CITY OF PROSPECT HEIGHTS
2011-12 DRAINAGE STUDY

Prepared For:

City of Prospect Heights
8 N. Elmhurst Road
Prospect Heights, Illinois 6007

Prepared By:

Christopher B. Burke Engineering, Ltd.
9575 West Higgins Road, Suite 600
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CBBEL PROJECT No. 11-412

November 21, 2012

CHRISTOPHER B. BURKE ENGINEERING , LTD.
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TAB 1

Dorset Street Flooding Probem Area

MEMORANDUM

September 18, 2012

TO: Anne Marin – City Administrator, Prospect Heights
Steve Skiber – Director of Building and Zoning, Prospect Heights
James H. Johnson, PE – Director of Public Works and City Engineer
James O'Neill – Public Works Foreman, Prospect Heights

COPY: Donald R. Dressel, PE - CBBEL
Project Files (CBBEL Project No. 11-412)

FROM: Erik L. Gil, PE

SUBJECT: **Dorset Street Flooding Problem Area**
Project: 2011-12 Prospect Heights Flood Study
Location: Prospect Heights, Cook County, Illinois
Watershed: Tributary A to McDonald Creek

INTRODUCTION

Christopher B. Burke Engineering Ltd. (CBBEL) was retained by the City of Prospect Heights (City) to perform a flood risk reduction analysis based on the flooding from the July 22-23, 2011 event. The primary goals of this study were to determine the extent of the flood damage, establish possible causes for the flooding and to provide potential solutions to reduce the risk of future flooding.

This memorandum documents the analysis for the Dorset Street Study Area. Separate memoranda will be provided for each of the other study areas, and will be assembled in a single report at the conclusion of the study.

JULY 22-23, 2011 EVENT PRECIPITATION

On July 23, 2011 the City received approximately 4.81 inches of rain in a 3-hour period that resulted in extensive flood damage in certain areas of the City. The City received 6.17 inches of rain in a 24-hour period from July 22nd to the 23rd. The rainfall totals were based on the rainfall values obtained from the gages shown in Table 1 below, which are from both the O'Hare International Airport and the Chicago Executive Airport weather gages.

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TABLE 1
Rainfall Values

Gage ID	Location	3-hour Total (inches)	24-hour Total (inches)
04838	Chicago Executive Airport	4.71	6.06
94846	O'Hare International Airport	6.79	8.21
	Weighted Average =	*4.81*	*6.17*
	ISWS Bulletin 70 frequency at Prospect Heights*	100-year	40-year

*Note: The stated frequency is approximate.

Two durations were chosen for discussion purposes, the 3-hour duration and the 24-hour duration. The 24-hour duration is the traditional duration used for many engineering calculations and is the typical one reported by the media. The 3-hour duration was also chosen for comparison purposes for 2 reasons. The first is that most of the flooding problem drainage areas being evaluated in this flood study respond to significant short-duration rainfall events within or shortly after a 3-hour period, that is, the flood peak is typically reached shortly after this time period if rain is no longer falling, as was the case during July 23, 2011. The Des Plaines River, for example, would not respond as quickly to a significant short-duration rainfall event. The second reason is that the rainfall totals for the most severe continuous 3-hour period at the O'Hare International Airport gage exceeded the 100-year frequency as documented in the Illinois State Water Survey (ISWS) Bulletin 70 publication, the reference used by most regulatory agencies in the northeastern Illinois area for rainfall depth design values. The Chicago Executive Airport gage did not exceed the 100-year frequency value for the 3-hour event, but it was sufficiently close to be considered as the 100-year frequency. As can be observed, the two gage values at O'Hare International Airport and at Chicago Executive Airport differed by over 2 inches of rainfall for each of the reported totals. This meant that the July 22-23, 2011 event was a relatively localized storm event. For purposes of this study, a simple weighted average between the two gages was computed to estimate the rainfall totals that fell on the City, assigning a 95% weight to Chicago Executive Airport based on distance from the City as compared to the O'Hare International Airport, which was assigned a 5% weight.

The July 23rd–24th storm event exceeded the capacity of the storm sewer systems in the older parts of town and resulted in street, backyard, and home flooding. Approximately 161 residents within the City filled out a flood questionnaire after the July 23rd storm event.

REFERENCES AND AVAILABLE INFORMATION

- Meetings with City staff,
- Summary provided by City staff of 161 flood questionnaires submitted during 2011 by City residents,
- Site visits,
- Cook County 1-foot contour aerial topography,
- City storm sewer maps,

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- Approximate high water depths provided by City staff and residents,
- United States Geological Survey (USGS) Hydrologic Atlas (HA),
- Historic Aerial Photographs,
- Federal Emergency Management Agency (FEMA) Federal Insurance Rate Maps (FIRMs)

OVERVIEW

The Dorset Street study area is located in the south-central west area of the City. In general, the study area is bounded by Willow Road on the north, Olive Street on the south, Schoenbeck Road on the east and Dale Avenue on the west, with specific flooding concerns along Dorset Street. The street map of this location is shown on Figure 1.

The study area is within the Tributary A to McDonald Creek watershed and is located within a historical depressional area. Photograph 1 shows Dorset Street looking east toward Schoenbeck Road.

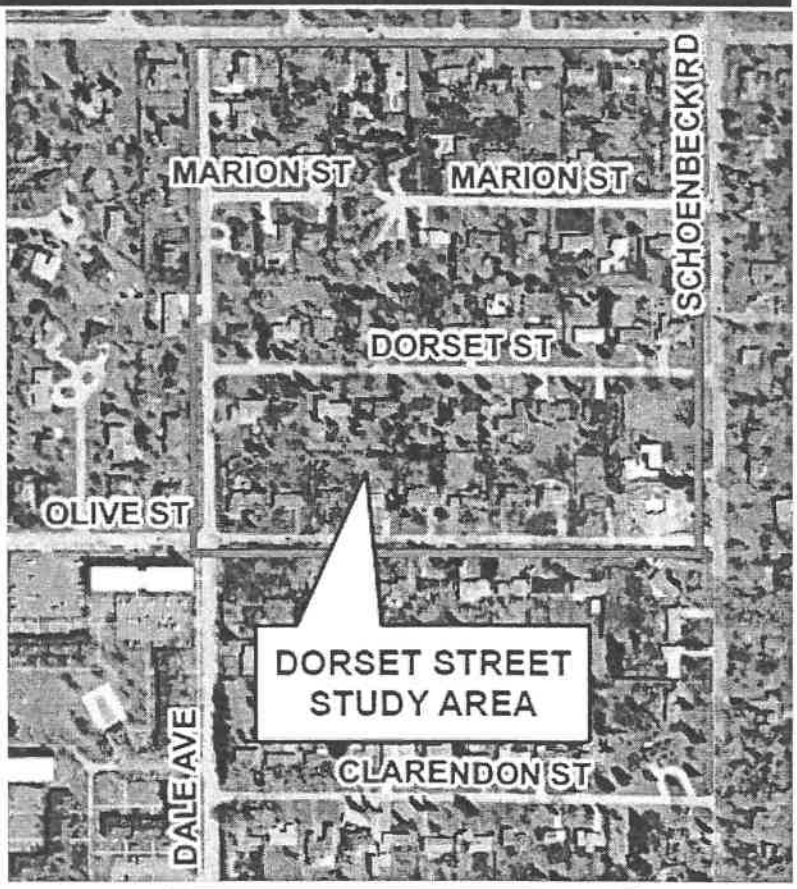

Figure 1
Dorset Street Map

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PHOTOGRAPH 1
Dorset Street Looking East (towards Schoenbeck Road)

EXISTING DRAINAGE PATTERN

Currently, most of the study area drains overland to a storm sewer system that begins on Dorset Street, flows south between side yards, turns east along Olive Street towards Schoenbeck Road at which point it continues south along Schoenbeck Road (Cook County right-of-way) where it connects to the Cook County storm sewer along Camp McDonald, which runs from west to east and discharges into Tributary A to McDonald Creek (Tributary A) within the Old Orchard Country Club, as shown on Exhibit 2.

The flooding problem area, the existing storm sewer system and the drainage divides are shown on Exhibit 2. These streets have a rural section, that is, there is no curb and gutter, and the residential lots are approximately ½ acre in size. There are approximately 37.7 acres of land that are tributary to the storm sewer system up to where it turns south at the intersection of Olive Street and Schoenbeck Road. The storm sewer system was designed and constructed prior to current stormwater management practices and ordinances. The storm sewer system capacity is less than the current design standard.

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During a rain event, water begins to collect along the roadside swales (though these are not well defined) as higher ground drains towards the lowest spots. Once the water reaches the grassed swale areas adjacent to the road there are catch basin grates at some locations where water can drain into the storm sewer, or else it will continue to collect onto these poorly defined swales if there isn't sufficient conveyance capacity to convey the runoff into an inlet. During storm events that exceed the capacity of the storm sewer or when the grates are blocked by debris, excess runoff drains overland through side yards and backyards and onto Dorset Street where it will begin to collect and flood the street and the adjacent low-lying areas. Generally, the prevalent flow direction is south, from Marion Street to Dorset Street to Olive Street, with water flowing through side yards and backyards until it reaches a low point or an inlet. For most moderate to heavy rain events the amount of water flowing into the road and backyard depressions is greater than its capacity to drain, therefore, water accumulates in these low areas to flooding depths that are below any well-defined spillover elevation, causing damages to the affected properties and the roadway.

Photograph 2 shows Dorset Street flooded during the July 2011 storm event with Dale Avenue in the background. A discernible debris line can be observed showing the approximate limits of how high the water level reached in this street. The photograph was taken at 6:18 am according to the digital file, and as can be seen the water had already began to recede from its peak. The last recorded rain depth was at approximately 3 am, so the peak likely occurred between 3 and 6 am on July 23, 2011. The approximate high water level (HWL) of the July 2011 event in this area is 675.5 as estimated from information obtained from personal conversations with at least one resident and Public Works staff, and Photograph 1. According to the Cook County 1-foot aerial topography, the 675.5 HWL limit inundates a substantial area from Marion to Olive Streets, which is shown on Exhibit 2. This inundation is formed by a level pool from north to south.

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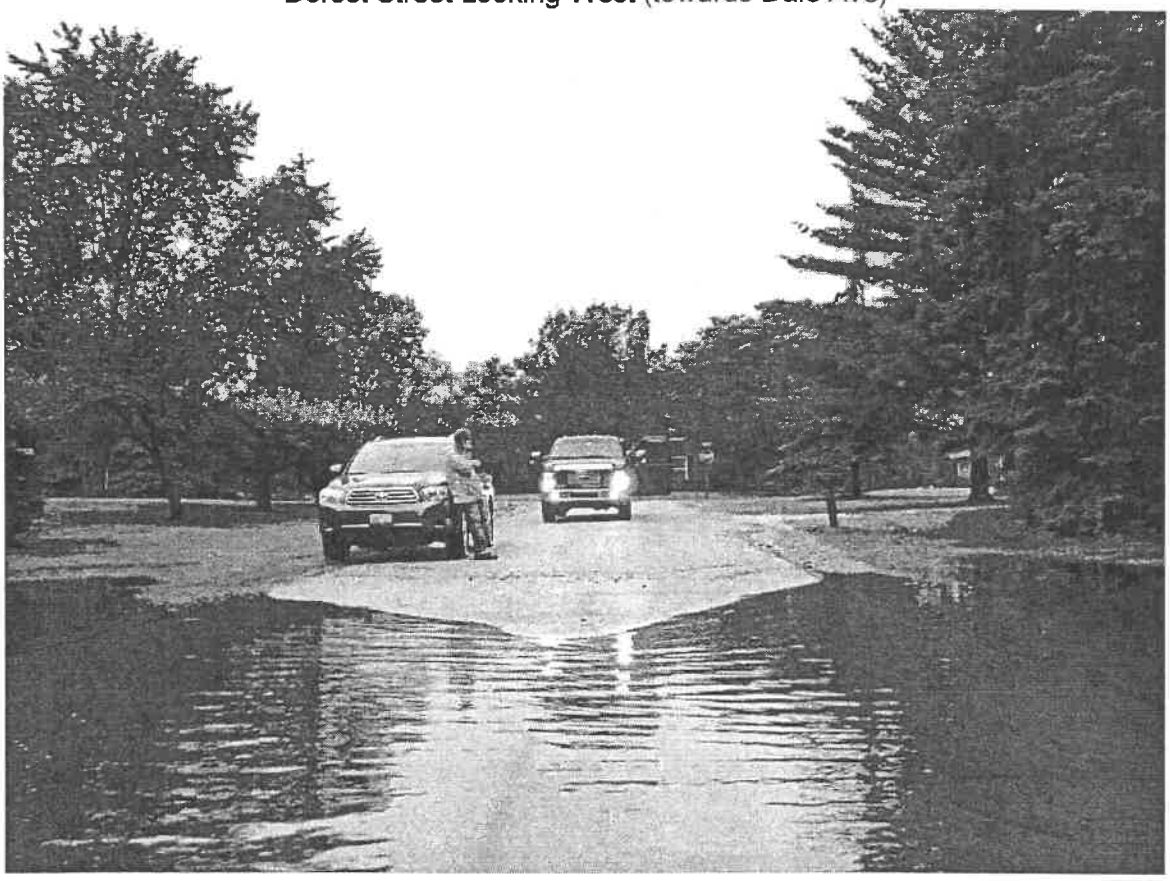
PHOTOGRAPH 1
Dorset Street Looking West (towards Dale Ave)



Once water reaches Olive Street, it can only drain by entering the storm sewer system via catch basins that flows east towards Schoenbeck Road, because there is no "low" spillover elevation to the south. The water would have to reach elevation 678 before it would begin to flow south overland toward Tributary A. However, there are no well-defined overland flow paths that would allow the water to drain south towards Tributary A or along the storm sewer alignment while not causing additional damages to property. Without the benefit of detailed field survey of top-of-foundation elevations and other critical elevations, it can only be assumed that more severe damages (from those reported) would occur if water were to reach this elevation.

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The existing drainage patterns are very similar to historic patterns that existed prior to development in this area. According to Hydrologic Investigations Atlas HA-67, Floods in Arlington Heights Quadrangle, Illinois, prepared in 1963, shown in Figure 2, there were two depressional areas within this study area prior to development, which are shown flooded during the July 1957 flood event. The elevation depicted on HA-67 associated with these depressional areas is 675.

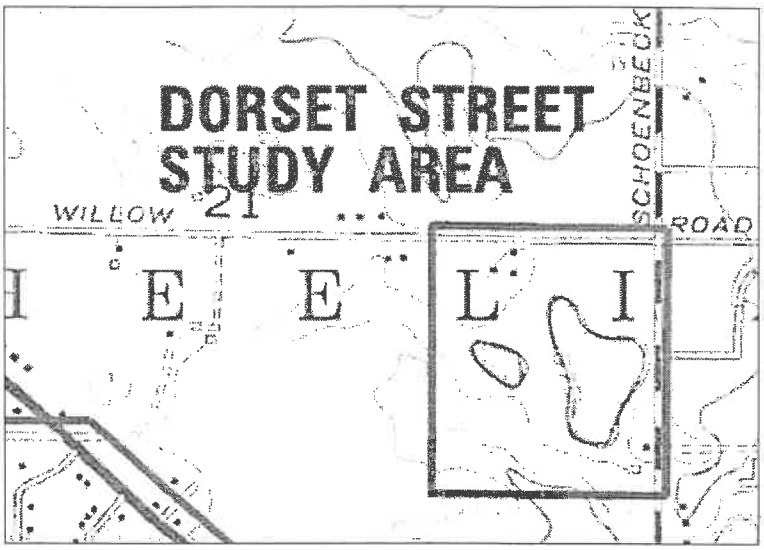

Figure 2
USGS Hydrologic Atlas

Table 1 summarizes the 18 flood questionnaires returned in this study area.

TABLE 2
Dorset Street Study Area
Flood Questionnaire Summary

Location	Questionnaires Submitted to the City	Basement Flooding (questionnaires reporting)	Basement Flooding Depth Reported (ranges)	Total Damage Reported*
Marion Street	9	3	1 to 12 inches	$49,800
Dale Street	2	1	2 inches	$6,500
Dorset Street	3	2	1 foot	$13,500
Olive Street	3	3	2 inches to 6 feet	$27,000
Schoenbeck Road	1	None reported	None reported	$5,000
TOTAL	**18**	**9**		**$101,800**

*Note: The reported damages are taken directly from the flood questionnaire.

STORMWATER DEFICIENCIES

Based on field visits, assessment of the topography, and relative size of the existing storm sewer system as shown on the City atlases, the following stormwater deficiencies have been identified for this area:

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1. The areas that flood are located within a "bowl" or depression with respect to the surrounding area. This can be clearly observed where Dorset Street rises approximately 3 feet just near the intersection to meet Schoenbeck Road to the east, and rises also approximately 3 feet just near the intersection to meet Dale Ave to the west, while remaining relatively "low" between these two intersections. Historically, "bowl" areas were poorly drained, and farmers installed field tiles to drain them. This "bowl" condition also indicates that most rainfall that falls on the watershed will ultimately be conveyed to the "low" spot and collect and pond if the conveyance system cannot drain the flow of runoff into it.
2. The storm sewer system does not have sufficient capacity to convey the amount of runoff entering it during moderate or greater storm events as evidenced by Public Works staff and residents.
3. No dedicated overland flow path exists to drain this area.

APPROACH TO SOLUTIONS

This area experiences flooding because historically this area was a depression, and it appears that development did not substantially alter the grades, thereby the depression continues to collect water from the contributing areas as it has done before. While the addition of the storm sewer has provided a means of draining this area, the sewer capacity is exceeded for moderate to significant storm events, and the area floods. This area was developed prior to the requirement for detention storage.

The area was inundated approximately to elevation 675.5 during the July 23, 2011 storm event. The volume of water stored below this elevation is approximately 5.0 acre-feet. The storm sewer that drains south from Dorset Street is 15 inches in diameter. While sufficient field information is not available to determine the flow capacity of this pipe, and more detailed modeling and field survey would be required, the approximate capacity is between 1.5 and 2.5 cubic feet per second (cfs). Based on a drainage area to this point of 28.2 acres the flow per acre is 0.07 cfs/acre. This is considered to be a relatively low value. For example, the proposed Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) Ordinance (not yet approved or effective), which is more conservative than the current Ordinance (at least for this aspect) requires that stormwater detention storage be determined assuming a release rate of 0.15 cfs/acre. A lower value means more volume is stored.

In general, structural approaches for alleviating flooding problems can be categorized into two types: storage creation, or conveyance improvements. Typically, conveyance improvements alone may cause impacts to downstream properties, and detailed modeling would be necessary to determine the location and magnitude of these impacts, which is beyond the scope of this study. The existing storm sewer is relatively old and it is probably no longer conveying water to its original capacity. The 2012 Road Bond program will at a minimum replace existing sewers in-kind within the improved right-of-ways. However, the

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program as currently proposed will not replace the storm sewers between side yards or backyards that connect to the road sewers.

Aside from possible public improvements, it is recommended is that the City encourage all residents to flood-proof their homes, especially those who have experienced flooding in the past. This will reduce the risk of future flooding due to overland flow, seepage and sump pump failures. A list of simple and inexpensive flood-proofing measures has been included as Attachment 1 of this memorandum. This recommendation is in addition to any other drainage improvements on public or private property.

The first approach to this flooding problem area is to replace the existing storm sewers along the right-of-ways and extend it along the north side of Dorset Street. The sewer segment between 403 and 405 Dorset and 402 and 404 Olive Street that connects to the Olive Street storm sewer should also be replaced. Additional grates should be added at Olive Street to accept as much flow as the storm sewer system can convey. This approach will restore the original capacity of the storm sewer system. The flow into a Cook County storm sewer cannot be increased without mitigation approved by the Cook County Highway Department. Therefore, the storm sewer system cannot be enlarged unless a more comprehensive project is undertaken, as discussed under the third approach.

The second approach would be to complete the improvements outlined under the first approach and add storage within the backyard areas of the properties between Willow and Marion, between Marion and Dorset Streets, and between Dorset and Olive Streets. This would create additional stormwater volume to store the water so that water level reached would be lower when compared to existing conditions. However, the impact to the backyards by excavating their backyards down 2 to 3 feet, the likely moist soil conditions that would be encountered and anticipated to be present nearly continuously, and the need to plat drainage easements enveloping these areas would require an almost unanimous buy-in among the impacted residents. Approximately half the backyards that would be impacted by such improvements were flooded during the July 2011 storm event.

The third approach would be to replace the existing storm sewer system from Dorset Street to Camp McDonald Road with a larger system capable of conveying more flow. The size would depend on detailed analysis of how much additional flow can be sent downstream and how much storage can be provided downstream to accept this flow so that no negative impacts occur to downstream properties. This approach will require coordination with residential property owners, Cook County, Mount Prospect Park District (Old Orchard Country Club), and depending on where storage is provided, permits from the Illinois Department of Natural Resources – Office of Water Resources and the U.S. Army Corps of Engineers may be required.

These three approaches are depicted as Alternative 1, 2 and 3, respectively, in the next section.

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ALTERNATIVE DRAINAGE SOLUTIONS

The possible drainage solutions for the Dorset and Marion study area were developed at a concept level based on feasibility of implementation and cost effectiveness. Based on this analysis, CBBEL identified the following projects to alleviate flooding in this area:

1. As part of the on-going road bond improvements, Marion and Dorset Street are identified for construction during 2012. Under this alternative, all storm sewers along these streets would be replaced in-kind. For Dorset Street, which is inundated the most within its right-of-way (ROW), the storm sewers along both sides of the street should be replaced in-kind as currently proposed by the road project. Also, ditches should be along both sides of the street to the approximate limits of the 675 elevation (almost from Dale to Schoenbeck) to add some storage, though the volume anticipated would be relatively small compared to the volume of flooding that was occupied during July 2011. This also would better drain local low spots within the ROW.

   The portion of Olive Street within this study area is not identified in the 2012 Road Bond Program. However, at the low spot of this street it is recommended that the City install additional grates. Depending on the type of storm and season at the time (leaves on the ground could clog grates), the storm sewer sizes would control the amount of water leaving this area or the clogged grates can be the controlling factor. The intent of this recommendation is to have the storm sewers control at all times, which maximizes the system's capacity during the entire duration of the storm.

   Marion Street has two drainage structures in front of 410 and 415 Marion Street. It appears that this system connects to a private drain system that runs south between 411 and 415 Marion Street, turns east, and then turns south again between 408 and 410 Dorset Street until it connects to the Dorset Street system on the north side of the road. Installing new storm sewers that connect to this private system without improving the existing private system and obtaining drainage easements for its entire alignment is not recommended. A resident stated that several property owners jointly improved the private yard drain system following the July 2011 event.

   The overland flow route between 406 and 408 Dorset Street should be maintained as it provides relief to the ponding that occurs in the backyards of the properties between Dorset and Marion Street. Observations during a site visit of this area indicate that the area and flow path are generally well maintained.

2. This alternative would still include all of the improvements proposed under Alternative 1, but would also include excavating three stormwater storage basins in the backyards of the properties between Willow and Marion, between Marion and Dorset Streets, and between Dorset and Olive Streets. The approximate depth of these basins would be 2 to 3 feet below the existing ground elevations, would be 50

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feet wide (25 feet to either side of the back property line), slope down at a 5 to 1 slope, and span lengthwise between 6 to 8 lots on each street. Structures and storm sewers would need to be installed to tie into the existing system to drain these basins. Permanent Drainage easements and temporary construction easements would be required impacting at least 40 properties.

3. A more comprehensive project would involve upgrading the entire storm sewer system between Marion Street and Camp McDonald Road. The size would be determined by the feasible level-of-protection that can be achieved in combination with providing mitigating additional stormwater storage at some hydraulically connected location. There are no public open areas between Dorset Street and Camp McDonald Road where storage can be created, and Cook County would require the City to meet existing flow rates into their storm sewer, or to possibly enlarge the County storm sewer between the connection at Schoenbeck and the outfall into Tributary A within the Old Orchard Golf Course to accept the additional flow without impacting the roadway drainage and other properties. The feasibility of creating mitigating storage within the Old Orchard Golf Course would need to be evaluated.

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RECOMMENDATIONS

Based on this analysis, CBBEL presents the pros and cons of each alternative, and provides estimated costs and a recommendation.

TABLE 3
Dorset Street Study Area
Alternatives Analysis Summary

Alternative	Description	Pros	Cons
1	Storm sewer in-kind replacement and sewer extensions	• Cost-effective • No work outside City ROW (unless the private drain system is also improved) • Will decrease amount of time road and properties are flooded • Can be implemented this year with the road program • Ditches will add some storage	• Will not eliminate flooding or level of inundation for large storm events • If the storm sewer between 403 and 405 Dorset Street and 402 and 404 Olive Street is not contained in easements, then agreements to replace this section will need to be obtained • Drainage easements may be required for the ditches • Due to the slopes, the ditches would remain wet longer than the other frontyard areas
2	Alternative 1 *plus* create 2 storage basins along the backyards	• Will decrease amount of time road is flooded • Will lower the flooding levels	• Will flood the backyards of more properties, but in dedicated drainage easements • Will require a significant number of drainage easements • Will likely require all affected residents to agree on the project
3	Alternative 1 *plus* storm sewer upgrade (enlargement) and storage creation	• Will significantly reduce flooding in Dorset Street and adjacent areas	• Larger cost project • Will require work outside City ROW • Detailed modeling will be necessary to properly size sewer and storage to not have downstream impacts • Would likely require permits from federal and state agencies for work in the Old Orchard Golf Course • Funding, agreements with the County, and permits all imply a long-term implementation time frame (at least over 1 year)

Table 4 below provides a summary of conceptual cost estimates associated with each of the above alternatives. The detailed conceptual cost estimates can be found under Attachment 2.

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TABLE 4
Dorset Street Study Area
Alternatives Analysis Cost Summary

Alternative	Description	Estimated Cost
1	Storm sewer in-kind replacement and sewer extensions	$460,000
2	Alternative 2 *plus* create 2 storage basins along the backyards	$1,320,000
3	Alternative 1 *plus* storm sewer upgrade (enlargement) and storage creation	$2,430,000

Based on the above, CBBEL recommends Alternative 1 be completed as part of the 2012 Road Bond program, and that Alternative 2 be explored with the residents.

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Attachment 1

Flood-proofing Techniques

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TIPS ON FLOOD PREVENTION FOR HOMEOWNERS

- Clean gutters and install gutter covers to prevent clogging.
- Redefine and clear swales throughout yard to allow an appropriate drainage way for storm water runoff.
- Raise the low entry elevation at which storm water can enter your home by berming around basement doorways or windows. A pump may be required to drain water away from inside the berm.
- Verify existing sump pump and outlet pipe have sufficient capacity for discharging during intense storm events.
- Provide a relief outlet for the sump pump outside of the house that is a safe distance from the foundation in case of surcharge, frozen outlet pipe, or other blockage.
- Install a backup source of power for sump pump in case of electrical power failure.
- Extend downspouts away from the foundation 5-10 feet.
- Repair foundation cracks throughout basement to prevent seepage.
- Raise the low-entry elevation of window wells and/or install drains in the window wells and connect them to the sump pump system.
- Install glass block windows in place of basement windows (except escape window) to prevent water inflow or infiltration.
- If a storm sewer structure is adjacent to the lot, an underdrain system could be installed to collect excess runoff, any remaining seepage or any infiltration resulting from hydrostatic pressure.
- For homes with a reverse-slope driveway, raise the sidewalk elevation to reduce the risk of standing water in the street draining down the driveway and into the garage.
- To further reduce the risk of flooding for homes with reverse slope driveways, it may be necessary to convert the lower level garage into a basement and completely fill in the reverse-slope driveway.

The recommendations provided above may not eliminate flooding or flood damage within the residence; however, if installed correctly they should effectively reduce the risk of flooding. It is should also be noted that any of the recommendations may be implemented

individually, however, many suggestions may be used in conjunction with one another to provide a greater impact in helping to reduce the risk of future flood damage.

WEBSITE LINKS FOR FLOOD PREVENTION

Lake County Stormwater Management Commission Website
http://www.co.lake.il.us/smc/citizens/default.asp

"Repairing Your Flooded Home" by FEMA and the Red Cross
http://www.co.lake.il.us/smc/fwa/ARC_RepFloodedHome.pdf

"Drainage Around Your Home" by the National Resource Conservation Service
http://www.co.lake.il.us/smc/citizens/drainbro.pdf

"Homeowners Guide to Retrofitting: Six Ways to Protect Your Home from Flooding" by FEMA
http://www.fema.gov/rebuild/mat/rfit.shtm

"Guide to Flood Protection in Northeastern Illinois" by the Illinois Association for Floodplain and Stormwater Management
http://www.illinoisfloods.org/documents/Guide_to_Flood_Prot--March_06.pdf

Attachment 2
Cost Estimates

Christopher B. Burke Engineering, Ltd.
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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
DORSET STREET STUDY AREA - ALTERNATE 1

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.1	$15,000.00	$1,500.00
TREE ROOT PRUNING	EACH	4	$200.00	$800.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	1220	$5.00	$6,100.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	1220	$5.00	$6,100.00
TRENCH BACKFILL, SPECIAL	CU YD	165	$45.00	$7,425.00
STORM SEWER, RCP 12"	FOOT	1760	$75.00	$132,000.00
STORM SEWER, RCP 15"	FOOT	395	$80.00	$31,600.00
PROPOSED MANHOLE, 4' DIA	EACH	8	$4,000.00	$32,000.00
PROPOSED CATCH BASIN, 4' DIA	EACH	10	$4,200.00	$42,000.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	150	$55.00	$8,250.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	50	$65.00	$3,250.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	200	$10.00	$2,000.00
CLASS D PATCHES, 12 INCHES	SQ YD	25	$75.00	$1,875.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	30	$40.00	$1,200.00
TRAFFIC CONTROL	LSUM	1	$10,000.00	$10,000.00
CONSTRUCTION LAYOUT	LSUM	1	$10,000.00	$10,000.00

SUB TOTAL =	$296,100.00
CONTINGENCY (30%) =	$88,830.00
CONSTRUCTION TOTAL =	$384,930.00
DESIGN ENGINEERING (10%) =	$28,869.75
CONSTRUCTION OBSERVATION (10%) =	$28,869.75
PERMITTING (5.0%) =	$14,805.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$457,474.50

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY

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Prospect Heights, Proposed Drainage Improvements
DORSET STREET STUDY AREA - ALTERNATE 2

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.2	$15,000.00	$3,000.00
TREE ROOT PRUNING	EACH	10	$200.00	$2,000.00
EARTH EXCAVATION	CU YD	5470	$40.00	$218,800.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	8620	$5.00	$43,100.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	8620	$5.00	$43,100.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
TRENCH BACKFILL, SPECIAL	CU YD	200	$45.00	$9,000.00
STORM SEWER, RCP 12"	FOOT	2740	$75.00	$205,500.00
STORM SEWER, RCP 15"	FOOT	395	$80.00	$31,600.00
PROPOSED MANHOLE, 4' DIA	EACH	11	$4,000.00	$44,000.00
PROPOSED CATCH BASIN, 4' DIA	EACH	13	$4,200.00	$54,600.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	180	$55.00	$9,900.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	50	$65.00	$3,250.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	230	$10.00	$2,300.00
CLASS D PATCHES, 12 INCHES	SQ YD	50	$75.00	$3,750.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	50	$40.00	$2,000.00
TRAFFIC CONTROL	LSUM	1	$10,000.00	$10,000.00
CONSTRUCTION LAYOUT	LSUM	1	$20,000.00	$20,000.00

SUB TOTAL =	$709,400.00
CONTINGENCY (30%) =	$212,820.00
CONSTRUCTION TOTAL =	$922,220.00
DESIGN ENGINEERING (10%) =	$69,166.50
CONSTRUCTION OBSERVATION (10%) =	$69,166.50
PERMITTING (5.0%) =	$35,470.00
EASEMENTS =	$220,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$1,316,023.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY.

Christopher B. Burke Engineering, Ltd.
9575 West Higgins Road, Suite 600
Rosemont, Illinois 60018
Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
DORSET STREET STUDY AREA - ALTERNATE 3

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.3	$15,000.00	$4,500.00
TREE ROOT PRUNING	EACH	15	$200.00	$3,000.00
EARTH EXCAVATION	CU YD	5470	$40.00	$218,800.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	9950	$5.00	$49,750.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	9950	$5.00	$49,750.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
STONE RIPRAP, CLASS A4	SQ YD	20	$30.00	$600.00
TRENCH BACKFILL, SPECIAL	CU YD	370	$45.00	$16,650.00
STORM SEWER, RCP 12"	FOOT	2740	$75.00	$205,500.00
STORM SEWER, RCP 30"	FOOT	2440	$110.00	$268,400.00
PROPOSED MANHOLE, 4' DIA	EACH	11	$4,000.00	$44,000.00
PROPOSED MANHOLE, 5' DIA	EACH	6	$5,000.00	$30,000.00
PROPOSED CATCH BASIN, 4' DIA	EACH	13	$4,200.00	$54,600.00
PROPOSED CATCH BASIN, 5' DIA	EACH	3	$5,200.00	$15,600.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 30" WITH GRATE	EACH	1	$3,000.00	$3,000.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	300	$55.00	$16,500.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	90	$65.00	$5,850.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	390	$10.00	$3,900.00
CLASS D PATCHES, 12 INCHES	SQ YD	160	$75.00	$12,000.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	130	$40.00	$5,200.00
TRAFFIC CONTROL	LSUM	1	$20,000.00	$20,000.00
CONSTRUCTION LAYOUT	LSUM	1	$30,000.00	$30,000.00

MITIGATION STORAGE (TO BE DETERMINED BY MODELING)

EARTH EXCAVATION	CU YD	8100	$40.00	$324,000.00
TOPSOIL FURNISH AND PLACE, 6"	SQ YD	4200	$6.00	$25,200.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	4200	$5.00	$21,000.00

SUB TOTAL =	$1,431,300.00
CONTINGENCY (30%) =	$429,390.00
CONSTRUCTION TOTAL =	$1,860,690.00
DESIGN ENGINEERING (10%) =	$139,551.75
CONSTRUCTION OBSERVATION (10%) =	$139,551.75
PERMITTING (5.0%) =	$71,565.00
EASEMENTS =	$220,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$2,431,358.50

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY.

TAB 2

Elm Street and Willow Road Flooding Probem Area

MEMORANDUM

September 18, 2012

TO: Anne Marin – City Administrator, Prospect Heights
Steve Skiber – Director of Building and Zoning, Prospect Heights
James H. Johnson, PE – Director of Public Works and City Engineer
James O'Neill – Public Works Foreman, Prospect Heights

COPY: Donald R. Dressel, PE - CBBEL
Project Files (CBBEL Project No. 11-412)

FROM: Erik L. Gil, PE

SUBJECT: **Elm Street and Willow Road Flooding Problem Area**
Project: 2011-12 Prospect Heights Flood Study
Location: South of the intersection of Elm Street and Willow Road
Prospect Heights, Cook County, Illinois
Watershed: Tributary A to McDonald Creek

INTRODUCTION

Christopher B. Burke Engineering Ltd. (CBBEL) was retained by the City of Prospect Heights (City) to perform a flood risk reduction analysis based on the flooding that occurred from the July 22-23, 2011 storm event. The primary goals of this study were to determine the extent of the flood damage, establish possible causes for the flooding and to provide potential solutions to reduce the risk of future flooding.

This memorandum documents the analysis for the Elm Street and Willow Road Study Area. Separate memoranda will be provided for each of the other study areas, and will be assembled in a single report at the conclusion of the study.

JULY 22-23, 2011 EVENT PRECIPITATION

On July 23, 2011 the City received approximately 4.81 inches of rain in a 3-hour period that resulted in extensive flood damage in certain areas of the City. The City received 6.17 inches of rain in a 24-hour period from July 22nd to the 23rd. The rainfall totals were based on the rainfall values obtained from the gages shown in Table 1 below, which are from both the O'Hare International Airport and the Chicago Executive Airport weather gages.

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TABLE 1
July 22-23, 2011 Rainfall Values

Gage ID	Location	3-hour Total (inches)	24-hour Total (inches)
04838	Chicago Executive Airport	4.71	6.06
94846	O'Hare International Airport	6.79	8.21
	Weighted Average =	*4.81*	*6.17*
	ISWS Bulletin 70 frequency at Prospect Heights*	100-year	40-year

*Note: The stated frequency is approximate.

Two durations were chosen for discussion purposes, the 3-hour duration and the 24-hour duration. The 24-hour duration is the traditional duration used for many engineering calculations and is the typical one reported by the media. The 3-hour duration was also chosen for comparison purposes for 2 reasons. The first is that most of the flooding problem drainage areas being evaluated in this flood study respond to significant short-duration rainfall events within or shortly after a 3-hour period, that is, the flood peak is typically reached shortly after this time period if rain is no longer falling, as was the case during July 23, 2011. The Des Plaines River, for example, would not respond as quickly to a significant short-duration rainfall event. The second reason is that the rainfall totals for the most severe continuous 3-hour period at the O'Hare International Airport gage exceeded the 100-year frequency as documented in the Illinois State Water Survey (ISWS) Bulletin 70 publication, the reference used by most regulatory agencies in the northeastern Illinois area for rainfall depth design values. The Chicago Executive Airport gage did not exceed the 100-year frequency value for the 3-hour event, but it was sufficiently close to be considered as the 100-year frequency. As can be observed, the two gage values at O'Hare International Airport and at Chicago Executive Airport differed by over 2 inches of rainfall for each of the reported totals. This meant that the July 22-23, 2011 event was a relatively localized storm event. For purposes of this study, a simple weighted average between the two gages was computed to estimate the rainfall totals that fell on the City, assigning a 95% weight to Chicago Executive Airport based on distance from the City as compared to the O'Hare International Airport, which was assigned a 5% weight.

The July 22nd–23rd storm event exceeded the capacity of the storm sewer systems in the older parts of town and resulted in street, backyard, and home flooding. Approximately 161 residents within the City filled out a flood questionnaire after the July 23rd storm event.

REFERENCES AND AVAILABLE INFORMATION

- Meetings with City staff,
- Summary provided by City staff of 161 flood questionnaires submitted by City residents,
- Site visits,
- Cook County 1-foot contour aerial topography,
- City storm sewer maps,

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- Approximate high water depths provided by City staff and residents,
- United States Geological Survey (USGS) Hydrologic Atlas (HA),
- Historic Aerial Photographs,
- Federal Emergency Management Agency (FEMA) Federal Insurance Rate Maps (FIRMs)

OVERVIEW

The Elm Street & Willow Road study area is located in the south central area of the City. In general, the study area is bounded by Willow Road on the north, Pine Street on the east Circle Avenue on the west, and the drainage divide on the south with specific flooding concerns along the backyards of the homes along Willow Road and a home along Elm Street. The street map of this location is shown on Figure 1.

The study area is within the Tributary A to McDonald Creek watershed and is located within a historical depressional area. Photograph 1 shows Elm Street looking south from the 111 Willow Road property during the July 2011 event.

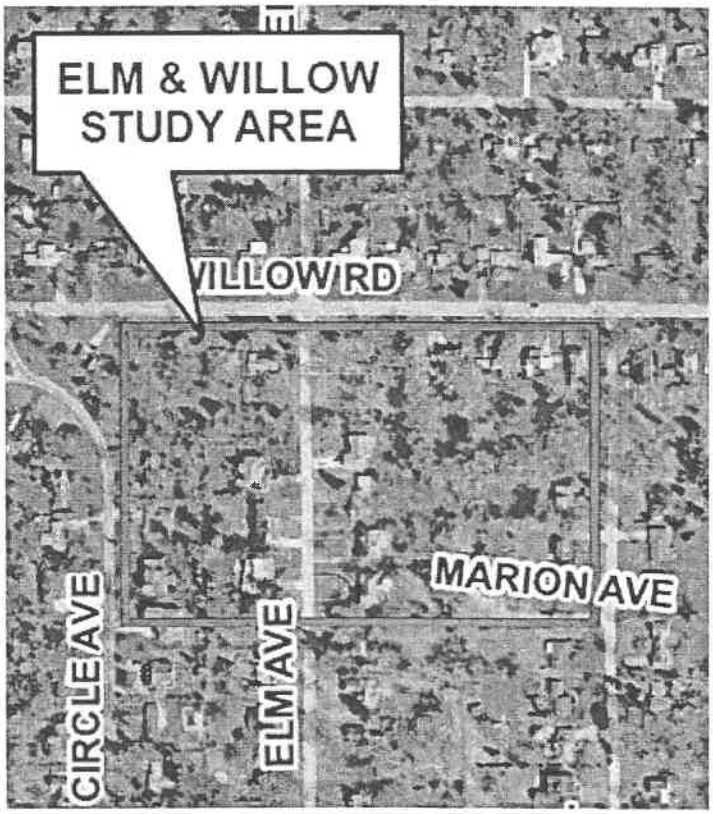

Figure 1
Elm Street & Willow Road
Location Map

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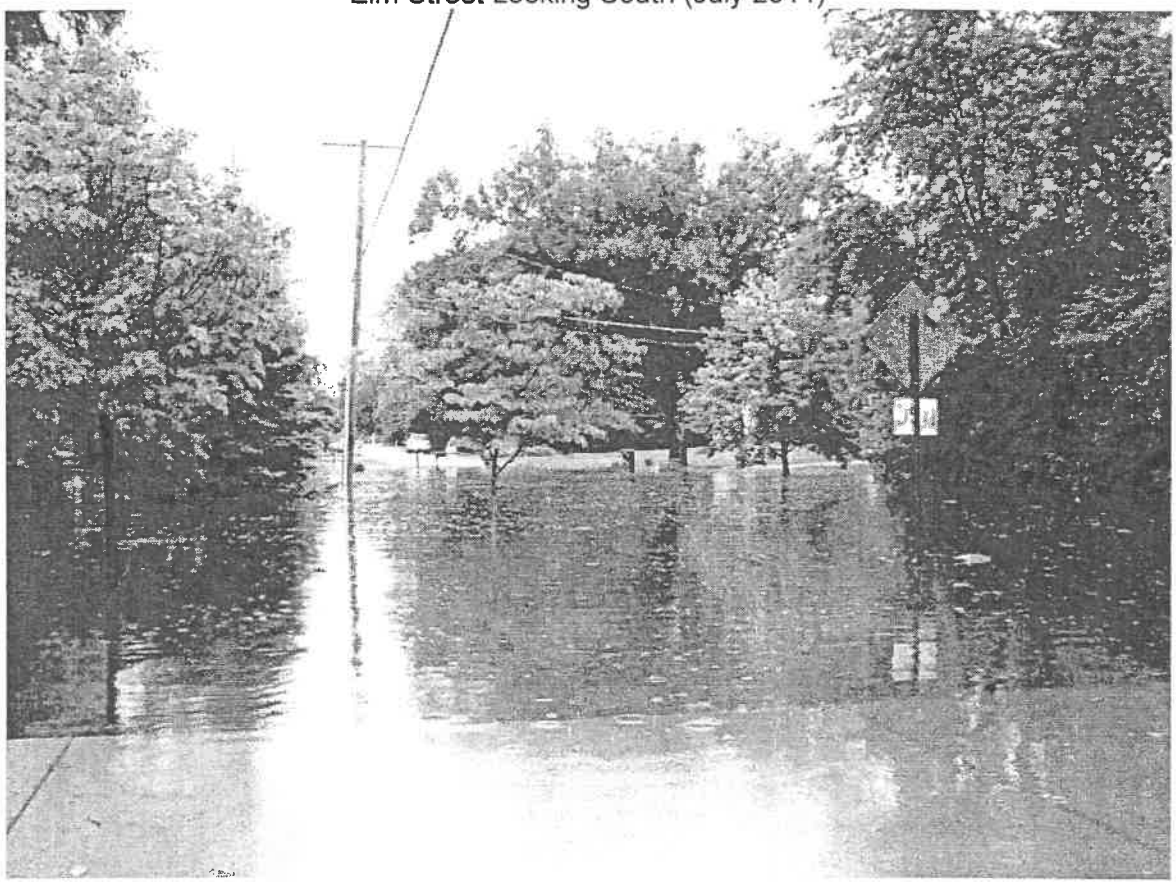
PHOTOGRAPH 1
Elm Street Looking South (July 2011)



EXISTING DRAINAGE PATTERN

The flooding problem area is split into two watersheds. The east watershed drains overland into the depressional area just south of the intersection of Willow Road and Elm Street, which floods and impacts the adjacent homes. This depressional area and its extent can be seen on Figure 2 and Exhibit 3A. It is located on both the east and the west sides of Elm Street. The shaded area is the approximate flood limits of the July 2011 storm event. The west watershed drains overland towards the east watershed; however, approximately 10 years ago the City constructed storm sewers along Circle Avenue that now intercept most of the runoff that used to flow east and conveys flows from north to south to Olive Avenue. If this storm sewer is surcharged, then some of the runoff will begin to overflow into the east watershed and contribute to flooding the depressional area. The overall watershed divide, flooding area, storm sewers, and aerial view are shown on Exhibit 3A.

