2014 Stormwater Drainage Study

Prepared for:

The Village of Glencoe

Submitted By:

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2014 Village of Glencoe Stormwater Drainage Study

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1.0 INTRODUCTION

The Village of Glencoe has historically experienced recurrent drainage problems in five drainage basins, referred to as Terrace Court, Skokie Ridge, Greenwood Avenue, Madison Avenue, and Hazel Avenue, during moderate and severe rainfall events. Extensive flooding problems were experienced during a storm event that occurred on July 22-23, 2011. Additionally, storms in May and June of 2014 caused flooding, though to a lesser extent than the 2011 storm. The Village of Glencoe hired Engineering Resource Associates, Inc. (ERA) to study these areas to determine the cause, extent and severity of the problems and to evaluate alternatives to reduce the impact of flooding.

In the four residential drainage basins, flooding problems can be directly attributed to inadequate storm sewer capacity and the lack of and poorly defined overland flow paths. In the fifth drainage basin, the flooding issue is caused by inadequate storm sewer capacity that causes flooding in the underpass and the nearby overflow path provided by the Village Hall driveway.

2.0 HYDROLOGIC / HYDRAULIC ANALYSIS

2.1 HYDROLOGY

Tributary areas to storm sewer systems were delineated using contour mapping provided by the Village of Glencoe. These tributary areas can be found on Exhibits 1, 5, 9, 13 and 18 for the Terrace Court, Greenwood Avenue, Skokie Ridge, Madison Avenue, and Hazel Avenue watersheds. Sub-basin areas and runoff characteristics were calculated using SCS methodology and input into the Rain Module for the XPSWMM 2D modeling.

Storm events studied were chosen based on the characteristics of each drainage basin studied. Critical duration was evaluated and utilized for each basin. It was determined that the 2-hour event was critical for each watershed. 2-, 10-, 50-, & 100-year, 2-hour storm events were input into XP SWMM and analyzed. XPSWMM uses the rainfall input to generate runoff hydrographs. These hydrographs are routed through storm sewers input into XPSWMM hydraulics as discussed below.

2.2 HYDRAULICS

Existing storm sewer sizes and routings were developed based upon a combination of survey from ERA, as-built construction plans and GIS atlas information provided by the Village of Glencoe. Storm sewer information was input into the XP SWMM 2D model.

The hydraulic models developed for this study utilized the main trunk lines to identify where in the storm sewer network there were deficiencies in conveyance. The hydraulic models often represented multiple pipe segments as a single segment, and often combined several locations with stormwater runoff inflow into a single inflow point. The hydraulic model was incorporated into the 2D model, which represents a more comprehensive picture of the water flowing through the basins. The 2D model includes a 3-dimensional surface which depicts the topography of the drainage basins. When the

water rises above the rims of the storm sewers in the XP SWMM 2D model the water follows the topography of the area as it would in a real storm event. The model then can demonstrate the extents, depth, and velocity of the water flowing over land after it surcharges the storm sewer system.

Tailwater for the basins was determined based on the conditions downstream of each basin. If the hydraulic grade line (HGL) would not be able to impact the upstream area being studied, such as Madison Avenue, the outfall was considered free to flow and no tailwater elevations was assigned. On the other hand, in basins where downstream conditions could impact the basin being studied, such as Terrace Court, the outlet condition was analyzed as if the outfall was flowing full. XPSWMM imports runoff hydrographs developed and routes them through the storm sewer input in the model. The model uses the runoff hydrographs, storm sewer information, and tailwater elevations to develop HGLs for each storm sewer system. HGLs for each drainage basin can be found within the modeling provided on the CD within Appendix F.

3.0 TERRACE COURT BASIN

3.1 PROBLEM AREA DESCRIPTION

The Terrace Court Watershed is a 55 acre watershed that drains stormwater from an area between Green Bay Road and the Union Pacific Railroad just west of the Glencoe Park District building and east of Kelling Lane. The basin limits are shown in Exhibit 1. In general, the watershed drains from south to north to a 36-inch culvert which conveys flow under the railroad tracks and into a ravine that discharges to Lake Michigan. The western portion of the watershed drains through storm sewers varying in size from 8- to 15-inch pipes and the eastern portion drains through the railroad ditch prior to flowing under the tracks.

Six problem areas have been identified in the watershed as shown in exhibit 2. These areas are located at the following locations:

1. East Elm Court
2. Old Elm Lane between West Elm Court and Park Place
3. Park Place just east of Carol Lane
4. Terrace Court at the sewer outfall
5. Intersection of Carol Lane and Park Place
6. Northern limits of Linda Lane

Problem areas 1 & 2 are caused by insufficient storm sewer capacity and inadequate overflow routes. When the storm sewer on Old Elm Lane is overwhelmed water ponds over 2.0 feet deep and encroaches onto private properties. Residents have reported yard and basement flooding due to this ponding. Access to homes in these areas are significantly impacted due to the depth of flooding.

Problem areas 3 & 4 are caused by insufficient storm sewer capacity and inadequate overflow routes on Park Place. When the storm sewer is overwhelmed water will pond approximately 0.5 feet prior to overflowing the right-of-way and into a resident's garage and private storm sewer. The private storm sewer is quickly overwhelmed allowing water to pond several feet. Runoff then continues northeast toward a home located on Terrace Court impacting the property before flowing into an 18-inch sewer which directs water under Terrace Court. Two residential structures are significantly impacted due to the flooding on Park Place. Other residents have reported yard and basement flooding.

Problem area 5 is caused by overland flow runoff coming from Kelling Lane. Kelling Lane is drained by a private 4-inch storm sewer pipe which can be quickly overwhelmed. When this occurs stormwater flows through the rear and side yards of two residents on Carol Lane. Residents have reported yard, garage, and basement flooding due to this flow.

Problem area 6 is caused by insufficient storm sewer capacity and inadequate overflow routes. When the Linda Lane storm sewer is overwhelmed water ponds approximately 2.0 feet deep and encroaches onto private properties. Residents have reported yard and garage flooding due to this ponding. Access to homes in this area is significantly impacted due to the depth of flooding.

Based on the hydrologic/hydraulic analysis, residential surveys, and discussions with Glencoe Public Works approximately 30 homes are impacted by road flooding and overflow through private properties. Exhibits 1 and 2 show the existing storm sewer network and flooding conditions. The following table provides the number of houses impacted in the storm events that were analyzed.

