,000					\$5,000,000	

JCW Integrated Plan Investment Opportunities		Facilities Projections (2018 Dollars)														
		Years 1 - 5					Years 6 - 10					Years 11 - 15	Years 16 - 20	Years 20 - 25	Total	
		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 - 2034	2035 - 2039		2040 - 2044
Pump Stations		\$477,774	\$2,597,213	\$6,176,813	\$0	\$0	\$0	\$3,191,000	\$2,120,000	\$16,535,000	\$1,800,000	\$1,805,000	\$0	\$0	\$3,300,000	\$38,002,800
Rock Creek Rehabilitation (Electrical Room)	WWTF and PS Renewal	\$387,774	\$591,613	\$591,613												\$1,571,000
Turkey Creek Pump Station Rehabilitation	WWTF and PS Renewal	\$90,000	\$1,365,600	\$2,695,200												\$4,150,800
Rock Creek Term and Supply Contract R&R	WWTF and PS Renewal		\$170,000	\$170,000												\$340,000
Brush Creek Term and Supply Contract R&R	WWTF and PS Renewal		\$190,000	\$200,000												\$390,000
Brush Creek Pump Station R&R Project	WWTF and PS Renewal							\$1,501,000	\$2,120,000							\$3,621,000
Brush Creek Pump Station Replacement	WWTF and PS Renewal														\$3,300,000	\$3,300,000
Belinder Pump Station Pumps (R&R and New Head Condition)	WWTF and PS Renewal		\$280,000	\$2,520,000												\$2,800,000
Belinder PS/PEFTF Comprehensive R&R	WWTF and PS Renewal									\$1,800,000	\$1,805,000					\$3,605,000
Rock Creek Pump Station and Forcemain Improvements for New Headworks at Nelson	Replacement/Regulatory							\$1,000,000	\$9,600,000							\$10,600,000
Belinder Forcemain Improvements for New Headworks at Nelson	Replacement/Regulatory							\$187,000	\$1,682,000							\$1,869,000
Turkey Creek Pump Station and Forcemain Improvements for New Headworks at Nelson	Replacement/Regulatory							\$503,000	\$4,523,000							\$5,026,000
Lamar Pump Station Improvements for New Headworks at Nelson	Replacement/Regulatory								\$730,000							\$730,000
Forcemains		\$1,430,000	\$4,350,000	\$1,200,000	\$500,000	\$1,200,000	\$500,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$9,180,000
Undefined Forcemain R&R	WWTF and PS Renewal	\$400,000	\$500,000	\$200,000	\$500,000	\$200,000	\$500,000									\$2,300,000
Dyke's Branch Forcemain Replacement	WWTF and PS Renewal	\$500,000	\$3,650,000	\$1,000,000		\$1,000,000										\$6,150,000
County Line Forcemain Improvements	WWTF and PS Renewal	\$530,000	\$200,000													\$730,000
PEFTFs		\$1,064,558	\$2,117,787	\$2,905,187	\$0	\$0	\$630,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$6,717,532
Martway and 75th and Nall Rehabilitation	PEFTF Interim Improvements	\$729,558	\$1,108,387	\$1,108,387												\$2,946,332
Turkey Creek PEFTF Rehabilitation	PEFTF Interim Improvements	\$60,000	\$1,009,400	\$1,796,800												\$2,866,200
MTM1 - CO73 Belinder PEFTF Safety & Chem Feed Piping	PEFTF Interim Improvements	\$275,000														\$275,000
PEFTF Chemical Upgrades (Bisulfite, Process Control)	PEFTF Interim Improvements						\$630,000									\$630,000
Nelson Complex WWTF		\$1,925,000	\$5,375,000	\$7,300,000	\$17,809,000	\$18,337,000	\$37,767,000	\$63,380,000	\$95,070,000	\$63,380,000	\$31,690,000	\$0	\$6,800,000	\$0	\$6,800,000	\$355,633,000
Nelson Complex WWTF Upgrade	Replacement/Regulatory		\$500,000	\$2,000,000	\$17,622,000	\$18,150,000	\$37,392,000	\$62,630,000	\$93,945,000	\$62,630,000	\$31,315,000					\$326,184,000
