Village of Oak Park

Combined Sewer System Review and Short-Term Improvement Projects Study

October 13, 2011

MWH Americas, Inc
175 W. Jackson Blvd, Suite 1900
Chicago, Illinois 60604

MWH®

BUILDING A BETTER WORLD

Contents

Appendices

1.0 Introduction

Basement backups resulting from large storm events in recent years in the Village of Oak Park have brought focus to the discussion of the sewer system's capacity. With approximately 15% of the residents of the Village reporting basement sewer backups associated with these large rain events[1], the Village is looking for ways to better protect residents against basement backups as well as continue to increase the level of service that the sewer system can provide.

The objective of this current study is to review the Village's current sewer improvement program and identify measures to reduce basement backups and improve the level of service of the sewer system by considering the current state of the system, reviewing the latest approaches to managing combined sewer systems, and refocusing resources for efficient and cost-effective improvement programs that are appropriate for the specific characteristics of the Village's system. Some of the recommendations from this report could be incorporated into the Village's 2012 budget.

The tasks accomplished as part of this study include:

- Reviewing previous floods and previous sewer system study;
- Assessing factors contributing to flooding problems;
- Developing short-term improvement actions;
- Evaluating external funding programs; and
- Developing a recommended action plan for the Village.

This report will present the findings associated with these tasks, the identified potential opportunities, and the resulting recommendations intended to help the Village continue to improve the sewer system's performance.

2.0 System Performance

To gain insight into the issues associated with the Village's sewer system, information from a number of sources were reviewed for relevance. These sources included:

- Discussions with Village staff on recent storm events that resulted in basement backups;
- Data provided by the Village, including geographic information system (GIS) files and recent reports on flooding; and
- Combined Sewer System Evaluation Study, Harza Environmental Services, Inc. (MWH), August 1994.

The information was used to summarize the sewer system's capacity as well as understand the reasons for basement backups in the Village. The following sections summarize the understanding gained from this analysis.

---

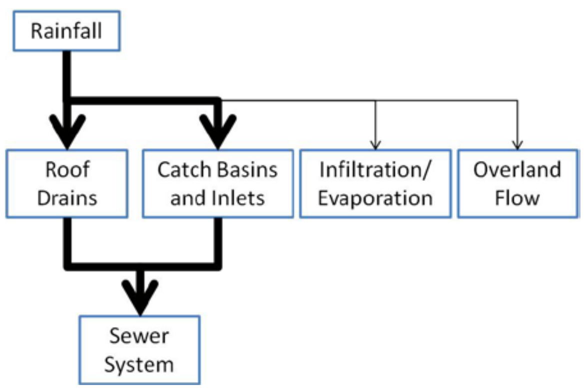
[1] Report on Flooding from July 2011, Village of Oak Park

2.1 Sewer System Capacity

The Village's sewer system is a combined sewer system that collects sanitary flows from homes and during rain events, stormwater from surface runoff. The Village's system drains the majority of these flows south into the Metropolitan Water Reclamation District of Greater Chicago (MWRD) system for conveyance to the Stickney Water Reclamation Plant. When rain falls in the Village, the sewer system currently acts as the main outlet for the stormwater through catch basins and inlets along the streets or downspouts directly connected to the sewer system from the roofs of homes, as is illustrated by the figure below.

Although some stormwater runs overland along drainage paths to either infiltrate, evaporate, or flow out of the Village boundary, there is minimal elevation change in the Village and no natural outlet for the Village to take advantage of in draining stormwater like other municipalities that are near waterways. Therefore, there is little opportunity for overland flow. At the same time, because the majority of downspouts that drain roofs are directly connected to the sewer system and the street flows drain easily, there is little opportunity for stormwater to first infiltrate into the ground or evaporate before flow enters the sewer system.

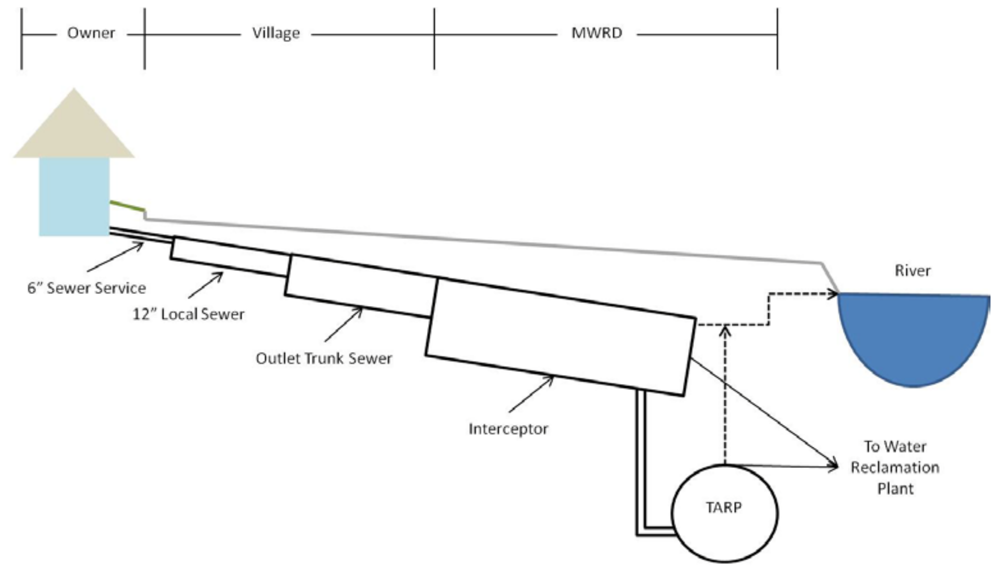
Figure 1 – Village Rainfall Outlets



Because the sewer system operates as the main outlet for stormwater, understanding the capacity of the system is important to understanding how to improve it. The 1994 study was conducted to develop an understanding of the system's performance and use that information to identify cost-effective improvements to raise the system's performance to a 5-year level of service. To meet this goal, the study found that the Village would need to spend approximately 16.1 million in 1994 dollars in trunk sewer improvements, involving the replacement of 20,500 feet of sewer, coupled with 6.9 million in 1994 dollars on local sewer improvements. Since that study, the Village's design goal has been increased to work toward attaining a 10-year level of service. Going forward with improvement projects will require a detailed system assessment and a thorough understanding of the system-wide hydraulics to bring the system to a 10-year level of service.

The figure below illustrates the approximate current capacity of the sewer system broken down by its components. Capacity ranges and typical peak runoff rates are presented in units of flow per area, cubic feet per second per acre, or gallons per minute per acre. To understand the capacities and their meaning, it is important to understand that the Village's current design goal when they are designing a new sewer is a 10-year level of service. Typical peak flow rates associated with the 10-year event are also provided for reference in the figure.

Figure 2 – Understanding of Capacity in Sewer System



6" Sewer Service	12" Local Sewer	Outlet Trunk Sewer	Interceptor	
2-4 cfs/ac 900-1800 gpm/ac	0.2-0.3 cfs/ac 90-135 gpm/ac	0.25-0.5 cfs/ac 115-225 gpm/ac	<0.7 cfs/ac <320 gpm/ac	**Typical Capacity of Pipe**
2-3 cfs/ac 900-1350 gpm/ac	1.5-2 cfs/ac 675-900 gpm/ac	±1 cfs/ac ±450 gpm/ac	±1 cfs/ac ±450 gpm/ac	**Typical 10-year Peak Flow**

Based on this figure, the sewer services that drain sanitary flows and rainfall from roofs normally have the capacity to convey flow created by a 10-year storm when they are in good condition and properly maintained. Subsequent components appear to lack the capacity necessary to convey flows associated with a 10-year storm. It is clear that the Village's system needs to be improved if it is to handle the stormwater created by a 10-year event. At the same time, it is important to note that currently, the MWRD interceptor that collects flows from Oak Park and conveys them to either the Stickney Water Reclamation Plant or for temporary storage to the Tunnel and Reservoir Plain (TARP) does not appear to have the capacity to convey the peak flows associated with a 10-year storm. If the Village were to increase their system's level of capacity, it appears that the interceptor system would remain a bottleneck for those additional flows.

2.2 Recent Flooding in Oak Park

On July 23rd, 2011, a severe thunderstorm resulted in basement backups throughout the Village, particularly in the North-East and North-Central parts of the Village. The 2011 storm occurred one year after a large event in 2010 that resulted in similar patterns of basement backups. In analyzing the rainfall data from these events and building on the historical rainfall analysis from the 1994 report, Table 1 was developed.

