Knoxville Utilities Board

Phase II: Corrective Action Plan/ Engineering Report

Submitted to EPA on
September 9, 2009

CDM

KUB

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D. Wayne Loveday

D. Wayne Loveday

9.09.09

Date

8/31/09

Contents

Executive Summary

ES.1 KUB's Integrated Approach to Achieving Consent Decree Goals ES-1
ES.2 Background and Purpose of CAP/ER ES-2
ES.3 Evaluation of Facility Improvements ES-6
ES.4 Implementation Plan ES-8
ES.5 Summary ES-24

Section – 1 Introduction

1.1 KUB's Integrated Approach to Achieving Consent Decree Goals 1-1
1.2 Background and Purpose of CAP/ER 1-2
1.3 Implementation of CAP/ER Projects 1-6
1.4 Description of Study Area 1-7
1.5 Organization of Report 1-8

Section – 2 System Monitoring and Modeling

2.1 Flow Monitoring Overview 2-1
2.2 Description of Flow Monitoring Programs 2-1
2.2.1 2006 Flow Monitoring Program 2-1
2.2.2 2007 Flow Monitoring Program 2-2
2.2.3 2008 Flow Monitoring Program 2-2
2.3 Modeling Update 2-3
2.4 Data Quality Review 2-3

Section – 3 KUB Service Area - Phase II Facility Improvements

3.1 Phase II Facility Improvements 3-1
3.2 First Creek 3-1
3.2.1 Phase II CAP/ER Facility Improvements 3-2
3.3 Second Creek 3-6
3.3.1 Phase II CAP/ER Facility Improvements 3-6
3.4 Third Creek 3-10
3.4.1 Phase II CAP/ER Facility Improvements 3-10
3.5 Fourth Creek 3-14
3.5.1 Phase II CAP/ER Facility Improvements 3-14
3.6 South Knoxville/Knob Creek 3-18
3.6.1 Phase II CAP/ER Facility Improvements 3-18
3.7 Williams Creek 3-22
3.7.1 Phase II CAP/ER Facility Improvements 3-22
3.8 Loves Creek 3-26
3.8.1 Phase II CAP/ER Facility Improvements 3-26
3.9 Eastbridge 3-29
3.9.1 Phase II CAP/ER Facility Improvements 3-29

Section – 4 Implementation Plan

Appendix A: CAP/ER Quarterly Progress Report Second Quarter 2009

List of Figures

Figure ES-1	Phase II: CAP/ER Study Area	ES-4
Figure ES-2	First Creek Phase II: CAP/ER Project Implementation	ES-16
Figure ES-3	Second Creek Phase II: CAP/ER Project Implementation	ES-17
Figure ES-4	Third Creek Phase II: CAP/ER Project Implementation	ES-18
Figure ES-5	Fourth Creek Phase II: CAP/ER Project Implementation	ES-19
Figure ES-6	South Knoxville/Knob Creek Phase II: CAP/ER Project Implementation	ES-20
Figure ES-7	Williams Creek Phase II: CAP/ER Project Implementation	ES-21
Figure ES-8	Loves Creek Phase II: CAP/ER Project Implementation	ES-22
Figure ES-9	Eastbridge Phase II: CAP/ER Project Implementation	ES-23
Figure 1-1	Phase II: CAP/ER Study Area	1-4
Figure 2-1	2006 Flow Meter, Rain Gauge, and Minibasin Locations	2-4
Figure 2-2	2007 Flow Meter, Rain Gauge, and Minibasin Locations	2-5
Figure 2-3	2007 Flow Meter, Rain Gauge, and Minibasin Locations	2-6
Figure 2-4	2008 Flow Monitoring Locations Third Creek	2-7
Figure 2-5	Scatterplot of Quality Flow Monitoring Data	2-8
Figure 3-1	First Creek Sewer Hydraulic Model	3-3
Figure 3-2	First Creek Phase II: CAP/ER SSOER Map	3-5
Figure 3-3	Second Creek Sewer Hydraulic Model	3-7
Figure 3-4	Second Creek Phase II: CAP/ER SSOER Map	3-9
Figure 3-5	Third Creek Sewer Hydraulic Model	3-11
Figure 3-6	Third Creek Phase II: CAP/ER SSOER Map	3-13
Figure 3-7	Fourth Creek Sewer Hydraulic Model	3-15
Figure 3-8	Fourth Creek Phase II: CAP/ER SSOER Map	3-17
Figure 3-9	South Knoxville/Knob Creek Sewer Hydraulic Model	3-19
Figure 3-10	South Knoxville/Knob Creek Phase II: SSOER Map	3-21
Figure 3-11	Williams Creek Sewer Hydraulic Model	3-23
Figure 3-12	Williams Creek Phase II: CAP/ER SSOER Map	3-25
Figure 3-13	Loves Creek Phase II: CAP/ER SSOER Map	3-28
Figure 3-14	Eastbridge Phase II: CAP/ER SSOER Map	3-31
Figure 4-1	First Creek Phase II: CAP/ER Project Implementation	4-9
Figure 4-2	Second Creek Phase II: CAP/ER Project Implementation	4-10
Figure 4-3	Third Creek Phase II: CAP/ER Project Implementation	4-11
Figure 4-4	Fourth Creek Phase II: CAP/ER Project Implementation	4-12
Figure 4-5	South Knoxville/Knob Creek Phase II: CAP/ER Project Implementation	4-13
Figure 4-6	Williams Creek Phase II: CAP/ER Project Implementation	4-14
Figure 4-7	Loves Creek Phase II: CAP/ER Project Implementation	4-15
Figure 4-8	Eastbridge Phase II: CAP/ER Project Implementation	4-16

List of Tables

Table ES-1	First Creek Implementation Plan	ES-9
Table ES-2	Second Creek Implementation Plan	ES-10
Table ES-3	Third Creek Implementation Plan	ES-11
Table ES-4	Fourth Creek Implementation Plan	ES-12
Table ES-5	South Knoxville/Knob Creek Implementation Plan	ES-13
Table ES-6	Williams Creek Implementation Plan	ES-14
Table ES-7	Loves Creek Implementation Plan	ES-14
Table ES-8	Eastbridge Implementation Plan	ES-15
Table 3-1	First Creek Phase II – Capacity Related SSOs	3-4
Table 3-2	First Creek Phase II – Non-Capacity Related SSOs	3-4
Table 3-3	Second Creek Phase II – Capacity Related SSOs	3-8
Table 3-4	Second Creek Phase II – Non-Capacity Related SSOs	3-8
Table 3-5	Third Creek Phase II – Capacity Related SSOs	3-12
Table 3-6	Third Creek Phase II – Non-Capacity Related SSOs	3-12
Table 3-7	Fourth Creek Phase II – Capacity Related SSOs	3-16
Table 3-8	Fourth Creek Phase II – Non-Capacity Related SSOs	3-16
Table 3-9	South Knoxville/Knob Creek Phase II – Capacity Related SSOs	3-20
Table 3-10	South Knoxville/Knob Creek Phase II – Non-Capacity Related SSOs	3-20
Table 3-11	Williams Creek Phase II – Capacity Related SSOs	3-24
Table 3-12	Williams Creek Phase II – Non-Capacity Related SSOs	3-24
Table 3-13	Loves Creek Phase II – Capacity Related SSOs	3-27
Table 3-14	Loves Creek Phase II – Non-Capacity Related SSOs	3-27
Table 3-15	Eastbridge Phase II – Capacity Related SSOs	3-30
Table 3-16	Eastbridge Phase II – Non-Capacity Related SSOs	3-30
Table 4-1	First Creek Implementation Plan	4-2
Table 4-2	Second Creek Implementation Plan	4-3
Table 4-3	Third Creek Implementation Plan	4-4
Table 4-4	Fourth Creek Implementation Plan	4-5
Table 4-5	South Knoxville/Knob Creek Implementation Plan	4-6
Table 4-6	Williams Creek Implementation Plan	4-7
Table 4-7	Loves Creek Implementation Plan	4-7
Table 4-8	Eastbridge Implementation Plan	4-8

Executive Summary

In February 2005, the Knoxville Utilities Board (KUB) entered a Consent Decree (CD) with the Tennessee Department of Environment and Conservation (TDEC), United States Environmental Protection Agency (EPA), the Department of Justice, Tennessee Clean Water Network and the City of Knoxville that outlined specific actions leading toward the goal of eliminating sanitary sewer overflows (SSOs) in the sewer collection system. In May 2006, KUB submitted the Phase I Corrective Action Plan / Engineering Report (CAP/ER) to address the SSOs contained within the Sanitary Sewer Overflow Evaluation Report (SSOER) dated September 2004 and an Annual Update to the SSOER submitted in April 2005. The SSOER contains a list of SSOs referred to as the "Long-Term List" that identifies all SSOs that occurred (including building back-ups) and the associated location, date, cause, and volume.

This Phase II CAP/ER evaluates all SSOs that were added to the Long-Term List pursuant to the Annual SSOER Update submitted on April 30, 2008 and all Annual SSOER Updates previously approved by EPA. Some SSO events that occurred in the 2008 SSOER were initially identified in the 2005 SSOER projects and were included in the Phase I CAP/ER. However, a repeat event may have occurred prior to completion of the Phase I CAP/ER project. In these cases, the Phase I project is identified in this CAP/ER to address the overflow. Phase II CAP/ER continues and expands the efforts initiated under Phase I.

This Executive Summary presents an overview of KUB's integrated approach to achieving CD goals, the background and purpose of the Phase II CAP/ER, a summary of the evaluation of alternatives, and an overview of the Implementation Plan.

ES.1 KUB's Integrated Approach to Achieving Consent Decree Goals

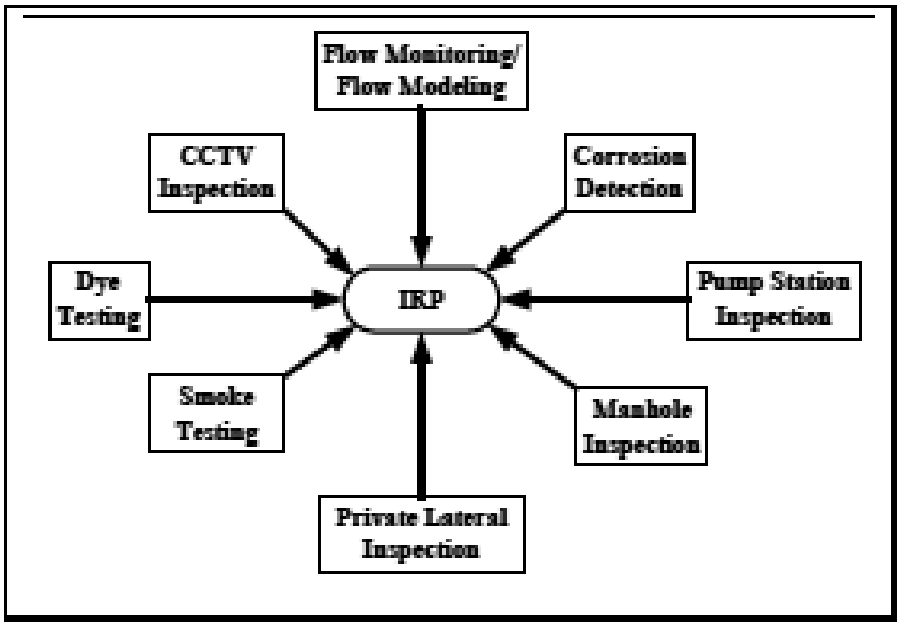
KUB continues to implement several complementary programs, in conjunction with Phase I CAP/ER, to comply with the requirements of the CD, specifically to "address the conditions causing SSOs with the goal of eliminating the SSO locations on the Long-Term List." KUB's holistic or total basin solution for each sewershed is to:

1. Implement capacity enhancement projects consistent with CAP/ER requirements. Such enhancements include storage facilities, relief sewers, pump station upgrades, and comprehensive rehabilitation in targeted areas with documented rainfall dependent infiltration and inflow (RDI/I) problems, and

2. Achieve capacity recovery through RDI/I removal with other complementary maintenance programs that are part of the Infrastructure Rehabilitation Program (IRP).

KUB developed the Phase I CAP/ER as a conceptual design document to guide the implementation of specific projects. Phase II CAP/ER continues this guidance. It is not intended to provide final design criteria, but to provide minimum criteria which will be further evaluated during preliminary and final design phases. In many cases, projects are being designed with capacities that exceed the minimum criteria established in the CAP/ER.

Other Complementary Programs Related to CAP/ER



KUB's other complementary programs that combine to comprise the IRP are supported by the previously approved Continuing Sewer System Assessment Program (CSSAP). These programs address performance enhancement (removal of roots, debris, grease), asset management (condition assessment, repair and replacement) and RDI/I removal (removal of inflow, repair of defective pipes and manholes that are the source of infiltration). Specifically, the smoke testing program addresses inflow elimination, and the lateral replacement program and sewer rehabilitation programs address infiltration reduction. It is important to note that RDI/I reduction benefits of these programs in restoring system capacity have not been considered in developing the conceptual capacity of CAP/ER solutions. This provides an added factor of safety because the CAP/ER project facilities will be able to store and/or convey flows from increasingly larger storm events as RDI/I is removed through KUB's comprehensive IRP. The IRP has been approved and is being aggressively implemented. KUB is monitoring the progress of these rehabilitation activities with ongoing permanent and temporary flow monitoring data to quantify their effectiveness.

ES.2 Background and Purpose of CAP/ER

The top priority of KUB's facility planning efforts is to provide a wastewater collection system that meets the needs of KUB customers while protecting the environment. Since 1987, KUB has performed several studies and made many improvements in a majority of the service area basins. However, there are still areas requiring capital improvements, particularly in older areas of the system where RDI/I is problematic.

RDI/I entering the sanitary sewer system during wet weather is a major consideration in this report. All combined sanitary and storm sewers have been eliminated from the wastewater service area. However, because of sewer system defects, unintentional or illegal cross connections with the storm sewer system, or other sources, extraneous storm water flows enter the sanitary sewer system during rainfall events as RDI/I. These RDI/I flows can overload the capacity of the sanitary sewer system and result in periodic SSOs from manholes and/or building back-ups.

The objective of the Phase II CAP/ER is to identify facility improvements required to address reported SSOs that have been reported in accordance with the Consent Decree since the Phase I CAP/ER implementation. The SSOs listed on the Long-Term List that require improvement projects are mapped and presented in **Figure ES-1**. These SSOs include building back-ups. Some of these SSOs were caused by capacity issues, and some were caused by non-capacity issues such as a pipe blockage caused by debris, grease, or roots. Many of the SSO events shown on Figure ES-1 were caused by extreme weather conditions during a September 23 – 25, 2006 storm event. That event produced localized totals as high as 5.15 inches in less than 24 hours based on KUB rain gages. The average 24-hour rainfall total for this event across all KUB rain gages was 4.14 inches, which is approximately a 10-year storm event in frequency for the Knoxville area.

Under Phase I CAP/ER efforts, capacity related SSOs were evaluated using a hydraulic modeling analysis. In keeping with KUB's goals, this hydraulic analysis consisted of first analyzing each basin using a hydraulic model and developing a total basin solution that would convey projected future flows and estimated RDI/I from a representative planning storm event. The total basin solution for each basin takes into account the whole system including the effects of transporting this flow to the wastewater treatment plants. The total basin solution addresses future projected SSOs and surcharge conditions in addition to the SSOs listed in the Long-Term List. Phase II CAP/ER continues Phase I efforts and intertwines projects from both phases to further increase total basin solution successes.

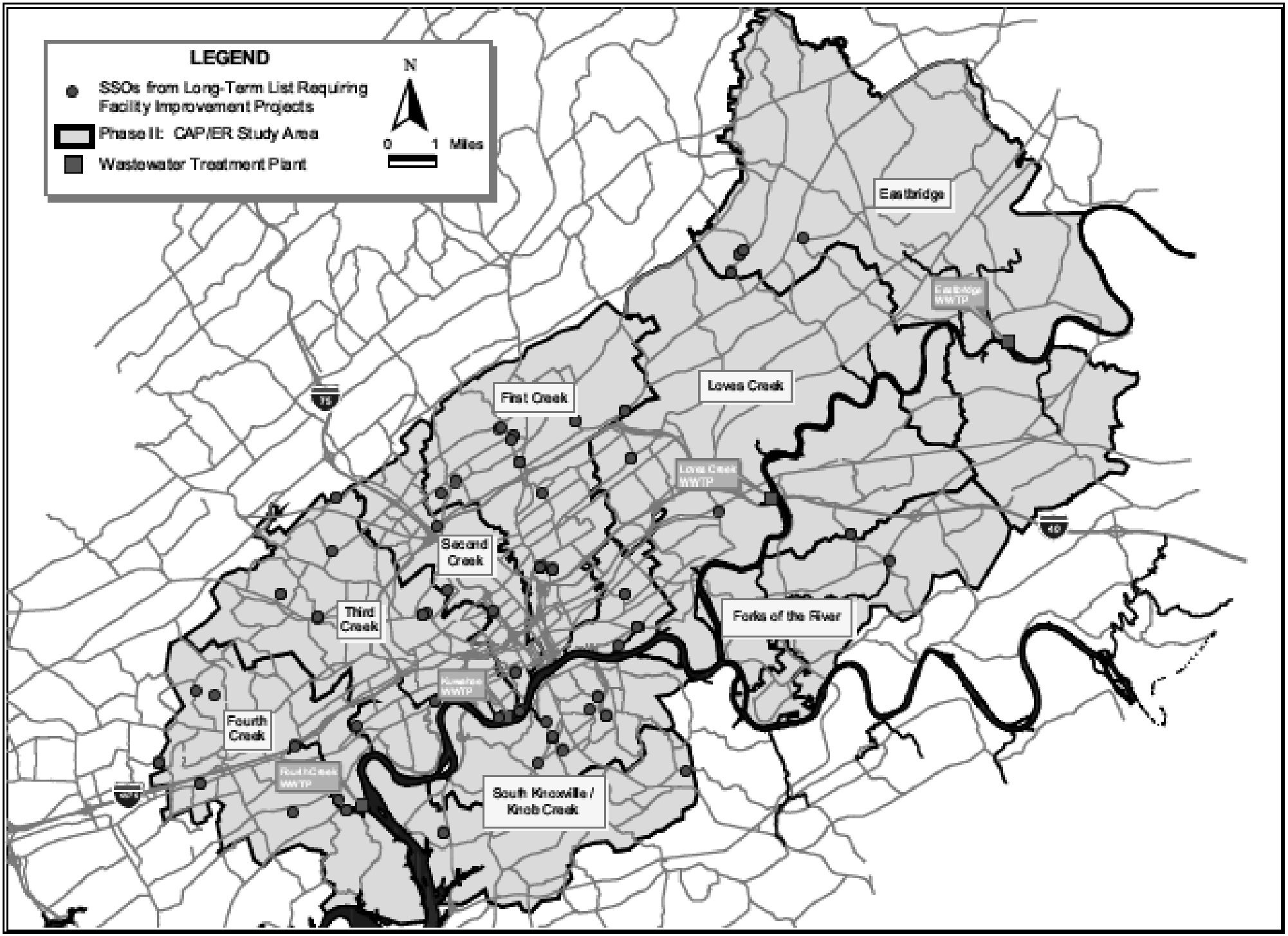


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Figure ES-1
Phase II: CAP/ER Study Area

CAP/ER Project Performance Criteria

The criteria used in evaluating wet-weather performance of the existing system and alternative capacity enhancement projects to address SSOER capacity related locations are summarized below:

1. Future base flows projected to occur at or near build-out conditions (20 years for highly developed sewersheds and 40 years for developing sewersheds) were used to represent dry-weather flows, including diurnal variations.

2. Winter/spring R values (percentage of rainfall that enters the sewers as RDI/I) were developed on the basis of extensive temporary flow monitoring program data and used to develop RDI/I influent hydrographs. The data indicate that winter/spring R values typically exceed other seasonal R values by up to 100 percent.

3. Projects selected for inclusion in the CAP/ER result in surcharging of less than 2.0 feet above top of pipe and no surcharging to within 3.0 feet of the manhole rim at SSOER locations during base wet-weather conditions (described below).

4. Projects selected for inclusion in the CAP/ER include sufficient downstream improvements and/or upstream comprehensive rehabilitation so that they do not result in moving overflows to downstream locations during base wet-weather conditions (described below).

5. Base wet-weather conditions consist of a synthetic rainfall event of 2.96 inches falling over a 24-hour period. In keeping with winter / spring R values, the synthetic rainfall event is based on the winter / spring rainfall in the Knoxville area.

The total basin solution consists of a number of individual projects including various sewer replacement projects, storage projects, and rehabilitation projects. In the Phase I CAP/ER, each of the individual projects in the total basin solution for each basin was analyzed to determine which were required to address the SSO locations on the Long-Term List. This included projects directly affecting the SSO location as well as projects required to address potential overflows downstream, which would be predicted to occur as a result of implementing upstream improvements. . Phase II CAP/ER projects expound upon Phase I projects to address SSOERs pursuant to the Annual SSOER update submitted on April 30, 2008.

Some SSOs reported on the Long-Term List occurred on small collector pipes that were not included in the hydraulic model evaluation. These are addressed within this Phase II CAP/ER by either collector sewer replacement projects or sewer rehabilitation projects. In addition, some SSOs reported on the Long-Term List were caused by non-capacity issues such as a pipe blockage caused by debris, grease, or roots. These SSOs have been addressed or are being addressed by KUB's CSSAP.

The primary function of the CSSAP, which has been approved by EPA, is to provide decision-support information for implementation of the IRP, along with KUB's other capital improvements to restore and maintain system hydraulic capacity, restore and maintain structural integrity of system components, and reduce corrective maintenance costs.

The primary objectives of the IRP, which was approved by EPA in December 2005, are to address RDI/I and other conditions causing SSOs through:

- Capacity restoration – this objective is aimed at keeping assets functioning at their full, original capacity. Examples include removing sediment or debris from a pipeline system, reducing infiltration and inflow (I/I) in a wastewater collection system, and/or repairing system defects that would limit flow capacity through a system. In some cases, it is cost effective and/or necessary to meet system growth needs by providing increased capacity or storage to attain the desired system hydraulic capacity.

- Damage repair – this objective is aimed at repairing structural damage and failures in the system that are the result of wear, corrosion, age, and/or construction-related damage to extend the useful life of the component. This function reduces the risk of system failure which could cause interruption in service and could result in impacts to the community and increase costs as compared to scheduled maintenance and repairs.

- Maintenance reduction – this objective is aimed at repairing portions of the system that are subject to known, repeated maintenance problems that increase maintenance costs and keep crews from conducting more productive preventive maintenance. Examples in a wastewater collection system are the repair of conditions such as root intrusion, offset joints, pipe sags, improper service connections, and other system deficiencies that typically lead to recurring problems for system operators.

This CAP/ER was developed using CSSAP elements (e.g., flow monitoring, hydraulic model) and will be implemented using other CSSAP elements (e.g., dye testing/dyed water flooding, CCTV inspection, smoke testing). Therefore, for program administration purposes, KUB considers the CAP/ER and its implementation to be part of its IRP.

ES.3 Evaluation of Facility Improvements

The development of this Phase II CAP/ER builds upon and extends the efforts undertaken under the Phase I CAP/ER. This includes ongoing flow monitoring throughout the collection system, hydraulic modeling analysis, and the evaluation of various alternative improvement options.

Flow Monitoring

During the period between Phase I CAP/ER and Phase II CAP/ER, KUB continued temporary flow monitoring programs in 2006, 2007, and 2008 as part of ongoing efforts to monitor capital improvement programs. In addition to temporary flow monitoring programs, KUB maintains 35 permanent flow monitors in the service area trunk sewer systems and 8 permanent rain gauges throughout the service area. The purpose of permanent and temporary flow monitoring is to collect wastewater flow data and to evaluate quantities of flow and changes in flow during dry-weather and wet-weather conditions.

The flow monitoring data is used in several ways to aid in the planning of capital improvements. First, the data is used to identify areas in the collection system that should receive the highest priority for sewer system evaluation survey (SSES) and rehabilitation based on observed response to wet-weather events. Second, the data is used to support a hydraulic analysis of the trunk sewers (including model calibration and development of design flows), where the purpose of the hydraulic analysis is to identify trunk sewers or pump stations that are predicted to be over-capacity during dry- or wet-weather conditions. Third, the data is used to measure the relative success of sewer rehabilitation projects by quantifying the amount of inflow and infiltration (I/I) that is reduced. Finally, the data from permanent flow meters is used for hydraulic model calibration and for flow trending analyses.

Section 2 further discusses the flow monitoring performed.

Hydraulic Modeling Analysis

Under Phase I CAP/ER efforts, CDM developed a hydraulic model of the major trunk sewers for six of the drainage basins: First Creek, Second Creek, Third Creek, Fourth Creek, South Knoxville/Knob Creek, and Williams Creek. Hydraulic models were not developed to the same extent for the Cheowa area of the Third Creek Basin, Loves Creek Basin, or Eastbridge Basin because of the limited number of overflows that had occurred in these areas, the majority of which were not capacity related. These SSOs were still addressed in the Phase 1 CAP/ER and in this Phase II CAP/ER; however, a full hydraulic modeling analysis was not required to adequately address them.

Section 3 further discusses hydraulic modeling analysis updates that have occurred since the Phase I CAP/ER.

Evaluation of Facility Improvements

Improvement alternatives that would convey projected future flows and projected RDI/I from a representative 24-hour planning storm event were developed under the Phase I CAP/ER. The Phase II CAP/ER looks at the effects of these alternatives on Phase II SSO's and evaluates the extension of, or addition to any of the previously defined Phase I CAP/ER projects. In addition, any Phase II SSOs not addressed by an implemented Phase I project were evaluated and new projects were developed to

address them. Section 3 details each Phase II SSO location and presents project descriptions to address each SSO.

ES.4 Implementation Plan

The Implementation Plan summarizes the facility improvements required to address SSOs in accordance with the CD. The plan also lists the Fiscal Year for starting and completing all work specified in this Phase II CAP/ER. The Implementation Plan includes projects that have been completed as well as those that are planned. Section 4 presents how these projects address the SSOs in accordance with the CD and includes tables of all SSOs on the Long-Term List and the associated project that addresses each.

Tables ES-1 through ES-8 present each facility improvement project including a project ID, project name, project description, start date, and end date. Start date and end date are given as fiscal year in accordance with the CD. It was assumed that the Phase II CAP/ER would be approved during Fiscal Year 09/10 and that Fiscal Year 09/10 represented the first year of the schedule to complete the Phase II CAP/ER projects by June 30, 2016.

Approximate sizing and extents of each project are given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Figures ES-2 through ES-9 present maps of each basin showing the planned and completed facility projects to address the SSOs. Already completed pipeline improvement projects are shown in dark grey. Planned trunk sewer improvement projects are shown in magenta. Collector system projects with the goal of finding and fixing other sewer defects are shown in blue. Each of the planned and completed projects that addresses an SSO is labeled with a project ID number. The project IDs listed on the figure match the project IDs in Tables ES-1 through ES-7.

