

City of

Prospect Heights



2013 Water System Study

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City of Prospect Heights, Illinois 2013 Water System Study

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EXECUTIVE SUMMARY

This Executive Summary provides highlights of the findings, conclusions and recommendations of this 2013 Water System Study.

1. The City of Prospect Heights retained Baxter & Woodman, Inc. to complete the 2013 Water System Study for an expansion of the City's existing water system to provide Lake Michigan water to the areas of the City currently served by private water wells or other Lake Michigan water providers.
2. The City of Prospect Heights owns and operates two supply connections with the Illinois-American Water Company; two ground storage reservoirs and a pumping station with re-chlorination equipment; and a water distribution system in the Rob Roy development, along Camp McDonald Road, Wheeling Road and Casa Court, and in the Lake Claire subdivision. The City's existing water system has approximately 1,080 service connections serving about 2,700 people.
3. The City is considering a Special Service Area 9 (SSA 9) project to install water mains west of Wheeling Road, which will increase the size of the existing water distribution system.
4. The City has an adequate Lake Michigan water supply to meet existing and future demands.
5. The City will need additional storage facilities and improvements to the City's water supply facilities to serve SSA 9 and future expansion of the system.
6. The City is considering a future expansion of the water system to include all areas of the City currently served by private water wells. There are approximately 2,140 residences (6,500 people), and commercial and institutional development to be served with an expansion of the existing system.
7. A water distribution system map and computer model was previously created to determine water main locations, sizes and capabilities to meet the ultimate goal of a Lake Michigan water supply for the Planning Area. The computer model was used to size water mains to provide adequate water volumes, flow rates and pressure for normal daily demands and fire protection. The expansion of the distribution system would include

12-inch and 8-inch water mains, valves, fire hydrants and service connections.

8. Additional water storage facilities consisting of two 750,000-gallon elevated water storage tanks would provide the City with adequate reserve storage capacity for emergencies and temporary supply interruptions. Several potential elevated storage tank locations have been identified and final site selection would be based on land availability and property acquisition.
9. Cost estimates were developed for improvements to expand the existing water supply, storage and distribution system for five sizes or phases of expansion. The sizes consisted of 300, 400, 500, 1,000 and 2,200 users. For the sake of space in this Executive Summary, the following is a summary of the opinions of probable cost for the 400 user (SSA 9) size and the 2,200 user (Ultimate Expansion) size:

Description	400 Users	2,200 Users
Water Supply Improvements	\$ 375,000	\$ 375,000
Water Storage Facility Improvements	\$ 1,900,000	\$ 3,665,000
Water Distribution System Improvements	\$ <u>9,077,000</u>	\$ <u>54,313,000</u>
Construction Cost Subtotal	\$11,352,000	\$58,353,000
Contingency	\$ <u>2,306,000</u>	\$ <u>11,671,000</u>
Opinion of Probable Construction Cost	\$13,658,000	\$70,024,000
Engineering	\$ 2,583,000	\$10,504,000
Legal and Administrative	\$ <u>121,000</u>	\$ <u>351,000</u>
Opinion of Probable Total Project Cost	\$16,362,000	\$80,879,000

The opinions of probable cost for the other three sizes/phases of water system expansion can be found in Appendix A of this report.

10. We recommend the City of Prospect Heights use this report for the planning, design and construction of water system facilities in SSA 9 and future expansions to serve all areas within the City currently served by private wells and neighboring municipal water supplies.

1. INTRODUCTION

1.1 Study Purpose and Scope

The purposes of this Water System Study were to:

- Review the City's Water System Master Plan, Water Rate Study, SSA 9 Feasibility Study, operation and maintenance records and information, and other relevant City water system documents;
- Evaluate the City of Prospect Heights' existing water supply, treatment, storage and distribution system to meet existing and future demands; and
- Identify and recommend improvements to expand the City's water system.

Evaluation of the expansion of the City's water system was to include a Sensitivity Analysis based on adding 300, 400, 500, 1,000 and 2,200 users to the system. The Evaluations are discussed in the following sections and the Sensitivity Analysis is included as Appendix A of this report.

This Study report can be used as a planning tool for the City of Prospect Heights, and provides sizes and general locations of water mains and water storage facilities required for expansion of the City's water system into areas currently served by private wells.

1.2 Planning Area

1.2.1 Boundaries - The Planning Area includes all areas within the City west of the railroad tracks and the small area south of Old Willow Road, from Wolf Road to the eastern City limits currently served by, or potentially served by an expansion of, the City's water system. The Planning Area includes 1) the Existing Area already served by

the City of Prospect Heights' water system; specifically a) the Rob Roy and neighboring developments, b) the residential development along Casa Court and c) SSA 6 (Lake Claire); and 2) the Expansion Area; specifically a) the small, isolated commercial and governmental services area served with Village of Mount Prospect water, b) the schools, commercial and other properties served by neighboring municipalities, but within City limits, and c) all properties currently served by private wells. Exhibit 1, enclosed in the back of this report, is a map of the Planning Area showing the areas served by the existing water system and the Expansion Area of the water distribution system.

1.2.2 Land Use - Land use within the Planning Area currently includes single family, and some low density multi-family, residential development; commercial development near Rand Road and Willow Road; City Hall, Police Station, Prospect Heights Fire Protection District (PHFD) building and Walgreens at Elmhurst Road and Camp McDonald Road; and churches and schools. In addition, there may be some minor infill commercial development at the intersections of some of the major roads within the City. The City of Prospect Heights is almost completely developed, except for some isolated vacant lots and unincorporated parcels located within or adjacent to existing City limits.

1.3 Water Distribution System Model

Baxter & Woodman previously developed a WaterCAD[®] water distribution system computer model of the City's water distribution system. The WaterCAD[®] model was used to determine recommended water main sizes to provide residential fire flow rates of 1,500 gallons per minute (gpm) and commercial area fire flow rates of 3,500

gpm, as well as normal daily water usage throughout the City's existing and future water system.

1.4 Population versus Population Equivalent

This Water System Study uses population equivalents (PE) to calculate existing and future capacity requirements. In general terms, a PE is a measure of water use applicable to both residential and non-residential use. For residential use, a flow of 100 gallons per capita per day (gpcpd) is used for sizing of water system facilities. In the case of non-residential use, a PE value is determined based on typical water usage for commercial or institutional customers. Because of the types of non-residential uses in the City of Prospect Heights and the lack of specific non-residential water use, a value of 10 PE per acre was used for non-residential development and a value of 20 gallons per student/staff per day was used for schools. These values are based on typical average non-residential water use seen in other municipal water systems.

2. EXISTING CONDITIONS

2.1 Population

The City of Prospect Heights is essentially fully developed, except for some isolated parcels throughout the City. The small increase in population and water demand attributable to any future development or annexation is negligible in sizing the water system facilities. The 2010 population of the City was approximately 16,300; with approximately 10,000 residents, and a few non-residential buildings at Elmhurst Road and Camp McDonald Road, already served with Lake Michigan water.

The portion of the Planning Area population to be served by a new expansion of the City's water system is estimated to be approximately 6,500 people living in approximately 2,140 single family houses. This population and number of houses are based on the previous 2000 population of 17,081 and the number of existing homes determined in the 2007 Water System Master Plan because of the population decrease in the 2010 census. In addition, there are approximately 60 acres of commercial development near the intersection of Rand Road and Willow Road and another 20 acres of non-residential development/potential development interspersed throughout the rest of the Planning Area.

2.2 Existing Water Supply

The City of Prospect Heights receives Lake Michigan water from the Illinois-American Water Company (IAWC) through a 12-inch connection on Camp McDonald Road and a 6-inch connection on Euclid Avenue. Water flows into the City's water

system at the two ground storage reservoirs at the pumping station on Camp McDonald Road.

Water is pumped out of the ground storage reservoirs using one or more of the four existing pumps at the pumping station. The four pumps have the following capacities:

Pump No. 1 (Variable speed)	150 gallons per minute
Pump No. 2 (Variable speed)	350 gallons per minute
Pump No. 3 (Constant speed)	2,000 gallons per minute
Pump No. 4 (Constant speed)	2,000 gallons per minute

When water pressure in the City's distribution system falls below approximately 50 pounds per square inch (psi) due to increased water usage; one of the variable speed pumps operates to increase water pressure. Operation of the pumps at the pumping station may or may not close the IAWC supply connections depending on the pressure and flow rate of the pumps, but during the time any of the pumps operate, the ground storage reservoirs are not being filled.

There are times when the pumps operate to draw water out of the reservoirs and when the pumps are shut off to allow the reservoirs to fill. This circulation of water in and out of the reservoirs eliminates stagnation of the water in the reservoirs, thereby providing higher quality water to the City's water customers.

The City's supply of water through the two connections is approximately 1,850 gpm. This supply flow rate is less than the 2,500 to 3,000 gpm fire flow rate suggested by the PHFD for the multi-family residences within the Rob Roy development. Therefore, the pumping station must be used to provide adequate flow rates for firefighting.

City residents and businesses not currently served with Lake Michigan water obtain their water from private water wells on each individual property. Fire protection is provided by the PHFD with pumper/tank trucks obtaining water from the nearest public water supply or ponds/lakes in the area.

2.3 Existing Water Usage

A water system's total water usage includes not only the quantity of water actually metered and billed to customers; but also water used at the treatment plant, water main and service line leakage, water not registered on individual meters, and water used for water and sewerage system maintenance, fire protection and construction. The City's Public Works Water Department provided us with an average daily total water usage of 142,700 gallons per day (gpd) for 2012.