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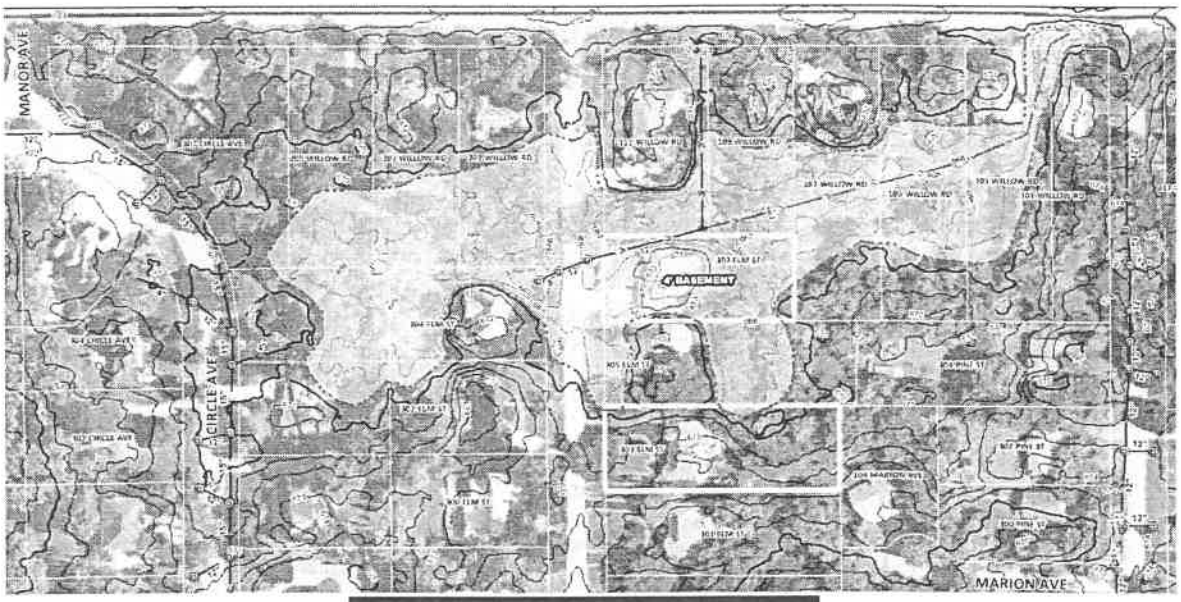

Figure 2
Elm Street & Willow Road
July 2011 Flooding

The existing drainage patterns are very similar to historic patterns that existed prior to development in this area. According to Hydrologic Investigations Atlas HA-67, Floods in Arlington Heights Quadrangle, Illinois, prepared in 1963, shown as Figure 3, there were two depressional areas within this study area prior to development. The elevation depicted on HA-67 associated with these depressional areas is 670.

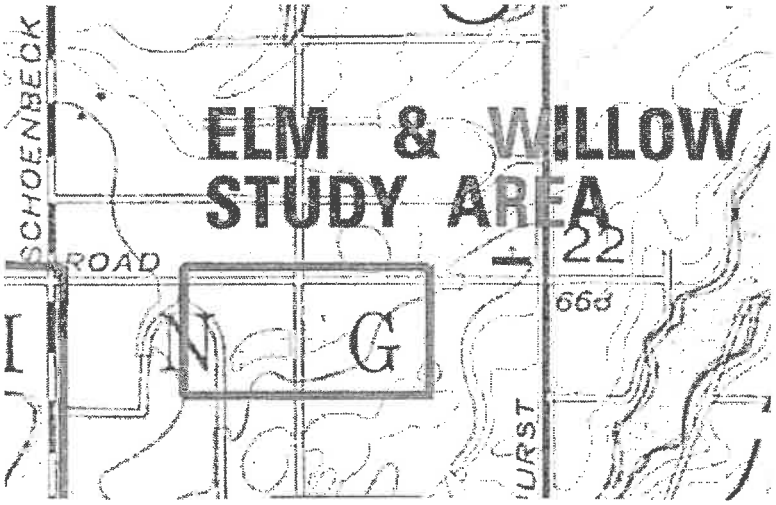

Figure 3
USGS Hydrologic Atlas

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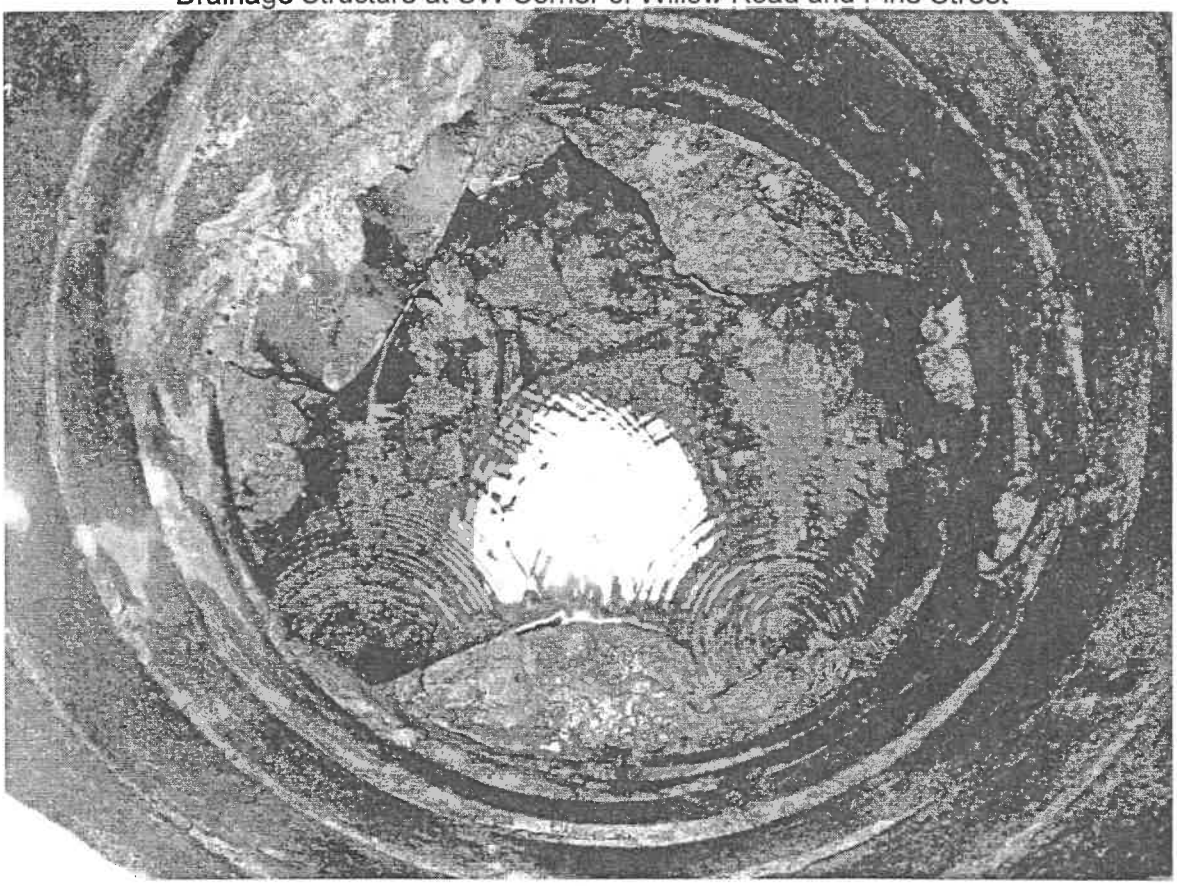
As can be seen by comparing Figure 2 to Figure 3, the size and shape of the depressional areas shown on the historic HA map are consistent with the extent of the flooding that occurred during the July 2011 event. The flooding levels observed during the July 2011 storm event are approximately equal to the enveloping contour associated with elevation 670. A field tile drains this depressional area and connects to a drainage structure located within the Willow Road ROW, just west of the intersection with Pine Street. This structure is shown on Photograph 2 (Willow & Pine structure).

PHOTOGRAPH 2
Drainage Structure at SW Corner of Willow Road and Pine Street



This structure (Photograph 2) has 2 inflow pipes and 1 outflow pipe. An 18-inch sewer from the west that conveys and drains right-of-way runoff along the south side of Willow Road and discharges into the structure, an approximate 8-inch tile from the south that drains the study area depressional area and discharges into the structure, and an approximate 8-inch tile that conveys water from the structure north. This 8-inch drain tile continues north-northeast until it discharges into McDonald Creek.

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Just based on the sizes of these pipes, the capacity to convey water away from this structure is limited.

The flooding problem area, the existing storm sewer system and the drainage divides are shown on Exhibit 3A. These streets have a rural section, that is, there is no curb and gutter, and the residential lots are approximately ½ acre in size. There are approximately 20.0 acres of land that are directly tributary to the Elm Street & Willow Road depressional area. The watershed to the west is approximately 30.8 acres in size, and while much of the flow is captured by the Circle Avenue storm sewer, there is a possibility that once the storm sewer is surcharging water can flow east towards the Elm Street & Willow Road depression.

During a rain event, water begins to collect within the low spots of the Elm Street & Willow Road depressional areas. During storm events that exceed the capacity of the drain tile system it will begin to collect and flood the low-lying areas within the depression. The prevalent flow direction is east, from Circle Avenue to Pine Street. For most moderate to heavy rain events the amount of water flowing into the depressional area is greater than its capacity to drain, therefore, water accumulates in these low areas to flooding depths that are below any well-defined spillover elevation, causing damages to the affected properties and the roadway.

Photograph 3 shows another view of Elm Street flooded during the July 2011 storm event (looking west) from the 111 Willow Road property. The photograph was taken at 9:35 am according to the digital file. Based on this photograph and Photograph 1, the approximate high water level (HWL) of the July 2011 storm event in this area is 669.5. According to the Cook County 1-foot aerial topography, the 669.5 HWL limit inundates a substantial area between Circle Avenue and Pine Street, which is shown on Exhibit 3A. This inundation is formed by a level pool from west to east.

Once water reaches the Elm Street & Willow Road depressional area, it can only drain by entering the drain tile that flows east towards the Willow Road & Pine Street structure. There is a private relief sewer shown on the City's storm sewer atlas along the 111 Willow Road property that takes water from the east depressional area to the Willow Road 18-inch storm sewer. There is no structure on Willow Road, so it is assumed that this is a blind connection. The water would have to reach elevation 670 before it would begin to overflow north across Willow Road near the outlet structure.

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PHOTOGRAPH 1
Elm Street Under Water (Looking West)

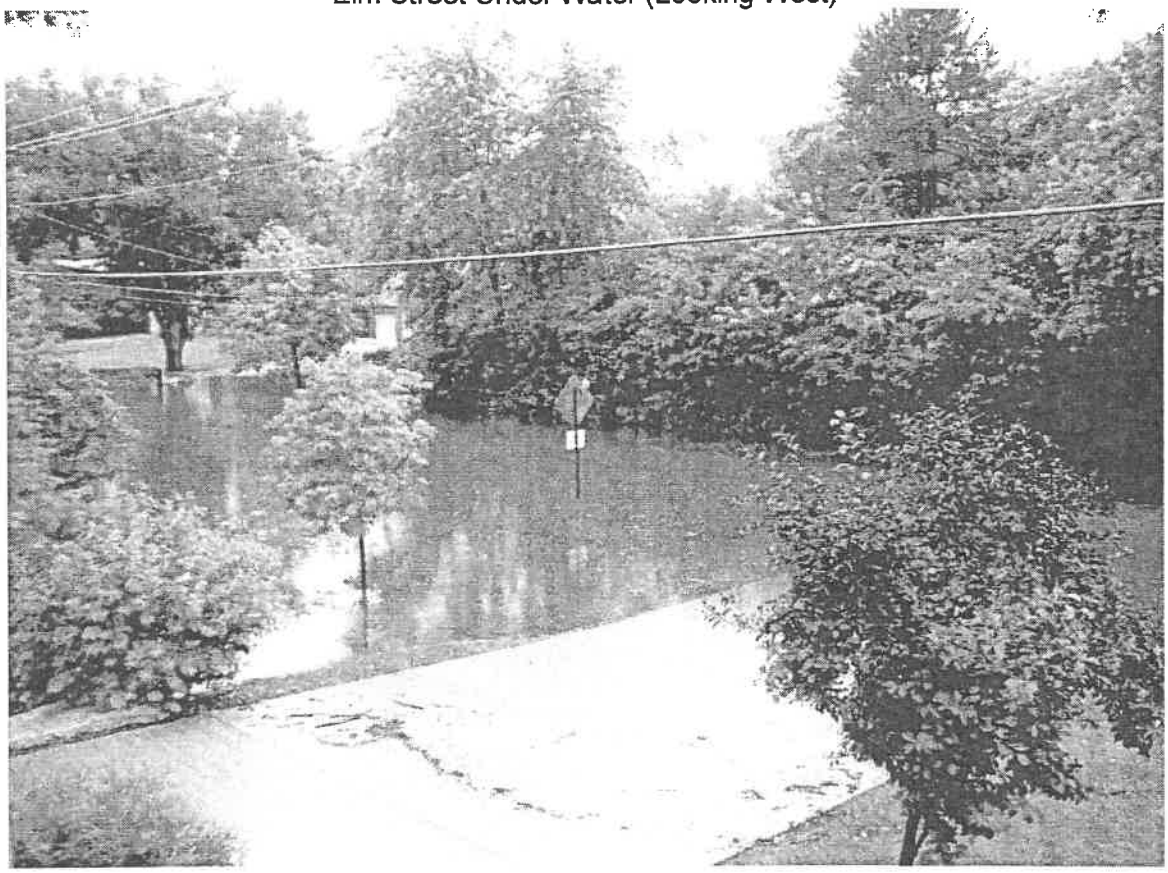

Table 1 summarizes the 2 flood questionnaires returned in this study area.

TABLE 2
Elm Street & Willow Road Study Area
Flood Questionnaire Summary

Location	Questionnaires Submitted to the City	Basement Flooding (questionnaires reporting)	Basement Flooding Depth Reported (ranges)	Total Damage Reported*
Elm Street	2	1	4 feet	$16,000
TOTAL	**2**	**1**		**$16,000**

*Note: The reported damages are taken directly from the flood questionnaire.

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STORMWATER DEFICIENCIES

Based on field visits, assessment of the topography, verbal communication with Public Works staff, and the limited existing storm sewer system shown on the City atlases for this area, the following stormwater deficiencies have been identified for this area:

1. The areas that flood are located within a "bowl" or depression with respect to the surrounding area. This can be clearly observed from Figure 3 that this condition existed prior to development, and from Figure 3A which shows the Cook County topography. Historically, "bowl" areas were poorly drained, and farmers installed field tiles to drain them. This "bowl" condition also indicates that most rainfall that falls on the watershed will ultimately be conveyed to the "low" spot and collect and pond if the conveyance system cannot drain the flow of runoff into it.
2. There is no storm sewer system to drain this area, just the drain tile which does not have sufficient capacity to convey the amount of runoff entering it during moderate or greater storm events as evidenced by Public Works staff and residents.
3. The private sewer along 111 Willow Road helps drain the area, but ultimately, the flow is controlled by the Willow Road & Pine Street structure. The only outlet in the structure is the 8-inch drain tile. This drain tile does not have sufficient capacity to drain the system such that flooding would not occur.
4. No dedicated overland flow path exists to drain this area. The overflow point should a larger storm event occur would be Willow Road, immediately west of the intersection with Pine Street.

APPROACH TO SOLUTIONS

This area experiences flooding because historically this area was a depression, and it appears that development did not substantially alter the grades, thereby the depression continues to collect water from the contributing areas as it has done before. While the field tile provides a means of draining this area, its capacity is exceeded for moderate to significant storm events, and the area floods. This area was developed prior to the requirement for detention storage.

The area was inundated approximately to elevation 669.5 during the July 23, 2011 storm event. The volume of water stored below this elevation is approximately 3.7 acre-feet. While sufficient field information is not available to determine the flow capacity of this field tile, the City did perform sewer cleaning operations but was not able to complete the cleaning all the way from Elm Street to the Willow Road & Pine Street structure because of blockages, either tree roots or collapsed sections, or both.

In general, structural approaches for alleviating flooding problems can be categorized into two types: storage creation, or conveyance improvements. Typically, conveyance improvements alone may cause impacts to downstream properties, and detailed modeling

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would be necessary to determine the location and magnitude of these impacts, which is beyond the scope of this study. The existing field tile is relatively old and it is probably no longer conveying water to its original capacity. Therefore, this study area stores stormwater runoff within the depression and releases it at a relatively low rate through an old drain tile.

Aside from possible public improvements, it is recommended that the City encourage all residents to flood-proof their homes, especially those who have experienced flooding in the past. This will reduce the risk of future flooding due to overland flow, seepage and sump pump failures. A list of simple and inexpensive flood-proofing measures has been included as Attachment 1 of this memorandum. This recommendation is in addition to any other drainage improvements on public or private property.

The first approach to this flooding problem area is to replace the existing drain tile with a storm sewer. Grates should be added at select locations along the backyards to accept as much flow as the storm sewer system can convey to the Willow Road & Pine Street structure. This approach will restore the original capacity of the field tile. The flow into the Cook County Highway Department (CCHD) right-of-way cannot be increased without approval by CCHD, and in addition, the outlet is still controlled by the 8-inch field tile. Therefore, the storm sewer system cannot be larger than the existing field tile unless a more comprehensive project is undertaken, as discussed under the third approach. This approach will require easements from all the properties along Willow Road between Elm Street and Pine Avenue, and the heavily vegetated backyards will be disturbed during the construction process. It should be noted that the flow based on implementing these improvements will still be controlled by the Willow Road & Pine Street structure, and that the levels of flooding would be unchanged for a storm with similar intensity as the July 2011 storm event. It is anticipated that the rate at which the flooding recedes would improve and that possibly for lesser storm events the flooding levels could be less due to the restoration of the original flow capacity of the field tile.

The second approach would be to install a relief storm sewer along Elm Street and connect it to the Willow Road 18-inch sewer, assuming that inverts allow a gravity connection. It is CCHD's policy not to allow new connection points into their drainage system that did not already drain into their right-of-way – their recommendation would be to use the existing connection at the Willow Road & Pine Street structure. Because the Willow Road right-of-way drains into the depressional area and its runoff does not appear to be effectively captured by the right-of-way drainage system, CCHD may be open to discussions for this approach. However, it is likely that the storm sewer installed along Willow Road is not deep enough to accept a connection from the depressional area. Therefore, the storm sewer along Willow Road would have to be lowered for this approach to be feasible. Alternatively, a pump station can be installed. It should be noted that any conveyance improvements will still be controlled by the Willow Road & Pine Street structure, and that the levels of flooding would be unchanged for a storm with similar intensity as the July 2011 event. It is anticipated that the rate the flooding recedes would improve and that possibly for lesser storm events the flooding levels could be less.

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An ancillary measure to the above two approaches would be to add storage within the backyard areas of the properties already within the depression. This would create additional stormwater volume to store the water so that water level reached would be lower when compared to existing conditions. However, the impact to the backyards by excavating their backyards down 2 to 3 feet, the likely moist soil conditions that would be encountered and anticipated to be present nearly continuously, and the need to plat drainage easements enveloping these areas would require an almost unanimous buy-in among the impacted residents.

The third approach would be to replace the existing field tile with a larger system capable of conveying more flow, and this replacement would extend until a suitable downstream storm sewer or to McDonald Creek. The approach would incur the highest cost of all the approaches, would require detailed analysis of how much additional flow can be sent downstream and how much storage can be provided downstream to accept this flow so that no negative impacts occur to downstream properties. This approach will require coordination with residential property owners, CCHD, and depending on where storage is provided, permits from the Illinois Department of Natural Resources – Office of Water Resources and the U.S. Army Corps of Engineers may be required.

These three approaches are depicted as alternatives in the next section.

ALTERNATIVE DRAINAGE SOLUTIONS

The possible drainage solutions for the Elm Street and Willow Road study area were developed at a concept level based on feasibility of implementation and cost effectiveness. Based on this analysis, CBBEL identified the following alternatives to reduce the risk of flooding in this area:

1. As part of the on-going road bond improvements, Elm Street is identified for construction during 2012. Under this alternative, the existing drain tile below Elm Street should be televised, and if appropriate, would be replaced in-kind. The intent of this recommendation is to take advantage of the existing road resurfacing project. Furthermore, the drain tile continues east within the 111 Willow Road property. Typically, easements for drain tiles were not dedicated. However, the City can approach the property owner to determine if there is interest in that the road contractor replace the drain tile to the extent possible (as far east as possible) within the 111 Willow Road property given the relatively open space grass backyard. Access would still be from Elm Street, and should be an activity that the contractor can perform without any special measures. The contractor should be able to restore the backyard to existing conditions and not impact any trees. Extending beyond this property east would have more extensive impacts to the backyards, would require easements from multiple property owners, and would be best done as a complete project through the Willow Road & Pine Street structure (Alternative 2).

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2. This alternative would be a continuation of Alternative 1 to replace the entire length of the field tile through the Willow Road & Pine Street structure with a storm sewer. This alternative would also include cleaning the field tile downstream of the Willow Road & Pine Street structure. Easements would be required from the affected property owners, and significant impacts to the vegetation would occur. A permit from CCHD would be required to replace the field tile connection at the Willow Road & Pine Street structure.

3. This alternative would still include all of the improvements proposed under Alternative 1, but would also include a relief storm sewer along Elm Street, from the catch basin structure just east of Elm Street, north to Willow Road. This alternative would require work in the CCHD right-of-way, and a permit from them. The inverts will likely not allow a gravity connection, therefore, a pump station would be required, or the entire sewer along Willow Road through the Willow Road & Pine Street structure will need to be lowered.

4. This alternative would still include all of the improvements proposed under Alternative 1 and 2, but would also include excavating stormwater storage basins in the backyards of the multiple properties west and east of Elm Street. The approximate depth of these basins would be 2 to 3 feet below the existing ground elevations, and slope down at a 5 to 1 slope. Structures and storm sewers would need to be installed to tie into the existing system to drain these basins. Permanent Drainage easements and temporary construction easements would be required impacting at least 11 properties.

5. A more comprehensive project would involve upsizing the field tile the entire length to a suitable outlet at Elmhurst Road. The size would be determined by the feasible level-of-protection that can be achieved in combination with providing mitigating additional stormwater storage at some hydraulically connected location. The feasibility of creating mitigating storage within the sewer alignment would need to be evaluated.

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RECOMMENDATIONS

Based on this analysis, CBBEL presents the pros and cons of each alternative, and provides estimated costs and a recommendation.

TABLE 3
Elm Street & Willow Road Flooding Problem Area
Alternatives Analysis Summary

Alternative	Description	Pros	Cons
1	Replace field tile under Elm Street and within 111 Willow Road	• Cost-effective • Work limited to City ROW and 111 Willow Road • Can be implemented this year with the road program	• Will not eliminate flooding or level of inundation for any storm events • Drainage easements may be required for the replaced drain tile within 111 Willow Road
2	Replace field tile from west of Elm Street to Willow & Pine structure	• Will decrease amount of time road is flooded • May lower the flooding levels for smaller storms	• Will not eliminate flooding or level of inundation for large storm events • Will require drainage easements • Will likely require all affected residents to agree on the project • Will require permit from CCHD
3	Alternative 1 *plus* relief sewer along Elm St to Willow Rd, and lowering Willow sewer or install pump station	• Will decrease amount of time road is flooded • May lower the flooding levels for smaller storms	• Will not eliminate flooding or level of inundation for large storm events • Will require drainage easements • Will require permit from CCHD • Pump station is a significant cost
4	Alternative 1 & 2, *plus* excavating the backyards for more storage	• Will decrease amount of time road is flooded • May lower the flooding levels for larger storms	• Will not eliminate flooding, but may lower level of inundation for large storm events • Will require drainage easements • Will likely require all affected residents to agree on the project • Will require permit from CCHD
5	Replace entire drain tile system	• Will significantly reduce flooding	• Larger cost project • Will require work outside City ROW • Detailed modeling will be necessary to properly size sewer and storage to not have downstream impacts • Would likely require permits from federal and state agencies • Funding, agreements with CCHD, and permits all imply a long-term implementation time frame (at least over 1 year)

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Table 4 below provides a summary of conceptual cost estimates associated with each of the above alternatives. The detailed conceptual cost estimates can be found under Attachment 2.

TABLE 4
Elm Street & Willow Road Flooding Problem Area
Alternatives Analysis Cost Summary

Alternative	Description	Estimate Cost
1	Replace field tile under Elm Street and within 111 Willow Road	$83,000
2	Replace field tile from west of Elm Street to Willow & Pine structure	$225,000
3	Alternative 1 *plus* relief sewer along Elm St to Willow Rd, and lowering Willow sewer or install pump station	$565,000
4	Alternative 1 & 2, *plus* excavating the backyards for more storage	$635,000
5	Replace entire drain tile system	$952,000

Based on the above, CBBEL recommends Alternative 1 be completed as part of the 2012 Road Bond program, and that Alternative 2 be explored with the residents.

ELG/ E:\Word\MEMOS\2012\M 11-412 Prospect Heights Elm and Willow Area 091812.docx

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Attachment 1

Flood-proofing Techniques

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TIPS ON FLOOD PREVENTION FOR HOMEOWNERS

- Clean gutters and install gutter covers to prevent clogging.
- Redefine and clear swales throughout yard to allow an appropriate drainage way for storm water runoff.
- Raise the low entry elevation at which storm water can enter your home by berming around basement doorways or windows. A pump may be required to drain water away from inside the berm.
- Verify existing sump pump and outlet pipe have sufficient capacity for discharging during intense storm events.
- Provide a relief outlet for the sump pump outside of the house that is a safe distance from the foundation in case of surcharge, frozen outlet pipe, or other blockage.
- Install a backup source of power for sump pump in case of electrical power failure.
- Extend downspouts away from the foundation 5-10 feet.
- Repair foundation cracks throughout basement to prevent seepage.
- Raise the low-entry elevation of window wells and/or install drains in the window wells and connect them to the sump pump system.
- Install glass block windows in place of basement windows (except escape window) to prevent water inflow or infiltration.
- If a storm sewer structure is adjacent to the lot, an underdrain system could be installed to collect excess runoff, any remaining seepage or any infiltration resulting from hydrostatic pressure.
- For homes with a reverse-slope driveway, raise the sidewalk elevation to reduce the risk of standing water in the street draining down the driveway and into the garage.
- To further reduce the risk of flooding for homes with reverse slope driveways, it may be necessary to convert the lower level garage into a basement and completely fill in the reverse-slope driveway.

The recommendations provided above may not eliminate flooding or flood damage within the residence; however, if installed correctly they should effectively reduce the risk of flooding. It is should also be noted that any of the recommendations may be implemented

individually, however, many suggestions may be used in conjunction with one another to provide a greater impact in helping to reduce the risk of future flood damage.

WEBSITE LINKS FOR FLOOD PREVENTION

Lake County Stormwater Management Commission Website
http://www.co.lake.il.us/smc/citizens/default.asp

"Repairing Your Flooded Home" by FEMA and the Red Cross
http://www.co.lake.il.us/smc/fwa/ARC_RepFloodedHome.pdf

"Drainage Around Your Home" by the National Resource Conservation Service
http://www.co.lake.il.us/smc/citizens/drainbro.pdf

"Homeowners Guide to Retrofitting: Six Ways to Protect Your Home from Flooding" by FEMA
http://www.fema.gov/rebuild/mat/rfit.shtm

"Guide to Flood Protection in Northeastern Illinois" by the Illinois Association for Floodplain and Stormwater Management
http://www.illinoisfloods.org/documents/Guide_to_Flood_Prot--March_06.pdf

Attachment 2
Cost Estimates

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Christopher B. Burke Engineering, Ltd.
9575 West Higgins Road, Suite 600
Rosemont, Illinois 60018
Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Elm/Willow - Alt 1

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
STORM SEWER, RCP 12"	FOOT	200	$75.00	$15,000.00
PROPOSED MANHOLE, 4'DIA	EACH	3	$5,000.00	$15,000.00
CLASS D PATCHES, 12 INCH	SQ YD	30	$75.00	$2,250.00
TRENCH BACKFILL, SPECIAL	CY	40	$45.00	$1,800.00
TREE REMOVAL	ACRE	0.1	$15,000.00	$1,500.00
TREES	EACH	4	$500.00	$2,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	350	$5.00	$1,750.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	350	$5.00	$1,750.00
TRAFFIC CONTROL	LSUM	1	$5,000.00	$5,000.00
CONSTRUCTION LAYOUT	LSUM	1	$2,000.00	$2,000.00
CATCHBASIN	EACH	1	$4,000.00	$4,000.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00

SUB TOTAL =	$52,850.00
CONTINGENCY (30%) =	$15,855.00
CONSTRUCTION TOTAL =	$68,705.00
DESIGN ENGINEERING (10%) =	$6,870.50
CONSTRUCTION OBSERVATION (10%) =	$6,870.50
TOTAL PROJECT COST INCLUDING ENGINEERING =	$82,446.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, OR RELOCATING ANY UTILITIES

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Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Elm/Willow - Alt 2

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
STORM SEWER, RCP 12"	FOOT	750	$75.00	$56,250.00
PROPOSED MANHOLE, 4'DIA	EACH	5	$5,000.00	$25,000.00
CLASS D PATCHES, 12 INCH	SQ YD	30	$75.00	$2,250.00
TRENCH BACKFILL, SPECIAL	CY	40	$45.00	$1,800.00
TREE REMOVAL	ACRE	0.4	$15,000.00	$6,000.00
TREES	EACH	10	$500.00	$5,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	1600	$5.00	$8,000.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	1600	$5.00	$8,000.00
TRAFFIC CONTROL	LSUM	1	$10,000.00	$10,000.00
CONSTRUCTION LAYOUT	LSUM	1	$5,000.00	$5,000.00
CATCHBASIN	EACH	1	$4,000.00	$4,000.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00

SUB TOTAL =	$132,100.00
CONTINGENCY (30%) =	$39,630.00
CONSTRUCTION TOTAL =	$171,730.00
DESIGN ENGINEERING (10%) =	$17,173.00
CONSTRUCTION OBSERVATION (10%) =	$17,173.00
PERMITTING (5%) =	$8,586.50
EASEMENTS (2 LOTS)=	$10,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$224,662.50

NOTE: THIS ESTIMATE INCLUDES A COST OF $5,000 PER EASEMENT REQUIRED. ESTIMATE DOES NOT INCLUDE ANY PRIVATE UTILITY RELOCATIONS

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Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Elm/Willow - Alt 3

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
STORM SEWER, RCP 12"	FOOT	500	$75.00	$37,500.00
PROPOSED MANHOLE, 4'DIA	EACH	4	$5,000.00	$20,000.00
CLASS D PATCHES, 12 INCH	SQ YD	230	$75.00	$17,250.00
TRENCH BACKFILL, SPECIAL	CY	320	$45.00	$14,400.00
TREE REMOVAL	ACRE	0.1	$15,000.00	$1,500.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	400	$5.00	$2,000.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	400	$5.00	$2,000.00
TRAFFIC CONTROL	LSUM	1	$1,000.00	$1,000.00
CONSTRUCTION LAYOUT	LSUM	1	$2,500.00	$2,500.00
CATCHBASIN	EACH	1	$4,000.00	$4,000.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	50	$40.00	$2,000.00
PUMP STATION	LSUM	1	$225,000.00	$225,000.00

SUB TOTAL =	$329,150.00
CONTINGENCY (30%) =	$98,745.00
CONSTRUCTION TOTAL =	$427,895.00
DESIGN ENGINEERING (10%) =	$42,789.50
CONSTRUCTION OBSERVATION (10%) =	$42,789.50
PERMITTING (5%) =	$21,394.75
EASEMENTS (6 LOTS)=	$30,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$564,868.75

NOTE: THIS ESTIMATE INCLUDES A COST OF $5,000 PER EASEMENT REQUIRED. ESTIMATE DOES NOT INCLUDE ANY PRIVATE UTILITY RELOCATIONS

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Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Elm/Willow - Alt 4

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
STORM SEWER, RCP 12"	FOOT	800	$75.00	$60,000.00
PROPOSED MANHOLE, 4'DIA	EACH	5	$5,000.00	$25,000.00
CLASS D PATCHES, 12 INCH	SQ YD	30	$75.00	$2,250.00
TRENCH BACKFILL, SPECIAL	CY	40	$45.00	$1,800.00
TREE REMOVAL	ACRE	1.2	$15,000.00	$18,000.00
TREES	EACH	10	$500.00	$5,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	5700	$5.00	$28,500.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	5700	$5.00	$28,500.00
EARTH EX	CY	5000	$30.00	$150,000.00
12" FES	EACH	2	$500.00	$1,000.00
RIPRAP	SQ YD	100	$100.00	$10,000.00
TRAFFIC CONTROL	LSUM	1	$10,000.00	$10,000.00
CONSTRUCTION LAYOUT	LSUM	1	$5,000.00	$5,000.00
CATCHBASIN	EACH	2	$4,000.00	$8,000.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00

SUB TOTAL =	$353,850.00
CONTINGENCY (30%) =	$106,155.00
CONSTRUCTION TOTAL =	$460,005.00
DESIGN ENGINEERING (10%) =	$46,000.50
CONSTRUCTION OBSERVATION (10%) =	$46,000.50
PERMITTING (5%) =	$23,000.25
EASEMENTS (6 LOTS)=	$60,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$635,006.25

NOTE: THIS ESTIMATE INCLUDES A COST OF $10,000 PER EASEMENT REQUIRED. ESTIMATE DOES NOT INCLUDE ANY PRIVATE UTILITY RELOCATIONS

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Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Elm/Willow - Alt 5

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
STORM SEWER, RCP 12"	FOOT	3000	$75.00	$225,000.00
PROPOSED MANHOLE, 4'DIA	EACH	6	$5,000.00	$30,000.00
CLASS D PATCHES, 12 INCH	SQ YD	2000	$75.00	$150,000.00
TRENCH BACKFILL, SPECIAL	CY	1500	$45.00	$67,500.00
TREE REMOVAL	ACRE	0.1	$15,000.00	$1,500.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	1600	$5.00	$8,000.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	1600	$5.00	$8,000.00
WATER SERVICE RELOCATIONS	FOOT	200	$45.00	$9,000.00
SANITARY SERVICE RELOCATIONS	FOOT	200	$45.00	$9,000.00
TRAFFIC CONTROL	LSUM	1	$30,000.00	$30,000.00
CONSTRUCTION LAYOUT	LSUM	1	$5,000.00	$5,000.00
12" FES	EACH	1	$500.00	$500.00
RIPRAP	SQ YD	10	$100.00	$1,000.00
CATCHBASIN	EACH	1	$4,000.00	$4,000.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00

SUB TOTAL =	$549,300.00
CONTINGENCY (30%) =	$164,790.00
CONSTRUCTION TOTAL =	$714,090.00
DESIGN ENGINEERING (10%) =	$71,409.00
CONSTRUCTION OBSERVATION (10%) =	$71,409.00
PERMITTING (5%) =	$35,704.50
EASEMENTS (1 LOT)=	$60,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$952,612.50

NOTE: THIS ESTIMATE INCLUDES A COST OF $10,000 PER EASEMENT REQUIRED. ESTIMATE DOES NOT INCLUDE ANY PRIVATE UTILITY RELOCATIONS

TAB 3

Arlington Countryside Flooding Probem Area

MEMORANDUM

September 18, 2012

TO: Anne Marin – City Administrator, Prospect Heights
Steve Skiber – Director of Building and Zoning, Prospect Heights
James H. Johnson, PE – Director of Public Works and City Engineer
James O'Neill – Public Works Foreman, Prospect Heights

COPY: Donald R. Dressel, PE - CBBEL
Project Files (CBBEL Project No. 11-412)

FROM: Erik L. Gil, PE

SUBJECT: **Arlington Countryside Flooding Problem Area**
Project: 2011-12 Prospect Heights Flood Study
Location: West of Rand Road, east of Windsor, south of Olive Street, and north of Oakton Street, Prospect Heights, Cook County, Illinois
Watershed: Tributary A to McDonald Creek (and Weller Creek)

INTRODUCTION

Christopher B. Burke Engineering Ltd. (CBBEL) was retained by the City of Prospect Heights (City) to perform a flood risk reduction analysis based on the flooding that occurred from the July 22-23, 2011 storm event. The primary goals of this study were to determine the extent of the flood damage, establish possible causes for the flooding and to provide potential solutions to reduce the risk of future flooding.

This memorandum documents the analysis for the Arlington Countryside Study Area. Separate memoranda will be provided for each of the other study areas, and will be assembled in a single report at the conclusion of the study.

JULY 22-23, 2011 EVENT PRECIPITATION

On July 23, 2011 the City received approximately 4.81 inches of rain in a 3-hour period that resulted in extensive flood damage in certain areas of the City. The City received 6.17 inches of rain in a 24-hour period from July 22nd to the 23rd. The rainfall totals were based on the rainfall values obtained from the gages shown in Table 1 below, which are from both the O'Hare International Airport and the Chicago Executive Airport weather gages.

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TABLE 1
July 22-23, 2011 Rainfall Values

Gage ID	Location	3-hour Total (inches)	24-hour Total (inches)
04838	Chicago Executive Airport	4.71	6.06
94846	O'Hare International Airport	6.79	8.21
	Weighted Average =	*4.81*	*6.17*
	ISWS Bulletin 70 frequency at Prospect Heights*	100-year	40-year

*Note: The stated frequency is approximate.

Two durations were chosen for discussion purposes, the 3-hour duration and the 24-hour duration. The 24-hour duration is the traditional duration used for many engineering calculations and is the typical one reported by the media. The 3-hour duration was also chosen for comparison purposes for 2 reasons. The first is that most of the flooding problem drainage areas being evaluated in this flood study respond to significant short-duration rainfall events within or shortly after a 3-hour period, that is, the flood peak is typically reached shortly after this time period if rain is no longer falling, as was the case during July 23, 2011. The Des Plaines River, for example, would not respond as quickly to a significant short-duration rainfall event. The second reason is that the rainfall totals for the most severe continuous 3-hour period at the O'Hare International Airport gage exceeded the 100-year frequency as documented in the Illinois State Water Survey (ISWS) Bulletin 70 publication, the reference used by most regulatory agencies in the northeastern Illinois area for rainfall depth design values. The Chicago Executive Airport gage did not exceed the 100-year frequency value for the 3-hour event, but it was sufficiently close to be considered as the 100-year frequency. As can be observed, the two gage values at O'Hare International Airport and at Chicago Executive Airport differed by over 2 inches of rainfall for each of the reported totals. This meant that the July 22-23, 2011 event was a relatively localized storm event. For purposes of this study, a simple weighted average between the two gages was computed to estimate the rainfall totals that fell on the City, assigning a 95% weight to Chicago Executive Airport based on distance from the City as compared to the O'Hare International Airport, which was assigned a 5% weight.

The July 22nd–23rd storm event exceeded the capacity of the storm sewer systems in the older parts of town and resulted in street, backyard, and home flooding. Approximately 161 residents within the City filled out a flood questionnaire after the July 23rd storm event.

REFERENCES AND AVAILABLE INFORMATION

- Meetings with City staff,
- Summary provided by City staff of 161 flood questionnaires submitted by City residents,
- Site visits,
- Cook County 1-foot contour aerial topography,
- City storm sewer maps,

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- United States Geological Survey (USGS) Hydrologic Atlas (HA),
- Historic Aerial Photographs,
- Federal Emergency Management Agency (FEMA) Federal Insurance Rate Maps (FIRMs)

OVERVIEW

The Arlington Countryside study area is located in the western most area of the City. In general, the study area is bounded by Olive Street on the north, Windsor Drive on the west, Rand Road on the east, and Oakton Street on the south with specific flooding concerns along the front yards and backyards of the homes along the north-south streets and the roads. The street map of this location is shown on Figure 1.

