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Sleepy Hollow, Tarrytown and Briarcliff Manor Water Supply, Pumping and Storage Consolidation

FINAL REPORT

May 24, 2016



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

May 24, 2016

Mr. Anthony Giaccio
Village Administrator
VILLAGE OF SLEEPY HOLLOW
28 Beekman Avenue
Sleepy Hollow, NY 10591

Dear Mr. Giaccio:

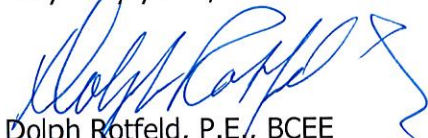
This Draft Report for consolidation was limited to the water supply, pumping and storage facilities owned by the Villages of Sleepy Hollow, Tarrytown and Briarcliff Manor and was undertaken at the request of said Villages.

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

Some of the systems and features that will be reported are already being shared by the three Villages. Those features that may be appropriate and cost-effective to be shared have been noted. An interim draft of the feasibility study was distributed to the Steering Committee for discussion. The result of the meeting and input has been incorporated in the final draft report on the feasibility of consolidation.

The final draft report will be presented at a public meeting to solicit comments on the proposals recommended. As a result of the public meeting and continued evaluation, the final report will be prepared and provided at a meeting of the Trustees of the three Villages. Upon receipt of comments and desires of the Trustees, the final report will be prepared indicating whether all, some or none of the potential features are to be consolidated.

Very truly yours,


Dolph Rotfeld, P.E., BCEE
President



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

BACKGROUND

The Villages of Sleepy Hollow, Tarrytown and Briarcliff Manor are the subject of this feasibility study and financial analysis of consolidation of source of water supply and pumping facilities.

During most of the 20th Century, the Village of North Tarrytown, now known as Sleepy Hollow, used New York City's New Croton Aqueduct as its water supply. A pumping station was constructed in 1923 at Shaft 9. This station served as the sole source of water until the construction of the current pumping station on Neperan Road.

At the same time the Village of Tarrytown source of water supply was the Tarrytown Lakes. A treatment plant was then in operation at the eastern end of the lower lake. Water was pumped into the Village through a transmission line located on the south side of the lake.

During the same period, the Village of Briarcliff Manor water supply came from Shaft 6 of the New Croton Aqueduct. Prior to that, several wells in the vicinities of Buckout Road and Village Hall were used. Due to inconsistent acceptable water quality from the Croton Reservoir system, the Villages of Tarrytown and North Tarrytown in 1974 decided to connect to the New York City Catskill Aqueduct. A tap was made to the Aqueduct in the vicinity of Executive Boulevard in the Town of Greenburgh. A 30" diameter transmission main, about 2.5 miles long was constructed along Executive Boulevard, NYSDOT Routes 9A and 100C and Neperan Road, along the lower Tarrytown Lake, to the two pumping stations.

In August of 2012 the Village of Briarcliff completed construction of a new pumping facility including a second tap in the Catskill Aqueduct and connected the discharge to an existing 24" line which ties into the 30" transmission main. The pumping station was connected at the end of the 30" transmission main and constructed on land adjacent to the western side of the Tarrytown pumping station.

All three municipalities are currently using the Catskill Aqueduct, downstream of Kensico Reservoir, as their primary source of water supply. This source is New York City's Catskill/Delaware system which consists of reservoirs located in Delaware, Greene, Schoharie, Sullivan and Ulster Counties, all west of the Hudson River; and the West Branch Reservoir in Putnam County and Kensico Reservoir in Westchester County east of the Hudson River. The Catskill/Delaware system is the major source of water for New York City and Westchester County.

The Sleepy Hollow pump station serves a total population of 9,870 (2010 census) through 1,535 service connections. The daily average of water pumped into the distribution system is 1.3 million gallons per day. The highest single day consumption was 3.2 million gallons. The Sleepy Hollow Water Department maintains a storage reservoir of 800,000 gallons' capacity situated on the Rockefeller State Park Preserve property.

The Tarrytown pump station serves approximately 11,753 people through 2,506 service connections. Average daily flow is 1.7 million gallons per day with the highest peak flow being 4.6 million gallons per day. Three storage tanks have a total storage capacity of about 4.9 million gallons. At present only 2.9 million gallons are usable.

Briarcliff Manor has a water system that serves a population of 9,190 people through 2,700 service connections in Briarcliff Manor and portions of the Towns of Mount Pleasant and Ossining. The average amount of water supplied to customers averages 1.0 million gallons per day. The peak single day flow was 2.14 million gallons per day.

All three Villages have an emergency connection to New York City's New Croton Aqueduct. Due to a NYCDEP maintenance project in 2012, the period January 6th thru January 27th, water supply from the Catskill Aqueduct was not available. During this period the three villages were supplied from the New Croton Aqueduct.

The Kensico Reservoir meets Federal and State microbiological standards. However, the Catskill Aqueduct source does not meet the 1996 Surface Water Treatment Rule (SWTR) requirements for turbidity, which is caused by suspended material, such as fine clay which is normally not seen by the naked eye. A filtration avoidance provision was granted by the EPA to New York City to allow the usage of this source without filtration processes provided that certain conditions exist.

The New Croton Aqueduct (NCA) supply is only utilized by the Villages in the event of an emergency. If water from the NCA is used there is a requirement for the Villages to issue a boiled water advisory according to the SWTR since filtration is needed to use the NCA.

SOURCE

Currently the villages are using the same connection to the New York City Catskill Aqueduct, downstream of Kensico Reservoir. The water is obtained from the original and a newly installed supplementary tap in the Aqueduct. The water supply at this tap has been treated at the recently constructed ultra-violet (UV) treatment plant located on the north side of Grasslands Road (NYS Route 100C). The UV plant receives flow from Kensico Reservoir, the greater majority of which is fed by the water from the Catskill and Delaware watersheds. The meter/operations building at the Catskill Aqueduct contains a Venturi meter, a vacuum prime pump and a tablet chlorinator. Maintenance of this building and the 30 inch transmission main is now shared by the three Villages.

