



November 5, 2012

Mr. John Walsh
 Vice President, MA & NH Operations
 Aquarion Water Company of Massachusetts
 900 Main Street
 Hingham, MA 02043

Subject: South Shore Industrial Park Demand and Supply Evaluation

Dear Mr. Walsh:

Tata & Howard is pleased to submit the South Shore Industrial Park (SSIP) Demand and Supply Evaluation. The project includes a review of potential growth south of Route 3 in Hingham and associated water demands as provided by the Town of Hingham. Additionally, the work included an analysis of the needed infrastructure to serve this area and an update of supply alternatives. The results of the study are presented herein.

Existing Demands

The average day demand, maximum day demand, and peak hour demand for the years 2007 through 2011 are summarized in Table No. 1. The information presented was obtained directly from the Annual Statistical Reports submitted to the Massachusetts Department of Environmental Protection (MassDEP).

**Table No. 1
 Existing Demands**

Year	ADD (mgd)	MDD (mgd)	MDD/ADD Ratio	SADD (mgd)	Peak Hour/ADD Ratio	Estimated Peak Hour (mgd)	Unaccounted for Water (%)	Residential GPCD
2007	3.48	5.78	1.66	4.57	3.20	11.14	14.78	59.03
2008	3.20	6.86	2.14	4.26	3.20	10.24	15.70	57.30
2009	3.08	5.23	1.70	3.67	3.20	9.86	12.00	50.00
2010	3.30	5.82	1.76	4.15	3.20	10.56	13.00	50.00
2011	3.33	6.76	2.03	4.37	3.20	10.66	19.30	60.00

The **average day demand (ADD)** is the total water supplied to a community in one year divided by 365 days. This term is commonly expressed in millions of gallons per day. This demand includes all water used for domestic (residential), commercial, industrial, agricultural, and municipal purposes. Municipal use includes water consumed by system maintenance such as hydrant flushing, fire flows, street-sweeping activities, fire fighting, cleaning storm drains and construction. In addition, the ADD includes unaccounted-for-water, water lost to unmetered water uses and system leakage. The unaccounted-for water percentage has ranged between approximately 12 percent to approximately 19 percent over the last five years. The ADD for Hingham, Hull, and northern Cohasset ranged between 3.08 and 3.48 mgd between 2007 and 2011. The raw water amount does not account for the interconnection with the Town of Cohasset that serves Linden Ponds.

The **maximum day demand (MDD)** is the maximum one day (24-hour) total quantity of water supplied during a one year period. This term is also typically expressed in million gallons per day. Typically, the MDD occurs during the summer months, when the seasonal population reaches its peak and temperatures are also at the annual peak. MDD is a critical factor to be considered when determining the adequacy of a water supply system. The distribution system must be capable of meeting maximum day demands with coincident fire demands with sufficient residual pressures to be considered adequate. Estimates of the projected maximum day demand and an allowance for the required fire flow are used to evaluate and design pumping, transmission and storage facilities. As shown in Table No. 1, the maximum day demands ranged from 5.23 mgd to 6.86 mgd between 2007 and 2011.

Peak hour demand is the maximum total quantity of water supplied in a single hour over a one year period typically expressed in mgd. These demands are typically met by distribution water storage facilities. Since records of system peak hourly demands are not available, the peaking factor for the current usage was estimated based on typical historical consumption for communities of similar size. The estimated peak hour peaking factor (peak hour demand vs. ADD) for the system is approximately 3.2. Therefore, the estimated peak hour ranged between approximately 10 mgd and 11 mgd between 2007 and 2011.

The **summer average day demand (SADD)** is estimated by averaging the three maximum demand months for the past five years. The SADD peaking factor is determined by dividing the SADD by the average ADD for each of the past five years. These peaking factors are averaged to estimate the future summer peaking factor. The 2011 SADD was calculated to be 4.37 mgd.

Projected Demands

DCR follows specific guidelines when projecting the water usage for communities in conjunction with the MassDEP Water Management Act (WMA). These guidelines incorporate trends in the use of water conservation devices in homes and industry, and emphasize the importance of monitoring the distribution system through water audits and leak detection surveys to reduce unaccounted-for water. It is important to note that the DCR has a key role in the water management approval process. Water demand projections through the year 2030 were

completed for the Hingham, Hull and northern Cohasset system by DCR in November 2009 as part of the WMA permitting process. Any alternative demand projections must be approved by DCR before MassDEP will approve development of a new water supply source or authorize the withdrawal of additional volume from existing sources.

Based on recent developments, the Massachusetts Water Resource Commission (MWRC) has adopted new water management standards for all registered and permitted withdrawals. The policy includes performance standards and conditions for all registered and permitted public water suppliers in the following areas:

- Maximum residential consumption of 65 gallons per capita per day (gpcd).
- Maximum of 10 percent unaccounted-for water.

DCR used the following criteria to develop the 2030 ADD:

- Residential consumption of 65 gpcd
- Year 2030 service population of 40,900
- Maximum of 10 percent unaccounted for water.

Based on existing demands, the Hingham, Hull, and northern Cohasset system has been consistently under the 65 gpcd; however, the unaccounted for water has ranged between 12 and 19 percent as reported on the recent Annual Statistical Reports. Because all new Water Management Act Permits require a community to maintain 10 percent unaccounted for water, it has been assumed that this criteria will be achieved by 2030. DCR estimated demand projections for five year time blocks from 2015 to 2030 as presented in Table No. 2.

