



Our Columbia Waters
Integrated Management Plan
Wastewater & Stormwater

Columbia Wastewater and Stormwater Integrated Management Plan

Final Report



City of Columbia, MO

September 28, 2018

<https://www.como.gov/utilities/sewer/imp/>

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List of Attachments

- Attachment A.** City of Columbia Clean Water Act Compliance Timeline.
- Attachment B.** Memorandum of Understanding between the Missouri Department of Natural Resources and the City of Columbia, Missouri regarding the Integrated Management Plan for Wastewater and Stormwater.
- Attachment C.** Project Framework and Approach.
- Attachment D.** Visioning Workshop Summary.
- Attachment E.** Technical Memorandum 1 – Surface Water Quality and Biological Conditions.
- Attachment F.** Technical Memorandum 2 – Wastewater Collection System Evaluation.
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- Attachment I.** Community Outreach Plan.
- Attachment J.** Technical Memorandum 8 – Community Outreach Results.
- Attachment K.** Technical Memorandum 5 – Wastewater Collection System Alternatives.
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- Attachment O.** Technical Memorandum 10 – Residential Affordability and Socioeconomic Evaluation.

Section 1. Introduction and Objectives

Over the past decade, population growth, aging infrastructure, increasingly complex water quality issues, and challenging economic conditions have strained municipal utility management across the country. This situation has been further complicated by federal and state regulatory structures that historically focused on enforcing individual Clean Water Act (CWA) requirements on fixed schedules, without full consideration of all obligations that a utility may be facing or whether compliance efforts will result in meaningful improvements in environmental and public health. These narrow regulatory processes limit a community's ability to efficiently manage their utilities because they must address new regulatory requirements on a "first come, first served" basis, rather than prioritizing affordable and protective solutions to resolve the most critical environmental and public health issues.

"The integrated planning approach does not remove obligations to comply with the CWA [Clean Water Act], nor does it lower existing regulatory or permitting standards, but rather recognizes the flexibilities in the CWA for the appropriate sequencing and scheduling of work."

From EPA's 2012 Integrated Municipal Stormwater and Wastewater Planning Approach Framework

In 2011, the US Environmental Protection Agency (EPA) recognized that when afforded the flexibility to balance wastewater and stormwater improvements, municipalities can 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). The Missouri Department of Natural Resources (MDNR) also supports municipal integrated planning and has developed a similar framework³. 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.

The City of Columbia, Missouri (City) initiated this Integrated Planning effort after multiple and significant regulatory challenges, and aging infrastructure demands highlighted the importance of balancing and prioritizing investments. In January 2011, the Missouri Department of Natural Resources (MDNR) initiated enforcement negotiations with the Sewer Utility Division for wet weather sanitary sewer overflows (SSOs). During this timeframe, MDNR and the US Environmental Protection Agency (USEPA) developed the Hinkson Creek Total Maximum Daily Load (TMDL) to address a biological impairment. The Hinkson Creek TMDL did not include specific pollutant wasteload allocations but rather established stream flow targets to restore the beneficial use. Urban stormwater discharged from the City's municipal separate storm sewer system (MS4), as well as the Boone County's and University of Missouri's MS4s, were considered significant pollution sources in the TMDL. The TMDL resulted in the creation of the

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.

³ Hirschvogel, Lacey. 2016. Missouri Integrated Planning Framework. Water Protection Program. Jefferson City, MO.

Collaborative Adaptive Management (CAM) process that the City is currently implementing in coordination with EPA, MDNR, Boone County, and the University of Missouri. With these two impactful regulatory drivers alone, the City realized that the community may ultimately face unaffordable program costs with typical regulatory implementation requirements, which would be exacerbated by additional regulatory obligations and the City's other infrastructure challenges.

In addition to these two significant regulatory issues, the City also faces a number of future issues (**Attachment A**) and service demands that will continue to impact wastewater and stormwater infrastructure decisions and investments for the next several decades. When EPA's Framework was issued, the Columbia City Council, Mayor, and Utility managers recognized that it provided a means to address existing and future regulatory requirements while continuing to meet the needs of the systems operations and chose to use it to develop this Integrated Management Plan (IMP). In 2017, the City and MDNR executed a Memorandum of Understanding (MOU) which acknowledged that the City would prepare the IMP to prioritize



future wastewater and stormwater improvements (**Attachment B**) and MDNR would use the IMP recommendations in future regulatory and permitting decisions.

The City retained HDR Engineering, Inc., and their team, which includes Geosyntec Consultants, Inc., Shockey Consulting Services, LLC, Black and Veatch, Inc., and TREKK Design Group, LLC (collectively, the Project Team), to assist in developing the IMP. This planning effort is focused on developing a prioritized and balanced infrastructure investment

Integrated planning allows the City to proactively and affordably balance and prioritize regulatory issues and infrastructure needs

strategy to address wastewater and stormwater management needs, including programmatic and capital funding for the wastewater collection, wastewater treatment, and stormwater management programs.

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

- **Element 1** – A description of the water quality⁴, human health and regulatory issues (**Attachment A**) 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.



Columbia's IMP project approach

To develop this IMP, the City and the Project Team tailored an approach that aligns with EPA’s six elements and allows the City to affordably meet CWA requirements (**Attachment A**) while planning for infrastructure investments over the next 20 years (**Attachment C**).

The City envisions implementing the IMP in a phased manner to address the most critical existing infrastructure and regulatory drivers first, while allowing adequate time to gather the information needed for thoughtful infrastructure planning. As discussed in **Section 4.2** below, critical needs were identified and prioritized based on their anticipated environmental, social, and economic benefits. Using this approach, the City will have an adaptable plan that addresses current regulatory drivers, provides investment certainty over the next 5 to 10 years, accounts for necessary non-regulatory investments prior to taking on investments to deal with future regulations, and defines affordability for the City’s ratepayers.

This IMP also builds on previous sewer and stormwater planning efforts undertaken by the City. In 2004, the City completed wastewater master planning efforts⁵ to identify capital improvement projects and funding needed to address anticipated collection and treatment needs through

⁴ Throughout this report, the term “water quality” refers to surface water (streams, rivers, and lakes) quality.

⁵ <https://www.como.gov/utilities/wp-content/uploads/sites/20/2016/09/ColumbiaSewerMasterPlan-Nov2004.pdf>

2030. The City completed a similar stormwater assessment⁶ in 2008 and finalized a rate study⁷ in 2014 to identify revenue needs to satisfy forecasted annual operating, debt service, and capital requirements for the Storm Water Utility. The City recognizes that although these wastewater and stormwater plans continue to be useful planning documents, the recommendations must be reviewed periodically to account for changes in customer growth and economic projections, facility and program needs, and regulatory requirements.

In August 2015, the City formed the Mayor's Task Force on Infrastructure (MTFI) to broadly review and identify the City's overall infrastructure needs. The MTFI evaluated the overall operation, maintenance, and funding of the stormwater system, sewer system, downtown electric system, and major street plan and transportation infrastructure. The MTFI also reviewed past planning efforts, as well as current and future project priorities for these programs. The MTFI also provided both functional recommendations and financial/policy recommendations for the City Council and staff to consider. The functional recommendations were considered during the development of this IMP and incorporated where reasonable and appropriate. The majority of the MTFI financial and policy recommendations were beyond the scope of the IMP and were not evaluated. A summary of the functional recommendations and how they were addressed by the IMP is included in Section 7.

Details regarding the overall planning approach, as well as supporting data, information, and analyses used to inform the final IMP recommendations and actions are documented throughout the remainder of this report. A copy of this final report, as well as technical memoranda and community outreach materials, are available at www.como.gov/utilities/sewer/imp/.

⁶ <https://www.como.gov/utilities/stormwater-engineering/2008-stormwater-utility-assessment/>

⁷ Burton and Associates, Inc., 2014. City of Columbia Stormwater Utility Rate Study. September 30, 2014.

Section 2. Build the Vision

Element 1 of EPA's framework involves identifying the important regulatory, environmental, human health, and infrastructure issues that will be addressed in the planning process. To build a cohesive vision for the IMP, the City hosted a two-day visioning workshop in May 2016 to discuss existing and future challenges facing the City, goals and objectives of the IMP, and potential IMP strategies to meet those goals (**Attachment D**). Workshop participants included representatives from a number of City Departments, including: City Management, Utilities Department, Columbia/Boone County Public Health and Human Services, Finance Department, Sustainability Office, Legal Department, and Community Relations. Representatives from the University of Missouri, Boone County, and the Boone County Regional Sewer District also participated. The City Council and Mayor were also individually interviewed to capture the critical issues and desired outcomes for the IMP process.

Over the course of the two-day workshop, the group discussed issues that would impact IMP development such as anticipated state and federal regulatory drivers, affordability concerns and strategies for characterizing ratepayer impacts, current conditions and future expectations for the City's wastewater and stormwater systems, and key stakeholder groups that should be included in the process. Through these discussions, the group broadly characterized goals, priorities, and challenges to inform the IMP. These ideas were captured in a vision statement intended to clearly and effectively communicate the intent and desired outcomes of the IMP to community stakeholders.

Columbia IMP Vision Statement

The stormwater and wastewater Integrated Management Plan is a community-driven, affordable infrastructure plan that enhances human health and safety, water quality, economic vitality, and environmental resources by leveraging existing assets and implementing innovative solutions.

To achieve this vision and guide the successful development of the IMP, workshop participants identified several key considerations that should be addressed during the planning process.

- Regulatory uncertainty is one of the largest challenges facing the City. The plan should provide at least five years of regulatory certainty so that the City can conduct important system condition assessments, develop asset management tools, and undertake other improvements that are necessary to develop an effective, long-term asset management and capital improvement program.
- Financial impacts on all City ratepayers, and specifically disadvantaged communities, must be carefully considered as IMP alternatives are developed or implemented.
- Integrated planning is a community-driven process. Therefore, stakeholder and community involvement is critical to developing an effective IMP. As part of the community engagement effort, the City should obtain input from a wide variety of stakeholders. Project information should also be developed so that the community can

easily understand the known problems and how the proposed projects will address these problems and provide additional benefits.

- The IMP recommendations should focus on identifying projects that have multiple benefits and are technically-feasible, prioritized, funded, and supported by the community. Specifically, the IMP will be successful if it provides a means to implement currently planned, critical infrastructure projects over the next five years and positions the City to successfully plan for and meet long-term environmental and infrastructure goals. In the near term, the IMP should focus on the most critical wastewater and stormwater priorities, which include:
 - Developing and implementing an asset management system to support system renewal efforts, identify performance baselines, measure progress, and assist in communicating infrastructure needs to ratepayers;
 - Addressing wet-weather issues, particularly basement backups, SSOs, and areas with persistent inflow and infiltration (I/I) challenges;
 - Reducing capacity-related issues in the existing wastewater treatment and collection systems; and
 - Improving stormwater planning, education, outreach, and inter-departmental coordination in an effort to formalize projects needed to address known drivers and accurately characterize future funding needs.

The visioning workshop was an important first step in the IMP development process because the vision, goals, and considerations identified helped to focus planning activities and shape the overall direction and objectives of the plan.



Feedback received during the two-day IMP visioning workshop shaped the overall direction and objectives of the plan

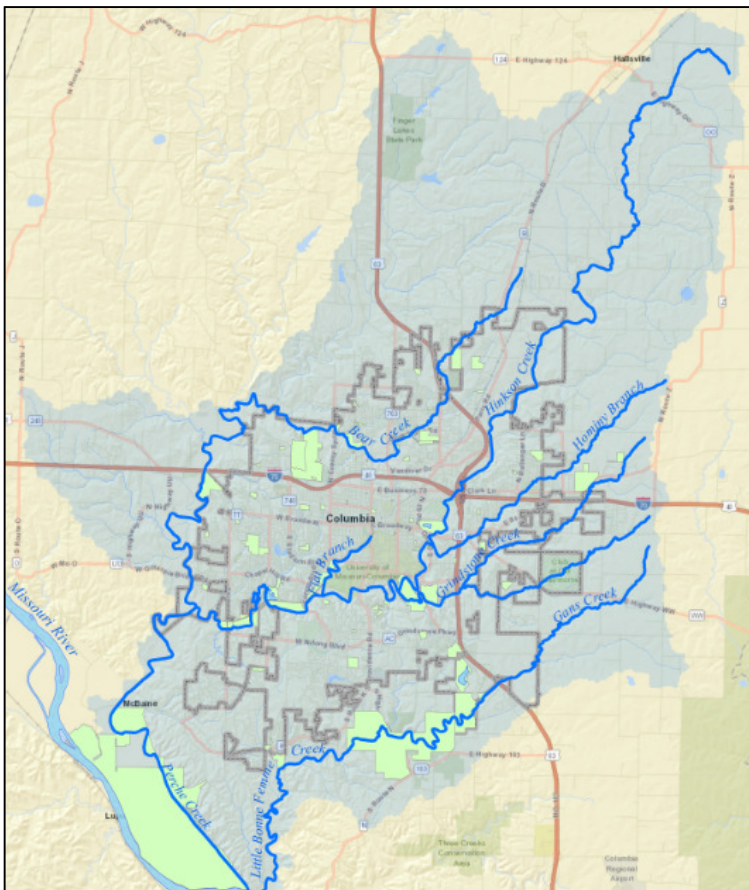
Section 3. Existing System Evaluation

The next step of the planning process includes evaluating the City’s environmental resources and infrastructure assets to better define the existing condition, performance, and needs of its systems. This step directly addresses Element 2 of EPA’s framework and forms the basis for developing alternatives (Element 4) and performance tracking systems to measure progress (Element 5) during future IMP phases.

