BASIS OF DESIGN REPORT FOR THE CONSTRUCTION OF A PUBLIC WATER SUPPLY SYSTEM

H2M Project No. EWTV1201

MARCH 2013
UPDATED AUGUST AND NOVEMBER 2014

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INC. VILLAGE OF EAST WILLISTON
BASIS OF DESIGN REPORT
FOR THE
CONSTRUCTION OF PUBLIC WATER SUPPLY SYSTEM
TABLE OF CONTENTS

MARCH 2013
UPDATED AUGUST 2014

TABLE OF CONTENTS (cont'd.)

MARCH 2013
UPDATED AUGUST 2014

List of Tables

TABLE OF CONTENTS (cont'd.)

List of Tables (Cont.)

List of Figures

List of Appendices

INCORPORATED VILLAGE OF EAST WILLISTON

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UPDATED AUGUST AND NOVEMBER 2014

EXECUTIVE SUMMARY

The Inc. Village of East Williston (Village) retained H2M architects + engineers (H2M) to prepare a report to evaluate the option to develop its own source of supply. This report has been updated to address the comments made by the Nassau County Department on the March 2013 report submission.

Presently the Village maintains and operates a water system which provides potable water and fire protection to the community it serves. Treated source water is purchased from the Inc. Village of Williston Park (Williston Park) and is transmitted through a single metered interconnection into the Village distribution system A recent and substantial water rate increase implemented by Williston Park has compelled the Village to evaluate the option to develop its own source of supply. The goal of the Village is to provide high quality and ample quantity of drinking water at a reasonable cost.

The report developed a "basis of design" to establish the preliminary design for six viable options, establish a plan to implement the project and provide the cost analysis of owning and operating a Village water supply system versus continuing with the wholesale purchase of water. An evaluation of Village water use statistics was conducted to determine required water supply and storage capacity. Projected water quality was reviewed to assess raw source water treatment requirements. This information and assessment was used to develop a preliminary design of a Village water supply system that will include supply wells; well pumps; chemical feed and storage systems for pH adjustment and chlorination; site work and site piping; buildings; electrical service and motor control center, instrumentation; wellhead treatment for VOC removal (if necessary); water main for connection to distribution system and provisions for standby power as needed. A detailed water supply system implementation plan was also prepared. The report developed a

detailed capital cost opinion and an estimate of annual operating costs to operate a separate water supply system, including labor, chemicals, electrical, laboratory testing, etc. This data was used to determine the total annual cost of operating a Village supply system. Subsequently the data and analysis was used to compare the cost of constructing a new supply system to purchasing water from Williston Park.

It was determined based on current and projected water supply needs for the Village, a new water supply system must be able to meet the following future demand conditions:

- Average Day : 0.49 MGD
- Maximum Day : 1.35 MGD
- Peak Hour : 2.02 MGD
- Max. Day + Fire Flow: 2.10 MGD
- Upper Fire Flow Limit: 0.63 MGD

Based on projected water demand for the Village two 1,400 gpm supply wells and a 100,000 gallon ground storage tank will be required. This will provide the Village with 4.13 MGD in total capacity. A single 1,400 gpm (2.0 MGD) supply well along with 100,000 gallons of storage will be able to satisfy all projected demand conditions. Each well will be screened within the magothy formation but at different intervals with as much vertical separation as possible to conform to the recommendations provided in Ten States Standards. Water will be drawn from our vast unconfined Long Island aquifer that in essence stores groundwater. This design proposal exceeds the capabilities and reliability of the supply system presently provided by the Village of Williston Park.

A 2.05 acre parcel (Section 9,Block 566, Lot 2) located on the north side of East Williston Avenue (Hillside Avenue) between the Long Island Railroad to the west and Bengeyfield Drive to the east is of sufficient size to accommodate the supply wells and required infrastructure. The parcel is currently used as a Village public park and recreation area. The Village, through legal counsel, will be required to obtain sanitary easements for the supply wells form the surrounding land owners.

A review of projected water quality concluded that basic raw water treatment will include the addition of sodium hydroxide (25% caustic soda) for pH adjustment and calcium hypochlorite

(less than 1 % chlorine) for disinfection. Based on local public water supply well data, trace levels of volatile organic compounds (VOCs) are present within the intermediate and deep regions of the magothy formation. Therefore air stripping removal or granular activated carbon filtration for VOC removal was considered as part of the overall cost should wellhead treatment be required.

The report determined that provisions will be required to provide standby power to the supply system to satisfy more than average day demand conditions should primary utility power be lost. A diesel generator equipped with an automatic transfer switch housed in a self contained sound attenuated enclosure with a minimum of 3 days of fuel supply will be necessary for standby power generation.

The Village distribution system presently meets its water demand requirements with a single interconnection on the west side of system that can supply a theoretical maximum capacity of 1,613 gpm,. The proposed system can supply 2800 gpm at the same location along with 100,000 gallons of storage. All Village water mains are 6-inches or larger, therefore modification of the distribution system is not recommended.

The proposed construction of new groundwater supply system for the Village with a design capacity of 2,800 gpm (4.0 MGD) would fall under an IB system classification and requires that a Plant Operator hold a valid IB certification. To mitigate labor costs the Village could consider having the current "D" operator pursue obtaining an IB certification. The Village can also consider other measures for IB plant operator supervision through outside consulting arrangements.

Option 3C that utilized hydropneumatic tanks was originally determined to be the most economically viable, however based on the size of the Village system the Nassau County Department of Health could not support the recommendation. Based on the capital and operating cost analysis of each option without the use of hydropneumatic tanks it was determined that Option 2B provides the lowest capital and operating cost to the Village. This design option consists of two supply wells equipped with variable speed drives that will pump through a GAC filtration system if needed with discharge directly to system and ground storage tank. Variable speed booster pumps

will be used to transfer water from ground storage tank to distribution system. As a cost savings measure a prefabricated treatment building will be utilized. The building will be situated on the site to minimize disturbance to the existing tennis courts and baseball field. The total first year cost (capital and operating) based on a 30 year bond at 3 % interest is estimated to be $581,246.

The current cost of purchased water from the Village of Williston Park is $4.33 per 1,000. Based on historical demand and projected maximum usage, this expense based on current wholesale rates, can range from $594,246 to $613,473 per year. This range was based on the lowest recorded annual use of 125 MG (during 2004-2014) and the projected maximum annual demand of 178.9 MG. Depending upon financing terms and water demand conditions, the implementation of Option 2B will be more cost effective to produce water rather than to purchase at the present wholesale rate from the Village of Williston Park. The savings will increase significantly when annual maximum demand conditions are experienced. Should the wholesale water rates charged by the Village of Williston Park increase again, then the savings become even more significant.

The following matrix summarizes the estimated cost per thousand pumped based on various annual water usage conditions for Option 2B:

Cost per Thousand Matrix for Option 2B			
Demand Category	**Annual Demand (Gallons)**	**First Year Cost**	**Cost per Thousand Billed**
Maximum [1]	161,100,000	$600,473	$ 3.73
Average [2]	124,400,000	$ 581,246	$ 4.68
Minimum [2]	111,600,000	$ 572,973	$ 5.13

Note: The net cost per gallon is expected to be lower due to the levying of the capital cost

Should the wholesale water rates charged by the Village of Williston Park increase again, then the savings become even more significant

The following actions are recommended should the Village decide to move forward with the construction of a new water supply system.

1. Detailed financial, design, operational and legal review will be required should the Village decide to construct a new water supply system. For example the Village should consult with legal counsel to determine if there are any particular legislative requirements related to the partial conversion of a public park and recreation area for water supply use.
2. Submit this "Basis of Design" report to the Nassau County Department of Health to commence the regulatory approval process and request that a concurrent review be conducted by the New York State Department of Health.
3. Commence the legal process for obtaining sanitary well easements from surrounding land owners.
4. Consult with Bond Counsel to review legal requirements related to water system financing options which can include financing through the New York State Drinking Water Revolving Loan Fund.
5. Solicit request for proposals to retain a qualified engineering consultant to commence with the regulatory permitting and detailed water system design.

INCORPORATED VILLAGE OF EAST WILLISTON

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1.0 INTRODUCTION

The Inc. Village of East Williston (Village) maintains and operates a water system which provides potable water and fire protection to the community it serves. Treated source water is purchased from the Inc. Village of Williston Park (Williston Park) and is transmitted through a single metered interconnection into the Village distribution system. A recent and substantial water rate increase implemented by Williston Park has compelled the Village to evaluate the option to develop its own source of supply. In the past the Village has explored purchasing water from neighboring systems. However the systems have indicated that they do not have excess capacity to supply the Village on a long term basis. Therefore the only alternative available to the Village at this time is to assess the option of constructing its own water supply.

1.1 SCOPE

This report will develop a "basis of design" to establish the preliminary design, establish a plan to implement the project and provide the cost analysis of owning and operating a Village water supply system versus continuing with the wholesale purchase of water. An evaluation of Village water use statistics will be used to determine required water supply and storage capacity. Projected water quality will also be reviewed to assess raw source water treatment requirements. This information and assessment will be used to develop a preliminary design of a Village water supply system that will include supply wells, well pumps, chemical feed and storage systems for pH adjustment and chlorination, site work and site piping, buildings, electrical service and motor control center, instrumentation, wellhead treatment for VOC removal (if necessary), water main for connection to distribution system and provisions for standby power as needed. A detailed water supply system implementation plan will also be prepared, including required permits and

summary of potential risks. This report has been updated to address the comments made by the Nassau County Department on the March 2013 report submission.

The report will develop a detailed capital cost opinion and an estimate of annual operating costs to operate a water supply system, including labor, chemicals, electrical, laboratory testing, etc. This data will be used to determine the total annual cost of operating a Village supply system which will be used to determine if it is more cost effective to construct a new supply system or continue to purchase water from Williston Park.

Our findings and recommendations will be summarized so the Village can determine the most economically viable option to provide its residents with a reliable supply of high quality drinking water at a reasonable cost.

2.0 - VILLAGE SERVICE AREA

The Inc. Village of East Williston is approximately 0.7 square miles in area and is located in the south central portion of the Town of North Hempstead in Nassau County (refer to Figure 2-1). Adjacent water suppliers are the Inc. Village of Williston Park to the west; the Albertson Water District to the north; the Inc. Village of Old Westbury to the east; and the Inc. Village of Mineola to the south. The topography of the Village can generally be classified as gently sloping with elevations of the terrain varying between 130 and 99 feet above mean sea level (msl). The highest elevations are recorded in the northwest corner of the Village at approximately 130 feet above msl.

Based on most recent LIPA population survey data the Village serves a population of 2,551 (LIPA 2011). April 2010 US census data indicated a total village population of 2,556. The community is primarily zoned for residential use. With the Village presently completely developed, the only significant change in population can come from redevelopment of existing properties. There are only a few properties of any substantial size within the Village boundaries that could possibly be redeveloped and have an impact on population growth and water demand. These properties include the Wheatley Hills Golf Club, the North Side Elementary School and a few religious institutions. The school and the religious institutions are well established and have not disclosed any plans for redevelopment within the foreseeable future. In addition, it does not appear that any development activity is planned for the golf club. Therefore, the Village population should remain relatively constant over the next 10 years and water usage should remain within historical ranges.

3.0 - SOURCE OF WATER SUPPLY AND EXISTING WATER SYSTEM

3.1 – Water System and Source of Supply

The Village presently obtains its entire source of supply from Williston Park. Potable water is conveyed to the Village through a single metered connection located at the western boundary of the Village at East Williston Avenue (NYS Route 25B). The water is purchased at a wholesale rate from Williston Park based on readings obtained from the metered interconnection. Water is then transmitted through approximately 10 miles of Village owned water main to 854 service connections. All Village water service connections are metered. The Village reads the residential meters and invoices their customers separately. The map provided in Appendix A depicts the present Village water system.

The Village water system primarily provides service to residential dwellings for indoor use and outdoor irrigation needs. The Village also provides water service to the Wheatley Hills Golf Course clubhouse. To mitigate demand on the Village water system the golf club maintains and operates two irrigation wells. However, the Village system serves as a backup water source to the golf club in emergencies.

As summarized on Table 2-1, the Village also maintains emergency interconnections with three neighboring water purveyors. The interconnections are with the Inc. Village of Mineola at Roslyn Road and Charles Street; the Inc. Village of Old Westbury at the eastern boundary of the Village at East Williston Avenue; and with the Albertson Water District at the northern boundary of the Village at Roslyn Road. The Village intends to maintain the water supply connection with the Village of Williston Park as an emergency interconnection should the new water system project move forward.

3.2 – Existing Cost of Supply

Presently the Village purchases its entire supply of potable water based on a flat rate of $4.33 per thousand gallons from the Village of Williston Park. This rate was adopted by Williston Park during August of 2012. The prior rate, which was in effect since April 1, 2011, was $3.83 per thousand. Before the April 2011 increase the rate was established at $2.99 per

thousand gallons. Therefore, the wholesale water rate charged to the Village has increase by approximately 45 percent in less than a two year period. Based on a eight year average annual Village water demand of 137.99 million gallons (metered and unmetered usage), the current average annual wholesale cost of water to the Village is $597,497 (based on the current wholesale rate).

The current Village water rates applied to each metered account are $5.47 per thousand gallons up to 100,000 gallons and $5.72 per each thousand gallons over 100,000 gallons. In addition to the Williston Park rate, the rates include an initial feasibility study for the cost to explore alternative suppliers of water, meter upgrade program, Village water system maintenance costs and a Village water use-loss factor and contingency.

3.3– Historical and Current Water Demand

Historical water use statistics can provide vital information for evaluating the current needs and forecasting the future supply requirements for a water system. In addition water demand and service growth data are useful for projecting water use in order to assess future water supply needs. Precipitation and warm weather conditions will impact water demand. Water use dramatically increases during the warm weather months and in particular when precipitation is low. Water system demand and infrastructure needs are assessed based on average annual use, average day demand, maximum day demand, peak hour demand and fire flow demand.

As summarized on Table 3-2, water use data for the Village was evaluated from October 2004 through September 2013. Water use data prior to 2004 was not available since the interconnection meter with Williston Park and the Village was reported to be inoperable from December 1990 to January 2004. Water purchased by the Village during that period was estimated by aggregating individual meter account readings. Therefore the eight years of data is deemed to be an accurate representation of the water use by Village residents over varying weather patterns ranging from cool wet summers to hot and dry warm month conditions.

3.3.1 – Annual Use and Average Day Demand

Annual water usage statistics are used to calculate and project water sale revenues for budgeting purposes. The average day demand is the mean amount of water used by the system over a 365 day period for a given year and is used to determine standby power requirement for water supply systems.

From 2004 to 2013, annual water use ranged from 125 to 149 million gallons (MG) which translates to an average day demand ranging from 0.34 to 0.41 million gallons per day. Average per capita use over the eight year period is computed to be 148 gallons per day (based on 2011 LIPA survey data). On Long Island the average annual single family home uses 150,000 gallons for indoor and outdoor use. Based on an average Nassau County household size of 2.94 people (2010 US Census), the per capita usage is computed to be 140 gallons per day. Therefore water use in the Village is comparable to the county average.

3.3.2 – Maximum Day Demand

Maximum day demand is the highest amount of water delivered to the system on any given day during the year. This peak day demand usually occurs in the summer after several very warm and dry days have occurred in a row. The statistic is used to determine supply well capacity needs for a water system. Residential communities on Long Island have maximum day demands that range from 200 to 300 percent of the average day consumption.

For the Village, the actual maximum day demand cannot be determined since the interconnection water meter with Williston Park is only read on a monthly basis. However data from similar communities with water supply systems, such as the Oyster Bay Water District and Village of Mineola, was reviewed to determine an average day to maximum day demand ratio. This data indicates that a conservative maximum to average day ratio of 2.75 (275 percent) is

reasonable for estimating maximum day water use. Based on this estimate, the eight year maximum day demand for the Village has averaged to be 1.04 MGD.

3.3.3 – Peak Hour Demand

Peak hour demand statistics are used to evaluate the water storage requirements for a water system. The maximum day plus fire flow statistic is also used to assess water storage needs (refer to subsection 3.3.4). The peak hour value is typical estimated to be 150 % of the maximum day demand. This estimate is deemed to be typical for the majority of Long Island water systems. For the Village the peak hour demand range from 2004 to 2013 has ranged from 1.41 to 1.68 MGD.

3.3.4 – Fire Flow Requirements

Having the resources to provide adequate fire protection in a community is important for the preservation of human life and reduction of human suffering, protection of the tax base from destruction and preservations of jobs. One of the criteria for adequate fire protection is the ability of the water supply and distribution system to meet needed fire flow at a residual pressure of 20 pounds per square inch (psi). In simple terms adequate fire flow is predicated on the volume of water necessary to control a major fire in a specific structure based on a specified rate of flow at a residual pressure of 20 psi over a particular time period. Fire flow requirements for specific structures are determined using a documented method. Recognized industry and government accepted approaches include methodologies developed by the Insurance Services Office (ISO), Illinois Institute of Technology Research Institute and Iowa State University Fire Extension Service.

On Long Island and within the Village service area, the ISO method is used for determining fire flow requirements or the needed fire flow (NFF). ISO defines the NFF as the rate of flow considered necessary to control a major fire in a specific building. The NFF, expressed in gpm, is a function of:

- Construction (Ci) – Construction class such as masonry, wood frame, etc.
- Occupancy (Oi) – Occupancy class such as combustible, non-combustible, free burning, etc.
- Exposure (Xi) - length, height, # of exposed walls.
- Communication (Pi) – partitions (fire stopping).

ISO stresses that the NFF is intended to assess adequacy of a water system as one element of an insurance rating schedule and is not intended as a design criterion. It should also be noted that the NFF determined by the ISO method are for non-sprinklered buildings only. The governing body of a community may extend a 100 percent or less credit to the needed fire flow in recognition of the value and effectiveness of automatic sprinklers. The upper limit that most municipal and private water companies should anticipate providing for fire flow is 3,500 gpm; facilities requiring greater than 3,500 are individually evaluated.

The determination of a fire insurance rating for a community is based on the following areas consisting of the NFF, how fire alarms are handled and received, fire department (equipment, personnel, etc.) and water supply.

At this time the Village does not have recent ISO NFF data, therefore a required fire flow of 3,500 GPM for 3 hours will be used to assess water supply needs. This value is equivalent to 0.63 MGD and is a practical upper fire flow limit most water suppliers should anticipate (AWWA Manual M31, 1st Ed.).

As previously mentioned the maximum day plus fire flow statistic is used to assess water storage needs for a water system. Since 2004 the maximum day demand plus fire flow demand has been estimated to range from 1.57 to 1.75 MGD. The Long Island aquifer system is unique and stores an abundant supply of water that will be used to satisfy maximum and fire flow demand conditions. It is estimated that the sole source aquifer has a storage capacity of over 9 trillion gallons.

3.4 – Projected Water Demand and Fire Flow Needs

In order to determine the current and future supply and storage capacity needs of a water supply system; average day, maximum day, peak hour and maximum day plus fire flow statistics are generally reviewed and analyzed. Average daily demand represents the total yearly pumpage uniformly distributed or averaged over the entire calendar year. This statistic provides a basis of forecasting estimated revenues budgetary purposes and is utilized in long-range water resources planning with respect to safe yield. Average day demand as it relates to system capacity assessment is used to establish the base need for minimum standby power pumping capacity during short-term regional electrical power outages.

Maximum day pumpage statistics are reviewed to evaluate available supply well capacity while peak hour and maximum day plus fire flow demand is used to analyze combined supply well and storage facility capacity requirements. Supply sources must be designed and maintained to satisfy average and maximum day demand. Storage facilities and excess well capacity must be capable of providing an adequate supply of potable water to satisfy peak hour and fire flow demands on the maximum day. Inadequate supply well and / or storage capacity under maximum day, peak hour and maximum day plus fire flow demand conditions can result in system pressures that are far below normal operating requirements.