Table ES-1: First Creek Implementation Plan[1]

Project ID	Project Name	Project Description	Start Date	End Date
FCR-1	Watercress Drive Project	Find and Fix work to identify and address cause of overflow in the vicinity of 1235 Watercress Drive	FY 2014	FY 2015
FCR-2	Upchurch Road Project	Find and Fix work to identify and address cause of overflow in the vicinity of 4600 Upchurch Road.	FY 2014	FY 2015
Phase 1 CAP/ER, 1-1	Upper First Creek Collector Project (Mini-basin 01A1, 02A2, 03D1)	Find and fix work to identify and address cause of overflow in the vicinity of 4811 Beverly Road, 4144 Oakland Drive, and 5511 Dogwood Road.	Completed 06/2009	
Phase 1 CAP/ER, 1-2	Lower First Creek Collector Project (Mini-basin 8B2)	Find and fix work to identify and address cause of overflow in the vicinity of 2412, 2514, 2528, 2806, 2808, 2900, 2528, 2700, and 2808 Tecoma Drive, 3501 Whittle Springs Road, Islington Avenue, 1800 Linden Avenue, 2524 Underwood Place, and 3008 Valley View Drive.	Completed 04/2008	
Phase 1 CAP/ER, 1-3	First Creek Storage Tanks	Design and construction of the upper First Creek storage tank and lower First Creek storage tank.	Upper First Creek Completed 04/2007, Lower First Creek Completed 12/2006	
Phase 1 CAP/ER, 1-5	Upper Fountain City Pipe Replacement Project	Replace approximately 1,053 lf of existing sewer with 12-in, 1,856 lf with 24-in, and 595 lf with 27-in pipe.	Completed 11/2007	
Phase 1 CAP/ER, 1-15	Replace trunk sewer upstream of lower storage unit	Replace approximately 3,700 lf of existing 54-in, and 331 lf of 18-in pipe.	Completed 02/2007	
Phase 1 CAP/ER, 1-25	Sub-basins 3&4 Rehabilitation Project	Rehabilitation to reduce R to 2% in Sub-basins 03B1, 03B2, and 04B1.	Completed 05/2008	

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table ES-2: Second Creek Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
SCR-1	Central Avenue Pike Project	Find and Fix work to identify and address cause of overflow in the vicinity of 4105 Central Avenue Pike	FY 2013	FY 2015
Phase 1 CAP/ER, 2-11	Burnside Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 2523 Burnside Street.	FY 2009	FY 2010
Phase 1 CAP/ER, 2-15	1000 block Elm Street Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 1025 Elm Street.	FY 2009	FY 2010
Phase 1 CAP/ER, 2-19	Cumberland Avenue RehabilitationProject	Find and fix work to identify and address cause of overflow in the vicinity of 1000 Phillip Fulmer Way, 1509 Cumberland Avenue, and Seventeenth Street and White Avenue.	FY 2009	FY 2010

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table ES-3: Third Creek Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
Phase 1 CAP/ER, 3-3	Subbasin 9 Rehabilitation Project	Rehabilitation to reduce R to 2% in Sub-basins 09A1, 09A2, 09A4, and 09D1.	Completed 10/2008	
Phase 1 CAP/ER, 3-4	Upper McKamey and Third Creek Road Replacement Project	Replace approximately 3,141 lf of existing sewer with 36-in sewer and approximately 1500 lf with 15-in sewer.	Completed 08/2008	
Phase 1 CAP/ER, 3-6	Interstate 40 and Middlebrook Pike Trunk Replacement Project	Replace approximately 400 lf of existing sewer with 15-in sewer, 750 lf with 24-in sewer, 2,000 lf with 30-in sewer, and 7,000 lf with 36-in sewer.	FY 2009	FY 2012
Phase 1 CAP/ER, 3-7	Neyland Drive Trunk Replacement Project	Replace approximately 5,900 lf of existing sewer with 48-in sewer.	FY 2010	FY 2012
Phase 1 CAP/ER, 3-21	Deerfield Road Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 4428 Deerfield Rd)	FY 2011	FY 2012
Phase 1 CAP/ER, 3-26	PCP, CPE, and CCP	Wastewater evaluation studies of the Kuwahee WWTP.	FY 2006	FY 2007
Phase 1 CAP/ER, 3-29	Highland Hills Road Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 409, 411, and 419 Highland Hills Road.	FY 2012	FY 2013

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table ES-4: Fourth Creek Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
4TH-1	Minibasin 32A4	Sewer Rehabilitation	05/2009	08/2009
4TH-2	Ten Mile Pump Station Removal	Decommission Ten Mile Pump Station to eliminate flows from adjacent utility districts while retaining current KUB connections	FY 2013	FY 2015
Phase 1 CAP/ER, 4-6	Shadyland Drive Rehabilitation (Sub-basin 36A2) Project	Find and fix work to identify and address cause of overflow in the vicinity of 7000 Rotherwood Drive and 7112 and 7712 Shadyland Drive.	Completed 11/2009	
Phase 1 CAP/ER, 4-17	Storage Tank	Storage upstream of Walker Springs Pump Station.	Completed 11/2006	
Phase 1 CAP/ER, 4-18	Papermill Phases I, II, and III Project	Replace approximately 3,500 lf of existing sewer with 15-in sewer and approximately 1,000 lf with 36-in sewer.	Completed 01/2007	

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table ES-5: South Knoxville / Knob Creek Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
STH-1	Goldfinch Avenue Project	Find and Fix work to identify and address cause of overflow in the vicinity of 820 Goldfinch Avenue	FY 2012	FY 2013
Phase 1 CAP/ER, S-2	Goose Creek Trunk Sewer Replacement	Replace approximately 725 lf of existing 8-in sewer with 18-in sewer, Replace approximately 418 lf of existing 12-in sewer with 18-in sewer, Replace approximately 841 lf of existing 21-in sewer with 36-in sewer, Replace approximately 160 lf of existing 24-in sewer with 36-in sewer.	Completed 02/2009	
Phase 1 CAP/ER, S-11	Ford Valley Pump Station Upgrade Project	Upgrade pump station	FY 2010	FY 2011
Phase 1 CAP/ER, S-15	Trunk Replacement in Sub-basin 40A2 Project	Replace approximately 1,932 lf of existing 12-in sewer with 24-in sewer, Replace approximately 810 lf of existing 12-in sewer with 30-in sewer, and replace approximately 1,326 lf of existing 24-in sewer with 30-in sewer.	FY 2011	FY 2013
Phase 1 CAP/ER, S-19	Maryville Pike Pipe Replacement Project	Replace approximately 800 lf of existing sewer	Completed 03/2006	
Phase 1 CAP/ER, S-21	Alpine Avenue Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 3609 Alpine Avenue.	FY 2012	FY 2013
Phase 1 CAP/ER, S-28	Trunk Sewer Project	Replace approximately 1,464 lf of 30-in sewer with 36-in sewer.	Completed 01/2009	

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table ES-6: Williams Creek Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
Phase 1 CAP/ER, W-1	Sub-basin 19A2 Rehabilitation	Rehabilitation to reduce R to 2% in Sub-basin 19A2.	Completed 05/2009	
Phase 1 CAP/ER, W-2	Williams Creek Trunk Line Replacement (Downstream of Golf Course)	Replace approximately 3,100 lf of existing sewer with 36-in sewer.	Completed 04/2006	
Phase 1 CAP/ER, W-7	Sunset Avenue Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 2614 SunsetAvenue.	Completed 01/2007	

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table ES-7: Loves Creek Implementation Plan[1]

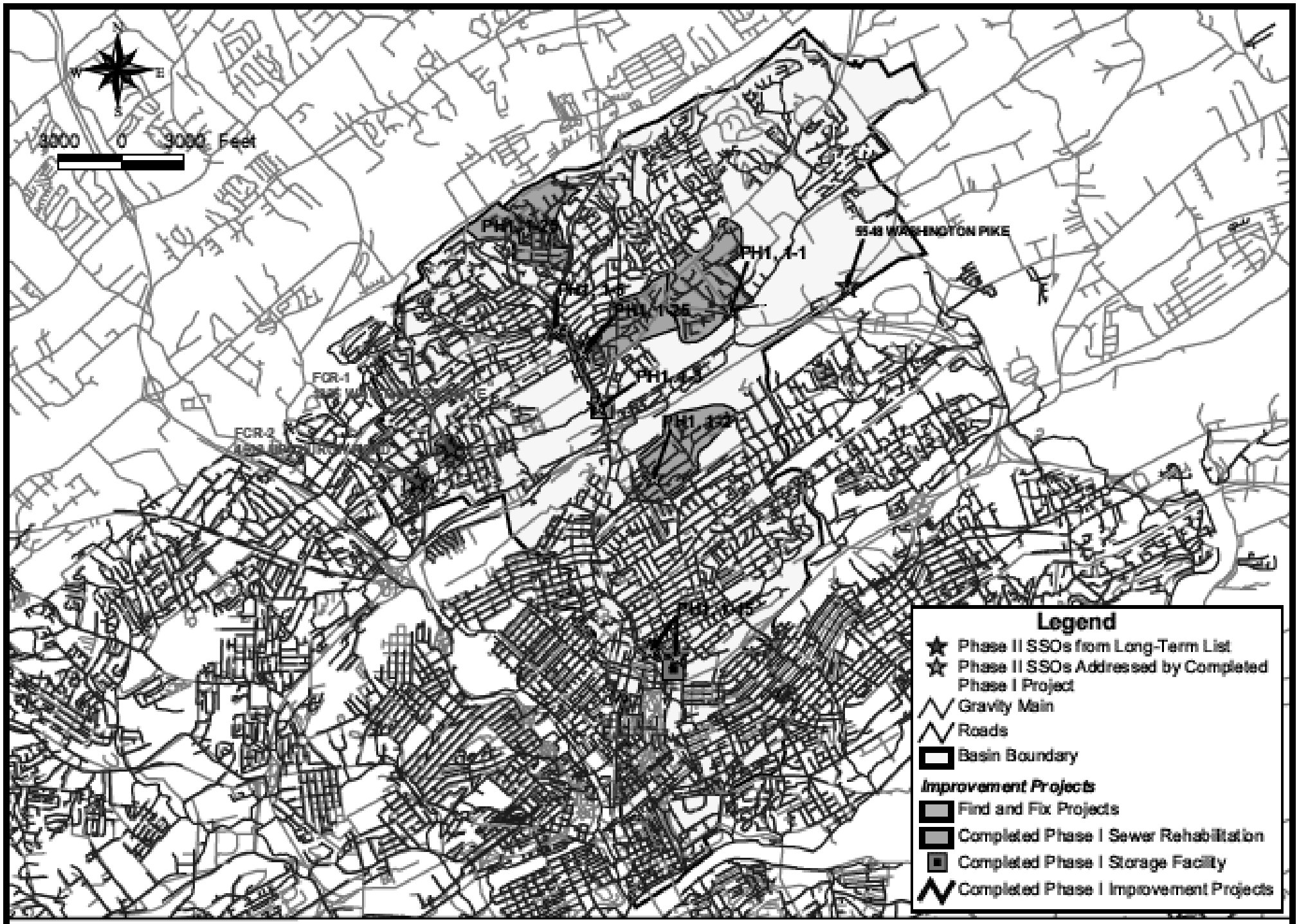
Project ID	Project Name	Project Description[1]	Start Date	End Date
LVS-1	Wayland Road Force Main Upgrade	Replaced 18,433 LF of 8" ductile iron force main with 10" PVC force main.	Completed 02/2009	
Phase 1 CAP/ER, L-1	Asheville Highway west of I-40 Trunk Replacement	Replace approximately 5,030 lf of existing 18-in pipe.	FY 2009	FY 2010
Phase 1 CAP/ER, L-9	Shelbourne Road Rehabilitation	Find and fix work to identify and address cause of overflow in the vicinity of 3001 Shelbourne Road.	FY 2009	FY 2010

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table ES-8: Eastbridge Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
EBR-1	Bud Hawkins pump station and force main project	Replaced the pump station and force main with a 21-inch gravity sewer, completed 2/23/09	Completed 02/2009	
Phase 1 CAP/ER, EB1	Maloneyville Road Rehabilitation	Find and fix work to identify and address cause of overflow in the vicinity of Maloneyville Road (MH 93-1, 93-7, 93-10, and at the lift station).	Completed 01/2009	

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.



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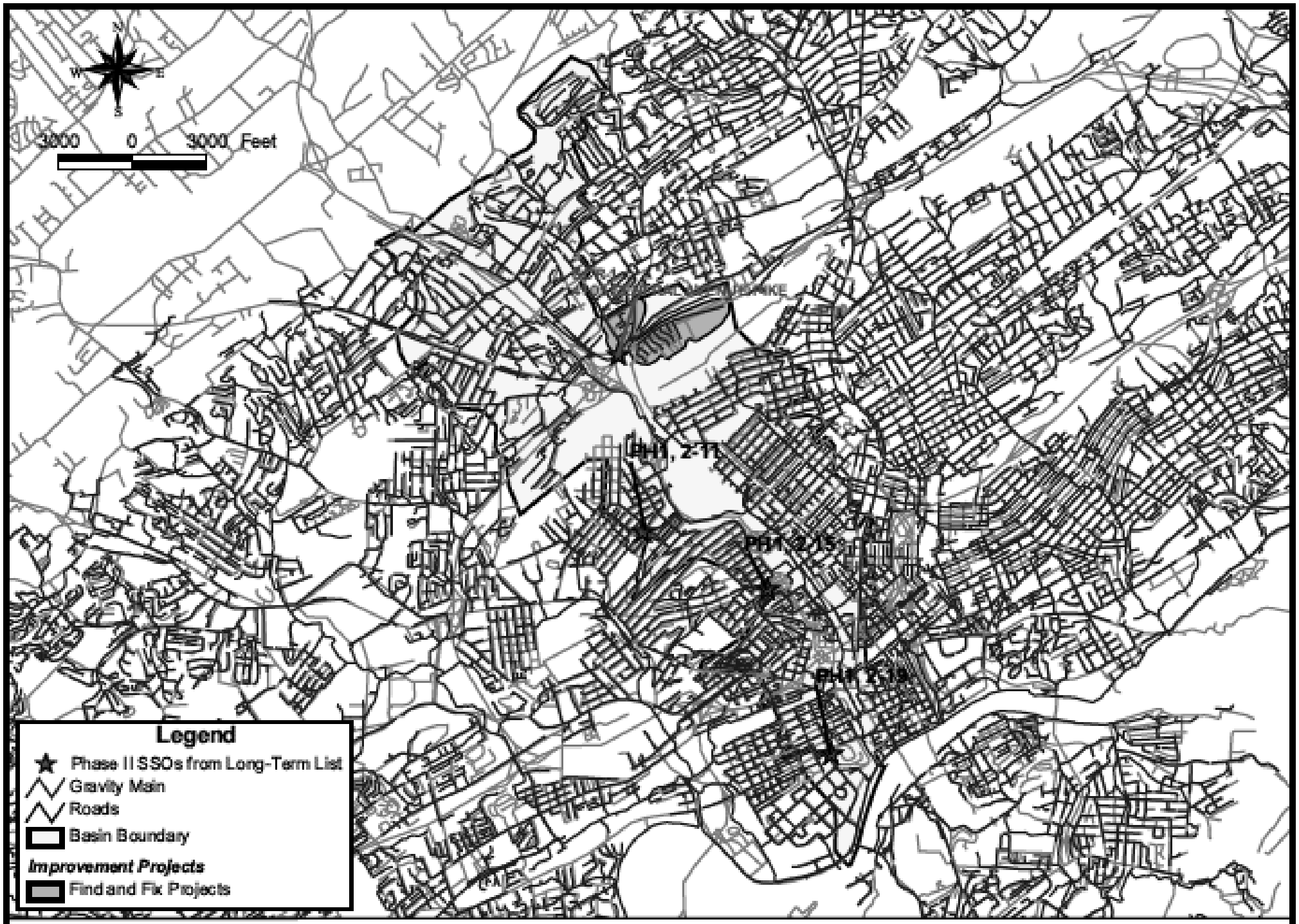
First Creek Phase II: CAP/ER Project Implementation

Figure ES-2



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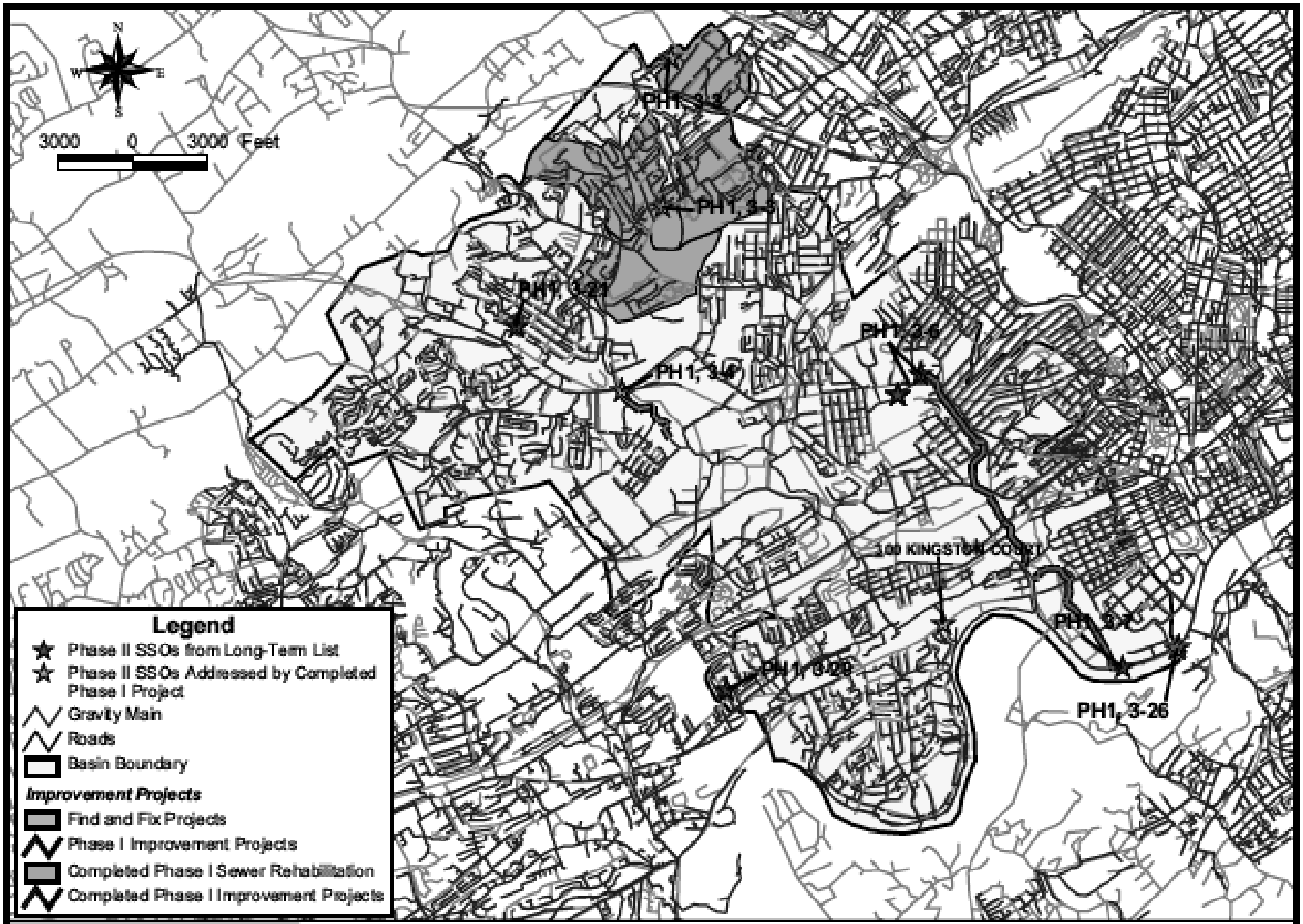
Second Creek Phase II: CAP/ER Project Implementation Figure ES-3



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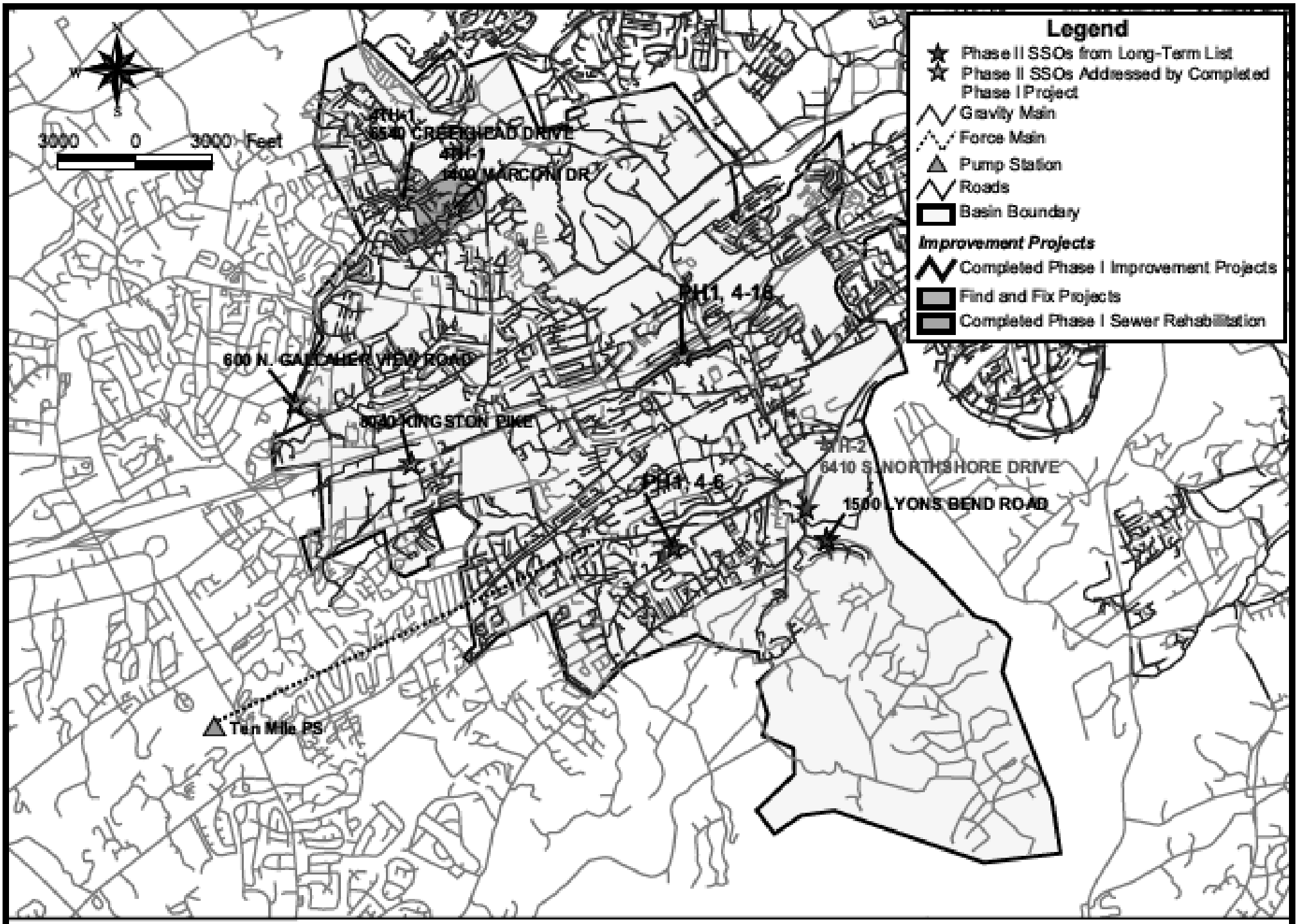
Third Creek Phase II: CAP/ER Project Implementation Figure ES-4



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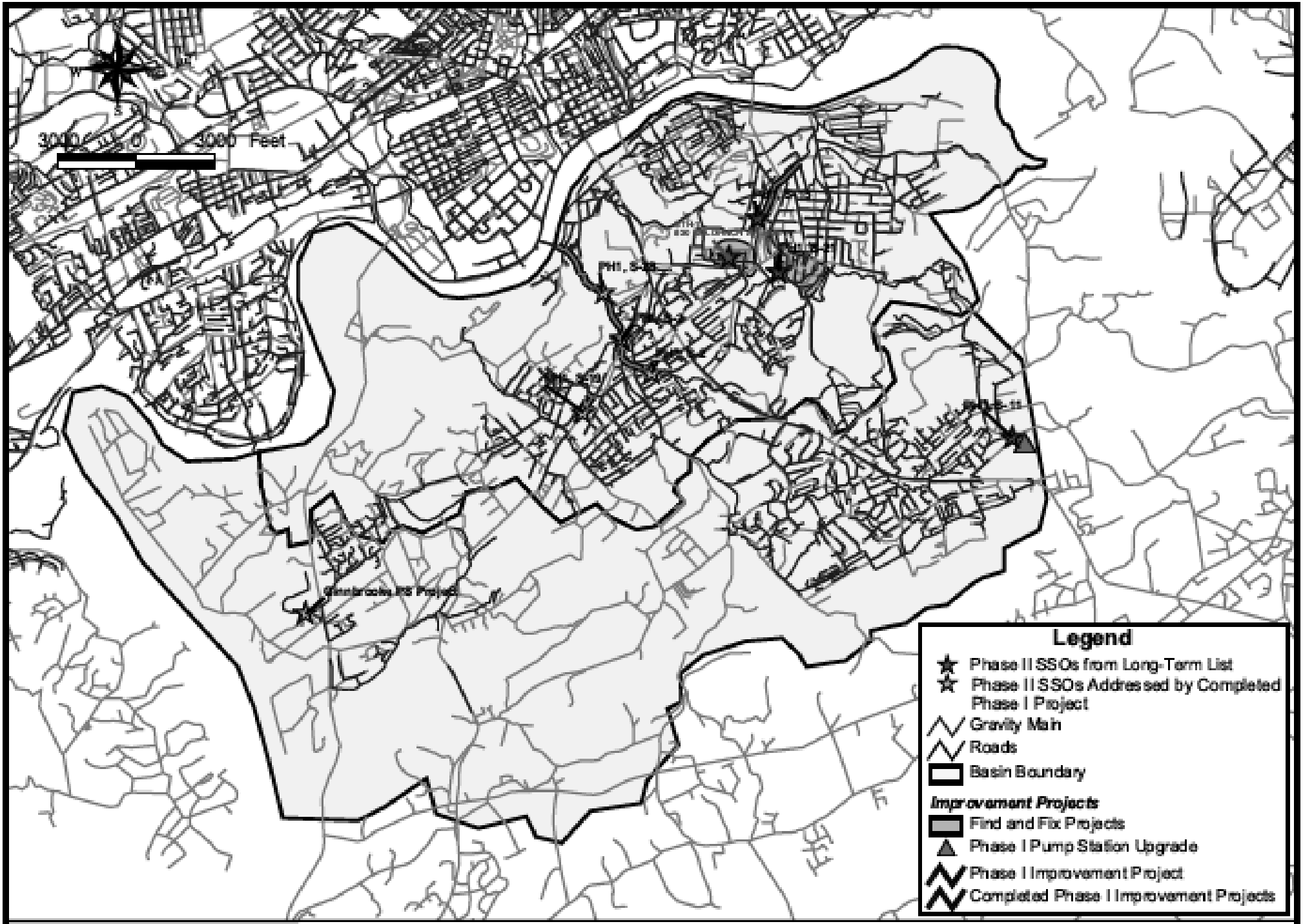
Fourth Creek Phase II: CAP/ER Project Implementation Figure ES-5



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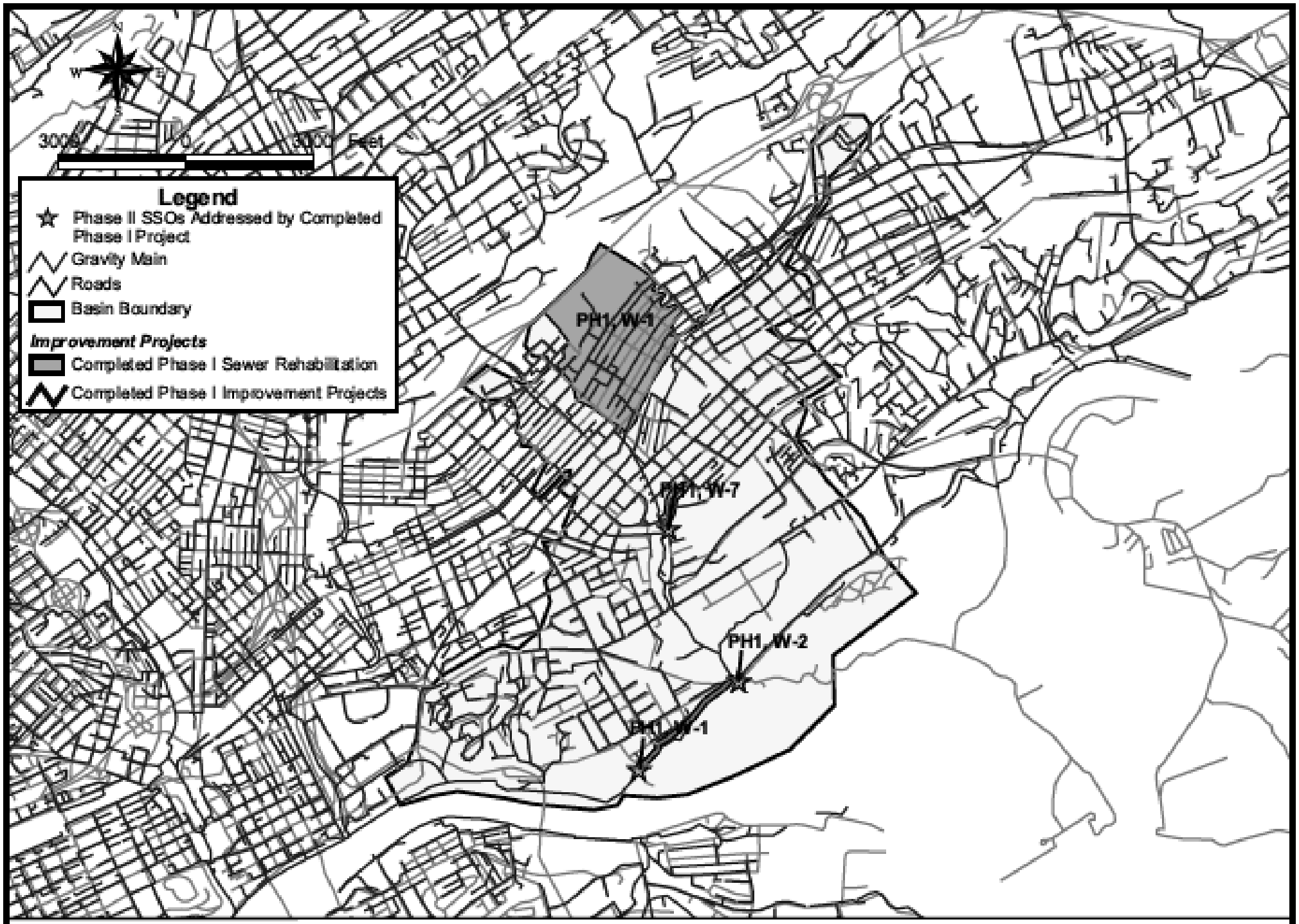
South Knoxville / Knob Creek Phase II: CAP/ER Project Implementation Figure ES-6



