APPENDIX 5

Western Lehigh Sewage Partners Sewer Capacity Assurance & Rehabilitation Program Approach Outline(2009)

BOROUGH OF ALBURTIS SEWER AUTHORITY
UPPER MACUNGIE TOWNSHIP AUTHORITY
LOWHILL TOWNSHIP

LEHIGH COUNTY AUTHORITY

Sewer Capacity Assurance & Rehabilitation Program *Program Approach Outline*

Western Lehigh Sewerage Partnership

October 2009

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Contents

List of Tables

List of Figures

Appendices

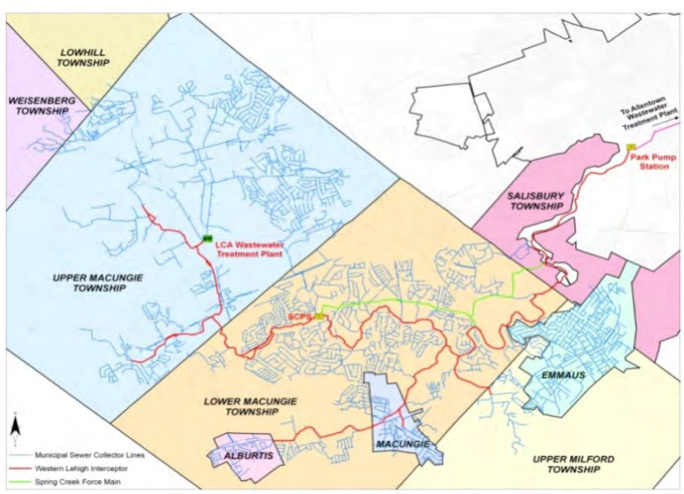
1. Introduction

Peak flow issues in the Lehigh County Authority (LCA) sewer conveyance systems and in the collections systems connected to it (namely Upper Milford Township, Weisenberg Township, Lower Macungie Township (LMT), Upper Macungie Township (UMT), Lowhill Township, Alburtis, and Macungie) have caused the Pennsylvania Department of Environmental Protection (PADEP) to begin reviewing sewer system extensions in each of these communities. Pursuant to communications with PADEP and in accordance with Chapter 94 requirements, LCA and the above municipalities and, where applicable, their wastewater authorities, have elected to prepare and implement a corrective action plan to collectively address the problems within each of these sanitary sewer systems. LCA and the above named LCA signatory parties have formed the Western Lehigh Sewerage Partnership (WLSP) to jointly investigate and develop an appropriate corrective action plan. The Sewer Capacity Assurance and Rehabilitation Program described in this outline will address both PADEP concerns and other related long-term wastewater needs for the Partners.

Since initial formation of the WLSP, the United States Environmental Protection Agency issued a Compliance Order to all municipal dischargers to the City of Allentown's Klines Island wastewater treatment plant. The technical requirements of that order are also addressed in this Program.

1.1. System Overview

All told, there approximately 262 miles of sewer mains in the above municipalities and LCA's system that discharge through the Western Lehigh Interceptor. Approximately 18,000 wastewater connections served by these systems.



1.1.1. Lehigh County Authority

In 1972, Lehigh County and Lehigh County Authority placed into service a sanitary sewer interceptor system in western Lehigh County to convey wastewater from the Boroughs of

Alburtis and Macungie and the Townships of Upper and Lower Macungie to the City of Allentown's Allentown/Emmaus Interceptor. Today, the system additionally serves portions of the Townships of Weisenberg, Upper Milford, and Lowhill, and portions of the Borough of Emmaus. The interceptor system, known as the Western Lehigh Interceptor (WLI) System, consists of 18 miles of gravity sewers ranging in size from 8 inch to 36 inch diameter pipe, one relief pumping station and force main (Spring Creek Road Pump Station), and five meter stations. Wastewater from the WLI discharges into the Allentown/Emmaus Interceptor at Keck's Bridge. The Allentown/Emmaus Interceptor flows from Keck's Bridge to its downstream confluence with the Cedar Creek Interceptor and Little Lehigh Interceptor. The Little Lehigh Interceptor begins at this confluence and serves as the final conveyance step in the transport of wastewater to the City of Allentown Wastewater Treatment Plant at Kline's Island. The Allentown/Emmaus Interceptor, Cedar Creek Interceptor, and Little Lehigh Interceptor are owned by the City of Allentown.

LCA also owns, operates, and maintains relief facilities along the Little Lehigh Creek to address intermittent hydraulic overloading of the Little Lehigh Interceptor: Park Pumping Station and Little Lehigh Relief Force Main, and the Keck's Bridge Relief Interceptor between Keck's Bridge and Park Pumping Station. The Park Pumping Station and Little Lehigh Relief Force Main were placed in operation in the fall of 1983 to supplement capacity in the Little Lehigh Interceptor and pump it through a force main to a location immediately upstream of the Kline's Island Wastewater Treatment Plant. In August 1986, the LCA completed construction of the Keck's Bridge Relief Interceptor to relieve overflows during storm events in existing interceptors in the Keck's Bridge area and to allow for future development in LCA service areas. The capacity of Park Pumping Station was also increased in 1986 to accommodate additional flows from the Keck's Bridge Relief Interceptor.

In 1998, the Spring Creek Road Pump Station (SCRPS) began operation. This relief pumping system includes 2,500 feet of 20-inch diameter force main and 11,900 feet of 24-inch diameter force main which bypass approximately 24,000 linear feet of the WLI in Lower Macungie Township. The pump station is designed to pump up to 7 MGD during peak flow periods typically associated with severe rain events.

In 2005, the 10,250 LF 24-inch SCRPS force main extension from Millrace Road to the 42-inch Little Lehigh Relief Interceptor near the interception of Devonshire Road and Keystone Avenue (approximately 2,000 feet downstream of Kecks Bridge) was completed. This extension relieved hydraulic loading on that section of the WLI between manholes L-66 and L-1.

1.1.2. Upper Milford Township

Upper Milford Township (UMiT) is located in southern Lehigh County, adjoining Emmaus Borough, Lower Macungie Township and the Borough of Macungie. The sanitary sewer system in UMiT is owned and operated by the Lehigh County Authority pursuant to a sewer service agreement dated January 1, 1982. UMiT designates the areas of the UMiT where sewer service will be provided and approves the allocation granted.

Currently, there are over 400 properties being served in the UMiT sewer system consisting of over 40,000 feet of pipe. Over 94% of the system is 8 inch pipe, 5% is 2 inch force main and less than 1% is 10 inch. The system is 95% PVC and the remainder is DIP. The majority of the system was constructed in the 1980s. The system consists of collection systems discharging into the Emmaus Borough system, into the Lower Macungie Township system and into the LCA WLI Interceptor system.

In 2009, an additional 21 EDUs will be connected in the S. 7th St. area. Sewering the Vera Cruz area of the Township is in final design phase. The project includes construction of 4.65 miles of low pressure force main and 276 grinder pumps to connect 299 existing EDUs.

1.1.3. Weisenberg Township

Weisenberg Township is located in the northwestern section of Lehigh County, adjoining Lowhill and Upper Macungie Township. The sanitary sewer system in Weisenberg Township is owned and operated by the Lehigh County Authority. In an agreement dated 4/19/1990, Weisenberg Township designated LCA as the operating agent for the Pointe West and Pennsylvania State University wastewater systems in the Township. Also in an agreement with Upper Macungie Township dated 4/19/1990, Upper Macungie Township agreed to accept the wastewater from the Pointe West Development. The agreement provided for repair and/or elimination of I&I by Weisenberg Township.

In an agreement dated 4/22/2002, the Township conveyed the wastewater systems in Service Area 1 and Service Area 2 to the LCA. Service Area 1 is the Pointe West system which discharges into the Upper Macungie Township collection system. The 4/19/1990 agreement between Upper Macungie Township and Weisenberg Township was transferred to LCA. Service area 2 is a separate system which is not part of the LCA Western Lehigh Interceptor system.

There are 149 customers being served in Weisenberg Township with a system consisting of almost 21,000 feet of pipeline which discharge flows through Upper Macungie Township and the WLI Interceptor system. Over 97% of the system is 8 inch pipe and 3% is 2 inch force main. The system is 99% PVC and 1% DIP. No new connections are expected within Weisenberg Township.

1.1.4. Upper Macungie Township and Upper Macungie Township Authority

Upper Macungie Township is a second class Township governed by a three member board of supervisors. UMT covers 24.5 square miles and is located in the southwestern portion of Lehigh County. The population, based on current information available, is approximately 17,390. A general breakdown of the land use within UMT shows that residential development accounts for about 22% of its land use while commercial and industrial development make up about 26% with the remaining 31% of the land divided among agriculture and public uses or is undeveloped.

The UMT sanitary sewer system is owned and operated by the Upper Macungie Township Authority (UMTA). UMTA is an operating authority managed by a five member board appointed by the Supervisors. The collector system comprises approximately 139 miles of sewer pipe and includes seven wastewater pumping stations. The sanitary sewer system based on the Act 537 boundary serves approximately 55% of UMT and contains 735,445 linear feet of 8-inch through 24-inch sewer main, 3,060 manholes and seven pumping stations and appurtenances. The original sanitary sewer system was installed in 1968 and was completed in 1972. Extensions to the public sewer system were added over the years by various UMTA projects as well as through development growth in UMT which accounts for its present size. Currently the UMTA system customer base consists of 5690 residential, 305 commercial and 7 industrial customers.

A breakdown of the of the UMTA sewer system by material, pipe size, length and age are as follows:

Material	Pipe Size	Length	Year
Vitrified Clay Pipe	8” to 15”	139,000’	1968-1982
Reinforced Concrete Pipe	15” to 18”	2,700’	1968-1972
Ductile Iron Pipe	8” to 24”	34,000’	1968-Present
PVC / C900	8” to 24”	540,500’	1982-Present
Low Pressure Force Main (PVC)	1¼” to 3”	17,700’	1998-Present

1.1.5. Lower Macungie Township

Lower Macungie Township is a first class township governed by a five member Board of Commissioners. LMT covers 22.5 square miles and is located in the southwestern portion of Lehigh County. The population, based on current information available, is approximately 31,000. LMT is characterized as a residential suburban community. A general breakdown of LMT land use based on zoning districts indicates residential development accounts for about 50% of the land use while commercial and industrial development makes up about 17%. The remaining 33% is divided among agriculture and public uses or is undeveloped.

The LMT sanitary sewer system is owned and operated solely by the LMT and administered by the Board of Commissioners. The collector system comprises approximately 122 miles of sanitary sewer pipe. The sanitary sewer system based on the current Act 537 boundary serves approximately 55% of LMT and contains 644,100 linear feet of 8-inch through 16-inch sewer main and 3,567 manholes. There are no pumping stations in the LMT sewer system. The original sanitary sewer system was constructed in 1968 and completed in 1972. Extensions to the public sewer system were added over the years by various LMT sponsored projects as well as through development growth which accounts for its present size. Currently the LMT system customer base consists of 8,971 residential and 24 commercial/industrial customers.

Most of the LMT sewer system drains, through a number of connection points, into the Lehigh County Authority conveyance system which in turn flows through the City of Allentown sewer system to the city wastewater treatment facility. There are several connection points in the LMT system that drain to the South Whitehall Township. Segments of the LMT sewer system which drain to South Whitehall Township are not included in the SCARP.

A breakdown of the of the LMT sewer system by material, pipe size, length and age follows:

Material	**Pipe Size**	**Length**	**Year**
Vitrified Clay Pipe, Polyvinyl Chloride Pipe and Ductile Iron Pipe	8”	605,000’	1968-Present

Vitrified Clay Pipe, Polyvinyl Chloride Pipe and Ductile Iron Pipe	10”	30,000’	1968-Present
Vitrified Clay Pipe, Polyvinyl Chloride Pipe and Ductile Iron Pipe	12”	1,800’	1968-Present
Vitrified Clay Pipe, Polyvinyl Chloride Pipe and Ductile Iron Pipe	15”	5,700’	1968-Present
Ductile Iron Pipe	16”	400’	1968-Present

1.1.6. Borough of Alburtis and Borough of Alburtis Sewer Authority

The Borough of Alburtis is governed by a seven member Borough Council. The Borough covers approximately 0.7 square mile and is located in the southwestern portion of Lehigh County. It is surrounded by Lower Macungie Township. The population is approximately 2,100 based on current census data. The Borough is characterized generally as a residential community although it does supports retail commercial business and industrial districts. A general breakdown of land use based on zoning districts indicates residential development accounts for about 75% of the land use while commercial and industrial accounts for about 20% of the land use. The remaining 5% is used for community facilities and parks.

The Borough of Alburtis sanitary sewer system is owned by the Borough of Alburtis Sewer Authority and is operated by the Borough of Alburtis. The collector system comprises approximately 8.04 miles of sanitary sewer pipe. The sewer system serves approximately 60% of the Borough and contains 42,480 linear feet of 8-inch through 12-inch sewer main and 220 manholes and one wastewater pumping station. The initial sanitary sewer system was constructed between 1968 and 1972. Extensions to the public sewer system were added primarily by development growth over the years accounting for its present size. Currently the Borough system customer base consists of 833 residential, 26 commercial and 1 Industrial customer.

The Borough’s sewer system drains directly to the Lehigh County Authority conveyance system which in turn flows through the City of Allentown sewer system to the city wastewater treatment facility. A breakdown of the of the Borough sewer system by material, pipe size, length and age follows:

Material	Pipe Size	Length	Year
Vitrified Clay Pipe	8”	28,304’	1968-1982
Vitrified Clay Pipe	10”	3,584’	1968-1972
Vitrified Clay Pipe	12”	555’	1968-1972
Cast Iron Pipe	8”	645’	1968-1972
Cast Iron Pipe	10”	287’	1968-1972
Cast Iron Pipe	4”	339’	1968-Present
Polyvinyl Chloride Pipe	8”	25,776’	1982-Present

1.1.7. Borough of Macungie

The Borough of Macungie is governed by a seven member Borough Council. The Borough covers approximately 1.0 square mile and is located in the southwestern portion of Lehigh County. It is primarily surrounded by Lower Macungie Township except on the south side where it borders Upper Milford Township. The population of the Borough is 3,039 based on the 2000 census. The Borough is characterized generally as a residential community although it does support retail commercial business and industrial districts. A general breakdown of the Borough land use based on zoning districts indicates residential development accounts for about 75% of the land use while commercial and industrial accounts for about 18% of the land use. The remaining 7% is used for community facilities and parks.

The Borough of Macungie sanitary sewer system is owned and operated by the Borough. The collector system comprises approximately 11.4 miles of sanitary sewer pipe. The sewer system serves approximately 65% of the Borough and contains 60,330 linear feet of 8-inch through 12-inch sewer main and 315 manholes. The initial sanitary sewer system construction began in 1968 and was completed in 1972. Extensions to the public sewer system were added primarily by development growth over the years accounting for its present size. Currently the Borough system customer base consists of 1654 residential, 83 commercial and 3 Industrial customers.

The Borough sewer system drains directly to the Lehigh County Authority conveyance system which flows through the City of Allentown sewer system to the city wastewater treatment facility. A breakdown of the of the Borough sewer system by material, pipe size, length and age follows:

Material	Pipe Size	Length	Year
Vitrified Clay Pipe	8”	32,114’	1968-1982
Vitrified Clay Pipe	10”	1,675’	1968-1972
Cast Iron Pipe	8”	645’	1968-1972
Cast Iron Pipe	10”	120’	1968-1972
Polyvinyl Chloride Pipe	8”	25,776’	1982-Present

1.1.8. Lowhill Township

Lowhill Township is located the northwestern section of Lehigh County, adjoining Weisenberg and Upper Macungie Township. The sanitary sewer system in Lowhill Township is operated by the Upper Macungie Township Authority through a service agreement. There are being served in Lowhill Township that eventually discharge to the LCA system. The Lowhill Township system consists of 3,052 feet of 8” PVC gravity pipeline and 587 feet of 2” PVC force main through which 43 connections discharge into the Upper Macungie Township collector system and ultimately into the LCA system.

1.2. Satellite System Obligations to LCA

There are a number of contractual and regulatory obligations of the signatory systems to LCA that compels actions by LCA on the signatories to ensure the LCA system is able to meet its regulatory requirements. LCA has a number of agreements in place to deal with accepting the wastewater from the municipalities that discharge from their collection systems to LCA’s Western Lehigh Interceptor system. Following are excerpts from those agreements that set forth an obligation to deal with inflow and infiltration in both types of relationships.

1.2.1. April 1, 1983 Agreement- LCA and its Signatories

§4.02 - Hydraulic Flow. If for any calendar year a Municipality's average hydraulic flow which shall be defined as the hydraulic flow as determined under the provisions of Section 3.o2 plus its pro rata share of the service area infiltration and inflow, exceeds the hydraulic flow allocations as set forth in this Agreement, then the Municipality shall pay penalty charges as follows…..

§5.03 - LCA and the Municipalities agree to pursue the removal of infiltration and inflow ("I/I") as part of the ongoing operation and maintenance of their respective systems…

1.2.2. August 4, 1987 Agreement (Post-1985 Allocation) - LCA and its Signatories

§3.02 - The Municipalities and LCA agree to cooperate in the institution of a coordinated program of inflow and infiltration (I/I) detection and removal. Any Municipality which fails to comply with the provisions of this program shall not have access to the allocation available under this Agreement. Determination of failure to comply shall be by vote of the Municipalities, excluding the accused Municipality, as provided in §2.09.

1.3. LCA Obligations to City of Allentown

There are a number of contractual requirements that LCA has toward the City that compel actions on the part of LCA to ensure the LCA system is able to meet its contractual obligations. LCA has agreements with the City of Allentown for transmission of some of its wastewater through City transmission mains and as well as for treatment of wastewater at the City's Kline's Island Treatment Plant. Although the December 29, 1981 Agreement between the City and various municipal entities that discharge to the City system (including LCA) is generally the governing agreement, the 1981 Agreement specifically states that if an issue is not addressed in the 1981 Agreement, in the case of LCA the pre-existing 1969 Agreement would govern. Since the 1981 Agreement does not have specific language dealing with inflow and infiltration, the following excerpts from the 1969 Agreement establish the Authority obligation to the City to deal with inflow and infiltration.

§4 - The City and LCA agree that the sewage and wastes discharged by any user into a City sewer line shall not contain storm water, roof or surface drainage…..

§11 - …LCA further agrees that it will cause to have enacted and enforced ordinances, resolutions, rules and regulations governing sewer connections and the admission of sewage into the sewers, which ordinances, resolutions, rules and regulations shall conform with existing ordinances, rules and regulations of the City and further agrees to cause to be enacted and enforced additional ordinances, resolutions, rules and regulations to conform with future ordinances, rules and regulations adopted by the City to govern the admission of sewage into the Allentown Collection System or Treatment Plant… .

1.4. Program Purpose

The purpose of this Sewer Capacity Assurance and Rehabilitation Program (SCARP) Approach Outline is to define a formal methodology to be used by the Partners (namely Upper Milford Township, Weisenberg Township, LCA, Lower Macungie Township (LMT), Upper Macungie Township (UMT), Upper Macungie Township Authority, Lowhill Township, Alburtis, Alburtis Sewer Authority, and Macungie) for planning, evaluating, prioritizing, and conducting sewer rehabilitation, conveyance expansion, and/or storage construction in a coordinated and consistent manner. The SCARP will be the mechanism by which the Partners achieve mutually agreed upon objectives and meet regulatory requirements in a timely, fiscally responsible, and cost effective manner.

As described in earlier paragraphs, the Partners recognize that the problems faced by partner community with respect to its sanitary sewer system are, for the most part, the same as those problems faced by the other partners. By acknowledging that the problems faced in one community eventually negatively impact the other parties, the Partners have agreed to take a unified regional approach to addressing these common problems. By acting in a coordinated manner, the common problems experienced by all of the Partners can be addressed in the most effective and efficient manner. This regional approach:

- Offers lower costs due to both economy of scale and the ability to apply resources and experience from multiple communities.
- Reduces the regulatory burden by nearly an order of magnitude.
- Increases the likelihood of success by ensuring all actions are complementary and mutually supported.
- Reduces the conflict between the parties that tends to arise when multiple communities try to independently solve their portion of a regional problem.

The Partners will develop and execute a memorandum of understanding (MOU) that will reference this SCARP Program Approach Outline and will commit the Partners to working together on all program activities through the investigative phase of the program.

Following completion of the investigative phase of the project, definitive information relative to the hydraulic and physical condition of the entire sewer collection system will be available. At the commencement of the implementation phase of the program, a second MOU will be considered for the balance of the SCARP.

In the event a partner elects not to participate in the Partners second MOU, a description of the plan for achieving their independent program objectives will be separately provided by said community.

1.5. Program Approach Outline Purpose

This Sewer Capacity Assurance and Rehabilitation Program Approach Outline (SCARP Approach Outline) is intended to outline the proposed planning, data gathering, and evaluation steps needed to determine the SCARP Improvements Plan, which will consist of two complementary plans: a Capital Improvement Plan and a Long-term Asset Management Plan.

This SCARP Approach Outline is the first of several SCARP planning and management documents that will be prepared. As the SCARP progresses, the availability of new information will promote further analysis and study that will undoubtedly require refinement of the SCARP. Phasing of the planning and management documents described in this SCARP Approach Outline is necessary because of the current overall lack of information and the time needed to collect the data necessary to properly define and quantify the problem(s), to evaluate methods of redress, and to determine the corrective actions required to achieve the goals of the SCARP and comply with regulatory requirements. The anticipated planning and management documents to be prepared for this SCARP are:

- SCARP Approach Outline (this document)
- SCARP Program Management Plan - Investigation Phase
- SCARP Objectives Evaluation
- SSES Workplan
- SCARP Improvements Plan
- SCARP Program Management Plan - Implementation Phase
- Annual Reports

The work involved in each of the various steps of the SCARP, the underlying logic and rationale for their sequence, and their place in each of the planning and management documents is more fully described in Section 3. Section 4 describes a methodology for the determination of future capacity allocation. The components, sequence of activities, and schedule of each report are elaborated in Section 5.

1.6. Regulatory Process Management

This SCARP Approach Outline is the first of several SCARP documents that will be submitted to PADEP. The following documents will be submitted to PADEP for action as noted:

- SCARP Approach Outline (this document) – for review, comment, and acceptance by PADEP
- SCARP Objectives Evaluation – for review and comment by PADEP

- SSES Workplan – for review and comment by PADEP
- SCARP Improvements Plan – For review, comment, and acceptance by PADEP
- Annual Reports

Each member of the WLSP has Act 537 and Chapter 94 planning and reporting responsibilities. Since the WLSP will be acting in concert (at least through the investigation phases of the SCARP), a streamlined regulatory process is desirable.

The SCARP Approach Outline (this report) constitutes a major sewerage planning change for each of the Partners. Accordingly, each municipal entity will issue a resolution adopting the SCARP Approach Outline as a 537 amendment. All WLSP resolutions will accompany the SCARP Approach Outline as a single deliverable to PADEP for review, comment, and acceptance.

All subsequent documents to be submitted to PADEP as part of the SCARP will be submitted in a similar manner. The SCARP Objectives Evaluation and the SSES Workplan will be submitted for regulatory review and comment only. The findings and recommendations from both of these documents will be detailed in the final planning document submission, the SCARP Improvements Plan, which will be submitted for PADEP review, comment, and acceptance in the same fashion as the SCARP Approach Outline; each municipal entity will issue a resolution adopting the SCARP Improvements Plan as a 537 amendment, and all WLSP resolutions will accompany the SCARP Improvements Plan as a single deliverable to PADEP.

2. Drivers, Problem Definition, and Objectives

2.1. Drivers

WLSP stakeholders participated in a number of workshops to identify program drivers, develop problem definition, and develop a list of preliminary objectives. The stakeholders are the individual communities and their associated authorities (where appropriate), as listed below:

- Lehigh County Authority
- Upper Milford Township
- Weisenberg Township
- Lower Macungie Township
- Upper Macungie Township
- Upper Macungie Township Authority
- Lowhill Township
- Borough of Alburtis
- Borough of Alburtis Sewer Authority
- Borough of Macungie

The drivers identified by the stakeholders as well as relevance to each stakeholder are summarized below:

- Keeping base infiltration flows controlled to help keep baseline flows below a yet to be defined rate to avoid having infiltration trigger expensive treatment expansions/upgrades
- Reducing peak flows at Klines Island WWTP to eliminate bypass
- Keeping peak flows below a yet to be defined rate to try to avoid triggering expensive treatment expansions/upgrades
- Preventing Sanitary Sewer Overflows (SSOs) in interceptors between Park Pump Station (PPS) and Klines Island WWTP
- Preventing SSOs in Western Lehigh Interceptor (WLI) and Little Lehigh Interceptors (LLI).
- Preventing SSOs in individual collection systems

- Providing aging collection systems with consistent and effective asset management practices that provide long term sustainability.

2.2. Generalized Problem Definition

Each of the Partners generally acknowledges that there are base flow and wet weather flow problems in their respective sewer collection systems. While each of the Partners has to a greater or lesser extent investigated their individual flow problems, the available information is not adequate to conduct broadly effective sewer rehabilitation or conveyance enhancements or to implement sophisticated long-term asset management programs as described in Section 3.8. The process for collecting the information necessary to define and quantify base and wet weather flow problems is summarized in Section 3 of this SCARP Approach Outline.

Several flow related problems beset the Partners. These are:

- Peak wet weather flows within some of the satellite WLSP systems may exceed their trunk lines' capacity, causing SSOs and/or sewage backups into basements (SIB). The current level of service (LOS) provided by each system individually, and by the total system as an integrated sanitary sewer system is undefined; therefore, the LOS gap is not quantified; therefore, this aspect of the problem is ill-defined.
- Peak wet weather flows, to which all of the Partners contribute, exceed the capacities of the WLI, LLI, and PPS, causing SSOs. The current level of service provided by these major conveyance components is ill-defined; therefore, this aspect of the LOS gap is not quantified; therefore, the problem is ill-defined.

- Peak wet weather flows, including flow from all of the Partners, exceed the capacity of the Klines Island WWTP headworks, causing bypasses of wet weather diluted sewage flows from the normal wastewater treatment processes. The current level of service provided is undefined; therefore, the LOS gap is not quantified; therefore, the problem is ill-defined.
- Infiltration, to which all of the Partners contribute, is consuming base capacity intended for planned 537 growth, and continued growth without significant reductions in baseline flows via infiltration reductions will trigger expensive upgrades at Kline Island WWTP to comply with recent DRBC regulations.
- Some system components are deteriorated, leak badly, and require rehabilitation or replacement. Structurally sound and leak-free sewers will require rehabilitation in the future to sustain their value, and these less compromised components require different

operation and maintenance attention than typically traditionally provided to sustain their life cycles.

The problem descriptions provided above contain a number of common elements that must be addressed before the problems can be properly defined and plans developed for resolution. The most important element is definition of the current and desired level of service. The current wet weather level of service of a system is generally defined by the ability of the system to contain and convey flows during periods of stress (i.e., high groundwater coincident with record period storms). During the investigative phase of this program, information about the sewer collection systems will be collected that will be used to define the current level of service. Once the levels of service are accurately defined, the rehabilitation, replacement, and expansion improvements strategies required to close any gap will be determined.

2.3. Preliminary Objectives

Based on the drivers and problem descriptions developed to date, the following preliminary SCARP objectives have been developed:

- Reduce peak wet weather flows to minimize the need for capacity expansion of the Western Lehigh Interceptor and the Little Lehigh Interceptor and their appurtenant components for system demands through 2030.
- Reduce peak wet weather flows from WLSP systems to help City of Allentown prevent bypasses from triggering expansions and upgrades at Klines Island WWTP and to prevent City of Allentown from claiming the bypasses are caused by the Partners.
- Reduce baseline flows to help prevent Partners from triggering treatment plant expansions and upgrades.
- Eliminate wet weather SSOs and SIBs in all systems within the yet to be defined level of service goals.
- Secure long term sustainability of all components of the sanitary sewer systems.

These preliminary objectives may be modified based on the extent of the problems (once they are quantified) and the cost and time needed to address them as described in Section 3.8. Additional goals may also be added as knowledge of the system increases and the need for further objectives are identified.

3. SCARP General Path Forward

3.1. Overview

As stated in Section 2, there is general recognition by the Partners that there are dry and wet weather related flow problems throughout the sanitary sewer system. These problems have caused capacity problems in the trunk lines, interceptors, pump stations and treatment plants. The exact nature, extent, and causes/sources underlying these problems are not currently defined. Without a thorough understanding of the underlying problems, it is not possible to develop an effective plan for addressing the recognized capacity issues. The SCARP activities as described in this Section will provide the information necessary to address the currently experienced problems and serve as the mechanism by which all Partners will meet the preliminary objectives described in Section 2. This Section outlines the overall SCARP program by introducing the steps of the SCARP, including management, planning, investigation, evaluation, and implementation.

The purpose of each major step of the SCARP is introduced below:

SCARP Management Planning - Establish management plans for the investigative and implementation phases of the program. The management plans will identify the responsibilities and authorities of each WLSP with respect to participating and funding of the SCARP. They will address commitments of labor, equipment, consultants, and other resources to the demands of the SCARP schedule.

SCARP Objectives Evaluation – Quantitatively define wet and dry weather flow performance characteristics necessary to define the current level of service.

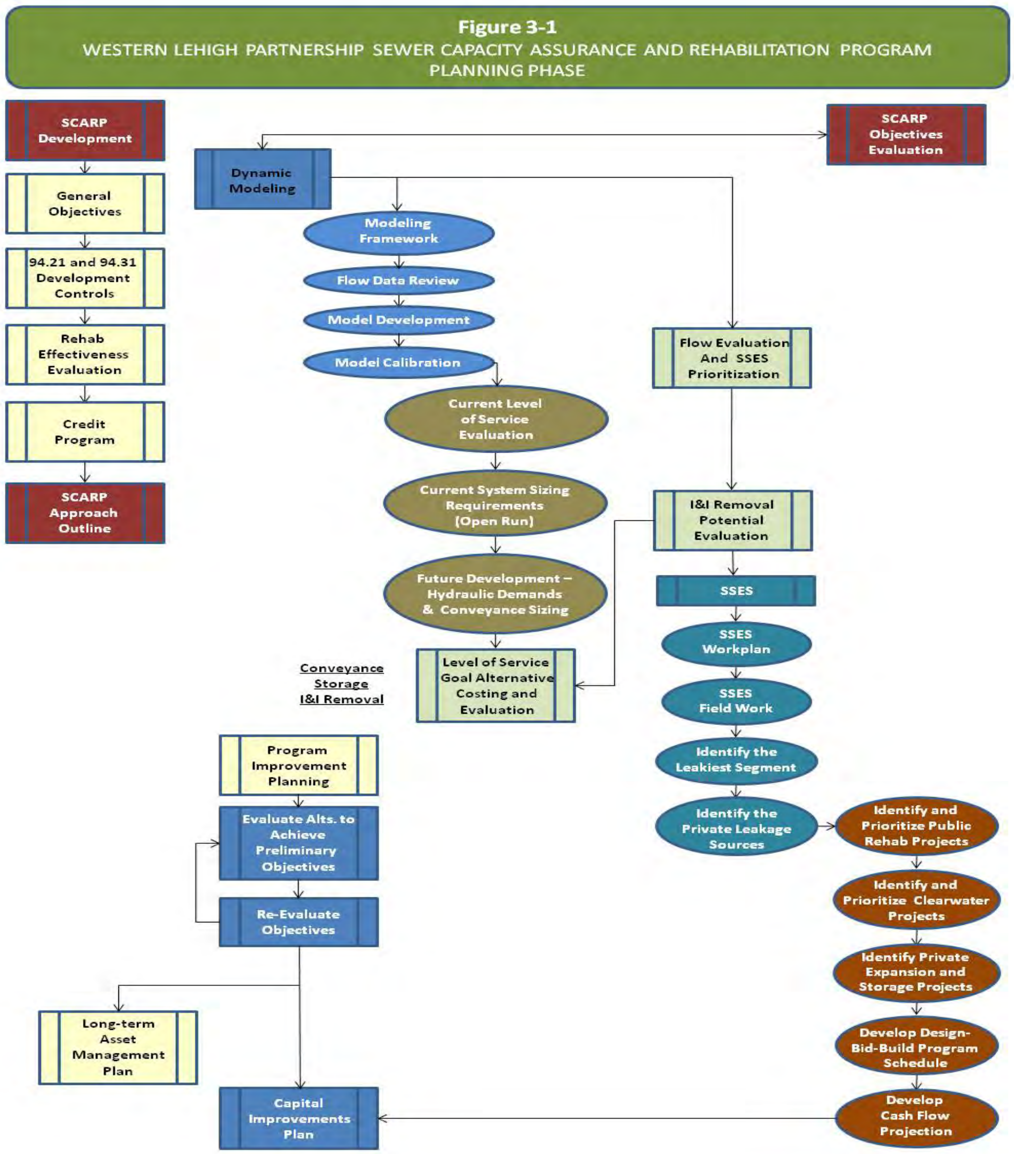
Sanitary Sewer Evaluation Study (SSES) Workplan – Develop a plan describing the field activities to be performed to collect the information necessary to identify specific areas and defects in segments of the sewer system that will require rehabilitation.

SCARP Improvements Planning – Evaluate and develop capital improvement and long-term asset management plans to achieve the final SCARP objectives.

Annual Reports and Closeout – Document actual implementation and effectiveness of the SCARP.

The remainder of this Section generally describes each component of the SCARP including relevance, purpose, methodologies, procedures, and relationship and sequences to other SCARP components. Most of these components will be reported or presented in one or more of the deliverables described in Section 1.6. Figure 3-1 shows the relationship and sequence of the SCARP components. The anticipated actual contents and schedule of each report is provided in Section 5.

Figure 3-1: SCARP Planning Phase Elements



3.2. SCARP Objectives Evaluation Steps

The first steps of the SCARP are focused on defining current system performance and to begin to assess what it might take to achieve various preliminarily considered objectives. The first steps are primarily data gathering and modeling steps that include collecting the information necessary to evaluate base and wet weather flows, defining the current level of service, and conducting hydraulic evaluations to determine if the preliminary objectives described in Section 2 can be achieved.

As described in Section 2.0, the information used to establish the preliminary SCARP objectives included institutional O&M knowledge, a limited amount of flow data, and wet weather flow observations. As there is very little empirical data available upon which to base SCARP objectives, these data will need to be collected at the onset of the program to verify the overall feasibility of the preliminary objectives. Once accurate and relevant data is collected and evaluated, the preliminary objectives will be reviewed and, if appropriate, revised. The information to be collected and used for validation of the preliminary objectives and, if necessary, development of final SCARP objectives is described in the following paragraphs.

3.2.1. Flow Evaluation Including I/I Removal Potential

In 2008, LCA retained the services of ADS, Inc. to conduct two individual flow metering programs. The program completed in March 2008 included installation of 16 ultrasonic flow meters including 6 in the LCA WLI, 1in Macungie, 1 in Alburtis, 1 in Upper Milford Township, 3 in Upper Macungie Township and 4 in Lower Macungie Township. The program completed in early November 2008 included installation of 17 ultrasonic flow meters including 4 in the LCA WLI, 3 in Macungie, 1 in Alburtis, 1 installed in Upper Milford Township, 4 in Upper Macungie Township, 3 in Lower Macungie Township and 1 in Weisenberg Township. The data collected as part of these flow monitoring programs helped to confirm that there are areas of the system that are significantly impacted by I/I. However, the location of the leakiest segments are not currently known and therefore cannot be systematically prioritized.

In March 2009, LCA initiated a comprehensive flow monitoring program that extended through September 2009. Included in the program is installation of 148 ultrasonic flow meters and 14 rain gages. Of the 148 flow meters, 10 were installed in Macungie, 4 were be installed in Alburtis Borough, 4 were installed in Upper Milford Township, 2 were installed in Emmaus, 50 were installed in Upper Macungie Township, 47 were installed in Lower Macungie Township, 22 were installed on LCA's Western Lehigh Interceptor, and 10 were installed in the Little Lehigh and Cedar Creek Interceptors.

Two quality assurance (QA) reviews on the first and last submittals of the flow data will be conducted. The initial QA review will check that the data being collected is valid and suitable for the RDII analysis phase and will provide recommendations for improving data suitability as needed. The final review will confirm the suitability of the full dataset for purposes of the RDII analysis. The reviews will address such issues as meter imbalance, sensor failure, low flow/level situations, velocity gain adjustments, and loss of storm peaks. The reviews will include data from 148 meters and flow balance analysis for 68 network balance points. The features and benefits of the QA review and RDII analysis are summarized in Table 1. A time series data management system will be used to store and evaluate all flow and rainfall data. All data will be validated to identify questionable flow meter and rain gauge data.

