MSD

Metropolitan Sewer District

Final Sanitary Sewer Discharge Plan

Volume 3 of 3

September 30, 2009

SSDP

PROJECT WIN

Waterway Improvements Now

Integrated Overflow Abatement Plan

VOLUME 3: FINAL SANITARY SEWER DISCHARGE PLAN

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FINAL SANITARY SEWER DISCHARGE PLAN (SSDP) 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 <u>not</u> 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

MSD

Metropolitan Sewer District

EXECUTIVE SUMMARY

FINAL SANITARY SEWER DISCHARGE PLAN (SSDP)

EXECUTIVE SUMMARY

INTRODUCTION

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 the 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.

Volume 3 of the IOAP is the Final SSDP. The Consent Decree requires the Final SSDP to include conventional and innovative solutions to eliminate SSOs as part of the plan. The Final SSDP when implemented will accomplish the following objectives:

- Achieve legal and regulatory compliance
- Reduce potential negative impacts on public health
- Reduce potential negative impacts on receiving waters
- Reduce future costs of operation

The Final SSDP contains details on the historical problems within the separate Sanitary Sewer System (SSS) areas and the long-term projects and programs to correct these problems as required by the Consent Decree. The Final SSDP is organized into four chapters that present a comprehensive overview of MSD’s previous and ongoing programs and projects, a history of Sanitary Sewer Overflows (SSOs), characteristics of the sanitary sewer system, development of control alternatives, and final recommended programs and projects.

FINAL SANITARY SEWER DISCHARGE PLAN DOCUMENT ORGANIZATION

The following is a summary of each chapter.

Chapter 1 Final Sanitary Sewer Discharge Plan Introduction

This chapter describes the relationship to the current Final SSDP planning process and presents summaries of previous and ongoing MSD projects and programs,. The chapter also reviews the role of public participation as well as the overall planning approach to SSO elimination.

Historically, MSD has been very active in SSO elimination and addressing SSOs that are documented in studies and reports. The following plans and programs have significant importance in developing the Final SSDP:

- Updated Sanitary Sewer Overflow Program
- Capacity, Management, Operations and Maintenance Programs
- Sewer Overflow Response Protocol (SORP)
- Interim Sanitary Sewer Discharge Plan

During 2007, MSD developed an Interim SSDP in accordance with the requirements of the Consent Decree. MSD initially submitted the Interim SSDP to the EPA and KDEP on September 28, 2007, and received comments on January 8, 2008. MSD resubmitted the revised Interim SSDP on March 7, 2008, and received approval on July 24, 2008. The Interim SSDP defines the plan for eliminating SSOs in the Beechwood Village area, the Hikes Point area, at the Highgate Springs Pump Station, and at the Southeastern Diversion Structure. The projects defined by the Interim SSDP include approximately $200 million in capital costs that will be expended by December 31, 2013.

The overall approach to SSO elimination planning is highly dependent on hydraulic models. Hydraulic models are the mathematical representations of a sewer system. They are used to characterize the existing sewer conditions, evaluate potential solutions, and determine the sizing of technically feasible alternatives for conveyance, storage, and/or treatment to relieve excess wet weather flows and eliminate SSOs. Additionally, benefit-cost evaluations are used to select appropriate control technologies to eliminate each SSO, to optimize the level of control provided for each SSO, and to assist in prioritizing the order of project implementation. Based on parameters from the hydraulic models, overflow elimination alternatives are sized by developing conceptual designs.

For the Final SSDP, costs were estimated using a standardized estimating tool that incorporated extensive databases calibrated with actual costs from similar projects. Benefits were based on a values-based risk management approach to SSO elimination. Typically, the project that eliminated SSOs with the best overall benefit-cost ratio was selected by MSD as the optimal solution for each area impacted by SSOs.

Chapter 2 System Characterization

This chapter defines the objectives of the system characterization program and provides a 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 describes the computer modeling process used to simulate and evaluate separate SSS areas.

MSD developed the Hydraulic Sewer System Modeling Guideline Manual (Appendix 2.4.3, Volume 2) to define procedures to ensure the detail, quality, and functionality of the sewer models while providing consistent model development criteria. A full set of modeling standards was developed prior to Final SSDP modeling. Standards included calibration standards, flow monitoring data protocols, use of previous models, input and export standards, quality assurance / quality control (QA/QC) procedures, and modeling techniques for rainfall-derived inflow and infiltration (RDI/I) and pump facilities.

As described within the Chapter, two storm distributions were considered for the Final SSDP modeling: 1) the Natural Resources Conservation Service distribution and; 2) the National Oceanographic and Atmospheric Administration (NOAA) "short-duration precipitation," also known as the "cloudburst" distribution. Based on an analysis of over fifty years of historical weather patterns for Louisville Metro, MSD determined that a three-hour, high-intensity cloudburst storm reflected the most appropriate storm pattern to use in SSO control evaluation.

During system characterization, a broad range of design storms and conditions were analyzed, ranging from storms with a 50 percent or greater probability of occurring in any given year to storms with a 10 percent probability of occurring in any given year. This allowed modelers the opportunity to validate models and determine the extent of various deficiencies, such as surcharging, at several different storm levels. During the evaluation, MSD assessed existing gravity sewer conditions, determined pump station capacity, consolidated past flow monitoring data, performed new flow monitoring specific to the Final SSDP modeling and maintained a rain gauge and radar rainfall network. Other key items outlined in Chapter 2 are outlined below.

Model Calibration and Validation – Model calibration is the process of comparing model predicted results to measured flow monitoring, rainfall, and other system data. Once calibrated, the model is then "validated." Model calibration requires comparison to a single wet weather event. Model validation cross-checks the model performance against a variety of historical data sources, (primarily observed SSO locations and surcharged pipes) to verify that the model predicts what has been observed during storms other than the calibration event.

Modeled Overflow Points (MOPs) – After validation, the models were simulated again at a 50 percent probability level (a 1.82-inch cloudburst storm) to identify any SSOs predicted by the models that were not associated with previously-known locations. These predicted SSO locations were subject to field investigation during wet weather events. Based on these investigations, several new SSOs were documented, and the models were re-validated.

RDI/I Reduction – RDI/I reduction was considered as an integral part of every solution. MSD developed a method to predict RDI/I reduction in specific basins, defined by the flow monitoring process, for use in the modeling and optimization process. Actual RDI/I reduction will depend on the level of sewer rehabilitation, and is especially dependent on the success of efforts to reduce infiltration and inflow (I/I) sources on private property. MSD is executing an on-going I/I Program for systemic improvements within the collection system. During implementation of the Final SSDP, post-construction monitoring will be used to demonstrate the impacts of I/I improvements on RDI/I reduction. An adaptive management approach will be used to modify a project's scope if the actual RDI/I reduction is significantly different than the predicted RDI/I reduction used in initial project development.

Build-out Development – In preparing conceptual designs of project alternatives, the potential for future development was considered. Flows predicted from future development were estimated for full build-out of un-developed areas that drain by gravity to known or suspected SSOs. Build-out considerations were limited to developable land consistent with current land use and growth planning documents for Louisville Metro.

This chapter concludes with the identification, validation, and characterization of SSOs subject to control under the Final SSDP. After model calibration, validation and the field investigation of the MOPs, a total of 173 SSO locations were listed as validated SSOs within the MSD system and are considered for the Final SSDP solution projects.

Chapter 3 Development and Evaluation of Alternatives for SSO Elimination

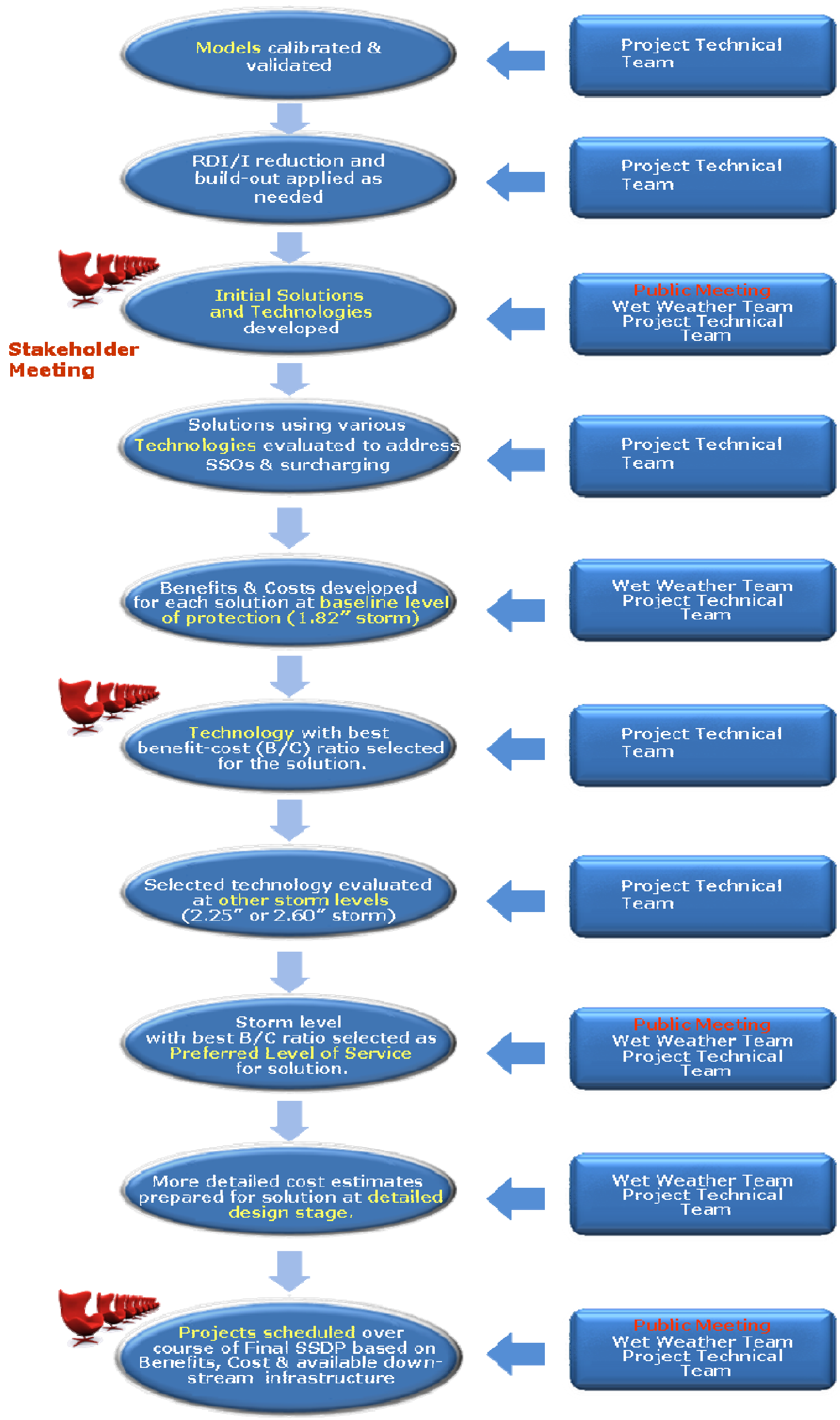
This chapter presents the methodologies used to evaluate the various SSO elimination alternatives. The chapter defines and discusses strategies and technologies available to control and eliminate SSOs in the separate SSS. The range of technology approaches available for the development of SSO elimination strategies and alternatives include:

- Source control through I/I flow reduction;
- Peak flow storage alternatives (constructed tanks or oversized pipes);
- Increased conveyance capacity (through larger pipe diameter, parallel relief sewers, or new or expanded pump stations);
- Flow diversion to other portions of the system that have available capacity;
- Expanded wastewater treatment capacity, provided either at existing regional treatment facilities or remotely as high-rate wet weather treatment facilities.

The chapter also provides the methodology for estimating costs and developing benefits for each solution considered. Figure ES.1 is a flow chart of the sequential SSO solution development process:

Finally, this chapter provides a summary of SSO technology alternative evaluations in each modeled area. The evaluation criterion includes feasibility screening, computer modeling, quality control, cost estimates, and a benefit-cost analysis. The initial SSO alternatives list considered 132 technology-based gray infrastructure projects addressing SSOs across the entire SSS. As a result of the structured evaluation and decision process, 49 preferred solutions were selected to proceed to the level of protection optimization process to develop final projects that represent the recommended solutions.

FIGURE ES.1 FINAL SSDP SSO SOLUTION DEVELOPMENT PROCESS



Chapter 4 Selection of Final Sanitary Sewer Discharge Plan

This chapter describes the application of the values-based risk management process utilized to optimize and prioritize the Final SSDP alternatives. The chapter describes the selection process for the final plan, including selected site-specific levels of protection, prioritization of projects, implementation schedules to comply with Consent Decree requirements, and measures to evaluate success of projects.

As previously described, the technology selection was determined based on a 1.82-inch cloudburst storm. In Chapter 4, the technology solution is fully described and the selection of the 1.82-inch cloudburst level was re-sized to prevent SSOs during a 2.25-inch cloudburst storm and also a 2.60-inch cloudburst storm under some conditions. For the re-sized facilities corresponding to each storm, the costs and benefits were re-evaluated and a new benefit-cost ratio was determined. Typically, the level of protection with the highest benefit-cost ratio was chosen as the final solution.

FINAL RECOMMENDED PROJECTS

The final projects selected to address SSOs include a mixture of source control (including I/I reduction efforts), wet weather storage, system diversion, and flow conveyance/transport. This mix of control options is the result of the process using community value based benefit-cost analyses as defined by the Wet Weather Team (WWT) Stakeholder Group. Consistent with the Final Combined Sewer Overflow Long-Term Control Plan (Final CSO LTCP), the Final SSDP project alternatives are designed to be built around MSD's existing infrastructure, which may include large diameter pipes and WQTCs, and draw on synergistic benefits from other MSD projects.

Overall, the Final SSDP includes 49 projects: 38 gray infrastructure projects, eight I/I reduction projects, and three SSO investigation projects. The Interim SSDP includes six gray infrastructure projects which are incorporated into the Final SSDP solutions. The gray infrastructure projects, including the six Interim SSDP projects, are divided into a combination of the following categories, (some projects fall into more than one category):

- 23 conveyance capacity upgrades
- 11 storage projects, inline and offline, many with pipe upgrades as well
- Upgrades or replacements to 12 pump stations
- Elimination of 18 pump stations
- Elimination of 6 small WQTCs, including 5 in the Prospect area
- Expansion of a WQTC

The site-specific level of protection for the 38 Final SSDP gray infrastructure projects as determined by the value-based benefit-cost analysis resulted in the following:

- 24 projects eliminate SSOs up to the 1.82-inch cloudburst storm
- 5 projects eliminate SSOs up to the 2.25-inch cloudburst storm
- 9 projects eliminate SSOs up to the 2.60-inch cloudburst storm

The suite of projects selected for the Final SSDP for SSO control will result in the elimination of capacity-related SSOs up to the site-specific level of protection. In an average year the SSO projects are anticipated to eliminate SSOs at an average of 145 SSO locations that currently discharge an estimated 290 million gallons (MG) of overflow volume per year, based on 2005–2007 data normalized for rainfall. In terms of water quality, SSO projects will annually eliminate 100 tons of 5-day biochemical oxygen demand (BOD_5) and approximately 200 tons of suspended solids.

Table ES.1 represents the final projects chosen for eliminating SSOs at the selected site-specific design level of protection. The table includes a list of projects, SSOs controlled by that project, selected level of protection, capital costs, and scheduled project completion year. In total, there are 214 documented, suspected, and modeled SSOs addressed by the 55 projects (49 Final SSDP and six Interim SSDP) listed in Table ES.1 and displayed in Figure ES.2. Projects are listed by modeled area.

- Cedar Creek
- Hite Creek
- Floyds Fork
- Jeffersontown
- Middle Fork
- Southeastern Diversion
- Pond Creek
- Ohio River Force Main
- Mill Creek
- Small WQTC Area
- CSS Area
- Other Project
- Interim SSDP Projects

The implementation schedule to achieve Consent Decree requirements and final project implementation is shown in Figure ES.3. The Final SSDP is being developed based on front-end consideration of source control. This means that traditional gray infrastructure in the Final SSDP were sized after considering the anticipated flow-reduction benefits of source control including reduction of private sources of I/I. Ultimate sizing of each project will be analyzed in design with adjustments to account for realized I/I reductions through source control. The following list represents the general order of priority that was used to set the implementation schedule for the IOAP Final SSDP projects, in descending order:

- Interim SSDP projects and milestones from previously approved submittals
- "Enabling projects" required to implement Consent Decree or Milestone projects
- Source control solutions (especially targeted I/I reduction locations)
- Downstream projects that need to be constructed to capture additional flow when smaller upstream projects are constructed
- Capital Improvement Projects already under design that address SSOs
- Remaining projects rank-ordered based on benefit-cost ratio and scheduled in that order at specific times to assist with cash flow leveling

The capital cost, in 2008 dollars, to implement the Final SSDP is $219,687,000, allocated as follows:

- Gray Infrastructure Program $168,687,000
- I/I Reduction Program $ 51,000,000

MEASURES OF SUCCESS

Measures of success are a means to demonstrate compliance with the Consent Decree requirements and to quantify the benefits achieved from SSO elimination projects. The success of the Final SSDP in meeting Consent Decree compliance requirements will be measured incrementally as the plan is implemented and also at plan completion in December 2024. A review of the Final SSDP projects after completion will evaluate how well the project accomplished the performance goals.

The performance goals to be tracked under the Final SSDP include:

- No wet weather capacity related SSOs from the system within the selected level of protection.
- No wet weather capacity related system surcharges causing basement back-ups within the selected level of protection and within the pre-remediation zone of influence.
- Secondary treatment of all flow within the selected level of protection.
- Project flow monitoring performed and documented. Post-construction flow rates are comparable to projected flow rates established in the design process.

If any of these measures are deemed to not be met for a defined level of protection storm event, MSD will utilize the adaptive management process to improve the performance of the impacted projects to achieve the intended goal. These improvements could include additional storage or targeted RDI/I reduction measures upstream of the solution.

MSD anticipates that new SSO locations could be found over time, as sewer system conditions change. As a result, if capacity related, existing solutions may be modified to address new SSO locations on a case-by-case basis through the adaptive management process (e.g., new SSOs will be added to the SORP investigation list and monitored. If necessary, hydraulic models will be re-validated to the new SSOs and used to analyze solution modifications.)

TABLE ES.1

SSDP FINAL PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Controlled	Technology	Selected Level of Protection	Capital Cost $[1]	Scheduled Completion Year
Cedar Creek Area					
Idlewood Inline Storage	28998, 28984, 63094, 63095, 70158	Inline Storage	1.82-inch	$2,317,000	2023
Fairmount Rd. PS Improvements	Fairmount Road PS (81316 & 97362)	PS Upgrades	2.60-inch	$874,000	2023
Little Cedar Creek Interceptor Improvements	67997, 67999, 86423, 89195, 89197	Pipe Upgrades	1.82-inch	$1,875,000	2024
Bardstown Rd. PS Improvements	88545	PS Upgrades	2.25-inch	$281,000	2021
Running Fox PS Elimination	MSD1080-LS	Diversion	1.82-inch	$96,000	2010
Hite Creek Area					
Meadow Stream PS Inline Storage	Meadow Steam PS (91087 & MSD1082-PS)	Inline Storage	1.82-inch	$974,000	2016
Floydsburg Rd. I/I Investigation & Rehabilitation	Floydsburg Road (MSD1086-PS, 90776, 108956, 108957, 108958)	I/I Reduction	1.82-inch	$57,000	2010
Kavanaugh Rd. PS Improvements	Kavanaugh Road (MSD1085-PS)	PS & Force Main Upgrades	2.60-inch	$1,110,000	2024
Floyds Fork Area					
Woodland Hills PS Diversion	33003, 65531	Diversion	1.82-inch	$20,000	2011
Eden Care PS SSO Investigation	Eden Care PS (MSD1105-PS)	Monitor	Monitor	--	2012
Ashburton PS Improvements & Diversion	Olde Copper Court PS (MSD0165-PS), Ashburton PS (MSD0166-PS)	Upgrade Force Main & Pipes	1.82-inch	$118,000	2021
Jeffersontown Area					

TABLE ES.1

SSDP FINAL PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Controlled	Technology	Selected Level of Protection	Capital Cost $[1]	Scheduled Completion Year
Jeffersontown WQTC Elimination	28390, 28391, 28392, 28395, 31733, Jeffersontown WQTC (28173 & 64505 & MSD0255 & IS028-SI)	Offline Storage & Pipe Upgrades, WQTC Elimination	1.82-inch	$23,737,000	2015
Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements	Chenoweth Run PS (MSD0196-PS & 86052 & 64096), Chippewa PS (92061), Chenoweth Hills WQTC PS (MSD0263A-PS), Chenoweth Hills WQTC (MSD0263)	PS & Force Main Upgrades, WQTC Elimination	1.82-inch	$3,140,000	2015
Dell Rd. and Charlane Pkwy Interceptor Improvements	Charlane Pky (28250, 28249, 28340, 28336, 104289), Dell Rd. (28413, 28414, 28415, 28416, 28417)	Pipe Upgrades	1.82-inch	$917,000	2022
Raintree & Marian Ct. PS Eliminations	28719, 28711, Marian Court PS (28729), Raintree PS (MSD0149-PS)	Diversion, Pipe Upgrades	1.82-inch	$1,005,000	2021
Monticello PS Elimination	Monticello Place PS (MSD0151-PS & 27969)	Diversion	2.60-inch	$207,000	2022
Middle Fork Area					
Middle Fork Relief Interceptor, Wet Weather Storage, and UMFLS Diversion	02932, 02933, 02935, 08537, 23211, 23212, 27005, 45835, 47583, 47593, 47596, 47603, 47604, 51221, 51161, 51160, 90700, IS021A-SI, 08935-SM	Offline Storage & Pipe Upgrades	1.82-inch	$26,627,000	2 Phases - 2013, 2023
Goose Creek Pump Station Improvements & Wet Weather Storage	Devondale PS (21628-W), Goose Creek PS (46891 & 62418 & 91629 & 91630 & 105936), Saurel PS (43472)	Offline Storage, PS & Force Main Upgrades	2.25-inch	$2,844,000	2024
Anchor Estates Inline Storage & PS Eliminations	Vannah PS (01106), Anchor Estates #1 Pump Station (00746 & 00056-W), Anchor Estates #2 PS (MSD0057-LS)	Inline Storage & Diversion	2.60-inch	$1,909,000	2 Phases - 2013, 2016
Hurstbourne I/I Investigation & Rehabilitation	01793	I/I Reduction	1.82-inch	$536,000	2011
Southeastern Diversion Area					
Parkview Estates I/I Investigation & Rehabilitation	47250	I/I Reduction	1.82-inch	$285,000	2011

TABLE ES.1

SSDP FINAL PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Controlled	Technology	Selected Level of Protection	Capital Cost $[1]	Scheduled Completion Year
Klondike Interceptor	25676 (Alcona), 26650, 26651	Pipe Upgrades	2.25-inch	$558,000	2015
Sutherland Interceptor	Sutherland (16649)	Pipe Upgrades	2.60-inch	$412,000	2023
Beargrass Interceptor Rehab Ph. 2	51594	Pipe Rehab	1.82-inch	$57,000	2010
Pond Creek Area					
Charleswood Interceptor Extension	25477, 25478, Cooper Chapel PS (25480 & MSD0130-PS)	Pipe Upgrades	1.82-inch	$603,000	2022
Cinderella PS Elimination	Cinderella PS (60679 & MSD1013-PS), 35309	Diversion	1.82-inch	$2,205,000	2023
Lantana PS I/I Investigation & Rehabilitation	Lantana Drive #1 PS (25484 & 93719 & MSD0101-PS)	Offline Storage & Pipe Upgrades	1.82-inch	$20,000	2011
Government Center PS Elimination	Government Center PS (MSD0180-PS)	Diversion	1.82-inch	$1,225,000	2024
Avanti Pump Station Elimination	Avanti PS (21229-W)	Diversion	2.60-inch	$31,000	2010
Lea Ann Way System Improvements	19360, 19369, 29933, 29948, 29943, 31083, 31084, 79076, Lea Ann Way PS (MSD1010-PS)	Pipe Upgrades	1.82-inch	$827,000	2015
Outer Loop & Caven Ave Wet Weather Storage	27116, 70212, 17724, Caven Ave PS (MSD0133-PS)	Offline Storage & Pipe Upgrades	1.82-inch	$6,084,000	2 Phases – 2016, 2024
Leven PS Elimination	Leven PS (36419 & MSD1019-PS)	Diversion	1.82-inch	$376,000	2022
Edsel PS I/I Investigation & Rehabilitation	Edsel PS (92098 & MSD1048-PS)	I/I Reduction	1.82-inch	$367,000	2011
ORFM Area					

TABLE ES.1

SSDP FINAL PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Controlled	Technology	Selected Level of Protection	Capital Cost $[1]	Scheduled Completion Year
Mellwood System Improvements & PS Eliminations	26752, 41374, 41416, Mockingbird Valley PS (MSD0007-PS), Winton PS (MSD0010-PS), Mellwood Avenue PS (24472 & MSD0023-PS), Canoe Lane PS (24152-W & MSD0024-PS)	PS Upgrades, Pipe Upgrades & Diversion	2.25-inch	$3,055,000	2 Phases – 2012, 2024
Leland Rd. SSO Investigation	96020	Condition Assessment	Monitor	--	2012
Derington Ct. PS I/I Investigation & Rehabilitation	Derington Court PS (MSD0095-PS)	I/I Reduction	1.82-inch	$265,000	2012
Prospect Area WQTC Eliminations, Harrods Creek PS, and ORFM System Improvements	40870, 40871, 40872, Barbour Lane PS (42680 & 65633 & 65635), West Goose Creek PS (22436 & MSD0123-PS), Phoenix Hill PS (MSD1044-PS), Glenview Hills PS (MSD0183-PS), Barbour Lane PS (MSD0192-PS), New Market PS (MSD0193-PS), Deep Creek PS (MSD1063-PS), Hunting Creek South WQTC (MSD0292)	PS and Pipe Upgrades, Diversion, WQTC eliminations	2.25-inch	$34,062,000	2 Phases - 2015, 2016
Mill Creek Area					
Shively Interceptor	04498, 04542, Pioneer PS (81814-W), Fern Lea PS (MSD0047-PS), Garr's Lane PS (MSD0050-PS)	Pipe Upgrades	2.60-inch	$16,419,000	2014
East Rockford PS Relocation	East Rockford PS (04699-W)	Pump Station Replacement and Relocation	1.82-inch	$1,044,000	2021
Small WQTC Area					
Lucas Ln. PS Inline Storage	Lucas Lane PS (MSD0199-LS)	Inline Storage	1.82-inch	$183,000	2021

TABLE ES.1

SSDP FINAL PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Controlled	Technology	Selected Level of Protection	Capital Cost $[1]	Scheduled Completion Year
Riding Ridge PS Improvements	Riding Ridge PS (MSD1060-LS)	PS Upgrades	1.82-inch	$27,000	2014
Gunpowder PS Inline Storage	Gunpowder PS (MSD1055-LS)	Inline Storage	1.82-inch	$176,000	2021
Fox Harbor Inline Storage	Fox Harbor #1 and #2 PS (62769)	Inline Storage	2.60-inch	$328,000	2021
Fairway View PS Improvements	Fairway View PS (MSD1065-PS)	PS Upgrades	1.82-inch	$87,000	2014
Lake Forest PS SSO Investigation	Lake Forest PS (MSD1169-LS)	Monitor	Monitor	--	2012
St. Rene Rd. PS Inline Storage	94187	Inline Storage	1.82-inch	$30,000	2021
CSS Area					
Sonne PS I/I Investigation & Rehabilitation	Sonne Avenue PS (MSD0042-PS)	I/I Reduction	1.82-inch	$265,000	2011
Camp Taylor System Improvements	08717, 13931, 13943, 36763, 44396, 44397, 66349, 104223, 104231	SSES, Sewer Rehabilitation & Replacement, Offline Storage	2.60-inch	$28,279,000	4 Phases - 2011, 2013, 2017, 2023
Hazelwood PS I/I Investigation & Rehabilitation	Hazelwood PS (55665)	I/I Reduction	1.82-inch	$173,000	2011
Other Project					
CPE/CCP Modifications to WQTC	--	--	--	$2,600,000	2011
			FINAL SSDP TOTAL	**$168,687,000**	

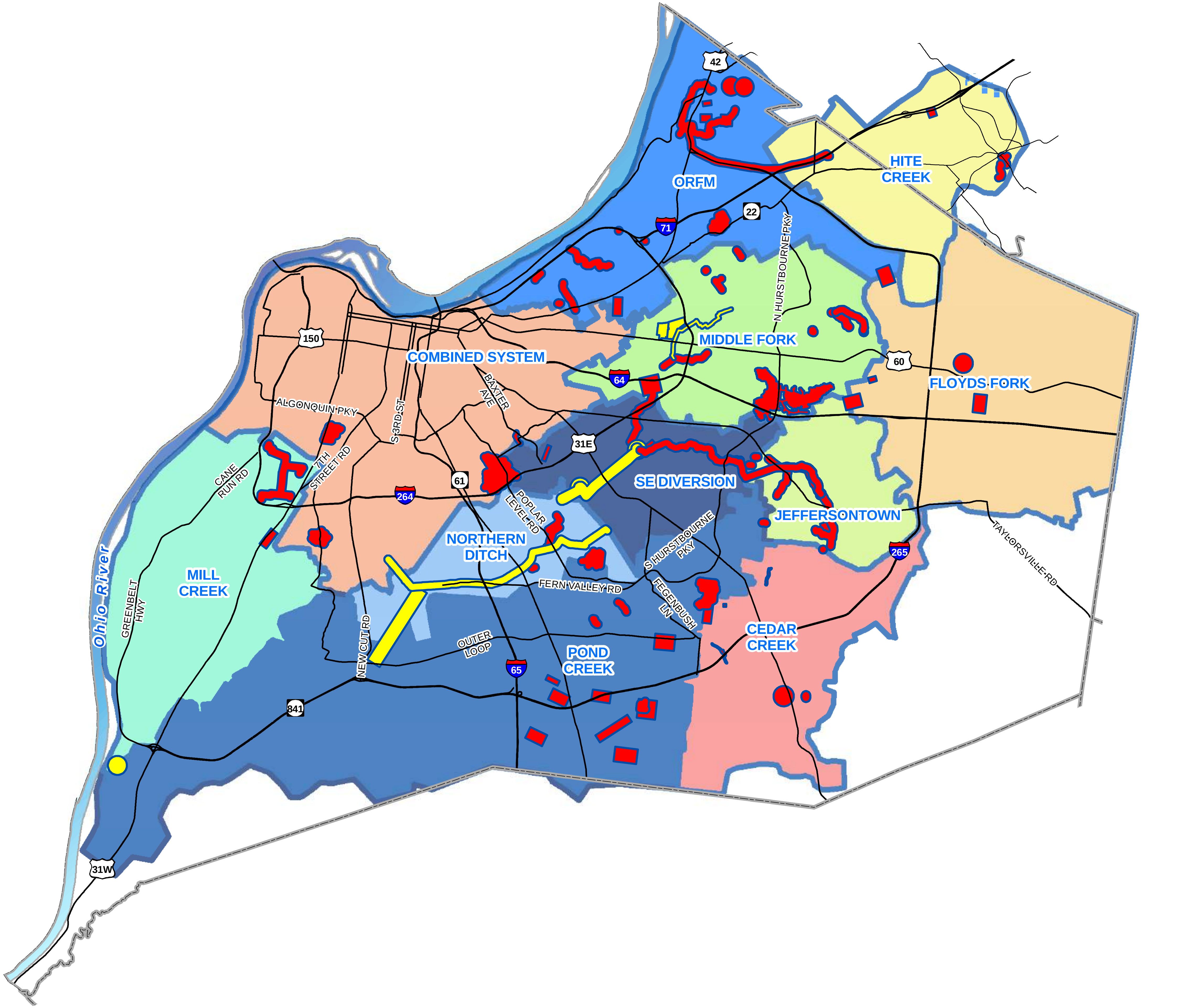
Legend: LS –Lift station, PS – Pump Station, CSO – Combined Sewer Overflow, SSO – Sanitary Sewer Overflow, CSS- Combined Sewer System, WQTC – Water Quality Treatment Center, SSES – Sanitary Sewer Evaluation Study, I/I – Inflow and Infiltration, ORFM – Ohio River Force Main, CPE - Comprehensive Performance Evaluation, CCP -Composite Correction Plan

TABLE ES.1

SSDP FINAL PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Controlled	Technology	Capital Cost $[1]	Scheduled Completion Year
Interim SSDP Projects				
Beechwood Village Sanitary Sewer Replacement	21061, 21089, 21101, 21153, 21156	Sewer Replacement	$11,800,000	2011
Hikes Lane Interceptor and Highgate Springs PS	17571, 18134, 18298, 18302, 18318-W, 18434, 18471, 18483, 18505, 18595, 49236, 49672, 49673, 49224, MSD0012-PS	PS Elimination and New Interceptor	$21,216,000	2012
Northern Ditch Diversion Interceptor	MSD0271	New Interceptor / WQTC Elimination	$20,397,000	2011
Sinking Fork Relief Sewer	21103, 25012, 63319	New Relief Sewer	$1,690,000	2010
Southeastern Diversion Structure and Interceptor	08426, 08427, 08430, 08431, 30701, 30702, 49647, 63779, 30680, 30681, 72571-X	New Relief Sewer and Flow Control Modifications	$1,744,000	2012
Derek R. Guthrie WQTC	22370, 22385, 32682, 32688, 59169, MSD0277	WQTC Upgrade	$102,700,000	2011
		INTERIM SSDP TOTAL	**$159,547,000**	
Note: Derek R. Guthrie WQTC (formerly known as the West County Wastewater Treatment Plant)				

[1] Detailed cost evaluations are included in Appendix 4.1.2, Final SSDP Project Cost Estimates



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Final SSDP Project Areas

Figure ES.2

Legend

- Jefferson County Boundary
- Major Roads

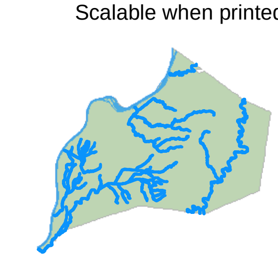
IOAP Project Areas

- ISSDP
- SSDP

Credits Catchment Areas

- CEDAR CREEK
- COMBINED SYSTEM
- FLOYDS FORK
- HITE CREEK
- JEFFERSONTOWN
- MIDDLE FORK
- MILL CREEK
- NORTHERN DITCH
- ORFM
- POND CREEK
- SE DIVERSION
- Ohio River

1 inch = 14,000 feet
Scalable when printed on 11" X 17" paper



Some boundaries are uniquely symbolized within the map.

Map Revision
May 7, 2009

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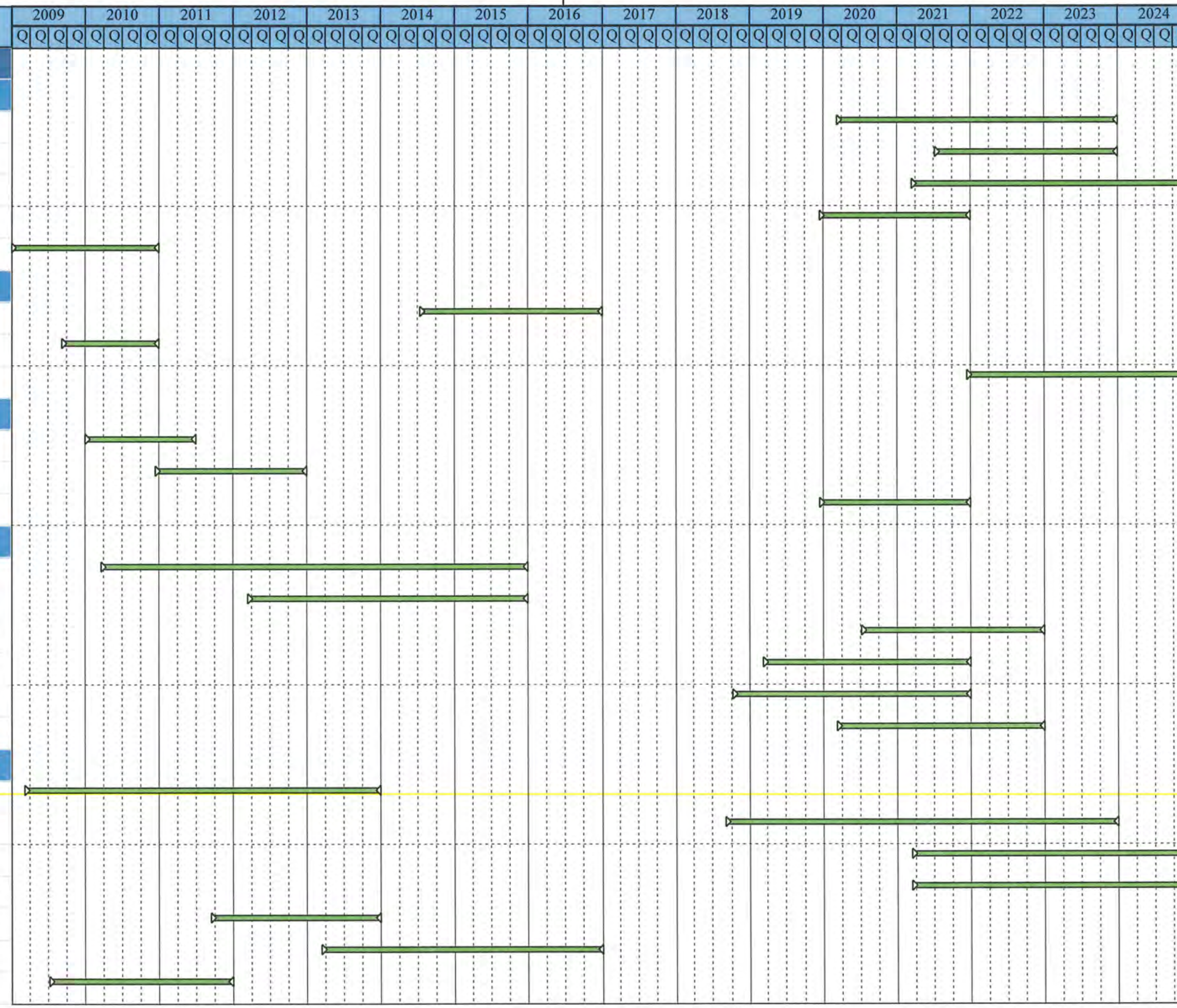
SDI Inc. Figure ES.2 Final SSDP Projects.mxd

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

Figure ES.3

Final Sanitary Sewer Discharge Plan Implementation Schedule

Project Name	Finish
Sanitary Sewer Discharge Plan	31-Dec-24
Cedar Creek Area	31-Dec-24
Idlewood Inline Storage	31-Dec-23
Fairmount Rd PS Improvements	31-Dec-23
Little Cedar Creek Interceptor Improvements	31-Dec-24
Bardstown Rd PS Improvements	31-Dec-21
Running Fox PS Elimination	31-Dec-10
Hite Creek Area	31-Dec-24
Meadow Stream PS Inline Storage	31-Dec-16
Floydsburgh Rd I/I Investigation & Rehabilitation	31-Dec-10
Kavanaugh Rd PS Improvements	31-Dec-24
Floyds Fork Area	31-Dec-21
Woodland Hills PS Diversion	30-Jun-11
Eden Care PS SSO Investigation	31-Dec-12
Ashburton PS Improvements & Diversion	31-Dec-21
Jeffersontown Area	31-Dec-22
Jeffersontown WQTC Elimination	31-Dec-15
Chenoweth Hills WQTC Elimination & PS Improvemets	31-Dec-15
Dell Rd & Charlane Pkwy Interceptor Improvements	31-Dec-22
Raintree & Marian Ct Ph 1-PS Eliminations	31-Dec-21
Raintree & Marian Ct Ph 2-Pipe Upgrades	31-Dec-21
Monticello PS Elimination	31-Dec-22
Beargrass Creek Middle Fork Area	31-Dec-24
UMF #1-Buechel Basin	31-Dec-13
UMF #2-PS Diversion & Storage	31-Dec-23
Goose Creek PS Ph 1-Devondale PS WW Storage	31-Dec-24
Goose Creek PS Ph 2-PS & Force Main Upgrades	31-Dec-24
Anchor Estates-Vannah PS Elimination	31-Dec-13
Anchor Estates-Anchor Ests PS 1&2 Eliminations	31-Dec-16
Hurstbourne I/I Investigation & Rehabilitation	31-Dec-11



All Projects

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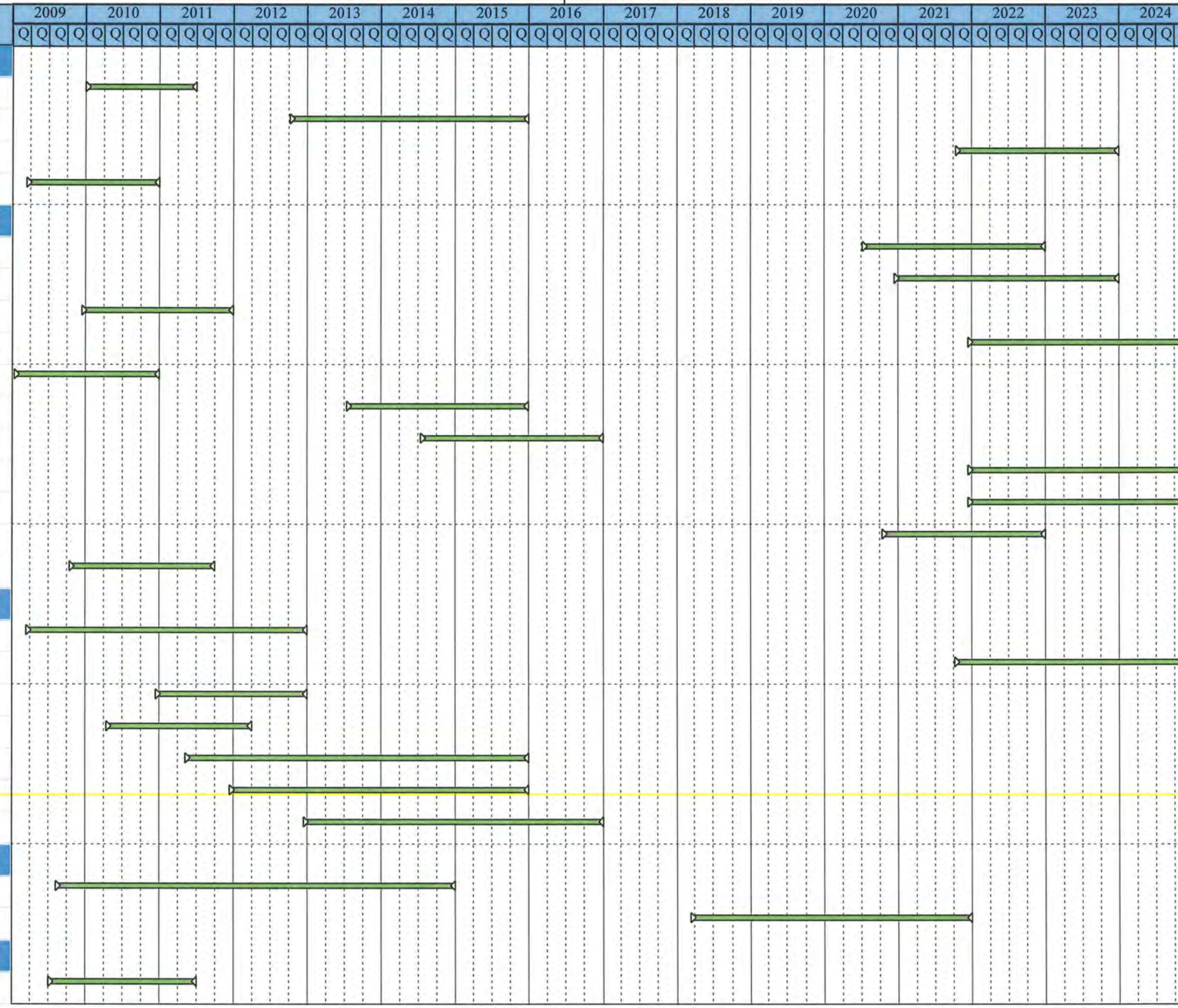
Final Sanitary Sewer Discharge Plan Implementation Schedule

Figure ES.3

Project Name	Finish
Southeastern Diversion Area	**31-Dec-23**
Parkview Estates I/I Investigation & Rehabilitation	30-Jun-11
Klondike Interceptor	31-Dec-15
Sutherland Interceptor	31-Dec-23
Beargrass Interceptor Rehabilitation Ph 2	31-Dec-10
Pond Creek Area	**31-Dec-24**
Charleswood Interceptor Extension	31-Dec-22
Cinderella PS Elimination	31-Dec-23
Lantana PS I/I Investigation & Rehabilitation	31-Dec-11
Government Center PS Elimination	31-Dec-24
Avanti PS Elimination	31-Dec-10
Lea Ann Way System Improvements	31-Dec-15
Outer Loop & Caven Area Pipe Upgrades	31-Dec-16
Outer Loop WW Storage	31-Dec-24
Caven Ave WW Storage	31-Dec-24
Leven PS Elimination	31-Dec-22
Edsel PS I/I Investigation & Rehabilitation	30-Sep-11
Ohio River Force Main Area	**31-Dec-24**
Mellwood Sys 1-Mellwood PS & Force Main	31-Dec-12
Mellwood Sys 2-Winton & Mockingbird PS Elims & Pipe Upgrds	31-Dec-24
Leland Rd SSO Investigation	31-Dec-12
Derington Ct PS I/I Investigation & Rehabilitation	31-Mar-12
Prospect #1 - WQTC Eliminations	31-Dec-15
Prospect #2 - Harrods Creek PS	31-Dec-15
Prospect #3 - ORFM System Improvements	31-Dec-16
Mill Creek Area	**31-Dec-21**
Shively Interceptor	31-Dec-14
East Rockford PS Relocation	31-Dec-21
Combined Sewer System Area	**31-Dec-23**
Sonne PS I/I Investigation & Rehabilitation	30-Jun-11



All Projects

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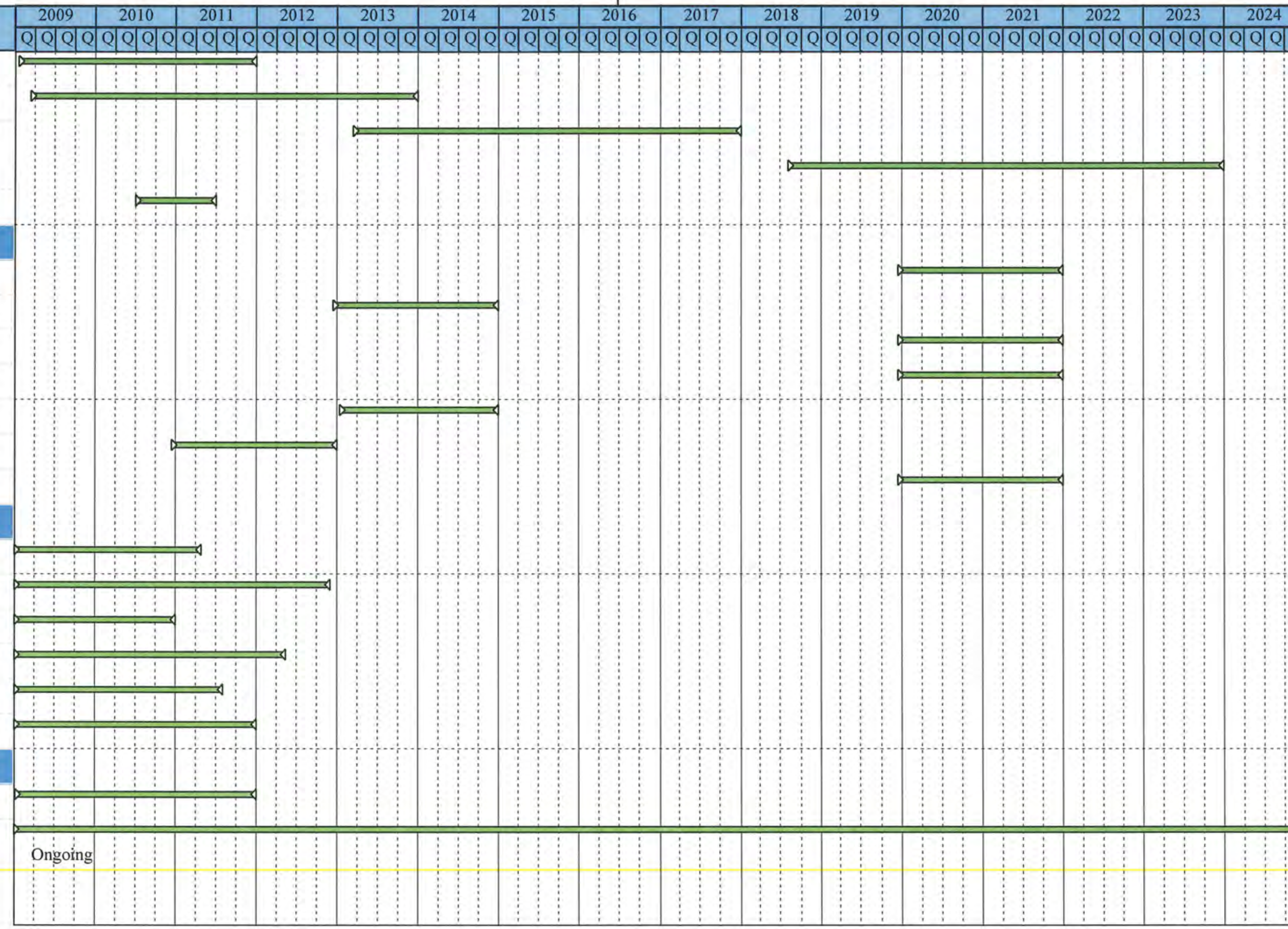
Figure ES.3

Final Sanitary Sewer Discharge Plan Implementation Schedule

Figure ES.3

Project Name	Finish
Camp Taylor #1 - SSES	31-Dec-11
Camp Taylor #2 - Replace Sewers	31-Dec-13
Camp Taylor #3 - Replace Sewer & Rehabilitation	31-Dec-17
Camp Taylor #4 - Rehabilitation & Off Line Storage	31-Dec-23
Hazelwood PS I/I Investigation & Rehabilitation	30-Jun-11
Small WWTP Area	31-Dec-21
Lucas Ln PS Inline Storage	31-Dec-21
Riding Ridge PS Improvements	31-Dec-14
Gunpowder PS Inline Storage	31-Dec-21
Fox Harbor Inline Storage	31-Dec-21
Fairway View PS Improvements	31-Dec-14
Lake Forest PS SSO Investigation	31-Dec-12
St. Rene Rd PS Inline Storage	31-Dec-21
Interim SSDP Projects	27-Nov-12
Beechwood Village Sanitary Sewer Replacement	27-Apr-11
Hikes Lane Interceptor & Highgate Springs PS	27-Nov-12
Sinking Fork Relief Sewer	30-Dec-10
Southeast Diversion Structure & Interceptor	12-May-12
Northern Ditch Diversion Interceptor	31-Jul-11
Derek R. Guthrie WQTC	31-Dec-11
Other Projects	30-Dec-24
CPE/CCP Modifications To WQTC	31-Dec-11
I/I Reduction Program	30-Dec-24



All Projects

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MSD

Metropolitan Sewer District

CHAPTER 1

CHAPTER 1: INTRODUCTION

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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.

FIGURE 1.3.1 SMOKE INDICATING AN INFLOW SOURCE AT A MANHOLE

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.

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).

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.

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

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.

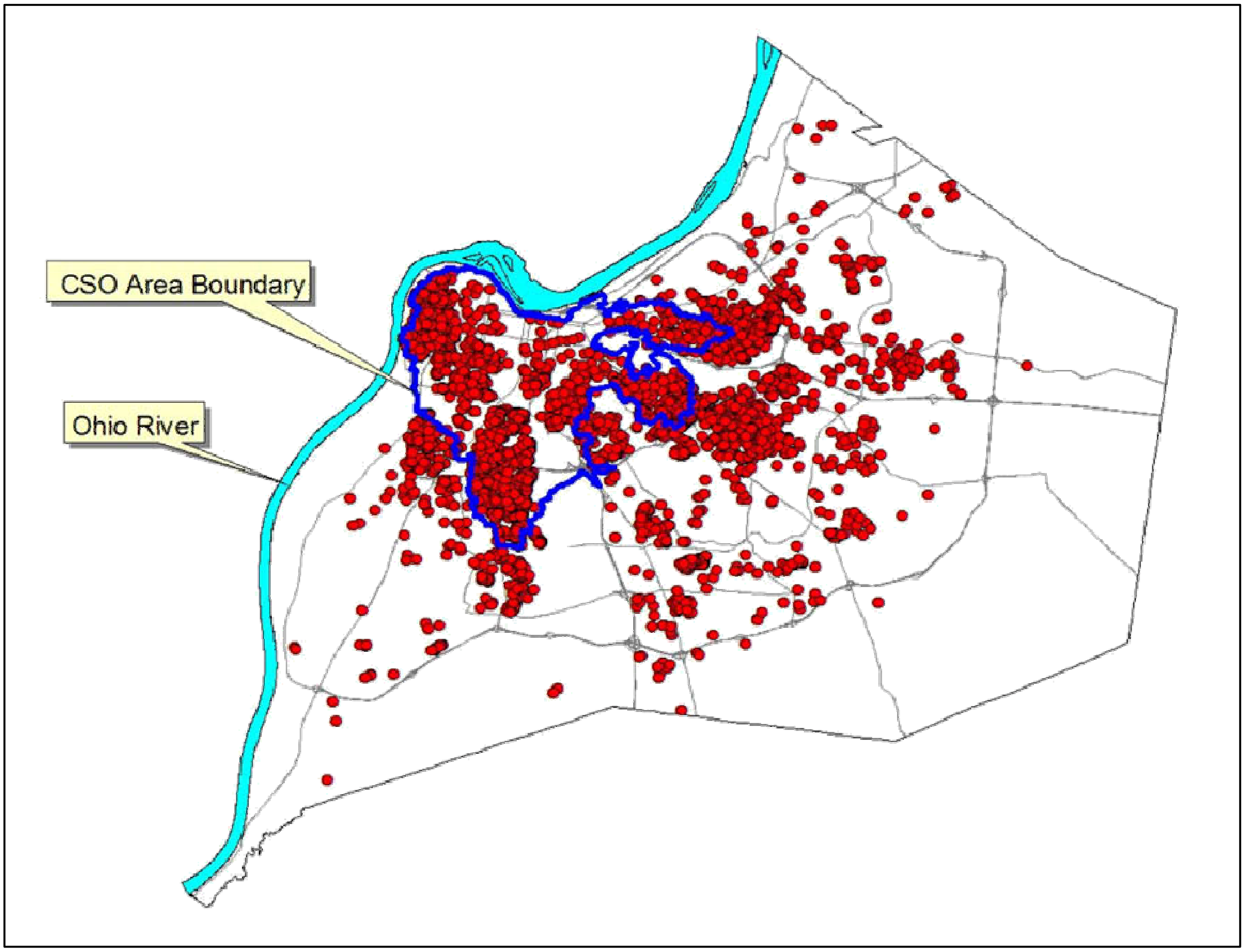
The hydraulic model has been used for improvement of the existing asset database, identification of significant hydraulic bottlenecks, testing rehabilitation scenarios, modeling wet weather system responses, SSO elimination alternatives, and identifying the impacts of future development scenarios. Additional 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.

Project 5: Northern Ditch Diversion Interceptor

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:

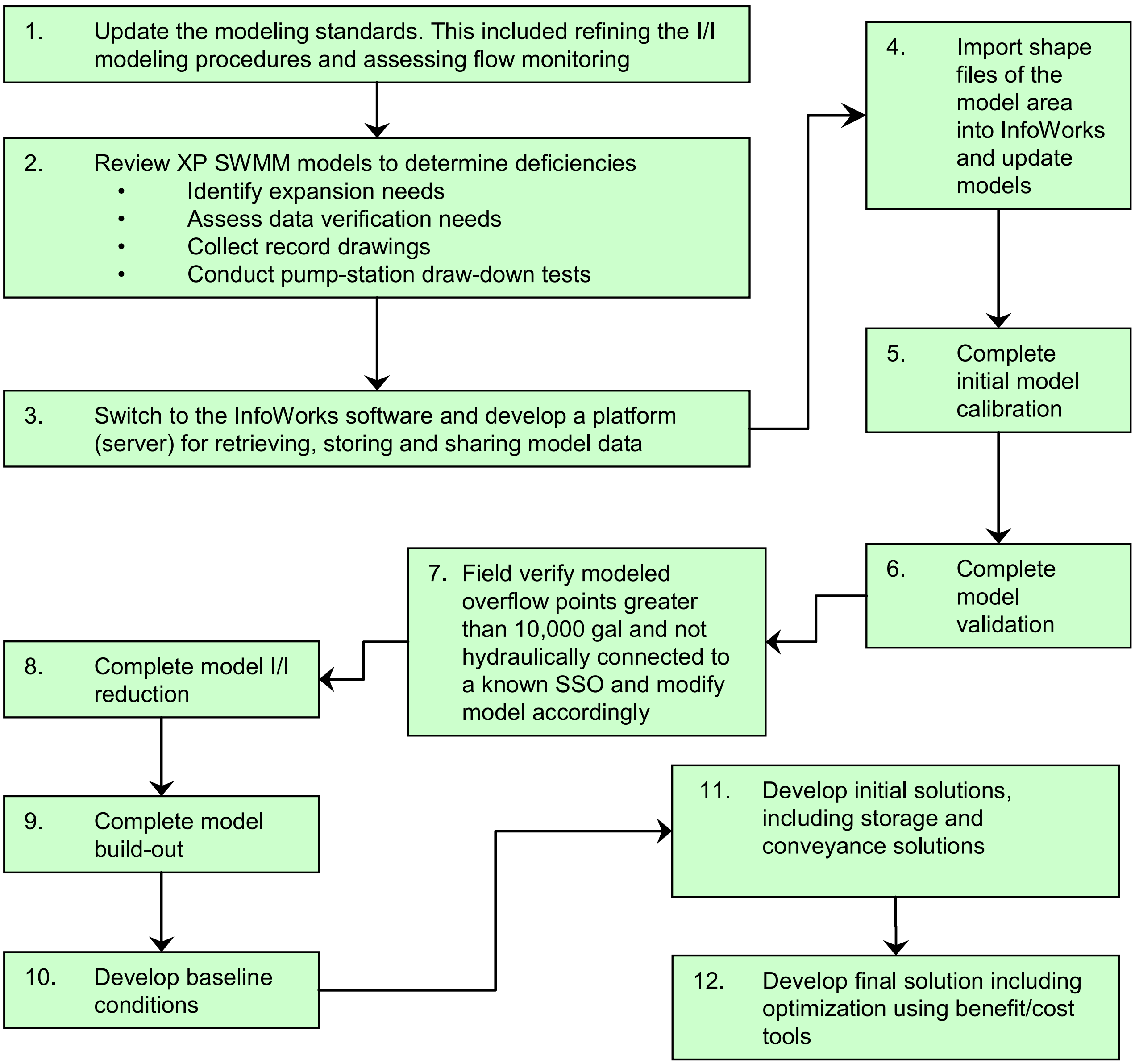
- Hydrological characterization, which uses databases on land types and soils to generate mathematical representation of rainfall and stormwater flow into the sewer system.
- The hydrological model, which uses the hydrological characterization to estimate I/I based on assumed rainfall and soil conditions.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

MSD

Metropolitan Sewer District

CHAPTER 2

CHAPTER 2: SYSTEM CHARACTERIZATION

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Appendix 3.1.1 I/I Program Documentation

Volume 2, Appendix 2.4.3 Hydraulic Sewer System Modeling Guideline Manual

CHAPTER 2: SYSTEM CHARACTERIZATION

2.1 SYSTEM CHARACTERIZATION OBJECTIVES

Objectives of system characterization within the context of the Final Sanitary Sewer Discharge Plan (SSDP) include:

- Calibrating and validating the hydraulic models.
- Identifying and verifying system deficiencies and problem areas, including sanitary sewer overflows (SSOs), by analysis of assembled data using validated hydraulic models.

The objectives are met by collecting system data and developing hydraulic models that are consistent with the data that represent Louisville and Jefferson County Metropolitan Sewer District (MSD)'s separate sanitary sewer system (SSS). This chapter serves as a framework for solution development to eliminate known or suspected capacity-related SSOs, within the established level of protection.

2.2 EXISTING SSDP DATA

This section of the Final SSDP provides compilation and evaluation of data from three key areas:

- Existing Water Quality Treatment Center (WQTC) service areas and existing WQTC capacity evaluations.
- Existing collection systems, primarily gravity sewers and pump stations.
- Flow Monitoring and associated rain gauge network.

These compilations are focused on building representative hydraulic models and in determining collection system deficiencies.

2.2.1 WQTC Service Areas

This section provides a background summary of each of the six WQTC regional service areas as well as a number of small WQTCs that make up MSD's sewer service area. Table 2.2.1 includes information on service area size, design capacities, dates of construction, and lengths and diameters of sewers.

While MSD has built the regional treatment facilities and the required interceptors to treat and convey flow in each service area, much of the collection system was built by other communities or by private developers. When MSD acquired these systems beginning in the 1960s, it also acquired the system deficiencies and operations and maintenance (O&M) concerns, many of which are the root cause of current SSOs.

TABLE 2.2.1

WATER QUALITY TREATMENT CENTER (WQTC) CHARACTERISTICS

WQTC	Sub-Service Area	KPDES Permit Number	Year Built	Year Acquired by MSD	Design Capacity	Discharge To	Sanitary Sewer Pipe in Collection System (mi)	Pipe Size Range	Most Common Pipe Materials	Sanitary Pump / Lift Stations	Scheduled WQTC Diversion Date	Expected Receiving WQTC
Cedar Creek	--	KY0098540	1995	1995	7.5 MGD	Cedar Creek	125	8"-36"	VCP, PVC	28	N/A	N/A
Hite Creek	--	KY0022420	1970	1970	6.0 MGD	Hite Creek	120	8"-27"	PVC	35	N/A	N/A
Floyds Fork	--	KY0102784	2001	2001	3.25 MGD	Floyds Fork	98	8"-54"	VCP, PVC	20	N/A	N/A
Jeffersontown	--	KY0025194	1956	1990	4.0 MGD	Chenoweth Run	112	8"-36"	VCP, PVC	27	2015	To be Determined
Morris Forman	--	KY0022411	1958	1958	120 MGD	Ohio River	1,000	8"-72"	VCP, RCP, PVC	118	N/A	N/A
--	Middle Fork	N/A	N/A	N/A	N/A	--	348	8"-53"	VCP, RCP, PVC	19	N/A	N/A
--	Beechwood Village	N/A	N/A	N/A	N/A	--	6.8	8"-10"	VCP	--	N/A	N/A
--	Ohio River Force Main / Muddy Fork	N/A	N/A	N/A	N/A	--	185	8"-48"	VCP, PVC	30	N/A	N/A
--	Hikes Point / Highgate Springs PS	N/A	N/	N/A	N/A	--	100	8"-36"	VCP	3	N/A	N/A
--	Buechel Branch	N/A	N/A	N/A	N/A	--	57	8"-36"	VCP	--	N/A	N/A
--	Northern Ditch	N/A	N/A	N/A	N/A	--	130	8"-72"	VCP	6	N/A	N/A
Derek R. Guthrie	--	KY0078956	1986	1986	30 MGD	Ohio River	852	8"-120"	VCP, PVC	68	N/A	N/A
--	Pond Creek	N/A	N/A	N/A	N/A	--	495	8"-120"	VCP, PVC	40	N/A	N/A
--	McNeely Lake	N/A	N/A	N/A	N/A	--	31	8"-24"	VCP, PVC	6	N/A	N/A
--	Mill Creek	N/A	N/A	N/A	N/A	--	309	8"-78"	VCP, PVC	20	N/A	N/A
--	Valley Village	N/A	N/A	N/A	N/A	--	17	8"-27"	VCP, PVC	2	N/A	N/A
Hunting Creek North	--	KY0029106	1964	1999	0.358 MGD	Harrods Creek	14	8"-15"	VCP, PVC	10	2015	HC WQTC

TABLE 2.2.1

WATER QUALITY TREATMENT CENTER (WQTC) CHARACTERISTICS

WQTC	Sub-Service Area	KPDES Permit Number	Year Built	Year Acquired by MSD	Design Capacity	Discharge To	Sanitary Sewer Pipe in Collection System (mi)	Pipe Size Range	Most Common Pipe Materials	Sanitary Pump / Lift Stations	Scheduled WQTC Diversion Date	Expected Receiving WQTC
Hunting Creek South	--	KY0029114	1968	1999	0.251 MGD	Harrods Creek	11	8"-10"	VCP, PVC	8	2015	HC WQTC
Ken Carla	--	KY0022497	1968	1997	0.010 MGD	Harrods Creek	0.5	8"	VCP	1	2015	HC WQTC
Shadow Wood	--	KY0031810	1979	2008	0.085 MGD	Harrods Creek	2.0	8"-10"	PVC	3	2015	HC WQTC
Timberlake	--	KY0043087	1973	1999	0.200 MGD	Harrods Creek	6.0	8"-10"	PVC	11	2015	HC WQTC
Berrytown	--	KY0036501	1975	1995	0.075 MGD	Floyds Fork	5.9	8"-12"	VCP, PVC	5	2011	FF WQTC
Chenoweth Hills	--	KY0029459	1972	1990	0.200 MGD	Chenoweth Run	6.4	8"-12"	VCP, PVC	2	2015	To be Determined
Silver Heights	--	KY0028801	1963	1990	0.500 MGD	Mud Creek	6.8	8"-15"	VCP	1	Beyond 2014	DRG WQTC
Bancroft	--	KY0039021	1966	1998	0.080 MGD	Goose Creek	3.0	8"-15"	VCP	--	Beyond 2014	MF WQTC
Glenview Bluff	--	KY0044261	1976	1976	0.010 MGD	--	0.3	8"	VCP, PVC	--	Beyond 2014	MF WQTC
Lake Forest	--	KY0042226	1988	2005	0.470 MGD	Chenoweth Run	22	8"-18"	VCP, PVC	6	2011	FF WQTC
Lake of the Woods	--	KY0044342	1976	1989	0.044 MGD	Chenoweth Run	1.0	8"	VCP, PVC	1	Beyond 2014	To be Determined
McNeely Lake	--	KY0029416	1964	1986	0.205 MGD	Pennsylvania Run	4.0	8"-12"	VCP	4	Beyond 2014	DRG WQTC
Starview	--	KY0031712	1971	1988	0.100 MGD	Chenoweth Run	2.4	8"-10"	VCP, PVC	1	2011	FF WQTC
Yorktown	--	KY0036323	1968	1991	0.150 MGD	Northern Ditch	2.9	8"-15"	VCP, PVC	1	2010	DRG WQTC

Legend: KPDES – Kentucky Pollutant Discharge Elimination System, MGD - million gallons per day, VCP – vitrified clay pipe, RCP - reinforced concrete pipe, PVC - polyvinyl chloride

WQTC: HC – Hite Creek, FF - Floyds Fork, DRG - Derek R. Guthrie, MF - Morris Forman

2.2.1.1 Cedar Creek

The Cedar Creek WQTC was constructed in 1995 by MSD to provide service to one of the fastest growing areas of Jefferson County. The new facility facilitated the elimination of nine small treatment plants and numerous septic systems. The plant was expanded in 2003 to its present design capacity of 7.5 million gallons per day (mgd). The Cedar Creek WQTC is located near Bardstown and Cedar Creek Roads in Southern Jefferson County. The landuse consists primarily of single-family residential with a small amount of multi-family, commercial, industrial, and vacant or undeveloped land. Refer to Exhibit 2.2.1 in Appendix 2.2.1, Pipe Material, 100-year Floodplain, and Non-conforming Slopes Maps, for a map of the Cedar Creek service area.

2.2.1.2 Floyds Fork

Construction of the Floyds Fork WQTC was completed in 2001 with a design capacity of 3.25 mgd to provide service to a fast growing area of Jefferson County. It also eliminated several small treatment plants and off-loaded some areas that were previously directed to the Jeffersontown WQTC. The Floyds Fork WQTC is located at the end of Blue Heron Road off Shelbyville Road in Eastern Jefferson County. The landuse consists primarily of single-family residential housing with a small amount of apartments, commercial development, and vacant or undeveloped land. Refer to Exhibit 2.2.2 in Appendix 2.2.1 for a map of the Floyds Fork service area.

2.2.1.3 Hite Creek

The Hite Creek WQTC was constructed by MSD in 1970 to provide service to the newly constructed Ford Motor Company Kentucky Truck Plant and the surrounding suburbs in eastern Jefferson County. Two expansions have occurred at the treatment plant, along with various upgrades, to increase the present design capacity to six mgd. The Ford Motor Company Kentucky Truck Plant contributes approximately 1 mgd to the treatment facility. The landuse consists primarily of single-family residential areas with a small amount of multi-family areas, commercial lots, vacant or undeveloped land, and the Ford Motor Company Kentucky Truck Plant. Refer to Exhibit 2.2.3 in Appendix 2.2.1 for a map of the Hite Creek service area.

2.2.1.4 Jeffersontown

The Jeffersontown WQTC was constructed in 1956 and was expanded several times to its current design capacity of four mgd. MSD acquired the Jeffersontown WQTC in 1990. In 1998, the system was placed under an Agreed Order by the Kentucky Department of Environmental Protection (KDEP) (Case No. 97201). The Agreed Order required various rehabilitation projects and treatment plant upgrades because the average annual hydraulic load was at 90 percent of its permitted capacity and the system experienced wet weather SSOs at the siphon just upstream of the WQTCs headworks. Improvements made by MSD to the plant from 1997 to 2000 added phosphorous removal, ultraviolet (UV) disinfection, and a new return activated sludge pump station. The Jeffersontown Service Area is located at Taylorsville Road and Watterson Trail in central Jefferson County. The landuse consists primarily of single-family residential and industrial with a small amount of commercial and vacant or undeveloped land. Refer to Exhibit 2.2.4 in Appendix 2.2.1 for a map of the Jeffersontown service area.

2.2.1.5 Morris Forman

The Morris Forman WQTC is the largest treatment plant in the MSD service area with a design capacity of 120 mgd. It was originally built in 1958 as a primary treatment plant that removed only heavy, solid wastes. The plant was rededicated in 1975 as a secondary treatment facility that treated organic matter and bacteria. The plant serves most of Louisville Metro and is the bio-solids processing facility for the entire service area.

The Morris Forman service area is the largest sewershed in the MSD collection system. The majority of the landuse in the service area is residential, with some smaller areas of commercial, industrial, and parks. Refer to Exhibits 2.2.5 through 2.2.7 in Appendix 2.2.1 for maps of the Morris Forman service area.

Within the Morris Forman service area are several key features associated with SSOs and known system deficiencies. These features are discussed below.

Middle Fork

The Middle Fork service area is located within the Morris Forman Service area and primarily serves the areas within the Middle Fork of Beargrass Creek watershed. The landuse consists primarily of single-family residential area.

Beechwood Village

Beechwood Village is located along the Sinking Fork Interceptor in St. Matthews, which is a part of the Middle Fork service area. The landuse consists of single-family residential area. The Beechwood Village separate SSS has experienced excessive inflow and infiltration (I/I) since the construction of the neighborhood's sanitary sewers in the early 1960s. Available data suggests that the separate SSS was constructed to substandard conditions, adding to the infiltration problems typically associated with clay pipe. The neighborhood is also located in an area with unusually high groundwater and poor drainage. MSD acquired the system in the mid-1960s and has since been working with the neighborhood to alleviate chronic basement backups. The five locations where temporary pumping occurs during wet weather are the locations called out in the Consent Decree as a part of the Beechwood Village neighborhood and are addressed in the Interim SSDP.

Ohio River Force Main / Muddy Fork

The Ohio River Force Main (ORFM) / Muddy Fork service area is located along the Ohio River in northeast Jefferson County. The area consists primarily of single-family residential housing and vacant or undeveloped land along with a small number of apartments and commercial development. The service area is generally bounded on the northwest by the Ohio River, northeast by Gene Snyder Freeway (I-265) South, and south by Westport Road.

Hikes Point / Highgate Springs Pump Station

The Hikes Point / Highgate Springs Pump Station area is located at the intersection of Hikes Lane and Goldsmith Lane. The majority of the landuse in the service are is residential, with some smaller areas of commercial and parks. MSD constructed Highgate Springs Pump

Station in 1963, which was designed to relieve the Beargrass Interceptor and prevent surcharging in the Highgate Springs sewer system. During dry weather, a weir prevents flow from the 36-inch diameter Highgate Springs Interceptor from entering the station's wet well. The flow is passed through the pump station by gravity and through a 30-inch tide gate into the Beargrass Interceptor. During wet weather, the tide gate closes, and flow from the Highgate Springs Interceptor spills into the wet well of the Highgate Springs Pump Station. For small storm events, one pump discharges directly into the Beargrass Interceptor. For increasingly larger events, the remaining three pumps will turn on sequentially until three pumps are discharging to the creek and preventing basement backups to approximately 300 homes. The Highgate Springs Pump Station and five additional locations where temporary pumping occurs during wet weather are the locations called out in the Consent Decree as a part of the Hikes Point area and are addressed in the Interim SSDP.

Buechel Branch

The Buechel Branch service area is located in central Jefferson County and is part of the South Fork of Beargrass Creek watershed. The landuse consists primarily of residential area with some commercial and industrial area. In the late 1970s, the Southeastern Interceptor was constructed because of a system constriction on the Beargrass Interceptor. The Southeastern Interceptor extends from the Southeastern Diversion structure to the Northern Ditch Interceptor.

Northern Ditch

The Northern Ditch area is located near the intersection of I-65 and Preston Highway. The majority of the landuse in the service area is residential and industrial.

2.2.1.6 Derek R. Guthrie WQTC

Construction of the Derek R. Guthrie WQTC (formerly known as the West County Wastewater Treatment Plant) began in 1984 and the WQTC came on-line in 1986 with a design capacity of 15 mgd. The Derek R. Guthrie WQTC eliminated over 45 small WQTCs and numerous pump stations and septic systems in the Pond/Mill Creek area where water quality was significantly impaired by small WQTC permit violations and failing septic systems. As the service area and population has grown, treatment capacity has been added to increase the present design capacity to 30 mgd. The Derek R. Guthrie modeled area serves primarily single-family residential customers, commercial, and vacant or undeveloped land. Refer to Exhibits 2.2.13 through 2.2.15 in Appendix 2.2.1 for maps of the Derek R. Guthrie service area.

There are four key features within the Derek R. Guthrie Service Area associated with SSOs and known system deficiencies. These features are outlined below.

Pond Creek

The Pond Creek area of Derek R. Guthrie is located at the intersection of Preston Highway and the I-265. The majority of the landuse in the service area is residential and undeveloped/vacant land.

McNeely Lake

The McNeely Lake sewershed is located at I-265 and Smyrna Parkway in southern Jefferson County. The majority of the landuse in the service area is residential and undeveloped/vacant land. The McNeely Lake area was acquired in stages during the late 1980s and 1990s. The area was comprised of six small WQTCs: The Pines; Pleasant Valley; Apple Valley; Maple Grove; Old Maple Grove; and McNeely Lake. In 1999, five of the small WQTCs were eliminated and directed to the Derek R. Guthrie WQTC. McNeely Lake WQTC is still in service.

Mill Creek

The Mill Creek sewershed is located near the intersection of Dixie Highway and Greenwood Road. The majority of the landuse is residential and undeveloped/vacant land.

Valley Village

The Valley Village sewershed is located at Dixie Highway and Watson Lane in southwestern Jefferson County. The majority of the landuse is residential and undeveloped/vacant land. The Valley Village system was acquired in 1986 and the original small WQTCs were eliminated in 1989 with the construction of a gravity interceptor to the Derek R. Guthrie WQTC.

2.2.1.7 Prospect

The Prospect area in northeastern Jefferson County contains five small WQTCs listed below and their characteristics are outlined in Table 2.2.1. These WQTCs primarily serve single-family residential customers with a small amount of multi-family residential and commercial area. Refer to Exhibit 2.2.8 in Appendix 2.2.1 for a map of the Prospect service area.

- Hunting Creek South WQTC
- Ken Carla WQTC
- North Hunting Creek WQTC
- Shadow Wood WQTC
- Timberlake WQTC

2.2.1.8 Small WQTCs

After the 1937 flood, less floodprone suburban areas became more desirable and began to be developed at an increasing rate. Suburban expansion occurred and new homes were built to use septic tanks to dispose of their sewage. However, in many suburban areas of Jefferson County, septic tanks were not a good solution due to topography, low permeability soil types, and shallow bedrock. In wet weather, groundwater would typically rise above the level of the septic tank systems, and raw sewage would stand in the yards and drainage ditches. As a solution, the Louisville Metro Board of Health agreed to allow individual septic tanks where the land could accommodate them, and to require small "package" WQTCs where septic tanks would not work well. These package WQTCs were typically operated by the developers. By mid-1972, there were about 350 small WQTCs in Jefferson County.

MSD began to acquire these systems as the regional sewer system developed. Small WQTC acquisitions became controversial, for a time, until pressure from state and federal regulators made it clear that their owners would have to make large investments to meet new water pollution regulations. Several court decisions also affirmed that MSD had the power to take over small WQTC systems when MSD sewer lines reached the area.

The ten small WQTC service areas currently operated by MSD located outside of the Prospect area are listed below and their characteristics are outlined in Table 2.2.1. These small WQTCs primarily serve single-family residential customers in multiple areas of Jefferson County. Refer to Exhibits 2.2.9 through 2.2.12 in Appendix 2.2.1 for maps of the Small WQTC service areas.

- Berrytown WQTC
- Chenoweth Hills WQTC
- Silver Heights WQTC
- Bancroft WQTC
- Glenview Bluff WQTC
- Lake Forest WQTC
- Lake of the Woods WQTC
- McNeely Lake WQTC
- Starview WQTC
- Yorktown WQTC

2.2.1.9 Existing Treatment Plant Capacity Evaluation

MSD has acquired and eliminated over 300 privately owned WQTCs and six regional plants were expanded, upgraded, or constructed. The Updated SSOP outlines WQTC operation parameters such as the year of construction, year acquired by MSD, design capacity, average influent flow, collection system size, and number of customers.

Under the CMOM Programs, MSD developed the Louisville and Jefferson County System Capacity Assurance Plan (SCAP). One of the activities of the SCAP is to confirm the flow capacities of all the WQTCs and pumping stations and compare them to current base and peak flows. The following summarizes the regional and small WQTC capacity evaluations.

Regional WQTCs

Treatment capacities at the regional WQTCs were evaluated in 2007. Evaluation included review of the most recent engineering design and construction plans, individual site visits, and performance certifications where available. WQTC performance under 2007 loading conditions was also reviewed to validate the results of the engineering studies.

Table 2.2.2 summarizes the annual average flow capacity and the peak flow capacity of each regional WQTC.

TABLE 2.2.2

SUMMARY OF REGIONAL WQTC CAPACITY EVALUATION & RESULTING LIMITATIONS

WQTC	Rated Permitted Capacity (mgd)	Peak Hour Design Flow (mgd)	2007 Average Day Flow (mgd)	2007 Peak Day Flow (mgd)	Limiting Unit Process (Peak Flow)
Morris Forman	120	350	100	204	Clarifier
Derek R. Guthrie	30	96	24	70	Clarifier
Cedar Creek	7.5	26.0	3.7	17.4	Clarifier
Hite Creek	6.0	16.0	4.0	14.0	Aeration
Jeffersontown	4.0	9.5	3.7	17.9	Clarifier
Floyds Fork	3.25	10.4	1.80	6.77	Clarifier

Small WQTCs

Treatment capacities at the small WQTCs were evaluated in 2007. Evaluation included review of the most recent engineering design and construction plans, individual site visits, and performance certifications where available. WQTC performance under 2007 loading conditions was also reviewed to validate the results of the engineering studies.

Table 2.2.3 summarizes the annual average flow capacity and the peak flow capacity of each small WQTC.

TABLE 2.2.3

SUMMARY OF SMALL WQTC CAPACITY EVALUATION & RESULTING LIMITATIONS

WQTC	Rated Permitted Capacity (gpd)	Peak Hour Design Flow (gpd)	2007 Average Day Flow (gpd)	2007 Peak Day Flow (gpd)	Limiting Unit Process (Peak Flow)	Planned Elimination Date
Bancroft	80,000	183,000	37,000	65,000	Disinfection	Beyond 2014
Berrytown	75,000	275,000	95,000	640,000	Disinfection	2011
Chenoweth Hills	200,000	576,000	147,000	738,000	Clarifier	2015
Glenview Bluff	10,000	26,000	4,000	6,000	Aeration	Beyond 2014
Hunting Creek South	251,000	630,000	180,000	768,000	Clarifier	2015
Ken Carla	10,000	50,000	3,000	29,000	Aeration	2015
Lake Forest	470,000	1,034,000	384,000	1,725,000	Aeration	2011
Lake of the Woods	44,000	161,000	31,000	285,000	Aeration	Beyond 2014
McNeely Lake	205,000	282,000	104,000	661,000	Disinfection	Beyond 2014
North Hunting Creek	358,000	792,000	325,000	786,000	Disinfection	2015
Shadow Wood	85,000	162,000	52,000	550,000	Disinfection	2015
Silver Heights	500,000	889,000	301,000	1,570,000	Disinfection	Beyond 2014
Starview	100,000	288,000	108,000	500,000	Clarifier	2011
Timberlake	200,000	646,000	76,000	606,000	Clarifier	2015
Yorktown	150,000	432,000	194,000	876,000	Clarifier	2010

2.2.2 Collection System Evaluation

MSD has developed detailed design models for each WQTC service area based on Louisville and Jefferson County Information Consortium (LOJIC) data, as-built drawings, and field investigation records. The models generally include sewers ranging from large interceptors to small local 8-inch lines, pump stations, and control features such as diversion weirs or interceptor flow controls.

Additionally, GIS tools were used to characterize the system, such as system connectivity, pipe material, pipe in the 100-year floodplain, and pipe with non-conforming slope (pipe slopes that do not meet minimum MSD design criteria). The calibrated and validated hydraulic models were used to establish existing system conditions such as surcharged pipes, SSO volumes, and hydraulic restrictions (outlined later in this section), as well as identify modeled overflow points (MOPs).

2.2.2.1 Existing Gravity-Sewer Condition Evaluation

GIS mapping and database queries were utilized to characterize the existing gravity sewer system. These evaluations were comprehensive and intended to provide initial assessments. In most cases, the evaluations were a review of the appropriate GIS mapping, especially those in the vicinity of known SSOs or MOPs, once identified.

The evaluations included the following by sewershed and shows references to relevant data and figures in this section:

- Sewer pipe material (Figure 2.2.1)
- Sewers in the 100-year floodplain (Figure 2.2.2)
- Sewers with non-conforming slopes (Figure 2.2.2)

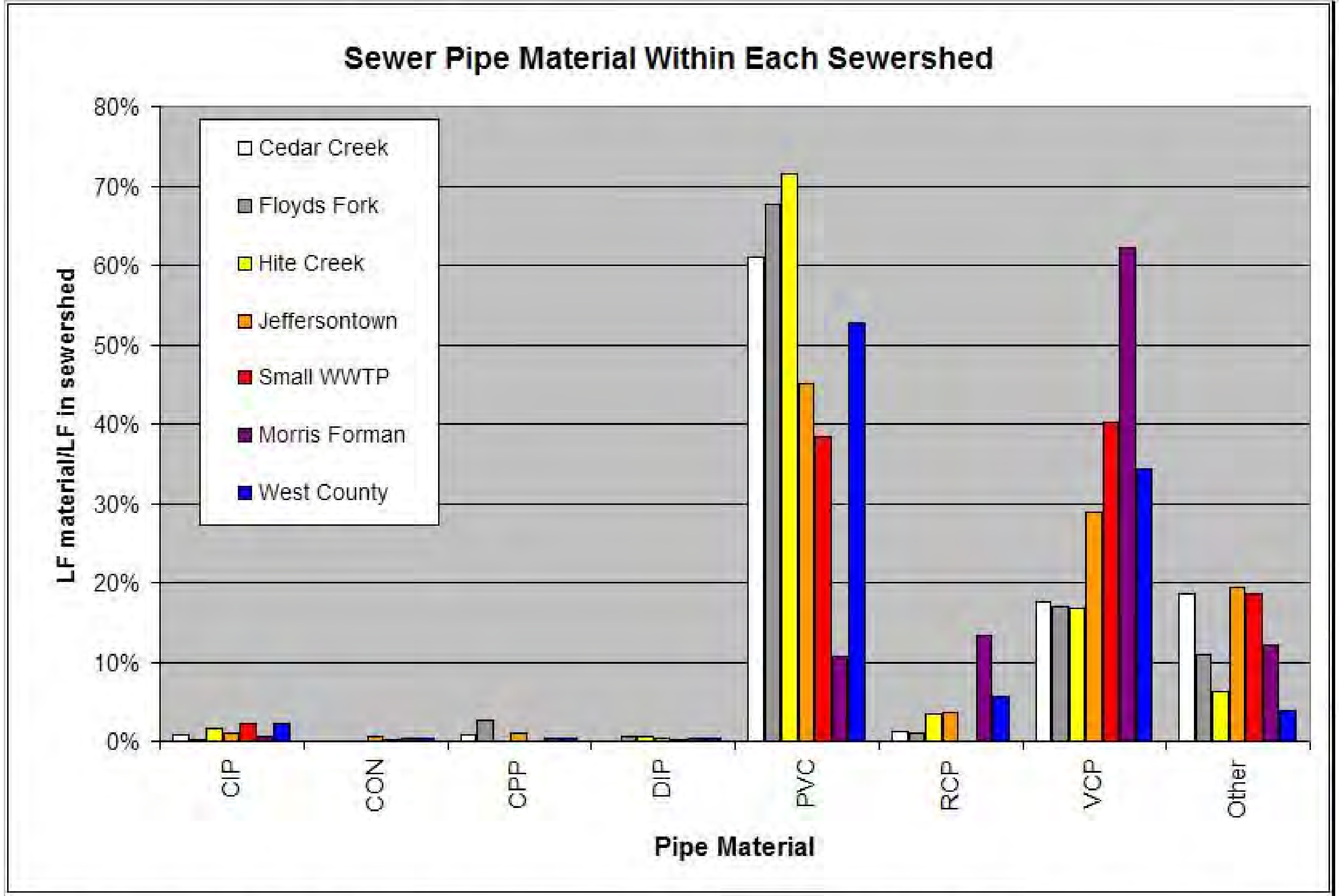
Mapping related to these evaluations are listed and available in Appendix 2.2.1:

- Sewer pipe material (Exhibits 2.2.1 through 2.2.15)
- Sewers in the 100-year floodplain (Exhibits 2.2.16 through 2.2.30)
- Sewers with non-conforming slopes (Exhibits 2.2.31 through 2.2.45)

Validated models were used to develop summaries of existing conditions for the hydraulic capacity in the gravity sewer system. These evaluations are summarized in this section and include the following:

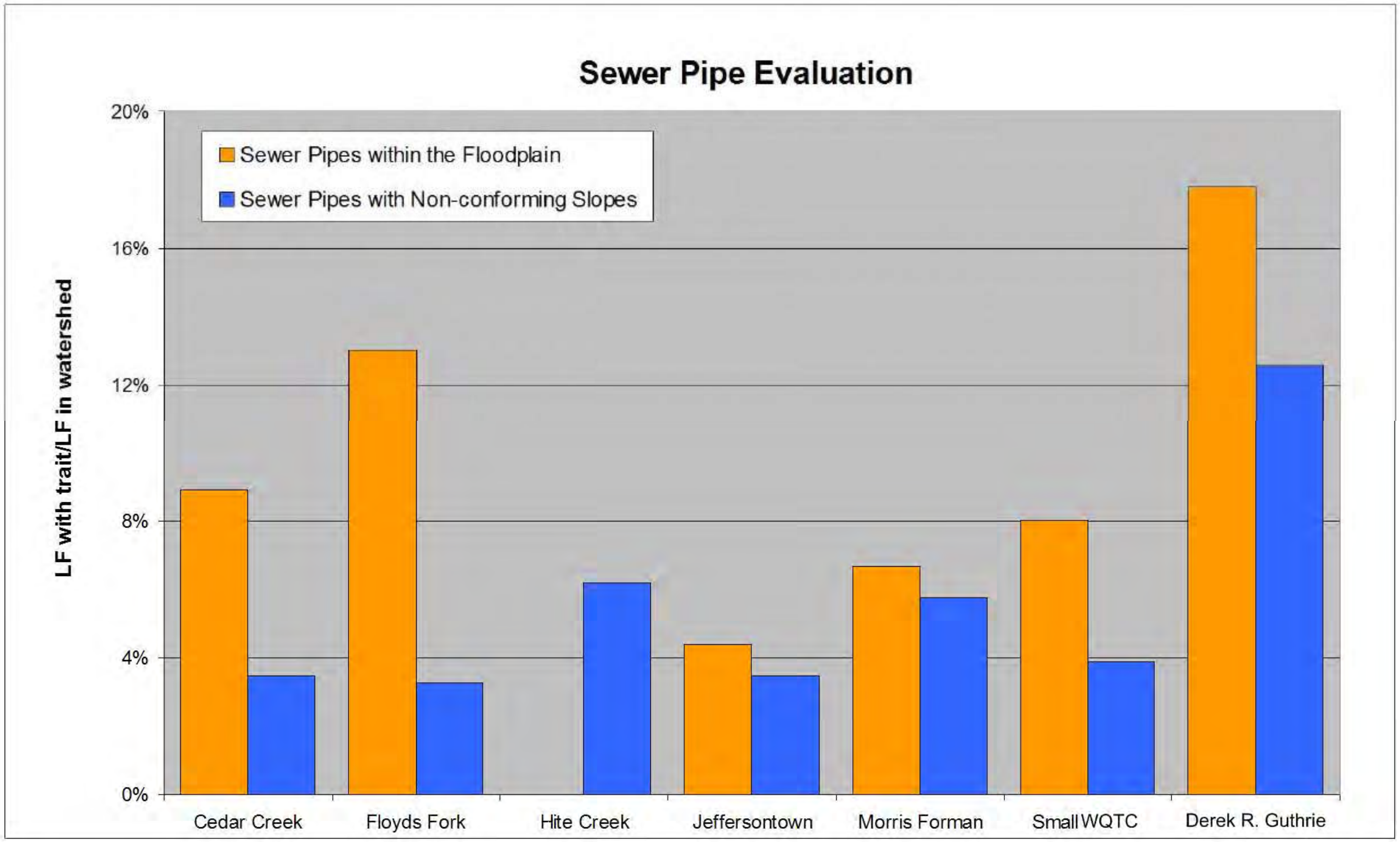
- Locations and volume of SSOs for various levels of protection
- Surcharged sewers
- Number of hydraulic bottlenecks
- The existing conditions evaluation identified specific capacity deficiencies in the system that would need to be addressed by SSO abatement solutions.

FIGURE 2.2.1 SEWER PIPE MATERIAL BY SEWERSHED



Note: CIP (cast iron pipe), CON (poured in place concrete pipe), CPP (cured in place pipe), DIP (ductile iron pipe), PVC (polyvinylchloride pipe), RCP (reinforced concrete pipe), VCP (vitrified clay pipe), Other (brick, ABP, ACP, ADS, CMP, HPDE, PEP, ST, STL, unlisted)

FIGURE 2.2.2 SEWERS LOCATED IN 100-YEAR FLOODPLAIN AND WITH NON-CONFORMING SLOPES BY SEWERSHED



2.2.2.2 Pump Station Capacity Evaluations

Developing pump station performance curves that represent the station's capacity under varying system conditions is a critical element for modeling a collection system. MSD maintains a set of as-built drawing and specifications that list pump capacity. While nameplate capacity and as-built drawings can list design capacity, actual in-situ testing provides the best estimate of capacity. Prior to modeling, MSD performed drawdown tests at pump stations, including all large pump stations and those associated with SSO or surcharged areas. The drawdown test consisted of measuring a pump's ability to drawdown, or drop, in the pump station wet-well volume and the corresponding time. After accounting for inflow during the test, the average pump discharge was determined. If there were several pumps, each was tested individually.

The drawdown tests results were compared to design data to note pump stations that were not performing at designed capacity. The design data was used at several small pump stations where drawdown tests were not performed.

2.2.3 Flow Monitoring

MSD has been collecting environmental data sets for almost 20 years. Rain data have been collected continuously on a network of rain gauges across Jefferson County since the early 1990s. In 2003, a network of radar rainfall data was added to fill in the gaps in physical distance between the rain gauges. Rain data can be simultaneously evaluated with many of the other data sets to help determine the timing and impact of wet weather.

Sewer flow meters have been in place in various locations in the MSD collection system since the early 1990s. These meters have been used to assess existing conditions, locate I/I, determine SSO volumes, and assist sewer modeling efforts. The majority of the historical meters were temporary meters used for evaluation studies, but MSD has installed several permanent meters that are used for real time control (RTC) of storage within larger pipes to reduce SSOs. For purposes of this Volume of the IOAP, flow monitoring is essential for capturing flow data used for model calibration, testing the success of SSO abatement projects, and analyzing system performance after projects have been constructed.

2.2.3.1 Flow Monitoring for SSDP Modeling

MSD had approximately 145 flow meters temporarily installed by a contractor from January 2007 through mid-June 2007 to support hydraulic modeling and sewer system improvements planning. Approximately 45 additional flow meters were purchased by MSD to provide better coverage of the system. With the addition of these monitors, MSD will have approximately 69 permanent flow meters for use within the system.

One storm during the 2007 monitoring period was used specifically to calibrate and verify the models. This storm occurred on April 14, 2007, and rainfall gauges recorded depths of 1.2-inch to 1.54-inch over 21 hours during the storm event. A smaller storm was also recorded on April 11, 2007, and in some modeling areas this storm was used to assist in model calibration.

2.2.3.2 Rain Gauge Network and Radar Rainfall

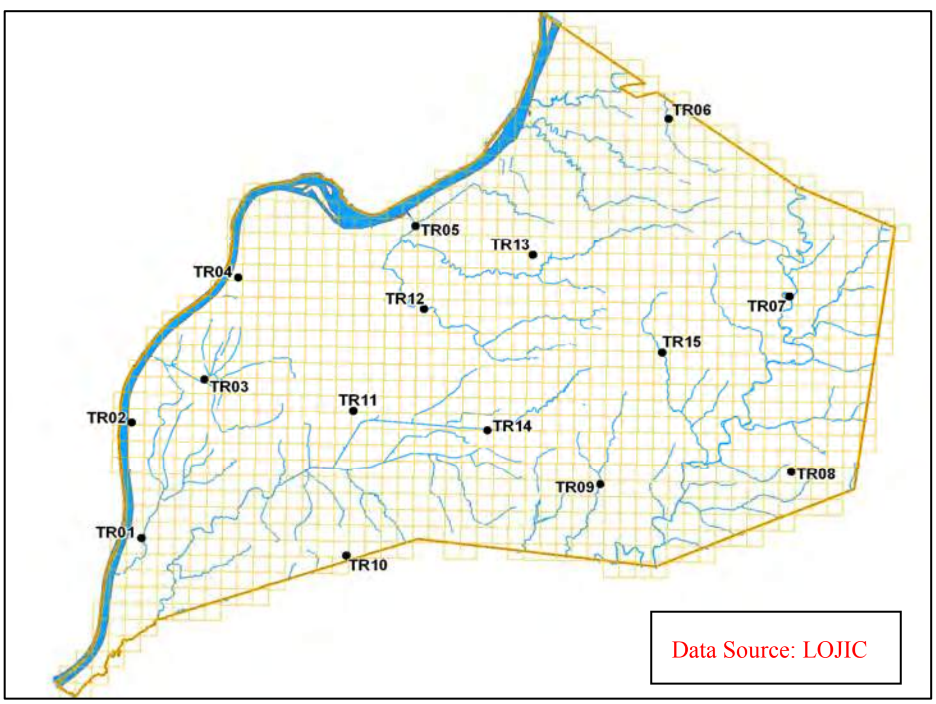
FIGURE 2.2.3 RAIN GAUGE

Rainfall data has been collected continuously on a network of rain gauges across Jefferson County since the early 1990s. During 2003, a network of radar rainfall data was added and rainfall data is currently gathered continuously at 15 rain gauge sites throughout the MSD sewer system.

The gauges are tipping-bucket type rain gauges (see Figure 2.2.3), where rainfall enters the gauge and is funneled down to a small "bucket." The bucket will tip and empty when 0.01 inches of rain is collected. The amount of rain (tips) is accumulated and every five minutes the data is stored in MSD's database for an accurate history of the rainstorm.

MSD currently receives radar rainfall data over a grid of approximately 1400 cells throughout the county and its immediate boundary (see Figure 2.2.4). These cells have rainfall depths reported every five minutes during wet weather and provide a thorough representation of the rainfall distribution differences across the county. Rainfall data is simultaneously evaluated with many of the other data sets to help determine the timing and impact of wet weather. Radar Rainfall and data from these gauges is used for model calibration, in determining "threshold" rainfall volumes for validation and for augmenting level of protection rainfall distributions.

FIGURE 2.2.4 TELEMETERED RAIN GAUGE NETWORK AND RAINFALL PIXEL GRID



Additional information on the rain gauge system can be found on MSD's website at http://www.msdlouky.org/aboutmsd/rainfall.cfm.

2.3 CONVEYANCE SYSTEM MODELING

This section provides general background information related to model development. Detailed discussions of individual modeling efforts are discussed in Section 2.5.

2.3.1 Modeling History

MSD's separate SSS system within Jefferson County is divided into three main areas: Beargrass Creek, Floyds Fork/North County, and Mill Creek/Pond Creek. The Beargrass Creek sewershed includes the Morris Forman WQTC; the Floyds Fork/North County sewershed includes the Cedar Creek, Floyds Fork, Hite Creek, and Jeffersontown WQTCs; and the Mill Creek/Pond Creek sewershed includes the Derek R. Guthrie WQTC.

The following discussion includes historic modeling efforts for the following areas:

- The Middle Fork and Beargrass Creek collection systems which flow to the Morris Forman WQTC, including Beechwood Village, ORFM/Muddy Fork, Hikes Point/Highgate Springs Pump Station, Buechel Branch, and Northern Ditch.
- The Cedar Creek collection system, which flows to the Cedar Creek WQTC.
- The Pond Creek, McNeely Lake, Mill Creek, and Valley Village collection systems, which flow to the Derek R. Guthrie WQTC.
- The Jeffersontown collection system, which flows to the Jeffersontown WQTC.
- A portion of the Prospect collection system, which includes Hunting Creek North, Hunting Creek South, and Timberlake WQTCs.

2.3.1.1 Middle Fork of Beargrass Creek Collection System

Middle Fork (including Beechwood Village)

In 2003, the Middle Fork XP-Stormwater and Wastewater Management Model (XP-SWMM) Hydraulic Model was built and calibrated to 1998-1999 flow monitoring data. This calibration was used to analyze the system for deficient sewers and SSOs for various rainfall depths. Since the original flow monitoring data was older, new flow monitoring was performed in 2003-2004 and the model was re-calibrated. The model covered an area of approximately 14,283 acres.

Both the 1998-1999 and 2003-2004 calibrated models showed similar results: the majority of the wet weather problems were occurring in the Beechwood Village/Sinking Fork and Lower Middle Fork sub-sewersheds. These two areas contain the majority of SSO locations, SSO volume, and capacity-deficient sewers in Middle Fork. The model was used to perform capacity assessments and analyze potential improvements in Beechwood Village and other areas of Middle Fork.

Ohio River Force Main / Muddy Fork

The ORFM XP-SWMM Hydraulic Model was built and calibrated in 2000-2001 using 1998-1999 flow monitoring data. The ORFM is a dual force main consisting of 92,000 linear feet (LF) of pipe. There are eight connected pump stations and approximately 7,600 acres covered in the model. The model was used to evaluate numerous operational scenarios to determine how the system would function with different combinations of pumps in operation and at maximum flow conditions.

Hikes Point / Highgate Springs

The Hikes Point XP-SWMM Hydraulic Model was developed as part of the 1997 Sanitary Sewer Evaluation Study (SSES). This model was used to test various scenarios for in-line storage in the area affected by wet weather emergency pumped SSOs and results were used to establish design parameters for the Hikes Point Phase 1B rehabilitation project. In 2002, the model was updated and recalibrated to 2002 flow monitoring data for use with the RTC system developed by MSD. Also at this time, the system was extended to include the Southeastern Diversion Structure. In 2003, the model was used to perform analyses for several SSO sites with the goal of determining whether emergency pumps were required and if so, at what depth of flow they should be activated. The model covers an area of approximately 5,500 acres.

In 2003-2004, the model was used as the basis for the Hikes Point System Improvement Phase 1 Project. It was used to develop a solution to eliminate SSOs, both model-predicted and known. The model was also used to determine available hydraulic capacity in the system for various storm events.

In 2004-2005, the XP-SWMM model was used for the Hikes Point Capacity Assessment Project to refine solutions developed in the system improvements project and evaluate options for redirecting flows external to the Hikes Point system throughout the area. Cost estimates were refined and ground truthing was performed to help identify the most viable abatement options.

Southeastern Diversion Structure / Buechel Branch / Northern Ditch

In the early 1990s, an evaluation of relief capacities of the Southeastern Diversion Structure and Southeastern Interceptor was conducted using the XP-SWMM program. The objective was to optimize the flow diversion approach to provide relief to the Hikes Point and Buechel Branch areas upstream of the diversion structure, but this created surcharging and SSOs upstream. Currently the flow diversion gate is normally closed during wet weather.

The Buechel Branch XP-SWMM hydraulic model was built and calibrated in 2002-2003, using 2002 flow monitoring data collected during the RTC project. The Buechel Branch RTC model covers approximately 2,800 acres and is centrally located at the intersection of Breckenridge and Nachand Lanes. The Northern Ditch area was also included in the Buechel Branch RTC model. In 2003, minor updates were made to this model, which included adding a small amount of new residential development.

2.3.1.2 Cedar Creek Collection System

The Cedar Creek XP-SWMM hydraulic model was originally built and calibrated in 2000-2001 using 1998-1999 flow monitoring data. This model consisted of sanitary sewers tributary to the Cedar Creek WQTC. New system infrastructure was added and system rehabilitation projects took place in 2002-2003 so the model was updated to include the changes. The model was recalibrated for wet weather flow and dry weather flow (DWF) using flow monitoring data collected in 2002-2003.

Future conditions scenarios were analyzed in conjunction with the Jeffersontown Interceptor Condition Assessment project. Areas that were proposed to be diverted to the Cedar Creek area in the Jeffersontown Action Plan were added to the model and the effects analyzed. The Cedar Creek model covers approximately 3,600 acres of area.

2.3.1.3 Pond Creek Collection System

The Pond Creek XP-SWMM hydraulic model was built and calibrated in 2002-2003 using 1997-1998 flow monitoring data. The model consists of 10-inch and greater diameter sanitary sewer tributary to the Pond Creek and Mill Creek interceptors but does not include the Valley Village Interceptor. The model covers approximately 29,100 acres.

Derek R. Guthrie Spline Model (including Valley Village)

The Derek R. Guthrie WQTC spline hydraulic model was built by joining the Mill Creek model with a spline model of the Pond Creek system under the Derek R. Guthrie Conveyance System Improvements Project. The Valley Village interceptor was incorporated into the model. This model was originally calibrated in 2002-2003 using 1997-1998 flow monitoring data in the Pond Creek system, and 2001-2002 flow monitoring data in the Mill Creek system. The model was updated and recalibrated after system rehabilitation using 2002-2003 flow monitoring data. The model covers approximately 43,000 acres. The Derek R. Guthrie WQTC spline model was used for analysis of the proposed Pond Creek Interceptor storage basin as well as to identify system corrections to eliminate the direct entry of Mill Creek floodwaters to the system.

McNeely Lake

The McNeely Lake hydraulic model is part of the Pond Creek hydraulic model. To improve the calibration, previous flow monitoring data, pump run records, and downstream flow monitoring data were reviewed. The Derek R. Guthrie WQTC spline model was used in 2004-2005 to review hydraulic solutions on the Pennsylvania Run study area collection system due to planned and future developments.

Mill Creek

The Mill Creek model was built and calibrated in 2001-2002 using 2001 flow monitoring data. The model was built to simulate dry weather and wet weather flow in the separate SSS system. This model was part of the Derek R. Guthrie WQTC spline model, which was built by joining the Mill Creek model with the Pond Creek system model.

2.3.1.4 Jeffersontown Collection System

The Jeffersontown XP-SWMM hydraulic model was originally built and calibrated in 1998-1999 using 1997-1998 flow monitoring data. This model consisted of sanitary sewer tributary to the Jeffersontown WQTC. Model runs were performed to evaluate the system response to various storm events and was used to identify SSOs within the model. The project modeled approximately 4,650 acres. In 2001, this model was used to evaluate scenarios for inclusion in the Jeffersontown Facilities Plan submitted to the KDOW in August 2002.

A simple hydraulic isolation analysis was performed in 2002-2003 using 2002 flow monitoring data. This analysis created several artificial free outfalls within the system to evaluate the performance of the sub-basins independent of the primary interceptors. The model was revised to reflect the impact of the Jeffersontown Facilities Plan. The Facilities Plan was then updated to include anticipated flows from undeveloped areas. Finally, the model was used to evaluate various options to improve the system and eliminate unauthorized discharges. A report detailing this information and providing recommendations for capacity improvements for SSO eliminations was completed in September 2005.

2.3.1.5 Prospect Collection System

The Prospect XP-SWMM Hydraulic Model includes the North Hunting Creek, Hunting Creek South, and Timberlake WQTCs covering approximately 1,856 acres. The Shadow Wood WQTC was not modeled because it was privately-owned at the time. The Prospect model was built to simulate dry weather and wet weather flows, and was calibrated in 2002 using 1999-2000 flow monitoring data. The model was used in conjunction with existing data and wet weather inspections to develop a comprehensive solution for the elimination of SSOs at the Gunpowder Pump Station. The project was completed in August 2004.

2.3.2 Objectives of the Modeling Program

Objectives and uses of the modeling program include:

- Performing alternative and solution analysis for SSO volume reduction and elimination
- Projecting capacity for new development
- Performing future analysis, with an increased investment in calibration/validation, of system upgrades due to age and asset deterioration
- Simulating storm events and system response investigation

2.3.3 SSDP Model Development

The hydrologic and hydraulic modeling software selected for all hydraulic modeling was InfoWorks. The InfoWorks program is designed not only to model wet weather effects on collection systems, but to also take advantage of a large GIS database provided by LOJIC. InfoWorks has the ability to import XP-SWMM models, allowing MSD to build on extensive prior modeling, as detailed in Section 2.3.1.

There are a total of 11 modeled areas in the Final SSDP (refer to Figure 2.3.1 at the end of the chapter). 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 relevant data for each modeled area. This information was used by the modeling teams in calibration and validation of the models.

2.3.3.1 Modeling Guidelines

As a first step in the program, MSD developed the Hydraulic Sewer System Modeling Guideline Manual (see Appendix 2.4.3 in Volume 2). These procedures improve the detail, quality, and functionality of the sewer models while providing consistent model development criteria.

The guidelines instructed the modelers how to:

- Perform the capacity assessments
- Develop a range of system improvements
- Develop the benefit/cost ratios for the various solutions in a consistent manner
- Confirm reported results are sufficient for development of the Final SSDP

MSD developed the Modeling Guidelines to address the following:

- Update modeling standards, including refining the I/I modeling procedures and assessing flow monitoring
- Review XP-SWMM models to determine deficiencies
    - Identify expansion needs
    - Assess data verification needs
    - Collect record drawings, and
    - Conduct pump-station drawdown tests.
- Switch to the InfoWorks software and develop a platform (server) for retrieving, storing and sharing model data
- Import shape files of the model area into InfoWorks
- Develop flow monitoring basins
- Define hydrologic and hydraulic parameters
- Review modeling input and output

The following summaries provide samples of important guidelines presented in the manual related to initial model development.

Modeling Standards and Migration of Model Data

MSD developed a full set of modeling standards prior to performing any separate SSS modeling. This included calibration standards, use of flow monitoring data, use of previous models, input and export standards, Quality Assurance / Quality Control (QA/QC) procedures, and modeling techniques for I/I and pump facilities. In parallel with that effort, MSD reviewed past models and determined deficiencies in data, such as inverts and pump data. They also coordinated with MSD crews who conducted drawdown tests at key pump station facilities.

InfoWorks CS is a modeling platform designed around GIS databases and is capable of importing data from other models. Thus, InfoWorks models were not designed from “scratch.”

Flow Monitor Basins

MSD determined that flow monitoring basins should have no more than 100,000 LF of pipe within its boundaries, not including areas contributing flows measured by upstream monitors. As much as practical, each basin had uniform landuse and soils data.

Hydrologic Parameters

Hydrologic parameters refer to the components of the model that are manipulated to simulate rainfall dependent inflow and infiltration (RDI/I). RDI/I is simulated as rain falling on catchments. These catchments are not real, but rather mathematical abstractions used to determine the rate and volume of RDI/I over time.

MSD system models do not account for the effects of snowmelt due to the small volume of water resulting from snowmelt for this region of the country. Likewise, evaporation is ignored due to the relatively short model runs.

DWF is a combination of groundwater infiltration, residential, industrial, and commercial user flows. DWF is defined as the flow that occurs in absence of any runoff due to precipitation. Three main features of DWF are flow volume and rate, diurnal pattern, and spatial distribution. Each is determined from flow monitoring data. DWF is allocated to individual manholes based on spatial data, such as census and landuse.

Hydraulic Parameters

Hydraulic parameters represent the infrastructure of the model. This would include features such as pipes, manholes, pump stations, and force mains. The modeler provides dimensional and geographical information for each feature. The modeler also provides the node and link arrangement to mimic actual infrastructure connections.

MSD provided each modeler with past models and pertinent LOJIC GIS data. With this information, each modeler developed the complete sewershed model and the models were checked with InfoWorks review tools. The following represent critical components of a model’s accuracy and the method used in the modeling procedure to address them.

Pump Stations

Since pump station capacity is critical to developing an accurate model, significant effort was paid to pump station representation (see Section 2.2.2.2). Each procedure was detailed by pump size within the Modeling Guideline Manual. Large pumps are always modeled as dynamic pumps, with capacity a function of wet well and outlet conditions.

Boundary Conditions

In most cases, a downstream boundary condition is a known hydraulic grade line elevation at the point of interface between the modeled system and a system outside of the modeled boundary (e.g. river). During periods of high flow, backwater effects in the conveyance system caused by a high hydraulic grade line at a pump station wet well were captured and modeled.

For the Final SSDP, the following boundary conditions were used:

- For downstream branches, the boundary condition could include WQTC capacity, Interim SSDP project allotment, or existing flow to the combined sewer area.
- For upper branches not tying into a WQTC, Interim SSDP project, or combined sewer system, solutions were determined without regard to downstream impacts (i.e. no penalty for conveyance).

Model Input and Output

Model input selection and the level of detail to which the model is constructed are important to confirm the model is properly constructed. Equally important is a complete review of model output prior to acceptance of model results. After the modeling teams made a thorough review, the model was reviewed by a separate modeling firm to verify accuracy. Additional detail on the quality assurance and quality control (QA/QC) procedure is described in the next section.

2.3.4 Rainfall Distribution and Level of Protection

Rainfall is characterized by temporal distribution and total volume. Both of these characteristics impact design capacity, pumping rates and optimized solutions. Level of protection is the selection of a rainfall-volume frequency or level for design. This is commonly denoted by an average interval, such as a two-year storm that has a 50 percent probability of occurring in any given year.

From a practical perspective, no sewer system can be designed to consistently convey all system flow during extreme weather events. Therefore, a “design condition” must be defined that reflects the level of protection consistent with community values. The costs for capturing wet-weather events must be balanced with the benefits to community associated with capturing that event. Section 3.2.1 in the following chapter outlines the procedure used for determining consistent costs. Section 3.2.2 outlines the procedure used for determining benefits consistent with community values, as outlined in the Stakeholder process. Section 3.2.3 outlines the procedure used for determining the best benefit-cost ratio, thus defining the preferred level of protection.

In the Final SSDP, the values evaluation framework was used to determine levels of protection that reflect an appropriate level of control of unauthorized discharges for the Louisville Metro community.

