

Innovative Developer Requirements for Meeting CSO Reduction Goals

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ABSTRACT

The North Hudson Sewerage Authority (Authority) owns and operates the combined sewerage system within Hoboken, Weehawken, and portions of West New York and Union City, New Jersey. To meet the goals of their long-term control plan (LTCP), the Authority is required to reduce their combined sewer overflow (CSO) events. The largest obstacle to stormwater control is the land resources available to allocate for stormwater storage in this highly developed urban area. The Authority realized the benefit of using innovative strategies to reduce the rate and quantity of flows entering into the combined sewer system during wet weather events. Ultimately, it was determined that many new development sites would require actively controlled stormwater systems. The Authority navigated through many iterations of its sewer connection requirements while addressing the challenges of their legal jurisdiction within private property. New maintenance requirements were developed in tandem with an online tool to be used by the sewer connection applicant for determining each applicant's storm water detention volume and control requirements. The online tool encourages the use of innovative green infrastructure technologies by providing credits for their use and for maintaining or increasing pervious area. Implementation of the new requirements is a critical step for meeting goals of the LTCP and for reducing the amount and severity of CSO discharge events to the Hudson River.

KEYWORDS

Combined sewer overflow (CSO), Long-term control plan (LTCP), Green infrastructure credits, Stormwater control, Online tool

BACKGROUND

The Authority operates and maintains the combined sewer collection system in the Northern New Jersey Communities of Hoboken, Weehawken, West New York, and Union City. The collection system is subdivided into twenty (20) drainage basins, each with their own challenges and flow restrictions. During periods of dry weather, the sanitary flow is conveyed to the two Wastewater Treatment Plants (WWTP) which the Authority operates and maintains (Figure 1). Under wet weather conditions the runoff from the various drainage basins can reach the point at which the WWTPs would be overwhelmed, therefore the combined sewerage is automatically diverted into the Hudson River via nine (9) regulators resulting in CSO events.