In the vicinity of this building an underground vault with check valve, meter and 8 inch pipe was constructed to connect to a Town of Greenburgh 10 inch watermain in Executive Boulevard. This watermain is supplied with water that the Town obtains from the Delaware Aqueduct. The cost of the \$110,000 construction was shared equally by the three Villages. The purpose of the connection was to make a source of water available to the three villages when the Catskill Aqueduct is shut down. This emergency connection was never planned to provide the full demand of the Villages, but it is a significant improvement over the four inch hose connections between fire hydrants previously used on the Town and Village systems during previous times of local water shortages.

In order to provide full service in case of power failure at the meter/operations building the installation of a generator is proposed by the Village of Briarcliff Manor. This too will be a three-way cost sharing feature.

For the most part, the two and a half mile thirty inch transmission main is either in or beside the road bed of Executive Boulevard, Saw Mill River Road (NYS Route 9), Old Saw Mill River Road and Neperan Road ending at the site of the Sleepy Hollow, Tarrytown and Briarcliff Manor pumping stations.

INTERCONNECTIONS

In addition to the interconnection to the Town of Greenburgh ten inch watermain containing Delaware Aqueduct water, downstream of Kensico Reservoir and the UV plant, which all three Villages share, are the following emergency interconnections.

Sleepy Hollow and Tarrytown have connected pipes at Hudson Street and North Broadway, College Avenue and Beekman Avenue. However, they are currently inoperable, since they do not comply with NYCDEP requirements. These connections would be for short term emergencies used to supply minimal water flow once upgraded.

Sleepy Hollow and Briarcliff Manor have a recently constructed interconnection with meter and backflow preventers in two separate underground vaults to direct flow to and from either Village, located at Webber Avenue and Sleepy Hollow Road. Actual usage indicates that about 1,250 gallons per minute has flowed through the connections for a total up to 1.8 million gallons per day.

Sleepy Hollow from the New Croton Aqueduct has since 1923 had a connection at Shaft #9 located on Sleepy Hollow Road. A pre-manufactured building was placed in operation in 2010 equipped with pumps, chemical treatment and disinfection equipment on NYC property at Shaft #9. This installation was placed to provide reliable flow capable of close to 4.1 million gallons/day due to two then proposed 6 month shutdowns of the Catskill Aqueduct, from October to March, for construction. No lengthy shutdowns have occurred necessitating operation of this facility.

Tarrytown and Sleepy Hollow interconnections have been described above.

Tarrytown from the Town of Greenburgh has a connection located in Benedict Avenue, but it is inoperable at this time, since it does not comply with NYC DEP requirements.

Tarrytown from the Village of Irvington has a connection located in East Sunnyside Lane, in the Village of Irvington but it is inoperable at this time, since it does not comply with NYC DEP requirements.

Tarrytown from the New Croton Aqueduct at Shaft #10, located near the intersection of Neperan Road and County House Road, is capable of pumping about 4 million gallons per day.

Briarcliff Manor from Sleepy Hollow has been described above.

Briarcliff Manor from United Water Westchester (UWW) has a sixteen inch watermain connection on Broadway (NYSDOT Route 9) at Langdon Avenue in Dobbs Ferry. An underground vault contains a four inch meter and valves, entering and leaving is a sixteen inch line capable of providing 800,000 gallons per day in the event of a Catskill Aqueduct shutdown. This transmission main is about 6.8 miles from a separate Briarcliff Manor pumping station located at Pocantico Lake.

Briarcliff Manor from the Village of Ossining has the ability to receive about 1.1 million gallons/day from connections at Chappaqua Road and at Ridgecrest Road.

Briarcliff Manor from the New Croton Aqueduct at Shaft #6; located at the Long Hill Road pumping station, can obtain about 3.4 million gallons per day. The same restrictions apply at this location as at other Villages' New Croton Aqueduct connections.

It should be noted that all Briarcliff Manor pump stations have independent generator facilities or are hard-wired for mobile support, if necessary.

An important factor with regard to using any of the existing connections to the New Croton Aqueduct is whether there is water in the Aqueduct, the quality of the water and obtaining approval from the Westchester County and/or New York State Departments of Health.

PUMPING

The Sleepy Hollow Pump Station operational equipment consists of two pumps capable of pumping 2,400 gallons per minute each and an emergency diesel operated pump that can pump 2,000 gallons per minute. The pumps are controlled by programmable variable speed drives. The start, speed and stop of the pumps are controlled by the water elevation in the Village 800,000 gallon storage tank in the Rockefeller Park Preserve. The elevation signal is sent from the storage tank via a radio transmitter to the Sleepy Hollow Pump Station.

At the pump station gaseous chlorine for disinfection, orthophosphate for corrosion control and caustic soda for pH adjustment are introduced into the water. The station is manned weekdays 7:00 a.m. to 3:00 p.m. and for three hours on Saturday and Sunday.

Most recent data indicates that the daily average for water treated and delivered is 1.3 million gallons. The highest single day was 3.2 million gallons.

The Village of Tarrytown Pump Station equipment consists of one 700 gallon per minute pump, two 1,350 gallon per minute pumps and one 2,000 gallon per minute pump. The pumps are direct drive pumps that operate in sequence as required by water level in the high gradient storage tank.

At the pump station liquid chlorine for disinfection, orthophosphate for corrosion control and caustic soda for pH adjustment are added to the water.

The station is manned seven days a week. Due to the age of the various controls and equipment, daily adjustments are made to its controls and operation. There are plans to install a SCADA system and install new variable speed pumps and controls.

The most recent data indicates that the daily average for water treated and delivered is 1.7 million gallons. The highest single day was 4.6 million gallons.