Table No. 2
DCR Projected Demands

Year	ADD (mgd)	MDD/ADD Ratio	MDD (mgd)	SADD (mgd)	Peak Hour/ADD Ratio	Estimated Peak Hour (mgd)
2015	3.75	2.14	8.03	4.80	3.2	12.0
2020	3.86	2.14	8.26	4.94	3.2	12.4
2025	3.91	2.14	8.37	5.00	3.2	12.5
2030	3.97	2.14	8.50	5.08	3.2	12.7

The projected MDD through 2030 was estimated based on the maximum MDD/ADD ratio of 2.14 as observed in 2008. The projected peak hour was estimated using a peak hour/ADD ratio of 3.2 which is based on typical historical consumption for communities of similar size. The ADD estimated by DCR is based on information provided by the Hingham, Hull and Cohasset Planning Boards, Tata & Howard and Aquarion Water Company. The information includes recently completed developments and planned growth within the water system boundaries as well as normal growth projections. The ADD does not include potential build-out of the system.

It is unknown when build-out may occur for the SSIP area. Therefore, the following section includes an analysis of the projected 2030 demands with complete build-out of the water system south of Route 3 and including Bristol Brothers Property and the Avalon Development.

South Shore Industrial Park Build-Out

The Town of Hingham prepared a build-out analysis of the SSIP for projected sewer use. The analysis included a comparison of existing buildings to the available land area for growth and development using a Floor Area Ratio (FAR) of 25 percent. Estimated projected water demands were developed based on existing water usage and a ratio of the existing building size and the potential building size for the parcel. Water usage for vacant properties was estimated based on the potential use of the property and zoning. Actual billing was analyzed for the existing properties to determine the MDD/ADD ratio for properties not currently served by the Aquarion Water Company. For the existing properties, the maximum quarterly water usage was utilized to determine the estimated MDD/ADD ratio and subsequently the projected estimated MDD per property. Maximum daily demands are not available per property. It was assumed that the increase in water usage from one quarter to another was largely due to irrigation for the commercial properties. Therefore, because irrigation would not vary considerably by day over the course of a billing quarter, the quarterly maximum usage was assumed to be the maximum day demand. An average of the MDD/ADD ratio of 2.17 was utilized to determine the MDD for properties not currently served by Aquarion Water Company. Peak hour for all properties was estimated based on the existing estimated peak hour/ADD ratio of 3.2. See Table No. 3 for the estimated demands per property. Based on the estimated demands provided by the Town of Hingham, the total ADD for the build-out of the SSIP is approximately 0.14 mgd. The estimated MDD for the area at build-out is 0.32 mgd and the estimated peak hour is 0.44 mgd. A map showing the existing properties currently served by Aquarion and the additional SSIP existing and proposed properties is included in Figure No. 1.

Additional Demands

Based on discussions with the Town of Hingham, additional developments are anticipated in the SSIP Area by Bristol Brothers and Avalon. The Bristol Brothers property is in the vicinity of Derby Street and Whiting Street. The proposed use of the property is unknown at this time, however, the Town of Hingham estimates a total sewer use of approximately 0.15 mgd. Because of the potential of irrigation on the site, an additional 25 percent was added to the proposed sewer use resulting in an estimated ADD of approximately 0.19 mgd. Utilizing the average maximum usage/ADD ratio, the estimated MDD for the site is approximately 0.41 mgd. Based on a peak hour/ADD ratio of 3.2, the estimated peak hour for the site is approximately 0.61 mgd.

The proposed Avalon property is a 40B project to be located off Recreation Park Drive. Reportedly, the development will include 175 units. Based on an average household size of 2.77 for the Town of Hingham and an estimated residential consumption of 65 gpcd, the estimated ADD for the development is approximately 0.03 mgd. Based on the ratios used previously, the corresponding MDD and peak hour is approximately 0.07 mgd and 0.10 mgd, respectively.

The proposed Bristol Brothers and Avalon properties are shown in Figure No. 1.

Summary of Demands

The following table provides a summary of estimated projected demands for Hingham, Hull, and northern Cohasset through 2030 including build-out of the SSIP, Bristol Brothers Property and the Avalon development.

Table No. 4
Summary of Demands – Year 2030

Water Demands	ADD (mgd)	MDD (mgd)	Estimated Peak Hour (mgd)
DCR Projections	3.97	8.50	12.70
South Shore Industrial Park	0.14	0.32	0.44
Bristol Brothers Property	0.19	0.41	0.61
Avalon Development	0.03	0.07	0.10
Totals	4.33	9.30	13.85

Water Supply Evaluation

In accordance with MassDEP, the supply sources of a water system must be capable of meeting existing and projected MDD conditions and existing and projected SADD conditions with the largest source out of service. In this section, safe yields of the supplies and permitted withdrawals of the existing supply sources are compared to current and future demand conditions.

In 1987, the Water Management Act (WMA) program was implemented by MassDEP to regulate withdrawal of water from the state's watershed basins. Under this program, all new and existing sources withdrawing more than 100,000 gallons per day (gpd) are required to obtain a withdrawal permit. When first implemented, the registered withdrawal volume for a public water system was based on historical pumping rates of the water supply source(s) between 1981 and 1985. However, permits can be renewed and amended as system demands increase and additional supply sources are utilized. The WMA program considers the need for the withdrawal, the impact of the withdrawal on other hydraulically connected water suppliers, the environmental impacts, and the water available in the river basin or subbasin (the basin safe yield). It is important to note that the basin safe yield is different from the safe yield of a supply. In accordance with the WMA permit application instructions, the basin safe yield is the total water available to be withdrawn from a river basin or subbasin; whereas the safe yield of a well is the volume of water the well is capable of pumping under the most severe pumping and recharge conditions that can be realistically anticipated.

