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To: Public Works Committee

From: Carl S. Goldsmith, Director of Public Works CJ

Date: June 5, 2013

Subject: Water System Network Analysis

Last year, the Village of Lombard hired the engineering firm of Alfred Benesch & Company to investigate water usage and analyze the distribution system network. Their analysis of the existing water system culminated with a comprehensive computer model, capable of identifying areas of reduced fire flow, assessing storage requirements and needs, and determining the water system's ability of meeting existing and future growth demands. The developed model will also serve as an invaluable tool to assist in the planning/assessment of short and long term projects, including the ten-year capital improvement program.

Representatives from Alfred Benesch & Company have been invited to present their model, demonstrate its capabilities, discuss their analysis of the water system's condition, and provide some short and long term recommendations for system improvements. The purpose of the presentation to the Committee is for the future planning of capital projects and a greater understanding of the Village's water system. Following the presentation, the staff requests that the Committee accept the report and further recommend the Committee forward the report to the Village Board for consideration.

FINAL

WATER SYSTEM NETWORK ANALYSIS

PREPARED FOR THE:

VILLAGE OF LOMBARD, ILLINOIS

May, 24 2013

benesch
engineers · scientists · planners

INTRODUCTION

The Village of Lombard engaged the services of Alfred Benesch to complete an evaluation of the Village's water distribution system. This report represents the findings of this study. The evaluation was completed via collection of extensive physical data regarding the Village's water system, and then assembling this information into a computer model to simulate the operations of the system.

This report consists of six sections as follows:

Introduction
This section provides a general overview of the system, the history of previous studies, the purpose of this study and the scope of this report.

Part I Existing Water Distribution System
This section provides a summary of the system facilities. Tables of each of the system components are provided for pump stations and storage facilities.

Part II Population and Water Demand Projections
This section contains data and graphs depicting historical and future population and water demand projections.

Part III Model Development and Hydraulic Analysis
This section contains a discussion of development of the computer model and the field calibration efforts.

Part IV Analysis and Recommended Improvements
This section addresses recommendations in the areas of water supply, water storage and distribution system improvements.

Part V Final Summary
This section provides a general synopsis of the results and recommendations of this report.
A standalone companion document entitled "WaterCAD Modeling Results" provides the Village with a printout of the analyses completed, along with a graphical representation of the system headlosses associated with each analysis, and a tabular summary of each computer run.

A. General System Information and History

Historically, the Village of Lombard provided water to its customers from five deep wells and three shallow wells. In May of 1992, the Village began using Lake Michigan as their water source and since that time has maintained two deep and two shallow wells in standby mode. The Village of Lombard provides Lake Michigan water to its customers from four pressure adjusting stations (PAS) and two booster stations as needed. These stations are Highland Avenue Water Storage Facility (PAS 14-a), North Avenue Water Storage Facility (PAS 14-b), Central Station Reservoir Facility (PAS 14-c), Civic Center Reservoir Facility (PAS 14-d), South Booster Station and Main Street Booster Station. Each pressure adjusting station receives water from the DuPage Water Commission (DWC) and is equipped with chlorination equipment and a storage facility. The water distribution system is divided into two distinct pressure zones. Generally, the low pressure zone is located north of Roosevelt Road and the high pressure zone is located south of Roosevelt Road. South Booster Station and Main Street Booster Station transfer water between the high and low pressure zones when required by the system.

B. History of Distribution System Studies

In 2001, a comprehensive hydraulic analysis on the water system was prepared by Burns & McDonnell. A WaterCAD computer model of the Village's distribution system was created for that report. In 1988, a comprehensive report on the waterworks system was prepared by Howard, Needles, Tammen and Bergendoff (HNTB). Due to computer limitations at that time, a skeletonized computer model of the Village's distribution system was assembled for that report. The 2001 model included a full model of all pipes in the system. Both studies included an evaluation of areas of concern for watermain replacement, improvements for fire flow deficiencies, and recommendations for future system improvements. One major recommendation from the 2001 model that the Village implemented was the construction of a new inter-zone transfer station in the high pressure zone. This was booster station was constructed in 2009. The Village also implemented the following recommendations from the 2001 model, backup power supply at all their stations and seasonal variation of pressure for station operations. There were a few recommendations from the 2001 model that were deferred. These recommendations included, the construction of a new storage facility in the high pressure zone, ongoing replacement of aging and smaller sized water mains, and replacement of watermains in areas flagged with low pressure and fire flows.

The Village staff has compiled a manual that details the existing water system. This manual contains all pertinent information for the waterworks system. Included within this document are reports, historical improvements, station data and emergency operation procedures.

This current report includes a hydraulic analysis of the entire Lombard water system and recommendations for improvements. A graphical hydraulic computer model was developed utilizing the Village's geographic information system (GIS) data and water atlases. Similar to the 2001 model, the 2012 model is a simulation of all pipes in the Village's water system.

One of the driving forces behind the development of the model at this time is to provide the Village with an updated analysis of the existing water system to identify areas of reduced fire flow, undersized/failing watermains and storage deficiencies and to help plan for future growth and development.

C. Purpose

The purpose of this report is to evaluate the Village of Lombard's water distribution system with a computerized hydraulic model and to provide a planning document for future distribution system capital improvements. This report is intended to be used as a planning and budgeting document. The model is also to be used to size watermains for additional land development or land use changes as it occurs throughout the Village. Prior to construction of the recommended improvements, the actual operating conditions should be reviewed for comparison with the operating condition assumptions used in this report.

