Village of Midlothian Stormwater Management Capital Plan

Report

April 2019

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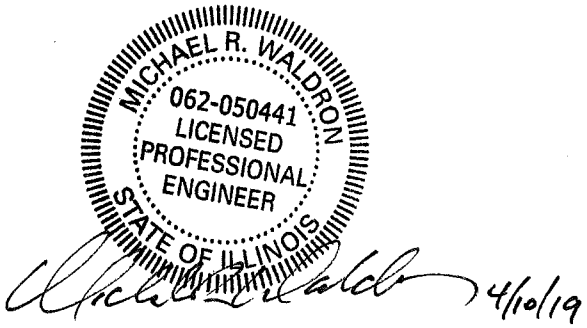
April 9, 2019



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SECTION 1
INTRODUCTION

1.01 INTRODUCTION

Through its Local Technical Assistance program, Chicago Metropolitan Agency for Planning (CMAP) has partnered with the Village of Midlothian, Illinois (Village) to develop a Stormwater Management Capital Plan (SMCP). This effort builds upon the RainReady Midlothian Plan adopted by the Village in January 2016 through partnerships with the Center for Neighborhood Technology (CNT), the United States Army Corps of Engineers (USACE), and a local stormwater interest group called Floodlothian Midlothian.

The purpose of the SMCP is to compile evaluations of stormwater flooding issues and mitigation opportunities into a single plan, prioritize the opportunities based on Village goals and values, and determine opinions of cost for select projects that will allow the Village to plan for funding and implementation of effective stormwater and flood control initiatives.

Development of the SMCP was a team effort between the Village's steering committee (Committee), CMAP, and Strand Associates, Inc.® (Strand) that started in September 2018. The steering committee consisted of representatives from the Village, Floodlothian Midlothian, CNT, the Village Engineer (Robinson Engineering), South Suburban Mayors and Managers Association, and the Metropolitan Water Reclamation District of Greater Chicago (MWRD). Development of the SMCP followed a course of action detailed in this report as follows:

A. Section 2–Village Inventory and Analysis

This section discusses the background information gathered to characterize the existing natural systems and hydrology of the Village and the existing built systems that are intended to provide stormwater drainage and protection for the community. This section also describes the methodology used to analyze this information and other supporting data to eventually identify potential mitigation opportunities.

B. Section 3–Previous Reports and Studies

This section reviews prior planning-level investigations and findings documented in various flooding reports, flood damage surveys, the Village's RainReady Plan, and other stormwater studies affecting the Village.

C. Section 4–Overview of Flooding Issues and Locations

This section builds on the inventory and analysis to identify stormwater drainage and flooding problem areas and locations in the Village. It also provides a review of potential causes for the problems in order to evaluate potential mitigation opportunities.

D. Section 5–Focus Areas Initial Evaluations

This section describes additional planning level investigations and findings performed as part of developing this SMCP. These investigations included site visits and field surveys to confirm existing conditions and better understand the existing drainage characteristics.

E. Section 6–Summary of Potential Opportunities

This section discusses potential stormwater and flood mitigation opportunities identified through the previous and additional investigations presented in Sections 4 and 5. These opportunities include traditional gray, sustainable green, and creative stormwater management tools and practices based on the particular stormwater or flooding need to be addressed. A brief description is provided of each opportunity, its advantages and disadvantages, regulatory issues, public and private impacts, and other identified factors affecting feasibility. All opportunities described in this section are listed in the Opportunity Matrix provided in Appendix A.

Sections 1 through 6 were presented in Technical Memorandum No. 1 for review and consideration by CMAP and the Committee. Upon review, the findings and merits of the various opportunities were discussed at Capital Planning Meeting No. 1 on December 13, 2018, at Midlothian Village Hall. Additional opportunities and feasibility considerations came out of the Capital Planning Meeting that was then incorporated into the SMCP.

F. Section 7–Prioritization of Potential Opportunities

The Opportunity Matrix ranks all identified opportunities based on a set of criteria established by the Committee, CMAP, and Strand. This section provides a discussion of the criteria used to evaluate and rank each opportunity and includes recommendations for groupings and phasing of feasible projects.

Section 7 was presented in Technical Memorandum No. 2 for review and consideration by CMAP and the Committee and was discussed at Capital Planning Meeting No. 2 on January 23, 2019, at Midlothian Village Hall. Comments and input from Capital Planning Meeting No. 2 were incorporated into the SMCP.

G. Section 8–Recommendations and Next Steps

This section provides a focused look at three initial opportunities for the Village to pursue, including concept-level drawings, opinions of probable cost, and implementation schedules.

1.02 ABBREVIATIONS

CDBG	Community Development Block Grant
CMAP	Chicago Metropolitan Agency for Planning
CNT	Center for Neighborhood Technology
Committee	steering committee
CUDD	Calumet Union Drainage Ditch
IEPA	Illinois Environmental Protection Agency
FSI	Flood Susceptibility Index
GIS	Geographical Information System
H&H	hydrologic and hydraulic
I/I	Infiltration/inflow
IDNR	Illinois Department of Natural Resources
IL-IN Sea Grant	Illinois-Indiana Sea Grant
MWRD	Metropolitan Water Reclamation District of Greater Chicago
NRCS	Natural Resources Conservation Service
OPC	Opinion of Probable Cost
OSLAD	Open Space Lands Acquisition and Development Grant
ROW	right-of-way
SMCP	Stormwater Management Capital Plan
SRLF	State Revolving Loan Fund
TNC	The Nature Conservancy
UIUC	University of Illinois at Urbana-Champaign
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
Village	Village of Midlothian, Illinois

SECTION 2
VILLAGE INVENTORY AND ANALYSIS

The following section provides a review of available information used to evaluate existing conditions that impact drainage, stormwater conveyance, and flooding within the Village and to identify potential stormwater improvement opportunities to help mitigate these issues. See Appendix B for referenced figures.

2.01 NATURAL SYSTEMS AND HYDROLOGY

The Village encompasses a total land area of 1,818 acres, or approximately 2.84 square miles. There are four major watercourses within the Village including the Cal-Sag Channel Tributary, Natalie Creek, Midlothian Creek, and the Calumet Union Drainage Ditch (CUDD). All these watercourses eventually flow to the Cal-Sag Channel. Figure 2.01-1 displays the watershed boundaries of these four major water courses within the Village.

As seen in Figure 2.01-2, the western edge of the Village is bounded by the ancient Lake Chicago that forms a shelf in the area's topography. Most of the Village is located in the former lake bed east of the shelf line and minimal flooding occurs to the west. The former lake bed is sunken and flat, making it difficult for stormwater to drain eastward and exit the Village. The flat topography is a contributing factor to flooding in the Village, which causes water to pond in the streets and other low areas during rainfall events. This flatness also limits the capacity of existing storm sewer systems to convey runoff to the nearest water way. When a storm event exceeds the capacity of the storm sewer system, runoff is trapped in low areas, causing flooding until flow in the storm sewer system recedes and can take in ponded water and the groundwater levels drop to allow infiltration (*RainReady Midlothian Plan, 2016*).

Before development, Midlothian Creek and Natalie Creek would flow across the flat surface forming marshlands. Once the area began rapidly developing, the creeks were channelized and much of the watersheds were paved over, causing disruptions to the natural watercourse.

According to the Natural Resources Conservation Service (NRCS) soil survey data, the Village is dominated by soils that are poorly drained; meaning the ability of the soils to infiltrate runoff is limited. Soils are generally categorized by hydrologic soil groups which, among other things, describe the soils' abilities to infiltrate water. Soils in Group A are highly permeable or well-drained compared to soils in Group D that are highly impermeable or poorly drained. For soils assigned to a dual hydrologic soils group, the first letter is for drained areas and the second is for undrained areas. Soils are assigned to dual soil classes when they are poorly drained (in Group D) in their natural condition.

Figure 2.01-3 shows that most of the soils in the Village are classified as Group C, characterized by clayey soils or soils of moderately fine texture with a layer that impedes infiltration of water. The Jolly Homes neighborhood is shown to have soils classified as Group A/D meaning that these soils act as Group D soils because of a variable high-water table. When the water table is lowered, the soils act more like Group A soils that are highly permeable and well-drained.

The United States Geological Survey (USGS) publishes historic well logs that are publicly available and include information on depth to groundwater, sand, gravel, and rock in various areas throughout Illinois. Sixteen of the well logs were found to be in proximity to Village limits and the results were mapped (see Figure 2.01-3). The well logs supplement the surface soils data by verifying soil characteristics. For instance, the Jolly Homes neighborhood shows soils classified as A/D with depth to water reported at 40 feet and depth to sand and gravel at 25 feet, indicating that this may be an area favorable for deep infiltration opportunities.

In May 2018, CMAP partnered with the University of Illinois at Urbana-Champaign (UIUC) and Illinois-Indiana Sea Grant (IL-IN Sea Grant) to study how soils within the Calumet region of northeastern Illinois affect the performance of green infrastructure. As part of this project, the UIUC and IL-IN Sea Grant team conducted soils tests using a Compact Constant Head Permeameter (also known as an Amoozemeter) to measure saturated hydraulic conductivity of the soil and abbreviated Ksat, which is the ease with which saturated soils transmit water. A higher Ksat value generally means more infiltration. The results of these tests were shared with CMAP and Strand and were used in conjunction with the soils investigations described above. The sites with the highest Ksat values were located in the Jolly Homes and Bremen Heights areas, while Kostner Park received the lowest value.

Figure 2.01-4 summarizes the results of the Amoozemeter test. Figure 2.01-4 also shows the approximate paleo shoreline of the ancient Lake Chicago previously discussed.

2.02 BUILT SYSTEMS

The Village has separate storm and sanitary sewer systems. The storm system includes belowground storm sewers and open ditch drainage systems that drain to one of the Village's four major waterways, Midlothian Creek, Natalie Creek, Cal-Sag Channel Tributary, and Park Creek. Most of the storm sewer system has been in place since the Village developed in the mid-20th century, with little to no improvements or significant replacement since the original construction (*RainReady Midlothian Plan, 2016*). At the time of development, there were no local stormwater management regulations or detailed design requirements (*Jolly Homes Drainage Study, 2017).*

Figure 2.02-1 shows a layout of the existing storm sewer system.

The Village encompasses a total land area of 1,818 acres, with approximately 580 acres (or 32 percent) as impervious area including rooftops, roadways, parking lots, and sidewalks. USGS terms this percentage of impervious surface coverage as medium-density development (ranging between 20 and 35 percent). This is a relatively high impervious surface coverage resulting in increased stormwater runoff within the watershed, and it places additional burden on the Village's existing stormwater drainage system.

Figure 2.02-2 shows the land cover throughout the Village that merges the Cook County building and roads geographical information system (GIS) layer with the Urban Tree Canopy layer developed by the University of Vermont's Spatial Analysis Laboratory to provide a summary of impervious versus pervious landcover. It should be noted that waterbodies, such as detention ponds on the golf

course near the Cal-Sag Channel Tributary, are considered impervious surfaces for the purposes of this inventory and analysis.

Figure 2.02-3 displays locations of public land ownership within the Village. As seen in the figure, most of the open spaces, such as parks and schools, are not Village-owned, posing potential challenges for land acquisition or easements to use these spaces for stormwater and flood mitigation improvements. The Village also provided CMAP with a list of properties currently listed as vacant. Vacant parcels have potential as opportunities for placement of stormwater management features, particularly in locations where multiple parcels are clustered together that could allow for neighborhood-level stormwater controls.

2.03 STORMWATER ANALYSIS APPROACH

CMAP's planning-level approach using the flood susceptibility index (FSI) represents an efficient method to initially identify depressional areas that are prone to flooding, in conjunction with the FSI approach, Strand evaluated flooding issues and reviewed opportunities through a GIS-based analysis by first mapping the known problem areas. This included information from conversations with the Village during the site visit and kickoff meeting, information from reports and previous studies, historic well logs from USGS, and GIS shapefiles provided by CMAP. This also included flow paths, depressional storage areas, and the regional FSI, which indicates areas of the region that may be more susceptible to urban or riverine flooding (see Figures 2.03-1 and 2.03-2).

