CHAPTER 1: INTRODUCTION

TABLE OF CONTENTS

1.1 BACKGROUND 2
1.2 FINAL SSDP DOCUMENT ORGANIZATION 4
1.3 PREVIOUS / ONGOING PROGRAMS 5
1.3.1 Updated Sanitary Sewer Overflow Plan (SSOP) 5
1.3.1.1 Flow Monitoring 5
1.3.1.2 Sanitary Sewer Evaluation Study (SSES) and other Sewer Investigations/Studies 9
1.3.1.3 Hydrologic and Hydraulic Modeling 14
1.3.1.4 Plumbing Modification Program 14
1.3.1.5 Rehabilitation, Repair or Replacement Projects 16
1.3.1.6 Post-Rehabilitation Flow Monitoring and Results 19
1.3.1.7 Relation to Final SSDP Planning 19
1.3.2 Capacity, Management, Operations and Maintenance (CMOM) Program 19
1.3.2.1 Relation to Final SSDP Planning 21
1.3.2.2 System Capacity Assurance Plan (SCAP) 22
1.3.3 Sewer Overflow Response Protocol (SORP) 23
1.3.3.1 Preparatory Actions 23
1.3.3.2 Overflow Management and Field Documentation 23
1.3.3.3 Public Notification and Communication 24
1.3.3.4 Regulatory Reporting and Data Management 24
1.3.3.5 Staff Training and Communication 24
1.3.3.6 Relation to Final SSDP Planning 25
1.3.4 Interim Sanitary Sewer Discharge Plan 25
1.3.4.1 Background 26
1.3.4.2 Interim SSDP Solution 26
1.3.4.3 Preliminary Project Schedule and Cost 29
1.4 PLANNING APPROACH 30
1.4.1 Modeling Overview 30
1.4.3 Public Participation 33
1.4.4 Measures of Success: Performance Goals 33

SUPPORTING INFORMATION

Appendix 1.3.1 Plumbing Modifications Program and Downspout Disconnection Program packet

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

On August 12, 2005, the 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 Final Sanitary Sewer Discharge Plan (Final SSDP).

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.

MSD is required to prepare and submit a Final SSDP designed to eliminate unauthorized discharges in the separate sanitary sewer system (SSS). The Consent Decree requires the Final SSDP to include consideration of conventional and innovative or alternative designs as part of the plan, including, but not limited to, sewer rehabilitation, sewer separation, relief sewers, above ground or below ground storage, high rate secondary treatment, illicit connection removal, remote wet weather secondary treatment facilities, and other appropriate alternatives. As interim milestones, MSD was also required to update its existing Sanitary Sewer Overflow Plan (SSOP) and to prepare an Interim SSDP identifying remedial measures to eliminate specific unauthorized discharges.

The Consent Decree requires that the Interim SSDP identify remedial measures to eliminate the unauthorized discharges identified in the Consent Decree for the Interim SSDP. These discharges include those resulting from MSD's use of portable pumps within the Hikes Point and Beechwood Village areas, and to eliminate unauthorized discharges at the Highgate Springs Pump Station and the Southeastern Diversion Structure.

The Final SSDP is intended to identify remedial measures to eliminate unauthorized discharges from the separate SSS locations not previously addressed in the Interim SSDP. The Final SSDP contains the long-term projects including schedules, milestones, and deadlines as required by the Consent Decree. The Final SSDP also includes the results of an evaluation of WQTC peak flow treatment capacity for the Jeffersontown WQTC and any WQTC that will receive additional flow as a result of any Final SSDP project. Such evaluations are consistent with the EPA publications "Improving POTW Performance Using the Composite Correction Approach," EPA CERI, October 1984, and "Retrofitting POTWs," EPA CERI, July 1989.

The Final SSDP is in coordination with elements of the Capacity, Management, Operations, and Maintenance (CMOM) programs. The Final SSDP includes the following elements and descriptions:

- Maps of known unauthorized discharges (capacity related), including the areas and sewer lines that serve as a tributary to each unauthorized discharge
- Each known unauthorized discharge location including:
  - Discharge frequency
  - Type of discharge and the receiving stream
  - Annual volume of the discharge
  - Immediate area and downstream landuse (including the potential for public health concerns)
  - Studies to investigate the discharge (previously performed within the last five years, current, or proposed)
  - Rehabilitation or construction work to remediate or eliminate the discharge (previously performed within the last five years, current, or proposed)
- Prioritization of unauthorized discharge locations based upon frequency, volume, impact on receiving streams and public health
- Involvement of stakeholders in the planning, prioritization, and selection of projects
- Documentation of the prioritization process including:
  - Hydraulic modeling, including calibration, validation, addressing wet-weather inflow and infiltration (I/I) and accounting for future growth (build-out)
  - Baseline or existing conditions
  - Rules for abating SSOs and surcharged areas
  - Preliminary or initial solutions
  - Ground-truthing or field verification of preliminary locations
  - Sizing of facilities (solutions) and determining benefits and costs for facilities
  - Level of protection
  - Final costs and descriptions of preferred solutions
- Source Control, including targeted I/I reduction and plumbing modification programs
- Measures of success including: Elimination of SSOs, Reduction or elimination of basement flooding and Reduction in I/I
- Remedial measures, expeditious budgets, and schedules for design, initiation of construction and completion of construction. The schedules are phased based upon sound engineering judgment and do not extend beyond December 31, 2024
- Continuous modifications, including plans for measuring success via flow monitoring and modeling and addressing newly discovered SSOs

1.2 FINAL SSDP DOCUMENT ORGANIZATION

As the third volume of the IOAP, the Final SSDP focuses on the control and mitigation of SSOs. The following text outlines the Final SSDP with a brief description on the focus of each chapter.

Chapter 1 Introduction

This chapter presents summaries of previous/ongoing projects and programs, describing the relationship to the current planning process. Previous/ongoing projects and programs include the Updated SSOP, CMOM, Sewer Overflow Response Protocol (SORP), and Interim SSDP. This chapter reviews the role of public participation and agency interaction with specific Final SSDP issues. The final section of the chapter describes in general terms the approach used to evaluate the projects and programs of the Final SSDP.

Chapter 2 System Characterization

This chapter defines the goals of the system characterization program and provides an extensive compilation and analysis of unauthorized discharges in the separate SSS. This chapter includes MSD service area maps showing the unauthorized discharge areas and associated WQTCs, collection system modeling, and system monitoring. This chapter also includes a description of the computer models used to simulate separate SSS areas.

Chapter 3 Development and Evaluation of Alternatives for SSO Abatement

This chapter presents the methodologies used to evaluate the various discharge elimination solutions. The chapter defines and discusses strategies and technologies available to control and eliminate unauthorized discharges in the separate SSS. Discussions include alternatives for discharge elimination in each area of an unauthorized discharge. Finally, this chapter provides a summary of the evaluation for each discharge abatement alternative. The evaluation criterion includes feasibility screening, computer modeling, quality control, level of protection, cost estimates, and a benefit-cost analysis.

Chapter 4 Selection of the Sanitary Sewer Discharge Plan

This chapter includes an explanation of the values-based risk management process used to select and prioritize the Final SSDP alternatives. This chapter examines the various issues associated with implementation of the alternative(s) selected as integral to the Final SSDP. Issues discussed include community values, benefit-cost analysis, environmental impact, technical concerns, prioritization of projects, and implementation schedules compatible with the Consent Decree requirements.

1.3 PREVIOUS / ONGOING PROGRAMS

This section provides a summary of previous and ongoing programs relative to SSO control. These programs and studies serve as the foundation for the current planning effort of the Final SSDP. The following plans and programs are summarized in this section.

- Updated SSOP
- CMOM Programs
- SORP
- Interim SSDP

1.3.1 Updated Sanitary Sewer Overflow Plan (SSOP)

MSD has been active in the SSO planning area for years and has focused collection system repair and rehabilitation efforts on wet weather I/I issues that contribute to SSOs. The projects have been successful in reducing SSO volume and frequencies, but have not completely eliminated SSOs. Prior to the development of the Final SSDP, the SSOP was MSD's centralized program for managing the investigation, prioritization, and rehabilitation of the separate SSS. The program goals were to reduce SSOs, basement backups, and other unauthorized discharges. This program represented MSD's proactive approach toward eliminating excess I/I from the separate SSS. The SSOP was submitted on February 10, 2006, to the EPA and KDEP; however, no review or approval was required by the Consent Decree. The previous studies have been divided into the following phases and are further described in the sections that follow:

- Flow Monitoring
- Sanitary Sewer Evaluation Study (SSES) and Other Sewer Investigation/Study Projects
- Hydrologic and Hydraulic Modeling
- Rehabilitation, Repair or Replacement Projects
- Post-Rehabilitation Flow Monitoring and Results

1.3.1.1 Flow Monitoring

The goal of flow monitoring is to collect sufficient dry and wet weather data to assess I/I levels, provide calibration data to models and to assess the success of any rehabilitation. During the flow monitoring phase, sewersheds are divided into sub-basins which often coincide with key hydraulic features or SSO locations. To collect data, rain gauges and flow monitors are installed in each sub-basin and monitored for a specified period of time or until sufficient rainfall and flow responses has been obtained. Each sub-basin flow monitoring data is analyzed for typical parameters such as peaking factors, average dry weather flow, and wet weather flow characteristics in order to determine the nature of the I/I problem. This flow data serves as the basis for prioritizing projects in the sewershed, calibration of models for further study, and assessing rehabilitation. Flow-monitoring studies performed from 1997 to 2008 are summarized in Table 1.3.1.