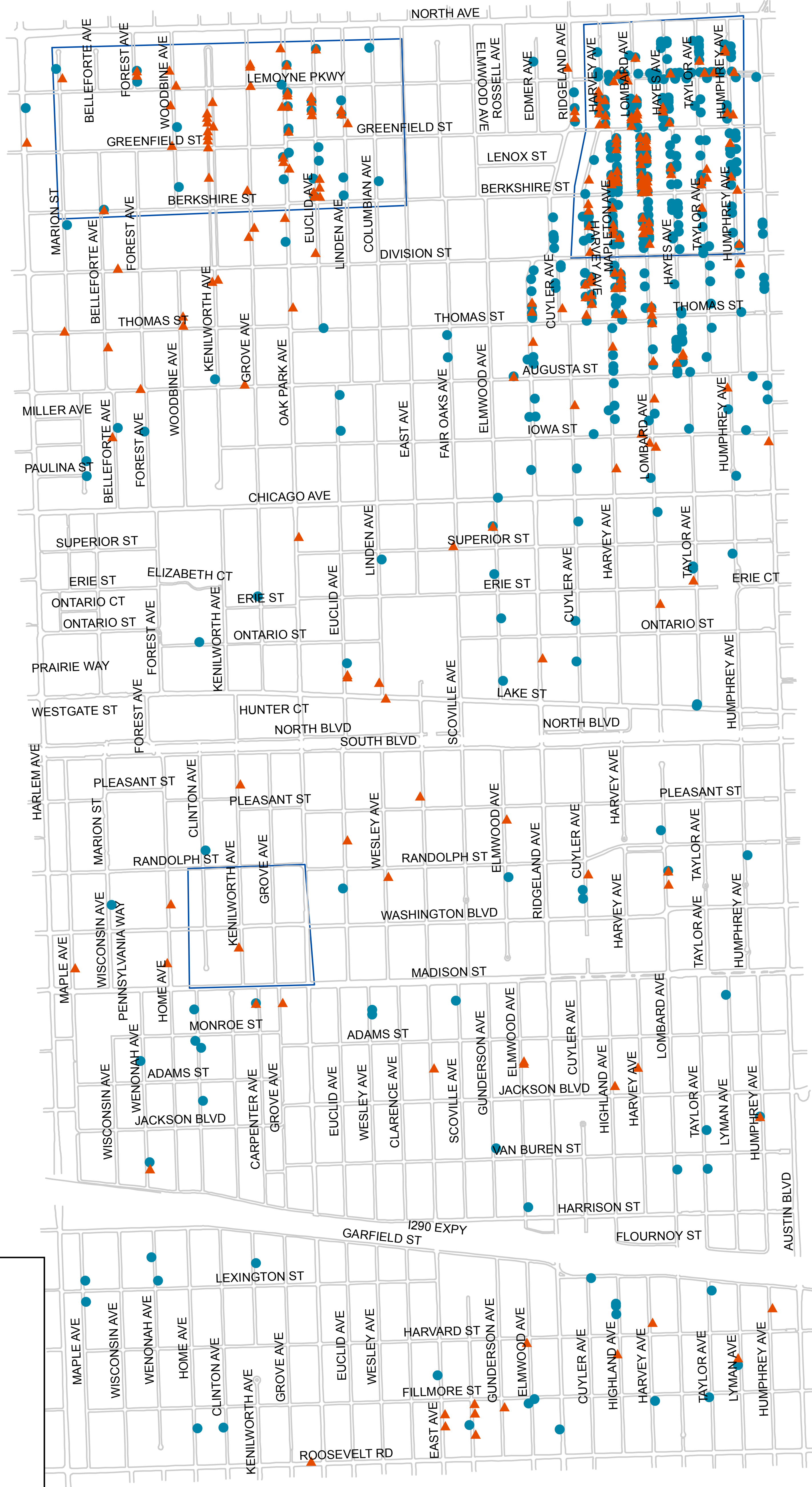
Table 1 – Storm Event Analysis

Date	Rainfall Depth (Inches)	Rainfall Duration (hours)	Rainfall Intensity (inches/hours)	Rainfall Frequency (year)	No. of Complaints
August 13, 1987	6.12	13	0.47	75	75
September 1, 1989	2.57	5	0.51	3	27
August 23, 1993	2.48	3	0.83	5	106
July 24, 2010	8.33	18	0.46	225	424
July 23, 2011	4.3	3	1.43	60	239

The data from these storm events indicate that the 2010 and 2011 events were equal to a 225-year event and 60-year event, respectively. The flows created by storms of this magnitude greatly exceed those created by a 10-year storm event. **Even if the Village's sewer system were improved to the 10-year level of service goal, it is believed that many of the associated basement backups from these storm events would still have occurred.**

To better understand the pattern of complaints and the reason for the basement backups, the complaints from these recent events were compared with the general areas of complaints from the 1993 storm event that prompted the 1994 sewer study. Figure 3 below illustrates the comparison between these three events.

The complaints for 1993, 2010, and 2011 show consistency in the approximate areas where basement backups occur. Based on this comparison, the assumption was made that the basement backups resulting from both the 2010 and 2011 storms were related to the same capacity issues that were identified in 1994 as part of the sewer system study.



Legend

2010-2011 Complaints

Year

- 2010
- 2011
- Curbs
- 1993 Complaint Areas

Village of Oak Park
Reported Flooding Complaints
Comparison of Approximate 1994 Flooding Complaints with 2010 and 2011 Flooding Complaints
Figure 3

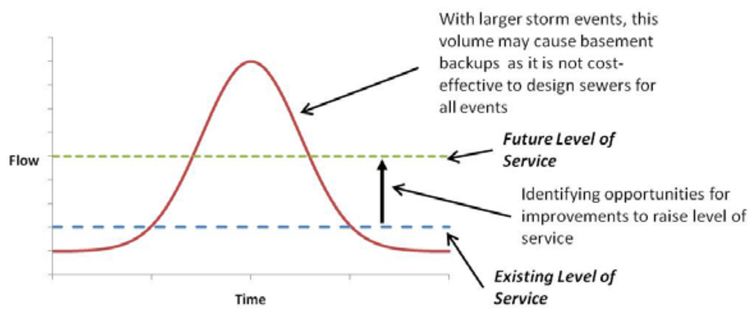
MWH

10/10/2011

2.3 Understanding of Issues

Based on the data review, it is clear that the Village's sewer system would need to be improved to provide a higher level of service to protect homes against basement backups. At the same time, the recent storm events shed light on an important point. It would be a significant cost to the Village and its residents to improve the capacity of the sewer system to convey flows associated with the events from 2010 and 2011. Figure 4 illustrates the idea that the Village needs to improve its system's current performance, but it is not currently cost-effective to design the sewer system for the additional volume that results from larger storm events.

Figure 4 – Illustration of Storm Event in Village



As was demonstrated previously in Figure 2, even if the Village were to improve the sewer system to have the ability to convey the stormwater associated with large events, like the 2010 and 2011 events, the interceptor system appears to not have enough capacity to convey these greater flows. With a fixed outlet capacity on one end, and rainfall events that cannot be controlled on the other end, the Village needs to look at the opportunities between these points for improving the management of combined sewer flows throughout its system. Figure 5 illustrates the opportunities for improving the system that were examined for this study.

Figure 5 – Opportunities for Improving the Sewer System

Basements in the Village of Oak Park currently act as temporary storage for excess combined sewer flows until the system can convey the flows to the proper outlet. Potential opportunities to keep flows out of the basements include:

- Reducing the peak flow rate of the stormwater entering the sewers – if the peak flow rate of the stormwater entering the sewer system is reduced, the same volume of stormwater enters over a longer period and at a slower rate to better use the sewer system's capacity; and
- Reducing the volume of stormwater into the sewers – if less volume enters the sewer system, less volume will have the potential of backing up and being stored in basements during large storm events.

3.0 Opportunity Identification

Opportunities to improve the system were proposed for their potential to reduce the peak rate and the volume of stormwater entering the storm system. This analysis evaluates current programs for their ability to grow as well as potential program opportunities that will benefit the system with short-term results and with the opportunity to be incorporated into a more comprehensive combined sewer program.

3.1 Recent Flood Mitigation

The Village has implemented several programs and improvements to better protect its residents against basement backups and to help residents respond to the recent large storm events. These programs are summarized in the Table 2.