The Village of Briarcliff Manor Pump Station equipment consists of three 1,450 gallon per minute pumps. The pumps are controlled by computer programmable variable speed drives. The pump cycles are controlled by the water level in the Rosecliff Tank.

At the pump station liquid chlorine for disinfection, orthophosphate for corrosion control and caustic soda for pH adjustment are computer programmed and introduced to the water.

As the equipment is automated, personnel presence is limited largely to inspection and physical reporting. An operator visits the station daily and on weekends to check operations and the condition of the facility. This generally takes about one hour per day.

The daily average for water treated and delivered is 1.0 million gallons. The highest single day was 2.14 million gallons.

Briarcliff Manor maintains two separate chlorine infusers: one for lower water volumes largely < 1.5 MGD and a second when volumes are in excess of 1.5 MGD. Recently a turbidity meter was installed that reports the “cloudiness” of the water due to fractional particulate matter that is inherent in the system. The turbidity provides the Village with advance warning of potential system shutdowns due to natural occurring events.

STORAGE

The **Village of Sleepy Hollow** 800,000 gallon storage tank was constructed in 1927 on the Rockefeller property, which is now part of the Rockefeller State Park Preserve. The tank has an overflow elevation of 408. Telemetry at the site sends signals to the main pumping station to start and stop pumps depending on the water elevation in the tank.

The Village of Tarrytown water system has a low pressure system 800,000 gallon water tank with an overflow elevation of 327, located on the south side of the lower Tarrytown Lake. On the hill in back of the Tarryhill Subdivision is a four million gallon high pressure system storage tank with an overflow elevation of 490 feet. Currently the operator must go to the tanks to check water levels. There is no direct communication system from the tanks to the pumping station. The operator can only tell the approximate water level of the tanks from the system pressure. At this time the Village can only utilize half the volume of the four million gallon tank before customers begin to lose service pressure.

The Village of Briarcliff Manor has a three million gallon tank located on Wilderness Way off Long Hill Road and a one million gallon tank on Farm Road. Both tanks have an overflow elevation of 564. The level transmitters at both tanks send water elevation data to the main pumping station for activating and stopping the pumps. These tanks feed the main service area of the Village as well as the high service areas through booster pumps to small storage tanks. A full SCADA driven reporting system is being implemented for the Village's water and sanitary pump/lift systems. In addition, a separate 150,000 gallon tank stands on the former King's College campus. This tank stands at Elevation 646 feet to meet the needs of the high elevation areas. The Village is replacing the tank with a hydro-pneumatic pump station whose variable speed pumps initiate higher water pressures to service all higher elevations and meet firefighting needs. Briarcliff Manor also has a 300,000 gallon tank at the Edith Macy Girl Scout Conference Center in the Town of Mount Pleasant. While integral to Briarcliff Manor's system, it is a dedicated supply to the high service areas in the Town of Mount Pleasant.

Sleepy Hollow, Tarrytown and Briarcliff Manor
Water Supply, Pumping, and Storage Consolidation
FEASIBILITY STUDY DRAFT

ANNUAL OPERATION & MAINTENANCE COSTS

Catskill Connection & 30" Transmission Pipe

	Sleepy Hollow	Tarrytown	Briarcliff Manor
Electricity	\$360 *	—	—
Manpower	\$16,315 *	\$16,315 *	\$16,315 *
Chemicals	—	—	\$12,000 *
Miscellaneous and Repairs	—	—	—
Total	\$16,675	\$16,315	\$28,315

Main Pump Station

	Sleepy Hollow	Tarrytown	Briarcliff Manor
Electricity	\$100,000 †	\$90,000 †	\$73,333 *
Manpower	\$144,608 *	\$151,905 *	\$36,036 †
Chemicals	\$50,000 †	\$60,000 †	\$36,000 †
Miscellaneous and Repairs	\$27,078 *	\$55,600 †	\$10,000 †
Total	\$321,686	\$357,505	\$155,369

See **ANNUAL COST ANALYSIS** section of this report for explanation of costs.

* Actual 2013 costs.

† Budgeted 2013/14 costs.

Sleepy Hollow, Tarrytown and Briarcliff Manor
Water Supply, Pumping, and Storage Consolidation
FEASIBILITY STUDY DRAFT

ANNUAL OPERATION & MAINTENANCE COSTS

Transmission From Pump Stations to Storage Tanks

	Sleepy Hollow	Tarrytown	Briarcliff Manor
Manpower	—	—	—
Miscellaneous and Repairs	\$1,850 ‡	\$1,850 ‡	\$6,000 *
Total	\$1,850	\$1,850	\$6,000

Storage Tanks

	Sleepy Hollow	Tarrytown	Briarcliff Manor
Electricity	\$900 *	—	\$600 *
Manpower	\$7,000 *	\$15,000 *	\$6,000 *
Miscellaneous and Repairs			
Total	\$7,900	\$15,000	\$6,600

See **ANNUAL COST ANALYSIS** section of this report for explanation of costs.

* Actual 2013 costs.

† Budgeted 2013/14 costs.

‡ Estimated cost for leak detection services.

Sleepy Hollow, Tarrytown and Briarcliff Manor
Water Supply, Pumping, and Storage Consolidation
FEASIBILITY STUDY DRAFT

TOTAL ANNUAL OPERATION & MAINTENANCE COSTS

Operation	Sleepy Hollow	Tarrytown	Briarcliff Manor
Catskill Connection	\$16,675	\$16,315	\$28,315
Main Pump Station	\$321,686	\$357,505	\$155,369
Transmission	\$1,850	\$1,850	\$6,000
Storage Tanks	\$7,900	\$15,000	\$6,600
Total	\$348,111	\$390,670	\$196,284

ANNUAL COST ANALYSIS

The following cost analysis does not include a comparison of water usage and purchase by each community.