TABLE 1.3.1

FLOW MONITORING STUDIES (1997-2008)

Service Area	Project Name	Flow Monitoring Beginning Date	Flow Monitoring Ending Date	Collection Period (days)	No. of Sub-basins	No. of Flow Monitors used	No. Significant Rain Events	I/I Found?	Results Developed Into	Project Completion Date
MF	Beechwood Village Flow Monitoring	6-Mar-98	9-Aug-98	157	--	5	6	Yes	SSES Project	July-99
MF	Ohio River Force Main/Muddy Fork Flow Monitoring	15-Jan-99	12-Mar-99	56	44	7	2	Yes	SSES Projects	December-99
MF	Priority SSO Flow Monitoring Part 1: Middle Fork Beargrass Creek	19-Feb-99	4-Apr-99	45	60	1	2	Yes	SSES Projects	February-99
MF	Beechwood Village Chimney Seal and Cured-in-place Pipe Installation: Post-rehab Flow Monitoring	12-Feb-01	16-Apr-01	64	--	6	2	Reductions Found	Post-Rehab Flow Monitoring	June-01
MF	Hikes Point Chimney Seal and Cured-in-place Pipe Installation: Post-rehab Flow Monitoring	12-Feb-01	16-Apr-01	64	--		2	Reductions Found	Post-Rehab Flow Monitoring	June-02
MF	Buechel Branch Chemical Root Control: Post-rehab Flow Monitoring	3-Jan-02	3-Mar-02	60	--		2	Reductions Found	Post-Rehab Flow Monitoring	June-02
MF	Buechel Branch (and Northern Ditch) Real-Time Control Flow Monitoring	1-Jan-02	16-May-02	120 (2 waves)	--	12	12	Yes	RTC Model Calibration	November-02
MF	Hikes Point Real-Time Control Flow Monitoring	17-Jan-02	16-May-02	120	--	5	12	Yes	RTC Model Calibration	November-02
MF	Middle Fork Flow Monitoring	9-Dec-03	16-Feb-04	70	--	23	2	--	Model Calibration	May-04
MF	County-wide Flow Monitoring	15-Jan-07	8-Jun-07	144	--	86	--	--	--	--
MF	County-wide Flow Monitoring	3-Nov-05	24-Jul-07	628	--	15	--	--	--	--

TABLE 1.3.1

FLOW MONITORING STUDIES (1997-2008)

Service Area	Project Name	Flow Monitoring Beginning Date	Flow Monitoring Ending Date	Collection Period (days)	No. of Sub-basins	No. of Flow Monitors used	No. Significant Rain Events	I/I Found?	Results Developed Into	Project Completion Date
DRG	Valley Village Flow Monitoring	3-Mar-98	11-May-98	68	6	6	3	Yes	System Characterization	February-99
DRG	Priority SSO Flow Monitoring Part 2: Pond Creek (and: Silver Heights, McNeely Lake) Flow Monitoring	13-Apr-98	27-May-98	45	48	48	3	Yes	SSES Projects	February-99
DRG	Mill Creek Flow Monitoring	6-Oct-98	18-Jan-99	105	--	4	4	--	System Characterization	April-99
DRG	Pond Creek Chimney Seal and Cured-in-place Pipe Installation: Post-rehab Flow Monitoring	3-Jan-02	14-Mar-02	71	--		2	Reductions Found	Post-Rehab Flow Monitoring	2003
DRG	Mill Creek Flow Monitoring	16-Dec-01	18-Mar-02	92	6		2	Yes	System Characterization	June-02
DRG	Derek R. Guthrie Flow Monitoring	23-Dec-02	5-Feb-03	45	--	13	--	--	Model Calibration	March-03
DRG	County-wide Flow Monitoring	8-Jan-07	20-Apr-07	102	--	23	--	--	--	--
DRG	County-wide Flow Monitoring	22-May-08	23-Jul-08	62	--	10	--	--	--	--
CC	Cedar Creek Flow Monitoring	16-Mar-99	6-May-99	51	6	6	4	Some	SSES Project	November-01
CC	Cedar Creek Watershed Flow Monitoring	23-Dec-02	5-Feb-03	45	8		--	--	Model Calibration	--
CC	County-wide Flow Monitoring	23-Mar-07	2-Jul-07	101	--	7	--	--	--	--
HC	Hite Creek (and Crestwood) Flow Monitoring	2-May-00	11-Jul-00	70	1	7	--	Yes	System Characterization	September-03
		14-Aug-00	23-Oct-00	70	1	1	3	Some	Flow Monitoring Data Correction	September-03
HC	County-wide Flow Monitoring	19-May-06	21-Jun-07	398	--	2	--	--	--	--
HC	County-wide Flow Monitoring	22-Mar-07	17-Jul-07	117	--	9	--	--	--	--

TABLE 1.3.1

FLOW MONITORING STUDIES (1997-2008)

Service Area	Project Name	Flow Monitoring Beginning Date	Flow Monitoring Ending Date	Collection Period (days)	No. of Sub-basins	No. of Flow Monitors used	No. Significant Rain Events	I/I Found?	Results Developed Into	Project Completion Date
FF	Pope Lick Flow Monitoring	31-Jan-98	22-Mar-98	51	6	6	2	Yes	PS Sizing & SSES Project	December-99
FF	Woodland Hills Chimney Seal and Cured-in-place Pipe Installation: Post-rehab Flow Monitoring	5-Jan-00	31-Mar-00	87	--		2	A Few Improvements	Post-Rehab Flow Monitoring	June-01
FF	Pope Lick Chimney Seal and Cured-in-place Pipe Installation: Post-rehab Flow Monitoring	12-Feb-01	16-Apr-01	64	--		2	A Few Improvements	Post-Rehab Flow Monitoring	June-01
FF	County-wide Flow Monitoring	5-Apr-07	17-Jul-07	103	--	8	--	--	--	--
FF	County-wide Flow Monitoring	16-May-07	4-Aug-07	80	--	4	--	--	--	--
JT	Jeffersontown Flow Monitoring	1-Sep-98	10-Oct-98	40	23	24	2	Yes	System Characterization	June-99
JT	Jeffersontown Chimney Seal Installation: Post-rehab Flow Monitoring	5-Jan-00	31-Mar-00	87	--		3	Reductions Found	Post-Rehab Flow Monitoring	June-00
JT	Jeffersontown Cured-in-place Pipe Installation: Post-rehab Flow Monitoring	3-Jan-02	14-Mar-02	71	--		2	No Conclusions	Post-Rehab Flow Monitoring	June-02
JT	Jeffersontown Flow Monitoring	23-Dec-02	5-Feb-03	45	--	10	--	--	Model Calibration	March-03
JT	Jeffersontown I/I Rehab Phase 3: Post-rehab Flow Monitoring	8-Dec-03	26-Jan-04	50	--		2	Improvements Found	Post-Rehab Flow Monitoring	May-04
JT	Countywide Flow Monitoring	13-Jan-07	23-May-07	130	--	19	--	--	--	--
PP	Prospect Flow Monitoring	22-Dec-99	19-Feb-00	60	10	10	2	Yes	System Characterization	June-00

Service Areas: MF = Morris Forman, DRG = Derek R. Guthrie (formerly West County – WC), CC = Cedar Creek, HC = Hite Creek, FF = Floyds Fork, JT = Jeffersontown, PP = Prospect
Note: Derek R. Guthrie WQTC (formerly West County Wastewater Treatment Plant)

1.3.1.2 Sanitary Sewer Evaluation Study (SSES) and other Sewer Investigations/Studies

The goal of an SSES is to provide data to identify likely sources of I/I and to prioritize areas for repairs. An SSES is an important tool for diagnosing the condition of the sewer system and determining what types of repairs might be necessary and successful. The defects identified are often used with flow monitor data to prioritize areas for rehabilitation, construction, and maintenance activities. The SSES process includes several tests and inspections that complement each other, which are described in the following text. Table 1.3.2 at the end of the section lists the studies that have been performed by MSD from 1997 to 2008.

Smoke Testing

The goal of smoke testing is to identify defects by emulating water entering inflow locations. Smoke under pressure flows through inflow defects to the surface, where it can be observed and documented.

The test consists of generating nontoxic, non-staining smoke and forcing it into less-than-full sewer lines by a portable, high-volume blower. The smoke can reach distances up to 600 feet and will appear at inflow locations that lead to the surface. The location is noted and the smoke-test crew investigates the emission point. If the emission point is determined to be an inflow source (see Figure 1.3.1), the area is photographed and the pertinent data are entered into MSD's data management system.

FIGURE 1.3.1 SMOKE INDICATING AN INFLOW SOURCE AT A MANHOLE

Smoke testing is generally low cost and is a proven method for locating collection system defects, such as structurally-damaged manhole frames and damaged cleanouts, and illicit connections, such as yard connections and cross-connected storm sewers. The smoke will also identify private side defects without accessing private property. This is critical given the increasing realization that private property defects can contribute significantly to wet weather I/I sources.

