6.1.3 Residential Structure Flood Proofing

In addition to the previous short term drainage improvements that could be completed by the Village, residents can flood-proof their homes. Flood-proofing of residential structures is the single most effective measure that can be completed to protect homes from flooding. A few of these measures include:

- Sanitary backflow valve: Valve that allows water to flow in one direction, but automatically closes when the direction of flow is reversed. When the HGL in the sanitary sewer line exceeds the adjacent basement floor elevation, the check valve will engage preventing sanitary backup into the basement.
- Sump pump with battery backup: In the event of an electrical outage during a flood, a battery backup to provide power to the sump pump is recommended to prevent basement flooding.
- Directing downspouts away from structures: Downspouts that outlet near a structure allows stormwater to infiltrate and collect against the foundation resulting in seepage and/or additional strain on the sump pump. Directing downspouts away from the structure is a simple flood-proofing measure to help reduce the amount of water against the foundation.
- Raising window wells or other low entry points: Raising the window wells and low entry points increases the level of flood protection around a home by blocking overland flood access into the structure (Figure 10).

Figure 10. Window Well Elevation

Completing these flood-proofing measures in homes that are susceptible to flooding can provide a level of freeboard above the street flooding elevation that will significantly improve the effectiveness of the long term capital improvement projects to be discussed later in the report. The Village currently has a program that provides a list of engineering firms to residents with a set fee schedule for site visits and flooding assessments. It is recommended that this program be continued and utilized to the maximum extent possible by residents.

6.1.4 Green Infrastructure Improvements

Over the last 20 years many communities throughout our region have increased implementation of green infrastructure by adding green infrastructure to their toolkit of approaches for the management of stormwater. Green infrastructure techniques include using vegetation to control stormwater, restoring wetlands to retain floodwater, installing permeable pavement to mimic natural hydrology, and using or capturing and re-using stormwater more efficiently on site.

Figure 11. Green Road

Figure 12. Green Road

By attempting to mimic natural hydrologic functions, such as infiltration and evaporation, these approaches prevent stormwater from flowing into surface waters or storm sewer systems already under great stress using natural features. Green infrastructure is typically used to compliment or assist traditional stormwater management practices and is not meant to replace engineered grey stormwater management practices.

Although green infrastructure practices cannot single-handedly mitigate the flooding during extreme storm events, they provide a reduction in stormwater runoff volumes and improve water quality. Green infrastructure should be an integral part of stormwater management strategies given the cost-effectiveness of green approaches across a variety of categories. On a national scale, policies that favor or stimulate the wider adoption of green infrastructure strategies have been gaining notoriety while providing opportunity and available financial resources.

CBBEL has identified numerous areas where green infrastructure could be implemented throughout the Village. Recommendations of types and locations are as follows:

- Green Roads
  - Future Village projects as warranted (**Figure 12**)
- Island rain gardens (examples of locations)
  - Valley View Drive
  - Thelin Court
  - Cove Lane
  - Greenleaf Avenue and Laurel Lane
  - Wilshire Drive, 4 locations
  - Romona Road – south of Wilmette Avenue
  - Other locations as appropriate
- Rain barrels and downspout disconnection
  - Program for downspout disconnection and rain barrel assistance (**Figures 13 and 14**)
  - Limited to private property
- Permeable pavement
  - Pilot program in business districts or alleys

Figure 13. Downspout Disconnection

Figure 14. Rain Barrel

6.1.5 Green Infrastructure Ordinance Requirements

Under the new Cook County Watershed Management Ordinance (WMO), infiltration of the first 1 inch of rainfall is required for new commercial developments greater than 0.5 acres in size and single family residential development greater than 1.0 acre in size. The Village, as an authorized community under the WMO, enforces these requirements for new development within the Village. The Village also requires that downspouts for new residential homes be discharged to pervious surfaces to promote infiltration rather than connected directly to the storm sewer system. This is a beneficial green infrastructure requirement that reduces the flowrate from roof runoff into the storm sewer system. Other municipalities like Elmhurst and Barrington have implemented more stringent requirements such as requiring all new residential structures to store a portion of the runoff from the impervious area in a stormwater storage facility on the lot (rain garden or underground storage system). The Village may wish to consider a similar requirement which would reduce the peak runoff rate from residential redevelopment.

