AGENDA
President and Board of Trustees
Village of Arlington Heights
Committee-of-the-Whole
Board Room
Arlington Heights Village Hall
33 S. Arlington Heights Road
Arlington Heights, IL 60005
January 20, 2016
7:30 PM

**I. CALL TO ORDER**

**II. PLEDGE OF ALLEGIANCE**

**III. ROLL CALL OF MEMBERS**

**IV. NEW BUSINESS**

A. Draft CDM-Smith Combined Sewer Findings/Open House

**V. OTHER BUSINESS**

**VI. ADJOURNMENT**

Persons with disabilities requiring auxiliary aids or services, such as an American Sign Language interpreter or written materials in accessible formats, should contact David Robb, Disability Services Coordinator, at 33 S. Arlington Heights Road, Arlington Heights, Illinois 60005, (847)368-5793 (Voice), (847)368-5980 (Fax) or drobb@vah.com.

**Item:** Draft CDM-Smith Combined Sewer Findings

**Department**: Village Manager's Office

Draft CDM-Smith Combined Sewer Findings/Open House

**ATTACHMENTS:**

| **Description** | **Type** |
| --- | --- |
| CSTA Executive Summary | Presentation |

# Executive Summary

## ES.1 Background and Objectives

The Village of Arlington Heights (Village) is located in Cook County Illinois about 20 miles northwest of Chicago. The Village is served by both sanitary and combined sewers. Sanitary flows in separate sewered areas of the Village primarily flow to the Metropolitan Water Reclamation District of Greater Chicago's (MWRDGC) interceptor sewers. In combined areas, the sanitary sewers discharge into combined sewers and the combined sewers eventually discharge into the MWRDGC's Tunnel and Reservoir Plan (TARP) System. For purposes of this study, the study area is limited to the areas of the combined sewer system that experienced structure flooding/basement backup and is defined as the Combined Sewer Tributary Area (CSTA).

During a rain storm event on July 23, 2011, the Village experienced widespread basement backups and significant street flooding in the CSTA. These basement backups were similar to those experienced during severe storms in 2001, 2002, and 2008. The following **Table ES-1** lists the dates of all four of these storm events along with the maximum hour rainfall intensity and the maximum total cumulative rainfall and the duration.

**Table ES-1. CSTA's Historical Storm Events**

| Date | Maximum Hour (in) | Maximum 24-Hour (in) |
|---|---|---|
| October 13, 2001 | 2.29 | 3.31 |
| August 22, 2002 | 4.00 | 4.00 |
| September 13, 2008 | 4.00 | 5.70 |
| July 23, 2011 | 2.58 | 7.50 |

The Village has invested many millions of dollars in a number of storm and combined relief sewer improvements across the CSTA over the past 30 years. Until this study, the cumulative effect of these improvements has never been fully analyzed or evaluated in the context of the performance of the overall combined sewer system. Given the observed performance over the past 12 years and the damages incurred by local residents, the Village wants to quantify how its system works, what level of service it provides and determine the cost and benefit of providing a higher level of performance.

The CSTA Flood Study is intended to conduct a comprehensive analysis of the Village's combined sewer collection system to determine whether it provides the desired level of service for conveyance of wet weather flows and what improvements can be made to meet this level of service. The desired level of service is the approximate once in 10-year frequency storm, 2.1 inches in 1-hour (design storm). The 2.1 inches in 1-hour design event represents the most intense period of the 10-year, 24-hour design storm which is approximately 4.3 inches in 24 hours. The Village has experienced significant capacity-driven backups at least four times in the past 12 years as shown in the above **Table ES-1**. All four of these storm events exceeded the 10-year frequency design storm for 1-hour rainfall. To evaluate this issue, the Village retained CDM Smith to develop a comprehensive hydrologic and hydraulic model of the combined sewer area and to use the model for evaluating existing system performance and potential improvements. **Figure ES-1** shows the extent of the CSTA study area.

The CSTA Flood Study will conduct a hydrologic and hydraulic analysis of the CSTA to assess the performance of the existing combined sewer system and will formulate potential improvements to address basement backup problems that provide a level of service to handle the 2.1 inches in 1-hour storm event.

Associated with or supporting this overall objective are the following secondary objectives:

- Identify if the existing combined sewer system provides basement backup protection from the 2.1 inches in 1-hour storm event;
- Identify effective measures for mitigating basement backups and increasing the level of service for the combined sewer system to the 2.1 inches in 1-hour level (if not presently provided) and to a 2.59 inches in 1-hour(25-year frequency storm) higher level of service (only at the eight identified basement backup problem areas as defined in the CSTA Flood Study scope of work);
- Incorporate green infrastructure improvements to reduce runoff and wet weather flows in the CSTA;
- Inform the Village Board and the public regarding the capacity and performance of the existing combined sewer system and the required steps to reduce basement backups to achieve the desired level of service.

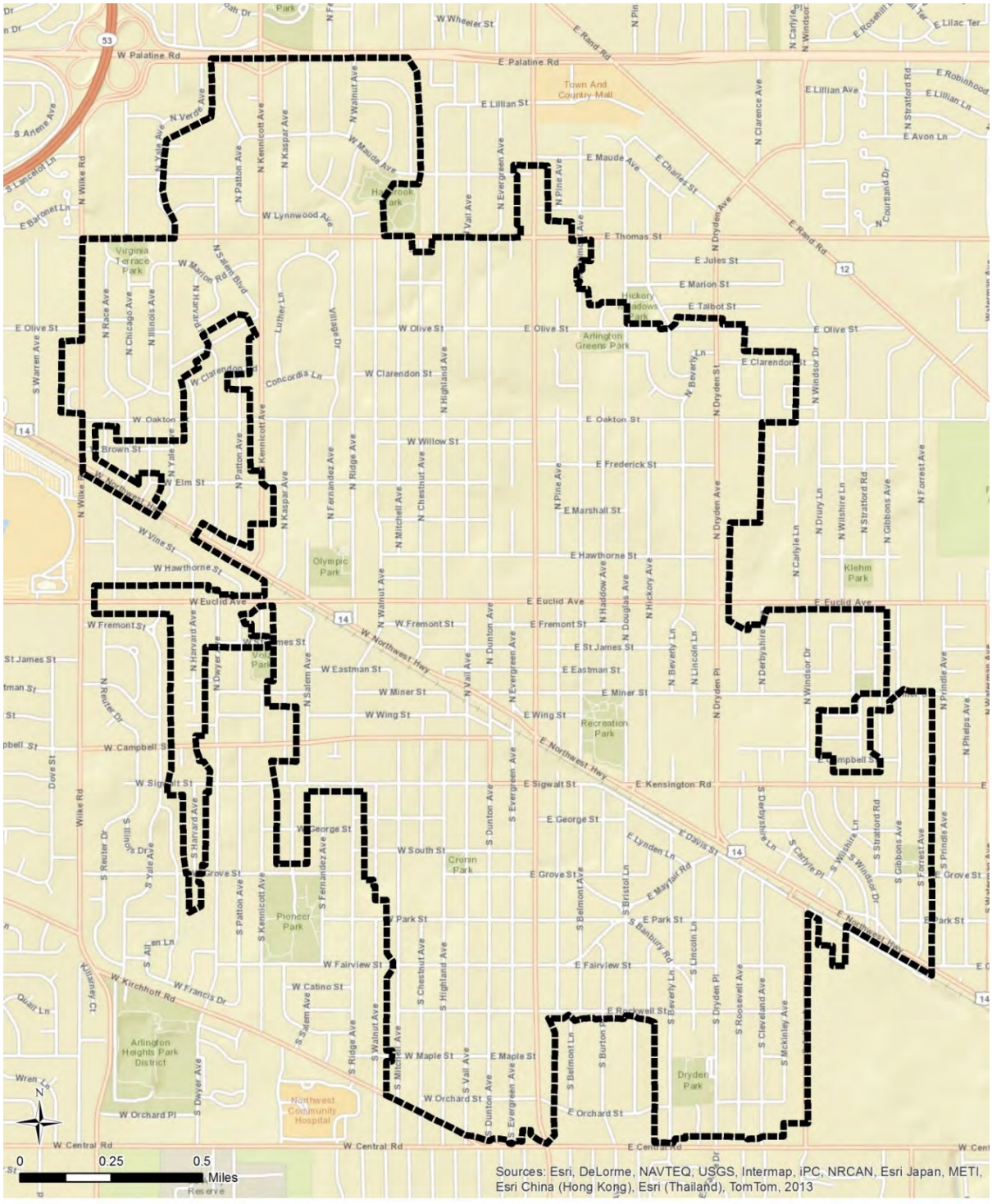


**Figure ES-1. CSTA Boundary**

## ES.2 CSTA System Representation

The hydrologic and hydraulic characteristics of the CSTA collection system were represented in the InfoWorks CS modeling software using ArcGIS application tools. InfoWorks is a dynamic model that routes inflow hydrographs through a network of inlet controls, manholes and pipes.