To develop a comprehensive understanding of existing conditions, the City and their Project Team compiled and evaluated existing surface water quality and biological condition (**Attachment E**), wastewater collection (**Attachment F**), wastewater treatment (**Attachment G**), and stormwater management (**Attachment H**) data. For a detailed description of the data, performance assessments, and identified data gaps, refer to the corresponding technical memoranda attached to this report. Summaries of these evaluations are included below.

3.1 Surface Water Quality Conditions in Columbia

Columbia is widely known for its urban area streams, lakes, and wetlands and natural areas. There are approximately 300 miles of streams and more than 100 public and private lakes



Quality of life in the Columbia area is improved by the numerous water and natural resources

within the 200 square miles of watersheds that adjoin or intersect the City. The Missouri Department of Conservation’s (MDC) Eagle Bluffs Conservation Area (Eagle Bluffs) is a regional natural resource asset and is supported by treated effluent from the Columbia Regional Wastewater Treatment Plant (CRWWTP). The City’s water resources are prominent natural features that support wildlife habitat and recreational opportunities. Therefore, understanding current water quality conditions in Columbia area streams is critical for establishing priorities through the IMP process.

The State of Missouri has established water quality standards for streams, lakes, and wetlands across the state. These standards are implemented by MDNR and specify water quality conditions that are protective of both aquatic life and public health. If water quality

standards are not met, the City may be required to take corrective action if the impairment is attributed to activities within the City’s jurisdictional area.

There are a number of streams and lakes in Columbia that MDNR has identified as impaired because conditions do not meet water quality thresholds intended to protect designated beneficial uses. Designated beneficial uses associated with waters in the Columbia area include: whole body contact recreation or swimming, secondary contact recreation such as fishing or wading, protection of warm water aquatic life, protection of human health-fish consumption, and livestock and wildlife watering. The most common impairment in the Columbia area is for whole body contact recreation, or swimming. These recreational impairments are related to high bacteria levels that may pose health risks to users.

Beneficial uses of several regional streams and lakes are considered impaired due to unsatisfactory water quality conditions

Waterbody	Impaired Designated Beneficial Use	Impairment Source	Pollutant	Impairment Status
Hinkson Creek	Swimming and Wading	Nonpoint and Urban Runoff	Bacteria	Awaiting TMDL
Hinkson Creek	Aquatic Life Support	Nonpoint and Urban Runoff	Unknown	Approved TMDL & CAM Process Initiated
Hominy Branch	Swimming and Wading	Nonpoint and Urban Runoff	Bacteria	Awaiting TMDL
Grindstone Creek	Swimming and Wading	Nonpoint and Urban Runoff	Bacteria	Awaiting TMDL
Little Bonne Femme Creek	Swimming and Wading	Unknown	Bacteria	Awaiting TMDL
Perry Phillips Lake	Human Health Protection	Atmospheric Deposition	Mercury	Awaiting TMDL
Lake of the Woods	Human Health Protection	Atmospheric Deposition	Mercury	Awaiting TMDL

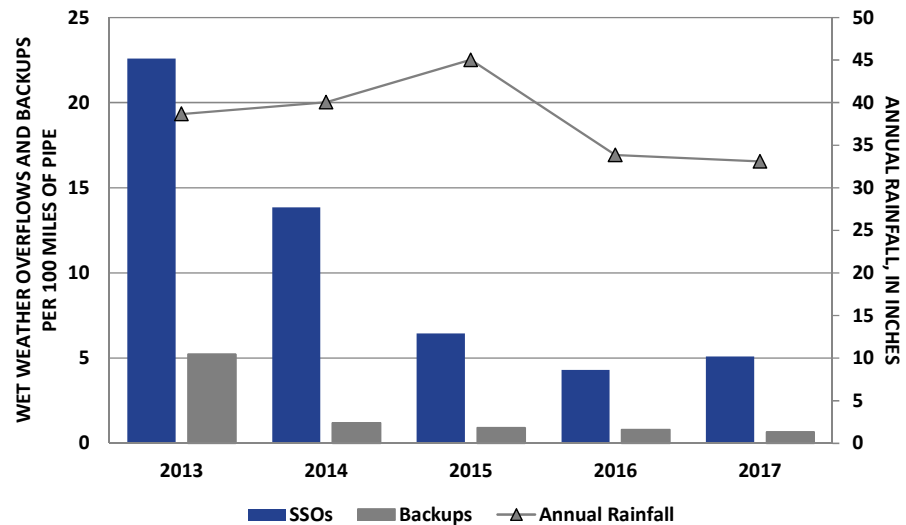
In addition to reviewing existing impairments, the Project Team compiled data from accessible, publicly-available sources to facilitate characterization of water quality conditions in and around Columbia. The water quality database included more than 17,000 data records from over 100 monitoring locations in Columbia watersheds. Most of the historical data were collected from the main stem of Hinkson Creek but are not robust or consistent throughout the remaining watersheds. Although these data were sufficient for evaluating large scale patterns and trends, the limited data available from most sites generally prevented detailed analysis needed to identify potential pollution sources or areas of concern.

Results of the data analysis indicated that the current list of impaired waters adequately characterizes the existing water quality concerns in Columbia. In general, elevated bacteria levels are the most pervasive issue throughout Columbia area waters. These high levels are exacerbated following rainfall events that contribute runoff to the streams. Significant or widespread impacts caused by other parameters such as low dissolved oxygen, chloride, and nutrients were not apparent from the data.

3.2 Wastewater Collection System Review

The wastewater collection system is an important component of the infrastructure owned and operated by the City’s Sewer Utility. Effective management of the collection system is vital for meeting important goals like reducing SSOs, achieving regulatory compliance, efficiently managing wastewater, and improving customer satisfaction. The Project Team worked with City staff to review the existing program and characterize the City’s current collection system management strategies and practices in the context of good engineering practices and core attributes that are fundamental to effectively managing and operating sanitary collection systems.

The collection system performance review indicated that City’s program has consistently improved over time and is meeting or exceeding expectations associated with an effectively managed Utility. For example, the City has made significant progress addressing overflows and building backups that occur during major wet weather



The Sewer Utility has implemented effective measures to reduce overflows and backups from Columbia’s sanitary sewer system

events through a combination of operational improvements at the CRWWTP influent pump station, I/I reduction efforts, and capacity improvement projects. Although the influent pump station continues to be a significant hydraulic restriction during wet-weather events, these improvements dramatically reduced surcharging and SSOs in the collection system upstream of the CRWWTP in 2015.

While the City has made significant improvements in the collection system, a number of capital and programmatic needs and data gaps were identified during the wastewater collection system assessment. According to the assessment, the City should:

- Develop and implement strategies to support system renewal and maintenance efforts using an asset management approach, including a mechanism to establish sufficient dedicated funding for these efforts.
- Develop a hydraulic model to identify improvements that will address remaining system capacity limitations and reduce I/I, building backups, and SSOs caused by wet weather flows.

- Maintain collection system maintenance performance to limit dry weather backups and SSOs due to blockages despite the challenges presented by aging infrastructure and community growth. Ensure adequate funding is available to achieve this performance.
- Update collection system goals to ensure they reflect the City's short and long-term priorities. Progress towards achieving these goals could be measured through actionable Key Performance Indicators (KPIs) that support the City in making business decisions, allocating resources, and identifying challenges that could negatively impact performance and service levels.

Planning level alternatives to address these needs are included in **Section 5** of this report.

3.3 Wastewater Treatment System Review

Wastewater treatment is an essential service provided by the City and is critical for protection of human health and regional water quality. The CRWWTP treats residential, commercial, and industrial wastewater generated within the Columbia metropolitan area and is one of the City's most significant infrastructure assets. The CRWWTP's ability to comply with current and future regulations, while managing wastewater from a growing population, was a vital consideration for the City during the IMP development process.

The CRWWTP consists of a mechanical treatment plant followed by a series of four treatment wetlands units that provide additional wastewater treatment. The constructed treatment wetlands are a unique feature of the CRWWTP. Constructed treatment wetlands use natural



The Columbia Regional Wastewater Treatment Plant is a critical asset to effectively manage and treat wastewater from the City and surrounding area

physical, biological, and chemical processes to remove a wide array of wastewater pollutants, including organics, nutrients, ammonia, metals, and bacteria. Treated effluent from the CRWWTP is discharged into Eagle Bluffs to provide a valuable water source for wildlife habitat.

Since the CRWWTP was initially constructed in 1983, more than 100 small WWTPs have been eliminated in Columbia. The CRWWTP continues to be an important regional asset that is effectively used to manage and treat wastewater generated from this growing community.

Currently, there are 38 domestic and 8 industrial wastewater treatment plants in or near Columbia. Of the 38 domestic National Pollutant Discharge Elimination System (NPDES) permits, 11 are decommissioning and joining either the CRWWTP or Boone County Regional Sewer District (BCRSD) systems.

In 2013, the City completed a \$64 million upgrade and expansion of the CRWWTP. The upgrade was necessary to meet more stringent ammonia limits established by MDNR in the City's discharge permit. The upgrade also increased the capacity of the CRWWTP from a design average flow (DAF) of 20.6 million gallons per day (MGD) to 25.2 MGD. The project included the addition of two new mechanical plant treatment trains and improvements to the headworks, wet wells, grit removal system, solids handling, and various upgrades intended to improve treatment efficiency, effectiveness, and health and safety protections.

With the CRWWTP upgrade, effluent quality has dramatically improved. Specifically, discharged ammonia, biochemical oxygen demand, and bacteria concentrations have decreased and are maintained at levels necessary to support aquatic life and secondary contact recreational uses in Eagle Bluffs. The CRWWTP has also consistently complied with discharge permit limits implemented by MDNR.

The CRWWTP is currently producing a high quality effluent, but the City understands that it is appropriate to plan for future treatment system needs that will improve existing operations; address anticipated regulatory drivers related to the wet-weather program, disinfection, nutrient removal, and more stringent ammonia limits; and continue to provide for efficient and effective regional treatment services. Planning level alternatives to address these needs are included in **Section 5** of this report.

3.4 Stormwater System Review

Effective management and efficient implementation of the stormwater program is necessary for meeting important environmental and public safety goals such as improving water quality, minimizing flooding impacts, and reducing property damage. To develop a better understanding of the City's existing stormwater assets, the Project Team compiled relevant data and worked with the City to inventory the existing system, review its performance, and evaluate system capacity. More specifically, the Project Team characterized the number, size, and probable condition of existing stormwater conduits and structures; evaluated historical drainage and flooding issues; and reviewed conveyance system capacity design standards. From a water quality and regulatory perspective, the Project Team assessed the City's ability to maintain compliance with the requirements of their municipal separate storm sewer system (MS4) permit. This MDNR-issued permit outlines provisions for how the City must develop, implement, and enforce their stormwater management program and plan to reduce pollutant discharges to the maximum extent practicable.



Stormwater system failures contribute to public health, safety, and water quality concerns across Columbia

Most critically, the evaluation highlighted the fact that the current level of asset management investment is not sufficient to address existing and future needs. Currently, approximately 15% of pipes in the system are likely beyond their physical effective life. This number is expected to grow to nearly 60% over the next 20 years at the current renewal rate. The assessment findings also indicated that only 1% of the pipes and 7% of the structures have been inspected and assigned a condition rating. The City currently spends a portion of the annual storm water budget addressing failing pipes and inlets. Continued underfunding and deferment of system replacement, renewal, and assessment activities will further reduce system function and reliability.

