SECTION 10
EDUCATION, ENFORCEMENT, AND PUBLIC INVOLVEMENT

10.01 EDUCATION AND OUTREACH PROGRAM FRAMEWORK

We recommend expanding the City's current education and outreach program to further educate residents and officials of impacts of discharging clear water into the sanitary sewers, impacts of keeping catch basins and curb lines clean of leaves or grass clippings, and the impacts of storms on the sanitary and storm sewer systems. The information and education program is intended to raise awareness among individuals and organizations concerning stormwater runoff.

According to documentation in the 2009 WDNR municipal separate storm sewer system (MS4) Annual Report, the City has already developed a public education and outreach program for purposes of stormwater permit compliance. This program is geared mainly to stormwater quality issues. Currently, the City has developed an informative brochure (*Lake Michigan: IT's Worth Protection)* and plans to begin developing informative newsletters that will be available on the Stormwater Utility Web site. The Stormwater Utility also plans to participate in community events such as the "Kenosha Expo."

Once additional programs are selected, an implementation schedule should be developed. Measureable goals, anticipated completion dates and responsible parties can then be assigned to various tasks. Programs may include the following.

A. <u>Stormwater Utility Web site</u>

The Stormwater Utility Web site is currently being updated and has an expected completion date of September 2010. This Web site will be an important tool for providing residents with information about the utility, contact information, resources, and what they can do to help. It is recommended that additional flood-related information be posted on the Web site.

B. <u>Publication Development and Distribution</u>

Pamphlets can be distributed regarding such topics as rain barrels, downspout disconnection and compost piles. Preprinted materials may be available from sources such as University of Wisconsin-Extension, WDNR, or the Milwaukee Metropolitan Sewerage District (MMSD). These may be distributed at locations such as municipal buildings, schools, and libraries. Small fliers could be sent with fall utility bills to remind residents to use proper yard disposal practices, keep storm sewer inlets clear of debris, and use proper sump pump discharge locations. One newsletter, one newspaper article, and one poster are to be completed as part of the Forest Park Area Storm and Sanitary Management Plan. In the future, each of these items could be completed on an annual basis.

C. <u>Provide Educational Displays</u>

Outdoor message boards could be installed in parks or public recreation areas educating residents on watersheds and importance of keeping drains clean. Educational displays/booths could be provided within municipal facilities (museum, municipal building with renderings as well as sump pump and yard waste best practice information).

D. Expanded Involvement with Local Schools

In late 2008, the Stormwater Utility purchased "Watershed, Nonpoint Source, Stormwater Pollution and Prevention" Enviroscape®, a portable stormwater model, to assist in education throughout the community. This interactive tool can be used in a classroom setting to address the topics listed above. Visits could be arranged to coincide with Earth Day events and provide education on stormwater runoff. Students could also become involved by participating in a City-sponsored stormwater poster contest where the winner's art would be made into a poster and put on display within the community.

E. Storm Drain Labeling

Storm drains can be stenciled to remind residents to keep inlets clear and discourage dumping of oil and other pollutants. A cost-effective approach may be to work with the Boy Scouts and other groups and school organizations to promote this activity as an educational program. This activity is mentioned in the Annual Report, but no program has been developed to date.

F. Annual Meeting

An annual meeting could be held to update City officials, residents, regulatory agencies, local contractors, and interested stakeholders on the progress of the City's stormwater program.

G. Establish Policy for Addressing Stormwater Issues

A policy should be established for receiving and addressing stormwater management issues. This would include providing a standard form to residents with stormwater concerns (see Appendix I), performing a stormwater review based on the submitted form, and responding within a reasonable time frame. Stormwater complaint forms could be maintained in the Municipal Building. This form could be available on the Stormwater Utility Web site.

H. Investigate Yard Waste Collection Procedures

Currently, spring and fall yard waste must be placed in City-approved, biodegradable yard waste bags available from local retail stores. The City could consider potential modifications to its yard waste collection procedures by considering street side collection of leaves using a vacuum truck in lieu of requiring residents to bag debris. This modification may encourage increased participation by residents and result in less leaves ending up in the storm sewer drains. Procedure modifications must also consider availability of resources and budget impacts.

10.02 ORDINANCE REVIEW AND ENFORCEMENT OPTIONS

Section 1.05 presented a summary of applicable standards and design criteria, including a summary of the applicable City ordinances. These ordinances were reviewed to recommend updates and additions that will be beneficial in reducing long-term clear water connections to the sanitary sewer system.

The City ordinances listed in Section 1.05 were reviewed with this stated goal in mind. All ordinances stress the requirement that discharge of clear water into the sanitary sewer system is prohibited. The following minor modifications may be considered:

a. Chapter IX–Building Code

(2) Section 9.17–Razing of Buildings–Consider adding text to provide guidance with regard to abandoning building laterals.

(4) Section 9.25–Downspout Discharge–Consider adding text to specifically prohibit downspout connection to the sanitary sewer (This prohibition is included in Chapter XXXII–Kenosha Water Utility–Rule 05-04.)

b. Chapter XVI–Property Maintenance Code

(1) Section 16.18–Exterior of Structure–Consider adding text to specifically prohibit downspout connection to the sanitary sewer (This prohibition is included in Chapter XXXII–Kenosha Water Utility–Rule 05-04.)

In general, the ordinances appear to achieve the goal of minimizing the potential for introduction of clear water into the sanitary sewer system.