The objective of the CSTA hydrologic model is to estimate the rate and volume of storm runoff generated by the design event over the CSTA catchment area and to properly route through the sewer system. InfoWorks provides several options for simulation of storm runoff, including an option that mimics the approach used in the United States Environmental Protection Agency (USEPA) Storm Water Management Model (SWMM), which is the option used for the CSTA analyses. The total CSTA is 3,331 acres (or 5.2 square miles) of which 2,267 acres are drained by the combined sewers and the remaining 1,064 acres are in catchments drained by separate storm sewers. The 2,267 acres drained by the combined sewers is further divided into smaller catchments that range from 0.6 to 70 acres in size with an average size of 4.8 acres. The percentages of pervious and impervious surfaces were calculated using the National Land Cover Database 2011 (NLCD, 2011). Overall the CSTA was determined to average about 36 percent impervious cover and 64 percent pervious cover. The downspout connections in the CSTA were represented as:

- In downtown catchments, all roof drains are routed directly to the combined sewers. Runoff from all other impervious cover (street, parking lot and walkway) are routed to the catch basins; or,
- In residential catchments, all the roof drains are routed to the pervious area (front lawn areas and back yards).

The physical information describing the collection system (pipes, manholes, inlet controls) was obtained from the Village's Sewer GIS database, Utility Atlas, Weller Creek Sewer Project Phase I, II, & III drawings, 1967 Sewer Report exhibits, and 2014 Field Survey and Verification conducted by Village staff. The hydraulic model included mostly combined sewers that are 12 inches and larger. **Figure ES-2** presents the combined sewers included in the CSTA hydraulic model; the figure shows different colors for different ranges of pipe diameters (conduit height). The combined sewers range from 12 inches to 144 x 96 inches in sizes.

After a 1987 Harza study of the CSTA's performance, inlet controls (controls rate of inflow) were added to the catch basin inlets throughout the combined system. Approximately 1,500 inlet controls were added in the combined sewer system catch basins. These inlet controls allow storm water to be temporarily stored on the street. This process slows the effect of the storm and allows the combined sewer system to pass the required flows. In the CSTA model, the overall effect of inlet controls in each catchment is represented in three ways:

- Catchments with no inlet controls in the catch basins
- Catchments with inlet controls in catch basins
- Catchments with a combination of catch basins with and without inlet controls

Dry weather and moderate wet weather flows from the CSTA are intercepted by the MWRDGC's TARP system. The CSTA trunk sewers are connected to the TARP system through Control Structure 1 and Control Structure 1A located near Melas Park. At the beginning of the project, the CDM Smith team and Village staff met with MWRDGC's staff (Kevin Fitzpatrick and Joseph Schuessler) to collect plans for the control structures, understand the operation of the control structures, and receive information for the design capacity of the TARP system and the Gloria Alitto Majewski reservoir. The sluice gates in Control Structures 1 and 1A are open 25% during dry weather flow conditions and the openings during wet weather flow

conditions are operated by MWRDGC based on the capacity in the TARP system and the Gloria Alitto Majewski reservoir. The connections and operating conditions of Control Structures 1 and 1A are represented in the CSTA model.

The hydrologic and hydraulic representations were refined during the calibration process. The CSTA model was calibrated and verified using the Village's 2012 flow monitoring and 2014 sewer depth data.

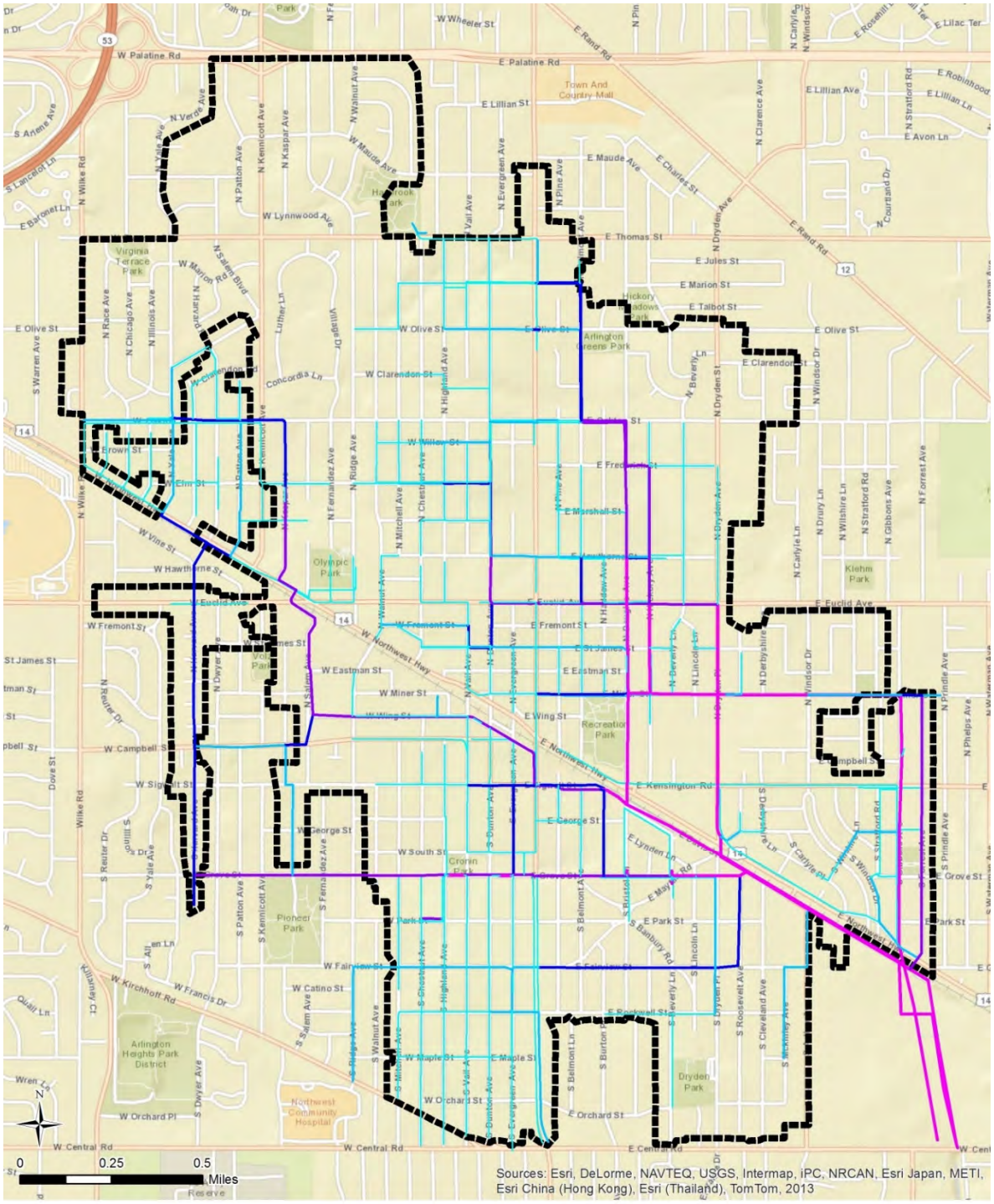


**Figure ES-2. CSTA Model Sewer Network**

## ES.3 Existing CSTA System Performance

Once the CSTA model was calibrated, it was used to evaluate the performance of the combined sewers for the Village's design storm. The Village's design storm for the CSTA system was a 4.3 inches in a 24-hour event. This design storm was used for the design of the CSTA improvements in 1990's. This synthetic storm event hyetograph contains an intense storm period of 2.1 inches in 1-hour event embedded in the 24-hour storm. The remaining 2.2 inches is distributed throughout the remaining 23-hours. CDM Smith used the same rainfall volume of 2.1 inches in 1-hour but the rainfall distributions were based on Illinois State Water Survey Bulletin 70 (Huff and Angel, 1992), which is currently used for stormwater management design in Illinois. The 2.1 inches in 1-hour storm event with the boundary condition of 100% sluice gate openings at the Control Structures 1 and 1A was used to evaluate system performance as well as to serve as the design basis for the potential improvements.