These asset renewal issues contribute to public health, safety, and water quality concerns. Yard, street, and house flooding is an important health and safety concern for the City because these issues can affect the integrity of other infrastructure such as roads and sewer lines. Collapsing storm pipes and roadway failures can also impact water quality in area streams and lakes, which is a significant concern for the Storm Water Utility because there are seven water quality impairments in the City that are identified as being caused by urban and other nonpoint source runoff.

To address water quality issues, the City has developed a joint stormwater management plan (SWMP) under their MS4 permit in coordination with Boone County and the University of Missouri. The SWMP reflects federal (40 CFR 122.34) and state (10 CSR 20-6.200(5)(A)1-6)) regulations which requires the City to implement six minimum control measures (MCMs) to protect water quality and effectively reduce stormwater runoff to the maximum extent practicable. The six minimum controls are: public outreach and education, public involvement and participation, illicit discharge detection and elimination, construction stormwater runoff control, post-construction stormwater management in new development and redevelopment, and pollution prevention and good housekeeping for municipal operations.

The City and their co-permittees are currently fulfilling the requirements of the MS4 permit. However, the evaluation highlighted several opportunities for improvement in the current program. Most notably, developing a more strategic and proactive illicit discharge detection and elimination inspection program and refining erosion and sediment control inspection operations would allow the City to more effectively resolve issues that cause immediate water quality concerns.

The stormwater system review also identified a number of gaps and limitations related to management of the existing system data and database. The City is aware of these issues and has been working to advance their data collection, tracking, and maintenance procedures but continued and better-funded efforts will help improve future stormwater system planning, maintenance, and performance.

Planning level alternatives to address identified stormwater needs are included in **Section 5** of this report.

Section 4. Community Outreach

Effective outreach is a vital component of the planning process since the community's input directly informs development of the IMP. During the outreach process, the Project Team educated participants by highlighting important infrastructure, environmental, and public health needs; consulted participants to gain an understanding of community needs; and involved



The Columbia IMP was developed with robust community input using multiple methods of engagement

participants by working with them directly throughout the process to identify criteria by which to measure the benefit of potential solutions. Through early and continuous outreach, the City brought diverse perspectives and values into the decision-making process and strived to ensure that concerns and needs were thoroughly considered. This outreach process will result in an IMP that incorporates community goals and values.

Element 3 of EPA's Framework suggests that municipalities pursue the following principles when conducting integrated planning outreach activities:

- Provide appropriate opportunities that allow for meaningful input during the identification, evaluation, and alternative selection phases of the planning effort,
- Make new information available and provide opportunities for input into the development of proposed modifications of the plan, and
- Allow public involvement to assist in evaluating the opportunities and effectiveness of potential green infrastructure alternatives, if they are relevant to the plan.

The Project Team worked with City staff to implement an engagement strategy (**Attachment I, Attachment J**) that described the planning process, provided for continuing input by stakeholders, and ensured that stakeholder concerns received fair consideration. The approach was intended to bring a diverse group of stakeholders together, educate them regarding various options, and gather input in a structured, inclusive, and transparent process. In the context of EPA's Framework, community outreach should be an ongoing process that is used to inform and refine IMP goals and outcomes over time. Therefore, the City expects that IMP implementation will be reviewed through outreach activities such as an open comment period and public hearings and Columbia City Council meetings.

4.1 Stakeholder Involvement

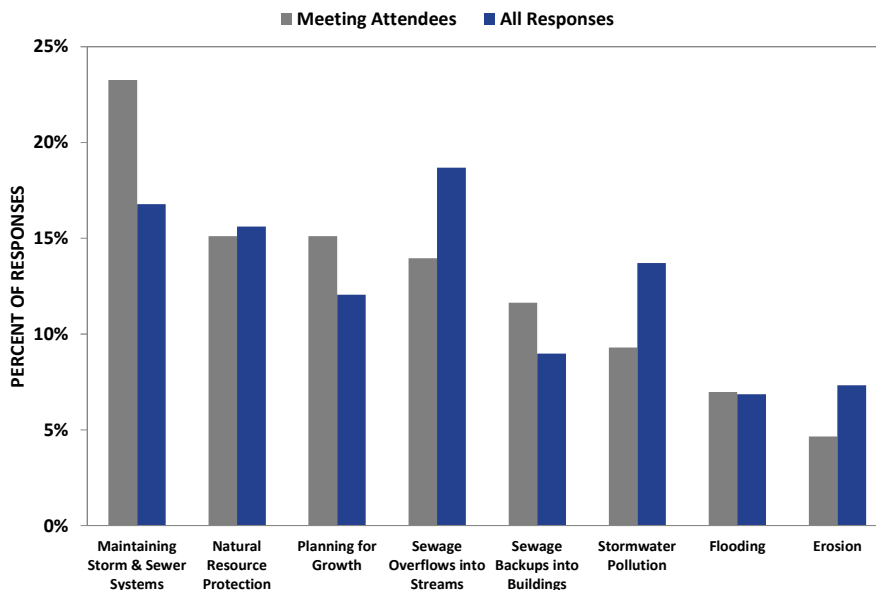
In addition to the general public, the Project Team identified key stakeholders from a balance of interests across the community. These stakeholders included representatives from the Columbia City Council, government agencies, representatives of economically and socially disadvantaged populations, environmental and conservation groups, the business and development community, nonprofit and civic organizations, large impervious surface property owners, and residents who have experienced chronic building backups. The team reached out to specific organizations within these groups in an attempt to get a wide variety of participation in the planning process. Overall, more than 160 members of the community participated or provided input into the planning process.



IMP Workshops provided an opportunity to inform the public about wastewater and stormwater infrastructure issues and capture community priorities

4.2 IMP Outreach Activities

Outreach efforts with the general public focused on preparing and providing relevant information to educate the community at large and getting high-level, value-based input from interested stakeholders. The activities included distributing project fact sheets to introduce the IMP, share the desired outcomes, and provide opportunities for the public to get involved; maintaining a project website; and issuing press releases and social media posts to notify the public of opportunities to provide input. The project website has since been incorporated into the City’s website: <https://www.como.gov/utilities/sewer/imp/>.



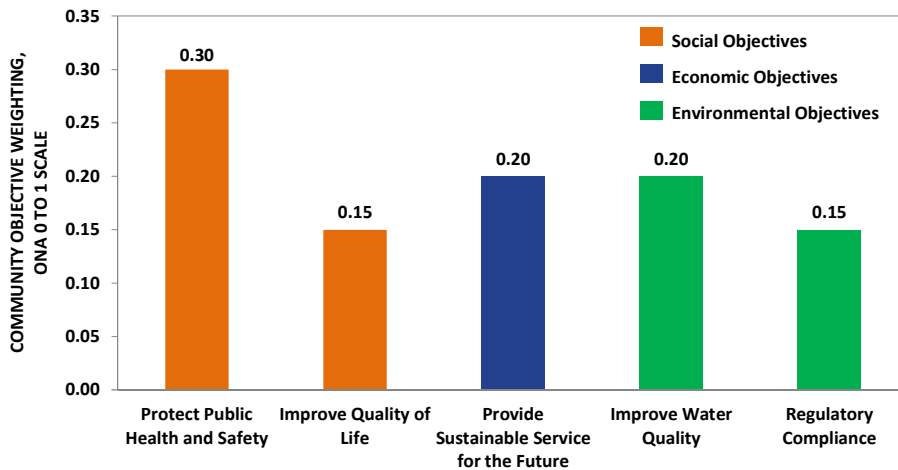
Workshop and survey participants provided important input on infrastructure, public health, and water quality priorities that should be addressed in the IMP

In addition to these broad outreach efforts, the Project Team developed an online survey and conducted a series of four workshops; 162 people participated in the survey and 77 individuals attended at least one community workshop. The goal of these efforts was to obtain specific input on the infrastructure, water quality, and public health needs that should be addressed by the IMP (Workshops #1 and #2); review potential solutions (Workshop #2); discuss the resources needed to implement the solutions affordably (Workshop #3); and outline the process and decision criteria used to evaluate project costs and benefits (Workshop #4).

The City and Project Team also met with Council members throughout development of the IMP so that they were informed about the planning process. Each Council member was invited to meet, both individually and in pairs, and discuss the planning process; these meetings were held early during the Visioning phase of the project to ensure that each person’s priorities were captured in the plan and then later to discuss the engineering alternatives, costs, and potential ratepayer impacts associated with addressing those priorities. A preliminary draft of this IMP was presented to the Council during a work session on August 7, 2017. Prior to finalizing the IMP, the City also offered a 30-day public comment period to solicit additional input and allow the public to review recommendations included in the plan.

4.3 Applying Outreach Results to the IMP

Feedback received over the course of the IMP outreach indicated that maintaining storm and sewer systems was the highest programmatic and infrastructure-related priority for Columbia stakeholders. However, other issues such as natural resource protection, planning for growth, reducing building backups and sewage overflows into streams, and flooding were also important issues to participants. Although all waterbodies in and around Columbia are important to



Columbia residents, Hinkson Creek and its tributaries, Eagle Bluffs, and regional high quality streams such as Bonne Femme and Little Bonne Femme Creeks are generally valued highest.

IMP community outreach provided social, environmental, and economic – the triple bottom line – priorities and weightings for informed decision making

Based on this information and other feedback received from the survey, workshops, and City

Council coordination described above, the Project Team used a triple bottom line approach to develop a series of weighted objectives that captured the community’s social, economic, and environmental goals for the IMP. These five objectives were used as the primary decision criteria for evaluating potential IMP wastewater and stormwater alternatives to ensure that all potential community needs and priorities were considered in the planning process.

Section 5. Alternatives Analysis

Element 4 of EPA’s Framework includes the identification, evaluation, and selection of alternatives and implementation schedules for system and water quality improvements. For Columbia, these solutions were developed based on the outcomes of the Visioning Workshop, existing system performance assessment, and community outreach program. This element is by far the most complex step in the planning process, as the goal is to identify alternatives that could meet all of those needs effectively and affordably. The Project Team’s approach for identifying and optimizing alternatives, as well as the proposed implementation schedule for those alternatives, is summarized below.

5.1 Identifying Alternatives

The goal of the alternatives identification process was to develop planning level project descriptions and cost estimates to characterize the additional level of investment required to address system needs, anticipated regulatory drivers, and City goals over the next 20 years (the IMP planning period). This step included outlining alternatives for the wastewater collection (**Attachment K**), wastewater treatment (**Attachment L**), and stormwater management programs (**Attachment M**). To facilitate this evaluation, wastewater and stormwater alternatives were grouped and analyzed by project category.

Wastewater and stormwater program alternatives were assessed by project category to characterize long-term IMP investment needs

Wastewater Treatment	Wastewater Collection	Stormwater Management
<ul style="list-style-type: none"> • Wet Weather Improvements • Expanded Nitrification • Biological Nutrient Removal • Chemical Disinfection • Constructed Wetlands Maintenance • Digester Rehabilitation • Digester Capacity Improvements 	<ul style="list-style-type: none"> • Wet Weather Program Planning • Asset Management • System Renewal • System Capacity • Reducing Building Backups • Private Common Collector Elimination • System Expansion • Cleaning Program • Pump Station Repair • Annual Sewer Improvements 	<ul style="list-style-type: none"> • Stormwater Planning • System Assessment and Cleaning • System Renewal • Flood Control • Stream Erosion • Runoff Treatment to Improve Water Quality • Stormwater Management Program

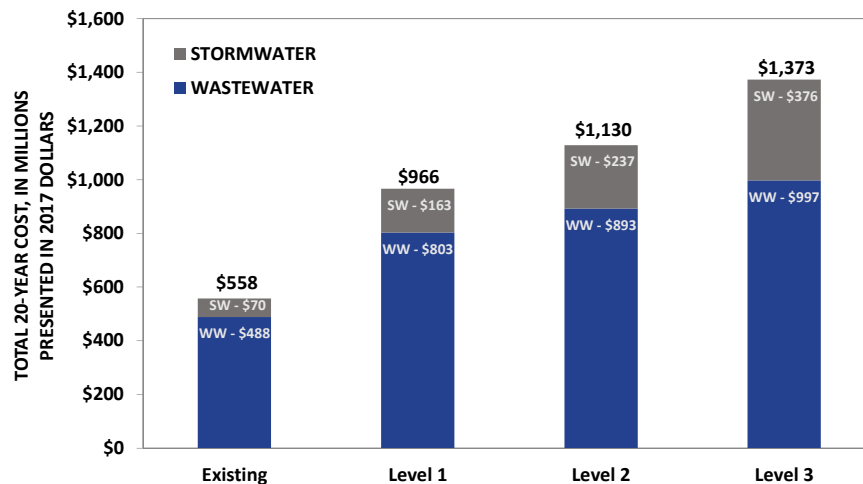
Cost estimates were developed for each project category to quantify the investments and resources needed *in addition to* those already expended by the Sewer and Storm Water Utilities. The planning level cost estimates included potential additional capital costs, operation and maintenance costs, and costs associated with necessary planning or data collection activities needed over the 20-year IMP planning period.