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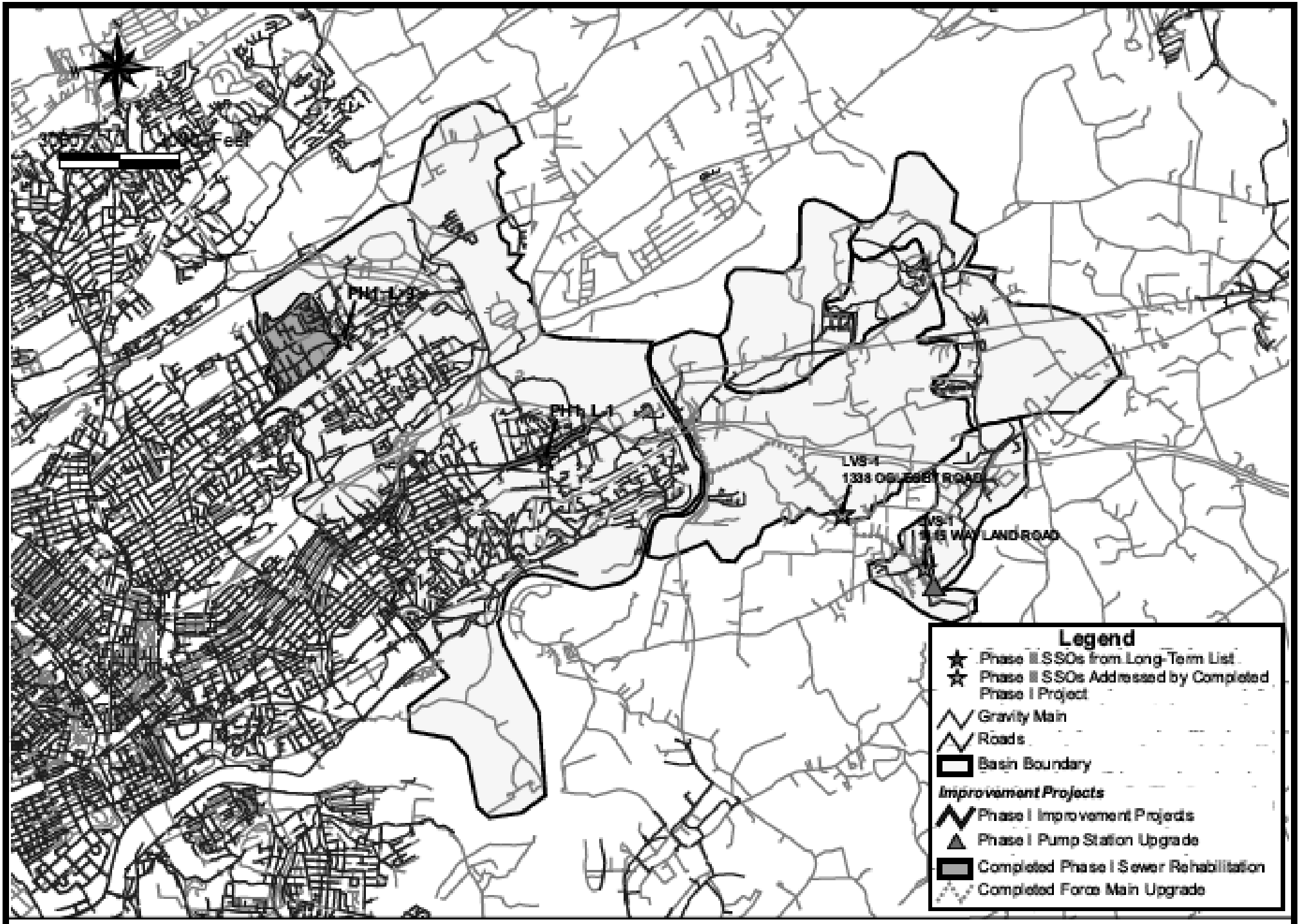
Williams Creek Phase II: CAP/ER Project Implementation

Figure ES-7



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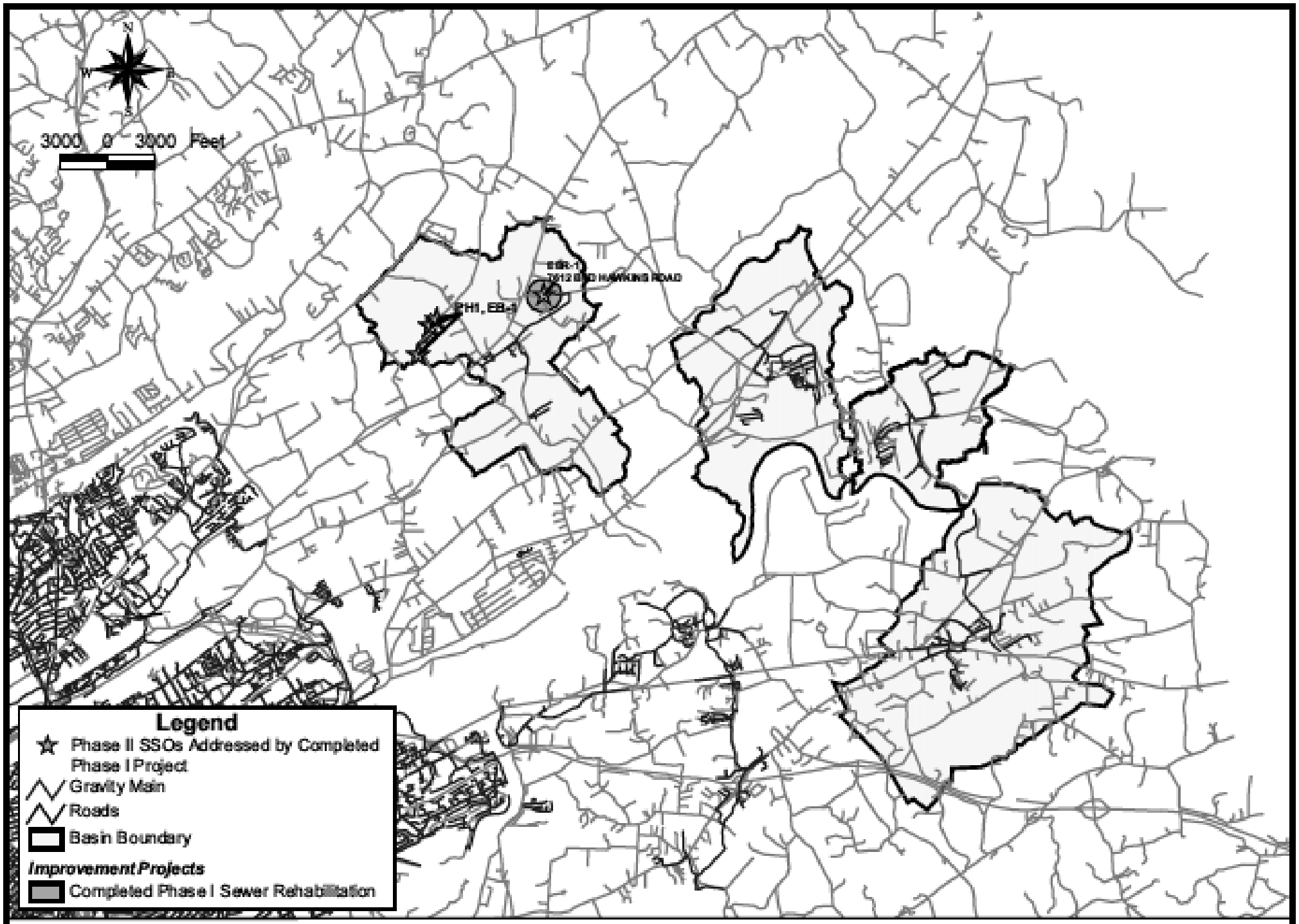
Loves Creek Phase II: CAP/ER Project Implementation

Figure ES-8



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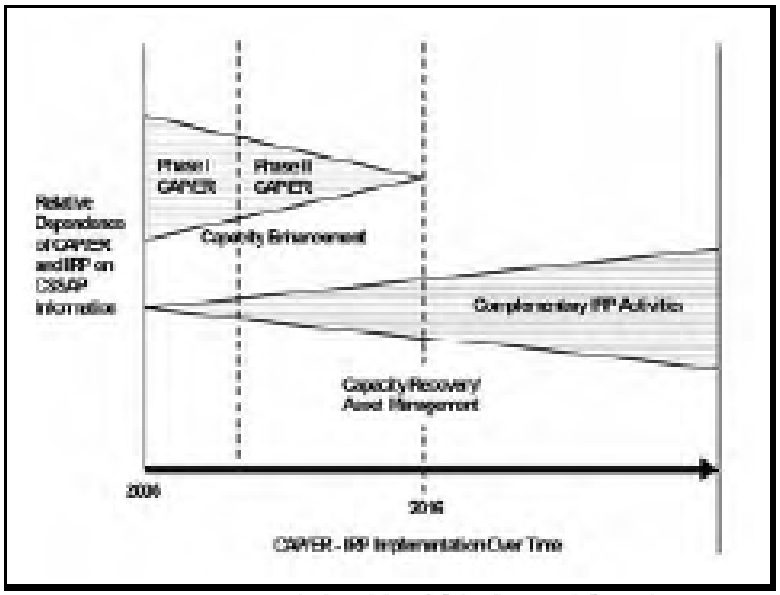
Eastbridge Phase II: CAP/ER Project Implementation

Figure ES-9

ES.5 Summary

KUB continues to aggressively implement an integrated approach to enhancement and recovery of sewer system capacity to address conditions that cause SSOs in the system. The CAP/ER, or capacity enhancement phase relies primarily on known problem locations and temporary flow monitoring and hydraulic modeling to analyze system performance and evaluate alternative improvements. As the CSSAP matures, it will play an increasingly important role in supporting KUB's IRP to address capacity recovery and asset management goals.



Relationship of CAP/ER and Complementary IRP Activities to CSSAP

In summary, this Phase II CAP/ER meets the objective stated in the CD: "to address the conditions causing reported SSOs with the goal of eliminating SSO locations on the Long-Term List" of the SSOER.

Section 1
Introduction

In February 2005, the Knoxville Utilities Board (KUB) entered a Consent Decree (CD) with the Tennessee Department of Environment and Conservation (TDEC), United States Environmental Protection Agency (EPA), the Department of Justice, Tennessee Clean Water Network and the City of Knoxville that outlined specific actions leading toward the goal of eliminating sanitary sewer overflows (SSOs) in the sewer collection system. In May 2006, KUB submitted the Phase I Corrective Action Plan / Engineering Report (CAP/ER) to address the SSOERs contained within the Sanitary Sewer Overflow Evaluation Report (SSOER) dated September 2004 and an Annual Update to the SSOER submitted in April 2005. The SSOER contains a list of SSOs referred to as the "Long-Term List" that identifies all SSOs that occurred (including building back-ups) and the associated location, date, cause, and volume.

This Phase II CAP/ER evaluates all SSOs that were added to the Long-Term List pursuant to the Annual SSOER Update submitted on April 30, 2008 and all Annual SSOER Updates previously approved by EPA. Phase II CAP/ER continues Phase I's efforts. This section describes the background and purpose of the Phase II CAP/ER, including study area descriptions and organization of the report. As a review, an overview of KUB's integrated approach to improving sewer system performance is presented.

1.1 KUB's Integrated Approach to Achieving Consent Decree Goals

KUB continues to implement several complementary programs, in conjunction with Phase I CAP/ER, to comply with the requirements of the CD, specifically to "address the conditions causing SSOs with the goal of eliminating the SSO locations on the Long-Term List." KUB's holistic or total basin solution for each sewershed is to:

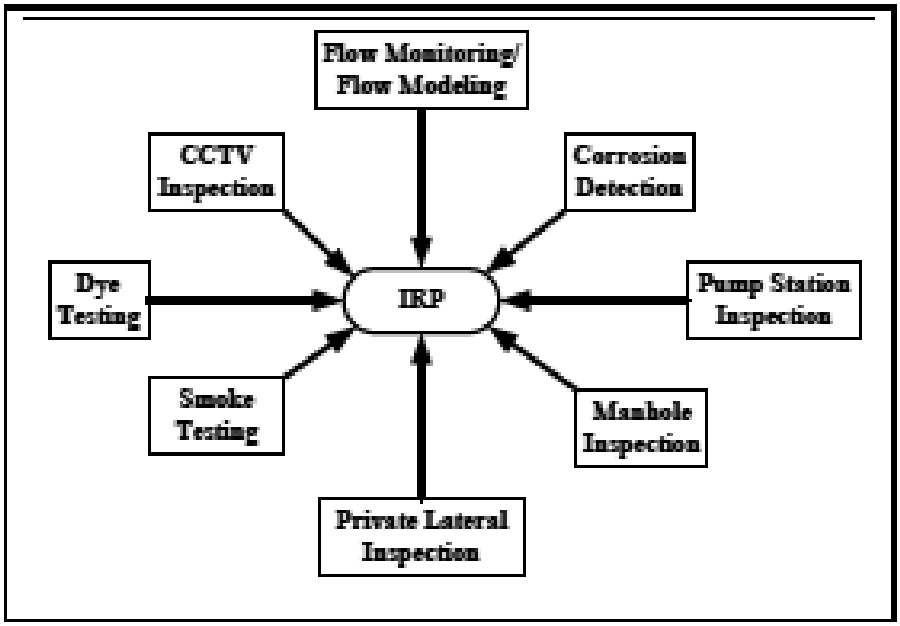
1. Implement capacity enhancement projects consistent with CAP/ER requirements. Such enhancements include storage facilities, relief sewers, pump station upgrades, and comprehensive rehabilitation in targeted areas with documented rainfall dependent infiltration and inflow (RDI/I) problems, and

2. Achieve capacity recovery through RDI/I removal with other complementary maintenance programs that are part of the Infrastructure Rehabilitation Program (IRP).

KUB developed the Phase I CAP/ER as a conceptual design document to guide the implementation of specific projects. Phase II CAP/ER continues this guidance. It is not intended to provide final design criteria, but to provide minimum criteria which will be further evaluated during preliminary and final design phases. In many cases,

projects are being designed with capacities that exceed the minimum criteria established in the CAP/ER.

Other Complementary Programs Related to CAP/ER



CSSAP Components Supporting the IRP

KUB's other complementary programs that combine to comprise the IRP are supported by the previously approved Continuing Sewer System Assessment Program (CSSAP). These programs address performance enhancement (removal of roots, debris, grease), asset management (condition assessment, repair and replacement) and RDI/I removal (removal of inflow, repair of defective pipes and manholes that are the source of infiltration). Specifically, the smoke testing program addresses inflow elimination, and the lateral replacement program and sewer rehabilitation programs address infiltration reduction. It is important to note that RDI/I reduction benefits of these programs in restoring system capacity have not been considered in developing the conceptual capacity of CAP/ER solutions. This provides an added factor of safety because the CAP/ER project facilities will be able to store and/or convey flows from increasingly larger storm events as RDI/I is removed through KUB's comprehensive IRP. The IRP has been approved and is being aggressively implemented. KUB is monitoring the progress of these rehabilitation activities with ongoing permanent and temporary flow monitoring data to quantify their effectiveness.

1.2 Background and Purpose of CAP/ER

The top priority of KUB's facility planning efforts is to provide a wastewater collection system that meets the needs of KUB customers while protecting the environment. Since 1987, KUB has performed several studies and made many improvements in a majority of the service area basins. However, there are still areas requiring capital improvements, particularly in older areas of the system where RDI/I is problematic.

RDI/I entering the sanitary sewer system during wet weather is a major consideration in this report. All combined sanitary and storm sewers have been eliminated from the

wastewater service area. However, because of sewer system defects, unintentional or illegal cross connections with the storm sewer system, or other sources, extraneous storm water flows enter the sanitary sewer system during rainfall events as RDI/I. These RDI/I flows can overload the capacity of the sanitary sewer system and result in periodic SSOs from manholes and/or building back-ups.

The objective of the Phase II CAP/ER is to identify facility improvements required to address reported SSOs that have been reported in accordance with the Consent Decree since the Phase I CAP/ER implementation. The SSOs listed on the Long-Term List that require improvement projects are mapped and presented in **Figure 1-1**. These SSOs include building back-ups. Some of these SSOs were caused by capacity issues, and some were caused by non-capacity issues such as a pipe blockage caused by debris, grease, or roots. Many of the SSO events shown on Figure 1-1 were caused by extreme weather conditions during a September 23 – 25, 2006 storm event. That event produced localized totals as high as 5.15 inches in less than 24 hours based on KUB rain gages. The average 24-hour rainfall total for this event across all KUB rain gages was 4.14 inches, which is approximately a 10-year storm event in frequency for the Knoxville area.

Under Phase I CAP/ER efforts, capacity related SSOs were evaluated using a hydraulic modeling analysis. In keeping with KUB's goals, this hydraulic analysis consisted of first analyzing each basin using a hydraulic model and developing a total basin solution that would convey projected future flows and estimated RDI/I from a representative planning storm event. The total basin solution for each basin takes into account the whole system including the effects of transporting this flow to the wastewater treatment plants. The total basin solution addresses future projected SSOs and surcharge conditions in addition to the SSOs listed in the Long-Term List. Phase II CAP/ER continues Phase I efforts and intertwines projects from both phases to further increase total basin solution successes.

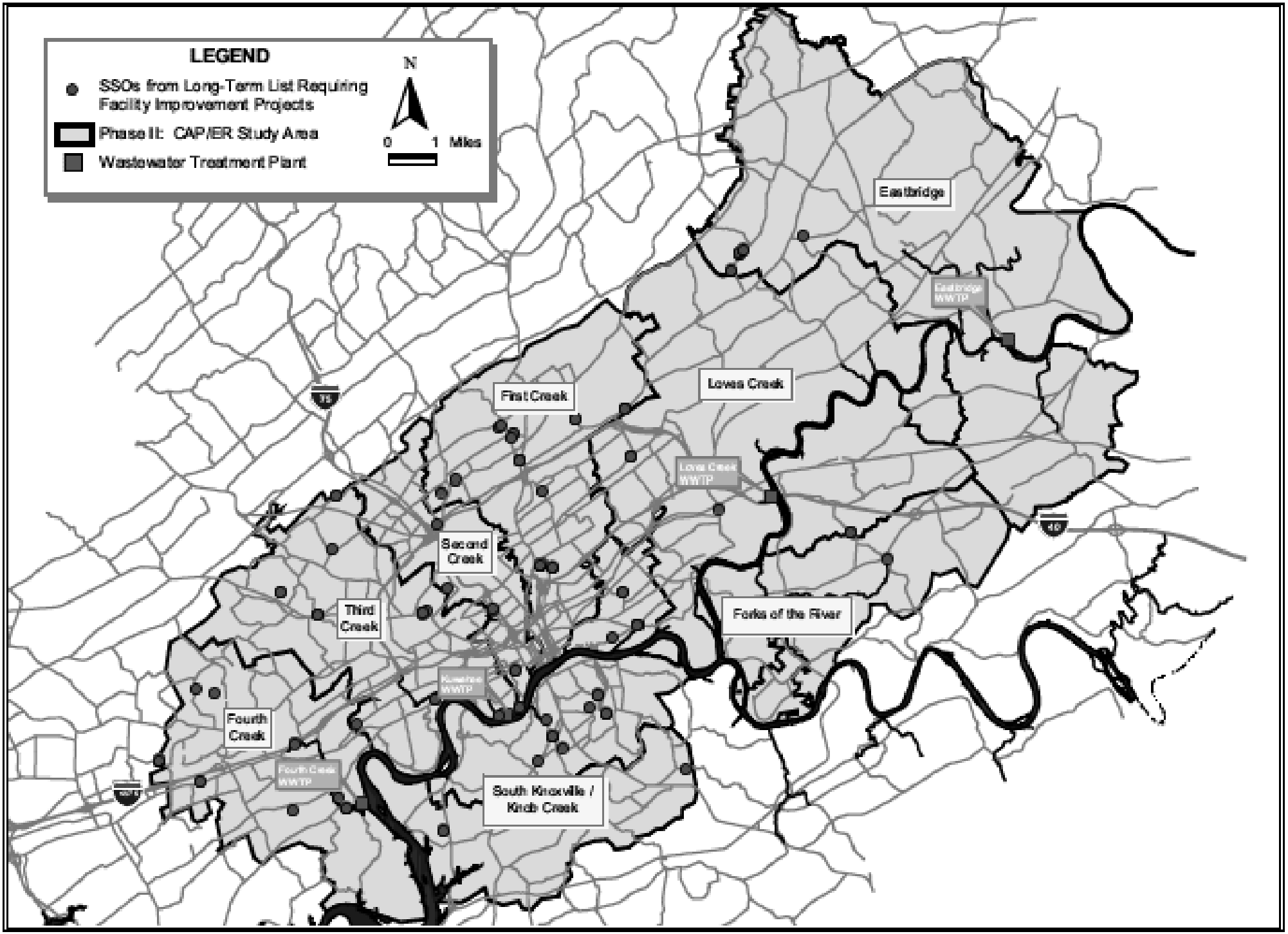


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Figure 1-1
Phase II: CAP/ER Study Area

CAP/ER Project Performance Criteria

The criteria used in evaluating wet-weather performance of the existing system and alternative capacity enhancement projects to address SSOER capacity related locations are summarized below:

1. Future base flows projected to occur at or near build-out conditions (20 years for highly developed sewersheds and 40 years for developing sewersheds) were used to represent dry-weather flows, including diurnal variations.

2. Winter/spring R values (percentage of rainfall that enters the sewers as RDI/I) were developed on the basis of extensive temporary flow monitoring program data and used to develop RDI/I influent hydrographs. The data indicate that winter/spring R values typically exceed other seasonal R values by up to 100 percent.

3. Projects selected for inclusion in the CAP/ER result in surcharging of less than 2.0 feet above top of pipe and no surcharging to within 3.0 feet of the manhole rim at SSOER locations during base wet-weather conditions (described below).

4. Projects selected for inclusion in the CAP/ER include sufficient downstream improvements and/or upstream comprehensive rehabilitation so that they do not result in moving overflows to downstream locations during base wet-weather conditions (described below).

5. Base wet-weather conditions consist of a synthetic rainfall event of 2.96 inches falling over a 24-hour period. Additional information on the synthetic rainfall event is provided in a subsequent portion of this document.

The total basin solution consists of a number of individual projects including various sewer replacement projects, storage projects, and rehabilitation projects. In the Phase I CAP/ER, each of the individual projects in the total basin solution for each basin was analyzed to determine which were required to address the SSO locations on the Long-Term List. This included projects directly affecting the SSO location as well as projects required to address potential overflows downstream, which would be predicted to occur as a result of implementing upstream improvements. . Phase II CAP/ER projects expound upon Phase I projects to address SSOERs pursuant to the Annual SSOER update submitted on April 30, 2008.

Some SSOs reported on the Long-Term List occurred on small collector pipes that were not included in the hydraulic model evaluation. These are addressed within this Phase II CAP/ER by either collector sewer replacement projects or sewer rehabilitation projects. In addition, some SSOs reported on the Long-Term List were caused by non-capacity issues such as a pipe blockage caused by debris, grease, or roots. These SSOs have been addressed or are being addressed by KUB's CSSAP.

The primary function of the CSSAP, which has been approved by EPA, is to provide decision-support information for implementation of the Infrastructure Rehabilitation Program (IRP), along with KUB's other capital improvements to restore and maintain system hydraulic capacity, restore and maintain structural integrity of system components, and reduce corrective maintenance costs.

The primary objectives of the IRP, which was approved by EPA in December 2005, are to address RDI/I and other conditions causing SSOs through:

- Capacity restoration – this objective is aimed at keeping assets functioning at their full, original capacity. Examples include removing sediment or debris from a pipeline system, reducing infiltration and inflow (I/I) in a wastewater collection system, and/or repairing system defects that would limit flow capacity through a system. In some cases, it is cost effective and/or necessary to meet system growth needs by providing increased capacity or storage to attain the desired system hydraulic capacity.

- Damage repair – this objective is aimed at repairing structural damage and failures in the system that are the result of wear, corrosion, age, and/or construction-related damage to extend the useful life of the component. This function reduces the risk of system failure which could cause interruption in service and could result in impacts to the community and increase costs as compared to scheduled maintenance and repairs.

- Maintenance reduction – this objective is aimed at repairing portions of the system that are subject to known, repeated maintenance problems that increase maintenance costs and keep crews from conducting more productive preventive maintenance. Examples in a wastewater collection system are the repair of conditions such as root intrusion, offset joints, pipe sags, improper service connections, and other system deficiencies that typically lead to recurring problems for system operators.

This CAP/ER was developed using CSSAP elements (e.g., flow monitoring, hydraulic model) and will be implemented using other CSSAP elements (e.g., dye testing/dyed water flooding, CCTV inspection, smoke testing). Therefore, for program administration purposes, KUB considers the CAP/ER and its implementation to be part of its IRP.

1.3 Implementation of CAP/ER Projects

Phase II CAP/ER describes projects in the conceptual phase. As CAP/ER projects are moved from the conceptual phase to implementation, KUB considers other factors in developing actual project performance criteria. Such factors include short-term risks of SSOs that may occur in sensitive areas such as parks, near schools, on residential property, and other locations where public contact may be expected. These considerations are expected to result in designs that provide enhanced capacity.

1.4 Description of Study Area

As shown in Figure 1-1, KUB's wastewater planning area includes the following eight basins: First Creek, Second Creek, Third Creek, Fourth Creek, South Knoxville/Knob Creek, Williams Creek, Loves Creek, and Eastbridge Basins. The Forks of the River service area drains to the Williams Creek Basin via pump station and force main.

Wastewater from the First Creek, Second Creek, Third Creek, South Knoxville/Knob Creek, and Williams Creek Basins flows by gravity and an intricate network of pump stations to an interceptor sewer along the Tennessee River. This interceptor sewer conveys wastewater flows to the Kuwahee Wastewater Treatment Plant (WWTP), which is the largest of four main wastewater treatment plants operated by KUB. The Fourth Creek Basin is served by a separate treatment facility, the Fourth Creek WWTP. The Loves Creek sewer basin flows by gravity and pump station to the Loves Creek WWTP. The Eastbridge Basin flows by gravity and multiple pump stations to the Eastbridge WWTP.

Treatment plant improvements are addressed separately by the Process Controls Program as well as the Comprehensive Performance Evaluation and Composite Correction Program. Flows resulting from the improvements recommended herein are conveyed to the treatment plant and treated appropriately. The SSOs noted on the Long-Term List as a plant bypass are addressed separately by the Process Controls Program and/or as part of the plant improvements in the Comprehensive Performance Evaluation and Composite Correction Program.

The wastewater planning study area includes urban and suburban development and commercial/industrial land uses. The oldest and densest portions of the system are located near the Fort Loudon Reservoir in the First and Second Creek Basins—with ages of some portions of the early system dating back to the mid-1920s. The system's age and density decreases as it heads out concentrically from this central location. The central portions of the area contain significant industrial and commercial development, while the northern, southern, eastern, and western portions of the planning area contain significant residential development. Like most municipalities, future residential growth and commercial developments are spreading to these outskirt areas. Model analysis of proposed improvements takes into consideration potential build-out in both new and existing service areas.

A majority of the trunk sewers in the service area are comprised of reinforced concrete. Main trunk sewers range in size from 21 inches to the 72-inch diameter interceptor that conveys flow to the Kuwahee WWTP. The planning study area of the report covers roughly 68,400 KUB customers, 248 square miles, and focuses on the backbone of a sanitary sewer network that contains roughly 1,310 miles of pipe. While a majority of the system flows by gravity, KUB also operates and maintains a network of 67 pump stations designed to overcome the rocky, and often times steep terrain of the Knoxville metropolitan area.

1.5 Organization of Report

This Phase II CAP/ER is organized into 4 sections as listed below. Sections 1 and 2 document background information, updates since Phase I CAP/ER, and flow monitoring programs occurring since Phase I. Section 3 describes the results of each basin analysis and presents the recommended projects to address the Phase II SSOs. Section 4 provides an implementation plan for completing basin projects.

Section 1 – Introduction

Section 2 – System Monitoring and Modeling

Section 3 – KUB Service Area - Phase II Facility Improvements

Section 4 – Implementation Plan

Section 2
System Monitoring and Modeling

2.1 Flow Monitoring Overview

During the period between Phase I CAP/ER and Phase II CAP/ER, KUB continued temporary flow monitoring programs in 2006, 2007, and 2008 as part of ongoing efforts to monitor capital improvement programs. In addition to temporary flow monitoring programs, KUB maintains 35 permanent flow monitors in the service area trunk sewer systems and 8 permanent rain gauges throughout the service area. The purpose of permanent and temporary flow monitoring is to collect wastewater flow data and to evaluate quantities of flow and changes in flow during dry-weather and wet-weather conditions.

The flow monitoring data is used in several ways to aid in the planning of capital improvements. First, the data is used to identify areas in the collection system that should receive the highest priority for sewer system evaluation survey (SSES) and rehabilitation based on observed response to wet-weather events. Second, the data is used to support a hydraulic analysis of the trunk sewers (including model calibration and development of design flows), where the purpose of the hydraulic analysis is to identify trunk sewers or pump stations that are predicted to be over-capacity during dry- or wet-weather conditions. Third, the data is used to measure the relative success of sewer rehabilitation projects by quantifying the amount of inflow and infiltration (I/I) that is reduced. Finally, the data from permanent flow meters is used for hydraulic model calibration and for flow trending analyses.

2.2 Description of Flow Monitoring Programs

KUB continues to perform a series of extensive short-term flow monitoring programs throughout their system to monitor project success and give guidance for future planning. This section describes the flow monitoring programs since the Phase I CAP/ER.

2.2.1 2006 Flow Monitoring Program

From January 23 through April 10, 2006, KUB performed a flow monitoring study involving 10 temporary flow monitoring locations and 5 temporary rain gauge sites to specifically track the progress of rehabilitation projects within KUB's system. Figure 2-1 gives an overview of the 2006 flow monitoring locations. The results from the rehabilitated minibasins were compared to flow monitoring results from study control areas in which no rehabilitation was performed. These study control areas are similar in land use, age, material, and pre-rehabilitation flow characteristics to the rehabilitated areas.

