Task 8.3

INTRODUCTION AND HISTORICAL PERSPECTIVE

Unlike many parts of the country that have relied on distant water sources (consisting of either large well fields or surface impoundments), and long distance transmission to the points of consumption, Long Island water suppliers, in particular the Suffolk County Water Authority (SCWA), have relied on localized supply and distribution of water. It was recognized early on that an abundant fresh water supply exists below the ground virtually anywhere on Long Island, and the most economical and efficient method of providing water to an expanding population on Long Island was to acquire land and construct wells as needed in response to population trends, and to interconnect these multiple local sources of supply with appropriately sized pipes. The existing water supply infrastructure has reflected this practice.

Mains are typically 12" to 16" in diameter, and are designed to accommodate flows of up to several thousand gallons per minute. Well fields are located within 1 to 2 miles of each other in populated areas. This practice has allowed for local control and local resolution to distribution related problems. The manifestation of this local approach has been the formation of numerous water purveyors supplying water to a relatively small geographic area. Nassau County exemplifies this localized approach, with 46 community public water systems serving a 287 square mile area. In Suffolk County, this practice has been modified somewhat, with the formation of the Suffolk County Water Authority, which today serves approximately 85% of residents in Suffolk. Even so, Suffolk County has historically had a multitude of small to medium sized water purveyors serving many parts of the county. Over time, the Suffolk County Water Authority has acquired the majority of them. Table 1 below lists the water purveyors that have been acquired by the SCWA. Despite these acquisitions, there are still currently 37 other community public water systems and 227 non-community systems located throughout Suffolk County. This preponderance of small municipal and private suppliers has suppressed the implementation of a more regional approach to water supply, such as large centralized pumping centers and/or large diameter, high-capacity transmission mains. Facilities of this nature, which are capable of moving tens of thousands of gallons per minute of water 10 to 30 miles or more, have only recently been considered as possible water supply alternatives and will be the subject of this report.

Even in areas where regional-scale groundwater contamination has been a problem, such contamination has, for the most part, been handled using a similar localized approach. Beginning in the 1970s, Volatile Organic Chemical (VOC) contamination affected numerous wells in western and central Suffolk County. Such contamination has been addressed through the installation of Granular Activated Carbon (GAC) adsorption units or air strippers installed at individual well fields. The SCWA currently has 125 GAC units treating 118 wells located throughout its distribution system. Each GAC system costs approximately $500,000 to construct. Despite this expense, the economy of scale enjoyed by a system as large as SCWA's has allowed GAC treatment to remain a fairly cost effective methodology for remediation of VOC contamination. The SCWA has calculated that the use of GAC adds approximately 24 cents per thousand gallons to the operational costs of supplying water.

Elevated concentrations of iron and manganese in some regions of Suffolk have necessitated the installation of iron removal plants at some well fields throughout the county. Even though iron and manganese are secondary contaminants, elevated concentrations in water pumped by wells so affected can cause operation and maintenance issues and is responsible for customer complaints. In order to avoid these problems, the SCWA currently operates 26 iron removal plants at well fields throughout Suffolk.

Table 1: Water suppliers acquired by the Suffolk County Water Authority

Name of Water Supply	Year Acquired
Amagansett Water Co.	1975
Bevon Water Corp.	1981
Blue Point Community Assoc.	1971
Bridgehampton Water Co.	1992
Browns Hills	1997
Captain Kidd Water Co. Inc.	1987
Cedar Grove Park Assoc.	1972
Cedar Water Supply Co.	1978
Central Suffolk Water Corp.	1967
Cherry Grove	1997
Colonial Springs Water Co., Inc.	1966
Community Water Corp.	1972
Davis Park	1996
Eastern Suffolk Water Corp.	1981
Eastwood Waterworks, Inc.	1961
Farmingville Water Co.	1964
Fire Island Pines	1997
Forest Brook Acres Water Supply	1966
Great Beach Water Corp.	1981
Green Meadows Water Co., Inc.	1964
Green Turf Water Co.	1965
Groveland Park Water Works Co., Inc.	1970
Home Water Co.	1963
Indian Head Water Co., inc.	1960
Kismet	1995
Lonelyville Water Corp.	1995
Montauk Water Supply Corp.	1973
New Highway Water works Co.	1967
New Zone Inc.	1965
North Sayville Water Co.	1964
North Shore Water	1991
Northport Water Works Co.	1960
Oakwood Water Corp.	1970
Parsnip Pond Waterworks Co.	1977
Patchogue Shores Water Co.	1969
Point O' Woods	1997
Ronkonkoma Water Co.	1974
Selden Water Co.	1975
Shirley Water Works Co.	1985
Shorehaven Water Corp.	1964
Shorewood Water Corp.	1993
Smithtown Water Co.	1963
Summer Club	1997
Sunhill	1995
Sunnyside Water Corp.	1964
Terraces-On-The-Sound	1991
Village of Greenport Water District	1997

As with GAC treatment, the economy of scale enjoyed by the SCWA has made iron and manganese removal reasonably cost effective. According to SCWA calculations, iron and manganese removal adds approximately 9 cents per thousand gallons to the operational cost of supplying water. However, one type of regional groundwater contamination, elevated Nitrate levels, may eventually necessitate a more regional remedial approach, namely the long distance transmission of water from unaffected areas.

