MSD
Metropolitan Sewer District

Final Long-Term Control Plan
Volume 2 of 3
September 30, 2009

LTCP

PROJECT WIN
Waterway Improvements Now

Integrated Overflow Abatement Plan

VOLUME 2: FINAL COMBINED SEWER OVERFLOW (CSO) LONG-TERM CONTROL PLAN (LTCP)

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FINAL COMBINED SEWER OVERFLOW LONG-TERM CONTROL PLAN (LTCP)

GLOSSARY

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DEFINITIONS

Amended Consent Decree (ACD) - Specific to this document, a federal judicial order expressing a voluntary agreement ordered on April 10, 2009 and filed on April 15, 2009 that incorporates all elements of the original Consent Decree (see Consent Decree definition) as well as imposing new requirements to cease activities alleged by the government to be illegal.

Average Annual Overflow Volume (AAOV) - The total volume of overflow predicted to occur from a specific location or consolidation of locations, calculated using a continuous simulation of precipitation that occurs in a "typical year." For the purpose of this Integrated Overflow Abatement Plan (IOAP), calendar year 2001 represents the typical year, based on an evaluation of precipitation patterns in that year compared to long-term meteorological averages.

Average Daily Flow (ADF) - The calculated or assumed average daily flow within the sewer system attributed to users without rainfall derived inflow and infiltration (I/I) within a 24-hour period.

Avoidable - A legal term of art meaning that a consequence could have been prevented with the exercise of reasonable engineering judgment in facilities planning and implementation, and/or adequate management, operations, and maintenance practices.

Baseline - The existing conditions. An initial set of observations or data used as a comparison or starting point from which the magnitudes of an alternative's effects are measured.

Benefit - Cost Analysis - A formal process used to help appraise, or assess, the cost effectiveness of different alternatives. The higher the Benefit-Cost Ratio, the more effective the alternative is.

Best Management Practices (BMPs) - Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to Waters of the United States. BMPs also include treatment requirements, operating procedures, and practice to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Biochemical Oxygen Demand (BOD) - A measurement of the amount of oxygen used by the decomposition of organic material over a specified time period (usually 5 days) in a wastewater sample. Used as a measurement of the readily decomposable organic content of water.

Bypass - The intentional diversion of waste streams from any portion of a treatment facility as set forth in 40 Code of Federal Regulations (CFR), § 122.41(m)(1) and 401 Kentucky Administrative Regulations (KAR) 5:002, Section 1(36). The practice of bypassing secondary treatment units and recombining the bypass flow with the secondary effluent prior to discharge, known commonly as blending, recombination, or diversion, constitutes a "Bypass." The term Bypass shall specifically exclude (1) practices at MSD's Morris Forman Wastewater Treatment Plant (WWTP) that are in accordance with the KPDES permit and the CSO Control Policy and (2) any flow that exceeds the design capacity of a tertiary process at any WWTP in accordance with a Kentucky Pollutant Discharge Elimination System (KDPES) permit.

Chemical Treatment - Any water or wastewater treatment process involving the addition of chemicals to obtain a desired result, such as precipitation, coagulation, flocculation, sludge conditioning, disinfection, or odor controls.

Combined Sewer Overflow (CSO) - an outfall identified as a combined sewer overflow or CSO in MSD's KPDES permit for the Morris Forman WWTP from which MSD is authorized to discharge during wet weather.

- **Dry Weather CSO** - An overflow from a permitted outfall identified as a combined sewer overflow or CSO in MSD's Morris Forman WWTP KPDES permit that is not the result of a wet weather event.
- **Wet Weather CSO** - An overflow from a permitted outfall identified as a combined sewer overflow or CSO in MSD's Morris Forman WWTP KPDES permit that is the result of a wet weather event.

Combined Sewer System (CSS) - the portion of MSD's Sewer System designed to convey municipal sewage (domestic, commercial, and industrial wastewaters) and stormwater runoff through a single-pipe system to MSD's Morris Forman WWTP or CSOs.

Consent Decree - A judicial decree expressing a voluntary agreement between parties to a suit, especially an agreement by a defendant to cease activities alleged by the government to be illegal in return for an end to the charges.

Controls - Processes and/or activities which contribute to removal of pollutants from wastewater or to containing and conveying wastewater for treatment and discharge.

Dissolved Oxygen (DO) - A measurement of the amount of oxygen dissolved in water.

Fats, Oils, and Grease (FOG) – A general category of lipid-based wastewater constituents that often are responsible for sewer blockages and resulting back-ups or overflows.

Feasible Alternatives - The legal term of art used in the "Bypass" regulation to identify alternative controls which are both technically achievable and affordable (40 CFR 122.42m).

Fecal Coliform - Bacteria present in the feces of warm blooded animals typically used as an indicator of fecal contamination and the potential presence of pathogens.

Flow Equalization - Transient storage of wastewater for release to a sewer system or treatment process at a controlled rate to provide a reasonably uniform flow.

Geographic Information System (GIS) - A computer based system that is capable of storing, managing, and analyzing geographic spatial data. This capability includes producing maps, displaying the results of data queries, and conducting spatial analysis.

Gray Infrastructure - Constructed structures such as treatment facilities, sewer systems, stormwater systems, or storage basins. The term "gray" refers to the fact that such structures are typically made of, or involve the use of concrete.

Green Infrastructure - An adaptable term used to describe an array of materials, technologies, and practices that use natural systems—or engineered systems that mimic natural processes—to enhance overall environmental quality and provide utility services. As a general principal, green infrastructure techniques use soils and vegetation to infiltrate, evapotranspirate, and/or recycle stormwater runoff. Examples of green infrastructure include green roofs, porous pavement, rain gardens, and vegetated swales.

Infiltration - Groundwater that enters a wastewater system through such means as defects in pipes, pipe joints, connections, or manholes.

Inflow - Water other than wastewater that enters a wastewater system from sources such as stormwater, runoff, and drainage. Inflow is generally derived from surface water, as compared to infiltration that is generally derived from groundwater.

InfoWorks Collection Systems (CS) - Hydraulic modeling software developed by Wallingford Software used by MSD for collection system modeling.

Kentucky Department for Environmental Protection (KDEP) - Agency responsible for administering KPDES permits and receiving permit-related reports.

Kentucky Pollutant Discharge Elimination System (KPDES) Permit - Any National Pollutant Discharge Elimination System permit issued to MSD by the Cabinet pursuant to the authority of the Clean Water Act and Kentucky Revised Statues (KRS) Chapter 224 and the regulations promulgated thereunder.

Leadership in Energy and Environmental Design (LEED) - A rating system that is administered by the US Green Building Council (USGBC) and is currently the most accepted benchmark for the design, construction, and operation of high performance green buildings and neighborhood developments in the U.S. The five key areas include sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

Louisville and Jefferson County Metropolitan Sewer District (MSD) - The agency responsible for providing wastewater, stormwater, and flood protection services in Jefferson County. MSD is also responsible for response, mitigation, notification, and reporting of overflows, including unauthorized discharges.

Lower Gauge (LG) - A measure of the Ohio River's stage (elevation) below the McAlpine Lock and Dam. Gauge 0 is equal to an elevation of 373.2' above mean sea level. Normal pool elevation for the Ohio River is 384.5' or a lower gauge of 11.3.

National Pollutant Discharge Elimination System (NPDES) - A national program under the Clean Water Act that regulates discharges of pollutants from point sources to Waters of the United States. Discharges are illegal unless authorized by an NPDES permit.

Overflow - Any release of wastewater from MSD's sanitary or combined sewer system at locations not specified in any KPDES permit. This includes any Unauthorized Discharge and releases to public or private property that do not reach Waters of the United States, such as basement backups. However, wastewater backups into buildings caused by blockages, flow conditions, or malfunctions in a building lateral, other piping or conveyance system that is not owned or operationally controlled by MSD are not overflows for the purposes of the IOAP.

Pathogen - An organism capable of causing disease, including disease-causing bacteria, protozoa, and viruses.

Peak Flow - The maximum flow that occurs over a specific length of time (e.g., daily, hourly, instantaneous).

Peak Wet Weather Flow - The anticipated, calculated, or monitored maximum flow within the sewer system during an actual or synthetic rainfall event.