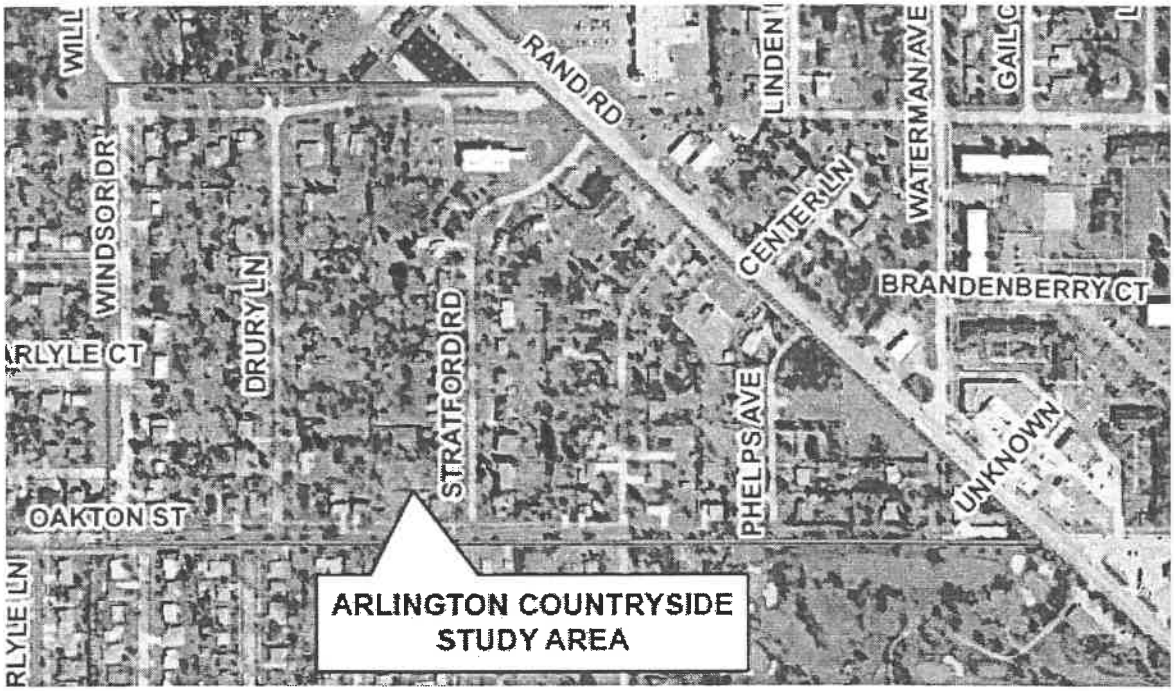

Figure 1
Arlington Countryside
Location Map

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The western corporate boundary between the City of Prospect Heights and the Village of Arlington Heights at this location is Windsor Drive. The area is located on the most western portion of the City's corporate limits and is essentially a "peninsula" surrounded by the Village of Arlington Heights. It is topographically a "bowl" with limited underground drainage capacity and practically nonexistent overland overflow routes with Rand Road acting as a "dam".

The watershed divide extends north, west, and south of this area into the Village of Arlington Heights. The study area is located at the divide between Tributary A to McDonald Creek and Weller Creek watersheds and is located within a historical depressional area. Photograph 1 shows a view at a vacant property on Phelps Avenue looking east.

PHOTOGRAPH 1
Phelps Avenue Looking East into 1127 Phelps

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EXISTING DRAINAGE PATTERN

The historic patterns that existed prior to development in this area were of a poorly drained area. According to Hydrologic Investigations Atlas HA-67, Floods in Arlington Heights Quadrangle, Illinois, prepared in 1963, shown as Figure 2, there was a depressional area within this study area prior to development that extends through a substantial portion of the study area. The encompassing elevation depicted on HA-67 associated with this depressional area is 685. However, based on the Cook County aerial topography, some of the backyards are as low as elevation 680.

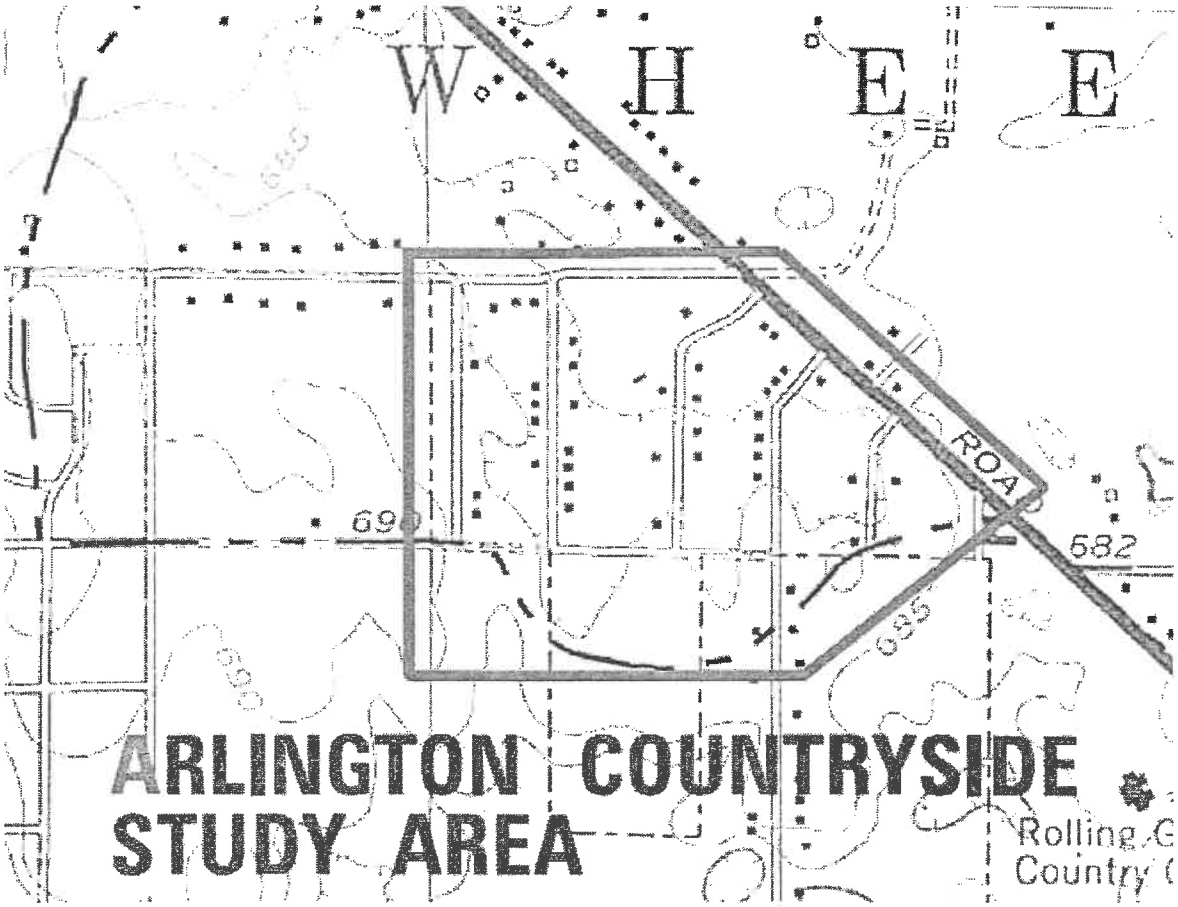

Figure 2
USGS Hydrologic Atlas

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Arlington Countryside has five local depressional areas and insufficient underground drainage capacity to drain these depressional areas. The existing depressional ground areas are located in the rear yards of the residential properties. Up until 2002, the depressional ground areas were drained by an existing field tile which crossed roadways and platted lots, without the benefit of drainage easements. The existing 12-inch field tile was reported by the City of Prospect Heights as an inadequate outlet for stormwater runoff in the Arlington Countryside area. Therefore, as a result of public meetings with the affected residents, in 2002 the City replaced the drain tile through this area with a storm sewer varying in size between 12 inches and 21 inches. This drainage project restored the original conveyance of the drain tile, but did not significantly lower flooding levels in Arlington Countryside for the larger storm events. Therefore, for moderate to severe events, stormwater ponds within the depressional areas and does not typically drain for over 24 hours or more. Stormwater runoff generally flows west to east within this area and is drained by the new storm sewer system. This storm sewer connects to an 18" storm sewer under Rand Road (outlet point) which connects to the Village of Arlington Heights Brandenberry Apartment complex storm sewer system, which then drains to the Camp McDonald Road storm sewer. The 18" field tile used to go through the Jesurun Presbyterian Church site in the Village of Arlington Heights (between Forrest and Phelps Avenues). When this parcel was developed in 2000, the City requested that the 18" field tile be relocated along the property boundary within drainage easements as part of the improvements for the church construction. This relocation was reflected in the engineering plans submitted to the City for review.

The Arlington Countryside area receives stormwater from both City of Prospect Heights and Village of Arlington Heights. However, it depends on the severity of the storm as to when these other areas begin to contribute flow towards Arlington Countryside because some of the areas are served by storm sewers, which convey the flow to a different outlet point. When these other storm sewer systems reach their conveyance capacity (either the pipes are surcharging or the inlets cannot take more water), then the rainfall runoff begins to flow overland towards Arlington Countryside. Therefore, it is appropriate to consider two different drainage divides for the Arlington Countryside: 1) the storm sewer divide and 2) the overland flow divide.

The storm sewer divide area would be the area that flows to Arlington Countryside via field tile/storm sewer and any overland flow area that is not being picked up by another storm sewer system that outlets at a different point. Typically, local storm sewer systems are designed for the 10-year storm event rainfall, but the 5-year event was also used during the periods when these areas were developed. However, the 10-year design rainfall depths have changed since the construction of these storm sewer systems. Therefore, they no longer represent a current 10-year design. However, for simplicity, this area will be called the 10-year divide. The overland flow divide is the entire area draining to Arlington Countryside when all underground systems are at capacity. This will be called the 100-year divide.

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There are 224 acres tributary to the intersection of Rand Road and Camp McDonald Road that consists of residential and commercial areas within the City of Prospect Heights and the Village of Arlington Heights. The drainage problems occurring in the Arlington Countryside area are the result of an inadequate outlet condition which consists of an existing 12-to 21-inch storm sewer, the limited capacity of the 18-inch sewer outlet under Rand Road, and a lack of an adequate overland overflow route. The overland overflow route control is located at the southeast corner of Phelps Avenue and Rand Road, and its overtopping elevation is between 683 and 684. During any moderate rainfall, the runoff begins to pond within the existing depressional ground areas until it is either pumped out by the City's Public Works Department or slowly drained by the existing storm sewer. The following areas store water within the watershed.

Table 2
Summary of Locations that Store Water

Description
Somerset Courts stormwater detention facility
Depressional ground area north of Olive Street and south of Rand Road
Depressional ground area along Drury Lane between Olive Street and Oakton Street
Depressional ground area along Stratford Road north of Oakton Street
Depressional ground area between Stratford Road and Forrest Avenue north of Oakton Street
Depressional ground area between Forrest Avenue and Phelps Avenue north of Oakton Street
Depressional ground area between Phelps Avenue and Watermain Avenue north of Oakton Street

Once water reaches the Rand Road right-of-way, it can only drain by gravity by entering the 18-inch sewer that flows east, or once the water reaches elevation 683+ it would begin to overflow southeast along the Rand Road right-of-way. By then, the streets, backyards, and low-lying properties have been flooded.

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Table 1 summarizes the 8 flood questionnaires returned in this study area.

TABLE 3
Arlington Countryside Study Area
Flood Questionnaire Summary

Location	Questionnaires Submitted to the City	Basement Flooding (questionnaires reporting)	Basement Flooding Depth Reported (ranges)	Total Damage Reported*
Drury Lane	1	None reported	None reported	$5,000
Phelps Avenue	3	2	1 to 8 inches	$12,000
Stratford Road	2	2	3.5 to 5+ feet	$25,550
Forrest Ave	2	None reported	None reported	$30,000
TOTAL	**8**	**4**		**$72,550**

*Note: The reported damages are taken directly from the flood questionnaire.

STORMWATER DEFICIENCIES

Based on field visits, assessment of the topography, verbal communication with Public Works staff, and the limited existing storm sewer system shown on the City atlases for this area, the following stormwater deficiencies have been identified for this area:

1. The areas that flood are located within a "bowl" or depression with respect to the surrounding area. This can be clearly observed from Figure 2 that this condition existed prior to development. Historically, "bowl" areas were poorly drained, and farmers installed field tiles to drain them. This "bowl" condition also indicates that most rainfall that falls on the watershed will ultimately be conveyed to the "low" spot and collect and pond if the conveyance system cannot drain the flow of runoff into it.
2. There is one storm sewer system that drains this area, but it does not have sufficient capacity to convey the amount of runoff entering it during moderate or greater storm events as evidenced by Public Works staff and residents.
3. The storm sewer system, which was built by the City circa 2002, helps drain the area, but ultimately, the flow is controlled by the 18-inch storm sewer under Rand Road. The only gravity outlet for this area is the 18-inch Rand Road sewer. The storm sewer system and outlet does not have sufficient capacity to drain the system such that flooding would not occur.
4. No dedicated and adequate overland flow path exists to drain this area. The overflow point, should a sufficiently large storm event occur, would be the southeast corner of where Phelps Avenue and Rand Road intersect, and into the Rand Road right-of-way.

APPROACH TO SOLUTIONS

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This area experiences flooding because historically this area was a depression, and it appears that development did not substantially alter the grades, thereby the depression continues to collect water from the contributing areas as it has done before. While the storm sewer provides a means of draining this area, its capacity is exceeded for moderate to significant storm events, and the area floods. This area was developed prior to the requirement for detention storage. The circa 1960 condition depicted by the USGS HA (Figure 2) shows homes already in existence at the time, which shows approximately 30% of the homes built. There is no mapped floodplain or floodway within the Arlington Countryside area.

There are no available photographs for this area during the July 23, 2011 storm event. While sufficient field information is not available to determine the flow capacity of this storm sewer, the City did perform sewer cleaning operations, and found the pipe to be in good condition.

In general, structural approaches for alleviating flooding problems can be categorized into two types: storage creation, or conveyance improvements. Typically, conveyance improvements alone may cause impacts to downstream properties, and detailed modeling would be necessary to determine the location and magnitude of these impacts, which is beyond the scope of this study. The storm sewer system replaced an old field tile through this area, but is limited by the 18-inch storm sewer under Rand Road. Therefore, this study area stores stormwater runoff within the depressions and releases it at a relatively low rate through the 18-inch pipe under Rand Road.

Aside from possible public improvements, it is recommended that the City encourage all residents to flood-proof their homes, especially those who have experienced flooding in the past. This will reduce the risk of future flooding due to overland flow, seepage and sump pump failures. A list of simple and inexpensive flood-proofing measures has been included as Attachment 1 of this memorandum. This recommendation is in addition to any other drainage improvements on public or private property. Furthermore, as this area is redeveloped with teardowns, the City should require that proposed plans maintain the stormwater volumes that these properties hold below the 100-year storm event flooding levels.

There are various approaches to alleviating flooding for this area:

- To provide a level of protection for the July 2011 event (considered to substantially represent the 100-year event), and with minimal disruption to the existing properties within Arlington Countryside, a large storm sewer would have to be constructed from Rand Road, along Camp McDonald Road, to the Old Orchard Country Club, where Tributary A to McDonald Creek is located. In addition to that trunk sewer, an upsized storm sewer system with Arlington Countryside would be required. The downstream impacts to properties along Tributary A and downstream of the Old Orchard Country Club would need to be evaluated with modeling, and it is

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anticipated that additional storage would need to be created to compensate for conveying the water at a higher rate downstream. This approach will require coordination with residential property owners, the Illinois Department of Transportation (IDOT), Cook County Highway Department (CCHD), and depending on where storage is provided, permits from the Illinois Department of Natural Resources – Office of Water Resources and the U.S. Army Corps of Engineers may be required.

- To provide a 10-year level of protection, the current level required by the City, and with minimal disruption to the existing properties within Arlington Countryside, the approach would be very similar as for the 100-year, except that the storm sewer would not be as large. The downstream impacts to properties along Tributary A and downstream of the Old Orchard Country Club would still need to be evaluated with modeling, and it is anticipated that additional storage would need to be created to compensate for convey the water at a higher rate downstream. This approach will require coordination with residential property owners, IDOT, CCHD, and depending on where storage is provided, permits from the Illinois Department of Natural Resources – Office of Water Resources and the U.S. Army Corps of Engineers may be required.
- Improve (lower) the overflow point where water begins to overtop onto the Rand Road right-of-way. This option, while relatively inexpensive, would likely not be allowed by IDOT, and would be the least effective when considering the above-described options. However, this option can be combined with other approaches to the extent that IDOT would allow.
- Another option is to tap into the Arlington Heights storm sewer system. This option will require further coordination with the Village of Arlington Heights. This option could be studied in more detail if field survey and modeling of the Arlington Heights storm sewer system was performed. However, the ability to add flow to the Arlington Heights storm sewer is expected to be limited. In the past, the Village has allowed the City to pump water from Arlington Countryside to the Village's storm sewer system with portable pumps, but at a controlled rate. For this approach by itself, the levels of flooding would be unchanged for a storm with similar intensity as the July 2011 event, but the inundation times would be reduced.
- Another option would be to construct a storm sewer along Olive Street and tap into the Rand Road IDOT storm sewer system. Based on a review of ground elevations, a pump station would be required. Furthermore, IDOT would limit the flow that could enter the system. Similarly, for this approach by itself, the levels of flooding would be unchanged for a storm with similar intensity as the July 2011 event, but the inundation times would be reduced.
- The storm sewer constructed by the City circa 2002 did not lower the ponding levels within Arlington Countryside for large storm events, but reduced the time of inundation for each of the depressional areas. The continuation of that project would be to create additional storage such that flood elevations would be reduced. Due to the "bowl" topography of the site, the project constraints only allowed excavation of the backyards of properties to provide additional storage. A geotechnical analysis

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will be necessary to determine the maximum depth of excavation before groundwater problems begin. This approach will require easements from all the affected properties and the heavily vegetated backyards will be disturbed during the construction process. This is the only alternative that, by itself, would not necessarily require coordinating with outside agencies, with the exception of the U.S. Army Corps of Engineers, as nearly all projects require their review.

ALTERNATIVE DRAINAGE SOLUTIONS

The possible drainage solutions for the Arlington Countryside study area were developed at a concept level based on feasibility of implementation and cost effectiveness. Based on this analysis, CBBEL identified the following alternatives to reduce the risk of flooding in this area:

1. This alternative would consist of a conveyance project from Arlington Countryside to Tributary A to McDonald Creek at the Old Orchard Country Club, and storage creation to mitigate the increases in flow that would be expected to occur downstream of the Old Orchard Country Club due to larger storm sewer outfall. This would require modeling not only the Arlington Countryside system but the Camp McDonald Road drainage system. The Tributary A model developed as part of the Metropolitan Water Reclamation District (MWRD) watershed study would be used to couple with the other models to evaluate downstream impacts. Within this alternative, various levels of protection can be analyzed. While the conveyance from Arlington Countryside should be feasible within IDOT and CCHD right-of-way regardless of the size of the storm sewer, creating sufficient storage to mitigate increases will be challenging given already existing flooding problems within this tributary, and the apparent lack of open space that doesn't already have a dedicated use. It is recommended that the 5-year, 10-year, and 100-year levels be investigated for cost versus flooding levels. It would appear that the improvements that the City performed circa 2002 had some positive impacts in the intervening years, and protecting for a storm with similar intensity as the July 2011 event will have a relatively high cost.
2. This alternative would consist of pumping water to either or both the IDOT Rand Road system and the Arlington Heights storm sewer system. The existing system is a gravity-drained system that is limited by both the outlet pipe size under Rand Road and the downstream system's inherent design to also capture areas east of Rand Road. A new storm sewer system can be designed for Arlington Countryside to capture the flows for the design storm, and these would be pumped to either or both the IDOT and Arlington Heights storm sewer systems. The rate of pumping would be limited by the capacity of these storm sewers. This alternative is probably more practical in combination with one of the other alternatives as a means to optimize costs or impacts to private property.

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3. This alternative can be considered a continuation of the project the City completed circa 2002, which was replacing the field tile with a storm sewer system. If a larger conveyance option, as suggested by either of the first two alternatives described above, is not feasible, then "on site" storage is necessary. Because the Arlington Countryside area is fully developed (with the exception of 1 lot off Phelps Avenue), there are no dedicated open spaces. Therefore, storage would have to be created within the backyards of the existing properties. The storage areas would be located as follows:
    - Between Windsor Drive and Drury Lane
    - Between Drury Lane and Stratford Road
    - Between Stratford Road and Forrest Avenue
    - Between Forrest Avenue and Phelps Avenue

    The depth below existing ground of these storage areas would vary between 4 and 6 feet, and the side slopes would be approximately 5 to 1. These storage areas would impact the usability of the backyards and the likelihood of relocating some of the detached garages. A geotechnical analysis would be required to verify the viability of the depths and the groundwater levels, which may require constant pumping. Its construction would occur entirely with the City corporate limits. This alternative could either be with or without a pump station. If no pump station is used, then the ability to create storage will be limited by the existing gravity storm sewer, and the corresponding level of protection would be less than if a pump station is used and the storage areas are deeper.

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RECOMMENDATIONS

Based on this analysis, CBBEL presents the pros and cons of each alternative, and provides estimated costs and a recommendation.

TABLE 3
Arlington Countryside Flooding Problem Area
Alternatives Analysis Summary

Alternative	Description	Pros	Cons
1	Conveyance improvements from Arlington Countryside to Camp McDonald Road, and storage creation along Tributary A	• May substantially reduce flooding within Arlington Countryside, depending on the level of protection • Least impact to residential properties	• Will require mitigating storage within Tributary A • Will require CCHD and IDOT permits
2	Pump flows into Arlington Heights and/or IDOT storm sewer system	• May lower the flooding levels for smaller storms • Will decrease inundation times • Least impact to residential properties	• Will not eliminate flooding or level of inundation for large storm events • Will require permit from IDOT and Arlington Heights
3	Storage Creation within Arlington Countryside (no pumping)	• May lower the flooding levels for smaller storms • Will decrease inundation times	• Will not eliminate flooding or level of inundation for large storm events • Will require drainage easements • Less benefits than alternative with pumping
3A	Storage Creation between Forrest and Stratford Countryside (no pumping)	• To be done as a first phase of more improvements as funds become available • May lower the flooding levels for small storms in this area only	• Will not eliminate flooding or level of inundation for large storm events • Limited benefit
4	Storage creation within Arlington Countryside (with pumping)	• May lower the flooding levels for smaller storms • Will decrease inundation times	• Will not eliminate flooding or level of inundation for large storm events • Will require drainage easements • Pump station is a significant cost
4A	Alternative 2 *plus* Alternative 3A with a deeper basin with retaining walls	• May lower the flooding levels for smaller storms • Will decrease inundation times	• Will not eliminate flooding or level of inundation for large storm events • Will require permit from IDOT and Arlington Heights • Retaining walls adjacent to residential properties

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Table 4 below provides a summary of conceptual cost estimates associated with each of the above alternatives. The detailed conceptual cost estimates can be found under Attachment 2.

TABLE 4
Arlington Countryside Flooding Problem Area
Alternatives Analysis Cost Summary

Alternative	Description	Estimated Cost
1	Conveyance improvements from Arlington Countryside to Camp McDonald Road, and storage creation along Tributary A	$3,130,000
2	Pump flows into Arlington Heights and/or IDOT storm sewer system	$670,000
3	Storage Creation within Arlington Countryside (no pumping)	$1,250,000
3A	Storage Creation between Forrest and Stratford Countryside (no pumping)	$390,000
4	Storage creation within Arlington Countryside (with pumping)	$1,760,000
4A	Alternative 2 *plus* Alternative 3A with a deeper basin with retaining walls	$1,860,000

Based on the above, CBBEL recommends the following:

- The City should meet with IDOT to discuss pumping to their system for Alternative 2 and 4; and also to discuss the feasibility of installing a large storm sewer under Alternative 1. This meeting would establish the constraints that the City will need to conform to in performing detailed modeling.
- The City should meet with CCHD to discuss the possibility of installing a large storm sewer under Alternative 1. This meeting would establish the constraints that the City will need to conform to in performing detailed modeling, and developing Alternative 1 further.
- The City should meet with Arlington Heights to discuss the possibility of a pump station to their system. Historically, the Village has allowed the City to pump water given certain constraints.

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- The City should conduct public meetings with the Arlington Countryside residents to determine whether they are amenable to creating storage areas in their backyards. At this point, it is anticipated that all four storage areas described above would be necessary given the limited space and ability to go deep.
- Alternative 1 requires additional detailed preliminary engineering analyses, including a large modeling effort to develop a solution that does not flood other City properties. It requires the highest level of stakeholder coordination. It is suggested that the City attempt the above steps first prior to committing resources to Alternative 1. As a first step to this, it is recommended that the City meet with the Mount Prospect Park District to discuss how much of the Old Orchard Country Club can be disturbed to create additional storage. Finding locations to create storage downstream is anticipated to be challenging.
- Alternative 3A is the least cost alternative and would only benefit the flooding at Forrest Avenue for smaller storms. However, this could be considered a first phase of storage creation as part of a larger improvement alternative as funds become available. As such, Alternative 3A is a cost effective first step in alleviating some of the flooding in the Forrest Avenue low area.
- Alternative 4A would maximize the storage of Alternative 3A by excavating deeper and pumping it out. However, retaining walls would be necessary.

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Attachment 1

Flood-proofing Techniques

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TIPS ON FLOOD PREVENTION FOR HOMEOWNERS

- Clean gutters and install gutter covers to prevent clogging.
- Redefine and clear swales throughout yard to allow an appropriate drainage way for storm water runoff.
- Raise the low entry elevation at which storm water can enter your home by berming around basement doorways or windows. A pump may be required to drain water away from inside the berm.
- Verify existing sump pump and outlet pipe have sufficient capacity for discharging during intense storm events.
- Provide a relief outlet for the sump pump outside of the house that is a safe distance from the foundation in case of surcharge, frozen outlet pipe, or other blockage.
- Install a backup source of power for sump pump in case of electrical power failure.
- Extend downspouts away from the foundation 5-10 feet.
- Repair foundation cracks throughout basement to prevent seepage.
- Raise the low-entry elevation of window wells and/or install drains in the window wells and connect them to the sump pump system.
- Install glass block windows in place of basement windows (except escape window) to prevent water inflow or infiltration.
- If a storm sewer structure is adjacent to the lot, an underdrain system could be installed to collect excess runoff, any remaining seepage or any infiltration resulting from hydrostatic pressure.
- For homes with a reverse-slope driveway, raise the sidewalk elevation to reduce the risk of standing water in the street draining down the driveway and into the garage.
- To further reduce the risk of flooding for homes with reverse slope driveways, it may be necessary to convert the lower level garage into a basement and completely fill in the reverse-slope driveway.

The recommendations provided above may not eliminate flooding or flood damage within the residence; however, if installed correctly they should effectively reduce the risk of flooding. It is should also be noted that any of the recommendations may be implemented

individually, however, many suggestions may be used in conjunction with one another to provide a greater impact in helping to reduce the risk of future flood damage.

WEBSITE LINKS FOR FLOOD PREVENTION

Lake County Stormwater Management Commission Website
http://www.co.lake.il.us/smc/citizens/default.asp

"Repairing Your Flooded Home" by FEMA and the Red Cross
http://www.co.lake.il.us/smc/fwa/ARC_RepFloodedHome.pdf

"Drainage Around Your Home" by the National Resource Conservation Service
http://www.co.lake.il.us/smc/citizens/drainbro.pdf

"Homeowners Guide to Retrofitting: Six Ways to Protect Your Home from Flooding" by FEMA
http://www.fema.gov/rebuild/mat/rfit.shtm

"Guide to Flood Protection in Northeastern Illinois" by the Illinois Association for Floodplain and Stormwater Management
http://www.illinoisfloods.org/documents/Guide_to_Flood_Prot--March_06.pdf

Attachment 2
Cost Estimates

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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 1

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.3	$15,000.00	$4,500.00
TREE ROOT PRUNING	EACH	15	$200.00	$3,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	3350	$5.00	$16,750.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	3350	$5.00	$16,750.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
TRENCH BACKFILL, SPECIAL	CU YD	1150	$45.00	$51,750.00
STORM SEWER, RCP 30"	FOOT	290	$110.00	$31,900.00
STORM SEWER, RCP 54"	FOOT	3820	$130.00	$496,600.00
STONE RIPRAP, CLASS A4	SQ YD	40	$30.00	$1,200.00
PROPOSED MANHOLE, 7' DIA	EACH	16	$6,500.00	$104,000.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	300	$55.00	$16,500.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	200	$65.00	$13,000.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	500	$10.00	$5,000.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 54" WITH GRATE	EACH	1	$4,000.00	$4,000.00
CLASS D PATCHES, 12 INCHES	SQ YD	265	$75.00	$19,875.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	120	$40.00	$4,800.00
TRAFFIC CONTROL	LSUM	1	$50,000.00	$50,000.00
CONSTRUCTION LAYOUT	LSUM	1	$30,000.00	$30,000.00
IDOT COORDINAITON AND PERMITTING	LSUM	1	$40,000.00	$40,000.00

MITIGATION STORAGE (TO BE DETERMINED BY MODELING)

EARTH EXCAVATION	CU YD	24300	$40.00	$972,000.00
TOPSOIL FURNISH AND PLACE, 6"	SQ YD	12600	$6.00	$75,600.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	12600	$5.00	$63,000.00

SUB TOTAL =	$2,023,725.00
CONTINGENCY (30%) =	$607,117.50
CONSTRUCTION TOTAL =	$2,630,842.50
DESIGN ENGINEERING (10%) =	$197,313.19
CONSTRUCTION OBSERVATION (10%) =	$197,313.19
PERMITTING (5.0%) =	$101,186.25
TOTAL PROJECT COST INCLUDING ENGINEERING =	$3,126,655.13

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY

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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 2

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.1	$15,000.00	$1,500.00
TREE ROOT PRUNING	EACH	3	$200.00	$600.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	360	$5.00	$1,800.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	360	$5.00	$1,800.00
TRENCH BACKFILL, SPECIAL	CU YD	60	$45.00	$2,700.00
FORCE MAIN	FOOT	600	$50.00	$30,000.00
PROPOSED MANHOLE, 4' DIA	EACH	1	$4,000.00	$4,000.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	40	$55.00	$2,200.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	20	$65.00	$1,300.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	60	$10.00	$600.00
CLASS D PATCHES, 12 INCHES	SQ YD	20	$75.00	$1,500.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00
TRAFFIC CONTROL	LSUM	1	$5,000.00	$5,000.00
CONSTRUCTION LAYOUT	LSUM	1	$5,000.00	$5,000.00
PUMP STATION	LSUM	1	$370,000.00	$370,000.00

SUB TOTAL =	$428,800.00
CONTINGENCY (30%) =	$128,640.00
CONSTRUCTION TOTAL =	$557,440.00
DESIGN ENGINEERING (10%) =	$41,808.00
CONSTRUCTION OBSERVATION (10%) =	$41,808.00
PERMITTING (5.0%) =	$21,440.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$662,496.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY

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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 3

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	1.5	$15,000.00	$22,500.00
TREE ROOT PRUNING	EACH	20	$200.00	$4,000.00
EARTH EXCAVATION	CU YD	9760	$40.00	$390,400.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	9400	$5.00	$47,000.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	9400	$5.00	$47,000.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	4	$3,500.00	$14,000.00
TRENCH BACKFILL, SPECIAL	CU YD	20	$45.00	$900.00
STORM SEWER, RCP 21"	FOOT	250	$90.00	$22,500.00
PROPOSED MANHOLE, 4' DIA	EACH	3	$4,000.00	$12,000.00
PROPOSED RESTRICTOR MH, 5' DIA	EACH	4	$4,500.00	$18,000.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 21"	EACH	7	$1,000.00	$7,000.00
CLASS D PATCHES, 12 INCHES	SQ YD	35	$75.00	$2,625.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00
TRAFFIC CONTROL	LSUM	1	$20,000.00	$20,000.00
CONSTRUCTION LAYOUT	LSUM	1	$40,000.00	$40,000.00

SUB TOTAL =	$648,725.00
CONTINGENCY (30%) =	$194,617.50
CONSTRUCTION TOTAL =	$843,342.50
DESIGN ENGINEERING (10%) =	$63,250.69
CONSTRUCTION OBSERVATION (10%) =	$63,250.69
PERMITTING (5.0%) =	$32,436.25
EASEMENTS =	$220,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$1,222,280.13

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, PROPERTY ACQUISITION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY.

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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 3A

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.5	$15,000.00	$7,500.00
TREE ROOT PRUNING	EACH	5	$200.00	$1,000.00
EARTH EXCAVATION	CU YD	4200	$40.00	$168,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	3600	$5.00	$18,000.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	3600	$5.00	$18,000.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
STORM SEWER, RCP 21"	FOOT	20	$90.00	$1,800.00
PROPOSED MANHOLE, 4' DIA	EACH	1	$4,000.00	$4,000.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 21"	EACH	2	$1,000.00	$2,000.00
PROPOSED RESTRICTOR MH, 5' DIA	EACH	1	$4,500.00	$4,500.00
TRAFFIC CONTROL	LSUM	1	$8,000.00	$8,000.00
CONSTRUCTION LAYOUT	LSUM	1	$15,000.00	$15,000.00

SUB TOTAL =	$251,300.00
CONTINGENCY (30%) =	$75,390.00
CONSTRUCTION TOTAL =	$326,690.00
DESIGN ENGINEERING (10%) =	$24,501.75
CONSTRUCTION OBSERVATION (10%) =	$24,501.75
PERMITTING (5.0%) =	$12,565.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$388,258.50

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISITION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, RELOCATING ANY PRIVATE PROPERTY,

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Rosemont, Illinois 60018
Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 4

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	1.6	$15,000.00	$24,000.00
TREE ROOT PRUNING	EACH	23	$200.00	$4,600.00
EARTH EXCAVATION	CU YD	6580	$40.00	$263,200.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	9760	$5.00	$48,800.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	9760	$5.00	$48,800.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	4	$3,500.00	$14,000.00
TRENCH BACKFILL, SPECIAL	CU YD	90	$45.00	$4,050.00
STORM SEWER, RCP 21"	FOOT	850	$90.00	$76,500.00
PROPOSED MANHOLE, 4' DIA	EACH	4	$4,000.00	$16,000.00
PROPOSED RESTRICTOR MH, 5' DIA	EACH	4	$4,500.00	$18,000.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 21"	EACH	7	$1,000.00	$7,000.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	40	$55.00	$2,200.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	20	$65.00	$1,300.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	60	$10.00	$600.00
CLASS D PATCHES, 12 INCHES	SQ YD	80	$75.00	$6,000.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	40	$40.00	$1,600.00
TRAFFIC CONTROL	LSUM	1	$20,000.00	$20,000.00
CONSTRUCTION LAYOUT	LSUM	1	$40,000.00	$40,000.00
FORCE MAIN	FOOT	600	$50.00	$30,000.00
PUMP STATION	LSUM	1	$370,000.00	$370,000.00

SUB TOTAL =	$996,650.00
CONTINGENCY (30%) =	$298,995.00
CONSTRUCTION TOTAL =	$1,295,645.00
DESIGN ENGINEERING (10%) =	$97,173.38
CONSTRUCTION OBSERVATION (10%) =	$97,173.38
PERMITTING (5.0%) =	$49,832.50
EASEMENTS =	$220,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$1,759,824.25

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, PROPERTY ACQUISITION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY.

Christopher B. Burke Engineering, Ltd.
9575 West Higgins Road, Suite 600
Rosemont, Illinois 60018
Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 4A

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.6	$15,000.00	$9,000.00
TREE ROOT PRUNING	EACH	8	$200.00	$1,600.00
EARTH EXCAVATION	CU YD	9600	$40.00	$384,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	3960	$5.00	$19,800.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	3960	$5.00	$19,800.00
TRENCH BACKFILL, SPECIAL	CU YD	60	$45.00	$2,700.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
STORM SEWER, RCP 21"	FOOT	270	$90.00	$24,300.00
PROPOSED MANHOLE, 4' DIA	EACH	2	$4,000.00	$8,000.00
PROPOSED RESTRICTOR MH, 5' DIA	EACH	1	$4,500.00	$4,500.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	40	$55.00	$2,200.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	20	$65.00	$1,300.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	60	$10.00	$600.00
CLASS D PATCHES, 12 INCHES	SQ YD	20	$75.00	$1,500.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00
RETAINING WALLS	SQ FT	7200	$40.00	$288,000.00
TRAFFIC CONTROL	LSUM	1	$10,000.00	$10,000.00
CONSTRUCTION LAYOUT	LSUM	1	$18,000.00	$18,000.00
FORCE MAIN	FOOT	600	$50.00	$30,000.00
PUMP STATION	LSUM	1	$370,000.00	$370,000.00

SUB TOTAL =	$1,199,600.00
CONTINGENCY (30%) =	$359,880.00
CONSTRUCTION TOTAL =	$1,559,480.00
DESIGN ENGINEERING (10%) =	$116,961.00
CONSTRUCTION OBSERVATION (10%) =	$116,961.00
PERMITTING (5.0%) =	$59,980.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$1,853,382.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISITION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, RELOCATING ANY PRIVATE PROPERTY,

TAB 4

Lake Claire and Shire Pond Flooding Probem Area

MEMORANDUM

September 18, 2012

TO: Anne Marin – City Administrator, Prospect Heights
Steve Skiber – Director of Building and Zoning, Prospect Heights
James H. Johnson, PE – Director of Public Works and City Engineer
James O'Neill – Public Works Foreman, Prospect Heights

COPY: Donald R. Dressel, PE - CBBEL
Project Files (CBBEL Project No. 11-412)

FROM: Erik L. Gil, PE

SUBJECT: **Lake Claire and Shires Pond Flooding Problem Area**
Project: 2011-12 Prospect Heights Flood Study
Location: East of Wheeling Road, west of Coldren Drive, south of Shawn Lane, and north of Claire Lane (but including lots along Claire Lane, Prospect Heights, Cook County, Illinois
Watershed: McDonald Creek

INTRODUCTION

Christopher B. Burke Engineering Ltd. (CBBEL) was retained by the City of Prospect Heights (City) to perform a flood risk reduction analysis based on the flooding that occurred from the July 22-23, 2011 storm event. The primary goals of this study were to determine the extent of the flood damage, establish possible causes for the flooding and to provide potential solutions to reduce the risk of future flooding.

This memorandum documents the analysis for the Lake Claire/Shires Pond Study Area. Separate memoranda will be provided for each of the other study areas, and will be assembled in a single report at the conclusion of the study.

JULY 22-23, 2011 EVENT PRECIPITATION

On July 23, 2011 the City received approximately 4.81 inches of rain in a 3-hour period that resulted in extensive flood damage in certain areas of the City. The City received 6.17 inches of rain in a 24-hour period from July 22nd to the 23rd. The rainfall totals were based on the rainfall values obtained from the gages shown in Table 1 below, which are from both the O'Hare International Airport and the Chicago Executive Airport weather gages.

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W Higgins Road, Suite 600 Rosemont, Illinois 60018-4920 Tel (847) 823-0500 Fax (847) 823-0520

TABLE 1
July 22-23, 2011 Rainfall Values

Gage ID	Location	3-hour Total (inches)	24-hour Total (inches)
04838	Chicago Executive Airport	4.71	6.06
94846	O'Hare International Airport	6.79	8.21
	Weighted Average =	*4.81*	*6.17*
	ISWS Bulletin 70 frequency at Prospect Heights*	100-year	40-year

*Note: The stated frequency is approximate.

Two durations were chosen for discussion purposes, the 3-hour duration and the 24-hour duration. The 24-hour duration is the traditional duration used for many engineering calculations and is the typical one reported by the media. The 3-hour duration was also chosen for comparison purposes for 2 reasons. The first is that most of the flooding problem drainage areas being evaluated in this flood study respond to significant short-duration rainfall events within or shortly after a 3-hour period, that is, the flood peak is typically reached shortly after this time period if rain is no longer falling, as was the case during July 23, 2011. The Des Plaines River, for example, would not respond as quickly to a significant short-duration rainfall event. The second reason is that the rainfall totals for the most severe continuous 3-hour period at the O'Hare International Airport gage exceeded the 100-year frequency as documented in the Illinois State Water Survey (ISWS) Bulletin 70 publication, the reference used by most regulatory agencies in the northeastern Illinois area for rainfall depth design values. The Chicago Executive Airport gage did not exceed the 100-year frequency value for the 3-hour event, but it was sufficiently close to be considered as the 100-year frequency. As can be observed, the two gage values at O'Hare International Airport and at Chicago Executive Airport differed by over 2 inches of rainfall for each of the reported totals. This meant that the July 22-23, 2011 event was a relatively localized storm event. For purposes of this study, a simple weighted average between the two gages was computed to estimate the rainfall totals that fell on the City, assigning a 95% weight to Chicago Executive Airport based on distance from the City as compared to the O'Hare International Airport, which was assigned a 5% weight.

The July 22nd–23rd storm event exceeded the capacity of the storm sewer systems in the older parts of town and resulted in street, backyard, and home flooding. Approximately 161 residents within the City filled out a flood questionnaire after the July 23rd storm event.

REFERENCES AND AVAILABLE INFORMATION

- Meetings with City staff,
- Summary provided by City staff of 161 flood questionnaires submitted by City residents,
- Site visits,
- Cook County 1-foot contour aerial topography,
- City storm sewer maps,

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- United States Geological Survey (USGS) Hydrologic Atlas (HA),
- Historic Aerial Photographs,
- Federal Emergency Management Agency (FEMA) Federal Insurance Rate Maps (FIRMs)

OVERVIEW

The Lake Claire/Shires Pond study area is located in a south-central area of the City. In reference to major roads, the study area is within the area generally bounded by Willow Road on the north, Wheeling Road on the west, McDonald Creek on the east, and Camp McDonald Road on the south with specific flooding concerns within Lake Claire and the backyards of the homes within this area. The street map of this location is shown on Figure 1.