As with any future planning tool, a number of future growth assumptions were made. These assumptions should also be confirmed as future improvements are implemented. This includes assumptions regarding population projected growth, water usage patterns, future developments as identified by the Village, as well as hydraulic analysis criteria. These assumptions and values used for these components are discussed throughout the remainder of this text.

One of the driving forces for this effort at this time was the desire to examine the Roosevelt Road watermain system. An upgrade project was targeted to be completed, and up to date hydraulic information was desired to ensure proper sizing and system reconfiguration.

D. Scope

The scope of this report volume includes the following:

- Description of the existing water distribution system facilities and operations.
- Population and water demand projections.
- Development of a calibrated hydraulic model utilizing the WaterCAD modeling program from Bentley.
- Hydraulic analyses evaluating demand conditions for average day, maximum day, and maximum day plus fire demand for existing and future conditions.
- Evaluate the effect of tapping into transmission mains for water services, fire hydrants and small service mains.
- Analyze the Roosevelt Road corridor for hydraulic information on construction abandonment, and resizing of watermains.
- Recommend improvements including the need for a transmission main to serve South Booster Station from Civic Center Reservoir Facility.
- Recommendations for system improvements to correct system deficiencies and meet future water demands.

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PART V
FINAL SUMMARY

A. General

Part V of this report serves to summarize the recommendations outlined in Part IV, as well as to provide additional suggestions to the Village for future data maintenance and updates.

B. Recommended Actions

The following items are discussed in Part IV and are summarized here in tabular format for reference. They are as follows:

1. Transmission Main

Improvement	Cost	Date
New Transmission main from CCRF to South Booster Station	$1,100,500.00	Immediately

2. Operational Improvements

Improvement	Cost	Date
Fire Flow Improvements/Watermain Replacement	$250,000.00 per year	Immediately and ongoing
Implement four locations for fire flow improvements – Glen Oak; Westmore Avenue and Madison Street; Lodge Lane; Craig Place and Stewart Avenue	varies depending on options selected	
Seasonal Variation of System Pressure	In house	Begin 2013

3. Additional Distribution System Improvements

The system is relatively strong, with very few systems exhibiting low pressures or flows, even during fire flows. However, the system is aging, and the C value testing indicates that the carrying capacity of your mains is degrading over time, and very old mains should be considered for replacement when the opportunity emerges. The Village should develop a flow testing program in locations of planned street improvements to determine the current C value of the main and assess whether or not the main should be replaced. C value testing is relatively quick and easy, so this would be a good investment in the future It is recommended that the Village continue to evaluate age and break history, and use this data to evaluate if a main makes sense to replace concurrent with road projects.

4. Future Growth Improvements

The Village has provided some areas of potential development. This information was input into the model to determine some suggested sizes to support these developments. These are shown on Figure I-2. It is important to note that these are conceptual plan type recommendations and should be evaluated based on actual site plans and proposed water usage. We have made

assumptions based on typical type users at these locations and if a high capacity water user were to be located there, these would need further evaluation:

a. Commercial & Industrial (2 sections in low pressure zone, 1 in high pressure:
   - Area 1: water main extension 600'-10", 500'-4" water service to building
   - Area 2: water main extension 650'-10", 500'-4" water service to building
   - Area 7: water main extension 550'-12", 300'-4' water service to building (HP)

b. Residential/Multi-Family (3 in low pressure zone, 6 in high pressure zone):
   - Area 3: 3,000'-8" water main, 18-1"-2" water service lines (LP)
   - Area 4: 5,000'-8" water main, 100- 1"-2" water service lines (LP)
   - Area 5: 6,500-8" water main, 98- 1"-2" water service lines (LP)
   - Area 6: 10,000-8" water main, 150-1"-2" water service lines
   - Area 8: 10-1-2" water service connections (mains already there)
   - Area 9: 17,500'-8" water main, 930-1"-2" water service lines (this is Highland Hills, they already have mains, but unsure if Village would use the existing ones) (HP)
   - Area 10: 5-1-2" water service connections (HP)
   - Area 11: 9-1-2" water service connections (HP)

C. Other Recommendations

In addition to the recommendations outlined above, there are a few other procedural recommendations that we suggest that will facilitate additional water system analysis and other department functions.

Model Updates

It is recommended that the Village plan a major update of the computer model every five to ten years to complete a big picture analysis of the system in operation. In addition, it is suggested that the Village establish a task order contract for on call assignments to evaluate potential additions and changes to the system. Several communities utilize this system, and in many cases back charge the developer for the cost of the sizing work.

D. Summary

Overall, the Village of Lombard's distribution system is very strong and healthy. The Village staff has done an excellent job of adding system enhancements of the proper size and location. It was a rewarding experience to have the opportunity to reevaluate a system 10 years after the completion of a major water system master plan, evaluating the impact of the improvements introduced and observe the impacts of ten years of aging. The improvements outlined have been outlined have been implemented, and the system is operating even more efficiently than before. And even, better news is that 10 years of aging had very minimal impact on the flow characteristics of the system. With the investment in the modeling tool, the Village continues to be positioned to evaluate future improvements on an ongoing basis.

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