City of Prospect Heights, Illinois

Water System Master Plan

November 2007

8678 Ridgefield Road
Crystal Lake, IL 60012
815.459.1260
Fax 815.455.0450
info@baxterwoodman.com

City of Prospect Heights, Illinois
Water System Master Plan

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

LIST OF EXHIBITS

EXECUTIVE SUMMARY

This Executive Summary gives highlights of the findings, conclusions and recommendations of this 2007 Water System Master Plan (WSMP).

1. The City of Prospect Heights retained Baxter & Woodman, Inc. to prepare this Water System Master Plan 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 a supply connection with the Illinois-American Water Company; two ground storage tanks and a pumping station with rechlorination equipment; and a water distribution system in the Rob Roy area and along Camp McDonald Road and Casa Court. The City's existing water system has approximately 920 service connections serving about 2,700 people.

3. The City has a project designed for a second supply connection with Illinois-American to be located along Camp McDonald Road, from Mandel Lane to the pumping station at the northeast corner of the Rob Roy development.

4. The City is planning to redesign the Special Service Area 6 (SSA 6) project to install water mains, which will increase the extent of the existing water distribution system.

5. The City has adequate water supply, treatment and storage facilities to meet existing and Special Service Area 6 demands. After completion of the water system in Special Service Area 6, the City will be able to provide water service to approximately 90 residences before improvements to the pumping system are necessary and approximately 170 residences before additional storage facilities are needed.

6. The City is looking to expand 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 some commercial and institutional development to be served with an expansion of the existing system.

7. A water distribution system map and computer model was 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 volume, 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 acquisition.

9. Cost estimates were developed for improvements to expand the existing water supply, storage and distribution system. The opinion of probable construction plus contingency costs of these improvements, based on 2007 costs, is approximately $53,740,000. The opinion of probable total project cost, including construction and contingencies, design and construction engineering, and legal and administrative costs is $62,115,000. The following is a summary of the opinions of probable cost:

Description	**Construction Plus Contingency Cost**	**Engineering, Legal and Administrative Cost**	**Total Cost**
Water Supply Improvements:			
Pumping Station	$ 210,000		
Water Supply Main	$ 375,000		
Euclid Ave Supply	$ 50,000		
Mt. Prospect Supply	$ 110,000		
Construction:	$ 745,000		
Contingency:	$ 75,000		
Engineering, Legal and Administrative:		$ 155,000	
Total:			$ 975,000
Water Storage Facilities:			
Construction:	$3,510,000		
Contingency:	$ 350,000		
Engineering, Legal and Administrative:		$ 618,000	
Total:			$ 4,478,000
Water Distribution System:			
Construction:	$44,600,000		
Contingency:	$ 4,460,000		
Engineering, Legal and Administrative:		$7,602,000	
Total:			$56,662,000
Totals:	**$53,740,000**	**$8,375,000**	**$62,115,000**

10. It is recommended the City of Prospect Heights approve this report and use it for the planning, design and construction of water system facilities to serve all areas within the City currently served by private wells and other municipal water supplies.

1. INTRODUCTION

1.1 Master Plan Purpose and Scope

The purposes of this Water System Master Plan (WSMP) were to:

- Evaluate the adequacy of the City of Prospect Heights' existing water supply, treatment, storage and distribution system to meet existing and future demands;
- Identify required improvements to the existing water facilities to meet current demands;
- Identify required improvements to expand the water system to serve the areas within the City currently served by private wells and
- Recommend improvements/additions to the water supply, storage, treatment and distribution facilities to provide Lake Michigan water to the areas within the City currently served by private wells.

The WSMP will serve as a planning tool for the City of Prospect Heights. This report provides the sizes and general locations of the water mains and water storage facilities required to serve areas of the City located west of Mandel Lane.

1.2 History of Master Plans and Studies

The City and some neighboring communities have had various water master plans and studies completed that relate to providing water to various portions of the City. City staff provided copies of these past reports for review as part of this WSMP. The following is a summary of the various reports and the highlights of those reports:

1. Engineering Report on the Proposed Water Distribution System for the City of Prospect Heights by PRC Consoer Townsend, dated February 1984 (2 volumes).
    a. Purpose was to review of all available alternatives for a water supply for the western portion of Prospect Heights through the year 2000.
    b. Groundwater (municipal wells) were not a favorable alternative for the long term supply of municipal water.
    c. Lake Michigan water was determined to be the best, and only, long term water supply to be considered, and was to be provided by the Northwest Water Commission.

d. Water distribution system could be designed and built for $4,550,000.
e. Total project cost for distribution, transmission, pumping and storage facilities was $7,840,000.

2. Report on Municipal Water System for the City of Prospect Heights by Alvord, Burdick & Howson, dated November 30, 1989.
   a. Water system for area served by private wells.
   b. Assumed Glenview would provide the Lake Michigan water to Prospect Heights.
   c. Also looked at using groundwater/well supply for City's system.
   d. Water system providing Lake Michigan water to Prospect Heights had a cost of $24,000,000.
   e. Conclusion that a new water system would provide a savings to each property owner of $98 to $428 per year relative to use of a private well.

3. Engineering Report for the Village of Glenview providing Lake Michigan Water to the City of Prospect Heights for the Village of Glenview by Consoer, Townsend & Associates, Inc., dated September 18, 1990.
   a. 1.05 million gallons per day (MGD) Average Daily Demand and 2.63 MGD Maximum Daily Demand from Glenview to Prospect Heights.
   b. Improve an existing 30-inch gravity water main to a pressurized main to transport more water or construct a new west side pumping station with an increase in the size of the 20-inch water main for Citizens' Utilities (now Illinois-American Water Company) to a 24-inch main.
   c. Provide 5 million gallon (MG) storage at the west side pumping station instead of the 4 MG originally planned.
   d. Cost of $3,445,000 to $3,925,000.

4. Prospect Heights Water System Rob Roy Commercial Area Fire Flow Analysis for the City of Prospect Heights by Christopher B. Burke Engineering, Ltd., dated September, 1992.
   a. Rob Roy system can provide 2,500 gpm at a pressure of 20 psi or more.
   b. Minimal water storage capacity is required for 2,500 gpm and higher flows.

5. Feasibility Study of a Provision of Lake Michigan Water Supply to Eastern Boundary of Prospect Heights for the City of Prospect Heights by Camp Dresser & McKee dated March 1996.
   a. Study to provide Lake Michigan water from the Village of Northbrook to the area along Sanders Road, between Milwaukee Avenue and I-294.

b. Area and supply separate from the western portion of Prospect Heights (not considered in this WSMP).

6. Update of Municipal Water Supply Study for the City of Prospect Heights by Camp Dresser & McKee, dated October 1996.
   a. Review of 1989/1990 AB&H report.
   b. $24,000,000 (1989 costs) for improvements to the system at $11 per 1,000 gallons (1989).
   c. Still looking at NWC and Northbrook as supplier of Lake Michigan water.
   d. Phased approach to reduce cost, but extend the length of time to serve the entire City.
   e. Capital cost of $47,000,000 (1996 costs) for improvements.

7. Lake Michigan Water Supply Transmission Pipeline Preliminary Design Study for the City of Prospect Heights by Camp Dresser & McKee, dated October 1998.
   a. Water main from Glenview (Des Plaines River Road and Euclid Avenue) to the Rob Roy Well House/Tanks, via Euclid to railroad, north along railroad to north side of River Trails Park District to east side of Rob Roy. (This is no longer a consideration as there will be a second connection to the Illinois-American Water Company, which is already designed.)

8. Lake Michigan Water Supply to Rob Roy Country Club Water System for the City of Prospect Heights by Alvord, Burdick and Howson, dated December 2002.
   a. Study of providing Lake Michigan water from Illinois-American Water Company (previously Citizens' Utilities) to Rob Roy and eliminating the use of two groundwater wells.
   b. Recommended numerous improvements to the pumps, valves, piping and controls at the Rob Roy pumping station (which have been completed).
   c. Recommended a second supply connection from the Illinois-American water system along Camp McDonald Road, which has been designed.