System pressure must be such as to maintain a minimum of 20 psi at the entry point of the service with the customer. In today's environment with a fair amount of residences being two (2) stories high and with a substantial amount of fixtures in the home, including automatic lawn irrigation, 20 psi is not generally adequate. Recommended minimum pressures of at least 35 psi are desired. The Village reports that pressures well above 35 psi are generally maintained throughout the distribution system.

Major development within the Village is not planned within the foreseeable future. Therefore water use is projected to remain consistent with no major increase forecasted. Factors that can impact water demand can be associated with increased use for irrigation due to variations in the weather.

For conservative water system design planning purposes a 20 percent water use growth factor was applied to the maximum recorded demand values that were recorded and estimated over the past eight years. This will conservatively account for any unexpected variations in water use primarily with changes in weather patterns. However for budget forecasting it is recommended to use the eight year annual average without the application of a growth factor so that revenues can be more accurately determined based on current use patterns.

For water supply system design purposes, the following demand values are recommended for determining infrastructure requirements:

Average Day:	0.49 MGD (340 gpm)
Maximum Day:	1.35 MGD (938 gpm)
Peak Hour:	2.02 MGD (1403 gpm)
Maximum Day plus Fire Flow:	2.10 MGD (1458 gpm)
Upper Fire Flow Limit :	0.63 MGD (438 gpm)

The following section will provide an evaluation of Village water supply infrastructure needs with respect to the demand values summarized above.

4.0 - PROPOSED NEW SOURCE WATER SYSTEM

This section will assess water supply system infrastructure requirements based on projected demand and water quality within the Village service area. The attributes of the water system will be evaluated with respect to prevailing regulatory requirements and recommended industry practice.

New water systems are required to conform to Part 5 of the New York State Sanitary Code, Articles VI and XI of the Nassau County Public Health Ordinance and New York State Department of Environmental Conservation regulations relating to the storage of hazardous chemicals and Long Island well permits. The state sanitary code by reference, requires compliance with the "Recommended Standards for Water Works" (i.e., "Ten States Standards"). Accordingly infrastructure requirements will be evaluated based on prevailing state and local regulatory requirements.

4.1 - Evaluation of Proposed Well Site

Based on projected water demand for the Village and to conform to regulatory requirements, two supply wells will be required for a new system. Specific design requirements are provided later in this report.

The Village owns and maintains several parcels of land that would be deemed suitable for the construction of a public water supply facility. One of the largest and most conducive properties for this purpose is a 2.05 acre parcel (*Section 9,Block 566, Lot 2*) located on the north side of East Williston Avenue (Hillside Avenue) between the Long Island Railroad to the west and Bengeyfield Drive to the east (refer to Appendix A). A Nassau County stormwater recharge basin abuts the parcel to the north. The approximately 185 foot wide (east to west) by 475 foot deep (north to south) parcel is used a Village public park and recreation area. The south side of the parcel is used as a park, the center portion is provided with two tennis courts and a little league baseball field situated at the north end of the property. The Village should confirm with

legal counsel to determine if there are any particular legislative requirements related to the partial conversion of a public park and recreation area for water supply use.

The 2005 regulations of the New York State Department of Health on "Special Requirements for Wells Serving Public Water Systems", mandates specific separation distances between wells and potential discharges to the groundwater. Of particular concern is the discharge of storm water that may contain potentially deleterious materials (i.e., automotive oils, anti-freeze, gasoline, etc.) that could be introduced into the ground and impact a nearby well. Section 5-D.2a of the regulations states:

"*Wells serving public water systems shall be located such that the owner of the water system possesses legal title to lands within 100 feet of the well and the owner controls by ownership, lease, easement or other legally enforceable arrangement, the land use activities within 200 feet of the well. Hydrogeologic evaluations and source water assessments should be used to determine appropriate separation from potential contamination sources*".

Essentially, this regulation requires that a 200-foot radius around the new well be protected from potential sources of pollution. The water supplier must have legal title to the first 100 feet and the second 100 feet, must be protected by a "non-pollution" easement or ownership of the lands. The net effect is an area of 31,500 SF (0.72 acre) must be in ownership and an overall 125,700 SF (2.88 acres) must be protected.

The proposed supply wells will be located in the vicinity of the tennis courts which is centrally located on the parcel. The Village has indicated that the tennis courts will be modified / relocated in order to accommodate new supply wells. According to the Village the ballfield cannot be encroached. Therefore all infrastructure will be located in the center and south side of the property with the well located in the center of the parcel to optimize compliance with regulatory setback requirements.

The width of the Village parcel is 185 feet. Therefore approximately a maximum of 7.5 feet on the east and west of the property would fall outside of the direct 100 foot radius ownership provision based on locating supply wells on the center of the property. The Village will need to obtain a variance from the state health department. A non-pollution easement to the east and west side of the parcel would also be required for the second hundred feet. Situated to the east is a multistory residential condominium and to the west is the Long Island Railroad. In addition all dwellings and business in the area are connected to public sewers, therefore there are no point sources for wastewater discharge within non-pollution easement. The Village will be able to maintain 200 foot ownership in the north and south direction. It should be noted that the Village met with representatives from the Nassau County Health Department and were advised that the subject parcel would be considered a viable location for public water supply wells. Consequently by means of ownership and non-pollution easement, the Village will control all incompatible land use activities within 200 feet of the proposed supply facility. Appendix A provides a closer plan view the sanitary setbacks that will be provided for the subject supply wells.

As per the request of the Nassau County Department of Health (NCDH) (*December 4, 2013 response letter to the Village*) further investigated the following two potential sources of well contamination as summarized below. On August 20, 2014, H2M performed an inspection of the properties / facilities referenced in the NCDH letter.

- A review of the Site Plan provided with your report depicts commercial parking lots to the east and west of the property as well as Hillside Avenue to the south, all located within 200-foot radius of the wells, which could potentially contain surface wastewaters recharge absorption systems (i.e.drywells, storm water catch basins). **Findings and Assessment:** A small storm water catch basin was observed in the parking lot of a residential apartment building located to the east of the proposed well site. This structure was located outside of the 100 foot radius but within the 200 foot radius.
- In addition, the two commercial facilities located to the east and west of the property should be evaluated to determine if underground single walled chemical or petroleum storage vessels exist within the 200-foot radius of each proposed well. **Findings and Assessment:** A two story structure providing office space for professional use is located

west of the property and a two story residential apartment building is located to the east. Both facilities are served by natural gas. There was no aboveground visual evidence of any chemical and / or petroleum storage vessels in use.

4.2 – Design Requirements

The basis for water system design is predicated under "Recommended Standards For Water Works" (2012 Edition) also commonly known as "Ten States Standards". This document provides the policies for the review and approval of plans and specifications for public water supplies and is referenced under Part 5 of the New York State Sanitary Code. Therefore the local health department will review system design reports and plans for conformance with the recommendations and guidelines disseminated in Ten States Standards. For new groundwater systems the standard provides the following major design considerations:

- The system including the water source and treatment facilities shall be designed for maximum day.
- The total developed groundwater source capacity, unless otherwise specified by the reviewing authority, shall equal or exceed the design maximum day demand with the largest producing well out of service.
- A minimum of two sources of groundwater shall be provided, unless otherwise specified by the reviewing authority. Consideration should be given to locating redundant sources in different aquifers or different depths of an aquifer.

The following subsections will address the major design areas and other areas related to treatment, storage, back-up power and distribution.

4.2.1– Supply Wells

Maximum day pumpage statistics are used to evaluate available supply well capacity. Therefore supply sources must be designed and maintained to satisfy average and maximum day demand. A maximum day demand of 1.35 million gallons per day (MGD), which is equivalent to 938 gpm, is projected for the Village and will be used as a basis of source water supply well

design. To conform with Ten States Standards and to provided adequate redundancy two 1,400 gallon per minute (GPM) supply wells are proposed. This will provide the Village with 4.0 MGD of supply well capacity. The recommended individual 1,400 gpm supply well capacity is 49 percent greater than the projected maximum day demand which will provide an allowance for a typical reduction in well pump capacity over the operating life of the equipment. Supply well capacity may decrease over time based on pump and well screen age and condition.

Both wells will be located at the East Williston Avenue Park and Recreation Area site and have a minimum separation of 100 feet. Each well be screened within the magothy formation but at different intervals with as much vertical separation as possible to conform with the recommendations provided in Ten States Standards.

More than 80 percent of the public drinking water wells on Long Island are screened within the magothy aquifer. The magothy formation is one of the three (3) distinct aquifers that underlies the District, as well as most of Long Island. These aquifers generally consist of unconsolidated sand and gravels, separated from one another by layers of silt and clay. These three aquifers are bounded on the top by the water table surface, on the bottom by the clay member of the Raritan formation with bedrock below the clay.

The deepest of the three aquifers that underlie the Village is the Lloyd sand member of the Raritan formation. It lies on the bedrock surface and is composed of lenticular deposits of coarse sands and gravel, clay, silt and sandy clay. The Lloyd formation is strictly used by coastal communities for water supply. Presently there is a moratorium on the use of this aquifer by non-coastal communities.

Overlying the Lloyd sand member is a layer of clay belonging to the Raritan formation. This clay member of the Raritan reduces the potential for recharge of the Lloyd sand member and hydraulically confines the Lloyd aquifer, making it an artesian aquifer.

The Magothy formation rests on top of the Raritan formation. The magothy is approximately 600 to 650 feet thick beneath the project area. Upper portions of the magothy consist of lenticular beds of very fine sand to medium sand, and beds of clay and sandy clay. In some locations, the magothy becomes increasingly coarser with depth. These coarser areas of the magothy form a second or intermediate aquifer. While the extensive clay layers in the upper part of the aquifer confine the groundwater in the lower portions of the magothy Aquifer, the glacial and upper magothy aquifers are hydraulically interconnected in many locations. This intermediate aquifer extends about 550 feet below sea level. The magothy aquifer yields abundant quantities of generally high quality water and is recommended to be screened by the proposed supply wells.

The Glacial formation rests on top of the Magothy formation. The Glacial varies in thickness from approximately 80 to 120 feet beneath the project area. Upper portions of the Glacial consist of glacial moraine deposits of sands and gravels, small boulders, silts, clay, and lake deposits. The Glacial aquifer is generally not utilized for public potable wells, as the water quality is marginal. This aquifer yields water of generally good quality, but is most susceptible to contamination from surface sources.

Recharge of the aquifers beneath the District is derived entirely from the seepage of rainfall through the ground surface and then downward through the various geologic strata. The United States Geological Survey and the New York State Department of Environmental Conservation estimate that approximately 50 % of the average rainfall that falls on the land eventually percolates through the soil to the water table. The balance is returned to the atmosphere via evapotranspiration by plants, surface evaporation and direct run-off to surface waters.

The groundwater divide for both the Glacial and Magothy Aquifers in the project area is located approximately 1 mile north of the project area in the vicinity of the Long Island Expressway. The groundwater divide is a zone extending generally east and west that passes lengthwise through the top of the groundwater mound. Groundwater normally flows in a

northerly direction from the mound towards the Long Island Sound or in a southerly direction to the Atlantic Ocean.

Based on the 1998 Nassau County Groundwater Study, Nassau County's water demand is expected to average 180 mgd through the year 2010. It was also determined that the groundwater system beneath the County is continually recharged at an average rate of 341 mgd. Therefore, the study concluded that as long as recharge exceeds the amount of groundwater withdrawn for water supply, the quantity of groundwater available for public water supply would be more than adequate. According to the 1998 Groundwater Study, the amount of water that can be withdrawn without causing unacceptable environmental impacts has been traditionally expressed as a single number defined as "safe yield." The study put "safe yield" into perspective by acknowledging that the location of supply wells with respect to coastlines and important surface water features is a critical factor in determining safe yield and water supply pumping impacts. It was determined that such impacts are localized in nature. The study concluded that if supply wells were located sufficiently distant from coastlines and important stream corridors, not only would the current 180 mgd rate of water supply withdrawal be sustainable, but a higher rate of withdrawal could be sustained with less environmental impact. It was also noted in the study that a safe yield value is impracticable to establish for the groundwater system as a whole. Therefore, the safe yield of the aquifers far exceeds the expected future demands of the Village based on the location of the proposed supply wells.

Generally, a groundwater flow direction in the area of the proposed well, in the magothy aquifer, is to the north to northeast. Therefore the existing water quality and potential sources of contamination will be evaluated in the vicinity of the proposed supply wells.

4.2.2- Projected Water Quality

There is no source water assessment program (SWAP) data available for this specific location. Available information does not indicate the presence of known existing discharges and of potentially contaminated surface waters within the 200 foot protective radius of the proposed supply well. However water quality data obtained for water supply wells from nearby systems operated by the Villages of Williston Park and Mineola provide data that can be used for

planning purposes and is reflective of the water quality that is typical for the middle and deep regions of the magthoy formation.

Water quality is expected to be fair based on local supply and regional monitoring well data. Based on regional public water supply well data, the general inorganic water quality data can be characterized as follows:

- Corrosive with a relatively low pH that is less than 6.0. The water can be expected to be aggressive and can cause undesirable amounts of corrosion to ferrous iron and copper piping resulting in red and green water complaints.
- Dissolved iron levels of less than 0.3 milligrams per liter (mg/l).
- Low in chlorides generally less than 40.0 mg/l.

Basic raw water treatment will include the addition of sodium hydroxide (25% caustic soda) for pH adjustment and calcium hypochlorite (less than 1 % chlorine) for disinfection. Based on local public water supply well data, trace levels of volatile organic compounds (VOCs) are present within the intermediate and deep regions of the magothy formation. The Village of Williston Park operates a public water supply well (Well no. 4 on Nassau Boulevard) approximately 750 feet to the southwest of the proposed well site. Presently trace levels of trichloroethene is detected in the raw water at levels of less than 7 parts per billion (ppb) but has been as high as 13 ppb during 2011. This data was obtained by the Village through a freedom of information request. The well is equipped with an air stripping treatment system for VOC removal. Based on the water quality data obtained, the VOC levels detected in the impacted supply well have remained stable and have not increased. Supply wells operated by the Village of Mineola have been impacted by trace levels of tetrachioroethene (PCE) and TCE. VOC levels have been less than 15 ppb. Therefore, it is reasonable to plan for wellhead treatment for VOC removal for the proposed supply wells. A shallower well screen setting or different location does not provide ample assurance for VOC contamination avoidance. Wellhead treatment is an effective and viable option. Furthermore, wellhead treatment will remediate the impacted aquifer to a certain extent. Water quality data from the local water supply well is provided in Appendix B.

Nitrate levels are projected to be well below the 10 ppm drinking water standard based on the local water quality data reviewed. The local Williston Park Well No. 4 has nitrate levels that have been less than 5 ppm. A test well will be used to assess site specific water quality and formulate recommendations for wellhead treatment as deemed necessary.

4.2.3- Treatment and Future Wellhead Treatment Needs

Based on the best available regional water quality data and the recommended screening interval for the proposed supply wells, the projected treatment will consist of corrosion control, disinfection and VOCs removal. Sodium hydroxide (25 % solution), commonly known as caustic soda, will be used for pH adjustment to achieve optimum corrosion control. Most Long Island water suppliers successfully and safely use caustic soda for this chemical treatment method. Raw water pH from the mid to deeper regions of the magothy are approximately in the 5.0 range and can vary from 4.8 to 5.6. Based on past water quality studies and a projected annual pumpage of 179 MG, average annual caustic use is projected to be 10,200 gallons. Therefore a 1,500 gallon underground, double walled chemical storage tank would be recommended for the proposed supply facility.

The Village can also consider using calcium hydroxide also known as hydrated lime for pH adjustment. The water treatment chemical is shipped in dry bag form and is generally manually introduced into a mixing tank to create slurry. The lime slurry is injected into the water plant discharge main for pH adjustment. Hydrated lime because of its dry bulk powder form generally has higher operating and maintenance costs when compared to caustic soda. However since hydrated lime is not considered a hazardous substance under NYSDEC regulations, secondary containment of the tank, overfill and leak alarm system and installation of a chemical transfer pad is not required. Thus the capital cost for a lime system can be $60,000 to $90,000 less than a comparable liquid caustic system.

The disinfection of groundwater on Long Island is a mandatory proactive requirement to prevent biological and pathogenic contamination. Calcium hypochlorite is the recommended disinfection method for the Village based on low capital and maintenance costs when compared to other options. The chemical is used in a solid briquette form and decanted into a modular

mixing and dispensing system that produce a low strength liquid chlorine solution. Since the treatment unit produces a solution that is less than one percent chlorine, compliance with the county and state chemical bulk storage regulations will not be required. To maintain a desired target chlorine residual of 1 ppm leaving the plant, approximately 1,250 pounds of chemical is projected to be used on an annual basis. However , storage of the chemical would be required to comply with Article III of the Nassau County Fire Prevention Ordinance.

Wellhead treatment for VOC removal is recommended based on the neighboring Williston Park supply well impact. The selection of a groundwater treatment system for a particular site is based on two distinct criteria: (1) the type and concentrations of contaminants in the raw water; and (2) the type and concentrations of contaminants that can safely be allowed in the treated water (drinking water standards). Selection among the technically feasible treatment systems will be based upon the results of an analysis of each system. Two different treatment processes will be evaluated for the project site. The two types of treatment which are most commonly employed for removal of organic contaminants from groundwater are air stripping and granular activated carbon (GAC) filtration. Air stripping and GAC filtration are effective for the removal of PCE and TCE and will be evaluated and selected based on cost.

An air stripping installation would consist of several distinct components. The discharge of the supply wells would be piped to the top of the air stripping tower. The tower itself would contain an inlet water distribution system, demisters, packing media, support gratings, flow redirectors, effluent water collection system and influent air connection. The tower would be approximately 12 feet in diameter by 30 feet high based on an upper design TCE level of 20 ppb. A blower and motor would be required to provide a filtered air supply for the tower. After air stripping, a 30-minute contact time for chlorination is required. Therefore a reinforced concrete clearwell would be proposed to be constructed below grade to receive the treated effluent from the air stripping tower and to provide the necessary contact time. The tower would be located on top of the clearwell. This would reduce to overall height of the treatment tower.

Four vertical turbine booster pumps will be utilized to pump from the clearwell into the distribution system. Two pumps would be sized to match the capacities of the proposed well pumps, each at 1,400 GPM with variable frequency control. One booster pump will be a back-up. A selector control switch will be provided so that each booster pump is equally cycled. Two smaller 500 gpm pumps with variable frequency control would be used to provide water under low demand conditions and would be controlled similar to the higher capacity pumps. The control logic of the booster pumps would be configured to maintain a constant water level in the clearwell. The well pump would be controlled by the demands of the distribution system.

GAC filtration units have distinctly different operational and cost features as compared to air stripping units. As a generalization, GAC units have lower capital costs and are quicker to construct. However, the operating costs of GAC rise rapidly with increasing contaminant levels while those for an air stripping tower remain relatively constant independent of the contaminant loading. Based on regional water quality data, TCE and PCE levels are not projected to increase significantly and should stay below 20 ppb. Therefore this makes GAC a more desirable option when compared to air stripping. Air stripping is generally recommended for high levels (50ppb or greater) of PCE and TCE.

Carbon is used to adsorb or remove VOCs from the impacted raw well water. The adsorption capacity of activated carbon for organic contaminants can be estimated from an adsorption isotherm, which relates the concentration of a contaminant in water to that which is adsorbed by the GAC. This is derived by fitting the results of multiple batch equilibrium isotherm tests to the Freundlich equation to obtain values of empirical coefficients which characterize the properties of the carbon used and the contaminant adsorbed. Using a TCE upper design limit of 20 ppb, carbon consumption is projected to be 24.5 pounds per million gallons of water treated.

Some of the advantages of GAC filtration as compared to air stripping are: a GAC installation can normally be constructed more quickly than an air stripping facility, and at a lower capital cost; there is no noise associated with the GAC operation and the filter building tends to be of lower profile than an air stripper. Based on the well flow required for treatment

(2,800 gpm), four skid mounted 12 foot diameter by 17 feet high vessels will be required. Since the wells will operate year round, the vessels must be housed within a building.

