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2020 Engineer's Report for Sewer and Drainage System

Louisville and Jefferson County Metropolitan Sewer District
Sewer and Drainage System Revenue Bonds, Series 2020A

June 2020

In preparing this report, Jacobs has relied upon certain historical and projected performance data provided by the Louisville and Jefferson County Metropolitan Sewer District (MSD). Jacobs has not independently verified the detailed accuracy of such data. Additionally, the cost estimates presented for the FY 2021 CIP projects appear to be reasonable for the work to be performed. The proposed FY 2021 CIP and the 5-Year CIP are technically sound and are in accordance with generally accepted engineering practice.

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Acronyms & Abbreviations

AADF	Annual Average Daily Flow
ADF	Average Daily Flow
BG	Billions of Gallons
BMP	Best Management Practices
CAP	Corrective Action Plan
cBOD	Chemical Biochemical Oxygen Demand
CIP	Capital Improvement Plan
CMOM	Capacity, Management, Operation & Maintenance
CRRP	Critical Repair and Reinvestment Plan
CPE-CCP	Comprehensive Performance Evaluation – Composite Correction Plan
CRS	Community Rating System
CSO	Combined Sewer Overflow
DOJ	U.S Department of Justice
DRI	Drainage Response Initiative
ESU	Equivalent Service Unit
FEMA	Federal Emergency Management Agency
FM	Force Main
FOG	Fats, Oils and Grease
FPS	Flood Pump Station
FY	Fiscal Year
GI	Green Infrastructure
GIS	Geographical Information System
ILA	Interlocal Agreement
IOAP	Integrated Overflow Abatement Plan
IT	Information Technology
KDEP	Kentucky Department of Environmental Protection
LOJIC	Louisville Jefferson County Information Consortium
KPDES	Kentucky Pollution Discharge Elimination System
KRS	Kentucky Revised Statutes
lb/d	Pounds per Day
LF	Linear Feet
LTCP	Long Term Control Plan
mg/l	Milligram per Liter
MG	Millions of Gallons
MGD	Millions of Gallons per Day
mL	Milliliters
MS4	Municipal Separate Storm Sewer System
MSD	Louisville & Jefferson County Metropolitan Sewer District
NMC	Nine Minimum Controls
NPDES	National Pollution Discharge Elimination System

ORFPS	Ohio River Flood Protection System
ORSANCO	Ohio River Valley Water Sanitation Commission
RTC	Real Time Control
SCADA	Supervisory Control and Data Acquisition
SCAP	Sewer Capacity Assurance Plan
SORP	Sewer Overflow Response Plan
SSDP	Sanitary Sewer Discharge Plan
SSO	Sanitary Sewer Overflow
THP	Thermal Hydrolysis Process
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	Ultraviolet Disinfection
WIFIA	Water Infrastructure Finance and Investment Act
WQTC	Water Quality Treatment Center
WWTF	Wet Weather Treatment Facility
WWTP	Wastewater Treatment Plant

1. Introduction

This report was prepared in connection with the issuance by the Louisville and Jefferson County Metropolitan Sewer District (the "District" or "MSD") of its Sewer and Drainage Revenue Bonds, Series 2020A (the "2020A Bonds") being issued in the estimated principal amount of approximately $247,500,000 for the purpose of paying at maturity, redeeming, and refunding MSD's Program Notes issued and outstanding as Senior Subordinated Debt under MSD's General Bond Resolution and under MSD's Program Note Resolution.

MSD utilizes a sewer and drainage system ("System"), which includes the collection, transmission, treatment and effluent disposal of wastewater; processing, management, and disposal of biosolids; the collection, transmission of stormwater within the City and adjacent areas; and operations and maintenance of the Ohio River flood protection system infrastructure. Also included in the sewer and drainage system are the existing properties and assets, real and personal, tangible and intangible, owned or operated by MSD that are used or useful for the aforementioned purposes and all properties and assets constructed or acquired as additions, improvements and betterments to the sewer and drainage system and extensions thereof.

Portions of MSD's sewer and drainage system have been in service since the late 1800's and have/are reaching the end of their useful life. MSD is implementing an industry-standard asset management program to coordinate repair and replacement of existing assets in a timely and cost-effective manner. Current work activities related to MSD's asset management program includes upgrading tools, training staff, determining asset condition, calculating remaining useful life, and developing protocols for prioritizing capital needs. In addition to improving existing assets, MSD is investing in new infrastructure in accordance with a federally mandated Consent Decree to address sewer overflows and unauthorized discharges.

This report (i) provides an overview of MSD's infrastructure, (ii) describes the sewer and drainage system improvements made since the District's last public bond issuance in 2017, and (iii) provides an overview of MSD's 5-year Capital Improvement Plan (CIP).

1.1 History of MSD

Beginning at or around 1850, the first sewers were constructed in Louisville and the first combined storm and sanitary sewers were constructed in 1860. MSD was formed in 1946 as a public body corporate and subdivision of the Commonwealth of Kentucky. MSD was created to 1) operate and maintain the existing City of Louisville sewer and drainage system and 2) to expand the system throughout Jefferson County.

In 1986, an Interlocal Agreement (ILA) was executed between MSD, the City of Louisville, and Jefferson County[1] to improve and enhance flood control and stormwater drainage services. The ILA transferred all drainage and flood control facilities and property to the custodianship of MSD and mandated MSD be the responsible agency for providing flood and stormwater drainage services. The communities of Anchorage,

[1] The City of Louisville and Jefferson County subsequently merged to form Louisville Metro.

Jeffersontown, Shively, and St. Matthews own and operate the drainage systems serving their communities. However, MSD continues to provide flood protection services that benefit these communities through the Ohio River flood protection system floodwalls, levees, and flood pump stations. These communities are co-permittees under the stormwater management program that MSD administers.

1.2 Background of Capital Priorities

MSD is responsible for the operation of the sewer and drainage system serving most of Louisville Metro, which encompasses the City of Louisville and all of Jefferson County. MSD is authorized by Chapter 76 of the Kentucky Revised Statues (KRS) to construct additions, betterments, and extensions within its service area and to recover the cost of its services in accordance with rate schedules adopted by the MSD Board. Like many utilities throughout the country, MSD is faced with maintaining its existing utility assets in a fit-for-purpose condition while balancing changing environmental conditions that have started to impact its infrastructure.

1.2.1 2005 Consent Decree & 2009 Amended Consent Decree

On August 12, 2005, MSD entered into a Consent Decree with the Kentucky Energy and Environment Cabinet, Division of Water of the Kentucky Department of Environmental Protection (KDEP), U.S. Environmental Protection Agency (USEPA), and the U.S. Department of Justice (DOJ) (collectively referred to as "the Regulators"). The Consent Decree was in response to an enforcement action taken by USEPA and KDEP alleging violations of the Clean Water Act, primarily related to sewer overflows and unauthorized discharges. The enforcement actions initiated by the USEPA are not unique in the wastewater treatment industry. The Consent Decree created the framework for a long-term capital program to manage and mitigate combined sewer overflows (CSOs) and eliminate sanitary sewer overflows (SSOs) up to a certain storm event.

The Consent Decree called for MSD to submit a final Long-Term Control Plan (LTCP) that included schedules, deadlines, and timetables for projects to be completed by December 31, 2020. In addition, a Sanitary Sewer Discharge Plan (SSDP) was required that included schedules and deadlines for capital projects to be completed by the end of 2024. Both plans (LTCP and SSDP) were subsequently consolidated into the Integrated Overflow Abatement Plan (IOAP). The IOAP is expected to improve water quality in Beargrass Creek and the Ohio River.

On April 10, 2009, the Consent Decree was amended to address recordkeeping and Water Quality Treatment Center (WQTC) bypasses and treatment performance. The amendment called for MSD to implement projects to upgrade the separate sewer system, combined sewer system, and the WQTCs to adequately address SSOs and CSOs from locations identified in the Morris Forman WQTC Kentucky Pollution Discharge Elimination System (KPDES) permit. The first submittal of the IOAP was approved with the Amended Consent Decree.

1.2.2 2012 IOAP Modification

MSD's Wet Weather Team, which includes a broad range of community stakeholders, MSD staff, and consultants identified the need for modifications to the IOAP to incorporate through an adaptive management process additional information developed from continued flow monitoring, enhanced hydraulic modeling, and a detailed review of the project types, size, location and schedule. Modifications represented a revision to 28 separate projects set forth in the original IOAP, dated September 30, 2009. The IOAP Modifications were approved on June 19, 2014; and superseded and replaced the 2009 IOAP.

The following highlights the projects incorporated into the IOAP Modification to control CSOs:

- 3 sewer separation projects
- 14 storage basin projects including in-line storage/real-time control and off-line storage (250 MG)
- 1 project to replace and expand the Nightingale Sanitary Pump Station
- 2 conveyance expansion projects
- 1 additional green infrastructure project
- 1 high rate wet weather treatment facility (WWTF)

The following highlights the projects incorporated into the IOAP Modification to control SSOs:

- 19 conveyance capacity upgrades and interceptor relief projects
- 9 storage projects (in-line and off-line)
- 13 pump station upgrades or replacements
- 12 pump station eliminations
- 7 small WQTC eliminations

Over the past 10 years, MSD's CIP has been focused on implementing the projects required to comply with a federally mandated Consent Decree and subsequent IOAP. Since 2005, MSD has focused $1.01 billion of its resources toward mitigating and reducing unauthorized discharges and has made great progress in that effort as highlighted below.

- **Engaged Stakeholders:** In 2006, MSD initiated a Wet Weather Team Stakeholder Group which is still in existence and active today.

- **Mitigated CSOs**: MSD certified completion of 38 CSO LTCP projects to date, 4 remain. Overflows to local waterways have been reduced by approximately 5 billion gallons per typical year.

- **Eliminated SSOs**: MSD certified completion of 48 SSO SSDP projects to date, 18 remain. SSOs have been reduced approximately 61% by location and approximately 70% by volume.

- **Eliminated Facilities**: MSD certified completion of the required Comprehensive Performance Evaluation – Composite Correction Plan (CPE-CCP) projects, which included elimination of 6 WQTCs. Five regional wastewater treatment facilities remain.

- **Improved Ohio River Water Quality**: MSD received ORSANCO sampling data on the Ohio River indicating significant reductions in median fecal coliform levels downstream of Louisville, Kentucky.

- **Verifying Results**: MSD initiated a post construction compliance monitoring program on completed projects to proactively ensure satisfactory achievement of the design level of control as approved.

- **Fulfilled Amended Consent Decree Programmatic Elements**: Early Action Plan projects completed; Nine Minimum Controls (NMC) Program approved and ongoing; Capacity, Management, Operation, and Maintenance (CMOM) Program approved and ongoing; community input, outreach and notification program approved and ongoing; Sewer Overflow Response Protocol (SORP) approved and ongoing; Sewer Capacity Assurance Plan (SCAP) approved and ongoing; and certified completion of the required supplemental environmental projects.

- **Realized Additional Improvements for Our Community**: MSD exceeded the original commitments made to the community by spending 35% more for community benefits including: expanded system monitoring and rain gage networks to improve model calibration and discharge reporting; increased system storage capacity over original commitments by 25%; increased sanitary pump station capacity over original commitments by 50%; and improved community engagement and created neighborhood green spaces.

In order to fund the new infrastructure, MSD had to continue deferring critical existing infrastructure needs for piping, pumps, treatment plants, and flood gates. In 2019, MSD initiated discussions with the Regulators to reprioritize funding for critical infrastructure needs in lieu of some of the remaining SSDP projects included in the 5-year CIP. These discussions were slowed due to the COVID19 pandemic.

1.2.3 2017 Critical Repair and Reinvestment Plan

While MSD was implementing the Amended Consent Decree, it conducted a comprehensive assessment of its major infrastructure to assess long-term investment needs. In June 2017, the District published its *20-Year Comprehensive Facility Plan, Critical Repair and Reinvestment Plan* (CRRP)[2]. The CRRP estimated MSD needs to invest approximately $4.3 billion over a 20-year period to address all wastewater ($1.85 billion); stormwater ($2.34 billion) and support systems ($124.5 million) needs.

1.2.4 2018 Agreed Order for Morris Forman WQTC

On May 3, 2018, MSD entered into an Agreed Order with KDEP addressing improvements necessary to recover from a mechanical failure due to a lightning strike resulting with a power outage at Morris Forman WQTC that occurred April 8, 2015. Extensive damage was experienced to the primary treatment, secondary treatment, and electrical systems causing the plant to be out of compliance with effluent discharge limits established in Permit KY0022411. MSD is working diligently to restore the Morris Forman WQTC to its full

[2] 20-Year Comprehensive Facility Plan, Critical Repair and Reinvestment Plan, June 2017

operational capacity. MSD invested $37 million in this facility since 2016 and developed a draft Corrective Action Plan (CAP) for additional improvements necessary to:

- Assist with reduction effluent Biochemical Oxygen Demand (BOD)
- Assist with reduction effluent Total Suspended Solids (TSS)
- Allow continued operation of critical systems
- Prevent catastrophic failure at the plant
- Address safety issues/concerns.

The proposed CAP remains under discussion with KDEP.

1.2.5 2019 Reprioritization Discussions

Some deferred infrastructure has continued to deteriorate to the level that immediate investment is required for sustained regulatory compliance and protection of public health and community safety. In 2019, MSD updated its conceptual 30-year CIP forecast inclusive of all capital needs (approximately $4.6 billion) in conjunction with discussions with the Regulators. This forecast includes the projects identified in the CRRP, current regulatory requirements, additional planning evaluations, regionalization discussions, and partial funding for replacement of the Morris Forman WQTC. More information regarding these capital programs is presented throughout this report.

1.3 Purpose of the 2020A Bonds

Program Notes were issued by the District to finance on a short-term basis capital additions and improvements to the System pending the permanent refinancing of the Program Notes by the issuance of the District's bonds under its General Bond Resolution. An overview of the additions/improvements financed over the past couple years is provided in Table 1-1. More details regarding specific projects is provided in subsequent sections of this report.

Table 1-1: Overview of Capital Work Performed Since Last Bond Issue

CIP Program	Projects Finishing Design		Projects Finishing Construction	
	Number of Projects	Lifetime Actuals	Number of Projects	Lifetime Actuals
Consent Decree	0	$ -	5	$ 152,466,921
Facilities	1	$ 157,209	3	$ 3,769,146
Flood Protection	5	$ 1,481,044	8	$ 2,503,644
Stormwater	1	$ 18,866	7	$ 7,109,421
Wastewater Collection	7	$ 8,167,250	7	$ 20,981,312
Wastewater Treatment	8	$ 8,164,405	12	$ 57,343,141
TOTAL	**22**	**$ 17,988,774**	**42**	**$ 244,173,584**

This report does not discuss financial considerations. All information regarding rates, revenues, debt, and other financial considerations are discussed in the Official Statement.

2. MSD Organization

An eight-member citizen Board appointed by the Louisville Metro Mayor governs MSD's budget, rates, policies and initiatives. These members serve three-year overlapping terms and are eligible for reappointment. Each member represents a different state senatorial district in Louisville Metro. No more than five board members can belong to the same political party. The Board holds one regular meeting on the fourth Monday of each month, and committees meet as necessary. The current MSD Board Members are listed in Figure 2-1.

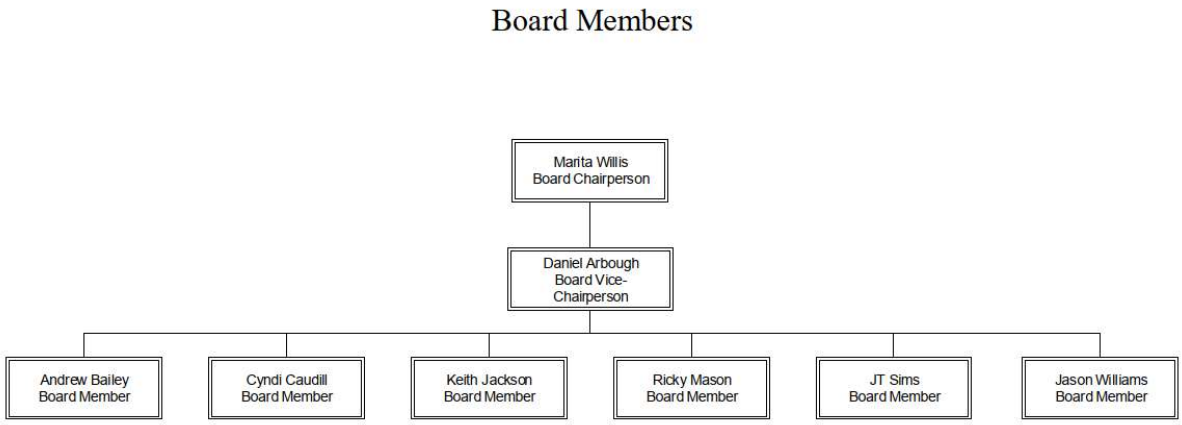

Figure 2-1: MSD's Board Members

The Board has delegated and placed the conduct of the day-to-day business affairs of the District under the direction of an Executive Director. The current Executive Director of MSD is James A. "Tony" Parrott. Mr. Parrott has been the full time MSD Executive Director since September 2015. Mr. Parrott leads an executive leadership team comprised of Division heads from eight divisions (refer to Figure 2-2):

- Executive Offices Division
- Supplier Diversity & Economic Inclusion Division
- Legal Division
- Human Resources Division
- Information Technology Division
- Finance Division
- Engineering Division
- Operations Division

MSD currently employs approximately 640 staff throughout the eight divisions. A brief description of each division is provided herein.