The current Hingham/Hull system is comprised of seven supply sources and one emergency source. Table No. 5 provides the current maximum withdrawal rates from each well combined with the maximum sustainable withdrawal from Accord Pond or the average daily withdrawal from Accord Pond. The total maximum withdrawal rate from existing sources is approximately 8.64 mgd without the emergency source Free Street Well No. 2. Accord Pond has an estimated sustainable yield of 3.0 mgd for 80 days as determined by a study completed in 1984. The total estimated safe yield of the pond is approximately 0.69 mgd. Additionally, it should be noted that the existing wells are currently limited by the raw water system. It has been assumed that improvements will be completed and the total current yield of the wells will be available in 2030. The projected ADD and MDD for the year 2030 with build-out of the SSIP, Bristol Brothers property, and the Avalon Development are 4.33 mgd and 9.30 mgd, respectively.

MassDEP recommends that a system have adequate supply to meet (1) the projected MDD, and (2) the projected SADD with the largest source offline. Based on 2007 through 2011 monthly demand data, the summer peaking factor is 1.28. Based on a projected ADD of 4.33 mgd, the estimated future SADD is 5.55 mgd. Figure No. 2 provides a comparison of the current available supply versus the current and project demands without buildout of the South Shore Industrial Park, Bristol Brothers Property and Avalon. Figure No. 3 provides a comparison of the current available supply versus the current and project demands with buildout of the South Shore Industrial Park, Bristol Brothers Property and Avalon.

Table No. 5
Estimated Yield of Existing Sources

Groundwater Source Name	Current Estimated Maximum Withdrawal (mgd)	Current Estimated Maximum Withdrawal (mgd)
Downing Street	0.32	0.32
Free Street No. 2A and 4*	1.80	1.80
Free Street No. 3/5	0.37	0.37
Fulling Mill Station	1.36	1.36
Prospect Street Well	0.24	0.24
Scotland Street Well	1.55	1.55
Surface Water Name	Maximum Yield (mgd)	Safe Yield (mgd)
Accord Pond	3.0	0.69
Total	8.64	6.33

*Free Street No. 4 has a maximum withdrawal rate of 0.81 mgd. The total combined withdrawal rate from Free Street No. 2A and 4 is 1.80 mgd.

Figure No. 2
Current Available Supply and Estimated Demands without Buildout
South Shore Industrial Park Demand Evaluation
Aquarion Water Company

