

ENGINEERING REPORT

EVALUATION OF THE MUNSEY PARK ELEVATED WATER STORAGE TANK

Manhasset Lakeville Water District
Town of North Hempstead
Nassau County, New York

H2M Project No.
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water

MANHASSETT-LAKEVILLE WATER DISTRICT
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0.0 EXECUTIVE SUMMARY

The 85 year old Munsey Park elevated water storage tank has reached the end of its useful life. Persistent and extensive corrosion have comprised the sanitary and structural integrity of the tank that now requires frequent monitoring and interim emergency repairs. Furthermore based on the age of the structure, the existing tank does not conform with current state building code standards related to hurricane wind and seismic load conditions.

To proactively maintain reliable water service to the community, replacement of the structure is required at this time. The 500,000 gallon steel structure is a critical water supply asset that provides water to meet peak summer and fire flow demand. Failure to have the tank available would result in the loss of vital fire protection. Furthermore deficits under peak water demand conditions could result in negative pressures in the distribution system. This could subsequently result in contamination of the public water supply system.

Based on current water needs of the community and importance to meet peak and fire flow demands, a slight increase in storage capacity from 500,000 to 750,000 gallons has been recommended. The proliferation of residential automatic lawn irrigation systems over the past two decades has significantly increased maximum day and peak hour water demand and stress on water district infrastructure. A new tank with additional capacity at the site would maintain pressures for a longer period of time during the District's peaks and also supply additional capacity for fire reserve.

The report recommends that the District construct a new elevated tank with a slightly larger capacity to replace the existing storage structure. A replacement elevated single pedestal water spheroid tank is determined to be more aesthetically appealing when compared to other elevated water storage options. In addition a 750,000 gallon spheroid design provides high reliability and the lowest capital and life cycle costs when compared to other tank types.



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1.0 GENERAL

1.1 SCOPE AND PURPOSE

The results of the most recent bi-annual inspection of the Munsey Park elevated water storage tank recommended that the structure undergo major rehabilitation or be replaced within the next one to two years. Persistent and extensive corrosion has comprised the sanitary integrity of the tank, which now requires frequent monitoring and interim emergency repairs. The tank, originally constructed during 1929 is approaching the end of its useful life. Based on the age of the structure, the design of the existing tank does not conform with current state building code standards related to hurricane wind and seismic load conditions.

This report will evaluate assess options for replacement of the existing water storage structure including rehabilitation. A review of the various types of storage tanks and the advantages and disadvantages of each will also be conducted. Since the community has grown and water demands have increased substantially since construction of the existing tank over 85 years ago, this report will also evaluate the need and capacity required for storage based on District demands. The August 2013 report provided the preliminary design and cost opinion to implement the recommended plan. Since August 2013, the Water District better defined the project scope. Accordingly, this update will provide additional information related to the project that will include detailed design attributes of the tank and an updated cost opinion.

It should be noted that New York State Public Health Law, Section 225, Part 5, Subpart 5- Public Water Systems requires public water purveyors to undertake specific actions when any modification, addition or deletion of a public water system is to be made. More specifically, the following provisions of the law apply:

Section 5-1.22 - Approval of plans and completed works

§5.-1.22 Approval of plans and completed works. (a) No supplier of water shall make, install or construct, or allow to be made, installed or constructed, a public water system or any addition or deletion to or modification of a public water system until the plans and specifications have been

submitted to and approved by the State. Materials used in the design, construction and repair of a public water system shall be lead-free. For this Subpart, lead-free shall mean solder or flux which contains no more than 0.2 percent lead and pipes, pipe fittings or any appurtenances which contain no more than eight percent lead.

(b) Approval of plans and specifications for public water systems shall be based on the following standards in their entirety. The State may allow deviations from these standards in accordance with procedures established by the commissioner.

(1) "Recommended Standards for Water Works", (Appendix 5-A)

(2) Standards for Water Wells (Appendix 5-B)

(3) Special Requirements for Wells Serving Public Water Systems (Appendix 5-D)

(c) The State may approve such plans or may require such modification which is deemed necessary to protect public health or safety. Application for plan approval shall be made on a form prescribed by the department.

(d) A supplier of water shall receive the approval of the State before placing into service any public water system constructed under the requirements of this section.