All the combined sewer flows in the CSTA system flow southeast towards Melas Park and are intercepted by the MWRDGC's TARP system. The majority of the north portion of the CSTA system flows from north of W. NW HWY and east of N. Ridge Avenue are conveyed through the 108-inch trunk sewer that runs east on W. Miner Street and South on N. Gibbons Avenue. The CSTA system flows south of W. NW HWY are conveyed through the 114 x 78-inch trunk sewer and the 114–inch trunk relief sewer on E. Davis Street. The northwest portion of the CSTA system, west of N. Ridge Avenue and north of W. NW HWY is also conveyed through these two trunk sewers.

The CSTA model was simulated for the design storm event to identify the locations where the system does not provide the desired level of protection from basement backups. Manholes with Hydraulic Grade Lines (HGL or pressure and water flow depth in the sewer) that rise to within 5 feet or less of the ground are flagged as potential basement backup locations and the manhole catchments are highlighted to show the generalized areas of potential basement backups. **Figure ES-3** shows the catchments that do not provide protection from basement backups for the design storm event. It should be noted that the catchments shown on **Figure ES-3** provide a general indication of areas that may be subject to potential basement backups due to local and trunk sewer capacity limitations. The actual number of and locations of basement backups are subject to additional factors including the actual basement floor elevation and the presence of preventive measures such as overhead sewers and backflow preventers. The areas of potential basement backups in the combined sewer system were grouped into seven "problem" areas and one subdivision (Westgate). Problem area eight was identified in the separate sewer system as shown in the **Figure ES-3**.

The CSTA model shows that the current CSTA system does not provide the level of service that was planned for the Village's current design storm of 2.1 inches in a 1-hour increment at the eight problem areas. The current level of service of the CSTA system provides protection from basement backups for a 1.79 inches in 1–hour storm event. All the eight problem areas identified for the Village's design storm as shown on **Figure ES-3** are due to insufficient local sewer capacities. The trunk sewers have adequate capacity and do not cause backwater problems provided that the sluice gates at Control Structures 1 and 1A are fully (100%) open. There are approximately 800 properties that are susceptible to potential basement backups during the Village's design storm. This estimate excludes the properties with overhead sewers and teardowns.

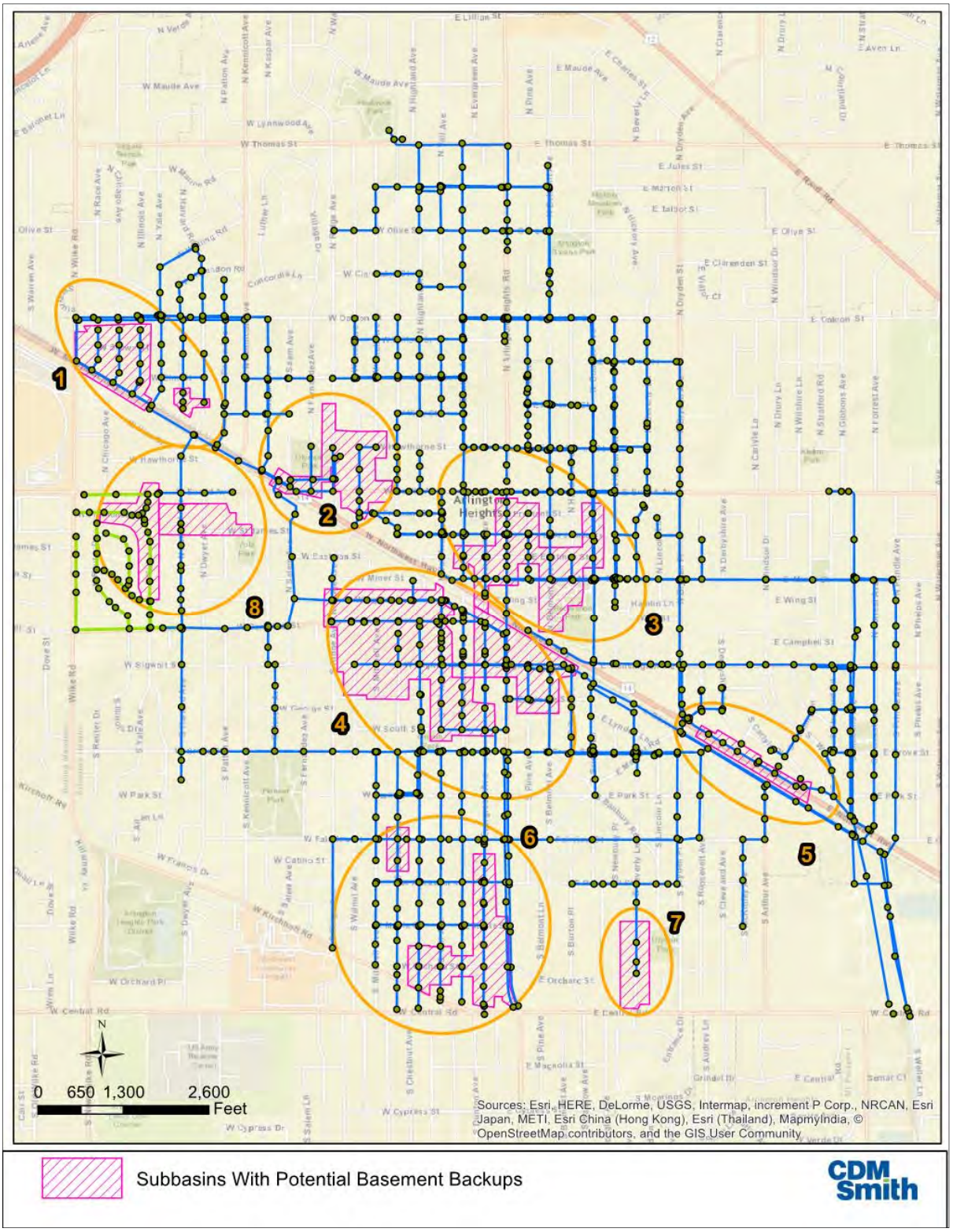


**Figure ES-3. CSTA Catchments with Potential Basement Backups for 2.1 inches in 1-hour Storm Event**

## ES.4 CSTA Alternative Analysis

CDM Smith with assistance from the Village staff performed an alternative screening analysis so that all potential improvements received an appropriate level of consideration. The process of identifying potential alternative components began with identification of the location, extent and severity of basement backup problems and deficiencies within the CSTA system along with an assessment of the root cause of each problem. Once the basement backup problems were defined, a series of alternative components were selected that would potentially reduce the basement backup problems. A brainstorming session was conducted with the Village staff to consider each alternative component in the interest of ensuring that no good idea was overlooked. Below is the list of alternative components that were identified by the Village staff and CDM Smith for further screening analysis:

- Local combined sewer improvements
- Diversion to existing relief sewers to make use of available capacity if present
- Local storage improvements
- Trunk relief sewers discharging into the TARP system
- Overhead sewers

Using the above selected alternative components, an alternative component screening analysis was performed for each of the eight basement backup problem areas. The alternative components were evaluated based on the following criteria:

- Effectiveness
- Permitting
- Constructability
- Public acceptance
- Relative cost

The above criteria were applied to the selected alternative components for each basement backup problem location and evaluated using a scale of easy, moderate and difficult. The screening analysis results were presented to the Village staff to select the most applicable alternative component for each basement backup problem location. The selected alternative components, relief sewers and overhead sewers, for each basement backup problem were further analyzed for performance. In the analysis of the performance of the selected alternative components, it was determined that in some problem areas, an overhead sewer alternative might be more cost effective then a relief sewer alternative. Initial evaluation of these alternatives led to consideration of an overhead sewer improvements as an alternate to a relief sewer improvements. As a result, two potential alternate improvement options were developed and considered to address the basement back up problems in the CSTA:

- Relief sewer improvements consisting of new local combined sewers to provide additional capacity and diversion connections from local combined sewers to existing relief sewers to make use of available capacity.
- Overhead sewer system improvements to prevent sewage from backing up in the sanitary lateral and entering a house or building basement. With the overhead sewer system, the sanitary service line

discharges from the house or building at an elevation at or near the street level before entering into the Village's sewer system.

Development and evaluation of the overhead sewer alternative improvements for each problem area identified that although the overhead sewers provided a robust way to address basement backups, several problem areas still experienced high HGLs during the design event. To reduce the HGLs during the design events, a relief sewer improvement was added to the overhead sewer alternative in those problem areas where warranted. It was also determined that in the non-residential areas, overhead sewers would not likely be practical and therefore overhead sewer improvements were not developed for those problem areas (Areas 3 and 4).