9. Preliminary Engineering Study – Water Main Extension for the Lake Claire Water Association by Baxter & Woodman, Inc., dated July 25, 2006.
   a. Study to determine water main sizes and routing to serve the Lake Claire neighborhood with Lake Michigan water.
   b. Included opinion of probable construction and total project costs.

10. Special Service Area 6 & 7 Water Main Extensions for the City of Prospect Heights by Baxter & Woodman, Inc., dated March 9, 2007.
    a. Drawings and Project Manual for the construction of water mains to serve SSA 6 and 7.
    b. Project was bid, but subsequently tabled due to dissolution of Special Service Area 7.
    c. Average of unit prices from bids used in developing costs for distribution system improvements in this Water System Master Plan.

1.3 Planning Area

1.3.1 Regional Location **-** The City of Prospect Heights currently encompasses approximately 4.5 square miles in Wheeling and Northfield Townships in Cook County, Illinois.

1.3.2 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 seven lot residential development along Casa Court and c) Special Service Area 6; and 2) the Expansion Area to be served by the expansion of the City's water system; specifically a) the small, isolated area served by a connection to the Village of Mount Prospect's water system, including City Hall, Walgreen, Prospect Heights Fire District, and the Police Center, b) the schools, commercial and individual residential properties served by other 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.

1.3.3 Land Use - Land use within the Planning Area is currently comprised of single family and some low density multi-family residential development, some commercial development near Rand Road and Willow Road, and the City Hall, Prospect Heights Fire District building, and churches and schools. In addition, there may be some minor infill commercial development at the intersections of some of the main roads in 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 the existing City limits.

1.4 Water Distribution System Model

A WaterCAD® distribution system model was developed to include the City's water distribution system; including the Rob Roy development, the existing mains along Camp McDonald Road and Casa Court, and SSA 6; and the water distribution system for the Expansion Area.

Several hydrant tests had been conducted by other consultants as part of previous water system studies to simulate high demands similar to fire flows in the distribution system while residual pressures were monitored at adjacent hydrants. The information gathered from those hydrant tests indicated existing water mains are in very good condition and the information was used to calibrate the model of the existing system.

The previous fire hydrant tests and water distribution system modeling indicated fire suppression flow rates throughout the Rob Roy development are adequate to protect the area served by the existing water system. The WaterCAD® model for this study confirmed the fire flow rates in the Rob Roy development would increase with the construction of the expanded water system.

The WaterCAD® model was also used to verify that available fire suppression flow rates throughout the expanded water system would be equal to or greater than the minimum fire suppression flow rates recommended by the Insurance Services Office (ISO). For this WSMP we used a residential fire flow rate of 1,500 gallons per minute (gpm) and commercial area fire flow rate of 3,500 gpm.

1.5 Population versus Population Equivalent

This Water System Master Plan uses population equivalents (PE) to calculate existing and future capacity requirements. In general terms, a PE is a measure of water usage 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 a typical water usage for each commercial or institutional customer. Because of the types of non-residential uses in the City of Prospect Heights, we used a value of 10 PE per acre for non-residential development. This value is based on typical average non-residential water use seen in other community water systems.

2. EXISTING CONDITIONS

2.1 Introduction

2.1.1 Topography **-** The ground surface elevations in the Planning Area vary from a low elevation of 643 feet above sea level along McDonald Creek in the southeast corner of the City to a high elevation of 690 feet above sea level at Rand Road and Willow Road.

The difference in the City's low to high elevations of 643 and 690, respectively, is 47 feet. This difference in elevations is equal to a difference in water pressure of 20 pounds per square inch (psi). This minimal elevation/pressure difference will allow the City's water system expansion to be designed with a single pressure zone, thereby simplifying and reducing the cost of the design, construction and operation of the system.

2.1.2 Water Supply and Treatment **-** The City of Prospect Heights obtains Lake Michigan water from the Illinois-American Water Company and monitors chlorine levels in the water leaving the pumping station. If required, the City re-chlorinates the water to meet Illinois Environmental Protection Agency (IEPA) standards.

Those residents and businesses not currently served with Lake Michigan water obtain their water from private water wells on each individual property. Any treatment of well water is done on an individual basis as determined by the property owner or water user.

2.2 Population

The City of Prospect Heights is essentially fully developed, except for some isolated parcels throughout the City, and the small increase in population and water demand attributable to any future development or annexation is negligible in sizing the water system facilities. The 17,081 population of the City is fairly constant and is not anticipated to

increase in the foreseeable future. Approximately 10,600 people, and a few non-residential buildings at Elmhurst Road and Camp McDonald Road, are already served with Lake Michigan water.

The portion of 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. In addition there are approximately 60 acres of commercial development near the intersection of Rand Road and Willow Road and another 20 acres interspersed throughout the rest of the Planning Area. The 6,500 population and 2,140 lots do not include the existing customers and SSA 6.

2.3 Existing Water Usage

A water system's total water usage is defined as the quantity of water required to meet all regular usage needs of the community. It includes not only the quantity actually metered and billed to customers, but also water used at the treatment plant, water that leaks out of the water mains, water not registered on individual meters, and water used by the municipality for water and sewerage system maintenance, fire protection and construction.

The City's Water Department provided us with an average daily water usage of 134,400 gallons per day (gpd) for 2005. The existing customer base consists of the Rob Roy and adjacent developments and a few houses on Casa Court. There are plans to serve Special Service Area 6 (SSA 6) with an extension of the City's water distribution system starting in 2008. Using a design flow rate of 100 gpcpd and a typical population of 3.5 persons per single family house for the 160 lots in SSA 6, it is estimated the average daily water usage

would increase by 56,000 gpd. Therefore, the estimated existing average daily water usage, or Average Daily Demand (ADD) will be considered to be approximately 190,000 gpd.

2.4 Existing Water Supply

Currently, the City of Prospect Heights receives Lake Michigan water from the Illinois-American Water Company through a 6-inch connection on Euclid Avenue. Water flows into the City's water distribution system providing water and water pressure to the City's distribution system and providing water to fill the two ground storage tanks at the pumping station on Camp McDonald Road.

When pressure in the City's water distribution system falls below approximately 50 psi due to increased water usage, a variable speed pump operates at the pumping station to increase water pressure. Operation of the pump(s) at the pumping station may or may not close the Illinois-American supply connection depending on the pressure and flow rate of the pump(s). During the time the pump(s) operates, the ground storage reservoir tanks are not being filled.

There are times when the pump(s) operates to draw water out of the tanks and when the pump(s) is shut off to allow the tanks to fill. This circulation of water in and out of the tanks eliminates stagnation of the water in the tanks, thereby providing higher quality water to the City's customers.

The City's supply of water through the 6-inch connection is limited to approximately 450 gpm. This flow rate is much less than the 2,500 to 3,000 gpm fire flow rate suggested for the multi-family residences within the Rob Roy development. Therefore, the pumping

station must be used to provide adequate flow rates for fire fighting. The pumping station includes four pumps with 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

If the maximum water supply demand, including fire suppression flow rates, can be met with the largest pump out-of-service due to failure or unforeseen maintenance, then most, if not all, other demand scenarios can be met. The capacity of the supply system is approximately 2,500 gpm with the largest pump out-of-service. During a fire fighting effort, water pressure in the distribution system would be reduced and the pump capacities would increase. Therefore, the existing pumping station and supply system is adequate to meet the needs of the existing water system.

The City has plans to construct a second, larger water supply main along Camp McDonald Road, between Mandel Lane and the pumping station. The construction of this 12-inch diameter supply main is scheduled for completion in 2008. This 12-inch main will increase the capacity of the City's water supply and will allow the existing 6-inch supply connection to be used as a redundant supply if, and when, the 12-inch supply main requires maintenance or is out-of-service for any reason.

2.5 Existing Water Treatment

The City of Prospect Heights' water treatment system consists of equipment to re-chlorinate water being pumped from the ground storage tanks. The re-chlorination system is automatic, and operation consists of a chlorine analyzer determining the chlorine

concentration in the water leaving the pumping station and chlorine supply equipment to add chlorine to the water in amounts sufficient to meet IEPA standards.

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.