The requirements for system capacity, since most water systems have storage facilities, are outlined in the 2012 Recommended Standards for Water Works under FINISHED WATER STORAGE, paragraph 7.0.1 – Sizing. Water systems without storage facilities must also meet these requirements by providing the capacity normally supplied by storage, via other means such as additional well capacity or supply from an alternate source. Paragraph 7.0.1 – Sizing, reads as follows:

7.0.1 Sizing

Storage facilities should have sufficient capacity, as determined from engineering studies, to meet domestic demands, and where fire protection is provided, fire flow demands.

a. The minimum storage capacity (or equivalent capacity) for systems not providing fire protection shall be equal to the average daily consumption. This requirement may be reduced when the source and treatment facilities have sufficient capacity with standby power to supplement peak demands of the system.



- b. *Excessive storage capacity should be avoided to prevent potential water quality deterioration problems.*

- c. *Fire flow requirements established by the appropriate state Insurance Services Office should be satisfied where fire protection is provided.*

The authorization of this study based on the proactive actions of the Board of Commissioners conforms to the applicable provisions of the New York State Public Health Law.

2.0 EXISTING WATER SUPPLY SYSTEM

2.1 WATER SUPPLY SYSTEM DESCRIPTION

2.1.1 SERVICE AREA

Geographically, the Manhasset-Lakeville Water District (District) is located in the northwestern section of the Town of North Hempstead. The Town is in the northwest portion of the County of Nassau. Figure 2-1 indicates the District's service area within the Town of North Hempstead.

Adjacent water suppliers to the District are: the Port Washington Water District to the north; Roslyn Water District and Albertson Water District to the east; Garden City Park Water District and the Water Authority of Western Nassau County to the south; New York City to the west; and the Water Authority of Great Neck North to the northwest. The Village of Plandome Water system lies entirely within the northern section of the District.

The District services the following communities: the Village of Thomaston, the Village of Munsey Park, the Village of Lake Success, the Village of Plandome Manor (partial), the Village of North Hills, the Village of Russell Gardens, the Village of Plandome Heights, the Village of Flower Hill (partial), Village of Great Neck Plaza (partial), the unincorporated areas of Great Neck, University Gardens, Manhasset, a portion of Manhasset Hills and a portion of North New Hyde Park.

The District maintains water supply and purchase agreements with the Port Washington Water District and the Morewood Public Facility. The Morewood facility is a Town of North Hempstead owned park property in the Port Washington Water District. A 1997 agreement requires the District to provide, up to 35 MG/year to Port Washington, for 20 years, which will be delivered through Port Washington's system to Morewood. The District is also under contract to supply water to the Village of Plandome Water Supply system.

2.1.2 GENERAL DESCRIPTION AND INFORMATION

The Manhasset-Lakeville Water District was created on May 23, 1911, as a special improvement District of the Town of North Hempstead, under Town Law of the State of New York. The Town approves the District's budget, collects the Real Property taxes, maintains the District's debt service and approves all

long-term debt. The District operates pursuant to Town Law, the Local Finance Law and other general laws of the State of New York.

The decision making authority of the District is vested in the Board of Commissioners. There are three (3) members of the Board, each of whom is elected for a term of three (3) years. The Chairman serves as Chief Executive Officer, the Treasurer serves as Chief Financial Officer and the Secretary serves as Chief Administration Officer. All governmental activities and functions performed by the District are the direct responsibility of the Board of Commissioners.

The Town Board of the Town of North Hempstead approves the annual budget prepared by the District and must authorize any District bonding.

The District presently supplies water to a service area of 10.2 square miles. At present, except for the inclusion of the Village of Plandome system, there are no major areas adjacent to the District that would warrant consideration for a future District extension. All services are metered.

2.1.3 DISTRICT POPULATION

The present population of the District is currently estimated to be 43,000 persons including residents in several apartment house complexes; and is distributed throughout most of the service area. The southwestern portion of the District is comprised of major office and industrial facilities and the North Shore University Hospital Complex. The hospital has a total daily population of over 3,000 persons, including patients, staff and visitors. This number is not included in the District population. Except for large commercial shopping strips along the major roads, the balance of the District is residential in nature. The population is, generally, evenly spread throughout these residential neighborhoods. The only major undeveloped property within the District is the Whitney Estate. The Whitney Estate, commonly known as "Greentree", although intended to remain intact, if developed at the present zoning, could add 300 more residents to the District.