As a cross-comparison check of rehabilitation results, pre- and post-rehabilitation flow monitoring data were examined independently by Dr. Zhi Zhang from the University of North Carolina, Charlotte. Dr. Zhang applied statistical models to flow

monitoring results from individual rehabilitated minibasins, without the aid of control minibasins, to study the reductions gained in RDI/I. The end result of both post-rehabilitation analyses in 2006 showed an overall median reduction of 51% in RDI/I influences in the studied minibasins. The RDI/I reduction results documented by this study were considered when examining Phase II SSOERs as many of the SSOERs occurred prior to completion of Phase I projects. These same SSOERs have not reoccurred since completion of the RDI/I reduction projects. Therefore, Phase II projects have not been included to address these SSOs.

2.2.2 2007 Flow Monitoring Program

KUB continued their efforts to track post-rehabilitation efforts by initiating a post-rehabilitation flow monitoring study in the Spring of 2007. This flow monitoring study was performed at 16 temporary flow monitoring and 11 temporary rain gauge locations from January 17, 2007 through April 10, 2007. Minibasin areas in both First Creek and South Knoxville from the 2006 flow monitoring study were studied to determine the RDI/I reduction benefits achieved from further rehabilitation work conducted in those minibasins after the 2006 study. Figure 2-2 and Figure 2-3 map the locations of the all the flow monitor and rain gauge locations utilized in this study.

As in the 2006 study, flow monitoring results from each rehabilitated minibasin were compared to minibasin control areas as well as independently analyzed by Dr. Zhi Zhang's statistical method. Further reductions in RDI/I were observed in both analyses showing a new overall median RDI/I reduction of 56% in all studied rehabilitated minibasins.

2.2.3 2008 Flow Monitoring Program

KUB initiated flow monitoring of the Third Creek Basin (see Figure 2-4) in the Spring of 2008 to monitor and track the progress of collection system improvement projects performed within the basin.

Third Creek was last flow monitored in two phases; phase one included upper Third Creek (all minibasins upstream of 21A1) in 2004 and phase two included lower Third Creek in 2005 (all minibasins downstream of 12A1_21A2).

The 2008 flow monitoring program included Phase I CAP/ER minibasins that were designated for rehabilitation. Significant RDI/I reductions were achieved in these minibasins (09A1, 09A2, 09A4, 09D1) and the results from 2008 were included with the overall minibasins studied for post-rehabilitation RDI/I reduction. With the inclusion of the 2008 post-rehabilitation data, KUB has seen an overall median reduction of 58% in RDI/I in minibasins studied after rehabilitation projects.

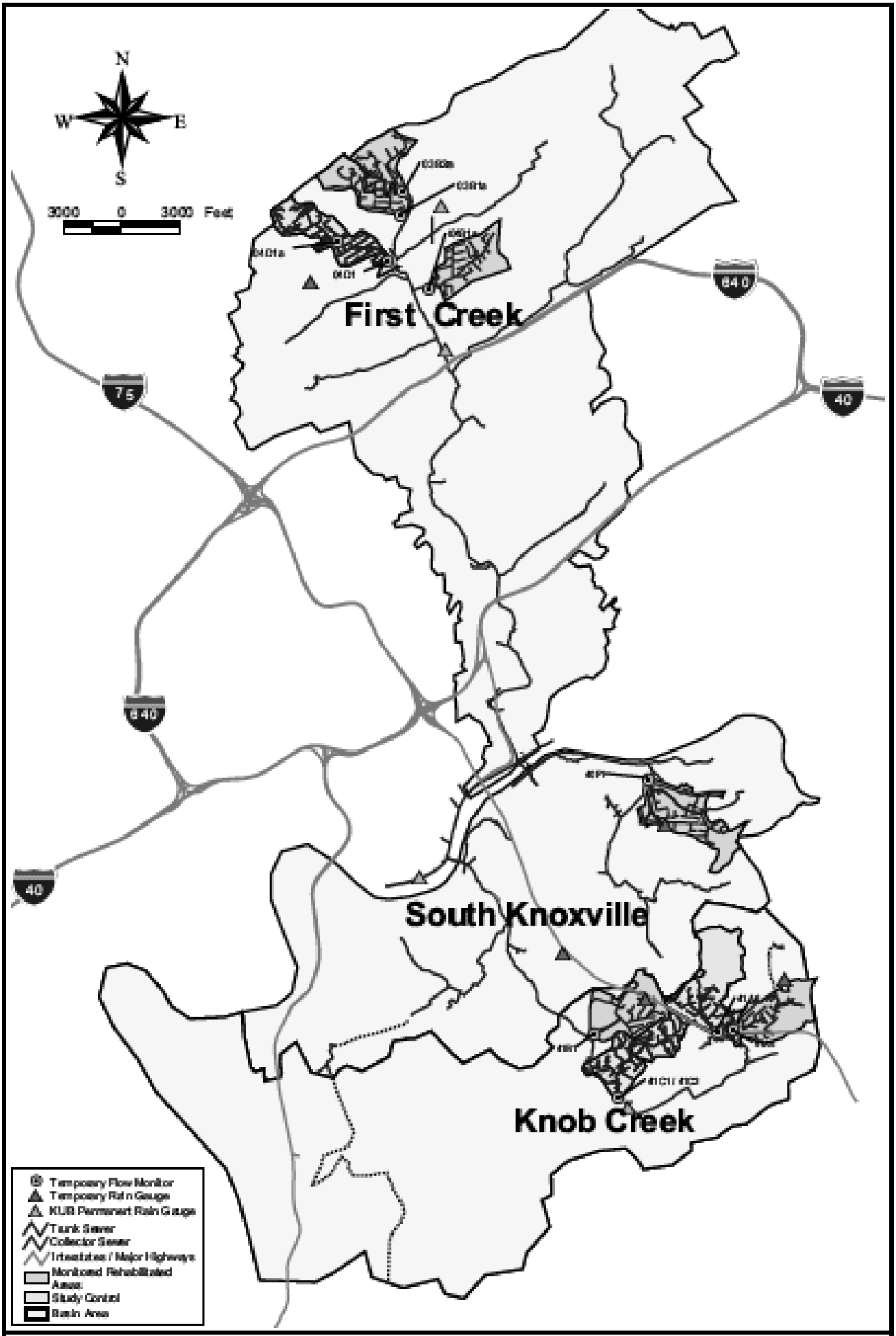
2.3 Modeling Update

Under the 2004 and 2005 flow monitoring analyses for the Third Creek Basin, a hydraulic model was calibrated and used as a tool for CAP/ER Phase I project development. During the calibration process, each minibasin within Third Creek was characterized, and R values were developed to test the system and give subsequent guidance to the extent and location of Phase I CAP/ER projects.

As a part of the 2008 flow monitoring effort, the model calibrations and minibasin R value characterizations were updated. These efforts were undertaken as a result of widespread collection system improvements designed and completed under Phase I CAP/ER.

2.4 Data Quality Review

After the data were collected, quality control reviews were implemented to ensure that only quality data was used in each analysis. Flow data were plotted over time to ensure that there were no unjustified changes in base wastewater flow and to ensure that base flow was of sufficient quantity to be reliably measured by the flow monitor. The velocity and level data recorded were used to make scatterplots. Scatterplots of level versus velocity for a given flow monitor can be interpreted to evaluate the quality of the data and provide insight to the hydraulic conditions of the site. For example, a cluster of data that appears flat (i.e., the same velocity is recorded over a range of measured sewer flow depths) can indicate that a downstream blockage may exist. If a bottleneck occurs downstream, velocities will increase at a dramatically slower rate than during free flow conditions. In severely restricted lines, velocities will decrease as depths increase. An example scatterplot of reliable flow data is shown in Figure 2-5. The graph at the top of Figure 2-5 shows flow recorded at the monitor in red and corresponding rainfall events in blue. The graph in the middle of Figure 2-5 shows the velocity recorded at the monitor in red and the level or depth in blue. The graph at the bottom of Figure 2-5 is the scatterplot of level versus velocity for this data set. The data exhibits a good correlation of velocity and depth. The velocity increases with depth similar to the relationship predicted by the Manning equation showing the sewer is operating as an open channel.



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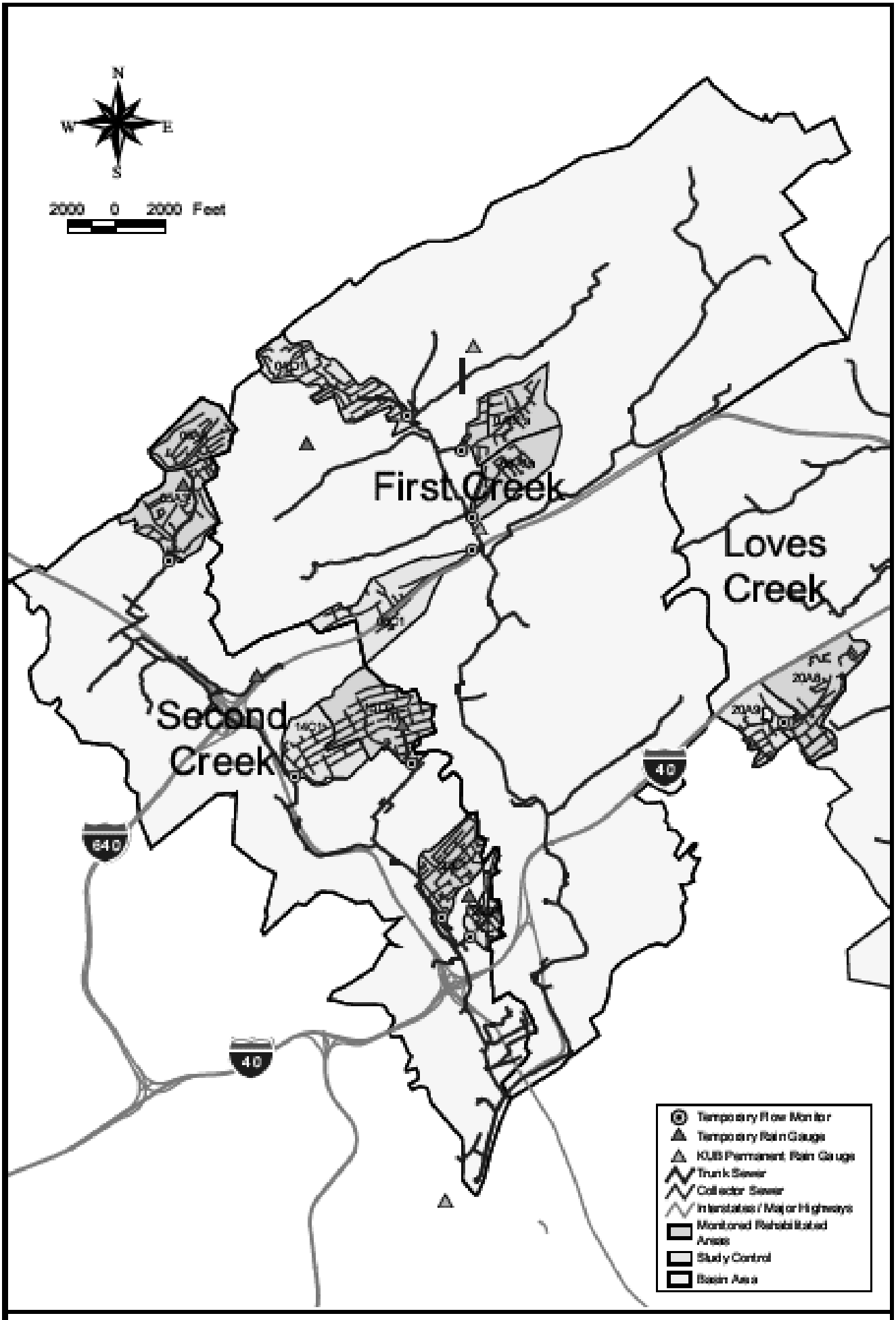
2006 Flow Meter, Rain Gauge, and Minibasin Locations

Figure 2-1



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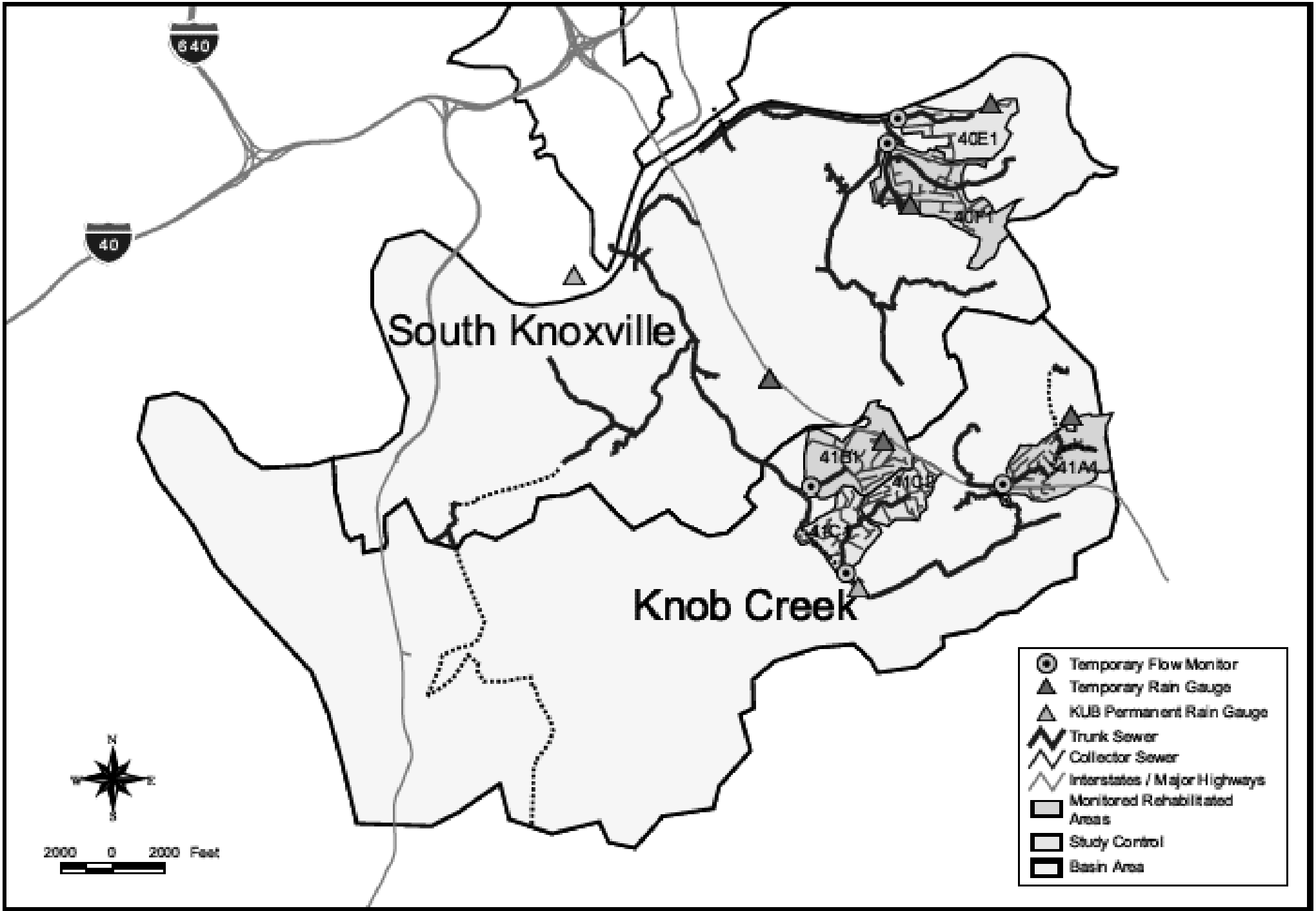
2007 Flow Meter, Rain Gauge, and Minibasin Locations

Figure 2-2



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2007 Flow Meter, Rain Gauge, and Minibasin Locations

Figure 2-3

CDM

2008 Flow Monitoring Locations
Third Creek

Figure 2-4

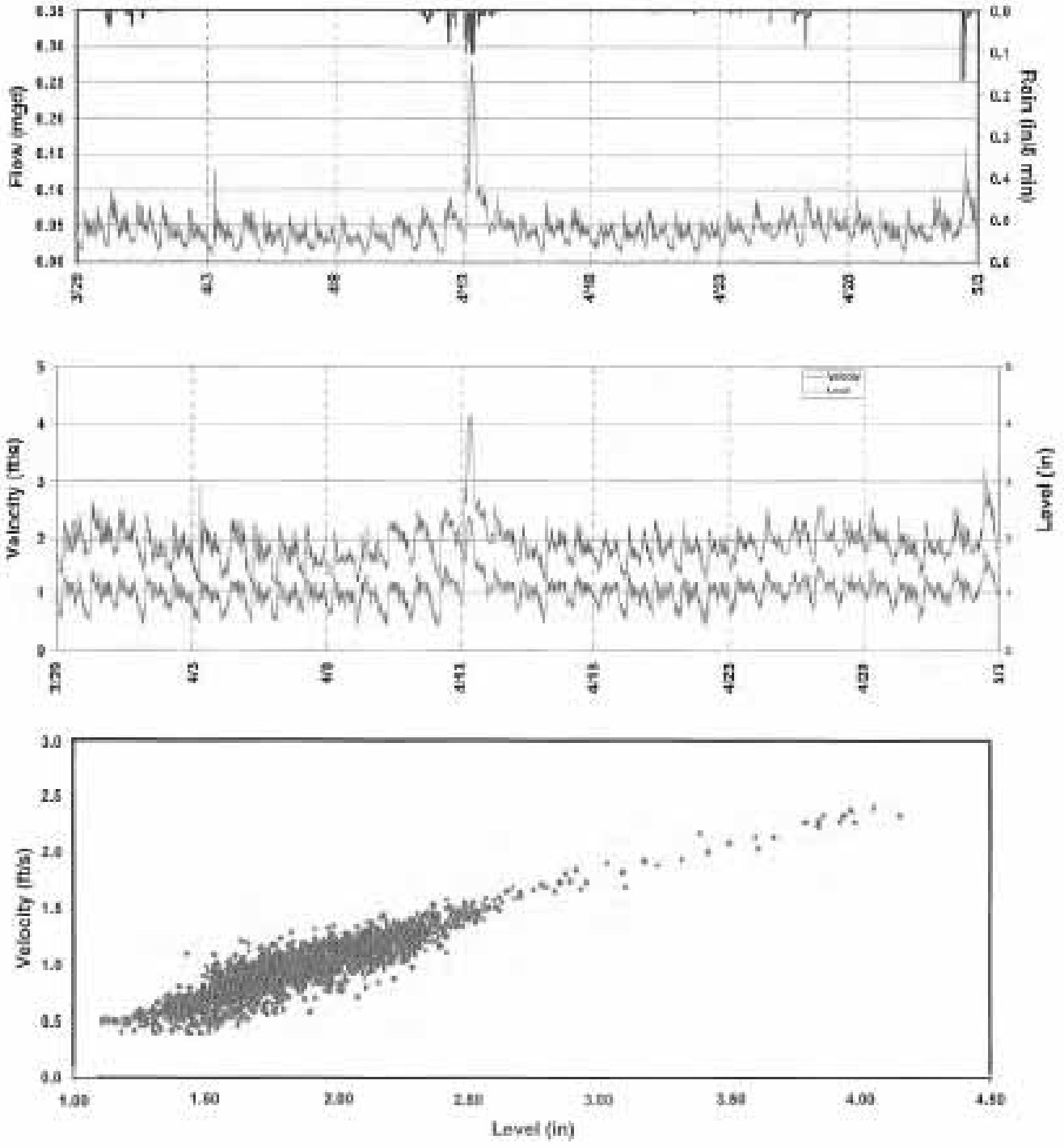


Figure 2-12
Scatterplot of Reliable Flow Monitoring Data

Section 3
KUB Service Area - Phase II Facility Improvements

3.1 Phase II Facility Improvements

The objective of the Phase II CAP/ER is to address all SSOs that were added to the Long-Term List pursuant to the Annual SSOER Update submitted on April 30, 2008 and all Annual SSOER Updates previously approved by EPA. Phase I CAP/ER addressed the conditions causing reported SSOs with the goal of eliminating SSO locations on the Long-Term List of the 2001-2004 SSOER Annual Update submitted April 26, 2005. Phase II continues the goals of Phase I and addresses reported SSOs occurring after the completion of the Phase I CAP/ER.

In this section, the SSOs listed on the Long-Term List are addressed by facility improvement projects and corrective actions listed for each sewer service basin. Some of the SSOs listed occurred prior to the completion of corresponding Phase I CAP/ER projects in the vicinity. In instances where the reported SSO has not occurred since the completion of the Phase I CAP/ER project, the project along with its completion date is noted.

The SSOs on the Long-Term List that are not capacity related are addressed by either a "find and fix" facility improvement project or KUB's Blockage Abatement Program. Many of the SSOs on the Long-Term List that are not capacity related are the result of a blockage (debris, grease, roots, etc.) that have been addressed by KUB's Blockage Abatement Program. These include all the SSOs on the Long-Term List that have the designation "N/A" or are blank under the "Long Term Capital Project" field. However, if the source of the blockage could not be fixed by maintenance and re-occurred after flushing or root cutting, then these SSOs were assigned a "find and fix" facility improvement project. "Find and fix" facility improvement projects will first involve further investigation into the source of the SSO through the use of smoke testing, manhole inspection, and/or CCTV inspection. Next, a determination will be made of the type and extent of the improvement required to address the SSO. In some cases, the blockage may have been only partially removed and further flushing or root cutting is required to address the SSO. In other cases, replacement of sagged pipe or lining of pipe to prevent root intrusion may be required.

3.2 First Creek

Since the Phase I CAP/ER, limited updates based on final project designs have been incorporated into the First Creek sewer hydraulic model. A detailed overview of the sewer hydraulic model for First Creek is contained in the Phase I CAP/ER with specific details on the sewer hydraulic model flows and model development for the First Creek Basin. Figure 3-1 shows the extent of the sewer hydraulic model which incorporates all trunk sewers in First Creek greater than 8 inches in diameter.

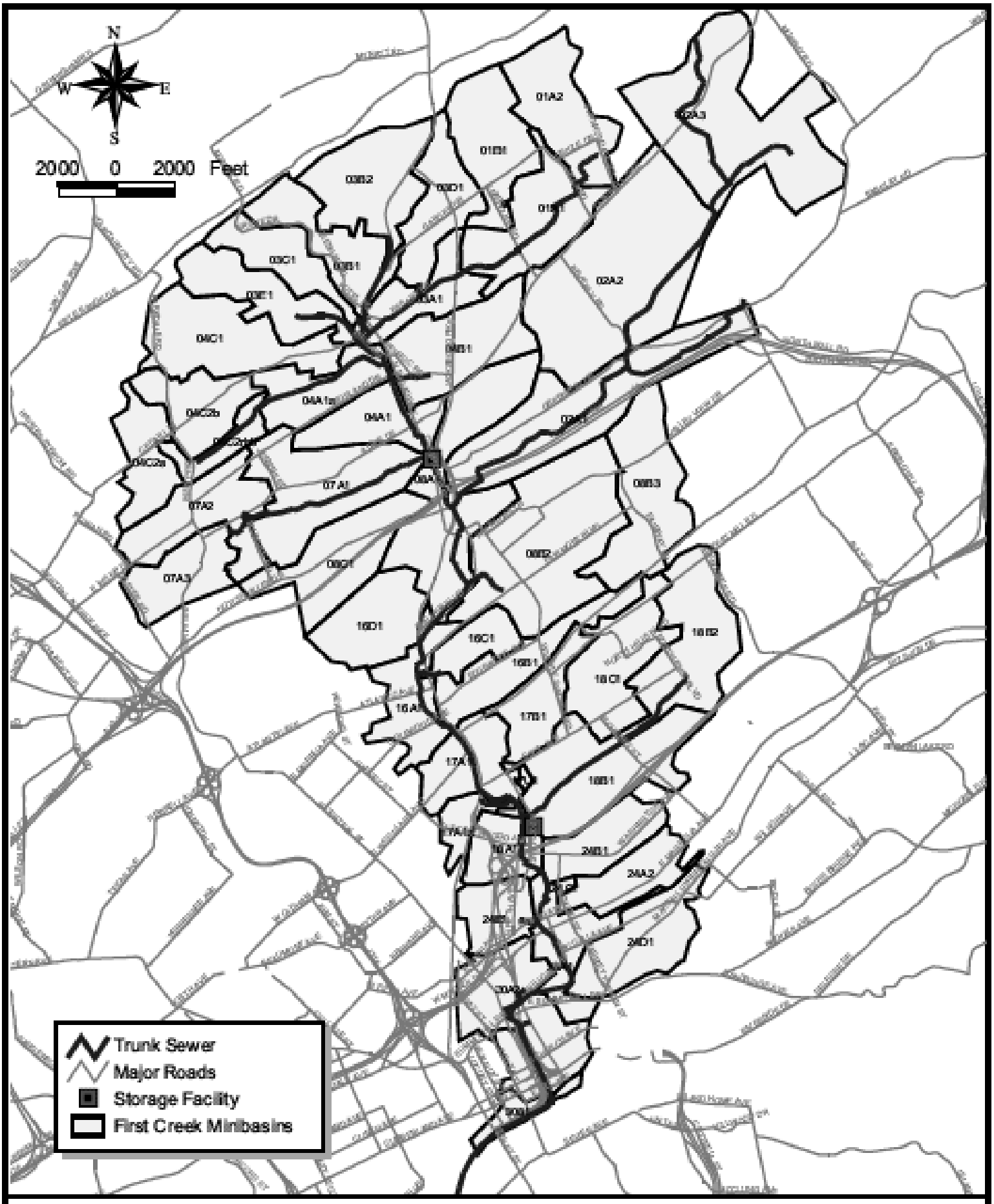
3.2.1 Phase II CAP/ER Facility Improvements

In First Creek, the SSOs listed on the Long-Term List that are capacity related are addressed by facility improvement projects as outlined in **Table 3-1**. This table lists all capacity related SSOs and a corresponding project ID, which addresses the SSO. In some instances, an SSO occurred prior to the completion of a Phase I CAP/ER project and has not occurred since. In those instances, the corresponding Phase I project and completion date is noted on the table in the project ID column.

Table 3-2 presents all SSOs on the Long-Term List that are not capacity related. In the project ID column is either a "find and fix" project ID that addresses the SSO or the designation "has been addressed by CSSAP Program", as discussed in Section 3.1. As noted for capacity related SSOs, should a Phase I project be considered as having addressed an SSO, that corresponding project and its completion date are included in the project ID column.

Figure 3-2 presents a map showing the locations of all SSOs on the Long-Term List after Phase I CAP/ER through the Annual SSOER Update submitted on April 30, 2008. The figure also shows the planned and completed facility projects which address each SSO. Already completed pipeline improvement projects and minibasin rehabilitation projects are shaded grey. Collector system projects with the goal of finding and fixing other sewer defects are shown in blue.

Each of the planned and completed projects that address an SSO is labeled with a project ID. The project IDs listed on the figure correspond with project IDs and project descriptions found on Tables 3-1 and 3-2. Section 4 will present the Phase II CAP/ER implementation plan that provides start and end dates for each of these projects.