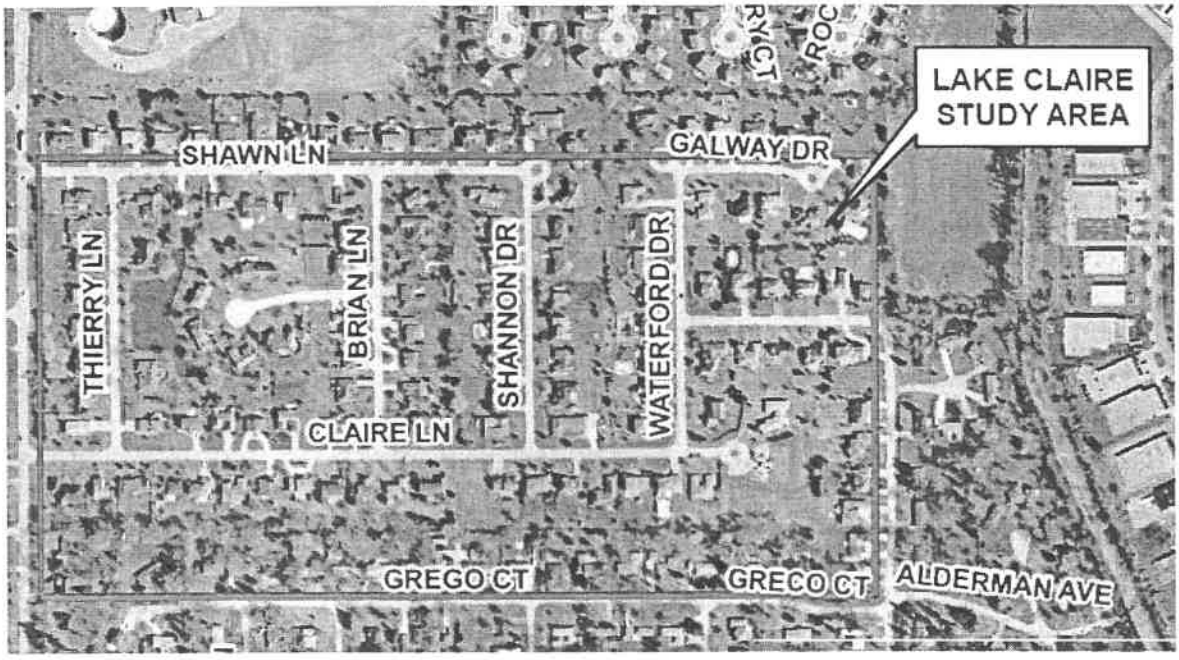

Figure 1
Lake Claire and Shires Pond Area
Location Map

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TAB 3

Arlington Countryside Flooding Probem Area

MEMORANDUM

September 18, 2012

TO: Anne Marin – City Administrator, Prospect Heights
Steve Skiber – Director of Building and Zoning, Prospect Heights
James H. Johnson, PE – Director of Public Works and City Engineer
James O'Neill – Public Works Foreman, Prospect Heights

COPY: Donald R. Dressel, PE - CBBEL
Project Files (CBBEL Project No. 11-412)

FROM: Erik L. Gil, PE

SUBJECT: **Arlington Countryside Flooding Problem Area**
Project: 2011-12 Prospect Heights Flood Study
Location: West of Rand Road, east of Windsor, south of Olive Street, and north of Oakton Street, Prospect Heights, Cook County, Illinois
Watershed: Tributary A to McDonald Creek (and Weller Creek)

INTRODUCTION

Christopher B. Burke Engineering Ltd. (CBBEL) was retained by the City of Prospect Heights (City) to perform a flood risk reduction analysis based on the flooding that occurred from the July 22-23, 2011 storm event. The primary goals of this study were to determine the extent of the flood damage, establish possible causes for the flooding and to provide potential solutions to reduce the risk of future flooding.

This memorandum documents the analysis for the Arlington Countryside Study Area. Separate memoranda will be provided for each of the other study areas, and will be assembled in a single report at the conclusion of the study.

JULY 22-23, 2011 EVENT PRECIPITATION

On July 23, 2011 the City received approximately 4.81 inches of rain in a 3-hour period that resulted in extensive flood damage in certain areas of the City. The City received 6.17 inches of rain in a 24-hour period from July 22nd to the 23rd. The rainfall totals were based on the rainfall values obtained from the gages shown in Table 1 below, which are from both the O'Hare International Airport and the Chicago Executive Airport weather gages.

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Two durations were chosen for discussion purposes, the 3-hour duration and the 24-hour duration. The 24-hour duration is the traditional duration used for many engineering calculations and is the typical one reported by the media. The 3-hour duration was also chosen for comparison purposes for 2 reasons. The first is that most of the flooding problem drainage areas being evaluated in this flood study respond to significant short-duration rainfall events within or shortly after a 3-hour period, that is, the flood peak is typically reached shortly after this time period if rain is no longer falling, as was the case during July 23, 2011. The Des Plaines River, for example, would not respond as quickly to a significant short-duration rainfall event. The second reason is that the rainfall totals for the most severe continuous 3-hour period at the O'Hare International Airport gage exceeded the 100-year frequency as documented in the Illinois State Water Survey (ISWS) Bulletin 70 publication, the reference used by most regulatory agencies in the northeastern Illinois area for rainfall depth design values. The Chicago Executive Airport gage did not exceed the 100-year frequency value for the 3-hour event, but it was sufficiently close to be considered as the 100-year frequency. As can be observed, the two gage values at O'Hare International Airport and at Chicago Executive Airport differed by over 2 inches of rainfall for each of the reported totals. This meant that the July 22-23, 2011 event was a relatively localized storm event. For purposes of this study, a simple weighted average between the two gages was computed to estimate the rainfall totals that fell on the City, assigning a 95% weight to Chicago Executive Airport based on distance from the City as compared to the O'Hare International Airport, which was assigned a 5% weight.

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REFERENCES AND AVAILABLE INFORMATION

- Meetings with City staff,
- Summary provided by City staff of 161 flood questionnaires submitted by City residents,
- Site visits,
- Cook County 1-foot contour aerial topography,
- City storm sewer maps,

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- United States Geological Survey (USGS) Hydrologic Atlas (HA),
- Historic Aerial Photographs,
- Federal Emergency Management Agency (FEMA) Federal Insurance Rate Maps (FIRMs)

OVERVIEW

The Arlington Countryside study area is located in the western most area of the City. In general, the study area is bounded by Olive Street on the north, Windsor Drive on the west, Rand Road on the east, and Oakton Street on the south with specific flooding concerns along the front yards and backyards of the homes along the north-south streets and the roads. The street map of this location is shown on Figure 1.

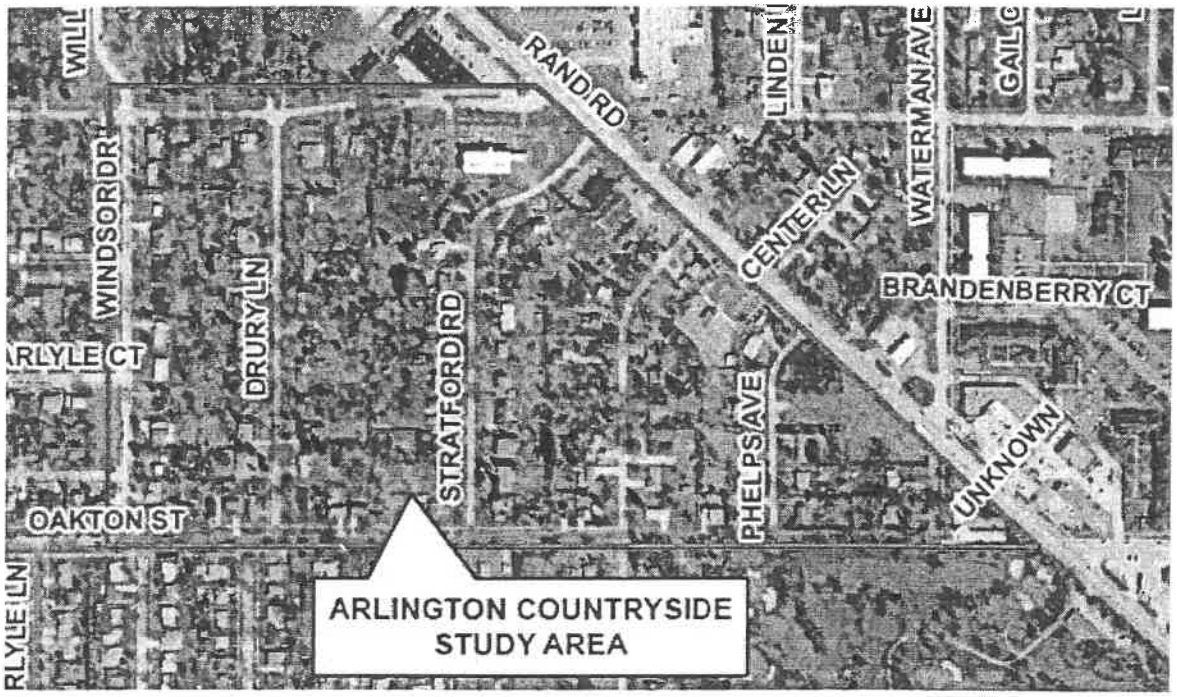

Figure 1
Arlington Countryside
Location Map

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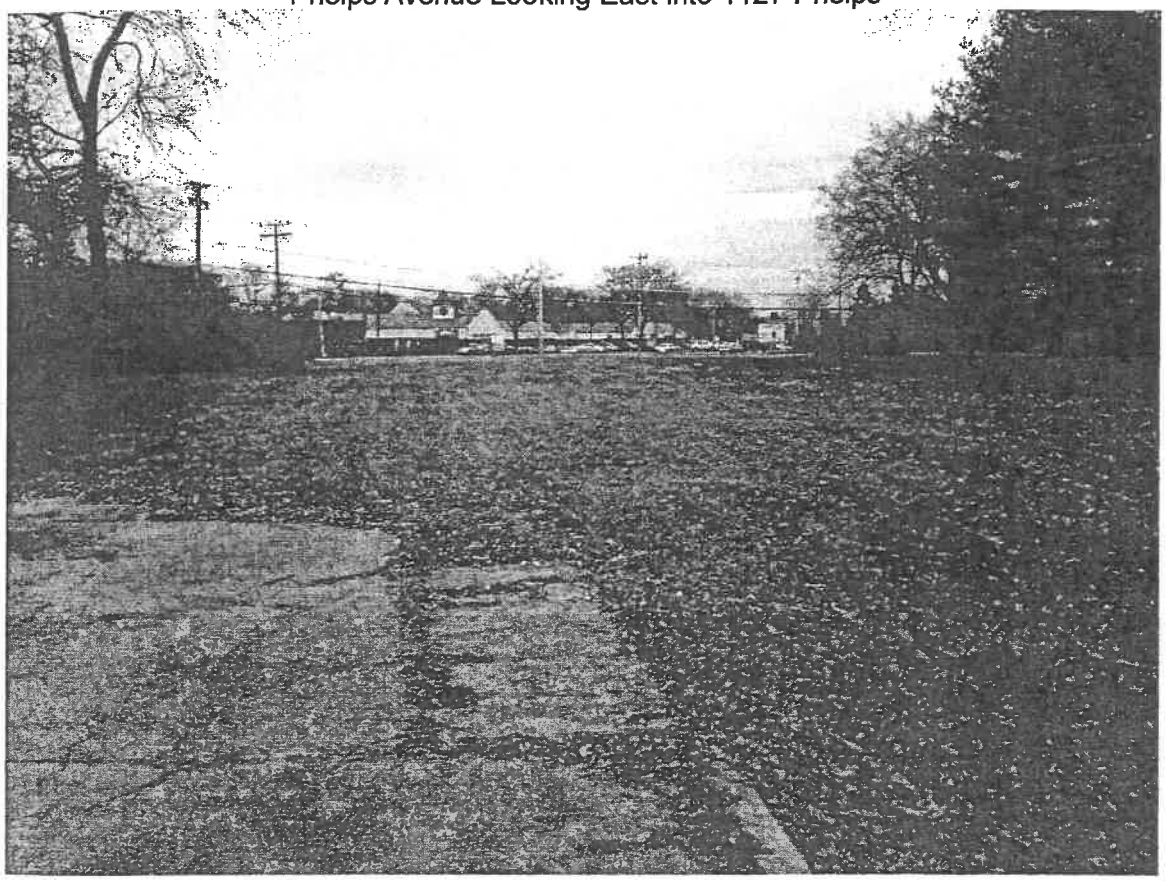
The western corporate boundary between the City of Prospect Heights and the Village of Arlington Heights at this location is Windsor Drive. The area is located on the most western portion of the City's corporate limits and is essentially a "peninsula" surrounded by the Village of Arlington Heights. It is topographically a "bowl" with limited underground drainage capacity and practically nonexistent overland overflow routes with Rand Road acting as a "dam".

The watershed divide extends north, west, and south of this area into the Village of Arlington Heights. The study area is located at the divide between Tributary A to McDonald Creek and Weller Creek watersheds and is located within a historical depressional area. Photograph 1 shows a view at a vacant property on Phelps Avenue looking east.

PHOTOGRAPH 1
Phelps Avenue Looking East into 1127 Phelps



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EXISTING DRAINAGE PATTERN

The historic patterns that existed prior to development in this area were of a poorly drained area. According to Hydrologic Investigations Atlas HA-67, Floods in Arlington Heights Quadrangle, Illinois, prepared in 1963, shown as Figure 2, there was a depressional area within this study area prior to development that extends through a substantial portion of the study area. The encompassing elevation depicted on HA-67 associated with this depressional area is 685. However, based on the Cook County aerial topography, some of the backyards are as low as elevation 680.

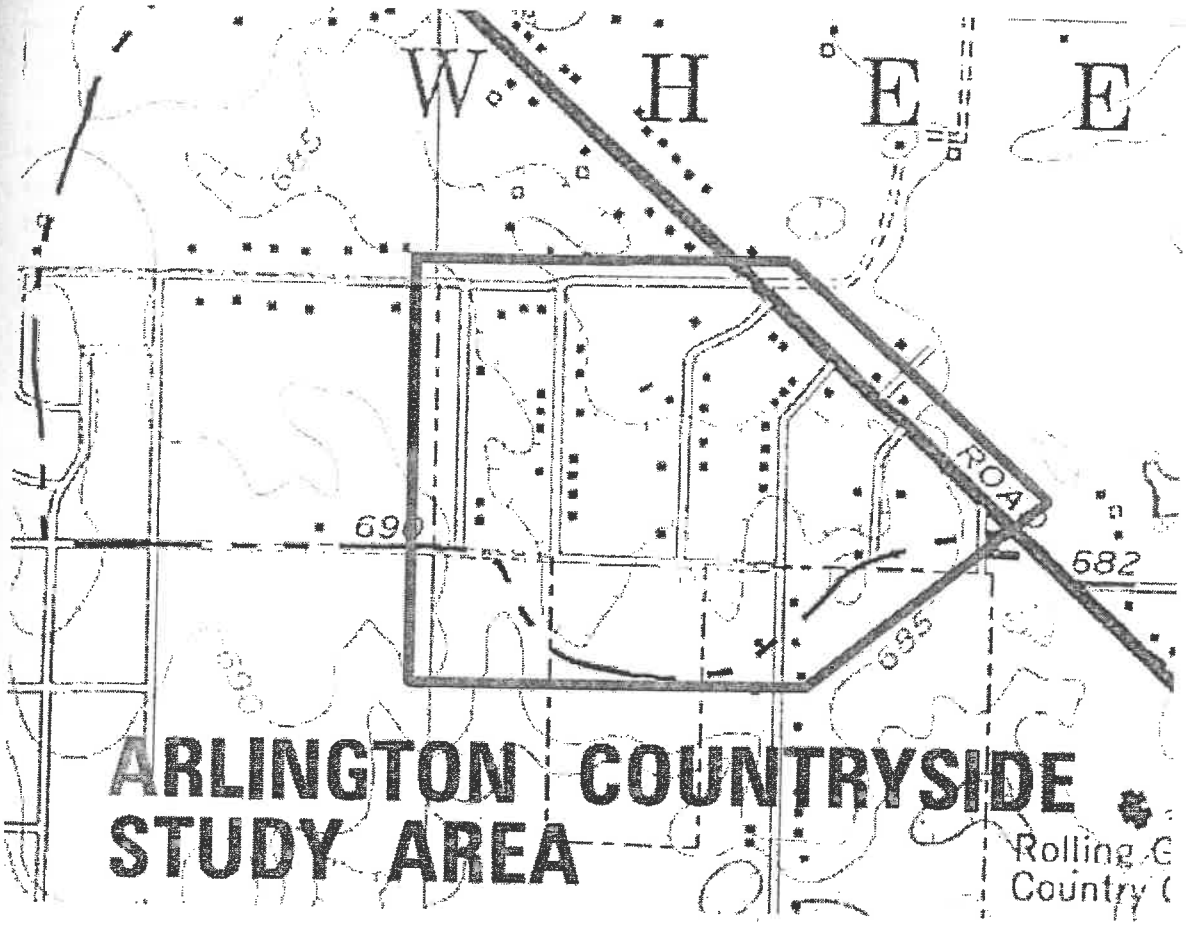

Figure 2
USGS Hydrologic Atlas

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Arlington Countryside has five local depressional areas and insufficient underground drainage capacity to drain these depressional areas. The existing depressional ground areas are located in the rear yards of the residential properties. Up until 2002, the depressional ground areas were drained by an existing field tile which crossed roadways and platted lots, without the benefit of drainage easements. The existing 12-inch field tile was reported by the City of Prospect Heights as an inadequate outlet for stormwater runoff in the Arlington Countryside area. Therefore, as a result of public meetings with the affected residents, in 2002 the City replaced the drain tile through this area with a storm sewer varying in size between 12 inches and 21 inches. This drainage project restored the original conveyance of the drain tile, but did not significantly lower flooding levels in Arlington Countryside for the larger storm events. Therefore, for moderate to severe events, stormwater ponds within the depressional areas and does not typically drain for over 24 hours or more. Stormwater runoff generally flows west to east within this area and is drained by the new storm sewer system. This storm sewer connects to an 18" storm sewer under Rand Road (outlet point) which connects to the Village of Arlington Heights Brandenberry Apartment complex storm sewer system, which then drains to the Camp McDonald Road storm sewer. The 18" field tile used to go through the Jesurun Presbyterian Church site in the Village of Arlington Heights (between Forrest and Phelps Avenues). When this parcel was developed in 2000, the City requested that the 18" field tile be relocated along the property boundary within drainage easements as part of the improvements for the church construction. This relocation was reflected in the engineering plans submitted to the City for review.

The Arlington Countryside area receives stormwater from both City of Prospect Heights and Village of Arlington Heights. However, it depends on the severity of the storm as to when these other areas begin to contribute flow towards Arlington Countryside because some of the areas are served by storm sewers, which convey the flow to a different outlet point. When these other storm sewer systems reach their conveyance capacity (either the pipes are surcharging or the inlets cannot take more water), then the rainfall runoff begins to flow overland towards Arlington Countryside. Therefore, it is appropriate to consider two different drainage divides for the Arlington Countryside: 1) the storm sewer divide and 2) the overland flow divide.

The storm sewer divide area would be the area that flows to Arlington Countryside via field tile/storm sewer and any overland flow area that is not being picked up by another storm sewer system that outlets at a different point. Typically, local storm sewer systems are designed for the 10-year storm event rainfall, but the 5-year event was also used during the periods when these areas were developed. However, the 10-year design rainfall depths have changed since the construction of these storm sewer systems. Therefore, they no longer represent a current 10-year design. However, for simplicity, this area will be called the 10-year divide. The overland flow divide is the entire area draining to Arlington Countryside when all underground systems are at capacity. This will be called the 100-year divide.

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There are 224 acres tributary to the intersection of Rand Road and Camp McDonald Road that consists of residential and commercial areas within the City of Prospect Heights and the Village of Arlington Heights. The drainage problems occurring in the Arlington Countryside area are the result of an inadequate outlet condition which consists of an existing 12-to-21-inch storm sewer, the limited capacity of the 18-inch sewer outlet under Rand Road, and a lack of an adequate overland overflow route. The overland overflow route control is located at the southeast corner of Phelps Avenue and Rand Road, and its overtopping elevation is between 683 and 684. During any moderate rainfall, the runoff begins to pond within the existing depressional ground areas until it is either pumped out by the City's Public Works Department or slowly drained by the existing storm sewer. The following areas store water within the watershed.

Table 2
Summary of Locations that Store Water

Description
Somerset Courts stormwater detention facility
Depressional ground area north of Olive Street and south of Rand Road
Depressional ground area along Drury Lane between Olive Street and Oakton Street
Depressional ground area along Stratford Road north of Oakton Street
Depressional ground area between Stratford Road and Forrest Avenue north of Oakton Street
Depressional ground area between Forrest Avenue and Phelps Avenue north of Oakton Street
Depressional ground area between Phelps Avenue and Watermain Avenue north of Oakton Street

Once water reaches the Rand Road right-of-way, it can only drain by gravity by entering the 18-inch sewer that flows east, or once the water reaches elevation 683+ it would begin to overflow southeast along the Rand Road right-of-way. By then, the streets, backyards, and low-lying properties have been flooded.

Table 1 summarizes the 8 flood questionnaires returned in this study area.

TABLE 3
Arlington Countryside Study Area
Flood Questionnaire Summary

Location	Questionnaires Submitted to the City	Basement Flooding (questionnaires reporting)	Basement Flooding Depth Reported (ranges)	Total Damage Reported*
Drury Lane	1	None reported	None reported	$5,000
Phelps Avenue	3	2	1 to 8 inches	$12,000
Stratford Road	2	2	3.5 to 5+ feet	$25,550
Forrest Ave	2	None reported	None reported	$30,000
TOTAL	**8**	**4**		**$72,550**

*Note: The reported damages are taken directly from the flood questionnaire.

STORMWATER DEFICIENCIES

Based on field visits, assessment of the topography, verbal communication with Public Works staff, and the limited existing storm sewer system shown on the City atlases for this area, the following stormwater deficiencies have been identified for this area:

1. The areas that flood are located within a "bowl" or depression with respect to the surrounding area. This can be clearly observed from Figure 2 that this condition existed prior to development. Historically, "bowl" areas were poorly drained, and farmers installed field tiles to drain them. This "bowl" condition also indicates that most rainfall that falls on the watershed will ultimately be conveyed to the "low" spot and collect and pond if the conveyance system cannot drain the flow of runoff into it.
2. There is one storm sewer system that drains this area, but it does not have sufficient capacity to convey the amount of runoff entering it during moderate or greater storm events as evidenced by Public Works staff and residents.
3. The storm sewer system, which was built by the City circa 2002, helps drain the area, but ultimately, the flow is controlled by the 18-inch storm sewer under Rand Road. The only gravity outlet for this area is the 18-inch Rand Road sewer. The storm sewer system and outlet does not have sufficient capacity to drain the system such that flooding would not occur.
4. No dedicated and adequate overland flow path exists to drain this area. The overflow point, should a sufficiently large storm event occur, would be the southeast corner of where Phelps Avenue and Rand Road intersect, and into the Rand Road right-of-way.

APPROACH TO SOLUTIONS

CHRISTOPHER B. BURKE ENGINEERING, LTD.
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This area experiences flooding because historically this area was a depression, and it appears that development did not substantially alter the grades, thereby the depression continues to collect water from the contributing areas as it has done before. While the storm sewer provides a means of draining this area, its capacity is exceeded for moderate to significant storm events, and the area floods. This area was developed prior to the requirement for detention storage. The circa 1960 condition depicted by the USGS HA (Figure 2) shows homes already in existence at the time, which shows approximately 30% of the homes built. There is no mapped floodplain or floodway within the Arlington Countryside area.

There are no available photographs for this area during the July 23, 2011 storm event. While sufficient field information is not available to determine the flow capacity of this storm sewer, the City did perform sewer cleaning operations, and found the pipe to be in good condition.

In general, structural approaches for alleviating flooding problems can be categorized into two types: storage creation, or conveyance improvements. Typically, conveyance improvements alone may cause impacts to downstream properties, and detailed modeling would be necessary to determine the location and magnitude of these impacts, which is beyond the scope of this study. The storm sewer system replaced an old field tile through this area, but is limited by the 18-inch storm sewer under Rand Road. Therefore, this study area stores stormwater runoff within the depressions and releases it at a relatively low rate through the 18-inch pipe under Rand Road.

Aside from possible public improvements, it is recommended that the City encourage all residents to flood-proof their homes, especially those who have experienced flooding in the past. This will reduce the risk of future flooding due to overland flow, seepage and sump pump failures. A list of simple and inexpensive flood-proofing measures has been included as Attachment 1 of this memorandum. This recommendation is in addition to any other drainage improvements on public or private property. Furthermore, as this area is redeveloped with teardowns, the City should require that proposed plans maintain the stormwater volumes that these properties hold below the 100-year storm event flooding levels.

There are various approaches to alleviating flooding for this area:

- To provide a level of protection for the July 2011 event (considered to substantially represent the 100-year event), and with minimal disruption to the existing properties within Arlington Countryside, a large storm sewer would have to be constructed from Rand Road, along Camp McDonald Road, to the Old Orchard Country Club, where Tributary A to McDonald Creek is located. In addition to that trunk sewer, an upsized storm sewer system with Arlington Countryside would be required. The downstream impacts to properties along Tributary A and downstream of the Old Orchard Country Club would need to be evaluated with modeling, and it is

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anticipated that additional storage would need to be created to compensate for conveying the water at a higher rate downstream. This approach will require coordination with residential property owners, the Illinois Department of Transportation (IDOT), Cook County Highway Department (CCHD), and depending on where storage is provided, permits from the Illinois Department of Natural Resources – Office of Water Resources and the U.S. Army Corps of Engineers may be required.

- To provide a 10-year level of protection, the current level required by the City, and with minimal disruption to the existing properties within Arlington Countryside, the approach would be very similar as for the 100-year, except that the storm sewer would not be as large. The downstream impacts to properties along Tributary A and downstream of the Old Orchard Country Club would still need to be evaluated with modeling, and it is anticipated that additional storage would need to be created to compensate for convey the water at a higher rate downstream. This approach will require coordination with residential property owners, IDOT, CCHD, and depending on where storage is provided, permits from the Illinois Department of Natural Resources – Office of Water Resources and the U.S. Army Corps of Engineers may be required.
- Improve (lower) the overflow point where water begins to overtop onto the Rand Road right-of-way. This option, while relatively inexpensive, would likely not be allowed by IDOT, and would be the least effective when considering the above-described options. However, this option can be combined with other approaches to the extent that IDOT would allow.
- Another option is to tap into the Arlington Heights storm sewer system. This option will require further coordination with the Village of Arlington Heights. This option could be studied in more detail if field survey and modeling of the Arlington Heights storm sewer system was performed. However, the ability to add flow to the Arlington Heights storm sewer is expected to be limited. In the past, the Village has allowed the City to pump water from Arlington Countryside to the Village's storm sewer system with portable pumps, but at a controlled rate. For this approach by itself, the levels of flooding would be unchanged for a storm with similar intensity as the July 2011 event, but the inundation times would be reduced.
- Another option would be to construct a storm sewer along Olive Street and tap into the Rand Road IDOT storm sewer system. Based on a review of ground elevations, a pump station would be required. Furthermore, IDOT would limit the flow that could enter the system. Similarly, for this approach by itself, the levels of flooding would be unchanged for a storm with similar intensity as the July 2011 event, but the inundation times would be reduced.
- The storm sewer constructed by the City circa 2002 did not lower the ponding levels within Arlington Countryside for large storm events, but reduced the time of inundation for each of the depressional areas. The continuation of that project would be to create additional storage such that flood elevations would be reduced. Due to the "bowl" topography of the site, the project constraints only allowed excavation of the backyards of properties to provide additional storage. A geotechnical analysis

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will be necessary to determine the maximum depth of excavation before groundwater problems begin. This approach will require easements from all the affected properties and the heavily vegetated backyards will be disturbed during the construction process. This is the only alternative that, by itself, would not necessarily require coordinating with outside agencies, with the exception of the U.S. Army Corps of Engineers, as nearly all projects require their review.

ALTERNATIVE DRAINAGE SOLUTIONS

The possible drainage solutions for the Arlington Countryside study area were developed at a concept level based on feasibility of implementation and cost effectiveness. Based on this analysis, CBBEL identified the following alternatives to reduce the risk of flooding in this area:

1. This alternative would consist of a conveyance project from Arlington Countryside to Tributary A to McDonald Creek at the Old Orchard Country Club, and storage creation to mitigate the increases in flow that would be expected to occur downstream of the Old Orchard Country Club due to larger storm sewer outfall. This would require modeling not only the Arlington Countryside system but the Camp McDonald Road drainage system. The Tributary A model developed as part of the Metropolitan Water Reclamation District (MWRD) watershed study would be used to couple with the other models to evaluate downstream impacts. Within this alternative, various levels of protection can be analyzed. While the conveyance from Arlington Countryside should be feasible within IDOT and CCHD right-of-way regardless of the size of the storm sewer, creating sufficient storage to mitigate increases will be challenging given already existing flooding problems within this tributary, and the apparent lack of open space that doesn't already have a dedicated use. It is recommended that the 5-year, 10-year, and 100-year levels be investigated for cost versus flooding levels. It would appear that the improvements that the City performed circa 2002 had some positive impacts in the intervening years, and protecting for a storm with similar intensity as the July 2011 event will have a relatively high cost.
2. This alternative would consist of pumping water to either or both the IDOT Rand Road system and the Arlington Heights storm sewer system. The existing system is a gravity-drained system that is limited by both the outlet pipe size under Rand Road and the downstream system's inherent design to also capture areas east of Rand Road. A new storm sewer system can be designed for Arlington Countryside to capture the flows for the design storm, and these would be pumped to either or both the IDOT and Arlington Heights storm sewer systems. The rate of pumping would be limited by the capacity of these storm sewers. This alternative is probably more practical in combination with one of the other alternatives as a means to optimize costs or impacts to private property.

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3. This alternative can be considered a continuation of the project the City completed circa 2002, which was replacing the field tile with a storm sewer system. If a larger conveyance option, as suggested by either of the first two alternatives described above, is not feasible, then "on site" storage is necessary. Because the Arlington Countryside area is fully developed (with the exception of 1 lot off Phelps Avenue), there are no dedicated open spaces. Therefore, storage would have to be created within the backyards of the existing properties. The storage areas would be located as follows:
    - Between Windsor Drive and Drury Lane
    - Between Drury Lane and Stratford Road
    - Between Stratford Road and Forrest Avenue
    - Between Forrest Avenue and Phelps Avenue

    The depth below existing ground of these storage areas would vary between 4 and 6 feet, and the side slopes would be approximately 5 to 1. These storage areas would impact the usability of the backyards and the likelihood of relocating some of the detached garages. A geotechnical analysis would be required to verify the viability of the depths and the groundwater levels, which may require constant pumping. Its construction would occur entirely with the City corporate limits. This alternative could either be with or without a pump station. If no pump station is used, then the ability to create storage will be limited by the existing gravity storm sewer, and the corresponding level of protection would be less than if a pump station is used and the storage areas are deeper.

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RECOMMENDATIONS

Based on this analysis, CBBEL presents the pros and cons of each alternative, and provides estimated costs and a recommendation.

TABLE 3
Arlington Countryside Flooding Problem Area
Alternatives Analysis Summary

Alternative	Description	Pros	Cons
1	Conveyance improvements from Arlington Countryside to Camp McDonald Road, and storage creation along Tributary A	• May substantially reduce flooding within Arlington Countryside, depending on the level of protection • Least impact to residential properties	• Will require mitigating storage within Tributary A • Will require CCHD and IDOT permits
2	Pump flows into Arlington Heights and/or IDOT storm sewer system	• May lower the flooding levels for smaller storms • Will decrease inundation times • Least impact to residential properties	• Will not eliminate flooding or level of inundation for large storm events • Will require permit from IDOT and Arlington Heights
3	Storage Creation within Arlington Countryside (no pumping)	• May lower the flooding levels for smaller storms • Will decrease inundation times	• Will not eliminate flooding or level of inundation for large storm events • Will require drainage easements • Less benefits than alternative with pumping
3A	Storage Creation between Forrest and Stratford Countryside (no pumping)	• To be done as a first phase of more improvements as funds become available • May lower the flooding levels for small storms in this area only	• Will not eliminate flooding or level of inundation for large storm events • Limited benefit
4	Storage creation within Arlington Countryside (with pumping)	• May lower the flooding levels for smaller storms • Will decrease inundation times	• Will not eliminate flooding or level of inundation for large storm events • Will require drainage easements • Pump station is a significant cost
4A	Alternative 2 *plus* Alternative 3A with a deeper basin with retaining walls	• May lower the flooding levels for smaller storms • Will decrease inundation times	• Will not eliminate flooding or level of inundation for large storm events • Will require permit from IDOT and Arlington Heights • Retaining walls adjacent to residential properties

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Table 4 below provides a summary of conceptual cost estimates associated with each of the above alternatives. The detailed conceptual cost estimates can be found under Attachment 2.

TABLE 4
Arlington Countryside Flooding Problem Area
Alternatives Analysis Cost Summary

Alternative	Description	Estimated Cost
1	Conveyance improvements from Arlington Countryside to Camp McDonald Road, and storage creation along Tributary A	$3,130,000
2	Pump flows into Arlington Heights and/or IDOT storm sewer system	$670,000
3	Storage Creation within Arlington Countryside (no pumping)	$1,250,000
3A	Storage Creation between Forrest and Stratford Countryside (no pumping)	$390,000
4	Storage creation within Arlington Countryside (with pumping)	$1,760,000
4A	Alternative 2 *plus* Alternative 3A with a deeper basin with retaining walls	$1,860,000

Based on the above, CBBEL recommends the following:

- The City should meet with IDOT to discuss pumping to their system for Alternative 2 and 4; and also to discuss the feasibility of installing a large storm sewer under Alternative 1. This meeting would establish the constraints that the City will need to conform to in performing detailed modeling.
- The City should meet with CCHD to discuss the possibility of installing a large storm sewer under Alternative 1. This meeting would establish the constraints that the City will need to conform to in performing detailed modeling, and developing Alternative 1 further.
- The City should meet with Arlington Heights to discuss the possibility of a pump station to their system. Historically, the Village has allowed the City to pump water given certain constraints.

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- The City should conduct public meetings with the Arlington Countryside residents to determine whether they are amenable to creating storage areas in their backyards. At this point, it is anticipated that all four storage areas described above would be necessary given the limited space and ability to go deep.
- Alternative 1 requires additional detailed preliminary engineering analyses, including a large modeling effort to develop a solution that does not flood other City properties. It requires the highest level of stakeholder coordination. It is suggested that the City attempt the above steps first prior to committing resources to Alternative 1. As a first step to this, it is recommended that the City meet with the Mount Prospect Park District to discuss how much of the Old Orchard Country Club can be disturbed to create additional storage. Finding locations to create storage downstream is anticipated to be challenging.
- Alternative 3A is the least cost alternative and would only benefit the flooding at Forrest Avenue for smaller storms. However, this could be considered a first phase of storage creation as part of a larger improvement alternative as funds become available. As such, Alternative 3A is a cost effective first step in alleviating some of the flooding in the Forrest Avenue low area.
- Alternative 4A would maximize the storage of Alternative 3A by excavating deeper and pumping it out. However, retaining walls would be necessary.

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Attachment 1
Flood-proofing Techniques

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TIPS ON FLOOD PREVENTION FOR HOMEOWNERS

- Clean gutters and install gutter covers to prevent clogging.
- Redefine and clear swales throughout yard to allow an appropriate drainage way for storm water runoff.
- Raise the low entry elevation at which storm water can enter your home by berming around basement doorways or windows. A pump may be required to drain water away from inside the berm.
- Verify existing sump pump and outlet pipe have sufficient capacity for discharging during intense storm events.
- Provide a relief outlet for the sump pump outside of the house that is a safe distance from the foundation in case of surcharge, frozen outlet pipe, or other blockage.
- Install a backup source of power for sump pump in case of electrical power failure.
- Extend downspouts away from the foundation 5-10 feet.
- Repair foundation cracks throughout basement to prevent seepage.
- Raise the low-entry elevation of window wells and/or install drains in the window wells and connect them to the sump pump system.
- Install glass block windows in place of basement windows (except escape window) to prevent water inflow or infiltration.
- If a storm sewer structure is adjacent to the lot, an underdrain system could be installed to collect excess runoff, any remaining seepage or any infiltration resulting from hydrostatic pressure.
- For homes with a reverse-slope driveway, raise the sidewalk elevation to reduce the risk of standing water in the street draining down the driveway and into the garage.
- To further reduce the risk of flooding for homes with reverse slope driveways, it may be necessary to convert the lower level garage into a basement and completely fill in the reverse-slope driveway.

The recommendations provided above may not eliminate flooding or flood damage within the residence; however, if installed correctly they should effectively reduce the risk of flooding. It is should also be noted that any of the recommendations may be implemented

individually, however, many suggestions may be used in conjunction with one another to provide a greater impact in helping to reduce the risk of future flood damage.

WEBSITE LINKS FOR FLOOD PREVENTION

Lake County Stormwater Management Commission Website
http://www.co.lake.il.us/smc/citizens/default.asp

"Repairing Your Flooded Home" by FEMA and the Red Cross
http://www.co.lake.il.us/smc/fwa/ARC_RepFloodedHome.pdf

"Drainage Around Your Home" by the National Resource Conservation Service
http://www.co.lake.il.us/smc/citizens/drainbro.pdf

"Homeowners Guide to Retrofitting: Six Ways to Protect Your Home from Flooding" by FEMA
http://www.fema.gov/rebuild/mat/rfit.shtm

"Guide to Flood Protection in Northeastern Illinois" by the Illinois Association for Floodplain and Stormwater Management
http://www.illinoisfloods.org/documents/Guide_to_Flood_Prot--March_06.pdf

Attachment 2
Cost Estimates

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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 1

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.3	$15,000.00	$4,500.00
TREE ROOT PRUNING	EACH	15	$200.00	$3,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	3350	$5.00	$16,750.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	3350	$5.00	$16,750.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
TRENCH BACKFILL, SPECIAL	CU YD	1150	$45.00	$51,750.00
STORM SEWER, RCP 30"	FOOT	290	$110.00	$31,900.00
STORM SEWER, RCP 54"	FOOT	3820	$130.00	$496,600.00
STONE RIPRAP, CLASS A4	SQ YD	40	$30.00	$1,200.00
PROPOSED MANHOLE, 7' DIA	EACH	16	$6,500.00	$104,000.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	300	$55.00	$16,500.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	200	$65.00	$13,000.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	500	$10.00	$5,000.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 54" WITH GRATE	EACH	1	$4,000.00	$4,000.00
CLASS D PATCHES, 12 INCHES	SQ YD	265	$75.00	$19,875.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	120	$40.00	$4,800.00
TRAFFIC CONTROL	LSUM	1	$50,000.00	$50,000.00
CONSTRUCTION LAYOUT	LSUM	1	$30,000.00	$30,000.00
IDOT COORDINAITON AND PERMITTING	LSUM	1	$40,000.00	$40,000.00

MITIGATION STORAGE (TO BE DETERMINED BY MODELING)

EARTH EXCAVATION	CU YD	24300	$40.00	$972,000.00
TOPSOIL FURNISH AND PLACE, 6"	SQ YD	12600	$6.00	$75,600.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	12600	$5.00	$63,000.00

SUB TOTAL =	$2,023,725.00
CONTINGENCY (30%) =	$607,117.50
CONSTRUCTION TOTAL =	$2,630,842.50
DESIGN ENGINEERING (10%) =	$197,313.19
CONSTRUCTION OBSERVATION (10%) =	$197,313.19
PERMITTING (5.0%) =	$101,186.25
TOTAL PROJECT COST INCLUDING ENGINEERING =	$3,126,655.13

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY

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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 2

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.1	$15,000.00	$1,500.00
TREE ROOT PRUNING	EACH	3	$200.00	$600.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	360	$5.00	$1,800.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	360	$5.00	$1,800.00
TRENCH BACKFILL, SPECIAL	CU YD	60	$45.00	$2,700.00
FORCE MAIN	FOOT	600	$50.00	$30,000.00
PROPOSED MANHOLE, 4' DIA	EACH	1	$4,000.00	$4,000.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	40	$55.00	$2,200.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	20	$65.00	$1,300.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	60	$10.00	$600.00
CLASS D PATCHES, 12 INCHES	SQ YD	20	$75.00	$1,500.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00
TRAFFIC CONTROL	LSUM	1	$5,000.00	$5,000.00
CONSTRUCTION LAYOUT	LSUM	1	$5,000.00	$5,000.00
PUMP STATION	LSUM	1	$370,000.00	$370,000.00

SUB TOTAL =	$428,800.00
CONTINGENCY (30%) =	$128,640.00
CONSTRUCTION TOTAL =	$557,440.00
DESIGN ENGINEERING (10%) =	$41,808.00
CONSTRUCTION OBSERVATION (10%) =	$41,808.00
PERMITTING (5.0%) =	$21,440.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$662,496.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY

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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 3

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	1.5	$15,000.00	$22,500.00
TREE ROOT PRUNING	EACH	20	$200.00	$4,000.00
EARTH EXCAVATION	CU YD	9760	$40.00	$390,400.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	9400	$5.00	$47,000.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	9400	$5.00	$47,000.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	4	$3,500.00	$14,000.00
TRENCH BACKFILL, SPECIAL	CU YD	20	$45.00	$900.00
STORM SEWER, RCP 21"	FOOT	250	$90.00	$22,500.00
PROPOSED MANHOLE, 4' DIA	EACH	3	$4,000.00	$12,000.00
PROPOSED RESTRICTOR MH, 5' DIA	EACH	4	$4,500.00	$18,000.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 21"	EACH	7	$1,000.00	$7,000.00
CLASS D PATCHES, 12 INCHES	SQ YD	35	$75.00	$2,625.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00
TRAFFIC CONTROL	LSUM	1	$20,000.00	$20,000.00
CONSTRUCTION LAYOUT	LSUM	1	$40,000.00	$40,000.00

SUB TOTAL =	$648,725.00
CONTINGENCY (30%) =	$194,617.50
CONSTRUCTION TOTAL =	$843,342.50
DESIGN ENGINEERING (10%) =	$63,250.69
CONSTRUCTION OBSERVATION (10%) =	$63,250.69
PERMITTING (5.0%) =	$32,436.25
EASEMENTS =	$220,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$1,222,280.13

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, PROPERTY ACQUISITION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY.

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Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 3A

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.5	$15,000.00	$7,500.00
TREE ROOT PRUNING	EACH	5	$200.00	$1,000.00
EARTH EXCAVATION	CU YD	4200	$40.00	$168,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	3600	$5.00	$18,000.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	3600	$5.00	$18,000.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
STORM SEWER, RCP 21"	FOOT	20	$90.00	$1,800.00
PROPOSED MANHOLE, 4' DIA	EACH	1	$4,000.00	$4,000.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 21"	EACH	2	$1,000.00	$2,000.00
PROPOSED RESTRICTOR MH, 5' DIA	EACH	1	$4,500.00	$4,500.00
TRAFFIC CONTROL	LSUM	1	$8,000.00	$8,000.00
CONSTRUCTION LAYOUT	LSUM	1	$15,000.00	$15,000.00

SUB TOTAL =	$251,300.00
CONTINGENCY (30%) =	$75,390.00
CONSTRUCTION TOTAL =	$326,690.00
DESIGN ENGINEERING (10%) =	$24,501.75
CONSTRUCTION OBSERVATION (10%) =	$24,501.75
PERMITTING (5.0%) =	$12,565.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$388,258.50

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISITION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, RELOCATING ANY PRIVATE PROPERTY,

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Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 4

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	1.6	$15,000.00	$24,000.00
TREE ROOT PRUNING	EACH	23	$200.00	$4,600.00
EARTH EXCAVATION	CU YD	6580	$40.00	$263,200.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	9760	$5.00	$48,800.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	9760	$5.00	$48,800.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	4	$3,500.00	$14,000.00
TRENCH BACKFILL, SPECIAL	CU YD	90	$45.00	$4,050.00
STORM SEWER, RCP 21"	FOOT	850	$90.00	$76,500.00
PROPOSED MANHOLE, 4' DIA	EACH	4	$4,000.00	$16,000.00
PROPOSED RESTRICTOR MH, 5' DIA	EACH	4	$4,500.00	$18,000.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 21"	EACH	7	$1,000.00	$7,000.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	40	$55.00	$2,200.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	20	$65.00	$1,300.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	60	$10.00	$600.00
CLASS D PATCHES, 12 INCHES	SQ YD	80	$75.00	$6,000.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	40	$40.00	$1,600.00
TRAFFIC CONTROL	LSUM	1	$20,000.00	$20,000.00
CONSTRUCTION LAYOUT	LSUM	1	$40,000.00	$40,000.00
FORCE MAIN	FOOT	600	$50.00	$30,000.00
PUMP STATION	LSUM	1	$370,000.00	$370,000.00

SUB TOTAL =	$996,650.00
CONTINGENCY (30%) =	$298,995.00
CONSTRUCTION TOTAL =	$1,295,645.00
DESIGN ENGINEERING (10%) =	$97,173.38
CONSTRUCTION OBSERVATION (10%) =	$97,173.38
PERMITTING (5.0%) =	$49,832.50
EASEMENTS =	$220,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$1,759,824.25

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, PROPERTY ACQUISITION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY.