Based upon the current zoning, it is anticipated the ultimate population of the District will be 45,600 people by 2021.

2.1.4 ZONING

The District is comprised of several Villages and unincorporated areas of the Town of North Hempstead, with each Village and the Town establishing their own zoning classifications.

Permitted zoning, depending upon the jurisdiction, includes single family dwellings, multiple residences, public housing, apartments, planned unit development, business/commercial, light industrial, medium industrial, hospital, municipal, parking and open space uses.

Residential zoning lot sizes vary from five (5) acres down to 2,000 square feet. The predominant residential zoning within the District is one-third to one acre. The Whitney Estate property, of approximately 415 acres, is currently zoned for five (5) acre residential. The Whitney Estate has been classified by the Town of North Hempstead as a special groundwater protection area (SGPA) and is in the Town's Aquifer Protection Overlay Zoning District. As such, development of the area must meet strict zoning requirements, including water use, vegetation types, sanitary waste treatment/disposal and pesticide use limitations.

2.1.5 TOPOGRAPHY

The topography of the District can generally be classified as hilly. The terrain varies from elevation 0 feet at Manhasset Bay to a high elevation of 306 feet above mean sea level (MSL) within the area known as Stone Hill (north of the North Hills Country Club).

2.1.6 WELL FACILITIES

Currently, all water supplies for the District are obtained from 18 wells located at 13 of the District's plant sites scattered throughout the service area.

The District has, over the years, abandoned a few wells because of either limited capacity, deteriorated quality or the loss of a secure well field. The suction field wells at East Shore Road, the original wells at the Valley Station (NYSDEC Well No. N-01618) and Lakeville Road (N-1802) have been abandoned and filled in accordance with New York State Department of Environmental Conservation (NYSDEC) and American Water Works Association (AWWA) guidelines and recommendations. New wells have been re-drilled at Valley Road (N-12802) and Lakeville Road (N11139) and a new well at I.U. Willets (N-13704) has been added.

The 18 wells have a combined NYSDEC approved pumping capacity of 22,980 gpm, or the equivalent of 33.09 million gallons per day (MGD). However, at present, due to various restrictions, the wells can produce a maximum of 26.25 MGD. The location and description of the existing wells are summarized in Tables 2-1 and 2-1A. All of the wells are equipped with flow meters and flow recorders. Disinfection by chlorination is provided at each well. Each well also has caustic soda (sodium hydroxide) feed equipment and pH monitoring stations for pH adjustment as a method to control corrosion of metallic piping systems. Additional treatment for volatile organic contamination is provided at most wells.

2.1.7 STORAGE FACILITIES

The District owns and operates two (2) elevated steel storage tanks, Thomaston and Munsey Park, and two (2) concrete ground storage tanks at the Searingtown plant. The total storage capacity of all tanks is 5.5 million gallons. The tanks are in generally fair to good condition. The location and description of the existing storage facilities are summarized in Tables 2-2. In addition, the District has two ground storage tanks at the Campbell and Parkway plant sites which are not currently utilized by due to operational and sanitary reasons, as well as the high cost to upgrade.

2.1.8 INTERZONE FACILITIES

Since the ground elevations within the District vary between 0 and 306 feet above mean sea level (MSL). The upper floors of some buildings within the District may be located at an elevation above 306 feet. Due to the rather wide range of ground elevations across the District, along with the necessity to maintain reasonable static water pressures, the District operates with two distinct pressure zones. The area of higher elevation is designated as the high pressure zone service area. This area is located in the east-central portion of the District. The lower elevation levels are located in the low pressure zone service area.

The 200± foot land contour, above MSL, was determined to be the desired boundary between the two pressure zones. Local variations of this boundary are necessary due to street configurations. The Campbell Wells are contained within the high pressure zone, and are dedicated to use in this zone during the summer.

Water supply and pressure is currently maintained in the high pressure zone by the use of three (3) booster pumps located at the Searingtown Road and Campbell pump stations, in addition to the Campbell

wells. The two (2) pressure zones are isolated by check valves located in the distribution system at the high zone boundary. These valves presently prevent the high zone water from flowing into the low pressure zone. Pressure is maintained in the balance of the system by the Thomaston and Munsey Park elevated tanks.

