

Administrative Order CWA-03-2009-0313DN

Five-Year Summary of Activities

Respondent: Western Lehigh Sewerage Partnership (WLSP), consisting of:

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

Respondent: Lehigh County Authority for WLSP
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Section 1: Progress Toward System Characterization

Table 1-1: Flow Monitoring and Rehabilitation Effectiveness																										
Flow Metering	<p>In March 2009, prior to the receipt of the AO, LCA retained the services of ADS, Inc. to conduct a Comprehensive Flow Study that extended through September 2009. ADS installed 148 ultrasonic flow meters and 14 rain gauges throughout the WLSP to monitor 262 miles of the WLSP system. The Report identified areas that were contributing the rainfall derived infiltration and inflow (RDII) to the system and quantified the severity of the RDII.</p> <p>Hydrographs and ADS Report were presented in the January 2011 USEPA Semi-Annual Report.</p> <p>At the conclusion of the 2009 Comprehensive Flow Study, 14 flow meters and 3 rain gauges were left in the system until December 2012 to continue monitoring existing conditions. Data from these meters is for historical purposes and results were not analyzed and I/I was not calculated. In December 2012 the number of long term flow meters was reduced to 2 meters because sufficient historical data had been gathered. LCA also maintains five permanent meters on the Western Lehigh Interceptor (WLI) for operational purposes.</p>																									
Rehabilitation Effectiveness Metering	<p>Five rehabilitation meters and four control meters were installed in Spring 2012. These meters have been used (where possible) to quantify I/I removal for the lining project discussed in section 4. The flow meter data has been analyzed and I/I removal rates have been calculated in accordance with Section 4 of the SCARP Program Approach Outline. This metering will continue for future rehab projects to determine the I & I removal and peak flow reductions achieved.</p>																									
Rehabilitation Effectiveness Results	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Rehabilitation Basin</th> <th style="text-align: center;">Control Basin</th> <th style="text-align: center;">Study Type</th> <th style="text-align: center;">Pre-Post Study?</th> <th style="text-align: center;">I/I Volume % Reduction</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">LCA10</td> <td style="text-align: center;">LMT24B</td> <td style="text-align: center;">Pre/Post</td> <td style="text-align: center;">Yes</td> <td style="text-align: center;">35%</td> </tr> <tr> <td style="text-align: center;">LMT19A</td> <td style="text-align: center;">LMT24B</td> <td style="text-align: center;">Pre/Post</td> <td style="text-align: center;">Yes</td> <td style="text-align: center;">29%</td> </tr> <tr> <td style="text-align: center;">LMT26</td> <td style="text-align: center;">LMT28</td> <td style="text-align: center;">Pre/Post</td> <td style="text-align: center;">Yes</td> <td style="text-align: center;">98%</td> </tr> <tr> <td style="text-align: center;">UMTB010</td> <td style="text-align: center;">LMT24B</td> <td style="text-align: center;">Pre/Post</td> <td style="text-align: center;">Yes</td> <td style="text-align: center;">60%</td> </tr> </tbody> </table>	Rehabilitation Basin	Control Basin	Study Type	Pre-Post Study?	I/I Volume % Reduction	LCA10	LMT24B	Pre/Post	Yes	35%	LMT19A	LMT24B	Pre/Post	Yes	29%	LMT26	LMT28	Pre/Post	Yes	98%	UMTB010	LMT24B	Pre/Post	Yes	60%
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Model Recalibration Metering	<p>The LCA and COA models are being combined to form the Kline's Island Sanitary Sewer (KISS) model. Part of the combination effort is gathering additional flow metering data from 10 meter locations. The 10 meters have been installed since Spring of 2014. The flow meter data will be reviewed and assessed for accuracy. Up to four wet weather events will be selected for use during the KISS model calibration.</p>																									

Table 1-2: Sanitary Sewer Evaluation Study Summary			
SSES Activities	SSES Activity	Catchments Completed	Catchments Identified for SSES
	Nighttime Weiring	152	152
	Smoke Testing	97	97
	Basement Inspections	100	100
	Above Grade Storm Water	83	91
Manhole Inspections	Manhole inspections were completed on the entire WLI which included 552 manholes.		
CCTV Inspections	Since the AO was issued CCTV has been completed for various areas of the system. 65,000 LF of the WLI and Little Lehigh Relief interceptor have been inspected. The results of the WLI and LLRI inspections were provided in the January 2013 USEPA Semi-Annual Report. 58,000 LF of catchments with high weiring results have been televised since the AO was issued.		

