

Administrative Order CWA-03-2009-0313DN

Five-Year Summary of Activities

Respondent: City of Allentown

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Section 1: Progress Toward System Characterization

Table 1-1: Flow Monitoring and Evaluation

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|------------------------|--|
| <p>Flow Metering</p> | <p>In 2008, the City engaged ADS Environmental Services, Inc. (ADS) to conduct a Sanitary Sewer Flow Monitoring Program during a 90 day period between July 31, 2008 and October 31, 2008. A total of 169 flow meters were installed to monitor flow throughout the City. The average sewer shed (basin) tributary to each meter was approximately 12,230 linear feet. The flow monitoring data was utilized to evaluate rainfall-derived infiltration and inflow (RDII) and base infiltration in each basin.</p> <p>The data collected and evaluations performed were presented in the ADS report entitled <i>City of Allentown Sanitary Sewer System Flow Monitoring Report</i> dated April 2009. A copy of this report was presented in Appendix B of the AO Progress Report for Period 1 dated January 27, 2010.</p> <p>Based on the findings of ADS' April 2009 Report, a Targeted flow Monitoring Program was conducted in ten (10) of the high priority basins during the period of April 2009 through June 2009. A total of 18 City-owned flow meters were utilized. The information generated from Target Flow Monitoring further refined the location of areas to be prioritized for RDII source identification via a sanitary sewer evaluation study (SSES).</p> <p>The data collected and evaluations performed were presented in the ADS report entitled <i>City of Allentown Sanitary Sewer System Flow Monitoring Report, Target Monitoring #1</i> dated August 28, 2009. A copy of this report was presented in Appendix B of the AO Progress Report for Period 1 dated January 27, 2010.</p> <p>The data collected from both reports was also utilized in the development and calibration of a hydraulic model of the City's sewer system, and in the preparation of the <i>System Assessment and Phase 1 Corrective Action Plan Report</i> dated January 2013 (Phase 1 Corrective Action Plan Report). The Executive Summary of the Phase 1 Corrective Action Plan Report was presented in Appendix B of the Progress Report for Period 8 dated July 30, 2013.</p> |
| <p>Data Evaluation</p> | <p>The flow metering data was used to perform RDII analyses within each of the 169 basins. Normalization of RDII flows on an inch-diameter-mile (IDM) basis was used to rank the basins. The top nineteen (19) basins having the highest potential impact were identified and were divided into primary and secondary basins for modeling analyses as part of the Phase 1 Corrective Action Plan Report, and for SSES investigation as part of the Phase 2 Corrective Action Plan Report.</p> |

Table 1-2: Sanitary Sewer Evaluation Study Summary

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|--|---|
| SSES Project | <p>The Phase 1 Corrective Action Plan Report recommended that the City perform sanitary sewer evaluation study (SSES) field work in the primary and secondary basins. The SSES field work includes: (1) CCTV inspection of 102,210 linear feet of sewer ranging in size from 8 to 36 inches; (2) detailed inspection of 543 manholes; and (3) contingent bid items to be implemented based on the findings of the CCTV and manhole inspections. The contingent bid items include: (1) heavy cleaning of sewer lines, (2) point repairs/removal of obstructions, (3) sealing and testing of sewer line joints, and (4) smoke testing.</p> <p>Specifications for the SSES project were prepared in the second half of 2013 and the project was advertised for bids on March 20, 2014. A contract was subsequently awarded on the May 27, 2014 and the Notice to Proceed was issued on June 23, 2014. This work is now complete except for point repairs which are underway and are being implemented as a contingent bid item. A technical memorandum presenting the findings of the SSES will be prepared within approximately 3 months. The findings of the SSES will also be used to develop a refined RDII removal value for the City's system.</p> |
| Other SSES Activities | <p>In addition to the SSES Project described above, there have been ongoing SSES activities performed by the City, and subsequent to the <i>Allentown Water and Sewer Utility System Concession and Lease Agreement</i>, by LCA.</p> |
| Manhole Inspections | 971 |
| CCTV Inspections | 224,120 feet ⁽¹⁾ |
| Rental Unit Inspections | Approximately 800 per year ⁽²⁾ |
| Pre-sale Inspections | Approximately 1,900 per year ⁽²⁾ |
| Building inspections in Primary & Secondary Basins | 2,920 ⁽³⁾ |

(1) The Concession and Lease Agreement requires LCA to clean and televise 55,000 LF on an annual basis.