2.3.4.1 Base Rainfall Distribution

For the separate SSS modeling, MSD considered two storm distributions: 1) the Natural Resources Conservation Service (NRCS) “long duration” distribution and; 2) the National Oceanographic and Atmospheric Administration (NOAA) “short-duration precipitation,” often referred to as the “cloudburst” distribution. The Natural Resources Conservation Service method is a general large-area storm often used for design of large stormwater and flood control structures such as dams and detention facilities. The NOAA cloudburst distribution uses depth-area-reduction-factors derived from frequency analyses of local hourly precipitation data recorded at the Louisville International Airport. This distribution is typical of shorter duration storms that often cause SSOs in individual basins. It is also similar to the storms captured during the system flow monitoring used for model calibration.

Based on an analysis of over fifty years of historical weather patterns for Jefferson County, MSD determined that a three-hour, high-intensity cloudburst storm reflected the most appropriate storm pattern to use in SSO control evaluation. The NRCS long duration distribution is more appropriate for total system-wide modeling for larger service areas, such as inflow to regional wastewater treatment plants, since the attenuation of the peaks for the larger service area is less dramatic. However, the cloudburst storm is more appropriate for localized collection system modeling and provides for better calibration and validation of the hydraulic models to known SSO locations.

See Appendix 2.3.1, Selection of the Cloudburst Storm, for additional details on the selection of the cloudburst storm.

2.3.4.2 Second Storm Distribution

In some cases, the preferred solution for an SSO will be storage of excess wet-weather flow. Storage, however, will only be effective as an SSO abatement strategy if it can empty in short order. Otherwise, a small second storm immediately after the design storm could cause a full storage facility to overflow.

To account for this, a second smaller rainfall distribution was added after the first such that the rainfall peaks were 12 hours apart. The total rainfall depth for the second storm was consistently set at 0.46”, corresponding to a 10-day recurrence interval storm.

2.3.4.3 Model Simulations

During system characterization, a suite of design conditions was analyzed starting at the 1.27-inch cloudburst up to the 2.60-inch cloudburst. This allowed the opportunity to validate models and determine the extent of various deficiencies, such as surcharging, at each level. During solution optimization, the baseline storm was at the 1.82-inch cloudburst storm level. Once a solution had been identified at this level, the solution was then analyzed at a 2.25-inch cloudburst level and 2.60-inch cloudburst level to compare benefit-cost ratios for a modeled watershed branch. Solution optimization is discussed in detail in Volume 3, Chapter 4.

2.3.5 Model Calibration, Validation, and Baseline Conditions

The following sub-sections summarize critical modeling components related to model and solution development.

2.3.5.1 Model Calibration

Model calibration is the process of comparing model-predicted results to measured flow monitoring and rainfall data from a single, significant rainfall event and to match pump station drawdown test results. The process is iterative and proceeds until the modeled results match the measured data within a pre-defined percentage level of accuracy, called action levels. Model calibration and validation reports are located in Appendix 2.3.2.

Action Levels

The action level of accuracy is 20 percent for the difference in base flow rate (minimum); the action level is 10 percent for the difference in flow volume and the difference in peak flow rate (maximum). The hydrograph shape, mean flow velocity, and water depth predicted by the model and measured by the flow monitoring is also qualitatively compared. Guidelines on adjusting models are detailed in MSD's Hydraulic Sewer System Modeling Guideline Manual, Volume 2, Appendix 2.4.3.

Model Re-calibration

Model re-calibration was required after validation and verification of modeled overflow points (MOPs). MOPs are discussed in detail later in this section. Model calibration and re-calibration was completed in accordance with MSD modeling standards and protocols. The standards can be found in the Hydraulic Sewer System Modeling Guideline Manual, Volume 2, Appendix 2.4.3.

2.3.5.2 Model Validation

Once the model is calibrated, the model is then "validated." Model validation is simply cross-checking the model performance against other recorded storm events or historical system performance data sources, such as known SSO locations, using threshold rainfall depths known to cause overflows, reported overflow volumes, and surcharged pipes. Due to lack of additional, system-wide storm events during the 2007 flow monitoring period, model validation was focused on validating the models to readily available historical overflow data. For details on future model calibration, validation, and flow monitoring procedures reference MSD's Post-Construction Compliance Monitoring Plan detailed in Volume 1, Chapter 6.

Known SSOs

MSD provided threshold 24-hour rainfall and average reported SSO volume for each known SSO in MSD's service area. The calibrated model simulated the 2.2-inch, 2.7-inch, and 3.2-inch level (this corresponds roughly to the six-month, one-year, and two-year Natural Resources Conservation Service design rainfall events) and the modeled SSO locations and volumes were noted. In some cases, modeled SSOs occurred within a few manholes of known SSOs, these locations were considered to represent the known SSOs.

The results were compared to the initial SSO list with two goals in mind. The primary goal was to show overflows at each known SSO location for similar rainfall depth. A secondary goal was to have relative agreement in SSO volume; for example, the SSOs in the sewershed within the top third of the reported volumes were not in the lowest third of the modeled SSO volumes. If parameters needed to be adjusted, the model was modified in a manner similar to calibration modifications. The validated MOPs were not considered for this criterion since there were no reported SSO volumes associated with the locations. Initial validation took place prior to MOP investigations in the spring of 2008.

Surcharged Pipe

MSD provided maps of areas with historical basement flooding based on complaint records and installed back-flow preventers. In most cases these areas coincided with known SSO locations and known hydraulic restrictions. In the few instances where surcharging was not noted in the model, parameters were adjusted upwards to induce surcharging for a 1.27-inch storm in a manner similar to calibration modifications.

Unvalidated SSOs

In some cases, SSOs could not be induced in the model where known SSOs occurred. If the pipe slope in the area was shallow, sedimentation could be applied to the model to induce the SSO (process was performed according to modeling standards). In these cases, MSD investigated the downstream sewer system to locate blockages or other operational problems. If the problem was cleared, the SSO status was changed to “Remediated.” These cases are detailed in Appendix 2.3.2, Model Calibration/Validation Reports, and the sewershed summaries in Section 2.5.

Recalibration

After validation was completed, the model was reviewed to confirm it met calibration standards. If it did not, the model was recalibrated and revalidated until all action items and validation goals were met. In practice, validation and any re-calibration took place simultaneously.

Appropriate Rainfall Distribution

While model calibration and validation was being conducted, MSD contracted to have a rainfall analysis performed and synthetic rainfall events produced for the Louisville Metropolitan area, based on 59 years of rainfall records at the Louisville International Airport. (See Appendix 2.3.1.) The analysis indicated that the typical storm type and duration for Louisville rainfall events is the 3-hour duration cloudburst event, especially for events over the two-year recurrence interval.

MSD compared the typical Natural Resources Conservation Service Type II 24-hour rainfall distributions with the 3-hour cloudburst distributions to determine the best synthetic rainfall event to use for further validation and additional analyses. The Natural Resources Conservation Service distributions resulted in unrealistic model results that did not match calibration and validation data from storm events of similar recurrence intervals. The results typically showed higher overflow volumes, longer overflow durations, and more modeled overflow points that did not correspond with field data. The cloudburst storm overwhelmingly showed a closer resemblance to overflow recurrence intervals, approximated overflow volumes, and documented overflow locations that had been recorded over the past five years. Because of this approximation of typical events, the cloudburst storm distribution was selected for the development of overflow abatement solutions.

2.3.5.3 Model QA/QC Process

As mentioned earlier, calibrated and validated models were also subjected to a QA/QC process as discussed in the Modeling Guidelines. This QA/QC peer review involved a "swapping" of models based on a pre-determined assignment list. The process involved reviewing dry-weather and wet-weather flow surveys, comparing results for calibration storm, and reporting discrepancies in a QA/QC checklist and comments form. Reviews were then returned to the model development teams for responses and revisions. In some cases, recalibration was necessary. Table 2.3.2 is a sample of the QA/QC checklist used by modelers to verify and validate model accuracy. Full Model QA/QC documents are provided in Appendix 2.3.3.

TABLE 2.3.2

QA/QC CHECKLIST SAMPLE

GENERAL REQUIREMENTS

ITEM	OK	SEE COMMENT
Model Development		
1. Standard Data Flags – Ensure data flags have been properly used. (Section 3.4.1)	☐	
2. Rainfall Data – Check the rainfall data to ensure the PIXEL number has been used for the profile ID (Section 3.4.2). Ensure pixels cover the entire modeling catchment.	☐	
3. Rainfall Data – Check rainfall data units. Rainfall data should be in inches/hour.	☐	
4. Model Building – Check the unique IDs used for nodes and links (Table 3-2 Section 3.4.3).	☐	
5. Model Building – Check pipe invert and manhole rim elevations. Generally these should range from 400ft to 800ft above sea level for Louisville.	☐	
6. Model Building - Run the network validation and check to see if there are any errors or warnings that need to be addressed.	☐	
7. Model Building – Check the simulation parameters. Generally the "Simulation: Tolerance for Volume Balance" parameter should be set to 0.01 for model stabilization. (Section 3.4.6)	☐	
8. Standard Naming Convention – Check naming convention used for groups listed in the Guidelines. (Section 3.4.8)	☐	
Hydrologic Parameters		
1. Runoff – Runoff Volume Type should be set to Fixed for all Runoff Surfaces. Can be set to SCS only if in a rural area. (Section 4.1.1)	☐	
2. Runoff – Routing Model should be set to SWMM for all Runoff Surfaces (Section 4.1.1)	☐	
3. Evaporation & Other Losses – For single storm event analysis evaporation losses should be set to zero. See Guidelines for continuous annual simulations. (Section 4.4)	☐	
4. RDII – Check to ensure the model has the proper number of dummy subcatchments to simulate the fast, medium, and slow response of for RDII. A minimum of two are required. (Section 4.5)	☐	
5. Subcatchment Areas – Check for large subcatchment areas. Ensure these areas represent the contributing area to the sewer system. For large parcels the subcatchments should only be drawn around the contributing area and not the entire parcel.	☐	
Hydraulic Parameters		
1. Conduit Data – Pipe shapes should be predominately circular except in the CSS area.	☐	
2. Datum shift – Spot check 5 pre-2002 and 5 post-2002 constructed conduits and manholes to ensure the -0.5 feet datum shift from NGVD29 to NAVD88 was properly applied. (Section 5.1)	☐	
3. Conduit Data – Check for elevations of zero, adverse slopes, and non-standard pipe diameters. (Section 5.1)	☐	
4. Conduit Data – Manning's N values should be set 0.013 in the Separate Sewer System and 0.013 – 0.016 in the Combined Sewer System based upon pipe material. (Section 5.1)	☐	
5. Conduit Data – Headloss Types should be set to 'normal'. (Section 5.1)	☐	
6. Node Data - All junction chambers and shafts should have a diameter of 4.0 feet. For pipe diameters greater than 4.0 feet the chamber diameter should equal the pipe diameter. (Section 5.2)	☐	

2.3.5.4 Modeled Overflow Points (MOPs)

After validation and peer review, the models were simulated again at the 1.82-inch cloudburst storm level to note any modeled SSOs that were not associated with known SSOs. These SSOs were designated as MOPs. MOP locations were targeted for further analysis and field investigations. Section 2.4.2 describes the MOP investigation and validation procedures.

2.3.5.5 System Deficiencies

Once models were calibrated and validated, system deficiencies were determined for various levels of protection. The system was characterized by SSOs, surcharged pipes, and areas at or near capacity for each analyzed level, including peak flow rates, time to peak, and total SSO volumes. System deficiencies noted include hydraulic restrictions, hydraulic jumps, bottlenecks, pump limitations, flow monitoring limitations, insufficient slopes, and non-standard diameters. System deficiencies can be divided into two categories: 1) construction and 2) hydraulic, as explained below.

Construction Deficiencies

Construction deficiencies are related to operation and maintenance issues. Deficiencies may not directly cause SSOs or hydraulic issues but they require additional maintenance and, therefore, contribute to conditions that can promote the formation of SSOs. The InfoWorks Engineering Tool includes a variety of tests to identify engineering deficiencies such as pipe slopes (which can promote silting), pipes with insufficient soil cover (which may be damaged by traffic), and excessively long pipes (which are difficult to access for inspection and cleaning).

Hydraulic Deficiencies

Hydraulic deficiencies are related to physical limitations of the system. Such systems may meet specific Engineering Standards for normal flow, but are insufficient for the flows observed in the field. These deficiencies could include bottlenecks, hydraulic jumps, and surcharged pipes. While InfoWorks can identify numerous minor reductions in flow that have no impact on sewer performance, only hydraulic restrictions that result in surcharging under modeled flow are flagged as restrictions.

Hydraulic deficiencies are identified through several features integral to InfoWorks. This will take advantage of the rigorous examination of the data performed during the model construction. For example, hydraulic jumps are marked as part of the surcharge identifier. Other deficiencies require modeler evaluation. For example, pump station limitations are highlighted by surcharging upstream of the pump station, but requires the modeler to confirm the pump station capacity as the true restriction.

2.3.5.6 Model Branching

Prior to the solution development process, the models were subdivided into “branches.” These branches were analyzed separately, beginning at the most upstream branches and proceeding downward toward the sewershed outlet or WQTC. During solution development, costs, benefits and benefit-cost ratios were determined for each branch separately. Once a preferred solution was determined for upstream branches, development proceeded downstream.

Ideally, each branch would address a separate hydraulic issue that caused SSOs and surcharging. In practice, branches were set by grouping hydraulically connected SSOs, surcharging and system deficiencies. These groupings often contained several SSOs and often two or more groupings would be in close proximity.

Section 2.5 provides details on the branch selection for each model area. Figures 2.3.2 through 2.3.11 at the end of the chapter provide maps of each modeled area and respective branch boundaries.

2.3.5.7 RDI/I Reduction

RDI/I reduction, identified by the Wet Weather Stakeholder Group as a critical component of solution development, was an integral part of every solution. MSD developed a method to project estimated RDI/I reduction for the entire MSD service area. Appendix 2.3.4, RDI/I Method and Modeling Techniques Technical Paper, provides a technical paper outlining this application and the modeling techniques.

The RDI/I reduction projections were:

- Applied to all models prior to solution evaluation.
- Based on flow monitoring results, namely peaking factors at flow monitoring basins. The peaking factors were calculated prior to modeling by comparing monitored flow to average flow determined from a period of dry weather.
- Applied only in areas with high peaking factors (greater than four).
- Conservative in that RDI/I reduction was set at a maximum of 25 percent reduction and then only at areas with peaking factors greater than 14.

It should be noted that the projected RDI/I reduction used in the models is based on estimated values. The actual RDI/I reduction will be based on the type and comprehensiveness of the rehabilitation effort. This is not to say that actual RDI/I reduction exceeding the projected reduction values used in the models cannot be accomplished. It is expected that they will in many cases. Such successful RDI/I reduction projects will provide capacity for areas where reduction is not as successful. It is, however, prudent that overly optimistic values are not used in planning and design. This is especially important in transport-based solutions where the diameter of installed piping cannot readily be changed once it is installed. The projected RDI/I reduction applied to each model is listed in the Section 2.5.

2.3.5.8 I/I Program

MSD will execute an on-going I/I Program for systemic improvements in the collection system during implementation of the Final SSDP. At the behest of Stakeholders MSD committed to use RDI/I removal as the first approach to eliminate SSOs. MSD recognizes that, based on past I/I Program Projects, the degree of RDI/I removal is often difficult to predict and success is not always assured. Accordingly, MSD has committed to achievable levels of RDI/I removal in areas where success is most likely.

Projected RDI/I removal was applied to all hydraulic models prior to solution development and optimization. Details of this approach are found in Appendix 2.3.4. Once optimized solutions for all SSOs had been developed, RDI/I reduction was removed from the models. The models were re-evaluated and solutions were re-sized at the 1.82-inch cloudburst storm level. The cost differential between the two sets of solutions, one with and one without RDI/I reduction, was used to determine appropriate I/I Program costs, as presented in Chapter 3, Appendix 3.1.1, I/I Program Documentation. It is estimated that the annual cost would average $1.6 million. This cost does not include programmatic needs for inspection and rehabilitation related to associated programs such as CMOM, SCAP, and the Nine Minimum Controls (NMCs). To provide contingency and to account for the costs to accommodate associated programs, the annual cost of the I/I program was set at $3 million.

Appendix 3.1.1 (Table 6) lists projects dependant on RDI/I reduction as part of the SSO elimination solution. Appropriate rehabilitation for these projects will take place as part of the I/I Program prior to actual capital construction of these solutions. The earliest I/I projects will likely concentrate on areas solely dependent on RDI/I removal (such as Branch MSD1086 in Hite Creek); these projects already have funds allocated for RDI/I removal. Other early candidates include areas with the highest peaking factors and thus the highest potential for RDI/I reduction. The actual schedule will be determined by MSD in conjunction with the CMOM Program, SCAP, and other associated programs.

Given the uncertainty of RDI/I removal, monitoring and adapted management techniques are critical to success of the I/I Program. Pre- and post rehabilitation flow monitoring will take place as part of the Final SSDP (refer to Volume 2, Section 1.3.1 for a description of this program) and will include areas in the I/I program. SSOs will also be monitored under SORP guidelines (refer to Section 1.3.1.5). Post-construction monitoring will be used to demonstrate the impacts of I/I improvements on RDI/I reduction. As SSOs are eliminated they will be removed from the I/I Program. If flow monitoring and the SORP program show that RDI/I removal has been effective but insufficient, additional RDI/I removal may be implemented as part of the I/I Program or the CMOM Program. If flow monitoring and the SORP program indicate that RDI/I removal has not been effective, additional construction alternatives may occur at the SSO.

2.3.5.9 Capital Improvement Projects

All MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. In some cases, the project was expanded and lengthened; in others, the project was shortened. In all cases, some portion of the capital project was included in the optimized solution, although this was not a requirement. The Capital Improvement Projects used in solution development are listed for each modeled area in Section 2.5.

2.3.5.10 Build-out Development

In preparing solutions, potential future development was considered. Consequently, MSD developed a method to determine areas likely to be developed and added to existing systems.

In general, build-out was applied as additional flow using the following criteria:

- Upstream of SSOs
- Drained by gravity to the SSO
- Limited to open areas outside of 100-year floodplain, parks and recreational areas
- Limited to buildable areas (no steep slopes or shallow bedrock)
- Developable in phases consistent with planning documents
- Single-family home equivalents, with peaked wastewater flows per MSD's Design Manual
- Flow added to the existing system at an appropriately sized interceptor
- Peak flow added to the model to coincide with peak rainfall
- Additional flows from all other areas would fall under the SCAP requirements

Appendix 2.3.5, Build-out Method and Modeling Techniques, provides the full reports describing the build-out potential and the techniques used for determining the areas. Specific build-out parameters used in solution development are listed for each modeled area in Section 2.5.

2.3.5.11 Future Model Updates

Following construction, calibration, and validation of models under the Final SSDP program, periodic updates to the model will be conducted. Every 12 months, each model will be reviewed internally by MSD to document any changes to the system that have occurred. Changes include new sewers, pump station eliminations, pump station upgrades, capacity upgrades, etc. With the results from this review, MSD will proceed with updating any significant changes in the sewer models. The need for an update will vary for each model due to the unique characteristics of each model. Appropriate documentation will take place for all model updates. The scale of the necessary documentation will be related to the scale of the changes to the model, the length of time since the last full model report was prepared, and the end use of the model.

2.4 SSO CHARACTERIZATION

This section discusses the initial SSO list and the process for the validation of MOPs by field investigation. It also presents the final SSO list used for Final SSDP solution development.

2.4.1 Initial SSOs

Identification, validation and characterization of SSOs are a continuous process. Management of the data associated with these activities is described in the SORP.

In the Spring of 2007, flow monitoring data collected throughout the MSD collection system along with continuous rainfall data from the MSD rainfall network, were used for initial calibration of the models. The calibrated models were then validated against 126 "initial" SSOs: those known to be active, known SSOs at the beginning of the modeling process in the Fall of 2007.

For each initial SSO, the following data was developed:

- **The 24-hour "threshold rainfall" volume**. This threshold rainfall was determined by noting the minimum (non-zero) 24-hour rainfall for each SSO event at each initial SSO. The rainfall was derived from the nearest rain gauge and centered on the time the SSO was first reported to overflow.
- **Average reported volume for each initial SSO**. This data is not as dependable as threshold rainfall since SSO volumes are estimated and reported based on when the SSO was first discovered until it ceases. This data was not used in calibration. MSD used this data for general guidance in the validation phase after calibration was performed to ensure models were predicting known overflows within a reasonable range of the reported volume. Refer to Section 2.3.5.2 for a description of the Model Validation process.

As described later in this section, MOPs that became validated by field investigation were added to the initial SSO list and used in further model validation.

2.4.2 MOP Validation Process

Early modeling based on initial SSOs indicated that SSOs might occur at locations other than documented SSOs. A separate category, known as MOPs, was created to classify these SSOs. A MOP corresponds to a particular manhole or pump station location.

MSD's goal was to verify the existence (or lack thereof) of the MOPs through field investigations. In particular, MSD focused on "targeted" MOPs, with the following characteristics:

- Modeled overflow volumes greater than 10,000 gallons during a 1.82-inch cloudburst storm
- Not hydraulically connected to a documented SSO

The following subsections summarize the field investigation process.

2.4.2.1 Investigation Procedures

The following steps briefly describe the investigation procedures developed by MSD for validating MOPs:

- Investigation teams attended MSD training for inspecting manholes and how to document findings.
- Seventy-one targeted MOPs were divided among teams by geographical location.
- During and immediately following three significant rain events in March, April, and May 2008, investigation teams performed the following:

- For each MOP, the surrounding area was inspected for sewer debris and other waste.
- Each MOP manhole, if possible, was opened, checked, and marked with chalk for future investigations. The chalk was used to assist in future inspections for determining if surcharge conditions occurred within the manhole.
- Upstream and downstream manholes were investigated if the MOP manhole could not be accessed or flow conditions in the MOP manhole could not be determined.
- Data was documented in work orders provided by MSD.
- MSD Customer Service was notified if an active overflow was observed.
- Overflow Report Forms were completed for any observed overflow.

2.4.2.2 MOP Classification

Based on field investigation findings, MOPs were classified into one of six categories. A summary of each category is outlined in the following.

1. Documented - An overflow was witnessed. MOP locations coded as documented SSOs require solution development by the modelers and added to the documented SSO list.

2. Suspected - Evidence found indicating an overflow had occurred. MOP locations coded as suspected overflows require solution development by the modelers and are added to the suspected SSO list.

3. Surcharged - Evidence found indicating manhole surcharging but not an overflow. Solution required. MOP locations coded as surcharged should remain a MOP status and will require solution development by the modelers according to surcharge criteria specified in the System Capacity Assurance Plan, described in Volume 1.

4. Remediated – Manhole was found to have a bolt-down lid. No solution was required. These manholes are all located along major streamlines or within the 100-year floodplain. Upstream and downstream manholes were investigated and also found to have bolt-down lids.

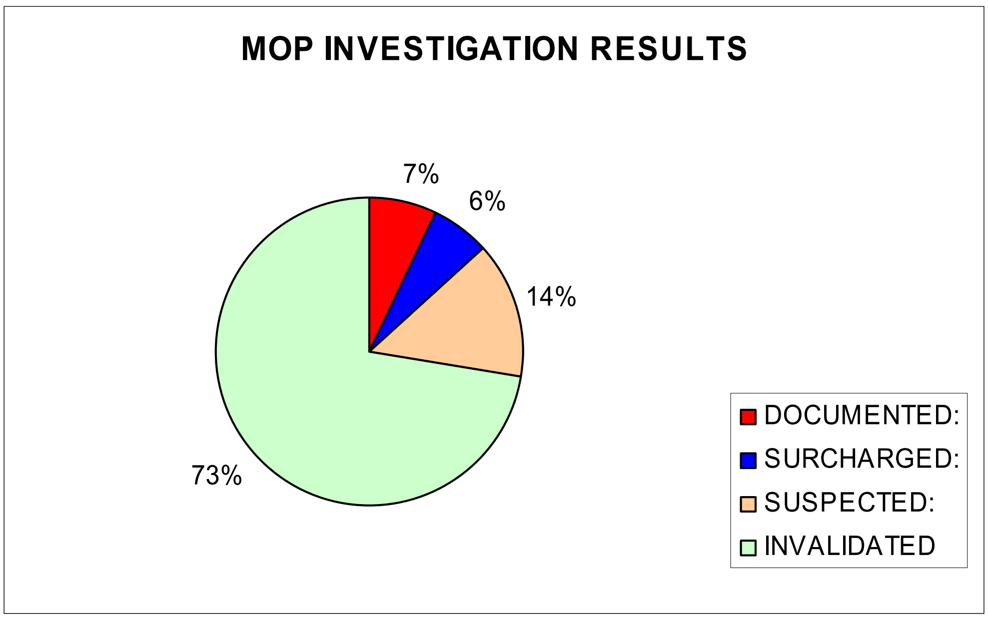
5. Invalidated - No problems found and no solution was required. Modeling teams were provided a list of invalidated MOPs and were directed to adjust I/I factors accordingly until the MOP locations have been successfully eliminated from the hydraulic models.

6. Unconfirmed - Could not locate the MOP manhole in the field, but upstream/downstream manholes displayed no problems. No solution required. These locations had upstream and/or downstream manholes that were inspected to determine flow conditions. All respective manholes displayed good flowing conditions; therefore, the unconfirmed MOP has become invalidated.

2.4.2.3 Specific Findings

On March 20 and 21, 2008, two-person teams performed extensive field manhole inspections following the storm event that ended on March 19. Additionally, on April 4-5 and May 9, 2008, inspection teams revisited and field-investigated all invalidated and unconfirmed MOPs following the April 3 and 4 rain event that produced approximately four inches of rain in a 24-hour period and the May 8 rain event of similar magnitude. This was performed as follow-up reconnaissance and confirmation that invalidated MOPs were accurately categorized and unconfirmed MOPs were given a second and even third attempt to locate. In total, 211 manholes were investigated during the MOP investigation process. Detailed results from these investigations are included in Appendix 2.4.1, MOP Investigation Findings. Figure 2.4.1 summarizes the investigation results.

FIGURE 2.4.1 MOP INVESTIGATION SUMMARY



2.4.2.4 Re-validation of Models

After the final set of validated SSOs was developed, it was necessary to re-validate the hydraulic models to these SSOs. After this validation process was completed, the final list of targeted SSOs was compiled for project development. This list is discussed in the following section.

2.4.3 SSOs Targeted for Solution Development

A total of 173 SSO locations were validated within the MSD system and are considered in the Final SSDP projects (refer to Volume 3, Chapter 3). Table 2.4.2 summarizes the typical volume, receiving stream, model region, and service area of each SSO. The SSO volume information was averaged based on actual field investigation and was used to estimate life-cycle costs such as pumping, fines, and cleanup.

TABLE 2.4.2

SSOS TARGETED FOR FINAL SSDP SOLUTION DEVELOPMENT

No.	SSO ID	SSO Name/ Address	Service Area	Receiving Stream	Model Region	Overflow Type	Avg Per Incident (gal)
1	MSD0199-LS	Lucas Lane	Berrytown	Goose Creek	Berrytown	LS	5,000
2	28984	Plumwood #1	Cedar Creek	Cedar Creek	Cedar Creek	Manhole	21,600
3	28998	Plumwood #2	Cedar Creek	Cedar Creek	Cedar Creek	Manhole	21,600
4	63094	Plumwood #4	Cedar Creek	Cedar Creek	Cedar Creek	Manhole	50
5	63095	Plumwood #5	Cedar Creek	Cedar Creek	Cedar Creek	Manhole	13
6	67997	7906 Gainsborough Court	Cedar Creek	Little Cedar Creek	Cedar Creek	Manhole	25
7	67999	7904 Shaw Court	Cedar Creek	Little Cedar Creek	Cedar Creek	Manhole	Suspected- no data
8	70158	Plumwood #3	Cedar Creek	Cedar Creek	Cedar Creek	Manhole	378,333
9	81316	Fairmount Road #1	Cedar Creek	Big Run	Cedar Creek	Manhole	500
10	86423	8314 Casualwood Way	Cedar Creek	Little Cedar Creek	Cedar Creek	Manhole	MOP - No data
11	88545	11101 Cambridge Commons Drive	Cedar Creek	Big Run	Cedar Creek	Manhole	Suspected- no data
12	89195	8104 Kimberly Way	Cedar Creek	Little Cedar Creek	Cedar Creek	Manhole	MOP - No data
13	89197	8104 Kimberly Way	Cedar Creek	Little Cedar Creek	Cedar Creek	Manhole	MOP - No data
14	97362	Fairmount Road #2	Cedar Creek	Big Run	Cedar Creek	Manhole	212,100
15	MSD1080-LS	Running Fox	Cedar Creek	Little Cedar Creek	Cedar Creek	LS	36,940
16	94187	Wet Well for St. Rene Road PS	Chenoweth Hills	Chenoweth Run	Chenoweth Hills	Manhole	4,380
17	33003	815 Tucker Station Road	Floyds Fork	Pope Lick	Floyds Fork	Manhole	Suspected- no data
18	65531	12400 Brierly Hill Place	Floyds Fork	Pope Lick	Floyds Fork	Manhole	Suspected- no data
19	MSD0165-PS	Olde Copper Court	Floyds Fork	Floyds Fork	Floyds Fork	LS	2,320
20	MSD0166-PS	Ashburton	Floyds Fork	Floyds Fork	Floyds Fork	LS	No Data
21	MSD0263	Chenoweth Hills WQTC	Floyds Fork	Chenoweth Run	Jeffersontown	Treatment Plant	2,767
22	MSD1105-PS	Eden Care	Floyds Fork	Floyds Fork	Floyds Fork	LS	200
23	90776	Floydsburg Road #1	Hite Creek	Floyds Fork	Hite Creek	Manhole	30,700
24	91087	Near Meadow Stream PS	Hite Creek	South Fork Harrods Creek	Hite Creek	Manhole	405,001
25	108956	Floydsburg Road #2	Hite Creek	Floyds Fork	Hite Creek	Manhole	75
26	108957	Floydsburg Road #3	Hite Creek	Floyds Fork	Hite Creek	Manhole	85,500
27	108958	Floydsburg Road #4	Hite Creek	Floyds Fork	Hite Creek	Manhole	13,000
28	MSD1082-PS	Meadow Stream	Hite Creek	Floyds Fork	Hite Creek	LS	51,000
29	MSD1085-PS	Kavanaugh Rd	Hite Creek	Hite Creek	Hite Creek	LS	176,000
30	MSD1086-PS	Floydsburg Road	Hite Creek	Floyds Fork	Hite Creek	LS	2,502

TABLE 2.4.2

SSOS TARGETED FOR FINAL SSDP SOLUTION DEVELOPMENT

No.	SSO ID	SSO Name/ Address	Service Area	Receiving Stream	Model Region	Overflow Type	Avg Per Incident (gal)
31	62769	Fox Hill Road/ Fox Hunt Court	Hunting Creek North	Harrods Creek	Hunting Creek North	Constructed	No data
32	MSD1055-LS	Gunpowder	Hunting Creek North	Harrods Creek	Hunting Creek North	Pumped	17,199
33	MSD1060-LS	Riding Ridge	Hunting Creek North	Harrods Creek	Hunting Creek North	Pumped	4,700
34	MSD0292	Hunting Creek South WQTC	Hunting Creek South	Harrods Creek	ORFM	Treatment Plant	117,436
35	MSD1063-PS	Deep Creek	Hunting Creek South	Harrods Creek	Hunting Creek South	LS	15,623
36	MSD1065-PS	Fairway View	Hunting Creek South	Harrods Creek	Hunting Creek South	LS	19,500
37	27969	4304 Rivanna Dr	Jeffersontown	Fern Creek	Jeffersontown	Manhole	Suspected- no data
38	28173	Watterson Trail	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	46,028
39	28249	Charlane Parkway/St Edwards Drive	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	14,676
40	28250	Charlane Parkway Near the Street	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	31,422
41	28336	Parking Lot Charlane Parkway	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	247,618
42	28340	Charlane Parkway at Pool	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	36,804
43	28390	10025 Grassland Road	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	MOP - No data
44	28391	Grassland #3	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	387,000
45	28392	Grassland #2	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	2,160,000
46	28395	Grassland #1	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	251,378
47	28413	3317 Dell Road	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	No Data
48	28414	3322 Dell Road	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	55,012
49	28415	3406/3404 Dell Road	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	143,920
50	28416	Marlin Drive	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	78,000
51	28417	Locust Avenue/Marlin Drive	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	15,000
52	28711	9510 Taylorsville Road	Jeffersontown	Avoca Creek	Jeffersontown	Manhole	Suspected- no data
53	28719	Intersection of Gleeson and Wendell	Jeffersontown	Avoca Creek	Jeffersontown	Manhole	MOP - No data
54	31733	10001 Grassland Road	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	Suspected- no data
55	64096	Chenoweth Run #1	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	51
56	64505	3200 Ruckreigel Pky	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	Suspected- no data

TABLE 2.4.2

SSOS TARGETED FOR FINAL SSDP SOLUTION DEVELOPMENT

No.	SSO ID	SSO Name/ Address	Service Area	Receiving Stream	Model Region	Overflow Type	Avg Per Incident (gal)
57	86052	4706 Chenoweth Run	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	Suspected- no data
58	92061	11804 Chippewa Ridge Lane	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	3,917
59	104289	3620 Charlane Pky	Jeffersontown	Chenoweth Run	Jeffersontown	Manhole	Suspected- no data
60	IS028-SI	Jeffersontown WQTC Siphon	Jeffersontown	Chenoweth Run	Jeffersontown	Constructed	113,000
61	MSD0151-PS	Monticello Place	Jeffersontown	Fern Creek	Jeffersontown	LS	10,000
62	MSD0196-PS	Chenoweth Run	Jeffersontown	Chenoweth Run	Jeffersontown	LS	212,117
63	MSD0255	Jeffersontown WQTC	Jeffersontown	Chenoweth Run	Jeffersontown	Treatment Plant	1,800,658
64	MSD1169-LS	Lake Forest	Lake Forest	Floyds Fork	Lake Forest	LS	MOP - No data
65	00746	Manhole Adjacent to Anchor Estates PS #1	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Pumped	10,762
66	01106	Vannah PS Wetwell Manhole	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Constructed	No Data
67	01793	9 Muirfield Place	Morris Forman	Middle Fork Beargrass Creek	Southeastern Diversion	Manhole	109,000
68	02932	Oxmoor #1	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	1,203,000
69	02933	Oxmoor #2	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	150,000
70	02935	Oxmoor #3	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	3,420
71	08537	Northern Ditch Blow-off	Morris Forman	Greasy Ditch	Middle Fork	Constructed	No data
72	08717	Fincastle #2	Morris Forman	South Fork Beargrass Creek	Combined	Manhole	100
73	13931	Camp Taylor #4	Morris Forman	South Fork Beargrass Creek	Combined	Manhole	6,000
74	13943	Camp Taylor #3	Morris Forman	South Fork Beargrass Creek	Combined	Manhole	250
75	16649	Wickland Road/ Sutherland Drive	Morris Forman	South Fork Beargrass Creek	Southeastern Diversion	Constructed	1,078,972
76	22436	Manhole Adjacent to West Goose Creek PS	Morris Forman	Goose Creek	ORFM	Pumped	30,275

TABLE 2.4.2

SSOS TARGETED FOR FINAL SSDP SOLUTION DEVELOPMENT

No.	SSO ID	SSO Name/ Address	Service Area	Receiving Stream	Model Region	Overflow Type	Avg Per Incident (gal)
77	23211	Peabody Lane #1	Morris Forman	South Fork Beargrass Creek	Middle Fork	Constructed	2,309,980
78	23212	Peabody Lane #2	Morris Forman	South Fork Beargrass Creek	Middle Fork	Manhole	9,720
79	24472	501 Mockingbird Valley Road	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Manhole	MOP - No data
80	25676	Alcona Lane	Morris Forman	South Fork Beargrass Creek	Southeastern Diversion	Manhole	288,969
81	26650	Briarbridge Ln at South Fork Beargrass Creek	Morris Forman	South Fork Beargrass Creek	Southeastern Diversion	Manhole	150
82	26651	Klondike Ln at South Fork Beargrass Creek	Morris Forman	South Fork Beargrass Creek	Southeastern Diversion	Manhole	2,511,000
83	26752	Brownsboro Road at Mockingbird Valley #1	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Manhole	25
84	27005	Bridge #6 - Cherokee Park	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	2,152,664
85	36763	3520 Fincastle Road	Morris Forman	Camp Taylor Ditch	Combined	Manhole	Suspected- no data
86	40870	Muddy Fork PS #1	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Manhole	41,800
87	40871	Muddy Fork PS #2	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Manhole	150,067
88	40872	Muddy Fork PS #3	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Manhole	183,400
89	41374	Brownsboro Road at Mockingbird Valley #2	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Manhole	100
90	41416	3202 Brownsboro Road	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Manhole	Suspected- no data
91	42680	Barbour Lane #1	Morris Forman	Little Goose Creek	ORFM	Pumped	162,000
92	43472	Near Saurel Drive PS	Morris Forman	Goose Creek	Middle Fork	Manhole	118
93	44396	Fincastle #4	Morris Forman	South Fork Beargrass Creek	Combined	Manhole	79,500

TABLE 2.4.2

SSOS TARGETED FOR FINAL SSDP SOLUTION DEVELOPMENT

No.	SSO ID	SSO Name/ Address	Service Area	Receiving Stream	Model Region	Overflow Type	Avg Per Incident (gal)
94	44397	Fincastle #3	Morris Forman	South Fork Beargrass Creek	Combined	Manhole	41,420
95	45835	Beargrass Road near Big Rock	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	456,021
96	46891	Goose Creek PS Wet Well	Morris Forman	Goose Creek	Middle Fork	Manhole	246,000
97	47250	1645 Rangeland Rd	Morris Forman	No Data	Southeastern Diversion	Capacity	MOP - No data
98	47583	Oxmoor #4	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	2,557,520
99	47593	Near LG&E Power Station	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	359,960
100	47596	7410 Steeplecrest Circle	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	Suspected- no data
101	47603	Kindercare #1	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	120
102	47604	Kindercare #2	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	17,083
103	51160	Peabody Lane #3	Morris Forman	South Fork Beargrass Creek	Middle Fork	Manhole	55,500
104	51161	Brooklawn	Morris Forman	South Fork Beargrass Creek	Middle Fork	Manhole	438,000
105	51221	Watterson Expressway at South Fork Beargrass Creek	Morris Forman	South Fork Beargrass Creek	Middle Fork	Constructed	13,500
106	51594	Trevilian Way	Morris Forman	South Fork Beargrass Creek	Southeastern Diversion	Manhole	51
107	55665	Hazelwood PS wetwell	Morris Forman	Upper Mill Creek	Combined	Manhole	28,000
108	62418	Goose Creek PS Near Goose Creek	Morris Forman	Goose Creek	Middle Fork	Manhole	128,000
109	65633	Barbour Lane #2	Morris Forman	Little Goose Creek	ORFM	Manhole	102,125
110	65635	Barbour Lane #3	Morris Forman	Little Goose Creek	ORFM	Manhole	25,500

TABLE 2.4.2

SSOS TARGETED FOR FINAL SSDP SOLUTION DEVELOPMENT

No.	SSO ID	SSO Name/ Address	Service Area	Receiving Stream	Model Region	Overflow Type	Avg Per Incident (gal)
111	66349	Fincastle #1	Morris Forman	South Fork Beargrass Creek	Combined	Manhole	15
112	90700	Christian Court	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	5,400
113	91629	Old Westport Road at Goose Creek PS #2	Morris Forman	Goose Creek	Middle Fork	Manhole	15,750
114	91630	Old Westport Road at Goose Creek PS #3	Morris Forman	Goose Creek	Middle Fork	Manhole	5,250
115	96020	Leland Road	Morris Forman	Cherrywood Creek	ORFM	Manhole	20
116	104223	Camp Taylor #1	Morris Forman	South Fork Beargrass Creek	Combined	Manhole	40
117	104231	Camp Taylor #2	Morris Forman	Camp Taylor Ditch	Combined	Manhole	1,217
118	105936	Old Westport Road at Goose Creek PS #1	Morris Forman	Goose Creek	Middle Fork	Manhole	10,927
119	00056-W	Anchor Estates #1 Wetwell	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Manhole	11,929
120	08935-SM	Middle Fork at Breckenridge Lane	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Constructed	3,020,300
121	21628-W	Devondale Wet Well Manhole (PS Overflow)	Morris Forman	Goose Creek	Middle Fork	Pumped	58,013
122	24152-W	3733 Canoe Lane (Wet Well for Canoe Ln PS)	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Constructed	60,750
123	IS021A-SI	Bowman Field Siphon	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	Constructed	No data
124	MSD0007-PS	Mockingbird Valley	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Constructed	10,840
125	MSD0010-PS	Winton	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Constructed	45
126	MSD0023-PS	Mellwood Avenue	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Constructed	287,472
127	MSD0024-PS	Canoe Lane	Morris Forman	Muddy Fork Beargrass Creek	ORFM	LS	15,769
128	MSD0042-PS	Sonne Avenue	Morris Forman	Paddy Run	Combined	Pumped	156,075
129	MSD0057-LS	Anchor Estates #2	Morris Forman	Middle Fork Beargrass Creek	Middle Fork	LS	14,519

TABLE 2.4.2

SSOS TARGETED FOR FINAL SSDP SOLUTION DEVELOPMENT

No.	SSO ID	SSO Name/ Address	Service Area	Receiving Stream	Model Region	Overflow Type	Avg Per Incident (gal)
130	MSD0095-PS	Derington Court	Morris Forman	Goose Creek	ORFM	Pumped	18,875
131	MSD0123-PS	West Goose Creek	Morris Forman	Goose Creek	ORFM	LS	36,750
132	MSD0183-PS	Glenview Hills	Morris Forman	Ohio River	ORFM	LS	73,733
133	MSD0192-PS	Barbour Lane	Morris Forman	Little Goose Creek	ORFM	LS	38,581
134	MSD0193-PS	New Market	Morris Forman	Muddy Fork Beargrass Creek	ORFM	LS	16,333
135	MSD1044-PS	Phoenix Hill	Morris Forman	Muddy Fork Beargrass Creek	ORFM	Pumped	2,252
136	28729	9100 Marian Ct (Wet Well for Marian Ct PS)	No Plant	Avoca Creek	Jeffersontown	Constructed	No data
137	21229-W	Avanti Way at Fernview Road	No plant	Little Cedar Creek	Pond Creek	Constructed	No data
138	MSD0149-PS	Raintree	No Plant	Avoca Creek	Jeffersontown	Constructed	MOP - No data
139	MSD0263A-PS	Chenoweth Hills WQTC PS	No Plant	Chenoweth Run	Jeffersontown	LS	108,767
140	04498	820 Echo Bridge Road	Derek R. Guthrie	Mill Creek	Mill Creek	Manhole	Suspected- no data
141	04542	Fern Lea PS Wet Well	Derek R. Guthrie	Heatherfield Ditch	Mill Creek	Manhole	91,500
142	17724	1096 Springview Drive	Derek R. Guthrie	Pond Creek	Pond Creek	Manhole	33
143	19360	Rockwood Dr / Monaco	Derek R. Guthrie	Northern Ditch	Pond Creek	Manhole	Suspected- no data
144	19369	5221 Layne Road	Derek R. Guthrie	Northern Ditch	Pond Creek	Manhole	Suspected- no data
145	25477	6101 Price Lane Road	Derek R. Guthrie	Fishpool Creek	Pond Creek	Manhole	Suspected- no data
146	25478	6006 Cooper Chapel Road	Derek R. Guthrie	Fishpool Creek	Pond Creek	Manhole	Suspected- no data
147	25480	6112 Cooper Chapel Rd	Derek R. Guthrie	Fishpool Creek	Pond Creek	Manhole	6,500
148	25484	Near Lantana PS	Derek R. Guthrie	Pennsylvania Run	Pond Creek	Manhole	180,875
149	27116	10306 Caven Avenue	Derek R. Guthrie	Mud Creek	Pond Creek	Manhole	Suspected- no data
150	29933	6926 Sandstone Blvd	Derek R. Guthrie	Fern Creek	Pond Creek	Manhole	Suspected- no data
151	29943	6906 Sandstone Blvd	Derek R. Guthrie	Fern Creek	Pond Creek	Manhole	Suspected- no data
152	29948	Sandstone Blvd	Derek R. Guthrie	Fern Creek	Pond Creek	Manhole	75
153	31083	6924 Sandstone Blvd	Derek R. Guthrie	Fern Creek	Pond Creek	Manhole	Suspected- no data
154	31084	6916 Sandstone Blvd	Derek R. Guthrie	Fern Creek	Pond Creek	Manhole	Suspected- no data
155	35309	Marjorie Drive	Derek R. Guthrie	Manslick Branch	Pond Creek	Manhole	10,825
156	36419	10601 Leven Blvd	Derek R. Guthrie	Pennsylvania Run	Pond Creek	Manhole	Suspected- no data
157	60679	Manhole Adjacent to Cinderella PS	Derek R. Guthrie	Fishpool Creek	Pond Creek	Manhole	8,100
158	70212	1095 Springview Drive	Derek R. Guthrie	Fishpool Creek	Pond Creek	Manhole	Suspected- no data

TABLE 2.4.2

SSOS TARGETED FOR FINAL SSDP SOLUTION DEVELOPMENT

No.	SSO ID	SSO Name/ Address	Service Area	Receiving Stream	Model Region	Overflow Type	Avg Per Incident (gal)
159	79076	6308 Hanses Drive	Derek R. Guthrie	Blue Spring Ditch	Pond Creek	Manhole	Suspected- no data
160	92098	7801 Edsel Lane (Upstream of Edsel Lane PS)	Derek R. Guthrie	Fern Creek	Pond Creek	Pumped	3,600
161	93719	Wet Well for Lantana PS	Derek R. Guthrie	Pennsylvania Run	Pond Creek	Manhole	5,625
162	04699-W	East Rockford PS	Derek R. Guthrie	Mill Creek	Mill Creek	Pumped	No data
163	81814-W	Pioneer Road PS	Derek R. Guthrie	Mill Creek	Mill Creek	Pumped	32,750
164	MSD0047-PS	Fern Lea	Derek R. Guthrie	Mill Creek	Mill Creek	Pumped	141,083
165	MSD0050-PS	Garrs Lane	Derek R. Guthrie	Mill Creek	Mill Creek	Pumped	72,000
166	MSD0101-PS	Lantana Drive PS #1	Derek R. Guthrie	Pennsylvania Run	Pond Creek	LS	22,300
167	MSD0130-PS	Cooper Chapel	Derek R. Guthrie	Fishpool Creek	Pond Creek	Constructed	4,442
168	MSD0133-PS	Caven Avenue	Derek R. Guthrie	Mud Creek	Pond Creek	Pumped	15,250
169	MSD0180-PS	Government Center	Derek R. Guthrie	Pennsylvania Run	Pond Creek	LS	12,381
170	MSD1010-PS	Lea Ann Way	Derek R. Guthrie	Northern Ditch	Pond Creek	Pumped	3,024,040
171	MSD1013-PS	Cinderella	Derek R. Guthrie	Fishpool Creek	Pond Creek	LS	71,356
172	MSD1019-PS	Leven	Derek R. Guthrie	Pennsylvania Run	Pond Creek	Pumped	Suspected- no data
173	MSD1048-PS	Edsel	Derek R. Guthrie	Fern Creek	Pond Creek	LS	91,500
PS- pump station, LS – lift station, CO- cleanout, SI-siphon, W-wet well, MOP – Modeled Overflow Point							

2.5 FINAL SSDP WATERSHED MODEL DEVELOPMENT

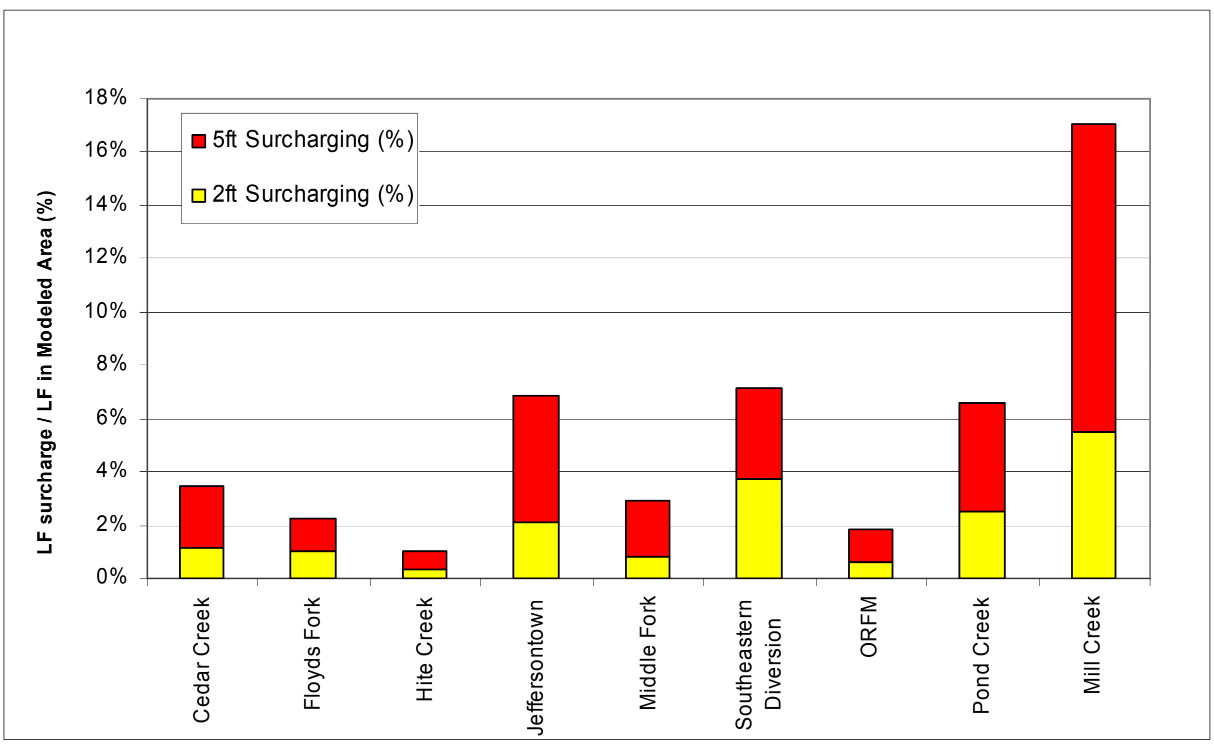
This section provides an overview of existing sewer system deficiencies and individual watershed model development, including validation, RDI/I reduction, build-out potential, and branching. System deficiencies include surcharged pipes and hydraulic bottlenecks. System deficiencies were analyzed and considered for determining causes of SSOs and SSO solution projects.

2.5.1 Surcharged Pipe Criteria

For the Final SSDP, surcharged pipes were categorized and analyzed using two criteria: 1) two feet below the manhole rim; and 2) five feet below the manhole rim. This criterion was formulated based on SCAP methodology. According to the SCAP, a wet weather surcharge condition is defined 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 a residential area with historical capacity-related backup complaints, then a surcharge condition is considered to be a water surface level within five feet of the manhole rim. Based on this data, models were analyzed at the 1.82-inch cloudburst storm under existing system conditions to determine surcharge levels.

Figure 2.5.1 shows surcharge percentages for each modeled watershed area during the 1.82-inch cloudburst storm under existing sewer system conditions. Mapping related to these evaluations are found in Appendix 2.5.1.

FIGURE 2.5.1 TOTAL SURCHARGING PERCENT BY MODELED AREA



2.5.2 Hydraulic Bottlenecks

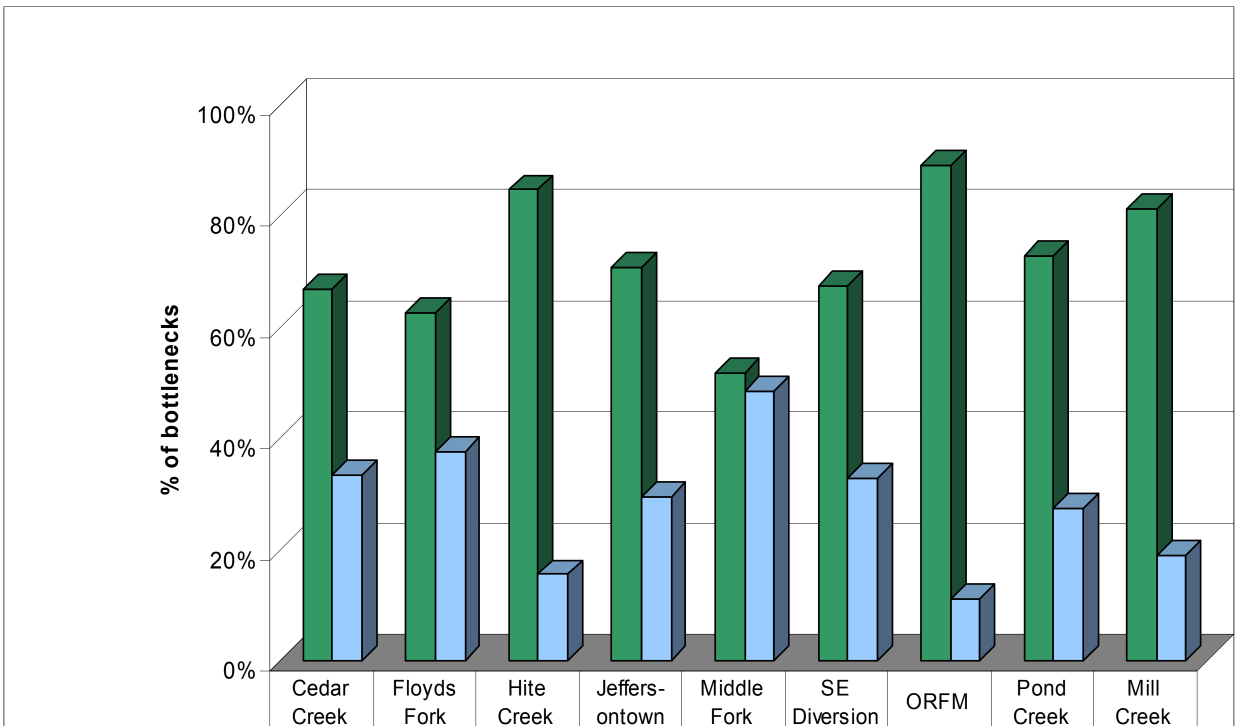
A hydraulic bottleneck is characterized by upstream system capacity that is greater than the downstream system capacity as identified by the model. The number of hydraulic bottlenecks by modeled watershed area is summarized in Table 2.5.1 and Figure 2.5.2. Most of the bottlenecks were found in the collection system, with the exception of Middle Fork where many of the bottlenecks were found in interceptor pipe (12-inch diameter and greater). Mapping related to these evaluations are found in Appendix 2.5.1, Surcharge/Bottleneck Maps.

TABLE 2.5.1

NUMBER OF SEPARATE SSS BOTTLENECKS BY MODELED AREA

Modeled Bottlenecks	
Modeled Area	**Number of Bottlenecks**
Cedar Creek	18
Floyds Fork	8
Hite Creek	13
Jeffersontown	136
Middle Fork	64
Southeastern Diversion	58
ORFM	91
Pond Creek	92
Mill Creek	48
Total	**516**

FIGURE 2.5.2 SUMMARY OF SEPARATE SSS BOTTLENECKS IN MODELED AREA



	Cedar Creek	Floyds Fork	Hite Creek	Jeffers-ontown	Middle Fork	SE Diversion	ORFM	Pond Creek	Mill Creek
Collectors (6" - 10")	67%	63%	85%	71%	52%	67%	89%	73%	81%
Interceptors (12" - 72")	33%	38%	15%	29%	48%	33%	11%	27%	19%

2.5.3 Cedar Creek Model Development

This section provides a summary of the Cedar Creek watershed model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed. The full calibration/validation report is available for review in Appendix 2.3.2.

2.5.3.1 SSO Descriptions for Cedar Creek

Cedar Creek is divided into five branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Refer to Figure 2.5.3 for a map of the Cedar Creek branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Branch 70158 addresses five SSOs: 28984, 28998, 63094, 63095, and 70158. The SSOs are due to shallow invert levels and a hydraulic bottleneck where a 15-inch diameter sewer line combines with a 10-inch diameter sewer line, which both flow into an 8-inch diameter line. The contributing area is single-family residential.

Branch 81316 addresses two SSOs: 81316 and 97362. These SSOs are just upstream of the Fairmount Road Pump Station, MSD1022-PS. The SSOs are most likely caused by upstream flows greater than the available pump station wet weather capacity. The area surrounding the SSO is residential with open spaces.

Branch 67997 addresses five SSOs: 67997, 67999, 86423, 89195, and 89197. During wet weather, the interceptor is unable to handle peak wet weather flow rates, and lower elevation manholes that are below the hydraulic grade line are shown to overflow in the model. Peak wet weather flow is the anticipated, calculated, or monitored maximum flow within the sewer system during an actual or synthetic rainfall event. The contributing area is single-family residential.

Branch MSD1025 addresses one SSO: 88545. This SSO is just upstream of the Bardstown Road Pump Station, MSD1025-PS. It is most likely caused by upstream flows greater than the available pump station wet weather capacity. The contributing area is single-family residential.

Branch MSD1080 addresses one SSO: MSD1080-LS (Running Fox Lift Station). The SSO is located in the Fox Ridge Subdivision off Beulah Church Road. It is likely caused by upstream flows greater than the available pump station wet weather capacity. The contributing area is single-family residential.

2.5.3.2 Validation for Cedar Creek

There is a modeled SSO near each known SSO at the appropriate threshold rain event (explained in Section 2.3.5.2). There were five validated SSOs in the Cedar Creek model: 28984, 28998, 70158, 81316, and 97362. 28984, 28998, and 70158 are hydraulically connected with each other and were validated by modeled SSOs at 28998, 63094, and 63095. Similarly, SSOs 81316 and 97362 are hydraulically connected and were validated by a single modeled SSO at 97365.

2.5.3.3 RDI/I Reduction for Cedar Creek

The RDI/I reduction process for Cedar Creek follows the procedures described in Section 2.3.5.7. Table 2.5.2 summarizes the average peaking factor and projected RDI/I reduction for sub-catchments of Cedar Creek. Peaking factor is the peak flow (the monitored maximum flow within the sewer system during a rainfall event) at the flow monitor compared to average DWF at the flow monitor. The average peaking factor is computed from three major storms that occurred in the flow-monitoring period. The projected RDI/I reduction represents the percent of contributing area which was reduced for models used in MSD SSO evaluation modeling (see Appendix 2.3.4 for explanation of peaking factors, RDI/I reduction, and model refinements).

TABLE 2.5.2

CEDAR CREEK PROJECTED RDI/I REDUCTION

Rainfall Dependent Inflow and Infiltration Reduction		
Flow Monitoring Location (Manhole ID)	**Average Peaking Factor**	**Projected RDI/I Reduction**
81316	2.3	0%
87001	2.6	1%
74696	3.1	3%
83010	3.1	3%
89176	3.2	3%
63095	3.4	4%
64023	3.8	5%
98027	8.0	23%
Average Projected RDI/I Reduction		**5.3%**

2.5.3.4 Build-out for Cedar Creek

In preparing solutions, potential future development (build-out) was considered. Build-out was only applied as additional flow upstream of known or suspected SSOs. The build-out process for Cedar Creek followed the procedures described in Section 2.3.5.10 and results are listed in Table 2.5.3. There are five general locations where additional flow was applied to the model to represent future development and corresponding flows.

TABLE 2.5.3

CEDAR CREEK PROJECTED BUILD-OUT

Build-out Areas		
Branch	**Build-out Input Location (Manhole/node ID)**	**Future development additional DWF (gpd)**
70158	28278	1,353
70158	28298	5,727
70158	28981	31,274
70158	28985	3,424
70158	28976	4,421
Total Future Projected Additional Flows		**46,129**

2.5.3.5 Capital Improvement Projects for Cedar Creek

MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. There was one Capital Improvement Project integrated into the Cedar Creek hydraulic model.

MSD Project C94086: Fern Hill Subdivision Interceptor No. 8. The project takes flow from Holly Oaks Pump Station (MSD0161-PS) and Exhibition Court Pump Station (MSD1052-PS) to the Fern Creek / Nottingham Interceptor No. 6 near Stonybrook Drive and Hurstbourne Parkway, eliminating the SSOs at these pump stations. The Holly Oaks and Exhibition Court Pump Stations were eliminated.

2.5.4 Floyds Fork Model Development

This section provides a summary of the Floyds Fork watershed model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed. The full calibration/validation report is available for review in Appendix 2.3.2.

2.5.4.1 SSO Descriptions for Floyds Fork

Floyds Fork is divided into three branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Refer to Figure 2.5.4 for a map of the Floyds Fork branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Branch 1 addresses two SSOs: 33003, 65531, and several surcharged areas. These SSOs are located in Douglas Hills Subdivision on Tucker Station Road. The SSO 33003 occurs at a manhole that is part of a 15-inch interceptor that runs parallel to Tucker Station Road. The SSO 65531 occurs at a manhole that is part of the same 15-inch interceptor as 33003. The SSOs are located in a residential area along a stream, and are likely caused by inability of the interceptor to convey upstream flow.

Branch 2 addresses one SSO: MSD1105-PS (Eden Care Pump Station). The SSO is located in Martin C.B. Farm Subdivision off Blankenbaker Parkway next to the Eden Terrace Retirement Community. It is likely caused by upstream flows greater than the available pump station wet weather capacity.

Branch 3 addresses two SSOs: MSD0165-PS (Olde Copper Ct. Pump Station) and MSD0166-Pump Station (Ashburton Pump Station). These SSOs are located in Copperfield Subdivision near Beckley Station. In this branch, the Ashburton Pump Station pumps to a gravity line that drains into the Olde Copper Court Pump Station. The Olde Copper Court Pump Station is located alongside a small creek that is downhill from a residential area. The Ashburton Pump Station is located alongside a small creek that is downhill from a residential area. Both SSOs are most likely caused by upstream flows greater than the available pump station wet weather capacity.

2.5.4.2 Validation for Floyds Fork

There is a modeled SSO near each known SSO at the appropriate threshold rain event (explained in Section 2.3.5.2) with the exception of SSO 65531. However, this SSO is hydraulically connected to SSO 33003. There were five validated SSOs in the Floyds Fork modeled area.

2.5.4.3 RDI/I Reduction for Floyds Fork

The RDI/I reduction process for Floyds Fork follows the procedures described in Section 2.3.5.7. Table 2.5.4 summarizes the average peaking factor and projected RDI/I reduction for sub-catchments of Floyds Fork. Peaking factor is the peak flow (the monitored maximum flow within the sewer system during a rainfall event) at the flow monitor compared to average DWF at the flow monitor. The average peaking factor is computed from three major storms that occurred in the flow-monitoring period. The projected RDI/I reduction represents the percent of contributing area which was reduced for models used in MSD SSO evaluation modeling (see Appendix 2.3.4 for explanation of peaking factors, RDI/I reduction, and model refinements).

TABLE 2.5.4

FLOYDS FORK PROJECTED RDI/I REDUCTION

Rainfall Dependent Inflow and Infiltration Reduction		
Flow Monitoring Location (Manhole ID)	**Average Peaking Factor**	**Projected RDI/I Reduction**
96911A	2.1	0%
99901	2.6	1%
46316	3.6	5%
97793	4.6	9%
84509	4.9	10%
46327	5.0	11%
97804	5.3	12%
108245A	6.6	17%
Average Projected RDI/I Reduction		**8.0%**

2.5.4.4 Build-out for Floyds Fork

In preparing solutions, potential future development (build-out) was considered. Build-out was only applied as additional flow upstream of known or suspected SSOs. The build-out process for Floyds Fork follows the procedures described in Section 2.3.5.10 and listed in Table 2.5.5. There are two general locations where additional flow was applied to the model to represent future development and corresponding flows.

TABLE 2.5.5

FLOYDS FORK PROJECTED BUILD-OUT

Build-out Areas		
Branch	**Build-out Input Location (Manhole/node ID)**	**Future development additional DWF (gpd)**
Branch 1	33003	79,200
Branch 2	MSD1105-PS	5,500
Total Future Projected Additional Flows		**84,700**

2.5.4.5 Capital Improvement Projects for Floyds Fork

MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design.

Middletown Recapture. This project eliminates the Berrytown, Starview, Middletown Industrial, and Chenoweth Run WQTCs by connecting to the Old Henry Road Force Main which delivers wastewater to the Floyds Fork WQTC. Additionally, a new Lake Forest Pump Station will be constructed to deliver the flow from these WQTCs to the Old Henry Road Force Main. Construction is expected to be complete by late 2011.

2.5.5 Hite Creek Model Development

This section provides a summary of the Hite Creek watershed model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed. The full calibration/validation report is available for review in Appendix 2.3.2.

2.5.5.1 SSO Descriptions for Hite Creek

Hite Creek is divided into three branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Refer to Figure 2.5.5 for a map of the Hite Creek branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Branch MSD1082 addresses two SSOs: 91087 and MSD1082-PS (Meadow Stream Pump Station). Meadow Stream Pump Station is on the south end of the city of Crestwood near I-71. The SSOs are located in a residential area along South Fork Beargrass Creek, and are likely caused by upstream flows greater than the available pump station wet weather capacity.

Branch MSD1085 addresses one SSO: MSD1085-PS (Kavanaugh Rd. Pump Station). The SSO is located on the southwest side of Crestwood, downstream of Cherry Lane Pump Station and Kavanaugh Rd. Pump Station. The site of the SSO occurrence is between two homes, and the area surrounding the SSO is residential with open spaces. This SSO is likely caused by upstream flows greater than the available pump station wet weather capacity.

Branch MSD1086 addresses five SSOs: 90776, 108596, 108957, 108958, and MSD1086-PS (Floydsburg Rd. Pump Station). These SSOs are located on the south end of Crestwood just west of Floydsburg Road. The SSOs are located at the Floydsburg Road Pump Station or just upstream of the pump station. The pump station is in an industrial area with some residential area. The SSOs are likely caused by upstream flows greater than the available pump station wet weather capacity.

2.5.5.2 Validation for Hite Creek

There is a modeled SSO near each known SSO at the appropriate threshold rain event (explained in Section 2.3.5.2). There were five validated SSOs in the Hite Creek model. SSOs MSD1086-PS, 90776, and 108956 (associated with MSD1086-PS) are hydraulically connected and were validated by a single modeled SSO at 90776.

Reported SSOs 11877 and 30520 at the Hite Creek WQTC were originally ranked in the top third of the reported SSO volumes, but were invalidated during the modeling process because the Hite Creek WQTC influent pumping station was relocated out of the 100-year floodplain which eliminated the problem. Under normal conditions, the WQTC's wet weather capacity is sufficient and there are no SSOs.

2.5.5.3 RDI/I Reduction for Hite Creek

The RDI/I reduction process for Hite Creek follows the procedures described in Section 2.3.5.7. Table 2.5.6 summarizes the average peaking factor and projected RDI/I reduction for sub-catchments of Hite Creek. Peaking factor is the peak flow (the monitored maximum flow within the sewer system during a rainfall event) at the flow monitor compared to average DWF at the flow monitor. The average peaking factor is computed from three major storms that occurred in the flow-monitoring period. The projected RDI/I reduction represents the percent of contributing area which was reduced for models used in MSD SSO evaluation modeling (see Appendix 2.3.4 for explanation of peaking factors, RDI/I reduction, and model refinements).

TABLE 2.5.6

HITE CREEK PROJECTED RDI/I REDUCTION

Rainfall Dependent Inflow and Infiltration Reduction		
Flow Monitoring Location (Manhole ID)	**Average Peaking Factor**	**Projected RDI/I Reduction**
00205	0.0	0%
29526	2.2	0%
30521	2.5	0%
40943	2.6	1%
29499	2.7	1%
91122	3.1	3%
MSD1082-PS	3.1	3%
90719	7.4	20%
Average Projected RDI/I Reduction		**3.5%**

2.5.5.4 Build-out for Hite Creek

In preparing solutions, potential future development (build-out) was considered. Build-out was only applied as additional flow upstream of known or suspected SSOs. The build-out process for Hite Creek follows the procedures described earlier in Section 2.3.5.10 and listed in Table 2.5.7. There are five general locations where additional flow was added to the model to represent future development and corresponding flows.

TABLE 2.5.7

HITE CREEK PROJECTED BUILD-OUT

Build-out Areas		
Branch	**Build-out Input Location (Manhole/node ID)**	**Future development additional DWF (gpd)**
MSD1085	90781	600
MSD1085	90811	2,000
MSD1085	102897	40,000
MSD1085	90877	64,300
MSD1086	90776	25,400
Total Future Projected Additional Flows		**132,300**

The addition of build-out flow was considered for one other location in the Hite Creek model, areas surrounding the Meadow Stream Pump Station. Future rates amounting to 1,579,200 gpd were so large that build-out flow significantly outweighed the reported SSO amount and would have been beyond the extent of the SSO solutions development. Although portions of this flow were added at upstream locations (listed above for Kavanaugh Road and Floydsburg Road), the majority was considered outside the scope of modeling SSO solutions.

2.5.5.5 Capital Improvement Projects for Hite Creek

MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. There were no Capital Improvement Projects integrated into the Hite Creek hydraulic model.

2.5.6 Jeffersontown Model Development

This section provides a summary of the Jeffersontown watershed model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed. The full calibration/validation report is available for review in Appendix 2.3.2.

2.5.6.1 SSO Descriptions for Jeffersontown

Jeffersontown is divided into five branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Branch 1A is a sub-section of Branch 1, created to minimize the extreme size of the branch. They were analyzed separately but combined for project solution development. Refer to Figure 2.5.6 for a map of the Jeffersontown branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Branch 1 addresses nine SSOs: 28173, 28390, 28391, 28392, 28395, 31733, 64505, MSD0025 (Jeffersontown WQTC), and ISO28-SI (Jeffersontown Siphon). The SSOs are upstream of the Jeffersontown WQTC, which is on Chenoweth Run north of Taylorsville Road. Many of the SSOs in this branch are caused by insufficient wet weather capacity in the Jeffersontown Interceptor to convey excess flow downstream. The SSO ISO28-SI is most likely caused by upstream flows greater than the available Jeffersontown WQTC wet weather capacity. The contributing area is a mix of single-family residential, industrial, and commercial.

Branch 1A addresses five SSOs: 64096, 86052, 92061, MSD0196-PS (Chenoweth Run Pump Station), and MSD0263A-PS (Chenoweth Hills WQTC Pump Station). This branch has 38,200 LF of sewer in the Chenoweth Hills WQTC service area. The SSOs 64096, 86052 and MSD0196-PS are likely caused by upstream flows greater than the available Chenoweth Run Pump Station wet weather capacity. The SSO 92061 is likely caused by upstream flows greater than the available Chippewa Pump Station wet weather capacity. The SSO MSD0236A-PS is likely caused by upstream flows greater than the available Chenoweth Hills WQTC wet weather capacity. The contributing area is single-family residential.

Branch 2 addresses ten SSOs: 28249, 28250, 28336, 28340, 28413, 28414, 28415, 28416, 28417, and 104289. The SSOs are caused by the gravity lines having insufficient wet weather capacity. The contributing area is single-family residential.

Branch 3 addresses four SSOs: 28711, 28719, 28729, and MSD0149-PS (Raintree Pump Station). The SSOs 28711 and 28719 are caused by the insufficient wet weather capacity of the interceptor. The SSOs 28729 is likely caused by upstream flows greater than the available Marian Court Pump Station wet weather capacity. MSD0149-PS is likely caused by upstream flows greater than the available Raintree Pump Station wet weather capacity. Both pump stations have constructed overflow pipes in the wet well that were constructed before MSD acquired the system in 1990. The contributing area is single-family residential.

Branch 4 addresses two SSOs: 27969 and MSD0151-PS (Monticello Place Pump Station). The SSOs are likely caused by upstream flows greater than the available Monticello Place Pump Station wet weather capacity. The contributing area is single-family residential.

2.5.6.2 Validation for Jeffersontown

There is a modeled SSO near each known SSO at the appropriate threshold rain event (explained in Section 2.3.5.2). There were 28 validated SSOs in the Jeffersontown model.

2.5.6.3 RDI/I Reduction for Jeffersontown

The RDI/I reduction process for Jeffersontown follows the procedures described in Section 2.3.5.7. Table 2.5.8 summarizes the average peaking factor and projected RDI/I reduction for sub-catchments of Jeffersontown. Peaking factor is the peak flow (the monitored maximum flow within the sewer system during a rainfall event) at the flow monitor compared to average DWF at the flow monitor. The average peaking factor is computed from three major storms that occurred in the flow-monitoring period. The projected RDI/I reduction represents the percent of contributing area which was reduced for models used in MSD SSO evaluation modeling (see Appendix 2.3.4 for explanation of peaking factors, RDI/I reduction, and model refinements).

TABLE 2.5.8

JEFFERSONTOWN PROJECTED RDI/I REDUCTION

Rainfall Dependent Inflow and Infiltration Reduction		
Flow Monitoring Location (Manhole ID)	**Average Peaking Factor**	**Projected RDI/I Reduction**
46300	2.5	0%
93434	2.5	0%
86162	2.9	2%
42026	3.0	2%
42275	3.2	3%
28111-SM	3.4	4%
64096	3.4	4%
27668	3.6	5%
31742	3.6	5%
42273-X	3.9	6%
28564	4.1	7%
28602	4.1	7%
28173	4.2	7%
29386	4.4	8%
28553	4.8	10%
104337	5.0	10%
86057	5.1	11%
28351	6.9	18%
42268	29.7*	25%
Average Projected RDI/I Reduction		**7.1%**
*Note: High peaking factor due to minimal dry weather flow		

2.5.6.4 Build-out for Jeffersontown

In preparing solutions, potential future development (build-out) was considered. This build-out evaluation assumed that the Consent Decree requirements limiting new flows to the Jeffersontown system have been removed by improvements to the system that eliminate the practice of "blending" during wet weather. This will be accomplished either by eliminating the Jeffersontown WQTC or by expanding and upgrading the WQTC to take all wet weather flows through full secondary treatment. The elimination or expansion of the Jeffersontown WQTC is required by the Consent Decree to be completed no later than December 31, 2015. For the purpose of this IOAP it is assumed that after that time adequate conveyance and treatment capacity will be provided to allow development in the current Jeffersontown WQTC service area to proceed in accordance with Louisville Metro land-use plans.

The build-out process for Jeffersontown follows the procedures described in Section 2.3.5.10 and the result is listed in Table 2.5.9. There is one general location where additional flow was added to the model to represent future development and corresponding flows. The build-out potential occurs in areas that would require pumping the flow to the Jeffersontown WQTC; therefore, a build-out inflow hydrograph was created and applied at the WQTC. No additional flow will be allowed to Jeffersontown WQTC until blending is eliminated at the plant; unless the process outlined in the Amended Consent Decree is followed.

TABLE 2.5.9

JEFFERSONTOWN PROJECTED BUILD-OUT

Build-out Areas		
Branch	**Build-out Input Location (Manhole/node ID)**	**Future development additional DWF (gpd)**
Branch 1	MSD0255	1,180,000
Total Future Projected Additional Flows		**1,180,000**

2.5.6.5 Capital Improvement Projects for Jeffersontown

MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. There was one Capital Improvement Project integrated into the Jeffersontown hydraulic model.

Rehl Road Recapture. Construct 14,250 LF of 15”-21” interceptor, 9,500 LF of 16” force main, and a regional 4.3 MGD peak flow pumping facility located near Rehl Road and Pope Lick Road. This is intended to serve 212 acres in Jefferson County proposed to be developed. Construction is complete and the interceptor, pump station, and force main are in use.

2.5.7 Middle Fork Model Development

This section provides a summary of the Middle Fork watershed model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed. The full calibration/validation report is available for review in Appendix 2.3.2.

2.5.7.1 SSO Descriptions for Middle Fork

Middle Fork is divided into four branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Refer to Figure 2.5.7 for a map of the Middle Fork branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Branch 1 addresses 19 SSOs: 02932, 02933, 02935, 08537, 23211, 23212, 27005, 45835, 47583, 47593, 47596, 47603, 47604, 51221, 51161, 51160, 90700, 08935-SM, and ISO21A-SI. Most of the SSOs are gravity SSOs to the Middle Fork of Beargrass Creek from manhole rims. They are caused by excess wet weather flows and partially by the condition of the interceptor under I-264. The SSO 08935-SM near the Upper Middle Fork Lift Station is a constructed overflow structure to Middle Fork Beargrass Creek along the Middle Fork Interceptor, and it overflows when the downstream interceptor becomes surcharged. It is located in a commercial area. The SSO ISO21A-SI is a constructed overflow structure to Middle Fork Beargrass Creek upstream of an inverted siphon and it overflows when the downstream interceptor and siphon become surcharged. The SSO 08537 is a constructed overflow structure that does not overflow during regular wet weather events. This overflow structure, better known as the Northern Ditch Blowoff, is located along the Northern Ditch Interceptor. The upstream contributing area consists of industrial, commercial, and residential area.

Branch 4 addresses seven SSOs: 21628-W, 43472, 46891, 62418, 91629, 91630, and 105936. The SSO 21628-W is a gravity manhole SSO near the Devondale Pump Station in a residential area, and it is most likely caused by upstream flows greater than the available Devondale Pump Station wet weather capacity. The SSO 43472 is a gravity manhole SSO in a residential area and is most likely caused by upstream flows greater than the available Saurel Road Pump Station wet weather capacity. The other SSOs in this branch are gravity SSOs from manhole rims that overflow to Goose Creek; they are likely caused by upstream flows greater than the available Goose Creek Pump Station wet weather capacity.

Branch 6 addresses four SSOs: 00056-W (Anchor Estates #1 Pump Station), 00746, 01106 (Vannah Way Pump Station), and MSD0057-LS (Anchor Estates #2 Lift Station). The SSO 01106 is a constructed overflow structure in the wet well that overflows to a storm sewer and is most likely caused by upstream flows greater than the available Vannah Way Pump Station wet weather capacity. The SSOs 00056-W and 00746 are gravity manholes located in a residential area and are most likely caused by upstream flows greater than the available Anchor Estates #1 Pump Station wet weather capacity. The SSO MSD0057-LS occurs at a gravity manhole in a residential area, and is likely caused by upstream flows greater than the available Anchor Estates # 2 Pump Station wet weather capacity.

Branch 7 addresses one SSO: 01793. This manhole is located in the Hurstbourne subdivision near Hurstbourne Country Club. The SSO at this manhole was assumed to be caused by backwater conditions in the Lower Middle Fork Interceptor due to insufficient capacity in the interceptor. In 2005, the force main at the Hurstbourne Pump Station was re-routed to relieve flow to the interceptor and the SSO did not occur again and, therefore, was believed to be eliminated. In March 2008, however, the SSO reappeared and is now assumed to be caused by insufficient wet weather capacity.

There are other SSOs in Middle Fork that are being addressed by Interim SSDP projects; these locations are described below.

SSOs 21153, 21101, 21061, 21156, and 21089 are locations that are pumped from the sanitary sewer during wet weather. These SSOs are in the Beechwood Village neighborhood and the contributing area is single family residential. The pumps are activated to eliminate residential basement backups. The cause of the overflows are downstream surcharging and significant I/I. These locations are addressed by Interim SSDP projects, namely the Beechwood Village and Sinking Fork Relief Interceptor projects.

SSOs 25012, 63319, and 21103 are gravity SSOs through manhole rims that occur during wet weather. The contributing area is mostly single family residential. The cause of the overflows are downstream surcharging and significant I/I. These locations are addressed by Interim SSDP projects, namely the Beechwood Village and Sinking Fork Relief Interceptor projects.

2.5.7.2 Validation for Middle Fork

There is a modeled SSO near each known SSO at the appropriate threshold rain event (explained in Section 2.3.5.2). There were 31 validated SSOs in the Middle Fork modeled area. There was one unvalidated SSO at manhole 01793; this area was investigated by MSD Infrastructure & Flood Protection group to determine if a downstream blockage had occurred. Investigation did not identify any blockages downstream of the manhole; therefore, this SSO will be targeted for I/I reduction and an SSES will be performed upstream of the manhole.

2.5.7.3 Sedimentation for Middle Fork

Based on validation results and a review of the interceptor condition assessment, sedimentation was needed in the model for the Middle Fork SSO validation. Sediment amounts, which are listed in Table 2.5.10, were added in the pipes downstream of the listed manhole ID in the hydraulic model. The majority of these blockages have since been removed through cleaning and rehabilitation projects completed in late 2008.

TABLE 2.5.10

MIDDLE FORK SEDIMENTATION

Sedimentation for SSO Validation	
Site (Manhole ID)	**Sediment Depth (Upstream Pipe Diameter)**
63324	4 inches (18 inches)
63321	6 inches (18 inches)
45443	6 inches (27 inches)
21156	6 inches (27 inches)
21150	8 inches (21 inches)
21155	8 inches (27 inches)
Average Sediment Depth	**6.3 inches**

2.5.7.4 RDI/I Reduction for Middle Fork

The RDI/I reduction process for Middle Fork follows the procedures described in Section 2.3.5.7. Table 2.5.11 summarizes the average peaking factor and projected RDI/I reduction for sub-catchments of Middle Fork. Peaking factor is the peak flow (the monitored maximum flow within the sewer system during a rainfall event) at the flow monitor compared to average DWF at the flow monitor. The average peaking factor is computed from three major storms that occurred in the flow-monitoring period. The projected RDI/I reduction represents the percent of contributing area which was reduced for models used in MSD SSO evaluation modeling (see Appendix 2.3.4 for explanation of peaking factors, RDI/I reduction, and model refinements).

TABLE 2.5.11
MIDDLE FORK PROJECTED RDI/I REDUCTION

Rainfall Dependent Inflow and Infiltration Reduction		
Flow Monitoring Location (Manhole ID)	**Average Peaking Factor**	**Projected RDI/I Reduction**
24551	2.2	0%
45835	2.4	0%
48763	2.4	0%
02933	2.5	0%
48758	2.5	0%
45449	2.8	2%
65746	2.8	1%
01793	2.9	2%
21150	3.1	3%
62425	3.1	3%
96675	3.5	4%
45381	3.6	5%
45440	3.7	5%
71004	3.7	5%
01268	3.8	6%
47098	3.8	6%
22610	4.0	6%
25012	4.4	8%
91629	5.5	13%
21155	5.6	13%
Average Projected RDI/I Reduction		**4.1%**

2.5.7.5 Build-out for Middle Fork

There was no build-out applied to the Middle Fork watershed model for future development flows because the area is fully developed.

2.5.7.6 Capital Improvement Projects for Middle Fork

MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. There was one Capital Improvement Project integrated into the Middle Fork hydraulic model.

MSD Project F05039: Woodlawn Road Pump Station Relocation. The project will construct 2,200 LF of gravity interceptor from the existing pump station site to the existing Muddy Fork interceptor at Foeburn Lane, as well as a diversion structure. In coordination with the widening of Westport Road the project will eliminate the existing Woodlawn Park Pump Station, which will help relieve SSO conditions at Falgate Court and in the Beechwood Village system. The project is currently under design.

2.5.8 Southeastern Diversion Model Development

This section provides a summary of the Southeastern Diversion watershed model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed. The full calibration/validation report is available for review in Appendix 2.3.2.

2.5.8.1 SSO Descriptions for the Southeastern Diversion

Southeastern Diversion was originally divided into eight branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Only four branches remain after modifications have taken place to the model and the SSO list and modeling process throughout the Final SSDP process. Refer to Figure 2.5.8 for a map of the Southeastern Diversion branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Branch 3 addresses one SSO: 47250. It is an SSO that was modeled and field verified as significantly surcharged. This manhole is on a 12-inch diameter sewer line located on a Jefferson County School property. The contributing area is mixed with single and multi-family residential. The SSO is likely caused because the entire interceptor in the local 12-inch collection system is surcharged and cannot convey peak discharges during wet weather.

Branch 4 addresses three SSOs: 25676, 26650, and 26651. The other SSOs in this branch (18134, 18298, 18302, 18318-W, 49224, 49236, 49672, and 49673) are addressed in the Interim SSDP projects. The SSOs have a mixed contributing landuse area of residential and commercial. The SSOs are likely caused due to surcharging in the Beargrass Interceptor during wet weather.

Branch 5 addresses one SSO: 16649. SSO 16649 is a constructed overflow structure in the Sutherland neighborhood, and it occurs when the local 10-inch diameter sewer becomes surcharged. The contributing area is mostly single-family residential.

Branch 6 addresses one SSO: 51594. Early field investigation of Manhole 51594 suggested that this manhole had a downstream blockage coupled with the Beargrass Interceptor surcharge effects causing the SSO. The Interceptor Condition Assessment Phase 1 project noted numerous obstructions and root masses in the Beargrass Interceptor near this location. The contributing area is mostly single-family residential.

There are other SSOs in Southeastern Diversion that are being addressed by a combination of the Interim SSDP projects, maintenance activities, and other branch solutions. These locations are described below.

SSOs 08426, 08427, 08430, 08431, 30701, 30702, 49647, and 63779 are SSOs along the Buechel Branch Trunk. These are known as the Pruitt Court SSOs. The contributing area is mostly residential with some commercial and industrial. There are two main causes of these SSOs: downstream surcharging in the Southeastern Diversion Structure and excessive blockages per the Interceptor Condition Assessment and model validation activities. These SSOs will be addressed by Interim SSDP projects and maintenance activities.

SSOs 23211, 23212, 51160, 51161, and 51221 are SSOs at or near the confluence of the Goldsmith Lane Trunk and the Beargrass Interceptor. The Goldsmith Lane Trunk and Beargrass Interceptor exceed capacity during wet weather. SSO 23211 was originally a constructed overflow structure but has since been welded shut. In addition, the Upper Middle Fork Lift Station currently flows through this location; it peaks at 6.6 mgd for a period of nearly 48 hours during a 1.82-inch rainfall event. Due to the significant I/I at the Upper Middle Fork Lift Station, SSOs occur at these locations. These locations will be addressed by Interim SSDP projects and the solution involving the diversion of the Upper Middle Fork Lift Station to the Hikes Lane Interceptor in Middle Fork Branch 1.

SSOs 72571-X, 30680, and 30681 will also be addressed by Interim SSDP projects. SSO 72571-X is better known as the Southeastern Diversion structure which is a constructed overflow structure. SSOs 30680 and 30681 are several manholes upstream of the Southeastern Diversion structure along the Buechel Branch Trunk. These manholes overflow due to local I/I and surcharging at the Southeastern Diversion. SSO 72751-X overflows due to two influent interceptors (30-inch and 33-inch) that flow into the structure and only one interceptor exiting (30-inch) the structure. There is an additional 60-inch interceptor exiting the structure but the gate is left mostly closed due to downstream operational restrictions.

SSOs 18471, 18483, 18505, and 18595 are locations that are pumped from the sanitary sewer during wet weather. These overflows are in the Hikes Point area and the contributing area is single family residential. The pumps are activated to eliminate residential basement backups. The cause of the overflows are downstream surcharging and significant I/I. These locations are addressed by Interim SSDP projects, namely the Hikes Lane Interceptor project.

SSO 17571 is an overflow that is pumped from the sanitary sewer during wet weather. This overflow is near the Hikes Point area and the contributing area is single family residential. The pump is activated to eliminate residential basement backups. The cause of the overflow is downstream surcharging and significant I/I. This location is addressed by Interim SSDP projects.

SSOs MSD0012-PS and 18434 are located in the Hikes Point area and the contributing area is single family residential. MSD0012-PS is known as the Highgate Springs Pump Station, which overflows to Beargrass Creek during extreme wet weather. This was constructed as a wet weather relief to eliminate basement backups. SSO 18434 is located a few manholes upstream. The cause of these overflows is due to surcharging in the Beargrass Interceptor and significant I/I. These locations are addressed by Interim SSDP projects, namely the Hikes Lane Interceptor project.

SSOs 18134, 18298, 18302, 18370, 18318-W, 49224, 49236, 49672, and 49673 are overflows along the Beargrass Interceptor between the Southeastern Diversion and the Highgate Springs Pump Station. The contributing area is mostly residential with some commercial and industrial. The main cause of these SSOs is downstream surcharging at the Southeastern Diversion Structure and excessive wet weather flow in the Beargrass Interceptor. These locations are addressed by Interim SSDP projects, namely the Hikes Lane Interceptor project.

2.5.8.2 Validation for the Southeastern Diversion

There is a modeled SSO near each known SSO at the appropriate threshold rain event (explained in Section 2.3.5.2). There were two validated SSOs in the Southeastern Diversion modeled area. There are three unvalidated SSOs at manholes 18134, 18370, and 51594. Manholes 18134 and 18370 are in the tributaries upstream of the Beargrass Interceptor in the Hikes Point area that will be addressed with the new Hikes Lane Interceptor (Interim SSDP project). The Interceptor Condition Assessment Phase 1 project noted numerous obstructions and root masses in the Beargrass Interceptor near Manhole 51594. This part of Beargrass Interceptor will be recommended for the next phase of the Beargrass Interceptor rehabilitation work.

2.5.8.3 Sedimentation for the Southeastern Diversion

Based on validation results and a review of the interceptor condition assessment, sedimentation was needed in the model for the Southeastern Diversion SSO validation. Sediment amounts that are listed in Table 2.5.12 were added in the pipes downstream of the listed manhole ID in the hydraulic model. The majority of these blockages have since been removed through cleaning and rehabilitation projects completed in late 2008.

TABLE 2.5.12

SOUTHEASTERN DIVERSION SEDIMENTATION

Sedimentation for SSO Validation					
Site (Manhole ID)	**Sediment Depth (Upstream Pipe Diameter)**	**Site (Manhole ID)**	**Sediment Depth (Upstream Pipe Diameter)**	**Site (Manhole ID)**	**Sediment Depth (Upstream Pipe Diameter)**
72555	18 inches (36")	51147	8 inches (42")	49245-T	6 inches (33")
30703-T	15 inches (30")	51221	8 inches (42")	72552	6 inches (21")
30704	14 inches (30")	72353-T	8 inches (42")	49468	6 inches (27")
08535C-T	14 inches (72")	72354	8 inches (42")	22574	6 inches (30")
50682	13 inches (36")	72396-T	8 inches (42")	22576	6 inches (30")
51186-T	13 inches (36")	73168	8 inches (42")	49664	6 inches (30")
51147-T	13 inches (42")	51232	8 inches (36")	49778	6 inches (30")
30683-T	11 inches (30")	63832	8 inches (36")	54003	6 inches (30")
30703	11 inches (30")	30720	7 inches (30")	66205	6 inches (30")
30705	11 inches (30")	24299	7 inches (39")	28080T	5 inches (24")
50648	11 inches (30")	26640	7 inches (33")	49446	5 inches (24")
68190	11 inches (21")	18465-T	7 inches (33")	19255	5 inches (27")
51221-T	10 inches (42")	51175	7 inches (36")	49779	5 inches (27")
49767	10 inches (21")	51187-T	7 inches (36")	49781	5 inches (27")
51222	9 inches (42")	51191	7 inches (36")	49807	5 inches (27")
23249C-AG	9 inches (48")	51203	7 inches (36")	49818	5 inches (27")
51189	9 inches (36")	26645	7 inches (27")	49703	5 inches (24")
51192-T	9 inches (36")	30683SM	7 inches (30")	25345	4 inches (18")
51194	9 inches (36")	18465	6 inches (33")	112639	4 inches (21")
49473	9 inches (27")	18704	6 inches (21")	30714	4 inches (21")
24299-T	8 inches (39")	26642	6 inches (33")	30715	4 inches (21")
30685	8 inches (33")	48885	6 inches (33")	49459	4 inches (21")
49244-T	8 inches (33")	48886	6 inches (33")	49710	4 inches (18")
49810	8 inches (27")	48894	6 inches (33")	19769	3 inches (18")
				Average Sediment Depth	**7.7 inches**

2.5.8.4 RDI/I Reduction for the Southeastern Diversion

The RDI/I reduction process for Southeastern Diversion follows the procedures described in Section 2.3.5.7. Table 2.5.13 summarizes the average peaking factor and projected RDI/I reduction for sub-catchments of the Southeastern Diversion. Peaking factor is the peak flow (the monitored maximum flow within the sewer system during a rainfall event) at the flow monitor compared to average DWF at the flow monitor. The average peaking factor is computed from three major storms that occurred in the flow-monitoring period. The projected RDI/I reduction represents the percent of contributing area which was reduced for models used in MSD SSO evaluation modeling (see Appendix 2.3.4 for explanation of peaking factors, RDI/I reduction, and model refinements).

There were 32 flow monitoring locations in the Southeastern Diversion modeled area. There were six flow monitoring locations that the RDI/I reduction was adjusted from what MSD provided. These were HP22, HP24, HP25A, HP31, HP32, and HP33. These were adjusted by taking an average of adjacent flow monitoring basins. This was done because the flow monitors either had volume-balancing problems or were highly influenced by an upstream pump station. There were two instances where MOPs were invalidated so the RDI/I were redistributed.

TABLE 2.5.13
SOUTHEASTERN DIVERSION PROJECTED RDI/I REDUCTION

Rainfall Dependent Inflow and Infiltration Reduction			
Basin	**Flow Monitoring Location (Manhole ID)**	**Average Peaking Factor**	**Projected RDI/I Reduction**
Buechel Branch	25330	2.5	0%
Buechel Branch	51762	2.8	1%
Buechel Branch	25331	3.2	3%
Buechel Branch	49641	3.4	4%
Buechel Branch	25370	3.7	5%
Buechel Branch	49467	4.0	6%
Buechel Branch	68191	27.8*	25%
Hikes Point	16762	1.3	0%
Hikes Point	27293	1.4	0%
Hikes Point	49323	2.1	0%
Hikes Point	30684	2.2	0%
Hikes Point	48894	2.5	0%
Hikes Point	104816	2.5	0%
Hikes Point	18429	2.9	2%
Hikes Point	18434	2.9	2%
Hikes Point	26648	3.1	3%
Hikes Point	49546	3.4	4%
Hikes Point	49518	3.6	5%
Hikes Point	18475	4.1	7%
Hikes Point	71738	4.9	10%
Hikes Point	26642	5.3	12%
Hikes Point	104818	7.1	19%
Hikes Point	48864	7.9	23%
Hikes Point	73087	16.1*	25%
Hikes Point	23214	22.1*	25%
Hikes Point	43711	281.3*	25%
Northern Ditch	54546	4.0	6%
Northern Ditch	23278	5.0	11%
Northern Ditch	23288	5.2	11%
Northern Ditch	08531	5.7	14%
Northern Ditch	23275	5.9	14%
Northern Ditch	80515	6.6	17%
		Average Projected RDI/I Reduction	**8.8%**

*Note: High peaking factor due to minimal dry weather flow

2.5.8.5 Build-out for the Southeastern Diversion

There was no build-out applied to the Southeastern Diversion watershed model for future development flows because the area is fully developed.

2.5.8.6 Capital Improvement Projects for the Southeastern Diversion

MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. There were three Capital Improvement Projects integrated into the Southeastern Diversion hydraulic model.

MSD Project B00234: Cavelle Avenue Sanitary Sewer. The assessment project consists of 15 residential properties in which property owners currently use on-site disposal systems. The project will construct approximately 560 LF of separate SSS.

MSD Project B98235: Newburg Road at Tartain Road Sanitary. The assessment project consists of five residential properties in which property owners currently use on-site disposal systems. The project will construct approximately 1,200 LF of gravity sewers. Alternatives to conventional sewers will be considered.

MSD Project E98307: Taylorsville Road at Six Mile Lane. The assessment project consists of 12 residential properties in which property owners have requested service in this unsewered area of Jeffersontown. The project will construct approximately 1,700 LF of separate SSS for the properties.

2.5.9 Ohio River Force Main Model Development

This section provides a summary of the ORFM watershed model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed. The full calibration/validation report is available for review in Appendix 2.3.2.

2.5.9.1 SSO Descriptions for the Ohio River Force Main

The ORFM area is divided into four branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Refer to Figure 2.5.9 for a map of the ORFM branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Branch 1 addresses nine SSOs: 24152-W, 24472, 26752, 41374, 41416, MSD0007-PS (Mockingbird Valley Pump Station), MSD0010-PS (Winton Ave. Pump Station), MSD0023-PS (Mellwood Ave Pump Station), and MSD0024-PS (Canoe Ln Pump Station). The SSOs at MSD0007-PS, MSD0010-PS, Mellwood Avenue Pump Station (24472 and MSD0023-PS), and Canoe Lane Pump Station (24152-W and MSD0024-PS) are likely caused by upstream flows greater than the available pump station wet weather capacity. The SSOs at 26752, 41374, and 41416 are caused by insufficient wet weather capacity of the interceptor upstream of Mockingbird Valley Pump Station. The contributing area is mostly single-family residential.

Branch 2 addresses one SSO: 96020. The SSO is caused by a hydraulic bottleneck in the 8" gravity line. The contributing area is mostly single-family residential.

Branch 3 addresses one SSO: MSD0095-PS (Derington Ct. Pump Station). The SSO is likely caused by upstream flows greater than the wet weather capacity of the Derington Court Pump Station. The contributing area is mostly single-family residential.

Branch 4 addresses 13 SSOs in the Prospect area: 22436, 40870, 40871, 40872, 42680, 65633, 65635, MSD0123-PS (West Goose Creek Pump Station), MSD1044-PS (Phoenix Hill Pump Station), MSD0183-PS (Glenview Hills Pump Station), MSD0192-PS (Barbour Ln Pump Station), MSD0193-PS (New Market Pump Station), and MSD0292 (Hunting Creek South WQTC). The SSOs at 22436 and MSD0123-PS are caused by the head in the ORFM limiting the Goose Creek Pump Station and the insufficient wet weather capacity at the pump station to convey flow. The SSOs at 40870, 40871, and 40872 are caused by the head in the ORFM limiting the Muddy Fork Pump Station. The SSOs at 42680, 65633, 65635, and MSD0192-PS are caused by insufficient wet weather capacity at the Barbour Lane Pump Station to convey wet weather flow. The SSOs at MSD0183-PS, MSD0193-PS, and MSD1044-PS are caused by the head in the ORFM and the insufficient capacities at the pump stations to convey the wet weather flow. The SSO at MSD0292 is likely caused by upstream flows greater than the wet weather capacity at the Hunting Creek South WQTC. The contributing area at all these locations is mostly single-family residential.

2.5.9.2 Validation for the Ohio River Force Main

There is a modeled SSO near each known SSO at the appropriate threshold rain event (explained in Section 2.3.5.2). There were 20 validated SSOs in the ORFM modeled area.

The SSO 22436 is currently a documented SSO but only validates to a 2.60-inch cloudburst storm; there is a possibility that excessive inflow exists in the small upstream system.

2.5.9.3 RDI/I Reduction for the Ohio River Force Main

The RDI/I reduction process for ORFM follows the procedures described in Section 2.3.5.7. Table 2.5.14 summarizes the average peaking factor and projected RDI/I reduction for sub-catchments of ORFM. Peaking factor is the peak flow (the monitored maximum flow within the sewer system during a rainfall event) at the flow monitor compared to average DWF at the flow monitor. The average peaking factor is computed from three major storms that occurred in the flow-monitoring period. The projected RDI/I reduction represents the percent of contributing area which was reduced for models used in MSD SSO evaluation modeling (see Appendix 2.3.4 for explanation of peaking factors, RDI/I reduction, and model refinements).

TABLE 2.5.14

OHIO RIVER FORCE MAIN PROJECTED RDI/I REDUCTION

Rainfall Dependent Inflow and Infiltration Reduction		
Flow Monitoring Location (Manhole ID)	**Average Peaking Factor**	**Projected RDI/I Reduction**
42675	2.2	0%
42742	2.2	0%
42788	2.2	0%
32191	2.5	0%
22433e	2.6	1%
66021	2.6	1%
44084	2.8	1%
48228	3.1	3%
27035	3.5	4%
43569	3.5	4%
40872	3.6	5%
22433w	4.4	8%
91799-10	4.7	10%
91799-12	4.8	10%
24077	6.3	16%
27435	6.3	16%
Average Projected RDI/I Reduction		**4.9%**

2.5.9.4 Build-out for the Ohio River Force Main

The build-out process for ORFM included Sewer Assessment Projects only. It follows the procedures described in Section 2.3.5.10 and are listed in Table 2.5.15. Additional flow was applied to the model to represent future flow based on the following assessment projects:

- D98333 - Upper River Road / Overbrook Area Sanitary Sewer Assessment Project
- D00252 – Indian Hills North - River Road Assessment Project
- D96177 – Riviera Area Sanitary Sewer Assessment Project
- D94203 – Future Upper Muddy Fork Pump Station (Boxhill Road Sanitary Sewer Assessment Project)
- D98331 – Cabin Way Sanitary Sewer Assessment Project
- D98334 – Orion / Hillsdale Sanitary Sewer Assessment Project
- D98338 – Ten Broeck Phase II Sanitary Sewer Assessment Project
- D98343 – Winchester Acres Sanitary Sewer Assessment Project
- D96179 – Wallbrook Subdivision Sanitary Sewer Assessment Project

TABLE 2.5.15

OHIO RIVER FORCE MAIN PROJECTED BUILD-OUT

Build-out Areas			
Branch	**Assessment ID**	**Build-out Input Location (Manhole/node ID)**	**Future development additional DWF (gpd)**
Branch 1	D98333	40388	10,800
Branch 4	D00252	40866	22,400
Branch 4	D96177	110797	34,800
Branch 4	D94203	Upper Muddy	32,800
Branch 4	D98331	44109	2,400
Branch 4	D98334	66019	16,800
Branch 4	D98338	42726	2,800
Branch 4	D96179	24233	6,400
Branch 4	D98343	42726	16,000
Total Future Projected Additional Flows			**145,200**

2.5.9.5 Capital Improvement Projects for the Ohio River Force Main

MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. There were three Capital Improvement Projects integrated into the ORFM hydraulic model. There was also a capital project completed in 2005, which eliminated the Jarvis Lane Pump Station SSO; the constructed overflow structure was sealed and the force main was upsized. Additionally, in 2003, pump replacements occurred and a permanent generator was placed at Glen Oaks Pump Station, which eliminated the SSO.

MSD Project F05039: Woodlawn Park Pump Station Relocation. The project consists of diverting flow from the Middle Fork Modeling area to the Muddy Fork Interceptor. The project will construct 2,200 LF of gravity interceptor from the existing pump station site to the existing Muddy Fork interceptor at Foeburn Lane. In coordination with the widening of Westport Road the project will eliminate the existing Woodlawn Park Pump Station, which will help relieve sewer SSO conditions at Falgate Court and in the Beechwood Village system. The project was completed on March 31, 2009.

MSD Project F06298: Canoe Pump Station Elimination. The project consists of diverting flow from the Canoe Lane Pump Station and the Fairway Lane Pump Station to the existing Muddy Fork Interceptor. The Canoe Lane Pump Station will be eliminated. The flow currently goes to the Mellwood Pump Station, but it does not have the ability to accept all wet weather flow so this project will reduce flow to Mellwood Pump Station.

MSD directed project to upgrade Hillsdale, Barbour Lane, Glenview Hills, and New Market Pump Stations by a private party. The project includes replacing a 75 horsepower pump with a 200 horsepower pump in the Barbour Lane Pump Station; replacing the existing 8-inch force main with a 12-inch and replacing the existing pumps with two 107 horsepower pumps at Hillsdale Pump Station; replacing the existing pumps with two 65 horsepower pumps and replacing the 4-inch force main with a 6-inch force main at New Market Pump Station; installing a new wet well and two 65 horsepower pumps for Glenview Hills Pump Station. The construction plans for improvements are on file, MSD Record No. 15271.

2.5.10 Combined Sewer Overflow Area Model Development

The CSO hydraulic model provides solutions for the modeling of SSOs within the combined sewer system (CSS) combined sewer overflow (CSO) area boundary. Although they are located within the CSS boundary, they are included in the Final SSDP in order to develop elimination projects for the SSOs. This section provides a summary of the CSO area model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed.

2.5.10.1 SSO Descriptions for the CSO Model

The CSO area is divided into three branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Refer to Figure 2.5.10 for a map of the CSO area branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Branch 42007 addresses one SSO: MSD0042-PS (Sonne Pump Station). The SSO occurs at Sonne Pump Station which is a hauling operation site during wet weather conditions. This SSO is likely caused by upstream flows greater than the available Sonne Pump Station and force main capacity during wet weather or excess wet weather flow in the system caused by excessive I/I. This pump station was recently upgraded to 225 gpm from its original design peak flow capacity of 150 gpm. The pump station upgrade appears to eliminate the 1.27-inch cloudburst event overflows, but SSOs still occur for the 1.52-inch, 1.82-inch, 2.25-inch, and 2.60-inch cloudburst events. The contributing area is single-family residential.

Branch 30917 addresses nine SSOs: 08717, 13931, 13943, 36763, 44396, 44397, 66349, 104223, and 104231. This branch (known as Camp Taylor) is near the Camp Zachary Taylor Neighborhood Association and Subdivision, west of Poplar Level and the Louisville Zoo. The available sewer system information in this area is limited; therefore, an accurate cause of the SSO is unknown. It appears that the collection system is very old in some areas and the capacity is inadequate to handle excess wet weather flow.

Branch 55665 addresses one SSO: 55665 (Hazelwood Pump Station). The SSO occurs at Hazelwood Pump Station which is a hauling operation site during wet weather conditions. The SSO is most likely caused by excess wet weather flow in the system caused by excessive I/I. The contributing area is single-family residential.

2.5.10.2 Validation for the CSO Model

The Camp Taylor area was not modeled due to the lack of available data to build the hydraulic model. Record drawings were available but pertinent information was missing from the drawings. There was no flow monitoring data available to assess the system responses to various wet weather events. The alternative to modeling was to develop a regression equation using estimated SSO volume and total rainfall depth. The equation was applied to the total rainfall depth for various storm events to estimate the SSO volume.

The Sonne Pump Station (hauling operation site) is located within the CSO boundaries. The existing CSO model was expanded to include the service area for the Sonne Pump Station. Calibration of Sonne Pump Station was assumed to be part of the CSO model calibration. Validation was completed by using 1.27-inch, 1.52-inch, 1.82-inch, 2.25-inch, and 2.60-inch cloudburst storm events. Initial validation showed an SSO during the 1.27-inch cloudburst storm with original pump peak flow capacity. Based on pump upgrade information provided by MSD staff in June 2008, no SSO occurred during the 1.27-inch cloudburst storm event.

The Hazelwood Pump Station (hauling operation site) is located just outside of the CSO boundaries. The existing CSO model was expanded to include the service area for Hazelwood Pump Station. Calibration was based on estimated volume hauled and wet well level data. Validation runs reported SSO volumes at the pump station and upstream locations in the system.

2.5.10.3 RDI/I Reduction for the CSO Model

RDI/I reduction was not applied to the CSO area model.

2.5.10.4 Build-out for the CSO Model

There was no build-out applied to the CSO area model because the area is fully developed.

2.5.10.5 Capital Improvement Projects for the CSO Model

MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. One Capital Improvement Project was considered when designing solutions for the branches in the CSO area.

<u>Sonne Pump Station Pump Replacement</u>. This project was completed in 2007. The Sonne Pump Station peak flow capacity was upgraded from 150 gpm to 225 gpm.

2.5.11 Small WQTC Model Development

This section provides a summary of the Small WQTC watershed model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed. The full calibration/validation report is available for review in Appendix 2.3.2.

2.5.11.1 SSO Descriptions for Small WQTCs

The small WQTC areas are divided into eight branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Refer to Figures 2.5.11 through 2.5.13 for maps of the small WQTC branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Berrytown Branch 1 addresses one SSO: MSD0199-LS (Lucas Ln. Pump Station). The SSO is caused by limited Lucas Lane Pump Station wet weather capacity. It is located adjacent to a drainage ditch that drains to Goose Creek. The contributing area is single-family residential.

North Hunting Creek Branch 1 addresses one SSO: MSD1060-LS (Riding Ridge Lift Station). This SSO is likely caused by upstream flows greater than the available Riding Ridge Lift Station wet weather capacity. The contributing area is single-family residential.

North Hunting Creek Branch 2 addresses one SSO: MSD1055-LS (Gunpowder Lift Station). This SSO is likely caused by upstream flows greater than the available Gunpowder Lift Station wet weather capacity. The contributing area is single-family residential.

North Hunting Creek Branch 3 addresses one SSO: 62769, upstream of the Fox Harbor #2 Lift Station. This SSO is most likely caused by upstream flows greater than the available Fox Harbor #1 Lift Station (MSD1053-LS) and Fox Harbor #2 Lift Station (MSD1054-LS) wet weather capacity. The contributing area is single-family residential.

Hunting Creek South Branch 1 addresses one SSO: MSD1065-PS (Fairway View Pump Station). It is located next to the Hunting Creek golf course in a residential area. This SSO is most likely caused by upstream flows greater than the available Fairway View Pump Station wet weather capacity. The contributing areas is single-family residential.

Hunting Creek South Branch 2 addresses one SSO: MSD1063-PS (Deep Creek Pump Station). The SSO occurs at the Deep Creek Pump Station, and is located approximately 550 feet from Harrods Creek in a residential area. This SSO is most likely caused by upstream flows greater than the available Deep Creek Pump Station wet weather capacity. The contributing area is single-family residential.

Lake Forest Branch 1 addresses one SSO: MSD1169-LS (Lake Forest Lift Station). The SSO occurs at the Lake Forest Lift Station and is most likely caused by upstream flows greater than the available Lake Forest Lift Station wet weather capacity. The contributing area is single-family residential.

Chenoweth Hills Branch 1 addresses one SSO: 94187, which is caused by MSD1084-PS (St. Rene Road Pump Station). The SSO is likely caused by upstream flows greater than St. Rene Road Pump Station wet weather capacity. It is located in a residential area, approximately 550 feet from Chenoweth Run. The contributing area is single-family residential.

2.5.11.2 Validation for Small WQTCs

There is one validated SSO in the Berrytown WQTC modeled area (in addition to the SSO at the WQTC) located at the Lucas Lane Pump Station (MSD0199-LS). There is a modeled SSO during the 2.25-inch cloudburst storm at the Creel Lodge Pump Station (MSD1001-LS), which is upstream of the Lucas Lane Pump Station.

Excluding the SSO at the WQTC, there is one validated SSO in the Chenoweth Hills model: MSD1084-PS.

There are four validated SSOs in the North Hunting Creek model. There is a modeled SSO during the 1.52-inch cloudburst storm at manhole 66750, which is upstream of the Gunpowder Lift Station (MSD1055-LS).

Excluding the SSO at the WQTC, there are two validated SSOs in the Hunting Creek South model, and three modeled SSOs: Manhole 68563 (just upstream of Covered Cove Way Pump Station), MSD1064-PS (Westover Pump Station), both located upstream of SSO MSD1065-PS, and Manhole 66584, located upstream of SSO MSD1063-PS.

There is one validated SSO in the Lake Forest model: MSD1169-LS.

For procedures on the validation process, see Section 2.3.5.2.

2.5.11.3 RDI/I Reduction for Small WQTCs

RDI/I reduction was not applied to the Small WQTC models.

2.5.11.4 Build-out for Small WQTCs

There was no build-out applied to the Small WQTC models for future development flows.

2.5.11.5 Capital Improvement Projects for Small WQTCs

MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. There were no Capital Improvement Projects integrated into the Small WQTC hydraulic model.

2.5.12 Pond Creek Model Development

This section provides a summary of the Pond Creek watershed model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed. The full calibration/validation report is available for review in Appendix 2.3.2.

2.5.12.1 SSO Descriptions for Pond Creek

Pond Creek is divided into nine branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Refer to Figure 2.5.14 for a map of the Pond Creek branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Branch 3 addresses four SSOs: 25477, 25478, 25480, and MSD0130-PS (Cooper Chapel Pump Station). The SSOs occur at or directly upstream of the Cooper Chapel Pump Station in a residential area and are most likely caused by upstream flows greater than the available Cooper Chapel Pump Station wet weather capacity. The contributing area is single-family residential.

Branch 4 addresses three SSOs: 35309, 60679 and MSD1013-PS (Cinderella Pump Station). The SSOs 60679 and MSD1013-PS occur at the Cinderella Pump Station in a residential area and are most likely caused by upstream flows greater than the available Cinderella Pump Station wet weather capacity. Manhole 35309 is immediately downstream of the Cinderella PS force main discharge point. Given the drawdown peak flow capacity of the pump station, there is no hydraulic reason for the line to overflow. Model-simulated sedimentation was used immediately downstream to cause the SSO. The contributing area is single-family residential.

Branch 5 addresses three SSOs: 25484, 93719, and MSD0101-PS (Lantana Drive Pump Station). The SSOs occur near the Lantana Dr. Pump Station in a residential area. They are most likely caused by upstream flows greater than the available Lantana Drive Pump Station wet weather capacity. The contributing area is single-family residential.

Branch 6 addresses one SSO: MSD0180-PS (Government Center Pump Station). The SSOs occur at the Government Center Pump Station near the parking lot of a Louisville Metro government building. They are most likely caused by upstream flows greater than the available Government Pump Station wet weather wet weather capacity. The contributing area is primarily single-family residential with some public landuse.