NITRATE PROBLEMS IN SUFFOLK COUNTY – HISTORICAL APPROACHES

In most instances, Nitrate contamination affects shallow wells, typically those screened in the upper glacial aquifer. At most SCWA well fields so affected, there are also deeper Magothy wells with much lower Nitrate concentrations. The usual remedial methodology employed by the SCWA is to pump shallow and deep wells simultaneously. The result is a water that has Nitrate concentrations substantially below the New York State standard of 10 mg/L with no special treatment facilities required.

At some SCWA well fields, elevated Nitrate levels exist deep into the Magothy aquifer and the usual blending scenario described above cannot be implemented. At these sites, the SCWA must seek a less conventional, more innovative, and often more expensive solution. One such alternative solution that the SCWA attempted at its Middleville Road well field in Northport was to blend with a well screened in the Lloyd aquifer.

The Lloyd aquifer is well known for its uncontaminated water, largely due to the presence of the overlying Raritan clay confining unit over most if its surface. As a result, many of the Nassau County water suppliers, especially those in so-called “coastal communities”, have relied on Lloyd wells for all or part of their supply since the early 1960s, after many Magothy wells became contaminated by chlorides and anthropegenic chemicals. In Nassau County, there are over 40 wells screened in the Lloyd aquifer, pumping an average of 12 million gallons per day, or approx. 85% of all available water in the Lloyd beneath Nassau. ***None of this water is returned to the aquifer system, since virtually 100% of Nassau is sewered. In contrast, Suffolk County only utilizes approximately 5 Lloyd wells, specifically in northern Huntington and at the VA Hospital in Northport. These 5 wells pump an average of only 650,000 gallons per day, and were constructed prior to the 1986 Lloyd moratorium, which was enacted in order to prevent further exploitation of the Lloyd aquifer except in certain very specific instances.*** The only recently constructed Lloyd wells in Suffolk have been replacements for some of these original 5 wells.

Given the abundance of contaminant-free water in the Lloyd aquifer, the SCWA proposed to construct a Lloyd aquifer well, and blend approximately 300 gpm of water in the Lloyd with approximately 1400 gpm of Magothy water that had nitrate levels of approximately 9 mg/L. Similar to the blending that occurs with a Nitrate removal plant, the Lloyd-Magothy blended water would have a nitrate concentration of approximately 7 mg/L, thereby meeting drinking water standards without treatment and with minimal additional cost. However, construction of a Lloyd aquifer well requires the granting by the NYSDEC of a variance from the Lloyd moratorium. Such a variance was sought by SCWA, via the existing well permitting process. The SCWA submitted a water supply application for Middleville Rd. well no. 3 in July of 2006.

DEC staff, upon review of the SCWA’s application for the Lloyd well, ultimately approved the application. However, petitioners representing Nassau County Water Suppliers and other interested parties intervened in an effort to stop the issuance of the permit. As per NYSDEC legal procedure, an adjudicatory public hearing was held so that applicable issues could be

heard. The NYSDEC Administrative Law Judge ruled in favor of the SCWA, upholding the DEC's initial decision to grant the permit. However, when the judge's decision was forwarded to the NYSDEC Commissioner for final approval, the decision was reversed and the application for permit was denied. As a result, the blending option was never initiated at Middleville Road, and the 2 existing Magothy wells are pumped on an abbreviated schedule and their Nitrate levels are monitored closely. The most recently proposed solution for Middleville Rd. is to extend a water main from the nearby Wayne Court well field. Wayne Court well no. 1 is screened in a sandy section of the Raritan clay, and produces approximately 600 gpm with nitrate levels of 4 to 6 mg/L. Even though nitrate levels have increased at Wayne Court over time, use of this well for blending purposes in this manner is seen by SCWA as a viable, though perhaps temporary solution to the elevated nitrates at Middleville Rd.

There are two additional locations within the SCWA distribution system where conventional blending is not an option: South Spur Drive well field in East Northport and Brown's Hills Road well field in Orient.