2.6 Existing Water Storage

The City of Prospect Heights has two ground storage tanks located on Camp McDonald Road at the northeast corner of the Rob Roy development. The east tank is a 300,000-gallon tank and the west tank is a 250,000-gallon tank, for a combined capacity of 550,000 gallons. The combined storage capacity of 550,000 gallons is in excess of the 380,000-gallon volume needed to provide two days of the existing ADD of 190,000 gallons per day (130 gpm). The storage volume also exceeds the volume of water to provide the current 3,000 gpm fire flow rate for the recommended duration of 3 hours (3,000 gpm fire flow + 130 gpm ADD – 450 gpm supply = 2,680 gpm for 3 hours x 60 minutes/hour = 482,000 gallons).

Maintenance, such as inspection or painting, of the existing tanks would require one of the two tanks to be taken out of service for an extended period of time, leaving only one tank available for storage. During a maintenance project, there should be enough storage to provide at least one day of ADD, or 190,000 gallons of storage, with the largest tank out of service. The smallest tank as a capacity of 250,000 gallons, so there would be 60,000 gallons of storage available for service to additional customers. The 60,000 gallons would be equal

to the average daily demand of approximately 170 single family residences. Therefore, approximately 170 houses could be added to the City's water system before additional storage facilities would be required.

2.7 Existing Water Distribution System

A water distribution system has two main functions: (1) to convey water at adequate pressure and flow rates to meet demand needs; and (2) to convey water to meet required fire suppression flow rates. To meet these two needs, water mains must be sized to meet fire suppression flow rates and the distribution system must operate with a hydraulic grade line (pressure) adequate to provide desired pressures, without excessive pressure. A hydraulic grade line is equal to the elevation of the water surface in an elevated water storage tank, if an elevated tank was present in the system.

The City's existing distribution system and the water distribution system for the Expansion Area are shown in Exhibit 1. The water supply main and the water mains in SSA 6 have been shown as existing mains in Exhibit 1 because their construction cost would not be part of water system expansion costs.

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 Illinois-American supply connection 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 pump(s) to meet changes in demand.

2.8 Summary

Improvements to the existing water system are not necessary because the City's existing water supply, storage, treatment and distribution system, and the SSA 6 water main extensions, are adequate to meet existing and anticipated demands.

With the expansion of the existing system into SSA 6, the City should consider reviewing its water rates with respect to operation and maintenance costs of the expanded, larger system.

3. FUTURE CONDITIONS

3.1 Planning Area

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

3.2 Residential Population

The population of the City of Prospect Heights is currently listed as 17,081. As described in previous sections, it is anticipated the population of Prospect Heights will not vary significantly from the current population. 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 interspersed 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 to be approximately 6,500 people. Using an average water usage of 100 gpcpd, it is anticipated the ADD for residential customers will 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 (190,000 gpd existing + 650,000 gpd residential + 112,000 gpd non-residential = 952,000 gpd), or 0.95 million gallons per day (MGD).

The City's water system was analyzed for ADD, maximum daily demands (MDD) and peak hourly demands (PHD). The national average ratio for 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 for a smaller system. For purposes of this WSMP, a ratio of 2.0 was used to analyze the system for future conditions. Therefore, the future MDD will be approximately 1,904,000 gpd, or 1.90 MGD.

Experience with other communities indicates PHDs are approximately 2.75 to 3.25 times ADD, and we have used a ration of 3.0 for this Master Plan. Therefore, the PHD for the expanded water system in the Planning Area is 2,856,000 gpd, or 2.86 MGD.

4. EVALUATION OF WATER SYSTEM FACILITIES

4.1 Lake Michigan Water Providers/Suppliers

Discussions with City staff and members of the Water Committee indicated there were five potential providers/suppliers of Lake Michigan water to be considered for expansion of the City of Prospect Heights' water system. We contacted the Illinois-American Water Company, the Village of Mount Prospect, the Village of Glenview, the Northwest Suburban Municipal Joint Action Water Agency (NSMJAWA), and the Northwest Water Commission (NWC) about the possibility of providing water, the improvements necessary to bring Lake Michigan water to the City, and the cost of those improvements and other costs associated with obtaining water from each provider.

The Village of Glenview responded to the inquiry for Lake Michigan water with a telephone call from Mr. Doug Fick, Water Division Superintendent, stating Glenview provides water to Illinois-American and that Prospect Heights should obtain water from Illinois-American. Mr. Fick further stated Glenview would not directly supply Lake Michigan water to Prospect Heights. The Village of Glenview was supposed to have received a payment from the City of Prospect Heights several years ago to cover the costs of improvements to provide 1.8 MGD of Lake Michigan water from Glenview to Prospect Heights via Illinois-American. City staff confirmed payment was received and improvements were completed by the Village of Glenview.

The NSMJAWA responded to the request with a telephone call from Mr. Joe Fennell stating NSMJAWA would consider adding the City as a member of NSMJAWA. The seven current member communities would have to vote to add Prospect Heights as a member, and

then the City would have to "buy in" as if the City had been a member since the inception of the NSMJAWA. The "buy in" cost was estimated to be approximately $20,000,000 to $25,000,000 and there would also be a cost to install a new water transmission main through Mount Prospect to Prospect Heights. The estimated cost of this transmission main would probably be approximately $5,000,000. Because of the high costs just to have NSMJAWA's Lake Michigan water supply brought to the city limit, this potential supplier was eliminated as a reasonable consideration. Other communities have considered joining NSMJAWA or other water agencies in the past and initial costs were always so high the communities decided to obtain water from other sources.

The NWC initially responded with a letter from Mr. John DuRocher, Executive Director, stating they were not in a position to provide water to the City of Prospect Heights. Subsequently, Mr. Rich Tibbits, Chairman of the City's Water Committee, spoke with Mr. DuRocher about reconsidering the City's request. In June 2007, Mr. Tibbits was informed the NWC would not be responding to the City's request for connection information due to concerns about the operational security of the NWC. It is anticipated a connection(s) to the NWC system would require a "buy in" and some additional improvements to the NWC system similar in cost to the "buy in" with NSMJAWA. For these reasons it appears only the Village of Mount Prospect and the Illinois-American Water Company are feasible providers/suppliers of Lake Michigan water to the City of Prospect Heights.

The Village of Mount Prospect currently provides water to serve several properties, including the City Hall, at the intersection of Elmhurst Road and Camp McDonald Road. The Village agreed to meet with the City and Baxter & Woodman to discuss the possibility

of increasing the size and capacity of the Village's supply to serve the City. Mr. Glen Andler, Director of Public Works and Mr. Sean Dorsey, Deputy Director of Public Works met with City staff to discuss the improvements necessary and the flow rate and water pressure anticipated for a water supply at the intersection of Elmhurst Road and Camp McDonald Road. The Village of Mount Prospect was having a water system analysis completed during the preparation of this report, and did not have flow and pressure information available prior to the completion of this report. However, the Village was in favor of providing Lake Michigan water to Prospect Heights as a back-up supply. If the water system expansion is constructed, an intergovernmental agreement should be prepared for a Mount Prospect/Prospect Heights water system interconnection to be used during temporary emergency situations.

The Illinois-American Water Company (I-A) and the City have an existing Water Supply Agreement good through the year 2020. I-A is obligated to provide the quantity of water listed in the Agreement and discussed in more detail in the following section. I-A reviewed the proposed water supply main to be constructed by the City along Camp McDonald Road, and has agreed to replace one block of water main in their own system to increase the amount of flow and pressure available to the City. The benefits and advantages of the existing Agreement with I-A, the second water supply main and the existing facilities to efficiently use the supply connections with I-A make the Illinois-American Water Company the preferred provider/supplier of Lake Michigan water for the City of Prospect Heights.

4.2 Supply Facilities

The City's water supply facilities consist of two facilities, the supply connections with the I-A and the City's pumping station. Supply facilities should be capable of providing MDD with the largest supply connection/equipment unit out-of-service.

As mentioned previously, the existing supply facilities are capable of meeting the current ADD and MDD. There will be an additional, larger supply connection with I-A with the completion of the Camp McDonald Road water supply main project. The second supply connection will increase the capacity of the Lake Michigan water supply and allow the existing I-A supply connection on Euclid Avenue to become a redundant/emergency connection.