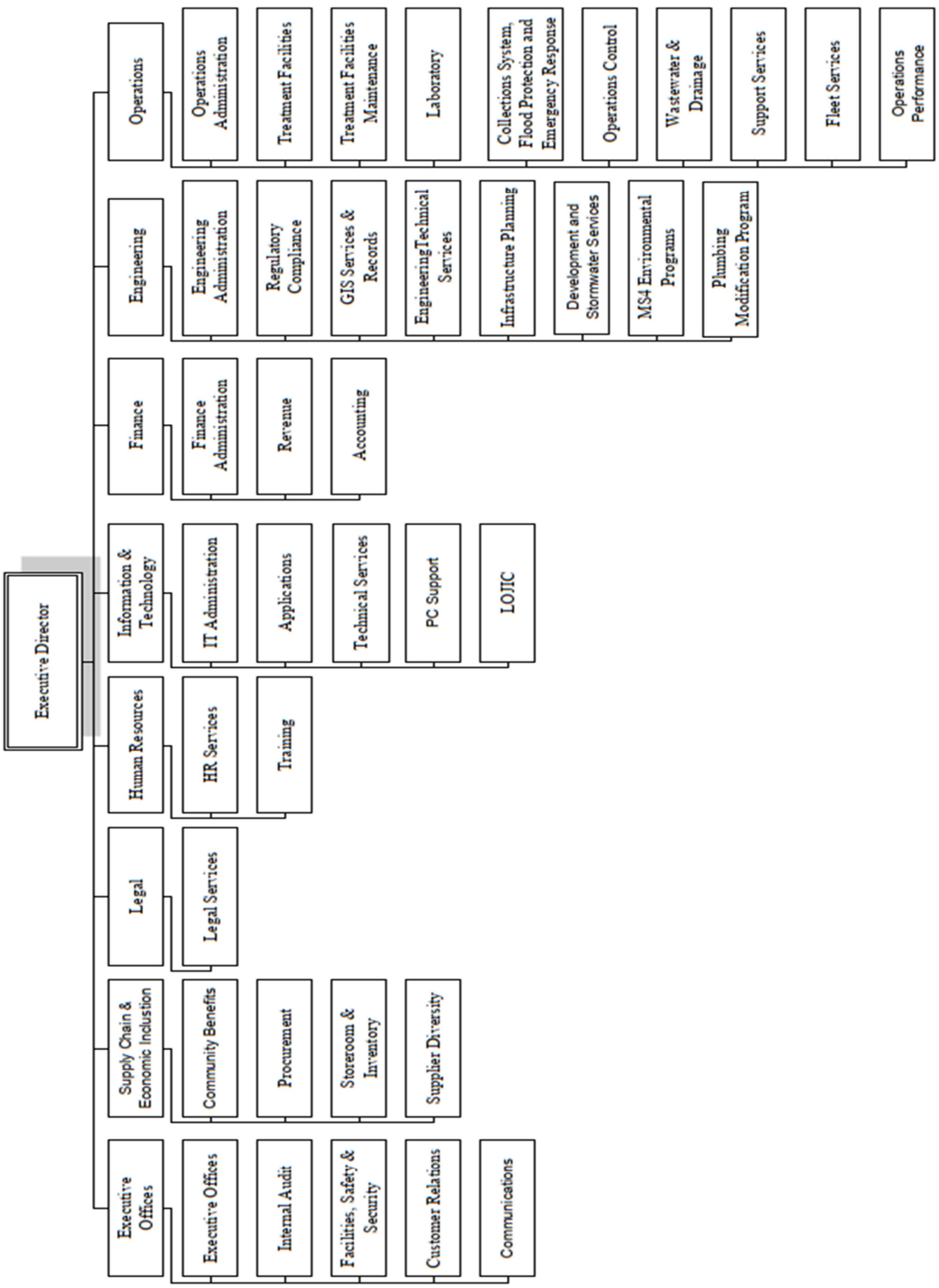

Figure 2-2: MSD's Organizational Chart

2.1 Executive Offices Division

The Executive Offices Division includes 13 executive positions; 18 customer relations and communications positions; and 21.5 facilities, safety, and security positions. The executive positions are comprised of Chief and Director level staff who provide leadership for the various Divisions. The customer relations and communication staff are part of the One Water Shared Services. One Water is organizational unit that operates in conjunction with the Louisville Water Company. This initiative is designed to provide consistent, high quality support services between the utilities, as well as to lower overall support costs for both MSD and the Water Company. The facilities staff provides support for keeping buildings operational for MSD's staff. The health and safety staff provide training for all MSD staff. Security staff provide on-site security services and investigate events as needed.

2.2 Supply Chain and Economic Inclusion Division

This One Water Division has 23 positions and is led by the One Water Chief Procurement Officer. The Division provides procurement buying services; management of the storeroom and materials; management and enforcement of the supplier diversity program; and services focused on community benefits.

2.3 Legal Division

The Legal Division includes 10 positions including the General Counsel/MSD Legal Director and Deputy General Counsel. Services provided by the Legal Division include contract reviews; claims and disputes; regulatory agreements; and interpretation of documents and terms of conditions.

2.4 Human Resources Division

The Human Resources Division includes 18 positions led by MSD's Human Resources Director. The Division provides organizational development, staff training, performance analytics, benefits and payroll administration, employee relations, and complete human resources support.

2.5 Information Technology Division

The Information Technology (IT) Division includes 32 positions led by the One Water Chief Information Officer. The Division manages IT hardware (servers, networks, computers, mobile phones); provides cybersecurity and staff technical support; oversees and supports software applications; and administers and manages the Louisville – Jefferson County Information Consortium (LOJIC) Program.

2.6 Finance Division

The Finance Division includes 29 positions led by MSD's Chief Financial Officer. A new Chief Financial Officer was selected in 2020. In May 2020, some job functions and roles within the Division were realigned to better support MSD with advancing regionalization and financial reporting. Services provided by the Finance Division include budget development and management; revenue and collections management; accounting; records management; and information governance.

2.7 Engineering Division

The Engineering Division includes 94 positions led by MSD's Chief Engineer. A new Chief Engineer was selected in 2020. Services provided by the Engineering Division include regulatory compliance; geographical information system (GIS) administration; engineering technical services (35.5 positions); and development and stormwater services (44 positions).

- **Regulatory Compliance**: leads the organization in process improvement activities that improve communication, documentation and efficiency required to maintain compliance with permits and regulations and advance the asset management program. Additionally, the team manages and coordinates Consent Decree-mandated activities including sewer overflow response, discharge and overflow reporting activities, and periodic reporting to regulators, and provides support to implement business requirements in information systems like IPS® and Telog®.

- **GIS Services**: supports MSD's mission by building and maintaining an accurate and detailed database model, generate high quality maps, perform spatial analysis, and serve as a support network to all departments within MSD. Additionally, the GIS Team provides support and information not only to MSD, but to outside customers and agencies as well.

- **Engineering Technical Services:** provides planning, design oversight, and construction management of all capital projects related to wastewater, stormwater, drainage, flood protection, and facility improvements. This group also administers the Drainage Response Initiative Program (DRI) to address localized drainage problems ranging from structural flooding to minor standing water problems.

- **Development Services:** responsible for review and permitting of development projects throughout Louisville Metro including proposed land disturbing activities on behalf of the community to advocate for public health, safety and protection in accordance with Louisville MSD's mission and the Louisville and Jefferson County Erosion Prevention and Sediment Control and Floodplain Ordinances. This group also provides construction field inspection services to confirm assets are built in accordance with MSD's standards and administers the plumbing modification program to

prevent rain-related sewer backups into basements.

- **Stormwater Services:** manages and administers the Municipal Separate Storm Sewer System (MS4) and Floodplain Management Programs. The MS4 Program addresses drainage related issues related to pollution, erosion, water quality monitoring, and construction site management. The Floodplain Management Program coordinates grants from the Federal Emergency Management Agency (FEMA) to purchase homes located in flood prone areas.

2.8 Operations Division

The Operations Division includes 342 positions led by MSD's Chief of Operations. Operations staff are spread across five working groups including: treatment facilities (130 positions); collections, flood protection, and emergency response (77 positions); wastewater and drainage; (194 positions); operations support services (36 positions); and the One Water Fleet Services (19 positions).

- **Treatment Facilities Services**: responsible for operation and maintenance of the five water quality treatment centers 24 hours per day, 7 days per week including all electrical and mechanical components; performance analytics; and laboratory services. This group actively participates in the Operator-in-Training program to grow the next generation of staff.

- **Collections, Flood Protection, & Emergency Response Services**: responsible for operation and maintenance of all sanitary pump stations, sanitary and combined sewer systems; real time control facilities; SCADA system; and flood protection system (floodwall, levee, gates, and flood pump stations). This group provides emergency response for sewer force main breaks and pump station overflows and updates the Emergency Preparedness Plan required for the Flood Protection System per the U.S. Army Corps of Engineers (USACE).

- **Wastewater & Drainage Services**: responsible for operation and maintenance of the stormwater drainage network including field inspection of customer complaints. Wastewater services provided by this group include televising sewer systems and performing standard routine maintenance related to root control, cleaning, condition assessment, debris removal, and response to cave-ins.

- **Operational Support Services**: responsible for management and administration of industrial programs related to industrial pretreatment, grease management, hazardous materials, and industrial stormwater discharges. This group provides water quality sampling and performance analysis and tracking for all operating groups.

- **One Water Fleet Services**: provides full service maintenance for MSD's fleet vehicles and heavy equipment

3. Stormwater Drainage and Management

MSD is responsible for the operation, maintenance, replacement, improvements and additions to the public stormwater facilities. Runoff during rain events is collected and either stored, retained, and/or conveyed to sewers, rivers, streams, creeks, channels, and ditches for eventual discharge to the Ohio River, either directly or through one of its tributaries. The drainage system includes the following infrastructure that is operated by MSD (or through a combination of MSD staff and contractors).

- 3,616 miles of channels, ditches, and culverts
- 1,080 miles of storm sewers pipe (including culverts under roads)
- 870 miles of inland streams (both natural and improved)

MSD's combined sewer system provides storage, conveyance, and treatment of both sanitary sewage and stormwater. During dry weather, the system carries only sanitary sewage to the Morris Forman WQTC for treatment and discharge. During wet weather events, the combined sewers also convey urban runoff in the same pipe system. The boundaries of the combined sewer system are shown in Figure 3-1.

In April 2017, MSD published the *Louisville MSD Watershed Mater Plan* to help effectively manage present and future regional stormwater drainage in Louisville Metro. The basis of this Plan was MSD's original Watershed Master Plan, which was created in 1988 as part of the *Stormwater Drainage Master Plan*, and the *2010 Stormwater Management Master Plan*, which was the most recent update of that plan.

MSD is working on a comprehensive update to the *Stormwater Drainage Master Plan* which, after public participation and approvals by local governments, will be used by the District for implementing improvements and extensions to the existing drainage facilities. It is currently anticipated the first working draft of the *Stormwater Drainage Master Plan* will be published in 2025. Over the next few years, a significant effort will continue to inventory and document the condition of existing drainage system assets.

3.1 Stormwater Service Area

Louisville Metro is a river city located along the Ohio River. The area is drained by two major drainage systems: the Ohio River and the Salt River[3]. The Ohio River receives discharges from Mill Creek, Beargrass Creek, Goose Creek, Harrods Creek, and the combined sewer system. Cedar Creek and Pennsylvania Run discharge into Floyds Fork, which in turn, discharges in the Salt River. The Salt River also receives discharge from Pond Creek near its confluence with the Ohio River.

The challenges still facing MSD with regard to stormwater are exacerbated by the County's geography. Some areas are previous swampland with little slope, while other areas are very hilly. As such, if not properly

[3] April 2017 Louisville MSD Watershed Master Plan

controlled, development could lead to excessive streamflow and erosion. Much of the area within the old Louisville city limits is in the combined sewer system. When the system reaches capacity, many places in this highly developed urban area flood despite not being next to an open stream. This occurs because the combined sewer system took the place of the original streams and ditches.

The District through ILAs with the City of Louisville and Jefferson County assumed responsibility for stormwater management in 1987 for all of Jefferson County, except for the Cities of Anchorage, Jeffersontown, Shively, and St. Matthews. Those cities provide most of those services within their borders, and partner with MSD on other aspects including review of new development plans and water quality reporting.

The District serves a population of approximately 650,000 and bills for stormwater services using equivalent service units (ESUs). The District currently has approximately 6,956,000 ESUs, in total, from residential, commercial, industrial, and city-owned properties.

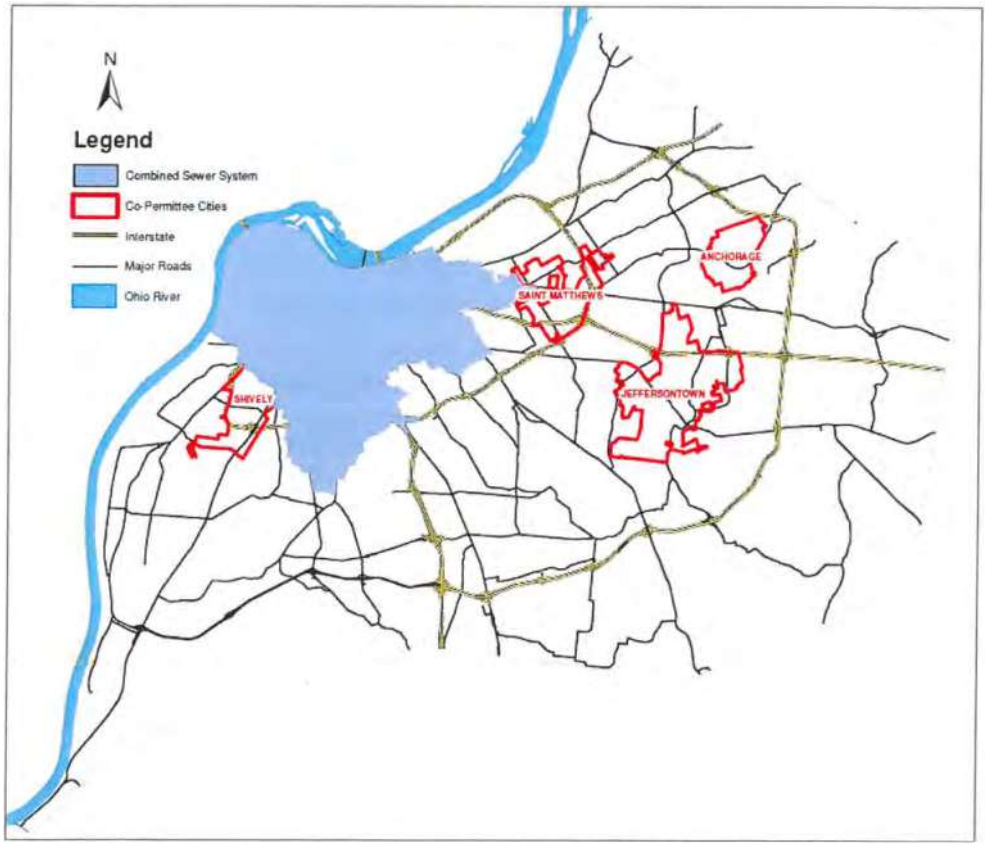

Figure 3-1: Stormwater and MS4 Service Areas

3.2 Stormwater & Drainage Regulatory Requirements

MSD is required to comply with the Federal and State Regulations related to stormwater management listed in Table 3-1.

Table 3-1: Federal and State Stormwater Management Regulations

Reference	Title	Description
401 KAR 5:060 Section 12	Municipal Separate Storm Sewer Systems	Establishes procedures for permitting Phase I and II municipal separate storm sewer systems (MS4s).
401 KAR 4:200; 33 US Code, Title 33, Chapter 26, Section 1341	Section 401 Application for Water Quality Certification	Establishes the requirements for permitting discharges to streams in the KDEP jurisdiction.
33 US Code, Title 33, Chapter 26, Section 1342	National Pollutant Discharge Elimination System (NPDES)	Establishes procedures for permitting discharges that may affect floodplains or navigable waters.
33 US Code, Title 33, Chapter 26, Section 1344	Section 404 Nationwide Permit	Establishes the requirements for permitting discharges of soil, sand, gravel, or dredged material into streams under USACE jurisdiction.
401 KAR 5:005	KPDES for the Morris Forman WQTC	Establishes procedures and permits for operation of the combined sewer system and its associated storage and treatment facilities

3.2.1 Metro Government Local Ordinances Related to Stormwater

MSD is required to comply with the following local regulations related to the stormwater system.