CATSKILL CONNECTION

According to the **Village of Sleepy Hollow's** Department of Public Works General Foreman, Richard Gross, and the head water system operator, John Arena, the annual cost to operate the Village's connection to the Catskill Aqueduct includes the electricity costs and manpower. The cost of electricity is derived from lighting the equipment at the point of connection while manpower is the product of a one-hour-per-day visit to the site.

Based on information provided by the **Village of Tarrytown's** Department of Public Works Superintendent, Howard Wessells, the annual cost to operate the Village's connection to the Catskill Aqueduct only includes manpower. The cost of manpower is the product of a one-hour-per-day visit to the site.

According to the **Village of Briarcliff Manor's** Department of Public Works Superintendent, Edward Torhan, the annual cost to operate the Village's connection to the Catskill Aqueduct includes the cost of manpower and chemical addition to the water supply. The cost of manpower is the product of a one-hour-per-day visit to the site while the chemical addition for disinfection by chlorination in the form of tablets amounts to a cost of \$1,000 per month.

MAIN PUMP STATIONS

Based on conversations with and materials provided by the **Village of Sleepy Hollow's** Treasurer, Sara DiGiacomo, the following items are considered in calculating the annual cost to operate and maintain the Village's main pump station: electricity to run the pumps and electrical components of the station; one full-time employee; gaseous chlorine disinfection and chemical treatment; and miscellaneous costs for repairs and incidentals including phones, gas, trucks, etc.

Village of Tarrytown Department of Public Works Superintendent, Howard Wessells, and head water system operator, Steve Cowles, it was determined that the following are factors in the annual cost to operate and maintain the Village's main pump station: electricity to run the pumps and electrical components of the station; one full-time employee; liquid chlorine disinfection and chemical treatment; and miscellaneous costs for repairs and incidentals including phones, gas, testing, lab expenses, equipment maintenance, office supplies etc.

The annual costs to operate and maintain the **Village of Briarcliff Manor's** main pump station were established based on discussions with and materials provided by, Edward Torhan, the Village's Department of Public Works Superintendent. The annual costs include: electricity to run the pumps and electrical components of the station; one part-time employee; gaseous chlorine disinfection and chemical treatment; and miscellaneous costs for repairs and incidentals.

TRANSMISSION

Referring to conversations with Richard Gross, the **Village of Sleepy Hollow's** Department of Public Works General Foreman, and confirmed upon review of provided water budget documents, the Village incurs no cost to operate and maintain the transmission line that conveys water from the point of connection at the Catskill Aqueduct to the Village's main pump station.

As concluded by examining materials provided by the **Village of Tarrytown's** Department of Public Works Superintendent, Howard Wessells, the Village incurs no cost to operate and maintain the transmission line that conveys water from the point of connection at the Catskill Aqueduct to the Village's main pump station.

There is no indication that the **Village of Briarcliff Manor** incurs any cost to operate and maintain the transmission line that conveys water from the point of connection at the Catskill Aqueduct to the Village's main pump station.

TRANSMISSION FROM PUMP STATIONS TO STORAGE TANKS

The length of pipe from the **Village of Sleepy Hollow's** pump station to its storage tank is approximately 2.33 miles with another 0.7 miles to be completed with the construction of the new storage tank. Although leak detection on the transmission mains is not a scheduled annual occurrence it could be completed in one (1) day. Based on the prevailing rate for leak detection (\$1,850 per day) if it is done annually the Village would spend an estimated \$1,850 per year on leak detection between its pump station and storage tank.

The length of pipe from the **Village of Tarrytown's** pump station to its storage tank is 3.07 miles. Although leak detection on the transmission main is not a scheduled annual occurrence it could be completed in one (1) day. Based on the prevailing rate for leak detection (\$1,850 per day) if it is done annually the Village would spend an estimated \$1,850 per year on leak detection between its pump station and storage tank.

The **Village of Briarcliff Manor** has 3.59 miles of pipe between its pump station and its storage tank. In 2013, the Village spent \$6,000 on repairs and miscellaneous maintenance of its transmission pipes between its pump station and its storage tank.

STORAGE TANKS

The annual cost to operate and maintain the **Village of Sleepy Hollow's** storage tank includes the electricity cost to operate telemetry and a heater at the site as well as manpower for site visits. Site visits amount to two hours per week. This information was obtained from discussions with the Village of Sleepy Hollow's Department of Public Works General Foreman, Richard Gross and head water system operator, John Arena.

The cost to the **Village of Tarrytown** to operate and maintain the Village's storage tank only includes the manpower required for site visits according to the Department of Public Works Superintendent, Howard Wessells. Site visits amount to five hours per week.

From discussions with Edward Torhan, the **Village of Briarcliff Manor's** Department of Public Works Superintendent, the annual cost to operate and maintain the Village's storage tanks is based on electricity costs and manpower. Telemetry, a transmitter and site lighting are included in the electricity costs. Manpower costs account for site visits amounting to about two hours per week.

CONSOLIDATION POTENTIAL

The following improvements have been proposed by the three villages for their own purposes and those to be shared by all three Villages.

There exists an agreement between **Briarcliff Manor** and **Tarrytown** concerning water supply, dated July 16, 2004. The agreement generally is joint use of the connection at the Catskill Aqueduct and transmission line to the pump stations on Neperan Road.

There is also a similar agreement between **Briarcliff Manor** and **Sleepy Hollow** dated January 5, 2005, that speaks of joint use of the facilities stated in the previous noted agreement.

The three villages now have a written agreement to share costs of operation and maintenance of the water supply at the Catskill Aqueduct and then via a 30 inch transmission to their individual pump stations. Each Village's portion of the shared cost is based on its system's water usage.