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Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
ARLINGTON COUNTRYSIDE FLOODING PROBLEM AREA - ALTERNATE 4A

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.6	$15,000.00	$9,000.00
TREE ROOT PRUNING	EACH	8	$200.00	$1,600.00
EARTH EXCAVATION	CU YD	9600	$40.00	$384,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	3960	$5.00	$19,800.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	3960	$5.00	$19,800.00
TRENCH BACKFILL, SPECIAL	CU YD	60	$45.00	$2,700.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
STORM SEWER, RCP 21"	FOOT	270	$90.00	$24,300.00
PROPOSED MANHOLE, 4' DIA	EACH	2	$4,000.00	$8,000.00
PROPOSED RESTRICTOR MH, 5' DIA	EACH	1	$4,500.00	$4,500.00
HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"	SQ YD	40	$55.00	$2,200.00
PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 6 INCH	SQ YD	20	$65.00	$1,300.00
DRIVEWAY PAVEMENT REMOVAL	SQ YD	60	$10.00	$600.00
CLASS D PATCHES, 12 INCHES	SQ YD	20	$75.00	$1,500.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00
RETAINING WALLS	SQ FT	7200	$40.00	$288,000.00
TRAFFIC CONTROL	LSUM	1	$10,000.00	$10,000.00
CONSTRUCTION LAYOUT	LSUM	1	$18,000.00	$18,000.00
FORCE MAIN	FOOT	600	$50.00	$30,000.00
PUMP STATION	LSUM	1	$370,000.00	$370,000.00

SUB TOTAL =	$1,199,600.00
CONTINGENCY (30%) =	$359,880.00
CONSTRUCTION TOTAL =	$1,559,480.00
DESIGN ENGINEERING (10%) =	$116,961.00
CONSTRUCTION OBSERVATION (10%) =	$116,961.00
PERMITTING (5.0%) =	$59,980.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$1,853,382.00

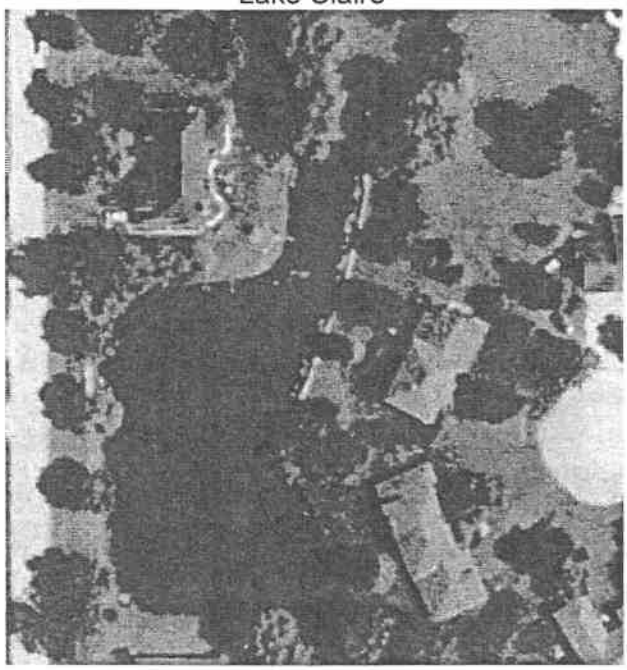
NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISITION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, RELOCATING ANY PRIVATE PROPERTY,

St. Alphonsis Catholic School is located to the north of Lake Claire Estates, and the corporate limits run along the north property limit of the school and then along the north property line of the eastern most lots of Shawn Lane. The topography of the area is relatively flat with little variation of elevation difference between the yard grades surrounding the homes across the two subdivisions (Lake Claire Estates and Shires Subdivision).

The Lake Claire Estates residential subdivision was built in the late 1970s. Downstream of Lake Claire Estates is the Shires of Prospect Heights residential subdivision that also has a detention facility. The two detention facilities drain into the same storm sewer system that eventually discharges into McDonald Creek near Alderman Avenue. The topographical watershed divide between McDonald Creek and Tributary B to McDonald Creek crosses the study area, however, it appears that storm sewers likely capture most of the runoff and direct it to McDonald Creek. The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), Panel 206 of Cook County and Incorporated Areas, shows that the study area is not located in a regulatory floodplain with the exception of the outfall (and upstream sewer leg) which discharges into McDonald Creek. Although the floodplain of McDonald Creek does not encroach into the study area, the tailwater effects from the flooded creek impact the storm sewer conveyance that drains the area because the regulatory FEMA floodplain elevation of approximately 647 is slightly above the lowest elevation of the lake and the pond.

Photograph 1 shows an aerial view of Lake Claire.

PHOTOGRAPH 1
Lake Claire



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EXISTING DRAINAGE PATTERN

According to Hydrologic Investigations Atlas HA-67, Floods in Arlington Heights Quadrangle, Illinois, prepared in 1963, shown as Figure 2, the study area was located at the drainage divide between McDonald Creek and Tributary B to McDonald Creek. There were no depressional areas shown. Elevations depicted on HA-67 ranged in general from 650 to 655. Based on the Cook County aerial topography, most of the yard grades immediately adjacent to the homes are in the 655 to 656 range. These elevations are above the nearest floodplain elevation from McDonald Creek.

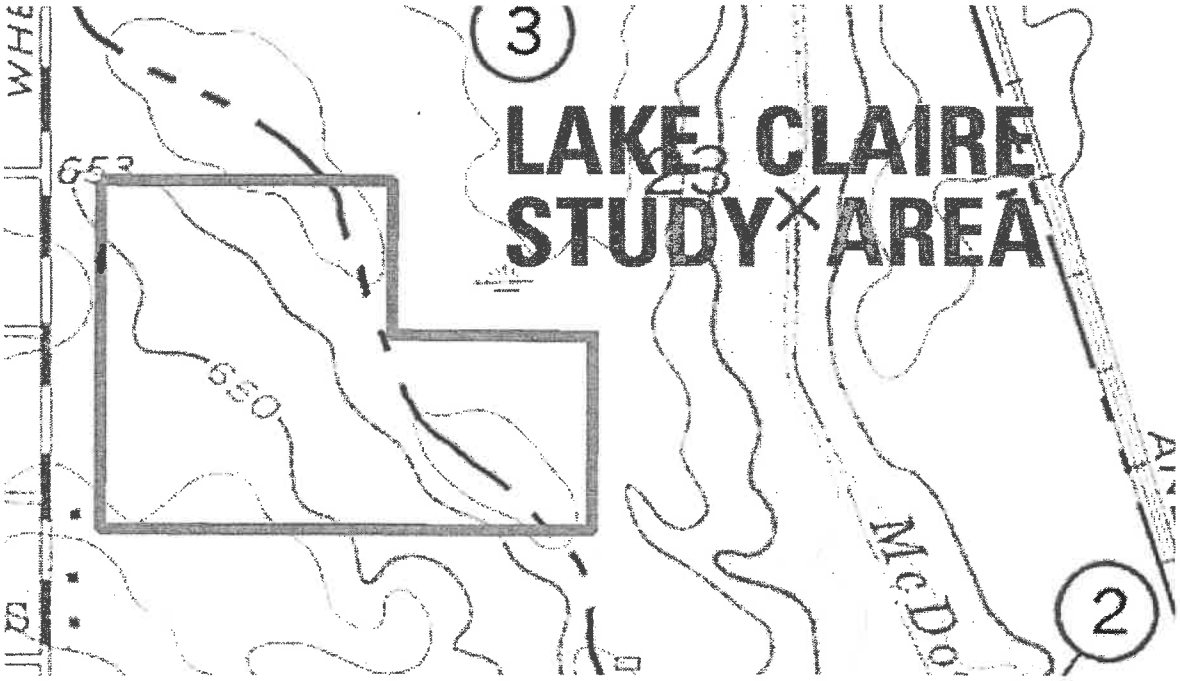

Figure 2
USGS Hydrologic Atlas

The two subdivisions were built on what could be considered a near plateau, and due to this feature, overland flow routes are not well defined through this subdivision. According to City staff, Lake Claire fills up and exceeds its design high water level (HWL) while the Shires of Prospect Heights detention facility does not fill up to its design HWL during storm events although the normal water level (NWL) and HWLs of Lake Claire and Shires Pond are very similar. Furthermore, Lake Claire has been observed to drain slowly, and to significantly

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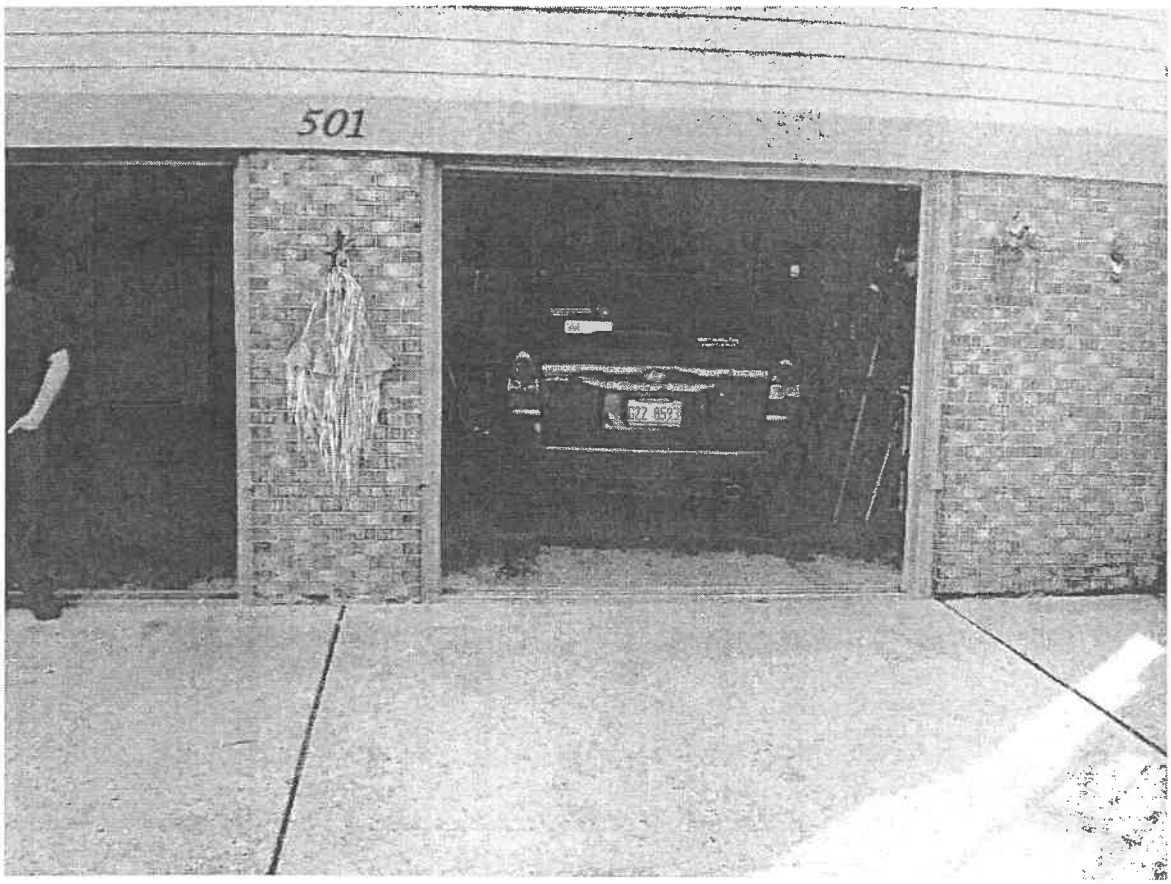
flood the 501 Shawn Lane property. Below is a photograph of the garage doors where water enters the home. It can be observed that the owner of the property has installed braces/grooves approximately 20 inches off the concrete floor where "gates" are anchored to hold back the water. However, this arrangement is not water tight and an interior pump is still necessary. The property owner has stated that water reaches 17 inches at the garage door.

PHOTOGRAPH 2
501 Shawn Lane (north of Lake Claire)



The design NWL of Lake Claire is 646.47, and the design HWL is 649.67, with a design stormwater detention volume of 3.3 acre-feet. The Shires detention pond is a dry-bottom facility with an approximate bottom of 646 and a design HWL of 649.0. The design detention volume was not available, but according to the Cook County 1-foot aerial

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topography, the volume up to elevation 649.0 is approximately 1.56 acre-feet, about half the detention provided by Lake Claire.

If Lake Claire floods above its design HWL, it floods to the north and to the east at the southeast corner of the lake. However, the overflow route to the north is lower and it floods at least one home due to overbank flooding. According to the Cook County 1-foot aerial topography, if the lake elevations exceed those of Shawn Lane, then stormwater would reach Wheeling Road where it would then flow north towards McDonald Creek. The overland flow route to the east located at the southeast corner of the lake is approximately 1 foot higher than the north route and would likely not be accessed unless the storm were extreme. City staff has not observed such a condition to date.

The Shires Pond has not caused overbank flooding to the adjacent properties, rather, during storm events the pond does not appear to fill to the level that would be expected. The overland flow route when water exceeds the design HWL is to the south at the southeast corner of the basin. If the basin were to fill up, water would spill onto this overland flow route and proceed south along the backyards of properties on Coldren Drive. The Cook County aerial topography suggests that a couple of the properties are only about 1 foot above the low points of this route.

Table 2 summarizes the 9 flood questionnaires returned in this study area.

TABLE 2
Lake Claire/Shires Pond Study Area
Flood Questionnaire Summary

Location	Questionnaires Submitted to the City	Basement Flooding (questionnaires reporting)	Basement Flooding Depth Reported (ranges)	Total Damage Reported*
Thierry Lane	3	1	None reported	$35,000
Shawn Lane	3	2	1 to 4 inches	$31,500
Claire Lane	1	None reported	None reported	$5,000
Wheeling Road	1	None reported	None reported	$5,000
Brian Lane	1	None reported	None reported	$10,000
TOTAL	**9**	**3**		**$86,500**

*Note: The reported damages are taken directly from the flood questionnaire.

STORMWATER DEFICIENCIES

Based on field visits, assessment of the topography, verbal communication with Public Works staff, and the limited existing storm sewer system shown on the City atlases for this area, the following stormwater deficiencies have been identified for this area:

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1. The study area has two detention areas that were designed according to the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) requirements, which are still in effect as of the date of this memorandum. However, the flooding of Lake Claire is causing flooding to adjacent properties, which are due to the lake exceeding its HWL and the long duration which the pond takes to drain.
2. There is one storm sewer system that drains this area and connects the two ponds, and City staff indicates that surcharging of this storm sewer is not a problem and therefore appears to have sufficient capacity to convey the amount of runoff entering it during storm events that do not exceed its design capacity. Therefore, the restrictor at Lake Claire appears to be subject to clogging and/or there is a blockage somewhere in the system.
3. The clogging or blockage is not only causing flooding levels at Lake Claire to be higher than they otherwise would be, but also to drain more slowly. This slow draining negatively influences the groundwater levels around the adjacent properties, and sump pumps are likely not able to sufficiently drain their sumps.
4. No dedicated and adequate overland flow path exists to drain Lake Claire, and the overflow route to the north is not low enough to minimize flooding. The 501 Shawn Lane property, which is adjacent to the overflow route, has a below-grade driveway/garage. This condition creates an opening to flood this home.
5. The Shires Pond does not appear to be effectively storing water. This could be caused by a compromised restrictor.
6. The Shires Pond also has an overflow grated structure that is in need of repair or replacement. Photograph 3 below shows this structure.

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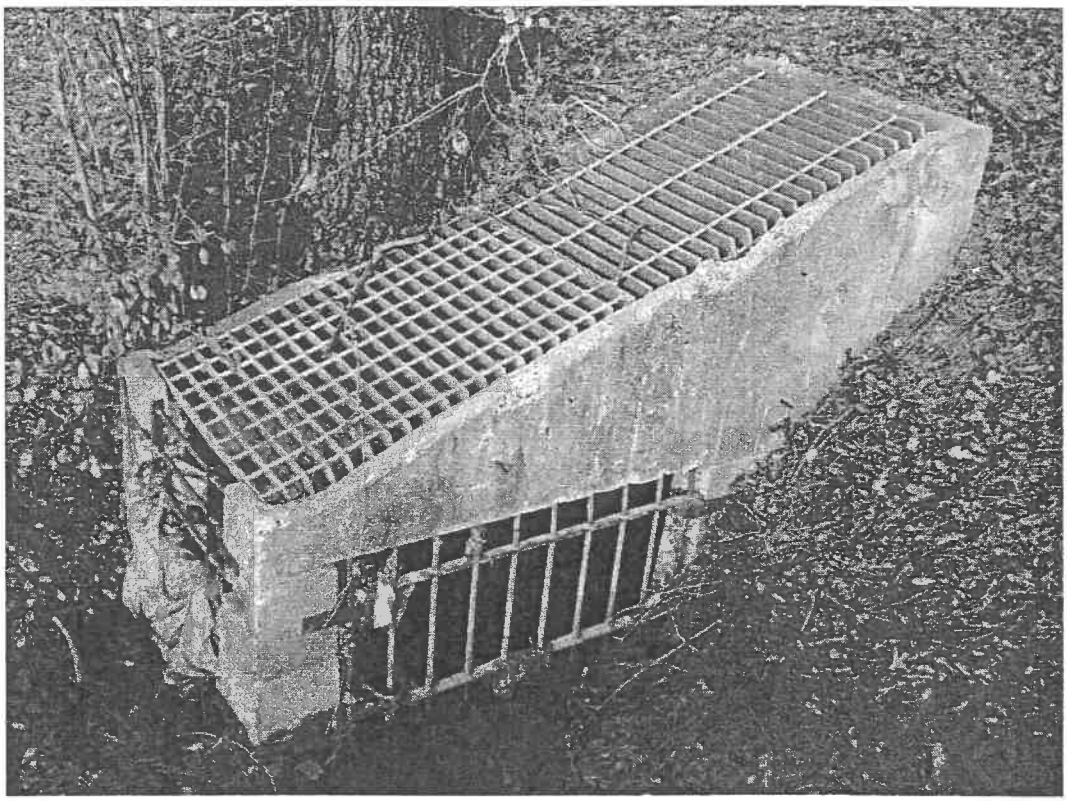
PHOTOGRAPH 3
Shires Pond Emergency Flow Structure (north of Lake Claire)



APPROACH TO SOLUTIONS

This area experiences flooding mainly because Lake Claire floods beyond its HWL and drains slowly. There is no mapped floodplain or floodway within the Lake Claire/Shires Pond areas. There are no available photographs for this area during the July 23, 2011 storm event, however, during a field visit to 501 Shawn Lane flooding signs were observed.

In general, structural approaches for alleviating flooding problems can be categorized into two types: storage creation, or conveyance improvements. Typically, conveyance improvements alone may cause impacts to downstream properties, and detailed modeling would be necessary to determine the location and magnitude of these impacts, which is beyond the scope of this study.

Aside from possible public improvements, it is recommended that the City encourage all

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residents to flood-proof their homes, especially those who have experienced flooding in the past. This will reduce the risk of future flooding due to overland flow, seepage and sump pump failures. A list of simple and inexpensive flood-proofing measures has been included as Attachment 1 of this memorandum. This recommendation is in addition to any other drainage improvements on public or private property.

There are various approaches to alleviating flooding for this area:

- The storm sewer system between Lake Claire and Shires Pond should be televised to check for blockage. Since no surcharging was reported, it is anticipated that the restrictor is the likely cause of the lake not functioning properly. However, the televising will confirm this condition.
- The overland flow route to the north of Lake Claire should be surveyed to determine if minor improvements could be made to provide further protection. It is not anticipated that this approach by itself would provide sufficient conveyance to protect the below-grade garage of 501 Shawn Lane, however, it could be combined with flood proofing improvements to the property for maximum effectiveness.
- The Shires Pond drainage structures should be repaired.

ALTERNATIVE DRAINAGE SOLUTIONS

The possible drainage solutions for the Lake Claire/Shires Pond study area were developed at a concept level based on feasibility of implementation and cost effectiveness. Based on this analysis, CBBEL identified the following alternatives to reduce the risk of flooding in this area:

1. Televise and clean the 24 inch storm sewer system that drains Lake Claire.
2. Replace the restrictor structure at Lake Claire to a structure that could reduce clogging that it currently experiences. The MWRDGC permit obtained for this development will need to be amended so that the original release rate from Lake Claire is maintained.
3. The drainage system along the bottom of the Shires Pond should also be televised. Since this system is not flooding, the televising would be done to confirm that the system was substantially constructed according to plans.
4. Replace and/or repair the emergency overflow structure at Shires Pond.
5. While these two ponds are hydraulically connected, the Shires Pond does not receive flows from Lake Claire (unless conditions were created that could cause flow from the 24 inch storm sewer to back up into Shires Pond, which are very unlikely during a typical storm event). The improvements suggested for Lake Claire may not sufficiently lower elevations to alleviate flooding at 501 Shawn Lane. It should be noted that design rainfall standards have changed since Lake Claire was permitted, and the City now uses a higher rainfall for detention design. The Shires Pond has been reported to not fill to design levels. City staff has contemplated improvements

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that could optimize the functioning of these two detention ponds. To accomplish this, detailed hydrologic/hydraulic modeling would be necessary to size the improvements. Both MWRDGC permits would need to be amended, but conceptual approvals from MWRDGC should be obtained first as the release rates that could result may not strictly meet their criteria. This alternative should only be investigated after the results of the televising suggested above are reviewed, and the first step would be to meet with MWRDGC to discuss the approach and receive a conceptual acceptance that if the models show a more optimal set-up for both ponds, that MWRDGC would permit the project. This approach would also determine what the impacts of the McDonald Creek floodplain elevations are to the storm sewer system. Because the downstream floodplain elevation is 647, which is above the NWL of both ponds, tailwater impacts are anticipated, but would need to be quantified by the modeling.

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RECOMMENDATIONS

Based on this analysis, CBBEL presents the pros and cons of each alternative, and provides estimated costs and a recommendation.

TABLE 3
Lake Claire/Shires Pond Flooding Problem Area
Alternatives Analysis Summary

Alternative	Description	Pros	Cons
1	Televise and clean the 24 inch sewer that drains Lake Claire	• Can be performed by City staff • Results would determine if additional investigations are necessary	• May not address the problem at Lake Claire
2	Replace the restrictor at Lake Claire	• Would be subject to less clogging • May decrease inundation times • Cost-effective	• Will not eliminate flooding or level of inundation for large storm events • Will require permit from MWRDGC
3	Televise the Shires Pond system with the pond limits	• Will verify that the system was constructed according to plans	• (none)
4	Replace or repair the emergency overflow structure at Shires Pond	• Will restore design conditions	• (none)
5	Perform hydrologic and hydraulic modeling to optimize the use of both ponds	• Will determine if additional improvements beyond those described above can be made to optimize the use of both ponds • If optimization is possible, the Lake Claire elevations would be lowered for typical storm events	• Will require MWRGC concept approval that such improvements would be acceptable based on the modeling • An additional cost to perform the study • Improvements may effect better functioning for moderate storm events, but may not improve large storm events
6	(After modeling) Alternative 4 *plus* reroute 24 inch from Lake Claire into Shires Pond and modify restrictor	• Will optimize the use of both ponds	• Will require MWRDGC permit • Improvements may effect better functioning for moderate storm events, but may not improve large storm events

Table 4 below provides a summary of conceptual cost estimates associated with each of the above alternatives. The detailed conceptual cost estimates can be found under Attachment 2.

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The Prospect Heights Hazard Mitigation Plan estimated that the cost of this high priority project would be 3.2 million dollars. With the long-term development of this project the City staff has developed engineering and feasibility estimates at 2.5 million dollars, significantly reducing the burden on grant funds and taxpayer dollars.

As noted within the application documents, City officials have garnered the support of legislators who have found additional supporting dollars as well as local operating funds to complete the match requirements for this grant project.

Prospect Heights has been working to mitigate flooding issue in the City for decades. These projects have been intergovernmental, collaborative and solution based to impact the largest areas with the fewest dollars, effectively mitigating flooding in priority areas. Prospect Heights has a capable staff to meet all grant contracts and requirements in a timely and efficient manner. We also work to coordinate our projects with area municipalities to ensure there is no duplication of effort or duplication of cost to taxpayers. Our work is in concert with regional efforts to mitigate flooding to save in the costs of response and recovery.

The following is our engineer's opinion of probable costs as of Jan 22, 2020 (see document attached):

ITEM NO	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	VALUE
1	Landscape Restoration	1.0	LS	$67,000.00	$67,000.00
2	Trench Backfill	2,900.0	CY	$50.00	$145,000.00
3	Precast Reinforced Concrete Flared End Section 36"	1.0	EA	$6,250.00	$6,250.00
4	Storm Sewers, Rubber Gasket, Class A, Type 2 36"	4,250.0	FT	$145.00	$616,250.00
5	Catch Basins, Type A, 6'-Diameter, Type 1 Frame, Closed Lid	1.0	EA	$7,500.00	$7,500.00
6	Manholes, Type A, 6'-Diameter, Type 1 Frame, Closed Lid	15.0	EA	$6,250.00	$93,750.00
7	Auger and Jack Steel Casing Pipe, 48"	150.0	FT	$450.00	$67,500.00
8	Non-Special Waste Disposal and Analysis	1.0	LS	$25,000.00	$25,000.00
9	Hot-Mix Asphalt Pavement Removal and Replacement	3,350.0	SY	$125.00	$418,750.00
10	Mobilization	1.0	LS	$90,000.00	$90,000.00
11	Traffic Control and Protection	1.0	LS	$50,000.00	$50,000.00
12	Permit Fees	1.0	LS	$80,000.00	$80,000.00
13	IEPA Separation Requirements & Utility Conflicts	1.0	LS	$130,000.00	$130,000.00
14	Easement Acquisition	1.0	LS	$100,000.00	$100,000.00
		SUBTOTAL:			$1,897,000.00
		CONTINGENCY (20%):			$379,400.00
		CONSTRUCTION ENGINEERING (±10%):			$223,600.00
		GRAND TOTAL:			**$2,500,000.00**

Prospect Heights has a demonstrated and sustained capability of completing project small and larger than this while adhering to local, state and federal procurement rules and laws. Prospect Heights has extensive experience with grants and grant management requirements, contracts, quarterly reports and close out reports. Prospect Heights is dedicated to being excellent stewards of the taxpayer dollar, whether local, state, federal and grant related, our commitment is to ensure the project reaches maximum effectiveness, maximum positive impact while stretching every dollar to the greatest extent. We ensure that we will meet or exceed expectations on deadlines and requirements. Thank you for your consideration on this proposal.

Source of matching funds: Representative Walker and Senator Gillespie, and City Operating Fund

Amount of matching funds: $260,000 of assistance and $340,000 from City funds

GEWALT HAMILTON ASSOCIATES, INC.

East Side Drainage Study

August 2019

Levee 37 Drainage Study

Levee 37 Drainage Study

Mount Prospect, IL

Prepared for

Village of Mount Prospect, IL
50 South Emerson Street
Mount Prospect, IL 60056

September 22, 2015

Prepared by

Christopher B. Burke Engineering, Ltd.
9575 W. Higgins Road, Suite 600
Rosemont, IL 60018

CBBEL Project No. 15-0225

Levee 37 Drainage Study

- Analyzed Pre-Levee Conditions
- Analyzed Post-Levee (Current) Conditions
- Provided Alternatives to Minimize Current Flooding
- Did not show impacts to the City of Prospect Heights
  - Our scope is to show impacts and evaluate additional potential improvements

Rainfall Terminology

- Analyzed 10 Year Critical Duration Event
  - 10 Year = Sizing for Storm Sewer Systems
  - Critical Duration = Worst Case Scenario

Event	Rainfall (inches)
10 Year - 2 Hour	2.64

  - Tailwater or River Water Level Influence = The Des Plaines River is at the 10-year floodplain elevation

Pre-Levee Conditions

- Des Plaines River flooded properties in Mount Prospect and Prospect Heights
- Total of 240 cubic feet per second (cfs) gravity flow to river

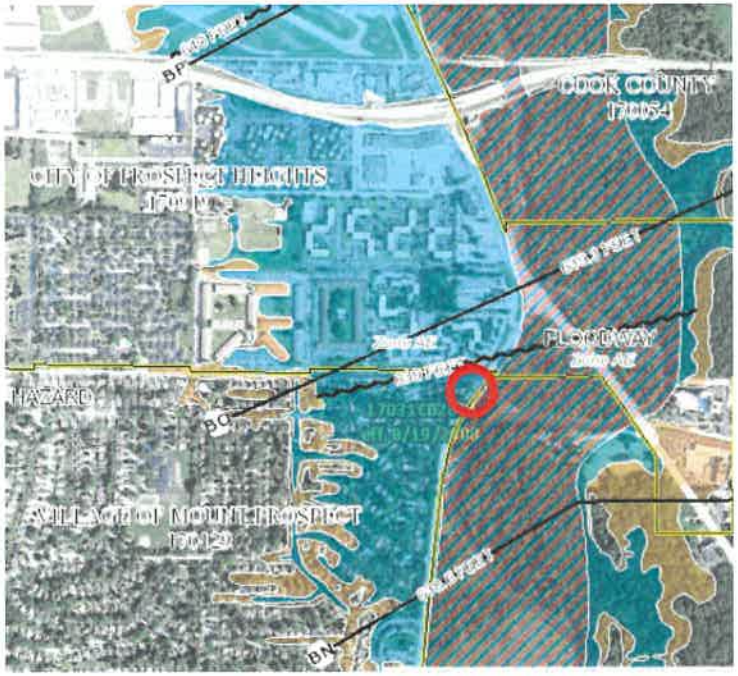


Figure 3. 10-Year Storm with FEMA FIS 10-Year DPR Tailwater Prior to Levee 37 Construction

Post-Levee (Current) Conditions

- Levee 37 constructed along Des Plaines River
- 3 Pump Stations – Total 60 cfs Capacity
  - Pump Station #3 in Prospect Heights – 2 pumps at 8.5 cfs
  - Pump Station #2 in Mount Prospect – 3 pumps at 8.5 cfs
  - Pump Station #1 in Mount Prospect – 2 pumps at 8.5 cfs
- Pump Station #2 receives drainage from Prospect Heights and Mount Prospect

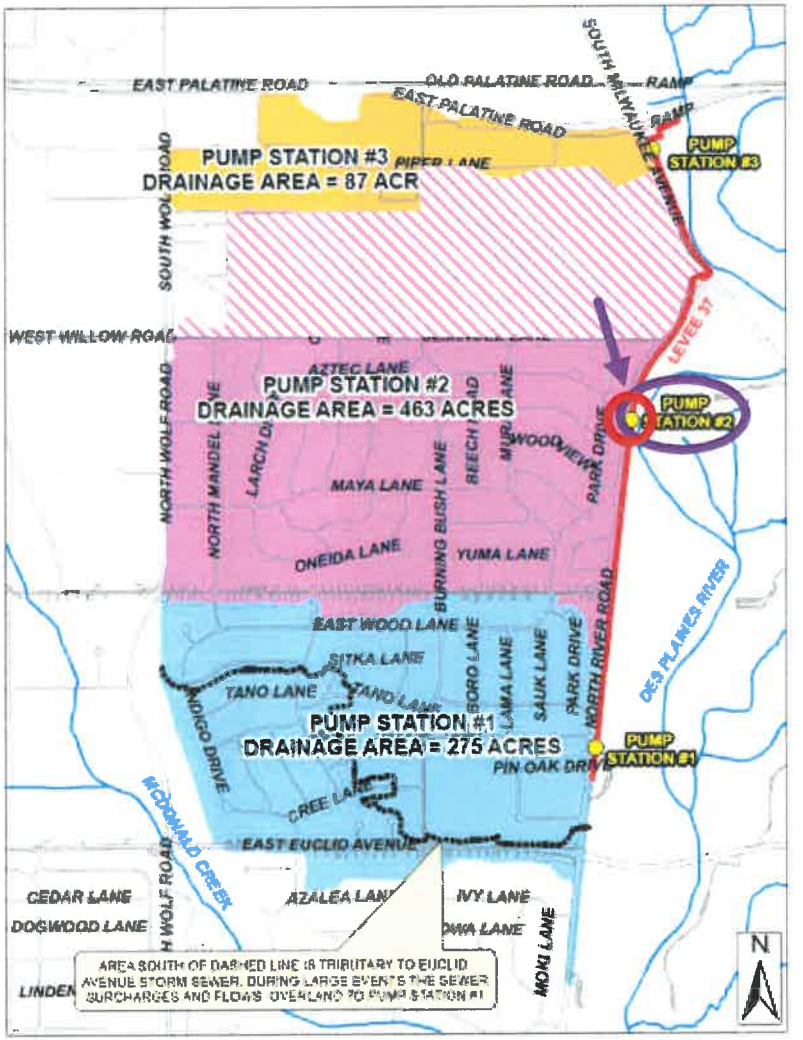
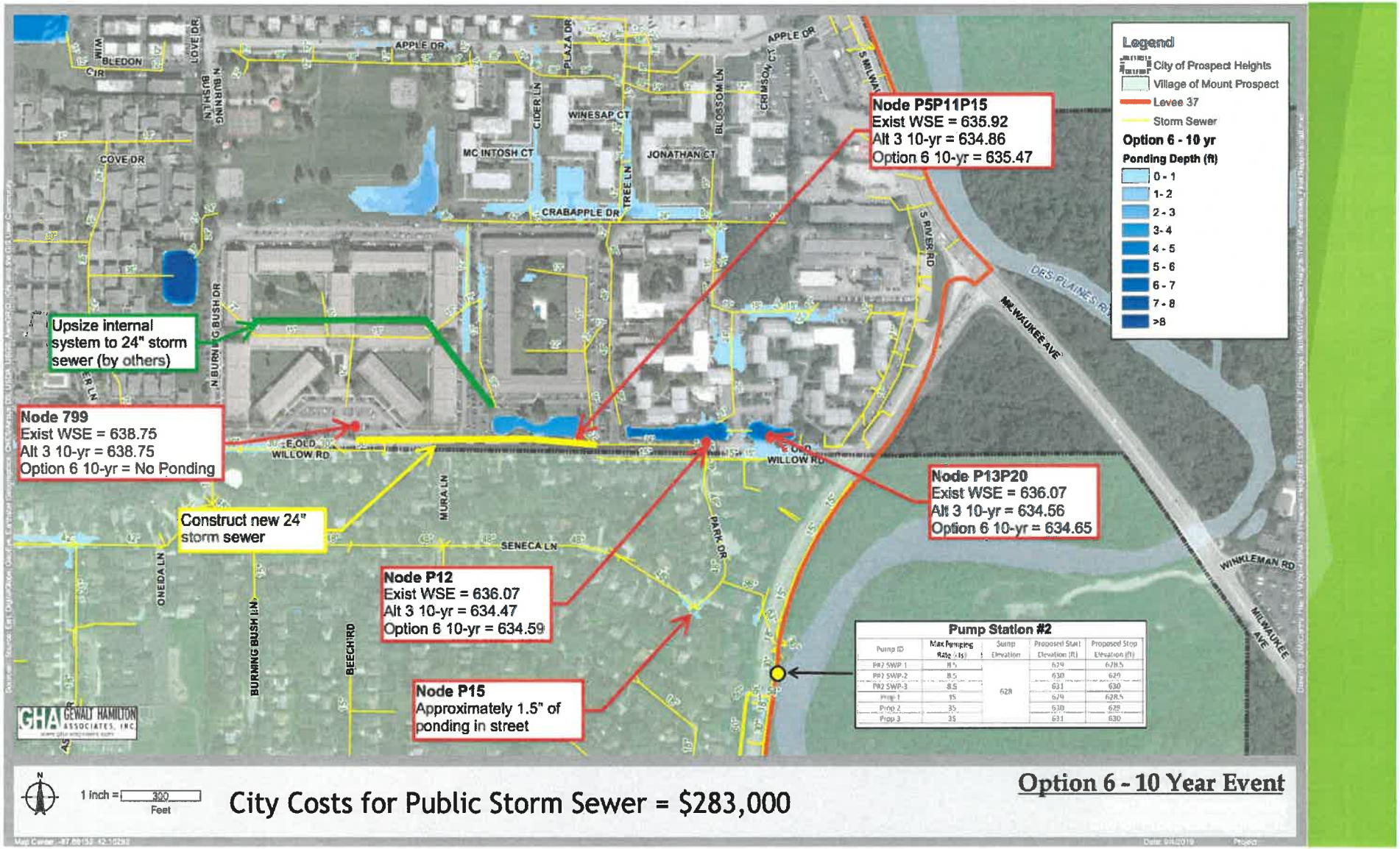
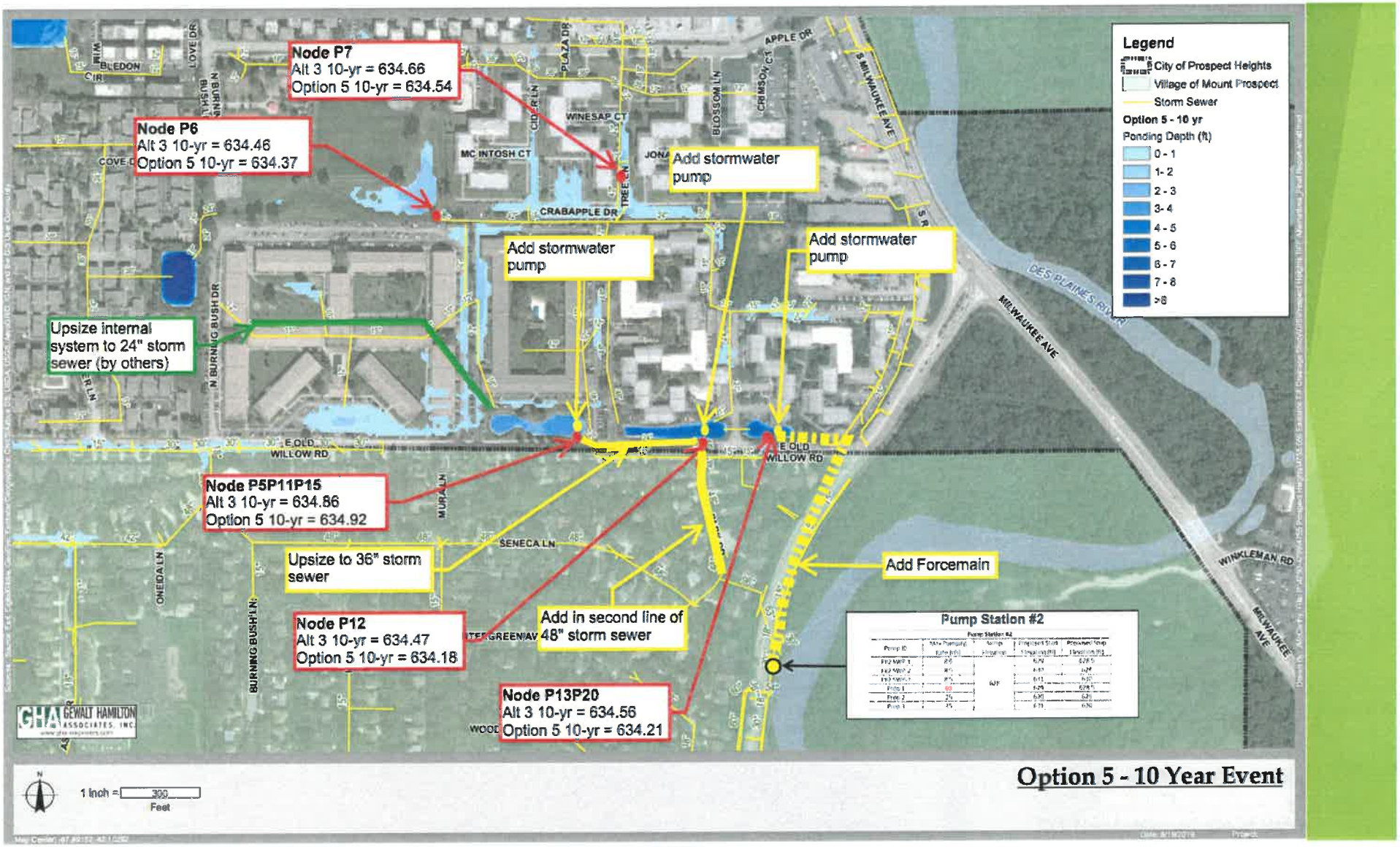
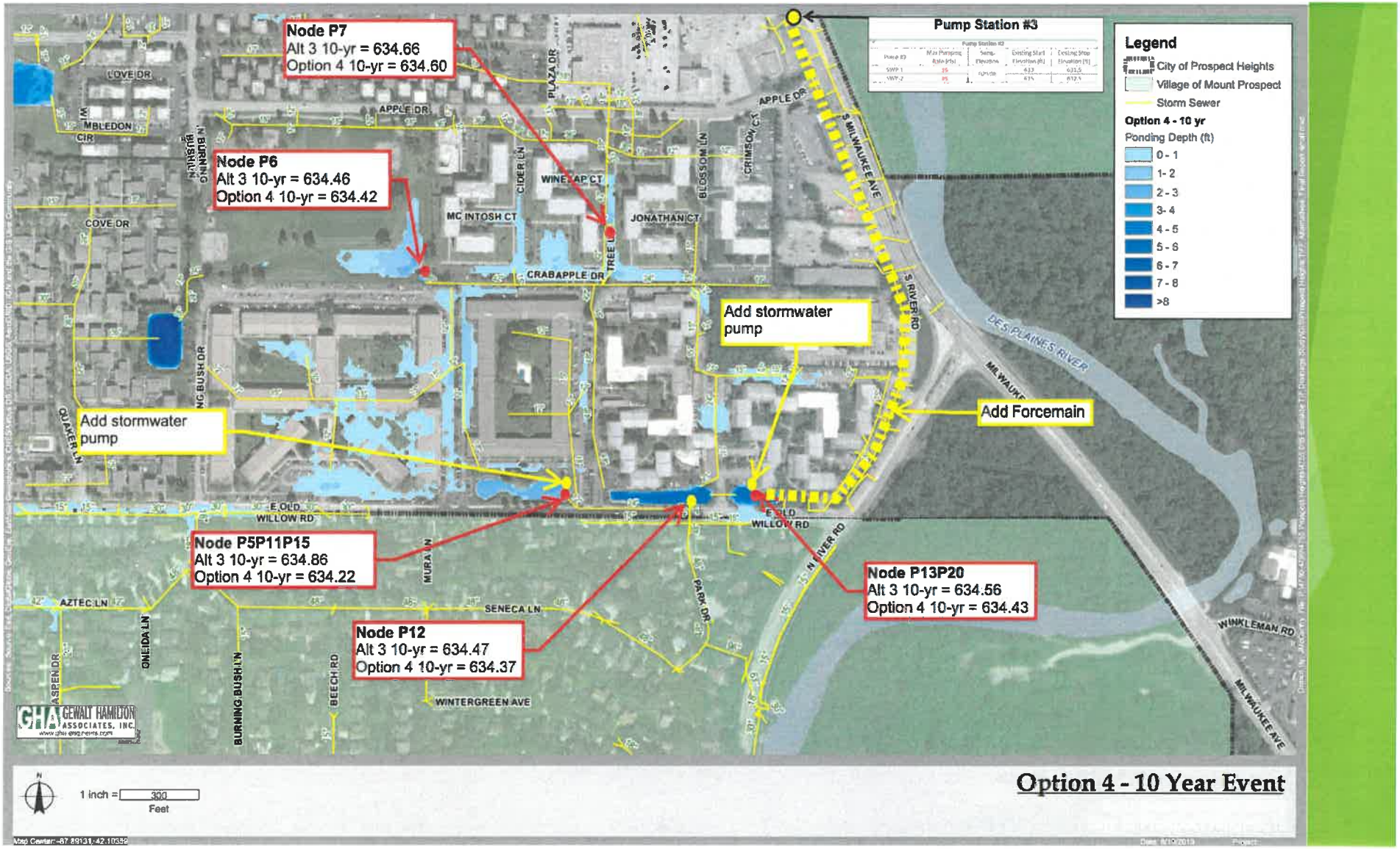