- **Drainage Master Plan**. Louisville Metro Government Code of Ordinances, Title V, Chapter 50.67
- **Comprehensive Storm Water Drainage Authority.** Louisville Metro Government Code of Ordinances, Title V, Chapter 50.55-99.
- **Floodplain Management**. Louisville Metro Government Code of Ordinances, Title XV, Chapter 157.
- **Erosion Prevention and Sediment Control**. Louisville Metro Government Code of Ordinances, Title XV, Chapter 159.
- **Engineering Standards**. Louisville and Jefferson County MSD Design Manual

3.2.2 Municipal Separate Storm Sewer System (MS4) Program

The permit to operate a drainage system and discharge stormwater to waterways is administered by the KDEP. Management of stormwater in the District outside the combined sewer area is regulated through a Municipal Separate Storm Sewer System (MS4) permit, which requires periodic reporting on water quality in area streams. The Louisville MS4 Permit includes over 100 activities and is organized into several program elements including:

- Illicit Discharge Detection and Elimination
- Construction Site Runoff Controls (Erosion Prevention and Sediment Control)
- Post Construction Site Runoff Controls (Long-term Water Quality Control)
- Public Involvement and Outreach Programs
- Monitoring
- Reporting and Assessment

3.3 Stormwater Drainage Programs

Stormwater management is a vital component of MSD's system, because it directly impacts the health and safety of all Louisville and Jefferson County residents. Inland drainage systems include the infrastructure to collect and convey drainage across the County via pipes, ditches, streams, and channels to the Ohio River. The flood protection system is described in Section 4. The combined sewer system is described in Section 5.

The CRRP included a number of programs related to drainage and floodplain management. A summary of the Stormwater Drainage Programs included in the 5-year CIP forecast is provided below.

- **Community Rating System Program**: The National Flood Insurance Program Community Rating System (CRS) is a voluntary incentive program encouraging community floodplain management activities that exceed the minimum requirements. Communities taking part in this program are awarded points for participating in public information, mapping and regulation, flood damage reduction, and flood preparedness. Through MSD's participation in the program, Louisville Metro is a Class 3 community, granting the community a 35-percent discount on flood insurance premiums. The Class 3 rating saves the Louisville Metro community approximately $2 million each year in flood insurance premiums.

- **Municipal Separate Storm Sewer System Program (MS4):** The MS4 Program is a drainage-related program to improve the quality of surface waters through controls on stormwater runoff quality in Jefferson County and to protect the public health, safety, and welfare by reducing the introduction of harmful materials into the MS4s that discharge into community streams. The CRRP identified several large stormwater retention basins with the potential for conversion of all or part of the basin to provide infiltration of stormwater.

- **Drainage Response Initiative Program (DRI)**: Since 2003, MSD has been implementing an aggressive program to address a wide variety of drainage issues that are pointed out by customers to address problems ranging from structural flooding to alleviating minor standing water problems. MSD has invested nearly $200 million in stormwater improvements through the DRI Program.

- **Floodplain Management Program**: Since 1997, MSD has purchased homes located in flood prone areas through federal grant programs. Following a number of spring flooding events in 2015, the Mayor formed a multiagency Flood Mitigation Workgroup to address impacted residents who were unable, for a variety of reasons, to get back in their homes after the floodwaters receded. The Flood Mitigation Workgroup recommended several mitigation approaches, including establishment of a "quick-buy" program to allow property owners to sell flood-impacted property in a much shorter time than would typically be possible. The Workgroup recommended annual fund be established to provide timely relief to property owners impacted by future extreme storm events. The projects continue to be advanced but are not part of the CIP due to the reimbursement portion of the program.

- **Stormwater Master Plan Implementation Program:** MSD has begun an extensive 5-year stormwater asset inventory project. Following this effort, the *Stormwater Master Plan* will be updated to prioritize stormwater needs throughout the District. The CRRP estimated approximately $600 million would be required to address the stormwater needs. Implementation of the *Stormwater Master Plan* will occur after the 5-year CIP.

3.4 Stormwater & Drainage Capital Projects

MSD continues to fund stormwater and drainage projects with its annual CIP. Projects are generally a combination of discrete local improvements and appropriations for District-wide needs/services.

3.4.1 Projects Funded from Program Notes

The projects completed since 2017 have primarily been focused on construction of green infrastructure (refer to Table 3-2). The green infrastructure program was included in the Amended Consent Order. MSD has invested more than $40 million in green infrastructure projects over the past 10 years.

Table 3-2: Stormwater Projects Completing Design/Construction Since 2017

Program	Budget ID	Project	Task Name	Finish	Lifetime Actuals
Stormwater & Drainage Improvements	H20164	346 S Peterson Ave Stream Restoration	Design Finish	4/21/2020	$18,866
	H19249	Stormwater Drainage Early Action Planning	Construction Finish	6/30/2019	$84,000
Green Infrastructure Projects	H20144	Churchill Downs East Side Improvements GI	Construction Finish	3/4/2020	$1,200,000
	H20168	Louisville FC Stadium Green Infrastructure	Construction Finish	12/31/2019	$250,000
	H13099	Spalding University Green Infrastructure	Construction Finish	11/22/2019	$539,826
	H19059	Churchill Downs Green Infrastructure Ph 2	Construction Finish	11/15/2018	$2,960,819
	H18332	Botanical Garden Biofilter Upgrades	Construction Finish	9/28/2018	$61,509
	H18195	Churchill Downs Green Infrastructure Ph 1	Construction Finish	8/23/2018	$2,013,267
				TOTAL STORMWATER PROJECTS	**$7,128,287**

In addition to these projects, MSD funds the following appropriations annually in support of activities related to the stormwater and drainage system:

- **Environmental Data Collection**: MSD collects over 3 million individual water quality records each year. This monitoring program provides a detailed picture of the health of streams in Jefferson County. Monitoring results are summarized on an annual basis in the *Stormwater MS4 Annual Report*. The data are provided electronically annually to the Kentucky Division of Water. MSD budgets approximately $875,000 per year to support this effort.

- **Tree Program**: MSD's Urban Reforestation Program plants 1,000 trees annually by working with local businesses, municipal organizations and neighborhood associations. The program replenishes and expands the tree canopy throughout Jefferson County. These trees redirect an average of 1.35 million gallons of stormwater away from the sewer system every year, which decreases sewer overflows into waterways. MSD budgets approximately $150,000 per year to support the program.

- **MS4 Program**: MSD budgets approximately $600,000 per year to manage and administer the MS4 Program. Work performed includes but is not limited to: public education and outreach; pollution prevention program; performance assessment and reporting; recreational monitoring for bacteria levels between May 1st and October 31st; and wet weather monitoring during storm events.

- **USGS Stream Monitoring**: In 1988, MSD and the United States Geological Survey (USGS) began monitoring water quality and stream flow throughout the Jefferson County area. The Long-Term

Monitoring Network has changed over the years and currently includes 27 monitoring sites. The monitoring sites were selected to represent streams in each of eleven watersheds. Each monitoring site is sampled four times per year and is analyzed for a variety of parameters including fertilizers, sediment, and metals. MSD budgets approximately $400,000 per year to support this effort.

3.4.2 5-Year CIP for Stormwater & Drainage System

During the 5-year CIP, the following stormwater and drainage projects will be partially or wholly budgeted.

Table 3-3: Overview of 5-Year Forecasted Spending for Stormwater

Stormwater Priorities		5-Year CIP Forecasted Spending
Stormwater & Drainage Improvements	Local Drainage Improvements	**Stormwater $6.9 million**
	3-Forks Beargrass Creek USACE General Investigation	
	Stormwater Master Plan	
MS4 Program	Environmental Data Collection	**MS4 $9.5 million**
	MS4 Program Support	
	Tree Program	
	USGS Stream Monitoring	
Drainage Response Initiative (DRI)	DRI Projects	**DRI $13 million**
	DRI Field Inspections	
Green Infrastructure (GI) Projects	GI Projects with Signed Agreements	**GI $2.3 million**
	Future GI Projects	
Land Use Planning	Maple Street Land Use Planning	**Land Use $60,000**
	Other Future Projects	
Total 5-Year CIP Forecast for Stormwater & Drainage		**$31.8 million**

4. Flood Protection System

Louisville's flood problems originate from the Ohio River as it rises above its normal pool depth, as well as contributing creeks, storm sewers, and major drainage systems. After devastating floods on the Ohio River in 1937, the U.S. Army Corps of Engineers (USACE) was given authority by Congress to construct flood damage reduction projects under the Flood Control Act of 1936. Under this authority, the USACE built the Ohio River Flood Protection System (ORFPS) that stretches from Butchertown to the southwestern part of Jefferson County near West Point, Kentucky. The original 13.9 mile section of the floodwall was constructed along the Ohio River between 1946 and 1956 (Louisville Reach) and turned over to MSD as functional pieces were completed in 1953, 1954, and 1957. The USACE constructed the 12.6 mile southwestern Jefferson County floodwall extension (Southwestern Jefferson County Reach) between 1973 and 1989.

When the elevation of the Ohio River rises, MSD's service area is protected from flooding through levees and floodwalls. The 185 street crossings, pipe openings, and gates that allow creeks to pass through are sealed and the river is held back. With the creeks and storm sewer system prevented from discharging into the Ohio River, MSD relies on the 16 flood pump stations to pump drainage over the floodwall and levee to prevent stormwater from backing up and causing flooding within the area. It is important to understand that the operation of the flood pumping stations is intermittent and infrequent, only occurring when both the Ohio River is in flood stage and there is a rain event within the drainage system. Many of the pumping stations operate only once every few years. The existing system is more than 60 years old and most components are original parts. In many cases, the original equipment is no longer available for replacement.

MSD is responsible for ensuring all components of the ORFPS are fully operational when they are needed. Today, the ORFPS protects 240,000 people and $60 billion of property within the levee area and includes the following components (refer to Figure 4-1):

- 22.2 miles of earthen levee
- 3.9 miles of concrete wall
- 16 flood pump stations (total of 73 pumps)
- 152 gates
- 97 closures (21 permanently sealed)

4.1 Service Area

A large portion of Jefferson County lies within the broad floodplain of the Ohio River. Approximately 17,600 acres of this floodplain (extending from Beargrass Creek to Pond Creek) are protected by the ORFPS.

Figure 4-1: Ohio River Flood Protection System

Several flood pump stations have watersheds and sewersheds that extend across the Metro area and into eastern Jefferson County. Four distinct topographic regions exist throughout MSD's service area as shown in Figure 4-2 and described below[4].

Figure 4-2: MSD's Topographic Regions

- **Flood Plain**: A strip of land bordering one-half to five miles wide along the Ohio River. The Flood Plain extends from the Salt River in the southwest, north to downtown Louisville, and continues northeast to the Oldham County line. The area is best characterized as flat to gently rolling and with very flat sloped stream beds. Mill Creek and the combined sewer system drain the majority of this region.

- **Knobs**: A triangular area in the southwestern portion of the county bounded approximately by Iroquois Park on the north, South Park Hills on this southeast, and the Southern Railroad on the southwest. The hills in this region have been highly dissected by stream erosion. Most streams in this area drain to Pond Creek.

- **Central Basin**: The west central portion of the county, bounded approximately by I-264 on the north, Shepherdsville Road on the east, and the "Knobs" region on the south and west, is the "Central Basin. Various improvements to the Northern and Southern Ditch systems have helped alleviate the lack of natural drainage in the region.

[4] 2016 Louisville Metro Hazard Mitigation Plan

- **Eastern Uplands**: The remainder and largest portion of the county. This region is characterized by gently rolling to hilly plains to moderate to very steep valleys. Goose Creek, Harrods Creek, Floyds Fork, and the Beargrass Creek system drain this region.

4.2 Regulatory Requirements

As previously noted, the interior drainage system is regulated by MSD's MS4 permit. The Ohio River flood-protection system is not regulated by a single agency or permit. A series of requirements and standards established by multiple state and federal agencies such as FEMA and USACE regulate the flood protection system.

Table 4-1: Federal and State Flood Protection Regulations

Reference	Title	Description
40 CFR, Chapter 1, Part 230, Section 230.30	Threatened and Endangered Species	Identifies endangered or threatened species likely to become endangered in the foreseeable future.
44 CFR, Chapter 1, Part 73	National Flood Insurance Program Flood Insurance Manual, Appendix F, Community Rating Systems	The CRS offers NFIP policy premium discounts in communities that develop and execute extra measures beyond minimum floodplain management requirements to provide protection from flooding.
44 CFR Chapter 1, Part 79	Flood Mitigation Grants	Establishes procedures and requirements for grant programs to mitigate losses from flooding.
44 CFR, Chapter 1, Part 207	Disaster Mitigation Act of 2000	Provides information for state and local governments to identify and mitigate natural hazards.
16 US Code, Title 16, Chapter 84, Section 6514	National Environmental Policy Act Environmental Assessment	Establishes criteria to determine whether an impact significantly affects the quality of the human environment.
33 US Code, Title 33, Chapter 15, Section 701b-12	Floodplain Management Requirements	Established following construction, the non-federal sponsor (MSD) has full legal responsibility for replacing, repairing, and rehabilitating the flood protection facilities.
33 US Code, Title 33, Chapter 46, Section 3301	USACE Regulations regarding Operations and Maintenance of flood damage and reduction facilities	Established guidelines for maintenance and operation of levees, floodwalls, drainage structure, closures, pumping stations, channels and floodways.
42 US Code, Title 42, Chapter 68, Section 5165	Mitigation Planning	Provides information on the policies and procedures for mitigation planning as required by the provisions of section 322 of the Stafford Act, 42 U.S.C. 5165.

4.2.1 Metro Government Local Ordinances Related to Flood Protection

MSD is required to comply with the following local regulations related to the flood protection system.

- **Engineering Standards**. Louisville and Jefferson County MSD Design Manual

4.3 Flood Protection System Evaluation

As noted, the USACE inspect the ORFPS components every two years to ensure it remains fit for purpose. A more comprehensive evaluation was completed in 2019.

4.3.1 2019 USACE ORFPS Reliability Improvements Evaluation

The most recent condition assessment for MSD's ORFPS components was performed by the USACE in 2018-2019. The following conclusions were made[5]:

- The National Flood Insurance Program Levee System Evaluation determined the floodwall and levee features are in an acceptable condition.
- The 2019 Periodic Inspection rated the overall system as "minimally acceptable".
- The 2019 Semi-Quantitative Risk Assessment performed by USACE identified features with a performance issue to lessen likelihood or consequences of failure in accordance with Tolerable Risk Guidelines.
- MSD's CRRP recommended rehabilitation/expansion for 15 of the 16 aging flood pump stations to have sufficient capacity forecasted through 2065.

In 2019, the USACE completed its Feasibility Study and recommended projects needed to ensure flood protection levels meet today's standards. These projects may be eligible for federal dollars through USACE construction appropriation. The improvements are restricted for RELIABLITY purposes and exclude any capacity upgrades. The study indicated the following flood protection system needs:

- **Levee System**: Well maintained and has not had any significant performance issues during high water events, but no event has significantly loaded the levee system.
- **Mechanical/Electrical**: The systems are aging, and mechanical and electrical components are requiring regular and often significant maintenance each year.

[5] USACE Louisville Metro Flood Protection System, Emergency Supplemental Reconstruction Feasibility Study with Integrated Environmental Assessment, Volume 1, 2019.

- **Pumps & Motors**: Approximately 75% of the pumps and motors need rebuilt or replaced. The original pumps, motors, and ancillary systems are still in service and have not had a major rebuild since they were originally installed.

- **Control Systems**: 80% of the controls systems at the flood pump stations are outdated. The control systems are rudimentary by today's standards, requiring the station to be fully staffed at all times during flood pumping operations.

- **Transformers & Motor Control Centers**: 88% of the electrical components need to be replaced. The electrical system is original equipment, which cannot be repaired with currently available components.

- **Gates and Floodwalls**: 25% of the system needs to be replaced or refurbished: 15 new actuators, 13 new gates, and 10 gates to be refurbished. Most of the 152 gates are 65 years old.

The USACE identified $167 million of improvements needed to increase the reliability of the Flood Pump Stations (FPS) along the Ohio River as well as other components, such as gates and flood walls. The USACE will contribute approximately $109 million and MSD will contribute approximately $58 million toward the total cost. MSD does not have any control regarding the timing of projects completed by USACE. Therefore, MSD must be ready with its cost share portion at the USACE's schedule. Preliminary discussions have indicated design for the FPS Reliability Improvements Projects could begin in FY21 with construction advancing FY23 through FY 25.

In addition to these reliability improvements, the CRRP completed multiple evaluations of the 16 flood pump stations and identified additional needs that will not be addressed by the USACE's Reliability Improvements Program. A preliminary breakdown of the projects qualifying for the USACE Reliability Improvements Program and other CRRP projects not covered by USACE are listed in the table below. The 5-Year CIP includes MSD's full share of the USACE Reliability Improvements Program.

