

MEMORANDUM

TO: The Honorable Mayor and City Council

FROM: Joseph E. Tebrugge, Stormwater Engineer

DATE: May 7, 2015

SUBJECT: Briarcliffe Lakes System Flood Study Overview

OBJECTIVE

Review and summarize the Briarcliffe Lakes System Flood Study prepared by Christopher B. Burke Engineering, Ltd which is a hydraulic study of the tributary area to the Flood Prone Area "Brentwood Lane east of Briarcliffe Boulevard".

BACKGROUND

Strategic Goal – Strategic Goal 3, Efficient and Effective Services, Key Performance Indicator D, provides that an understanding of the contributing variables causing overland flooding during various rain events of principle structures in flood prone and flood plain areas be completed by April 2017.

On April 18, 2013 a major storm event occurred over the City of Wheaton. Many areas throughout the City were flooded including the Flood Prone Area Brentwood Lane east of Briarcliffe Boulevard. During the storm the system of Lakes north of Brentwood Lane all filled to capacity and then floodwaters poured over the southern berm of Lake Four flooding a large residential area, disrupting residents lives, and causing property damage and loss. The flooding that occurred is not an isolated incidence. Based on the City's records and best available information the berm has overtopped seven times in the last forty-five years. In response to the flooding and in conjunction with Strategic Goal 3D the City Council approved the Briarcliffe Lakes System Flood Study to analyze and document the flooding conditions of this Flood Prone Area as well as propose possible mitigation options.

FLOOD STUDY PROCESS

A hydraulic model was created for the entire watershed which begins north of Roosevelt Road with the already studied Williston Basin Tributary Area and is generally bounded by Naperville Road to the west, Lambert Road to the east, and Butterfield Road to the south. (A map of the watershed can be found in the Flood Study on page iv.)

Data Gathering - The framework for the model begins by surveying all pertinent storm sewers, roads, detention basins, ponds, overflow areas, and all other flow paths along the flood water's route through the watershed to document how the water flows through the watershed. This data was then entered into the hydraulic model. Additionally high water marks of the April 2013 storm event, depicted in

photographs taken by residents and Staff were surveyed to determine the height and breadth of the flood waters.

The required survey for the hydraulic model included surveying Lake A, Lake 1, Lake 2, Lake 3, and Lake 4 aiding in furthering Strategic Goal 2C, the identification and documentation of existing storm water storage areas.

Calibration - Next rainfall data from the April 18, 2013 storm was run through the hydraulic model and the estimated high water levels were compared to real water levels that occurred during the storm. The model then went through a long series of minor changes or tweaks to ensure that the computer model was calibrated properly to output estimated flooding that matched the flooding that occurred in the April 18, 2013 storm.

Hydraulic Model Simulation - With a properly functioning hydraulic model a large series of simulated rainfall events are run through the model to determine what duration is the “critical storm” also known as the duration of storm event that causes the worst flooding for a specific area. The watershed is so large that different areas in the watershed happen to have different critical storm durations (Flood Study page 13) with the 48 hour storm duration being critical for Brentwood Lane east of Briarcliffe. After knowing the critical storm duration, the differing storm frequencies (5, 10, 25, 50, 100, & 500 year storms) can be modeled to know the true flood risk during the worse case storm for the area.

FLOOD RESULTS

- The resulting 100 year critical High Water Level (HWL) of the flood prone area is between 746.42-746.00.
- The maximum depth of the flooding is 5.61 feet in the 100 year critical storm event.
- 43 homes will experience overland flooding into the structure in the 100 year critical storm event.
- 30 of the 43 homes will receive overland flooding over the top of their foundation in the 100 year critical storm event.
- 11 of the 43 homes will receive overland flooding on the first floor in the 100 year critical storm event.

MITIGATION OPTIONS EXPLORED

The Briarcliffe Lakes System Flood Study explored many mitigation options and five mitigation alternatives were included in the report.

Alternative 1 – Briar Patch Park Storage

Convert Briar Patch Park from a Park District owned park which does not currently flood located at the intersection of Briarcliffe Boulevard and 22nd Street into a pond. This pond would be able to provide an additional 26 acre-feet of storage in the watershed. The effect of this project in the 100 year critical storm on flood elevations was very small and would only lower the High Water Level (HWL) by 1.2

inches. This project would remove overland flooding from no homes. The cost for this project is estimated at \$6.90 Million.

Alternative 2 – Berm Restoration

Restore the southern berm of Lake 4 to the historical design freeboard elevation of 746.00. The original design HWL of Lake 4 was 745.30. After a long series of events the final berm elevation along the COD owned portion of the berm was set to be 746.00. The existing survey shows that the lowest point on the current berm is at elevation 745.35 and is an isolated twenty foot long area in the 1350 foot long berm. A total of 437 feet of the berm is below the 746.00 elevation. The entire berm is above the original design HWL and as such the lake still holds to the regulatory elevation. The effect of this project in the 100 year critical storm on flood elevations was zero and as such removes no overland flooding from any structure. The cost for this project is estimated at \$380,000. This cost does not take into account any additional work that may arise from IDNR-OWR classifying the berm as a dam after the flood event.