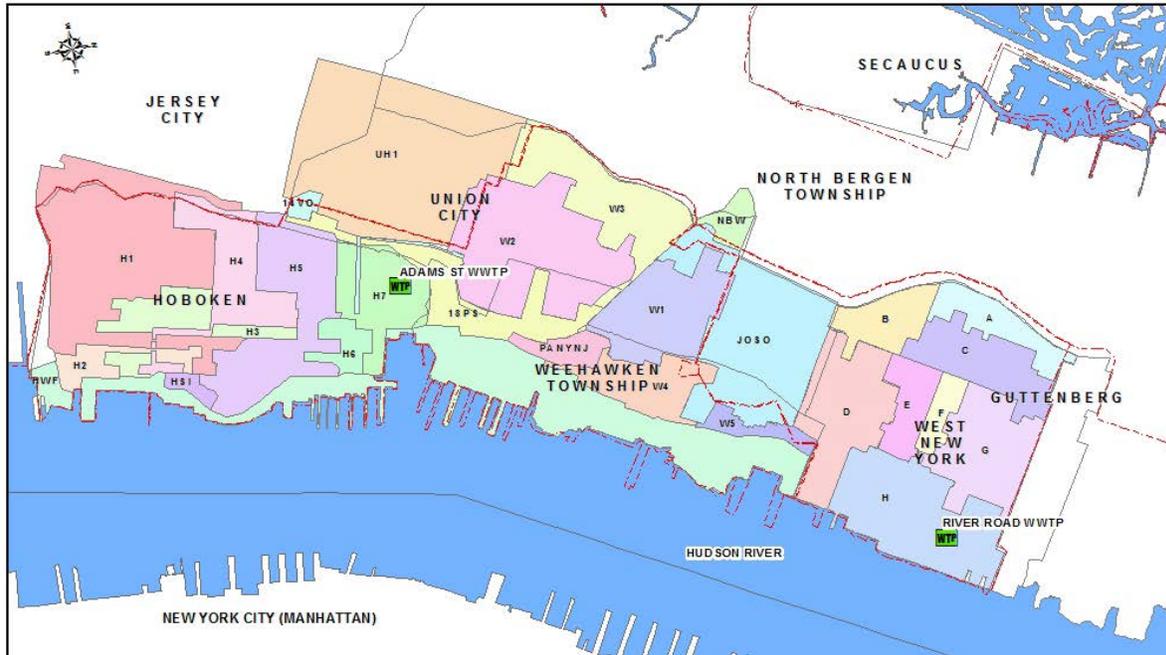


Figure 1 North Hudson Sewerage Authority Drainage Areas / Location Map

Similar to many other mature northeastern United States urban communities, the Authority has been mandated by the New Jersey Department of Environmental Protection (NJDEP) to prepare a LTCP to address CSOs. The Authority has made significant progress towards successful completion of its LTCP, by having successfully completed mapping of the collection system, performed closed circuit television (CCTV) inspections, implemented a flow monitoring program, and initiated a web based public notification system. However, there is still more that can be done to further the Authority's goals of having fewer CSO events and localized community flooding events. As the Authority continues to address the LTCP requirements, the characterization study is underway to assist in quantifying flow sources and in understanding strategies for reducing CSOs. The characterization study is focusing on two critical aspects of these events including Infiltration and Inflow (I/I) reduction and CSO reduction controls. Efficient I/I reduction is accomplished by understanding the collection system and by identifying locations which can be cost-effectively managed. CSO reduction controls include various techniques such as increasing conveyance to the WWTPs, installing inline and offline storage for later treatment, and installing end-of-pipe treatment. While the characterization study findings will provide valuable insights and direction to the future of the Authority's operations, there is also an immediate need to take steps toward achieving the goals of their LTCP.

Each new development which connects to the Authority's combined sewer system discharges its sewer and stormwater into the Authority's combined system. While fees are collected for the connection and usage of the combined system, New Jersey Statutes do not allow for the establishment of a Stormwater Utility. To make matters more difficult, the Authority has no legal jurisdiction to pass ordinances directly to enact rules controlling stormwater within the service area. As the communities under the Authority's jurisdiction undergo further development, there is potential for stormwater runoff to further increase.

With limited land area, regulatory constraints, and the impact of development on stormwater flow to the Authority's combined sewer system the Authority needed to find efficient, cost effective solutions.

NEW STORMWATER CONTROL REQUIREMENTS

In 2016, there were approximately sixty applications for new development projects within the Authority's service area. For each development proposing a modification or new construction, a Sewer Connection Application is submitted to the Authority. Previous requirements imposed by the Authority required compliance with New Jersey's regulations for peak flow attenuations (N.J.A.C. 7:8) and imposed similar peak flow attenuation requirements for all lot sizes during the 2, 10, and 100-year storm events. These requirements were still found to be too lenient for meeting the Authority's goals. Stormwater attenuation during the 2, 10, and 100-year storm events did not contribute to the reduction of CSO events with multiple occurrences annually.

The high frequency storm events are of higher concern. The Authority developed new, more rigorous sewer connection requirements based on a goal of restoring pre-development hydrology to the site throughout the Authority's service area. Accordingly, the new requirements set a maximum allowable 2-year post-construction peak discharge rate equivalent to that of Woods in Good Condition based on the Natural Resources Conservation Service (NRCS) Urban Hydrology for Small Watersheds Technical Release 55 (TR-55) methodologies. Without a need to quantify existing conditions, the basis for new construction is simplified. Figure 2 presents the required volume of storage necessary at each site to meet the requirements.