SSES catchments were identified by analysis in the 2009 Comprehensive Flow Study. Catchments where meters indicated high levels of inflow or infiltration were selected for the additional SSES study. More information about the SSES prioritization can be found in Table 1-4.

Table 1-3: Hydraulic Modeling	
Model Development	<p>Prior to the development of the model, the optimal operating conditions of the flow equalization basin (FEB), Spring Creek Pumping Station, and Park Pumping Station were defined. The optimum levels were determined utilizing the Planning Level Model to simulate different operating conditions and resulting system reaction for a 10-year storm. The wet weather operating logic technical memorandum was presented in the January 2012 USEPA Semi-Annual Report.</p> <p>A dynamic hydraulic model was developed for the LCA 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, or storage) might be needed, and to estimate what impact I/I reduction projects might have on overflows.</p>
Level of Service Analyses	<p>The draft level of service goal for the system is to maintain flow levels at least three feet below the rim or such lower elevations in portions of the WLI as necessary for adequate performance of the connected Partner sewer lines in close proximity to the WLI. An exception is made for shallow pipes where there is less than three feet of cover over the existing pipe. This level of service goal provides a factor of safety in the analyses compared to a "no overflows" level of service.</p> <p>The results of the level of service analyses are presented separately for two distinct portions of the WLI network:</p> <p><u>Upstream of Park Pump Station</u></p> <p>Due to optimized use of the FEB at the LCA wastewater pretreatment plant, the majority of the WLI currently meets the level of service goals for the 10-year storm event. The level of service violations for the existing system are located on the branches of the WLI that serve Alburdis and Macungie (i.e. "the Alburdis/Macungie Branch") and Upper Milford (i.e. "the Upper Milford Branch"). These two branches currently generally meet the level of service goal for a 2-year storm, but not the 5-year or 10-year storms. It is suspected that grease accumulations in the Upper Milford Branch may be contributing to the level of service violations identified in the model. Further study of the Upper Milford Branch may be performed to determine if the pipe needs to be upsized.</p> <p><u>Near Park Pump Station</u></p> <p>Below Park Pump Station and within about 0.5 mile upstream of Park Pump Station, the level of service is not achieved even for a 2-year storm event due to a combination of factors including:</p>

Table 1-3: Hydraulic Modeling

- The Little Lehigh Relief Interceptor is shallow with less than three feet of cover in some locations.
- The flows from Allentown's system influence system performance near Park Pump Station and create a "backwater" effect, with flows from the Allentown system flowing backward into the Park pump station wetwell.

Current System Upsizing

The hydraulic model was used to determine how many pipe segments need to be upsized in order to meet the draft level of service goal (defined above) for the selected 2-year, 5-year and 10-year storm events for 2010 flows. Pipes in the vicinity of Park Pump Station and any required capacity increases to Park Pump Station were not included in the analysis. The table below presents a summary of the total number of segments that must be replaced in order to meet the level of service for the three selected storm events.

Storm Size	Number of Pipes to Upsize (2010 Flows)	Location of Pipes to Upsize (2010 Flows)
2-year	10	Upper Milford Branch
5-year	47	Upper Milford Branch and Alburdis/Macungie Branch
10-year	98	Upper Milford Branch and Alburdis/Macungie Branch

Pipe Upsizing – 2040 Flows

The hydraulic model was used to determine how many pipe segments need to be upsized in order to meet the draft level of service goal for the selected 2-year, 5-year and 10-year storm events based on anticipated 2040 flows. Pipes in the vicinity of Park Pump Station and any required capacity increases to Park Pump Station were not included in the analysis. The table below presents a summary of the total number of segments that must be replaced in order to meet the level of service for the three selected storm events.