Nelson Complex - ATF Phases 2 and 3	System Capacity and PEFTF Elimination											\$6,800,000			\$6,800,000	\$13,600,000
Nelson Complex WWTF Resource Recovery	Resource Recovery				\$187,000	\$187,000	\$375,000	\$750,000	\$1,125,000	\$750,000	\$375,000					\$3,749,000
Nelson Biosolids Facilities	Resource Recovery	\$1,025,000	\$2,575,000	\$4,000,000												\$7,600,000
Turkey Creek Kitchen Sink R&R	WWTF and PS Renewal		\$590,000	\$590,000												\$1,180,000
Mission Main T&S	WWTF and PS Renewal		\$210,000	\$210,000												\$420,000
SMTC Clarifier Repairs	WWTF and PS Renewal	\$400,000														\$400,000
Clarifiers (IC 3 and 4, FC 1, 2, 3)	WWTF and PS Renewal	\$500,000	\$1,500,000	\$500,000												\$2,500,000

JCW Integrated Plan Investment Opportunities		Facilities Projections (2018 Dollars)															
		Years 1 - 5					Years 6 - 10					Years 11 - 15	Years 16 - 20	Years 20 - 25	Total		
		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 - 2034	2035 - 2039		2040 - 2044	
Tomahawk Creek WWTF		\$105,074,000	\$140,145,000	\$18,065,000	\$3,231,000	\$116,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$266,631,000	
Tomahawk Creek WWTF Upgrade	Replacement/Regulatory	\$105,074,000	\$140,145,000	\$18,065,000	\$3,231,000	\$116,000										\$266,631,000	
Middle Basin WWTF		\$3,283,000	\$1,171,000	\$0	\$0	\$500,000	\$2,500,000	\$2,500,000	\$0	\$0	\$1,000,000	\$9,000,000	\$0	\$0	\$21,000,000	\$40,954,000	
Middle Basin Wet Weather Treatment Upgrade	Replacement/Regulatory														\$21,000,000	\$21,000,000	
Biosolids Improvements	Resource Recovery									\$1,000,000	\$9,000,000					\$10,000,000	
RDT Improvements	Resource Recovery					\$500,000	\$2,500,000	\$2,500,000								\$5,500,000	
Hot Water Loop and FOG Improvements Phase 1	WWTF and PS Renewal	\$267,000														\$267,000	
IMB1-Bldg2 & Chlorine Mix Chamber Improvements	WWTF and PS Renewal	\$350,000														\$350,000	
MB Sodium Bicarbonate Feed System	WWTF and PS Renewal	\$1,500,000	\$480,000													\$1,980,000	
Middle Basin FOG & Centrifuge System Improvements	WWTF and PS Renewal	\$1,166,000	\$691,000													\$1,857,000	
Mill Creek Regional WWTF		\$250,000	\$1,500,000	\$500,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10,000,000	\$240,000,000	\$0	\$0	\$252,250,000	
Mill Creek WWTF Upgrade	Replacement/Regulatory											\$10,000,000	\$240,000,000			\$250,000,000	
Kitchen Sink R&R	WWTF and PS Renewal	\$250,000	\$1,500,000	\$500,000												\$2,250,000	
Blue River WWTF		\$429,000	\$50,000	\$0	\$700,000	\$7,119,400	\$12,306,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$75,000,000	\$75,000,000	\$170,604,400
Blue River Wet Weather Capacity	Replacement/Regulatory	\$429,000	\$50,000		\$700,000	\$7,119,400	\$12,306,000									\$20,604,400	
Blue River Expansion	Expansion													\$75,000,000	\$75,000,000	\$150,000,000	
New Century WWTF		\$0	\$0	\$0	\$500,000	\$3,600,000	\$0	\$0	\$1,000,000	\$4,000,000	\$0	\$0	\$6,725,000	\$0	\$0	\$15,825,000	
New Century WWTF Upgrade	Replacement/Regulatory												\$4,754,000			\$4,754,000	
New Century WWTF Expansion	Expansion				\$500,000	\$3,600,000			\$1,000,000	\$4,000,000			\$1,971,000			\$11,071,000	
System Wide Categories		\$8,165,731	\$9,280,000	\$5,834,000	\$5,409,000	\$8,389,000	\$12,284,000	\$14,369,000	\$14,380,000	\$16,000,000	\$14,200,000	\$14,695,000	\$71,500,000	\$62,500,000	\$59,200,000	\$316,205,731	