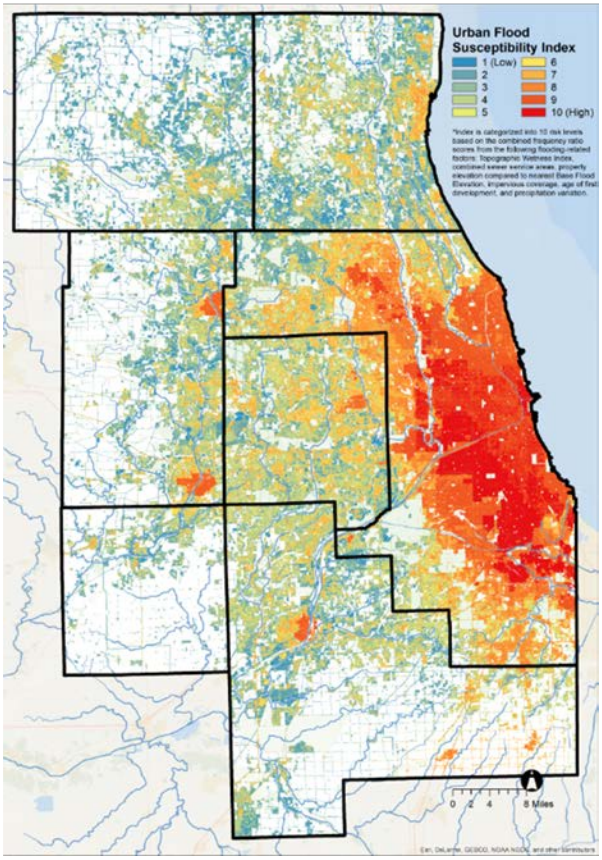

Figure 2.03-1 Regional Urban FSI (CMAP 2018)

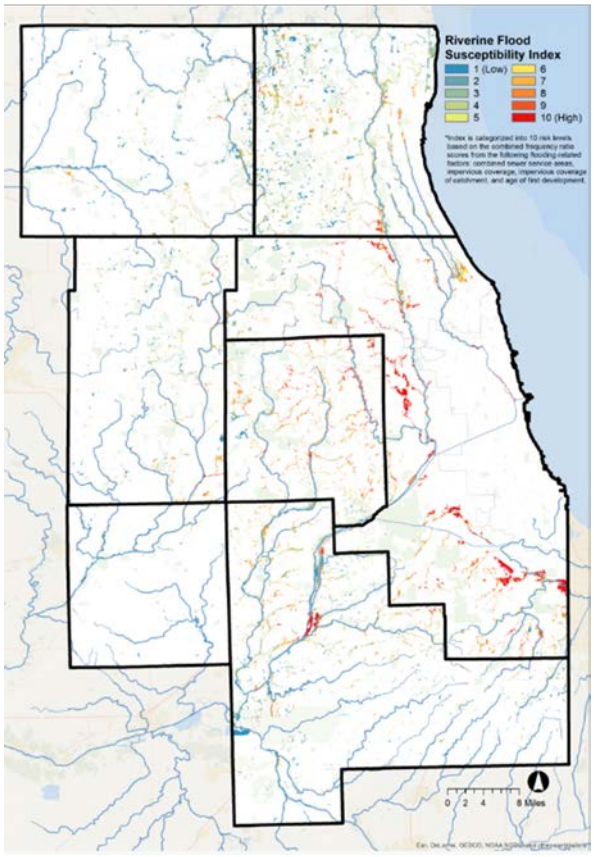

Figure 2.03-2 Regional Riverine FSI (CMAP 2018)

Using the Village's storm sewer atlas, contour mapping, and depressional storage areas, Strand delineated sub-catchments to the local storm sewer systems at the main problem areas identified by the Village. Section 6 provides more detail on how the information and delineations were used to review opportunities for potential stormwater management and flood mitigation.

SECTION 3
PREVIOUS REPORTS AND STUDIES

3.01 REVIEW OF PREVIOUS REPORTS AND STUDIES

The following reports and studies were provided to Strand through CMAP, the Village, Robinson Engineering (Robinson), and the MWRD. These reports and studies were reviewed to provide an initial understanding of documented flooding issues and previously developed conceptual opportunities for stormwater management. The documents were used to supplement the evaluation of the stormwater and flooding issues throughout the Village.

A. Jolly Homes Drainage Study

In November 2017, Robinson completed a drainage study of the Jolly Homes neighborhood, located in the southeast region of the Village and within the Little Calumet River Watershed. As part of the study, Robinson evaluated the existing drainage conditions, identified problem areas, and provided recommendations for flood mitigation and stormwater improvements alternatives.

The analysis determined that most of the flooding issues in this area are concentrated along 151st Street and at the outfall tributary to the CUDD, known as Park Creek. Flooding issues at these locations were indicated to be a result of flat topography and dated storm sewer infrastructure. Robinson recommended cleaning and televising the existing storm sewer system to determine whether there are any short-term improvements that would aid the function of the system along with improvements to the conveyance system.

This report was used to inform Strand's evaluation of existing conditions and potential opportunities in Jolly Homes. All recommendations outlined in Robinson's report were reviewed and can be found in Section 6 of this report.

B. CNT RainReady Midlothian Plan and Interim Report

In early 2015, CNT partnered with the USACE and the Village to develop a stormwater management planning process for the Midlothian known as the RainReady Plan. The goals of the plan include establishing an understanding of the flooding issues within the Village and why they occur, developing a vision to reduce the impacts of flooding, developing priorities within the vision, providing a roadmap for implementing the program that includes partnerships and financing strategies, and creating a reference document to guide future planning. The Interim Report preceded the Village's RainReady Plan and summarizes the information collected to develop the plan.

Both documents provided comprehensive summaries of the historic and existing flooding issues within the Village, the causes of flooding, and a list of potential and ongoing projects identified by the Village and partnered agencies. All projects identified in these documents were reviewed for feasibility and can be found in Section 6 of this report.

C. Midlothian Creek Green Infrastructure Plan

The Midlothian Green Infrastructure Plan expands on the Sustainable Watershed Action Team program through Chicago Wilderness to explore opportunities for green infrastructure and complete streets initiatives in the Village. Goals for the program include protection of natural areas, restoration along Midlothian Creek, developing education and outreach practices to inform future planning and

development, protect water resources, improve quality of life, and increase economic growth. The plan identifies opportunities along 147th Street as a complete streets project and provides summaries of different types of green infrastructure practices and features that could be implemented. Village-wide green infrastructure practices included in this plan were incorporated into the matrix.

D. Midlothian 147th Street Corridor Plan

To implement the RainReady Plan, the Village collaborated with CMAP, CNT, and the Active Transportation Alliance to develop a vision to improve the pedestrian environment and stormwater management along 147th Street, the Village's main thoroughfare. Sections of the street occasionally flood, which affects passage of both vehicles and pedestrians and contributes to pollution at Natalie and Midlothian Creeks. The plan identified several opportunities for sidewalk replacement, intersection improvements, and green infrastructure improvements. The plan included concepts for three bioretention areas at specific locations along 147th Street. This plan was used to inform and review potential opportunities along 147th Street, included in Section 6.

E. Calumet Regional Study: Native Soils and Green Infrastructure

UIUC partnered with IL-IN Sea Grant to study how soils in the Calumet region of northeastern Illinois affect the performance of green infrastructure. As part of the study, the UIUC and IL-IN Sea Grant team conducted soils tests using a Compact Constant Head Permeameter (also known as an Amoozemeter) to measure saturated soil conductivity. This study is ongoing and preliminary results were used in the evaluation of existing conditions and review of potential opportunities for the SMCP.

F. Little Calumet River Watershed-Based Plan[1]

The Little Calumet River Watershed-Based Plan provides a comprehensive overview of water quality conditions and the restoration measures needed to protect water quality in the Little Calumet River Watershed. Three of the four major waterways in the Village (Natalie Creek, Midlothian Creek, and Park Creek) are all tributary to the Little Calumet River, which flows east to west beginning in Indiana and flowing to the Cal-Sag Channel. The plan identified Natalie Creek, Midlothian Creek, and the CUDD as focus areas requiring water quality restoration. The plan also identified multiple improvements to alleviate overbank flooding along Natalie Creek, which were used to inform the subsequent Natalie Creek Flood Mitigation Preliminary Design Report.

G. Natalie Creek Flood Mitigation Preliminary Design Report

MWRD contracted with Burns and McDonnell to perform a detailed analysis of flood mitigation alternatives along Natalie Creek, some of which were identified in the Little Calumet River Watershed-Based Plan, and to prepare preliminary engineering design plans for selected alternatives. Construction of the project is now underway, and the report was used to understand the existing flow characteristics of Natalie Creek and its flooding issues. The alternatives to the selected design detailed in the report were reviewed as potential alternatives in Section 6 to increase flood protection along the creek.

[1] https://www.mwrd.org/irj/go/km/docs/documents/MWRD/internet/protecting_the_environment/Stormwater_Management/htm/WBP/Little_Calumet_WBP.htm

H. Midlothian Active Transportation Plan

This plan presents improvement recommendations for the physical infrastructure, policies, and programs that make it safer and more convenient for people to walk, bike, and use transit in the Village. The Plan also made a point for implementation of improved stormwater management, including green infrastructure, sustainable design, and green streets, as a part of a "complete streets" focus on transportation infrastructure.

SECTION 4
OVERVIEW OF FLOODING ISSUES AND LOCATIONS

The following section outlines the existing stormwater and flooding issues within the Village.

4.01 VILLAGE-WIDE STORMWATER AND FLOODING ISSUES

The Village's RainReady Plan, developed by the CNT, identifies several factors, described below, that contribute to stormwater and flooding issues within the Village.

A. Flat Topography

The western edge of the Village is bounded by the ancient Lake Chicago that forms a shelf in the area's topography. Most of the Village is located in the former lake bed east of the shelf line and minimal flooding occurs to the west. The former lake bed is sunken and flat, making it difficult for stormwater to drain eastward and exit the Village. Flat topography is a contributing factor to flooding in the Village, which causes water to pond in the streets and other low areas during rainfall events. This flatness also limits the capacity of the existing storm sewer systems to convey runoff to the nearest waterway. When a storm event exceeds the capacity of the storm sewer system, runoff is trapped in low areas causing flooding until flow in the storm sewer system recedes and can take in ponded water and the groundwater levels from to allow infiltration.

Prior to development in the mid-20th century, Midlothian Creek and Natalie Creek would flow across the flat surface forming marshlands. Once the area began rapidly developing, the creeks were channelized, which changed and disrupted the natural watercourse.

B. Increased Impervious Surfaces

The magnitude of flooding issues is further compounded by development that has resulted in impervious surfaces, including rooftops, streets, parking lots, and sidewalks. The Village encompasses a total land area of approximately 1,818 acres, and existing impervious surfaces total approximately 580 acres or 32 percent of the Village. Most of the open spaces—such as parks and schools—are not Village-owned, posing potential challenges to use these spaces for stormwater and flood mitigation improvements.

The Village experienced an increase in development during the mid-20th century. At that time, there were little to no regulations on stormwater management, causing an increase in impervious surfaces when natural wetlands and floodplains were paved over to make room for new development. Watersheds transformed from open, permeable marshlands into impervious residential, commercial, and industrial developments without native grasses, trees, and ponds to store and slow runoff. Today, runoff flows over parking lots, buildings, streets, and sidewalks, thus overwhelming the storm sewer system and causing flooding in basements, overflow in streets, and overbanking of the creeks.

C. Outdated Infrastructure

Most of the Village's stormwater infrastructure was constructed prior to current-day stormwater management standards. Therefore, the ditches, creeks, and pipes meant to capture and convey stormwater throughout the Village are undersized and exceeded during small rainfall events. Additionally, a lack of storm inlets or catch basins with adequate capacity is also likely contributing to flooding conditions during rainfall events.

4.02 STORMWATER AND FLOODING LOCATIONS

Strand met with the Village, residents, and CMAP on October 3, 2018, to discuss and visit the locations most susceptible to flooding and stormwater issues. Figure 4.02-1 in Appendix B identifies the existing issues discussed during the site visit and identified through previous reports and documentation. The existing stormwater issues were confirmed during a kickoff meeting with the Committee on October 11, 2018, and are summarized in the following:

A. Natalie Creek

As identified in the Village's RainReady Plan, Natalie Creek currently provides a two-year storm level of service. This means that overbank flooding can occur following 3.04 inches of precipitation in a 24-hour period. The MWRD Natalie Creek project, which recently broke ground for construction, is intended to increase this level of service to a 25-year storm event (equivalent to 5.51 inches of precipitation in a 24-hour period). At the kickoff meeting, Committee members noted that this level of service still leaves approximately 240 homes unprotected in the floodplain during heavier storm events. A Conditional Letter of Map Revision and/or Letter of Map Revision will be prepared and submitted as a result of the implementation of the Natalie Creek project. While the Natalie Creek project is underway, the Village has expressed interest in exploring opportunities to increase beyond a 25-year level of service where feasible.

B. Midlothian Creek

During storm events, water levels of Midlothian Creek rise above the outfall at Keeler Avenue, restricting drainage out of the upstream sewer and flooding 151st Street and the roadside ditches. During the first Committee meeting, members reported that this is the only location where Midlothian Creek overtops. Members also noted that floodplain mapping for the section of Midlothian Creek further downstream is not indicative of actual flooding conditions (see Paragraph E).

C. Cal-Sag Channel Tributary

The Cal-Sag Channel Tributary north of 143rd Street experiences overbank flooding and ponding in the streets. This area was evaluated separately by MWRD as part of a Phase II project and a conceptual project was developed that includes bank stabilization, excavating the existing basin at 143rd Street and Linder Avenue, and installing a box culvert at the basin’s outfall. This conceptual project also focuses on mitigation and storage opportunities on the Midlothian Golf Course, although the Village noted that the project is not progressing and that the stormwater issues are being reevaluated. Because the flooding issues in this area are less-severe and isolated from other more-severe flooding issues in Midlothian, and because of the ongoing study by others, this area of the Village was not included as a priority area as part of this stormwater evaluation.

D. Infrastructure Standards

As previously discussed, there were little to no stormwater infrastructure standards during most of the residential and commercial development of Midlothian. The Village noted a need to develop or enhance standards for stormwater infrastructure to protect open drainage systems and keep property owners from compromising sufficient stormwater conveyance capacity. Standards are also needed to control impacts

to existing open drainage features like roadside ditches and swales. Isolated local drainage issues, especially in the Bremen Heights and Belly Button Hill neighborhoods, have potentially been caused by undersized or deteriorated driveway culverts and uncontrolled filling of the open drainage systems.