Alternative 3 – 42" Sewer from Lake 3 to Nottingham

Install a new 42" storm sewer from Lake 3 to downstream of Nottingham Lane. During the hydraulic modeling it was found that the storm sewer downstream of Nottingham Lane is not filled to capacity during flood events. The proposed project was to increase the flow to this storm sewer to ensure that it is flowing at maximum capacity. The effect of this project in the 100 year critical storm on flood elevations was zero and as such removes no overland flooding from any structure. The cost of this project is estimated at \$3.46 Million.

Alternative 4 – Box Culvert from Brentwood to Windsor Channel

Install a new 3.5' x 10' reinforced concrete box culvert conveyance pipe from the low point at Brentwood and Cheshire, south along Cheshire to Windsor Drive, and west along Windsor Drive to Windsor Channel where the box culvert increases in size to 4'x10' and replaces an existing pipe. This project decreases the flooding of the entire area between Lake 3 to southwest of Sussex Lane. The decrease in flood elevation varies depending on the location but the decrease in flood elevation at Brentwood Lane and Cheshire is 5.5 feet. This project eliminates overland flooding in the 100 year critical event in 42 out of the 43 homes. The cost of this project is estimated at \$10.43 Million.

The project, however, also increases the flood elevation in Windsor Channel by 0.3 feet which is above the regulatory allowed level of 0.1 feet. Although there is an increase in flood elevation, the water never is modeled as able to leave the bounds of the channel. However in order for the project to be permitted through the DuPage County Stormwater Ordinance additional work would have to be done. Currently the downstream limit of the study was the north face of Butterfield Road. Additional study would have to be performed to determine if the proposed project would have a negative effect on flood elevations in Rice Lake and any additional downstream properties. Once the full effect of the negative conditions is determined, additional work to compensate for the increase in flood elevations may be necessary. The current level of Engineering done is also preliminary and as such additional conflicts found during final Engineering and/or construction are not reflected in the current estimation.

Alternative 5 – Combine Alternatives One and Four

Combine Alternatives 1 and 4 to increase the flood storage and conveyance of the Briarcliffe Lake System Area. The additional effect on flood elevation when compared to Alternative 4 is generally an additional 1.3 inches. The project still eliminates overland flooding in the 100 year critical event in 42 out of the 43 homes. The cost for this project is estimated at \$17.23 Million.

Alternative 6 - Buyouts

Buyout and demolish all of the homes effected by overland flooding in the 100 year critical storm event. This alternative was provided in part as a baseline and had no regard to whether a structure had any other structural flood protection possibilities such as elevating foundations, removing low entry points, elevating window wells, etc. The estimated cost to buyout and demolish the 43 effected homes was \$14.69 Million.

Of the mitigation options reviewed, the recommended mitigation alternative in the Briarcliffe Lakes System Flood Study was Alternative 4. A diagram of the properties currently affected and a diagram of the properties affected after the construction of Alternative 4 is attached at the end of this memorandum.

CURRENT GRANT FUNDING OPTIONS

The Briarcliffe Lakes System Flood Study provided a hydraulic model that determined the extent of the flooding in the flood prone area Brentwood Lane east of Briarcliffe Boulevard. The study also went one step further in comparison to the two previous studies (Cherry Street & Williston Basin) and also provided a mitigation alternative analysis. However, as in any major stormwater improvement plan, a major hurdle is how to fund any proposed improvement. There are currently two known possible grant options available to help in the construction of a stormwater flood protection project for this area.

- 1) Department of Housing and Urban Development – Community Development Block Grant (CDBG) – National Disaster Resilience Competition (NDRC). The NDRC is a competitive grant which DuPage County has been invited to be a participant in. Through NDRC, HUD is awarding up to \$1 billion for projects that demonstrate innovative and broad resiliency strategies in areas that still have unmet needs from the April 2013 flood. DuPage County has identified the East Branch DuPage River Watershed as one that meets the criteria for this opportunity and this area is tributary to the East Branch. Additionally since the NDRC is a CDBG it is a requirement that 50% of all funding be used in low to moderate income areas. According to the latest HUD low/mod income map the flood prone area Brentwood Lane east of Briarcliffe Boulevard is a low/mod income area which could aid in the selection of a project in this area by DuPage County. The City of Wheaton is an active partner of DuPage County in this endeavor, but not a decision making partner in the process. As such this funding option is reliant on other governmental entities for action.
- 2) FEMA Hazard Mitigation Grant Program (HGMP). All FEMA grant programs require a benefit cost analysis created by FEMA's Benefit Cost Analysis Software. In order to perform the Benefit Cost Analysis (BCA) documented flood elevations and known elevations of specific structure data from the effected homes are necessary. The Briarcliffe Lakes System Flood Study provides the hydraulic study which determines the flood elevations and well as part of the structure data from the affected homes. However additional structure information is needed from all of the affected homes to be able to perform the BCA. The needed information is the elevation of the lowest floor of the home, the square footage of the basement, as well as the square footage of any finished basement area. Only once this information is collected can a grant application be prepared and submitted to try to obtain funding. Funding is only available if the BCA is above 1 meaning it is cost effective. Grants submitted to FEMA from all entities are competitive with each other with preference given to the highest BCA.

