



MEMORANDUM

Subject: Village of Mount Prospect Stormwater Master Plan
Existing Conditions Summary

Date: 11/4/2025

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The purpose of this memorandum is to summarize the tasks completed to date for the Village of Mount Prospect Stormwater Master Plan (SMP) project. The Village has tasked CBBEL with the development of a comprehensive stormwater master plan that will serve as a guide for future policies, programs, and projects. CBBEL has completed a substantial portion of the tasks outlined in the scope of work including consolidation of relevant structure survey data and stormwater facility as-built data into a GIS database, development of a Village-wide stormwater model and mapping of areas of inundation to identify at-risk structures and excessive street ponding.

1. INTRODUCTION

The Village of Mount Prospect, like many similar older communities, has historically experienced widespread flooding from combined and separated storm sewers from a wide range of storm events with varying degrees of intensity and durations. To effectively address the flooding issue, the Village contracted CBBEL to complete a Stormwater Master Plan (SMP). Two main objectives of the SMP are to assess the existing level of service (LOS) of the storm and combined sewer network and to develop improvement projects to alleviate flooding. The SMP includes the preparation of a Village-wide 2D hydrologic and hydraulic model to simulate the rainfall-runoff-conveyance process and its effect on the sewer system for a variety of real and design storm events.

2. MODEL DEVELOPMENT

The purpose of creating a stormwater model is to evaluate the existing drainage systems and how they respond to various storm event, to depict the expected surface flooding, and ultimately to determine whether improvements to the drainage infrastructure should be made. The process of developing the Village-wide stormwater model is summarized in the following sections.

2.1. DATA COLLECTION

The data collection phase was integral to the model development to create an accurate baseline condition for the SMP. It included a substantial work effort to ensure accurate sewer system data was obtained for the Village-wide 19-square mile study area. The main data source for the sewer system was the Village's GIS sewer atlas. This was supplemented with extensive in-field data collection conducted by Village staff in 2023 and 2024, who collected GIS data on more than 1,100 sewer structures that proved instrumental in developing the existing conditions models. Additionally, the Village provided nearly 200 as-built plans for public and private stormwater facilities including detention basin storage, parking lot storage and storm sewer storage, which helped to accurately portray existing flood storage in the model.

Recently constructed Village drainage projects were also shared with CBBEL for inclusion in the model such as projects from the Village's Backyard Drainage Program. These projects typically involve a storm sewer connection from a previously undrained backyard into the Village's storm sewer system in the street. Wherever possible, data from these private systems has been included in the modeling effort.

GIS DATABASE

Data within the sewer pipe and sewer manhole shapefiles initially provided by the Village included the owner, pipe sizes, rim elevations and some invert elevations. The inverts not available in the GIS sewer atlas were supplemented with the data collection conducted by the Village. CBBEL combined the supplemental invert data with the original Village GIS data to develop a complete sewer atlas with all the available GIS data. The enhanced GIS database will be an important deliverable at the end of the SMP process. Key additions to the GIS database include:

- Approximately 2,000 structures updated with pipe inverts
- 121 Detention Basins with corresponding outlet control structure data
- 59 Private property drainage systems