2.1.9 DISTRIBUTION SYSTEM

The District distribution system consists of 169.8 miles of water main of varying sizes from 2" to 24" diameter. A copy of the distribution map is enclosed as Figure 2-2.

The linear footage of water main by size and number of valves are indicated in Table 2-3. The District owns and maintains 1,428 fire hydrants.

2.1.10 INTERCONNECTIONS

The District maintains 11 interconnections with adjacent water suppliers for use during emergencies as listed on Table 2-4. Two interconnections are with the Port Washington Water District. A 6" interconnection is located at Stonytown Road, east of Rockwood Road. A 12" interconnection is located at Plandome Road, north of Luquer Road. Four of the interconnections are with the Village of Plandome Water Service. A 6" interconnection is at Parkwoods Road east of Rockwood Road. A 6" interconnection is located on the west end of Walter Lane. A 6" interconnection is located on Parkwoods Road at Pinewood Road. An 8" interconnection is located on Plandome Road at West Gate Boulevard. Two interconnections are with the Water Authority of Great Neck North. A 12" interconnection is located at East Shore Road north of the Long Island Railroad Right-Of-Way. A 6" interconnection is located on Great Neck Road at Brompton Road. One interconnection is with the Albertson Water District. An 8" interconnection is located on the North Service Road of the Long Island Expressway (LIE), east of Searingtown Road. One interconnection is with the Garden City Park Water District. A 6" interconnection is at the east end of Executive Drive. One interconnection is with the Water Authority of Western Nassau. An 8" interconnection is on Lakeville Road at Fairfield Lane.

The hydraulic gradients for each interconnection are compatible. The interconnections with the Village of Plandome are always open and continuously metered since the District supplies the Village with water on a daily basis. The other interconnections remain closed, except those with Port Washington Water District, which are periodically opened on an as-needed basis, as per the water supply agreement between the two Districts.

2.1.11 PUMPAGE

As shown in Table 2-5, the District has pumped an average of 2,456 MG a year for the last 20 years; with an average daily consumption per capita over the same period of 158 GPD; and a historical maximum daily consumption of 422 GPD per capita. The total average day demand over the past 20 years is 6.8 MGD. The historical high peak day demand was in 1999 and was 18.0 MGD.

Modest increases will be associated with small population and moderate water demand growth trends, particularly in the District's affluent communities. These communities have intense landscaping, greater domestic use of appliances – bathtubs, showers, personal hygiene devices, sinks, dishwashers, washing machines, swimming pools, hot tubs, etc., and the continuing installation of automatic lawn and garden irrigation systems.

The analysis does not take into account any advances in future efficiencies that may be developed for these appliances or compliance with stricter local conservation measures.

The District has consistently maintained pumpage well below the five (5) year running average pumpage cap of 2,600 MG and has not come close to the maximum NYSDEC annual pumpage cap of 2,851 MG. It is not anticipated that this maximum annual cap will be exceeded in the next 15 years, unless significant development occurs within the District causing a dramatic increase in water demand.

The District will continue to implement water conservation measures to foster conservation.

3.0 PROJECT LOCATION AND EXISTING FACILITIES AT THE MUNSEY PARK SITE

The Munsey Park pump station is located in the northeastern corner of the District on the west side of Dogwood Lane south of Mason Drive and north of Manhasset Woods Road in the Village of Munsey Park (Figure 3-1). The site is completely surrounded by residential properties. Average ground elevation of this plant is about 205 feet above mean sea level when compared to the general topography within the District is deemed to be optimal for located an elevated water structure. The ground elevation drops off about fifteen feet from the tank foundation elevation to the southwest corner of the property.

Well No. 8 (N-03523) was constructed during 1955 and is located on the south side of the site. Degrading groundwater quality condition required the construction of a GAC treatment filter system in 1995 to treat the well. During 2005 the well was removed from service due to elevated levels of nitrates and has been held in reserve since. The District does not have any plans to re-activate the supply well at this time based on current water quality conditions.

The Munsey Park tank was constructed in 1929 to provide critical gravity water storage. This facility is directly and strategically connected to the distribution system. The tank is an old style 500,000 gallon riveted steel multi-legged elevated tank with a hemispherical bottom and conical roof commonly referred to as a Witch's Hat. The tank has a height from ground to overflow of 151 feet. The tank is 49 feet in diameter with a side shell height of 32 feet. The overall depth of water in the tank from the bottom of the bowl to the overflow is 47 feet. The tank has a balcony approximately 120 feet above the ground. The tank has nine I-beam column legs which are each supported on an individual concrete foundation.