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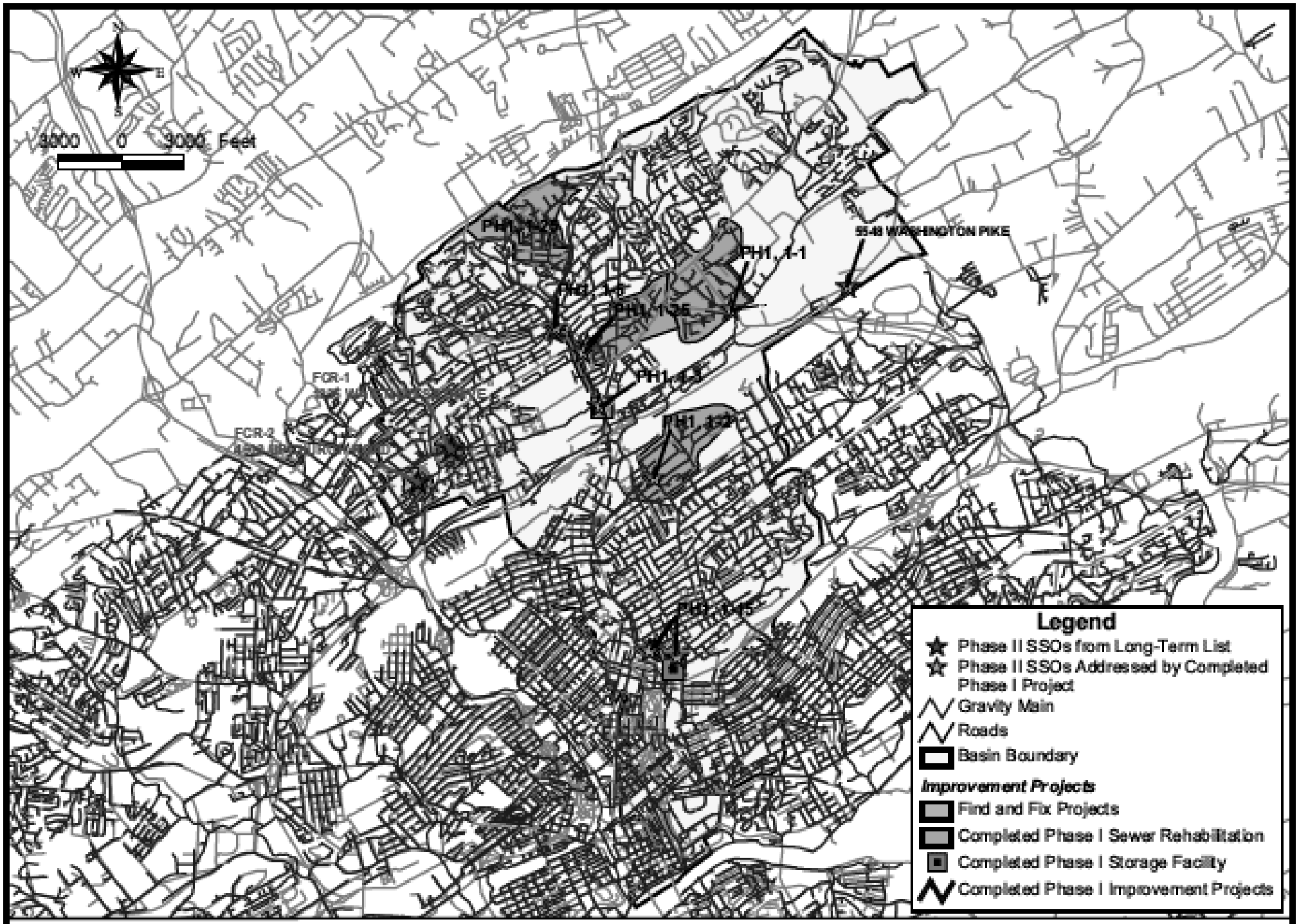
First Creek
Sewer Hydraulic Model

Figure 3-1

Table 3-1: First Creek Phase II - Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20060607	4817 BEVERLY RD	MH 39-46	Phase I CAP/ER, 1-1	Minibasin 01A1, 02A2, 03D1 Find and Fix work, completed 06/2009
20060607	1422 HOITT AVE	MH 4	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007
20060117	4713 OLD BROADWAY	MH 2	Phase I CAP/ER, 1-3	First Creek Storage tanks , Upper First Creek completed 04/2007, Lower First Creek completed 12/2006
20060126	4713 OLD BROADWAY	MH 2	Phase I CAP/ER, 1-3	First Creek Storage tanks , Upper First Creek completed 04/2007, Lower First Creek completed 12/2006
20060406	4713 OLD BROADWAY	MH 2	Phase I CAP/ER, 1-3	First Creek Storage tanks , Upper First Creek completed 04/2007, Lower First Creek completed 12/2006
20060406	1422 HOITT AVENUE	MH 4	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007
20060406	2900 RENNOC ROAD	MH 13-28	Phase I CAP/ER, 1-25	Rehabilitation in sub-basins 03 and 04, completed 05/2008
20060422	4713 OLD BROADWAY	MH 2	Phase I CAP/ER, 1-3	First Creek Storage tanks , Upper First Creek completed 04/2007, Lower First Creek completed 12/2006
20060422	1422 HOITT AVENUE	MH 4	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007
20060424	2900 RENNOC ROAD	MH 13-28, 13-49 & 13-55	Phase I CAP/ER, 1-25	Rehabilitation in sub-basins 03 and 04, completed 05/2008
20060923	4817 BEVERLY ROAD	Lateral Cleanout & MH 39-4	Phase I CAP/ER, 1-1	Minibasin 01A1, 02A2, 03D1 Find and Fix work, completed 06/2009
20060923	3700 WHITTLE SPRINGS ROAD	MH 9-34	Phase I CAP/ER, 1-2	Find and fix work in minibasin 06B2, completed 04/2008
20060923	2544 FAIR DRIVE	MH 71	Phase I CAP/ER, 1-5	Upper Fountain City Pipe Replacement Project, completed 11/2007
20060923	1422 HOITT AVENUE	MHS 4, 4-9 & 3-7	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007
20060923	2837 E. WOODROW DRIVE	MHS 13-28, 13-49 & 13-55	Phase I CAP/ER, 1-25	Rehabilitation in sub-basins 03 and 04, completed 05/2008
20060923	1235 WATERCRESS DRIVE	MH 29-9	FCR-1	Find and Fix work to identify and address cause of overflow in the vicinity of 1235 Watercress Drive FY 2014/2015
20060923	4600 UPCHURCH ROAD	MH 45	FCR-2	Find and Fix work to identify and address cause of overflow in the vicinity of 4600 Upchurch Road. FY 2014/2015
20060924	4713 OLD BROADWAY	MH 2	Phase I CAP/ER, 1-3	First Creek Storage tanks , Upper First Creek completed 04/2007, Lower First Creek completed 12/2006
20060925	306 KNOX ROAD	MH 60	Phase I CAP/ER, 1-5	Upper Fountain City Pipe Replacement Project, completed 11/2007
20061027	1500 HOITT AVENUE	MHs 4 & 4-9	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007
20061101	304 SEVENTH AVENUE	MH 15	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007
20061101	1422 HOITT AVENUE	MHS 4 & 3-7	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007
20061107	1422 HOITT AVENUE	MH 4	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007
20061115	1422 HOITT AVENUE	MH 4	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007

Table 3-2: First Creek Phase II - Non-Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20060928	302 SEVENTH AVENUE	MHS 15 & 16	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007
20070106	302 SEVENTH AVENUE	MH 15	Phase I CAP/ER, 1-15	Lower First Creek Trunk Replacement Project, completed 02/2007
20050419	4713 OLD BROADWAY	MH 2	Phase I CAP/ER, 1-3	First Creek Storage tanks , Upper First Creek completed 04/2007, Lower First Creek completed 12/2006
20050606	5548 WASHINGTON PK	Broken Force Main	NA	Addressed by CSSAP Program, completed 06/2005
20050121	5548 WASHINGTON PIKE	Leaking Force Main Valve	NA	Addressed by CSSAP Program, completed 01/2005
20050622	5548 WASHINGTON PIKE	Force Main Valve Leak	NA	Addressed by CSSAP Program, completed 06/2005
20050309	5548 WASHINGTON PIKE	Leaking LP Force Main	NA	Addressed by CSSAP Program, completed 03/2005



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First Creek Phase II: CAP/ER SSOER Map

Figure 3-2

3.3 Second Creek

Since the Phase I CAP/ER, limited model updates as a result of completed pipe projects have occurred in the Second Creek model. However, an important addition since Phase I in the Second Creek sewer hydraulic model is the Composite Correction Plan (CCP) storage facility currently being constructed in the middle of the Second Creek Basin north of the intersection of Bernard Avenue and Van Street. Though the CCP storage facility is being constructed to reduce peak flows to the Kuwahee Wastewater Treatment Plant, a positive impact of that peak flow reduction is an increase in wet-weather capacity now available to the Second Creek trunk line downstream of this facility. Figure 3-3 shows the extent of the sewer hydraulic model along with the location of the CCP storage facility.

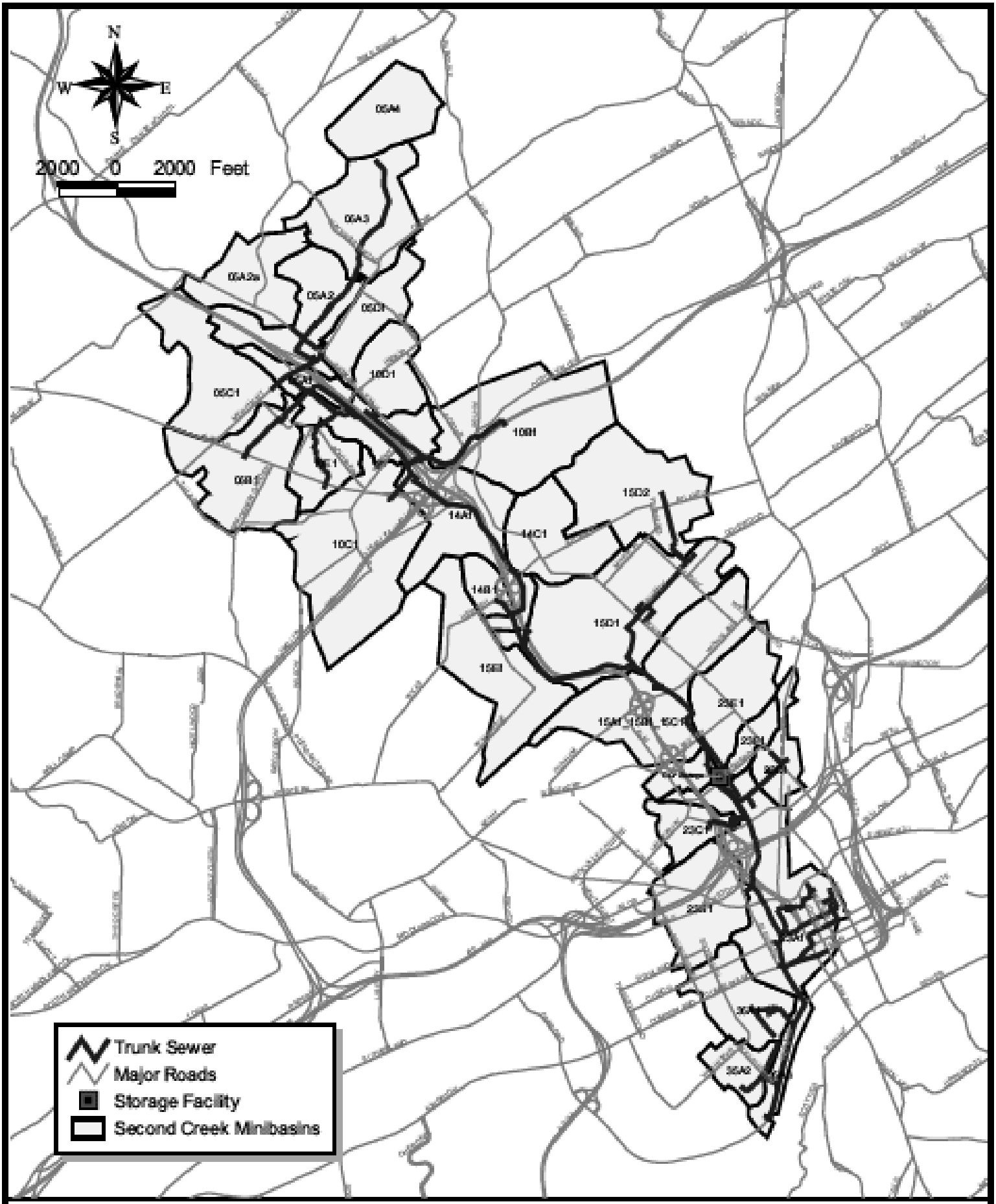
3.3.1 Phase II CAP/ER Facility Improvements

In Second Creek, the SSOs listed on the Long-Term List that are capacity related are addressed by facility improvement projects as outlined in Table 3-3. This table lists all capacity related SSOs and a corresponding project ID, which addresses the SSO. In some instances, an SSO occurred prior to the completion of a Phase I CAP/ER project and has not occurred since. In those instances, the corresponding Phase I project and completion date is noted on the table in the project ID column.

Table 3-4 presents all SSOs on the Long-Term List that are not capacity related. In the project ID column is either a "find and fix" project ID that addresses the SSO or the designation "has been addressed by CSSAP Program", as discussed in Section 3.1. As noted for capacity related SSOs, should a Phase I project be considered as having addressed an SSO, that corresponding project and its completion date are included in the project ID column.

Figure 3-4 presents a map showing the locations of all SSOs on the Long-Term List after Phase I CAP/ER through the Annual SSOER Update submitted on April 30, 2008. The figure also shows the planned and completed facility projects which address each SSO. Already completed pipeline improvement projects and minibasin rehabilitation projects are shaded grey. Collector system projects with the goal of finding and fixing other sewer defects are shown in blue.

Each of the planned and completed projects that address an SSO is labeled with a project ID. The project IDs listed on the figure correspond with project IDs and project descriptions found on Tables 3-3 and 3-4. Section 4 will present the Phase II CAP/ER implementation plan that provides start and end dates for each of these projects.



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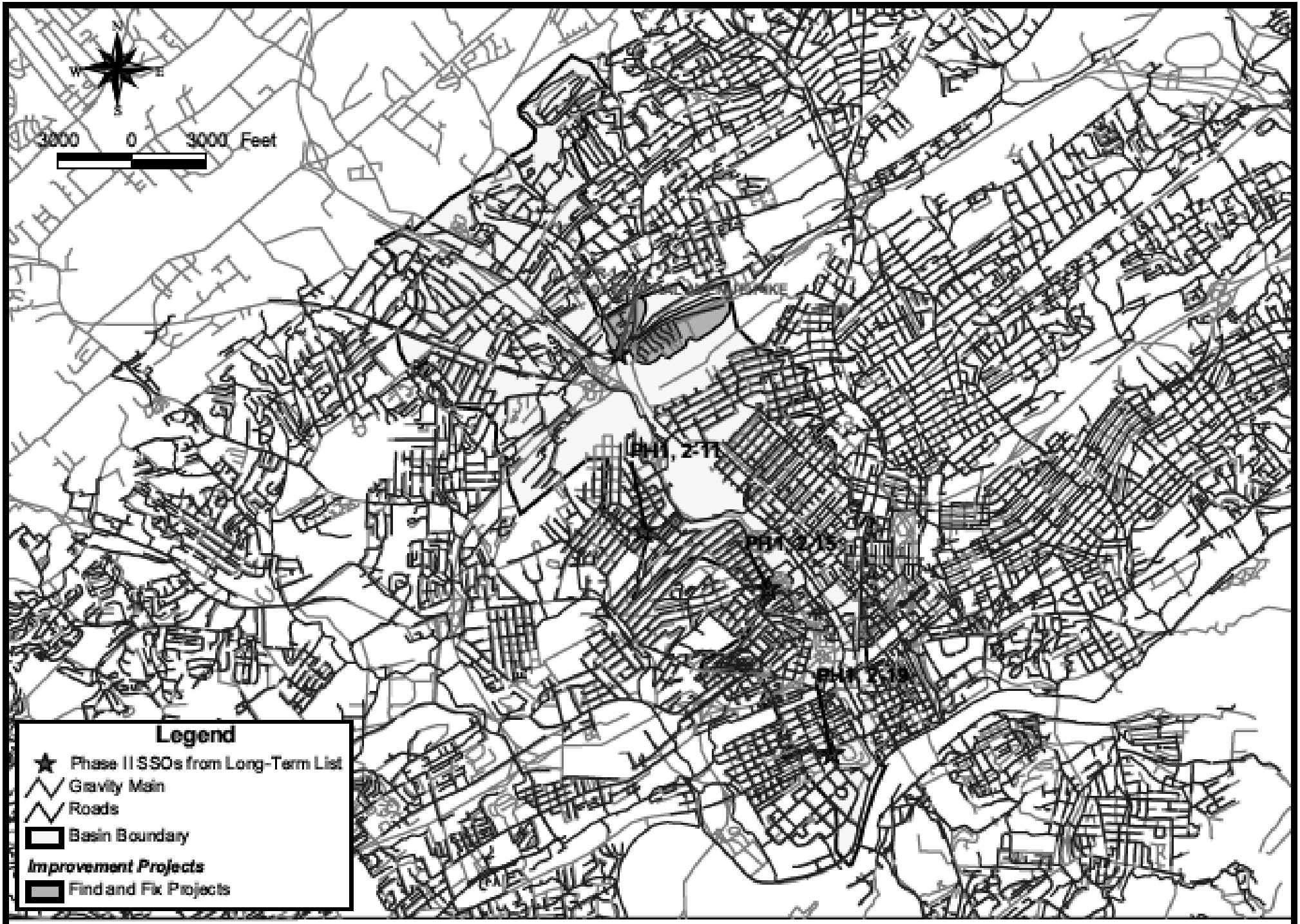
Second Creek
Sewer Hydraulic Model

Figure 3-3

Table 3-3: Second Creek Phase II - Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20050613	1335 NEW YORK AVE	MH 21-117	Phase 1 CAPER, 2-11	Subbasin 15 Rehabilitation/Replacement Project - FY 2009/2010
20060923	4105 CENTRAL AVENUE PIKE	MH 17-8	SCR-1	Find and Fix work to identify and address cause of overflow in the vicinity of 4105 Central Avenue Pike - FY 2013/2015

Table 3-4: Second Creek Phase II - Non-Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20060518	1015 PHILLIP FULMER WAY	MH 20	Phase 1 CAPER, 2-19	Second Creek SSO Abatement Project - FY 2009/2010
20060526	1015 PHILLIP FULMER WAY	Broken Pipe	Phase 1 CAPER, 2-19	Second Creek SSO Abatement Project - FY 2009/2010
20050707	816 BAXTER AVE	MH 19-99	Phase 1 CAPER, 2-15	Second Creek SSO Abatement Project - FY 2009/2010
20060425	816 W. BAXTER AVENUE	MH 19-99	Phase 1 CAPER, 2-15	Second Creek SSO Abatement Project - FY 2009/2010



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Second Creek Phase II: CAP/ER SSOER Map

Figure 3-4

3.4 Third Creek

In the spring of 2008, all of the Third Creek Basin was flow monitored and the sewer hydraulic model was updated with new RDI/I characterization data reflecting the progress KUB has made under Phase I CAP/ER. The sewer hydraulic model for Third Creek was recalibrated as a result of these efforts and updated with completed pipe project as-built information. CCP storage has also been planned within the Third Creek Basin. Unlike the facility in Second Creek though, the location of the storage basin on the west end of the Kuwahee WWTP has limited direct impacts for the Third Creek collection system. Figure 3-5 shows the extent of the sewer hydraulic model.

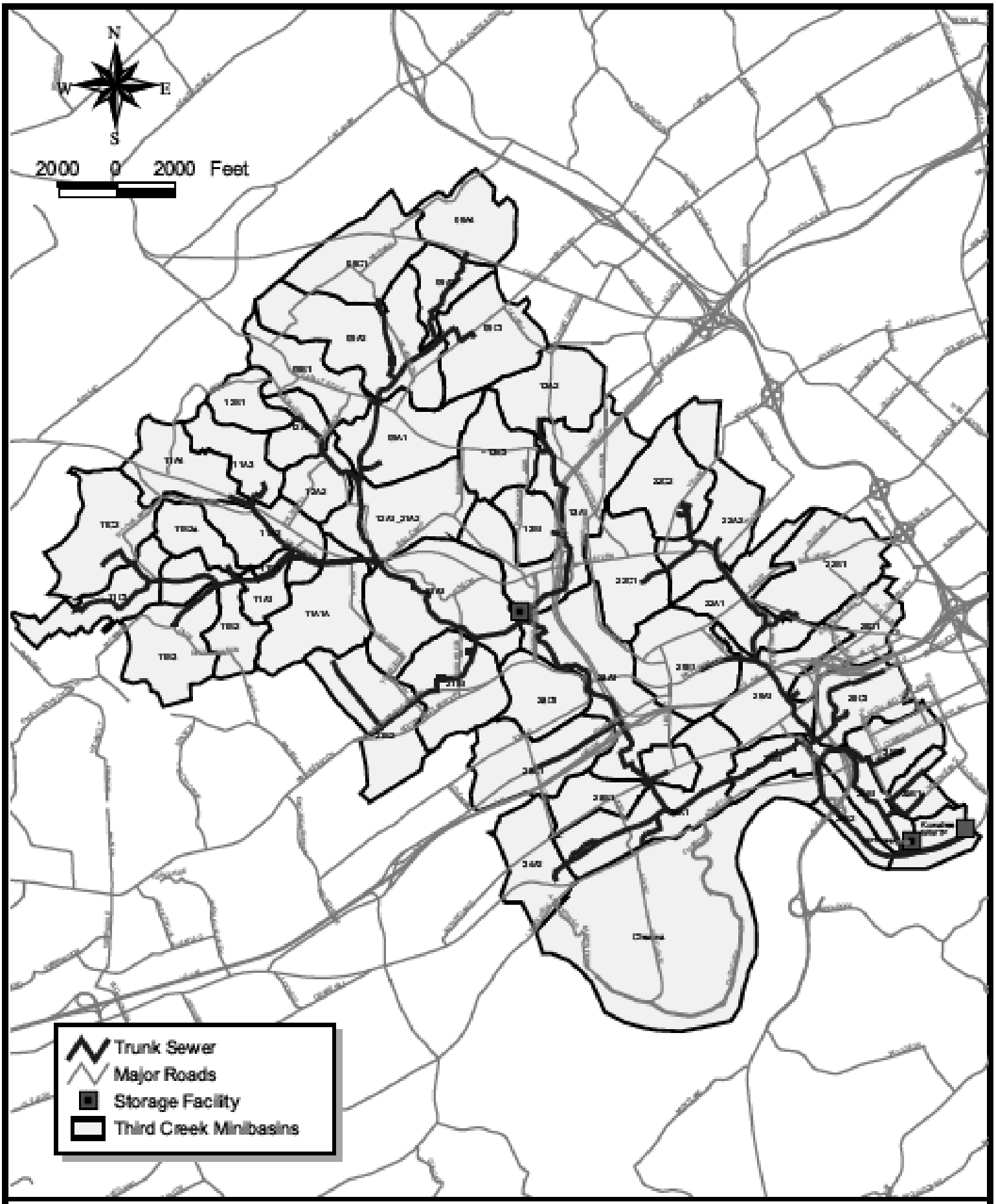
3.4.1 Phase II CAP/ER Facility Improvements

In Third Creek, the SSOs listed on the Long-Term List that are capacity related are addressed by facility improvement projects as outlined in Table 3-5. This table lists all capacity related SSOs and a corresponding project ID, which addresses the SSO. In some instances, an SSO occurred prior to the completion of a Phase I CAP/ER project and has not occurred since. In those instances, the corresponding Phase I project and completion date is noted on the table in the project ID column.

Table 3-6 presents all SSOs on the Long-Term List that are not capacity related. In the project ID column is either a "find and fix" project ID that addresses the SSO or the designation "has been addressed by CSSAP Program", as discussed in Section 3.1. As noted for capacity related SSOs, should a Phase I project be considered as having addressed an SSO, that corresponding project and its completion date are included in the project ID column.

Figure 3-6 presents a map showing the locations of all SSOs on the Long-Term List after Phase I CAP/ER through the Annual SSOER Update submitted on April 30, 2008. The figure also shows the planned and completed facility projects which address each SSO. Already completed pipeline improvement projects and minibasin rehabilitation projects are shown in grey. Collector system projects with the goal of finding and fixing other sewer defects are shown in blue and pipeline improvement projects are shown in magenta.

Each of the planned and completed projects that address an SSO is labeled with a project ID. The project IDs listed on the figure correspond with project IDs and project descriptions found on Tables 3-5 and 3-6. Section 4 will present the Phase II CAP/ER implementation plan that provides start and end dates for each of these projects.



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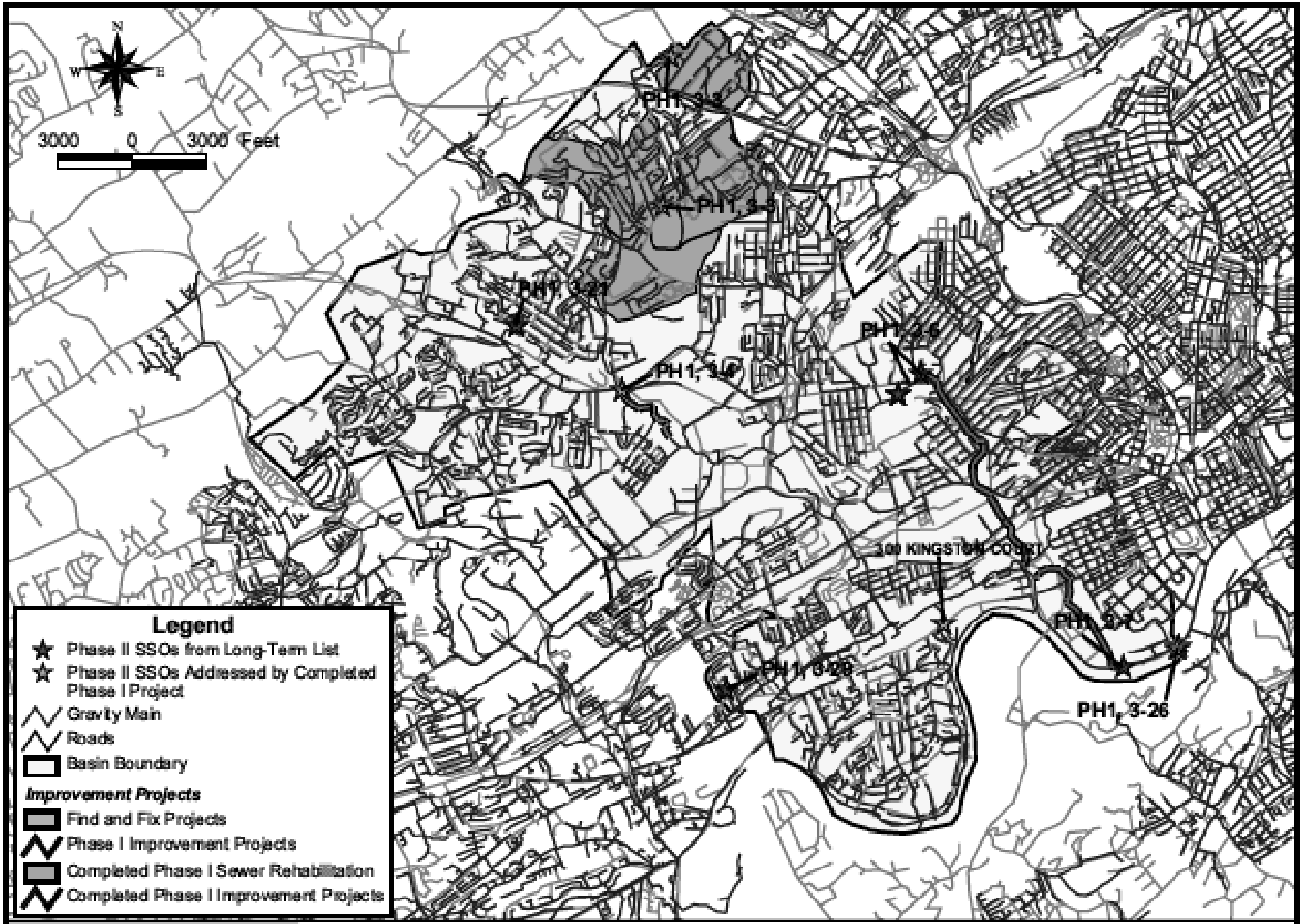
Third Creek
Sewer Hydraulic Model

Figure 3-5

Table 3-5: Third Creek Phase II - Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20060110	2724 WESTERN AVE	MH 16-56	Phase 1 CAP/ER, 3-6	I-40 Middlebrook Pike Trunk Replacement Project, FY 2009/2011
20060402	2015 NEYLAND DR	Secondary Junction Box	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 04/2006
20060520	2015 NEYLAND DR	Primaries # 3-4 Influent Box	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 05/2006
20060823	2015 NEYLAND DR	Kuwahee WWTP Digester MH	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 08/2006
20060408	5000 WESTERN AVENUE	MH 1	Phase 1 CAP/ER, 3-4	Upper McKamey and Third Creek Rd Replacement Project, completed 08/2007
20060424	5000 WESTERN AVENUE	MH 1	Phase 1 CAP/ER, 3-4	Upper McKamey and Third Creek Rd Replacement Project, completed 08/2007
20060804	2724 WESTERN AVENUE	MH 16-56	Phase 1 CAP/ER, 3-6	I-40 Middlebrook Pike Trunk Replacement Project, FY 2009/2011
20060823	5513 FENWAY LANE	MH 20	Phase 1 CAP/ER, 3-3	Subbasin 9 rehabilitation projects, completed 10/2006
20060823	2724 WESTERN AVENUE	MH 16-56	Phase 1 CAP/ER, 3-6	I-40 Middlebrook Pike Trunk Replacement Project, FY 2009/2011
20060823	2015 NEYLAND DRIVE	Secondary Splitter Box	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 08/2006
20060823	411 HIGHLAND HILLS DRIVE	MH 62	Phase 1 CAP/ER, 3-29	Highland Hills Road Rehabilitation, FY 2012/2013
20060828	2377 NEYLAND DRIVE	MHS 4-2, 4-36, 4-38 & 4-6	Phase 1 CAP/ER, 3-7	Third Creek Trunk Replacement Project, FY 2011/2012
20060828	5000 WESTERN AVENUE	MHS 1 & 29	Phase 1 CAP/ER, 3-4	Upper McKamey and Third Creek Rd Replacement Project, completed 08/2007
20061027	2706 MYNDERS AVENUE	MH 10-3	Phase 1 CAP/ER, 3-6	I-40 Middlebrook Pike Trunk Replacement Project, FY 2009/2011
20061027	2724 WESTERN AVENUE	MH 16-56	Phase 1 CAP/ER, 3-6	I-40 Middlebrook Pike Trunk Replacement Project, FY 2009/2011
20061101	2724 WESTERN AVENUE	MH 16-56	Phase 1 CAP/ER, 3-6	I-40 Middlebrook Pike Trunk Replacement Project, FY 2009/2011
20061115	2724 WESTERN AVENUE	MH 16-56	Phase 1 CAP/ER, 3-6	I-40 Middlebrook Pike Trunk Replacement Project, FY 2009/2011

Table 3-6: Third Creek Phase II - Non-Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20061231	2004 NEYLAND DRIVE	MH 1	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 12/2006
20070303	2004 NEYLAND DRIVE	MH 1	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 03/2007
20050215	2015 NEYLAND DR	#6 Digester	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 02/2005
20050222	2015 NEYLAND DR	#6 Digester	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 02/2005
20050322	2015 NEYLAND DR	Filtrate Tank	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 03/2005
20051011	2015 NEYLAND DR	Septage Unloading Site	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 10/2005
20070303	2015 NEYLAND DRIVE	Ruptured Force Main	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 03/2007
20060823	2015 NEYLAND DRIVE (420 ft East)	Undesignated MH	Phase 1 CAP/ER, 3-26	POP, CPE, and OOP corrective actions, completed 08/2006
20070201	300 KINGSTON COURT	MH 8-50	NA	Addressed by CISSAP Program, completed 11/2007
20070806	300 KINGSTON COURT	MH 8-50	NA	Addressed by CISSAP Program, completed 11/2007
20070206	4421 ROYALVIEW ROAD	Cleanout	Phase 1 CAP/ER, 3-21	Deerfield Road Rehabilitation Project, FY 2011/2012
20060920	4421 ROYALVIEW ROAD	Lateral Cleanout	Phase 1 CAP/ER, 3-21	Deerfield Road Rehabilitation Project, FY 2011/2012
20050606	751 MURRAY DR	Grinder Pump	Phase 1 CAP/ER, 3-3	Subbasin 9 rehabilitation projects, completed 10/2006
20050417	751 MURRAY DR	Grinder Pump	Phase 1 CAP/ER, 3-3	Subbasin 9 rehabilitation projects, completed 10/2006



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Third Creek Phase II: CAP/ER SSOER Map

Figure 3-6

3.5 Fourth Creek

Since the Phase I CAP/ER, limited updates based on final project designs have been incorporated into the Fourth Creek sewer hydraulic model. A detailed overview of the sewer hydraulic model for Fourth Creek is contained in the Phase I CAP/ER with specific details on the sewer hydraulic model flows and model development for the Fourth Creek Basin. Figure 3-7 shows the extent of the sewer hydraulic model which incorporates all trunk sewers in Fourth Creek greater than 8 inches in diameter.