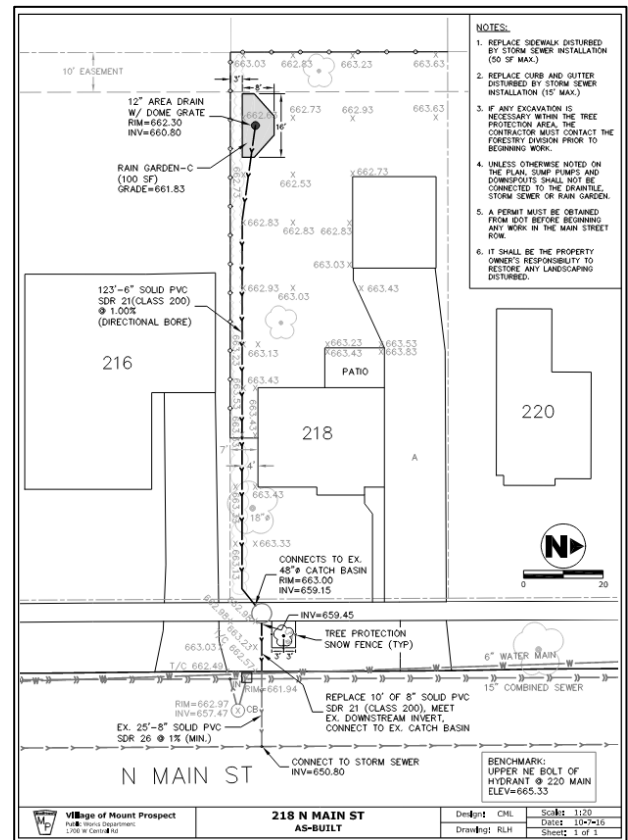


Figure 1. Example Private Property Drainage Improvement Project

2.2. HYDROLOGIC AND HYDRAULIC MODELING OVERVIEW

A Personal Computer Stormwater Management Model (PCSWMM) was created of the Village's entire combined and separate sewer system. The PCSWMM software is a dynamic modeling program that determines the hydrologic response from a storm event and routes the runoff through the sewer network. There are three main components to a stormwater model. One is the pipe network including structures which conveys stormwater flows. The second is the surface data which determines how stormwater flows across the surface and where surface inundation (flooding) may occur. The third component is watershed data which describes how much area and the type of land cover that drains to a particular point.

The pipe network (storm and combined) was input to the model using the GIS database information described previously. Pipe attribute information such as diameter, shape, slope, length, and invert elevation were assigned to each pipe segment in the model.

The overland flow component (ground surface) was represented using the 2D hydraulic modeling feature. In a 2D model, a digital terrain model (DTM) represents the ground surface. Once the pipe system is surcharged, stormwater flows across the ground surface based on the elevations in the DTM. Surface storage, ponding areas, overland flow routes, etc. are represented in the 2D portion of the model. For this study, the DTM was generated using 2022 Cook County LiDAR data for the entire Village.

The GIS sewer database was combined with the 2022 Cook County 1-foot aerial topography and DTM to complete the subbasin delineation. Subbasins were manually delineated using previous delineations provided by the Village as a guide. The subbasins were generally divided to drain to low points at either intersections or mid-block. The Village-wide model area is 7.5 square miles and the average subbasin size was 2.7 acres which provides a high level of detail for the hydrologic portion of the PCSWMM model.