TERRACE CT. IMPACT SUMMARY					
LOCATION		STORM EVENT			
		2-YEAR	10-YEAR	50-YEAR	100-YEAR
EAST ELM COURT	PROPERTIES IMPACTED	0	0	4	4
OLD ELM LANE	PROPERTIES IMPACTED	0	8	9	9
PARK PLACE	PROPERTIES IMPACTED	2	6	8	8
TERRACE COURT	PROPERTIES IMPACTED	2	2	3	3
CAROL LANE	PROPERTIES IMPACTED	2	2	2	2
LINDA LANE	PROPERTIES IMPACTED	0	0	4	4
TOTAL	PROPERTIES IMPACTED	6	18	30	30

3.2 ANALYSIS OF ALTERNATIVES

Based upon the analysis performed, it is apparent that reported flooding problems within the Terrace Court Basin are caused by inadequate conveyance capacity of storm sewers and poorly defined overflow routes. Several design alternatives to reduce the frequency and severity of flooding were developed and analyzed. The alternatives that were considered most feasible and effective are described below.

Alternative 1: Upsize storm sewer to convey the 10-year event from the Terrace Court Basin area to its outlet underneath the railroad tracks.

Alternative 2: Upsize storm sewer to convey the 100-year event from the Terrace Court Basin area to its outlet underneath the railroad tracks.

The proposed alternatives were analyzed in detail to determine their effectiveness in reducing flooding frequency and severity. Both alternatives included proposed storm sewer improvements to reduce roadway flooding and overtopping at roadway sag points on Park Place, Old Elm Lane, and Terrace Court. The 10-year storm event option included the installation of approximately 1,400 linear feet of 18 to 24-inch pipes at an estimated cost of $790,000. The 100-year storm event option included the installation of approximately 1,800 linear feet of 12 to 36-inch pipes at an estimated cost of $1,240,000. To address issues upstream of the public ROW on Kelling Lane and Linda Lane, proposed storm sewers are assumed to be jacked and bored underneath private property to minimize impacts in those areas. Exhibits 3 and 4 show the proposed storm sewer network and flooding conditions for each alternative. Detailed cost estimate information can be found in Appendix A. The following table details the properties impacted for both proposed alternatives.

TERRACE COURT ALT. 1/ALT. 2 IMPACT SUMMARY					
LOCATION		STORM EVENT			
		2-YEAR	10-YEAR	50-YEAR	100-YEAR
		ALT. 1/ALT. 2	ALT. 1/ALT. 2	ALT. 1/ALT. 2	ALT. 1/ALT. 2
EAST ELM COURT	PROPERTIES IMPACTED	0/0	0/0	4/0	4/0
OLD ELM LANE	PROPERTIES IMPACTED	0/0	0/0	9/0	9/0
PARK PLACE	PROPERTIES IMPACTED	0/0	0/0	8/0	8/0
TERRACE COURT	PROPERTIES IMPACTED	0/0	0/0	3/0	3/0
CAROL LANE	PROPERTIES IMPACTED	2/2	2/2	2/0	2/0
LINDA LANE	PROPERTIES IMPACTED	0/0	0/0	4/0	4/0
TOTAL	PROPERTIES IMPACTED	2/2	2/2	30/0	30/0

3.3 RECOMMENDATIONS & CONCLUSIONS

Based upon the alternatives presented above, Alternative 2, a 100-year storm sewer system, is recommended at this time. This basin experiences significant flood depths that result in structural flooding and blocked vehicular and emergency access. Providing a storm sewer with less than a 100-year level of protection would still result in significant flooding for a number of homes.

We recommend that the private property owners improve and or maintain the overland flow paths from Park Place to Terrace Court and Kelling Lane to Carol Lane. The current overland flow path directs water towards residential structures. By implementing Alternative 2 overflow through these properties is significantly reduced but not eliminated. Modifications to overland flow paths should be made to direct the water away from the structures. The Village should consider methods to inform residents of the importance of these overflow paths and should enforce keeping them clear of landscaping, berms, or any other obstructions. In addition, future building permits on properties identified as overflow routes should be evaluated very carefully to maintain or re-establish adequate routes.

4.0 GREENWOOD AVENUE BASIN

4.1 PROBLEM AREA DESCRIPTION

The Greenwood Avenue Watershed is a 78 acre watershed that drains stormwater from an area with approximate limits of Bluff Street to the west Vernon Avenue to the east Lincoln Avenue to the north and South Avenue to the south. Exhibit 5 shows the drainage basin limits. The south portion of the basin drains north to the Park Avenue storm sewer and the northern portion drains south to local low areas on Greenwood, Grove, and Bluff approximately 300 feet north of Park Avenue. The low areas are drained by existing 15- and 18-inch storm sewer that traverses west through private properties prior to connecting with the Park Avenue sewer at Bluff Street. The Park Avenue sewer ultimately drains west through the golf course and into the Cook County Forest Preserve just west of Prairie Street.

The drainage problems in the watershed are directly related to the capacity of the existing storm sewer and the lack of a defined overland flow path between Greenwood, Grove, and Bluff Street. Stormwater is conveyed down roadways to the low areas on Greenwood, Grove, and Bluff where it enters the 15- and 18-inch storm sewer. The sewer is frequently overwhelmed causing the roadways to flood. Once flood depths are high enough to leave the right-of-way water flows west through private properties impacting several structures and properties. Property owners along the overflow path have reported home, basement, garage and yard flooding. Based on the hydrologic/hydraulic analysis, residential surveys, and discussions with Glencoe Public

Works approximately 25 homes are impacted by road flooding and overflow through private properties. The following table details the number of houses impacted in existing conditions.

GREENWOOD IMPACT SUMMARY					
LOCATION		STORM EVENT			
		2-YEAR	10-YEAR	50-YEAR	100-YEAR
GREENWOOD/ GROVE ST	PROPERTIES IMPACTED	7	10	10	10
GROVE ST/ BLUFF ST	PROPERTIES IMPACTED	5	8	10	10
WEST OF BLUFF ST	PROPERTIES IMPACTED	5	5	5	5
TOTAL	PROPERTIES IMPACTED	17	23	25	25

4.2 ANALYSIS OF ALTERNATIVES

Based upon the analysis performed, it is apparent that reported flooding problems within the Greenwood Avenue basin are caused by inadequate conveyance capacity of storm sewers and poorly defined overflow routes. Several design alternatives to reduce the frequency and severity of flooding were developed and analyzed. The alternatives that were considered most feasible and effective are described below.