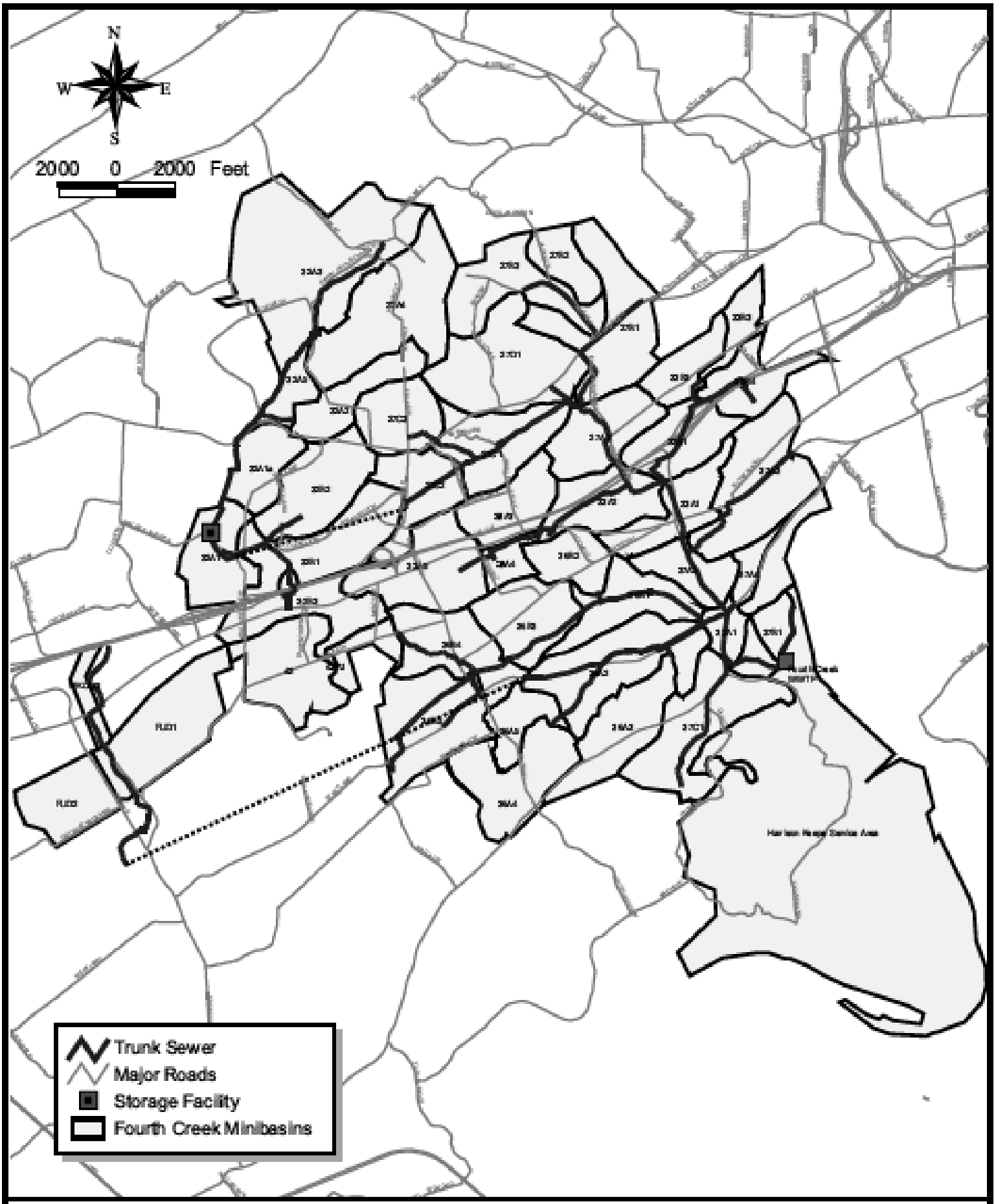
3.5.1 Phase II CAP/ER Facility Improvements

In Fourth Creek, the SSOs listed on the Long-Term List that are capacity related are addressed by facility improvement projects as outlined in Table 3-7. This table lists all capacity related SSOs and a corresponding project ID, which addresses the SSO. In some instances, an SSO occurred prior to the completion of a Phase I CAP/ER project and has not occurred since. In those instances, the corresponding Phase I project and completion date is noted on the table in the project ID column.

Table 3-8 presents all SSOs on the Long-Term List that are not capacity related. In the project ID column is either a "find and fix" project ID that addresses the SSO or the designation "has been addressed by CSSAP Program", as discussed in Section 3.1. As noted for capacity related SSOs, should a Phase I project be considered as having addressed an SSO, that corresponding project and its completion date are included in the project ID column.

Figure 3-8 presents a map showing the locations of all SSOs on the Long-Term List after Phase I CAP/ER through the Annual SSOER Update submitted on April 30, 2008. The figure also shows the planned and completed facility projects which address each SSO. Already completed pipeline improvement projects and minibasin rehabilitation projects are shaded grey. Collector system projects with the goal of finding and fixing other sewer defects are shown in blue.

Each of the planned and completed projects that address an SSO is labeled with a project ID. The project IDs listed on the figure correspond with project IDs and project descriptions found on Tables 3-7 and 3-8. Section 4 will present the Phase II CAP/ER implementation plan that provides start and end dates for each of these projects.



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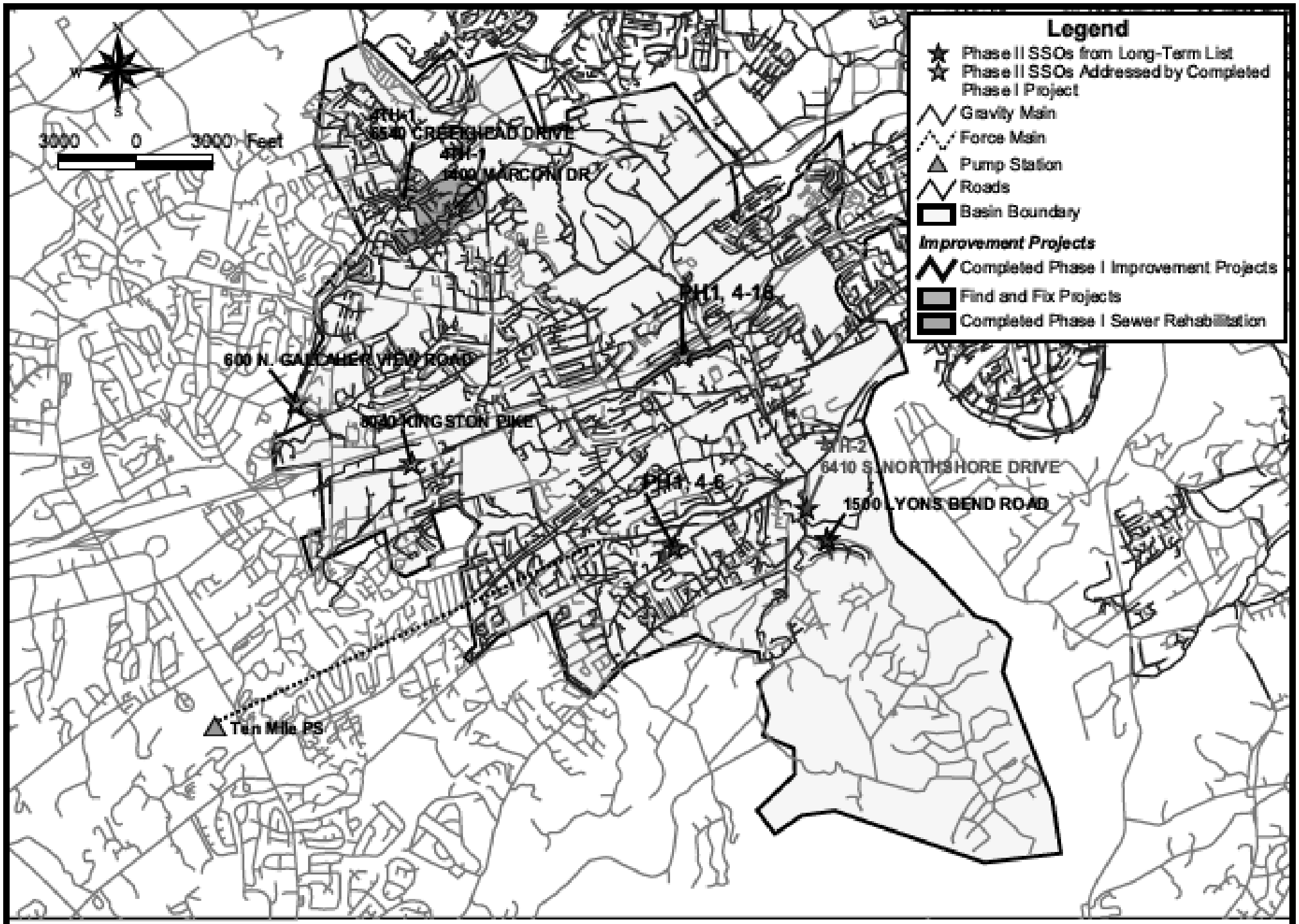
Fourth Creek
Sewer Hydraulic Model

Figure 3-7

Table 3-7: Fourth Creek Phase II - Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20050221	600 N GALLAHER VIEW RD	MH 77	Phase 1 CAPER, 4-17	Walker Springs Storage Tank, completed 11/2006
20050328	1500 LYONS BEND RD (4TH CREEK)	Influent Structure	NA	Addressed by CCP - to be completed in FY 2013/2014
20050402	600 N GALLAHER VIEW RD	MH 77	Phase 1 CAPER, 4-17	Walker Springs Storage Tank, completed 11/2006
20050413	600 N GALLAHER VIEW RD	MH 77	Phase 1 CAPER, 4-17	Walker Springs Storage Tank, completed 11/2006
20050520	600 N GALLAHER VIEW RD	MH 77	Phase 1 CAPER, 4-17	Walker Springs Storage Tank, completed 11/2006
20050719	600 N GALLAHER VIEW RD	MH 77	Phase 1 CAPER, 4-17	Walker Springs Storage Tank, completed 11/2006
20050719	1400 MARCONI DR	MH 49-6	4TH-1	Sewer rehabilitation in minibasin 32A4, completed 09/2007
20060406	600 N. GALLAHER VIEW ROAD	MH 77	Phase 1 CAPER, 4-17	Walker Springs Storage Tank, completed 11/2006
20060424	600 N. GALLAHER VIEW ROAD	MH 77	Phase 1 CAPER, 4-17	Walker Springs Storage Tank, completed 11/2006
20060706	6410 PAPERMILL DRIVE	MH 24	Phase 1 CAPER, 4-18	Papermill Phase I, II, and III, completed 01/2007
20060823	7112 SHADYLAND DRIVE	MH 36	Phase 1 CAPER, 4-6	Shadyland Drive Rehabilitation, FY 2009/2010
20060823	6422 PAPERMILL DRIVE	MHS 24, 23, 23-1 & 22	Phase 1 CAPER, 4-18	Papermill Phase I, II, and III, completed 01/2007
20060823	1500 LYONS BEND DRIVE	Influent Structure	NA	Addressed by CCP - FY 2013/2014
20060823	6540 CREEKHEAD DRIVE	MH 49-4	4TH-1	Sewer rehabilitation in minibasin 32A4, completed 09/2007
20060824	600 N. GALLAHER VIEW ROAD	MH 77	Phase 1 CAPER, 4-17	Walker Springs Storage Tank, completed 11/2006
20060825	6410 S. NORTHSHORE DRIVE	MH 8	4TH-2	Removal of Ten Mile PS upstream, FY 2013/2014

Table 3-8: Fourth Creek Phase II - Non-Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20070807	1500 LYONS BEND ROAD	Leaking Valve	NA	Addressed by CSSAP Program, completed 08/2007
20061120	6040 KINGSTON PIKE	MH 9-35	NA	Addressed by CSSAP Program, removed Fiber-optic line directional drilled through the sewer line, completed 12/2006
20061202	6040 KINGSTON PIKE	MHS 9-35 & 9-85	NA	Addressed by CSSAP Program, removed Fiber-optic line directional drilled through the sewer line, completed 12/2006



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Fourth Creek Phase II: CAP/ER SSOER Map

Figure 3-8

3.6 South Knoxville / Knob Creek

Limited updates based on final project designs have been incorporated into the South Knoxville / Knob Creek sewer hydraulic model since the Phase I CAP/ER. A detailed overview of the sewer hydraulic model for South Knoxville / Knob Creek is contained in the Phase I CAP/ER with specific details on the sewer hydraulic model flows and model development. **Figure 3-9** shows the extent of the sewer hydraulic model which incorporates all trunk sewers in the basin greater than 8 inches in diameter.

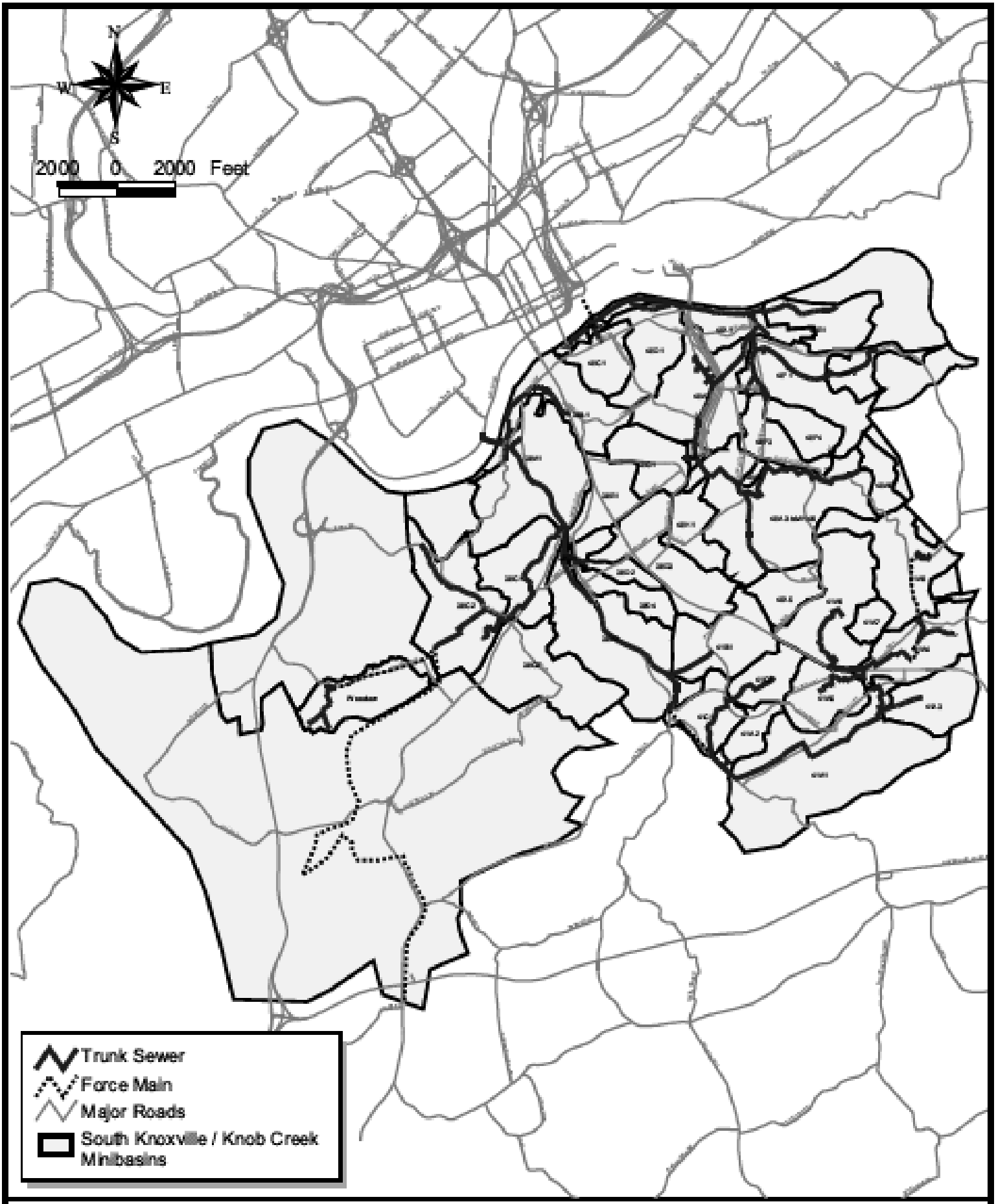
3.6.1 Phase II CAP/ER Facility Improvements

In South Knoxville / Knob Creek, the SSOs listed on the Long-Term List that are capacity related are addressed by facility improvement projects as outlined in **Table 3-9**. This table lists all capacity related SSOs and a corresponding project ID, which addresses the SSO. In some instances, an SSO occurred prior to the completion of a Phase I CAP/ER project and has not occurred since. In those instances, the corresponding Phase I project and completion date is noted on the table in the project ID column.

Table 3-10 presents all SSOs on the Long-Term List that are not capacity related. In the project ID column is either a "find and fix" project ID that addresses the SSO or the designation "has been addressed by CSSAP Program", as discussed in Section 3.1. As noted for capacity related SSOs, should a Phase I project be considered as having addressed an SSO, that corresponding project and its completion date are included in the project ID column.

Figure 3-10 presents a map showing the locations of all SSOs on the Long-Term List after Phase I CAP/ER through the Annual SSOER Update submitted on April 30, 2008. The figure also shows the planned and completed facility projects which address each SSO. Already completed pipeline improvement projects and minibasin rehabilitation projects are shaded grey. Collector system projects with the goal of finding and fixing other sewer defects are shown in blue and pipeline improvement projects are shown in magenta.

Each of the planned and completed projects that address an SSO is labeled with a project ID. The project IDs listed on the figure correspond with project IDs and project descriptions found on Tables 3-9 and 3-10. Section 4 will present the Phase II CAP/ER implementation plan that provides start and end dates for each of these projects.



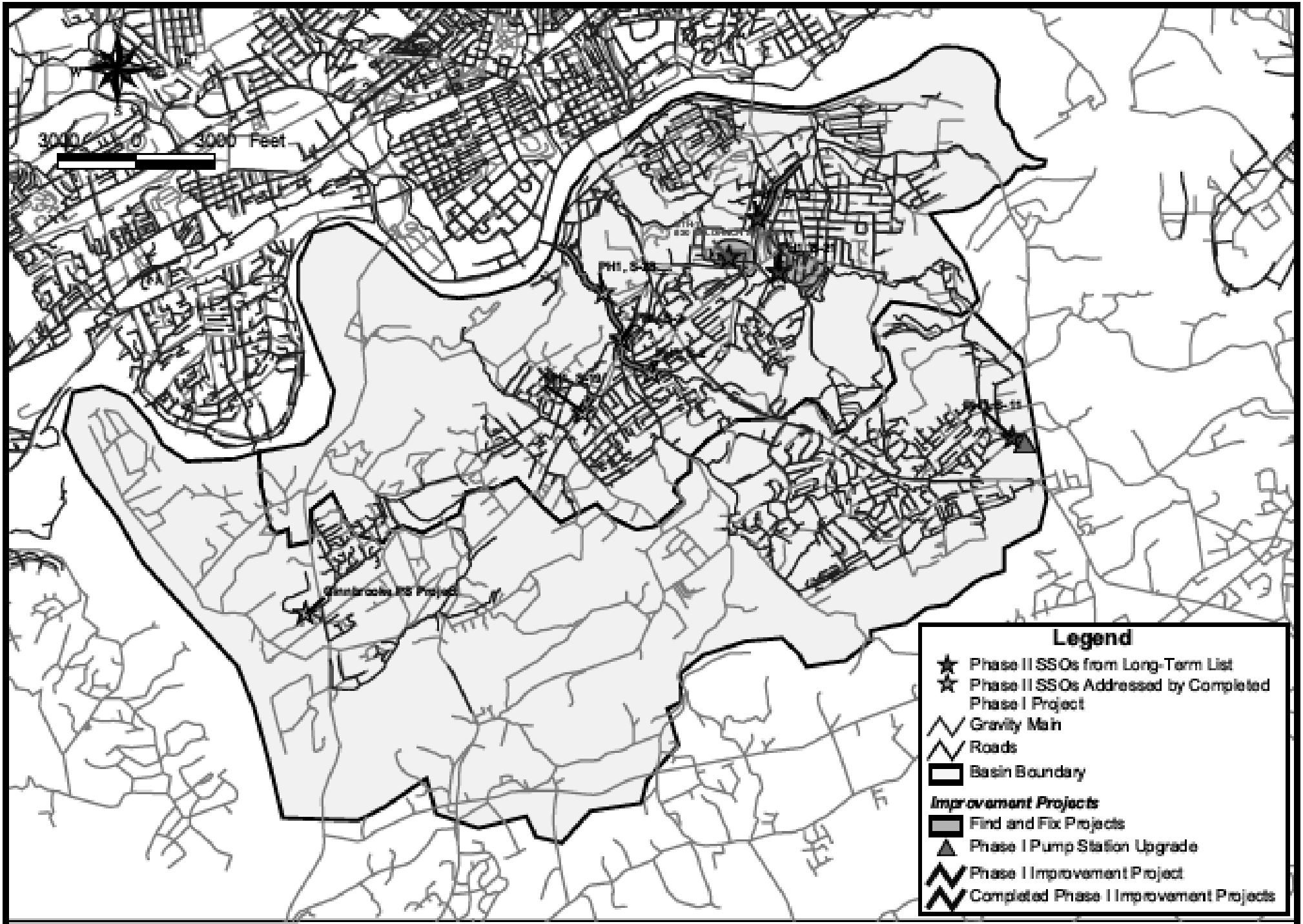
CDM

South Knoxville / Knob Creek
Sewer Hydraulic Model

Figure 3-9

Table 3-9: South Knoxville / Knob Creek Phase II - Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20050221	436 MARYVILLE PIKE	MH 30	Phase 1 CAPIER, S-2	Goose Creek Trunk Sewer Replacement, completed 02/2009
20050328	436 MARYVILLE PIKE	MH 30	Phase 1 CAPIER, S-2	Goose Creek Trunk Sewer Replacement, completed 02/2009
20050402	436 MARYVILLE PIKE	MH 30	Phase 1 CAPIER, S-2	Goose Creek Trunk Sewer Replacement, completed 02/2009
20050404	3741 EAKERS ST	MH 47-1	Phase 1 CAPIER, S-21	Alpine Avenue Rehabilitation Project, FY 2012/2013
20050520	925 MARYVILLE PIKE	MHS 27-345 & 27-344	Phase 1 CAPIER, S-19	Maryville Pike Pipe Replacement Project, completed 03/2006
20050520	436 MARYVILLE PIKE	MH 29-2	Phase 1 CAPIER, S-2	Goose Creek Trunk Sewer Replacement, completed 02/2009
20050524	3741 EAKERS ST	MH 47	Phase 1 CAPIER, S-21	Alpine Avenue Rehabilitation Project, FY 2012/2013
20050707	428 MARYVILLE PIKE	MH s 29-2 & 30	Phase 1 CAPIER, S-2	Goose Creek Trunk Sewer Replacement, completed 02/2009
20060117	436 MARYVILLE PIKE	MH 29-2	Phase 1 CAPIER, S-2	Goose Creek Trunk Sewer Replacement, completed 02/2009
20060408	436 MARYVILLE PIKE	MH 29-2	Phase 1 CAPIER, S-2	Goose Creek Trunk Sewer Replacement, completed 02/2009
20060422	436 MARYVILLE PIKE	MHs 29-2 & 30	Phase 1 CAPIER, S-2	Goose Creek Trunk Sewer Replacement, completed 02/2009
20060923	1210 E. MOODY AVENUE	MH 39	Phase 1 CAPIER, S-15	Sub-basin 40A2 Trunk Replacement, FY 2011/2013
20060923	410 MARYVILLE PIKE	MHS 29-2 & 30	Phase 1 CAPIER, S-2	Goose Creek Trunk Sewer Replacement, completed 02/2009
20060923	3741 EAKERS ROAD	MHS 47 & 47-103	Phase 1 CAPIER, S-21	Alpine Avenue Rehabilitation Project, FY 2012/2013
20060923	3400 W. BLOUNT AVENUE	MH 15	Phase 1 CAPIER, S-28	3400 Blount Avenue - Trunk Sewer project to correct reverse slopes, completed 01/2009
20060923	413 HIGGINS AVENUE	MH 63	Phase 1 CAPIER, S-2	Goose Creek Trunk Sewer Replacement, completed 02/2009
20060924	2907 GINNBROOKE DRIVE	Pump Station Wetwell	NA	Ginnbrooke Pump Station Upgrade and Forcemain Project, completed 09/2008
20060923	961 E. FORD VALLEY ROAD	Pump Station Wetwell	Phase 1 CAPIER, S-11	Ford Valley Pump Station Upgrade, FY 2010/2011
20060923	820 GOLDFINCH AVENUE	MH 45-16	STM-1	Find and Fix work to identify and address cause of overflow in the vicinity of 820 Goldfinch Avenue, FY 2012/2013
20061101	1210 E. MOODY AVENUE	MH 39	Phase 1 CAPIER, S-15	Sub-basin 40A2 Trunk Replacement, FY 2011/2013

Table 3-10: South Knoxville / Knob Creek Phase II - Non-Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20060512	2907 GINNBROOKE LANE	Wetwell	NA	Addressed by CMOM; completed 06/2006



CDM

South Knoxville / Knob Creek Phase II: CAP/ER SSOER Map

Figure 3-10

3.7 Williams Creek

Since the Phase I CAP/ER, limited updates based on final project designs have been incorporated into the Williams Creek sewer hydraulic model. Complete details on the sewer hydraulic model flows and model development for Williams Creek are contained in the Phase I CAP/ER. Figure 3-11 shows the extent of the sewer hydraulic model which incorporates all trunk sewers greater than 8 inches in diameter within the Williams Creek Basin.

3.7.1 Phase II CAP/ER Facility Improvements

In Williams Creek, the SSOs listed on the Long-Term List that are capacity related are addressed by facility improvement projects as outlined in Table 3-11. This table lists all capacity related SSOs and a corresponding project ID, which addresses the SSO. In some instances, an SSO occurred prior to the completion of a Phase I CAP/ER project and has not occurred since. In those instances, the corresponding Phase I project and completion date is noted on the table in the project ID column.

Table 3-12 presents all SSOs on the Long-Term List that are not capacity related. In the project ID column is either a "find and fix" project ID that addresses the SSO or the designation "has been addressed by CSSAP Program", as discussed in Section 3.1. As noted for capacity related SSOs, should a Phase I project be considered as having addressed an SSO, that corresponding project and its completion date are included in the project ID column.

Figure 3-12 presents a map showing the locations of all SSOs on the Long-Term List after Phase I CAP/ER through the Annual SSOER Update submitted on April 30, 2008. The figure also shows the planned and completed facility projects which address each SSO. Already completed pipeline improvement projects and minibasin rehabilitation projects are shown in grey. All projects are currently complete in the Williams Creek basin.

Each of the planned and completed projects that address an SSO is labeled with a project ID. The project IDs listed on the figure correspond with project IDs and project descriptions found on Tables 3-11 and 3-12. Section 4 will present the Phase II CAP/ER implementation plan that provides start and end dates for each of these projects.