The tank was last rehabilitated during 1998. A recent inspection of the structure conducted during January 2014 recommends that the tank be scheduled for rehabilitation or replacement within the next 1 to 2 years. There is a specific concern with respect to the corrosion and penetrations observed at the interior roof and sidewall interface. In addition deterioration of approximately 30 percent of the roof rivets was observed. During 2013 temporary emergency repairs were made to the roof to seal penetrations caused by corrosion and deterioration of the rivets. This emergency action was required to prevent potential contamination of the water stored in the tank. During 2012, replacement of the tank anchor bolts was required due to excessive corrosion. Persistent and extensive corrosion have comprised the sanitary and structural integrity of the tank that now requires frequent monitoring and interim emergency repairs.

4.0 CURRENT OPERATION

4.1 SYSTEM CAPACITY

An important factor in analyzing the District's needs is the determination of the storage capacity required to supplement the available well capacity necessary to supply the variable peak hourly demands on the maximum day. The significant increase in the installation of residential automatic lawn irrigation over the past 20 years has resulted in a notable increase in warm weather water use. This translates into increased maximum day and peak hour demand which place additional stress on the water system. During peak use periods, there are many continuous hours where the rate of consumption exceeds the average well supply rate. The additional capacity needed to satisfy the peak hourly use must be supplied from storage facilities or from excess well capacity above the average. Conversely, during the hours that the well supply exceeds the rate of consumption, the excess well supply pumping rate replenishes or fills the storage tanks. The minimum required storage is generally referred to as "balancing" or "operating" storage. To this minimum amount of storage, should be added the amount that is needed for a pump control range and for an emergency fire reserve.

Storage can be provided by any combination of elevated tanks, standpipes, ground storage tanks or reservoirs with or without booster pumps, and by excess wells pumping from the groundwater reservoir. The District presently utilizes a combination of existing elevated tank facilities, ground storage tanks with booster pumps together with additional supply wells, to provide the necessary operating storage plus a small reserve.

One conservative planning approach is to assume that all of the existing storage is needed to provide a range of pump control plus a fire reserve. In this case, the available well capacity required would be equal to the maximum hourly demand rate, or something approaching it. For example, the rate which would be the average of the two adjoining peak hours of demand should be analyzed. For the peak day in 2010 (July 7), the peak hourly rate was approximately 18,883 gpm or 27.2 million gallons per day (MGD). Table 4-1 summarizes the demand on the system on July 7, 2010. This compares to total system capacity (supply well plus storage) of 28.9 MGD that yields a modest surplus of 1.7 MGD. However the loss of a large 2.02 MDG supply well would drop total system capacity to 26.7 MDG thus creating a slight deficit of 0.3 MGD.

The potential 0.3 MGD deficit, it is not significant enough to warrant construction of an additional tank. However, should the Munsey Park tank be replaced, it would be prudent to look at a slightly larger tank to eliminate this deficit and provide much needed redundancy to offset potential lost well capacity.

4.2 STORAGE CAPACITY

The existing available storage capacity of the District supplied by elevated and ground storage tanks is 5,500,000 gallons, or 40 percent of the historical maximum daily demand. This storage capacity exceeds the typical design criteria of approximately 20 to 25 percent of maximum day demand. However, only 1,500,000 gallons is elevated storage.

Another method for determining storage capacity is to compare the storage to the average daily demand. The storage capacity of a District is considered adequate if it meets the total of three types of storage, equalization, fire reserve and emergency reserve.

Equalization or operating storage can be considered adequate if it equals 15 percent of the average daily demand. The required equalizing storage for the Water District equal to 15 percent of the design average day demand of 6.73 million gallons, is 1,009,500 gallons.

The storage requirement for fire reserve for the Water District is based upon providing a fire flow of 3,500 gallons per minute for a four-hour period. The fire reserve storage requirement for the Water District calculates to be 840,000 gallons.

A value of 15 to 25 percent of the average daily demand is used for the amount of storage required for emergency reserve for the Water District; the emergency reserve storage required would equal 1,009,500 to 1,682,500 gallons.