Alternative 1: Upsize storm sewer and direct water from the sags on Greenwood Avenue, Grove Street, and Bluff Road to Park Avenue storm sewer ending approximately 200 feet southwest of Bluff Road. Storm sewers are designed to convey the 10-year event sizes and range from 18- to 36-inches.

Alternative 2: Upsize storm sewer and direct water from the sags on Greenwood Avenue, Grove Street, and Bluff Road to Park Avenue storm sewer ending approximately 200 feet southwest of Bluff Road. Storm sewers are designed to convey the 100-year event sizes and range from 30- to 48-inches.

The proposed alternatives were analyzed in detail to determine their effectiveness in reducing flooding frequency and severity. Both alternatives included proposed storm sewer improvements to reduce roadway flooding and overtopping at the low areas on Greenwood Avenue, Grove Street, and Bluff Street. The first alternative provided

protection for the 10-year storm event and the second provided protection for the 100-year storm event as shown on Exhibits 7 and 8. Both solutions include replacing storm sewer on Greenwood, Grove, and Bluff Street to Park Avenue and replacing the Park Avenue storm sewer from Greenwood to just west of Bluff Street. In both cases, the proposed storm sewer ties into existing sewer on Park Avenue that is smaller than the proposed pipe. This effectively moves the surcharge and overflow from residential yards between Bluff Street and Greenwood Avenue to the Park Avenue ROW. Water will be able to flow down Park Avenue to the golf course within the ROW. The 10-year storm event option included the installation of approximately 2,200 linear feet of 18 to 36-inch pipes at an estimated cost of $1,210,000. The 100-year storm event option included the installation of approximately 2,200 linear feet of 30 to 48-inch pipes at an estimated cost of $1,430,000. Detailed cost estimate information can be found in Appendix B. The following table details the properties impacted for both proposed alternatives.

GREENWOOD ALT. 1/ALT. 2 IMPACT SUMMARY					
LOCATION		STORM EVENT			
		2-YEAR	10-YEAR	50-YEAR	100-YEAR
		ALT. 1/ALT. 2	ALT. 1/ALT. 2	ALT. 1/ALT. 2	ALT. 1/ALT. 2
GREENWOOD/ GROVE ST	PROPERTIES IMPACTED	0/0	0/0	8/0	8/0
GROVE ST/ BLUFF ST	PROPERTIES IMPACTED	0/0	0/0	6/0	6/0
WEST OF BLUFF ST	PROPERTIES IMPACTED	0/0	0/0	5/0	5/0
TOTAL	PROPERTIES IMPACTED	0/0	0/0	19/0	19/0

4.3 RECOMMENDATIONS & CONCLUSIONS

Alternative 1, construct a storm sewer sized for the 10-year event to convey flow west of Bluff Street, does not protect a majority of the houses in the drainage basin during larger storm events. Therefore, Alternative 2, construct a storm sewer sized for the 100-year event to convey flow west of Bluff Street, is recommended at this time. We recommend that the Village work with residents in this area to preserve overland flow routes similar to the recommendations for the Terrace Court Basin.

5.0 SKOKIE RIDGE BASIN

5.1 PROBLEM AREA DESCRIPTION

The Skokie Ridge Watershed is a 75-acre watershed that drains storm water from an area with approximate limits of Oak Ridge Drive to the west, Eastwood Road to the east, Green Bay Road to the north, and Dundee Road to the south. Exhibit 9 shows the watershed area for the Skokie Ridge area. In general, the watershed drains from north to south through small to moderate diameter storm sewers ranging from 8- to 15-inches in diameter. The eastern portion of the watershed drains to a low area on Bluff Road just south of Sunset Lane. At this location a 15-inch sewer conveys flow to the southwest through private properties and ultimately discharging to the storm sewer on Dundee Road. The western portion of the watershed drains to Sunset Lane where an existing 8-inch sewer conveys flows west to Oak Ridge Drive and then south through an existing 60-inch storm sewer installed through the side yard of 1032/1038 Skokie Ridge Drive out to Dundee Road. The southern portion of the watershed collects at a low area on Skokie Ridge Drive just north of Dundee Road. At this location an 8-inch sewer collects runoff and directs flows north and west through existing sewers to this same 60-inch diameter system. Ultimately, the Skokie Ridge Watershed drains through the Dundee Road sewer system to the East Diversion Ditch through existing 42- and 60-inch pipe.

Three main problem areas have been identified in the watershed. These areas are located at the following locations:

1. Bluff Road just south of Sunset Lane
2. Sunset Lane between Oak Ridge Drive and Elm Ridge Drive
3. Skokie Ridge Drive just north of Dundee Road

Problem area 1 is caused by insufficient storm sewer capacity and inadequate overflow routes. When the storm sewer on Bluff Road is overwhelmed water ponds to depths in excess of 1.5 feet until it overflows through side yards and into a rear yard ravine area. The ravine directs water southwest towards the backyards and side yards of several homes on Dundee Road. This overflow causes street, structural, and yard flooding as confirmed in the storm water model and reported by the residents in the area. Access to homes near the Bluff Road sag point and Dundee Road are significantly impacted due to street flooding. The overland runoff eventually flows west down Dundee Road and into the low area on Skokie Ridge Drive significantly contributing to the flooding problems in problem area 3.

Problem area 2 is caused by insufficient storm sewer capacity and inadequate overflow routes on Sunset Lane. When the existing storm sewer is overwhelmed water will pond to depths in excess of 1 foot at the sag point prior to overflowing the right-of-way. Once outside the public ROW storm water flows south through private properties resulting in basement, garage, and yard flooding. As water continues south it contributes to flooding problems in problem area 3.

Problem area 3 is caused by insufficient storm sewer capacity, inadequate overflow routes, and overland flow coming from problem areas 1 & 2. Skokie Ridge Drive north of Dundee Road is currently served by an 8-inch pipe which can be quickly overwhelmed. When this occurs storm water ponds to depths in excess of 3-feet resulting in significant structural, street, and yard flooding.

Based on the hydrologic/hydraulic analysis performed, a review of completed residential surveys, and discussions with Village Public Works staff approximately 30 homes within this basin area are impacted by roadway flooding and overland flow through private properties. The table below details the properties impacted in existing conditions.