Primary Treatment - The practice of treatment by screening, sedimentation, and skimming adequate to remove at least 30 percent of both the biochemical oxygen demanding material and the suspended solids, as defined in 40 CFR Part 125.58(r). Primary treatment may also include disinfection, where appropriate or required.

Reasonable Engineering - As a legal term of art, this is the statutory and regulatory standard for judgment evaluating engineering practices.

Rim Elevation - The elevation of the top of a manhole cover. If the water surface elevation in a manhole is higher than the rim elevation, a sewer overflow will occur.

Risk Management - The process of identification, analysis and either acceptance or mitigation of risk. Essentially, risk management occurs anytime one analyzes the probability and consequences of an event happening, thereby quantifying the potential for losses and then takes the appropriate action (or inaction) given their objectives and risk tolerance.

Sanitary Sewer - A pipe or conduit (sewer) intended to carry wastewater or water-borne wastes from homes, businesses, and industries to the publicly owned treatment works.

Sanitary Sewer Overflow (SSO) - Any discharge of wastewater to waters of the United States from MSD's Sewer System through a point source not authorized by a KPDES permit, as well as any release of wastewater from MSD's Sewer System to public or private property that does not reach Waters of the United States, such as a release to a land surface or structure that does not reach Waters of the United States; provided, however, that releases or wastewater backups into buildings that are caused by blockages, flow conditions, or malfunctions in a building lateral, or in other piping or conveyance system that is not owned or operationally controlled by MSD are not SSOs.

Sanitary Sewer System (SSS) - The portion of MSD's sewer system designed to convey only municipal sewage (domestic, commercial, and industrial wastewaters) to MSD's WWTPs.

Secondary Treatment - A biological wastewater treatment technology required by the Clean Water Act for discharges from Publicly Owned Treatment Works, as that term is defined in 40 CFR Part 403.3(q). The minimum level of effluent quality attainable through the application of secondary treatment is established in 40 CFR Part 133.102 in terms of the parameters for 5-day biochemical oxygen demand ("BOD5") concentration and percent removal, total suspended solids ("TSS") concentration and percent removal, and pH.

Sensitive Areas - Areas of particular environmental significance or sensitivity as determined by the KPDES permitting authority in coordination with State and Federal agencies, that include Outstanding National Resources Waters, waters with threatened or endangered species and their habitats, waters with primary contract recreation, public drinking water intakes or their designated protection areas.

Sewer System - The wastewater collection, retention, and transmission system that MSD owns or operates, that are designed to collect, retain and convey municipal sewage (domestic, commercial and industrial wastewaters) to MSD's WWTPs or CSOs which is comprised of the CSS and the SSS.

Solids and Floatables (S&F) – Materials in sewage that are large enough to be visibly recognizable. Most solids and floatables in combined sewage are comprised of street litter and debris, but some plastic and paper products flushed down toilets stay in a visibly recognizable form, and are objectionable to some people.

Solution - A set of modifications to existing conditions in the hydraulic model developed to satisfy the overflow and surcharging requirements. Solutions are generally developed by trial and error modifications to the hydrological and hydraulic system at a given design storm. Modifications may include minimizing inflow and infiltration, modifications to conveyance (pipe diameter or pump capacity), added storage, system diversions or combinations thereof.

Surcharge - The condition within the sewer when the hydraulic grade line (water surface level) within the sewer system exceeds the crown of pipe elevation. The System Capacity Assurance Program (SCAP) defines a wet weather surcharge condition as a water surface level within the sewer that is less than two feet from the manhole rim elevation. If the sewer system is in an area of chronic backup complaints, then a surcharge condition is considered to be a water surface level within five feet of the manhole rim.

Upper Gauge (UG) - A measure of the Ohio River's stage (elevation) above the McAlpine Lock and Dam. Gauge 0 is equal to an elevation of 407.5' above mean sea level. Normal pool elevation for the Ohio River is 420.0' or an upper gauge of 12.5.

U.S. Environmental Protection Agency (EPA) - The federal agency responsible for enforcing the Clean Water Act, Safe Drinking Water Act and other federal environmental regulations.

Unauthorized Discharge - (a) any discharge of wastewater to waters of the United States from MSD's Sewer System or WWTPs through a point source not authorized by a KPDES permit and (b) any Bypass at MSD's WWTPs prohibited pursuant to the provisions of 40 CFR § 122.41(m)(2) and (4) or 401 KAR 5:065, Section 1(13)(a) and (c).

Water Quality Standards (WQS) - Standards that set the goals, pollution limits, and protection requirements for each waterbody. These standards are composed of designated (beneficial) uses, numeric and narrative criteria, and antidegradation policies and procedures.

Water Quality Treatment Center (WQTC) - The devices or systems used in the storage, treatment, recycling, and reclamation of municipal sewage that MSD owns or operates, and for which KPDES permits have been or will be issued to MSD. Treatment facilities may be referenced as Wastewater Treatment Plants (WWTPs) on enclosed maps or within the IOAP appendices due to MSD's transition to the WQTC terminology during IOAP development.

Waters of the United States - As defined in 40 CFR I22.2:

(a) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(b) All interstate waters, including interstate "wetlands,"

(c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters**:**

(1) Which are or could be used by interstate or foreign travelers for recreational or other purposes; or

(2) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

(3) Which are used or could be used for industrial purposes by industries in interstate commerce;

(d) All impoundments of waters otherwise defined as waters of the United States under this definition;

(e) Tributaries of waters identified in paragraphs (a) through (d) of this definition;

(f) The territorial sea; and

(g) "Wetlands" adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through ('1) of this definition.

Note that the intent of the regulations cited above excludes waste treatment systems, manmade ponds, and prior converted cropland from the definition of "Waters of the US." With respect to prior converted cropland, EPA maintains jurisdiction for purposes of the Clean Water Act.

Watershed Approach - A flexible framework used for managing water resources within a specified drainage area, or watershed. This approach includes stakeholder involvement and management actions supported by sound science and appropriate technology.

Watershed - Land area that drains to a common waterway, such as a stream, lake, estuary, wetland, or ultimately the ocean.

Wet Weather Event - A discharge from a combined or sanitary sewer system that occurs in direct response to rainfall or snowmelt.

Wet Weather Team (WWT) - An advisement group for MSD composed of four subgroups: The Stakeholder Group, MSD employees, a Technical Team, and the Facilitation Team. A WWT is required by the Consent Decree.

ACRONYMS AND ABBREVIATIONS

AAOV	Average annual overflow volume
ACD	Amended Consent Decree
ADF	Average daily flow
BG	Billion gallons
BGCMI	Beargrass Creek Middle Fork
BGCMU	Beargrass Creek Muddy Fork
BGCSF	Beargrass Creek South Fork
BMP	Best management practice
BOD	Biochemical oxygen demand
CCTV	Closed-circuit television
CDS	Continuous Deflection Separator
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cfu	Colony forming unit
CMF	Central Maintenance Facility
CMOM	Capacity, Management, Operations, and Maintenance
COD	Chemical oxygen demand
CSO	Combined sewer overflow
CSS	Combined sewer system
CWA	Clean Water Act
DMR	Discharge monitoring report
DO	Dissolved oxygen
DWF	Dry weather flow

E. Coli	Escherichia Coli
EAP	Early Action Plan
ENR-CCI	Engineering News Record – Construction Cost Index
EPA	U.S. Environmental Protection Agency
FOG	Fats, oils, and grease
FY	Fiscal year
GIS	Geographic Information System
gpd	Gallons per day
GPS	Global Positioning Satellite
HEC RAS	hydraulic water flow modeling software
I&FP	Infrastructure and Flood Protection
I/I	inflow and infiltration
IOAP	Integrated Overflow Abatement Plan
IWD	Industrial Waste Department (also known as ICAM)
JCPS	Jefferson County Public Schools
JTown	Jeffersontown
KDEP	Kentucky Department of Environmental Protection
KPDES	Kentucky Pollutant Discharge Elimination System
KRS	Kentucky Revised Statute
LEED	Leadership in Energy and Environmental Design
LF	Linear feet
LG	Lower gauge
LG&E	Louisville Gas & Electric
LOJIC	Louisville and Jefferson County Information Consortium
LS	Lift station
LTCP	Long-Term Control Plan
LTMN	Long Term Monitoring Network
LWC	Louisville Water Company
MHI	Median Household Income
MG	Million gallons
mgd	Million gallons per day
mg/l	Milligrams per liter
ml	Milliliter
MOP	Modeled overflow point
MS4	Municipal Separate Storm Sewer System
MSD	Louisville and Jefferson County Metropolitan Sewer District