(2) Based on data from July 1, 2013 through June 30, 2014

(3) Number of inspections performed in the first half of 2014 following initiation of this program in January 2014.

Table 1-3: Hydraulic Modeling

| | |
|--|---|
| <p>Model Development</p> | <p>In order to evaluate the sewer system's response to and performance during a 10-year, 24-hour storm event of 4.59 inches, and to evaluate the impact of RDII removal and other potential capital improvement on SSOs, a sewer system hydraulic model was developed. The entire process of model development, flow metering data analysis, and model calibration is presented in the report entitled <i>RDII Removal Corrective Action Plan Phase 1, Model Development and Calibration Report</i>, dated January 2013.</p> <p>In summary, the modelled network consists of pipelines within the City's system that are 8 inches in diameter and larger and includes manholes, junction structures, signatory connection points to the system, the Kline's Island WWTP (KIWWTP) influent pumping station, and LCA's Park Pumping Station and flow equalization basin. Two calibrations were developed: one for average antecedent moisture conditions and one for high antecedent moisture conditions. These calibrations were subsequently referred to as the "calibrated model" and the "modified-calibrated model".</p> |
| <p>Modeling Analyses</p> | <p>The 10-year, 24-hour storm of 4.59 inches was routed through the calibrated and modified-calibrated models. The SSO locations resulting from this storm event are predominately along major trunk sewers and are caused by insufficient conveyance capacity and downstream tailwater conditions causing the hydraulic grade line (HGL) to rise above the crown of the pipe. The HGL is largely controlled by the capacity of the Park Pump Station and of the KIWWTP. Seventeen (17) SSO locations were identified for the calibrated model and twenty-seven (27) for the modified-calibrated model. The SSO locations are shown in the Phase 1 Corrective Action Plan Report.</p> <p>A sensitivity analysis was performed to evaluate the effect of signatory flows on SSOs within the City's system. It was determined that signatory flow is a major contributor to SSOs within the City. However, a hypothetical removal of all signatory flows was not sufficient to eliminate hypothetical SSOs within the City during a 10-year storm event, particularly along the Trout Creek Trunk Sewer.</p> |
| <p>SSO Elimination Analyses</p> | <p>A series of capital improvements were individually evaluated to assess their impact on potential SSO mitigation, including: (1) extending the Park Pumping Station Force Main to the KIWWTP together with a new 3 million gallon flow equalization basin at the KIWWTP, (2) 40% RDII removal in the primary and secondary basins, (3) addition of parallel truck sewers, (4) flow equalization basin upstream of the KIWWTP, (5) sealing manholes, (6) increase in Park Pumping Station capacity to 30 mgd and Force Main Extension, and (7) increase in Park Pumping Station Capacity to 40 mgd and Force Main Extension.</p> <p>The analysis indicated that none of the individual improvements would be sufficient to completely eliminate potential SSOs. Therefore, ten different groupings of individual improvements were identified and evaluated. The ten resulting alternatives were routed through the calibrated and modified-calibrated models to evaluate their effectiveness in eliminating potential SSOs.</p> |

Table 1-3: Hydraulic Modeling

The results from the calibrated model are presented in the table that follows.

