TASK III:
SEWER AND WATER COMPREHENSIVE PLAN

PREPARED FOR:

VILLAGE OF MILLBROOK, NY

PREPARED BY:

R. S. LYNCH & COMPANY
RSL

WITH ASSISTANCE FROM:

VRI
Environmental Services, Inc.

Clark Patterson Lee
DESIGN PROFESSIONALS

This document was prepared with funds provided by the New York State Department of State under the Local Government Efficiency Grant Program.

June 9, 2011

Table of Contents

Introduction

This proposed Comprehensive Sewer and Water Plan was prepared for the Village of Millbrook, NY (Village) and the Town of Washington, NY (Town) by R.S. Lynch & Company, Inc. with assistance from VRI Environmental Services Inc. and Clark Patterson Lee. It can serve as an Appendix to both the Village and the Town Comprehensive Municipal Plans currently being drafted.

As Project Manager, R.S. Lynch & Company, Inc. (R.S. Lynch) sought input from the Village Board of Trustees, the Village Water Committee and individual members of Village government throughout the drafting of this Comprehensive Sewer and Water Plan (Plan) regarding the goals and desired direction for future Village sewer and water initiatives.

The Village is in the enviable position of having its own sewer and water infrastructure and thus not being reliant on the provision of sewer and water services from other public or private entities. Given that portions of the Village's sewer and water infrastructure date from as early as 1932 and still provide services to Village and Town residents, it is reasonable to surmise that the current system has been reasonably well-maintained and offers substantial capabilities in its current form to meet the needs of most of the residents and businesses of the Village as well as some users located within the Town.

The Village's overall objective is to continue to operate and maintain the sewer and water system in an environmentally responsible and cost-effective manner for the long-term provision of sewer and water services. The Village understands that potential system improvements and expansions must be undertaken only upon full research and analysis and an understanding of the costs and benefits any expansions or improvements will incur and/or achieve, how these costs and benefits will be distributed among taxpayers and system users and how any improvements or expansions will be financed and maintained on a long-term basis. All of these items have been addressed in this Plan.

Another key objective is to continue to work cooperatively with the town of Washington. Specifically, it is important that specific and formal agreements be developed that address programs and policies which the Town may adopt to protect the area surrounding the Village's current water source in the Hamlet of Mabbettsville.

This Plan describes the approach which the Village used to analyze and meet the demand for water within the Village with an aging infrastructure and also addresses the needs of non-Village users such as residents of the Town and certain other Dutchess County users. In addition to evaluating future demands for system users, the Plan also addresses asset management, source water protection, conservation and development of new sources or enhancement of existing ones.

Background

The Village of Millbrook is located in eastern Dutchess County, NY. As of the 2000 Census, the Village had a population of 1,429 residents and consists of 1.9 square miles. The population density of the Village is 764.3 persons/square mile.

The Village has been fortunate to be self-sufficient and have the ability to provide the majority of its businesses and residents with sewer and water services. Village residents which are not served by the Village sewer or water infrastructure provide their own with personal wells and septic systems. Additionally, the Village's sewer and water infrastructure also provides services to some Town residents as well as the former Dutchess County infirmary. As of the summer of 2010, there were a total of 696 different hookups to the Village water system. Of the 696 hookups, 80 were from the Town. Additionally, there were a total of 607 different hookups to the Village sewer system. Of the 607 different hookups to the Village sewer system, 33 were from the Town.

VILLAGE WATER SYSTEM

The Village currently sources its water from a developed infiltration system within an aquifer located south of Route 44 between the Village of Millbrook and the Hamlet of Mabbettsville. The aquifer is traversed by the Shaw Brook and the Mill Brook streams. The Shaw Brook stream runs south and west into the Mill Brook stream and the Mill Brook stream travels north and west

into Dietrich Pond. The Shaw Brook watershed is approximately 6,600 acres while the Mill Brook watershed is approximately 2,800 acres.

The infiltration system, a shallow horizontal groundwater collection system, consists of seven rectangular shaped concrete bunkers. Two of these bunkers were part of the original system construction and have been in service since 1932. An additional bunker was added to the system in 1939. Four more bunkers were added to the system in 1990. The bunkers are positioned in a radial pattern extending approximately 150 feet and feed into the main gallery and pump house. The bunkers range in depth (6, 7.5, 10 and 12 feet below the ground surface) and contain outlet pipes at their bottoms which lead to the main gallery. Gravity directs the water flows from the bunker outlet pumps to the main gallery.

Two vertical turbine pumps with a combined rated capacity of 250 Gallons per Minute (GPM) located at the infiltration gallery service the Village water system. The water is treated with an on-demand injection system which only treats the water when it is charging. The water is injected with sodium hydroxide for PH adjustment, zinc orthophosphate for corrosion control and sodium hypochlorite for disinfection.

A 10-inch diameter main distribution line directs the treated water from the pump house to the Village storage tank located on Haight Avenue. The location of the 90 foot tall cylindrical storage tank has an elevation of 762 feet. The tank has a capacity of 500,000 gallon. Secondary and tertiary distribution lines traverse the road system throughout the Village and are sized anywhere from 8- to 2-inches in diameter. The lines are all cast iron and were installed in 1933.

The storage tank located on Haight Avenue has a telemetric metering device which automatically signals the water pumps to turn on whenever the tank water level is eight feet below the maximum water level height of the tank. The tank is regularly maintained by VRI. VRI inspects the tank every 5 years to look for sedimentation, ensure that the cathodic protection is in place and check for rust and corrosion. The last time the water tank was painted was in 1990. VRI externally inspects the water tank on a continuous basis and has recommended to the Village that it should be replaced in 2013-2014.

There is also a 75,000 gallon storage tank located off of Church Street on the Millbrook Golf Course. This storage tank was previously leased by the Bennett Complex. However, upon closure of the Bennett Complex, all water lines feeding into it have been shut off. This tank would need to be further evaluated to see how much it would cost to put it back on-line since it has not been in use since the late 1970's.

The Village water system has a permitted water supply of 374,400 Gallons Per Day (GPD). The average daily usage of the Village water system is 186,000 GPD. The peak daily usage is approximately 287,500 GPD.

VILLAGE WASTEWATER SYSTEM

The Village has a wastewater treatment facility located off of North Avenue on the western boundary of the Village. The Village contracts VRI, a private operator, to service the facility. VRI continuously performs preventative maintenance to ensure the longevity of the equipment and building such as painting and repairs to the building roof.

All sewage that is treated at the facility flows by gravity to the influent structure through a screen to remove large pieces of material and then a grit channel to remove smaller solids such as sand. Once the wastewater has been screened it flows through a Parshall Flume where a monitoring device is located which monitors all water treated at the facility.

During times of normal flow levels water then travels from the Parshall Flume to a flow splitter which evenly divides the water into two extended aeration treatment units. The mixed liquid is aerated for a 24 hour period before it is clarified through sedimentation. During periods of high flow (generally wet weather events, or historically high flow time such as spring and fall) the operators will close the valve to the splitter box and pump flow to the Overflow Retention Basin. This is a 400,000 gallon above ground storage tank that allows the operators to equalize the flow to the treatment plant. It also functions as a primary settling basin removing organic loads to the aerations basins if necessary.

The resultant sludge is removed from the bottom of the clarifiers and placed in an aerated sludge holder with an odor distract unit and eventually poured into sludge drying beds on-site. The sludge is then dried and raked and sent to a landfill in Pennsylvania in approximately 80% solid form.

The mechanically clarified water then flows from the aeration treatment units into two dosing tanks in an intermittent filter system. The dosing tanks subsequently discharge the aerated water into two of the four 5,000 square foot sand filter beds which are owned by the Village and operated by VRI. Once the water has filtered through the sand beds, it flows via gravity into a chlorine contact tank to be disinfected. The disinfected water is detained for approximately four hours in three baffles with weirs before it is released into the east branch of Wappinger's Creek. Wappinger's Creek is classified as a class "C" water body according to the New York State Department of Environmental Conservation ("NYSDEC"), which means that it cannot be used for bathing, drinking or food processing. The creek's classification is not based on any factors derived from effluent from the wastewater treatment process, but has been determined based on the historical and best use for the stream.