NEXRAD	Next-Generation Radar
NMC	Nine Minimum Controls
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
OR	Ohio River
ORFM	Ohio River Force Main
ORSANCO	Ohio River Sanitation Commission
OSHA	Occupational Safety and Health Administration
PE	Professional Engineer
PM	Preventive maintenance
POTW	Publicly owned treatment works
Project DRI	Project Drainage Response Initiative
Project WIN	Project Waterway Improvements Now
PS	Pump station
PIO	Public Information and Outreach
PVC	Polyvinyl chloride
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
RBP	Stream Rapid Bioassessment Protocol
RDI/I	Rainfall-derived infiltration and inflow
ROW	Right-of-way
RTC	Real time control
S&F	solids and floatables
SAP$_{TM}$	Systems Analysis Program (MSD's financial management software)
SCADA	Supervisory Control and Data Acquisition
SCAP	Louisville Metro Sewer Capacity Assurance Plan
SED	Southeastern Diversion Structure
SIU	Significant Industrial User
SOP	Standard Operating Procedure
SORP	Sewer Overflow Response Protocol
SSDP	Sanitary Sewer Discharge Plan
SSES	Sanitary Sewer Evaluation Survey
SSO	Sanitary sewer overflow
SSOP	Sanitary Sewer Overflow Plan
SSS	Sanitary sewer system

SWMM	Stormwater and Wastewater Management Model
TMDL	Total maximum daily load
TSS	Total suspended solids
UAA	Use Attainability Analysis
UG	Upper Gauge
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WDR	Waste Discharge Regulations
WEF	Water Environment Federation
WERF	Water Environment Research Foundation
WQT	water quality tool
WQTC	Water Quality Treatment Center
WWT	Wet Weather Team

MODELING AND FLOW MONITORING BASINS

BB	Buechel Branch	MC	Mill Creek
CC	Cedar Creek	MF	Middle Fork Beargrass Creek
FF	Floyds Fork	ND	Northern Ditch
HC	Hite Creek	ORFM	Ohio River Force Main
HP	Hikes Point	PC	Pond Creek
JT	Jeffersontown		

REGIONAL WATER QUALITY TREATMENT CENTERS

	KPDES No.	MSD No.
Cedar Creek	KY0098540	MSD0289
Floyds Fork	KY0102784	MSD0294
Hite Creek	KY0022420	MSD0202
Jeffersontown	KY0025194	MSD0255
Morris Forman	KY0022411	MSD0278
Derek R. Guthrie	KY0078956	MSD0277

(Formerly known as the West County Wastewater Treatment Plant)

SMALL WATER QUALITY TREATMENT CENTERS

	KPDES No.	MSD No.
Bancroft	KY0039021	MSD0290
Berrytown	KY0036501	MSD0209
Chenoweth Hills	KY0029459	MSD0263
Glenview Bluff	KY0044261	MSD0207
Hunting Creek North	KY0029106	MSD0291
Hunting Creek South	KY0029114	MSD0292
Ken Carla	KY0022497	MSD0208
Lake Forest / Beckley Woods	KY0042226	MSD0403
Lake of the Woods	KY0044342	MSD0251
McNeely Lake	KY0029416	MSD0228
Shadow Wood	KY0031810	MSD0404
Silver Heights	KY0028801	MSD0258
Starview	KY0031712	MSD0247
Timberlake	KY0043087	MSD0293
Yorktown	KY0036323	MSD0271

FINAL COMBINED SEWER OVERFLOW LONG-TERM CONTROL PLAN

EXECUTIVE SUMMARY

INTRODUCTION

On August 12, 2005, Louisville and Jefferson County Metropolitan Sewer District (MSD) entered into a Consent Decree in Federal Court with the United States Environmental Protection Agency (EPA) and the Kentucky Environmental and Public Protection Cabinet. The Consent Decree was developed in response to an enforcement action taken by EPA and Kentucky Department of Environmental Protection (KDEP) alleging violations of the Clean Water Act (CWA) primarily related to sewer overflows. One of the requirements of the Consent Decree is the development and submittal of a Combined Sewer Overflow (CSO) Long-Term Control Plan (LTCP).

On December 1, 2008, a draft Amended Consent Decree (ACD) was released for public comment. The draft ACD addressed alleged violations of the CWA primarily related to water quality treatment center (WQTC) performance, record-keeping, and reporting. The public comment period closed on the draft ACD December 31, 2008. The ACD was entered into Federal Court on April 15, 2009.

The Consent Decree amendments were negotiated over several months, and the terms of the draft amendments were known to MSD during the final stages of development of this Integrated Overflow Abatement Plan (IOAP). For the purposes of the IOAP, except where specifically noted otherwise, the term “Consent Decree” will be understood to mean the ACD as it was entered into Federal Court April, 15, 2009.

Volume 2 of the IOAP is the Final CSO LTCP and presents the proposed plan for compliance in reducing wet weather CSO frequency and volume to levels required by the Consent Decree. The Final CSO LTCP when implemented will accomplish the following objectives:

- Provide that if CSOs occur, they are only the result of a wet weather event;
- Perform modifications to the Ohio River Flood Protection System Infrastructure to provide that discharges only occur during a wet weather event;
- Bring wet weather CSO discharge points into compliance with the technology-based and water-quality-based requirements of the CWA; and
- Minimize the impacts of wet weather CSOs on water quality, aquatic biota, and human health.

The Final CSO LTCP details the history of problem areas and presents solutions to bring the combined sewer system (CSS) into compliance. The Final CSO LTCP is organized into four chapters that present a comprehensive overview of MSD, its history of CSS operations, characteristics of the CSS, development of control alternatives, and final recommended programs and projects.

FINAL CSO LTCP DOCUMENT ORGANIZATION

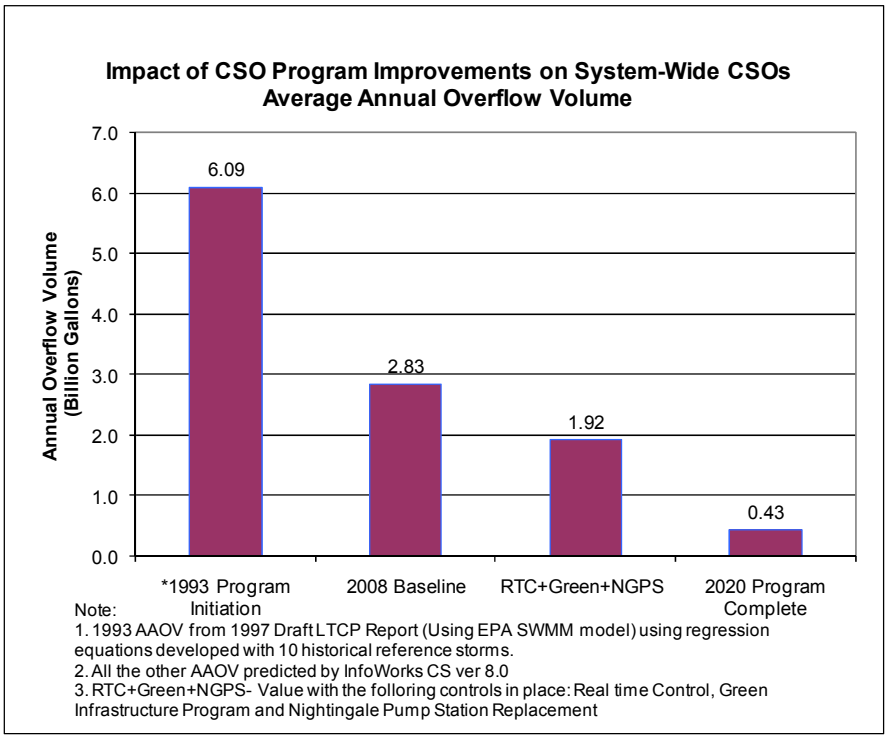
The following is a summary of each chapter.

Chapter 1 Introduction

This chapter provides a description of MSD's past and current sewer system infrastructure, a history of the CSO control policy, and MSD's CSO abatement program initiatives since 1991. Figure ES.1, at the end of the Executive Summary, outlines specific MSD initiatives and lists documents and submittals resulting from these initiatives. This introductory chapter also provides information related to the Final CSO LTCP approach, including public participation efforts, coordination with applicable regulatory agencies, water quality standards, receiving stream classifications, and the existing recreational use and ecological condition of the receiving streams.