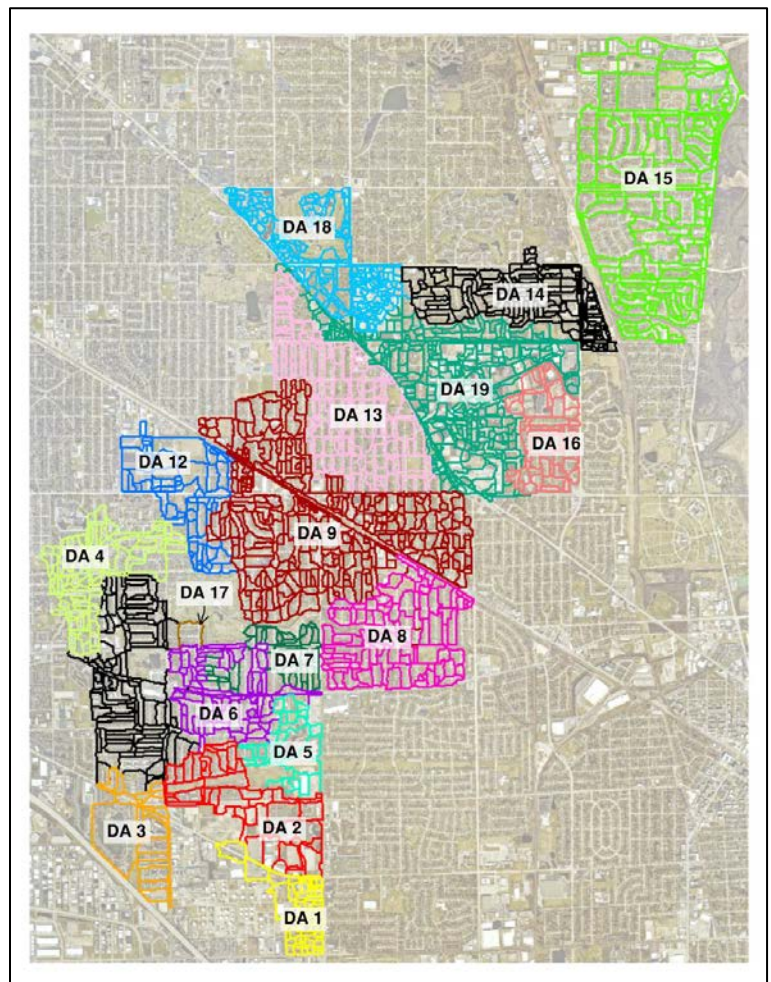


Figure 2. Drainage Areas and Subbasin Delineation

Land use information, which includes the amount of impervious versus pervious area in a particular subbasin, was developed using Cook County building footprint layers, Mount

Prospect roads and driveways layer, and supplemented manually with parking lot and missing impervious surfaces based on Cook County 2023 aerial imagery. A unique impervious area for each subbasin was calculated and input into the model. A detailed Village-wide subbasin map is provided as **Exhibit 1**.

2.3. MODELED COMPONENTS

The 18 individual models created for the SMP account for all collector and trunk sewers under most streets in the Village and contains 4,488 junctions and 4,528 conduits. 5 pumps, 22 underground storage facilities, and 99 above ground detention basins were represented in the models. Both above ground and underground detention basin restrictor pipes were added manually based on Village provided as-built engineering plans. Several of the provided detention basin plans referenced storm sewer pipe storage and parking lot storage that was constructed to meet site detention requirements. These plan elements were not counted in Figure 3 below but were represented in the models.

	By the Numbers							
	Area (ac)	Subbasins	Avg Area (ac)	Junctions	Conduits	Pumps	Underground Storage Facility	Above Ground Detention Basin
DA 1	116	57	2.0	186	184	1	1	4
DA 2	283	41	6.9	92	87	0	0	8
DA 3	184	21	8.8	49	47	0	3	9
DA 4	233	88	2.6	186	187	0	0	3
DA 5	148	28	5.3	114	112	0	0	4
DA 6	209	65	3.2	130	130	0	0	2
DA 7	217	43	5.0	115	120	0	0	0
DA 8	324	83	3.9	152	153	0	1	1
DA 9	898	245	3.7	741	785	0	5	4
DA 12	242	63	3.8	181	187	2	1	4
DA 13	214	114	1.9	438	486	0	1	3
DA 14	127	150	0.8	259	258	1	0	5
DA 15	136	48	2.8	95	96	1	0	2
DA 16	310	46	6.7	118	113	0	2	5
DA 18	263	230	1.1	542	516	0	2	14
DA 19	450	369	1.2	859	826	0	5	22
DA 79C	467	111	4.2	231	241	0	1	9
	4821	1802	2.7	4488	4528	5	22	99

Figure 3. Summary of PCSWMM Modeled Elements

3. RAINFALL

A “storm event” is defined by the total amount of rain, the duration in which it fell, and the distribution of the rainfall within the overall storm duration. Storms are often characterized as being an “X-year” storm; this term is often used to describe the magnitude of a storm, although more precisely it describes the likelihood of the storm happening in a given year. A 100-year storm has a 1% chance (1 in 100) of happening in any given year; a 10-year storm has a 10% chance (10 in 100) of happening in any given year (**Table 1**). This terminology can be confusing

because, as stated above, a “storm event” includes both rainfall depth and duration. A storm that produces 4” or rain in one hour does not have the same likelihood of occurrence as a storm that produces 4” or rain in 24 hours, therefore they would not have the same “X-year” designation.

Table 1. Design Storm Statistics

Recurrence Interval in Years	Probability of Occurrence in any Given Year	Percent Chance of Occurrence in any Given Year
100	1 in 100	1
10	1 in 10	10
5	1 in 5	20
2	1 in 2	50

For these types of stormwater analyses, it is common practice to establish a “critical duration”, which is the duration of storm that generates the most flooding. Depending on the specific characteristics of a particular drainage system, a short-duration, high-intensity storm will produce the most flooding. This is common in pipe systems with limited capacity. Other systems with large storage volumes may require a greater rainfall depth to generate the greatest flooding even though the storm intensity is lower. To establish the critical duration, a model is run for all of the standard “X-year” storm durations (1-hour, 2-hour, 3-hour, etc.). The storm that generates the most flooding is considered to be the critical duration. While there may be variations throughout the Village in different drainage systems, a single duration is chosen for practicality.