SITE-SPECIFIC DETAILS IN SUFFOLK COUNTY

The South Spur Drive well field, located in East Northport, has three Magothy wells, with Nitrate concentrations ranging from as low as 8 mg/L to as high as 12 mg/L. Nitrate levels fluctuate seasonally and due to pumpage of the individual wells. There are no deeper, low Nitrate wells on this site that would facilitate blending as a remedial solution. Therefore, the SCWA has constructed and currently operates one large-capacity Nitrate removal plant at this well field. The Nitrate removal facility treats approximately 1/3 of the total well field capacity (approx. 3600 gpm) to a concentration of zero mg/L. This treated water is then blended with the remaining water from the other wells, resulting in a finished water with a Nitrate concentration of approx. 6 to 7 mg/L. ***While the resulting water quality from the nitrate removal plant is essentially the same as would result from simultaneous pumping of shallow and deep wells, the nitrate removal process generates substantial quantities of waste brine. This brine is held on site in a tank, and ultimately transported by tanker truck to the Bergen Point sewage treatment plant, where it is disposed. The SCWA has calculated the cost of producing Nitrate free water from the South Spur plant at $2.46 per thousand gallons. This is almost double the retail water rate of $1.44 per thousand gallons. Even when this water is blended with "raw" water from the other wells, the South Spur Drive Nitrate removal plant adds an unacceptably high $0.97 per thousand gallons to the production cost of water. The Nitrate removal process and its associated costs make widespread use of this technology unfeasible.***

The Brown's Hills Road well field, located in Orient, contains two shallow upper glacial wells. This well field was acquired by the SCWA in 1997 from a private developer. The well field is not connected to the SCWA system by any water mains, so no alternative sources exist. The Brown's Hills Road wells have Nitrate concentrations ranging between 10 and 13 mg/L. In this eastern Long Island setting, both the Magothy and Lloyd aquifers consists of naturally salty groundwater, and so blending with deeper wells is not an alternative. The SCWA continues the practice of the former owner of the system, namely, providing under-sink reverse osmosis filtration units, thereby providing potable water at this one tap location for each of the 24 homes served by this water system. The SCWA is also responsible for changing out these units as they age. This requires the presence of the individual homeowners to allow the SCWA personnel access to the units, which are located inside the houses. The SCWA has investigated the possibility of constructing a Nitrate removal facility for the Brown's Hills Road system. However, given the small capacity of this isolated system, construction and operation would be cost prohibitive. Additionally, with no sewage treatment plant nearby to receive waste brine,

subsurface disposal of this brine is a more cost effective approach. The SCWA applied for and has received a permit from the USEPA to inject this waste brine into the underlying, non potable Magothy aquifer at this site. However, given the cost considerations for this small isolated system, this project has been put on hold while the option of transmission from unaffected areas is researched.

In summary, the expense of Nitrate removal, coupled with its associated generation of brine waste and the environmental ramifications of transporting and disposing it, make Nitrate removal a relatively expensive technology that the SCWA (and presumably most Long Island water suppliers) would wish to avoid. Additionally, the non-feasibility of blending with water pumped by deeper wells in some areas has forced the SCWA to look for innovative ways to provide low nitrate water to regions affected by elevated nitrates. One such innovation is to transmit water from unaffected areas. This option has been studied by the Suffolk County Water Authority in relation to the previously-mentioned South Spur Drive and Brown's Hills locations. Data from two proposed transmission main projects serving these areas will be used as the basis for cost considerations for any future transmission mains considered for purposes of this Task.

PREVIOUS ESTIMATES AND CONSIDERATIONS

The exact purpose for any proposed water main transmission project was also considered by SCWA personnel. Given the past experiences of relatively economical remediation treatment of VOC contamination and of elevated iron and manganese levels, it was assumed that the SCWA would not embark on a transmission project to address these issues. Rather, the SCWA would only transmit water great distances to address nitrate contamination due to the expense, environmental issues, and legal/procedural hurdles associated with nitrate removal. Therefore, the two areas that would receive the transmitted water would be those most affected by nitrate contamination: the north fork and the Northport-East Northport-Huntington area as previously mentioned. In the case of the north fork, there is another reason behind the investigation of the transmission alternative, namely overall water quantity.

Currently, the well and treatment facilities on the north fork are capable of supplying potable water to the existing population. Depending on future population growth and land use patterns, this may not be the case in the future. Available water quantity on the north fork, especially when considering future saturation population and the resulting peak water demand, will need to be supplemented through the importation of water.

The principal source of the water that would be transmitted to both of the previously mentioned regions would be the relatively uncontaminated and "water-rich" areas of the Pine Barrens of east-central Brookhaven and Southampton. Since this has never been attempted before, developing an accurate cost estimate for a water transmission project of this nature is difficult. Fortunately, the SCWA has investigated the concept of long distance transmission of water via relatively large diameter water mains in two areas affected by elevated nitrate levels.