The City may want to consider adding a “point-of-sale” (POS) ordinance. A POS ordinance spells out inspection and repair procedures to be followed when a property is sold. Many communities use this as a mechanism to identify and correct inappropriate connections to the sanitary sewer system. Examples of POS ordinances are included in Appendix J.

10.03 PUBLIC INVOLVEMENT PROCESS

Two main objectives for the public involvement process include providing a sense of community ownership in the solutions and obtaining needed information for effective stormwater and sanitary design. The interactive workshops provide a setting where residents can openly express their concerns as well as learn about the process required to complete a storm and sanitary sewer study.

Two public meetings have been held with residents from the Forest Park area thus far. Residents received a public meeting notice before each meeting with details regarding the upcoming meeting (Appendix K).

A. Workshop 1: Hopes, Fears and Prioritization

Workshop 1 was held on Thursday, September 24, 2009, from 6 to 7 P.M. Approximately 20 residents were in attendance. After a short presentation to explain the Forest Park area project, residents were then engaged in a hopes and fears whiteboard exercise (Figure 10.03-1). With this exercise, residents list all the hopes they have for the project along with all the things they fear about the project. Once all

thoughts are compiled, the lists are placed on the wall where residents are given four dots and asked to prioritize their two greatest hopes and two greatest fears (Figure 10.03-2).

Figure 10.03-1 Short Presentation About Project

Figure 10.03-2 Residents Prioritizing Hopes and Fears

The two hopes that received the most votes were:

1. No more flooding in basements.
2. A long-term solution will be implemented.

The two fears that received the most votes were:

1. Solution will not work.
2. Property will be devalued.

The complete list of hopes and fears can be found in Appendix K.

B. Workshop 2: Progress Meeting

Workshop 2 was held on Tuesday, January 26, 2010, from 6 to 7 P.M. Approximately 20 residents were in attendance. The intent of this meeting was to present responses form the resident surveys, inform residents about field work that has been performed, and provide an update on progress that has been made on the storm and sanitary analysis.

SECTION 11
CONCLUSIONS AND RECOMMENDATIONS

11.01 GENERAL

Specific recommendations are presented here for achieving the goals of the storm and sanitary management plan. These recommendations are based on the discussion in the preceding sections and on hydrologic and hydraulic analyses performed as part of this project.

11.02 CONCLUSIONS

A. Stormwater System Conclusions

1. Alternative 1 through 11 Conclusions

(a) The existing storm sewer capacity was evaluated for a series of design storm events using the xpswmm hydraulic computer model. The model was calibrated to the May 20 to 23, 2004, storm event with high water depths provided by the City. A critical duration analysis was completed resulting in the 2-hour duration storm event being the critical duration storm (i.e., the storm creating the highest peak flows and/or flooding) for the modeled system.

(b) An analysis of the entire modeled system using the 2-, 5-, 10-, 25-, 50-, and 100-year design storm events and SEWRPC rainfall amounts and distribution was completed. The results of this analysis are shown in Figure 7.02-3. This figure shows there are significant bottlenecks in the storm sewer system downstream of the Forest Park North watershed and the Forest Park South watershed. Pipe capacities shown in Figure 7.02-3 assume adequate inlet capacity is available in the modeled watershed so the full pipe capacity is realized. It is likely that inlet capacity in the modeled system is in the 2- to 10-year range, so the listed pipe capacities may not be realized. Also, the listed pipe capacities would have to be coupled with an equivalent downstream system capacity for the listed pipe capacity to be realized. Figure 7.02-3 shows the "potential" capacity of that particular pipe segment.

(c) An alternatives analysis has been completed and the results are summarized in Section 9. Design criteria goals for the alternatives analysis have been established and include passing the 10-year storm event without surcharging to the ground and passing the 25-year storm event without getting up to the home foundation/first floor elevation/low entry point. The 100-year storm was run to show the flooding extents and overflow routes or lack thereof. Alternatives considered include combinations of underground dry detention, surface dry detention, conveyance upgrades, inlet upgrades, downstream bottleneck upsizing, and home purchase. It has been found that analyzed improvements in the Forest Park North Area have little hydraulic impact on the Forest Park South Area and vice versa.

(d) SWU staff have systematically been making various storm sewer system improvements in the Forest Park Area. Recent efforts include manhole/inlet rehabilitation, manhole cover replacement (change from solid cover to grated cover), and storm sewer and inlet reconstruction on 50th Avenue. Storm sewer televising was also completed as part of this plan.

2. Additional Conclusions

(a) This study separated the study area into a north study area and a south study area. The existing storm sewer capacity was evaluated using a hydraulic computer model for a series of storm events ranging from 1.54 inches over a 2-hour duration storm to 3.64 inches over a 2-hour duration storm. A 2-hour duration storm event is the storm duration that creates the highest peak flows in the Forest Park Area storm sewer system and is considered the critical duration storm event. This model confirmed there are significant bottlenecks in the storm sewer system downstream of the Forest Park North and South Areas. These bottlenecks would only be removed if additional storm sewer capacity were provided all of the way to the Pike Creek and Lake Michigan outfalls. It also confirmed that the Forest Park North and South watersheds have less than a 10-year storm sewer inlet and storm sewer capacity.