E. Existing Floodplain Mapping

The Village informed Strand during the kickoff meeting that, contrary to the floodplain mapping, the northeast section of the Village does not flood. As a result, the northeastern area of the Village was not included as a priority area for this part of the stormwater evaluation. However, the Village expressed interest in applying for a Letter of Map Amendment to remove this area from the floodplain if funding for this effort can be obtained and the necessary modeling to support the amendment can be achieved.

F. Opportunity Focus Areas

The consensus of the Committee was to prioritize the Jolly Homes, Bremen Heights, and Belly Button Hill neighborhoods as areas requiring stormwater and flood mitigation. These areas have historically reported significant stormwater conveyance and flooding issues. The existing conditions within each neighborhood are discussed in more detail in Section 5.

SECTION 5
FOCUS AREA INITIAL EVALUATIONS

The information provided to Strand, summarized in the Information and Data Request Log in Appendix E, proved helpful in determining the existing drainage characteristics, floodprone locations, and stormwater issues throughout the Village. As discussed with the Committee at the kickoff meeting, the focus areas prioritized for stormwater management and flood mitigation opportunities include the three neighborhoods of Jolly Homes, Belly Button Hill, and Bremen Heights, and the Natalie Creek corridor. This section provides descriptions of the existing drainage characteristics of each focus area.

5.01 JOLLY HOMES NEIGHBORHOOD

The Jolly Homes neighborhood is in the southeast region of the Village bounded by Pulaski Road to the west, 151st Street to the north, and 153rd Place to the south. As specified in the Village's RainReady Plan, approximately 350 single-family residential homes are located within the neighborhood that is serviced by a separate storm sewer system that outlets to Park Creek, northwest of Birch Road and Roesner Drive.

Figure 5.01-1 in Appendix B shows the existing drainage patterns and local sewer subcatchment delineations. Jolly Homes is divided into three main subcatchment areas. The first subcatchment, JH-1, is approximately 36 acres and generally includes the rights-of-way (ROW) and residential properties between Harding Avenue and Central Park Avenue, 150th Street, and 151st Street. Runoff from this subcatchment is conveyed to the east through an existing storm sewer system along 151st Street before heading south to discharge into Park Creek. According to sewer atlas data, the storm sewer along 151st Street ranges in diameter from 8 to 24 inches. Plans for Central Park Elementary School, provided by School District No. 143, show two overflow detention basins in the open space east of the school. The detention basins are intended to provide storage during storm events when the tributary conveyance systems are overwhelmed. However, deficiencies in the conveyance system along 151st Street inhibit stormwater water from entering the detention basins, causing flooding in the street and surrounding properties. In fact, the Village has to pump stormwater from 151st Street to the detention site, as shown in Figure 5.01-2.

Figure 5.01-2 Pumping from 151st Street to Central Park Elementary School Detention Site (Jolly Homes CDBG Grant Application)

151st Street is very flat and there are numerous low points, noted as depressional areas on Figure 5.01-1, specifically at the intersections and rear yards of Hamlin Avenue, Ridgeway Avenue, and Lawndale Avenue. Because there is little elevation change from the storm sewer along 151st Street to the outfall at Park Creek, stormwater backs up from the outfall during heavy rainfall events, overwhelms the detention basins, and frequently floods 151st Street in the depressional areas. The Village confirmed that 151st Street is the most heavily impacted area in Jolly Homes. The Jolly Homes drainage report also noted that there are sections of the 151st Street storm sewer pipe and several connecting laterals that are back-pitched.

Subcatchments JH-2 and JH-3 are approximately 78 and 52 acres, respectively, and include the residential properties and ROW south of 151st Street. JH-2 also captures a portion of Bremen Community High School and drains north to south, while JH-3 drains south to north before both converge at the main storm sewer system midblock of Hamlin Avenue, Ridgeway Avenue, Lawndale Avenue, and Millard Avenue. At the convergence, JH-2 and JH-3 drain east to Park Creek just east of the municipal boundary.

In December 2016, Bremen Community High School began improvements to build a new synthetic turf field and a building pad for future additions to the school. To accommodate the increase in developed impervious surfaces, the improvements also included a new stormwater detention basin and detention in a layer of stone underneath the new turf field. Both detention systems discharge to the existing storm sewer structure on the eastern edge of the school's parcel line, to Subcatchment JH-2. Design and calculations of the detention basin were provided by M. Gingerich, Geraux and Associates. Although approximately 21 acres of school property drains to eastern edge of the school site and into the existing storm sewer infrastructure, the detention basin and synthetic turf field storage system were intended to provide stormwater control only for the 8.6 acres of development. The detention basin was designed to manage a drainage area of 6.3 acres (including 1.8 acres of impervious surfaces). Stormwater within the basin is controlled through a 6-inch-diameter orifice at a release rate of 1.89 cubic feet per second during a 100-year design storm, or 0.3 cubic feet per second per acre according to MWRD regulations. The detention basin footprint encompasses one acre of school property and provides approximately 1.6 acre-feet of storage, according to the design calculations. Although the detention basin appears to have been designed according to MWRD regulations, opportunities to retrofit or modify the detention basin to provide additional attenuation of flows or stormwater reduction (potentially through infiltration) should be considered given the flooding issues in the Jolly Homes area.

The Village informed Strand during the site visit that the outfall to Park Creek frequently floods. Similar to the topography challenges along 151st Street, the slope of Park Creek is extremely flat, making it difficult for the waterway to efficiently drain and, therefore, creating a backup within the local storm sewer network.

The lack of elevation change poses the greatest challenge to conveyance opportunities in Jolly Homes. Additional storm sewer infrastructure or upsizing of existing storm sewer infrastructure may potentially have minimal benefit to flood reduction because of the flat topography and downstream conveyance limitations. Therefore, potential stormwater improvement opportunities may need to provide increased storage to redirect stormwater ponding out of the depressional areas along 151st Street. Storage opportunities would also be intended to more effectively control flow tributary to the outfalls until adequate capacity is available downstream.

5.02 BELLY BUTTON HILL NEIGHBORHOOD

The Belly Button Hill neighborhood, which includes Belly Button Hill Park/Koster Park, is another area within the Village prone to frequent flooding. The park is bounded by 150th Street to the north, Kilbourn Avenue to the west, 151st Street to the south, and Kostner Avenue to the east. Figure 5.02-1 in Appendix B shows the existing drainage patterns and local sewer subcatchment delineations. The subcatchments generally drain from west to east and discharge to Midlothian Creek. During the site visit, participants noted that the Belly Button Hill neighborhood experienced repetitive overland flooding in the streets. Flooding has generally impacted streets and yards but has caused minimal impact to structures or homes.

Photo taken on February 20, 2018

Figure 5.02-2 Flooding along 151st Street at Southeast Corner of Belly Button Hill Park, Facing East (CDBG-DR Design/Engineering Grant Application)

Photo taken on February 20, 2018

Figure 5.02-3 Flooding at Southeast Corner of Belly Button Hill Park, Facing West (CDBG Grant Application)

The neighborhood surrounding the park has a widespread open ditch system conveying runoff to main underground storm sewer lines on 148th Street, 149th Street, and 150th Street. During the site visit, the Village noted that ditch capacity is limited by driveway culverts and filled-in ditches. Currently, the Village does not have regulations in place regarding constructing driveway culverts and controlling ditches that have been filled in by residents; thus, compromising the ability for the open drainage system to effectively drain stormwater.

The southern half of the Belly Button Hill neighborhood (Subcatchment BB-1) outlets to a ditch system on 151st Street that flows east to Midlothian Creek, indicated on Figure 5.02-1 with red flow path arrows. The area's topography shows approximately a 10-foot difference in elevation over the 1,400-foot distance along 151st Street from the southeast corner of Belly Button Hill Park to the Midlothian Creek outfall at Keeler Avenue. Unlike conditions at the Jolly Homes outfall, there appears to be moderate elevation change that would typically be sufficient to convey overland flow from the depressional area at the intersection of 151st Street and Kostner Avenue. However, the flooding seen in Figures 5.02-2 and 5.02-3 illustrate ponding along 151st Street during the February 20, 2018 storm event. This appears to indicate there are conveyance capacity issues in this area that may be a result of limited ditch and driveway capacity. It may also be because of backflow from the outfall at Midlothian Creek. The Village's

RainReady Plan notes that flooding issues at Belly Button Hill Park are caused by conditions of the outfall at Midlothian Creek. During storm events, water levels of Midlothian Creek rise above the outfall restricting drainage out of the upstream sewer. Potential stormwater improvement opportunities for this area may include increased open drainage conveyance, but more likely will need to consider increased storage to reroute stormwater ponding out of the depressional areas at Belly Button Hill/Kostner Park (see Figure 5.02-3) and 151st Street.

The other area of frequent flooding within the Belly Button Hill neighborhood is at the intersection of Kilbourn Avenue and 150th Street. The red flow arrows on Figure 5.02-1 show that the conveyance system diverges in two directions with one system heading south along Kilbourn Avenue into Subcatchment BB-1 and the other heading east along 150th Street into Subcatchment BB-2. Subcatchment BB-1/BB-2 has been delineated as such because without an in-depth hydraulic analysis, it is unclear how much flow is directed south and how much is directed east. Potential stormwater improvement opportunities at this location will need to consider additional conveyance to reroute stormwater ponding in the street to potential storage areas.

5.03 BREMEN HEIGHTS NEIGHBORHOOD

The Bremen Heights neighborhood is located in the north central region of the Village bounded by Cicero Avenue to the west, 143rd Street to the north, Kostner Avenue to the east, and 147th Street to the south. Figure 5.03-1 in Appendix B shows the existing drainage patterns and local sewer subcatchment delineations. The subcatchments generally drain from west to east.

Like Belly Button Hill, Bremen Heights has a widespread open ditch conveyance system. The southern portion of the neighborhood, delineated as Subcatchment BH-1, drains to a main open ditch system along 145th Street and the south side of Bremen Heights Park. BH-1 eventually drains to two 12-inch-diameter storm sewers at Kostner Avenue and 145th Street heading north. The northern half of the neighborhood is delineated as BH-2 and BH-3, with BH-3 capturing runoff north of 143rd Street outside the Village limits. This area drains to a main 24- to 30-inch storm sewer running east along 143rd Street. The north and south subcatchments converge at 143rd Street and Kostner Avenue into one 36-inch storm sewer running east that eventually outlets to a 96-inch storm sewer, the Natalie Creek Diversion Conduit—on Pulaski Road and then to the Cal-Sag Channel.

During the site visit, the Village noted that ditch capacity is limited by driveway culverts and that there are currently no regulations in place for constructing driveway culverts. Some of the ditches have been filled in by residents, further compromising the ability of the ditches to effectively drain stormwater. This area has experienced repetitive flooding since it was developed. The RainReady Plan identified the ditch along 145th Street near the south side of Bremen Heights Park as a problem area, stating that water commonly backs up to Kenton Avenue as a result of undersized and outdated culvert and ditch geometry. Figures 5.03-2 and 5.03-3 (on page 5-5) show pictures of recent flooding at Kenneth Avenue and Bremen Heights Park. Potential stormwater improvement opportunities for this area will need to consider increased storage at Bremen Heights Park and upgrades to the existing ditch system

Photo taken Spring 2018

Figure 5.03-2 Flooding at Kenneth Avenue and Bremen Heights Park, Facing West (CDBG-DR Design/Engineering Grant Application)

Photo taken Spring 2018

Figure 5.03-3 Flooding at Southeast Corner of Bremen Heights Park and Kenneth Avenue, Facing Southwest (CDBG-DR Design/Engineering Grant Application)

5.04 NATALIE CREEK CORRIDOR

Natalie Creek flows through the center of the Village through residential areas before entering the Natalie Creek Diversion Conduit at Pulaski Road. The creek is channelized and constrained throughout the Village and lacks a riparian corridor because of its proximity to urban development. As such, the only green space adjacent to the creek is turf grass located mostly on private property, which provides little function as a wetland buffer and has resulted in moderate bank erosion.

As noted in the Village's RainReady Plan, Natalie Creek overtops its banks and inundates the surrounding properties during as little as a two-year storm event, leaving residents with frequent and severe flooding. The MWRD Natalie Creek project will provide a level of service for the 25-year storm event. This level of service will still leave approximately 240 homes unprotected during more intense storm events. Potential opportunities along Natalie Creek will endeavor to increase the level of flood protection.

SECTION 6
SUMMARY OF POTENTIAL OPPORTUNITIES

Strand reviewed the feasibility of the village-wide opportunities identified in Midlothian's RainReady Plan and other previous plans and studies (see Section 3) and conducted its own evaluation of floodprone areas of the Village to identify preliminary stormwater management opportunities intended to potentially reduce the frequency and magnitude of flooding in the Village. To supplement the evaluation, Strand developed a matrix of opportunities (Opportunity Matrix) to assess potential projects and activities and correlate them to other Village projects. Opportunities were identified in four focus areas. Three of the focus areas included the three neighborhoods of Jolly Homes, Belly Button Hill, and Bremen Heights, as these areas have experienced reoccurring flooding and conveyance issues. The fourth area is along Natalie Creek, with an objective to potentially increase the level of protection following construction of the current MWRD improvement project. Section 5 provides descriptions of the existing conditions and flooding and conveyance issues at each of these locations.