Branch 7 addresses one SSO: 21229-W, which occurs at the Avanti Pump Station in a residential area. It is most likely caused by upstream flows greater than the available Avanti Pump Station wet weather wet weather capacity. The contributing area is single-family residential.

Branch 8 addresses nine SSOs: 19360, 19369, 29933, 29943, 29948, 31083, 31084, 79076, and MSD1010-PS. The SSO MSD1010-PS occurs at the Lea Ann Way Pump Station in a residential area. MSD Operations have replaced the three existing pumps with higher peak flow capacity pumps in 2008, and a fourth pump has been installed by a contractor as a development agreement. The pump station is now rated at 22 mgd peak wet weather capacity, which eliminates the pump station wet weather capacity problems. The SSO 79076 occurs upstream of the Lea Ann Way Pump Station and is due to backwater conditions at the pump station; this SSO should be eliminated by the pump station upgrades. The other SSOs occur upstream of the Lea Ann Way Pump Station at gravity manholes in a residential area. These SSOs are caused by upstream flows greater than the available collector system wet weather capacity. The contributing area is single-family residential.

Branch 9 addresses four SSOs: 27116, 70212, 17724, and MSD0133-PS (Caven Ave. Pump Station). The SSOs 70212 and 17724 occur upstream of a hydraulic constriction at I-65 and the Outer Loop and is due to backwater conditions caused by the constriction in addition to insufficient collector system wet weather capacity. SSOs 27116 and MSD0133-PS are caused by upstream flows greater than the available Caven Avenue. Pump Station wet weather wet weather capacity. The contributing area is single-family residential.

Branch 10 addresses two SSOs: 36419 and MSD1019-PS (Leven Pump Station). The SSOs occur at the Leven Pump Station in a residential area. They are most likely caused by upstream flows greater than the available Leven Pump Station wet weather capacity. The contributing area is single-family residential.

Branch 11 addresses two SSOs: 92098 and MSD1048-PS (Edsel Pump Station). The SSOs occur at the Edsel Pump Station in a residential area. The SSOs are suspected to be caused by maintenance-related issues or excessive I/I during wet weather. They are targeted for investigation by MSD I&FP to determine if a downstream blockage has occurred.

2.5.12.2 Validation for Pond Creek

There is a modeled SSO near each known SSO at the appropriate threshold rain event (explained in Section 2.3.5.2). There were 32 validated SSOs in the Pond Creek modeled area. There were two unvalidated SSOs at manhole 35309 and Edsel Pump Station (MSD1048-Pump Station) and are believed to be maintenance-related issues or I/I induced.

The SSO 35309 is immediately downstream of the Cinderella Pump Station force main. Given the drawdown peak flow capacity of the pump station, there is no hydraulic reason for the line to overflow. Model-simulated sedimentation was used immediately downstream to cause the SSO.

The Valley Village SSOs (32682 and 32688) were not validated as they are due to backwater conditions from Derek R. Guthrie WQTC and will be eliminated as part of the Interim SSDP Derek R. Guthrie WQTC improvements.

2.5.12.3 Sedimentation for Pond Creek

Based on validation results and a review of the interceptor condition assessment, sedimentation was needed in the model for the Pond Creek SSO validation. Sediment amounts, which are listed in Table 2.5.16, were added in the pipes downstream of the listed manhole ID in the hydraulic model.

TABLE 2.5.16

POND CREEK SEDIMENTATION

Sedimentation for SSO Validation	
Site (Manhole ID)	**Sediment Depth**
35308	6 inches
35309	6 inches
Average Sediment Depth	**6 inches**

2.5.12.4 RDI/I Reduction for Pond Creek

The RDI/I reduction process for Pond Creek follows the procedures described in Section 2.3.5.7. Table 2.5.17 summarizes the average peaking factor and projected RDI/I reduction for sub-catchments of Pond Creek. Peaking factor is the peak flow (the monitored maximum flow within the sewer system during a rainfall event) at the flow monitor compared to average DWF at the flow monitor. The average peaking factor is computed from three major storms that occurred in the flow-monitoring period. The projected RDI/I reduction represents the percent of contributing area which was reduced for models used in MSD SSO evaluation modeling (see Appendix 2.3.4 for explanation of peaking factors, RDI/I reduction, and model refinements).

TABLE 2.5.17

POND CREEK PROJECTED RDI/I REDUCTION

Rainfall Dependent Inflow and Infiltration Reduction		
Flow Monitoring Location (Manhole ID)	**Average Peaking Factor**	**Projected RDI/I Reduction**
58046	2.4	0%
41789	2.7	1%
22349	3.5	4%
84926-42	3.7	5%
22324	3.8	6%
22340	3.8	6%
61725-21	3.8	6%
85330	4.0	7%
22304	4.4	8%
61725-36	4.4	8%
64052	4.5	8%
60325	4.8	10%
82316	5.8	14%
84926-21	7.1	19%
32685	11.6	25%
Average Projected RDI/I Reduction		**8.4%**

2.5.12.5 Build-out for Pond Creek

In preparing solutions, potential future development (build-out) was considered. Build-out was only applied as additional flow upstream of known or suspected SSOs. The build-out process for Pond Creek follows the procedures described in Section 2.3.5.10 and the result is listed in Table 2.5.18. There are four general locations where additional flow was added to the model to represent future development and corresponding flows.

TABLE 2.5.18

POND CREEK PROJECTED BUILD-OUT

Build-out Areas		
Branch	**Build-out Input Location (Manhole/node ID)**	**Future development additional DWF (gpd)**
Branch 1	32682	211,789
Branch 4	102339	3,492
Branch 4	35308	3,903
Branch 6	31300	30,904
Total Future Projected Additional Flows		**250,088**

2.5.12.6 Capital Improvement Projects for Pond Creek

MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. There were three Capital Improvement Projects integrated into the Pond Creek hydraulic model. In addition, there was a capital project completed in March 2008 that eliminated the Valley Village Pump Station SSO; a pump was repaired and placed back into service.

MSD Project C94103: Charleswood Subdivision Interceptor. The project includes 3,150 LF of sewer and a system of collector sewers along Cooper Chapel Road between Charleswood Road and Price Lane. All the improvements are planned to be constructed in conjunction with the widening of Cooper Chapel Road. The Cooper Chapel Pump Station will be eliminated and sanitary sewer service will be provided to an area currently using on-site disposal systems (58 properties). This project is scheduled to be completed in 2010.

MSD Project C06295: Zabel Way Pump Station Elimination. The project included 2,000 LF of new 10-inch sewer to eliminate the Zabel Way Pump Station. This project was completed in September 2008.

Lea Ann Way Pump Station Upgrades. MSD Operations have replaced the three existing pumps with higher peak flow capacity pumps in 2008. A fourth pump has been installed by a contractor as a development agreement. The pump station is now rated at 22 mgd peak flow capacity.

2.5.13 Mill Creek Model Development

This section provides a summary of the Mill Creek watershed model development including SSO descriptions, validation process, RDI/I reduction, build-out potential, and existing or proposed capital improvement projects relevant to the watershed. The full calibration/validation report is available for review in Appendix 2.3.2.

2.5.13.1 SSO Descriptions for Mill Creek

Mill Creek is divided into two branches (see Section 2.3.5.6 for details on branching) based on SSO locations and system deficiencies. Refer to Figure 2.5.15 for a map of the Mill Creek branching and SSO locations at the end of this chapter. Brief descriptions of the SSOs in each branch are below.

Branch 1 addresses five SSOs: 04498, 04542, 81814-W (Pioneer Rd. Pump Station), MSD0047-PS (Fern Lea Pump Station), and MSD0050-PS (Garrs Lane Pump Station). The SSO 81814-W occurs at the Pioneer Road Pump Station in a residential area; the SSO is most likely caused by upstream flows greater than the available Pioneer Road Pump Station wet weather capacity. The SSOs at 04542 and MSD0047-PS occur at the Fern Lea Pump Station in a residential area; the SSOs are most likely caused by upstream flows greater than the available Fern Lea Pump Station wet weather capacity. The SSO MSD0050-PS occurs at the Garrs Lane Pump Station in a residential area; the SSO is most likely caused by upstream flows greater than the available Garrs Lane Pump Station wet weather capacity. SSO 04498 occurs along the 10” sewer line between Pioneer Road. Pump Station and Fern Lea Pump Station and most likely occurs due to backwater conditions from the Fern Lea Pump Station.

Branch 2 addresses one SSO: 04699-W. The SSO occurs at the East Rockford Pump Station in a residential area. This pump station is built in an area prone to surface flooding, which most likely inundates the pump station and causes the SSO.

2.5.13.2 Validation for Mill Creek

There is a modeled SSO near each known SSO at the appropriate threshold rain event (explained in Section 2.3.5.2). There are four validated SSOs in the Mill Creek modeled area.

The Derek R. Guthrie SSOs (22385, 22370, 59169, and MSD0277) were not validated as they are due to backwater conditions from Derek R. Guthrie WQTC and will be eliminated as part of the Interim SSDP Derek R. Guthrie WQTC improvements.

2.5.13.3 RDI/I Reduction for Mill Creek

The RDI/I reduction process for Mill Creek follows the procedures described in Section 2.3.5.7. Table 2.5.19 summarizes the average peaking factor and projected RDI/I reduction for sub-catchments of Mill Creek. Peaking factor is the peak flow (the monitored maximum flow within the sewer system during a rainfall event) at the flow monitor compared to average DWF at the flow monitor. The average peaking factor is computed from three major storms that occurred in the flow-monitoring period. The projected RDI/I reduction represents the percent of contributing area which was reduced for models used in MSD SSO evaluation modeling (see Appendix 2.3.4 for explanation of peaking factors, RDI/I reduction, and model refinements).

TABLE 2.5.19

MILL CREEK PROJECTED RDI/I REDUCTION

Rainfall Dependent Inflow and Infiltration Reduction		
Flow Monitoring Location (Manhole ID)	**Average Peaking Factor**	**Projected RDI/I Reduction**
100763	2.7	1%
33000	3.1	3%
26716-NE	3.3	4%
22382	3.4	4%
08689	3.5	4%
26716-NW	3.6	5%
81919	3.8	6%
96658	4.1	7%
59250	4.3	8%
56968	5.9	14%
Average Projected RDI/I Reduction		**5.6%**

2.5.13.4 Build-out for Mill Creek

In preparing solutions, potential future development (build-out) was considered. Build-out was only applied as additional flow upstream of known or suspected SSOs. The build-out process for Mill Creek follows the procedures described in Section 2.3.5.10 and listed in Table 2.5.20. There are five general locations where additional flow was applied to the model to represent future development and corresponding flows.

TABLE 2.5.20

MILL CREEK PROJECTED BUILD-OUT

Build-out Areas		
Branch	**Build-out Input Location (Manhole/node ID)**	**Future development additional DWF (gpd)**
NB01	22370	23,500
NB01	22385	3,600
NB01	59169	17,100
NB01	MSD0047	9,600
Total Future Projected Additional Flows		**53,800**

2.5.13.5 Capital Improvement Projects for Mill Creek

All MSD projects within the current five-year capital plan were considered in branch solutions. In considering these projects, modelers were given the latitude to modify design parameters (such as pipe diameter or pump capacity) to the extent of the preliminary project design. There was one Capital Improvement Project integrated into the Mill Creek hydraulic model.

MSD Project Budget ID B06208 Shively Interceptor. This project will eliminate five pump stations (Jacks Lane, Pioneer Road, Fern Lea, Garrs Lane, and City Park Pump Stations) to provide gravity service and eliminate SSOs due to Mechanical and/or Power failures.

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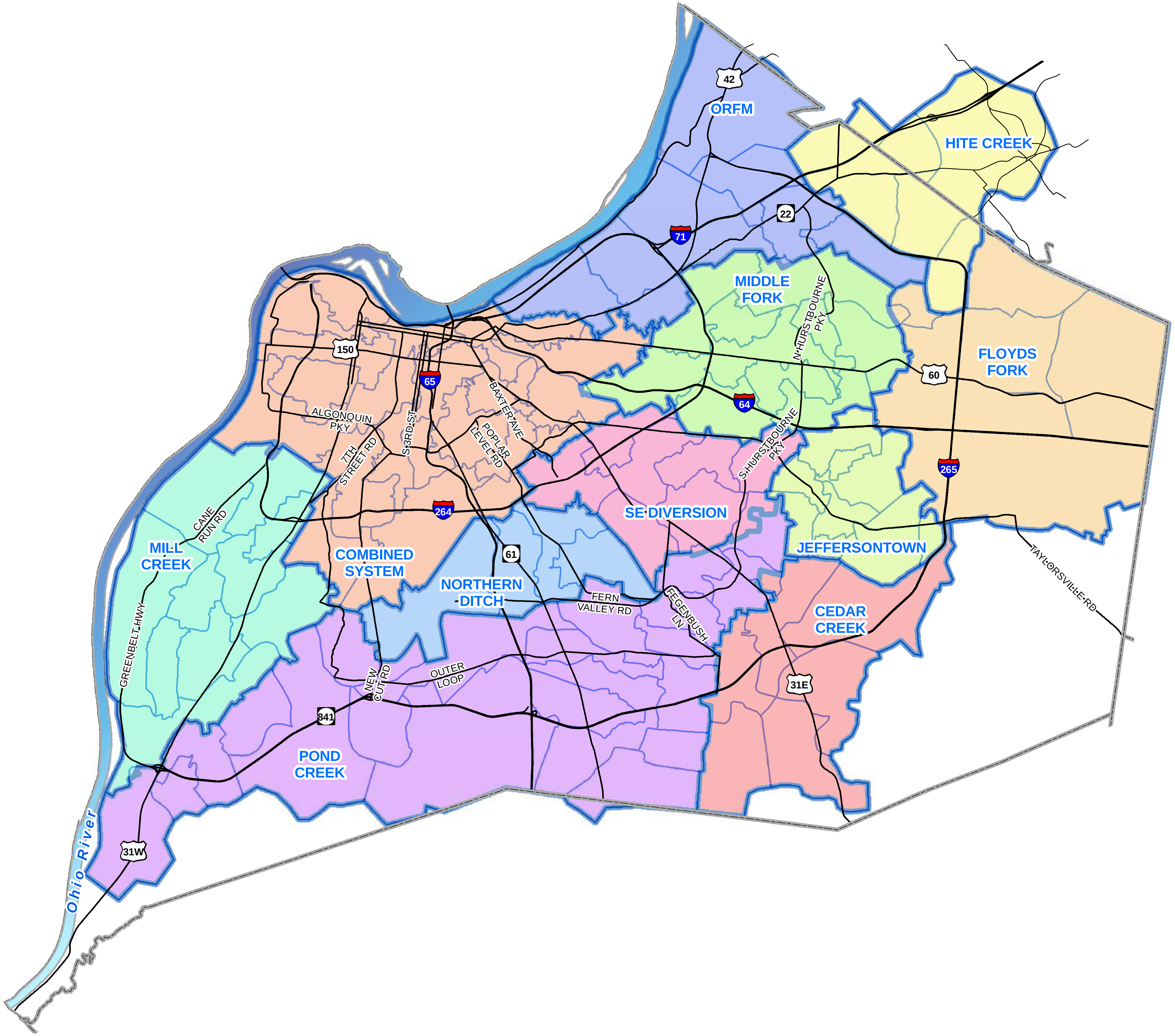
Final SSDP Model Areas

Figure 2.3.1



Legend

Jefferson County Boundary

Major Roads

System Capacity Credit Basins

- Cedar Creek
- Combined System
- Floyds Fork
- Hite Creek
- Jeffersontown
- Middle Fork
- Mill Creek
- Northern Ditch
- ORFM
- Pond Creek
- SE Diversion
- SCAP Sub Areas
- Ohio River

1 inch = 14,000 feet
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Some boundaries are uniquely symbolized within the map.

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SDI Inc. Figure 2.3.1 Model Areas.mxd

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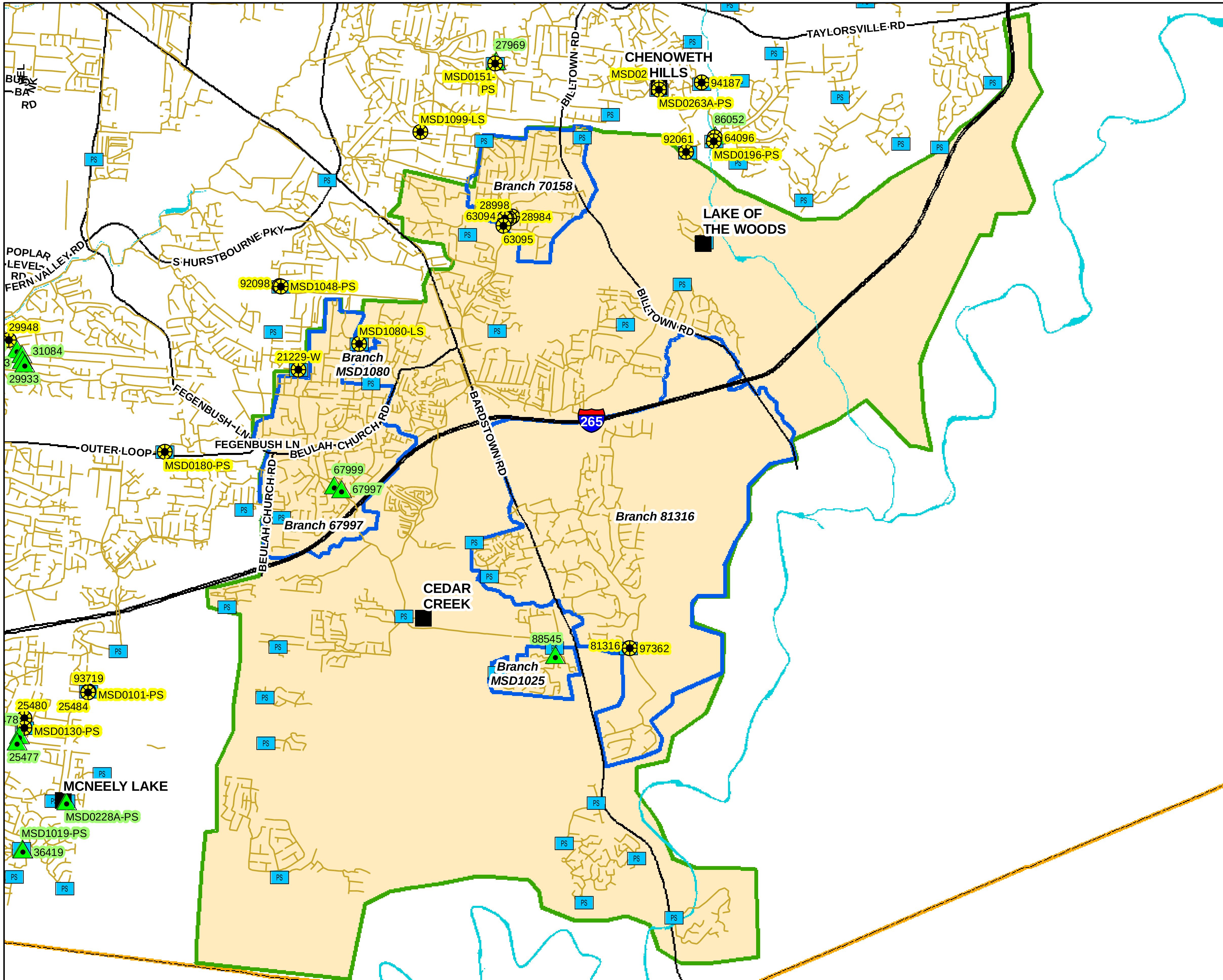

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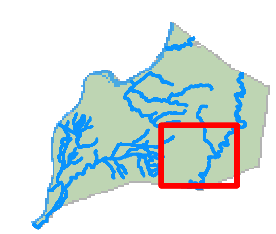
Cedar Creek Model Area and Branch Network

Figure 2.3.2

Legend

- Documented SSO
- Suspected SSO
- Pump Station
- WWTP
- Sewer Lines
- Major Road
- Major Stream
- Credits Catchment Boundary
- CSO Area
- Branch Boundary
- County Boundary

1 inch = 4,000 feet
Scalable when printed on 11" X 17" paper



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CMS Inc. Figure 2.3.2 Cedar_Creek_credit catchment

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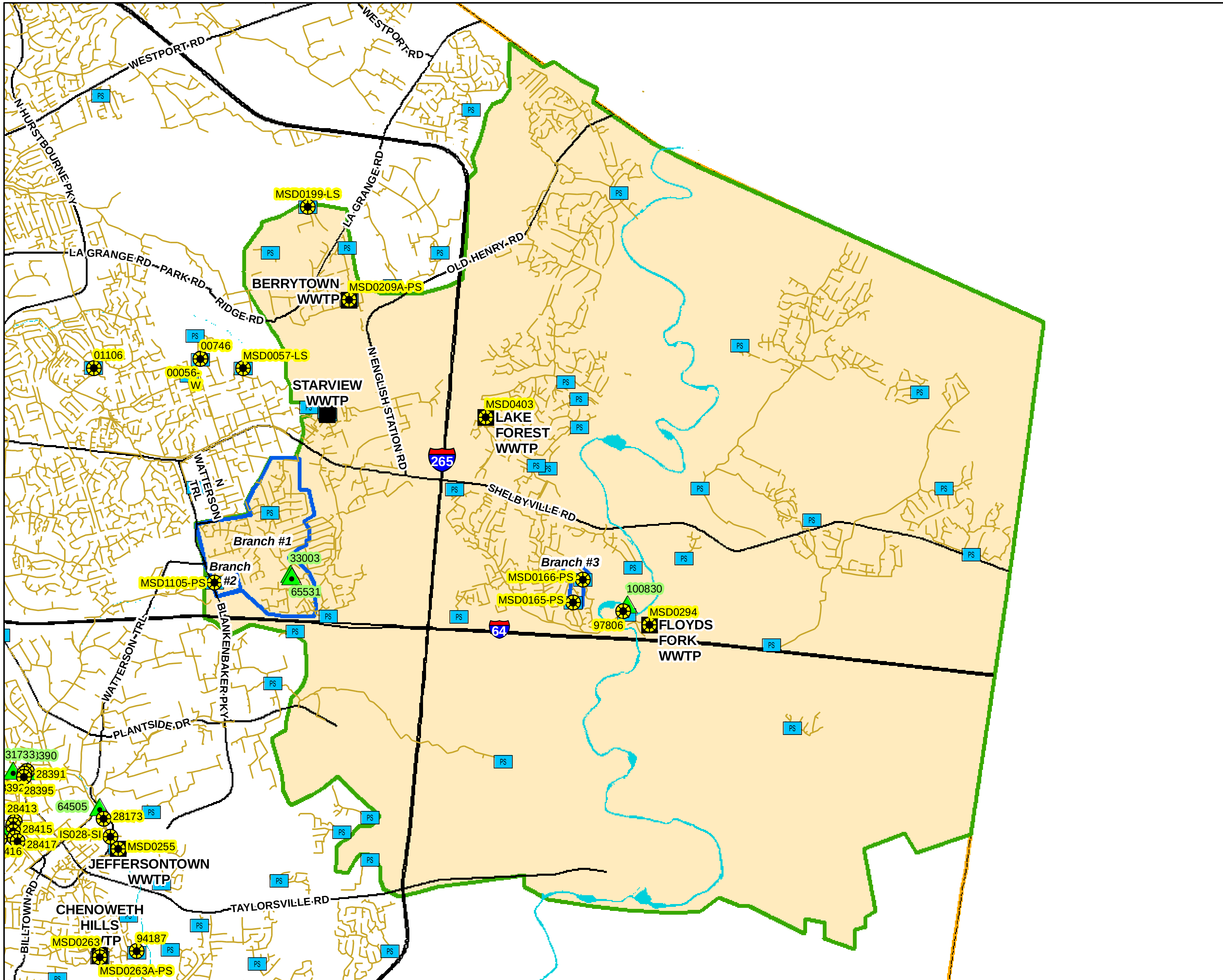
Floyd Fork Model Area and Branch Network

Figure 2.3.3



Legend

- Documented SSO
- Suspected SSO
- Pump Station
- WWTP
- Sewer Lines
- Major Road
- Major Stream
- Credits Catchment Boundary
- CSO Area
- Branch Boundary
- County Boundary

1 inch = 4,600 feet
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CMS Inc. Figure 2.3.3 Floyds Fork_credit catchment

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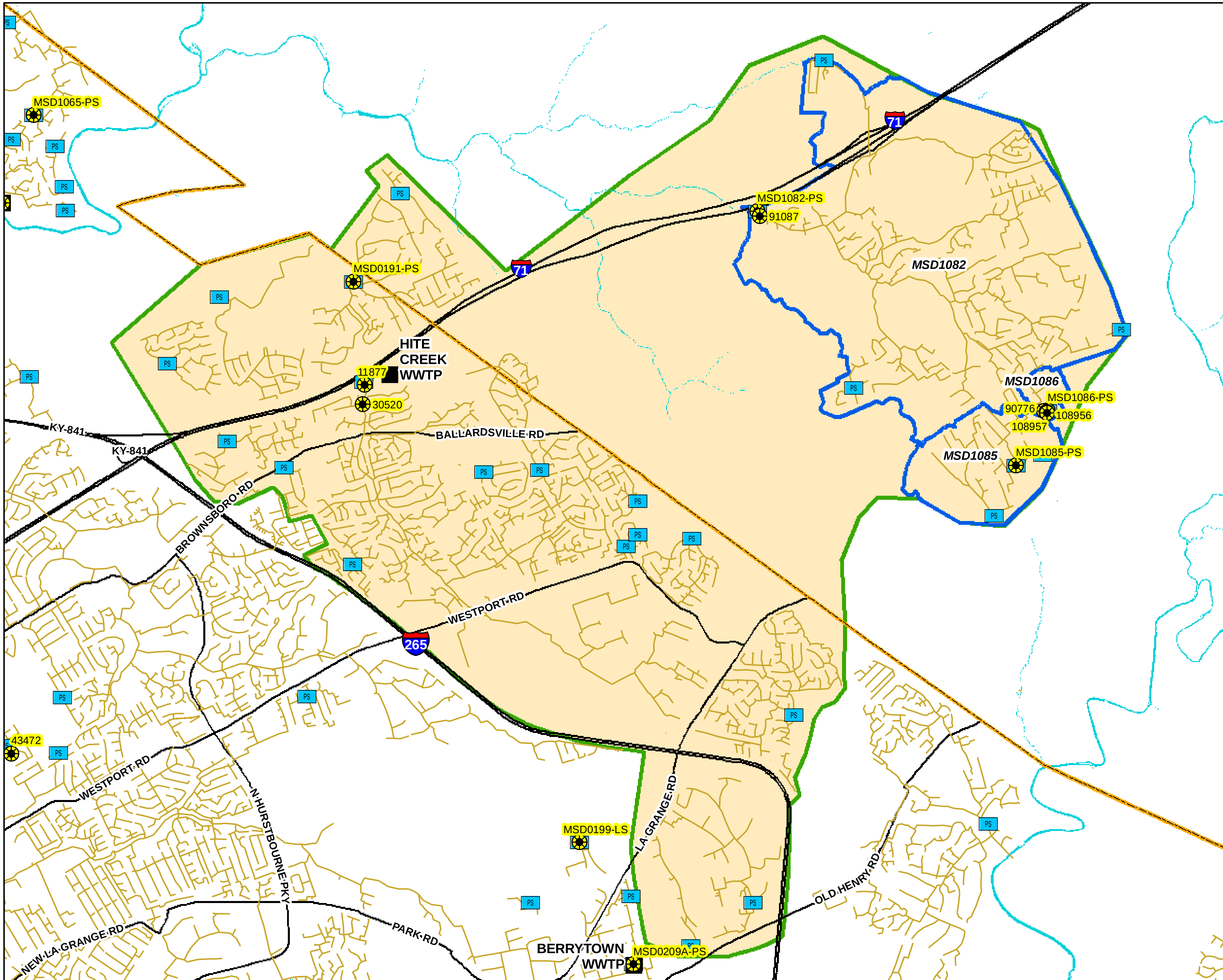
Hite Creek Model Area and Branch Network

Figure 2.3.4



Legend

- Documented SSO
- Suspected SSO
- Pump Station
- WWTP
- Sewer Lines
- Major Road
- Major Stream
- Credits Catchment Boundary
- CSO Area
- Branch Boundary
- County Boundary

1 inch = 3,500 feet
Scalable when printed on 11" X 17" paper

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CMS Inc. Figure 2.3.4 hite_Creek_credit catchment

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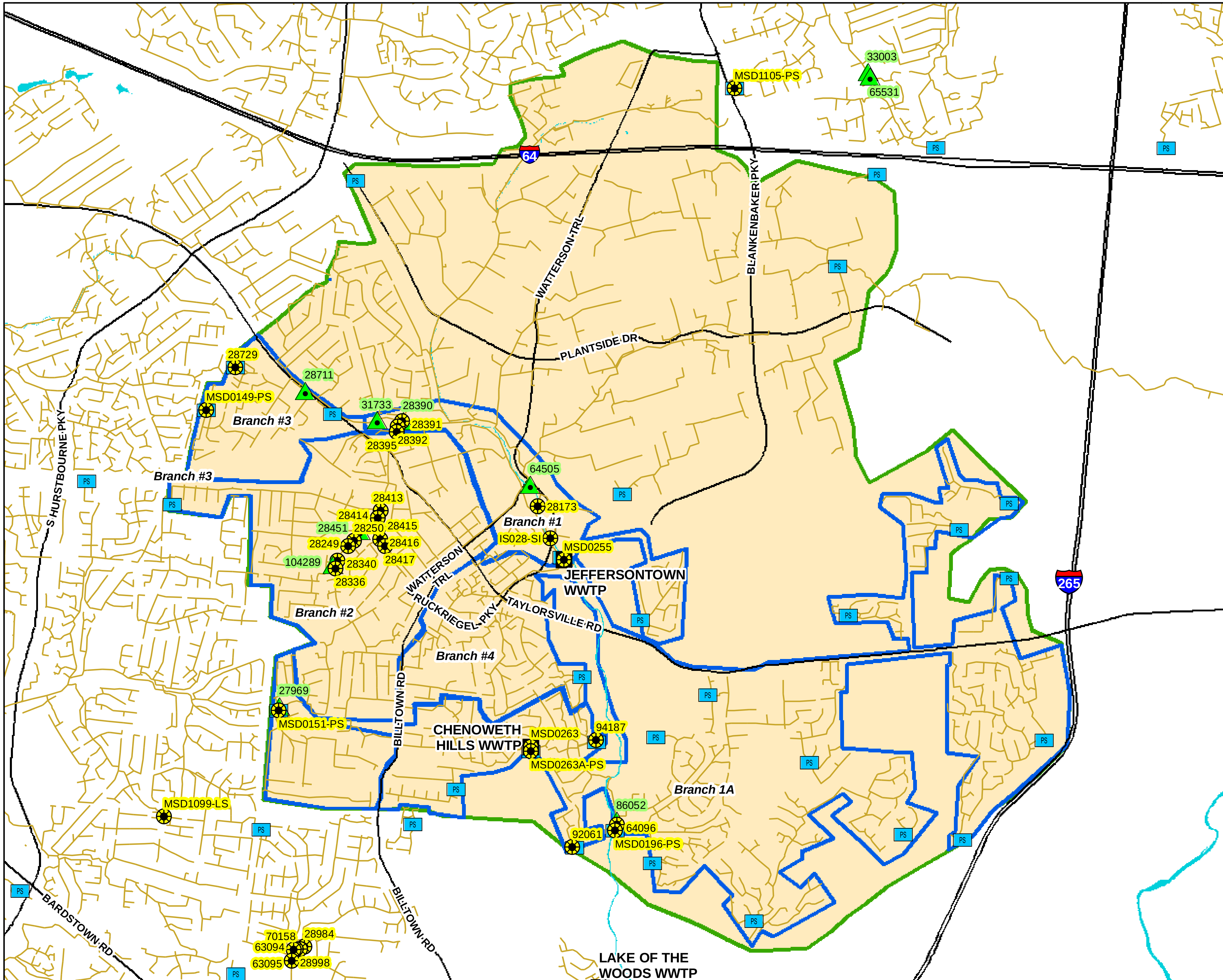
**Jeffersontown Model Area
and Branch Network**

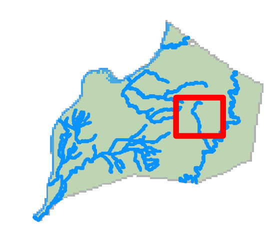
Figure 2.3.5



Legend

- Documented SSO
- Suspected SSO
- WWTP
- Pump Station
- Sewer Lines
- Major Road
- Major Stream
- Credits Catchment Boundary
- CSO Area
- Branch Boundary
- County Boundary

1 inch = 2,600 feet
Scalable when printed on 11" X 17" paper



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CMS Inc. Figure 2.3.5_jeffersontown_credit catchment

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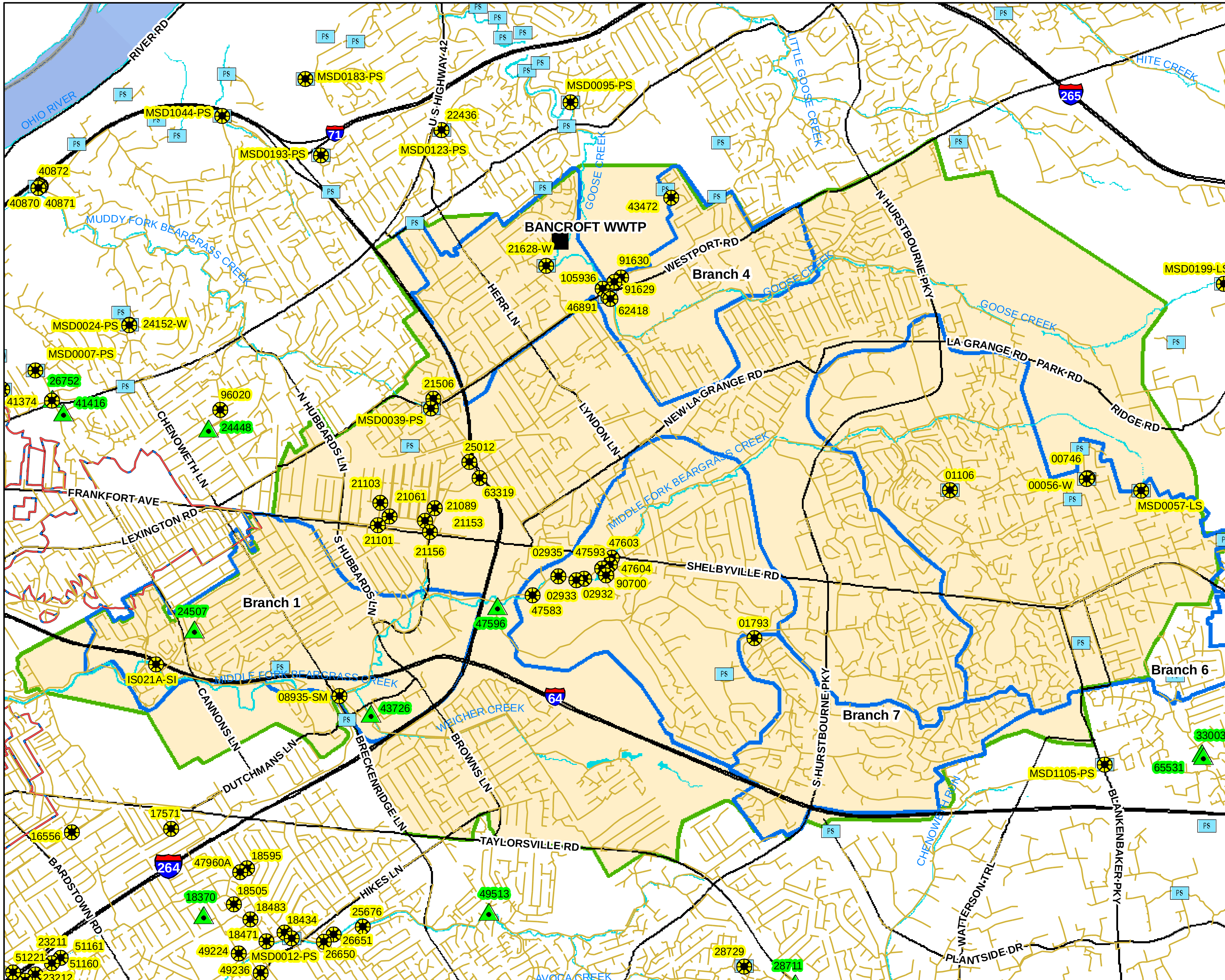

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Middle Fork Model Area and Branch Network

Figure 2.3.6

Legend

- Documented SSO
- Suspected SSO
- Pump Station
- Sewer Lines
- Major Road
- Major Stream
- Credits Catchment Boundary
- CSO Area
- Branch Boundary
- County Boundary

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MSD Metropolitan Sewer District

PROJECT WIN

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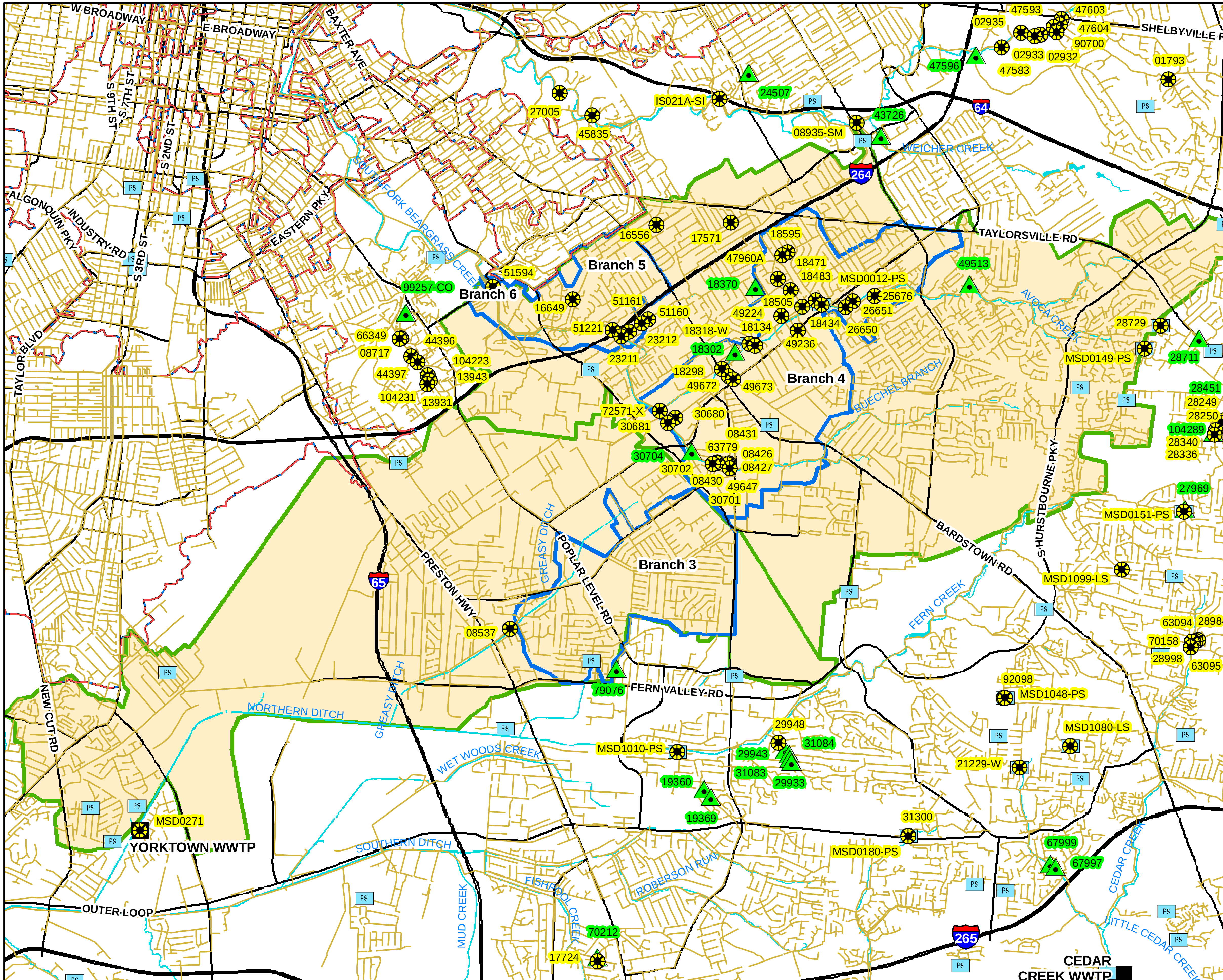
Southeastern Diversion
Model Area and Branch Network
Figure 2.3.7



Legend

- Documented SSO
- Suspected SSO
- Pump Station
- Sewer Lines
- Major Road
- Major Stream
- Credits Catchment Boundary
- CSO Area
- Branch Boundary
- County Boundary

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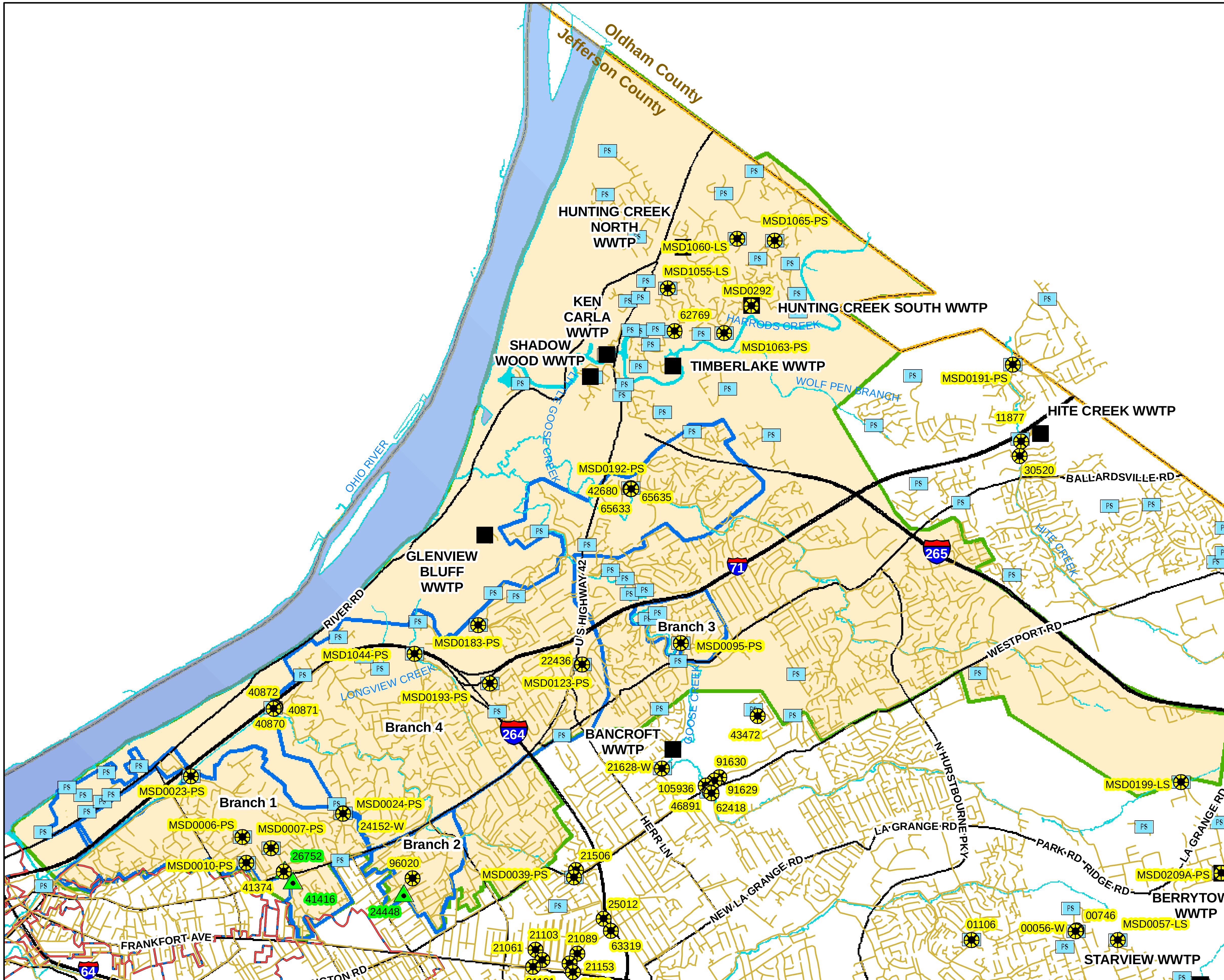
**ORFM Model Area
and Branch Network
Figure 2.3.8**



Legend

- Documented SSO
- Suspected SSO
- Pump Station
- Sewer Lines
- Major Road
- Major Stream
- Credits Catchment Boundary
- CSO Area
- Branch Boundary
- County Boundary

1 inch equals 4,700 feet
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SDI Inc. Figure 2.3.8 ORFM Model Area and Branch Network.mxd

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CSS Model Area and Branch Network
Figure 2.3.9

Legend

- Documented SSO
- Suspected SSO
- Pump Station
- Sewer Lines
- Major Road
- Major Stream
- Credits Catchment Boundary
- CSO Area
- Branch Boundary
- County Boundary

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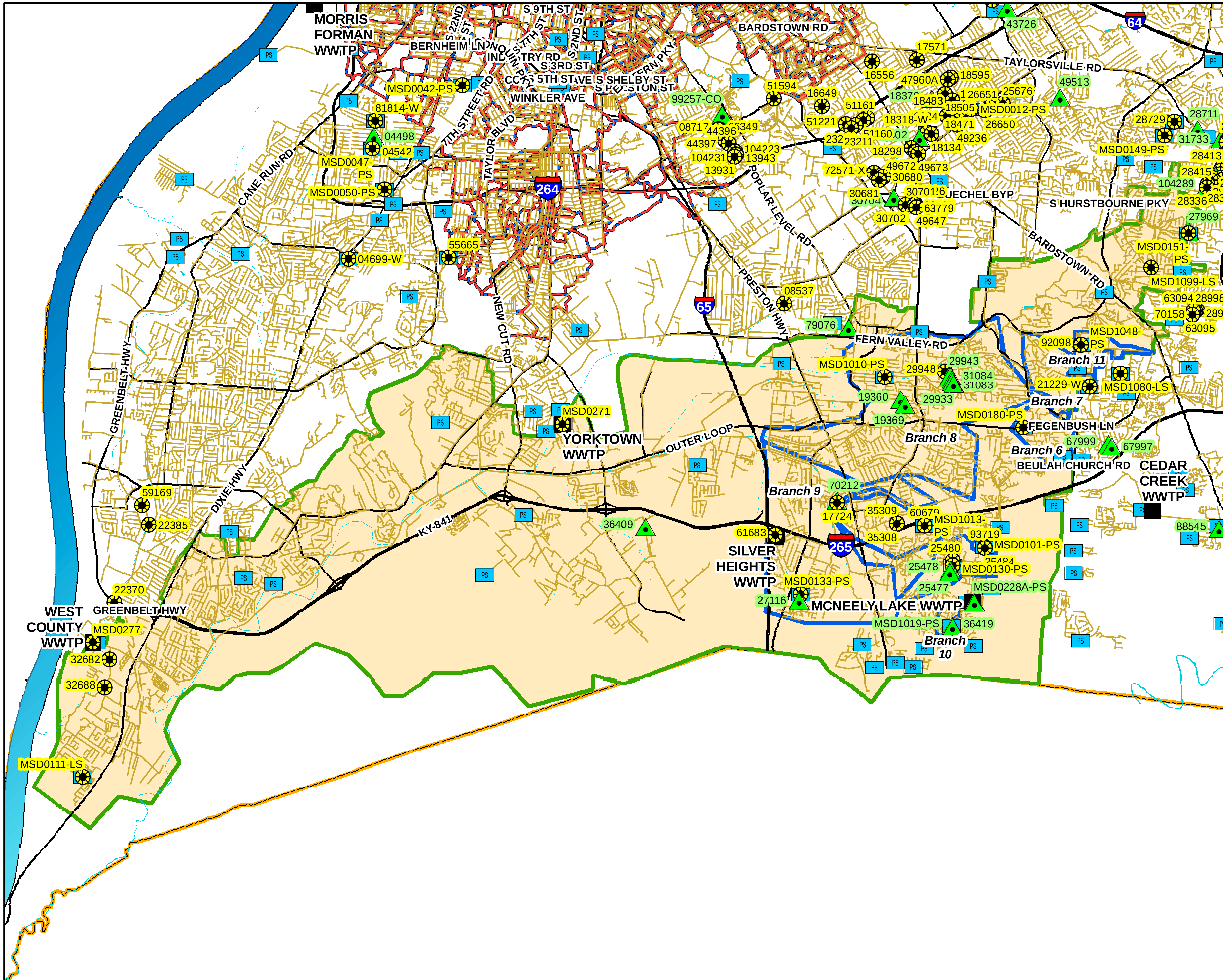

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Pond Creek Model Area and Branch Network

Figure 2.3.10

Legend

- Documented SSO
- Suspected SSO
- Pump Station
- WWTP
- Sewer Lines
- Major Road
- Major Stream
- Credits Catchment Boundary
- CSO Area
- Branch Boundary
- County Boundary

1 inch = 8,000 feet
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CMS Inc. Figure 2.3.10_pond_Creek_credit catchment

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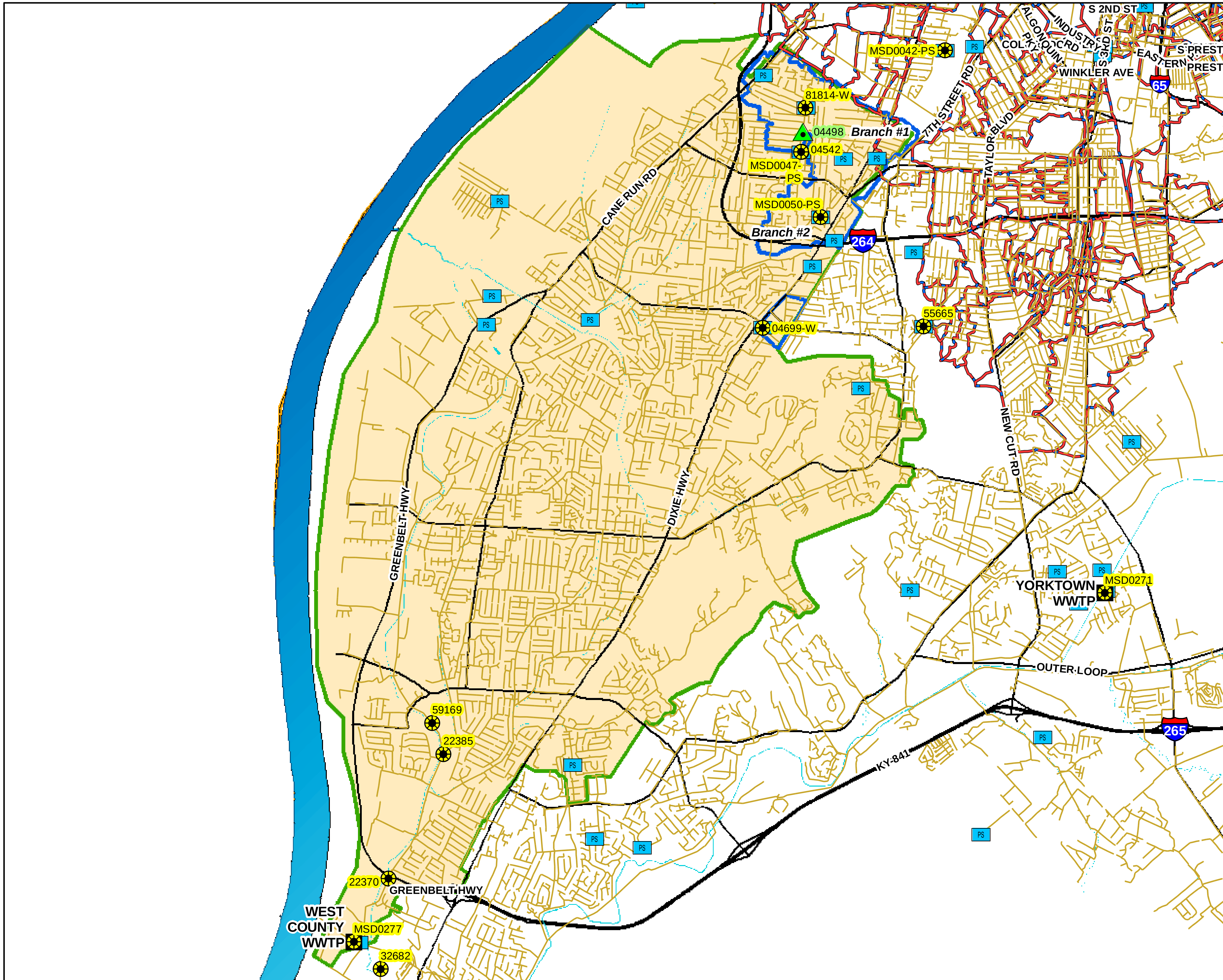
Mill Creek Model Area and Branch Network

Figure 2.3.11



Legend

- Documented SSO
- Suspected SSO
- Pump Station
- WWTP
- Sewer Lines
- Major Road
- Major Stream
- Credits Catchment Boundary
- CSO Area
- Branch Boundary
- County Boundary

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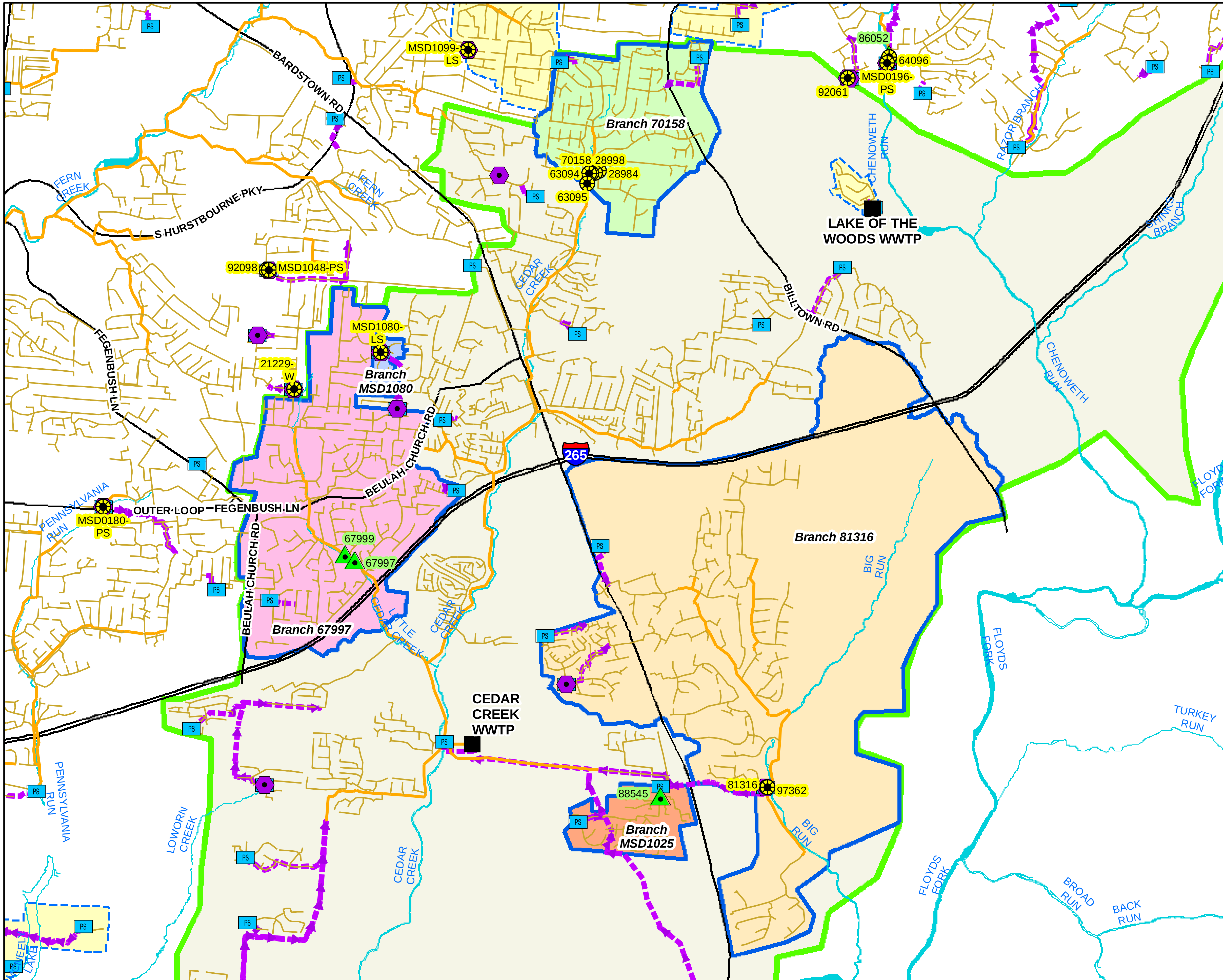

Integrated Overflow Abatement Plan

Vol. 3 Sanitary Sewer Discharge Plan

Cedar Creek Sewershed
Branch Network
Figure 2.5.3

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Major Road
- Streams
- CSO Area
- Small WWTP Service Area
- Large WWTP Service Area
- Branch 67997
- Branch 70158
- Branch 81316
- Branch MSD1080
- Branch MSD1025
- County Boundary

1 inch = 2,800 feet
Scalable when printed on 11" X 17" paper

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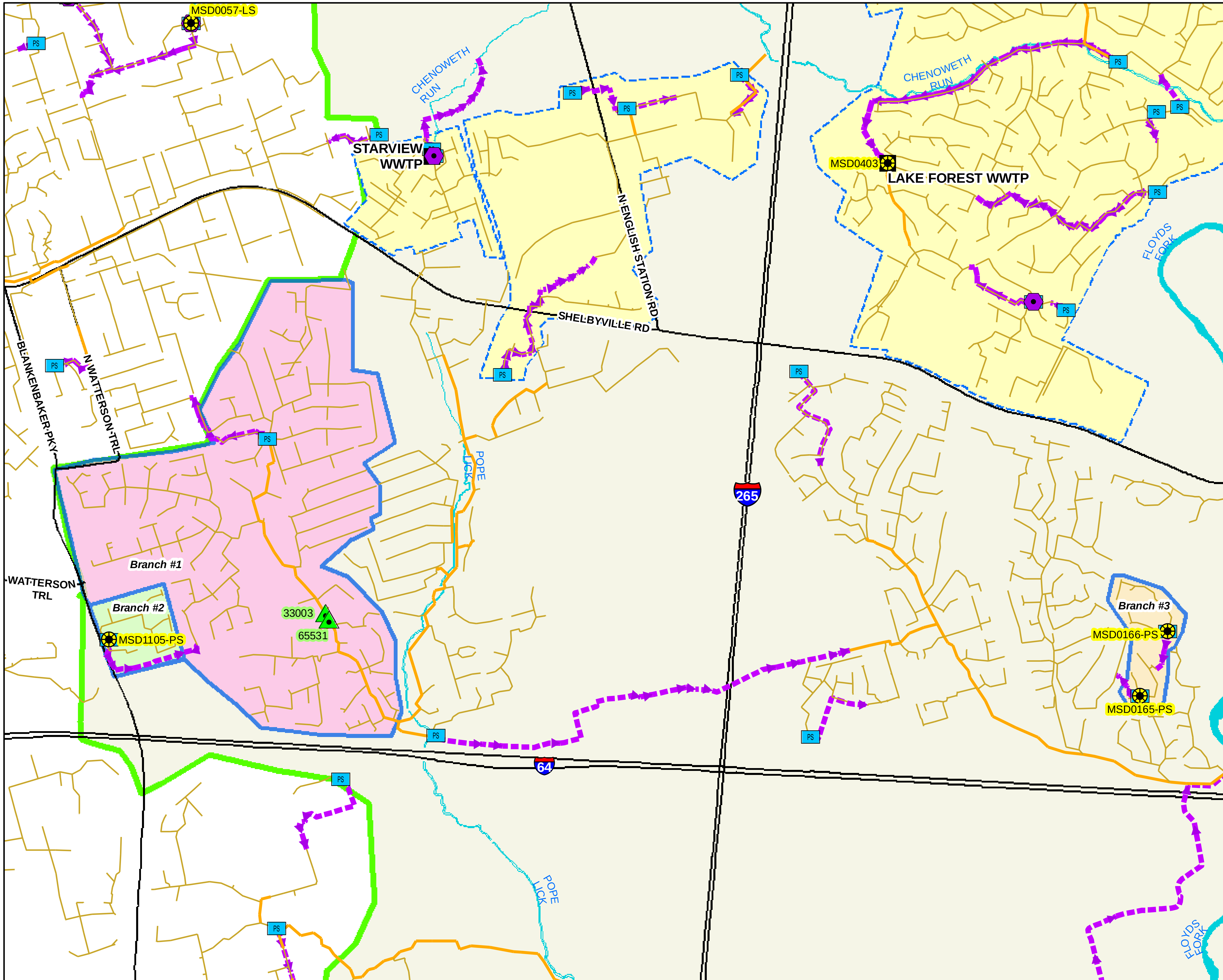
Floyds Fork Sewershed
Branch Network
Figure 2.5.4



Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Major Road
- Streams
- CSO Area
- Small WWTP Service Area
- Large WWTP Service Area
- Branch #1
- Branch #2
- Branch #3
- County Boundary

1 inch = 1,600 feet
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CMS Inc. Figure 2.5.4 Floyds_Fork_Branch_11x17_size.mxd

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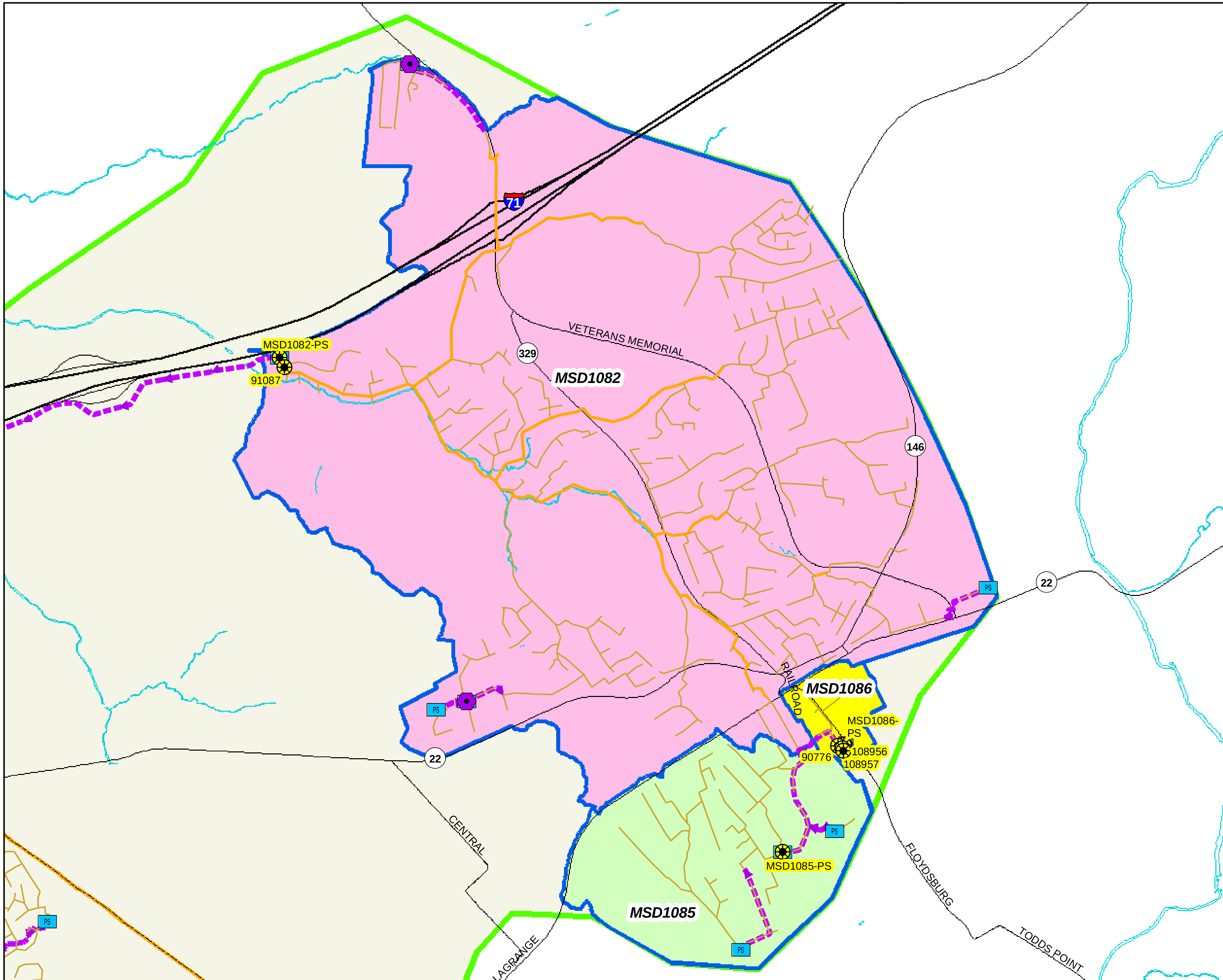
Vol. 3 Sanitary Sewer Discharge Plan

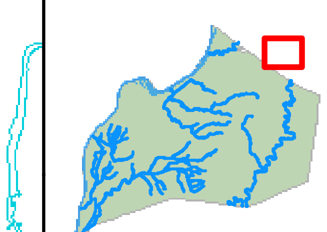
Hite Creek Sewershed
Branch Network
Figure 2.5.5



Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Major Road
- Streams
- CSO Area
- Small WWTP Service Area
- Large WWTP Service Area
- Branch MSD1085
- Branch MSD1086
- Branch MSD1082
- County Boundary

1 inch = 1,800 feet
Scalable when printed on 11" X 17" paper



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CMS Inc. Figure 2.5.5 Hite Creek_Branch_11x17_size.mxd

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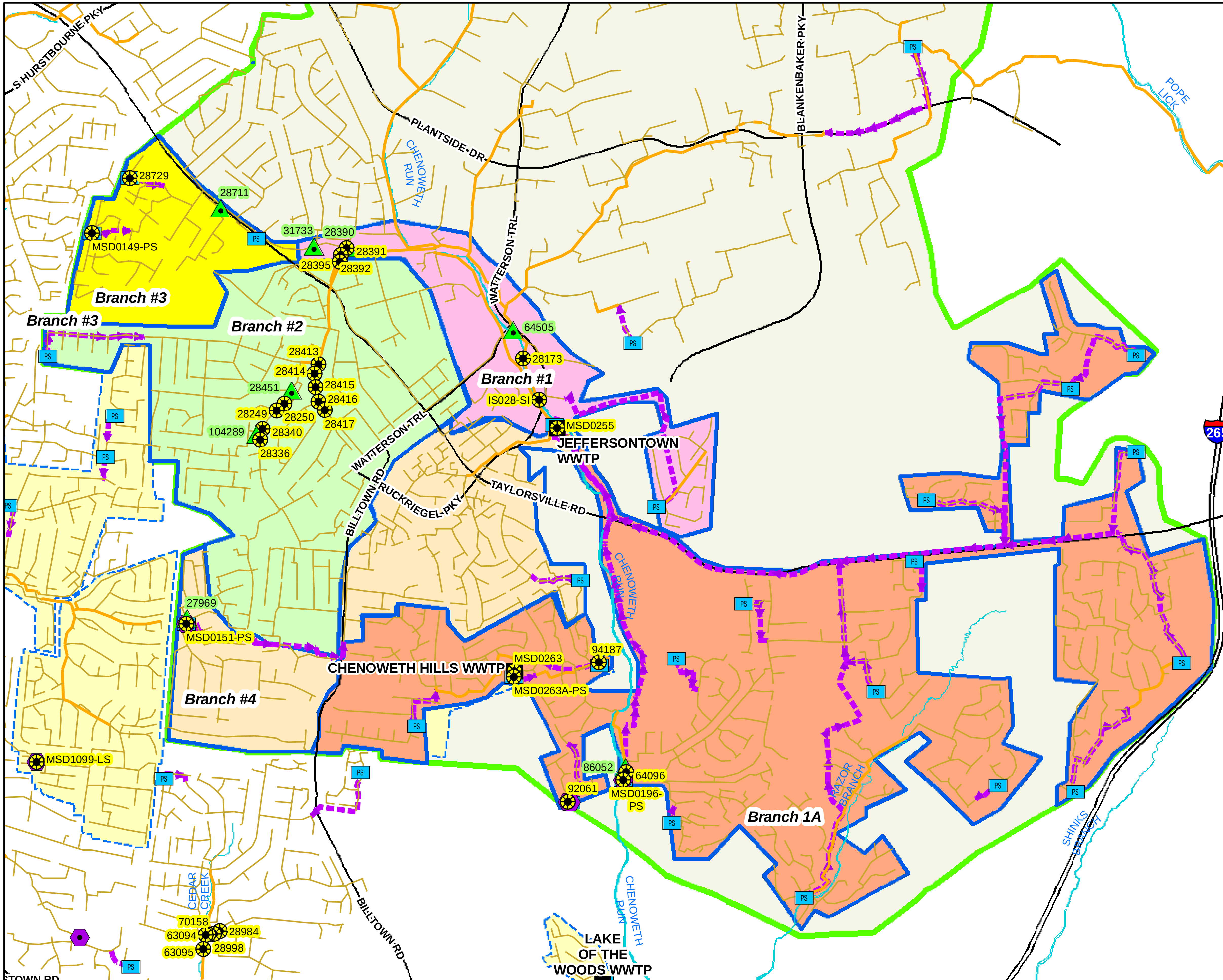

Integrated Overflow Abatement Plan

Vol. 3 Sanitary Sewer Discharge Plan

Jeffersontown Sewershed
Branch Network
Figure 2.5.6

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Major Road
- Streams
- CSO Area
- Small WWTP Service Area
- Large WWTP Service Area
- Branch #1
- Branch #2
- Branch #3
- Branch #4
- Branch 1A
- County Boundary

1 inch = 2,000 feet
Scalable when printed on 11" X 17" paper

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LOJIC MSD PROJECT WIN

CMS Inc. Figure 2.5.6 Jeffersontown_Branch_11x17_size.mxd

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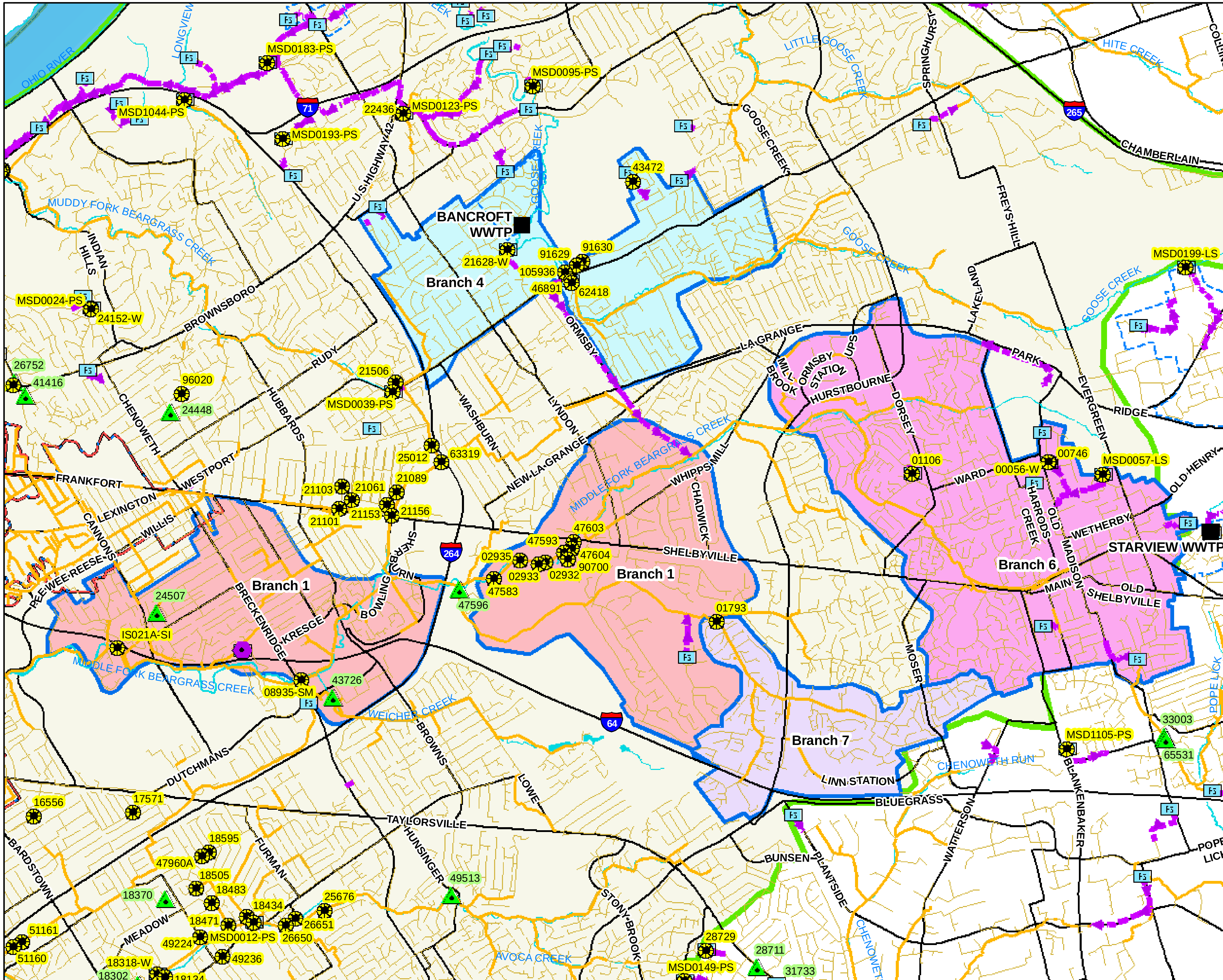
Vol. 3 - Sanitary Sewer Discharge Plan

Morris Forman Sewershed
Middle Fork
Branch Network
Figure 2.5.7



Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Streams
- Interstates
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Branch 1
- Branch 4
- Branch 6
- Branch 7
- County Boundary

1 inch equals 3,600 feet
Scalable when printed on 11" X 17" paper

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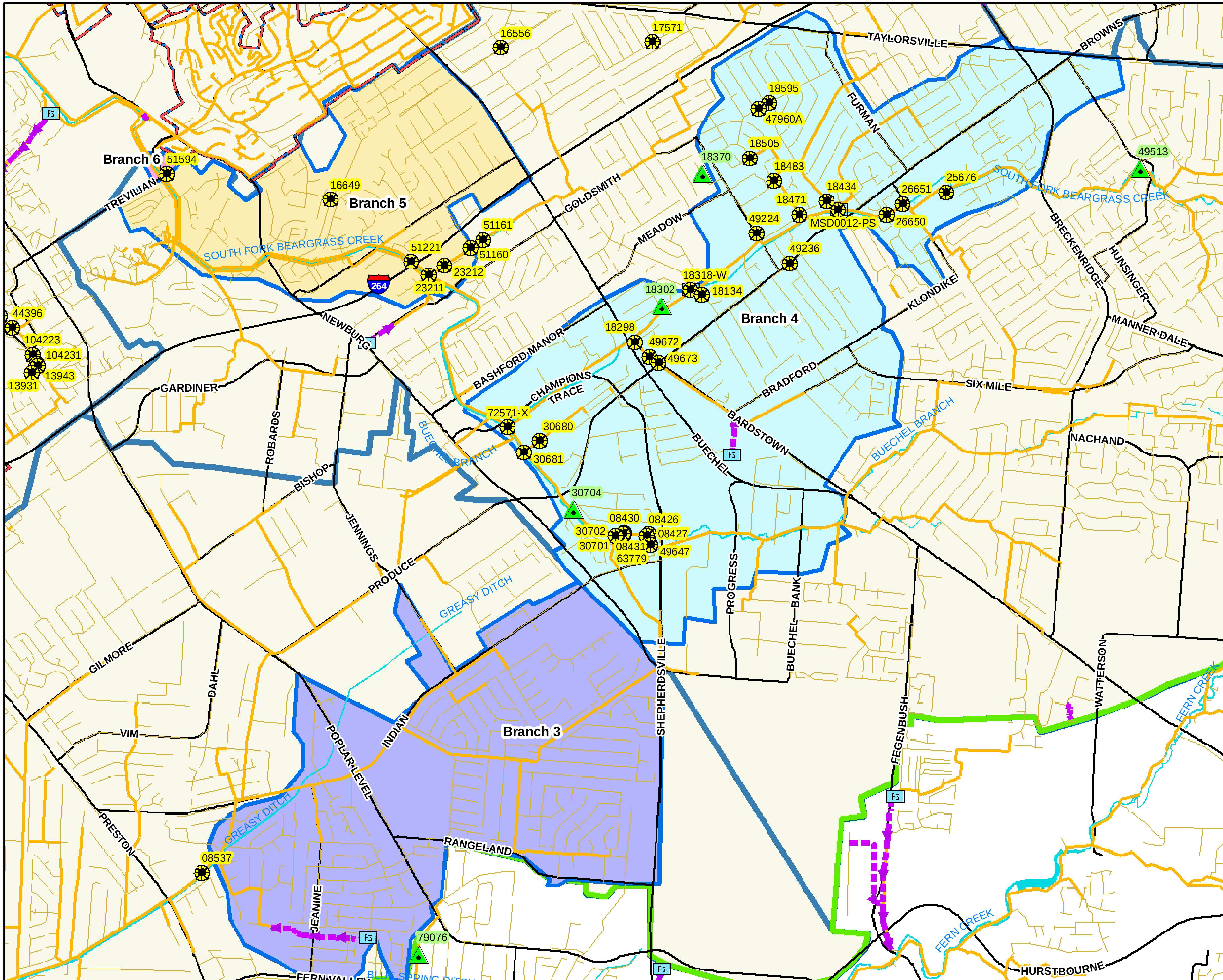

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Morris Forman Sewershed
Southeast Diversion
Branch Network
Figure 2.5.8

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Streams
- Interstates
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Branch 3
- Branch 4
- Branch 5
- Branch 6
- County Boundary

1 inch equals 2,350 feet
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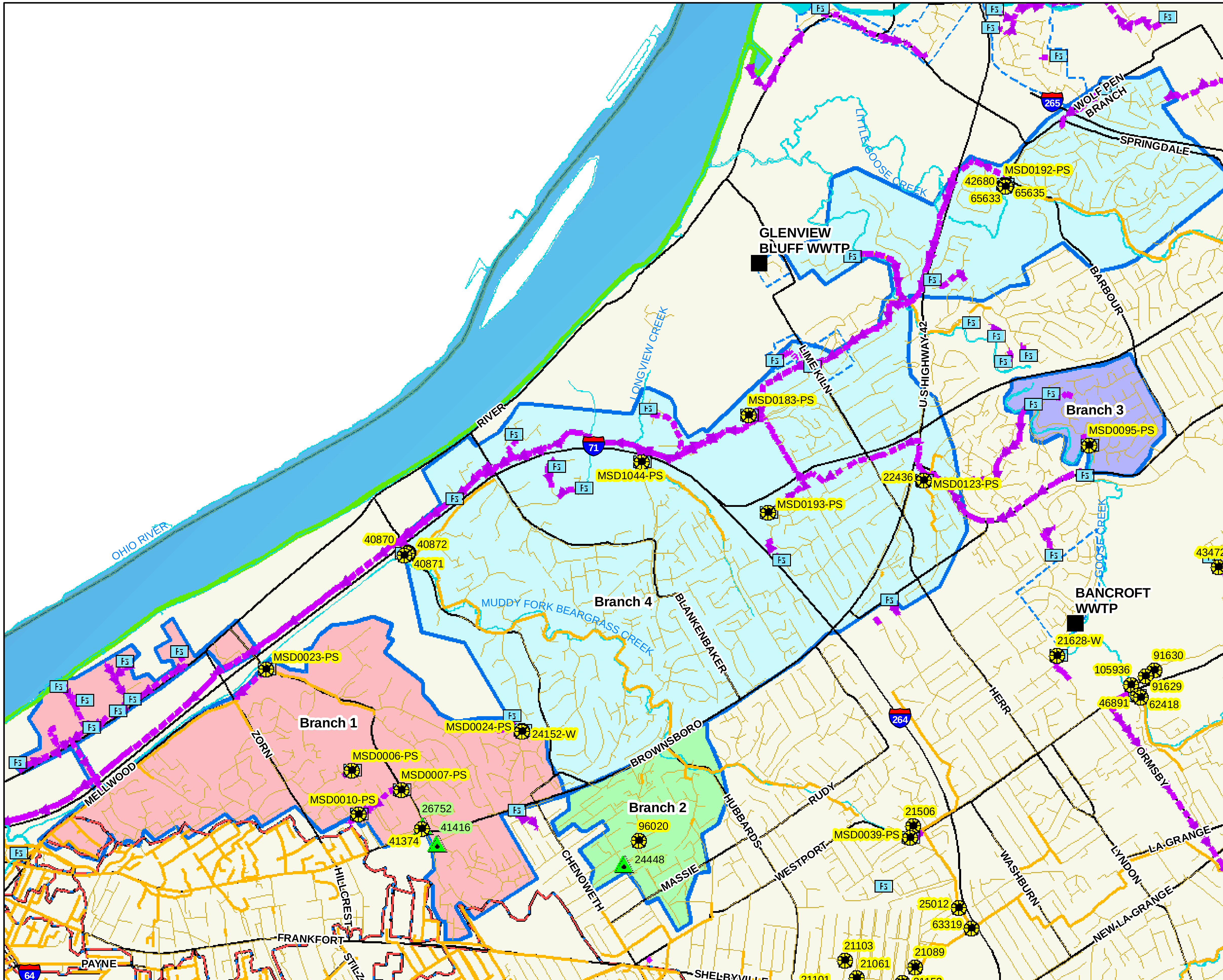
Vol. 3 - Sanitary Sewer Discharge Plan

Morris Forman Sewershed
ORFM
Branch Network
Figure 2.5.9



Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Streams
- Interstates
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Branch 1
- Branch 2
- Branch 3
- Branch 4
- County Boundary

1 inch equals 2,800 feet
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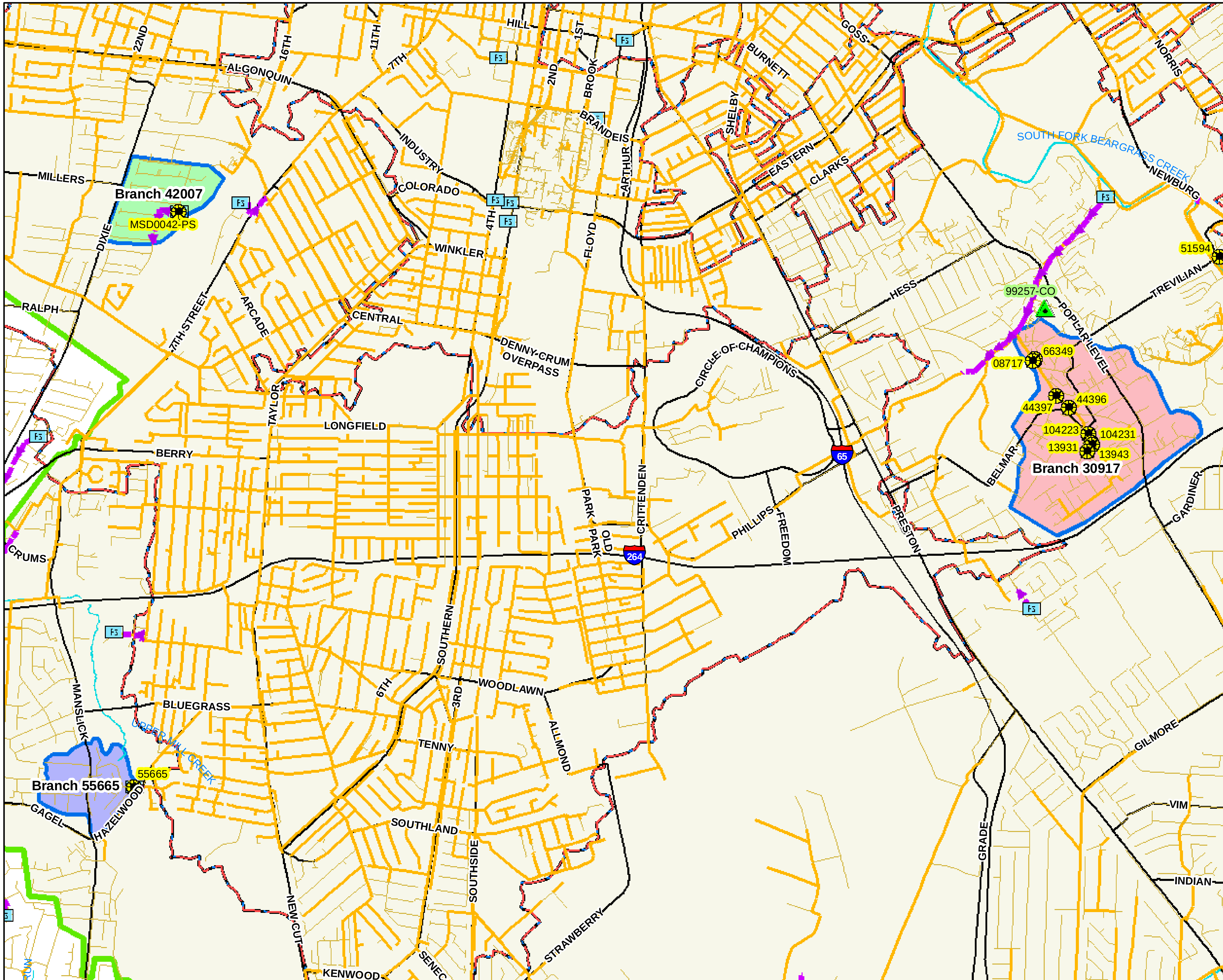

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Morris Forman Sewershed
CSS Area
Branch Network
Figure 2.5.10

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Streams
- Interstates
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Branch 30917
- Branch 42007
- Branch 55665
- County Boundary

1 inch equals 2,400 feet
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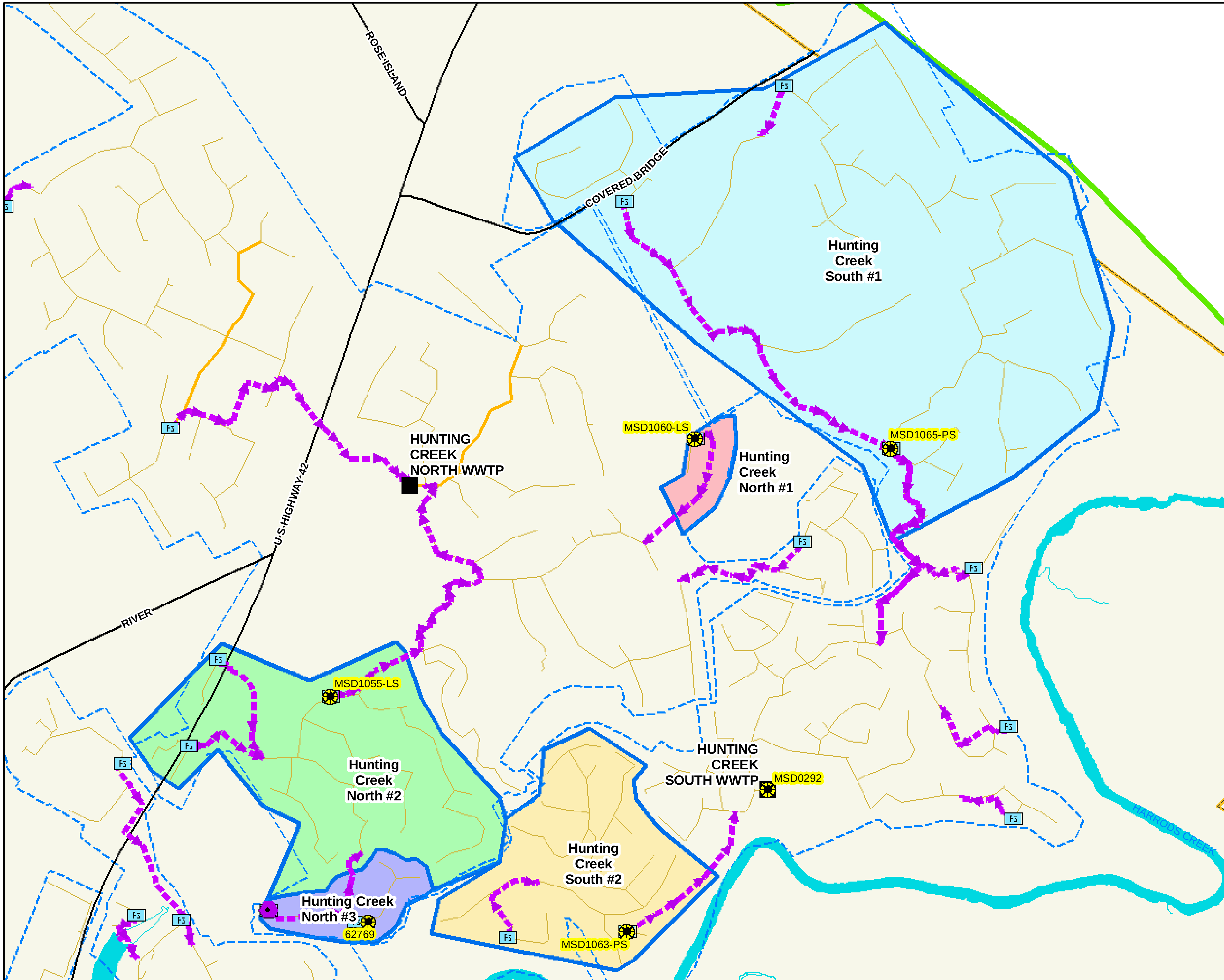
Vol. 3 - Sanitary Sewer Discharge Plan

Morris Forman Sewershed
Small WWTP - Hunting Creek Area
Branch Network
Figure 2.5.11



Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Streams
- Interstates
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Hunting Creek North #1
- Hunting Creek North #2
- Hunting Creek North #3
- Hunting Creek South #1
- Hunting Creek South #2
- County Boundary

1 inch equals 900 feet
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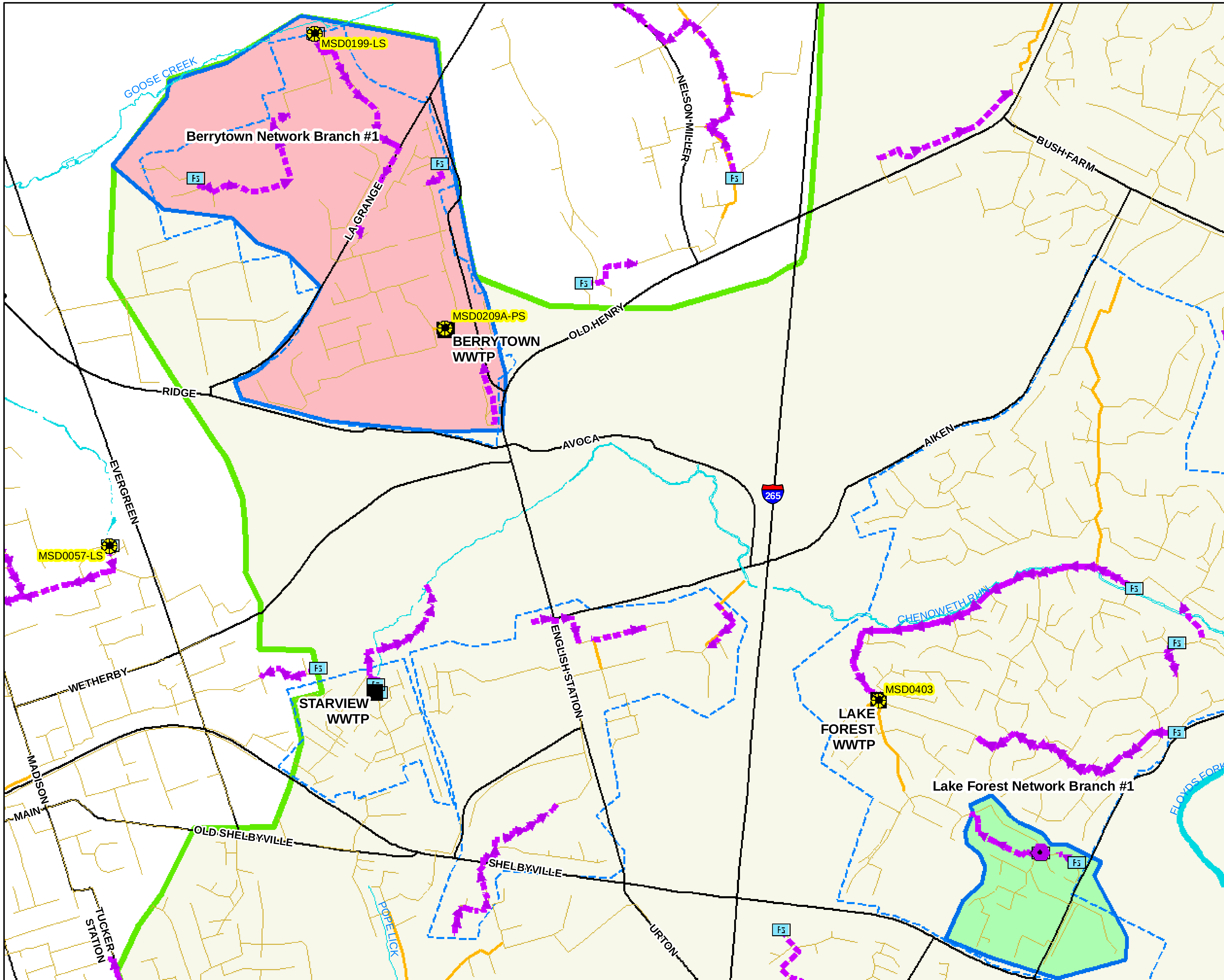
Morris Forman Sewershed

Small WWTP - Berrytown and Lake Forest Area Branch Network

Figure 2.5.12



Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Streams
- Interstates
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Berrytown Network Branch #1
- Lake Forest Network Branch #1
- County Boundary

1 inch equals 1,450 feet
Scalable when printed on 11" X 17" paper

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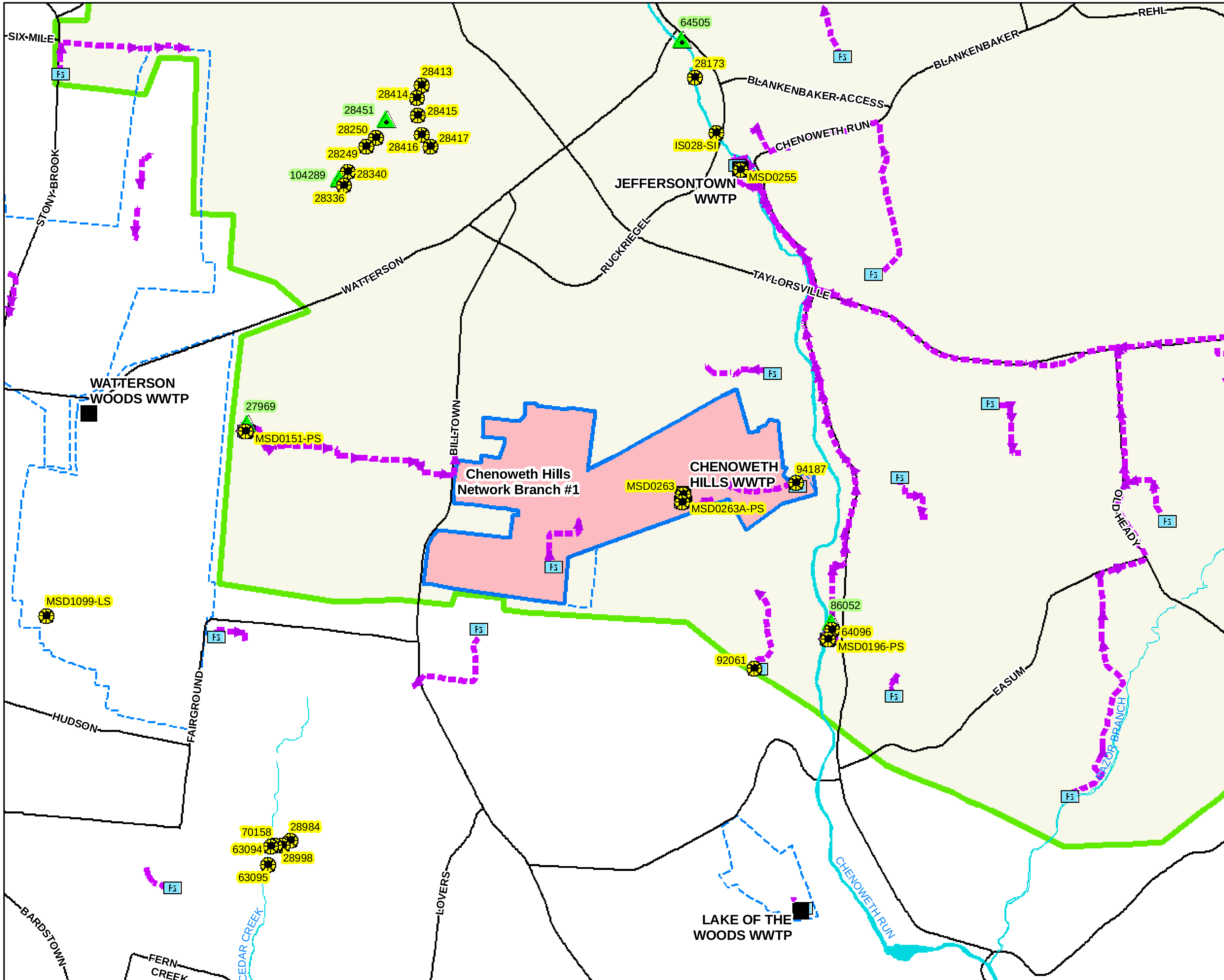
Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

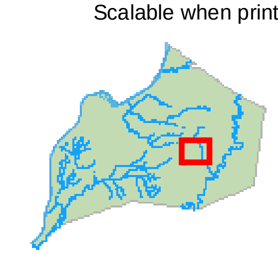
Morris Forman Sewershed
Small WWTP - Chenoweth Hills Area
Branch Network
Figure 2.5.13



Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Streams
- Interstates
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Chenoweth Hills Network Branch #1
- County Boundary

1 inch equals 1,500 feet
Scalable when printed on 11" X 17" paper



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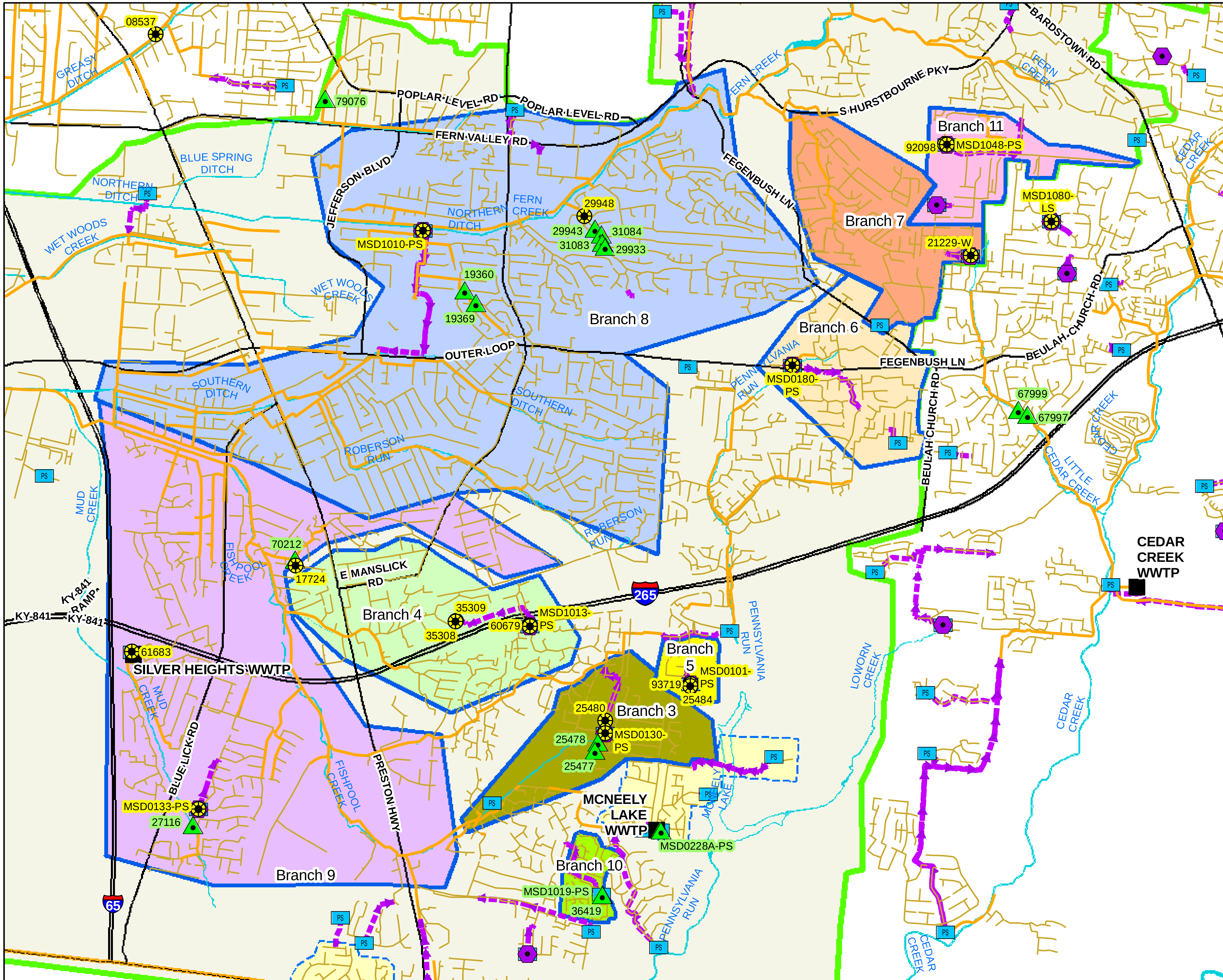

Integrated Overflow Abatement Plan

Vol. 3 Sanitary Sewer Discharge Plan

West County Pond Creek Area Sewershed Branch Network

Figure 2.5.14

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Streams
- Major Road
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Branch 3
- Branch 4
- Branch 5
- Branch 6
- Branch 7
- Branch 8
- Branch 9
- Branch 10
- Branch 11
- County Boundary

1 inch = 3,000 feet
Scalable when printed on 11" X 17" paper

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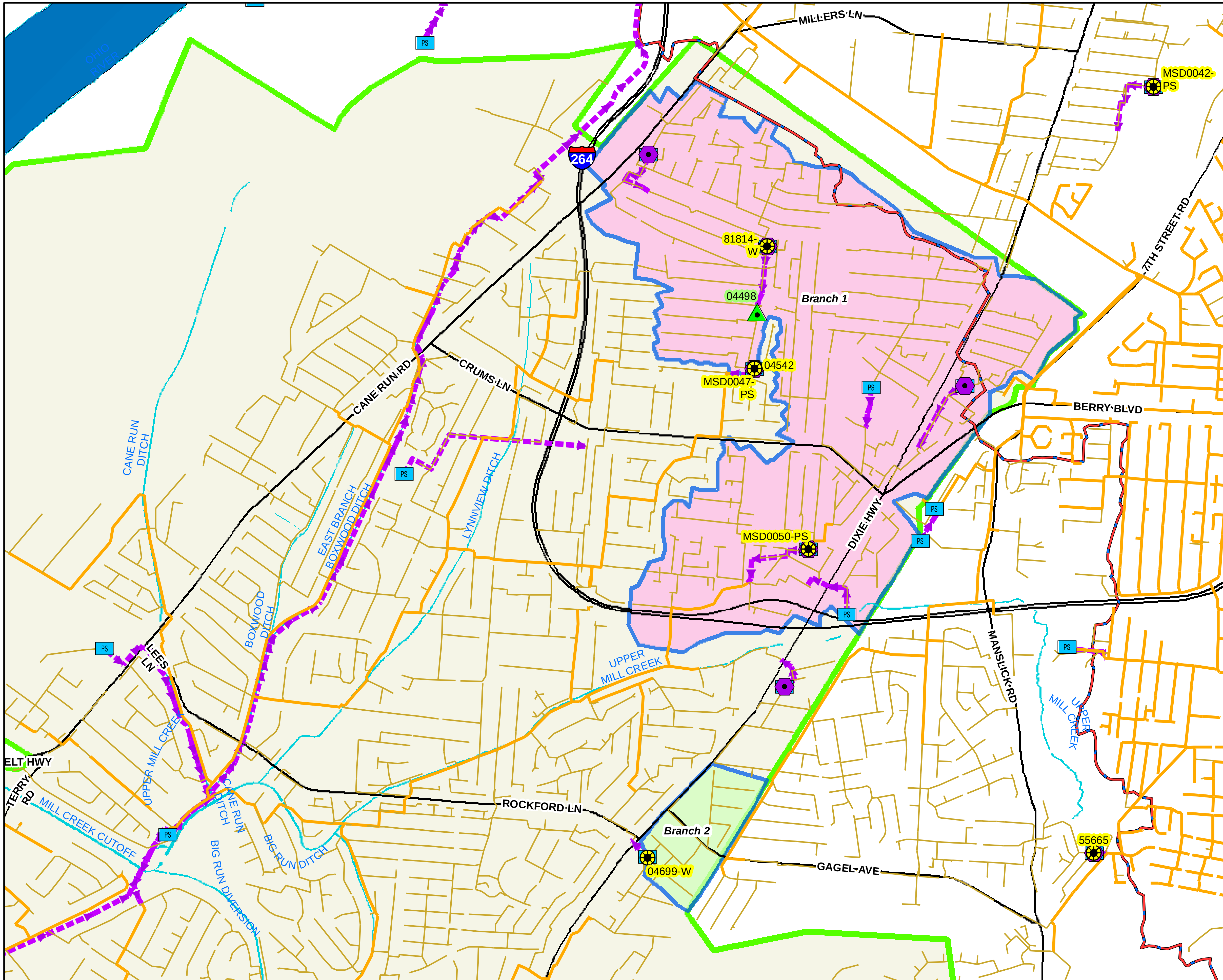
Integrated Overflow Abatement Plan

Vol. 3 Sanitary Sewer Discharge Plan

West County Mill Creek Area Sewershed Branch Network

Figure 2.5.15



Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- WWTP
- Pump Station
- Force Main
- Collector < 12 "
- Interceptor =>12"
- Major Road
- Streams
- CSO Area
- Small WWTP Service Area
- Large WWTP Service Area
- Branch 1
- Branch 2
- County Boundary

1 inch = 1,800 feet
Scalable when printed on 11" X 17" paper

Some boundaries are uniquely symbolized within the map.

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MSD

Metropolitan Sewer District

CHAPTER 3

CHAPTER 3: DEVELOPMENT AND EVALUATION OF ALTERNATIVES FOR SSO ELIMINATION

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SUPPORTING INFORMATION

Appendix 3.1.1 I/I Program Documentation
Appendix 3.1.2 Ground Truthing Documentation
Appendix 3.2.1 Re-evaluation of Preferred Projects Analysis
Appendix 3.3.1 Preferred Solution Cost Tables, Benefit-Cost Tables, Maps, Fact Sheets

CHAPTER 3: DEVELOPMENT AND EVALUATION OF ALTERNATIVES FOR SSO ELIMINATION

Once a clear understanding of the root problems of sanitary sewer overflows (SSOs) is obtained through the system characterization process, it is important to develop a comprehensive set of potential solutions that are effective and acceptable by the public.

Chapter 3 presents the methodologies used to evaluate the various SSO elimination solutions. The chapter defines and discusses strategies and technologies available to control and eliminate unauthorized discharges in the separate sanitary sewer system (SSS). The chapter also provides a summary of the evaluation for each SSO elimination alternative. The evaluation criterion includes feasibility screening, computer modeling, quality control, level of protection, cost estimates, and a benefit-cost analysis.

3.1 THE FINAL SSDP APPROACH

Overall, the Final Sanitary Sewer Discharge Plan (SSDP) approach to SSO elimination is to determine the solution that provides the greatest benefit-cost ratio for each watershed branch. Modeling teams used the Louisville and Jefferson County Metropolitan Sewer District (MSD) Project Cost Estimating Tool and the Benefit-Cost Value Model, both developed specifically for the Integrated Overflow Abatement Plan (IOAP). These tools were used to determine benefit scores, capital costs, long-term operation and maintenance (O&M) costs, and the benefit-cost ratio. The process is discussed in more detail in this section.

3.1.1 Solution Development Overview

The major steps in the solution development process are summarized below:

- Models were calibrated and validated (Volume 3, Chapter 2, Section 2.3).
- Where appropriate, rainfall dependent inflow and infiltration (RDI/I) and build-out was applied to the validated models (Volume 3, Chapter 2, Section 2.3.5.7).
- Where appropriate, capital projects were incorporated into the models (Volume 3, Chapter 2, Section 2.3.5.9).
- Input was gathered from public meetings, as well as guidance from the Wet Weather Team (WWT) Stakeholder Group and ground truthing exercises.
- Initial solutions were developed and presented at WWT Stakeholder Group meetings for review and comments.
- Solutions that addressed SSOs and reduced known surcharging under site-specific design conditions were developed using a diverse set of solution technologies.
- Benefits, capital costs, and benefit-cost ratios for each solution were developed at the baseline level of protection (1.82-inch cloudburst storm event).
- The solution with the best benefit-cost ratio was selected for development of the preferred level of protection (Volume 3, Chapter 4).

3.1.2 SSO Control Measures and Technologies

A wide range of technology approaches is available for the development of SSO abatement strategies and alternatives. These approaches are summarized in the following sub-sections.

3.1.2.1 Source Control through Infiltration and Inflow (I/I) Reduction

Source reduction focuses on preventing wet weather flows through various sources from reaching the sewer. Source reduction was considered for each branch solution. The method and degree of source reduction is described in Volume 3, Chapter 2, Section 2.3.5.7. MSD is embarking on programs to address countywide, private-side, and public-side source reduction. As it pertains to the Final SSDP, a 20-year program will be implemented to reduce flows in areas critical to Final SSDP success. The program is outlined in Appendix 3.1.1, I/I Program Documentation.

3.1.2.2 Basement Backups and Sewer Surcharging

Surcharge reduction focuses on the prevention of basement flooding during wet weather. Basement flooding protection was considered and analyzed for all branch solutions using the System Capacity Assurance Plan criterion discussed in Volume 3, Chapter 2, Section 2.5.1. The surcharge criterion was applied to all areas hydraulically connected to a documented or suspected SSO location (known as the “zone of influence”) and/or downstream of an SSDP solution. Solutions were then sized accordingly to reduce or eliminate surcharging to the Louisville Metro Sewer Capacity Assurance Plan (SCAP) criterion.

Other basement backup complaints or modeled surcharging not within the SSO zone of influence or downstream of an SSDP solution will be addressed by MSD’s Plumbing Modification Program, which is available to all MSD customers, as discussed in Volume 3, Chapter 1, Section 1.3.1.4. To-date, MSD has completed over 8,100 projects totaling approximately $16 million dollars under the Plumbing Modification Program. Refer to Appendix 1.3.1 for the Plumbing Modifications Program and Downspout Disconnection Program packet available to MSD customers.

3.1.2.3 Peak Flow Storage Alternatives

A storage solution is an alternative where flow is temporarily stored to eliminate SSOs. This includes inline storage (large diameter pipe(s) built into the sewer system) or offline storage (covered or open storage facilities). Storage alternatives may also include additional pumping capacity, conveyance to and from the storage location, controls, easements, land purchases, odor control, surface treatment, and long-term O&M. Storage solutions developed are then evaluated through a complete “fill-and-empty” cycle in the model, which also includes a secondary storm analysis (as described in Volume 3, Chapter 2, Section 2.3.4).

A significant cost factor in storage is whether the constructed storage facility is open or closed to the environment. Open facilities are generally less expensive, but they present potential problems such as odors and poor aesthetics. Covering the facility, generally by burying, can improve these conditions but significantly increases the cost of the facility.

For any facility, the siting location is critical. Thus, the ground truthing exercises were developed to assist with the siting process. Section 3.1.3.3 describes the ground truthing process in more detail.

3.1.2.4 Increased Conveyance Capacity

A conveyance solution increases the sewer capacity to eliminate SSOs. The solution may include: increases in pipe size, additional pumping capacity, parallel sewer conveyance, and elimination of bottlenecks. Pure conveyance solutions will usually result in increased flow downstream. In these cases, the increase in flow must be addressed by downstream branches in the system.

