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.

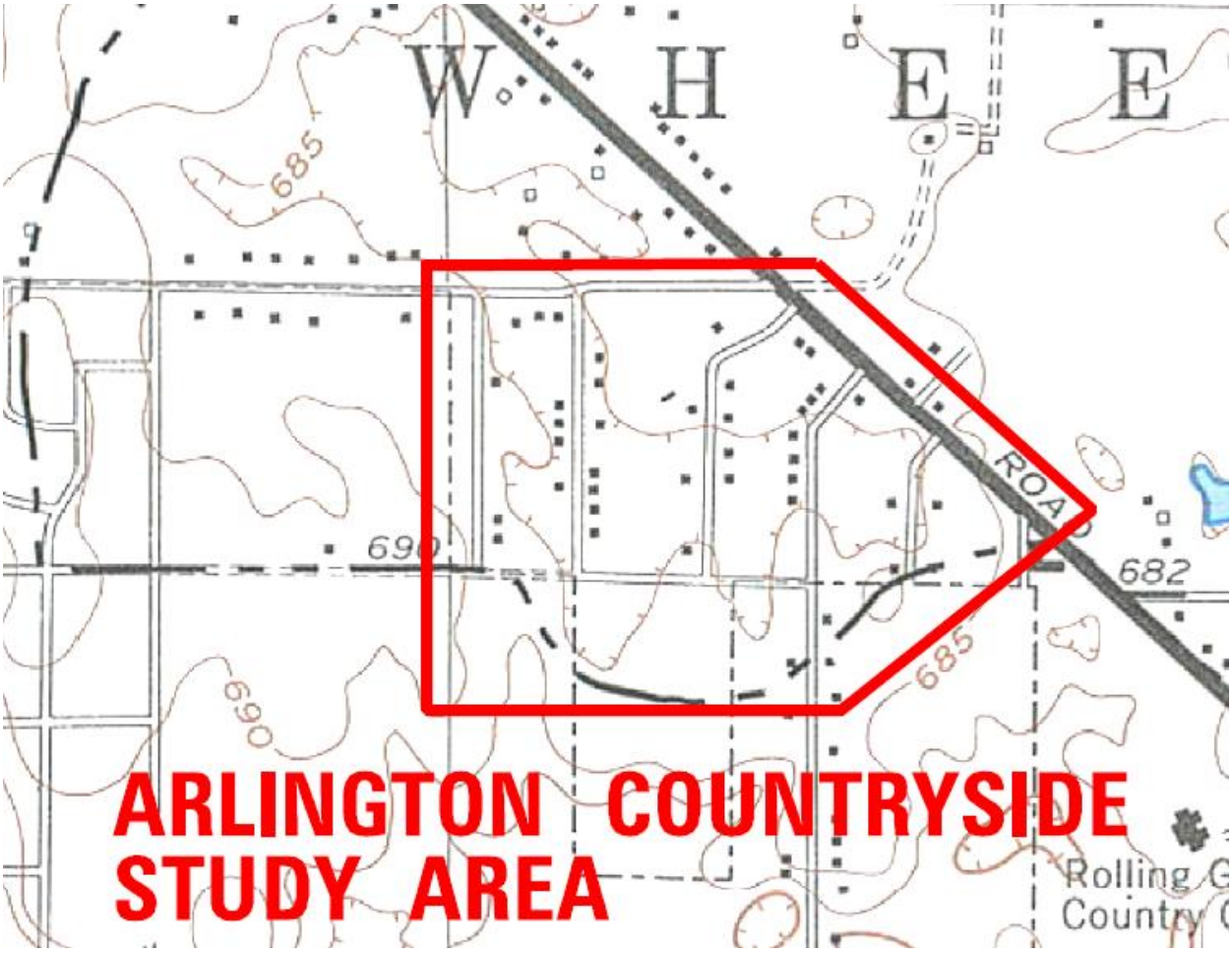

Figure 2
USGS Hydrologic Atlas

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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

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

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 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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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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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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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,