2.4 Existing Water Treatment

The City monitors chlorine levels in the water leaving the pumping station, and if required, re-chlorinates the water to meet Illinois Environmental Protection Agency (IEPA) standards. The re-chlorination system is automatic and consists of a chlorine analyzer to determine the chlorine concentration in the water and chlorine supply equipment to add chlorine to the water as required.

Lake Michigan water supplied by the Village of Mount Prospect at the intersection of Elmhurst Road and Camp McDonald Road is previously treated water and does not require any additional treatment due to its immediate use by the various commercial and governmental buildings at this intersection.

Any treatment of private well water is done on an individual basis as determined by the property owner or water user.

2.5 Existing Water Storage

The City of Prospect Heights has two ground storage reservoirs located on Camp McDonald Road at the northeast corner of the Rob Roy development. The east tank has a 300,000-gallon capacity, while the west tank has a 250,000-gallon capacity for a combined capacity of 550,000 gallons. These two tanks can be operated individually to allow maintenance of one tank while the other tank provides water storage capabilities.

2.6 Existing Water Distribution System

A water distribution system has two main functions: 1) to convey water at adequate pressure and flow rates to meet daily demands; and 2) to convey water to meet required fire suppression flow rates while maintaining minimum water pressure. To meet these two needs, water mains must be sized to meet fire suppression flow rates. The computer model of the City's existing and proposed water distribution systems was previously used to determine the sizes of the water mains. A map of the City's water distribution system and the water distribution system for the Expansion Area is shown in Exhibit 1.

In addition to adequate sizing of water mains, the distribution system must operate with a hydraulic grade line (pressure) adequate to provide desired system pressure, without excessive pressure. The static hydraulic grade line of a water system would be equal to the elevation of the water surface in an elevated water storage tank, if an elevated tank was present in the system.

The water pressure at any point in the distribution system is the difference between the operating "hydraulic grade" and the ground elevation at that point. The hydraulic grade in the Prospect Heights existing system is established by the water

pressure of the IAWC supply connections or by the pump(s) at the pumping station. The hydraulic grade/pressure established by the pumping station is controlled by a system which increases or decreases the speed of the variable speed pump(s) to meet changes in demand.

2.7 Water Rates

As part of this Study, we reviewed the City's 2012 Water Rate Study. We agree with the methodology of the Water Rate Study and with the recommendations made in the Water Rate Study. Water rates need to provide funding for operation expenses and several reserve accounts, and the City should be moving toward annual reviews and increases in water rates as required and based on those reviews.

As discussed in the Water Rate Study, the largest portion of water rates is related to the cost of water purchased from the IAWC. A clear summary of the various items which make up a monthly water bill allow customers to understand approximately half of their water bill is a pass-through cost from IAWC, which is not under the control of the City.

The Water Rate Study stated there were no planned expansions to the City's water system through 2017. This statement may or may not be true depending on the process and progress of the SSA 9 project. This Study's work and this report may be used to facilitate the implementation of SSA 9 and its construction.

3. FUTURE CONDITIONS

3.1 Study Area

Descriptions of the Planning Area and Expansion Area limits, land use, population and non-residential PE used in this Water System Study report are contained in Sections 1 and 2.

3.2 Residential Population

The population of the City of Prospect Heights is currently listed as 16,300. As discussed previously, the population of Prospect Heights could increase from the current population to a population similar to that of the 2000 Census, or about 17,100 or slightly higher. The Planning Area population to be served by a new, expanded water system is estimated to be approximately 6,500 people living in approximately 2,140 single family houses.

3.3 Non-Residential Development

As with the residential population, the non-residential PE is expected to remain fairly constant for existing and future conditions. There are approximately 60 acres of commercial development around the intersection of Rand Road and Willow Road and another 20 acres spread throughout the rest of the Planning Area.

3.4 Future Water Usage

3.4.1 Residential Water Usage - The population to be served by the expanded water system was estimated by the City in 2007 to be approximately 6,500 people.

Using an average water usage of 100 gpcpd, the Average Daily Demand (ADD) for residential customers would be approximately 650,000 gallons.

3.4.2 Non-residential Water Usage - As discussed previously, there are approximately 80 acres of commercial development and 4 schools in the City of Prospect Heights. The commercial development is estimated to have a PE of 10 PE per acre for a total ADD of 800 PE, or 80,000 gpd. The schools have an estimated student and staff population of approximately 1,600 people (1,490 students and 105 teachers). Water usage for schools with cafeterias, gymnasiums and showers is estimated at 20 gpcpd for a total ADD for the schools of 32,000 gpd (320 PE). Although the schools have existing Lake Michigan water supplies from various Lake Michigan water providers other than the City of Prospect Heights, it is prudent to include the schools as future customers and users of the City's water system. Therefore, the total non-residential water usage for the future water system expansion is estimated to be approximately 112,000 gpd, or 1,120 PE.

3.4.3 Total Water Usage and Demands - The total ADD for the water system expansion in the Planning Area is estimated to be approximately 952,000 gpd (144,000 gpd existing + 650,000 gpd residential + 112,000 gpd non-residential = 906,000 gpd), or 0.906 million gallons per day (MGD). These water usage and demand values are shown in the column for the Ultimate Expansion (2,200 users) in Appendix A of this report.

4. EVALUATION OF WATER SYSTEM FACILITIES

4.1 General Evaluation Criteria

The City's water system was analyzed for ADD, maximum daily demand (MDD) and peak hourly demand (PHD). In addition, flow rates and volumes for firefighting purposes were also used to evaluate the water system.

The ADD for the City's ultimate expansion is 906,000 gpd, or 0.906 MGD.

The national average ratio of MDD to ADD is approximately 1.75. For smaller water systems such as Prospect Heights' system, the ratio should be increased because of increased variation in flow rates in a smaller system. For purposes of this Study, a ratio of 2.0 was used to analyze the system for future conditions. Therefore, the future MDD will be approximately 1,812,000 gpd, or 1.812 MGD.

Experience with other communities indicates PHDs are approximately 2.75 to 3.25 times ADD, and we have used a ratio of 3.0 for this Study. Therefore, the PHD for the expanded water system in the Planning Area is 2,718,000 gpd, or 113,300 gallons per hour (gph).

The values for ADD, MDD and PHD are shown in Lines 11, 12 and 13 of Appendix A for each of the five sizes of expansion (300, 400, 500, 1,000 and 2,200 users) to be analyzed, evaluated and included in the Sensitivity Analysis.

4.2 Lake Michigan Water Allocation and Supply

The IAWC and the City have an existing Water Supply Agreement with terms through the year 2020. IAWC is obligated to provide the quantity of water listed in the Agreement and as shown below:

TABLE 1

City of Prospect Heights/Illinois-American Water Company
Water Supply Agreement Water Demands

<u>Accounting Period</u>	<u>Average Day Water Quantity (MGD)</u>	<u>Maximum Day Water Demand (MGD)</u>
October 2006 – September 2007	0.57	1.14
October 2007 – September 2008	0.57	1.14
October 2008 – September 2009	0.57	1.14
October 2009 – September 2010	0.57	1.14
October 2010 – September 2020	0.94	1.88

As stated in the City/IAWC Agreement, the quantity of Lake Michigan water taken by the City in any one accounting period may be up to 15 percent more than the Average Day Water Quantity for the corresponding accounting period. Also, in any given day, IAWC may transmit more than the Maximum Day Water Demand, although IAWC is not obligated to supply more than one day of Maximum Day Water Demand during any one accounting period.

The ADD and MDD for the expanded water system are 0.906 MGD and 1.812 MGD, respectively. Even without the additional 15 percent increase in the Average Day Water Quantity; the available 0.94 MGD water supply and Lake Michigan Water Allocation is more than adequate for the 0.906 MGD ADD. As shown in the above table, the 1.88 MGD on any given maximum day is more than adequate for the MDD of 1.812 MGD. These values are also shown in Appendix A in Lines 14A and 14B, along with

notes to indicate the IAWC water supply is adequate for the ultimate expansion of the City's water system.

4.3 City Water Supply

As discussed above, the Lake Michigan Water allocation is adequate for the City's normal water consumption, but the Lake Michigan and City supply/connection capacities also need to be evaluated. A comparison of supply capacities and daily demands is included in Appendix A as Line 15C, with notes to indicate the adequacy or deficiency of the City's water supply system. As shown in Appendix A, the City's supply connections will not provide enough water to meet future demands with the largest (the 12-inch water main along Camp McDonald Road) supply out of service. In that case, the City would need to implement emergency water restrictions to minimize water use, or rely on additional storage facilities to provide water needed for MDDs.

If the supply from Mount Prospect is included in the City's water supply, which it should be with the SSA 9 expansion to Elmhurst Road and Camp McDonald Road; additional water would be available to meet daily demands. As shown in Line 16D of Appendix A, the ADD for ultimate expansion could be met even with the proposed 12-inch supply connection out of service, but the MDD still could not be provided. Therefore, the supply connection with Mount Prospect should be reconfigured as a secondary/redundant supply of Lake Michigan water as part of the expansion of the City's water system. Normally, all Lake Michigan water would be provided by IAWC, and the Mount Prospect connection would remain closed. The Mount Prospect supply connection would be used only in the event of a supply interruption from IAWC or other

supply emergency, and upon notification from the City to the Village as established in an Intergovernmental Agreement.

Many communities with Lake Michigan water do not have adequately sized redundant water supplies and establish interconnections with neighboring communities for secondary/emergency water supplies. The ultimate expansion of the water system could, and should, include interconnections to at least one neighboring municipal water system to provide a reliable water supply for the City's water system.