Table 2 – Summary of Oak Park's flood mitigation programs

Program	Reason
Sewer Maintenance Projects	The Village has spent $20 million in sewer improvement projects to maintain the aging system and protect the system's current level of service. Figure 6 below shows the sewer maintenance projects constructed throughout the Village since 1994 as well as the proposed capital improvement projects for 2012-2013.
Removal of Flood Debris	After the recent storm events, the Village provided affected residents with flood debris removal services to aid in the recovery and repair effort.
Televising	Televised sewer inspections were performed to identify the sewers most in need of repair and potential upgrade.
Data Collection	The Village has developed a database of basement backup complaints from the recent storm events to track damage and to identify problems.
Outreach and Fact Sheets	The Village researched basement flood-prevention programs from other local municipalities, including downspout disconnections, the installation of overhead sewers, and the MWRD rain barrel program to develop information to give to residents.

3.2 Goals of 2012 Solutions

While combined sewer basement backups are undesirable at any level, the total elimination of such events is a costly proposition and a task seldom undertaken by municipalities. One action that a municipality can take toward eliminating combined sewer basement backups is to separate the combined sewer system. For the Village of Oak Park, this endeavor would likely cost hundreds of millions of dollars for the required infrastructure improvements, assuming that an acceptable storm sewer outlet can be identified and built. Even with such improvements, the work would not guarantee the complete elimination of sanitary basement backups or surface flooding during large storm events. Each municipality must determine an acceptable level of protection to provide to its residents, and then work toward reaching that goal.

Village of Oak Park
Sewer Improvements Since 1994
Figure 6

MWH

10/10/2011

As described previously, the ultimate capacity of the combined sewer system in Oak Park is limited by the capacity of the MWRD system to which it discharges. It is reasonable, then, that the Village of Oak Park would work to maximize the available outlet capacity and provide its residents a comparable level of protection against combined sewer basement backups. Until the current outlet capacity can be specifically analyzed and determined, a 10-year level of protection will be pursued. The pace at which the Village proceeds to meet this goal will be based on available financial and political capital reflecting the desires of the community.

For this study, as was discussed previously, solutions were identified for their ability to reduce the peak flow and/or the volume of stormwater entering the sewer system. Additionally, as the Village moves toward developing a more comprehensive improvement plan, the opportunities for 2012 should help the Village prepare for those future solutions. The opportunities identified for the Village for the possible inclusion into the 2012 budget cycle are highlighted in the following section.

4.0 Identified Sewer System Improvement Projects

The projects listed below are improvements that have been identified that can bring the Village closer to its 10-year level of service design goal for the combined sewer system. They are being reviewed here to determine the feasibility of short-term implementation. On an individual basis, some of these projects may have little measurable effect, but when applied at a system-wide level, they could delay and potentially reduce the threat of basement backups in the community. Several of the projects involve the diversion of stormwater from the combined sewer system. Keeping stormwater out of the combined system essentially frees up capacity, allowing the system to function under larger rain events without backing up.

Some minor construction improvements are also considered for near term implementation. However, before significant capital investments are made to the system, an update to the 1994 Combined Sewer System Study is recommended. These projects and their potential benefits are summarized in Table 3, and described with more detail in the following sections.

Table 3 – Identified Solutions and their Benefits

		Location	Offset Peak?	Reduce Volume?	Increase Capacity?	Increase Level of Service?
1	Downspout Disconnection	Private	X	X		X
2	Rain Barrels	Private	X	X		X
3	Rain Gardens	Private	X	X		X
4	Dry Wells	Private	X	X		X
5	Overhead Sewers and Other Backflow Prevention	Private				X
6	BMP Demonstration Sites	Public	X	X		X
7	Permeable Pavement	Public	X	X		X
8	Boulevard Bioswale	Public	X	X		X
9	Inlet Restriction	Public	X			X
10	Local Sewer Improvements	Public			X	X
11	Trunk Sewer Improvements	Public			X	X
12	Sewer System Study	Private and Public	X	X	X	X

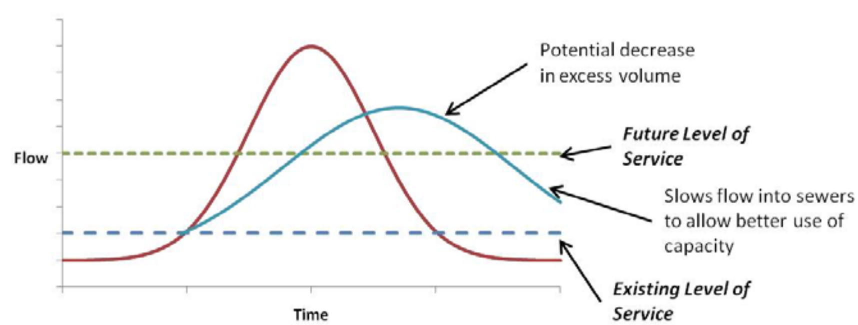
4.1 Option 1: Downspout Disconnection

Benefit: Moderate/High

The practice of directing water from rooftops straight to sewers was common practice and is the standard throughout Oak Park. During small rainfalls, residents see a benefit from this practice from the reduction of surface water runoff. However, during larger rainfalls, direct downspout connections exacerbate basement flooding by quickly filling the sewers with rainwater and surcharging the system. Diverting stormwater from the sewers will help reduce the occurrence of basement backups by reducing the load on the combined sewer system during rain events. In an effort to reduce the peak flow of a storm and slow the flow of stormwater into the sewers, disconnecting roof downspouts was identified as a potential solution for the Village.

As is shown in Figure 7, the intention of disconnecting downspouts is to redirect flow from storms (original shown in red) to flow over other surfaces before entering the sewer system. Through this additional drainage path, the flows into the sewers are potentially slowed down with the possibility of infiltrating as the water passes over pervious area, and the peak flow and volume have the potential to be reduced allowing better use of the capacity of the sewer system, as is illustrated by the blue line in the figure.

Figure 7 – Flow and volume comparison for downspout disconnections



Eliminating downspout connections helps address two potential causes of basement backups. First, disconnecting downspouts helps reduce the occurrence of basement backups caused by compromised residential service lateral connections that do not have the capacity to handle heavy stormwater flow, causing the home to back-up with its own combined sewer flow. Second, disconnecting downspouts benefits the system as a whole by reducing the overall load on the system.

The flow from the downspouts does need to be managed appropriately and redirected to yards or parkways. However, this may not be possible in all locations. The redirected overland flow does need to be considered in all cases to check that no surface flooding problems are created. In cases where the additional overland flow would cause problems, direct downspout connections to the sewer system should be allowed to remain. It is estimated that approximately 0.06 cfs/acre or 29 gallons/min/acre of runoff per rooftop would be redirected through catch basins if all four downspouts were disconnected.

Cost: Low

The cost to the resident for disconnecting downspouts is minimal and involves little more than some basic tools, items to redirect the stormwater flow, and the time to do the work. The cost to the Village is minimal and based on community outreach and education consisting of items such as flyers sent to homeowners, instructions provided to local hardware stores, and communication through other public venues.

Action

The Village can continue or increase community outreach and education to promote voluntary downspout disconnections. Alternately, the Village can adopt an ordinance mandating the disconnection of all downspouts with the ability for the Village to provide waivers if there is no opportunity to manage overland flow.

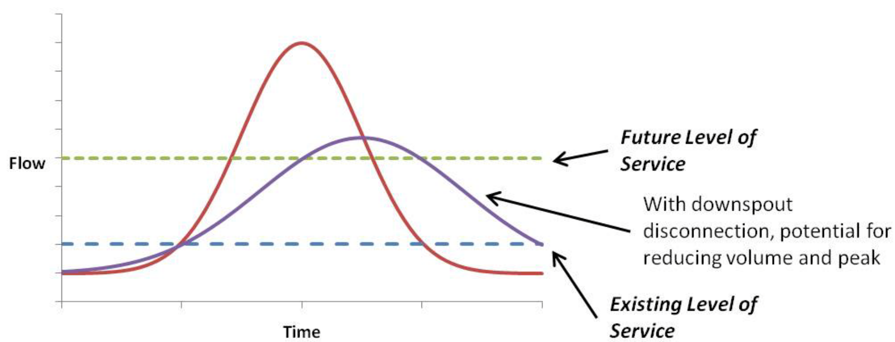
4.2 Option 2: Rain Barrel

Benefit: Moderate

Rain barrels provide another opportunity to divert or delay the flow of stormwater to the combined sewer system and provide all the benefits of downspout disconnection described previously. Rain barrels can result in better managed overland flow than basic downspout disconnections as residents using rain barrels are typically conscious of the landscaping and overland flow paths through their yard. Rain barrels also have the added benefit of offsetting potable water consumption with rainwater for irrigation and other outdoor water use.