One such project consists of a total of over 88,000 ft. of water main (16.8 miles) ranging is size from 30" diameter down to 12" diameter. This main will originate in the Dix Hills area and connect to the Northport, East Northport, and Huntington areas, all of which have wells with elevated Nitrate levels. A map showing the route of this proposed transmission main is shown in Figure 1. This main is designed to transmit 12,000 gpm, and will cost an estimated $20.5 million, or $1.22 million per mile. The second transmission main project that has been investigated by the SCWA is a water main that connects the Greenport and Orient areas. It consists of over 17,000 ft. (3.36 miles) of 12" diameter pipe. The route of this proposed main is shown in Figure 2. With a design flow of 500 gpm, its estimated cost is approximately $3.84

million, or approximately $1.14 million per mile. There is remarkably good agreement in price between the two project estimates, despite the fact that they are quite different in terms of quantity of water, size, and length. For purposes of this Task, the figure of $1.5 million per mile will be used when considering the cost of new transmission mains.

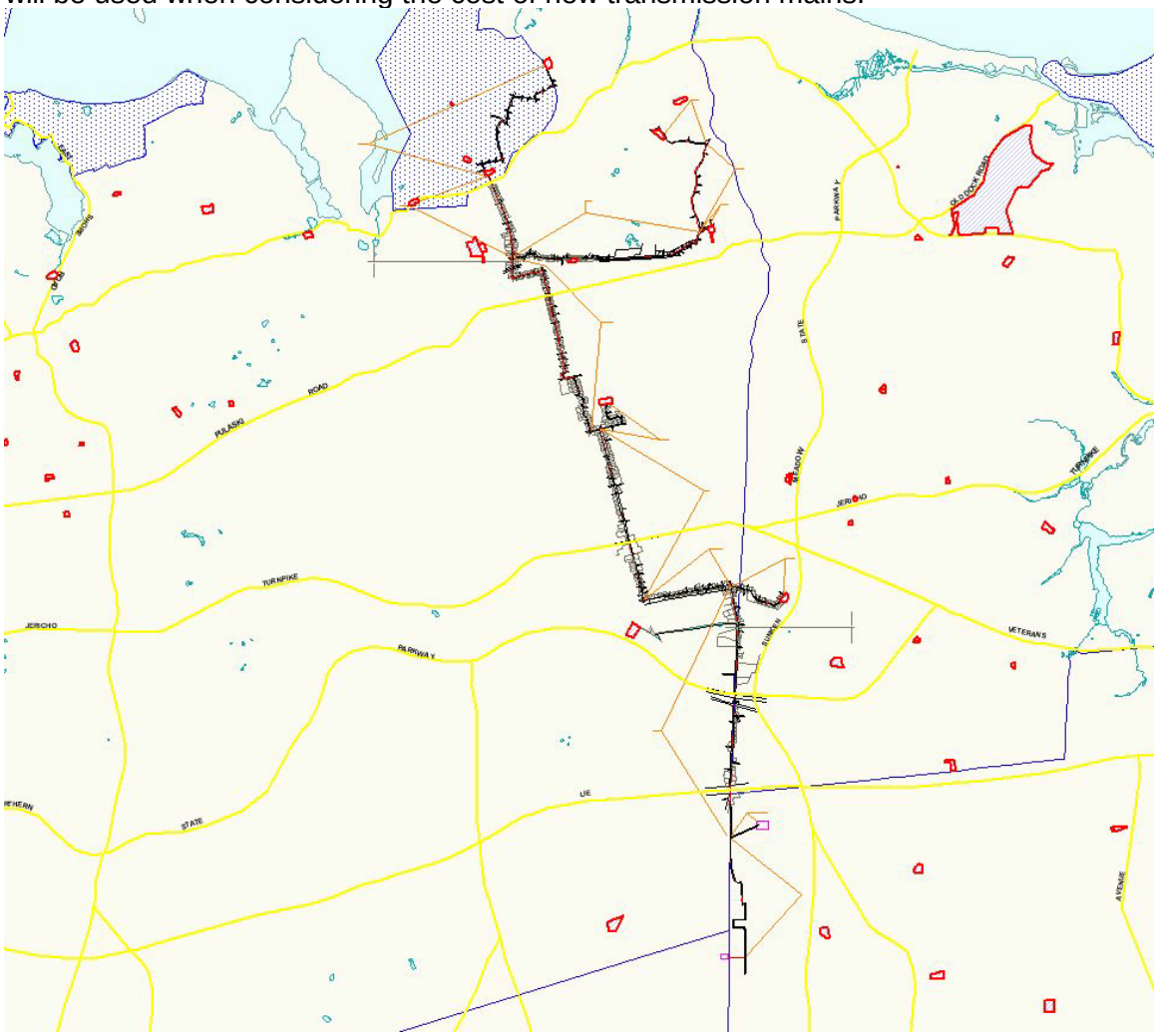

Figure 1: Proposed Northport Transmission Main

POTENTIAL PINE BARRENS WELL SITES AND CONSIDERATIONS

Currently, the SCWA owns a total of 33 properties located within the Pine Barrens Core Preservation and Compatible Growth Areas. Eighteen of these parcels contain one or more public supply wells (there are 40 wells in total within the Pine Barrens). Additionally, SCWA has access to an additional 24 pine barrens properties belonging to Suffolk County via an agreement forged between the two agencies in early 2010. A map showing the locations of these properties is shown in Figure 3. It is important to realize, however, that not all of these properties – even those that already have wells on them – can be utilized as future well fields, due to a variety of factors.