Figure ES.2 presents progress of MSDs CSO program since the initial 1993 hydraulic sewer model run by means of the average annual overflow volume (AAOV). The values were predicted utilizing a hydraulic model to calculate a system-wide AAOV with the CSO controls in place at that time, applying an average annual rainfall. The 1993 initial program AAOV was calculated utilizing the EPA-SWMM hydraulic model (Stormwater and Wastewater Management Model) and the subsequent values were calculated using InfoWorks Collection Systems (InfoWorks CS) hydraulic model.

FIGURE ES.2 PROJECTED IMPACT OF CSO PROGRAM IMPROVEMENTS



Chapter 2 System Characterization

This chapter presents MSD's CSO abatement efforts resulting from the Early Action Plan (Nine Minimum Controls {NMC} requirements) and provides descriptions of the CSS and flood pump station infrastructure and operations. Additionally, the chapter outlines an overview of the hydraulic and water quality modeling objectives and execution, watershed data and characterization, and recreational use survey and sensitive area results. Figure ES.3 at the end of the Executive Summary provides an overview of the CSS.

Communities with collection systems that contain CSOs were required to implement NMCs by January 1, 1997. Chapter 2 summarizes MSD's initiatives and programs to meet these requirements. MSD continues to enhance components of NMC through present-day.

MSD has the responsibility to operate and maintain an extensive flood protection system infrastructure initiated by the U.S. Army Corp of Engineers (USACE) in the 1950's. In the chapter, a brief description of these facilities and operating requirements is provided, with recommended operational modifications to the flood pump stations and flood control gates. The objective of the modifications is to reduce CSO discharge volumes from the flood pump stations. The chapter also discusses controls to address dry weather overflows resulting from MSD's compliance with the requirements of the USACE Flood Pump Station operations manual.

Since the inception of software-based hydraulic models, modeling of the CSS has been performed using various rainfall scenarios and model platforms. In the chapter, a detailed description of how the rainfall condition was selected, the software applications, and model results are discussed. For the purpose of the Final CSO LTCP, MSD selected Wallingford InfoWorks CS software, using Jefferson County, KY 2001 as the typical year rainfall data. This chapter also details a description of the CSS with an overview of physical configurations of MSD's complicated sewer network. As part of the green infrastructure analysis, additional characterizations of the entire CSS are outlined, along with more detailed evaluations of each sewershed with active overflows.

The CSO Control Policy requires consideration and priority ranking of CSO discharges to areas meeting the criteria of sensitive area classification. Using the CSO Policy criteria, all Forks of Beargrass Creek are classified as sensitive, so no prioritization is possible using these criteria. To allow prioritization of CSO discharges, MSD developed a process to rate the ecological condition of each stream reach (defined as length between CSO outfalls). This data was one element used to create the CSO controls implementation schedule. Another requirement of the CSO Control Policy is the protection of public health. In order to assess the potential for human contact with streams receiving CSO discharge, a recreational use survey was conducted on both the Ohio River and Beargrass Creek. The survey results indicate that the Beargrass Creek Middle Fork has the greatest potential for human contact resulting from recreational activities.

This chapter concludes with a discussion of water quality standards, and current water quality conditions of the Ohio River and the three Beargrass Creek Forks: Beargrass Creek Muddy Fork, Beargrass Creek Middle Fork, and Beargrass Creek South Fork. Historic sampling data inclusive of existing CSO impacts are summarized as well as the development of water quality models respective to each receiving stream. The impacts to water quality, primarily through reductions in pathogen concentrations, complete this chapter.

Chapter 3 Development and Evaluation of Alternatives for CSO Control

This chapter discusses the process to identify and validate solutions that achieve the objectives of the Final CSO LTCP. The programs and technologies available for CSO abatement are discussed in detail. Programmatic-based alternatives include solutions such as source control (a Green Infrastructure Program), and technology-based solutions such as storage either within the existing collection system or in new off-line basins.

This chapter also provides the methodology for assessing and comparing the value of the solutions considered. The primary decision guide is a benefit-cost analysis, using tools such as project-specific values, a standardized cost-estimating tool, and stream ecological reach ratings. Additional decision parameters include CSS operation and maintenance considerations, plus opportunities for infrastructure investment that optimizes CSS wet weather operation. The chapter also presents the approach toward structuring solutions and the process of solution evaluation and ranking. Figure ES.4 is a flow chart of the sequential CSO Control Alternative Process, including the associated inter-active community and technical teams.

The initial CSO controls list considered 198 technology-based gray infrastructure projects comprehensive to the entire CSS. A screening process reduced this number to 136 projects for evaluation. As a result of the decision process, 19 preferred solutions were selected to proceed to the optimization process to develop final recommended projects that represent the recommended solutions. In addition, the Green Infrastructure Program and demonstration projects are considered in the final suite of CSO controls.

FIGURE ES.4 CSO CONTROL ALTERNATIVE PROCESS

Chapter 4 Final Selection of the Recommended Plan

This chapter presents the level of control optimization process and subsequent final programs and technologies recommended to achieve the objectives of the Final CSO LTCP. These include the following CSO controls:

- Implementation of 19 Green Demonstration Projects and a Green Infrastructure Program, to reduce wet weather flow to the sewer collection system and increase potential for stormwater infiltration into the ground;
- Completion of a collection system real-time control (RTC) program to maximize in-line storage;
- Flow re-direction among sewersheds to optimize CSS wet weather operations;
- Construction of 23 technology-based gray infrastructure solutions to eliminate, store, or treat wet weather CSOs to performance levels determined by knee of the curve analyses, which results in a 96 percent reduction in CSO capture of flows entering the CSS;
- Five flood pump station modification projects to prevent dry weather CSO discharges; and
- Improvement in receiving water quality through CSO volume reduction; however, significant non-point source loading (non-CSO discharges) on each stream result in periods of non-attainment of water quality standards established by the CWA.

FINAL RECOMMENDED PROJECTS

Tables ES.1 and ES.2, at the end of the Executive Summary, list the Final Recommended Green Demonstration Projects and the Green Infrastructure Program, respectively. MSD anticipates the green demonstration projects to be initiated early in the Final CSO LTCP implementation schedule in order to assess source control performance and the impact, if any, to sizing gray solutions. In addition, the costing of the green programs were developed for a 15-year program duration. However, MSD has specifically committed to implementing green programs at this level only for the first six years. Throughout the six-year implementation period, the programs will be monitored and evaluated. Years seven through 15 will still have green programs, but the implementation levels and allocation of fees between specific program elements may be adjusted in order to achieve the maximum benefit, based on previous program performance.

Table ES.3 lists the Final Recommended Gray Infrastructure Projects, and Table ES.4 lists the Final Recommended Flood Pump Station Projects. Figure ES.5, at the end of the Executive Summary, summarizes the Final CSO LTCP implementation schedule, inclusive of the comprehensive Green Infrastructure Program. These projects are sequenced-based applying the ecological characterization criteria, CSS system operating requirements, constructability, and cash flow required to meet the Consent Decree Final CSO LTCP compliance date of

December 31, 2020. The capital cost, in 2008 dollars, to implement the Final CSO LTCP is $320 million, allocated as follows:

- Green Infrastructure Program $ 47 million
- Gray Infrastructure Program $ 270 million
- Flood Pump Station Modifications $ 3 million

As depicted in Table ES.5 completion of the elements recommended in this Final CSO LTCP results in increase of percent capture of combined sewage volume from a modeled 2008 baseline of 75 percent CSS capture, to a predicted level of 96 percent CSS capture.

TABLE ES.5
PERCENT CAPTURE OF COMBINED SEWAGE

	No Control (2008 Baseline)	Final CSO LTCP
Volume of combined sewage collected in the CSS during precipitation events million gallons (MG)	11,369	11,369
Volume of combined sewage captured and treated (MG)	8,536	10,944
Percent of volume captured and treated	75%	96%
Volume of remaining CSOs (MG)	2,833	425
Percent of CSO remaining	25%	4%

The selected plan exceeds the minimum presumptive approach of 85 percent capture of CSO (per the CSO Control Policy) and also successfully meets the criteria of demonstrative approach (per the CSO Control Policy) listed below:

- The planned program captures 96 percent of combined sewer overflow in a typical year, and water quality models for the Ohio River and Beargrass Creek predict that CSOs will not cause violations of the water quality standards with background pollutant loads from other sources removed.
- Benefit-cost evaluation and water quality modeling of the control plan demonstrate that the selected plan provides the maximum pollution reduction benefits reasonably attainable.
- The selected plan will be designed to allow for reasonable expansion or retrofitting of controls to meet water quality objectives based on post construction compliance monitoring. Additional options to modify the plan include expansion of the Green Infrastructure Program, if proven cost-effective, to reduce source runoff to the CSS.