The total minimum storage requirement for the Water District would be as follows:

Equalizing Storage (15%)	1,009,500 gallons	1,009,500 gallons
Fire Reserve	840,000 gallons	840,000 gallons
Emergency Reserve	<u>277,425 gallons (15%)</u>	<u>462,375 gallons (25%)</u>
Total Storage Required	2,126,925 gallons	2,311,875 gallons

The Water District currently has 5,500,000 gallons in storage capacity. Thus, the Water District has a surplus in storage capacity. However despite this surplus, most of the storage is in ground storage tanks which must be pumped to supply the system. Elevated tanks offer benefits that cannot be attained with ground storage that include emergency water supply without electrical power; Instantaneous fire fighting



supply and hydraulic surge protection and distribution system pressure balance to prevent water main breaks. Furthermore an elevated tank minimizes overall water district energy use which is beneficial to the environment.

While system storage capacity falls within the range of adequate storage for emergency reserve, additional fire reserve, specifically in elevated tanks, is warranted. An additional 250,000 gallons of fire reserve can provide over an hour of additional critical fire flow capacity at 3,500 gpm.

4.3 PEAK PUMPING DATA

In addition, in reviewing the data from July 7, 2010, it can be seen that tank water levels dropped quickly between 1:00 a.m. and 7:00 a.m.

During the peak period of 2010 between July 3 and July 13, the tank levels at Munsey Park fluctuated dramatically during the day. On several occasions in the early mornings, the tank level would drop over 30 feet in approximately 6 hours to less than 5 feet of water in the tank. This equates to a pressure drop of 13 psi, which is a significant drop. It is estimated that water was feeding the system at a rate of approximately 2.25 MGD.

Unfortunately, during these peaks the Thomaston tank was out of service which contributed to the levels drops. To further analyze the situation, we looked at a peak week in August 2012. During this week with the Thomaston tank in operation, the levels at the Munsey Park Tank still dropped approximately 25 feet in the same six hour period. In addition, the system demands during August 2012 were several MGD lower than in July 2010. Therefore, the water usage and tank level performance at Munsey Park in 2010 were systematic and not based on the Thomaston Tank being out of service.

As evidenced in the numerical analysis, there is slight deficit in system capacity that could be addressed with a larger tank, but would not require an additional storage tank or well. More importantly, the tank level drops evidenced during peak periods of the summer over the past few years indicate that additional system capacity is warranted.

The existing elevated tank at Munsey Park is a small diameter tank with a longer sidewall. Newer tanks will have a larger diameter which in turn will enable tanks to maintain pressures for longer periods of time as the tank level drops.

For instance a release of 250,000 gallons, or half the storage capacity to the system by the existing tank would result in a drop of 21 feet in the tank. This same release in a newer tank with a larger diameter would result in a level drop of 14 feet and a 750,000 tank with a 65 feet diameter would result in a 10 foot drop. This equates to an approximate 5 psi difference in system pressure, which may seem trivial but as evidenced during peak hour scenarios, when the tank level begins to drop this pressure difference will be more substantial.

As evidenced during the peak hour in July, a drop of 30 feet in a new 500,000 tank may equate to a drop of approximately 20 feet in a newer, larger diameter tank. A new 750,000 gallon tank will have a level drop of roughly 15 feet, which will increase system pressure 7 psi, as opposed to the original tank.

Based on current water needs of the community and importance to meet peak and fire flow demands a slight increase in storage capacity from 500,000 to 750,000 gallons is recommended. The proliferation of residential automatic lawn irrigation systems over the past two decades has significantly increased maximum day and peak hour water demand and stress on water district infrastructure.



5.0 ALTERNATIVES

The alternatives for the Munsey Park site include the rehabilitation of the existing tank or the construction of a new replacement storage tank with a capacity of 500,000 gallons or 750,000 gallons.