Table 3-1:
Features and Benefits

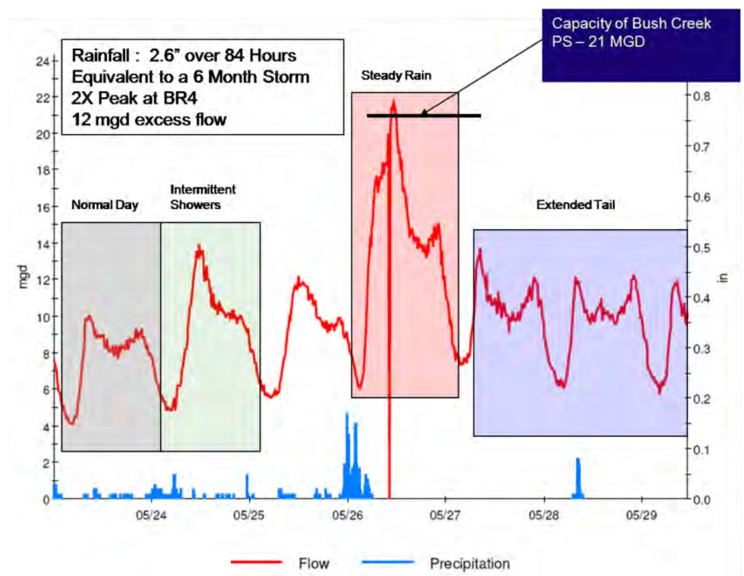
Problem	Probability/ Frequency of Occurrence	Risk/Consequence	Feature/Solution	Benefit
Meter network imbalance	40%	Data from one or more meters cannot be used	Calculate flow balances on intermediate data deliverables	Identify problems during collection period and address the issues
Sensor failure	10%	Meter down time; no data collected by failed meter	Independent review of data; a "second set of eyes"	Greater percentage of valid data for analysis and modeling
Low flow/low level	20%	If levels are low, velocity-level meters can under-report flow	Identify low level situations and recommend appropriate technology	Greater confidence in meter accuracy; additional valid data
Velocity gain adjustment	15%	Velocity readings adjusted to balance meters; can result in inaccurate flows	Compare velocity adjustments and verify their necessity	Assurance that velocity adjustments are field verified and valid
Loss of storm peaks	20%	Automated software can remove storm peaks; inaccurate RDII analysis	Compare raw data to edited data	Recover deleted storm peaks for more accurate RDII analysis

The goals of the 2009 Comprehensive Flow Study program are to:

- Determine the nature and extent of the various types of inflow and infiltration in each sewer basin.
- Identify the sources/locations of various types of infiltration and inflow.

The results of the 2009 Comprehensive Flow Study will be used to:

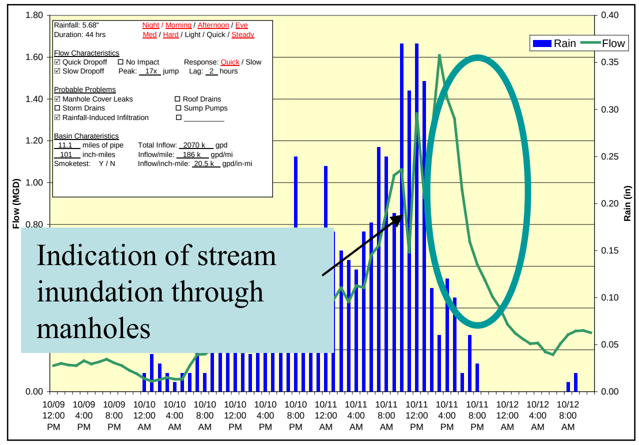
- Quantify the baseline and seasonal infiltration rates for each catchment.
- Identify the types and amounts of I/I for each catchment. Within each flow basin, interpretation of the flow hydrographs will yield the identity of potential I/I sources.
- Identify the SSES activities to be included in the SSES Workplan for each catchment. Using the flow monitoring data, the most effective and efficient methods of inspection can be selected to identify the sources of infiltration or inflow. Not all SSES activities need to be performed in each catchment.
- Determine the peak flows throughout the system and where they occur. The comprehensive flow monitoring network will record the peak flows at many points throughout the system.
- Pinpoint the locations of hydraulic restrictions in the system's interceptors and trunklines. The peak flows will be compared to the maximum allowable load to the interceptors, pump stations, and treatment plants to establish how much I/I must be removed to meet the level of service goals and to confirm that it is realistic to expect I/I source removal efforts (i.e., sewer rehabilitation) to achieve the desired performance levels.



- Serve as the basis for the calibration and validation of future dynamic hydraulic modeling efforts.

3.2.2. SSES Prioritization

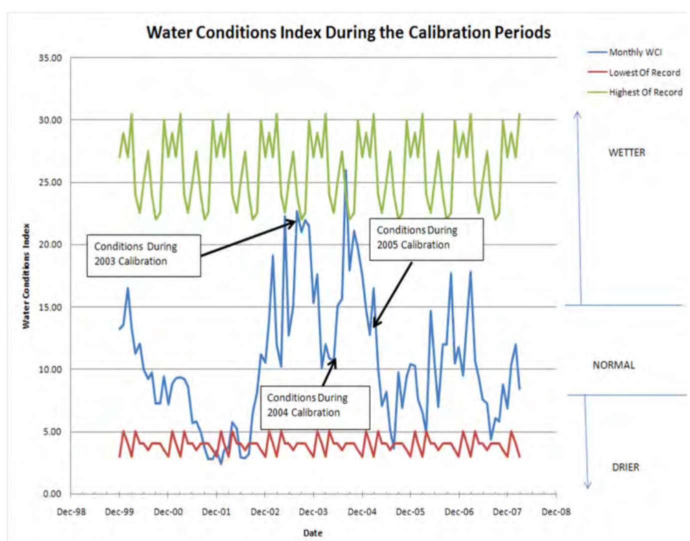
Analysis of the flow hydrographs described in Section 3.2.1 will provide insight into the sources of I/I in each catchment. Different sources of I/I have different flow signatures. For example, high peaks in the hydrograph over a short duration are evidence of sources of inundation or inflow. SSES activities in the workplans for these catchments will include strategies that specifically identify inflow and inundation sources as well as cross connections with storm sewer systems as well as illicit storm and/or groundwater connections to the sewer system by private property connections. Conversely, hydrographs illustrating peaks that are sustained over a long duration are evidence of sources of rainfall induced infiltration. Hydrographs may also indicate a combination of infiltration and inflow within the same catchment. In summary, the hydrograph for each catchment will be used to select the initial SSES activities.



The hydrographs will also be used to prioritize catchments for SSES activities. In addition to identifying the types of I/I sources present in a catchment, the hydrograph will also be used to determine the actual amount of I/I entering the system under wet and dry weather conditions. Each catchment will be prioritized based on the amount of wet weather I/I entering the system. The activities to be performed as part of each SSES is described in Section 3.7.

3.3. Dynamic Modeling

A dynamic hydraulic model (e.g., XP-SWMM, InfoWorks) will be developed for the system to assess sewer capacity, to better understand current system performance during record period storm events, to assess where potential capacity improvements (e.g., pump station upgrades, construction of relief or replacement interceptors, storage) might need be needed, and to estimate what impact I/I reduction projects might have on overflows and basement backups. The



existing GIS system contains asset information that when combined with the results of the 2009 Comprehensive Flow Study will serve as the backbone for a hydraulic/hydrologic model.

The flow data and rainfall data collected during flow monitoring will be utilized to calibrate and validate the dynamic model for both dry and wet weather conditions. This calibration will include storm data that can be reasonably extrapolated to the LOS goal.

Once calibrated, the model will be used to determine current system performance (i.e., what type of storm events under what type of groundwater conditions cause the system to overflow). The model will also be used to determine what reductions in flows are needed to achieve the LOS goal.

Year 2040 future flow conditions will be projected and analyzed. Existing and future system assessments /evaluations will employ continuous simulations of historic rainfall and groundwater records to develop design storms based on peak flow frequency analysis of actual events.

Critical to the development of the model plan will be coordination with any ongoing modeling efforts by the City of Allentown. The interconnected nature of the WLSP's systems and the Allentown collection systems requires an integrated approach to model development, calibration, and long-term planning usage. Meetings with Allentown's modeling team to ensure similar procedures are developed and applied will be required.

3.3.1. Flow and Rainfall Monitoring Data Review

A detailed review of the flow and rain data collected during the 2009 Comprehensive Flow Study to ensure the data are useful for calibration and verification will be conducted. Base (dry weather) flow patterns will be generated for each of the flow meters which will be used in conjunction with rain events and water consumption values to calculate I/I influence. Wet weather events will be defined and classified according to local Intensity/ Duration/Frequency (IDF) curves.

3.3.2. Collect and Review Additional System Information

Additional system information will be used to complete the model development and calibration. This will include:

- Census Data: In the absence of water consumption data, population data will be used to estimate dry-weather flow allocations. Readily available census data will be collected in GIS format.
- Land Use/Zoning Mapping: Information will be used in conjunction with the water consumption data to determine current and future dry weather loads.

- Water Consumption Information: Water consumption information will be collected for a winter quarter period. Water consumption data will be used to allocate dry-weather flows to each of the modeled subbasins. The water and/or sewer billing data will also be reviewed and processed to calculate the average daily sanitary flow for each parcel. Missing or inconsistent information will be documented and presented for review. For parcels without adequate billing records, the land use mapping, populations, or building square footage will be used to estimate the average flow.
- Contributing Community Information: This information includes wastewater collection system assets (sewer, manholes, force mains, etc.), scanned or hard-copy as-built drawings, service boundaries, parcel data, census data, and land use/zoning. The quality and quantity of available data from the Partners may be insufficient or inadequate, so field work/survey may need to be conducted.

These additional data will provide information to adequately represent sewer drainage areas, base wastewater (dry weather) flow contributions, and future development potential.

3.3.3. Model Development

The dynamic model developed for use in the SCARP will have hydrologic and hydraulic modeling capabilities. The hydrologic model provides the basis for generating wet weather flows for routing in the hydraulic model. Analysis of meter data from small, upstream catchments will be used for development of typical diurnal flow patterns that will be applied throughout the model. Using the catchment delineations, a model network will be defined. At a minimum, the model will include:

- All pipes in the WLSP system 10-inches and greater
- Interceptors from the Park PS to the head of the Klines Island WWTP
- Lift stations and force mains
- Other hydraulic controls structures within the 10-inch and greater network
- All known structural sanitary sewer overflow (SSO) locations
- Areas served by 8-inch diameter sewers will be added where necessary to define known chronic problem areas or expand the model to sufficient detail for I/I and capacity planning.

3.3.4. Model Calibration

The model will be calibrated using data collected at 50 flow meter locations and 10 rain gage locations throughout the collection system. It is anticipated that four wet weather events will be used for model calibration, and two wet weather events will be used for model verification. Calibration will be comprised of:

- **Dry weather calibration:** Calibration of the model to dry weather flows or inter-wet weather events, including diurnal patterns and seasonally varying groundwater infiltration. The following will be compared:
    - Verify that the model is routing dry-weather flows correctly. If the modeled flow data does not closely match the monitored flow data, the model will be reviewed for possible connectivity errors.
    - A continuous simulation will be performed to adjust parameters such as infiltration rates that are more directly affected by inter-event hydrologic conditions. Such continuous simulation will be done by simulating the entire monitoring period or selected portions of the monitoring period to predict the pre and post storm conditions at each of the meter locations.
    - Compare the measured and modeled flow depths, adjusting Manning's n as needed, or identifying the cause of discrepancies (e.g., downstream blockage, manhole friction losses, local flow effect).
    - Interviews with key collection system operation staff to find known capacity problems as well as locations of other service-related problems, such as roots and grease
- **Wet weather calibration:**
    - Calibration of the model will be completed for up to four storm events at the flow meters throughout the collection system. These events will cover a range of events from smaller storms to significant storm events.
    - The calibration will be completed by adjusting additional parameters to simulate the rainfall-induced flow response of the system for each storm event. Hydrologic parameters will be adjusted as needed to generate volume and peak flow.
    - Peak flow, total volume and surcharge depth model to monitor comparisons will be made in order to develop a robust tool for future flow projections and I/I alternative analyses.
- **Wet weather validation:**
    - Once the model is calibrated, a period of up to one year *not used for the* calibration will be simulated to assess the validity and robustness of the model calibrations dependent on available flow data sets.
    - The model validation period will be taken from available historic data. The use of a storm of record will be considered if sufficient comparative data are available (e.g., flow data, customer complaint data, etc.).
    - Model results will be compared to available data to assess the model calibrations.

3.4. Current Level of Service Assessment

Until completion of the 2009 Comprehensive Flow Study, adequate data will not be available to define the levels of service currently provided in each catchment. Having an accurate understanding of current conditions is paramount to understanding if the current level of service provided in each catchment is consistent with utility performance goals.

Until actual data are available, the current level of service can only be broadly estimated. It is likely that the current level of service provided by the system is somewhat below the level desired by the Partners. In this event, an evaluation will be performed to identify the alternatives needed to narrow the gap between current and desired levels of service.

It is envisioned that the current level of service will be established for the following groupings:

- Trunk lines within townships and boroughs
- LCA trunklines tributary to the Western Lehigh Interceptor
- Western Lehigh Interceptor/Spring Creek Road Relief Pump Station
- Little Lehigh Interceptor/Spring Creek Road Relief Pump Station
- Park Pump Station, the Little Lehigh Interceptor immediately downstream of the Park Pump Station, and the Cedar Interceptor immediately downstream of the confluence of the Little Lehigh and Cedar Creek Interceptors.

The dynamic model will be used to determine the current level of service for each portion of the system. The calibrated model will be used to conduct a detailed system analysis and identify deficiencies in existing system components. The first step will be to perform an existing system performance analysis for dry weather and wet weather conditions using 50 years of historic rainfall records. Statistical analyses will be performed to determine the peak flow and peak overflow volume frequency event. The selected level of control events will be used for subsequent tasks to assess and evaluate the system's level of service: the combination of rainfall and antecedent moisture conditions under which portions of the system overflow. It also shows where immediate capacity and other service-related problems potentially exist. This existing system analysis will define capacity issues and bottlenecks within the systems, including the existing gravity sewers from Keck's Bridge to Kline's Island WWTP. The current Level of Control Assessment will include:

- System performance (overflow frequency, volume, and location) during wet weather events using a continuous simulation of approximately 50 years of hourly rainfall data collected from a nearby weather station
- System performance during dry weather conditions using a continuous simulation described above. The analysis will focus on select dry weather intervals.
- System performance under peak wet weather flows using a continuous simulation where all hydraulic bottle necks are removed (open system) to eliminate all surcharging and flooding
- Statistical comparison of the overflow volume and frequency as well as the open system peak flow to determine the recurrence intervals for up to five historic events and to determine a desired level of control event for system improvement analysis

The system performance evaluations will be conducted for five selected storm events and will include a wet weather capacity assessment to identify the hydraulic bottlenecks of the existing system. The five events, determined from the continuous simulation described above, will be used on an open system model to determine the peak wet weather flows in each of the gravity sewers. The resulting sewer peak flow will be compared to its flowing full capacity to identify hydraulic bottlenecks in the system for the wet weather events.

3.5. Current System Sizing Requirements

The calibrated model and the Current Level of Service Assessment will be used to develop alternatives for providing necessary relief to any areas identified as capacity limited under existing conditions. This will involve an evaluation of system performance during wet weather events using the historic level of service events where all hydraulic bottle necks are removed (open system) such that all surcharging and flooding is eliminated. Estimates of I/I removal required to eliminate capital improvements will also be made using the model. The system performance evaluation will be conducted using the five selected storm events to identify the appropriate size of the conveyance if no storage or I/I reductions are made. The capital costs of these capacity increases will be estimated as well as any projected benefits (increased level of service).

3.6. Future Development – Hydraulic Demands and Conveyance Sizing

Future populations and additional wastewater flows (both dry and wet weather) into the WLSP systems will be projected so that the evaluation of alternatives for capacity management recognize the impact of these loadings too. Estimated future population and employment/industrial growth will be estimated through Year 2040, and will include estimates for the following communities:

a. Allentown
b. Emmaus
c. LCA and LCA signatory communities
d. Salisbury Twp.
e. South Whitehall Twp.

This will require collection of all available growth projections (primarily through each municipality's existing 537 Plan projections), outlining of appropriate additional areas that will be added to the WLSP service area either through development growth or acquisition/annexation, and projecting both dry and wet weather flows. It is anticipated that wet weather flows will be based on calibrated model parameters, slightly modified to reflect core assumptions such as ongoing increases in I/I over the planning horizon due to continued sewer deterioration.

Using the 2040 development projections, an analysis will also be completed for each event considered to determine how much I/I would need to be removed to eliminate overflows and minimize capacity limitations, and the required system improvements to convey wet weather flows without any I/I reductions.

Where necessary, additional service areas will be added and new facilities necessary to convey flows to the system will be incorporated into a baseline future model.

3.7. SSES Steps

Upon conclusion of the activities described in Section 3.2 through 3.6, the following information will be known for all catchments:

- Volume of baseline infiltration prioritized by catchment.
- Volume of rainfall derived I/I (RDII) contributed by each catchment, and likely cause (nature) of the catchment's RDII.
- Level of service for each catchment.
- Segments of the system that are undersized for current or anticipated future flows.
- Locations of anticipated wet weather SSOs.
- I/I volume and peak inflow reduction needed to eliminate capacity expansion or storage now and at all points through 2040.

This information will be used to define SSES activities for each catchment impacted by I/I. Review of flow monitoring data and flow hydrographs will identify the nature and extent of infiltration or inflow experienced in each catchment, but not the actual locations of the leaks. The goal of the SSES activities described in this Section is to specifically identify neighborhoods, pipe segments, or private properties contributing the highest levels of infiltration and or inflow. The following steps will be followed to successfully execute all SSES activities.

- Develop the SSES Workplan
- Conduct the SSES Fieldwork
- Identify Leakiest Public Sewers
- Identify Private Leakage Sources

Each of these steps are described in greater detail in the following sections.

3.7.1. SSES Workplan

An SSES Workplan will be developed for each catchment. The purpose of the workplan is to ensure that all SSES activities are planned and executed in a consistent and efficient manner. The workplan will be the mechanism by which all field personnel will consistently collect, record, and store all field collected data. In addition to addressing administration and management concerns, the workplan will define the SSES activities to be performed in each catchment. Each workplan will define the procedures, techniques, data capture and management tools, analysis methods, and QA/QC steps to be used by each WLSP for each type of SSES activity to be performed. The potential SSES activities that will be prescribed by the workplans include smoke testing, basement inspections, stormwater observations, post-storm trunkline walks, wet weather CCTV work, weiring, and manhole inspections. Not all SSES activities described above will be used in each catchment.

In addition to including written policies and procedures for performing the work, the workplans will ensure that the SSES activities performed by each WLSP is performed in a consistent manner that will yield the data necessary to select the appropriate rehabilitation/replacement strategies.

3.7.2. SSES Fieldwork

Field personnel will conduct the SSES activities as described in each SSES Workplan. The information collected during this step will serve as the basis for selecting rehabilitation or replacement strategies to address the identified defects. The SSES activities potentially included in each workplan are described in the following paragraphs.

3.7.2.1. Smoke Testing

In the event flow meter data indicate that direct inflow sources exist (e.g., cross-connected roof leaders or storm drains, badly leaking manholes/covers), additional investigation will be necessary to find these particular sources. Smoke-testing will be utilized for its effectiveness and low cost in locating inflow sources without traps or check valves (i.e., it won’t locate sump pumps, or roof drains connected to soil pipes with P-traps).

Alternatively, dye testing may also be used to verify suspected cross connections in the event smoke testing is not practical or in an effort to confirm sewer connections on a small scale basis.

3.7.2.2. Basement Inspections

In the event flow meter data indicate that direct inflow sources such as cross connected sump pumps or punctured floor drains exist, it will be necessary to conduct basement inspections. Basement inspections will be conducted to specifically identify households containing illegal connections to the sewer system. These connections often take the form of punctured floor drains, punctured riser pipes, and cross connected sump pumps.

3.7.2.3. Above-Grade Stormwater Observations

It is also helpful to physically inspect the system during wet-weather events. On-site observations will be conducted in catchments that are heavily impacted by direct inflow sources and of manholes in the streets impacted by sheet runoff or manholes in easement areas that may become inundated by elevated stream levels. Manholes will also be opened to see if there is any overtly obvious significant increases in flows resulting from direct inflow sources.

3.7.2.4. CCTV Inspections During Rainfall

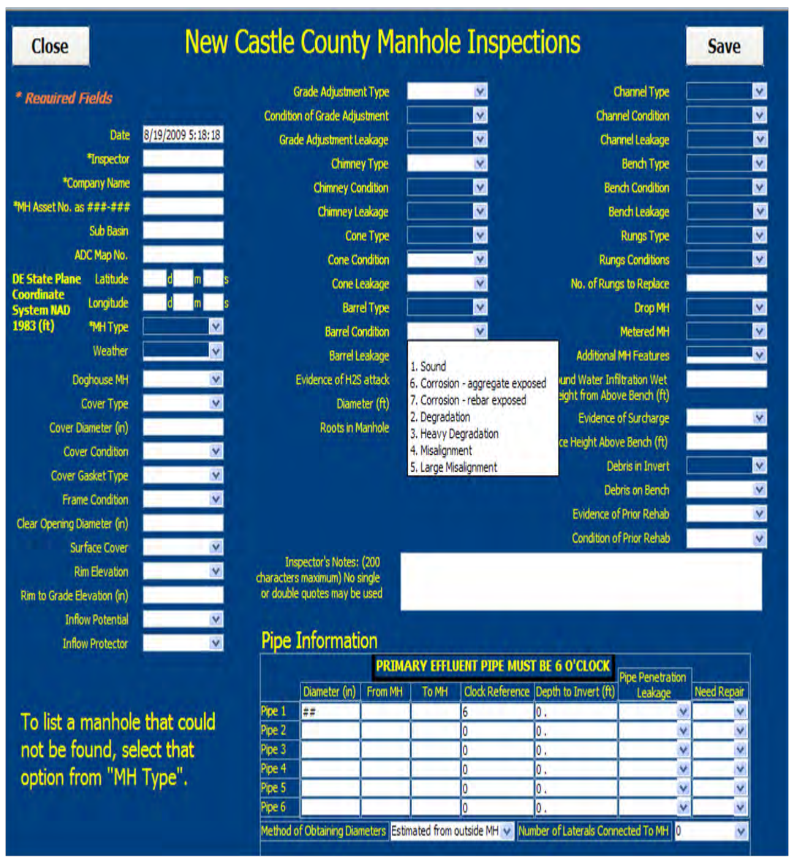
Closed circuit television inspection is the best, albeit most difficult and expensive method of conducting gravity system condition assessments where sources of RDII are suspected. Standardized coding of defects using the NASSCO PACP system will be used to reduce the subjectivity of data evaluation.

3.7.2.5. Nighttime Flow Weiring

Given the age of the collection system, it is anticipated that rainfall-induced infiltration (RII) will likely be identified as a major contributor of flow in some catchment areas. For these catchments, night-time weiring work will be conducted during elevated groundwater conditions to identify which sections do and do not leak. While nighttime weiring is, strictly speaking, a measurement of infiltration, it is also a good surrogate indicator of RII.

3.7.2.6. Manhole Inspections

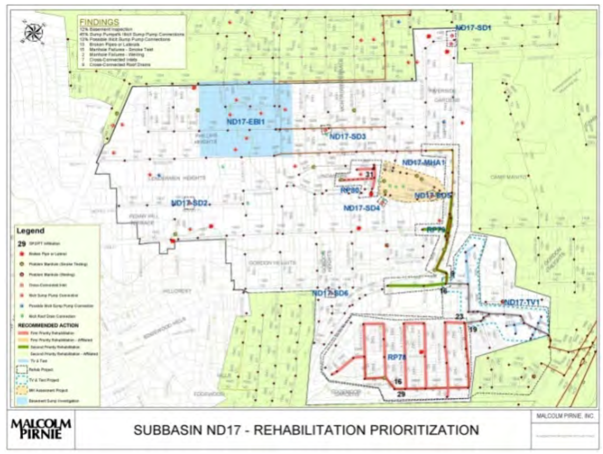
Manhole inspections will be conducted on every manhole utilized during weiring and smoke testing. These inspections will be used to not only collect structural information, but to also assess the hydraulic condition of these manholes. The elevated groundwater conditions that are preferred field conditions for weiring work will also reveal if any of the inspected manholes are subject to infiltration. This work will gather structural and hydraulic information and provide even greater inspection coverage of the manholes in each sewer basin. This work will be considered preliminary only, as experience has shown that groundwater levels rise dramatically after sewer main and lateral rehabilitation, and manholes that previously appeared to be watertight in fact leak significantly once the lower lying components are sealed.



Finally, manhole inspections will be conducted in areas along streams to identify manholes that either become inundated during stream flooding or have evidence of overflow or surcharge. Data on manholes exhibiting evidence of surcharge will be used to support truthing of modeling.

3.7.3. Identify Leakiest Public Sewers

From the SSES work, the actual hydraulic condition of sections of the public sewer system will be clearly understood and the location of leakage will be documented. The data collected during the SSES activities will be used to organize the leaking segments on a neighborhood by neighborhood basis. Leaking defects that are anticipated to be identified within the domain of the WLSP (public sewers) include cross connections between the sanitary and stormwater system, leaking pipe joints, collapsed and broken piping, illicit connections to private systems, deteriorated manholes, and manholes that are subject to inundation due to stream flooding or sheet flow generated by impervious surfaces.



3.7.4. Identify Private Leakage Sources

SSES activities will also locate illicit connections to the public sewer system as well as private clearwater sources. The sewer ordinance of each WLSP will be used to determine whether a suspect connection is illicit. If the connection is not permitted in accordance with the sewer ordinance, the owner of the illicit connection will be required to eliminate the connection or obtain a permit for its operation. Private leakage sources detected during the performance of basement and CCTV investigations may include clearwater connections such as roof drains, cross-connected sump pumps, leaking building drains, and area drains.

The cost and political inexorabilities of a private clearwater disconnection program will be weighed. Similarly, an evaluation of the financial and political costs and benefits of addressing those portions of leaking laterals owned by the property owner will also be conducted.

3.8. Program Improvements Planning Steps

The purpose of these steps of the SCARP are to identify the rehabilitation needs, replacement needs, expansion requirements, costs of improvements, and schedule for implementing a program to achieve the SCARP objectives. This will be accomplished by evaluating the various combinations of methods and costs to achieve the preliminary objectives, revising the preliminary objectives to yield final SCARP objectives (if necessary), prioritizing projects, developing a design and construction schedule, and projecting a cash flow plan that constitutes a reasonable Capital Improvements Plan, and developing of a long-term Asset Management Plan to maximize the overall life-cycle of all assets.

3.8.1. Evaluate Alternatives to Achieve Preliminary Objectives

There is no one path forward that will achieve the preliminary objectives. All of the information necessary for this analysis will be available following development of the hydraulic model, identification of likely I/I sources, and identification of the actual sanitary sewer leakage locations through implementation of the SSES Workplan (Section 3.7.

It is likely that the path forward to meeting the level of service goals will not consist solely of either I/I reduction or capacity enhancements. The SSES and modeling data will be used to build and analyze the feasibility of alternatives that include combinations of I&I source removal, storage, and conveyance expansion for addressing the preliminary objectives and level of service goals.

From the SSES work, sections of the public sewers system will be prioritized for replacement or rehabilitation based on their leakage, location, and cost:benefit ratio. From the SSES work, an evaluation of the impact of flows from privately owned clearwater connections such as roof drains, cross-connected sump pumps, leaking building drains, and area drains and the cost and political inexorabilities of a private clearwater disconnection program will be weighed. Similarly, an evaluation of the financial and political costs and benefits of addressing those portions of leaking laterals owned by the private property owner will be conducted.

Methods for rehabilitation and replacement of public sewers that will be considered as part of this evaluation will include, but are not limited to, replacement of pipe segments, pressure testing and chemical grouting, cured-in-place pipe lining, cured-in-place lateral lining, and removal of other illegal connections to the sewer system including sump pumps, roof drains, etc. Estimates of the potential amount of I/I that can be removed upon implementation of a rehabilitation program utilizing each of the methods above will also be prepared.

The hydraulic model will be used to evaluate what combinations of I&I source removal, storage, and conveyance expansion best meet future flow conditions for storm return frequencies of 1, 5, 10 and 20 years and an I/I creep rate of 0.5% per year. These alternatives will be developed using the model and costed for both capital and operating costs. The model will be used to analyze the following scenarios:

a. System improvements, including storage tank locations/sizes and trunkline/interceptor/relief pump station expansion and paralleling requirements, that would be needed assuming no I/I is removed.
b. Impact of system capacity restored as a result of eliminating sources of I/I and/or construction of system improvements on future development and demand for service.
c. Amount of I/I that will need to be removed to reduce/eliminate the need for storage or increased conveyance capacity.
d. Impact of alternative on sanitary sewer overflows for the various return frequencies.
e. Effect of the alternatives on City of Allentown flows.

The alternatives analysis described above will be used to determine the rehabilitation, replacement, and expansion requirements to meet the preliminary objectives. Included in these analyses will be the physical reality that much of the existing piping systems will require rehabilitation or replacement with the next 30-50 years. The rehabilitation, replacement, storage, and expansion alternatives identified to meet the preliminary objectives will be ranked based on effectiveness, constructability, timeliness, capital cost, and lifecycle cost.

3.8.2. Re-evaluate Objectives

The analysis conducted in the previous section will be the first real attempt by the Partners to identify actual strategies and life cycle costs for achieving the preliminary objectives. The identified strategies will undergo an analysis of cost versus effectiveness to identify the strategies that have the greatest “bang for the buck”. It is likely that the most attractive strategies will not be perfectly aligned with the preliminary objectives. The preliminary objectives will need to be reviewed and if necessary revised based on the specific political and financial considerations of each WLSP. It is intended that “knee-of-the-curve” cost: benefit evaluation will be used to drive selection of the final LOS objectives.

Upon re-evaluation of the objectives, new or modified final SCARP objectives will be confirmed by each WLSP. The MOU will be amended to include the final SCARP objectives as well as the overall strategy for achieving the objectives.

3.8.3. Develop Capital Improvements Plan

As previously stated, the overall strategy for achieving the SCARP objectives will likely reflect a balance between storage, conveyance expansion, I/I reduction via public sewer rehabilitation, I/I reduction through private sewer rehabilitation, and clearwater removal.

From a capital expense perspective, it is obvious that the required improvements will not be simultaneously implemented. All planned improvements will need to be sequenced to reflect available capital resources. The Capital Improvements Plan will be the mechanism for implementing the recommended improvements. This Capital Improvement Plan will have the following components:

- I/I Mitigation: Based on the hydraulic modeling analysis, flow metering data evaluation, and SSES results and engineering experience, a comprehensive I/I mitigation plan that will prioritize areas for follow-up SSES investigation and I/I mitigation based on comprehensive data and modeling analyses will be proposed. This portion of the plan will provide a target I/I removal percentage.
- Capacity and Storage: Augmenting the I/I mitigation activities will be recommended capacity and storage improvements for the conveyance systems that will provide sufficient capacity (assuming the target I/I reductions are achieved) for a selected, cost-effective level of service.
- Implementation of Final Future Alternative Analysis: A phased Implementation Plan that will outline an achievable program that will address existing and projected future capacity needs.
- Costs: Estimated life-cycle costs, including O&M, will be developed for the recommended Improvements Plan.

A schedule for the needed improvements based on an estimate of I/I removal, future flows and growth of the service area will be prepared. A sewer rate model specific to the Partners will be developed and used to determine if sewer rate increases are required to support the desired improvements. In the event the cost of the needed improvements exceeds capital generated by an acceptable increase in sewer rates, the improvement implementation schedule will be revised to reconcile these competing demands.

Once the iterative process of rectifying the implementation schedule and capital funding has been completed, a Capital Improvement Plan (CIP) will be finalized. The Capital Improvements Plan will define the needed improvements, implementation schedule, cash flow demands by WLSP, and any needed changes to the existing sewer rate structure to support the implementation schedule.

3.8.4. Develop Long-term Asset Management Plan

An Asset Management Plan will be developed and implemented that is complementary to the Capital Improvements Plan and ensures that the improvements defined by the Capital Improvements Plan are integrated with supporting operation and maintenance strategies to maximize the life cycle of critical assets. In essence, the combination of the Long-term Asset Management Plan and the CIP will effectively provide a common CMOM Plan for all the Partners. The Asset Management Plan will address utility organization, business processes, information and technology systems, design standards, operating and maintenance procedures to ensure that these important elements can support the overall

SCARP objectives within the available financial resources. The Asset Management Plan is intended to be a living document with revisions occurring at biannual frequency.

The long term Asset Management Plan will include:

Engineering

- System Inventory Procedures
- System Mapping Procedures
- New Sewer System Design Standards
- New Sewer Construction inspection Standards and Procedures
- Rehabilitation Inspection Standards and Procedures
- Continuing Sewer System Assessment Procedures
- Scheduled Manhole Inspection Procedures
- Flow Monitoring Procedures
- CCTV Procedures
- Gravity System Defect Analysis Procedures
- Service Lateral Investigation Procedures
- Pump Station O&M Procedures
- Pumping Station Scheduled Inspection Procedures
- Pumping Station Performance and Adequacy Evaluation
- Force Main Assessment Procedures
- Sanitary Sewer Overflow Reporting, Notification and Record Keeping Procedures
- Un-permitted Discharge Reporting, Notification and Record Keeping Procedures
- Emergency Operation and Maintenance Procedures

Management

- Training Programs
- Safety Programs
- Confined Space Entry Procedures
- General Safety Procedures
- Traffic Management Procedures

Operations and Maintenance

- Wet Well Cleaning Procedures
- Odor and Corrosion Control Procedures
- Air Relief and Vacuum Relief Valve Maintenance Procedures
- Standby Power Operations Procedures
- Emergency Operating Procedures
- Grease Trap Inspection and Enforcement Procedures
- New Connection Tap-in Procedures
- Line Location for Third Parties Procedures
- Pumping Station Maintenance Procedures
- Force Main Maintenance Procedures
- Valve Exercise Procedures
- Gravity Line Hydraulic Cleaning Procedures
- Gravity Line Mechanical Cleaning Procedures
- Gravity Line Root Control Procedures
- Manhole Preventative Maintenance Procedures
- Maintenance of Rights of-Way and Easements Procedures

3.9. Annual Reporting

To document the progress of the SCARP, the Partners will prepare a joint Annual Report for submission to PADEP. With respect to the SCARP, program progress will be measured by improvements made with respect to the following criteria:

- Project Implementation
- Rehabilitation Effectiveness
- Level of Service Performance Measurement

3.9.1. Project Implementation

In accordance with the Capital Improvement Plan, projects will be scheduled for implementation and completion on an ongoing basis. The Annual Report will track the progress of projects scheduled for implementation or completion. SCARP success will initially be based on the ability of the Partners to maintain the implementation schedule.

3.9.2. Rehabilitation Effectiveness

Rehabilitation project specific effectiveness monitoring will be conducted to:

- Quantify the I/I removal effectiveness of the rehabilitation projects.
- Quantify the cost-benefit of the various rehabilitation methods.
- Fine tune or refocus the selection of rehabilitation techniques based on these findings.

For many of the rehabilitation projects, flow meters will be installed to gauge project specific effectiveness. Two metrics will be used to determine the effectiveness of projects designed to eliminate I/I:

1. Reduction in total system volume resulting from a rain event - Total system volume resulting from a rain event is calculated by totaling the hourly flow volumes measured during the I/I period.
2. Reduction of peak flow rate during a rain event - Peak flow rates are determined by reviewing the hourly data collected during each rain event and identifying the highest measured flow rate.

The above metrics will be based on actual post-rehabilitation flow monitoring data. Ideally, flow monitoring will be conducted in each project area for six months prior to the start of rehabilitation and for six months after completion of rehabilitation in order to capture data from a significant number of storms. At least six storms are anticipated to be captured by the flow monitoring both before and after rehabilitation.

The Control Basin Method (CBM) of analysis will be used to analyze the pre- and post-rehabilitation flow data. The CBM is a correlation between the metrics of the basin undergoing rehabilitation and the “simultaneous” metrics from a control basin. Scatter plots are generated with the metric values from the control basin on the x-axis and the corresponding metric values from the rehabilitation basin on the y-axis. Pre-rehabilitation data is plotted separately from post-rehabilitation data and both sets are linearly regressed. The percentage difference between the slope from the pre-rehab regression and the slope from the post-rehab regression yields the percentage reduction due to rehabilitation.

If the control basin is well selected (i.e. it exhibits similar physical condition, I/I characteristics, groundwater and rainfall conditions, and is geographically close to the rehabilitation basin), the relationship between the two basins is linear because it is a direct comparison of metrics which occurred during the same storm event.

Percent reduction is determined by the measuring the difference between the pre-rehabilitation and post-rehabilitation trend lines.