Development of numerous parcels may be stifled because of potential impacts to wetlands. The proximity to wetlands may make physically locating facilities on the site difficult to impossible, given the distance setbacks required. More importantly from a hydrogeology perspective may be the impacts of future pumping on water levels in nearby wetlands.

Figure 2: Proposed Orient Transmission Main

The NYSDEC Bureau of Habitat (BOH) oversees the regulation of wetlands, and participates in the permitting process for any action that may involve wetland impacts. If the pumping of one or more wells on a well field might have any calculated impact on a wetland, the applicant is required to address this impact during the application process. The DEC may either deny a permit all together, or may issue a conditional permit restricting the applicant's activities somewhat.

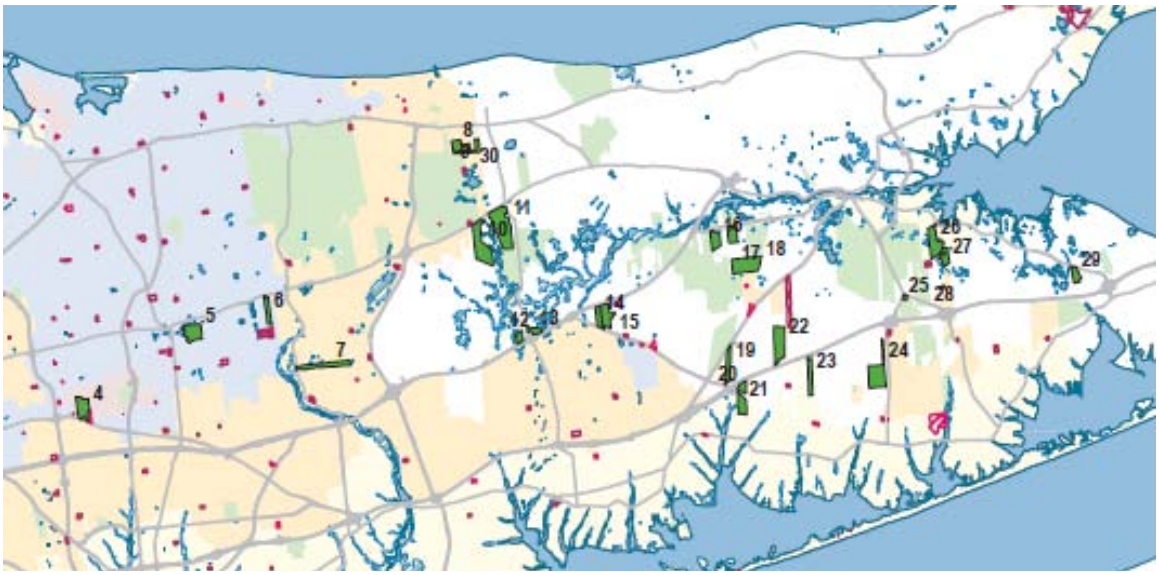

Figure 3: SCWA easements on Suffolk County properties

Calculated impacts on the order of 0.01 feet have often times been addressed by the NYSDEC and have required the permittee to operate under some type of restriction. In the case of the SCWA, these restrictions have included limitations of the number of hours per day a well can be pumped, and/or the requirement to monitor water levels in a nearby wetland and coordinate pumpage with water levels. The restrictions routinely imposed by the NYSDEC have the potential to severely limit a given parcel's ability to be used for water supply.