The existing Water Supply Agreement between the City and I-A establishes the maximum amount of water which may be taken by the City from I-A and the minimum amount of water which must be provided by I-A to the City. Table 1 is a summary of quantities as listed in the City/I-A Water Supply Agreement:

City of Prospect Heights, Illinois
Water System Master Plan

TABLE 1

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

Accounting Period	Average Day Water Quantity (MGD)	Maximum Day Water Demand (MGD)
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 discussed in the City/I-A 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. In any given day I-A may transmit more than the Maximum Day Water Demand, although I-A 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 0.95 MGD and 1.90 MGD, respectively. The City can obtain up to 15 percent more than the Average Day Water Quantity; and starting in October of 2010, the City would be able to obtain up to 1.08 MGD of water, which is more than adequate for the 0.95 MGD ADD. It is anticipated the entire water system expansion would not be complete by the year 2010. Therefore, the City's supply from I-A would meet the ADDs of the water system expansion.

As shown in the above table, the City would be able to obtain only 1.88 MGD on any given maximum day, so any additional water needed to meet MDDs would have to be provided by storage or a connection with a different water system.

The City's supply connections with I-A will not provide enough water to meet MDDs with the largest (the 12-inch water main along Camp McDonald Road) supply out-of-service. If the supply from Mount Prospect is included in the total water supply for the City, the ADD could be met if the proposed 12-inch supply connection is out-of-service, but the MDD could not be provided. In that case, the City would need to implement emergency water restrictions to minimize water use.

Many communities with Lake Michigan water do not have adequately sized redundant supply connections and establish interconnections with other neighboring

communities for secondary water supplies. Therefore, the supply connection with Mount Prospect should be reconfigured as a secondary/redundant supply of Lake Michigan water.

After the water distribution system has been expanded, the existing supply connection from the Village of Mount Prospect should be maintained, but only as an emergency water supply connection. All Lake Michigan water would be provided by I-A, and the Mount Prospect connection would normally be closed. The Mount Prospect supply connection could be used in the event of a supply interruption from I-A, and upon notification from the City to the Village as established in an Intergovernmental Agreement.

4.3 Treatment Facilities

The expanded water system would be supplied with Lake Michigan water because previous water studies completed for the City by several other consulting engineering firms determined the only acceptable water supply to expand the City's water system is from a Lake Michigan water provider. Lake Michigan water from any of the providers would be treated by the provider prior to entering the City's system. 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 tanks 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 elevated tanks during the day and filling of the elevated tanks during the night to ensure a constant turnover of water in the

elevated tanks. Future water system operation would determine the amount of re-chlorination needed in the system, but it is anticipated the volume of water in the elevated 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 the elevated water storage tank construction.

4.4 Storage Facilities

Water storage facilities for the community provide the following: (1) water to meet PHD, (2) water for fire protection, (3) reserve capacity for emergencies when the storage facility is not completely full 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 usually greater than the cumulative volume required for the first three purposes, so 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.

4.4.1 Peak Hourly Demand - Storage facilities should be capable of providing the difference between the MDD and the PHD when the water supply rate equals the MDD. As discussed above, the maximum water supply rate of 1.88 MGD is somewhat less than the MDD of 1.90 MGD, so the storage facilities should provide the difference between the supply rate and the PHD. We recommend storage facility volume be sufficient to provide the difference in the water supply or MDD rate and the PHD rate for at least an eight hour period. Therefore, the City's storage facilities should provide the difference between the

maximum supply rate of 1.88 MGD and the PHD rate of 2.86 MGD for eight hours. The storage facility volume required to do so is 327,000 gallons (2.86 MGD - 1.88 MGD = 0.98 MGD/24 hours per day x 8 hours = 0.327 MG or 327,000 gallons).

4.4.2 Fire Flow Demand **-** The storage volume required for fire protection is dependent on the fire flow rate and duration. The maximum fire flow rate as established by the ISO is 3,500 gpm in commercial areas for a duration of 3 hours. The required fire flow volume is, therefore, 630,000 gallons (3,500 gpm x 3 hours x 60 minutes/hour = 630,000 gallons).

4.4.3 Reserve Capacity **-** The third 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 (this volume is equal to 25 percent of the volume for the first two purposes). The volume required for reserve capacity is, therefore, 239,000 gallons (25% of (327,000 + 630,000) gallons = 239,000 gallons).

4.4.4 Supply Interruption **-** A water system's storage facilities should also provide an adequate volume of water to provide water to the system 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.

The City's future ADD is estimated to be 0.95 MGD, so the storage volume required for two days of ADD is 1.9 MG or 1,900,000 gallons, which is larger than the 1,196,000-

gallon cumulative volume for the first three purposes. Therefore, the volume for the maximum of the first three purposes equal to 630,000 gallons for fire protection would be added to the volume required for two days of ADD, and the total volume of storage required if both I-A supply connections are out-of-service would be 2,530,000 gallons.

4.4.5 Required Storage - It is highly unlikely that both the I-A and Mount Prospect supplies would be interrupted at the same time because 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 at Elmhurst Road and Camp McDonald Road is approximately 450 gpm (equal to the capacity of the existing I-A supply connection on Euclid Avenue), 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 approximately 1,235,000 gallons (2,530,000 gallons – 1,296,000 gallons = 1,234,000 gallons, say 1,235,000 gallons).

The City currently has two ground storage tanks at the pumping station with a combined volume of 550,000 gallons, leaving a future requirement of approximately 685,000 gallons of additional storage (1,235,000 gallons – 550,000 gallons = 685,000 gallons). Storage facilities are normally sized in increments of 100,000 gallons for small facilities 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.

At times, storage tanks must be taken out of service for repair or repainting, which can keep an elevated tank out of service for up to 4 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 would be desirable to have two new storage facilities, each with a capacity of 750,000 gallons. Communities with similar size and population of Prospect Heights, and even smaller communities, often have at least two elevated storage tanks as part of their water system.

4.5 Distribution System

Water distribution systems are designed to supply both domestic and fire suppression needs of a community. The sizes (diameter) 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.

4.5.1 Existing Distribution System Improvements **-** The existing water distribution system in the Rob Roy development and along Camp McDonald Road, and the system to be constructed in SSA 6, are adequately sized to meet existing domestic and fire protection needs and no improvements to the existing system are necessary.

4.5.2 Future Distribution System for Expansion Area **-** The future water distribution system is shown in Exhibit 1, as are the water mains in the Rob Roy area and SSA 6. The location of the water mains was discussed with City staff and the sizes were established to provide sufficient water main looping of larger diameter mains along the main roads and in commercial areas. The sizes of the water mains and the fire protection capabilities of the system were verified using a WaterCAD® water system computer model.

A drawing of the system model is included as Exhibit 2. The model was also used to analyze the water system in SSA 6 to verify sizes of water mains in that area.

5. DISCUSSION OF IMPROVEMENTS

5.1 General

The City of Prospect Heights is essentially fully developed and its population is expected to remain fairly constant for the foreseeable future. As discussed previously, the population equivalent of residential, commercial and institutional development within the Planning Area is estimated to be approximately 9,520 PE. There may be some infill of commercial development and some minor annexations to the City, but the PE and water use of these potential minor developments is anticipated to cause very little additional demand on the expanded water system.

Following are discussions of the improvements necessary to expand the City's water system to provide Lake Michigan water to the entire Planning Area.

5.2 Water Supply

Currently, the City uses the I-A supply connection to provide water pressure to the distribution system, and only when pressure drops below approximately 50 psi, or water needs to be circulated through the ground storage tanks, do the pumps at the pumping station operate. Using the pressure available in the I-A system is very efficient. However, and as will be discussed in the subsequent section on storage facilities, the hydraulic grade line or pressure in the expanded water distribution system will be greater than the existing system's hydraulic grade line/pressure. This is due to ground elevations in the Planning Area being approximately 40 feet higher than ground elevations in the existing system's service area. In addition, it is desirable to have a minimum pressure of 50 psi in commercial areas, which happen to be located in areas with higher ground elevations. The hydraulic grade line

elevation of the expanded water system is approximately 814 feet above sea level, whereas the hydraulic grade line in the existing (and I-A) system is approximately 790 feet above sea level. Therefore, the existing I-A system pressure will not be adequate to operate the expanded system and all water received from I-A will need to be pumped into the expanded water distribution system.