3.9.3. Level of Service Performance Measures

When source removal work is a featured part of a sewer capacity assurance and rehabilitation program, it is impossible to predict exactly how much work will be required to meet the level of service program performance goals. The only way to demonstrate that the improvements have met the goals is to project flow monitoring results collected after the system improvements have been implemented to the level of service event using dynamic modeling.

It is anticipated that the Program Improvements Plan will be broken into at least two phases, with flowmetering, recalibration of the system model, and level of service performance evaluations conducted after each phase. It is anticipated that the first phase will be 8-12 years in duration.

At the end of each phase, the model will be updated to reflect physical changes to the system such as the storage tanks and in-line storage, relief line or line expansion, flow diversions, and system extensions. The model will be recalibrated using flow meter data collected from the inter-phase flow monitoring. Additionally, the period during which these data are collected will be cross referenced to the water conditions index to ensure that the model is recalibrated using flow data subject to appropriate water conditions index to ensure an appropriate level of consistency is achieved between the 2010 Model and the subsequent models. The newly calibrated model will be used to characterize improved system performance under the new flow regimes derived from the I/I source removal projects and to determine the Level of Service provided by the Partners systems at the end of each phase.

4. Future Capacity Allocation

The Western Lehigh Sewerage Partnership(WLSP) has acknowledged that, under PA Code 94.21, each Partner must implement a corrective action plan that addresses hydraulic overloads and specifies how new connections will be responsibly managed. As stated in 94.21.a.3, the written corrective action plan must include, but not be limited to, a program for control of new connections to the overloaded sewerage facilities and a schedule showing the dates of each step toward compliance. This SCARP Approach Outline constitutes the required corrective action plan.

The corrective action plan includes a program for control of new connections. Accordingly, the procedure described in the following paragraphs will be used to control new connections to the sewer system to ensure that new development does not outpace capacity assurance and flow reduction measures taken by the Partners.

4.1. Development Flow Credits

New connections to the system will be allowed as measurable reductions in flows, through a combination of I/I reduction, capacity increases, or storage, are achieved. In the interim, proposals for new connections will continue to be received, reviewed and conditionally approved by LCA using existing review and approval procedures, with the codicil that they may not be connected to the sewer system until flow is made available, as described below. New connections are those connections from development that receive PADEP planning module approval on or after January 1, 2009; these shall not be permitted to connect to and utilize any of the WLSP collection systems unless they receive an allocation of sufficient development flow credits. Those developments that received PADEP planning module approval prior to January 1, 2009, are not new connections, and do not need an allocation of development flow credits, and there shall be no reduction in the Development Flow Credit Account related to any of those connections. LCA will track the flow credits for all municipalities within the LCA system and provide letters to municipalities for inclusion with planning module submissions stating that an amount equal to the development's wastewater flow will be allocated from the Development Flow Credit Account for the project when the connection is made for each EDU within the Development. In addition LCA will monitor the number of actual connections to the sewer system from developments that received PADEP planning module approval prior to January 1, 2009 to ensure those connections do not occur at a pace that will impact negatively on the collection and conveyance system.

As capital projects are completed, benefits to peak flow conditions in the sewer system will be realized. Capacity increases will reduce flow levels in critical lines and, properly done, will not cause flow levels to unacceptably increase in other portions of the sewer system. Storage will reduce peak flow volumes in critical lines. Rehabilitation and clearwater removals will reduce the I/I demands placed on the sewer system. However, there may be a delay in measured response as the system is currently surcharged (pressurized) and leakage removed, stored, or conveyed may be replaced by leakage from other sources not currently able to enter the system due to pressurization, or by flows that are currently leaving the sewer via SSO that, once I/I flows are reduced, will now stay in the sewer.

Reduction in flows from rehabilitation and clearwater removals and in flow levels from storage and capacity increases will be largely applied directly to reducing the current hydraulic overload. A portion will be made available to new connections, as described below.

4.1.1. Source Reductions via Rehabilitation

To determine the actual effectiveness of rehabilitation, post-rehabilitation flow monitoring will be conducted to measure the amount of I/I eliminated from the system using the Control Basin Method (CBM) described in Section 3.9.2. Both the volume of flow eliminated and the peak flow rate reduction achieved will be calculated. The point of calculation of reduction between the control basin data and the rehabilitated basin data will be four times the average daily dry day diurnal peak rate. Thirty percent of the lower of these two reductions will be applied to a Development Flow Credits Account.

Because determination of actual flow benefits won't be completed until at least six months after completion of the project, and to continue to foster economic growth, a method that applies some portion of the anticipated flow reduction earlier will be used. The anticipated effectiveness of each rehabilitation project can be estimated based on previously conducted rehabilitation work. The anticipated reduction for each project will be documented in a memo that includes a documented basis for flow reduction. One third of the anticipated flow credit will be applied to a Development Flow Credits Account at project award, and this front loaded credit will be deducted from final, actual flow credit applied upon completion of rehabilitation effectiveness determination.

4.1.2. Source Reductions via Clearwater Removals

Source reduction for clearwater removals will be dependent on the nature of the clearwater disconnection. Cross connected sump pumps have been demonstrated in past investigations to deliver an average of 6 gallons per minute during storm events. (Actual rates of discharge vary from 0 gpm to 70 gpm, but when averaged out over the duration of storm events, they average 6 gpm. This has been confirmed via post disconnection analysis using CBM methods describe in the above section.

Leaking building drains deliver widely different rates of I/I. For the purposes of this SCARP, it will be assumed that they deliver two-thirds the rate of a cross connected sump pump: 4 gpm. (Sump pumps deliver flow at pressure and are able to discharge into surcharged sewers). Clearwater flows will be converted to volume by assuming a 24 hour event. Therefore, a sump pump will discharge 8640 gallons and a leaking building drain will discharge 5760 gallons.

Roof drains, driveway drains, and area drains rate of discharge is a function of the area serviced by the drain. For the purposes of the SCARP, flow removals from these clearwater connections will be calculated by multiplying the areas served by the depth of the 2 year- 24 hour storm (inches).

Thirty percent of these source water reductions will be applied to a Development Flow Credits Account upon successful disconnection.

4.1.3. Peak Flow Reductions via Storage

Peak flow reductions provided by additionally provided storage in off-line tank storage will be the volume of the tank. Peak flow reductions provided by additionally provided storage in in-line pipe storage will be measured using the dynamic model run under a 2 year-24 hour storm event using an Alternating Block synthetic storm distribution. Thirty percent of the flow benefit will be applied to a Development Flow Credits Account. One third of this credit will be applied at project award, and this front loaded credit will be deducted from final, actual flow credit applied upon completion of construction.

4.1.4. Peak Flow Reductions via Capacity Increases

Peak flow reductions provided by additionally provided capacity increase (e.g., relief interceptor, interceptor replacement with larger diameter pipe, interceptor lining with lower Mannings coefficient materials, relief pump station/force main) will be measured using the dynamic model run under a 2 year-24 hour storm event using an Alternating Block synthetic storm distribution. The calculation of benefit will be the difference in SSO volume under the current system performance (as provided by the model described in Section 3) versus SSO volume with the new storage in place. Thirty percent of the flow benefit will be applied to a Development Flow Credits Account.

One third of the flow credit will be applied to a Development Flow Credits Account at project award, and this front loaded credit will be deducted from final, actual flow credit applied upon completion of construction.

4.1.5. Conversion of Peak Flow to EDUs for Development Flow Credits

I&I reductions and flow capacity improvements will be appropriately measured at peak flow periods, and a portion of that peak flow reduction will be converted to Development Flow Credits which will allow ongoing development as described above. For the purposes of the applying these Development Flow Credits to allowable connections, the resulting peak flow reductions will be converted at a rate of 223 gpd per EDU.

For example, a 10 unit subdivision with a 223 gallon per day per unit base wastewater load is proposed. This equals a base load rate of 2230 gallons per day. These 2230 gallons per day will be subtracted from the peak flow reduction credit accrued in the Development Flow Credits Account as each connection is made.

4.2. Storage and Conveyance Measures Underway

4.2.1. Iron Run Pump Station and Flow Equalization Basin

For the last few years, LCA has been designing a third high flow sewage relief pumping station (the first two being the Park Pump Station and the Spring Creek Road Pump Station) to alleviate overflows from the upper third of the Western Lehigh Interceptor during extreme rainfall events. This new pump station, coined the Iron Run Pump Station (IRPS), is designed to be located just downstream of the LCA wastewater pretreatment plant (WWPTP). Designed to take treated flow from the WWPTP and pump it into the existing force main of the Spring Creek Pump Station and discharge the flow into the Little Lehigh Interceptor downstream of Kecks Bridge and upstream of the Park Pump Station, this station would reduce or eliminate overflows between the LCA WWPTP and Spring Creek Pump Station. Since its original conception, however, broader issues regarding overflows in the Little Lehigh Interceptor and the downstream components of Allentown’s conveyance system have added design objectives that the IRPS cannot meet. Recent modeling to demonstrate the efficacy of the IRPS shows that while overflows in the Western Lehigh Interceptor and Little Lehigh Interceptor will decrease, overflows in the Little Lehigh Interceptor near Park Pump Station will increase with the operation of the Iron Run Pump Station. See Appendix A.

Concurrent with the design of the IRPS has been a separate effort to increase the flow equalization capabilities at the LCA WWPTP. LCA recently completed modeling that indicates a flow equalization basin (FEB) located at the head of the LCA WWPTP would perform similarly to the IRPS with regard to SSO volume reductions between the WWPTP and the Spring Creek Pump Station; unlike the IRPS, the FEB does not increase overflows near Park Pump Station. As shown in Appendix A, modeling predicted that the FEB would store approximately 2.3 MG during the March 27, 2005 storm (a 2-year 24 hours storm that caused several overflows in the WLI system). To provide for additional growth in Upper Macungie Township, a 3.0 MG FEB was proposed as the hydraulic basis of design.

Because the FEB meets the goals of the IRPS without increasing overflows near Park Pump Station, is half the cost of the IRPS, and better supports the possible conversion of the LCA WWPTP to a direct discharge WWTP, a 3.0 MG FEB will be constructed at the head of the LCA WWPTP. This FEB is currently being designed, with the facility slated to come on line in Fall 2010. This FEB will postpone or eliminate the need to construct the IRPS.

4.2.1.1. FEB Development Credit Calculation

Per Section 4.1.3, 10 percent of the total 3.0 MG benefit (300,000 gallons) will be applied to the Development Flow Credits Account at storage project award, which is anticipated in November 2009, and PADEP receives the 537 Plan Amendment resolutions adopting this SCARP Program Approach Outline,. This front loaded credit will be deducted from the final 30 percent credit (900,000 gallons) applied upon completion of construction. The remaining 70% of the FEB benefit will be applied to SSO/flow reduction. These flows need to be adjusted per Section 4.1.5 for final application to residential, commercial, and/or industrial flows (for example, for the Coke development).

4.3. Development Flow Credit Reporting

The WLSP will prepare and submit to PADEP a Development Flow Credit Report annually on March 31st as part of the Annual Report documenting what source reduction or peak flow reduction work has been planned, awarded, implemented, and measured. These reports will include supporting calculations for each project, including projections of likely benefits, pre- and post- rehabilitation/construction flow monitoring data, efficacy analyses, modeling results, and any other supporting proofs of project benefits. These will be presented in a single table that lists all projects included in the SCARP. The first of these will be the FEB.

A second table reporting new connections to WLSP system that had planning module approval after January 1, 2009 and demonstrating available flow credits will also be prepared; LCA will be responsible for tracking both credits and their distribution and reporting these to PADEP. The WLSP will also track and report the new approved planning modules for the reporting period and report the number of actual connections to the sewer system that had planning module approval before January 1, 2009.

4.3.1. PADEP Approvals

To facilitate responsible development and redevelopment, PADEP will have 60 calendar days to reject the flow credits or request additional supporting information. If no response is received from PADEP within 60 days of receipt of the report, the credits and their application to the listed residential, commercial, and industrial developments at the rates shown in the report will be automatically approved.

5. Management and Implementation Documents

This Section describes the deliverable documents that will be submitted to PADEP over the planning and implementation phases of the SCARP. A project schedule for the investigation and planning phase of the program is shown in Figure 5-1.

5.1. Program Management Plan - Investigation Phase

5.1.1. Purpose

The management plan for the investigative phase will be developed following finalization of the Program Approach Outline and execution of the MOU. One common management plan for all Partners will be developed for the investigation phase of the program which includes the activities described in Section 3.2 through 3.7. The purpose of the Program Management Plan developed for the investigative phase of the project will be to define, coordinate, and manage the SCARP efforts of each WLSP.

5.1.2. Components

For the investigative phase of the SCARP program, it is envisioned that one common Program Management Plan will be developed for all Partners. The Program Management Plan will include:

Introduction and Purpose – Description of the Partners, system components, and the MOU. Also included will be definition of program drivers, problem definition(s), primary objectives, and secondary objectives.

Administration and Management Plan – Description of how the Partners will work together to complete the investigation phase of the SCARP. The plan will include definition of roles and responsibilities of each WLSP, resource allocation, identification of written agreements between Partners, and description of reporting requirements. During the investigative phase, a benefit of developing one program for all Partners is that each WLSP will be committing fewer resources than if implementing individual programs. The strength of each WLSP with respect to management, administration, operations, and engineering will be considered when assigning resources from each WLSP to the program.

Financial Plan – The estimated budget for the investigative phase of the program will be identified. As the program progresses, the budget will be periodically revised to reflect changing conditions and a greater understanding of program requirements. The management plan will also identify the financial obligations of each WLSP including definition of program budgets, financial obligations of each WLSP, and description of methodologies for managing budget change.

Risk Management Plan – Throughout the investigative and implementation phases of the program, a risk register will be maintained and revised as necessary to identify project risks that could impede the achievement of the program objectives. The risk register will also include identification of program risks and mitigation strategies.

Schedule – An overall program schedule will be developed and used to monitor program progress.

Reporting Requirements **-** Throughout the investigative and implementation phases of the program, periodic progress reports will be distributed to the Partners and an Annual Report to PADEP. Report templates will be developed to maintain consistency of content.

Public Relations – Throughout the investigative and implementation phases of the program, plans for obtaining and maintaining public support for the program will be developed. Opportunities for public communications and education include program websites, community fliers, and newspaper articles.

5.1.3. Sequence and Schedule

Development of the Program Management Plan – Investigative phase will begin in the fourth quarter of 2009. A draft of the plan will be submitted to PADEP in the first quarter of 2010 for information purposes and comment only; as this is largely an internal workplan, no acceptance or approval from PADEP will be required. Critical to completion of the management plan will be execution of the MOU and agreements between the Partners defining fiscal responsibility.

5.2. Program Objectives Evaluation

5.2.1. Purpose

This document will define current system performance and begin to assess what it might take to achieve various preliminarily considered objectives. In the event it is determined that the current system performance cannot meet the current desired level of performance, the preliminary objectives will be revised and the improvements to meet the revised objectives in both the near and long-term will be identified.

5.2.2. Components

The deliverable for the Program Objectives Evaluation will contain the following Sections:

Flow Evaluation and I/I Removal Potential - Presentation of the flow data, discussion of model development and calibration, and findings with respect to base flows, wet weather flows, locations of hydraulic restrictions, quantification of the baseline and seasonal infiltration rates for each catchment, identification of the types and amounts of I/I for each catchment.

SSES Prioritization – The catchments will be prioritized based on the amount of I/I entering the system. The activities to be included in each catchment's SSES Workplan will be identified.

Dynamic Modeling – A description of the model including its framework, development, and calibration will be provided.

Current Level of Service – The level of service for each catchment and for the groupings described in Section 3.4 will be established.

Current System Sizing Requirements – Development of alternatives for providing necessary relief of any area identified as capacity limited under existing conditions.

Future Development – Hydraulic Demands and Conveyance Sizing – Future 2040 growth projections, hydraulic loads, and capacity requirements will be calculated. An assessment of the potential improvements necessary to provide adequate future capacity will be performed.

5.2.3. Sequence and Schedule

The 2009 Comprehensive Flow Study is currently in progress with scheduled completion in the fourth quarter of 2009. Collection of accurate data during wet weather periods of differing intensities, durations, and frequencies will be critical to accurate hydraulic model calibration. The hydraulic model will be calibrated using the 2009 data in the 2010. Current level of service, current system flow sizing requirements, and sizing for future flow demands will be defined by the end of 2010.

5.3. SSES Workplan

5.3.1. Purpose

The SSES Workplan will describe the actual SSES activities (as described in Section 3) to be performed in each catchment.

5.3.2. Components

Workplans will be developed for selected catchment based on the recommendations provided at the conclusion of Program Objectives Evaluation. It is anticipated that a single workplan will be developed to encompass all catchments. For each catchment included in the SSES, the SSES Workplan will contain the following Sections:

Hydraulic Condition Assessment – Description of the scope of activities to be performed including but not limited to smoke testing, night-time weiring, above-grade stormwater observations, and basement inspections.

Physical Condition Assessment – Description of the scope of activities to be performed including but not limited to manhole and CCTV inspection. The information collected during this assessment will be used to collect information necessary for the design of the rehabilitation strategy to be implemented.

Standard Procedures and Protocols – Written procedures to be used for all activities will be prepared. Procedures will be prepared for the planning, data collection, and analysis phase for each SSES activity. Standard tools will be developed for all activities including procedures for collecting information, inspection forms, data bases, and interfaces will be developed to ensure that all Partners are performing and documenting the SSES activities in a consistent, efficient, and effective manner.

Cost Estimate – Detailed cost estimates for SSES activities for each catchment will be presented.

Schedule – Detailed schedule for performing hydraulic and physical condition assessment activities. Included in the schedule will be tasks for review and analysis of SSES data.

5.3.3. Sequence and Schedule

The comprehensive SSES Workplan will be completed for Spring 2010. All SSES activities will be completed within two years of approval of the SSES Workplan by PADEP. Critical to the success of SSES Workplan development and implementation will be coordination and consistent data collection, evaluation, and storage between the Partners and SSES engineers and contractors.

5.4. Program Improvements Planning

5.4.1. Purpose

The Program Improvements Planning phase of the SCARP will identify the rehabilitation needs, replacement needs, expansion requirements, costs of improvements, and schedule for implementing a program to achieve the SCARP objectives within the desired level of service.

5.4.2. Components

The Program Improvements Plan will consist of two documents; the Capital Improvement Plan and the Long-term Asset Management Plan. The anticipated sections to be included in each plan are summarized below:

1. Capital Improvement Plan

    a. **Objectives** – In addition to the SCARP objectives, additional objectives will be developed that address administration, operations, financial, engineering, and information technology.

    b. **Prioritization of Recommended Improvements** – The recommended improvements developed as described in Section 3 will be grouped into projects and prioritized.

    c. **Cost Analysis** – The capital and life cycle costs for the prioritized projects will be developed.

    d. **Implementation Schedule** – The prioritized projects will be scheduled for implementation based on available funding.

    e. **Impact on Sewer Rate Structure** – The impact of the cost analysis and implementation schedule on the existing sewer rate structure will be evaluated. Sewer rates necessary to fund the recommended improvements will be calculated and the existing sewer rate structure will be adjusted as necessary.

2. Long-term Asset Management Plan

    a. **Objectives** – In addition to the SCARP objectives, additional objectives will be developed that address administration, operations, financial, engineering, and information technology.

    b. **Administration and Management** – Definition of authorship responsibilities for the required standard policies and procedures.

    c. **Standard Procedures** – Written Standard policies, procedures, and programs for the Engineering, Management, and Operations and Maintenance groups within each WLSP.

    d. **Implementation Schedule** – Schedule for developing the policies and procedures, review of existing policies and procedures, and overall implementation of the Long-term Asset Management Plan.

5.4.3. Sequence and Schedule

The Capital Improvement Plan and Long-term Asset Management Plan will be completed by Summer 2012. Critical to development of the Capital Improvement Plan will be the Long-term Asset Management Plan. In addition to the improvements required for the collection system, the asset management plan will identify other improvement needs that encompass the entire organization including information technology, administration, and operations. All of these improvement needs must be addressed by the Capital Improvement Plan.

5.5. Program Management Plan - Implementation Phase

5.5.1. Purpose

A management plan for the implementation of the Capital Improvements and Long-Term Asset Management Plan will be developed by each LCP simultaneous to the Program Improvements Planning steps described in Section 3.12. While each Partners will develop their own plan, many elements of the plan will be developed jointly with the other Partners as appropriate. The purpose of the Program Management Plan developed for the implementation phase of the project will be to define, coordinate, and manage the SCARP efforts of each WLSP.

5.5.2. Components

For the implementation phase of the SCARP program, it is envisioned that one common Program Management Plan will be developed for all Partners. The Program Management Plan will include the following sections:

Introduction and Purpose – Description of the Partners, system components, and the amended MOU. Also included will be definition of program drivers, problem definition(s), primary objectives, and secondary objectives.

Administration and Management Plan – Description of how the Partners will work together to complete the implementation phase of the SCARP. The plan will include definition of roles and responsibilities of each WLSP, resource allocation, identification of written agreements between Partners, and description of reporting requirements. A breakdown of the responsibilities with respect to authoring the policies and procedures defined in Section 3.12.4 will also be provided.

Financial Plan – The estimated budget for the implementation phase of the program will be identified. As the program progresses, the budget will be periodically revised to reflect changing conditions and a greater understanding of program requirements. The management plan will also identify the financial obligations of each WLSP including definition of program budgets, and description of methodologies for managing budget change.

Risk Management Plan – Throughout the implementation phases of the program, a risk register will be maintained and revised as necessary to identify project risks that could impede the achievement of the program objectives. The risk register will also include identification of program risks and mitigation strategies.

Schedule – An overall program schedule will be developed and used to monitor program progress.

Reporting Requirements **-** Throughout the implementation phases of the program, periodic progress reports will be distributed to the Partners and an Annual Report to PADEP. Report templates will be developed to maintain consistency of content.

Client Relations – Throughout the implementation phases of the program, plans for obtaining and maintaining public support for the program will be developed. Opportunities for public communications and education include program websites, community fliers, and newspaper articles.

5.5.3. Sequence and Schedule

The Management Plan for the implementation phase will be developed in conjunction with the CIP and Long-term Asset Management Plan and will be maintained for the duration of the SCARP program.

5.6. Annual Reports

5.6.1. Purpose

The Annual Reports will provide PADEP and Partners a way to monitor SCARP progress and effectiveness.

5.6.2. Components

The Annual Report will include the following components:

Performance Measures Summary – Summary of the success of the signatory parties with respect to the metrics established for each performance measure. This section will also include descriptions of new/revised performance measures, associated metrics, scores, and strategies to improve success.

Improvements Summary – Summary of the improvements implemented throughout the year. A project description including scope, schedule and budget will be included for each completed and on-going project summary. The improvements described in this section will include projects described in the Capital Improvements Plan as well as those described in the Asset Management Plan.

Implementation Schedule – A schedule will be prepared which illustrates projects and programs planned for continuation, initiation, or completion in the upcoming year. The schedule will include anticipated start dates, durations, and project/program dependencies.

Rehabilitation Effectiveness – For all completed rehabilitation or replacement projects designed to eliminate I/I, an estimate of the volume of I/I eliminated will be provided.

Redevelopment Flow Credits – Based on the effectiveness of rehabilitation as documented above, a summary of the flow credits calculated in accordance with the method described in Section 4 and with the semiannual reports provided under Section 4.3 will be provided.

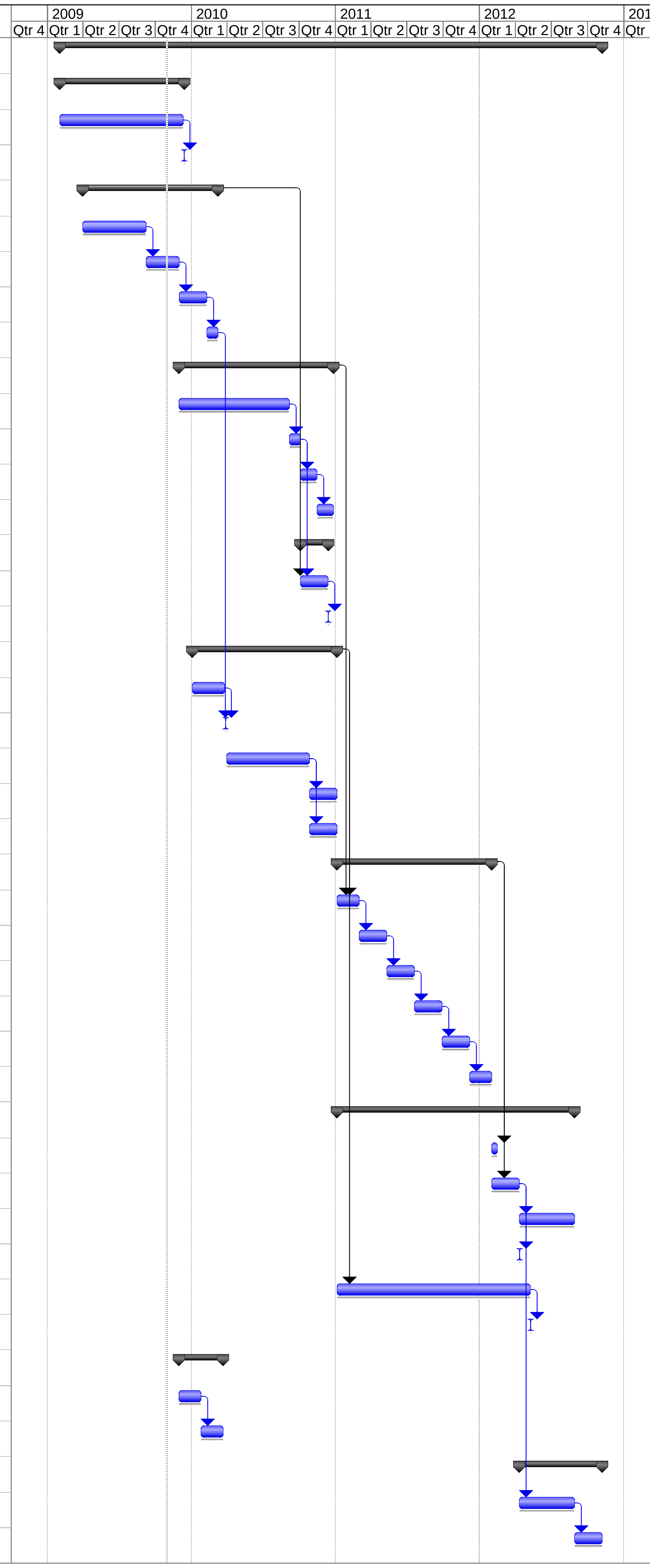
5.6.3. Sequence and Schedule

Annual Reports will be submitted to PADEP by March 31st of each year, with the first report due March 31, 2011.

Figure 5-1 Planning Phase Schedule

Figure 5-1 Planning Phase Schedule

ID	Task Name
1	**SCARP**
2	**SCARP Program Approach Outline**
3	SCARP Program Approach Outline Development
4	SCARP Program Approach Outline Submission
5	**Flow Assessment**
6	Flow Metering Field Work
7	Flow Data Compilation
8	I&I Removal Potential Evaluation
9	SSES Prioritizations
10	**System Modeling**
11	Model Development and Calibration
12	Current Level of Service Assessment
13	Current System Sizing Requirements
14	Hydraulic Demands/Sizing for Future Development
15	**Preliminary Objectives Evaluation**
16	Preliminary Objectives Evaluation
17	Preliminary Objectives Evaluation Report Submission
18	**SSES**
19	SSES Workplans Development
20	SSES Workplan Submission
21	SSES Field Activities
22	Prioritization of Public Sewers
23	Identification of Private Leakage Sources
24	**Alternative Analysis**
25	Identification of Storage, Conveyance, and Source Reduction Options
26	Modeling of Options
27	Cost Evaluation of Options
28	Development and Costing of Alternatives
29	Alternatives Evaluations
30	Objectives Reevaluation
31	**Program Improvements Planning**
32	Level of Service Goals and Key Performance Indicators Finalizations
33	Draft Capital Improvements Plan, Schedule, and Cash Flow
34	Financial Wherewithal Analysis and Rate Planning
35	Captial Improvements Plan Submission
36	Long-term Asset Management Plan Development
37	Long-term Asset Management Plan Submission
38	**Program Management Plan - Investigation Phase**
39	Develop PMP-Investigation Phase
40	MOU- Investigation Phase
41	**Program Management Plan - Implementation Phase**
42	Develop PMP-Implementation Phase
43	MOU- Implementation Phase



APPENDIX A

Malcolm Pirnie Memo, dated ______, entitled FEB Memo

MALCOLM PIRNIE

Technical Memorandum

Date: July 22, 2009

To: Mike Barron, Lehigh County Authority

Copy: Craig Murray

From: Eric Harold, William Barrack, Carolina Gonzalez

Re: Phase 1 Modeling Impacts and Alternatives Analysis

Executive Summary

This memorandum presents the results of the dynamic modeling analysis that was performed to address the three primary issues listed below:

1. Effect of Coca-Cola Discharge on Western Lehigh Interceptor/Little Lehigh Relief (WLI/LLR)
2. Effect of Proposed Iron Run Pump Station (IRPS) on WLI/LLR and Park Pump Station (Park PS)
3. Effect of Proposed Flow Equalization Basin (FEB) on WLI/LLR and Park PS

The Phase 1 model of the LCA sewer system represents a planning-level model that was developed using the best available information as of Spring 2009, and calibrated to Spring 2005 conditions. The purpose of this sewer system model is to establish a solid, consistent analysis tool to support the Authority in planning level capacity analyses, to assess the efficacy of proposed capital improvements, and to provide a tool capable of predicting sewer system responses to a given discrete hydrologic event (single storm).

Once the model was calibrated to Spring 2005 flow and depth data, the model was updated as described in Section 2 of this memo, and then evaluated under dry weather conditions (Coca-Cola discharge analysis only) and wet weather conditions (Coca-Cola discharge, IRPS, and FEB analyses). For wet weather analysis, both a 2-year storm (rainfall event recorded on March 27, 2005) and a 5-year 24-hour synthetic design storm event were used.

The analysis revealed that the WLI/LLR system has very limited dry weather capacity issues and the addition of Coca-Cola flow does not create any dry weather capacity concerns. The wet weather simulation for the 2-year event (March 27, 2005) indicated no overflows at the Park PS. Wet weather simulations for the 5-year 24-hour synthetic storm indicated flow reaching or exceeding theoretical pipe capacities throughout the modeled network as well as potential flooding near the Park PS.

Table 1 summarizes the projected flooding near the Park PS during the 5-year 24-hour synthetic storm for all four scenarios. Based on the results presented in this table and on the figures presented in Section 3, the following conclusions were made:

Table 1
Summary of Park PS Overflows for All Modeled Scenarios
5-Year 24-Hour Synthetic Storm

	Existing Conditions	With Additional Coca-Cola Discharge	IRPS Analysis	FEB Analysis
Overflow Near Park PS (MGal)	0.5	0.5	1.0	0.5
Percent Change: Overflow Volume Near Park PS[1]	NA	0.0%	100.0%	0.0%

[1] Change in Park PS overflow volume for IRPS and FEB scenarios is with respect to "With Additional Coca-Cola Discharge" volumes.

1. LCA System Performance During Wet Weather:

   After reviewing LCA documentation for the period 1997 through 2005, it was determined that while overflows were reported at manholes near Park PS, they occurred infrequently and in nearly all cases due to flows resulting from storms at or greater than a 5-year return period. This observation was confirmed by running the LCA model for the recorded 2-year storm event (March 27, 2005), which revealed no predicted overflows near the Park PS.

2. Effect of Coca-Cola Discharge on WLI/LLR:

   As expected, during dry weather conditions, the additional discharge (172,500 gpd) from Coca-Cola has very little effect on the available dry weather capacity. For wet weather conditions (5-year 24-hour synthetic storm), the increased flow from Coca-Cola has a negligible impact on projected overflow volumes near Park PS.

3. Effect of Proposed IRPS on WLI/LLR and Park PS:

   While the IRPS will improve conditions along the WLI between the PTP and Keck's Bridge, the discharge flow from the pump station is projected to increase the flows in the LLR and the parallel Allentown sewer down to Park PS. This increases the overflows near the Park PS.

4. Effect of Proposed FEB on WLI/LLR and Park PS:

   Model results indicate that this option will significantly reduce flow in the downstream system during storm events. For the 5-year 24-hour synthetic storm, and predicted Park PS overflow volumes will be reduced by 4 percent. The volume diverted for the recorded 2-year storm (March 27, 2005), assuming the discharge downstream of the pre-treatment plant was limited to 3.5 MGD, was approximately 2.3 million gallons. This confirmed the planned 3 million gallon sizing of the FEB.

1.0 Introduction

This document summarizes the results of the Phase 1 model analysis. Please note that all figures not embedded directly in this document are included at the end of the memorandum. Model development, calibration, and quality assurance procedures were documented in technical memorandum *Phase 1 Model Development and Calibration Procedures* submitted to LCA May 11, 2009. Model calibration results were presented in technical memorandum *Phase 1 Model Calibration Results* submitted to LCA June 11, 2009. This memorandum presents the results of the analysis to address the three primary issues listed below:

1. Effect of Coca-Cola Discharge on Western Lehigh Interceptor/Little Lehigh Relief (WLI/LLR)
2. Effect of Proposed Iron Run Pump Station (IRPS) on WLI/LLR and Park Pump Station (Park PS)
3. Effect of Proposed Flow Equalization Basin (FEB) on WLI/LLR and Park PS

The Phase 1 model of the LCA sewer system represents a planning-level model that was developed using the best available information as of Spring 2009, and calibrated to Spring 2005 conditions. The purpose of this sewer system model is to establish a solid, consistent analysis tool to support the Authority in planning level capacity analyses, to assess the efficacy of proposed capital improvements, and to provide a tool capable of predicting sewer system responses to a given hydrologic event (single storm).

While the LCA Phase 1 model meets these objectives, there are the following limitations that the Authority should be aware of as it continues to update and apply the model:

- The model was developed to meet master planning level goals and objectives, which provides a system-wide overview of performance, not a design-level analysis.
- The model calibration parameters, and therefore any projected design storm flows, have greater uncertainty in areas that were not directly metered (e.g., near the Park PS). Any recommendations resulting from this model can be more specific in locations that have more calibration data (i.e., the larger pump stations or the larger downstream trunk sewers).

While these accuracy limitations are unavoidable, the model still represents the best available tool to adequately represent complex system interactions for facilities planning purposes.

The anticipated Phase 2 model development would expand the model to include all sewers 10-inches and greater, extend into the signatory communities, and include a portion of the system between Park PS and Kline Island WWTP to further evaluate City of Allentown effects on Park PS. This model would include more detailed calibration using data from up to 40 flow meters from Spring – Summer 2009 and nearly 14 rain gauges. This expanded model will provide LCA an extremely useful tool to conduct system-wide planning and analysis of available capacity, assess wet weather management strategies and evaluate proposed inflow and infiltration (I/I) mitigation measures.

2.0 LCA Phase 1 Baseline Model Development

This section briefly summarizes the model development and calibration methodology and goals, describes the computer software used and explains model and data limitations.

2.1 Spring Creek Force Main

The Phase 1 model is a skeletal representation of the main Western Lehigh Interceptor (WLI) and the Little Lehigh Relief (LLR) Sewer down to the Park PS. Existing pump stations that were explicitly modeled are the Spring Creek and Park Pump Stations. The existing conditions model, calibrated to 2005 conditions, has the original Spring Creek force main connection upstream of Keck's Bridge (meter L-3). During Spring 2005 the force main was reconstructed to connect to the Little Lehigh Relief Sewer downstream of Keck's Bridge. This connection became active in August 2005. Figure 1 shows the updated baseline Phase 1 model extents including the location of the modeled pump stations, the original Spring Creek force main connection and the new force main connection.

2.2 2009 Baseflows

The Phase 1 model was calibrated to 2005 conditions, and applied water consumption data to develop base wastewater conditions. Model evaluations for this analysis were conducted on 2009 conditions. Generally, adjustments to base wastewater flows would be warranted to account for increased growth and changes in industrial activity between 2005 and 2009. Before making adjustments, model dry weather flows were compared to 2009 metering data for dry weather conditions at several key locations along the interceptor (LCA-23 near the PTP, ALN-80 and ALN-81 near Park PS). Comparison of model dry weather flows to monitored dry weather flows at those locations showed very good correlation, and in the case of meters ALN-80/ALN-81 modeled dry weather flows were slightly higher than recorded dry weather flows in Spring of 2009. Therefore, no changes to modeled dry weather flows were made.

2.3 Boundary Conditions

The Phase 1 calibration model did not include any boundary conditions downstream of the Park PS. The effect of the City of Allentown system near the Park PS as well as at the Park PS force main discharge point was modeled for calibration purposes as a free outfall. The locations of the five meters available for calibration in relation to these points are sufficiently upstream (over five miles from the most downstream calibration point L-3 to the Park PS) that any affect of the City of Allentown system downstream of Park PS can be ignored.