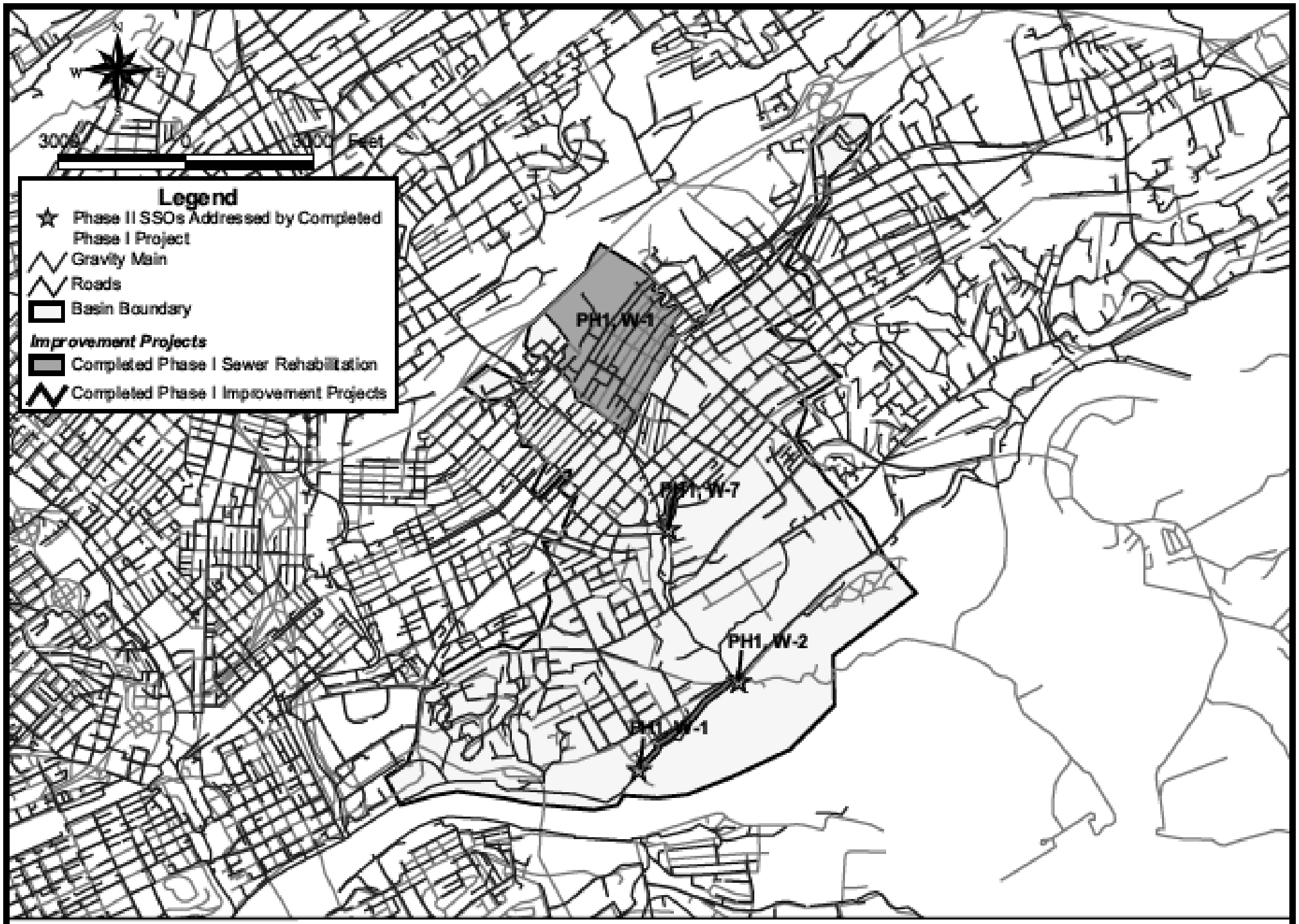
CDM

Williams Creek
Sewer Hydraulic Model

Figure 3-11

Table 3-11: Williams Creek Phase II - Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20060329	2505 DELROSE DR	MH 12	Phase 1 CAPER, W-2	Williams Creek Trunk line replacement (downstream of Golf Course), completed 04/2006
20060402	2505 DELROSE DR	MH 12	Phase 1 CAPER, W-2	Williams Creek Trunk line replacement (downstream of Golf Course), completed 04/2006
20060520	2505 DELROSE DR	MH 12	Phase 1 CAPER, W-2	Williams Creek Trunk line replacement (downstream of Golf Course), completed 04/2006
20060607	2505 DELROSE DR	MH 12	Phase 1 CAPER, W-2	Williams Creek Trunk line replacement (downstream of Golf Course), completed 04/2006
20060707	2505 DELROSE DR	MH 12	Phase 1 CAPER, W-2	Williams Creek Trunk line replacement (downstream of Golf Course), completed 04/2006
20060117	2505 DELROSE DRIVE	MH 12	Phase 1 CAPER, W-2	Williams Creek Trunk line replacement (downstream of Golf Course), completed 04/2006
20060924	2008 RIVERSIDE DRIVE	MHS 1-1 & 2	Phase 1 CAPER, W-1	Rehabilitation of all of Sub-basin 19, completed 05/2009

Table 3-12: Williams Creek Phase II - Non-Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20061026	923 BIDDLE STREET	MH 29	Phase 1 CAPER, W-7	Sunset Avenue Rehabilitation Project, completed 01/2007
20061214	923 BIDDLE STREET	MH 29	Phase 1 CAPER, W-7	Sunset Avenue Rehabilitation Project, completed 01/2007



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Williams Creek Phase II: CAP/ER SSOER Map

Figure 3-12

3.8 Loves Creek

Since Phase I CAP/ER development, Loves Creek underwent an extensive flow monitoring study in the spring of 2005. Baseline RDI/I characterizations for each minibasin within the Loves Creek Basin were developed to help with guidance on addressing the few SSOs within the Loves Creek Basin. Few capacity related SSOs occurred in Loves Creek during Phase I CAP/ER and even fewer occurred during Phase II. All have been addressed by the completion of Phase I CAP/ER projects. Therefore, a complete hydraulic capacity analysis as performed for the previous six basins was not performed for this basin. All SSOs on the Long-Term List are still addressed in this Phase II CAP/ER; however, a full sewer hydraulic modeling analysis was not required to adequately address them.

3.8.1 Phase II CAP/ER Facility Improvements

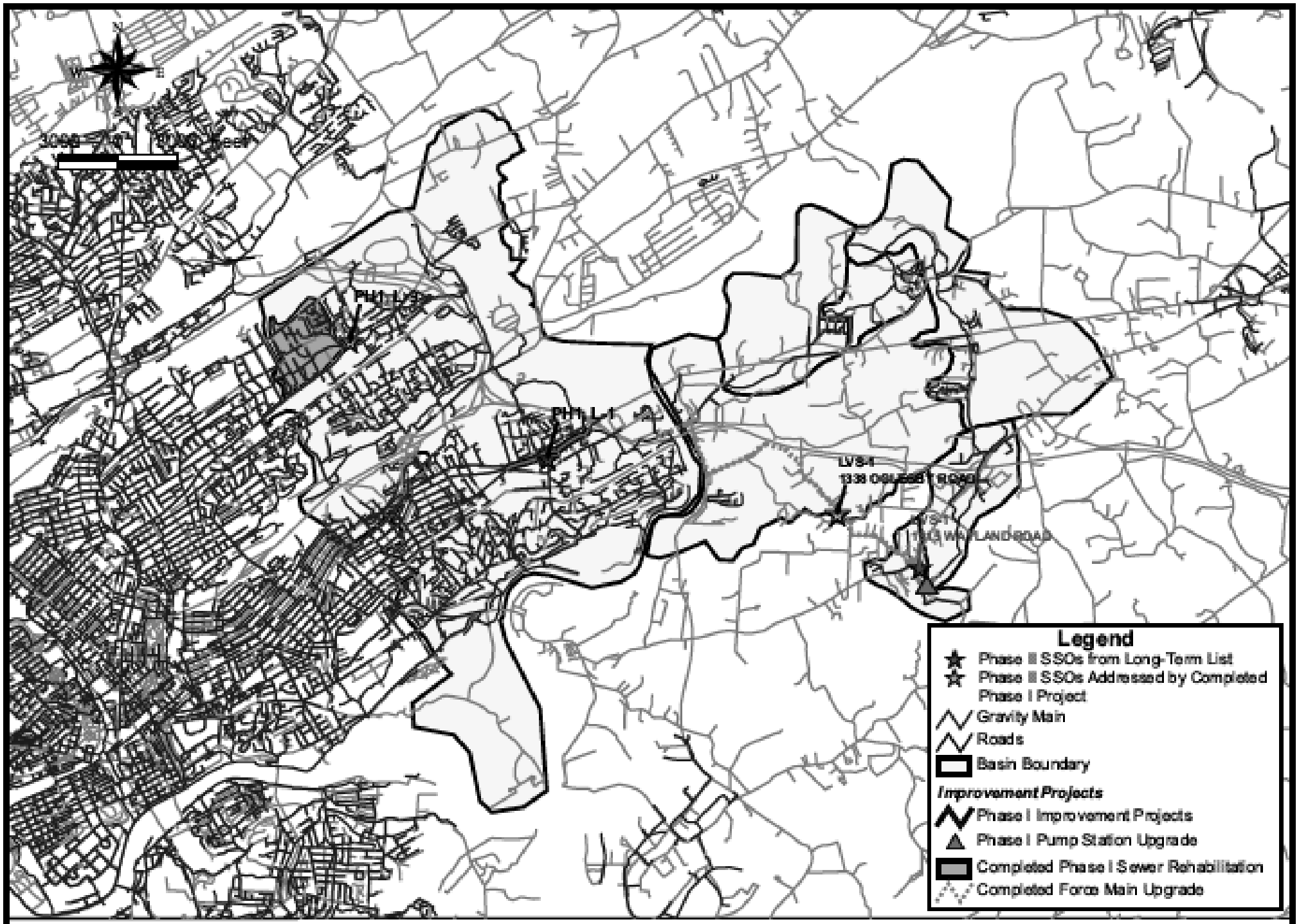
In Loves Creek, the SSOs listed on the Long-Term List that are capacity related are addressed by facility improvement projects as outlined in **Table 3-13**. This table lists all capacity related SSOs and a corresponding project ID, which addresses the SSO. In some instances, an SSO occurred prior to the completion of a Phase I CAP/ER project and has not occurred since. In those instances, the corresponding Phase I project and completion date is noted on the table in the project ID column.

Table 3-14 presents all SSOs on the Long-Term List that are not capacity related. In the project ID column is either a "find and fix" project ID that addresses the SSO or the designation "has been addressed by CSSAP Program", as discussed in Section 3.1. As noted for capacity related SSOs, should a Phase I project be considered as having addressed an SSO, that corresponding project and its completion date are included in the project ID column.

Figure 3-13 presents a map showing the locations of all SSOs on the Long-Term List after Phase I CAP/ER through the Annual SSOER Update submitted on April 30, 2008. The figure also shows the planned and completed facility projects which address each SSO. Already completed pipeline improvement projects and minibasin rehabilitation projects are shaded grey. Pipeline improvement projects to be completed are shown in magenta.

Table 3-13: Loves Creek Phase II - Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20060116	1615 WAYLAND ROAD	Cleanout	LVS-1	Replaced 16,433 LF of 8" ductile iron force main with 10" PVC force main, completed 02/2009. Pump Station Upgrade FY 2010/FY2012
20060925	203 S. CHILHOWEE DRIVE	MH 25	Phase I CAPER, L-1	Asheville Hwy Pipe Replacement Project, FY 2009/2010
20060406	3001 SHELBOURNE ROAD	MH 82-1	Phase I CAPER, L-9	Minibasin 06A4 / 06A5 rehabilitation, completed 07/2007
20060422	3001 SHELBOURNE ROAD	MH 82-1	Phase I CAPER, L-9	Minibasin 06A4 / 06A5 rehabilitation, completed 07/2007
20060923	3001 SHELBOURNE ROAD	MH 82-1	Phase I CAPER, L-9	Minibasin 06A4 / 06A5 rehabilitation, completed 07/2007

Table 3-14: Loves Creek Phase II - Non-Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20071019	1336 OGLESBY ROAD	Leading Force Main	NA	Addressed by CSSAP and LVS-1, completed 02/2009
20071027	1336 OGLESBY ROAD	Leading Force Main	NA	Addressed by CSSAP and LVS-1, completed 02/2009
20071229	1336 OGLESBY ROAD	Leading Force Main	NA	Addressed by CSSAP and LVS-1, completed 02/2009



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Loves Creek Phase II: CAP/ER SSOER Map

Figure 3-13

3.9 Eastbridge

No capacity-related SSOs occurred in Eastbridge during Phase I CAP/ER and only one capacity related SSO occurred during Phase II. Therefore, a complete hydraulic capacity analysis was not performed for this basin. All SSOs on the Long-Term List are still addressed in this Phase II CAP/ER; however, a full sewer hydraulic modeling analysis was not required to adequately address them.

3.9.1 Phase II CAP/ER Facility Improvements

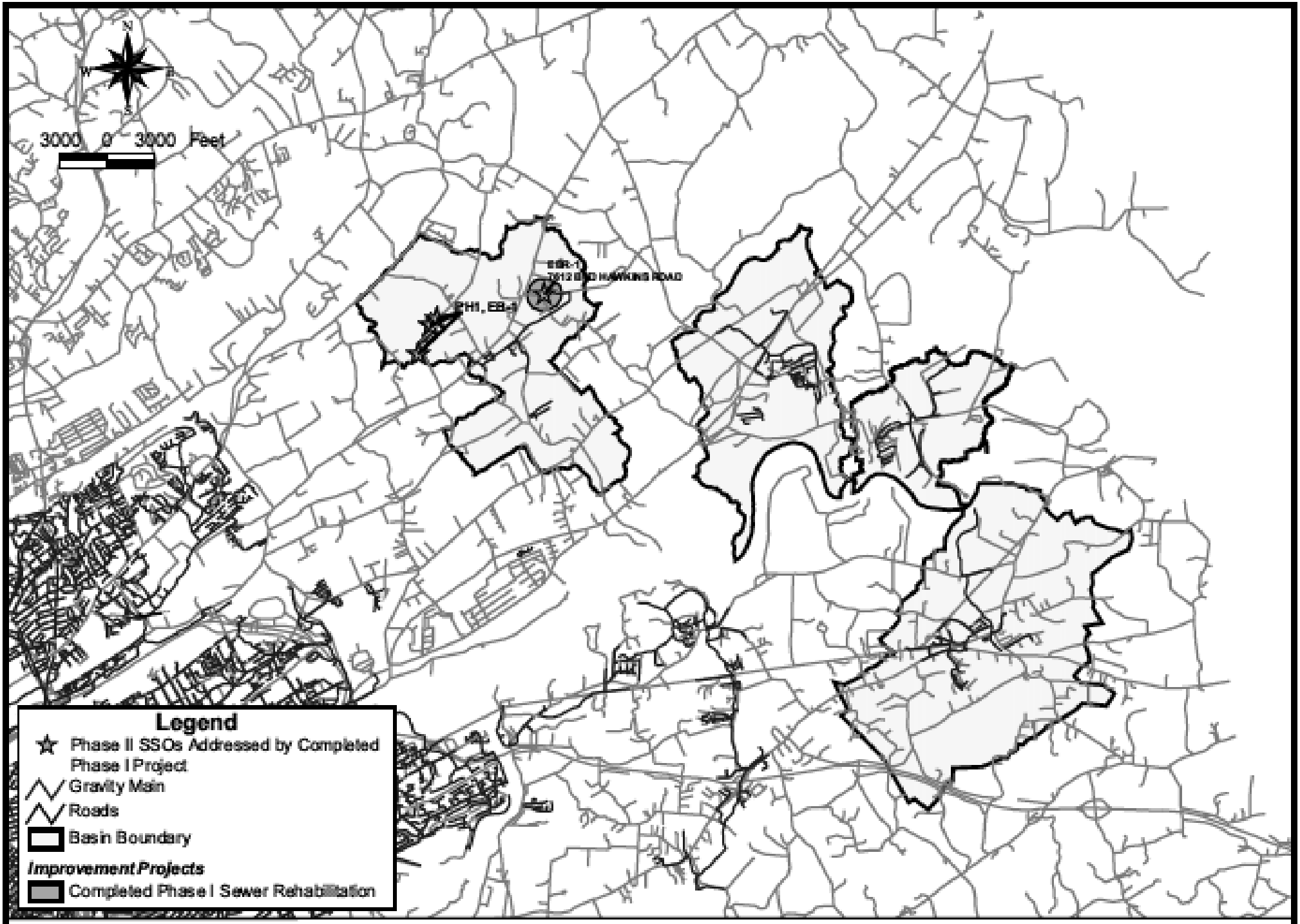
In Eastbridge, the SSOs listed on the Long-Term List that are capacity related are addressed by facility improvement projects as outlined in Table 3-15. This table lists all capacity related SSOs and a corresponding project ID, which addresses the SSO. In some instances, an SSO occurred prior to the completion of a Phase I CAP/ER project and has not occurred since. In those instances, the corresponding Phase I project and completion date is noted on the table in the project ID column.

Table 3-16 presents all SSOs on the Long-Term List that are not capacity related. In the project ID column is either a "find and fix" project ID that addresses the SSO or the designation "has been addressed by CSSAP Program", as discussed in Section 3.1. As noted for capacity related SSOs, should a Phase I project be considered as having addressed an SSO, that corresponding project and its completion date are included in the project ID column.

Figure 3-14 presents a map showing the locations of all SSOs on the Long-Term List after Phase I CAP/ER through the Annual SSOER Update submitted on April 30, 2008. The figure also shows the planned and completed facility projects which address each SSO. Already completed pipeline improvement projects and minibasin rehabilitation projects are shaded grey. All projects are currently complete in the Eastbridge service area.

Table 3-15: Eastbridge Phase II - Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20060629	7812 BUD HAWKINS ROAD	Wetwell	EBR-1	Replaced the pump station and force main with a 21-inch gravity sewer; completed 02/2009

Table 3-16: Eastbridge Phase II - Non-Capacity Related SSOs				
Date	Address	Overflow Location	Project ID	Project Description
20070723	5101 MALONEYVILLE ROAD	MH 93-26	Phase 1 CAPER, EBI	Addressed by CAPER Phase I: Project EBI, completed 01/2009
20070819	5101 MALONEYVILLE ROAD	MH 93-26	Phase 1 CAPER, EBI	Addressed by CAPER Phase I: Project EBI, completed 01/2009
20051108	4800 MALONEYVILLE RD	Abandoned Grease Trap	Phase 1 CAPER, EBI	Addressed by CAPER Phase I: Project EBI, completed 01/2009
20060419	4800 MALONEYVILLE ROAD	Abandoned Grease Trap	Phase 1 CAPER, EBI	Addressed by CAPER Phase I: Project EBI, completed 01/2009
20050210	5001 MALONEYVILLE RD	MH 93-10	Phase 1 CAPER, EBI	Addressed by CAPER Phase I: Project EBI, completed 01/2009
20051031	5001 MALONEYVILLE RD	MH 93-10	Phase 1 CAPER, EBI	Addressed by CAPER Phase I: Project EBI, completed 01/2009
20060117	5001 MALONEYVILLE ROAD	MH 93-10	Phase 1 CAPER, EBI	Addressed by CAPER Phase I: Project EBI, completed 01/2009



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Eastbridge Phase II: CAP/ER SSOER Map

Figure 3-14

Section 4
Implementation Plan

This section summarizes the implementation plan for the Phase II CAP/ER. The implementation plan summarizes the facility improvements required to address SSOs in the planning area in accordance with the CD. The plan also lists the fiscal year for starting and completing all work specified in this Phase II CAP/ER.

The implementation plan includes projects that have been completed as well as those that are planned. **Tables 4-1 through 4-8** present each facility improvement project including a project ID, project name, project description, start date, and end date. Start date and end date are given as fiscal year in accordance with the CD. It was assumed that the Phase II CAP/ER would be approved during Fiscal Year 09/10 and that Fiscal Year 09/10 represented the first year of the schedule to complete the Phase II CAP/ER projects by June 30, 2016.

Approximate sizing and extents of each project are given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Figures 4-1 through 4-8 present maps of each basin showing the planned and completed facility projects to address the SSOs. Already completed pipeline improvement projects are shaded in grey. Phase I pipe projects not yet complete are shown as magenta pipes. Completed collector system rehabilitation projects are shaded in grey. Collector system projects with the goal of finding and fixing other sewer defects are shown in blue. Any project indicated with a red star and a red text description indicates a completely new Phase II project.

Each of the planned and completed projects that addresses an SSO is labeled with a project ID number. The project IDs listed on the figure match the project IDs in Tables 4-1 through 4-8.

Table 4-1: First Creek Implementation Plan[1]

Project ID	Project Name	Project Description	Start Date	End Date
FCR-1	Watercress Drive Project	Find and Fix work to identify and address cause of overflow in the vicinity of 1235 Watercress Drive	FY 2014	FY 2015
FCR-2	Upchurch Road Project	Find and Fix work to identify and address cause of overflow in the vicinity of 4600 Upchurch Road.	FY 2014	FY 2015
Phase 1 CAP/ER, 1-1	Upper First Creek Collector Project (Mini-basin 01A1, 02A2, 03D1)	Find and fix work to identify and address cause of overflow in the vicinity of 4811 Beverly Road, 4144 Oakland Drive, and 5511 Dogwood Road.	Completed 06/2009	
Phase 1 CAP/ER, 1-2	Lower First Creek Collector Project (Mini-basin 8B2)	Find and fix work to identify and address cause of overflow in the vicinity of 2412, 2514, 2528, 2806, 2808, 2900, 2528, 2700, and 2808 Tecoma Drive, 3501 Whittle Springs Road, Islington Avenue, 1800 Linden Avenue, 2524 Underwood Place, and 3008 Valley View Drive.	Completed 04/2008	
Phase 1 CAP/ER, 1-3	First Creek Storage Tanks	Design and construction of the upper First Creek storage tank and lower First Creek storage tank.	Upper First Creek Completed 04/2007, Lower First Creek Completed 12/2006	
Phase 1 CAP/ER, 1-5	Upper Fountain City Pipe Replacement Project	Replace approximately 1,053 lf of existing sewer with 12-in, 1,856 lf with 24-in, and 595 lf with 27-in pipe.	Completed 11/2007	
Phase 1 CAP/ER, 1-15	Replace trunk sewer upstream of lower storage unit	Replace approximately 3,700 lf of existing 54-in, and 331 lf of 18-in pipe.	Completed 02/2007	
Phase 1 CAP/ER, 1-25	Sub-basins 3&4 Rehabilitation Project	Rehabilitation to reduce R to 2% in Sub-basins 03B1, 03B2, and 04B1.	Completed 05/2008	

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table 4-2: Second Creek Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
SCR-1	Central Avenue Pike Project	Find and Fix work to identify and address cause of overflow in the vicinity of 4105 Central Avenue Pike	FY 2013	FY 2015
Phase 1 CAP/ER, 2-11	Burnside Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 2523 Burnside Street.	FY 2009	FY 2010
Phase 1 CAP/ER, 2-15	1000 block Elm Street Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 1025 Elm Street.	FY 2009	FY 2010
Phase 1 CAP/ER, 2-19	Cumberland Avenue RehabilitationProject	Find and fix work to identify and address cause of overflow in the vicinity of 1000 Phillip Fulmer Way, 1509 Cumberland Avenue, and Seventeenth Street and White Avenue.	FY 2009	FY 2010

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table 4-3: Third Creek Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
Phase 1 CAP/ER, 3-3	Subbasin 9 Rehabilitation Project	Rehabilitation to reduce R to 2% in Sub-basins 09A1, 09A2, 09A4, and 09D1.	Completed 10/2008	
Phase 1 CAP/ER, 3-4	Upper McKamey and Third Creek Road Replacement Project	Replace approximately 3,141 lf of existing sewer with 36-in sewer and approximately 1500 lf with 15-in sewer.	Completed 08/2008	
Phase 1 CAP/ER, 3-6	Interstate 40 and Middlebrook Pike Trunk Replacement Project	Replace approximately 400 lf of existing sewer with 15-in sewer, 750 lf with 24-in sewer, 2,000 lf with 30-in sewer, and 7,000 lf with 36-in sewer.	FY 2009	FY 2012
Phase 1 CAP/ER, 3-7	Neyland Drive Trunk Replacement Project	Replace approximately 5,900 lf of existing sewer with 48-in sewer.	FY 2010	FY 2012
Phase 1 CAP/ER, 3-21	Deerfield Road Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 4428 Deerfield Rd)	FY 2011	FY 2012
Phase 1 CAP/ER, 3-26	PCP, CPE, and CCP	Wastewater evaluation studies of the Kuwahee WWTP.	FY 2006	FY 2007
Phase 1 CAP/ER, 3-29	Highland Hills Road Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 409, 411, and 419 Highland Hills Road.	FY 2012	FY 2013

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table 4-4: Fourth Creek Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
4TH-1	Minibasin 32A4	Sewer Rehabilitation	05/2009	08/2009
4TH-2	Ten Mile Pump Station Removal	Decommission Ten Mile Pump Station to eliminate flows from adjacent utility districts while retaining current KUB connections	FY 2013	FY 2015
Phase 1 CAP/ER, 4-6	Shadyland Drive Rehabilitation (Sub-basin 36A2) Project	Find and fix work to identify and address cause of overflow in the vicinity of 7000 Rotherwood Drive and 7112 and 7712 Shadyland Drive.	Completed 11/2009	
Phase 1 CAP/ER, 4-17	Storage Tank	Storage upstream of Walker Springs Pump Station.	Completed 11/2006	
Phase 1 CAP/ER, 4-18	Papermill Phases I, II, and III Project	Replace approximately 3,500 lf of existing sewer with 15-in sewer and approximately 1,000 lf with 36-in sewer.	Completed 01/2007	

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table 4-5: South Knoxville / Knob Creek Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
STH-1	Goldfinch Avenue Project	Find and Fix work to identify and address cause of overflow in the vicinity of 820 Goldfinch Avenue	FY 2012	FY 2013
Phase 1 CAP/ER, S-2	Goose Creek Trunk Sewer Replacement	Replace approximately 725 lf of existing 8-in sewer with 18-in sewer, Replace approximately 418 lf of existing 12-in sewer with 18-in sewer, Replace approximately 841 lf of existing 21-in sewer with 36-in sewer, Replace approximately 160 lf of existing 24-in sewer with 36-in sewer.	Completed 02/2009	
Phase 1 CAP/ER, S-11	Ford Valley Pump Station Upgrade Project	Upgrade pump station	FY 2010	FY 2011
Phase 1 CAP/ER, S-15	Trunk Replacement in Sub-basin 40A2 Project	Replace approximately 1,932 lf of existing 12-in sewer with 24-in sewer, Replace approximately 810 lf of existing 12-in sewer with 30-in sewer, and replace approximately 1,326 lf of existing 24-in sewer with 30-in sewer.	FY 2011	FY 2013
Phase 1 CAP/ER, S-19	Maryville Pike Pipe Replacement Project	Replace approximately 800 lf of existing sewer	Completed 03/2006	
Phase 1 CAP/ER, S-21	Alpine Avenue Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 3609 Alpine Avenue.	FY 2012	FY 2013
Phase 1 CAP/ER, S-28	Trunk Sewer Project	Replace approximately 1,464 lf of 30-in sewer with 36-in sewer.	Completed 01/2009	

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table 4-6: Williams Creek Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
Phase 1 CAP/ER, W-1	Sub-basin 19A2 Rehabilitation	Rehabilitation to reduce R to 2% in Sub-basin 19A2.	Completed 05/2009	
Phase 1 CAP/ER, W-2	Williams Creek Trunk Line Replacement (Downstream of Golf Course)	Replace approximately 3,100 lf of existing sewer with 36-in sewer.	Completed 04/2006	
Phase 1 CAP/ER, W-7	Sunset Avenue Rehabilitation Project	Find and fix work to identify and address cause of overflow in the vicinity of 2614 SunsetAvenue.	Completed 01/2007	

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table 4-7: Loves Creek Implementation Plan[1]

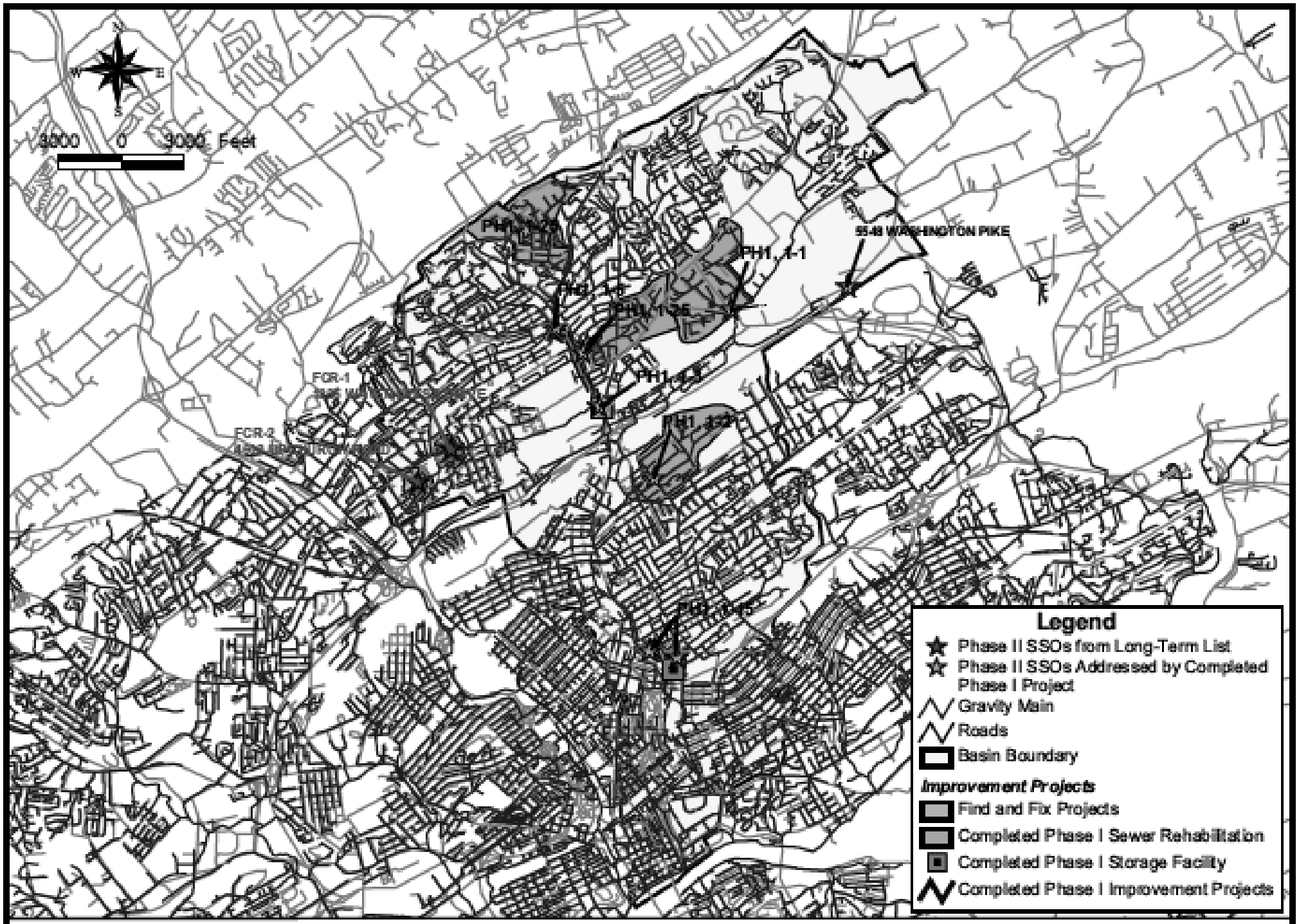
Project ID	Project Name	Project Description[1]	Start Date	End Date
LVS-1	Wayland Road Force Main Upgrade	Replaced 18,433 LF of 8" ductile iron force main with 10" PVC force main.	Completed 02/2009	
Phase 1 CAP/ER, L-1	Asheville Highway west of I-40 Trunk Replacement	Replace approximately 5,030 lf of existing 18-in pipe.	FY 2009	FY 2010
Phase 1 CAP/ER, L-9	Shelbourne Road Rehabilitation	Find and fix work to identify and address cause of overflow in the vicinity of 3001 Shelbourne Road.	FY 2009	FY 2010

[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.