The three potential funding scenarios used to guide the cost analyses for each project category were broadly defined as follows:

- **Level 1 Funding (Level 1)** – Funding needed to **provide the minimum** level of service that meets both community-wide expectations and **existing** regulatory requirements over the 20-year IMP planning period.
- **Level 2 Funding (Level 2)** – Funding needed to **exceed the minimum** level of service that meets community-wide expectations and **more proactively** meets existing regulatory requirements over the 20-year IMP planning period.
- **Level 3 Funding (Level 3)** – Funding needed to **address all** forecasted infrastructure needs, and proactively meet **both** existing and forecasted regulatory requirements over the 20-year IMP planning period.

The project categories and funding assumptions were refined during a series of workshops between the Project Team and the City’s Sewer and Storm Water Utilities. Specific methodologies and assumptions used to develop funding level estimates for each of the project categories, as well as detailed cost forecasts, are described in more detail in the corresponding technical memoranda attached to this report (**Attachments K, L, and M**). Given the uncertainties and data gaps identified during the existing system evaluation described in **Section 3**, the alternatives and costs identified for the IMP were only intended to serve as planning level estimates. These alternatives and associated costs should be refined as additional information is developed during future phases of the IMP.

The alternatives analysis identified three potential funding levels to address system needs, regulatory drivers, and customer expectations

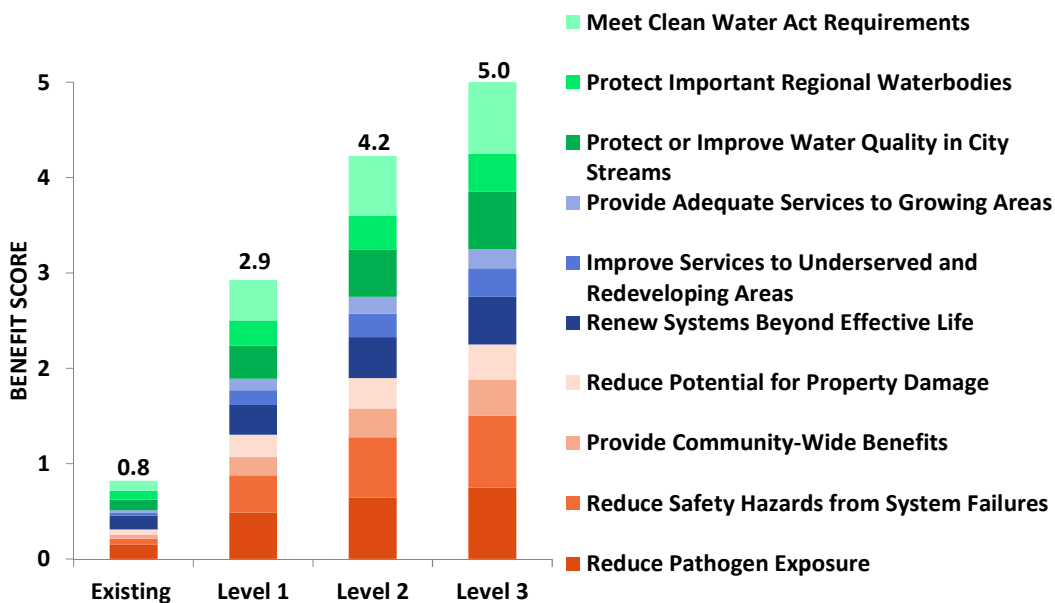


The City’s existing (as of 2017) annual Sewer and Storm Water Utility budgets were approximately \$24.4 million and \$2.4 million, respectively, with stormwater set to increase through 2020. If the City were to maintain the existing programs and associated levels of funding over the 20-year IMP planning period, the City’s total investment (in 2017 dollars) for wastewater and stormwater would be approximately \$488 million and \$70 million, respectively. The funding scenarios evaluated as part of the alternatives identification process indicate that significant additional investments would be needed to address system needs, regulatory drivers, and customer expectations over that same timeframe. According to the analysis, total costs to

meet wastewater and stormwater needs over the next 20 years are potentially between \$966 million and \$1.37 billion.

5.2 Optimizing Programs to Maximize Community Benefits

To determine which funding level alternative appropriately balanced costs with community objectives over the 20-year IMP planning period, the Project Team applied a multiple criteria decision analysis (MCDA) tool to calculate a total benefit score that represented the anticipated value that each alternative would produce for the community. Community priorities established through the outreach program were the primary decision criteria used and formed the basis for the MCDA scoring process. Using the MCDA tool (**Attachment N**), the Project Team rated each of the funding level alternatives relative to those community priorities with a standardized rating system and final scores were normalized using a 0 to 5 scale. The MCDA results indicate that each potential IMP funding level produces varying degrees of community benefits.

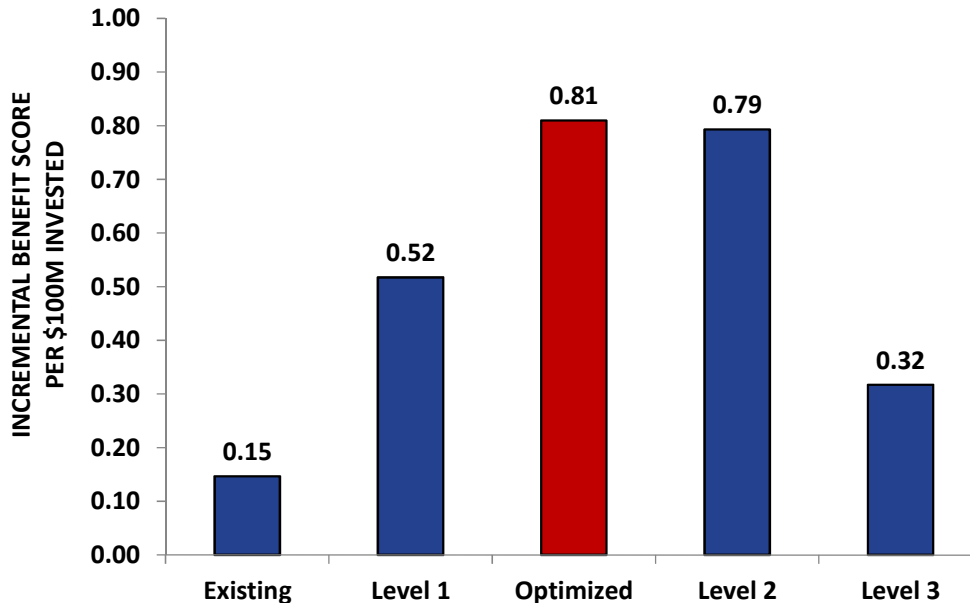


Columbia's IMP funding level alternatives deliver varying degrees of community benefits

Cost-effectiveness is a critical consideration in selecting a balanced and prioritized suite of wastewater and stormwater management alternatives. According to the benefits analysis, the greatest increase in benefit occurs when moving from the Existing funding to Level 1 funding (2.1 point increase). However, this increase in benefit must be evaluated with respect to the increased cost to implement the alternatives. When assessed in this way, results showed that Level 2 funding is the most cost-effective alternative because it produces the greatest benefit (0.79 points) for every \$100 million dollars of total cost.

The Project Team recognized that although Level 2 funding had the highest benefit to cost ratio, an Optimized suite of alternatives could be developed by combining the project categories that

provided the best value from among the four funding levels. On a per dollar basis, this Optimized suite of alternatives produced marginally greater benefit than the Level 2 funding alternative (0.81 points vs. 0.79 points) while costing \$114 million dollars less over the 20-year planning period. Due to the reduced cost of this best value suite of alternatives, the Optimized suite of alternatives is the preferred program portfolio for the IMP.



The Optimized suite of IMP alternatives produces the greatest overall benefit to the community

5.3 Residential Affordability and Socioeconomic Evaluation

The MCDA evaluation was limited to quantifying the costs and benefits of potential alternatives and did not assess the impact of the increased cost of Utility services on the City’s customers. Before committing to the implementation of the Optimized suite of alternatives, the City evaluated its impact relative to community socioeconomic conditions and average residential monthly bills to confirm that forecasted financial impacts would be affordable to residential customers (**Attachment O**).

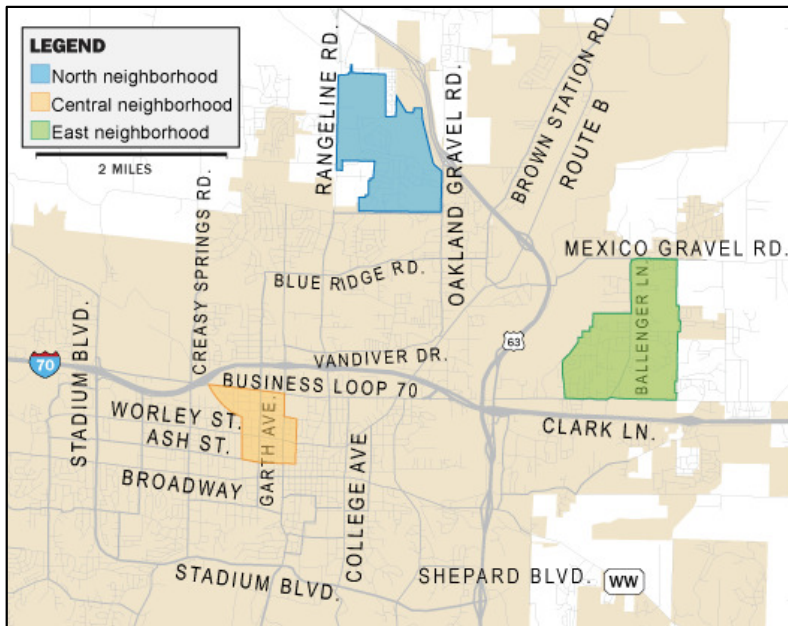
Both EPA and MDNR allow communities the flexibility to consider financial and economic impacts and affordability when developing implementation schedules for integrated planning or permitting purposes. Historically, the affordability analysis tools that regulators have relied upon are narrowly-focused and did not provide communities sufficient flexibility to fully consider local socioeconomic considerations that may impact the financial capability of the municipality and customers. Recent guidance issued by both EPA⁸ and MDNR⁹ however, has clarified expectations for municipalities conducting affordability analyses in the context of an integrated

⁸ Kopocis, K., and C. Giles. 2014. Financial Capability Assessment Framework for Municipal Clean Water Act Requirements. Office of Enforcement and Compliance Assurance. Washington, D.C.

⁹ Hirschvogel, L. 2016. Missouri Integrated Planning Framework. Water Protection Program. Jefferson City, Missouri.

plan. These guidance documents recognize that community-specific information may be necessary to develop a “more accurate and complete picture” of financial capability.

Additional flexibility is important for assessing affordability conditions in the City, as one of the City’s goals in the most recent 2016-2019 Strategic Plan¹⁰ is to improve social equity across the entire community. To this end, the City has identified three neighborhoods in north, central, and east Columbia on which to initially focus their resources to improve equity issues. The IMP affordability evaluation was structured to complement the City’s Strategic Plan by characterizing



Source: Ysteboe, Taylor. “City begins effort to address social, economic equity issues in three neighborhoods.” Columbia Missourian (Columbia, MO). April 13, 2016.

Evaluating impacts on Columbia’s strategic planning focus neighborhoods is important to the consideration of overall economic and social equity of IMP investments

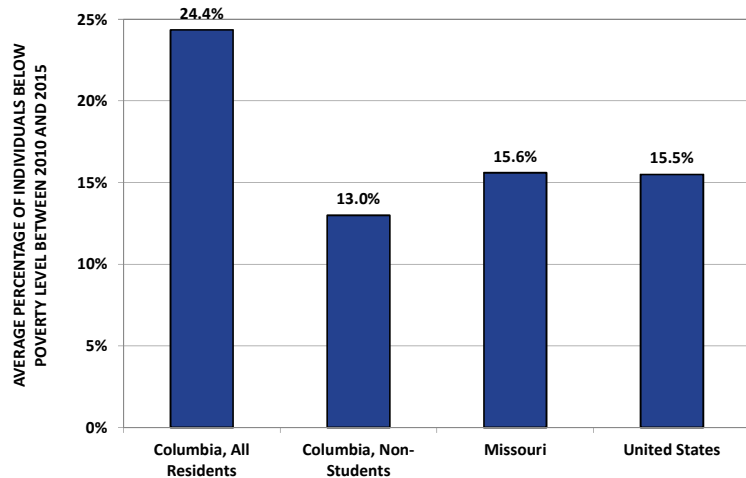
that future Sewer Utility rate increases will impact both City and BCRSD ratepayers. However, a focused analysis of potential impacts to BCRSD customers was not conducted because sufficiently detailed socioeconomic data specific to those users were not readily available.

socioeconomic conditions and potential financial impacts both broadly across the City and within sensitive neighborhoods (as measured by Census tracts).