This indicates that some consolidation exists at this time, but without a defined leadership position to direct the operation and maintenance and costs thereof. If the Villages were to consolidate they would share the operation and maintenance costs of the water supply at the Catskill Aqueduct and the 30 inch transmission main. They would also share the operation and maintenance costs of the pump stations, the transmission mains to the storage tanks and the storage tanks themselves regardless of the Village in which they are currently located. Each Village's share of the cost to operate and maintain these facilities would be based on each Village's individual water usage. This is similar to the agreement that the Villages currently employ with regards to the water supply at the Catskill Aqueduct and the 30 inch transmission main.

The Village of Sleepy Hollow, in order to comply with Westchester County Department of Health's one day storage requirement of 2.42 million gallons, a second tank is proposed to be constructed. The new tank capacity will be 1.62 million gallons and it is to be located on property owned by the Rockefeller Brothers Fund in the vicinity of Lake Road north of Neperan Road. Both of Sleepy Hollow's storage tanks will have the same high water elevation of 408 feet.

The new tank will have a diameter of 140 feet and a wall height of seventeen feet. The roof will be about at grade with plantings around the perimeter. A 3,500 foot long sixteen inch diameter water main will connect the tank to the existing line on County House Road in close proximity to the pumping station.

Telemetry will connect to the SCADA and the pump control system. The budget estimate for the new storage tank and the transmission line is about \$5.7 million. The existing 0.8 million gallon storage tank, now almost 90 years old, needs major work to be considered reliable. The interior walls need to be repaired with concrete coating, painted and the roof needs to be replaced. Cost for this work is estimated at \$400,000.

The Village of Tarrytown had in its capital budget construction of a replacement pump station building and system for \$4.25 million. However, only design is in the current five year capital plan. The cost in the future could be in the \$6-\$7 million range. Also proposed is inspection, cleaning and repair of the water storage tanks projected at \$3.5 million.

Currently, each Village individually bonds the cost of repairs and upgrades to their pumping, transmission and storage facilities. The most efficient way to manage costs under a consolidation would be for the three Villages to continue to bond the cost of infrastructure repairs and upgrades with each Village's portion of the shared cost being based on its system's water usage.

A preliminary plan for a three Village shared project has been started for constructing a transmission line to obtain water from the NYC-UV plant and be connected to the existing thirty inch pipe in Executive Boulevard. This will assure a treated water supply in case of a Catskill Aqueduct shutdown. The connection point design at the Westchester County wet well has been completed and preliminary meetings have been held with NYCDEP to discuss the proposal. Although there have been discussions with NYCDEP, formal permit applications will be made in April 2016.

- The three Villages now share the source at the Catskill Aqueduct and the transmission line getting the water to their own pumping stations. A generator is proposed to be installed to serve the equipment in the meter building at the Catskill Aqueduct. The emergency interconnection with the Town of Greenburgh is also shared.
- There is a good indication that the Villages of Sleepy Hollow and Briarcliff Manor's main pumping stations have the capacity and ability to provide water to all three Villages. If proven, the construction of a new pumping station by the Village of Tarrytown would not be necessary. Having two pumping stations would reduce the manpower cost required to operate the system.
- If the Village of Tarrytown pumping station is not needed, a 490,000 gallon air break storage tank could be constructed on the site. The existing small air break tanks would be eliminated. This would provide

additional water for use by the two pumping stations in an emergency situation.

- The addition of a pump at the Briarcliff Manor and Sleepy Hollow pump stations may be necessary to obtain production to meet above average daily consumption in the three villages. Estimated costs would be about \$200,000 for the two stations.
- The Village of Briarcliff Manor's three million gallon storage tank combined with the Village of Tarrytown's high service tank and the proposed Village of Sleepy Hollow tank could provide the necessary storage capacity for all the Villages. If verified as meeting Westchester County Health Department storage requirements, the rehabilitation of the existing tank by the Village of Sleepy Hollow may not be necessary.
- Upon consolidation of the Villages' pumping capabilities site visitations to each pump station will be required on a daily basis as required by the Westchester County Department of Health. Whereas each Village now complies with this policy, after the consolidation this duty could be handled by less manpower.
- Formation of the governing entity shall include a representative from each Village, one of which is to be the Chairman or Executive Director. The duty of this governing body shall be to establish a budget to manage the purchase of water from the City of New York, treating, pumping and transmitting the water to each Village. The distribution system in each of the Villages will be operated and maintained by the Village that now has responsibility. The requirements for operation of the entity by the New York State Department of Health are as follows:
 - o One Designated Grade IIB Treatment Operator and one Assistant Designated Grade IIB Treatment Operator each for the Sleepy Hollow and Briarcliff Manor pump stations.
 - o Under current conditions, each of the three Villages needs one Designated Grade IIB Treatment Operator and one Assistant Designated Relief Grade IIB Treatment Operator.
 - o After consolidation Tarrytown's pump station and its operator would no longer be needed. There would have to be negotiations with the operator's union (Civil Service Employees Association) to lay-off or reassign the operator which would require a new contract with the union.
 - o Operating and maintenance costs shall be assessed to each Village by the Entity according to the percentage of the amount of water used.

- Each Village currently adds to its water supply chlorine for disinfection, orthophosphate for corrosion and caustic soda for pH adjustment. If the Villages were to consolidate the pumping operation then the process of adding chemicals would not change; however, there may be an opportunity for some savings by procuring the chemicals in bulk for the two or three pump stations.
- There is no indication that upgrades beyond those discussed above are needed for any of the three Villages' transmission lines, pump stations or storage tanks.
- Possible names for the entity are:
 - o Tri-Village Water Works
 - o East Hudson Water Works
 - o Tarryhollow Manor Water Works
 - o Sleepytown Manor Water Works
 - o Briartown Hollow Water Works
 - o Campo Rosso Water Works

A detailed hydraulic model of the three Villages' storage, transmission and selected points in the distribution systems will provide the most effective method for evaluating the existing and proposed pumping, storage and transmission improvements.