Strand evaluated opportunities through a GIS-based analysis by first mapping the known problem areas. This included information from conversations with the Committee, information from reports and previous studies, and data provided by CMAP. A list of all reports, documents, and GIS shapefiles used by Strand is listed in the Data Request Log, provided in Appendix E.

Using the Village's storm sewer atlas, contour mapping, and depressional storage areas, Strand delineated sub-catchments to the local storm sewer systems within each of the four focus areas to gain an understanding of each area's drainage characteristics. Available soils information was also reviewed to understand potential feasibility of stormwater infiltration. USGS has historic well logs that are publicly available and include information on depth to groundwater, sand, gravel, and rock in various areas throughout Illinois. Fifteen of the well logs were found to be within Village limits and the results were mapped at each focus area. The well logs were used in conjunction with the information provided by UIUC and IL-IN Sea Grant to determine cursory infiltration potential within each of the focus areas. Potential opportunities were then evaluated based on land use, soil characteristics, and knowledge of previous and ongoing projects.

All opportunities were compiled into a preliminary Opportunity Matrix that was shared with the Committee at the first capital planning meeting held on December 13, 2018 at Midlothian Village Hall. The Committee expressed the importance of implementing projects throughout the Village and prioritizing the three focus areas identified in the RainReady Plan. The areas in order of highest priority are Jolly Homes (specifically 151st Street), Belly Button Hill, and Bremen Heights.

The Opportunity Matrix was updated after the first capital planning meeting in consideration of the Committee's comments. For this updated matrix, all identified opportunities were ranked based on a set of planning-level criteria detailed in Section 7. The second draft of the Opportunity Matrix was presented to the Committee at the second Capital Planning Meeting held on January 23, 2019 at Midlothian Village Hall.

The Village and CMAP met with representatives from Midlothian Park District and School District No. 143 on February 14, 2019, to discuss potential opportunities on public land owned by both entities. The final Opportunity Matrix, included as Appendix A, lists all opportunities in prioritized order and considers feedback from both the Park and School Districts and final comment from the Committee.

The following section describes the identified potential stormwater management opportunities and the advantages, disadvantages, regulatory issues, public and private impacts, and other factors affecting the feasibility of each opportunity identified by both Strand and other agencies in the four focus areas and Village-wide. Each opportunity described below is labeled corresponding to its label in the Opportunity Matrix.

6.01 PLANNING LEVEL OPPORTUNITIES

The first table of the Opportunity Matrix presents planning opportunities imperative to the implementation of other infrastructure projects. These opportunities are anticipated to be completed in conjunction with infrastructure projects and Village-wide stormwater and flood control programs, listed in the second table of the Opportunity Matrix and described in more detail in the following sections.

A. Topographic Survey

The first step in investigating different stormwater opportunities is understanding how the existing storm system works. There are gaps in the Village's storm sewer atlas, for instance pipes that are shown without connections or pipes and structures that are not shown at all when they have been verified in the field. Topographic surveys and field investigations in each of the focus areas would support detailed planning and design of specific improvements and could be completed concurrently with infrastructure projects.

B. Storm Sewer Televising

The RainReady Plan notes that most of the Village's storm sewer system has been in place since development in the mid-20th century with little to no improvements or significant replacements since the original construction. Storm sewer televising would further investigations of the existing stormwater infrastructure by determining if there are any deficiencies in the system.

C. Storm Sewer Cleaning

Storm sewer cleaning would be dependent on the televising results and would offer opportunities for immediate fixes to the storm sewer system by clearing any obstructions or debris from the existing sewer lines.

D. Hydrologic and Hydraulic (H&H) Modeling

H&H models are invaluable tools for understanding and simulating flooding conditions and evaluating potential flood control improvement projects. The XP-SWMM 2D modeling platform allows for integrating available surface topographic data into the model to define the limits and volumes of surface flooding, represent overland flood routes, and allow the modeling results to be generated in a visual format. The visual modeling output depicts specific flooding limit extents and depths for a range of storm events. Topographic LiDAR data is available from Cook County to generate the 2D model surface and the topographic survey could be used to develop the storm sewer system in the model. Alternatively, the survey for the model could be completed before and used to inform the full topographic survey. The model survey would require rim and invert elevations of the storm sewer structures but not detailed contouring.

E. Village Rain Fund

A rain fund or stormwater utility is a strategy to generate funding for stormwater management and flood control projects without raising property taxes. Conceptually, the Midlothian Rain Fund could start with an initial investment from IEPA's State Revolving Loan Fund (SRLF), which could be repaid through a small monthly fee by all property owners that is based on the area of impervious surface of their property. This fund could be used to keep the Village stormwater system in good standing, help residents pay for property improvements to reduce flood risk, install green infrastructure across the Village, and implement solutions to mitigate stormwater issues in the Jolly Homes, Belly Button Hill, and Bremen Heights neighborhoods. CNT wrote a memorandum covering best practices for community outreach and engagement when establishing a stormwater utility. This memorandum is included as Appendix D.

If implemented, this fund would provide a long-term stream of funding for stormwater and flood management projects. However, it could take a long time to establish. See Section 8.04 on page 8-5 for more information.

F. Private Property Home Floodproofing and Lateral Repair Program

Concurrent with the Village's Private Sector Program under MWRD's Infiltration/Inflow (I/I) Corrective Action Program, the Village could develop a floodproofing program for community outreach, financing, and flood mitigation measures to complement I/I repairs. Stormwater services that this type of program could provide include:

1. Regrading yards to reduce pooling near structure foundations
2. Sealing foundation cracks
3. Directing runoff away from homes and to green infrastructure sites

If implemented, this program could provide qualifying homeowners with a small grant or cost-share opportunity that could be established through an initial investment from IEPA's SRLF. This program could be pursued in conjunction with a Village Rain fund. While this program would help residents protect their homes from flooding and help the Village meet MWRD's ICAP requirements, these improvements are small-scale and would not provide additional stormwater storage.

6.02 JOLLY HOMES OPPORTUNITIES

The Jolly Homes neighborhood is located in the southeast region of the Village and bounded by Pulaski Road to the west, 151st Street to the north, and 153rd Place to the south. As discussed in Section 5, most of the stormwater and flooding issues within this area are concentrated along 151st Street. The area's topography is very flat with limited storm sewer and inlets, rendering it difficult to convey runoff to the storm sewer system and resulting in localized ponding water in the street.
Figure 6.02-1 in Appendix B provides a visual summary of the potential stormwater management opportunities in the Jolly Homes neighborhood.

A. Central Park Elementary School Detention Basin (East)

Opportunity 2A involves expanding the footprint of the existing detention site east of the elementary school into a larger detention basin. The new basin would capture and store runoff from the 151st Street corridor and stormwater from the 151st Street and elementary school's conveyance systems and have a controlled release to Park Creek. This opportunity would provide a significant increase in storage and help reduce flooding along 151st Street. The flat topography limits the depth of the basin to naturally drain to Park Creek. To realize the most storage capacity, pumping would be required to drain the new detention basin, but not convey stormwater from 151st Street to basin.

Figure 6.02-2 Central Park Elementary School Green Space

The basin could be either wet or dry. Designing it as a wet detention basin could provide an opportunity for the Village to acquire grant funding and partner with The Nature Conservancy (TNC) on outreach and education. A wet basin could include native plantings that would filter pollution from stormwater, expand habitat along the edge of Sundrop Prairie, and create an opportunity for education and outreach for students at Central Park Elementary and the community as a whole.

As illustrated in Figure 6.02-1 in Appendix B, the primary storage area is shown as a wet/wetland pond coordinating well with Sundrop Prairie. The storage area could, however, be expanded or configured in the dark green area and could take the form of a dry bottom storage area depending on the needs of the Village and School District. This opportunity is further discussed in Section 8.

B. 151st Street Conveyance Upgrades

Robinson completed a drainage study of Jolly Homes in November 2017. As part of the study, Robinson recommended improving the conveyance system along 151st Street.

Alternatives were evaluated with the intent of reducing and eliminating stormwater from ponding in the street and adjacent ROWs. The first alternative would reduce street ponding by removing and replacing inlets and laterals along 151st Street with those of higher capacity and installing new laterals to tie into the main storm sewer line.

The second alternative would provide a 10-year level of service by removing the existing 8-inch to 24-inch storm sewer and replacing it with a new 18- to 60-inch storm sewer along 151st Street and installation of new lateral sewers.

The third alternative would provide a 100-year level of service through removal and replacement of the existing main storm sewer line along 151st Street and reprofiling the street and grading within the ROW to ensure positive drainage.

Strand evaluated conveyance improvements along 151st Street concurrent with Opportunity 2A. Both opportunities are discussed further in Section 8.

C. 151st Street Green Infrastructure

There are depressional areas at the intersections of 151st Street and Avers Avenue, Hamlin Avenue, Raday Avenue, Ridgeway Avenue, and Lawndale Avenue. Potential improvements could capitalize on the large ROWs at these intersections to install green infrastructure features such as bioretention basins or rain gardens to capture ponding water from the street. These green infrastructure features would be used to store and treat stormwater before it discharges to the main storm sewer pipe on 151st Street, thus helping to meet water quality goals in the Little Calumet Watershed-based Plan. Figure 6.02-3 provides an example of this opportunity. As part of the Village's Complete Streets policy, installation of green infrastructure or some type of stormwater management feature should be considered any time there is a road project. Green infrastructure features could therefore be installed concurrently with upgrades to the conveyance system along 151st Street.

Figure 6.02-3 Bioretention Basin

Local green infrastructure practices are meant for smaller-intensity and more frequent storm events. Flood control benefits are anticipated to be relatively minimal for the magnitude of the flooding issues in this location, but these treatments still provide a small level of storage while also providing water quality benefits.

D. Central Park Elementary School New Detention Basin (Southwest)

On the southwest portion of the Central Park Elementary School property, there is a large green space that is partially used by the school for recreational activities during recess. This area could be used as another detention basin, wet or dry, with potential for green infrastructure features to provide water quality and biodiversity benefits. The basin would capture and store runoff from 151st Street then discharge to the storm sewer at 152nd Place or to a new detention basin east of the school (Opportunity 2A). The effectiveness of this opportunity would depend on Opportunity 2A. For instance, if Opportunity 2A is pursed and can provide enough capacity to capture all runoff from 151st Street, Opportunity 2D may not be necessary.

E. Central Park Elementary School Green Infrastructure

School District No. 143 owns the open space east and south of the elementary school, immediately west of the Markham Park District property and Sundrop Prairie Nature Preserve. There is opportunity in this location to partner with the School District, Markham Park District, and TNC to use the open space for a bioretention basin or other green infrastructure features. This space provides another opportunity for education and outreach efforts through TNC.

F. Infiltration Opportunities and Sundrop Prairie Groundwater Recharge

As part of the Native Soils and Green Infrastructure Study headed by the IL-IN Sea Grant, five soils test were conducted in Midlothian. Out of the five soil tests, the preliminary results indicated Jolly Homes as the most favorable area for infiltration opportunities. The soils test supporting this determination was conducted on the west side of Bremen Community High School at Pulaski Road, as shown in Figure 2.01-4. Soil characteristics at this location may therefore not be indicative of soil characteristics throughout the entire Jolly Homes area. Should infiltration opportunities be pursued within the Jolly Homes area, additional soil borings will be required to verify the permeable soil characteristics. Various infiltration opportunities are discussed further in Section 6.06.

The previous opportunity includes rain gardens and bioretention areas. If infiltration wells are considered, soil conditions at greater depths will need to be determined, but there is uncertainty of regulatory agency (IEPA and Illinois Department of Natural Resources [IDNR]) acceptability of this concept and it is difficult to predict the stormwater volume reduction effectiveness that could be realized. More information on infiltration wells can be found on page 6-20 of this section.

Sundrop Prairie is owned and managed by TNC as a State Nature Preserve, which are designated areas to protect high quality natural areas and habitats of endangered and threatened species. While Sundrop Prairie is outside of the Village, any future opportunities for TNC to restore the property, particularly on the west side along Central Park Avenue, could have a beneficial impact on the Jolly Homes neighborhood. Recreating a natural wetland on the property would capture and absorb stormwater runoff that naturally flows to the prairie.

This opportunity does not have a direct infrastructure cost to the Village but will take time and effort and may result in minor costs for education materials.

G. Central Park Avenue Bioretention Basin

The Village identified a number of vacant properties throughout the community. In the Jolly Homes neighborhood, there are a couple locations where vacant properties could be used for extra stormwater storage, specifically at 151st Street and Central Park Avenue. There is a depressional area in this location behind some of the homes that could be used as a bioretention basin to alleviate some flooding along 151st Street and Central Park Avenue.

H. Jolly Homes South Conveyance Upgrades

As part of the Jolly Homes drainage study, Robinson recommended improving the conveyance system in the southern region of the Jolly Homes neighborhood.
Alternatives were evaluated with the intent of reducing and eliminating stormwater from ponding in the street and adjacent ROWs. The first alternative would reduce street ponding by removing, replacing, and adding new inlets and laterals on Lawndale Avenue and Millard Avenue between 152nd Place and 153rd Place.

The second alternative would provide a 10-year level of service by removing, replacing, and extending portions of the main sewer line midblock of Hamlin, Ridgeway, Lawndale, and Millard Avenues.