If the existing supply pumps and ground storage tanks continue to be used, all water supplied to the City will enter the tanks and the energy (pressure) available from the I-A system will be lost when the water enters the tanks. Pumping from the existing tanks to the expanded system will require an increase in pressure from a water surface elevation of approximately 655 in the tanks to the hydraulic grade line elevation of 814, or 69 psi, to provide adequate pressure.

An alternate pumping system consisting of a booster pumping station would use the pressure available in the I-A system and would require much less energy to pump water into the City's expanded distribution system. A booster pumping station would increase the 60 to 64 psi pressure in the I-A system to about 70 to 75 psi in the expanded system. This alternate would require remodeling of the existing pumping station to a booster pumping station and would eliminate the need for the existing ground storage tanks. However, this would also require the abandonment of the existing tanks and would increase the size of future storage facilities.

A brief economic analysis of the energy cost savings versus the cost of remodeling the pumping station, abandoning the existing tanks and increasing the size of the storage facilities is summarized on the following page.

Energy Savings:

Pumping 0.95 MGD from Tanks to System for one year:	
217,000 Kw-Hr	= $14,650 per year
Pumping 1.00 MGD from I-A to System for one year:	
31,000 Kw-Hr	= $ 2,400 per year
Energy cost savings	= $12,250 per year

Improvement Costs:	
Remodel pumping station to booster pumping station	= $ 50,000
Abandon the two ground storage tanks	= $ 100,000
Increase size of new storage facilities (2 @ 1,000,000 gallons)	= $ 800,000
Increase size of foundation for storage facilities	= $ 50,000
Engineering, Legal and Administrative	= $ 150,000
Total Estimated Cost	= $1,150,000

Present Worth of Energy Savings (7% discount rate, 100 years):	= $ 175,000
Present Worth of Improvement Costs:	= $1,150,000

This brief economic analysis shows the improvement costs exceed the anticipated energy savings of a booster pumping station using pressure available in the I-A system. Therefore, the existing pumping station and ground storage tanks 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 in 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, approximately 1,400 feet of 12-inch main would be required to extend the proposed Camp McDonald Road water supply main to the large diameter water main in the I-A system located at Burning Bush Lane.

The existing I-A water supply connection on Euclid Avenue would become a secondary/emergency connection once the Camp McDonald Road water supply main is

constructed. Currently, this connection feeds water directly into the Prospect Heights water system. With the construction of the expanded water system and increased water pressure in the Prospect Heights system, this connection would no longer provide water to the system without pumping facilities.

Improvements necessary to use the Euclid Avenue I-A connection as a source of water consist of a new dedicated supply water main from the Euclid Avenue connection to the pumping station or pumping equipment to draw water from the I-A system and pump it into the Prospect Heights system. A dedicated water supply main would consist of an 8-inch pipe located along the boundaries of the Rob Roy Golf Course, or some similar route, from Euclid Avenue to the ground storage tanks on Camp McDonald Road. A much less expensive and much easier to implement option would be to construct a small facility to allow temporary pumping of I-A water into the future Prospect Heights water system.

It is anticipated pressure in Mount Prospect's water system is not enough to match or exceed the water pressure in the City's future water system. Any future water system interconnection with the Village of Mount Prospect should include provisions for temporary pumping equipment similar to those for the Euclid Avenue I-A connection.

The costs of improvements to the City's Lake Michigan supply facilities are discussed in greater detail in a following section of this report.

5.3 Water Treatment

As discussed above, the Lake Michigan water received from I-A will have been previously treated and the only treatment anticipated in 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 would be determined after there is some operating history. The design and construction of future storage facilities should include provisions for treatment facilities.

5.4 Water Storage

To meet the PHD and to provide adequate fire suppression throughout the future area served by the City, additional storage is required. As discussed above, it is recommended the water system expansion include two new storage facilities. While the existing water system's pressure can be provided by the pumping station, the system usually "floats" on the water pressure provided by I-A. The future water system should include elevated storage tanks to provide normal water system pressure and allow the system to "float" on the pressure provided by the elevated tanks.

The general purposes of elevated storage include stabilizing system pressure by providing an instantaneous "on-demand" source of water during PHD, providing high flow rates to meet fire suppression requirements, and providing a large volume of water to meet other emergency demands. 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 tanks would continue to be used and would be controlled by the water level in one or both of the elevated water storage tanks.

One of the challenges to locating elevated storage tanks is balancing the aesthetic and operational needs of the community. The City's existing and future water system has its

water supply at the southeast corner of the system. For operational purposes, the elevated tanks should be located toward the northerly and westerly sides of the future water system and the elevated tanks should be located proximate to each other so adequate pressure control and fire suppression can be maintained. However, adequate distance should be maintained between the tanks to limit an undesirable aesthetic appearance.

During a meeting with City staff, seven locations were selected as potential locations for elevated tanks. These potential locations are shown in Exhibits 1 and 2. Each of the locations was ranked for various design considerations including ground elevation, location in the water system, adjacent development, location relative to the airport, and other considerations as shown in Appendix A.

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. The second elevated tank should be located at either the corner of Palatine Road and Schoenbeck Road or near the Sullivan or Ross schools.

Both of these tanks should have a capacity of 750,000 gallons and would be approximately 140 feet from the ground to the high water (overflow) elevation. The overall height of each tank would be approximately 150 feet, not including any lights or antenna masts. In addition, each tank would be connected to the water system with a 16-inch diameter water main and each tank would have a fill/draw pipe fitted with rubber, non-mechanical check valves to ensure adequate water circulation within the tank. It is anticipated at least one, if not both, of these elevated tanks would include an altitude control valve to prevent tank overflows while the pumping station is operating to fill the other tank.

The costs to construct these elevated tanks and associated facilities are discussed in a subsequent section of this report.

The Federal Aviation Administration's (FAA) regulations indicate the elevated tanks would require obstruction markings and lighting to warn pilots flying in and out of the Chicago Executive Airport. However, the FAA has the authority to declare a structure as not being a hazard to air navigation. A review of elevated tanks and standpipes in communities surrounding Prospect Heights indicates the FAA has not required any special marking (painting) of the elevated tanks or standpipes. Buffalo Grove's elevated tanks/standpipes have typical lighting fixtures mounted at the top of the tanks, but the painting appears to be Buffalo Grove's choice for color and pattern. It is anticipated the elevated tanks in the Prospect Heights system could be painted with colors, logos and patterns as decided by the City. A notification would have to be filed with the FAA during the planning/design phase of a project, but not later than 30 days prior to the start of construction.

5.5 Water Distribution System

The water distribution system was developed and sized to provide adequate fire suppression flow rates and a domestic water supply with adequate pressure to all portions of the City. The distribution system, as shown in Exhibit 1, will provide 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, with a minimum normal operating pressure of 50 psi and a maximum normal operating pressure of 75 psi.

The water distribution system would consist of approximately 63,500 feet of 12-inch and 182,000 feet of 8-inch water main pipe, approximately 460 main line valves and

approximately 710 fire hydrants. 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. The locations include Hintz Road, Palatine Road, Wheeling Road, Willow Road and Rand Road.

Most of the water mains would be installed in open cut trenches, while some locations would require or benefit from trenchless technologies such as horizontal directional drilling and boring and jacking of casing pipes. The design and construction of the distribution system would include site specific construction such as creek crossings, tree tunneling and sanitary and storm sewer replacement. Construction required to complete the water distribution system expansion and associated costs are discussed in the following section.

6. ENGINEER'S OPINIONS OF PROBABLE COST

6.1 General

The opinions of probable cost presented in this report are based on 2007 costs and the value of the dollar in 2007. It is recommended costs be reviewed and updated prior to the design and construction of improvements.

Unit prices for water main construction were determined by using an average of 9 of the 11 bids received for the SSA 6 project in March of 2007. The low and high unit prices bid for each item were not used, and the remaining 9 unit prices were averaged and rounded up to a precision equal to about 5% of the average price.