While siting is not as critical as storage alternatives, ground truthing is still required to properly cost the improvements for some conveyance solutions (see Section 3.1.3.3 for more detail on ground truthing).

3.1.2.5 Flow Diversion

A diversion solution is an alternative where flow is diverted to other systems or sewersheds to alleviate capacity at the solution location. Generally, a diversion solution will involve gravity solutions, although some pump station improvements may be included.

Diversion alternatives will undoubtedly impact other branches and potentially other watersheds. As a result, solutions will have to account for the additional flows to the impacted branches. Similar to conveyance alternatives, ground truthing is required to properly price diversion alternatives.

3.1.2.6 Water Quality Treatment Center (WQTC) Upgrades

In accordance with the Consent Decree, all WQTCs with the potential to receive additional flow as a result of SSO elimination were evaluated by developing a “Comprehensive Performance Evaluation” (CPE) in accordance with EPA guidance documents called out in the Consent Decree. The CPE process was originally developed to provide a systematic approach to improving the performance of WQTCs that were not in compliance with discharge standards. In this application it was necessary to conduct an evaluation based on the anticipated performance of the plants in treating the modeled peak wet weather flows. Initial evaluations considered the worst case scenario assuming SSO eliminations were accomplished by increasing conveyance capacity, essentially pushing the entire wet weather flow increase to the WQTC. Final evaluations were refined based on modeled wet weather hydrographs considering the actual SSO elimination projects selected in the Final SSDP.

The Consent Decree also required CPEs be conducted on the five plants in the Prospect area, and the Lake Forest WQTC. As a result of both sets of requirements, CPEs were developed for the following WQTCs in accordance with the Consent Decree:

- Berrytown WQTC
- Cedar Creek WQTC

- Chenoweth Hills WQTC
- Hite Creek WQTC
- Hunting Creek South WQTC
- Jeffersontown WQTC
- Ken Carla WQTC
- Lake Forest WQTC
- North Hunting Creek WQTC
- Starview WQTC
- Timberlake WQTC

A more complete description of the CPE process and the resultant Composite Correction Approach WQTC improvement recommendations is contained in Volume 1, Section 4.4. This section in Volume 1 also presents the evaluation of potential collection system modifications compared to WQTC expansions to address wet weather peaks.

CPEs were not developed for the Derek R. Guthrie WQTC (formerly known as the West County Wastewater Treatment Plant) or the Floyds Fork WQTC because both plants are scheduled to undergo significant expansions in the near future. The WQTC expansions will be sized to include any additional wet weather flow peaks anticipated as a result of SSO elimination. In lieu of CPEs, the preliminary design reports for those WQTC expansions are addressed in Volume 1. A CPE was not developed for the Morris Forman WQTC because it serves the combined sewer system and is specifically excluded from the CPE requirement in the Consent Decree.

3.1.3 Initial Solutions

MSD was committed to obtaining WWT Stakeholder Group input throughout the IOAP development. In particular, MSD solicited WWT Stakeholder Group input before modeled solution development began. To “kick off” the potential solution process, the initial solutions were developed for each modeled branch. The initial solution development phase involved desktop evaluation and simple sizing using existing condition model runs and MSD’s historical work order database.

Initial solutions were presented to the WWT Stakeholder Group in a series of meetings where the Group was engaged in discussions about the initial solutions and their comments or concerns were noted. This information was then considered and included in future modeled solution development. The following sections summarize the initial solution phase, from SSO characterization to the ground truthing process, and provide a general overview of the types and number of initial solutions that were a result of this particular stage of solution development.

3.1.3.1 SSO Characterization

Initially, there were 109 SSOs and more than 200 modeled overflow points (MOPs) used to determine the design of initial solution projects. Refer to Volume 3, Chapter 2, Section 2.4.2 for a discussion of the MOP validation process. Many aspects of each area were reviewed before the initial solutions were developed; for example, the source or cause of the SSO(s) was investigated through a review of discharge work orders and, based on initial evaluation, the overflow volume for various levels of protection was reported.

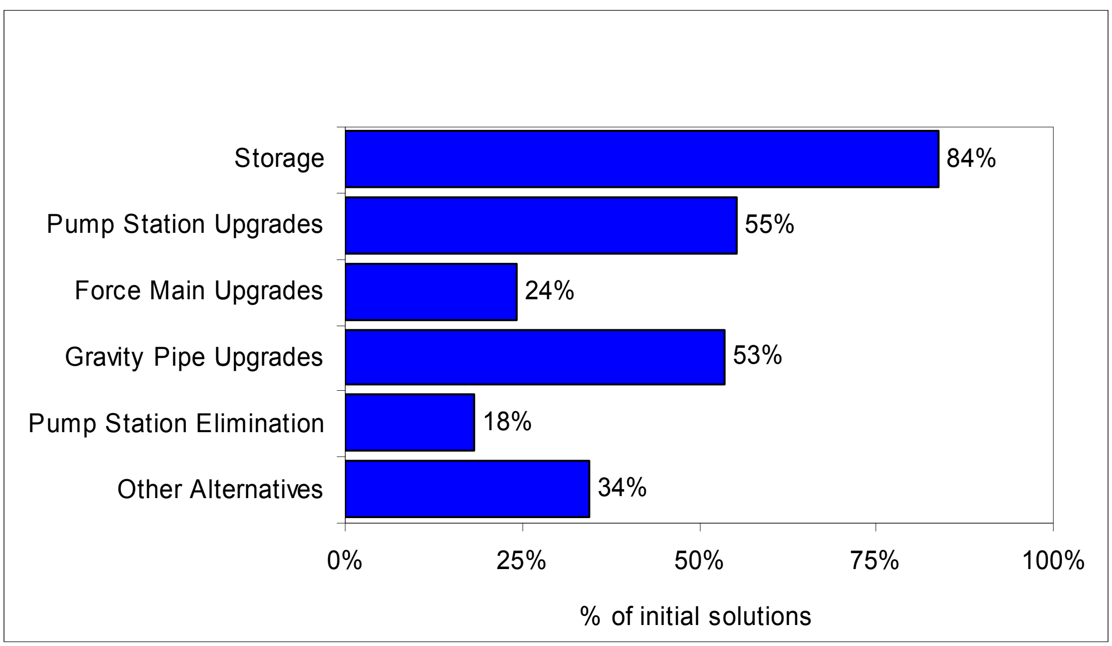
Site conditions for the entire area surrounding the SSOs and MOPs were also investigated and reported for each initial solution. Surrounding landuse, apparent utility conflicts, and other aspects that could affect a project were reviewed and documented.

Additionally, capital projects and proposed developments in the area were reviewed and summarized in each initial solution development phase. The initial solutions were developed after investigation of the cause of the SSO, surrounding area landuse, apparent utilities, proposed developments, capital projects, and modeling needs. The research was conducted with the objective of integrating the most important characterizations of each project location into the solution alternatives.

3.1.3.2 Initial Solution Alternatives

The initial solution alternatives that were considered included one or more of the available technologies as described in Section 3.1.2. Figure 3.1.2 summarizes the developed solutions. Some of the initial locations were identified as having more than one potential solution and the graph shows the percentage of initial solution options by solution type that may be able to eliminate the SSOs. The pump station elimination, sewer upgrades, force main upgrades, and pump station upgrades could be part of either a conveyance solution or a diversion solution.

FIGURE 3.1.2 SUMMARY OF INITIAL SOLUTION ALTERNATIVES



Storage Alternatives

More than eighty percent of the initial solution locations displayed potential for storage facilities and inline storage pipes. However, some locations were determined to be unsuitable for storage solutions due to maintenance access and land acquisition concerns.

Conveyance Alternatives

The conveyance alternatives included pump station, force main, and gravity pipe upgrades, pump station eliminations, and diversions. These alternatives were usually more complex requiring sewer pipe upgrades, newly constructed sewer pipe, and/or pump station upgrades. More than eighty percent of the initial solutions displayed potential for conveyance alternatives.

Other Alternatives

Other alternatives included capital project solutions, raising manholes and reducing I/I.

3.1.3.3 Ground Truthing

As mentioned earlier, siting is a critical component of project development. Thus, MSD developed a ground truthing process to consistently evaluate storage, conveyance, and diversion alternatives. Ground truthing collects critical information that could affect cost, such as soil conditions and easements, or, in some cases, prevent the site from being further considered, such as future planned development.

Each modeling team was responsible for ground truthing storage, conveyance, and diversion alternatives considered within the respective watersheds. In some cases, the solution involved alignments in existing rights-of-way or easements, such as pipe upsizing, and ground truthing was not necessary. The following list provides examples of features that were investigated during the ground truthing process:

- Rock depth
- 100-Year floodplain location
- Threatened/endangered species assessment
- Potential utility conflicts
- Required Permits, i.e. Kentucky Department of Environmental Protection (KDEP), U.S. Army Corp of Engineers (USACE), Etc.
- Green space initiatives
- National historic registry
- Development conflicts
- Significant topographical features, i.e. steep slope

Once ground truthing was completed, a recommendation was made labeling the site as either suitable or unsuitable for the particular solution type. Specific ground truthing and significant findings are briefly discussed for each individual watershed (see Section 3.3), and full ground truthing documents along with pictures of the sites are available for review in Appendix 3.1.2 Ground Truthing Documentation.

3.2 PROJECT SELECTION ANALYSIS

MSD used a standard benefit-cost ratio process to determine and select the most effective solution for each branch of SSOs for a baseline level of protection. In this case, the 1.82-inch cloudburst storm was utilized as the baseline level of protection. The same process was used to set optimal levels of protection for the selected solutions (described in Volume 3, Chapter 4).

Additionally, several projects were conceptually re-designed using a 2.25-inch cloudburst storm to evaluate if the initial level of control used as the baseline condition created any bias toward a particular technology in selecting a preferred solution from a group of initial competing technologies. The evaluation, detailed in Sections 3.3.5.2, 3.3.9.2, and 3.3.11.2, showed that the initial level of control used as the baseline condition appeared to have no impact on the technology selected. For a full explanation and results of the analysis refer to Appendix 3.2.1, Re-evaluation of Preferred Projects Analysis.

The MSD Project Cost Estimating Tool and the benefit-cost value model were utilized to develop Final SSDP solution costs and benefits, based on input from the WWT. These planning models are fully described in Volume 1, Section 2.5. The individual components are summarized in the following section.

3.2.1 Cost Analysis

A total project capital cost and present worth (including O&M) cost was computed for each solution alternative using the MSD Project Cost Estimating Tool, which uses cost curves based on common parameters obtained from model runs. This includes parameters such as pipe diameters, location (i.e. paved areas versus non-paved) and site conditions (i.e. site dewatering). It also includes costs for easements and land acquisitions, as well as O&M costs for pumping, cleaning and other recurring tasks.

It is important to understand that costs developed at this stage were planning level costs only and included planning level contingencies for the uncertainties at this level. Cost estimates that are more detailed were prepared for selected projects after the optimized solution evaluation stage and are discussed in Volume 3, Chapter 4.

3.2.2 Benefit Analysis

The MSD benefit-cost value model was used to consistently calculate benefits for the solution alternatives. Project-specific values, branching, and benefits based on SSO solutions and locations are discussed in this section.

3.2.2.1 Project-Specific Values

The WWT identified community values to be considered during SSO abatement planning. The community values identified were asset protection, customer satisfaction, eco-friendly solutions, economic vitality, environmental enhancement, environmental justice and equity, financial equity, financial stewardship, public health enhancement, public education, and regulatory performance. However, not all of these values were specifically analyzed as part of the benefit-cost analysis. Five project specific values were selected to provide a comprehensive and viable benefit-cost analysis.

Five Project-Specific Core Values

1. Regulatory Performance
2. Public Health Enhancement
3. Asset Protection
4. Environmental Enhancement
5. Eco-Friendly Solutions

To enhance the benefit-cost ratio process, the WWT assigned weighting factors on a zero to ten scale to each of the five values to reflect the degree of importance to the overall control plan impact to the community. The values and assigned weights that were used to score benefits were as follows:

- Public Health 10
- Regulatory Performance 8
- Environmental Enhancement 8
- Asset Protection 6
- Eco-Friendly Solution 6

One module for each of the five core values exists within the benefit-cost analysis tool in addition to a module that summarizes the resulting scores and costs for up to five alternatives per SSO or branch.

Regulatory Performance and Public Health were scored on a 25-point severity-frequency matrix according to SSO volume and frequency. The baseline characteristics of the SSO were initially scored, followed by scoring the remaining overflow/frequency resulting from the proposed solution. The difference in these values was the benefit score, with a higher score indicating a higher reduction in risk, or higher value of benefit. The Asset Protection value was also scored on a 25 point severity-frequency scale (level of protection versus damage impact) to account for reduction in basement flooding by a proposed SSO solution.

The Environmental Enhancement and Eco-Friendly Solution values were scored using several performance metrics that represent a variety of aspects related to the environment or ecosystems, Each of the aspects were scored on a 10-point negative-to-positive scale (-5 to +5). Environmental Enhancement primarily assesses aquatic impact, while Eco-Friendly Solutions assesses broader land/energy impacts of proposed SSO solution alternatives.

3.2.2.2 Benefits Based on SSO Locations and SSO Solutions

Two values, Regulatory Performance and Public Health Enhancement, are specific to the frequency and magnitude of each individual SSO location. Therefore, benefits are calculated separately for each SSO for both the existing conditions and proposed conditions, after the solution is in place.

The other three values, Eco-Friendly Solutions, Environmental Enhancement and Asset Protection, are specific to the type of solution. Therefore, benefits are calculated by solution and SSOs in the branch receive the same score for both the existing conditions and proposed conditions, after the solution is in place.

3.2.2.3 Branching or Clusters

As described above, benefits are calculated for each SSO individually at the Regulatory Performance and Public Health levels, and then aggregated for a "cluster" (branch) of SSOs to calculate Asset Protection, Environmental Enhancement, and Eco-Friendly Solutions scores.

Consequently, the net benefit is very much dependent on the number of SSOs in each cluster. Accordingly, net benefits cannot be compared directly from branch to branch. Likewise, benefit-cost ratios cannot be directly compared. Within a branch, however, net benefits can be directly compared and resulting benefit-cost ratios will identify the best solutions.

Table 3.2.1 shows an example of the calculations involved in determining a total benefit score for a cluster of SSOs.

TABLE 3.2.1

EXAMPLE BENEFIT CALCULATION

Example Benefit Calculation for One Branch					
SSO ID	**Regulatory Performance**	**Public Health**	**Asset Protection**	**Environmental Enhancement**	**Eco-Friendly Solutions**
MSD0023	12	7	4	4	1
MSD0010	5	2	4	4	1
MSD0007	5	2	4	4	1
26752	5	7	4	4	1
41416	5	5	4	4	1
24472	5	5	4	4	1
41374	0	0	4	4	1
MSD0024	0	2	4	4	1
24152-W	0	0	4	4	1
Sum	***37***	***30***	***36***	***36***	***9***
Weighting Factor	***8***	***10***	***6***	***8***	***6***
Weighted Benefit Score	***296***	***300***	***216***	***288***	***54***
Total Benefit Score	***1154***				

3.2.3 Benefit-Cost Ratio Analysis

The total weighted benefit-cost ratio can be automatically calculated for alternatives based on the total costs and the weighted benefit scores. Two weighted benefit-cost ratios are calculated; one using capital costs and the other using total present worth costs. Each branch solution has unique benefit-cost ratios for each level of protection. Once the ratios are calculated, the alternatives require further review relative to overall program values and objectives to determine which alternative best fits the overall needs of the community. In addition to the five core values, other values were considered including: Customer Satisfaction, Economic Vitality, Environmental Justice and Equity, Financial Equity, Financial Stewardship, and Public Education.

Benefit-cost Ratio Analysis examples are presented for each individual watershed solution in the following section.

3.3 EVALUATION OF SSO ABATEMENT ALTERNATIVES

The following sections summarize initial solutions considered for each modeled watershed, and the solution feasibility screening that included a thorough investigation of individual properties and sewer alignments in each branch (ground truthing). Additionally, modeled solution analyses including the benefit-cost procedure and the solution technology selected for each branch at the 1.82-inch cloudburst storm level are summarized for each modeled watershed. Appendix 3.1.2 contains the detailed ground truthing documents related to initial solutions. Appendix 3.3.1, Preferred Solution Cost Tables, Benefit-Cost Tables, Maps, Fact Sheets, contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

3.3.1 Cedar Creek Alternatives

Details on branching and SSO descriptions for Cedar Creek can be found in Volume 3, Chapter 2, Section 2.5.1. The initial solution development process is summarized in detail in Sections 3.1.3 and 3.1.3.3 contains information on the ground truthing procedure.

3.3.1.1 Initial Solutions and Feasibility Screening

Initial solutions were investigated before any baseline conditions (i.e. Capital Projects) or RDI/I reduction were applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated and, therefore, is not summarized below.

<u>Branch 70158</u>

This branch includes SSOs caused by a hydraulic bottleneck. The land surrounding the SSOs includes homes that are approximately 100 feet away from the SSO location, which was the former location of the Idlewood WQTC.

The conveyance alternative considered was to build a parallel relief line or increase the existing interceptor size. Initial assessment showed enough room for a construction easement. The first storage alternative considered was to construct a wet weather storage facility near the SSO location. Based on ground truthing, the open land originally considered for the storage facility near the SSO site has development planned. The best location for a storage facility would require additional conveyance downstream approximately 500 feet away. The second storage alternative considered was to construct large pipe in the vicinity of the SSOs to provide inline storage. Ground truthing for inline storage found that 70 percent of the property is in the 100-year floodplain, and the utility conflicts would be minimal.

Branch 81316

This branch includes SSOs caused by insufficient capacity at the Fairmount Road Pump Station to handle upstream flows. The surrounding area is residential but consists of ample open space.

The conveyance alternative considered upgrading the pump station. The first storage alternative considered was to construct a wet weather storage facility onsite. The second storage alternative considered was to construct large pipe in the vicinity of the SSOs to provide inline storage. Ground truthing for inline storage found that 80 percent of the property is in the 100-year floodplain and there is a potential utility conflict with an overhead electrical line.

Branch 67997

This branch includes SSOs caused by insufficient capacity of the interceptor to handle upstream flows during wet weather. The conveyance alternative considered was to increase the existing interceptor pipe size. No storage alternatives were considered for this branch due to lack of available open land. Ground truthing for pipe upgrades found that 90 percent of the property is in the 100-year floodplain and potential utility conflicts may occur with electrical and gas line crossings.

Branch MSD1025

This branch includes an SSO caused by insufficient capacity at the Bardstown Road Pump Station to handle upstream flows. This pump station was not reported as an SSO location until mid-2008; therefore, no initial solutions were developed for this location since it was not known at the time of initial solution development. Solutions, however, were developed later during the solution alternative analysis process discussed below.

Branch MSD1080

This branch includes an SSO caused by insufficient capacity at the Running Fox Pump Station to handle upstream flows. This SSO location was not reported as an SSO until mid-2008; therefore, no initial solutions were developed for the locations since they were not known at the time of initial solution development. Solutions, however, were developed later during the solution alternative analysis process.

3.3.1.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in Cedar Creek. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Branch 70158

Based on the benefit-cost analysis, the chosen solution for Cedar Creek Branch 70158 is Inline Storage. Table 3.3.1 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.1

CEDAR CREEK BRANCH 70158 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_CC_CC_70158_M_09A_C	Inline Storage	Inline storage with 955 linear feet (LF) of (84" - 120") pipe to store wet weather peak flow, and upgrade 1,747 LF of (8" - 15") sewer to increase hydraulic capacity during wet weather peak flows.	24.66	31.36
S_CC_CC_70158_M_01_C	Pipe Upgrades	Upsize 8,218 LF of interceptor pipes.	5.76	7.26

Branch 81316

The chosen solution for Cedar Creek Branch 81316 (Fairmount Rd. PS) is Pump Station Upgrades. The Pump Station Upgrades solution is a capital project known as the Fairmount Rd. Pump Station Expansion Project (E00303) which is currently planned to install three new pumps at Fairmount Rd. Pump Station. The new pumps are sized to accommodate future development per the Cedar Creek Action Plan. Table 3.3.2 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.2

CEDAR CREEK BRANCH 81316 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_FF_CC_81316_M_03_C	PS Upgrades	Install (3) 130 HP, 1750 gpm pumps to increase capacity at the Fairmount Rd. Pump Station. (Cedar Creek Action Plan)	26.79	26.79
S_FF_CC_81316_M_09A_C	Inline Storage	Inline storage with 407 LF of 36" pipe to store wet weather peak flow.	21.29	27.00

Branch 67997

The chosen solution for Cedar Creek Branch 67997 is Pipe Upgrades. As discussed earlier, the only solution considered for this branch was the conveyance alternative. Table 3.3.3 summarizes the solution and the benefit-cost ratio associated with that solution.

TABLE 3.3.3

CEDAR CREEK BRANCH 67997 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_CC_CC_67997_M_01_C	Pipe Upgrades	Upsize 3,916 LF with (12" - 21") sewer pipe.	19.06	23.86

Branch MSD1025

Based on the benefit-cost analysis, the chosen solution for Cedar Creek Branch MSD1025 (Bardstown Rd. PS) is Pump Station Upgrades. Table 3.3.4 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.4

CEDAR CREEK BRANCH MSD1025 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_CC_CC_MSD1025_S_03_C	PS Upgrades	Increase capacity of the Bardstown Rd PS to handle peak flows of 0.39 mgd	34.40	29.42
S_CC_CC_MSD1025_S_09B_C	Offline Storage	Construct offline covered storage (0.063 MG) at manhole 88545 just upstream of the Bardstown Rd. PS.	28.19	28.52
S_CC_CC_MSD1025_S_09A_C	Inline Storage	Inline storage with 283 LF of 72" pipe to store wet weather peak flow.	12.88	16.50

Branch MSD1080

Based on the benefit-cost analysis, the chosen solution for Cedar Creek Branch MSD1080 (Running Fox PS) is Diversion. Table 3.3.5 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.5

CEDAR CREEK BRANCH MSD1080 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_CC_CC_MSD1080_S_01_C	Diversion	Construct 375 LF of 8" gravity sewer to eliminate Running Fox PS.	577.08	659.52
S_CC_CC_MSD1080_S_09A_C	Inline Storage	Inline storage with 400 LF of 60" pipe upstream of Running Fox PS to store wet weather peak flow.	86.72	108.82
S_CC_CC_MSD1080_S_09B_C	Offline Storage	Construct offline covered storage (.015 MG)	44.44	45.57
S_CC_CC_MSD1080_S_03_C	PS Upgrades	Increase the capacity of the Running Fox PS to handle peak flows of 0.4 mgd. Upsize 700 LF of force main to 6".	43.97	38.72

3.3.2 Floyds Fork Alternatives

Details on branching and SSO descriptions for Floyds Fork can be found in Volume 3, Chapter 2, Section 2.5.2. The initial solution development process summarized in detail in Sections 3.1.3 and 3.1.3.3 contains information on the ground truthing procedure.

3.3.2.1 Initial Solutions and Feasibility Screening

Initial solutions were developed before any baseline conditions (i.e. Capital Projects) or RDI/I reduction had been applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated by one of the two and therefore is not summarized below.

<u>Branch 1</u>

This branch includes SSOs due to insufficient conveyance capacity and surcharged pipe during wet-weather events. The surrounding area is residential but includes some small open space.

The conveyance alternative considered was to increase the existing interceptor pipe size upstream of the Pope Lick Pump Station. The diversion alternative considered conveying more flow to the Woodland Hills Pump Station, and then on to the Morris Forman WQTC. The first storage alternative considered was to construct a wet weather storage facility in the residential area. The second storage alternative considered was to construct large pipes in the vicinity of the SSOs to provide inline storage.

Branch 2

This branch includes an SSO believed to be caused by a blockage at the Eden Care Pump Station that was cleared on March 18, 2006. The pump station is located in a small residential area.

The conveyance alternative considered was to upgrade the pump station and force main. The first storage alternative considered was to construct a wet weather storage facility near the SSO location but available land near the pump station is limited. The best location for a storage facility would require additional conveyance upstream approximately 600 feet. The second storage alternative considered was to construct large pipe in the vicinity of the SSOs to provide inline storage. Ground truthing for inline storage found that a small drainage ditch with riprap runs parallel to the gravity line and would most likely need to be replaced.

Branch 3

This branch includes SSOs caused by insufficient capacity at both Olde Copper Court and Ashburton Pump Stations to handle upstream flows. The surrounding area is residential with some small wooded areas near the pump stations.

The diversion alternative considered was to divert flow from the Ashburton Pump Station to an alternate gravity system. The first storage alternative considered was to construct a wet weather storage facility near the Olde Copper Court Pump Station. The second storage alternative considered was to construct large pipe in the vicinity of the Olde Copper Court Pump Station to provide inline storage. The third storage alternative considered was to construct large pipe in the woods behind residences near the Ashburton Pump Station to provide inline storage.

Ground truthing identified that a threatened/endangered species assessment is recommended because construction will take place near the wooded area. It also found potential conflicts of force main construction with two electrical lines and one gas main, and gravity sewer construction with an electrical line. Other conflicts with force main construction reveals that it runs along a very steep hill and is located very close to an existing home (would need to be constructed under existing driveway).

3.3.2.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in Floyds Fork. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Branch 1

Based on the benefit-cost analysis, the chosen solution for Floyds Fork Branch 1 is Diversion. Table 3.3.6 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.6

FLOYDS FORK BRANCH 1 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Costs)	Benefit/Cost Ratio (Present Worth Costs)
S_FF_FF_NB01_S_01_C_A	Diversion	Replace the existing overflow and automated gate (to the Woodland Hills PS) with a double barrel overflow that consists of two-15 LF 12" diameter pipes. The upstream invert of the pipes needs to be 2" above the upstream invert of the exiting gravity pipe in manhole 82058. This new invert elevation will allow dry weather flow to gravity drain through the interceptor, but anything greater than dry weather flow will be diverted to the PS by an overflow pipe and reduce the surcharge further down the gravity line.	321.41	92.26
S_FF_FF_NB01_S_09A_C_A	Inline Storage	Inline storage with 400 LF and 110 LF of 48" pipes to store wet weather peak flow.	12.83	16.28
S_FF_FF_NB01_S_03_C_A	Pipe Upgrades	Upsize 1,650 LF of 15" sewer pipe with 18" sewer pipe.	10.84	13.60

Branch 2

The chosen solution for Floyds Fork Branch 2 (Eden Care PS) is Monitoring. The only overflow at this Pump Station occurred on March 18, 2006 and was believed to be caused by a blockage at the Eden Care Pump Station that was cleared on that date. Table 3.3.7 summarizes the solution chosen for Floyds Fork Branch 2.

TABLE 3.3.7

FLOYDS FORK BRANCH 2 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Costs)	Benefit/Cost Ratio (Present Worth Costs)
S_FF_FF_NB02_S_13_C	Monitor	Monitor the Eden Care PS during rain events for the next three years according to SORP protocols.	--	--

Branch 3

Based on the benefit-cost analysis, the chosen solution for Floyds Fork Branch 3 (Ashburton PS / Olde Copper PS) is Pipe and Force Main Upgrades (A). Table 3.3.8 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.8

FLOYDS FORK BRANCH 3 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Costs)	Benefit/Cost Ratio (Present Worth Costs)
S_FF_FF_NB03_M_01_C_A	Upgrade Force Main & Pipes (A)	Divert flow from Ashburton PS by upgrading 370 LF of force main from 2" to 3" and constructing 115 LF of 8" gravity sewer, also eliminates the SSO at Olde Copper Ct PS.	150.66	161.00
S_FF_FF_NB03_M_03_C_B	Force Main Upgrades	Upgrade 620 LF of force main from 2.5" to 4" at Olde Copper Ct PS and 700 LF of force main from 2" to 3" at Ashburton PS.	111.57	106.61
S_FF_FF_NB03_M_HB_C_C	Upgrade Force Main & Pipes (B)	Eliminate Olde Copper Ct PS, construct 370 LF of 8" gravity sewer to divert flow to another part of the system, upgrade 700 LF of force main from 2" to 3" for Ashburton PS.	86.27	91.31
S_FF_FF_NB03_M_HB_C_B	Inline Storage & Upgrade Force Main (A)	Inline storage with 320 LF of 42" pipe at Olde Copper Ct PS, upgrade 700 LF of force main from 2" to 3" at Ashburton PS.	52.51	59.44
S_FF_FF_NB03_M_HB_C_A	Inline Storage & Upgrade Force Main (B)	Inline storage with 150 LF of 60" pipe at Olde Copper Ct PS, upgrade 700 LF of force main from 2" to 3" at Ashburton PS.	51.19	58.40
S_FF_FF_NB03_M_03_C_A	PS & Force Main Upgrades (A)	Upgrade both pumps at Olde Copper Ct PS for a combined 60 gpm to 100 gpm; upgrade 700 LF of force main from 2" to 3" at the Ashburton PS.	47.82	42.51
S_FF_FF_NB03_M_03_C_C	PS & Force Main Upgrades (B)	Upsize existing wet well from 4' to 8' diameter and pumps at Olde Copper Ct PS for a combined 60 gpm to 90 gpm, upgrade 700 LF of force main from 2" to 3" at Ashburton PS.	27.03	27.73

3.3.3 Hite Creek Alternatives

Details on branching and SSO descriptions for Hite Creek can be found in Volume 3, Chapter 2, Section 2.5.3. The initial solution development process is summarized in detail in Sections 3.1.3 and 3.1.3.3 contains information on the ground truthing procedure.

3.3.3.1 Initial Solutions and Feasibility Screening

Initial solutions were investigated before any baseline conditions (i.e. Capital Projects) or RDI/I reduction had been applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated by one of the two and, therefore, is not summarized below.

Branch MSD1082

This branch includes SSOs caused by insufficient capacity at the Meadow Stream Pump Station to handle upstream flows. The surrounding area is a mix of single-family residential, multi-family residential, and light industrial. There is ample open space in the area.

The conveyance alternative considered either upsizing the force main or adding a wet weather force main and pump. The first storage alternative considered was to construct a wet weather storage facility in an open area near the SSO locations. The second storage alternative considered was to construct a large pipe in the vicinity of the SSOs to provide inline storage. Ground truthing found that a portion of the pump station property is in the 100-year floodplain but construction would take place outside of the floodplain.

Branch MSD1085

This branch includes an SSO caused by insufficient capacity at the Kavanaugh Road Pump Station to handle upstream flows. The surrounding area is residential with available open space.

The conveyance alternative considered upgrading the pump station. The first storage alternative considered was to construct a wet weather storage facility on residential property. The best location for a storage facility would require additional conveyance downstream approximately 200 feet. The second storage alternative considered was to construct large pipe in the vicinity of the SSO to provide inline storage. Ground truthing found a potential utility conflict with overhead electrical lines.

Branch MSD1086

This branch includes SSOs caused by insufficient capacity at the Floydsburg Road Pump Station to handle upstream flows. The surrounding area is industrial with some residential. There is some open space near the pump station and in a wooded area to the west.

The conveyance alternative considered upgrading the pump station. The storage alternative considered was to construct a wet weather storage facility on developed property. The best location for a storage facility would require additional conveyance downstream approximately 200 feet. Another alternative considered I/I reduction since the area is small (16 properties) and mostly industrial. Ground truthing at the pump station location found that the site is next to an electrical substation and several overhead and underground lines are onsite.

Branches MSD1085/MSD1086

An alternative that would eliminate SSOs at both Floydsburg Road and Kavanaugh Road Pump Stations was also considered. This alternative consisted of eliminating Floydsburg Road and Kavanaugh Road Pump Stations and constructing interceptors to run south to a new pump station site to serve the whole Crestwood area. A force main would be constructed parallel to the Floydsburg Road Interceptor.

3.3.3.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in Hite Creek. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Branch MSD1082

Based on the benefit-cost analysis, the chosen solution for Hite Creek Branch MSD1082 (Meadow Stream PS) is Inline Storage. Table 3.3.9 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.9

HITE CREEK BRANCH MSD1082 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_HC_HC_MSD1082_S_09A_C	Inline Storage	Inline storage with dual 238 LF, 120" parallel pipes to store wet weather peak flow.	10.77	13.77
S_HC_HC_MSD1082_S_09B_C	Offline Storage	Construct aboveground storage vault (0.2 MG).	8.67	8.85
S_HC_HC_MSD1082_S_03_C	PS & Force Main Upgrades	Increase the capacity of the Meadow Stream PS to handle peak flows of approximately 4.5 mgd, upgrade 15,395 LF to 18" force main.	3.14	2.77

Branch MSD1085

Based on the benefit-cost analysis, the chosen solution for Hite Creek Branch MSD1085 (Kavanaugh Rd. PS) is Pump Station and Force Main Upgrades. Table 3.3.10 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.10

HITE CREEK BRANCH MSD1085 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_HC_HC_MSD1085_S_03_C	PS & Force Main Upgrades	Increase the capacity of the Kavanaugh Rd. PS to handle peak flows of 0.674 mgd and upgrade 2,458 LF of force main.	19.46	19.77
S_HC_HC_MSD1085_S_09A_C	Inline Storage	Inline storage with dual 968 LF, 72" influent PS lines. Additional 2,243 LF of upsized sewer is required.	5.25	6.71

Branch MSD1086

The chosen solution for Hite Creek Branch MSD1086 (Floydsburg Rd. PS) is I/I Reduction. This solution was chosen as the recommended alternative since the contributing area is small and the pump station should have enough capacity based on design calculations. If I/I reduction is deemed unsuccessful in eliminating the SSO, then the next best alternative is Pump Station Upgrades. Table 3.3.11 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.11

HITE CREEK BRANCH MSD1086 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_HC_HC_MSD1086_M_07_C	I/I Reduction	This location is targeted for I/I source control (I/I rehab and private property program).	Cost only for Sanitary Sewer Evaluation Study (SSES) - no benefits calculated	
S_HC_HC_MSD1086_M_03_C	PS & Force Main Upgrades	Upgrade the capacity of the Floydsburg Rd. PS to handle peak flows of 0.30 mgd and upgrade 1,183 LF of force main.	19.78	19.80

Branches MSD1085/MSD1086

The Regional Pump Station alternative was not a favorable solution for Hite Creek Branches MSD1085 and MSD1086 based on the benefit-cost analysis; therefore, no further evaluation occurred for this solution. Table 3.3.12 summarizes the solution considered and the associated benefit-cost ratio.

TABLE 3.3.12

HITE CREEK REGIONAL PUMP STATION SOLUTION ALTERNATIVE

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_HC_HC_CrestwoodPS_M_13_C	New Regional PS	Eliminate Floydsburg Road PS and Kavanaugh Road PS, construct interceptors to a new regional PS to serve the entire Crestwood area, construct 6,135 LF of force main parallel to Floydsburg Road Interceptor. Additional 6,914 LF of new sewer construction required.	8.14	9.28

3.3.4 Jeffersontown Area Alternatives

Details on branching and SSO descriptions for Jeffersontown are in Volume 3, Chapter 2, Section 2.5.4. The initial solution development process is summarized in detail in Sections 3.1.3 and 3.1.3.3 contains information on the ground truthing procedure.

3.3.4.1 Initial Solutions and Feasibility Screening

Initial solutions were investigated before any baseline conditions (i.e. Capital Projects) or RDI/I reduction had been applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated by one of the two and, therefore, is not summarized below.

Branch 1

This branch includes SSOs caused by insufficient capacity of the interceptor, siphon and Jeffersontown WQTC to handle wet weather flows. The surrounding area is a mix of commercial, industrial, residential, and athletic facilities.

Numerous storage, conveyance and diversion alternatives were considered. Most alternatives required the replacement of the interceptor from the Grassland area to the Jeffersontown WQTC. Another alternative considered a pump station or storage facility in the Grassland area.

Ground truthing revealed that 10 percent of the gravity interceptor line from the Grassland area to the Jeffersontown WQTC lies within the 100-year floodplain, has significant steep slopes, and an endangered/threatened species assessment is recommended due to the wooded area. The proposed storage site and the pump station at the Jeffersontown WQTC location lie within the 100-year floodplain and very near Chenoweth Run stream.

Branch 1A

Branch 1A includes the SSOs at the Chippewa and Chenoweth Run Pump Stations, which had previously been considered in the initial alternatives for Branch 4. Both SSOs are caused by insufficient capacity at the pump stations to handle upstream flows. The surrounding area is residential with lot sizes of approximately one acre or less. There is a large undeveloped area to the south of the Chenoweth Run Pump Station.

The conveyance alternative considered upgrading the pump station and the force main. The storage alternative considered was to construct a wet weather storage facility in the area to the south of the SSO locations.

Branch 2

This branch includes SSOs caused by insufficient capacity of the interceptor downstream of Charlane Parkway and Dell Road. The surrounding area is a mix of commercial, single-family, and multi-family residential.

The conveyance alternative considered upsizing the interceptor. The storage alternative considered was to construct a wet weather storage facility in a grassy area east of SSO ID 28391 between the railroad tracks and the sewer. Ground truthing found several utility crossings and a creek located north of the conveyance alternative.

Branch 3

This branch includes SSOs caused by insufficient capacity at the Raintree and Marian Court Pump Stations to handle upstream flows. The surrounding area is a mix of single-family and multi-family residential.

The conveyance alternative considered upgrading the pump stations. The storage alternative considered was to construct a wet weather storage facility at some undeveloped land to the northeast. An additional storage alternative could be under an existing commercial parking lot on Taylorsville Road. A diversion alternative included construction of new pipe to divert flows to an alternate system and eliminate the pump stations. Ground truthing found several utility crossings for the Marian Court Pump Station and Raintree Pump Station diversion alternative.

Branch 4

This branch includes an SSO caused by insufficient capacity at the Monticello Place Pump Station to handle upstream flows. As discussed in the Branch 1A description, several SSO locations initially evaluated in the Branch 4 network are now included in the Branch 1 solutions.

The Monticello Pump Station is the only SSO location that remains in Branch 4. The surrounding area is a mix of single-family and multi-family residential.

The conveyance alternative considered upgrading the pump station. The storage alternative considered was to construct a wet weather storage facility to the south of the pump station. A diversion alternative included construction of new pipe to divert flows to an alternate system and eliminate the pump station. Ground truthing for the diversion alternative found one underground utility crossing and a creek located near the site.

3.3.4.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in Jeffersontown WQTC Branch Network. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Branch 1

Based on the benefit-cost analysis, the chosen solution for Jeffersontown Branch 1 is Offline Storage and Pipe Upgrades as well as a new pump station to be constructed at the Jeffersontown WQTC site. This solution will eliminate the Jeffersontown WQTC. The alternative shown in the following table with the highest benefit-cost ratio initially assumed that the Jeffersontown WQTC would be available for upgrading. With the goal being to eliminate the Jeffersontown WQTC this alternative was not evaluated further. Table 3.3.13 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.13

JEFFERSONTOWN BRANCH 1 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Costs)	Benefit/ Cost Ratio (Present Worth Costs)
S_JT_JT_NB01_M_01_C_A	Offline Storage, Pipe Upgrades, WQTC Elimination	Upsize the interceptor (6,200 LF) from Grassland to the WQTC. Storage facility (5.7 MG) at the WQTC site and a new PS with capacity of 10 mgd. 32,100 LF of 24" force main constructed to convey flows to the Hikes Lane Interceptor.	4.93	5.23
S_JT_JT_NB01_M_01_C_B	WQTC & Pipe Upgrades	Upsize the interceptor (6,200 LF) from Grassland to the WQTC and increase the capacity of the WQTC to 20 mgd (full plant upgrade).	12.01	11.81
S_JT_JT_NB01_M_01_C_C	WQTC Upgrades, Storage & Pipe Upgrades	Upsize the interceptor (6,200 LF) from Grassland to the WQTC. Storage facility (2.3 MG) at the WQTC site and a new PS with capacity of 10 mgd. 32,100 LF of 24" force main constructed to convey flows to the Hikes Lane Interceptor. Convey Chenoweth Hills WQTC and the pumped zone of Jeffersontown (J'town) to the Billtown Road Interceptor for diversion to Cedar Creek WQTC. Plant upgrades required at Cedar Creek WQTC.	3.29	No Present Worth analysis performed
S_JT_JT_NB01_01_C_D	WQTC Upgrades, Storage, & Pipe Upgrades	Upsize the interceptor (6,200 LF) from Grassland to the WQTC. Storage facility (2.3 MG) at the WQTC site and a new PS with capacity of 10 mgd. 8,000 LF of 24" to 30" force main installed to the Chenoweth Run PS. All J'town flow (including Chenoweth Hills WQTC) is diverted to Cedar Creek WQTC. Plant upgrades required at Cedar Creek WQTC.	2.60	No Present Worth analysis performed

Branch 1A

Based on the benefit-cost analysis, the chosen solution for Jeffersontown Branch 1A is Pump Station and Force Main Upgrades and directs the flow from the Chenoweth Hills WQTC to the Chenoweth Run Pump Station. Each alternative in Branch 1A included the elimination of the Chenoweth Hills WQTC. Table 3.3.14 summarizes the solutions considered and the benefit-cost ratios associated with each solution; however, the costs for Branch 1A are incorporated into Branch 1.

TABLE 3.3.14

JEFFERSONTOWN BRANCH 1A SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Costs)	Benefit/ Cost Ratio (Present Worth Costs)
S_JT_JT_NB01A_M_03_C	PS & Force Main Upgrades, WQTC Elimination	Upgrade Chenoweth Run PS to handle peak flow of 2.7 mgd and upsize 8,030 LF of force main to 12". Chenoweth Hills WQTC elimination. Upgrade Chippewa PS to handle peak flow of 0.15 mgd. Install 1,995 LF of new 15" sewer and replace 600 LF of 8" with 18" sewer pipe for Chenoweth Hills WQTC diversion.	22.47	20.05
S_JT_JT_NB01A_M_09_C	Offline Storage & Pipe Upgrades	Construct offline wet weather storage facility (0.8 MG) at Chenoweth Run PS and Chenoweth Hills WQTC diversion with Chippewa PS upgrades.	11.66	12.24

Branch 2

Based on the benefit-cost analysis, the chosen solution for Jeffersontown Branch 2 is Pipe Upgrades. Table 3.3.15 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.15

JEFFERSONTOWN BRANCH 2 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Costs)	Benefit/ Cost Ratio (Present Worth Costs)
S_JT_JT_NB02_M_01_C	Pipe Upgrades	Upsize interceptor downstream of Charlane and Dell Road SSOs with 4,000 LF of (10"-21") sewer.	25.01	31.35
S_JT_JT_NB02_M_09_C	Offline Storage	Construct underground pumped offline storage facility (0.18 MG) near swimming pool site and storage facility (0.03 MG) at manhole 103647.	12.02	12.55

Branch 3

Based on the benefit-cost analysis, the chosen solution for Jeffersontown Branch 3 (Raintree PS / Marian Ct. PS) is Diversion and Pipe Upgrades. Table 3.3.16 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.16

JEFFERSONTOWN BRANCH 3 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Costs)	Benefit/ Cost Ratio (Present Worth Costs)
S_JT_JT_NB03_M_01_C	Diversion & Pipe Upgrades	Eliminate Marian Ct. and Raintree PSs by installing 455 LF of 8" sewer from Marian Ct. PS and 400 LF of 8" sewer from Raintree PS to divert flows to the Southeast Diversion system, additional 2,675 LF of 15" sewer upgrades is required downstream of the PS diversions.	59.44	72.76
S_JT_JT_NB03_M_09_C	Offline Storage & Pipe Upgrades	Construct underground offline storage facility (0.007 MG) for Marian Ct PS, upgrade 928 LF of force main and pumps for Raintree PS to handle peak flow of 0.63 mgd, additional 2,530 LF of sewer upgrades downstream of the PS is required.	34.31	34.57
S_JT_JT_NB03_M_03_C	PS & Pipe Upgrades	Replace 878 LF of force main at Raintree PS, replace pumps at Marian Ct (to 0.3 mgd) PS and Raintree (to 0.6 mgd) PS, upsize 2,480 LF of gravity sewer downstream of the force main.	33.59	36.94

Branch 4

Based on the benefit-cost analysis, the chosen solution for Jeffersontown Branch 4 (Monticello PS) is Diversion. Table 3.3.17 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.17

JEFFERSONTOWN BRANCH 4 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Costs)	Benefit/Cost Ratio (Present Worth Costs)
S_JT_JT_NB04_M_01_C_C	Diversion	Eliminate Monticello PS by diverting to Derek R. Guthrie WQTC approximately 625 LF of 8" sewer.	39.43	48.90
S_JT_JT_NB04_M_03_C_C	PS Upgrades	Upgrade Monticello PS to handle peak flow of 0.75 mgd.	25.16	19.34
S_JT_JT_NB04_M_09_C_C	Offline Storage	Construct offline storage (0.053 MG) at Monticello PS.	8.83	8.59

3.3.5 Middle Fork Alternatives

Details on branching and SSO descriptions for Middle Fork can be found in Volume 3, Chapter 2, Section 2.5.5. The initial solution development process is summarized in detail in Sections 3.1.3 and 3.1.3.3 contains information on the ground truthing procedure.

3.3.5.1 Initial Solutions and Feasibility Screening

Initial solutions were investigated before any baseline conditions (i.e. Capital Projects) or RDI/I reduction had been applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated by one of the two and, therefore, is not summarized below.

Branch 1

This branch includes SSOs caused by insufficient capacity in the collection system and the Upper Middle Fork Pump Station to handle upstream flows. The surrounding area is mostly commercial and residential with some industrial areas in the vicinity. This Branch has been evaluated with Southeastern Diversion branches to include the costs of the Buechel Basin for various comparative analyses. Initially, alternatives for this area were developed with the review of the Interim SSDP solutions, namely the Hikes Lane Interceptor and Northern Ditch Interceptor.

Ground truthing was performed at six locations in the area. Three of the locations had property in the 100-year floodplain, and three locations showed potential utility conflicts. Ground truthing identified two sites where a threatened/endangered species assessment was recommended. Four sites contained a protected waterway and another location was identified as a potential wetland (hydric soil was found). Several creeks were noted in the areas near the investigated sites.

Branch 4

This branch includes SSOs caused by insufficient capacity at Devondale, Goose Creek and Saurel Road Pump Stations to handle upstream flows. The surrounding area is primarily residential along with a large tract of farmland to the north, and a school to the east.

The conveyance alternative considered upgrading the Goose Creek, Devondale and Saurel Road Pump Stations and force mains. The storage alternative considered was to construct a wet weather storage facility on an undeveloped property adjacent to the pump station on the north and east. Additional storage sites are also available to the east on school property and to the west on undeveloped property.

Ground truthing was performed at four locations, and all had property in the 100-year floodplain. The Saurel Road force main location showed potential utility conflicts and the project could involve construction between existing homes within the easement.

Branch 6

This branch includes SSOs caused by insufficient capacity at Anchor Estates No. 1 and No. 2 Pump Stations, and Vannah Way Pump Station. The surrounding area is single-family residential.

The conveyance alternative considered upgrading the Anchor Estates No. 1, No. 2, and Vannah Way Pump Stations and force mains. The storage alternative considered was to construct large pipe to provide inline storage at Anchor Estates No. 1 and No. 2 Pump Stations. The diversion alternative considered constructing gravity lines to alternate systems to eliminate each of the three pump stations.

Ground truthing was performed at three locations in the area, and a creek was identified at the southern end of the projects. Two locations had property in the 100-year floodplain, and one site had a threatened/endangered species assessment that was recommended. One site identified a protected waterway in the vicinity.

Branch 7

This branch includes an SSO caused by insufficient wet weather capacity in the collection system due to excessive I/I. This SSO location was not reported as an SSO until mid-2008; therefore, no initial solutions were developed for the locations since they were not known at the time of initial solution development. Solutions, however, were developed later during the solution alternative analysis process.

3.3.5.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in Middle Fork. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Branch 1

Based on the benefit-cost analysis, the chosen solution for Middle Fork Branch 1 is Offline Storage and Pipe Upgrades (A). This branch is one of the three branches requested to be re-evaluated at the 2.25-inch cloudburst level to ensure the validity of the technology selection approach at the 1.82-inch cloudburst level. Table 3.3.18(A) summarizes the solutions considered for the 1.82-inch cloudburst storm and the benefit-cost ratios associated with each solution. Table 3.3.18(B) summarizes the solutions considered for the 2.25-inch cloudburst storm and the benefit-cost ratios associated with each solution.

TABLE 3.3.18(A)

MIDDLE FORK BRANCH 1 – 1.82-INCH SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_MISF_MF_NB01_M_01_C_A1	Offline Storage & Pipe Upgrades (A)	Construct 30" force main diversion to Hikes Lane Interceptor (10,200 LF), construct Middle Fork Relief Interceptor between Oxmoor Mall and Upper Middle Fork Lift Station (UMFLS), construct 1.6 MG covered facility near Car Wash Site and 17.3 MG facility at Buechel Site. 11,800 LF total new gravity pipe including Relief Interceptor, storage piping, and relief at manhole 15138.	1.14	1.26
S_MISF_MF_NB01_M_01_C_A2	Offline Storage & Pipe Upgrades (B)	Divert UMFLS to Hikes Lane Interceptor using capacity of existing pumps (no Middle Fork Interceptor required). Construct 17.3 MG storage facility at Buechel Site and 3.0 MG covered storage near Oxmoor Mall. 4,750 LF of additional gravity pipe improvements, 10,200 LF of force main.	1.06	1.15
S_MISF_MF_NB01_M_01_C_A3	Offline Storage & Pipe Upgrades (C)	Construct 30" force main diversion to Hikes Lane Interceptor (10,200 LF), construct Middle Fork Relief Interceptor between Oxmoor Mall and UMFLS, construct 3 MG covered facility at Cannons Lane site and 17.3 MG storage facility at Buechel site, 11,800 LF total new gravity pipe including Relief Interceptor, storage piping, and relief at manhole 15138.	1.05	1.16
S_MISF_MF_NB01_M_01_C_B1	PS & Pipe Upgrades with Offline Storage	Divert all necessary flow through UMFLS to Hikes Lane Interceptor by upgrading pumps to convey peak discharge in diversion, construct 20.5 MG storage at Buechel Site, and construct 36" force main diversion to Hikes Lane Interceptor, 11,800 LF total new gravity pipe including Relief Interceptor, storage piping, and relief at manhole 15138., 10,200 LF of force main.	0.84	0.93

TABLE 3.3.18(B)

MIDDLE FORK BRANCH 1 – 2.25-INCH SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_MISF_MF_NB01_M_01_B_A1	Offline Storage & Pipe Upgrades (A)	Construct 30" force main diversion to Hikes Lane Interceptor (10,200 LF), construct Middle Fork Relief Interceptor between Oxmoor Mall and Upper Middle Fork Lift Station (UMFLS), construct 7.9 MG covered facility near Car Wash Site and 30.1 MG facility at Buechel Site. 16,900 LF total new gravity pipe including Relief Interceptor, storage piping, and relief at manhole 15138.	0.96	1.07
S_MISF_MF_NB01_M_01_B_B1	PS & Pipe Upgrades with Offline Storage	Divert all necessary flow through UMFLS to Hikes Lane Interceptor by upgrading pumps to convey peak discharge in diversion, construct 57.2 MG storage at Buechel Site, and construct 36" force main diversion to Hikes Lane Interceptor, 16,900 LF total new gravity pipe including Relief Interceptor, storage piping, and relief at manhole 15138., 10,200 LF of force main.	0.95	1.06
S_MISF_MF_NB01_M_01_B_A2	Offline Storage & Pipe Upgrades (B)	Divert UMFLS to Hikes Lane Interceptor using capacity of existing pumps (no Middle Fork Interceptor required). Construct 43.1 MG storage facility at Buechel Site and 8.5 MG covered storage near Oxmoor Mall. 5,900 LF of additional gravity pipe improvements, 10,200 LF of force main.	0.95	1.03
S_MISF_MF_NB01_M_01_B_A3	Offline Storage & Pipe Upgrades (C)	Construct 30" force main diversion to Hikes Lane Interceptor (10,200 LF), construct Middle Fork Relief Interceptor between Oxmoor Mall and UMFLS, construct 11.3 MG covered facility at Cannons Lane site and 34 MG storage facility at Buechel site, 25,800 LF total new gravity pipe including Relief Interceptor, storage piping, and relief at manhole 15138.	0.74	0.83

As indicated in the table, the Offline Storage and Pipe Upgrades (A) alternative had the best benefit-cost ratio, independent of level of control. It can be noted that the Pump Station and Pipe Upgrades with Offline Storage changed from the worst benefit-cost ratio at the 1.82-inch level to the second best benefit-cost ratio at the 2.25-inch level. The other 3 alternatives used underground, covered storage which increased in cost significantly at the higher storm level. The Pump Station and Pipe Upgrades with Offline Storage assumed an open, earthen facility which has a lower incremental cost to expand. A detailed evaluation of the odor generating potential was not conducted for this technology screening step, but there is a high potential that depending on the final site selected for the storage facility, the larger facility needed to contain the 2.25-inch rain could exceed the criteria established for uncovered facilities, thus increasing the cost considerably for this alternative.

Branch 4

Based on the benefit-cost analysis, the chosen solution for Middle Fork Branch 4 (Devondale, Goose Creek, and Saurel Rd. PSs) is Storage and Force Main Upgrades. Table 3.3.19 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.19

MIDDLE FORK BRANCH 4 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_MI_MF_NB04_M_03_B_A	Offline Storage, PS & Force Main Upgrades	Construct 0.5 MG covered storage facility near Devondale PS. Upsize 16" portion of force main at Goose Creek PS to 20" force main. Upgrade Goose Creek PS to 7.2 mgd. Replace Saurel Rd 4" force main with 6" force main. Upsize a total of 3,300 LF of force main.	10.78	11.00
S_MI_MF_NB04_M_09B_B	Inline and Offline Storage	Construct offline covered storage at Devondale PS (0.48 MG) and Goose Creek PS (0.19 MG). Inline storage with 72" pipe to store wet weather peak flow at Saurel Road PS.	9.04	9.17
S_MI_MF_NB04_M_03_B	Force Main & PS Upgrades	Upgrade the Devondale PS to handle peak flow of 1.5 mgd, upsize the force main to an 8" force main, and upsize downstream gravity pipes to 12" and 15" (5,710 LF). Upsize the 16" portion of Goose Creek force main to a 20" force main, and upgrade the PS to 7.2 mgd. Upsize 4" Saurel Rd force main to a 6" force main.	8.66	8.71

Branch 6

The chosen solution for Middle Fork Branch 6 (Anchor Estates No. 1 and 2 Pump Stations / Vannah Way Pump Station) is Diversion. This alternative was chosen because it eliminates three pump stations and has the potential for cost sharing with developers planning for new future connections in a currently un-sewered area. Table 3.3.20 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.20

MIDDLE FORK BRANCH 6 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_MI_MF_NB06_M_01_C_A	Diversion	Construct 9,790 LF of 8" to 10" diversion gravity pipe to eliminate Anchor Estates No. 1 and No. 2 PSs, and Vannah Way PS. SSES upstream of Anchor Estates No. 2 PS.	20.86	25.39
S_MI_MF_NB06_M_01_C_C	Inline Storage & Diversion (A)	Construct 3,950 LF of 8” diversion gravity pipe to eliminate Vannah Way and Anchor Estates No. 1 PS, and construct 150 LF of 72” pipe at Anchor Estates No. 2 PS to provide inline storage	32.27	39.83
S_MI_MF_NB06_M_09_C	Inline Storage & Diversion (B)	Diversion pipe to eliminate Vannah Way PS, 150 LF of 72” pipe (at Anchor Estates No. 2 PS) and 300 LF of 72” pipe (at Anchor Estates No. 1 PS) to provide inline storage.	27.70	35.43
S_MI_MF_NB06_M_01_C_B	PS Upgrades & Diversion	Construct 3,950 LF of 8” diversion gravity pipes to eliminate Vannah Way and Anchor Estates No. 1 PSs, and Anchor Estates No. 2 PS upgrades with flow diverted to Vannah PS diversion.	20.10	23.05
S_MI_MF_NB06_M_03_C	PS Upgrades	Upgrade all PSs, upsize 2,300 LF of force main, upsize 2,300 LF of downstream collector sewers.	5.34	6.11

Branch 7

The chosen solution for Middle Fork Branch 7 is I/I Reduction. This solution was chosen as the recommended alternative based on modeling results. An overflow did not occur at this manhole in the existing conditions model at the 1.82-inch or 2.25-inch cloudburst storm indicating excessive I/I during heavy rainfall is likely the problem. Table 3.3.21 summarizes the solution considered.

TABLE 3.3.21

MIDDLE FORK BRANCH 7 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_MI_MF_NB07_S_07_C	I/I Reduction	This location is targeted for I/I source control (I/I rehab and private property program).	Cost only for SSES - no benefits calculated.	

3.3.6 Southeastern Diversion Alternatives

Details on branching and SSO descriptions for Southeastern Diversion can be found in Volume 3, Chapter 2, Section 2.5.6. The initial solution development process is summarized in detail in Sections 3.1.3 and 3.1.3.3 contains information on the ground truthing procedure.

3.3.6.1 Initial Solutions and Feasibility Screening

Initial solutions were investigated before any baseline conditions (i.e. Capital Projects) or RDI/I reduction had been applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated by one of the two and, therefore, is not summarized below.

<u>Branch 3</u>

This branch includes an SSO caused by insufficient capacity of the interceptor to handle upstream flows during wet weather. The surrounding area is a mix of single-family residential, multi-family residential, and light industrial.

The conveyance alternative considered was to upsize the interceptor. The first storage alternative considered was to construct a wet weather storage facility on land at the upper end of the industrial area or behind the school property. The second storage alternative considered was to construct large pipe in the vicinity of the SSOs to provide inline storage.

Ground truthing at the storage location and along the Rustic Way corridor found hydric soil which may classify the area as a potential wetland site. Additionally, the locations were recommended for a threatened/endangered species assessment.

<u>Branch 4</u>

This branch includes an SSO caused by insufficient capacity of the system to handle upstream flows during wet weather. The surrounding area is single-family residential.

The conveyance alternative considered was to construct a relief sewer from the SSO at Alcona Lane to the new Hikes Lane Interceptor. The storage alternative considered was to construct a wet weather storage facility on the school property adjacent to the SSO location.

Ground truthing for the conveyance alternative found the alignment is 100 percent within the 100-year floodplain and a Louisville and Jefferson County Information Consortium (LOJIC) sensitive feature tool identified a protected waterway. A threatened/endangered species assessment was recommended because a portion of the construction would take place adjacent to a stream. Potential utility conflicts identified include water service replacements.

Branch 5

This branch includes an SSO caused by insufficient capacity of the interceptor to handle upstream flows during wet weather. The surrounding area is single-family residential.

The conveyance alternative considered was to upsize the interceptor behind homes on Sutherland Drive. The first storage alternative considered was to construct a wet weather storage facility on the school property to the south of the SSO locations. The second storage alternative considered was to construct large pipe in the vicinity of the SSOs to provide inline storage.

Ground truthing for the conveyance alternative found the property is 45 percent within the 100-year floodplain and a LOJIC sensitive feature tool identified a protected waterway. The Beargrass Creek was identified at the south end of the project.

Branch 6

This branch includes an SSO caused by backwater in the Beargrass Interceptor due to obstructions in the sewer line. No initial solutions were developed for this location. This SSO is targeted for interceptor rehabilitation to remove obstructions in the downstream 42” interceptor.

3.3.6.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in the Southeastern Diversion area. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Branch 3

The chosen solution for Southeastern Diversion Branch 3 is I/I Reduction. This solution was chosen as the recommended alternative since the contributing area is small and the interceptor should contain enough capacity based on design calculations. If infiltration reduction is deemed unsuccessful in eliminating the SSO, then the next best alternative is Pipe Upgrades. This solution is more desirable than the storage solution due to the proximity of the nearby school. Table 3.3.22 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.22

SOUTHEASTERN DIVERSION BRANCH 3 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_SD_MF_NB03_S_07_C	I/I Reduction	This location is targeted for I/I source control (I/I rehab and private property program).	Cost only for SSES - no benefits calculated.	
S_SD_MF_NB03_S_09B_C	Offline Storage	Construct offline covered (0.084 MG) storage in open field adjacent to SSO.	22.76	22.88
S_SD_MF_NB03_S_01_C	Pipe Upgrades	Construct 2,394 LF of 10" relief sewer that parallels the existing sewer along Rustic Way.	17.14	21.23
S_SD_MF_NB03_S_09A_C	Inline Storage	Construct 752 LF of 60" sewer from manhole 19320 to 47252 and 497 LF of 42" sewer from manhole 47252 to 27280 to provide inline storage.	10.62	13.48

Branch 4

The solution for the Southeastern Diversion Branch 4 is Pipe Upgrades. This solution involves a 30” gravity interceptor connecting to the Hikes Lane Interceptor where the Jeffersontown Branch 1 24” force main solution connects to the Hikes Lane Interceptor. The Southeastern Diversion Branch 4 solution was priced with a 30” gravity interceptor constructed to the Hikes Lane Interceptor minus the cost of the 24” Jeffersontown force main along the same route. Table 3.3.23 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.23

SOUTHEASTERN DIVERSION BRANCH 4 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_SD_MF_NB04_S_01_C_A	Pipe Upgrades	Construct 2,830 LF of 30” gravity interceptor connecting the Jeffersontown Branch 1 24” force main to the Hikes Lane Interceptor.	6.21	9.11
S_SD_MF_NB04_S_01_C_B	Pipe Upgrades	Construct 2,830 LF of 12" relief interceptor.	3.47	4.35
S_SD_MF_NB04_S_09B_C	Offline Storage	Construct a covered 0.12 MG offline storage facility in the school property adjacent to the SSO.	1.21	1.21

Branch 5

Based on the benefit-cost analysis, the chosen solution for Southeastern Diversion Branch 5 is Pipe Upgrades. Table 3.3.24 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.24

SOUTHEASTERN DIVERSION BRANCH 5 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_SD_MF_NB05_M_01_C	Pipe Upgrades	Upsize 1,760 LF of gravity pipe from 10" to 15" along rear yards.	20.54	25.22
S_SD_MF_NB05_M_09B_C	Offline Storage	Construct offline covered (0.089 MG) storage in an open field on school property.	18.10	18.10
S_SD_MF_NB05_M_09A_C	Inline Storage	Construct 620 LF of 60" sewer downstream of manhole ID 16649 to provide inline storage.	16.03	20.34

Branch 6

The chosen solution for Southeastern Diversion Branch 6 is Pipe Rehab. This is based on findings during the Interceptor Condition Assessment Phase 1. Table 3.3.25 summarizes the solution considered.

TABLE 3.3.25

SOUTHEASTERN DIVERSION BRANCH 6 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_SD_MF_NB06_S_13_C	Pipe Rehab	Heavily clean 2,000 LF of 42” interceptor	Cost only for Maintenance - no benefits calculated.	

3.3.7 Ohio River Force Main (ORFM) Alternatives

Details on branching and SSO descriptions for ORFM can be found in Volume 3, Chapter 2, Section 2.5.7. The initial solution development process is summarized in detail in Sections 3.1.3 and 3.1.3.3 contains information on the ground truthing procedure.

3.3.7.1 Initial Solutions and Feasibility Screening

Initial solutions were investigated before any baseline conditions (i.e. Capital Projects) or RDI/I reduction had been applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated by one of the two and, therefore, is not summarized below.

Branch 1

This branch includes SSOs caused by insufficient capacity at pump stations in residential neighborhoods to handle upstream flows. Each pump station location was analyzed separately.

Many of the pump stations had available space for onsite storage alternatives. The conveyance alternatives considered would include pump station upgrades as well as pipe upgrades. The diversion alternatives involved elimination of pump stations by constructing new pipe to alternate systems.

Ground truthing was performed at six locations. Four of the locations include property in the 100-year floodplain. Two locations had a threatened/endangered species assessment recommended and two locations found potential utility conflicts with water lines. One location is located 70 percent in a golf course, and another location is located east of a creek. The Mockingbird Pump Station diversion location has potential steep slope and is in a Floodplain Management Ordinance review zone. The Mellwood Pump Station ground truthing noted a protected waterway. The Mellwood Pump Station force main project has numerous water lines to cross at Zorn Avenue.

Branch 2

This branch includes an SSO caused by a hydraulic bottleneck of two 8” pipes flowing into one 8” pipe. The surrounding area is single-family residential.

The conveyance alternative considered was to increase the existing pipe size downstream of the SSO. The storage alternative considered was to construct a wet weather storage facility behind residential lots due to lack of available land.

Branch 3

This branch includes an SSO caused by insufficient capacity at the Derington Court Pump Station to handle upstream flows. The surrounding area is single-family residential.

The conveyance alternative considered upgrading the pump station. The first storage alternative considered was to construct a wet weather storage facility in an area adjacent to the SSO. The second storage alternative considered was to construct large pipe in the vicinity of the SSO to provide inline storage.

Ground truthing at the pump station property found that 10 percent of the property is in the 100-year floodplain and a sensitive feature was identified as a protected waterway southwest of the pump station. Ground truthing for offline storage found that 100 percent of the property is in the 100-year floodplain. A threatened/endangered species assessment was recommended.

Branch 4

This branch includes SSOs caused by insufficient capacity at pump stations in residential neighborhoods to handle upstream flows. Each pump station location was analyzed separately.

The conveyance alternatives considered would include pump station upgrades. The storage alternatives considered offline storage facilities in areas adjacent to the SSOs.

Ground truthing was performed at six locations. Five of the locations had properties in the 100-year floodplain. Two locations had a threatened/endangered species assessment recommended and many stream crossings were found in the area.

3.3.7.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in ORFM. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Branch 1

Based on the benefit-cost analysis, the chosen solution for ORFM Branch 1 is Pump Station and Pipe Upgrades and Diversion. The Winton Avenue Pump Station and Mockingbird Valley Pump Station will be eliminated by the project. Table 3.3.26 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.26

ORFM BRANCH 1 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_OR_MF_NB01_M_01_C	PS Upgrades, Pipe Upgrades & Diversion	Replace 1,760 LF of gravity sewer flowing into Mockingbird Valley PS, upgrade Mellwood Ave PS to handle peak flow of 2.5 mgd and flood-proof PS, upsize approximately 1,240 LF of 6" force main with 12" force main for Mellwood Ave PS, installation of 400 LF of 8" pipe for Winton PS diversion and 2,210 LF of 15" pipe for Mockingbird Valley PS diversion to alternate systems.	21.11	25.09
S_OR_MF_NB01_M_03_C	PS Upgrades & Pipe Upgrades	Replace 1,890 LF of gravity sewer flowing into Mockingbird Valley PS, upgrade pumps at Mockingbird Valley PS and Winton PS, total PS upgrade at Mellwood Ave PS, upsize 2,000 LF of force main for Mockingbird Valley PS, and upsize 1,240 LF of force main for Mellwood Ave PS.	19.55	22.90
S_OR_MF_NB01_M_09_C	Pipe Upgrades & Storage	Replace 200 LF of gravity sewer flowing into the storage area for Mockingbird Valley PS, divert Winton PS, construct 0.12 MG pumped storage facility at Mockingbird Valley PS, and construct 0.15 MG covered storage facility at Mellwood Ave PS.	14.27	15.38
S_OR_MF_NB01_M_01_C_A	Diversion, Pipe Upgrades & Storage	Replace 685 LF of 10" gravity sewer, construct 875 LF of 12" relief sewer, and 200 LF of 15" relief sewer for Mockingbird Valley PS. Additional upgrade of storage at Mellwood Ave PS to 1 MG (flood-proofed). Installation of 400 LF of 8" pipe for Winton PS diversion and 2,210 LF of 15" pipe for Mockingbird Valley PS diversion to alternate systems.	8.42	9.31

Branch 2

The chosen solution for ORFM Branch 2 is Condition Assessment. This solution was chosen because cleaning/flushing has occurred twice since March 2006 (the last documented overflow date) at this location and no additional overflows have been reported since that date. Table 3.3.27 the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.27

ORFM BRANCH 2 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_OR_MF_NB02_S_13_C	Condition Assessment	Perform periodic condition assessment (TVI and Wet Weather Monitoring) for three years to determine if SSO has been eliminated.	--	--
S_OR_MF_NB02_S_01_B	Pipe Upgrades	Construct 325 LF of 8" relief sewer.	85.67	102.80
S_OR_MF_NB02_S_09_B	Offline Storage	Construct offline covered pumped storage (0.048 MG) along the gravity sewer in the rear of homes on Leland Ave.	12.74	11.45

Branch 3

The chosen solution for ORFM Branch 3 (Derington Ct. PS) is I/I Reduction. This solution was chosen as the recommended alternative due to the small contributing area and difficult surrounding conditions (steep slopes and lack of available storage sites). If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best solution will be inline storage (based on Present Worth Benefit Cost ratio). Table 3.3.28 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.28

ORFM BRANCH 3 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_OR_MF_NB03_S_07_C	I/I Reduction	This location is targeted for I/I source control (I/I rehab and private property program).	Cost only for SSES - no benefits calculated.	
S_OR_MF_NB03_09_C_B	Offline Storage	Construct offline covered storage facility (0.016 MG) between the edge of pavement of Derington Court and the creek.	43.48	20.75
S_OR_MF_NB03_09_C_A	Inline Storage	Install 285 LF of 60" pipe parallel to the 8" gravity upstream of Derington Court PS to provide inline storage.	16.85	21.49
S_OR_MF_NB03_03_C	PS Upgrades	Upsize pumps at Derington Court PS, upsize 460 LF of force main from 4" to 6".	16.24	13.68

Branch 4

Based on the benefit-cost analysis, the chosen solution for ORFM Branch 4 is Pump Station and Pipe Upgrades and WQTC Elimination. This solution includes the elimination of five Prospect WQTCs. These solutions include the cost for a new Harrods Creek Pump Station but do not include the cost for additional treatment at Hite Creek WQTC. Table 3.3.29 summarizes the solutions considered and the benefit-cost ratios associated with each solution. A present worth analysis was not performed for these solutions.

TABLE 3.3.29

ORFM BRANCH 4 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_OR_MF_NB04_M_03_B_B	PS & Pipe Upgrades, WQTC Elimination	Upsize 8,300 LF of interceptor upstream of Muddy Fork PS. Upgrade pumps at Muddy Fork, Winding Falls/Phoenix Hill PS, and New Market PS. Upsize force main from Muddy Fork PS from 14" to a 24". Construct new 7.2 mgd Harrods Creek PS and 24,000 LF of 24" force main to pump flow to Hite Creek WQTC. The solution includes the elimination of the 5 Prospect WQTCs: Hunting Creek North, Hunting Creek South, Timberlake, Ken Carla, and Shadow Wood.	2.46	No Present Worth Analysis performed
S_OR_MF_NB04_M_01_B_B	Storage & PS Upgrades (A)	Construct covered storage facilities at Barbour Lane PS. Additional upsizing of interceptor upstream of Muddy Fork PS. Upgrade pumps at New Market PS.	1.94	No Present Worth Analysis performed
S_OR_MF_NB04_M_09_B_B2	PS & Force Main Upgrades	Construct additional 18" barrel for the ORFM from Muddy Fork PS to the outfall of the ORFM. This additional barrel would isolate Muddy Fork flow. Additional upsizing of interceptor required upstream of Muddy Fork PS. Upgrade pumps at Muddy Fork and New Market PSs. Upsize force main from Muddy Fork PS from 14" to an 18".	1.45	No Present Worth Analysis performed
S_OR_MF_NB04_M_09_B_B1	Storage & PS Upgrades (B)	Construct covered storage facilities at Muddy Fork PS and Winding Falls/Phoenix Hill PS. Additional upsizing of interceptor upstream of Muddy Fork PS. Upgrade pumps at New Market PS.	1.19	No Present Worth Analysis performed

3.3.8 CSO Area Alternatives

Details on branching and SSO descriptions for the CSO area can be found in Volume 3, Chapter 2, Section 2.5.8. The initial solution development process is summarized in detail in Sections 3.1.3 and 3.1.3.3 contain information on the ground truthing procedure.

3.3.8.1 Initial Solutions and Feasibility Screening

Initial solutions were investigated before any baseline conditions (i.e. Capital Projects) or RDI/I reduction had been applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated by one of the two and therefore is not summarized.

Branch 30917

This branch includes SSOs caused by insufficient capacity in the collection system in the Camp Taylor neighborhood. The land surrounding the SSOs consists of single-family and multi-family residential.

The first conveyance alternative considered replacing the entire sewer system with approximately 47,000 LF of new sewer pipe. The second conveyance alternative considered building a relief sewer to convey excess wet weather flow from documented SSOs to the downstream interceptor. The storage alternative considered construction of offline storage facilities to store excess wet weather flow. Due to the age and condition of the system, a storage option alone was not viable. Another alternative considered performing an SSES to better define the problem and target the isolated problem area.

Branch 42007

This branch includes an SSO caused most likely by insufficient capacity at the Sonne Avenue Pump Station to handle excess wet weather flow and cross connections in the Sonne Avenue Pump Station area. The surrounding area is residential and industrial and is near electrical utilities.

The conveyance alternative considered upgrading the Sonne Avenue Pump Station to handle excess wet weather flow and convey flow to the downstream combined sewer system. The storage alternative considered construction of an offline storage facility at the adjacent property.

Ground truthing found a potential utility conflict at the pump station location with electrical and gas laterals nearby.

Branch 55665

This branch includes an SSO caused most likely by insufficient capacity at the Hazelwood Pump Station to handle excess wet weather flow. This pump station was not reported as an SSO location until mid-2008; therefore, no initial solutions were developed for this location since it was not known at the time of initial solution development. Solutions, however, were developed later during the solution alternative analysis process.

3.3.8.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in the CSO area. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Branch 30917

Based on the benefit-cost analysis, the chosen solution for CSO Branch 30917 (Camp Taylor Neighborhood) is SSES, Rehabilitation, and Replacement. The chosen solution will include a full SSES to target sewers for replacement. Table 3.3.30 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.30

CSO BRANCH 30917 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_SF_MF_30917_M_09_C	SSES, Sewer Rehabilitation/ Replacement, Offline Storage	Replace and rehabilitate targeted sewer pipe after full SSES of the Camp Taylor area. Construct a pumped 0.02 MG covered storage facility to store excess wet weather flows, additional 3,395 LF of 8" pipe required to convey flow to the facility.	69.19	65.12
S_SF_MF_30917_M_12_A_A	System Replacement	Construct approximately 46,786 LF of new sanitary sewer pipe (8" - 15") to replace existing system.	7.18	9.05

Branch 42007

The chosen solution for CSO Branch 42007 (Sonne PS) is I/I Reduction. This solution was chosen as the recommended alternative due to the small contributing area and the fact that the area is located in the combined sewer system area and likely contains numerous cross connections. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative is Offline Storage. Table 3.3.31 summarizes the solution and benefit-cost ratio associated with the solution.

TABLE 3.3.31

CSO BRANCH 42007 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_OR_MF_42007_S_07_C	I/I Reduction	This location is targeted for I/I source control (I/I rehab and private property program)	Cost only for SSES - no benefits calculated.	
S_OR_MF_42007_S_09_C	Offline Storage	Construct offline covered pumped storage facility (0.18 MG) to store excess wet weather flows.	19.53	15.53
S_OR_MF_42007_S_03_C	PS Upgrades	Expand wet well from 6' to 12' diameter at the Sonne PS and upgrade PS to handle peak flow of 1.7 mgd.	9.26	10.12

<u>Branch 55665</u>

The chosen solution for CSO Branch 55665 (Hazelwood PS) is I/I Reduction. This solution was chosen as the recommended alternative due to the small contributing area and the fact that the area is located in the combined sewer system area and most likely contains numerous cross connections. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative is Offline Storage and Pipe Upgrades. Table 3.3.32 summarizes the solution and the benefit-cost ratio associated with that solution.

TABLE 3.3.32

CSO BRANCH 55665 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_MC_MF_55665_S_07_C	I/I Reduction	This location is targeted for I/I source control (I/I rehab and private property program).	Cost only for SSES - no benefits calculated.	
S_MC_MF_55665_S_13_C_B	Offline Storage & Pipe Upgrades	Construct offline covered storage facility (0.45 MG) to store excess wet weather flows and upsize 1,858 LF of 8" pipe to (12"-18")	10.98	11.60

3.3.9 Small WQTC Area Alternatives

Details on branching and SSO descriptions for the Small WQTC areas can be found in Volume 3, Chapter 2, Section 2.5.9. The initial solution development process is summarized in detail in Sections 3.1.3 and 3.1.3.3 contains information on the ground truthing procedure.

3.3.9.1 Initial Solutions and Feasibility Screening

Initial solutions were investigated before any baseline conditions (i.e. Capital Projects) or RDI/I reduction had been applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated by one of the two and therefore is not summarized.

Berrytown Branch 1

This branch includes an SSO caused by insufficient capacity at the Lucas Lane Lift Station (LS) to handle upstream flows. With the exception of a few residences, the area surrounding the SSO is mostly open space and is adjacent to Goose Creek.

The conveyance alternative considered upgrading the wet well, pump station, and force main. The storage alternative considered constructing large pipe in the vicinity of the SSOs to provide inline storage. The diversion alternative considered diverting flow to the Morris Forman WQTC through a force main. However, numerous utility lines would need to be avoided.

Ground truthing found a significant topographical feature identified as a drainage ditch that runs the length of the last two gravity sewer pipes upstream of the Lift Station. There are several trees growing above or very near the existing gravity sewer (sewer is currently scheduled to be replaced) potentially making replacement very difficult, and a resident's retaining wall is within ten feet of the proposed construction. The retaining wall would not impede construction of the proposed storage facility and the offline storage alternative would not require replacement of the entire sewer.

Chenoweth Hills Branch 1

This branch initially included an SSO located at the Chenoweth Hills WQTC caused by upstream flows greater than the WQTC capacity. The surrounding area is single-family residential. After initial solutions were investigated, it was found that the Chenoweth Hills WQTC location could be incorporated into the Jeffersontown Branch 1A solution. The SSO addressed by this branch is now the St. Rene Road Pump Station. This pump station was not reported as an SSO location until mid-2008; therefore, no initial solutions were developed for this location since it was not known at the time of initial solution development. Solutions, however, were developed later during the solution alternative analysis process.

Hunting Creek North Branch 1

This branch includes an SSO caused by insufficient capacity at the Riding Ridge Pump Station to handle upstream flows. The surrounding area is primarily residential with wooded and green space.

The conveyance alternative considered upgrading the wet well, pump station, and force main. Storage alternatives included constructing storage facilities in wooded areas near the SSO. Another storage alternative considered was to construct a large pipe in the vicinity of the SSO to provide inline storage. Ground truthing found an overhead electrical line runs near the pump station but is not in the potential area for a storage facility.

Hunting Creek North Branch 2

This branch includes an SSO caused by insufficient capacity at the Gunpowder Pump Station to handle upstream flows. The surrounding area is primarily residential.

The conveyance alternative considered upgrading the wet well, pump station, and force main. The only storage alternative considered was to construct large pipe in the vicinity of the SSO to provide inline storage. Ground truthing at the Gunpowder Pump Station found water and gas mains and an underground electrical line that run parallel to the pump station, but the site was found to be suitable.

Hunting Creek North Branch 3

This branch includes an SSO caused by insufficient capacity at the Fox Harbor No. 1 and No. 2 Pump Stations to handle upstream flows. These SSO locations were not reported as SSOs until mid-2008; therefore, no initial solutions were developed for the locations since they were not known at the time of initial solution development. Solutions, however, were developed later during the solution alternative analysis process.

Hunting Creek South Branch 1

This branch includes an SSO caused by insufficient capacity at the Fairway View Pump Station to handle upstream flows. The surrounding area is mostly residential with some open area and a golf course.

The conveyance alternative considered upgrading the wet well, pump station, and force main. The first storage alternative considered was to construct a wet weather storage facility in a small wooded area. The second storage alternative considered was to construct a large pipe in the vicinity of the SSO to provide inline storage. Ground truthing found the pipe upstream of the SSO intersects with three electrical lines and a gas main.

Hunting Creek South Branch 2

This branch includes an SSO caused by insufficient capacity at the Deep Creek Pump Station to handle upstream flows. The surrounding area is mostly residential with wooded areas in backyards.

The conveyance alternative considered upgrading the wet well and the pump station, and possibly the force main. The first storage alternative considered was to construct a wet weather storage facility in a small wooded area. The second storage alternative considered was to construct large pipe in the vicinity of the SSO to provide inline storage. Another alternative considered building a storage facility at Deep Creek Trail Pump Station and reducing the pumping rate at Deep Creek Pump Station. Ground truthing identified electrical, water, and gas lines as potential utility conflicts.

Lake Forest Branch 1

This branch includes an SSO caused by insufficient capacity at the Lake Forest Pump Station to handle upstream flows. The surrounding area is single-family residential.

The conveyance alternative considered upgrading the wet well, pump station, and force main. The first storage alternative considered was to construct a wet weather storage facility; however, there are no locations available to build a storage facility near the pump station. There is an area near the Worthing Pump Station where volume could be stored to delay pumping to the Lake Forest Pump Station. The second storage alternative considered was to construct large pipe in the vicinity of the SSO to provide inline storage.

3.3.9.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in Small WQTC areas. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Berrytown Branch 1

Based on the benefit-cost analysis, the chosen solution for Berrytown Branch 1 (Lucas Lane PS) is Inline Storage. The offline and inline storage solution ratios were almost identical, so other values were taken into account such as reduced maintenance costs due to self-flushing pipe (no need to clean). Table 3.3.33 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.33

BERRYTOWN BRANCH 1 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_FF_BT_NB01_S_09A_C_A	Inline Storage	Replace 90 LF of 8" pipe upstream of the Lucas Lane PS with a 54" pipe and install an additional 90 LF of 54" pipe parallel to it to provide inline storage. Also, lower the invert of the influent 8" pipe to PS and replace that pipe with a 36" pipe	88.53	112.86
S_FF_BT_NB01_S_09B_C_B	Offline Storage	Construct covered storage facility (0.031 MG)	88.61	90.92
S_FF_BT_NB01_S_03_C_A	PS Upgrades	Upgrade Lucas Lane LS to handle peak flows of 0.23 mgd.	78.51	72.76

Chenoweth Hills Branch 1

Based on the benefit-cost analysis, the chosen solution for Chenoweth Hills Branch 1 (St. Rene Rd. PS) is Inline Storage. Table 3.3.34 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.34

CHENOWETH HILLS BRANCH 1 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_FF_CH_NB01_S_09A_C_A	Inline Storage	Replace 42 LF of 8" pipe with 48" pipe just upstream of the St. Rene Rd. PS to provide inline storage.	163.34	212.00
S_FF_CH_NB01_S_01_C_B	Pipe Upgrades	Divert flow that currently flows to the St. Rene Road PS to a new gravity line that will connect to an existing 18" line that flows to the current location of the Chenoweth Run PS, however, eventually it will be taken offline by the Billtown Road Interceptor. Involves 1,291 LF of new gravity sewer.	72.17	88.66
S_FF_CH_NB01_S_01_C_A	Pipe Upgrades	Divert approximately 60% of the flow that currently flows to the St. Rene Road PS to a new gravity line that will take the flow to the Jeffersontown system. This portion of the Jeffersontown system will eventually be diverted to the Cedar Creek WQTC by the Billtown Road interceptor. Involves 605 LF of new gravity sewer.	44.35	56.16
S_FF_CH_NB01_S_03_C_A	PS Upgrades	Upgrade St. Rene Rd. PS to handle peak flows of 0.44 mgd.	42.87	36.13

Hunting Creek North Branch 1

Based on the benefit-cost analysis, the chosen solution for Hunting Creek North Branch 1 (Riding Ridge PS) is Pump Station Upgrades. Table 3.3.35 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.35

HUNTING CREEK NORTH BRANCH 1 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_HC_HN_NB01_S_03_C_A	PS Upgrades	Upgrade Riding Ridge PS to handle peak flow of 0.075 mgd.	66.40	52.02
S_HC_HN_NB01_S_09A_C_A	Inline Storage	Upsize 131 LF of existing 8" sewer to 12", and lower its slope via a drop manhole at its upstream end.	29.65	37.96
S_HC_HN_NB01_S_03_C_B	Force Main Upgrades	Upsize 1,464 LF of force main at Riding Ridge PS from 2" to 2.5".	24.95	24.12

Hunting Creek North Branch 2

Based on the benefit-cost analysis, the chosen solution for Hunting Creek North Branch 2 (Gunpowder PS) is Inline Storage. This branch is one of the three branches requested to be re-evaluated at the 2.25-inch cloudburst level to ensure the validity of the technology selection approach at the 1.82-inch cloudburst level. Table 3.3.36(A) summarizes the solutions considered for the 1.82-inch cloudburst storm and the benefit-cost ratios associated with each solution. Table 3.3.36(B) summarizes the solutions considered for the 2.25-inch cloudburst storm and the benefit-cost ratios associated with each solution.

TABLE 3.3.36(A)

HUNTING CREEK NORTH BRANCH 2 - 1.82-INCH SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_HC_HN_NB02_S_09A_C_B	Inline Storage	Replace 120 LF of 8" with 60" sewer pipe to provide inline storage, 28 LF of additional pipe upgrades required.	61.73	78.71
S_HC_HN_NB02_S_09A_C_A	Inline Storage	Replace 252 LF of 8" with 48" sewer pipe to provide inline storage.	39.75	50.66
S_HC_HN_NB02_S_03_C_A	PS Upgrades	Upgrade both pumps to 155 gpm each, increase wet well to 8 ft diameter, and upsize 3,485 LF of force main to 6" at the Gunpowder PS	8.87	9.09

TABLE 3.3.36(B)

HUNTING CREEK NORTH BRANCH 2 - 2.25-INCH SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_HC_HN_NB02_S_09A_B_B	Inline Storage	Replace 120 LF of 8" (east of the lift station) with 60" sewer pipe as well as replace 148 LF of 8" sewer (west of the lift station) with 60" sewer pipe to provide in-line storage.	46.33	59.15
S_HC_HN_NB02_S_03_B_A	PS Upgrades	Upgrade both pumps to 220 gpm each, increase the wet well to 8 feet in diameter and upsize entire force main to 6" at the Gunpowder PS	11.29	11.62

As indicated Table 3.3.36(B), Inline Storage is the preferred alternative independent of level of control.

Hunting Creek North Branch 3

Based on the benefit-cost analysis, the chosen solution for Hunting Creek North Branch 3 (Fox Harbor No. 1 and No. 2 PSs) is Inline Storage. It was chosen based on the present worth benefit-cost ratio to avoid moving the problem downstream. Table 3.3.37 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.37

HUNTING CREEK NORTH BRANCH 3 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_HC_HN_NB03_M_09A_C_A	Inline Storage	Upsize 133 LF of 8" pipe upstream and east of the Fox Harbor No. 2 PS with 24" pipe. Upsize 110 LF of 8" pipe upstream of the Fox Harbor No. 1 PS with 18" pipe and lower the upstream invert of the pipe, new drop manhole required.	34.11	43.49
S_HC_HN_NB03_M_03_C_B	Inline Storage & Force Main Upgrades	Upgrade 810 LF of force main at Fox Harbor No. 2 PS to 6", upsize 110 LF of gravity sewer upstream of the Fox Harbor No. 1 PS from 8" to 18" to provide inline storage, lower upstream invert, new drop manhole required.	38.30	39.80

Hunting Creek South Branch 1

The chosen solution for Hunting Creek South Branch 1 (Fairway View PS) is Pump Station Upgrades. While Offline Storage had a higher benefit/cost ratio, pump replacement is a lower capital cost and can be accomplished easily with no underground construction that would disrupt the surrounding neighborhood. This is consistent with the community values of customer satisfaction and economic vitality. Table 3.3.38 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.38

HUNTING CREEK SOUTH BRANCH 1 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_HC_HS_NB01_S_03_C_A	PS Upgrades	Upgrade the three pumps at Fairway View PS to 100, 100, and 120 gpm (previously 88 gpm each).	10.71	10.32
S_HC_HS_NB01_S_09A_C_B	Offline Storage	Construct offline covered storage facility (.0075 MG) upstream of Fairway View PS, upsize additional 175 LF of gravity sewer upstream of the PS.	29.69	33.55
S_HC_HS_NB01_S_13_C_A_	PS & Pipe Upgrades	Upgrade the three pumps to 92 gpm (previously 88 gpm each), upsize 152 LF of gravity sewer upstream of PS from 8" to 24", new pipe entrances at a lower elevation drilled into wet well for larger pipe diameters.	10.25	10.20

Hunting Creek South Branch 2

The chosen solution for Hunting Creek South Branch 2 (Deep Creek PS) is Diversion. During the solution optimization process (discussed in Volume 3, Chapter 4) it was discovered that this pump station could be eliminated with 130 linear feet of 8" pipe connecting to the new Harrods Creek Interceptor, analyzed in Branch 4 of the ORFM model. Therefore, the solutions initially analyzed for this branch are no longer warranted and the Deep Creek Pump Station will be addressed with ORFM Branch 4 solutions. Table 3.3.39 summarizes the solutions previously considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.39

HUNTING CREEK SOUTH BRANCH 2 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
See ORFM Branch 4	Diversion	Construct 130 LF of 8" gravity sewer connecting to the new Harrods Creek Interceptor in ORFM Branch 4 to eliminate Deep Creek PS	--	--
S_HC_HS_NB02_S_09A_C_A	Inline Storage	Replace two 8" gravity sewers immediately upstream of the Deep Creek PS with 150 LF of 42" and 170 LF of 30" sewer pipe respectively to provide inline storage.	64.09	80.83
S_HC_HS_NB02_S_13_C_A	PS Upgrades & Inline Storage	Install two new 138 gpm pumps at PS (previously 122 gpm). Replace 150 LF of 8" sewer directly upstream of the PS with 36" pipe to provide inline storage.	22.45	22.75
S_HC_HS_NB02_S_03_C_A	PS Upgrades	Upgrade the Deep Creek PS by installing a 7' diameter wet well and installing new 156 gpm pumps (previously 122 gpm).	7.89	8.79

Lake Forest Branch 1

The chosen solution for Lake Forest Branch 1 (Lake Forest PS) is Monitoring. The Lake Forest Pump Station was upgraded in June 2008. Two new 144 gpm pumps were installed. Table 3.3.40 summarizes the solution chosen for Lake Forest Branch 1.

TABLE 3.3.40

LAKE FOREST BRANCH 1 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_FF_LF_NB01_S_13_C_A	Monitor	Monitor the Lake Forest PS during rain events for the next three years according to SORP protocols.	--	--

3.3.10 Pond Creek Alternatives

Details on branching and SSO descriptions for Pond Creek can be found in Volume 3, Chapter 2, Section 2.5.10. The initial solution development process is summarized in detail in Sections 3.1.3 and 3.1.3.3 contains information on the ground truthing procedure.

3.3.10.1 Initial Solutions and Feasibility Screening

Initial solutions were investigated before any baseline conditions (i.e. Capital Projects) or RDI/I reduction had been applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated by one of the two and therefore is not summarized below.

Branch 3

This branch includes SSOs caused by insufficient capacity at the Cooper Chapel Pump Station to handle upstream flows. The surrounding area is single-family residential.

The conveyance alternative considered upgrading the pump station and collection system pipe. The storage alternative considered was to construct an off-site storage facility upstream of the pump station. The diversion alternative considered was to construct a sewer line to an alternate system to eliminate the pump station. Ground truthing at the storage location found that 30 percent of the property is in the 100-year floodplain, and a blue line stream runs through the middle of the open field. This site was not suitable for the project.

Branch 4

This branch includes SSOs caused by insufficient capacity at the Cinderella Pump Station to handle upstream flows and limited interceptor capacity downstream. The surrounding area is single-family residential.

The conveyance alternative considered upgrading the pump station and increasing the capacity of the interceptor. The storage alternative considered was to construct a larger wet well at the pump station or a storage facility at the pump station site.

Branch 5

This branch includes SSOs caused by insufficient capacity at the Lantana Drive Pump Station to handle upstream flows. The surrounding area is single-family residential.

The conveyance alternative considered upgrading the pump station. The first storage alternative considered was to construct a larger wet well at the pump station. The second storage alternative considered was to construct large pipe in the vicinity of the SSOs to provide inline storage.

Branch 6

This branch includes SSOs caused by insufficient capacity at the Government Center Pump Station to handle upstream flows. The surrounding area is mostly single-family residential with some government-owned property.

The conveyance alternative considered upgrading the pump station. The storage alternative considered was to construct underground storage beneath the parking lot at the Government Center.

Branch 7

This branch includes SSOs caused by insufficient capacity at the Avanti Pump Station to handle upstream flows. The surrounding area is primarily residential with some commercial.

The conveyance alternative considered upgrading the pump station and increasing the capacity in the downstream collector sewer. The storage alternative considered was to construct offline storage near the pump station. The diversion alternative considered was to eliminate the pump station and divert all flow to the Cedar Creek WQTC.

Branch 8 / Branch 11

This branch includes SSOs caused by insufficient capacity at the Lea Ann Way Pump Station to handle upstream flows and limited collector sewer capacity upstream of the pump station. Initially, this branch included the SSO at the Edsel Pump Station which is now included in Branch 11. This SSO is most likely caused by excessive I/I in the upstream collection system. The surrounding area is primarily single-family residential.

The conveyance alternative considered was to upgrade the pump stations. The first storage alternative considered constructing larger wet wells at the pump stations. The second storage alternative considered was to construct large pipe in the vicinity of the SSOs to provide inline storage.

Ground truthing found 60 percent of one property near Edsel Pump Station (Branch 11) is in the 100-year floodplain and a creek runs through the center of the wooded area. A threatened/endangered species assessment was recommended for this location. The location was found unsuitable for the solution.

Branch 9

This branch includes SSOs caused by a hydraulic constriction at the I-65 crossing, limited collector sewer capacity, and insufficient capacity at the Caven Avenue Pump Station to handle upstream flows. The surrounding area is mostly single-family residential with some industrial and commercial properties.

The conveyance alternative considered was to upgrade the Caven Avenue Pump Station and upsize the interceptor under I-65 and down the Outer Loop. The storage alternative considered constructing offline storage facilities in open land near the SSO locations.

Ground truthing for one potential storage location found a potential utility conflict with an electrical line. Ground truthing at the Meijer site found 10 percent of the property is in the 100-year floodplain and creeks border the west and north sides of the wooded area. A threatened/endangered species assessment was recommended for this site. A retention basin is located just west of the property. Ground truthing at another site near a nursing home found five percent of the property is in the 100-year floodplain and a threatened/endangered species assessment was recommended for the wooded area. Fishpool Creek and utilities may create conflicts. The site was found unsuitable due to shallow rock and a force main and sewer line located on the property.

Branch 10

This branch includes an SSO caused by insufficient capacity at the Leven Pump Station to handle upstream flows. This SSO location was not reported as an SSO until mid-2008; therefore, no initial solutions were developed for the locations since they were not known at the time of initial solution development. Solutions, however, were developed later during the solution alternative analysis process.

3.3.10.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in Pond Creek. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Branch 3

The chosen solution for Pond Creek Branch 3 is Pipe Upgrades. The Charleswood Interceptor Capital Improvement Project specifically eliminates the Cooper Chapel Pump Station. This was the only solution considered at this phase because the project is currently under design. The solution listed in the table is an extension to the Capital Improvement Project due to downstream capacity problems caused by the additional flow. Table 3.3.41 summarizes the solution considered and the benefit-cost ratio associated with the solution.

TABLE 3.3.41

POND CREEK BRANCH 3 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_PO_WC_PC03_M_01_C	Pipe Upgrades	Upsize additional 1,846 LF of gravity sewer downstream of the Charleswood Interceptor connection to correct capacity problems.	50.30	62.84

Branch 4

The chosen solution for Pond Creek Branch 4 (Cinderella PS) is Diversion. While this does not appear to have the highest benefit/cost ratio, the cost estimates do not reflect the costs likely needed to keep the pump station in service. This pump station is nearly thirty years old and may require continual servicing and upgrades over time. When these costs are fully considered, it is likely that the diversion solution would have the highest benefit/cost ratio. Table 3.3.42 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.42

POND CREEK BRANCH 4 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_PO_WC_PC04_M_01_C	Diversion	Eliminate Cinderella PS by constructing 2,250 LF of 10" pipe. 208 LF of tunneling under I-265.	17.41	22.14
S_PO_WC_PC04_M_09B_C	Offline Storage	Construct offline covered storage facility at Cinderella PS (0.22 MG).	32.35	32.40
S_PO_WC_PC04_M_0103_C	PS Upgrades	Upgrade pumps at Cinderella PS to 1.5 mgd each (previously 0.5 mgd) and upsize 2,953 LF of force main from 6" to 15". Additional 2,918 LF of sewer improvements required downstream of new force main.	12.94	14.51

Branch 5

The chosen solution for Pond Creek Branch 5 (Lantana PS) is I/I Reduction. This solution was chosen as the recommended alternative due to the small contributing area. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative is Offline Storage and Pipe Upgrades. Table 3.3.43 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.43

POND CREEK BRANCH 5 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_PO_WC_PC05_M_07_C	I/I Reduction	This location will be targeted for I/I source control (I/I Rehab and private property program.)	Cost only for SSES - no benefits calculated.	
S_PO_WC_PC05_M_0109B_C	Offline Storage & Pipe Upgrades	Construct offline covered storage facility at Lantana PS (0.08 MG). Additional 241 LF of sewer improvements (10" - 15") required upstream of PS.	71.21	72.58
S_PO_WC_PC05_M_0103_C	PS & Pipe Upgrades	Upgrade Lantana PS to handle peak flow of 1.45 mgd, upgrade or replace 1,345 LF of 8" force main, 3,770 LF of additional conveyance improvements (10" - 27") required upstream of the PS and downstream of force main.	12.53	14.48
S_PO_WC_PC05_M_09A_C	Inline Storage	Install 667 LF of 60" pipe upstream of Lantana PS to provide inline storage.	5.05	6.49

Branch 6

Based on the benefit-cost analysis, the chosen solution for Pond Creek Branch 6 (Government Center PS) is Diversion. The cost estimates for Offline Storage and Pump Station Upgrades do not reflect the costs likely needed to keep the pump station in service. When these costs are fully considered, it is likely that these solutions would have even lower benefit/cost ratios. Table 3.3.44 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.44

POND CREEK BRANCH 6 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_PO_WC_PC06_M_01_C	Diversion	Eliminate Government Center PS by constructing 1,350 LF of 10" pipe.	35.50	44.91
S_PO_WC_PC06_M_0109B_C	Offline Storage & Pipe Upgrades	Construct offline covered storage facility at Government Center PS (0.31 MG). Additional 220 LF of sewer improvements (10" - 12") required upstream of PS.	21.29	22.17
S_PO_WC_PC06_M_0103_C	PS & Pipe Upgrades	Upgrade pumps at Government Center PS to 2.1 mgd each (previously 1 mgd) and upsize 3,107 LF of force main to 10". Additional 3,032 LF of sewer improvements (10" - 12") required downstream of new force main.	15.38	16.70

Branch 7

Based on the benefit-cost analysis, the chosen solution for Pond Creek Branch 7 (Avanti PS) is Diversion. The cost estimates for Offline Storage and Pump Station Upgrades do not reflect the costs likely needed to keep the pump station in service. When these costs are fully considered, it is likely that these solutions would have even lower benefit/cost ratios. Table 3.3.45 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.45

POND CREEK BRANCH 7 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_PO_WC_PC07_M_01_C	Diversion	This alternative eliminates Avanti PS by constructing 150 LF of 8" pipe	900.43	1000.48
S_PO_WC_PC07_M_09B_C	Offline Storage	Construct offline covered storage facility at Avanti PS (0.023 MG).	256.76	263.10
S_PO_WC_PC07_M_0103_C	PS & Pipe Upgrades	Upgrade Avanti PS to handle peak flow of 1.8 mgd. Additional 1,886 LF of sewer improvements (10") required downstream of new force main.	16.80	19.52

Branch 8

The chosen solution for Pond Creek Branch 8 is Pipe Upgrades. This was the only solution considered because the pumps at the Lea Ann Way Pump Station are currently being replaced, which will increase the capacity of the pump station to 22 mgd and eliminate the SSO at the Pump Station. The first pump has been replaced and a developer is installing a fourth pump. The second and third pumps were replaced by MSD Operations in September 2008. The Pipe Upgrades solution addresses insufficient pipe capacity in the collection system upstream of the Lea Ann Way Pump Station. Table 3.3.46 summarizes the solution and the benefit-cost ratio associated with that solution.

TABLE 3.3.46

POND CREEK BRANCH 8 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_PO_WC_PC08_M_01_C	Pipe Upgrades	Upsize 3,255 LF of gravity sewer (12" - 18") upstream of Lea Ann Way PS.	39.74	49.01

Branch 9

Based on the benefit-cost analysis, the chosen solution for Pond Creek Branch 9 is Offline Storage and Pipe Upgrades. The storage facility behind the Meijer on Preston Highway is necessary to alleviate future predicted overflows caused by upstream IOAP projects. Table 3.3.47 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.47

POND CREEK BRANCH 9 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_PO_WC_PC09_M_09B_C	Offline Storage & Pipe Upgrades	Construct offline covered storage facility at Caven Avenue PS (0.21 MG) and offline open storage facility behind the Meijer (1.42 MG) on Preston Hwy. Upsize 1,536 LF of sewer to 18” downstream of MH 70212.	6.61	7.08
S_PO_WC_PC09_M_0103_C	PS & Pipe Upgrades	Upsize Caven Avenue PS to handle peak flow of 3.9 mgd and upsize 1,715 LF of force main to 8". Additional 18,242 LF of sewer improvements (8” - 48”) required in Okolona area.	3.28	4.06

Branch 10

Based on the benefit-cost analysis, the chosen solution for Pond Creek Branch 10 is Diversion. The cost estimates for Offline Storage, Inline Storage, and Pump Station Upgrades do not reflect the costs likely needed to keep the pump station in service. When these costs are fully considered, it is likely that these solutions would have even lower benefit/cost ratios. Table 3.3.48 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.48

POND CREEK BRANCH 10 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_PO_WC_PC10_M_01_C	Diversion	Eliminate Leven PS by constructing 890 LF of 10" pipe.	76.88	95.93
S_PO_WC_PC10_M_09B_C	Offline Storage	Construct offline covered storage facility at Leven PS (0.12 MG).	64.21	65.61
S_PO_WC_PC10_M_03_C	PS Upgrades	Upgrade Leven PS to handle peak flow of 3.42 mgd.	42.87	41.44
S_PO_WC_PC10_M_09A_C	Inline Storage	Install 1,084 LF of 48" pipe upstream of Leven PS to provide inline storage.	14.46	18.51

Branch 11

The chosen solution for Pond Creek Branch 11 is I/I Reduction. This solution was chosen as the recommended alternative based on modeling results. An overflow did not occur at this pump station in the existing conditions model at the 1.82-inch, 2.25-inch, or even 2.60-inch cloudburst storm indicating excessive I/I during heavy rain events is likely the problem rather than insufficient capacity at the pump station. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative is Offline Storage. Table 3.3.49 summarizes the solutions considered and the benefit-cost ratios associated with each solution.

TABLE 3.3.49

POND CREEK BRANCH 11 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_PO_WC_PC11_M_07_C	I/I Reduction	This location is targeted for I/I source control (I/I rehab and private property program).	Cost only for SSES - no benefits calculated.	
S_PO_WC_PC11_M_0109B_C	Offline Storage	Construct offline covered storage facility at Edsel PS (0.09 MG). Additional 457 LF of sewer improvements (10" – 12") required upstream of PS.	58.87	62.63
S_PO_WC_PC11_M_0103_C	PS Upgrades	Upgrade Edsel PS to handle peak flow of 0.7 mgd and upsize 3,468 LF of force main to 10". Additional 925 LF of sewer improvements (10" – 12") required.	9.92	10.49
S_PO_WC_PC11_M_0109A_C	Inline Storage	Install 572 LF of 96" pipe upstream of Edsel PS to provide inline storage. Additional 423 LF of sewer improvements (10" - 12") required.	5.41	6.94

3.3.11 Mill Creek Alternatives

Details on branching and SSO descriptions for Mill Creek can be found in Volume 3, Chapter 2, Section 2.5.11. The initial solution development process is summarized in detail in Sections 3.1.3 and 3.1.3.3 contain information on the ground truthing procedure.

3.3.11.1 Initial Solutions and Feasibility Screening

Initial solutions were investigated before any baseline conditions (i.e. Capital Projects) or RDI/I reduction had been applied; therefore, some preliminary SSOs analyzed in the initial solutions were not considered in the project development phase due to the effects of the baseline conditions or RDI/I reduction. In these cases, the SSO was eliminated by one of the two and therefore is not summarized below.

<u>Branch 1</u>

This branch includes SSOs caused by insufficient capacity at Pioneer, Fern Lea, and Garrs Lane pump stations to handle upstream flow. The landuse in the area is a combination of park, residential, vacant lots, commercial, and industrial. Each pump station location was analyzed separately.

The conveyance alternatives considered pump station upgrades, pump station replacement, pipe upgrades, and pump station eliminations. The storage alternatives considered off-line storage facilities and expansion of pump station wet wells.

Ground truthing was performed at 22 locations in the Shively area. Twelve of the locations had 15 to 100 percent of the property in the 100-year floodplain. All twenty locations were found to have potential utility conflicts including water lines, gas lines, storm drains, and electrical lines. The pipe upgrade solution could affect many residential properties and landscapes.

Branch 2

This branch includes an SSO caused most likely by surface flooding in the East Rockford Pump Station area during wet weather. This pump station was not reported as an SSO location until mid-2008; therefore, no initial solutions were developed for this location since it was not known at the time of initial solution development. Solutions, however, were developed later during the solution alternative analysis process.

3.3.11.2 Modeled Solutions - Benefit Cost Analysis

The following section summarizes the solution alternative analysis for each of the branches in Mill Creek. Based on ground truthing findings and judgments made during the modeling process, some initial solutions identified in the previous section may not have been evaluated. Section 3.2 provides detail on the solution alternative development and selection process. Appendix 3.3.1 contains the detailed cost sheets, benefit-cost analyses, solution maps, and fact sheets for all modeled solutions.

Branch 1

The Shively Interceptor Capital Improvement Project specifically eliminates five pump stations: Jacks Lane Pump Station, Pioneer Pump Station, Fern Lea Pump Station, Garrs Lane Pump Station, and City Park Pump Station, three of which are documented SSOs. This project is currently in the preliminary design stage. The solution listed below includes the benefit-cost ratio for the entire project. This branch is one of the three branches requested to be re-evaluated at the 2.25-inch cloudburst level to ensure the validity of the technology selection approach at the 1.82-inch cloudburst level. Table 3.3.50(A) summarizes the solutions considered for the 1.82-inch cloudburst storm and the benefit-cost ratios associated with each solution. Table 3.3.50(B) summarizes the solutions considered for the 2.25-inch cloudburst storm and the benefit-cost ratios associated with each solution.

TABLE 3.3.50(A)

MILL CREEK BRANCH 1 - 1.82-INCH SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_MC_WC_NB01_M_01_C	Pipe Upgrades	Construct 18,830 LF of new gravity sewers (8" – 18") to eliminate the Jacks Lane, Pioneer, Garrs Lane, Fern Lea, and City Park PSs. This is the Shively Interceptor capital improvement project.	4.11	5.20
S_MC_WC_NB01_M_0109_C	Offline Storage & Pipe Upgrades	Construct new gravity sewers (2,821 LF). Construct seven small offline storage facilities (0.63 MG total) and 3,214 LF of force main.	1.44	1.70

TABLE 3.3.50(B)

MILL CREEK BRANCH 1 – 2.25-INCH SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description	Benefit/ Cost Ratio (Capital Cost)	Benefit/ Cost Ratio (Present Worth)
S_MC_WC_NB01_M_01_B	Pipe Upgrades	Construct 18,830 LF of new gravity sewers (10” – 21”) to eliminate the Jacks Lane, Pioneer, Garrs Lane, Fern Lea, and City Park PSs.	5.27	6.68
S_MC_WC_NB01_M_0109_B	Offline Storage & Pipe Upgrades	Construct new gravity sewers (2,821 LF). Construct seven small offline storage facilities (0.74 MG total) and 3,214 LF of force main.	1.41	1.66

As indicated in Table 3.3.50(b), the pipe upgrades accomplished by expanding the Shively Interceptor Project has the highest benefit-cost ratio, independent of level of control. Costs are fairly similar for both technologies at each level of evaluation; however, the benefit scores are significantly lower for the Offline Storage solution due to storage facility construction in residential neighborhoods and lower impact in reducing overflow volumes during larger storm events.

Branch 2

The chosen solution for Mill Creek Branch 2 is Pump Station Replacement and Relocation. No modeling was used to identify this solution. It is the only solution considered for this branch because the problem is due to street surface flooding. Table 3.3.51 summarizes the solution.

TABLE 3.3.51

MILL CREEK BRANCH 2 SOLUTION ALTERNATIVES

Project ID	Solution Technology	Project Description
S_MC_WC_NB02_S_03_C	PS replacement and relocation	Relocate and replace East Rockford PS at 300 gpm. 150 LF of 4" force main will be replaced. Additional 150 LF of 10" gravity improvements required to relocate PS.

MSD

Metropolitan Sewer District

CHAPTER 4

CHAPTER 4: SELECTION OF FINAL SANITARY SEWER DISCHARGE PLAN

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CHAPTER 4: SELECTION OF FINAL SANITARY SEWER DISCHARGE PLAN

The Final Sanitary Sewer Discharge Plan (SSDP) approach to sanitary sewer overflow (SSO) elimination is based upon identifying the solution that provides the highest benefit-cost ratio for each modeled watershed branch. As presented in Chapter 3, Louisville and Jefferson County Metropolitan Sewer District (MSD) developed a solution development process. The following is a summary of the Final SSDP solution development process.

- Solutions were developed that eliminated SSOs and known surcharging under site-specific levels of protection using a diverse set of solution technologies.
- Benefits, capital costs, and benefit-cost ratios were developed for each solution at the baseline level of protection (1.82-inch cloudburst storm event).
- The solution with the best benefit-cost ratio was selected for further development and analysis of the preferred level of protection.

Chapter 4 summarizes the final steps in the solution development process. The Chapter discusses the optimized level of protection evaluations and the resulting list of selected projects. Additionally, the chapter reviews the Integrated Overflow Abatement Plan (IOAP) public involvement process. The chapter ends by discussing the process used for tracking and determining success of the Final SSDP projects.

4.1 FINAL PROJECT SELECTION

As detailed in Chapter 3, MSD used a standard benefit-cost ratio process to determine and select the most effective solution (referred to as the preferred solution). The same process was used to set optimal levels of protection for the selected solutions. The following section revisits the preferred solution process.

4.1.1 Preferred Solutions

During the development of SSO elimination strategies and alternatives, a wide range of technology approaches were considered for the baseline level of protection. The approaches included the following:

- Source control through infiltration and inflow (I/I) reduction
- Reduced surcharging in systems hydraulically connected to SSOs and solutions
- A wide variety of conventional constructed facilities commonly referred to as gray infrastructure, including:
    - Peak flow storage (constructed storage tanks, or oversized pipes providing “in-line” storage)

- Increased conveyance capacity (increased pipe sizes, parallel relief sewers, new or expanded pump stations)
- Flow diversions to other portions of the system that have available capacity
- Expanded wastewater treatment capacity (provided at existing regional treatment facilities or provided remotely as high-rate wet weather treatment facilities)

Table 4.1.1 recaps the preferred solution technology list developed for the baseline level of protection. Projects are listed by the eleven model areas.