An additional complication with assessing affordability in Columbia is that residential customers reside within both the City limits and portions of the Boone County Regional Sewer District (BCRSD) service area outside of the City boundary. The City and BCRSD operate under multiple agreements whereby the City accepts wastewater flows from some BCRSD facilities in order to provide regional treatment services. The City understands

¹⁰ City of Columbia, Missouri. 2015. Strategic Plan 2016-2019. <https://www.como.gov/wp-content/uploads/2016-2019-Strategic-Plan.pdf>

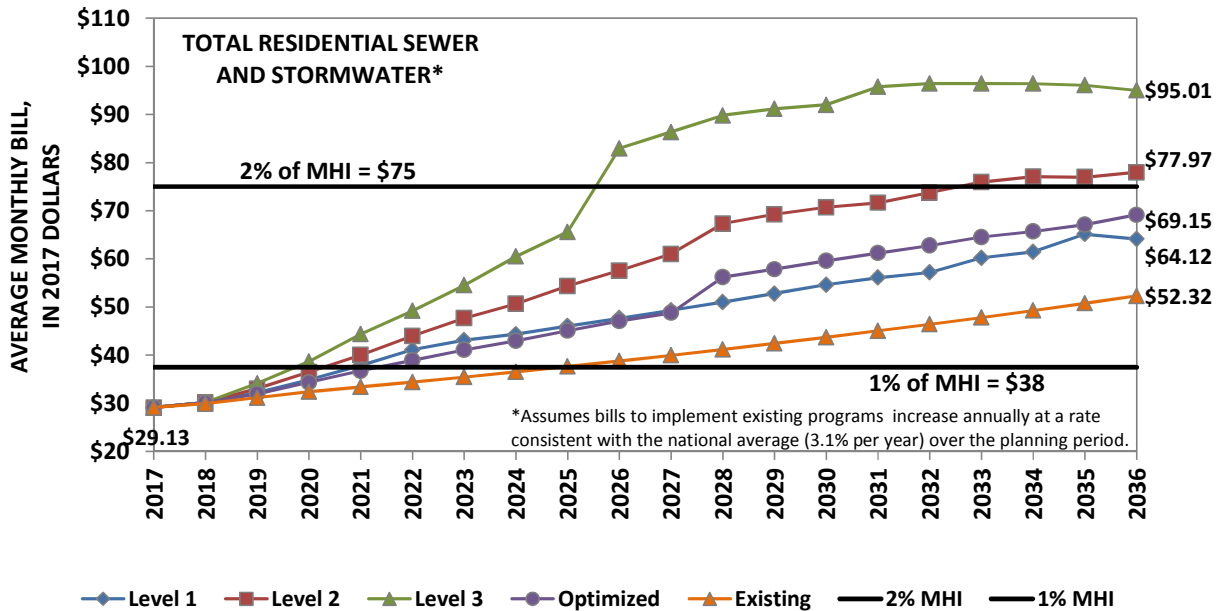
In the analysis of City-wide socioeconomic conditions, the Project Team found that resident college students influence results of important socioeconomic metrics that are traditionally used to characterize communities. For example, approximately 24% of individuals in Columbia are below the poverty level. However, that estimate is influenced by the resident college student population because traditional poverty level measures exclude individuals who live in dormitories but include students living in off-campus housing within the City limits. These students generally report low incomes and contribute to higher poverty rate estimates. After removing students from the population, the individual poverty level in Columbia falls to approximately 13%, which is comparable to levels in Missouri and the United States. In Columbia, resident students also impact estimates of population (driving it higher) and median household income (driving it lower). While the student population is an important segment of the City's customer base, evaluation of socioeconomic metrics of the City's permanent population is a key consideration for the IMP.



While Columbia's overall population indicates significant poverty, the City's permanent population is comparable to the State and National averages

When metrics are assessed for the City's permanent population, overall socioeconomic conditions in the City are generally strong. However, there are disadvantaged segments of the community which warrant additional consideration. To identify those disadvantaged areas, the Project Team evaluated economic stress indicators related to median household income (MHI), median family income (MFI), poverty rates, occupancy rates, homeowner housing costs, renter housing costs, supplemental nutrition assistance program participation rates, and health insurance coverage rates across the 25 census tracts in the City. The analysis indicated that four tracts, primarily located in central Columbia, exceeded stress thresholds for at least 80% of the metrics reviewed and exhibited a strong potential for economic stress.

The qualitative review of socioeconomic stress was coupled with a quantitative assessment of future billing impacts across census tracts to characterize potential affordability issues associated with implementing the Optimized level of funding. Future bills were calculated by the City using existing stormwater and wastewater rate models to forecast future residential user rates and bills based on projected 20-year cash flows for the IMP alternatives. Rate structures were maintained at current base and volume charge ratios for rate and bill forecasting.



The Optimized IMP funding level supports moderate bill increases and maintains community-wide affordability

Under the Optimized funding level, the average community-wide combined stormwater and sewer bill would increase from approximately \$29 dollars per month in 2017 to \$69 dollars per month in 2036 (in 2017 dollars). Although it is an imperfect indicator, EPA generally considers 1% to 2% of MHI as the limit of affordability for municipal sewer and stormwater ratepayers. Under the Optimized funding scenario, community-wide average bills remain below 2% of MHI during the 20-year planning period. Some residents in the central neighborhood of Columbia may face some affordability impacts, but average bills in that area will not approach the potentially unaffordable level of 2% MHI until 2028 (see Figure 9 of Attachment O). Therefore, the affordability and socioeconomic evaluation suggests that the Optimized funding level will be affordable over the first 10 years of IMP implementation.

The Optimized funding level is preferred because it provides the most overall value to the community, maintains community-wide monthly bills within EPA’s traditional 1-2% MHI threshold bounds for affordability, and supports moderate bill increases throughout the planning period. Because the forecasted billing impacts were based on planning level cost estimates, they will likely change as the City gathers additional information and innovates to find cost-effective solutions during IMP implementation. Additionally, changes in regulatory requirements, program needs, or socioeconomic conditions across the City may also influence future affordability projections. Therefore, the City understands that it will be important to refine projected sewer and stormwater program needs, costs, and bill impact evaluations every 5 to 10 years.

5.4 Optimized IMP Suite of Alternatives

The Optimized suite of alternatives is the preferred program portfolio for the IMP because it provides the greatest value to the community and can be implemented affordably. The Optimized portfolio includes a combination of Level 1 funding for most wastewater treatment and collection system project categories and Level 2 funding for stormwater projects. The higher level of stormwater projects is consistent with the results of the existing system performance evaluation (**Section 3**) which highlighted the significance of the City’s stormwater system needs relative to the funding currently available.

System	Wastewater Treatment						Wastewater Collection								Stormwater Management										
Project Category	Wet Weather Imp.	Expanded Nitrification	Biological Nutrient Removal	Chemical Disinfection	Constructed Wetlands Impr.	Digester Rehabilitation	Digester Capacity Imp.	Wet Weather Program	Asset Management	System Renewal	System Capacity	Building Backups	Private Common Collectors	System Expansion	Cleaning Program	Pump Station Repair	Annual Improvements	SW Planning	System Assessment	System Renewal	Flood Control	Stream Erosion	Runoff Treatment	M54 Program	
Level 1		✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓					✓		✓
Level 2	✓					✓					✓								✓	✓	✓		✓		
Level 3																									

The Optimized suite of alternatives includes the combination of Level 1 and Level 2 funding projects that provide the best value for the community and ratepayers

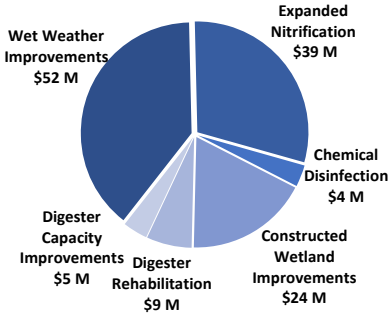
For the wastewater treatment system, the City’s largest planned capital expenditure over the 20-year IMP planning period is targeted for addressing wet weather capacity issues at the CRWWTP. Inflow and infiltration into the City’s sewer system has caused sewer backups and overflows for decades. Since 2012, significant collection system rehabilitation and I/I reduction projects have been completed and staff have implemented operational changes at the CRWWTP that have significantly reduced sewer overflows along the major trunk sewers, mostly near the treatment plant. Despite these recent improvements, the CRWWTP can further improve management of peak wet weather flows in a manner that effectively limits the number of SSOs within the collection system during very large events. Improvements identified in the Optimized suite of alternatives are intended to reduce SSOs and allow the City to effectively manage peak flows.

Although wet weather improvements are the largest wastewater treatment capital expenditure identified, these improvements will not be implemented until at least 2027 to allow the City to continue ongoing I/I reduction efforts and develop a better understanding of wet weather peak flows and volumes through flow monitoring and modeling. In the near term, necessary projects related to digester rehabilitation and constructed wetlands maintenance are anticipated.

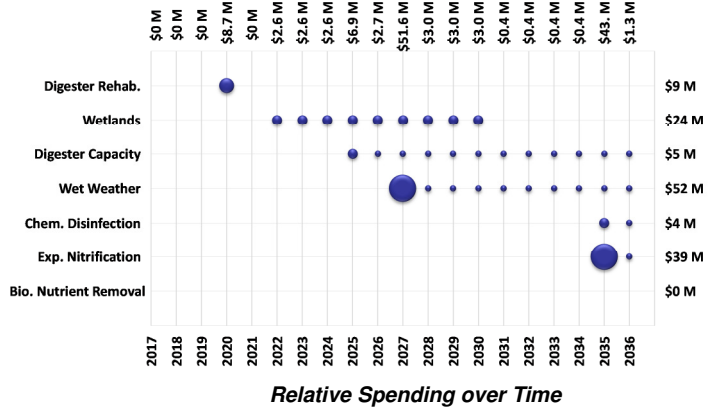
Columbia's Optimized Suite of IMP Alternatives

Refer to Attachments 5, 6, and 7 for Project Descriptions and Detailed Cost Estimates