Options using air stripping and GAC filtration will be evaluated and will be selected based on cost.

4.2.4- Storage

Peak hour and maximum day plus fire flow demand is used to analyze combined supply well and storage facility capacity requirements. Supply sources must be designed and maintained to satisfy average and maximum day demand. Storage facilities and excess well capacity must be capable of providing an adequate supply of potable water to satisfy peak hour and fire flow demands on the maximum day. Inadequate supply well and / or storage capacity under maximum day, peak hour and maximum day plus fire flow demand conditions can result in system pressures that are far below normal operating requirements.

To fully assess storage capacity requirements the hourly demand for a typical maximum day is evaluated to compute the required operating or equalization storage. Common practice in the United States is to provide enough equalization storage to allow water supply facilities to operate at a uniform rate at all hours of the day of peak consumption (Viessman & Hammer, 1985).

According to Ten States Standards " *Storage facilities should have sufficient capacity, as determined from engineering studies, to meet domestic demands, and where fire protection is provided, fire flow demands*". As discussed in Section 3 of this study, a required fire flow of 3,500 GPM for 3 hours will be used to assess water supply needs. This value is equivalent to 0.63 MDG and is a practical upper fire flow limit most water suppliers should anticipate (AWWA Manual M31, 1st Ed.).

Storage options available to the Village include elevated storage tanks, ground storage tanks and hydropneumatic tank systems. Construction materials for the various types of tanks are

generally concrete and steel. The operation of storage tanks is critical to maintaining pressure and continuous supply of water to the distribution system for domestic use and for fire protection.

Elevated tanks do not require the continuous operation of pumps. Short term pump shutdown does not affect water pressure in the distribution system since the pressure is maintained by gravity. Elevated tanks generally have much higher capital and maintenance costs when compared to ground storage facilities. Furthermore, elevated tanks, particularly when constructed in established residential communities, are not generally well accepted by the community based on aesthetic concerns and potential diminution of property values. Ground storage tanks can be designed to blend into residential communities but require more land area when compared to a single pedestal elevated tank. The primary disadvantage of a ground tank is the lack of water pressure by gravity. The water from a ground tanks does not provide a significant amount of pressure to the distribution system unless the tank is located at a high elevation, such as on top of a hill. The terrain of the Village is relatively flat. Therefore booster pumps must be used to draw water from the ground tank and must operate continuously in order to maintain adequate pressure in the distribution system. The continuous pumping translates into higher energy costs. In addition the water pressure in the distribution system will drop if the pumps are shut down.

Hydropneumatic tanks are used to provide pressure to very small public water systems such as resorts, mobile home parks and very small communities. They are not a good storage vessel for fire protection purposes due to the small volume of water within the vessel. According to Ten States Standards Hydropneumatic (pressure) tanks, when provided as the only water storage are acceptable only in very small water systems. Systems serving more than 150 living units should have ground or elevated storage. In addition the standard states that hydropneumatic tank storage is not to be permitted for fire protection purposes.

To mitigate the volume of stored water for fire protection purposes, the Village can consider the modification of an existing emergency interconnection with an adjoining water system. The use of an automatic control valve, designed to open at a preset pressure, can be used to provide water should pressures drop during a fire event. Theoretical interconnections

capacities range from 409 to 1,642 gpm at a 20 psi differential through the four interconnections maintained by the Village. At this time the use of emergency interconnections to supplement water storage will not be considered.

This study will evaluate various storage options in order to address the challenges of constructing a new water supply system within an established residential community and to mitigate capital and operating costs.

4.2.5- Backup Power

Average day demand as it relates to system capacity assessment is used to establish the base need for minimum standby power pumping capacity during short-term regional electrical power outages. Ten State Standards recommends that dedicated standby power shall be required by the reviewing authority so that water may be treated and/or pumped to the distribution system during power outages to meet the average day demand. Accordingly provisions will be made to provide standby power to the supply system to satisfy more than average day demand conditions should primary utility power be lost. This would include one supply well, corresponding booster pumps and treatment.

A diesel generator equipped with an automatic transfer switch housed in a self contained sound attenuated enclosure with a minimum of 3 days of fuel supply will be recommended for standby power generation.

4.2.6- Distribution System and Interconnections

The current distribution system presently satisfies all water demand requirements with a single interconnection on the west side of system that can supply a theoretical maximum capacity of 1,613 gpm. The proposed system will supply 2800 gpm at the same location along with 100,000 gallons of storage. There are no mains smaller than six inches in the Village distribution system. Therefore no distribution system improvements are recommended.

Interconnection capacity was also assessed as it relates to emergency water supply needs. According Ten States Standards, interconnections should be of sufficient capacity to provide an adequate volume of water equivalent to the largest supply plant taken out of service. Presently the four interconnections maintained by the Village provide an aggregate theoretical capacity of 4,460 gpm which is more than twice the design flow of the two supply wells proposed for the Village. The theoretical capacities were derived from computations performed by Holzmacher, McLendon and Murrell, P.C. under the 1980 Nassau County Master Water Plan.

Improvements related to interconnection capacity are not recommended at this time with the exception for considering the mitigation of storage requirements through the modification of an existing interconnection.

4.3- Operation Requirements

4.3.1 – Staff

All community water systems are required to place the direct supervision of their water system, including each treatment plant and/or the distribution system, under the responsible charge of a water treatment operator holding a valid certification. This requirement is regulated under Subpart 5-4 of the State Sanitary Code. The level of certification varies by plant type and complexity. Presently the Village owns and operates a water distribution system serving greater than 1,000 people and is a purchasing water system. Based on this "plant type" the current system is a "D" classification which requires a Plant Operator to possess a "D" certification. The Village presently employees a "D" operator.

The proposed construction of new groundwater supply system for the Village with a design capacity of 2,800 gpm (4.0 MGD) would fall under an IB system classification. This classification, as defined under Subpart 5-4, stipulates that a water treatment plant which is designed to treat over 2.5 MGD of groundwater (excluding ground water under the direct influence of surface water) requires a Plant Operator to hold a valid IB certification.

To mitigate labor costs the Village could consider having the current "D" operator pursue obtaining an IB certification. To obtain an IB certification a staff member must have ten years of operating experience at a water treatment plant, with two years operating experience at a minimum of a grade B water treatment plant. Education can also be used to reduce the required operating experience. For example a bachelor's degree in engineering, natural science or a related field from an accredited or New York State registered college or university, may be substituted for eight years of experience. The operator must also have a minimum of a High school diploma or New York State Equivalency Diploma. The Village can also consider other measures for IB plant operator supervision through outside consulting arrangements.

4.3.2 – Testing and Regulatory Requirements

Water quality testing of the raw and treated source water will be required for a wide range of inorganic, principal organic, metals, synthetic organic, radiological and bacteriological parameters at various intervals in accordance with Article VI of the Nassau County Public Health Ordinance and Subpart 5-1 of the New York State Sanitary Code. Presently basic sampling and testing of the distribution system water is performed by the Village. Table 4-1 provides a listing of the sampling requirements for the proposed Village supply system.

In addition to additional water quality testing and sampling requirements, the Village will be required to comply with the following:

- NYSDEC Chemical Bulk Storage Rule – develop a spill prevention plan. This will require annual update of the plan and inspection of the tank used to store caustic soda for pH adjustment.
- Annual Drinking Water Quality Report – prepare annual water quality report to be distributed to all customers within the Village in accordance with Part 5 of the State Sanitary code.
- Bi-Annual Water Storage Tank Inspections – sanitary inspection of all water storage facilities every 6 months is required by the Nassau County Department of Health.

- Water Supply Emergency Response Plan and Vulnerability Assessment – development of the plan and assessment is required under Part 5 of the State Sanitary code and must be updated every 5 years.

4.4– Project Regulatory Requirements and Approvals

The proposed water supply system will be required to conform to the applicable provisions of Part 5 of the New York State Sanitary Code (Sanitary Code), Article VI of the Nassau County Public Health Ordinance (NCPHO) and New York State Department of Environmental Conservation regulations for constructing public water supply wells on Long Island. In addition the bulk storage of chemicals and fuel require regulatory review and approval. This subsection will outline the major regulatory compliance areas related to the proposed project.

4.4.1 - Well Location and Setback Requirements

In selecting a site for a new wells, there are specific requirements with respect to location. The primary location and setback requirements are established in Part 5 of the New York State Sanitary Code. These requirements are enforced by the NYSDOH and NCDH. The NYSDEC has additional requirements, which require that an engineering report, in a specific format, be prepared, submitted for approval, and that a permit to drill the well be obtained from NYSDEC. New York State Sanitary Code requirements and NCPHO requirements have been detailed in Section 4.1 of this report.

4.4.2 - Well Permitting Requirements

Regulatory authority for supply well withdrawals is based in Article 15, Title 15 of the Environmental Conservation Law, and administered through 6NYCRR Part 601 (Water Supply Applications) and Part 602 (Long Island Wells). NYSDEC is responsible for the quantity and quality aspects of groundwater (in the environment), while NYSDOH, under Part 5 of the State Sanitary Code, is responsible for quantity and quality aspects of water from the well casing,

through the treatment and distribution system, to the consumer's tap. Withdrawal applications for public supply wells are reviewed jointly by both departments for public necessity, alternate sources, proper and safe construction, sanitary control, watershed protection, and adequacy of supply. Well permit applications, for Long Island supply wells, are based on the NYSDEC memorandum "Division of Water, Technical and Operational Guidance Series (3.2.2), Engineer's Reports; Application for Water Supply and Long Island Well Permits".

It is estimated that it would take up to approximately 30 months from the time authorization is issued to commence design and project permitting for the new well. Table 4-2 provides an implementation schedule and summary of milestones. The schedule also anticipates timely approvals from NCDH and NYSDEC, for permits to drill the new well.

4.4.3 – Other Regulatory Requirements

The storage of caustic soda for pH adjustment and diesel fuel for standby power generation will require regulatory agency approval. As previously noted it is recommended that caustic soda be stored in a 1,500 gallon double walled underground tank and be provided with a containment pad for chemical transfer. The chemical storage facility must comply with Article XI of the NCPHO entitled *Toxic and Hazardous Materials Storage, Handling and Control*, which regulates the storage of toxic or hazardous materials and the NYSDEC Chemical Bulk Storage (CBS) Rule. NCDH performs a formal plan review while registration of the tank must be filed separately with NCDH and NYSDEC. Although NYSDEC does not perform a plan review, the agency will send inspectors out on a periodic basis to inspect facilities for compliance with the CBS rule. The Village may elect to use hydrated lime for pH adjustment. Since this water treatment chemical is not considered a hazardous substance, the use of hydrated lime would eliminate the requirement to comply with the provisions of NCPHO Article XI.

Diesel fuel storage used for standby power generation is regulated under Article III of the Nassau County Fire Prevention Ordinance (NCFPO). Plans and specifications must be filed with

the Nassau County Fire Marshal (NCFM) for review and approval. Registration of the facility is also filed with the NCFM.

4.5 - Review of Operational Scenarios and Options

There are several options that are available for the Village to consider for the design and development of a new source water system. Primary variables include the type of water storage and wellhead treatment system for VOC removal. Cost savings measure such as prefabricated versus traditional masonry construction for the treatment building will also be evaluated. Accordingly six scenarios / options have been selected evaluation. All of the options will provide a reliable supply of potable water.

The goal is to provide high quality and ample quality of drinking water at the lowest possible cost. Therefore, the selection of the most viable option will be predicated on the lowest capital and operating cost. The following summarizes the options that will be evaluated:

- Option 1 – Supply wells pump through GAC Filtration System to elevated storage tank.
- Option 2A – Supply wells pump to Air Stripping Tower with gravity discharge to clearwell. Booster pumps used to pump from clearwell to distribution system.
- Option 2B – Supply wells pump through GAC Filtration System with discharge directly to system and ground storage tank. Booster pumps used to pump from ground storage tank to distribution system.
- Option 3A – Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system.
- Option 3B – Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system. Prefabricated treatment building will be used.
- Option 3C – Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system. Prefabricated treatment building will be used be positioned on site to minimize disturbance to the existing tennis courts.

The following summarizes the base preliminary design attributes that will be considered when evaluating operating scenarios and developing operating and capital costs:

Attribute / Category / Design Parameters	Applicable Option
Supply Wells: • Two 1,400 (2.0 MGD) supply wells. • One screened in the upper to mid magothy and the other in the lower.	All Options
Well Pumps: • Well pump to elevated storage tank, ground storage tank or hydro pneumatic tanks: - Submersible pumps – 1,400 gpm at 277 ft TDH - 100 hp motor	Options 1, 3A and 3B
Well Pumps: • Well pump to air stripper or GAC to clearwell or ground storage: - Submersible pump – 1,400 gpm at 171 ft TDH - 75 hp motor	Options 2A and 2B
Distribution System Pressure: • Well site elevation: 110 ft msl • Highest elevation in system: 130 ft msl • Lowest elevation in system: 90 ft msl • Design pressure at highest elevation: 50 psi • Normal system operating pressure range: 67 to 50 psi	All options
Treatment Building • 2,800 sf for Option 2B • 3,500 sf for all other options • Options masonry or pre-fabricated metal	Masonry for Options 1 and 3A Prefabricated for Options 2A, 2B, 3B and 3C
Major Well Site Modifications • Relocation of tennis courts	All Options except Option 3C
Back-up Power : • Design based on Average Day demand (0.49 MGD) • One 1400 GPM well, 500 GPM booster or 1400GPM booster and 20 HP blower plus building and basic treatment loads : 225kw generator (approx) • Self-contained sound attenuated enclosure • 2,000 gallon AST diesel fuel tank	All options
Basic Treatment • pH adjustment – 25% sodium hydroxide o 1,500 gallon UST o Chemical transfer pad • Disinfection – calcium hypochlorite	All options

Attribute / Category / Design Parameters	Applicable Option
Booster Pumps from clearwell / ground storage to system • Two 500 gpm boosters: - Vertical turbine – 500 gpm at 160 ft TDH - 25 HP motor • Two 1,400 gpm boosters - Vertical turbine – 1,400 gpm at 161 ft TDH - 75 HP motor	Options 2A and 2B
Wellhead Treatment: • Contaminant information: - TCE is the only VOC impacting closest supply well (Williston Park) - TCE has ranged from 3 to 7 ppm - TCE upper limit design – 10 to 20 ppm • GAC: - TCE at 20 ppm – 24.5 lb / MG • Air Stripping: - TCE at 20 ppm – 12 foot diameter tower and 25 feet of packing	All Options Air Stripping for Option 2A GAC for all other options
Automatic Interconnection to supplement storage • Automatic control valve with manual by-pass • Maximum flow rate – 400 gpm (0.58 MGD)	Will not be considered at this time
Elevated Storage Tank: • Type: single pedestal steel spheroidal elevated tank • Capacity : 250,000 gallons • High water level: 135 ft above grade.	Option 1
Clearwell / ground storage: • Type: partially below grade concrete • Capacity : 100,000 gallons	Options 2A and 2B
Hydropneumatic Tank: • Type: Horizontal • Capacity : 25,000 gallons (Effective volume: 16,700 gallons) • Number of units: 4 • Total effective volume: 66,800 gallons • Equivalent high water level: 135 ft above grade. • Operating pressure: 60 psi	Options 3A, 3B and 3C

Figures 4-1 through 4-3 provide a schematic for each of the options.

4.6 - Design Summary Update

This report has been revised to reevaluate and update the proposed water system design parameters. Based on prior comments and discussions the Nassau County Department of Health did not support the construction of an automatic interconnection to provide supplemental water capacity. Therefore the design approach has been reevaluated to provide a water system that is not reliant on an adjoining system for additional capacity.

Based on current and projected water supply needs for the Village in this updated report, the following demand conditions were projected:

- Average Day : 0.49 MGD
- Maximum Day : 1.35 MGD
- Peak Hour : 2.02 MGD
- Max. Day + Fire Flow: 2.10 MGD
- Upper Fire Flow Limit: 0.63 MGD

The original recommended design proposed two 1,100 gpm supply wells (equipped with variable speed pumps) and 66,800 gallons of storage supplemented by an automatic interconnection with an adjoining water supplier. For this report update two 1,400 gpm supply wells and a 100,000 gallon ground storage tank is proposed. This will provide the Village with 4.13 MGD in total capacity. As summarized on Table 3-3, a single 1,400 gpm (2.0 MGD) supply well along with 100,000 gallons of storage will satisfy all projected demand conditions. Water will be drawn from our vast unconfined Long Island aquifer that in essence stores groundwater.

Option 2B will meet the required water demand criteria. This design option consists of two supply wells equipped with variable speed drives that will pump through a GAC filtration system with discharge directly to system and ground storage tank. Variable speed booster pumps will be used to transfer water from ground storage tank to distribution system.

Water plant security will employ a multi barrier approach consisting of an access control ornamental security fencing; intrusion alarms, video surveillance and the hardening of all windows and doors.

Emergency power provisions will be provided to satisfy average day demand conditions. The generator will be designed to operate either well based on selection and will have enough power to operate booster pumps to draw from the ground storage tank. Average day demand for the Village is projected to be 0.49 MGD. A 2.0 MGD supply well with standby power provisions will be able to provide four times more than the projected average day demand. During regional power outages, water demand would be anticipated to decrease based on the shutdown of irrigation systems.

As depicted on the preliminary site plan contained in Exhibit B, a supply well, booster pumps and a pair of GAC filter vessels will be located inside a prefabricated building on the south side of the site. The storage tank will be integral with the building. The back-up generator will be located in an exterior sound attenuated enclosure. The second well and another set of GAC filter vessels will be located to the north.

5.0- FINANCIAL ANALYSIS

All six options presented and detailed in Section 4.0 of this study are technically viable options available to the Village for the design, development and implementation of a new source water system. The final selection of the most viable option will be predicated on cost. The following subsections of this study will detail and review the capital and operating costs for each option.

5.1 CAPITAL COSTS

Tables 5-1 through 5-6 provide a detailed capital cost summary for all of the options reviewed in this study. These costs include construction, engineering, permits, regulatory review, reports, construction administration, construction observation, legal and contingencies. The cost opinion for each option is summarized below:

Option	Description	Estimated Capital Cost
1	Supply wells pump through GAC Filtration System to elevated storage tank.	$ 8,823,660
2A	Supply wells pump to Air Stripping Tower with gravity discharge to clearwell. Booster pumps used to pump from clearwell to distribution system.	$ 7,015,500
2B	Supply wells pump through GAC Filtration System with discharge directly to system and ground storage tank. Booster pumps used to pump from ground storage tank to distribution system.	$ 6,955,900
3A	Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system	$ 6,670,150
3B	Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system. Prefabricated treatment building will be used.	$ 6,038,020
3C	Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system. Prefabricated treatment building will be used. The building will be positioned on the site to minimize disturbance to the existing tennis courts.	$ 5,753,020

Debt service tables for 20 and 30 year bonds based on a 3% interest rate are summarized on Table 5-7 through 5-18. Interest rates have been as low as 2%. However, for planning purposes, a 3% interest rate has been used for this study. The first year debt service expense for a 20 and 30 year bond is provided below for each option based on average annual demand:

Option	Estimated Capital Cost	First Year Debt Service 20 Year Bond	First Year Debt Service 30 Year Bond
1	$ 8,823,660	$ 617,656	$ 500,007
2A	$ 7,015,500	$ 491,085	$ 397,545
2B	$ 6,955,990	$ 486,919	$ 394,173
3A	$ 6,670,150	$ 454,311	$ 367,775
3B	$ 6,038,020	$ 410,061	$ 331,954
3C	$ 5,753,020	$ 390,111	$ 315,804

5.2 OPERATING COSTS

Operating costs (based on average annual demand) for the options evaluated included electrical for power and heat, increased water quality monitoring, labor, chemical, GAC replacement (where applicable), regulatory compliance and maintenance. Tables 5-19 through 5-22 detail the projected operating costs for each option and annual operating cost including regulatory compliance and chemicals (caustic and chlorine) are summarized as follows:

Option	Description	Estimated Annual Operating Cost
1	Supply wells pump through GAC Filtration System to elevated storage tank.	$211,906
2A	Supply wells pump to Air Stripping Tower with gravity discharge to clearwell. Booster pumps used to pump from clearwell to distribution system.	$208,746
2B	Supply wells pump through GAC Filtration System with discharge directly to system and ground storage tank. Booster pumps used to pump from ground storage tank to distribution system.	$200,073
3A	Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system	$176,822
3B	Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system. Prefabricated treatment building will be used.	$176,822
3C	Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system. Prefabricated treatment building will be used be positioned on site to minimize disturbance to the existing tennis courts.	$176,822

5.3 TOTAL COSTS

A comparison of the capital and operating costs indicated that Option 2B provided the lowest capital and operating cost to the Village when consideration of hydropneumatic tanks are excluded. The option includes supply wells equipped with variable speed drives pump through GAC Filtration System to a ground storage tank and distribution system. Variable speed booster pumps will be used to draw water from the storage tank. In addition to further reduce capital costs a prefabricated treatment building will be utilized. The building will be positioned on site to minimize disturbance to the existing tennis courts. The total first year cost (capital and operating) based on a 20 year bond at 3 % interest is estimated to be $673,992. Should the Village be able to obtain 30 year financing, the estimated first year debt service and operating expense decreases to $581,246. The annual costs were based on average annual pumpage of 138.3 MG. Table 5-23 provides a summary of all of the options along with a 20 and 30 year debt service options for comparison purposes.