Manhole Inspections

The goal of manhole inspections is to visually identify defects that often contribute to inflow. Inspections can be done from the surface (see Figure 1.3.2), or if safety equipment is available, within the structure itself.

Inspections generally follow a checklist which is used to note the condition of various manhole features: cover, frame, risers, corbels and walls, pipe sizes, materials of construction, evidence of corrosion, and I/I (from the surface, cross connections, and illegal connections). It is also possible to lamp (shine high intensity light between manholes) the sewer between two adjacent manholes to look for defects and evidence of clogs or sedimentation.

FIGURE 1.3.2 VIEW INSIDE A MANHOLE

Television Inspection Review

The goal of television inspection is to provide condition assessment of sewers. The pipe is cleaned if necessary just prior to the television inspection. For television inspection review, a camera is lowered through a manhole and into the pipe and a continuous recording video inspection from within the line is completed with reference distances (See Figure 1.3.3). Inspections focus on pipe structural defects and improper connections. Beginning in 2005, the log information on each defect is used referencing Pipeline Assessment and Certification Program (PACP) codes, which is digitally linked to the video image. Inspections include noting sedimentation, pipe sags, and pipe defects.

FIGURE 1.3.3 VIEW INSIDE SEWER PIPE FROM A TELEVISION INSPECTION

Dye Testing

FIGURE 1.3.4 VIEW INSIDE SEWER PIPE FOR DYE TESTING

The goal of dye testing is to emulate inflow sources using dyed water, which, unlike normal inflow, can be readily identified. Dye testing involves injecting dyed water into a suspected inflow source and then noting the appearance (or lack thereof) of dyed water in a nearby sanitary sewer (See Figure 1.3.4). The test will confirm potential cross-connections, inflow sources and structural defects. This test is generally used as a contingency after other tests such as smoke testing cannot positively identify potential cross-connections. After the dye has penetrated the pipeline, a television inspection may be used to precisely locate the problem area.

Night Flow Isolation

The goal of night-flow isolation is to determine infiltration rates during periods of time when little sanitary flow can be expected, such as, during the middle of the night or early in the morning. Night flow testing consists of installing temporary weirs or other flow measuring devices at manholes to identify areas that have relatively high nighttime flows. In addition to the flow measurements, the real-time dissolved oxygen and temperature data can be noted.

The test can be conducted rather rapidly. This allows a large area to be analyzed in the course of a single night, which greatly aids in identifying high I/I areas. Water quality and temperature are also analyzed; infiltration has better water quality and lower temperature than sewer flow. Often night-flow isolation occurs over a series of nights and the preceding night's data is used to direct the subsequent night's test areas. Night-flow isolation must occur when there is no inflow and preferably, when the groundwater is higher than the pipe. This is typically a few days after a series of rainfall or in the fall months.

Wet Weather Inspections

FIGURE 1.3.5 OVERFLOW DURING WET WEATHER

The goal of wet weather inspections is to visually identify SSOs (See Figure 1.3.5) and surcharging. While the benefits of such inspections are obvious, it is very difficult to mobilize such inspections given the infrequency of overflow-causing rain events.

Tests can be aided by installing surcharge level indicators ahead of time. Surcharge level indicators are simple devices, which can indicate SSOs and surcharge conditions during wet weather. However, surcharge level indicators must be monitored frequently to minimize false readings. To indicate exfiltration of surcharged sewers inspections, dye may also be used. When time permits and where possible, inspections include estimating the timing of the SSO, the peak overflow rate, and the amount of overflow volume at each location.

Focused Electrode Leak Locator 41 Inspections

The goal of Focused Electrode Leak Locator 41 inspections is to determine defect locations through non-intrusive electrical means to complement or direct other SSES tests and inspections. Focused Electrode Leak Locator 41 is a technology that generates an electrical field from a specially-constructed electrode probe called a "sonde" and uses a second electrode (a metal stake) that is put in the ground surface adjacent to the pipe being tested (see Figure 1.3.6).

FIGURE 1.3.6 FOCUSED ELECTRODE LEAK LOCATOR SONDE AND EQUIPMENT VEHICLE FOR PIPE INSPECTIONS

The sonde is pulled through a surcharged, non-conductive sewer pipe and the magnitude of the current flow is measured by the surface electrode. Spikes in electric current identify all types of pipe defects (within inches) that are potential locations for leaks including faulty joints, pipe cracks, and defective service connections. The variation of the current is recorded and displayed as a plot of current versus distance along the pipe. The Focused Electrode Leak Locator 41 inspection also assesses the pipe defect size and continuously tests along the pipe. This inspection is simple, accurate, reliable, repeatable, and can be used at any time of the year.

TABLE 1.3.2

SANITARY SEWER EVALUATION STUDIES (SSES) 1997 - 2008

Service Area	Project Name	Completion Date	Smoke Testing (LF)	Manhole Inspections	Television Inspections (LF)	Dye Testing	Manhole Wet Well Investigation	Focused Electrode Leak Locator -41 (LF)	Cost
CC	**Cedar Creek SSES**	Nov. 2001	284,000	633	134,000	N/A	20 Hours	N/A	$246,000
FF	**Pope Lick SSES**	Dec. 1999	75,700	354	33,800	Yes	N/A	N/A	$388,000
HC	**North County SSES**	Sept. 2003	72,100	360	8,000	Yes	N/A	N/A	$291,000
JT	**Jeffersontown Condition Assessment**	Jul. 2005	86,000	N/A	56,000	N/A	N/A	N/A	$682,000
MF	**Middle Fork SSES Phase 1A**	Jul. 1998	126,350	600	31,100	Yes	N/A	N/A	$299,000
MF	**Hikes Point SSES**	Dec. 1998	500,000	2,143	Yes	Yes	Installed 25 flow meters and 4 rain gauges		$1,100,000
MF	**Beechwood Village SSES**	Jul. 1999	34,000	147	34,000	Yes	N/A	N/A	$117,000
MF	**Buechel Branch SSES Phase 1**	Mar. 2000	37,500	157	44,500	Yes	N/A	N/A	$50,000
MF	**Middle Fork SSES Phase 1B**	Jun. 2000	253,600	1,004	42,000	Yes	N/A	N/A	$434,000
MF	**Middle Fork SSES Phase 2**	Apr. 2002	214,814	954	38,294	Yes	N/A	N/A	$465,000
MF	**Northern Ditch SSES**	Sept. 2002	N/A	459	52,791	N/A	149	4,889	$272,000
PP	**Prospect SSES**	Oct. 2001	154,572	802	87,014	Yes	N/A	N/A	$143,000
DRG	**Valley Village SSES**	Feb. 1999	54,000	184	35,000	Yes	N/A	N/A	$193,000
DRG	**McNeely Lake SSES**	Dec. 1999	165,000	688	41,000	Yes	N/A	N/A	$494,000
DRG	**Derek R. Guthrie SSES Phase 1A**	Mar. 2000	242,500	932	48,400	Yes	N/A	N/A	$567,000
DRG	**Derek R. Guthrie SSES Phase 1B**	Sept. 2000	200,000	952	50,000	Yes	N/A	N/A	$936,000
DRG	**Derek R. Guthrie SSES Phase 2**	Jan. 2002	234,600	978	60,000	N/A	N/A	N/A	$491,000
DRG	**Mill Creek SSES**	Oct. 2002	150,000	682	30,000	Yes	N/A	N/A	$284,000
DRG	**Pond Creek SSES**	Oct. 2004	193,000	1,200	16,650	N/A	23,500	N/A	$306,000
		TOTALS	**2,559,936**	**11,882**	**610,749**		**23,649**	**4,889**	**$6,151,000**

Service Areas: CC = Cedar Creek, FF = Floyds Fork, HC = Hite Creek, JT = Jeffersontown, , MF = Morris Forman, PP = Prospect, DRG = Derek R. Guthrie
Note: Derek R. Guthrie WQTC (formerly West County Wastewater Treatment Plant)

1.3.1.3 Hydrologic and Hydraulic Modeling

The goal of hydrologic and hydraulic modeling is to provide a computer model that mimics the function of the actual sewer system, including sanitary flow and I/I sources. Once calibrated to dry and wet weather data, the model can be used to assess existing conditions, qualify and quantify deficiencies, and evaluate potential solutions. It also can serve as a tool for future planning and capacity assurance studies.

Hydrologic and hydraulic models of the MSD separate SSS have historically been constructed using the XP-SWMM (Stormwater and Wastewater Management Model) hydrologic and hydraulic modeling software. More recently, MSD models have been converted to the Wallingford software known as InfoWorks. The models were populated with infrastructure data from MSD's Hansen Information Management System (Hansen) sewer asset database. This database includes manhole locations and depths, pipe sizes, pipe slopes, and other data. This data is supplemented with pump station data, survey data, and field investigations. The models are calibrated based on flow monitoring data and updated based on needs, resource, availability, system changes, and reporting requirements.