Using average unit prices and rounding the average prices resulted in unit prices in the Opinions of Probable Construction Cost being approximately 15% higher than the low bid unit prices for the SSA 6 project. Adding known additional items such as creek crossings and sidewalk restoration increased the cost by a total of approximately 18% over the low bid costs for SSA 6.

6.2 Construction and Project Cost Summary

The supply, storage and water distribution facilities necessary to provide Lake Michigan water to the Expansion Area 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 and D. The following is a summary of the construction, contingency, design and construction engineering, and legal and administrative costs for a project to provide Lake Michigan water to the Planning Area:

Water Supply Improvements (Appendix B):

Construction:	$ 745,000	
Contingency (10%)	$ 75,000	
Total Construction:		$ 820,000
Engineering:		
Design		$ 82,000
Construction – GCA & RPR		$ 58,000
Legal and Administrative		$ 15,000

Water Storage Facilities* (Appendix C):

Construction:	$ 3,510,000	
Contingency (10%)	$ 350,000	
Total Construction:		$ 3,860,000
Engineering:		
Design		$ 232,000
Construction – GCA & RPR		$ 271,000
Legal and Administrative		$ 115,000

Water Distribution System (Appendix D):

Construction:	$44,600,000	
Contingency (10%)	$ 4,460,000	
Total Construction:		$49,060,000
Engineering:		
Design		$ 3,187,000
Construction – GCA & RPR		$ 3,680,000
Legal and Administrative		$ 735,000

Opinion of Probable Construction Cost:	**$53,740,000**	
(Construction Cost includes Contingency Costs)		
Opinion of Probable Total Project Cost:		**$62,115,000**

* 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 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.

6.3 Costs to Future Water Customers

The question most often asked during discussion of a master plan is how much a project will cost a resident or business. The simplest, and easiest to understand, method to answer this question is to determine the cost on a PE basis. The total project cost of the water system expansion is approximately $62,115,000. As discussed earlier in the report, the population equivalent to be served by the City's future system (Planning Area) is 9,520 PE, while the number of customers to be served by the expanded system is estimated to be approximately 6,500 people (6,500 PE) in 2,140 residences and approximately 1,120 PE from commercial/institutional development.

The water supply and storage facilities costs could be charged to all users of the City's water system because every customer would benefit from these improvements. The total cost for the supply and storage facilities is $5,453,000, or $575 per PE for the 9,520 PE throughout the entire water system. The cost of the expanded water distribution system would be charged to the benefiting property owners in the Expansion Area. The total cost for the new distribution system is $56,662,000, or $7,450 per PE for the 7,620 PE (6,500 PE + 1,120 PE = 7,620 PE) in the expanded portion of the water system. Therefore, the total cost for residents or businesses in the expansion area is $8,025 per PE, or approximately $24,125 per single family residence. It is stressed this cost is an average cost for the 2,140 single family residences in the expansion area. Depending on the financing method, the cost per each individual residence could increase or decrease. In addition, this cost does not include financing charges.

We are not suggesting that existing customers be charged for the future supply and storage facility improvements. The above cost splitting was completed only to provide a realistic, average cost per PE for customers (or single family residence) in the expanded portion of the City's water system. If the customers in the expanded area paid for all improvements, the average cost per single family residence would be $24,500.

The cost of the water system improvements does not include the City's water service, water meter, tap-on fee, construction of service lines or private well abandonment. The City's current water connection charge is $600, while the City's water meter cost is approximately $500. The cost to connect existing building plumbing to the water service pipe at the property line would be different for each individual property, but is estimated to be in the range of $2,500 to $4,000 per property. The cost of well abandonment, or plumbing changes to isolate the building plumbing and irrigation piping, is estimated to be an additional $500 to $1,000 per property. Therefore, the total cost per average single family residence to obtain Lake Michigan water in the expansion area is between approximately $28,250 and $30,500, without interest or debt financing costs included.

The actual cost to future water users would be based on actual construction bid prices, engineering, legal and administrative costs and not the opinions of probable cost presented in this Master Plan. The costs presented are based on recent bid prices and current estimated percentages for engineering, legal and administrative costs. The costs are meant for planning purposes and are presented as a realistic range of costs to be anticipated with a decision to proceed with the expansion of the City's water system.

In 2006, Baxter & Woodman, Inc. was contracted to preliminarily design and estimate the cost of a City water system expansion into the Lake Claire area, which has been identified as SSA 6, consisting of 162 residential properties. At that time, the construction cost estimated for purposes of establishing SSA 6 was $2,804,000, or approximately $17,310 per single family residence. Subsequently, bids were received for construction of this water system expansion and the lowest responsible bid received was $2,374,784, which would have resulted in an average construction cost for water distribution system improvements of approximately $14,660 per single family residence.

The average construction cost of $14,660 per single family residence for the SSA 6 project can not be compared to the $28,250 to $30,500 average total project cost for the expansion area discussed above. The $14,660 cost is for water distribution system construction only, while the total expansion project cost range of $28,250 to $30,500 includes:

- Improvements to supply and storage facilities
- An approximate 18% increase in cost due to averaging and rounding the bid prices for water main construction
- 10% construction contingencies
- An approximate 16% increase in costs to include engineering, legal and administrative costs
- The connection charge, water meter cost, water service pipe on private property and well abandonment/plumbing changes
- Commercial/institutional customers

7. RECOMMENDATIONS

The following is a list of recommended actions to be taken by the City of Prospect Heights:

1. Approve this 2007 Water System Master Plan and use it for planning, design and construction of water system facilities if the City decides to serve the Expansion Area with Lake Michigan water. The water main sizes and locations shown in Exhibit 1 should be used to establish required water main sizes if additional Special Service Areas, or similar project sponsoring groups, are formed.

2. Update this report as required to reflect changes in construction costs prior to the design and construction of improvements.

3. At the time the future water system is to be constructed:
   a. Enter into an Intergovernmental Agreement with Mount Prospect for the secondary (emergency) water system interconnection.
   b. File a notification with the Federal Aviation Administration during the planning/design phase of elevated tank project(s).

4. Whether or not the future water system is constructed, adjust water user fees annually based on increases in the consumer price index or actual operating cost increases, whichever is greater.

City of Prospect Heights, Illinois
Water System Master Plan

Elevated Water Storage Tank Site Evaluation

	Elevated Tank Location						
Design Consideration	Northeast corner of Palatine Road and Elmhurst Road	St. Alphonsus Parish & School	Corner of Palatine Road and Schoenbeck Road	Sullivan / Ross School properties	Willow Road, east of Rand Road	Eisenhower School property	Euclid Avenue at entrance to Rob Roy
Ground Surface Elevation	3	2	6	5	7	4	1
Location in Distribution	4	2	6	5	7	3	1
Location relative to high fire flow rate areas	2	1	3	6	7	5	4
Minimal development to north of tank (shadow)	1	7	4	3	5	2	6
Minimal development for painting/maintenance	3	7	5	6	4	2	1
Exposure for City name/logo on tank	2	3	6	4	7	1	5
Location relative to airport.	2	1	4	6	7	5	3
Water main to connect to distribution system	1	2	6	4	7	5	3
Acquisition of Land/Easement	7	4	2	6	3	5	1
Total Score/Rating of Site	25	29	42	45	54	32	25

Note: Each site ranked on a scale of 1 to 7 (7 being best) relative to the other sites.