CURRENT STORMWATER PROGRAM OBJECTIVES

The creation of a successful, equitable, and cost effective Stormwater Improvement Program is a methodical, step by step process. Below is a summary of the framework that is currently being worked towards.

- 1) Perform Hydraulic Studies:** The hydraulic studies and surveying is the required data to even begin the process. This is currently being funded at \$600,000 over the next two years to complete the needed information in the remaining seventeen flood prone areas and all floodplain properties. All areas are being examined at the critical 100 year storm event to ensure fairness and equality between locations.
- 2) Obtain Alternative Analysis:** An alternative analysis has been completed for the flood prone area Brentwood Lane east of Briarcliffe Blvd only. An alternative analysis for each of the seventeen remaining flood prone areas will be included in the hydraulic studies completed in the next two years. Already completed studies will be revisited to complete the alternative analysis.
- 3) Perform the Benefit Cost Analysis:** As hydraulic studies are being completed and affected structures determined, Staff will gather the needed information from the hydraulic study and create the BCA. It is preferred that the BCA be performed by Staff rather than consulting engineering firms. In this way is ensured that each area is entered into the BCA software in the exact same way thereby creating a consistent BCA generation between all areas.
- 4) Rank Flood Protection Projects based on BCA:** The point of flood protection projects is to remove damage that occurs during flood events. Ranking projects that remove the most damage from the community for the least amount of money first provides a sound and cost effective structure to evaluate flood protection. It also provides a clear, data driven format as to where it is best to spend monies first.
- 5) Explore outside funding options:** Once flood protection projects are ranked and the City is prepared to proceed with projects outside funding sources will be explored. FEMA grant applications are generally available for any cost effective project throughout the City. There are other funding options that may only be available for projects in certain watersheds or certain economic zones and be much more sporadic in nature. Frequently the application window for funding is small and projects generally need to be "shovel ready" to even be able to apply. At this point having projects ready will prepare the City to be able to vastly increase the cost effectiveness of the stormwater program by obtaining funding from outside sources as they become available. Additionally if outside funding is available for only one area it could have an effect on the flood protection project ranking as the cost to the City would decrease.

- 6) **Construct Flood Protection Projects:** Finally when all due diligence has been done to explore the existing conditions, the best flood protection projects determined, and outside funding explored can projects be constructed.

RECOMMENDED ACTION

1) **Continue Flood Studies of Flood Prone Areas and Floodplain Areas (2 to 3 year time frame)**

Continue to work towards achieving Strategic Goal 3, Efficient and Effective Services, Key Performance Indicator D, provide an understanding of the contributing variables causing overland flooding during various rain events of principle structures in flood prone and flood plain areas. As provided for in the 2015/16 Budget, continue to manage consultant work gathering data and developing flood studies for the identified flood prone areas. Once completed, turn attention to data gathering of properties within established floodplain areas.