Table 4-2: Summary of Flood Protection System CIP Needs

Flood Protection System Project	Estimated USACE Participation for Reliability Improvements	Estimated MSD Participation for Reliability Improvements	CRRP FPS Improvements Not Included in Reliability Program
Paddy's Run FPS Improvements	$12,194,300	$6,566,000	$44,260,000
10th Street FPS Improvements	$2,131,200	$1,147,600	$750,000
17th Street FPS Improvements	$1,368,400	$736,800	$4,313,200
27th Street FPS Improvements	$3,701,300	$1,993,000	$10,027,000
34th Street FPS Improvements	$1,827,700	$984,200	$1,020,000

Flood Protection System Project	Estimated USACE Participation for Reliability Improvements	Estimated MSD Participation for Reliability Improvements	CRRP FPS Improvements Not Included in Reliability Program
4th Street FPS Improvements	$0	$0	$12,920,000
5th Street FPS Improvements	$1,403,800	$755,900	$700,000
Beargrass Creek FPS Improvements	$16,009,000	$8,620,200	$88,259,800
Bingham Way FPS Improvements	$0	$0	$6,590,000
Lower Mill Creek FPS Improvements	$3,481,000	$1,874,400	$11,575,700
Pond Creek FPS Improvements	$15,434,200	$8,310,700	$9,750,000
Riverport FPS Improvements	$1,358,200	$731,300	$5,378,700
Shawnee Park FPS Improvements	$7,832,600	$4,217,500	$38,512,500
Starkey FPS Improvements	$3,500,00	$1,885,100	$4,360,000
Upper Middle Creek FPS Improvements	$7,647,400	$4,117,900	$44,922,200
Western Parkway FPS Improvements	$1,183,300	$637,200	$21,832,900
Levees, Floodwalls, Gates & Closures	$19,846,400	$8,201,500	$1,049,700
Cultural Mitigation & Engineering	$13,529,200	$7,885,000	$0
TOTAL	**$108,948,000**	**$58,664,300**	**$306,221,700**

Note: The projects and preliminary costs presented in this table are for informational purposes only and are subject to change as discussions continue between MSD and the USACE. They represent a level of capital investment for each location. However, the actual costs are likely to vary from these preliminary values as projects are further planned and vetted.

4.4 Flood Protection Capital Projects

The projects completed since 2017 have primarily been focused on replacing aging assets (refer to Table 4-3). The 5-year CIP includes several projects that will increase the capacity of the flood pump stations and improve the overall system reliability.

4.4.1 Projects Funded from Program Notes

Minimal investment has been focused on the flood protection system due to the requirements of the Amended Consent Decree and other MSD priorities. MSD completed repairs for valves, gates, pump, and motors at six of the flood pump stations.

Table 4-3: Flood Protection Projects Completing Design/Construction Since 2017

Program	Budget ID	Project	Task Name	Finish	Lifetime Actuals
Flood Pump Station Improvements	F20265	Beargrass Creek Bay Gate 4 Repairs	Construction Finish	1/10/2020	$109,652
	F19277	Beargrass Creek FPS Wetwell Relief Gate	Design Finish	12/12/2019	$41,530
	F20013	Beargrass FPS Pump 8	Design Finish	12/3/2019	$491
	F19276	FPS Auto Grease Systems Upgrades	Design Finish	12/3/2019	$43,997
	F20240	Shawnee Park FPS Motor No 3 Emergency Repairs	Construction Finish	10/14/2019	$112,130
	F18295	Starkey Check Valve Replacement	Construction Finish	7/31/2019	$190,998
	F18302	Paddy's Run FPS Pumps 1, 2 and 6 Rehab	Design Finish	4/18/2019	$1,288,560
	F19269	Upper Mill Creek Emergency Pump Repairs	Construction Finish	4/17/2019	$1,092,856
	F18279	Paddys Run FPS Access Road	Construction Finish	11/30/2018	$293,034
	F18296	5th Street FPS Roof Replacement	Construction Finish	11/9/2018	$57,517
Levee, Floodwall, and Gate Improvements	F19245	Flood Gate 1 Replacement	Design Finish	9/24/2019	$106,466
	F16021	Gates 136 and 145 Floodwall Actuator Replacement	Construction Finish	4/11/2019	$592,816
	F19218	Flood Gate 110 and 111 Elimination	Construction Finish	2/21/2019	$54,641
TOTAL FLOOD PROTECTION PROJECTS					**$3,984,688**

4.4.2 5-Year CIP for Flood Protection System

MSD is forecasting to spend $153 million of the $306 million of flood protection needs during the 5-year CIP. These projects are not part of the USACE Reliability Improvements Program. The ORFPS is a critical component for public protection and as such has become a priority for the capital program. During the 5-year CIP, the following Flood Pump Station Capacity Upgrades projects will be partially or wholly budgeted. These projects were identified and estimated in the CRRP.

Table 4-4: Summary of 5-Year CIP Forecasted Spending for ORFPS

CIP Program	Project	5-Year CIP Forecasted Spending
Capacity or Electrical Improvements	10th Street FPS - Generator Improvements	**$99.7 million**
	17th Street FPS - Capacity and Generator Improvements	
	27th Street FPS - Capacity and Generator Improvements	
	34th Street FPS - Generator Improvements	
	4th Street FPS - Capacity and Electrical Service Improvements	
	5th Street FPS - Generator Improvements	
	Bingham Way FPS - Capacity and Generator Improvements	
	Paddys Run FPS Capacity Upgrade	
	Pond Creek FPS - Electrical Service Improvements	
	Starkey FPS Transformer Replacement and Generator	
	Upper Mill Creek FPS Transformer Replacement	
Asset Management Improvements	Beargrass Creek FPS Wetwell Relief Gate	**$53.5 million**
	Beargrass FPS Pump 8	
	Flood Gate 1 Replacement	
	FPS Auto Grease System Upgrades	
	Flood Structures & Flood Pump Station Equipment R&R	
	Gate 102 Replacement	
	Paddy's Run FPS Pumps 1, 2, and 6 Rehab	
	Pond Creek Emergency Pump Repairs	
	Canal Street Floodwall	
	Total 5-Year CIP Forecast	**$153.2 million**

Note: These projects exclude MSD's $58 million participation in the USACE Reliability Improvements Program

- **Paddy's Run FPS Capacity Improvements**: The $79 million Paddy's Run Flood Protection Station Capacity Improvements project is MSD's highest ranked capital priority to mitigate flood pump station public health protection risk. MSD completed an Alternatives Analysis for increasing the capacity of the station to 975 mgd. The CRRP recommended two equally important project phases for the Paddy's Run FPS. The first phase will improve the reliability of the existing Paddy's Run FPS (originally constructed in 1953) by removing, inspecting, and rehabilitating or replacing the station's existing pumps and motors to maintain the station's current total pumping capacity of 925 mgd. The reliability improvements will be implemented through the USACE Program. MSD must construct the capacity improvements project independent of the USACE project.

As noted in Table 4-3, MSD funds the following appropriations annually in support of activities related to the flood protection system:

- **Flood Pump Station Equipment Repair & Replacement**: This annual appropriation is intended to better facilitate key equipment replacements. Funds are budgeted to replace pumps, motors, electrical switchgear, generators, and other critical equipment. MSD budgets approximately $1 million per year to support this effort.

- **Flood Structures Repair & Replacement**: MSD maintains a proactive maintenance program to assure the integrity of the levee and floodwall system. Worked performed using these funds includes: repair and/or replacement of trusses, sheeting, and closure walkways; corrugated metal pipe replacement; toe drain access repairs; trail repairs and unwanted vegetation removal; level gate repair or automation; painting; floodwall joint repair; and floodwall concrete sealing and surface crack repairs. MSD budgets approximately $2 million per year to support the program.

5. Wastewater Collection System

Like many cities developing in the 19th century, Louisville's sewers were constructed many decades prior to the construction of the treatment facilities. MSD's first sewers were installed before 1850 and routed directly to the Ohio River. By the end of the 19th century, the collection system had expanded to almost 100 miles of clay, brick, and timber-lined sewers. Today, MSD has over 3,200 miles of sewers, approximately 500 miles being over 100 years old. The oldest sewers in the system are primarily in the combined sewer system built between the 1860s to the 1950s. Beginning in 1955, all of the sewer systems built in the Louisville Metro area have been separate sanitary sewers. MSD's first Sewer Master Plan was developed in 1964.

MSD serves approximately 243,000 customer accounts and 650,000 people. The collection system operated and maintained by MSD includes:

- 256 wastewater pump stations
- ≈79,000 manholes
- ≈2,500 miles of sanitary sewers
- ≈700 miles of combined sewers (24,000 acres)
- ≈160 miles of force mains
- ≈1,400 miles of lateral connections to buildings
- Real Time Control facilities to reduce overflows 48%
- In-Line Storage Systems
- Waterway Protection Tunnel for wet weather management (currently under construction)

A breakdown of the major collection components by sewershed is presented in Table 5-1.

Table 5-1: Inventory of Wastewater Collection System by Sewershed

WQTC SEWERSHED	MANHOLES	GRAVITY SEWERS (FT)	PUMP STATIONS	FORCE MAINS (FT)
Morris Forman	41,315	9,055,643	94	325,109
Derek R. Guthrie	21,184	4,777,509	41	75,831
Hite Creek	5,089	963,949	51	190,596
Floyds Fork	5,256	966,863	34	125,576
Cedar Creek	5,998	1,114,183	36	136,648
Total	**78,842**	**16,878,147**	**256**	**853,760**

5.1 Wet Weather Storage

Under the Amended Consent Decree, MSD constructed the wet weather storage facilities listed in Table 5.2. These systems are consistent with the USEPA's Nine Minimum Controls (NMC) Program that requires utilities to maximize storage within the collection system. Many of MSD's wet weather storage facilities are operated using real-time control (RTC) to optimize available flow and storage capacities within the wastewater collection system.

A summary of MSD's wet weather storage systems is presented in Table 5-2. These systems are preventing billions of gallons of sewer overflows from occurring. In FY19 nearly 2 billion gallons of flow was stored in the system and later treated – in lieu of resulting in unauthorized discharges. In FY20, through March 31st, nearly 1.3 billion gallons have been stored and subsequently treated. These systems are proving to be very effective with managing wet weather flows.

Table 5-2: Wet Weather Storage Systems

Wet Weather Storage and Real Time Control	Capacity (MG)	Date Storage On-line	FY19 Volume Stored (MG)	FY20 Volume Stored* (MG)
Southwestern Pump Station Sluice Gates Chamber (SWSG)	14.25	2006	484.85	267.65
Southwest Outfall Retention Basin #2 (SWOR2)	4.1	12/31/2008	151.75	67.65
Brady Lake & Executive Inn Storage Basin (Upper Dry Run Trunk System)	21.5	2006	278.85	221.15
Ashland In-Line Storage Facility	1.0	2008 Upgraded 2019	361.45	15.8
Southern Outfall In-Line Storage @43rd Street (SOR1)	14.05	11/30/2018	29.75	272.85
Ohio River Interceptor (MDS)	1.8	2008	205.85	69.25
Sneads Branch In-Line Storage	2.5	9/30/2006	56.85	19.65
Logan & Breckinridge Street CSO Basin	17	12/20/2017	317.55	234.3
Nightingale Pump Station Replacement & Storage (NGPS)	8.0	6/30/2017	11.4	21.85
Clifton Heights CSO Storage Basin	6.9	12/21/2018	13.6	44
Southwestern Parkway Storage Basin	17.5	3/29/2019	0	45
Portland CSO Basin	6.7	8/30/2019	0	0
Total	**115.3**		**1,911.9**	**1,279.15**
Waterway Protection Tunnel	52.2	Future	0	0
Idlewood Inline Storage	TBD	Future	0	0

**FY20 Volume Stored July 1, 2019 through March 31, 2020.*

5.2 Service Area

By Kentucky state statute, MSD is authorized to provide wastewater collection, treatment, and disposal services in Jefferson County. Through interlocal agreements, MSD also provides these services to portions of Oldham County and small parts of Bullitt County (refer to Figure 5-1). This area includes approximately 270 square miles and serves approximately 243,000 customers.

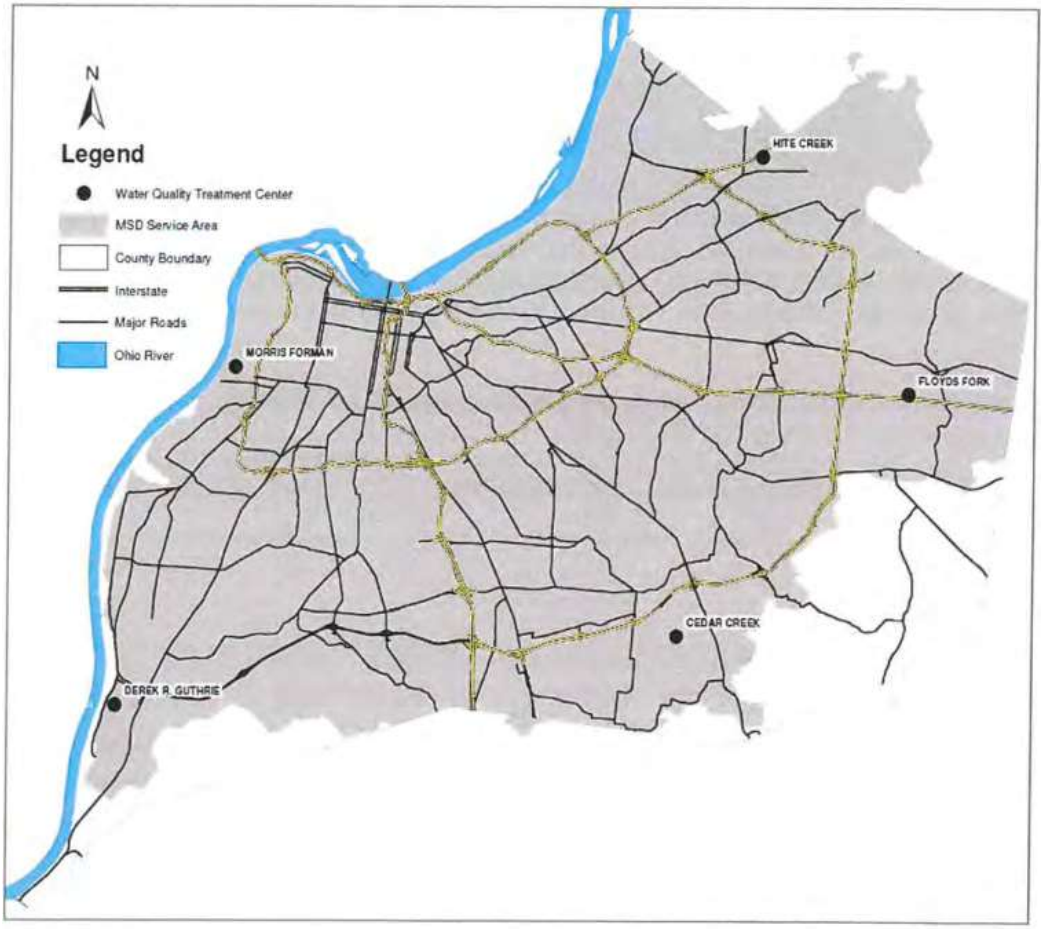

Figure 5-1: MSD's Wastewater Service Area

5.3 Regulatory Requirements

MSD is required to comply with the regulations listed in Table 5-3 related to wastewater systems as referenced in the Kentucky Revised Statutes (KRS).

Table 5-3: Federal and State Applicable Wastewater Regulations

Reference	Title	Description
401 KAR 5:050, 5:060; 5:065 KRS 224.16-050	Permits and Planned Changes	Establishes fees and procedures to obtain a permit and criteria for alterations or additions that must obtain a permit.
401 KAR 5:005	Permits to construct, modify or operate a facility	Establishes when permits are required for construction, of sewer line extensions & defines application submittals and fees.
401 KAR 5:006	Wastewater Regional Planning Requirements	Defines requirements for Regional Facility Plan to construct new infrastructure to serve 30% more of the population.
401 KAR 5:010 401 KAR 11:030 KRS 224.73-110	Operation of Wastewater Systems by Certified Operators	Establishes requirements for certification of collection system operations staff. Specifies Operator in Training Program requirements.
401 KAR 5:015	Releases to be Reported	Establishes reporting requirements for certain releases, spills, and bypasses of pollutants into the environment.
401 KAR 5:065 KRS 224.99-010	Monitoring & Records	Establishes information retainage requirements for monitoring and performance records.
401 KAR 5:055 KRS 224.70-110 40 CFR Part 403	Pretreatment Requirements	Establishes pretreatment requirements as part of the Kentucky Pollutant Discharge Elimination System (KPDES). Provides for the protection of domestic wastewater facilities from pass through or interference from pollutants contributed by industrial users of the domestic wastewater facility.
401 KAR 5:320	Wastewater Laboratory Certification Program	Defines the minimum laboratory quality assurance, methodological and reporting requirements.
KRS 224.73-120	Monitor/Report Introduction of Incompatible Pollutants	Authorizes application of monitoring, record keeping, and reporting requirements of pollutants which interfere with, pass through, or are otherwise incompatible with WQTC.

5.3.1 Metro Government Local Ordinances Related to Wastewater Collection

MSD is required to comply with the following local regulations related to the wastewater collection system.

- **Sewerage Plan Review and Inspection**. Louisville Metro Government Code of Ordinances, Title V, Chapter 50.06
- **Capacity Charge**. Louisville Metro Government Code of Ordinances, Title V, Chapter 50.45-48.
- **Engineering Standards**. Louisville and Jefferson County MSD Design Manual.

5.3.2 IOAP/Consent Decree Work

As has been noted throughout this report, much of MSD's annual capital program has been focused on the Consent Decree Requirements. The following projects were completed since the 2017 bonds were issued. The Waterway Protection Tunnel was under construction and has required significant capital investment to-date.