Storm Size	Number of Pipes to Upsize (2040)	Location of Pipes to Upsize (2040)
2-year	195	Upper Milford Branch, Alburdis/Macungie Branch, Breinigsville Branch to Spring Creek Pump Station
5-year	281	Upper Milford Branch, Alburdis/Macungie Branch, Breinigsville Branch to Spring Creek Pump Station
10-year	475	Upper Milford Branch, Alburdis/Macungie Branch, Upper Macungie Branch, Breinigsville Branch to Spring Creek Pump Station

Table 1-4: Other Engineering Activities	
SCARP Development	<p>The Sewer Capacity Assurance and Rehabilitation Program (SCARP) was developed by the WLSP to define a formal methodology for planning, evaluating, prioritizing, and conducting the sewer rehabilitation, conveyance expansion, and/or storage construction in a coordinated and consistent manner. The Act 537 Plan Amendment Resolution adopting the SCARP was presented in the July 2010 USEPA Semi-Annual Report.</p>
SSES Prioritization, Workplans, and Training	<p>Catchments were prioritized based on the findings from the 2009 Comprehensive Flow Study. The prioritization of catchments determined where SSES activities were required, 67 catchments were eliminated from further investigation since they showed little signs of I/I presence. Storm hydrographs were developed for four storms that occurred during the 2009 Comprehensive Flow Study. The hydrographs were analyzed qualitatively to determine the nature of I/I in each catchment and the appropriate SSES technique(s).</p> <p>SSES Workplans were developed for smoke testing, basement inspections, above ground stormwater observations, weiring, and manholes inspections. The workplan was the mechanism by which all field personnel consistently collected, recorded, and stored all field data. Each workplan defined the procedures, techniques, data capture and management tools, analysis methods, and QA/QC steps.</p> <p>To ensure the SSES workplans were understood and followed, ARCADIS conducted several trainings with WLSP personnel who would be performing the SSES work. Trainings for manhole inspection and nighttime weiring were conducted with field personnel.</p>
Wet Weather Operating Logic	<p>To support the WLSP model efforts the optimal operating conditions of the FEB, Spring Creek Pumping Station, and Park Pumping Station were defined. The optimum levels were determined utilizing the Planning Level Model to simulate different operating conditions and resulting system reaction for a 10-year storm. Operation recommendations were provided to cover different weather and flow scenarios.</p>
KISS Model	<p>The LCA and COA models were combined in 2013 to create the KISS model. Both the COA and LCA models were assessed and compared for similarities. Nodes and conduits from the overlapping portions of the models were matched and compared. It was found that the COA model was using the 1929 City Datum that was 230.66 feet less than the USGS datum; this correction was made to the COA model. The real time controls for the operation of system assets was extended from the LCA model to the COA model.</p> <p>All three models, COA, LCA, and KISS were run under dry weather conditions. Comparison of dry weather runs showed that there were no major differences in the KISS model compared to the two original models.</p>

	<p>Additional flow metering occurred in Spring and Summer 2014 to provide four wet weather events for wet weather calibration. A wet weather recalibration will be performed using the additional flow metering data.</p>
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Section 2: Progress Toward Eliminating Inflow

Table 2-1: Inflow Sources Removed						
Municipalities	Number of Basement Disconnections	Number of Manhole Dishes Installed	Number of Manhole Frame and Covers Reset/Replaced	Cleanout Repair / Cap Replacement	Roof Drains Disconnected	Other Lateral Repairs
Alburtis	5	3	7	24		0
Lower Macungie Township	46	61	8	0		2
Lowhill	0	0	0	0		0
Macungie	11	125	10	67		13
Upper Macungie Township	87	368	61	2	1	2
Upper Milford	0	0	1	0		0
Weisenberg	0	0	0	0		0
Western Lehigh Interceptor	0	3	9	0		0
Total	99	441	96	61	1	17

During basement inspections 210 properties were found to have illegal connections, including sump pumps, floor drains, french drains, and area drains. Disconnections have been occurring on a voluntary basis, and will continue on a voluntary basis. Only 2 roof drain connections were located during smoke testing, both in Upper Macungie. No additional cross connections between the sewer and storm systems were located. No new storm sewers will be installed to handle disconnected storm flow.