SKOKIE RIDGE IMPACT SUMMARY					
LOCATION		STORM EVENT			
		2-YEAR	10-YEAR	50-YEAR	100-YEAR
EAST OF BLUFF ROAD	PROPERTIES IMPACTED	0	0	7	7
BLUFF ROAD TO DUNDEE	PROPERTIES IMPACTED	2	4	8	8
SKOKIE RIDGE AND DUNDEE	PROPERTIES IMPACTED	4	4	4	4
SUNSET LANE WEST OF BLUFF	PROPERTIES IMPACTED	0	0	11	11
TOTAL	PROPERTIES IMPACTED	6	8	30	30

5.2 ANALYSIS OF ALTERNATIVES

Based upon the analysis performed, it is apparent that reported flooding problems within the Skokie Ridge Basin are caused by inadequate conveyance capacity of storm sewers and poorly defined overflow routes. Several design alternatives to reduce the frequency and severity of flooding were developed and analyzed. The alternatives that were considered most feasible and effective are described below and shown on Exhibits 11 and 12.

Alternative 1: Upsize storm sewer to convey the 10-year event from the Skokie Ridge Basin to the 60–inch storm sewer on Dundee Road flowing west to East Diversion Ditch.

Alternative 2: Upsize storm sewer to convey the 100-year event from the Skokie Ridge Basin to the 60–inch storm sewer on Dundee Road flowing west to East Diversion Ditch.

The proposed alternatives were analyzed in detail to determine their effectiveness in reducing flooding frequency and severity. Both alternatives include proposed storm sewer improvements to reduce roadway flooding and overtopping at roadway sag points on Bluff Road, Sunset Lane, and Skokie Ridge Drive. The first alternative provides protection for the 10-year storm event and the second provides protection for the 100-year storm event. The 10-year storm event option includes the installation of approximately 2,800 linear feet of 15 to 24-inch diameter pipes at an estimated cost of $1,250,000. The 100-year storm event flood risk option included the installation of approximately 3,500 linear feet of 18 to 30-inch pipes at an estimated cost of $1,840,000. Both alternatives have been designed to utilize the capacity of the 60-inch storm sewer installed in 2005 to help alleviate flooding at the sag point on Oak Ridge Drive just south of Sunset Lane. This sewer was designed to accommodate future storm sewer improvements within the entire watershed. Detailed cost estimate information can be found in Appendix B. The following table details the properties impacted for both proposed alternatives.

SKOKIE RIDGE ALT. 1/ALT. 2 IMPACT SUMMARY					
SCENARIO		STORM EVENT			
		2-YEAR	10-YEAR	50-YEAR	100-YEAR
		ALT 1./ALT. 2	ALT 1./ALT. 2	ALT 1./ALT. 2	ALT 1./ALT. 2
EAST OF BLUFF ROAD	PROPERTIES IMPACTED	0/0	0/0	6/0	6/0
BLUFF ROAD TO DUNDEE	PROPERTIES IMPACTED	0/0	0/0	7/0	7/0
SKOKIE RIDGE AND DUNDEE	PROPERTIES IMPACTED	0/0	0/0	4/0	4/0
SUNSET LANE WEST OF BLUFF	PROPERTIES IMPACTED	0/0	0/0	11/0	11/0
TOTAL	PROPERTIES IMPACTED	0/0	0/0	28/0	28/0

5.3 RECOMMENDATIONS & CONCLUSIONS

Based upon the alternatives presented above, Alternative 2, a 100-year storm sewer system, is recommended at this time. This basin experiences significant flood depths that result in structural flooding and blocked vehicular and emergency access. Providing a storm sewer with less than a 100-year level of protection would still result in significant flooding for a number of homes. We recommend that the village work with residents in this area to preserve overland flow routes similar to the recommendations for the Terrace Court Basin.

6.0 MADISON AVENUE BASIN

6.1 PROBLEM AREA DESCRIPTION

The Madison Avenue Watershed is an 8-acre watershed that drains stormwater from an area with approximate limits of Jefferson Avenue to the north, Maddison Avenue to the south, Vernon Avenue to the east, and Greenwood Avenue to the west. Exhibit 13 shows the drainage area for the Madison Avenue Basin. Runoff from the basin is directed to the sag point on Madison Avenue where dual 10-inch sewers drain water west to Grove Street where water is conveyed south ultimately discharging to the Ivy Lane outlet to the East Diversion Ditch.

The drainage problems in this watershed are directly related to the capacity of the existing storm sewer and the lack of a defined overland flow path between Madison and Monroe Avenues. When runoff from the watershed overwhelms the dual 10-inch storm sewers water ponds on Madison Avenue to depths in excess of 2-feet blocking access to homes and causing significant structural and yard flooding. When flood elevations get high enough stormwater overflows south and west through private properties adding to flood damages as shown on Exhibit 14. Based on the hydrologic/hydraulic analysis, residential surveys, and discussions with Glencoe Public Works staff approximately 13 homes are impacted by road flooding and overflow through private properties. The table below summarizes the properties impacted for the storm events analyzed.

MADISON IMPACT SUMMARY					
SCENARIO		STORM EVENT			
		2-YEAR	10-YEAR	50-YEAR	100-YEAR
EXISTING	PROPERTIES IMPACTED	6	13	13	13

6.2 ANALYSIS OF ALTERNATIVES

Based upon the analysis performed, it is apparent that reported flooding problems within the Madison Avenue Basin are caused by inadequate conveyance capacity of storm sewers and poorly defined overflow routes. Several design alternatives to reduce the frequency and severity of flooding were developed and analyzed. The alternatives that were considered most feasible and effective are described below.

Alternative 1: Upsize storm sewer to 15-inch to convey the 10-year event from the sag on Madison Avenue to storm sewer on Greenwood Avenue south of Madison Avenue.

Alternative 2: Upsize storm sewer to convey the 100-year event from the sag on Madison Avenue to storm sewer on Greenwood Avenue south of

Madison Avenue. Increased storm sewer sizes range from 15- to 24-inches.

Alternative 3: Provide detention on Madison Avenue in 48-inch oversized storm sewers and grading improvements at the Madison Avenue sag to contain the flooding to the Madison Avenue ROW.

Three proposed alternatives were analyzed in detail to determine their effectiveness in reducing flooding frequency and severity. The alternatives can be seen on Exhibits 15, 16, and 17. Two alternatives included proposed storm sewer improvements to reduce roadway flooding and overtopping at the low areas on Madison Avenue. Both of these alternatives tie proposed storm sewer into smaller existing storm sewer. The overflow is then contained to the ROW on Greenwood Avenue rather than overtopping Madison Avenue and running through residential property and then flowing onto Greenwood Avenue ROW. The third alternative utilizes underground detention along Madison Avenue and grading improvements in the low area on Madison Avenue. The first alternative provides protection for the 10-year storm event and the second provides protection for the 100-year storm event. Both storm sewer options include replacing storm sewer on Madison Avenue and routing it south along Greenwood Avenue. The third option protects the residents in the 100-year storm event and it protects from street flooding in the 50-year storm event.