We also evaluated the existing pumping station and pump capacity relative to PHD and fire flows. As shown in Line 17E of Appendix A, the existing pumps will be deficient in providing adequate fire flows for the expansion of the water system. Recommendations to increase the water supply for fire protection include replacing the pumps and motors and/or constructing an elevated tank(s), and will be discussed in the next section of this report.

4.4 Treatment Facilities

Water treatment for the future water system would continue to consist of re-chlorination facilities at the pumping station. The capacity of the equipment would need to be increased, but the scheme of analyzing the water being pumped from the ground storage reservoirs and adding chlorine as required would remain the same.

It is anticipated elevated water storage tanks would be constructed as part of the expanded water system. Operation of the pumping station, water system and elevated tanks would include regular and consistent drawdown of the ground storage reservoirs and elevated tank(s) during the day; and filling of the reservoirs and elevated tank(s) during the night to ensure a constant turnover of water in the storage facilities.

Future water system operation would determine the amount of re-chlorination needed in the system, but it is anticipated the volume of water in elevated water storage tanks and in the water distribution system would result in a need for re-chlorination. Re-chlorination facilities should be included as part of any elevated water storage tank construction.

4.5 Storage Facilities

Water storage facilities provide the following: 1) Water to meet PHDs; 2) Water for fire protection; 3) Water as reserve capacity for consumption during peak flow events and/or emergencies; and 4) Water during periods when the supply is interrupted for an extended period of time. The volumes of water to be stored for the first three purposes are cumulative as their need may occur simultaneously. The volume required for the supply interruptions is often significant and it would be combined with the maximum volume required for any one of the first three purposes to provide a volume of water to meet any anticipated demand or emergency situation.

4.5.1 Peak Hourly Demand - Storage facilities should be capable of providing the difference between the water supply rate and the PHD for a specific length of time. We recommend storage facility volume be sufficient to provide the difference in the water supply rate and the PHD rate for a period of at least eight hours. The volumes of water to provide the PHD for the various sizes of water system expansion are shown in Appendix A, Line 19A.

4.5.2 Fire Flow Demand - The storage volume required for fire protection is dependent on the fire flow rate and the duration of the firefighting efforts. The maximum fire flow rate, as established by the Insurance Services Office (ISO), is 3,500

gpm in commercial areas for a duration of 3 hours. In addition to ISO criteria, the PHFD stated they are looking for a water system capable of delivering 3,500 gpm to commercial, institutional (schools) and other non-residential development. Therefore, the maximum volume of water recommended for fire protection is 630,000 gallons (3,500 gpm x 60 minutes/hour x 3 hours = 630,000 gallons). The volumes of water needed for fire protection in the existing and water system expansions are shown in Appendix A, Line 19C.

4.5.3 Reserve Capacity - The third concurrent purpose of storage is to provide a reserve supply of water to meet the consumption demands during emergencies. Normally, about 20 percent of the total storage capacity is reserved for this purpose. Mathematically, the reserve capacity would be equal to 25 percent of the volume required for PHD and fire protection. The volumes of water needed for reserve capacity in the existing and water system expansions are shown in Appendix A, Line 19D.

4.5.4 Cumulative Storage - As mentioned above, volumes of water to be stored for the three purposes of PHD, fire protection and a reserve capacity are cumulative as their need may occur simultaneously. As shown in Appendix A, the Sensitivity Analysis, Line 19E, existing storage facilities are deficient for any expansion of the water system. Therefore, additional storage facilities will be required, and will be discussed in Section 5 of this report.

4.5.5 Supply Interruption - A water system's storage facilities should also provide an adequate volume of water to provide water in the event of an interruption to the water supply. Current regulations of the State of Illinois require a minimum of one day of ADD to be in storage. However, many communities, water providers and

consulting engineers consider it prudent to have at least two days of ADD in storage. We recommend the City have at least two days of ADD, plus the volume required to meet the maximum of the first three purposes of storage facilities discussed above. This volume can be reduced with a reliable source of water being available for the two day interruption of the normal supply of water.

As discussed previously, future expansion of the City's water system should include the reconfiguration of the Mount Prospect connection as an emergency water supply for the City. This would provide a secondary, reliable water supply because it would be highly unlikely that both the IAWC and Mount Prospect supplies would be interrupted at the same time as these two Lake Michigan water providers obtain their water from two separate sources.

A reasonable estimate of the capacity of the 8-inch Mount Prospect connection is approximately 450 gpm, or a volume of approximately 1,296,000 gallons over a two day period. This emergency supply of water would reduce the total required volume of water storage to be provided for supply interruptions in the expansion of the water system.

The volumes of water to be in storage for a supply interruption, in addition to the largest volume for PHD, fire protection or reserve capacity, are shown in Appendix A, Line 20B. These values are the total volume of storage required if the IAWC supply connections were out of service at the same time, but with the Mount Prospect emergency connection in operation.

4.5.6 Required Storage - As shown in Line 19E of Appendix A, even the existing ground storage reservoirs are marginally deficient for existing needs. Therefore, any

expansion to the City's water system needs to include at least one additional storage facility as discussed below. The ultimate expansion of the water system would require 1,208,000 gallons of total storage volume with the largest storage facility out of service as shown in Line 20B of Appendix A.

The City currently has two ground storage reservoirs at the Camp McDonald Road pumping station with a combined volume of 550,000 gallons. The ultimate expansion of the City's water system would require a total volume of 1,208,000 gallons, leaving a future requirement of approximately 658,000 gallons of additional storage (1,208,000 gallons - 550,000 gallons = 658,000 gallons).

As shown in Line 17E of Appendix A, the existing pumps at the pumping station are inadequately sized to provide fire flow rates for future expansion of the water system. A new water storage facility should either be provided with higher capacity pumps, or the new storage facility should be an elevated tank. An elevated tank provides adequate fire flows and pressures immediately upon demand because of the availability of a large volume of water held above the water distribution system.

Storage facilities are normally sized in increments of 100,000 gallons for small facilities up to approximately 500,000 gallons, and in increments of 250,000 gallons, for larger structures. Therefore, the City's future water system should have an additional 750,000 gallons of water storage to provide the 658,000 gallons of additional storage.

At times, water storage reservoirs and elevated tanks must be taken out of service for repair or repainting, which can keep a reservoir or tank out of service for up to 4 or 6 months. In communities similar to Prospect Heights, it is often advisable to have sufficient storage to meet the storage requirements with the largest tank out of

service. Consequently, it is desirable to eventually have two new storage facilities, each with a capacity of 750,000 gallons. Communities with similar size and population to Prospect Heights, and even smaller communities, often have at least two elevated storage tanks as part of their water system.

Although it would be preferable to have the two future elevated tanks designed and constructed as one project, this is rarely economically feasible. It appears the second elevated tank should be considered near the time that approximately one half of the expansion area is provided with water mains. The location of the two elevated tanks and their connecting water mains, and the size of future expansion phases, would be determining factors as to when the second tank would be constructed.

4.6 Distribution System

Water distribution systems are designed to supply both domestic and fire suppression needs of a community. The sizes (diameters) of the pipes in the system are determined by the fire suppression flow rates because those rates are significantly higher than domestic needs. However, overly large distribution system mains can contribute to water quality problems if the water is allowed to stagnate in the pipes. Consequently, care must be taken to adequately size the mains to meet demands while maintaining a sufficient flow of water through the mains to maintain water quality.

4.6.1 Existing Distribution System Improvements - The existing water distribution system in the Rob Roy development; along Camp McDonald Road, Wheeling Road and Casa Court; and in the Lake Claire subdivision are adequately sized to meet existing and future domestic and fire protection needs and no improvements to the existing system are necessary.

4.6.2 Future Distribution System for Expansion Area - The future water distribution system is shown schematically in Exhibit 1, as are the City's existing water mains. The locations of the water mains were previously discussed with City staff and the sizes were established with the City's WaterCAD[®] water system computer model. The layout of the water mains was meant to provide water main looping of larger diameter mains along the main roads and in commercial areas, and to provide smaller water mains to serve development along the City's local streets and throughout the neighborhoods.

5. DISCUSSION OF IMPROVEMENTS

5.1 General

Following are brief discussions of the improvements necessary for future expansions of the City's water system and for the entire Planning Area. More detailed discussions and descriptions were included in the 2007 Water System Master Plan.

5.2 Water Supply

Currently, the City usually uses IAWC water pressure as the hydraulic grade line for its distribution system. With continued expansion of the water system, the existing IAWC system pressure will not be adequate due to planned increased water pressure in the water distribution system. Two alternatives were considered to increase the water pressure; and a brief economic analysis of energy cost savings versus costs to remodel the pumping station as a booster pumping station, abandon the existing reservoirs and increase the size of new storage facilities; was completed. That analysis showed the improvement costs of a booster pumping station exceeded the anticipated energy savings of the booster pumping station. The conclusion of the analysis was the existing pumping station and ground storage reservoirs should continue to be used as part of the City's water supply system.

The continued use of the existing pumping station with the higher pressure and increased pumping rates for the future water system would require modifications consisting of replacement pumps and motors, piping/plumbing changes, an upgraded electrical and motor drive system, and improvements to the supervisory control and

data acquisition (SCADA) system. In addition, the existing IAWC water supply connection on Euclid Avenue and the connection to Mount Prospect's water system should include provisions for temporary pumping equipment.