The Village wastewater system has a permitted discharge, calculated on a 30 day average, of 250,000 GPD and an actual daily discharge of approximately 196,000 GPD. Although the average daily discharge is actually less than the permitted discharge, over the last several years, the Village wastewater system has experienced months where the recorded daily discharge has surpassed the permitted discharge. According to system operators and engineers, the permitted discharge levels have been exceeded in months where the Village had experienced heavy

rainfall. Inflow & Infiltration ("I&I") issues alone have been so problematic that they have caused the Village of Millbrook to pass a Resolution on August 21, 2007 that restricts any additional non-Village residents from connecting or "hooking-in" to the Village sewer and water systems. Consequently, the Village has conducted Inflow & Infiltration analysis to identify problems with the aging infrastructure.

VRI conducted the I&I analysis using flow meters and data logging devices accompanied by visual inspections of the flows. Additionally, smoke testing was also conducted. The analysis indicated that I&I occurring within the Village's sewer collection system was having significant impacts on the flow to the Village wastewater treatment facility. The Village engaged a firm to perform video inspection of the identified problem areas determined via flow measurements and smoke testing performed by VRI. The video inspection revealed several breaks and cracks in the pipes, misaligned and unsealed joints, holes, sagging pipes, protruding roots, buried manholes and debris.

SHARING OF VILLAGE WATER & WASTEWATER SYSTEMS

For years the Village of Millbrook and the Town of Washington have recognized the need to address regional water and sewer needs on a shared basis. It has been speculated for many years that sharing such services could lead to substantial cost savings. Furthermore, the County, independently of the Village and Town, is developing plans for renovations and expansions at the former County infirmary site located in the Town of Washington. This facility is expected to assume the continued use of the Village's sewer and water system. The most pressing issue has been determined to be the recurrent sewer system capacity issues due to severe I&I problems. I&I problems and the associated reduced capacity of the sewer system is now prohibiting the further sharing of the system among the Village, Town and County.

Thus, while some future savings have been analyzed and presented herein from the shared use of a single sewer and water system among the Village, Town and the former County infirmary site, implementation of such future sharing is currently stalled until remediation of the I&I problems. One of the purposes of this Plan is to address the appropriate type and level of growth in these communities.

Acknowledging the need to remediate the I&I issues with the aging infrastructure and address the potential benefits of a regional sewer and water system, the Village applied for a Shared Municipal Services Incentive Program grant offered by the New York State Department of State.

In July of 2009, it was announced that the Village of Millbrook was awarded a $600,000 grant to remediate the I&I issues, continue implementation and improvements to sewer and water infrastructure, provide professional assistance to coordinate sections of Comprehensive plan updates, analyze the existing water and sewer consumption charge structure and implement a water and sewer infrastructure inventory.

Rate Structure Survey

The Village bills users of the systems based on the amount of water they consume using uniform volumetric consumption charges. Additionally, the Village also funds capital expenditures incurred by the Village sewer system with a Sewer Capital Assessment. These are just a two examples of the numerous ways in which a municipality can fund the capital and operating costs of a sewer or water system.

An analysis of the Village's sewer and water system consumption charges and Sewer Capital Assessment was recently completed comparing the Village's rate structure and consumption charge to other municipalities located within Dutchess County. The purpose of the report was to compare the current Village sewer and water rate structure to other municipally owned sewer and water systems located in Dutchess County, NY and identify the advantages and disadvantages of the various options. In order to obtain this information we conducted a phone survey and requested information from every municipality located in Dutchess County which owns a sewer or water system. We also obtained information from the Dutchess County Water and Wastewater Authority (DCWWA) regarding the rate structures of 9 water and 3 sewer districts which they operate in Dutchess County.

As demonstrated on Page 11, Village of Millbrook water system customers located within the Village pay less than the average municipal water system user in Dutchess County. However, users located outside the Village pay more than the average municipal water system user in Dutchess County since their rate is twice that of Village residents. The fact that residents located within the Village pay less than the municipal average is impressive considering the fact that the Village funds all system capital expenditures with consumption charges and none with taxes which typically would result in higher system consumption charges.

The following Table identifies the consumption charge structures used by each of the 48 different water systems surveyed. For purposes of this analysis, we have assumed a different water system if a municipality charges a different rate to users outside of their jurisdiction, such as the Village of Millbrook does.

Type of Consumption Charge	Number of Systems	Percent
Flat	4	8%
Uniform Volumetric	20	42%
Decreasing Block	14	29%
Increasing Block	8	17%
Decreasing Block, Then Increasing	2	4%
TOTAL:	**48**	**100%**

As demonstrated above, 42% of the identified water systems use a uniform volumetric consumption charge structure, including the Village of Millbrook. Only 8% of the identified

water systems use a flat rate consumption charge. This type of consumption charge is primarily used in municipalities which do not offer water meters to their users. The remaining 50% of the water systems use some form of block rate consumption charge, with the majority using a decreasing block rate consumption charge. Municipalities that utilize a decreasing block rate consumption charge typically do so to offer economies of scale to system users which are typically commercial entities or large housing complexes.

As demonstrated on Page 12, Village of Millbrook sewer system customers pay slightly higher consumption charge than the average municipal sewer system user in Dutchess County. It is important to note that capital improvements made to the Village's sewer system are funded through a Sewer Capital Assessment and many of the municipal systems in Dutchess County which make up the average fund capital improvements through consumption charges. Typically, if a municipality funds capital expenditures through consumption charges, it will have higher consumption charge than one that does not. If the Village's Sewer Capital Assessment was included and compared to municipalities which pay capital expenses through consumption charges, the Village consumption charge would appear higher.

The following Table identifies the consumption charge structures used by each of the 32 different sewer systems surveyed. For purposes of this analysis, we have assumed a different sewer system if a municipality charges a different amount to users outside of their jurisdiction.