(b) An alternatives analysis was completed seeking to provide a 10-year storm sewer capacity (2.23 inches over a 2-hour duration storm event) in the Forest Park North and South watersheds. The 10-year storm sewer capacity is a requirement of new developments in Kenosha, is considered the industry standard for new developments, and was used as a goal in this study. Use of the 10-year goal also translates to reduced extents and duration of ponded water in yards outside of the City-owned right-of-way during modest and larger storm events. This reduction has the logical benefit of reducing the potential for ponded water to infiltrate (becoming rainfall-induced raised groundwater levels) into the sanitary sewer by way of defects in the sanitary sewer laterals and mainlines and through foundation drains and sump pump connections to the sanitary sewer as well as infiltration into manhole defects. This benefit is difficult to quantify because of the unknowns related to the soil infiltration rate in terrace and yard areas.

(c) As the study progressed, it became evident that providing a 10-year storm sewer and inlet capacity in the Forest Park North and South watersheds would be financially burdensome on the City. While it would provide significant improvement to the system, a certain number of homes would still likely be prone to surface flooding and basement backups during larger storm events. With this in mind, it appears that initial efforts to reduce basement backups by way of reducing the amount of rainfall-related flows reaching the sanitary sewer system should focus on removing known foundation drains and sump pump connections to the sanitary sewer system as well as fixing sanitary sewer system defects. In this way, incremental steps can be taken to reduce basement backups by first focusing on the sanitary sewer system and tracking the performance of the improvements over time prior to contemplating more expansive solutions. Part of the incremental steps include complementary storm sewer system improvements defined further. This is a financially prudent way to approach reducing basement backups in the Forest Park Area. The sanitary sewer upgrades completed on Pershing Boulevard and 61st Street in 2010 show promise that sanitary sewer upgrades are having a positive impact on reduction of basement backups.

Should the performance of the incremental improvements prove to be inadequate, this study includes recommendations on stormwater system improvements that do provide a 10-year storm sewer system capacity that could be pursued in the future.

B. Sanitary System Conclusions

The existing sanitary sewer capacity was evaluated for a series of theoretical wet weather conditions using a hydraulic computer model. This model confirmed the presence of significant surcharging in the study area sanitary sewers during wet weather conditions.

For the north study area, the model results indicate surcharging for all wet weather events equal to or greater than a 6-month recurrence interval event (this equates to a rainfall rate of 1.42 inches an hour/30-minute duration event). Limited surcharging occurs during the 6-month recurrence interval event, and widespread surcharging begins to occur during the 5-year recurrence interval event (2.58 inches an hour/30-minute duration event).

For the south study area, the model results indicate surcharging for all events equal to or greater than a 5-year recurrence interval event (2.58 inches an hour/30-minute duration event). Limited surcharging occurs during the 5-year recurrence interval event, and widespread surcharging begins to occur during the 25-year recurrence interval event (3.36 inches an hour/30-minute duration event).

The results of the analysis indicate that the wet weather performance of the north basin is not as effective as the performance of the south basin. For this reason, the north basin improvements should be implemented prior to the south basin improvements. Also, additional flow metering is recommended in the south basin to verify peak wet weather flow rates prior to implementation of the recommendations.

Information obtained by KWU staff and from residents in the study area confirm the presence of surcharging in the sewers during wet weather events, as manifested by the reporting of basement backups as shown in Figure 4.01-22.

An analysis of potential collection system improvements for various recurrence interval events was presented in Section 8. Potential improvements include upgrades to existing gravity sewer service, the installation of a wet weather pumping station, or the installation of underground storage.

KWU staff have an ongoing program of I/I identification and removal in all areas of the City, including the study area. Recent efforts have included smoke testing, manhole inspections, and sewer televising. As sewer defects are noted, they are included in an ongoing program to be eliminated. Collection system repairs may include spot repairs, sewer replacement, manhole repairs, and manhole replacement. Historically, I/I identification and removal programs have not resulted in significant reductions in peak flow rates. Rather, they have the net result of maintaining the structural integrity of the collection system, while maintaining, or slightly reducing, peak flow rates.

The City and the KWU have a series of ordinances aimed at addressing I/I in the sanitary sewer system, including provisions for addressing I/I from private sources such as homes. The existing ordinances were reviewed and appear to contain the necessary language to allow the City to prevent and/or eliminate I/I from private sources. Minor modifications to ordinance language were suggested in Section 10.

Consideration should be given to adopting a POS ordinance to address private I/I issues. POS ordinances require that all homes be brought up to date with all applicable codes at the time a home is sold. Several communities have found that POS ordinances have been effective at facilitating modifications to existing properties to address private I/I issues. Examples of POS ordinances have been provided in Appendix J.

Private I/I sources can add significantly to peak flow rates in a sanitary sewer system. Leaking laterals, sump pump and downspouts connected to the sanitary lateral, and other sources of clearwater need to be removed from the sanitary sewer system. These activities are the responsibility of the individual homeowners. City staff should continue to impress upon the residents of the entire City the vital role they play in reducing peak wet weather flows in the sanitary sewer system. Simple activities such as sloping the yard away from the foundation of the home can significantly improve the overall performance of the system.

Preliminary I/I estimates indicate that foundation drain/sump pump connections may account for a significant percentage of the I/I in the basins. Elimination of these cross-connections will greatly improve the performance of the sanitary sewers, especially during rainfall events. This improved performance includes the minimization of the potential for basement backups.

11.03 POTENTIAL FUTURE IMPROVEMENTS FOR ACHIEVING STORM AND SANITARY MANAGEMENT GOALS

A. Stormwater System Potential Future Improvements

1. Sump Pump Collection Systems–In areas where sump pumps discharge to roadways or over sidewalks making for potential intermittent or sustained safety issues, the City should consider sump pump collection systems that would collect multiple sump pump discharges and route them underground to the nearest storm sewer inlet. These systems will also likely be instrumental in collecting the disconnected foundation drains that will be drained by sump pump systems.