| Basis of Analysis | Alternative Summary | Volume Lost through SSO's (MG) | Number of SSO Locations | SSO Volume Reduction (%) |
|-------------------|---|--------------------------------|-------------------------|--------------------------|
| Existing System | | 3.21 | 17 | -- |
| Alternative 1 | FM extension, RDII removal (primary and secondary), IPS FEB | 1.44 | 16 | 55% |
| Alternative 2 | FM extension, RDII removal (primary), IPS FEB | 1.50 | 13 | 53% |
| Alternative 3 | FM extension, RDII removal, IPS FEB, Trout Creek Parallel | 1.02 | 5 | 68% |
| Alternative 4 | FM extension, RDII removal, IPS FEB, Trout Creek Parallel, 40% Signatory Flow Reduction | 0.25 | 3 | 92% |
| Alternative 5 | FM extension, RDII removal, IPS FEB, Trout Creek Parallel, 40% Signatory Flow Reduction, Sealed MH | 0 | 0 | 100% |
| Alternative 6 | FM extension, RDII removal, IPS FEB, Trout Creek and Little Lehigh Parallel, 40% Signatory Flow Reduction, Sealed MH | 0 | 0 | 100% |
| Alternative 7 | FM extension, RDII removal, IPS FEB, Trout Creek and Little Lehigh Parallel, 10% Signatory Flow Reduction, Sealed MH | 0 | 0 | 100% |
| Alternative 8 | FM extension, RDII removal, IPS FEB, Trout Creek and Little Lehigh Parallel, Sealed MH | 0 | 0 | 100% |
| Alternative 9 | FM Extension, RDII Removal, Trout Creek Trunk Parallel, Sealed MH, Park PS/FM Upgrade, COM FEB | 0.06 | 2 | 98% |
| Alternative 10 | FM Extension, RDII Removal, Trout Creek Trunk Parallel, Sealed MH, Park PS/FM Upgrade, COM FEB, 40% RDII Signatory Flow Reduction | 0 | 0 | 100% |

As indicated, Alternatives 5, 6, 7, 8 and 10 are each capable of eliminating potential SSOs during the 10-year, 24-hour storm under average antecedent moisture conditions.

The modified-calibrated model indicated that only Alternatives 6 and 10 are capable of achieving $\geq 99\%$ potential SSO volume reduction under high antecedent moisture conditions.

The refined RDII removal value for the City's system, together with any refined RDII removal values from the signatories, will be used to perform additional modeling runs to further evaluate alternatives 5 through 10. Three flow scenarios will be considered for each alternative: the current flow; the future flow as presented in the 537 Plan Update under the scenario of a KIWWT expansion; and the future flow as presented in the 537 Plan Update under the scenario of a direct discharge of LCA's upgraded pretreatment plant. In addition, for each of the short-listed alternatives, the option of blending will be evaluated in comparison to flow equalization.

The additional modeling runs, together with corresponding improvement sizing and cost evaluations, will be used to identify the most cost effective approach to SSO mitigation within the City system, and thus to establish the specific capital improvements to be implemented. The recommended capital improvement plan and schedule will be presented in the Phase II RDII Corrective Action Plan Report.

Table 1-4: Other Engineering Activities

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|---------------------------------------|--|
| <p>Manhole Lining Project</p> | <p>As authorized by the City, LCA issued an RFP and subsequently engaged an engineering firm to design and prepare bid-ready documents for the Manhole Lining Project, which will result in the lining of approximately 50 manholes. The design was subsequently completed, the project was publicly bid, and on October 7, 2014 work was initiated. This project is further described in the AO Progress Report for Period 10 dated July 30, 2014.</p> |
| <p>Manhole Chimney Repair Project</p> | <p>As authorized by the City, LCA issued an RFP and subsequently engaged an engineering firm to design and prepare bid-ready documents for the Manhole Chimney Repair Project, which will result in the repair of approximately 100 manhole brick chimneys including the installation of bolted frames and covers. The design of this project is complete and the project is currently being publicly bid. A pre-bid meeting for prospective bidders was held on October 8, 2014. This project is further described in the AO Progress Report for Period 10 dated July 30, 2014.</p> |
| <p>NASSCO Certification Training</p> | <p>In order to implement an industry-standard approach to condition assessment and defect rating, the City arranged for National Association of Sewer Services Companies (NASSCO) Pipeline, Manhole and Lateral Assessment and Certification training for eleven staff members of the Bureau of Water Resources on February 21, 22 and 23 of 2011. The training and certification program is further described in the AO Progress Report for Period 3 dated January 28, 2011.</p> |
| <p>Manhole Inspection Project</p> | <p>The City initiated the Sanitary Sewer Manhole Inspection Project in 2008 to formally evaluate the condition of manholes with initial focus in floodplains and low lying areas. This project has been ongoing since 2008 and progress has been reported in each AO Progress Report.</p> |