**Table ES-2** lists the summary of CSTA relief sewer alternative improvements for each problem area and **Figure ES-4** summarizes the locations of the relief sewer alternative improvements.

**Table ES-2. Summary of CSTA Relief Sewer Alternative Improvements**

| Location | Potential Improvements |
|---|---|
| Area 1 – NW HWY and Chicago Avenue | ▪ 1,350 feet of 24–inch relief combined sewer on NW HWY from Wilke Road to Yale Avenue<br>▪ 2,000 feet of 36-inch relief combined sewer on NW HWY from Yale Avenue to Kasper Avenue, connecting to existing 66-inch relief combined sewer |
| Area 2 – Ridge Avenue and Euclid Avenue / Walnut Avenue and Hawthorne Street | ▪ 1,350 feet of 24–inch relief combined sewer on Euclid Avenue from Ridge Avenue to Freemont Street<br>▪ 1,110 feet of 15-inch combined sewer on Mitchell Avenue from Hawthorne Street to Elm Street<br>▪ 21–inch overflow connection between 21–inch combined sewer and 66–inch combined relief sewer at Salem Avenue and NW HWY<br>▪ Catch basin disconnection to the 12-inch combined sewer flowing South from Vine Street and Ridge Avenue and connecting back to the 15–inch combined sewer at the same intersection but flowing north to Elm Street |
| Area 3 – Arlington Heights Road and Miner Street | ▪ 350 feet of 15-inch relief sewer on Eastman Street from Dunton Avenue to Evergreen Avenue<br>▪ 350 feet of 30-inch relief sewer on Evergreen Avenue from Eastman Street to Miner Street<br>▪ 350 feet of 30-inch relief sewer on Evergreen Avenue from Eastman Street to St. James Street, connecting to existing 36-inch<br>▪ 700 feet of 24-inch relief sewer on Eastman Street from Arlington Heights Road to Belmont Avenue, making connections at Arlington Heights Road and Pine Avenue<br>▪ 350 feet of 30-inch relief sewer going North on Belmont Avenue from Eastman Street to St. James Street and connecting to existing 36-inch sewer<br>▪ 650 feet of 18-inch relief sewer going East on Freemont Street from Arlington Heights Road to Pine Avenue and then going South on Pine Avenue to St. James Street connecting to the 36-inch sewer<br>▪ Replace 42-inch shallow combined sewer from Arlington Heights Road to Douglas Avenue with deeper 48-inch sewer from Arlington Heights Road to Haddow Avenue (1,000 feet) and 54-inch sewer from Haddow Avenue to Douglas Avenue (350 feet) and 25 feet of 60-inch sewer connecting to the existing 96-inch relief sewer |

| Location | Potential Improvements |
|---|---|
| Area 4 – Campbell Street, Vail Avenue, Dunton Avenue and Sigwalt Street | ▪ 1,050 feet of 18-inch relief sewer on Campbell Street from Ridge Avenue to Chestnut Avenue<br>▪ Five, 15-inch relief sewer connections (30 feet each) between the potential 18-inch and the existing 12-inch sewers on the Campbell Street<br>▪ 30-inch relief sewer (350 feet) on Chestnut Avenue from Campbell Street to Wing Street connecting the 18-inch sewer to the 72-inch relief sewer<br>▪ 350 feet of 24-inch sewer from Chestnut Avenue to Highland Avenue and 100 feet of 24-inch connection from the existing 10-inch sewer on Highland Avenue to the potential 24-inch on Campbell Street<br>▪ 450 feet of 30-inch sewer on Campbell Street from Highland Avenue to Vail Avenue<br>▪ 500 feet of 36-inch sewer on Vail Avenue from South of Campbell Street to Sigwalt Street<br>▪ Replace the existing sewer on Sigwalt Street with 350 feet of 24-inch from Walnut to Mitchell Avenues, 650 feet of 30–inch sewer from Mitchell Avenue to Highland Avenues, and 350 feet of 42-inch from Highland Avenue to Vail Avenue<br>▪ 100 feet of 18-inch overflow connection between the 12-inch combined sewer near Vail Avenue and Campbell Street flowing to 24-inch sewer on Vail Avenue flowing South<br>▪ Three, 24-inch overflow connections (30 feet each)between the combined and storm sewers at Dunton Avenue, Evergreen Avenue and Arlington Heights Road<br>▪ One, 15-inch relief sewer (30 feet) connection between existing 10-inch and potential 24-inch relief sewer (300 feet), north of Sigwalt Street and Highland Avenue<br>▪ 15- to 18-inch relief sewer of 450 feet on Dunton Avenue towards Sigwalt Street<br>▪ 18-inch relief sewer of 250 feet on Evergreen Avenue towards Sigwalt Street |
| Area 5 – NW HWY and Chatham Place | ▪ 1,700 feet of 18–inch combined sewer along the alley parallel to NW HWY from Chatham Place to Windsor Drive<br>▪ Two, 15–inch relief connections of total length of 250 feet between the existing and potential sewers |
| Area 6 – Chestnut Avenue, Vail Avenue, and Evergreen Avenue | ▪ 1,000 feet of 18-inch combined sewer on Orchard Street from Highland Avenue to Evergreen Avenue<br>▪ 450 feet of 24-inch relief sewer on Orchard Street from Evergreen Avenue to Arlington Heights Road<br>▪ 30 feet of 12-inch overflow connection between 12- and 30-inch combined sewers at Chestnut Avenue and Fairview Street<br>▪ 30 feet of 12-inch connection between 12- and 24-inch combined sewers located 300 feet south of Evergreen Avenue and Rockwell Street |
| Area 7 – Beverly Lane and Orchard Street | ▪ 900 feet of 24-inch combined sewer on Beverly Lane from North of Orchard Street to Rockwell Street |
| Area 8 – Westgate Subdivision | ▪ Implement Area 1 improvements<br>▪ 900 feet of 24- and 30-inch relief sanitary sewer from Miner Street and Yale Avenue to Campbell Street (24-inch), and Campbell Street to Harvard Avenue (30-inch) |