The typical rain barrel that is installed has the ability to store 55 gallons of roof runoff. Though this is minimal storage for a large rain event, rain barrels have the additional benefit of disconnecting a roof downspout and therefore redirecting flow across a longer drainage path. The flow and volume curve would look similar to the graph developed for the downspout disconnection with some potential for an overall decrease in total volume as is shown in Figure 8 below.

Figure 8 - Flow and volume comparison for rain barrels and rain gardens with downspout disconnection



Cost: Low

The cost to the resident to install a rain barrel includes the cost for the rain barrel, optional stand, appurtenances, and the time to do the work. The cost to the Village is minimal and based on community outreach and education consisting of items such as flyers sent to homeowners, instructions provided to local hardware stores, and communication through other public venues.

Because the Village of Oak Park is tributary to MWRD, it can participate in the current MWRD rain barrel program through which residents can purchase rain barrels at a cost of $51 each. The Village may choose to provide further incentive to the program by:

- Publicizing the current MWRD promotional information.
- Hosting an in-town rain barrel pickup location.

- Providing supplemental information regarding installation and maintenance.
- Developing demonstration sites as described later in this section.

Action

The Village can create a public awareness campaign to promote the use of rain barrels in conjunction with downspout disconnections in line with the Village's previous efforts. Similar to downspout disconnections, the Village can develop an ordinance to limit the amount of stormwater runoff from properties both into sewers and over land.

4.3 Option 3: Rain Gardens

Benefit: Moderate

While stormwater diverted by downspout disconnections or overflowing from rain barrels may eventually find its way into the sewer system, the goal of rain gardens is to promote the infiltration of rainwater into the ground rather than sending it all to the sewers. This is particularly viable in areas of Oak Park where there are sandy soils. However, with additional planning and continual maintenance, rain gardens can be effective most anywhere. Based on the Green Values® Stormwater Management Calculator[2], a 0.15 acre lot with a roof of 1500 square feet has the ability to reduce peak discharge by 43% and total volume by 39% if roof downspouts are disconnected and drain to rain gardens. The figure illustrating the benefits of the rain barrels option is also applicable to the potential improvements that rain gardens could offer.

Cost: Low/Moderate

The cost to the resident for installation of a rain garden can vary greatly depending on the size, soil conditions, and vegetation that is selected. The cost to the Village is minimal and based on community outreach and education consisting of items such as flyers sent to homeowners, instructions provided to local nurseries and home improvement stores, and communication through other public venues.

Action

Similar to the incentives with the rain barrels, the Village can promote the use of rain gardens through a variety of avenues from outreach programs to subsidies. The visible and aesthetically pleasing nature of rain gardens provides an additional benefit to their use. In addition to the outreach and subsidies that can be considered, the Village can sponsor a rain garden design contest where a number of residents on a particular block commit to participating with the goal of reducing runoff by a specified percentage. Like the other programs associated with downspout disconnection, Village can develop an ordinance to limit the amount of stormwater runoff from properties both into sewers and over land.

4.4 Option 4: Dry Wells

Benefit: Low/Moderate

Dry wells provide a method of managing overland stormwater flow when downspouts are disconnected and the rainwater would otherwise result in unwanted flooding. The dry wells also delay the flow from entering the system, which can reduce the overall peak flow in the sewers and the occurrence of basement backups. Depending on soil conditions, they may also reduce the total flow into the sewer system by promoting infiltration. The potential improvement that dry wells could contribute is

---

[2] "Green Values® Stormwater Management Calculator". Center for Neighborhood Technology. <http://greenvalues.cnt.org/calculator/calculator.php>

dependent on the design, but because it is incorporated into the disconnection of downspouts, it is likely that it would at least offer the same benefit as that program.

Cost: Low
The cost to homeowners for dry wells can be relatively high, requiring new sewer lines, excavation, materials, and restoration. Estimated typical costs can range from $900-1,400[3]. The cost to the Village is minimal and based on community outreach and education consisting of items such as information provided directly to homeowners and communication through other public venues.

Action
The Village can continue to provide educational material to private property owners to consider for the mitigation of excessive stormwater runoff. Some information previously provided by the Village to residents is included in Appendix A. Like the other programs associated with downspout disconnection, Village can develop an ordinance to limit the amount of stormwater runoff from properties both into sewers and over land.

4.5 Option 5: Overhead Sewers and Other Backflow Prevention

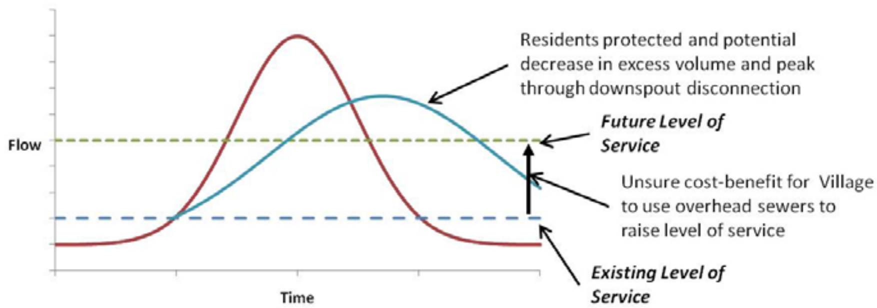
Benefit: High
The installation of overhead sewers provides residents a high level of protection against sewer backups. When installed and working properly, the system stops sewage from backflowing into a home, while providing a positive discharge for regular sanitary flows. The level of protection provided by this home improvement far exceeds the level of protection typically provided by the public sewer system.

While overhead sewers are typically considered an improvement to private property, some municipalities have determined that the cost for the higher level of protection is less than the cost of system-wide improvements to the public system that would provide a lower level of protection, and therefore have provided financial support for these improvements. With the potential for a study in 2012 that will clearly identify and define the necessary solutions and associated costs for bringing the sewer system to a 10-year level of service, a cost-benefit analysis of the potential for overhead sewers to raise level of service can be performed. This analysis will help better understand how an overhead sewer program can be incorporated into the overall solution in helping the Village raise the sewer system's level of service.

In addition to providing protection for residents, when overhead sewers are implemented, they are typically coupled with the disconnection of downspouts as well. With disconnection, there is a potential for the decrease in volume and peak flow as was seen by the downspout disconnection option and is illustrated below. There are also other lower-cost backflow prevention devices that provide a lower level of protection.

[3] Lake George Park Commission. "Dry Wells" <http://www.lgpc.state.ny.us/pdf/DryWell.pdf>

Figure 9 - Flow and volume for overhead sewer implementation



In some communities, there are concerns that the residents on a block who do not install overhead sewers will see a potential increase in the number and severity of sewer backups when their neighbors install overhead sewers. In Oak Park, basements currently serve as additional storage for combined sewer flows. When some residents install overhead sewers, eliminating the associated storage from the system, there is a possibility that backups will occur where they have not occurred previously or that backups will be more severe. However, once long-term improvements are made to the public system to provide a target base level of protection, the installation of overhead sewers in some homes will not reduce that level of protection for homes without overhead sewers. Overhead sewers are intended to provide short-term protection to private residents while public system improvements are being implemented, and also provide a higher level of protection to residents in the long run.

Cost: Moderate

The cost to residents for the installation of overhead sewers is typically on the order of $15,000[4]. The cost to the Village is low to moderate, depending on the level of participation that the Village chooses to promote the program.

Action

The Village can provide information to encourage residents to take action to protect their property against sewer backups with the installation of overhead sewers and other backflow prevention systems. The Village can consider a cost-sharing program to further encourage these systems. A sewer system study would be required to understand the full cost/benefit of the tradeoff between installation of overhead sewers and public sewer system improvements.

4.6 Option 6: BMP Demonstration Site

Benefit: Moderate

Because downspout disconnection and rain barrel and rain garden installation have not been traditional options for managing stormwater in the Village, educating residents on proper installation is the key to obtaining the best results from implementing those programs. Installing a best management practice (BMP) demonstration site or sites at buildings easily accessible to all residents may help the Village in encouraging residents to take on these types of programs by allowing the Village to demonstrate proper installation.

---

[4] "Storm Water Task Force Cost Sharing Programs Overhead Sanitary Sewer Service Conversions ". City of Glenview, IL. < http://www.glenview.il.us/development/inspectional/Reports/overheadsewerinfo.pdf>

Because this program is not intended to be a wide-scale program, it is unlikely to have a significant, direct reduction on stormwater flows. However, it offers the Village a relatively low-cost program alternative that is visible to the residents and offers residents additional resources for taking on private property-focused programs.