5.3 Water Treatment

As discussed above, Lake Michigan water received from IAWC is treated prior to delivery to the City, and the only treatment anticipated for the future water system would be re-chlorination facilities at the existing pumping station site. The operation of the expanded future water system may require re-chlorination facilities at the additional water storage facilities, but the need for such facilities could be determined after there is some operating history. The design and construction of future storage facilities should include provisions for treatment facilities consisting of re-chlorination equipment and piping.

5.4 Water Storage

To meet PHD and fire suppression demands throughout the City's water system, additional storage is required. As discussed previously, the recommended water system expansion includes two new storage facilities. The future ultimate water system should include two elevated storage tanks to allow the system to "float" on the pressure provided by the elevated tanks.

The storage volume required for the future water system was determined to be 750,000 gallons provided by each one of two elevated water storage tanks for redundancy in the water storage facilities. The existing pumping station and ground storage reservoirs would continue to be used and would be controlled by the water level in one or both of the elevated tanks.

One of the challenges to locating elevated storage tanks is balancing the aesthetic and operational needs of the community. During a Water System Master Plan meeting with City staff, and another meeting with staff for this project, eight locations were selected as potential locations for elevated tanks. These potential locations are shown in Exhibit 1. The most advantageous site for an elevated tank was determined to be in the commercial development near the intersection of Rand Road and Willow Road. If possible, the second elevated tank should be located at one of the various sites along or near Palatine Road. Discussions with property owners and neighbors would dictate which sites could be acquired for siting of the elevated tanks. For purposes of this Study, the first elevated tank would be located along Palatine Road to correspond to the proposed SSA 9 limits.

5.5 Water Distribution System

The water distribution system expansion was developed and sized to provide adequate fire flow rates and domestic water supply with adequate pressure to all portions of the City. The distribution system is shown in Exhibit 1 and provides fire flow rates of 1,500 gpm for residential development and 3,500 gpm for commercial/institutional development at a minimum 20 psi residual pressure in the system during a large fire flow. Normal minimum pressure in the system would be 35 psi, with a maximum normal operating pressure of 75 psi.

The ultimate expansion of the water distribution system would consist of approximately 61,000 feet of 12-inch and 176,000 feet of 8-inch water main pipe; approximately 470 main line valves; approximately 770 fire hydrants, and the

installation of approximately 2,200 water service lines and connections to the new water mains.

As shown in Exhibit 1, some portions of the water mains would be constructed outside City limits, through other municipal or unincorporated Cook County rights-of-way. Following completion of the 2007 Water System Master Plan, concern has been expressed about dead-end water mains in cul-de-sacs. We have included additional 8-inch pipe to provide a looped water main in and around each cul-de-sac. The length of some of these looped water mains could be reduced at the time of final design by the acquisition of easements in various locations.

Approximately one half of the water mains are anticipated to be installed in open cut trenches, with the other half installed with trenchless technologies such as horizontal directional drilling and boring and jacking of casing pipes. Actual installation methods would be based on the results of soil borings, utility locations, wetland delineations and final alignment/location of the water mains. The design and construction of the distribution system would include site specific construction such as creek crossings, tree tunneling, sanitary and storm sewer replacement, and complete surface restoration.

5.6 Water System Operation and Permitting

The operation of the expanded water system would be similar to the existing system, although the addition of an elevated storage tank(s) would require some changes. However, these changes would be mostly limited to the initial start-up of new pumps, pump control systems and SCADA. Once operational, an elevated tank has minimal operation and maintenance requirements other than inspections and

painting/coating. The new pumps, motors and controls would function much as they do now. The additional water mains would function just like the existing water mains.

The engineer doing the design of the expanded system would work with the City's staff to determine the City's wishes and needs, and would design the system to meet those conditions. There would be some startup time and effort, and most likely be some trial and error, in determining the pressures/tank levels used to control the pumps and re-chlorination system. The City's SCADA system would be expanded and would, most likely, be used to control the system on a day-to-day basis.

Permitting of the project would include the usual IEPA – Division of Public Water Supplies permit(s) and Cook County highway permits. Depending on the size, location and pipe installation method of the project; Corps of Engineers, Illinois Department of Natural Resources, IEPA, IEPA-NOI and SWPPP permits might be required. In addition, in those locations where the water mains would be installed through other municipalities or in unincorporated Cook County, additional permitting would be necessary.

The City already has a water system, and the expansion of the system would not result in any additional or changed regulatory requirements. Once constructed, the expanded system would operate under an IEPA Operating Permit as currently operated. The additional facilities might increase reporting requirements, but there would be no undue or extraordinary regulatory impacts to the City or its Public Works Department.

6. ENGINEER'S OPINION OF PROBABLE COST

6.1 General

The opinions of probable cost presented in this report are based on 2013 costs. We recommend costs be reviewed and updated prior to the design and construction of each phase of water system expansion improvements.

Unit prices for water main construction were based on bids received for the City's SSA 6 project and were averaged and rounded to provide the unit prices in the Opinions of Probable Construction Cost. We then updated and increased costs using two sources of a Construction Cost Index.

The unit costs include mobilization and demobilization, general conditions, and overhead and profit. The bidding documents could include separate line items for these three items of work. If these items are included as line items in the bids, payment of these items should be based on the percentage of total project completed rather than an up-front payment when the Contractor begins construction.

6.2 Construction and Project Cost Summary

The supply, storage and water distribution facilities necessary to provide Lake Michigan water for the five sizes of water system expansion were discussed in various previous sections of this report. Detailed, itemized opinions of probable construction cost for these improvements are included as Appendices B, C, D and E.

Costs of improvements to the City's supply facilities are presented in Appendix B, and are included for each of the five sizes of system expansion in Appendix A of this

report. As shown in Appendix A, the supply improvements are the same, and necessary, for any and all sizes of the water system expansion.

Storage improvement costs are included in Appendix C. We have shown the cost to construct both elevated tanks as one project, and also a cost to construct one elevated tank as part of the first expansion of the water system. It is unlikely funding would be available to construct both elevated tanks and the connecting water mains between the two tanks and the expanded water system. Therefore, the second tank has been considered as a portion of the ultimate expansion of the system; to be constructed at the time approximately 1,000 users have been added to the City's existing water system. As discussed above, all sizes of expansion up to and including the 1,000 user size include the construction of one elevated tank, with its location at a site along Palatine Road. The ultimate expansion of the water system includes the construction of two elevated tanks.

Construction costs for an expansion to serve 400 users and to serve 2,200 users are included in Appendix D and E, respectively. Pay item quantities were developed for the 400 and 2,200 user sizes of water system expansion because the former is approximately equal to the number of users in proposed SSA 9, while the latter is the ultimate expansion of water system. We also developed a detailed pay item list for the 300 user size, in addition to the 400 user pay item list in Appendix D, because the general area of these two sizes of expansion were better defined than the 500 and 1,000 user sizes. The 400 user expansion included some additional water main installed by horizontal directional drilling (HDD) methods along the Slough and Hillcrest Lake. The 300 user expansion, as well as the 400 user expansion, included 12-inch pipes around

the perimeter of the area bounded by Wheeling Road, Palatine Road, Elmhurst Road and Camp McDonald Road. This loop of 12-inch pipe would be needed to connect a new elevated tank on Palatine Road to the expansion area. As with the supply and storage improvements, Appendix A includes costs for the five various sizes of water distribution system expansion.

Appendix A includes costs for construction; contingency; engineering, including survey, design, permitting, construction administration, and observations of construction; and legal and administration for each of the five sizes of water system expansion. Table 2 is a summary of the construction and total project costs for the five sizes of expansion of the City's water system.

TABLE 2

Opinions of Probable Project Cost

Description	300 Users	400 Users	500 Users	1,000 Users	2,200 Users
Water Supply Improvements	\$ 375,000	\$ 375,000	\$ 375,000	\$ 375,000	\$ 375,000
Water Storage Facility Improvements	\$ 1,900,000	\$ 1,900,000	\$ 1,900,000	\$ 1,900,000	\$ 3,665,000
Water Distribution System Improvements	\$ 6,648,000	\$ 9,077,000	\$11,600,000	\$24,160,000	\$54,313,000
Construction Cost Subtotal	\$ 8,923,000	\$11,352,000	\$13,875,000	\$26,435,000	\$58,353,000
Contingency	\$ 1,785,000	\$ 2,306,000	\$ 2,826,000	\$ 5,428,000	\$11,671,000
Opinion of Probable Construction Cost	\$10,708,000	\$13,658,000	\$16,701,000	\$31,863,000	\$70,024,000
Engineering	\$ 2,142,000	\$ 2,583,000	\$ 3,023,000	\$ 5,223,000	\$10,504,000
Legal and Administrative	\$ 108,000	\$ 121,000	\$ 134,000	\$ 198,000	\$ 351,000
Opinion of Probable Total Project Cost	\$12,958,000	\$16,362,000	\$19,858,000	\$37,284,000	\$80,879,000

* The costs for the water storage facilities shown above do not include the cost of land acquisition. The locations of the tanks are unknown at this time; as is the zoning, land use or cooperation of the land owners of the potential sites. The land area needed to operate and maintain each of the two elevated tanks is approximately ¼ to ½ acre, while the total area temporarily needed for construction of each tank is between ¾ and 1-acre. The cost of the land acquisition could vary from high costs for commercial property to no cost for land donated to the City.