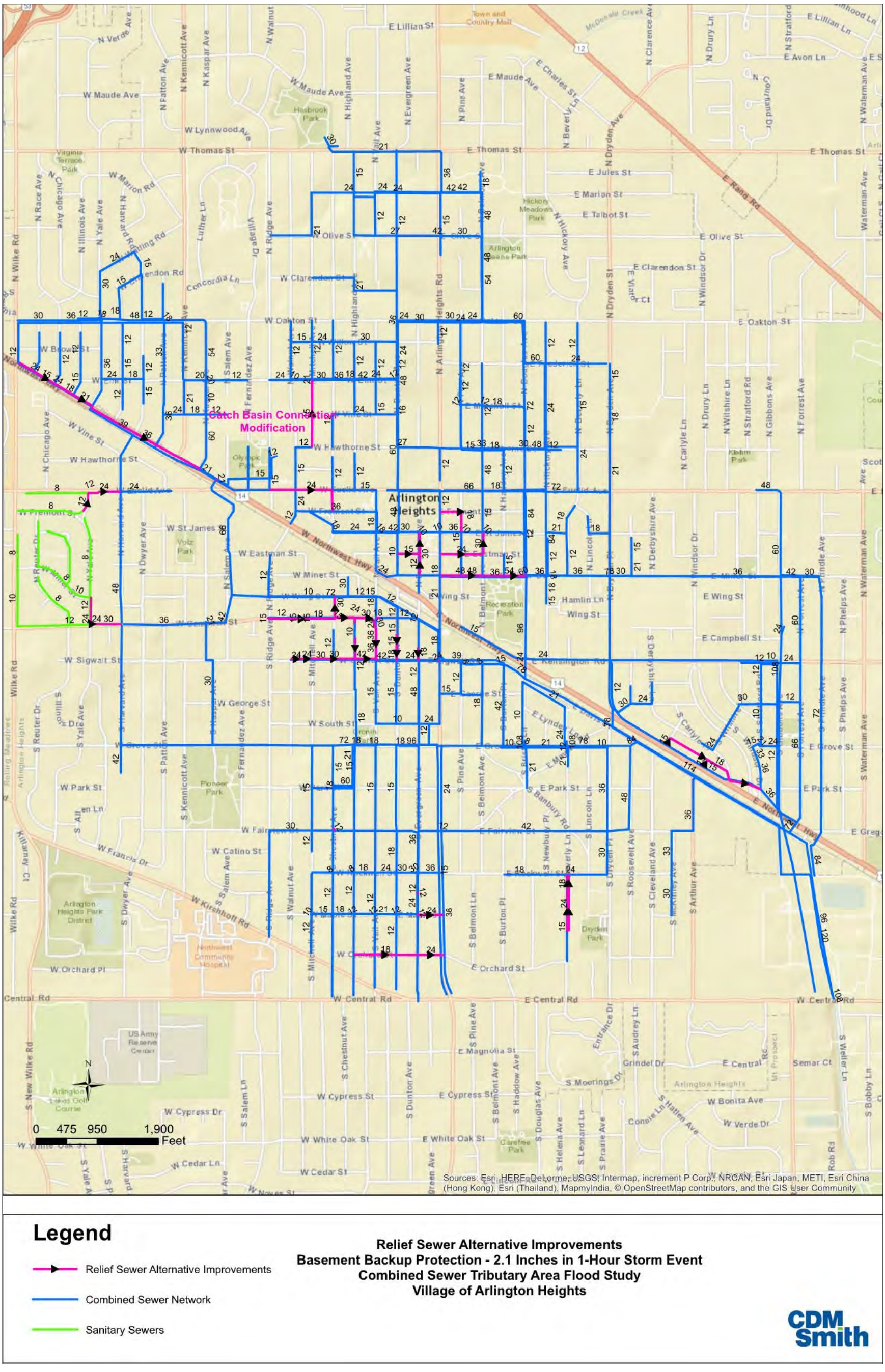


**Figure ES-4. CSTA Relief Sewer Alternative Improvements for Village's Design Storm**

**Table ES-3** lists the summary of CSTA overhead sewer alternative improvements for each problem area and **Figure ES-5** summarizes the locations of the overhead sewer alternative improvements.

**Table ES-3. Summary of CSTA Overhead Sewer Alternative Improvements**

| Location | Potential Improvements |
|---|---|
| Area 1 – NW HWY and Chicago Avenue | ▪ Overhead sewer system at approximately 80 properties |
| Area 2 – Ridge Avenue and Euclid Avenue / Walnut Avenue and Hawthorne Street | ▪ Overhead sewer system at approximately 50 properties<br>▪ 1,110 feet of 15-inch combined sewer on Mitchell Avenue from Hawthorne Street to Elm Street<br>▪ Catch basin disconnection to the 12-inch combined sewer flowing South from Vine Street and Ridge Avenue and connecting back to the 15–inch combined sewer at the same intersection but flowing North to Elm Street |
| Area 3 – Arlington Heights Road and Miner Street | ▪ 350 feet of 15-inch relief sewer on Eastman Street from Dunton Avenue to Evergreen Avenue<br>▪ 350 feet of 30-inch relief sewer on Evergreen Avenue from Eastman Street to Miner Street<br>▪ 350 feet of 30-inch relief sewer on Evergreen Avenue from Eastman Street to St. James Street, connecting to 36-inch<br>▪ 700 feet of 24-inch relief sewer on Eastman Street from Arlington Heights Road to Belmont Avenue, making connections at Arlington Heights Road and Pine Avenue<br>▪ 350 feet of 30-inch relief sewer going North on Belmont Avenue from Eastman Street to St. James Street and connecting to 36-inch sewer<br>▪ 650 feet of 18-inch relief sewer going East on Freemont Street from Arlington Heights Road to Pine Avenue and then going South on Pine Avenue to St. James Street connecting to the 36-inch sewer<br>▪ Replace 42-inch shallow combined sewer from Arlington Heights Road to Douglas Avenue with deeper 48-inch sewer from Arlington Heights Road to Haddow Avenue (1,000 feet) and 54-inch sewer from Haddow Avenue to Douglas Avenue (350 feet) and 25 feet of 60-inch sewer connecting to the existing 96-inch relief sewer |
| Area 4 – Campbell Street, Vail Avenue, Dunton Avenue and Sigwalt Street | ▪ 1,050 feet of 18-inch relief sewer on Campbell Street from Ridge Avenue to Chestnut Avenue<br>▪ Five, 15-inch relief sewer connections (30 feet each) between the potential 18-inch and the existing 12-inch sewers on the Campbell Street<br>▪ 30-inch relief sewer (350 feet) on Chestnut Avenue from Campbell Street to Wing Street connecting the 18-inch sewer to the 72-inch relief sewer<br>▪ 350 feet of 24-inch sewer from Chestnut Avenue to Highland Avenue and 100 feet of 24-inch connection from the existing 10-inch sewer on Highland Avenue to the potential 24-inch on Campbell Street<br>▪ 450 feet of 30-inch sewer on Campbell Street from Highland Avenue to Vail Avenue<br>▪ 500 feet of 36-inch sewer on Vail Avenue from South of Campbell Street to Sigwalt Street<br>▪ Replace the existing sewer on Sigwalt Street with 350 feet of 24-inch from Walnut to Mitchell Avenues, 650 feet of 30–inch sewer from Mitchell Avenue to Highland Avenues, and 350 feet of 42-inch from Highland Avenue to Vail Avenues<br>▪ 100 feet of 18-inch overflow connection between the 12-inch combined sewer near Vail Avenue and Campbell Street flowing to 24-inch sewer on Vail Avenue flowing South<br>▪ Three, 24-inch overflow connections (30 feet each)between the combined and storm sewers at Dunton Avenue, Evergreen Avenue and Arlington Heights Road<br>▪ One, 15-inch relief sewer (30 feet) connection between existing 10-inch and potential 24-inch relief sewer (300 feet), north of Sigwalt Street and Highland Avenue |

| Location | Potential Improvements |
|---|---|
| | ▪ 15- to 18-inch relief sewer of 450 feet on Dunton Avenue towards Sigwalt Street<br>▪ 18-inch relief sewer of 250 feet on Evergreen Avenue towards Sigwalt Street |
| Area 5 – NW HWY and Chatham Place | ▪ Overhead sewer system at approximately 20 properties<br>▪ 1,700 feet of 12–inch combined sewer along the alley parallel to NW HWY from Chatham Place to Windsor Drive<br>▪ Two, 12–inch relief connections of total length of 250 feet between the existing and potential sewers |
| Area 6 – Chestnut Avenue, Vail Avenue, and Evergreen Avenue | ▪ Overhead sewer system at approximately 205 properties |
| Area 7 – Beverly Lane and Orchard Street | ▪ Overhead sewer system at approximately 13 properties<br>▪ 600 feet of 18-inch combined sewer on Beverly Lane from North of Orchard Street to Rockwell Street |
| Area 8 – Westgate Subdivision | ▪ Overhead sewer system at approximately 70 properties |