For system analysis, however, the influence of the Allentown system downstream of Park PS on the Park PS and potential overflows in that area needs to be accounted for. To do this, City of Allentown flow monitoring data was evaluated to develop a suitable boundary condition near the Park PS connection point. Data from meter ALN-U613 for the period March through May 2009 were reviewed and a boundary condition level was chosen to approximate downstream Allentown system effects on the Park PS. This boundary condition was applied as a fixed level at the model outfall just downstream of Park PS, and therefore is not suitable for a complete assessment of the impact of the City of Allentown system on the Park PS. The full ramifications of this and the influence of the City of Allentown system on the Park PS will be better understood in the Phase 2 expanded model of the LCA system.

3.0 Model Evaluation of Coca-Cola Discharge, IRPS and FEB

After the Phase 1 model of LCA's wastewater collection system was developed, it was calibrated to match model-predicted responses to in-system meter data collected during the Spring 2005 monitoring period. The model was further checked against historical daily influent flow records for the same period at the Pre-treatment Plant (PTP) as well as dry weather flows collected in the system during Spring 2009. The purpose of calibrating the model was to ensure that it can be used for analysis of existing system capacity around the proposed Coca-Cola discharge as well as for analyzing the affects of the proposed FEB and IRPS on the Park PS. Using rainfall data collected in the Spring 2005 period, the sewer system model was calibrated to flow and depth data collected during the same period. The model was calibrated to meet industry-standard guidelines (see memo *Phase 1 Model Calibration Results*, June 11, 2009).

Once the calibration was completed, the model was updated as described in Section 2 of this memo, and then evaluated under dry weather conditions (Coca-Cola discharge analysis only) and wet weather conditions (Coca-Cola discharge, IRPS, and FEB analyses). For wet weather analysis, a 5-year 24-hour synthetic storm event was applied. Since a 2-year event does not cause overflows at Park PS, the 5-year storm allows for a better analysis of the impacts of the IRPS and FEB.

3.1 Evaluation of Coca-Cola Discharge

Based on information provided by LCA, the Phase 1 model was evaluated to assess the impact of an expected 172,500 gpd discharge from the Coca-Cola plant. Since the specific location within the LCA system to which Coca-Cola discharges was not included in the Phase 1 model, this flow was loaded at the PTP. Further, the 172,500 gpd was applied as a constant flow over the entire day. The potential effects of this discharge were analyzed for the following conditions:

a. Existing (2009) conditions, without Coca-Cola flow
b. Existing (2009) conditions, with Coca-Cola flow
c. Dry weather flow analysis for both conditions above
d. Wet weather flow analysis for both conditions above

The following figures summarize the projected affects of the Coca-Cola discharge on the WLI/LLR system:

- **Figure 2 through Figure 5:** Thematic maps summarizing projected *dry weather depth ratio* as assessed by the peak depth to pipe diameter ratio (Figures 2 and 4) and pipe capacity as assessed using the peak DWF / pipe capacity ratio (Figure 3 and Figure 5) for existing conditions and with the additional 172,500 gpd Coca-Cola discharge. These maps show the following information:

Parameter	Map Coding	Parameter Value
Pipe Depth Ratio: Measured by Peak Depth to Pipe Diameter Ratio	Green Yellow Red	< 0.5 0.5 to 0.9 > 0.9
Pipe Capacity: Measured by Peak Flow to Pipe Capacity Ratio	Green Yellow Red	< 0.5 0.5 to 0.9 > 0.9

- **Figure 6 and Figure 7:** These figures present thematic maps that summarize results of the 5-year 24-hour synthetic storm for existing conditions (Figure 6) and with the additional Coca-Cola discharge (Figure 7). The maps show the following information:

Parameter	Map Coding	Parameter Value
Model predicted pipe status	Green Yellow Red	Pipe peak flow less than capacity Backwater Insufficient Capacity

Figures 2 through 5 indicate that the additional Coca-Cola discharge will have little impact on available dry weather capacity. Overall, more than 60 percent of the modeled network has less than 50 percent of the pipe capacity utilized during dry weather under both existing conditions and with the additional Coca-Cola discharge. Less than 6 percent of the system is predicted to have dry weather flows exceed 90% of the theoretical pipe capacity. Maximum flow depth compared to pipe diameter under dry weather conditions, however, appears a bit more extensive than the pipe capacity utilization would indicate. Almost 20 percent of the modeled system has a dry weather peak depth to pipe diameter ratio of greater than 0.9, and the addition of the Coca-Cola discharge increases this slightly.

A comparison of Figure 6 and Figure 7 also indicates that the addition of the Coca-Cola discharge may slightly increase the amount of predicted surcharge within the modeled WLI/LLR system. However, this does not translate into a noticeable increase in overflow volume at the Park PS.

3.2 Evaluation of Iron Run Pump Station (IRPS)

The Phase 1 baseline model was evaluated to assess the effect of the IRPS on the system operation during wet weather conditions. For this analysis, the Coca-Cola discharge (172,500 gpd) was included. To model the operation of the IRPS, a pump station was added to the model downstream of the PTP. The pump curves were applied assuming maximum pump speed/capacity. The IRPS was modeled discharging to the existing force main from the Spring Creek PS. Further, flow was limited downstream of the IRPS to 3.5 MGD. Figure 8 summarizes the results of the 5-year 24-hour synthetic storm for existing conditions with the additional Coca-Cola discharge and the IRPS. These results should be compared to Figure 7. The maps show the following information:

Parameter	Map Coding	Parameter Value
Model predicted pipe status	Green Yellow Red	Pipe peak flow less than capacity Backwater Insufficient Capacity

As shown on Figure 8, the inclusion of the IRPS greatly reduces the projected capacity issues by reducing flow between the PTP and the Iron Run & Spring Creek Force Main discharge point. However, flooding near the Park PS is projected to increase by approximately 100 percent, a result of the IRPS manifolding with the Spring Creek PS and subsequently discharging in the LLR upstream of the Park PS.

3.3 Evaluation of Flow Equalization Basin (FEB)

The Phase 1 baseline model was evaluated to assess the effect of the IRPS on the system operation during wet weather conditions. For this analysis, the Coca-Cola discharge (172,500 gpd) was included. To model the operation of the FEB, an outfall pipe was added to the model downstream of the PTP. As with the IRPS, flow was limited downstream of the FEB to 3.5 MGD, and any flow in excess was diverted to the FEB.

This simple configuration allowed for the evaluation of the effect of removing excess flow from the downstream system and for the estimation of required storage volumes. Storage tank dewatering was not modeled in this analysis. Figure 9 summarizes the results of the 5-year 24-hour synthetic storm for existing conditions with the additional Coca-Cola discharge and the FEB. These results should be compared to Figure 7. The maps show the following information:

Parameter	Map Coding	Parameter Value
Model predicted pipe status	Green Yellow Red	Pipe flow less than capacity Backwater Insufficient Capacity

As shown on Figure 9, the inclusion of the FEB greatly reduces the projected capacity issues in the WLI/LLR system by reducing flow in the modeled system downstream of the PTP. In addition, flooding near the Park PS is projected to remain about the same or even less than existing conditions. The predicted volume diverted to the FEB under the 2-year storm event, assuming a limiting discharge of 3.5 MGD, would be approximately 2.3 million gallons.

4.0 Conclusions

The results presented in Section 3 indicate that the WLI/LLR system has very limited dry weather capacity issues. Wet weather simulations for the 5-year 24-hour synthetic storm indicated flow reaching pipe capacity throughout the modeled network and flooding at the Park PS.

Table 2 summarizes the projected flooding near the Park PS for all four scenarios.

Table 2
Summary of Park PS Overflows for All Modeled Scenarios
5-Year 24-Hour Synthetic Storm

	Existing Conditions	With Additional Coca-Cola Discharge	IRPS Analysis	FEB Analysis
Overflow Near Park PS (MGal)	0.5	0.5	1.0	0.5
Percent Change: Overflow Volume Near Park PS[1]	NA	0.0%	100.0%	0.0%

[1] Change in Park PS overflow volume for IRPS and FEB scenarios is with respect to "With Additional Coca-Cola Discharge" volumes.

Figure 10 displays the change in projected model pipe status by percent of total length of modeled pipe for simulated wet weather conditions (5-year 24-hour synthetic storm) for the following three scenarios:

- Existing system with Coca-Cola discharge (blue bar)
- IRPS with Coca-Cola discharge (red bar)
- FEB with Coca-Cola discharge (green bar)

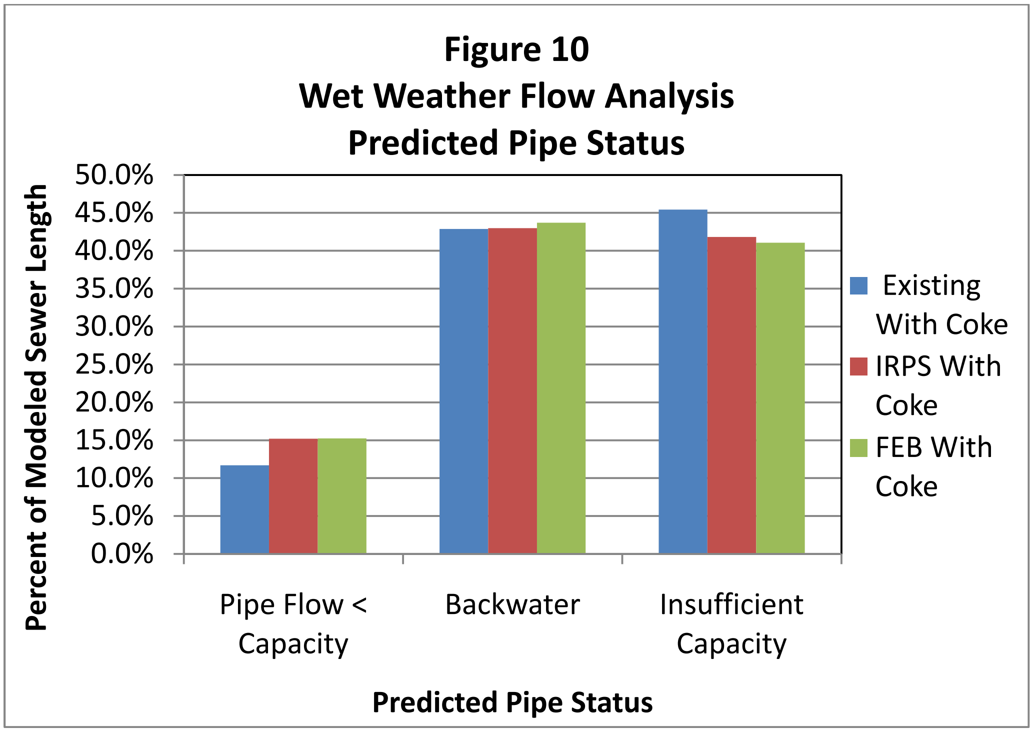
Parameter	Parameter Value
Model predicted pipe status	Pipe flow less than capacity Backwater Insufficient Capacity

As can be seen, both the IRPS and the FEB show a net benefit on overall system operation, by reducing the length of modeled pipe predicted to have insufficient capacity as well as increasing the percent of modeled pipe predicted to be able to convey peak wet weather flows for the 5-year 24-hour storm. The FEB shows the greatest improvement to the overall system capacity.

Based on the results presented on this Table 2, Figure 10, and on the figures presented in Section 3, the following conclusions were made:

1. LCA System Performance During Wet Weather:

   After reviewing LCA documentation for the period 1997 through 2005, it was determined that while overflows were reported at manholes near Park PS, they occurred infrequently and in nearly all cases due to flows resulting from storms at or greater than a 5-year return period. This observation was confirmed by running the LCA model for the recorded 2-year storm event (March 27, 2005), which revealed no predicted overflows near the Park PS.



2. Effect of Coca-Cola Discharge on WLI/LLR:

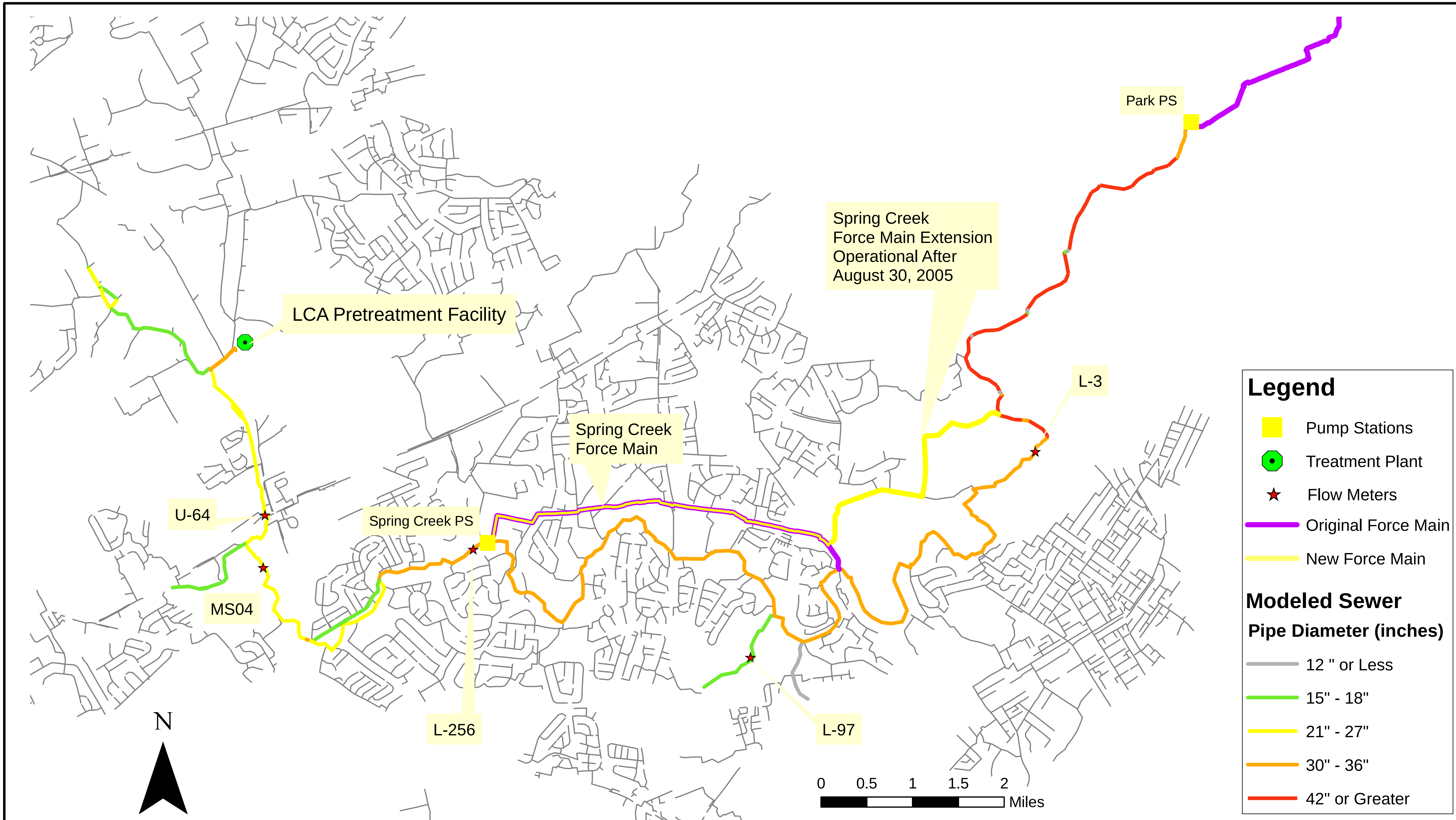
   As expected, during dry weather conditions, the additional discharge (172,500 gpd) from Coca-Cola has very little effect on the available dry weather capacity. For wet weather conditions (5-year 24-hour synthetic storm), the increased flow from Coca-Cola has a negligible impact on projected overflow volumes near Park PS.

3. Effect of Proposed IRPS on WLI/LLR and Park PS:

   While the IRPS will improve conditions along the WLI between the PTP and Keck's Bridge, the discharge flow from the pump station is projected to increase the flows in the LLR and the parallel Allentown sewer down to Park PS. This increases the overflows near the Park PS.

4. Effect of Proposed FEB on WLI/LLR and Park PS:

   Model results indicate that this option will significantly reduce flow in the downstream system during storm events. For the 5-year 24-hour synthetic storm, and predicted Park PS overflow volumes will be reduced by 4 percent. The volume diverted for the recorded 2-year storm (March 27, 2005), assuming the discharge downstream of the pre-treatment plant was limited to 3.5 MGD, was approximately 2.3 million gallons. This confirmed the planned 3 million gallon sizing of the FEB.

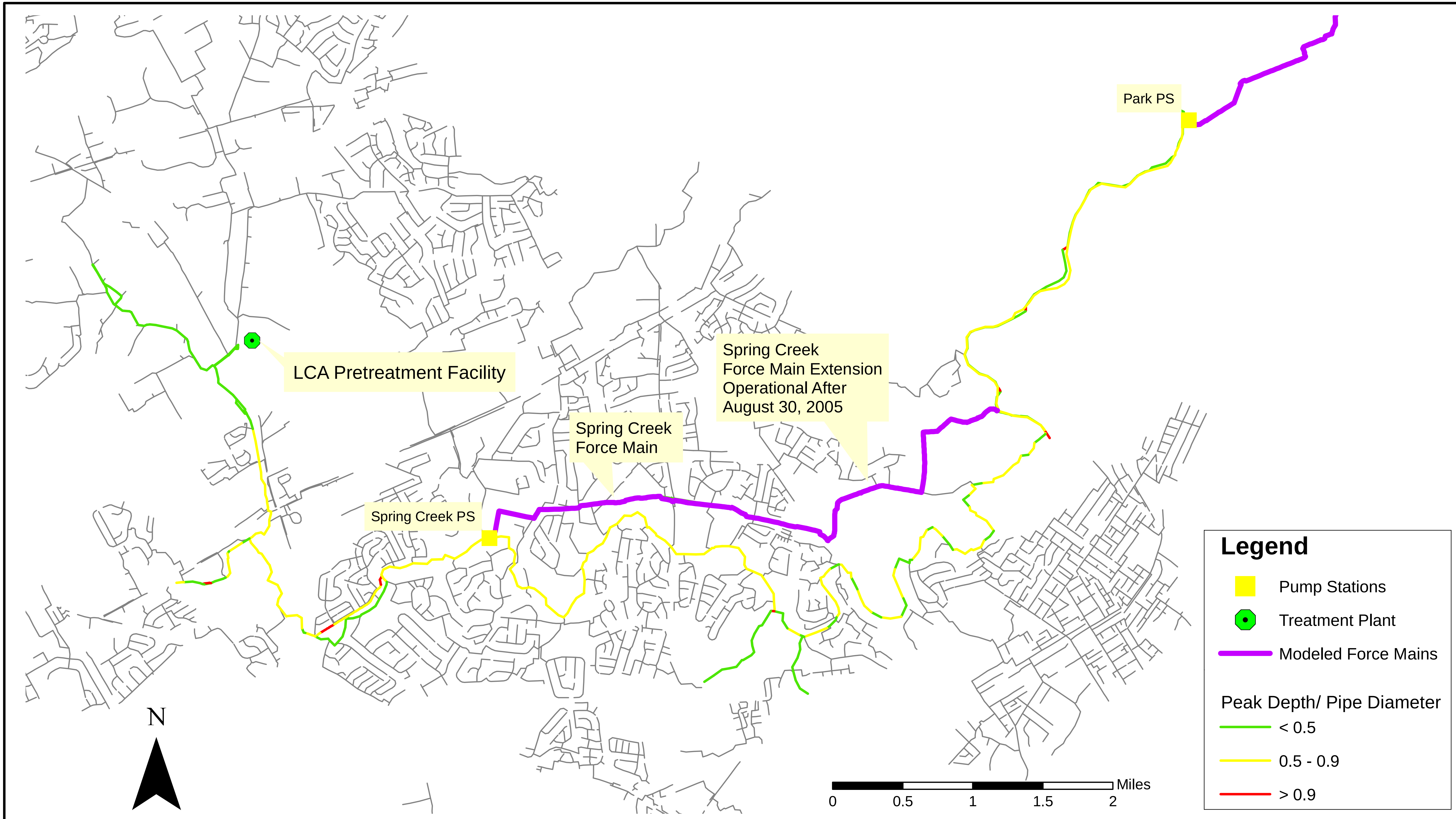


MALCOLM PIRNIE

Western Lehigh Interceptor and Little Lehigh Relief Sewer
Phase 1 Hydraulic/Hydrologic Model and Analysis

Figure 1
Baseline Model System Overview

LEHIGH COUNTY AUTHORITY

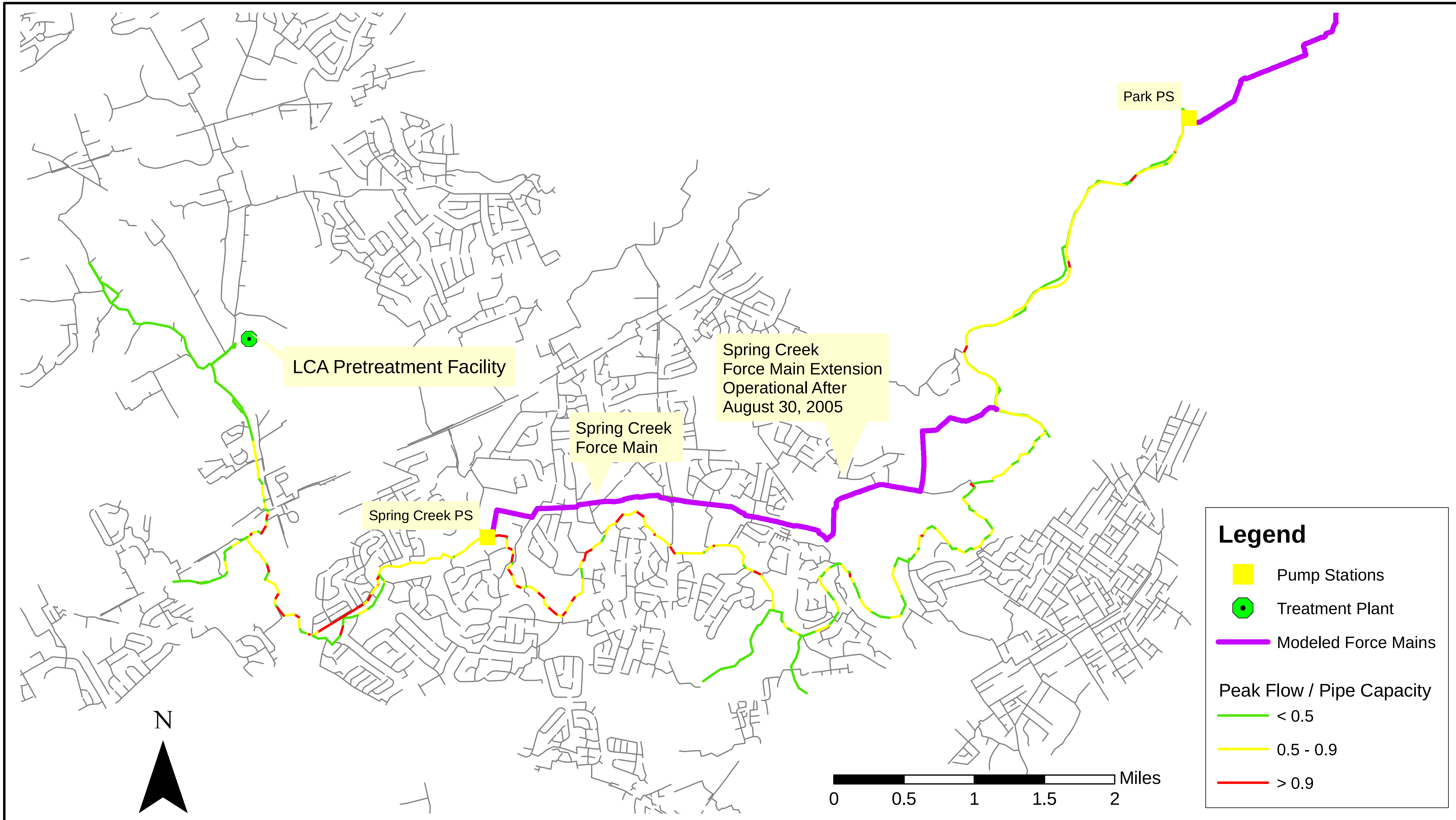


MALCOLM PIRNIE

Western Lehigh Interceptor and Little Lehigh Relief Sewer
Phase 1 Hydraulic/Hydrologic Model and Analysis

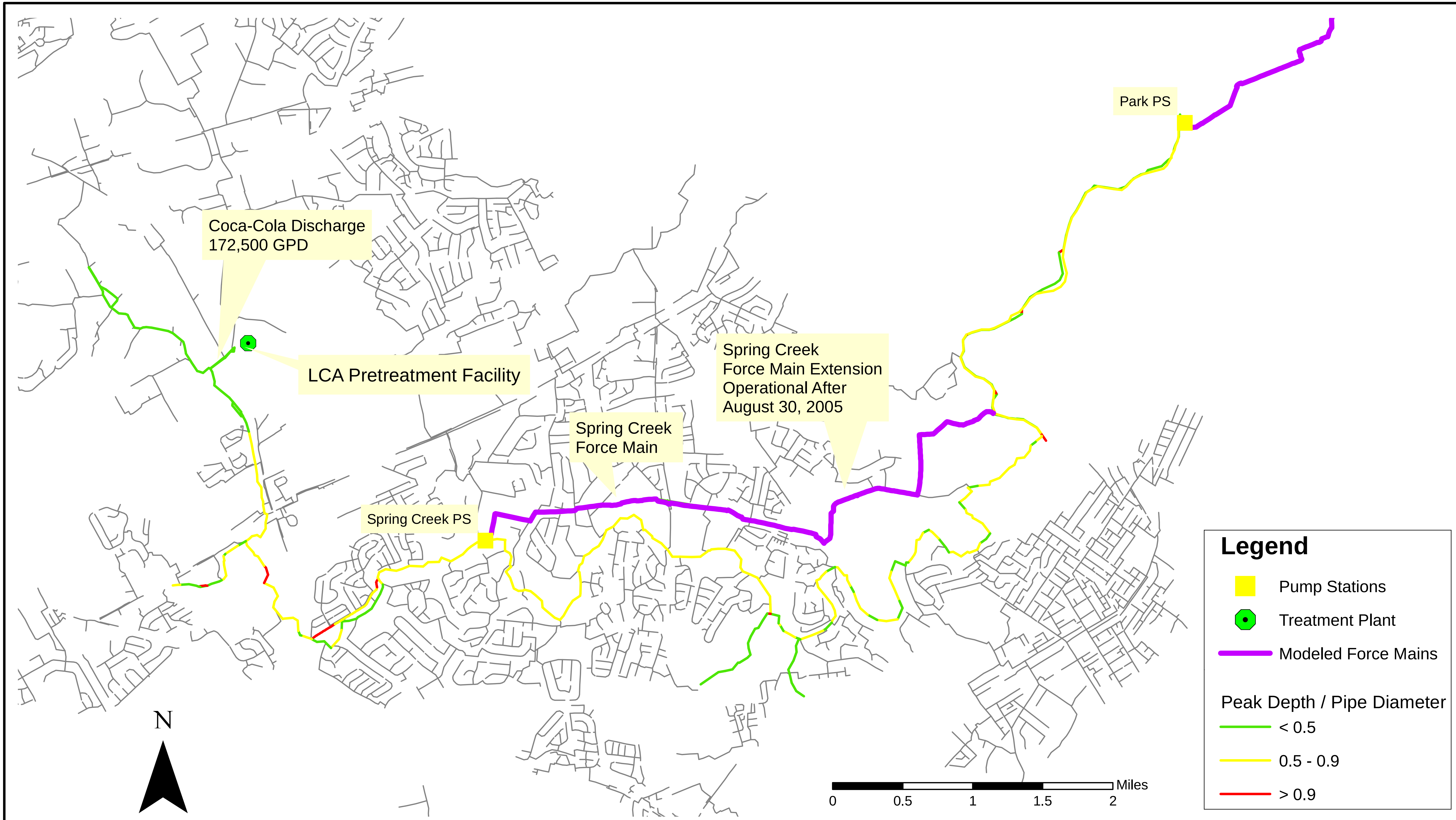
Figure 2
Dry Weather Flow
Pipe Depth Ratio

LEHIGH COUNTY AUTHORITY



Western Lehigh Interceptor and Little Lehigh Relief Sewer
Phase 1 Hydraulic/Hydrologic Model and Analysis

Figure 3
Dry Weather Flow
Peak Flow/ Pipe Capacity Ratio

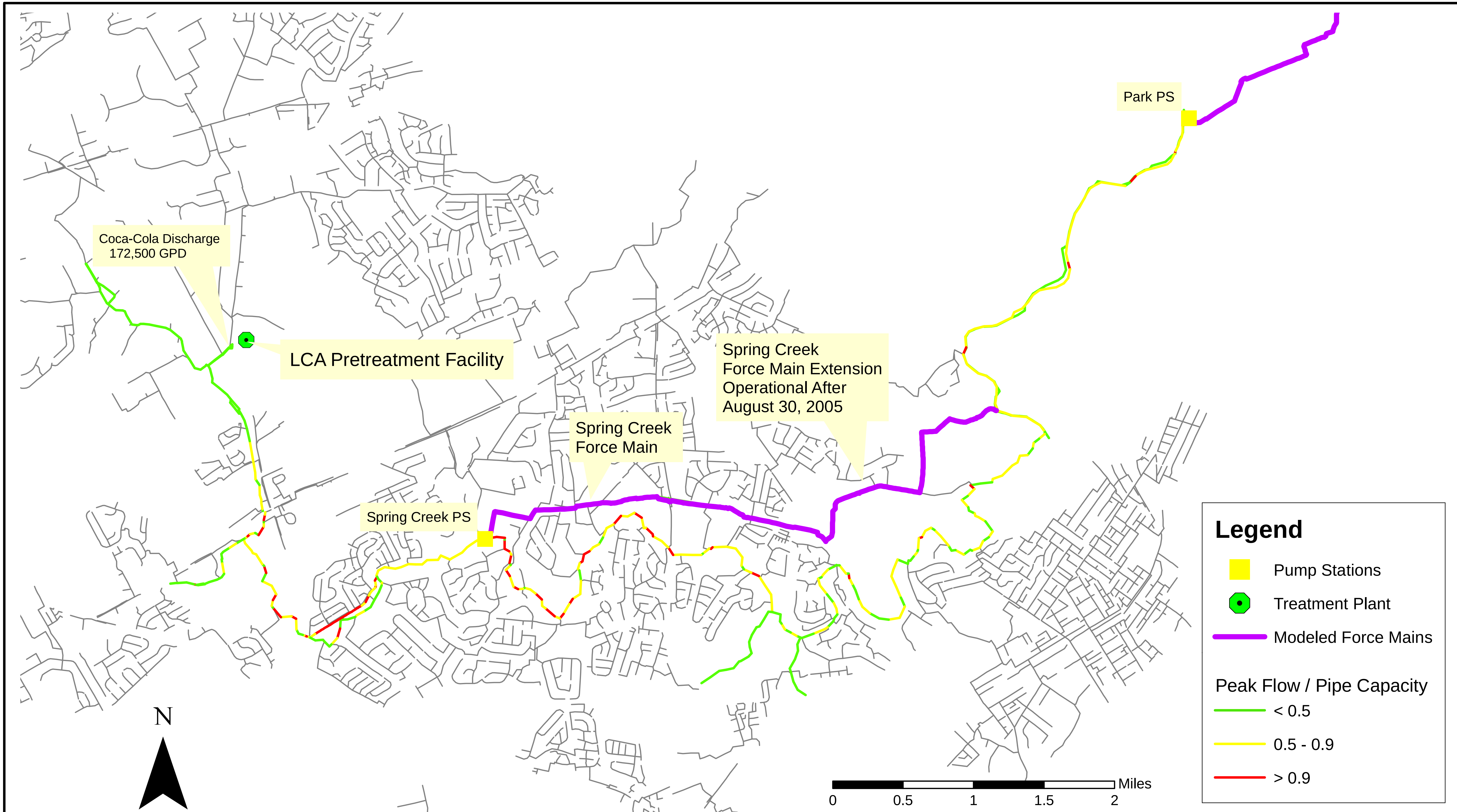


MALCOLM PIRNIE

Western Lehigh Interceptor and Little Lehigh Relief Sewer
Phase 1 Hydraulic/Hydrologic Model and Analysis

Figure 4
Dry Weather Flow
Pipe Depth Ratio with Coca-Cola Flow

LEHIGH COUNTY AUTHORITY

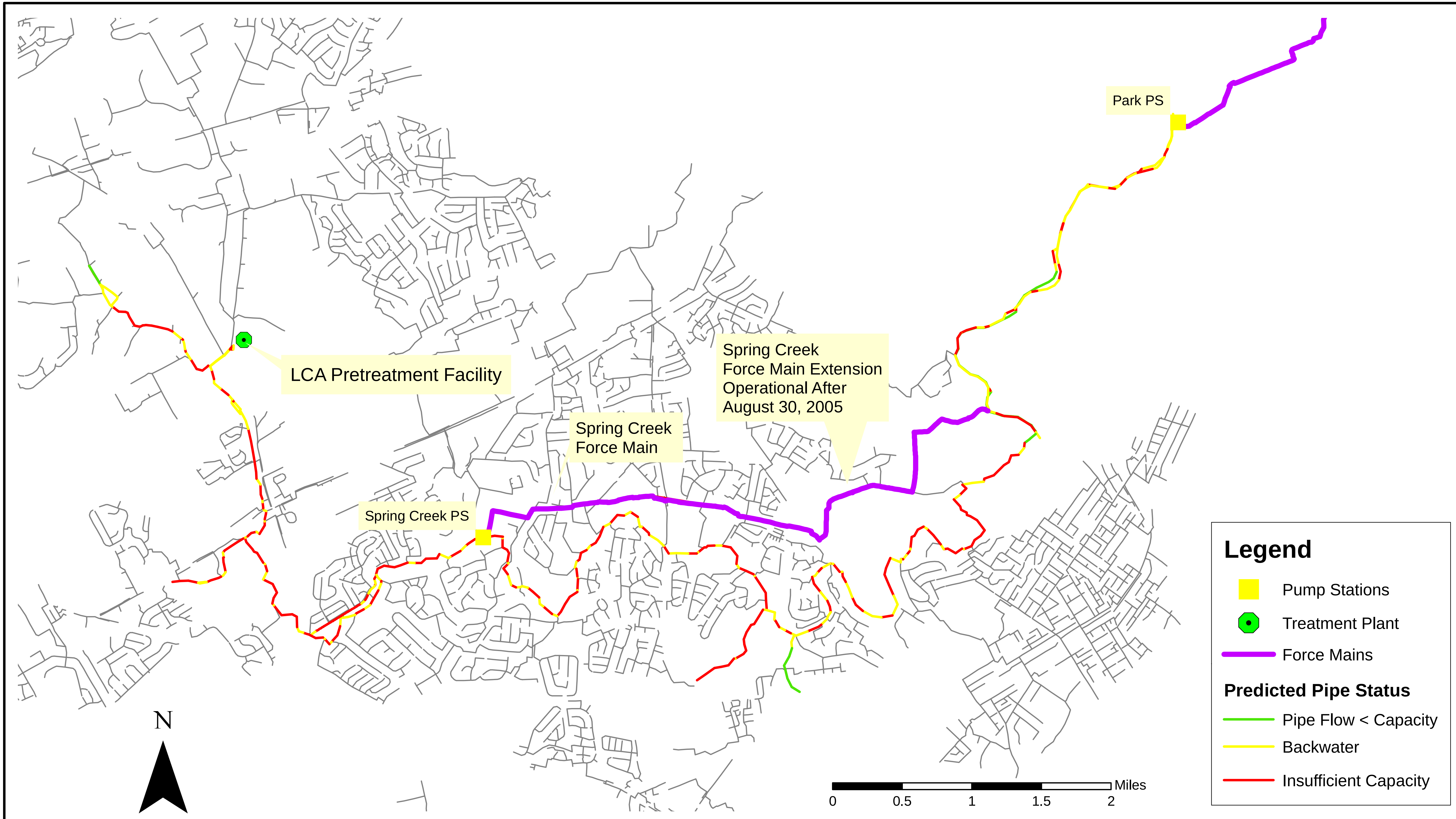


MALCOLM PIRNIE

Western Lehigh Interceptor and Little Lehigh Relief Sewer
Phase 1 Hydraulic/Hydrologic Model and Analysis

