## Sanitary Sewer Overflow (SSO) Elimination Program

Trenton, Michigan

The City of Trenton encompasses 4,180 acres of heavy industrial, commercial and residential developments. The population of the community is 19,500. The existing City owned and operated wastewater collection system is comprised of over 400,000 lineal feet of various diameter pipe, ranging in size from 8"-60", seven pump stations, four overflows, a 1,400,000 cubic feet retention basin, and a 14.6 MGD peak flow Wastewater Treatment Plant (WWTP).

**OWNER / CLIENT**

City of Trenton

**PROJECT START - END**

1996 - 2007

Due to the discharge of Sanitary Sewer Overflows (SSO) into the Detroit River during large rain events, the City of Trenton was placed under an Administrative Consent Order (ACO) in September 1996. Based on the ACO, the City of Trenton was required to upgrade the sanitary sewerage system to meet the following goals:

- Eliminate Raw Sewage By-Passes from Three of the Four Outfalls
- Achieve System Capacity for Transporting the 100 Year – 24 hour Storm Event (4.7" for Peak Hour Flow Rate
- Achieve System Capacity for Transporting the 25 Year-24 Hour Storm Event (3.9") for Flow Volume over a 24 Hour Period Without Bypassing
- Outfall 002 Would Remain as an Emergency By-pass Point for Flows in Excess of the Equivalent 100 Year – 24 Hour Storm Event

**INFILTRATION AND INFLOW STUDY**

In 1996, the City contracted with SDA to perform an Infiltration and Inflow (I/I) Study, which employed 18 sanitary sewer flow monitors, five pump station meters and five rain gauges placed in three districts. The I/I study results revealed that all three districts contained high inflow and one district contained high infiltration levels.

**SEWER SYSTEM EVALUATION SURVEY**

Based on the results of the I/I Study, SDA conducted a Michigan Department of Environmental Quality (MDEQ) approved and manageable Sewer System Evaluation Survey (SSES) program in

1997. As part of the in-depth physical inspection of the Wastewater Drainage System, over 1,450 manholes were physically inspected. Over 350,000 lineal feet of pipe, ranging in size from 8"to 36"in diameter were smoke tested. Flood and dye testing was performed on selected defective manholes to quantify infiltration and inflow values. A downspout inspection program was also performed during the smoke testing to locate connections to underground sanitary drainage facilities. Over 95,000' of pipes with high levels of infiltration were video inspected.

Detailed databases were developed to catalog manhole inspections, photographs and smoke testing data, and to develop a program for cost-effective rehabilitation. Queries were developed to list defects and to rank the deficiencies by I&I rates.

**HYDRAULIC MODELING**

Utilizing data from the I&I and SSES studies, an XP-SWMM hydraulic model of the trunk sewers connecting the meter districts was created and calibrated. The calibrated model was used to develop options that would allow for the transport and storage of wet weather flow during the 10 year – 1 hour, 25 year – 24 hour, and 100 year – 24 hour design storms without creating an SSO. Nine system improvement options were eventually developed. The options included retention basins, pump stations, and various relief sewers.

**STATE REVOLVING FUND (SRF) LOANS**

The City of Trenton initiated a large capital improvement project in 1999 based on the results of the hydraulic modeling and to meet the ACO requirements. SDA developed a State Revolving Fund (SRF) Project Plan and assisted the City in securing $46,080,000 in SRF loans for these improvements.

**SYSTEM UPGRADES**

The upgrades and improvements to the City of Trenton's sewerage system began in 1999 and were completed in 2006. The City of Trenton's Engineering staff designed and administrated the sewer cleaning, rehabilitation programs, the manhole rehabilitation program, and the storm sewer and downspout disconnection program.

The improvements designed and administrated by SDA on behalf of the City consisted of several projects:

- **RETENTION BASIN ENLARGEMENT**
  An addition to the existing open top 1,400,000 cubic feet retention basin was designed to contain a 100 year – 24 hour rain event. The existing basin and the new extension were connected by a weir through the existing basin wall for a total volume of 2,650,000 cubic feet (19.8 million gallons). To comply with MDEQ standards, the enlarged basin was designed to drain automatically after each storm event. A new drainage system was designed to include two drainage structures. The new basin was paved with bituminous asphalt and the basins and extension were both lined with a High Density Polyethlene (HDPE) geomembrane. A system of water canons, hydrants, and a booster pump station were constructed to clean the basins after each use. Water from the chlorine contact chamber of the WWTP is being used to flush the new basin. The project is complete and the retention basin is operational.