Section 2: Progress Toward Eliminating Inflow

| Table 2-1: Inflow Sources Removed | | | | |
|--|--|----------------------------------|---|---|
| Number of Basement Disconnections | Number of Manhole Inserts Installed | Number of Manhole Repairs | Number of Roof Drains Disconnected | Number of Trestle and Bridge Clearings |
| (1) | 1,374 (2) | 167 | 45 | 26 |

- (1) The City's Bureau of Building Standards and Safety is responsible for conducting rental property inspections and presale inspections of residential and commercial properties prior to property transfer. Inspectors from this Bureau are required to check for sources of RDII such as sump pumps and roof drains. However, record keeping has not been sufficient to obtain an accurate accounting of the specific number of disconnections resulting from these frequent inspections. Certificates of occupancy are not issued until illicit sources of RDII have been disconnected.
- (2) Total number of inserts installed following issuance of the AO. The total number of manholes with inserts, including those installed prior to issuance of the AO, is 6,538. A Sanitary Sewer Insert Status Map is presented in Appendix A of the AO Progress Report for Period 10 dated July 30, 2014.

Section 3: Progress Toward Eliminating Infiltration

| Table 3-1: Infiltration Sources Removed | | | | | |
|--|--|---------------------------|-----------------------|--------------------------------|---|
| Number of Trenchless Sewer Repairs | Number of Sewer Repairs by Excavation | Pipe Joint Sealing | Manhole Lining | Manhole Chimney Repairs | Heavy Cleaning of Sewer Lines (LF) |
| 66 ⁽¹⁾ | 38 ⁽¹⁾ | >1,200 ⁽²⁾ | ⁽³⁾ | ⁽⁴⁾ | 9,722 ⁽⁵⁾ |

- (1) A map showing the location of trenchless sewer repairs and repairs by excavation is presented in Appendix A of the AO Progress Report for Period 10 dated July 30, 2014. The total numbers of repairs include the 8 trenchless repairs and 7 repairs by excavation performed as part of the SSES Project described in Table 1-2.
- (2) The City sealed more than 1,200 infiltrating joints prior to issuance of the AO. In addition, approximately 25 point repairs have been completed thus far as part of the SSES Project described in Table 1-2.
- (3) A project has been designed for the lining of approximately 50 manholes and work was initiated October 7, 2014.
- (4) A project is currently nearing design completion that will result in the repair of approximately 100 manhole brick chimneys. The project has been advertised for bids and a pre-bid meeting for prospective bidders was held on October 8, 2014.
- (5) This work to clear partially blocked sewer lines was performed as part of the SSES Project described in Table 1-2.

Section 4: Other Related Projects

| Table 4-1: Other Related Projects | |
|--|--|
| KIWWTP Influent Screen Replacement Project | <p>This project is related to the AO because the existing influent screens at the KIWWTP were prone to blockages and mechanical failures which contributed significantly to SSOs at Outfall 003 and also increased the HGL in the system thereby exacerbated sewer system SSOs. The City issued an RFP and subsequently engaged an engineering firm to design and prepare bid-ready documents for this project to replace the existing influent screens with new influent screens. Bids were received for this project on July 3, 2013 and the project is now substantially complete as the new screens are presently in service.</p> |
| Concession and Lease Agreement | <p>As first reported in the AO progress Report for Period 7 dated January 28, 2013, a Request for Qualifications (RFQ) was issued by the City in the second half of 2012 for a long term lease of its water and wastewater systems. An RFP was subsequently prepared and issued to the short-listed firms resulting in the receipt of four (4) proposals in the first half of 2013. On August 8, 2013, the City and LCA executed the concession and lease agreement.</p> <p>The Operating Standards of the concession and lease agreement identifies responsibilities for work to be performed related to the AO. In summary, all capital projects related to the AO are to be undertaken by LCA but are to be funded by the City. However, LCA has certain operational responsibilities that are also related to the AO, such as the CCTV inspection of at least 55,000 LF of the City's system per year.</p> |
| 537 Plan Update | <p>LCA and the City, through the assistance of a consultant, are preparing a joint Wastewater Capacity Sewage Facilities Plan (Act 537 Plan) inclusive of the LCA and City service areas. The key issue to be addressed in this plan is how to best meet LCA's future capacity needs. Options being considered include expanding the KIWWTP or by modifying LCA's pretreatment plant to serve as a direct discharge facility to either the Jordan Creek, Lehigh River, or via land application. Because the outcome of this planning study will have an impact on future wastewater flows through the City's conveyance system, it will impact the extent of improvements needed to mitigate SSOs.</p> |