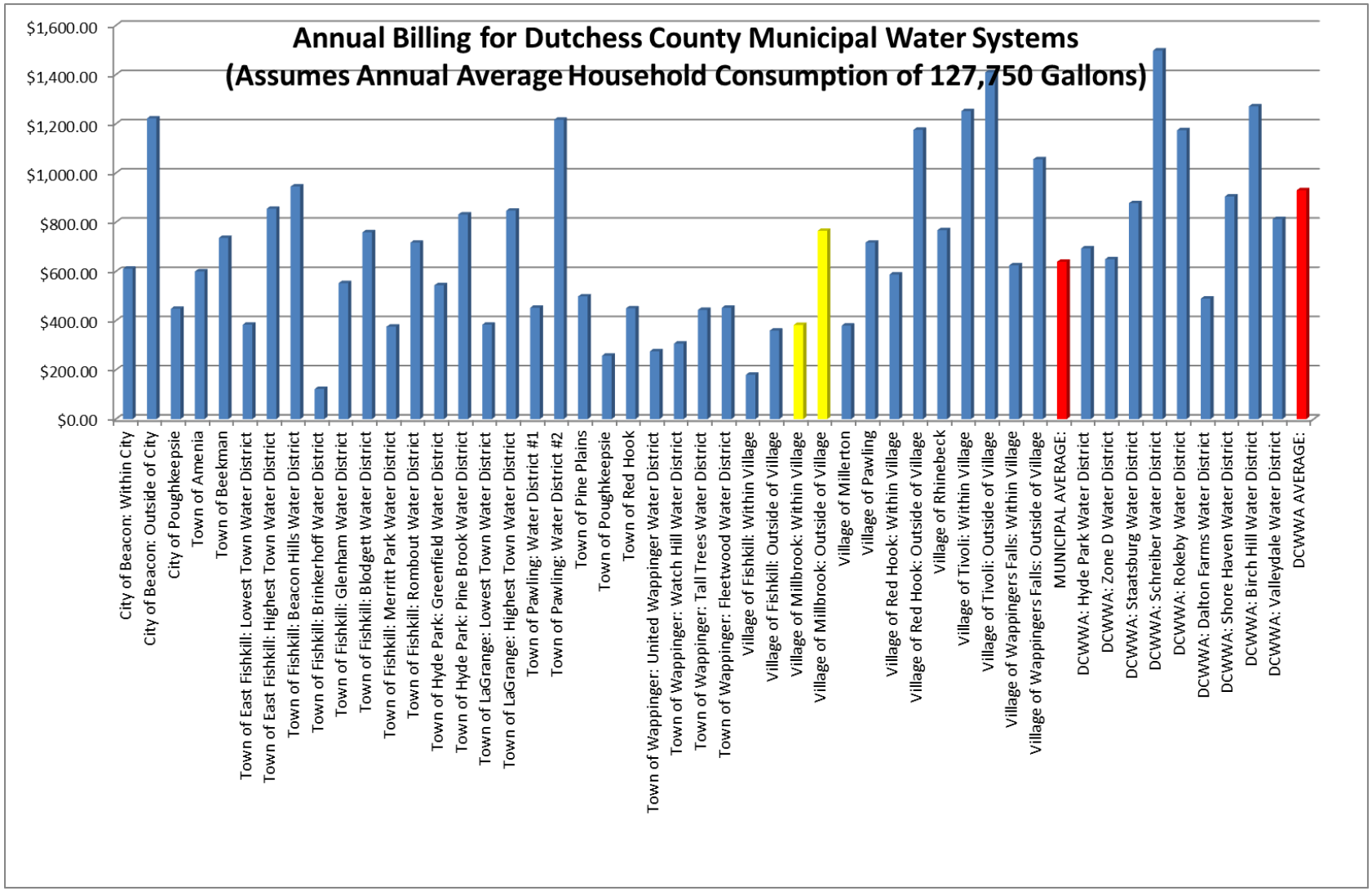
Type of Consumption Charge	Number of Systems	Percent
Flat	11	34%
Uniform Volumetric	12	38%
Decreasing Block	5	16%
Increasing Block	3	9%
Percentage of Water Bill	1	3%
TOTAL:	**32**	**100%**

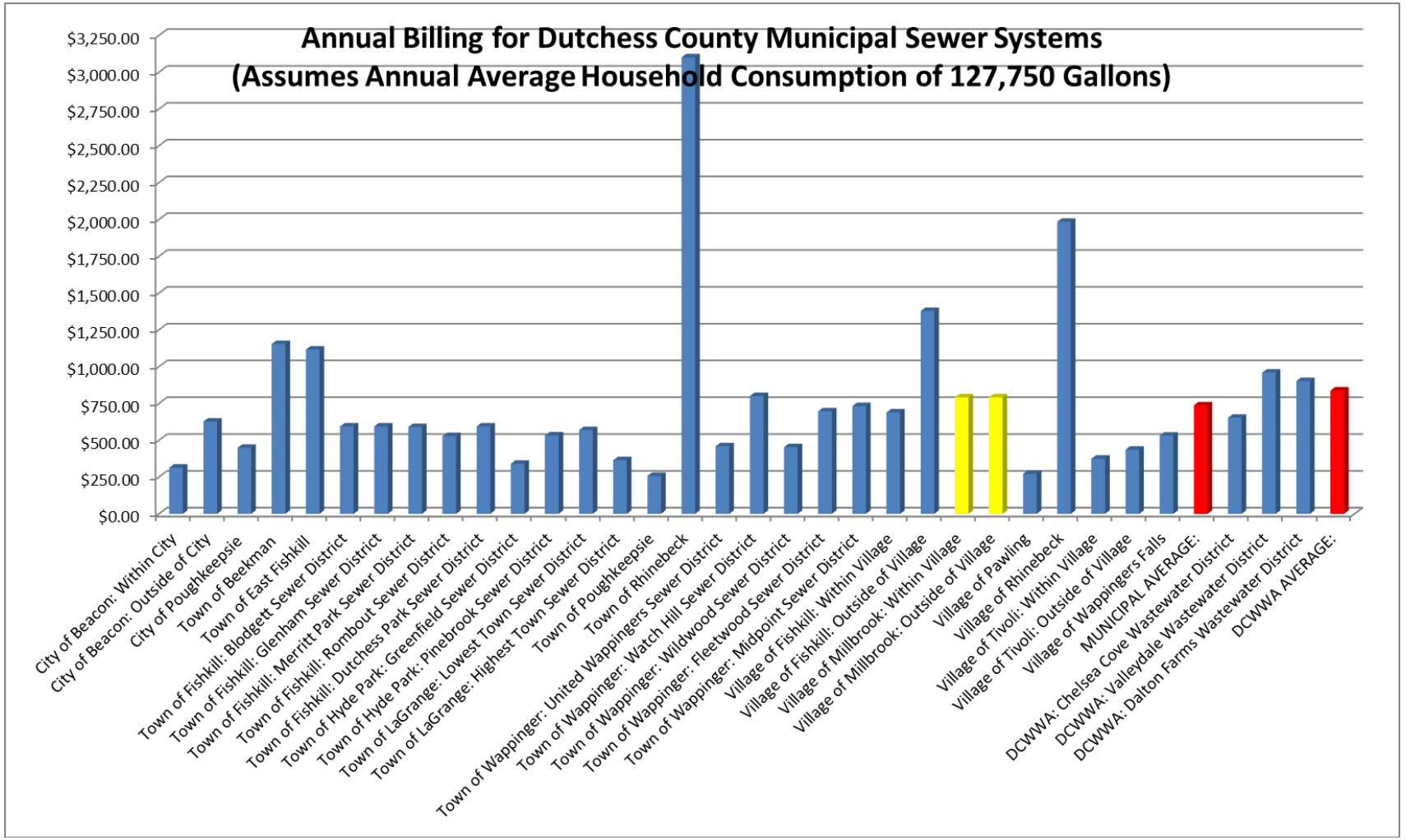
As demonstrated above, 38% of the identified sewer systems use a uniform volumetric consumption charge structure, including the Village of Millbrook. The second most common type of consumption charge utilized by the identified sewer systems is a flat rate consumption charge at 34%. This type of consumption charge is primarily used in municipalities which do not offer meters to their users. It is also common for a municipality which also offers water services with a metering system to assume an amount of water consumed for sewage purposes based on the amount of water metered by the water system meter, including the Village of Millbrook. This provides the municipality with the option of implementing a consumption charge structure other than just a flat rate consumption charge, such as a uniform or block rate consumption charge structure. Another option available to municipalities which have both a sewer and water system, but no meter on the sewer system is to charge users based upon a percentage of the water bill. This form of billing was utilized in only one of the identified sewer systems.

The most environmentally beneficial type of consumption charge utilized by the identified sewer and water systems is the increasing block rate consumption charge. This structure encourages

water conservation since the user is charged higher rates the more water it consumes. However, municipalities which utilize increasing block rate consumption charges have found that these types of systems are not as effective if the block price increases are small or if users of the water system are unaware of how their bills are being calculated.

At this time, the Village has decided to continue to use uniform volumetric consumption charges for purposes of billing its sewer and water system users. However, in the event that the Village experiences water supply issues, it will reevaluate this position and consider some form of an increasing block rate consumption charge. The Village also plans to continue its use of a Sewer Capital Assessment to fund major capital improvements to the Village sewer system.