A critical duration analysis was completed using the PCSWMM models. The critical duration was determined for the Village’s sewer system utilizing rainfall depths published in the 2020 Precipitation Frequency Study for Illinois (aka Bulletin 75) prepared by the Illinois State Water Survey (ISWS) and Huff rainfall distributions. Drainage Area 4 (DA 4) was chosen to represent the critical duration for the entire Village in order to reduce simulations times and because the 18 drainage areas have similar hydrologic and hydraulic characteristics. The results demonstrated that ***the 2-hour storm duration is the critical duration*** for the Village’s storm sewer network.

3.1. RAINFALL HISTORY

Engineers have always relied on various rainfall statistics when designing drainage systems. However, those statistics have changed over the years as more rainfall data has been added to the historical record. Each time new statistics have been adopted, the rainfall depths and intensities have generally increased. Four sets of rainfall data are relevant. Technical Paper No. 40, Rainfall Frequency Atlas of the United States (TP-40) by the Weather Bureau (now known as the National Weather Service), was the most widely used data up until the 1970s and 80s. The ISWS began publishing statistics in 1976. The ISWS data was updated in 1989 in what was called Bulletin 70, which was later updated in 2019 and referred to as Bulletin 75. **Table 2** shows the 10-year, 2-hour rainfall values for these various data sources.

Table 2. 10-year, 2-hour Rainfall Values from Various Sources

Source	10-Year, 2-Hour Rainfall Depth	100-Year, 2-Hour Rainfall Depth
TP-40	2.4"	3.3"
ISWS 1976	2.2"	N/A*
ISWS Bulletin 70	2.6"	4.47"
ISWS Bulletin 75	3.0"	4.97"

*The ISWS did not publish rainfall depths for recurrence intervals greater than 50 years in the 1976 study

According to historical records, much of the Village was developed during the 1950's and 60's. Specific design standards of the era are unknown, but a 5- or 10-year design standard for storm systems would have been common. It is reasonable to assume that the original systems in the Village would have been designed using TP-40 rainfall and a 5- or 10-year design storm.

In the 50's and 60's, receiving 2.4-inches of rain in 2 hours would have been considered a 10-year storm. Under current, Bulletin 75 standards, a 2.4" rainfall event would be considered less than a 5-year design storm.

A 10-year storm is the modern design standard for construction of new storm sewer and is required by the Village Ordinance. While the older drainage systems in town may have been originally designed for a 10-year storm, based upon the newer rainfall data, these systems may only have the capacity to convey the runoff generated by what would be considered a 2-year storm by today's design standards.

4. MODEL RESULTS

The existing conditions models were simulated for the 10-year and 100-year, 2-hour (critical duration) storm event.

4.1. EXISTING CONDITIONS RESULTS

The model results are best represented by mapping the anticipated inundation areas resulting from the two storm events analyzed. Inundation mapping results are provided in **Exhibit 2** and in a [GIS Online WebMap](#). Two factors should be considered when viewing the inundation mapping. First, a storm simulation is a dynamic event as runoff moves through the system to the outfall point. However, the flood mapping is a static picture that shows the maximum ponding in each area at any time. While it does show the maximum impacts, there is not a singular time when flooding is as widespread as is shown in the exhibits. Second, as described in the description of the critical duration, the mapping shows the most flooding that a 10-year storm would generate as this is commonly used for planning purposes.

It should be noted that although they may overlap, the inundation areas produced by the existing conditions models **are not the same** as flood hazard areas published by the Federal Emergency Management Agency (FEMA). Neither the model identifying flood-prone areas, nor any improvements triggered by it, will impact a property's floodplain designation.