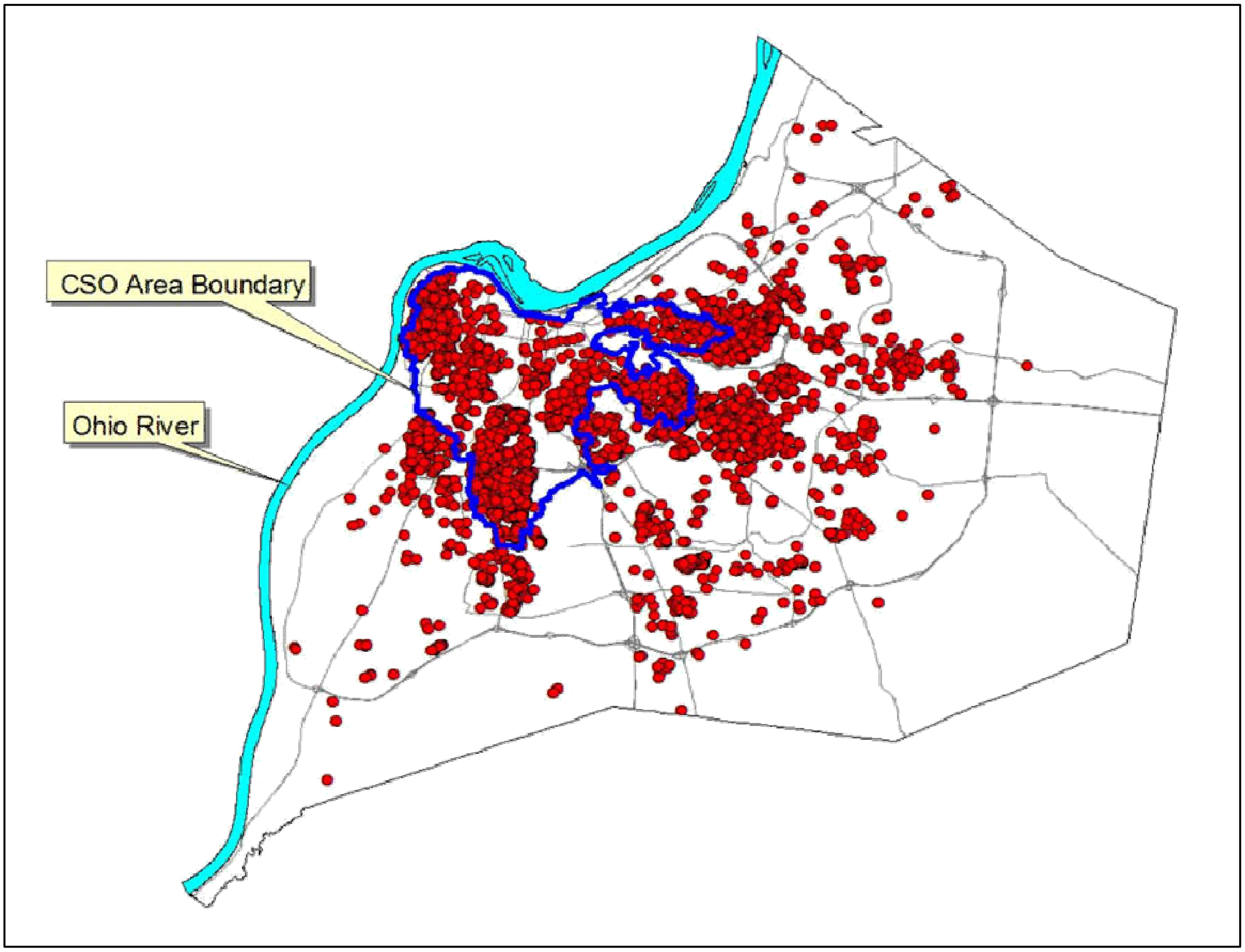
The hydraulic model has been used for improvement of the existing asset database, identification of significant hydraulic bottlenecks, testing rehabilitation scenarios, modeling wet weather system responses, SSO elimination alternatives, and identifying the impacts of future development scenarios. Additional detail on historic modeling, XP-SWMM model development, and future uses can be found in Volume 3, Chapter 2.

1.3.1.4 Plumbing Modification Program

In 1994, MSD started a program to help owners of homes that experience basement backups to install backflow prevention devices at MSD's expense. For the first few years, MSD offered the program to about 450 property owners per month. After the March 1997 flood, MSD began offering a backflow prevention device to any separate SSS residential customer reporting a backup. The countywide program is now available to all MSD customers experiencing basement backups. MSD will pay up to $3,000 per residence for plumbing modifications. Generally, installations average about $1,600.

Since the program's inception, MSD has completed over 8,100 projects totaling approximately $16 million dollars. See Figure 1.3.7 for a map of completed Plumbing Modification Program Projects.

FIGURE 1.3.7 LOCATION OF COMPLETED PLUMBING MODIFICATION PROGRAM PROJECTS



The two most common plumbing modifications involve a sump pump or a backwater and ball valve. A sump pump will be installed if a floor drain is present in the basement but no toilet or shower. Usually the floor drain is connected to the main sewer in the street and is the first place the main sewer could backup into the basement.

The sump pump installation consists of capping the existing floor drain, installing a sump pump, and then installing a new floor drain that will be connected to the sump pump. The new floor drain runs into the new sump pump that discharges in the outside yard.

A backwater valve and a ball valve will be installed, if a toilet and/or shower exist in the basement. The valve installation consists of placing a backwater and ball valve between the toilet and floor drain and the main sewer in the street. Therefore, if the main sewer backs up into the basement, the backwater and ball valve will prevent the water from getting to an outlet (the toilet, shower or floor drain).

An example Plumbing Modifications Program and Downspout Disconnection Program packet available to MSD customers can be found in Appendix 1.3.1.

1.3.1.5 Rehabilitation, Repair or Replacement Projects

The goal of rehabilitation projects is to reduce or eliminate surcharging and SSOs through the actual repair of defects in areas of high I/I. MSD performs as-needed maintenance repairs based on planned maintenance, unplanned maintenance, and customer service requests. These repairs include mainline repairs, manhole repairs, property service connection repairs, and downspout disconnections. Table 1.3.3 summarizes the "repair required" work orders completed from 1997 - 2008.

TABLE 1.3.3

I&FP WORK (1997-2008)

Repair Required	Work Order Count
Sliplining	1,559 (since October 2003)
Sewer Depression Repair	200
Sewer Cave-in	540
Property Service Connection Cave-in	845 (since January 2000)
Service Line Repair	14,407
Manhole Replaced	34
Manhole Repair	959
Manhole Raised	1,677
Manhole Lid Replacement	243
Manhole Installed	73
Manhole Frame Repair	287
Mainline Sewer Repair	1,171
Downspout Disconnection	174 (since November 2005)

Prioritization of rehabilitation areas draws on data from flow monitoring, SSES work, and computer modeling. The location and severity of the I/I issues dictates the order in which the projects are implemented. Table 1.3.4 lists the individual rehabilitation projects that have been performed by MSD from 1997 to 2008.

TABLE 1.3.4

REHABILITATION WORK (1997 - 2008)

Service Area	Project Name	Completion Date	Cured-in-place Sewer (LF)	Cured-in-place Lateral Connections	Chimney Seal Installations	Manhole Rehab.	Cost
CC	**Cedar Creek Phase 1**	Oct. 2001	2,859	12	432	N/A	$495,000
CC	**Cedar Creek Phase 2**	Jun. 2002	2,115	21	1,487	N/A	$1,015,000
FF	**Woodland Hills Phase 2**	Dec. 1997	5,667	51	N/A	23	$474,000
FF	**Woodland Hills Phase 1**	Fall 1999	3,381	81	18	N/A	$485,000
FF	**Pope Lick Phase 1A**	Aug. 2000	5,805	99	253	5	$941,000
FF	**Pope Lick Phase 1B**	Dec. 2000	4,973	114	90	5	$839,000
HC	**Interceptor Manhole Rehab**	2004	N/A	N/A	64	21	$202,000
JT	**Jeffersontown Phase 1A**	Dec. 1998	3,685	N/A	N/A	11	$188,000
JT	**Jeffersontown Phase 1B**	Jun. 1999	N/A	N/A	408	N/A	$280,000
JT	**Jeffersontown Manhole Rehab Pilot**	Oct. 1999	N/A	N/A	N/A	15	$45,000
JT	**Jeffersontown Phase 1C**	Oct. 2001	N/A	N/A	755	N/A	$546,000
JT	**Jeffersontown Phase 2**	May, 2002	2,540	67	920	N/A	$805,000
JT	**Jeffersontown Phase 3**	Sept. 2003	3,247	38	320	120	$1,240,000
MF	**Newmarket/ Northfield**	1997	1,000	N/A	22	21	$226,000
MF	**Hikes Point Phase 1A**	Fall 1999	7,611	N/A	309	N/A	$670,000
MF	**Old Cannons Lane**	Fall 1999	2,153	20	12	N/A	$213,000
MF	**Hikes Point Phase 1B**	Fall 2000	Upsized 1,885 LF of 15" clay sewer to 21" PVC sewer main				$656,000
MF	**Hikes Point Phase 2**	Jun. 2001	N/A	N/A	701	N/A	$469,000
MF	**Buechel Branch Phase 2**	Sept. 2001	Chemical root control 52,888 LF		409	N/A	$423,000
MF	**Hikes Point Phase 3**	Oct. 2001	8,062	95	N/A	N/A	$1,008,000

TABLE 1.3.4

REHABILITATION WORK (1997 - 2008)