The most important factor influencing the suitability of any potential site to be a well field is the subsurface water quality. Before any vacant parcel can be considered by the SCWA as a potential well field, the subsurface geology and water quality must first be examined via a deep test boring. The procedure for the construction of such a test boring generally consists of the following e. A borehole is drilled to an approximate depth of 800 ft. below grade. Site-specific conditions will determine the exact depth drilled. Split spoon core samples are taken while drilling at ten-to twenty-foot increments starting at approximately 50 ft. below the water table and continuing to the bottom of the borehole. These cored samples are studied for their water bearing potential, and a grain sized distribution analysis is performed for each core that appears to be in a water bearing stratum. After drilling and coring are completed, geophysical logs are performed within the open borehole. Consisting of a gamma radiation and a formation resistivity survey, these geophysical logs help to determine the relative permeability of each formation penetrated, and assist the geologist in determining the best aquifer sections to test pump.

The above geologic information is used to determine the aquifer sections that will be test pumped for water quality analyses. Each section is screened and gravel packed with a test screen assembly lowered into the borehole, and test pumped. Depending on the subsurface geology at each site, as many as five aquifer sections can be test pumped for a particular test boring. The water samples are then analyzed by the SCWA's state certified laboratory. Each zone is typically test pumped for approximately 40 hours for all New York State and USEPA drinking water parameters. The combination of the water quality data and the geologic and geophysical data will then determine the suitability of a particular parcel for future development as a SCWA well field.

Not all parcels, even some parcels located within the pine barrens area, have sufficiently good water quality to ultimately be developed as a well field. Despite the relative lack of anthropogenic contamination in the region, there are some sites that are in close enough proximity to contamination sources that they have been negatively affected. Such contamination sources include golf courses, farms, and mines. For example, the SCWA's County Road 111 well no. 2 has recently been impacted by low levels of VOCs. In addition, naturally high levels of iron and manganese could also serve to limit the future development of a given parcel. This has already happened at several pine barrens properties owned by SCWA. In particular, SCWA properties located on Longwood Road, Sally Lane, and Bridgewater Drive (all of which are located in Ridge) and Clancy Road (Manorville) have exhibited elevated iron levels when test pumped and so are not considered to be feasible for future development. Another pine barrens parcel, Country Club Drive in Manorville, has been a SCWA well field for over 30 years and has three upper glacial wells. The SCWA had considered putting additional Magothy wells on this site, but a deep test boring showed elevated iron and manganese in the deeper Magothy aquifer, and elevated nitrate and perchlorate in the shallow Magothy aquifer. No additional glacial wells are planned for this well field, in part due to nearby upgradient contamination threats. It is not known how many potential well sites in the pine barrens will contain water of insufficient quality. The possibility always exists that, despite their remote locations, some potential well fields will not be developable.

PIPELINE ROUTING CONSIDERATIONS

Numerous factors go into the decision on the exact route of a transmission main. Construction-related factors include the road opening permits that may be required from different municipalities and the resulting necessary restoration, the proximity to wetlands and the mitigation that will be required, the depth to groundwater and any dewatering that may be necessary during construction (including the discharge and/or disposal of the pumped water), and the requirements for jacking or horizontal directional drilling for long underground crossings of creeks or highways. Overall planning related factors influencing the route include elevation changes and the number and severity of any bends in the pipeline, both of which dictate head losses along the route of the pipeline and the possible requirement for booster pumps. All of these factors add to the expense of the overall project to a degree indeterminate at this time. For purposes of this report, the shortest road distance between the origin and the terminus of the pipeline, using existing road map software, was chosen. The objective of this report is to generate a rough, “ball park” estimate of the routes and distances involved in this undertaking. Numerous alternative routes are possible, and may be preferred if and when these projects are ultimately constructed.

NORTH FORK TRANSMISSION MAIN – SCENARIO #1

The schematic route chosen for the transmission main serving the north fork begins at the Brookhaven/Southampton border along County Route 51 (Moriches-Riverhead Rd.), which is close to the existing SCWA Moriches Riverhead Rd. well field. From that point it runs northeastward into downtown Riverhead, across the Peconic River and follows Northville Turnpike to its terminus at Sound Avenue. From there the proposed main will run eastward along Sound Ave. and then along Main Road (C.R. 48) into East Marion, where it will connect with the proposed Orient Water Main. The total length of this route is approximately 32 miles. Using the previously-mentioned figure of $1.5 million per mile, this main would cost approx. $48 million to construct.

The volume of water supplied by this main has been calculated in previous Tasks based on future build out and the 5 hr. peak demand that would result. The worst case scenario uses the saturation population based on figures provided by the Suffolk County Department of Planning, and the historic peak demand figures provided by the SCWA for existing water supply systems on the north fork. Based on these data, an additional 4500 gpm would be needed to supplement the water supply on the north fork. The typical public supply well constructed on the north fork has a capacity of approximately 150 gpm. Therefore, meeting this projected peak demand with wells located on the north fork would require the construction of 30 additional wells. Given the water quality and quantity issues inherent in supplying water to this area, it is doubtful that this could be accomplished.