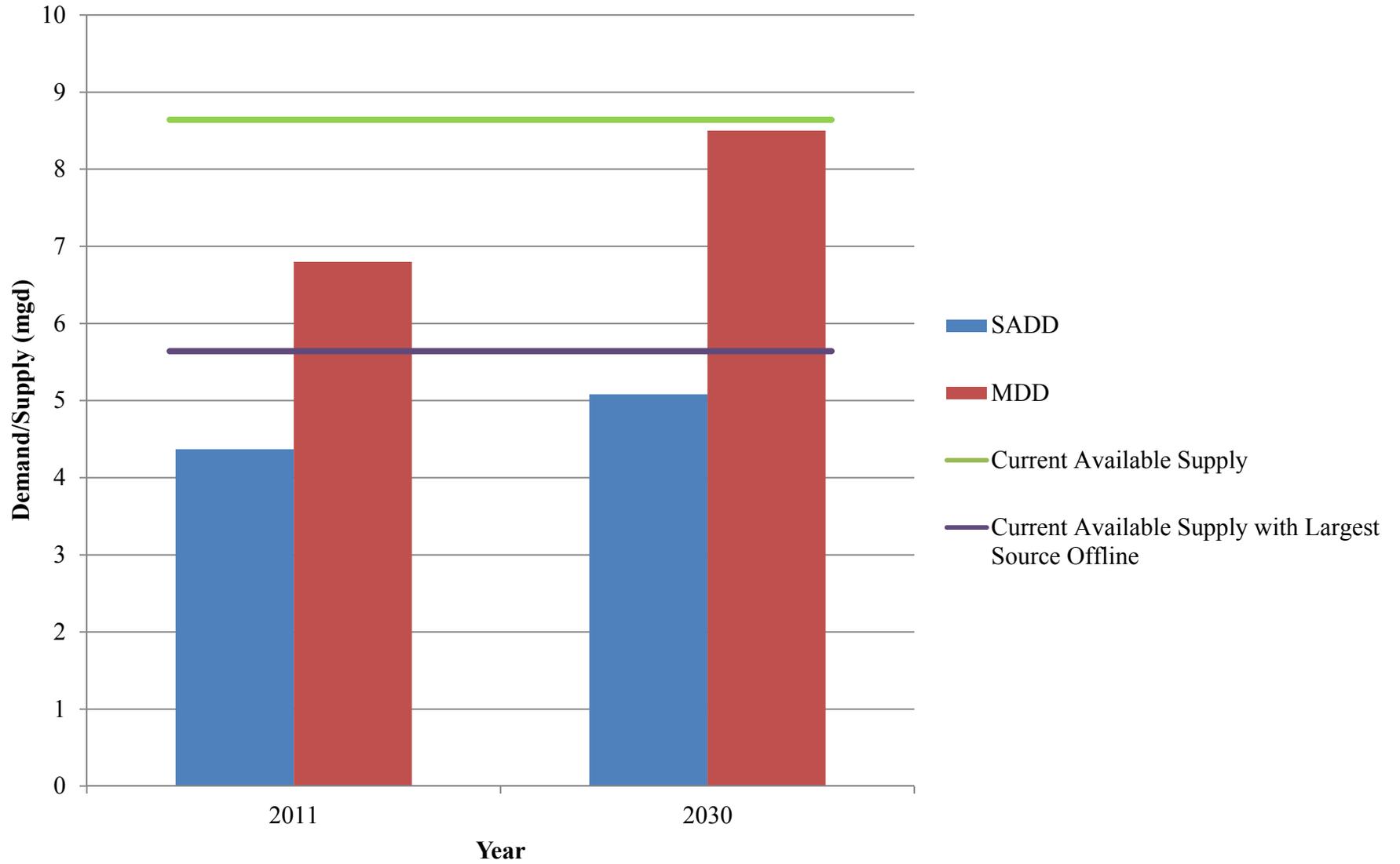
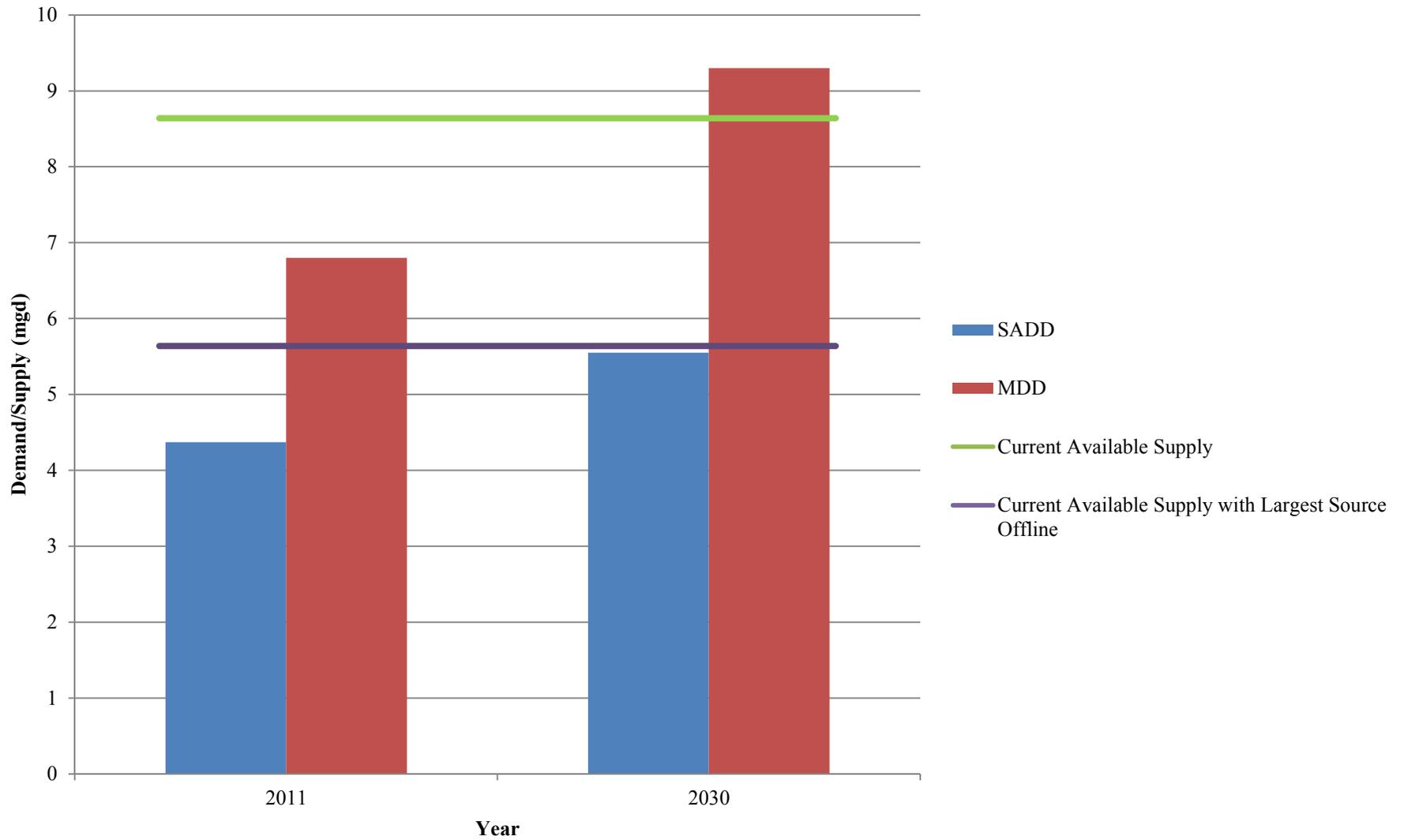


Figure No. 3
Current Available Supply and Estimated Demands with Buildout
South Shore Industrial Park Demand Evaluation
Aquarion Water Company



The system's total combined maximum withdrawal of the active supply sources is approximately 8.64 mgd. Compared to the projected 2030 MDD of 9.30 mgd, a deficit of 0.66 mgd is estimated.