5.4 – COST COMPARISON – PRODUCED WATER VERSUS PURCHASED WATER

The current cost of purchased water from Village of Williston Park is $4.33 per 1,000. Based on historical demand and projected maximum usage, this expense based on current wholesale rates, can range as follows:

Category	Annual Demand (Thousand Gallons)	Annual Billed (Thousand Gallons) (1)	Annual Cost (2)
Eight year average	138,300	124,200	$ 581,246
Eight year minimum	125,010	111,600	$ 572,973
Projected maximum demand	178,870	161,100	$ 600,473

(1) - Projections based on 2004 to 2014 water usage that factors in 10% unaccounted for water.

(2) - Based on 30 year bond at 3% interest.

It should be noted that the Village of Williston Park water rate has increased significantly over the past three years. During April 2011 the rate jumped a dramatic 28 percent from $2.99 per thousand to $3.83 per thousand. The wholesale water rate escalated again by another 13 percent during August 2012. Therefore the annual cost of water to the Village of East Williston could experience another double digit rate increase in the not too distant future.

Depending upon debt service financing terms, the first year cost to produce water can range from $594,246 to $613,473 depending upon projected water demand. The following matrix summarizes the estimated cost per thousand pumped based on various annual water usage conditions for Option 2B:

Cost per Thousand Matrix for Option 2B			
Demand Category	**Annual Demand (Gallons)**	**First Year Cost**	**Cost per Thousand Billed**
Maximum [1]	161,100,000	$600,473	$ 3.73
Average [2]	124,400,000	$ 581,246	$ 4.68
Minimum [2]	111,600,000	$ 572,973	$ 5.13

Note: The net cost per gallon is expected to be lower due to the levying of the capital cost

The cost per thousand decreases as more water is pumped and billed. The cost per thousand is $4.68 based on an annual billed volume of 124,400,000 gallons. Therefore any annual billed volume above the 124.4 MG threshold is more cost effective to produce water rather than to purchase at the present wholesale rate from the Village of Williston Park. The savings is far more significant when under annual maximum demand conditions.

Should the wholesale water rates charged by the Village of Williston Park increase again, then the savings become even more significant. A 10 percent increase would escalate the wholesale rate to $4.76.

6.0- CONCLUSIONS AND RECOMMENDATIONS

This report developed a basis of design and evaluated six options for the design and implementation of a water supply system should the Village of East Williston decide not to continue with purchasing wholesale water from the neighboring Village of Williston Park supply system. Accordingly the following conclusions have been formulated:

- Based on current and projected water supply needs for the Village, a new water supply system must be able to meet the following demand conditions:
  - Average Day : 0.49 MGD
  - Maximum Day : 1.35 MGD
  - Peak Hour : 2.02 MGD
  - Max. Day + Fire Flow : 2.10 MGD
  - Upper Fire Flow Limit : 0.63 MGD

- Based on projected water demand for the Village two 1,400 gpm supply wells and a 100,000 gallon ground storage tank will be required. This will provide the Village with 4.13 MGD in total capacity. A single 1,400 gpm (2.0 MGD) supply well along with 100,000 gallons of storage will be able to satisfy all projected demand conditions. Each well will be screened within the magothy formation but at different intervals with as much vertical separation as possible to conform to the recommendations provided in Ten States Standards. Water will be drawn from our vast unconfined Long Island aquifer that in essence stores groundwater. This design proposal exceeds the capabilities and reliability of the supply system presently provided by the Village of Williston Park

- A 2.05 acre parcel (Section 9,Block 566, Lot 2) located on the north side of East Williston Avenue (Hillside Avenue) between the Long Island Railroad to the west and Bengeyfield Drive to the east is of sufficient size to accommodate the supply wells and required infrastructure. The parcel is currently used a Village public park and recreation area. The Village, through legal counsel, will be required to obtain sanitary easements for the supply wells form the surrounding land owners.

- Based on projected water quality basic raw water treatment will include the addition of sodium hydroxide (25% caustic soda) for pH adjustment and calcium hypochlorite (less than 1 % chlorine) for disinfection. Based on local public water supply well data, trace levels of volatile organic compounds (VOCs) are present within the intermediate and deep regions of the magothy formation. Therefore air stripping removal or granular activate carbon filtration for VOC removal will be required for each supply well.

- Provisions will be required to provide standby power to the supply system to satisfy more than average day demand conditions should primary utility power be lost. A diesel generator equipped with an automatic transfer switch housed in a self contained sound attenuated enclosure with a minimum of 3 days of fuel supply will be necessary for standby power generation. The generator will be designed to operate either well based on selection and will have enough power to operate booster pumps to draw from the ground storage tank. Average day demand for the Village is projected to be 0.49 MGD. A 2.0 MGD supply well with standby power provisions will be able to provide four times more than the projected average day demand. During regional power outages, water demand would be anticipated to decrease based on the shutdown of irrigation systems.

- The Village distribution system presently meets its water demand requirements with a single interconnection on the west side of system that can supply a theoretical maximum capacity of 1,613 gpm,. The proposed system can supply 2800 gpm at the same location along with 100,000 gallons of storage. All Village water mains are 6-inches or larger, therefore modification of the distribution system is not recommended.

- The proposed water supply system will be required to conform to the applicable provisions of Part 5 of the New York State Sanitary Code (Sanitary Code), Article VI of the Nassau County Public Health Ordinance (NCPHO) and New York State Department of Environmental Conservation regulations for constructing public water supply wells on Long Island.

- All community water systems are required to place the direct supervision of their water system, including each treatment plant and/or the distribution system, under the responsible charge of a water treatment operator holding a valid certification. The proposed construction of new groundwater supply system for the Village with a design capacity of 2,800 gpm (4.0 MGD) would fall under an IB system classification and requires that a Plant Operator hold a valid IB certification. To mitigate labor costs the Village could consider having the current "D" operator pursue obtaining a IB certification. The Village can also consider other measures for IB plant operator supervision through outside consulting arrangements.

- A total of six viable water supply options for the Village were developed and along with a basis of design. The options assessed included:
    - Option 1 – Supply wells pump through GAC Filtration System to elevated storage tank.
    - Option 2A – Supply wells pump to Air Stripping Tower with gravity discharge to clearwell. Booster pumps used to pump from clearwell to distribution system.
    - Option 2B – – Supply wells pump through GAC Filtration System with discharge directly to system and ground storage tank. Booster pumps used to pump from ground storage tank to distribution system.
    - Option 3A – Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system.
    - Option 3B – Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system. Prefabricated treatment building will be used.
    - Option 3C – Supply wells equipped with variable speed drives pump through GAC Filtration System to hydropneumatic tanks and distribution system. Prefabricated treatment building will be used. The building will be positioned on the site to minimize disturbance to the existing tennis courts.

- The goal is to provide high quality and ample quality of drinking water at the lowest possible cost. Therefore, the selection of the most viable option will be predicated on the lowest capital and operating cost. Option 3C that utilized hydropneumatic tanks was determined to be the most economically viable, however based on the size of the Village system the Nassau County Department of Health could not support the recommendation.

Therefore based on the capital and operating cost analysis of each option without the use of hydropneumatic tanks it was determined that Option 2B provides the lowest capital and operating cost to the Village. The total first year cost (capital and operating) based on a 30 year bond at 3 % interest is estimated to be $ 581,246.

- The current cost of purchased water from the Village of Williston Park is $4.33 per 1,000. Based on historical demand and projected maximum usage, this expense based on current wholesale rates, can range from $594,246 to $613,473 per year. This range was based on the lowest recorded annual use of 125 MG (during 2010-2013) and the projected maximum annual demand of 178.9 MG. Depending upon financing terms and water demand conditions, the implementation of Option 2B will be more cost effective to produce water rather than to purchase at the present wholesale rate from the Village of Williston Park. The savings will increase significantly when annual maximum demand conditions are experienced. Should the wholesale water rates charged by the Village of Williston Park increase again, then the savings become even more significant.

The following actions are recommended should the Village decide to move forward with the construction of a new water supply system:

1. Detailed financial, design, operational and legal review will be required should the Village decide to construct a new water supply system. For example the Village should consult with legal counsel to determine if there are any particular legislative requirements related to the partial conversion of a public park and recreation area for water supply use.
2. Submit this "Basis of Design" report to the Nassau County Department of Health to commence the regulatory approval process.
3. Commence the legal process for obtaining sanitary well easements from surrounding land owners.
4. Consult with Bond Counsel to review legal requirements related to water system financing options which can include financing through the New York State Drinking Water Revolving Loan Fund.

5. Solicit request for proposals to retain a qualified engineering consultant to commence with the regulatory permitting and detailed water system design.

7.0 – REFERENCES

- AWWA, "Distribution *Requirements for Fire Protection*", AWWA Manual of Water Supply Practices M31, Denver, Co., 1992.

- New York State - NY State Department of Health Part 5, Title 10NYCRR "*New York State Sanitary Code*".

- *"Recommended Standards for Water Works"*, Ten States Standards, 2012.

- Insurance Service Office, *"Fire Suppression Rating Schedule"*, Edition 6-80, 1980.

- *"Handbook of Public Water Systems"*, Culp, Wesner, Cup, Van Nostrand, Reinhold Company, 1986.

- Hardman, J.L and P.N. Cheremisinoff, "Determining the Utility Value of Water Supply Interconnections, Parts I, II and III." Water and Sewage Works, December 1978, January 1979 and February 1979.

List of Tables

Table 3-1
Inc. Village of East Williston
Interconnection Capacity Summary

Water Supplier	Interconnection Location	Size (inches)	Estimated Capacity Range [1] (gpm)	Theoretical Maximum Capacity [1] [2] [3] (gpm)
Village of Mineola	Roslyn Road & Charles Street	6 x 12	400 to 800	1,642
Village of Old Westbury	East Williston Avenue at Village Boundary (East)	6 x 6	200 to 400	409
Albertson Water District	Roslyn Road at Village Boundary (North)	6 x 6	400 to 800	796
Village of Williston Park	East Williston Avenue at Village Boundary (West)	8 x 8	600 to 1,000	1,613

Notes:
(1) - Capacity at 20 psi differential
(2) - Short term rate
(3) - Hardman & Cheremisinoff
gpm - gallons per minute

Table 3-2
Inc. Village of East Williston
Historical and Projected Water Demand

Year [1]	Annual Demand (MG)	Average Day (MGD)	Maximum Day [2] (MGD)	Peak Hour [3] (MGD)	Maxium Day plus Fire Flow [4] (MGD)
2004-05	139.28	0.38	1.05	1.57	1.68
2005-06	132.49	0.36	1.00	1.50	1.63
2007-08	143.36	0.39	1.08	1.62	1.71
2008-09	140.50	0.38	1.06	1.59	1.69
2009-10	149.06	0.41	1.12	1.68	1.75
2010-11	125.01	0.34	0.94	1.41	1.57
2011-12	131.68	0.36	0.99	1.49	1.62
2012-13	142.52	0.39	1.07	1.61	1.70
8 Year Average:	137.99	0.38	1.04	1.56	1.67
8 Year Maximum:	149.06	0.41	1.12	1.68	1.75
Growth Factor [5]:	178.87	0.49	1.35	2.02	2.10

Notes:
(1) -From October to September
(2) - Estimated to be 275% of Average Day demand
(3) - Estimated to be 150 % of Maximum Day demand
(4) - 3,500 GPM for 3 hours is a practical upper fire flow limit most water suppliers should anticipate. (AWWA Manual M31, 1st Ed.)
(5) - 20 % factor applied
MG - Million Gallons
MGD - Million Gallons Per Day

Table 3-3
Inc. Village of East Williston
Water System Source and Storage Capacity Design Summary

Design Demand Summary	Capacity with one 2 MGD (1400 GPM Well) and 0.10 MG Storage			
Average Day:	0.49 MGD	2.10	1.61	Surplus
Maximum Day:	1.35 MGD	2.10	0.75	Surplus
Peak Hour:	2.02 MGD	2.10	0.08	Surplus
Maximum Day plus Fire Flow:	2.10 MGD	2.10	0.00	equal
Upper Fire Flow Limit [1]:	0.63 MG			

Design Capacity Requirements Summary		
Standby Power:	340 gpm	based on Average Day demand
Well Capacity:	938 gpm	based on Max. Day demand
Storage Capacity:	0.67 MG	based on est. Peak Hour
Storage Capacity:	0.75 MG	based on est. Max. Day plus FF
Storage Capacity:	0.63 MG	based on FF only

Proposed System Design Summary

	Units	Unit Capacity		Total Capacity	
Supply wells:	2	1400	gpm	4.03	MGD (2,800 gpm)
Storage Tanks:	1	0.1	MG	0.1	MGD [2]
			Total:	4.13	MGD

Storage Tank Capacity Mitigation			
Automatic Interconnection:	0	0 gpm	0 MGD
Required Storage:	0	0 MG	0 MGD [2]
Equivalent Available Storage:			0 MGD [2]

Notes:

(1) - 3,500 GPM for 3 hours is a practical upper fire flow limit most water suppliers should anticipate (AWWA Manual M31, 1st Ed.)

(2) -based on a 24 hour discharge from available storage

gpm - gallons per minute

MG - Million Gallons

MGD - Million Gallons Per Day

FF - Fire Flow

UPDATED 06.26.2014

Table 4-1: Water Quality Monitoring Requirements
Constituents/Contaminants Required to be Tested

Analysis Category	Constituents/Contaminants	Maximum Contaminant Level (mg/l)
IOC's	Alkalinity, Total	--
	Ammonia as N	--
	Antimony	0.006
	Arsenic	0.05
Physical And Inorganic Constituents (mg/l)	Barium	2
	Beryllium	0.004
	Cadmium	0.005
	Calcium Hardness	--
	Chloride	250
	Chromium	0.10
	Color	15 units
	Conductivity	--
	Copper	1.3(A)
	Cyanide, Free	0.2
	Dissolved Solids, Total	--
	Foaming Agents	--
	Fluoride	2.2
	Hardness, Total	--
	Iron	0.3(B)
	Langelier Index	(C)
	Lead	0.015(A)
	Manganese	0.3(B)
	Magnesium	--
	Mercury	0.002
	Nickel	0.1
	Nitrate as N	10.0(D)
	Nitrite as N	1.0(D)
	Odor	3 units
	pH	7.5-8.5(F)
	Perchlorate	(L)
	Selenium	0.05
	Silver	0.1
	Sodium	(E)
	Suflate	250
	Temperature (F or C)	--
	Thallium	0.002
	Turbidity	5 units
	Zinc	5.0

Analysis Category	Constituents/Contaminants	Maximum Contaminant Level (mg/l)
SOC's	Alachlor	0.002 (K)
	Aldicarb	0.003 (K)
	Aldicarb Sulfone	0.002 (K)
	Aldicarb Sulfoxide	0.004 (K)
Specific Organic Chemicals/ Pesticides (mg/l)	Atrazine	0.003
	Carbofuran	0.04 (K)
	Chlordane, Total	0.002 (K)
	DBCP (G)	0.0002 (K)
	2,4,D	0.05
	Endrin	0.002 (K)
	1,2-Dibromoethane (EDB)	0.00005 (K)
	Heptachlor	0.0004 (K)
Group 1 Chemicals	Heptachlor Epoxide	0.0002 (K)
	Lindane	0.0002 (K)
	Methoxychlor	0.04 (K)
	Polychlorinated Biphenyls (PCBs)	0.0005
	Pentachlorophenol	0.001
	Toxaphene	0.003
	2,4,5-TP (Silvex)	0.01
Group 2 Chemicals	Aldrin	0.005 (K)
	Benzo(a)pyrene	0.0002
	Butachlor	0.05
	Carbaryl	0.05
	Dalapon	0.2
	Di(2-ethylhexyl)adipate	0.4
	Di(2-ethylhexyl)phthalate	0.006
	Dicamba	0.05
	Dieldrin	0.005
	Dinoseb	0.007
	Diquat	0.02
	Endothall	0.1
	Glyphosate	0.7
	Hexachlorobenzene	0.001
	Hexachlorocyclopentadiene	0.05
	3-Hydroxycarbofuran	0.05 (K)
	Methomyl	0.05 (K)
	Metolachlor	0.05
	Metribuzin	0.05
	Oxamyl (Vydate)	0.2 (K)
	Pichloram	0.5
	Propachlor	0.05
	Simazine	0.004
	2,3,7,8-TCDD (Dioxin)	0.00000003

Table 4-1 (Continued)

Analysis Catergory	Constituents/Contaminants	Maximum Contaminant Level (mg/l)
POC's	Benzene	0.005
	Bromobenzene	0.005
	Bromochloromethane	0.005
	Bromomethane	0.005
Principal Organic Contaminants	N-Butylbenzene	0.005
	sec-Butylbenzene	0.005
	tert-Butylbenzene	0.005
	Carbon Tetrachloride	0.005
	Chlorobenzene	0.005
	Chloroethane	0.005
	Chloromethane	0.005
	2-Chlorotoluene	0.005
	4-Chlorotoluene	0.005
	Dibromomethane	0.005
	1,2-Dichlorobenzene	0.005
	1,3-Dichlorobenzene	0.005
	1,4-Dichlorobenze	0.005
	Dichlorodifluoromethane	0.005
	1,1-Dichloroethane	0.005
	1,2-Dichloroethane	0.005
	1,1-Dichloroethene	0.005
	cis-1,2-Dichloroethene	0.005
	trans-1,2-Dichloroethene	0.005
	1,2-Dichloropropane	0.005
	1,3-Dichloropropane	0.005
	2,2-Dichlropropane	0.005
	1,1-Dichloropropene	0.005
	cis-1,3-Dichloropropene	0.005
	trans-1,3-Dichloropropene	0.005
	Ethylbenzene	0.005
	Hexachlorobutadiene	0.005
	Isopropylbenzene	0.005
	p-Isopropyltoluene	0.005
	Methylene Chloride	0.005

Analysis Catergory	Constituents/Contaminants	Maximum Contaminant Level (mg/l)
POC's (continued)	Methyl Tert. Butyl Ether (MTBE)	0.05
	n-Propylbenzene	0.005
	Styrene	0.005
	1,1,1,2-Tetrachloroethane	0.005
Principal Organic Contaminants Pesticides (mg/l)	1,1,2,2,-Tetrachloroethane	0.005
	Tetrachloroethene	0.005
	Toluene	0.005
	1,2,3-Trichlorobenzene	0.005
	1,2,4-Trichlorobenzene	0.005
	1,1,1-Trichloroethane	0.005
	1,1,2-Trichloroethane	0.005
	Trichloroethene	0.005
	Trichlorofluoromethane	0.005
	1,2,3-Trichloropropane	0.005
	1,2,4-Trimethylbenzene	0.005
	1,3,5-Trimethylbenzene	0.005
	m-Xylene	0.005
	o-Xylene	0.005
	p-Xylene	0.005
	Vinyl Chloride	0.002
	Bromoform	0.05
	Bromodichloromethane	0.05
	Chloroform	0.05
	Chlorodibromomethane	0.05
TTHM's	Total Trihalomethanes (H)	0.1
UOC	Unspecified Organic Contaminant	0.05
	Total POC's and UOC's	0.1
Microbiological MIC.	Total Coliform	None Detected
	Escherichia Coliform (I)	None Detected
Radiological RAD.	Gross Alpha Particle Activity	15.0 (J)

Table 4-1 (Continued)

Legend for Table 4-1

(A) USEPA Action Level
(B) The combined concentration of iron and manganese should not exceed 0.5 mg/l.
(C) The NCDH recommends that the Langelier Index Saturation Index should be close to zero as possible.
(D) The total Nitrate and Nitrite should not exceed 10.0 mg/l.
(E) The NYSDOH recommends that the sodium level not exceed 20 mg/l for severely restricted sodium diets and 270 mg/l for moderately restricted sodium diets.
(F) NCDH guideline
(G) 1,2-Dibromo-3-Chloropropane
(I) The Escherichia Coliform (E.Coli) analysis is only required in a sample where the Total Coliform is positive.
(J) If the gross alpha particle activity is >5 pc/l, the same or an equivalent sample shall be analyzed for Radium-226.
If the concentration of Radium-226 is >3 pc/l, the same or equivalent sample shall be analyzed for Radium-228.
(K) Monitoring waived by NCDH due to past experience.
(L) NYSDOH Action Level 18.0 ppb

Additional Requirements

Treatment Provided	Monitoring Required(1)	Raw(2)	Treated
VOC or SOC Removal(3) By Air Stripper or GAC Facility	Organic Design Chemicals(4)	Monthly	Monthly
	Organic (POC.1, POC.2)		
	Bacteriological (MIC.1)	Quarterly	Monthly
	Physical (PHY.1)		
	Inorganic (IOC.1, IOC.2, COR.1)	Annually	Annually

(1)All analyses must be performed by a NYSDOH approved laboratory with results sent to NCDH.
(2)If more than one well is being treated by the same removal system, a raw water sample must be collected from each well.
(3)The minimum run time before sample collection should be one hour at air stripping facilities and 30 minutes at GAC facilities.
(4)Testing is required only for those compounds for which the removal system was designed during the first six months of operation.
Thereafter, organic (POC.1, POC.2) monitoring requirements should be followed.