The third alternative would provide a 100-year level of service through increased storage. Robinson noted that the entire neighborhood is builtout, leaving no room for an aboveground detention facility. Instead, underground detention was recommended in combination with a parallel storm sewer system. Storage location and volume would still need to be determined.

I. Bremen High School Detention Basin Retrofit (East)

As seen in Figure 5.01-2 in Appendix B, most of Bremen Community High School drains east to the neighborhood storm sewer system before discharging to Park Creek. Recent improvements to the playing fields and school building necessitated a new detention basin on the east side of the school's property. The new detention basin was designed to compensate the increase in impervious surfaces from the school's improvements. Potential opportunities at this location would include a retrofit of the new detention basin to capture and store runoff from 152nd Street. Given the location of the detention basin within the Jolly Homes study area, capitalizing on the basin to effectively and efficiently control stormwater runoff to improve flood reduction benefits should be evaluated.

J. Bremen High School Detention Basin Retrofit (West)

There is an existing dry detention basin west of Bremen High School, at Pulaski Road, that could be retrofitted for additional storage. As shown in Figure 6.02-1 in Appendix B, this basin retrofit would accommodate runoff from 152nd Street west toward Pulaski Road.

K. 152nd Street Green Infrastructure

There are also several open green spaces in the ROW along 152nd Street that could be used for green infrastructure features. These features would instead route runoff from 152nd Street to the existing detention basin at Pulaski Road, or to the retrofitted basin per Opportunity 2J.

L. Jolly Homes Vacant Property Green Infrastructure

As mentioned in Opportunity 2G, the Village identified a number of vacant properties throughout the community that could be used for extra stormwater storage. Particularly, parcels at Springfield Avenue and Hamlin Avenue along 151st Street could be used to capture additional runoff from 151st Street.

6.03 BELLY BUTTON HILL OPPORTUNITIES

Most of the stormwater and flooding issues in the Belly Button Hill neighborhood are associated with the southeastern portion of Belly Button Hill/Kostner Park, the open ditch system along 151st Street, and the storm sewer outfall to Midlothian Creek at Keeler Avenue. During storm events, water levels of Midlothian Creek rise above the outfall restricting the stormwater drainage out of the upstream sewer and ditch system. This causes flooding along 151st Street. The other area of concern near Belly Button Hill/Kostner Park is at the intersection of Kilbourn and 150th Street where water frequently ponds in the street. Figure 6.03-1 in Appendix B provides a summary of potential opportunities to alleviate flooding at these locations.

The magnitude of available open space areas for neighborhood-scale stormwater detention or green infrastructure practices is limited throughout the Village. There are few open spaces within Midlothian, and most are owned by the Midlothian Park District or Forest Preserve District of Cook County. Because of the limited number of available spaces, capitalizing on these existing areas should be further explored and discussed with all project stakeholders. For example, opportunities at Belly Button Hill Park would require partnership with the Park District. As mentioned earlier, the Village met with Midlothian Park District on February 14, 2019 to discuss potential opportunities on parklands throughout Midlothian, including those described in the following in the Belly Button Hill neighborhood.

It should be noted that out of the five soil tests conducted in Midlothian by UIUC and IL-IN Sea Grant, the preliminary results indicated Belly Button Hill was the least favorable area for infiltration opportunities. Soil characteristics at this location revealed clayey soils and the saturated conductivity at Kostner Park was categorized as either low or moderately low, resulting in infiltration rates that would limit the ability for significant stormwater infiltration. As such, infiltration opportunities in the Belly Button Hill area were not included in the Opportunity Matrix. The soils test was conducted at the southeast corner of the park, at 151st Street and Kostner Avenue, as seen in Figure 2.01-4 in Appendix B.

A. Belly Button Hill/Kostner Park New Dry Detention Basin

The existing park was identified as a large open space that could potentially be used for creation of stormwater detention storage. Potential opportunities at Belly Button Hill Park include a combination of storage and conveyance improvements.

The center of the park is currently used as a playing field. This area could be regraded to a dry detention basin, similar to that shown in Figure 6.03-3, that could still be used as a functional playing field, although the dimensions of the field may need to be reduced to accommodate the side slopes of the basin. Sizing of the proposed detention basin would be limited by the hill in the northwest corner of the park.

Depending on the level of active recreation determined by the Park District for the site, portions of the turf-bottom detention could be an open water or wetland-type detention facility, which would be more effective in providing additional storage capacity. This type of facility would be an attractive passive recreational amenity to the park and provide water quality, biodiversity, and aesthetic benefits to the neighborhood. This opportunity is further discussed in Section 8.

Figure 6.03-3 Dry Detention Basins Used for Recreation

B. Belly Button Hill/Kostner Park Bioretention Basin

As seen in Figure 6.03-1 in Appendix B, there is an existing depressional area in the southern portion of the park. The site visit revealed that this location is a turf grass depression where stormwater collects during flooding conditions. This existing depressional area could be expanded and transformed into a large bioretention basin. The basin would provide a buffer between the homes at the southwestern portion of the park and the park itself while also providing water quality, habitat, and aesthetic benefits. The basin could also be connected to the larger detention basin in the center of the park (Opportunity 3A) for additional storage. These detention basins would reduce the flows that the downstream sewers are conveying, therefore helping to alleviate flooding along 151st Street.

C. Belly Button Hill/Kostner Park Conveyance Upgrades

The storm system surrounding Belly Button Hill Park is comprised primarily of open ditches that have either been filled in with recent development or are under capacity. These ditches are not conveying sufficient stormwater away from the park causing flooding in the streets and on park property. This opportunity includes upsizing the existing mainline along Kilbourn Avenue, installing new inlets and laterals lines to the mainline, and constructing a new mainline along 151st Street from Belly Button Hill

Park to the outfall at Midlothian Creek. Conveyance upgrades would also include new conveyance to the detention basins on park property should these projects be pursued concurrently.

D. Belly Button Hill/Kostner Park Green Infrastructure Retrofit

There are existing green infrastructure features with native plantings surrounding Belly Button Hill/Kostner Park. This opportunity consists of retrofitting the existing green infrastructure for increased storage around the park. The Park District indicated that they are receptive to improving the efficacy of the green infrastructure features at the February 14, 2019 meeting.

E. Kilbourn Avenue and 150th Street Green Infrastructure

At the northwest corner of Belly Button Hill/Kostner Park, at Kilbourn Avenue and 150th Street, there is a 30-foot ROW that could be used for another green infrastructure feature such as a bioswale or rain garden. By themselves, green infrastructure features might only address small and more frequent storms, but they would provide water quality, habitat, and aesthetic benefits to the park.

F. Belly Button Hill/Kostner Park Underground Detention

The parking lot at the northeast corner of Belly Button Hill Park could be used for an underground detention. However, given that underground detention is about four times the cost of above ground detention, this opportunity should be explored only if aboveground detention is not feasible.

G. Splish Splash Pool Detention Basin

The Park District owns the vacant property on 150th Street between Kenton and Kilbourn Avenues. This property was previously a public pool called Splish Splash Pool. The Village secured $40,000 in funding through the Community Development Block Grant (CDBG) program to construct a rain garden in the ROW adjacent to the park. Through partnership with the Park District, there is potential to transform the park property with a detention basin, surrounding green infrastructure features, and a pedestrian path. It is also understood that the Park District is contemplating a shelter or gazebo on this park property, so any improvements would

Figure 6.03-4 Bioretention Basin

be integrated with the Park District's desired facility. The intersection of 150th Street and Kilbourn Avenue frequently floods, and additional conveyance could reroute stormwater into the new detention basin before releasing it back into the storm sewer system at a controlled rate.

Surrounding green infrastructure features, such as bioretention basins (see Figure 6.03-4) and rain gardens, would provide water quality, habitat, and aesthetic benefits. Signage along the pedestrian path could provide public education and outreach to the stormwater issues and implemented control measures within the community.

H. Belly Button Hill Vacant Property Green Infrastructure

Similar to Jolly Homes, there are a number of vacant properties throughout Belly Button Hill that could be used for extra stormwater storage. Particularly two parcels along Kilbourn Avenue, as shown on Figure 6.03-1 in Appendix B, could be used to capture additional runoff from the street.

I. New Midlothian Creek Outfall

There is potential to reduce flows from the park in the 151st Street storm system by constructing a second outfall point to Midlothian Creek through a new conveyance system connected to the proposed detention basin at Belly Button Hill. The new conveyance system would offload some flow from the detention basin to a new outfall point upstream of the existing one at 151st Street and Keeler to not overwhelm the existing outfall. There is a mapped vacant property along Waverly that could be used for the new outfall point. Construction of the new outfall would require coordination with and approval from MWRD, the USACE, and the IDNR.

6.04 BREMEN HEIGHTS OPPORTUNITIES

Most of the stormwater and flooding issues in the Bremen Heights neighborhood are associated with the open ditch system along 145th Street, between Kenton Avenue and Kostner Avenue. The following potential stormwater improvement opportunities consider increased storage at Bremen Heights Park and upgrades to the existing ditch system. Figure 6.04-1 in Appendix B provides a summary of potential opportunities to alleviate flooding at these locations.

A. Kolmar Avenue and 145th Street Green Corridor

This opportunity involves closing the intersection at Kolmar Avenue and 145th Street and constructing cul-de-sacs at each end of Kolmar Avenue to create a new bioretention basin or wetland corridor. The intent of this opportunity is to alleviate downstream flooding along 145th Street and Kenneth Avenue while enhancing aesthetics, biodiversity, and water quality in the neighborhood and community. The green corridor could provide park space with green infrastructure features, benches, a pedestrian path, and educational material to inform residents and visitors of the Village's stormwater management efforts. This opportunity would require permanent disruption to the Village's current road network and likely would involve some utility relocation, though with the disruption to the road network, it would also provide traffic calming in the neighborhood. Figure 6.04-2 in Appendix B provides a rendering of this opportunity (see opportunity 4D as an alternative).

B. Bremen Heights Park Green Infrastructure

There is a linear stretch of open space along the eastern perimeter of the park, adjacent to Kenneth Avenue and an open parcel at the northeast corner of Kenneth Avenue and 144th Street. These areas provide opportunities for green infrastructure features to help alleviate small, frequent flooding and provide water quality benefits along Kenneth Avenue and at the park.

C. Bremen Heights Park Green Infrastructure Retrofit

There are two existing green infrastructure features on the north side of the park. These features were identified for potential retrofitting to provide increased relief from small, frequent flooding in the depressional areas along 144th Street.

D. Kolmar Avenue Culvert

This opportunity is a modification of opportunity 4A in the event that closing Kolmar is not desired by the Village. There is a 65-foot-wide ROW where 145th Street ends between Kenton Avenue and Kilbourn Avenue that is currently used to convey stormwater through a ditch system. A potential opportunity at this location involves using the width of the ROW to widen the ditch channel and construct a culvert underneath Kolmar Avenue. The new ditch and culvert would provide more capacity, thus containing stormwater within the ditch. This opportunity would require improvements to the ditch system downstream to ensure that increased capacity upstream does not overwhelm the downstream system.

Like Opportunity 4A, this opportunity has potential to provide water quality, habitat, and aesthetic benefits, though unlike 4A, it intends to keep Kolmar Avenue as a through street with a new culvert underneath.

E. Bremen Heights Park New Dry Detention Basin: Center of Park

Like Belly Button Hill, the open spaces best-suited for stormwater storage opportunities are owned by Midlothian Park District. Stormwater storage opportunities at the park include a dry detention basin in the center of the park that could still be used as a functional playing field. Should the Village and Park District determine that active recreational use of Bremen Heights Park is not needed, the dry detention basin could be an open water- or wetland-type detention basin, which would be more effective in providing additional storage capacity and provide water quality and biodiversity benefits.

This opportunity, however, is probably not viable as the Park District already received funding through the Open Space Lands Acquisition and Development (OSLAD) Grant for renovations to Bremen Heights Park and is, therefore, not included in the Opportunity Matrix.

F. Bremen Heights Park New Dry Detention Basin: South End of Park

A second option for a detention basin is at the southwest corner of the park to relieve flooding along Kenneth Avenue. There is currently a playground at this location that would need to be relocated to the center of the park to provide space for the detention basin. Because of its proximity to the open

ditch system along 145th Street, the detention basin would be intended to relieve flooding in the ditch system.

This opportunity, however, is probably not viable as the Park District already received funding through the OSLAD Grant for renovations to Bremen Heights Park and is, therefore, not included in the Opportunity Matrix.

G. Bremen Heights Park Underground Detention

According to the UIUC and IL-IN Sea Grant soils test results, there are sandy soils present at Bremen Heights Park. This means that Bremen Heights may be a good candidate for infiltration opportunities, including underground storage beneath the ball fields and parking lot across from the park. Good infiltration characteristics are important if underground storage is implemented because the bottom portion of the storage facility will most likely be lower than the existing storm sewer system and will not be able to drain by gravity. Figure 6.04-3 shows installation of an underground storage system.

Figure 6.04-3 Underground Storage System

This opportunity, however, is probably not viable as the Park District is undergoing a $13 million redevelopment for a new recreational center and improvements to the ball fields and is, therefore, not included in the Opportunity Matrix.