2. 46th Avenue to Pershing Boulevard Relief Sewer–Identified as Alternative 12 in the study, a relief sewer extending from the midblock inlets on 46th Avenue (between 60th and 61st Street) to Pershing Boulevard could be constructed. This relief sewer would be coupled with disconnection of the storm sewer that currently connects these inlets to the mainline storm sewer on 61st Street. This incremental improvement appears to provide significant relief to this persistently flooded area while not significantly increasing flow rates downstream. The City should confirm that the increase in hydraulic grade line at the storm sewer connection at Pershing Boulevard will not affect surrounding buildings. However, during the 10-, 25-, and 100-year storm events, the homes at 6028 and 6051 46th Avenue area would still be prone to surface flooding into the home low entry point, according to hydraulic model output.

3. Storm Sewer, Manhole, Inlet Rehabilitation Program–Section 3 describes the storm sewer televising and manhole/inlet ratings that were completed as part of this project. The City can use this information to generate a priority list for rectifying deficiencies/defects in the storm sewer, manholes, and inlets. Based on information in Table 3.01-4, there are 20 manholes and seven inlets classified as having either minor

defects, severe defects or are a total failure. If it is assumed that rehabilitation can be accomplished for approximately $2,000 per manhole and $1,500 per inlet, a budgetary amount of $50,500 should be adequate to address the majority of the issues identified. Further explanation on rehabilitation techniques can be found in Section 11.02.D.1. A priority list for rectifying deficiencies in storm sewers should be developed by the City. In general, pipe deficiencies can be resolved by either relaying or lining the pipes. Many of the deficiency/defect locations have the potential to be rectified as part of the improvement alternatives considered in Section 9, or as a part of future City reconstruct projects in the Forest Park area.

4. Storm Sewer System Metering–To gain additional information to assist in further validation of the operation of the storm sewer system, SWU can install flow meters in strategic locations within the storm sewer system.

5. Terrace and Yard Infiltration Rate Testing–To gain additional information regarding the potential contribution of surface flooding in terraces and yards to sanitary sewer inflows, SWU can provide double-ring infiltrometer testing to determine in-situ infiltration rates in areas experiencing persistent surface flooding in terraces and yards.

6. Potential Future Improvements–While not recommended at this time, if the City decides in the future to do additional improvements to the storm sewer system to achieve a 10-year storm sewer system capacity, Alternative 3 for the Forest Park North Area and Alternative 6 for the Forest Park South Area appear to be the most cost-effective. The City could consider purchase and removal of homes, perhaps up to 13 or more homes, to remove surface flooding-prone homes from the watershed. Additional considerations regarding these potential future improvements are included below.

   (a) Alternatives 1 through 7 Discussion–Section 9 includes information regarding Alternatives 1 through 7. Consideration should be given to the impact of the 100-year storm in the Forest Park North and South Areas. While each of the alternatives meet the 10-year and 25-year design criteria goals, the 100-year storm still causes flooding that appears to be at a level that will enter homes with the alternative in place. With this in mind, we recommend that the City survey all homes in and adjacent to flood-prone areas to obtain their lowest entry point elevations. If a home has the potential to be flooded after obtaining this elevation information, we would recommend expanding the amount of detention provided within a particular alternative to bring the 100-year flood elevation to an acceptable level. Alternatively, the City could consider buying flood impacted properties and removing them from the urban floodplain.

   Analysis herein indicates that the combination of Alternative 3 for the Forest Park North Area and Alternative 6 for the Forest Park South Area is the most cost-effective alternative of the alternatives analyzed. Alternative 3 consists of underground detention at the Immanuel Baptist Church parking lot as shown in Figure 9.04-2 and described in Section 9.04. Alternative 6 consists of storm sewer upsizing from midblock on 50th Avenue between 65th Street and 67th Street to proposed underground detention in the Forest Park School recreational field at the northeast corner of 47th Avenue/69th Street Alternative 6 is shown on

Figure 9.07-1 and described in Section 9.07. Each of these alternatives includes storm sewer and inlet upgrades as shown in Figure 9.03-3 for the Forest Park North Area and on Figure 9.07-1 for the Forest Park South Area.

Alternative 3 includes construction of an underground detention basin on private land owned by Immanuel Baptist Church. The land is currently a parking lot that would be reconstructed after construction of the underground detention basin. Alternative 3 has excellent performance for the 10-year and 25-year storm events and appears to have the best performance among alternatives considered. The City can initiate discussions with representatives of Immanuel Baptist Church to determine its willingness to grant a permanent limited easement (PLE) to the City for this project.

Alternative 6 includes construction of an underground detention basin on land owned by the Kenosha Unified School District No. 1 at Forest Park Elementary School. The City can initiate discussions with representatives of the School District to determine their willingness to grant a PLE to the City for this project.

Costs of each alternative are shown in Table 9.09-1 Detailed planning-level OPCCs are included in Appendix H.

During design, we recommend running the hydraulic models to maximize the performance of the designed system. After design is complete, we recommend that the hydraulic model be rerun with all changes to document the benefit of the final design with the recommended alternative in-place.

(b) Alternatives 8 through 11 Discussion–Section 9 includes information regarding Alternatives 8 through 11. Analysis shows that the most cost-effective Alternatives are alternatives 9 and 11 in meeting the City's goal for the project.