Village of East Williston
Table 4-2 : Implementation Schedule
Construction of New Public Water Supply Well and Wellhead Treatment System

Month	Task	Task Duration
1	Notice to Proceed issued for Permit and Design Phase	
	Prepare Engineering Report and Permit Applications for Public Water Supply Well include SEQRA	8 weeks
	Prepare Engineering Report for Villlage Water Department system	8 weeks
2	Prepare plans and specifications for construction of test and permanent wells	6 weeks
3	Submit Engineering Report and Permit Applications for Public Water Supply Well To NYSDEC for review and approval	8 weeks
	Submit Engineering Report for Water System Extension to Nassau County Health Department for review and approval	8 weeks
4	Submit plans and specifications for construction of test and permanent wells to Nassau County Health Department for review	8 weeks
5	Advertise and bid contract for construction of test and permanent wells	
6	Start construction of test well	6 weeks
7	Obtain water quality samples from test well	
	Start construction of permanent well	8 weeks
8	Based on water quality, prepare engineering report for well head treatment	6 weeks
	Prepare plans and specifications for construction of well head treatment facility.	12 weeks
10	Permanent Well construction complete	
	Submit plans and specifications for construction of wellhead treatment facility to Nassau County Health Department for review	8 weeks
12	Advertise and bid contract for construction of wellhead treatment facility.	4 weeks
13	Start Construction of wellhead treatment facility	18 months
30	Plant operational and accepted for service by Nassau County Health Department	

X:\EWTV (Inc. Village of East Williston) - 10295\EWTV 1201 - (Construction of PWS Design Report)\03-2014 Report Update\Tables\Table 4-2 Implementation schedule

H2MGROUP

Table 5-1

Village of East Williston

OPINION OF COST

Construction of New Public Water Supply Well and Wellhead Treatment System

GAC Treatment - Option 1

	DESCRIPTION	Cost
1	Bonds and insurances	$339,460
2	General conditions*	$617,200
3	Clearing, excavation, subgrade preparation, grading, restoration	$125,000
3a	Tennis court reconstruction	$200,000
4	Drainage piping / blow-off system	$50,000
5	Paving, sidewalks,aprons and curbs	$50,000
6	Site watermain (pipe,valves,fittings)**	$50,000
7	250,000 gallon Elevated Storage Tank	$1,700,000
8	Masonry treatment building (3,600 sqft.)	$792,000
9	Construction of test well, two permanent well, two 1,100 gpm well pump and motor	$550,000
10	GAC Filters (4 Vessels)	$700,000
11	Chemical transfer containment pad	$30,000
13	Transfer and Booster pump systems	$250,000
14	Large piping, valves.and appurtenances	$200,000
15	Small piping, valves, and appurtenances	$50,000
16	Chemical treatment systems	$125,000
17	Electric power distribution	$250,000
18	Electrical controls and instrumentation	$300,000
19	Electrical site work including Generator	$750,000
CONSTRUCTION TOTAL		**$7,128,660**
	Engineering, Design & Construction Administration (10%)	$713,000
	New Public Supply Well Engineering Report and Permit Application	$25,000
	Wellhead Treatment System Engineering Report	$20,000
	Nassau County Health Department Review Fees	$10,000
	Construction Observation (2.5%)	$178,000
	Legal (3%)	$214,000
	Contingencies (7.5%)	$535,000
PROJECT TOTAL		**$8,823,660**

**General Conditions includes specific and non-specific costs including survey, clerical tasks, mobilization, demobilization, project management and supervision etc.*

*** Water main work will include installation of pipe, valves and fittings to connect new water treatment plant to existing 8" diameter water main located on NYS Rt 25A*

H2MGROUP

Table 5-2

Village of East Williston

OPINION OF COST

Construction of New Public Water Supply Well and Wellhead Treatment System

Air Stripping Treatment - Option 2A

	DESCRIPTION	Cost
1	Bonds and insurances	$269,500
2	General conditions*	$490,000
3	Clearing, excavation, subgrade preparation, grading, restoration	$125,000
3a	Tennis court reconstruction	$200,000
4	Drainage piping / blow-off system	$50,000
5	Paving, sidewalks,aprons and curbs	$50,000
6	Site watermain (pipe,valves,fittings)**	$50,000
7	Concrete clearwell	$500,000
8	Masonry treatment building (3,500 sqft.)	$770,000
9	Construction of test well, two permanent well, two 1,400 gpm well pump and motor	$700,000
10	Air stripping tower system (1 Tower)	$500,000
11	Chemical transfer containment pad	$30,000
13	Transfer and Booster pump systems	$250,000
14	Large piping, valves.and appurtenances	$200,000
15	Small piping, valves, and appurtenances	$50,000
16	Chemical treatment systems	$125,000
17	Electric power distribution	$250,000
18	Electrical controls and instrumentation	$300,000
19	Electrical site work including Generator	$750,000
CONSTRUCTION TOTAL		**$5,659,500**
	Engineering, Design & Construction Administration (10%)	$566,000
	New Public Supply Well Engineering Report and Permit Application	$25,000
	Wellhead Treatment System Engineering Report	$20,000
	Nassau County Health Department Review Fees	$10,000
	Construction Observation (2.5%)	$141,000
	Legal (3%)	$170,000
	Contingencies (7.5%)	$424,000
PROJECT TOTAL		**$7,015,500**

**General Conditions includes specific and non-specific costs including survey, clerical tasks, mobilization, demobilization, project management and supervision etc.*

*** Water main work will include installation of pipe, valves and fittings to connect new water treatment plant to existing 8" diameter water main located on NYS Rt 25A*

H2MGROUP

Table 5-3

Village of East Williston

OPINION OF COST

Construction of New Public Water Supply Well and Wellhead Treatment System

GAC Treatment - Option 2B

	DESCRIPTION	Cost
1	Bonds and insurances	$267,190
2	General conditions*	$485,800
3	Clearing, excavation, subgrade preparation, grading, restoration	$125,000
3a	Tennis court reconstruction	$200,000
4	Drainage piping / blow-off system	$50,000
5	Paving, sidewalks,aprons and curbs	$50,000
6	Site watermain (pipe,valves,fittings)**	$50,000
7	Concrete storage tank (100,000 gallon)	$500,000
8	Prefabricated well and treatment building (2,400 sqft.)	$528,000
9	Construction of test well, two permanent well, two 1,400 gpm well pump and motor	$700,000
10	GAC Filters (4 Vessels) - one indoor pair and one exterior pair	$700,000
11	Chemical transfer containment pad	$30,000
13	Transfer and Booster pump systems	$250,000
14	Large piping, valves.and appurtenances	$200,000
15	Small piping, valves, and appurtenances	$50,000
16	Chemical treatment systems	$125,000
17	Electric power distribution	$250,000
18	Electrical controls and instrumentation	$300,000
19	Electrical site work including Generator	$750,000
CONSTRUCTION TOTAL		**$5,610,990**
	Engineering, Design & Construction Administration (10%)	$561,000
	New Public Supply Well Engineering Report and Permit Application	$25,000
	Wellhead Treatment System Engineering Report	$20,000
	Nassau County Health Department Review Fees	$10,000
	Construction Observation (2.5%)	$140,000
	Legal (3%)	$168,000
	Contingencies (7.5%)	$421,000
PROJECT TOTAL		**$6,955,990**

**General Conditions includes specific and non-specific costs including survey, clerical tasks, mobilization, demobilization, project management and supervision etc.*

*** Water main work will include installation of pipe, valves and fittings to connect new water treatment plant to existing 8" diameter water main located on NYS Rt 25A*

Table 5-4

INC. VILLAGE OF EAST WILLISTON

OPINION OF COST

Construction of New Public Water Supply Well and Wellhead Treatment System

GAC TREATMENT OPTION 3A

	DESCRIPTION	Cost
1	Bonds and insurances	$249,150
2	General conditions*	$453,000
3	Clearing, excavation, subgrade preparation, grading, restoration	$125,000
3a	Tennis court reconstruction	$200,000
4	Drainage piping / blow-off system	$50,000
5	Paving, sidewalks,aprons and curbs	$50,000
6	Site watermain (pipe,valves,fittings)**	$50,000
7	Four 25,000 gallon hydropneumatic tanks (66,700 gal effective volume)	$304,000
8	Masonry Treatment Building and Foundation (3,600 sqft.)	$796,000
9	Construction of test well, two permanent well, two 1,100 gpm well pump and motor	$550,000
10	GAC Filters (4 Vessels)	$700,000
11	Chemical transfer containment pad	$30,000
13	Large piping, valves.and appurtenances	$200,000
14	Small piping, valves, and appurtenances	$50,000
15	Chemical treatment systems	$125,000
16	Electric power distribution	$250,000
17	Electrical controls and instrumentation	$300,000
18	Electrical site work including Generator	$750,000
CONSTRUCTION TOTAL		**$5,232,150**
	Engineering, Design & Construction Administration (10%)	$523,000
	New Public Supply Well Engineering Report and Permit Application	$25,000
	Wellhead Treatment System Engineering Report	$20,000
	Nassau County Health Department Review Fees	$10,000
	Construction Observation (2.5%)	$131,000
	Legal (3%)	$157,000
	Contingencies (7.5%)	$392,000
PROJECT TOTAL		**$6,490,150**

**General Conditions includes specific and non-specific costs including survey, clerical tasks, mobilization, demobilization, project management and supervision etc.*

*** Water main work will include installation of pipe, valves and fittings to connect new water treatment plant to existing 8" diameter water main located on NYS Rt 25A*

Table 5-5

INC. VILLAGE OF EAST WILLISTON

OPINION OF COST

Construction of New Public Water Supply Well and Wellhead Treatment System

GAC TREATMENT OPTION 3B

	DESCRIPTION	Cost
1	Bonds and insurances	$224,620
2	General conditions*	$408,400
3	Clearing, excavation, subgrade preparation, grading, restoration	$125,000
3a	Tennis court reconstruction	$200,000
4	Drainage piping / blow-off system	$50,000
5	Paving, sidewalks,aprons and curbs	$50,000
6	Site watermain (pipe,valves,fittings)**	$50,000
7	Four 25,000 gallon hydropneumatic tanks (66,700 gal effective volume)	$304,000
8	Metal Prefab Treatment Building and Foundation (3,600 sqft.)	$350,000
9	Construction of test well, two permanent well, two 1,100 gpm well pump and motor	$550,000
10	GAC Filters (4 Vessels)	$700,000
11	Chemical transfer containment pad	$30,000
13	Large piping, valves.and appurtenances	$200,000
14	Small piping, valves, and appurtenances	$50,000
15	Chemical treatment systems	$125,000
16	Electric power distribution	$250,000
17	Electrical controls and instrumentation	$300,000
18	Electrical site work including Generator	$750,000
CONSTRUCTION TOTAL		**$4,717,020**
	Engineering, Design & Construction Administration (10%)	$472,000
	New Public Supply Well Engineering Report and Permit Application	$25,000
	Wellhead Treatment System Engineering Report	$20,000
	Nassau County Health Department Review Fees	$10,000
	Construction Observation (2.5%)	$118,000
	Legal (3%)	$142,000
	Contingencies (7.5%)	$354,000
PROJECT TOTAL		**$5,858,020**

**General Conditions includes specific and non-specific costs including survey, clerical tasks, mobilization, demobilization, project management and supervision etc.*

*** Water main work will include installation of pipe, valves and fittings to connect new water treatment plant to existing 8" diameter water main located on NYS Rt 25A*

Table 5-6

INC. VILLAGE OF EAST WILLISTON

OPINION OF COST

Construction of New Public Water Supply Well and Wellhead Treatment System

GAC TREATMENT OPTION 3C

	DESCRIPTION	Cost
1	Bonds and insurances	$213,620
2	General conditions*	$388,400
3	Clearing, excavation, subgrade preparation, grading, restoration	$125,000
4	Drainage piping / blow-off system	$50,000
5	Paving, sidewalks,aprons and curbs	$50,000
6	Site watermain (pipe,valves,fittings)**	$50,000
7	Four 25,000 gallon hydropneumatic tanks (66,700 gal effective volume)	$304,000
8	Metal Prefab Treatment Building and Foundation (3,600 sqft.)	$350,000
9	Construction of test well, two permanent well, two 1,100 gpm well pump and motor	$550,000
10	GAC Filters (4 Vessels)	$700,000
11	Chemical transfer containment pad	$30,000
13	Large piping, valves.and appurtenances	$200,000
14	Small piping, valves, and appurtenances	$50,000
15	Chemical treatment systems	$125,000
16	Electric power distribution	$250,000
17	Electrical controls and instrumentation	$300,000
18	Electrical site work including Generator	$750,000
CONSTRUCTION TOTAL		**$4,486,020**
	Engineering, Design & Construction Administration (10%)	$449,000
	New Public Supply Well Engineering Report and Permit Application	$25,000
	Wellhead Treatment System Engineering Report	$20,000
	Nassau County Health Department Review Fees	$10,000
	Construction Observation (2.5%)	$112,000
	Legal (3%)	$135,000
	Contingencies (7.5%)	$336,000
PROJECT TOTAL		**$5,573,020**

**General Conditions includes specific and non-specific costs including survey, clerical tasks, mobilization, demobilization, project management and supervision etc.*

*** Water main work will include installation of pipe, valves and fittings to connect new water treatment plant to existing 8" diameter water main located on NYS Rt 25A*

Table 5-7

INC. VILLAGE OF EAST WILLISTON

OPTION 1
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $8,823,660
Bond Duration = 20 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	8,823,660	352,946	264,710	617,656
2016	8,470,714	362,234	254,121	616,356
2017	8,108,479	371,523	243,254	614,777
2018	7,736,957	380,811	232,109	612,919
2019	7,356,146	390,099	220,684	610,783
2020	6,966,047	399,387	208,981	608,368
2021	6,566,661	408,675	197,000	605,675
2022	6,157,986	417,963	184,740	602,702
2023	5,740,023	427,251	172,201	599,452
2024	5,312,772	436,539	159,383	595,922
2025	4,876,233	445,827	146,287	592,114
2026	4,430,406	455,115	132,912	588,027
2027	3,975,291	464,403	119,259	583,662
2028	3,510,888	473,691	105,327	579,018
2029	3,037,197	482,979	91,116	574,095
2030	2,554,217	492,267	76,627	568,894
2031	2,061,950	501,555	61,859	563,414
2032	1,560,395	510,843	46,812	557,655
2033	1,049,551	520,132	31,487	551,618
2034	529,420	529,420	15,883	545,302
			TOTAL PAYMENT:	$ 11,788,410

Table 5-8

Inc. Village of East Williston

OPTION 2A
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $7,015,500
Bond Duration = 20 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	7,015,500	280,620	210,465	491,085
2016	6,734,880	288,005	202,046	490,051
2017	6,446,875	295,389	193,406	488,796
2018	6,151,486	302,774	184,545	487,319
2019	5,848,712	310,159	175,461	485,620
2020	5,538,553	317,544	166,157	483,700
2021	5,221,009	324,928	156,630	481,559
2022	4,896,081	332,313	146,882	479,196
2023	4,563,767	339,698	136,913	476,611
2024	4,224,069	347,083	126,722	473,805
2025	3,876,987	354,467	116,310	470,777
2026	3,522,519	361,852	105,676	467,528
2027	3,160,667	369,237	94,820	464,057
2028	2,791,431	376,622	83,743	460,364
2029	2,414,809	384,006	72,444	456,451
2030	2,030,803	391,391	60,924	452,315
2031	1,639,412	398,776	49,182	447,958
2032	1,240,636	406,161	37,219	443,380
2033	834,475	413,545	25,034	438,580
2034	420,930	420,930	12,628	433,558
			TOTAL PAYMENT:	$ 9,372,708

Table 5-9

Inc. Village of East Williston

OPTION 2B
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $6,955,990
Bond Duration = 20 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	6,955,990	278,240	208,680	486,919
2016	6,677,750	285,562	200,333	485,894
2017	6,392,189	292,884	191,766	484,649
2018	6,099,305	300,206	182,979	483,185
2019	5,799,099	307,528	173,973	481,501
2020	5,491,571	314,850	164,747	479,597
2021	5,176,721	322,172	155,302	477,474
2022	4,854,549	329,494	145,636	475,131
2023	4,525,055	336,816	135,752	472,568
2024	4,188,238	344,138	125,647	469,786
2025	3,844,100	351,461	115,323	466,784
2026	3,492,639	358,783	104,779	463,562
2027	3,133,857	366,105	94,016	460,120
2028	2,767,752	373,427	83,033	456,459
2029	2,394,325	380,749	71,830	452,579
2030	2,013,576	388,071	60,407	448,478
2031	1,625,505	395,393	48,765	444,158
2032	1,230,112	402,715	36,903	439,619
2033	827,397	410,037	24,822	434,859
2034	417,359	417,359	12,521	429,880
			TOTAL PAYMENT:	**$ 9,293,203**