Table 5-4: Consent Decree Projects Completing Design/Construction Since 2017

Program	Budget ID	Project	Task Name	Finish	Lifetime Actuals
Sewer Separation Projects	H20215	Camp Taylor 2A SSR - Union St Sewers	Construction Finish	2/16/2020	$41,676
Wet Weather Storage Capacity & Real Time Control Projects	H09125	Portland CSO Basin	Construction Finish	8/9/2019	$37,829,646
	D17047	MF Brady Lake and Executive Inn Gate Study	Study Finish	7/25/2019	$37,992
	H09132	Southwestern Parkway Storage Basin	Construction Finish	5/10/2019	$80,623,143
	H09123	Clifton Heights Storage Basin	Construction Finish	11/15/2018	$33,934,464
	H09133	Waterway Protection Tunnel	Construction In-Progress		$113,500,000
				TOTAL CONSENT DECREE PROJECTS	**$265,966,921**

5.3.3 Remaining IOAP/Consent Decree Work

The cost of the capital improvements required to be completed under the Amended Consent Decree is currently estimated to be $1.5 billion of which MSD has spent $1.01 billion as of April 30, 2020.

During the 5-year CIP, construction for the Waterway Protection Tunnel will be completed. The remaining SSDP projects will be phased over time. The specific timing for each remaining project is currently under discussion with the federal and state Regulators. The remaining Consent Decree work to be completed includes the following projects.

- **Waterway Protection Tunnel ($55 million remaining):** The last Long-Term Control Plan project (Waterway Protection Tunnel) remains under construction with an estimated completion date in FY22. The following LTCP projects are nearly completed:
    - I-64 and Grinstead CSO Interceptor
    - Lexington and Payne CSO Interceptor
    - Rowan Pump Station & Downtown CSO Interceptor

- **Sanitary Sewer Discharge Plan (SSDP) Projects ($144 million remaining):** MSD must complete several remaining projects identified in the SSDP. The schedule for completion of these projects is currently under discussion with the Regulators given other urgent needs that have developed over the past few years related to Biosolids Management and the Ohio River Flood Protection System. The following SSDP projects have yet to be completed:

    - ***Sewer Projects***
        - Little Cedar Creek Interceptor Improvements
        - Dell Road and Charlaine Parkway Interceptor Improvements
        - Sutherland Interceptor

    - ***Storage Projects***
        - Idlewood Inline Storage
        - Gunpowder Pump Station In-Line Storage
        - Lucas Lane Pump Station Inline Storage
        - Goose Creek Pump Station Storage

    - ***Pump Station Projects***
        - Raintree Court & Marian Court Pump Station Eliminations Phase 1A
        - Bardstown Road Pump Station Improvements
        - Cinderella Pump Station Elimination
        - Kavanaugh Road Pump Station Improvements
        - Leven Pump Station Elimination
        - Monticello Pump Station Elimination
        - Mellwood System Pump Station Eliminations
        - Upper Middle Fork Pump Station

- **Upper Middle Fork Pump Station ($86 million remaining):** The largest remaining SSDP project is the Upper Middle Fork bundle. This project includes replacement of the existing Upper Middle Fork Pump Station, which has a current capacity of 9 mgd, with a new efficient 30 mgd pump station. A relief interceptor will convey flows in excess of the current interceptor capacity, and a diversion gate will be installed on the existing interceptor to force flows into the pump station. This timing for completing this project is under discussion with the Regulators.

- **IOAP Support Projects (approximately $2 million per year):** Annual support for post construction compliance monitoring and external resources to assist with IOAP modifications is included in this investment.

5.4 Wastewater Collection System Programs

MSD administers and manages several programs related to the wastewater collection system. The key programs are summarized herein.

5.4.1 Capacity, Management, Operations and Maintenance (CMOM) Program

MSD's Consent Decree requires implementation of a CMOM Program including major renewal and replacement projects at the Hite Creek, Floyds Fork, Cedar Creek, and Derek R. Guthrie WQTCs to ensure MSD can maintain effective wastewater collection, transmission, and treatment. The CMOM Program provides proactive asset management of sewers, pump stations, and major interceptors that make up most of MSD's collection system. CMOM compliance is required as a component in each WQTC's KPDES permit with the following stated comprehensive CMOM Program goals:

- To better manage, operate, and maintain the collection system
- Investigate capacity constrained areas of the collection system
- Proactively prevent or minimize SSOs
- Respond to SSO events
- Proactively prevent or minimize the potential for release of pollutants

5.4.2 Industrial Pretreatment Program

MSD is the administering agency for the Metro Louisville Hazardous Materials Ordinance (HMO) and the approval authority for Hazardous Material Spill Prevention and Control (HMPC) Plans mandated by this ordinance. This ordinance was created for the protection of public health and safety in Louisville Metro, through the prevention and control of hazardous materials incidents and releases and the timely reporting of releases. The ordinance has been incorporated into MSD's Industrial Pretreatment Program which has the following objectives:

- Protect the Water Quality Treatment Centers and sewer collection system
- Protect the health and safety of MSD workers and general public
- Protect the waterways
- Prevent violations of permits
- Enhance biosolids reuse and water reclamation

The Industrial Pretreatment Program is subdivided into the following programmatic areas:

- **Fats, Oils and Grease (FOG) Program**: MSD's FOG Management Policy requires Food Service Establishments to use grease traps and/or grease interceptors to prevent FOG clogs. These devices must be certified annually by an MSD approved Certified Grease Waste Hauler or Plumber.

- **Dental Amalgam Program**: designed to reduce the amount of toxic metals entering the sanitary sewer system. MSD requires all dental facilities that discharge into the sanitary sewer system to complete a one-time compliance report for dental dischargers.

- **Unusual Discharge Request (UDR) Program**: Any short-term one-time discharge to the sewer system requires approval through MSD's UDR Program. The program gives MSD control over the type and characteristics of the wastewater being discharged to ensure that contaminants that might cause problems at the treatment plants are not allowed to enter the sewer system.

- **Pretreatment Requirements Review and Modification**: The Nine Minimum Control Program reviews and modifies business and industry wastewater pretreatment requirements in order to minimize the impacts of non-domestic dischargers on CSOs.

5.4.3 Nine Minimum Controls Program

MSD's Consent Decree requires compliance with the USEPA NMC Program that was initially developed as part of the Clean Water Act CSO Policy to address combined sewer system best management practices that do not require significant construction. NMC projects tend to be technology based. NMC programmatic compliance is required in the Morris Forman WQTC KPDES Permit. The 20-year CRRP includes projects focused on NMC including 1) real-time control (RTC) of assets in the combined sewer system and 2) capacity upgrades for WQTCs to maximize the flow able to be received and processes at the treatment plants.

The 5-year CIP includes projects for NMC including: annual as-needed appropriations for NMC improvements, CSO inspection cameras, and RTC refinements.

NMC #3 – Maximize Collection System Storage

- SGC RTC Enhancements Project
- NMC RTC Support, $2.4 million (as-needed annual appropriations)
- NMC Program Support, $690,000 (as-needed annual appropriations)

NMC # 4 – Maximize Flow to WQTC

- CCWQTC Expansion
- HCWQTC Expansion

NMC # 9 – Monitor CSO Controls

- NMC CSO Inspection Cameras, $445,000 (as-needed annual appropriations)

5.4.4 Sewer Asset Management Program

Asset management programs are required to ensure assets perform as intended and are available when needed. While the Consent Decree focused on constructing new assets to address wet weather and mitigate resulting overflows, asset management focuses on minimizing the risk of failure for existing assets. USEPA

recognizes the importance of asset management and requires utilities to comply with programs intended to keep existing infrastructure fit for purpose.

Sewers represent some of the oldest components of the wastewater system. Some of MSD's sewers are 150 years old. MSD utilizes an industry-standard risk scoring system for the sewers. In total MSD estimates $2.2 billion is needed to address all sewer rehabilitation and known structural deficiencies.

MSD is focusing on large diameter interceptors for rehabilitation. Significant major interceptor failure has occurred in the past two years due to severe deterioration of large pipe segments. USEPA noted in its 2019 Inspection Report[6] that MSD had 12 major pipe collapses in a 15-month period. In addition to the Large Diameter Interceptor Rehabilitation Program, MSD continues to improve sewers and pump stations throughout the District.

5.4.5 Planning Initiatives

The 5-year CIP includes the following planning initiatives related to the wastewater collection system. These plans will be utilized to implement a comprehensive asset management program, prioritize capital needs, and update the CRRP.

- Odor Management Plan, $250,000
- SCADA Master Plan, $796,000
- Wastewater Pump Stations Facility Asset Management Plan, $750,000

5.5 Wastewater Collection System Capital Projects

MSD continues to fund wastewater collection projects with its annual CIP. Projects are generally a combination of discrete local improvements and appropriations for District-wide needs/services.

5.5.1 Projects Funded from Program Notes

Projects completed since the 2017 bond issuance have addressed both sewer and pump station needs. The largest project, the Ohio River Interceptor Structural Rehabilitation Project, necessitated expensive sewer repairs and replacement for portions of the major interceptor that failed in downtown Louisville.

[6] United States Environmental Protection Agency, Region 4, Water Protection Division, NPDES Permitting and Enforcement Branch, Compliance Evaluation Inspection Report, Louisville & Jefferson County Metropolitan Sewer District, June 25, 2019.

Table 5-5: Wastewater Collection Projects Completing Design/Construction Since 2017

Program	Budget ID	Project	Task Name	Finish	Lifetime Actuals
Real Time Control Facilities	F16003	Ashland RTC Facility Upgrades	Construction Finish	6/25/2019	$469,839
Pump Stations	H20153	SWPS Flood Repair	Design Finish	1/14/2020	$79,852
	E15033	Shively Pump Station Generator Replacement	Construction Finish	10/30/2019	$1,723,284
	D19275	MDS Downstream Flow Meter	Design Finish	9/17/2019	$251,121
	H19288	Terra Crossing Pump Station Upgrades	Construction Finish	6/30/2019	$13,361
	G18326	Catalpa Farms PS Odor Control Evaluation	Evaluation Finish	3/8/2019	$22,009
	F19234	Breakwater PS Electrical Modifications	Construction Finish	12/27/2018	$15,717
	A18324	Oreland Mill Pump Station Elimination	Construction Finish	5/2/2019	$294,952
Sewers	D18285	ORFM Odor and Corrosion Control	Design Finish	3/3/2020	$289,231
	H19142	Upper Floyds Fork Interceptor	Design Finish	2/4/2020	$232,887
	H16074	Nightingale Rehab	Design Finish	10/8/2019	$427,268
	A16073	Mud Lane Interceptor	Design Finish	8/6/2019	$1,490,854
	H19247	I-64 and Grinstead CSO Interceptor	Design Finish	4/2/2019	$5,396,037
	A18353	Ohio River Interceptor Structural Rehabilitation	Construction Finish	12/15/2018	$18,442,150
TOTAL WASTEWATER COLLECTION PROJECTS					**$29,148,562**

5.5.2 5-Year CIP for Wastewater Collection System

The following priorities are forecasted in the 5-year CIP to address deficiencies and mitigate risks for the wastewater collection system totaling $182 million. A breakdown of the projects is provided in Figure 5-2 and Table 5-6.

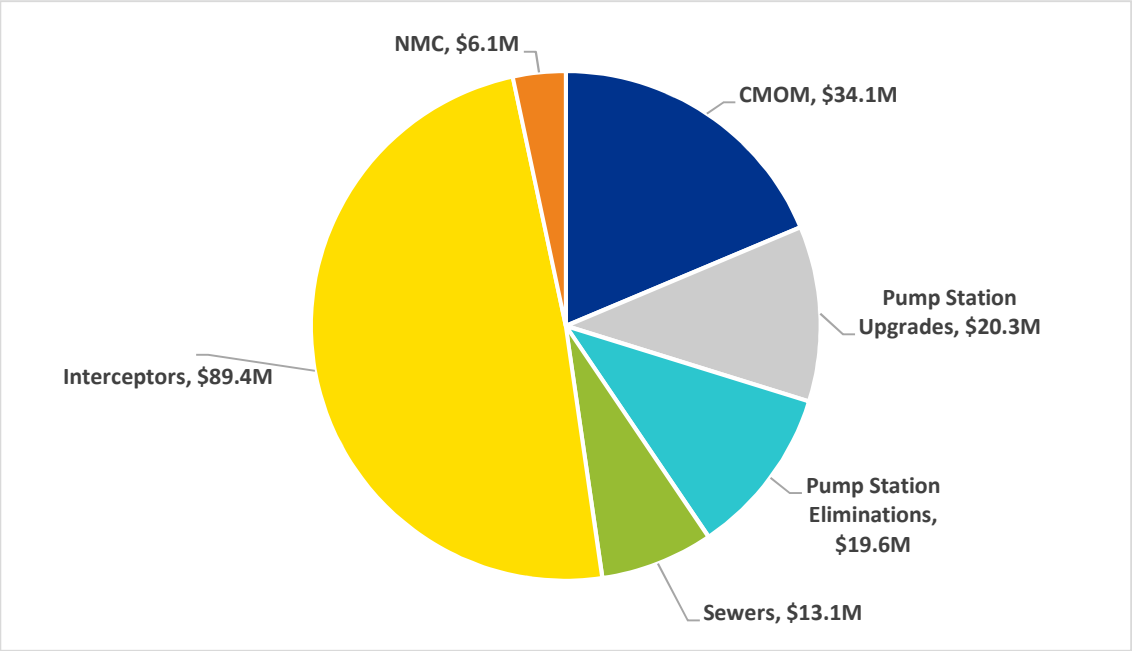

Figure 5-2: Summary of 5-Year CIP for Wastewater Collection System

Table 5-6: Overview of 5-Year Forecasted Spending for Wastewater Collection System

Wastewater Collection System Priorities		5-Year CIP Forecasted Spending
Pump Station Projects	Enhanced Odor Control for Pump Stations	**CMOM Program Pump Stations $18.8 million**
	Back-Up Power for Critical Pump Stations	
	Inventory for Critical Pump Stations	
	Upgrade Critical Pump Stations with	
	CMOM Collection System Pump R&R	
	CMOM Grinder R&R	
	CMOM I&C Implementation	
	CMOM Pump Station Generator Upgrades	
	Asset Management Pump Stations R&R	**Pump Station Improvements $20.3 million**
	PS Replacement or Overhaul Projects	
	Northern Ditch Pump Station Replacement & Odor Control	
	Prospect Phase II PS Rehabilitation	
	Shively Area Suite PS Upgrades	
	Sneads Branch Pump Replacement	
	Southwestern Pump Station Improvements	

Wastewater Collection System Priorities		5-Year CIP Forecasted Spending
	Bluegrass Fields PS Renovation	
	Admiral Way PS Foundation Repairs	
Sewer Projects	Gravity Line Cleaning and Inspection	**CMOM Program Sewers $15.3 million**
	Program Management Assistance	
	CMOM SCAP, AAM, & FOG Programs	
	Operations R&R	
	Broadfern Pump Station Elimination	**Pump Station Eliminations $19.6 million**
	Gorham Way Pump Station Elimination	
	Kirby Lane Pump Station Elimination	
	Lake Forest Pump Station Eliminations	
	Lea Ann Way Pump Station Eliminations	
	Modesto Pump Station Elimination	
	Pirogue Pump Station Elimination	
	Shady Villa Pump Station Elimination	
	Shively Area Suite Pump Station Eliminations	
	Rehl Road East SSES	**Sewer Projects $13.1 million**
	Harrods Creek Force Main Repair	
	KTC Greenwood Road Assessment	
	Middle Fork Beargrass Creek SSR Phase 1	
	ORFM Odor and Corrosion Control	
Large Diameter Interceptor Projects	Broadway Interceptor Rehabilitation	**Interceptor Rehabilitation Projects $89.4 million**
	Buechel Branch Interceptor Rehabilitation	
	I-64 and Grinstead Interceptor Rehabilitation	
	Interceptors Rehabilitation and Replacement	
	Western Outfall Infrastructure Rehabilitation	
	Large Diameter Interceptor Rehabilitation Program	
	Nightingale Interceptor Rehabilitation	
	Rudd Avenue Sewer Rehabilitation	
Nine Minimum Control Projects	CSO Inspection Cameras	**NMC Projects $6.2 million**
	RTC Support Services	
	SGC RTC Enhancements	
	Total 5-Year CIP Forecast for Wastewater Collection System	**$182.7 million**

Note: excludes projects listed in the Consent Decree

6. Wastewater Treatment

MSD was formed in 1946, and the first treatment plant went into operation in 1958. MSD's Southwestern Outfall Pump Station went online in 1959 and pumped wastewater from the system's largest sewer to the first wastewater plant (Morris Forman). Although the 1964 Countywide Sewer Master Plan specified new treatment plants, a lack of financing for large treatment plants and their associated trunk sewers delayed their construction. As such septic systems and package treatment plants were constructed and/or installed by land developers and homeowners through the mid-1970s. By mid-1972, there were more than 300 small treatment plants in Jefferson County. In 2016, MSD decommissioned the final remaining package treatment facility leaving five regional water quality treatment centers (WQTC) to serve all of Louisville and Jefferson County. Elimination of these facilities in conjunction with removing 40,000 septic systems has helped improve the quality of local streams and the Ohio River. A summary of MSD's existing treatment facilities provided below.

- **Cedar Creek WQTC**: The Cedar Creek WQTC was originally constructed in 1995 with a capacity of 2.2 mgd. In 2005, the plant capacity was expanded to 7.5 mgd average daily flow (ADF). Today, approximately 5 mgd of flows are treated and disinfected (UV) before being released into Cedar Creek.