TABLE 4.1.1

SUMMARY OF PREFERRED SOLUTIONS

SSDP Recommended Project Name/Location	Region and Branch ID	SSO(s) Addressed	Technology
Cedar Creek Area			
Idlewood Inline Storage	Cedar Creek - 70158	28998, 28984, 63094, 63095, 70158	Inline Storage
Fairmount Rd. Pump Station Improvements	Cedar Creek - 81316	Fairmount Road Pump Station (PS) (81316 & 97362)	PS Upgrades
Little Cedar Creek Interceptor Improvements	Cedar Creek - 67997	67997, 67999, 86423, 89195, 89197	Pipe Upgrades
Bardstown Rd. PS Improvements	Cedar Creek - MSD1025	88545	PS Upgrades
Running Fox PS Elimination	Cedar Creek – MSD1080	Running Fox PS (MSD1080-LS)	Diversion
Hite Creek Area			
Meadow Stream PS Inline Storage	Hite Creek - MSD1082	Meadow Steam PS (91087 & MSD1082-PS)	Inline Storage
Floydsburg Rd. I/I Investigation & Rehabilitation	Hite Creek - MSD1086	Floydsburg Road (MSD1086-PS, 90776, 108956, 108957, 108958)	I/I Reduction
Kavanaugh Rd. PS Improvements	Hite Creek - MSD1085	Kavanaugh Road (MSD1085-PS)	PS & Force Main Upgrades
Floyds Fork Area			
Woodland Hills PS Diversion	Floyds Fork - NB01	33003, 65531	Diversion
Eden Care PS SSO Investigation	Floyds Fork - NB02	Eden Care PS (MSD1105-PS)	Monitor
Ashburton PS Improvements & Diversion	Floyds Fork - NB03	Olde Copper Court PS (MSD0165-PS), Ashburton PS (MSD0166-PS)	Upgrade Force Main & Pipes
Jeffersontown Area			
Jeffersontown WQTC Elimination	Jeffersontown - NB01	28390, 28391, 28392, 28395, 31733, Jeffersontown WQTC (28173 & 64505 & MSD0255 & IS028-SI)	Offline Storage, Pipe Upgrades, WQTC Eliminations
Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements	Jeffersontown - NB01A	Chenoweth Run PS (MSD0196-PS & 86052 & 64096), Chippewa PS (92061), Chenoweth Hills WQTC PS (MSD0263A-PS), Chenoweth Hills WQTC (MSD0263)	PS & Force Main Upgrades, WQTC Eliminations
Dell Rd and Charlane Pkwy Interceptor Improvements	Jeffersontown - NB02	Charlane Pkwy (28250, 28249, 28340, 28336, 104289), Dell Rd. (28413, 28414, 28415, 28416, 28417)	Pipe Upgrades
Raintree & Marian Ct PS Eliminations	Jeffersontown - NB03	28719, 28711, Marian Ct. PS (28729), Raintree PS (MSD0149-PS)	Diversion, Pipe Upgrades
Monticello PS Elimination	Jeffersontown - NB04	Monticello Place PS (MSD0151-PS & 27969)	Diversion

TABLE 4.1.1

SUMMARY OF PREFERRED SOLUTIONS

SSDP Recommended Project Name/Location	Region and Branch ID	SSO(s) Addressed	Technology
Middle Fork Area			
Middle Fork Relief Interceptor, Wet Weather Storage, and UMFLS Diversion	Middle Fork - MF01	02932, 02933, 02935, 08537, 23211, 23212, 27005, 45835, 47583, 47593, 47596, 47603, 47604, 51221, 51160, 51161, 90700, IS021A-SI, Middle Fork at Breckenridge (08935-SM)	Offline Storage & Pipe Upgrades
Goose Creek PS Improvements & Wet Weather Storage	Middle Fork - MF04	Devondale PS (21628-W), Goose Creek PS (46891 & 62418 & 91629 & 91630 & 105936), Saurel PS (43472)	Offline Storage, PS & Force Main Upgrades
Anchor Estates Inline Storage & PS Eliminations	Middle Fork - MF06	Vannah PS (01106), Anchor Estates #1 PS (00746 & 00056-W), Anchor Estates #2 PS (MSD0057-LS)	Inline Storage & Diversion
Hurstbourne I/I Investigation & Rehabilitation	Middle Fork – MF07	01793	I/I Reduction
Southeastern Diversion Area			
Parkview Estates I/I Investigation & Rehabilitation	Southeastern Diversion – NB03	47250	I/I Reduction
Klondike Interceptor	Southeastern Diversion – NB04	25676 (Alcona), 26650, 26651	Pipe Upgrades
Sutherland Interceptor	Southeastern Diversion – NB05	Sutherland (16649)	Pipe Upgrades
Beargrass Interceptor Rehab Ph. 2	Southeastern Diversion – NB06	51594	Pipe Rehab
Pond Creek Area			
Charleswood Interceptor Extension	Pond Creek - PC03	25477, 25478, Cooper Chapel PS (25480 & MSD0130-PS)	Pipe Upgrades
Cinderella PS Elimination	Pond Creek - PC04	Cinderella PS (60679 & MSD1013-PS), 35309	Diversion
Lantana PS I/I Investigation & Rehabilitation	Pond Creek - PC05	Lantana Drive #1 PS (25484 & 93719 & MSD0101-PS)	I/I Reduction
Government Center PS Elimination	Pond Creek - PC06	Government Center PS (MSD0180-PS)	Diversion
Avanti PS Elimination	Pond Creek - PC07	Avanti PS (21229-W)	Diversion
Lea Ann Way System Improvements	Pond Creek - PC08	19360, 19369, 29933, 29948, 29943, 31083, 31084, 79076, Lea Ann Way PS (MSD1010-PS)	Pipe Upgrades
Outer Loop & Caven Ave Wet Weather Storage	Pond Creek - PC09	27116, 70212, 17724, Caven Ave PS (MSD0133-PS)	Offline Storage & Pipe Upgrades
Leven PS Elimination	Pond Creek - PC10	Leven PS (36419 & MSD1019-PS)	Diversion
Edsel PS I/I Investigation & Rehabilitation	Pond Creek - PC11	Edsel PS (92098 & MSD1048-PS)	I/I Reduction

TABLE 4.1.1

SUMMARY OF PREFERRED SOLUTIONS

SSDP Recommended Project Name/Location	Region and Branch ID	SSO(s) Addressed	Technology
ORFM Area			
Mellwood System Improvements & PS Eliminations	ORFM - NB01	26752, 41374, 41416, Mockingbird Valley PS (MSD0007-PS), Winton PS (MSD0010-PS), Mellwood Avenue PS (24472 & MSD0023-PS), Canoe Lane PS (24152-W & MSD0024-PS)	PS Upgrades, Pipe Upgrades & Diversion
Leland Rd. SSO Investigation	ORFM - NB02	96020	Condition Assessment
Derington Ct. PS I/I Investigation & Rehab	ORFM - NB03	Derington Court PS (MSD0095-PS)	I/I Reduction
Prospect WQTC Eliminations, Harrods Creek PS, and ORFM System Improvements	ORFM - NB04 (Prospect)	40870, 40871, 40872, Barbour Lane PS (42680 & 65633 & 65635), West Goose Creek PS (22436 & MSD0123-PS), Phoenix Hill PS (MSD1044-PS), Glenview Hills PS (MSD0183-PS), Barbour Lane PS (MSD0192-PS), New Market PS (MSD0193-PS), Deep Creek PS (MSD1063-PS), Hunting Creek South WQTC (MSD0292)	PS and Pipe Upgrades, Diversion, WQTC eliminations
Mill Creek Area			
Shively Interceptor	Mill Creek - NB01	04498, 04542, Pioneer PS (81814-W), Fern Lea PS (MSD0047-PS), Garr's Lane PS (MSD0050-PS)	Pipe Upgrades
East Rockford PS Relocation	Mill Creek - NB02	East Rockford PS (04699-W)	PS Replacement and Relocation
Small WQTC Area			
Lucas Ln. PS Inline Storage	Berrytown - NB01	Lucas Lane PS (MSD0199-LS)	Inline Storage
Riding Ridge PS Improvements	Hunting Creek North - NB01	Riding Ridge PS (MSD1060-LS)	PS Upgrades
Gunpowder PS Inline Storage	Hunting Creek North - NB02	Gunpowder PS (MSD1055-LS)	Inline Storage
Fox Harbor Inline Storage	Hunting Creek North - NB03	Fox Harbor #1 and #2 PS (62769)	Inline Storage
Fairway View PS Improvements	Hunting Creek South - NB01	Fairway View PS (MSD1065-PS)	PS Upgrades
Lake Forest PS SSO Investigation	Lake Forest - NB01	Lake Forest PS (MSD1169-LS)	Monitor
St. Rene Rd. PS Inline Storage	Chenoweth Hills - CH01	94187	Inline Storage

TABLE 4.1.1

SUMMARY OF PREFERRED SOLUTIONS

SSDP Recommended Project Name/Location	Region and Branch ID	SSO(s) Addressed	Technology
CSS Area			
Sonne PS I/I Investigation & Rehabilitation	CSO - 42007	Sonne Avenue PS (MSD0042-PS)	I/I Reduction
Camp Taylor System Improvements	CSO - 30917	08717, 13931, 13943, 39763, 44396, 44397, 66349, 104223, 104231	SSES, Sewer Rehabilitation & Replacement, Offline Storage
Hazelwood PS I/I Investigation & Rehabilitation	CSO - 55665	Hazelwood PS (55665)	I/I Reduction
Legend: LS –Lift station, PS – Pump Station, CSO – Combined Sewer Overflow, SSO – Sanitary Sewer Overflow, CSS- Combined Sewer System, WQTC – Water Quality Treatment Center, SSES – Sanitary Sewer Evaluation Study, I/I – Inflow and Infiltration, UMFLS – Upper Middle Fork Lift Station, ORFM – Ohio River Force Main			

4.1.2 Level of Protection Evaluation

The IOAP sets the minimum level of protection at a 1.82-inch cloudburst storm event, and the maximum level of protection evaluated at a 2.60-inch cloudburst storm event. A 1.82-inch cloudburst storm is equivalent to a 3-hour, high-intensity event with a 50 percent probability of occurring in a given year. MSD selected this level of protection to be consistent with the cities of Atlanta, Cincinnati, and Knoxville who also use a 50 percent probability (often referred to as a two-year recurrence interval design storm) as the minimum protection level for SSOs.

For solution optimization, the starting point is the preferred solution and a baseline level of protection set at a 1.82-inch cloudburst storm. The solution is then analyzed at a 2.25-inch cloudburst and 2.60-inch cloudburst (if needed) storm level to compare benefit-cost ratios for the modeled branch. The method implemented involves analyzing the same solution determined at the 1.82-inch cloudburst level and modifying the solution to capture flows and prevent SSOs during the higher-intensity cloudburst storm events.

Costs and benefits are re-evaluated and a new benefit-cost ratio is determined for that solution. The following rules apply to the re-evaluated results:

- If the 2.25-inch cloudburst benefit-cost ratio does not exceed the 1.82-inch cloudburst benefit-cost ratio then the level of protection chosen for that particular solution is the 1.82-inch cloudburst storm level.
- If the 2.25-inch cloudburst benefit-cost ratio does exceed the 1.82-inch cloudburst benefit-cost ratio then the same process is repeated at the 2.60-inch cloudburst storm level.
- If the 2.60-inch cloudburst benefit-cost ratio does not exceed the 2.25-inch cloudburst benefit-cost ratio then the level of protection chosen for that particular solution is the 2.25-inch cloudburst storm level.
- If the 2.60-inch cloudburst benefit-cost ratio does exceed the 2.25-inch cloudburst benefit-cost ratio then the level of protection chosen for that particular solution is the 2.60-inch cloudburst storm level and no further evaluation is performed.

This approach to determine the optimal level of protection means that solutions to address an individual SSO location may be designed to protect against larger storms if that will yield a higher benefit-cost ratio in the analysis of project alternatives.

Additionally, three projects were chosen to examine the above approach by evaluating the 2.60-inch cloudburst event where all three levels of control had not been previously developed. The projects subject to this further evaluation are: Klondike Interceptor, Middle Fork Relief Interceptor, and the Shively Interceptor. The results presented in Table 4.1.2 illustrate that the evaluation rules presented above are appropriate, and identify the level of protection with the highest benefit-cost ratio. Table 4.1.2 sites the modeled area, lists the SSOs that are controlled, summarizes the design level of protection evaluation process for each modeled branch, and highlights the ultimate design level of protection for that particular branch. Projects are listed by modeled area. Level of Protection costs and benefit-cost detailed evaluation tables for each modeled branch are available in Appendix 4.1.1 Optimized Solution Cost Estimates and Benefit-Cost Analyses.

TABLE 4.1.2

SUMMARY OF LEVEL OF PROTECTION EVALUATION

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Present Worth Benefit-Cost Ratio
Cedar Creek Area				
Idlewood Inline Storage	28998, 28984, 63094, 63095, 70158	Inline Storage	1.82-inch	31.36
			2.25-inch	27.11
Fairmount Rd. PS Improvements	Fairmount Road PS (81316 & 97362)	PS Upgrades	1.82-inch	26.79
			2.25-inch	31.33
			2.60-inch	33.29
Little Cedar Creek Interceptor Improvements	67997, 67999, 86423, 89195, 89197	Pipe Upgrades	1.82-inch	23.86
			2.25-inch	17.43
Bardstown Rd. PS Improvements	88545	PS Upgrades	1.82-inch	29.42
			2.25-inch	46.50
			2.60-inch	33.85
Running Fox PS Elimination	MSD1080-LS	Diversion	1.82-inch	659.52
			2.25-inch	118.87
Hite Creek Area				
Meadow Stream PS Inline Storage	Meadow Steam PS (91087 & MSD1082-PS)	Inline Storage	1.82-inch	13.77
			2.25-inch	11.71
Floydsburg Rd. I/I Investigation & Rehabilitation	Floydsburg Road (MSD1086-PS, 90776, 108956, 108957, 108958)	I/I Reduction	Sewer System Evaluation Study (SSES)/Rehab	
Kavanaugh Rd. PS Improvements	Kavanaugh Road (MSD1085-PS)	PS & Force Main Upgrades	1.82-inch	19.77
			2.25-inch	20.23
			2.60-inch	21.09
Floyds Fork Area				
Woodland Hills PS Diversion	33003, 65531	Diversion	1.82-inch	92.26
			2.25-inch	17.75
			2.60-inch	15.45
Eden Care PS SSO Investigation	Eden Care PS (MSD1105-PS)	Monitoring	Monitoring	
Ashburton PS Improvements & Diversion	Olde Copper Court PS (MSD0165-PS), Ashburton PS (MSD0166-PS)	Upgrade Force Main & Pipes	1.82-inch	161.00
			2.25-inch	82.24

TABLE 4.1.2

SUMMARY OF LEVEL OF PROTECTION EVALUATION

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Present Worth Benefit-Cost Ratio
Jeffersontown Area				
Jeffersontown WQTC Elimination	28390, 28391, 28392, 28395, 31733, Jeffersontown WQTC (28173 & 64505 & MSD0255 & IS028-SI)	Offline Storage, Pipe Upgrades, WQTC Elimination	1.82-inch	5.23
			2.25-inch	5.09
Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements	Chenoweth Run PS (MSD0196-PS & 86052 & 64096), Chippewa PS (92061), Chenoweth Hills WQTC PS (MSD0263A-PS), Chenoweth Hills WQTC (MSD0263)	PS & Force Main Upgrades, WQTC Elimination	1.82-inch	20.05
			2.25-inch	17.94
Dell Rd and Charlane Pkwy Interceptor Improvements	Charlane Pkwy (28250, 28249, 28340, 28336, 104289), Dell Rd. (28413, 28414, 28415, 28416, 28417)	Pipe Upgrades	1.82-inch	31.34
			2.25-inch	26.28
Raintree & Marian Ct. PS Eliminations	28719, 28711, Marian Court PS (28729), Raintree PS (MSD0149-PS)	Diversion, Pipe Upgrades	1.82-inch	72.76
			2.25-inch	51.97
Monticello PS Elimination	Monticello Place PS (MSD0151-PS & 27969)	Diversion	1.82-inch	48.90
			2.25-inch	63.24
			2.60-inch	65.85
Middle Fork Area				
Middle Fork Relief Interceptor, Wet Weather Storage, and UMFLS Diversion	02932, 02933, 02935, 08537, 23211, 23212, 27005, 45835, 47583, 47593, 47596, 47603, 47604, 51221, 51160, 51161, 90700, IS021A-SI, Middle Fork at Breckenridge (08935-SM)	Offline Storage & Pipe Upgrades	1.82-inch	1.26
			2.25-inch	1.07
			2.60-inch	0.90
Goose Creek PS Improvements & Wet Weather Storage	Devondale PS (21628-W), Goose Creek PS (46891 & 62418 & 91629 & 91630 & 105936), Saurel PS (43472)	Offline Storage, PS & Force Main Upgrades	2.25-inch	11.00
			2.60-inch	6.84
Anchor Estates PS Eliminations	Vannah PS (01106), Anchor Estates #1 PS (00746 & 00056-W), Anchor Estates #2 PS (MSD0057-LS)	Diversion	1.82-inch	25.39
			2.25-inch	29.55
			2.60-inch	31.14
Hurstbourne I/I Investigation & Rehabilitation	01793	I/I Reduction	SSES/Rehab	

TABLE 4.1.2

SUMMARY OF LEVEL OF PROTECTION EVALUATION

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Present Worth Benefit-Cost Ratio
Southeastern Diversion Area				
Parkview Estates I/I Investigation & Rehabilitation	47250	I/I Reduction	SSES/Rehab	
Klondike Interceptor	Alcona (25676), 25560, 25561	Pipe Upgrades	1.82-inch	9.11
			2.25-inch	9.11
			2.60-inch	7.02
Sutherland Interceptor	Sutherland (16649)	Pipe Upgrades	1.82-inch	25.22
			2.25-inch	31.98
			2.60-inch	32.71
Beargrass Interceptor Rehab Phase 2	51594	Sewer Rehab	Rehabilitation	
Pond Creek Area				
Charleswood Interceptor Extension	25477, 25478, Cooper Chapel PS (25480 & MSD0130-PS)	Pipe Upgrades	1.82-inch	62.84
			2.25-inch	7.14
Cinderella PS Elimination	Cinderella PS (60679 & MSD1013-PS), 35309	Diversion	1.82-inch	43.86
			2.25-inch	38.20
Lantana PS I/I Investigation & Rehabilitation	Lantana Drive #1 PS (25484 & 93719 & MSD0101-PS)	I/I Reduction	SSES/Rehab	
Government Center PS Elimination	Government Center PS (MSD0180-PS)	Diversion	1.82-inch	50.05
			2.25-inch	48.01
Avanti PS Elimination	Avanti PS (21229-W)	Diversion	1.82-inch	1448.28
			2.25-inch	1448.28
			2.60-inch	1448.28
Lea Ann Way System Improvements	19360, 19369, 29933, 29948, 29943, 31083, 31084, 79076, Lea Ann Way PS (MSD1010-PS)	Pipe Upgrades	1.82-inch	49.01
			2.25-inch	5.63
Outer Loop & Caven Ave Wet Weather Storage	27116, 70212, 17724, Caven Ave PS (MSD0133-PS)	Offline Storage & Pipe Upgrades	1.82-inch	7.08
			2.25-inch	5.38
Leven PS Elimination	Leven PS (36419 & MSD1019-PS)	Diversion	1.82-inch	152.13
			2.25-inch	74.72
Edsel PS I/I Investigation & Rehabilitation	Edsel PS (92098 & MSD1048-PS)	I/I Reduction	SSES/Rehab	

TABLE 4.1.2

SUMMARY OF LEVEL OF PROTECTION EVALUATION

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Present Worth Benefit-Cost Ratio
ORFM Area				
Mellwood System Improvements & PS Eliminations	26752, 41374, 41416, Mockingbird Valley PS (MSD0007-PS), Winton PS (MSD0010-PS), Mellwood Avenue PS (24472 & MSD0023-PS), Canoe Lane PS (24152-W & MSD0024-PS)	PS Upgrades, Pipe Upgrades & Diversion	1.82-inch	25.09
			2.25-inch	26.97
			2.60-inch	26.09
Leland Rd. SSO Investigation	96020	Condition Assessment	Condition Assessment	
Derington Ct. PS I/I Investigation & Rehabilitation	Derington Court PS (MSD0095-PS)	I/I Reduction	SSES/Rehab	
Prospect WQTC Eliminations, Harrods Creek PS, and ORFM System Improvements	40870, 40871, 40872, Barbour Lane PS (42680 & 65633 & 65635), West Goose Creek PS (22436 & MSD0123-PS), Phoenix Hill PS (MSD1044-PS), Glenview Hills PS (MSD0183-PS), Barbour Lane PS (MSD0192-PS), New Market PS (MSD0193-PS), Deep Creek PS (MSD1063-PS), Hunting Creek South WQTC (MSD0292)	PS and Pipe Upgrades, Diversion, WQTC eliminations	2.25-inch	1.69
			2.60-inch	0.99
Mill Creek Area				
Shively Interceptor	04498, 04542, Pioneer PS (81814-W), Fern Lea PS (MSD0047-PS), Garr's Lane PS (MSD0050-PS)	Pipe Upgrades	1.82-inch	5.20
			2.25-inch	6.68
			2.60-inch	6.70
East Rockford PS Relocation	East Rockford PS (04699-W)	PS Replacement and Relocation	PS Relocation	
Small WQTC Area				
Lucas Ln. PS Inline Storage	Lucas Lane PS (MSD0199-LS)	Inline Storage	1.82-inch	112.86
			2.25-inch	95.75
Riding Ridge PS Improvements	Riding Ridge PS (MSD1060-LS)	PS Upgrades	1.82-inch	52.02
			2.25-inch	19.61
Gunpowder PS Inline Storage	Gunpowder PS (MSD1055-LS)	Inline Storage	1.82-inch	78.71
			2.25-inch	59.15
Fox Harbor Inline Storage	Fox Harbor #1 and #2 PS (62769)	Inline Storage	1.82-inch	43.49
			2.25-inch	81.40
			2.60-inch	87.55

TABLE 4.1.2

SUMMARY OF LEVEL OF PROTECTION EVALUATION

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Present Worth Benefit-Cost Ratio
Fairway View PS Improvements	Fairway View PS (MSD1065-PS)	PS Upgrades	1.82-inch	10.32
			2.25-inch	7.64
Lake Forest PS SSO Investigation	Lake Forest PS (MSD1169-LS)	Monitoring	Monitoring	
St. Rene Rd. PS Inline Storage	94187	Inline Storage	1.82-inch	212.00
			2.25-inch	97.68
CSS Area				
Sonne PS I/I Investigation & Rehabilitation	Sonne Avenue PS (MSD0042-PS)	I/I Reduction	SSES/Rehab	
Camp Taylor System Improvements	08717, 13931, 13943, 36763, 44396, 44397, 66349, 104223, 104231	SSES, Sewer Rehabilitation & Replacement, Offline Storage	1.82-inch	65.12
			2.25-inch	67.63
			2.60-inch	68.47
Hazelwood PS I/I Investigation & Rehabilitation	Hazelwood PS (55665)	I/I Reduction	SSES/Rehab	
Legend: LS –Lift station, PS – Pump Station, CSO – Combined Sewer Overflow, SSO – Sanitary Sewer Overflow, CSS- Combined Sewer System, WQTC – Water Quality Treatment Center, SSES – Sanitary Sewer Evaluation Study, I/I – Inflow and Infiltration, UMFLS – Upper Middle Fork Lift Station, ORFM – Ohio River Force Main				

Level of Protection Evaluation Results

The level of protection evaluation presented in Table 4.1.2 was assessed by an analysis referred to as the "knee-of-the-curve" analysis. A knee-of-the-curve analysis typically involves estimating costs for a range of design levels, then comparing performance (benefits) versus cost and identifying the point of diminishing returns. For the Final SSDP, the knee-of-the-curve analysis focused on a comparison of total benefits versus total capital costs at various levels of protection.

The Final SSDP optimization process did not calculate the total capital costs and benefits for each preferred technology at all levels of protection. Total capital costs and benefits were calculated for 35 preferred technologies at a level of protection corresponding to the 1.82-inch and 2.25-inch cloudburst storms. Cost and benefits were calculated for several of the preferred technologies at the 1.52-inch and 2.60-inch levels of protection (recall the 2.60-inch level was not calculated if the 1.82-inch benefit-cost ratio was higher than the 2.25-inch benefit-cost ratio). Costs and benefits for all other preferred technologies at the 1.52-inch and 2.60-inch levels were estimated by extrapolation of the 1.82-inch or 2.25-inch level-of-protection values. All costs reflect the more detailed budget-level cost estimates prepared for the preferred alternatives.

Figure 4.1.1 shows a curve of total benefits as a function of total capital cost for each level of protection. This figure also shows a single point above the curve denoting the total benefits (26,800) and total capital cost ($169 million, 2008 dollars) for the recommended projects (not including Interim SSDP projects). The figure illustrates a typical knee of the curve response, with the point of inflection representing the point of diminishing returns. As depicted, beyond the 1.82-inch level of protection, additional capital expenditures result in a much slower increase in total benefits. The single point corresponding to the recommended projects lies just at the knee of the curve, demonstrating that the program maximizes benefits to the community with a controlled cost.

Figure 4.1.2 shows a curve of average project benefit-cost ratio versus total capital cost for each level of protection. There is a single point representing the average benefit-cost ratio (94) and total capital cost ($169 million, 2008 dollars) for the recommended projects. This curve is plotted in a format to illustrate optimization of the benefit-cost ratio. This figure shows that the maximum average benefit-cost ratio occurs around the 1.82-inch cloudburst storm and benefit-cost ratios decline significantly beyond a 1.82-inch level of protection. The single point shows that the recommended projects are at the highest benefit-cost ratio, again demonstrating that the program maximizes benefits to the community.

Figure 4.1.3 shows a Benefit-Cost curve of three projects (Klondike Interceptor, Middle Fork Relief Interceptor, and Shively Interceptor) at all three levels of evaluation. Based on the evaluation of the three projects selected, the assumptions regarding benefit-cost trends appear to be valid. In two of the three cases, the benefit-cost score for the 2.25-inch cloudburst storm alternative is equal to or less than the score for the 1.82-inch cloudburst storm. In both of these cases the benefit-cost scores for the 2.60-inch cloudburst storm are less than that of the 2.25-inch cloudburst storm. In one case, the benefit-cost score for the 2.25-inch cloudburst storm is greater than the 1.82-inch cloudburst storm, and in this case the 2.60-inch cloudburst storm benefit/cost score is slightly greater than the 2.25-inch cloudburst storm, and this is the level of protection that was selected. For a full explanation and results of the analysis refer to Appendix 4.1.3 Evaluation of All Levels of Protection Analysis.

FIGURE 4.1.1 SSDP PROJECT OPTIMIZATION: TOTAL BENEFITS VERSUS TOTAL CAPITAL COST (2008 DOLLARS)

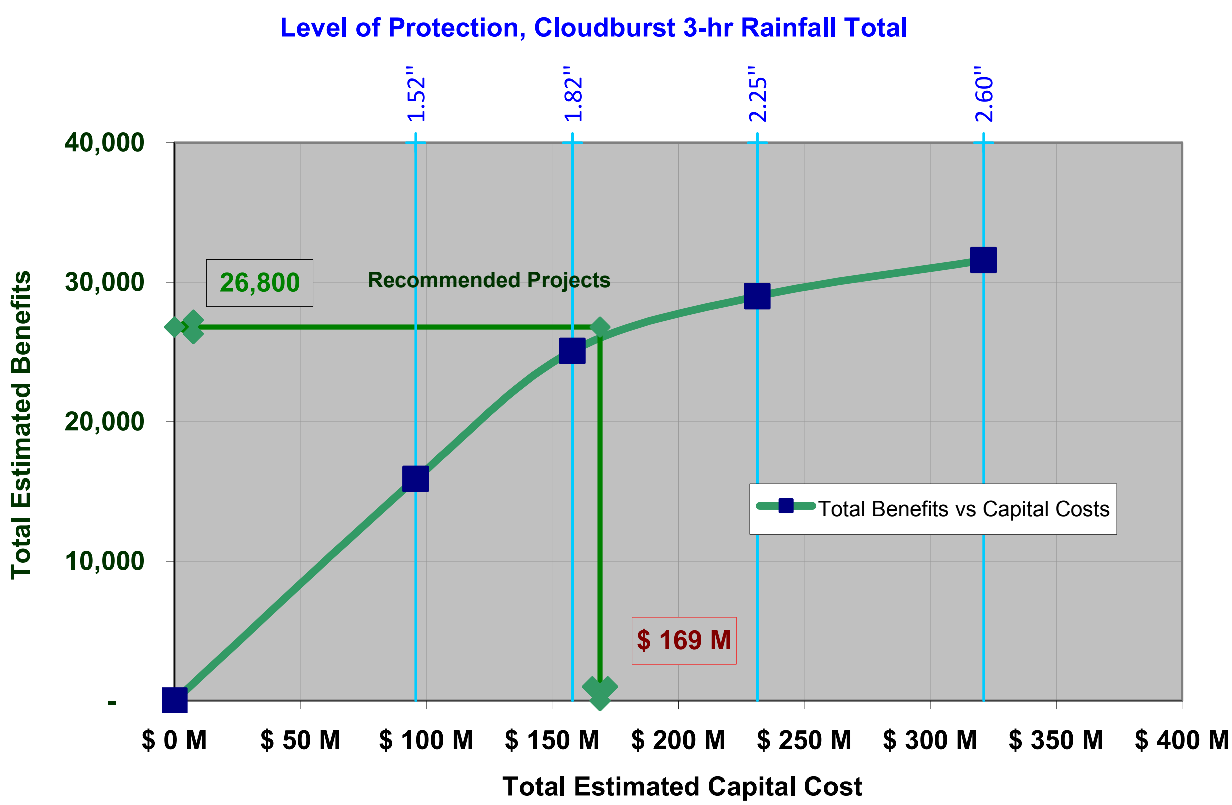


FIGURE 4.1.2 SSDP PROJECT OPTIMIZATION: AVERAGE B/C RATIO VERSUS TOTAL CAPITAL COST (2008 DOLLARS)

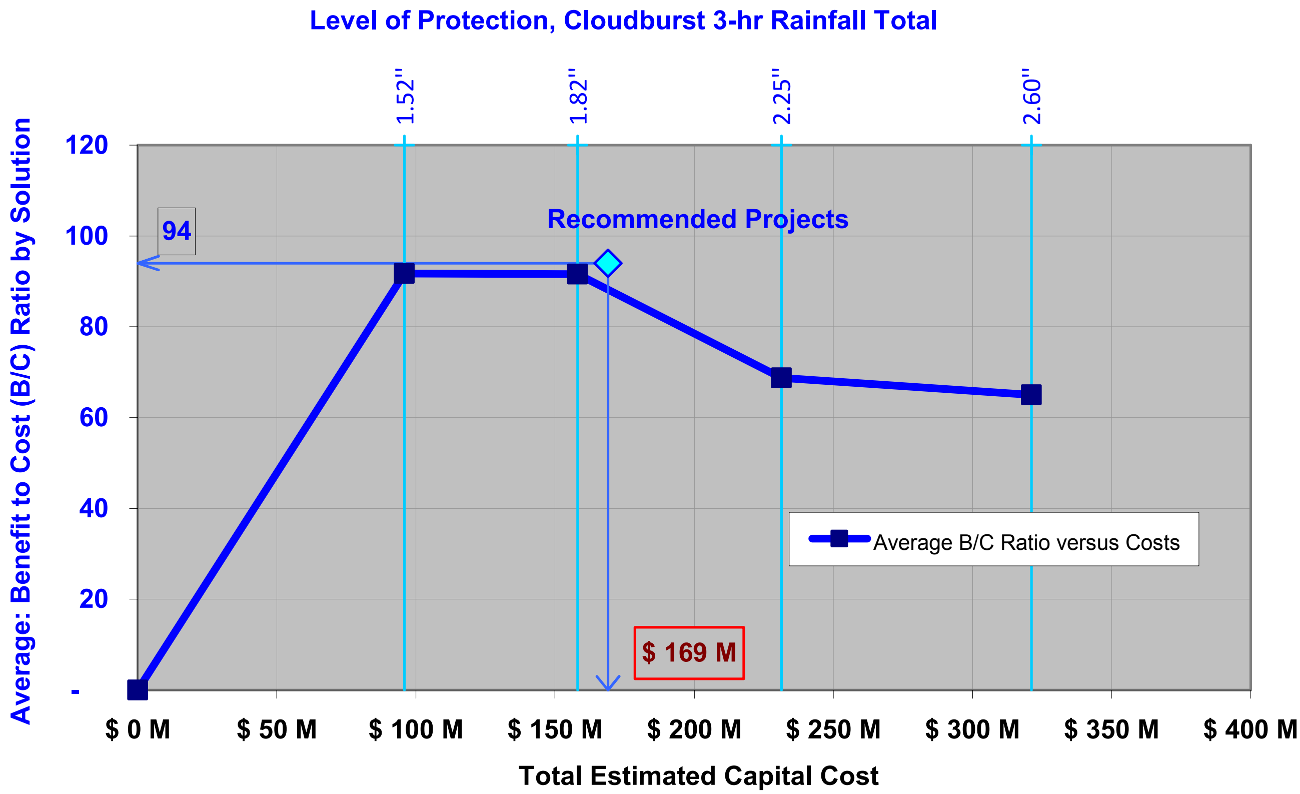
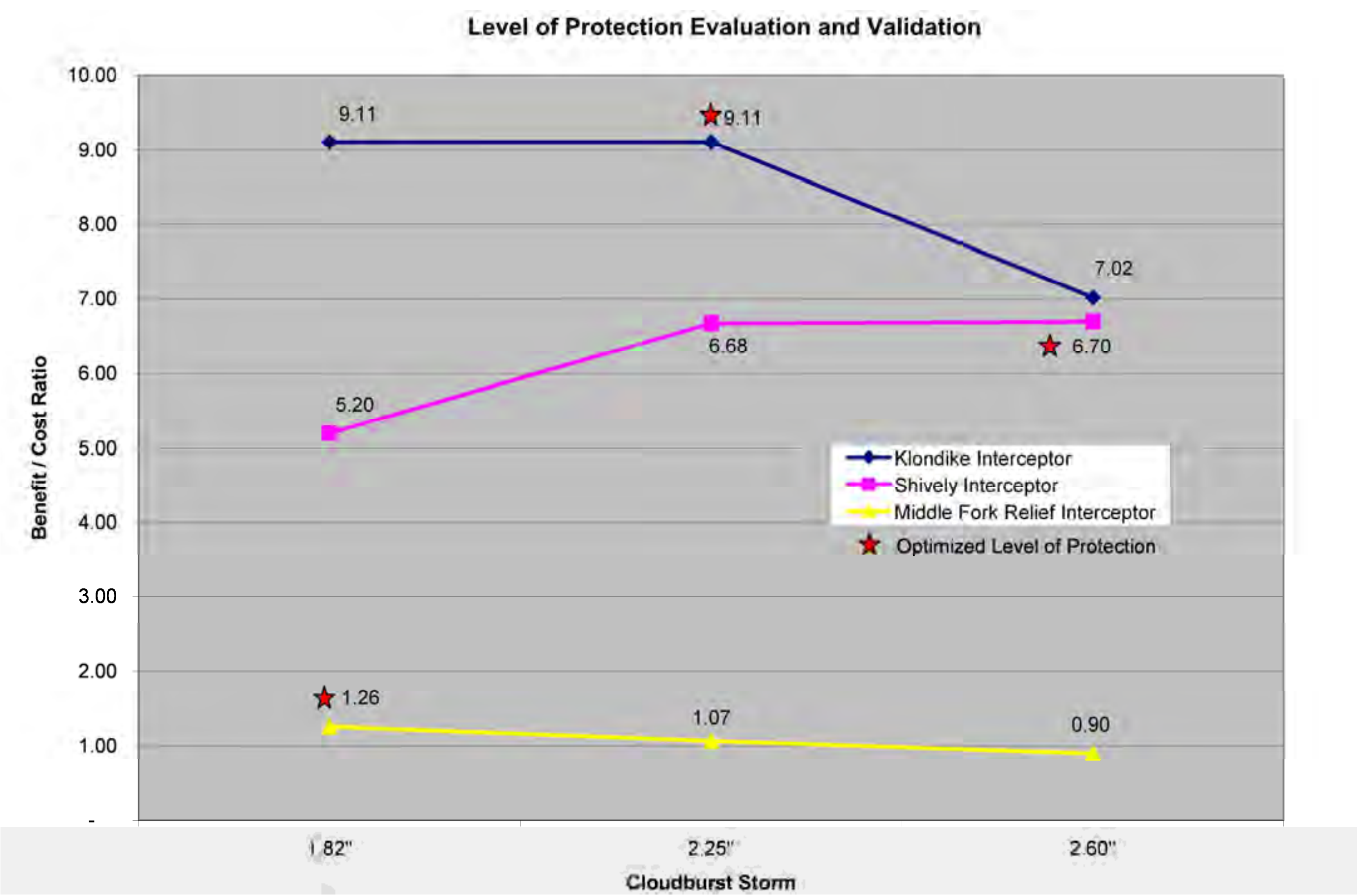


FIGURE 4.1.3 SSDP LEVEL OF PROTECTION EVALUATION



4.1.3 Final SSDP Projects

Driven by the values-based benefit-cost analysis discussed in Chapter 3, the IOAP seeks to present a balanced mix of “green infrastructure” and “gray” solutions to prevent and control SSOs. Since green infrastructure generally is intended to reduce stormwater runoff, it is not directly applicable to flow reduction in a separate sanitary sewer system (SSS). The equivalent to green infrastructure in the Final SSDP includes controlling I/I, using techniques such as disconnecting building laterals, downspouts, sump pumps, and foundation drains that are a direct source of I/I. Gray solutions include options such as storage, diversion, treatment, and conveyance/transport.

The final projects selected for eliminating SSOs also include a mixture of source control (including I/I reduction efforts), wet weather storage, system diversion, conveyance/transport, and basement flooding protection. This mix of control options for SSO locations is a reflection of the benefit-cost analysis and site-specific considerations. Consistent with the Final CSO Long-Term Control Plan (LTCP), the Final SSDP project alternatives are designed to be built around MSD’s existing infrastructure, which may include large diameter pipes and water quality treatment centers (WQTC), and draw on synergistic benefits from other MSD projects.

Overall, the Final SSDP includes 38 gray infrastructure projects, eight I/I reduction projects, and three SSO investigation projects. The Interim SSDP includes six gray infrastructure projects.

The gray infrastructure projects, including the six Interim SSDP projects, are divided into a combination of the following categories, (some projects fall into more than one category):

- 23 conveyance capacity upgrades
- 11 storage projects, inline and offline, many with pipe upgrades as well
- Upgrades or replacements to 12 pump stations
- Elimination of 18 pump stations
- Elimination of 6 small WQTCs, including 5 in the Prospect area
- Expansion of a WQTC

The site-specific level of protection as determined by the value-based benefit-cost analysis resulted in the following for the 38 Final SSDP gray infrastructure projects:

- 24 projects eliminate SSOs up to the 1.82-inch cloudburst storm
- 5 projects eliminate SSOs up to the 2.25-inch cloudburst storm
- 9 projects eliminate SSOs up to the 2.60-inch cloudburst storm

Table 4.1.3 represents the final projects chosen for eliminating SSOs at the selected site-specific level of protection. The table includes a list of projects, SSOs controlled by that project, chosen level of protection, capital costs, and scheduled project completion year. In total, there are 214 documented, suspected, and modeled SSOs addressed by the 55 projects (49 Final SSDP and 6 Interim SSDP) listed in Table 4.1.3. This number includes SSOs eliminated by the Interim SSDP projects. Projects are listed by modeled area.

Final SSDP Project Fact Sheets and Maps

Project fact sheets for the Final SSDP projects detailing project specifics are available at the end of this chapter. Each fact sheet includes a project description for the abatement solution, associated capital cost and associated benefit-cost ratio, and lists SSOs addressed by the project solution.

Detailed project maps for each Final SSDP project specify project location and type of solution. Maps also are located at the end of this chapter behind each respective project fact sheet. *Please note: The general representation of the overflow abatement solutions are for preliminary planning purposes only. Alignments and locations may be altered or refined during the design phase.*

The Final SSDP project fact sheets and maps are presented in the same order as the projects listed in Table 4.1.3. Additionally, project fact sheets and detailed project maps for the six Interim SSDP projects are located at the end of this chapter behind the Final SSDP fact sheets and maps. A total of 41 SSOs are addressed by the six Interim SSDP projects.

TABLE 4.1.3

LIST OF FINAL SSDP PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Present Worth Benefit-Cost Ratio	Capital Cost $[1]	Annual O&M Dollars	Scheduled Completion Year
Cedar Creek Area							
Idlewood Inline Storage	28998, 28984, 63094, 63095, 70158	Inline Storage	1.82-inch	31.36	$2,317,000	$2,800	2023
Fairmount Rd. PS Improvements	Fairmount Road PS (81316 & 97362)	PS Upgrades	2.60-inch	33.29	$874,000	$0	2023
Little Cedar Creek Interceptor Improvements	67997, 67999, 86423, 89195, 89197	Pipe Upgrades	1.82-inch	23.86	$1,875,000	$21,800	2024
Bardstown Rd. PS Improvements	88545	PS Upgrades	2.25-inch	46.50	$281,000	$400	2021
Running Fox PS Elimination	MSD1080-LS	Diversion	1.82-inch	659.52	$96,000	$100	2010
Hite Creek Area							
Meadow Stream PS Inline Storage	Meadow Steam PS (91087 & MSD1082-PS)	Inline Storage	1.82-inch	13.77	$974,000	$13,000	2016
Floydsburg Rd. I/I Investigation & Rehabilitation	Floydsburg Road (MSD1086-PS, 90776, 108956, 108957, 108958)	I/I Reduction	1.82-inch	--	$57,000	$0	2010
Kavanaugh Rd. PS Improvements	Kavanaugh Rd (MSD1085-PS)	PS & Force Main Upgrades	2.60-inch	21.09	$1,110,000	$1,400	2024
Floyds Fork Area							
Woodland Hills PS Diversion	33003, 65531	Diversion	1.82-inch	92.26	$20,000	$100	2011
Eden Care PS SSO Investigation	Eden Care PS (MSD1105-PS)	Monitor	Monitor	--	--	--	2012
Ashburton PS Improvements & Diversion	Olde Copper Court PS (MSD0165-PS), Ashburton PS (MSD0166-PS)	Upgrade Force Main & Pipes	1.82-inch	161.00	$118,000	$100	2021

[1] Detailed cost evaluations are included in Appendix 4.1.2 Final SSDP Project Cost Estimates

TABLE 4.1.3

LIST OF FINAL SSDP PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Present Worth Benefit-Cost Ratio	Capital Cost $[1]	Annual O&M Dollars	Scheduled Completion Year
Jeffersontown Area							
Jeffersontown WQTC Elimination	28390, 28391, 28392, 28395, 31733, Jeffersontown WQTC (28173 & 64505 & MSD0255 & IS028-SI)	Offline Storage, Pipe Upgrades, WQTC Elimination	1.82-inch	5.23	$23,737,000	$28,500	2015
Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements	Chenoweth Run PS (MSD0196-PS & 86052 & 64096), Chippewa PS (92061), Chenoweth Hills WQTC PS (MSD0263A-PS), Chenoweth Hills WQTC (MSD0263)	PS & Force Main Upgrades, WQTC Elimination	1.82-inch	20.05	$3,140,000	$43,800	2015
Dell Rd and Charlane Pkwy Interceptor Improvements	Charlane Pkwy (28250, 28249, 28340, 28336, 104289), Dell Rd. (28413, 28414, 28415, 28416, 28417)	Pipe Upgrades	1.82-inch	31.34	$917,000[1]	$1,900	2022
Raintree & Marian Ct PS Eliminations	28719, 28711, Marian Court PS (28729), Raintree PS (MSD0149-PS)	Diversion, Pipe Upgrades	1.82-inch	72.76	$1,005,000	$1,000	2021
Monticello PS Elimination	Monticello Place PS (MSD0151-PS & 27969)	Diversion	2.60-inch	65.85	$207,000	$300	2022
Middle Fork Area							
Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	02932, 02933, 02935, 08537, 23211, 23212, 27005, 51221, 51160, 51161, 45835, 47583, 47593, 47596, 47603, 47604, 90700, IS021A-SI, Middle Fork at Breckenridge (08935-SM)	Offline Storage & Pipe Upgrades	1.82-inch	1.26	$26,627,000	$18,700	2013, 2023
Goose Creek PS Improvements & Wet Weather Storage	Devondale PS (21628-W), Goose Creek PS (46891 & 62418 & 91629 & 91630 & 105936), Saurel PS (43472)	Offline Storage, PS & Force Main Upgrades	2.25-inch	11.00	$2,844,000	$2,100	2024

[1] Detailed cost evaluations are included in Appendix 4.1.2

TABLE 4.1.3

LIST OF FINAL SSDP PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Present Worth Benefit-Cost Ratio	Capital Cost $[1]	Annual O&M Dollars	Scheduled Completion Year
Anchor Estates PS Eliminations	Vannah PS (01106), Anchor Estates #1 PS (00746 & 00056-W), Anchor Estates #2 PS (MSD0057-LS)	Diversion	2.60-inch	31.14	$1,909,000	$51,200	2013, 2016
Hurstbourne I/I Investigation & Rehabilitation	01793	I/I Reduction	1.82-inch	--	$536,000	$0	2011
Southeastern Diversion Area							
Parkview Estates I/I Investigation & Rehabilitation	47250	I/I Reduction	1.82-inch	--	$285,000	$0	2011
Klondike Interceptor	25676 (Alcona), 26650, 26651	Pipe Upgrades	2.25-inch	9.11	$558,000	$2,200	2015
Sutherland Interceptor	Sutherland (16649)	Pipe Upgrades	2.60-inch	32.71	$412,000	$900	2023
Beargrass Interceptor Rehab Ph. 2	51594	Pipe Rehab	1.82-inch	--	$57,000	$0	2010
Pond Creek Area							
Charleswood Interceptor Extension	25477, 25478, Cooper Chapel PS (25480 & MSD0130-PS)	Pipe Upgrades	1.82-inch	62.84	$603,000	$900	2022
Cinderella PS Elimination	Cinderella PS (60679 & MSD1013-PS), 35309	Diversion	1.82-inch	22.14	$2,205,000[1]	$100	2023
Lantana PS I/I Investigation & Rehabilitation	Lantana Drive #1 PS (25484 & 93719 & MSD0101-PS)	I/I Reduction	1.82-inch	--	$20,000	$100	2011
Government Center PS Elimination	Government Center PS (MSD0180-PS)	Diversion	1.82-inch	44.91	$1,225,000	$100	2024
Avanti PS Elimination	Avanti PS (21229-W)	Diversion	2.60-inch	1000.48	$31,000	$200	2010

[1] Detailed cost evaluations are included in Appendix 4.1.2

TABLE 4.1.3

LIST OF FINAL SSDP PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Present Worth Benefit-Cost Ratio	Capital Cost $[1]	Annual O&M Dollars	Scheduled Completion Year
Lea Ann Way System Improvements	19360, 19369, 29933, 29948, 29943, 31083, 31084, 79076, Lea Ann Way PS (MSD1010-PS)	Pipe Upgrades	1.82-inch	49.01	$827,000	$1,600	2015
Outer Loop & Caven Ave Wet Weather Storage	27116, 70212, 17724, Caven Ave PS (MSD0133-PS)	Offline Storage & Pipe Upgrades	1.82-inch	7.08	$6,084,000	$100	2016, 2024
Leven PS Elimination	Leven PS (36419 & MSD1019-PS)	Diversion	1.82-inch	95.93	$376,000	$100	2022
Edsel PS I/I Investigation & Rehabilitation	Edsel PS (92098 & MSD1048-PS)	I/I Reduction	1.82-inch	--	$367,000	$0	2011
ORFM Area							
Mellwood System Improvements & PS Eliminations	26752, 41374, 41416, Mockingbird Valley PS (MSD0007-PS), Winton PS (MSD0010-PS), Mellwood Avenue PS (24472 & MSD0023-PS), Canoe Lane PS (24152-W & MSD0024-PS)	PS Upgrades, Pipe Upgrades & Diversion	2.25-inch	26.97	$3,055,000[1]	$2,100	2012, 2024
Leland Rd. SSO Investigation	96020	Condition Assessment	Monitor	--	--	--	2012
Derington Ct. PS I/I Investigation & Rehabilitation	Derington Court PS (MSD0095-PS)	I/I Reduction	1.82-inch	--	$265,000	$700	2012
Prospect WQTC Eliminations, Harrods Creek PS, and ORFM System Improvements	40870, 40871, 40872, Barbour Lane PS (42680 & 65633 & 65635), West Goose Creek PS (22436 & MSD0123-PS), Phoenix Hill PS (MSD1044-PS), Glenview Hills PS (MSD0183-PS), Barbour Lane PS (MSD0192-PS), New Market PS (MSD0193-PS), Deep Creek PS (MSD1063-PS), Hunting Creek South WQTC (MSD0292)	PS and Pipe Upgrades, Diversion, WQTC eliminations	2.25-inch	1.69	$34,062,000	$78,300	2015, 2016

[1] Detailed cost evaluations are included in Appendix 4.1.2

TABLE 4.1.3

LIST OF FINAL SSDP PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Present Worth Benefit-Cost Ratio	Capital Cost $[1]	Annual O&M Dollars	Scheduled Completion Year
Mill Creek Area							
Shively Interceptor	04498, 04542, Pioneer PS (81814-W), Fern Lea PS (MSD0047-PS), Garr's Lane PS (MSD0050-PS)	Pipe Upgrades	2.60-inch	6.70	$16,419,000	$11,400	2014
East Rockford PS Relocation	East Rockford PS (04699-W)	PS Replacement and Relocation	1.82-inch	----	$1,044,000	$9,300	2021
Small WQTC Area							
Lucas Ln. PS Inline Storage	Lucas Lane PS (MSD0199-LS)	Inline Storage	1.82-inch	112.86	$183,000	$400	2021
Riding Ridge PS Improvements	Riding Ridge PS (MSD1060-LS)	PS Upgrades	1.82-inch	52.02	$27,000	$100	2014
Gunpowder PS Inline Storage	Gunpowder PS (MSD1055-LS)	Inline Storage	1.82-inch	78.71	$176,000	$9,700	2021
Fox Harbor Inline Storage	Fox Harbor #1 and #2 PS (62769)	Inline Storage	2.60-inch	87.55	$328,000	$8,000	2021
Fairway View PS Improvements	Fairway View PS (MSD1065-PS)	PS Upgrades	1.82-inch	10.32	$87,000	$300	2014
Lake Forest PS SSO Investigation	Lake Forest PS (MSD1169-LS)	Monitor	Monitor	--	--	--	2012
St. Rene Rd. PS Inline Storage	94187	Inline Storage	1.82-inch	212.00	$30,000	$400	2021
CSS Area							
Sonne PS I/I Investigation & Rehabilitation	Sonne Avenue PS (MSD0042-PS)	I/I Reduction	1.82-inch	--	$265,000	$11,600	2011
Camp Taylor System Improvements	08717, 13931, 13943, 36763, 44396, 44397, 66349, 104223, 104231	SSES, Sewer Rehabilitation & Replacement, Offline Storage	2.60-inch	68.47	$28,279,000	$0	2011, 2013, 2017, 2023
Hazelwood PS I/I Investigation & Rehabilitation	Hazelwood PS (55665)	I/I Reduction	1.82-inch	--	$173,000	$1,400	2011

[1]Detailed cost evaluations are included in Appendix 4.1.2, Final SSDP Project Cost Estimates

TABLE 4.1.3

LIST OF FINAL SSDP PROJECTS

SSDP Recommended Project Name/Location	SSO(s) Addressed	Technology	Level of Protection	Capital Cost $[1]	Scheduled Completion Year
Interim SSDP Projects					
Beechwood Village Sanitary Sewer Replacement	21061, 21089, 21101, 21153, 21156	Sewer Replacement	--	$11,800,000	2011
Hikes Lane Interceptor and Highgate Springs PS	17571, 18134, 18298, 18302, 18318-W, 18434, 18471, 18483, 18505, 18595, 49236, 49672, 49673, 49224, MSD0012-PS	PS Elimination and New Interceptor	--	$21,216,000	2012
Northern Ditch Diversion Interceptor	MSD0271	New Interceptor / WQTC Elimination	--	$20,397,000	2011
Sinking Fork Relief Sewer	21103, 25012, 63319	New Relief Sewer	--	$1,690,000	2010
Southeastern Diversion Structure and Interceptor	08426, 08427, 08430, 08431, 30701, 30702, 49647, 63779, 30680, 30681, 72571-X	New Relief Sewer and Flow Control Modifications	4.50-inch	$1,744,000	2012
Derek R. Guthrie WQTC	22370, 22385, 32682, 32688, 59169, MSD0277	WQTC Upgrade	4.50-inch	$102,700,000	2011

[1] Detailed cost evaluations are included in Appendix 4.1.2 Final SSDP Project Cost Estimates

4.2 DEVELOPMENT OF RECOMMENDED PLAN

4.2.1 Prioritization of Projects

As a guiding principle, MSD's IOAP is being developed based on front-end consideration of source control and green infrastructure. Overall, this means that traditional gray infrastructure in the IOAP are sized after considering both the anticipated flow-reduction benefits of programmatic and site-specific green infrastructure solutions (in the Final LTCP), and source control including reduction of private sources of I/I (in the Final SSDP). Prior to the final design of gray solutions, the actual flow reduction performance will be documented and compared against the estimated targets. The final sizing of the gray solutions will then be based on documented performance of the green infrastructure or other source control solutions previously implemented.

Several green infrastructure and source control solutions in the IOAP will be implemented early in the program to allow data to be gathered on the flow reduction benefits. The following list represents the general order of priority that was used to set the implementation schedule for the Final SSDP projects, in descending order:

- Interim SSDP projects and milestones from previously approved submittals
- "Enabling projects" required to implement Consent Decree or milestone projects
- Source control solutions (especially targeted I/I reduction locations)
- Downstream projects that need to be constructed to capture additional flow when smaller upstream projects are constructed (for example, the Buechel Basin is required prior to constructing the Upper Middle Fork Relief Sewer)
- Capital Improvement Projects already under design that address SSOs, as discussed in Chapter 2, Section 2.3.5.9 (i.e., Shively Interceptor)
- Remaining projects rank-ordered based on benefit-cost ratio and scheduled to assist with cash flow leveling

4.2.2 Implementation Schedule to Achieve Consent Decree Requirements

The Final SSDP project implementation schedule is represented in Figure 4.2.1 at the end of this chapter, prior to the project fact sheets and maps. Eight Final SSDP projects have been divided into multiple construction phases and are reflected in multiple fact sheets and maps at the end of the chapter. Multiple cost estimates representing these projects are also in Appendix 4.1.2.

This phasing approach was implemented to accommodate various construction schedules occurring in one project or to allow for components of one project (if vastly different) to be constructed at different times.

The eight Final SSDP projects that are divided into multiple phases are:

- Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork Lift Station Diversion
- Camp Taylor System Improvements
- Prospect WQTC Eliminations, Harrods Creek Pump Station, and Ohio River Force Main System Improvements
- Mellwood System Improvements and Pump Station Eliminations
- Anchor Estates Pump Station Eliminations
- Outer Loop and Caven Avenue Wet Weather Storage
- Raintree and Marian Court Pump Station Eliminations
- Goose Creek Pump Station Improvements and Wet Weather Storage

4.3 PUBLIC INVOLVEMENT

As stated in the Consent Decree, one requirement for public involvement is for the Wet Weather Team (WWT) to assist in developing the plan to involve the public in planning, prioritization and selection of projects. This section recaps the public involvement process throughout the development of the Final SSDP projects.

Early in the IOAP development stage, the WWT, including the WWT Stakeholder Group and the technical team, developed a risk-management approach to evaluating and prioritizing alternative approaches to SSO control. This process was based on managing the risks to a set of community values identified by the WWT Stakeholder Group. The process of identifying, evaluating, and prioritizing projects was a highly interactive process involving all members of the WWT. The interactive process, with the essential engagement of the WWT Stakeholder Group, was critical to the success of the Final SSDP because it created a well-documented and transparent process to consider a wide range of community concerns. This process used a benefit-cost approach with performance measures that had complete buy-in from the WWT Stakeholder Group.

A review of the steps of the values-based decision making process is as follows:

- WWT Stakeholder Group defined values and relative weights for the values;
- The technical team developed draft performance measures and scales based on the “focus areas” or objectives WWT Stakeholder Group identified for the values;
- WWT Stakeholder Group reviewed and helped refine the performance measurement scales;
- The technical team used the performance scales to evaluate alternatives; and
- WWT Stakeholder Group reviewed the results and refined scoring considerations.

During the course of 22 WWT Stakeholder Group meetings, numerous ideas for specific education programs and potential SSO abatement solutions were identified. Records of the ideas were distributed to the technical team for consideration as the potential solutions were identified and evaluated.

The work of the WWT was essential to define the goals and objectives of the IOAP and the public involvement program. With the goals and objectives in hand, the technical team of consultants and MSD staff conceptualized and prepared approaches for the broader public to review and provide comment at public meetings. MSD and the WWT believed it would be valuable to have frequent contact with the public to validate the guidance provided by the WWT Stakeholder Group. As a result, there were four rounds of public meetings; each at a specific phase of the planning process when decisions and selection of priorities were needed.

The first two rounds of public meetings, held in Spring 2007 and Fall 2007 respectively, focused on defining the Project WIN purpose and preparing the public for what was to come in the future related to infrastructure improvements and associated sewer rate increases. The third round of public meetings, in Spring 2008, was specifically designed to give the public and impacted neighborhoods information on the types, locations, and size of facilities that were being considered. The public meetings provided public notice that the facilities were under serious consideration for mitigation; engaged the public in discussion about these facilities and the proposed schedule for construction; and informed the public of the remaining steps of the process.

The fourth round of public meetings to receive public comment on the IOAP was held in November 2008. These public meetings were specifically designed to present the IOAP program in an informal forum that encouraged questions and answers with the public. The presentations included an overview of the program, including project lists, budgets, schedules, and potential rate impacts. To reach as many customers as possible, a presentation was also videotaped for viewing by the public.

In addition to the public meetings, a public hearing was held on December 2, 2008. The purpose of the public hearing was to receive formal comments from the public about the content of the IOAP. The draft IOAP was distributed for public review 30 days before the public hearing. The public notice was published in *The Courier-Journal* announcing the availability of the draft plan, the public hearing date, time and location, and the deadline for the acceptance of comments on the plan. The deadline for accepting comments on the plan was 30 days after the notice of the plan availability.

4.4 ENVIRONMENTAL BENEFITS OF RECOMMENDED PROGRAM

Environmental benefits, in addition to the public health benefits of SSO reduction, are a critical measure for selecting and optimizing solutions to eliminate SSOs and basement backups. This section describes the environmental benefits of SSO elimination.

Five Project-Specific Values with Required Environmental Benefits

1 Regulatory Performance
2 Public Health Enhancement
3 Asset Protection
4 Environmental Enhancement
5 Eco-Friendly Solutions

4.4.1 Determining Environmental Benefits

Through the stakeholder process, a list of values most vital to the community, as well as the means to measure them, was identified and refined. The WWT Stakeholder Group ultimately identified five project-specific values and associated performance criteria that were selected to be evaluated during the benefit-cost analysis. All of the criteria included environmental benefit.

The benefit-cost analysis tool was important because it provided the means to track and rate the diverse environmental benefits of each solution. It also included cost contingencies for properly designing, installing, and maintaining the environmental benefits inherent to the proposed solutions. The benefit-cost analysis tool also provided standards through a list of criteria that could not be violated (fatal flaws) regardless of any cost advantage.

Table 4.4.1 provides an overview of how the Final SSDP performs with respect to these five values. Under some values, such as Regulatory Performance, the Final SSDP will provide complete compliance for all rainfall events at or less than the defined level of protection.

TABLE 4.4.1

SSDP PROJECT-SPECIFIC VALUES WITH ENVIRONMENTAL BENEFITS

Criteria		SSDP Distinguishing Attribute
Regulatory Performance	Eliminating Overflows	No overflows at or below the defined level of protection at known or suspected SSO locations.
Public Health	Eliminating or Reducing Overflow Volume	No overflows at or below defined level of protection at known or suspected SSO locations.
		Overflow volumes may be reduced above the defined level of protection at known and suspected SSOs.
Asset Protection	Eliminating or reducing surcharging and basement back-ups	No basement back-ups at or below the defined level of protection within zone of influence of known or suspected SSO locations.
		Surcharging reduced above the defined level of protection within zone of influence of known or suspected SSO locations.
Environmental Enhancement	Aquatic and Terrestrial Habitat Protection	No solution will, in any way, impact the aquatic and terrestrial habitat of endangered species.
	Aesthetics - Solids and Floatables	All solutions will reduce floatables by 1) eliminating overflows, and thus floatables, at or below the defined level of protections and 2) reducing overflow volumes above the defined level of protections, in particular first-flush floatables.
	Aesthetics - Odor and Air Emissions	No solution will create odors occasionally affecting more than 20 customers. All storage solutions near customers will be required to install and maintain odor-control equipment.
	Dissolved Oxygen Impacts	All solutions will provide intermittent improvement of in-stream dissolved oxygen.
	Downstream Impacts	All solutions will provide intermittent improvement of in-stream BOD and nutrient loads.
	Stream Flow Impacts (Peak flows)	All solutions will provide intermittent reduction of stream peak flows.
	Stream Flow Impacts (Dry Weather Flow)	No solution will impact dry weather flow.
Eco-Friendly Solutions	Non-Renewable Energy Consumption	No solution will require energy greater than secondary treatment. All conveyance solutions and many storage solutions will rely on gravity and will require no energy except for periodic O&M measures.
	Use of Natural Systems	No solutions will permanently displace more than 5 acres of wetlands or 50% of locally available green space. Most conveyance solutions will replace existing features and will have no permanent displacement of wetlands or green areas.
	Multiple-Use Facilities	No Solution will impact recreational opportunities. In fact, many solutions will provide new recreational opportunities.
	Source Control of sub watershed pollutant loads	By elimination of overflows at known, suspected and new SSOs, there will be complete source control at or below the defined level of protection. There will be some source control above the defined level of protection, particularly of the first-flush contaminants.
	Non-Obtrusive Construction Techniques	All RDII reduction will be done with the latest non-obtrusive techniques such as in-situ lining and repairs. There will also be opportunities for non-obtrusive pipe work such as directional drilling. Given the nature of the solutions, there will be limited opportunities for non-obtrusive construction techniques for gray projects such as storage sites. BMPs will be required for all construction projects.
	Consistent Land Use	All features will be consistent with neighborhood or adjacent land use. Most conveyance solutions will be underground using existing right of ways.
	Impermeable Surfaces	Most conveyance solutions and many storage solutions, especially underground storage, will result in no change in impervious areas. All other solutions will include stormwater management features.
	LEEDS Performance	Most systems use gravity for energy. There will be opportunities for LEEDS in pumps, controls and lighting.

4.4.2 Measuring and Modeling Environmental Benefits

Elimination of SSOs and basement backups clearly provide environmental benefits as a whole. Based on water quality data from 2005-2007 normalized by rainfall annually, over 290 million gallons (MG) of overflows could potentially be removed by implementing the Final SSDP. On average, this would annually remove 100 tons of biochemical oxygen demand $(BOD)_5$ and 200 tons of suspended solids from local waterways. In addition, the improvements to the Jeffersontown WQTC and elimination of the Prospect WQTCs would reduce nutrient loads in the respective watersheds.

Under the Final SSDP, there is no specific program to measure and model the benefits of SSO reduction on the environment. In the next section, the elimination of SSOs and basement backups as the key measurement of success are discussed. Moreover, other programs will capture the benefits and evaluate the overall improvements of modeled areas. For example, the Beargrass Creek Total Maximum Daily Load (TMDL) program will use reduced SSO events and volumes as well as positive impacts from the Final CSO LTCP to predict in-stream improvements.

4.5 MEASURES OF SUCCESS

This section provides an overview of known, documented SSO locations and the associated project that addresses the SSO, as well as a detailed discussion of the performance goals that will be used to measure the success of each Final SSDP project. 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. 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.

Table 4.5.1 at the end of this chapter, following the implementation schedule, lists the known, documented SSOs, SSO characteristics, the associated project that addresses the SSO (including Final SSDP, Interim SSDP, and Capital Improvement Projects), levels of protection, overflow volumes, and project start/complete dates. The table is sorted by Project Name followed by SSO ID. Detailed fact sheets for each documented SSO are available for review in Appendix 4.5.1 SSO Fact Sheets. The SSO fact sheets provide additional information such as a map of the SSO location, a background and history of the SSO location, downstream landuse, receiving stream, and the overflow volume summary for the past five years.

The four performance goals to be tracked under the Final SSDP include:

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

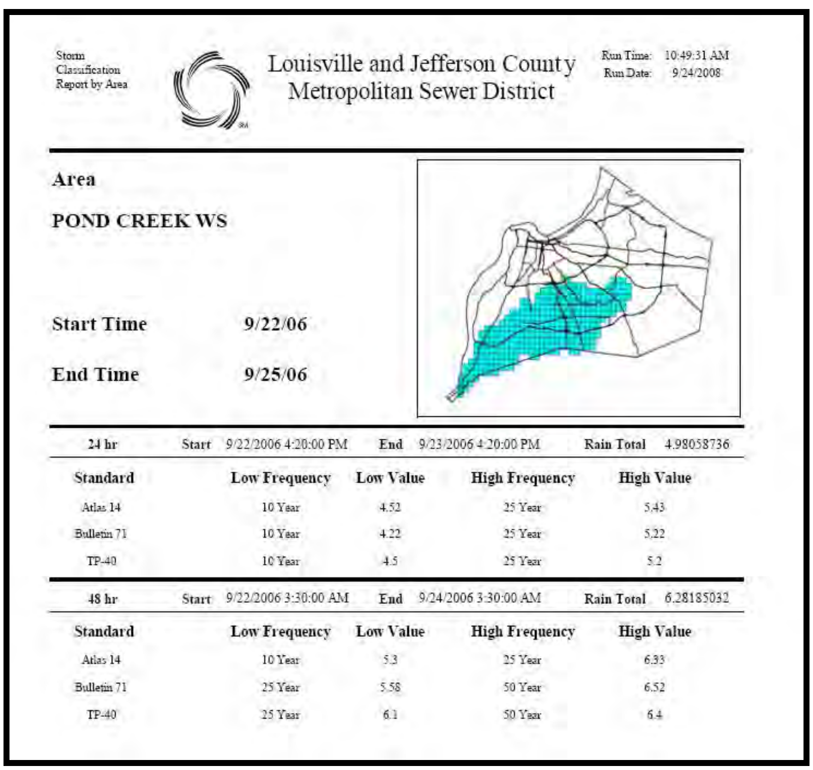
It is worth noting that Goal One is the only goal specifically required by the Consent Decree. Goals Two through Four are in response to WWT Stakeholder Group requests and/or Kentucky Department of Environmental Protection (KDEP) Permit and regulatory requirements. Additionally, an overriding success measure and initial goal identified by MSD already met is that the plan is cost-effective for MSD ratepayers as presented in Figure 4.1.2. The next section provides an overview of the measure of success for each performance goal.

4.5.1 Goal One: No Wet Weather, Capacity-Related SSOs under the Selected Level of Protection

Since the main premise of the Consent Decree is to prevent unauthorized discharges, the goal of the Final SSDP is to eliminate capacity-related SSOs under the site-specific levels of protection. To demonstrate the success of the Consent Decree premise, monitoring of the SSOs will be implemented. MSD will follow Sewer Overflow Response Protocol (SORP) guidelines to monitor SSOs.

Key to the monitoring is determining the magnitude of the rainfall, how significant the rainfall event was, and did the event exceed the level of protection for the appropriate area. MSD developed a rain-tracking tool called *MSD-NET RainTrack* that utilizes MSD's rain gauge network, radar data, and various software to determine the rainfall frequency for any area within the MSD collection system. Figure 4.5.1 is an example of the tool output displaying the rainfall frequency for various durations and rainfall distributions for a significant September 2006 storm in the Pond Creek watershed.

FIGURE 4.5.1 EXAMPLE OF OUTPUT FROM MSD RAIN-TRACKING TOOL


Storm Classification Report by Area

Louisville and Jefferson County
Metropolitan Sewer District

Run Time: 10:49:31 AM
Run Date: 9/24/2008

Area

POND CREEK WS

Start Time 9/22/06

End Time 9/25/06

24 hr **Start** 9/22/2006 4:20:00 PM **End** 9/23/2006 4:20:00 PM **Rain Total** 4.98058736

Standard	Low Frequency	Low Value	High Frequency	High Value
Atlas 14	10 Year	4.52	25 Year	5.43
Bulletin 71	10 Year	4.22	25 Year	5.22
TP-40	10 Year	4.5	25 Year	5.2

48 hr **Start** 9/22/2006 3:30:00 AM **End** 9/24/2006 3:30:00 AM **Rain Total** 6.28185032

Standard	Low Frequency	Low Value	High Frequency	High Value
Atlas 14	10 Year	5.3	25 Year	6.33
Bulletin 71	25 Year	5.58	50 Year	6.52
TP-40	25 Year	6.1	50 Year	6.4

In addition to the rain-tracking tool, the hydraulic models can provide insight into the magnitude of the storm. The Post Construction Compliance Monitoring Plan, (Volume 1, Section 6.5) discusses how the hydraulic models will be maintained. The models will be re-calibrated on a regular basis and will be modified to reflect changes in collection systems, Final SSDP improvements, and rainfall-derived infiltration and inflow (RDI/I) reduction measures. Additionally, calibrated models can be used to determine if specific significant storms created watershed conditions that exceed the levels of protection.

Once a solution has been constructed and a significant storm has been monitored, MSD can measure the success of that solution. If the measure is successful for two consecutive significant storm events, then the solution is deemed successful relative to Goal One.

If the measure is unsuccessful under one significant (defined level of protection) storm event, MSD will utilize its adaptive management process to improve the project. For example, these improvements could include additional storage or targeted RDI/I-reduction measures upstream of the solution.

4.5.2 Goal Two: No Wet Weather, Capacity-Related Basement Backups under the Selected Design Level

A second goal for measuring the success of Final SSDP projects is to ensure basement flooding does not occur in the pre-remediated surcharge zone of influence under the level of protection and after the projects are complete. This is not a Consent Decree requirement, but rather a priority identified by the Wet Weather Stakeholder Group.

Success will be measured in the same manner as Goal One, except that the measurement will be for basement flooding in the zone of influence of known or suspected SSOs. If no basement backups due to capacity are reported for two consecutive significant storm events (defined level of protection or greater), then the solution is deemed to be successful relative to Goal Two.

If the measure is unsuccessful under one significant (defined level of protection) storm event, MSD will utilize their adaptive management process to improve the project. For example, these improvements could include additional storage or targeted RDI/I-reduction measures upstream of the solution.

4.5.3 Goal Three: Sufficient Treatment Capacity under the Selected Level of Protection

A third goal for measuring success of Final SSDP projects is to prevent WQTCs from exceeding wet weather capacity, which could potentially cause basement backups and SSOs in the upstream system and at the WQTC. The System Capacity Assurance Plan (SCAP) provides standards and details how the capacity of a WQTC is established, updated, and used for project evaluations. The SCAP is available on MSD's website under the Project WIN public repository at http://www.msdlouky.org/projectwin/docs.htm.

Success will be measured in the same manner as Goal One and Goal Two, except that the measurement will be for bypasses or violations at the WQTC. If no capacity related bypasses or violations are reported for two consecutive significant storm events (defined level of protection or greater), then WQTC improvements are deemed to be successful relative to Goal Three.

If the measure is unsuccessful under one significant (defined level of protection) storm event, MSD will utilize its adaptive management process to improve the project. For example, these improvements could include additional storage or targeted RDI/I-reduction measures upstream of the WQTC or additional WQTC improvements.

4.5.4 Goal Four: Project Flow Monitoring Performed and Documented

Flow monitoring related to the Final SSDP will build upon the pre-established Post Construction Compliance Monitoring program. Pre-construction data will be compared to the post-construction data to evaluate the effectiveness of improvements. Success will be measured in two ways. First, the flow monitoring will be used to determine if projected RDI/I reduction efforts (refer to Appendix 2.3.4 RDI/I Method and Modeling Techniques Technical Paper) utilized in solution development has been achieved. Second, downstream solutions must be successful, as measured by Goal One. Ultimately, data provided by flow monitoring will dictate success of the project.

Table 4.5.2 provides an overview of the specific requirements for each goal, type, the characteristics of success, and the specific feature that is successful.

TABLE 4.5.2

FINAL SSDP MEASURES OF SUCCESS

	Goal	Measurement	Location of Measurement	Event Triggering Measurement	Program Responsible for Measurement	Agency Requiring Measurement	Characteristics of Success	Successful Feature
1	**No Capacity Related Overflows under the Level of Protection**	Overflow, or lack thereof, at known, suspected or new SSO location	By solution (branch)	Large rainfall event near or above level of protection for solution area (branch)	SORP	Consent Decree	Two or more periods with rainfall at or above design conditions with NO overflows at known, suspected or new SSO locations within branch	Solution
2	**No Capacity Related Basement Back-ups under the Level of Protection**	Basement back-ups, or lack thereof, in zone of influence upstream of known, suspected or new SSOs	By solution (branch)		SORP	WWT Stakeholder Group	Two or more periods with rainfall at or above design conditions with NO basement back-ups within zone of influence of overflows at known, suspected or new SSO locations	Downstream Solution
3	**Sufficient Treatment Capacity under the Level of Protection**	Bypass or inadequate treatment, or lack thereof, at WQTCs in separate sewer system	By WQTC	Large rainfall event near or above cloudburst conditions for collection-system area	SCAP/CMOM	KDEP	Two or more periods with rainfall at or above 2-year cloudburst design conditions with NO bypasses or WQTC violations	WQTC
4	**Project Flow Monitoring Performed and Documented**	Reduction of projected RDI/I used in Hydraulic Modeling (1)	By any solution requiring RDI/I reduction as part of technology (2)	Any large storm (comparison based on control basin)	Post Construction Compliance Monitoring Plan, (See Volume 1, Section 6.5)	WWT Stakeholder Group requirement for RDI/I reduction as first part of any solution	Two or more periods with rainfall where RDI/I is reduced at or above requirement listed in RDI/I reduction memorandum	Downstream Solutions success eliminates the need for additional monitoring
		Overflow, or lack thereof, at downstream known, suspected or new SSO locations	By solution (branch)	Large rainfall event near or above level of protection for solution area (branch)	SORP		Two or more periods with rainfall at or above level of protection with NO overflows at downstream known, suspected or new SSO locations	

Legend: CMOM - Capacity, Management, Operations, and Maintenance
Notes: 1. These RDI/I reduction rates are listed in RDI/I-reduction memorandum (Appendix 2.3.4).
2. These solutions are listed in I/I program memorandum (Appendix 3.1.1)

4.5.5 Benefits of the Measures of Success

The measures of success are a means to show compliance and benefits achieved from projects undertaken. Meeting these performance goals has many potential benefits including: improved water quality, reducing negative impacts on public health, fewer impacts on receiving waters, and legal compliance. These measures are also a means to provide documented project results and verification that the benefit-cost analyses and risk management approach used to choose targeted deficiencies, levels of protection, and project scheduling were effective. The success measures encompass a flexibility to consider site-specific and project-specific values in an effort to find cost-effective means to reduce SSOs. Communication, collaboration, data tracking, documentation, and trend monitoring will be instrumental in achieving these success measures. Operational data from the Capacity, Management, Operations, and Maintenance (CMOM) and SORP may also be useful to incorporate into projects.

4.5.6 Additional Performance Goals

In addition to the performance goals described in the previous section, projects will follow standard MSD business practices. Performance goals for sewer construction and acceptance testing will be based on MSD standard specifications and the Inspector Guidance Manual. The Flow Monitoring Field Operations Program (CMOM Section 2.2.6) provides data to support specific project needs such as watershed hydraulic modeling and calibration. The Water Quality Monitoring Program (CMOM Section 2.1.11) is a well-established program that uses a watershed management approach with routine water quality monitoring, investigative water quality monitoring, and water quality monitoring for spill impact. The Contingency Plan for Sewer and Treatment Systems Programs (CMOM Section 2.1.12) has its own performance goals for emergency response, public notification, agency notification, planning and water quality monitoring. Documentation and policies for emergency issues that could result in unauthorized discharges are detailed in the SORP section of the contingency plan. Additional green solution benefits and detailed monitoring procedures are found in Volume 1 of the IOAP.

4.5.7 New SSO Locations

It is anticipated that new SSO locations will be found over time. As a result, existing solutions will be modified to address new SSO locations. New SSOs could be a result of the following:

- Structural deficiencies that cause a loss of downstream capacity over time which may result in an overflow upstream of the structural deficiency. These structural deficiencies could include sewer collapses, the loss of efficiency at pump stations, blockages, or root intrusions.
- Increases in RDI/I due to long-term deterioration of the sewer system.
- Increases in flow through private property connections, such as illicitly-connected sump pumps. During wet weather, the increased flow could result in an overflow in the area adjacent or downstream of the connections.

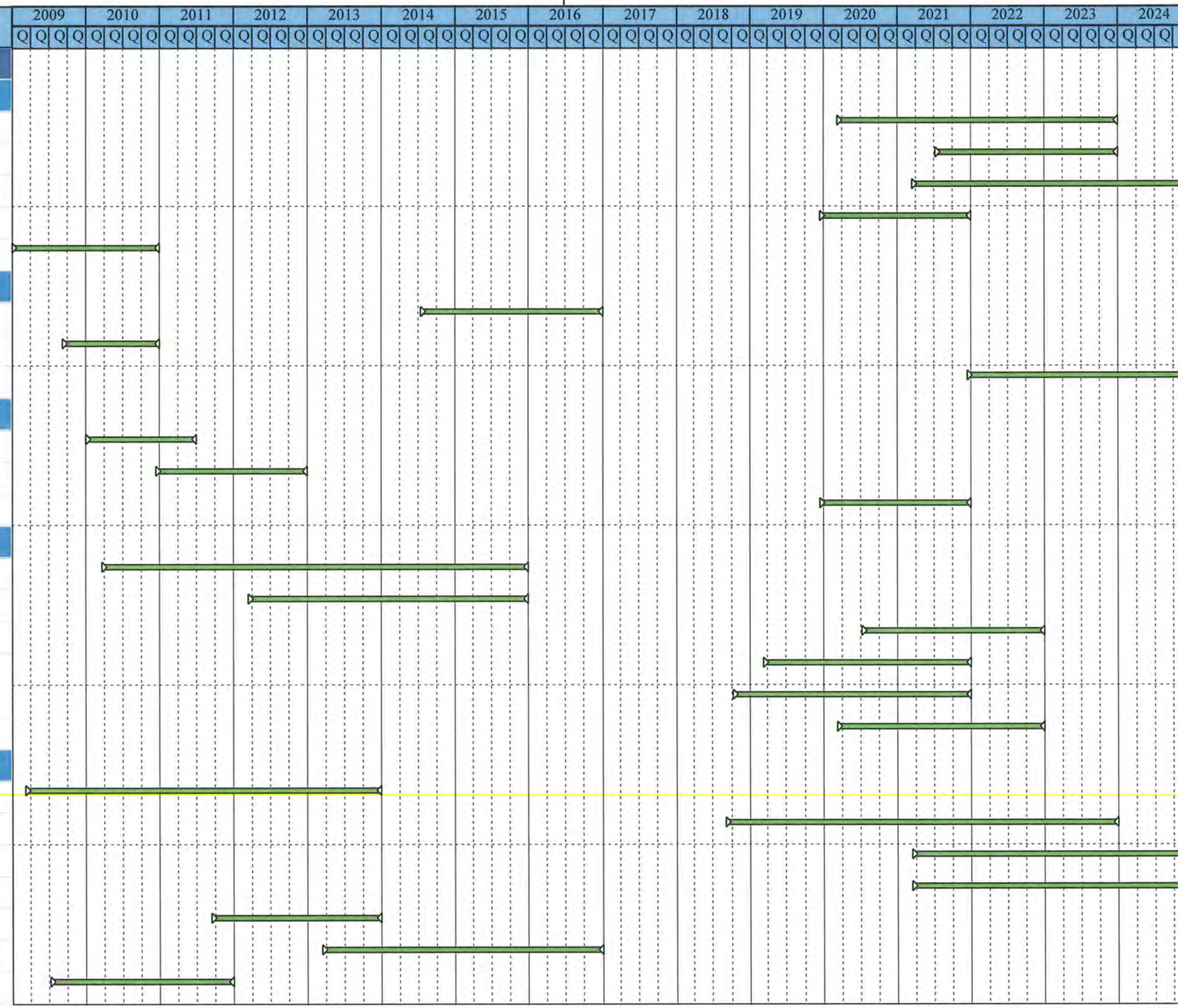
These new locations will be addressed on a case-by-case basis through MSD's adaptive management process (e.g., new SSOs will be added to the SORP investigation list and monitored. If necessary, hydraulic models will be validated to the new SSOs and used to develop solutions). SSOs that are not capacity-related will be addressed through the Gravity Preventative Maintenance and Continuing Sanitary Sewer Assessment (CSSA) Programs.

Figure 4.2.1

Figure 4.2.1

Final Sanitary Sewer Discharge Plan Implementation Schedule

Project Name	Finish
Sanitary Sewer Discharge Plan	31-Dec-24
Cedar Creek Area	31-Dec-24
Idlewood Inline Storage	31-Dec-23
Fairmount Rd PS Improvements	31-Dec-23
Little Cedar Creek Interceptor Improvements	31-Dec-24
Bardstown Rd PS Improvements	31-Dec-21
Running Fox PS Elimination	31-Dec-10
Hite Creek Area	31-Dec-24
Meadow Stream PS Inline Storage	31-Dec-16
Floydsburgh Rd I/I Investigation & Rehabilitation	31-Dec-10
Kavanaugh Rd PS Improvements	31-Dec-24
Floyds Fork Area	31-Dec-21
Woodland Hills PS Diversion	30-Jun-11
Eden Care PS SSO Investigation	31-Dec-12
Ashburton PS Improvements & Diversion	31-Dec-21
Jeffersontown Area	31-Dec-22
Jeffersontown WQTC Elimination	31-Dec-15
Chenoweth Hills WQTC Elimination & PS Improvemets	31-Dec-15
Dell Rd & Charlane Pkwy Interceptor Improvements	31-Dec-22
Raintree & Marian Ct Ph 1-PS Eliminations	31-Dec-21
Raintree & Marian Ct Ph 2-Pipe Upgrades	31-Dec-21
Monticello PS Elimination	31-Dec-22
Beargrass Creek Middle Fork Area	31-Dec-24
UMF #1-Buechel Basin	31-Dec-13
UMF #2-PS Diversion & Storage	31-Dec-23
Goose Creek PS Ph 1-Devondale PS WW Storage	31-Dec-24
Goose Creek PS Ph 2-PS & Force Main Upgrades	31-Dec-24
Anchor Estates-Vannah PS Elimination	31-Dec-13
Anchor Estates-Anchor Ests PS 1&2 Eliminations	31-Dec-16
Hurstbourne I/I Investigation & Rehabilitation	31-Dec-11



All Projects

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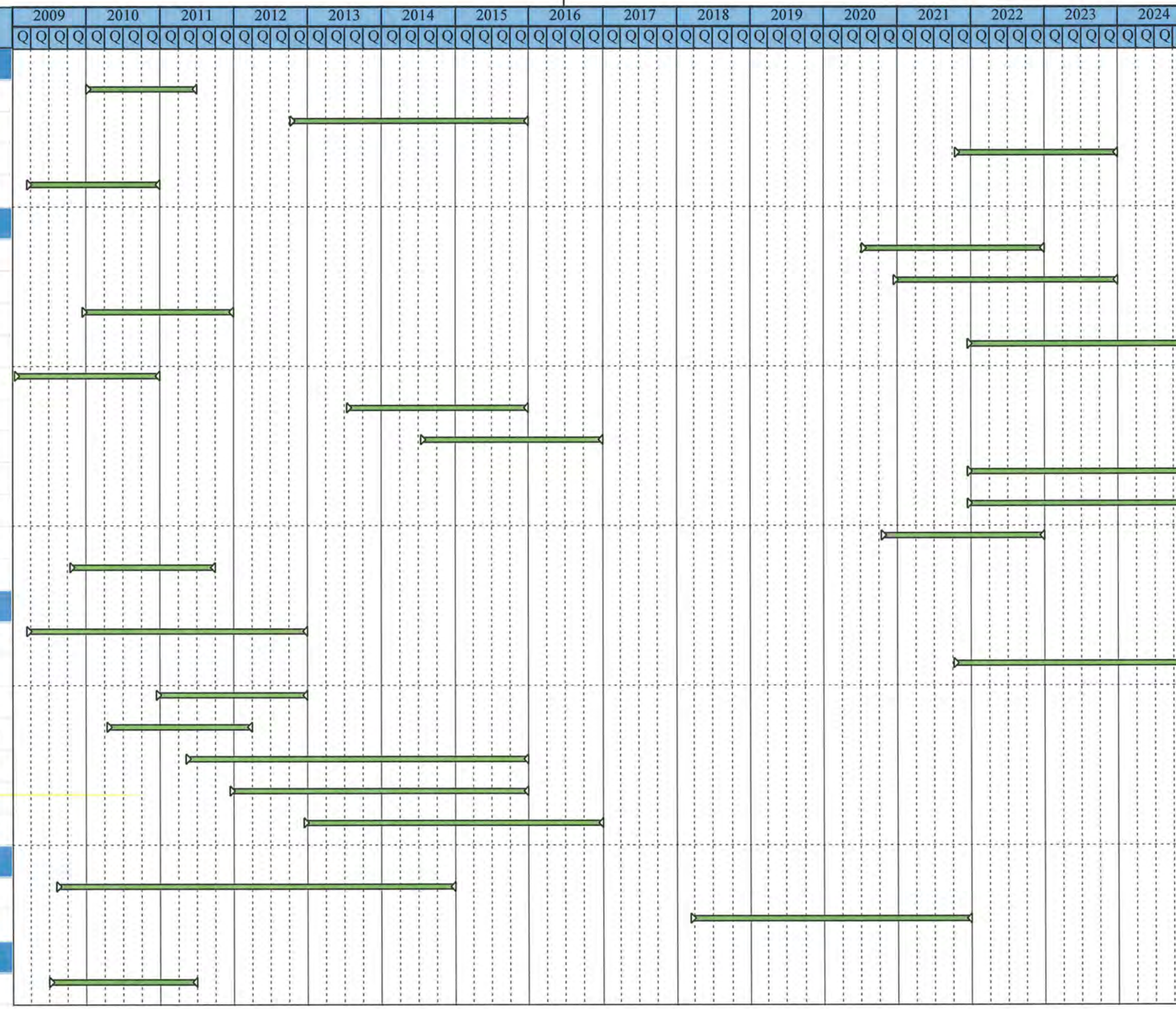
Figure 4.2.1

Final Sanitary Sewer Discharge Plan Implementation Schedule

Figure 4.2.1

Project Name	Finish
Southeastern Diversion Area	31-Dec-23
Parkview Estates I/I Investigation & Rehabilitation	30-Jun-11
Klondike Interceptor	31-Dec-15
Sutherland Interceptor	31-Dec-23
Beargrass Interceptor Rehabilitation Ph 2	31-Dec-10
Pond Creek Area	31-Dec-24
Charleswood Interceptor Extension	31-Dec-22
Cinderella PS Elimination	31-Dec-23
Lantana PS I/I Investigation & Rehabilitation	31-Dec-11
Government Center PS Elimination	31-Dec-24
Avanti PS Elimination	31-Dec-10
Lea Ann Way System Improvements	31-Dec-15
Outer Loop & Caven Area Pipe Upgrades	31-Dec-16
Outer Loop WW Storage	31-Dec-24
Caven Ave WW Storage	31-Dec-24
Leven PS Elimination	31-Dec-22
Edsel PS I/I Investigation & Rehabilitation	30-Sep-11
Ohio River Force Main Area	31-Dec-24
Mellwood Sys 1-Mellwood PS & Force Main	31-Dec-12
Mellwood Sys 2-Winton & Mockingbird PS Elims & Pipe Upgrds	31-Dec-24
Leland Rd SSO Investigation	31-Dec-12
Derington Ct PS I/I Investigation & Rehabilitation	31-Mar-12
Prospect #1 - WQTC Eliminations	31-Dec-15
Prospect #2 - Harrods Creek PS	31-Dec-15
Prospect #3 - ORFM System Improvements	31-Dec-16
Mill Creek Area	31-Dec-21
Shively Interceptor	31-Dec-14
East Rockford PS Relocation	31-Dec-21
Combined Sewer System Area	31-Dec-23
Sonne PS I/I Investigation & Rehabilitation	30-Jun-11



All Projects

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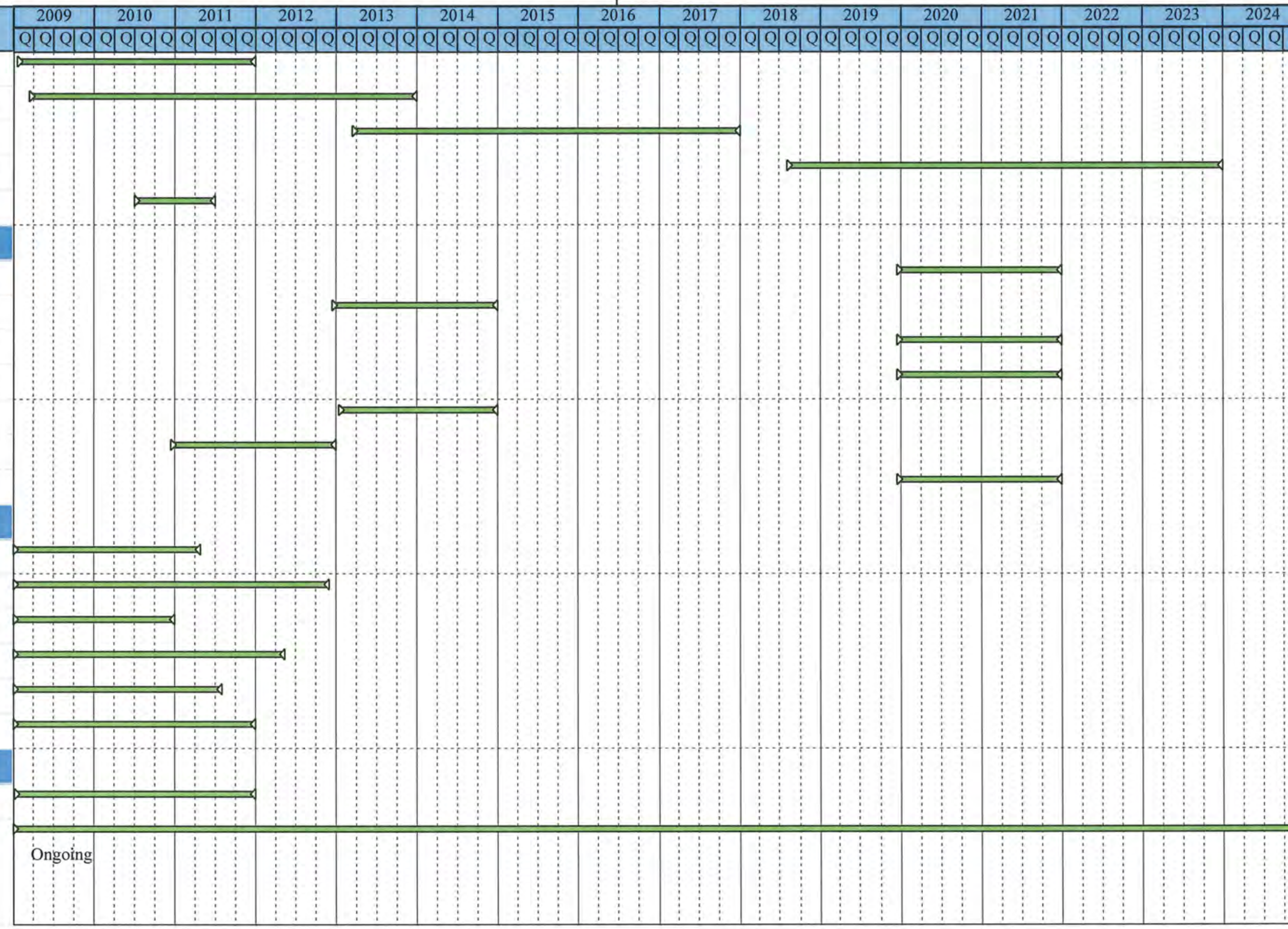
Figure 4.2.1

Final Sanitary Sewer Discharge Plan Implementation Schedule

Figure 4.2.1

Project Name	Finish
Camp Taylor #1 - SSES	31-Dec-11
Camp Taylor #2 - Replace Sewers	31-Dec-13
Camp Taylor #3 - Replace Sewer & Rehabilitation	31-Dec-17
Camp Taylor #4 - Rehabilitation & Off Line Storage	31-Dec-23
Hazelwood PS I/I Investigation & Rehabilitation	30-Jun-11
Small WWTP Area	31-Dec-21
Lucas Ln PS Inline Storage	31-Dec-21
Riding Ridge PS Improvements	31-Dec-14
Gunpowder PS Inline Storage	31-Dec-21
Fox Harbor Inline Storage	31-Dec-21
Fairway View PS Improvements	31-Dec-14
Lake Forest PS SSO Investigation	31-Dec-12
St. Rene Rd PS Inline Storage	31-Dec-21
Interim SSDP Projects	27-Nov-12
Beechwood Village Sanitary Sewer Replacement	27-Apr-11
Hikes Lane Interceptor & Highgate Springs PS	27-Nov-12
Sinking Fork Relief Sewer	30-Dec-10
Southeast Diversion Structure & Interceptor	12-May-12
Northern Ditch Diversion Interceptor	31-Jul-11
Derek R. Guthrie WQTC	31-Dec-11
Other Projects	30-Dec-24
CPE/CCP Modifications To WQTC	31-Dec-11
I/I Reduction Program	30-Dec-24



All Projects

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TABLE 4.5.1 SSOs ADDRESSED BY FINAL SSDP PROJECTS

No.	SSO ID	SSO Name/ Address	SSO Class	Overflow Type	Primary Cause	Project ID	Project Name	Solution Technology	Branch ID	Level of Protection	Minimum Rainfall after IOAP Project Completion[1]	Model-Predicted Volume per Incident beyond Level of Protection (gal)[2]	Scheduled Project Start Date	Scheduled Project Completion Date
1	00746	Manhole Adjacent to Anchor Estates PS #1	Documented	Pumped	Bypass Pipe at Vannah Way, Undersized Pumps at Anchor Estates #1 and #2.	S_MI_MF_NB06_M_01_A_A	Anchor Estates PS Elimination	Diversion	MF06	2.60-inch	>2.60-inch	20,000 - 50,000	2013	2016
2	01106	Vannah PS Wetwell Manhole	Documented	Constructed	Bypass Pipe at Vannah Way, Undersized Pumps at Anchor Estates #1 and #2.	S_MI_MF_NB06_M_01_A_A	Anchor Estates PS Elimination	Diversion	MF06	2.60-inch	>2.60-inch	less than 10,000	2010	2013
3	00056-W	Anchor Estates #1 Wetwell	Documented	Manhole	Bypass Pipe at Vannah Way, Undersized Pumps at Anchor Estates #1 and #2.	S_MI_MF_NB06_M_01_A_A	Anchor Estates PS Elimination	Diversion	MF06	2.60-inch	>2.60-inch	Volume accounted for at MH 00746	2013	2016
4	MSD0057-LS	Anchor Estates #2	Documented	Lift Station	Bypass Pipe at Vannah Way, Undersized Pumps at Anchor Estates #1 and #2.	S_MI_MF_NB06_M_01_A_A	Anchor Estates PS Elimination	Diversion	MF06	2.60-inch	>2.60-inch	20,000 - 50,000	2013	2016
5	MSD0165-PS	Olde Copper Court	Documented	Lift station	Pump station capacity	S_FF_FF_NB03_M_01_C_A	Ashburton PS Improvements & Diversion	Upgrade Force Main & Pipes	NB03	1.82-inch	2.25-inch	10,000 - 20,000	2019	2021
6	MSD0166-PS	Ashburton	Documented	Lift station	Pump station capacity	S_FF_FF_NB03_M_01_C_A	Ashburton PS Improvements & Diversion	Upgrade Force Main & Pipes	NB03	1.82-inch	2.25-inch	10,000 - 20,000	2019	2021
7	21229-W	Avanti Way at Fernview Road	Documented	Constructed	Pump station capacity	S_PO_WC_PC07_M_01_A	Avanti PS Elimination	Diversion	PC07	2.60-inch	N/A	PS will be eliminated	2009	2010
8	88545	11101 Cambridge Commons Drive	Suspected	Manhole	System Capacity	S_CC_CC_MSD1025_S_03_B	Bardstown Rd PS Improvements	PS Upgrades	MSD1025	2.25-inch	2.60-inch	20,000 - 50,000	2019	2021
9	51594	Trevilian Way	Documented	Manhole	Obstructions and root masses	S_SD_MF_NB06_S_13_C	Beargrass Interceptor Rehab Ph 2	Pipe Rehab	NB06	1.82-inch	N/A	Not an overflow in model indicating maintenance-related	2009	2010
10	08717	Fincastle #2	Documented	Manhole	System capacity and poor system conditions in some areas	S_SF_MF_30917_M_09_A	Camp Taylor System Improvements	SSES, Sewer Replacement and Rehabilitation, Offline Storage	30917	2.60-inch	>2.60-inch	10,000 - 20,000	2009	2023
11	13931	Camp Taylor #4	Documented	Manhole	System capacity and poor system conditions in some areas	S_SF_MF_30917_M_09_A	Camp Taylor System Improvements	SSES, Sewer Replacement and Rehabilitation, Offline Storage	30917	2.60-inch	>2.60-inch	10,000 - 20,000	2009	2023
12	13943	Camp Taylor #3	Documented	Manhole	System capacity and poor system conditions in some areas	S_SF_MF_30917_M_09_A	Camp Taylor System Improvements	SSES, Sewer Replacement and Rehabilitation, Offline Storage	30917	2.60-inch	>2.60-inch	10,000 - 20,000	2009	2023
13	36763	3520 Fincastle Road	Suspected	Manhole	System capacity and poor system conditions in some areas	S_SF_MF_30917_M_09_A	Camp Taylor System Improvements	SSES, Sewer Replacement and Rehabilitation, Offline Storage	30917	2.60-inch	>2.60-inch	10,000 - 20,000	2009	2023
14	44396	Fincastle #4	Documented	Manhole	System capacity and poor system conditions in some areas	S_SF_MF_30917_M_09_A	Camp Taylor System Improvements	SSES, Sewer Replacement and Rehabilitation, Offline Storage	30917	2.60-inch	>2.60-inch	10,000 - 20,000	2009	2023
15	44397	Fincastle #3	Documented	Manhole	System capacity and poor system conditions in some areas	S_SF_MF_30917_M_09_A	Camp Taylor System Improvements	SSES, Sewer Replacement and Rehabilitation, Offline Storage	30917	2.60-inch	>2.60-inch	10,000 - 20,000	2009	2023
16	66349	Fincastle #1	Documented	Manhole	System capacity and poor system conditions in some areas	S_SF_MF_30917_M_09_A	Camp Taylor System Improvements	SSES, Sewer Replacement and Rehabilitation, Offline Storage	30917	2.60-inch	>2.60-inch	10,000 - 20,000	2009	2023
17	104223	Camp Taylor #1	Documented	Manhole	System capacity and poor system conditions in some areas	S_SF_MF_30917_M_09_A	Camp Taylor System Improvements	SSES, Sewer Replacement and Rehabilitation, Offline Storage	30917	2.60-inch	>2.60-inch	10,000 - 20,000	2009	2023
18	104231	Camp Taylor #2	Documented	Manhole	System capacity and poor system conditions in some areas	S_SF_MF_30917_M_09_A	Camp Taylor System Improvements	SSES, Sewer Replacement and Rehabilitation, Offline Storage	30917	2.60-inch	>2.60-inch	10,000 - 20,000	2009	2023
19	25477	6101 Price Lane Road	Suspected	Manhole	Pump station capacity	S_PO_WC_PC03_M_01_C	Charleswood Interceptor Extension	Pipe Upgrades	PC03	1.82-inch	>2.60-inch	0	2020	2022
20	25478	6006 Cooper Chapel Road	Suspected	Manhole	Pump station capacity	S_PO_WC_PC03_M_01_C	Charleswood Interceptor Extension	Pipe Upgrades	PC03	1.82-inch	>2.60-inch	0	2020	2022
21	25480	6112 Cooper Chapel Rd	Documented	Manhole	Pump station capacity	S_PO_WC_PC03_M_01_C	Charleswood Interceptor Extension	Pipe Upgrades	PC03	1.82-inch	>2.60-inch	0	2020	2022
22	MSD0130-PS	Cooper Chapel	Documented	Constructed	Pump station capacity	S_PO_WC_PC03_M_01_C	Charleswood Interceptor Extension	Pipe Upgrades	PC03	1.82-inch	>2.60-inch	PS will be eliminated	2020	2022
23	64096	Chenoweth Run #1	Documented	Manhole	System capacity, siphon, and WQTC	S_JT_JT_NB01A_M_03_C	Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements	Pump Station & Force Main Upgrades, WQTC Elimination	NB01A	1.82-inch	2.25-inch	20,000 - 50,000	2012	2015
24	86052	4706 Chenoweth Run	Suspected	Manhole	System capacity, siphon, and WQTC	S_JT_JT_NB01A_M_03_C	Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements	Pump Station & Force Main Upgrades, WQTC Elimination	NB01A	1.82-inch	2.25-inch	10,000 - 20,000	2012	2015
25	92061	11804 Chippewa Ridge Lane	Documented	Manhole	System capacity, siphon, and WQTC	S_JT_JT_NB01A_M_03_C	Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements	Pump Station & Force Main Upgrades, WQTC Elimination	NB01A	1.82-inch	2.25-inch	Volume accounted for at 64096 & 86052	2012	2015
26	MSD0196-PS	Chenoweth Run	Documented	Lift Station	System capacity, siphon, and WQTC	S_JT_JT_NB01A_M_03_C	Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements	Pump Station & Force Main Upgrades, WQTC Elimination	NB01A	1.82-inch	2.25-inch	Volume accounted for at 64096 & 86052	2012	2015
27	MSD0263	Chenoweth Hills WQTC	Documented	Treatment Plant	System capacity, siphon, and WQTC	S_JT_JT_NB01A_M_03_C	Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements	Pump Station & Force Main Upgrades, WQTC Elimination	NB01A	1.82-inch	2.25-inch	20,000 - 50,000	2012	2015
28	MSD0263A-PS	Chenoweth Hills WQTC PS	Documented	Lift Station	System capacity, siphon, and WQTC	S_JT_JT_NB01A_M_03_C	Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements	Pump Station & Force Main Upgrades, WQTC Elimination	NB01A	1.82-inch	2.25-inch	Volume accounted for at MSD0263	2012	2015
29	35309	Marjorie Drive	Documented	Manhole	Pump station and system capacity	S_PO_WC_PC04_M_01_C	Cinderella PS Elimination	Diversion	PC04	1.82-inch	N/A	PS will be eliminated	2020	2023
30	60679	Manhole Adjacent to Cinderella PS	Documented	Manhole	Pump station and system capacity	S_PO_WC_PC04_M_01_C	Cinderella PS Elimination	Diversion	PC04	1.82-inch	N/A	PS will be eliminated	2020	2023
31	MSD1013-PS	Cinderella	Documented	Lift Station	Pump station and system capacity	S_PO_WC_PC04_M_01_C	Cinderella PS Elimination	Diversion	PC04	1.82-inch	N/A	PS will be eliminated	2020	2023
32	28249	Charlane Parkway/St Edwards Drive	Documented	Manhole	System capacity	S_JT_JT_NB02_M_01_C	Dell Rd & Charlane Pkwy Interceptor Improvements	Pipe Upgrades	NB02	1.82-inch	2.25-inch	Volume accounted for at MH 28336 & 28340	2020	2022
33	28250	Charlane Parkway Near the Street	Documented	Manhole	System capacity	S_JT_JT_NB02_M_01_C	Dell Rd & Charlane Pkwy Interceptor Improvements	Pipe Upgrades	NB02	1.82-inch	2.25-inch	Volume accounted for at MH 28336 & 28340	2020	2022
34	28336	Parking Lot Charlane Parkway	Documented	Manhole	System capacity	S_JT_JT_NB02_M_01_C	Dell Rd & Charlane Pkwy Interceptor Improvements	Pipe Upgrades	NB02	1.82-inch	2.25-inch	20,000 - 50,000	2020	2022
35	28340	Charlane Parkway at Pool	Documented	Manhole	System capacity	S_JT_JT_NB02_M_01_C	Dell Rd & Charlane Pkwy Interceptor Improvements	Pipe Upgrades	NB02	1.82-inch	2.25-inch	10,000 - 20,000	2020	2022
36	28413	3317 Dell Road	Documented	Manhole	System capacity	S_JT_JT_NB02_M_01_C	Dell Rd & Charlane Pkwy Interceptor Improvements	Pipe Upgrades	NB02	1.82-inch	2.60-inch	Volume accounted for at MH 28415 & 28416	2020	2022
37	28414	3322 Dell Road	Documented	Manhole	System capacity	S_JT_JT_NB02_M_01_C	Dell Rd & Charlane Pkwy Interceptor Improvements	Pipe Upgrades	NB02	1.82-inch	2.60-inch	Volume accounted for at MH 28415 & 28416	2020	2022
38	28415	3406/3404 Dell Road	Documented	Manhole	System capacity	S_JT_JT_NB02_M_01_C	Dell Rd & Charlane Pkwy Interceptor Improvements	Pipe Upgrades	NB02	1.82-inch	2.60-inch	10,000 - 20,000	2020	2022
39	28416	Marlin Drive	Documented	Manhole	System capacity	S_JT_JT_NB02_M_01_C	Dell Rd & Charlane Pkwy Interceptor Improvements	Pipe Upgrades	NB02	1.82-inch	2.60-inch	10,000 - 20,000	2020	2022
40	28417	Locust Avenue/Marlin Drive	Documented	Manhole	System capacity	S_JT_JT_NB02_M_01_C	Dell Rd & Charlane Pkwy Interceptor Improvements	Pipe Upgrades	NB02	1.82-inch	2.60-inch	Volume accounted for at MH 28415 & 28416	2020	2022

TABLE 4.5.1 SSOs ADDRESSED BY FINAL SSDP PROJECTS

No.	SSO ID	SSO Name/ Address	SSO Class	Overflow Type	Primary Cause	Project ID	Project Name	Solution Technology	Branch ID	Level of Protection	Minimum Rainfall after IOAP Project Completion[1]	Model-Predicted Volume per Incident beyond Level of Protection (gal)[2]	Scheduled Project Start Date	Scheduled Project Completion Date
41	104289	3620 Charlane Pky	Suspected	Manhole	System capacity	S_JT_JT_NB02_M_01_C	Dell Rd & Charlane Pkwy Interceptor Improvements	Pipe Upgrades	NB02	1.82-inch	2.25-inch	Volume accounted for at MH 28340	2020	2022
42	MSD0095-PS	Derington Court	Documented	Pumped	Pump station capacity	S_OR_MF_NB03_S_07_C	Derington Ct. PS I/I Investigation & Rehabilitation	I/I Reduction	NB03	1.82-inch	N/A	N/A	2010	2012
43	04699-W	East Rockford PS	Documented	Pumped	Surface flooding	S_MC_WC_NB02_S_03_C	East Rockford PS Relocation	Pump Station Replacement and Relocation	NB02	1.82-inch	N/A	N/A	2018	2021
44	MSD1105-PS	Eden Care	Documented	Lift Station	Pump station capacity	S_FF_FF_NB02_S_13_C	Eden Care PS SSO Investigation	Monitor	NB02	N/A	N/A	N/A	2009	2012
45	92098	7801 Edsel Lane (Upstream of Edsel Lane PS)	Documented	Pumped	Pump station capacity and hydraulic bottlenecks	S_PO_WC_PC11_M_07_C	Edsel PS I/I Investigation & Rehabilitation	I/I Reduction	PC11	1.82-inch	N/A	N/A	2009	2011
46	MSD1048-PS	Edsel	Documented	Lift Station	Pump station capacity and hydraulic bottlenecks	S_PO_WC_PC11_M_07_C	Edsel PS I/I Investigation & Rehabilitation	I/I Reduction	PC11	1.82-inch	N/A	N/A	2009	2011
47	81316	Fairmount Road #1	Documented	Manhole	Pump station capacity	S_FF_CC_81316_M_03_C_A	Fairmount Rd. PS Improvements	PS Upgrades	81316	2.60-inch	>2.60-inch	Volume accounted for at MH 97362	2021	2023
48	97362	Fairmount Road #2	Documented	Manhole	Pump station capacity	S_FF_CC_81316_M_03_C_A	Fairmount Rd. PS Improvements	PS Upgrades	81316	2.60-inch	>2.60-inch	50,000 - 100,000	2021	2023
49	MSD1065-PS	Fairway View	Documented	Lift Station	Pump station capacity	S_HC_HS_NB01_S_03_C_A	Fairway View PS Improvement	Pump Station Upgrades	NB01	1.82-inch	2.25-inch	less than 10,000	2013	2014
50	90776	Floydsburg Road #1	Documented	Manhole	Pump station capacity	S_HC_HC_MSD1086_M_07_C_A	Floydsburg Rd. I/I Investigation and Rehabilitation	I/I Reduction	MSD1086	1.82-inch	N/A	N/A	2009	2010
51	108956	Floydsburg Road #2	Documented	Manhole	Pump station capacity	S_HC_HC_MSD1086_M_07_C_A	Floydsburg Rd. I/I Investigation and Rehabilitation	I/I Reduction	MSD1086	1.82-inch	N/A	N/A	2009	2010
52	108957	Floydsburg Road #3	Documented	Manhole	Pump station capacity	S_HC_HC_MSD1086_M_07_C_A	Floydsburg Rd. I/I Investigation and Rehabilitation	I/I Reduction	MSD1086	1.82-inch	N/A	N/A	2009	2010
53	108958	Floydsburg Road #4	Documented	Manhole	Pump station capacity	S_HC_HC_MSD1086_M_07_C_A	Floydsburg Rd. I/I Investigation and Rehabilitation	I/I Reduction	MSD1086	1.82-inch	N/A	N/A	2009	2010
54	MSD1086-PS	Floydsburg Road	Documented	Lift Station	Pump station capacity	S_HC_HC_MSD1086_M_07_C_A	Floydsburg Rd. I/I Investigation and Rehabilitation	I/I Reduction	MSD1086	1.82-inch	N/A	N/A	2009	2010
55	62769	Fox Hill Road/ Fox Hunt Court	Documented	Constructed	Pump station capacities	S_HC_HN_NB03_S_09A_A_A	Fox Harbor Inline Storage	Inline Storage	NB03	2.60-inch	>2.60-inch	10,000 - 20,000	2019	2021
56	43472	Near Saurel Drive PS	Documented	Manhole	Pump station capacity	S_MI_MF_NB04_M_03_B	Goose Creek PS Improvements & Wet Weather Storage	Offline Storage, PS and Force Main Upgrades	MF04	2.25-inch	2.60-inch	10,000 - 20,000	2021	2024
57	46891	Goose Creek PS Wet Well	Documented	Manhole	Pump station capacity	S_MI_MF_NB04_M_03_B	Goose Creek PS Improvements & Wet Weather Storage	Offline Storage, PS and Force Main Upgrades	MF04	2.25-inch	2.60-inch	Volume accounted for at MH 105936	2021	2024
58	62418	Goose Creek PS Near Goose Creek	Documented	Manhole	Pump station capacity	S_MI_MF_NB04_M_03_B	Goose Creek PS Improvements & Wet Weather Storage	Offline Storage, PS and Force Main Upgrades	MF04	2.25-inch	2.60-inch	Volume accounted for at MH 105936	2021	2024
59	91629	Old Westport Road at Goose Creek PS #2	Documented	Manhole	Pump station capacity	S_MI_MF_NB04_M_03_B	Goose Creek PS Improvements & Wet Weather Storage	Offline Storage, PS and Force Main Upgrades	MF04	2.25-inch	2.60-inch	Volume accounted for at MH 105936	2021	2024
60	91630	Old Westport Road at Goose Creek PS #3	Documented	Manhole	Pump station capacity	S_MI_MF_NB04_M_03_B	Goose Creek PS Improvements & Wet Weather Storage	Offline Storage, PS and Force Main Upgrades	MF04	2.25-inch	2.60-inch	Volume accounted for at MH 105936	2021	2024
61	105936	Old Westport Road at Goose Creek PS #1	Documented	Manhole	Pump station capacity	S_MI_MF_NB04_M_03_B	Goose Creek PS Improvements & Wet Weather Storage	Offline Storage, PS and Force Main Upgrades	MF04	2.25-inch	2.60-inch	>100,000	2021	2024
62	21628-W	Devondale Wet Well Manhole (PS Overflow)	Documented	Pumped	Pump station capacity	S_MI_MF_NB04_M_03_B	Goose Creek PS Improvements & Wet Weather Storage	Offline Storage, PS and Force Main Upgrades	MF04	2.25-inch	2.60-inch	20,000 - 50,000	2021	2024
63	MSD0180-PS	Government Center	Documented	Lift Station	Pump station and system capacity	S_PO_WC_PC06_M_01_C	Government Center PS Elimination	Diversion	PC06	1.82-inch	N/A	PS will be eliminated	2021	2024
64	MSD1055-LS	Gunpowder	Documented	Pumped	Pump station capacity	S_HC_HN_NB02_S_09A_C_B	Gunpowder PS Inline Storage	Inline Storage	NB02	1.82-inch	2.25-inch	less than 10,000	2019	2021
65	55665	Hazelwood PS wetwell	Documented	Manhole	Pump Station capacity	S_MC_MF_55665_S_07_C	Hazelwood PS I/I Investigation & Rehabilitation	I/I Reduction	55665	1.82-inch	N/A	N/A	2010	2011
66	01793	9 Muirfield Place	Documented	Manhole	System Capacity	S_MI_MF_NB07_S_07_C	Hurstbourne I/I Investigation & Rehabilitation	I/I Reduction	MF07	1.82-inch	N/A	N/A	2009	2011
67	28984	Plumwood #1	Documented	Manhole	Hydraulic Bottleneck	S_CC_CC_70158_M_09A_C	Idlewood Inline Storage	Inline Storage	70158	1.82-inch	2.25-inch	Volume accounted for at MH 63095	2020	2023
68	28998	Plumwood #2	Documented	Manhole	Hydraulic Bottleneck	S_CC_CC_70158_M_09A_C	Idlewood Inline Storage	Inline Storage	70158	1.82-inch	2.25-inch	Volume accounted for at MH 63095	2020	2023
69	63094	Plumwood #4	Documented	Manhole	Hydraulic Bottleneck	S_CC_CC_70158_M_09A_C	Idlewood Inline Storage	Inline Storage	70158	1.82-inch	2.25-inch	Volume accounted for at MH 63095	2020	2023
70	63095	Plumwood #5	Documented	Manhole	Hydraulic Bottleneck	S_CC_CC_70158_M_09A_C	Idlewood Inline Storage	Inline Storage	70158	1.82-inch	2.25-inch	>200,000	2020	2023
71	70158	Plumwood #3	Documented	Manhole	Hydraulic Bottleneck	S_CC_CC_70158_M_09A_C	Idlewood Inline Storage	Inline Storage	70158	1.82-inch	2.25-inch	Volume accounted for at MH 63095	2020	2023
72	28173	Watterson Trail	Documented	Manhole	System capacity, siphon, and WQTC	S_JT_JT_NB01_M_01_C_A	Jeffersontown WQTC Elimination	Off-line Storage, Pipe Upgrades, WQTC Elimination	NB01	1.82-inch	2.25-inch	Volume accounted for at MH 64505	2010	2015
73	28390	10025 Grassland Road	MOP	Manhole	System capacity, siphon, and WQTC	S_JT_JT_NB01_M_01_C_A	Jeffersontown WQTC Elimination	Off-line Storage, Pipe Upgrades, WQTC Elimination	NB01	1.82-inch	2.25-inch	10,000 - 20,000	2010	2015
74	28391	Grassland #3	Documented	Manhole	System capacity, siphon, and WQTC	S_JT_JT_NB01_M_01_C_A	Jeffersontown WQTC Elimination	Off-line Storage, Pipe Upgrades, WQTC Elimination	NB01	1.82-inch	2.60-inch	Volume accounted for at MH 28395	2010	2015
75	28392	Grassland #2	Documented	Manhole	System capacity, siphon, and WQTC	S_JT_JT_NB01_M_01_C_A	Jeffersontown WQTC Elimination	Off-line Storage, Pipe Upgrades, WQTC Elimination	NB01	1.82-inch	2.60-inch	Volume accounted for at MH 28395	2010	2015
76	28395	Grassland #1	Documented	Manhole	System capacity, siphon, and WQTC	S_JT_JT_NB01_M_01_C_A	Jeffersontown WQTC Elimination	Off-line Storage, Pipe Upgrades, WQTC Elimination	NB01	1.82-inch	2.60-inch	10,000 - 20,000	2010	2015
77	31733	10001 Grassland Road	Suspected	Manhole	System capacity, siphon, and WQTC	S_JT_JT_NB01_M_01_C_A	Jeffersontown WQTC Elimination	Off-line Storage, Pipe Upgrades, WQTC Elimination	NB01	1.82-inch	2.25-inch	10,000 - 20,000	2010	2015
78	64505	3200 Ruckreigel Pky	Suspected	Manhole	System capacity, siphon, and WQTC	S_JT_JT_NB01_M_01_C_A	Jeffersontown WQTC Elimination	Off-line Storage, Pipe Upgrades, WQTC Elimination	NB01	1.82-inch	2.25-inch	10,000 - 20,000	2010	2015