Though the scope of this Study did not include a determination or discussion of the cost of the project per user, we believe a brief discussion of cost per user trends in the Sensitivity Analysis is in order. The construction cost of water distribution system improvements per user went up as the project size increased, which would usually not be expected. The ultimate expansion of the water system includes numerous water mains located along the City limits, with services on only one side of the water main. This makes the per user cost of the water mains up to twice as expensive as a typical water main located along a local, interior street with development on both sides of the street. These relatively expensive water mains for the ultimate expansion also increased the costs of the 500 and 1,000 user estimates because the costs for water distribution system improvements were interpolated between the 400 and 2,200 user costs.

The water distribution system improvement costs per user for the 300 user size of expansion were also less than the 400 user size. A review of the anticipated location of the additional 100 users indicated the additional length of water mains was not offset by a similar increase in the number of services. In addition, the increase in HDD installed water mains combined with a limited number of service connections on one side of the water mains (water mains along Hillcrest Lake) all combined to increase the per user cost between the 400 user and 300 user sizes of expansion.

However, as expected, the opinion of probable construction cost per user went down as the size of the project increased. This was due to costs for the supply and storage facility improvements being added to the water distribution system

improvements. In addition, we accounted for reduced percentages for contingencies as the sizes of the projects increased.

As shown in Appendix A, we also reduced engineering and legal and administrative percentages as the size of the projects increased. This also reduced the costs per user as the project increased in size. Reducing percentages for these “soft” costs is common practice, and is based on some costs being fixed regardless of the size of the project. For example, the cost to produce a set of specifications or detail sheets for a project is basically the same whether 100 feet of pipe or 10,000 feet of pipe is to be installed.

The costs present herein are meant to provide a basis for any bonds or other funding of City of Prospect Heights’ water system expansions. The costs presented in this report and appendices do **not** include any interest, bond, or consulting costs or fees to establish and administer a Special Services Area.

7. RECOMMENDATIONS

The following are our recommendations for the City of Prospect Heights:

1. Use this Study Report for planning, design and construction of water system expansion facilities if the City decides to serve portions or all of the Expansion Area with Lake Michigan water. Exhibit 1 should be used to establish required water main locations and sizes for any future Special Service Areas or other expansions of the water system.
2. At the time the next water system expansion design is imminent, and when construction would soon follow:
 - a. Enter into an Intergovernmental Agreement with Mount Prospect for the secondary (emergency) water system interconnection, if the expansion will include the intersection of Elmhurst Road and Camp McDonald Road.
 - b. File a notification with the Federal Aviation Administration during the planning/design phase of an elevated tank project.
3. Determine if the Water Department budget can include future improvements consisting of flushing stations and sampling stations to minimize water quality problems, and to verify water quality, on dead-end mains. Consider an option to construct a second water main parallel to existing water mains along cul-de-sacs to loop dead-end water mains in cul-de-sacs.
4. Whether or not future water system expansions are constructed, adjust water user fees annually in accordance with recommendations in the City's 2012 Water Rate Study.

**City of Prospect Heights, Illinois
2013 Water System Study
Sensitivity Analysis**

1	Number of Water Users	Existing Water System 1,080	Water System Expansion Area (Number of Additional Users)										
			300			400 (Approx. equal to SSA 9)		500		1,000		2,200 (Ultimate ⁵ Expansion)	
			Residential	Commercial and Institutional	Residential	Commercial and Institutional	Residential	Commercial and Institutional	Residential	Commercial and Institutional	Residential	Commercial and Institutional	
2	Estimated Number of Residential Users	1,076	283		380		476		959		2,140		
3	Estimated Non-Residential Acreage	4		17	20		24		41		80		
4	Estimated number of School students and staff	0		0	0		0		0		1,600		
5	Residential PE	2,700	900		1,200		1,500		2,900		6,500		
6	Non-Residential PE	10		40	80		120		320		800		
7	School PE (Upon completion of expansion)	0		0	0		0		0		320		
			300			400		500		1,000		2,200	
8	PE for Existing City System based on Actual Average Daily Demand (ADD) for 2012	1,437											
9	PE for Expansion Area based on Ultimate PE total from 2007 Water Master Plan	0	940		1,280		1,620		3,220		7,620		
10	Total PE for Existing City and Expansion Area Water System	1,437	2,377		2,717		3,057		4,657		9,057		
11A	Average Daily Demand (ADD - gpd ¹)	144,000	238,000		272,000		306,000		466,000		906,000		
11B	Average Daily Demand (ADD - MGD ²)	0.144	0.238		0.272		0.306		0.466		0.906		
11C	Average Daily Demand (ADD - gpm ³)	100	170		190		220		330		630		
12A	Maximum Daily Demand (MDD - gpd)	288,000	476,000		544,000		612,000		932,000		1,812,000		
12B	Maximum Daily Demand (MDD - MGD)	0.288	0.476		0.544		0.612		0.932		1.812		
12C	Maximum Daily Demand (MDD - gpm)	200	340		380		430		650		1,260		
13A	Peak Hourly Demand (PHD - gph ⁴)	18,000	29,800		34,000		38,300		58,300		113,300		
13B	Peak Hourly Demand (PHD - gpm)	300	500		570		640		980		1,890		
Evaluation and Analyses:													
Illinois-American Water Company Supply													
14A	Lake Michigan Water Allocation - Average Day	940,000											
	Compare Line 14A to Line 11A - ADD	Adequate	Adequate		Adequate		Adequate		Adequate		Adequate		
14B	Lake Michigan Water Allocation - Maximum Day	1,880,000											
	Compare Line 14B to Line 12A - MDD	Adequate	Adequate		Adequate		Adequate		Adequate		Adequate		
City Water Supply													
Existing Supply													
15A	IAWC - Camp McDonald Road 12" - gpm	1,400											
15B	IAWC - Euclid Avenue (Standby) 6" - gpm	450											
15C	Capacity of Existing Supply, with largest supply out of service - gpm	450											
	Compare Line 15C to Line 11C - ADD	Adequate	Adequate		Adequate		Adequate		Adequate		Deficient		
	Compare Line 15C to Line 12C - MDD	Adequate	Adequate		Adequate		Adequate		Deficient		Deficient		
Future Supply after water system expansion to the intersection of Elmhurst Road and Camp McDonald Road													
16A	IAWC - Camp McDonald Road 12" - gpm	1,400											
16B	IAWC - Euclid Avenue (Standby) 6" - gpm	450											
16C	Mount Prospect - Elmhurst Road - 8" - gpm	450											
16D	Capacity of Existing / Emergency Supply after expansion of water system, with largest supply out of service - gpm	900											
	Compare Line 16D to Line 11C - ADD	-	Adequate		Adequate		Adequate		Adequate		Adequate		
	Compare Line 16D to Line 12C - MDD	-	Adequate		Adequate		Adequate		Adequate		Deficient *	See Note Below	

* Establish an emergency connection with another neighboring community other than Mount Prospect

Footnotes:

- 1 gpd= gallons per day (volume)
- 2 MGD = Million Gallons per Day (volume)
- 3 gpm = gallons per minute (flow rate)
- 4 gph = gallons per hour (flow rate)
- 5 Does not include the area within the City of Prospect Heights served by the Illinois American Water Company

**City of Prospect Heights, Illinois
2013 Water System Study
Sensitivity Analysis**

1	Number of Water Users	Existing Water System	Water System Expansion Area (Number of Additional Users)				
			300	400 (Approx. equal to SSA 9)	500	1,000	2,200 (Ultimate ⁵ Expansion)
		1,080					

Evaluation and Analyses (continued):

City Water Supply (Continued)							
Flow Rates for PHD and Fire Protection compared to City's existing pumping station (only one of Pump Nos. 3 or 4 operates at a time)							
17A	Pump No. 1 (Variable speed)	150					
17B	Pump No. 2 (Variable speed)	350					
17C	Pump No. 3 (Constant speed)	2,000					
17D	Pump No. 4 (Constant speed)	2,000					
17E	Capacity of Existing Supply Pumps with largest pump out of service - gpm	2,500					
	Compare Line 17E to Line 13B - PHD	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
	Compare Line 17E to Line 14 - MFFR	Adequate	Adequate *	Deficient	Deficient	Deficient	Deficient
* Adequate if expansion does not include any commercial or institutional users.							

City Water Storage							
18	Capacity of Existing Water Storage - gallons	550,000					
<i>Storage to meet PHDs</i>							
19A	8 hours of PHD less the supply rate - gallons	N.A.	24,000	58,000	92,000	255,000	692,000
<i>Storage for Fire Protection</i>							
19B	Maximum Fire Flow Rate (MFFR - gpm)	2,500	3,500	3,500	3,500	3,500	3,500
19C	Three Hours of MFFR - gallons	450,000	630,000	630,000	630,000	630,000	630,000
<i>Storage for Reserve Capacity</i>							
19D	20% of total storage capacity = 25% of the water storage for PHD and fire protection	113,000	164,000	172,000	181,000	222,000	331,000
<i>Storage for PHD, Fire Protection, and Reserve</i>							
19E	Total Storage Volume for PHD, fire protection and reserve capacity	563,000	818,000	860,000	903,000	1,107,000	1,653,000
	Compare Line 19E to Line 18	Marginal	Deficient	Deficient	Deficient	Deficient	Deficient
<i>Storage for Supply Interruption</i>							
20A	2 days of ADD	288,000	476,000	544,000	612,000	932,000	1,812,000
20B	Total Storage Volume needed for 2 days of ADD less reliable supply; plus the largest volume of water for PHD, fire protection or reserve capacity	738,000	Supply exceeds storage needed	Supply exceeds storage needed	Supply exceeds storage needed	266,000	1,208,000
	Compare Line 20B to Line 18	Deficient	Adequate	Adequate	Adequate	Adequate	Deficient