Service Area	Project Name	Completion Date	Cured-in-place Sewer (LF)	Cured-in-place Lateral Connections	Chimney Seal Installations	Manhole Rehab.	Cost
MF	**Buechel Branch Phase 1**	Nov. 2001	2,782	26	N/A	N/A	$273,000
MF	**Beechwood Village I/I remediation**	Nov. 2001	10,991	29	N/A	24	$608,000
MF	**Middle Fork Phase 2**	Feb. 2002	1,872	47	382	N/A	$435,000
MF	**ORFM chimney seal reinstallation**	2004	Reinstalled chimney seals disconnected by paving operations				$83,000
MF	**Beechwood Village lateral lining**	2005	Continuation of Beechwood Village Rehab Phase 1 project from FY00				$532,000
MF	**Northern Ditch Interceptor Rehab**	Nov. 2008	N/A	N/A	49	55	$120,000
MF	**Sinking Fork Interceptor Rehab**	Dec. 2008	3,205	N/A	117	49	$480,000
MF	**Middle Fork Interceptor Rehab**	Dec. 2008	958	N/A	27	35	$600,000
MF	**Beargrass Interceptor (Hikes Point)**	Dec. 2008	Clean 4588 LF	N/A	152	32	$200,000
MF	**Goldsmith Ln./Buechel Branch Int.**	Dec. 2008	Clean 3737 LF	N/A	273	93	$250,000
DRG	**McNeely Lake Phase 1A**	Dec. 2000	2,709	56	644	152	$1,068,000
DRG	**WC/Valley Village**	Mar. 2001	3,326	Chemical root control 46,423 LF			$332,000
DRG	**Derek R. Guthrie I/I Phase 2**	Jun. 2001	2,574	N/A	204	N/A	$461,000
DRG	**Derek R. Guthrie Phase 1**	Oct. 2001	1,147	8	357	N/A	$362,000
DRG	**Pond Creek Rehab**	Nov. 2001	7,036	130	N/A	N/A	$637,000
DRG	**McNeely Lake Phase 1B**	Nov. 2001	4,624	27	N/A	N/A	$299,000
DRG	**Derek R. Guthrie WQTC**	May 2003	Improvements to prevent Mill Creek flood waters from entering WQTC				$180,000
		TOTALS	**94,322**	**921**	**8405**	**661**	**$18,140,000**
Service Areas: CC = Cedar Creek, FF = Floyds Fork, HC = Hite Creek, JT = Jeffersontown, MF = Morris Forman, DRG = Derek R. Guthrie							

1.3.1.6 Post-Rehabilitation Flow Monitoring and Results

After each rehabilitation phase, post-rehabilitation flow monitoring is performed. The monitoring program will be based on the original sub-basin monitoring. The flow monitors are placed in the same manholes that were used for preliminary testing, and are left to collect information until adequate wet weather response flow data is acquired. This monitoring often includes a control basin (one that is not rehabilitated) to normalize post-rehabilitation flow data for any seasonal discrepancies. A combination flow monitoring and calibration provides a way for data to be accurately compared for rehabilitation effectiveness.

Historically, post rehabilitation flow monitoring indicated that, in many areas, rehabilitation (pipe and lateral lining) resulted in inconsistent I/I reduction. Sometimes post-rehabilitation monitoring showed substantial reduction, yet other times it showed almost none. Private property I/I was suspected as the primary reason that rehabilitation had not proven more effective.

As a result, MSD's design rehabilitation philosophy has focused on building system capacity controls and not strictly the rehabilitation of public-side systems. Pipeline rehabilitation, however, does continue to be implemented in an ongoing capital program.

1.3.1.7 Relation to Final SSDP Planning

The SSOP was MSD's centralized program for managing the investigation, prioritization, and rehabilitation of the separate SSS to reduce unauthorized discharges. It documents the history of the MSD wet weather program and is related to the Final SSDP in this respect. The SSOP serves as a summary of historical efforts and findings to show the breadth and depth of past efforts in relation to eliminating SSOs. Since 1997, thirty-two projects costing nearly $16.5 million have been completed and documented within the SSOP. The SSOP document serves as the obvious foundation for the Final SSDP by providing both data for evaluating current conditions and experience in adopting preferred solutions.

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

According to the EPA, the purpose of the CMOM Program is to:

"*incorporate many of the standard operation and maintenance activities that are routinely implemented by the owner or operator with a new set of information management requirements in order to:*

- Better manage, operate, and maintain collection systems
- Investigate capacity constrained areas of the collection system
- Proactively prevent SSOs
- Respond to SSO events

The CMOM approach helps the owner provide a high level of service to customers and reduce regulatory noncompliance."

Like other sewer districts, MSD has been using many techniques outlined in CMOM for decades to continually enhance the system. In 2003, MSD initiated a *CMOM Challenge Analysis* as the first step in a comprehensive Self-Assessment Program to provide a management-level evaluation of their organizational structure and corresponding programs, activities, and tasks.

Specific objectives of the CMOM Challenge Analysis were to:

- Provide MSD's management staff with an overview of the fundamental components of EPA's proposed SSO Rule and CMOM provisions.
- Inventory and compare MSD's CMOM Program areas and activities with regards to EPA guidance material.
- Identify program activities that should be recommended for enhancement targeted at improving service or compliance performance.

The CMOM Self Assessment Report was originally submitted to the EPA and KDEP on February 10, 2006, re-submitted on May 12, 2006, and approved on August 22, 2006. The full analysis can be found on the MSD Project WIN website at: http://www.msdlouky.org/projectwin/docs.htm.

Through the self-assessment process MSD documented that many activities were performing well. Nevertheless, in some cases, MSD implemented changes and improvement activities to provide continuity and consistency with other activities. The management policies, operational programs, and operational activities that were found to be performing well are listed below.

- Technical Training
- Skills Training
- Safety Training
- Safety Department
- Confined Space Entry
- General Safety Procedures
- Traffic Management
- Lock Out/ Tag Out
- Safety Equipment
- Performance Measures
- Monitoring of Street Pavement
- Mapping
- Acquisition Consideration
- Capital Improvement Program Funding
- Pretreatment Legal Support
- Septic Tank Haulers Legal Support
- "Call Before You Dig" Legal Support
- Industrial User Permitting
- Inspection and Sampling Enforcement

The self-assessment process also identified program areas and activities that would benefit from improvement, such as:

Program 1.	Continuous Sewer System Assessment
Program 2.	Infrastructure Rehabilitation
Program 3.	System Capacity Assurance Plan (SCAP)
Program 4.	Pump Station Preventive Maintenance Program
Program 5.	Gravity Line Preventive Maintenance Program
Program 6.	Sewer Use Ordinance Legal Support Program

Through continuous improved performance, MSD expects to see benefits such as:

- Reduced incidence of SSOs due to wet weather events
- Enhanced customer service response and relations
- Optimized existing resources to meet growing demands and expectations
- Financial stability through better anticipation of capital and operations and maintenance (O&M) requirements

1.3.2.1 Relation to Final SSDP Planning

As outlined above, the CMOM Self Assessment Report identified areas that needed improvement, recommended specific improvements, and set a schedule for those improvements to be implemented. Implementation of improvements is critical for other programs, including the Final SSDP and the overall IOAP. MSD staff developed performance goals for the programs and activities that needed improvement and worked throughout the organization to discuss, develop, and implement the improvements.

MSD continues to improve programs with the intent of mitigating SSOs. The next step involves development and implementation of system capacity-related solutions to address issues, which is part of the Final SSDP.

Through the CMOM Program, MSD is to coordinate capacity decision criteria under a System Capacity Assurance Plan (SCAP). These criteria will:

- Improve upon existing support for each watershed's community values including a process to confirm and document the capacity of WQTCs, pump station, and conveyance systems.
- Identify hydraulic constrictions, which are characterized by upstream system capacity that is greater than downstream system capacity.
- Propose capacity improvements that support IOAP performance objectives.

- Directly affect the modeling efforts performed under the Final SSDP and the planning of SSO elimination projects.
- Confirm that sewers are designed to handle additional flow and prevent excessive I/I as a result of new connections.
- Prevent sewers already over-capacity during dry and/or wet weather from receiving new flows.
- Identify pump station and gravity line activities to be integrated into the Final SSDP.

1.3.2.2 System Capacity Assurance Plan (SCAP)

The SCAP applies to the separate sanitary system only and works in conjunction with the Final SSDP to ensure that MSD's efforts for SSO abatement are successful. The SCAP is a living, dynamic document that will continue to change due to various components. Changing components include modeling improvements, map updates, Consent Decree program implementation, reporting automation, capital improvement projects, development capacity requests, and other CMOM and MSD programs. An overview of the SCAP can be found on the MSD Project WIN website at http://www.msdlouky.org/projectwin/docs.htm.

The SCAP is the basis for coordinating capacity decision criteria for each separate SSS sewershed. Providing wastewater collection, conveyance, and treatment that will meet the expansion needs of MSD's customers, while protecting the environment and meeting regulatory requirements, are top priorities of MSD's facility improvements efforts.

New service connections contribute additional flow that utilizes available capacity in the system. Since wet weather capacity deficiencies have been identified as the cause for a significant portion of SSOs, it is important for MSD to have a program that ensures new sanitary flow connections do not cause or contribute to SSOs.