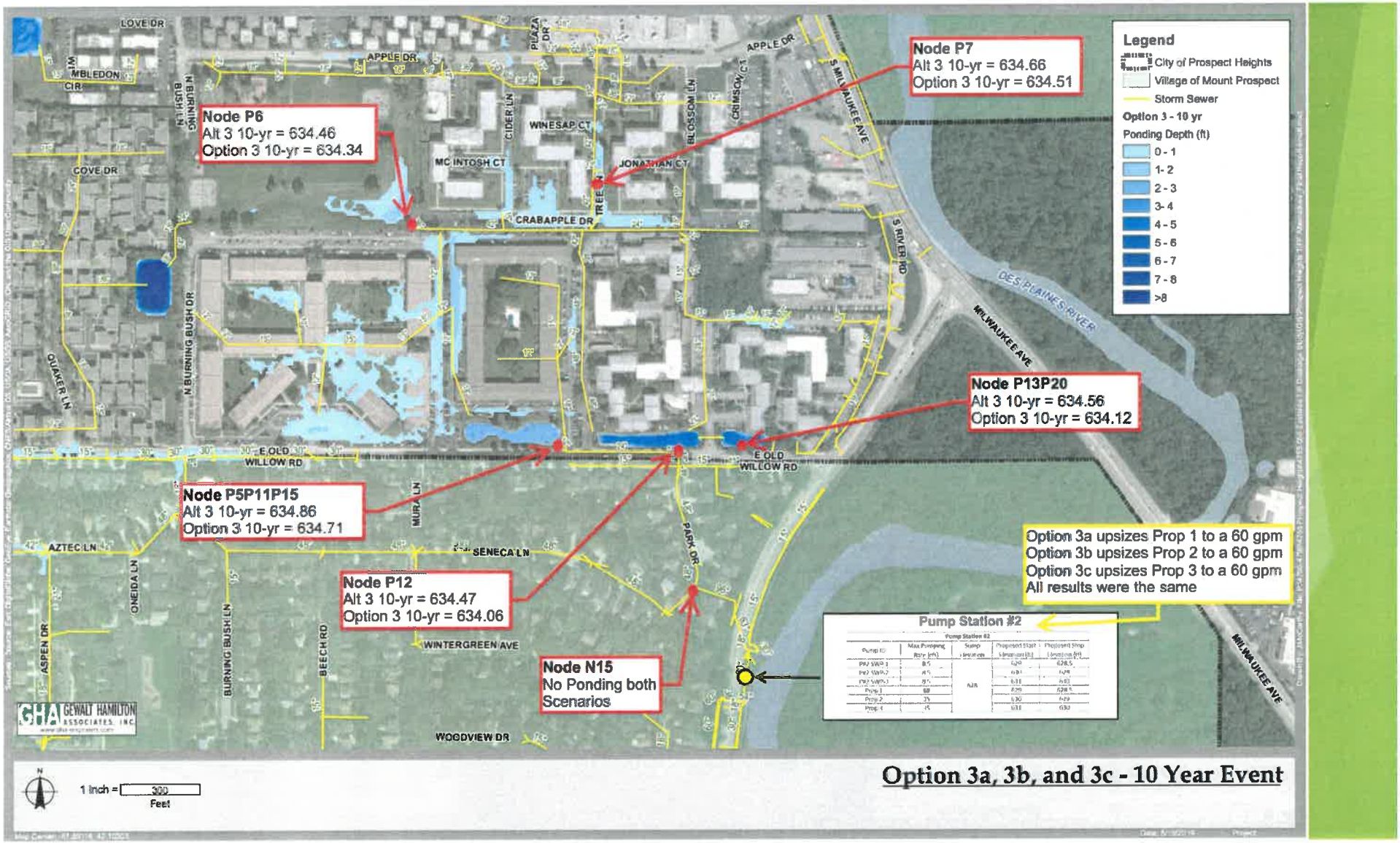
Figure 4. Pump Station Drainage Areas


Legend
City of Prospect Heights
Village of Mount Prospect
Levee 37
Storm Sewer
Option 6 - 10 yr
Ponding Depth (ft)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
>8
Node P5P11P15
Exist WSE = 635.92
Alt 3 10-yr = 634.86
Option 6 10-yr = 635.47
Upsize internal system to 24" storm sewer (by others)
Node 799
Exist WSE = 638.75
Alt 3 10-yr = 638.75
Option 6 10-yr = No Ponding
Construct new 24" storm sewer
Node P12
Exist WSE = 636.07
Alt 3 10-yr = 634.47
Option 6 10-yr = 634.59
Node P15
Approximately 1.5" of ponding in street
Node P13P20
Exist WSE = 636.07
Alt 3 10-yr = 634.56
Option 6 10-yr = 634.65
Pump Station #2
Pump ID
Max Pumping Rate (cfs)
Sump Elevation
Proposed Start Elevation (ft)
Proposed Stop Elevation (ft)
PR2 SWP-1
PR2 SWP-2
PR2 SWP-3
Prop 1
Prop 2
Prop 3
628
APPLE DR
BLEDON CIR
COVE DR
N BURNING BUSH DR
WINESAP CT
MC INTOSH CT
JONATHAN CT
CRABAPPLE DR
CIDER LN
PLAZA DR
TREE LN
BLOSSOM LN
CRIMSON CT
S RIVER RD
DES PLAINES RIVER
MILWAUKEE AVE
E OLD WILLOW RD
MURA LN
SENECA LN
ONEIDA LN
BURNING BUSH LN
BEECH RD
PARK DR
WINKLEMAN RD
GHA GEWALT HAMILTON ASSOCIATES, INC.
1 inch = 300 Feet
City Costs for Public Storm Sewer = $283,000
Option 6 - 10 Year Event

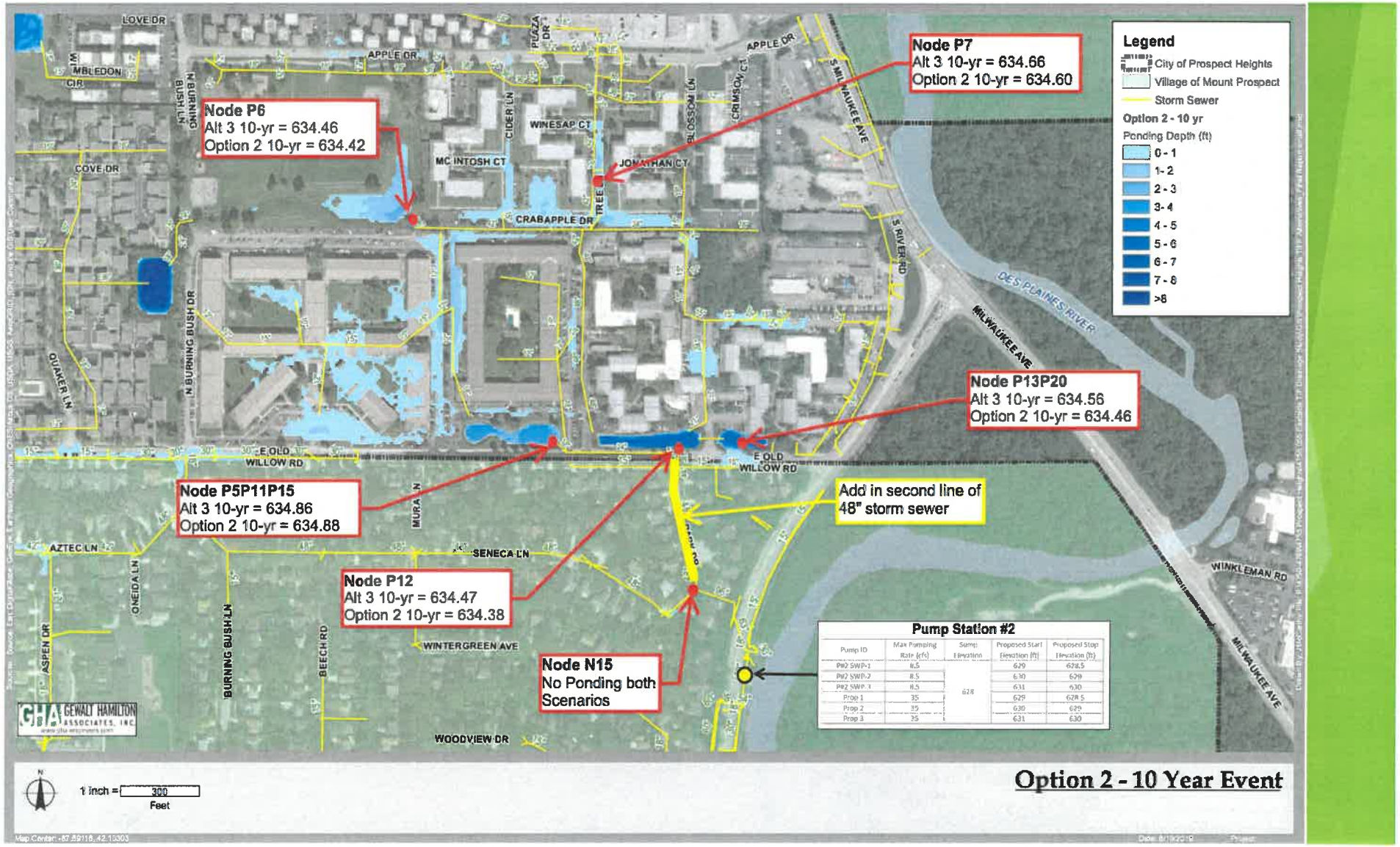


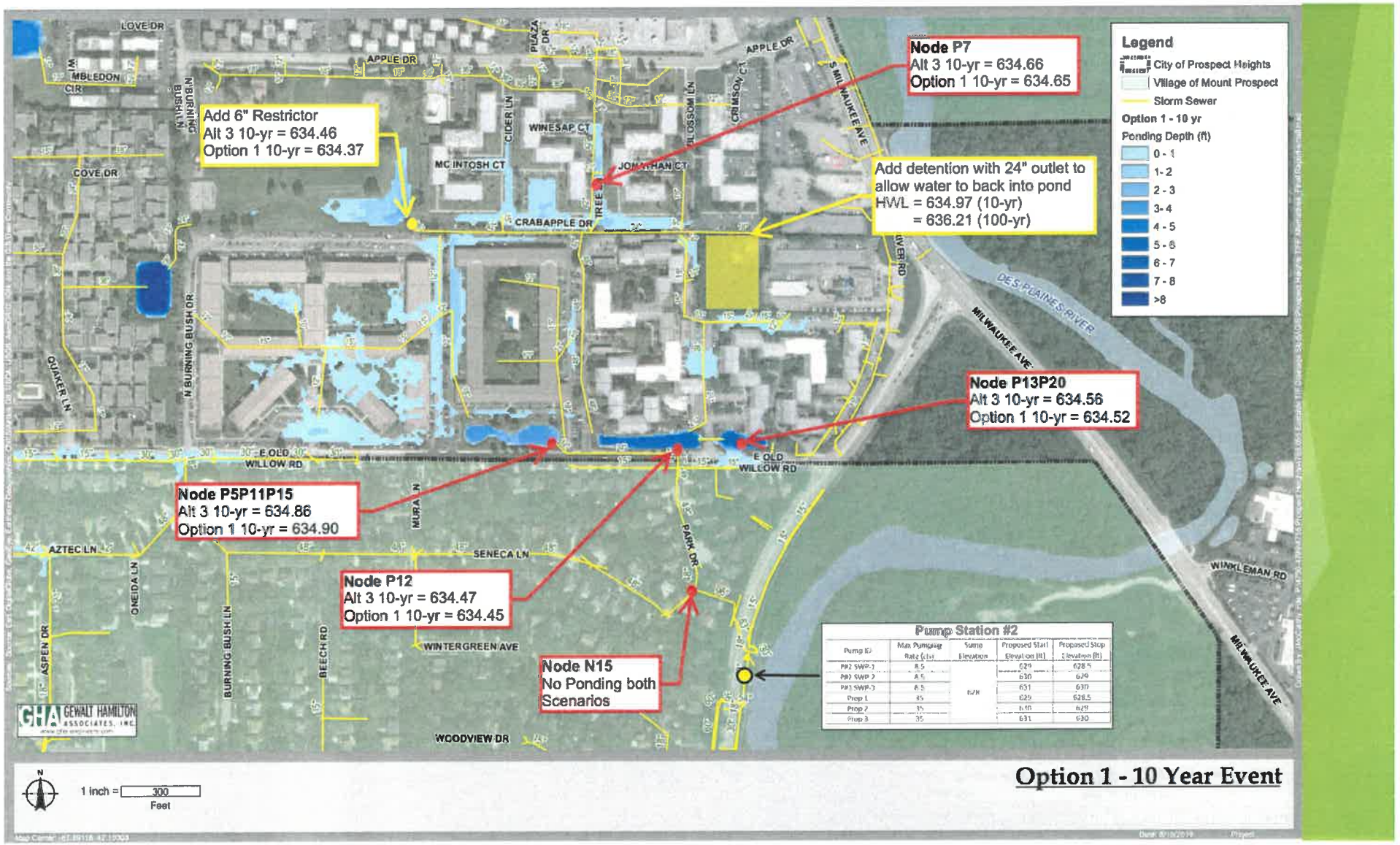
Option 5 - 10 Year Event


Node P7
Alt 3 10-yr = 634.66
Option 4 10-yr = 634.60
Node P6
Alt 3 10-yr = 634.46
Option 4 10-yr = 634.42
Add stormwater pump
Add stormwater pump
Add Forcemain
Node P5P11P15
Alt 3 10-yr = 634.86
Option 4 10-yr = 634.22
Node P12
Alt 3 10-yr = 634.47
Option 4 10-yr = 634.37
Node P13P20
Alt 3 10-yr = 634.56
Option 4 10-yr = 634.43
Pump Station #3
Legend
City of Prospect Heights
Village of Mount Prospect
Storm Sewer
Option 4 - 10 yr
Ponding Depth (ft)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
>8
LOVE DR
APPLE DR
COVE DR
CRABAPPLE DR
E OLD WILLOW RD
SENECA LN
WINTERGREEN AVE
WINKLEMAN RD
MILWAUKEE AVE
S RIVER RD
DES PLAINES RIVER
1 inch = 330 Feet
Option 4 - 10 Year Event



Option 3a, 3b, and 3c - 10 Year Event

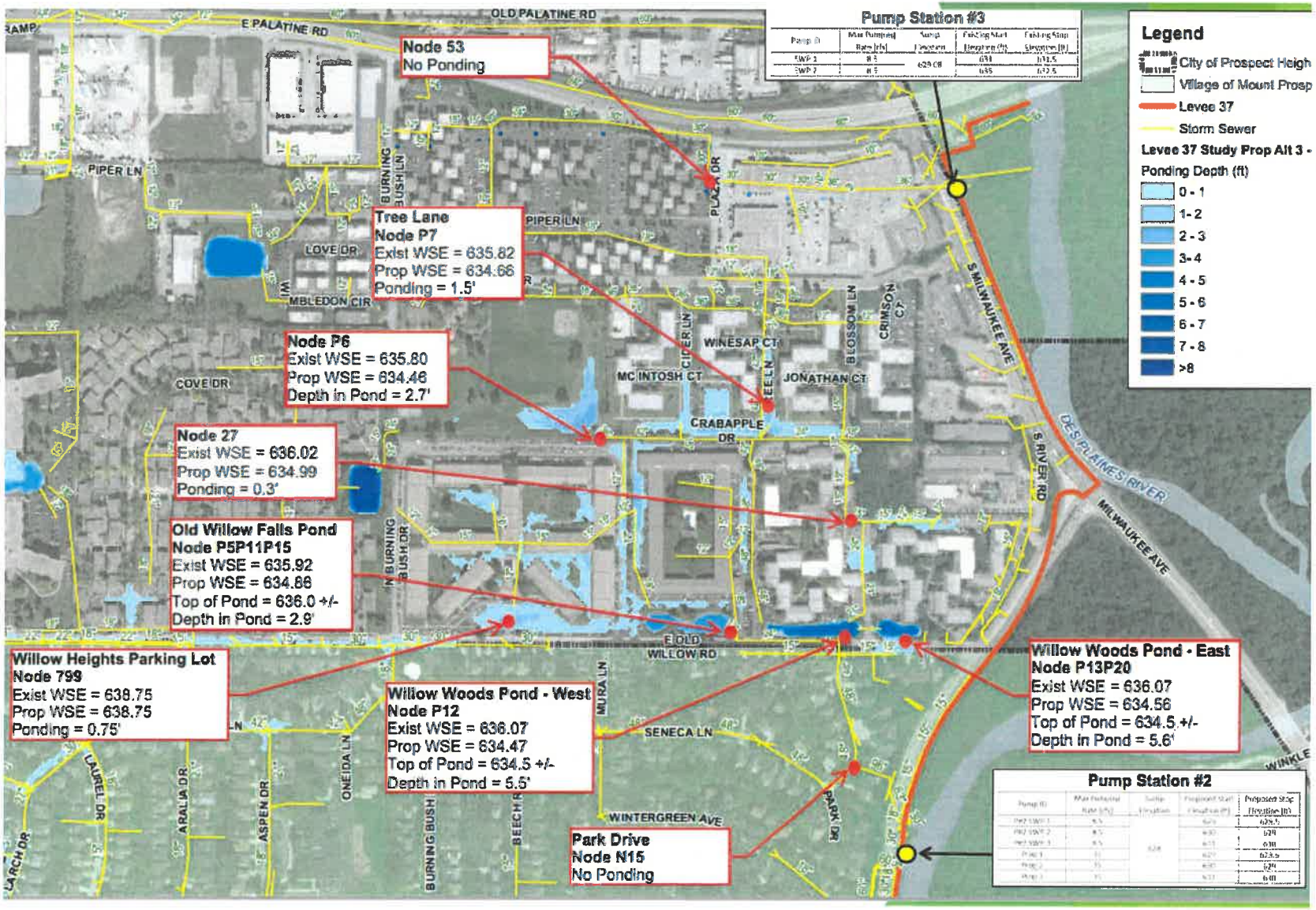

Node P6
Alt 3 10-yr = 634.46
Option 2 10-yr = 634.42
Node P7
Alt 3 10-yr = 634.66
Option 2 10-yr = 634.60
Node P13P20
Alt 3 10-yr = 634.56
Option 2 10-yr = 634.46
Node P5P11P15
Alt 3 10-yr = 634.86
Option 2 10-yr = 634.88
Node P12
Alt 3 10-yr = 634.47
Option 2 10-yr = 634.38
Node N15
No Ponding both Scenarios
Add in second line of 48" storm sewer
Legend
City of Prospect Heights
Village of Mount Prospect
Storm Sewer
Option 2 - 10 yr
Ponding Depth (ft)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
>8
Pump Station #2
Pump ID
Max Pumping Rate (cfs)
Sump Elevation
Proposed Start Elevation (ft)
Proposed Stop Elevation (ft)
PW2 SWP-1
8.5
628
629
628.5
PW2 SWP-2
8.5
630
629
PW2 SWP-3
8.5
631
630
Prop 1
35
629
628.5
Prop 2
35
630
629
Prop 3
35
631
630
LOVE DR
APPLE DR
PLAZA DR
MBLEDON CIR
N BURNING BUSH LN
CIDER LN
WINESAP CT
MC INTOSH CT
JONATHAN CT
TREE
CRABAPPLE DR
CRIMSON CT
S MILWAUKEE AVE
S RIVER RD
DES PLAINES RIVER
MILWAUKEE AVE
COVE DR
N BURNING BUSH DR
QUAKER LN
E OLD WILLOW RD
MURA N
AZTEC LN
SENECA LN
ONEIDA LN
ASPEN DR
BURNING BUSH LN
BEECH RD
WINTERGREEN AVE
WOODVIEW DR
WINKLEMAN RD
GHA GEWALT HAMILTON ASSOCIATES, INC
1 inch = 300 Feet
Option 2 - 10 Year Event



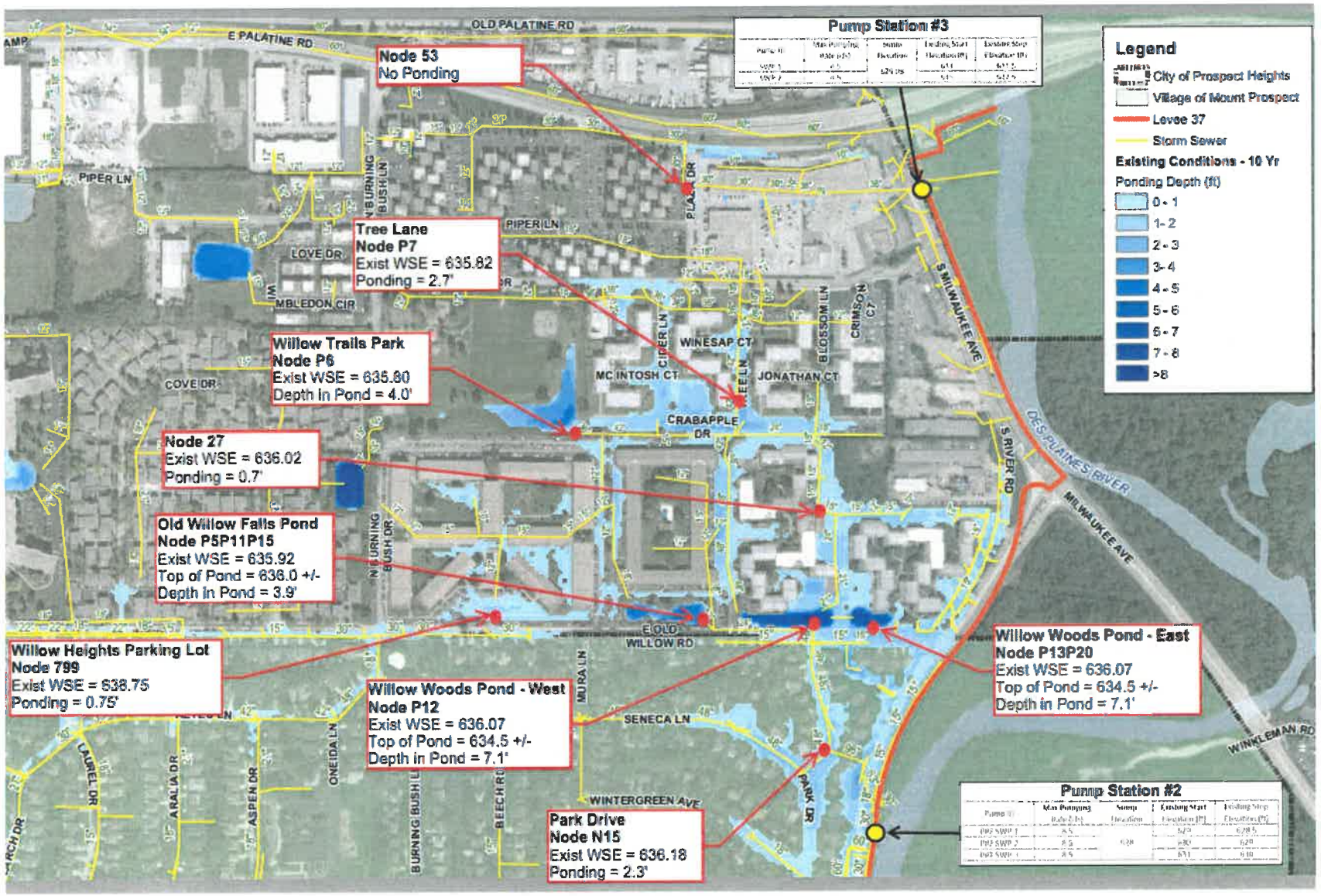
Option 1 - 10 Year Event

After Alternative 3 is Built

Node	Decrease in Ponding Depth
P6 (Willow Trails Park)	-1.3'
P7 (Tree Lane)	-1.2'
Node 27	-0.4'
P5P11P12 (Old Willow Falls Pond)	-1.0'
P12 (Willow Woods Pond West)	-1.6'
P13P20 (Willow Woods Pond East)	-1.5'
N15 (Park Drive)	-2.3'

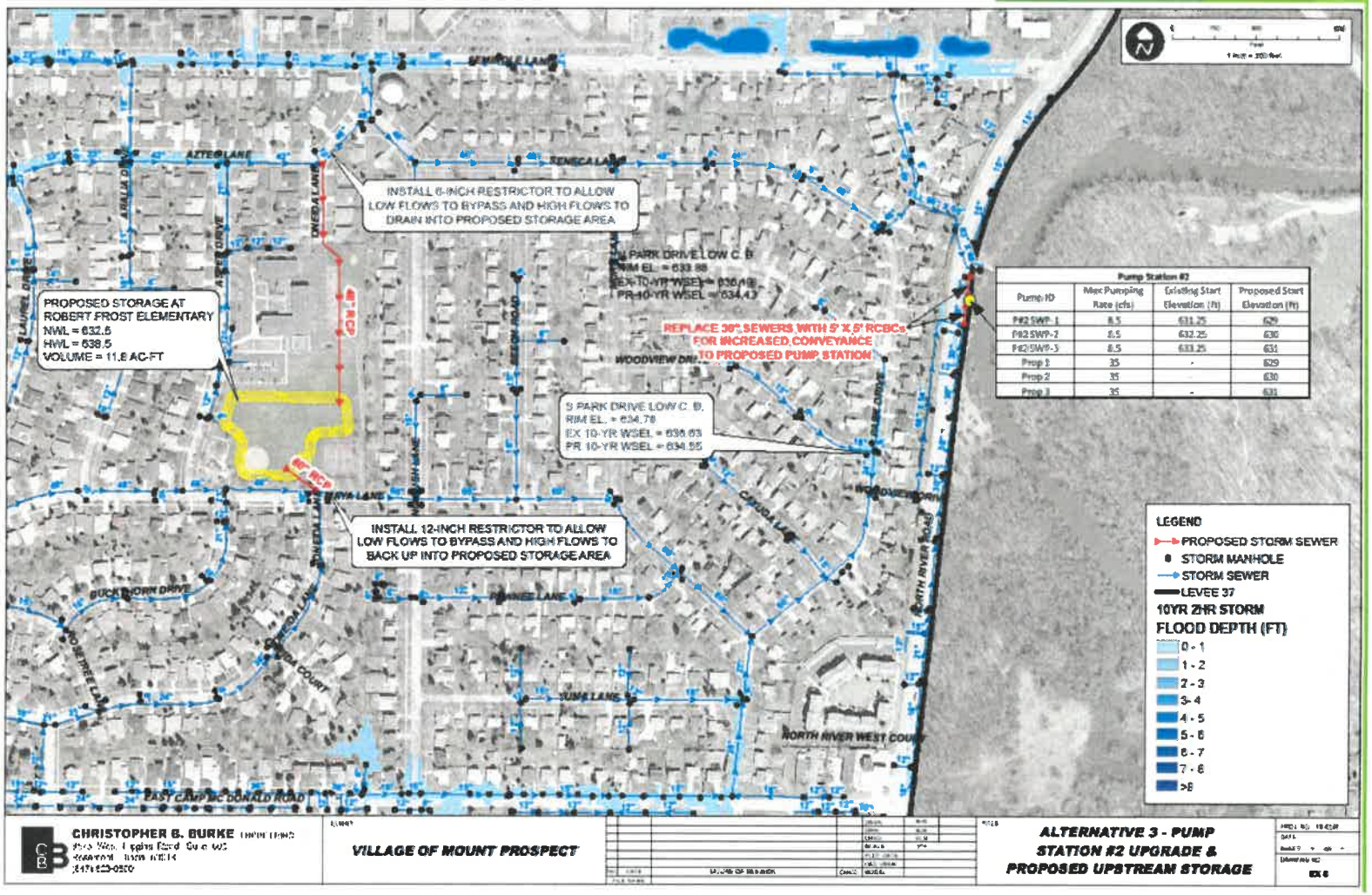


Current Drainage

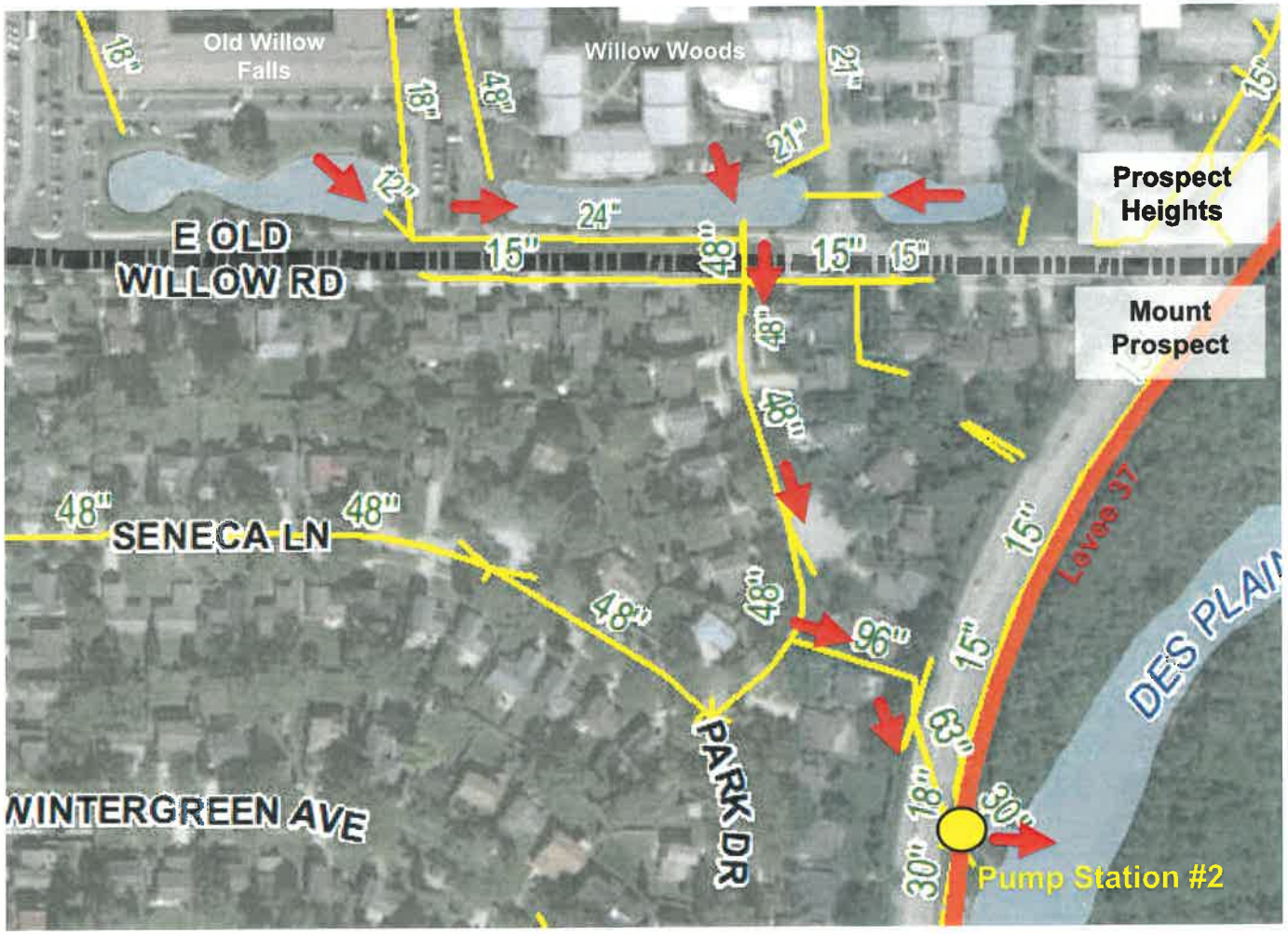


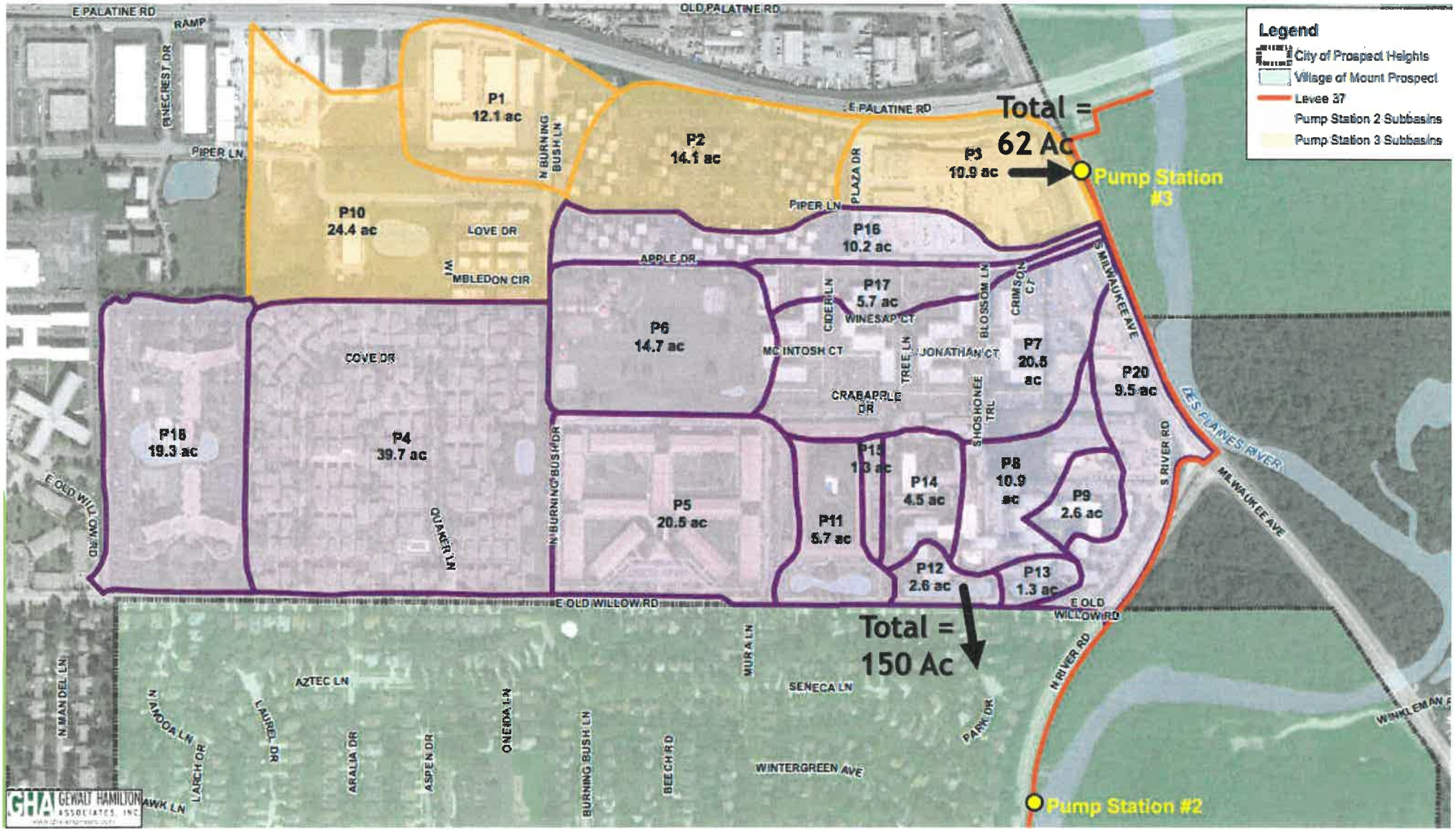
Levee 37 Study - Alternative 3

- Add three pumps to Pump Station #2
- Adjust existing three pumps
- Upsize segments of storm sewer in Village
- Add detention at school property



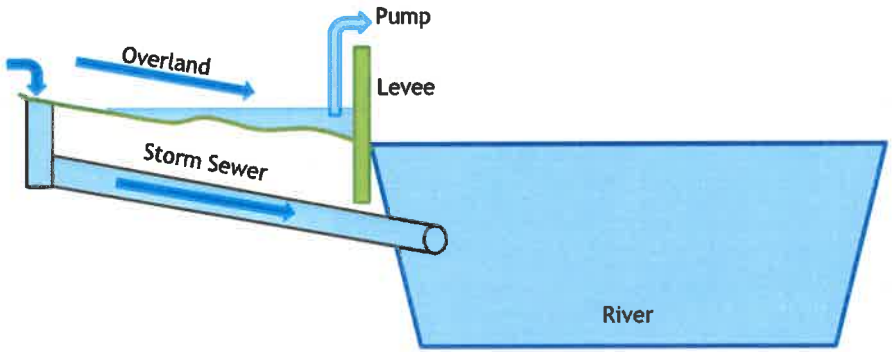
Current Drainage Patterns




Legend
City of Prospect Heights
Village of Mount Prospect
Levee 37
Pump Station 2 Subbasins
Pump Station 3 Subbasins
Total = 62 Ac
Pump Station #3
Total = 150 Ac
Pump Station #2
P1 12.1 ac
P2 14.1 ac
P3 10.9 ac
P4 39.7 ac
P5 20.5 ac
P6 14.7 ac
P7 20.5 ac
P8 10.9 ac
P9 2.6 ac
P10 24.4 ac
P11 5.7 ac
P12 2.6 ac
P13 1.3 ac
P14 4.5 ac
P15 1.3 ac
P16 10.2 ac
P17 5.7 ac
P18 19.3 ac
P20 9.5 ac
E PALATINE RD
OLD PALATINE RD
RAMP
PINECREST DR
PIPER LN
N BURNING BUSH LN
PLAZA DR
LOVE DR
WIMBLEDON CIR
APPLE DR
CIDER LN
WINESAP CT
MC INTOSH CT
TREE LN
JONATHAN CT
BLOSSOM LN
CRIMSON CT
S MILWAUKEE AVE
CRABAPPLE DR
SHOSHONEE TRL
COVE DR
QUAKER LN
N BURNING BUSH DR
E OLD WILLOW RD
DES PLAINES RIVER
S RIVER RD
MILWAUKEE AVE
N RIVER RD
AZTEC LN
SENECA LN
WINTERGREEN AVE
PARK DR
WINKLEMAN R
MURA LN
ONEIDA LN
BURNING BUSH LN
BEECH RD
ASPEN DR
ARALIA DR
LAUREL DR
LARCH DR
N MANDEL LN
GHA GEWALT HAMILTON ASSOCIATES, INC.

Levee 37 Study Conclusions

- "Levee 37 project pump station's capacities are not sufficient to maintain the existing storm sewer gravity flow capacity when the Des Plaines River water level elevation has an influence."
- "Since the three (3) existing Levee 37 pump stations have a cumulative maximum capacity of 60 cfs, this means 180 cfs of additional proposed pumping capacity is allowable."



East Side Drainage Study Conclusions

- Proposed Mount Prospect improvements to Pump Station #2 (Alternative 3) will greatly benefit the City of Prospect Heights by:
  - Decreasing water surface elevations throughout the City
  - Providing more capacity in three existing ponds and storm sewer
- Potential options evaluated provided very small decreases in water surface elevations
  - Option 6 could provide additional protection in private parking lot, and will require improvements by others

TABLE 4
Lake Claire/Shires Pond Flooding Problem Area
Alternatives Analysis Cost Summary

Alternative	Description	Estimated Cost
1	Televise and clean the 24 inch sewer that drains Lake Claire	$14,000
2	Replace the restrictor at Lake Claire	$13,000
3	Televise the Shires Pond system with the pond limits	$3,000
4	Replace or repair the emergency overflow structure at Shires Pond	$60,000
5	Perform hydrologic and hydraulic modeling to optimize the use of both ponds	$35,000
6	(After modeling) Alternative 4 *plus* reroute 24 inch from Lake Claire into Shires Pond and modify restrictor	$77,000

Based on the above, CBBEL recommends the following:

- The City should televise both the 24 inch system and the Shires Pond drainage system within the pond limits. The results of this study would suggest further action.
- The City should replace the restrictor at Lake Claire to one that is less subject to clogging. The possibility of relocating this restrictor further downstream should be discussed with MWRDGC. This relocation may improve the functioning while substantially maintaining the existing flow rates, although the modeling recommended under Alternative 5 may be necessary to determine an optimal location.
- The City should field survey the overland flow to the north of Lake Claire. The results of this survey may suggest whether minor improvements can be made to this overland route to reduce flooding when the lake exceeds its design HWL.