4.2. LEVEL OF SERVICE

The Level of Service (LOS) can have varying definitions. Ultimately, this study will identify areas where there are structures (homes) at risk of flooding from certain storm events and will develop conceptual projects to better protect these areas. The desired level of protection or service will be determined at that time. While there are variations throughout the Village, generally speaking, the existing systems can handle a 2-year critical duration storm without significant street ponding. This is a reasonable characterization of the current Level of Service.

5. NEXT STEPS

The immediate next steps of the stormwater master plan development include a public engagement period that will include soliciting questions and comments from residents on stormwater-related issues in the Village. This will be implemented through the Village social media accounts, the Village newsletter, and open houses. The purpose of the public comment period is to validate model results and to obtain a better understanding of flood risk for structures. For instance, the modeling may show widespread backyard flooding. The level of detail needed to acquire actual low-entry elevations of each home, which would be needed to establish actual flood risk, is beyond the scope of this project. The open house forums will provide an opportunity for residents to weigh in on model results and narrow the scope of actual at-risk structures so that improvement areas can be better targeted.

To begin the public engagement process, CBBEL will prepare a recorded presentation that describes the SMP process and the work that has been done on the project to date. The presentation, which will be hosted online and promoted through Village channels, will invite residents to complete a questionnaire to provide property-specific information on flooding history. The questionnaire will be GIS-based and allow residents to draw directly on a map to describe historic flooding limits or any other similar data. Based upon the data received and level of interest from residents, an in-person meeting schedule will be developed to provide opportunities for residents to speak directly with Village staff and project engineers.

Beyond the public engagement and model validation phase, a significant portion of the overall SMP remains to be completed. The remaining tasks involve developing concept level improvement projects which may form the basis for a stormwater Capital Improvement Program, reviewing and considering modifications to the Village's stormwater ordinances and policies, and outlining the feasibility of a Stormwater Utility Fee, among other tasks. A brief summary of remaining tasks from the project's Scope of Work is as follows:

- **Stormwater Capital Improvement Plan.** Following the public outreach and in consultation with Village staff, a criteria for the desired level of flood protection will be established. A series of concept-level stormwater infrastructure projects and corresponding cost estimates will be developed using the PCSWMM model to raise the level of protection to the desired standard.

- **Basin 79C Analysis.** The modeling analysis and recommended solutions for this known problematic area will be enhanced to a greater level beyond the rest of the concept-level SMP analysis.
- **Review Village Code, Ordinances, and Maintenance Plans.** Based on our understanding of the Village's stormwater challenges, we will review the Village's development codes and policies and suggest revisions so that they properly address the issues experienced by residents. This may include good-neighbor issues such as sump pump and gutter discharge locations or larger programs such as backyard drainage improvements. This task will also look at the Village's procedures for maintaining its stormwater system so that it is compliant with National Pollutant Discharge Elimination System (NPDES) requirements.
- **Green Infrastructure Plan.** The Stormwater Capital Plan tends to look at large-scale projects that provide flood relief to a block or multi-block level. Green infrastructure is often used to supplement these designs to improve stormwater discharge quality or to address targeted problem areas. We will work with Village staff to identify areas where green infrastructure is best suited to be utilized and will develop an overall plan for its implementation.
- **Stormwater Utility Fee Feasibility Review.** This qualitative task will use readily available GIS mapping and the estimated cost of the potential recommended improvements to broadly outline the potential parameters of a Stormwater Utility Fee. We will describe the pros and cons of establishing a fee and provide recommendations on the steps the Village could take to further investigate this option.
- **Stormwater Toolbox.** We understand that many of the drainage problems experienced by residents occur in rear yard areas outside of the public right of way. Unfortunately, not all of these areas can be addressed by the SMP. The purpose of this task is to provide tools for residents to assess their individual issues and to provide guidance on the types of projects that may be beneficial. We envision this deliverable to be a stand-alone document that can be distributed to residents.

These remaining tasks are typical of a comprehensive SMP project such as the Village's. The timeline for completion is often tied in part to the duration of public engagement and the number and timing of public presentations to the Village Board. We anticipate the recorded presentation and survey to be available for public viewing in January. The open house will take place in February with the public comment period ending shortly after. Public feedback will then be reviewed and a draft SMP completed in June. The final SMP is anticipated to be completed in August with a presentation to the Village Board.