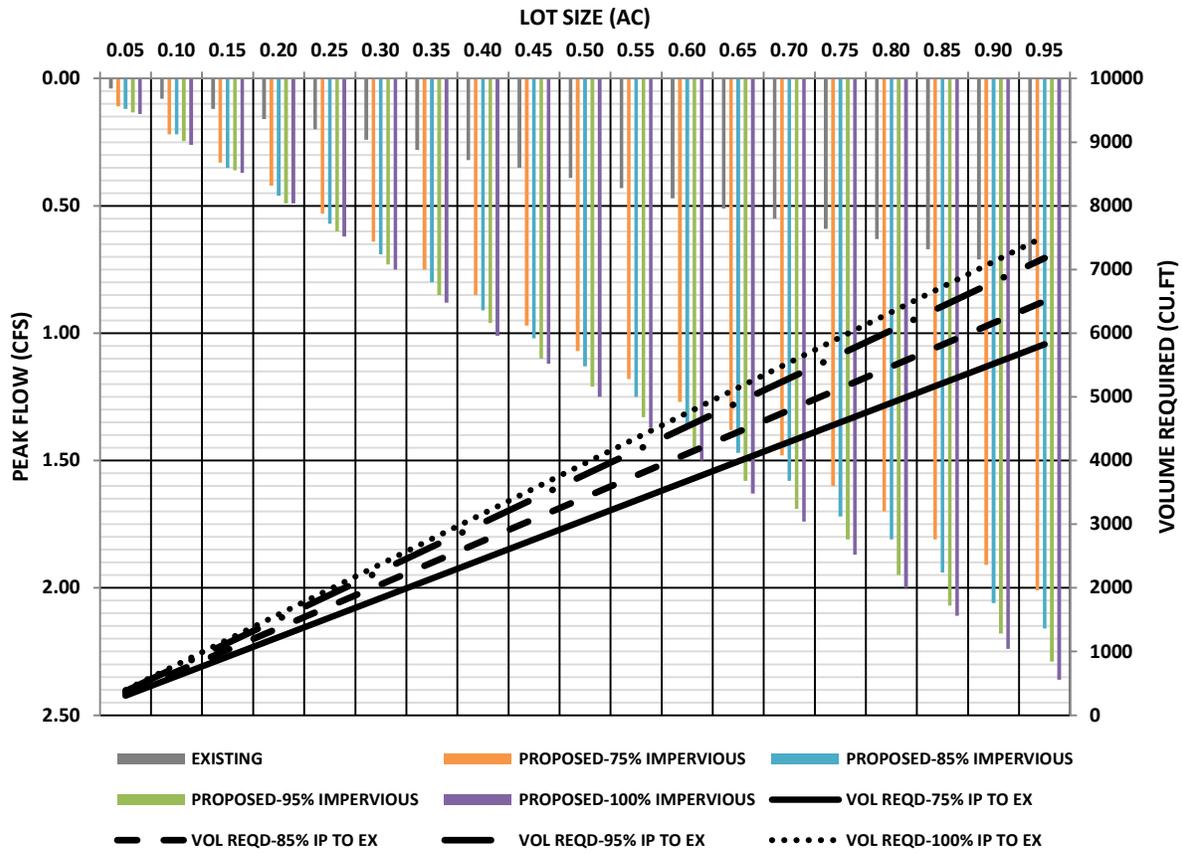


Figure 2 Authority Stormwater Storage Volume Requirements based on “Woods in Good Condition”, TR-55.

DEVELOPMENT OF WED-BASED TOOL

Using the basic calculation results presented in Figure 2, a new web-based interface was developed such that users can input their site conditions and determine basic stormwater design criteria. The new storage and control requirements is determined through the on-line calculator illustrated in Figure 3. Each applicant requiring a new or revised connection to the Authority's combined sewer must use the tool to determine stormwater control requirements. The user inputs the lot size and proposed impervious acreages. The calculator “reverse engineers” the volume of detention storage required, minimum primary orifice size and the allowable head over the orifice (depth of detention storage) that is optimized for the lot size and the site configuration.

Credits are offered in the form of impervious area reduction for certain stormwater infrastructure measures such as porous pavement, green roofs, blue roofs, permeable pavers, and bio-retention systems (rain-gardens). The list is expandable for the introduction of additional Green or Gray Stormwater Technologies.