Alternative 9 includes upsized inlets and inlet leads in Forest Park North, upsized Forest Park North Mainline storm sewer, and downstream bottleneck upsizing. Alternative 9 will increase flows and HGLs at the downstream terminus of the bottleneck upsizing. It also shows that there will be significant improvement in the flooding conditions in the Forest Park North Area. In effect, Alternative 9 provides a 10-year storm event level of protection for the Forest Park North Area. However, the increase in flows and HGLs at the downstream terminus of the bottleneck upsizing may have the effect of shifting flooding issues from the Forest Park North Area to downstream areas.

Alternative 11 includes upsized inlets and inlet leads in Forest Park South, upsized Forest Park South Mainline storm sewer, and downstream bottleneck upsizing. Alternative 11 will increase flows and HGLs at the downstream terminus of the bottleneck upsizing. At and downstream of the 47th Avenue/70th Street intersection, Table 9.14-2 shows decreases in flows at this location (Pipe P-5491.1). This is deceiving in that the bottlenecks downstream of this location are creating flooding that in effect stagnate the ability for storm sewers in this area to pass more flow. Alternative 11 contributes to the severity of flooding in

this area because of the higher HGL created in the vicinity of Node 5489 (47th Avenue/70th St Intersection). It also shows there will be improvement in the flooding conditions in the Forest Park South Area. In effect, Alternative 11 provides a 10-year storm event level of protection for the Forest Park South Area. However, the increase in flows and HGLs at the downstream terminus of the bottleneck upsizing may have the effect of shifting flooding issues from the Forest Park South Area to downstream areas.

In the case of Alternatives 8 through 11, modeling shows that bottleneck upsizing will have the effect of increasing downstream peak flows and HGLs. While these alternatives improve flooding conditions in the Forest Park Area, they may have the effect of shifting flooding issues from the Forest Park Area to downstream areas. Standard stormwater management planning protocol would dictate that downstream pipe upsizing be coupled with upstream detention to minimize downstream flow increases. Therefore, we recommend that the increased flow be offset by addition of detention upstream of the bottlenecks (similar to Alternatives 3 and 6) or by further study of the potential downstream impacts.

Consideration should be given to the impact of the 100-year storm in the Forest Park North and South Areas. While each of the alternatives meet the 10-year and 25-year design criteria goals, the 100-year storm still causes flooding that appears to be at a level that will enter homes with the alternative in place. If a home has the potential to be flooded during the 100-year storm event, we would recommend expanding improvements provided within a particular alternative to bring the 100-year flood elevation to an acceptable level. Alternatively, the City could consider buying flood-impacted properties and removing them from the urban floodplain.

Being a planning-level study that has both data and model limitations, modeled elevations should not be taken as exact but rather as a representation of anticipated flooding depths and extents. This underlies the importance of maintenance of freeboard to home low entry points. We therefore suggest that the City consider maintaining as much freeboard as possible, with 1 foot or more being ideal, between the modeled high water elevation during the 100-year storm event and the home low entry point. As this is a retrofit situation, maintenance of appreciable freeboard on certain homes may be difficult to achieve without significant expenditures.

As can be seen in the flood extent maps for the various alternatives, each of the alternatives will still have flooding outside of City right-of-way that will cause nuisance flooding on resident's properties. The City should make a determination on the community acceptability of this flooding.

(c) Utility Conflict Checks–As part of this project, a planning level utility conflict check was performed for the alternatives with available information. All alternatives will likely have some level of utility conflict because of pipe upsizing and connections that cross sanitary sewer or water main. It appears utility conflict resolution is possible by modification of the alternatives during design to achieve/maintain the

performance level reported in this plan. Specific recommendations regarding resolution of conflicts between the proposed storm sewer improvements and the sanitary sewer and water main are further discussed.

(1) Utility conflicts between the proposed storm sewer and the existing sanitary system may need to be resolved by use of an equivalent capacity horizontal elliptical concrete storm pipe to reduce height of the pipe, by adding a smaller parallel pipe than that recommended adjacent to the existing storm sewer system to attain the proposed capacity, and potentially relay sanitary laterals. We recommend that the City provide additional sanitary sewer data south of 67th Street and on 54th Avenue to assist in our planning level utility conflict identification. A detailed survey of the sanitary sewer and lateral system is recommended during design.

(2) Utility conflicts between the proposed storm sewer and the existing water main and water services would likely be resolved with vertical offsets on the water main. We request the City provide the water main GIS layer to assist in our planning level utility conflict resolution. A detailed survey of the water main and service system is recommended during design.

(d) Inlet and Storm Sewer Capacity Upgrades–Alternatives 1 through 7 include storm sewer and inlet upgrades described in Section 9.03 to achieve a 10-year storm event capacity in conjunction with detention improvements. Alternatives 8 through 11 include inlet and inlet lead upgrades described in Section 7.02 C. During design of the improvements, the City should obtain detailed survey of proposed inlet locations and reevaluate available inlet capacity to confirm the results herein.

7. Public Information Framework–As described in Section 10, the City can expand upon existing public information efforts with some of the public information framework described in Section 10. The City should continue to educate the public on how they can assist in reducing private I/I to the sanitary system. In general, methods such as separation of perimeter foundation drains and sump pumps from the sanitary sewer lateral or floor drain, creating positive drainage away from the home foundation, and keeping catch basins free of leaves, snow, and ice are instrumental in assisting the City in resolving the flooding in the Forest Park Area.

8. Potential Funding Opportunities–Investigate funding opportunities for the recommended improvements through the WDNR Municipal Flood Control Grant Program and Federal Emergency Management Agency (FEMA) hazard and prehazard mitigation grant programs.