Table 5-10

Inc. Village of East Williston

OPTION 3A
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $6,490,150
Bond Duration = 20 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	6,490,150	259,606	194,705	454,311
2016	6,230,544	266,438	186,916	453,354
2017	5,964,106	273,269	178,923	452,193
2018	5,690,837	280,101	170,725	450,826
2019	5,410,736	286,933	162,322	449,255
2020	5,123,803	293,765	153,714	447,479
2021	4,830,038	300,596	144,901	445,498
2022	4,529,442	307,428	135,883	443,311
2023	4,222,013	314,260	126,660	440,920
2024	3,907,753	321,092	117,233	438,324
2025	3,586,662	327,923	107,600	435,523
2026	3,258,738	334,755	97,762	432,517
2027	2,923,983	341,587	87,720	429,306
2028	2,582,397	348,419	77,472	425,890
2029	2,233,978	355,250	67,019	422,270
2030	1,878,728	362,082	56,362	418,444
2031	1,516,646	368,914	45,499	414,413
2032	1,147,732	375,746	34,432	410,177
2033	771,986	382,577	23,160	405,737
2034	389,409	389,409	11,682	401,091
			TOTAL PAYMENT:	$ 8,670,840

Table 5-11

Inc. Village of East Williston

OPTION 3B
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $5,858,020
Bond Duration = 20 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	5,858,020	234,321	175,741	410,061
2016	5,623,699	240,487	168,711	409,198
2017	5,383,212	246,653	161,496	408,150
2018	5,136,559	252,820	154,097	406,917
2019	4,883,739	258,986	146,512	405,498
2020	4,624,753	265,152	138,743	403,895
2021	4,359,600	271,319	130,788	402,107
2022	4,088,281	277,485	122,648	400,134
2023	3,810,796	283,651	114,324	397,975
2024	3,527,145	289,818	105,814	395,632
2025	3,237,327	295,984	97,120	393,104
2026	2,941,343	302,151	88,240	390,391
2027	2,639,192	308,317	79,176	387,493
2028	2,330,875	314,483	69,926	384,409
2029	2,016,392	320,650	60,492	381,141
2030	1,695,743	326,816	50,872	377,688
2031	1,368,927	332,982	41,068	374,050
2032	1,035,945	339,149	31,078	370,227
2033	696,796	345,315	20,904	366,219
2034	351,481	351,481	10,544	362,026
			TOTAL PAYMENT:	**$ 7,826,315**

Table 5-12

Inc. Village of East Williston

OPTION 3C
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $5,573,020
Bond Duration = 20 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	5,573,020	222,921	167,191	390,111
2016	5,350,099	228,787	160,503	389,290
2017	5,121,312	234,653	153,639	388,293
2018	4,886,659	240,520	146,600	387,120
2019	4,646,139	246,386	139,384	385,770
2020	4,399,753	252,252	131,993	384,245
2021	4,147,500	258,119	124,425	382,544
2022	3,889,381	263,985	116,681	380,667
2023	3,625,396	269,851	108,762	378,613
2024	3,355,545	275,718	100,666	376,384
2025	3,079,827	281,584	92,395	373,979
2026	2,798,243	287,451	83,947	371,398
2027	2,510,792	293,317	75,324	368,641
2028	2,217,475	299,183	66,524	365,707
2029	1,918,292	305,050	57,549	362,598
2030	1,613,243	310,916	48,397	359,313
2031	1,302,327	316,782	39,070	355,852
2032	985,545	322,649	29,566	352,215
2033	662,896	328,515	19,887	348,402
2034	334,381	334,381	10,031	344,413
			TOTAL PAYMENT:	$ 7,445,555

Table 5-13

INC. VILLAGE OF EAST WILLISTON

OPTION 1
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $8,823,660
Bond Duration = 30 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	8,823,660	235,298	264,710	500,007
2016	8,588,362	239,354	257,651	497,005
2017	8,349,008	243,411	250,470	493,882
2018	8,105,597	247,468	243,168	490,636
2019	7,858,128	251,525	235,744	487,269
2020	7,606,603	255,582	228,198	483,780
2021	7,351,022	259,639	220,531	480,169
2022	7,091,383	263,696	212,741	476,437
2023	6,827,687	267,752	204,831	472,583
2024	6,559,935	271,809	196,798	468,607
2025	6,288,126	275,866	188,644	464,510
2026	6,012,259	279,923	180,368	460,291
2027	5,732,336	283,980	171,970	455,950
2028	5,448,356	288,037	163,451	451,487
2029	5,160,320	292,094	154,810	446,903
2030	4,868,226	296,150	146,047	442,197
2031	4,572,076	300,207	137,162	437,370
2032	4,271,868	304,264	128,156	432,420
2033	3,967,604	308,321	119,028	427,349
2034	3,659,283	312,378	109,779	422,156
2035	3,346,906	316,435	100,407	416,842
2036	3,030,471	320,492	90,914	411,406
2037	2,709,979	324,548	81,299	405,848
2038	2,385,431	328,605	71,563	400,168
2039	2,056,826	332,662	61,705	394,367
2040	1,724,163	336,719	51,725	388,444
2041	1,387,444	340,776	41,623	382,399
2042	1,046,669	344,833	31,400	376,233
2043	701,836	348,890	21,055	369,945
2044	352,946	352,946	10,588	363,535
			TOTAL PAYMENT:	$ 13,200,195

Table 5-14

INC. VILLAGE OF EAST WILLISTON

OPTION 2A
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $7,015,500
Bond Duration = 30 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	7,015,500	187,080	210,465	397,545
2016	6,828,420	190,306	204,853	395,158
2017	6,638,114	193,531	199,143	392,674
2018	6,444,583	196,757	193,338	390,094
2019	6,247,827	199,982	187,435	387,417
2020	6,047,845	203,208	181,435	384,643
2021	5,844,637	206,433	175,339	381,772
2022	5,638,204	209,659	169,146	378,805
2023	5,428,546	212,884	162,856	375,741
2024	5,215,661	216,110	156,470	372,579
2025	4,999,552	219,335	149,987	369,322
2026	4,780,217	222,561	143,406	365,967
2027	4,557,656	225,786	136,730	362,516
2028	4,331,870	229,012	129,956	358,968
2029	4,102,858	232,237	123,086	355,323
2030	3,870,621	235,463	116,119	351,581
2031	3,635,158	238,688	109,055	347,743
2032	3,396,470	241,914	101,894	343,808
2033	3,154,556	245,139	94,637	339,776
2034	2,909,417	248,365	87,282	335,647
2035	2,661,052	251,590	79,832	331,422
2036	2,409,461	254,816	72,284	327,100
2037	2,154,646	258,041	64,639	322,681
2038	1,896,604	261,267	56,898	318,165
2039	1,635,337	264,492	49,060	313,553
2040	1,370,845	267,718	41,125	308,843
2041	1,103,127	270,943	33,094	304,037
2042	832,183	274,169	24,966	299,134
2043	558,014	277,394	16,740	294,135
2044	280,620	280,620	8,419	289,039
			TOTAL PAYMENT:	**$ 10,495,188**

Table 5-15

INC. VILLAGE OF EAST WILLISTON

OPTION 2B
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $6,955,990
Bond Duration = 30 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	6,955,990	185,493	208,680	394,173
2016	6,770,497	188,691	203,115	391,806
2017	6,581,806	191,889	197,454	389,344
2018	6,389,916	195,088	191,697	386,785
2019	6,194,829	198,286	185,845	384,131
2020	5,996,543	201,484	179,896	381,380
2021	5,795,059	204,682	173,852	378,534
2022	5,590,377	207,880	167,711	375,591
2023	5,382,497	211,078	161,475	372,553
2024	5,171,419	214,276	155,143	369,419
2025	4,957,142	217,475	148,714	366,189
2026	4,739,668	220,673	142,190	362,863
2027	4,518,995	223,871	135,570	359,441
2028	4,295,124	227,069	128,854	355,923
2029	4,068,055	230,267	122,042	352,309
2030	3,837,788	233,465	115,134	348,599
2031	3,604,322	236,664	108,130	344,793
2032	3,367,659	239,862	101,030	340,891
2033	3,127,797	243,060	93,834	336,894
2034	2,884,737	246,258	86,542	332,800
2035	2,638,479	249,456	79,154	328,611
2036	2,389,023	252,654	71,671	324,325
2037	2,136,368	255,853	64,091	319,944
2038	1,880,516	259,051	56,415	315,466
2039	1,621,465	262,249	48,644	310,893
2040	1,359,216	265,447	40,776	306,223
2041	1,093,769	268,645	32,813	301,458
2042	825,124	271,843	24,754	296,597
2043	553,281	275,041	16,598	291,640
2044	278,240	278,240	8,347	286,587
			TOTAL PAYMENT:	**$ 10,406,161**

Table 5-16

INC. VILLAGE OF EAST WILLISTON

OPTION 3A
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $6,490,150
Bond Duration = 30 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	6,490,150	173,071	194,705	367,775
2016	6,317,079	176,055	189,512	365,567
2017	6,141,025	179,039	184,231	363,269
2018	5,961,986	182,023	178,860	360,882
2019	5,779,963	185,007	173,399	358,405
2020	5,594,957	187,991	167,849	355,839
2021	5,406,966	190,975	162,209	353,184
2022	5,215,992	193,959	156,480	350,438
2023	5,022,033	196,942	150,661	347,603
2024	4,825,091	199,926	144,753	344,679
2025	4,625,164	202,910	138,755	341,665
2026	4,422,254	205,894	132,668	338,562
2027	4,216,360	208,878	126,491	335,369
2028	4,007,481	211,862	120,224	332,087
2029	3,795,619	214,846	113,869	328,715
2030	3,580,772	217,830	107,423	325,253
2031	3,362,942	220,814	100,888	321,703
2032	3,142,128	223,798	94,264	318,062
2033	2,918,330	226,782	87,550	314,332
2034	2,691,547	229,766	80,746	310,513
2035	2,461,781	232,750	73,853	306,604
2036	2,229,031	235,734	66,871	302,605
2037	1,993,297	238,718	59,799	298,517
2038	1,754,578	241,702	52,637	294,339
2039	1,512,876	244,686	45,386	290,072
2040	1,268,190	247,670	38,046	285,716
2041	1,020,520	250,654	30,616	281,270
2042	769,866	253,638	23,096	276,734
2043	516,228	256,622	15,487	272,109
2044	259,606	259,606	7,788	267,394
			TOTAL PAYMENT:	**$ 9,709,264**

Table 5-17

INC. VILLAGE OF EAST WILLISTON

OPTION 3B
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $5,858,020
Bond Duration = 30 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	5,858,020	156,214	175,741	331,954
2016	5,701,806	158,907	171,054	329,961
2017	5,542,899	161,601	166,287	327,888
2018	5,381,298	164,294	161,439	325,733
2019	5,217,004	166,987	156,510	323,497
2020	5,050,017	169,681	151,501	321,181
2021	4,880,337	172,374	146,410	318,784
2022	4,707,963	175,067	141,239	316,306
2023	4,532,895	177,761	135,987	313,747
2024	4,355,135	180,454	130,654	311,108
2025	4,174,681	183,147	125,240	308,388
2026	3,991,534	185,841	119,746	305,587
2027	3,805,693	188,534	114,171	302,705
2028	3,617,159	191,227	108,515	299,742
2029	3,425,932	193,921	102,778	296,699
2030	3,232,011	196,614	96,960	293,574
2031	3,035,397	199,307	91,062	290,369
2032	2,836,090	202,001	85,083	287,083
2033	2,634,089	204,694	79,023	283,717
2034	2,429,395	207,387	72,882	280,269
2035	2,222,008	210,081	66,660	276,741
2036	2,011,927	212,774	60,358	273,132
2037	1,799,153	215,467	53,975	269,442
2038	1,583,685	218,161	47,511	265,671
2039	1,365,525	220,854	40,966	261,820
2040	1,144,671	223,547	34,340	257,888
2041	921,123	226,241	27,634	253,874
2042	694,882	228,934	20,846	249,781
2043	465,948	231,627	13,978	245,606
2044	234,321	234,321	7,030	241,350
			TOTAL PAYMENT:	**$ 8,763,598**

Table 5-18

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INC. VILLAGE OF EAST WILLISTON

OPTION 3C
BOND RETIREMENT SCHEDULE
WATER SUPPLY IMPROVEMENTS

Bond Amount = $5,573,020
Bond Duration = 30 years
Interest Rate = 3.00 %

YEAR	OUTSTANDING DEBT ($)	PRINCIPAL PAYMENT ($)	INTEREST PAYMENT ($)	TOTAL PAYMENT ($)
2015	5,573,020	148,614	167,191	315,804
2016	5,424,406	151,176	162,732	313,908
2017	5,273,230	153,738	158,197	311,935
2018	5,119,491	156,301	153,585	309,886
2019	4,963,191	158,863	148,896	307,759
2020	4,804,328	161,425	144,130	305,555
2021	4,642,902	163,988	139,287	303,275
2022	4,478,914	166,550	134,367	300,917
2023	4,312,364	169,112	129,371	298,483
2024	4,143,252	171,675	124,298	295,972
2025	3,971,577	174,237	119,147	293,384
2026	3,797,341	176,799	113,920	290,719
2027	3,620,541	179,362	108,616	287,978
2028	3,441,180	181,924	103,235	285,159
2029	3,259,256	184,486	97,778	282,264
2030	3,074,770	187,048	92,243	279,292
2031	2,887,721	189,611	86,632	276,242
2032	2,698,110	192,173	80,943	273,116
2033	2,505,937	194,735	75,178	269,914
2034	2,311,202	197,298	69,336	266,634
2035	2,113,904	199,860	63,417	263,277
2036	1,914,044	202,422	57,421	259,844
2037	1,711,622	204,985	51,349	256,333
2038	1,506,637	207,547	45,199	252,746
2039	1,299,090	210,109	38,973	249,082
2040	1,088,981	212,672	32,669	245,341
2041	876,309	215,234	26,289	241,523
2042	661,075	217,796	19,832	237,628
2043	443,279	220,358	13,298	233,657
2044	222,921	222,921	6,688	229,608
			TOTAL PAYMENT:	$ 8,337,238

Table 5-19
INC. VILLAGE OF EAST WILLISTON
OPTION 1
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH AN AIR STRIPPING WELLHEAD TREATMENT SYSTEM

A. Summary of New Water Supply and Wellhead Treatment System Electrical Equipment:

Electric Utility Provider	LIPA
Projected Electrical Rate Code	285 (>145 KW in any two Peak Season Months)
New Water Supply Plant Electrical Equipment Descriptions	2- 100 HP (75KW) 1,100 GPM Well Pump
	4 - 5 KW Heaters - Off Peak Season Only
	5 KW Miscellaneuos Equipment
New Water Supply Plant Electrical Demand Totals	100 KW Off Peak Season (One Well) 155 KW Peak Season

B. Annual Electric Usage and Demand Costs of New Water Supply Facilities:

Off Peak Season			Peak Season		
Demand	100	KW	Demand	155	KW
Monthly Demand Charge	$ 5.26	Per KW	Monthly Demand Charge	$ 27.35	Per KW
Season Duration	8	Months	Season Duration	4	Months
Total Demand Cost	$ 4,208		Total Demand Cost	$ 16,957	
Monthly Operating Hours (Water Supply and Misc.)[1]	225	Hrs	Monthly Operating Hours (Water Supply and Misc.)[4]	300	Hrs
Monthly Operating Hours (Heating Only)[2]	120	Hrs	Monthly Operating Hours (Heating Only)	0	Hrs
Monthly Usage	20400	KWH	Monthly Usage	46500	KWH
Usage Charge[3]	$ 0.0108	Per KWH	Usage Charge[5]	$ 0.113	Per KWH
Total Usage Cost	$ 1,763		Total Usage Cost	$ 21,018	
Total Electric Cost	$ 5,971		Total Electric Cost	$ 37,975	
Total Annual Electric Cost of New Water Supply Facilities:				**$ 43,946**	

1. Based on average day pumpage and well pump flow rate - One pump at 7.5 hours per day
2. Each heater is estimated to operate for a total of 4 hours per day
3. Weighted average of LIPA usage period charges plus the power supply charge - $0.034KWH + $0.074KWH
4. Based on maximum day pumpage and well pump flow rate - Two pumps at 10 hours per day
5. Weighted average of LIPA usage period charges plus the power supply charge - $0.039/KWH + $0.074/KWH

INC. VILLAGE OF EAST WILLISTON

OPTION 1 (CONT'D)
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH AN AIR STRIPPING WELLHEAD TREATMENT SYSTEM

C. Annual Lab Monitoring Operating Costs of New Water Supply and Wellhead Treatment Facilities:

Monthly Raw and Treated VOC Sample Sets	2
VOC Sample Rate Charge	$ 295
Total VOC Sample Cost	$ 14,160
Annual IOC Samples	2
IOC Sample Rate Charge	$ 375
Annual IOC Sample Cost	$ 750
Quarterly Microbiological Samples - Wells	2
Microbiological Sample Rate Charge	$ 20
Annual Microbiological Sample Cost	$160
Total Annual Lab Monitoring Operating Cost of New Water Supply and Wellhead Treatment Facilities	**$ 15,070**

D. Annual Labor Operating Costs of New Water Supply and Wellhead Treatment Facilities:

Required Additional Plant Monitoring Per Day	4	Hrs
Required Additional Man-Hours Per Year	1460	Man-Hours
Unit Cost of Labor	$ 41.50	Per Man-hour
Annual Labor Cost of New Water Supply and Wellhead Treatment Facilities	**$ 60,590**	

E. Annual Costs Associated with 30 Year Life of New Equipment

	Well Pumps	Elevated Storage Tank
Rehabilitation Interval	5	15
Number of Rehabilitations Over 30 Years	3	2
Cost Per Rehabilitation	$ 10,000	$ 750,000
Total Lifetime Rehabilitation Cost	$ 30,000	$ 1,500,000
Replacement Interval - Years	10	-
Number of Replacements Over 30 Years	3	-
Cost Per Replacement	$ 130,000	$ -
Total Lifetime Replacement Cost	$ 390,000	$ -
Costs Associated with 30 Year Life of New Equipment		$ 1,920,000
Annual Costs Associated with 30 Year Life of New Equipment		**$ 64,000**

INC. VILLAGE OF EAST WILLISTON

OPTION 1 (CONT'D)
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH AN AIR STRIPPING WELLHEAD TREATMENT SYSTEM

F. Sum of Operating Costs for New Water Supply and Wellhead Treatment Facilities:

B. Annual Electric Usage and Demand Costs of New Water Supply Facilities	$ 43,946
C. Annual Lab Monitoring Operating Costs of New Water Supply and Wellhead Treatment Facilities	$ 15,070
D. Annual Labor Operating Costs of New Water Supply and Wellhead Treatment Facilities	$ 60,590
E. Annual Costs Associated with 30 Year Life of New Equipment	$ 64,000
Total Operating Costs for New Water Supply and Wellhead Treatment Facilities	**$183,606**
Present Worth Value (30 Years, 5.0% Inflation and 2.6% Investment Interest)	**$2,120,786**

Table 5-20
INC. VILLAGE OF EAST WILLISTON
OPTION 2A
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH AN AIR STRIPPING WELLHEAD TREATMENT SYSTEM

A. Summary of New Water Supply and Wellhead Treatment System Electrical Equipment:

Electric Utility Provider	LIPA
Projected Electrical Rate Code	285 (>145 KW in any two Peak Season Months)
New Water Supply Plant Electrical Equipment Descriptions	2- 75 HP (55KW) 1,400 GPM Well Pumps
	4 - 5 KW Heaters - Off Peak Season Only
	5 KW Miscellaneuos Equipment
New Water Supply Plant Electrical Demand Totals	70 KW Off Peak Season (One Well) 95 KW Peak Season
New Wellhead Treatment System Electrical Equipment Descriptions	2 - 20 HP (15 KW) Blowers
	2 - 25 HP (19 KW) 500 GPM Off Peak Season Booster Pumps
	2 - 60 HP (45 KW) 1,400 GPM Peak Season Booster Pumps
New Wellhead Treatment System Electrical Demand	34 KW Off Peak Season 120 KW Peak Season