This tool also makes it easier for site owners to understand their storage requirements. The owner is able to work with the tool directly and understand options.

|  North Hudson Sewerage Authority Stormwater Reporting | | | |
|---|------------------------|--------------------------|--|
| A) Total Site Area | 10890.0 | (Square Feet) | |
| B) Impervious Site Area | 9000.0 | (Square Feet) | |
| Green Infrastructure (GSI) Credits: | | | |
| GSI Type | GSI Area (Square Feet) | % Credit | Impervious Area Deductions (Square Feet) |
| Porous Pavement | | 25% | |
| Green Roof | | 50% | |
| Blue Roof | | 60% | |
| Permeable Pavers | | 25% | |
| Bioretention | | 50% | |
| Total | 0.0 | | 0.0 |
| C) Revised Site Impervious Area | 9000.0 | (Square Feet) | |
| D) Percent Site Impervious Area | 82.6 | (%) | |
| Approximate Detention Storage Size Required | | 1670 (Cubic Feet) | |
| Allowable Depth of Storage | | 3.0 (Feet) | |
| Approximate Detention Footprint | | 557 (Square Feet) | |
| Primary Orifice Size | | 2.0 (Inches) | |
| Commercial Product Required to Achieve Effective Orifice Size | | | |
| If the Applicant Chooses Pipe Storage, This Site Will Require 236 Ft of 36 in Pipe | | | |

Figure 3 Authority Online Calculator - User Interface

IMPLEMENTATION CHALLENGES

The Authority’s stormwater attenuation goals proved difficult to meet with passive detention systems which require a minimum orifice size to prevent clogging. The minimum allowable primary orifice size per NJDEP requirements is 2.5 inches. In review of the existing flow reduction requirements, it was found that very little flow reduction from the 2-year storm events was occurring by using such a large orifice, particularly on smaller sites. In general,

developments less than 0.3 acres in size could not meet the goals with only a passive stormwater detention system. The majority of new developments were on small lots, less than 5,000 square feet (0.1 acres). Therefore, additional flow restrictions are needed.

The Authority is evaluating the use of automated flow valves. This will allow construction and effective operation of small volume stormwater storage facilities suitable for small properties. The first installation of the first automated flow valve system is scheduled to be installed in September 2017.

An additional challenge with the use of automated controls is the monitoring of proper operation and maintenance of these systems. On private property, the Authority does not have access rights. Originally, the Authority considered placing all automated valve systems within the right-of-way. This would provide the Authority needed access, however, there are many systems already in place that the Authority cannot inspect. The Authority is now working to address this issue with its four corresponding municipalities to pass an Authority Inspection Program. This latter option appears to be a better solution, which would allow the Authority access to inspect all passive and actively controlled detention systems. The implementation of this program would be the most advantageous to the overall stormwater control program.

The Authority understands that the goal to reduce stormwater to their desired attenuation level will take time. Using a combination of tools and techniques, there will be challenges when unique site conditions are encountered that do not allow the developer to install appropriate controls at a reasonable cost. As requirements change the ability to modify the tool in real-time allows the Authority to fine-tune the results based on new requirements and goals.

CONCLUSIONS

The proposed new standards for stormwater control for new developments can help achieve the desired stormwater goals. The advantage of developer standards is that it requires the owner to pay the capital cost for green infrastructure and stormwater control systems rather than burden the sewer authority for treatment of the stormwater that originates from their site. The municipality and the sewer authority should review their existing stormwater regulations and identify opportunities to modify the existing sewer connection requirements to require stormwater management that meets design criteria targeted at reducing combined sewer overflows. This may entail different requirements for new development and redevelopment projects. For redevelopment projects that may face challenges in implementing stormwater management on existing sites, the municipality should consider offering equivalent stormwater credits or a fee so that equivalent or greater stormwater management benefits can be achieved offsite. In cases where the sewer authority cannot directly pass ordinances, the sewer connection requirements may be adapted. Imposing requirements should include credits for green infrastructure controls.