The following page includes two tables: the first table lists up-front, one-time capital costs associated with consolidating and the second table lists up-front, one-time capital costs slated to be incurred should the water districts choose not to consolidate. The page after that lists projected annual operation and maintenance costs for the both the consolidation and non-consolidation scenarios.

Sleepy Hollow, Tarrytown and Briarcliff Manor
Water Supply, Pumping, and Storage Consolidation
FEASIBILITY STUDY DRAFT

Consolidation Cost*

Improvement	Capital Cost
Build Tarrytown Air Break Tank (490,000 gal.)	\$735,000
Build Manifold Interconnection with Metering at the Current Location of the Three Pump Stations	\$330,000
Miscellaneous Upgrades to Sleepy Hollow and Briarcliff Manor Pump Stations (Includes additional pumps, controls and internal piping)	\$500,000
Build a Booster Pump Station to Supply Tarrytown High Gradient Tank	\$350,000
Total	\$1,915,000

See **CONSOLIDATION POTENTIAL** and **OTHER RECOMMENDATIONS** sections of this report for explanation of each improvement.

*The improvements listed above are only those that are specific to a consolidation of facilities. If a facility improvement will be completed regardless of a consolidation then it has not been included in the above analysis.

Cost Without Consolidation**

Improvement	Capital Cost
Build New Tarrytown Pump Station	\$6,000,000
Upgrade Tarrytown Connection to 30" Transmission Line	\$75,000
Total	\$6,075,000

See **CONSOLIDATION POTENTIAL** and **OTHER RECOMMENDATIONS** sections of this report for explanation of each improvement.

**The improvements listed above are only those that are specific to a non-consolidation scenario. If a facility improvement will be completed regardless of a consolidation then it has not been included in the above analysis.

Sleepy Hollow, Tarrytown and Briarcliff Manor
Water Supply, Pumping, and Storage Consolidation
FEASIBILITY STUDY DRAFT

Annual Operation & Maintenance After Consolidation*

Operation and Maintenance Item	Annual Cost
Leak Detection of Transmission Main from Pump Stations to Storage Tanks (2 days)	\$3,700
Manpower (2 Operators per Main Pump Station = 4 Employees Total)†	\$222,000
Tarrytown Booster Pump Station Operation	\$100,000
Total	\$325,700

See **ANNUAL COST ANALYSIS** section of this report for explanation of each annual cost.

*The items listed above are only those that are specific to a consolidation of facilities. If an annual cost is to be incurred regardless of a consolidation then it has not been included in the above analysis.

†This figure is derived from the following line items in Actual Village Budgets. The figure is calculating by applying the average cost of manpower among the 3 pump stations to the operation of only 2 pump stations.

Sleepy Hollow:	\$144,608
Tarrytown:	\$151,905
Briarcliff Manor:	\$36,036

Annual Operation & Maintenance Without Consolidation**

Operation and Maintenance Item	Annual Cost
Leak Detection of Transmission Main from Pump	\$5,550
Manpower (2 Operators per Main Pump Station = 6 Employees Total)††	\$330,000
Tarrytown Main Pump Station Operation	\$160,000
Total	\$495,550

See **ANNUAL COST ANALYSIS** section of this report for explanation of each annual cost.

**The items listed above are only those that are specific to a non-consolidation scenario. If an annual cost is to be incurred regardless of a consolidation then it has not been included in the above analysis.

††Includes the following from Actual Village Budgets:

Sleepy Hollow:	\$144,608
Tarrytown:	\$151,905
Briarcliff Manor:	\$36,036

OTHER RECOMMENDATIONS

Automated Metering

Automatic Meter Reading (AMR) is a technology whereby water usage can be transmitted from a meter and recorded by the utility. This technology is currently employed in at least one of the Villages in this consolidation study. It is a way to simplify meter reading and reduce the time required to take readings thereby reducing operation costs. It also provides accurate water consumption data instead of usage estimates based on past or predicted use however, it requires manpower to visit the site and record the meter reading.

To take this technology a step further Advanced Metering Infrastructure (AMI) is a system that allows the water service utility to remotely receive meter readings in real time from a central location. This system gives the utility the ability to monitor live usage, a feature from which leaks can be detected and addressed immediately. This technology also eliminates the manpower required to manually take meter readings as this is now done. The implementation of AMI is a way of further reducing operation costs and preventing sustained leakage.

The current metering system employed by each Village should be evaluated in order to determine the degree of upgrade required to implement an AMI. Some homes may not even have electronic meters which would necessitate a full replacement of the device so that it could communicate with the AMI. A review of each Village's water records, discussions with the operators and potentially some site visits would be necessary to fully complete this assessment.

Tarrytown Pump Station

For Tarrytown's water supply system to continue to operate on its own into the future the Village's pump station would need to be replaced. Based on the recent construction cost of Briarcliff Manor's pump station, it is estimated that the cost of constructing a new Tarrytown pump station would be in the range of \$6-\$7 million.

A consolidation of the villages could eliminate the need to replace the Tarrytown Pump Station. The pump stations of Sleepy Hollow and Briarcliff Manor would also be able to supply Tarrytown. In the Tarrytown pump station's place a 490,000 gallon air break storage tank (80 feet in diameter, 13 feet high) would be constructed. The estimated cost of an aboveground steel tank and necessary piping is estimated at \$725,000.

Additionally, a booster pump station may need to be installed to supply Tarrytown's high gradient tank at the Tarryhill subdivision and supplement

pressure in the system. Alternatively, the homes around Marymount College, which has one of the highest elevations in the village system, could be made a “High Service” area. It then can be served by a booster pump station working off the transmission line in Neperan Road.

On the discharge points of the existing pump stations, three meter vaults would be strategically placed to monitor each municipality’s individual water usage. With 16” and 20” water transmission mains supplying each Village, each vault would house a 12” magnetic flow meter and a check valve with reducers outside the vaults to accommodate the meters. Total meter, piping and vault cost installation is estimated to range between \$50,000 and \$75,000 per unit.