Figure 5
Dry Weather Flow
Peak Flow / Pipe Capacity Ratio with Coca-Cola Flow

LEHIGH COUNTY AUTHORITY



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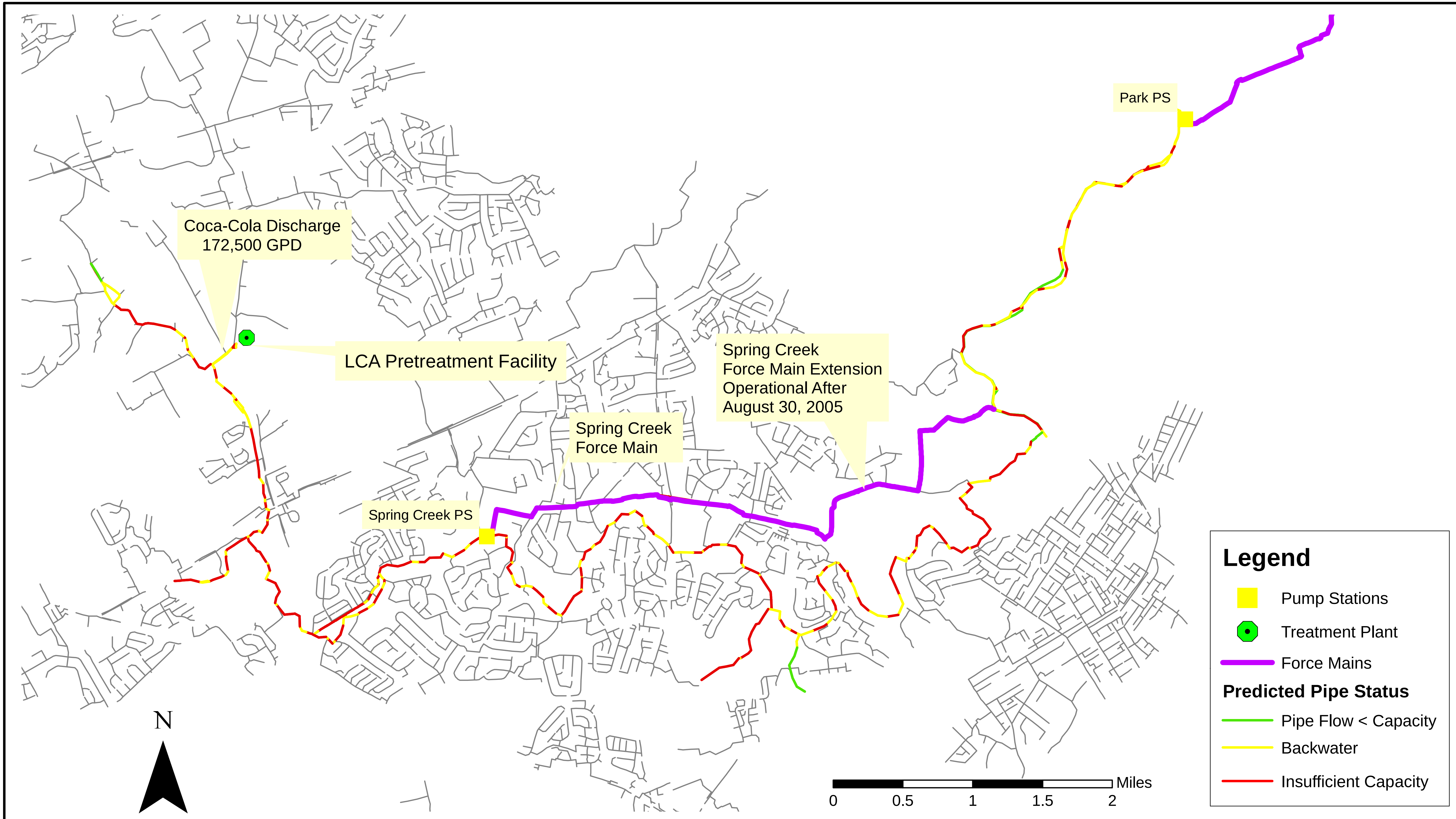
Western Lehigh Interceptor and Little Lehigh Relief Sewer
Phase 1 Hydraulic/Hydrologic Model and Analysis

Figure 6
Wet Weather 5-year 24-Hour Synthetic Storm
Existing System

LEHIGH COUNTY AUTHORITY



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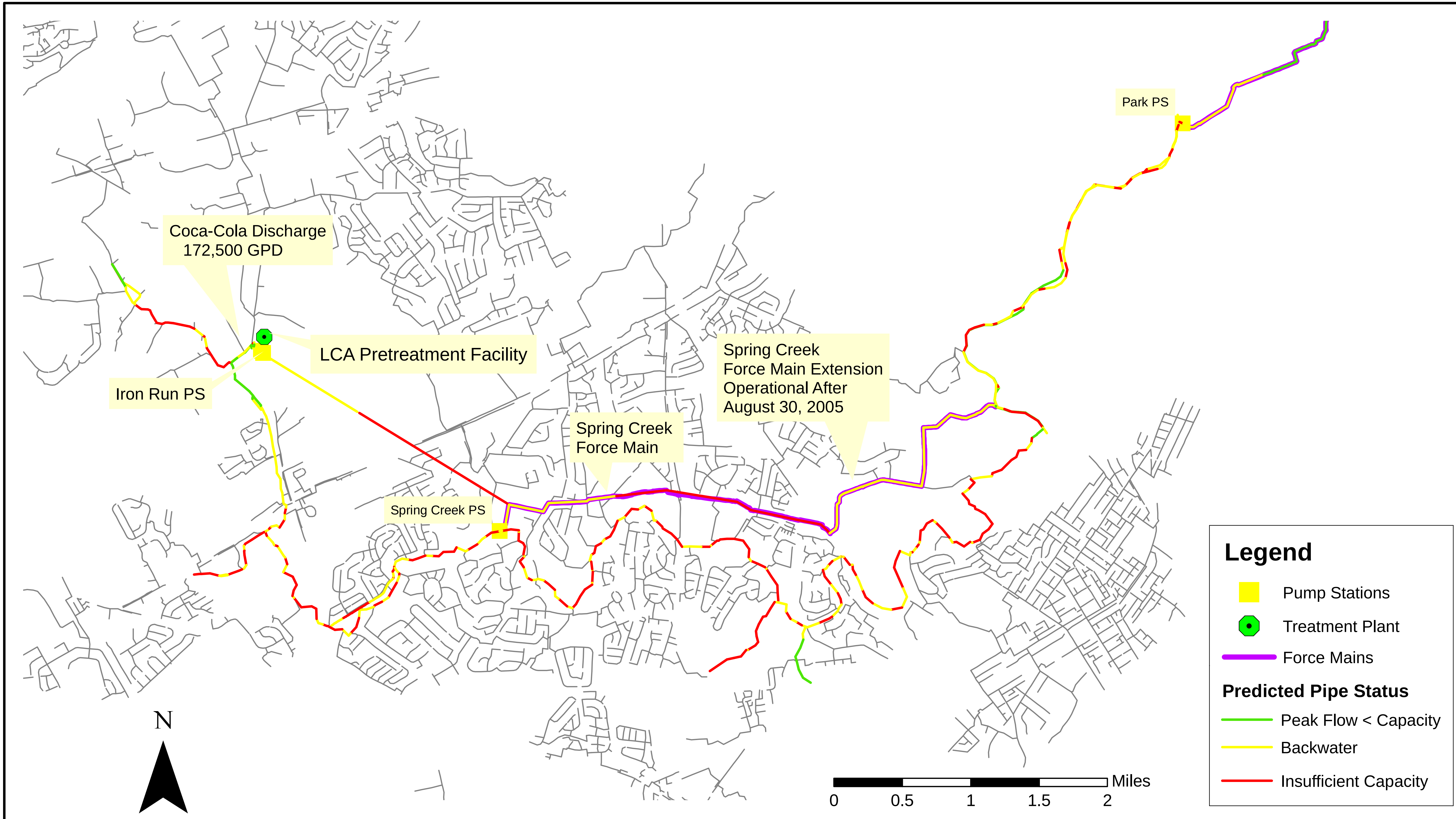
Western Lehigh Interceptor and Little Lehigh Relief Sewer
Phase 1 Hydraulic/Hydrologic Model and Analysis

Figure 7
Wet Weather 5-Year 24-Hour Synthetic Storm
Existing System with Coca-Cola Flow

LEHIGH COUNTY AUTHORITY

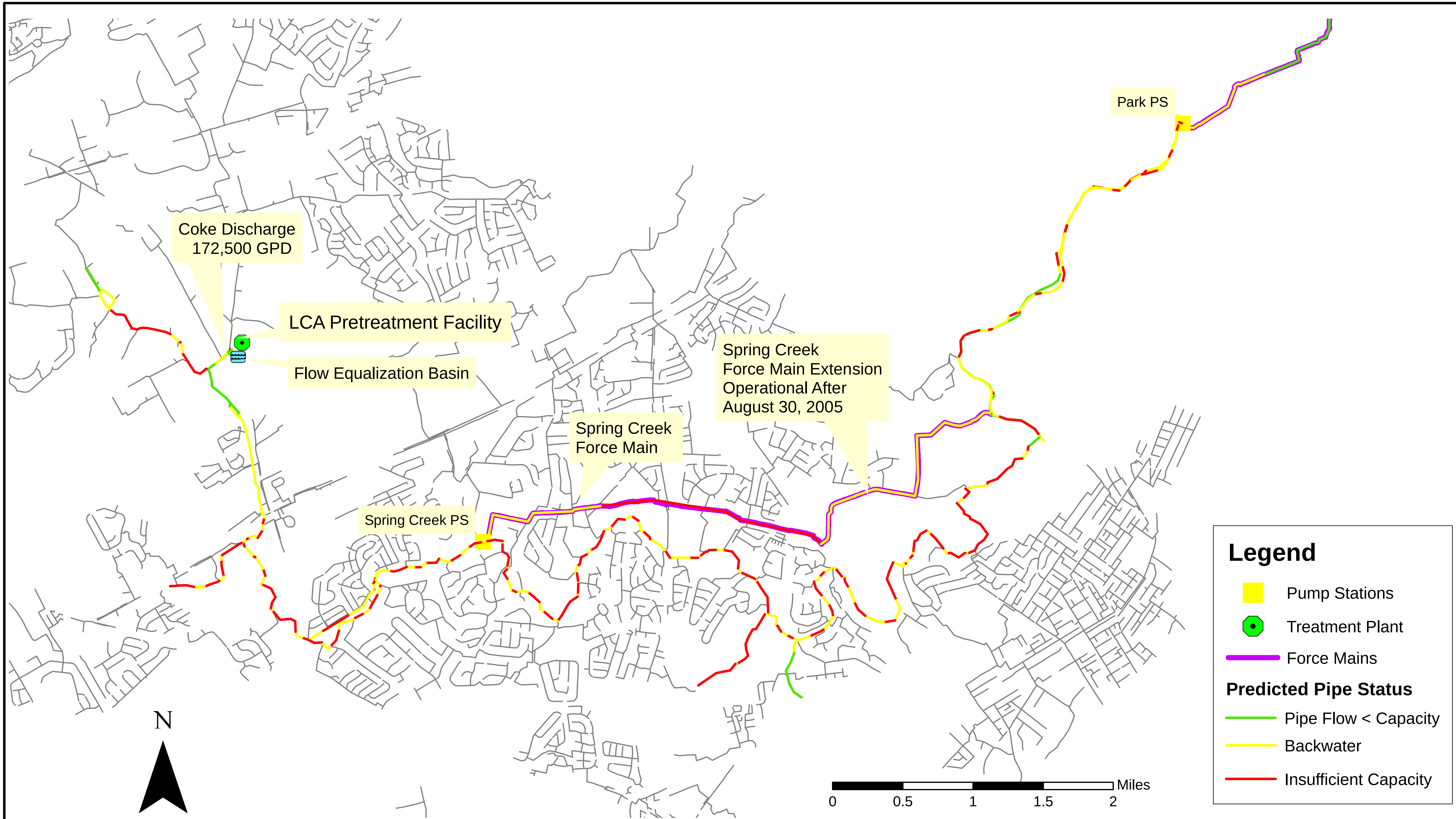


MALCOLM PIRNIE

Western Lehigh Interceptor and Little Lehigh Relief Sewer
Phase 1 Hydraulic/Hydrologic Model and Analysis

Figure 8
Wet Weather 5-Year 24-Hour Synthetic Storm
IRPS with Coca-Cola Flow

LEHIGH COUNTY AUTHORITY



Western Lehigh Interceptor and Little Lehigh Relief Sewer
Phase 1 Hydraulic/Hydrologic Model and Analysis

Figure 9
Wet Weather 5-Year 24-Hour Synthetic Storm
FEB with Coca-Cola Flow

APPENDIX 6

Kline's Island Wastewater Treatment Plant Hydraulic Design Capacity Evaluation

KLEINFELDER
Bright People. Right Solutions.

CITY OF ALLENTOWN PENNSYLVANIA

Lehigh County Authority

KLINE'S ISLAND WASTEWATER TREATMENT PLANT

HYDRAULIC DESIGN CAPACITY EVALUATION

PREPARED BY:
KLEINFELDER, INC.

OCTOBER 2019

TIMOTHY D. BRADLEY, P.E.
PA P.E. LIC. NO. PE-035163-E

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
TIMOTHY DAVID BRADLEY
ENGINEER
No. 35163E

Table of Contents

Page

List of Tables

List of Figures

1.0 INTRODUCTION

As defined in the Chapter 94 municipal wasteload management regulations, hydraulic design capacity is the "*maximum monthly design flow, expressed in millions of gallons per day, at which a plant is expected to consistently provide the required treatment… This capacity is specified in the water quality management permit (Part II permit issued under Chapter 91).*"

The most recent Part II permit issued for the Kline's Island Wastewater Treatment Plant (KIWWTP), Permit No. 3915403, lists the KIWWTP's Hydraulic Design Capacity as 40 million gallons per day (mgd). It also lists the "annual average flow" as 40 mgd and the "design organic capacity" as 70,000 lbs/day.

As also defined in the Chapter 94 municipal wasteload management regulations, hydraulic overload is the "condition that occurs when the monthly average flow entering the plant exceeds the hydraulic design capacity for 3-consecutive months out of the preceding 12 months." Because the KIWWTP's monthly average flow recently exceeded 40 mgd for three consecutive months during an unprecedented wet period, the Pennsylvania Department of Environmental Protection (PADEP) notified the City of Allentown (City) and Lehigh County Authority (LCA) that a hydraulic overload occurred, thus requiring follow-up actions in accordance with Section 94.21 of the municipal wasteload management regulations.

During the unprecedented wet period in which the KIWWTP monthly average flow exceeded 40 mgd for three consecutive months, the KIWWTP performed exceptionally well, fully complying with all effluent limitations by a significant margin. As a result, and as discussed in detail during a meeting between PADEP, the City and LCA on September 12, 2019, the KIWWTP's actual hydraulic design capacity has been demonstrated to be significantly greater than 40 mgd. However, a detailed evaluation is required to determine the specific extent to which the KIWWTP's hydraulic design capacity exceeds 40 mgd.

The objective of the Kline's Island Wastewater Treatment Plant Hydraulic Design Capacity Evaluation is to determine the KIWWTP's actual hydraulic design capacity in comparison to the hydraulic design capacity of 40 mgd presented in the Part II permit noted above.

The findings of this evaluation will be used to support and formally request a revision to the Part II permit's hydraulic design capacity of 40 mgd. A modification of the KIWWTP's 40 mgd permitted Annual Average Flow is not being requested and is not required.

2.0 KIWWTP OVERVIEW

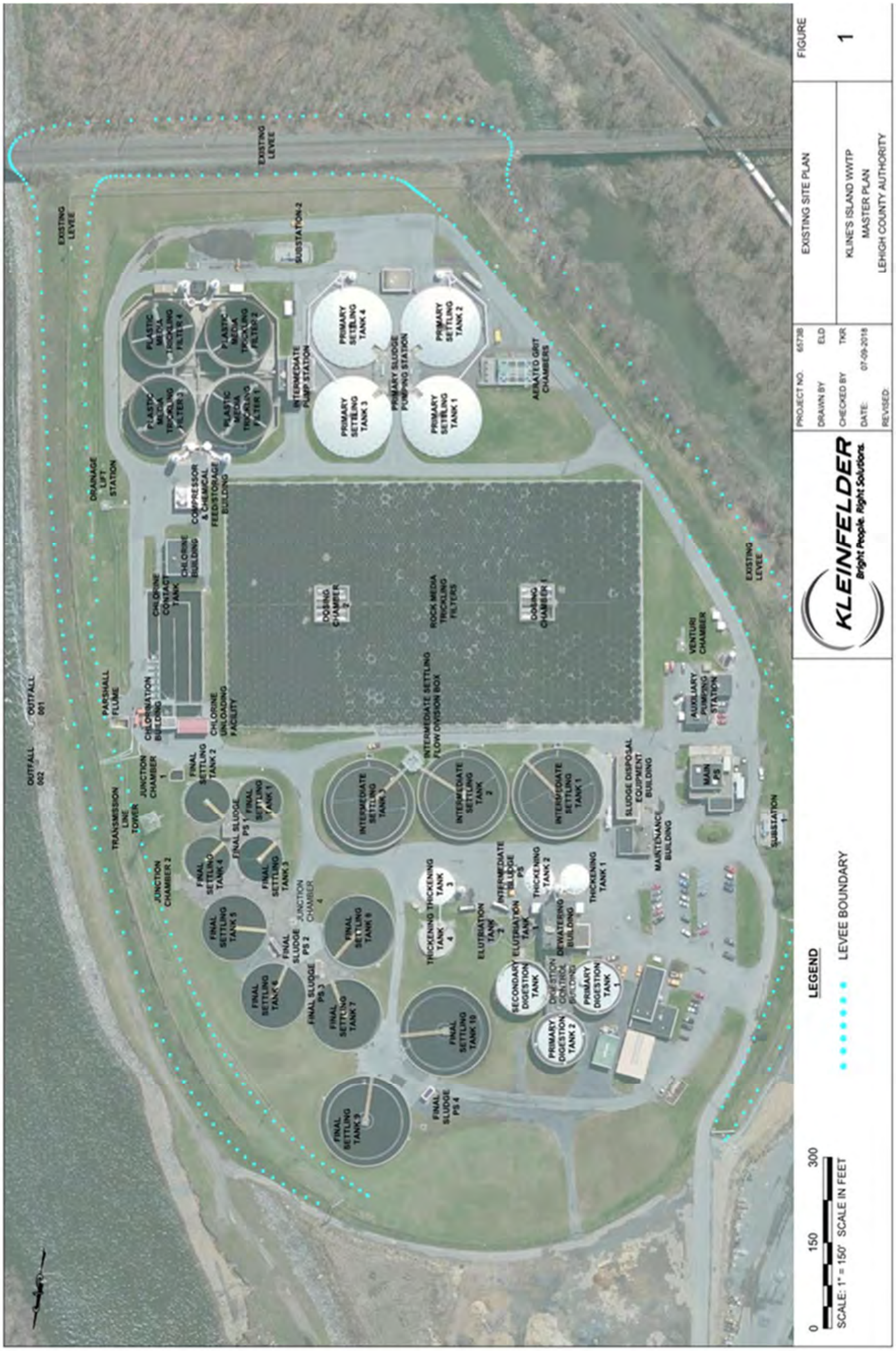
The KIWWTP has been in operation since November 1929. Many improvements have been implemented over its long period of service to address various needs including capacity expansion, enhancing the level of treatment, and rehabilitating or replacing aging infrastructure. An aerial site plan of the existing KIWWTP is presented as Figure 1. The levee shown in Figure 1 that surrounds the KIWWTP provides flood protection. Figures 2 and 3 present the wastewater flow schematic and solids flow schematic, respectively, for the KIWWTP, which collectively depict all unit processes that the KIWWTP comprises.

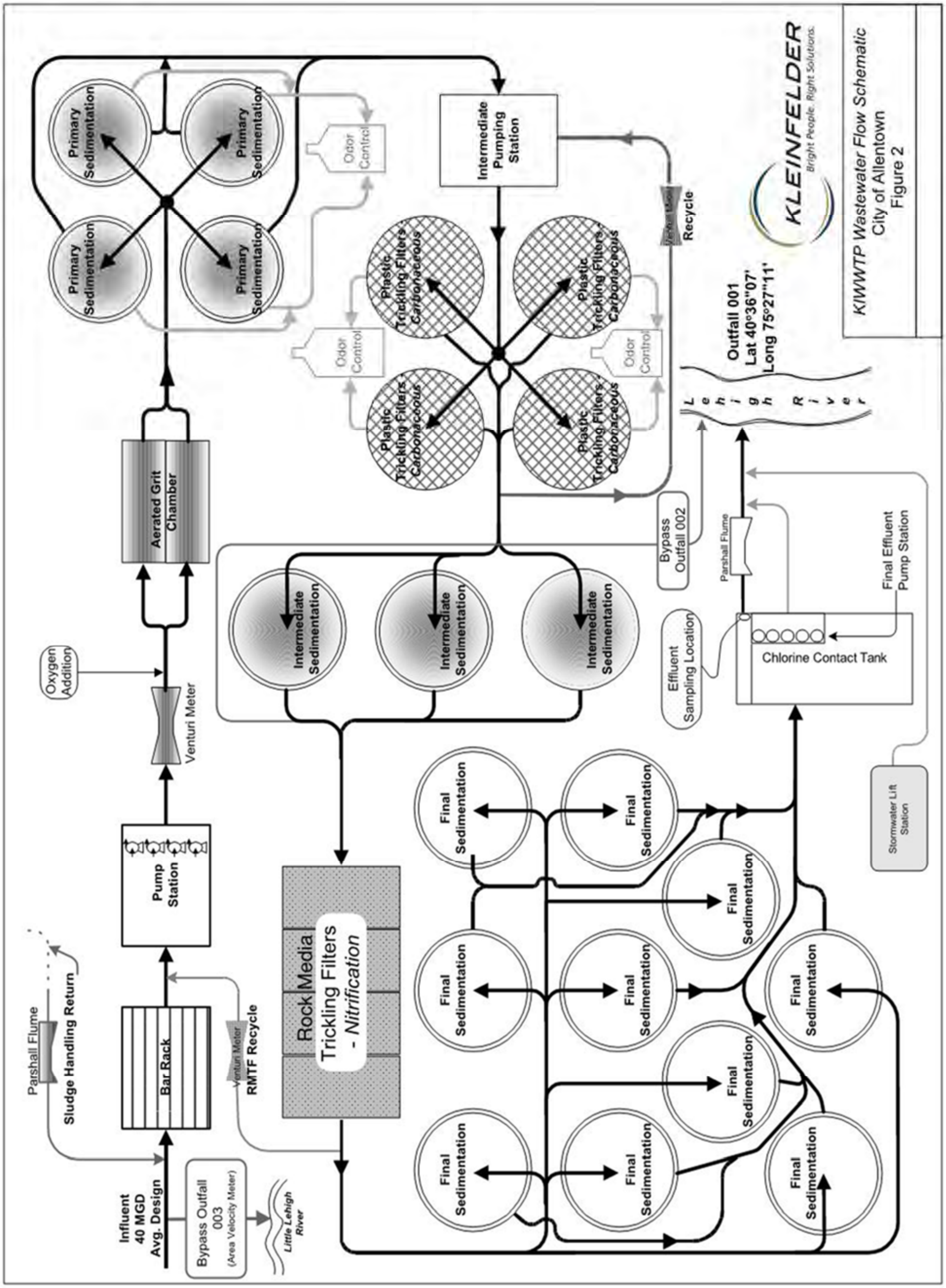
The KIWWTP is authorized to discharge treated effluent to the Lehigh River in accordance with National Pollutant Discharge Elimination System (NPDES) Permit No. PA-0026000. The key effluent limitations stipulated by the NPDES permit are presented in Table 2-1.

Table 2-1: KIWWTP Key NPDES Permit Effluent Limits

Parameter	Monthly Average Effluent Limit	Weekly Average Effluent Limit	Instantaneous (Daily) Maximum Effluent Limit
Flow	(1)	(1)	(1)
$CBOD_5$	20 mg/l & 6,672 lbs/day	30 mg/L & 10,008 lbs/day	40 mg/l
TSS	30 mg/l & 10,008 lbs/day	45 mg/l & 15,012 lbs/day	60 mg/l
NH_3 (5/1 – 10/31)	5 mg/l & 5,004 lbs/day	-	10 mg/l
NH_3 (11/1 – 4/30)	15 mg/l	-	30 mg/l
Fecal Coliform (5/1 – 9/30)	200/100 ml geometric mean (2)		
Fecal Coliform (10/1 – 4/30)	2,000/100 ml geometric mean		
Residual Chlorine	0.5 mg/l	-	1.0 mg/l
pH	6.0 to 9.0 SU		
Dissolved Oxygen	5.0 mg/l minimum		

(1) Flow is not a regulated parameter, requiring only continuous monitoring.
(2) Not more than 10% of the samples shall have a fecal coliform concentration greater than 1,000/100 ml


EXISTING SITE PLAN
KLINE'S ISLAND WWTP
MASTER PLAN
LEHIGH COUNTY AUTHORITY
FIGURE
1
LEGEND
LEVEE BOUNDARY
0
150
300
SCALE: 1" = 150' SCALE IN FEET
EXISTING LEVEE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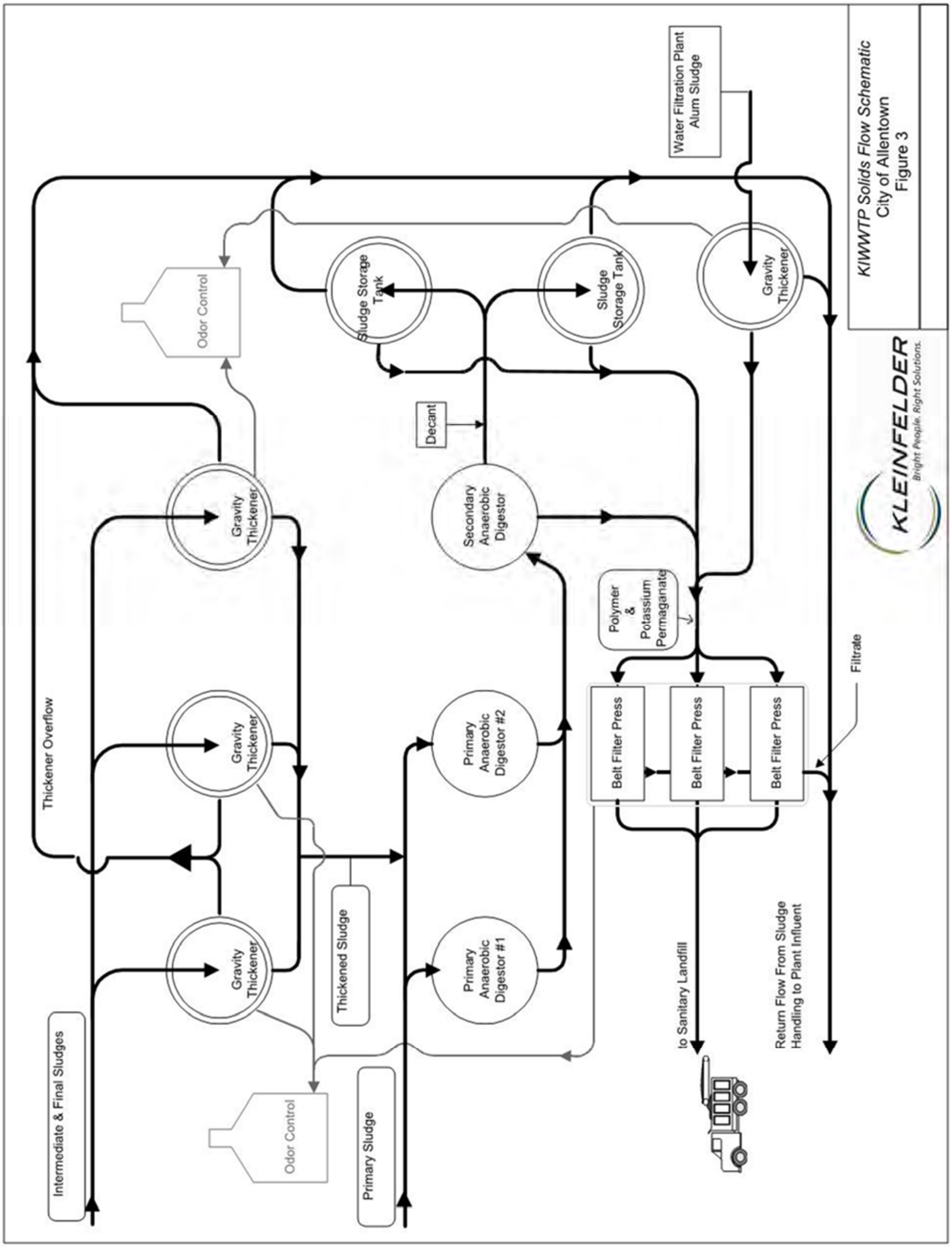
KIWWTP Wastewater Flow Schematic
City of Allentown
Figure 2
Influent
40 MGD
Avg. Design
Bypass Outfall
003
(Area Velocity Meter)
Little Lehigh River
Parshall Flume
Sludge Handling Return
Bar Rack
Venturi Meter
RMTF Recycle
Pump Station
Venturi Meter
Oxygen Addition
Aerated Grit Chamber
Primary Sedimentation
Primary Sedimentation
Primary Sedimentation
Primary Sedimentation
Odor Control
Odor Control
Intermediate Pumping Station
Recycle
Plastic Trickling Filters - Carbonaceous
Plastic Trickling Filters - Carbonaceous
Plastic Trickling Filters - Carbonaceous
Plastic Trickling Filters - Carbonaceous
Odor Control
Odor Control
Outfall 001
Lat 40°36"07'
Long 75°27"11'
Lehigh River
Bypass
Outfall 002
Intermediate Sedimentation
Intermediate Sedimentation
Intermediate Sedimentation
Parshall Flume
Effluent Sampling Location
Chlorine Contact Tank
Final Effluent Pump Station
Rock Media
Trickling Filters
- Nitrification
Final Sedimentation
Stormwater Lift Station


KIWWTP Solids Flow Schematic
City of Allentown
Figure 3
Water Filtration Plant Alum Sludge
Odor Control
Sludge Storage Tank
Sludge Storage Tank
Gravity Thickener
Decant
Secondary Anaerobic Digestor
Polymer & Potassium Permaganate
Filtrate
Belt Filter Press
Belt Filter Press
Belt Filter Press
Thickener Overflow
Gravity Thickener
Gravity Thickener
Gravity Thickener
Primary Anaerobic Digestor #2
Primary Anaerobic Digestor #1
Thickened Sludge
Odor Control
Intermediate & Final Sludges
Primary Sludge
To Sanitary Landfill
Return Flow From Sludge Handling to Plant Influent

As described in Part A of the NPDES permit, the effluent limitations presented in Table 2-1 were determined by PADEP using an effluent discharge rate of 40 mgd. This is consistent with the above-referenced Part II permit indicating that the KIWWTP's permitted Annual Average Flow is 40 mgd. As previously indicated, a modification of the permitted Annual Average Flow is not being requested, nor is it required.

Wastewater is conveyed to the KIWWTP through 933 miles of sewer pipe from a total of fourteen (14) municipalities. The fourteen (14) municipalities have collaboratively developed a Regional Flow Management Strategy (RFMS) to reduce infiltration and inflow over a multi-year period.

The first step in the hydraulic capacity evaluation is to characterize the wastewater flow and loads to the KIWWTP over several years encompassing both dry and wet periods such that variability in flows and loads can be properly assessed, particularly during wet periods, because such periods are directly relevant to determining the KIWWTP's hydraulic design capacity.

3.0 WASTEWATER CHARACTERIZATION

The specific purpose of wastewater characterization is to establish the variability in wastewater flows and loads on an annual average, maximum month (maximum 30-day average), and maximum day (maximum 24-hour average) basis. The variability in flows and loads must be known to evaluate the hydraulic design capacity of each unit process and thus to determine the KIWWTP's overall hydraulic design capacity.

The period of analysis selected for wastewater characterization is January 1, 2015, through July 31, 2019. The annual rainfall in each of these years is presented in Table 3-1.

Table 3-1: Precipitation

Year	Annual Precipitation, Inches
2015	40.24
2016	36.82
2017	50.18
2018	66.96
2019(1)	41.50(2)

(1) January 1, 2019, through July 31, 2019.
(2) Total rainfall of 41.5 inches during the first seven months of 2019 exceeded the total 12-month rainfall during the years 2015 and 2016 of 40.24 and 36.82 inches, respectively.

Based on data from the National Centers for Environmental Information, the twelve (12) month total rainfall in Pennsylvania for the period September 2018 through August 2019 was the wettest twelve (12) month period in the last one hundred and twenty-four (124) years. Therefore, the period of study for wastewater characterization encompasses a broad range of wet and dry periods, with the wet period in 2018 and 2019 unprecedented in recent history.

Influent wastewater characteristics are measured at the effluent of the aerated grit chamber, which, in addition to influent wastewater, includes rock media trickling filter (RMTF) recycle flows (recycle of flow to the RMTF is needed during low flow periods to maintain a minimum acceptable wetting rate for the biofilm on the rock media), and solids processing (SP) return flows. The influent flow rate is measured at the influent flow meter, and the RMTF and SP return flows are metered separately. For reporting of influent flow on the discharge monitoring reports, RMTF flow and SP flow are subtracted from the influent flow measured at the effluent end of the aerated grit chambers. Similarly, to characterize the plant influent loads, the load contributions from the RMTF and SP return flows are subtracted from the values measured at the aerated grit chamber.

The plant influent also includes trucked septage and leachate, which are received at the plant to generate revenue. Septage is not characterized on a routine basis, and therefore limited analytical data is available. Leachate is characterized on a regular basis, and is processed with the gravity sludge thickener overflow, which is accounted for in the SP return flow. From a hydraulic loading perspective, septage and leachate flows are insignificant.

3.1 Influent Flow

Table 3-2 summarizes the calculated influent annual average, maximum month, and maximum day flows for the period 2015 through 2019 resulting from the subtraction of measured SP return flows and RMTF recycle flows from the metered influent which includes these flows.

Table 3-2: Annual Average Influent Flow and Precipitation

Year	Annual Avg Flow, mgd	Max Month Flow, mgd	Max Day Flow, mgd	Annual Rainfall, Inches
2015	30.44	36.16	55.25	40.24
2016	29.65	36.41	69.98	36.82
2017	30.80	34.53	51.92	50.18
2018	36.07	44.42	72.46	66.96
2019(1)	41.25	47.46	68.89	41.50

(1) January 1, 2019, through July 31, 2019.

As indicated, and consistent with all wastewater systems, annual average, maximum month, and maximum daily flows vary in response to changes in rainfall. The changes in groundwater levels resulting from changes in precipitation also impact wastewater flow rates.

The maximum monthly average flows are particularly relevant to hydraulic design capacity, because compliance with NPDES effluent limits must be achieved each month of the year, and because PADEP defines hydraulic design capacity as the maximum monthly design flow at which a plant is expected to consistently provide the required treatment.

As shown in Table 3-2, the highest monthly average flow during the period of study was 47.46 mgd, which occurred in May of 2019, i.e. within the wettest 12-month period during the last 124 years. Therefore, the maximum monthly average flow of 47.46 mgd was the result of an unprecedented and prolonged period of precipitation.

3.2 Influent BOD Load

As previously noted, the influent biochemical oxygen demand (BOD) loads were calculated by subtracting the BOD loads of the return streams from the BOD loads measured at the aerated grit chamber. Table 3-3 presents the calculated influent annual average BOD loads during the years 2015 through 2019 and the corresponding annual average flows.

Table 3-3: Influent Annual Average Flow and BOD Loads

Year	Annual Average Flow, mgd	Annual Average BOD Load, lbs/day
2015	30.44	48,421
2016	29.65	50,871
2017	30.80	45,970
2018	36.07	47,079
2019(1)	41.25	46,167

(1) January through July.

As shown in Table 3-3, the increase in annual average flow in 2018 and 2019 did not result in an increase in the influent BOD load. This is expected, because the increase in flow was due to infiltration and inflow (I&I) entering the system during the unprecedented wet period, and I&I does not contain significant concentrations of BOD, because it is a combination of groundwater and rainfall entering the system.

It is also noted that the annual average BOD loads are substantially less than the KIWWTP's design organic loading of 70,000 lbs/day presented in the Part II permit.

Table 3-4 presents the monthly average influent BOD loads during the maximum monthly flow month during each year of the study.

Table 3-4: Influent BOD Loads during Maximum Monthly Average Flow

Year	Maximum Monthly Average Flow, mgd	Monthly Average BOD Load, lbs/day
2015	36.16	46,199
2016	36.41	44,552
2017	34.53	39,817
2018	44.42	43,538
2019(1)	47.46	47,267

(1) January through July.