Table 4-8: Eastbridge Implementation Plan[1]

Project ID	Project Name	Project Description[1]	Start Date	End Date
EBR-1	Bud Hawkins pump station and force main project	Replaced the pump station and force main with a 21-inch gravity sewer, completed 2/23/09	Completed 02/2009	
Phase 1 CAP/ER, EB1	Maloneyville Road Rehabilitation	Find and fix work to identify and address cause of overflow in the vicinity of Maloneyville Road (MH 93-1, 93-7, 93-10, and at the lift station).	Completed 01/2009	

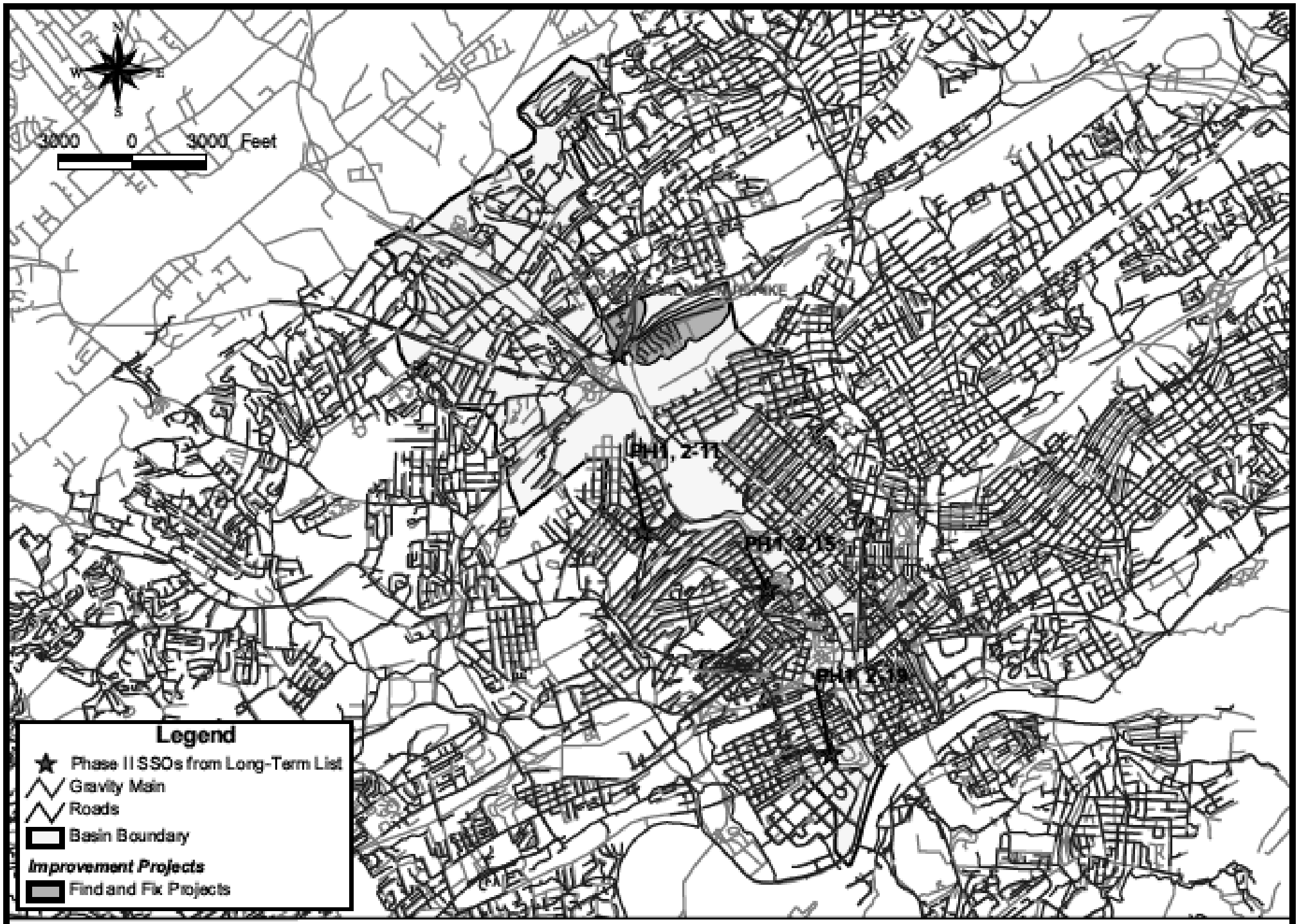
[1]Approximate sizing and extents of each project is given for planning level purposes. The exact sizing and extent of each project will be determined during preliminary design. Other modifications to the projects may occur during preliminary design. For example, it may be determined that parallel relief sewers would be more cost effective than replacement sewers for some projects. Any modifications will be explained in the quarterly updates submitted after approval of the Phase II CAP/ER.



CDM

First Creek Phase II: CAP/ER Project Implementation

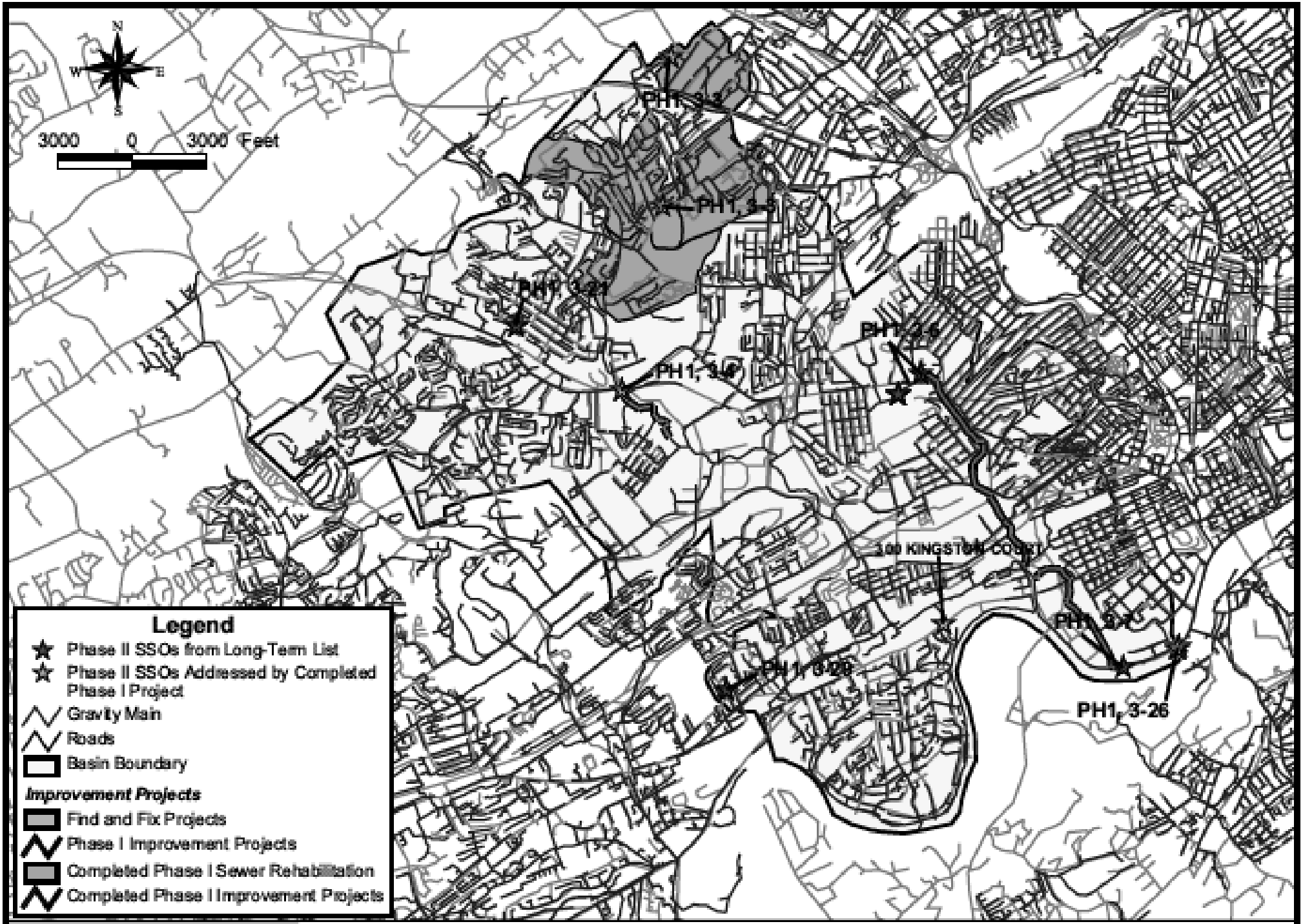
Figure 4-1



CDM

Second Creek Phase II: CAP/ER Project Implementation

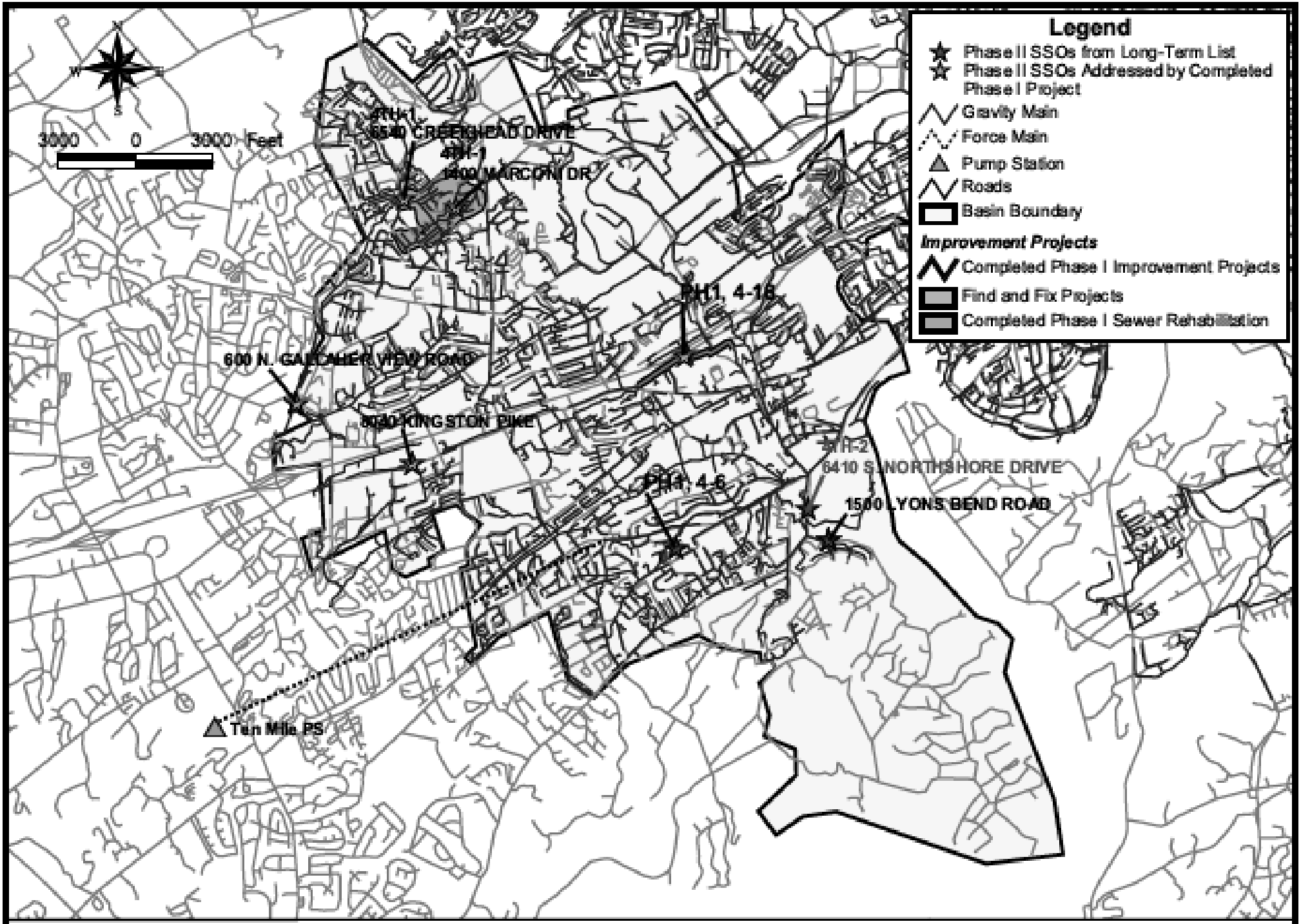
Figure 4-2



CDM

Third Creek Phase II: CAP/ER Project Implementation

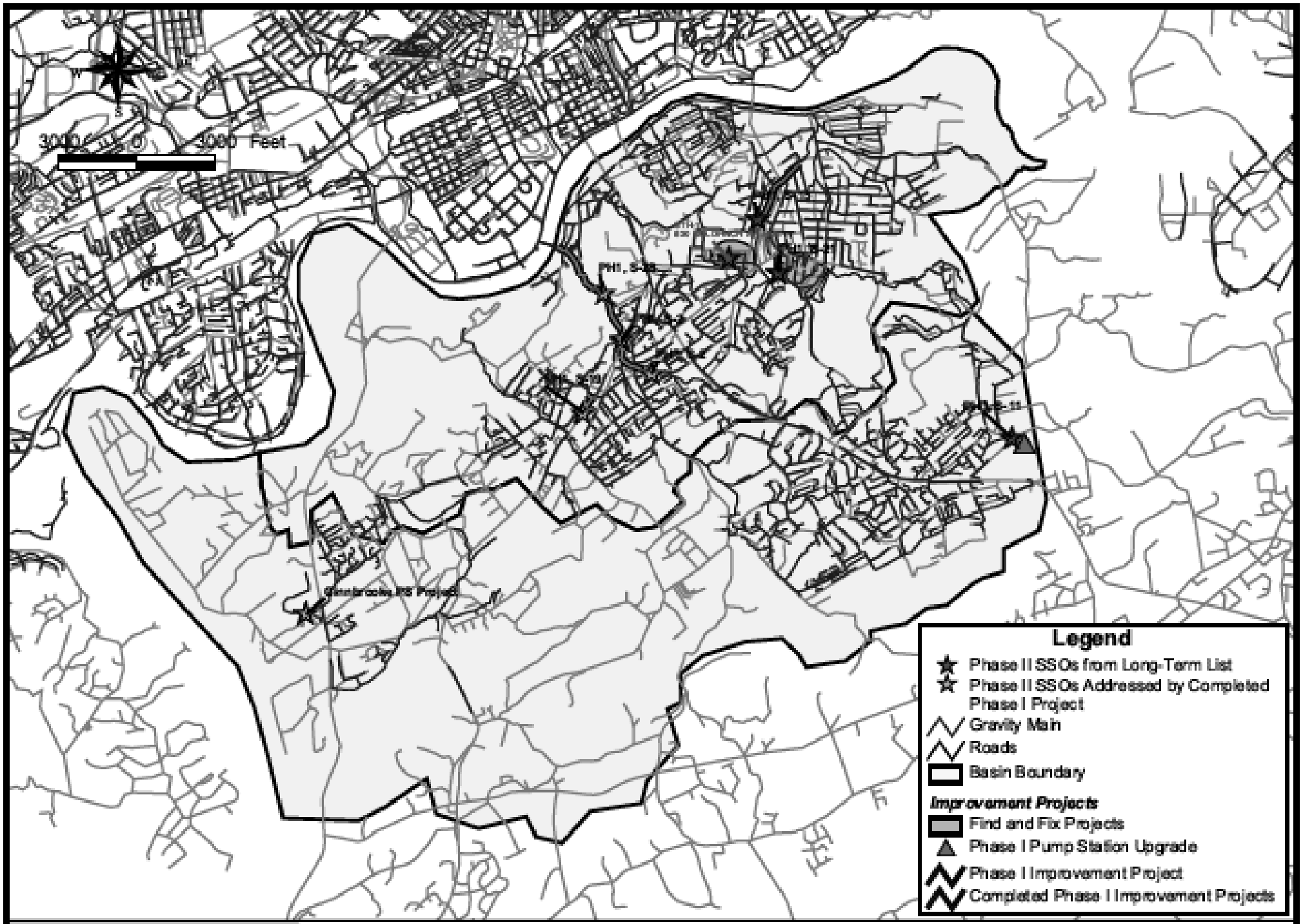
Figure 4-3



CDM

Fourth Creek Phase II: CAP/ER Project Implementation

Figure 4-4



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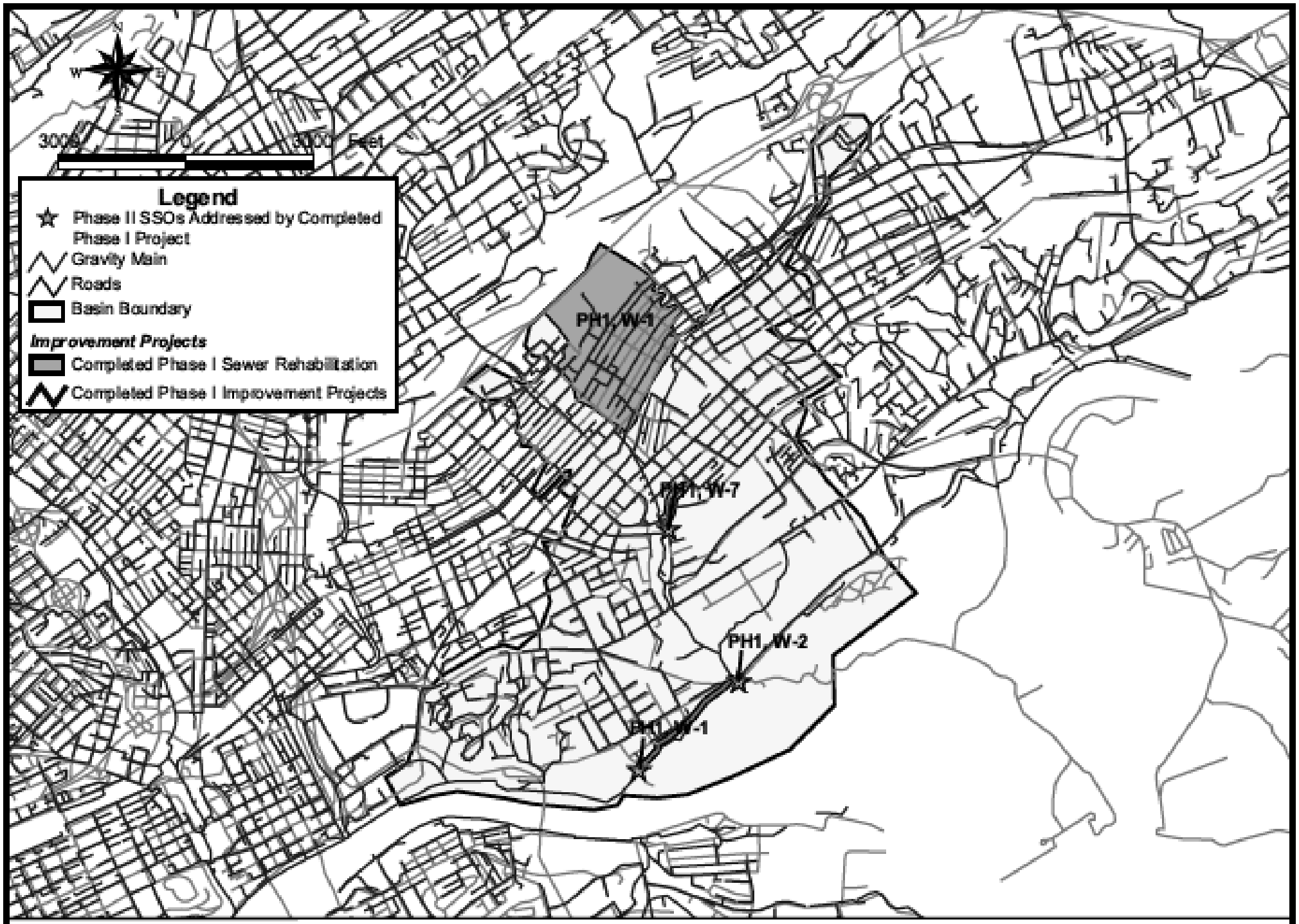
South Knoxville / Knob Creek Phase II: CAP/ER Project Implementation

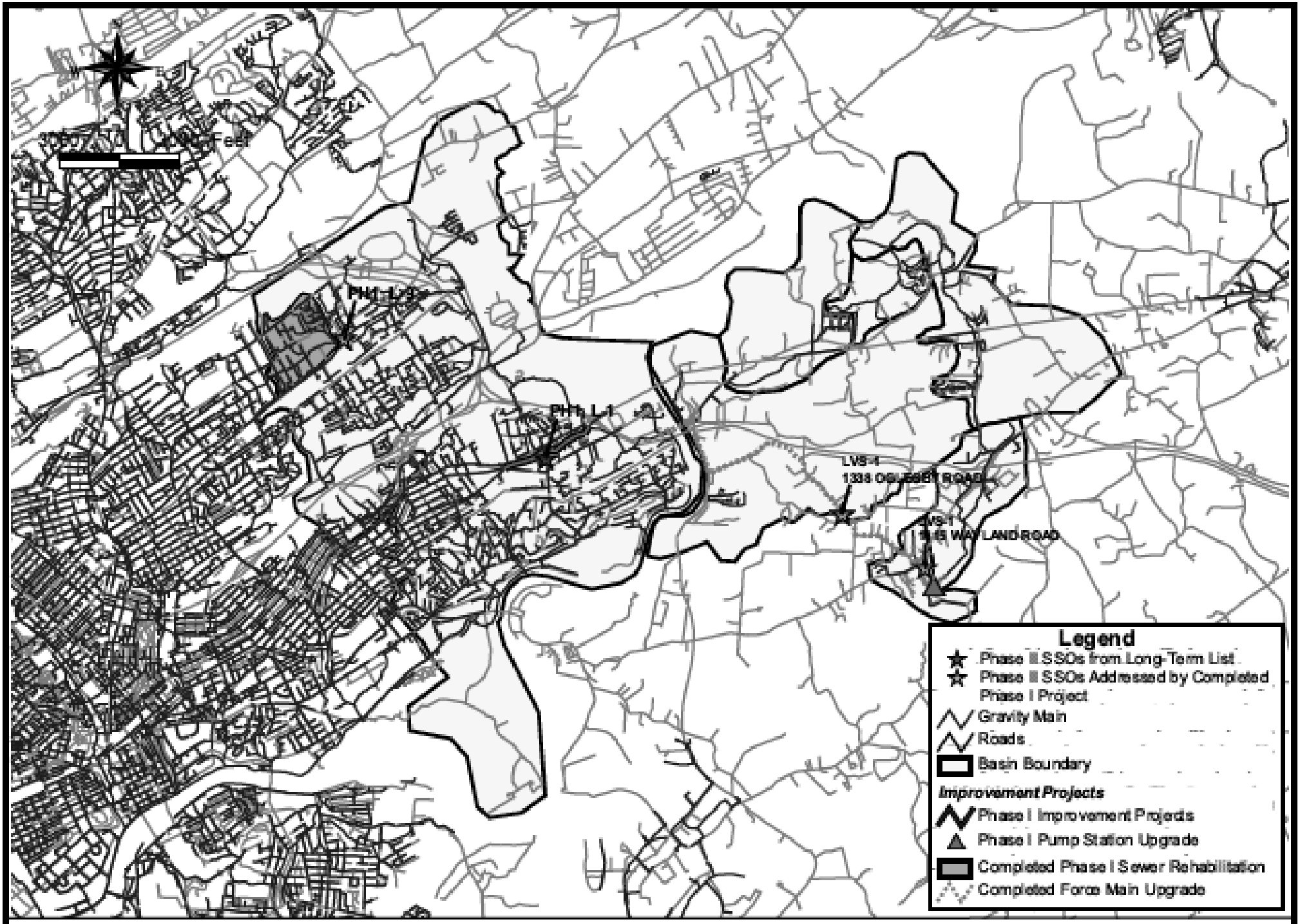
Figure 4-5



CDM

Williams Creek Phase II: CAP/ER Project Implementation

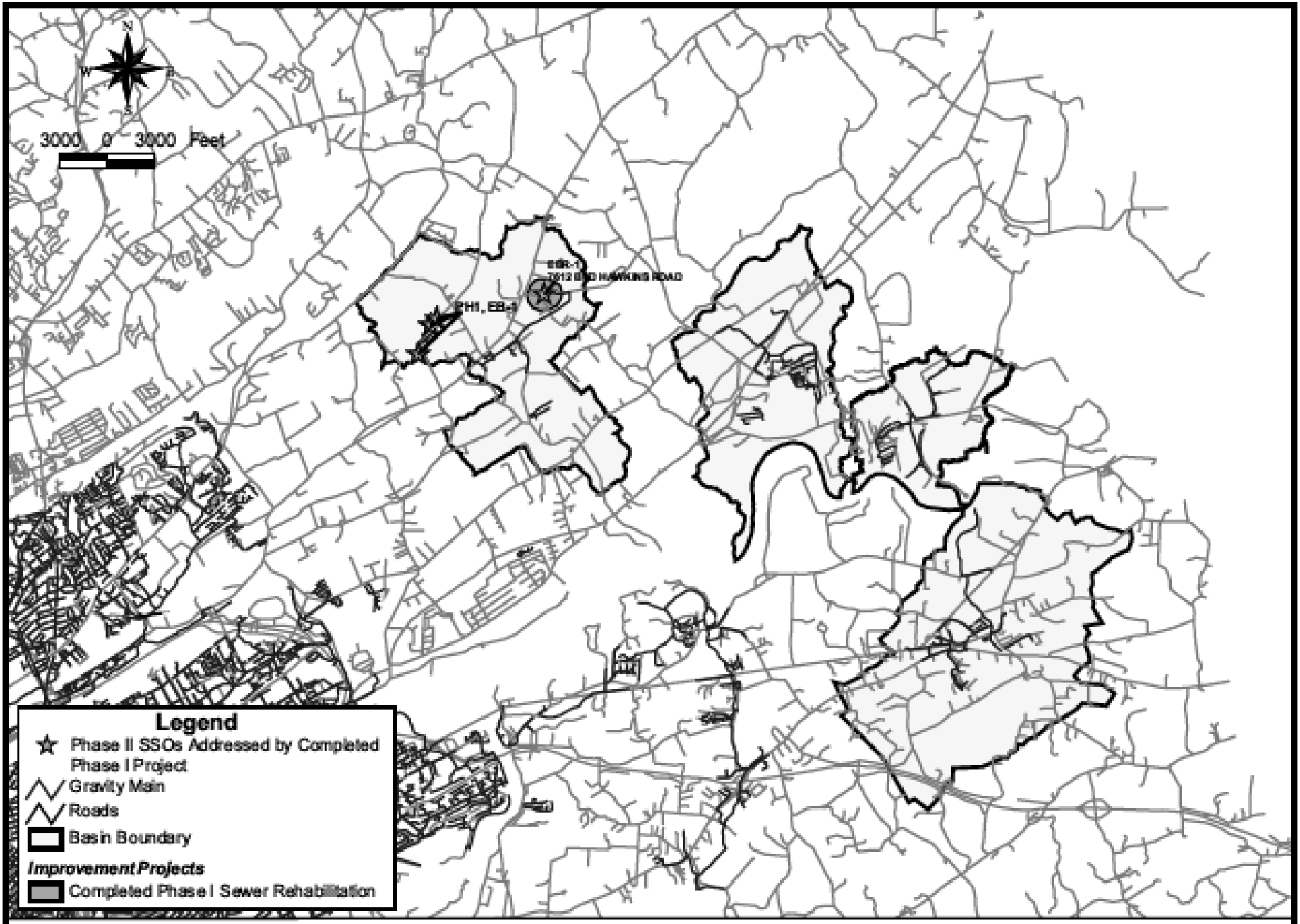
Figure 4-6



CDM

Loves Creek Phase II: CAP/ER Project Implementation

Figure 4-7



CDM

Eastbridge Phase II: CAP/ER Project Implementation

Figure 4-8