The objective of the SCAP is to enable MSD to authorize new sewer service connections or increases in flow from existing sewer service connections while making system improvements in accordance with the May 2006 CMOM recommendations. The SCAP process includes a programmatic approach for items such as confirming capacity of plants, pump stations, and conveyance systems; identifying hydraulic constrictions; and proposing capacity improvements that support interim and WQTC performance objectives. The SCAP contains technical information, methodology, and analytical techniques to be used that will:

- Calculate the peak flow capacity of system components (collector sewers, interceptor sewers, treatment plants and pump stations);
- Calculate the increase in flows from new service connections;
- Calculate the increase in peak flow capacity resulting from specific system improvements projects;
- Integrate current new development approvals, acquisition of sewers, and extension of service to un-sewered areas.

The SCAP also details the steps to approve new flow requests in areas of limited capacity through a flow credits "banking" system. This "banking" system requires that for every one gallon of new flow, three gallons of I/I must be removed from the system through rehabilitation. A presumptive approach to this removal is outlined within the SCAP document; please refer to this document for additional detail.

1.3.3 Sewer Overflow Response Protocol (SORP)

The purpose of the SORP is to provide guidance to MSD personnel regarding response to SSOs, mitigation of the SSO's impact, public notification, and reporting of the SSO. Utilizing the SORP enables MSD to respond to SSOs in a consistent and effective manner and reduces an SSO's impact on the environment and human health.

Per Paragraph 24.d. of the Amended Consent Decree, MSD initially submitted the SORP to the EPA and KDEP on February 10, 2006 and received comments on March 13, 2006. MSD resubmitted the revised SORP on May 12, 2006, and received an approval letter on August 22, 2006. The SORP undergoes regular annual reviews and updates; the last update was approved in late 2008. The updated SORP document can be found on the MSD Project WIN website at http://www.msdlouky.org/projectwin/docs.htm.

1.3.3.1 Preparatory Actions

An important component of MSD's SORP is preparing for wet weather SSO incidents before they actually occur. By assuming an SSO could occur and taking proactive measures, MSD may prevent the SSO from actually occurring. In cases where the SSO cannot be prevented, this strategy minimizes MSD's response time, reduces the SSO's volume, and mitigates the SSO's impact.

MSD's preparatory strategy has two major components. The first is wet weather monitoring which provides early warning of events that may result in SSO conditions. If wet weather monitoring indicates that SSO conditions are likely, then the second component, the pre-positioning of personnel and equipment, is implemented.

1.3.3.2 Overflow Management and Field Documentation

Once MSD becomes aware of a possible SSO event, a cascade of actions and responses begin. These actions include the following:

- Initial response, identifying the origin and cause of the SSO. Determining the boundaries of the SSO's impact area and performing an initial assessment of the SSO's impact are also required during the initial response. After the initial extent and impact are assessed, a control zone is established, and public notification is completed. The responding personnel determine which method, or combination of methods, will best minimize the SSO's impact.

- Mitigation, preventing an SSO from moving into non-impacted areas, and therefore limiting the extent of the impacted area. Examples of containment technologies or mitigation include sand bags, inflatable plugs, as well as spill containment equipment.
- Clean-up of the impacted area. The immediate area around the SSO site is inspected and cleaned of residual material in order to minimize public health and environmental risks.

1.3.3.3 Public Notification and Communication

When an SSO occurs, MSD utilizes an event-based public notification program. These are localized, short-term, and field-based activities designed to warn the public and limit access to areas impacted by the SSO. Event-based notification methods include the use of signage, establishment of a control zone (discussed previously), and placement of door-hangers.

In addition to the event-based notification methods, MSD also practices programmatic activities. Programmatic activities are long-term, community-wide activities designed to increase awareness of SSOs including their cause and prevention, potential health hazards, environmental impacts, and MSD's abatement activities. Examples of programmatic activities include overflow advisory signs posted at SSO locations and public access areas downstream of SSOs. MSD also posts email notices and has prepared educational videos, brochures, and billing inserts in an effort to inform the public about SSOs.

1.3.3.4 Regulatory Reporting and Data Management

The complete and accurate documentation of SSO data is required for the purpose of regulatory reporting. In addition, such data is crucial for tracking the SSO history of system assets such as manholes, sewer lines, and pump stations. MSD also utilizes this data to make decisions regarding SSO response methods, procedures, monitoring frequencies, and abatement strategies.

Personnel responsible for responding to SSOs, including unauthorized discharges, are responsible for gathering and documenting pertinent SSO data. Work orders must be initiated within 10 hours of a verified SSO. This protocol is necessary to provide transmission of the unauthorized discharge's data to KDEP and EPA within the required timeframe. In addition, MSD submits a monthly summary of all unauthorized discharges occurring by WQTC. The summary is submitted as a component of the sewershed's respective wastewater treatment plant's Discharge Monitoring Report (DMR).

1.3.3.5 Staff Training and Communication

The SORP is a dynamic document that is monitored and adjusted as new or improved procedures, practices, and technologies become available. The SORP is reviewed annually and amended as appropriate. Proposed changes to the SORP are submitted to the EPA and KDEP for review and approval. MSD continually enhances the SORP training modules, ensuring MSD staff remains current on existing and updated procedures.

Knowledge of SORP procedures and practices is transferred to MSD's employees through a comprehensive training program. MSD employees receive the SORP Overview training that discusses the purpose, objectives, and scope of the SORP as well as an understanding of the requirements for its execution. Personnel involved in overflow response activities receive additional quarterly training to ensure that they possess the knowledge and skills necessary to properly implement the SORP.

1.3.3.6 Relation to Final SSDP Planning

MSD maintains a database of documented SSOs, which is utilized to validate hydraulic models used in the Final SSDP. In turn, the hydraulic modeling efforts have identified potential SSO points at other locations, also known as Modeled Overflow Points (MOPs). These points were screened and did not include those hydraulically connected to a known SSO or have modeled overflow volumes less than 10,000 gallons to account for modeling accuracy. All other points were field verified. Refer to Chapter 2, Section 2.4.2 for a more detailed explanation of the MOP validation process.

Additionally, follow-up monitoring will be required after implementation and final construction of solution alternatives to abate known and suspected SSOs. A phasing plan will be implemented under SORP protocols to monitor the sites for three years until it is proven, under design conditions, that the SSO has been eliminated or mitigated. Periodic flow monitoring and hydraulic-model recalibration will also be performed to report on systematic performance of SSO abatement efforts.

New MOPs or SSOs identified by new modeling or field inspection will be added to the database and will be subject to follow-up monitoring, especially if it occurs at less than the design level of protection. Areas upstream of these SSOs will also be targeted in the I/I Program as outlined in Volume 3, Chapter 2, Section 2.3.5.8.

1.3.4 Interim Sanitary Sewer Discharge Plan

On September 28, 2007, MSD submitted to the EPA and KDEP the Interim SSDP identifying remedial measures for specific unauthorized discharges (specified in Paragraph 25(a) (2) of the Amended Consent Decree) in the separate SSS. Comments were received on January 8, 2008. The Interim SSDP was resubmitted on March 7, 2008, and approved on July 24, 2008. The Interim SSDP document can be found on the MSD Project WIN website at: http://www.msdlouky.org/projectwin/docs.htm.

The primary goals of the Interim SSDP are to define a plan to eliminate unauthorized pumped discharges in Beechwood Village and Hikes Point, the elimination of the pumped discharge at the Highgate Springs Pump Station, and the closure of the constructed overflow at the Southeastern Diversion. The efficiency of the proposed projects will be verified using the following categories of post construction monitoring:

- Three years of observations at current SSO locations to confirm that overflows (pumped or otherwise) have been eliminated.
- Flow monitoring within the collection system to confirm flows predicted by modeling.

- Verification of full secondary treatment of all flows received at the Derek R. Guthrie WQTC (formerly formerly West County Wastewater Treatment Plant), based on an evaluation of its first year of operation.

1.3.4.1 Background

Most of the Interim SSDP projects are interdependent. Staging their implementation, therefore, will be an important task. The sequence of projects is outlined in Chapter 3, Section 3.2 of the Interim SSDP. In general, downstream projects will have priority for implementation to allow increased levels of wastewater to be properly conveyed via the Pond Creek Interceptor and treated at the Derek R. Guthrie WQTC. If any upstream project is completed prior to a prerequisite downstream project, it will not be connected until capacity is available.

1.3.4.2 Interim SSDP Solution

The six projects developed in the Interim SSDP are currently being designed and coordinated with Final SSDP and IOAP projects. All projects will likely require easements and/or property acquisitions, as well as construction permits. The six Interim SSDP projects are summarized below.

<u>Project 1: Beechwood Village Sanitary Sewer Replacement</u>

The entire local collection system, including homeowner's service connections, will either be rehabilitated or replaced in the city of Beechwood Village and a portion of the City of St. Matthews. This will eliminate wet weather pumping of unauthorized discharges and reduce I/I currently entering the Sinking Fork Interceptor.

The sanitary portion of the project will consist of lining 19,000 linear feet (LF) of 8-inch diameter, 700 LF of 10-inch diameter and 4,000 LF of 18-inch diameter sanitary sewer pipe. The service connections at 580 homes will be replaced and modifications made to the internal plumbing of most of the homes. The project is divided into two phases, East and West, to help ease project implementation. Final design plans were substantially complete as of March 2008. Final design contract documents will be amended to include any special conditions required by customers once residential customer negotiations have been completed and all easements have been acquired. It is assumed that no temporary easements will have to be acquired through the condemnation process.