Based on the total average withdrawal rate for the system of 6.33 mgd, a surplus of 2.0 mgd is estimated in comparison the projected 2030 ADD of 4.33 mgd.

Accord Pond is the largest source based on sustainable yield during a high demand period; therefore, the available pumping rate while the largest source is off-line is 5.64 mgd. This amount does not include the available emergency withdrawal volume of 0.81 mgd from Free Street Well No. 2. Compared to the projected 2030 SADD of 5.55 mgd, a surplus of 0.09 mgd is estimated.

Supply Improvements

Replacement wells have been installed at the Scotland Street Well site, Free Street Well site, and the Fulling Mill Well site. The wells are in good condition; however, the existing raw water system is limiting the amount of water that can be pumped from these sources. The headloss in the raw water mains is causing the pumps to pump at a higher head, resulting in lower flow rates. Aquarion continues to investigate the condition of the raw water system to ensure that the total current yield from the wells is available.

Additional discussions with MassDEP have been conducted regarding the total allowable withdrawal volume from Free Street No. 2A and 4. As noted in MassDEP correspondence dated September 24, 1998, the Zone II delineation was delineated and approved using a combined volume of 1.80 mgd and 0.81 mgd, for Free Street Well No. 2 and 4, respectively. In a November 8, 2008 correspondence from MassDEP, Free Street Well No. 2 was classified as an emergency source, while Free Street Well No. 4 was designated as an active source. Therefore, Aquarion has requested to withdraw the original MassDEP approved daily volume of the 2.61 mgd from Free Street Wells No. 2A and No. 4. Free Street Well No. 2 will remain as an emergency source at a rate of 0.81 mgd. Therefore, an additional 0.81 mgd has been requested to be withdrawn from the system resulting in a total maximum withdrawal of 9.45 mgd. MassDEP has not provided approval for the increase in withdrawal at this time. In comparison to the projected 2030 MDD, a surplus of 0.15 mgd is estimated.

If Aquarion improves the raw water system and receives approval for the total withdrawal of 2.61 mgd from Free Street No. 2A and 4, adequate supply will be available even with the addition of the demands from the full buildout of the SSIP. As an alternative option for supply, an MWRA connection was investigated. The MWRA currently provides wholesale water to approximately 50 communities throughout Massachusetts. The closest area for Aquarion to connect to the MWRA system is the City of Quincy, Massachusetts. This would require the construction of approximately two miles of water main along Route 3A and a new pump station. Reportedly, the current rates for MWRA are approximately \$3,032 per 1.0 million gallons. The MWRA entrance fee is approximately \$5.16/gallon or \$5,161,646 per 1.0 mgd. It should be

noted that the actual entrance fee is calculated based on considerations of average annualized demands and peak month demands. Assuming the total amount of water to be purchased from MWRA would equal the increased demands in the SSIP, the total entrance fee would be approximately \$3,000,000 based on an average usage of 0.36 mgd and a peak usage of 1.15 mgd. The MWRA Advisory Board has recently adopted recommendations that there be no interest charges on the entrance fee and that the entrance fee can be paid over a 25 year period.

Water Management Act Registration

The Aquarion Water Company has a WMA permit and registration to withdraw water from the Boston Harbor River Basin. In accordance with the WMA Permit and Registration for water withdrawal from the Aquarion Water Company supply sources (Registration No. 41913101), the system is authorized to withdraw an average daily volume of 3.51 mgd and a total annual volume of 1,281.15 million gallons per year (mgy) through December 31, 2017.

The system currently does not exceed its registered average withdrawal volume. However, based on the demand projections, Aquarion Water Company could exceed their authorized volume by 2013 if build-out of the SSIP was initiated. A Water Management Act Permit would need to be completed and submitted to MassDEP for approval to increase the WMA permit limit.

System Improvements

In order to serve the proposed customers in the SSIP, new 12-inch diameter water mains are recommended on Abington Road and Sharp Street. The proposed water main configuration is shown in Figure No. 4. The water mains would have to connect between Abington Street and Sharp Street at the Rockland town line. These water mains would connect to the existing system through a water main between Research Road and Abington Street. A 12-inch diameter water main is also recommended on Commerce Road from the existing 12-inch diameter water main on Commerce Road to the Rockland town line. An additional 12-inch diameter water main should be installed to connect the proposed Commerce Road water main to the proposed water main on Abington Street to provide looping. The proposed water main expansion within the SSIP is estimated to be approximately 16,500 linear feet of new 12-inch diameter water main. The total estimated probable construction cost is \$3,300,000 including 25 percent for engineering and contingencies.

It has been assumed that the proposed Bristol Brothers Development will be served from a new 8-inch diameter water main that connects the existing water mains on Old Derby Street and Whiting Street. The proposed water main is estimated to be approximately 1,300 linear feet and the estimated probable construction cost is \$460,000 including 25 percent for engineering and contingencies. It is uncertain of how the property will be developed and the total length of new water main is an assumption. It has been assumed that the proposed Avalon Development will be served off the existing water main on Recreation Park Drive.

Evaluation Criteria

According to the American Water Works Association (AWWA) “Manual of Water Supply Practices: Computer Modeling of Water Distribution Systems” a system has deficient pipe looping or sizing if the following conditions occur:

- Velocities greater than 5 feet per second (ft/sec)
- Headlosses greater than 6 feet per 1,000 feet of water main (ft/1,000 ft)
- Large diameter pipes (16-inch diameter or greater) having headlosses great than 2 feet/1,000 feet.