The success of this Final CSO LTCP in meeting Consent Decree compliance requirements will be measured incrementally as the plan is implemented and also at plan completion in December 2020:

- The performance of the green demonstration projects and comprehensive Green Infrastructure Program will be measured to determine if source reduction goals are being achieved. As the first set of green infrastructure demonstration projects is built, the controls will be monitored and data on the effectiveness in reducing stormwater runoff will be generated and analyzed.
- Since engineering design of gray infrastructure projects will parallel reporting of green performance, any impact to gray solutions performance requirements will be integrated, including design characteristics to incorporate future modifications or retrofits. MSD will use the schedule developed for the design and construction of gray projects to assist in finalizing the location selection for green projects in an attempt to implement and monitor efficacy of green projects before implementing gray projects. When possible, green projects will be constructed and system monitoring data collected before gray infrastructure projects move into the final design phase. After the green monitoring results have been analyzed, a sizing evaluation, using the CSS hydraulic model, will be performed to determine the efficacy of green controls (or system changes) that have taken place since the original sizing of the gray control. The gray projects will be sized to provide the committed level of protection based upon this analysis.
- The performance evaluation of both green technologies and gray technologies will be an on-going process under the Post Construction Compliance Monitoring Program. If the result of the green controls performance proves to be ineffective for a particular basin, then MSD will ensure that the design of gray project reflects the size needed to achieve the necessary level of control. MSD will downsize the gray project if the green controls prove to be more cost-effective for a particular basin.
- As performance metrics are established and data collected, any modifications to the Final CSO LTCP will be executed through adaptive management techniques to modify controls as necessary to bring operation of the CSS into compliance with the CWA and CSO Control Policy requirements, and the Consent Decree.

Future conditions or regulations may require a higher level of CSO control than is provided for in this Final CSO LTCP. Higher levels of control may be obtained through expansion of existing controls (where space allows), addition of facilities such as supplemental storage in other locations, or retrofitting modifications to existing facilities (such as making process additions, for example, coagulant addition and disinfection to convert storage basins to discharging equivalent primary treatment under some flow conditions). Other opportunities to modify the level of CSO controls may include enhancement or expansion of the Green Infrastructure Program should monitoring indicate cost-effective source runoff reduction.

TABLE ES.1

FINAL RECOMMENDED GREEN DEMONSTRATION PROJECT LIST

Project Name	Location	CSO Controlled	Technology	Gallons Removed Annually (MG)	Capital Cost (2008 Dollars)	Cost per Gallon Removed	Completion Date
MSD Main Office Parking Lot Bioswale	Ohio River	CSO053	Biofiltration Technique	0.88 MG	$80,000	$0.09	12/31/2010
Seventh and Cedar Green Parking Lot	Ohio River	CSO053	Biofiltration Technique	1.1 MG	$96,000	$0.09	12/31/2010
Second and Broadway Green Parking Lot	Ohio River	CSO181, CSO118	Biofiltration Technique	1.1 MG	$96,000	$0.09	12/31/2010
Third and Ormsby Biofiltration Swales	Ohio River	CSO198	Biofiltration Technique	0.53 MG	$ 48,000	$0.09	12/31/2010
Sixth and Muhammad Ali Green Parking Lot	Ohio River	CSO022	Biofiltration Swale	1.1 MG	$96,000	$0.09	12/31/2010
Sixth and Broadway Rain Garden	Ohio River	CSO028	Rain Garden	0.53 MG	$48,000	$0.09	12/31/2010
Seventeenth and W Hill Permeable Alley	Ohio River	CSO015	Permeable Alley	1.74 MG	$278,000	$0.16	12/31/2010
Seventh and Market Permeable Alley	Ohio River	CSO053	Permeable Alley	0.97 MG	$155,000	$0.16	12/31/2010
Campbell and Main Permeable Alley	South Fork	CSO121	Permeable Alley	0.41 MG	$65,000	$0.16	12/31/2010
Twelfth and Jefferson Green Street	Ohio River	CSO208	Green Street	0.53 MG	$48,000	$0.09	12/31/2010
I-264 Off-Ramp Dry Well	Middle Fork	CSO189	Dry Well	0.15 MG	$30,000	$0.20	12/31/2011
I-264 On-Ramp Dry Well	Ohio River	CSO019	Dry Well	0.15 MG	$30,000	$0.20	12/31/2011
I-264 and Gibson Dry Well	Ohio River	CSO191	Dry Well	0.6 MG	$120,000	$0.20	12/31/2011
Russell Lee Drive Dry Well	Ohio River	CSO191	Dry Well	0.15 MG	$30,000	$0.20	12/31/2011
JFK Montessori Area Dry Well	Ohio River	CSO191	Dry Well	0.3 MG	$60,000	$0.20	12/31/2011
Additional Rain Garden Site	TBD	TBD	Rain Garden	0.53 MG	$48,000	$0.09	12/31/2010
Additional Rain Garden Site	TBD	TBD	Rain Garden	0.53 MG	$48,000	$0.09	12/31/2010
Additional Rain Garden Site	TBD	TBD	Rain Garden	0.53 MG	$48,000	$0.09	12/31/2011
Additional Rain Garden Site	TBD	TBD	Rain Garden	0.53 MG	$48,000	$0.09	12/31/2011
TOTAL				**12 MG**	**$1,500,000**	**$0.13**	

TABLE ES.2
GREEN INFRASTRUCTURE PROGRAM INITIATIVE (FIRST 6 YEARS) 1

Impervious Surface and Best Management Practice (BMP) Type[1]	Implementation Level over a 15-year Planning Horizon[2]	Estimated Annual Stormwater Reduction over a 15-year Planning Horizon[3]	Annual Cost[4]	Program Cost per Gallon[5]
Public Roofs				
Extensive Vegetated Roofs	7%	21,327,000	$427,000	$0.30
Tray System Vegetated Roofs	3%	5,625,000	$112,000	$0.30
Commercial Roofs				
Extensive Vegetated Roofs	1%	4,376,000	$88,000	$0.30
Tray System Vegetated Roofs	1%	2,693,000	$54,000	$0.30
Industrial Roof				
Extensive Vegetated Roofs	1%	6,532,000	$131,000	$0.30
Tray System Vegetated Roofs	1%	4,020,000	$80,000	$0.30
Single Family Residential Roofs				
Downspout Disconnection	10%	123,792,000	$386,000	$0.05
Rain Barrel Program	N/A	0	$165,000	$0.00
Local Roads				
Green Street	1%	245,901,000	$3,070,000	$0.19
Urban Reforestation	14,000 trees	11,200,000	$224,000	$0.30
Highways				
Biofiltration	0.5%	10,691,000	$7,000	$0.01
Alleys				
Type A Alley (porous strip)	5%	11,885,000	$238,000	$0.30
Type B Alley (porous entire width)	5%	11,885,000	$238,000	$0.30
Public Parking/Driveways				
Biofiltration	5%	305,541,000	$191,000	$0.01
Commercial Parking/Driveways				
Biofiltration	1%	84,098,000	$52,000	$0.01
Industrial Parking/Driveway				
Biofiltration	0.5%	44,716,000	$28,000	$0.01
Single Family Residential Property				
Biofiltration	0.5%	52,035,000	$32,000	$0.01
Subtotal		**946,317,000 gallons**	**$5,523,000**	**N/A**
Technical Support			**$276,000**	**N/A**
TOTAL			**$5,799,000**	**N/A**
Green Infrastructure Program Cost to MSD per Gallon Removed			**$0.09**	

[1] Estimated stormwater reductions and Green Infrastructure Program costs were derived from the green infrastructure cost tool developed by Strand Associates, Inc.
[2] Implementation level defines the proposed percentage of that impervious surface type to be retrofitted with a green control as part of the Green Infrastructure Program.
[3] Represents the potential reduction in annual stormwater reduction if the listed implementation rates are successfully carried out over 15 years as part of the Green Infrastructure Program.
[4] Anticipated Annual Costs will vary based on opportunities and partnership agreements. Total six-year costs will not be less than $36,000,000.
[5] MSD's cost share for green infrastructure controls is based on the marginal cost of gray storage at $0.30 per gallon. Therefore, the maximum amount MSD will pay for a green control is $0.30 per gallon of stormwater removed.