Cost: Moderate
The cost to the Village would be relatively low, involving the cost of disconnecting downspouts and potentially implementing a rain barrel or rain garden. Additional cost would be necessary for educational material distribution and signage at the location to inform residents about the demonstration sites and how they could implement similar measures on their properties.

Action
To implement this type of program, the Village will need to identify sites that offer high visibility to residents that also have the space to install a rain garden, a rain barrel, or disconnect the roof downspout, or a combination of all three. The Village will also need to develop the signage and materials necessary to provide residents with information at the demonstration site locations. This type of program would also benefit from marketing and advertisement after the sites are completed as well as the organization of an event to create public interest around the project and bring residents to the site or sites.

4.7 Option 7: Permeable Pavement

Benefit: Moderate
As roadways and alleys are rehabilitated and replaced in the Village, they offer the opportunity for detaining stormwater through the installation of permeable pavement systems. Permeable pavement systems replace traditional, impervious hard surfaces with a pervious surface coupled with storage underneath. The main goal of most permeable pavement installations is to provide detention to reduce the peak loading of stormwater into the sewer system. However, depending on subsurface conditions, infiltration of stormwater into the ground may be possible reducing the overall volume of stormwater entering the sewers.

Several factors must be addressed when considering installation of permeable pavements, including maintenance, durability, cost, and impact to the sewer system. Permeable pavements can be considered for roads, driveways (public and private), parking lots, and alleys. The City of Chicago is currently piloting a Green Alley program, installing permeable pavements in alley ways throughout the City. Without further understanding of the specific designs of the permeable pavement systems, it is difficult to quantify their benefit, but Chicago's program has shown the potential to reduce alley runoff flows for smaller rain events.

Costs: High
The relative costs of permeable pavement projects along with the additional infrastructure needed for stormwater management are relatively high.

Action
The Village can perform a survey of potential sites, the benefit to the sewer system, and associated costs with the project to determine the best locations for implementation, particularly when considered system-wide. The potential benefits of detention and infiltration should be considered

4.8 Option 8: Boulevard Bioswale

Benefit: Low/Moderate

Oak Park's boulevards and green space offer the opportunity to install public green infrastructure systems that can serve as another method of reducing the peak load on the combined sewer system for the Village to implement. In addition to potential public parks and gardens that can be converted into rain gardens or bioswales, Village staff has identified the boulevards along Lemoyne Parkway and Kenilworth Avenue as potential locations for implementing green infrastructure.

To allow greater stormwater to flow to these systems in addition to the rain directly landing on the site, consideration for directing stormwater to these systems is necessary. Tributary areas should be re-graded to create drainage paths to the bioswales to improve the benefit to the Village in reducing stormwater volume or off-setting peak flows into the sewers.

Cost: Moderate/High

The cost for establishing public rain gardens or bioswales is moderate, but can be high depending on the subsurface conditions and the infrastructure required to direct stormwater to these systems.

Action

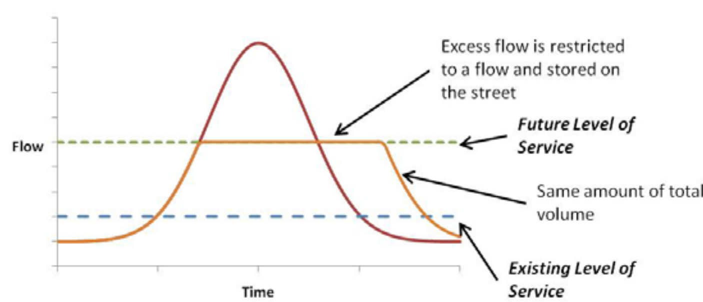
The Village can perform a survey of potential sites, the benefit to the sewer system, and associated costs with the project to determine the best locations for implementation, particularly when considered system-wide. In addition to the surface vegetation, below grade conditions need to be considered. If natural infiltration is not possible with native soils, detention can be incorporated into the project.

4.9 Option 9: Inlet Restriction

Benefit: Moderate/High

Inlet restrictors provide another method of reducing and controlling the amount of stormwater entering a combined sewer system. There are several types of inlet restrictors that can be utilized depending on flow requirements, maintenance needs, and budget. The restrictors are installed inside catch basins and inlets to reduce the inflow of stormwater into the sewers and detain the stormwater in the streets. Water is typically held in the streets for a few hours until the peak rain event has passed. The temporary nuisance flooding in the streets and parkways is accepted to reduce the occurrence of combined sewage backups in basements.

Figure 10 – Flow and comparison associated with inlet restriction



The inlet restrictor program is most successful when considered on a system-wide basis and implemented in conjunction with downspout disconnections and sewer improvements as part of an overall sewer management plan. Inlet restrictors will not eliminate all basement backups, particularly when installed in a piece-meal fashion without consideration of overall sewer capacity. However, any reduction of stormwater flows through a combined sewer system will increase the level of protection to residents against basement backups, provided that the detained stormwater does not find another way of entering the sewers. Depending on the size of restrictors and the available detention volume, the installation of restrictors can have varied effects on the flow into the sewer system. When designed properly, restrictors can significantly restrict flows into the sewers allowing for better use of sewer capacity.

Inlet restrictors should only be installed after thoughtful selection of the implementation area and proper planning to manage the detained stormwater to minimize disruptions and unwanted flooding.

Cost: Moderate/High

Because of the need to adequately manage detained stormwater to avoid flooding of private property and minimize disruption caused by the stormwater, installation of inlet restrictors needs to be carefully planned.

Action

The Village can install restrictors in selected areas where detained stormwater can be adequately managed. The Village can consider the use of inlet restrictors in the overall sewer system management plan to be updated in the 2012 Study, analyzing and maximizing the benefit of the inlet restrictors.

4.10 Option 10: Local Sewer Improvements

Benefit: High

The 1994 Sewer Study analyzed and recommended options for local sewer improvements in the Village to be coupled with larger, trunk main improvements. Specifically, the improvements included:

- Construction of approximately 17,500 feet of new 15-inch and 18-inch diameter lateral sewer to replace existing 9-inch diameter lines;
- Construction of approximately 15,200 feet of new branch relief sewers to relieve areas where small diameter laterals are draining areas greater than one block; and
- Rehabilitation or replacement of approximately 6,100 feet of 12-inch, 15-inch and 18-inch diameter determined to be in poor structural condition.

These improvements are shown on Figure 11 below along with the trunk sewer improvements proposed in the 1994 Sewer Study. When Figure 11 is compared to Figure 6, which shows the sewer improvements during the period of 1995-2011, it appears that the Village has constructed some of these local sewer improvements. As an option for 2012, the Village could continue to construct these improvements as these improvements will help the system better convey water away from homes to trunk mains.

Combined wastewater flows from more than 60% of Oak part are initially collected and conveyed by lateral collector sewers 18-inches in diameter or smaller. Because of the heavy reliance on the local sewers, improving the performance of these sewers has the potential to help maintain and improve the performance of the sewer system resulting in a high benefit to the Village if implemented.

Village of Oak Park

Proposed Local and Trunk Sewer Improvements from 1994 Report

Figure 11

MWH

10/13/2011

Cost: High

When the Sewer Study was developed in 1994, the local sewer improvement cost was estimated to be approximately $6.9 million. With the changes in construction costs since 1994,it is predicted that the current costs would be on the order of 20% to 60% higher.

Action

The Village can continue to implement the rehabilitation and replacement of recommended local sewer improvements from the 1994 Sewer Study.

4.11 Option 11: Trunk Sewer Improvements

Benefit: High

The 1994 Combined Sewer Study identified three large scale sewer improvement projects with potential to bring the existing sewer system to a 5-year level of service. Those alternatives are presented here as options to help the Village obtain a higher level of service. These projects include:

1. Relief sewer in addition to capital improvement projects;
2. Additional outlet in addition to capital improvement projects; and
3. Inlet restriction program in the northwest in addition to capital improvement projects.

The relief sewer alternative is shown on Figure 11. When coupled with the proposed local sewer improvements from the study, brings the Village's system to a 5-year level of service. The review of these projects is outside the scope of this current study, and will be deferred to the Sewer Study Update described below.

Cost: High

Costs associated with large scale sewer improvement projects can be very high. When the costs were estimated in 1994, updating the sewer system to a 5-year level of service would cost 16.1 million 1994 dollars. Current costs for improving the system to a 10-year level of service would be considerably more.