5.1 REHABILITATION

Recent inspection of the Munsey Park elevated water storage tank recommended that the structure undergo major rehabilitation or be replaced within the next one to two years. Persistent and extensive corrosion has comprised the sanitary and structural integrity of the tank requires the District to perform frequent monitoring and interim emergency repairs. As previously discussed, temporary emergency repairs were made to the roof to seal penetrations caused by corrosion during 2013. This was required to prevent potential contamination of the water stored in the tank. During 2012, replacement of the tank anchor bolts was required due to excessive corrosion. Based on the nature of the old style riveted tanks, this condition will continue through the next several painting cycles which will continue increase the annual maintenance costs on an ongoing basis. It should be noted that based on the age of the structure, the design of the existing tank does not conform with current state building code standards related to hurricane wind and seismic load conditions. Therefore the tank, originally constructed during 1929 is approaching the end of its useful life.

The cost of tank rehabilitation is projected to be in excess of \$2,000,000 which does not consider costs to bring the tank into current building code compliance if at all feasible. During 2011, the Water District rehabilitated the Thomaston Elevated tank at a cost of \$2,005,000.

5.2 NEW CONSTRUCTION

Due to the age and additional costs associated with maintaining a riveted tank, the construction of a new tank is more feasible, especially when considering upgrading the size of the storage facility. As previously noted the existing tank based on its age and high level of deterioration required interim repairs to the roof to prevent contamination from migrating into the tank. Therefore a new tank will improve public health protection based on its roof design and base metal thickness to keep contamination from entering the tank.

As discussed in Section 4, the existing elevated tank at Munsey Park is a small diameter tank with a longer sidewall. Newer tanks will have a larger diameter which in turn will enable tanks to maintain pressures for longer periods of time as the tank level drops.

The additional cost of increasing the tank capacity from 500,000 to 750,000 is warranted to allow the District to maintain pressure for longer periods of time during the peak days.

5.3 TANK TYPES

There are four types of elevated tanks considered in this report:

- Multi-legged Tanks
- Fluted Column/Hydropillars
- Pedestal Spheroids
- Composite

Figures 5.1A and 5.2B provide an elevation for each type of tank that will be evaluated in this report. Each type of tank has its benefits and drawbacks, which will be discussed below:

5.3.1 MULTI-LEGGED TANK

The existing tank on site is a multi-legged tank with I beam columns. Newer tanks have circular legs which are more pleasant aesthetically as well as easier to maintain and paint.

A Multi-legged tank is the old style tank structure which is not as sleek looking as the newer style. However, the legged tank also provides a cleaner view through the tank and blends into the horizon since the majority of the riser is open area.

The multi-leg style would also provide a new tank similar in style and look to the existing tank, which may be a consideration of the nearby residents.

Maintenance of the new tank will be less expensive than the current tank since it will eliminate the bolts, but the amount of painting surfaces will be greater than the other types of tanks except for the fluted column. Life cycle costs are evaluated in Section 6.

5.3.2 PEDESTAL SPHEROID

The pedestal Spheroid is an aesthetically pleasing style consisting of a pedestal supporting a spheroid shaped water storage cavity. The benefits of this style is the aesthetic look which provides a smaller



footprint at the base and a smaller pedestal than the other styles, which enables the tank to blend into the horizon or landscape easier since it does not cause a major visual obstruction.

The spheroid is a lower cost option than the other styles and is cost effective up to roughly 750,000 gallons and then the costs begin to even out with the other styles.

This style minimizes the surface area of exposed tank which in turn will reduce maintenance and painting costs in the future. In addition, if desired, the pedestal base can be used for storage or an office.

5.3.3 HYDROPILLAR

The hydropillar design provides a clean modern appearance with vertical architectural lines which blend into the surrounding environment.

The column style also allows the base of the tank to be used as a garage, storage area, etc. saving space on-site and reducing the cost of constructing other structures.

Hydropillars, however, have large bases which block sightlines. In addition, the amount of painting surfaces is far greater than any other tank style, making the life cycle costs extremely high.

Hydropillars are generally more cost effective in larger quantities and are not generally economically viable at 500,000 to 750,000 gallons.

5.3.4 COMPOSITE TANK

The hydropillar design provides a clean modern appearance with vertical and horizontal architectural lines which blend into the surrounding environment.

The column style also allows the base of the tank to be used as a garage, storage area, etc. saving space on-site and reducing the cost of constructing other structures.

The concrete base structure drastically reduces the amount of painting, both during new construction and during rehabilitations, thus having the lowest maintenance cost of the various tank styles.

Composite tanks, however, have large bases which block sightlines. Composite tanks are more cost effective in larger quantities and are not generally economically viable at 500,000 to 750,000 gallons. In