Annual Billing for Dutchess County Municipal Water Systems
(Assumes Annual Average Household Consumption of 127,750 Gallons)
$1,600.00
$1,400.00
$1,200.00
$1,000.00
$800.00
$600.00
$400.00
$200.00
$0.00
City of Beacon: Within City
City of Beacon: Outside of City
City of Poughkeepsie
Town of Amenia
Town of Beekman
Town of East Fishkill: Lowest Town Water District
Town of East Fishkill: Highest Town Water District
Town of Fishkill: Beacon Hills Water District
Town of Fishkill: Brinkerhoff Water District
Town of Fishkill: Glenham Water District
Town of Fishkill: Blodgett Water District
Town of Fishkill: Merritt Park Water District
Town of Fishkill: Rombout Water District
Town of Hyde Park: Greenfield Water District
Town of Hyde Park: Pine Brook Water District
Town of LaGrange: Lowest Town Water District
Town of LaGrange: Highest Town Water District
Town of Pawling: Water District #1
Town of Pawling: Water District #2
Town of Pine Plains
Town of Poughkeepsie
Town of Red Hook
Town of Wappinger: United Wappinger Water District
Town of Wappinger: Watch Hill Water District
Town of Wappinger: Tall Trees Water District
Town of Wappinger: Fleetwood Water District
Village of Fishkill: Within Village
Village of Fishkill: Outside of Village
Village of Millbrook: Within Village
Village of Millbrook: Outside of Village
Village of Millerton
Village of Pawling
Village of Red Hook: Within Village
Village of Red Hook: Outside of Village
Village of Rhinebeck
Village of Tivoli: Within Village
Village of Tivoli: Outside of Village
Village of Wappingers Falls: Within Village
Village of Wappingers Falls: Outside of Village
MUNICIPAL AVERAGE:
DCWWA: Hyde Park Water District
DCWWA: Zone D Water District
DCWWA: Staatsburg Water District
DCWWA: Schreiber Water District
DCWWA: Rokeby Water District
DCWWA: Dalton Farms Water District
DCWWA: Shore Haven Water District
DCWWA: Birch Hill Water District
DCWWA: Valleydale Water District
DCWWA AVERAGE:


Annual Billing for Dutchess County Municipal Sewer Systems
(Assumes Annual Average Household Consumption of 127,750 Gallons)
$3,250.00
$3,000.00
$2,750.00
$2,500.00
$2,250.00
$2,000.00
$1,750.00
$1,500.00
$1,250.00
$1,000.00
$750.00
$500.00
$250.00
$0.00
City of Beacon: Within City
City of Beacon: Outside of City
City of Poughkeepsie
Town of Beekman
Town of East Fishkill
Town of Fishkill: Blodgett Sewer District
Town of Fishkill: Glenham Sewer District
Town of Fishkill: Merritt Park Sewer District
Town of Fishkill: Rombout Sewer District
Town of Fishkill: Dutchess Park Sewer District
Town of Hyde Park: Greenfield Sewer District
Town of Hyde Park: Pinebrook Sewer District
Town of LaGrange: Lowest Town Sewer District
Town of LaGrange: Highest Town Sewer District
Town of Poughkeepsie
Town of Rhinebeck
Town of Wappinger: United Wappingers Sewer District
Town of Wappinger: Watch Hill Sewer District
Town of Wappinger: Wildwood Sewer District
Town of Wappinger: Fleetwood Sewer District
Town of Wappinger: Midpoint Sewer District
Village of Fishkill: Within Village
Village of Fishkill: Outside of Village
Village of Millbrook: Within Village
Village of Millbrook: Outside of Village
Village of Pawling
Village of Rhinebeck
Village of Tivoli: Within Village
Village of Tivoli: Outside of Village
Village of Wappingers Falls
DCWWA: Chelsea Cove Wastewater District
DCWWA: Valleydale Wastewater District
DCWWA: Dalton Farms Wastewater District
MUNICIPAL AVERAGE:
DCWWA AVERAGE:

Asset Management

An integral role of any municipal sewer and water comprehensive plan is to assess current system assets and replace any which are no longer functioning properly. Using funds provided by the New York State Department of State Local Government Efficiency Grant, an Asset Management System was recently created by VRI, the current system operator.

The goal of any good asset management system is to provide clear and concise information regarding each asset in the system, this information includes:

1. ***Asset number:*** this allows asset records to be tracked easily, assigning an individual identification number to each asset.
2. ***Description:*** short, user-entered description of asset.
3. ***Original cost:*** cost of asset on date of purchase/construction.
4. ***Depreciation:*** loss of the original value of an item, calculated by the system for an up-to-date value.
5. ***Escalation:*** ability to understand the replacement cost of an asset today, or projected into the future.
6. ***Condition:*** ranges from "poor" to "like-new," indicating how likely the requirement of replacing the asset will be.

When VRI began work on the asset management system for the Village of Millbrook, which they have named MIMS, "Millbrook Inventory Management System" they determined that the 6 attributes listed above were of primary importance. In addition to those attributes a graphical interface utilizing GIS mapping was desired to allow the staff to see the aging of the infrastructure on a map of the system. This would provide a fast and easy way to view those assets that are in need of attention and record and represent those assets that have been recently replaced or improved.

These criteria necessitated the development of an asset management system that could collect and manage all the necessary data and interface with a standard GIS program in order to meet the Village's objectives.

The foundation upon which any asset-management program is built is a good inventory of assets. The first step of the process was to physically inventory the major equipment and infrastructure units in the water and wastewater system. This involved working with the Utility Operator to understand the units in each system and record them for the data base. Each unit was placed in inventory and given:

- A unique asset number, which was generated by the MIMS system
- Descriptive information such as serial number, manufacturer, etc.
- Condition assessment
- Useful life

- Original cost
- Location information

When designing the system for the Village of Millbrook it was determined that a robust reporting system must be available in order to truly understand and assess the assets in the system. The reporting system has the capability to show the operator a great deal of valuable data including:

- Asset number
- Asset identifier
- Asset description
- Original cost
- Accumulated depreciation
- Current value
- Current condition code
- Total maintenance performed on the asset
- In service date
- Useful life
- Replacement value (changes depending on selected escalation factor)
- Remaining life
- Replacement year

The information included in the reports allows the Village to make educated decisions regarding the assets that are in need of replacement and amounts that should be budgeted in current or future years (since the escalation factors can be forecasted to future dates).

Sewer System

The Village Sewer System is comprised of an Activated Sludge Wastewater Treatment Plant and sewer collection system which is comprised 36,212 feet of main piping, 166 manholes and 3 lift stations.

Much of the collection system and manholes were constructed in 1933 and are constructed of clay tile and brick.

The Wastewater Treatment plant has the following major components:

• Influent channel	1971
○ Course bar screen	2006
• Pump chamber	1971
○ 10 hp pump	2008
○ 3 hp pump	2007
• Overflow retention basin (original tank from the 1950's)	1996
• Two aeration basins	1971
○ HSI turbo blowers	2010

- Fine bubble diffusers 2010
- Two final clarifiers 1971
  - Flights and chains 2007/2008
  - Shafts/bearings and sprockets 2007/2008
  - Weirs 2007/2008
  - Collection troughs 1971
- Two dosing chambers 1971
  - Dosing bells 1971
- 4 Slow sand filters 1995
  - Distribution boxes and piping 1995
- Chlorine Contact tank 1996
- Generator 1991

The facility also has several buildings including

- Brick lab building 1930
- Wood storage shed 1992
- Wood and stucco control building and garage 1977
- Brick blower building 1930
- Wood and stucco office 1968

Much of the collection system is comprised of clay tile pipe varying from 8" to 12" in diameter with brick manholes. Most of the system was installed in 1933 with some additional work performed in 1970. In 2010, the Village received funds provided by the New York State Department of State under the Local Government Efficiency Grant Program to make upgrades to the system to remediate the Inflow and Infiltration. That program allowed the Village to line over 3,000 feet of sewer main, thereby effectively increase the longevity of those portions of the system by 25 - 50 years. As part of the asset management plan, the Village will continue to line the collection system in order to reduce I&I and lengthen the service cycle of the collection system.

Additionally, the Village has embarked on a program of refurbishing every manhole in the system at a pace of approximately 15 per year. They are utilizing a grouting process that will provide an additional 25 -50 years of useful life while removing I&I from the system.