Action

The Village can consider large-scale sewer improvement projects as part of a Sewer Study Update.

4.12 Option 12: Sewer Study Update

Benefit: High

The 1994 MWH Study provided a thorough review of the Village's combined sewer system and recommendation for large-scale improvements to address basement backups. Over the past 17 years, the Village has made improvements to the sewer system. The Study should be updated to account for these improvements and consider the latest approaches to combined sewer and stormwater management. In addition, the technology used to perform the previous analysis and develop the corresponding improvement recommendations has changed considerably. The true capacity of a sewer system is based on the sum of its components, and can be fully appraised with the use of a hydraulic model. A model update will facilitate an efficient analysis of the current system and provide the Village with a tool to help develop specific sewer system projects and quantify improvements. Specific tasks that should be included in the Sewer Study Update include:

- Define the goals and timeline for sewer system improvements.
- Develop a 5-year Capital Improvement Plan.

- Update the Village's sewer system GIS database.
- Prepare updated sewer atlases from the GIS database.
- Link the Village's sewer televising inspection library to the GIS database.
- Update the sewer system model based on the updated GIS database.
- Perform field testing and verify the model results.
- Analyze the current capacity of the sewer system.
- Determine the receiving capacity of the MWRD facilities, in particular the West Town Outlet Sewer and the Northwest Intercepting Sewer.
- Refine the previously recommended improvements, including the impact of implementing the east-west separation of the northern portion of the Village's sewer system along Thomas and Greenwood prior to construction of additional relief sewers.
- Account for green infrastructure improvements within the recommended improvements.

Cost: Moderate
The relative cost of an update to the sewer study is moderate, considering the potential to reduce over-all program costs with a properly planned and implemented long-term improvement plan.

Action
The Village can hire a qualified engineering firm to perform an update to the 1994 Sewer System Study.

5.0 External Funding Opportunities

As Oak Park examines its options for improving the capacity and performance of its combined sewer system, it must also examine the options available for funding such improvements and/or mitigating the costs to property owners of flood mitigation measures. These options include a range of external and internal funding approaches.

External funding options for stormwater management/combined sewer system improvements include low-interest infrastructure loans, hazard preparedness or hazard mitigation grants, and partial or full grants for specific types of stormwater management improvement or demonstration projects. Features of several potential external funding programs are described below.

5.1 Illinois Environmental Protection Agency Revolving Loan Funds

The Illinois Environmental Protection Agency (IEPA) manages and administers low-interest, revolving loan funds designed to support municipalities' efforts to improve their water supply and wastewater management infrastructure. These programs are funded through a combination of federal capitalization, state matching funds, and loan repayment funds to provide a perpetual source of low-interest funding for environmental infrastructure projects. The program that could serve as a potential source of external funding for Oak Park's flood mitigation efforts is the Water Pollution Control Loan Program (WPCLP). Details related to the program can be found on the IEPA's website at: http://www.epa.state.il.us/water/financial-assistance/state-revolving-fund.html.

The WPCLP provides low-interest loans to municipalities for projects that have been shown to be effective alternatives for improving the performance of the community's wastewater management infrastructure. Typical loans offered in recent years have been based on a repayment period of 20 years at an annual interest rate of only about 1.25%. For a hypothetical $1,000,000 infrastructure improvement project, these terms can provide a total $450,000 savings in finance costs over more traditional funding options based on a 5% interest rate and a 20-year loan term as shown below.

Table 4 – Comparison of Loans

	20-year Loan at 5% Interest	20-year Loan at 1.25% Interest
Loan Principal	$1,000,000	$1,000,000
Loan Interest Rate	5.0%	1.25%
Loan Term	20 years	20 years
Total Interest Payments	$583,894	$130,721
Total Loan Cost	$1,583,894	$1,130,721
Loan Cost Savings	-	$453,173

However, the WPCLP is a highly competitive program, and in recent years, project applications submitted to the IEPA for WPCLP funding have far exceeded the capacity of the loan program. As such, it is critical that efforts to secure WPCLP funding for projects in Oak Park be organized and structured to comply with program requirements. In particular, the Village must complete a wastewater facilities plan that defines its planned approach to improved wastewater management prior to actively pursuing revolving loan funding for any specific project.

5.2 Illinois Green Infrastructure Grant Program (IGIG)

The IGIG provides grants to fund the design and implementation of green infrastructure best management practices within Municipal Separate Storm Sewer (MS4) or Combined Sewer Overflow (CSO) communities. At present, the funding available for IGIG grants state-wide is $5 million annually. The program is administered by the Illinois Environmental Protection Agency (IEPA). The IEPA accepts proposals for the following three categories of projects:

- *Combined Sewer Overflow (CSO) Rehabilitation Category* – Maximum IGIG amount is $3 Million or 85% of eligible project costs, whichever is lower. Local match requirement is 15%. Priority is given to projects that propose to remediate overflows that are discharging to an impaired waterway and are implementing a long term control plan.
- *Stormwater Retention and Infiltration Category* – Maximum IGIG amount is $750,000 or 75% of eligible project costs, whichever is lower. Local match requirement is 25%. Priority is given to projects that propose to improve water quality to an impaired waterway through stormwater runoff.
- *Green Infrastructure Small Projects Category* – Maximum IGIG amount is $75,000 or 75% of eligible project costs, whichever is lower. Local match requirement is 25%. Priority is given to projects that propose to improve water quality through the management of stormwater runoff through the implementation of highly visible, public outreach efforts and demonstration sites.

The 2011 deadline for applications is **December 15th, 2011**. Additional information related to the IGIG program can be found on the IEPA website at http://www.epa.state.il.us/water/financial-assistance/igig.html.

5.3 Federal Emergency Management Agency (FEMA) Funding

The Federal Emergency Management Agency (FEMA) administers a range of grant programs that provide federal funding to states which then use the funds to support planning and project activities undertaken by local governments and communities. These programs fall under five general categories:

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)

- Flood Mitigation Assistance (FMA)
- Repetitive Flood Claims (RFC)
- Severe Repetitive Loss (SRL)

The **Hazard Mitigation Grant Program (HMGP)** provides funding assistance for implementation of long-term hazard mitigation measures (including capital projects) after a presidential major disaster declaration in the areas of the state requested by the Governor of a state. In addition, a portion of the HMGP funds allocated to a state following a disaster declaration can also be allocated to mitigation planning. In Illinois, the program is administered through the Illinois Emergency Management Agency (IEMA).

Pre-Disaster Mitigation (PDM) grants are available to communities on an annual basis to provide a source of funding for mitigation planning and/or capital projects to mitigate the potential impacts of a disaster. These grants are awarded by FEMA based on a competitive analysis of applications submitted from communities throughout the United States.

To be eligible for funding under either of these programs, communities must have in place or be covered by an approved Multi-Hazard Mitigation Plan. Cook County was awarded HMGP funds in November 2009 for the preparation of a county-wide multi-hazard mitigation plan. This plan is scheduled to be completed in 2012. While efforts to complete the countywide plan are in progress, some Cook County communities have opted to prepare their own plans so as to have access to potential FEMA mitigation funds prior to release and approval of the county's plan. Currently in Illinois, private property overhead sewer protection or other backflow protection improvements are not eligible.

Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC) support, and **Severe Repetitive Loss (SRL)** support are provided by FEMA under the auspices of the **National Flood Insurance Program (NFIP)**. The NFIP is a Federal program that is administered by the Federal Emergency Management Agency (FEMA) that enables property owners in NFIP participating communities to purchase federal flood insurance. However, as there are no significant waterways within Oak Park and not all types of flooding are covered by federal flood insurance, the NFIP has limited direct applicability to the Village. Under the NFIP, damage from basement backups of sewers and/or seepage is only covered if it is associated with a recognized flooding event. Damage due to seepage associated with a high groundwater table is not covered. Also not covered is damage associated with sewer backups into basements that result from a lack of capacity not associated with a recognized flooding event.