6.05 NATALIE CREEK OPPORTUNITIES

The Natalie Creek project recently broke ground for construction. This project intends to provide flood protection up to a 25-year storm event through construction of two detention ponds between Kostner Avenue and Kilbourn Avenue, replacement of six culverts, and widening and stabilization of 5,500 feet of the waterway (*RainReady Midlothian, 2016*). As seen in Figure 3.02-1 in Appendix B, Natalie Creek has an overland flow path when it overtops that extends from Kenton Avenue to Karlov Avenue. The project improvements reduce the footprint of this path, but the Village noted that approximately 240 homes will still remain unprotected in the floodplain. Figure 6.05-1 in Appendix B summarizes the ongoing improvements to the Natalie Creek corridor and shows the proposed resultant 100-year floodplain. Additional opportunities along Natalie Creek are also shown in Figure 6.05-1 with the intent to provide a level of service beyond the 25-year storm event and enhance the stream corridor for recreation, habitat, and aesthetics.

A. St. Christopher School Dry Detention Basins

Another opportunity for Village stormwater storage is located at the St. Christopher Catholic School property on 147th Street, between Keeler and Karlov Avenues. This property was also identified in the 147th Street Study as an opportunity to reclaim paved surfaces for green infrastructure. The school property comprises the entire block and most of the area is impervious. There are two existing parking lots that appear to be underused, leaving a large portion of the eastern half of the property as unused impervious space. There is potential to partner with the school and church to use the property for stormwater detention. At the first Capital Planning meeting held on December 18, 2018, the Village noted that flooding issues at Karlov Avenue and 147th Street are because of local storm sewer system inefficiencies and not overbanking from Natalie Creek. Two detention basins with new conveyance would be designed to store overflow from Keeler Avenue, Karlov Avenue, and 147th Street. Green infrastructure features would be designed in conjunction with the detention basins to provides small storage, water quality, and aesthetic benefits.

B. 147th Street Green Infrastructure

The 147th Street Corridor Plan identified opportunities along 147th Street to reduce localized flooding and improve pedestrian infrastructure. These projects, conceptualized by Christopher B. Burke Engineering, include three green infrastructure features along 147th Street and Kilpatrick Avenue, Kostner Avenue, and Karlov Avenue. The green infrastructure site at Karlov Avenue also noted that there is potential to partner with St. Christopher Catholic School and Church to use part of the impervious parking area as green space. These opportunities provide aesthetic appeal, habitat, and improved water quality along 147th Street, however, as is the challenge with most local green infrastructure features, they do not provide significant storage. The total drainage area tributary to the green infrastructure features along 147th Street is approximately three acres.

There is a privately owned open parcel at the green infrastructure site at Kostner Avenue that could potentially be used for a larger bioretention basin. This property is located within the resultant 100-year floodplain for Natalie Creek and has potential to relieve and store some overland flow from 147th Street.

C. Kenton Avenue Detention Basins

In the Phase I Design Report for Natalie Creek, MWRD identified two properties along Kenton Avenue for potential detention basins. Both properties include vacant, forested land in the resultant Natalie Creek 100-year floodplain. Detention basins on these properties would be designed to store overflow from Kilpatrick Avenue and 149th Street and to prevent the overland flow route of Natalie Creek during storm events. The report noted that the maximum depth in each pond would be three feet. The ownership of these properties is unclear, and they may be private property, which would add effort and cost for negotiation of land purchase and acquisition.

D. Natalie Creek Trail

The Village's RainReady Plan identified an opportunity for a multi-use trail network along Natalie Creek that would connect neighboring municipalities of Oak Forest, Crestwood, and Robbins. Green infrastructure features would be designed in conjunction with the trail to provide increased water quality benefits, reduce runoff, and provide a higher level of flood protection.

Green infrastructure features, however, do not provide as much storage as larger detention basins, however the water quality benefits realized through treatment of stormwater from source areas that generate significant pollutants and the neighborhood aesthetic and park area created render them good supplements to other stormwater management improvements.

E. Property Buyouts Along Natalie Creek

The Village's RainReady Plan identified property buyouts within the floodplain as viable opportunities to store and retain stormwater. This opportunity proves challenging as it is dependent on cooperation from residents to relocate their homes. The feasibility and potential benefit of property buyouts has yet to be explored as part of this stormwater evaluation and it requires further coordination with the Village and other entities like MWRD and South Suburban Land Bank and Development Authority before additional exploration is initiated.

6.06 VILLAGE-WIDE OPPORTUNITIES

The following section provides a summary of the Village-wide opportunities that have already been identified. Reviews of each opportunity are provided below and tabulated in the Opportunity Matrix in Appendix A.

It should be noted that the Cal-Sag Tributary Channel, north of 143rd Street was not evaluated for stormwater management opportunities. At the kickoff meeting held on October 11, 2018, the Committee decided that since the flooding issues in this area are isolated from other more severe flooding issues in Midlothian and because of the ongoing study by others, it should not be included as a priority area as part of this stormwater evaluation.

A. Green Infrastructure Across Village

Green infrastructure practices provide improved water quality benefits and small-scale stormwater storage opportunities on both public and private properties. Descriptions of different practices are described in the following.

1. Green Infrastructure Practices on Private Properties

Green infrastructure practices on private property can be an effective component of the overall stormwater and flood control vision, but their effectiveness is closely tied to the private property owner's willingness to participate. Programs like the Private Property Home Floodproofing and Lateral Repair Program and the Village Rain Fund can improve private property owner's willingness to participate by establishing green infrastructure incentives. Even with high levels of

participation, the flood storage achieved through private property green infrastructure is relatively small compared to what is needed to significantly mitigate the flooding issues within the Village. The following green infrastructure practices are suitable for private properties.

a. Rain Barrels

Rain barrels, as seen in Figure 6.06-1, are common property-level stormwater management practices that allow for collection and storage of rainwater from rooftop downspouts for nonpotable exterior use, such as irrigation. The typical volume of a rain barrel varies between 55 and 90 gallons and generally costs between $120 and $200. However, MWRD currently has a rain barrel program that allows residents that live in communities enrolled in the program to receive rain barrels at reduced fees.

Figure 6.06-1 Rain Barrel

b. Pervious Driveways

Pervious driveways, as seen in Figure 6.06-2, are another property-level stormwater control technique that involves construction of permeable pavement over an underlying base and subbase that allows stormwater storage and potential infiltration, thus reducing runoff rates and potentially volumes. These measures can include pervious concrete, porous asphalt, or paving stones. Pervious driveways are generally more effective at reducing runoff when underlying soils are conducive for infiltration.

Figure 6.06-2 Pervious Driveway Pavers

c. Rain Gardens

Rain gardens, as shown in Figure 6.06-3, are typically private property-level stormwater control measures that involve establishment of specially-designed gardens that collect, store, and infiltrate stormwater from impervious surfaces such as rooftops, driveways, and heavily compacted lawns. Rain gardens are typically planted with deep-rooted native wet-tolerant or wetland-type vegetation such as wildflowers, sedges, rushes, ferns, and shrubs.

Figure 6.06-3 Rain Garden–Private Property

2. Green Infrastructure Practices on Public Properties

Potential neighborhood-level green infrastructure practices that provide more stormwater control than small-scale features are those that can be done in conjunction with major conveyance improvement projects, such as bioretention basins. Similarly, the Village should also consider integrating these green infrastructure improvements into other capital improvement projects such as roadway and significant utility replacement projects.

Like private property-level green infrastructure measures, the benefits of these opportunities are for smaller intensities and more frequent storm events. Typically, green infrastructure practices, even at a neighborhood-level scale, are designed for smaller events (e.g., 1-inch rainfall event) and allow for bypass of runoff during larger design storms (e.g., 10-year event). Flood control benefits are a small portion of the larger magnitude of flooding issues within the Village. However, the importance of these opportunities are the water quality benefits realized through treatment of stormwater from source areas that generate significant pollutants as well as neighborhood aesthetic and park area created.

The following green infrastructure practices are suitable in public properties across the Village.

a. Street Curb Bumpout Bioretention Basins and Bioretention Basins in Existing ROW

Figure 6.06-4 Street Curb Bumpout

Street curb bumpout bioretention basins, as seen in Figure 6.06-4, are distributed green infrastructure practices that would likely be implemented by the Village and involve construction of a vegetated curb extension into the street near intersections or sometimes at midblock. The bumpout typically receives street runoff through curb openings and has a ponding depth of about one foot. The bottom of the storage area generally consists of an engineered soil layer underlain by a coarse granular stone storage area that is drained by perforated underdrain directed to the storm sewer system. Bioretention basins within the existing ROW would be constructed in the same way but without extension of the curb. Typical vegetation types are similar to the wet tolerant plantings used in rain gardens. Because curb bumpouts receive stormwater from source areas that generate significant pollutants, these devices also provide important stormwater treatment benefits.

Stormwater tree pits provide similar water quality and aesthetic benefits as street bioretention basins. These practices could be implemented in more urban areas (e.g., along 147th Street).

b. Street Intersection Storage Basins

Street intersection storage basins would entail closing select street intersections and constructing traditional stormwater storage and/or bioretention facilities in their place. This option would require permanent disruption to the Village's current road network and likely would involve some utility relocations. Preliminary evaluation of the Village's roadway network indicates the viability of this opportunity in neighborhoods with a gridded street network. There are several intersections in the Bremen Heights neighborhood where this practice could potentially be implemented. Figure 6.04-2in Appendix B provides a rendering at Kolmar Avenue in Bremen Heights.

B. Infiltration Opportunities Across Village

Beginning in May 2018, the UIUC and IL-IN Sea Grant conducted a soils study in the Calumet region. This study is ongoing with the development of the Village's SMCP.

Part of the study includes calculating infiltration rates at five locations within the Village and preliminary results of the infiltration rates were provided to Strand. In general, the results revealed that there are several locations within the Village that may allow for the infiltration of stormwater. For example, saturated conductivity (as discussed in Section 2.01) values at Bremen Heights Park were categorized as moderately high and between 0.5 and 2.5 inches per hour at shallow depths. Although the infiltration testing was conducted at shallow depths (less than 4 feet below ground), implementing infiltration at these shallow depths could potentially be a feasible strategy to help mitigate flooding or drainage issues within the study areas. As more information is developed through the study, it will be used to inform prioritization of potential projects. The following provides descriptions of potential infiltration opportunities.

1. Induced Infiltration Structures

In 2009 the USGS, in cooperation with MWRD, performed a study to evaluate the potential for included infiltration structures in Cook County as a means to reduce stormwater runoff volumes that could provide flood relief (*Preliminary Assessment of Potential for Inducing Stormwater Infiltration in Cook County, Illinois, 2009*). Artificial or induced recharge can typically be provided with passive-induced structure such as surface infiltration basin or with active-induced structure such as injection wells.

One of the goals of the assessment was to identify areas in Cook County that have favorable hydrogeological and land cover conditions for induced infiltration practices. This includes areas of permeable glacial deposits that would be located beneath infiltration measure that can sufficiently accept surface stormwater. Figure 6.06-5 is a map from the USGS report showing that only about 12.4 percent of the land area within Cook County exhibits these favorable conditions, which are shaded in brown. This map depicts areas with permeable glacial deposits 20 feet or greater in thickness and within 50 feet of land surface in relation to the study watershed limits. As seen in the figure, suitable areas for passive-induced infiltration within Midlothian appear to be available.

Figure 6.06-5 USGS Induced Infiltration Study (MWRD, 2009)

2. Infiltration Wells

Infiltration wells are designed to extend through impermeable layers to access permeable glacial deposit layers that are located at greater depths, but there is uncertainty of regulatory agency's (IEPA and IDNR) acceptance of this concept and the difficult to predict the stormwater volume reduction effectiveness that could be realized. While some states have allowed infiltration wells, other states like Illinois have not yet accepted this practice. Although the preliminary soils study provided by the UIUC and IL-IN Sea Grant Team identified the Jolly Homes neighborhood as the most favorable for soil infiltration opportunities, it must be noted that the preliminary soils study only included soil borings up to four feet, which does not inform the feasibility of infiltration wells.

Because there is uncertainty of agency acceptance of this concept, it is not included in the Opportunity Matrix.

SECTION 7
PRIORITIZATION OF POTENTIAL OPPORTUNITIES

The Opportunity Matrix, provided in Appendix A, ranks all identified opportunities based on priority location, affected properties, and planning-level metrics corresponding to opportunity footprint and relative stormwater runoff capture. The matrix also includes ranges of concept level planning opinions of probable cost, potential phasing of opportunities and projects, and potential funding sources. The following section includes a discussion of the criteria used to evaluate and rank each opportunity in the matrix and provides recommendations for groupings and phasing of feasible projects.

7.01 OPPORTUNITY MATRIX AND PRIORITIZATION CRITERIA

As mentioned in Section 6, the Opportunity Matrix is comprised of two tables. The first table presents planning opportunities, such as storm sewer cleaning and televising, topographic surveying, and storm sewer modeling, imperative to implementation of other infrastructure projects. These opportunities are anticipated to be completed in conjunction with infrastructure projects and Village-wide stormwater and flood control programs, listed in the second table. The second table summarizes 35 individual infrastructure projects and Village-wide stormwater and flood control program opportunities of various types and purposes. Many of these opportunities are interdependent, meaning their effectiveness depends on other opportunities also being implemented. It is important to recognize that implementation of interdependent projects may be necessary for the Village to achieve desired flood reduction benefits in priority focus. Therefore, evaluation of each individual opportunity in the matrix starts from an assumption that all other dependent opportunities have been implemented. This interdependency of opportunities was considered during Strand's evaluation of priority projects and is discussed further in Section 7.02.