Undefined Treatment, Pumping, and Forcemain Renewal	WWTF and PS Renewal	\$4,097,000	\$2,190,000	\$2,172,000	\$2,873,000	\$6,389,000	\$10,284,000	\$11,869,000	\$11,880,000	\$14,000,000	\$12,200,000	\$12,195,000	\$60,000,000	\$60,000,000	\$56,700,000	\$266,849,000	
Roof Asset Management Program	WWTF and PS Renewal	\$780,000	\$740,000	\$662,000	\$536,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$2,500,000	\$2,500,000	\$2,500,000	\$13,718,000	
Lagoon Cleanout T&S	Miscellaneous Projects	\$2,000,000	\$1,500,000	\$2,000,000	\$2,000,000	\$1,500,000	\$1,500,000	\$2,000,000	\$2,000,000	\$1,500,000	\$1,500,000	\$2,000,000	\$9,000,000			\$28,500,000	
Operational Assistance	WWTF and PS Renewal	\$80,000	\$80,000													\$160,000	
Wastewater Facilities Electrical Improvements (CMSD - CO27)	WWTF and PS Renewal	\$1,208,731	\$4,770,000	\$1,000,000												\$6,978,731	

JCW Integrated Plan Investment Opportunities	Program Planning and Support Projections (2018 Dollars)														
	Years 1 - 5					Years 6 - 10					Years 11 - 15	Years 16 - 20	Years 20 - 25	Total	
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 - 2034	2035 - 2039		2040 - 2044
Total - Other Programs and Support	\$4,500,000	\$4,125,000	\$4,075,000	\$5,250,000	\$5,200,000	\$5,050,000	\$4,600,000	\$4,450,000	\$4,600,000	\$4,450,000	\$4,600,000	\$21,000,000	\$21,000,000	\$21,000,000	\$113,900,000
Programmatic Support	\$2,950,000	\$2,925,000	\$2,175,000	\$3,600,000	\$3,600,000	\$3,600,000	\$3,500,000	\$3,500,000	\$3,500,000	\$3,500,000	\$3,500,000	\$17,500,000	\$17,500,000	\$17,500,000	\$88,850,000
Asset Management Program	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$2,500,000	\$2,500,000	\$2,500,000	\$13,000,000
Integrated Plan Development	\$50,000	\$325,000	\$325,000												\$700,000
Middle Basin WWTF Study		\$750,000													\$750,000
Blue River WWTF Wet Weather Study			\$750,000												\$750,000
Mill Creek WWTF Study	\$250,000	\$750,000													\$1,000,000
Nelson Treatment/Collections Improvements	\$1,200,000														\$1,200,000
Collection System Studies & Optimization		\$500,000	\$500,000												\$1,000,000
General Flow Monitoring	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000									\$600,000
AM CPMS Purchase & Implementation	\$850,000														\$850,000
Integrated Plan Delivery Support				\$3,000,000	\$3,000,000	\$3,000,000	\$3,000,000	\$3,000,000	\$3,000,000	\$3,000,000	\$3,000,000	\$15,000,000	\$15,000,000	\$15,000,000	\$69,000,000
Other Items	\$1,550,000	\$1,200,000	\$1,900,000	\$1,650,000	\$1,600,000	\$1,450,000	\$1,100,000	\$950,000	\$1,100,000	\$950,000	\$1,100,000	\$3,500,000	\$3,500,000	\$3,500,000	\$25,050,000
City Street/Storm Program	\$700,000	\$700,000	\$700,000	\$700,000	\$700,000	\$700,000	\$700,000	\$700,000	\$700,000	\$700,000	\$700,000	\$3,000,000	\$3,000,000	\$3,000,000	\$16,700,000
Customer Service Software Improvements	\$150,000		\$150,000		\$150,000		\$150,000		\$150,000		\$150,000				
Lab Equipment	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$250,000	\$250,000	\$250,000	\$1,300,000
Large O&M Vehicles	\$450,000	\$250,000	\$800,000	\$700,000	\$500,000	\$500,000						\$0	\$0	\$0	\$3,200,000
SCADA/Network	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$250,000	\$250,000	\$250,000	\$2,950,000