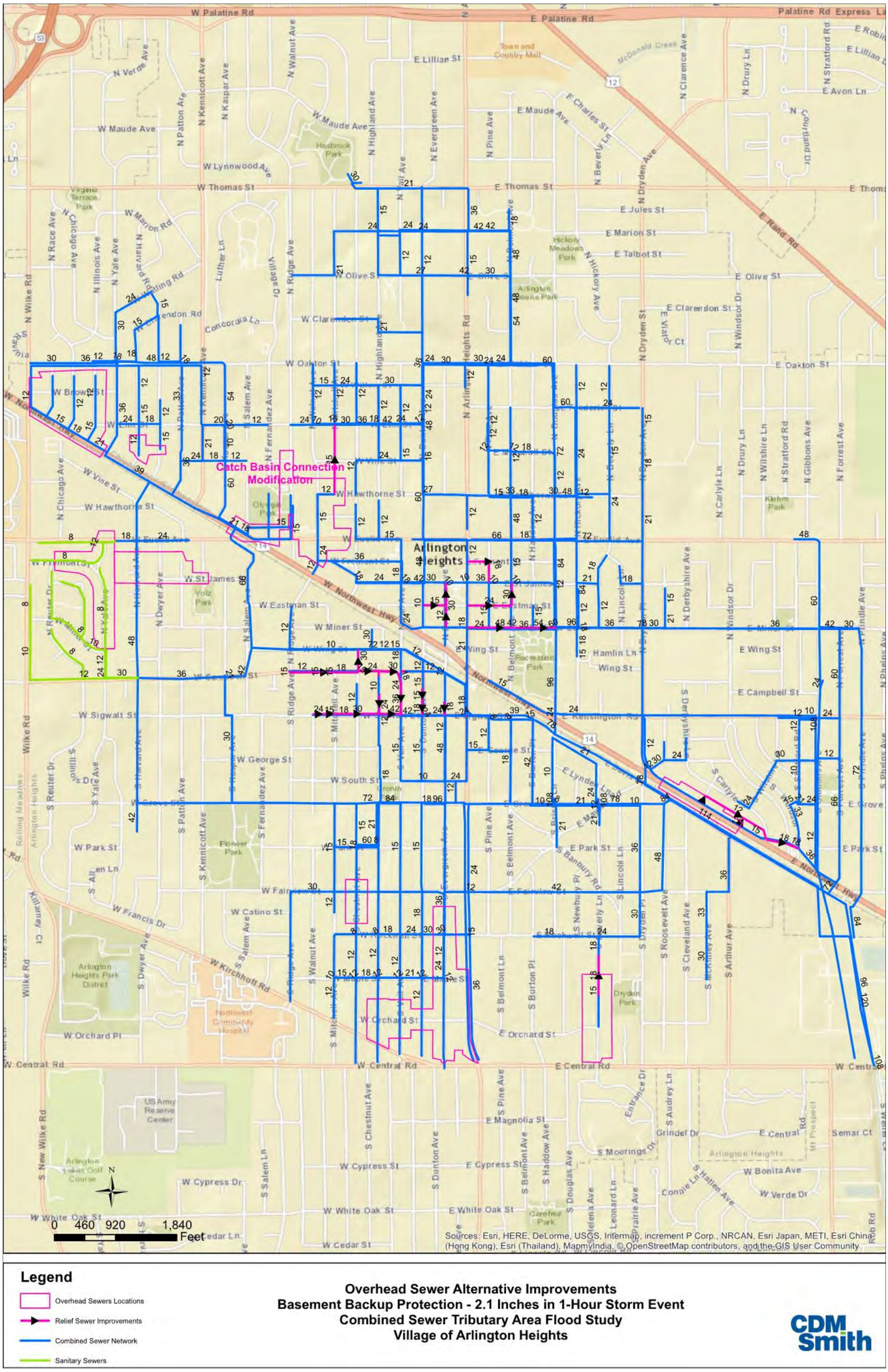


**Figure ES-5. CSTA Overhead Sewer Alternative Improvements for Village's Design Storm**

# ES.5 Street Ponding Analysis

CDM Smith was also tasked by the Village to perform a street ponding analysis and develop potential improvements at three locations as listed below:

- Race and Chicago Avenues
- Campbell and Sigwalt Streets (near downtown)
- Cleveland and Roosevelt Avenues

The above three locations have experienced street ponding during recent storm events and the Village intends to provide protection from the 2.59 inches in 1-hour storm event. In the CSTA, street ponding generally occurs for storms that are greater than the 2.1 inches in 1-hour storm because inlet controls restrict the flow into the combined sewers for storms greater than this event. Inlet controls restrict flows on the street to provide protection from basement backups. Once the inlet controls restrict the flows, street ponding starts to occur in the low topographic areas. The Village selected this level of service, 2.59 inches in 1-hour storm event, for street ponding analysis and improvements based on these reasons. The two locations, Race and Chicago Avenues and Cleveland and Roosevelt Avenues are separate storm sewer areas that discharge into the combined sewers. The Campbell and Sigwalt Streets (Downtown area) is located within the combined sewer system. The root cause of the street ponding problems are low topography areas and insufficient storm and combined sewer capacity. CDM Smith has evaluated improvement components to provide protection from street ponding. The potential improvements were sized to reduce the ponding depths to 6 inches or less at the crown of the street. **Table ES-4** lists the summary of potential improvements at each street ponding problem area and **Figure ES-6** summarizes the conceptual layout of the potential improvements.

**Table ES-4. Summary of Potential Improvements – Street Ponding Locations**

| Location | Potential Improvements |
|---|---|
| Race Avenue and Chicago Avenue | ▪ 350 feet long, 96- x 48-inch underground stormwater storage on West Jo Lane from North Chicago Avenue to North Illinois Avenue<br>▪ 125 feet long, 96- x 48-inch underground stormwater storage on North Race Avenue, near the depression area<br>▪ Two 8-inch orifices that discharge the flow from the underground stormwater storage into the downstream storm sewers and<br>▪ 300 feet long, 36–inch storm sewer from Race Avenue and Clarendon Road to Chicago Avenue and Oakton Street |
| Campbell Street and Sigwalt Street[1] | ▪ 1,050 feet of 18-inch relief sewer on Campbell Street from Ridge Avenue to Chestnut Avenue<br>▪ Five, 15-inch relief sewer connections (30 feet each) between the potential 18-inch and the existing 12-inch sewers on the Campbell Street<br>▪ 30-inch relief sewer (350 feet) on Chestnut Avenue from Campbell Street to Wing Street connecting the 18-inch sewer to the 72-inch relief sewer<br>▪ 350 feet of 24-inch sewer from Chestnut Avenue to Highland Avenue and 100 feet of 24-inch connection from the existing 10-inch sewer on Highland Avenue to the potential 24-inch on Campbell Street<br>▪ 450 feet of 30-inch sewer on Campbell Street from Highland Avenue to Vail Avenue<br>▪ 500 feet of 36-inch sewer on Vail Avenue from South of Campbell Street to Sigwalt Street<br>▪ Replace the existing sewer on Sigwalt Street with 350 feet of 24-inch from Walnut to Mitchell Avenues, 650 feet of 30–inch sewer from Mitchell Avenue to Highland Avenues, and 350 feet of 42-inch from Highland Avenue to Vail Avenue |

| Location | Potential Improvements |
|---|---|
| | ▪ 100 feet of 18-inch overflow connection between the 12-inch combined sewer near Vail Avenue and Campbell Street flowing to 24-inch sewer on Vail Avenue flowing South<br>▪ Three, 24-inch overflow connections (30 feet each)between the combined and storm sewers at Dunton Avenue, Evergreen Avenue and Arlington Heights Road<br>▪ One, 15-inch relief sewer (30 feet) connection between existing 10-inch and potential 24-inch relief sewer (300 feet), north of Sigwalt Street and Highland Avenue<br>▪ 15- to 18-inch relief sewer of 450 feet on Dunton Avenue towards Sigwalt Street<br>▪ 18-inch relief sewer of 250 feet on Evergreen Avenue towards Sigwalt Street |
| Roosevelt Avenue and Cleveland Avenue | ▪ 700 feet of 120- x 60-inch underground storm water storage on Roosevelt Avenue from Orchard Street to Maple Avenue<br>▪ 250 feet long of 168- x 60-inch underground stormwater storage on Cleveland Avenue, near the low topography/depression area<br>▪ New street inlets to accommodate the runoff from the 2.59 inches rainfall volume<br>▪ Overflow weirs that divert the flow from the existing storm sewers into the underground stormwater storage during the storm event at Orchard Street and Roosevelt Avenue and at South of Orchard Street and Cleveland Avenue and<br>▪ Two 12-inch orifices that control the flow from the underground stormwater storage into the downstream storm sewers |

[1]These improvements are the same as those outlined in Table ES-2 for Area 4.