B. Annual Electric Usage and Demand Costs of New Water Supply Facilities:

Off Peak Season			Peak Season		
Demand	70	KW	Demand	95	KW
Monthly Demand Charge	$ 5.26	Per KW	Monthly Demand Charge	$ 27.35	Per KW
Season Duration	8	Months	Season Duration	4	Months
Total Demand Cost	$ 2,946		Total Demand Cost	$ 10,393	
Monthly Operating Hours (Water Supply and Misc.)[1]	225	Hrs	Monthly Operating Hours (Water Supply and Misc.)[4]	300	Hrs
Monthly Operating Hours (Heating Only)[2]	120	Hrs	Monthly Operating Hours (Heating Only)	0	Hrs
Monthly Usage	13650	KWH	Monthly Usage	28500	KWH
Usage Charge[3]	$ 0.0108	Per KWH	Usage Charge[5]	$ 0.113	Per KWH
Total Usage Cost	$ 1,179		Total Usage Cost	$ 12,882	
Total Electric Cost	$ 5,971		Total Electric Cost	$ 23,275	
Total Annual Electric Cost of New Water Supply Facilities:				**$ 29,246**	

1. Based on average day pumpage and well pump flow rate - One pump at 7.5 hours per day
2. Each heater is estimated to operate for a total of 4 hours per day
3. Weighted average of LIPA usage period charges plus the power supply charge - $0.034KWH + $0.074KWH
4. Based on maximum day pumpage and well pump flow rate - Two pumps at 10 hours per day
5. Weighted average of LIPA usage period charges plus the power supply charge - $0.039/KWH + $0.074/KWH

INC. VILLAGE OF EAST WILLISTON

OPTION 2A (CONT'D)
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH AN AIR STRIPPING WELLHEAD TREATMENT SYSTEM

C. Annual Electric Usage and Demand Costs of New Wellhead Treatment Facilities:

Off Peak Season			Peak Season		
Demand	34	KW	Demand	120	KW
Monthly Demand Charge	$ 5.26	Per KW	Monthly Demand Charge	$ 27.35	Per KW
Season Duration	8	Months	Season Duration	4	Months
Total Demand Cost	$ 1,431		Total Demand Cost	$ 13,128	
Monthly Operating Hours (Blower)[6]	225	Hrs	Monthly Operating Hours (Blowers and one Booster)[7]	300	Hrs
Monthly Operating Hours (Booster)[6]	720	Hrs	Monthly Operating Hours (Booster)[7]	720	Hrs
Monthly Usage	17055	KWH	Monthly Usage	54900	KWH
Usage Charge[3]	$ 0.0108	Per KWH	Usage Charge[5]	$ 0.113	Per KWH
Total Usage Cost	$ 1,474		Total Usage Cost	$ 24,815	
Total Electric Cost	$ 2,904		Total Electric Cost	$ 37,943	
Total Annual Electric Cost of New Wellhead Treatment Facilities				**$ 40,847**	

D. Annual Lab Monitoring Operating Costs of New Water Supply and Wellhead Treatment Facilities:

Monthly Raw and Treated VOC Sample Sets	2
VOC Sample Rate Charge	$ 295
Total VOC Sample Cost	$ 14,160
Annual IOC Samples	2
IOC Sample Rate Charge	$ 375
Annual IOC Sample Cost	$ 750
Quarterly Microbiological Samples - Wells	2
Quarterly Microbiological Samples - Clearwells	2
Microbiological Sample Rate Charge	$ 20
Annual Microbiological Sample Cost	$320
Total Annual Lab Monitoring Operating Cost of New Water Supply and Wellhead Treatment Facilities	**$ 15,230**

3. Weighted average of LIPA usage period charges plus the power supply charge - $0.034/KWH + $0.074/KWH
5. Weighted average of LIPA usage period charges plus the power supply charge - $0.039/KWH + $0.074/KWH
6. Based on average day pumpage and well pump flow rate - One blower at 7.5 hours per day and one booster pump running continuously to provide system pressure
7. Based on maximum day pumpage and well pump flow rate - Two blowers and one booster at 10 hours per day and one booster pump running continuously to provide system pressure

INC. VILLAGE OF EAST WILLISTON

OPTION 2A (CONT'D)
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH AN AIR STRIPPING WELLHEAD TREATMENT SYSTEM

E. Annual Labor Operating Costs of New Water Supply and Wellhead Treatment Facilities:

Required Additional Plant Monitoring Per Day	4	Hrs
Required Additional Man-Hours Per Year	1460	Man-Hours
Unit Cost of Labor	$ 41.50	Per Man-hour
Annual Labor Cost of New Water Supply and Wellhead Treatment Facilities	**$ 60,590**	

F. Annual Costs Associated with 30 Year Life of New Equipment

	Well Pumps	Booster Pumps	Air Stripper Media	Blowers
Rehabilitation Interval	5	5	0	5
Number of Rehabilitations Over 30 Years	3	4	0	4
Cost Per Rehabilitation	$ 10,000	$ 20,000	$ -	$ 1,000
Total Lifetime Rehabilitation Cost	$ 30,000	$ 80,000	$ -	$ 4,000
Replacement Interval - Years	10	15	15	15
Number of Replacements Over 30 Years	3	2	2	2
Cost Per Replacement	$ 130,000	$ 144,000	$ 120,000	$ 2,000
Total Lifetime Replacement Cost	$ 390,000	$ 288,000	$ 240,000	$ 4,000
Costs Associated with 30 Year Life of New Equipment			**$ 1,036,000**	
Annual Costs Associated with 30 Year Life of New Equipment			**$ 34,533**	

G. Sum of Operating Costs for New Water Supply and Wellhead Treatment Facilities:

B. Annual Electric Usage and Demand Costs of New Water Supply Facilities	$ 29,246
C. Annual Electric Usage and Demand Costs of New Wellhead Treatment Facilities	$ 40,847
D. Annual Lab Monitoring Operating Costs of New Water Supply and Wellhead Treatment Facilities	$ 15,230
E. Annual Labor Operating Costs of New Water Supply and Wellhead Treatment Facilities	$ 60,590
F. Annual Costs Associated with 30 Year Life of New Equipment	$ 34,533
Total Operating Costs for New Water Supply and Wellhead Treatment Facilities	**$180,446**
Present Worth Value (30 Years, 5.0% Inflation and 2.6% Investment Interest)	**$2,084,285**

Table 5-21
INC. VILLAGE OF EAST WILLISTON
OPTION 2B
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH AN GAC WELLHEAD TREATMENT SYSTEM

A. Summary of New Water Supply and Wellhead Treatment System Electrical Equipment:

Electric Utility Provider	LIPA
Projected Electrical Rate Code	285 (>145 KW in any two Peak Season Months)
New Water Supply Plant Electrical Equipment Descriptions	2- 75 HP (55KW) 1,400 GPM Well Pumps
	4 - 5 KW Heaters - Off Peak Season Only
	5 KW Miscellaneous Equipment
New Water Supply Plant Electrical Demand Totals	70 KW Off Peak Season (One Well) 95 KW Peak Season
New Wellhead Treatment Electrical Equipment Descriptions	2 - 25 HP (19 KW) 500 GPM Off Peak Season Booster Pumps
	2 - 60 HP (45 KW) 1,400 GPM Peak Season Booster Pumps
New Wellhead Treatment System Electrical Demand	38 KW Off Peak Season 90 KW Peak Season

B. Annual Electric Usage and Demand Costs of New Water Supply Facilities:

Off Peak Season			Peak Season		
Demand	70	KW	Demand	95	KW
Monthly Demand Charge	$ 5.26	Per KW	Monthly Demand Charge	$ 27.35	Per KW
Season Duration	8	Months	Season Duration	4	Months
Total Demand Cost	$ 2,946		Total Demand Cost	$ 10,393	
Monthly Operating Hours (Water Supply and Misc.)[1]	225	Hrs	Monthly Operating Hours (Water Supply and Misc.)[4]	300	Hrs
Monthly Operating Hours (Heating Only)[2]	120	Hrs	Monthly Operating Hours (Heating Only)	0	Hrs
Monthly Usage	13650	KWH	Monthly Usage	28500	KWH
Usage Charge[3]	$ 0.0108	Per KWH	Usage Charge[5]	$ 0.113	Per KWH
Total Usage Cost	$ 1,179		Total Usage Cost	$ 12,882	
Total Electric Cost	$ 5,971		Total Electric Cost	$ 23,275	
Total Annual Electric Cost of New Water Supply Facilities:				**$ 29,246**	

C. Annual Electric Usage and Demand Costs of New Wellhead Treatment Facilities:

1. Based on average day pumpage and well pump flow rate - One pump at 7.5 hours per day
2. Each heater is estimated to operate for a total of 4 hours per day
3. Weighted average of LIPA usage period charges plus the power supply charge - $0.034KWH + $0.074KWH
4. Based on maximum day pumpage and well pump flow rate - Two pumps at 10 hours per day
5. Weighted average of LIPA usage period charges plus the power supply charge - $0.039/KWH + $0.074/KWH

INC. VILLAGE OF EAST WILLISTON

OPTION 2B (CONT'D)
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH AN GAC WELLHEAD TREATMENT SYSTEM

Off Peak Season			Peak Season		
Demand	19	KW	Demand	90	KW
Monthly Demand Charge	$ 5.26	Per KW	Monthly Demand Charge	$ 27.35	Per KW
Season Duration	8	Months	Season Duration	4	Months
Total Demand Cost	$ 800		Total Demand Cost	$ 9,846	
Monthly Operating Hours (Continuous Booster)[6]	720	Hrs	Monthly Operating Hours (Booster)[7]	300	Hrs
			Monthly Operating Hours (Continuous Booster)[7]	720	Hrs
Monthly Usage	13680	KWH	Monthly Usage	45900	KWH
Usage Charge[3]	$ 0.0108	Per KWH	Usage Charge[5]	$ 0.113	Per KWH
Total Usage Cost	$ 1,182		Total Usage Cost	$ 20,747	
Total Electric Cost	$ 1,982		Total Electric Cost	$ 30,593	
Total Annual Electric Cost of New Wellhead Treatment Facilities				**$ 32,574**	

D. Annual Lab Monitoring Operating Costs of New Water Supply and Wellhead Treatment Facilities:

Monthly Raw and Treated VOC Sample Sets	2
VOC Sample Rate Charge	$ 295
Total VOC Sample Cost	$ 14,160
Annual IOC Samples	2
IOC Sample Rate Charge	$ 375
Annual IOC Sample Cost	$ 750
Quarterly Microbiological Samples - Wells	2
Quarterly Microbiological Samples - Clearwells	2
Microbiological Sample Rate Charge	$ 20
Annual Microbiological Sample Cost	$320
Total Annual Lab Monitoring Operating Cost of New Water Supply and Wellhead Treatment Facilities	**$ 15,230**

3. Weighted average of LIPA usage period charges plus the power supply charge - $0.034/KWH + $0.074/KWH
5. Weighted average of LIPA usage period charges plus the power supply charge - $0.039/KWH + $0.074/KWH
6. Based on one booster pump running continuously to provide system pressure
7. Based on maximum day pumpage and well pump flow rate – One booster at 10 hours per day and one booster pump running continuously to provide system pressure

INC. VILLAGE OF EAST WILLISTON

OPTION 2B (CONT'D)
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH AN GAC WELLHEAD TREATMENT SYSTEM

E. Annual Labor Operating Costs of New Water Supply and Wellhead Treatment Facilities:

Required Additional Plant Monitoring Per Day	4	Hrs
Required Additional Man-Hours Per Year	1460	Man-Hours
Unit Cost of Labor	$ 41.50	Per Man-hour
Annual Labor Cost of New Water Supply and Wellhead Treatment Facilities	**$ 60,590**	

F. Annual Costs Associated with 30 Year Life of New Equipment

	Well Pumps	Booster Pumps	GAC Media	
Rehabilitation Interval	5	5	0	
Number of Rehabilitations Over 30 Years	3	4	0	
Cost Per Rehabilitation	$ 10,000	$ 20,000	$ -	
Total Lifetime Rehabilitation Cost	$ 30,000	$ 80,000	$ -	
Replacement Interval - Years	10	15	15	
Number of Replacements Over 30 Years	3	2	2	
Cost Per Replacement	$ 130,000	$ 144,000	$ 144,000	
Total Lifetime Replacement Cost	$ 390,000	$ 288,000	$ 288,000	
Costs Associated with 30 Year Life of New Equipment			**$ 1,080,000**	
Annual Costs Associated with 30 Year Life of New Equipment			**$ 34,133**	

G. Sum of Operating Costs for New Water Supply and Wellhead Treatment Facilities:

B. Annual Electric Usage and Demand Costs of New Water Supply Facilities	$ 29,246
C. Annual Electric Usage and Demand Costs of New Wellhead Treatment Facilities	$ 32,574
D. Annual Lab Monitoring Operating Costs of New Water Supply and Wellhead Treatment Facilities	$ 15,230
E. Annual Labor Operating Costs of New Water Supply and Wellhead Treatment Facilities	$ 60,590
F. Annual Costs Associated with 30 Year Life of New Equipment	$ 34,133
Total Operating Costs for New Water Supply and Wellhead Treatment Facilities	**$171,773**
Present Worth Value (30 Years, 5.0% Inflation and 2.6% Investment Interest)	**$2,003,208**

INC. VILLAGE OF EAST WILLISTON

OPTION 2B (CONT'D)
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH AN GAC WELLHEAD TREATMENT SYSTEM

Notes:

- The above estimate is based on projected average annual demand

- For minimum projected demand off peak well hours will decrease to 195 hours per month and peak well and single booster pump hours will decrease to 260 hours per month decreasing annual estimated operating costs by $8,300.

- For maximum projected demand off peak well hours will increase to 290 hours per month and peak well and single booster pump hours will increase to 390 hours per month increasing annual estimated operating costs by $19,300.

Table 5-22
INC. VILLAGE OF EAST WILLISTON
OPTION 3
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH GAC WELLHEAD TREATMENT SYSTEM

A. Summary of New Water Supply and Wellhead Treatment System Electrical Equipment:

Electric Utility Provider	LIPA
Projected Electrical Rate Code	285 (>145 KW in any two Peak Season Months)
New Water Supply Plant Electrical Equipment Descriptions	2- 100 HP (75KW) 1,100 GPM Well Pump At 50% Flow – Each Pump Requires 55KW
	4 - 5 KW Heaters - Off Peak Season Only
	5 KW Miscellaneuos Equipment
New Water Supply Plant Electrical Demand Totals	100 KW Off Peak Season (One Well) 155 KW Peak Season

B. Annual Electric Usage and Demand Costs of New Water Supply Facilities:

Off Peak Season			Peak Season		
Demand	100	KW	Demand	155	KW
Monthly Demand Charge	$ 5.26	Per KW	Monthly Demand Charge	$ 27.35	Per KW
Season Duration	8	Months	Season Duration	4	Months
Total Demand Cost	$ 4,208		Total Demand Cost	$ 16,957	
Monthly Operating Hours (Water Supply and Misc.)[1]	380	Hrs	Monthly Operating Hours (Water Supply and Misc.)[5]	600	Hrs
Monthly Operating Hours (Heating Only)[2]	120	Hrs	Monthly Operating Hours (Heating Only)	0	Hrs
Monthly Usage[3]	25200	KWH	Monthly Usage[3]	36000	KWH
Usage Charge[4]	$ 0.0108	Per KWH	Usage Charge[6]	$ 0.113	Per KWH
Total Usage Cost	$ 2,177		Total Usage Cost	$ 16,272	
Total Electric Cost	$ 6,385		Total Electric Cost	$ 33,229	
Total Annual Electric Cost of New Water Supply Facilities:				$ 39,614	

1. Based percentage of total pumpage for the season (56% of 179 MG) and 50% flow rate of one well pump.
2. Each heater is estimated to operate for a total of 4 hours per day
3. Based on typical pump curve of 1100 gpm pump @ 277 TDH, at 50% flow 55KW is required.
4. Weighted average of LIPA usage period charges plus the power supply charge - $0.034KWH + $0.074KWH
5. Based percentage of total pumpage for the season (44% of 179 MG) and 50% flow rate of one well pump.
6. Weighted average of LIPA usage period charges plus the power supply charge - $0.039/KWH + $0.074/KWH

INC. VILLAGE OF EAST WILLISTON

OPTION 3 (CONT'D)
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH GAC WELLHEAD TREATMENT SYSTEM

C. Annual Lab Monitoring Operating Costs of New Water Supply and Wellhead Treatment Facilities:

Monthly Raw and Treated VOC Sample Sets	2
VOC Sample Rate Charge	$ 295
Total VOC Sample Cost	$ 14,160
Annual IOC Samples	2
IOC Sample Rate Charge	$ 375
Annual IOC Sample Cost	$ 750
Quarterly Microbiological Samples - Wells	2
Microbiological Sample Rate Charge	$ 20
Annual Microbiological Sample Cost	$160
Total Annual Lab Monitoring Operating Cost of New Water Supply and Wellhead Treatment Facilities	**$ 15,070**

D. Annual Labor Operating Costs of New Water Supply and Wellhead Treatment Facilities:

Required Additional Plant Monitoring Per Day	4	Hrs
Required Additional Man-Hours Per Year	1460	Man-Hours
Unit Cost of Labor	$ 41.50	Per Man-hour
Annual Labor Cost of New Water Supply and Wellhead Treatment Facilities	**$ 60,590**	

E. Annual Costs Associated with 30 Year Life of New Equipment

	Well Pumps	GAC Media	Hydropneumatic Storage Tanks
Rehabilitation Interval	5	0	-
Number of Rehabilitations Over 30 Years	3	0	-
Cost Per Rehabilitation	$ 10,000	$ -	$ -
Total Lifetime Rehabilitation Cost	$ 30,000	$ -	$ -
Replacement Interval - Years	10	15	30
Number of Replacements Over 30 Years	3	2	4
Cost Per Replacement	$ 130,000	$ 144,000	$ 80,000
Total Lifetime Replacement Cost	$ 390,000	$ 288,000	$ 320,000
Costs Associated with 30 Year Life of New Equipment			$ 998,030
Annual Costs Associated with 30 Year Life of New Equipment			**$ 33,268**

INC. VILLAGE OF EAST WILLISTON

OPTION 3 (CONT'D)
ANNUAL OPERATING COSTS OF NEW WATER SUPPLY FACILITIES
WITH GAC WELLHEAD TREATMENT SYSTEM

F. Sum of Operating Costs for New Water Supply and Wellhead Treatment Facilities:

B. Annual Electric Usage and Demand Costs of New Water Supply Facilities	$ 39,614
C. Annual Lab Monitoring Operating Costs of New Water Supply and Wellhead Treatment Facilities	$ 15,070
D. Annual Labor Operating Costs of New Water Supply and Wellhead Treatment Facilities	$ 60,590
E. Annual Costs Associated with 30 Year Life of New Equipment	$ 33,268
Total Operating Costs for New Water Supply and Wellhead Treatment Facilities	**$148,542**
Present Worth Value (30 Years, 5.0% Inflation and 2.6% Investment Interest)	**$1,715,770**

Table 5-23
Inc. Village of East Williston
Cost Comparison of Water System Options