- **RETENTION BASIN PUMP STATION**
  The pump station was designed to remove the excessive hydraulic loading and lift the excess flows from the WWTP to the enlarged retention basin. The pump station was designed to lift flows using variable vertical turbine speed pumps ranging in speed from 4,500 to 13,500 gpm. Three pumps will be able to handle the excess wet-weather flows up to a 100 year – 24 hour rain event. The fourth pump will be a back-up pump as per MDEQ guidelines. The pump station was designed to have a circular wet-well with an inside diameter of 25' and a depth of approximately 35'. A Supervisory Control and Data Acquisition (SCADA) system was used for automatic operation of the pump station. The pump station was designed to the Ten States Standards including proper ventilation and a gas detection system. The entire WWTP had a new switchgear and a dual power source added for redundancy. The project is complete and the pump station is operational.

- **ELIZABETH PARK PUMP STATION**
  The lift station was designed to lift flows using vertical turbine variable speed pumps and a total capacity of 13,500 gpm (30 cfs). Two pumps are able to handle the excess wet-weather flows up to a 100 year – 24 hour rain event. The third pump is a back-up pump as

per MDEQ guidelines. The lift station was designed to have a circular wet-well with an inside diameter of 17' and a depth of approximately 46'. The station was designed architecturally to present an aesthetically pleasing appearance to the surrounding park.

- **THE RIVER NORTH INTERCEPTOR**
  A new interceptor sewer of over 20,900 lineal feet, ranging in size from 12-60" and 5,050 lineal feet of 42" interceptor from the new Elizabeth Park Pump Station to the WWTP were constructed. The depth of cut on this project ranged from 17-34'. Ground conditions varied from firm clay to limestone rock. The limestone rock was connected by aquifer to the Detroit River channel bottom which is also limestone along Trenton. Miscellaneous utility relocations, new watermains to improve pressure, and new street construction, were all designed as part of this project. The project is complete and the interceptor is operational.

- **THE RIVER SOUTH INTERCEPTOR**
  A new sanitary drainage interceptor sewer along Jefferson Avenue in the industrial part of the City was constructed. The interceptor ranged in size from 21-36". The total length of the interceptor was over 6,600 lineal feet. Because of the industrial sewage entering the interceptor, SDA had the sewage analyzed and designed the sanitary drainage interceptor using PVC pipe and fiberglass manholes, making this project unique to the industry. Traffic was maintained in both directions of Jefferson Avenue at all times. The project is complete and the interceptor is operational.

- **JEFFERSON AVENUE SEWER EXTENSION**
  A new interceptor sewer over 6,500 lineal feet of 21" sanitary sewer to eliminate a pump station with an SSO bypass component was constructed. Variable ground conditions including rock blasting, miscellaneous utility relocations, and new pond construction was involved. The project is complete and the sewer is operational.

- **JEFFERSON AVENUE PUMP STATION AND BYPASS 002**
  This is the only SSO by-pass to remain in service as part of the MDEQ requirements. The by-pass was redesigned to allow only flows in excess of the 100 year – 24 hour rain event to be by-passed. The existing Jefferson Avenue Pump Station was to be demolished and a smaller submersible pump station was designed to allow the City to salvage the property. The new pump station will be equipped with two (2) mixed flow propeller pumps, each rated for 13,500 gpm for a total capacity of 27,000 gpm.

**PROJECT PERFORMANCE CERTIFICATION (PPC)**

In 2006, SDA was contracted by the City to perform the Project Performance Certificate (PPC). The purpose of the PPC was to:

- Certify that all Raw Sewage Bypasses have been Eliminated and/or Modified to Meet The Conditions of the ACO
- Verify that the City's Sewer Collection System and WWTP do not Experience Capacity Problems
- Compare Post Construction Average and Peak Sanitary Wastewater Flows Entering the City's Sewer Collection System and WWTP with the System Design Capacities.

SDA field personnel installed eleven (11) flow meters and two (2) rain gauges in the City of Trenton for a period of seven (7) months. SCADA Data was also collected during the study period. The meter and SCADA data was used to update the sanitary sewer hydraulic model. The monitoring program showed that I/I rates had substantially decreased since the 1996 I/I Study, likely due to a combination of recent sewer rehabilitation as well as system upgrades.

The results of the PPC Study showed that:

- Raw sewage bypasses 003, 005, and 006 had been eliminated.
- The 25 year – 24 hour design storm, and the 100 year – 24 hour design storm were simulated with the hydraulic model. The model showed that the newly constructed sewers and facilities have adequate capacity to transport and treat the flows. The model also showed that the post-construction average and peak sanitary wastewater flows entering the City's sewer collection system and WWTP meet the system design capacities.
- Outfall 002 was upgraded and according to the hydraulic model will not be used as an emergency by-pass point for flows in equal to or less than the equivalent 100 year – 24 hour storm event.