

2- Proposed Response

2.1 – Solution Alternatives

Following the July 15 and 22, 2010 rains, the Village has decided that there would be a comprehensive approach to providing our residents with increased protection against damage caused by basement backups.

Extensive hydraulic models were created, and Shorewood’s hydraulic neighbors were included in the analysis. Whitefish Bay sewers to the north and Milwaukee combined sewers to the south have been included in the work. All known system improvements performed by both Whitefish Bay and Shorewood in recent years, most notably the MIS work on Fairmount and Diversey in Whitefish Bay are included in the analysis.

In general, the response of Shorewood’s sewers to various rains depends on sewershed and location within that sewershed; therefore it is not possible to offer general solutions to basement backup problems. This means that our approach will include some very localized actions, in concert with sewershed-wide and Village-wide initiatives.

“Basement backup risk” is defined by comparing sewer hydraulic grade lines to basement floor elevations. The sewer hydraulic grade lines are computed through modeling for various discrete rainfall events. The basement floor elevations are estimated based on 105 measurements performed at various locations throughout the Village.

Based on survey data, we estimate that the average basement in the separate sewer area is 6 to 7 feet below street level, while on the combined side; the average basement was found to be between 5 to 6 feet below street level. These numbers are used in evaluating surcharge conditions with respect to basement backup risk.

In evaluating existing conditions and developing solution alternatives, we have adopted the following principles:

- All municipalities, including Shorewood, have discharge limits to MMSD system, which means we cannot simply collect all the rainwater in our sanitary sewers and hand it over to MMSD
- High levels of protection from basement backups will require a three pronged solution:
 - Improve public sewers for better flow
 - Reduce flows from public system components
 - Reduce flows from private system components

The Village has adopted a novel approach to streamline the development of viable solution alternatives to its sewer and drainage problems. Four consulting engineering firms were retained and tasked with the creation of solution alternatives and recommendations in each of the Village’s problem areas: Basin 1 and Basin 6 solutions in the separated sewer service area, combined sewer improvements in the north side and separation of sewers in the south side of the combined sewer service area.

2.2 – Design Criteria

2.2.1 - Separate Sanitary Sewers

The design criteria adopted for hydraulic improvements in the separated sewer service area are in line with the design guidance provided by the Milwaukee Metropolitan Sewerage district for the design of sewers that discharge into the Metropolitan Interceptor System. As such, the design criteria used in the Village of Shorewood Comprehensive facility Plan meets the hydraulic criteria set in the 202 MMSD Facility Plan. Accordingly, at the prescribed maximum design flow (corresponding to the 5 year recurrence interval sewage flow as determined by MMSD), the design depth of flow in the proposed sanitary sewers is as follows:

Sanitary Sewer Design Depth of Flow

Sewer Size (inches)	Depth (%)
8, 10 and 12	50
15 and greater	65

2.2.2 - Combined Sewers

The design criteria for combined sewers is the basic $Q=CIA$. The Shorewood Facility Plan uses the XP-SWMM software and the rainfall runoff estimates are generated using the Huff Distribution of a 60 minute rainfall. The runoff generated is routed through the combined sewers, and the basement backup risk is determined by calculating the hydraulic grade line elevation throughout the service area. Pipe sizes are computed to reduce basement backup risk by controlling the hydraulic grade line using the 1.9 inch, 60 minute rainfall.

2.2.3 – Emergency Flooding Control

The design criteria for new separate and combined sewers in Shorewood includes the installation of emergency temporary bypass locations to limit hydraulic grade line elevations in case of wide-spread flooding due to catastrophic amounts of rainfall. The design direction is as follows:

- Eliminate the four (4) existing SSO locations in Basin 6. These four bypasses are along Glendale Avenue and consist of gravity connections from the separate sewers into storm sewers.
- Eliminate the one known CSO location in the combined sewer service area. This CSO is located on Kensington Avenue at Maryland Avenue.
- Establish one new temporary bypass in Basin 1 to control hydraulic grade lines during wide-spread flooding due to catastrophic amounts of rainfall. This bypass will have monitoring and measuring capability for reporting purposes.
- Establish one new temporary bypass in Basin 6 to control hydraulic grade lines during wide-spread flooding due to catastrophic amounts of rainfall. This bypass will have monitoring and measuring capability for reporting purposes.
- Establish and plan for three (3) temporary flood relief structures in the combined sewer service area to control hydraulic grade lines during wide-spread flooding due to catastrophic amounts of rainfall.