As the velocity in a pipe increases, the risk of potential problems, such as water hammer, increases. Excessive headloss in water main results in wasted energy in the system, due to increased pumping and power costs. The velocity and headloss were considered in evaluating the options.

In general, a minimum pressure of 35 pounds per square inch (psi) at ground level is required during average day, maximum day, and peak hour demand conditions. During MDD with a coincident fire flow, a minimum pressure of 20 psi is required at ground level throughout the system. Because it is difficult to determine the needed fire flow for the SSIP area at build-out, two separate fire flow requirements were run using the hydraulic model. Fire flows were run at 2,250 gpm and 3,500 gpm at build-out. Currently, an ISO fire flow recommendation of 2,250 gpm is needed on Industrial Road. It was assumed that this fire flow would be required throughout the area. A fire flow of 3,500 gpm is the maximum amount required to be supplied by a water system at any point in the system. Therefore, additional runs were conducted assuming a required fire flow of 3,500 gpm throughout the area.

Improvement Alternatives

The following summarizes options analyzed to serve the SSIP. Costs are based on the August 2012 Engineering News Record (ENR) construction cost index for Boston, MA of 12029.97, and include a 25 percent allowance for engineering and contingencies and costs associated with water services, hydrants, and temporary and permanent trench pavement. **Estimates do not include costs for land acquisition, easements or legal fees.** For the purposes of this study, conceptual estimates were provided.

Option 1 – Water Main Improvements

Option 1A considers recommended water main improvements to the existing water distribution system to maintain adequate pressures and provide 2,250 gpm, while maintaining 20 psi during MDD conditions. A new 20-inch diameter water main is recommended from the tank to behind the Derby Street Shops. A new 16-inch diameter water main is recommended on Industrial Park Road and Commerce Road. Also, it is recommended that the proposed 12-inch diameter water mains within the SSIP expansion be 16-inch diameter water mains. The existing water main under Route 3 would not need to be replaced. The estimated probable cost for approximately 7,700 linear feet of 20-inch diameter ductile iron water main, approximately 3,000 linear feet of

16-inch diameter ductile iron water main, and upsizing approximately 12,800 linear feet of 12-inch diameter water main to 16-inch diameter water main is \$2,730,000.

To provide 3,500 gpm to the SSIP, the proposed 20-inch diameter water main must extend to Abington Street along Industrial Park Road and Research Road. Under this water main configuration that available flow at the highest elevation in the proposed SSIP would be 3,500 gpm while maintaining approximately 15 psi in the area. In order to provide 3,500 gpm while maintaining 20 psi, a parallel 16-inch diameter water main would need to be installed under Route 3. Installing a water main under Route 3 would require directional drilling. The estimated probable construction cost for the additional 3,600 linear feet of new 16-inch water is \$900,000. The total estimated probable cost for Option 1B is \$3,700,000.

The proposed water main improvements for Options 1A and No. 1B are shown in Figures No. 5 and 6, respectively.

Option 2 – Water Main Improvements and Booster Pump Station

Option 2 utilizes a booster pump station to provide adequate pressure and flow. The booster pump station would be located on the existing 12-inch water main that feeds the SSIP off Industrial Park Drive. To provide adequate suction pressure at the BPS, while providing MDD and 2,250 gpm for fire protection to the SSIP, a new 16-inch diameter water main is recommended on Whiting Street from the Accord Tank driveway to Derby Street. The estimated probable construction cost for the booster pump station and approximately 4,300 linear feet of 16-inch diameter ductile iron water main is \$1,450,000.

Option 2B considers the additional water main improvements recommended to provide adequate suction pressure at the proposed pump station, while providing MDD and 2,250 gpm for fire protection to the SSIP. A new 20-inch diameter water main is recommended on Derby Street from Whiting Street to Recreation Park Drive and a new 16-inch diameter water main is recommended on Keith Way and Recreation Park Drive from Keith Way to Derby Street. The estimated probable cost for the booster pumps station, approximately 5,200 linear feet of 20-inch diameter ductile iron water main, and approximately 2,500 linear feet of 16-inch diameter ductile iron water main, is \$2,290,000.

The proposed booster pump station and water main improvements for Options 2A and No. 2B are shown in Figures No. 7 and 8, respectively.

Option 3 - Water Main Improvements and Second Feed to SSIP

A second transmission line to the SSIP was considered for Option 3. A second transmission main to the SSIP will provide redundancy. In order to provide 2,250 gpm while maintaining 20 psi throughout the distribution system (Option 3A), a new 16-inch diameter water main is recommended from Whiting Street to the proposed water main expansion on Commerce Road. The water main route would include Accord Pond Drive, Harvest Lane, Devon Terrace and Deerfield Road. A new 16-inch diameter water main would need to be installed under Route 3.

Installing a water main under Route 3 would require directional drilling. It is recommended that the proposed water main expansion between Commerce Road and Abington Street be 16-inch diameter instead of the proposed 12-inch diameter. The estimated probable cost for approximately 7,700 linear feet of 16-inch diameter water main, and upsizing approximately 2,500 linear feet of 12-inch diameter water main to 16-inch diameter is \$1,840,000.

To provide 3,500 gpm while maintaining 20 psi in the water distribution system, it is recommended that the new 16-inch diameter water main proposed in Option be 20-inch diameter water main. A new 20-inch diameter water main is also recommended on Whiting Street from the tank driveway to Accord Pond Drive. The estimated probable cost for approximately 9,200 linear feet of 20-inch diameter water main, and upsizing approximately 2,500 linear feet of 12-inch diameter water main to 16-inch diameter is \$2,370,000.