Leak Detection

Leak detection and elimination could further reduce the cost of operating each Village’s water system. Estimates for leak detection are about \$120 per mile of water main. Tarrytown, Sleepy Hollow and Briarcliff Manor’s water main lengths are about 27.0, 19.2 and 59.7 miles of water main piping, respectively. The total preliminary cost of leak detection in the three systems would be less than \$15,000. Eliminating the leaks would reduce operation costs.

Supplemental Transmission Main

Because of its age and importance it may be desirable to supplement the shared 30” transmission main from the Catskill Aqueduct to the three pump stations.

The route of a potential new 30 inch transmission main would start in the vicinity of the existing meter building receiving water from the Catskill Aqueduct, then run parallel to the existing transmission main but on the opposite side of it on the following streets: Executive Boulevard, Saw Mill River Road (Route 9A) and Old Saw Mill River Road (Route 100C) to the Westchester County Trailway. At that point, the Trailway, on a former railroad bridge, and the Saw Mill River Parkway both pass over Old Saw Mill River Road. Several pipes including the existing 30” transmission main are in close proximity to one another in the street beneath the overpasses. Additionally, some previous investigations indicate that rock may also be present. This may preclude any additional work in the street.

Chances are that a new 30” pipe would have to be installed by boring under the old railroad embankment and the parkway a distance of about 465 feet. After passing the west embankment of the Parkway, the pipe would be placed on the south side of Neperan Road to the site of the former Tarrytown Water Filtration Plant. From there, continuing the 30” main to the three pumping stations could be along Neperan Road or along the south side of the lower Tarrytown Lake and

then on Neperan Road, between the two lakes, to the pumping stations. Both paths present challenges.

Going on the north side of the lake on a heavily travelled narrow winding roadway containing the existing 30" main could create severe construction problems. The path on the south side of the lake also has potential problems due to the presence of a gas transmission line and the fact that easements may have to be obtained. The installation of a new 30 inch main, however, could be placed in the path of the previous 10 inch water line that came from the filtration plant to the Village. The line would finally be placed in Neperan Road between the lakes and then along a short stretch of road to the pumping stations. Estimated costs for construction of a supplemented 30" transmission main are \$11.7 million if on the north side of the lake and \$13.1 million if on the south side of the lake.

A third option is to construct a 30" line for a distance of about 2,200 feet from the previous filter plant along the south side of Tarrytown Lake and then construct a line across the lake to the pump stations. The approximate 800 feet of pipe crossing the lake would be assembled and floated and then dropped to the bottom using a type of pipe specially designed for such applications. The estimated construction cost of this option is \$10.9 million. See the following pages for estimated construction costs of each segment of potential path and a map illustrating each path.

Comments/Questions:

Sleepy Hollow, Tarrytown and Briarcliff Manor
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**ESTIMATED CONSTRUCTION COST OF
SUPPLEMENTAL TRANSMISSION MAIN**

North Route

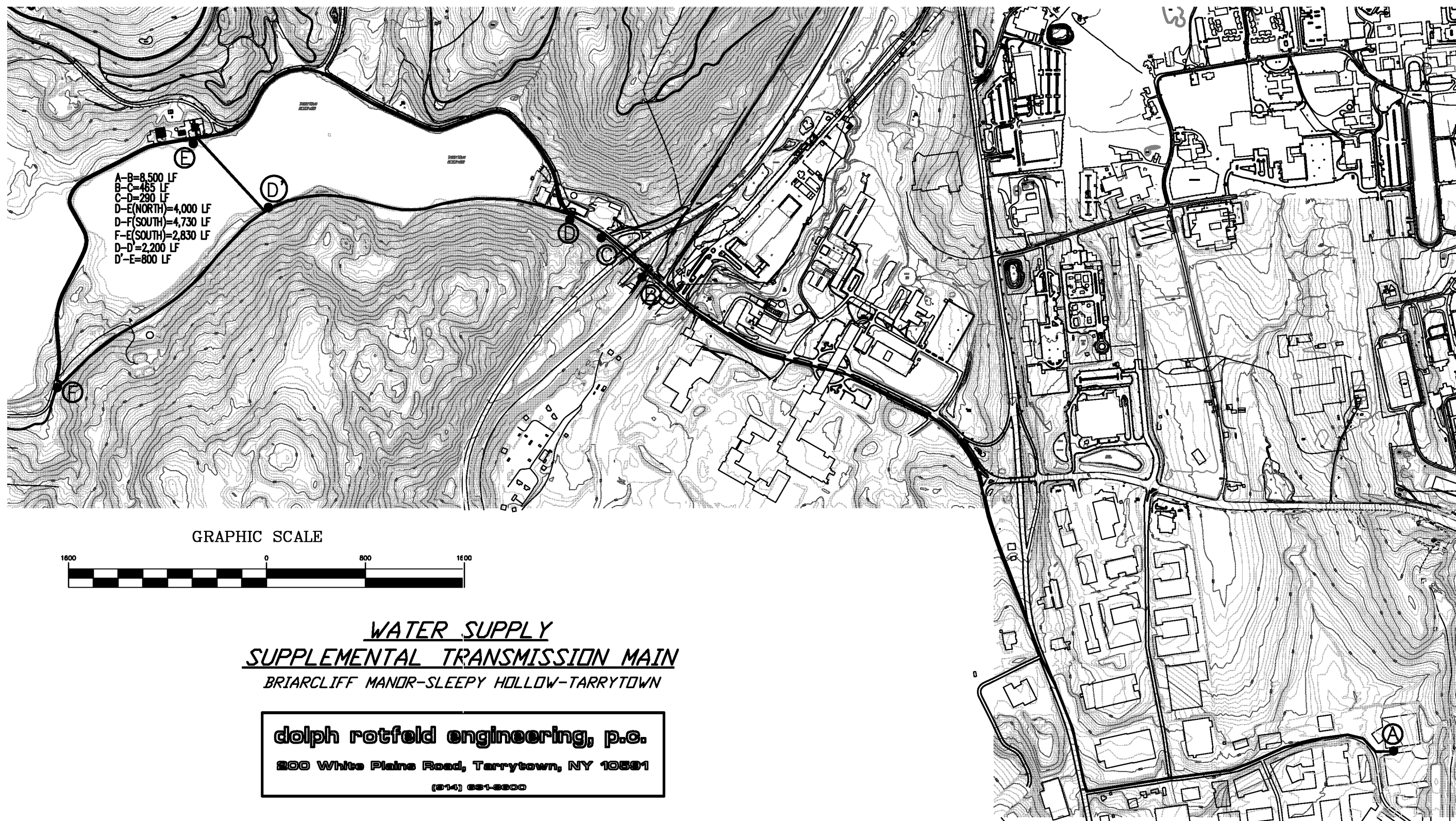
Pipe Section	Length (feet)	Cost (per foot)	Total
A to B	8,500	\$700	\$5,950,000
B to C	465	\$5,000	\$2,325,000
C to D	290	\$700	\$203,000
D to E	4,000	\$800	\$3,200,000
Total	13,255		\$11,678,000