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- Alternative 5 is only recommended after the televising tasks, and the City should meet with MWRDGC staff prior to authorizing any modeling to proceed to confirm their conceptual agreement. If this alternative is selected for further investigation, then the overland flow route for the Shires Pond should be field surveyed, including the adjacent homes. Although this overland flow route is not reportedly flooded during large events because the Shires Pond does not overtop, any solution should include the limitations of this overland flow route.
- Alternative 6 would only be recommended after the modeling under Alternative 5 is performed and the benefits can be quantified. Alternative 6 is recommended as a long term solution to the flooding at Lake Claire.

ELG/ E:\Word\MEMOS\2012\M 11-412 Prospect Heights Lake Claire and Shires Pond 091812.docx

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Attachment 1
Flood-proofing Techniques

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TIPS ON FLOOD PREVENTION FOR HOMEOWNERS

- Clean gutters and install gutter covers to prevent clogging.
- Redefine and clear swales throughout yard to allow an appropriate drainage way for storm water runoff.
- Raise the low entry elevation at which storm water can enter your home by berming around basement doorways or windows. A pump may be required to drain water away from inside the berm.
- Verify existing sump pump and outlet pipe have sufficient capacity for discharging during intense storm events.
- Provide a relief outlet for the sump pump outside of the house that is a safe distance from the foundation in case of surcharge, frozen outlet pipe, or other blockage.
- Install a backup source of power for sump pump in case of electrical power failure.
- Extend downspouts away from the foundation 5-10 feet.
- Repair foundation cracks throughout basement to prevent seepage.
- Raise the low-entry elevation of window wells and/or install drains in the window wells and connect them to the sump pump system.
- Install glass block windows in place of basement windows (except escape window) to prevent water inflow or infiltration.
- If a storm sewer structure is adjacent to the lot, an underdrain system could be installed to collect excess runoff, any remaining seepage or any infiltration resulting from hydrostatic pressure.
- For homes with a reverse-slope driveway, raise the sidewalk elevation to reduce the risk of standing water in the street draining down the driveway and into the garage.
- To further reduce the risk of flooding for homes with reverse slope driveways, it may be necessary to convert the lower level garage into a basement and completely fill in the reverse-slope driveway.

The recommendations provided above may not eliminate flooding or flood damage within the residence; however, if installed correctly they should effectively reduce the risk of flooding. It is should also be noted that any of the recommendations may be implemented

individually, however, many suggestions may be used in conjunction with one another to provide a greater impact in helping to reduce the risk of future flood damage.

WEBSITE LINKS FOR FLOOD PREVENTION

Lake County Stormwater Management Commission Website
http://www.co.lake.il.us/smc/citizens/default.asp

"Repairing Your Flooded Home" by FEMA and the Red Cross
http://www.co.lake.il.us/smc/fwa/ARC_RepFloodedHome.pdf

"Drainage Around Your Home" by the National Resource Conservation Service
http://www.co.lake.il.us/smc/citizens/drainbro.pdf

"Homeowners Guide to Retrofitting: Six Ways to Protect Your Home from Flooding" by FEMA
http://www.fema.gov/rebuild/mat/rfit.shtm

"Guide to Flood Protection in Northeastern Illinois" by the Illinois Association for Floodplain and Stormwater Management
http://www.illinoisfloods.org/documents/Guide_to_Flood_Prot--March_06.pdf

Attachment 2
Cost Estimates

Christopher B. Burke Engineering, Ltd.
9575 West Higgins Road, Suite 600
Rosemont, Illinois 60018
Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Lake Claire/Shires Pond - Alt 1

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
CLEAN AND TELEVISE STORM SEWER, 24"	FOOT	2550	$3.00	$7,650.00

SUB TOTAL =	$7,650.00
CONTINGENCY (30%) =	$2,295.00
CONSTRUCTION TOTAL =	$9,945.00
REVIEW TAPES AND MAKE REPAIR RECOMMENDATIONS=	$4,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$13,945.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, OR RELOCATING ANY UTILITIES

Christopher B. Burke Engineering, Ltd.
9575 West Higgins Road, Suite 600
Rosemont, Illinois 60018
Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Lake Claire/Shires Pond - Alt 2

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
REPLACE RESTRICTOR/STRUCTURE	EACH	1	$5,000.00	$5,000.00
RESTORATION	L SUM	1	$2,000.00	$2,000.00

SUB TOTAL =	$7,000.00
CONTINGENCY (30%) =	$2,100.00
CONSTRUCTION TOTAL =	$9,100.00
DESIGN=	$4,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$13,100.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, OR RELOCATING ANY UTILITIES

Christopher B. Burke Engineering, Ltd.
9575 West Higgins Road, Suite 600
Rosemont, Illinois 60018
Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Lake Claire/Shires Pond - Alt 1

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
CLEAN AND TELEVISE STORM SEWER, 6-12""	FOOT	350	$4.00	$1,400.00

SUB TOTAL =	$1,400.00
CONTINGENCY (30%) =	$420.00
CONSTRUCTION TOTAL =	$1,820.00
REVIEW TAPES AND MAKE REPAIR RECOMMENDATIONS=	$1,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$2,820.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, OR RELOCATING ANY UTILITIES

Christopher B. Burke Engineering, Ltd.
9575 West Higgins Road, Suite 600
Rosemont, Illinois 60018
Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Lake Claire/Shires Pond - Alt 4

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
REPLACE EMERGENCY OVERFLOW	EACH	1	$35,000.00	$35,000.00
RESTORATION	L SUM	1	$5,000.00	$5,000.00

SUB TOTAL =	$40,000.00
CONTINGENCY (30%) =	$12,000.00
CONSTRUCTION TOTAL =	$52,000.00
DESIGN=	$8,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$60,000.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, OR RELOCATING ANY UTILITIES

Christopher B. Burke Engineering, Ltd.
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Rosemont, Illinois 60018
Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Lake Claire/Shires Pond - Alt 5

H & H Modeling = $35,000

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Rosemont, Illinois 60018
Project # 11-412
Date: Sept. 17, 2012

Prospect Heights, Proposed Drainage Improvements
Lake Claire/Shires Pond - Alt 6

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
REPLACE OUTLET STRUCTURE	EACH	1	$25,000.00	$25,000.00
NEW INLET PIPE/FES	L SUM	1	$7,500.00	$7,500.00
MANHOLE	EACH	1	$5,000.00	$5,000.00
RIPRAP	SQ YD	25	$100.00	$2,500.00
RESTORATION	L SUM	1	$3,500.00	$3,500.00

SUB TOTAL =	$43,500.00
CONTINGENCY (30%) =	$13,050.00
CONSTRUCTION TOTAL =	$56,550.00
DESIGN=	$10,000.00
PERMITTING=	$10,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$76,550.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, OR RELOCATING ANY PRIVATE UTILITIES

TAB 5

Eastside TIF District Flooding Probem Area

MEMORANDUM

September 18, 2012

TO: Anne Marin – City Administrator, Prospect Heights
Steve Skiber – Director of Building and Zoning, Prospect Heights
James H. Johnson, PE – Director of Public Works and City Engineer
James O'Neill – Public Works Foreman, Prospect Heights

COPY: *Project Files (CBBEL Project No. 11-412)*

FROM: Erik L. Gil, PE

SUBJECT: **Eastside TIF District Flooding Problem Area**
Project: 2011-12 Prospect Heights Flood Study
Location: East of Milwaukee Avenue, West of Wolf Road, south of Palatine Road, and north of Willow Road, Prospect Heights, Cook County, Illinois
Watershed: Des Plaines River (subarea adjacent to river)

INTRODUCTION

Christopher B. Burke Engineering Ltd. (CBBEL) was retained by the City of Prospect Heights (City) to perform a flood risk reduction analysis based on the flooding that occurred from the July 22-23, 2011 storm event. The primary goals of this study were to determine the extent of the flood damage, establish possible causes for the flooding and to provide potential solutions to reduce the risk of future flooding.

This memorandum documents the analysis for the Eastside TIF District Study Area. Separate memoranda will be provided for each of the other study areas, and will be assembled in a single report at the conclusion of the study.

JULY 22-23, 2011 EVENT PRECIPITATION

On July 23, 2011 the City received approximately 4.81 inches of rain in a 3-hour period that resulted in extensive flood damage in certain areas of the City. The City received 6.17 inches of rain in a 24-hour period from July 22nd to the 23rd. The rainfall totals were based on the rainfall values obtained from the gages shown in Table 1 below, which are from both the O'Hare International Airport and the Chicago Executive Airport weather gages.

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TABLE 1
July 22-23, 2011 Rainfall Values

Gage ID	Location	3-hour Total (inches)	24-hour Total (inches)
04838	Chicago Executive Airport	4.71	6.06
94846	O'Hare International Airport	6.79	8.21
	Weighted Average =	*4.81*	*6.17*
	ISWS Bulletin 70 frequency at Prospect Heights*	100-year	40-year

*Note: The stated frequency is approximate.

Two durations were chosen for discussion purposes, the 3-hour duration and the 24-hour duration. The 24-hour duration is the traditional duration used for many engineering calculations and is the typical one reported by the media. The 3-hour duration was also chosen for comparison purposes for 2 reasons. The first is that most of the flooding problem drainage areas being evaluated in this flood study respond to significant short-duration rainfall events within or shortly after a 3-hour period, that is, the flood peak is typically reached shortly after this time period if rain is no longer falling, as was the case during July 23, 2011. The Des Plaines River, for example, would not respond as quickly to a significant short-duration rainfall event. The second reason is that the rainfall totals for the most severe continuous 3-hour period at the O'Hare International Airport gage exceeded the 100-year frequency as documented in the Illinois State Water Survey (ISWS) Bulletin 70 publication, the reference used by most regulatory agencies in the northeastern Illinois area for rainfall depth design values. The Chicago Executive Airport gage did not exceed the 100-year frequency value for the 3-hour event, but it was sufficiently close to be considered as the 100-year frequency. As can be observed, the two gage values at O'Hare International Airport and at Chicago Executive Airport differed by over 2 inches of rainfall for each of the reported totals. This meant that the July 22-23, 2011 event was a relatively localized storm event. For purposes of this study, a simple weighted average between the two gages was computed to estimate the rainfall totals that fell on the City, assigning a 95% weight to Chicago Executive Airport based on distance from the City as compared to the O'Hare International Airport, which was assigned a 5% weight.

The July 22nd–23rd storm event exceeded the capacity of the storm sewer systems in the older parts of town and resulted in street, backyard, and home flooding. Approximately 161 residents within the City filled out a flood questionnaire after the July 23rd storm event.

REFERENCES AND AVAILABLE INFORMATION

- Meetings with City staff,
- Summary provided by City staff of 161 flood questionnaires submitted by City residents,
- Site visits,
- Cook County 1-foot contour aerial topography,
- City storm sewer maps,

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- United States Geological Survey (USGS) Hydrologic Atlas (HA),
- Historic Aerial Photographs,
- Federal Emergency Management Agency (FEMA) Federal Insurance Rate Maps (FIRMs)

OVERVIEW

The Eastside TIF District is located in the eastern most area of the City. In general, the study area is bounded by Palatine Road to the north, Milwaukee Avenue to the east, Willow Road to the south, and Wolf Road to the west. This study area is within the Eastside TIF District and is bounded by Apple Drive to the north and Burning Bush Drive to the west. The Village of Mount Prospect is located immediately south of the Eastside TIF District, and the Chicago Executive Airport is located to the north. The street map of this location is shown on Figure 1.

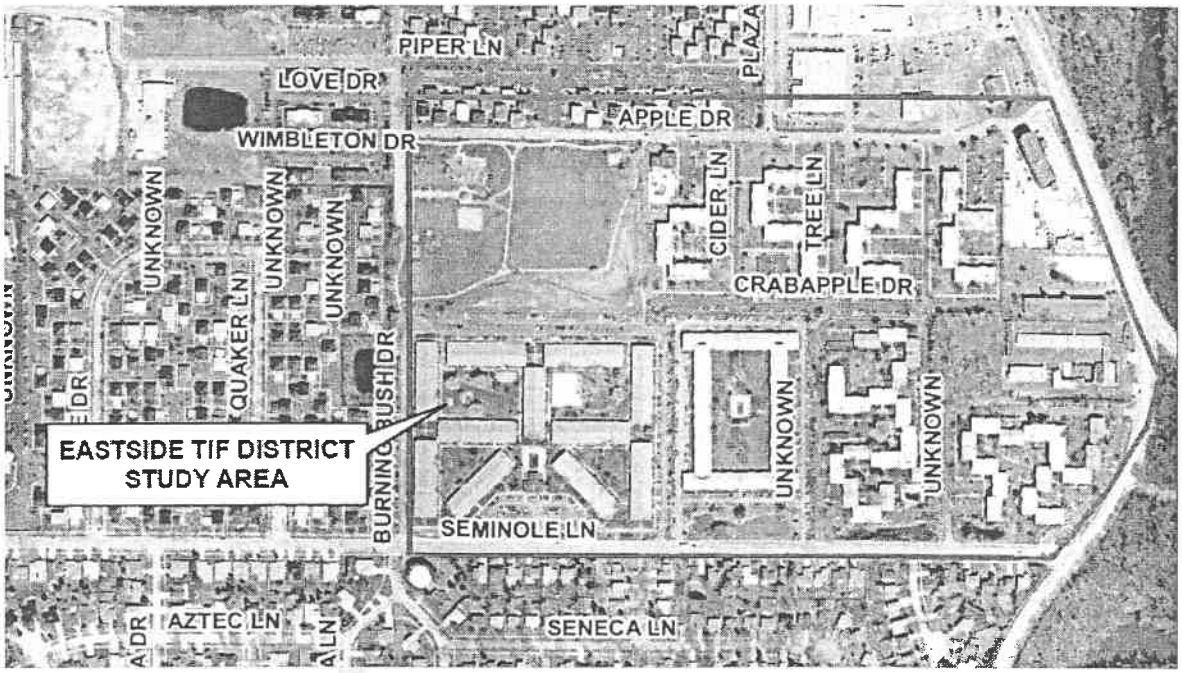

Figure 1
Eastside TIF District Study Area
Location Map

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The study area is located entirely in a Federal Emergency Management Agency (FEMA) Zone AE regulatory floodplain, according to Flood Insurance Rate Map (FIRM) Panel 207 of 832, revised August 19, 2008. The approximate floodplain elevation across the study area is 639. The ground elevations within the study area range from approximately 635 to 639. Therefore, under FEMA's 1% chance storm event (or the 100-year event) portions of the study area are inundated by as much as 4 feet of depth by the Des Plaines River.

The Eastside TIF District drains to the Des Plaines River. The most northern areas of it drain directly to the Des Plaines River, while the majority drains south into the Willow Woods Condominiums Detention Ponds system that discharges into a storm sewer that drains south into the Mount Prospect storm sewer system.

PHOTOGRAPH 1
Willow Woods Condominiums Detention Pond Outlet Looking South

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EXISTING DRAINAGE PATTERN

The historic patterns that existed prior to development in this area were of a nearly flat area that drained mostly south into a small tributary to the Des Plaines River. According to Hydrologic Investigations Atlas HA-67, Floods in Arlington Heights Quadrangle, Illinois, prepared in 1963, shown as Figure 2, this tributary drained a substantial portion of the study area. This tributary has been enclosed as the area developed, and the runoff is now conveyed via storm sewers into the Des Plaines River.

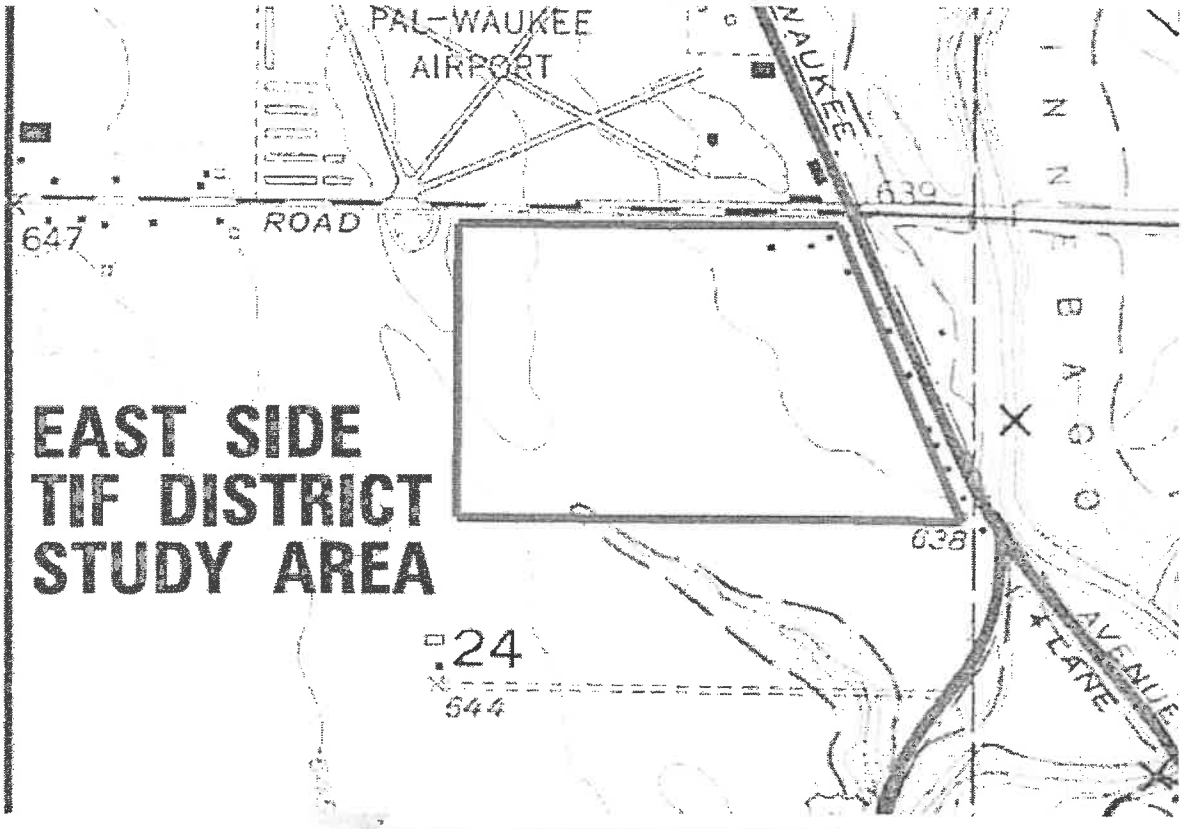

Figure 2
USGS Hydrologic Atlas

Because of its location within the Des Plaines River floodplain and generally flat terrain, the Eastside TIF District has historically experienced significant flooding. Back in the 1990s, the USACE planned and designed the Levee 37 project. This project was proposed to alleviate overbank flooding due to the Des Plaines River from affecting areas within the City of Prospect Heights and the Village of Mount Prospect. The levee portion of the project is

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99% complete, with the remaining component being an opening left with the levee system to allow Des Plaines River water to flood the areas until the mitigating Heritage Park storage area is completed next year. Once Heritage Park improvements are complete, the levee system will be completed, and a 1% chance or 100-year level of protection will be achieved. The Levee 37 flood control project consists of approximately of 9,000 LF of floodwall including a small portion of levee, three pumping stations, a number of gravity outlet structures, a roadway closure structure and a road raise. The floodwall runs along the eastside of Des Plaines River Road from Euclid Avenue to Milwaukee Avenue, and continues along the eastside of Milwaukee Avenue from Des Plaines River Road to Palatine Road then west along the north side of Palatine Road to a tieback into high ground. The road closure structure will consist of a double swing gate structure across Milwaukee Avenue on the north side of Palatine Road. A road raise on Milwaukee Avenue, extending from its intersection with Des Plaines River Road proceeds to the east from this intersection and was constructed by IDOT. The construction of the road raise eliminated the need to install a large vertical closure gate at the intersection of Milwaukee Avenue and Des Plaines River Road. However, the Levee 37 system was not designed to specifically alleviate local or interior flooding west of the levee (the interior drainage system), but due to its pumping stations, it may have the benefit of reducing the backwater (tailwater) condition that used to impact the storm sewer systems that drain the study area.

The current land use of the study area consists of an industrial park on the northwest corner of the study area, a commercial area on the northeast corner, a park district recreational area in the center of the area, and multi-family residential units in the remaining portions of the study area.

Old Willow Falls

This is a multi-family residential development consisting of condominiums and a detention pond. The development drains north to south into a detention pond and also receives stormwater runoff from Willow Heights Condominiums to the west and River Trails Condominiums to the north. There is street ponding along the western parking lot due to a 8" restrictor in the storm sewer system from Willow Heights Condominiums. The City has indicated that there are flooding problems in the development.

Willow Heights Condominiums

This is a multi-family residential development consisting of condominiums. This development does not have any open-space detention ponds. The parking lot of Willow Heights is used for detention storage and ponding occurs in the parking lot due to the 8" restrictor in the east parking lot adjacent to the Old Willow Falls west parking lot. The development drains west to east into the Old Willow Falls storm sewer system and takes stormwater runoff from the Quincy Park Subdivision to the west. There is ponding in the parking lot because the parking lot functions as the detention pond for the development. The City has indicated that flooding occurs in the development; however, it appears that the flooding problems can be attributed to the parking lot functioning as a detention basin as it was designed to perform.

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Willow Woods Condominiums
This is a multi-family residential development consisting of condominiums and two detention ponds. The development drains north to south into the two detention ponds. The east detention pond drains into the west detention pond which discharges into the storm sewer system on Old Willow Road. The development receives stormwater runoff from Willow Trails Park to the northwest, from River Trails Condominiums to the north, and from Apple Drive to the north. There is street/parking lot ponding reported.

River Trails Condominiums
This is a multi-family residential development consisting of condominiums. There are no detention ponds in this development. The development drains north to south into the Willow Woods storm sewer system. The development receives stormwater runoff from Palwaukee Plaza from the north and along Apple Lane to the north. The detention storage for River Trails Condominiums is located in small street/parking lot "pockets" throughout the development. Street ponding occurs at the intersection of Crabapple Drive and Tree Lane and along Tree Lane.

Palwaukee Plaza
This is a commercial development which has no detention ponds. The development drains west to east into the storm sewer system that discharges into the Des Plaines River. Any overflow drains to the south to the River Trails Condominiums. The development receives stormwater runoff form Country Pine Apartments to the west. There is street ponding in the parking lot of Palwaukee Plaza. The City has indicated that there are historical flooding problems in the area.

There were no flood questionnaires returned in this study area.

STORMWATER DEFICIENCIES

Based on field visits, assessment of the topography, verbal communication with Public Works staff, and the limited existing storm sewer system shown on the City atlases for this area, the following stormwater deficiencies have been identified for this area:

1. In general, the study area is a highly impervious watershed system with limited storage areas, and a private storm sewer system. The result is significant street flooding. There does not appear to be land available to expand the existing detention ponds which would be the cost effective option.
2. There is one area in which the flow is being restricted due to the size of the storm sewer pipe. The storm sewer line that discharges into the Old Willow Falls detention basin and originates at the west parking lot of the Willow Heights Condominiums consists of a 15"-12"-8"-18". The 12" and 8" storm sewer pipes are located in the parking lots at the property boundary of the Willow Heights Condominiums and the

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Old Willow Falls Condominiums. This restriction causes stormwater runoff to pond in the parking lot of the Willow Heights Condominiums, which acts as a detention for the runoff from the condominiums. It is assumed that this restriction in the storm sewer exists to provide detention storage for the Willow Heights Condominiums. Therefore, upsizing the 12" and 8" storm sewer pipes is not recommended if the parking lot of the condominiums is to continue to serve as a detention area. However, the ponding at the west parking lot of the Old Willow Falls Condominiums could be caused by clogging of the inlet grate structure.

3. The area is located in the Des Plaines River floodplain. However, as previously described, overbank flooding due to a rising Des Plaines River will be eliminated up to the design 100-year elevation due to the Levee 37 project once it is completed. Backwater effects into the storm sewers from the Des Plaines River, a historic deficiency, will also be significantly reduced due to the functioning of the Levee 37 pumping stations.
4. There is an open-grate top of a manhole structure at the end of the 48" reinforced concrete pipe (RCP) which outfalls at the Willow Woods West Detention Pond. There is a low-flow opening at this structure and any surcharge flows would bubble from the top of the structure through the grate. The invert of this opening is low enough so that most of the 36" sewer line through the River Trails Condominiums parking lot should be dry during dry periods (only the last leg of the 36" system before it enters the Willow Woods Condominiums system would have ponded water); however, it is not low enough to drain the 48" RCP, which is constantly under water. Prior to the City's televising and cleaning, there was an obstruction somewhere between the parking lot and the Willow Woods West Detention Pond that was blocking the sewer line from draining by gravity to the invert of the structure opening at the pond. If this obstruction is removed (as it has been), the stormwater ponding can be significantly reduced (but not eliminated) during moderate storm events.
5. Also, the 48" storm sewer pipe through the Willow Woods Condominiums is lower than the downstream storm sewer system in the Village of Mount Prospect. Without pumping or lowering the storm sewer system through the Village of Mount Prospect, the 48" RCP will always remain ponded (unless during extreme drought periods, the Willow Woods Condominiums West basin would dry up such that its normal water level (NWL) would be below the 48" system's invert).

APPROACH TO SOLUTIONS

This area experiences flooding because this area is relatively flat and has historically benn impacted by the flood levels in the Des Plaines River. While the storm sewer provides a means of draining this area, its capacity is exceeded for moderate to significant storm events, and the area floods. Some portions of this area were developed prior to the requirement for detention storage.

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There are no available photographs for this area during the July 23, 2011 storm event. The City has recently completed sewer cleaning operations, and found obstructions in the system, which have since been cleared.

In general, structural approaches for alleviating flooding problems can be categorized into two types: storage creation, or conveyance improvements. Typically, conveyance improvements alone may cause impacts to downstream properties, and detailed modeling would be necessary to determine the location and magnitude of these impacts, which is beyond the scope of this study.

Aside from possible public improvements, it is recommended that the City encourage all residents to flood-proof their homes, which in this study area would require the cooperation of all the residents within a building, especially those who have experienced flooding in the past. This will reduce the risk of future flooding due to overland flow, seepage and sump pump failures. A list of simple and inexpensive flood-proofing measures has been included as Attachment 1 of this memorandum. This recommendation is in addition to any other drainage improvements on public or private property.

There are various approaches to alleviating flooding for this area, some of which have already occurred or soon will be completed but are listed for completeness.

- Protect the area from overbank flooding. Levee 37 was designed to protect this area from the FEMA 1% chance flood, and when the existing openings are closed, will function as such.
- Reduce the backwater (or tailwater) impacts from the Des Plaines River into the existing storm sewers that drain this area. This system is either operational or nearly operational with 2 pump stations that discharge runoff from the study area into the Des Plaines River. The impacts of this improvement have likely not been observed yet as the Des Plaines River has not significantly flooded when the system has been operational. While no modeling has been performed for this study, the USACE has indicated that there were no interior drainage issues with the pumps operating.
- Clean the existing storm sewer system. This was completed by the City as part of the overall Drainage Study. The results of this work were that the Willow Woods Condominiums storm sewer system was obstructed by significant debris, and this debris has been cleaned.
- Perform modeling to determine if the entire system can be optimized; however, the above-described improvements, either already completed or soon to be completed as mentioned are anticipated to improve the flooding problems of this area.

ALTERNATIVE DRAINAGE SOLUTIONS

The possible drainage solutions for the Eastside TIF District study area were developed at a concept level based on feasibility of implementation and cost effectiveness. Based on this

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analysis and the understanding that the Levee 37 project is planned to be operational by 2014, CBBEL identified the following alternatives to reduce the risk of flooding in this area:

1. The 36"-48" system from the River Trails Condominiums to the Willow Woods West Detention Facility should be cleaned and televised. The size of the system appears to be adequate for its designed rainfall event. By cleaning this system and assuming that no rehabilitation to the sewer line is necessary (it has been assumed that the pipe does not need repairs), the Willow Woods West Detention Pond will experience higher water levels than it currently does, but that the adjacent parking area should experience less inundation. It appears that the City's televising found that the main blockage was occurring within the 48" pipe between the condominiums. This televising and cleaning should be performed at least every 5 years.
2. The Willow Trails Park can be modified to provide more storage and to directly take the outflow from the Quincy Park detention basin. The Quincy Park detention basin should be pumped after the detention basin is full or the end of the storm event. The water from the Quincy Park basin enters the detention area of the park where it is restricted by a 12" pipe before entering the 30" RCP. By providing more storage and restricting this flow, the River Trails Condominiums storm sewer system can be surcharged to a lesser extent during storm events alleviating some of the flooding at the Tree Lane and Crabapple Drive intersection. This component will require coordination with the Park District.
3. Modify the outlet structure of the Willow Woods Condominiums West Detention Basin, dredge approximately one foot of the pond below NWL, and lower the outlet invert by replacing the 48" pipe from the structure to the next manhole structure. Approximately 75 feet of storm sewer would be replaced. The purpose of this modification is to lower the invert of the outlet by 1 ft from. The goal of this is to provide more hydraulic head to the 36"-48" storm sewer system by lowering the normal water of the basin. Although some additional storage will be provided by this project, the improved conveyance of the 36"-48" storm sewer system is its main benefit. The additional storage can be considered as a factor of safety for overtopping the Willow Woods West detention basin in the events lower than the 10-year event. This project will require considerable coordination with the Village of Mount Prospect.
4. To reduce ponding in the center parking lot of the River Trails Condominiums, the vacant lot west of the Excel Inn can be excavated to provided approximately 2.2 acre-feet of additional detention storage. This storage area will drain into the 21"-24" RCP storm sewer system along the east side of Willow Woods West basin. The outlet of the storage area consists of a 12" RCP storm sewer with a 3" restrictor. This storage area should reduce the ponding in the center parking lot of the River Trails Condominiums for the storm events less than the 10-year event.
5. In order to reduce the ponding areas in the parking lot of the Willow Heights Condominiums and the Old Willow Falls condominiums, the existing storm sewer line through this area needs to be upsized, an additional storm system needs to be

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added parallel to the existing storm sewer, and the Old Willow Falls basin needs to be enlarged. The extent of this basin expansion would be expected to be significant.

RECOMMENDATIONS

Based on this analysis, CBBEL presents the pros and cons of each alternative, and provides estimated costs and a recommendation.

TABLE 2
Eastside TIF Flooding Problem Area
Alternatives Analysis Summary

Alternative	Description	Pros	Cons
1	Televise and clean the sewer system that drains into the Willow Woods West Detention Facility	• Cost effective • May substantially reduce flooding within the Willow Woods area • Least impact to residential properties	• Will not solve flooding in other areas
2	Provide additional storage at the Willow Trails Park	• May lower the flooding levels for smaller storms • Will decrease inundation times • Least impact to residential properties	• Will not eliminate flooding or level of inundation for large storm events • Will require coordination with the Park District • Park will be subject to more water inundation
3	Lower 48 inch outlet at the Willow Woods West Detention Facility by about 1 foot and dredge the pond	• May lower the flooding levels for smaller storms • Will decrease inundation times • Least impact to residential properties	• Will not eliminate flooding or level of inundation for large storm events • Will require coordination and agreement from the Village of Mount Prospect • Will require modeling
4	Create storage at the wooded vacant lot west of Excel Inn	• May lower the flooding levels for smaller storms • Will decrease inundation times • Least impact to residential properties	• Will not eliminate flooding or level of inundation for large storm events • Will require land acquisition • Tree screening will be eliminated
5	Deepen the Old Willow Falls detention basin and add a pump station	• May lower the flooding levels for smaller storms • Will decrease inundation times	• Will not eliminate flooding or level of inundation for large storm events • Will mainly alleviate flooding at Old Willow Falls and Willow Heights • Will require authorization from the Old Willow Falls residents • Relatively high cost

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Table 3 below provides a summary of conceptual cost estimates associated with each of the above alternatives. The detailed conceptual cost estimates can be found under Attachment 2.

TABLE 3
Eastside TIF Flooding Problem Area
Alternatives Analysis Cost Summary

Alternative	Description	Estimated Cost
1	Televise and clean the sewer system that drains into the Willow Woods West Detention Facility	$13,100
2	Provide additional storage at the Willow Trails Park	$570,000
3	Lower 48 inch outlet at the Willow Woods West Detention Facility by about 1 foot and dredge the pond	$170,000
4	Create storage at the wooded vacant lot west of Excel Inn	$420,000
5	Deepen the Old Willow Falls detention basin and add a pump station	$2,170,000

Based on this analysis, CBBEL recommends that:

- The City should allow the Levee 37 project to be completed so that the full benefits to the storm sewer system can be observed during significant events.
- The City should regularly maintain the 36"-48" storm sewer system.
- The City should explore adding stormwater storage, such as Alternatives 2 and 4, as described above to further reduce parking lot flooding.

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Attachment 1

Flood-proofing Techniques

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TIPS ON FLOOD PREVENTION FOR HOMEOWNERS

- Clean gutters and install gutter covers to prevent clogging.
- Redefine and clear swales throughout yard to allow an appropriate drainage way for storm water runoff.
- Raise the low entry elevation at which storm water can enter your home by berming around basement doorways or windows. A pump may be required to drain water away from inside the berm.
- Verify existing sump pump and outlet pipe have sufficient capacity for discharging during intense storm events.
- Provide a relief outlet for the sump pump outside of the house that is a safe distance from the foundation in case of surcharge, frozen outlet pipe, or other blockage.
- Install a backup source of power for sump pump in case of electrical power failure.
- Extend downspouts away from the foundation 5-10 feet.
- Repair foundation cracks throughout basement to prevent seepage.
- Raise the low-entry elevation of window wells and/or install drains in the window wells and connect them to the sump pump system.
- Install glass block windows in place of basement windows (except escape window) to prevent water inflow or infiltration.
- If a storm sewer structure is adjacent to the lot, an underdrain system could be installed to collect excess runoff, any remaining seepage or any infiltration resulting from hydrostatic pressure.
- For homes with a reverse-slope driveway, raise the sidewalk elevation to reduce the risk of standing water in the street draining down the driveway and into the garage.
- To further reduce the risk of flooding for homes with reverse slope driveways, it may be necessary to convert the lower level garage into a basement and completely fill in the reverse-slope driveway.

The recommendations provided above may not eliminate flooding or flood damage within the residence; however, if installed correctly they should effectively reduce the risk of flooding. It is should also be noted that any of the recommendations may be implemented

individually, however, many suggestions may be used in conjunction with one another to provide a greater impact in helping to reduce the risk of future flood damage.

WEBSITE LINKS FOR FLOOD PREVENTION

Lake County Stormwater Management Commission Website
http://www.co.lake.il.us/smc/citizens/default.asp

"Repairing Your Flooded Home" by FEMA and the Red Cross
http://www.co.lake.il.us/smc/fwa/ARC_RepFloodedHome.pdf

"Drainage Around Your Home" by the National Resource Conservation Service
http://www.co.lake.il.us/smc/citizens/drainbro.pdf

"Homeowners Guide to Retrofitting: Six Ways to Protect Your Home from Flooding" by FEMA
http://www.fema.gov/rebuild/mat/rfit.shtm

"Guide to Flood Protection in Northeastern Illinois" by the Illinois Association for Floodplain and Stormwater Management
http://www.illinoisfloods.org/documents/Guide_to_Flood_Prot--March_06.pdf

Attachment 2
Cost Estimates

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Rosemont, Illinois 60018
Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
EASTSIDE TIF DISTRICT FLOODING PROBLEM AREA - ALTERNATE 1

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
CLEAN AND TELEVISE STORM SEWER	FOOT	2000	$3.50	$7,000.00

SUB TOTAL =	$7,000.00
CONTINGENCY (30%) =	$2,100.00
CONSTRUCTION TOTAL =	$9,100.00
REVIEW TAPES AND MAKE REPAIR RECOMMENDATIONS=	$4,000.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$13,100.00

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, OR RELOCATING ANY UTILITIES

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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
EASTSIDE TIF DISTRICT FLOODING PROBLEM AREA - ALTERNATE 2

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.2	$15,000.00	$3,000.00
TREE ROOT PRUNING	EACH	10	$200.00	$2,000.00
EARTH EXCAVATION	CU YD	4840	$40.00	$193,600.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	14000	$5.00	$70,000.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	14000	$5.00	$70,000.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
TRAFFIC CONTROL	LSUM	1	$5,000.00	$5,000.00
CONSTRUCTION LAYOUT	LSUM	1	$20,000.00	$20,000.00

SUB TOTAL =	$367,100.00
CONTINGENCY (30%) =	$110,130.00
CONSTRUCTION TOTAL =	$477,230.00
DESIGN ENGINEERING (10%) =	$35,792.25
CONSTRUCTION OBSERVATION (10%) =	$35,792.25
PERMITTING (5.0%) =	$18,355.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$567,169.50

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY.

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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
EASTSIDE TIF DISTRICT FLOODING PROBLEM AREA - ALTERNATE 3

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
EARTH EXCAVATION	CU YD	900	$40.00	$36,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	2670	$5.00	$13,350.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	2670	$5.00	$13,350.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
STONE RIPRAP, CLASS A4	SQ YD	20	$30.00	$600.00
TRENCH BACKFILL, SPECIAL	CU YD	40	$45.00	$1,800.00
STORM SEWER, RCP 48"	FOOT	70	$120.00	$8,400.00
PROPOSED MANHOLE, 6' DIA	EACH	1	$5,000.00	$5,000.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 48" WITH GRATE	EACH	1	$2,500.00	$2,500.00
CLASS D PATCHES, 12 INCHES	SQ YD	30	$75.00	$2,250.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	20	$40.00	$800.00
TRAFFIC CONTROL	LSUM	1	$8,000.00	$8,000.00
CONSTRUCTION LAYOUT	LSUM	1	$15,000.00	$15,000.00

SUB TOTAL =	$110,550.00
CONTINGENCY (30%) =	$33,165.00
CONSTRUCTION TOTAL =	$143,715.00
DESIGN ENGINEERING (10%) =	$10,778.63
CONSTRUCTION OBSERVATION (10%) =	$10,778.63
PERMITTING (5.0%) =	$5,527.50
TOTAL PROJECT COST INCLUDING ENGINEERING =	$170,799.75

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY.

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Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
EASTSIDE TIF DISTRICT FLOODING PROBLEM AREA - ALTERNATE 4

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	1.2	$15,000.00	$18,000.00
TREE ROOT PRUNING	EACH	20	$200.00	$4,000.00
EARTH EXCAVATION	CU YD	3550	$40.00	$142,000.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	6000	$5.00	$30,000.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	6000	$5.00	$30,000.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
STONE RIPRAP, CLASS A4	SQ YD	40	$30.00	$1,200.00
TRENCH BACKFILL, SPECIAL	CU YD	40	$45.00	$1,800.00
STORM SEWER, RCP 12"	FOOT	60	$75.00	$4,500.00
PROPOSED MANHOLE, 4' DIA	EACH	2	$4,000.00	$8,000.00
PROPOSED RESTRICTOR MH, 5' DIA	EACH	1	$4,500.00	$4,500.00
PRECAST REINFORCED CONCRETE FLARED END SECTIONS 12"	EACH	2	$500.00	$1,000.00
TRAFFIC CONTROL	LSUM	1	$5,000.00	$5,000.00
CONSTRUCTION LAYOUT	LSUM	1	$15,000.00	$15,000.00

SUB TOTAL =	$268,500.00
CONTINGENCY (30%) =	$80,550.00
CONSTRUCTION TOTAL =	$349,050.00
DESIGN ENGINEERING (10%) =	$26,178.75
CONSTRUCTION OBSERVATION (10%) =	$26,178.75
PERMITTING (5.0%) =	$13,425.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$414,832.50

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY.

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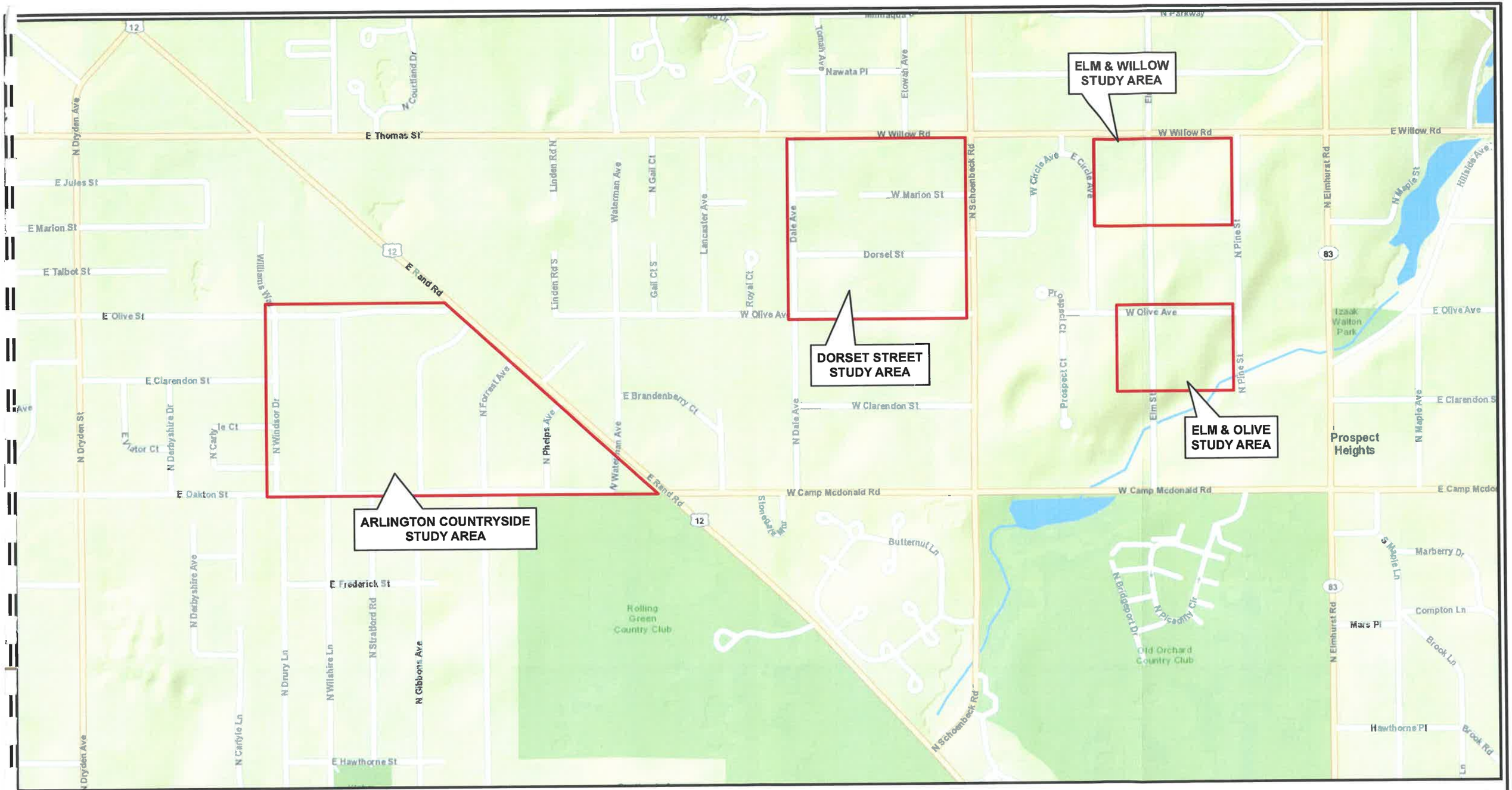
Project# 110412
Date: September 17, 2012

Prospect Heights, Proposed Drainage Improvements
EASTSIDE TIF DISTRICT FLOODING PROBLEM AREA - ALTERNATE 5

ITEMS	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
TREE REMOVAL	ACRE	0.2	$15,000.00	$3,000.00
TREE ROOT PRUNING	EACH	5	$200.00	$1,000.00
EARTH EXCAVATION	CU YD	10370	$40.00	$414,800.00
TOPSOIL FURNISH AND PLACE, 4"	SQ YD	4440	$5.00	$22,200.00
SEEDING WITH EROSION CONTROL BLANKET	SQ YD	4440	$5.00	$22,200.00
STABILIZED CONSTRUCTION ENTRANCE	EACH	1	$3,500.00	$3,500.00
STONE RIPRAP, CLASS A4	SQ YD	40	$30.00	$1,200.00
TRENCH BACKFILL, SPECIAL	CU YD	200	$45.00	$9,000.00
STORM SEWER, RCP 12"	FOOT	2000	$75.00	$150,000.00
PROPOSED MANHOLE, 4' DIA	EACH	8	$4,000.00	$32,000.00
PROPOSED RESTRICTOR MH, 5' DIA	EACH	1	$4,500.00	$4,500.00
CLASS D PATCHES, 12 INCHES	SQ YD	200	$75.00	$15,000.00
CURB AND GUTTER REMOVAL AND REPLACEMENT	FOOT	50	$40.00	$2,000.00
RETAINING WALLS	SQ FT	12000	$40.00	$480,000.00
TRAFFIC CONTROL	LSUM	1	$15,000.00	$15,000.00
CONSTRUCTION LAYOUT	LSUM	1	$25,000.00	$25,000.00
FORCE MAIN	FOOT	50	$50.00	$2,500.00
PUMP STATION	LSUM	1	$200,000.00	$200,000.00

SUB TOTAL =	$1,402,900.00
CONTINGENCY (30%) =	$420,870.00
CONSTRUCTION TOTAL =	$1,823,770.00
DESIGN ENGINEERING (10%) =	$136,782.75
CONSTRUCTION OBSERVATION (10%) =	$136,782.75
PERMITTING (5.0%) =	$70,145.00
TOTAL PROJECT COST INCLUDING ENGINEERING =	$2,167,480.50

NOTE: THIS ESTIMATE DOES NOT INCLUDE ROW ACQUISTION, TEMPORARY OR CONSTRUCTION EASEMENTS, RELOCATING ANY UTILITIES, OR RELOCATING ANY PRIVATE PROPERTY.