Wastewater Treatment

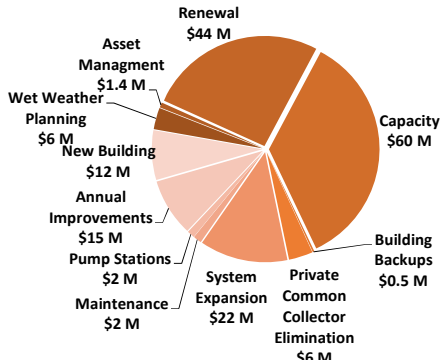


20-Year Total Cost

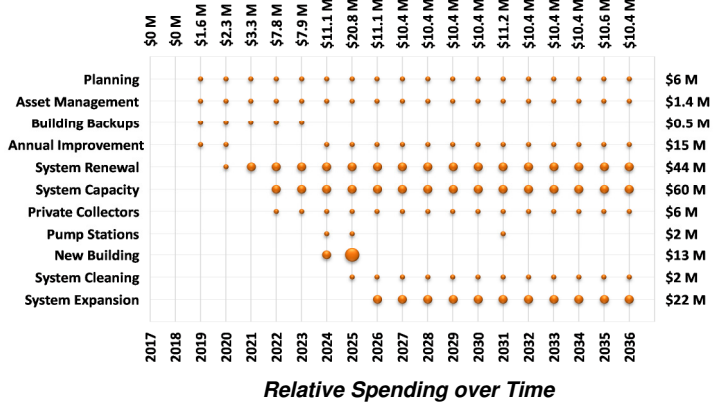


Relative Spending over Time

Wastewater Collection

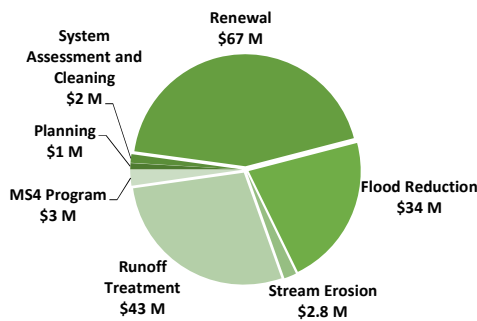


20-Year Total Cost

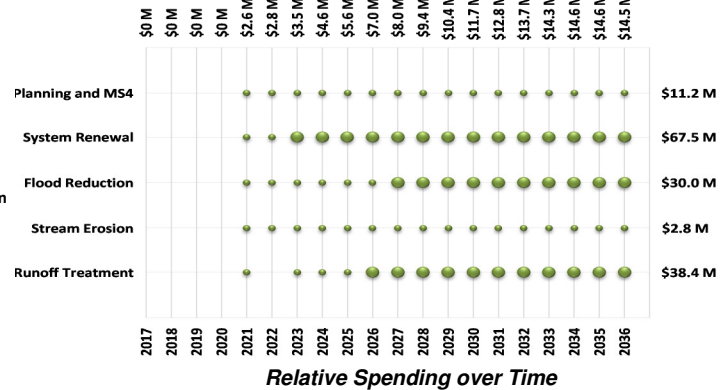


Relative Spending over Time

Stormwater Management



20-Year Total Cost

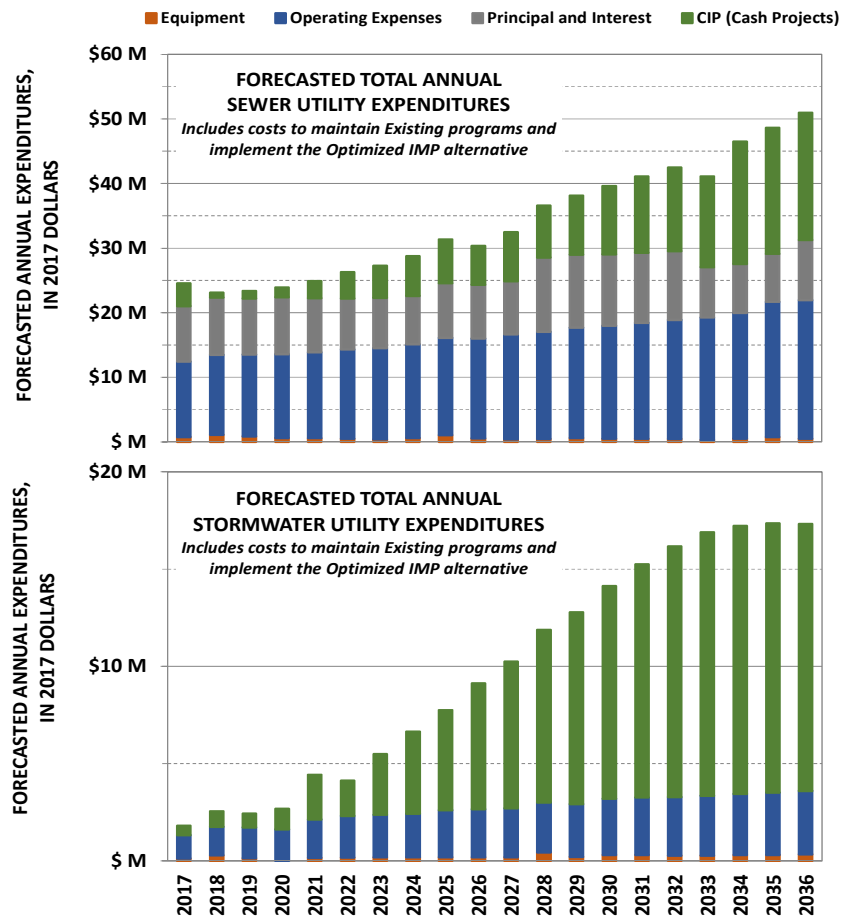


Relative Spending over Time

The optimized IMP funding level includes a suite of projects and program enhancements that balance and prioritize infrastructure needs and community expectations with Clean Water Act goals

In addition to addressing peak flow capacity issues at the CRWWTP, one of the primary goals identified during the two-day IMP visioning workshop described in **Section 2** was to reduce wet weather backups and overflows caused by capacity constraints in the collection system. During early stages of IMP implementation, the Optimized alternative includes funding to improve wet weather planning and implement a backflow prevention program to reduce building backups at individual residences and businesses. The largest anticipated collection system expenditures over the 20-year IMP implementation period are for system renewal and capacity improvements. Anticipated annual costs for these improvements are relatively consistent throughout the period and are intended to address aging infrastructure, reduce public and private I/I, and improve system capacity in critical areas. All of these planning activities, programs, and improvements will address system capacity issues and reduce building backups and SSOs over time.

For stormwater, the 2015 voter-approved rate increase is scheduled to continue through 2020. As a result, the IMP assumes that additional expenditures will not be committed until the City can address potential rate increases in 2021. After 2021, the largest planned expenditures address system renewal needs, flooding issues, and water quality improvements through runoff treatment. Raising the revenue to meet these current and future needs is contingent upon voter approval of stormwater rate increases. In the interim, the City plans to add staff that will help to enhance the stormwater management program and ultimately improve surface water quality across the City. Similar to the sewer system, additional planning resources are needed to improve the longevity and effectiveness of the stormwater system. It has been almost 20 years since comprehensive stormwater management, planning, and modeling tools have been evaluated. Over this period, Columbia has grown and the existing system has



Under the Optimized IMP alternative, forecasted annual expenditures will increase gradually over time

continued to age. Therefore, the Optimized alternative anticipates that resources will be needed during early phases of IMP implementation to conduct stormwater planning that is necessary to maintain the expected level of service.

Annual expenditures to fund the Optimized alternative depend largely on the timing of major capital projects, but must be balanced with respect to financial considerations such as maintaining sufficient debt capacity and cash reserves to ensure the City's programs are planned and administered in a financially responsible manner. Given the anticipated timing and magnitude of projects outlined in the Optimized funding level, the City determined that the annual Sewer Utility budget is projected to increase by approximately \$25 million over the 20-year IMP planning period. These projections include the costs for equipment purchases, operations, cash-funded capital projects, and principal and interest payments corresponding to existing and anticipated bond-funded capital projects. For the Storm Water Utility, the annual budget is projected to increase by approximately \$15 million over the planning period. As described previously, these Sewer and Storm Water Utility budget increases correspond to a 30% total increase in combined sewer and stormwater bills for the average user in Columbia over the 20-year period.

5.5 5-Year Action Plan to Implement the Optimized Alternative

Element 4 of EPA's Framework specifies that municipalities identify an implementation schedule for their integrated planning projects. The Optimized IMP alternative reflects the City's understanding of infrastructure and regulatory needs and priorities over the next 20-years with respect to the information currently available. As discussed in **Sections 3** and **5.1**, a number of data gaps and uncertainties exist that precluded the development or analysis of specific projects, costs, or implementation dates for many of the program elements evaluated for the IMP. In addition, judicial interpretation of the Missouri Constitution stipulates that municipal stormwater rates must be approved by a majority vote. Bond financing of wastewater capital projects must also be approved through a local election. Therefore, the forecasted timing and cost of wastewater and stormwater program improvements included in the Optimized alternative are planning level estimates that must be more accurately characterized, and in some cases affirmed, by residents before the City can commit to implementation.

To refine the estimates and implement early actions, the City will pursue a 5-Year IMP Action Plan focused on collecting critical data needed to more precisely forecast future needs while continuing to implement currently-identified Capital Improvement Program¹¹ projects and necessary operation and maintenance activities. The City will pursue these actions to the extent possible but acknowledge that weather, funding, staff availability, and other resource constraints or unanticipated needs may impede complete implementation of the plan. After five years, the City will use the new information to revise IMP projections with respect to evolving regulatory requirements, program needs, and socioeconomic conditions across the City. This implementation approach satisfies Element 6 of EPA's Framework, which requires that municipalities include a process for reevaluating projects and schedules based on changing circumstances to improve overall effectiveness of the plan.

¹¹ <https://www.como.gov/finance/wp-content/uploads/sites/21/2017/10/FY-2018-CIP.pdf>

The City's 5-Year IMP Action Plan addresses a range of wastewater and stormwater program needs that were identified during the IMP planning process. Several high priority, early actions will be implemented in the near term to directly and expeditiously reduce significant public health risks, improve water quality, or enhance customer service. These early actions include the following:

- **Wet Weather Improvements (Wastewater Treatment) and Planning (Wastewater Collection)** – As discussed in the previous section, wet weather capacity limitations at the CRWWTP and I/I issues within the collection system currently contribute to sewer backups and overflows in the City. In recent years, City staff have reduced sewer overflows along major trunk sewers through a combination of collection system rehabilitation and I/I reduction projects and operational changes at the CRWWTP. However, additional improvements are needed to more effectively manage peak wet weather flows and the City's existing hydraulic model is not sufficiently accurate to develop long-term capacity improvement alternatives with a high degree of confidence.

Over the next five years, the City will conduct flow monitoring and develop a comprehensive hydraulic model to yield a better understanding of the collection system. This model will allow the City to better evaluate the benefits and costs of necessary system improvements. In the interim, the City plans to repurpose an existing sludge storage lagoon to provide excess flow storage at the CRWWTP. When combined with the existing peak flow lagoon, this interim improvement will increase wet weather storage capacity to more than 13 million gallons.

- **Digester Rehabilitation (Wastewater Treatment)** – Digester rehabilitation must be completed during the first five years to address aging infrastructure and ensure sound operation of the existing CRWWTP. The City is targeting completion of the planned rehabilitation project by 2021.
- **System Renewal (Wastewater Collection)** – The City owns and operates over 715 miles of gravity sewer lines and forcemains. As this existing infrastructure ages and deteriorates, the probability for the occurrence and frequency of overflows and backups in the system increases. Proactive condition assessment and renewal efforts will allow the City to address aging infrastructure through cost-effective, trenchless rehabilitation techniques that minimize disruption to the public. These renewal activities also address a portion of the infiltration entering the system from public sources, which may reduce backups and SSOs. In addition, these improvements mitigate potential exfiltration from the sewer system through broken pipes that could adversely affect water quality. The City currently renews approximately 0.8% of the existing system annually. Current funding (\$2.7 million per year) for renewal work is provided through a 2013 bond issue that extends through 2019. A key area of focus in the City's 5-Year IMP Action Plan is to secure a dedicated, consistent long-term source of funding after 2019 so that the City can continue these renewal efforts uninterrupted.

- **Private Common Collector Elimination (PCCE) (Wastewater Collection)** – Private common collectors (PCC) are privately-owned collection systems that serve multiple homes or businesses. PCCs typically consist of small diameter pipes that have generally not been maintained by the property owners since installation. As these are privately owned collection systems, the City does not have access to maintain or repair these lines. These aging PCCs are prone to blockage or failure resulting in significant public health and water quality risk. Failing PCCs may cause building backups, exfiltrate sewage that exposes the public to pathogens, and exacerbate I/I issues that ultimately contribute to overflows to local water bodies. The City has been working to eliminate PCCs, but funding for these efforts is currently provided through a 2013 bond issue that extends through 2019. A key area of focus in the City’s 5-Year IMP Action Plan is to secure a dedicated, consistent long-term source of funding after 2019 so that the City can continue these PCC elimination efforts uninterrupted.
- **Building Backup Reduction (Wastewater Collection)** – Sewage backups into buildings pose significant public health risks. Backups may be due to poor plumbing practices and/or condition, building floor elevations that were constructed too low relative to the sanitary sewer elevation, inadequate capacity in the sewer system, and private I/I sources connected to the service lateral. Many building backups cannot be cost effectively addressed through capacity improvements to the public sewer system. To address this issue, the City recently approved a cost reimbursement program for the installation of low pressure sewers, installation of backflow prevention devices, or the removal of plumbing fixtures on private property (Columbia, MO – Code of Ordinances, Chapter 22, Article II, Section 22-254). Over the next five years, the City will conduct community outreach to build awareness and increase participation in this new program.
- **System Capacity Enhancements and Private I/I Reduction (Wastewater Collection)** – Ultimately, the scope of the program and level of funding needed for system capacity enhancements will be determined based on the wet weather program management and planning activities discussed above. However, capital improvements needed to meet the City’s desired level of wet weather service will likely include a combination of capacity improvement projects and I/I reduction efforts. Public I/I reduction is primarily addressed through system renewal efforts. The cost-effectiveness of private I/I control is highly dependent on the source and location. Once the system hydraulic model is developed, the City will evaluate private I/I costs compared to system capacity improvements to determine the most cost-effective strategy to address wet weather challenges.