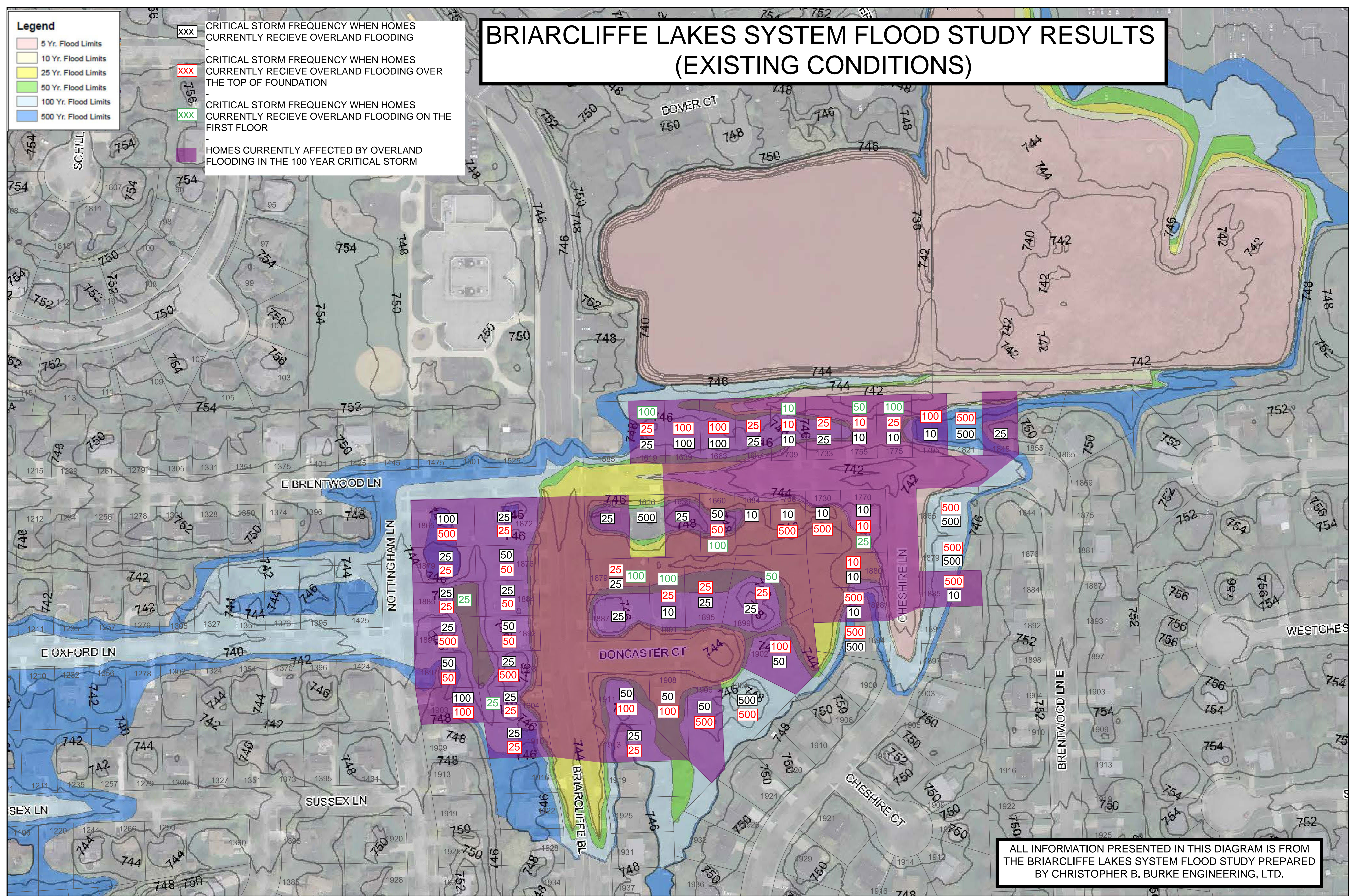
2) **Briarcliffe Flood Study Follow-up (1 year time frame)** – Should the City Council desire to move forward with the Study’s recommendation, the staff would recommend the following:

- a. Select and contract with an engineering consultant to study any possible downstream impacts to Windsor Channel and/or Rice Lake, provide preliminary engineering, and develop cost estimates for the project(s).
- b. Select and contract with an engineering consultant to collect data from single family homes that is required to complete the Cost Benefit Analysis (Homeowner cooperation will be necessary.)
- c. Staff input collected Cost Benefit Analysis data into FEMA software.
- d. Communicate with DuPage County on funding opportunities.
- e. Communicate with Forest Preserve once study is completed.

3) **Stormwater Policy Development (2 year time frame)** – Continue stormwater research, and policy analysis and preparation on the following:

- a. Review revenue options for funding stormwater improvement programs and projects.
- b. Review types of projects that would be permissible; establish metrics to evaluate potential projects.
- c. Review creating minimum Benefit Cost Analysis ratio in an effort to define funding priorities.

BRIARCLIFFE LAKES SYSTEM FLOOD STUDY RESULTS (EXISTING CONDITIONS)



BRIARCLIFFE LAKES SYSTEM FLOOD STUDY

ALTERNATIVE 4 - MITIGATION RESULT

- Legend**
- 5 Yr. Flood Limits
 - 10 Yr. Flood Limits
 - 25 Yr. Flood Limits
 - 50 Yr. Flood Limits
 - 100 Yr. Flood Limits
 - 500 Yr. Flood Limits

HOMES AFFECTED BY OVERLAND FLOODING IN THE 100 YEAR CRITICAL STORM POST CONSTRUCTION

ALL INFORMATION PRESENTED IN THIS DIAGRAM IS FROM THE BRIARCLIFFE LAKES SYSTEM FLOOD STUDY PREPARED BY CHRISTOPHER B. BURKE ENGINEERING, LTD.