TABLE ES.3
FINAL RECOMMENDED GRAY INFRASTRUCTURE PROJECT LIST

Project Name and Project ID	Watershed	CSOs Controlled	Technology	Storage Volume or Treatment/Pumping Rate	Capital Cost (2008 Dollars)	Completion Date
CSO108 Dam Modification **L_SO_MF_108_S_09A**	South Fork	CSO108	In-Line Storage	NA	$150,000	12/31/2010
CSO123 Downspout Disconnection **L_MI_MF_123_S_08**	Middle Fork	CSO123	Sewer Separation	NA	$315,000	12/31/2012
Adams Street Storage Basin **L_OR_MF_172_S_09B**	Ohio River	CSO172	Off-Line Storage	0.12 MG	$983,000	12/31/2012
Story Avenue and Main Street Storage Basin **L_OR_MF_020_S_09B**	Ohio River	CSO020	Off-Line Storage	0.13 MG	$1,580,000	12/31/2013
CSO206 Sewer Separation **L_MI_MF_206_S_08**	Middle Fork	CSO206	Sewer Separation	NA	$3,842,000	12/31/2013
Paddy's Run Wet Weather Treatment Facility **L_OR_MF_015_M_13**	Ohio River	CSO015, CSO191	Treatment with RTC	50 mgd	$24,940,000	12/31/2014
I-64 and Grinstead Drive Storage Basin **L_MI_MF_127_M 09B**	Middle Fork	CSO127, CSO125, CSO126, CSO166	Off-Line Storage	2.74 MG	$12,950,000	12/31/2014
CSO058 Sewer Separation **L_OR_MF_058_S_08**	Ohio River	CSO058	Sewer Separation	N/A	$1,361,000	12/31/2014
CSO140 Sewer Separation **L_MI_MF_140_S_08**	Middle Fork	CSO140	Sewer Separation	N/A	$3,150,000	12/31/2015
CSO093 Sewer Separation **L_SO_MF_093_S_08**	South Fork	CSO093	Sewer Separation	N/A	$952,000	12/31/2015
CSO160 Sewer Separation **L_OR_MF_160_S_08**	Ohio River	CSO160	Sewer Separation	N/A	$237,000	12/31/2015
Nightingale Pump Station Replacement **L_SO_MF_018_S_03**	South Fork	CSO018	Pump Station Expansion	60 mg	$15,710,000	12/31/2016

TABLE ES.3
FINAL RECOMMENDED GRAY INFRASTRUCTURE PROJECT LIST

Project Name and Project ID	Watershed	CSOs Controlled	Technology	Storage Volume or Treatment/Pumping Rate	Capital Cost (2008 Dollars)	Completion Date
Story Avenue and Spring Street Storage Basin L_SO_MF_130_S_09B	South Fork	CSO130	Off-Line Storage	0.01 MG	$1,077,000	12/31/2016
Logan Street and Breckinridge Street Storage Basin L_SO_MF_092_M_09B	South Fork	CSO 113, CSO152, CSO091, CSO146, CSO149, CSO117, and 11 Sneads Branch Relief Sewer CSOs	Off-Line Storage	11.83 MG	$30,320,000	12/31/2017
Calvary - Creekside Storage Basin L_SO_MF_097_M_09B	South Fork	CSO097, CSO106, CSO110, CSO137, CSO148, and CSO151	Off-Line Storage	3.46 MG	$13,720,000	12/31/2017
18th and Northwestern Pky. Storage Basin L_OR_MF_190_S_09B	Ohio River	CSO190	Off-Line Storage	1.31 MG	$4,514,000	12/31/2017
Beargrass Creek Parallel Interceptor – Lower and Upper Reaches L_SO_MF_097_M_13	South Fork	Lower Reach: Logan Street and Breckenridge Street Storage Basin to Starkey Pumping Plant Upper Reach: Calvary-Creekside Storage Basin to Nightingale Pump Station	Conveyance	NA	$12,994,000	12/31/2017
Clifton Heights Storage Basin L_MU_MF_154_M_09B	Muddy Fork	CSO154, CSO132 and CSO167	Off-Line Storage	6.55 MG	$13,870,000	12/31/2018
Algonquin Parkway Storage Basin L_OR_MF_211_M_13	Ohio River	CSO211, CSO016, and CSO210	Off-Line Storage with RTC	4.84 MG	$17,300,000	12/31/2018

TABLE ES.3
FINAL RECOMMENDED GRAY INFRASTRUCTURE PROJECT LIST

Project Name and Project ID	Watershed	CSOs Controlled	Technology	Storage Volume or Treatment/Pumping Rate	Capital Cost (2008 Dollars)	Completion Date
Southwestern Parkway Storage Basin L_OR_MF_105_M_13	Ohio River	CSO105, CSO104, and CSO189	Off-Line Storage with RTC	5.08 MG	$17,620,000	12/31/2018
Portland Wharf Storage Basin L_OR_MF_019_S_13	Ohio River	CSO019	Off-Line Storage with RTC	6.37 MG	$20,000,000	12/31/2019
13th Street and Rowan Street Storage Basin L_OR_MF_155_M_09B	Ohio River	CSO155, CSO022, CSO023, CSO050, CSO051, CSO052, CSO053, CSO054, CSO055, CSO056, CSO150, CSO156, CSO208, and Central Relief Drain (CRD)	Off-Line Storage	14.44 MG	$49,680,000	12/31/2020
Lexington Road and Payne Street Storage Basin L_SO_MF_083_M_09B	South Fork	CSO084, CSO118, CSO119, CSO120, CSO121, CSO141, CSO153 & CSO082	Off-Line Storage	7.31 MG	$25,200,000	12/31/2020

TABLE ES.4
FINAL RECOMMENDED FLOOD PUMP STATION PROJECT LIST

Project Name	Watershed	CSO Controlled	Technology	Size (MG)	Capital Cost (2008 Dollars)	Completion Date
34th Street Flood Pump Station **L_OR_MF_019_S_03_A_B**	Ohio River	CSO019	Flow Control	N/A	$541,000	12/31/2012
4th Street Flood Pump Station **L_OR_MF_022_S_03_A_A**	Ohio River	CSO022,CSO023	Flow Control	N/A	$944,000	12/31/2012
27th Street Flood Pump Station **L_OR_MF_019_S_03_A_A**	Ohio River	CSO019	Flow Control	N/A	$476,000	06/30/2013
Shawnee Flood Pump Station **L_OR_MF_189_S_03_A_A**	Ohio River	CSO104, CSO105, CSO189	Flow Control	N/A	$411,000	06/30/2013
17th Street Flood Pump Station **L_OR_MF_190_S_03_A_A**	Ohio River	CSO190	Flow Control	N/A	$625,000	12/31/2014