Improvements to the Beechwood Village East and West collection systems will reduce wastewater flow by reducing I/I, thereby improving downstream conditions. The only prerequisite project is the Sinking Fork Interceptor Relief Sewer (Project 2). This relief sewer is planned to take the flow from some of the new Beechwood Village sewers and must be in operation before the Beechwood Village collection system improvements can be connected. The Beechwood Village East construction contract began in the first quarter of 2009 and be completed in the first quarter of 2011. The Beechwood Village West construction contract will begin in the second quarter of 2009 and will be completed in the second quarter of 2011.

Project 2: Sinking Fork Relief Sewer

The Sinking Fork Relief Sewer will convey flows from a portion of Project 1 and will provide additional wet weather capacity downstream of the Beechwood Village East area to accommodate final SSDP projects upstream. This project consists of 2,800 LF of 24-inch diameter sanitary sewer interceptor pipe, which will extend from the 18-inch diameter interceptor being installed as part of Project 1 – Beechwood Village East. Design was completed and sent for KDEP review in December 2008. Construction began in the second quarter of 2009 and will be completed in the fourth quarter of 2010.

Project 3: Hikes Lane Interceptor and Highgate Springs Pump Station

Improvements to the Hikes Point sewer system will eliminate the need for wet weather pumping in the Hikes Point area. Improvements will also eliminate the Highgate Springs Pump Station and reduce wet weather flow into the Beargrass Interceptor. The Hikes Point sewer improvements will impact two sanitary sewer basins:

- One basin is northwest of the Watterson Expressway, (I-264) and flows by gravity to the Beargrass Interceptor via the Goldsmith Lane Trunk Sewer. The improvements will consist of 1,000 LF of relief sewer along Carson Way and Ribble Road pumped locations to a new connection into the Goldsmith Trunk. This part of the project is fully independent of other components, with preliminary design completed and final design in progress.
- The second basin is located in the general Hikes Point area south of I-264, where wet weather pumping occurs. Here the improvements will consist of 10,000-LF, 72-inch-diameter Hikes Lane interceptor, a total of 3,500 LF of smaller, new or replacement sewers, and the decommissioning of the Highgate Springs Pump Station. The flows from the Highgate Springs Pump Station will be diverted by gravity to the Southeastern Interceptor downstream of the Southeastern Diversion via the new Hikes Lane Interceptor. Once the Hikes Lane Interceptor is constructed, Highgate Springs Pump Station will be decommissioned.

Preliminary design including route selection, field investigations, geotechnical exploration, surveying, and utility research were completed in October 2008. The geotechnical evaluations, 50 percent of the surveying, and 50 percent of design are scheduled to be completed by September 2009. Design will be completed in April 2010. Construction will begin in the fourth quarter of 2010 and be completed in the fourth quarter of 2012.

Project 4: Southeastern Diversion Structure and Interceptor

Following the commissioning of the Northern Ditch Diversion Interceptor and the Derek R Guthrie WQTC, operational improvements to the Southeastern Diversion Structure will provide the necessary flexibility to increase Real Time Control (RTC) effectiveness and eliminate the need to overflow at the Southeastern Diversion Structure during wet weather. Additional work in the vicinity of the Southeastern Diversion Structure will be needed to accommodate the additional flows from the new Hikes Lane Interceptor, Project 3. This project will consist of a new Southeastern Interceptor Relief Sewer, two flow control junction boxes, and modifications to the existing Southeastern Diversion Structure. A new parallel Southeastern Interceptor Relief Sewer will run between the Southeastern Diversion and the 72-inch diameter Northern Ditch Interceptor and will transport additional flows to the Derek R. Guthrie WQTC. The Southeastern Interceptor Relief Sewer is being sized to convey flows from future Final SSDP projects and can provide in-line storage. The Southeastern Interceptor Relief Sewer sizing will accommodate other Final SSDP projects bringing additional flows to the Southeastern Diversion.

The other improvements involve the following:

- A new junction structure located near Fountain Drive will connect the Southeastern Interceptor Relief sewer to the Hikes Lane Interceptor and Buechel Branch Interceptor.
- Another structure will be required at the junction with the Northern Ditch Interceptor. This second structure will contain RTC gates to prevent overwhelming the downstream system and to utilize the Southeastern Interceptor and Southeastern Interceptor Relief sewer for in-line storage.
- The control weir in the Southeastern Diversion will be removed after the Southeastern Interceptor Relief and junction structures are complete allowing flow from the upper Beargrass Interceptor into the Southeastern Interceptor under dry conditions.
- Other modifications will include re-programming RTC gates to prevent most flow into the Beargrass Interceptor.

Construction of the Southeastern Interceptor Relief Sewer will be completed in the second quarter of 2012. The connections at the Southeastern Diversion and the Northern Ditch Interceptor cannot be completed until the Derek R. Guthrie WQTC wet weather facilities (Project 6) are operational. Derek R. Guthrie WQTC and the Northern Ditch Interceptor provide for SSO elimination at the Southeastern Diversion Structure without modifications to the Southeastern Diversion or the Southeastern Interceptor. Preliminary design, including route selection and surveying, will be completed in the third quarter of 2009. Final design including field investigations, geotechnical exploration, wetlands delineation, and utility research, will be completed in the third quarter of 2010.

<u>Project 5: Northern Ditch Diversion Interceptor</u>

Construction of the new Northern Ditch Diversion Interceptor will allow flows from upstream projects to reach Derek R. Guthrie WQTC. The Northern Ditch Diversion Interceptor project will consist of 13,000 LF of new 84-inch-diameter pipe constructed along Greasy Ditch from the Northern Ditch Pump Station to the Pond Creek Interceptor. A new flow control structure near Enterprise Drive to divert flow from the Northern Ditch Interceptor to the new Northern Ditch Diversion Interceptor will be constructed to control flow between the Northern Ditch Pump Station and the Derek R. Guthrie WQTC using a 144-inch weir gate and 84-inch sluice gate. There are 45 private property easements that will be required along with a Section 404 Permit from the USACE.

The Northern Ditch Diversion Interceptor is scheduled for completion in the third quarter of 2011. It cannot be connected to the Pond Creek Interceptor until expansion at the Derek R. Guthrie WQTC is complete and operational. Preliminary design including route selection was completed in October 2007. Field investigations consisting of geotechnical exploration, wetlands delineation, utility research, and final design were initiated in November 2007. The design was completed and sent for KDEP review in December 2008.

Project 6: Derek R. Guthrie WQTC

Improvements to Derek R. Guthrie WQTC will allow treatment of all wet weather flow from the other Interim SSDP improvements. The 100 million gallons per day (mgd) peak flow capacity secondary treatment facility will consist of the following:

- New influent pumps and piping modifications providing 200 mgd firm pumping capacity.
- Construction of a wet weather pump station with an initial capacity of 104 mgd and an ultimate capacity of 145 mgd to be in service when influent flow exceeds 200 mgd.
- New screening facility with three units, each with capacity of 172.5 mgd.
- Wet Weather Treatment Plant with 100 MGD capacity including a short-term detention basin, initially two channels and ultimately four channels, a new grit removal system, one new contact basin, six new secondary clarifiers and new chlorine contact basins.
- New 20 MG (million gallons) equalization basin.

These facilities will be located at the Derek R. Guthrie WQTC site. The proposed wet weather treatment facility is an expansion of the existing contact stabilization activated sludge process with one additional contact basin and six additional secondary clarifiers, sized to produce effluent that meets secondary treatment discharge standards when operating on relatively dilute wet weather flows.

Preliminary design for process selection and sizing, including field investigations for geotechnical exploration, wetlands delineation, and utility research, was completed in November 2008. Final design, initiated in November 2008, will be completed in the third quarter of 2009.

The construction period was established to provide two full warm-weather building seasons to reach substantial completion, allowing testing and start-up to be completed prior to the required completion date of December 31, 2011. Construction and commissioning of the Derek R. Guthrie WQTC wet weather flow equalization and wet weather treatment facilities are critical paths to implementing the overall Interim SSDP.

1.3.4.3 Preliminary Project Schedule and Cost

The estimated capital cost to implement the Interim SSDP is approximately $200 million. Estimated costs were calculated using planning level cost estimating tools developed for projects associated with MSD's IOAP. The planning level costs are based on historical data from multiple cities, EPA documentation, and similar project data. The estimates prepared are based on the best available data and judgments by engineering firms under contract for either the planning or design of the respective project components at the time they were developed. Refined estimates will be prepared as projects move to detailed-design stages.

In accordance with the Consent Decree, the Interim SSDP will implement the corrective measures necessary for remediation of the unauthorized discharges in the Beechwood Village area and at the Southeastern Diversion Structure by December 31, 2011. Similarly, the unauthorized discharges at Hikes Point and Highgate Springs Pump Station will be eliminated by December 31, 2013.

1.4 PLANNING APPROACH

This section provides a brief summary of the Final SSDP planning approach used by MSD. The following are summarized in this section:

- Modeling Overview
- Public Participation and Agency Interaction
- Measures of Success: Performance Goals

1.4.1 Modeling Overview

A hydraulic model is the mathematical representation of a sewer system in a computer. Models use basic laws of physics, such as conservation of mass and energy, to continuously model flows through sewers systems. In addition, models are used to characterize the existing sewer conditions so that the magnitude and extent of SSOs and surcharging can be assessed. The same models are used to evaluate potential solutions. However, adequate models are dependent upon the supporting databases; therefore, much effort is placed on calibrating and validating models prior to any assessment or evaluation.