By comparing the influent BOD loads in Table 3-3 and 3-4, it is evident that the influent BOD loads during the maximum monthly flows are not greater than the influent BOD loads during the annual average flows. This is because whether it is a wet year or dry year, maximum monthly average flows are the result of I&I entering the system, which does not contribute to organic loading.

As also indicated in Table 3-4, the monthly average BOD load during the unprecedented wet period in 2018 and 2019 were essentially the same as during the preceding years with normal annual precipitation and were substantially less than the KIWWTP's design organic loading of 70,000 lbs/day presented in the Part II permit.

In summary, the temporary high flows resulting from the unprecedented wet period in 2018 and 2019 did not result in an increase in organic loading to the KIWWTP.

3.3 Influent TSS Load

Table 3-5 presents the calculated influent annual average total suspended solids (TSS) loads during the years 2015 through 2019 and the corresponding annual average flows.

Table 3-5: Influent Annual Average Flow and TSS Loads

Year	Annual Average Flow, mgd	Annual Average TSS Load, lbs/day
2015	30.44	50,525
2016	29.65	54,633
2017	30.80	48,504
2018	36.07	50,977
2019(1)	41.25	49,294

(1) January through July.

As shown in Table 3-5, the increase in annual average flow in 2018 and 2019 did not result in an increase in the influent TSS load. This is expected, because the increase in flow was due to I&I entering the system during the unprecedented wet period, and I&I does not contain significant concentrations of TSS, because it is a combination of groundwater and rainfall entering the system.

Table 3-6 presents the monthly average influent TSS loads during the maximum monthly flow month during each year of the study.

Table 3-6: Influent TSS Loads during Maximum Monthly Average Flow

Year	Maximum Monthly Average Flow, mgd	Monthly Average TSS Load, lbs/day
2015	36.16	46,421
2016	36.41	42,541
2017	34.53	42,811
2018	44.42	48,880
2019(1)	47.46	52,943

(1) January through July.

By comparing the influent TSS loads in Table 3-5 and 3-6, it is evident that there is not a significant increase in TSS loads during the maximum monthly average flow compared to the TSS loads during the annual average flow. This is because whether it is a wet year or dry year, maximum monthly average flows are the result of I&I entering the system, which does not contribute to TSS loading.

In summary, the temporary high flows resulting from the unprecedented wet period in 2018 and 2019 did not result in a significant increase in TSS loading to the KIWWTP.

3.4 Influent TKN Loads

Table 3-7 presents the calculated influent annual average total Kjeldahl nitrogen (TKN) loads during the years 2015 through 2019 and the corresponding annual average flows.

Table 3-7: Influent Annual Average Flow and TKN

Year	Annual Average Flow, mgd	Annual Average TKN Load, lbs/day
2015	30.44	8,572
2016	29.65	9,002
2017	30.80	8,549
2018	36.07	8,486
2019(1)	41.25	9,358

(1) January through July.

As shown in Table 3-7, the increase in annual average flow in 2018 and 2019 did not result in a significant increase in the influent TKN load. This is expected, because the increase in flow was due to I&I entering the system during the unprecedented wet period, and I&I does not contain a significant concentration of TKN, because it is combination of groundwater and rainwater.

Table 3-8 presents the monthly average influent TKN loads during the maximum monthly flow month during each year of the study.

Table 3-8: Influent TKN Loads during Maximum Monthly Average Flow

Year	Maximum Monthly Average Flow, mgd	Monthly Average TKN Load, lbs/day
2015	36.16	9,752
2016	36.41	8,172
2017	34.53	8,643
2018	44.42	8,441
2019(1)	47.46	9,920

(1) January through July.

By comparing the influent TKN loads in Table 3-7 and 3-8, it is evident that the influent TKN loads during the maximum monthly flows are not significantly greater than the influent TKN loads during the annual average flows. This is because whether it is a wet year or dry year, maximum monthly average flows are the result of I&I entering the system, which does not contain significant concentrations of TKN.

In summary, the temporary high flows resulting from the unprecedented wet period in 2018 and 2019 did not result in an increase in TKN loading to the KIWWTP.

3.5 Influent Ammonia Loads

Table 3-9 presents the calculated influent annual average ammonia (NH_3) loads during the years 2015 through 2019 and the corresponding annual average flows for ease of comparison.

Table 3-9: Influent Annual Average Flow and NH_3

Year	Annual Average Flow, mgd	Annual Average NH_3 Load, lbs/day
2015	30.44	4,044
2016	29.65	4,715
2017	30.80	4,767
2018	36.07	4,548
2019(1)	41.25	5,272

(1) January through July.

As shown in Table 3-9, the increase in annual average flow in 2018 did not result in an increase in the influent NH_3 load. However, there was a nominal increase in the influent NH_3 loading in the first half of 2019 compared to the preceding years. This is believed to be an anomaly, because I&I does not contain significant concentrations of NH_3.

Table 3-10 presents the monthly average influent NH_3 loads during the maximum monthly flow month during each year of the study.

Table 3-10: Influent NH_3 Loads during Maximum Monthly Average Flow

Year	Maximum Monthly Average Flow, mgd	Monthly Average NH_3 Load, lbs/day
2015	36.16	4,293
2016	36.41	4,651
2017	34.53	4,761
2018	44.42	4,846
2019(1)	47.46	5,290

(1) January through July.

By comparing the influent NH_3 loads in Table 3-9 and 3-10, it is evident that the influent NH_3 loads during the maximum monthly flows are not greater than the influent NH_3 loads during the annual average flows. This is because whether it is a wet year or dry year, maximum monthly average flows are the result of I&I entering the system, which does not contain significant concentrations of NH_3.

In summary, the temporary high flows resulting from the unprecedented wet period in 2018 and 2019 did not result in a significant increase in NH_3 loading to the KIWWTP.

3.6 Recycle Streams

3.6.1 Rock Media Trickling Filter Recycle Flow

As previously noted, recycling of RMTF effluent is performed to maintain a minimum wetting rate for the RMTF biofilm. Table 3-11 presents the annual average and maximum monthly average RMTF recycle flows for the period 2015 - 2019.

Table 3-11: RMTF Recycle Flows

Year	Annual Average Flow, mgd	Max Month Flow, mgd
2015	3.84	5.51
2016	4.11	4.97
2017	3.33	4.95
2018	1.61	4.12
2019(1)	0.28	0.98

(1) January through July.

Consistent with LCA's operational procedure to maintain a flow rate of approximately 35 mgd through the RMTF, the recycle flow is reduced as the plant influent flow increases. As a result, the annual average recycle flow in 2018 and 2019 were negligible. Therefore, RMTF recycle flow is not relevant to the KIWWTP's hydraulic design capacity.

3.6.2 Solids Processing Return Flow

The SP return stream includes sludge thickening supernatant, sludge digester supernatant, sludge holding tank supernatant, and belt filter press filtrate. As previously noted, leachate is bled into the thickener overflow and therefore contributes flow and load to the SP return stream.

Table 3-12 presents the annual average, maximum monthly, and maximum daily SP flows for the period 2015 - 2019.

Table 3-12: SP Return Flows

Year	SP Annual Average Flow, mgd	SP Flow during Max Month Flow, mgd
2015	1.58	1.85
2016	1.63	1.56
2017	1.68	1.83
2018	1.88	1.94
2019(1)	1.86	1.77

(1) January through July.

As shown in Table 3-12, the annual average SP return flows are not significantly different between dry and wet years, and the SP flows during the KIWWTP maximum monthly average flow are not significantly different than the SP return flows during the KIWWTP annual average flows. Because SP return flows are directly related to sludge production, and sludge is generated by the removal of BOD and TSS from the wastewater, this finding is consistent with the fact that the BOD and TSS influent loads do not vary significantly between wet and dry years and the maximum monthly average loads are not significantly different than during the annual average flow.

Because of the consistency and magnitude of SP flows, they are not significant in terms of the KIWWTP's hydraulic design capacity.

3.7 Sludge Production

The monthly average sludge production during the period 2015 - 2019 and the monthly average sludge production during the maximum monthly average flow each year are presented in Table 3-13.

Table 3-13: Sludge Production

Year	Monthly Average Sludge Production, lbs	Monthly Sludge Production during Max Monthly Flow, lbs
2015	1,130,649	1,220,022
2016	1,156,043	993,005
2017	1,166,382	1,209,739
2018	1,058,446	1,014,231
2019(1)	1,065,532	1,149,086

(1) January through July.

As shown in Table 3-13, the increase in annual average flow in 2018 and 2019 did not result in an increase in monthly average sludge production compared to the preceding years with normal precipitation. This is expected, because sludge is generated by the removal of BOD and TSS from the wastewater, and the BOD and TSS loads in 2018 and 2019 were not significantly different that the BOD and TSS loads in the preceding years with normal precipitation.

As also shown in Table 3-13, the monthly sludge production during maximum monthly average flow each year was not significantly different than the monthly average sludge production throughout each year. This is because maximum monthly average flows are due to I&I, which does not contain significant concentrations of BOD or TSS and therefore does not result in additional sludge production.

4.0 KIWWTP PERFORMANCE

This section of the report summarizes overall performance of the KIWWTP during the period 2015 - 2019. It also addresses the performance of the individual unit processes.

Table 4-1 presents a performance and compliance summary of the KIWWTP during the maximum three-month average flow during the period 2015 - 2019. The maximum three-month average flow during this period was 42.71 mgd, which occurred during May 2019 through July 2019. Performance during the maximum three-month average flow is relevant because a “hydraulic overload” is defined by PADEP as the condition that occurs when the monthly average flow entering the plant exceeds the hydraulic design capacity for three consecutive months.

Table 4-1: Performance and Compliance Summary during Max Three-Month Average Flow

Parameter	Data	NPDES Limit
Maximum 3-Month Average Flow (mgd)	42.71	Report only
$CBOD_5$ 3-Month Avg (mg/l)	4.5	20
$CBOD_5$ 7-Day Avg (mg/l)	5.9	30
$CBOD_5$ 3-Month Avg Load (lbs/day)	1,641	6,672
$CBOD_5$ 7-Day Avg Load(lbs/day)	2,643	10,008
NH_3 3-Month Avg (mg/l)	1.5	5
NH_3 3-Month Avg Load (lbs/day)	534	1,668
TSS 3-Month Avg (mg/l)	6.3	30
TSS Max 7-Day Avg (mg/l)	9.3	45
TSS 3-Month Avg Load (lbs/day)	2,295	10,008
TSS Max 7-Day Avg Load (lbs/day)	4,190	15,012
Fecal Coliform 3-Month Avg (^/100 mg)	9.7	200 (geomean)
Residual Cl_2 3-Month Avg (mg/l)	0.45	0.5

As shown in Table 4-1, the KIWWTP complied with all NPDES concentration-based and load-based effluent limits, by a significant margin, during the maximum three-month average flow of 42.71 mgd.

Table 4-2 presents a performance and compliance summary of the KIWWTP during the maximum monthly average flow during the period 2015 - 2019. The maximum monthly average flow during this period was 47.46 mgd, which occurred in May 2019. Performance during the maximum monthly average flow is relevant because hydraulic design capacity is defined by the PADEP as the maximum monthly design flow at which a plant is expected to consistently provide the required treatment.

Table 4-2: Performance and Compliance Summary during Max Monthly Average Flow

Parameter	Data	NPDES Limit
Maximum Monthly Avg Flow (mgd)	47.46	Report only
$CBOD_5$ Monthly Avg (mg/l)	5.3	20
$CBOD_5$ Max 7-Day Avg (mg/l)	6	30
$CBOD_5$ Monthly Avg Load (lbs/day)	2,095	6,672
$CBOD_5$ Max 7-Day Avg Load (lbs/day)	2,643	10,008
NH_3 Monthly Avg (mg/l)	1.5	5
NH_3 Monthly Avg Load (lbs/day)	579	1,668
TSS Monthly Avg (mg/l)	8	30
TSS Max 7-Day Avg (mg/l)	9	45
TSS Monthly Avg Load (lbs/day)	3,219	10,008
TSS Max 7-Day Avg Load (lbs/day)	4,190	15,012
Fecal Coliform Monthly Avg (^/100 mg)	11	200 (geomean)
Residual Cl_2 Monthly Avg (mg/l)	0.45	0.5

As shown in Table 4-2, the KIWWTP complied with all NPDES concentration-based and load-based effluent limits, by a significant margin, during the maximum monthly average flow of 47.46.

Therefore, the demonstrated hydraulic design capacity of the KIWWTP is greater than 47.46 mgd.

The KIWWTP also has concentration-based maximum day effluent limits for several parameters. Table 4-3 on the following page presents a performance and compliance summary during the maximum daily flow during each month of the unprecedented wet period during January 2018 through July 2019.

Table 4-3: Performance and Compliance Summary during Maximum Daily Flows

Month	Maximum Daily Flow (mgd)	$CBOD_5$ Max Day (mg/l)	NH_3 Max Day (mg/l)	TSS Max Day (mg/l)
January 2018	48.01	5	2.7	5
February 2018	47.01	5	1	7
March 2018	56.86	7	2.9	10
April 2018	47.51	7	1.8	6
May 2018	43.81	5	1.8	7
June 2018	35.87	5	1.8	4
July 2018	45.36	5	2.2	4
August 2018	72.46	6	1.2	7
September 2018	57.49	5	0.8	6
October 2018	43.73	5	1.9	6
November 2018	71.16	7	1.7	11
December 2018	62.36	8	1.6	11
January 2019	62.69	7	3.5	11
February 2019	44.69	5	2.9	8
March 2019	56.99	6	1.6	10
April 2019	54.04	8	0.6	8
May 2019	68.89	6	1.4	10
June 2019	49.67	4	2.1	6
July 2019	64.3	6	2.1	5

Maximum Day Effluent Limits	
Parameter	**Limit**
Maximum Day Flow (mgd)	Report only
$CBOD_5$ Max Day (mg/l)	40
NH_3 Max Day (mg/l), Summer	10
NH_3 Max Day (mg/l), Winter	30
TSS Max Day (mg/l)	60
DO Max Day	N/A
Fecal Coliform Max Day	N/A
Residual Chlorine Max Day	N/A

As shown in Table 4-3, the KIWWTP complied with all maximum day effluent limits during the maximum daily average flow during each month of the unprecedented wet period of January 2018 through July 2019.

Table 4-4 presents the monthly average effluent concentration of BOD, TSS, TKN, NH_3 and fecal coliform during the maximum monthly average flow during each year of the period of study. Table

4-4 also presents the concentration of various parameters at various intermediate sampling locations throughout the KIWWTP including aerated grit chamber effluent (INF), primary settling tank effluent (PRI), plastic media trickling filter effluent (PMTF), intermediate settling tank effluent (IST), and final plant effluent (EFF).

Table 4-4: Performance Summary During Maximum Monthly Average Flows

Maximum Month	Flow (mgd)	BOD (mg/l)				
		Return	INF	PRI	IST	EFF
March 2015	36.16	44	142	75	25	6
February 2016	36.41	35	134	81	25	6
July 2017	34.53	41	128	69	27	3
November 2018	44.42	96	118	74	30	5
May 2019	47.46	130	122	79	37	5

Maximum Month	TSS (mg/l)					
	Return	INF	PRI	PMTF	IST	EFF
March 2015	161	148	51	45	17	6
February 2016	57	130	56	75	21	6
July 2017	100	141	49	77	18	3
November 2018	71	131	58	64	33	8
May 2019	71	133	61	85	36	8

Maximum Month	TKN (mg/L)						
	Return	INF	PRI	PMTF	IST	RMTF	EFF
March 2015	70.2	27.4	24.5	10.9	8.8	2.9	3.4
February 2016	70.5	27.7	26.3	9.6	7.4	3.0	3.3
July 2017	30.5	29.0	21.7	10.6	7.2	2.4	2.8
November 2018	78.9	25.6	22.9	9.9	8.9	No Sample	3.4
May 2019	84.5	30.0	24.0	13.0	10.9	No Sample	3.6

Maximum Month	NH3-N (mg/l)				Fecal Coliforms
	INF	PRI	IST	EFF	(^/100 ml)
March 2015	15.9	15.6	5.7	1.6	15
February 2016	16.4	16.6	5.4	1.5	18
July 2017	17.6	15.5	5.2	1.4	14
November 2018	15.9	16.0	6.1	1.9	17
May 2019	16.0	15.5	5.6	1.5	11

*2019 data through July

Based on the data presented in Table 4-4 for the maximum flow month of May 2019, the KIWWTP settling unit processes achieved the following removal efficiencies during a monthly average flow of 47.46 mgd:

1. Primary Clarifier BOD removal efficiency – 35%
2. Primary Clarifier TSS removal efficiency – 54%
3. Intermediate Settling Tank BOD removal efficiency – 59%
4. Intermediate Settling Tank TSS removal efficiency – 48%
5. Final Clarifier BOD removal efficiency – 86%

6. Final Clarifier TSS removal efficiency – 78%

Based on the removal efficiencies listed above, each of the KIWWTP's settling-related unit processes performed exceptionally well during a maximum monthly average flow of 47.46 mgd.

5.0 UNIT PROCESS HYDRAULIC DESIGN CAPACITY EVALUATION

As previously described, the Chapter 94 municipal wasteload management regulations define hydraulic design capacity as the "maximum monthly design flow, expressed in millions of gallons per day, at which a plant is expected to consistently provide the required treatment."

In this section of the report, the hydraulic design capacity of each unit process is assessed individually, beginning with the mechanically cleaned screens at the head end of the KIWWTP.

5.1 Mechanically Cleaned Influent Screens

Wastewater entering the KIWWTP first undergoes screening by two (2) climber-type mechanically cleaned screens with ¾-inch spacing between bars and a manufacturer's rated capacity of 100 mgd per screen. Therefore, the firm capacity of the influent screens (i.e. with one unit of service for maintenance) is 100 mgd.

Because the mechanically cleaned screens can consistently and reliably screen the influent wastewater at a rate of 100 mgd, the hydraulic design capacity of the mechanically cleaned screens is 100 mgd.

5.2 Main and Auxiliary Pumping Stations

Screened influent wastewater flows by gravity to the Main and Auxiliary pumping stations, which function together to pump screened influent wastewater via force main to the aerated grit chambers. There are four (4) pumps in the Main Pumping Station and two (2) pumps in the Auxiliary Pumping Station. The four (4) pumps in the Main Pumping Station consist of two (2) pumps rated for 11,000 gpm at 40 feet total dynamic head (TDH) and two (2) pumps rated for 15,300 gpm at 42.5 feet TDH. The two (2) pumps in the Auxiliary Pumping Station are both rated for 16,000 gpm at 30 feet TDH.

The firm capacity of the Main and Auxiliary pumping stations, i.e., with the largest capacity pump out of service for maintenance, is 85 mgd. Therefore, because the Main and Auxiliary pump stations can consistently and reliably pump screened influent wastewater at a rate of 85 mgd, the hydraulic design capacity of the Main and Auxiliary pumping stations is 85 mgd.

5.3 Aerated Grit Chambers

Aerated grit chambers are sized to achieve a minimum acceptable hydraulic detention time (HDT) at peak flow. The PADEP Domestic Wastewater Facilities Manual does not specifically present sizing/design parameters for aerated grit chambers. The Metcalf & Eddy (M&E) Wastewater Engineering textbook recommends a HDT of 2 to 5 minutes at peak flow (based on a 0.21 mm grit particle), while the 10 States Standards recommendation is 3 to 5 minutes at peak flow. There are no HDT guidelines for average flow, because adequate grit removal is provided at HDTs equal to or less than the HDT at peak flow. Therefore, an aerated grit chamber can be operated at the peak flow HDT for 30 consecutive days (i.e. the maximum monthly design flow) and consistently provide effective grit removal.

The two aerated grit chambers are each 52 feet long, 18 feet wide, and 12 feet deep, resulting in a combined volume of approximately 168,000 gallons. Based on a 2.5 minute HDT at peak flow, the hydraulic design capacity of the aerated grit chambers is 96.8 mgd.

5.4 Primary Clarifiers

Primary clarifiers are sized to achieve specific surface overflow rates (SORs) at average and peak flow. SOR is the flow rate per square feet of tank surface area expressed in gpd/sf. While older publications such as the PADEP Domestic Wastewater Facilities Manual present guidelines for weir loading rates, the M&E Wastewater Engineering Textbook states that "weir loading rates have little effect on the efficiency of primary sedimentation tanks and should not be considered when reviewing the appropriateness of clarifier design." Therefore, the hydraulic design capacity assessment of the primary clarifiers is based on SOR.

The PADEP Domestic Wastewater Facilities Manual recommends that the SOR should not exceed 1,000 gpd/sf at maximum monthly average flow and 2,500 gpd/sf at peak hourly flow. The M&E Wastewater Engineering textbook recommends 800 to 1,200 gpd/sf at average flow and 2,000 to 3,000 gpd/sf at peak hourly flow. The 10 States Standards recommendation is 1,000 gpd/sf at design average flow and 1,500 to 2,000 gpd/sf at design peak hourly flow. Based on feedback from PADEP on another project, PADEP primary clarifier sizing guidelines can be exceeded if justified. The M&E Wastewater Engineering Textbook recommendations should be considered justification to exceed the PADEP SOR guidelines, particularly when actual performance during sustained wet-weather flows supports a higher SOR.

The four primary clarifiers are each 120 feet in diameter and 12 feet deep, resulting in a combined surface area of approximately 45,239 sf. As previously indicated, during the maximum monthly average flow of 47.46 mgd, the KIWWTP achieved all effluent limits by a significant margin, and as indicated in Table 4-4, the primary clarifiers achieved BOD and TSS removal efficiencies of 35% and 58%, respectively. At 47.46 mgd, the primary clarifier SOR was 1,050 gpd/sf. Therefore, a SOR greater than 1,050 gpd/sf is justified. Due to the extent to which the KIWWTP achieved its effluent limits combined with the high primary clarifier BOD and TSS removal efficiencies achieved at an SOR of 1,050 gpd/sf, a 1,200 gpd/sf SOR (i.e., the upper end of the M&E recommended range) will be used to establish the hydraulic design capacity of the primary clarifiers.

At a 1,200 gpd/sf maximum month SOR, the resulting hydraulic design capacity of the primary clarifiers is 54 mgd.

A hydraulic design capacity of 54 mgd is further justified by the exceptional performance of the KIWWTP during maximum flow days that exceeded 54 mgd, as presented in Table 4-3.

5.5 Intermediate Pumping Station

The Intermediate Pumping Station contains a total of ten (10) two-stage vertical turbine pumps arranged into two sets of pumps with five (5) pumps in each set. The first set is the primary effluent pumps, which pump primary effluent to the PMTFs. The second set is the PMTF effluent pumps, which pump PMTF effluent to the intermediate clarifiers.

All ten (10) pumps have a rated capacity of 15,000 gpm at 44 ft TDH. The design firm capacity of each set of pumps (i.e. with one pump out of service) is 60,000 gpm or 86.4 mgd.

Because both pumping systems in the Intermediate Pumping Station have a firm capacity of 86 mgd, the primary effluent and PMTF effluent can consistently and reliably pump at a rate of 86 mgd. Therefore, the hydraulic design capacity of the Intermediate Pumping Station is 86 mgd.

5.6 Plastic Media Trickling Filters

The key design/sizing criteria for PMTFs is the BOD loading rate in pounds per day per 1,000 cubic feet (ppd/1,000 ft^3) of trickling filter media. The resulting hydraulic loading rate in gallons per day per square feet (gpd/sf) of tank area should then fall within a broad range of acceptable hydraulic loading rates. To achieve a conservative 82% BOD removal rate (excluding the BOD removal that occurs in the upstream primary clarifiers and the downstream rock media trickling filters), the M&E Wastewater Engineering textbook recommends a BOD loading rate of less than or equal to 62 ppd/1000 ft^3 and a resulting hydraulic loading rate that should fall within the range of 245 to 1,800 gpd/sf of tank area. The PADEP Domestic Wastewater Facilities Manual does not present specific sizing criteria for plastic media trickling filters, nor does the 10 States Standards.

The four PMTFs are each 100 feet in diameter, with a 32-foot-depth of plastic media. The original PMTFs had 18 layers of Surfpac media with a surface area of 27 square feet per cubic foot of volume. In 1998, the first layer of the filter media was replaced with Brentwood media with a surface area of 30 square feet per cubic foot of packing volume. The total resulting volume of media in service is 1,005,310 cubic feet, and the total surface area of the plastic media trickling filter tanks is 32,416 square feet.

From a hydraulic design capacity perspective, the PMTFs need to achieve the required effluent limits every month of the year, including the month with the highest average flow. However, as previously describe in Section 3.0, the influent BOD loading is not significantly different during extreme wet-weather events than during dry periods. Therefore, the KIWWTP performed essentially the same during the unprecedented wet period in 2018 and 2019 as it did during the years of 2015, 2016 ad 2017, which had normal amounts of precipitation.

Based on the M&E textbook recommended BOD loading rate of 62 ppd/1000 ft^3 of media and 1,005,310 ft^3 of media in service, the resulting BOD loading capacity is 62,329 ppd, which is substantially greater than the influent BOD loads that occurred in 2015 - 2019. Furthermore, this BOD loading capacity applies to the primary clarifier effluent, not influent wastewater. Because the primary clarifiers remove approximately 35% of the influent BOD, the PMTFs can accommodate an KIWWTP influent BOD loading rate approximately 35% greater than 62,329 lbs/day.

As noted above, based on a BOD loading rate of less than or equal to 62 ppd/1000 ft^3, the hydraulic loading rate should fall within the range of 245 to 1,800 gpd/sf. As previously indicated, during the maximum monthly average flow of 47.46 mgd, the KIWWTP achieved all effluent limits by a significant margin. At 47.46 mgd, the PMTF hydraulic loading rate was 1,464 gpd/sf. Therefore, a hydraulic loading rate greater than 1,464 gpd/sf is justified.

Due to the extent to which the KIWWTP achieved its effluent limits at a hydraulic loading rate of 1,464 gpd/sf, a hydraulic loading rate at the upper end of the recommended range (i.e., 1,800 gpd/sf) will be used to establish the hydraulic design capacity. At a hydraulic loading rate of 1,800 gpd/sf, the corresponding hydraulic design capacity is 58 mgd.

A hydraulic design capacity of 58 mgd is further justified by the exceptional performance of the KIWWTP during maximum flow days that exceeded 58 mgd, as presented in Table 4-3.

5.7 Intermediate Settling Tanks

ISTs, like primary clarifiers, are sized based on SOR. There are three (3) ISTs, each 138 feet in diameter and 12 feet deep, resulting in a total surface area of 44,870 sf. They were specifically designed in 1994 for a peak hourly flow of 93.3 mgd. At the maximum monthly flow of 47.46 mgd that occurred in May 2019, the SOR was 1,060 gpd/sf. As indicated in Table 4-4, the ISTs achieved 58% and 49% BOD and TSS removal efficiencies, respectively, during the maximum monthly average flow of 47.46 mgd.

PADEP's recommended SOR at peak flow is 1,500 gpd/sf, which results in a peak hourly flow capacity of 67 mgd rather than 93 mgd. The M&E textbook does not present recommendations specifically for ISTs, only for final settling tanks following trickling filters. The 10 States Standards recommendation is an SOR of 1,200 gpd/sf at peak hourly flow but that higher SORs may be used "if such rates are shown to have no adverse impact on subsequent treatment units."

Because the ISTs achieve similar removal efficiencies at 47.46 mgd as the primary clarifiers, the hydraulic design capacity of the intermediate settling tanks will be based on the same SOR as the primary clarifiers, i.e., 1,200 gpd/sf.

At a 1,200 gpd/sf maximum month SOR, the resulting hydraulic design capacity of the ISTs is 54 mgd. A hydraulic design capacity of 54 mgd is further justified by the exceptional performance of the KIWWTP during maximum flow days that exceeded 54 mgd, as presented in Table 4-3.

5.8 Rock Media Trickling Filters

The four (4) RMTFs have a total surface area of 5.3 acres (230,868 square feet) and a 10-foot-depth of rock media. The RMTFs were originally designed for BOD removal before the PMTFs were constructed in the late 1970s. The rock media trickling filters currently provide NH_3 removal via the nitrification process prior to final settling.

As shown in Table 4-4, during the maximum monthly average flow of 47.46 mgd, the IST effluent NH_3 concentration was 5.6 mg/l. Therefore, the PMTF removed 63% of the influent ammonia. As a result, the RMTFs only need to remove a nominal amount of NH_3 to enable the KIWWTP to comply with its NH_3-N effluent limitations. As shown in Table 4-4, the effluent NH_3 concentration during the 47.46 mgd maximum monthly average flow was 1.5 mg/l, i.e., substantially below the monthly average effluent limit of 5 mg/l.

The 10 States Standards does not present sizing criteria for nitrifying rock media trickling filters, nor does the PADEP Domestic Wastewater Facilities Manual or the M&E Wastewater

Engineering textbook. However, the United States Environmental Protection Agency (EPA) Process Design Manual for Nitrogen Control indicates that a 9-foot-deep bed of rock media in a separate stage trickling filter for nitrification can be expected to remove 2.4 pounds per day of NH_3 per 1,000 cubic feet of rock media.

The total volume of rock media in the 5.3-acre RMTF is 2,308,680 cubic feet. Based on an NH_3 removal rate of 2.4 pounds per day per 1,000 cubic feet; the RMTF has the capacity to remove 5,540 pounds per day of NH_3.

From a hydraulic design capacity perspective, the RMTF needs to achieve the required effluent limits every month of the year, including the month with the highest average flow. However, as previously described in Section 3.0, the influent NH_3 loading is not significantly different during extreme wet-weather events than during dry periods. Therefore, the KIWWTP performed essentially the same from an NH_3 removal perspective during the unprecedented wet period in 2018 and 2019 as it did during the years of 2015, 2016 and 2017, which had normal amounts of precipitation.

The EPA Process Design Manual for Nitrogen Control does not provide design guidelines for hydraulic loading rates to rock media trickling filters. However, logically, the hydraulic loading rates to rock media trickling filters should not be significantly different than the hydraulic loading rate to plastic media trickling filters. Therefore, to establish a conservative hydraulic design capacity for the RMTF, the very low end of the recommended range of hydraulic loading rates for plastic media trickling filters will be used, i.e., 245 gpd/sf. Based on a hydraulic loading rate of 245 gpd/sf, the corresponding hydraulic design capacity of the RMTF is 56 mgd.

A hydraulic design capacity of 56 mgd is further justified by the exceptional performance of the KIWWTP during maximum flow days that exceeded 56 mgd, as presented in Table 4-3.

5.9 Final Clarifiers

Final clarifiers following trickling filters are sized based on SORs. The PADEP Domestic Wastewater Facilities Manual and the 10 States Standards both indicate that the SOR should not exceed 1,200 gpd/sf based on peak hourly flow. They do not present average flow SORs. The M&E Wastewater Engineering textbook indicates that the recommended average and peak flow SOR is a function of clarifier depth. At a typical depth of 10 feet, the recommended average and peak flow SORs are 500 gpd/sf and 1,030 gpd/sf, respectively.

There are 10 final clarifiers of varying diameters and depths. Final clarifiers 1 through 4 are 70 feet in diameter, and 8.5 feet deep. Final clarifiers 5 and 6 are 100 feet in diameter and 9.5 feet deep. Final clarifiers 7 and 8 are 110 feet in diameter and 11 feet deep. Final clarifiers 9 and 10 are 138 feet in diameter and 11 feet deep. The total combined surface area of the final settling tanks is 80,020 ft^2.

At the PADEP and 10 States Standard peak flow SOR of 1,200 gpd/sf, the peak flow capacity of the ten (10) final clarifiers is 96 mgd. At the M&E textbook recommended average flow SOR of 500 gpd/sf, the average flow capacity of the final clarifiers is 40 mgd. However, during the maximum monthly average flow of 47.46 mgd, the SOR was 593 gpd/sf, which resulted final clarifier BOD and TSS removal efficiencies of 86% and 78%, respectively, which produced effluent BOD and TSS concentrations substantially below the effluent limitations for BOD and TSS.

Because the KIWWTP achieve all effluent limits by a substantial margin at a SOR of 593 gpd/sf, it is reasonable to assume that compliance would be achieved at an SOR 15% greater than 593 gpd/sf. Therefore, to establish the hydraulic design capacity of the final clarifiers, a SOR of 680 gpd/sf will be utilized. Based on a SOR of 680 gpd/sf, the hydraulic design capacity of the final clarifiers is 54 mgd.

A hydraulic design capacity of 54 mgd is further justified by the exceptional performance of the KIWWTP during maximum flow days that exceeded 54 mgd as presented in Table 4-3. For example, during the maximum daily flow of 57.49 mgd in September 2018, the effluent CBOD and TSS concentrations were 5 mg/l and 6 mg/l, respectively. During the maximum daily flow of 62.36 mgd in December 2018, the effluent CBOD and TSS concentrations were 8 mg/l and 11 mg/l, respectively, and during the maximum daily flow of 64.3 mgd in July 2019, the effluent CBOD and TSS concentrations were 6 mg/l and 5 mg/l, respectively. Therefore, a hydraulic design capacity of 54 mgd is conservative.

5.10 Chlorine Contact Tank

Chlorine contact tanks are sized to achieve certain specific HDTs at average and peak flows. The PADEP Domestic Wastewater Facilities Manual requires a minimum contact period of 15 minutes at peak hourly flow and 30 minutes at the maximum monthly average flow. The 10 States Standards recommendation is a minimum contact period of 15 minutes at the design peak hourly flow and does not require a minimum contact time at average or maximum monthly average flow. The M&E Wastewater Engineering textbook does not recommend minimum contact periods but rather identifies C_rt values (C_rt is the product of dose and contact time) to achieve various log reductions of bacteria.

There is one chlorine contact tank, 194 feet by 83 feet, and 11 feet deep, resulting in a volume of 1,324,900 gallons. Based on this volume and the PADEP contact time of 30 minutes at maximum monthly average flow, the maximum monthly average flow capacity of the chlorine contact tank is 63.6 mgd. Because the maximum monthly average flow capacity is the hydraulic design capacity, the hydraulic design capacity of the chlorine contact tank is 63.6 mgd.

5.11 Effluent Pumping System

During infrequent periods when the Lehigh River reaches flood levels, treated and disinfected effluent from the KIWWTP must be pumped to the Lehigh River.

The effluent pumping system consists of a total of five (5) pumps each rated for a capacity of 13,890 gpm at 26 feet TDH. The design firm capacity of the effluent pumping system (i.e. with one pump out of service) is 86 mgd.

Therefore, because the effluent pumping system can consistently and reliably pump treated and disinfected effluent at a rate of 86 mgd, the hydraulic design capacity of the effluent pumping system is 86 mgd.

5.12 Solids Handling Processes

The KIWWTP's solids handling processes consist of the following:

1. Gravity thickeners to thicken IST and final clarifier sludge prior to anaerobic digestion (primary sludge is not gravity thickened prior to anaerobic digestion).
2. Anaerobic digesters to reduce the mass of solids to be disposed and to produce digester gas for beneficial reuse.
3. Belt filter presses to dewater the anaerobically digested sludge prior to disposal.

Each of these solids handling processes are sized based on sludge flows and loads, which are generated by the removal of BOD and TSS from the influent wastewater.

As previously shown in Table 3-12, the increase in annual average flow in 2018 and 2019 did not result in an increase in sludge production compared to the preceding years with normal precipitation. This is expected, because sludge is generated by the removal of BOD and TSS from the wastewater, and the BOD and TSS loads in 2018 and 2019 were not significantly different than the BOD and TSS loads in the preceding years with normal precipitation.

As a result, hydraulic design capacity is not relevant to the solids handling unit processes.

5.13 Hydraulic Design Capacity Summary

A summary of the hydraulic design capacity of the individual unit processes is presented in Table 5-1 on the following page.

Because the overall hydraulic design capacity of the KIWWTP is dictated by the unit processes with the lowest hydraulic design capacity, it is the primary clarifiers, intermediate settling tanks and final clarifiers that limit the overall design capacity of the KIWWTP to 54 mgd.

Table 5-1: Hydraulic Design Capacity Summary

UNIT PROCESS	HYDRAULIC DESIGN CAPACITY
Influent Screening	100 mgd
Main and Auxiliary Pumping Station	85 mgd
Aerated Grit Removal	96.8 mgd
Primary Clarifiers	54 mgd
Intermediate Pumping Station	86 mgd
Plastic Media Trickling Filters	58 mgd
Intermediate Settling Tanks	54 mgd
Rock Media Trickling Filters	56 mgd
Final Clarifiers	54 mgd
Chlorine Contact Tank	63.6 mgd
Effluent Pumping System	86 mgd
Solids Handling Unit Processes	n/a (1)

(1) As further described in Section 5.12, hydraulic design capacity is not applicable to the solids handling unit processes.

6.0 CONCLUSION AND RECOMMENDATION

The overall conclusion is that the KIWWTP's actual hydraulic design capacity is 54 mgd rather than 40 mgd as shown in the Part II permit referenced in Section 1.0.