- **Derek R. Guthrie WQTC**: The original facilities at the Derek R. Guthrie WQTC site consisted of a screening chamber and a raw sewage pump station brought online in 1979. The secondary treatment facilities were brought online in 1986 when the WQTC was known as the West County Wastewater Treatment Plant. The WQTC had a capacity of 15 mgd with peak flow of 30 mgd. Plants expansions in 2001 and 2004 increased the ADF capacity to 30 mgd. In 2012 additional facilities enabled the WQTC to treat up to 200 mgd of wet weather flow using a modified contact stabilization process. Further improvements have since been constructed to increase plant capacity to 60 mgd ADF and 300 mgd peak (for short durations). MSD began construction of a new dewatering facility in 2019 to receive biosolids from all the regional WQTCs. Construction is scheduled for completion in FY22. Today approximately 40 mgd of flows are treated and disinfected (sodium hypochlorite) before being released into the Ohio River.

- **Floyds Fork WQTC**: The Floyds Fork WQTC was originally constructed in 2001 at a capacity of 3.25 mgd. In 2012, a major plant expansion increased capacity and added sludge holding tanks. Today approximately 3.5 mgd of flows are treated and disinfected (UV) before being released into Floyds Fork.

- **Hite Creek WQTC**: The Hite Creek WQTC was originally constructed in 1970 with a capacity of 2.2 mgd to serve the Ford truck assembly plant and its surrounding neighborhoods. The capacity of the treatment center was expanded to 6.6 mgd to eliminate sanitary sewer overflows upstream of

the treatment center and allow for future growth. The WQTC is under construction to expand its capacity to 9 mgd ADF and 24 mgd peak flow. Construction is scheduled for completion in FY22. Today approximately 4.4 mgd of flows are treated and disinfected (UV) before being released into Hite Creek.

- **Morris Forman WQTC**: The Morris Forman WQTC was originally constructed in 1956 for preliminary and primary treatment and was referred to as the Fort Southworth Plant. It was designed to receive a maximum daily flow of 105 mgd and peak hour flow of 338 mgd. Secondary treatment facilities were installed in the 1970s in accordance with federal regulations. The plant was named after MSD's retired executive director. Plant upgrades in late 1990s and early 2000s improved performance and increased treatment capacity to its current level of 120 mgd with peak flow capacity of 350 mgd. Today approximately 100 mgd of flows are treated before being released into the Ohio River. The Morris Forman WQTC is the largest facility in Kentucky and treats over 70% of the wastewater generated in MSD's service area; including the entire combined sewered area.

- **Bells Lane WWTF**: The Bells Lane WWTF was brought online in 2017. The project converted an existing 105 mgd dry-pit pump station to a 160 mgd submersible pump station and added 1) screening and grit facilities; 2) 50 mgd high rate treatment basin to provide chemically-enhanced primary sedimentation; 3) disinfection/dechlorination; and 4) 25 MG equalization basin.

6.1 Service Area

As noted, MSD owns five WQTCs and one WWTF as shown in Figure 6-1.

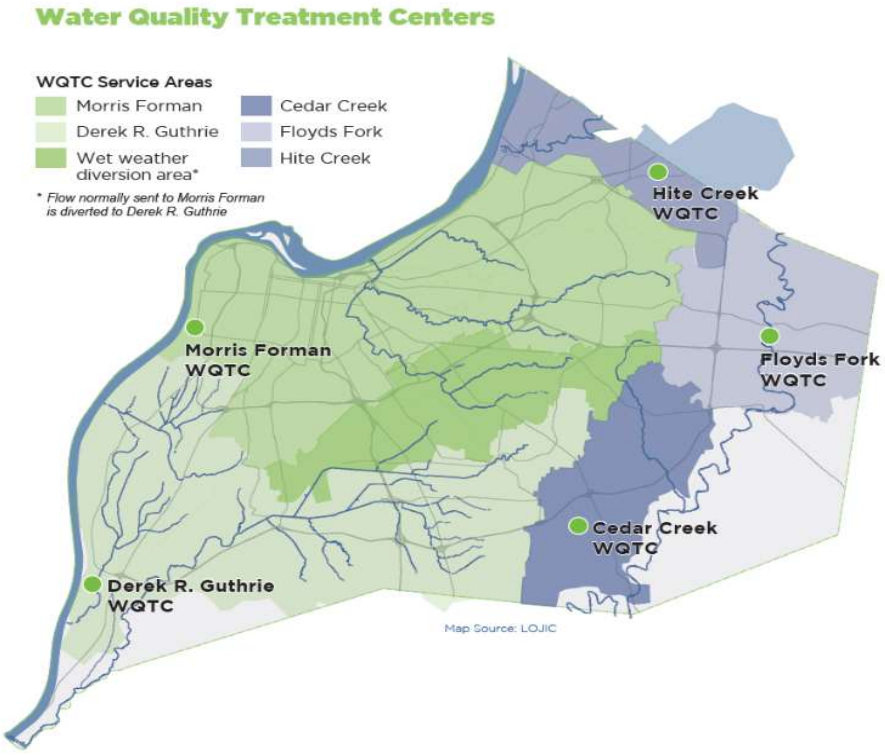

Figure 6-1: MSD's Water Quality Treatment Centers Service Areas

6.2 Regulatory Requirements

The District is required to comply with the regulations listed in Table 6-1 related to wastewater treatment systems as referenced in the Kentucky Revised Statutes (KRS).

Table 6-1: Federal and State Applicable Wastewater Treatment Regulations

Reference	Title	Description
KRS 224.16-050	Permits and Planned Changes	Establishes fees and procedures to obtain a permit and criteria for alterations or additions that must obtain a permit.
KRS 224.70-130 401 KAR 5:080	Criteria & Standards for KPDES	Establishes criteria and fees for permit to discharge into waters of the Commonwealth.
401 KAR 5:005	Permits to construct, modify or operate a facility	Establishes when permits are required for construction, of sewer line extensions, WQTC improvements, or new discharges & defines application submittals and fees.

Reference	Title	Description
401 KAR 5:006	Wastewater Regional Planning Requirements	Defines requirements for Regional Facility Plan to construct new WQTC, expand existing WQTC by 30%, or serve 30% more of the population.
401 KAR 5:010 **401 KAR 11:030** **KRS 224.73-110**	Operation of Wastewater Systems by Certified Operators	Establishes requirements for certification of domestic wastewater treatment plant and collection system operations staff. Specifies Operator in Training Program requirements.
401 KAR 5:015	Releases to be Reported	Establishes reporting requirements for certain releases, spills, and bypasses of pollutants into the environment.
401 KAR 5:026	Designated Uses of Surface Waters	Establishes surface water designations of creeks and rivers and the associated water quality criteria.
401 KAR 5:029 **401 KAR 5:031** **401 KAR 10:030**	Antidegradation Policy Surface Water Standards	Establishes water quality criteria.
401 KAR 5:035 **401 KAR 5:045** **401 KAR 5:060**	Treatment Requirements and Compliance	Establishes minimum treatment requirements for domestic wastewater facilities and associated water quality sampling frequency.
401 KAR 5:065 **KRS 224.99-010**	Monitoring & Records	Establishes information retainage requirements for monitoring and performance records.
401 KAR 5:055 **KRS 224.70-110** **40 CFR Part 403**	Pretreatment Requirements	Establishes pretreatment requirements as part of the Kentucky Pollutant Discharge Elimination System (KPDES). Provides for the protection of domestic wastewater facilities from pass through or interference from pollutants contributed by industrial users of the domestic wastewater facility.
401 KAR 5:320	Wastewater Laboratory Certification Program	Defines the minimum laboratory quality assurance, methodological and reporting requirements.
KRS 224.73-120	Monitor/Report Introduction of Incompatible Pollutants	Authorizes application of monitoring, record keeping, and reporting requirements of pollutants which interfere with, pass through, or are otherwise incompatible with WQTC.
401 KAR 45 **40 CFR 503**	Sludge Disposal	Establishes procedures and requirements for disposal of biosolids.
401 KAR 52:020	Title V Air Permits	Establishes requirements for air contaminant sources located in Kentucky that are required to obtain a Title V permit.

6.2.1 Metro Government Local Ordinances Related to Wastewater Treatment

MSD is required to comply with the following local regulations related to the wastewater treatment:

- **Engineering Standards**. Louisville and Jefferson County MSD Design Manual.

6.2.2 Morris Forman WQTC Agreed Order

The Morris Forman WQTC experienced multiple non-compliance events due in part to 1)a lightning strike and 2) accelerated deterioration of the biosolids system. MSD is working with the KDEP to develop/execute a Corrective Action Plan (CAP) to address the deficiencies at the plant that are contributing or have the potential to contribute to permit exceedances. The projects included in the 5-Year CIP that have been suggested as candidates for the CAP are listed in Table 6-2.

Table 6-2: MFWQTC Projects Under Agreed Order CAP Consideration

MFWQTC Treatment Process	Morris Forman Agreed Order Projects	Estimated Completion Date
Primary Treatment	D17042 | MFWQTC Sedimentation Basin Rehabilitation	June 30, 2024
	D19227 | MFWQTC Primary Sludge Line Replacement	July 31, 2020
	New_BD096 | MFWQTC Primary Sludge Line Replacement Phase 2	June 30, 2022
Secondary Treatment	D18160 | MFWQTC Secondary Clarifiers Structural Repairs	June 30, 2024
	D20229 | MFWQTC Clarifier Floor Repairs	January 31, 2021
Disinfection	D18159 | MFWQTC HPO Tanks Structural Repairs	June 30, 2024
	D18161 | MFWQTC Chlorine Contact Tanks Structural Repairs	June 30, 2024
Final Effluent Pump Station (FEPS)	D18130 | MFWQTC FEPS MCC Replacement	June 30, 2021
	D18162 | MFWQTC FEPS Structural Repairs	June 30, 2024
	D19307 | MFWQTC FEPS VFD Replacement	Sept 30, 2020
	Multiple | MFWQTC FEPS Pump and Motor Repair	June 30, 2024
Biosolids	D18158 | MFWQTC Digester Control Building Structural Repairs	June 30, 2024
	D19045 | MFWQTC Sodium Hypochlorite Building Relocation	Dec 31, 2022
	D20228 | MFWQTC Centrifuge Replacement/Rehabilitation	August 31, 2020
	D20285 | MFWQTC LG Dryer Replacements	November 5, 2021
	D20284 | DRGWQTC Dewatering	October 5, 2021
	D20249 | District-Wide Biosolids Master Plan	Completed
	H14126 | HCWQTC Dewatering Improvements	January 21, 2022
	D20291 | DRGWQTC Phase 1 Dewatering	January 4, 2021
Other	New_BD106 | MFWQTC Asset Management Plan	Dec 31, 2021
Electrical	D18156 | MFWQTC Service & Blower Building Structural Repairs	June 30, 2022
	D20167 | MFWQTC East Headworks HVAC	October 29, 2020

6.3 WQTC Performance

The primary driver for capital improvements at the WQTCs is having the ability to reliably comply with permitted requirements. The following information summarizes the performance of MSD's WQTCs.

6.3.1 WQTC Permitted Capacity

MSD's active WQTC permits are listed in Table 6-3. The Morris Forman WQTC has been operating under the 2004 KPDES permit via an Administrative Order. All other WQTC permits have been updated.

Table 6-3: Water Quality Treatment Center Capacities

WQTC Facility	Average Day Capacity (MGD)	Peak Hour Capacity (MGD)	KPDES Permit Number	Permit Expiration Date	Receiving Water
Cedar Creek WQTC	7.5	N/A	KY0098540	August 31, 2020*	Cedar Creek
Derek R. Guthrie WQTC	60	300	KY0078956	April 30, 2023	Ohio River
Floyds Fork WQTC	6.5	N/A	KY0102784	August 31, 2020*	Floyds Fork
Hite Creek WQTC	6	16	KY0022420	March 31, 2023	Hite Creek
Morris Forman WQTC	120	350	KY0022411	September 30, 2004	Ohio River
Total	**200**	**666**			

*MSD submitted permit renewal applications for the Cedar Creek WQTC and Floyds Fork WQTC to KDEP on March 31, 2020. Both submittals have been approved as administrative complete by the Division of Water.

6.3.2 WQTC Permitted Effluent Quality

All five wastewater plants use similar treatment processes to meet the discharge requirements established for the waterways adjacent to each WQTC. The effluent requirements are presented in Table 6-4.

Table 6-4: WQTCs Permitted Effluent Limitations

Parameter	CCWQTC		DRGWQTC		FFWQTC		HCWQTC		MFWQTC	
	Monthly Average	Max Week Avg	Monthly Average	Max Week Avg	Monthly Average	Max Week Avg	Monthly Average	Max Week Avg	Monthly Average	Max Week Avg
$CBOD_5$, mg/L	10	15	N/A	N/A	6	9	N/A	N/A	N/A	N/A
BOD_5, mg/L	N/A	N/A	30	45	N/A	N/A	10	15	30	45
TSS, mg/L	30	45	30	45	30	45	30	45	30	45
Ammonia, mg/L May-Oct	4	6	20	30	1	1.5	2	3	20	30
Ammonia, mg/L Nov-Apr	10	15	20	30	3	4.5	5	7.5	20	30
E. Coli, #/100 ml[1]	130	240	130	240	130	240	N/A	N/A	N/A	N/A
Total Phos. mg/L, May-Oct	1.0	1.5	N/A	N/A	0.5	0.75	1.0	1.5	N/A	N/A
Total Phos. mg/L, Nov-Apr	2.0	3.0	N/A	N/A	0.5	0.75	2.0	3.0	N/A	N/A
Total Residual Chlorine, mg/L	N/A	N/A	0.019	0.019	N/A	N/A	N/A	N/A	N/A	0.019
Fecal Coliform #/100	N/A	N/A	N/A	N/A	N/A	N/A	200	400	200	400

1. *Expressed as 30-day geometric mean and 7-day geometric mean*
2. *pH limits are 6.0 minimum and 9.0 maximum*

6.3.3 Historical Wastewater Flows

The amount of flow processed at the WQTCs is dependent upon the volume of stormwater entering the combined sewer system. Over the past five years, MSD has processed an average of 150 mgd collectively through all the WQTCs. MSD treated more than 281 billion gallons of flow during 2015-2019.

Table 6-5: Historical Wastewater Flows

WQTC	2015 Flow		2016 Flow		2017 Flow		2018 Flow		2019 Flow	
	Monthly Average (mgd)	Total Flow Treated (MG)	Monthly Average (mgd)	Total Flow Treated (MG)	Monthly Average (mgd)	Total Flow Treated (MG)	Monthly Average (mgd)	Total Flow Treated (MG)	Monthly Average (mgd)	Total Flow Treated (MG)
CCWQTC	4.4	1,477	5.2	1,896	5.2	1,899	6.4	2,332	7.0	2,562
DRGWQTC	42.3	15,482	35.0	12,758	35.4	13,048	49.5	17,946	46.0	16,698
FFWQTC	2.9	1,069	3.1	1,112	3.2	1,179	4.1	1,473	4.6	1,673
HCWQTC	4.8	1,552	4.8	1,773	4.4	1,587	4.7	1,701	4.6	1,655
MFWQTC	99.8	36,471	90.1	32,908	87.6	31,937	113.1	40,948	106.4	38,002
	154.2	**56,052**	**138.2**	**50,446**	**135.8**	**49,650**	**177.8**	**64,399**	**168.6**	**60,590**

Values represent calendar years (not fiscal years) taken from Discharge Monitoring Reports submitted to KDEP.

The impact of weather on the collective total WQTC flows is demonstrated in Figure 6-2. Daily maximum flows can be 2.5 times higher than the monthly average flow.

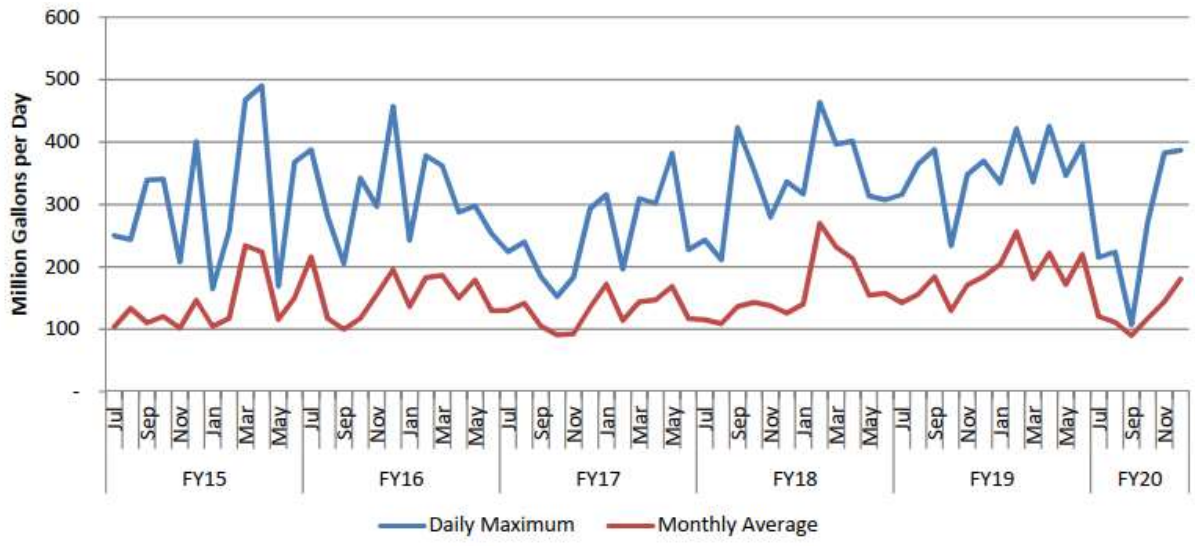

Figure 6-2: Historical Collective Flows from All WQTCs

Given the Derek R. Guthrie and Morris Forman WQTCs receive flow from the combined sewer system, they are most susceptible to high peak flows due to wet weather. The "wet season" impact is more clearly demonstrated for the Morris Forman WQTC in Figure 6-3.