Section 3: Progress Toward Eliminating Infiltration

Table 3-1: Infiltration Sources Removed

Municipalities	Number of Chimney Seals	Number of Manholes Lined	Number of Manholes Grouted	Cured-in-Place Pipe Line (LF)	Lateral Replacement (to Right-of-way)	Sewer Line Replacement (LF)
Alburtis	0	3	3	16,710	0	0
Lower Macungie Township	10	22	37	22,427	21	1,315
Lowhill	0	0	0	0	0	0
Macungie	11	10	0	5,291	0	0
Upper Macungie Township	83	14	33	27,585	0	0
Upper Milford	2	0	0	0	0	0
Weisenberg	0	0	0	0	0	0
Western Lehigh Interceptor	0	1	1	0	0	0
Total	95	50	74	72,013	21	1,315

Section 4: Other Related Projects

Table 4-1: Other Related Projects	
Flow Equalization Basin	A 3.0 MG FEB was constructed at the Wastewater Pre-Treatment Plant to address short-term capacity issues and provide flow and downstream load equalization benefits. Construction of the FEB was completed September 2010. A technical sizing memo was presented in the January 2011 USEPA Semi-Annual Report.
Western Lehigh Interceptor — Physical Condition Assessment: Pipes	<p>LCA is implementing a program of periodic inspections of the WLI. The results of 2011 and 2012 inspections (44,000 ft of pipe) were evaluated by ARCADIS and recommendations have been made regarding rehabilitation of these portions of the WLI. The pipes were generally found to be in good structural condition with relatively few sources of leakage identified. Recommended actions for these portions of the WLI include:</p> <ul style="list-style-type: none"> • Repair one break in the top of the reinforced concrete pipe that is actively leaking. • Repair one defective link pipe (a prior repair) that is actively leaking. • Test and seal 12,000 ft of pipe due to presence of leaking joints. • Replacement or cured-in-place pipe lining of 2,000 ft of pipe to address structural defects. • Clean 7,000 ft of pipe. <p>In 2012, the Little Lehigh Relief Interceptor (21,000 ft) was also inspected and assessed. No defects were found. However, the siphons along the Interceptor required cleaning to remove grease and debris and are recommended for routine cleaning.</p>
Western Lehigh Interceptor — Physical Condition Assessment: Manholes	Manhole inspections were completed in Spring 2014 on the entire WLI system. Manhole inspections will determine the condition of the manholes and dictate future manhole rehabilitation. A map of the WLI system, showing the CCTV schedule, and manhole inspections is included in Appendix A. Inspection data is being reviewed by ARCADIS and rehabilitation recommendations will be made in Fall 2014.
WLSP Collector Systems	CCTV was previously captured in the WLSP for a variety of reasons. ARCADIS and LCA have been working together to review the CCTV and perform condition assessment and provide rehabilitation recommendations. In conjunction with the CCTV, the areas identified as having high infiltration rates during nighttime weiring were televised and are being reviewed. Approximately 11 miles of pipe showing high infiltration rates were televised since the AO was issued. Review of recently televised and CCTV captured prior to the AO is being reviewed. Rehabilitation recommendations have not been finalized.

Section 5: Progress Toward Cooperative Management of Flows

Table 5-1: Progress Toward Cooperative Management of Flows	
WLSP Formation	Prior to the issuance of the AO, in September 2009, the WLSP was formed. The WLSP was formed to manage the development of the area and the AO as a regional partnership, rather than individual municipalities. The WLSP has since re-affirmed their partnership as part of the SCARP process.
Semi-Annual Meetings	The signatories have participated in semi-annual meetings to discuss activities related to the administrative order and to discuss activities each signatory has implemented as they relate to elimination of inflow and infiltration.
Park Pump Station	The City and the LCA personnel have developed procedures to work together on the operation of the pump station during wet weather events to assist with reducing peak flows at Klines' Island WTP.
Wet Weather Operating Logic	As part of the WLSP model development a memo was developed defining the optimal operating logic of the various system assets. The operating logic has been applied to the FEB, Spring Creek Pumping Station, and Park Pumping Station.
Concession Agreement	The Lehigh County Authority has assumed operational control of the City of Allentown collection system and Kline's Island Wastewater Treatment Plant under a long-term lease agreement. The concession of the Allentown system will allow LCA to optimize the operation of the LCA and COA system. The concession also increases the regionalization of the sewer system which should streamline AO efforts.
KISS Model	The WLSP and the City of Allentown have agreed to combine hydraulic models such that future planning and alternative evaluations can consider impacts on the combined model area. The combined model is referred to as the Kline's Island Sewer System (KISS) Model.