6.1.6 Green Infrastructure Limitations

Green infrastructure systems have a growing record of reducing runoff from smaller and more frequent rain events. However these systems do not target low-frequency high-volume rainfall events. Care should be taken to realize that while green infrastructure can be used to compliment a stormwater management system for frequent storm events, flooding will continue throughout the Village from high-volume rainfall events due to the undersized storm sewer system.

It is important to understand the magnitude of the flooding problem in the Village, the capacity of the existing storm sewer network and the relation of limitations of green infrastructure. In typical urban flood problem areas, the storage volumes required to reduce the flood depths to an acceptable level are significant. **Flood reduction throughout the western portion of the Village will require ± 50 acre-ft of storage.** Flood volumes are typically quantified in acre-feet. One acre-foot is the equivalent of an acre of land that is flooded one foot deep. Comparing 50 acre-feet of volume to volumes provided by green infrastructure, limitations of green infrastructure can be quantified:

- Capacity limitations
  - A single 0.15 acre lot in the Village would generate up to 15,000 gallons of runoff during the April 2013 storm event:
    - 235 rain barrels (55 gallons each) per property are required to store this water
    - Runoff from roof only = 110 rain barrels
  - 1 acre-ft of flood storage equals:
    - 5,925 rain barrels (55 gallons each)
    - 8,250 feet of green alleys (0.08 acre-feet per 660 ft block)
    - 2,520 feet of roadway with pervious pavement

The construction of green infrastructure techniques like green streets and rain gardens also has a heavy reliance on soil type for infiltration. Soil amendments to achieve proper infiltration rates to meet performance stands can increase construction costs. Roadway jurisdictions and requirements can also limit the use and increase construction cost of green streets. Vegetation used in rain gardens and bio

retention areas also requires establishment and maintenance.

To quantify the effect of green infrastructure throughout the Village, CBBEL performed XP-SWMM analysis using the MWRDGC volume control methodology to determine the impact of implementing rain gardens throughout the Village. RCN values were reduced by implementing a two foot deep, 10-foot x 20-foot rain garden on every residential property in each subbasin within the watershed. The XP-SWMM results indicate less than a 0.2 foot reduction in water surface elevation for the 10-year design storm event. This reduction is only realized under this hypothetical simulation if every residential property throughout the Village constructed a rain garden.

6.2 LONG TERM CAPITAL DRAINAGE IMPROVEMENTS

CBBEL identified **three** long term capital improvement projects that include increasing storm sewer sizes, adding relief storm sewers and incorporating stormwater storage to reduce flooding from the 10-year design storm below the street elevation. These long term improvements were analyzed with the XP-SWMM model to determine the effect on peak water surface elevations throughout the entire western portion of the Village and to verify that the proposed drainage projects did not negatively impact downstream areas. A delineation of the proposed condition 10-, 25-, 50-, and 100-year flood inundation areas for each alternative was created to quantify the structures removed, reduction of street flooding and overall reduction in flood depths throughout the Village.

6.2.1 Engineer's Estimate of Probable Cost Analysis and Assumptions

A conceptual engineer's estimate of probable cost for each of the proposed drainage improvement alternatives has been prepared. There are many unknowns including soil conditions, utility conflicts and right-of-way limits that will affect the ultimate design and cost of the improvements. Because of this, the engineer's estimate of probable cost includes a 20% contingency. Permitting, design and construction engineering for each project has also been included in the estimates as a percentage of the total cost of the project.

Figure 15. Typical Storm Sewer

In preparation of the conceptual engineer's estimate of probable cost, CBBEL has completed a unit price analysis utilizing recently submitted bid prices from three awarded CBBEL projects in various municipalities in the Chicagoland area to develop applicable unit prices for the proposed improvements in the western Village. These three projects were used to develop estimated unit prices as they are similar in scope and size to the improvements identified for this SMR. The three projects include the following:

- Village of Elmwood Park's Thatcher Avenue Storm Sewer
  - Bid in May of 2014
  - 3 bidders
  - Awarded for $5.9 million