APPENDIX A

Opinion of Probable Construction Cost for Water Supply Improvements to provide Lake Michigan water to the entire Planning Area

Item No.	Description	Quantity	Unit	Unit Price	Amount
Improvements to Pumping Station for higher capacity/pressure pumps:					
1.	Upgrade/Replace Pumps and Motors 700 gpm at 200 feet TDH (3 of these 4 pumps ≥ Maximum Daily Demand)	4	each	$ 25,000	$ 100,000
2.	Upgrade Electrical System, including motor drives, wiring, etc.			Lump Sum	$ 60,000
3.	Upgrade/Replace Controls			Lump Sum	$ 10,000
4.	Provide and Install SCADA system between elevated tanks and ground storage tanks			Lump Sum	$ 40,000
5.	Emergency Power is provided by dual feed from ComEd and is already in place				$ -
	Subtotal for Improvements to Pumping Station				$ 210,000

Opinion of Probable Construction Cost for Water Supply Improvements to provide Lake Michigan water to the entire Planning Area

Item No.	Description	Quantity	Unit	Unit Price	Amount
Camp McDonald Road Water Main to Illinois-American Connection at Burning Bush Lane:					
1.	Water Main (Open Cut)				
	12-inch	1,100	lin.ft.	$ 75	$ 82,500
	12-inch restrained joint	100	lin.ft.	$ 85	$ 8,500
2.	Water Main (Directionally Drilled)				
	12-inch	200	lin.ft.	$ 150	$ 30,000
	Mobilization/Demobilizaton	1	each	$ 2,500	$ 2,500
3.	Water Main Fittings - Restrained Joint Type				
	12-inch x 6-inch Tee	5	each	$ 650	$ 3,250
	12-inch 90^{O} Bend	2	each	$ 600	$ 1,200
	12-inch 45^{O} Bend	4	each	$ 575	$ 2,300
	12-inch Cutting-In Sleeve	1	each	$ 1,250	$ 1,250
4.	Connection to Existing Water Main (Pressure)				
	20-inch x 12-inch	1	each	$ 20,000	$ 20,000
5.	Connection to Existing Water Main (Non-Pressure)				
	12-inch	1	each	$ 3,000	$ 3,000
6.	Gate Valve and Valve Box				
	12-inch	1	each	$ 2,250	$ 2,250
7.	Gate Valve and Valve Vault				
	12-inch in 5 foot diameter vault	1	each	$ 4,500	$ 4,500
8.	Fire Hydrant	5	each	$ 3,750	$ 18,750
9.	Water Service Connection				
	1-1/2 inch	32	each	$ 750	$ 24,000
10.	Water Service Pipe				
	1-1/2 inch - Same side of street	16	each	$ 750	$ 12,000
	1-1/2 inch - Opposite side of road	16	each	$ 3,000	$ 48,000
11.	Tree Tunneling (Water Main)				
	Tunnel	100	lin.ft.	$ 100	$ 10,000
	Mobilization/Demobilization	5	each	$ 750	$ 3,750
12.	Removal and Replacement of Unsuitable Material	50	cu.yd.	$ 75	$ 3,750

Opinion of Probable Construction Cost for Water Supply Improvements to provide Lake Michigan water to the entire Planning Area

Item No.	Description	Quantity	Unit	Unit Price	Amount
13.	Sanitary Sewer Service Line Repair	16	each	$ 500	$ 8,000
14.	Replacement of Drain Tiles				
	8-inch	20	lin.ft.	$ 40	$ 800
	6-inch	40	lin.ft.	$ 35	$ 1,400
15.	Granular Backfill Material	360	lin.ft.	$ 32	$ 11,520
16.	Backfilling with Controlled Low Strength Flowable Fill Mixture	60	cu.yd.	$ 125	$ 7,500
17.	Pavement Restoration				
	Bituminous Street - 4"	60	sq.yd.	$ 45	$ 2,700
	Concrete Curb and Gutter	30	lin.ft.	$ 35	$ 1,050
	Bituminous Driveway - 2-1/2"	190	sq.yd.	$ 40	$ 7,600
	Concrete Driveway	30	sq.yd.	$ 75	$ 2,250
18.	Restoration of Lawns and Parkways				
	Topsoil and Sod	800	lin.ft.	$ 10	$ 8,000
19.	Preconstruction Video Recording			Lump Sum	$ 2,000
20.	Traffic Control and Protection			Lump Sum	$ 10,000
21.	Erosion and Sedimentation Control			Lump Sum	$ 5,500
22.	Cash Allowance for Landscaping and work outside Prospect Heights			Lump Sum	$ 25,000
	Subtotal for Camp McDonald Road Water Supply Main				$ 375,000

Opinion of Probable Construction Cost for Water Supply Improvements to provide Lake Michigan water to the entire Planning Area

Item No.	Description	Quantity	Unit	Unit Price	Amount
	Improvements to I-A 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	$ 20,000
2.	Install concrete pad, drive, landscaping, controlled environment enclosure and security with SCADA connection			Lump Sum	$ 30,000
	Subtotal for Euclid Avenue Emergency Supply Connection				$ 50,000
	Improvements to Mount Prospect connection at Camp McDonald Road/Elmhurst Road for emergency supply:				
1.	Install additional water main to site of City Hall site	300	lin.ft.	$ 200	$ 60,000
2.	Cut supply main and install bends with thrust blocks, elbows with restraint structure, valves, and quick connect fittings			Lump Sum	$ 20,000
3.	Install concrete pad, drive, landscaping, controlled environment enclosure and security with SCADA connection			Lump Sum	$ 30,000
	Subtotal for Mount Prospect Emergency Supply Connection				$ 110,000

Opinion of Probable Construction Cost for Water Supply Improvements to provide Lake Michigan water to the entire Planning Area

Item No.	Description	Quantity	Unit	Unit Price	Amount
Summary of Improvements for Water Supply Facilities :					
	Subtotal for Improvements to Pumping Station				$ 210,000
	Subtotal for Camp McDonald Road Water Supply Main				$ 375,000
	Subtotal for Euclid Avenue Emergency Supply Connection				$ 50,000
	Subtotal for Mount Prospect Emergency Supply Connection				$ 110,000
OPINION OF PROBABLE CONSTRUCTION COST					**$ 745,000**

City of Prospect Heights, Illinois
Water System Master Plan

APPENDIX C

Opinion of Probable Construction Cost for Water Storage Facilities to store Lake Michigan water 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	2	each	$ 1,400,000	$ 2,800,000
2.	Foundations for Tanks:				
	50 foot diameter ring, 9 feet deep				
	Excavation	2	each	$ 15,000	$ 30,000
	Bedding and compaction	2	each	$ 5,000	$ 10,000
	Concrete	2	each	$ 100,000	$ 200,000
	Anchor bolts	2	each	$ 5,000	$ 10,000
	Backfill and compaction	2	each	$ 9,000	$ 18,000
	Contingency for differing sites (20% for one of two)			$ 27,000	$ 27,000
3.	Internal piping modifications for flow circulation valves	2	each	$ 12,500	$ 25,000
4.	Lighting, security,access drive and landscaping	2	each	$ 25,000	$ 50,000
	Contingency for differing sites (25% for one of two)			$ 6,250	$ 6,250
5.	16-inch water main, from tank to distribution system, including restoration				
	125 lin.ft. at each site @ $200 per foot	2	each	$ 25,000	$ 50,000
	Hydrant, valves, vaults at each site	2	each	$ 20,000	$ 40,000
	Contingency for differing sites (25% for one of two)			$ 12,000	$ 12,000
6.	Altitude Control Valve with SCADA	2	each	$ 75,000	$ 150,000
7.	Rechlorination facilities	2	each	$ 40,000	$ 80,000
					$ 3,508,250
OPINION OF PROBABLE CONSTRUCTION COST					**$ 3,510,000**

Opinion of Probable Construction Cost for Water Distribution System to provide Lake Michigan water to the entire Expansion Area