Section 6: Funding

Table 6-1: Financial Reports	
Cost of SCARP to Date	The WLSP has expended \$9,292,521 to date for system rehabilitation, repair, and replacement. LCA has expended \$1,483,921 on SCARP activities to date.
Anticipated Costs to Eliminate SSOs	Anticipated costs to eliminate SSOs and meet the requirements of the Administrative Order are unknown. The capital improvement plan and associated cash flow planning will provide a better understanding of the anticipated cost to satisfy the Administrative Order.

Section 7: Future Activities

Table 7-1: Future Activities and Schedule	
Level of Control Goals	Based on the current and future flow modeling work, preliminary level of control goals will be proposed. These will be included in the Preliminary Objectives Evaluation, which is expected to be submitted to PADEP Fall 2014.
Alternatives Evaluation	The KISS Model is being used to analyze the feasibility of alternatives that include combinations of I/I source removal, storage, and conveyance expansion for addressing the goals. The alternative evaluation is being phased to reduce the vast number of permutations available in the universe of potential solutions to a manageable number. Currently, the work is in the preliminary screening of alternatives phase. The primary goal of that work is to narrow the potential alternatives to address the current and future (2040) peak and dry weather flow conditions in the WLI system. The results of this work will be used to scope the next phase of the alternatives analysis, including timing of capital improvements needed to facilitate expected growth in the WLI system over the next 30 years.
Capital Improvements Plan	<p>The initial draft Capital Improvements Plan (CIP) will have the following components:</p> <ul style="list-style-type: none"> • I/I Mitigation: Based on the hydraulic modeling analysis, flow metering data evaluation, and SSES results and engineering experience, a comprehensive rehabilitation plan prioritizing for rehabilitation will be described. • Capacity and Storage: Recommended capacity and storage improvements for the conveyance systems that provide sufficient capacity (assuming the target I/I reductions are achieved) for a selected, cost-effective level of service. • Implementation Schedule: A phased Implementation Plan outlining an achievable program that addresses existing and projected future capacity needs as flow demands increase over time. • Costs: Estimated life-cycle costs, including O&M, developed for the recommended Improvements Plan. <p>Once the iterative process of rectifying the implementation schedule and capital funding has been completed, a SCARP CIP Implementation Plan will be finalized. The SCARP CIP Implementation Plan will define the needed improvements, implementation schedule, cash flow demands by WLSP, and any needed changes to the existing sewer rate structures to support the implementation schedule.</p>

Table 7-1: Future Activities and Schedule

<p>Schedule</p>	<p>The preliminary screening of alternatives is underway and will be completed in 3rd quarter 2014. The intermediate and final screening of alternatives is slated to be completed summer 2015. The initial CIP, including a cash flow plan that covers the 2020, 2030, and 2040 planning horizons, is slated to be completed in 3rd quarter 2015. Given that the WLSP is composed of 9 separate municipal entities with disparate fiscal situations, we expect that it will take 15 months to arrive at a SCARP CIP Implementation Plan, including rate structure changes that might be dictated by the CIP, to which all of the WLSP Partners can fiscally commit. We expect that a concurrent review with USEPA and PADEP (please recall that the WLSP is also under a corrective action plan dictated by PADEP) will occur during this same time period.</p> <p>Initial compliance with the requirements of the AO related directly to the WLSP is expected to be achieved around 2019. Full compliance will be an ongoing business, as new connections to the system dictate ongoing improvements to conveyance capacity, storage capacity, and I/I reductions through holistic rehabilitation; hence the time-sequenced 30-year SCARP CIP Implementation Plan.</p>
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