The proposed water main improvements for Options 3A and No. 3B are shown in Figures No. 9 and 10, respectively.

Option 4 – New Water Storage Tank

Option 4 considers a new water storage tank in the SSIP area. The water storage tank would be utilized for fire protection and to maintain adequate pressure during peak hour demands. The water storage tank should be approximately 0.75 mg and be constructed to an overflow of 282 feet to match the existing hydraulic gradeline of the Accord Tank. There are parcels owned by the Town of Hingham within the SSIP area, however, the ground elevations in these areas are around 125 feet. This would result in a water storage tank over 150 feet tall. The highest elevations in the developable area are approximately 170 to 180 feet. These elevations are along Commerce Way within the 0 Commerce Road property. No additional water main improvements would be recommended. The estimated probable cost for a new water storage tank and associated water mains is \$2,000,000. This estimate does not include costs associated land acquisition, easements, legal work, or significant site work. The proposed water storage tank is shown in Figure No. 11. Based on the Capital Efficiency Plan™ prepared by Tata & Howard, the total usable storage in the Hingham/Hull water distribution system is approximately 2.56 mg. The projected required storage for the design year is approximately 2.10 mg. Therefore, the system has approximately 0.46 mg of surplus storage. Therefore, additional storage is not needed. A mixing system would be required to maintain good water quality within the proposed storage tank. Permitting an elevated tank may be difficult in the area due to the visibility of the tank. Additionally, Aquarion Water Company does not own any land in the area and would therefore, need to obtain an easement or purchase land, which could be costly. Table No. 6 includes a summary of costs and Table No. 7 includes a summary of pros and cons for each of the system improvement options presented in this letter report.

Table No. 6
Summary of Estimated Costs

Option*	Water Main Expansion Costs within SSIP	Improvement Costs	Total
1A – Water Main Improvements (2,250 gpm)	\$3,300,000	\$2,730,000	\$6,030,000
1B – Water Main Improvements (3,500 gpm)	\$3,300,000	\$3,700,000	\$7,000,000
2A – Booster Pump Station (2,250 gpm)	\$3,300,000	\$1,450,000	\$4,750,000
2B – Booster Pump Station (3,500 gpm)	\$3,300,000	\$2,290,000	\$5,590,000
3A – Second feed into SSIP (2,250 gpm)	\$3,300,000	\$1,840,000	\$5,140,000
3B – Second feed into SSIP (3,500 gpm)	\$3,300,000	\$2,370,000	\$5,670,000
4 – New Water Storage Tank	\$3,300,000	\$2,000,000	\$5,300,000

* Estimates do not include costs for land acquisition, easements or legal fees.

Table No. 7
Pros and Cons

Option	Pro	Con
1 – Water Main Improvements	Strengthens transmission mains in the southern portion of the system	Large capital cost, disruption to system, directional drilling required under Route 3
2 – Booster Pump Station	Eliminate low pressure concerns within SSIP	Large capital cost, increased operational and maintenance
3 – Second feed into SSIP	Redundant feed into SSIP	Large capital cost, disruption to system, directional drilling required under Route 3
4 – New Water Storage Tank	Less capital cost, less disruption to the system	Stagnation concerns, permitting concerns, need to purchase land or obtain easement

Recommendations

It is recommended that Aquarion pursue Option 4, the new water storage tank, to provide adequate flow and pressure to the SSIP. The water storage tank should be constructed at the same overflow elevation of the Accord Tank. The most favorable location for the new storage tank would be at the higher elevations along Commerce Road. The elevated water storage tank

should be approximately 0.75 mg. There are not any parcels in this area owned by Aquarion or the Town of Hingham. Easements would have to be established to construct the tank along the proposed water main expansion route. This option has less capital costs than the other options, and will cause less disruption to the existing distribution system.

Sincerely,
TATA & HOWARD, INC.

Karen L. Gracey, P.E.
Associate

DRAFT

Table No. 3
Water Demand Evaluation for the South Shore Industrial Park
Aquarion Water Company
Hingham, Massachusetts

Address	Use	Projected Water Use (gpd)	Maximum Month/ADD Ratio	Maximum Day Demand (gpd)	Estimated Peak Hour Demand (gpd)
0 Abington Street	Vacant	6,762	2.17	14,674	21,638
0 Abington Street	Vacant	5,194	2.17	11,271	16,621
0 Abington Street	Vacant	8,850	2.17	19,205	28,320
0 Abington Street	Vacant	330	2.17	716	1,056
0 Abington Street	Vacant	2,400	2.17	5,208	7,680
0 Abington Street	Residential	330	2.17	716	1,056
0 Commerce Road	Vacant	2,043	2.17	4,433	6,538
0 Dennis Road	Residential	330	2.17	716	1,056
1 Pond Park Road	Warehouse	468	2.17	1,015	1,497
1 Springwood Drive	Residential	330	2.17	716	1,056
10 Old Mine Rock Way	Manufacturing	302	1.04	315	965
100 Industrial Park Rd	Warehouse	701	1.91	1,338	2,242
100 Research Road	Warehouse/Office	240	2.49	599	769
100 Sharp Street	Warehouse	284	2.17	617	910
105 Research Road	Vacant/Office	1,374	2.57	3,533	4,397
110 Industrial Park Rd	Manufacturing	949	1.40	1,326	3,036
120 Industrial Park Rd	Manufacturing	2,978	1.57	4,681	9,530
125 Industrial Park Rd	Warehouse/Office	1,149	1.45	1,666	3,678
14 Sharp Street	Vacant	2,100	2.17	4,557	6,720
15 Abington Street	Residential	330	2.17	716	1,056
17 Abington Street	Residential	330	2.17	716	1,056
175 Derby Street	Office	4,084	5.35	21,846	13,068
19 Abington Street	Residential	330	2.17	716	1,056
2 Pond Park Road	Medical Office	6,600	3.43	22,653	21,120
2 Sharp Street	Vacant/Office	2,967	2.17	6,438	9,494
20 Pond Park Road	Adult Daycare/Office	1,257	1.26	1,578	4,021