If we were to take age alone as the deciding factor for replacement of the system we would find that many components of the Wastewater Plant and almost all of the collection system should be refurbished or replaced already. For example with a useful life of 50 years nearly all of the collection system with manholes should have been systematically replaced starting in 1983. The original cost to construct the collection system in 1933 was approximately $300,000 and the replacement cost in 1983 given an average escalation factor of 3.5% would have been $1.5 million. Today that same replacement cost with a 3.5% escalation factor would be $4.2 million. By performing systematic refurbishment of the collection system the Village can increase its useful life and utilize a well thought out asset management plan to effectively budget those improvements rather than have to make costly emergency repairs or replacements.

The collection system is also comprised of the three following lift stations:

- County House Road Pump Station 1991
- Bennett Pump Station 1986
- North Avenue Pump Station 2005

The Bennett Pump Station is nearing the end of its useful life and should be assessed for refurbishment. The County House Road Pump Station is twenty years old and has another 5 years remaining of its useful life and should be assessed for refurbishment within the next five years. The North Avenue Pump Station was refurbished in 2005 and has nearly 20 years left before a major refurbishment is necessary, pumps should be assessed in 5 years.

After reviewing the assets that require replacement/improvements, a detailed list of which can be found in the Asset Management Plan completed by VRI, the Village determined that the following capital budgets will be put in place over the next five years. During the fourth and fifth years of this capital program assets will be selected to continue this capital program for the next five year. This capital management program will continue with a review annually and a new five year plan introduced in the fourth year of the current plan.

The following chart shows a five year snapshot of the Asset Management Plan that is being submitted to the Board of Trustees for their approval. This plan was developed using data provided by the new MIMS asset management system that was developed as part of the Government Efficiency Grant.

Sewer	**2011-2012**	**2012-2013**	**2013-2014**	**2014-2015**	**2015-2016**
Inflow and Infiltration Abatement	$ 31,000.00	$ 31,414.00	$ 32,412.00	$ 32,885.00	$ 31,000.00
Other	$ 4,700.00				$ 6,885.00
Chlor/Dechlor Project	$ 250,000.00				
Energy Efficiency Study		$ 5,000.00			
Preliminary Plant Improvement Study			$ 5,000.00	$ 5,000.00	
Overflow Retention Basin					$ 1,000,000.00
Annual Totals	**$ 285,700.00**	**$ 36,414.00**	**$ 37,412.00**	**$ 37,885.00**	**$ 1,037,885.00**

Water System

The Village of Millbrook water system is comprised of a central pumping system which draws water from several infiltration galleys. Water is treated with Sodium Hypochlorite, Orthophosphate and Caustic Soda. After treatment the water is pumped through the distribution system to a 500,000 gallon water tank. Water leaves the tank and flows by gravity to the residents of the Village.

Much of the pumping facility and distribution system were constructed in the early 1930's with the addition of hydrants in 1950 and expansion of the infiltration galleys in 1990. The system is comprised of 60,238 feet of ductile iron and plastic water main varying in size from 6" to 12" with 88 fire hydrants, 147 gate valves and 4 recently installed insta-valves. The system is also comprised of a 500,000 gallon steel water tank constructed in 1930.

The Water Treatment Plant has the following major components:

• Turbine pump	1991
• Turbine pump	2006
• 25 hp turbine pump motor	1991
• 25 hp turbine pump motor	2006
• Pump motor control	2008
• Pump motor control	2008
• Concrete clear well	1930
• Propane furnace	2008
• Master water meter	1990
• 2 concrete infiltration bunkers	1932
• 1 concrete infiltration bunker	1939
• 4 concrete infiltration bunkers	1990
• Galley collection pipe	1950
• Generator	1990
• Brick water plant building	1930

While much of the Water Treatment plant has been updated over the years, there are 3 infiltration galleys that date to 1930's and are either in need of refurbishment or will be in need shortly. Another key component of the water system that is in need of repair/replacement is the steel water tank that is significantly beyond its useful life.

The full replacement cost of an infiltration galley would be $ 54,000 for each unit. There are currently options to refurbish the galleys which will reduce the cost significantly. Of great concern is the water tank. This unit is far beyond its useful life and will need to be replaced within the next five years. The current cost of replacement is estimated to be $1,091,000 by the MIMS system. However, new technologies have allowed the cost to be lowered for such tanks and costs estimates for such are tank are approximately $725,000.

When looking at the distribution system, we see that many of the hydrants and valves have exceeded their useful life. The Village has committed to replacing valves and hydrants system wide over the next ten to fifteen years and has placed a capital line item in the budget to assure this program is maintained.

The following chart shows a five year snapshot of the Asset Management Plan that is being submitted to the Board of Trustees for their approval. This plan was developed using data

provided by the new MIMS asset management system that was developed as part of the Government Efficiency Grant.

Water	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Valve Replacement Program	$ 36,557.00	$ 35,000.00	$ 35,000.00	$ 35,000.00	$ 35,000.00
Hydrant Replacement Program	$ 2,500.00		$ 5,000.00	$ 20,000.00	
Hand Held and Software upgrade	$ 15,000.00				
Backup Generator		$ 30,000.00			
Water Meter Replacement			$ 275,000.00		
Water Tank Replacement			$ 725,000.00		
GUIDI Filtration System			$ 200,000.00		
Valve Replacement Program					
Turbine Pump and Motor					$ 50,000.00
Annual Totals	**$ 54,057.00**	**$ 65,000.00**	**$ 1,240,000.00**	**$ 55,000.00**	**$ 85,000.00**

Planning Initiatives

Sewer and Water System Expansions/Improvements

The Village water system currently has capacity to add additional users. Upon remediation of the Village sewer system I&I problems, the Village sewer system will also have capacity to add additional users. Clark Patterson Lee, the Project's consulting engineer, has evaluated the potential costs of extending sewer and water services to five different areas located within the Village and the Town. These include the following areas:

Expansion Area	Estimated Total Demand (GPD)	Estimated Demand at 80% Participation (GPD)	Estimated Maximum Probable Capital Cost
Nine Partners Lane Area: Water	13,650	10,850	$1,215,000
Nine Partners Lane Area: Sewer	11,550	9,100	$790,000
Former Bennett College Site: Water	30,000	NA	$0
Former Bennett College Site: Sewer	30,000	NA	$1,080,000
Rodrigo Knolls Area: Water	10,850	8,400	$648,000
Rodrigo Knolls Area: Sewer	8,050	6,300	$675,250
Horseshoe Area: Water	48,600	38,800	$2,706,000
Horseshoe Area: Sewer	25,200	19,950	$2,353,400
Former County Infirmary Site: Water	800	NA	$0
Former County Infirmary Site: Sewer	800	NA	$135,000

A potential expansion area analyzed in this report is the Nine Partners Lane expansion area. The Nine Partners Lane expansion area to be potentially served by the Village water system is comprised of 39 residential parcels along Nine Partners Lane, Linden Lane and Linden Court. It consists of approximately 149 acres and is located entirely within the Village.

The Nine Partners Lane expansion area to be potentially served by the Village sewer system is comprised of 33 residential parcels along Nine Partners Lane, Linden Lane and Linden Court. It consists of approximately 130 acres and is located entirely within the Village.

The former Bennett College expansion area to be potentially served by the Village water system is comprised of 95 residential parcels, consisting of duplexes and single family homes on the former Bennett College site. The former Bennett College site is approximately 27 acres and is located entirely within the Village.

The former Bennett College expansion area to be potentially served by the Village sewer system is comprised of 95 residential parcels, consisting of duplexes and single family homes on the former Bennett College site. The former Bennett College site is approximately 27 acres and is located entirely within the Village.

The Rodrigo Knolls expansion area to be potentially served by the Village water system is comprised of 31 residential parcels along Rodrigo Knolls, Rodrigo Court, Stanford Road and Sharon Turnpike. It consists of approximately 50 acres and is located entirely outside of the Village.