TABLE 4.5.1 SSOs ADDRESSED BY FINAL SSDP PROJECTS

No.	SSO ID	SSO Name/ Address	SSO Class	Overflow Type	Primary Cause	Project ID	Project Name	Solution Technology	Branch ID	Level of Protection	Minimum Rainfall after IOAP Project Completion[1]	Model-Predicted Volume per Incident beyond Level of Protection (gal)[2]	Scheduled Project Start Date	Scheduled Project Completion Date
79	IS028-SI	Jeffersontown WQTC Siphon	Documented	Constructed	System capacity, siphon, and WQTC	S_JT_JT_NB01_M_01_C_A	Jeffersontown WQTC Elimination	Off-line Storage, Pipe Upgrades, WQTC Elimination	NB01	1.82-inch	2.25-inch	50,000 - 100,000	2010	2015
80	MSD0255	Jeffersontown WQTC	Documented	Treatment Plant	System capacity, siphon, and WQTC	S_JT_JT_NB01_M_01_C_A	Jeffersontown WQTC Elimination	Off-line Storage, Pipe Upgrades, WQTC Elimination	NB01	1.82-inch	2.25-inch	*	2010	2015
81	MSD1085-PS	Kavanaugh Rd	Documented	Lift Station	Pump station capacity	S_HC_HC_MSD1085_S_03_A	Kavanaugh Rd PS Improvements	PS & Force Main Upgrades	MSD1085	2.60-inch	>2.60-inch	10,000 - 20,000	2021	2024
82	25676	Alcona Lane	Documented	Manhole	System Capacity	S_SD_MF_NB04_S_01_B_A	Klondike Interceptor	Pipe Upgrades	NB04	2.25-inch	>2.60-inch	less than 10,000	2012	2015
83	26650	Briarbridge Ln at South Fork Beargrass Creek	Documented	Manhole	System Capacity	S_SD_MF_NB04_S_01_B_A	Klondike Interceptor	Pipe Upgrades	NB04	2.25-inch	>2.60-inch	less than 10,000	2012	2015
84	26651	Klondike Ln at South Fork Beargrass Creek	Documented	Manhole	System Capacity	S_SD_MF_NB04_S_01_B_A	Klondike Interceptor	Pipe Upgrades	NB04	2.25-inch	>2.60-inch	less than 10,000	2012	2015
85	MSD1169-LS	Lake Forest	MOP	Lift Station	Pump station capacity	S_FF_LF_NB01_S_13_C_A	Lake Forest PS SSO Investigation	Monitor	NB01	N/A	N/A	N/A	2009	2012
86	25484	Near Lantana PS	Documented	Manhole	Pump station and system capacity	S_PO_WC_PC05_M_07_C	Lantana PS I/I Investigation and Rehabilitation	I/I Reduction	PC05	1.82-inch	N/A	N/A	2009	2011
87	93719	Wet Well for Lantana PS	Documented	Manhole	Pump station and system capacity	S_PO_WC_PC05_M_07_C	Lantana PS I/I Investigation and Rehabilitation	I/I Reduction	PC05	1.82-inch	N/A	N/A	2009	2011
88	MSD0101-PS	Lantana Drive PS #1	Documented	Lift Station	Pump station and system capacity	S_PO_WC_PC05_M_07_C	Lantana PS I/I Investigation and Rehabilitation	I/I Reduction	PC05	1.82-inch	N/A	N/A	2009	2011
89	19360	Rockwood Dr / Monaco	Suspected	Manhole	Pump station capacity	S_PO_WC_PC08_M_01_C	Lea Ann Way System Improvements	Pipe Upgrades	PC08	1.82-inch	2.25-inch	less than 10,000	2013	2015
90	19369	5221 Layne Road	Suspected	Manhole	Pump station capacity	S_PO_WC_PC08_M_01_C	Lea Ann Way System Improvements	Pipe Upgrades	PC08	1.82-inch	2.25-inch	less than 10,000	2013	2015
91	29933	6926 Sandstone Blvd	Suspected	Manhole	Pump station capacity	S_PO_WC_PC08_M_01_C	Lea Ann Way System Improvements	Pipe Upgrades	PC08	1.82-inch	2.60-inch	Volume accounted for at MH 29948	2013	2015
92	29943	6906 Sandstone Blvd	Suspected	Manhole	Pump station capacity	S_PO_WC_PC08_M_01_C	Lea Ann Way System Improvements	Pipe Upgrades	PC08	1.82-inch	2.60-inch	Volume accounted for at MH 29948	2013	2015
93	29948	Sandstone Blvd	Documented	Manhole	Pump station capacity	S_PO_WC_PC08_M_01_C	Lea Ann Way System Improvements	Pipe Upgrades	PC08	1.82-inch	2.60-inch	20,000 - 50,000	2013	2015
94	31083	6924 Sandstone Blvd	Suspected	Manhole	Pump station capacity	S_PO_WC_PC08_M_01_C	Lea Ann Way System Improvements	Pipe Upgrades	PC08	1.82-inch	2.60-inch	Volume accounted for at MH 29948	2013	2015
95	31084	6916 Sandstone Blvd	Suspected	Manhole	Pump station capacity	S_PO_WC_PC08_M_01_C	Lea Ann Way System Improvements	Pipe Upgrades	PC08	1.82-inch	2.60-inch	Volume accounted for at MH 29948	2013	2015
96	79076	6308 Hanses Drive	Suspected	Manhole	Pump station capacity	S_PO_WC_PC08_M_01_C	Lea Ann Way System Improvements	Pipe Upgrades	PC08	1.82-inch	2.25-inch	>100,000	2013	2015
97	MSD1010-PS	Lea Ann Way	Documented	Pumped	Pump station capacity	S_PO_WC_PC08_M_01_C	Lea Ann Way System Improvements	Pipe Upgrades	PC08	1.82-inch	>2.60-inch	0	2013	2015
98	96020	Leland Road	Documented	Manhole	Hydraulic bottleneck	S_OR_MF_NB02_S_13_C	Leland Rd SSO Investigation	Condition Assessment	NB02	N/A	N/A	N/A	2009	2012
99	36419	10601 Leven Blvd	Suspected	Manhole	Pump station capacity and hydraulic bottlenecks	S_PO_WC_PC10_M_01_C	Leven PS Elimination	Diversion	PC10	1.82-inch	N/A	PS will be eliminated	2020	2022
100	MSD1019-PS	Leven	Suspected	Pumped	Pump station capacity and hydraulic bottlenecks	S_PO_WC_PC10_M_01_C	Leven PS Elimination	Diversion	PC10	1.82-inch	N/A	PS will be eliminated	2020	2022
101	67997	7906 Gainsborough Court	Documented	Manhole	System capacity	S_CC_CC_67997_M_01_C	Little Cedar Creek Interceptor Improvements	Pipe Upgrades	67997	1.82-inch	2.25-inch	Volume accounted for at MH 86423	2021	2024
102	67999	7904 Shaw Court	Suspected	Manhole	System capacity	S_CC_CC_67997_M_01_C	Little Cedar Creek Interceptor Improvements	Pipe Upgrades	67997	1.82-inch	2.25-inch	Volume accounted for at MH 86423	2021	2024
103	86423	8314 Casualwood Way	MOP	Manhole	System capacity	S_CC_CC_67997_M_01_C	Little Cedar Creek Interceptor Improvements	Pipe Upgrades	67997	1.82-inch	2.25-inch	20,000 - 50,000	2021	2024
104	89195	8104 Kimberly Way	MOP	Manhole	System capacity	S_CC_CC_67997_M_01_C	Little Cedar Creek Interceptor Improvements	Pipe Upgrades	67997	1.82-inch	2.25-inch	Volume accounted for at MH 86423	2021	2024
105	89197	8104 Kimberly Way	MOP	Manhole	System capacity	S_CC_CC_67997_M_01_C	Little Cedar Creek Interceptor Improvements	Pipe Upgrades	67997	1.82-inch	2.25-inch	Volume accounted for at MH 86423	2021	2024
106	MSD0199-LS	Lucas Lane	Documented	Lift Station	Pump station capacity	S_FF_BT_NB01_S_09A_C_A	Lucas Ln PS Inline Storage	Inline Storage	NB01	1.82-inch	2.25-inch	20,000 - 50,000	2019	2021
107	91087	Near Meadow Stream PS	Documented	Manhole	Pump station capacity	S_HC_HC_MSD1082_S_09A_C	Meadow Stream PS Inline Storage	Inline Storage	MSD1082	1.82-inch	2.25-inch	>100,000	2014	2016
108	MSD1082-PS	Meadow Stream	Documented	Lift Station	Pump station capacity	S_HC_HC_MSD1082_S_09A_C	Meadow Stream PS Inline Storage	Inline Storage	MSD1082	1.82-inch	2.25-inch	Volume accounted for at MH 91087	2014	2016
109	24472	501 Mockingbird Valley Road	MOP	Manhole	Pump station capacity & system capacity	S_OR_MF_NB01_M_01_B	Mellwood System Improvements & PS Elimination	Pump Station Upgrades, Pipe Upgrades, & Diversion	NB01	2.25-inch	2.60-inch	20,000 - 50,000	2021	2024
110	26752	Brownsboro Road at Mockingbird Valley #1	Documented	Manhole	Pump station capacity & system capacity	S_OR_MF_NB01_M_01_B	Mellwood System Improvements & PS Elimination	Pump Station Upgrades, Pipe Upgrades, & Diversion	NB01	2.25-inch	2.60-inch	10,000 - 20,000	2021	2024
111	41374	Brownsboro Road at Mockingbird Valley #2	Documented	Manhole	Pump station capacity & system capacity	S_OR_MF_NB01_M_01_B	Mellwood System Improvements & PS Elimination	Pump Station Upgrades, Pipe Upgrades, & Diversion	NB01	2.25-inch	2.60-inch	Volume accounted for at MH 26752	2021	2024
112	41416	3202 Brownsboro Road	Suspected	Manhole	Pump station capacity & system capacity	S_OR_MF_NB01_M_01_B	Mellwood System Improvements & PS Elimination	Pump Station Upgrades, Pipe Upgrades, & Diversion	NB01	2.25-inch	2.60-inch	10,000 - 20,000	2021	2024
113	24152-W	3733 Canoe Lane (Wet Well for Canoe Ln PS)	Documented	Constructed	Pump station capacity & system capacity	S_OR_MF_NB01_M_01_B	Mellwood System Improvements & PS Elimination	Pump Station Upgrades, Pipe Upgrades, & Diversion	NB01	2.25-inch	>2.60-inch	Volume accounted for at MSD0024-PS	2021	2024
114	MSD0007-PS	Mockingbird Valley	Documented	Constructed	Pump station capacity & system capacity	S_OR_MF_NB01_M_01_B	Mellwood System Improvements & PS Elimination	Pump Station Upgrades, Pipe Upgrades, & Diversion	NB01	2.25-inch	N/A	PS will be eliminated	2021	2024
115	MSD0010-PS	Winton	Documented	Constructed	Pump station capacity & system capacity	S_OR_MF_NB01_M_01_B	Mellwood System Improvements & PS Elimination	Pump Station Upgrades, Pipe Upgrades, & Diversion	NB01	2.25-inch	N/A	PS will be eliminated	2021	2024
116	MSD0023-PS	Mellwood Avenue	Documented	Constructed	Pump station capacity & system capacity	S_OR_MF_NB01_M_01_B	Mellwood System Improvements & PS Elimination	Pump Station Upgrades, Pipe Upgrades, & Diversion	NB01	2.25-inch	2.60-inch	20,000 - 50,000	2009	2012
117	MSD0024-PS	Canoe Lane	Documented	Lift Station	Pump station capacity & system capacity	S_OR_MF_NB01_M_01_B	Mellwood System Improvements & PS Elimination	Pump Station Upgrades, Pipe Upgrades, & Diversion	NB01	2.25-inch	>2.60-inch	20,000 - 50,000	2021	2024
118	02932	Oxmoor #1	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	Volume accounted for at MH 02933	2018	2023
119	02933	Oxmoor #2	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	>200,000	2018	2023
120	02935	Oxmoor #3	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	>200,000	2018	2023

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No.	SSO ID	SSO Name/ Address	SSO Class	Overflow Type	Primary Cause	Project ID	Project Name	Solution Technology	Branch ID	Level of Protection	Minimum Rainfall after IOAP Project Completion[1]	Model-Predicted Volume per Incident beyond Level of Protection (gal)[2]	Scheduled Project Start Date	Scheduled Project Completion Date
121	08537	Northern Ditch Blow-off	Documented	Constructed	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	less than 10,000	2018	2023
122	23211	Peabody Lane #1	Documented	Constructed	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	>2.60-inch	Volume accounted for at MH 51160 & MH 51161	2018	2023
123	23212	Peabody Lane #2	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	>2.60-inch	Volume accounted for at MH 51160 & MH 51161	2018	2023
124	27005	Bridge #6 - Cherokee Park	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	>200,000	2018	2023
125	45835	Beargrass Road near Big Rock	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	>2.60-inch	20,000 - 50,000	2018	2023
126	47583	Oxmoor #4	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	>200,000	2018	2023
127	47593	Near LG&E Power Station	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	Volume accounted for at MH 02933	2018	2023
128	47596	7410 Steeplecrest Circle	Suspected	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	>100,000	2018	2023
129	47603	Kindercare #1	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	10,000 - 20,000	2018	2023
130	47604	Kindercare #2	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	Volume accounted for at MH 47603	2018	2023
131	51160	Peabody Lane #3	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	>2.60-inch	50,000 - 100,000	2018	2023
132	51161	Brooklawn	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	>2.60-inch	50,000 - 100,000	2018	2023
133	51221	Watterson Expressway at South Fork Beargrass Creek	Documented	Constructed	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	>2.60-inch	Volume accounted for at MH 51160 & MH 51161	2018	2023
134	90700	Christian Court	Documented	Manhole	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	Volume accounted for at MH 47603	2018	2023
135	08935-SM	Middle Fork at Breckenridge Lane	Documented	Constructed	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	2.25-inch	>200,000	2018	2023
136	IS021A-SI	Bowman Field Siphon	Documented	Constructed	System capacity	S_MISF_MF_NB01_M_01_C_A1	Middle Fork Relief Interceptor, Wet Weather Storage, and Upper Middle Fork LS Diversion	Off-line Storage and Pipe Upgrades	MF01	1.82-inch	>2.60-inch	>200,000	2018	2023
137	27969	4304 Rivanna Dr	Suspected	Manhole	Pump station capacity	S_JT_JT_NB04_M_01_A	Monticello PS Elimination	Diversion	NB04	2.60-inch	>2.60-inch	10,000 - 20,000	2020	2022
138	MSD0151-PS	Monticello Place	Documented	Lift Station	Pump station capacity	S_JT_JT_NB04_M_01_A	Monticello PS Elimination	Diversion	NB04	2.60-inch	>2.60-inch	Volume accounted for at MH 27969	2020	2022
139	17724	1096 Springview Drive	Documented	Manhole	System Capacity	S_PO_WC_PC09_M_09B_C	Outer Loop & Caven Ave Wet Weather Storage	Off-line Storage and Pipe Upgrades	PC09	1.82-inch	>2.60-inch	less than 10,000	2014	2016
140	27116	10306 Caven Avenue	Suspected	Manhole	System Capacity	S_PO_WC_PC09_M_09B_C	Outer Loop & Caven Ave Wet Weather Storage	Off-line Storage and Pipe Upgrades	PC09	1.82-inch	>2.60-inch	less than 10,000	2021	2024
141	70212	1095 Springview Drive	Suspected	Manhole	System Capacity	S_PO_WC_PC09_M_09B_C	Outer Loop & Caven Ave Wet Weather Storage	Off-line Storage and Pipe Upgrades	PC09	1.82-inch	>2.60-inch	less than 10,000	2014	2016
142	MSD0133-PS	Caven Avenue	Documented	Pumped	System Capacity	S_PO_WC_PC09_M_09B_C	Outer Loop & Caven Ave Wet Weather Storage	Off-line Storage and Pipe Upgrades	PC09	1.82-inch	>2.60-inch	less than 10,000	2021	2024
143	47250	1645 Rangeland Rd	MOP	Manhole	System Capacity	S_SD_MF_NB03_S_07_C	Parkview Estates I/I Investigation & Rehabilitation	I/I Reduction	NB03	1.82-inch	N/A	N/A	2010	2011
144	22436	Manhole Adjacent to West Goose Creek PS	Documented	Pumped	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	>2.60-inch	less than 10,000	2011	2015
145	40870	Muddy Fork PS #1	Documented	Manhole	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	2.60-inch	>100,000	2011	2015
146	40871	Muddy Fork PS #2	Documented	Manhole	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	2.60-inch	Volume accounted for at MH 40870 & MH 40872	2011	2015
147	40872	Muddy Fork PS #3	Documented	Manhole	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	2.60-inch	>100,000	2011	2015
148	42680	Barbour Lane #1	Documented	Pumped	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	>2.60-inch	less than 10,000	2011	2015
149	65633	Barbour Lane #2	Documented	Manhole	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	>2.60-inch	less than 10,000	2011	2015
150	65635	Barbour Lane #3	Documented	Manhole	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	>2.60-inch	less than 10,000	2011	2015
151	MSD0123-PS	West Goose Creek	Documented	Lift Station	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	>2.60-inch	less than 10,000	2011	2015
152	MSD0183-PS	Glenview Hills	Documented	Lift Station	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	>2.60-inch	less than 10,000	2011	2015
153	MSD0192-PS	Barbour Lane	Documented	Lift Station	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	>2.60-inch	less than 10,000	2011	2015
154	MSD0193-PS	New Market	Documented	Lift Station	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	2.60-inch	20,000 - 50,000	2011	2015
155	MSD0292	Hunting Creek South WQTC	Documented	Treatment Plant	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	N/A	WQTC will be eliminated	2011	2015
156	MSD1044-PS	Phoenix Hill	Documented	Pumped	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	2.60-inch	10,000 - 20,000	2011	2015
157	MSD1063-PS	Deep Creek	Documented	Lift Station	ORFM and pump station capacity	S_OR_MF_NB04_M_03_B_B	Prospect WQTC Elimination, Harrods Creek PS, and ORFM System Improvements	Pump Station & Pipe Upgrades, Diversion, WQTC Eliminations	NB04	2.25-inch	N/A	PS will be eliminated	2011	2015
158	28711	9510 Taylorsville Road	Suspected	Manhole	System & pump station capacity	S_JT_JT_NB03_M_01_C	Raintree and Marian Ct PS Elimination	Pipe Upgrades and Diversion	NB03	1.82-inch	2.25-inch	10,000 - 20,000	2018	2021
159	28719	Intersection of Gleeson and Wendell	MOP	Manhole	System & pump station capacity	S_JT_JT_NB03_M_01_C	Raintree and Marian Ct PS Elimination	Pipe Upgrades and Diversion	NB03	1.82-inch	2.25-inch	10,000 - 20,000	2018	2021

TABLE 4.5.1 SSOs ADDRESSED BY FINAL SSDP PROJECTS

No.	SSO ID	SSO Name/ Address	SSO Class	Overflow Type	Primary Cause	Project ID	Project Name	Solution Technology	Branch ID	Level of Protection	Minimum Rainfall after IOAP Project Completion[1]	Model-Predicted Volume per Incident beyond Level of Protection (gal)[2]	Scheduled Project Start Date	Scheduled Project Completion Date
160	28729	9100 Marian Ct (Wet Well for Marian Ct PS)	Documented	Constructed	System & pump station capacity	S_JT_JT_NB03_M_01_C	Raintree and Marian Ct PS Elimination	Pipe Upgrades and Diversion	NB03	1.82-inch	2.25-inch	10,000 - 20,000	2018	2021
161	MSD0149-PS	Raintree	MOP	Constructed	System & pump station capacity	S_JT_JT_NB03_M_01_C	Raintree and Marian Ct PS Elimination	Pipe Upgrades and Diversion	NB03	1.82-inch	2.25-inch	20,000 - 50,000	2018	2021
162	MSD1060-LS	Riding Ridge	Documented	Pumped	Pump station capacity	S_HC_HN_NB01_S_03_C_A	Riding Ridge PS Improvements	Pump Station Upgrades	NB01	1.82-inch	2.25-inch	less than 10,000	2012	2014
163	MSD1080-LS	Running Fox	Documented	Lift Station	Pump station capacity	S_CC_CC_MSD1080_S_01_C	Running Fox PS Elimination	Diversion	MSD1080	1.82-inch	N/A	PS will be eliminated	2009	2010
164	04498	820 Echo Bridge Road	Suspected	Manhole	Pump station capacity (hydraulic bottleneck & backwater effects)	S_MC_WC_NB01_M_01_C_A	Shively Interceptor	Pipe Upgrades	NB01	2.60-inch	N/A	PS will be eliminated	2009	2014
165	04542	Fern Lea PS Wet Well	Documented	Manhole	Pump station capacity (hydraulic bottleneck & backwater effects)	S_MC_WC_NB01_M_01_C_A	Shively Interceptor	Pipe Upgrades	NB01	2.60-inch	N/A	PS will be eliminated	2009	2014
166	81814-W	Pioneer Road PS	Documented	Pumped	Pump station capacity (hydraulic bottleneck & backwater effects)	S_MC_WC_NB01_M_01_C_A	Shively Interceptor	Pipe Upgrades	NB01	2.60-inch	N/A	PS will be eliminated	2009	2014
167	MSD0047-PS	Fern Lea	Documented	Pumped	Pump station capacity (hydraulic bottleneck & backwater effects)	S_MC_WC_NB01_M_01_C_A	Shively Interceptor	Pipe Upgrades	NB01	2.60-inch	N/A	PS will be eliminated	2009	2014
168	MSD0050-PS	Garrs Lane	Documented	Pumped	Pump station capacity (hydraulic bottleneck & backwater effects)	S_MC_WC_NB01_M_01_C_A	Shively Interceptor	Pipe Upgrades	NB01	2.60-inch	N/A	PS will be eliminated	2009	2014
169	MSD0042-PS	Sonne Avenue	Documented	Pumped	System capacity	S_OR_MF_42007_S_07_C	Sonne PS I/I Investigation & Rehabilitation	I/I Reduction	MSD0042-PS	1.82-inch	N/A	N/A	2009	2011
170	94187	Wet Well for St. Rene Road PS	Documented	Manhole	Pump station capacity	S_FF_CH_NB01_S_09A_C_A	St. Rene Rd. PS Inline Storage	Inline Storage	CH01	1.82-inch	2.25-inch	less than 10,000	2019	2021
171	16649	Wickland Road/ Sutherland Drive	Documented	Constructed	System Capacity	S_SD_MF_NB05_M_01_A	Sutherland Interceptor	Pipe Upgrades	NB05	2.60-inch	>2.60-inch	10,000 - 20,000	2021	2023
172	33003	815 Tucker Station Road	Suspected	Manhole	Hydraulic Bottleneck	S_FF_FF_NB01_S_01_C_A	Woodland Hills PS Diversion	Diversion	NB01	1.82-inch	2.25-inch	>100,000	2010	2011
173	65531	12400 Brierly Hill Place	Suspected	Manhole	Hydraulic Bottleneck	S_FF_FF_NB01_S_01_C_A	Woodland Hills PS Diversion	Diversion	NB01	1.82-inch	2.25-inch	Volume accounted for at MH 33003	2010	2011

[1]Minimum Rainfall Depth is Approximate and is dependent on Antecedent Conditions and Rainfall Patterns
[2]Predicted Volumes are based on modeled design level rainfall depths. Actual Post IOAP volumes will be dependent on Antecedent Conditions and Rainfall Patterns

TABLE 4.5.1 CONT'D SSOs ADDRESSED BY INTERIM SSDP AND OTHER CAPITAL PROJECTS

No.	SSO ID	SSO Name/ Address	SSO Class	Overflow Type	Primary Cause	Project ID	Project Name	Solution Technology	Scheduled Project Start Date	Scheduled Project Completion Date
174	21061	4432 Cordova Rd and Tyne Ave (Beechwood Village) - IFP Pumped Location	Documented	Pumped	System Capacity / High Inflow & Infiltration	N/A	Beechwood Village Sanitary Sewer Replacement	Sewer Replacement	2007	2011
175	21089	207 Brunswick Rd (Beechwood Village) - IFP Pumped Location	Documented	Pumped	System Capacity / High Inflow & Infiltration	N/A	Beechwood Village Sanitary Sewer Replacement	Sewer Replacement	2007	2011
176	21101	Shelbyville Rd and Marshall Dr IFP Pumped Location	Documented	Pumped	System Capacity / High Inflow & Infiltration	N/A	Beechwood Village Sanitary Sewer Replacement	Sewer Replacement	2007	2011
177	21153	Biltmore Rd and Cordova Rd - IFP Pumped Location	Documented	Pumped	System Capacity / High Inflow & Infiltration	N/A	Beechwood Village Sanitary Sewer Replacement	Sewer Replacement	2007	2011
178	21156	Shelbyville Rd and Stonehenge Rd (Beechwood Village) IFP Pumped Location	Documented	Pumped	System Capacity / High Inflow & Infiltration	N/A	Beechwood Village Sanitary Sewer Replacement	Sewer Replacement	2007	2011
179	MSD0209A-PS	Berrytown WQTC PS	Documented	Pumped	PS / WQTC Capacity	N/A	Berrytown Interceptor (Capital Project)	New Interceptor / WQTC Elimination	TBD	TBD
180	22370	Greenbelt Hwy	Documented	Manhole	WQTC Capacity	N/A	Derek R Guthrie WQTC	WQTC Upgrade	2008	2011
181	22385	Johnsontown Rd #2	Documented	Manhole	WQTC Capacity	N/A	Derek R Guthrie WQTC	WQTC Upgrade	2008	2011
182	32682	12700 Abbey Rd. #2	Documented	Manhole	System Capacity	N/A	Derek R Guthrie WQTC	WQTC Upgrade	2008	2011
183	32688	12700 Abbey Rd. #1	Documented	Manhole	System Capacity	N/A	Derek R Guthrie WQTC	WQTC Upgrade	2008	2011
184	59169	Johnsontown Rd #1	Documented	Manhole	WQTC Capacity	N/A	Derek R Guthrie WQTC	WQTC Upgrade	2008	2011
185	MSD0277	West County	Documented	Pumped	WQTC Capacity	N/A	Derek R Guthrie WQTC	WQTC Upgrade	2008	2011
186	97806	Floyds Fork WQTC Influent PS Near Creek	Documented	Lift Station	PS / WQTC Capacity	N/A	Floyds Fork WQTC Expansion Phase 2 (Capital Project)	WQTC Expansion	TBD	TBD
187	MSD0294	Floyds Fork	Documented	Treatment Plant	PS / WQTC Capacity	N/A	Floyds Fork WQTC Expansion Phase 2 (Capital Project)	WQTC Expansion	TBD	TBD
188	17571	Carson Way and Ribble Rd (Hikes Point) IFP Pumped Location	Documented	Pumped	System Capacity / High Inflow & Infiltration	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
189	18134	Downing At Wyckford Wy	Documented	Manhole	System Capacity	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
190	18298	Gerald Ct #3	Documented	Manhole	System Capacity	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
191	18302	Bardstown Rd / Paris Dr	Documented	Manhole	System Capacity	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
192	18434	Between Johnston Wy & Ainslie Wy	Documented	Manhole	System Capacity / High Inflow & Infiltration	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
193	18471	Dell Brooke Ave and Boaries Ln (Hikes Point) - IFP Pumped Location	Documented	Pumped	System Capacity / High Inflow & Infiltration	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
194	18483	3012 Boaries Ave and Rio Rita Ave (Hikes Point) - IFP Pumped Location	Documented	Pumped	System Capacity / High Inflow & Infiltration	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
195	18505	3540 Ramona Ave and Flora Ave - IFP Pumped Location	Documented	Pumped	System Capacity / High Inflow & Infiltration	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
196	18595	3101 Wedgewood Way (Hikes Point) - IFP Pumped Location	Documented	Pumped	System Capacity / High Inflow & Infiltration	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
197	49224	Goldsmith Ln At Beargrass Creek - Near Dell Brooke Av	Documented	Manhole	System Capacity	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
198	49236	Rosemont Bv At Hikes Ln	Documented	Manhole	System Capacity	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
199	49672	Gerald Ct #2	Documented	Manhole	System Capacity	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
200	49673	Gerald Ct #1	Documented	Manhole	System Capacity	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
201	18318-W	Terrier Lane PS Wetwell	Documented	Lift Station	System Capacity	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
202	MSD0012-PS	Highgate Springs	Documented	Constructed	System Capacity / High Inflow & Infiltration	N/A	Hikes Lane Interceptor & Highgate Springs PS	New Interceptor / PS Elimination	2008	2012
203	11877	Hite Creek Near Influent PS	Documented	Manhole	PS Capacity	N/A	Hite Creek WQTC Influent PS Replacement (Capital Project)	PS Upgrades	TBD	TBD
204	30520	10723 Copper Ridge - Along Interceptor	Documented	Manhole	PS Capacity	N/A	Hite Creek WQTC Influent PS Replacement (Capital Project)	PS Upgrades	TBD	TBD
205	MSD0403	Lake Forest/Beckley Woods	Documented	Treatment Plant	WQTC Capacity	N/A	Lake Forest PS & Force Main (Capital Project)	PS Upgrades / WQTC Elimination	2010	2012
206	16556	Upper Highlands	Documented	Manhole	Blockage	N/A	N/A	Pipe Cleaning	2008	2008
207	MSD0271	Yorktown	Documented	Treatment Plant	WQTC Capacity	N/A	Northern Ditch Diversion Interceptor	New Interceptor / WQTC Elimination	2007	2011
208	61683	9412 Slayton Cr (Upstream of Silver Heights PS)	Documented	Manhole	Capacity	N/A	Overflows only occur beyond MSD maximum level of protection		N/A	N/A
209	21103	Blenheim Rd / Taggart Dr	Documented	Manhole	System Capacity / High Inflow & Infiltration	N/A	Sinking Fork Relief Sewer	New Relief Sewer	2008	2011
210	25012	Beaver Rd	Documented	Manhole	System Capacity / High Inflow & Infiltration	N/A	Sinking Fork Relief Sewer	New Relief Sewer	2008	2011
211	63319	Watterson X-way	Documented	Manhole	System Capacity / High Inflow & Infiltration	N/A	Sinking Fork Relief Sewer	New Relief Sewer	2008	2011
212	30680	3420 Fountain Dr Near Buechel Branch	Documented	Manhole	Bottleneck / High Inflow & Infiltration	N/A	Southeastern Diversion Structure and Interceptor	New Relief Sewer / Flow Control Modifications	2008	2011
213	30681	3401 Fountain Drive At Creek	Documented	Manhole	Bottleneck / High Inflow & Infiltration	N/A	Southeastern Diversion Structure and Interceptor	New Relief Sewer / Flow Control Modifications	2008	2011
214	72571-X	Southeast Diversion Structure	Documented	Constructed	Bottleneck / High Inflow & Infiltration	N/A	Southeastern Diversion Structure and Interceptor	New Relief Sewer / Flow Control Modifications	2008	2011
215	08426	Pruitt Ct #5	Documented	Manhole	Blockage	N/A	Southeastern Diversion Structure and Interceptor / Buechel Branch Interceptor Rehab	New Relief Sewer / Flow Control Modifications / Pipe Rehab	2008	2009
216	08427	Pruitt Ct #6	Documented	Manhole	Blockage	N/A	Southeastern Diversion Structure and Interceptor / Buechel Branch Interceptor Rehab	New Relief Sewer / Flow Control Modifications / Pipe Rehab	2008	2009
217	08430	Pruitt Ct #1	Documented	Manhole	Blockage	N/A	Southeastern Diversion Structure and Interceptor / Buechel Branch Interceptor Rehab	New Relief Sewer / Flow Control Modifications / Pipe Rehab	2008	2009
218	08431	Pruitt Ct #2	Documented	Manhole	Blockage	N/A	Southeastern Diversion Structure and Interceptor / Buechel Branch Interceptor Rehab	New Relief Sewer / Flow Control Modifications / Pipe Rehab	2008	2009
219	30701	Pruitt Ct #3	Documented	Manhole	Blockage	N/A	Southeastern Diversion Structure and Interceptor / Buechel Branch Interceptor Rehab	New Relief Sewer / Flow Control Modifications / Pipe Rehab	2008	2009
220	30702	Pruitt Ct #4	Documented	Manhole	Blockage	N/A	Southeastern Diversion Structure and Interceptor / Buechel Branch Interceptor Rehab	New Relief Sewer / Flow Control Modifications / Pipe Rehab	2008	2009
221	49647	Pruitt Ct #8	Documented	Manhole	Blockage	N/A	Southeastern Diversion Structure and Interceptor / Buechel Branch Interceptor Rehab	New Relief Sewer / Flow Control Modifications / Pipe Rehab	2008	2009
222	63779	Pruitt Ct #7	Documented	Manhole	Blockage	N/A	Southeastern Diversion Structure and Interceptor / Buechel Branch Interceptor Rehab	New Relief Sewer / Flow Control Modifications / Pipe Rehab	2008	2009
223	21506	Falgate Ct - IFP Pumped Location.	Documented	Pumped	System Capacity	N/A	Woodlawn Road PS Relocation (Capital Project)	New Interceptor / PS Elimination	2005	2009
224	MSD0039-PS	Woodlawn Park	Documented	Lift Station	PS Capacity	N/A	Woodlawn Road PS Relocation (Capital Project)	New Interceptor / PS Elimination	2005	2009

MSD

Metropolitan Sewer District

CEDAR CREEK AREA

SSO SSDP
Project Fact Sheet

SSO Project Number: S_CC_CC_70158_M_09A_C

Project Name: Idlewood Inline Storage

Modeled Area: Cedar Creek

Branch or SSO ID: 70158

Project Type: Inline Storage

Receiving Stream: Cedar Creek

Project Description: This alternative includes in-line storage with 995 LF of (84" to 120") pipe to store wet weather peak flows. Also included are pipe upgrades for 1,747 LF of open cut (8" to 15") sewer to increase hydraulic capacity during wet weather peak flows.

Reason for Overflow: Hydraulic bottleneck

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

Project Constraints: Homes are ~100' from the SSO locations
Depth to rock is ~3'

Estimated Capital Cost (2008 dollars): $2,317,000

Weighted Benefit/Cost Ratio (Present Worth): 31.36

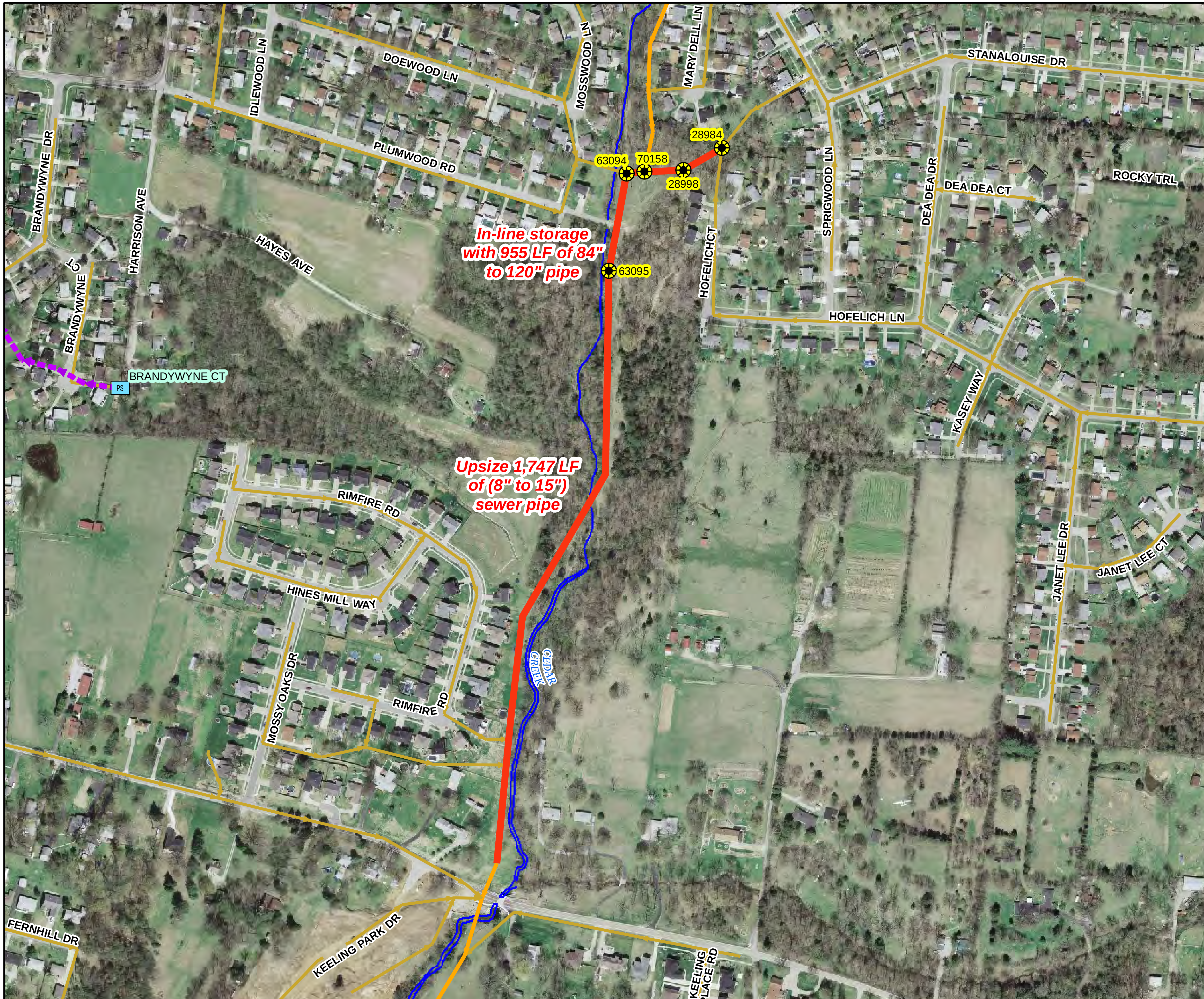
Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
28984	Plumwood #1	Cedar Creek	Manhole	Ground	21,600
28998	Plumwood #2	Cedar Creek	Manhole	Ground	21,600
63094	Plumwood #4	Cedar Creek	Manhole	Stream	50
63095	Plumwood #5	Cedar Creek	Manhole	Stream	13
70158	Plumwood #3	Cedar Creek	Manhole	Ground	378,333

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Cedar Creek Sewershed
Solution ID # S_CC_CC_70158_M_09A_C
Idlewood Inline Storage



Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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Map Revision
May 07, 2009

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_FF_CC_81316_M_03_C_A

Project Name: Fairmount Rd. PS Improvements

Modeled Area: Cedar Creek

Branch or SSO ID: 81316

Project Type: PS Upgrades

Receiving Stream: Big Run

Project Description: Install (3) 130 HP, 1750 gpm pumps to increase capacity

Reason for Overflow: Pump station capacity

Design Parameters / Assumptions: The Fairmount Rd Pump Station Expansion project will install new pumps, which eliminate overflows up to the 2.60-inch cloudburst storm event. This upgrade is part of the original design to accommodate future development.

Project Constraints: None

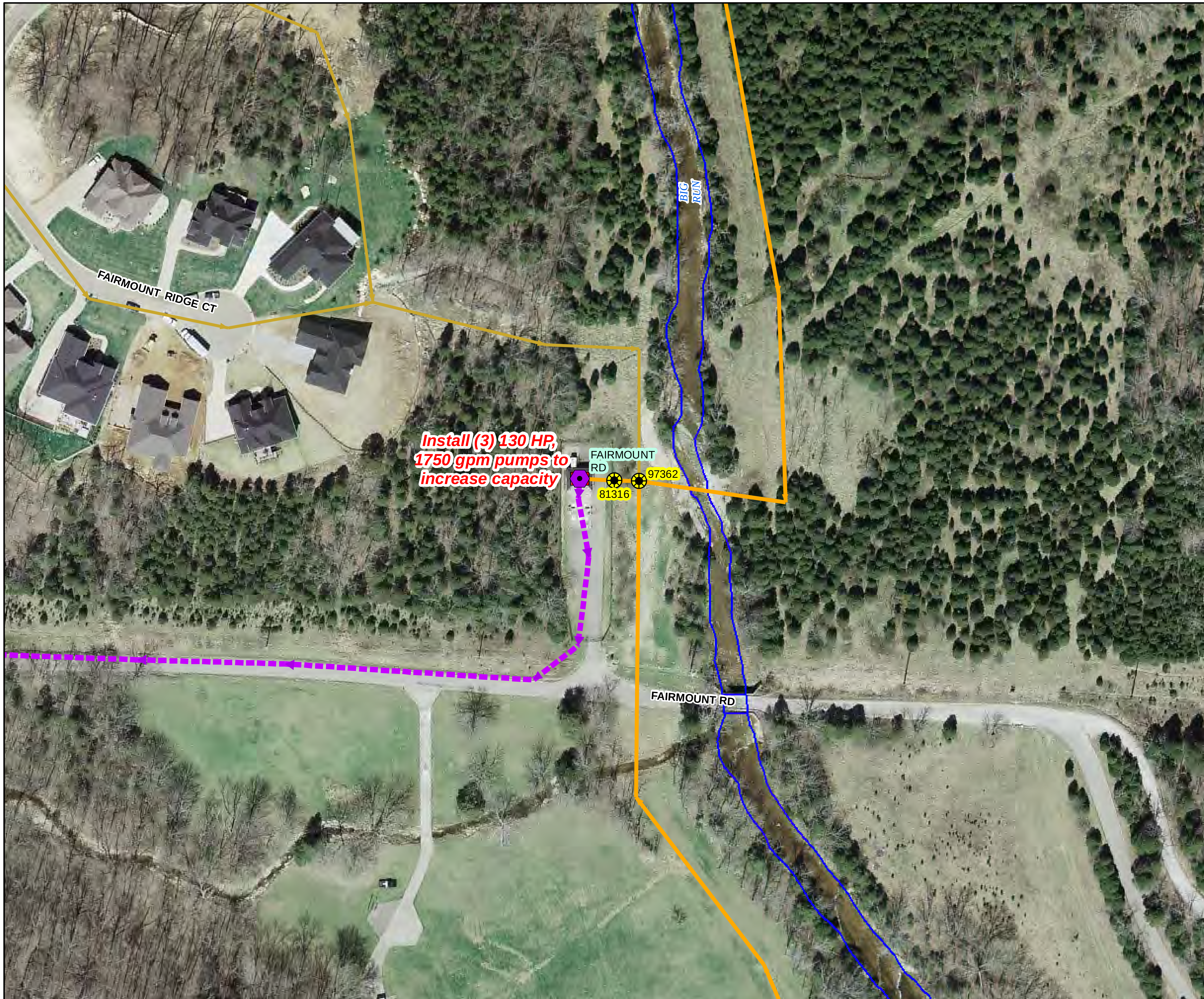
Capital Projects: E00303 ~ Fairmount Road Pump Station Expansion; E01037 ~ Fairmount Road Pump Station Expansion; E01238 ~ Broad Run Road Interceptor Sanitary - Outside 5 Year Plan; E01240 ~ Billtown Road Interceptor Sanitary - Awaiting Start; E93357 ~ Billtown Rd. Pump Station, Force Main - Outside 5 Year Plan; E94251 ~ Lake of the Woods WWTP Elimination - Outside 5 Year Plan; E94366 ~ Razor Branch Interceptor Sanitary Sewer - Awaiting Start

Estimated Capital Cost (2008 dollars): $874,000

Weighted Benefit/Cost Ratio (Present Worth): 33.29

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
81316	Fairmount Road #1	Cedar Creek	Manhole	Ground	500
97362	Fairmount Road #2	Cedar Creek	Manhole	Ground	212,100



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Cedar Creek Sewershed
Solution ID # S_FF_CC_81316_M_03_C_A
Fairmount Rd. PS Improvements

Preliminary - For Budget Development Only

Legend

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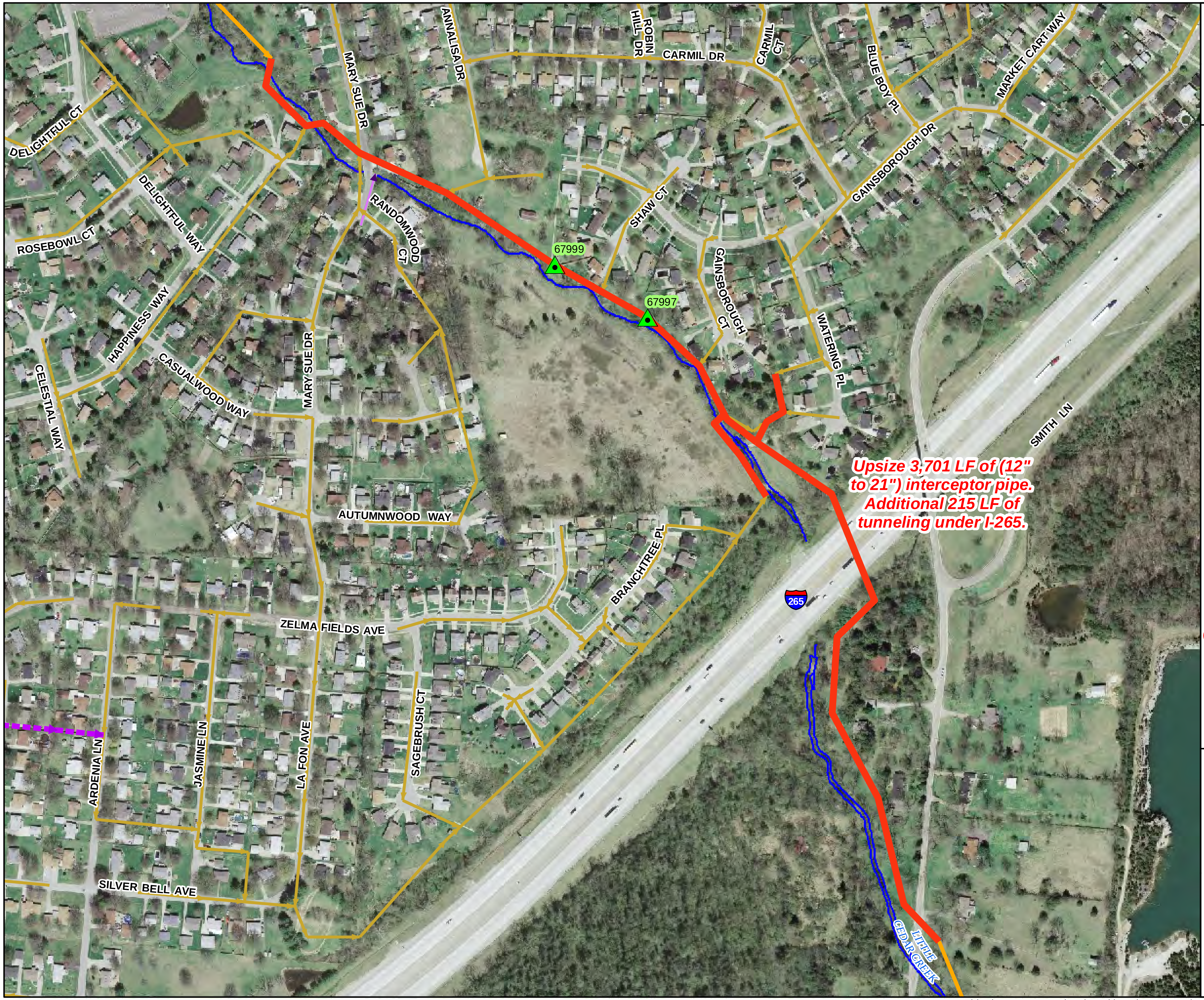
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_CC_CC_67997_M_01_C
Project Name:	Little Cedar Creek Interceptor Improvements
Modeled Area:	Cedar Creek
Branch or SSO ID:	67997
Project Type:	Pipe Upgrades
Receiving Stream:	Little Cedar Creek
Project Description:	This alternative includes upsizing 3,701 LF of open cut sewer and 215 LF of 21"tunneling interceptor pipe in the area to increase hydraulic capacity during wet weather peak flows.
Reason for Overflow:	System capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	Project will occur in MSD easements or land
Estimated Capital Cost (2008 dollars):	$1,875,000
Weighted Benefit/Cost Ratio (Present Worth):	23.86

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
67997	7906 Gainsborough Court	Cedar Creek	Manhole	Stream	25
67999	7904 Shaw Court	Cedar Creek	Manhole	Stream	Suspected-no data
86423	8314 Casualwood Way	Cedar Creek	Manhole	Stream	MOP-no data
89195	8104 Kimberly Way	Cedar Creek	Manhole	Stream	MOP-no data
89197	8104 Kimberly Way	Cedar Creek	Manhole	Stream	MOP-no data



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Cedar Creek Sewershed

Solution ID # S_CC_CC_67997_M_01_C

Little Cedar Creek Interceptor Improvements

Preliminary - For Budget Development Only

Legend

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SSO SSDP
Project Fact Sheet

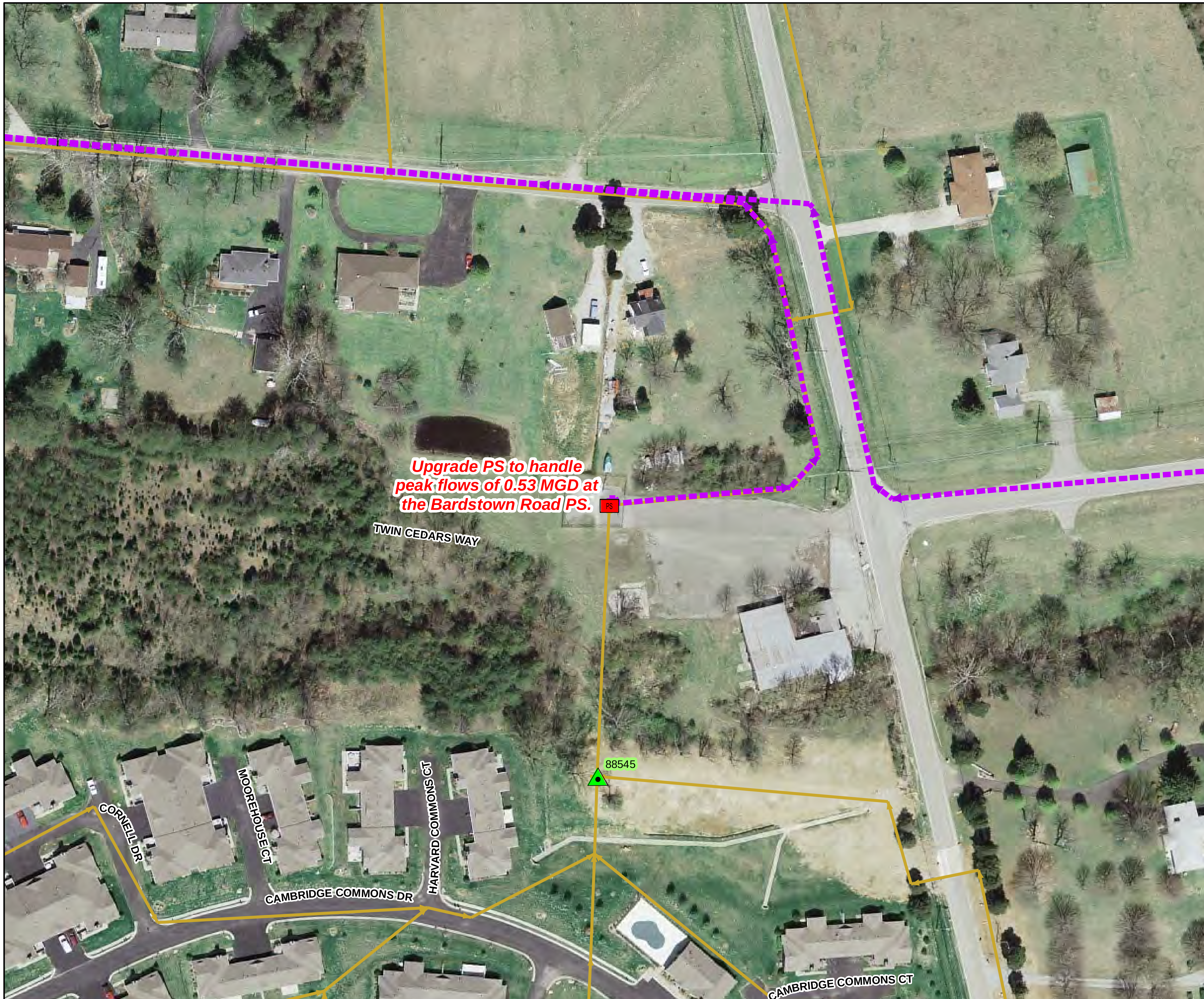
SSO Project Number:	S_CC_CC_MSD1025_S_03_B
Project Name:	Bardstown Rd. PS Improvements
Modeled Area:	Cedar Creek
Branch or SSO ID:	MSD1025
Project Type:	Pump Station Upgrades
Receiving Stream:	Big Run
Project Description:	This alternative includes increasing the capacity of the pump station with an additional 70% of hydraulic capacity to 0.53 MGD so that overflows do not occur upstream.
Reason for Overflow:	Capacity
Design Parameters / Assumptions:	This solution is based on a 2.25 inch cloudburst rain event
Project Constraints:	None at this time.
Estimated Capital Cost (2008 dollars):	$281,000
Weighted Benefit/Cost Ratio (Present Worth):	46.50

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
88545	11101 Cambridge Commons Drive	Cedar Creek	Manhole	Ground	Suspected- no data

Integrated Overflow Abatement Plan
Vol. 3 - Sanitary Sewer Discharge Plan

Cedar Creek Sewershed
Solution ID # S_CC_CC_MSD1025_S_03_B
Bardstown Rd. PS Improvements



Preliminary - For Budget Development Only

Legend

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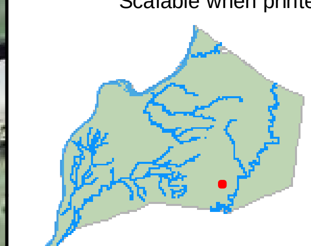

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_CC_CC_MSD1080_S_01_C

Project Name: Running Fox PS Elimination

Modeled Area: Cedar Creek

Branch or SSO ID: MSD1080

Project Type: Diversion

Receiving Stream: Little Cedar Creek

Project Description: Construct 375 LF of 8" gravity sewer to eliminate Running Fox PS. Existing PS and force main will remain functional, but dormant, to allow for monitoring downstream impacts of the new diversion. If no impacts are noted, station will be eliminated and force main taken out of service. If downstream impacts arise, the PS will be reconfigured to supplement the capacity of the new diversion line.

Reason for Overflow: Pump Station capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

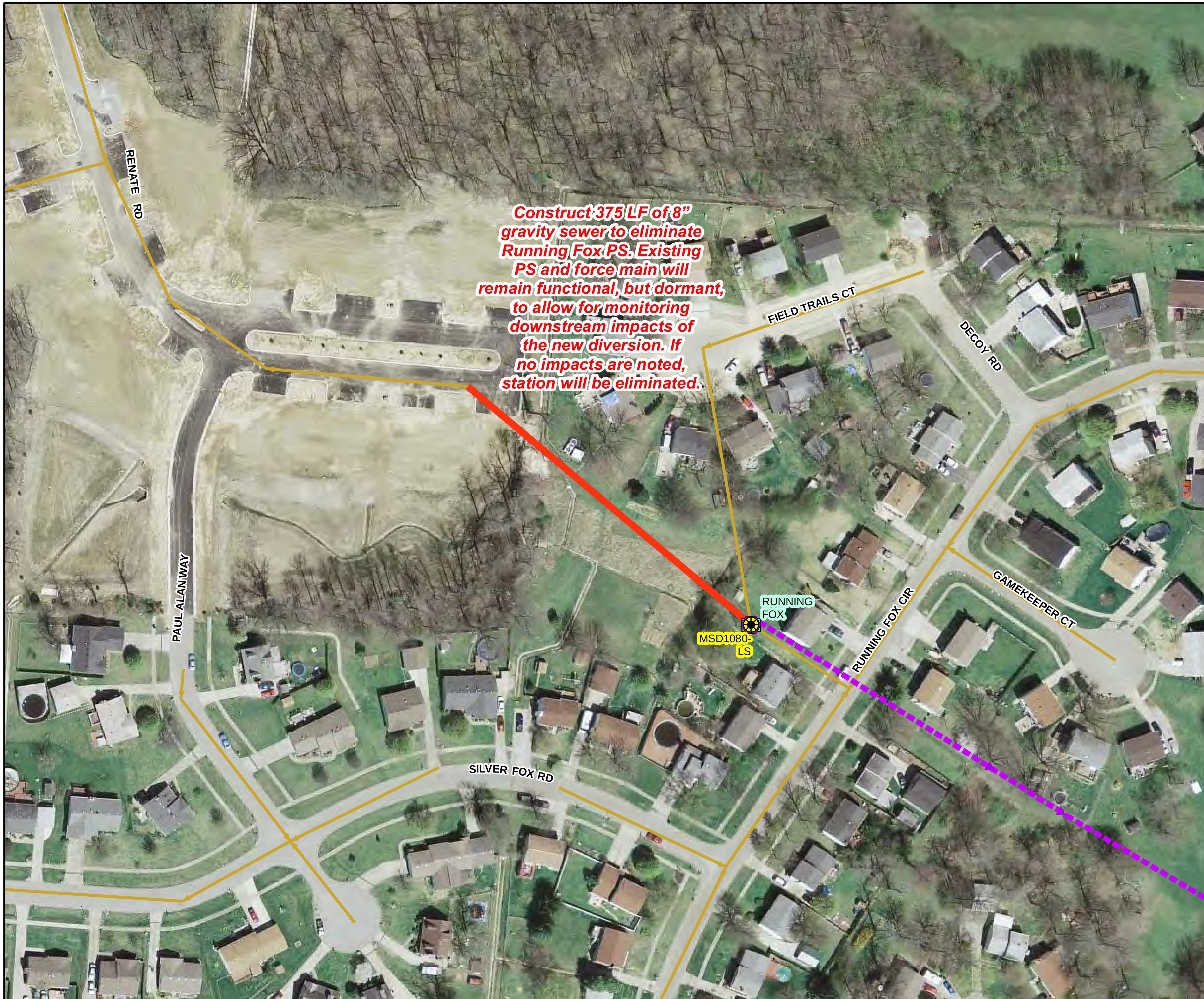
Project Constraints: None

Estimated Capital Cost (2008 dollars): $96,000

Weighted Benefit/Cost Ratio (Present Worth): 659.52

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD1080-LS	Running Fox	Cedar Creek	Lift Station	Ditch	37,000



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Cedar Creek Sewershed

Solution ID # S_CC_CC_MSD1080_S_01_C

Running Fox PS Elimination

Preliminary - For Budget Development Only

Legend

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MSD

Metropolitan Sewer District

HITE CREEK AREA

SSO SSDP
Project Fact Sheet

SSO Project Number:	S_HC_HC_MSD1082_S_09A_C
Project Name:	Meadow Stream PS Inline Storage
Modeled Area:	Hite Creek
Branch or SSO ID:	MSD1082
Project Type:	Inline Storage
Receiving Stream:	Floyds Fork and South Fork Harrods Creek
Project Description:	This alternative includes underground in-line storage with the current influent line to the PS, consisting of two, 120" diameter storage pipes each 238 LF.
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	Project will occur in MSD easements or land
Estimated Capital Cost (2008 dollars):	$974,000
Weighted Benefit/Cost Ratio (Present Worth):	13.77

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
91087	Near Meadow Stream PS	Hite Creek	Manhole	Stream	405,001
MSD1082-PS	Meadow Stream	Hite Creek	Lift Station	Ground	51,000

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Hite Creek Sewershed

Solution ID # S_HC_HC_MSD1082_S_09A_C

Meadow Stream PS Inline Storage

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
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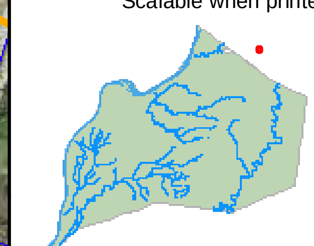

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SSO SSDP
Project Fact Sheet

SSO Project Number:	S_HC_HC_MSD1086_M_07_C_A
Project Name:	Floydsburg Rd. I/I Investigation and Rehabilitation
Modeled Area:	Hite Creek
Branch or SSO ID:	MSD1086
Project Type:	I/I reduction
Receiving Stream:	Floyds Fork
Project Description:	This location will be targeted for I/I source control (I/I rehab and private property program). A full SSES will be performed upstream of this PS. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative will be implemented, which is Pump Station & Force Main upgrades.
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	Project may need to include lateral work on private property
Estimated Capital Cost (2008 dollars):	$57,000 (Cost is for SSES only; rehabilitation will be performed under Annual I/I Rehab contracts and the private property program)
Weighted Benefit/Cost Ratio (Present Worth):	Only cost calculated for SSES, no benefits are calculated

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
90776	Floydsburg Road #1	Hite Creek	Manhole	Ditch	30,700
108956	Floydsburg Road #2	Hite Creek	Manhole	Stream	75
108957	Floydsburg Road #3	Hite Creek	Manhole	Ditch	85,500
108958	Floydsburg Road #4	Hite Creek	Manhole	Catch Basin	13,000
MSD1086-PS	Floydsburg Road	Hite Creek	Lift Station	Ditch	2,502

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Hite Creek Sewershed

Solution ID # S_HC_HC_MSD1086_M_07_C_A

Floydsburg Rd. I&I Investigation and Rehabilitation

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
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LOJIC MSD PROJECT WIN

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_HC_HC_MSD1085_S_03_A

Project Name: Kavanaugh Rd. PS Improvements

Modeled Area: Hite Creek

Branch or SSO ID: MSD1085

Project Type: Pump Station & Force Main Upgrades

Receiving Stream: Hite Creek

Project Description: This alternative includes upgrading the Kavanaugh Road pump station to handle peak flows of 0.84 MGD and upsize 2,458 LF of force main to 8".

Reason for Overflow: Pump station capacity

Design Parameters / Assumptions: This solution is based on a 2.60 inch cloudburst rain event

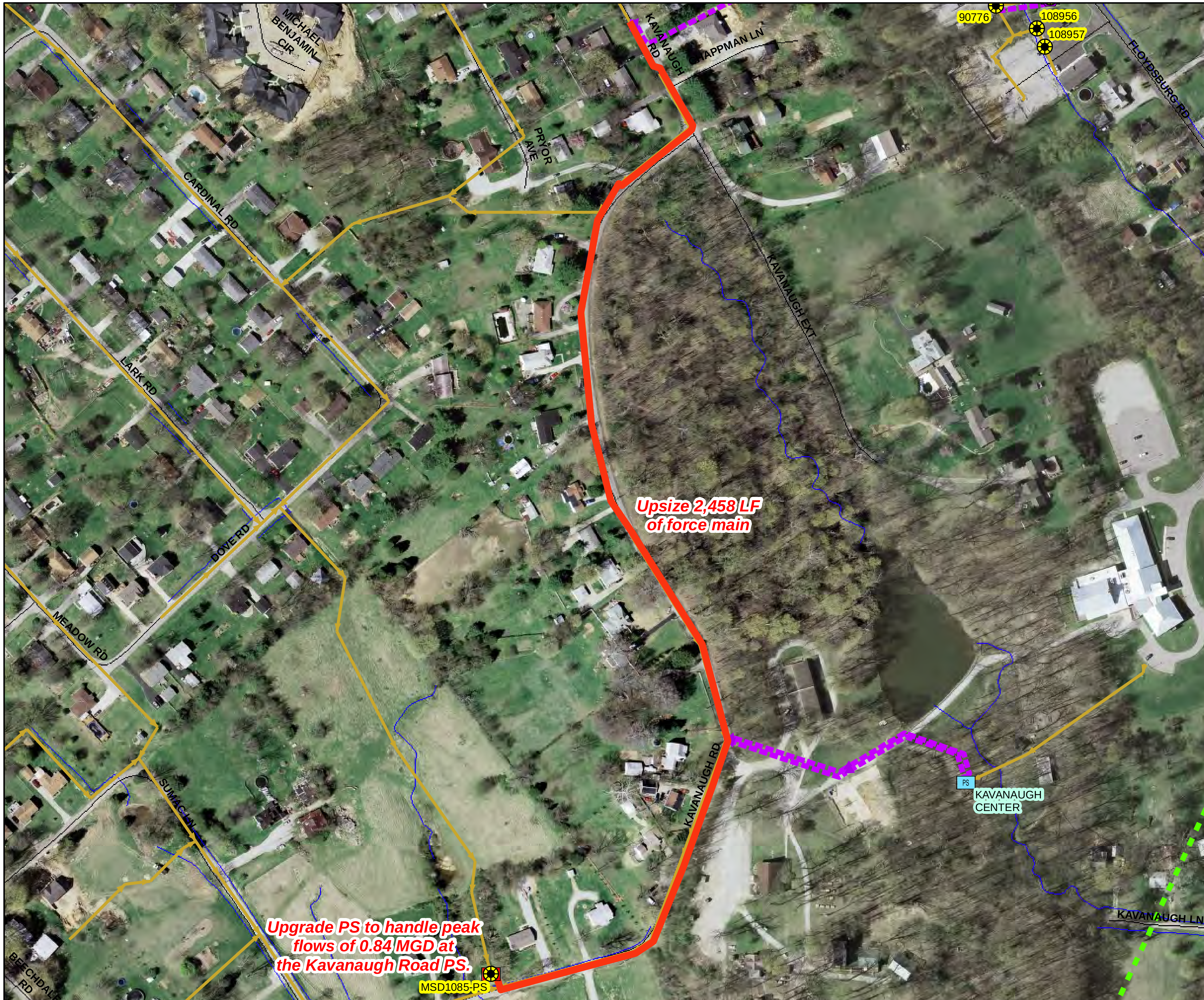
Project Constraints: Project will occur in MSD easements or land

Estimated Capital Cost (2008 dollars): $1,110,000

Weighted Benefit/Cost Ratio (Present Worth): 21.09

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD1085-PS	Kavanaugh Rd	Hite Creek	Lift Station	Ground	176,000



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Hite Creek Sewershed

Solution ID # S_HC_HC_MSD1085_S_03_A

Kavanaugh Rd. PS Improvements

Preliminary - For Budget Development Only

Legend

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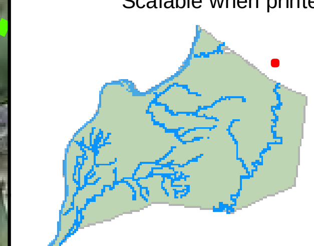

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MSD

Metropolitan Sewer District

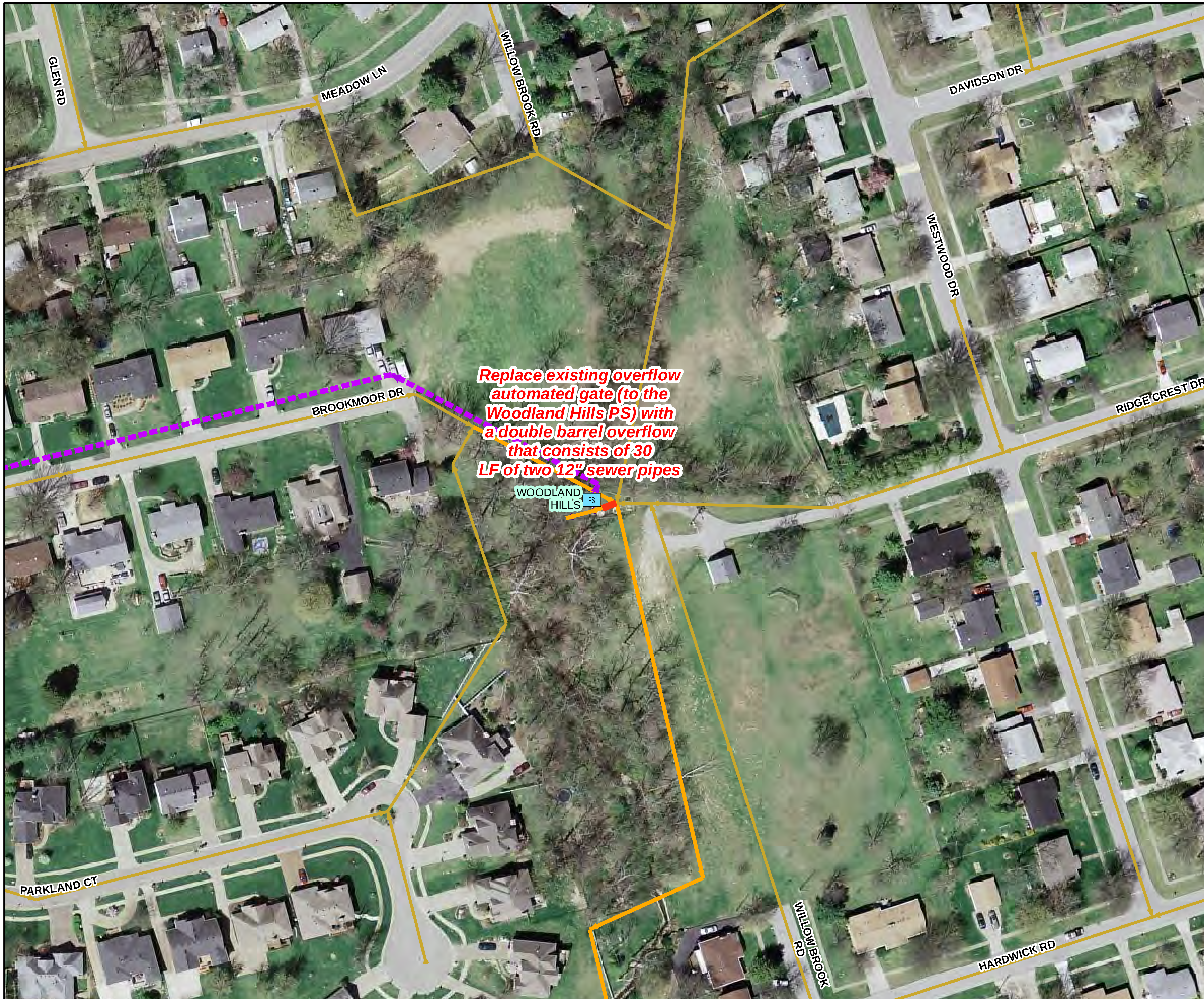
FLOYDS FORK AREA

SSO SSDP
Project Fact Sheet

SSO Project Number:	S_FF_FF_NB01_S_01_C_A
Project Name:	Woodland Hills PS Diversion
Modeled Area:	Floyds Fork
Branch or SSO ID:	NB01
Project Type:	Diversion
Receiving Stream:	Pope Lick
Project Description:	This alternative consists of replacing the existing overflow and automated gate (to the Woodland Hills PS) with a double barrel overflow that consists of 30 LF for two 12" diameter pipes. The upstream invert of these pipes needs to be 2 inches above the upstream invert of the exiting gravity pipe in MH 82058. This new invert elevation will allow dry weather flow to gravity drain down the interceptor, but anything greater than DWF will be diverted to the PS via the overflow pipes thus reducing the surcharge further down the gravity line. 15 LF of open cut sewer required.
Reason for Overflow:	Hydraulic bottleneck
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	Capacity of other system
Estimated Capital Cost (2008 dollars):	$20,000
Weighted Benefit/Cost Ratio (Present Worth):	92.26

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
33003	815 Tucker Station Road	Floyds Fork	Manhole	Stream	Suspected-no data
65531	12400 Brierly Hill Place	Floyds Fork	Manhole	Ditch	Suspected-no data



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Floyds Fork Sewershed

Solution ID # S_FF_FF_NB01_S_01_C_A

Woodland Hills PS Diversion

Preliminary - For Budget Development Only

Legend

- Documented SSO
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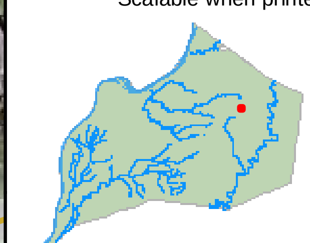

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_FF_FF_NB02_S_13_C

Project Name: Eden Care PS SSO Investigation

Modeled Area: Floyds Fork

Branch or SSO ID: NB02

Project Type: Monitor

Receiving Stream: Floyds Fork

Project Description: Monitor the Eden Care PS during rain events for the next three years according to SORP protocols .

Reason for Overflow: Pump station capacity / suspected blockage

Design Assumptions: The only overflow record for this location occurred on March 18, 2006 and is suspected to have been caused by a blockage.

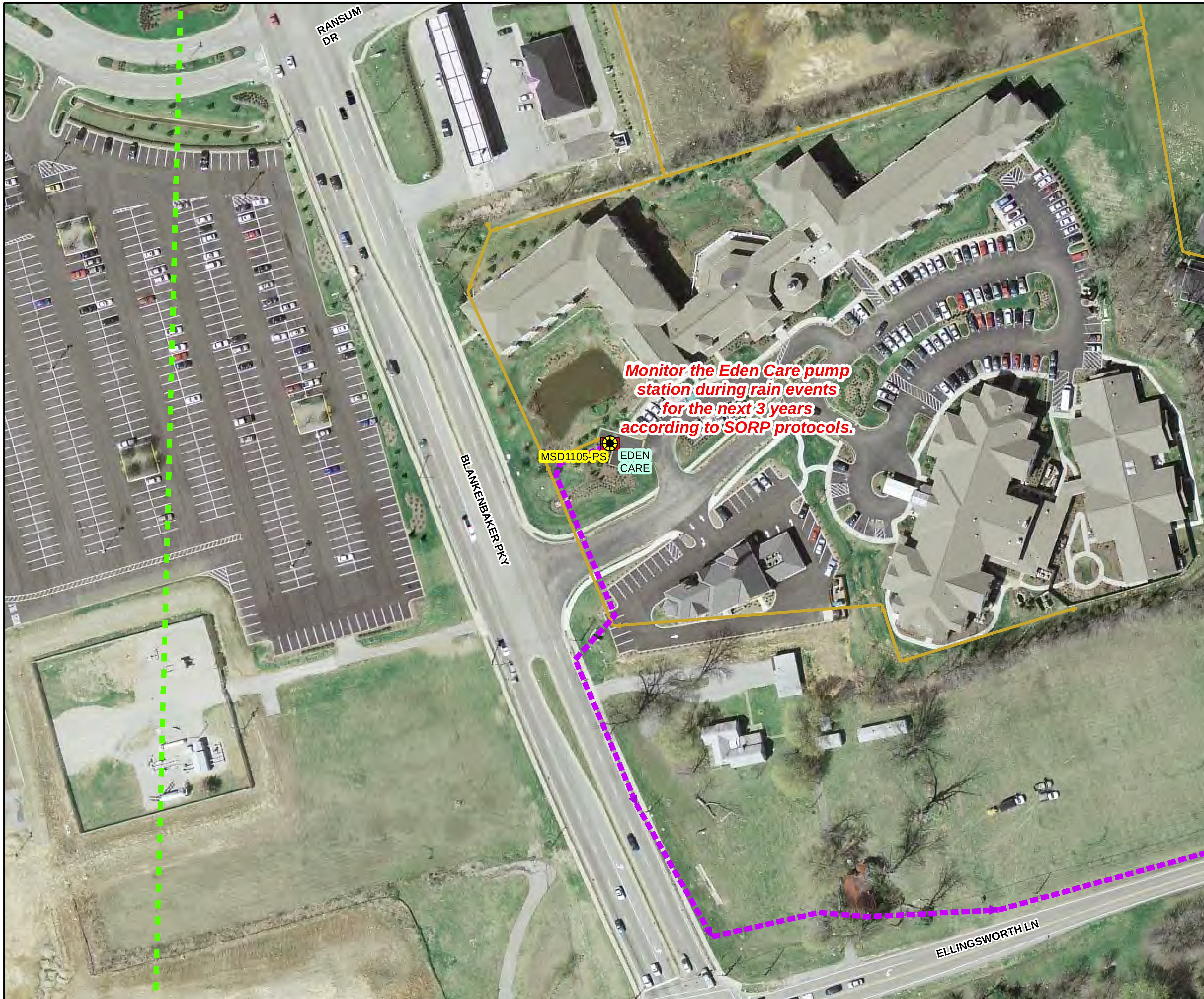
Project Constraints: None

Estimated Capital Cost (2008 dollars): This work will be performed under the SORP/CMOM programs

Weighted Benefit/Cost Ratio (Present Worth): --

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD1105-PS	Eden Care	Floyds Fork	Lift Station	Ground	200



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Floyds Fork Sewershed

Solution ID # S_FF_FF_NB02_S_13_C

Eden Care PS SSO Investigation

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
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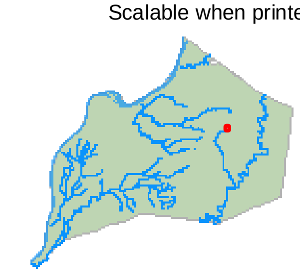

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Map Revision
May 07, 2009

Aerial Date: 2006

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_FF_FF_NB03_M_01_C_A

Project Name: Ashburton PS Improvements and Diversion

Modeled Area: Floyds Fork

Branch or SSO ID: NB03

Project Type: Upgrade Force Main & Pipes

Receiving Stream: Floyds Fork

Project Description: This alternative includes diverting flow from Ashburton PS by upgrading 370 LF of FM (from 2" to 6") and adding 115 LF of 8" gravity sewer. It also eliminates the overflow at Olde Copper Ct PS.

Reason for Overflow: Pump station capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

Project Constraints: None at this time

Estimated Capital Cost (2008 dollars): $118,000

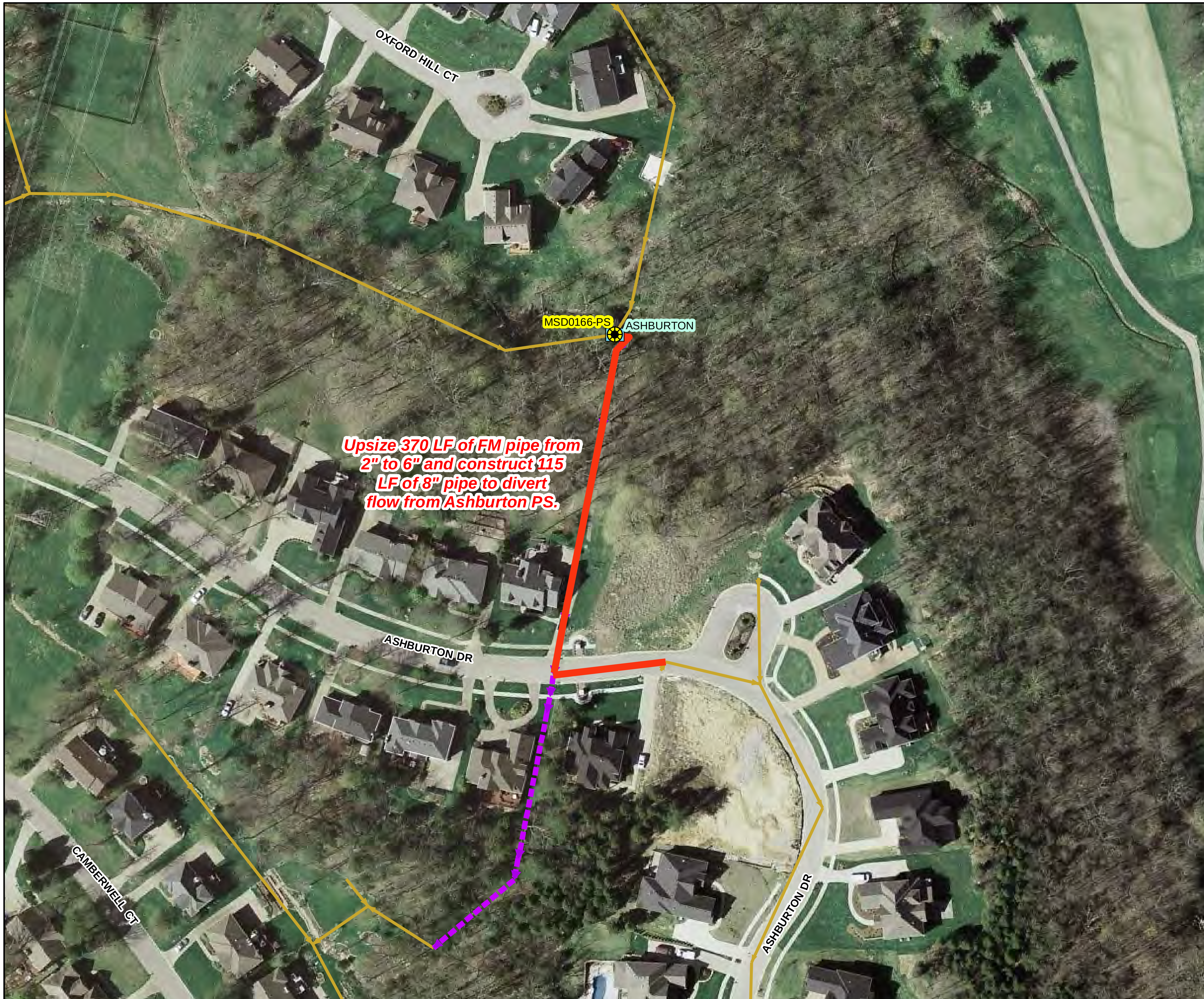
Weighted Benefit/Cost Ratio (Present Worth): 161.00

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD0165-PS	Olde Copper Court	Floyds Fork	Lift station	Ditch	2,320
MSD0166-PS	Ashburton	Floyds Fork	Lift station	Ground	No data

Integrated Overflow Abatement Plan
Vol. 3 - Sanitary Sewer Discharge Plan

Floyds Fork Sewershed
Solution ID # S_FF_FF_NB03_M_01_C_A
Ashburton PS Improvements & Diversion



Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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MSD

Metropolitan Sewer District

JEFFERSONTOWN AREA

SSO SSDP
Project Fact Sheet

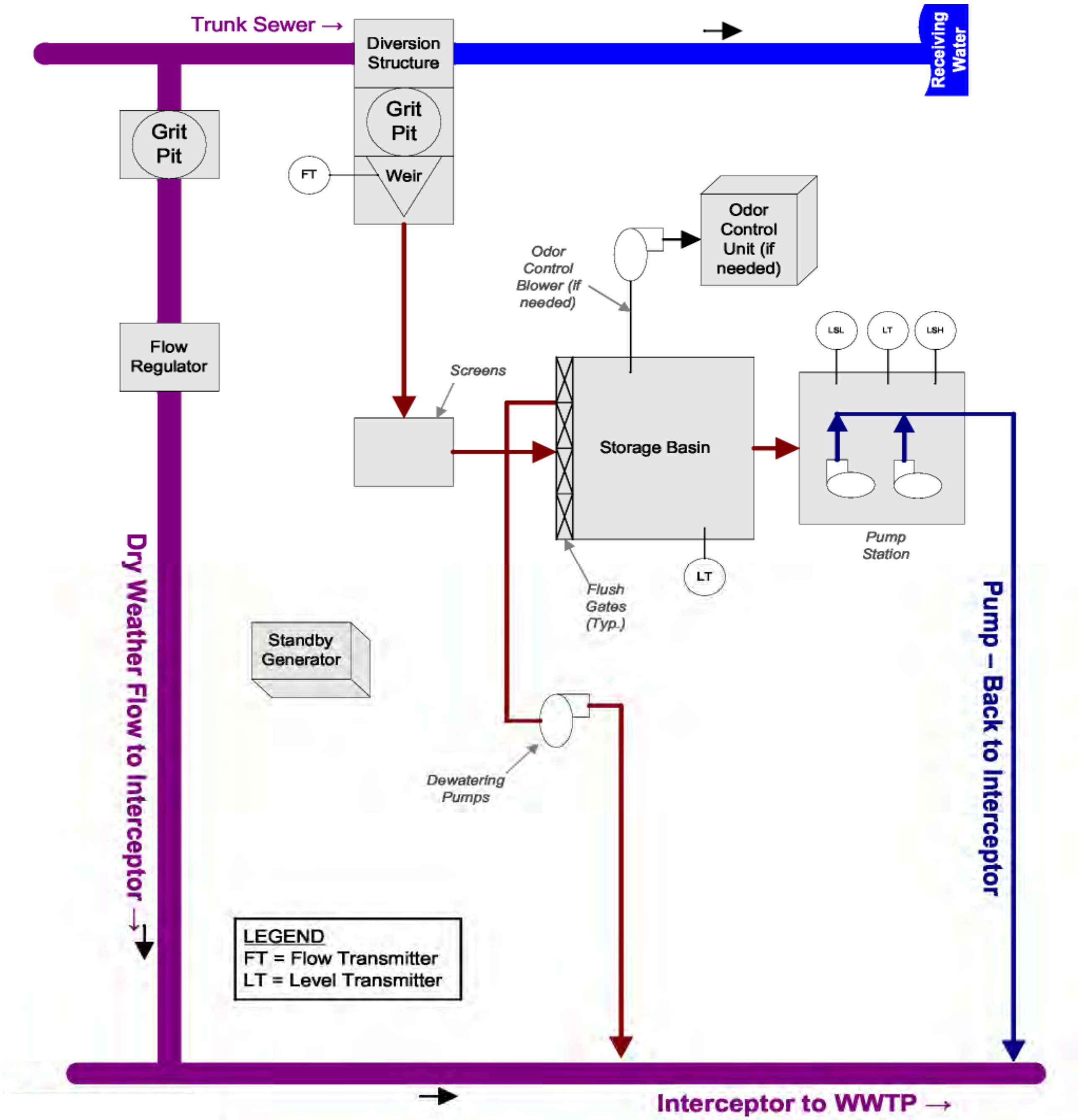
SSO Project Number:	S_JT_JT_NB01_M_01_C_A
Project Name:	Jeffersontown WQTC Elimination
Modeled Area:	Jeffersontown
Branch or SSO ID:	NB01
Project Type:	Off-line Storage & Pipe Upgrades, WQTC Elimination
Receiving Stream:	Chenoweth Run
Project Description:	Upsize the interceptor (6,200 LF) from Grassland to the WQTC. Offline storage facility (5.7 MG) at the WQTC site and a new PS with capacity of 10 MGD. 32,100 LF of 24" force main constructed to convey flows to the Hikes Lane Interceptor (HLI).
Reason for Overflow:	System capacity, siphon, and WQTC
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$23,737,000
Weighted Benefit/Cost Ratio (Present Worth):	5.23

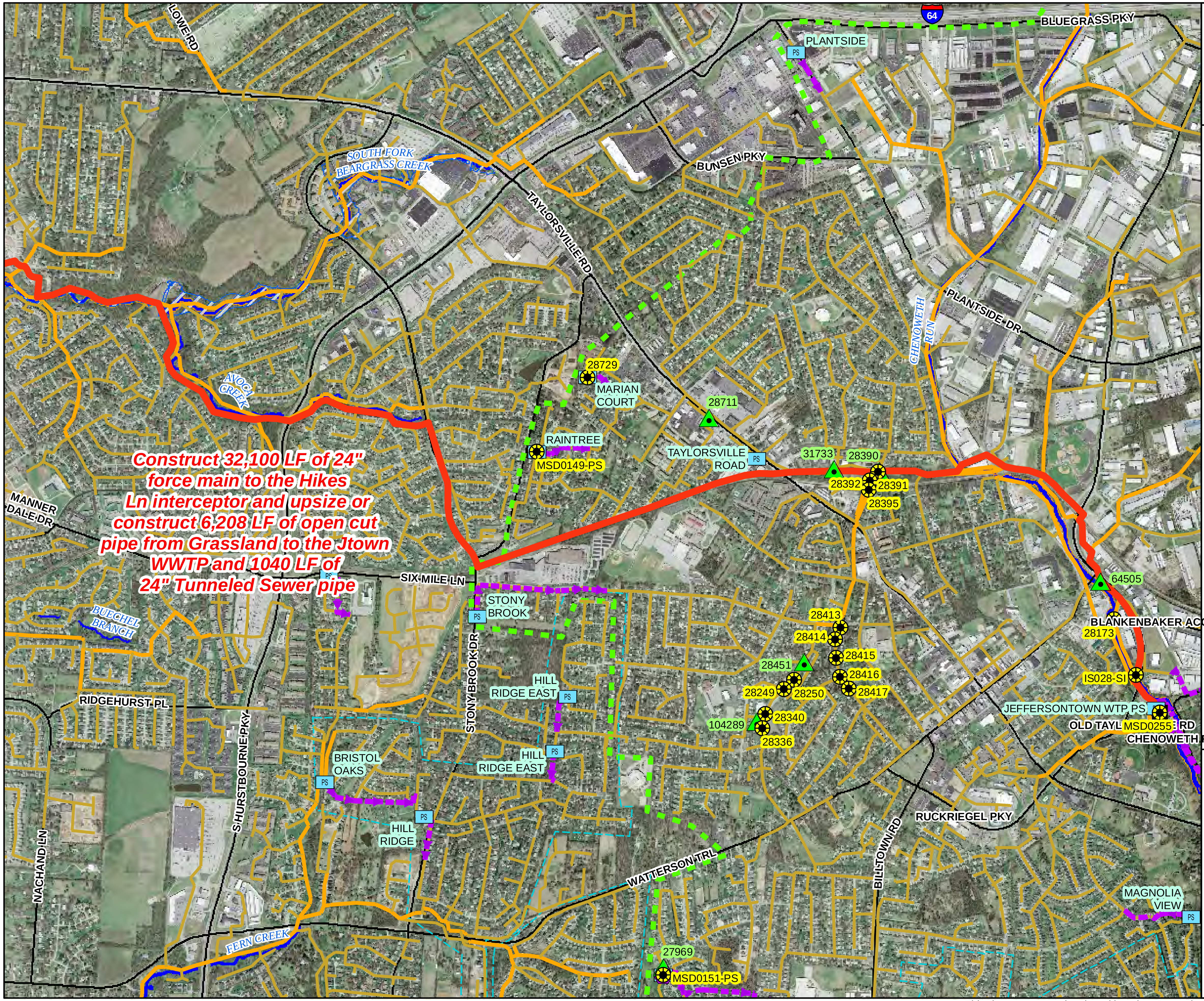
Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
28173	Watterson Trail	Jeffersontown	Manhole	Ground	46,028
28390	10025 Grassland Road	Jeffersontown	Manhole	Stream	MOP-no data
28391	Grassland #3	Jeffersontown	Manhole	Stream	387,000
28392	Grassland #2	Jeffersontown	Manhole	Stream	2,160,000
28395	Grassland #1	Jeffersontown	Manhole	Stream	251,378

31733	10001 Grassland Road	Jeffersontown	Manhole	Stream	Suspected-no data
64505	3200 Ruckreigel Pky	Jeffersontown	Manhole	Stream	Suspected-no data
IS028-SI	Jeffersontown WQTC Siphon	Jeffersontown	Constructed	Stream	113,000
MSD0255	Jeffersontown WQTC	Jeffersontown	Treatment Plant	Stream	1,800,658

Off-Line Storage
Pumped Effluent
Flow Diagram





Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Jeffersontown Sewershed

Solution ID # S_JT_JT_NB01_M_01_C_A

Jeffersontown WQTC Elimination

Northwest - Page 1 of 2

Preliminary - For Budget Development Only

Legend

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- Metro Parks

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1 inch = 1,500 feet
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CMS Inc. SSDP Map Series: Jeffersontown WWTP Elimination.mxd

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Integrated Overflow Abatement Plan

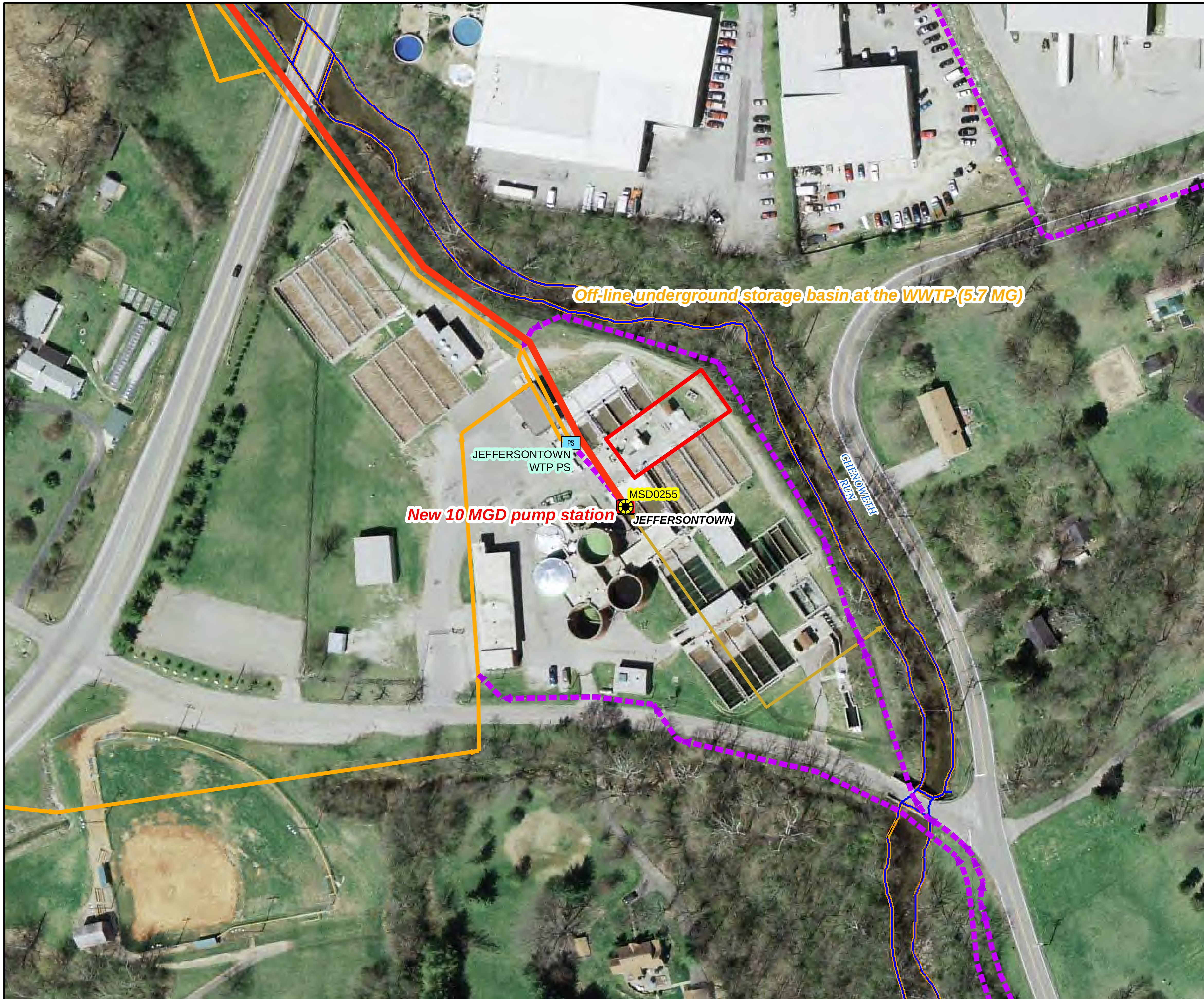
Vol. 3 - Sanitary Sewer Discharge Plan

Jeffersontown Sewershed

Solution ID # S_JT_JT_NB01_M_01_C_A

Jeffersontown WQTC Elimination

Southeast - Page 2 of 2



Preliminary - For Budget Development Only

Legend

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SSO SSDP
Project Fact Sheet

SSO Project Number:	S_JT_JT_NB01A_M_03_C
Project Name:	Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements
Modeled Area:	Jeffersontown
Branch or SSO ID:	NB01A
Project Type:	Pump Station & Force Main Upgrades, WQTC Elimination
Receiving Stream:	Chenoweth Run
Project Description:	This alternative includes upgrading pumps at Chenoweth Run PS to pump 2.7 MGD and upsizing the entire 8,030 LF of force main to 12". Chenoweth Hills WQTC will be eliminated. Pumps at Chippewa PS ugraded to 0.15 MGD. Install 1,995 LF of new 15" sewer and replace 600 LF of 8" with 18" sewer pipe for Chenoweth Hills WQTC diversion.
Reason for Overflow:	System capacity, siphon, and WQTC
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$3,140,000
Weighted Benefit/Cost Ratio (Present Worth):	20.05

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
64096	Chenoweth Run #1	Jeffersontown	Manhole	Stream	51
86052	4706 Chenoweth Run	Jeffersontown	Manhole	Stream	Suspected-no data

92061	11804 Chippewa Ridge Lane	Jeffersontown	Manhole	Ground	3,917
MSD0196-PS	Chenoweth Run	Jeffersontown	Lift Station	Stream	212,117
MSD0263A-PS	Chenoweth Hills WQTC PS	No Plant	Lift Station	Stream	108,767
MSD0263	Chenoweth Hills WQTC	Floyds Fork	Treatment Plant	Stream	2,767

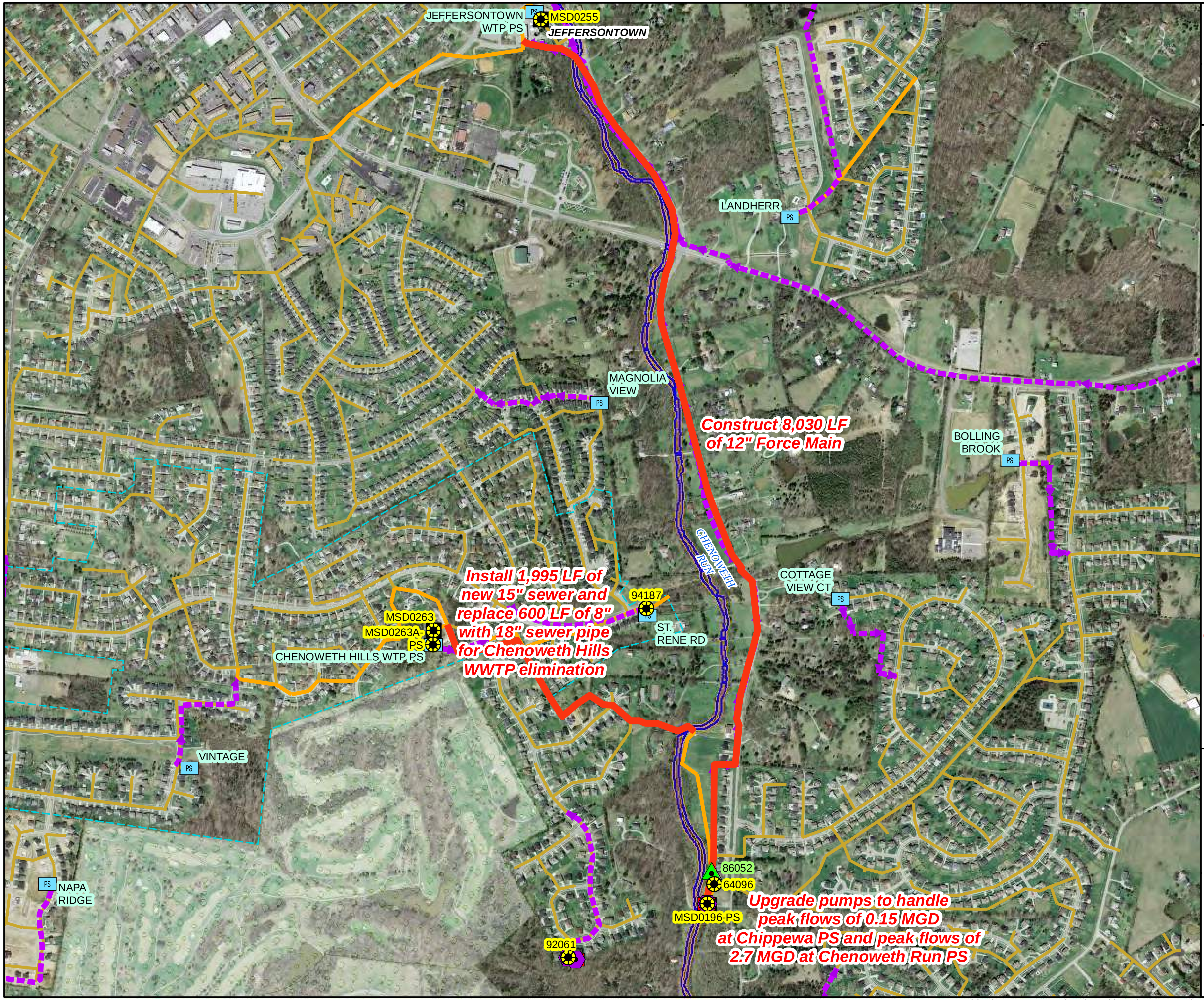
Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Jeffersontown Sewershed

Solution ID # S_JT_JT_NB01A_M_03_C

Chenoweth Hills WQTC Elimination, Chenoweth Run and Chippewa PS Improvements



Preliminary - For Budget Development Only

Legend

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- Floodway
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- CSO Area
- Metro Parks

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1 inch = 800 feet
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SSO SSDP
Project Fact Sheet

SSO Project Number: S_JT_JT_NB02_M_01_C

Project Name: Dell Rd. and Charlane Pkwy Interceptor Improvements

Modeled Area: Jeffersontown

Branch or SSO ID: NB02

Project Type: Pipe Upgrades

Receiving Stream: Chenoweth Run

Project Description: Upsize interceptor downstream of Charlane and Dell Road overflows with 3,788 LF of (10"-21") sewer.

Reason for Overflow: System capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

Project Constraints: None at this time

Estimated Capital Cost (2008 dollars): $917,000

Weighted Benefit/Cost Ratio (Present Worth): 31.34

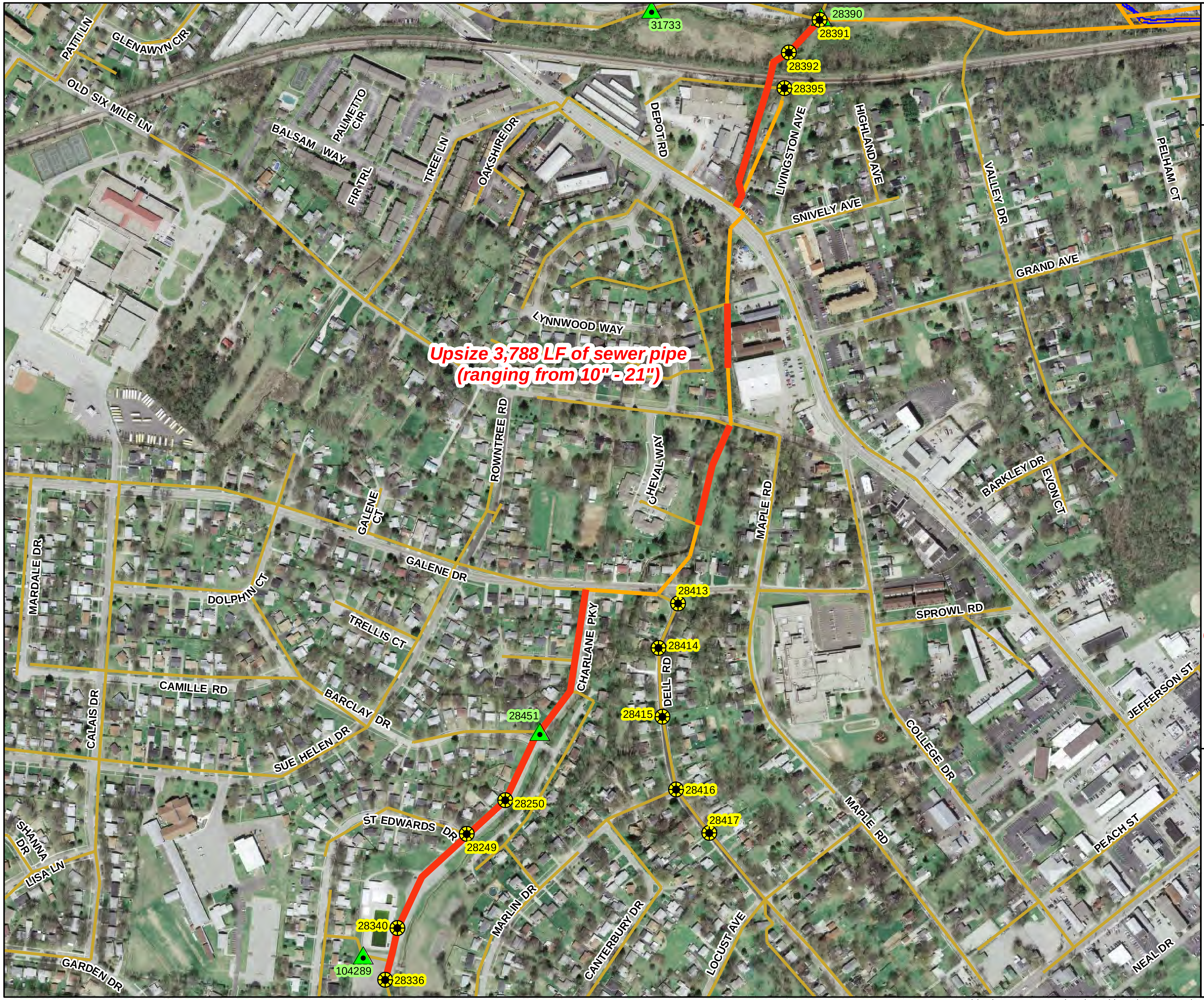
Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
28249	Charlane Parkway/St Edwards Drive	Jeffersontown	Manhole	Ditch	14,676
28250	Charlane Parkway Near the Street	Jeffersontown	Manhole	Ditch	31,422

28336	Parking Lot Charlane Parkway	Jeffersontown	Manhole	Ditch	247,618
28340	Charlane Parkway at Pool	Jeffersontown	Manhole	Ground	36,804
28413	3317 Dell Road	Jeffersontown	Manhole	Ground	No Data
28414	3322 Dell Road	Jeffersontown	Manhole	Ground	55,012
28415	3406/3404 Dell Road	Jeffersontown	Manhole	Ground	143,920
28416	Marlin Drive	Jeffersontown	Manhole	Ground	78,000
28417	Locust Avenue/Marlin Drive	Jeffersontown	Manhole	Ground	15,000
104289	3620 Charlane Pky	Jeffersontown	Manhole	Stream	Suspected- no data

Integrated Overflow Abatement Plan
Vol. 3 - Sanitary Sewer Discharge Plan

Jeffersontown Sewershed
Solution ID # S_JT_JT_NB02_M_01_C
Dell Rd and Charlane Pkwy Interceptor Improvements



Preliminary - For Budget Development Only

Legend

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- Floodway
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- CSO Area
- Metro Parks

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SSO SSDP
Project Fact Sheets

SSO Project Number: S_JT_JT_NB03_M_01_C

Project Name: Raintree and Marian Ct. PS Eliminations 1 - PS Eliminations

Modeled Area: Jeffersontown

Branch or SSO ID: NB03

Project Type: Diversion

Receiving Stream: Avoca Creek

Project Description: This alternative eliminates two pump stations by installing 455 LF of 8" open cut sewer from Marian Ct PS and 400 LF of 8" from Raintree PS to divert flows to the SED.