Table No. 3
Water Demand Evaluation for the South Shore Industrial Park
Aquarion Water Company
Hingham, Massachusetts

Address	Use	Projected Water Use (gpd)	Maximum Month/ADD Ratio	Maximum Day Demand (gpd)	Estimated Peak Hour Demand (gpd)
22 Abington Street	Vacant	3,750	2.17	8,138	12,000
27 Abington Street	Residential	330	2.17	716	1,056
28 Abington Street	Nursery	8,582	2.17	18,622	27,462
3 Hickey Road	Residential	330	2.17	716	1,056
3 Pond Park Road	Warehouse	1,997	2.17	4,333	6,390
3 Springwood Drive	Residential	330	2.17	716	1,056
30 Pond Park Road	Warehouse	1,079	8.38	9,038	3,452
31 Abington Street	Residential	330	2.17	716	1,056
35 Commerce Road	Manufacturing	122	1.28	156	390
35 Pond Park Road	Warehouse/Office	1,608	1.08	1,742	5,147
36 Abington Street	Residential	330	2.17	716	1,056
4 Dennis Road	Residential	330	2.17	716	1,056
4 Hickey Road	Residential	330	2.17	716	1,056
4 Pond Park Road	Offices	1,714	2.17	3,719	5,484
4 Springwood Drive	Residential	330	2.17	716	1,056
40 Abington Street	Residential	330	2.17	716	1,056
40 Pond Park Road	School	434	1.16	503	1,390
40 Sharp Street	Office	1,089	2.17	2,363	3,485
41 Abington Street	Residential	330	2.17	716	1,056
41 Sharp Street	Manufacturing	46	2.17	99	146
42 Abington Street	Residential	330	2.17	716	1,056
44 Abington Street	Residential	330	2.17	716	1,056
45 Industrial Park Rd	Printing	242	2.06	500	776
45 Pond Park Road	Warehouse	2,573	1.73	4,445	8,234
5 Abington Street	Residential	330	2.17	716	1,056
5 Hickey Road	Residential	330	2.17	716	1,056

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Address	Use	Projected Water Use (gpd)	Maximum Month/ADD Ratio	Maximum Day Demand (gpd)	Estimated Peak Hour Demand (gpd)
5 Pond Park Road	Light manufacturing	1,134	1.09	1,232	3,629
5 Springwood Drive	Residential	330	2.17	716	1,056
50 Pond Park Road	Warehouse	504	1.53	773	1,612
51 Sharp Street	Manufacturing	1,408	2.17	3,056	4,507
55 Industrial Park Rd	Office/Warehouse	551	1.49	823	1,764
55 Research Road	Manufacturing	1,368	1.28	1,757	4,377
55/65 Sharp Street	Manufacturing	189	2.17	411	606
59 Abington Street	Residential	330	2.17	716	1,056
6 Hickey Road	Residential	330	2.17	716	1,056
60 Research Road	Office?	1,703	3.07	5,228	5,449
60 Sharp Street	Office	234	2.17	508	749
61 Abington Street	Residential	330	2.17	716	1,056
65 Industrial Park Rd	Warehouse	663	3.92	2,599	2,122
67 Sharp Street	Manufacturing	1,152	2.17	2,499	3,685
7 Abington Street	Residential	330	2.17	716	1,056
7 Hickey Road	Residential	330	2.17	716	1,056
70 Research Road	Warehouse	704	1.22	855	2,252
70/80 Sharp Street	Manufacturing	1,668	2.17	3,619	5,337
72 Sharp Street	Office	17,801	2.17	38,628	56,963
73 Abington Street	Residential	330	2.17	716	1,056
74 Abington Street	Vacant	16,000	2.17	34,720	51,200
75 Industrial Park Rd	Warehouse/Office	631	1.82	1,147	2,018
75 Research Road	Office	1,005	2.16	2,170	3,217
80 Research Road	Office	1,582	2.45	3,878	5,061
80 Sharp Street	warehouse	129	2.17	281	414
85 Research Road	Warehouse	332	1.19	396	1,062

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Address	Use	Projected Water Use (gpd)	Maximum Month/ADD Ratio	Maximum Day Demand (gpd)	Estimated Peak Hour Demand (gpd)
9 Sharp Street	Manufacturing	140	2.17	303	447
90 Industrial Park Rd	School	845	2.02	1,710	2,705
90 Research Road	Vacant/Office	1,059	2.41	2,556	3,389
90A Industrial Park Rd		4,345	2.17	9,429	13,904
99 Industrial Park Rd	Manufacturing	472	1.23	581	1,511
Totals		138,797		319,821	444,151