The 10-year level of protection included the installation of approximately 960 linear feet of 15-inch pipes at an estimated cost of $570,000. The 100-year level of protection included the installation of approximately 960 linear feet of 15 to 24-inch pipes at an estimated cost of $620,000. The detention and grading option included the installation of 1000 linear feet of 48-inch pipes amounting to 0.3 acre-feet of storage along with grading and sidewalk and driveway replacement at an estimated cost of $770,000.

MADISON AVENUE IMPACT SUMMARY					
SCENARIO		STORM EVENT			
		2-YEAR	10-YEAR	50-YEAR	100-YEAR
EXISTING	PROPERTIES IMPACTED	4	13	13	13
ALTERNATE 1	PROPERTIES IMPACTED	0	0	13	13
ALTERNATE 2	PROPERTIES IMPACTED	0	0	0	0
ALTERNATE 3	PROPERTIES IMPACTED	0	0	0	8

6.3 RECOMMENDATIONS & CONCLUSIONS

Based upon the alternatives presented above, Alternative 2, a 100-year storm sewer system, is recommended at this time. This basin experiences significant flood depths that result in structural flooding and blocked vehicular and emergency access. Providing a storm sewer with less than a 100-year level of protection would still result in significant flooding for a number of homes. The 10-year storm sewer and detention options do not protect as many homes while costing similar amounts to Alternative 2. We recommend that the Village work with residents in this area to preserve overland flow routes similar to the recommendations for the Terrace Court Basin.

7.0 HAZEL AVENUE BASIN

7.1 PROBLEM AREA DESCRIPTION

The Hazel Avenue watershed is a 19-acre watershed that drains stormwater from an area with approximate limits of Park Avenue to the north, Hazel Avenue to the south, Vernon Avenue to the west, and Green Bay Road to the east. Exhibit 18 shows the drainage area for the Hazel Avenue Basin. Runoff from the basin is directed to the Green Bay Road and UP-North underpass on Hazel Avenue where an 18" storm sewer drains water east and south through 1800 feet of storm sewer to a natural ravine adjacent to Hawthorn Avenue that discharges to Lake Michigan.

The drainage problem in this watershed is directly related to the capacity of the existing storm sewers. When runoff from the watershed overwhelms the 18-inch storm sewer, water ponds in the Hazel Avenue underpass to depths in excess of 4-feet. When flood elevations get high enough stormwater overflows north along the Village Hall driveway causing structural flooding to the basement of the Village Hall.

7.2 ANALYSIS OF ALTERNATIVES

Based upon the analysis performed, it is apparent that reported flooding problems within the Hazel Avenue Basin are caused by inadequate conveyance capacity of storm sewers. Several design alternatives to reduce the frequency and severity of flooding were developed and analyzed. The alternatives that were considered most feasible and effective are described below.

Alternative 1: Upsize storm sewer to convey the 100-year event from the Hazel Avenue Basin to the natural ravine adjacent to Hawthorn Avenue.

Alternative 2: Reconstruct and re-grade the Village Hall driveway to provide protection from street flooding and installation of a sump pit and pump.

The proposed alternatives were analyzed in detail to determine their effectiveness in reducing flooding frequency and severity. The first alternative provides protection for the 100-year storm event. It includes replacing storm sewer from the Hazel Avenue underpass to the outlet at the Hawthorn Avenue ravine. The driveway reconstruction would involve re-grading the driveway off of Hazel Avenue to the east side of the Village Hall.

The 100-year storm option includes the installation of approximately 1800 linear feet of 48-inch pipes at an estimated cost of $1,370,000. Alternative 2 includes reconstruction of the existing driveway and the installation of a pump system adjacent to the building at an estimated cost of $190,000.

7.3 RECOMMENDATIONS & CONCLUSIONS

While the 100-year storm sewer protects the building from the 100-year storm event, its cost is over $1,000,000 more than the driveway reconstruction. The driveway work could be implemented at a much lower cost and protect from 100-year storm events.

Appendices

Appendix A:
Terrace Court Cost Estimates

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

TERRACE COURT
10-YEAR STORM IMPROVEMENTS
VILLAGE OF GLENCOE

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	PERIMETER EROSION BARRIER	FOOT	200	$6.00	$1,200.00
2	TRENCH BACKFILL	CU YD	1275	$50.00	$63,750.00
3	STORM SEWER CONNECTIONS	EACH	10	$1,500.00	$15,000.00
4	STORM SEWER, 18"	FOOT	360	$84.00	$30,240.00
5	STORM SEWER, 24"	FOOT	1025	$125.00	$128,125.00
6	MANHOLES, 4' DIA.	EACH	12	$4,000.00	$48,000.00
7	INLETS	EACH	24	$1,700.00	$40,800.00
8	PAVEMENT PATCHING, FULL DEPTH, 5"	SQ YD	925	$125.00	$115,625.00
9	DRIVEWAY REMOVAL & REPLACEMENT	SQ YD	15	$75.00	$1,125.00
10	SANITARY SERVICE ADJUST	FOOT	210	$90.00	$18,900.00
11	CURB & GUTTER REMOVAL & REPLACEMENT	FOOT	350	$35.00	$12,250.00
12	WATERMAIN ADJUST	FOOT	100	$200.00	$20,000.00
13	WATER SERVICE LINE ADJUST	EACH	14	$275.00	$3,850.00
14	ADDITIONAL HAULING	LOAD	40	$500.00	$20,000.00
15	TRAFFIC CONTROL & PROTECTION	L SUM	1	$50,000.00	$50,000.00

SUBTOTAL	$568,865.00
20% CONTINGENCY	$113,773.00
SUBTOTAL	$682,638.00
15% ENGINEERING COST	$102,395.70
TOTAL	**$785,033.70**