Until that time, the City will focus on conducting community outreach to build awareness and increase participation for its recently revised I/I reduction cost reimbursement program. This program reimburses property owners for activities that reduce the input of groundwater, stormwater, or other unpolluted water into the sanitary sewer system. The program was recently updated to more closely align with the building backup cost reimbursement program. The City expects that these revisions will increase I/I reduction

efforts by allowing for simpler navigation of the existing program and additional participation by property owners.

- **Municipal Separate Storm Sewer System Program Enhancements (Stormwater Management)** – The City, County, and University of Missouri are co-permittees under a Phase II municipal separate storm sewer system (MS4) permit issued by MDNR. The three entities are collectively responsible for compliance with their MS4 permit, which includes provisions for developing and implementing a stormwater management program to reduce pollutant discharges to the maximum extent practicable. The MS4 programs implement six minimum control measures (MCM): 1) Public Education and Outreach, 2) Public Involvement and Participation, 3) Illicit Discharge Detection and Elimination, 4) Construction Site Stormwater Runoff Control, 5) Post-Construction Stormwater Management, and 6) Pollution Prevention and Good Housekeeping for Municipal Operations. The City's ability to fulfill its commitments to the other co-permittees and maintain compliance with the requirements of the MS4 permit is an important consideration for the IMP.

Over the next five years, the City plans to increase stormwater management program activities under MCMs 1, 3, and 4 to enhance water quality protections. Specifically, the City will increase education and outreach activities to build public awareness for the stormwater program and positively influence individual behaviors (MCM 1); improve illicit discharge detection and elimination activities to reduce the direct contribution of bacteria, nutrients, and other pollutants to City streams (MCM 3); and update erosion and sediment control guidelines to reduce sediment runoff from urban areas and construction sites (MCM 4).

The City will also continue participation in the Hinkson Creek CAM process. As mentioned previously, the CAM process and underlying agreement was developed in response to the USEPA TMDL developed for Hinkson Creek in 2011. Under the agreement, the MS4 partners agreed to work collaboratively to improve water quality in Hinkson Creek using a science-based approach. The CAM process is guided by three stakeholder groups that identify scientific needs, implement management actions, and measure progress towards attaining water quality goals. The City has been actively involved in these stakeholder groups since April 2012, and will continue to work with the MS4 partners to further CAM goals.

Columbia 5-Year IMP Action Plan ¹			
Program or Project ²	Goal	Anticipated Actions	Targeted Community Benefits ³
Wastewater Treatment			
Wet Weather Improvements*	Implement early measures to enhance peak flow capacity at CRWWTP.	<ul style="list-style-type: none"> Modify existing CRWWTP structures to provide additional wet weather flow storage. 	<ul style="list-style-type: none"> Protect public health and safety. Improve quality of life. Provide sustainable services for the future. Improve water quality. Regulatory compliance.
Digester Rehabilitation*	Rehabilitate aging biosolids digestion facilities.	<ul style="list-style-type: none"> Target design completion by 2019. Target construction completion by 2021. 	<ul style="list-style-type: none"> Provide sustainable services for the future.
Constructed Wetlands Maintenance	Initiate constructed wetlands maintenance efforts to improve treatment efficiency.	<ul style="list-style-type: none"> Develop plan and detailed cost estimates for implementing improvement actions. 	<ul style="list-style-type: none"> Provide sustainable services for the future.
Wastewater Collection			
System Renewal*	Continue system renewal at current rates with appropriation of dedicated funding to provide effective wastewater collection.	<ul style="list-style-type: none"> Rehabilitate up to 1% of collection system structures per year, depending upon contractor availability and pricing. Secure dedicated annual funding for continued renewal. Current bond funding runs out in 2019. 	<ul style="list-style-type: none"> Protect public health and safety. Improve quality of life. Provide sustainable services for the future. Improve water quality.
Private Common Collector Elimination (PCCE)*	Implement identified PCCE projects in the CIP with appropriation of dedicated funding to reduce illicit sewage discharges.	<ul style="list-style-type: none"> Continue Private Common Collector elimination, depending on ability to gain easements, as well as contractor availability and pricing. Secure dedicated funding. Current bond funding runs out in 2019. 	<ul style="list-style-type: none"> Protect public health and safety. Improve quality of life. Provide sustainable services for the future. Improve water quality.
Reduce Building Backups*	Implement backflow prevention program to reduce building backups.	<ul style="list-style-type: none"> Obtain Council approval for backflow prevention program with allocation of \$100,000 per year for 5 years. Implement community outreach to build awareness of backflow prevention program. 	<ul style="list-style-type: none"> Protect public health and safety. Improve quality of life. Provide sustainable services for the future. Improve water quality.
System Capacity Enhancements and Private I/I Reduction*	Reevaluate private I/I program to reduce peak wet weather flows.	<ul style="list-style-type: none"> Assess benefits and cost-effectiveness of previous and modified private I/I program. Implement community outreach to build awareness of modified program. 	<ul style="list-style-type: none"> Protect public health and safety. Improve quality of life. Provide sustainable services for the future. Improve water quality. Regulatory compliance.
System Expansion	Provide adequate and cost-effective wastewater services to developing areas for watershed protection.	<ul style="list-style-type: none"> Fund expansion projects currently identified in the CIP, as needed. Develop systematic approach for evaluating sewer extensions to better identify sewer mains that should be upsized to convey future capacity. 	<ul style="list-style-type: none"> Protect quality of life. Provide sustainable services for the future. Improve water quality.
Wet Weather Planning*	Develop collection system model and evaluate future system capacity enhancement strategies.	<ul style="list-style-type: none"> Conduct comprehensive flow monitoring through 2020 to calibrate collection system model. Develop model by 2021. Evaluate system capacity enhancement strategies through 2022. 	<ul style="list-style-type: none"> Protect public health and safety. Improve quality of life. Provide sustainable services for the future. Improve water quality. Regulatory compliance.

Columbia 5-Year IMP Action Plan ¹			
Program or Project ²	Goal	Anticipated Actions	Targeted Community Benefits ³
System Cleaning	Enhance sewer cleaning program to practicably mitigate overflows and backups due to blockages.	<ul style="list-style-type: none"> • Develop prioritized cleaning program. • Purchase new jet truck. • Plan for new building for field operations and collections personnel. 	<ul style="list-style-type: none"> • Protect public health and safety. • Improve quality of life. • Provide sustainable services for the future. • Improve water quality.
Stormwater Management			
MS4 Program Enhancements*	Enhance Public Education and Outreach, Illicit Discharge Detection and Elimination, and Construction Site Stormwater Runoff Control to reduce bacteria, sediment, and trash discharges.	<ul style="list-style-type: none"> • Continue to develop and distribute public education messages as outlined in the Stormwater Management Plan. • Hire technician to support MS4 program with focus on IDDE. • Conduct streamwalks and outfall inspections in all City streams within 5-year action plan period. • Develop map of stormwater outfalls. • Update Erosion and Sediment Control Manual and policies and procedures. • Continue to work with MS4 partners to effectively implement stormwater management program, particularly Minimum Control Measure #4. • Continue to work with MS4 partners to implement CAM program to improve Hinkson Creek water quality. 	<ul style="list-style-type: none"> • Protect public health and safety. • Improve quality of life. • Provide sustainable services for the future. • Improve water quality. • Regulatory compliance.
System Renewal	Implement renewal program to address failing corrugated metal pipe (CMP) and structures beyond physical effective life.	<ul style="list-style-type: none"> • Initiate renewal activities as resources and funding allow. • Secure additional funding to implement these actions. 	<ul style="list-style-type: none"> • Protect public health and safety. • Improve quality of life. • Provide sustainable services for the future. • Improve water quality.
Condition Assessment	Establish and begin implementing a condition assessment program.	<ul style="list-style-type: none"> • Begin assessing CMP throughout the City. • Secure additional funding to implement these actions. 	<ul style="list-style-type: none"> • Protect public health and safety. • Provide sustainable services for the future. • Improve water quality.
Flood Reduction	Address known areas of flooding to reduce public health and safety concerns.	<ul style="list-style-type: none"> • Implement opportunistic flood reduction projects, depending on available funding after emergency and critical system repairs. • Develop stormwater project ranking system. 	<ul style="list-style-type: none"> • Protect public health and safety. • Provide sustainable services for the future. • Improve water quality.
Runoff Treatment	Reduce pollutant runoff in Hinkson Creek tributary watersheds to improve water quality.	<ul style="list-style-type: none"> • Implement opportunistic runoff treatment projects, depending on available funding. • Develop stormwater project ranking system. • Continue to implement CAM process. 	<ul style="list-style-type: none"> • Protect public health and safety. • Provide sustainable services for the future. • Improve water quality.

Columbia 5-Year IMP Action Plan ¹			
Program or Project ²	Goal	Anticipated Actions	Targeted Community Benefits ³
Stream Erosion Control	Stabilize stream channels with excessive channel erosion to reduce sediment discharges.	<ul style="list-style-type: none"> Identify and implement opportunistic stream erosion control projects, depending on available funding after emergency and critical system repairs. Develop stormwater project ranking system. Continue to implement CAM process. 	<ul style="list-style-type: none"> Protect public health and safety. Provide sustainable services for the future. Improve water quality.
Planning and Program Support	Develop stormwater master plan and enhance data management processes.	<ul style="list-style-type: none"> Initiate master planning and data management efforts. Secure additional funding to implement these actions. 	<ul style="list-style-type: none"> Protect public health and safety. Provide sustainable services for the future. Improve water quality.
Activities to Measure Water Quality Improvements ⁴			
Water Quality Monitoring	Implement water quality monitoring program to help define baseline conditions and track future improvements.	<ul style="list-style-type: none"> Develop water quality monitoring plan within first 5 years and implement when additional funding is secured. 	<ul style="list-style-type: none"> Evaluate IMP effectiveness. Provide technical basis for future IMP modifications.
Hinkson Creek Flow Gage	Collect continuous Hinkson Creek stream flow data.	<ul style="list-style-type: none"> Continue annual funding for USGS flow gage operation. 	<ul style="list-style-type: none"> Evaluate IMP effectiveness. Provide technical basis for future IMP modifications.
<p>Note 1 - Goals and actions identified in this 5-Year IMP Action Plan reflect the City's understanding of infrastructure and regulatory needs and priorities with respect to the information currently available. The City will implement these actions to the extent possible but acknowledge that weather, staff availability, Council approval and other resource constraints or unanticipated needs may impede complete implementation of the Action Plan or require that it be modified. Further, the City notes that many of the activities outlined in this Action Plan assume that sufficient additional funding will be made available through sewer rate increases, bond financing that must be approved through a local election, and stormwater rate increases that must be approved by a majority vote. If sufficient additional funding does not become available, the 5-Year IMP Action Plan will be modified to reflect available funding and resources.</p> <p>Note 2 - High priority program and project needs were identified by City staff and are denoted with an asterisk (*). These represent projects that are intended to directly and expeditiously reduce significant public health risks, improve water quality, or enhance customer service.</p> <p>Note 3 - Targeted community benefits are presented in Section 4.3 and explained in greater detail in Attachments J and N.</p> <p>Note 4 - Element 5 of EPA's Framework requires that municipalities outline activities that will be used to measure IMP effectiveness. Activities listed here will be used to measure water quality improvements that occur over time. Additional program management and Utility service performance measures are discussed in Section 6.</p>			

Section 6. Measuring IMP Success

Element 5 of EPA's Framework calls for municipalities to outline the performance measures, monitoring data, or milestones that will be used to measure progress as integrated plans are implemented. The City intends to measure both the environmental and programmatic improvements that result from implementing the IMP. These are discussed below.

Measuring Water Quality Improvements

The ultimate goal of EPA's integrated planning process is to provide municipalities with a framework that can be used to affordably meet human health and water quality protections required by the CWA. As presented in the 5-Year Action Plan, the City will measure progress towards meeting these regulatory requirements by developing a water quality monitoring program for City streams and continuing to fund the existing Hinkson Creek flow gage. These efforts will allow the City to track water quality improvements over time and adjust future IMP activities, if necessary.

Measuring Program Efficacy and Service Performance

Program efficacy is generally measured through an evaluation of level of service (LOS) goals. LOS goals are typically qualitative goals used by utilities to guide sewer and stormwater operations. Progress towards meeting LOS goals are generally tracked through a series of quantitative key performance indicators (KPI) that are used to evaluate a utility's success in meeting strategic goals, quantify the benefits of continuous improvement initiatives, and to measure performance in managing infrastructure.

Through IMP development, the City and Project Team reviewed existing LOS goals and KPIs for the Sewer (**Attachment K**) and Storm Water (**Attachment M**) Utilities to identify performance measures that could be used to measure success of the IMP over time. For the Sewer Utility, the City has focused on taking actions to address dry weather operations, wet weather operations, and system renewal. For the Storm Water Utility, the City is interested in providing public safety, improving environmental integrity, renewing and maintaining the conveyance system, and adequately funding and staffing the Utility.