The Rodrigo Knolls expansion area to be potentially served by the Village sewer system is comprised of 23 residential parcels along Rodrigo Knolls, Linden Court and Stanford Road. It consists of approximately 37 acres and is located entirely outside the Village.

The Horseshoe expansion area to be potentially served by the Village water system is comprised of a day camp area and 136 residential parcels along Horseshoe Road, College Lane, South Road, Oak Summit Road, Route 82 and Route 343. It consists of approximately 452 acres and is located entirely outside of the Village.

The Horseshoe expansion area to be potentially served by the Village sewer system is comprised of 72 residential parcels along Horseshoe Road and South Road. It consists of approximately 211 acres and is located entirely outside the Village.

The former County infirmary expansion area to be potentially provided with additional service by the Village water system covers approximately 95 acres and is located outside of the Village, in the Town of Washington. The Village water system currently services the existing building but the County is proposing to expand the existing building by 8,000 square feet of office space which would ultimately increase its water demand.

The former County infirmary expansion area to be potentially provided with additional service by the Village sewer system covers approximately 95 acres and is located outside of the Village, in the Town of Washington. The Village currently services the existing building but the County is proposing to expand the existing building by 8,000 square feet of office space which would ultimately increase its sewer demand.

A more detailed analysis of the identified areas listed above can be found in a separate report titled, *"Evaluation of Expansions and Improvements to Village of Millbrook Sewer and Water Systems"*. The report includes, among other things, a description of the identified area, estimated demand of the area, proposed formation, routing & distribution and required approvals and actions.

The following Table summarizes the FY 2011-2012 consumption charge, the projected 20 year average consumption charge, the cost to the average household in FY 2011-2012 and the projected 20 year average cost to the average household under the status quo scenario and under each of the five different expansion options:

	2011-2012 $/1,000 Gallons: In-Village	20 Year AVG $/1,000 Gallons: In-Village	2011-2012 $/1,000 Gallons: Outside Village	20 Year AVG $/1,000 Gallons: Outside Village	2011-2012 Average Household Bill: In-Village	20 Year AVG Average Household Bill: In-Village	2011-2012 Average Household Bill: Outside Village	20 Year AVG Average Household Bill: Outside Village
Status Quo: Water	$3.02	$4.60	$6.04	$9.20	$386	$589	$773	$1,177
Status Quo: Sewer	$6.43	$8.34	$6.43	$8.34	$863	$1,163	$863	$1,163
Status Quo with Nine Partners Expansion: Water	$4.15	$5.66	$8.29	$11.33	$531	$725	$1,061	$1,450
Status Quo with Nine Partners Expansion: Sewer	$6.85	$8.50	$6.85	$8.50	$950	$1,232	$950	$1,232
Status Quo with Bennett College Expansion: Water	**$2.88**	**$4.30**	**$5.75**	**$8.60**	**$368**	**$551**	**$737**	**$1,101**
Status Quo with Bennett College Expansion: Sewer	**$6.13**	**$7.90**	**$6.13**	**$7.90**	**$822**	**$1,099**	**$822**	**$1,099**
Status Quo with Rodrigo Knolls Expansion: Water	$3.47	$4.94	$6.94	$9.88	$444	$633	$889	$1,265
Status Quo with Rodrigo Knolls Expansion: Sewer	$6.81	$8.50	$6.81	$8.50	$940	$1,225	$940	$1,225
Status Quo with Horseshoe Expansion: Water	$4.43	$5.62	$8.86	$11.25	$567	$720	$1,135	$1,440
Status Quo with Horseshoe Expansion: Sewer	$7.68	$8.89	$7.68	$8.89	$1,118	$1,371	$1,118	$1,371
Status Quo with Infirmary Expansion: Water	**$3.00**	**$4.57**	**$6.00**	**$9.14**	**$384**	**$585**	**$769**	**$1,170**
Status Quo with Infirmary Expansion: Sewer	**$6.42**	**$8.33**	**$6.42**	**$8.33**	**$861**	**$1,160**	**$861**	**$1,160**

As summarized in the Table provided above, three of the expansion alternatives would cost current sewer and water customers more than the status quo scenario. This is due to the fact that the capital costs of the expansions would be spread out over all system users. The expansion alternative that would cost current system users the most is the Horseshoe expansion. Under the Horseshoe expansion scenario the projected 20 year average cost to the average household located within the Village would be $720 for water service and $1,371 for sewer service compared to $589 for water service and $1,163 for sewer service under the status quo scenario. This assumed an assessed value of an average household to be $400,000 with a .5% annual escalation.

However, there are two expansion alternatives which would lower the cost to current sewer and water customers compared to the status quo scenario. These are the former Bennett College and former County infirmary site expansions. Under the former Bennett College site expansion scenario the projected 20 year average cost to the average household located within the Village would be $551 for water service and $1,099 for sewer service compared to $589 for water

service and $1,163 for sewer service under the status quo scenario. The lower cost to current system users can be attributed to the fixed overhead costs of the status quo alternative being spread out over more users and/or gallons consumed. We have also assumed that the former Bennett College site developer would pay for all capital costs necessary to add the additional users to the system. It is expected that the capital costs to add the former Bennett College site to the current sewer system would cost $1,080,000.

Under the former County infirmary site expansion scenario the projected 20 year average cost to the average household located within the Village would be $585 for water service and $1,160 for sewer service compared to $589 for water service and $1,163 for sewer service under the status quo scenario. The lower cost to current system users can be attributed to the fixed overhead costs of the status quo alternative being spread out over more users and/or gallons consumed. We have also assumed that the County would pay for the estimated $135,000 it would cost to provide additional sewer service to the former County infirmary site.

Development of New Water Sources and Enhancement of Existing One

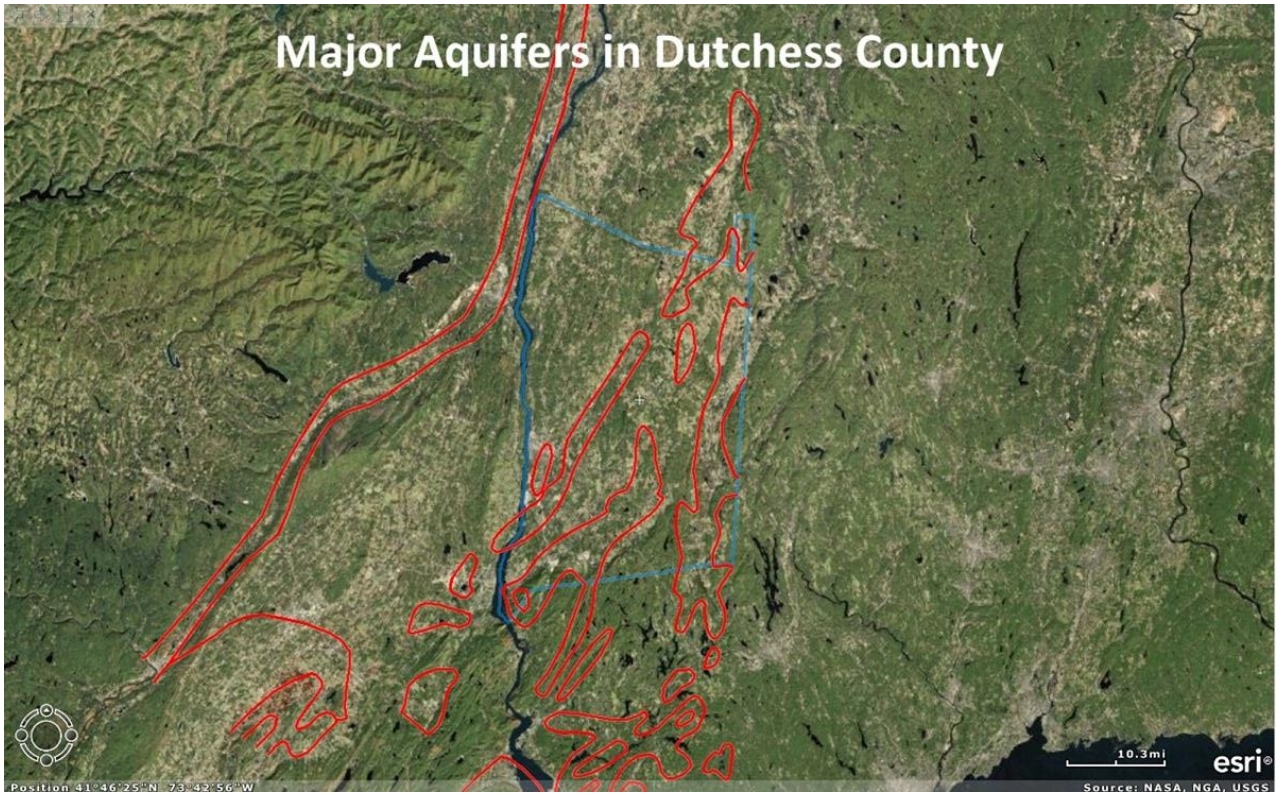
If the Village expands its water service to more than one of the identified Town and Village areas which are not being currently serviced, it may need to find a new water source to meet the increased demand or at the very least modify its existing permit. The Village's permitted water supply is 374,400 gpd. Based on historical usage, the systems average daily usage is approximately 186,000 gpd and the calculated peak usage is approximately 287,500 gpd. The Village's peaking factor between peak usage and average usage is calculated to be 1.5. Therefore, the Village has approximately 86,900 gpd of excess capacity water system usage. The following table summarizes the estimated water demand of five identified possible expansion areas.