Item No.	Description	Quantity	Unit	Unit Price*	Amount
1.	Water Main (Open Cut)				
	12-inch	52,000	lin.ft.	$ 75	$ 3,900,000
	12-inch restrained joint	1,600	lin.ft.	$ 85	$ 136,000
	8-inch	136,940	lin.ft.	$ 60	$ 8,216,400
	8-inch restrained joint	12,150	lin.ft.	$ 70	$ 850,500
	6-inch restrained joint	1,420	lin.ft.	$ 65	$ 92,300
2.	Water Main (In Casing - Open Cut)				
	12-inch R.JT. in 24-inch Casing	940	lin.ft.	$ 175	$ 164,500
	8-inch R.JT. in 24-inch Casing	1,130	lin.ft.	$ 160	$ 180,800
3.	Water Main (Directionally Drilled)				
	12-inch	7,300	lin.ft.	$ 150	$ 1,095,000
	8-inch	19,650	lin.ft.	$ 125	$ 2,456,250
	Mobilization/Demobilizaton	120	each	$ 2,500	$ 300,000
4.	Water Main (In Jacked Casing)				
	12-inch R.JT. in 24" Steel Casing	1,280	lin.ft.	$ 500	$ 640,000
	8-inch R.JT. in 24" Steel Casing	2,880	lin.ft.	$ 425	$ 1,224,000
	Mobilization/Demobilizaton	52	each	$ 5,000	$ 260,000
5.	Water Main Fittings - Restrained Joint Type				
	12-inch x 12-inch Cross	7	each	$ 900	$ 6,300
	12-inch x 12-inch Tee	6	each	$ 750	$ 4,500
	12-inch x 8-inch Tee	74	each	$ 700	$ 51,800
	12-inch x 6-inch Tee	213	each	$ 650	$ 138,450
	12-inch x 8-inch Reducer	2	each	$ 500	$ 1,000
	12-inch 90^{O} Bend	4	each	$ 600	$ 2,400
	12-inch 45^{O} Bend	20	each	$ 575	$ 11,500
	12-inch Plug	2	each	$ 300	$ 600
	12-inch Cutting-In Sleeve	2	each	$ 1,250	$ 2,500
	8-inch x 8-inch Cross	18	each	$ 650	$ 11,700
	8-inch x 8-inch Tee	91	each	$ 550	$ 50,050
	8-inch x 6-inch Tee	479	each	$ 500	$ 239,500
	8-inch x 6-inch Hydrant Tee	18	each	$ 800	$ 14,400
	8-inch x 6-inch Reducer	4	each	$ 350	$ 1,400
	8-inch 90^{O} Bend	20	each	$ 500	$ 10,000
	8-inch 45^{O} Bend	24	each	$ 500	$ 12,000
	8-inch 22-1/2^{O} Bend	12	each	$ 500	$ 6,000
	8-inch 11-1/4^{O} Bend	12	each	$ 500	$ 6,000
	8-inch Plug	4	each	$ 250	$ 1,000
	8-inch Cutting-In Sleeve	4	each	$ 1,000	$ 4,000

Opinion of Probable Construction Cost for Water Distribution System to provide Lake Michigan water to the entire Expansion Area

Item No.	Description	Quantity	Unit	Unit Price*	Amount
6.	Connection to Existing Water Main (Pressure)				
	12-inch x 12-inch	3	each	$ 12,500	$ 37,500
	12-inch x 8-inch	3	each	$ 10,000	$ 30,000
7.	Connection to Existing Water Main (Non-Pressure)				
	12-inch	2	each	$ 5,000	$ 10,000
	8-inch	2	each	$ 4,000	$ 8,000
8.	Gate Valve and Valve Box				
	12-inch	102	each	$ 2,750	$ 280,500
	8-inch	303	each	$ 2,000	$ 606,000
9.	Gate Valve and Valve Vault				
	12-inch in 5 foot diameter vault	11	each	$ 4,500	$ 49,500
	8-inch in 4 foot diameter vault	33	each	$ 3,500	$ 115,500
10.	Fire Hydrant	710	each	$ 3,750	$ 2,662,500
11.	Fire Hydrant Barrel Extension	237	vert.ft.	$ 500	$ 118,500
12.	Water Service Connection, includes corporation stop, curb stop and B-box				
	1-1/2 inch	2,368	each	$ 750	$ 1,776,000
13.	Water Service Pipe				
	1-1/2 inch - Same side of street	1,184	each	$ 750	$ 888,000
	1-1/2 inch - Opposite side of street	896	each	$ 2,000	$ 1,792,000
	1-1/2 inch - Opposite side of highway	288	each	$ 3,000	$ 864,000
14.	Sanitary Sewer Replacement				
	8-inch pipe	1,650	lin.ft.	$ 75	$ 123,750
	6-inch pipe	100	lin.ft.	$ 75	$ 7,500
	Connection to existing manhole	5	each	$ 1,250	$ 6,250
	Connection to existing pipe	78	each	$ 600	$ 46,800
	8-inch x 6-inch service connection	5	each	$ 1,000	$ 5,000
15.	Storm Sewer Replacement				
	24-inch pipe	20,940	lin.ft.	$ 100	$ 2,094,000
	18-inch pipe	3,520	lin.ft.	$ 90	$ 316,800
	16-inch pipe	1,530	lin.ft.	$ 80	$ 122,400
	12-inch pipe	6,820	lin.ft.	$ 75	$ 511,500
	Connection to existing structure/pipe	640	each	$ 750	$ 480,000

Opinion of Probable Construction Cost for Water Distribution System to provide Lake Michigan water to the entire Expansion Area

Item No.	Description	Quantity	Unit	Unit Price*	Amount
16.	Tree Tunneling (Water Main)				
	Tunnel	4,660	lin.ft.	$ 100	$ 466,000
	Mobilization/Demobilization	250	each	$ 750	$ 187,500
17.	Tree Removal	890	in.dia.	$ 50	$ 44,500
18.	Removal and Replacement of Unsuitable Material	1,250	cu.yd.	$ 75	$ 93,750
19.	Sanitary Sewer Service Line Repair	1,200	each	$ 500	$ 600,000
20.	Replacement of Drain Tiles				
	8-inch	250	lin.ft.	$ 40	$ 10,000
	6-inch	500	lin.ft.	$ 35	$ 17,500
21.	Stream/Creek Crossings	15	each	$ 5,000	$ 75,000
22.	Granular Backfill Material	62,710	lin.ft.	$ 32	$ 2,006,720
23.	Backfilling with Controlled Low Strength Flowable Fill Mixture	1,500	cu.yd.	$ 125	$ 187,500
24.	Pavement Restoration				
	Bituminous Street - 4"	33,180	sq.yd.	$ 45	$ 1,493,100
	Concrete Curb and Gutter	1,960	lin.ft.	$ 35	$ 68,600
	Bituminous Driveway - 2-1/2"	31,300	sq.yd.	$ 40	$ 1,252,000
	Concrete Driveway	12,970	sq.yd.	$ 75	$ 972,750
	Gravel shoulders	14,260	lin.ft.	$ 8	$ 114,080
	Sidewalk	130,000	sq.ft.	$ 7	$ 910,000
25.	Driveway Culvert Headwalls				
	Bituminous	24	each	$ 600	$ 14,400
	Concrete	36	each	$ 1,000	$ 36,000
	Railroad Tie or Landscaping Timbers	72	each	$ 650	$ 46,800
26.	Restoration of Lawns and Parkways				
	Topsoil and Seed	176,900	lin.ft.	$ 10	$ 1,769,000
	Topsoil and Sod	3,780	lin.ft.	$ 15	$ 56,700
27.	Culvert Removal and Replacement				
	12-inch CMP pipe	500	lin.ft.	$ 50	$ 25,000
	12-inch CMP flared end sections	50	each	$ 250	$ 12,500

Opinion of Probable Construction Cost for Water Distribution System to provide Lake Michigan water to the entire Expansion Area

Item No.	Description	Quantity Unit	Unit Price*	Amount
28.	Preconstruction Video Recording		Lump Sum	$ 70,000
29.	Traffic Control and Protection		Lump Sum	$ 620,000
30.	Erosion and Sedimentation Control		Lump Sum	$ 250,000
31.	Cash Allowance for Landscaping		Lump Sum	$ 125,000
				$ 44,567,250
OPINION OF PROBABLE CONSTRUCTION COST				**$ 44,600,000**

* Unit prices were determined by using an average of 9 of the 11 bids received for the Special Service Area 6 (SSA 6) project in March of 2007. The low and high unit prices bid for each item were not used, and the remaining nine unit prices were averaged, and rounded up to a precision equal to about 5% of the average price.

Using average unit prices and rounding the average prices resulted in unit prices in this Opinion of Probable Construction Cost being approximately 15% higher than the low bid unit prices for the Special Service Area 6 project. Adding known additional items such as creek crossings and sidewalk restoration increased the difference in "per lot" cost to a total of approximately 18% over the low bid cost for SSA 6.