Option:	1	2A	2B	3A	3B	3C
Number of Wells:	Two	Two	Two	Two	Two	Two
Storage:	Elevated Tank	Ground Tank	Ground Tank	Hydropneumatic Tanks	Hydropneumatic Tanks	Hydropneumatic Tanks
Treatment:	GAC	Air Stripping	GAC	GAC	GAC	GAC
Building:	Masonry	Masonry	Pre-fab Steel	Masonry	Pre-fab Steel	Pre-fab Steel
Tennis Courts:	Reconstructed	Reconstructed	Reconstructed	Reconstructed	Reconstructed	No modification
Capital	$8,823,660	$7,015,500	$6,955,990	$6,490,150	$5,858,020	$5,573,020
Suplement to Storage	$0	$0	$0	$180,000	$180,000	$180,000
Total Capital:	**$8,823,660**	**$7,015,500**	**$6,955,990**	**$6,670,150**	**$6,038,020**	**$5,753,020**
Debt Service 1st Year - 20 YR Bond [4]:	**$617,656**	**$491,085**	**$486,919**	**$454,311**	**$410,061**	**$390,111**
Debt Service 1st Year - 30 YR Bond [4]:	**$500,007**	**$397,545**	**$394,173**	**$367,775**	**$331,954**	**$315,804**
Annual Operating [5]	$183,606	$180,446	$171,773	$148,522	$148,542	$148,542
Treatment Chemicals	$15,300	$15,300	$15,300	$15,300	$15,300	$15,300
Total Annual Operating:	**$198,906**	**$195,746**	**$187,073**	**$163,822**	**$163,842**	**$163,842**
Total First Year Costs - 20 YR Bond [6]:	**$816,562**	**$686,831**	**$673,992**	**$618,133**	**$573,903**	**$553,953**
Total First Year Costs - 30 YR Bond [7]:	**$698,913**	**$593,291**	**$581,246**	**$531,597**	**$495,796**	**$479,646**

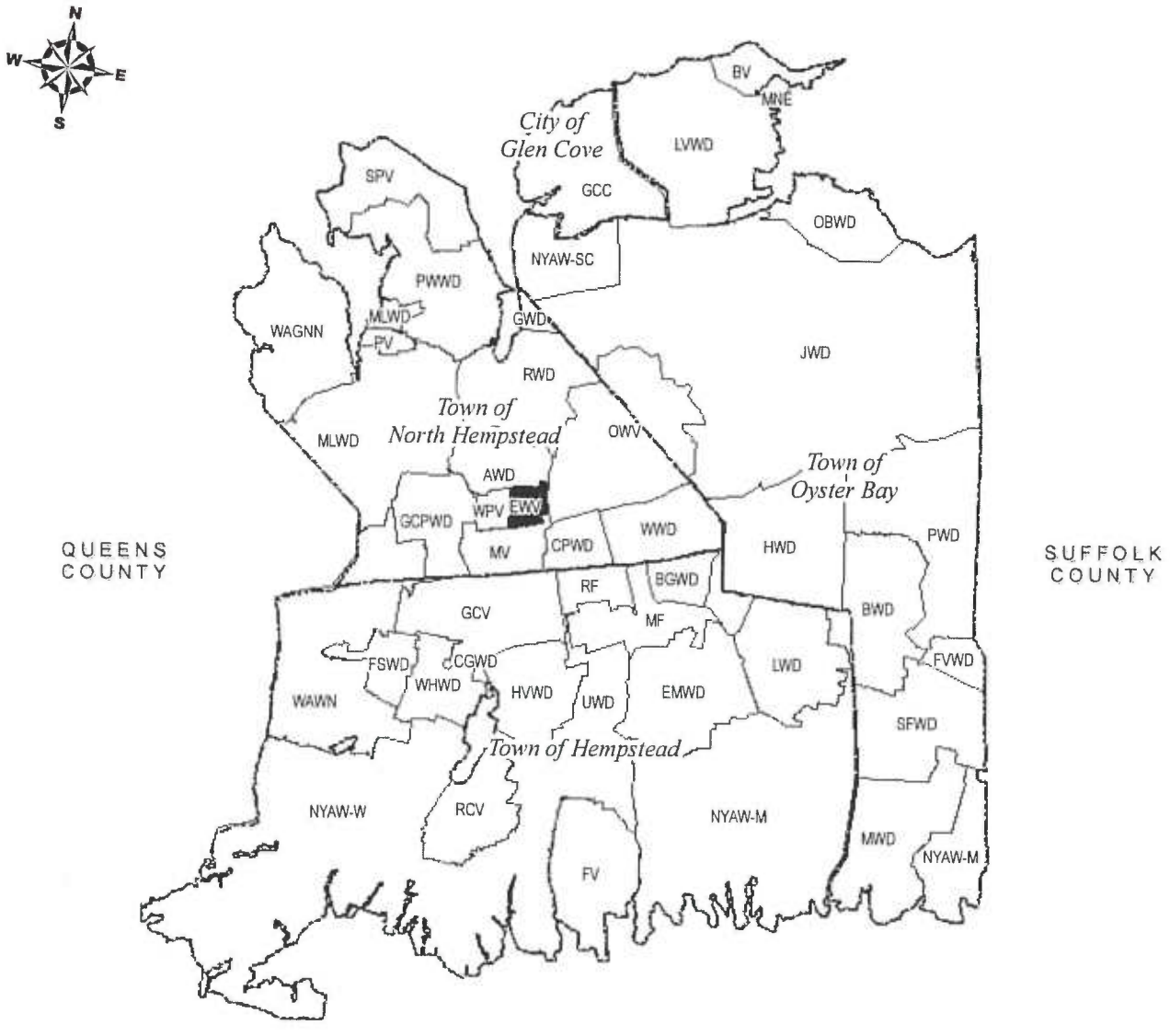
Notes:
(1) - 250,000 gallon elevated storage tank
(2) - 100,000 gallon ground storage tank / clearwell
(3) - four hydropneumatic tanks with total effective volume of 66,700 gallons
(4) - Based on 3% interest rate.
(5) - Includes lab analysis and labor
(6) - First year debt service (based on 20 years) and operating costs
(7) - First year debt service (based on 30 years) and operating costs

Table 5-23a
Inc. Village of East Williston
Cost Comparison of Water System Options

Option:	2B	2B	2B
Annual Demand:	**Average**	**Peak**	**Minimum**
Number of Wells:	Two	Two	Two
Storage:	Ground Tank	Ground Tank	Ground Tank
Treatment:	GAC	GAC	GAC
Building:	Pre-fab Steel	Pre-fab Steel	Pre-fab Steel
Tennis Courts:	Reconstructed	Reconstructed	Reconstructed
Volume water billed (MG):	124.2	161.1	111.6
Total Capital Cost:	$6,955,990	$6,955,990	$6,955,990
Debt Service 1st Year - 30 YR Bond [1]:	**$394,173**	**$394,173**	**$394,173**
Annual Operating [2]	$171,773	$191,000	$163,500
Treatment Chemicals	$15,300	$15,300	$15,300
Total Annual Operating:	**$187,073**	**$206,300**	**$178,800**
Total First Year Costs - 30 YR Bond [3]:	**$581,246**	**$600,473**	**$572,973**
Cost per thousand billed:	$4.68	$3.73	$5.13

Notes:
(1) - Based on 3% interest rate.
(2) - Includes lab analysis and labor
(3) - First year debt service (based on 30 years) and operating costs
- Projections based on 2004 to 2014 water usage that factors in 10% unaccounted for water.
- Unaccounted for water is water that is not billed that is attributed to hydrant use and leaks.
MG - Million Gallons

List of Figures



*Barrier island water systems not shown

KEY TO NASSAU COUNTY PUBLIC WATER SUPPLIERS

AWD	ALBERTSON W.D.	GCPWD	GARDEN CITY PARK W.D.	MLWD	MANHASSET-LAKEVILLE W.D.	RCV	ROCKVILLE CENTRE (V)
BGWD	BOWLING GREEN W.D.	GCV	GARDEN CITY (V)	MNE	MILL NECK ESTATES	RF	ROOSEVELT FIELD
BV	BAYVILLE (V)	GWD	GLENWOOD W.D.	MV	MINEOLA (V)	RWD	ROSLYN W.D.
BWD	BETHPAGE W.D.	HVWD	HEMPSTEAD (V)	MWD	MASSAPEQUA W.D.	SFWD	SOUTH FARMINGDALE W.D.
CGWD	CATHEDRAL GARDENS W.D.	HWD	HICKSVILLE W.D.	NYAW-M	NY AMERICAN WATER (EAST) - MERRICK	SPV	SANDS POINT (V)
CPWD	CARLE PLACE W.D.	JB*	JONES BEACH W.S.	NYAW-SC	NY AMERICAN WATER (EAST) - SEA CLIFF	UWD	UNIONDALE W.D.
EMWD	EAST MEADOW W.D.	JWD	JERICHO W.D.	NYAW-W*	NY AMERICAN WATER - WEST	WAGNN	W.A. OF GREAT NECK NORTH
EWV	EAST WILLISTON (V)	LBC*	CITY OF LONG BEACH	OBWD	OYSTER BAY W.D.	WAWN	W.A. OF WESTERN NASSAU
FSWD	FRANKLIN SQUARE W.D.	LPLWD*	LIDO POINT LOOKOUT W.D.	OWV	OLD WESTBURY (V)	WHWD	WEST HEMPSTEAD W.D.
FV	FREEPORT (V)	LVWD	LOCUST VALLEY W.D.	PV	PLANDOME (V)	WPV	WILLISTON PARK (V)
FVWD	FARMINGDALE (V)	LWD	LEVITTOWN W.D.	PWD	PLAINVIEW W.D.	WWD	WESTBURY W.D.
GCC	CITY OF GLEN COVE	MF	MITCHEL FIELD	PWWD	PORT WASHINGTON W.D.		

Figure No. 2-1

INC. VILLAGE OF EAST WILLISTON
LOCATION MAP

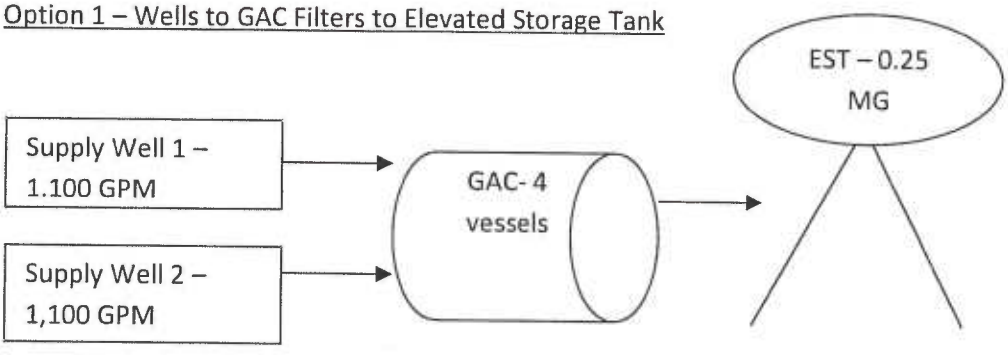
SCALE: 1" = 20,000'±

H2M architects + engineers
575 Broad Hollow Road
Melville, NY 11747

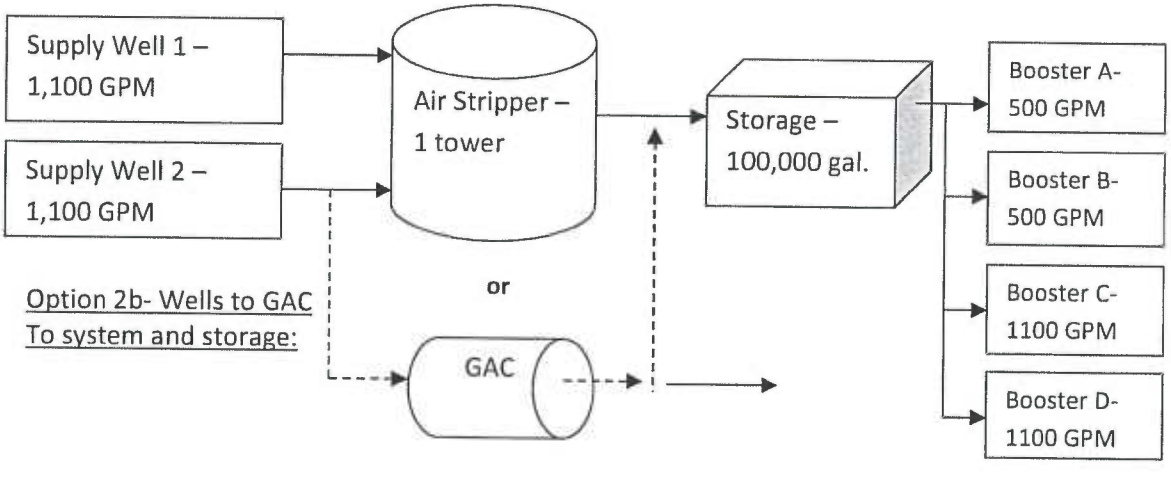
M:\gis\EWTV\1201\NC WD Map.mxd

Inc. Village of East Williston
Figure 4-1
Operating Schematic for Options 1, 2A and 2B

Option 1 – Wells to GAC Filters to Elevated Storage Tank



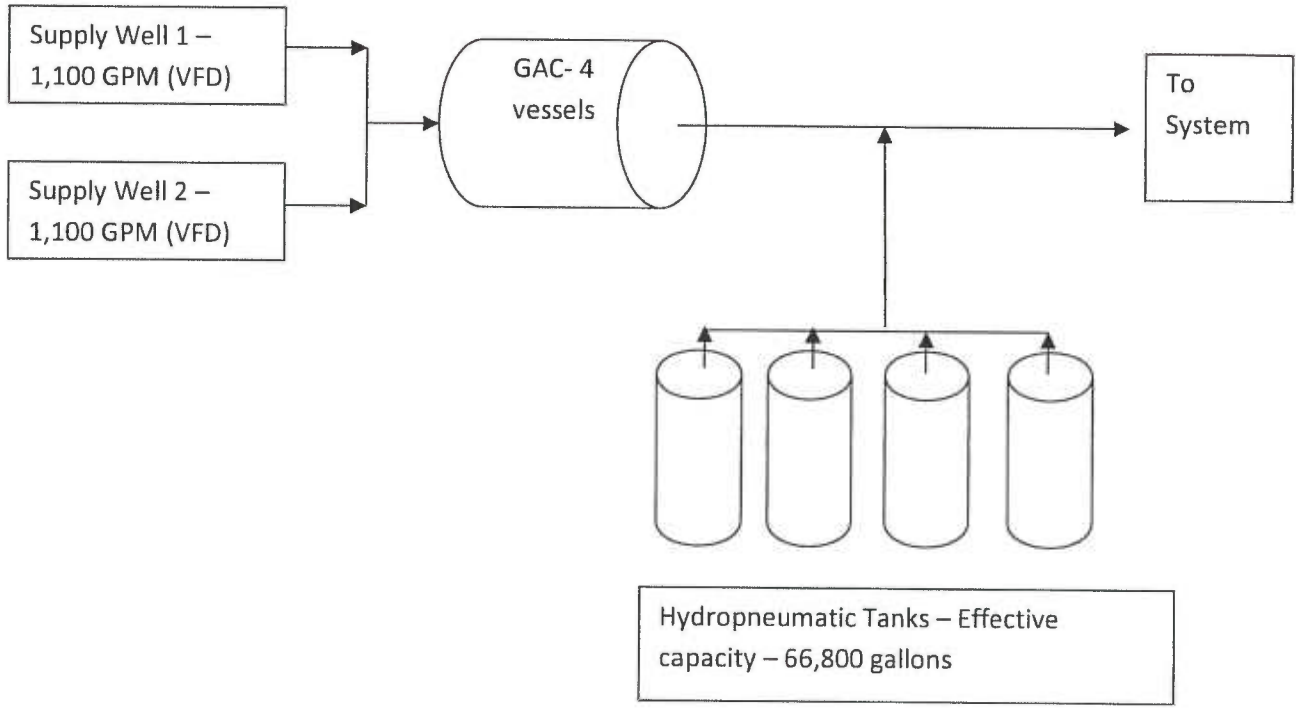
Option 2a – Wells to Air Stripping Tower to Clearwell



Inc. Village of East Williston
Figure 4-2

Operating Schematic for Option 3

Option 3 – Well to GAC to Hydropeumatic tanks



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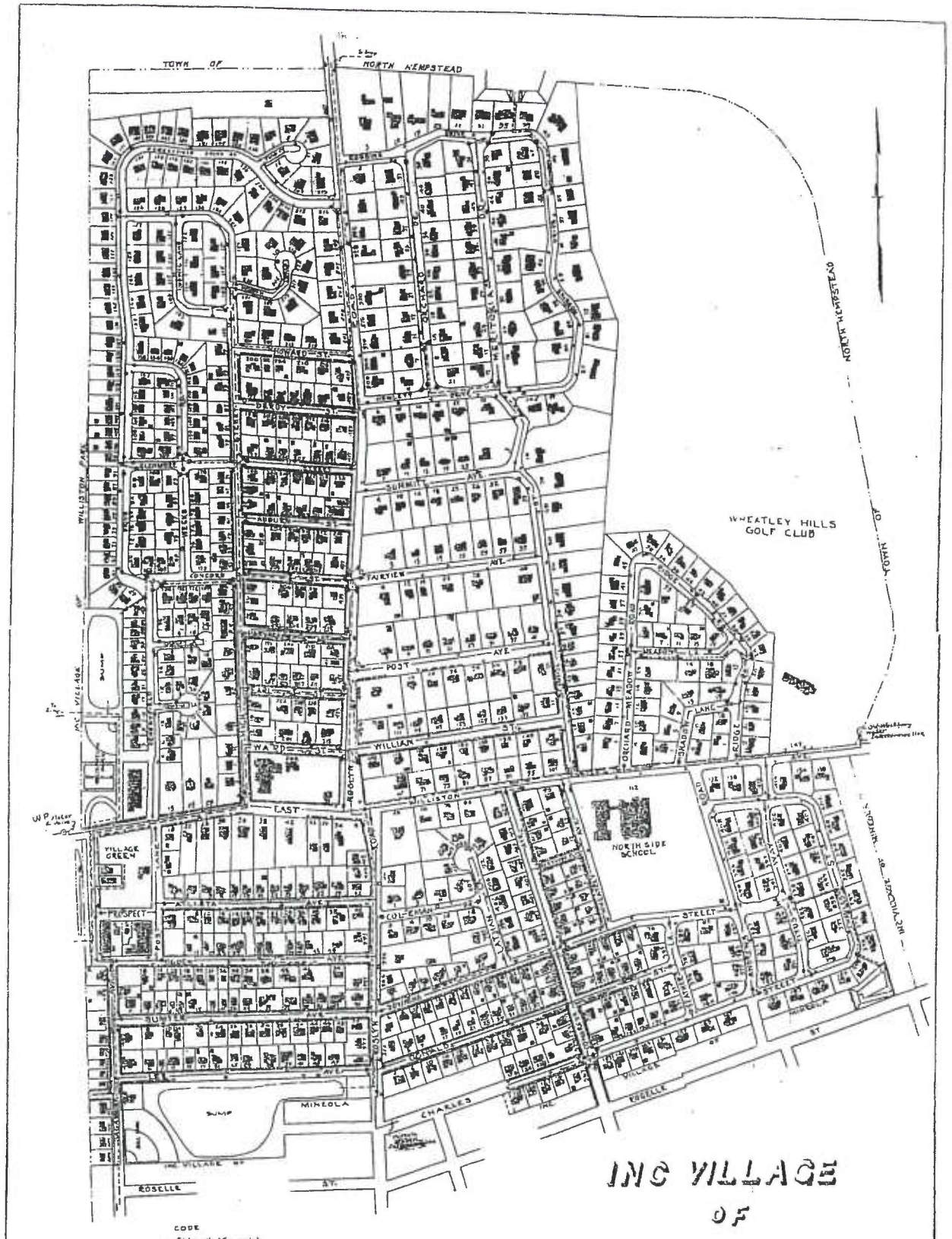
Appendix A

Existing Map of Village
Distribution System , Interconnections
and Proposed Water Plant



INC VILLAGE OF EAST WILLISTON

Appendix B

Preliminary Site Plan of
Proposed Well / Water Plant Site

SITE PLAN

NOTE:
LOCATIONS OF UNDERGROUND UTILITIES ARE APPROXIMATE

H2M architects + engineers

MARK	DATE	DESCRIPTION

EWTV1201

MARCH 2013

Inc. Village of East Williston

Water Supply Study

Exhibit B

Preliminary Site Plan of Proposed Wells & Water Plant

NOT FOR CONSTRUCTION