Expansion Area	Estimated Total Demand (GPD)	Estimated Total Demand with 1.5 Peaking Factor (GPD)
Nine Partners Lane Area	13,650	20,475
Former Bennett College Site	30,000	45,000
Rodrigo Knolls Area	10,850	16,275
Horseshoe Area	48,600	72,900
Former County Infirmary	800	1,200
TOTAL:	103,900	155,850

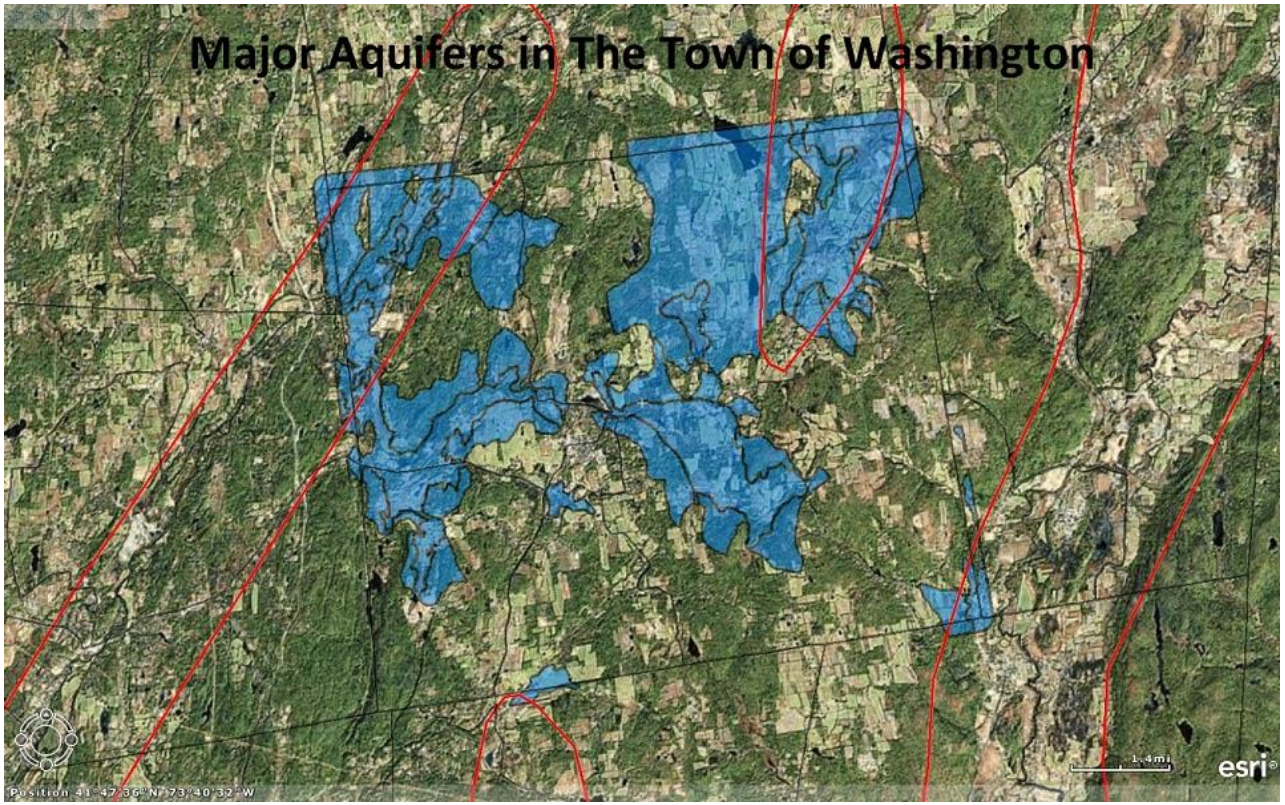
As stated above, the Village only has approximately 86,900 gpd of excess capacity water system usage left of its current permitted capacity. Therefore, not all of the identified expansion areas could be added to the current system without the Village first modifying its permit or receiving a new permit for an additional water source.

An additional restriction for the Village to consider is the capacity of its water storage tank. The water storage tank is only designed to accommodate a water system with a usage capacity of 374,400 gpd.

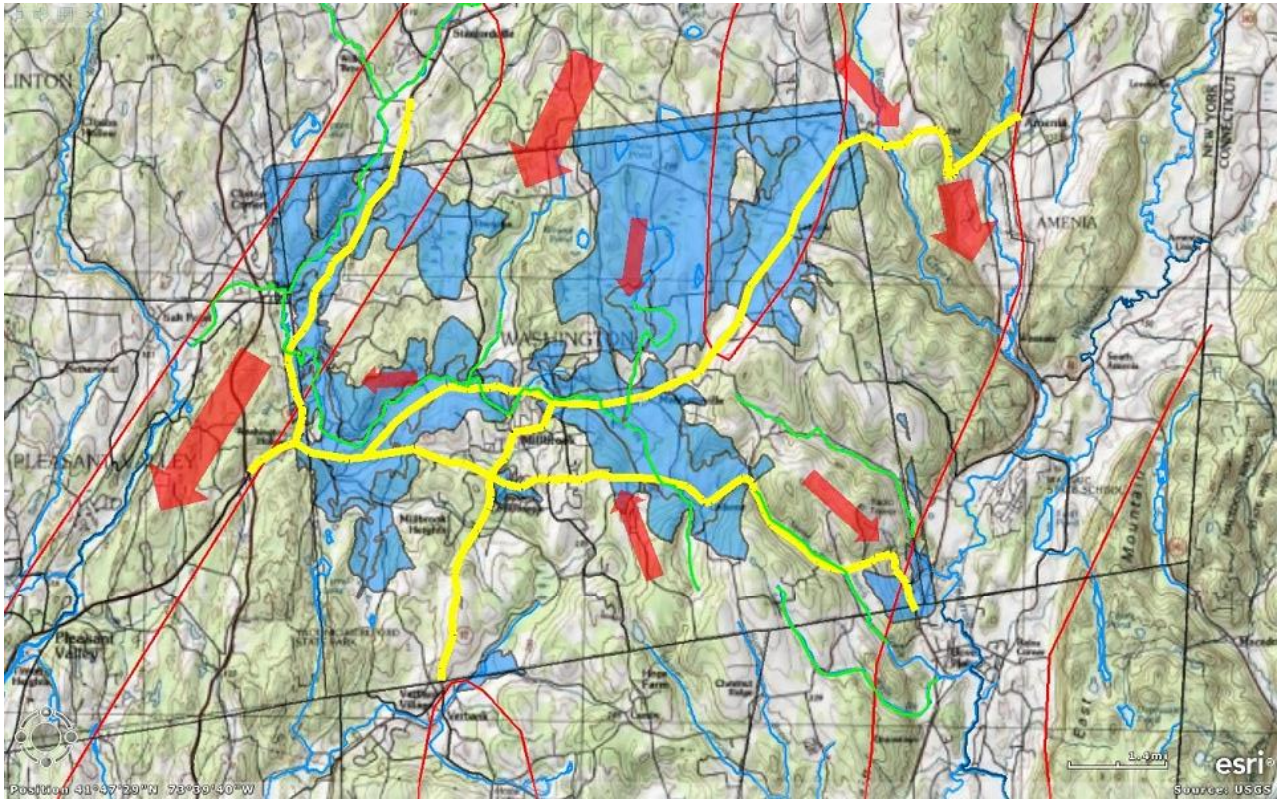
Having a second water source would also help the Village ensure that it has an adequate water supply in the event that its current lone water supply becomes contaminated. The following maps were prepared by VRI and show the principal aquifers in Dutchess County, Town of Washington and the Village of Millbrook.