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

TERRACE COURT
100-YEAR STORM IMPROVEMENTS
VILLAGE OF GLENCOE

TERRACE COURT IMPROVEMENTS

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	PERIMETER EROSION BARRIER	FOOT	200	$6.00	$1,200.00
2	TRENCH BACKFILL	CU YD	1675	$50.00	$83,750.00
3	STORM SEWER CONNECTIONS	EACH	10	$1,500.00	$15,000.00
4	STORM SEWER, 12"	FOOT	190	$68.00	$12,920.00
5	STORM SEWER, 24"	FOOT	217	$125.00	$27,125.00
6	STORM SEWER, 30"	FOOT	370	$150.00	$55,500.00
7	STORM SEWER, 36"	FOOT	1055	$180.00	$189,900.00
8	MANHOLES, 6' DIA.	EACH	14	$7,000.00	$98,000.00
9	MANHOLES, 4' DIA.	EACH	5	$4,000.00	$20,000.00
10	INLETS	EACH	38	$1,700.00	$64,600.00
11	DRIVEWAY REMOVAL & REPLACEMENT	SQ YD	25	$75.00	$1,875.00
12	PAVEMENT PATCHING, FULL DEPTH, 5"	SQ YD	1225	$125.00	$153,125.00
13	SANITARY SERVICE ADJUST	FOOT	270	$90.00	$24,300.00
14	CURB & GUTTER REMOVAL & REPLACEMENT	FOOT	500	$35.00	$17,500.00
15	WATERMAIN ADJUST	FOOT	100	$200.00	$20,000.00
16	WATER SERVICE LINE ADJUST	EACH	18	$275.00	$4,950.00
17	ADDITONAL HAULING	LOAD	60	$500.00	$30,000.00
18	TRAFFIC CONTROL & PROTECTION	L SUM	1	$50,000.00	$50,000.00
				SUBTOTAL	$869,745.00

LINDA LANE ADDITIONAL IMPROVEMENTS

1	TRENCH BACKFILL	CU YD	50	$50.00	$2,500.00
2	STORM SEWER, 18", RCP	FOOT	50	$84.00	$4,200.00
3	STORM SEWER, 18", RCP, DIR. DRILLED	FOOT	310	$300.00	$93,000.00
4	MANHOLES, 4' DIA.	EACH	3	$4,000.00	$12,000.00
				SUBTOTAL	$111,700.00

CAROL LANE ADDITIONAL IMPROVEMENTS

1	TRENCH BACKFILL	CU YD	25	$50.00	$1,250.00
2	STORM SEWER, 12", RCP	FOOT	25	$84.00	$2,100.00
3	STORM SEWER, 12", RCP, DIR. DRILLED	FOOT	150	$275.00	$41,250.00
4	MANHOLES, 4' DIA.	EACH	4	$4,000.00	$16,000.00
				SUBTOTAL	$60,600.00

20% CONTINGENCY	$208,409.00
SUBTOTAL	$1,078,154.00
15% ENGINEERING COST	$161,723.10
TOTAL	**$1,239,877.10**

Appendix B:
Greenwood Avenue Cost Estimates

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

GREENWOOD AVE
10-YEAR STORM IMPROVEMENTS
VILLAGE OF GLENCOE

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	PERIMETER EROSION BARRIER	FOOT	500	$6.00	$3,000.00
2	TRENCH BACKFILL	CU YD	2085	$50.00	$104,250.00
3	STORM SEWER CONNECTIONS	EACH	14	$1,500.00	$21,000.00
4	STORM SEWER, 18"	FOOT	870	$84.00	$73,080.00
5	STORM SEWER, 30"	FOOT	1200	$150.00	$180,000.00
6	STORM SEWER, 36"	FOOT	200	$180.00	$36,000.00
7	MANHOLES, 4' DIA.	EACH	4	$4,000.00	$16,000.00
8	MANHOLES, 6' DIA.	EACH	7	$7,000.00	$49,000.00
9	INLETS	EACH	22	$1,700.00	$37,400.00
10	PAVEMENT PATCHING, FULL DEPTH, 5"	SQ YD	1514	$125.00	$189,250.00
11	DRIVEWAY REMOVAL & REPLACEMENT	SQ YD	20	$75.00	$1,500.00
12	SANITARY SERVICE ADJUST	FOOT	345	$90.00	$31,050.00
13	CURB & GUTTER REMOVAL & REPLACEMENT	FOOT	300	$35.00	$10,500.00
14	WATERMAIN ADJUST	FOOT	200	$200.00	$40,000.00
15	WATER SERVICE LINE ADJUST	EACH	23	$275.00	$6,325.00
16	ADDITIONAL HAULING	LOAD	60	$500.00	$30,000.00
17	TRAFFIC CONTROL & PROTECTION	L SUM	1	$50,000.00	$50,000.00
				SUBTOTAL	$878,355.00
				20% CONTINGENCY	$175,671.00
				SUBTOTAL	$1,054,026.00
				15% ENGINEERING COST	$158,103.90
				TOTAL	**$1,212,129.90**

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

GREENWOOD AVE
100-YEAR STORM IMPROVEMENTS
VILLAGE OF GLENCOE

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	PERIMETER EROSION BARRIER	FOOT	500	$6.00	$3,000.00
2	TRENCH BACKFILL	CU YD	2217	$50.00	$110,850.00
3	STORM SEWER CONNECTIONS	EACH	22	$1,500.00	$33,000.00
4	STORM SEWER, 30"	FOOT	870	$150.00	$130,500.00
5	STORM SEWER, 36"	FOOT	900	$180.00	$162,000.00
6	STORM SEWER, 48"	FOOT	500	$245.00	$122,500.00
7	MANHOLES, 6' DIA.	EACH	11	$7,000.00	$77,000.00
8	INLETS	EACH	22	$1,700.00	$37,400.00
9	PAVEMENT PATCHING, FULL DEPTH, 5"	SQ YD	1514	$125.00	$189,250.00
10	DRIVEWAY REMOVAL & REPLACEMENT	SQ YD	20	$75.00	$1,500.00
11	SANITARY SERVICE ADJUST	FOOT	345	$90.00	$31,050.00
12	CURB & GUTTER REMOVAL & REPLACEMENT	FOOT	400	$35.00	$14,000.00
13	WATERMAIN ADJUST	FOOT	200	$200.00	$40,000.00
14	WATER SERVICE LINE ADJUST	EACH	23	$275.00	$6,325.00
15	ADDITIONAL HAULING	LOAD	60	$500.00	$30,000.00
16	TRAFFIC CONTROL & PROTECTION	L SUM	1	$50,000.00	$50,000.00

SUBTOTAL	$1,038,375.00
20% CONTINGENCY	$207,675.00
SUBTOTAL	$1,246,050.00
15% ENGINEERING COST	$186,907.50
TOTAL	**$1,432,957.50**