Opinions of Probable Project Cost							
Construction:							
	Water Supply Improvements	-	\$ 375,000	\$ 375,000	\$ 375,000	\$ 375,000	\$ 375,000
	Water Storage Facility Improvements	-	\$ 1,900,000	\$ 1,900,000	\$ 1,900,000	\$ 1,900,000	\$ 3,665,000
	Water Distribution System Improvements	-	\$ 6,648,000	\$ 9,077,000	\$ 11,600,000	\$ 24,160,000	\$ 54,313,000
	Construction Cost Subtotal	-	\$ 8,923,000	\$ 11,352,000	\$ 13,875,000	\$ 26,435,000	\$ 58,353,000
	Contingency (20% down to 15%) ⁶	-	\$ 1,785,000	\$ 2,306,000	\$ 2,826,000	\$ 5,428,000	\$ 11,671,000
	Opinion of Probable Construction Cost		\$ 10,708,000	\$ 13,658,000	\$ 16,701,000	\$ 31,863,000	\$ 70,024,000
	Engineering - Survey, Geotechnical, SUE	-	\$ 2,142,000	\$ 2,583,000	\$ 3,023,000	\$ 5,223,000	\$ 10,504,000
	Locates, Design, Permitting and Construction (20% down to 15%) ⁶						
	Legal and Administrative (1% down to 0.5%) ⁶	-	\$ 108,000	\$ 121,000	\$ 134,000	\$ 198,000	\$ 351,000
	Opinion of Probable Total Project Cost	-	\$ 12,958,000	\$ 16,362,000	\$ 19,858,000	\$ 37,284,000	\$ 80,879,000

The Opinions of Probable Total Project Cost do not include easement acquisition, land purchase, or utility relocations.

Footnotes:

⁵ Does not include the area within the City of Prospect Heights served by the Illinois American Water Company

⁶ Varying percentages of contingency were used based on the size of the project because the majority of the construction cost subtotal is based on the detailed Water Distribution System Expansion costs shown in Appendices D and E, which reduce the number and costs of unknown items of work. 20% was used for the smaller project of a 300 user phase, while 15% was used for the large project of a 2,200 user ultimate expansion.

**City of Prospect Heights, Illinois
2013 Water System Study**

APPENDIX B

**Opinion of Probable Construction Cost for Water Supply Improvements
for any Expansion of the Water System and for the entire Planning Area**

Item No.	Description	Quantity	Unit	Unit Price	Amount
Pumping Station with higher capacity/pressure pumps:					
1.	Upgrade/Replace Pumps and Motors 700 gpm at 200 feet TDH	4	each	\$ 30,000	\$ 120,000
2.	Upgrade Electrical System, with motor drives, wiring, etc.			Lump Sum	\$ 70,000
3.	Upgrade/Replace Controls			Lump Sum	\$ 15,000
4.	Provide and Install SCADA system between elevated tanks and ground storage tanks			Lump Sum	\$ 50,000
5.	Emergency Power is provided by dual feed from ComEd and is already in place				\$ -
	Subtotal for Improvements to Pumping Station				\$ 255,000
IAWC supply connection at Euclid Avenue for emergency supply:					
1.	Cut existing supply main and install bends with thrust blocks, elbows with restraint structure, valves, and quick connect fittings			Lump Sum	\$ 25,000
2.	Modify existing site, Install concrete pad, driveway, landscaping, controlled environment enclosure, and security with SCADA connection			Lump Sum	\$ 40,000
	Subtotal for Euclid Avenue Emergency Supply Connection				\$ 65,000
Mount Prospect connection at Camp McDonald Road/Elmhurst Road for emergency supply:					
1.	Cut supply main and install bends with thrust blocks, elbows with restraint structure, valves, and quick connect fittings			Lump Sum	\$ 25,000
2.	Install concrete pad, driveway, landscaping, controlled environment enclosure, and security with SCADA connection			Lump Sum	\$ 30,000
	Subtotal for Mount Prospect Emergency Supply Connection				\$ 55,000
OPINION OF PROBABLE CONSTRUCTION COST FOR SUPPLY IMPROVEMENTS					\$ 375,000

**City of Prospect Heights, Illinois
2013 Water System Study**

APPENDIX C

**Opinion of Probable Construction Cost for Water Storage Facility Improvements
for any Expansion of the Water System and for the entire Planning Area**

Item No.	Description	Quantity	Unit	Unit Price	Amount
1.	Elevated Water Storage Tanks: 750,000 gallon, single pedestal waterspheroid, 140' TCL. Seismic design, shop priming and paint, and spread footing foundation based on 4,000 psf soils	2	each	\$ 1,490,000	\$ 2,980,000
2.	Pile / Pier Foundation 50' ring, 6' wide, 3' thick	120	cu.yd.	\$ 750	\$ 90,000
	Piles	60	each	\$ 1,800	\$ 108,000
	Contingency for differing sites (20% for one of two)			\$ 20,000	\$ 20,000
3.	Internal piping modifications for flow circulation pump	2	each	\$ 15,000	\$ 30,000
4.	Electrical - Service and panels, wiring and SCADA	2	each	\$ 40,000	\$ 80,000
5.	Lighting, security, access drive and landscaping	2	each	\$ 30,000	\$ 60,000
	Contingency for differing sites (25% for one of two)			\$ 7,500	\$ 7,500
6.	16-inch water main, from tank to distribution system, including restoration				
	200 lin.ft. at each site @ \$250 per foot	2	each	\$ 50,000	\$ 100,000
	Hydrant, valves, vaults at each site	2	each	\$ 24,000	\$ 48,000
	Contingency for differing sites (25% for one of two)			\$ 19,000	\$ 19,000
7.	Altitude Control Valve at tank closest to pumping station	1	each	\$ 50,000	\$ 50,000
8.	Rechlorination facilities	2	each	\$ 10,000	\$ 20,000
9.	Contingencies (Logo, permitting, etc.)	2	each	\$ 25,000	\$ 50,000
					\$ 3,662,500
	OPINION OF PROBABLE CONSTRUCTION COST FOR STORAGE IMPROVEMENTS (TWO ELEVATED TANKS FOR PLANNING AREA)				\$ 3,665,000

The cost of a project to construct one elevated tank for an expansion of the water system would be approximately 5% greater than the cost of one-half of the two tank project (less the cost of the Altitude Control Valve which would only be needed when the second tank is constructed)

**OPINION OF PROBABLE CONSTRUCTION COST FOR STORAGE IMPROVEMENTS \$ 1,900,000
(ONE ELEVATED TANK FOR INITIAL EXPANSION OF WATER SYSTEM)**

**City of Prospect Heights, Illinois
2013 Water System Study**

APPENDIX D

**Opinion of Probable Construction Cost for Water Distribution System Improvements
for an Expansion Area approximately equal to proposed SSA 9 (400 users)**

Item No.	Description	Quantity	Unit	Unit Price	Amount
1.	Water Main (Open Cut)				
	12-inch	4,290	lin.ft.	\$ 95	\$ 407,550
	12-inch restrained joint	2,180	lin.ft.	\$ 115	\$ 250,700
	8-inch	5,920	lin.ft.	\$ 75	\$ 444,000
	8-inch restrained joint	3,180	lin.ft.	\$ 90	\$ 286,200
	6-inch restrained joint	170	lin.ft.	\$ 85	\$ 14,450
2.	Water Main (In Casing - Open Cut)				
	12-inch R.JT. in 24-inch Casing	230	lin.ft.	\$ 220	\$ 50,600
	8-inch R.JT. in 18-inch Casing	140	lin.ft.	\$ 200	\$ 28,000
3.	Water Main (Directionally Drilled)				
	12-inch	8,300	lin.ft.	\$ 180	\$ 1,494,000
	8-inch	12,500	lin.ft.	\$ 130	\$ 1,625,000
	Mobilization/Demobilization	50	each	\$ 3,000	\$ 150,000
4.	Water Main (In Jacked Casing)				
	12-inch R.JT. in 36" Steel Casing	400	lin.ft.	\$ 625	\$ 250,000
	8-inch R.JT. in 36" Steel Casing	500	lin.ft.	\$ 575	\$ 287,500
	Mobilization/Demobilization	9	each	\$ 5,000	\$ 45,000
5.	Water Main Fittings - Restrained Joint Type				
	12-inch x 12-inch Cross	3	each	\$ 1,125	\$ 3,375
	12-inch x 12-inch Tee	6	each	\$ 950	\$ 5,700
	12-inch x 8-inch Tee	12	each	\$ 875	\$ 10,500
	12-inch x 6-inch Tee	42	each	\$ 825	\$ 34,650
	12-inch x 8-inch Reducer	0	each	\$ 575	\$ -
	12-inch Bends	9	each	\$ 750	\$ 6,750
	12-inch Plug	1	each	\$ 375	\$ 375
	12-inch Cutting-In Sleeve	2	each	\$ 400	\$ 800
	8-inch x 8-inch Cross	1	each	\$ 775	\$ 775
	8-inch x 8-inch Tee	6	each	\$ 675	\$ 4,050
	8-inch x 6-inch Tee	57	each	\$ 625	\$ 35,625
	8-inch x 6-inch Hydrant Tee	3	each	\$ 1,000	\$ 3,000
	8-inch x 6-inch Reducer	2	each	\$ 425	\$ 850
	8-inch Bends	28	each	\$ 625	\$ 17,500
	8-inch Plug	1	each	\$ 325	\$ 325
	8-inch Cutting-In Sleeve	1	each	\$ 350	\$ 350
6.	Connection to Existing Water Main (Pressure)				
	12-inch x 12-inch	0	each	\$ 12,500	\$ -
	12-inch x 8-inch	0	each	\$ 10,000	\$ -