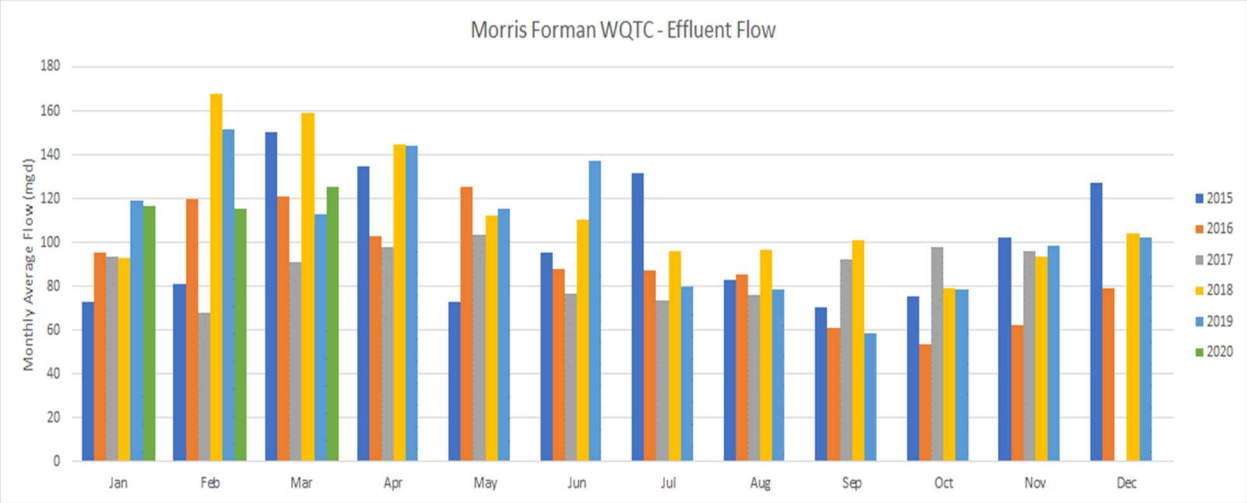

Figure 6-3: Comparison of Monthly Flow from 2015 – 2020 for Morris Forman WQTC

6.3.4 Historical Wastewater Loads

As shown in Table 6-6, excluding the Morris Forman WQTC, MSD has successfully met permit conditions for its WQTCs. In September 2018, there was an exceedance of the maximum weekly average BOD concentration.

Table 6-6: Historical Wastewater Loads – Annual Average BOD

WQTC	Permit Limits (Monthly Average, Max Weekly Average)	2015 BOD		2016 BOD		2017 BOD		2018 BOD		2019 BOD	
		Monthly Average (mg/L)	Max Weekly Average (mg/L)	Monthly Average (mg/L)	Max Weekly Average (mg/L)	Monthly Average (mg/L)	Max Weekly Average (mg/L)	Monthly Average (mg/L)	Max Weekly Average (mg/L)	Monthly Average (mg/L)	Max Weekly Average (mg/L)
CCWQTC	(10 mg/L, 15 mg/L)	2.7	6	2.6	5	2.8	5	2.9	10	3.0	6
DRGWQTC	(30 mg/L, 45 mg/L)	10.3	24	8.4	17	11.2	23	13.0	25	11.3	27
FFWQTC	(6 mg/L, 9 mg/L)	2.8	7	2.7	5	3.6	7	3.5	21	3.0	7
HCWQTC	(10 mg/L, 15 mg/L)	3.3	6	5.3	12	6.0	12	6.1	15	5.8	11
MFWQTC	(30 mg/L, 45 mg/L)	31.3	140	36	126	34	107	54	194	61	201
		50.4	183	54.8	165	57.4	154	79.4	265	84.0	252

Exceedances are shown in red.

As noted in Table 6-6, the Morris Forman WQTC has continued to experience permit exceedances for BOD and TSS since the 2014 lightning strike incident. The primary reason for these exceedances is failure of biosolids equipment (dryers, centrifuges, etc) which limited the plant's ability to reduce these pollutants. A historical perspective of effluent BOD for the Morris Forman WQTC is presented in Figure 6-4.

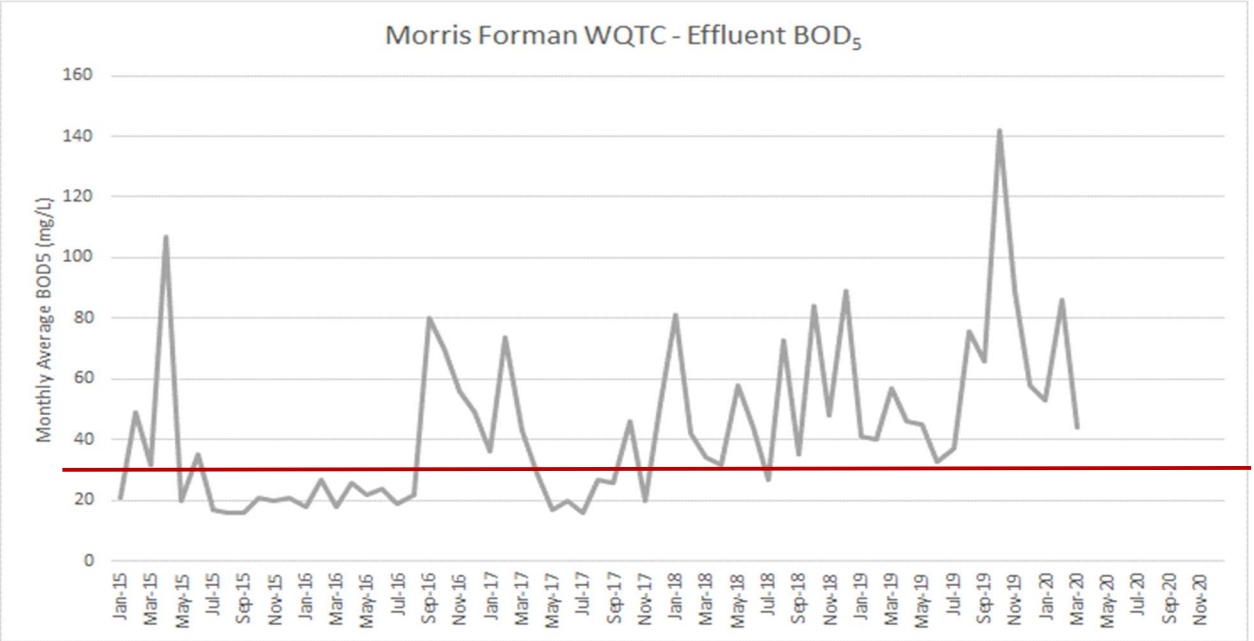

Figure 6-4: Effluent Quality from Morris Forman WQTC

6.4 Wastewater Treatment Programs

Most of MSD's investment at the wastewater treatment plants has been for asset management needs resulting from aging and deteriorating assets. In addition to asset management needs, MSD is in the process for addressing biosolids facilities and expanding one WQTC.

6.4.1 District-Wide Biosolids Management

The Morris Forman Water WQTC processes, markets (Louisville Green), and disposes of biosolids generated from all of MSD 's wastewater treatment facilities. The existing dewatering and drying equipment have reached the end of their useful life. Replacement of the biosolids infrastructure with a modern facility has been reviewed by two independent consulting engineers. MSD is ready to proceed with design-build procurement for the $198M project.

Due to the cost of the project, in 2018 MSD submitted a Letter of Interest to USEPA's Water Infrastructure Finance and Innovation Act Program (WIFIA) to request participation in a low-interest loan program for the

Morris Forman New Biosolids Facility. The project was accepted and the WIFIA loan closing date is scheduled for the summer of 2020.

In the meantime, the biosolids facilities have continued to deteriorate at an escalated rate. This has resulted in a situation in which MSD is able to process only 35% of the biosolids. In turn, the Morris Forman WQTC effluent permit limits for total dissolved solids (TSS) and biochemical oxygen demand (BOD_5) are not consistently met. In order to meet effluent permit water quality, MSD needs to process fewer biosolids at the Morris Forman WQTC. This challenge will continue until the new Biosolids Facility is operational in approximately five years.

In 2019, MSD commissioned Black & Veatch to prepare a District-Wide Biosolids Master Plan. The Master Plan confirmed the new Biosolids Facility to be constructed via the WIFIA loan program is the recommended long-term solution. The Master Plan identified short-term improvements that would help MSD achieve permit compliance and support construction of the new facility. The short-term improvements include replacing outdated equipment at Morris Forman (centrifuges and dryers) and offloading regional biosolids. All six centrifuges were sent to the manufacturer for refurbishment in a phased approach. An emergency certification project was issued in 2019 to replace the Morris Forman dryers.

To sufficiently offload regional biosolids from the Morris Forman WQTC, the Biosolids Master Plan recommended MSD construct dewatering facilities for the regional WQTCs. This approach will significantly increase MSD's reliability for processing biosolids. Staff and Black & Veatch confirmed the Derek R. Guthrie WQTC has adequate space to accommodate construction and operation of a regional dewatering facility. An emergency certification project was issued in 2019 to expedite off-loading the regional biosolids from Morris Forman by constructing a dewatering facility at the Derek R. Guthrie WQTC.

Brief descriptions of the major biosolids projects included in the 5-Year CIP are listed below.

- **New Biosolids Facility ($198M)**: This project will construct a modern biosolids processing facility at the Morris Forman WQTC that utilizes a thermal hydrolysis process (THP) to create a useable biogas. Benefits of the new facility include improved effluent quality; production of 4 MW of power; decreased consumption of natural gas; and reduced landfill utilization capacity.

- **Drying of Morris Forman WQTC Biosolids ($48M):** The dryers at the Morris Forman WQTC have been systematically failing over the past few years. In 2019, the last dryer failed and significantly impaired MSD's ability to process biosolids. Under an emergency certification, MSD is demolishing the outdated drying systems and replacing them with two state-of-the art dryers. This investment will ensure continuous biosolids processing during construction of the new Biosolids Facility and will provide added future system reliability. Additionally, the dryers will remain part of the biosolids management strategy going forward. Construction began in 2019 and will be fully completed in 2022.

- **Dewatering of Regional Biosolids ($50M):** Under an emergency certification, MSD is constructing a dewatering facility at the Derek R. Guthrie WQTC to process biosolids from all the regional WQTCs. The project includes an interim and permanent solution so regional biosolids could be immediately off-loaded from the Morris Forman WQTC. The dewatered biosolids are being landfilled in lieu of being pumped/hauled to the Morris Forman WQTC. Construction began in 2019 and will be fully completed in 2022. Regional biosolids were offloaded from the Morris Forman WQTC in February 2020.

6.4.2 WQTC Expansions

The only facility currently undergoing a plant expansion is the Hite Creek WQTC. The Hite Creek WQTC Expansion Project will increase the plant capacity from 6.0 to 9.0 mgd average daily flow. The increase in capacity will reduce sanitary sewer overflows upstream of the facility and allow for future growth demands. Rehabilitation at the facility will include the replacement of bar screens, existing ultraviolet system, and sludge holding tank blowers. The addition of aeration capacity/nutrient removal, aeration tank blower expansion and new tertiary disc filtration will increase treatment capacity. This project will provide the ability to dewater sludge on-site, thus eliminating over 400 truckloads of sludge per month being trucked to the Morris Forman WQTC.

6.4.3 Planning Initiatives

The 5-year CIP includes the following planning initiatives related to the WQTCs. These plans will be utilized to implement a comprehensive asset management program, prioritize capital needs, and update the CRRP.

- Bells Lane Asset Management Plan, $330,000
- CCWQTC Asset Management Plan, $330,000
- Comprehensive Facility Plan – Five Year Update, $450,000
- DRGWQTC Asset Management Plan, $530,000
- FFWQTC Asset Management Plan, $320,000
- Floyds Fork Regional Facilities Plan Update, $300,000
- HCWQTC Asset Management Plan, $500,000
- High Strength Waste Market Evaluation, $260,000
- MFWQTC Asset Management Plan, $1.5 million
- Odor Management Plan, $250,000
- SCADA Master Plan, $796,000

6.5 Wastewater Treatment Capital Projects

MSD continues to fund wastewater treatment projects with its annual CIP. Projects are generally a combination of discrete local improvements and appropriations for as-needed asset replacements.

6.5.1 Projects Funded from Program Notes

The two largest wastewater treatment projects completed since the last bond issuance are 1) the Bells Lane Wet Weather Treatment Facility and 2) expansion of the Hite Creek WQTC. A list of representative projects is provided in Table 6-7.

Table 6-7: WQTC Projects Completing Design/Construction Since 2017

Facility	Budget ID	Project	Task Name	Finish	Lifetime Actuals
Bells Lane WWTF	D20222	Bells Lane Grit Classifier Drain Line	Design Finish	12/5/2019	$3,871
	H09124	Bells Lane Wet Weather Treatment Facility	Construction Finish	7/31/2018	$51,760,788
	H18333	Bells Lane WWTF EQ Basin Modifications	Construction Finish	11/28/2018	$3,448,992
Cedar Creek WQTC	D19038	CCWQTC Hydraulics Study	Study Finish	2/22/2019	$54,590
	D16272	CCWQTC Influent PS MCC Upgrades	Design Finish	2/20/2020	$180,028
	D19268	CCWQTC Safety Items	Construction Finish	12/5/2018	$16,451
	D19248	CCWQTC Solids Study	Study Finish	2/28/2019	$34,711
Derek R. Guthrie WQTC	D18292	DRGWQTC Clarifier Grout Repair and RAS Gate Replacement	Design Finish	8/14/2019	$318,113
	F14156	DRGWQTC RAS 1 and 4 Pump Replacement	Construction Finish	3/6/2019	$1,502,673
	D18225	DRGWQTC WWPS Finite Element Analysis	Study Finish	7/27/2018	$40,663
Floyds Fork	D20227	FFWQTC Filter Evaluation	Study Finish	3/13/2020	$19,350
Hite Creek	H14126	HCWQTC Expansion	Design Finish	6/11/2019	$6,540,474
Morris Forman WQTC	D15020	MFWQTC Cake Pump Phase II	Design Finish	8/1/2019	$296,471
	D20167	MFWQTC East Headworks HVAC	Design Finish	10/17/2019	$101,900
	F14182	MFWQTC FEPS Pump Repair and Motor	Construction Finish	9/30/2019	$148,077
	D19046	MFWQTC Ground Water Well 10 Replacement	Construction Finish	3/6/2020	$178,428
	D19227	MFWQTC Primary Sludge Line Replacement	Design Finish	4/30/2019	$663,835
	D19044	MFWQTC Primary Sludge Pump Compressor	Construction Finish	5/31/2019	$83,498
	D18129	MFWQTC Secondary Electrical MCC Replacement Study	Study Finish	1/31/2019	$54,920
	D18118	MFWQTC Truck Unloading Station Pavement Repair	Design Finish	10/10/2019	$59,714
				TOTAL WQTC PROJECTS	**$65,507,546**

6.5.2 5-Year CIP for Wastewater Treatment System

MSD will continue spending on the biosolids emergency certification projects started in 2019 and completing in 2022. The majority of the 5-Year CIP related to biosolids is for the New Biosolids Facility to be located at the Morris Forman WQTC. Additional placeholder projects have been added to incorporate dewatering processes at the Cedar Creek and Floyds Fork WQTCs.

Annual capital investments are required to mitigate operator safety risks; maintain reliable system operations; and upgrade to new more energy efficient technologies. During the 5-year CIP, the following WQTC projects totaling $104 million will be partially or wholly budgeted for the regional WQTCs.

Table 6-8: Overview of 5-Year Forecasted Spending for Regional WQTCs

Wastewater Treatment Priorities		5-Year CIP Forecasted Spending
Bells Lane Wet Weather Facility	Bells Lane Grit System Improvements	**Bells Lane $1.4 million**
	Bells Lane WWTF Chemical Feed System Improvements	
	Bells Lane WWTF General R&R	
Cedar Creek WQTC	CCWQTC Admin Building Expansion & Painting	**CCWQTC $17.4 million**
	CCWQTC Power & MCC Upgrades	
	CCWQTC Oxidation Ditch Mods	
	CCWQTC Chemical Feed System Improvements	
	CCWQTC Effluent Parshall Flume Upgrade	
	CCWQTC Tertiary Filtration	
	CCWQTC WAS Improvements & Dewatering Facility	
	CCWQTC Expansion Project	
	CCWQTC General R&R	
Derek R. Guthrie WQTC	DRGWQTC Artificial Intelligence Pilot	**DRGWQTC $47.5 million**
	DRGWQTC Clarifier Replacements & Grout Repair	
	DRGWQTC Disinfection Upgrades	
	DRGWQTC Substation U-13 Modifications	
	DRGWQTC Alternate Outfall	
	DRGWQTC Dewatering Facility	
	DRGWQTC General R&R	
Floyds Fork WQTC	FFWQTC Chemical Feed System Improvements	**FFWQTC $3.5 million**
	FFWQTC Dewatering Facility	
	FFWQTC General R&R	
	FFWQTC Enhanced Biological Phosphorous Removal Study	
Hite Creek WQTC	HCWQTC Chemical Feed System Improvements	**HCWQTC $21.9 million**
	HCWQTC General R&R	

Wastewater Treatment Priorities		5-Year CIP Forecasted Spending
	HCWQTC Expansion Project	
General WQTCs	WQTC Elevator Repairs	**$12.6 million**
	WQTC General R&R/	
	Total 5-Year CIP Forecast for Regional WQTCs	**$104.3 million**

The following projects totaling $245 million are forecasted for the Morris Forman WQTC in the 5-Year CIP. The largest project is replacement of the biosolids facility.