Appendix C:
Skokie Ridge Cost Estimates

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

SKOKIE RIDGE / BLUFF RD
10-YEAR STORM IMPROVEMENTS
VILLAGE OF GLENCOE

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	PERIMETER EROSION BARRIER	FOOT	200	$6.00	$1,200.00
2	TRENCH BACKFILL	CU YD	2530	$50.00	$126,500.00
3	STORM SEWER CONNECTIONS	EACH	15	$1,500.00	$22,500.00
4	STORM SEWER, 15"	FOOT	550	$76.00	$41,800.00
5	STORM SEWER, 18"	FOOT	1750	$84.00	$147,000.00
6	STORM SEWER, 24"	FOOT	500	$125.00	$62,500.00
7	MANHOLES, 4' DIA.	EACH	12	$4,000.00	$48,000.00
8	MANHOLES, 6' DIA.	EACH	1	$7,000.00	$7,000.00
9	INLETS	EACH	26	$1,700.00	$44,200.00
10	DRIVEWAY REMOVAL & REPLACMENT	SQ YD	30	$75.00	$2,250.00
11	PAVEMENT PATCHING, FULL DEPTH, 5"	SQ YD	1870	$125.00	$233,750.00
12	SANITARY SERVICE ADJUST	FOOT	330	$90.00	$29,700.00
13	CURB & GUTTER REMOVAL & REPLACEMENT	FOOT	750	$35.00	$26,250.00
14	WATERMAIN ADJUST	FOOT	100	$200.00	$20,000.00
15	WATER SERVICE LINE ADJUST	EACH	22	$275.00	$6,050.00
16	ADDITIONAL HAULING	LOAD	50	$500.00	$25,000.00
17	TRAFFIC CONTROL & PROTECTION	L SUM	1	$60,000.00	$60,000.00

SUBTOTAL	$903,700.00
20% CONTINGENCY	$180,740.00
SUBTOTAL	$1,084,440.00
15% ENGINEERING COST	$162,666.00
TOTAL	**$1,247,106.00**

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

SKOKIE RIDGE / BLUFF RD
100-YEAR STORM IMPROVEMENTS
VILLAGE OF GLENCOE

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	PERIMETER EROSION BARRIER	FOOT	200	$6.00	$1,200.00
2	TRENCH BACKFILL	CU YD	3250	$50.00	$162,500.00
3	STORM SEWER CONNECTIONS	EACH	18	$1,500.00	$27,000.00
4	STORM SEWER, 18"	FOOT	100	$84.00	$8,400.00
5	STORM SEWER, 24"	FOOT	1350	$125.00	$168,750.00
6	STORM SEWER, 30"	FOOT	2050	$150.00	$307,500.00
7	MANHOLES, 6' DIA.	EACH	9	$7,000.00	$63,000.00
8	MANHOLES, 4' DIA.	EACH	9	$4,000.00	$36,000.00
9	INLETS	EACH	36	$1,700.00	$61,200.00
10	DRIVEWAY REMOVAL & REPLACMENT	SQ YD	35	$75.00	$2,625.00
11	PAVEMENT PATCHING, FULL DEPTH, 5"	SQ YD	2335	$125.00	$291,875.00
12	SANITARY SERVICE ADJUST	FOOT	405	$90.00	$36,450.00
13	CURB & GUTTER REMOVAL & REPLACEMENT	FOOT	1000	$35.00	$35,000.00
14	WATERMAIN ADJUST	FOOT	100	$200.00	$20,000.00
15	WATER SERVICE LINE ADJUST	EACH	27	$275.00	$7,425.00
16	ADDITIONAL HAULING	LOAD	90	$500.00	$45,000.00
17	TRAFFIC CONTROL & PROTECTION	L SUM	1	$60,000.00	$60,000.00

SUBTOTAL	$1,333,925.00
20% CONTINGENCY	$266,785.00
SUBTOTAL	$1,600,710.00
15% ENGINEERING COST	$240,106.50
TOTAL	**$1,840,816.50**

Appendix D:
Madison Avenue Cost Estimates

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MADISON BASIN
10-YEAR STORM IMPROVEMENTS
VILLAGE OF GLENCOE

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	PERIMETER EROSION BARRIER	FOOT	200	$6.00	$1,200.00
2	TRENCH BACKFILL	CU YD	1150	$50.00	$57,500.00
3	STORM SEWER CONNECTIONS	EACH	5	$1,500.00	$7,500.00
4	STORM SEWER, 15"	FOOT	960	$76.00	$72,960.00
5	MANHOLES, 4' DIA.	EACH	8	$4,000.00	$32,000.00
6	INLETS	EACH	16	$1,700.00	$27,200.00
7	DRIVEWAY REMOVAL & REPLACMENT	SQ YD	20	$75.00	$1,500.00
8	PAVEMENT PATCHING, FULL DEPTH, 5"	SQ YD	870	$125.00	$108,750.00
9	SANITARY SERVICE ADJUST	FOOT	195	$90.00	$17,550.00
10	CURB & GUTTER REMOVAL & REPLACEMENT	FOOT	500	$35.00	$17,500.00
11	WATERMAIN ADJUST	FOOT	75	$200.00	$15,000.00
12	WATER SERVICE LINE ADJUST	EACH	13	$275.00	$3,575.00
13	ADDITIONAL HAULING	LOAD	25	$500.00	$12,500.00
14	TRAFFIC CONTROL & PROTECTION	L SUM	1	$40,000.00	$40,000.00

SUBTOTAL	$414,735.00
20% CONTINGENCY	$82,947.00
SUBTOTAL	$497,682.00
15% ENGINEERING COST	$74,652.30
TOTAL	**$572,334.30**