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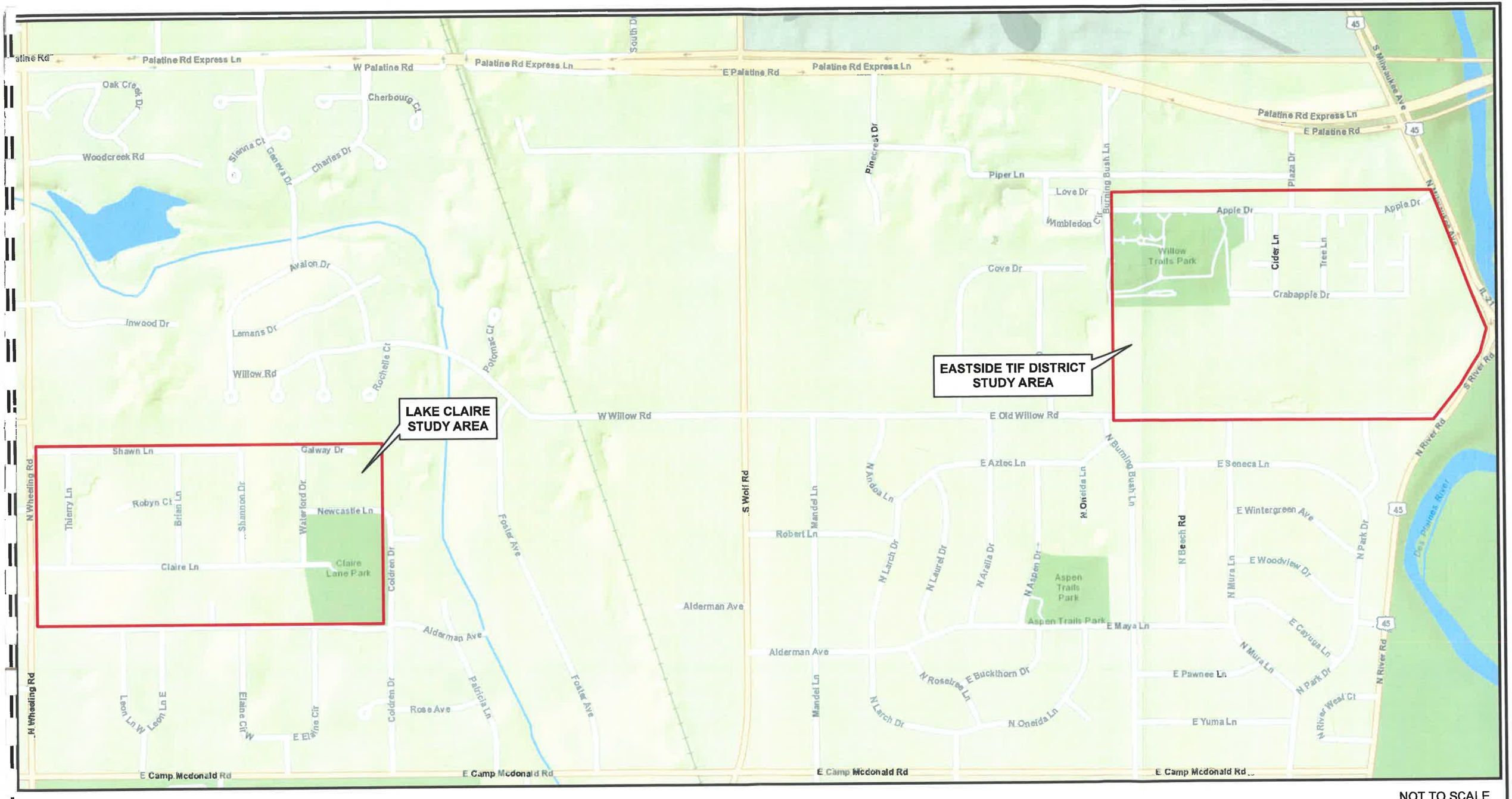
CLIENT	CITY OF PROSPECT HEIGHTS
PROJECT NO.	11-0412
TITLE	LOCATION MAP - WEST FLOOD STUDY AREAS
DATE	04/20/2012
	EXHIBIT 1A



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DSGN.	SAN	CHKD.	ELG

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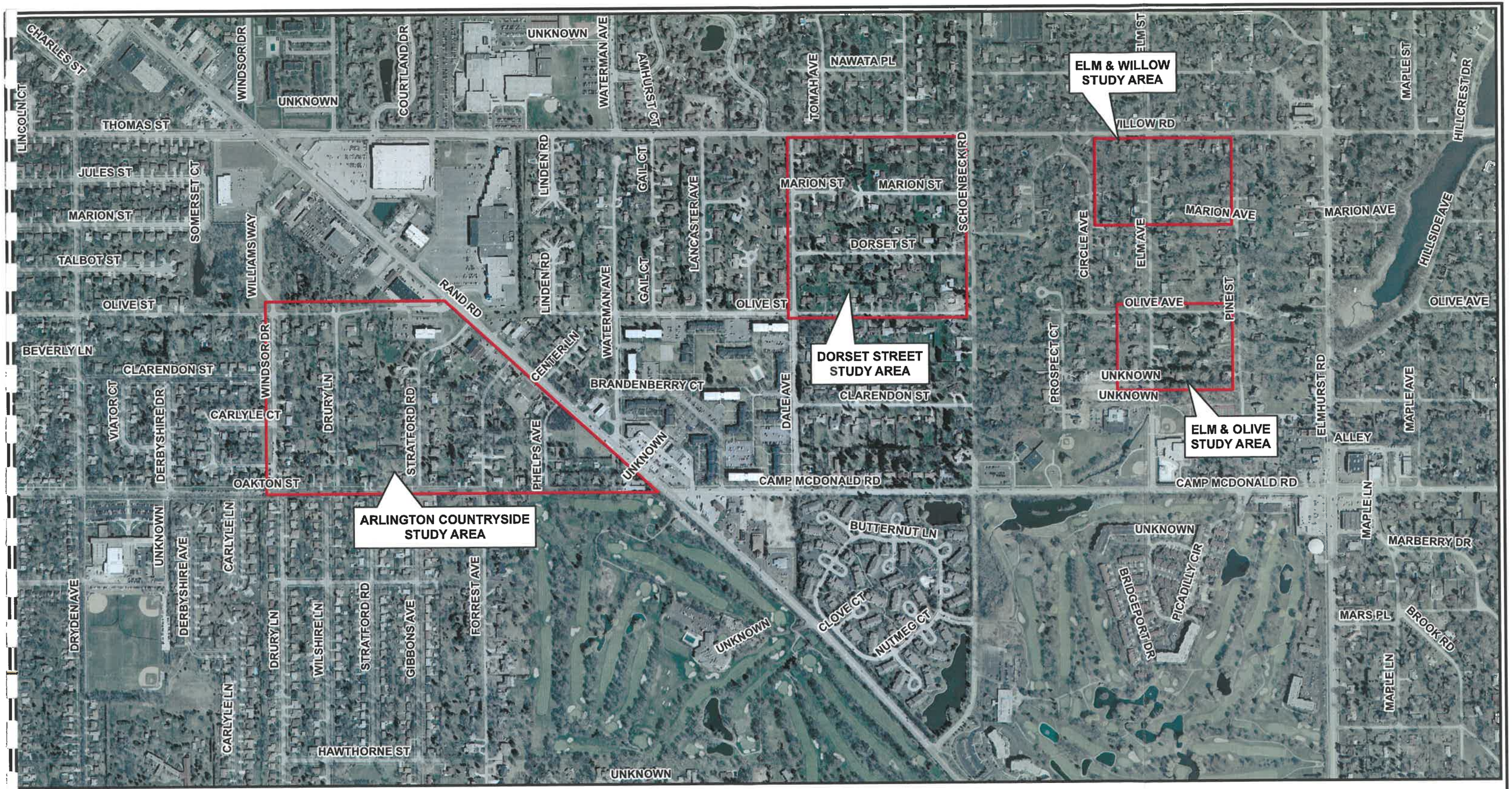
CLIENT	CITY OF PROSPECT HEIGHTS	PROJECT NO.	11-0412
TITLE	LOCATION MAP - EAST FLOOD STUDY AREAS	DATE	04/20/2012
			EXHIBIT 1B



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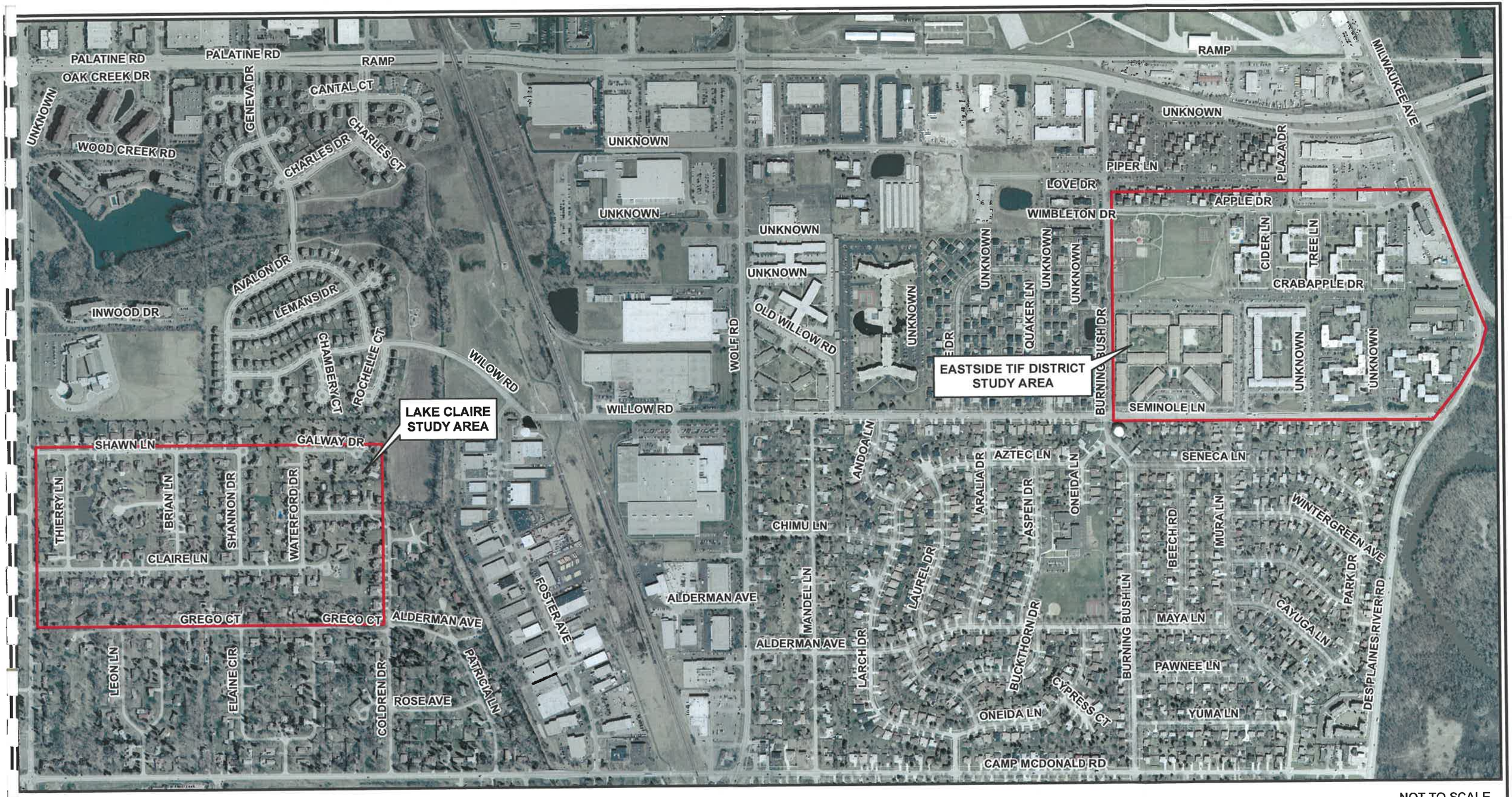
CLIENT: CITY OF PROSPECT HEIGHTS

PROJECT NO.: 11-0412

TITLE: AERIAL LOCATION MAP - WEST FLOOD STUDY AREAS

DATE: 04/20/2012

EXHIBIT 2A



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DSGN.	SAN
CHKD.	ELG

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CLIENT: CITY OF PROSPECT HEIGHTS

PROJECT NO.: 11-0412

TITLE: AERIAL LOCATION MAP - EAST FLOOD STUDY AREAS

DATE: 04/20/2012

EXHIBIT 2B

GEWALT HAMILTON ASSOCIATES, INC.
CONSULTING ENGINEERS

625 Forest Edge Drive, Vernon Hills, IL 60061
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MEMORANDUM REPORT

To: John Briggs – GHA

From: Tatiana Papakos – GHA

Cc: File; GHA Project #: 4755.033

Date: September 12, 2017

Subject: Drainage Assessment for Lake Claire/501 Shawn Lane, Prospect Heights, IL

Project Background

Gewalt Hamilton Associates, Inc. (GHA) was retained by the City of Prospect Heights to perform an existing drainage condition evaluation and to prepare a summary report of findings relating to the property at 501 Shawn Lane in Prospect Heights, IL. This parcel is adjacent to Lake Claire and experiences flooding when the water level in the lake rises above its designed high water elevation and flows onto the subject property's lowest elevation.

Concerns have been raised regarding the capacity of the existing system and if there are any potential options to improve the flow out of the area. The requested review options currently include: increasing the existing restrictor size on the existing outfall pipe; and connection of this system to another basin downstream (Shires Pond). It has also been suggested that improvements to the north at St. Alphonsus Church (Church) are a contributing factor to the flooding in the system.

A limited scope drainage study for Lake Claire is being prepared to evaluate the flooding issues and develop any potential solutions to eliminate or reduce the residential flooding at this property.

Existing Conditions

Based on the available topographic data, Lake Claire receives direct runoff from a drainage area of 14.2 acres. However, there is a restrictor structure further downstream from the lake that backs up stormwater into the lake and has a total tributary area of 40.7 acres. Exhibit 2 shows the stormwater infrastructure and location of the existing restrictor.

The topographic data also shows that there is not a suitable overland flow route for Lake Claire. Currently, as the lake elevation increases, water begins to travel north through the subject property to the roadside ditch along Shawn lane. It then flows to the storm sewers draining south along Thierry Lane (and eventually Lake Claire) or west to Wheeling Road and eventually heading north. Based on available topographic data, the overflow elevation appears to be between 651 and 652. If the water level raises above elevation 652, then it also begins to flow

east to Robyn Court, then south along Brian Lane and to the restrictor structure location, and south to Grego Court.

Current System Study Conditions

The preliminary analysis included a review of existing storm sewer data available, topography, GIS data, permit documents, and background information for past flooding events. Drainage areas tributary to the lake and the storm sewer system were delineated based on 1-foot contours and storm sewer information available from the City. Exhibit 1 shows the topographic and drainage area map. The vertical datum used for elevations is NAVD88. Elevations provided in historical documents were assumed in NGVD29 datum and were converted to NAVD88 datum by subtracting 0.28 feet.

A preliminary hydrologic and hydraulic analysis of the Lake Claire storm sewer system was developed using XPSWMM modeling software. The model simulated the storm sewer system from Lake Claire to upstream of Shires Pond, including the existing restrictor structure. Two simulations were created to model existing conditions (storm system with restrictor) and free outfall conditions (storm system without restrictor).

The existing conditions simulation includes storm sewer data from a recent survey and Lake Claire storage volumes from 1-foot contour data. The results for the existing conditions simulation show the restrictor causes water to back up into the lake, raising the water level up to 651.62 for the 100-year/24-hour storm event. Detailed information for the restrictor structure, such as invert elevation and diameter, was obtained from the 1978 MWRD permit issued when the subdivision was developed. Based on this information, the restrictor was modeled with a 9.8-inch diameter orifice and a maximum release rate of 5.71 cfs at the design high water level. The residential property's lowest elevations are approximately 650.33 at the front garage and 650.59 at the walk-out in the back, per an older existing topographic map. Based on these elevations and the simulation results, the depth of flooding is up to 1.3 feet for this property. Table 1 shows the summary results for the existing conditions simulation.

The free outfall condition simulation assumes that there is not a restrictor in the system. It was originally discussed that a new restrictor structure could possibly be built with the correct overflow weir elevation and that would solve the issue. After further investigation and the survey of the existing system was completed, it was decided that for this option to work, the underground pipe network would need to be able to transport the peak flow, as there was currently no viable overland flow route to convey the excess flow out of the system. Therefore, the free outfall condition model was created to simulate this alternative to determine if it was viable.

Based on the simulation results without a restrictor, the high water level at the lake decreased when compare to the previous simulation. However, it still rises up to elevation 651.04, which is still higher than the property's lowest elevations. This means that even if the restrictor is removed entirely, the high water level in Lake Claire would be higher than the property lowest

elevations and lake's design high water level. The simulation results for the free outfall conditions are also summarized in Table 1.

Table 1. Comparison of Design and Modeling Results for Lake Claire System

Description	1978 Design Permit*	Existing Conditions	Free Outfall (w/o Restrictor)
Drainage Area (ac)	38.48	40.7	40.7
Normal Water Level (ft)	646.22	646.01	646.01
High Water Level (ft)	649.42	651.62	651.04
Orifice Release Rate (cfs)	5.71	5.71	-
Orifice Invert (in)	644.02	644.02	
Orifice Diameter (in)	9.8	9.8	-
Maximum Orifice/Pipe Flow Rate (cfs)	5.71	6.76	21.1
Residential Flooding Depth (ft)	-	1.3	0.7

Note: * Elevations where converted from NGVD29 to NAVD88 datum.

Attachment A includes the modeling profiles for the two simulations, showing the high water levels throughout the system for storm events ranging from the 2-year to the 100-year event.

Interconnection to Shires Pond

Discussions were also had regarding the possibility of interconnection of the Lake Claire and Shires Pond basins to help alleviate flooding concerns within Lake Claire. While in theory it may be possible to interconnect the systems, a more in-depth drainage analysis must be conducted of the combined areas to determine what impacts may occur in each system. As these basins are usually designed to operate independently of any other system, it is not as simple as connecting them together. Any new flows introduced into one system that were not originally accounted for would have an unknown consequence on that system. It is highly probable that it would just move the issue downstream and could also possibly make the issue worse in a new area.

Additionally, as shown in the free outfall drainage analysis of Lake Claire, the flow would not be able to be conveyed to the Shires Pond basin without increasing the existing system's pipe capacity. If the entire 2,200 FT (approximate length) pipe network between the two systems was removed and replaced, it could cost in excess of $750,000.00. The pipe sizes would need to be larger than what exists currently, which is up to 30 inches in diameter in some sections. About half of the lines are located in rear yards, which contributes to site access issues and usually higher construction and restoration costs. This number includes estimated costs to perform the additional drainage analysis and design work to determine the viability of the solution.

It is also possible that additional work would need to be performed on the Shires Pond directly before additional flows could be routed to it. This would further increase the costs of the project and have not been currently estimated.

St. Alphonsus Church

We requested the past permit documents for Lake Claire, St. Alphonsus Church, and Shires Pond from MWRD. Permit documents were only provided for the Church and Lake Claire. Two permits approved in 2001 and 2003 were available for the Church.

The 2001 MWRD permit included the construction of the detention pond in the southwestern part of the property, which was designed to discharge through a 4-inch orifice to the Wheeling Road right-of-way. This discharge outlet appeared to be connected to the Lake Claire system during high water levels by interconnected swales and culverts along Wheeling Road and Shawn Lane.

The 2003 MWRD permit included the construction of a second detention pond in the southeastern part of the property and relocated the discharge outlet for the ponds to the north through a 3.2-inch orifice and storm sewer pipe that flows north in the storm system along Wheeling Road and eventually discharges to McDonald Creek. It also appears that during the 2003 work, the detention basins were left oversized to provide more detention than was required of the site improvements.

The front parking lot grading plan and runoff was reviewed and found that almost the entire front lot is not connected to the basins at all. It flows off the site unrestricted and is intercepted by the storm sewer that runs north to McDonald Creek. This was confirmed in the 2003 MWRD permit documents provided. This is not uncommon on development sites, as the detention basins are sized to over-detain the flow that is tributary to them to make up for areas that cannot be collected and routed through the system. The final result is a net balance of the site runoff as if it was all captured and detained.

Based on the information currently provided, the storm water runoff from the Church site or ponds is not interconnected with the Lake Claire storm system and should not impact the water levels at Lake Claire. The only time that flow should be travelling south from the Church site is when the detention basins completely overtop their banks. There is an outfall storm structure and pipe just on the outside of the detention basin berm peak that will collect overflow and discharge it to the ditchline along Wheeling Road. It may be possible to reroute this outfall to the north along with the rest of the flow, but it would require further investigation.

Summary

All of the project improvements were individually permitted by MWRD and modifications to any of the systems would also need to be approved by MWRD. Further investigations and design work would be necessary before any potential solutions or recommendations could be made to alter the function of any of these systems.

It appears that the Lake Claire system may have been functioning in its current manner from its installation date. The subdivision runoff is intended to back up into the Lake, there is no apparent

overland flow route out of the Lake and the pipe capacity upstream of the restrictor is insufficient to convey all of the flow unrestricted.

Any modifications to the current system will need to be reviewed and analyzed as part of a larger whole in order to provide any potential relief. If the restrictor for Lake Claire is removed, the system capacity must be increased. If the system capacity is increased, it must be analyzed and increased all the way to its next logical outfall. That outfall must also be analyzed to determine its capacity. This would continue until a viable outlet capacity is discovered or can be created.

Options for drainage system improvement may be possible, but further discussion and direction from the City would be needed to determine the next best course of action. While more cost-effective alternatives may still present themselves after more in-depth investigation is completed, the initial system review indicates that a viable solution would likely be expensive to implement.

Another option would be to remove the residence that is currently flooding altogether. If there is no building present, it cannot flood. This would provide for options that could include adding detention volume to the pond, or selling the vacant lot after structure demolition and permitting a new residence at a higher elevation.

Depending on how this option was implemented, it could prove to be the most cost effective as well. Additional system detention could be economically provided, or the City could recoup some costs if they chose to resell the vacant lot. This option will also be dependent on the appraisal values of the residence and the willingness of the property owners to work with the City regarding its sale and removal.

Enclosures
Exhibit 1 – Topographic and Drainage Area Map
Exhibit 2 – Storm Water Infrastructure
Attachment A – Model Layout and Water Surface Profiles

EXHIBITS

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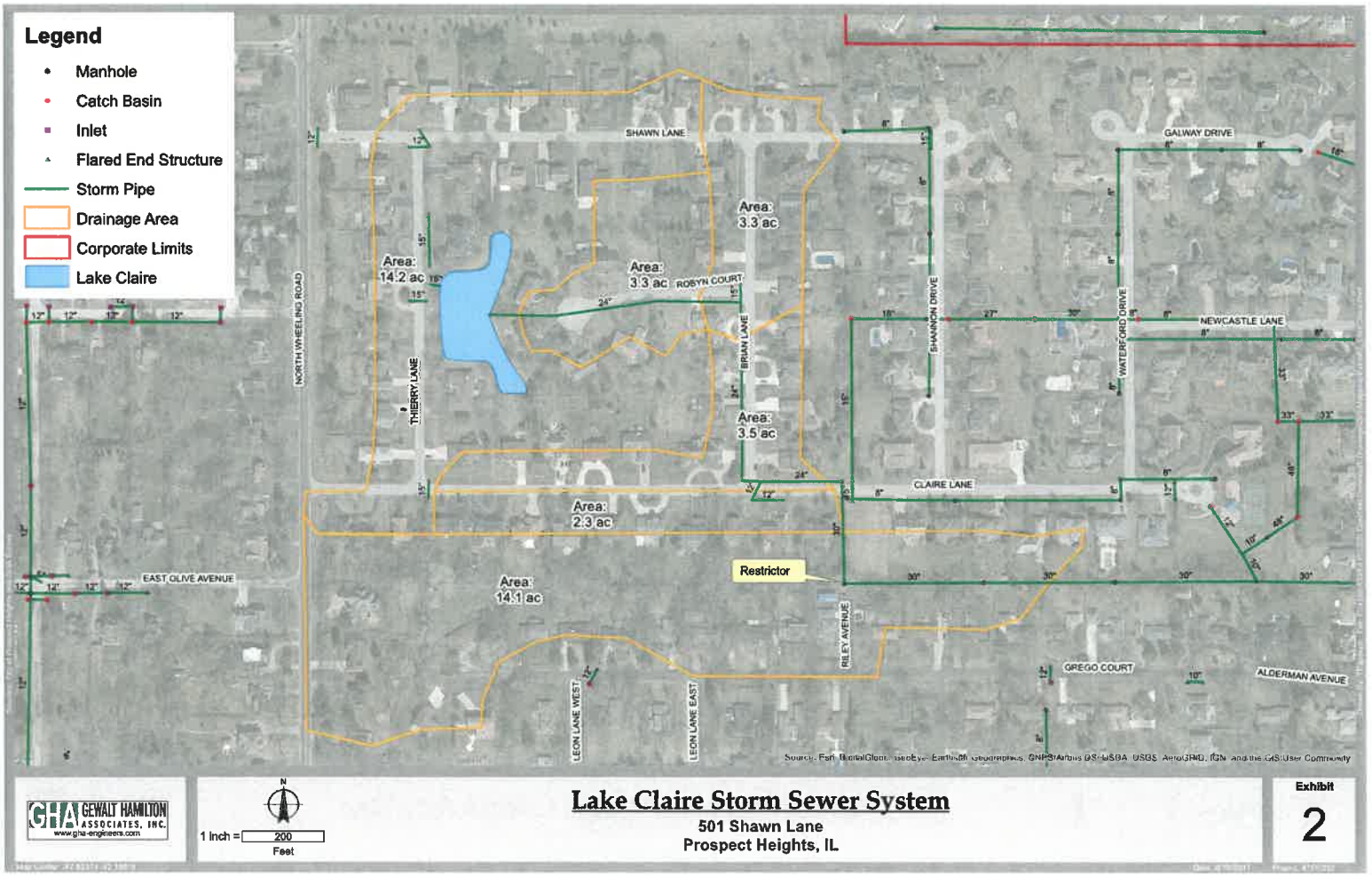
Lake Claire Contour and Drainage Area Map

501 Shawn Lane
Prospect Heights, IL

Exhibit
1



GHA GEWALT HAMILTON ASSOCIATES, INC.
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1 Inch = 200 Feet

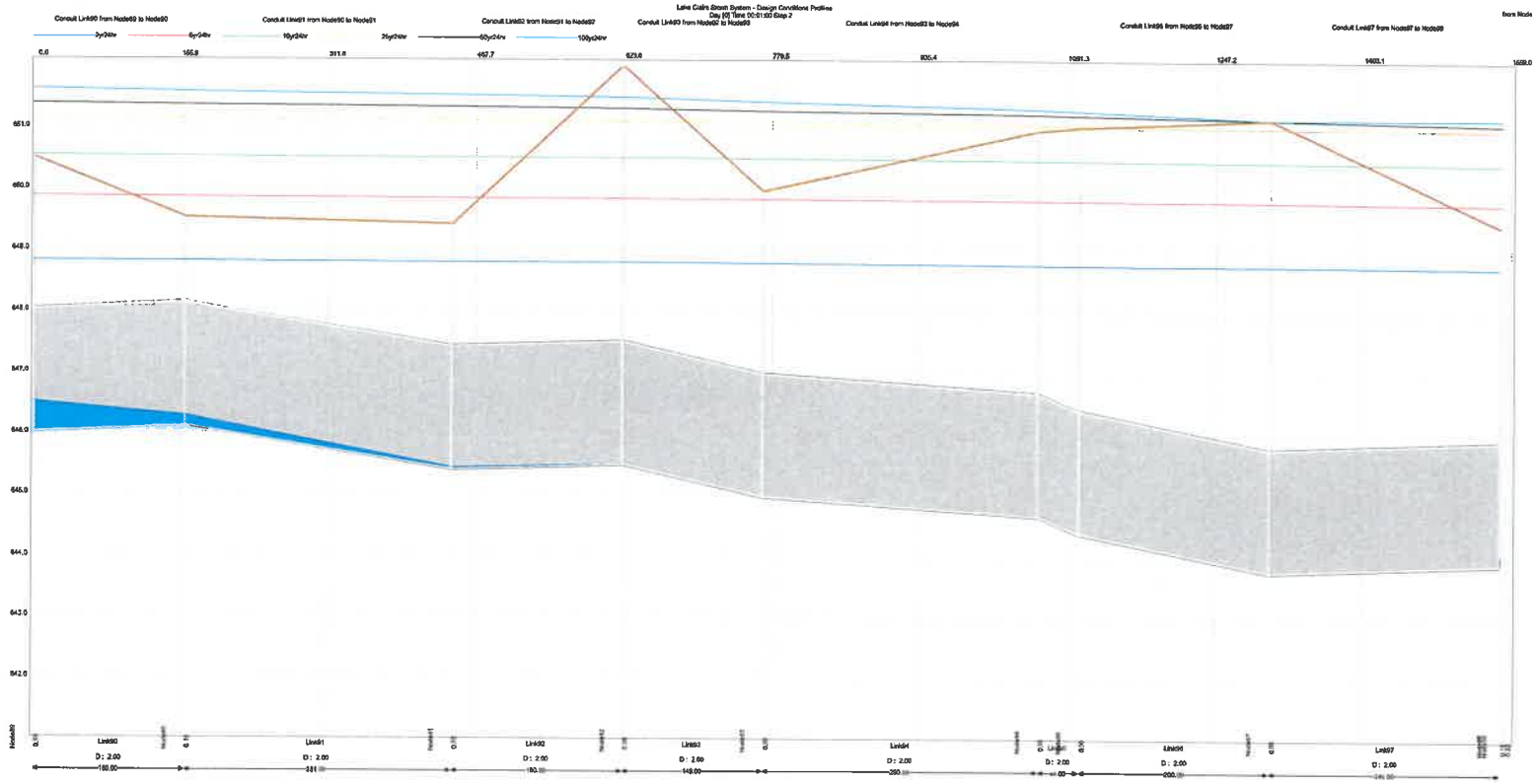
Lake Claire Storm Sewer System

501 Shawn Lane
Prospect Heights, IL

Exhibit
2

ATTACHMENT A
Model Layout and Water Surface Profiles

XPSWMM MODEL LAYOUT - LAKE CLAIRE STORMWATER SYSTEM


Lake Cairn Storm System - Design Conditions Profiles
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Conduit Link91 from Node90 to Node91
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Conduit Link93 from Node92 to Node93
Conduit Link94 from Node93 to Node94
Conduit Link95 from Node95 to Node97
Conduit Link97 from Node97 to Node98
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5yr24hr
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311.8
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779.5
935.4
1091.3
1247.2
1403.1
1559.0
651.0
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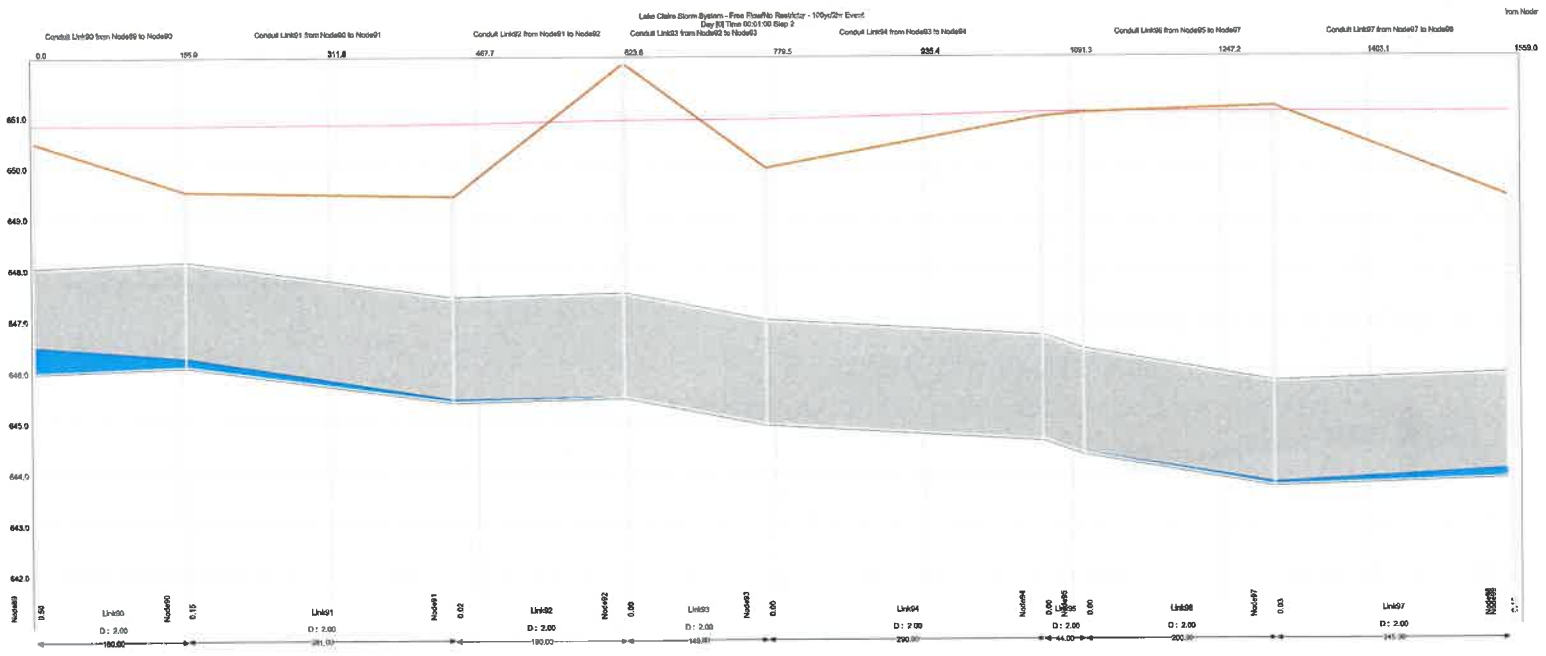
Lake Claire Storm System - Free Flow/No Restrictor - 100yr/2hr Event
Day 00 Time 00:01:00 Step 2
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Conduit Link91 from Node90 to Node91
Conduit Link92 from Node91 to Node92
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Link97
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Node98
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Memorandum

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To: Joe Wade, City of Prospect Heights

From: Steve Berecz, GHA

Date: August 7, 2018

Re: Conceptual Storm Water Management Memorandum
GHA Project 4755.000

Summary of Existing Conditions

Most of Prospect Heights was developed without the benefit of modern engineering design standards (Rob Roy subdivision is one example that was designed in accordance with modern engineering design standards). Most residential areas were designed as a "rural" cross section with ditches and landscaping mostly to the edge of the roadway. For ditches to effectively drain in the long term, the longitudinal slope generally needs to be more than a 3% slope. In general, the City has a relatively flat topography, which during development of the City, led to many ditches being less than 3% longitudinal slope. In fact, many ditches in the City have a slope of around 1%, which can cause water to drain very slowly and cause the ditches to be quite soggy for some periods. We see these issues as more of nuisance issues and in general, we recommend that the ditches throughout the City should remain as they currently are.

Another issue with the development of the City was that drainage for the rear yards was not designed in accordance with modern engineering standards. Most of the rear yards in the City do not have storm sewers and/or do not have positive overland storm water flow routes from the rear yards to the front yard ditches or to other drainage conveyance areas. This leads to rear yard ponding of water at numerous locations throughout the City during rain storms. I have met with many residents about this issue and explain to them the challenges of the existing conditions and the reality of the situation. These issues can be classified as localized ponding areas and generally affect individual properties. Most of these situations do not cause any flooding of residences, instead are more of a nuisance issue in the rear yards. We believe the most effective method to address this issue is for homeowners to be proactive and after a large rain event has ended use a submersible pump to "move the water" from the low area of their lawn to higher areas of their property, thus allowing the water to percolate back into the ground. Considering the City as a whole, we believe that the City trying to remediate these issues on a case by case basis is very difficult, extremely expensive and would rate low on a cost/benefit analysis.

The general overland drainage pattern of the City is from West to East, with McDonald Creek meandering across the City generally from the Northwest corner to the Southwest corner of the City. A significant portion of the City ultimately drains towards McDonald Creek. McDonald Creek eventually discharges into the Des Plaines River south of Kensington Road and East of River Road. During some past extended rain events, the Des Plaines river and its' tributaries (McDonald Creek) banks are overflowing and can't accept any local drainage. Any City level improvements generally can't address this issue.

Another issue in the City is that there are numerous depressional drainage areas, "bowls", that do not have any storm sewer conveyance outlet, discharge deficiencies and/or storage deficiencies to accept water during heavy rainstorms. These "bowls" fill up during large rain storms and the water ponds on streets, yards and sometimes into crawl spaces, basements and lower levels of residences. The size of the "bowl" areas vary from less than one block of residences to about seven blocks of residences. In September 2012, the engineering firm of Christopher

B. Burke Engineering (CBBEL), completed conceptual level studies of five such areas in the City. This report is about 50 pages long and presented a variety of possible improvements to lessen the flooding experienced in these five areas. None of the improvements mentioned in the CBBEL report would solve the issues, as flooding is a reality in this area, however the improvements could lessen the flooding. The CBBEL report identified about $18,000,000 of storm water improvements in the City to lessen the flooding in these 5 areas and recommended that further engineering studies be completed.

Possible Next Steps

GHA was asked to prepare this conceptual memorandum to aid with current discussions and to assist with possibly moving forward with larger scale studies for City wide storm water management improvements. To many residents' storm water management is a very personal and emotional issue. Completion of detailed engineering studies will help lessen the emotion over flooding issues and will aid with providing supporting data and cost/benefit calculations for improvements.

Based on our experiences as City Engineer for the past four years, review of the 2012 CBBEL report, discussions with residents and City personal over the years and our past storm water management studies, we provide the following outline for specific areas within the City. The priority list outlined below is based on the above and our instinctive thoughts. We suggest the following areas for additional studies:

1. Eastside TIF Area (generally South of Apple Dr., East of Burning Bush, North of Seminole, West of River)
2. Arlington Countryside Area (generally West of Rand, South of Olive, North of Oakton)
3. Dorset Street Study Area (generally South of Willow, East of Dale, North of Olive and West of Schoenbeck)
4. Elm Street just South of Willow Road
5. Flooding at Alton and Edward Roads near McDonald Creek
6. 214 Wheeling Road / Tully Creek flooding
7. Lake Claire Area and Shawn Lane house
8. Flooding at Patricia Lane near McDonald Creek
9. Other areas identified from community open house meetings
10. Note (Hillcrest Drive / Owen Court / Willow Road at Hillcrest Lake are currently being studied by MWRD project) otherwise we would rank this much higher.

The flooding problems in the City generally can't be solved but can be lessened during storm events and occur less frequently. Some neighboring communities have realistically found with funding constraints that designing to a maximum of a "10 year" rain event design level is all that can be reasonably accomplished. We have found that federal and/or state grants to assist in improving localized storm water management improvements are limited. We would expect that if the City moves forward, the bulk of the costs would need to be paid with local funds. This is just a starting point for more discussion. These issues are very complex, very expensive to make measurable changes and will take time to design and construct improvements. Individual homeowners being proactive about protecting their properties and making individual storm water management improvements might be as, if not more effective as the City implementing a City-wide program.

Such a program to make measurable improvements to the Citywide flooding will take a large-scale improvement program that will take many years, likely decades to implement. The cost of such program will likely be more than $10,000,000 and might reach $25,000,000. Of course, big projects need to start somewhere, so in our opinion if the City is committed to such a large-scale improvement, then the next logical step would be to conduct a more detailed engineering study to further refine the 2012 CBBEL report, study the priority list above, and to fully outline a systematic Citywide approach to this issue which could be considered for adoption by the City Council.