Therefore, it is recommended that the incorrect 40 mgd hydraulic design capacity presented in the Part II permit be corrected to 54 mgd.

This recommendation has no bearing on the KIWWTP's permitted annual average flow of 40 mgd, which should remain 40 mgd.

APPENDIX 7

Individual Municipality Flow Projections

City of Allentown

Signatory Flow Projections

INTERIM ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Municipality Name **City of Allentown**

GPD/EDU:	238

TOTALS	523	5,710	1,195,681
Residential	0	0	0
Comm./Ind.	523	5,710	1,195,681

Development Name	Address (OPTIONAL)	Tax Parcel ID (OPTIONAL)	Zoning (OPTIONAL)	Type of Development (OPTIONAL)	Acres (OPTIONAL)	EDUs	Specifics R= Residential; NR= Non-Residential	Projected Development Year	Projected 2020-2027 Flow (gpd)
347-361 Gordon Street Apartments	347-361 Gordon Street			Conversion from industrial use to apartments		40	R		9,520
	1384 S. 5TH STREET				10.8	94	NR		22,372
Atty. General's Office	2305 28TH ST SW			Building Addition		8	NR		1,904
	1215 S. 4TH ST			Redevelopment: new bldg & update parking	0.7494	7	NR		1,554
Trout Creek Cottages	1101 S. 6TH ST.			Pocket Neighborhood Development	5.3	52	R		12,376
The Landmark	90 S NINTH ST			33 story bldg-retail, office, residential	0.119	175	NR		41,650
801 N. Meadow Street	801 N. MEADOW ST.			Recycling Processing Center	2.5	33	NR		7,854
	1330 S 4TH ST			Retail	1	9	NR		2,142
Allentown Terminals Corporation	1114-1366 N QUEBEC ST			Storage tanks and warehousing	13.35	75	NR		17,850
Townes at the Jordan	948 N FRONT ST			Townhomes (Condominium)	2.72	18	R		4,284
Airport Rd. Shopping Center	1245 1353 AIRPORT RD			Retail Center (Expansion)	3.00	26	NR		6,188
	639 E. ALLEN STREET			Install 7,000 sf garage & 6 parking spaces	3.0581	20	NR		4,760
	265 LEHIGH ST			Multi-dwelling unit bldg containing 80 units	11.1559	80	R		19,040
1018 W. Walnut St.	1018 W WALNUT ST		R-H	Semi-detached Dwellings	0.35	6	R		1,428
Fearless Fire Company	14 46 EAST JUNIATA ST		R-ML	Parking Lot/Single Family	1.23	4	R		952
Common Ridge Estates	N FILBERT/E HAMILTON STS			Twins & Apartments (Condominium)	16.52	140	R		33,320
Townes at Trexler Square II	116 S 8TH ST		R-H	Townhomes	0.79	18	R		4,284
Former K-Mart	1502 S 4th Street	640634937415	B-4		0.2906	50	NR		11,900
American Pkwy & N. Irving St	1620 AIRPORT RD	640881312529	I-2		7.66	43			10,234
N. Ellsworth St	720 N ELLSWORTH ST	640766631519	I-2		3.47	24			5,712
Seftel Site	2843 MITCHELL AVE	549584493485	I-2		6.77	41			9,758
American Pkwy & N. Dauphin St	1019 AMERICAN PKWY, 1024 N BRADFORD ST, 500 AMERICAN PKWY	640758158799, 640758248221, 640759755865	B/LI		23.34	154			36,652
LSI (former Agere Site)	555 UNION BLVD	640757990536	I-2		35.77	142			33,796
Boulevard Drive-In	540 UNION BLVD	640767821628	B/LI		12.55	7			1,666
State Hospital	1900 E ALLEN ST, 1600 HANOVER AVE	641746460329, 641726847797	I-G		192.91	400			95,200
Lehigh Landing	51 N FRONT ST	640752151002	B-5		1.48	28			6,664
UGI Tank	202 W UNION ST	640740488709	I-2		3.45	18			4,284
Montex	1112 S 6TH ST, 1102 S 6TH ST, 1101 S 6TH ST, 1120 S 6TH ST, 1102 S 5TH ST	640636108387, 640636115157, 640636415274, 640635292480, 640636625261	R-M		4.52	65			15,470
South 5th St	1406 S 5TH ST	640634564687	I-2		5.30	65			15,470
S Glenwood St.	1811 S GLENWOOD ST	549567205959	B-4		9.86	47			11,186
South St Elmo St.	1834 W FAIRVIEW ST, 1940 W FAIRVIEW ST	549646946043, 549646507548	P		6.99	42			9,996
Lehigh Parkway East	1649 LEHIGH PKWY E	549675056761	R-H		3.02	201			47,838
Davis Site - Sumner Ave	183 SUMNER AVE	640726737584	B/LI		4.32	24			5,712
Paxus Townhouses	1312 S 8TH ST	640624371202	R-M		0.43	7			1,666
Phoenix	333 W COURT ST	640731269543	B/LI		3.41	237			56,406
1902 Lehigh St.	1902 LEHIGH ST	549680433515	B-3		4.95	18			4,284
9th St and Walnut St.	901 W WALNUT ST	640609052579	B-2		1.02	89			21,182

713 N. 13th St	713 N 13TH ST	549762389361	B/LI		0.50	47				11,186
513 N. 16th St	513 N 16TH ST	549751026319	R-MH		0.96	6				1,428
N Ivey St	929 N IVY ST, 901 N IVY ST, 901 N IVY ST REAR, 21 JORDAN DR	640736880126, 640736869299, 640736994963, 640737932179	I-3		7.91	25				5,950
N Bradford St	650 N BRADFORD ST	640765184835	I-2		7.03	22				5,236
Constitution Dr.	223 E WYOMING ST REAR	640687288387	R-LC		23.90	57				13,566
Hospital Development (Unallocated)	-	-	-			300				71,400
NIZ Tax Zone Place Holder (Unalloc	-	-	-			1500				357,000
	1430 OXFORD DR	549537940329	R-H		1.58	50				11,900
	3001 EVANS ST	549583798848	R-L		1.53	11				2,618
	502 CEDAR CREEK BLVD	549634686522	R-L		1.10	8				1,904
	1450 OXFORD DR	549536988334	R-ML		1.91	18				4,284
	1213 W LINDEN ST	549679882960	R-H		0.66	22				5,236
	1820 S 12TH ST	549691748930	I-2		2.72	8.5				2,023
	1802 S 12TH ST	549691786367	B-4		1.88	1				238
	606 S 10TH ST	549697354907	I-3		18.23	57				13,566
	602 N 7TH ST	549793642421	B1/R		1.73	49				11,662
	1711 W LIBERTY ST	549740184375	B-5		1.24	3.8				904
	1501 S 12TH ST	640603726039	I-3		11.74	36.8				8,758
	108 S 7TH ST	640619169631	B-2		1.06	36.4				8,663
	810 LINCOLN DR	640698302003	R-L		1.89	13.4				3,189
	1256 S 5TH ST	640635515244	I-2		3.64	11.41				2,716
	1947 BAKER DR	640631783769	R-MH		2.34	66.4				15,803
	801 N MEADOW ST	640715953804	I-3		2.59	8.13				1,935
	125 N 4TH ST	640722700446	R-H		1.79	61.5				14,637
	566 W EMAUS AVE	640650076616	R-L		1.50	1.6				381
	241 S 3RD ST	640740557304	I-2		2.68	8.4				1,999
	101 N RAILROAD ST	640742768667	R-MH		1.43	40				9,520
	5 N FRONT ST	640752215824	B-5		3.33	10				2,380
	900 N DAUPHIN ST	640757136555	I-2		1.79	5				1,190
	739 E FAIRMONT ST	640870551131	B/LI		2.31	7				1,666
	310 W UNION ST	640740224422	B/LI		8.34	26				6,188
	1715 UNION BLVD	641729432610	B/LI		1.13	3				714
	809 TACOMA ST	641738731250	R-M		1.12	13				3,094
	2124 HANOVER AVE	641748408681	B-3		1.61	4				952
	1706 HOOVER AVE	641811093744	I-3		6.77	21				4,998
	2500 LANCASTER AVE	640527200954	R-M		2.61	30				7,140
	626 E TILGHMAN ST	640776405846	I-2		3.88	12				2,856
	401 N FRONT ST	640744636767	I-3		2.01	6				1,428
	16 W LIBERTY ST	640744852027	I-3		2.14	6				1,428
	1202 N GODFREY ST	640870507604	B/LI		2.94	9				2,142
	1117 CATASAUQUA AVE	640747079685	I-3		9.76	30				7,140
	2814 MITCHELL AVE	549595131715	I-2		2.09	6				1,428
	1115 AMERICAN PKWY	640769981892	B/LI		17.98	56				13,328
Change of Use (Unallocated)						245				58,310
Unknown Projects (Unallocated)						245				58,310
										0
										0
										0
										0

Lehigh County Authority

Signatory Flow Projections

ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Municipality Name Lehigh County Authority

GPD/EDU:	223

TOTALS	0	1,580
Residential	0	0
Comm./Ind.	0	1,580

	352,340	151,640	89,200	111,500
Developments	0	0	0	0
8	352,340	151,640	89,200	111,500

Development Name	Address	Tax Parcel ID	Zoning	Type of Development	Acres	EDUs	Specifics	Projected Development Year	Projected Flow (gpd)	2020-2030 New Flow	2031-2040 New Flow	2041-2050 New Flow
Industrial Development						0		2021	0	0	0	0
Industrial Development						0		2022	0	0	0	0
Industrial Development						0		2023	0	0	0	0
Industrial Development						380		2024	84,740	84,740	0	0
Industrial Development						300		2025	66,900	66,900	0	0
Industrial Development						400		2031	89,200	0	89,200	0
Industrial Development						300		2041	66,900	0	0	66,900
Industrial Development						200		2050	44,600	0	0	44,600

	2025
0	151,640
2020	2021-###
-	-
-	-
-	-
-	84,740
-	66,900
-	-
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Borough of Macungie

Signatory Flow Projections

ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Municipality Name **Borough of Macungie**

GPD/EDU:	223

Development Name	Address	Tax Parcel ID	Zoning	Type of Development	Acres	EDUs	Specifics	Projected Development Year	Projected Flow (gpd)	2020-2030 New Flow	2030-2040 New Flow	After 2040 New Flow
				TOTALS	**56**	**203**			**45,269**	**40,809**	**2,230**	**2,230**
				Residential	52	158			35,234	35,234	0	0
				Comm./Ind.	4	45			10,035	5,575	2,230	2,230
Deleted									0	0	0	0
Brookside Country Club	901 Willow Lane	15 K08 15	R-10	Residential	10.00	95		2020	21,185	21,185	0	0
Main Street Commons, Phase 2	200 W MAIN ST	15 L08NW1A 0	GC	Comm./Ind.	3.50	15		2020	3,345	3,345	0	0
MSTJ Properties LLC	153 LUMBER ST	15 L08NW1C 0	TC	Residential	3.20	20		2021	4,460	4,460	0	0
Donald Young	123 E MAIN ST	15 L08NW1C 0	TC	Residential	1.40	15		2022	3,345	3,345	0	0
DRN REAL ESTATE OF MACUNG	* S LEA ST	15 L08NW1C 0	TC	Residential	0.10	2		2023	446	446	0	0
SUBJINEPROPERTY	33 S LEA ST	15 L08NW1C 0	TC	Residential	0.30	6		2024	1,338	1,338	0	0
TYLER PENN LLC	99 W MAIN ST	15 L08 001 00	TC	Residential	37.00	20		2025	4,460	4,460	0	0
MISC. OTHER	VARIES			Comm./Ind.	0.00	10		2026	2,230	2,230	0	0
MISC. OTHER	VARIES			Comm./Ind.		10		2036	2,230	0	2,230	0
MISC. OTHER	VARIES			Comm./Ind.		10		2046	2,230	0	0	2,230
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0
									0	0	0	0

Lower Macungie Township

Signatory Flow Projections

ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Municipality Name Lower Macungie Township

GPD/EDU:	**223**			**TOTALS**	**1,034**	**2,471**			**424,023**	**532,262**	**16,761**	**0**
				Residential	276	858		Developments	191,334	189,773	1,561	0
				Comm./Ind.	758	1,613		111	232,689	342,489	15,200	0

Development Name	Address	Tax Parcel ID	Zoning	Type of Development	Acres	EDUs	Specifics	Projected Development Year	Projected Flow (gpd)	2020-2030 New Flow	2031-2040 New Flow	2041-2050 New Flow
SPRING CREEK PROPERTIES - LUTRON ELECTRONICS SEWER CONNECTION	8240 SPRING CREEK RD	546441331883	O	Light Industry	51.17	6	Warehouse	2020	1,250	1,250	0	0
	3200 ORCHARD RD	547317461693	I	Commercial	36.62	2	Warehouse	2020	485	485	0	0
TACO BELL	5374 HAMILTON BLVD	547565309727 and 547565430027	C	Commercial	0.49	19	Fast Food Restaurant and Office Building	2020	4,237	4,237	0	0
SPRING CREEK	8783 CONGDON HILL DR	546317224584	HI-S	Heavy Industry	53.38	47	Warehouse	2020	10,444	10,444	0	0
SPRING CREEK	8615 CONGDON HILL DR	546327146378	HI-S	Heavy Industry	46.29	47	Warehouse	2020	10,444	10,444	0	0
SPRING CREEK	8449 CONGDON HILL DR	546337222951	HI-S	Heavy Industry	58.81	47	Warehouse	2020	10,444	10,444	0	0
SPRING CREEK	8444 CONGDON HILL DR	546328866910	HI-S	Heavy Industry	8.02	47	Warehouse	2020	10,444	10,444	0	0
SPRING CREEK	8323 CONGDON HILL DR	546338922117	C-SC	Commercial	16.37	47	Warehouse	2020	10,444	10,444	0	0
	6240 HAMILTON BLVD	547512982095	C	Commercial	1.35	5	Commercial Building	2020	1,200	1,200	0	0
	6217 HAMILTON BLVD	547513751934	C	Commercial	6.28	5	Commercial Building	2020	1,200	1,200	0	0
	1111 GRANGE RD	547523993704	U	Commercial	2.93	11	Restaurant	2020	2,380	2,380	0	0
TREXLER BUSINESS CENTER	6150 HAMILTON BLVD	547522461516, 547512886266, 547512989833, 547522291861, 547523312452, and 547523724340	C	Commercial	9.23	26	Office Space and Retail Center	2020	5,900	5,900	0	0
JAINDL COMMERCIAL PARK NORTH	6161 HAMILTON BLVD	547523172939	C	Commercial	4.93	19	Office Building, Restaurant, and Retail Center	2020	4,200	4,200	0	0
MILLBROOK FARMS 6	4521 INDIAN CREEK RD	548463715168	S	Residential	20.93	42	42 Lot Subdivision	2020	9,366	9,366	0	0
STONE HILL MEADOWS, PHASE 2	3611 GEHMAN RD	547366121766 and 547367516707	R	Residential	62.04	85	85 Lot Subdivision	2020	18,955	18,955	0	0
WEIS MARKETS	3440 GRANDVIEW DR	547358396443	C	Commercial	13.07	85	Commercial Building	2020	18,950	18,950	0	0
SCHOENECK ROAD LOT 1 - AIR PRODUCTS	3262 SCHOENECK RD	546397842621	I	Light Industry	13.43	16	Warehouse	2020	3,500	3,500	0	0
AL-MAQASID	7394 ALBURTIS RD	547307561048	I	Commercial	12.22		Seminary	2020				0
HAMILTON CROSSINGS NORTH	617 N KROCKS RD	547567692461	HC	Residential	52.81	416	400 Apartments, Commercial Building, and Restaurant	2020	92,768	92,768	0	0
	4511 CEDARBROOK RD	547599803773	HE	Commercial	25.22	57	2 Hotels, Office Building, and Small Commercial Building	2020	12,711	12,711	0	0
SUBURBAN SELF SERVE CARWASH	6452 HAMILTON BLVD	547502627743	C	Commercial	1.83	5	Car Wash	2020	1,104	1,104	0	0
U-HAUL OF LOWER MACUNGIE	7785 SPRING CREEK RD	546454069300	SR	Commercial	4.82	5	Commercial Building	2020	1,200	1,200	0	0
INDIAN CREEK VILLAGE	5415 INDIAN CREEK RD	548420386208	S	Residential	0.74	2	2 Lot Subdivision	2020	446	446	0	0
	1620 HIDDEN VALLEY RD	548523007822	S	Residential	0.64	1	Single Family Homes	2020	223	223	0	0
MOUNTAIN VIEW ESTATES	2062 ELBOW LN	548540155494	S	Residential	13.46	27	27 Lot Subdivision	2020	6,021	6,021	0	0
SCHAEFER RUN COMMONS	8189 HAMILTON BLVD	546436126075	SR	Residential	9.82	112	Condominium Town Homes	2020	24,976	24,976	0	0
	4440 HAMILTON BLVD	548518102010	HC	Commercial	1.93	5	Commercial Building	2020	1,200	1,200	0	0
KROCKS COURT	5621 HAMILTON BLVD	547554086045	C	Commercial	1.27	15	Retail Center and Commercial Building	2020	3,345	3,345	0	0
ALLEN ORGAN REDEVELOPMENT	3370 PA ROUTE 100	547358862563	C	Commercial	14.19	16	Office Building	2020	3,500	3,500	0	0
ABE DOORS & WINDOWS REDEVELOPMENT	6718 HAMILTON BLVD	546591274189	C	Commercial	1.00	15	Car Wash and Retail Center	2020	1,200	1,200	0	0
DRIES SUBDIVISION	3500 BROOKSIDE ROAD	548400346497	U	Residential	7.69	20	20 Apartments	2020	4,460	4,460	0	0
RESERVE ALLOCATION						560		2021 - 2025		125,000	0	0
COUNTRY HOME ACRES	1398 DORNEY AVE	548555146831	S	Residential	0.50	1	Single Family Homes	2021	223	223	0	0
SPRING CREEK	8120 SAUERKRAUT LN	546349494923	HI-S	Heavy Industry	32.96	47	Warehouse	2022	10,444	10,444	0	0
LEHIGH VALLEY S I P	7505 ALBURTIS RD	546397890673	O	Light Industry	3.58	6	Warehouse	2022	1,300	1,300	0	0
	1715 WEILERS RD	546424400941	U	Residential	0.21	1	Single Family Homes	2022	223	223	0	0
GRAYMOOR	6519 RUTHERFORD DR	547417365931	SR	Residential	2.25	1	Single Family Homes	2022	223	223	0	0
GRAYMOOR	1849 PEMBROOKE DR	547427543259	SR	Residential	0.64	1	Single Family Homes	2022	223	223	0	0
LOWER MACUNGIE FUNERAL HOME	6503 LOWER MACUNGIE RD	547510178161	U	Commercial	5.80	2	Funeral Home	2022	465	465	0	0
	6126 HAMILTON BLVD	547522687870	C	Commercial	4.34	16	Office Building	2022	3,500	3,500	0	0
	6084 HAMILTON BLVD	547523725177	C	Commercial	1.43	1	Commercial Building	2022	250	250	0	0
MILLBROOK FARMS	2887 EXETER DR	548456678394	S	Residential	1.36	1	Single Family Homes	2022	223	223	0	0
	2291 RIVERBEND RD	548459186327	S	Residential	0.29	1	Single Family Homes	2022	223	223	0	0
MILLBROOK FARMS	3170 SHEFFIELD DR	548465605590	S	Residential	0.54	1	Single Family Homes	2022	223	223	0	0
MILLBROOK FARMS	3184 SHEFFIELD DR	548465708045	S	Residential	0.53	1	Single Family Homes	2022	223	223	0	0
MILLBROOK FARMS	3177 SHEFFIELD DR	548465921353	S	Residential	0.71	1	Single Family Homes	2022	223	223	0	0
MILLBROOK FARMS	3194 SHEFFIELD DR	548475100121	S	Residential	0.95	1	Single Family Homes	2022	223	223	0	0
MILLBROOK FARMS	3183 SHEFFIELD DR	548475111895	S	Residential	0.92	1	Single Family Homes	2022	223	223	0	0
COUNTRY HOME ACRES	1406 DORNEY AVE	548555042697	S	Residential	0.49	1	Single Family Homes	2022	223	223	0	0
BODY ELITE	5518 HAMILTON BLVD	547554680166 and 547554687577	C	Commercial	0.49	2	Commercial Building	2022	530	530	0	0
SPRING CREEK	8219 SAUERKRAUT LN	546348273194	C-SC	Commercial	5.13	47	Warehouse	2023	10,444	10,444	0	0
SPRING CREEK	8290 SAUERKRAUT LN	546349045087	C-SC	Commercial	4.04	47	Warehouse	2023	10,444	10,444	0	0
LEHIGH VALLEY S I P	7428 INDUSTRIAL PARK WAY	546398930430	O	Light Industry	3.95	6	Warehouse	2023	1,300	1,300	0	0
ANCIENT OAKS	7680 CATALPA DR	546455709184	S	Residential	0.20	1	Single Family Homes	2023	223	223	0	0

ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Municipality Name Lower Macungie Township

GPD/EDU:	223	TOTALS	1,034	2,471		424,023	532,262	16,761	0
		Residential	276	858	Developments	191,334	189,773	1,561	0
		Comm./Ind.	758	1,613	111	232,689	342,489	15,200	0

Development Name	Address	Tax Parcel ID	Zoning	Type of Development	Acres	EDUs	Specifics	Projected Development Year	Projected Flow (gpd)	2020-2030 New Flow	2031-2040 New Flow	2041-2050 New Flow
L W & I A SCHMOYER	6275 MOUNTAIN RD	547385378248	R	Residential	2.11	1	Single Family Homes	2023	223	223	0	0
ALLEN WEST ESTATES	1065 PINE GROVE CIR	547595682090	S	Residential	1.73	5	Single Family Homes	2023	1,115	1,115	0	0
	1105 MINESITE RD	548505370858	U	Residential	1.03	1	Single Family Homes	2023	223	223	0	0
BROOKHAVEN	1885 BRIARCLIFFE TER	548561253973	S	Residential	1.60	1	Single Family Homes	2023	223	223	0	0
BROOKHAVEN	3866 MAULFAIR DR REAR	548571912045	S	Residential	3.97	1	Single Family Homes	2023	223	223	0	0
BROOKHAVEN	3800 MAULFAIR DR	548581145302	S	Residential	1.45	1	Single Family Homes	2023	223	223	0	0
ANCIENT OAKS	7601 SPRING CREEK RD	546465119437	S	Residential	0.22	1	Single Family Homes	2024	223	223	0	0
HARRIS YORK	2520 GRACIE LONE	548437783430	S	Residential	0.45	1	Single Family Homes	2024	223	223	0	0
	2164 S CEDAR CREST BLVD	548582221646	S	Residential	2.73	1	Single Family Homes	2024	223	223	0	0
SCHAEFER RUN WEST	1530 PINEWIND DR	546414784773	SR	Residential	0.18	1	Single Family Homes	2025	223	223	0	0
SCHAEFER RUN WEST	1541 WEILERS RD	546415805799	U	Residential	0.32	1	Single Family Homes	2025	223	223	0	0
SCHAEFER RUN WEST	1521 WEILERS RD	546415811614	U	Residential	0.32	1	Single Family Homes	2025	223	223	0	0
ANCIENT OAKS	7677 CATALPA DR	546455605571	S	Residential	0.22	1	Single Family Homes	2025	223	223	0	0
SPRING CREEK ESTATES	1255 DANNER RD	546590635649	U	Commercial	1.69	5	Commercial Building	2025	1,200	1,200	0	0
SCHAEFER RUN WEST	8330 SCHAEFER RUN RD	546425060178	R3	Residential	5.16	10	Condominium Town Homes	2026	2,230	2,230	0	0
ANCIENT OAKS	7699 CATALPA DR	546454684107	S	Residential	0.30	1	Single Family Homes	2026	223	223	0	0
ANCIENT OAKS	7687 CATALPA DR	546454694580	S	Residential	0.23	1	Single Family Homes	2026	223	223	0	0
ANCIENT OAKS	7673 SPRING CREEK RD	546454890055	S	Residential	0.24	1	Single Family Homes	2026	223	223	0	0
ANCIENT OAKS	7661 SPRING CREEK RD	546454990619	S	Residential	0.20	1	Single Family Homes	2026	223	223	0	0
MACUNGIE CROSSING	5949 HAMILTON BLVD	547534605755	C	Commercial	4.27	20	Commercial Shopping Center	2026	4,540	4,540	0	0
BELLE CHASE	6300 LOWER MACUNGIE RD	547429666813	U	Residential	45.65	68	68 Lot Subdivision	2027	15,164	15,164	0	0
HARRIS YORK	2645 HOUGHTON LEAN	548437003849	S	Residential	0.44	1	Single Family Homes	2027	223	223	0	0
HARRIS YORK	2630 HOUGHTON LEAN	548437133086	S	Residential	0.38	1	Single Family Homes	2027	223	223	0	0
HARRIS YORK	2605 GRACIE LONE	548437454473	S	Residential	0.39	1	Single Family Homes	2027	223	223	0	0
HARRIS YORK	2680 GRACIE LONE	548437606410	S	Residential	0.48	1	Single Family Homes	2027	223	223	0	0
CLEARVIEW MANOR	1215 MINESITE RD	548505837633	S	Residential	0.80	1	Single Family Homes	2027	223	223	0	0
	8401 BROOKDALE RD	546414452244	SR	Residential	1.59	1	Single Family Homes	2030	223	223	0	0
	1741 TREXLERTOWN RD	546455419805	C	Commercial	2.28	4	Commercial Building	2030	892	892	0	0
	2204 PA ROUTE 100	546463500437	AP	Commercial	5.65	5	Commercial Building	2030	1,200	1,200	0	0
SPRING CREEK PROPERTIES, REVISED SUBDIVISION 2	2550 PA ROUTE 100	546480379486	C-SC	Commercial	14.00	209	Warehouse	2030	46,500	46,500	0	0
	1873 MILL CREEK RD	547437488744	S	Residential	0.42	1	Single Family Homes	2030	223	223	0	0
RAY A LEIBENSPERGER	1696 BOGIE AVE	547459582883	S	Residential	0.69	1	Single Family Homes	2030	223	223	0	0
	2201 BROOKSIDE RD	547498965042	S	Commercial	38.73	10	Church	2030	2,300	2,300	0	0
	1138 MILL CREEK RD	547501927036	C	Commercial	1.36	5	Commercial Building	2030	1,200	1,200	0	0
	5500 EAST TEXAS RD	547570664009	S	Residential	0.42	1	Single Family Homes	2030	223	223	0	0
	5451 LOWER MACUNGIE RD	547580102825	S	Residential	0.47	1	Single Family Homes	2030	223	223	0	0
	895 N BROOKSIDE RD	547586843230	C	Commercial	0.20	5	Small Commercial Building	2030	1,200	1,200	0	0
	5739 N WALNUT ST	548308798301	S	Residential	0.25	1	Single Family Homes	2030	223	223	0	0
	5037 WILD CHERRY LN	548417521482	S	Residential	10.00	14	14 Single Family Homes	2030	3,122	3,122	0	0
	2812 MACUNGIE RD	548435592578	S	Residential	3.01	4	Single Family Homes	2030	892	892	0	0
	4261 INDIAN CREEK RD	548484009331	S	Residential	0.80	1	Single Family Homes	2030	223	223	0	0
	1790 MINESITE RD	548542683336	S	Residential	1.22	1	Single Family Homes	2030	223	223	0	0
	1799 MINESITE RD	548543920440	S	Residential	0.96	1	Single Family Homes	2030	223	223	0	0
	4175 EAST TEXAS RD	548544282198	S	Residential	0.14	1	Single Family Homes	2030	223	223	0	0
COUNTRY HOME ACRES	1414 DORNEY AVE	548545846577	S	Residential	0.63	1	Single Family Homes	2030	223	223	0	0
	7975 QUARRY RD	546450811376	HI-S	Heavy Industry	0.80	4	Small Commercial Building	2040	800	0	800	0
	7462 CHURCH LN	546458659265	S	Residential	1.00	1	Single Family Homes	2040	223	0	223	0
	7290 DRAGONFLY LN	546490973315	O	Commercial	1.13	5	Commercial Building	2040	1,200	0	1,200	0
SPRING CREEK ESTATES	6659 STEIN WAY	547500145077	U	Commercial	2.16	5	Commercial Building	2040	1,200	0	1,200	0
	6309 LOWER MACUNGIE RD	547510666928	U	Commercial	8.97	24	School Property	2040	5,400	0	5,400	0
	5606 EAST TEXAS RD	547570116323	S	Residential	0.50	1	Single Family Homes	2040	223	0	223	0
	1170 BROOKSIDE RD	547575517362	U	Commercial	229.89	24	School Property	2040	5,400	0	5,400	0
	4982 HAMILTON BLVD	547586456122	C	Commercial	0.25	5	Small Office Building	2040	1,200	0	1,200	0
	85 N WALNUT ST	548308523423	R-10	Residential	0.23	1	Single Family Homes	2040	223	0	223	0
	5390 INDIAN CREEK RD	548420454875	S	Residential	0.87	1	Single Family Homes	2040	223	0	223	0
	2940 MACUNGIE RD	548434570485	S	Residential	3.11	1	Single Family Homes	2040	223	0	223	0
COUNTRY HOME ACRES	1422 DORNEY AVE	548545735769	S	Residential	0.82	1	Single Family Homes	2040	223	0	223	0
	2760 RIVERBEND RD	549419516332	SR	Residential	1.00	1	Single Family Homes	2040	223	0	223	0

Upper Macungie Township

Signatory Flow Projections

ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Municipality Name **Upper Macungie Township**

GPD/EDU:	223

TOTALS	1,904	7,804
Residential	1,273	3,402
Comm./Ind.	631	4,402

	1,740,236	1,066,170	351,783	322,284
Developments	758,646	336,061	120,643	301,942
94	981,590	730,109	231,140	20,342

TOTALS	591,659	458,970
- Grandfathered	59,764	66,454
- Approved	103,628	66,744
= NET	428,267	325,772

Development Name	Address	Tax Parcel ID	Zoning	Type of Development	Acres	EDUs	Specifics	Projected Development Year	Projected Flow (gpd)	2020-2030 New Flow	2031-2040 New Flow	2041-2050 New Flow	2020 Flows	2021-2025 Flows	PLANNING MODULE STATUS
Woodmont Phase II	5265 Rockrose Lane	547624398227	GI	Residential	35.36	30	2 - Apartment Bldgs, 30 Units	2020	6,690	6,690	0	0	6,690	-	APPROVED
Ridgeline Warehouse	7352 Industrial Boulevard	546548068154	LI	Light Industry	91.86	1794	811200 - Manufacturer	2020	400,000	400,000	0	0	400,000	-	
Above and Beyond	5844 Daniel Street	547527381168	R2	Commercial	6.74	29	49714 - Care Facility	2020	6,489	6,489	0	0	6,489	-	APPROVED
67 Werley Road	67 Werley Road	547662332960	R5	Residential	12.11	112	7 - 16 Apartment Buildings	2020	24,976	24,976	0	0	24,976	-	APPROVED
Townplace Suites by Marriot	5828 Memorial Road	546685245001	HC	Commercial	4.03	21	14012 (Hotel) 7450 (Restaurant)	2020	4,594	4,594	0	0	4,594	-	APPROVED
Isett Development	5420 Crackersport Road	547606891901	LI	Light Industry	6.05	5	21609 Office	2020	1,200	1,200	0	0	1,200	-	
NFI - Lehigh Valley West	0371 - 0171 Oldt Road / 255 Nestle Way	545546394524, 545556280552, 545556886863, 545566289323, 545566695106, 545577129831	LI	Light Industry	51.50	5	384500 Warehouse	2020	1,148	1,148	0	0	1,148	-	
Wrenfield	1230 PA Route 100	545674239470	R5	Residential	15.00	111	Condominium Town Homes	2020	24,753	24,753	0	0	24,753	-	GRANDFATHERED
Laurel Fields Phase 5	Werley Road	547652518261	R5	Residential	7.45	25	Condominium Town Homes	2020	5,575	5,575	0	0	5,575	-	
Lehigh Hills Lot 5 (KRE Apartments)	1670 Route 100, 1250 Nursery Street, 1325 Church Street	545646416416, 545666149618, 545663095372, 545663817989, 545665892003	R2	Residential	51.05	273	Apartments	2020	60,879	60,879	0	0	60,879	-	APPROVED
Shoppes at Trexler Plaza	5917 W. Tilghman Street	546675889200	HC	Commercial	1.29	8	Service/Retail	2020	1,784	1,784	0	0	1,784	-	
Schaefer Run Commons	1445 Weilers Road	546426892469	R3	Residential	28.05	157	Twins	2020	35,011	35,011	0	0	35,011	-	GRANDFATHERED
Atas International	8364 Main Street	545640486849	LI	Light Industry	30.00	7	496800 Manufacturing Center	2020	1,561	1,561	0	0	1,561	-	
Mill Creek Hotel	0671 Grange Road	547515262267	R5	Commercial	11.00	76	142025 (6-Story Hotel)	2020	16,999	16,999	0	0	16,999	-	
Valley West Estates	0448 Oldt Road	545536806264	R1	Residential	25.00	18	18 Additional Connections	2021	4,014	4,014	0	0	-	4,014	GRANDFATHERED
Oak Tree Manor	5528 Muth Circle	547539186567	R2	Residential	0.47	1	Single Family Lots	2021	223	223	0	0	-	223	GRANDFATHERED
Parkland Fields	Krock's and Schantz's Road	Various	R2	Residential	3.25	6	6 - Single Family	2021	1,338	1,338	0	0	-	1,338	APPROVED
Trexler Fields	Swallow Tail Lane / Spring White Drive	Various	R2	Residential	3.08	25	Twins	2021	5,575	5,575	0	0	-	5,575	GRANDFATHERED
Trinity Wesleyan Church Additions	6735 Cetronia Road	546585241740	R2	Commercial	8.31	2	5500 Addition	2021	513	513	0	0	-	513	APPROVED
Lehigh Hills Lot 5 (Jaindl SFD)	1670 Route 100, 1250 Nursery Street, 1325 Church Street	545646416416, 545666149618, 545663095372, 545663817989, 545665892003	R2	Residential	211.93	291	Twins, Single Homes, Commercial Facility	2021	64,893	64,893	0	0	-	64,893	APPROVED
Weilers Road Twins	8451 Hamilton Boulevard	546407565875	R3	Residential	12.90	82	82 - Twins	2021	18,286	18,286	0	0	-	18,286	GRANDFATHERED
Woda Development	8853 Hamilton Boulevard	545486074486	NC	Commercial	8.65	55	Townhomes	2021	12,265	12,265	0	0	-	12,265	
Oak Tree Manor	5540 Muth Circle	547539591504	R2	Residential	0.50	1	Single Family Lots	2022	223	223	0	0	-	223	GRANDFATHERED
Upper Macungie Community Center	0360 Grange Road	546567986933	R2	Commercial	14.74	15	63750 Public Center	2022	3,345	3,345	0	0	-	3,345	
	1050 Mill Road	545697510390	LI	Light Industry	8.54	9	Office/ Warehouse	2023	2,114	2,114	0	0	-	2,114	
(Potential Large Industrial User?)	8364 Main Street	545640486849	LI	Light Industry	145.00	1000	Office/ Warehouse	2023	223,000	223,000	0	0	-	223,000	
Hidden Meadows	0600 Werley Road	547633789965	R5	Residential	34.77	168	Condominium Town Homes	2024	37,464	37,464	0	0	-	37,464	GRANDFATHERED
Summit Reality	Grim and Mosser	545590537065	HC	Commercial	5.00	25	Commercial Center	2025	5,575	5,575	0	0	-	5,575	
Summit Reality	1046 Grim Road	546500437908	HC	Commercial	6.12	27	Commercial Center	2025	6,021	6,021	0	0	-	6,021	
Haaf-tercha Industrial Park No. 2	9230 Long Lane	545449785823	R1	Residential	84.00	64	Single Family Lots	2025	14,272	14,272	0	0	-	14,272	
	7034 Ambassador Drive West	546607903881	LI	Light Industry	9.20	5	Office/ Warehouse	2025	1,200	1,200	0	0	-	1,200	
	7124 Ambassador Drive	545685938300	LI	Light Industry	19.13	158	Office/ Warehouse	2025	35,234	35,234	0	0	-	35,234	
	1331 Blue Barn Road	546698869134	R2	Residential	2.01	1	Single Family Lots	2025	223	223	0	0	-	223	
Green Hills	1330 Highland Drive	546659258727	R2	Residential	1.20	1	Single Family Lots	2025	223	223	0	0	-	223	GRANDFATHERED
Green Hills	5760 Clauser Road	546669313869	R2	Residential	1.50	1	Single Family Lots	2025	223	223	0	0	-	223	GRANDFATHERED
Morningside	6454 Overlook Road	546639810179	R2	Residential	1.11	1	Single Family Lots	2025	223	223	0	0	-	223	GRANDFATHERED
	5831 Cetronia Road	547527746367	R3	Residential	1.00	1	Single Family Lots	2025	223	223	0	0	-	223	
(fmr. Faust Junkyard)	0681 Grange Road	547515975744	R5	Residential	9.67	100	100 Apartments	2025	22,300	22,300	0	0	-	22,300	
Trexlertown Shopping Center	7150 Hamilton Boulevard	546469492409	HC	Commercial	14.96	13	Shopping Center	2026	2,999	2,999	0	0	-	-	
Lone Pond Estates	0319 Cressman Drive	547508747553	R2	Residential	0.72	1	Single Family Lots	2026	223	223	0	0	-	-	GRANDFATHERED
Hopewell Farms	6066 Palomino Drive	547526882409	R2	Residential	0.50	1	Single Family Lots	2028	223	223	0	0	-	-	GRANDFATHERED
Hopewell Farms	6074 Palomino Drive	547536091266	R2	Residential	0.50	1	Single Family Lots	2028	223	223	0	0	-	-	GRANDFATHERED

ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Municipality Name **Upper Macungie Township**

GPD/EDU:	223

TOTALS	1,904	7,804
Residential	1,273	3,402
Comm./Ind.	631	4,402

	Projected Flow (gpd)	2020-2030 New Flow	2031-2040 New Flow	2041-2050 New Flow
TOTALS	1,740,236	1,066,170	351,783	322,284
Developments	758,646	336,061	120,643	301,942
94	981,590	730,109	231,140	20,342

	2020 Flows	2021-2025 Flows
TOTALS	591,659	458,970
- Grandfathered	59,764	66,454
- Approved	103,628	66,744
= NET	428,267	325,772

Development Name	Address	Tax Parcel ID	Zoning	Type of Development	Acres	EDUs	Specifics	Projected Development Year	Projected Flow (gpd)	2020-2030 New Flow	2031-2040 New Flow	2041-2050 New Flow	2020 Flows	2021-2025 Flows	PLANNING MODULE STATUS
Hopewell Farms	6082 Palomino Drive	547537109316	R2	Residential	0.75	1	Single Family Lots	2028	223	223	0	0	-	-	GRANDFATHERED
	5947 Reppert Lane	547526702383	R3	Residential	3.16	1	Single Family Lots	2028	223	223	0	0	-	-	
Mill Run	1001 Glenlivet Drive	545683174905	LI	Light Industry	4.07	18	Office/ Warehouse	2030	4,068	4,068	0	0	-	-	
Blue Barn Estates	1450 Blue Barn Road	546699232555	R2	Residential	7.24	14	14 Lot Subdivision	2030	3,122	3,122	0	0	-	-	
	9141 Hamilton Blvd	545457900766	R1	Residential	11.78	19	Single Family Lots	2030	4,237	4,237	0	0	-	-	
Coke Expansion	7551 Schantz Road	546519682040	LI	Light Industry	43.01	734	100000-50000	2035	163,579	0	163,579	0	-	-	APPROVED
Two Windsor Plaza	7500 Windsor Drive	546601173950	LI	Light Industry	5.00	27	Office	2035	5,999	0	5,999	0	-	-	
Tamerler	0935 Blue Barn Road	546686969436	NC	Commercial	15.84	5	Commercial Center	2035	1,200	0	1,200	0	-	-	
Fallbrook	9160 Schantz Road	545542002551	R1	Residential	51.59	74	74 - Single Family	2035	16,502	0	16,502	0	-	-	GRANDFATHERED
Lone Pond Estates	0320 Burrell Boulevard	547508943111	R2	Residential	1.20	1	Single Family Lots	2035	223	0	223	0	-	-	GRANDFATHERED
Lone Pond Estates	0323 Burrell Boulevard	547518160051	R2	Residential	0.60	1	Single Family Lots	2035	223	0	223	0	-	-	GRANDFATHERED
Holiday Hills	5830 Mertz Drive	547610290812	R2	Residential	0.30	1	Single Family Lots	2035	223	0	223	0	-	-	GRANDFATHERED
Park Place West	0227 Hopewell Drive	546599845527	R2	Residential	0.30	1	Single Family Lots	2035	223	0	223	0	-	-	GRANDFATHERED
Mosser Road Development	1050 Mosser Road	546500715895	R3	Residential	7.78	10	10 - Single Family	2035	2,230	0	2,230	0	-	-	GRANDFATHERED
	0110 PA Route 100	546507790709	LI	Light Industry	11.31	51	Office/ Warehouse	2035	11,311	0	11,311	0	-	-	
	7761 Industrial Boulevard	546516308616	LI	Light Industry	20.37	91	Office/ Warehouse	2035	20,369	0	20,369	0	-	-	
	7762 Industrial Boulevard	546524269913	LI	Light Industry	38.82	5	Office/ Warehouse	2035	1,200	0	1,200	0	-	-	
	0749 PA Route 100	546535100991	LI	Light Industry	6.27	28	Office/ Warehouse	2035	6,282	0	6,282	0	-	-	
	0871 PA Route 100	545683851133	LI	Light Industry	9.97	75	Office/ Restaurant	2035	16,801	0	16,801	0	-	-	
	7312 Windsor Drive	546612222713	LI	Light Industry	7.62	8	Office/ Warehouse	2035	1,800	0	1,800	0	-	-	
	7240 Windsor Drive	546612728695	LI	Light Industry	2.04	8	Office/ Warehouse	2035	1,800	0	1,800	0	-	-	
	8738 Hamilton Boulevard	545486321583	NC	Commercial	2.67	4	Small Commercial Property	2035	801	0	801	0	-	-	
	8026 Main Street	545662219785	NC	Residential	1.00	1	Single Family Lots	2035	223	0	223	0	-	-	
	8557 Main Street	545631277726	R1	Residential	17.00	30	30 - Single Family	2035	6,690	0	6,690	0	-	-	
	0621 Twin Ponds Road	545560688996	R1	Residential	7.15	12	Single Family Lots	2035	2,676	0	2,676	0	-	-	
	5177 Cetronia Road	547517313750	R2	Residential	13.70	25	25 - Single Family	2035	5,575	0	5,575	0	-	-	
	9129 Breinigsville Road	545456811550	R2	Residential	1.57	1	Single Family Lots	2035	223	0	223	0	-	-	
	1190 Grange Road	547524880744	R5	Residential	46.00	200	200 Apartments	2035	44,600	0	44,600	0	-	-	
	6748 Ruppsville Road	546651689151	R3	Residential	10.10	52	52 Units (Apartments)	2040	11,596	0	11,596	0	-	-	
	5562 East Lane	546751861330	R1	Residential	13.87	12	12- 'Single Family Homes	2040	2,676	0	2,676	0	-	-	
	0450 Bastian Lane	546662292655	R3	Residential	26.42	120	120 - 'Twins	2040	26,760	0	26,760	0	-	-	
Allentown Osteopathic Med Center	5511 Crackersport Road	546697829967	R5	Residential	46.30	427	Town Homes and Apartments	2045	95,221	0	0	95,221	-	-	
Ash Lane	9229 Mertztown Road	545470990647	U	Residential	44.70	22	22 Lot Single Family Subdivision	2045	4,906	0	0	4,906	-	-	
	1334 Trexlertown Road	546448110709	C	Residential	21.84	70	Single Family Lots	2045	15,610	0	0	15,610	-	-	
	7540 Ruppsville Road	546543581137	LI	Light Industry	8.72	45	Office/ Warehouse	2045	9,999	0	0	9,999	-	-	
	0121 Nestle Way	545576122157	LI	Light Industry	3.76	5	Office/ Warehouse	2045	1,200	0	0	1,200	-	-	
	0690 Church Street	545671537591	NC	Commercial	9.00	41	Commercial Center	2045	9,143	0	0	9,143	-	-	
	9762 Trexler Road	545424874856	R1	Residential	28.00	60	60 - Single Family	2045	13,380	0	0	13,380	-	-	
	1260 Church Street	545642574354	R1	Residential	27.00	47	47 - Single Family	2045	10,481	0	0	10,481	-	-	
	8771 Main Street	545611783743	R1	Residential	80.50	141	141 - Single Family	2045	31,443	0	0	31,443	-	-	
	8363 Main Street	545642015742	R1	Residential	22.91	40	40 - Single Family	2045	8,920	0	0	8,920	-	-	
	9249 Newtown Road	545447796601	R1	Residential	7.52	14	Single Family Lots	2045	3,122	0	0	3,122	-	-	
	9233 Newtown Road	545457269545	R1	Residential	10.06	18	Single Family Lots	2045	4,014	0	0	4,014	-	-	
	9230 Long Lane	545449785823	R1	Residential	84.39	148	Single Family Lots	2045	33,004	0	0	33,004	-	-	
	5137 Schantz Road	547651078042	R2	Residential	6.97	16	16 - Single Family	2045	3,568	0	0	3,568	-	-	
	5383 Cetronia Road	547640516674	R2	Residential	9.42	21	21 - Single Family	2045	4,683	0	0	4,683	-	-	
	5148 Schantz Road	547650089963	R2	Residential	15.05	33	33 - Single Family	2045	7,359	0	0	7,359	-	-	
	9058 Hamilton Boulevard	545433245589	R2	Residential	11.70	40	40 - Single Family	2045	8,920	0	0	8,920	-	-	
	7051 Cetronia Road	546575017948	R2	Residential	35.06	80	80 Lot Subdivision	2045	17,840	0	0	17,840	-	-	
	6718 Ruppsville Road	546652186858	R3	Residential	2.00	4	4 - Single Family Homes	2045	892	0	0	892	-	-	
	7974 Hamilton Blvd	546437335092	R3	Residential	28.37	113	Twins	2045	25,199	0	0	25,199	-	-	
	9521 Hamilton Blvd	545437189821	RT	Residential	26.77	60	Twins, Single Homes	2045	13,380	0	0	13,380	-	-	

Upper Milford Township

Signatory Flow Projections

ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

GPD/EDU: 223

1/13/2020

Municipality Name Upper Milford Township

Development Name	Address	Tax Parcel ID	Zoning	Type of Development	Acres	EDUs	Sq. Ft	Projected Development Year	Projected Flow (gpd)	2021-2025 New Flow	2030-2040 New Flow	After 2040 New Flow	Explanation for Change
Maple Ridge Estates	4401 Main Road West/ 5051 Milford Road West	549304363575 549314377445	R-A	Residential	29.00	30	30 Lot Subdivision	2022	6,690	6,690	0	0	Only 30 Lots, Final Plans have been submitted.
Minnie Young	4489 Fairview Lane	548396873552	R-SR	Residential	1.00	1	Single Family Home	2022	223	223	0	0	Maple Ridge Sewer Extension Connections
Minnie Young	4501 Linda Lane	548396745700	R-SR	Residential	1.00	1	Single Family Home	2022	223	223	0	0	Maple Ridge Sewer Extension Connections
Minnie Young	4492 Linda Lane	548396516951	R-SR	Residential	1.00	1	Single Family Home	2022	223	223	0	0	Maple Ridge Sewer Extension Connections
Minnie Young	4496 Linda Lane	548396714139	R-SR	Residential	1.00	1	Single Family Home	2022	223	223	0	0	Maple Ridge Sewer Extension Connections
Minnie Young	4500 Linda Lane	548395991941	R-SR	Residential	1.00	1	Single Family Home	2022	223	223	0	0	Maple Ridge Sewer Extension Connections
Minnie Young	4549 Linda Lane	549306130321	R-SR	Residential	1.00	1	Single Family Home	2022	223	223	0	0	Maple Ridge Sewer Extension Connections
John Mondin	4502 Shimerville Rd.	549306214662	R-A	Residential	1.00	1	Single Family Home	2022	223	223	0	0	Maple Ridge Sewer Extension Connections
John Mondin	4741 Linda Lane	549306440631	R-A	Residential	1.05	1	Single Family Home	2023	223	223	0	0	Maple Ridge Sewer Extension Connections
John Mondin	4742 Linda Lane	549306214662	R-A	Residential	1.00	1	Single Family Home	2023	223	223	0	0	Maple Ridge Sewer Extension Connections
John Mondin	4773 Linda Lane	549306546040	R-A	Residential	1.25	1	Single Family Home	2023	223	223	0	0	Maple Ridge Sewer Extension Connections
John Mondin	4801 Linda Lane	549306734593	R-A	Residential	1.65	1	Single Family Home	2023	223	223	0	0	Maple Ridge Sewer Extension Connections
John Mondin	4833 Linda Lane	549306827245	R-A	Residential	1.58	1	Single Family Home	2023	223	223	0	0	Maple Ridge Sewer Extension Connections
John Mondin	4832 Linda Lane	549306508021	R-A	Residential	1.33	1	Single Family Home	2023	223	223	0	0	Maple Ridge Sewer Extension Connections
John Mondin	4780 Linda Lane	549306401760	R-A	Residential	1.37	1	Single Family Home	2023	223	223	0	0	Maple Ridge Sewer Extension Connections
NA	4758 Jasper Rd	549316034067	R-A	Residential	1.00	1	Single Family Home	2024	223	223	0	0	Future connections from Maple Ridge Extension
NA	4774 Jasper Rd	549316149226	R-A	Residential	1.80	3	Multi Family	2024	669	669	0	0	Future connections from Maple Ridge Extension
NA	4802 Jasper Rd	549316347050	R-A	Residential	1.00	1	Single Family Home	2024	223	223	0	0	Future connections from Maple Ridge Extension
NA	4820 Jasper Rd	549316315729	R-A	Residential	1.70	1	Single Family Home	2024	223	223	0	0	Future connections from Maple Ridge Extension
NA	4832 Jasper Rd	549316419324	R-A	Residential	1.00	1	Single Family Home	2024	223	223	0	0	Future connections from Maple Ridge Extension
NA	4848 Jasper Rd	549315590405	R-A	Residential	1.50	1	Single Family Home	2024	223	223	0	0	Future connections from Maple Ridge Extension
NA	4886 Jasper Rd	549315574924	R-A	Residential	1.80	1	Single Family Home	2024	223	223	0	0	Future connections from Maple Ridge Extension
NA	4878 Jasper Rd	549315262176	R-A	Residential	1.30	1	Single Family Home	2024	223	223	0	0	Future connections from Maple Ridge Extension
NA	4862 Jasper Rd	549315175899	R-A	Residential	1.70	1	Single Family Home	2024	223	223	0	0	Future connections from Maple Ridge Extension
NA	4854 Jasper Rd	549315093815	R-A	Residential	2.00	1	Single Family Home	2024	223	223	0	0	Future connections from Maple Ridge Extension
NA	4946 Jasper Rd	549315609270	R-A	Residential	3.00	1	Single Family Home	2024	223	223	0	0	Future connections from Maple Ridge Extension
Weaver	4521 Chestnut	548378534234	C	Commercial	1.80	4	Church	2021	892	892	0	0	Future connection
Weaver	4751 Mill Rd	548378838665	SR	Commercial	1.80	2	Commercial & Residential	2025	446	446	0	0	Future connection of existing buildings on lot
Tank Farm Road Future connect to exiting lots	From Raymond Court to Ford Drive		S-R & C	Residential		12		2024	2,676	2,676	0	0	existing lots with on-lot systems that could connect
Buckeye Road Future connections to exiting lots	Tank Farm Road to Chestnut Street		S-R & C	Residential		38		2024	8,474	8,474	0	0	existing lots with on-lot systems that could connect
Indian Creek Industrial Park	4650 Indian Creek Road	5484715755603	I	Commercial		11	11 Lot Subdivision	2023	2,453	2,453	0	0	
Total						124			27,652	27,652			

South Whitehall Township

Signatory Flow Projections

LONG TERM ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Year 2021 thru 2025

Municipality Name **South Whitehall Twp.**

GPD/EDU:	**223**

	Acres	EDUs	Projected 2020-2027 Flow (gpd)
TOTALS	**0**	**798**	**177,872**
Residential	0	0	0
Comm./Ind.	0	798	177,872

Development Name	Address (OPTIONAL)	Tax Parcel ID (OPTIONAL)	Zoning (OPTIONAL)	Type of Development (OPTIONAL)	Acres (OPTIONAL)	EDUs	Specifics	Projected Development Year	Projected 2020-2027 Flow (gpd)
1960 Harold Avenue	same					5	Res -Minor	2021	1,115
Chapmans Road Warehouse	4741 Chapmans Rd.					22	Commercial	2021	5,000
Blue Barn Estates	1530 Blue Barn Rd.					6	Res-Minor	2022	1,338
Hausman Rd Flex Warehouse	1215 Hausman Rd.					4	Commercial	2021	1,000
KRE Commercial	Broadway/Centronia Rd					7	Restaurant	2021	1,500
Miscellaneous & Change in Use						50	Residential	2021-2025	11,150
Miscellaneous & Change in Use						50	Commercial	2021-2025	11,150
Ridge Farm	Walbert Ave & Cedar Crest Blvd.					50	Res/Com	2022	11,150
						83		2023	18,509
						90		2024	20,070
						90		2025	20,070
						0		2026	0
						0		2027	0
						0		2028	0
						0		2029	0
									0
Hills at Winchester	Walbert Avenue					15	Residential	2021	3,345
						15		2022	3,345
						13		2023	2,899
									0
Regency at South Whitehall	Walbert Avenue					42	Residential	2021	9,366
						40		2022	8,920
						40		2023	8,920
									0
Blue Barn Meadows	Blue Barn Road					35	Residential	2021	7,805
						35		2022	7,805
						35		2023	7,805
						35		2024	7,805
						35		2025	7,805
									0
									0
									0
									0
									0

Coplay – Whitehall Sewer Authority

Signatory Flow Projections

INTERIM ACT 537 PLAN - FUTURE 2020 & 2021 - 2025 DEVELOPMENT FLOWS - PLANNING MODULE REQUIRED																	
COPLAY WHITEHALL SEWER AUTHORITY SERVICE AREA - WHITEHALL TOWNSHIP & COPLAY BOROUGH																	
GPD / EDU		215															
Line	Township	CWSA File	Development	PIN	Zoning	Type	Acres	Total	Total	Planning	Planning	Planning	Planning	Planning	Planning	Int	Comments
Ref #	Index		Name					Estimated	Estimated	Year	Year	Year	Year	Year	Year		
								EDU's	Discharge	2020	2021	2022	2023	2024	2025		
1	1733-07	D07-013	Catasauqua Rd & Lehigh Ave - Munzer Yacoub	640815635125	R-5A	Residential	0.7600	5	1,075	1,075							PM Required - In Process
2	1846-14	D15-009	215 Quarry St - Fullerton Mills - Redevelopment	640812367096	R-5A	Residential	1.2400	49	10,535	10,535							PM Required - Resolution Passed by Whitehall Twsp 11-13-2017
3	1884-16	D16-004	Eagle View Townhomes	558070209488	R-5A	Residential	7.8140	38	8,170	8,170							PM Required - Not Submitted by Developer
4	1821-12	D16-112	4154 Roosevelt Street - Factory Redevelopment	558040606115	R-5A	Residential	1.2100	49	10,535	10,535							PM Required - Not Submitted by Developer
5	NA	D17-104	Harrison Street	558050845809		Residential	3.2700	32	6,880	6,880							PM Required - Not Submitted by Developer
6	1913-18	D18-004	1942 Schadt Avenue	549823832220	R-4	Residential	4.6600	3	645	645							PM Required - In Process
7	1914-18	D18-005	2138 Lehigh Avenue - Atanos	640816118484	R-5A	Residential	0.6000	2	430	430							PM Required - Not Submitted by Developer
8	1915-18	D18-006	3101 MacArthur Road - Arlington Cemetary	549920401123	R4	Residential	14.7750	50	10,750	10,750							PM Required - Not Submitted by Developer
9	1916-18	D18-007	4303 Spruce Street	558050600259	R-5A	Residential	0.2300	4	860	800							PM Required - In Process
10	1917-18	D18-008	3030 S 3rd Street	549951424741	R-5A	Residential	0.6300	5	1,075	1,075							PM Required - In Process
11	NA	D18-108	4601 Quarry Street - Timberidge Nuss	548917042351	R-3A	Residential	2.8816	3	645	645							PM Required - Not Submitted by Developer
12	1930-19	D19-001	3585 S Church Street - Industrial Warehouse	548972994040	I	Industrial	39.3630	19	4,085	4,051							PM Required - In Process
13	1936-19	D19-007	135 Crest Drive	640716893289	R-4	Residential	1.3512	5	1,075	1,075							PM Required - Not Submitted by Developer
14	1941-19	D19-012	3434 N Front Street	549954815943	R-5A	Residential	0.4700	4	860	860							PM Required - Not Submitted by Developer
15	1943-19	D19-014	Townes at Schadt Avenue - United Liberty	549803441182	R-3A	Residential	6.6200	33	7,095	7,095							PM Required - Not Submitted by Developer
16	1944-19	D19-015	3614 Lehigh St - 4,000 SF Warehouse, 10 Empl	549849051858	C-2	Commercial	2.2490	2	430	430							PM Required - Not Submitted by Developer
17	1945-19	D19-016	3937 Mechanicsville Road	548887590427	R-2	Residential	21.5854	2	430	430							PM Required - Not Submitted by Developer
18	NA	CWSA Project	Summit Street	Various		Residential		32	6,880	6,800							PM Required - Not Submitted by CWSA - Whitehall Twsp
19	NA	CWSA Project	Prospect Street	Various		Residential		20	4,300	4,300							PM Required- Not Submitted by CWSA - Whitehall Twsp
20			LV Dairy Site - 1026 MacArthur Rd - Redevelopment	549785471751	C-2	Commercial	10.0415	47	10,105			10,105				DCF	Proposed 100,000 SF Retail Space x 0.10 GPD/SF = 10,000 GPD
21			LV Dairy Site - 1002 MacArthur Rd -Redevelopment	549786010140	C-2	Commercial	13.4100	47	10,105		10,105					DCF	
22	1951-19	D19-022	Creekside Apartments - (4) Bldgs (40) Apartments	549769438539	R-5A	Residential	2.9770	40	8,600		8,600					JC	
23			Whitehall Mall - Sears Redevelopment	549872328571	C-2	Commercial		50	10,750			10,750				JC	
24			Jandl Realty LP - 4321 S Church Street	548945571210	R-1	Residential	35.6900	26	5,590						5,590	CC	
25			Jandl Realty LP	548935244151	R-1	Residential	23.8100	18	3,870						3,870	CC	

CWSA SERVICE AREA
WHITEHALL TOWNSHIP and COPLAY BOROUGH

INTERIM ACT 537 PLAN - FUTURE 2020 & 2021 - 2025 DEVELOPMENT FLOWS - PLANNING MODULE REQUIRED																	
COPLAY WHITEHALL SEWER AUTHORITY SERVICE AREA - WHITEHALL TOWNSHIP & COPLAY BOROUGH																	
GPD / EDU		**215**															
Line	**Township**	**CWSA File**	**Development**	**PIN**	**Zoning**	**Type**	**Acres**	**Total**	**Total**	**Planning**	**Planning**	**Planning**	**Planning**	**Planning**	**Planning**	**Int**	**Comments**
Ref #	**Index**		**Name**					**Estimated**	**Estimated**	**Year**	**Year**	**Year**	**Year**	**Year**	**Year**		
								EDU's	**Discharge**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**		
26	1735-07	D07-014	Fort Deshler Office Complex - Chestnut St	548985454391	OS-2	Commercial	8.0000	20	4,300					4,300		CC	
27			Winding Brook - Redevelopment - Lauser	548993615940	C-2A	Commercial	7.4800	45	9,675					9,675		CC	Estimated 9 lots x 5 EDU's/Lot = 45 EDU's
28			Radio Towers - Redevelopment - Vertical Bridge	548980994728	R-2	Residential	33.2349	49	10,535						10,535	CC	
29			Radio Towers - Redevelopment - Vertical Bridge	548981086101	OS-2	Residential	9.9000	4	860						860	CC	
30			HA Williams	548983908300	C-2A	Commercial	2.9470	20	4,300					4,300		CC	Estimated 4 Lots x 5 EDU's/Lot = 20 EDU's
31			Vacant Land - Lehigh Valley Hospital Inc	548898689455	R-2	Residential	142.6000	212	45,580				45,580			CC	
32			Vacant Land - Saint Lukes Hospital of Bethlehem	549900241499	R-2	Residential	25.3600	38	8,170					8,170		CC	
33	1622-04	D04-013	Ringer Road Subdivision - (5) PIN's	548868873462	R-2	Residential	66.8127	130	27,950						27,950	CC	Subdivision will follow Line Ref 31 Lehigh Valley Hopsital
34			Ringer Road Subdivision	548868872135	R-2	Residential	1.9900										
35			Ringer Road Subdivision	548858655549	R-2	Residential	7.6656										
36			Ringer Road Subdivision	548950903760	R-2	Residential	13.9738										
37			Ringer Road Subdivision	548869856334	R-2	Residential	17.0400										
38			T Bossard - 3937 Mechanicsville Road	548887590427	R-2	Residential	21.9300	32	6,880					6,880		CC	Subdivision will follow Line Ref 31 Lehigh Valley Hopsital
39			M Hobel T/A Whitehall Realty - 3430 W	548980202758	R-2	Residential	14.6000	22	4,730					4,730		CC	Subdivision will follow Line Ref 31 Lehigh Valley Hopsital
40	1612-04	D04-006	Country Glen II	548886640488	R-3A	Residential	2.8200	5	1,075					1,075		CC	
41			Rural Road - Walter & Marilyn Groller	548886960381	R-3A	Residential	0.4940	1	215					215		CC	
42			Rural Raad - Edmund & Dolres Krupa	548886952410	R-3A	Residential	0.4760	1	215					215		CC	
43			Rural Road - Walter Groller & Dolores Krupa	548886943576	R-3A	Residential	0.4590	1	215					215		CC	
44	1947-19	D19-008	New K-1 Elementary School (Full Day Kindergarden)	549826530918	R-3A	School	46.3475	20	4,300		4,300					CC	350 Students x 25 GPD/Student = 8,750 GPD/2= 4,375 GPD
45			5127_Railroad_St_On-Lot	559002734669	OS-1	Residential	0.3352	1	215			215				UL	PennDOT Cementon - Northampton Bridge Project - Pocket Area
46			5121_Railroad_St_On-Lot	559002831301	OS-1	Residential	0.1833	1	215			215				UL	PennDOT Cementon - Northampton Bridge Project - Pocket Area
47			5119_Railroad_St_On-Lot	559002833028	OS-1	Residential	0.0720	1	215			215				UL	PennDOT Cementon - Northampton Bridge Project - Pocket Area
48			5117_Railroad_St_On-Lot	559002824923	OS-1	Residential	0.0742	1	215			215				UL	PennDOT Cementon - Northampton Bridge Project - Pocket Area
49			5115_Railroad_St_On-Lot	559002825784	OS-1	Residential	0.1277	1	215			215				UL	PennDOT Cementon - Northampton Bridge Project - Pocket Area
50			5103_Railroad_St_On-Lot	559002920286	OS-1	Residential	0.5419	4	860			860				UL	PennDOT Cementon - Northampton Bridge Project - Pocket Area
INTERIM ACT 537 PLAN - FUTURE 2020 & 2021 - 2025 DEVELOPMENT FLOWS - PLANNING MODULE REQUIRED																	
COPLAY WHITEHALL SEWER AUTHORITY SERVICE AREA - WHITEHALL TOWNSHIP & COPLAY BOROUGH																	
GPD / EDU		**215**															
Line	**Township**	**CWSA File**	**Development**	**PIN**	**Zoning**	**Type**	**Acres**	**Total**	**Total**	**Planning**	**Planning**	**Planning**	**Planning**	**Planning**	**Planning**	**Int**	**Comments**
Ref #	**Index**		**Name**					**Estimated**	**Estimated**	**Year**	**Year**	**Year**	**Year**	**Year**	**Year**		
								EDU's	**Discharge**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**		
51			5105 Main_Street On-Lot	559012011806	OS-1	Residential	0.5670	1	215			215				UL	PennDOT Cementon - Northampton Bridge Project - Pocket Area
52			Thomas Iron Works - WHW Company	549963670791	OS-1	Residential	49.057	19	4,085				4,085			ML	
53			Bible Fellowship Homes	548893625521	R-3A	Residential	12.786	33	7,095		7,095					LL	
57																	
			Totals - Planning Module Required					**1,247**	**268,105**	**76,581**	**30,100**	**23,005**	**49,665**	**39,775**	**48,805**		191,350
				Check	268,105												

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North Whitehall Township

Signatory Flow Projections

LONG TERM ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Year 2021 thru 2025

Municipality Name **North Whitehall Twp.**

TOTALS	**0**	**130**	**28,990**
Residential	0	0	0
Comm./Ind.	0	130	28,990

GPD/EDU:	**223**

Development Name	Address (OPTIONAL)	Tax Parcel ID (OPTIONAL)	Zoning (OPTIONAL)	Type of Development (OPTIONAL)	Acres (OPTIONAL)	EDUs	Specifics	Projected Development Year	Projected 2020-2027 Flow (gpd)
						40		2021	8,920
						30		2022	6,690
						30		2023	6,690
						20		2024	4,460
						10		2025	2,230
									0
									0

Salisbury Township

Signatory Flow Projections

INTERIM ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS - 2020 through 2024

Municipality Name **SALISBURY TOWNSHIP**

GPD/EDU: **247**

				TOTALS	**0**	**262**			**64,714**
				Residential		30			7,620
				Comm./Ind.		232			57,094
Development Name	**Address (OPTIONAL)**	**Tax Parcel ID (OPTIONAL)**	**Zoning (OPTIONAL)**	**Type of Development (OPTIONAL)**	**Acres (OPTIONAL)**	**EDUs**	**Specifics**	**Projected Development Year**	**Projected 2020-2024 Flow (gpd)**
Mosser Drive Residential Subdivision						5			1,235
Miscellaneous Residential Building Permits						25			6,175
Miscellaneous Commercial Building Permits						30			7,410
New Fire Station						2			494
Lehigh Valley Hospital Expansion						200			49,400
									0
									0
									0
									0
									0
									0
									0
									0
									0

Borough of Emmaus

Signatory Flow Projections

INTERIM ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Municipality Name **Emmaus Borough**

GPD/EDU:	280

								(This column added by Hanover Engineering)		
				TOTALS	**160**	**579**				**162,106**
				Residential	154	560				156,870
				Comm./Ind.	6	19				5,236
Development Name	**Address (OPTIONAL)**	**Tax Parcel ID (OPTIONAL)**	**Zoning (OPTIONAL)**	**Type of Development (OPTIONAL)**	**Acres (OPTIONAL)**	**EDUs**	**Specifics**	**Projected Module Submittal**	**Projected Development Year**	**Projected 2020-2027 Flow (gpd)**
Developments exempt from Planning or with Planning Modules previously approved but not yet developed/connected to the public sewer system										
710 Furnace Street	(Single open lot)			Residential	0.25	1			2021	280
Fields at Indian Creek	Former Golf Club of Emmaus site (total of 27 EDU's)			Residential	12.50		New 55+ Community	2017	2019 - 2021	0
|------>	Occupancy in 2019			Residential		5			2019	1,400
|------>	Occupancy in 2020			Residential		10			2020	2,800
|------>	Occupancy in 2021+			Residential		12			2021+	3,360
Wawa Convenience Store	11th & Green Streets			Comm./Ind.	2.30	6	New development	2019	2020	1,596
Re-Development of properties where the principal bldg. was previously removed and not yet redeveloped										
17 Main Street	(Single dwelling demolished)			Residential		1	Demolished 2014		?	280
327 S. 4th Street	(Single dwelling demolished)			Residential		1	Demolished 2015		?	280
56 S. Cherry Street	(Single dwelling demolished)			Residential		1	Demolished 2015		?	280
512 Chestnut Street	(Former jewelry shop)			Comm./Ind.		1	Demolished 2016		?	280
504 E. Main Street	(Single dwelling demolished)			Residential		1	Demolished 2016		?	280
1134 Pennsylvania Avenue	(Former school / Rodale offices)			Comm./Ind.		4	Demolished 2018		?	1,120
										0
Developments currently in the planning/design phase - Sewage Facilities Planning not yet submitted/approved as of 12/17/2019										
123 Macungie Ave Subdivision	123 Macungie Ave			Residential	0.10	1	One new residence			280
Towns at South Mountain	Between Arch & Tilghman	549420946925-1		Residential	9.84	49	New Development	Late 2019	2021	13,720
Chestnut Ridge at Rodale	S. 10th Street			Residential	32.10	2	Re-development of offices	Late 2019	2021	630
300 Furnace Street Apartments	Furnace & S. Mountain Streets			Residential	9.10	144	New Development	Early 2020	2021	40,320
Turkey Hill Redevelopment	6th & Chestnut Streets			Comm./Ind.	1.26	5	Re-development of mini-mart	Early 2020	2021	1,400
Wesley Works Townhouses	6th & NorthStreet			Residential	1.94	26	Re-development of office/whse	Early 2020	2021	7,280
										0
Other properties with development potential within a 5-year planning period										
Re-development of Rodale Offices	33 E. Minor Street			Residential	5.20	50	Former office bldg.	2021	2022	14,000
Fields at Indian Creek	Addl. Land for Development			Residential	5.50	17	55+ community	2021	2023	4,760
Slaski Subdivision	1267 Tilghman Street			Residential	1.14	5	6, less credit for 1 exist.	2021	2022	1,400
										0
										0

Development Name	Address (OPTIONAL)	Tax Parcel ID (OPTIONAL)	Zoning (OPTIONAL)	Type of Development (OPTIONAL)	Acres (OPTIONAL)	EDUs	Specifics	Projected Module Submittal	Projected Development Year	Projected 2020-2027 Flow (gpd)
Other properties with future development potential (long-term planning - no specific timeline projections available)										
Unami Fish & Game property	S. 2nd St		CR	Residential	20.27	34				9,520
	50 S. 6th St		RHO	Residential	2.26	66				18,480
	218 S. 6th St		RHO	Residential	0.60	3				840
	1318 S. 10th St		RL	Residential	0.80	3				840
	1254 S. 10th St		RL	Residential	1.30	6				1,680
	1264 S. 10th St		RL	Residential	0.80	4				1,120
	310 S. 12th St		RM	Residential	0.09	1				280
	S. 15th St		RL	Residential	4.90	12				3,360
	110 S. 16th St		RL	Residential	2.09	10				2,800
	306 Broad St		RHO	Residential	0.33	10				2,800
	306 Broad St, Rear		RHO	Residential	0.33	2				560
	301 Franklin St		RM	Residential	1.60	6				1,680
	710 Furnace St		RL	Residential	0.25	1				280
	123 Macungie Ave		RL	Residential	0.27	1				280
	165 E. Main St		BH	Comm./Ind.	0.10	1				280
	152 E. Minor St		IL	Comm./Ind.	1.80	1				280
	321 E. Minor St		RHO	Residential	0.41	1				280
	1002 PA Ave		IL	Comm./Ind.	0.28	1				280
	1017 PA Ave		RL	Residential	5.80	19				5,320
	1020 PA Ave		RM	Residential	0.95	5				1,400
	1030 PA Ave		RM	Residential	0.41	1				280
	1034 PA Ave		RM	Residential	0.41	1				280
	1258 PA Ave		RL	Residential	0.75	1				280
	1362 PA Ave		CR	Residential	3.80	6				1,680
	1480 PA Ave		CR	Residential	9.60	15				4,200
	1490 PA Ave		CR	Residential	3.91	6				1,680
	1527 PA Ave		CR	Residential	6.10	7				1,960
	Shimerville Rd		CR	Residential	3.87	4				1,120
	1380 Shimerville Rd		RL	Residential	1.20	3				840
	1378 Shimerville Rd		RL	Residential	1.05	3				840
	1222 Tilghman St		CR	Residential	1.94	2				560
	1260 Tilghman St		RL	Residential	0.28	1				280
										0
										0
										0
										0
										0
										0
										0
										0
										0
										0
										0
										0

Hanover Township

Signatory Flow Projections

INTERIM ACT 537 PLAN – FUTURE DEVELOPMENT FLOWS

Municipality Name **Hanover Township, Lehigh County**

GPD/EDU:	**223**				
		TOTALS	**0**	**1,121**	**99,904**
		Residential	0	0	0
		Comm./Ind.	0	1,121	99,904

Development Name	Address (OPTIONAL)	Tax Parcel ID (OPTIONAL)	Type of Development (OPTIONAL)	Acres (OPTIONAL)	EDUs	Projected Development Year	Projected 2020-2027 Flow (gpd)
Good Mac	Lloyd & Irving				224	2022	49,952
Patriot American	1110 American Pkwy				561	2023	
Goodman	Airport Centre				224	2025	49,952
New Pro	Dauphin St.				112	2025	
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
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							0
							0
							0
							0