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MADISON BASIN
100-YEAR STORM IMPROVEMENTS
VILLAGE OF GLENCOE

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	PERIMETER EROSION BARRIER	FOOT	200	$6.00	$1,200.00
2	TRENCH BACKFILL	CU YD	1163	$50.00	$58,150.00
3	STORM SEWER CONNECTIONS	EACH	5	$1,500.00	$7,500.00
4	STORM SEWER, 15"	FOOT	330	$76.00	$25,080.00
5	STORM SEWER, 18"	FOOT	330	$84.00	$27,720.00
6	STORM SEWER, 24"	FOOT	300	$125.00	$37,500.00
7	MANHOLES, 4' DIA.	EACH	8	$4,000.00	$32,000.00
8	INLETS	EACH	16	$1,700.00	$27,200.00
9	DRIVEWAY REMOVAL & REPLACMENT	SQ YD	25	$75.00	$1,875.00
10	PAVEMENT PATCHING, FULL DEPTH, 5"	SQ YD	855	$125.00	$106,875.00
11	SANITARY SERVICE ADJUST	FOOT	195	$90.00	$17,550.00
12	CURB & GUTTER REMOVAL & REPLACEMENT	FOOT	600	$35.00	$21,000.00
13	WATERMAIN ADJUST	FOOT	100	$200.00	$20,000.00
14	WATER SERVICE LINE ADJUST	EACH	13	$275.00	$3,575.00
15	ADDITIONAL HAULING	LOAD	30	$500.00	$15,000.00
16	TRAFFIC CONTROL & PROTECTION	L SUM	1	$50,000.00	$50,000.00
				SUBTOTAL	$452,225.00
				20% CONTINGENCY	$90,445.00
				SUBTOTAL	$542,670.00
				15% ENGINEERING COST	$81,400.50
				TOTAL	**$624,070.50**

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MADISON BASIN
DETENTION / GRADING ALTERNATE
VILLAGE OF GLENCOE

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	PERIMETER EROSION BARRIER	FOOT	200	$6.00	$1,200.00
2	TRENCH BACKFILL	CU YD	820	$50.00	$41,000.00
3	STORM SEWER CONNECTIONS	EACH	4	$1,500.00	$6,000.00
4	STORM SEWER, 48"	FOOT	1000	$245.00	$245,000.00
5	MANHOLES, 6' DIA.	EACH	5	$7,000.00	$35,000.00
6	INLETS	EACH	10	$1,700.00	$17,000.00
7	DRIVEWAY REMOVAL & REPLACMENT	SQ YD	25	$75.00	$1,875.00
8	PAVEMENT PATCHING, FULL DEPTH, 5"	SQ YD	670	$125.00	$83,750.00
9	SANITARY SERVICE ADJUST	FOOT	165	$90.00	$14,850.00
10	CURB & GUTTER REMOVAL & REPLACEMENT	FOOT	500	$35.00	$17,500.00
11	WATERMAIN ADJUST	FOOT	100	$200.00	$20,000.00
12	WATER SERVICE LINE ADJUST	EACH	11	$275.00	$3,025.00
13	ADDITIONAL HAULING	LOAD	35	$500.00	$17,500.00
14	TRAFFIC CONTROL & PROTECTION	L SUM	1	$50,000.00	$50,000.00
15	SIDEWALK REPLACEMENT	SF	1500	$5.00	$7,500.00

SUBTOTAL	$561,200.00
20% CONTINGENCY	$112,240.00
SUBTOTAL	$673,440.00
15% ENGINEERING COST	$101,016.00
TOTAL	**$774,456.00**

Appendix E:
Hazel Avenue Cost Estimates

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

HAZEL AVE
HAZEL AVE STORM IMPROVEMENTS
VILLAGE OF GLENCOE

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	PERIMETER EROSION BARRIER	FOOT	200	$6.00	$1,200.00
2	TEMPORARY FENCE	FOOT	3600	$4.00	$14,400.00
3	TRENCH BACKFILL	CU YD	1480	$50.00	$74,000.00
4	TREE TRUNK PROTECTION	EACH	80	$200.00	$16,000.00
5	TREE PRUNING	EACH	40	$200.00	$8,000.00
6	STORM SEWER CONNECTIONS	EACH	5	$1,500.00	$7,500.00
7	STORM SEWER, 48"	FOOT	1800	$245.00	$441,000.00
8	MANHOLES, 6' DIA.	EACH	10	$7,000.00	$70,000.00
9	MANHOLES, 4' DIA.	EACH	5	$4,000.00	$20,000.00
10	INLETS	EACH	30	$1,700.00	$51,000.00
11	DRIVEWAY REMOVAL & REPLACEMENT	SQ YD	25	$75.00	$1,875.00
12	PAVEMENT PATCHING, FULL DEPTH, 5"	SQ YD	1200	$125.00	$150,000.00
13	SANITARY SERVICE ADJUST	FOOT	210	$90.00	$18,900.00
14	CURB & GUTTER REMOVAL & REPLACEMENT	FOOT	500	$35.00	$17,500.00
15	WATERMAIN ADJUST	FOOT	100	$200.00	$20,000.00
16	WATER SERVICE LINE ADJUST	EACH	14	$275.00	$3,850.00
17	ADDITONAL HAULING	LOAD	60	$500.00	$30,000.00
18	TRAFFIC CONTROL & PROTECTION	L SUM	1	$50,000.00	$50,000.00

SUBTOTAL	$995,225.00
20% CONTINGENCY	$199,045.00
SUBTOTAL	$1,194,270.00
15% ENGINEERING COST	$179,140.50
TOTAL	**$1,373,410.50**

PRELIMINARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

HAZEL AVE
VILLAGE HALL PUMP IMPROVEMENTS
VILLAGE OF GLENCOE

	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	INLET PROTECTOR	EACH	3	$140.00	$420.00
2	INLET PROTECTOR CLEANING	EACH	3	$50.00	$150.00
3	DRIVEWAY PAVEMENT HMA R & R (SPECIAL)	SQ YD	530	$125.00	$66,250.00
4	PAVEMENT PATCH	SQ YD	33	$100.00	$3,300.00
5	PC CONC SIDEWALK 5" R&R	SQ FT	220	$13.00	$2,860.00
6	COMB CURB AND GUTTER, R & R	FOOT	45	$30.00	$1,350.00
7	STORM SEWER CONNECTIONS	EACH	1	$1,500.00	$1,500.00
8	FORCEMAIN PIPE AND FITTINGS, 4"	FOOT	125	$50.00	$6,250.00
9	STORM SEWER, 12"	FOOT	75	$70.00	$5,250.00
10	MANHOLES, 4' DIA.	EACH	1	$4,000.00	$4,000.00
11	INLETS	EACH	1	$1,700.00	$1,700.00
12	TRENCH BACKFILL	CU YD	90	$50.00	$4,500.00
13	PUMP, WET WELL & CONTROL PANEL	L SUM	1	$30,000.00	$30,000.00
14	TRAFFIC CONTROL & PROTECTION	L SUM	1	$10,000.00	$10,000.00

SUBTOTAL	$137,530.00
20% CONTINGENCY	$27,506.00
SUBTOTAL	$165,036.00
15% ENGINEERING COST	$24,755.40
TOTAL	**$189,791.40**