B. Sanitary System Potential Future Improvements

1. Section 3 describes the sanitary sewer televising completed as part of this project. KWU staff have already begun the process of addressing defects as part of its ongoing maintenance programs. Televising results from 2010 indicated the existing sewers in Pershing Boulevard were in poor structural shape. An analysis of these sewers indicated

replacement of the existing sewer with larger sewers improves the overall operation of the Forest Park north basin. A portion of this work was completed in 2010.

Section 3 also summarizes recent work by KWU staff in identifying defects in the sanitary sewer system via smoke testing and manhole inspections. Manhole defects can contribute significant amounts of I/I to the collection system. Fortunately, they are also the most accessible component of the collection system. For those areas where mainline sewer replacement is not being recommended, an aggressive manhole rehabilitation program should be implemented to address known defects and other sources of I/I.

Manhole rehabilitation techniques have improved in recent years. Spray on cementitious products can be applied to the lower portions of a manhole to restore the structural integrity. For a typical manhole (approximate depth of 6 feet), these products can be applied for about $1,000. Cast-in-place (CIP) liners are also available for restoration of the upper areas of the manhole (casting/frame and below to a depth of approximately 18 inches). These liners can be installed for about $1,000. Therefore, for an approximate cost of $2,000, significant improvements can be made to the entire manhole. Table 3.02-1 identified 100 to 150 manholes in need of some type of rehabilitation. If it is assumed that rehabilitation can be accomplished for approximately $2,000 per manhole, a budgetary amount of $300,000 should be adequate to address the majority of the issues identified. A manhole-specific rehabilitation plan needs to be developed that addresses the needs of each manhole.

2. Section 4 identified several properties where the foundation drains discharge to the sanitary sewer. This is in violation of current city codes. Preliminary I/I estimates indicate that foundation drain/sump pump connections may account for a significant percentage of the I/I in the basins. Elimination of these cross-connections will greatly improve the performance of the sanitary sewers, especially during rainfall events. This improved performance includes the minimization of the potential for basement backups. In addition, direct connections to the sanitary sewer may allow wastewater to flow back into a home if the lateral does not contain some type of backflow prevention device. City staff should work with homeowners where the lateral or sump pump discharges to the sanitary sewer. These clear water sources should be directed to the storm sewer system, if available. If no storm sewer system is available, these clear water sources should be directed to the ground surface in accordance with existing City codes.

   City staff should continue to impress upon the residents of the entire City the vital role they play in reducing peak wet weather flows in the sanitary sewer system. The legal framework exists to require homeowners to address these private sources of I/I. Public education and enforcement will be required if the city hopes to see any signs of significant improvement. Homeowner awareness of the role that they play in the solution to the problem should help increase participation.

3. Section 8 presented a series of potential sanitary sewer improvements intended to improve the wet weather conveyance capacity of the collection system. Improvements were presented for the north and south study basins.
   Three basic types of conveyance improvements were presented for the north basin. A review of the total net present worth of the alternatives (Table 8.02-1), as well as the

nonmonetary aspects of the various alternatives (Table 8.02-2), indicates that gravity conveyance improvements represent the most attractive alternative.

Table 8.01-1 presents a summary of the potential gravity conveyance improvements analyzed for the north basin, including sewer sizes and total net present worth. The difference in total net present worth between the 5-Year recurrence interval alternative ($680,000) and the 100-Year recurrence interval alternative ($880,000) is $200,000. It is recommended the City proceed with the 100-year recurrence interval improvements. All alternatives include the proposed improvements in Pershing Boulevard, as discussed above.

Table 8.01-1 also presents a summary of the potential gravity conveyance improvements analyzed for the south basin. The difference in total net present worth between the 5-/10-/25-Year recurrence interval alternative ($190,000) and the 100-Year recurrence interval alternative ($320,000) is $130,000. However, the difference in total net present worth between the 50-Year recurrence interval alternative ($220,000) and the 100-Year recurrence interval alternative is $100,000. It is recommended the City proceed with the 100-year recurrence interval improvements. All alternatives include the proposed improvements in Pershing Boulevard, as discussed above.

The total net present worth of the recommended gravity conveyance improvements for the north and south basins is $1,200,000.

Improvements recommended for the north basin should be implemented prior to those recommended for the south basin. Additional flow metering should be conducted in the south basin prior to implementing any south basin projects.

4. As described in Section 10, we recommend the City expand upon existing public information efforts with some of the public information framework described in Section 10.

C. Joint System Prioritization

At the onset of this evaluation, the overall intent of the project was to develop a thorough understanding of the wet weather operation of the storm and sanitary sewer systems in the Forest Park area. The following general statements describe the operation of the two systems.

1. An improperly operating storm sewer system can greatly impact the wet weather operation of the sanitary sewer system. If storm flows are not adequately conveyed in a timely fashion from an area, the potential for I/I increases in the sanitary sewer system. Increases in I/I result in higher peak flows in the sanitary sewer system, with the increased potential for basement backups.

   Widespread surface flooding in an area can also result in water entering homes, which in turn can result in increased flow to the sanitary system through foundation and floor drains and sump pumps. This again results in higher peak flow rates in the sanitary sewer system.
2. Defects in the sanitary sewer system allow clear water to enter the sanitary sewer system. This is true even in basins with properly designed and maintained storm sewer

systems. These defects can contribute large quantities of flow to the sanitary sewer, increasing the potential for basement backups and sanitary sewer overflows.