A second set of calculations was done using a more conservative figure for population to be served. The 2035 population scenario, also based on data supplied by the Suffolk County Department of Planning, the future peak demand would require an additional 2600 gpm. Supplying this quantity of water would require the construction of approximately 18 new wells. Similar to the above scenario, it is unlikely that this could be accomplished, given the quality and quantity considerations.

COST CONSIDERATIONS

In order to predict the cost of constructing these wells to meet future demands under the two above-mentioned scenarios, the latest well construction projects undertaken by the SCWA were examined. The SCWA recently constructed three 100 gpm replacement wells at its Sunset Drive

well field in Mattituck. The total cost of the project was approximately $400,000. At the SCWA's Sound Ave. well field in Jamesport, two additional 500 gpm capacity wells were recently constructed for a total of approximately $460,000. Given these figures and factoring in some degree of increase in the near future, we can estimate the future cost of a north fork well of appropriate design to be $250,000. This should be construed as the absolute minimum cost for future wells. Given that these wells were located at an existing fully operational well field, minimal additional structures and appurtenances were required. Should upgrades to an electric service, additional piping or treatment facilities be required, the cost would increase substantially. Any new new well fields that may be required would cost from $1.5 million to $2 million. Therefore, given the above-described scenarios, construction of wells on the north fork to satisfy future demand would cost a minimum of $4.5 million (for 18 new wells) to $7.5 million (30 new wells). Three to four new well fields would increase the cost by $4.5 to $6 million. However, as previously stated, quantity and quality issues on the north fork will prevent either of these two scenarios from happening.

The use of a transmission main from the Pine Barrens, would also require the construction of additional wells. Fortunately, wells in the main part of Suffolk can be constructed for a much higher capacity, typically 1300 gpm. With this in mind, the water demand on the north fork could be satisfied with 2 to 4 wells constructed on the main body of Suffolk in conjunction with the proposed transmission main. The latest SCWA well constructed in the pine barrens area was C.R. 111 well no. 3. This well had a capacity of 1,300 gpm and cost just under $500,000. Therefore, satisfying the north fork peak demand would require, in addition to the previously mentioned $48 million transmission main, approximately $1 million to $2 million for new wells, for a total of approximately $50 million.

NORTH FORK SCENARIO #2: RIVERHEAD TRANSMISSION MAIN

In an effort to avoid the high cost of a long distance transmission main from the pine barrens, an alternative of shorter distance transmission from east-central Riverhead was also examined. It is well documented that contaminant free, low chloride water is available in the shallower portion of the Magothy aquifer west of the Riverhead-Southold Town line. The SCWA has drilled test borings at the Hallockville Farm in Jamesport and at the Riverhead Fire District property in Northville. Both sites showed excellent quality water in the interval from 250 to 350 ft. below grade. Subsequent to those test borings, the SCWA has constructed four shallow Magothy production wells at its Sound Ave. well field in Jamesport, and water quality in all of those wells is excellent. Yields are better than on the north fork as well – all wells are capable of pumping at 500 gpm, though all have been put into service at 250 gpm as a safeguard against water quality degradation. They will be upgraded to 500 gpm as their operational history is tracked and they are deemed capable of providing the additional water with no degradation of the resource.

In this scenario, a transmission main could be run from the Riverhead/Southold town line, westward to Northville Turnpike, and then southward along Northville Turnpike, terminating in the vicinity of Doctor's Path. Several well sites could be utilized along this route, and the raw water could be treated at the existing Sound Ave. pump station. This would avoid the need to construct additional pump stations along the pipeline route. The construction of a pipeline approximately 5 miles in length along the above-described route would cost approximately $7.5 million. The construction of 5 new wells to supply the additional peak demand forcasted would cost approximately $2.5 million. The total project cost would be approximately $10 million, which is far less than the cost of supplying water from the pine barrens.

SCENARIO #3: NORTHPORT TRANSMISSION MAIN

The schematic route chosen for a pipeline to serve the Northport area from the Pine Barrens begins at exit 70 of the Long Island Expressway, close to the existing SCWA C.R. 111 well field. This proposed pipeline will run along the Expressway to Exit 52, where it will intersect with the previously-mentioned proposed Northport transmission main. The distance covered between Exits 70 and 52 is approximately 28 miles, for an approximate cost of $42 million. The exact number of wells that would be needed, as well as the ultimate quantity of water, is difficult to ascertain. There are numerous wells in the Northport area that have elevated levels of Nitrate, but only __ at close to or over the NYS drinking water standard of 10 mg/L. However, it is known that continued pumping of these impacted wells will most likely result in some further degradation in water quality. In addition, wells impacted by nitrates are usually only used heavily during the peak demand periods. As a result, these wells may be idle for more time than they are pumping. As an example, the rated capacity of the nitrate-impacted wells in the Northport area is 12,000 gpm. During a recent peak day, they were pumped at just over 7,000 gpm, but pumped less than 1,000 gpm when averaged over the entire year. When a large diameter transmission main is installed, the water must be allowed to flow through it at its design capacity on a continuous basis. Water that is left to stagnate in the main often presents taste and odor problems. For this reason, it is assumed that any long distance transmission main would be appropriately designed to carry the majority of the capacity of the Northport area wells.