**City of Prospect Heights, Illinois
2013 Water System Study**

APPENDIX D

**Opinion of Probable Construction Cost for Water Distribution System Improvements
for an Expansion Area approximately equal to proposed SSA 9 (400 users)**

Item No.	Description	Quantity	Unit	Unit Price	Amount
7.	Connection to Existing Water Main (Non-Pressure)				
	12-inch	2	each	\$ 5,000	\$ 10,000
	8-inch	3	each	\$ 4,000	\$ 12,000
8.	Gate Valve and Valve Box				
	12-inch	22	each	\$ 2,750	\$ 60,500
	8-inch	32	each	\$ 2,000	\$ 64,000
9.	Gate Valve and Valve Vault				
	12-inch in 5 foot diameter vault	5	each	\$ 5,625	\$ 28,125
	8-inch in 4 foot diameter vault	7	each	\$ 4,375	\$ 30,625
10.	Fire Hydrant	102	each	\$ 4,500	\$ 459,000
11.	Fire Hydrant Barrel Extension	30	vert.ft.	\$ 625	\$ 18,750
12.	Water Service Pipe				
	1-1/2 inch - Same side of street	184	each	\$ 1,900	\$ 349,600
	1-1/2 inch - Opposite side of street	184	each	\$ 3,450	\$ 634,800
	1-1/2 inch - Opposite side of highway	32	each	\$ 4,700	\$ 150,400
13.	Sanitary Sewer Replacement				
	8-inch pipe	320	lin.ft.	\$ 95	\$ 30,400
	6-inch pipe	880	lin.ft.	\$ 90	\$ 79,200
	Connection to existing manhole	8	each	\$ 1,500	\$ 12,000
	Connection to existing pipe	24	each	\$ 750	\$ 18,000
	8-inch x 6-inch service connection	5	each	\$ 1,250	\$ 6,250
14.	Storm Sewer Replacement				
	24-inch pipe	320	lin.ft.	\$ 125	\$ 40,000
	18-inch pipe	440	lin.ft.	\$ 110	\$ 48,400
	16-inch pipe	480	lin.ft.	\$ 100	\$ 48,000
	12-inch pipe	640	lin.ft.	\$ 90	\$ 57,600
	Connection to existing structure/pipe	100	each	\$ 950	\$ 95,000
15.	Tree Removal	100	in.dia.	\$ 60	\$ 6,000
16.	Tree Replacement	9	each	\$ 800	\$ 7,200
17.	Removal and Replacement of Unsuitable Material	850	cu.yd.	\$ 100	\$ 85,000
18.	Sanitary Sewer Service Line Repair	50	each	\$ 625	\$ 31,250
19.	Replacement of Drain Tiles				
	8-inch	50	lin.ft.	\$ 50	\$ 2,500

**City of Prospect Heights, Illinois
2013 Water System Study**

APPENDIX D

**Opinion of Probable Construction Cost for Water Distribution System Improvements
for an Expansion Area approximately equal to proposed SSA 9 (400 users)**

Item No.	Description	Quantity	Unit	Unit Price	Amount
	6-inch	90	lin.ft.	\$ 45	\$ 4,050
20.	Stream/Creek Crossings	5	each	\$ 5,000	\$ 25,000
21.	Granular Backfill Material	6,560	lin.ft.	\$ 40	\$ 262,400
22.	Backfilling with Controlled Low Strength Flowable Fill Mixture	170	cu.yd.	\$ 150	\$ 25,500
23.	Pavement Restoration				
	Bituminous Street - 4"	800	sq.yd.	\$ 55	\$ 44,000
	Concrete Curb and Gutter	320	lin.ft.	\$ 35	\$ 11,200
	Bituminous Driveway - 2-1/2"	1,780	sq.yd.	\$ 50	\$ 89,000
	Concrete Driveway	870	sq.yd.	\$ 95	\$ 82,650
	Gravel shoulders	320	lin.ft.	\$ 10	\$ 3,200
	Sidewalk	1,600	sq.ft.	\$ 12	\$ 19,200
24.	Driveway Culvert Headwalls				
	Bituminous	31	each	\$ 750	\$ 23,250
	Concrete	15	each	\$ 1,250	\$ 18,750
	Railroad Tie or Landscaping Timbers	45	each	\$ 825	\$ 37,125
25.	Restoration of Lawns and Parkways				
	Topsoil and Seed	15,330	lin.ft.	\$ 12	\$ 183,960
	Topsoil and Sod	1,720	lin.ft.	\$ 20	\$ 34,400
26.	Culvert Removal and Replacement				
	12-inch CMP pipe	80	lin.ft.	\$ 95	\$ 7,600
	12-inch CMP flared end sections	8	each	\$ 325	\$ 2,600
27.	Preconstruction Video Recording			Lump Sum	\$ 20,000
28.	Traffic Control and Protection			Lump Sum	\$ 120,000
29.	Erosion and Sedimentation Control			Lump Sum	\$ 50,000
30.	Cash Allowance			Lump Sum	\$ 110,000
31.	Warranty Period Leak Detection/Location			Lump Sum	\$ 60,000
					\$ 9,076,110
	OPINION OF PROBABLE CONSTRUCTION COST FOR WATER MAINS				\$ 9,077,000

**City of Prospect Heights, Illinois
2013 Water System Study**

APPENDIX E

**Opinion of Probable Construction Cost for Water Distribution System Improvements
for the entire Expansion Area**

Item No.	Description	Quantity	Unit	Unit Price	Amount
1.	Water Main (Open Cut)				
	12-inch	16,110	lin.ft.	\$ 95	\$ 1,530,450
	12-inch restrained joint	10,400	lin.ft.	\$ 115	\$ 1,196,000
	8-inch	57,110	lin.ft.	\$ 75	\$ 4,283,250
	8-inch restrained joint	25,170	lin.ft.	\$ 90	\$ 2,265,300
	6-inch restrained joint	1,290	lin.ft.	\$ 85	\$ 109,650
2.	Water Main (In Casing - Open Cut)				
	12-inch R.JT. in 24-inch Casing	900	lin.ft.	\$ 220	\$ 198,000
	8-inch R.JT. in 18-inch Casing	1,100	lin.ft.	\$ 200	\$ 220,000
3.	Water Main (Directionally Drilled)				
	12-inch	31,850	lin.ft.	\$ 180	\$ 5,733,000
	8-inch	88,800	lin.ft.	\$ 130	\$ 11,544,000
	Mobilization/Demobilization	410	each	\$ 3,000	\$ 1,230,000
4.	Water Main (In Jacked Casing)				
	12-inch R.JT. in 36" Steel Casing	1,600	lin.ft.	\$ 625	\$ 1,000,000
	8-inch R.JT. in 36" Steel Casing	3,600	lin.ft.	\$ 575	\$ 2,070,000
	Mobilization/Demobilization	52	each	\$ 5,000	\$ 260,000
5.	Water Main Fittings - Restrained Joint Type				
	12-inch x 12-inch Cross	6	each	\$ 1,125	\$ 6,750
	12-inch x 12-inch Tee	6	each	\$ 950	\$ 5,700
	12-inch x 8-inch Tee	84	each	\$ 875	\$ 73,500
	12-inch x 6-inch Tee	222	each	\$ 825	\$ 183,150
	12-inch x 8-inch Reducer	4	each	\$ 575	\$ 2,300
	12-inch Bends	28	each	\$ 750	\$ 21,000
	12-inch Plug	2	each	\$ 375	\$ 750
	12-inch Cutting-In Sleeve	2	each	\$ 400	\$ 800
	8-inch x 8-inch Cross	18	each	\$ 775	\$ 13,950
	8-inch x 8-inch Tee	91	each	\$ 675	\$ 61,425
	8-inch x 6-inch Tee	522	each	\$ 625	\$ 326,250
	8-inch x 6-inch Hydrant Tee	20	each	\$ 1,000	\$ 20,000
	8-inch x 6-inch Reducer	4	each	\$ 425	\$ 1,700
	8-inch Bends	130	each	\$ 625	\$ 81,250
	8-inch Plug	4	each	\$ 325	\$ 1,300
	8-inch Cutting-In Sleeve	4	each	\$ 350	\$ 1,400
6.	Connection to Existing Water Main (Pressure)				
	12-inch x 12-inch	2	each	\$ 12,500	\$ 25,000
	12-inch x 8-inch	3	each	\$ 10,000	\$ 30,000