3. Preliminary I/I estimates indicate that foundation drain/sump pump connections may account for a significant percentage of the I/I in the basins. Elimination of these cross-connections will greatly improve the performance of the sanitary sewers, especially during rainfall events. This improved performance includes the minimization of the potential for basement backups.

The overall impact of these statements is that it is not realistic to expect that improvements to one of the conveyance systems in the basin, storm or sanitary, will result in the elimination of the current issues that plague the residents of the Forest Park neighborhood. Inadequate storm conveyance facilities result in surface flooding, which has a detrimental impact on the neighborhood. Inadequate sanitary facilities result in basement backups and sanitary sewer overflows, which again has a detrimental impact on the neighborhood.

Section 11.03 presents an implementation plan that allows the City to continue the process of addressing the needs of both conveyance systems.

11.04 IMPLEMENTATION PLAN FOR POTENTIAL FUTURE PROJECTS

The focus of the implementation plan is to provide incremental improvement to both the storm and sanitary sewer systems. After a thorough review of the alternatives and information provided in this report, the SWU and KWU have developed a strategy for implementation of improvements to improve the performance of the storm sewers in the Forest Park area.

This study recommends an incremental solution to the surface flooding and basement backup issues within the Forest Park Basin. Within the Forest Park Basins, KWU has collected valuable flow data within the sanitary sewer system for a series of wet weather events. The response of the system to these various wet weather events correlates closely to the computer model completed as part of this study. Based on this correlation KWU feels comfortable in increasing capacity within the sanitary sewer system to convey the anticipated flow for a 100-yr storm event. This will require KWU to install a larger diameter sanitary sewers or new relief sewers on 61st Street between 46th Avenue and 50th Avenue and on 65th Street between 48th Avenue and 50th Avenue.. Following the sanitary sewer improvements continual monitoring of the flow within the sanitary sewer system will allow the City to assess the impact the enhancements have made on sanitary sewer flow rates and determine if upgrades within the storm sewer system are warranted. Should the sanitary sewer system upgrades prove to be inadequate in regards to reducing flow within the sanitary sewer system, additional SWU capacity upgrades within the study area would be implemented. These upgrades would generally follow Alternative SW2 and SW3.

The following table itemizes the steps to implement this plan.

TABLE 11.04-1

IMPLEMENTATION PLAN-POTENTIAL FUTURE PROJECTS

Rank No.	Component	Opinion of Probable Construction Cost	Tentative Timeline	Goal
	SANITARY SEWER SYSTEM (KWU)			
KWU1	Sanitary Sewer–Pershing Blvd.–60th Street to 61st Street	$290,000	Completed 2010	Increase ability for sanitary sewer to handle rainfall-related inflows.
KWU2	Sanitary Sewer–61st Street–Pershing Blvd. to 46th Avenue	$190,500	Completed 2010	Increase ability for sanitary sewer to handle rainfall-related inflows.
KWU3	Sanitary Sewer Reconstruction (Forest Park North): -61st Street (46th Avenue to 50th Avenue)	$545,000	Construction: 2014	Increase ability for sanitary sewer to handle rainfall-related inflows.
KWU4	Sanitary Sewer Reconstruction (Forest Park South): -Flow Metering Prior to Construction -65th Street (48th Avenue to 51st Aveue)	$375,000	Construction: 2014	Increase ability for sanitary sewer to handle rainfall-related inflows.
KWU5	Sanitary Manhole Rehabilitation Program	$300,000	Ongoing	Reduce rainfall-related flows from entering sanitary sewer.
KWU6	Sanitary Sewer Rehabilitation Program	On-going	Ongoing	Reduce rainfall-related flows from entering sanitary sewer.
	STORM SEWER SYSTEM (SWU)			
SWU1	City-Wide Comprehensive Stormwater Management Plan in progress	TBD	Complete by 2014	Increase understanding of storm sewer system's response to rainfall events.
SWU2	Forest Park Underground Detention	$1,630,000	TBD	Achieve a 10-year storm sewer system capacity in the Forest Park North Study Areas
SWU3	Little League Underground Detention	$1,650,000	TBD	Achieve a 10-year storm sewer system capacity in the Forest Park South Study Areas
SWU4	Relief Storm Sewer: 46th Avenue to Pershing Boulevard	$199,000	Design: 2013 Construction: 2015	Disconnect 46th Avenue from 61st Street mainline storm sewer and add capacity to more efficiently drain the low point on 46th Avenue.
SWU5	Storm Manhole and Inlet Rehabilitation Program	$51,000	Ongoing	Maintain integrity of storm sewer system.
SWU6	Storm Sewer Rehabilitation Program	On-going	Ongoing	Maintain conveyance capacity of storm sewer system.
	JOINT SANITARY AND STORM SEWER SYSTEMS			
JOINT1	Seek Funding Opportunities	NA	On-going	Potential budgetary relief.
JOINT2	Storm/Sanitary Disconnection: -Foundation Drain Disconnection -Sump Pump Collection Systems	$6,000 to $12,000 per home To Be Determined (TBD)	**TBD**	Reduce rainfall-related flows from entering sanitary sewer.
JOINT3	Public Information Framework	TBD	On-going	Increase public understanding of ways residents can reduce private I/I.

11.05 FUNDING OPPORTUNITIES

While it is anticipated that stormwater utility and sewer and water utility funds will be used to fund these projects, there are several grant opportunities that exist that may augment these funds. Some of the more popular and applicable grant and low-interest loan programs that have the potential to assist in funding a storm and sanitary management plan are the following:

A. Federal Emergency Management Agency Grants

1. Stafford Act Grant Programs

   a. Hazard Mitigation Grant (HMG).
   b. Pre-Disaster Hazard Mitigation Grant (PDM).
   c. Public Assistance (PA).