Reason for Overflow: System & pump station capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

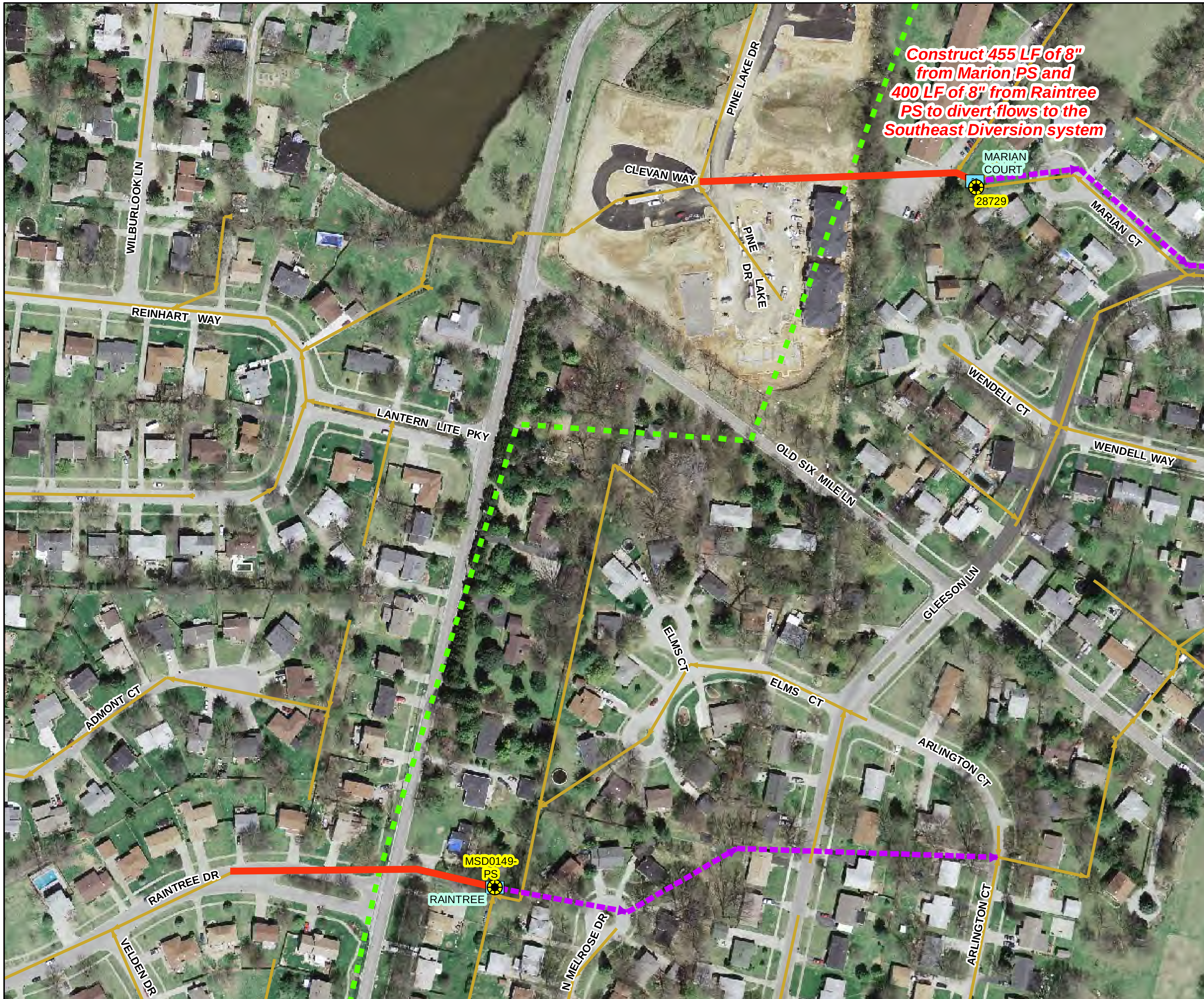
Project Constraints: None

Estimated Capital Cost (2008 dollars): $260,000

Weighted Benefit/Cost Ratio (Present Worth): 72.76

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
28711	9510 Taylorsville Road	Jeffersontown	Manhole	Ground	Suspected- no data
28719	Intersection of Gleeson and Wendell	Jeffersontown	Manhole	Ground	MOP-no data
28729	9100 Marian Ct (Wet Well for Marian Ct PS)	No Plant	Constructed	Catch Basin	Documented-no data
MSD0149-PS	Raintree	No Plant	Constructed	Ditch	No data



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Jeffersontown Sewershed

Solution ID # S_JT_JT_NB03_M_01_C

Raintree & Marian Ct PS Eliminations -1

PS Eliminations

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
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- Pump Station
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- Proposed Pipe Solution
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- Floodway
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- CSO Area
- Metro Parks

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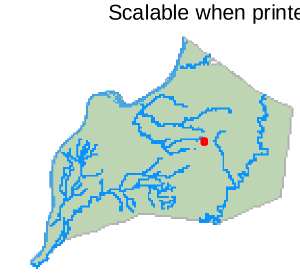

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SSO SSDP
Project Fact Sheets

SSO Project Number:	S_JT_JT_NB03_M_01_C
Project Name:	Raintree and Marian Ct. PS Eliminations 2 - Pipe Upgrades
Modeled Area:	Jeffersontown
Branch or SSO ID:	NB03
Project Type:	Pipe Upgrades
Receiving Stream:	Avoca Creek
Project Description:	This alternative includes 2,675 LF of 15" interceptor upgrades
Reason for Overflow:	System & pump station capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	$745,000
Weighted Benefit/Cost Ratio (Present Worth):	72.76

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
28711	9510 Taylorsville Road	Jeffersontown	Manhole	Ground	Suspected- no data
28719	Intersection of Gleeson and Wendell	Jeffersontown	Manhole	Ground	MOP-no data
28729	9100 Marian Ct (Wet Well for Marian Ct PS)	No Plant	Constructed	Catch Basin	Documented-no data
MSD0149-PS	Raintree	No Plant	Constructed	Ditch	No data

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Jeffersontown Sewershed

Solution ID # S_JT_JT_NB03_M_01_C

Raintree & Marian Ct PS Eliminations - 2 Pipe Upgrades

Preliminary - For Budget Development Only

Legend

- Documented SSO
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- Pump Station
- WWTP
- Proposed Pipe Solution
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SSO SSDP
Project Fact Sheet

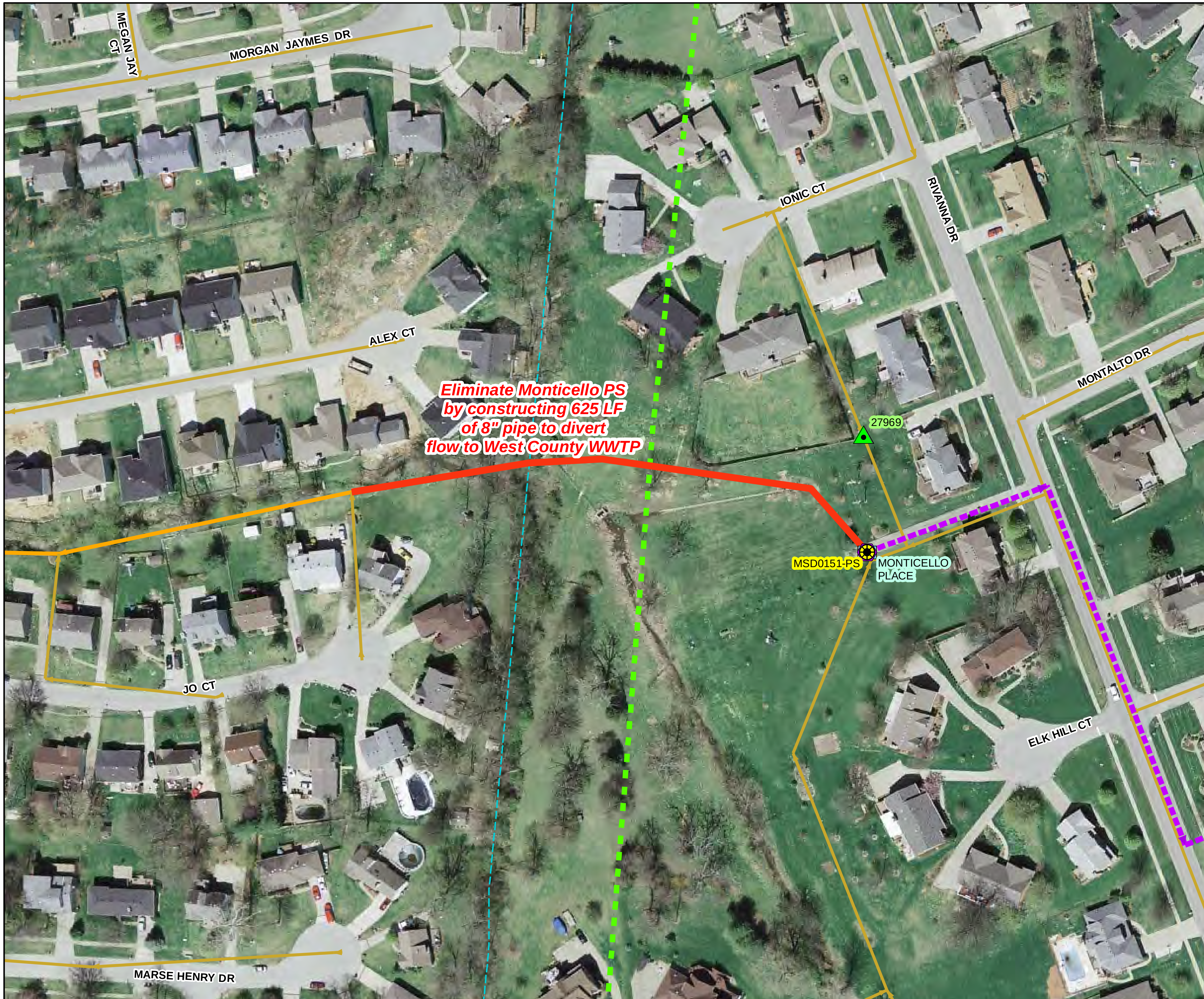
SSO Project Number:	S_JT_JT_NB04_M_01_A
Project Name:	Monticello PS Elimination
Modeled Area:	Jeffersontown
Branch or SSO ID:	NB04
Project Type:	Diversion
Receiving Stream:	Chenoweth Run and Fern Creek
Project Description:	This alternative includes eliminating Monticello PS by diverting to West County with 625 LF of 8" sewer.
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 2.60 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$207,000
Weighted Benefit/Cost Ratio (Present Worth):	65.85

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
27969	4304 Rivanna Dr	Jeffersontown	Manhole	Ground	Suspected- no data
MSD0151-PS	Monticello Place	Jeffersontown	Lift Station	Ground	10,000

Integrated Overflow Abatement Plan
Vol. 3 - Sanitary Sewer Discharge Plan

Jeffersontown Sewershed
Solution ID # S_JT_JT_NB04_M_01_A
Monticello PS Elimination



Preliminary - For Budget Development Only

Legend

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- Pump Station
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MSD

Metropolitan Sewer District

BEARGRASS CREEK
MIDDLE FORK AREA

SSO SSDP
Project Fact Sheet

SSO Project Number: S_MISF_MF_NB01_M_01_C_A1

Project Name: Middle Fork Relief Interceptor, Wet Weather Storage, and UMFLS Diversion 1- Buechel Basin

Modeled Area: Middle Fork

Branch or SSO ID: MF01

Project Type: Off-line Storage

Receiving Stream: Middle Fork Beargrass Creek, South Fork Beargrass Creek, Greasy Ditch, and Goose Creek

Project Description: This alternative includes constructing a 17.3 MG offline storage facility at the Buechel Site. The Buechel storage facility will be designed to allow for future expansion.

Reason for Overflow: System capacity

Design Parameters / Assumptions: This solution is based on a 1.82-inch cloudburst rain event

Project Constraints: Property Acquisition, Potential Wetlands at Buechel Site

Capital Projects: Southeastern Diversion Structure and Relief Interceptor

Estimated Capital Cost (2008 dollars): $13,478,000

Weighted Benefit/Cost Ratio (Present Worth): 1.26

Overflow Points Addressed:

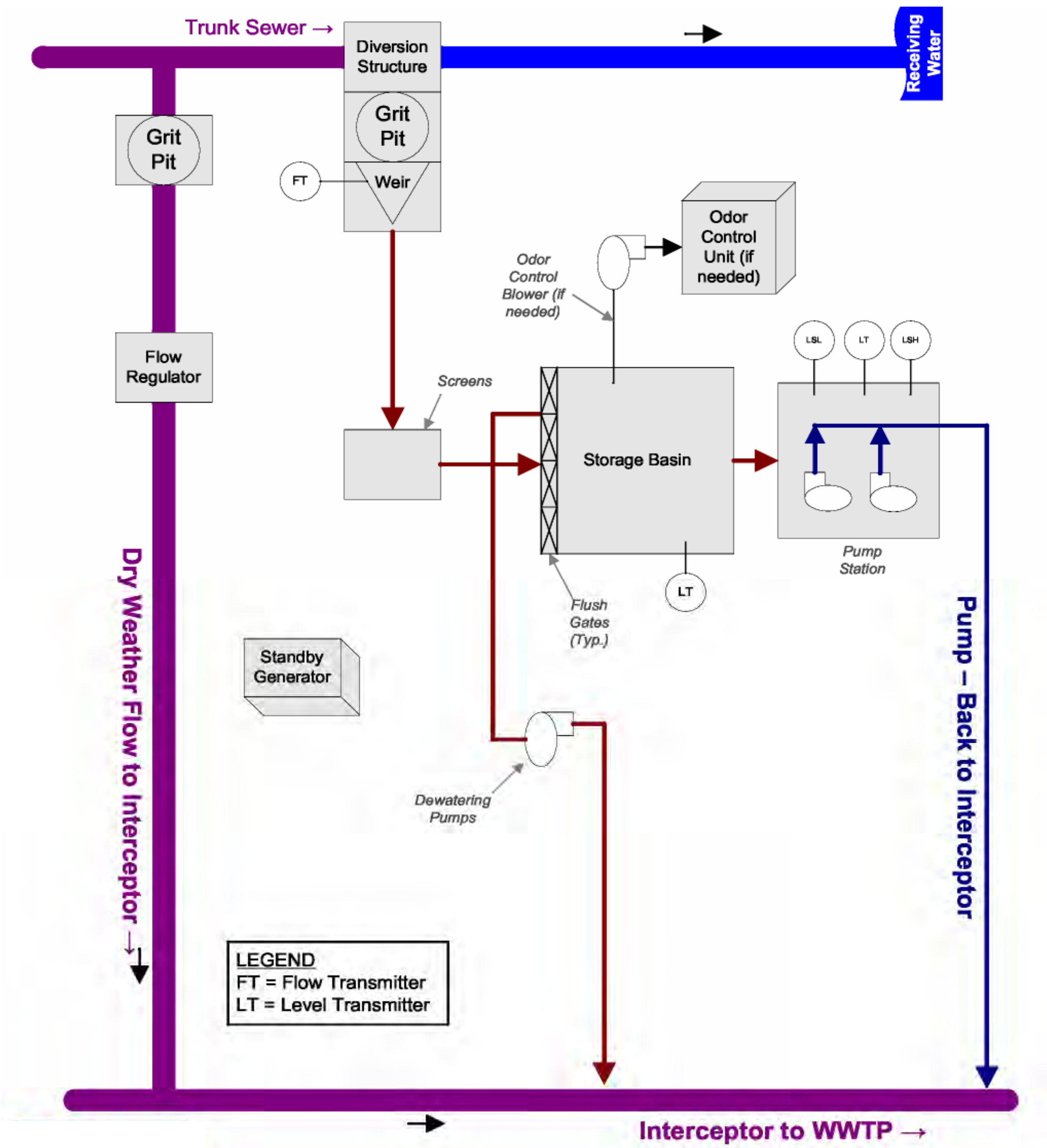
SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
23211	Peabody Lane #1	Morris Forman	Constructed	Stream	2,309,980
23212	Peabody Lane #2	Morris Forman	Manhole	Ground	9,720

27005	Bridge #6 - Cherokee Park	Morris Forman	Manhole	Ground	2,152,664
45835	Beargrass Road near Big Rock	Morris Forman	Manhole	Ground	456,021
47583	Oxmoor #4	Morris Forman	Manhole	Stream	2,557,520
47593	Near LG&E Power Station	Morris Forman	Manhole	Ground	359,960
47596	* EA 1500' SW	Morris Forman	Manhole	Ground	Suspected- no data
47603	Kindercare #1	Morris Forman	Manhole	Ground	120
47604	Kindercare #2	Morris Forman	Manhole	Ground	17,083
02932	Oxmoor #1	Morris Forman	Manhole	Ground	1,203,000
02933	Oxmoor #2	Morris Forman	Manhole	Stream	150,000
02935	Oxmoor #3	Morris Forman	Manhole	Stream	3,420
08537	Northern Ditch Blow-off	Morris Forman	Constructed	Stream	115,500,000
08935-SM	Middle Fork at Breckenridge Lane	Morris Forman	Constructed	Stream	3,020,300
51160	Peabody Lane #3	Morris Forman	Manhole	Ground	55,500
51161	Brooklawn	Morris Forman	Manhole	Ground	438,000
51221	Watterson Expressway at South Fork Beargrass Creek	Morris Forman	Constructed	Stream	13,500
90700	Christian Court	Morris Forman	Manhole	Catch Basin	5,400
IS021A-SI	Bowman Field Siphon	Morris Forman	Constructed	Stream	No data

SSO SSDP
Project Fact Sheet

SSO Project Number: S_MISF_MF_NB01_M_01_C_A1

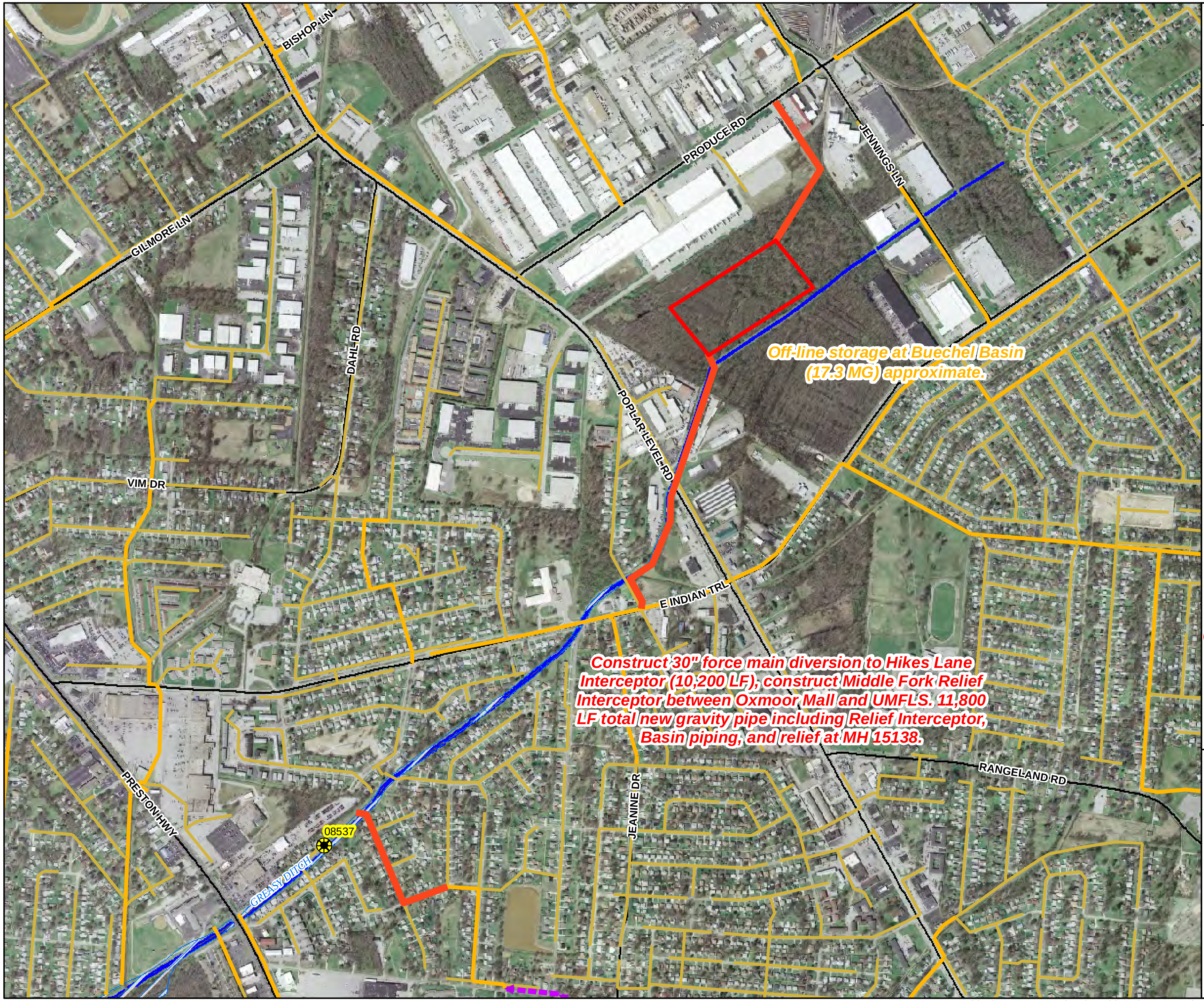
**Off-Line Storage
Pumped Effluent
Flow Diagram**



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Middle Fork Sewershed
Solution ID # S_MISF_MF_NB01_M_01_C_A1
Middle Fork Relief Interceptor,
Wet Weather Storage, and
UMFLS Diversion 1 - Buechel Basin



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Map Revision
May 7, 2009

Aerial Date: 2006

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SSO SSDP
Project Fact Sheet

SSO Project Number:	S_MISF_MF_NB01_M_01_C_A1
Project Name:	Middle Fork Relief Interceptor, Wet Weather Storage, and UMFLS Diversion 2 - PS Diversion and Storage
Modeled Area:	Middle Fork
Branch or SSO ID:	MF01
Project Type:	Off-line Storage & Pipe Upgrades
Receiving Stream:	Middle Fork Beargrass Creek, South Fork Beargrass Creek, Greasy Ditch, and Goose Creek
Project Description:	This alternative includes constructing 10,200 LF of 30" Force Main Diversion to Hikes Lane Interceptor from Ex UMFLS. Construct Middle Fork Relief Interceptor between Oxmoor and Middle Fork at Breckenridge. Construct 1.6 MG covered facility near Car Wash Site . Upsize pipe downstream of MH 15138 to 18". 11,800 LF total new gravity pipe including Relief Interceptor, storage piping, and relief at manhole 15138.
Reason for Overflow:	System capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	Property Acquisition, Stream Crossings for MFRI
Capital Projects:	Southeastern Diversion Structure and Relief Interceptor
Estimated Capital Cost (2008 dollars):	$13,149,000
Weighted Benefit/Cost Ratio (Present Worth):	1.26

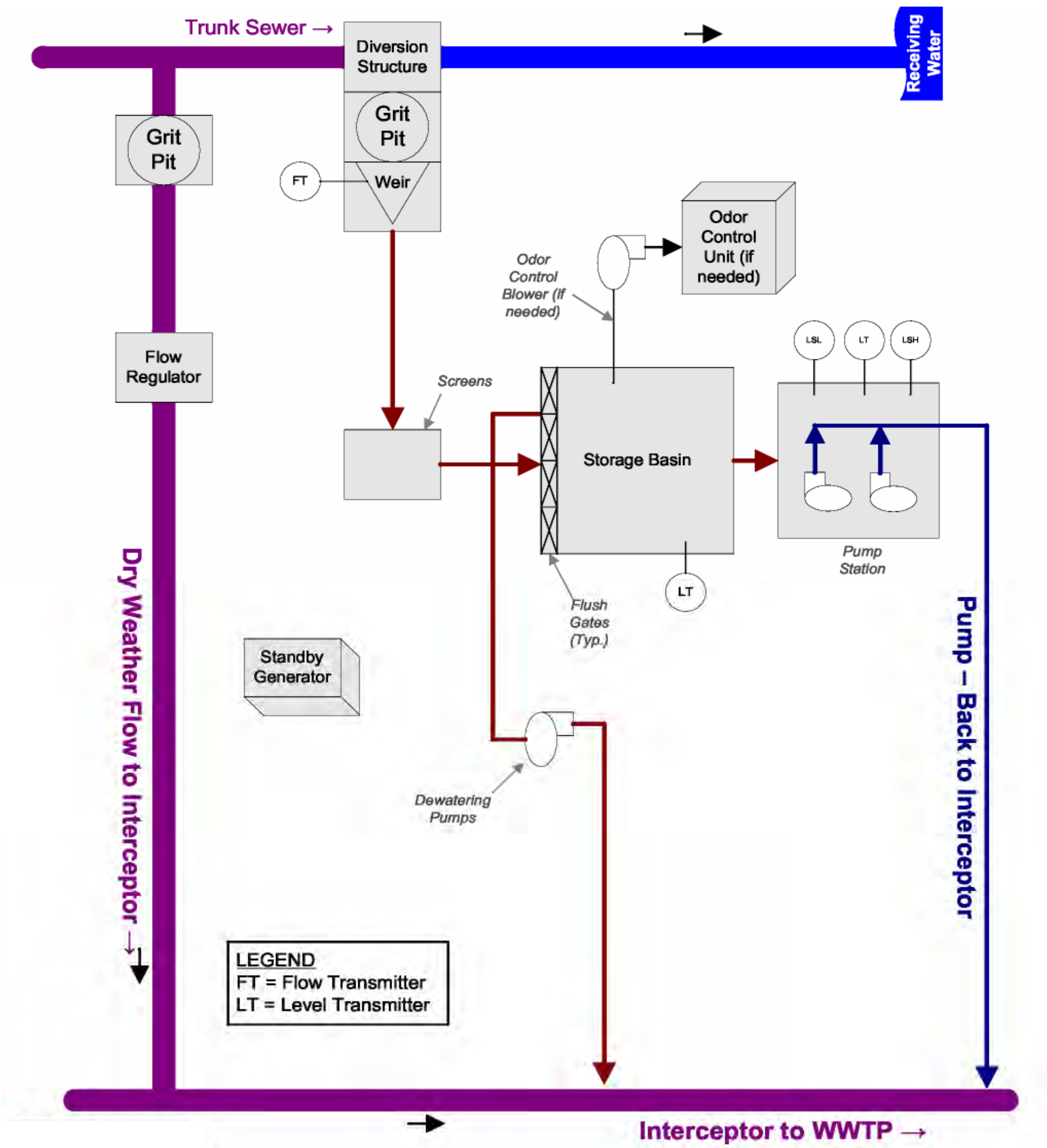
Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
23211	Peabody Lane #1	Morris Forman	Constructed	Stream	2,309,980
23212	Peabody Lane #2	Morris Forman	Manhole	Ground	9,720
27005	Bridge #6 - Cherokee Park	Morris Forman	Manhole	Ground	2,152,664
45835	Beargrass Road near Big Rock	Morris Forman	Manhole	Ground	456,021
47583	Oxmoor #4	Morris Forman	Manhole	Stream	2,557,520
47593	Near LG&E Power Station	Morris Forman	Manhole	Ground	359,960
47596	* EA 1500' SW	Morris Forman	Manhole	Ground	Suspected- no data
47603	Kindercare #1	Morris Forman	Manhole	Ground	120
47604	Kindercare #2	Morris Forman	Manhole	Ground	17,083
02932	Oxmoor #1	Morris Forman	Manhole	Ground	1,203,000
02933	Oxmoor #2	Morris Forman	Manhole	Stream	150,000
02935	Oxmoor #3	Morris Forman	Manhole	Stream	3,420
08537	Northern Ditch Blow-off	Morris Forman	Constructed	Stream	115,500,000
08935-SM	Middle Fork at Breckenridge Lane	Morris Forman	Constructed	Stream	3,020,300
51160	Peabody Lane #3	Morris Forman	Manhole	Ground	55,500
51161	Brooklawn	Morris Forman	Manhole	Ground	438,000
51221	Watterson Expressway at South Fork Beargrass Creek	Morris Forman	Constructed	Stream	13,500
90700	Christian Court	Morris Forman	Manhole	Catch Basin	5,400
IS021A-SI	Bowman Field Siphon	Morris Forman	Constructed	Stream	No data

SSO SSDP
Project Fact Sheet

SSO Project Number: S_MISF_MF_NB01_M_01_C_A1

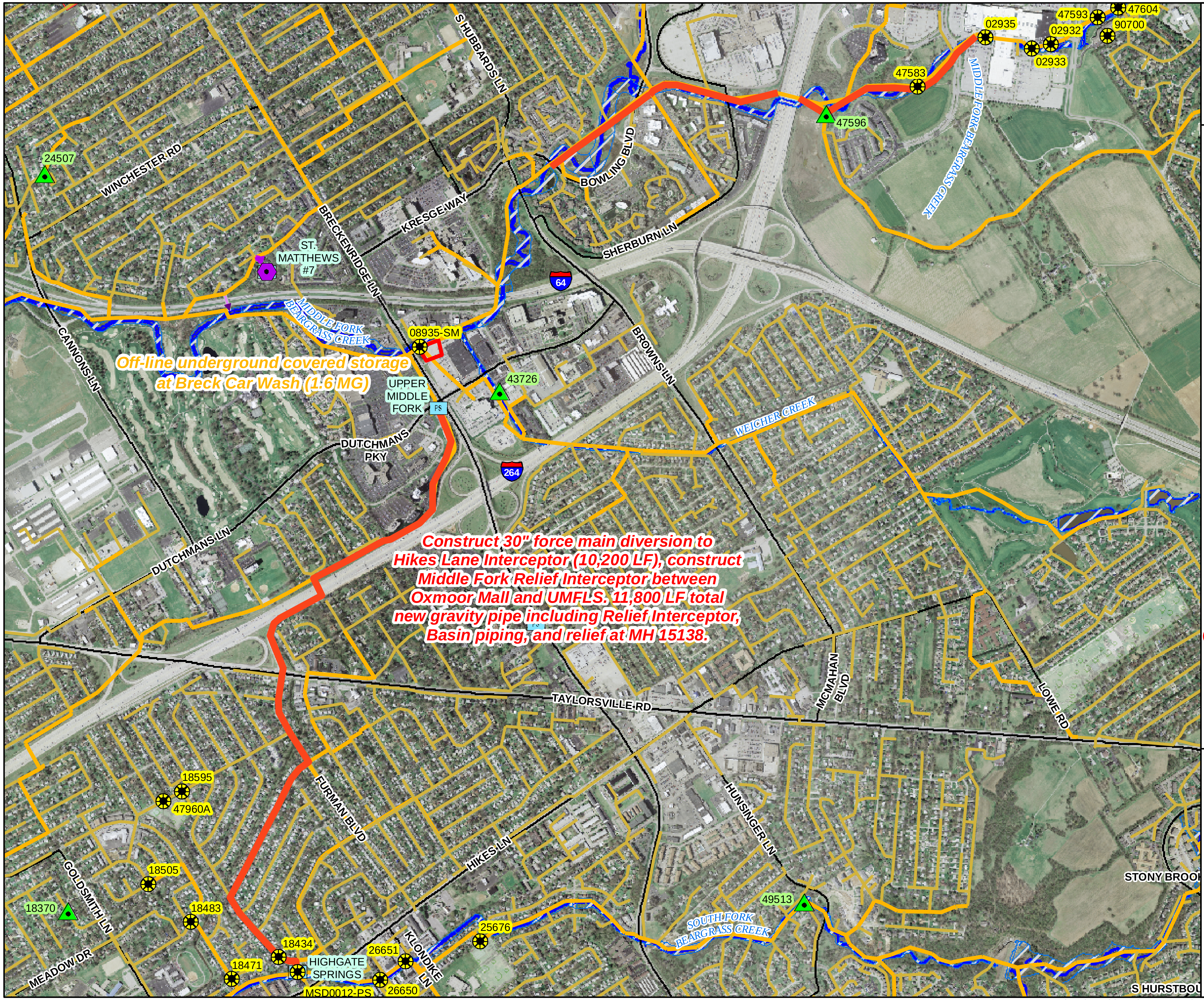
**Off-Line Storage
Pumped Effluent
Flow Diagram**



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Middle Fork Sewershed
Solution ID # S_MISF_MF_NB01_M_01_C_A1
Middle Fork Relief Interceptor, Wet Weather Storage, and UMFLS Diversion 2 - PS Diversion and Storage



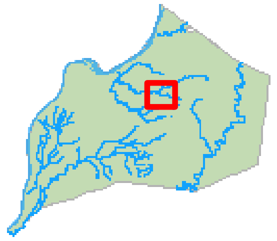
Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

General representation of overflow abatement solutions are for preliminary planning purposes. Alignments and locations may be altered during design.

1 inch equals 1,400 feet
Scalable when printed on 11" X 17" paper



Some boundaries are uniquely symbolized within the map.

Map Revision
May 7, 2009

Aerial Date: 2006

N

SDI Inc. SSDP Map Series: Middle Fork Relief Interceptor, Wet Weather Storage, and UMFPS Diversion_Southwest.mxd

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

SSO SSDP
Project Fact Sheet

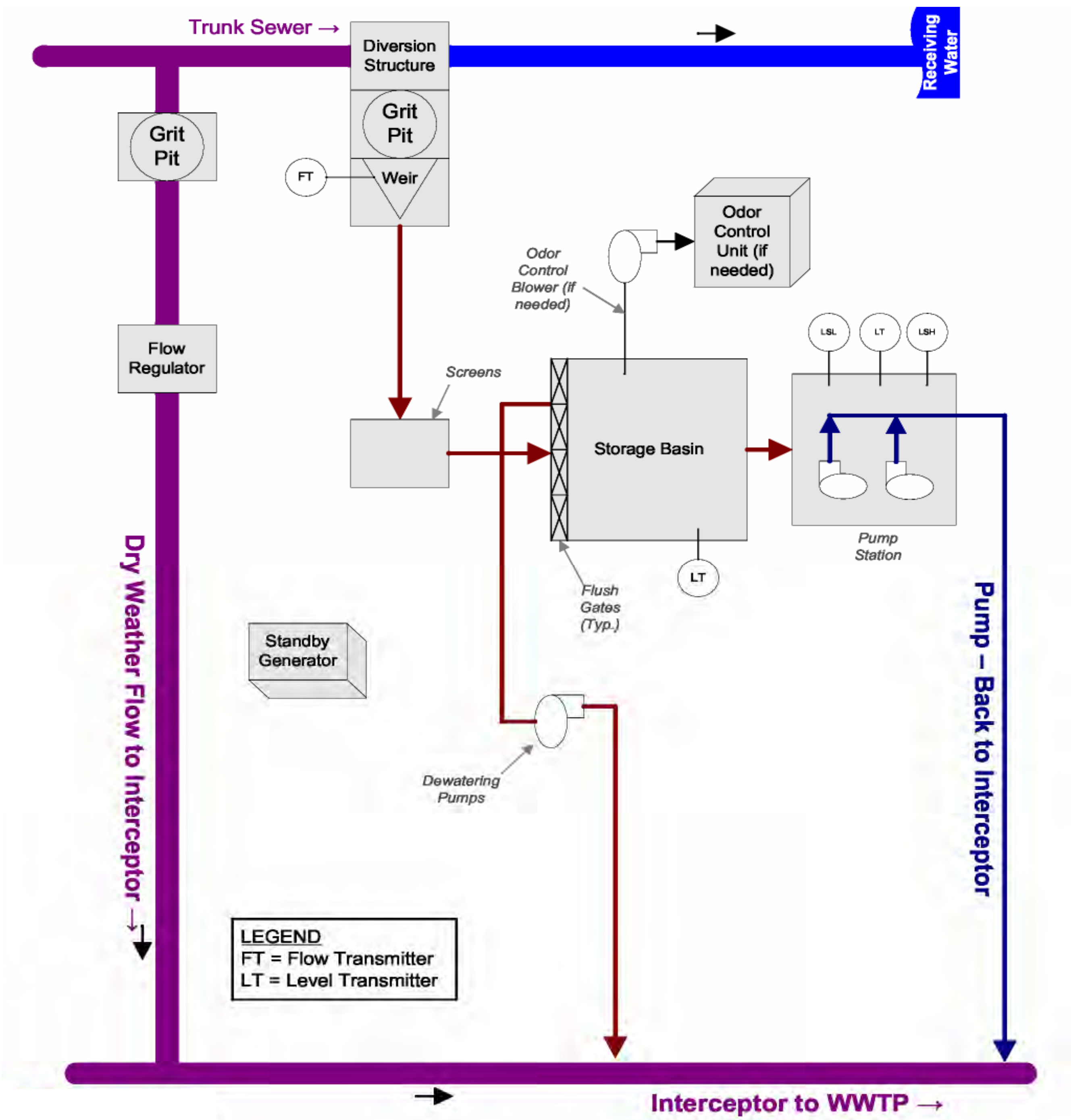
SSO Project Number:	S_MI_MF_NB04_M_03_B
Project Name:	Goose Creek PS Improvements and Wet Weather Storage 1 - Devondale Wet Weather Storage
Modeled Area:	Middle Fork
Branch or SSO ID:	MF04
Project Type:	Offline Storage
Receiving Stream:	Goose Creek
Project Description:	This alternative includes constructing a 0.5 MG covered storage basin near Devondale Pump Station.
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 2.25 inch cloudburst rain event
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	$1,781,000
Weighted Benefit/Cost Ratio (Present Worth):	11.00

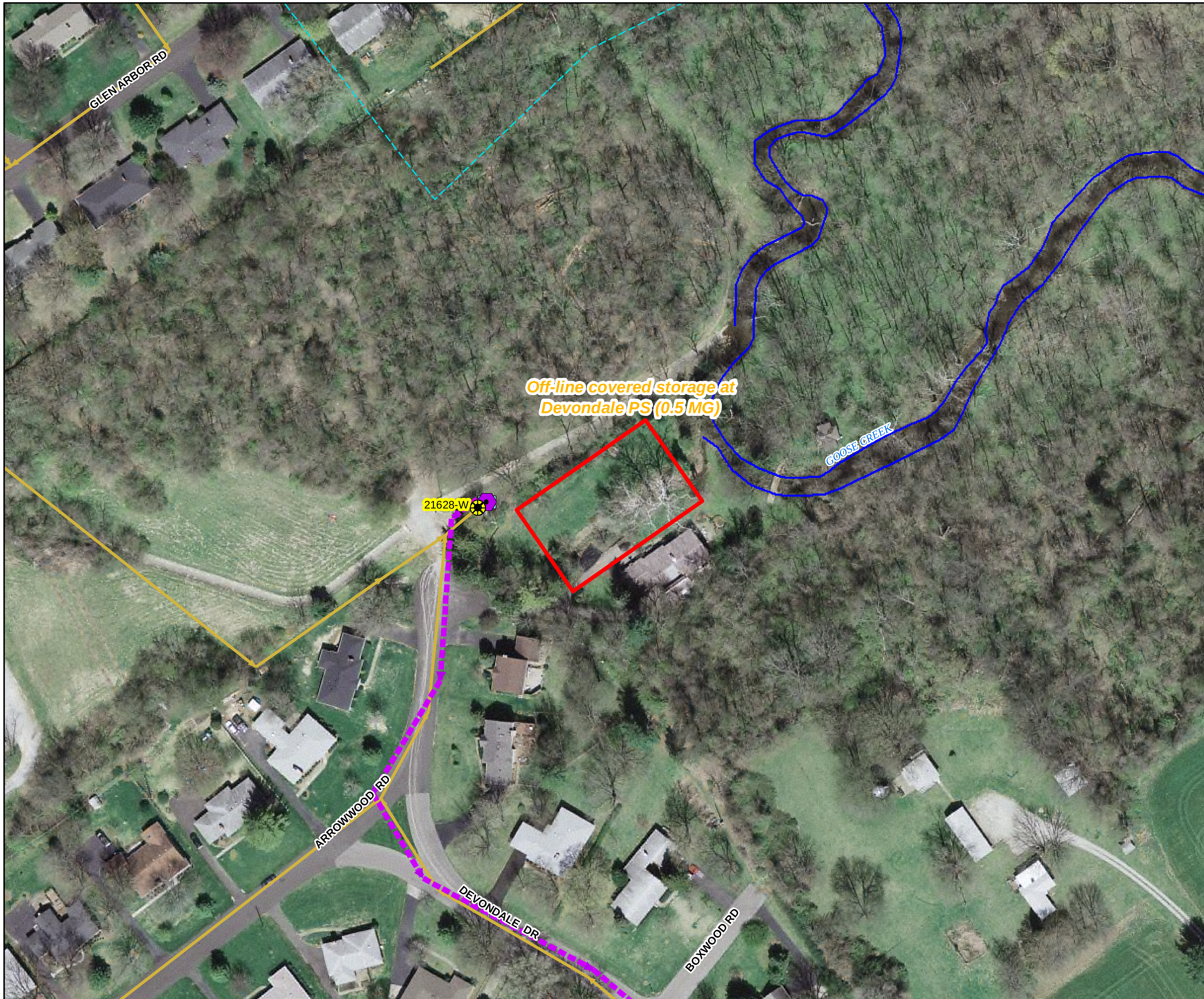
Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
43472	Near Saurel Drive PS	Morris Forman	Manhole	Ditch	118
46891	Goose Creek PS Wet Well	Morris Forman	Manhole	Ditch	246,000
62418	Goose Creek PS Near Goose Creek	Morris Forman	Manhole	Ground	128,000
91629	Old Westport Road at Goose Creek PS #2	Morris Forman	Manhole	Ground	15,750

91630	Old Westport Road at Goose Creek PS #3	Morris Forman	Manhole	Ground	5,250
105936	Old Westport Road at Goose Creek PS #1	Morris Forman	Manhole	Ground	10,927
21628-W	Devondale Wet Well Manhole (PS Overflow)	Morris Forman	Pumped	Ditch	58,013

Off-Line Storage
Pumped Effluent
Flow Diagram





Integrated Overflow Abatement Plan
Vol. 3 - Sanitary Sewer Discharge Plan
Middle Fork Sewershed
Solution ID # S_MI_MF_NB04_M_03_B
Goose Creek PS Improvements &
Wet Weather Storage 1
Devondale Wet Weather Storage

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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1 inch equals 100 feet
Scalable when printed on 11" X 17" paper

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Map Revision
May 7, 2009

Aerial Date: 2006

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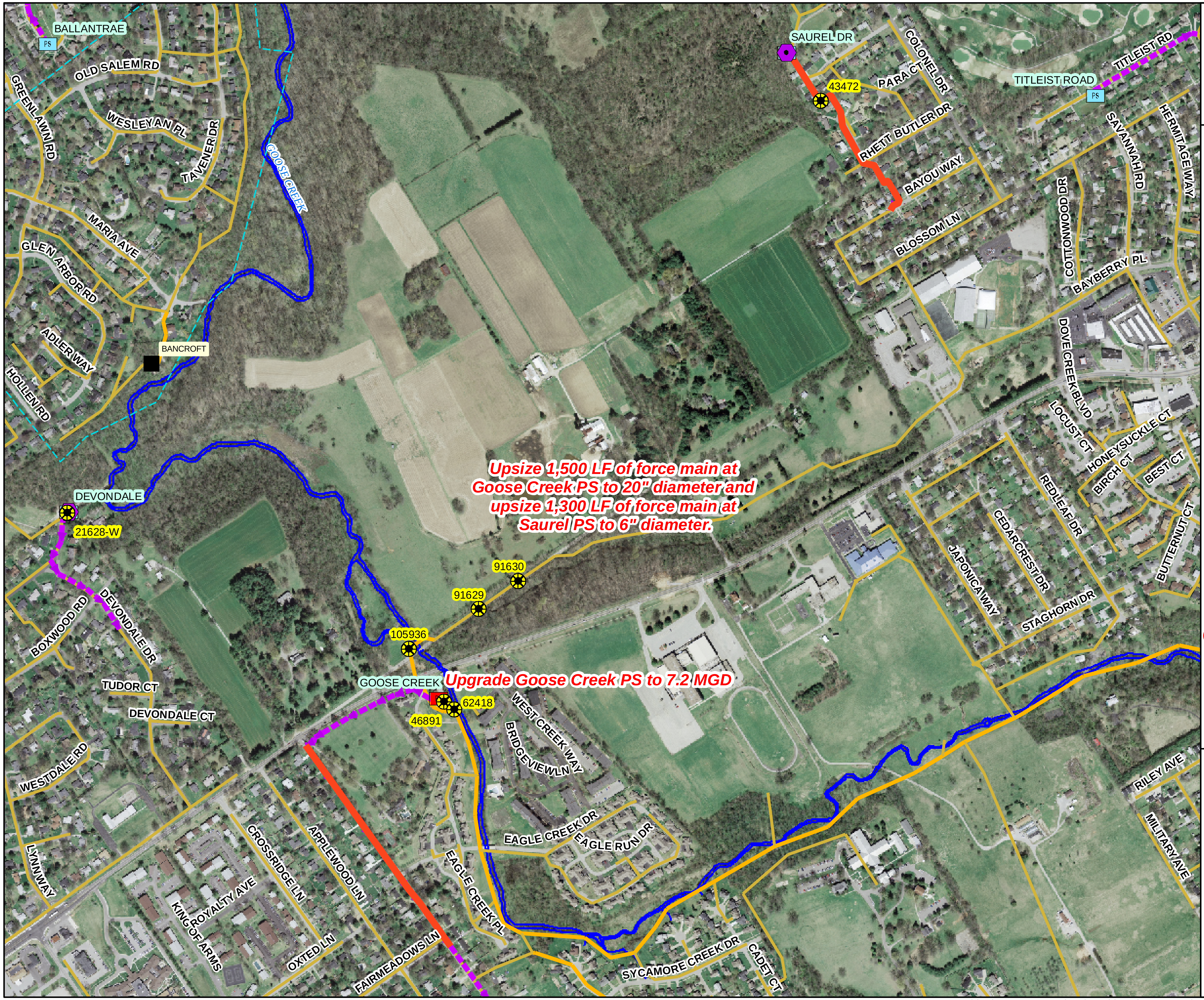
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_MI_MF_NB04_M_03_B
Project Name:	Goose Creek PS Improvements and Wet Weather Storage 2 - Pump Station & Force Main Upgrades
Modeled Area:	Middle Fork
Branch or SSO ID:	MF04
Project Type:	Pump Station & Force Main Upgrades
Receiving Stream:	Goose Creek
Project Description:	This alternative includes upgrading Goose Creek PS to 7.2 MGD, replacing 16" portion of Goose Creek PS with 20" force main, replacing Saurel Rd PS 4" force main with 6" force main. (3,300 LF total force main)
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 2.25 inch cloudburst rain event
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	$1,063,000
Weighted Benefit/Cost Ratio (Present Worth):	11.00

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
43472	Near Saurel Drive PS	Morris Forman	Manhole	Ditch	118
46891	Goose Creek PS Wet Well	Morris Forman	Manhole	Ditch	246,000

62418	Goose Creek PS Near Goose Creek	Morris Forman	Manhole	Ground	128,000
91629	Old Westport Road at Goose Creek PS #2	Morris Forman	Manhole	Ground	15,750
91630	Old Westport Road at Goose Creek PS #3	Morris Forman	Manhole	Ground	5,250
105936	Old Westport Road at Goose Creek PS #1	Morris Forman	Manhole	Ground	10,927
21628-W	Devondale Wet Well Manhole (PS Overflow)	Morris Forman	Pumped	Ditch	58,013



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Middle Fork Sewershed
Solution ID # S_MI_MF_NB04_M_03_B
Goose Creek PS Improvements & Wet Weather Storage 2
Pump Station & Force Main Upgrades

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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1 inch equals 600 feet
Scalable when printed on 11" X 17" paper

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Map Revision
May 7, 2009

Aerial Date: 2006

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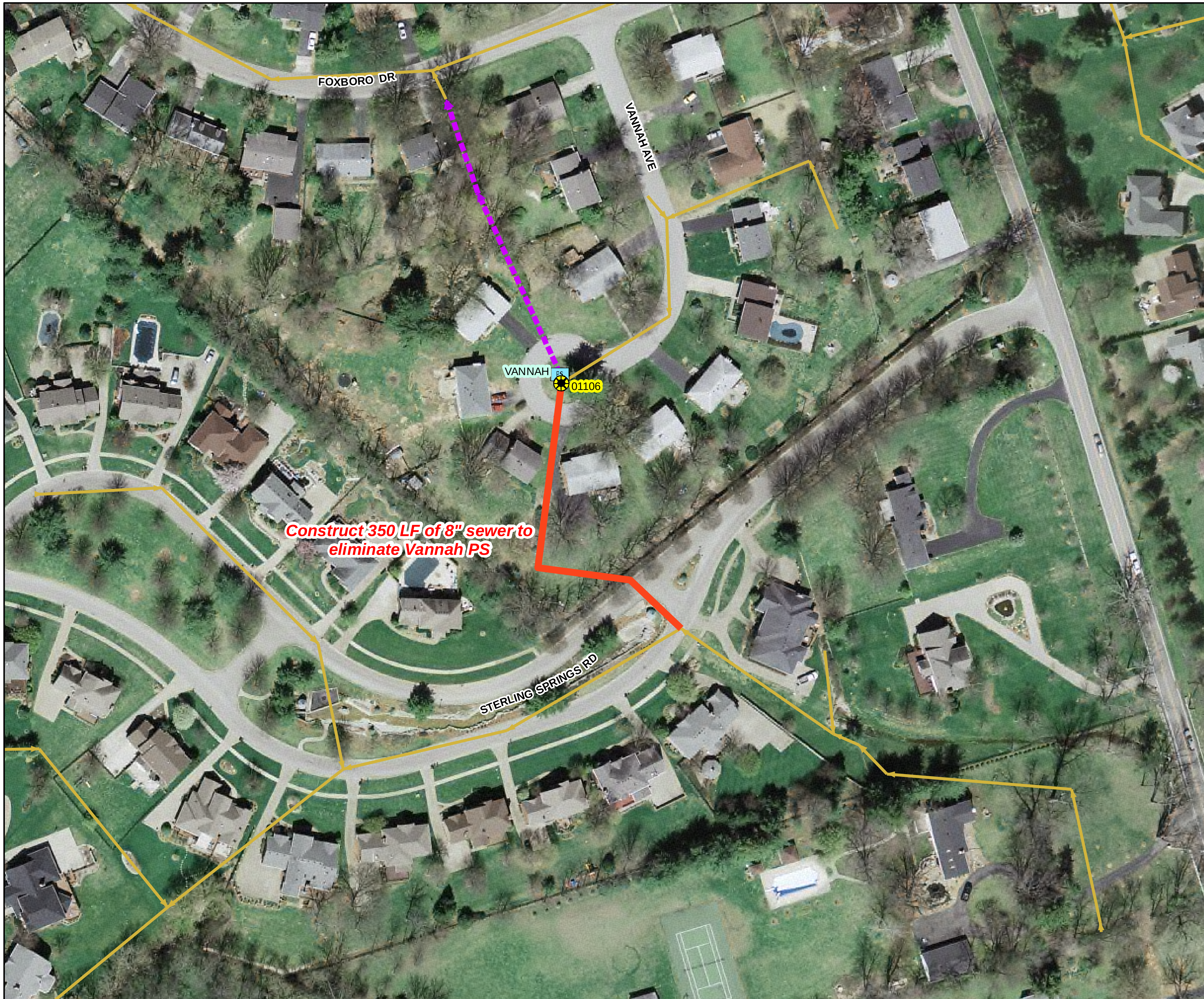
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_MI_MF_NB06_M_01_A_A
Project Name:	Anchor Estates PS Eliminations 1 - Vannah PS Elimination
Modeled Area:	Middle Fork
Branch or SSO ID:	MF06
Project Type:	Diversion
Receiving Stream:	Middle Fork Beargrass Creek
Project Description:	This alternative includes 350 LF of 8-inch pipe at Vannah PS to eliminate the PS.
Reason for Overflow:	Bypass Pipe at Vannah Way, Undersized Pumps at Anchor Estates #1 and #2.
Design Parameters / Assumptions:	This solution is based on a 2.60 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$59,000
Weighted Benefit/Cost Ratio (Present Worth):	31.14

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
00746	Manhole Adjacent to Anchor Estates PS #1	Morris Forman	Pumped	Ditch	10,762
01106	Vannah PS Wetwell Manhole	Morris Forman	Constructed	Catch basin	No Data
00056-W	Anchor Estates #1 Wetwell	Morris Forman	Manhole	Ground	11,929
MSD0057-LS	Anchor Estates #2	Morris Forman	Lift Station	Stream	14,519



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Middle Fork Sewershed
Solution ID # S_MI_MF_NB06_M_01_A_A
Anchor Estates PS Eliminations 1
Vannah PS Elimination

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
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- Large WWTP Service Area
- CSO Area
- Metro Parks

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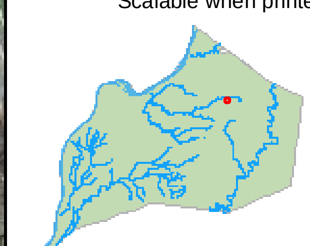

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Map Revision
May 7, 2009

Aerial Date: 2006

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SSO SSDP
Project Fact Sheet

SSO Project Number:	S_MI_MF_NB06_M_01_A_A
Project Name:	Anchor Estates PS Eliminations 2 - Anchor Estates #1 / #2 PS Elimination
Modeled Area:	Middle Fork
Branch or SSO ID:	MF06
Project Type:	Diversion
Receiving Stream:	Middle Fork Beargrass Creek
Project Description:	This alternative includes 9,440 LF of 8" - 12" pipe at Anchor Estates #1 and #2 pump stations to eliminate both pump stations.
Reason for Overflow:	Bypass Pipe at Vannah Way, Undersized Pumps at Anchor Estates #1 and #2.
Design Parameters / Assumptions:	This solution is based on a 2.60 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$1,850,000
Weighted Benefit/Cost Ratio (Present Worth):	31.14

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
00746	Manhole Adjacent to Anchor Estates PS #1	Morris Forman	Pumped	Ditch	10,762
01106	Vannah PS Wetwell Manhole	Morris Forman	Constructed	Catch basin	No Data
00056-W	Anchor Estates #1 Wetwell	Morris Forman	Manhole	Ground	11,929
MSD0057-LS	Anchor Estates #2	Morris Forman	Lift Station	Stream	14,519

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan
Middle Fork Sewershed
Solution ID # S_MI_MF_NB06_M_01_A_A
Anchor Estates PS Eliminations 2
Anchor Estates #1 & #2 PS Elimination

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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1 inch equals 400 feet
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Map Revision
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Aerial Date: 2006

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SSO SSDP
Project Fact Sheet

SSO Project Number:	S_MI_MF_NB07_S_07_C
Project Name:	Hurstbourne I/I Investigation and Rehabilitation
Modeled Area:	Middle Fork
Branch or SSO ID:	MF07
Project Type:	I/I Reduction
Receiving Stream:	Middle Fork Beargrass Creek
Project Description:	This location will be targeted for I/I source control (I/I rehab and private property program). Perform targeted SSES of 26,127 LF upstream of SSO at MH 01793. This accounts for 25% of upstream system.
Reason for Overflow:	System capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	$536,000 (Cost is for SSES only; rehabilitation will be performed under Annual I/I Rehab contracts and the private property program)
Weighted Benefit/Cost Ratio (Present Worth):	Only cost calculated for SSES, no benefits are calculated

Overflow Points Addressed:

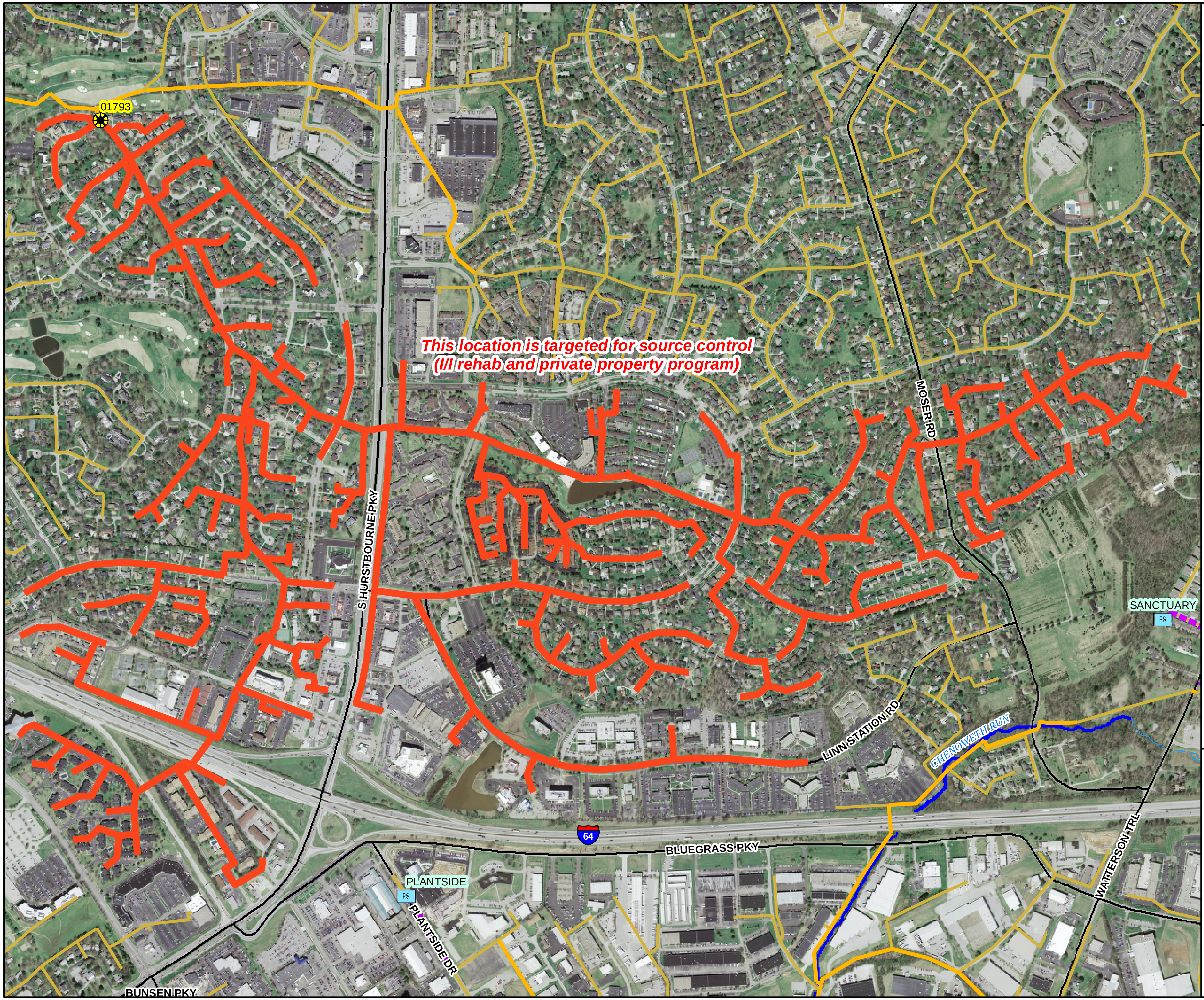
SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
01793	9 Muirfield Pl	Morris Forman	Manhole	Ground	109,000

Integrated Overflow Abatement Plan
Vol. 3 - Sanitary Sewer Discharge Plan

Middle Fork Sewershed

Solution ID # S_MI_MF_NB07_S_07_C

Hurstbourne I/I Investigation & Rehabilitation



Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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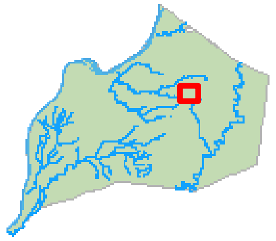
1 inch equals 900 feet

Scalable when printed on 11" X 17" paper



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Map Revision

May 7, 2009

Aerial Date: 2006

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LOJIC MSD Metropolitan Sewer District PROJECT WIN

SDI Inc. SSDP Map Series: Hurstbourne I/I Investigation & Rehabilitation.mxd

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MSD

Metropolitan Sewer District

SOUTHEASTERN DIVERSION AREA

SSO SSDP
Project Fact Sheet

SSO Project Number: S_SD_MF_NB03_S_07_C

Project Name: Parkview Estates I/I Investigation and Rehabilitation

Modeled Area: SED

Branch or SSO ID: NB03

Project Type: I/I Reduction

Receiving Stream: N/A

Project Description: This location will be targeted for I/I source control (I/I rehab and private property program). A full SSES will be performed upstream of MH 47250. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative will be implemented, which is Pipe Upgrades.

Reason for Overflow: System capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

Project Constraints: None

Estimated Capital Cost (2008 dollars): $285,000 (Cost is for SSES only; rehabilitation will be performed under Annual I/I Rehab contracts and the private property program)

Weighted Benefit/Cost Ratio (Present Worth): Only cost calculated for SSES, no benefits are calculated

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
47250	1645 Rangeland Rd	Morris Forman	Capacity	Ditch	MOP- no data

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Southeast Diversion
Solution ID # S_SD_MF_NB03_S_07_C
Parkview Estates I&I
Investigation & Rehabilitation

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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1 inch equals 300 feet
Scalable when printed on 11" X 17" paper

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Map Revision
May 7, 2009

Aerial Date: 2006

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LOJIC

MSD
Metropolitan Sewer District

PROJECT WIN

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_SD_MF_NB04_S_01_B_A

Project Name: Klondike Interceptor

Modeled Area: SED

Branch or SSO ID: NB04

Project Type: Pipe Upgrades

Receiving Stream: South Fork Beargrass Creek

Project Description: This solution involves 2,830 LF of 30" gravity interceptor connecting to the HLI where the Jeffersontown Branch 1 24" force main solution connects to the HLI. The SED Branch 4 solution was priced with a 30" gravity interceptor constructed to the HLI minus the cost of the 24" Jeffersontown force main along the same route.

Reason for Overflow: System capacity

Design Parameters / Assumptions: This solution is based on a 2.25 inch cloudburst rain event

Project Constraints: None at this time

Estimated Capital Cost (2008 dollars): $558,000

Weighted Benefit/Cost Ratio (Present Worth): 9.11

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
25676	Alcona Lane	Morris Forman	Manhole	Ground	288,969
26650	Briarbridge Ln at South Fork Beargrass Creek	Morris Forman	Manhole	Stream	150
26651	Klondike Ln at South Fork Beargrass Creek	Morris Forman	Manhole	Stream	2,511,000

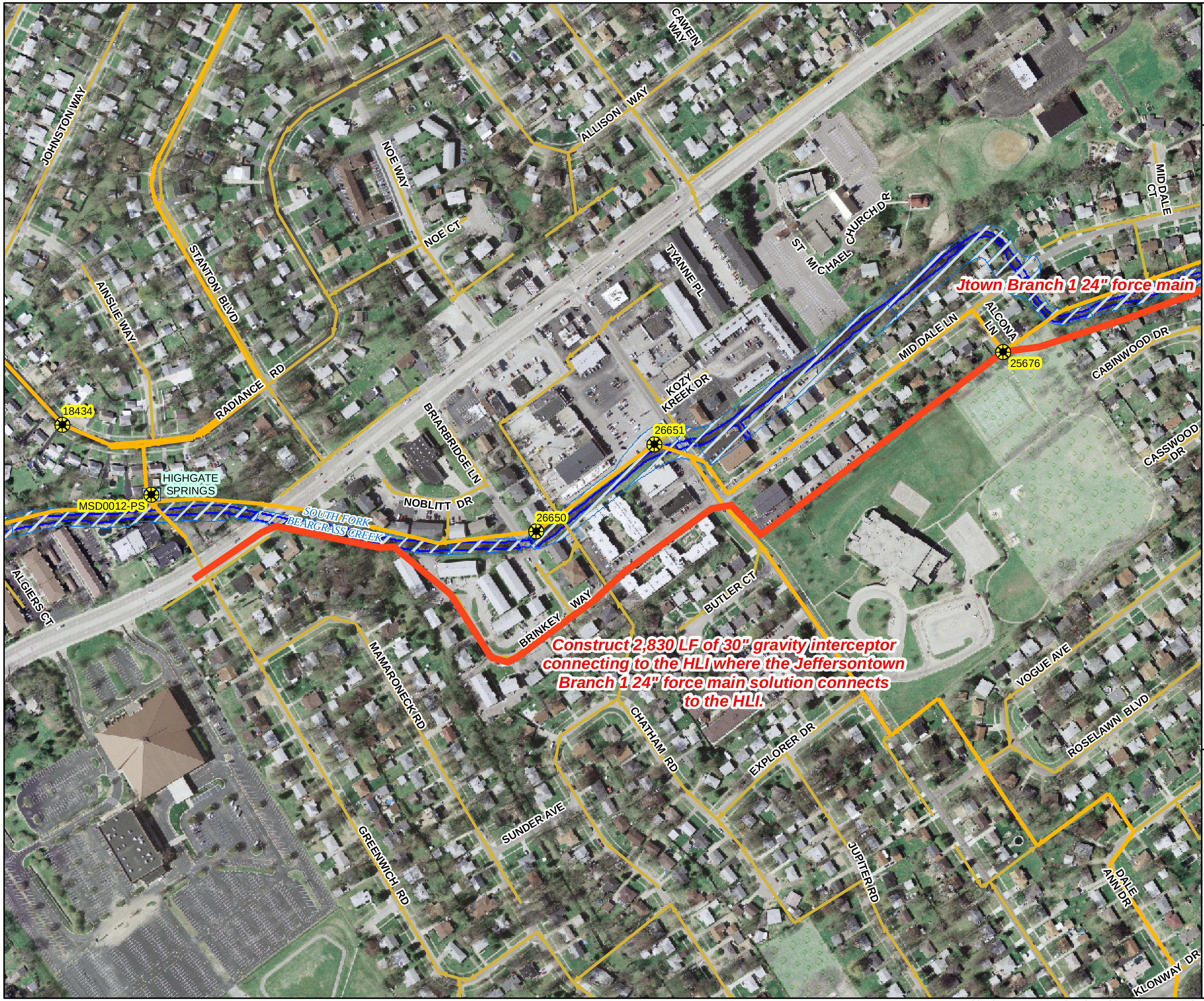
Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Southeast Diversion

Solution ID # S_SD_MF_NB04_S_01_B_A

Klondike Interceptor



Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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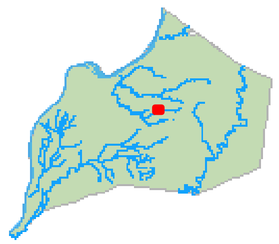

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Map Revision
May 7, 2009

Aerial Date: 2006

N

SDI Inc. SSDP Map Series: Klondike Interceptor.mxd

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SSO SSDP
Project Fact Sheet

SSO Project Number:	S_SD_MF_NB05_M_01_A
Project Name:	Sutherland Interceptor
Modeled Area:	SED
Branch or SSO ID:	NB05
Project Type:	Pipe Upgrades
Receiving Stream:	South Fork Beargrass Creek
Project Description:	This alternative includes upsizing 10" interceptor to 670 LF of 18" and 1,070 LF of 15" interceptor along rear yards to eliminate Sutherland SSO possibly with pipe-bursting.
Reason for Overflow:	System capacity
Design Parameters / Assumptions:	This solution is based on a 2.60 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$412,000
Weighted Benefit/Cost Ratio (Present Worth):	32.71

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
16649	Wickland Road/ Sutherland Drive	Morris Forman	Constructed	Ditch	1,078,972

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Southeast Diversion

Solution ID # S_SD_MF_NB05_M_01_A

Sutherland Interceptor

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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1 inch equals 200 feet
Scalable when printed on 11" X 17" paper

Some boundaries are uniquely symbolized within the map.

Map Revision
May 7, 2009

Aerial Date: 2006

N

SSO SSDP
Project Fact Sheet

SSO Project Number:	S_SD_MF_NB06_S_13_C
Project Name:	Beargrass Interceptor Rehab Ph. 2
Modeled Area:	SED
Branch or SSO ID:	NB06
Project Type:	Pipe Rehab
Receiving Stream:	South Fork Beargrass Creek
Project Description:	This solution involves heavily cleaning 2,000 LF of 42" interceptor between MH 51594 and MH 73227
Reason for Overflow:	Obstructions and root masses
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$57,000
Weighted Benefit/Cost Ratio (Present Worth):	N/A

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
51594	Trevilian Way-Near South Fork Beargrass Creek	Morris Forman	Manhole	Ditch	50

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Southeast Diversion

Solution ID # S_SD_MF_NB06_S_13_C

Beargrass Interceptor Rehabilitation Ph. 2

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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Map Revision
May 7, 2009

Aerial Date: 2006

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MSD

Metropolitan Sewer District

POND CREEK AREA

SSO SSDP
Project Fact Sheet

SSO Project Number:	S_PO_WC_PC03_M_01_C
Project Name:	Charleswood Interceptor Extension
Modeled Area:	Pond Creek
Branch or SSO ID:	PC03
Project Type:	Pipe Upgrades
Receiving Stream:	Fishpool Creek
Project Description:	This alternative includes upsizing 1,846 LF of open cut sewer (mostly in rock) downstream. This estimate does not include the Cooper Chapel PS elimination but the Charleswood Subdivision Interceptor will eliminate Cooper Chapel PS and require capacity increases downstream.
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None at this time
Capital Projects:	C94103 ~ Charleswood Subdivision Interceptor - Under Design
Estimated Capital Cost (2008 dollars):	$603,000
Weighted Benefit/Cost Ratio (Present Worth):	62.84

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
25477	EA 35' E	West County	Manhole	Ground	Suspected-no data
25478	EA 35' E	West County	Manhole	Ground	Suspected-no data
25480	6112 Cooper Chapel Rd	West County	Manhole	Ground	6,500
MSD0130-PS	Cooper Chapel	West County	Constructed	Ditch	4,442

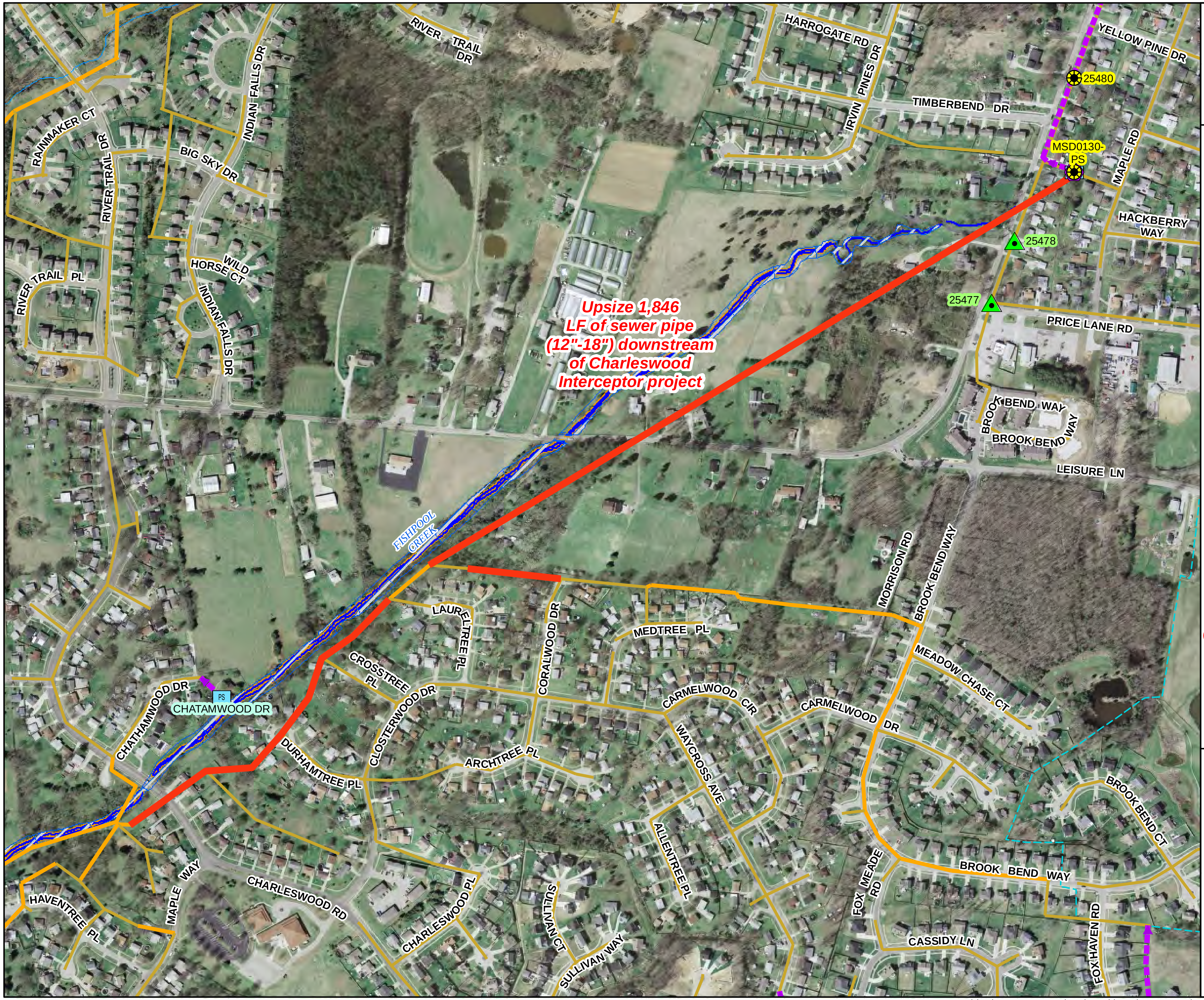
Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed

Solution ID # S_PO_WC_PC03_M_01_C

Charleswood Interceptor Extension



Preliminary - For Budget Development Only

Legend

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- Suspected SSO
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LOJIC MSD PROJECT WIN

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SSO SSDP
Project Fact Sheet

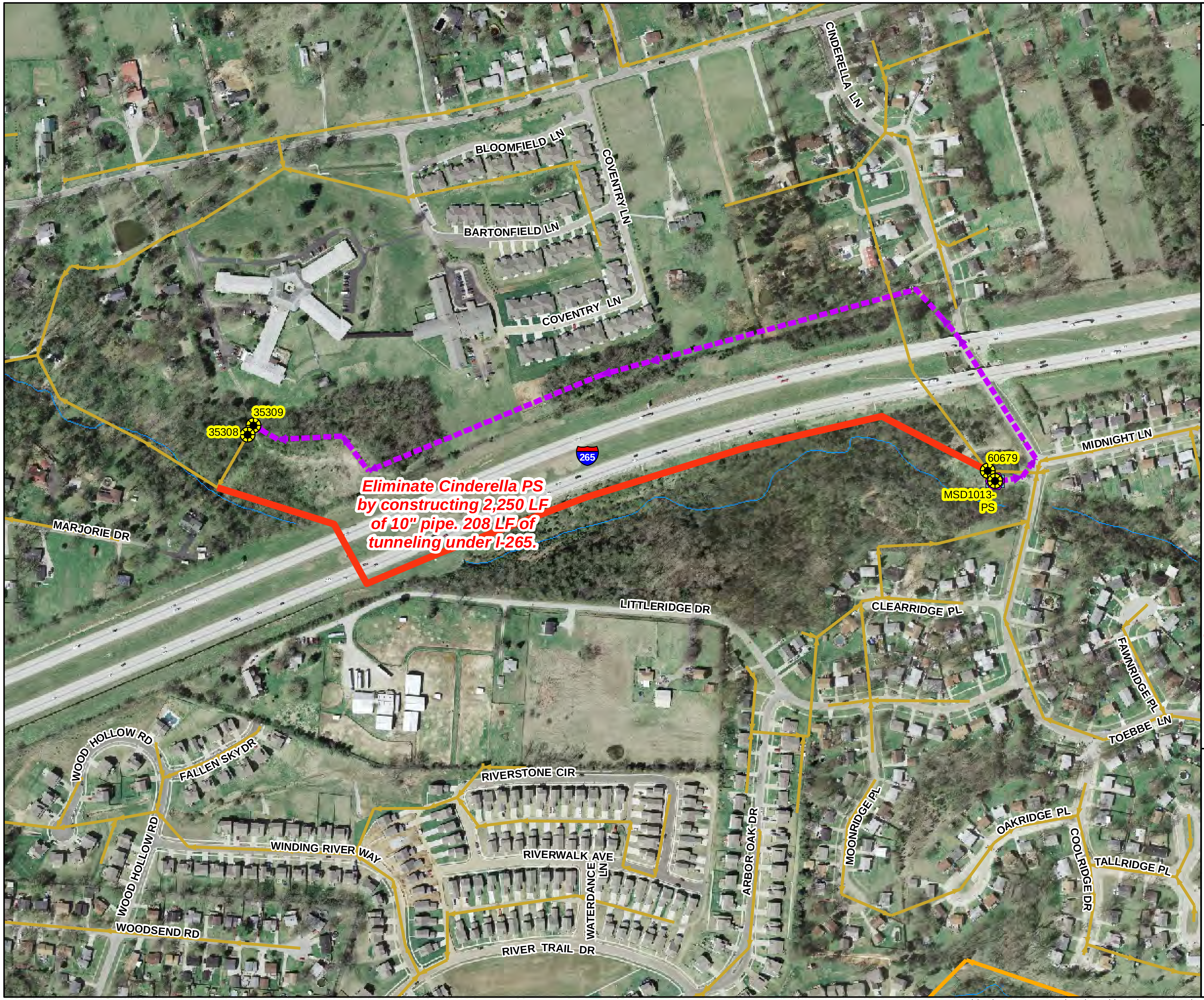
SSO Project Number:	S_PO_WC_PC04_M_01_C
Project Name:	Cinderella PS Elimination
Modeled Area:	Pond Creek
Branch or SSO ID:	PC04
Project Type:	Diversion
Receiving Stream:	Fishpool Creek and Manslick Branch
Project Description:	This alternative eliminates Cinderella PS by constructing 2,250 LF of 10" pipe. 208 LF of tunneling under I-265.
Reason for Overflow:	Pump station and system capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	$2,205,000
Weighted Benefit/Cost Ratio (Present Worth):	22.14

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
35309	Marjorie Drive	West County	Manhole	Ground	10,825
60679	Manhole Adjacent to Cinderella PS	West County	Manhole	Ditch	8,100
MSD1013-PS	Cinderella	West County	Lift Station	Ditch	71,356

Integrated Overflow Abatement Plan
Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed
Solution ID # S_PO_WC_PC04_M_01_C
Cinderella PS Elimination



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CMS Inc. SSDP Map Series: Cinderella PS Wet Weather Storage.mxd

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_PO_WC_PC05_M_07_C

Project Name: Lantana #1 PS I/I Investigation and Rehabilitation

Modeled Area: Pond Creek

Branch or SSO ID: PC05

Project Type: I/I Reduction

Receiving Stream: Pennsylvania Run

Project Description: This location will be targeted for I/I source control (I/I Rehab and private property program.) A full SSES will be performed upstream of this PS. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative will be implemented, which is Offline Storage.

Reason for Overflow: Pump station and system capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

Project Constraints: None

Estimated Capital Cost (2008 dollars): $20,000 (Cost is for SSES only; rehabilitation will be performed under Annual I/I Rehab contracts and the private property program)

Weighted Benefit/Cost Ratio (Present Worth): Only cost calculated for SSES, no benefits are calculated.

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
25484	Near Lantana PS	West County	Manhole	Stream	180,875
93719	Wet Well for Lantana PS	West County	Manhole	Ditch	5,625
MSD0101-PS	Lantana Drive PS #1	West County	Lift Station	Ditch	22,300

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed

Solution ID # S_PO_WC_PC05_M_07_C

Lantana #1 PS I/I Investigation & Rehabilitation

Preliminary - For Budget Development Only

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SSO SSDP
Project Fact Sheet

SSO Project Number:	S_PO_WC_PC06_M_01_C
Project Name:	Government Center PS Elimination
Modeled Area:	Pond Creek
Branch or SSO ID:	PC06
Project Type:	Diversion
Receiving Stream:	Pennsylvania Run
Project Description:	This alternative eliminates Government Center PS by constructing 1,324 LF of 10" pipe. 50 LF of tunneling is required.
Reason for Overflow:	Pump station and system capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	$1,225,000
Weighted Benefit/Cost Ratio (Present Worth):	44.91

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD0180-PS	Government Center	West County	Lift Station	Ditch	12,381

Integrated Overflow Abatement Plan
Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed
Solution ID # S_PO_WC_PC06_M_01_C
Government Center PS Elimination

Preliminary - For Budget Development Only

Legend

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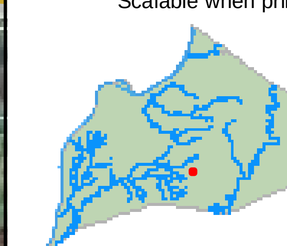

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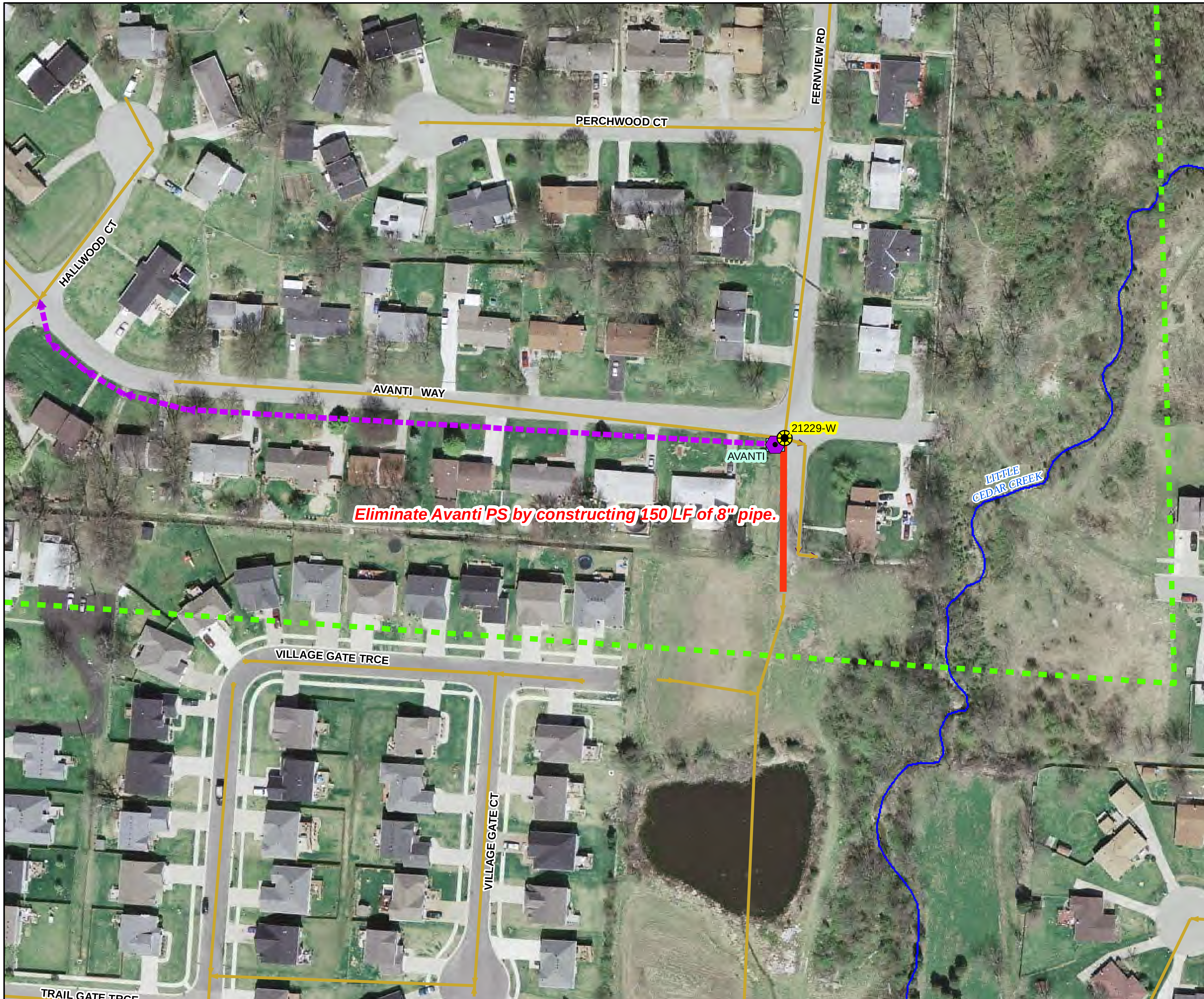
LOJIC MSD PROJECT WIN

SSO SSDP
Project Fact Sheet

SSO Project Number:	S_PO_WC_PC07_M_01_A
Project Name:	Avanti PS Elimination
Modeled Area:	Pond Creek
Branch or SSO ID:	PC07
Project Type:	Diversion
Receiving Stream:	Little Cedar Creek
Project Description:	This alternative eliminates Avanti PS by constructing 150 LF of 8" pipe.
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 2.60 inch cloudburst rain event
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	$31,000
Weighted Benefit/Cost Ratio (Present Worth):	1000.48

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
21229-W	Avanti Way at Fernview Road	No plant	Constructed	Ditch	No Data



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed

Solution ID # S_PO_WC_PC07_M_01_C

Avanti PS Elimination

Preliminary - For Budget Development Only

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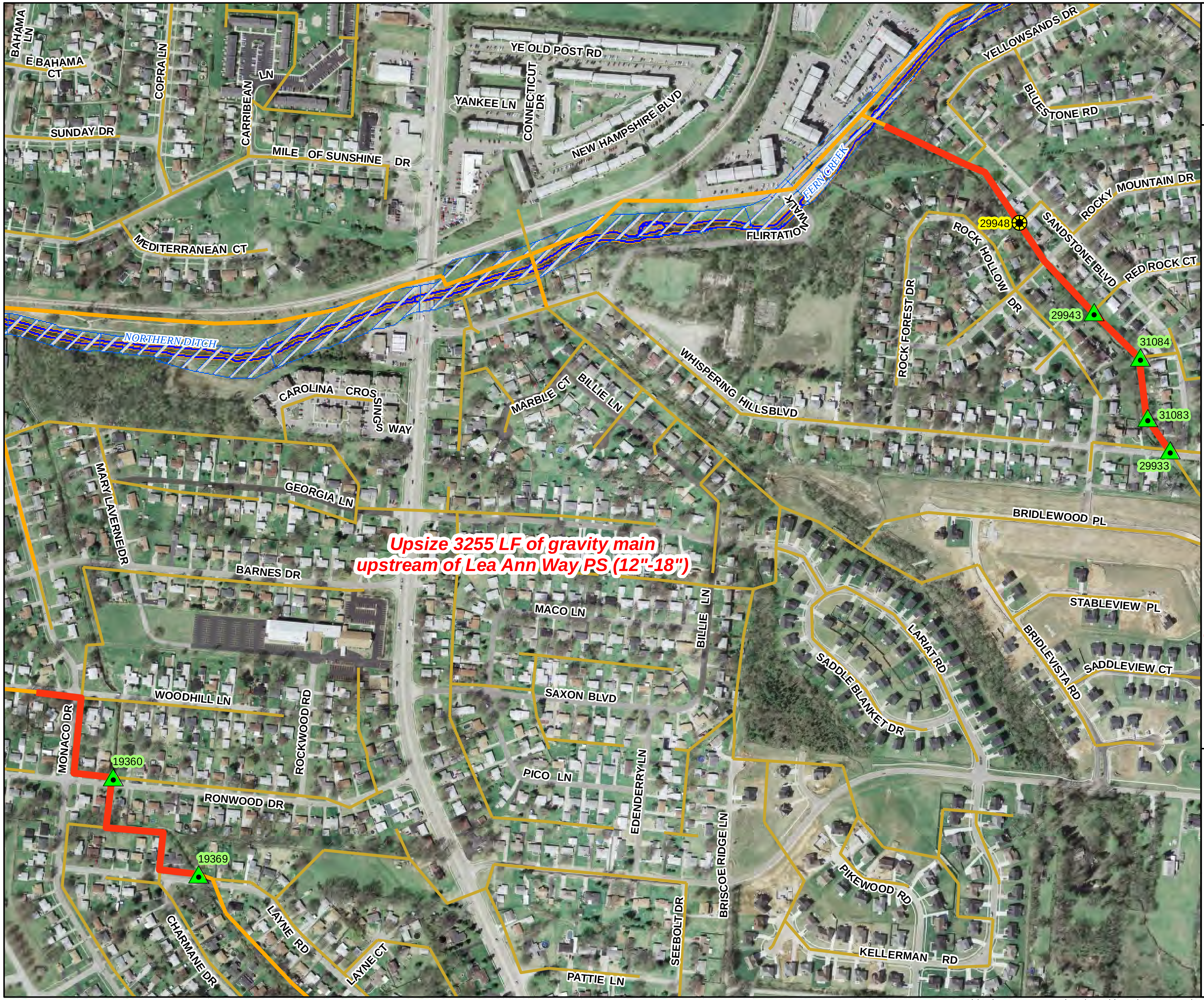
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_PO_WC_PC08_M_01_C
Project Name:	Lea Ann Way System Improvements
Modeled Area:	Pond Creek
Branch or SSO ID:	PC08
Project Type:	Pipe Upgrades
Receiving Stream:	Fern Creek and Northern Ditch
Project Description:	This alternative includes using the restored Lea Ann Way PS with 3,255 LF of open cut sewer (12" to 18") upstream improvements to prevent the overflows.
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$827,000
Weighted Benefit/Cost Ratio (Present Worth):	49.01

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
19360	Rockwood Dr / Monaco	West County	Manhole	Stream	Suspected-no data
19369	5221 Layne Road	West County	Manhole	Stream	Suspected-no data
29933	6926 Sandstone Blvd	West County	Manhole	Stream	Suspected-no data
29943	6906 Sandstone Blvd	West County	Manhole	Stream	Suspected-no data

29948	Sandstone Blvd	West County	Manhole	Ground	75
31083	6924 Sandstone Blvd	West County	Manhole	Stream	Suspected-no data
31084	6916 Sandstone Blvd	West County	Manhole	Stream	Suspected-no data
79076	6308 Hanses Drive	West County	Manhole	Ditch	Suspected-no data
MSD1010-PS	Lea Ann Way	West County	Pumped	Stream	3,024,040



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed

Solution ID # S_PO_WC_PC08_M_01_C

Lea Ann Way System Improvements

Preliminary - For Budget Development Only

Legend

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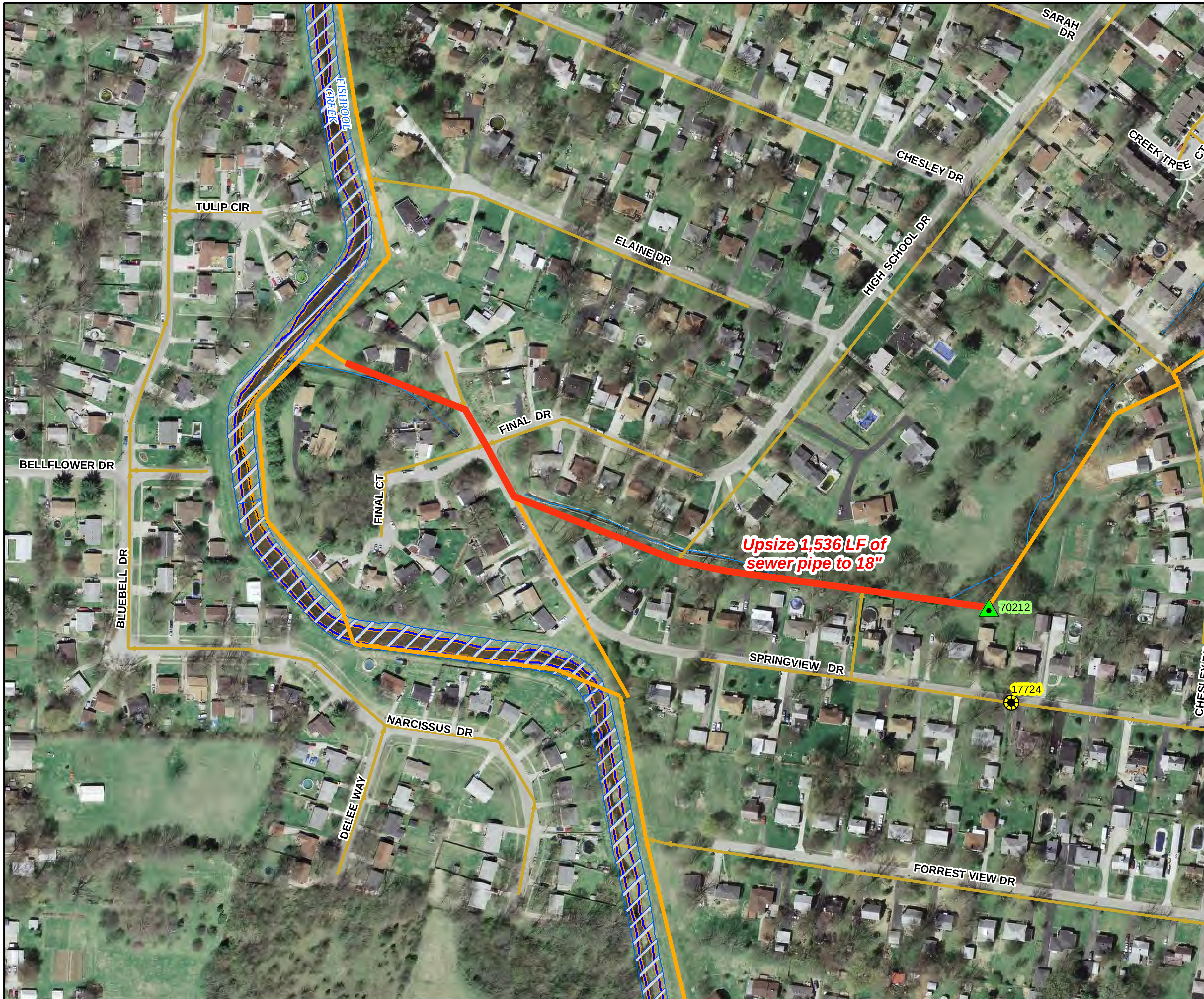
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_PO_WC_PC09_M_09B_C
Project Name:	Outer Loop and Caven Ave. Wet Weather Storage 1 - Pipe Upgrades
Modeled Area:	Pond Creek
Branch or SSO ID:	PC09
Project Type:	Pipe Upgrades
Receiving Stream:	Pond Creek and Mud Creek
Project Description:	This alternative 1,536 LF of pipe upsized to 18" downstream of MH 70212.
Reason for Overflow:	System capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	$731,000
Weighted Benefit/Cost Ratio (Present Worth):	7.08

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
17724	1096 Springview Drive	West County	Manhole	Ditch	33
27116	10306 Caven Avenue	West County	Manhole	Stream	Suspected-no data
70212	1095 Springview Drive	West County	Manhole	Stream	Suspected-no data
MSD0133-PS	Caven Avenue	West County	Pumped	Ground	15,250



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed

Solution ID # S_PO_WC_PC09_M_09B_C

Outer Loop & Caven Ave Wet Weather Storage 1 Pipe Upgrades

Preliminary - For Budget Development Only

Legend

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- Suspected SSO
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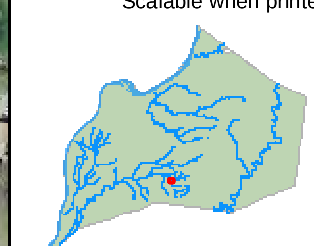

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CMS Inc. SSDP Map Series: Outer Loop & Caven Ave Wet Weather Storage.mxd

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SSO SSDP
Project Fact Sheet

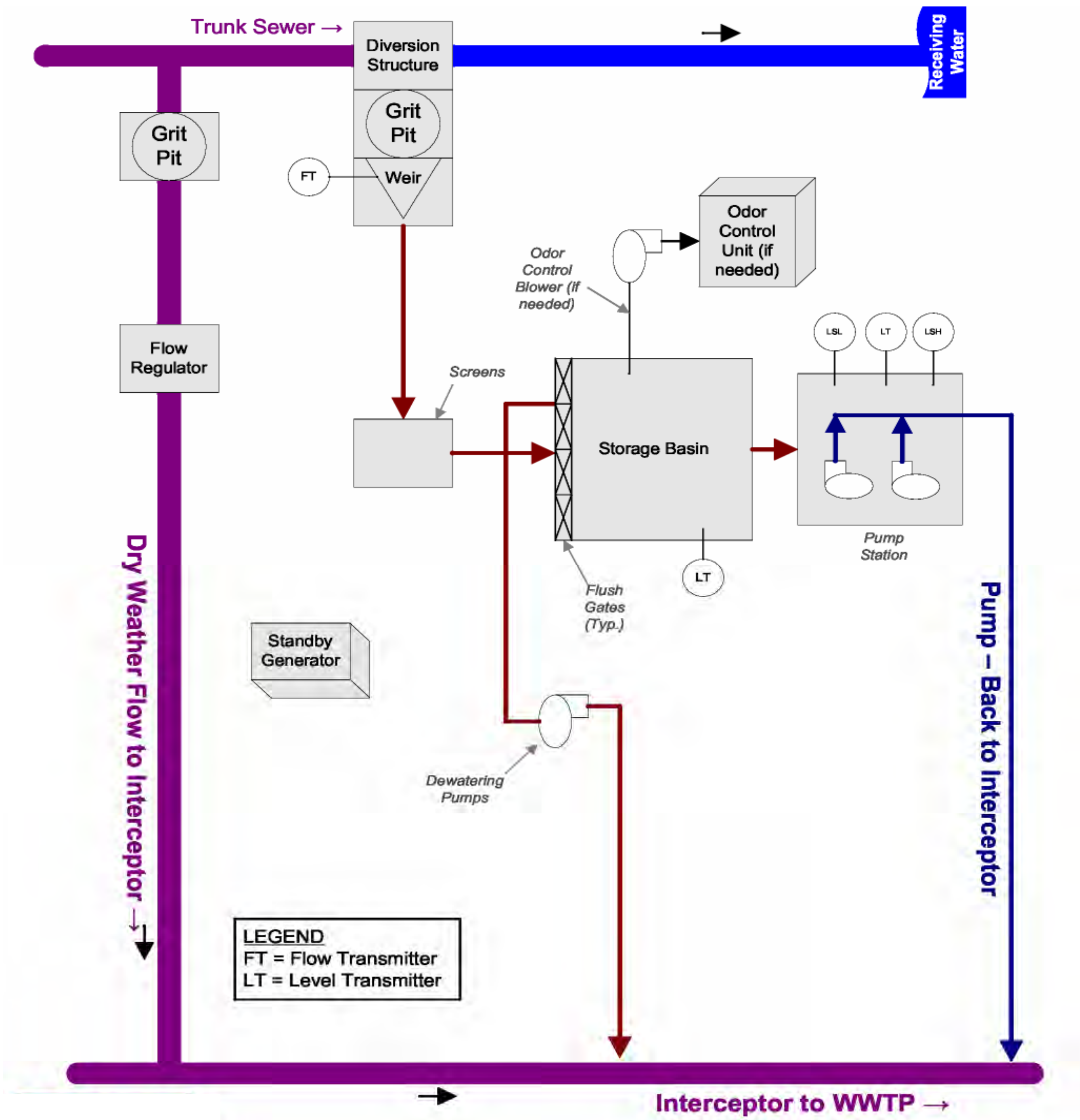
SSO Project Number:	S_PO_WC_PC09_M_09B_C
Project Name:	Outer Loop and Caven Ave. Wet Weather Storage 2 - Outer Loop Wet Weather Storage
Modeled Area:	Pond Creek
Branch or SSO ID:	PC09
Project Type:	Off-line Storage
Receiving Stream:	Pond Creek and Mud Creek
Project Description:	This alternative includes offline, pumped storage (closed 1.42 MG) behind the Meijer on Preston Highway. This facility may be necessary to alleviate future predicted overflows caused by upstream IOAP projects. The schedule allows for future consideration and investigation of alternate locations as well as re-evaluation of facility need based on future flow monitoring. If monitoring and modeling in the future proves this facility is not needed, documentation of the analysis will be submitted to appropriate regulatory agencies.
Reason for Overflow:	System capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	The excavation at the Meijer basin will occur in rock. Depth of rock at site is unknown.
Estimated Capital Cost (2008 dollars):	$4,280,000
Weighted Benefit/Cost Ratio (Present Worth):	7.08

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
17724	1096 Springview Drive	West County	Manhole	Ditch	33
27116	10306 Caven Avenue	West County	Manhole	Stream	Suspected-no data
70212	1095 Springview Drive	West County	Manhole	Stream	Suspected-no data
MSD0133-PS	Caven Avenue	West County	Pumped	Ground	15,250

SSO Project Number: S_PO_WC_PC09_M_09B_C

**Off-Line Storage
Pumped Effluent
Flow Diagram**



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed

Solution ID # S_PO_WC_PC09_M_09B_C

Outer Loop & Caven Ave Wet Weather Storage 2
Outer Loop Wet Weather Storage

Preliminary - For Budget Development Only

Legend

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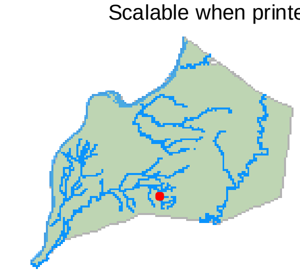

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MSD Metropolitan Sewer District

SSO SSDP
Project Fact Sheet

PROJECT WIN Waterway Improvements Now

SSO Project Number:	S_PO_WC_PC09_M_09B_C
Project Name:	Outer Loop and Caven Ave. Wet Weather Storage 3 - Caven Ave Wet Weather Storage
Modeled Area:	Pond Creek
Branch or SSO ID:	PC09
Project Type:	Off-line Storage
Receiving Stream:	Pond Creek and Mud Creek
Project Description:	This alternative includes an off-line gravity storage (covered 0.21 MG) at Caven Avenue PS
Reason for Overflow:	System capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	$1,073,000
Weighted Benefit/Cost Ratio (Present Worth):	7.08

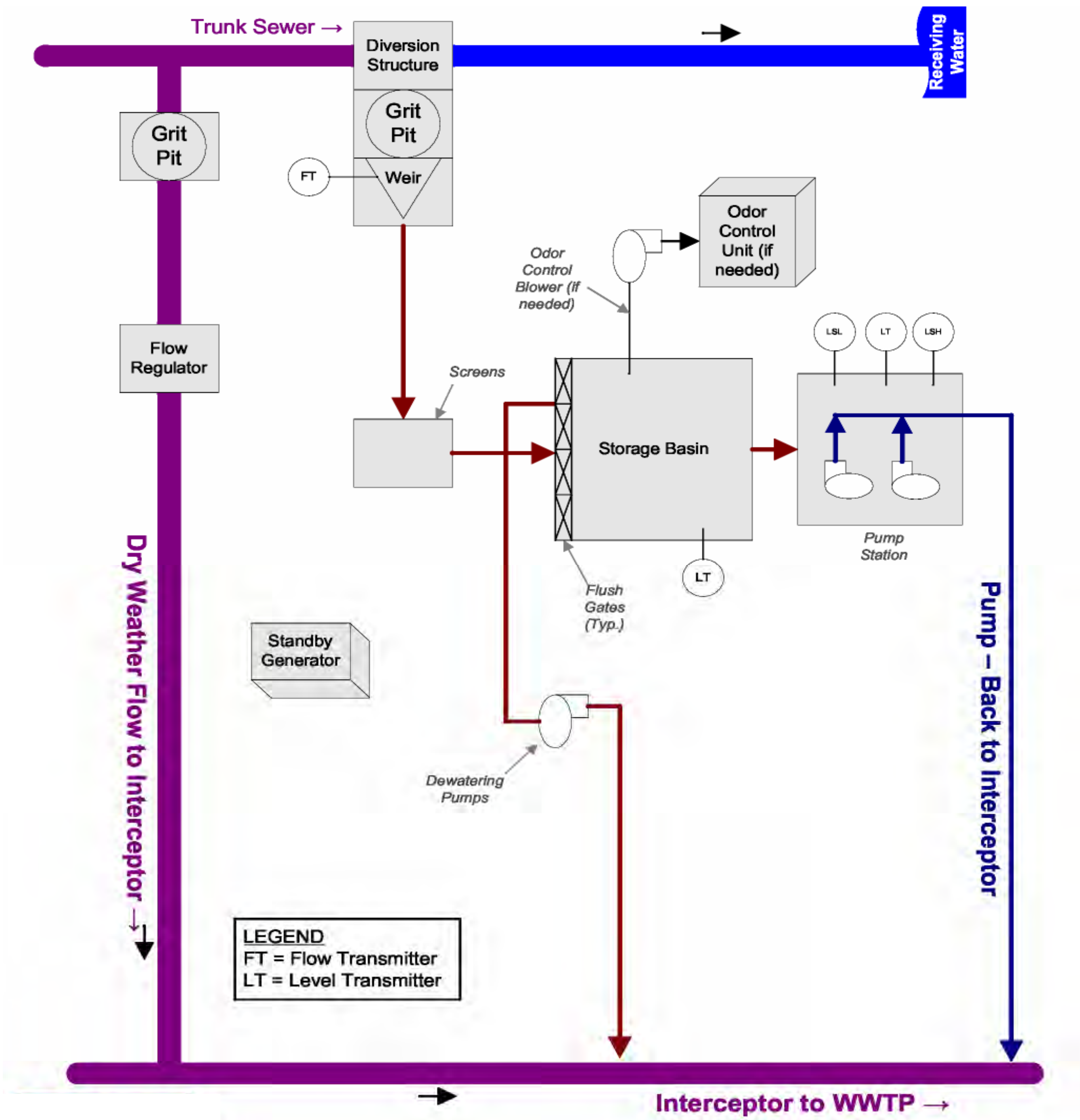
Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
17724	1096 Springview Drive	West County	Manhole	Ditch	33
27116	10306 Caven Avenue	West County	Manhole	Stream	Suspected-no data
70212	1095 Springview Drive	West County	Manhole	Stream	Suspected-no data
MSD0133-PS	Caven Avenue	West County	Pumped	Ground	15,250

SSO SSDP
Project Fact Sheet

SSO Project Number: S_PO_WC_PC09_M_09B_C

**Off-Line Storage
Pumped Effluent
Flow Diagram**



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed

Solution ID # S_PO_WC_PC09_M_09B_C

Outer Loop & Caven Ave Wet Weather Storage 3

Caven Ave. Wet Weather Storage

Preliminary - For Budget Development Only

Legend

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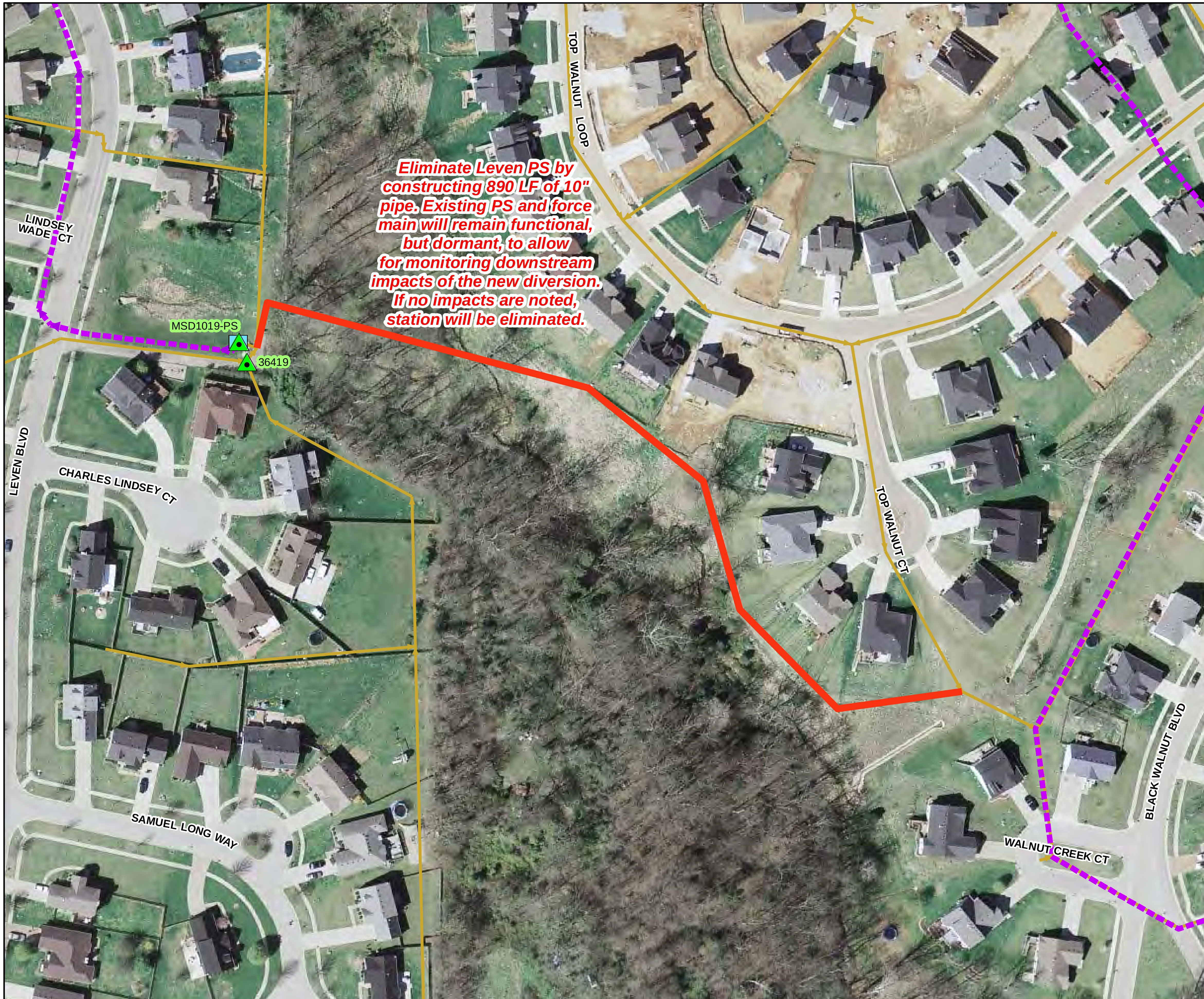
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_PO_WC_PC10_M_01_C
Project Name:	Leven PS Elimination
Modeled Area:	Pond Creek
Branch or SSO ID:	PC10
Project Type:	Diversion
Receiving Stream:	Pennsylvania Run
Project Description:	Eliminate Leven PS by constructing 890 LF of 10" pipe. Existing PS and force main will remain functional, but dormant, to allow for monitoring downstream impacts of the new diversion. If no impacts are noted, station will be eliminated and force main taken out of service. If downstream impacts arise, the PS will be reconfigured to supplement the capacity of the new diversion line.
Reason for Overflow:	Pump station capacity and hydraulic bottlenecks
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	$376,000
Weighted Benefit/Cost Ratio (Present Worth):	95.93

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
36419	10601 Leven Blvd	West County	Manhole	Ditch	Suspected-no data
MSD1019-PS	Leven	West County	Pumped	Stream	Suspected-no data



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed

Solution ID # S_PO_WC_PC10_M_01_C

Leven PS Elimination

Preliminary - For Budget Development Only

Legend

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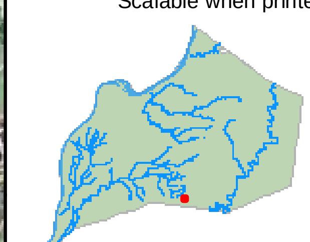

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_PO_WC_PC11_M_07_C

Project Name: Edsel PS I/I Investigation and Rehabilitation

Modeled Area: Pond Creek

Branch or SSO ID: PC11

Project Type: I/I Reduction

Receiving Stream: Fern Creek

Project Description: This location will be targeted for I/I source control (I/I rehab and private property program). A full SSES will be performed upstream of this PS. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative will be implemented, which is Offline Storage.

Reason for Overflow: Pump station capacity and hydraulic bottlenecks

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

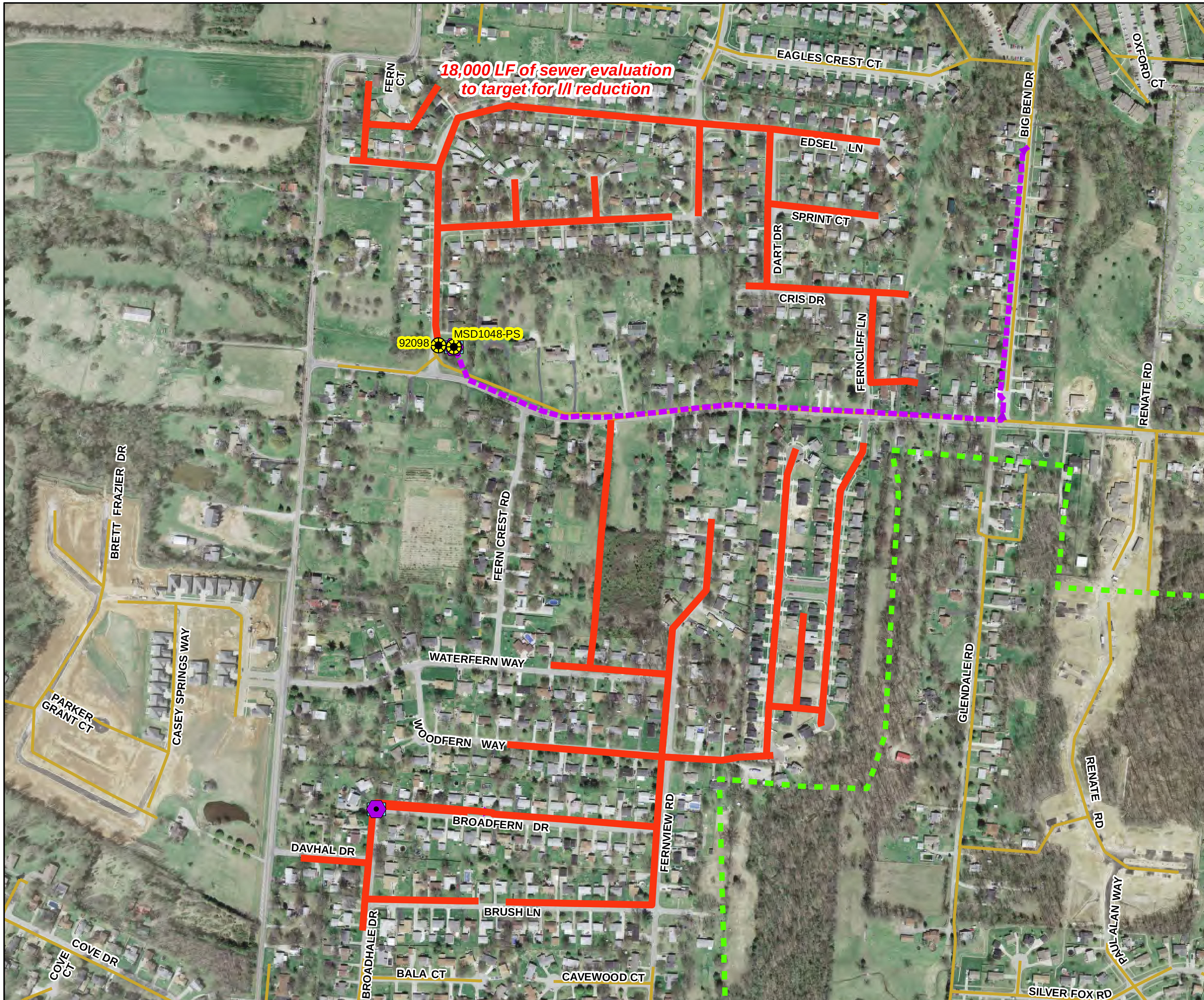
Project Constraints: None

Estimated Capital Cost (2008 dollars): $367,000 (Cost is for SSES only; rehabilitation will be performed under Annual I/I Rehab contracts and the private property program)

Weighted Benefit/Cost Ratio (Present Worth): Only cost calculated for SSES, no benefits are calculated

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
92098	7801 Edsel Lane (Upstream of Edsel Lane PS)	West County	Pumped	Ground	3,600
MSD1048-PS	Edsel	West County	Lift Station	Ground	91,500



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Pond Creek Sewershed

Solution ID # S_PO_WC_PC11_M_07_C

Edsel PS I&I Investigation and Rehabilitation

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

General representation of overflow abatement solutions are for preliminary planning purposes. Alignments and locations may be altered during design.