Table 6-9: Overview of 5-Year Forecasted Spending for Morris Forman WQTC

Treatment Process	Morris Forman WQTC Priorities	5-Year CIP Forecasted Spending
Primary Treatment	MFWQTC Sedimentation Basin Rehabilitation*	**$4.4 million**
	MFWQTC Primary Sludge Line Replacement*	
	MFWQTC Primary Sludge Line Replacement Phase 2*	
	MFWQTC Daft Rehab & TWAS Piping Replacement	
	MFWQTC Primary Sludge Pump Station Structural Repairs	
Secondary Treatment	MFWQTC Secondary Clarifiers Structural Repairs*	**$0.3 million**
	MFWQTC Clarifier Floor Repairs*	
Disinfection	MFWQTC HPO Tanks Structural Repairs*	**$0.5 million**
	MFWQTC Chlorine Contact Tanks Structural Repairs*	
Final Effluent Pump Station (FEPS)	MFWQTC FEPS MCC Replacement*	**$1.7 million**
	MFWQTC FEPS Structural Repairs*	
	MFWQTC FEPS VFD Replacement*	
	MFWQTC FEPS Pump and Motor Repair*	
Biosolids	MFWQTC Digester Control Building Structural Repairs*	**$206.3 million**
	MFWQTC Sodium Hypochlorite Building Relocation*	
	MFWQTC Centrifuge Replacement/Rehabilitation*	
	MFWQTC LG Dryer Replacements*	
	MFWQTC New Biosolids Facility	
	MFWQTC Cake Pump Phase 2	
Other	MFWQTC General R&R	**$30.9 million**
	MFWQTC Radio Repeater	
	MFWQTC Sewer and Manhole Rehabilitation	
	MFWQTC OGA PTO & Chlorine Rail Car Demolition	

Treatment Process	Morris Forman WQTC Priorities	5-Year CIP Forecasted Spending
	MFWQTC Process Water Pump & VFD	
	MFWQTC Facility Repairs	
	MFWQTC Service & Blower Building Structural Repairs*	
Electrical	MFWQTC Chiller Replacement	**$1.5 million**
	MFWQTC Upgrade PLCs	
	MFWQTC East Headworks HVAC*	
	Total 5-Year CIP Forecast for Morris Forman WQTC	**$245.6 million**

*project under consideration as part of the Agreed Order CAP.

7. Support Systems

MSD owns a large inventory of rolling stock, information technology systems, and above-ground facilities that support MSD's operation of wastewater, stormwater, and flood protection systems. This equipment is critical to MSD's ability to complete preventative and corrective maintenance activities required to provide sustainable and reliable wastewater, stormwater, and flood protection services.

MSD maintains an extensive inventory of IT hardware and software that is essential to overall agency operations. This includes the MSD intranet system that is the backbone of electronic communication and digital data generation, communication and storage, and regulatory reporting. This hardware and software are responsible for supplying the internet connection to MSD's Supervisory control and data acquisition (SCADA) system that controls more than 300 pump stations and control gates. This equipment is subject to periodic upgrade and replacement - like other MSD assets. The CRRP included projects and appropriations for upgrading MSD's facilities, fleet, and IT systems.

7.1 Support Systems Capital Projects

The CRRP recommended a series of corrective actions following comprehensive condition assessments of more than 200 buildings. MSD continues to address facility needs with each annual CIP. Projects are created as a need become known. MSD also includes as-needed appropriations into the annual CIP that address the following types of needs:

- HVAC Systems
- Roof Inspections, Repairs, and Replacement
- Paving Improvements
- Security Upgrades
- Information Technology (IT) Hardware & Software
- Fleet and Large Equipment

7.1.1 Projects Funded from Program Notes

A summary of the facility-type projects completed since the last bond issuance is presented in Table 7-1.

Table 7-1: Facilities Projects Completing Design/Construction Since 2017

Program	Budget ID	Project	Task Name	Finish	Lifetime Actuals
Building Improvements	N16071	Main Office Data Center Reconfiguration	Construction Finish	3/18/2020	$10,191
	G17027	CMF Roof	Construction Finish	11/27/2019	$3,321,990
	G18303	CMF Cooling Tower	Construction Finish	5/24/2019	$436,965
	G09535	CMF Parking Surface	Design Finish	12/11/2018	$157,209
				Total Facilities Projects	**$3,926,355**

7.1.2 5-Year CIP for Support Systems

During the 5-year CIP, improvements will continue to be phased for MSD's existing buildings including but not limited to: elevator upgrades, roof replacements, paving, and security enhancements. IT budgets will continue to be requested annually for assets related to system reconfiguration, cable management, network server upgrades, network switch replacements, desktop computers, and software programs needed to better manage MSD's assets and systems. Capital equipment budgets for updating MSD's fleet vehicles, heavy construction equipment, and portable equipment used by multiple working groups will be vetted annually. During the 5-year CIP, the following facilities improvement projects will be partially or wholly budgeted.

Table 7-2: Overview of 5-Year Forecasted Spending for Facilities

Facilities Priorities		5-Year CIP Forecasted Spending
Facilities Improvements	Building Improvements	**$17.1 million**
	Paving Improvements	
	Security Enhancements	
	Roof Inspections, Repairs and Replacements	
Information Technology	Hardware Related Projects	**$16.7 million**
	Software Related Projects	
Equipment	Fleet Vehicles	**$14.1 million**
	Large Equipment	
	Total 5-Year CIP Forecast for Facilities	**$47.9 million**

7.2 Support Services

Implementing a capital program of this size and complexity requires support services. Support services are generally contracted resources that provide specialized expertise; address program specific deliverables; supplement field staff; or support MSD staff as-needed. The following types capital support appropriations are included in the 5-year CIP.

- CIP Task Assistance
- Construction Inspection
- Emergency Preparedness Plan
- FOG Program Support
- Hydraulic Modeling
- WQTC Engineering Support

8. Regionalization & Economic Development

Economic development and expanding the area MSD provides utility services are opportunities for 1) generating additional revenue, 2) optimizing regional resources, and 3) further improving local water quality.

8.1 Jefferson County Development

Portions of Jefferson County remain unsewered. Over the past ten years, MSD has extended sewer service to many areas and eliminated hundreds of small package treatment plants and more than 40,000 septic tanks. The primary driver for eliminating these systems is to improve water quality of local rivers, creeks, and streams.

8.1.1 5-Year CIP for Development Program

Current development patterns suggest private investment is picking up in the Floyds Fork sewershed. MSD continues to coordinate with developers to streamline how to incorporate new assets and additional flows into its existing sewer network. It is important to coordinate these new developments to ensure consistency of construction and reliable service.

The CRRP recommended projects to ensure adequate conveyance and treatment capacity is available in advance of development and population growth. This program is particularly important for preventing a situation in which community development initiatives face moratoriums due to capacity constraints at the WQTCs. The development program includes a combination of phased WQTC capacity upgrades and under capacity sewers and pump stations. The following development related projects have been partially or fully budgeted in MSD's 5-year CIP.

- Cedar Creek Collection Systems
- Floyds Fork Collection Systems
- Floyds Fork Interceptor
- Fairmount Road Force Main Pump Station Improvements
- As-Needed Development Coordination

8.2 Regionalization to Adjacent Counties

The CRRP also identified potential regionalization corridors where MSD can further extend sewers to improve surface water quality and add new sewer customers. The CRRP recommended projects that included new interceptors, new gravity sewer collection systems, and a new treatment plant for accommodating future regionalization and/or growth.

In 2016, high profile failures of "package" treatment plants led to the passage of Kentucky House Joint Resolution 56, to initiate a study of regionalization opportunities to limit the risk of future failures. As a

result of this Joint Resolution, a study was performed in 2017 to provide an inventory of small "package" facilities and emergency risk mitigation.

During the 2018 Legislative Session in Kentucky, Senate Bill 151 (SB151) was filed to enable utility ownership of sewer assets outside of jurisdictional boundaries through inter-local agreements. House Bill 513 (HB513) was filed to require additional insurance, as well as regulatory and financial accountability for small "package" treatment facility operators/builders. These two bills were combined and passed under HB513 and signed by the Governor on April 25, 2018.

This legislation has facilitated extending MSD's programmatic approach for eliminating package treatment plants beyond Jefferson County. During FY21 MSD will complete the Floyds Fork WQTC Regional Facilities Plan Update. This project will assist MSD with addressing how regionalization initiatives with Bullitt and Oldham Counties will interconnect with MSD's assets. Depending on the timing of system improvements needed in these areas for public health protection, capital projects required to interconnect with MSD's wastewater system may need to be accelerated to the 5-year CIP.

- **Bullitt County**: In 2019, Bullitt County Sanitation District and Bullitt County Fiscal Court requested a proposal from MSD for acquisition and regional solutions. This proposal is currently in the due diligence phase.

- **Oldham County**: The City of Crestwood lobbied for enabling legislation, to allow MSD to acquire their system. This was accomplished in early 2019. Subsequent to the Crestwood acquisition, Oldham County Environmental Authority and Oldham County Fiscal Court requested MSD to submit a proposal to acquire this system. This acquisition is scheduled to close on June 30, 2020.

8.2.1 Oldham County

MSD has worked with Oldham County staff to develop a preliminary 5-year CIP to address known and immediate system capital needs. The FY21 CIP includes $3.64 million for the following needs:

- Facility Plan Update
- Collection System Inspection, Cleaning, Rehab, Modeling
- Gravity Sewer & Pump Station Rehab/Repair
- Pump Station Eliminations & Interceptor Projects
- WQTC R&R & Eliminations
- SCADA System & Rain Gauge Expansion

During the 5-year CIP, the following Oldham County projects will be partially or wholly budgeted.

Table 8-1: Overview of 5-Year Forecasted Spending for Oldham County

Oldham County Capital Priorities		5-Year CIP Forecasted Spending
Collection System Sewer Improvements	Sewer Inspection & Cleaning	**$5.9 million**
	Gravity Sewer Rehabilitation	
	Ash Avenue Interceptor	
	Collection System Modeling	
Collection System Pump Station Improvements	Pump Station R&R	**$4.5 million**
	Pump Elimination Project	
	SCADA System, Rain Gauge Expansion	
WQTC Improvements	WWTP Elimination Project	**$1.4 million**
	WQTC R&R	
System-Wide	Unplanned R&R	**$1.5 million**
	Facility Plan Update	
	Total 5-Year CIP Forecast for Oldham County	**$13.3 million**

9. Conclusions

The Engineer provides the following conclusions related to MSD's sewer and drainage system.

9.1.1 Wastewater Systems

- MSD is currently working to comply with mandates from Consent Orders issued by USEPA and KDEP related to unauthorized discharges from its wastewater system. MSD has met all required deadlines to-date and remains on schedule to complete the remaining Amended Consent Order requirements. To-date, MSD has spent $1.01 billion on Consent Decree projects of the total $1.5 billion estimate. MSD, USEPA, and KDEP are discussing a reprioritization schedule to complete the remaining work while addressing other higher system priorities.

- MSD certified completion of 38 CSO LTCP projects to date, 4 remain. Overflows to local waterways have been reduced by approximately 5 billion gallons per typical year. MSD certified completion of 48 SSO SSDP projects to date, 18 remain. SSOs have been reduced approximately 61% by location and approximately 70% by volume. MSD's wet weather storage systems are preventing nearly 2 billion gallons of sewer overflows from occurring by storing flow then sending it to treatment after storm events have passed.

- On May 3, 2018, MSD entered into an Agreed Order with KDEP addressing improvements necessary to recover from a mechanical failure due to a lightning strike resulting with a power outage at Morris Forman WQTC that occurred April 8, 2015. Extensive damage was experienced to the primary treatment, secondary treatment, and electrical systems causing the plant to be out of compliance with effluent discharge limits established in Permit KY0022411. MSD is working diligently to restore the Morris Forman WQTC to its full operational capacity. MSD invested $37 million in this facility since 2016 and developed a draft Corrective Action Plan (CAP) for additional improvement.

- MSD has operated the wastewater system for decades and is sufficiently organized and staffed to continue to operate, maintain, administer, and plan the wastewater infrastructure. In FY21 MSD will conduct a staffing evaluation to confirm sufficient positions and skill sets are in place or developed to operate and maintain the new assets being constructed under the Amended Consent Order.

- MSD is advancing multiple projects to improve District-wide biosolids management including constructing dewatering facilities at the regional WQTCs and building a new biosolids facility at the Morris Forman WQTC. These investments, while costly will enable MSD to meet KPDES permit requirements, improve efficiencies, and generate power.

- MSD is advancing some of the projects identified in the CRRP. Due to the Consent Decree

mandates, many projects continue to be deferred. As such, emergencies are increasing in frequency and severity. MSD's annual CIP includes appropriations to address as-needed improvements related to repair, rehabilitation, or replacement of aging assets and emergencies.

9.1.2 Stormwater System

- The District through ILAs with the City of Louisville and Jefferson County assumed responsibility for stormwater management in 1987 for all of Jefferson County, except for the Cities of Anchorage, Jeffersontown, Shively, and St. Matthews. Those cities provide most of those services within their borders, and partner with MSD on other aspects including review of new development plans and water quality reporting.

- The District bills for stormwater services using equivalent service units (ESUs). The District currently has approximately 6,956,000 ESUs, in total, from residential, commercial, industrial, and city-owned properties.

- MSD maintains and operates its stormwater collection and transmission system in accordance with industry-standard best management practices. MSD has operated the stormwater system for decades and is sufficiently organized and staffed to continue to operate, maintain, administer, and plan the stormwater infrastructure.

- MSD is working on a comprehensive update to the Stormwater Drainage Master Plan which, after public participation and approvals by local governments, will be used by the District for implementing improvements and extensions to the existing drainage facilities. It is currently anticipated the first working draft of the Stormwater Drainage Master Plan will be published in 2025. Over the next few years, a significant effort will continue to inventory and document the condition of existing drainage system assets.

- MSD collects over 3 million individual water quality records each year. This monitoring program provides a detailed picture of the health of streams in Jefferson County. Monitoring results are summarized on an annual basis in the Stormwater MS4 Annual Report.

- MSD's Urban Reforestation Program plants 1,000 trees annually by working with local businesses, municipal organizations and neighborhood associations. The program replenishes and expands the tree canopy throughout Jefferson County. These trees redirect an average of 1.35 million gallons of stormwater away from the sewer system every year, which decreases sewer overflows into waterways.

- In 1988, MSD and the United States Geological Survey (USGS) began monitoring water quality and stream flow throughout the Jefferson County area. The Long-Term Monitoring Network has changed over the years and currently includes 27 monitoring sites. The monitoring sites were

selected to represent streams in each of eleven watersheds. Each monitoring site is sampled four times per year and is analyzed for a variety of parameters including fertilizers, sediment, and metals.

9.1.3 Flood Protection System

- MSD maintains and operates the flood protection system in accordance with industry-standard best management practices. MSD has operated the flood protection system for decades and is sufficiently organized and staffed to continue to operate, maintain, administer, and plan the Ohio River Flood Protection System infrastructure.

- MSD maintains a proactive maintenance program to assure the integrity of the levee and floodwall system. Worked performed using these funds includes: repair and/or replacement of trusses, sheeting, and closure walkways; corrugated metal pipe replacement; toe drain access repairs; trail repairs and unwanted vegetation removal; level gate repair or automation; painting; floodwall joint repair; and floodwall concrete sealing and surface crack repairs.

- MSD is actively engaged with the USACE to advance $167 million of improvements to improve the reliability of the flood protection system. These improvements will replace and update original equipment that was installed in the 1950s and 1970s. These projects were included in the CRRP. This partnership represents a significant investment with improving flood protection.

- The Paddy's Run Flood Protection Station Capacity Improvements Project is MSD's highest ranked capital priority to mitigate flood pump station public health protection risk. MSD completed an Alternatives Analysis for increasing the capacity of the station to 975 mgd. The CRRP recommended two equally important project phases for the Paddy's Run FPS. The first phase will improve the reliability of the existing Paddy's Run FPS (originally constructed in 1953) by removing, inspecting, and rehabilitating or replacing the station's existing pumps and motors to maintain the station's current total pumping capacity of 925 mgd. The reliability improvements will be implemented through the USACE Program. MSD must construct the capacity improvements project independent of the USACE project.

END OF REPORT