6.0 Recommended Programs

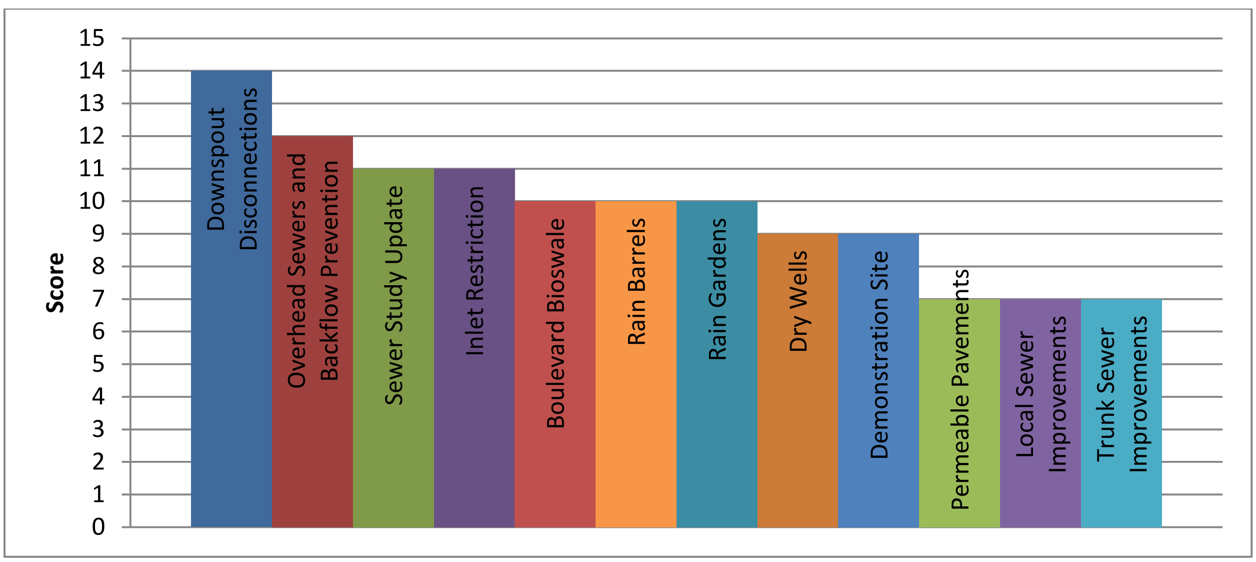
A qualitative analysis of the project options listed above identifies the options that can be undertaken in the near term. The rankings are summarized in Table 5 as well as Figure 12 that graphically shows the rankings. Projects with a low relative cost, high relative benefit to the community, and relative high ease of implementation based on previous programs and current knowledge ranked high and were selected as recommendations for potential incorporation into the Village's budget for 2012. Other projects with a higher cost or less immediate benefit should be considered as part of the Sewer System Study Update to determine if they can play a part in the Village's overall combined sewer system management plan.

Table 5 – Summary Table of Opportunities Ranking

	Improvement	Relative Benefit	Ease of Implementation for Village	Relative Cost	Score
1	Downspout Disconnections	4	5	5	14
2	Overhead Sewers and Backflow Prevention	5	4	3	12
3	Sewer Study Update	5	4	2	11
4	Inlet Restriction	4	4	3	11
5	Boulevard Bioswale	3	5	2	10
6	Rain Barrels	3	3	4	10
7	Rain Gardens	3	3	4	10
8	Dry Wells	2	3	4	9
9	Demonstration Site	3	3	3	9
10	Permeable Pavements	3	2	2	7
11	Local Sewer Improvements	4	1	2	7
12	Trunk Sewer Improvements	5	1	1	7

Key: Relative Benefit: 5 = High / 1 = Low
Ease of Implementation: 5 = Easy / 1 = Difficult
Relative Cost: 5 = Low Cost / 1 = High Cost

Figure 12 – Summary Figure of Opportunities' Ranking



The recommended short-term programs are listed here and further described in the following sections:

- Downspout Disconnection Program to aggressively promote the disconnection of downspouts in 2012;
- Overhead Sewer and Other Private Backflow Prevention Cost-share Program to support residents in installing backflow prevention systems in their homes;

- Education Program to promote implementation of rain barrels, rain gardens, overhead sewers, and dry wells (there may be an opportunity to develop cost-sharing programs for these improvements);
- Update to the Sewer Study, including development of an implementation plan for inlet restriction; and
- Construction of a bioswale along the Lemoyne Boulevard.

6.1 Program 1: Downspout Disconnection Program

With the potential discussion of rain barrels, rain gardens, dry wells, and inlet restriction, downspout disconnection is a necessary component to implement any of these programs. Because of the necessity to disconnect downspouts and the uncertainty of understanding the potential cost-benefit for these other programs in improving the Village system's level of service, it is recommended that the Village aggressively pursue downspout disconnection in 2012.

For developing the cost of this type of program, it is estimated that the program involve Village-wide outreach in the form of pamphlets summarizing why the Village is recommending the improvement, the benefits to the residents, and how a resident can disconnect downspouts. To gain additional community support for this program, it is recommended that the Village host one or multiple promotion events that can be developed as part of this program.

Table 6 – Summary of costs for downspout disconnection program

Items	Cost
Staff (1 day per week)	$42,000
Village-wide Outreach	$15,000
Promotion Event	$3,000
Total	**$60,000**

6.2 Program 2: Overhead Sewer Cost-Share Program

Providing the opportunity for better protection of private property from sewer backups, a cost-sharing program for overhead sewers and other backflow prevention is recommended for consideration for the 2012 budget. This program would be developed and implemented in 2012 and would allow homeowners to be partially reimbursed for the installation of an overhead sewer or other type of private property backflow prevention system.

Village staff has reviewed similar programs in the area and determined that a typical reimbursement grant for this type of program is 50% of the costs of the installation, with a maximum potential reimbursement of $5,000. To implement such a program, it is recommended to dedicate staff time toward developing the program details, application for the program, and education materials. Once developed, it would be necessary to print these materials and identify distribution pathways to residents, either through the Village website, at public meetings, or at public locations. Because reimbursements will be given out for the installation of these systems on private property, the program details should consider a process for application review and verification that the systems were installed properly. A summary of the potential costs is presented in the table below.

Table 7 – Summary of costs for private property backflow prevention program

Items	Cost
Staff (1 day per week)	$42,000
Village-wide Outreach	$15,000
Grants	$5,000/resident*Number of Grants Provided
Total	**$57,000+Total Cost of Grants Provided**

6.3 Program 3: Education Program

Although rain barrels, rain gardens, and dry wells were not ranked as highly as other programs, these options provide important opportunities for residents to disconnect downspouts and redirect roof flows away from the sewers, at least temporarily. Because of these benefits, it is recommended that the Village develop an education program around developing a resource packet to encourage residents in implementing such measures. The goal of the resource packet would be to help residents better understand the costs and potential benefits associated with these types of programs. This program builds upon the work that the Village has already done in developing resources for residents to understand the actions they can take to protect themselves against basement backups.

To implement such a program, it is recommended to dedicate some staff time toward developing the materials. Once developed, it would be necessary to print these materials and identify distribution pathways to residents, either through the Village website, at public meetings, or at public locations. A summary of the potential costs is presented in the table below.

Table 8 – Summary of costs for education program

Items	**Cost**
Staff (1 hour per week)	$6,000
Materials printing	$15,000
Total	**$21,000**

6.4 Program 4: Combined Sewer Study Update

The 1994 Combined Sewer System Study prepared for the Village of Oak Park remains a valuable reference for information related to the capacity of the existing combined trunk sewer network and options for improving the performance of the system. However, sewer system data contained in the 1994 report is now more than 17 years old and does not reflect the improvements made to the system in recent years. In addition, the modeling technology available in 1994 did not allow for the efficient analysis of the smaller local sewers in the Oak Park network. An updated analysis of the Oak Park sewer system could build upon the previous study, consider local sewers and recent sewer improvements completed, take advantage of improved Village infrastructure mapping, and incorporate greater consideration of the role of stormwater best management practices to provide Village decision-makers with an updated plan for addressing condition and capacity concerns within the existing sewer system.

The sewer system study update should address several key questions:

- What trunk and local sewer system improvements are needed to best match the capacity of the Oak Park combined sewer system with the outlet capacity provided by the MWRDGC? How can those improvements be coordinated with condition-related infrastructure improvements in the Village?

- What measures can be used to potentially reduce the rate and/of volume of runoff from developed properties throughout Oak Park?
- What public and/or private strategies can be implemented to best manage the runoff that cannot be captured and conveyed by the Oak Park and MWRDGC conveyance systems?
- How can available funding mechanisms be used to support the implementation of the needed improvements while controlling impacts on local sewer rates and/or property taxes?