The matrix presents the pros and cons of each identified opportunity. The merits of these pro and con determinations draw upon acceptable industry standards, understanding of basic design principles, established regulatory policies, and engineering experience and judgement. However, it is important that some level of measurable metrics be applied to each opportunity to further support the preference of one opportunity over another. The following basic measures were used to objectively and consistently judge the viability of the identified opportunities.

A. Drainage Area Capture

Preference (indicated by a "**+**" symbol in the matrix) was given to those opportunities that capture a drainage area of over fifteen acres. Preference (indicated by a **blank** entry in the matrix) was then given to opportunities that capture a drainage area between one and fifteen acres. Last preference (indicated by a "**-**" symbol in the matrix) was given to projects that capture less than one acre of drainage area. As mentioned in Section 6, green infrastructure practices provide small-scale storage opportunities but can also provide additional benefits corresponding with water quality improvement, aesthetics, and community amenities. Therefore, while green infrastructure practices ranked low in this category, some green infrastructure practices were prioritized above other larger-scale storage opportunities based on the other metrics and phasing potential with other infrastructure opportunities.

B. Land Acquisition

Preference (indicated by a "**+**" symbol in the matrix) was given to those opportunities that can be performed on Village-owned property or within existing applicable easements. Preference (indicated by

a **blank** entry in the matrix) was then given to opportunities that can be performed on public-owned property, such as parks, forest preserves, and schools, understanding that these opportunities bring with them an added requirement to obtain a partnership with the public landowner. Last preference (indicated by a "**-**" symbol in the matrix) is for projects on private property that would likely require land acquisition or permanent easements for project implementation.

C. Infiltration Potential

In coordination with the study performed by the UIUC and IL-IN Sea Grant, preference ("**+**") was given to opportunities in general locations with shallow sand that are potentially conducive to infiltration. A "**-**" indicates opportunities in general locations with clay soils having limited infiltration potential. Opportunities were evaluated for infiltration potential based on the best available information from the UIUC and IL-IN Sea Grant soils study, surface soil data from the NRCS, and historic well logs from the USGS.

D. Relative Construction Cost

It was not possible in the scope of this evaluation to develop detailed opinions of construction cost on every opportunity identified. However, engineering judgement and experience and similar recent local projects provided a perspective on the relative cost of the various opportunities. For example, underground stormwater storage facilities can typically cost up to five times as much as aboveground facilities. As another example, green infrastructure practices are generally much more expensive from a cost per square foot value than traditional storage such as dry detention basins. Engineering judgement and experience was used to evaluate each opportunity identified as to the magnitude of cost taking the relative effectiveness of the opportunity into account. A "**+**" indicates an opportunity with a concept level planning cost below $500 thousand, a **blank** indicates a moderate cost between $500 thousand and $1 million, and a "**-**" indicates a concept level planning cost above $1 million.

7.02 RECOMMENDATIONS FOR PHASING OF FEASIBLE PROJECTS

Many of the opportunities listed in the Opportunity Matrix are interdependent, meaning their effectiveness depends on other opportunities also being implemented. This interdependency played a large part in the final prioritization of projects in order to achieve the intended overall benefit to each focus area. Additionally, the planning opportunities listed in Table 1 (topographic survey, storm sewer televising and cleaning, and storm sewer modeling) are also essential to implementation of most opportunities. For instance, before implementation of infrastructure opportunities in any one focus area, the Village will need to model the focus area to determine sizing, layout, and effectiveness of the infrastructure improvements. Before modeling, the Village will need to gather additional data, perform topographic surveys, and make sure the existing storm systems are fully operational. Therefore, implementation of infrastructure opportunities should include implementation of planning opportunities in conjunction with the infrastructure projects.

The following sections summarizes groupings of interdependent projects and planning opportunities and provides recommendations for project phasing.

A. 151st Street/Central Park Elementary School Improvements

Opportunities 2a through 2d listed in the matrix intend to alleviate flooding along 151st Street by providing storage at Central Park Elementary School, upgrading the conveyance system, and installing green infrastructure features for additional storage and water quality benefits. Each project implemented individually would provide a measure of stormwater management and flood control to the Jolly Homes area. But these projects have been grouped, and thus prioritized together to achieve the full intended benefit. Opportunity 2c assumes the linear green infrastructure would be implemented concurrent with the conveyance improvements. Furthermore, implementation of each project requires performance of planning items 1a through 1d. The following provides recommended phasing for these opportunities:

- Televise the storm sewer system and clean as needed
- Collect topographic survey data
- Develop a model of the storm sewer system to assess existing H&H conditions and establish a level of service
- Explore opportunities for stormwater storage at Central Park Elementary School
- Evaluate storm sewer conveyance upsizing improvements along 151st Street
- Evaluate local green street features to be considered in conjunction with storm sewer conveyance improvements

B. Belly Button Hill Park Improvements

Opportunities 3a through 3e listed in the matrix aim to relieve flooding along 150th Street, Kilbourn Avenue, Kostner Avenue, and 151st Street by providing storage at Belly Button Hill Park through a new dry detention basin and green bioretention basin, upgrading the conveyance system along Kilbourn Avenue and 151st Street, retrofitting existing green infrastructure, and installing new green infrastructure features for additional storage and water quality benefits. Furthermore, implementation of each project requires performance of planning items 1a through 1d. The following provides recommended phasing for these opportunities:

- Collect topographic survey data
- Televise the storm sewer system and clean as needed
- Develop a model of the storm sewer system to asses existing H&H conditions and establish a level of service
- Explore opportunities for stormwater management at Belly Button Hill Park
- Evaluate storm sewer conveyance upsizing improvements along Kilbourn Avenue and 151st Street
- Evaluate local green street features to be considered in conjunction with storm sewer conveyance improvements

C. Kolmar Avenue and 145th Street Green Corridor and Bremen Heights Park Improvements

Opportunities 4a through 4e listed in the matrix intend to relieve flooding along the 145th Street ditch system south of Bremen Heights Park by providing storage through a naturalized green corridor at Kolmar Avenue, providing storage at Bremen Heights Park, retrofitting existing green

infrastructure, and installing new green infrastructure features for additional storage and water quality benefits. Furthermore, implementation of each project requires performance of planning items 1a through 1d. The following provides recommended phasing for these opportunities:

- Collect topographic survey data
- Televise the storm sewer system and clean as needed
- Develop a model of the storm sewer system to assess existing H&H conditions and establish a level of service
- Explore opportunities for stormwater management at Kolmar Avenue and Bremen Heights Park
- Evaluate local green infrastructure features to be considered in conjunction with park improvements

D. St. Christopher Church and School Detention Basins, 147th Street Green Infrastructure

Opportunities 5a through 5b listed in the matrix aim to alleviate flooding along 147th Street and Karlov Avenue by providing storage at the St. Christopher Church and School property and installing green street features along 147th Street for additional storage and water quality benefits. Furthermore, implementation of each project requires performance of planning items 1a through 1d. The following provides recommended phasing for these opportunities:

- Collect topographic survey data
- Televise the storm sewer system and clean as needed
- Develop a model of the storm sewer system to assess existing H&H conditions and establish a level of service
- Explore opportunities for stormwater management at St. Christopher Church and School property
- Evaluate local green infrastructure features to be considered in conjunction St. Christopher improvements

SECTION 8
RECOMMENDATIONS AND NEXT STEPS

At the second Capital Planning Meeting, three opportunities were identified for the Village to pursue first:

1. Opportunity 2A–Central Park Elementary School Detention Basin
2. Opportunity 2B–Conveyance Upgrades along 151st Street
3. Opportunity 2C–Green Infrastructure Improvements along 151st Street
4. Opportunity 3A–Belly Button Hill/Kostner Park Detention Basin

This section provides a focused look at the three projects with a discussion of the evaluation measures and includes concept-level drawings, opinions of probable cost, and implementation schedules. These evaluations are intended to provide the Village with an understanding of the magnitude of each project and act as a reference point for project funding. All figures can be found in Appendix B, which include extent of existing flood conditions, proposed concept drawings, and flooding conditions after proposed improvements. Opinions of probable cost (OPC) are provided in Appendix C.

8.01 EVALUATION APPROACH

In order to evaluate the efficacy of each opportunity, Strand developed concept-level XPSWMM 2D models of both the Jolly Homes and Belly Button Hill neighborhood. The 2D modeling platform allows integration of available surface topographic data into the model to more accurately define limits and volumes of surface flooding, better represent overland flood routes, and allow the modeling results to be generated in a visual format. For these cursory models, 1-foot contour data was used to create the surfaces.

Strand conducted a pick-up survey on February 19, 2019, to collect rim and invert elevations of the existing storm sewer structures along 151st Street in the Jolly Homes neighborhood and around Belly Button Hill/Kostner Park. It should be noted that this was not a complete survey of each area's storm sewer system, but rather a survey of select structures in the system to build the cursory XPSWMM 2D models.

Existing conditions models were run for a range of recurrence interval storm events (2-, 10-, 25-, and 100-year recurrence intervals). The storm recurrence interval is a simplified term portraying the probability that a given storm event will be equaled or exceeded in any given year. For example, a 100-year recurrence interval design storm does not necessarily mean a storm that only happens once every 100 years, but rather a storm with a 1 percent chance of occurring in any given year. It is a probability, which is why it is possible to have two 100-year storm events in less than 100 years. Once existing conditions were simulated, the models were used to evaluate several conceptual designs. The designs were developed iteratively by modeling various pipe sizes and detention basin storage capacities for each recurrence interval storm event.

8.02 JOLLY HOMES IMPROVEMENTS: OPPORTUNITIES 2A, 2B, AND 2C

The open space east of Central Park Elementary School currently has two stormwater basins providing some runoff storage during storm events when the tributary storm sewers are overwhelmed. From discussions with the Village it was noted there is a flap gate control on the storm sewer from 151st Street where it enters the existing detention basins. The Village reports the flap gate does not always open and inhibits stormwater from 151st Street to enter the basins. The lack

of elevation drop from the neighborhood to the existing basins also hinders conveyance of stormwater. Engineering drawings for Central Park Elementary School revealed flat pipe slopes (between 0.1 and 0.05 percent) from 151st Street to the detention basins. When pipe slopes are this flat, stormwater velocities are slow and tend to build up sediment in the pipe. As sediment builds up, it obstructs flow and can cause the conveyance system to surcharge.

Opportunities 2A and 2B endeavor to increase storage volume at the existing detention basins with a new 12.7-acre-foot storage facility and improve conveyance to the storage facility with a new 48-inch trunk storm sewer along 151st Street as well as upgrades to the lateral storm sewers tributary to the trunk sewer on 151st Street. Opportunity 2C supplements Opportunity 2B with green infrastructure features along 151st Street intended to improve water quality of surface runoff, provide additional runoff storage, and provide neighborhood aesthetics. The following provides an explanation of the opportunities evaluated in Jolly Homes.

A. Existing Conditions Model

The existing conditions model was constructed based on existing mapping and field data collection as previously discussed, as well as some assumptions. The model assumes that there is no flap gate on the 151st Street storm sewer before the existing detention basins east of Central Park Elementary School. This was done to simulate how the basins would fill up during the different storm events if stormwater was freely flowing and to determine the existing basin storage capacity.

Another assumption was made relative to Park Creek. As reported by the Village, it is believed that Park Creek tends to surcharge and back up into the Jolly Homes neighborhood. There is no current engineering information for Park Creek and how it reacts during various storm events. Therefore, it was assumed in the model that water levels in Park Creek surcharge to half the diameter of the Village's outfall pipe.

Figures 8.02-1 through 8.02-4 in Appendix B show the limits of existing flooding for the 2-, 10-, 25-, and 100-year storm events. The modeling results confirm the following:

1. Even without the flap gate, the lack of topography restricts conveyance of stormwater from 151st Street.
2. Ponding at the intersections of Avers, Hamlin, and Ridgeway Avenues could indicate limited inlet capacity.
3. The detention basins are undersized, and their capacities are exceeded during the 2-year storm event.

B. Proposed Conditions Model

The existing conditions model was updated to reflect implementation of Opportunity 2A, which is a new detention basin east of Central Park Elementary School and Opportunity 2B, which is a new stormwater conveyance system along 151st Street. Figure 8.02-5 in Appendix B provides a concept drawing of the proposed improvements.

Field survey data and topographic mapping were used to define the limits of the proposed new detention basin. The basin has a footprint of 2.19 acres and provides 12.7 ac.-ft. of storage with a bottom elevation of 604.0, a spillway crest of 611.0, and 4:1 (horizontal to vertical) side slopes. The basin in Figure 8.02-5 is shown with a wet bottom and wetland edge but could easily be a dry bottom pond depending on what the Village and School District would prefer. Creating a wetland or wet pond would coincide well with Sundrop Prairie immediately to the east and would provide a higher level of water quality improvement and opportunities for educational programs. The shape and contouring of the pond are also subject to change based on preference, assuming the necessary volume and dimensions of storage are provided.

The spillway crest elevation and the depth of the basin to the proposed bottom is controlled by the roadway elevations along 151st Street. Specifically, the low inlet rim elevations and the required diameter of the new trunk storm sewer on 151st Street. From the model, it was determined that a 48-inch-diameter pipe is required to provide capacity necessary to convey the 10-year storm event entirely within the storm sewer system. During the 25- and 100-year storm events, surcharging occurs in the pipe, but is generally contained within the roadway. Because the new trunk storm sewer along 151st Street is 4 feet in diameter and requires at least one foot of cover at the lowest point along 151st Street (Hamlin Avenue), the invert of the pipe and, thus, the bottom of the proposed detention basin must be about 7 feet deep.

