

Documenting the Effectiveness of Greencastle, Indiana's Private Property Inflow and Infiltration Policy

WERF performed a peer review of the private property inflow and infiltration (I/I) policy of the City of Greencastle, Indiana that was intended to reduce I/I from private property sources. The Greencastle policy requires that privately owned properties do not contribute excessive rain water to the sanitary sewer system and be documented by certified inspectors. The study analyzed monitoring and operational data and demonstrated that Greencastle's private property I/I policy delays and reduces the sewer system's response to rainfall. The study described a low cost municipal approach that used existing resources to control private property I/I and presents statistical techniques that analysts can use to quantitatively document the effectiveness of I/I reduction programs.



This study quantified the benefits achieved by a municipality and its community after implementing a private property I/I policy.

Research Background

The City of Greencastle, Indiana initiated a pollution prevention/source reduction/resource conservation program in 2003. The city set out to more efficiently operate its wastewater treatment plant by reducing peak wet weather flows that stressed plant hydraulic capacity and threatened biological processes. The private property I/I policy was implemented in addition to performing a sanitary sewer I/I reduction program for publicly owned sewers.

Key Findings

The city performed short-term flow monitoring at four of the most suitable and previously monitored sewersheds. Wet weather flow linear regression models were developed for the four metered areas for both before and after the I/I reduction policy was implemented and calibrated to the metering data. Model parameters for the after-policy models were compared to the before-policy model parameters to see if statistically significant changes occurred. Three of the four metered areas showed provable decreases in wet weather flow.

The program documented in this study reduced flow to the treatment plant significantly at minimal cost to the community, thereby conserving and reducing the resources required to operate the plant and decreasing the pollutants generated by the production of plant inputs (such as energy and chemicals), and better allocating the financial resources of the community. This study formally measured and documented the effectiveness of this innovative program so that it could be useful for other municipalities. The project provides critical information on the effectiveness of a program to reduce the amount of rain water that infiltrates into the sewer system and "contaminates" the waste stream. In recent years, I/I reduction projects have been occurring more and more frequently, but most still occur on public property with municipal or utility owned infrastructure. Further reductions in I/I require it to be addressed on private property. Research exists on the methods and costs associated with I/I removal on private property, but quantification of the effects of

BENEFITS

- Provides an assessment of supply chain efficiency improvement caused by implementing a private property I/I policy.
- Quantifies benefits of a private property I/I control policy including reductions in operating costs, non-hazardous material usage, energy usage, and water usage at the wastewater treatment plant.
- Provides a statistical evaluation of the data collected as a framework for evaluating benefits of implementing a private property I/I policy.
- Provides a model on how to incorporate measurement methods into wastewater industry pollution prevention projects throughout the U.S.

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I/I removal are not well researched. The City of Greencastle's I/I program allowed for the opportunity to document the positive results that private property I/I removal has on a system.

The monitoring program and associated analysis serve as a model on how to incorporate measurement methods into wastewater industry pollution prevention projects throughout the State of Indiana and the United States and may be used by communities to address sewer bans and other regulatory issues associated with treatment capacity and collection system conveyance.

Overview of the Data Analysis

The authors used two distinct approaches to analyze the data. One approach involved analyzing data recorded at daily intervals and wet weather events as a whole. This approach attempted to identify significant changes in bivariate trends. For example, did the amount of wet weather volume generated by a rainfall decrease once the I/I policy was implemented? Data examined included total event wet weather volume at each meter location, total event rainfall depth, daily average flow at the wastewater treatment plant, and daily 5-day Carbonaceous Biochemical Oxygen Demand (CBOD5) concentration and load.

The other approach involved analyzing the 5-minute interval data recorded at the four meter locations. This approach involved developing a multivariate linear regression augmented by an auto-regressive model. Data utilized in the linear regression, auto-regressive model included 5-minute interval rainfall, time of day, daily flow at a nearby creek, and recently recorded metered flow. The final report discusses the two approaches separately in detail.

The data analysis concluded with a discussion of what I/I reduction activities were performed as a result of the I/I policy and its acceptance by the citizens of Greencastle.

Supplemental Data Information

The final report also includes a disc containing all the information evaluated by the peer reviewers which included effluent flow and rainfall comparison for the relevant years being evaluated, flow meters data, lift station data, the city's private property I/I policy, and the detailed peer reviewers statistical analysis information.

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