1 inch = 400 feet
Scalable when printed on 11" X 17" paper

Some boundaries are uniquely symbolized within the map.

Map Revision
May 07, 2009

Aerial Date: 2006

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MSD

Metropolitan Sewer District

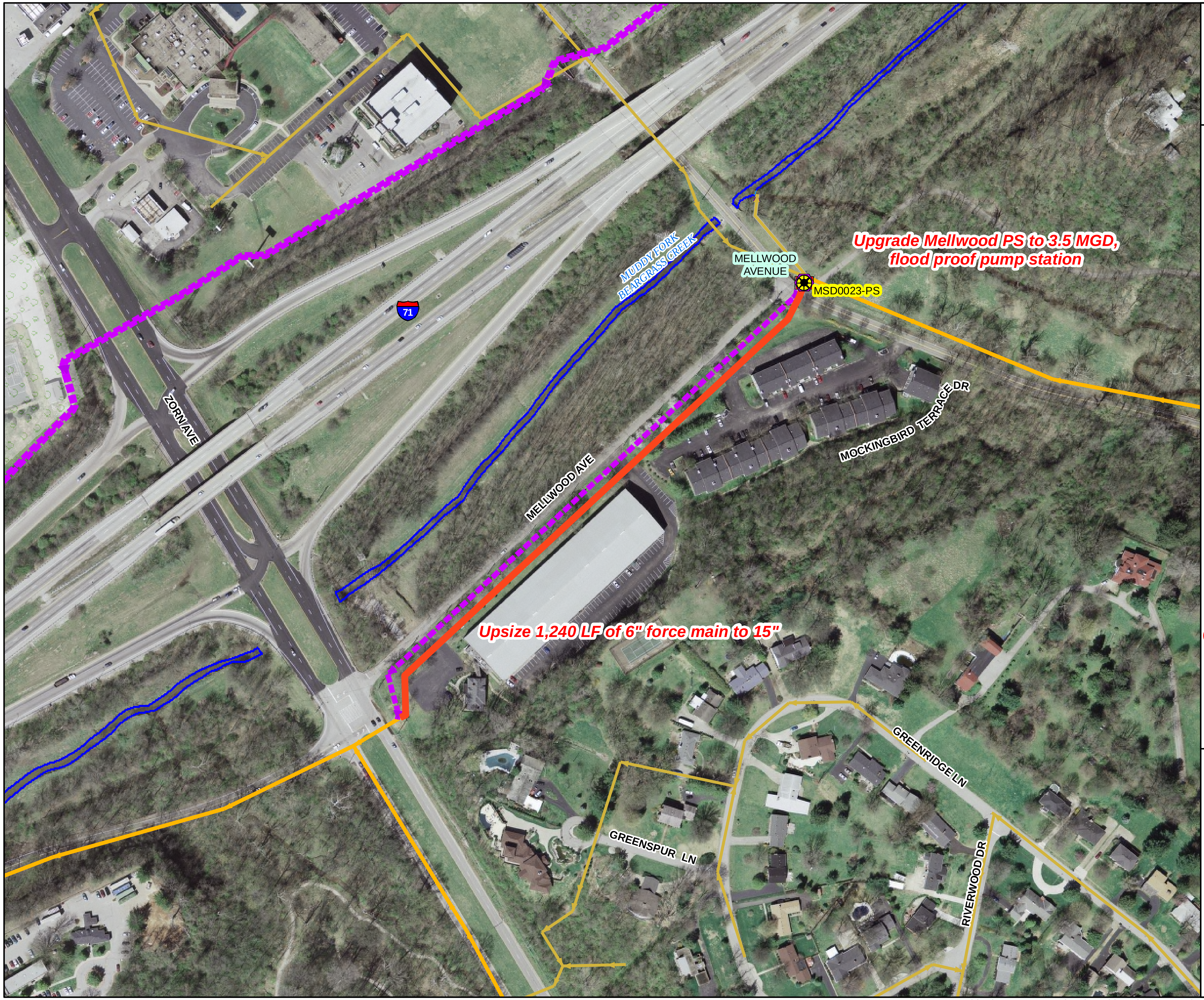
OHIO RIVER FORCE MAIN AREA

SSO SSDP
Project Fact Sheet

SSO Project Number:	S_OR_MF_NB01_M_01_B
Project Name:	Mellwood System Improvements and PS Eliminations 1 - Mellwood PS & Force Main
Modeled Area:	ORFM
Branch or SSO ID:	NB01
Project Type:	Pump Station & Pipe Upgrades
Receiving Stream:	Muddy Fork Beargrass Creek
Project Description:	This alternative includes a total pump station upgrade at Mellwood PS to 3.5 MGD and replace approximately 1,240 LF of 6" of force main with 15". PS needs to be flood-proofed due to its proximity to the Ohio River.
Reason for Overflow:	Pump station capacity & system capacity
Design Parameters / Assumptions:	This solution is based on a 2.25 inch cloudburst rain event
Project Constraints:	None
Capital Projects:	F06298 ~ Canoe Pump Station Elimination - Under Design; 2005 ~ Jarvis Pump Station upgrades - Completed
Estimated Capital Cost (2008 dollars):	$2,168,000
Weighted Benefit/Cost Ratio (Present Worth):	26.97

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
24472	501 Mockingbird Valley Road	Morris Forman	Manhole	Stream	MOP-no data
26752	Brownsboro Road at Mockingbird Valley #1	Morris Forman	Manhole	Ditch	25
41374	Brownsboro Road at Mockingbird Valley #2	Morris Forman	Manhole	Ditch	100
41416	3202 Brownsboro Road	Morris Forman	Manhole	Ditch	Suspected-no data
24152-W	3733 Canoe Lane (Wet Well for Canoe Ln PS)	Morris Forman	Constructed	Stream	60,750
MSD0007-PS	Mockingbird Valley	Morris Forman	Constructed	Ditch	10,840
MSD0010-PS	Winton	Morris Forman	Constructed	Catch Basin	45
MSD0023-PS	Mellwood Avenue	Morris Forman	Constructed	Stream	287,472
MSD0024-PS	Canoe Lane	Morris Forman	Lift Station	Ditch	15,769



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan
Ohio River Force Main Sewershed
Solution ID # S_OR_MF_NB01_M_01_B
Mellwood System Improvements &
PS Eliminations 1 - Mellwood PS & Force Main

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

General representation of overflow abatement solutions are for preliminary planning purposes. Alignments and locations may be altered during design.

1 inch equals 200 feet
Scalable when printed on 11" X 17" paper

Some boundaries are uniquely symbolized within the map.

Map Revision
May 7, 2009

Aerial Date: 2006

N

SDI Inc. SSDP Map Series: Mellwood System Improvements & PS Eliminations.mxd

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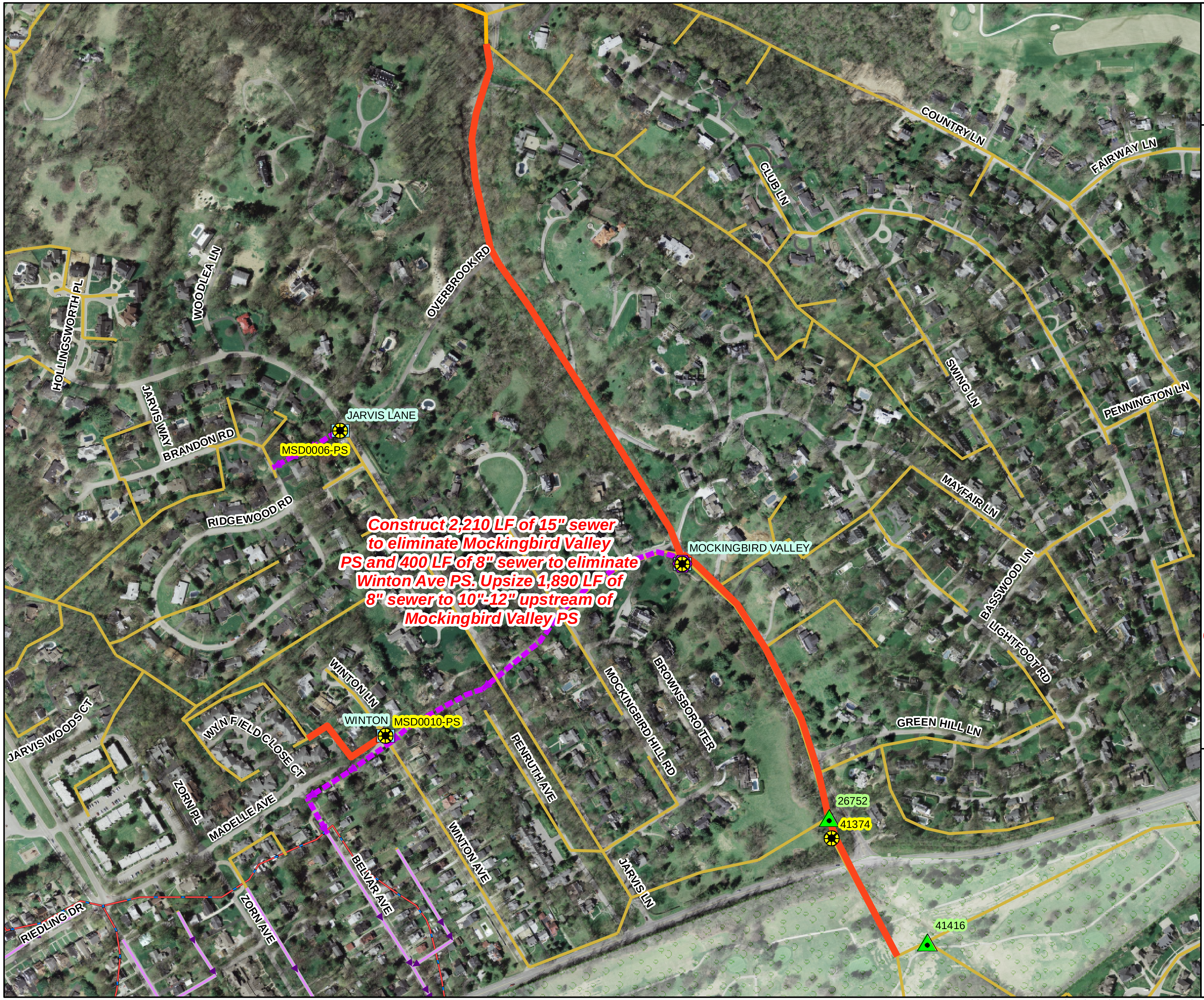
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_OR_MF_NB01_M_01_B
Project Name:	Mellwood System Improvements and PS Eliminations 2 - Winton Ave PS / Mockingbird Valley PS Eliminations
Modeled Area:	ORFM
Branch or SSO ID:	NB01
Project Type:	Pipe Upgrades & Diversion
Receiving Stream:	Muddy Fork Beargrass Creek
Project Description:	This alternative includes the replacement of approximately 1,890 LF of 8" gravity sewer flowing into Mockingbird Valley PS. Installation of 400 LF of 8" pipe for Winton Diversion and 2,200 LF of 15" pipe for Mockingbird Diversion. 300 LF of the sewer is tunneled. Winton and Mockingbird Valley PS will be eliminated.
Reason for Overflow:	Pump station capacity & system capacity
Design Parameters / Assumptions:	This solution is based on a 2.25 inch cloudburst rain event
Project Constraints:	None
Capital Projects:	F06298 ~ Canoe Pump Station Elimination - Under Design; 2005 ~ Jarvis Pump Station upgrades - Completed
Estimated Capital Cost (2008 dollars):	$887,000
Weighted Benefit/Cost Ratio (Present Worth):	26.97

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
24472	501 Mockingbird Valley Road	Morris Forman	Manhole	Stream	MOP-no data
26752	Brownsboro Road at Mockingbird Valley #1	Morris Forman	Manhole	Ditch	25
41374	Brownsboro Road at Mockingbird Valley #2	Morris Forman	Manhole	Ditch	100
41416	3202 Brownsboro Road	Morris Forman	Manhole	Ditch	Suspected-no data
24152-W	3733 Canoe Lane (Wet Well for Canoe Ln PS)	Morris Forman	Constructed	Stream	60,750
MSD0007-PS	Mockingbird Valley	Morris Forman	Constructed	Ditch	10,840
MSD0010-PS	Winton	Morris Forman	Constructed	Catch Basin	45
MSD0023-PS	Mellwood Avenue	Morris Forman	Constructed	Stream	287,472
MSD0024-PS	Canoe Lane	Morris Forman	Lift Station	Ditch	15,769



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan
Ohio River Force Main Sewershed
Solution ID # S_OR_MF_NB01_M_01_B
Mellwood System Improvements &
PS Eliminations 2 - Winton Ave PS /
Mockingbird Valley PS Eliminations

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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Scalable when printed on 11" X 17" paper

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Map Revision
May 7, 2009

Aerial Date: 2006

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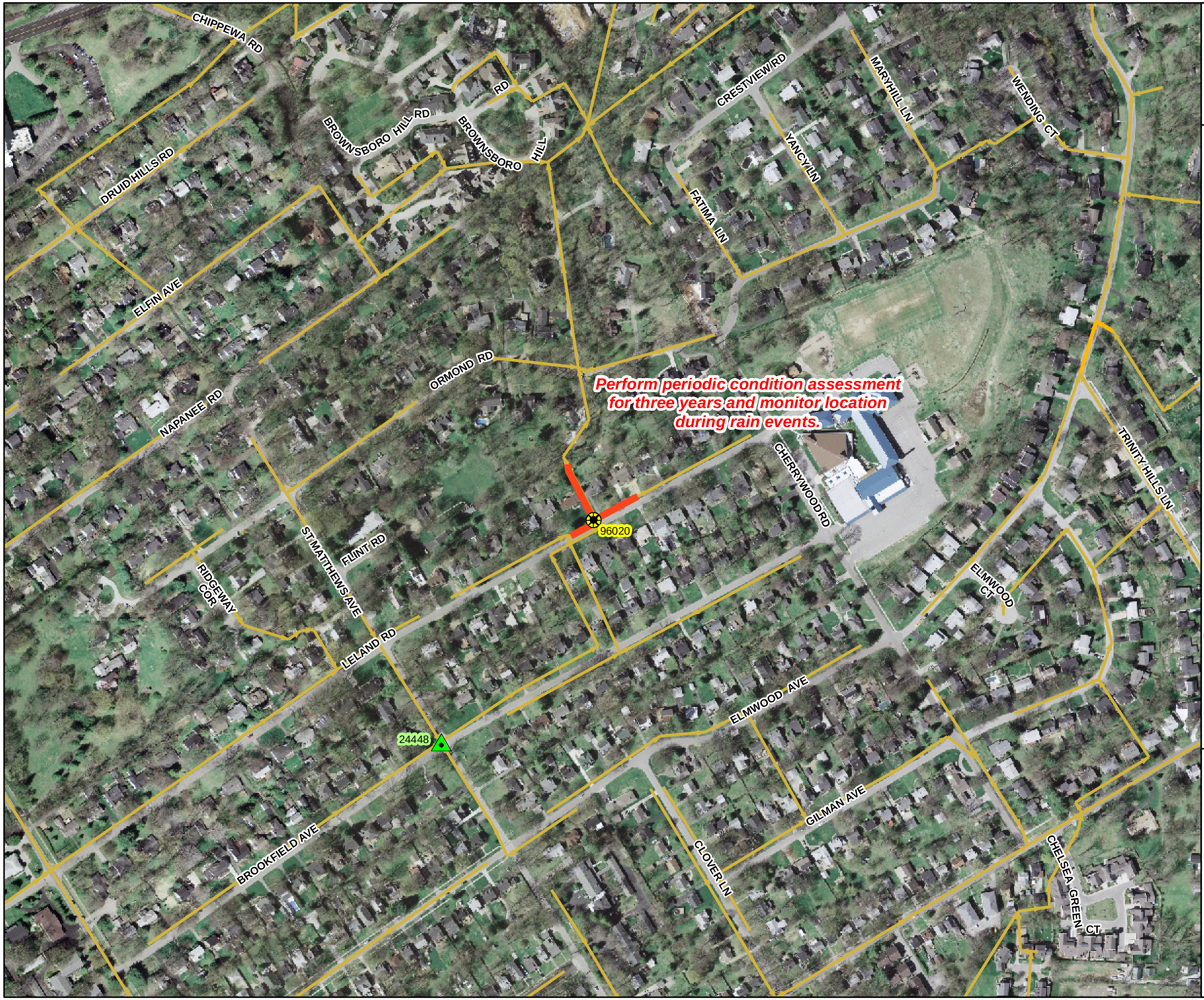
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_OR_MF_NB02_S_13_C
Project Name:	Leland Rd. SSO Investigation
Modeled Area:	ORFM
Branch or SSO ID:	NB02
Project Type:	Condition Assessment
Receiving Stream:	Cherrywood Creek
Project Description:	Perform periodic condition assessment for three years and monitor location during rain events.
Reason for Overflow:	Hydraulic bottleneck - Suspected Blockage
Design Assumptions:	Cleaning/flushing has occurred twice since March 2006 (last documented overflow date) and no additional overflows have been reported since that date. Overflow is believed to be a maintenance issue.
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	This work will be performed under the SORP/CMOM programs
Weighted Benefit/Cost Ratio (Present Worth):	--

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
96020	Leland Road	Morris Forman	Manhole	Ground	20



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Ohio River Force Main Sewershed
Solution ID # S_OR_MF_NB02_S_13_C
Leland Rd SSO Investigation

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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Map Revision
May 7, 2009

Aerial Date: 2006

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_OR_MF_NB03_S_07_C

Project Name: Derington Ct. PS I/I Investigation and Rehabilitation

Modeled Area: ORFM

Branch or SSO ID: NB03

Project Type: I/I Reduction

Receiving Stream: Goose Creek

Project Description: This location will be targeted for I/I source control (I/I rehab and private property program). A full SSES will be performed upstream of this PS. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative will be implemented, which is Inline Storage.

Reason for Overflow: Pump station capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

Project Constraints: None

Estimated Capital Cost (2008 dollars): $265,000 (Cost is for SSES only; rehabilitation will be performed under Annual I/I Rehab contracts and the private property program)

Weighted Benefit/Cost Ratio (Present Worth): Only cost calculated for SSES, no benefits are calculated.

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD0095-PS	Derington Court	Morris Forman	Pumped	Stream	18,875

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Ohio River Force Main Sewershed

Solution ID # S_OR_MF_NB03_S_07_C

Derington Ct. PS I&I

Investigation & Rehabilitation

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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Map Revision

May 7, 2009

Aerial Date: 2006

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LOJIC MSD Metropolitan Sewer District PROJECT WIN

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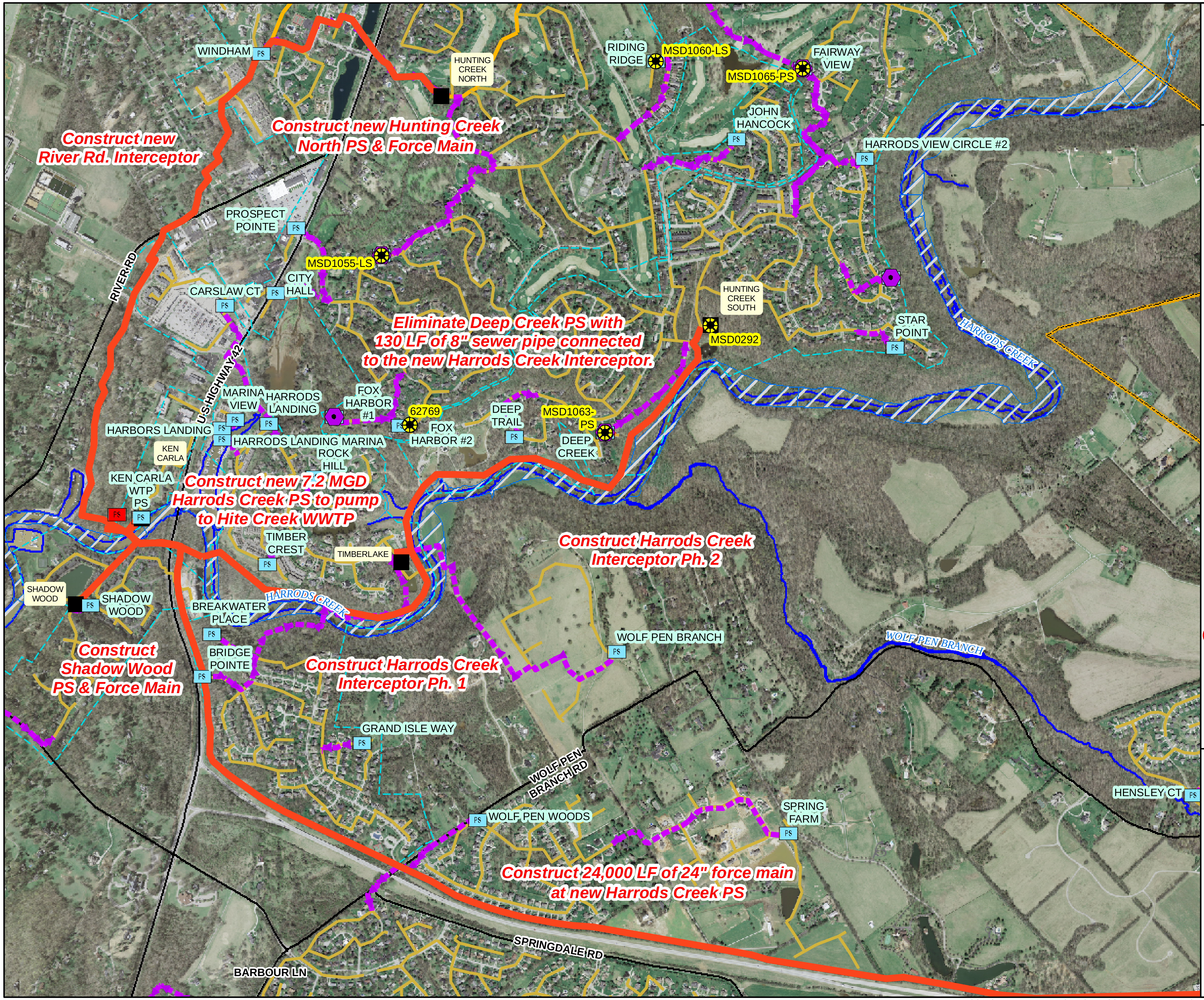
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_OR_MF_NB04_M_03_B_B
Project Name:	Prospect # 1 - WQTC Eliminations
Modeled Area:	ORFM
Branch or SSO ID:	NB04
Project Type:	Pipe Upgrades, Diversion, WQTC Eliminations
Receiving Stream:	Goose Creek, Little Goose Creek, Harrods Creek, Muddy Fork Beargrass Creek, and Ohio River
Project Description:	Construct new Harrods Creek Interceptor, including 15,000 LF of 24-42" sewer pipe and 3,400 LF of 6" force main to eliminate five Prospect WQTCs; also includes construction of two new pump stations. Eliminate Deep Creek PS by constructing 130 LF of 8" sewer pipe to the new Harrods Creek Interceptor. Elimination of the WQTCs by 2015 is a requirement of the Amended Consent Decree.
Reason for Overflow:	ORFM and pump station capacity, WQTC capacity
Design Parameters / Assumptions:	This solution is based on a 2.25 inch cloudburst rain event
Project Constraints:	None
Capital Projects:	Barbour Lane, Hillsdale, Glenview Hills & New Market Pump Station Expansions - Awaiting Bidding; Harrods Creek PS
Estimated Capital Cost (2008 dollars):	$17,247,000
Weighted Benefit/Cost Ratio (Present Worth):	1.69

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
22436	Manhole Adjacent to West Goose Creek PS	Morris Forman	Pumped	Ditch	30,275
40870	Muddy Fork PS #1	Morris Forman	Manhole	Ditch	41,800
40871	Muddy Fork PS #2	Morris Forman	Manhole	Ditch	150,067
40872	Muddy Fork PS #3	Morris Forman	Manhole	Ground	183,400
42680	Barbour Lane #1	Morris Forman	Pumped	Stream	162,000
65633	Barbour Lane #2	Morris Forman	Manhole	Stream	102,125
65635	Barbour Lane #3	Morris Forman	Manhole	Stream	25,500
MSD0292	Hunting Creek South WWTP	Hunting Creek South	Treatment Plant	Stream	117,436
MSD0123-PS	West Goose Creek	Morris Forman	Lift Station	Ditch	36,750
MSD0183-PS	Glenview Hills	Morris Forman	Lift Station	Ditch	73,733
MSD0192-PS	Barbour Lane	Morris Forman	Lift Station	Stream	38,581
MSD0193-PS	New Market	Morris Forman	Lift Station	Stream	16,333
MSD1044-PS	Phoenix Hill	Morris Forman	Pumped	Ground	2,252
MSD1063-PS	Deep Creek PS	Hunting Creek South	Lift Station	Ditch	15,623



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Ohio River Force Main Sewershed

Solution ID # S_OR_MF_NB04_M_03_B_B

Prospect #1 - WQTC Eliminations

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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1 inch equals 1,200 feet
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Map Revision
May 7, 2009

Aerial Date: 2006

N

LOJIC MSD PROJECT WIN

SDI Inc. SSDP Map Series: Prospect 1 - WWTP Eliminations.mxd

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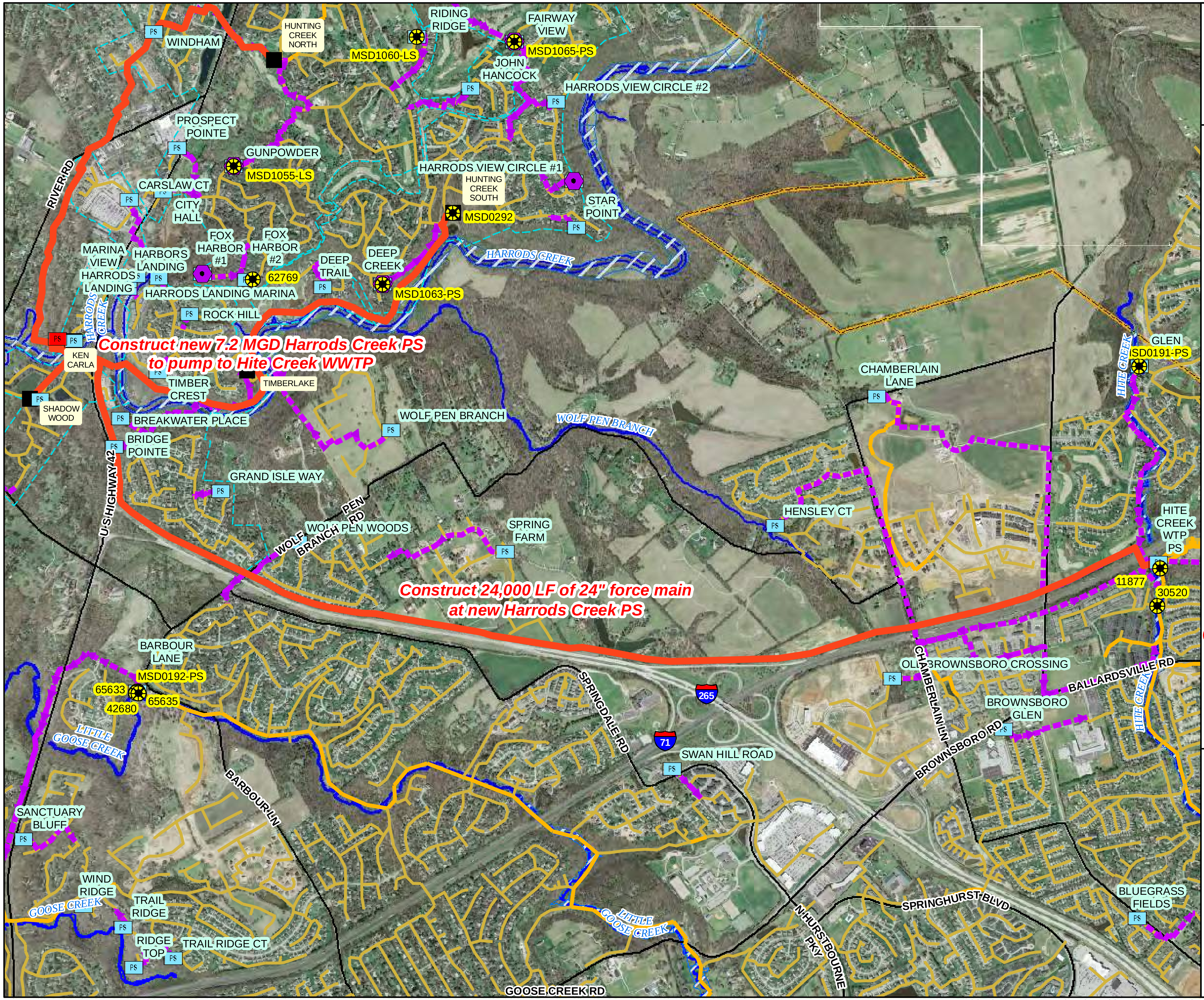
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_OR_MF_NB04_M_03_B_B
Project Name:	Prospect # 2 - Harrods Creek PS
Modeled Area:	ORFM
Branch or SSO ID:	NB04
Project Type:	Pump Station & Pipe Upgrades
Receiving Stream:	Goose Creek, Little Goose Creek, Harrods Creek, Muddy Fork Beargrass Creek, and Ohio River
Project Description:	Construct new 7.2 MGD Harrods Creek PS and 24,000 LF of 24" force main to pump flow to Hite Creek WQTC.
Reason for Overflow:	ORFM and pump station capacity, WQTC capacity
Design Parameters / Assumptions:	This solution is based on a 2.25 inch cloudburst rain event
Project Constraints:	None
Capital Projects:	Barbour Lane, Hillsdale, Glenview Hills & New Market Pump Station Expansions - Awaiting Bidding; Harrods Creek PS
Estimated Capital Cost (2008 dollars):	$9,621,000
Weighted Benefit/Cost Ratio (Present Worth):	1.69

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
22436	Manhole Adjacent to West Goose Creek PS	Morris Forman	Pumped	Ditch	30,275
40870	Muddy Fork PS #1	Morris Forman	Manhole	Ditch	41,800
40871	Muddy Fork PS #2	Morris Forman	Manhole	Ditch	150,067
40872	Muddy Fork PS #3	Morris Forman	Manhole	Ground	183,400
42680	Barbour Lane #1	Morris Forman	Pumped	Stream	162,000
65633	Barbour Lane #2	Morris Forman	Manhole	Stream	102,125
65635	Barbour Lane #3	Morris Forman	Manhole	Stream	25,500
MSD0292	Hunting Creek South WWTP	Hunting Creek South	Treatment Plant	Stream	117,436
MSD0123-PS	West Goose Creek	Morris Forman	Lift Station	Ditch	36,750
MSD0183-PS	Glenview Hills	Morris Forman	Lift Station	Ditch	73,733
MSD0192-PS	Barbour Lane	Morris Forman	Lift Station	Stream	38,581
MSD0193-PS	New Market	Morris Forman	Lift Station	Stream	16,333
MSD1044-PS	Phoenix Hill	Morris Forman	Pumped	Ground	2,252
MSD1063-PS	Deep Creek PS	Hunting Creek South	Lift Station	Ditch	15,623



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Ohio River Force Main Sewershed

Solution ID # S_OR_MF_NB04_M_03_B_B

Prospect #2 - Harrods Creek PS

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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1 inch = 1,800 feet
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Some boundaries are uniquely symbolized within the map.

Map Revision
May 7, 2009

Aerial Date: 2006

N

SSO SSDP
Project Fact Sheet

SSO Project Number:	S_OR_MF_NB04_M_03_B_B
Project Name:	Prospect # 3 - ORFM System Improvements
Modeled Area:	ORFM
Branch or SSO ID:	NB04
Project Type:	Pump Station & Pipe Upgrades
Receiving Stream:	Goose Creek, Little Goose Creek, Harrods Creek, Muddy Fork Beargrass Creek, and Ohio River
Project Description:	Upsize 8,300 LF of interceptor upstream of Muddy Fork PS to 27". Upgrade pumps at Muddy Fork, Winding Falls/Phoenix Hill PS and New Market PS. Upsize force main from Muddy Fork PS to 24".
Reason for Overflow:	ORFM and pump station capacity
Design Parameters / Assumptions:	This solution is based on a 2.25 inch cloudburst rain event
Project Constraints:	None
Capital Projects:	Barbour Lane, Hillsdale, Glenview Hills & New Market Pump Station Expansions - Awaiting Bidding; Harrods Creek PS
Estimated Capital Cost (2008 dollars):	$7,194,000
Weighted Benefit/Cost Ratio (Present Worth):	1.69

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
22436	Manhole Adjacent to West Goose Creek PS	Morris Forman	Pumped	Ditch	30,275
40870	Muddy Fork PS #1	Morris Forman	Manhole	Ditch	41,800
40871	Muddy Fork PS #2	Morris Forman	Manhole	Ditch	150,067
40872	Muddy Fork PS #3	Morris Forman	Manhole	Ground	183,400
42680	Barbour Lane #1	Morris Forman	Pumped	Stream	162,000
65633	Barbour Lane #2	Morris Forman	Manhole	Stream	102,125
65635	Barbour Lane #3	Morris Forman	Manhole	Stream	25,500
MSD0292	Hunting Creek South WWTP	Hunting Creek South	Treatment Plant	Stream	117,436
MSD0123-PS	West Goose Creek	Morris Forman	Lift Station	Ditch	36,750
MSD0183-PS	Glenview Hills	Morris Forman	Lift Station	Ditch	73,733
MSD0192-PS	Barbour Lane	Morris Forman	Lift Station	Stream	38,581
MSD0193-PS	New Market	Morris Forman	Lift Station	Stream	16,333
MSD1044-PS	Phoenix Hill	Morris Forman	Pumped	Ground	2,252
MSD1063-PS	Deep Creek PS	Hunting Creek South	Lift Station	Ditch	15,623

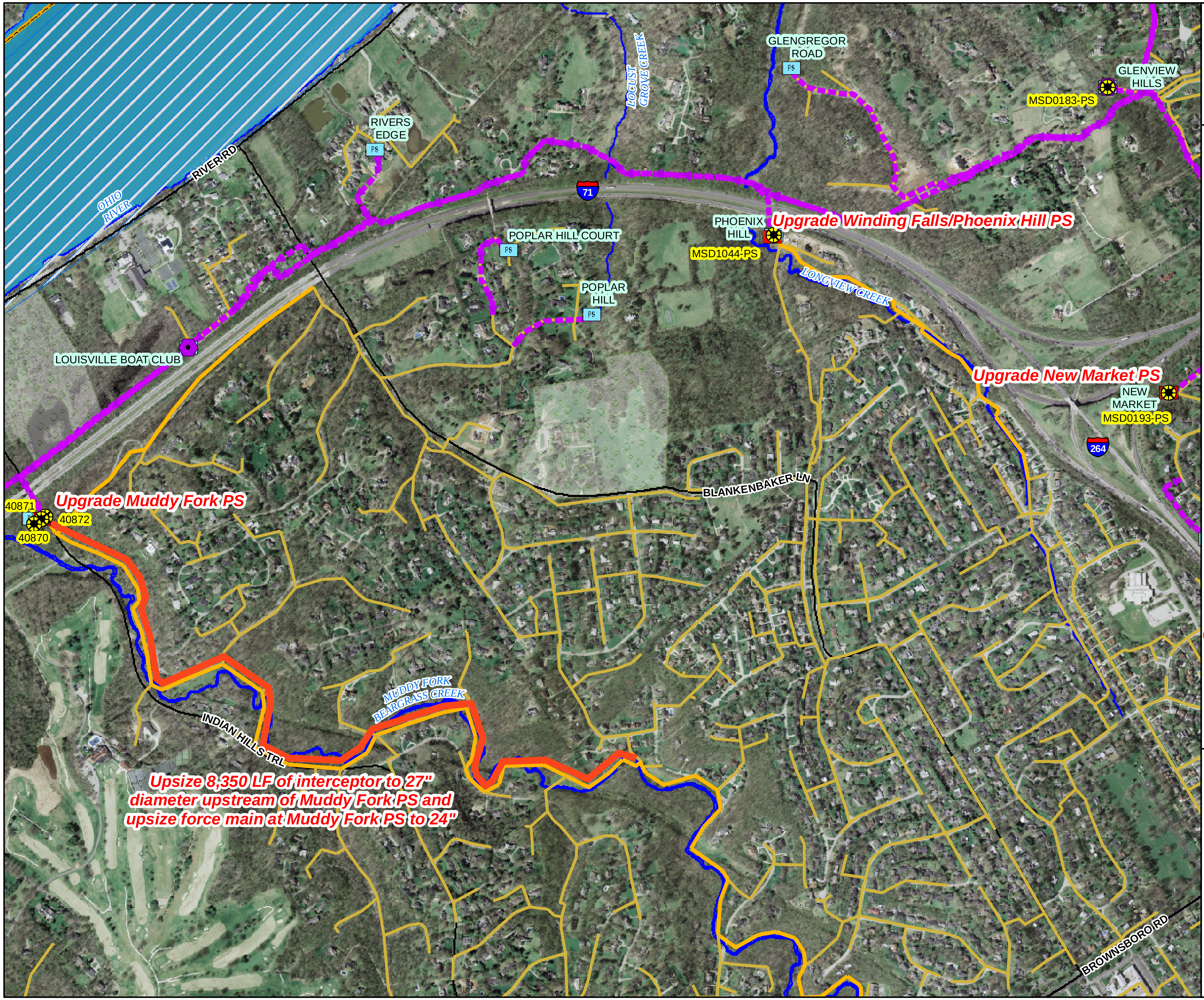
Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Ohio River Force Main Sewershed

Solution ID # S_OR_MF_NB04_M_03_B_B

Prospect #3 - ORFM System Improvements



Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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Map Revision
May 7, 2009

Aerial Date: 2006

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MSD

Metropolitan Sewer District

MILL CREEK AREA

SSO SSDP
Project Fact Sheet

SSO Project Number: S_MC_WC_NB01_M_01_A

Project Name: Shively Interceptor

Modeled Area: Mill Creek

Branch or SSO ID: NB01

Project Type: Pipe Upgrades

Receiving Stream: Mill Creek and Heatherfield Ditch

Project Description: Construct 18,830 LF of new gravity sewers (10" – 27") to eliminate pump stations. This is the Shively Interceptor capital improvement project.

Reason for Overflow: Pump station capacity (hydraulic bottleneck & backwater effects)

Design Parameters / Assumptions: This solution is based on a 2.60-inch cloudburst rain event

Project Constraints: None at this time

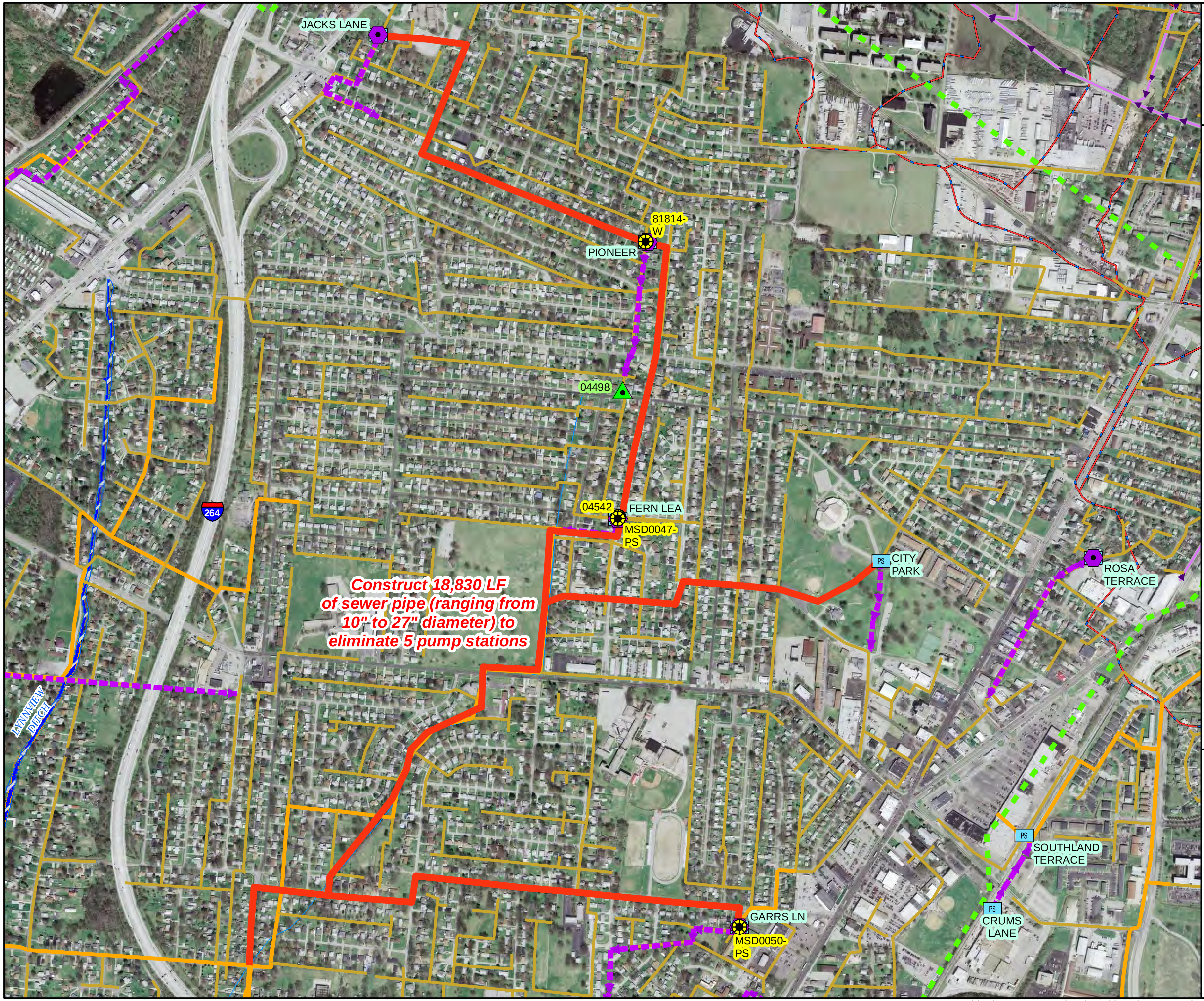
Capital Projects: B06208 ~ Shively Interceptor - Preliminary Design

Estimated Capital Cost (2008 dollars): $16,419,000

Weighted Benefit/Cost Ratio (Present Worth): 6.70

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
04498	820 Echo Bridge Road	West County	Manhole	Stream	Suspected-no data
04542	Fern Lea PS Wet Well	West County	Manhole	Ditch	91,500
81814-W	Pioneer Road PS	West County	Pumped	Ditch	32,750
MSD0047-PS	Fern Lea	West County	Pumped	Catch basin	141,083
MSD0050-PS	Garrs Lane	West County	Pumped	Ditch	72,000



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Mill Creek Sewershed

Solution ID # S_MC_WC_NB01_M_01_A

Shively Interceptor

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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Map Revision
May 07, 2009

Aerial Date: 2006

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_MC_WC_NB02_S_03_C

Project Name: East Rockford PS Relocation

Modeled Area: Mill Creek

Branch or SSO ID: NB02

Project Type: Pump Station Replacement and Relocation

Receiving Stream: Mill Creek

Project Description: Relocate and replace East Rockford PS at 300 GPM. 150 LF of 4" force main will be replaced. Additional 150 LF of 10" gravity improvements required to relocate PS.

Reason for Overflow: Surface flooding

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

Project Constraints: None at this time

Estimated Capital Cost (2008 dollars): $1,044,000

Weighted Benefit/Cost Ratio (Present Worth): N/A

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
04699-W	East Rockford PS	West County	Pumped	Ground	No data

Integrated Overflow Abatement Plan
Vol. 3 - Sanitary Sewer Discharge Plan

Mill Creek Sewershed
Solution ID # S_MC_WC_NB02_S_03_C
East Rockford PS Relocation

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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MSD

Metropolitan Sewer District

COMBINED SEWER SYSTEM AREA

SSO SSDP
Project Fact Sheet

SSO Project Number: S_OR_MF_42007_S_07_C

Project Name: Sonne PS I/I Investigation and Rehabilitation

Modeled Area: Combined Sewer System

Branch or SSO ID: MSD0042-PS

Project Type: I/I Reduction

Receiving Stream: Paddy Run

Project Description: This location will be targeted for I/I source control (I/I rehab and private property program). A full SSES will be performed upstream of this PS. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative will be implemented, which is Offline Storage.

Reason for Overflow: System capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

Project Constraints: None

Estimated Capital Cost (2008 dollars): $265,000 (Cost is for SSES only; rehabilitation will be performed under Annual I/I Rehab contracts and the private property program)

Weighted Benefit/Cost Ratio (Present Worth): Only cost calculated for SSES, no benefits are calculated.

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD0042-PS	Sonne Avenue	Morris Forman	Pumped	Ground	156,075

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Combined Sewer System

Solution ID # S_OR_MF_42007_S_07_C

Sonne PS I&I Investigation & Rehabilitation

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
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- CSO Area
- Metro Parks

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Map Revision
May 7, 2009

Aerial Date: 2006

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SSO SSDP
Project Fact Sheet

SSO Project Number:	S_SF_MF_30917_M_09_A
Project Name:	Camp Taylor System Improvements 1 - SSES
Modeled Area:	Combined Sewer System
Branch or SSO ID:	30917
Project Type:	SSES
Receiving Stream:	South Fork Beargrass Creek, Muddy Fork Beargrass Creek, and Camp Taylor Ditch
Project Description:	This phase is a special study which includes a full SSES of the entire Camp Taylor system
Reason for Overflow:	System capacity and poor system conditions in some areas
Design Parameters / Assumptions:	This solution is based on a 2.60 inch cloudburst rain event
Project Constraints:	Some overflow volumes were estimated using regression equation not a hydraulic model.
Estimated Capital Cost (2008 dollars):	$2,279,000
Weighted Benefit/Cost Ratio (Present Worth):	68.47

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
08717	Fincastle #2	Morris Forman	Manhole	Ground	100
13931	Camp Taylor #4	Morris Forman	Manhole	No Data	6,000
13943	Camp Taylor #3	Morris Forman	Manhole	Ground	250
36763	3520 Fincastle Road	Morris Forman	Manhole	Ground	Suspected- no data
44396	Fincastle #4	Morris Forman	Manhole	Ground	79,500

44397	Fincastle #3	Morris Forman	Manhole	Ground	41,420
66349	Fincastle #1	Morris Forman	Manhole	Ground	15
104223	Camp Taylor #1	Morris Forman	Manhole	Ground	40
104231	Camp Taylor #2	Morris Forman	Manhole	Ground	1,217

SSO SSDP
Project Fact Sheet

SSO Project Number:	S_SF_MF_30917_M_09_A
Project Name:	Camp Taylor System Improvements 2 - Phase 1 Sewer Replacement
Modeled Area:	Combined Sewer System
Branch or SSO ID:	30917
Project Type:	Sewer Replacement
Receiving Stream:	South Fork Beargrass Creek, Muddy Fork Beargrass Creek, and Camp Taylor Ditch
Project Description:	This alternative includes replacement of target sewers baed on past studies and historical work orders.
Reason for Overflow:	System capacity and poor system conditions in some areas
Design Parameters / Assumptions:	This solution is based on a 2.60 inch cloudburst rain event
Project Constraints:	Some overflow volumes were estimated using regression equation not by a hydraulic model.
Estimated Capital Cost (2008 dollars):	$6,500,000
Weighted Benefit/Cost Ratio (Present Worth):	68.47

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
08717	Fincastle #2	Morris Forman	Manhole	Ground	100
13931	Camp Taylor #4	Morris Forman	Manhole	No Data	6,000
13943	Camp Taylor #3	Morris Forman	Manhole	Ground	250
36763	3520 Fincastle Road	Morris Forman	Manhole	Ground	Suspected- no data
44396	Fincastle #4	Morris Forman	Manhole	Ground	79,500

44397	Fincastle #3	Morris Forman	Manhole	Ground	41,420
66349	Fincastle #1	Morris Forman	Manhole	Ground	15
104223	Camp Taylor #1	Morris Forman	Manhole	Ground	40
104231	Camp Taylor #2	Morris Forman	Manhole	Ground	1,217

SSO SSDP
Project Fact Sheet

SSO Project Number:	S_SF_MF_30917_M_09_A
Project Name:	Camp Taylor System Improvements 3 - Phase 2 Sewer Replacement & Phase 1 Sewer Rehab
Modeled Area:	Combined Sewer System
Branch or SSO ID:	30917
Project Type:	Sewer Replacement and Sewer Rehabilitation
Receiving Stream:	South Fork Beargrass Creek, Muddy Fork Beargrass Creek, and Camp Taylor Ditch
Project Description:	Phase 2 of replacement of target sewers after full SSES is complete. Additional rehabilitation of sewers based on SSES findings.
Reason for Overflow:	System capacity and poor system conditions in some areas
Design Parameters / Assumptions:	This solution is based on a 2.60 inch cloudburst rain event
Project Constraints:	Some overflow volumes were estimated using regression equation not by a hydraulic model.
Estimated Capital Cost (2008 dollars):	$9,750,000
Weighted Benefit/Cost Ratio (Present Worth):	68.47

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
08717	Fincastle #2	Morris Forman	Manhole	Ground	100
13931	Camp Taylor #4	Morris Forman	Manhole	No Data	6,000
13943	Camp Taylor #3	Morris Forman	Manhole	Ground	250
36763	3520 Fincastle Road	Morris Forman	Manhole	Ground	Suspected- no data
44396	Fincastle #4	Morris Forman	Manhole	Ground	79,500

44397	Fincastle #3	Morris Forman	Manhole	Ground	41,420
66349	Fincastle #1	Morris Forman	Manhole	Ground	15
104223	Camp Taylor #1	Morris Forman	Manhole	Ground	40
104231	Camp Taylor #2	Morris Forman	Manhole	Ground	1,217

SSO SSDP
Project Fact Sheet

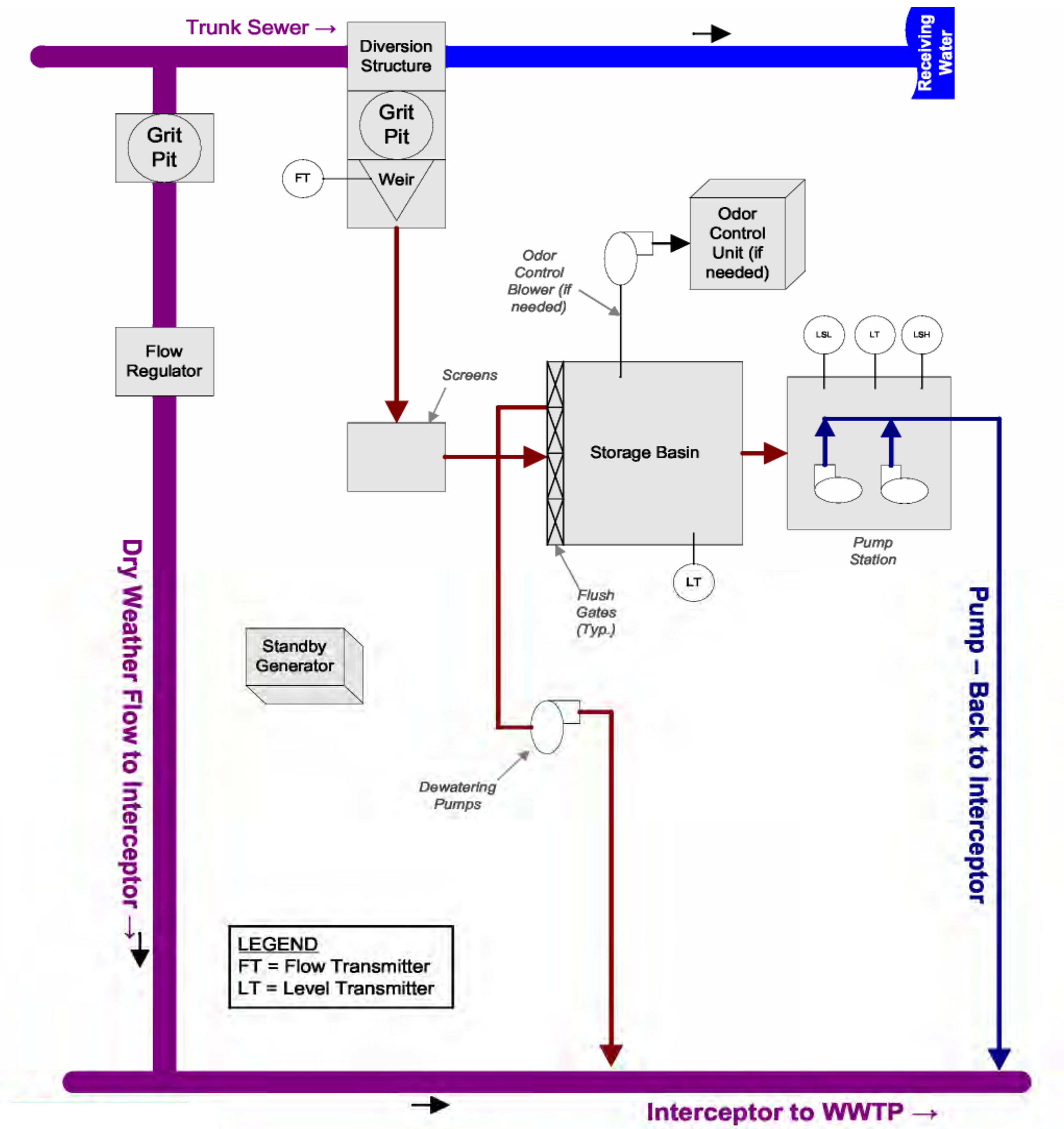
SSO Project Number:	S_SF_MF_30917_M_09_A
Project Name:	Camp Taylor System Improvements 4 - Phase 2 Sewer Rehab
Modeled Area:	Combined Sewer System
Branch or SSO ID:	30917
Project Type:	Sewer Rehabilitation & Offline Storage
Receiving Stream:	South Fork Beargrass Creek, Muddy Fork Beargrass Creek, and Camp Taylor Ditch
Project Description:	This alternative includes additional rehabilitation of sewers based on SSES findings and constructing an off-line pumped 0.038 MG storage basin at the PS to store excess wet weather flows, 3,395 LF of 8" sewer to convey flow to basin. Flow monitoring and system monitoring will be performed in the Camp Taylor system after rehab is complete. If the system is operating with no overflows at a 1.82-inch storm, no storage basin will be constructed. Documentation of this analysis will be submitted to the appropriate regulatory agencies.
Reason for Overflow:	System capacity and poor system conditions in some areas
Design Parameters / Assumptions:	This solution is based on a 2.60 inch cloudburst rain event
Project Constraints:	Some overflow volumes were estimated using regression equation not by a hydraulic model.
Estimated Capital Cost (2008 dollars):	$9,750,000
Weighted Benefit/Cost Ratio (Present Worth):	68.47

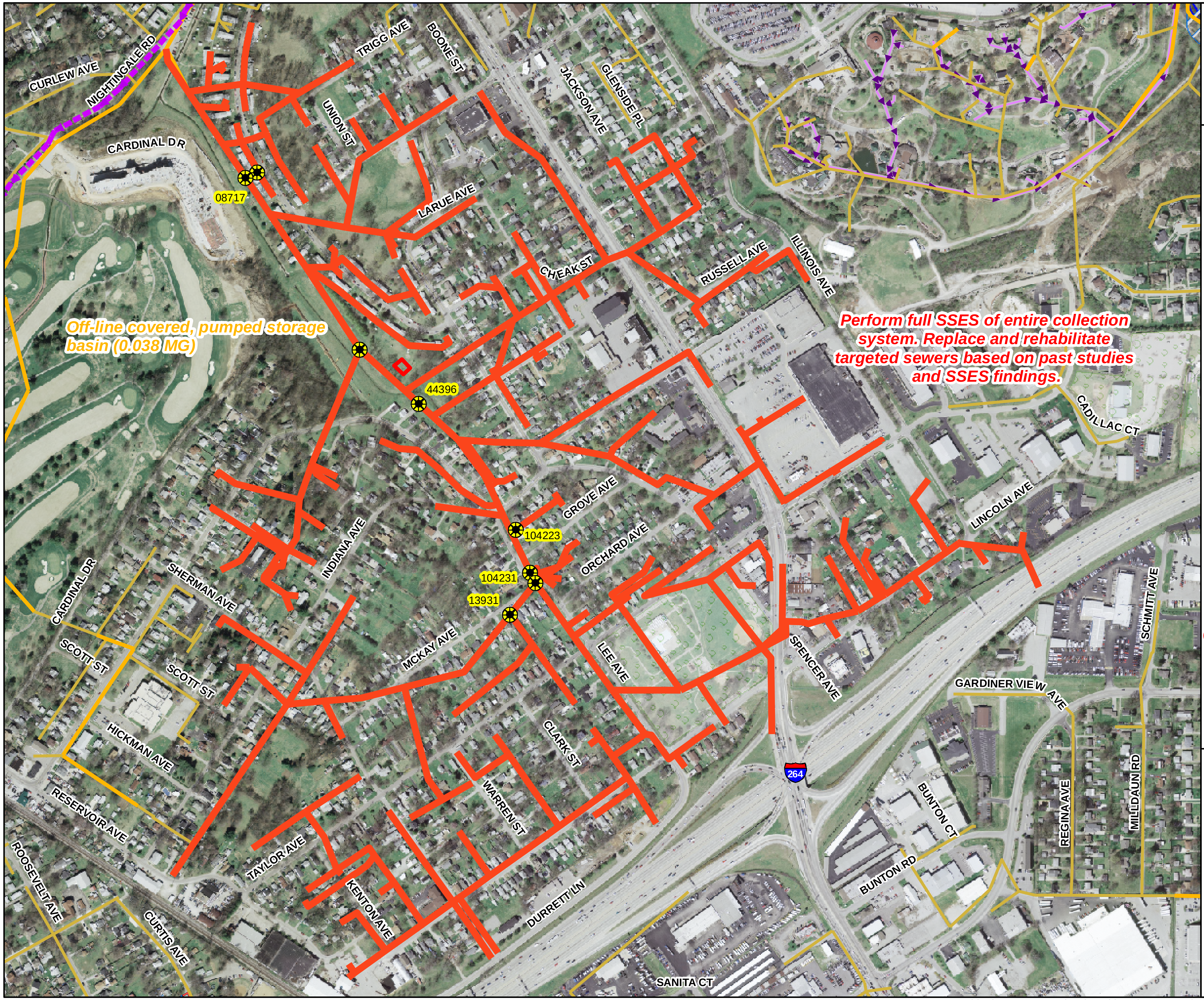
Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
08717	Fincastle #2	Morris Forman	Manhole	Ground	100
13931	Camp Taylor #4	Morris Forman	Manhole	No Data	6,000
13943	Camp Taylor #3	Morris Forman	Manhole	Ground	250

36763	3520 Fincastle Road	Morris Forman	Manhole	Ground	Suspected- no data
44396	Fincastle #4	Morris Forman	Manhole	Ground	79,500
44397	Fincastle #3	Morris Forman	Manhole	Ground	41,420
66349	Fincastle #1	Morris Forman	Manhole	Ground	15
104223	Camp Taylor #1	Morris Forman	Manhole	Ground	40
104231	Camp Taylor #2	Morris Forman	Manhole	Ground	1,217

Off-Line Storage Pumped Effluent Flow Diagram





Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Combined Sewer System

Solution ID # S_SF_MF_30917_M_09_A

Camp Taylor System Improvements

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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Map Revision
May 7, 2009

Aerial Date: 2006

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_MC_MF_55665_S_07_C

Project Name: Hazelwood PS I/I Investigation and Rehabilitation

Modeled Area: Combined Sewer System

Branch or SSO ID: 55665

Project Type: I/I Reduction

Receiving Stream: Upper Mill Creek

Project Description: This location will be targeted for I/I source control (I/I rehab and private property program). A full SSES will be performed upstream of this PS. If I/I reduction is deemed unsuccessful in eliminating the SSO, the next best alternative will be implemented, which is Offline Storage and Pipe Upgrades.

Reason for Overflow: Pump Station capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

Project Constraints: None

Estimated Capital Cost (2008 dollars): $173,000 (Cost is for SSES only; rehabilitation will be performed under Annual I/I Rehab contracts and the private property program)

Weighted Benefit/Cost Ratio (Present Worth): Only cost calculated for SSES, no benefits are calculated

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
55665	Hazelwood PS wetwell	Morris Forman	Manhole	Ditch	28,000

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Combined Sewer System

Solution ID # S_MC_MF_55665_S_07_C

Hazelwood PS I&I Investigation & Rehabilitation

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
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MSD

Metropolitan Sewer District

SMALL WQTC AREAS

SSO SSDP
Project Fact Sheet

SSO Project Number: S_FF_BT_NB01_S_09A_C_A

Project Name: Lucas Ln. PS Inline Storage

Modeled Area: Berrytown

Branch or SSO ID: NB01

Project Type: Inline Storage

Receiving Stream: Goose Creek

Project Description: This alternative includes installing two 90 LF long 54" wide parallel storage pipes that branch off the gravity main prior to the Lucas Lane PS. The invert must be lowered and upgraded to a 36" pipe.

Reason for Overflow: Pump station capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

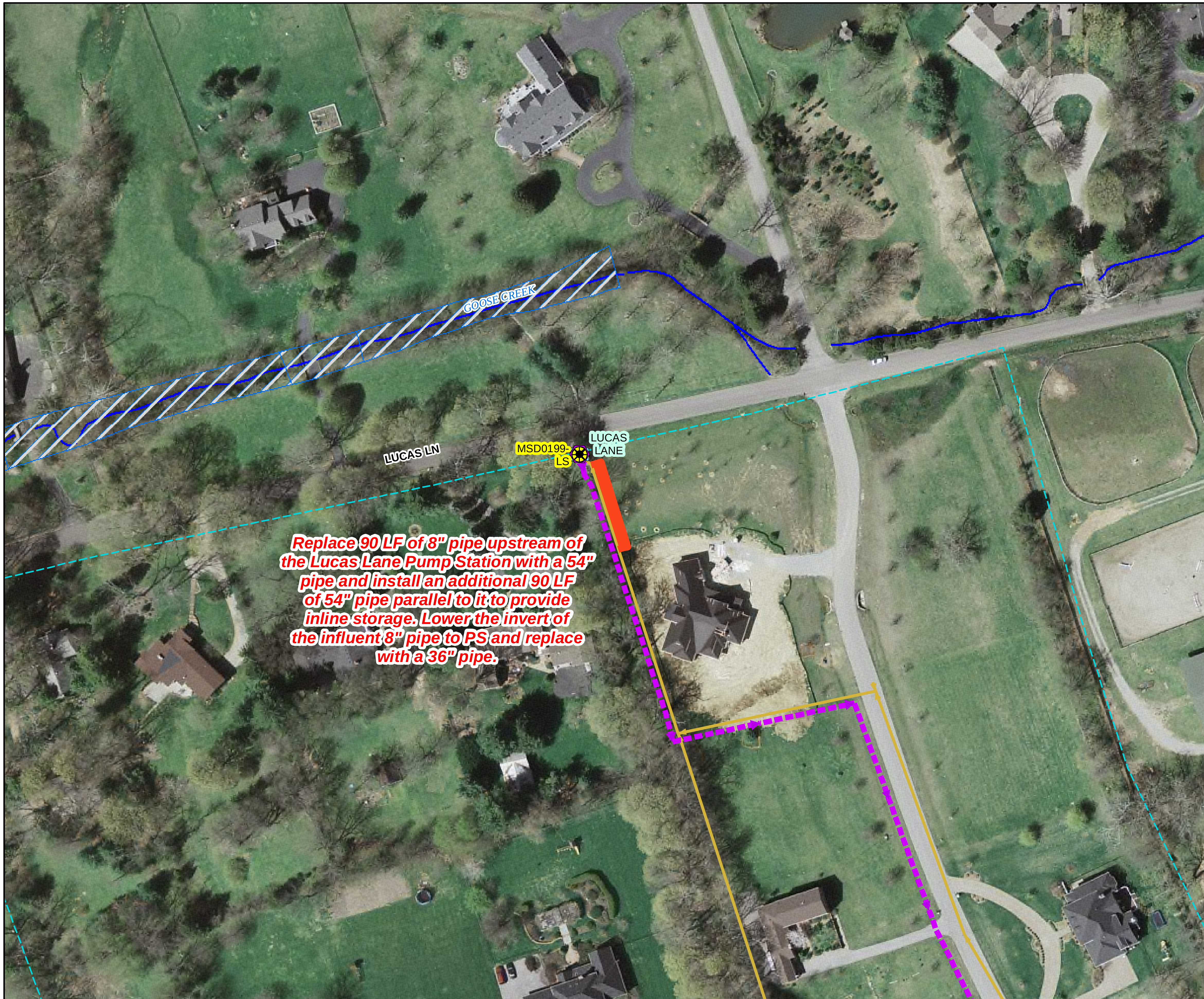
Project Constraints: None at this time

Estimated Capital Cost (2008 dollars): $183,000

Weighted Benefit/Cost Ratio (Present Worth): 112.86

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD0199-LS	Lucas Lane	Berrytown	Lift Station	Stream	5,000



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Berrytown Sewershed

Solution ID # S_FF_BT_NB01_S_09A_C_A

Lucas Ln. PS Inline Storage

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
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- Floodway
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- Metro Parks

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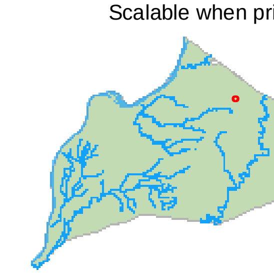

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SSO SSDP
Project Fact Sheet

SSO Project Number:	S_HC_HN_NB01_S_03_C_A
Project Name:	Riding Ridge PS Improvements
Modeled Area:	Hunting Creek North
Branch or SSO ID:	NB01
Project Type:	Pump Station Upgrades
Receiving Stream:	Harrods Creek
Project Description:	This alternative includes upgrading pumps at Riding Ridge PS from 17 GPM to 26 GPM. This will give the PS a peak pumping rate capacity of 0.075 MGD.
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$27,000
Weighted Benefit/Cost Ratio (Present Worth):	52.02

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD1060-LS	Riding Ridge	Hunting Creek North	Pumped	Ditch	4,700

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Hunting Creek North Sewershed
Solution ID # S_HC_HN_NB01_S_03_C_A
Riding Ridge PS Improvements

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
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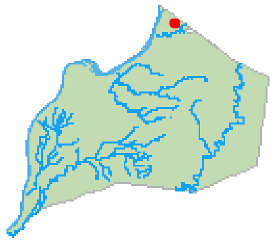

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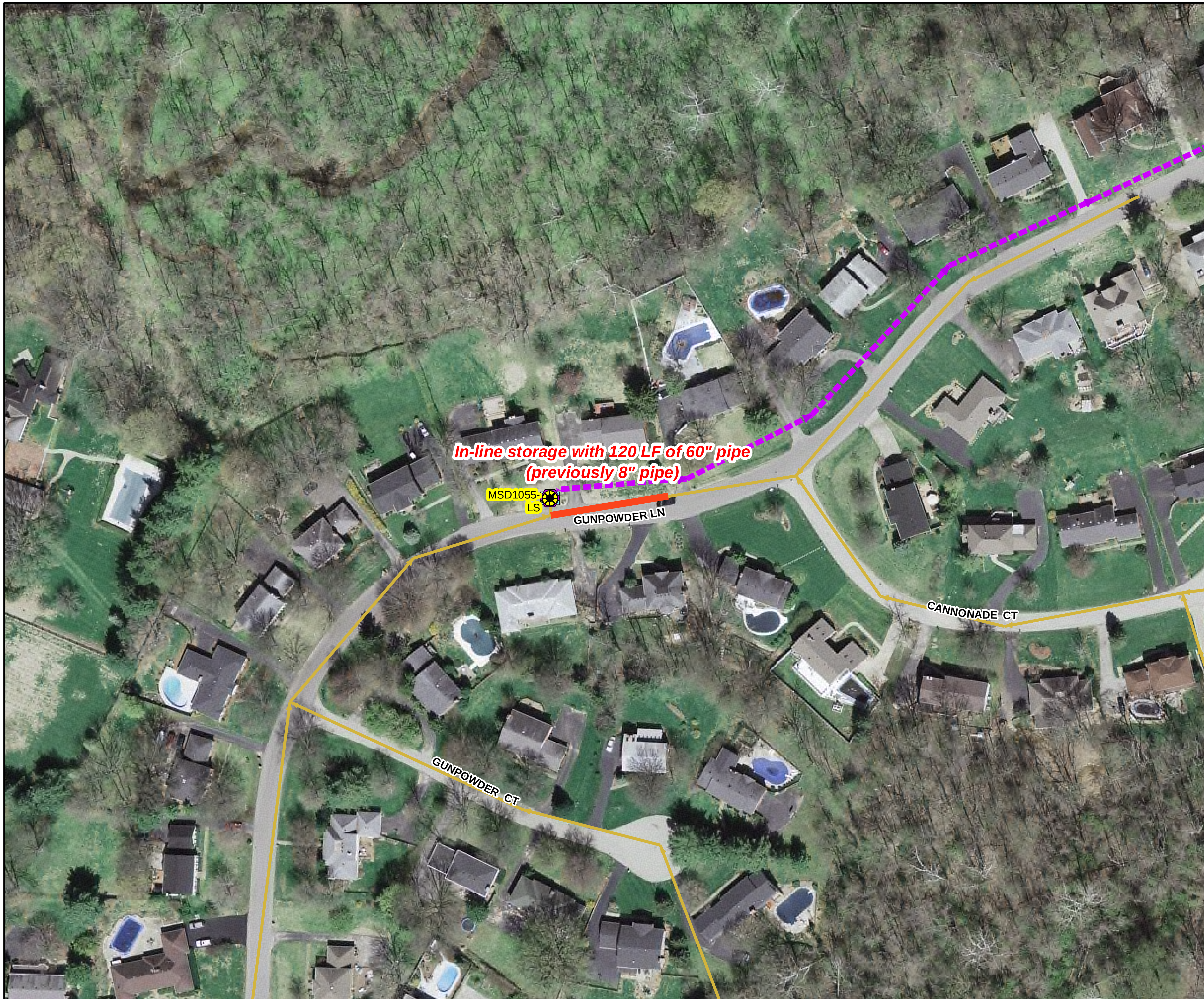
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_HC_HN_NB02_S_09A_C_B
Project Name:	Gunpowder PS Inline Storage
Modeled Area:	Hunting Creek North
Branch or SSO ID:	NB02
Project Type:	Inline Storage
Receiving Stream:	Harrods Creek
Project Description:	This alternative includes replacing 120 LF of 8" with 60" in-line storage pipe. In addition, 28 LF of pipe upgrades will be needed.
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$176,000
Weighted Benefit/Cost Ratio (Present Worth):	78.71

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD1055-LS	Gunpowder	Hunting Creek North	Pumped	Ditch	17,199



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Hunting Creek North Sewershed
Solution ID # S_HC_HN_NB02_S_09A_C_B
Gunpowder PS Inline Storage

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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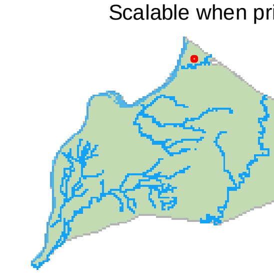

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SSO SSDP
Project Fact Sheet

SSO Project Number:	S_HC_HN_NB03_S_09A_A_A
Project Name:	Fox Harbor Inline Storage
Modeled Area:	Hunting Creek North
Branch or SSO ID:	NB03
Project Type:	Inline Storage
Receiving Stream:	Harrods Creek
Project Description:	This alternative includes replacing two 8" (total 133 LF) pipes upstream and east of the Fox Harbor #2 LS with 24" and 60" pipes respectively. For Fox Harbor #1: Install (194 LF of 24" to 54") parallel storage pipes upstream of the lift station and lower the upstream invert of that pipe (which will require a new drop manhole).
Reason for Overflow:	Pump station capacities
Design Parameters / Assumptions:	This solution is based on a 2.60 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$328,000
Weighted Benefit/Cost Ratio (Present Worth):	87.55

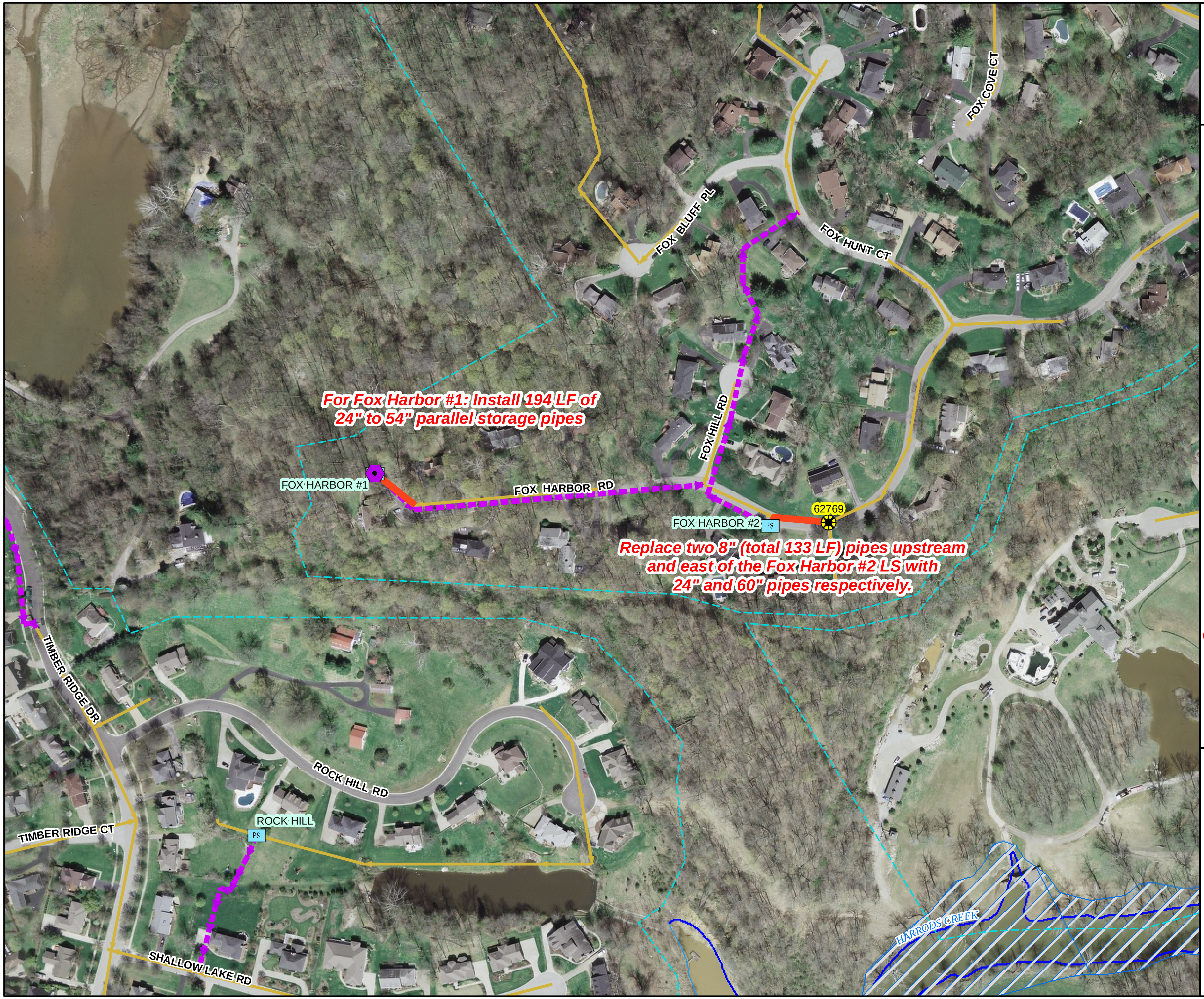
Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
62769	Fox Hill Road/ Fox Hunt Court	Hunting Creek North	Constructed	Ground	No data

Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Hunting Creek North Sewershed
Solution ID # S_HC_HN_NB03_S_09A_A_A
Fox Harbor Inline Storage



Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
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- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
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- Metro Parks

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LOJIC MSD Metropolitan Sewer District PROJECT WIN

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SSO SSDP
Project Fact Sheet

SSO Project Number: S_HC_HS_NB01_S_03_C_A

Project Name: Fairway View PS Improvements

Modeled Area: Hunting Creek South

Branch or SSO ID: NB01

Project Type: Pump Station Upgrades

Receiving Stream: Harrods Creek

Project Description: This alternative includes upgrading pumps at Fairway View PS to discharge: 100, 100, and 120 GPM (previously 88 GPM each)

Reason for Overflow: Pump station capacity

Design Parameters / Assumptions: This solution is based on a 1.82 inch cloudburst rain event

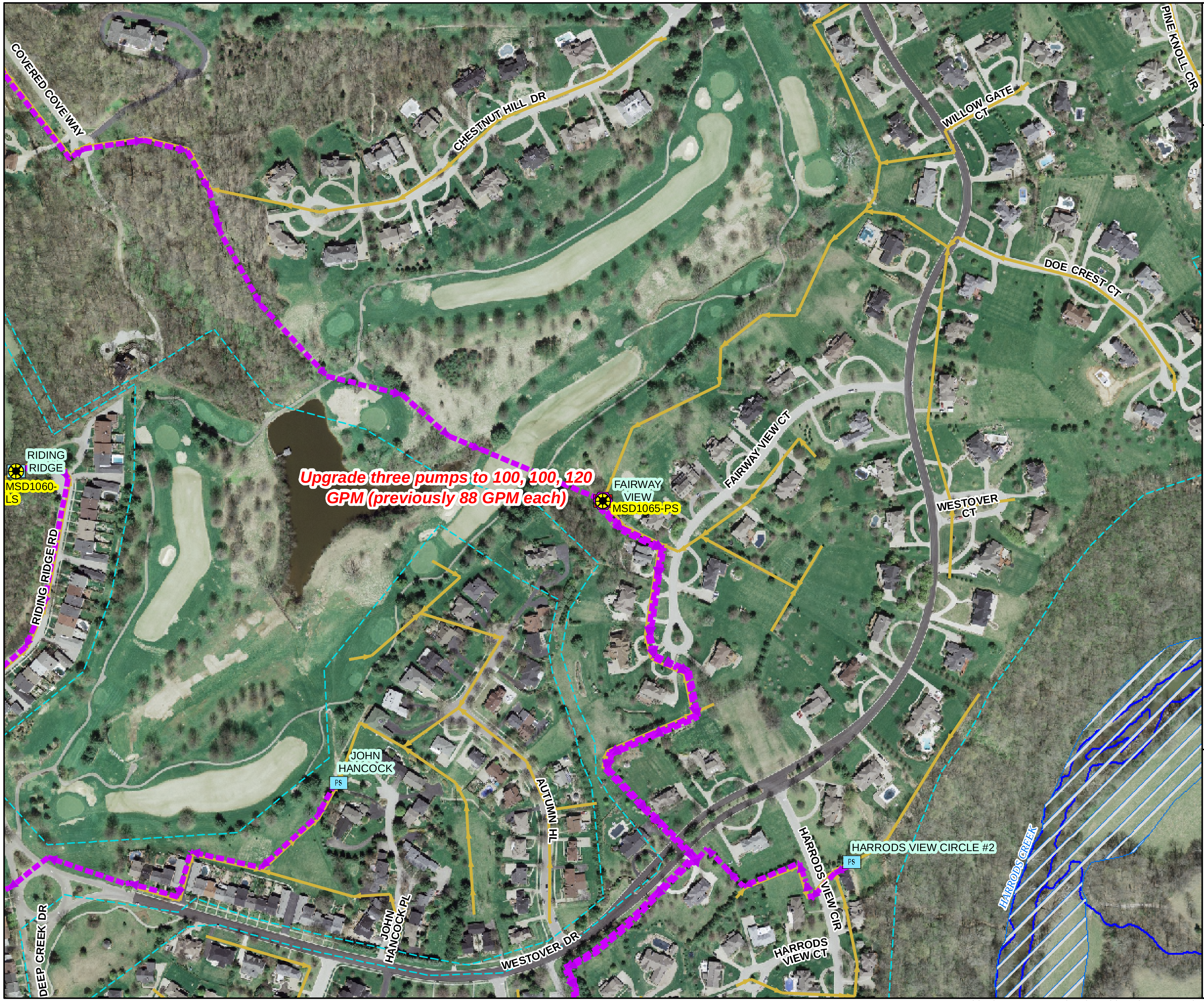
Project Constraints: None at this time

Estimated Capital Cost (2008 dollars): $87,000

Weighted Benefit/Cost Ratio (Present Worth): 10.32

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD1065-PS	Fairway View	Hunting Creek South	Lift Station	Ditch	19,500



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Hunting Creek South Sewershed

Solution ID # S_HC_HS_NB01_S_03_C_A

Fairway View PS Improvements

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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Map Revision
May 7, 2009

Aerial Date: 2006

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SSO SSDP
Project Fact Sheet

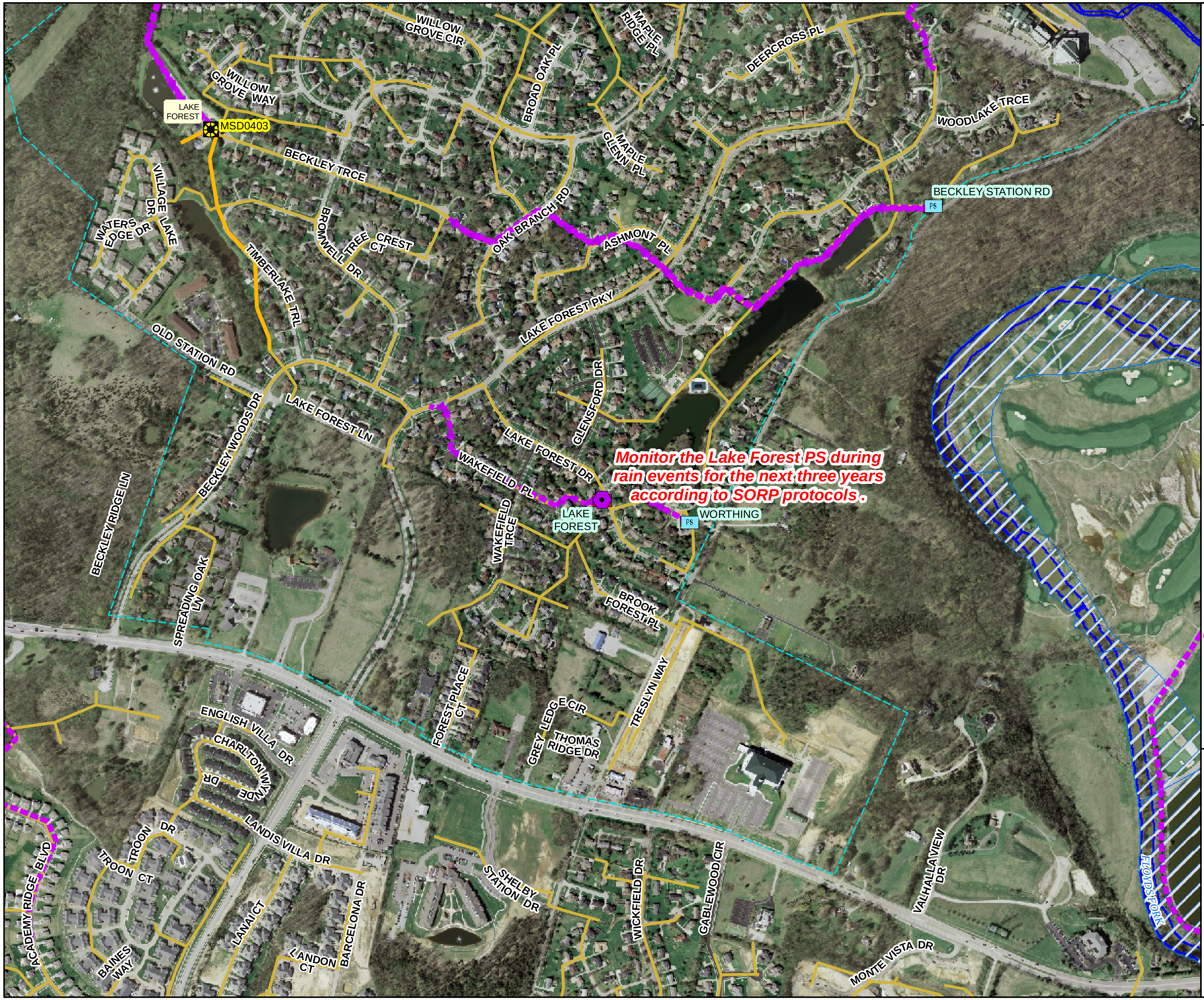
SSO Project Number:	S_FF_LF_NB01_S_13_C_A
Project Name:	Lake Forest PS SSO Investigation
Modeled Area:	Lake Forest
Branch or SSO ID:	NB01
Project Type:	Monitor
Receiving Stream:	Floyds Fork
Project Description:	Monitor the Lake Forest PS during rain events for the next three years according to SORP protocols .
Reason for Overflow:	Pump station capacity
Design Assumptions:	This PS was upgraded in June 2008. 144 gpm pumps were installed.
Project Constraints:	None
Estimated Capital Cost (2008 dollars):	This work will be performed under the SORP/CMOM programs
Weighted Benefit/Cost Ratio (Present Worth):	--

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD1169-LS	Lake Forest	Lake Forest	Lift Station	Ditch	MOP-no data

Integrated Overflow Abatement Plan
Vol. 3 - Sanitary Sewer Discharge Plan

Lake Forest Sewershed
Solution ID # S_FF_LF_NB01_S_13_C_A
Lake Forest PS SSO Investigation



Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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Map Revision
May 20, 2009

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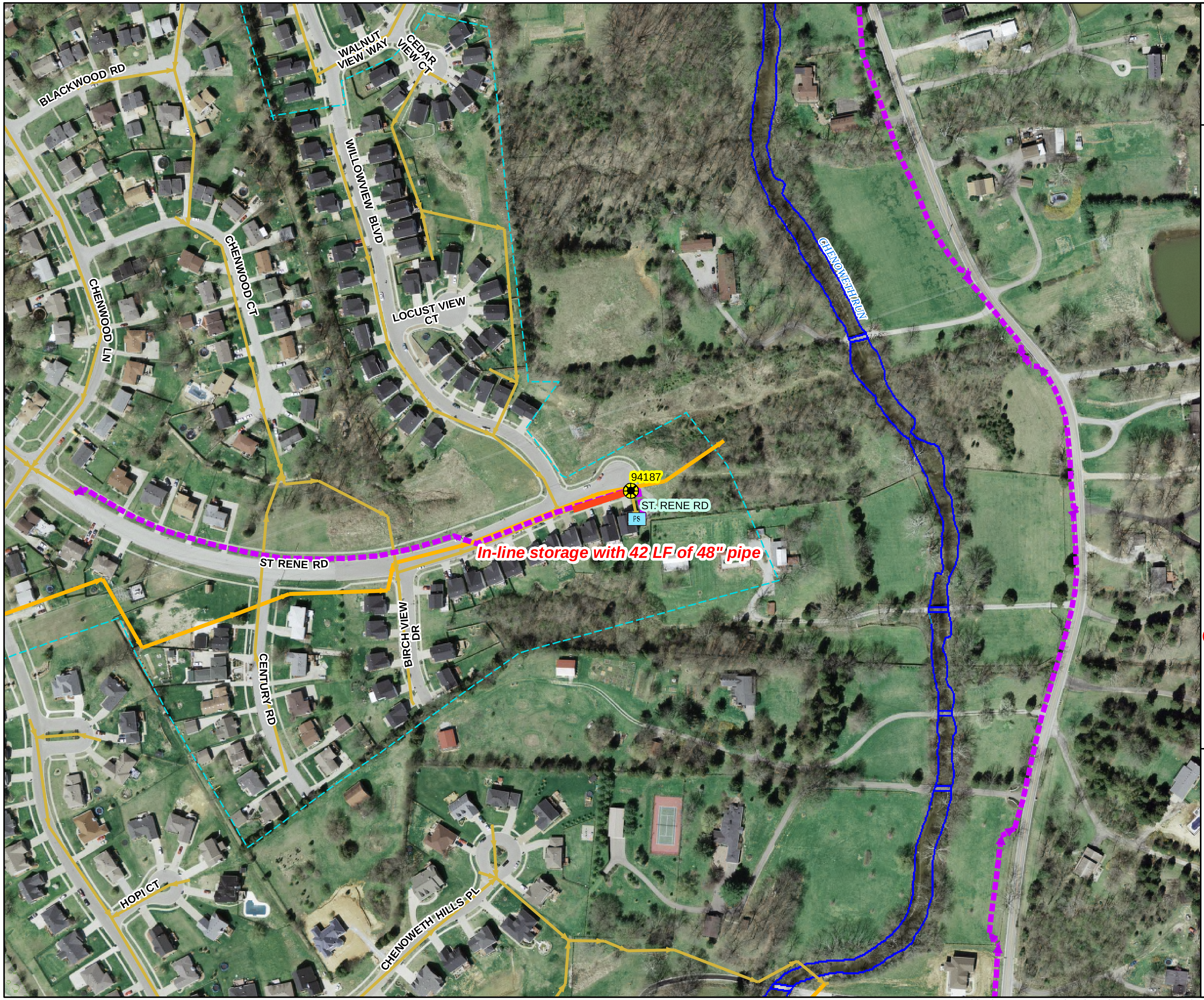
SSO SSDP
Project Fact Sheet

SSO Project Number:	S_FF_CH_NB01_S_09A_C_A
Project Name:	St. Rene Rd. PS Inline Storage
Modeled Area:	Chenoweth Hills
Branch or SSO ID:	CH01
Project Type:	Inline Storage
Receiving Stream:	Chenoweth Run
Project Description:	This alternative includes replacing 42 LF of 8" with 48" pipe just upstream of the PS.
Reason for Overflow:	Pump station capacity
Design Parameters / Assumptions:	This solution is based on a 1.82 inch cloudburst rain event
Project Constraints:	None at this time
Estimated Capital Cost (2008 dollars):	$30,000
Weighted Benefit/Cost Ratio (Present Worth):	212.00

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
94187	Wet Well for St. Rene Road PS	Chenoweth Hills	Manhole	Catch Basin	4,380



Integrated Overflow Abatement Plan

Vol. 3 - Sanitary Sewer Discharge Plan

Chenoweth Hills Sewershed

Solution ID # S_FF_CH_NB01_S_09A_C_A

St. Rene Rd. PS Inline Storage

Preliminary - For Budget Development Only

Legend

- Documented SSO
- Suspected SSO
- Haul Operation
- Proposed Pump Station Solution
- Pump Station
- WWTP
- Proposed Pipe Solution
- Force Main
- Collector < 12"
- Interceptor => 12"
- Combined Sewer Pipe
- Proposed Off-line Storage
- Road
- Streams
- Floodway
- Small WWTP Service Area
- Large WWTP Service Area
- CSO Area
- Metro Parks

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MSD

Metropolitan Sewer District

ISSDP PROJECTS

Interim SSDP Project Fact Sheet

SSO Project Number:	Interim SSDP Project
Project Name:	Beechwood Village Sanitary Sewer Replacement
Modeled Area:	N/A
Branch or SSO ID:	N/A
Project Type:	Sewer Replacement
Receiving Stream:	Upper Sinking Fork
Project Description:	This project includes replacing the entire local system, including 23,700 LF of sewer pipe and 580 homeowner's service connections. Existing pipes will be left in place as stormwater collection pipes. The project will be completed in two phases, East and West.
Reason for Overflow:	System Capacity and Inflow/Infiltration
Design Parameters / Assumptions:	N/A
Project Constraints:	Sinking Fork Relief Sewer must be completed first
Estimated Capital Cost (2008 dollars):	$11,800,000
Weighted Benefit/Cost Ratio (Present Worth):	N/A

Overflow Points Addressed:

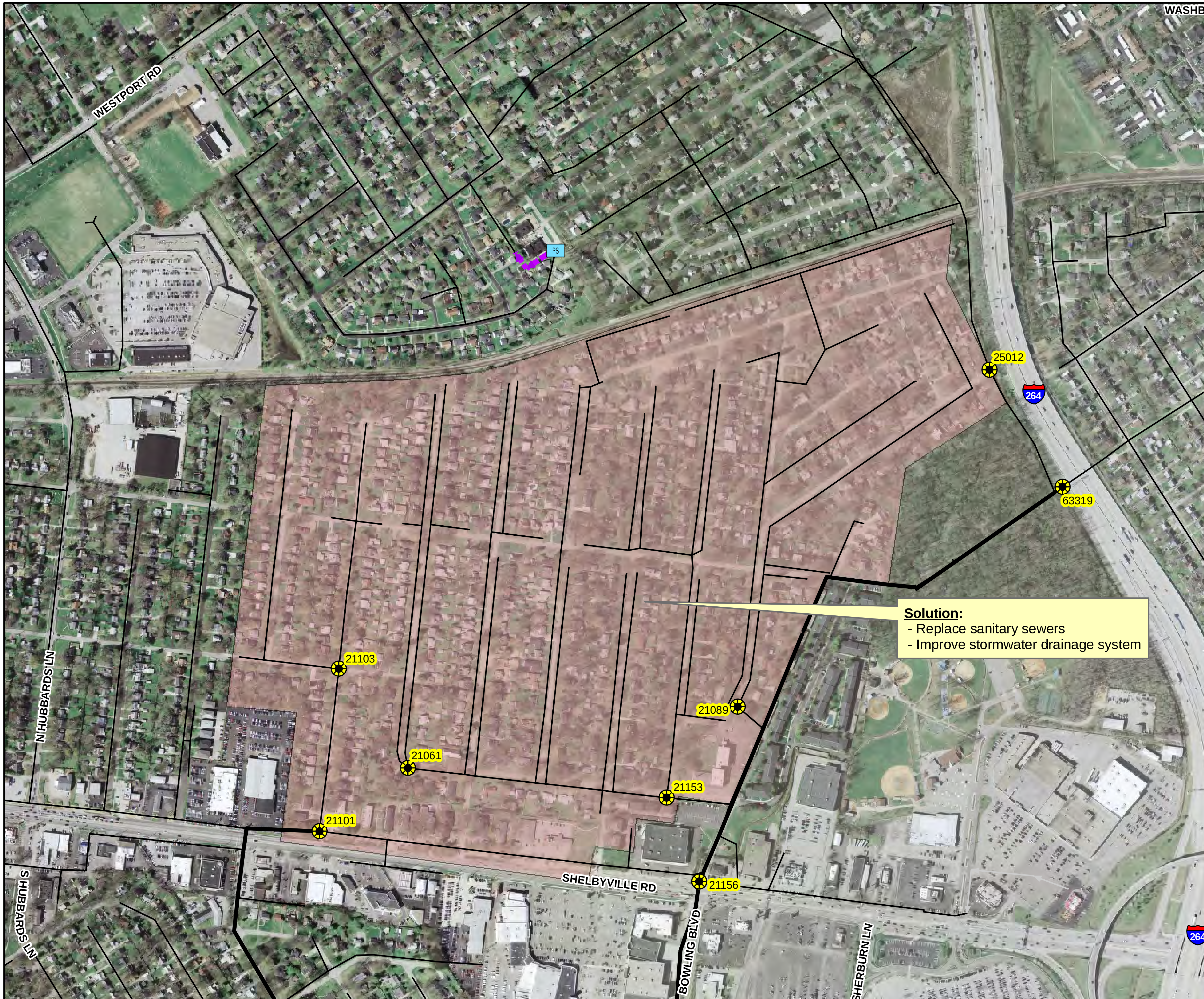
SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
21061	4432 Cordova Road & Tyne Avenue	Morris Forman	(IFP) Pumped	Catch Basin	2,114,680
21089	207 Brunswick Road	Morris Forman	(IFP) Pumped	Catch Basin	1,924,520

21101	Shelbyville Road & Marshall Drive	Morris Forman	(IFP) Pumped	Ditch	3,116,459
21153	Biltmore Road & Cordova Road	Morris Forman	(IFP) Pumped	Catch Basin	2,108,844
21156	Shelbyville Road & Stonehenge Road	Morris Forman	(IFP) Pumped	Catch Basin	2,536,542

Integrated Overflow Abatement Plan

Interim Sanitary Sewer Discharge Plan

Beechwood Village
Sanitary Sewer Replacements



Legend

- Documented SSO
- Suspected SSO
- WWTP
- Pump Station
- Force Main
- Force Main non MSD
- MSD Sewer
- non msd pipes
- Combined Sewer Pipe
- Streams
- Beechwood Village
- Metro Parks

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1 inch = 500 feet
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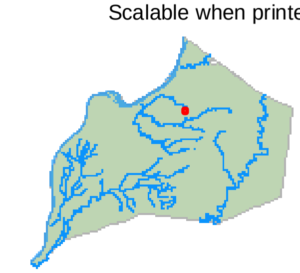

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Aerial Date: 2006

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Interim SSDP
Project Fact Sheet

SSO Project Number: Interim SSDP Project

Project Name: Hikes Lane Interceptor and Highgate Springs PS

Modeled Area: N/A

Branch or SSO ID: N/A

Project Type: Pump Station Elimination and New Interceptor

Receiving Stream: South Fork Beargrass Creek and Wedgewood Ditch

Project Description: This project includes improvements to the Hikes Point Sewer System and eliminates the Highgate Springs Pump Station. In the general Hikes Point area includes improvements of 3,500 LF of new or replacement sewers, and decommissioning the Highgate Springs Pump Station. The new Hikes Lane Interceptor consists of 10,000 LF of 72-inch sewer that connects to Southeastern Interceptor.

Reason for Overflow: System and Pump Station Capacity

Design Parameters / Assumptions: N/A

Project Constraints: N/A

Estimated Capital Cost (2008 dollars): $21,216,000

Weighted Benefit/Cost Ratio (Present Worth): N/A

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
17571	Carson Way & Ribble Road	Morris Forman	(IFP) Pumped	Catch Basin	1,380,492
18134	Downing at Wyckford Way	Morris Forman	Manhole	Catch Basin	100

18298	Gerald Court #3	Morris Forman	Manhole	Stream	59,418
18302	Bardstown Rd / Paris Dr	Morris Forman	Manhole	Catch Basin	No data
18318-W	Terrier Lane PS Wet Well	Morris Forman	Manhole	Stream	108,000
18434	Between Johnston Way & Ainslie Way	Morris Forman	Manhole	Catch Basin	275
18471	Dell Brooke Avenue & Boaries Lane	Morris Forman	(IFP) Pumped	Catch Basin	2,510,635
18483	3012 Boaries Avenue & Rio Rita Avenue	Morris Forman	(IFP) Pumped	Catch Basin	1,826,668
18505	3540 Ramona Avenue & Flora Avenue	Morris Forman	(IFP) Pumped	Catch Basin	1,907,896
18595	3101 Wedgewood Way	Morris Forman	(IFP) Pumped	Ditch	1,621,550
49236	Rosemont Boulevard at Hikes Lane	Morris Forman	Manhole	Ground	150
49672	Gerald Court #2	Morris Forman	Manhole	Ground	317,217
49673	Gerald Court #1	Morris Forman	Manhole	Catch Basin	23,250
49224	Goldsmith Ln at Beargrass Creek- Near Dell Brook Av	Morris Forman	Manhole	Stream	27,040
MSD0012-PS	Highgate Springs	Morris Forman	Constructed	Stream	4,551,300

Integrated Overflow Abatement Plan

Interim Sanitary Sewer Discharge Plan

Hikes Lane Interceptor and Highgate Springs Pump Station

Legend

- Documented SSO
- Suspected SSO
- WWTP
- Pump Station
- New Construction
- Force Main
- Force Main non MSD
- MSD Sewer
- Non MSD Pipes
- Combined Sewer Pipe
- Streams
- Hikes Point
- Metro Parks

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Map Revision
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Interim SSDP
Project Fact Sheet

SSO Project Number:	Interim SSDP Project
Project Name:	Northern Ditch Diversion Interceptor
Modeled Area:	N/A
Branch or SSO ID:	N/A
Project Type:	New Interceptor / WQTC Elimination
Receiving Stream:	Northern Ditch
Project Description:	This project includes construction of a new Northern Ditch Diversion Interceptor which will allow flow from upstream projects to reach the Derek R. Guthrie WQTC. The project consists of 13,000 LF of 84-inch pipe constructed along Greasy Ditch from the Northern Ditch Pump Station to the Pond Creek Interceptor.
Reason for Overflow:	System Capacity
Design Parameters / Assumptions:	N/A
Project Constraints:	Project is dependent on Derek R. Guthrie WQTC Improvements
Estimated Capital Cost (2008 dollars):	$20,397,000
Weighted Benefit/Cost Ratio (Present Worth):	N/A

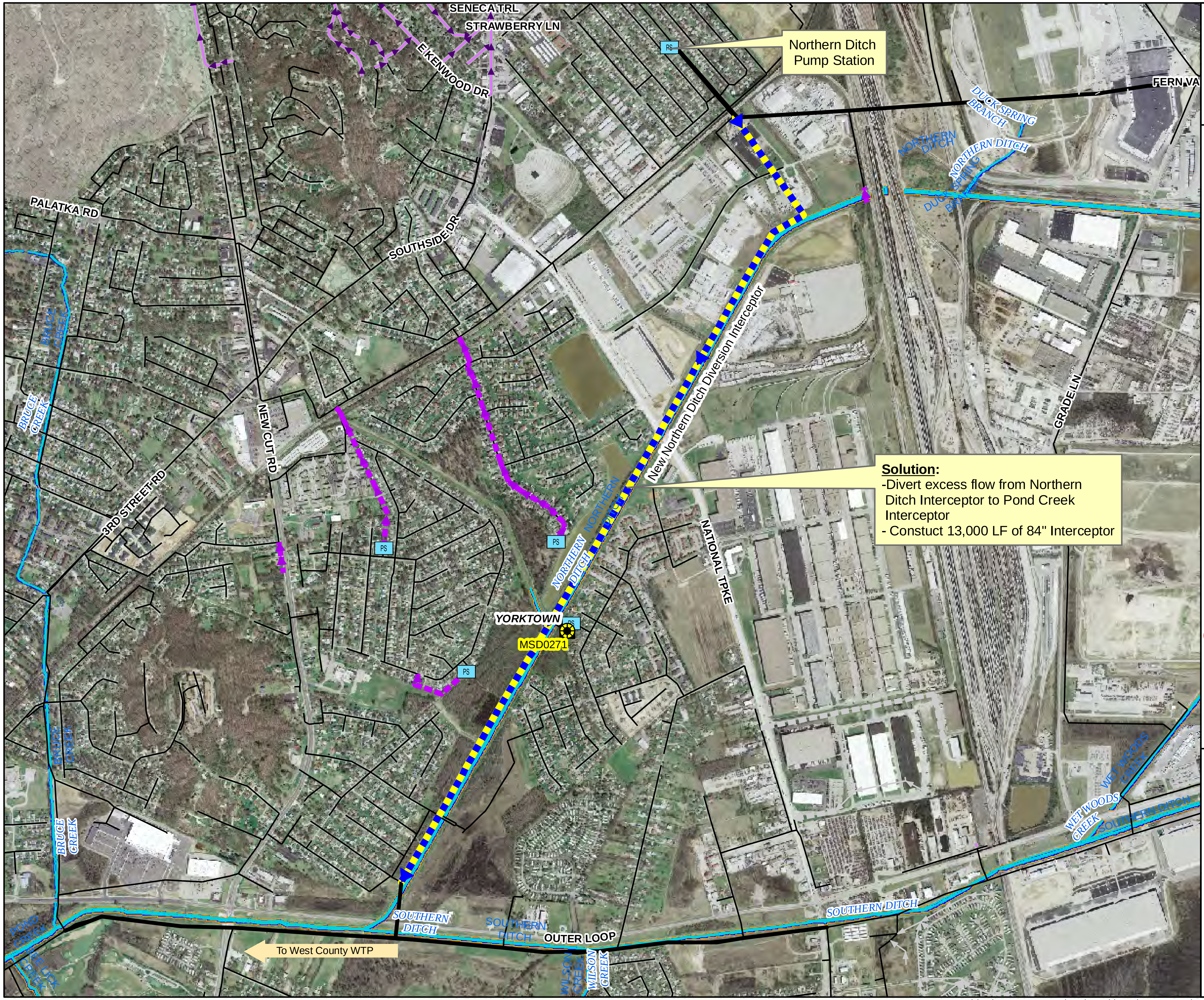
Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
MSD0271	Yorktown	Yorktown	Sewer Treatment Plant	Ditch	7,191

Integrated Overflow Abatement Plan

Interim Sanitary Sewer Discharge Plan

Northern Ditch Diversion Interceptor



Legend

- Documented SSO
- Suspected SSO
- WWTP
- Pump Station
- New Construction
- Force Main
- Force Main non MSD
- MSD Sewer
- Non MSD Pipes
- Combined Sewer Pipe
- Streams
- Hikes Point
- Metro Parks

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Interim SSDP
Project Fact Sheet

SSO Project Number:	Interim SSDP Project
Project Name:	Sinking Fork Relief Sewer
Modeled Area:	N/A
Branch or SSO ID:	N/A
Project Type:	New Relief Sewer
Receiving Stream:	Middle Fork Beargrass Creek and Upper Sinking Fork
Project Description:	This project includes conveying flow from some of the new Beechwood Village sewers and providing additional wet weather capacity downstream of the Beechwood Village East area to accommodate upstream SSDP projects. The project includes installing 2,800 LF of 24-inch relief sewer.
Reason for Overflow:	System Capacity
Design Parameters / Assumptions:	N/A
Project Constraints:	Project is subject to a potential change due to upstream projects
Estimated Capital Cost (2008 dollars):	$1,690,000
Weighted Benefit/Cost Ratio (Present Worth):	N/A

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
21103	Blenheim Road / Taggart Drive	Morris Forman	Manhole	Catch Basin	75
25012	Beaver Road	Morris Forman	Manhole	Ditch	1,480,406
63319	Watterson Expressway	Morris Forman	Manhole	Ditch	296,704

Integrated Overflow Abatement Plan

Interim Sanitary Sewer Discharge Plan

Sinking Fork Relief Sewer

Legend

- Documented SSO
- Suspected SSO
- WWTP
- Pump Station
- New Construction
- Force Main
- Force Main non MSD
- MSD Sewer
- non msd pipes
- Combined Sewer Pipe
- Streams
- Beechwood Village
- Metro Parks

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1 inch = 350 feet
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Interim SSDP
Project Fact Sheet

SSO Project Number:	Interim SSDP Project
Project Name:	Southeastern Diversion Structure and Interceptor
Modeled Area:	N/A
Branch or SSO ID:	N/A
Project Type:	New relief sewer and flow control modifications
Receiving Stream:	South Fork Beargrass Creek
Project Description:	This project includes improvements to the Southeast Diversion Structure for increased flows due to the Hikes Lane Interceptor and other Final SSDP projects. The project will consist of a new parallel Southeastern Interceptor relief sewer, two flow control junction boxes, and modifications to the existing Southeastern Diversion Structure (including removing control weirs and reprogramming Real Time Control gates).
Reason for Overflow:	System Capacity
Design Parameters / Assumptions:	N/A
Project Constraints:	Project is subject to a potential change due to upstream projects
Estimated Capital Cost (2008 dollars):	$1,744,000
Weighted Benefit/Cost Ratio (Present Worth):	N/A

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
08426	Pruitt Court #5	Morris Forman	Manhole	Ground	9,661
08427	Pruitt Court #6	Morris Forman	Manhole	Ground	13,500

08430	Pruitt Court #1	Morris Forman	Manhole	Ground	402,571
08431	Pruitt Court #2	Morris Forman	Manhole	Ground	35,500
30701	Pruitt Court #3	Morris Forman	Manhole	Stream	81,000
30702	Pruitt Court #4	Morris Forman	Manhole	Stream	81,000
49647	Pruitt Court #8	Morris Forman	Manhole	Ground	956,053
63779	Pruitt Court #7	Morris Forman	Manhole	Ground	2,268,606
30680	3420 Fountain Dr near Buechel Branch	Morris Forman	Manhole	Ground	29,582
30681	3401 Fountian Drive at Creek	Morris Forman	Manhole	Ground	23,100
72571-X	Southeat Diversion Structure	Morris Forman	Constructed	Stream	7,216,243

Integrated Overflow Abatement Plan

Interim Sanitary Sewer Discharge Plan

Southeastern Diversion Structure and Interceptor

Legend

- Documented SSO
- Suspected SSO
- WWTP
- Pump Station
- New Construction
- Modify Existing Sewer
- Force Main
- Force Main non MSD
- MSD Sewer
- Non MSD Pipes
- Combined Sewer Pipe
- Streams
- Hikes Point
- Metro Parks

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Interim SSDP
Project Fact Sheet

SSO Project Number:	Interim SSDP Project
Project Name:	Derek R. Guthrie WQTC
Modeled Area:	N/A
Branch or SSO ID:	N/A
Project Type:	WQTC Upgrade
Receiving Stream:	Mill Creek, Black Pond Creek, Alvey Ditch, and the Ohio River
Project Description:	This project includes improvements to the Derek R. Guthrie WQTC to allow treatment of all wet weather flow from other SSDP system improvements. The 100 MGD peak flow capacity secondary treatment facility will consist of a flow control structure, new influent pumps, piping modifications, new screening facility, a new equalization basin, construction of a wet weather pump station, and secondary clarifiers.
Reason for Overflow:	Treatment Plant Capacity
Design Parameters / Assumptions:	N/A
Project Constraints:	N/A
Estimated Capital Cost (2008 dollars):	$102,700,000
Weighted Benefit/Cost Ratio (Present Worth):	N/A

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)
22370	Greenbelt Highway	West County	Manhole	Ground	4,858,000

22385	Johsontown Road #2	West County	Manhole	Stream	1,628,500
32682	12700 Abbey Road #2	West County	Manhole	Stream	2,392,000
32688	12701 Abbey Road #1	West County	Manhole	Ground	No Data
59169	Johsontown Road #1	West County	Manhole	Ground	1,905,250
MSD0277	West County	West County	Pumped	Stream	48,477,223

Integrated Overflow Abatement Plan
Interim Sanitary Sewer Discharge Plan
Derek R. Guthrie WQTC

Legend

- Documented SSO
- Suspected SSO
- WWTP
- Pump Station
- Force Main
- Force Main non MSD
- MSD Sewer
- Non MSD Pipes
- Combined Sewer Pipe
- Streams
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- Metro Parks

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Final SSDP
Project Fact Sheet

SSO Project Number:	N/A
Project Name:	CPE/CCP Modifications to WQTCs
Modeled Area:	N/A
Branch or SSO ID:	N/A
Project Type:	Modifications to WQTCs
Receiving Stream:	N/A
Project Description:	This project provides funding for the implementation of Type 1 and Type 2 modifications recommended as part of the Comprehensive Performance Evaluation (CPE) and Composite Correction Program (CCP) conducted on several WQTCs
Reason for Overflow:	N/A
Design Parameters / Assumptions:	N/A
Project Constraints:	N/A
Estimated Capital Cost (2008 dollars):	$2,600,000
Weighted Benefit/Cost Ratio (Present Worth):	N/A

Overflow Points Addressed:

SSO	SSO Name	Service Area	Overflow Type	Discharge To	Average Overflow / Incident (gallons)