2. National Flood Insurance Act Grant Programs

   a. Flood Mitigation Assistance (FMA).
   b. Repetitive Flood Claims (RFC).
   c. Severe Repetitive Loss Claims (SRL).

The FEMA HMG Grant must be associated with a Presidential Disaster Declaration. It is our understanding that the City had flooding-related disaster declarations in June 2000, May/June 2004, August 2007, and June/July 2009. The following eligible project types for the HMG grant:

1. Elevating flood-prone homes or businesses.

2. Acquisition of (and either demolishing or relocating) flood-prone homes from willing owners and returning the property to open space. The local government becomes the new owner of the property.

3. Retrofitting buildings to minimize damage from high winds, flooding, earthquakes, and other hazards.

4. Floodwall systems to protect critical facilities.

The FEMA PDM Grant purpose is to raise risk awareness and reduce disaster losses through planning and project grants. Eligible project-types include the following.

1. Hazard Mitigation Plan
2. Structural Retrofits
3. Acquisitions of Property in High-Risk Areas
4. Safe Room Construction

The FEMA PA Grant Program must be associated with a Presidential Disaster Declaration and has its purpose as providing assistance for quick response to and recovery from major disasters or emergencies declared by the President. Eligible project types include the following:

1. Debris Removal.
2. Emergency Protective Measures.
3. Repair, Replacement, Restoration of Disaster Damaged Facilities (Public or Private Non-Profit Facilities Only).
4. Assistance for Hazard Mitigation Measures During Recovery Process.

The FEMA FMA Grant purpose is to provide planning and technical assistance grants to states and local governments to help reduce or eliminate the risk of repetitive flood damage. Eligible project types include the following:

1. Planning Grants to prepare Flood Mitigation Plans (must be in National Flood Insurance Program (NFIP).
2. Project Grants to implement measures to reduce flood losses: elevation, acquisition, relocation (must be in NFIP).
3. Technical Assistance Grants for the State to Administer FMA Program.

The FEMA RFC Grant purpose is to provide planning and technical assistance grants to states and local governments to help reduce or eliminate the risk of repetitive flood damage. Eligible project types include the following:

1. Acquisition of properties and either demolition or relocation (must be in NFIP).
2. Elevating homes.
3. Dry floodproofing of nonresidential structures.
4. Minor localized flood control projects (funding limited to $1 million per project).

The FEMA SRL Grant purpose is to provide planning and technical assistance grants to states and local governments to help reduce or eliminate the risk of repetitive flood damage. Eligible project types include the following:

1. Acquisition and demolition or relocation of at risk structures and conversion of the property to open space.
2. Elevation of existing structures to at least the Base Flood Elevation (BFE) or an Advisory Base Flood Elevation (ABFE) or higher. For the SRL program only, mitigation reconstruction is permitted only when traditional elevation cannot be implemented.
3. Minor physical localized flood reduction projects.
4. Dry floodproofing (historic properties only).

B. United States Environmental Protection Agency Grants

1. Great Lakes Restoration Initiative Grants

The President's 2010 budget provides $475 million in USEPA's budget for a new USEPA-led, interagency Great Lakes restoration initiative, which will target the most significant problems in the region, including invasive aquatic species, nonpoint source pollution, and contaminated sediment. From a flood-control standpoint, a wet detention basin would likely qualify for this grant program.

C. Wisconsin Department of Natural Resources Grants and Low Interest Loans

1. Municipal Flood Control Grant

   a. State 70 percent/Local 30 percent Match.
   b. Maximum Grant is $650,000.

2. Urban Nonpoint Source and Stormwater Grant

   a. State 50 percent/Local 50 percent Match.
   b. Maximum grant is $150,000 (Construction) plus $50,000 for property acquisition.

3. Lake Planning and Management Grant.
4. River Protection Planning and Management Grant.
5. Stewardship Grant.
6. Clean Water Fund.

   a. Low interest loan at 65 percent of WDNR market rate for stormwater quality projects.

   b. Low interest loan at WDNR market rate for flood control projects.

   c. Low interest loan at 55 percent of WDNR market rate for interceptor sewer and relay of gravity collection system piping. In addition to the low interest loan, the Clean Water Fund includes up to 30 percent principal forgiveness during the course of the loan. The federal subsidy of the Clean Water Fund Program includes stimulus funding that can be used for these purposes.

The WDNR Municipal Flood Control Grant would be ideal for home purchase and demolition, dry detention basin, and wet detention basins in the planning area because of the documented flooding problems and property damage in the watershed. The Urban Nonpoint Source and Stormwater grant would be ideal for wet detention basins that are able to accept the 2-year flow and thus treat the smaller storms for total suspended solids. The WDNR Lake Protection Grant program River Protection Grant program and the Stewardship Grant program should also be explored to see if these projects would be a fit for these programs. The Stewardship Grant program may assist in land acquisition to protect water resources and green space for facilities that might be able to incorporate some level of outdoor recreation facilities.

11.06 CONCLUSION

The goal of this report has been to provide the City with a framework of how storm and sanitary systems should be improved to address existing flooding and basement backups in the Forest Park Area. It is not expected that all the recommended measures will be constructed immediately. Implementation of measures recommended in this report will help to relieve the flooding and basement backups in the Forest Park Area.

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