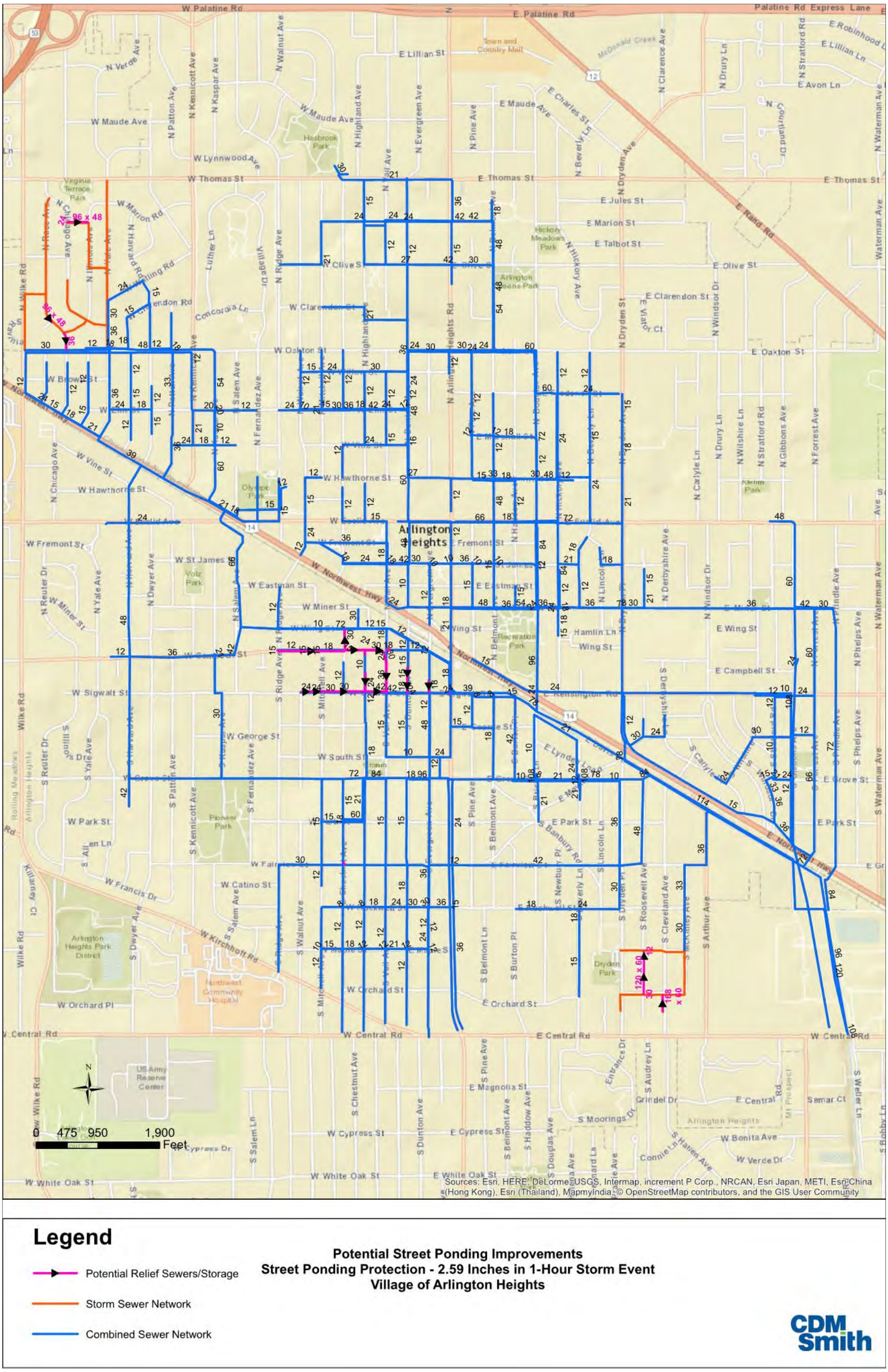


**Figure ES-6. CSTA Potential Street Ponding Improvements**

# ES.6 Alternatives

The CSTA flood study alternatives are divided into short-term alternatives and long-term alternatives. The short-term alternatives are capital improvement projects to address the level of service deficiencies in the identified problem areas. The long-term alternatives are ongoing activities that will continue to improve the level of service in the CSTA and make the CSTA facilities more resistant to storms that exceed the design storm. The following sections describe these alternatives and the associated planning level opinion of probable construction cost estimates.

## Short-Term Alternatives – Basement Backup Improvements

One of the important drivers for initiating the CSTA Flooding Study and the application of the 2.1 inches in 1-hour storm event was to provide a consistent level of service across the CSTA and the Village. The hydrologic and hydraulic analysis of the CSTA sewer system identified eight locations that do not have this level of service for basement backup protection from flooding. Implementation of the potential improvements would protect basements from backups for a 2.1 inches in 1-hour storm event provided MWRDGC's Control Structure gates are fully (100%) open. As discussed above, CDM Smith developed potential relief sewer and overhead sewer improvements for providing a consistent level of protection from basement backups. **Tables ES-5** and **ES-6** list the planning level opinion of probable construction costs for the relief sewer and overhead sewer improvements.

The planning level opinion of probable construction cost indicate that the potential relief sewer alternative improvements for the 8 problem areas range from $ 0.4 to $ 2.8 million in 2015 dollars as presented in **Table ES-5**.

**Table ES-5. Planning Level Opinion of Probable Construction Cost Estimates – Relief Sewer Alternative Improvements**

| Location | Estimated Design and Construction Cost | $/Property |
|---|---|---|
| Area 1 - Northwest Highway and Chicago Avenue | $1,800,000 | $23,000 |
| Area 2 - Ridge Avenue and Euclid Avenue/ Walnut Avenue and Hawthorne Street | $1,200,000 | $24,000 |
| Area 3 - Arlington Heights Road and Miner Street | $2,400,000 | $22,000[1] |
| Area 4 - Campbell Street, Vail Avenue, Dunton Avenue and Sigwalt Street (Downtown) | $2,700,000 | $11,000[1] |
| Area 5 - NW HWY and Chatham Place | $900,000 | $45,000 |
| Area 6 - Chestnut Avenue, Vail Avenue, and Evergreen Avenue | $1,000,000 | $5,000 |
| Area 7 – Beverly Lane and Orchard Street | $400,000 | $31,000 |
| Area 8 – Westgate Subdivision | $2,800,000 | $18,000 |
| **Total** | **$13,200,000** | |

[1]These $/Property do not account for multistory buildings that have multiple dwelling units

The planning level Opinions of Probable Construction Cost indicate that the potential overhead sewer alternative improvements for the 8 problem areas range from $ 0.4 to $ 2.7 million in 2015 dollars as presented in **Table ES-6**.

**Table ES-6. Planning Level Opinions of Probable Construction Cost Estimates – Overhead Sewer Alternative Improvements**

| Location | Estimated Overhead Sewers Cost[1] | Estimated Relief Sewers Cost[2] | Estimated Total Design and Construction Cost | $/Property |
|---|---|---|---|---|
| Area 1 - Northwest Highway and Chicago Avenue | $800,000 | - | $800,000 | $10,000 |
| Area 2 - Ridge Avenue and Euclid Avenue/ Walnut Avenue and Hawthorne Street | $500,000 | $600,000 | $1,100,000 | $22,000 |
| Area 3 - Arlington Heights Road and Miner Street | - | $2,400,000 | $2,400,000 | $22,000[3] |
| Area 4 - Campbell Street, Vail Avenue, Dunton Avenue and Sigwalt Street (Downtown) | - | $2,700,000 | $2,700,000 | $11,000[3] |
| Area 5 - NW HWY and Chatham Place | $200,000 | $800,000 | $1,000,000 | $50,000 |
| Area 6 - Chestnut Avenue, Vail Avenue, and Evergreen Avenue | $2,000,000 | - | $2,000,000 | $10,000 |
| Area 7 – Beverly Lane and Orchard Street | $125,000 | $300,000 | $425,000 | $32,000 |
| Area 8 – Westgate Subdivision | $700,000 | - | $700,000 | $10,000 |
| **Total** | **$4,325,000** | **$6,800,000** | **$11,125,000[4]** | |

[1]Costs do not include cost share of up to $7,500 from the residents
[2]Relief sewer improvements that are part of the overhead sewer alternative
[3]These $/Property do not account for multistory buildings that have multiple dwelling units
[4]Cost includes 50% share of overhead sewer installation from the residents. If the Village were to fund 100% of the private property overhead sewer improvements, the approximately $11 million cost would increase to approximately $15.5 million

The total cost of the relief sewer alternative is approximately $13 million and the overhead sewer alternative including Areas 3 and 4 relief sewers is approximately $11 million. The cost for the overhead sewer alternative assumes the Village continues its overhead sewer cost share program with the home owner and therefore the private component of the cost is not included in this total to provide a fair comparison to the relief sewer cost relative to the capital outlay required by the Village. Costs are similar in magnitude because several of the overhead sewer improvements also require minor relief sewer improvements to reduce the higher HGL during design rain events but the overhead sewer alternative is approximately 20 percent less expensive. With generally similar costs (if the homeowner costs are also considered), the selection of an appropriate alternative for the Village can be based more on which improvements best serves the Village's needs and the level of service it desires to provide to its residents than costs alone.

If the Village were to fund 100% of the private property overhead sewer improvements, the approximately $11 million cost for this alternative would increase to approximately $15.5 million.

Construction of new relief sewers provides the system with additional capacity and the desired level of service. However, larger rainfall events that exceed the Village design event could exceed the new relief sewer capacity and still result in basement backups in these and other areas of the Village.

Overhead sewers provide a significant upgrade in level of service to prevent basement backups. A home built today in the Village must include an overhead sewer for any living space below grade. Properties with overhead sewers provide a higher level of service than the current Village design standard and would not experience backups during rainfall events that exceed the design storm. However, if installation of overhead sewers does not occur in all of the properties within the problem area, basement backups would still occur to those homes without overhead sewer protection. A regional relief sewer provides protection to a determined level of service and all properties tributary to the relief sewer benefit from the improvement. However, if a rainfall event exceeds the design storm, properties within the area will still be susceptible to basement backups.