Evaluating sewers with a hydraulic model is much like evaluating an airplane using a wind tunnel. First, the model is constructed to mimic known conditions, then the shortcomings are noted and finally solutions are tested. The hydraulic model, like the wind tunnel, allows the modeler to assess a wide array of conditions and possible solutions without full-scale testing. Hydraulic models can be divided into a number of important features:

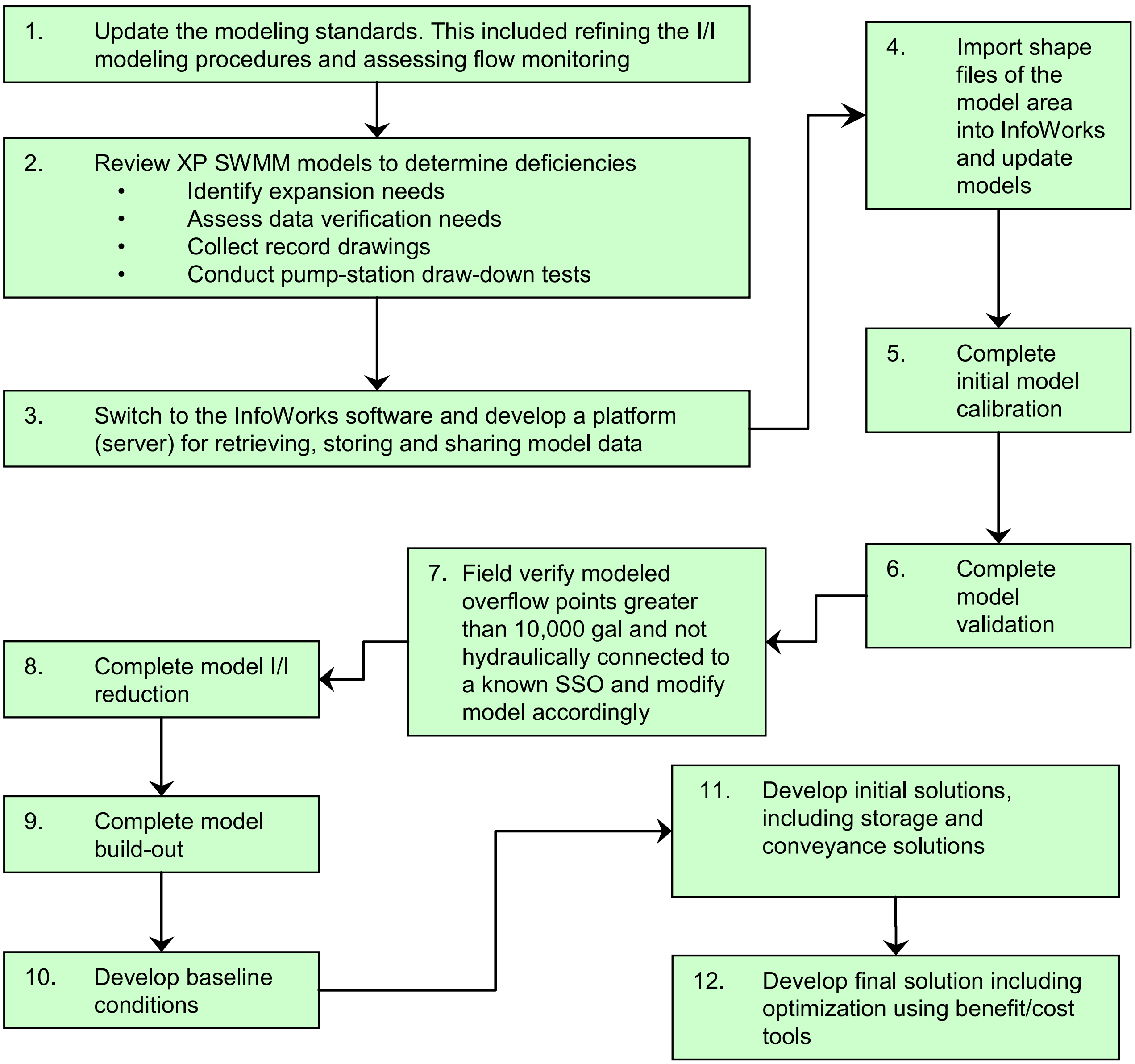
- Hydrological characterization, which uses databases on land types and soils to generate mathematical representation of rainfall and stormwater flow into the sewer system.
- The hydrological model, which uses the hydrological characterization to estimate I/I based on assumed rainfall and soil conditions.
- Base flow calculations, which estimate actual sewer flow from homes and businesses based on census data.

- Hydraulic characterization, which uses databases on manhole and sewer sizes, locations, depths and materials to generate mathematical representation of a sewer system. This characterization also includes pumps, diversions and other special structures normally found in sewer collection systems.
- The hydraulic model, which uses the I/I from the hydrological model, combines it with the base flow and uses the hydraulic characterization to predict flows and levels at any point in the system.

With the objective of the Final SSDP to eliminate SSOs, the sewer system hydraulic models must represent, as accurately as possible, known SSOs and surcharging within the system. Additionally, it is probable that the calibrated hydraulic models will identify new SSO locations. MSD determined that historical modeling efforts were not adequate for the detailed evaluations necessary to plan system improvements on a scale required by the Final SSDP. Therefore, MSD initiated a new sewer system modeling program using InfoWorks.

Prior to model calibration, MSD provided each modeling team with known system hydraulic information such as known SSO location, volume and duration; pump station runtime information; known surcharge areas; and other pertinent data for use in calibration and validation of the model results. The modelers validated SSOs and surcharging in the general location of the SSOs for various levels of protection as part of the calibration process. The models were then divided into model areas and further divided into branches based on SSO locations. The modeling process can be abridged into the components depicted in Figure 1.4.1.

FIGURE 1.4.1 MODELING FLOW CHART



Modeling is a complex task and is further explained and defined in Chapter 2. Using the model, potential solutions were developed, analyzed and optimized for each branch. Chapter 3 discusses the solution development and analysis. Chapter 4 details the optimized and selected projects. Once the optimized projects were chosen, an implementation schedule was developed along with project costs and is presented in Chapter 4.

1.4.2 Capacity Analysis and Other Model Applications

System capacity analyses are based on existing conditions and impacts of future population projections, reserved capacity for future assessments and new developments, and capacity requests currently being reviewed by MSD's Development Team. The hydraulic models will be used to support future evaluations of new connection requests and system capacity. The models determine the best range of feasible options for conveyance, storage, and/or treatment to abate excess wet weather flows and eliminate SSOs. MSD performed capacity assessments, compiled a range of system improvement approaches, and developed the benefit-cost evaluations for various solutions in a manner consistent with the Final SSDP.

1.4.3 Public Participation

Public participation is an integral component during the planning, development, evaluation, and selection stages of SSO abatement projects. By informing the public early in the planning process, potential conflicts can be identified and addressed during the development stages. The public outreach efforts include communication media, public meetings, public hearings, workshops, and discussion panels. Key target audiences include the public, property owners, advocacy groups, builders, restaurants, industries, and schools.

The backbone of the framework is the Wet Weather Stakeholder Group involvement. Effective input of Louisville Metro's community values is essential for the elements of the IOAP. The stakeholder process has provided meaningful involvement in discharge abatement, alternative development, evaluation, and prioritization. The stakeholder involvement activities have helped establish the performance objectives for the sanitary and combined sewer systems and the associated CMOM and Nine Minimum Controls (NMC) programs. Public participation and agency interaction is discussed in full detail in Volume 1, Chapter 3 of the IOAP.

1.4.4 Measures of Success: Performance Goals

The measures of success are a means to demonstrate compliance with the Consent Decree requirements and to quantify the benefits achieved from SSO elimination projects. Ongoing measurements of the system and analysis of measured results will help guide MSD by identifying specific methods that perform better or worse than predicted in time to modify future efforts. Each project's performance goals should be tailored to site-specific situations.

A review of the Final SSDP projects after completion will evaluate how well the project accomplished the performance goals that were established before the project began, and whether the project implemented was indeed the most cost effective approach. Results from the review should show that the cost-benefit analyses and risk management approach used to choose targeted deficiencies, level of protection, project alternatives and project scheduling were effective.

Deficiencies in the system addressed by the Final SSDP include wet weather capacity related problems and generally exclude maintenance issues, which are CMOM related. Therefore, these performance goals are only meant to encompass wet weather situations within the level of protection under the IOAP. Meeting these performance goals has many potential benefits including:

- Achieving Legal and Regulatory compliance
- Reducing potential negative impacts on public health
- Reducing potential negative impacts on receiving waters
- Reducing future costs of operation
- Documenting proof of project results and effectiveness.

Chapter 4 outlines the full details of the measures of success. The four performance goals for Final SSDP projects are:

1. No Wet Weather Capacity Related SSOs under the Selected Level of Protection
2. No Wet Weather Capacity Related Basement Back-ups within the Level of Protection
3. Sufficient Treatment Capacity within the Level of Protection
4. Project Flow Monitoring Performed and Documented