To provide answers to these questions, a structured work plan will be required. Key elements of the work plan should include:

1. Completion of recent efforts focused on the development of a complete and accurate inventory of the Village's combined sewer system using Geographic Information System (GIS) technology;
2. Creation and verification of an updated, detailed hydraulic model of the Oak Park combined sewer system for use in refining previous system improvement recommendations and/or developing new recommendations for improving system performance;
3. An updated analysis of the costs and benefits associated with potential sewer system improvement projects and programs including construction of supplemental sewer conveyance or storage capacity, implementation of runoff control and surface storage measures, structured application of stormwater best management practices, and/or promotion of private sector flood protection measures; and
4. Formulation of a proposed capital improvement strategy that considers coordination of effective sewer system performance improvements with projects needed to maintain or rehabilitate aging sewers, water main, and or streets in the community.

The study should also make use of available topographic mapping for Oak Park as a means of understanding natural drainage patterns and surface storage capacity for stormwater, and include discussions with representatives of the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) regarding the available capacity in the District's interceptor sewers. The use of this information, together with hydraulic modeling of the sewer system, will provide a strong basis for the identification of individual projects as part of the overall capital improvement strategy.

The actual cost for a study of this type will depend upon final Village decisions related to factors such as the degree of field work needed to complete development of a reliable sewer GIS coverage, the extent and duration of flow monitoring to be conducted to provide verification data, and the level of detail desired for descriptions of proposed improvements. However, preliminary estimates suggest that the Village should budget approximately $250,000 for completion of the overall effort. The table below provides a summary basis for this cost based on major tasks. It is estimated that a study of this magnitude could be completed in 6-9 months, again depending upon the extent and timing of field investigations. A summary of the potential costs is presented in the table below.

Table 9 – Summary of costs for update to sewer study

Tasks	Cost
GIS Data Development/Model Development/Analysis/Program Development/Cost Estimates	$190,000
Flow Metering/Calibration	$35,000
GIS Enhancements	$20,000
Total	$245,000

6.5 Program 5: Construction of Boulevard Bioswale

A water main beneath Lemoyne Boulevard is being rehabilitated in 2011 and 2012. As part of the project, it is recommended that the boulevard be reconstructed to include a depressed median area that contains a bioswale and re-grading the street to allow rainfall runoff to flow toward the bioswale. In addition to the cost of constructing that project, it is recommended that an educational sign is posted at the location to provide information on the bioswale's purpose to residents.

The costs for this project are in addition to the costs associated with the water main improvement and traditional street repaving project already underway. The costs for this project were estimated by determining the costs required to install a bioswale in addition to the cost for installing a new water main. A summary of the potential costs is presented in the table below.

Table 10 – Summary of costs for construction of the boulevard bioswale

Items	Cost
Construction	$1 million
Total	**$1 million**

6.6 Program 6: Inlet Restriction Program

As was recommended in the 1994 Sewer Study, implementing a pilot project of inlet restriction in the Village to better understand its potential benefits to the sewer system's capacity and residents is recommended. Implementation of an inlet restriction on an ad-hoc basis (rather than as part of an overall sewer system management plan) would involve the following steps:

- Site Selection: A review of potential areas to install inlet restrictors and ranking of the most favorable locations.
- Survey: A detailed survey of the selected areas to understand limitations on the capacity to detain stormwater based on topography, roadway geometry, public property limits, buildings, building access, and other structures.
- Planning: The total volume of available stormwater detention must be calculated so that the proper inlets are specified. The inlets must be selected based primarily on capacity, with consideration to maintenance and installation requirements.
- Installation: Depending on the site conditions and inlet capacity requirements, installation of the inlets can simply require proper placement of the devices in catch basins, or may involve minor sewer lateral and pavement replacement.
- Education and Follow-up: Sewer systems operating with inlet restrictors operate considerably differently than systems without restriction. A targeted outreach is recommended to educate residents to expect surface flooding where they may not have encountered it previously, and the benefits of detaining stormwater within Village right-of-ways. The Village should also follow up in areas where restrictors have been installed to confirm that the system responded as planned.

The cost for implementation of inlet restriction on a per-block basis would vary depending on the size and number of the areas. An approximate budgetary cost assuming a one block installation is shown in the table below.

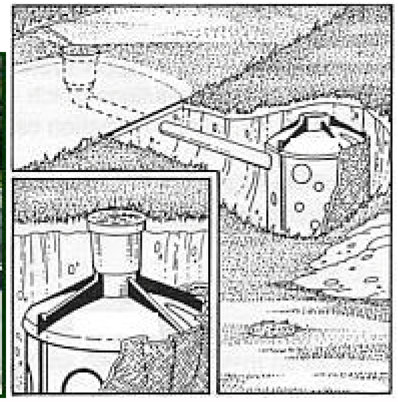
Table 11 – Summary of costs for inlet restriction pilot project

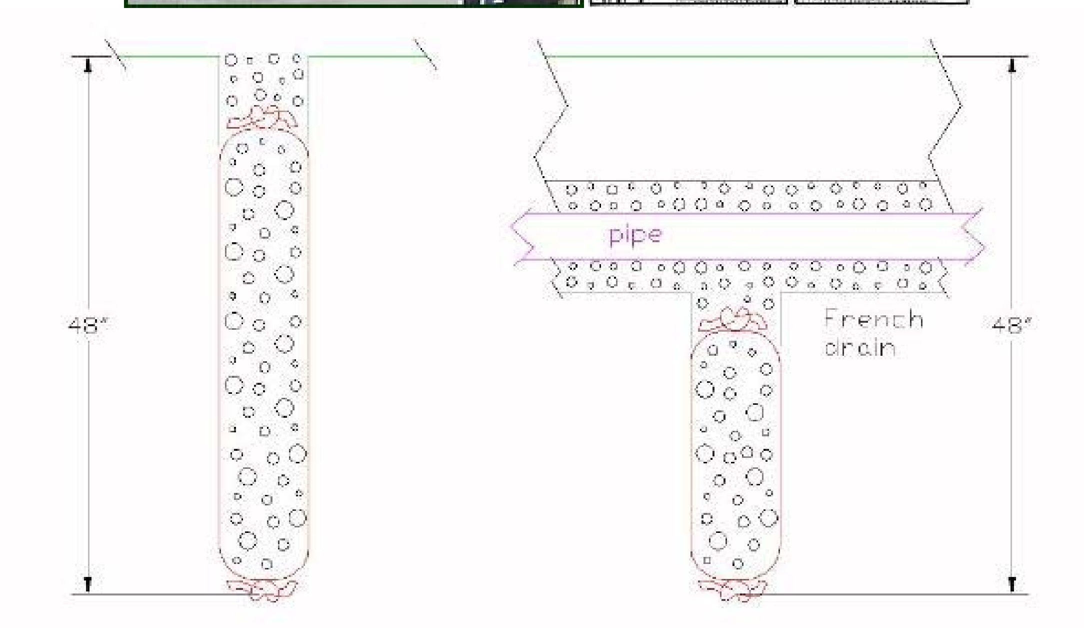
Task	**Cost Per Area**
Site Selection/Planning/Analysis	$25,000
Survey	$6,000
Installation	$15,000
Education and Follow-up	$5,000
Total	**$51,000**

Appendix A

Typical Information Provided to Residents on Dry Well Installation

Typical pictures provided to residents





Screenshot of website provided to residents
(http://www.easydigging.com/Drainage/drywell_soakaway.html)

Drywell and Soakaway design for better drainage

Home
Dig faster...
...with less effort
How to use
Buy your tools
About Us

Garden Guides
Useful Links

Drywell Design and Installation.
Soil percolation and drain time information.

Please first read Steps 1 through 4 of the Lawn and Garden Drainage Guide

On this page you will find information on:

- How to design, build and install small simple drywells
- Perform a percolation test and evaluate the drain time
- Information on large landscape drywells

Will a drywell work in your yard?

A drywell is used to quickly transfer excess surface water deeper into the subsoil. It can be as simple a hole dug with a post hole digger and filled with gravel and sand, or as complex as a pre-cast concrete sleeve lowered into a large hole and fed by drainage pipes.

Before putting in a drywell be sure to do a percolation test, or "perc test", to see if a drywell will work in your soil conditions. Using a pothole digger or soil auger dig a small diameter hole four feet deep. I realize that this is not easy to do, but it is easier in putting in drainage features that end up not working with your soil type.

Take note of the soil types coming up out of the hole – How deep is the subsoil? What is the soil texture? Soil texture determines how quickly water will be absorbed into the subsoil. The ability of soil to absorb water is known as soil percolation. Soils containing a balance of coarse and fine particles are the best types for drainage, or percolation, of water. Soil containing a high amount of clay is not a good choice for

Ready to start digging?

Want to dig faster than a shovel and with less effort?

Try our new Easy Digging tools!