The proposed detention basin and conveyance improvements were also modeled under the assumption there is zero outfall to Park Creek, meaning the detention basin was designed to capture and store all runoff from 151st Street. This represents a “worst-case” scenario based on the understanding that Park Creek backflows into Jolly Homes and would need to be isolated from the Jolly Homes stormwater management system.

These proposed improvements also include Opportunity 2C, which is linear green infrastructure in the ROW of 151st Street as shown on Figure 8.02-5. The purpose of this opportunity is to trap pollutant runoff and provide a small measure of stormwater runoff storage and infiltration. Because there is very little grade change along 151st Street to the proposed detention basin, the new trunk storm sewer on 151st Street will need to be installed at a very flat slope. The flat slope means flow in the sewer system will be at lower velocities and will tend to deposit pollutants and sediment in the pipe. The green infrastructure will go a long way in trapping pollutant runoff, reducing loading in the pipe, and reducing maintenance required of the Village to keep the sewer clean and flowing at capacity. It is anticipated that green infrastructure will be implemented at the same time as the trunk storm sewer is constructed and will require the Village to engage the property owners in location and final design of the facilities. Figure 8.02-5 shows different options for green infrastructure features in the ROW including grassed bioswales and rain gardens. The type of green infrastructure features can be addressed in final design depending on the desires of the Village and adjacent property owners.

OPC are provided in Appendix C for Opportunities 2A, 2B, and 2C. In developing the cost for Opportunity 2B, it was assumed all new storm sewer will be installed in the roadway. However, from discussions with Village staff and review of the wide ROW on 151st Street, it appears installation of the trunk sewer in the 151st Street parkway could be feasible without significant tree removal and would be conducive to construction of Opportunity 2C green infrastructure. Construction of a new

storm sewer in the side street parkways will be more difficult because of narrower ROW and conflicts with mature trees. However, if a storm sewer can be installed in the parkways on 151st Street and the side streets, it could result in up to 22 percent reduction in cost (approximately $655,000) for Opportunity 2B.

Figures 8.02-6 through 8.06-9 in Appendix B show flooding conditions with the proposed improvements for each of the recurrence intervals. The 25 and 100-year events under proposed conditions indicate some areas will still have flooding, but the flooding is shallow enough to allow for vehicle access. The flooding is mostly maintained in the ROW and those flooded areas outside of the ROW could be addressed in final design with regrading in the ROW. The modeling results indicate the proposed improvements solve the flooding issues along 151st Street, which may, therefore, render other opportunities, like the dry detention basin southwest of Central Park Elementary School (Opportunity 2D), as unnecessary.

8.03 BELLY BUTTON HILL IMPROVEMENTS

There is currently a depressional area in the southern portion of the park adjacent to 151st Street that is intended to provide stormwater storage. The Village reports this area becomes overwhelmed during small rainfall events and floods onto 151st Street. Opportunity 3A endeavors to relieve flooding at Belly Button Hill/Kostner Park, along Kostner Avenue, Kilbourne Avenue, and 151st Street by providing increased storage at the park in two locations. The first location is a dry detention basin in the center of the park, and the second location is expanding the footprint of the existing depressional area in the southern portion of the park. The following provides an explanation of the opportunities evaluated in Belly Button Hill.

A. Existing Conditions Model

Like the Jolly Homes model, rim and invert elevations for structures in the Belly Button Hill model were based on a cursory field survey and the Village's 1-foot contour mapping. However, unlike the Jolly Homes model, the Belly Button Hill area primarily relies on conveyance through a series of open ditches along the perimeter of the park. These ditches were modeled through the 2D surface using 1-foot contours.

Figures 8.03-1 through 8.03-4 in Appendix B show the limits of existing flooding for the 2-, 10-, 25-, and 100-year storm events. The modeling results confirm the following:

1. The low point at Belly Button Hill Park is located in the southeast area of the park, at the 151st Street and Kostner Avenue intersection.
2. The existing detention area in the southern portion of the park is under capacity and floods during small storm events.
3. The existing conveyance system and roadside ditches are under capacity and overtop into the street during small rainfall events.
4. Flooding at the park affects downstream flooding conditions at the Midlothian Creek outfall.

B. Proposed Conditions Model

The existing conditions model was updated to reflect implementation of two new detention basins, the first is a 15.8-acre-foot dry detention basin in the center of the park and the second a 4.0-acre-foot dry detention basin in the southern portion of the park, adjacent to 151st Street. Figure 8.03-5 in Appendix B provides a schematic of the proposed improvements. Both basins could easily be designed as wetland or wet pond basins depending on what the Village and Park District would prefer in these locations.

The modeling results of the proposed detention basins is shown in Figures 8.03-6 through 8.06-9 in Appendix B. The modeling exhibits reflect the depth and extents of flooding above existing grade to provide a comparison of the existing and proposed conditions relative to existing ground elevations.

The proposed conditions illustrate a reduction in flooding conditions because of the proposed detention facilities, mostly in the 2-year and 10-year events. The overall benefit of the proposed detention basins cannot be fully realized without also making changes to the existing stormwater conveyance system. It is anticipated that improvements to the conveyance system (3C and 3I) along with the proposed detention facilities (3A, 3B, 3D, and 3F) will result in further flood reduction in the Belly Button Hill neighborhood. The proposed detention basins will also mitigate flooding in the area of 151st Street and Tripp Avenue near the Midlothian Creek outfall. This occurs because the proposed detention basins hold back runoff that otherwise would flow freely to this point.

It was also noted the proposed detention basins result in a reduction in downstream flooding conditions to the Midlothian Creek outfall. This occurs because the proposed detention basins hold back runoff that otherwise would flow freely to this point.

8.04 FUNDING OPPORTUNITIES

The foundational purpose of this SMCP was to identify the Village's stormwater and flood control needs in order to determine how to plan for the associated costs. Without a foundational understanding of the costs the Village will not be able to plan for funding and solicit grant and loan sources.

There are generally two basic funding vehicles available to most municipalities; general fund and user fees. The general fund is filled through Village tax revenues and often is used for basic Village operations, police, and fire. Implementing stormwater management from this fund is often not possible because of the magnitude of the stormwater need. More commonly, communities will use the user fee revenue, typically from water and sewer rates and fees, to fund their stormwater management needs. However, this takes funding away from the Village's water and sewer infrastructure needs, which are often tightly funded. Additionally, the little most communities are able to divert from sewer and water to stormwater is insufficient to fund the level of stormwater need.

An alternative user fee the Village could consider would be a rain fund, commonly known as a stormwater utility fee. This is a user fee much like the Village's current water and sewer fees, which is based on the level of stormwater runoff contribution each user makes to the Village's stormwater management system. A residential property with impervious surfaces like a home (rooftop), driveway, and sidewalks contributes a calculable amount of stormwater runoff from those surfaces and would be charged a user fee based on that unit amount of runoff. A commercial property with a

building (rooftop), parking lot, driveways, and sidewalks would contribute a greater amount of stormwater units of runoff and would thus be charged a proportionally greater fee. The unit fee to be applied to property owners in the Village would be based on the Village's stormwater costs as identified in this Capital Plan distributed over the Village's desired time frame for implementation of the stormwater opportunities.

The benefit of implementing a stormwater utility is the Village would have a continual revenue based upon specific identified stormwater needs and goals that does not draw away from the Village's ability to continue to provide the community's expected level of service for Village services and infrastructure. This continual revenue also opens up other funding opportunities for the Village.

For the Village to proceed with consideration of a stormwater utility, it is recommended the Village perform a feasibility study. The feasibility study will inform the Village of the appropriate rate structure based on the level of improvement the Village chooses to implement as well as any incentive programs desired by the Village. The study will also identify the legal documents and ordinance updates necessary to adopt the stormwater utility and will include a public engagement process to inform and gain public support for the utility. It is estimated that a stormwater utility feasibility study would be performed by an experienced consultant and cost $60,000 to $80,000 to perform.

If the Village is able to show an ability to fund stormwater management projects, the Village will be able to apply for various bonds and loans. These funding vehicles generally provide a lump sum dollar amount the Village pays off over time from their established revenue source. One particular loan program available to the Village is through the IEPAs Stage Revolving Fund Loan Program. This is a low interest loan program (1.84 percent for FY2019) that makes funding available for water, wastewater, and stormwater infrastructure needs. There is a finite pool of funding so an application based on a supporting study (like this Capital Plan), preliminary engineering and OPC, and established revenue funding to pay back the loan must be submitted to the IEPA for their consideration. Currently the program is based on a 30-year payback term, but the IEPA is also considering 20-year terms. Loan applications for a fiscal year starting July 1 are due by the prior January 30.

Bonds are similar to the loan in that they are paid back at an interest rate over a given period of time. There are a number of different bond types and rates available. For all of the Village's funding needs it is strongly recommended the Village obtain a Municipal Financial Advisor.

In addition to bonds and loans, there are a number of grants available to the Village. One such grant is the MWRD Green Infrastructure Grant Program partners with local municipalities and local agencies to install green infrastructure throughout Cook County. While this program is closed for 2018, it is expected to return in 2019. Other funding opportunities have been outlined in the Calumet Stormwater Collaborative's repository of resources (see page 6 of the document).[1]

8.05 IMPLEMENTATION SCHEDULE

Implementation of the initial projects in the Jolly Homes and Belly Button Hill focus areas will require coordination of funding, planning, and design activities before the Village can consider proceeding with construction of the improvements. Following is an anticipated implementation schedule:

[1] https://www.cmap.illinois.gov/documents/10180/402128/Calumet+Stormwater+Collaborative+Repository.pdf/ff3c5945-6652-e917-5d9f-ea25dc7a730e

Implementation Schedule		
Task	**Year**	**Cost**
Determine Funding (see Section 8.04)	1	$60,000 to $80,000
Develop and implement a storm sewer system televising program starting with the Jolly Homes focus area followed by the other focus areas	Ongoing	$96,000 (Jolly Homes)
Clean storm sewer system as necessary based on televising results	Ongoing	$131,000
Jolly Homes Focus Area		
▪ Begin discussions with the School District for establishment of an intergovernmental agreement (IGA) for proposed improvements on School District property	1	NA
▪ Begin discussions with TNC on collaborative efforts at Central Park Elementary School and Sundrop Prairie.	1	Ongoing
▪ Begin a public information initiative regarding green infrastructure and start to identify property owners along 151st Street willing to participate in green infrastructure improvements	1	NA
▪ Collect general topographic survey data to support hydraulic modeling	1	$15,000
▪ Develop a hydraulic model of existing conditions for the entire focus area	1	$43,000
▪ Develop a hydraulic model of proposed conditions incorporating all potential opportunities in the focus area	1	NA
▪ Evaluate sizing, location, and effectiveness of the potential opportunities	1	NA
▪ Develop a “basis of design” report to guide implementation of opportunities throughout the entire focus area	1	$20,000
▪ Perform detailed topographic survey for Opportunities 2A, B, and C	2	$120,000
▪ Develop preliminary engineering drawings, specifications, and OPC	2	$107,100
▪ Submit for funding as determined	2	NA
▪ Develop pre-final engineering drawings, specifications, and OPC	2	$100,000
▪ Submit for permits as necessary	2	$8,000
▪ Finalize engineering drawings, specifications, and OPC	2	$18,000
▪ Advertise for bids	3	$5,800
▪ Award contract and finalize funding	3	NA
▪ Construction improvements	3 to 4	$5,425,166
▪ Finalize and closeout project and funding documents	4	NA
Belly Button Hill Focus Area		
▪ Begin discussions with the Park District for establishment of an IGA for proposed improvements on Park District property	1	NA
▪ Collect general topographic survey data to support hydraulic modeling	3	$18,000
▪ Develop a hydraulic model of existing conditions for the entire focus area	3	$50,000
▪ Develop a hydraulic model of proposed conditions incorporating all potential opportunities in the focus area	3	NA

Implementation Schedule		
Task	**Year**	**Cost**
▪ Evaluate sizing, location, and effectiveness of the potential opportunities	3	NA
▪ Develop a "basis of design" report to guide implementation of opportunities throughout the entire focus area	3	$20,000
▪ Perform detailed topographic survey for Opportunities 3A, B, C, D, and E	4	$36,000
▪ Develop preliminary engineering drawings, specifications, and OPC	4	$31,000
▪ Submit for funding as determined	4	NA
▪ Develop pre-final engineering drawings, specifications, and OPC	4	$30,000
▪ Submit for permits as necessary	4	$2,000
▪ Finalize engineering drawings, specifications, and OPC	4	$6,000
▪ Advertise for bids	5	$3,000
▪ Award contract and finalize funding	5	NA
▪ Construction improvements	5 to 6	$1,720,350
▪ Finalize and closeout project and funding documents	6	NA
▪ ***Future Implementation***		
▪ Proceed with data collection and modeling for Bremen Heights	5	$85,000
▪ Reassess funding capabilities for continued improvements	5	NA
▪ Reassess Opportunity Matrix for prioritization of projects based upon modeling and effectiveness of implemented projects	6	$15,000
▪ Proceed with engineering for Bremen Heights based on funding and updated prioritization	6 and beyond	$2,370,000