This map shows the principal aquifers in Dutchess County. This map was created using data from the Cornell University Geospatial Information Repository (CUGIR) and United States Geological Survey (USGS) website.



This map shows aquifers that are specific to the Village and the Town using data from Dutchess County in addition to the data from CUGIR and USGS.



This map shows the different waterways in the Village and the Town as well as the direction of water flow. The map also highlights the major roadways in the Village and the Town detailed in yellow with 100 foot buffers to show salt run off.

The following matrix was created to identify and evaluate the different water source alternatives available to the Village. The different water sources were graded based on preliminary estimates regarding the cost to develop the water source, the quality of the water using only independence from the existing water source as the lone evaluation criterion, and size and quantity of the water supply. Each source was given a number value from 1 to 5, one being the worst and 5 being the best. As far as the water quality evaluation, no drilling or test boring was done to actually test the water from these water sources. Water quality is strictly based on the independence from the existing water source in the event that the existing water source becomes contaminated. Therefore, the existing water source received a rating of 1 on quality, also referred as independence from source. A more detailed analysis of the different water source alternatives performed by the project engineer can be found on the following page.

Planned Location	Source #	Cost	Quantity	Independence of source	Average
Existing Source	1	5	3	1	3
Replacement Near Existing	2	3	2	1	2
Replacement Near Existing	3	3	2	1	2
Bennett College Site	4	2	1	4	2.3
Site North of Village	5	2	3	3	2.6
Wappinger Creek	6	1	5	5	3.6
Farm & Home Center	7	1	4	2	2.3
Millbrook School Property	8	1	3	5	3
South of Route 44	9	1	2	3	2

Top 3 locations based on Average-

1) Wappinger Creek
2) Millbrook School or Existing Source
3) Site North of Village

As summarized above, Wappinger Creek would be the most ideal alternative water source for the Village to consider developing. The source is independent from the existing source which is ideal in the event that the existing source becomes contaminated. It is also expected that the supply quantity would be similar to that of the existing source. However, one major disadvantage of developing Wappinger Creek as a new water source is the estimated cost. It has been estimated by the project engineer to be the most expensive water source alternative for the Village.

Supply #	Description	Cost		Quality	Quantity	Comments
		Source	Pipe			
1	Existing Source			No Change	No Change	
2	Replacement Near Existing	$250,000	$50,000	Same	Less than existing	Would be short term alternation in case of contaminant source near Route 44. This would require new wells to be tied into existing pump house for treatment and distribution.
3	Replacement Near Existing	$250.000	$ 50,000	Same	Less than existing	Would be short term alternation in case of contaminant source near Route 343. This would require new wells to be tied into existing pump house for treatment and distribution.
4	Bennett College Site	$350.000	$ 25,000	Marginal	Small	This is an independent source but it is believed that quality is acceptable but poorer than current source and quantity is much less than current source. This would be small rock wells with a treatment and pump to meet system pressure.
5	Site North of Village	$350,000	$634,000	Questionable	Questionable	This is a questionable source as it does not appear that the watershed will provide much recharge but it is independent of current source. This would be small gravel wells with a treatment and pumps to meet system pressure.
6	Wappinger Creek	$400,000	$3,432,000	Expected Good	Similar to Existing	This would be an independent source with no risk of common contaminant from existing source While this is the upper reaches of Wappinger Creek, the supply quantity would be expected to be similar to existing. This would be a well(s) with treatment and pumps to meet system pressure.
7	Farm & Home Center	$400.000	$1,690,000	Expected Good	Less than Existing	This is expected to be a good backup source of supply as it collects from additional watershed area but risk to contamination is not independent from existing source. This would be a well(s) with treatment and pumps to meet system pressure.
8	Millbrook School Property	$400,000	$3,168,000	Expected Good	Smaller than existing	This would be an independent source with no risk of common contaminant from existing source. The supply quantity is expected to be close to existing. This would be a well(s) with treatment and pumps to meet system pressure.
9	South of Route 44	$400,000	$2,112,000	Expected Fair	Smaller than existing	This would be an independent source with no risk of common contaminant from existing source. The supply quantity is expected to be close to existing. This would be a well(s) with treatment and pumps to meet system pressure.

**The above costs would be independent of cost for land acquisition which could be between $100,000 and $250,000*

Source Water Protection

In 1988, the Village of Millbrook drafted and enacted Rules and Regulations for protection from Contamination of the Public Water Supply of the Village of Millbrook promulgated by the New York State Commissioner of Health under Section 1100 of the Public Health Law. In light of the development of a secondary water source and/or system expansions, it is recommended that the Village review and modify the above referenced rules to include any secondary water source or system expansions.

Conservation

There are several reasons why the Village should practice and encourage conservation and the effective management of its water supply, the first reason being that it helps the environment. By conserving water use, the Village and its residents can effectively conserve their current sole water source. Undoubtedly, this also conserves water for the fish and animals which depend on this water.

Conserving water also saves energy and resources. By decreasing the amount of water the Village water system consumes, the amount of energy used to transport the water to users as well as the amount of energy the ultimate consumer uses to heat the water for certain applications can be conserved. Additionally, conserving water also decreases the need for chemicals required to treat the water for drinking as well as for ultimately treating the wastewater once it reaches the Village's wastewater treatment facility.

Ultimately conservation of energy and resources translates into saving money since less money is spent on the resources and energy required to treat and move the water to its ultimate location. One way in which the Village could increase participation in water conservation efforts would be to directly pass the cost savings on to the consumer. As detailed in the Rate Structure Survey section, this could be easily done by implementing an Increasing Block Rate Structure. In the event that the Village finds that its water demand is overburdening its water source or sewer and water infrastructures, it should look at implementing an Increasing Block Rate Structure and educate its users how their water and wastewater bills are calculated.

Recommendations

Upon reviewing the Village's current sewer and water system practices, identifying and evaluating the Village's current sewer and water system assets and analyzing and projecting the Village's future sewer and water system needs, the following recommendations have been formed for consideration by the Village:

- Finish Inflow and Infiltration remediation
- Finalize agreement with Dutchess County regarding expanding sewer and water services for the former County Infirmary office expansion
- Review and, if necessary, modify Rules and Regulations for Protection from Contamination of Public Water Supply of the Village of Millbrook written in 1982
- Provide water conservation education to sewer and water system users in the forms of educational brochures and/or information on the Village website
- If water demand is overburdening the Village water source or sewer and water infrastructures, the Village should further explore implementing an Increasing Block Rate Structure consumption charge
- Continue to use MIMS system to proactively budget capital improvements to aging infrastructure