INTEGRATED OVERFLOW ABATEMENT PLAN
VOL. 2 FINAL CSO LONG-TERM CONTROL PLAN

FIGURE ES.1
CSO PROGRAM ACCOMPLISHMENTS

MILESTONE:	YEAR:	CSO ABATEMENT PROJECTS:	
MSD Initiated CSO Abatement Program	1991	• BMP Evaluations Conducted • Sewer System Flow Monitoring • CSO Inventory • CSO & Stream Sampling • CSO Model Developed	
First Combined Sewer Operational Plan (CSOP) to KDOW	1993		
Yearly Reporting to KDOW	1994		
	1996	• Solids & Floatables Demonstration Projects • Central Relief Drain Cleaning • BMP Evaluations • Increase Overflow Weir Height • CSO143 Elimination • CSO065 Elimination • CSO162 Elimination	
CSO LTCP Submittal			
Nine Minimum Controls	1998		
	2000	• Sneads Branch In-Line Storage • Increase Overflow Weir Height • Upper Dry Run Trunk Storage • Wheeler Basin Storage • Robert J. Starkey Pumping Plant Modification • CSO108 CDS Facility	• CSO123 Elimination • CSO088 Sewer Separation Project • CSO080 Elimination • CSO209 Sewer Separation Project • CSO147 Sewer Separation Project • CSO049 Elimination • CSO204 Elimination
	2001		
	2002	• Airport Deicing Project • Stormwater Drainage Improvements • Pumping Station Upgrades • Morris Forman WWTP Upgrade • MDS Inflatable Dam • Flow Maximized to Morris Forman WWTP • Real Time Control Studies • Real Time Control Phase I Improvements • Sewer Diversions • Solids & Floatables Facilities • Sewer Cleaning at NSTS • CSO080 Elimination • CSO145 Elimination	
	2004		
Entered Into Consent Decree	2005		
	2006	• Prepared Consent Decree Documents • Real Time Control Phase I Implementation Project • CSO209 Elimination Project	
Interim LTCP			
	2008	• Solids & Floatables Control - System Wide • CSO206 Sewer Separation Project (On-Going) • CSO147 Elimination Project • CSO087 Sewer Separation and Elimination Project • Real Time Control Phase II Implementation Project	• CSO081 Elimination Project • CSO194 Elimination Project • CSO032 Elimination Project • CSO033 Elimination Project • CSO030 Elimination Project

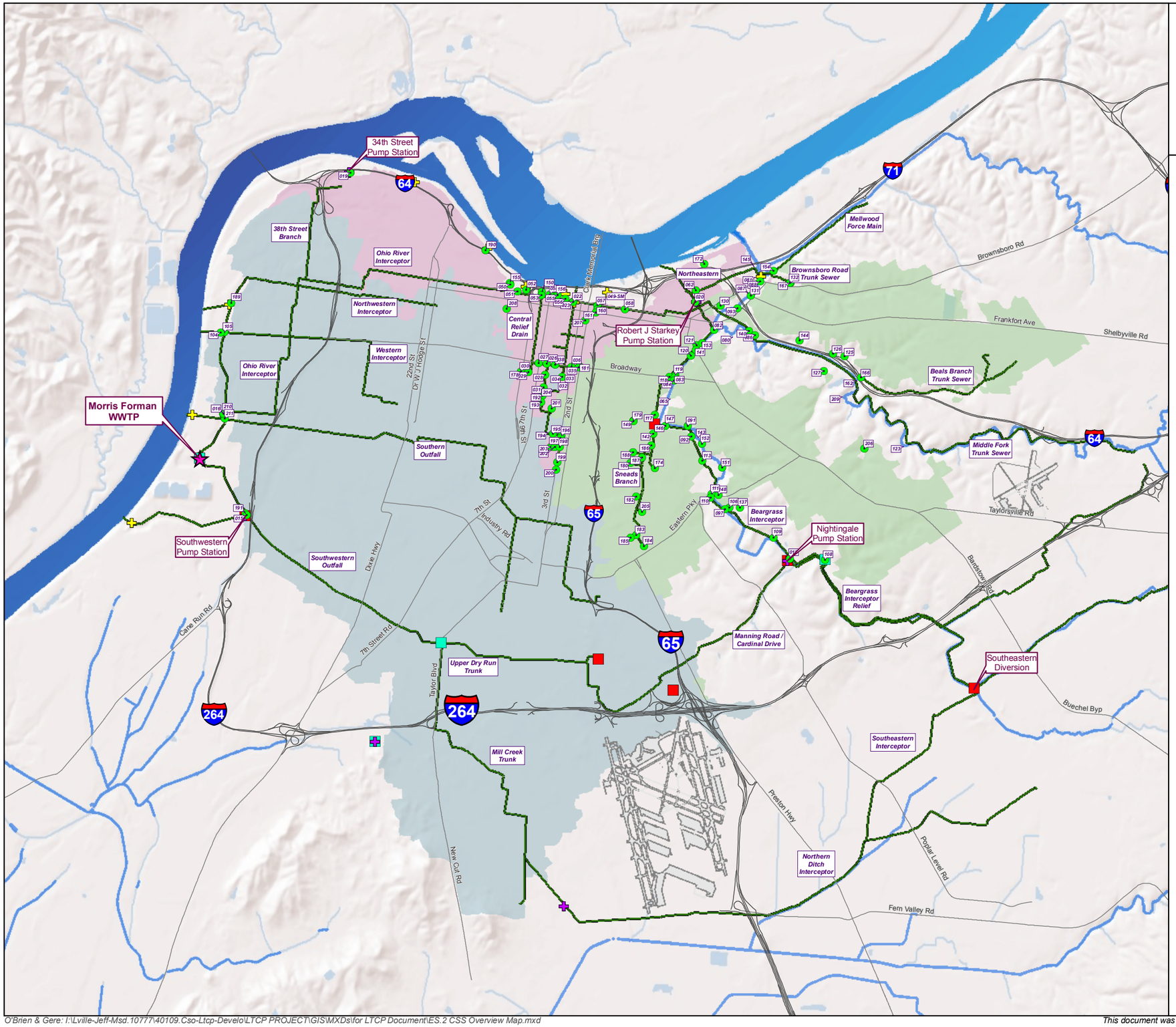
MSD
Metropolitan Sewer District

PROJECT WIN
Waterway Improvements Now

Integrated Overflow Abatement Plan

Vol. 2 - Final CSO Long-Term Control Plan

FIGURE ES.3
COMBINED SEWER SYSTEM OVERVIEW



LEGEND

- Real Time Control Phase 1
- Real Time Control Phase 2
- Active CSO Location
- Flood Pump Station
- Sanitary Pump Station
- Wastewater Treatment Plant
- Major Sewer Line
- Interstate
- Major Road

Regional Boundaries

- Beargrass Creek
- Ohio River North
- Ohio River West
- Water Feature

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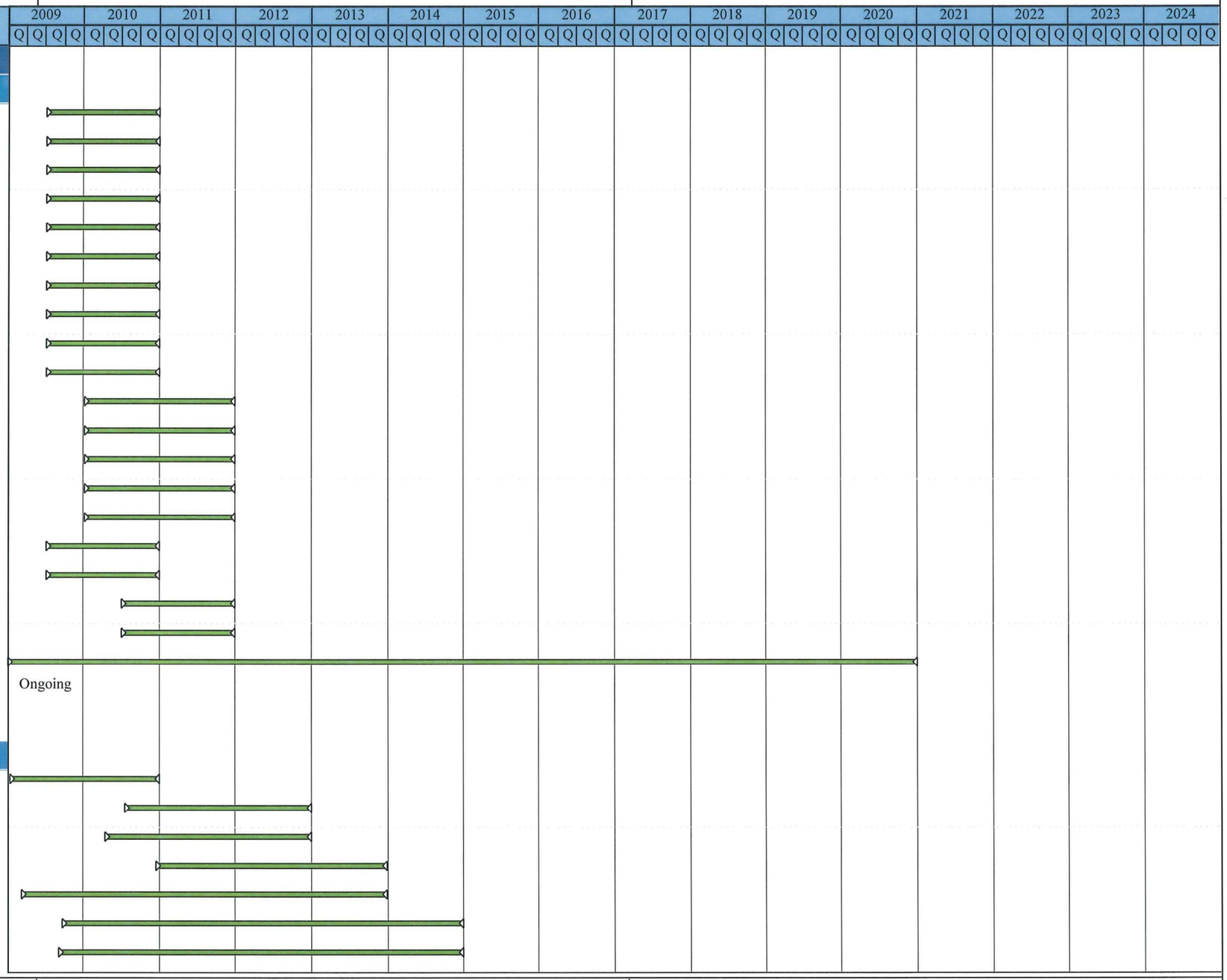
This document was developed in color. Reproduction in black and white may not represent the data as intended.