The final decision on which alternative is best for the Village is a policy decision that needs to be made at the Board level. To be consistent with current Village design standards and to provide equity to all its citizens, the relief sewer alternative may be the appropriate choice. Implementation of the relief sewer alternative would provide a uniform level of service from basement backups across the Village. However if this alternative is selected, it would still be prudent for the Village to continue its overhead sewer funding program so that residents with significant investments in their basement living areas can realize a level of protection that not only exceeds the minimum design standard for the Village but is also appropriate for their individual investment in their property.

## Short-Term Alternatives – Street Ponding Improvements

Short term recommendations also include implementation of improvements at three street ponding locations to provide protection from street ponding for the 2.59 inches in 1-hour storm event. Planning level Opinions of Probable Construction costs for the potential street ponding improvements are presented in **Table ES-7**.

**Table ES-7. Planning Level Opinions of Probable Construction Cost Estimates – Potential Street Ponding Improvements**

| Location | Estimated Design and Construction Cost | $/Property[1] |
|---|---|---|
| Race Avenue and Chicago Avenue | $900,000 | $2,600 |
| Campbell Street and Sigwalt Street (Downtown area)[3] | $2,700,000 | $11,000[2] |
| Roosevelt Avenue and Cleveland Avenue | $2,100,000 | $11,000 |
| **Total** | **$5,700,000[3]** | |

[1]Includes all the properties in the subbasin
[2]These $/Property do not account for multistory buildings that have multiple dwelling units
[3]If relief sewer improvements for Area 4 are implemented, the street ponding problem in this area is resolved and the total is $3M

## Long-Term Alternatives

The Village is planning to provide protection to the CSTA residents from basement backups for the Village's design storm event. The Village is also looking for ways to provide protection from storm events that exceed the current design storm event and to implement long term runoff and flow reduction practices. Below are some of the long term recommendations to provide a higher level of service to the CSTA residents and businesses.

### Downspout and Sump Pump Connections

Many downspout and sump pump connections in the CSTA area discharge storm water runoff directly into the combined sewers. In the CSTA, most of the downspout connections in the residential areas are disconnected while many downspouts serving commercial properties are directly connected into the

combined sewers and result in higher flows and HGL in the combined sewers. The Village ordinance states that:

- "All downspouts or roof drains shall discharge onto the ground or be connected to storm or combined sewers. No downspouts or roof drains shall be connected to the sanitary sewers"

The Village has done an excellent job of discouraging the downspout connections to the combined sewers in residential areas. In these areas downspouts are discharged on to lawn areas or the ground. By discharging on to lawn areas, the runoff infiltrates into the soil and the remaining runoff generally flows to nearby catch basins with inlet controls. When discharged on to the ground, the runoff also flows to nearby catch basins with inlet controls. These practices limit the amount of flow into the combined sewer and results in additional protection from basement backups. When feasible, CDM Smith recommends the Village disconnect those direct downspout connections from the combined sewers and continue to prohibit connections from new construction.

The Village ordinance also states that:

- "Sump pumps installed to receive and discharge ground waters or other storm waters shall be connected to the storm or combined sewers or discharge into a drainage ditch. Sump pumps installed to receive and discharge floor drain flow or other sanitary sewage shall be connected to the sanitary or combined sewers. A sump pump shall be used for one function only, either the discharge of storm waters or the discharge of sanitary sewage"

Sump pumps also contribute flows into the combined sewers but are a much smaller flow component than downspouts. Nonetheless, the Village should consider a sump pump disconnection program once all the downspout connections are disconnected.

Any such disconnection program would require a corresponding change to the two summarized sections of the Village code. The Village staff also notes that these types of disconnection programs can be intrusive and extremely unpopular with residents.

## Green Infrastructure

Green Infrastructure (GI) refers to stormwater management strategies that control the rate and volume of stormwater where it falls by encouraging additional infiltration and enhancing storage capacity. Common GI strategies include rain gardens, rain barrels, porous pavements, green roofs and grassed swales. While GI will be a part of the recommended CSTA improvement plan, it cannot be the entire improvement because it is insufficient for providing protection from the basement backups in the 2.1 inch, 1-hour design storm.

There are several reasons why the CSTA capacity issues cannot be solved using GI in the near term. The primary reason is that GI is based on managing stormwater where it falls, meaning that GI would need to be implemented on all land areas in the Village to have a substantial effect. In the near term, the Village is limited to implementing GI in the public right of way, which represents a small percentage of the land area in the CSTA. Much of the Village's land is street and sidewalk which will require a long time to convert to effective GI. A second problem is that many of the GI strategies are based on enhancing infiltration and these work best in highly permeable soils. Much of the soil in the Village has relatively low permeability.

GI components can complement the alternative components and provide environmental, economic and human health benefits. Most of the potential improvements include replacing the existing sewers, and in most cases include replacement of existing curb and gutter, and pavement. This provides an opportunity for street parkway rain gardens as shown in **Figure ES-7**. Rain gardens are watered by collected or pooled stormwater runoff, slowly infiltrating it into the ground along root pathways. They are typically planted

with wildflowers and deep-rooted native vegetation, which helps infiltrate rain channeled to them from roofs, driveways, streets, and other impervious surfaces, but they can also be simple grass-lined depressions that capture first-flush rain water to reduce pollutants and the volume of stormwater runoff. Projects using permeable pavements could also be explored on lightly traveled side streets, alleys and parking lots. The Village could also provide technical support to homeowners regarding the installation of rain barrels and the design of rain gardens.

**Figure ES-7. Street Rain Garden Concept Source: www.epa.gov**

Long term GI improvements in CSTA level of service could be achieved through widespread implementation of GI on private property. It is recommended that the Village develop incentives for commercial development to include bioretention facilities, permeable pavement, vegetated buffer and green roofs in new construction.

## ES.7 Funding Opportunities

The Village has been very proactive in providing its residents with protection from basement backups and has implemented several major sewer system improvement projects over the last 30+ years. The Village will be exploring funding opportunities, grants and loans for implementing basement backup and street ponding improvements. There are different funding sources that may present an opportunity for the implementation of the potential CSTA improvements. **Table ES-8** summarizes the potential available external and internal funding opportunities for the Village.

**Table ES-8. Potential Funding Opportunities for the Village**

| Funding Source | Funding Description |
|---|---|
| Illinois Environmental Protection Agency (IEPA) | The IEPA's Infrastructure Financial Assistance Section (IFAS) provides low interest loans through the State Revolving Fund (SRF). The SRF includes two loan programs: the Water Pollution Control Loan Program (WPCLP) which funds both wastewater and stormwater projects, and the Public Water Supply Loan Program (PWSLP) for drinking water projects. These programs are annually the recipients of federal capitalization funding which is combined with state matching funds, interest earnings, repayment money, and the sale of revenue bonds to form a perpetual source of financing for infrastructure projects. The WPCLP program provides financial assistance to eligible public or private applicants for the design and construction of a wide variety of projects that protect or improve the quality of Illinois' water resources. IEPA assists applicants with projects that address human health and failing water infrastructure. Eligible projects include new drinking water or wastewater infrastructure construction; upgrading or rehabilitating existing infrastructure; stormwater-related projects that benefit water quality; and a wide-variety of other projects that protect or improve the quality of Illinois's rivers, streams, and lakes. (http://www.epa.illinois.gov/topics/grants-loans/state-revolving-fund/index) |
| Illinois Environmental Protection Agency (IEPA) | The Illinois Green Infrastructure Grant Program for Stormwater Management (IGIG) provides grants to local units of government and organizations (storm sewer system or combined sewer overflow areas) to demonstrate green infrastructure best management practices to control stormwater runoff for water quality protection in Illinois. Currently the program is in a state of change. Once program specifics are finalized, information will be made available on the IEPA Web site. (http://www.epa.illinois.gov/topics/grants-loans/water-financial-assistance/igig/index) |
| Stormwater Utility | The Village can explore the option of establishing a Stormwater Utility. A Stormwater Utility provides a dedicated revenue source for stormwater management. A Stormwater Utility operates similarly to water service which are funded through service fees and administered separately from the general tax fund, ensuring stable and adequate funding for stormwater management services. |
| MWRDGC | MWRDGC has recently defined programs to provide funding assistance for GI and stormwater management projects and may provide funding opportunities once the specifics of the program are better defined and are distributed to municipalities in 2016. |