Section 5: Progress Toward Cooperative Management of Flows

| Table 5-1: Progress Toward Cooperative Management of Flows | |
|---|--|
| Signatory Meetings | The City, and jointly with LCA following execution of the Concession and Lease Agreement, has hosted a total eleven (11) semi-annual signatory meetings. The primary objective of each meeting has been for the signatories to share information regarding progress being made toward AO compliance and issues being experienced during severe storm events. |
| KISS Model | LCA (on behalf of the Western Lehigh Sewerage Partnership) and the City have agreed to combine hydraulic models so that future planning and alternative evaluations consider impacts on the combined model areas. |
| Maximizing In-System Storage | Prior to execution of the Concession and Lease Agreement, the City and LCA cooperated effectively to operate the Park Pump Station to maximize in-system storage for anticipated storm events. In summary, the Park Pump Station would be operated prior to the anticipated storm event to draw down the collection system upstream of the pumping station, thereby creating additional storage capacity for the anticipated storm event. As a result of the Concession and Lease Agreement, LCA is now responsible for operating the KIWWTP, and thus for integrating operation of the KIWWTP an Park Pump Station in a manner that maximizes in-system storage for anticipated storm events. |
| Central Lehigh County Wastewater Capacity Planning Steering Committee | A series of meetings were held in 2010 and 2011 to discuss future wastewater capacity needs in Lehigh County and the related issues of treatment options, I&I removal, KIWWTP capacity allocation, etc. The capacity needs of Central Lehigh County is relevant to the AO because the magnitude of additional future flow and how and where it is conveyed and treated has a direct impact on conveyance system capacity and performance during storm events. These meetings preceded initiation of the 537 Plan Update described in Table 4-1. |

Section 6: Funding

| Table 6-1: Financial Reports | |
|---|---|
| Cost of AO to Date | As reported in the Detailed Summary of Revenue and Expenditures in Appendix D of the AO Progress Reports for Periods 9 and 10, the City's total AO-related cost through June 30, 2014 is \$2,306,763. This total does not include expenditures for ongoing capital projects which will add approximately \$1,800,000 to the total. |
| Anticipated Costs to Eliminate Potential SSOs | While activities are in progress and significant costs are being incurred to mitigate potential SSOs, as described in the AO Progress Report for Period 10 dated July 30, 2014, the full scope of improvements to eliminate SSOs will not be known until the Phase 2 RDII Corrective Action Plan is complete, which is estimated to be November 2015. Therefore, the anticipated costs to eliminate potential SSOs will not be known until approximately November 2015. |

Section 7: Future Activities

| Table 7-1: Future Activities and Schedule | |
|--|----------------------------------|
| Activity | Estimated Completion Date |
| Complete the SSES Project point repairs described in Table 1-2 | October 30, 2014 |
| Complete the Manhole Lining Project described in Table 1-4 | December 5, 2014 |
| Complete the Manhole Chimney Repair Project Described in Table 1-4 | January 22, 2015 |
| Prepare Technical Memorandum summarizing the findings of the SSES Project | December, 2014 |
| Refine the anticipated RDII removal rates, perform additional modeling, further evaluate the short-listed alternatives, evaluate blending as an additional option to flow equalization, and prepare the Phase 2 Corrective Action Plan Report. | November 2015 |
| Funding of the recommended improvements (likely in phases) | (1) |
| Procure engineering services (likely in phases) | (1) |
| Design of the recommended improvements (likely in phases) | (1) |
| Permitting of the recommended improvements (likely in phases) | (1) |
| Bidding and award of the recommended improvements (likely in phases) | (1) |
| Construction of the recommended improvements (likely in phases) | (1) |

(1) The required effort and resulting completion dates will depend upon the specific improvements selected for implementation based on the Phase 2 Corrective Action Plan Report. However, the overall time required to obtain funding, procure engineering services, design, permit, bid, award and construct each phase of improvements is likely to be approximately 2-1/2 to 3-1/2 years, depending on the magnitude and complexity of each phase, the need to obtain easements, etc.