For purposes of this Task, the entire capacity of the nitrate-impacted wells in Northport will be replaced by water from the pine barrens. Given that the average capacity of a well in the main part of Suffolk is 1,300 gpm, this transmission main would require approximately 9 new wells, for an approximate additional cost of $4.5 million. It is safe to assume that not all of these wells could be accommodated on existing SCWA well fields. Assuming that 2 to 3 new pump stations would be required, approximately $5 million would need to be added to the costs. Therefore the rough estimate for the total cost of supplying 12,000 gpm to Northport from the pine barrens is approximately $51.5 million.

OTHER CONSIDERATIONS

Any lengthy transmission mains from the pine barrens as described in the first and third scenarios above would also require the use of booster pumps. This is due to the elevation changes along the route and the friction losses resulting from water flowing through a pipe. For example, based on the Hazen and Williams formula, 3,000 gpm flowing through a 24” diameter pipe will experience a head loss of 1 foot per thousand linear feet of pipe. Over the course of a 28 mile (148,000 feet) long pipeline, head loss will total 148 feet. In addition to friction losses, changes in elevation along the route would also add operational complexity to any of the above described scenarios. A quick check of the USGS quad maps reveal that the land surface elevation at exit 70 of the Long Island Expressway is approximately +50 msl. At the Carman’s River crossing (Exit 67), the elevation falls to approximately +35 msl, while at Exit 52, the proposed terminus of the Northport transmission main, the elevation is approx. +120 msl. Therefore, in order to recover the head loss due to friction, and provide water at the proper pressure and at the proper elevation, several booster pumps will undoubtedly be required. Acquiring land for booster pumps, as well as the cost of electricity to operate the pumps will add substantially to the cost of the first and third scenarios described above. The actual costs associated with the use of booster pumps is beyond the scope of this inquiry.

In most unsewered sections of Suffolk County, the vast majority (approximately 85%) of groundwater pumped is eventually returned to the aquifer system through cesspools and septic systems. Even in sewered areas that have their discharges in inland locations, most public supply pumpage is returned to the groundwater system. In the scenarios described above,

virtually all of the public supply pumpage would be considered consumptive. Since all the water will be used and recharged a substantial distance from its source, it will be permanently lost from the groundwater system in the area from which it is pumped. This could result in the long term lowering of the water table and of coastal plain ponds and wetlands within the Pine Barrens. The impacts of this hydrologic imbalance will need to be investigated to see if they meet permit criteria. The Suffolk County Groundwater Model is an excellent tool for investigating and quantifying such impacts. Some mitigating measures would undoubtedly be necessary to prevent quantity impacts to surface waters and wetlands. The NYSDEC would be in the best position to comment on the feasibility of, and mitigations required for a project of this size and scope.

CONCLUSION

Among the numerous water supply alternatives considered on Long Island, transmission from centralized pumping centers to outlying distant areas has only recently come to the forefront, largely in response to regional nitrate contamination. Other contaminants (such as VOCs), have been treated locally in a cost effective manner by conventional means, rendering the consideration of alternatives unnecessary for areas so affected. Two regions of Suffolk County that have nitrate contamination were examined for the feasibility of water transmission: Northport and the north fork. The north fork is an area that is also predicted to need additional sources of water in the future due to projected population increases. Using information from previous work, the estimated cost of constructing the transmission mains and additional wells needed to transmit water from the Central Pine Barrens region to Northport and to the north fork was calculated. In order to simplify the calculations, pipeline routes were assumed to be coincident with major road rights-of way. Distances from the Pine Barrens area to both impacted locations were between 28 and 30 miles.

The facilities construction costs for both these prospective projects was calculated at approximately $50 million. Additional associated costs, including the need for booster pumps, will add significantly to this total. A more cost-effective alternative exists for the north fork, which involves shorter distance (5 miles) transmission from east-central Riverhead. The construction costs for this alternative is approximately $10 million. In addition to costs, hydrologic impacts will also need to be assessed. The consumptive pumping of large volumes of water from one region may have ramifications for water levels in surface water bodies and wetlands in the vicinity of the sources of pumpage. The permitting implications, and the degree to which any impacts will need to be mitigated, will need to be addressed before any construction can begin.