Although the City has goals for each Utility, IMP planning efforts highlighted the fact that the City has numerous information gaps that must be filled in order to develop a more complete understanding of the systems, create formal goals, and reliably track KPIs. For example, the City needs to develop an accurate hydraulic model to understand the costs and benefits of establishing a specific wastewater collection system design storm prior to defining the City's LOS goal for wet weather conveyance. With respect to the Storm Water Utility, improved management of the existing data collection, tracking, and maintenance procedures will improve future stormwater system planning, maintenance, and performance.

The City will refine LOS goals and KPIs over time as the IMP is implemented. In the interim, IMP success will be measured using milestones and actions outlined in the 5-year IMP Action Plan. At the end of the first five year period, the City will evaluate progress to determine if goals were achieved and make necessary changes and adjustments during future phases to ensure continuing progress towards satisfying infrastructure demands and meeting CWA obligations.

Section 7. Alignment with Mayor's Task Force on Infrastructure

As discussed in **Section 1**, the City has proactively been working to identify and prioritize the City's infrastructure needs. In August 2015, the City formed the Mayor's Task Force on Infrastructure (MTFI) to review the City's infrastructure needs, including those in the sewer and stormwater systems. To maintain consistency between infrastructure planning activities being conducted in the City, the Project Team reviewed the functional stormwater and sewer recommendations outlined by the MTFI in their 2016 Final Report to evaluate alignment with recommendations developed independently from the IMP process. Financial and policy recommendations developed by the MTFI were not reviewed as these items are outside the scope of the IMP.

MTFI Functional Storm Water Utility Recommendations

The MTFI Final Report included the following four functional recommendations for the stormwater system:

1. The City should expand its internal and cooperative mapping capacity with MU and Boone County, cataloguing equipment information, engaging water runoff tools, and continued use of Light Detection and Ranging (LIDAR).

Currently, scheduled data exchanges occur on a regular basis with the members of the GIS consortium. This recommendation aligns with IMP recommendations to increase funding for program support, which would include enhancing data management and geographical information system (GIS) mapping processes. The Optimized alternative assumes approximately \$1 million in funding for this program element over the 20-year planning period. Additional discussion of this recommendation is included in **Section 3.1** of **Attachment M**.

2. The City should coordinate with MU and Boone County to install an automated rain gauge system to better track precipitation within the MS4 permit area.

An automated rain gauge system would be useful for characterizing rainfall patterns and runoff in the service area. However, it would take many years of data for any improvements in design criteria to be realized and would provide limited immediate operational improvements. Given the magnitude of funding allocated to the address immediate stormwater system needs in the Optimized alternative (\$224 million), installing and maintaining a rain gauge system is considered a low priority due to fiscal constraints. Therefore, this system is not included within the IMP recommendations. As the City implements the IMP over time, the addition of a rain gauge system should be reevaluated. The City should also investigate the utility of alternative methods, such as gauge adjusted radar, which may provide a more efficient tool for characterizing rainfall across the City.

The IMP does recommend that the City reevaluate key stormwater design standards, such as the assumed temporal storm distributions (See **Section 3.2 of Attachment H**), to help address runoff control and stream channel stability.

3. The City should model the public stormwater system hydraulics to identify system deficiencies to assess future impacts of development and troubleshoot existing capacity.

This MTFI recommendation aligns with IMP recommendations to increase funding for master planning and conveyance system modeling support. The Optimized alternative assumes approximately \$1 million in funding for this program element over the 20-year planning period. Additional discussion of this recommendation is included in **Section 3.1 of Attachment M**.

4. The City should adopt an objective grading system to prioritize stormwater capital improvement projects ensure a consistent and objective evaluation process for selecting projects.

This MTFI recommendation aligns with IMP recommendations to increase funding for master planning, modeling, and program support. These efforts will enhance project planning, prioritization, and identification of improvement locations to more fully meet conveyance system assessment goals. They will also help to refine future funding needs and identify a long term improvement plan to address the conveyance issues present within the system. The City has already started developing a weighted scoring system to prioritize potential projects. The Optimized alternative assumes approximately \$1 million in funding for continued development of a stormwater master plan. Additional discussion of this recommendation is included in **Section 3.1 of Attachment M**.

MTFI Functional Sewer Utility Recommendations

The MTFI final report included seven functional recommendations for the sewer system:

1. The City should create a comprehensive wastewater collection system model, including physical and hydraulic attributes to better analyze changes to the system.

This MTFI recommendation aligns with IMP recommendations to increase funding for wet weather program planning and asset management support. This will be one of the first objectives to be implemented. The Optimized alternative assumes \$6 million in funding for this program element, which is included within the 5-Year IMP Action Plan. Additional discussion of this recommendation is included in **Section 3.1 and 3.2 of Attachment K**.

2. The City should define a residential sewer user as “the owner or occupant of a dwelling unit that is connected directly or indirectly to the city’s sanitary sewer system”.

This MTFI recommendation is a policy decision that falls outside the scope of the IMP.

3. The City should rehabilitate or replace a minimum of one percent of the sewer collection system annually.

This MTFI recommendation generally aligns with IMP recommendations for system renewal. The Optimized alternative assumes \$44 million in funding for this program element. Additional discussion of this recommendation is included in **Section 3.3 of Attachment K**. Note that the exact percentage of the system renewed each year is anticipated to vary based on the size of the infrastructure being addressed and the corresponding types of renewal work required. On average, between 0.8% and 1% of the system will likely be renewed on an annual basis.

4. The City should pursue programs that place greater responsibility on property owners to identify and eliminate private sources of inflow and infiltration.

The IMP Project Team agrees with this MTFI recommendation. However, the recommendation contradicts the MTFI recommendation that the City should assume greater responsibility for the condition of private service lateral infrastructure (addressed in item 5, below). The IMP project team recommends that the City further evaluate cost-effective means of reducing private I/I during wet weather program development. The City recently revised Section 22-217.3 of the City code to update I/I reduction program requirements to more closely align with the cost reimbursement program for the installation of low pressure sewers, backflow prevention devices, or removal of plumbing fixtures. The City expects that these revisions will increase I/I reduction efforts by allowing for simpler navigation of the existing program and additional participation by property owners. The City will implement outreach to build awareness of the programs.

5. The City should assume responsibility for all connection points within the public sewer as well as responsibility for any portion of a private sewer service lateral located within a public right-of-way or within a dedicated sewer easement.

The IMP does not include this recommendation. There are approximately 50,000 private service lateral connections to the City's collection system. Assuming responsibility for all service lateral connection points and the portion of all private service laterals located within a public right-of-way or sewer easement would substantially increase the amount of sewer infrastructure managed by the City. A preliminary analysis based on typical right-of-way and easement widths estimated that this would add over 200 miles of sanitary sewer that would be managed by the City (note that mapping of the locations of these private service laterals is not available and this mileage could be greater than estimated).

Unlike the City's public sewers, most private service laterals have not been regularly cleaned, inspected, or repaired. If the City were to assume responsibility for this privately owned infrastructure, the City would need to regularly maintain, inspect, and rehabilitate these service laterals. Service laterals are typically small diameter pipes that often include many horizontal and vertical bends; this necessitates the use of special equipment to maintain and inspect these pipes. Additionally, many laterals have limited

accessibility and in their existing state would not be accessible except through interior building plumbing (as opposed to public sewers which are accessed through manholes for typical maintenance and inspection activities). Installation of cleanouts is anticipated to be required on the majority of lines in order to enable the City to access them. Cleanout installation alone for 50,000 service laterals would take more than 40 years based on completing five installations per day.

The inspection, maintenance, and rehabilitation of these private service laterals would represent a major ongoing expense for the City. A preliminary estimate of the 20-year cost of ownership to the City for this privately owned infrastructure is approximately \$237 million.

In addition to the economic cost of ownership, there are several other challenges involved with assuming ownership of this infrastructure that are not readily quantifiable. Other identified considerations involved with assuming ownership of sewer laterals are listed below:

- The full regulatory impacts of assuming ownership of the private service laterals is unclear, but it would likely increase the City's risk in this area. It is anticipated this would significantly increase the number of backups the City is considered responsible for by regulatory entities and could potentially increase the risk of regulatory enforcement.
- Whenever a building backup occurs due to a blockage in a private service lateral, an investigation would need to be completed in order to determine if it was caused by a blockage in the city-owned portion of the lateral, or in the privately owned portion (outside the public right-of-way or easement).
- The City would be responsible for providing location information for these service laterals whenever utility locates are called in prior to digging. The City would need to develop detailed mapping of the location of these laterals to facilitate locates. The City would also need to expend additional resources (either additional staff or increased contract costs) on an ongoing basis to administer the location of these service laterals. Note that service laterals are typically shallower than the public sewer and are more susceptible to being damaged during construction and utility installation efforts.
- Service lateral rehabilitation costs presented in the table at the end of this section are based on estimated contracted renewal costs. Assuming ownership of this infrastructure may also necessitate the City adding additional repair crews and equipment to execute emergency repairs of structurally failed service laterals.

Because the City is focused on securing long-term funding for maintenance and replacement/renewal of the existing public sewer system, the high financial cost to the City to take over ownership of these private systems and other challenges associated with assuming ownership of these private systems the Project Team suggests that the City not adopt this MTFI recommendation.

6. The City should continue investigating and rehabilitating the sewers in the “I&I Pilot Study Area”.

The I&I Pilot Study Area was an area identified for a pilot study in 2008¹². This area was expanded to become Flat Branch Basin D. Post flow monitoring of this area was conducted and a report was provided to Council in September 2014 that demonstrated a 19% reduction in peak flow and a 48% reduction in total volume. Since that time, more of the system in the area has been rehabilitated. At this time, additional funding for this area should be limited to providing assistance for backflow prevention and private I/I reduction. A very large amount of funding could be spent in this area with no further significant reduction in the amount of I/I entering the City's system. The financial resources should more appropriately be spent following the IMP recommendations for system renewal and public I/I (see **Section 3.3 of Attachment K**) and the system capacity enhancement and private I/I (see **Section 3.4 of Attachment K**). The Optimized alternative assumes approximately \$44 million and \$60 million in funding for these program elements over the 20-year planning period, respectively.

7. The City should implement a sanitary sewer backflow prevention program that would provide financial assistance to qualifying property owners.

This MTFI recommendation aligns with IMP recommendations for building backup alleviation. The Optimized alternative assumes \$500,000 funding for this program element. This program was approved by Council in 2017. Additional discussion of this recommendation is included in **Section 3.5 of Attachment K**.

¹² <https://www.como.gov/utilities/sewer/i-and-i/>

Preliminary Estimate of 20-Year Cost of Ownership for all Service Lateral Connection Points and the Portion of Service Laterals Located in the Public Right-of-Way and Easements		
Description	Unit	Value
Assumptions on Lateral Assets in Right-of-Way		
Total Service Laterals Managed by City	#	50,000
Total Estimated Length of Portion of Laterals Managed by City	LF	1,750,000
	MI	236.7
Service Lateral Maintenance Program (Cleaning)		
Lateral Cleaning Frequency	YR	5
Cleaning Unit Cost	\$/LF	1
Cleaning Truck w/ Specialized Equipment	\$/EA	250,000
Cleaning Truck Replacement Schedule	YR	10
Install Cleanouts to Access Lateral (Assume 75%)	EA	\$1,800
Cleaning Crew – Operator FTE	\$/YR	44,000
Cleaning Crew – Lead Jet Operator	\$/YR	52,000
Subtotal – 20-YR Cleaning Cost	\$	76,920,000
Service Lateral Inspection Program (CCTV)		
CCTV Unit Cost	\$/LF	1.25
Two CCTV Trucks With Special Equipment to Televisе Laterals	\$	500,000
CCTV Truck Replacement Schedule	YR	10
Lateral CCTV Frequency	YR	10
CCTV Crew – Operator FTE (2 Operators)	\$/YR	88,000
CCTV Crew – CCTV Tech (2 Techs)	\$/YR	124,000
Subtotal – 20-YR CCTV Cost	\$	9,615,000
Service Lateral Rehabilitation Program (CCTV)		
Assumed Rehabilitation Percentage	%	50
Rehabilitation Unit Cost (Lateral and Connection)	\$/EA	6,000
Subtotal – 20-YR Rehabilitation Cost	\$	150,000,000
Preliminary Estimate - Total 20-YR Cost of Ownership		\$237,000,000

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