Figure ES.5

Final Long Term Control Plan Implementation Schedule

Figure ES.5

Project Name	Finish
Long Term Control Plan	31-Dec-20
Green Demonstration Projects	31-Dec-20
MSD Main Office Parking Lot Bioswale	31-Dec-10
Seventh and Cedar Green Parking Lot	31-Dec-10
Second and Broadway Green Parking Lot	31-Dec-10
Third and Ormsby Biofiltration Swales	31-Dec-10
Sixth and Muhammad Ali Green Parking Lot	31-Dec-10
Sixth and Broadway Rain Garden	31-Dec-10
Seventeenth and W Hill Permeable Alley	31-Dec-10
Seventh and Market Permeable Alley	31-Dec-10
Campbell and Main Permeable Alley	31-Dec-10
Twelfth and Jefferson Green Street	31-Dec-10
I-264 Off-Ramp Dry Well	31-Dec-11
I-264 On-Ramp Dry Well	31-Dec-11
I-264 and Gibson Dry Well	31-Dec-11
Russell Lee Drive Dry Well	31-Dec-11
JFK Montessori Area Dry Well	31-Dec-11
Additional Rain Garden Project	31-Dec-10
Additional Rain Garden Project	31-Dec-10
Additional Rain Garden Project	31-Dec-11
Additional Rain Garden Project	31-Dec-11
Green Infrastructure Program	31-Dec-20
Gray Infrastructure Projects	31-Dec-20
CSO108 Dam Modification	31-Dec-10
CSO123 Downspout Disconnection	31-Dec-12
Adams Street Storage Basin	31-Dec-12
Story Avenue and Main Street Storage Basin	31-Dec-13
CSO206 Sewer Separation	30-Dec-13
Paddy's Run Wet Weather Treatment Facility	31-Dec-14
I-64 and Grinstead Drive Storage Basin	31-Dec-14



All Projects

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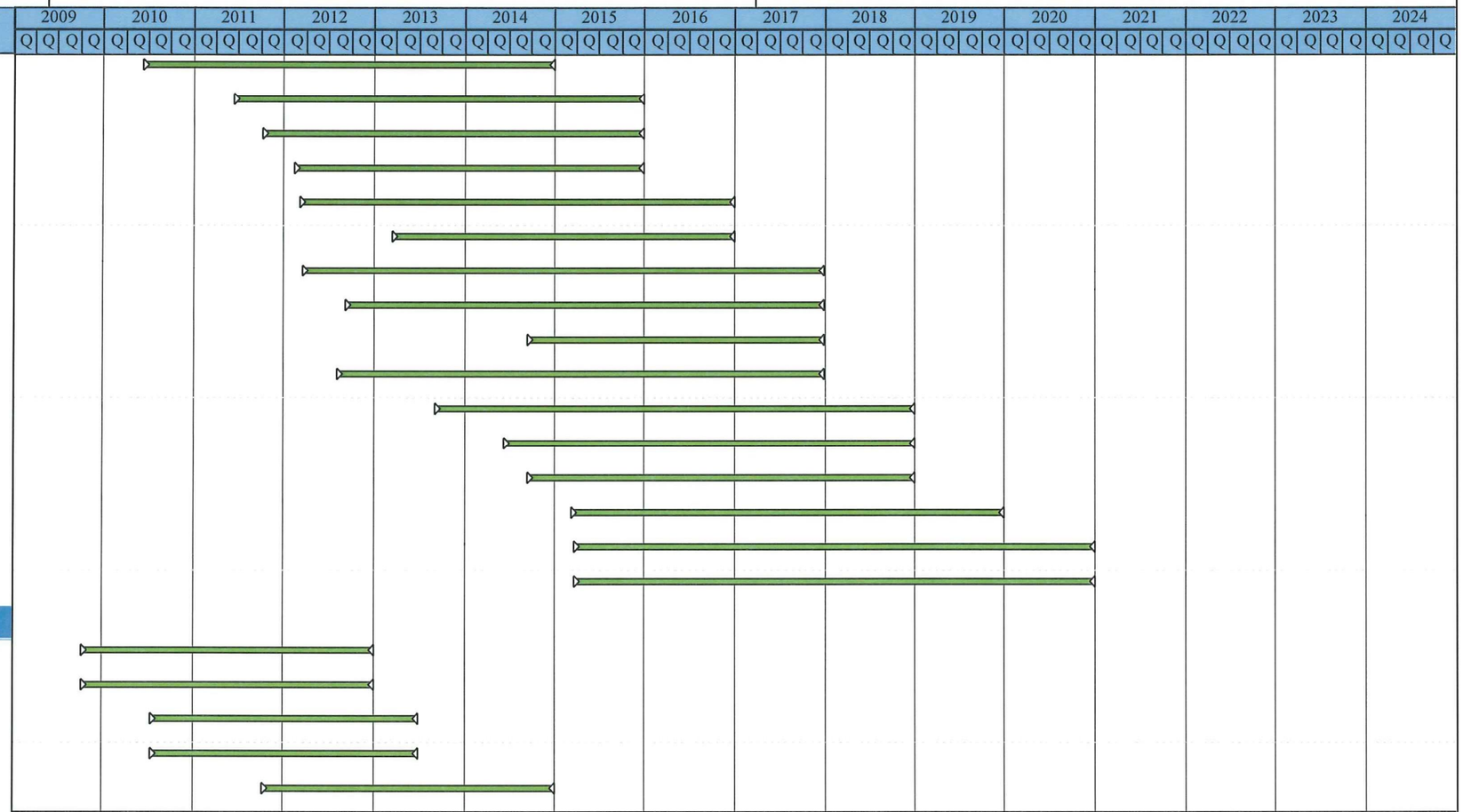
Final Long Term Control Plan Implementation Schedule

Figure ES.5

Project Name	Finish
CSO058 Sewer Separation	31-Dec-14
CSO140 Sewer Separation	31-Dec-15
CSO093 Sewer Separation	31-Dec-15
CSO160 Sewer Separation	31-Dec-15
Nightingale Pump Station Replacement	31-Dec-16
Story Avenue and Spring Street Storage Basin	31-Dec-16
Logan Street and Breckinridge St Storage Basin	31-Dec-17
Calvary - Creekside Storage Basin	31-Dec-17
18th and Northwestern Pky. Storage Basin	31-Dec-17
Beargrass Creek Parallel Interceptor	31-Dec-17
Clifton Heights Storage Basin	31-Dec-18
Algonquin Parkway Storage Basin	31-Dec-18
Southwestern Parkway Storage Basin	31-Dec-18
Portland Wharf Storage Basin	31-Dec-19
13th Street and Rowan Street Storage Basin	31-Dec-20
Lexington Road and Payne Street Storage Basin	31-Dec-20
Flood Pump Station Projects	31-Dec-14
34th Street Flood Pump Station	31-Dec-12
4th Street Flood Pump Station	31-Dec-12
27th Street Flood Pump Station	30-Jun-13
Shawnee Flood Pump Station	30-Jun-13
17th Street Flood Pump Station	31-Dec-14



All Projects

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