**City of Prospect Heights, Illinois
2013 Water System Study**

APPENDIX E

**Opinion of Probable Construction Cost for Water Distribution System Improvements
for the entire Expansion Area**

Item No.	Description	Quantity	Unit	Unit Price	Amount
7.	Connection to Existing Water Main (Non-Pressure)				
	12-inch	2	each	\$ 5,000	\$ 10,000
	8-inch	3	each	\$ 4,000	\$ 12,000
8.	Gate Valve and Valve Box				
	12-inch	88	each	\$ 2,750	\$ 242,000
	8-inch	286	each	\$ 2,000	\$ 572,000
9.	Gate Valve and Valve Vault				
	12-inch in 5 foot diameter vault	22	each	\$ 5,625	\$ 123,750
	8-inch in 4 foot diameter vault	71	each	\$ 4,375	\$ 310,625
10.	Fire Hydrant	770	each	\$ 4,500	\$ 3,465,000
11.	Fire Hydrant Barrel Extension	200	vert.ft.	\$ 625	\$ 125,000
12.	Water Service Connection and Pipe				
	1-1/2 inch - Same side of street	1,040	each	\$ 1,900	\$ 1,976,000
	1-1/2 inch - Opposite side of street	1,040	each	\$ 3,450	\$ 3,588,000
	1-1/2 inch - Opposite side of highway	120	each	\$ 4,700	\$ 564,000
13.	Sanitary Sewer Replacement				
	8-inch pipe	2,000	lin.ft.	\$ 95	\$ 190,000
	6-inch pipe	5,500	lin.ft.	\$ 90	\$ 495,000
	Connection to existing manhole	50	each	\$ 1,500	\$ 75,000
	Connection to existing pipe	150	each	\$ 750	\$ 112,500
	8-inch x 6-inch service connection	30	each	\$ 1,250	\$ 37,500
14.	Storm Sewer Replacement				
	24-inch pipe	2,000	lin.ft.	\$ 125	\$ 250,000
	18-inch pipe	2,700	lin.ft.	\$ 110	\$ 297,000
	16-inch pipe	3,000	lin.ft.	\$ 100	\$ 300,000
	12-inch pipe	4,000	lin.ft.	\$ 90	\$ 360,000
	Connection to existing structure/pipe	590	each	\$ 950	\$ 560,500
15.	Tree Removal	600	in.dia.	\$ 60	\$ 36,000
16.	Tree Replacement	50	each	\$ 800	\$ 40,000
17.	Removal and Replacement of Unsuitable Material	5,300	cu.yd.	\$ 100	\$ 530,000
18.	Sanitary Sewer Service Line Repair	280	each	\$ 625	\$ 175,000
19.	Replacement of Drain Tiles				
	8-inch	270	lin.ft.	\$ 50	\$ 13,500

**City of Prospect Heights, Illinois
2013 Water System Study**

APPENDIX E

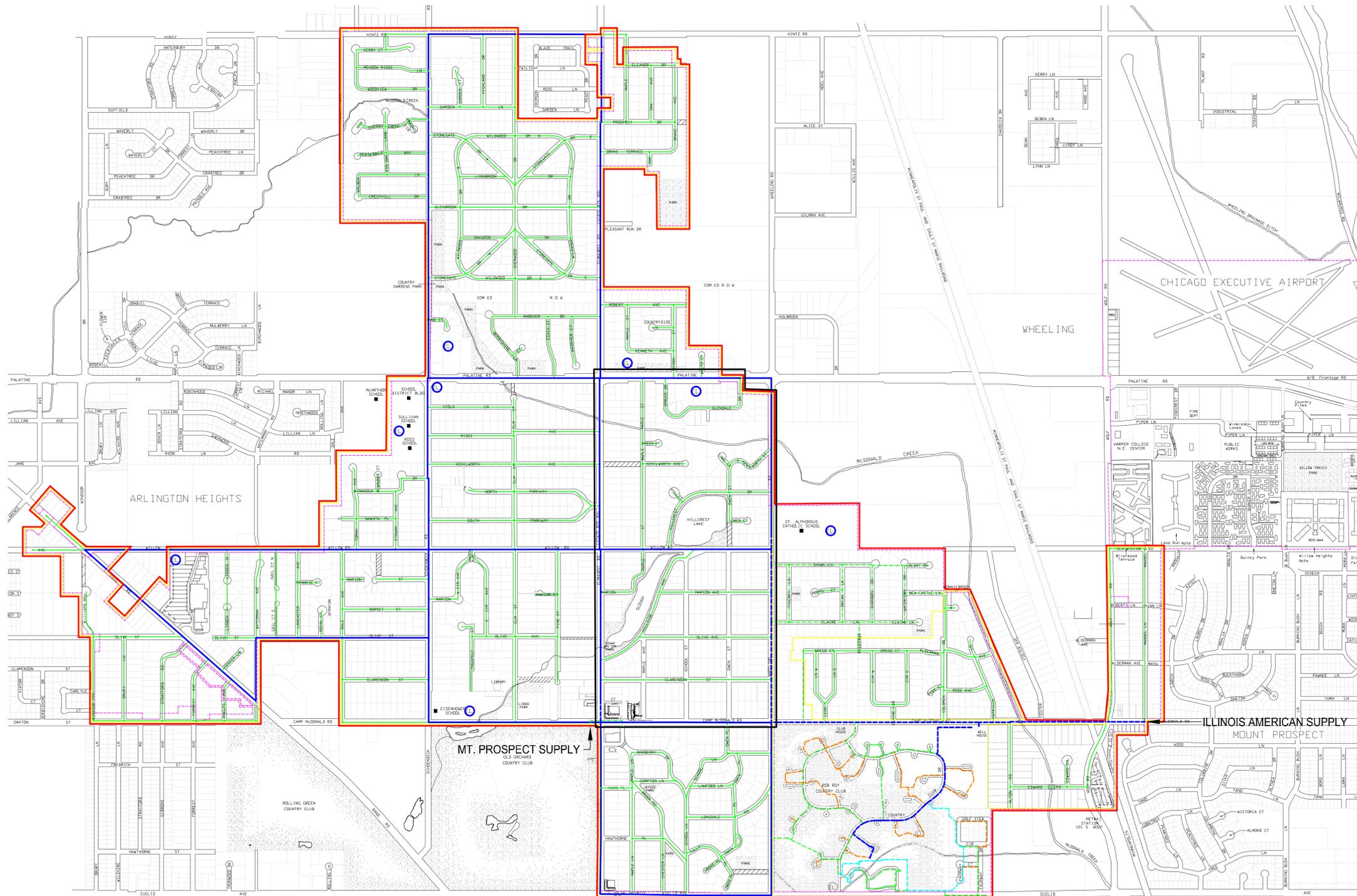
**Opinion of Probable Construction Cost for Water Distribution System Improvements
for the entire Expansion Area**

Item No.	Description	Quantity	Unit	Unit Price	Amount
	6-inch	540	lin.ft.	\$ 45	\$ 24,300
20.	Stream/Creek Crossings	15	each	\$ 5,000	\$ 75,000
21.	Granular Backfill Material	41,000	lin.ft.	\$ 40	\$ 1,640,000
22.	Backfilling with Controlled Low Strength Flowable Fill Mixture	1,100	cu.yd.	\$ 150	\$ 165,000
23.	Pavement Restoration				
	Bituminous Street - 4"	5,000	sq.yd.	\$ 55	\$ 275,000
	Concrete Curb and Gutter	2,000	lin.ft.	\$ 35	\$ 70,000
	Bituminous Driveway - 2-1/2"	11,100	sq.yd.	\$ 50	\$ 555,000
	Concrete Driveway	5,400	sq.yd.	\$ 95	\$ 513,000
	Gravel shoulders	2,000	lin.ft.	\$ 10	\$ 20,000
	Sidewalk	10,000	sq.ft.	\$ 12	\$ 120,000
24.	Driveway Culvert Headwalls				
	Bituminous	190	each	\$ 750	\$ 142,500
	Concrete	90	each	\$ 1,250	\$ 112,500
	Railroad Tie or Landscaping Timbers	275	each	\$ 825	\$ 226,875
25.	Restoration of Lawns and Parkways				
	Topsoil and Seed	95,800	lin.ft.	\$ 12	\$ 1,149,600
	Topsoil and Sod	10,700	lin.ft.	\$ 20	\$ 214,000
26.	Culvert Removal and Replacement				
	12-inch CMP pipe	500	lin.ft.	\$ 95	\$ 47,500
	12-inch CMP flared end sections	50	each	\$ 325	\$ 16,250
27.	Preconstruction Video Recording			Lump Sum	\$ 80,000
28.	Traffic Control and Protection			Lump Sum	\$ 710,000
29.	Erosion and Sedimentation Control			Lump Sum	\$ 300,000
30.	Cash Allowance			Lump Sum	\$ 600,000
31.	Warranty Period Leak Detection/Location			Lump Sum	\$ 300,000
					\$ 54,312,775
	OPINION OF PROBABLE CONSTRUCTION COST FOR WATER MAINS				\$ 54,313,000

City of Prospect Heights, Illinois

2013 Water System Study

Planning Area and Expansion Area



LEGEND

- BOUNDARY OF CITY WATER SYSTEM EXPANSION (EXPANSION AREA)
- BOUNDARY OF FUTURE CITY WATER SYSTEM (PLANNING AREA)
- APPROXIMATE BOUNDARY OF S.S.A. 9

- | PROPOSED | EXISTING |
|---------------------------------------|---|
| — | - - - 12" WATER MAIN |
| — | - - - 10" WATER MAIN |
| — | - - - 8" WATER MAIN |
| — | - - - 6" WATER MAIN |

HYDRANTS
AT 300' SPACING
PER P.H.F.D.

VALVES
1,500' MAXIMUM SPACING
2 VALVES AT TEE
3 VALVES AT CROSS

⊙ APPROXIMATE LOCATION OF POTENTIAL ELEVATED TANK SITE

NOTE:
WATER MAINS SHOWN FOR DISCUSSION AND MODELING PURPOSES ONLY.
WATER MAINS WILL NOT BE LOCATED ALONG CENTERLINES OF STREETS.

I:\Crystal Lake\PROH\121060-Water System Study\CADD\DWG\EXH P.A.&E.dwg - EXH1
 PLOTTED: 5-14-13 @ 9:41am
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