South Route

Pipe Section	Length (feet)	Cost (per foot)	Total
A to B	8,500	\$700	\$5,950,000
B to C	465	\$5,000	\$2,325,000
C to D	290	\$700	\$203,000
D to F	4,730	\$550	\$2,601,500
F to E	2,830	\$700	\$1,981,000
Total	16,815		\$13,060,500

South Route (Sub-Aqueous)

Pipe Section	Length (feet)	Cost (per foot)	Total
A to B	8,500	\$700	\$5,950,000
B to C	465	\$5,000	\$2,325,000
C to D	290	\$700	\$203,000
D to D'	2,200	\$550	\$1,210,000
D' to E	800	\$1,500	\$1,200,000
Total	12,255		\$10,888,000



ADDITIONAL CONSIDERATIONS *(Outside of the scope of this study)*

Financial Arrangement

Upon consolidation an agreement will need to be reached among the three municipalities with regards to how cost savings will be shared. The Village of Tarrytown will experience a substantial cost savings by not having to build the new pump station that it currently needs. It will need to be decided how the savings will be distributed among all three villages.

Furthermore, the Village of Briarcliff Manor has recently upgraded its pump station while the Village of Sleepy Hollow is in the process of upgrading its storage capabilities. These facilities are to become part of the consolidated water works system. Therefore, if each of these villages is currently paying for the construction of its respective facility then it may wish to share the cost with the other two villages in the consolidated water works.

Meter / Operations Building at Catskill Tap



PLAQUE
IN
HONOR
OF
THE
SACRED
SITES
OF
THE
CATHOLIC
CHURCH
IN
THE
CITY
OF
ST. LOUIS
MO.
1908

Pump Stations

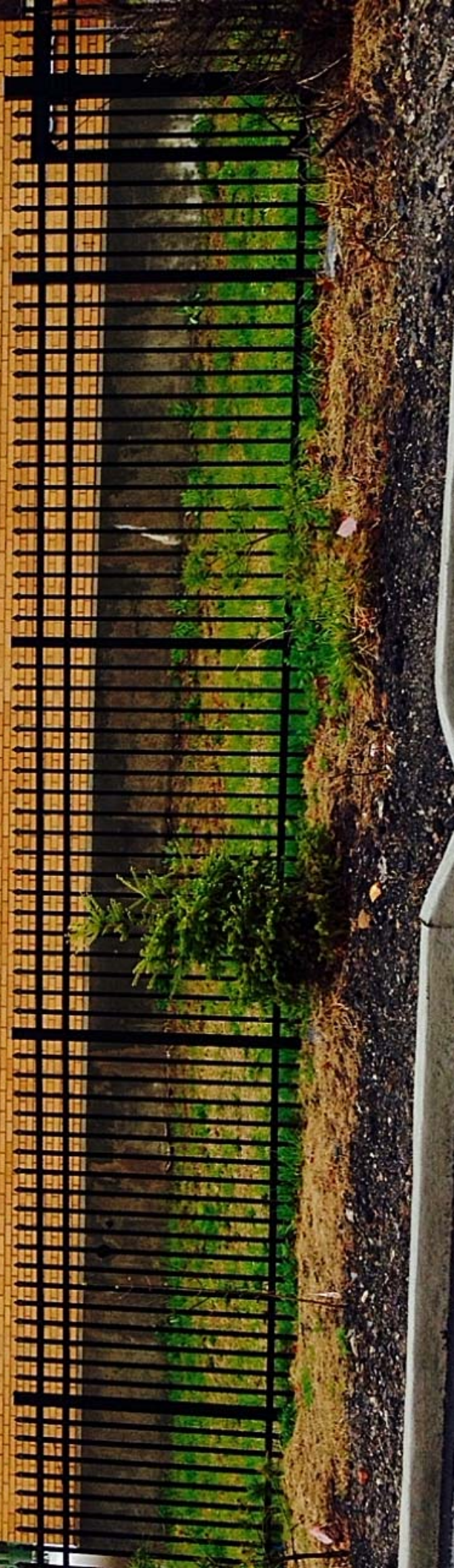
Sleepy Hollow, Tarrytown and Briarcliff Manor



VILLAGE OF NORTH TARRYTOWN
CATSKILL WATER SUPPLY

403
NYPDA RD

SHAFT NO. 10 PUMP STATION
TAKES FLOW FROM 6 FEET





VILLAGE OF
BRIARCLIFF MANOR
PUMPING STATION

Storage

Sleepy Hollow, Tarrytown and Briarcliff Manor





