Water Department Master Plan Draft
Date: April 2010

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Chapter 1: Demand Analysis
Date: February 25, 2010

General

The purpose of this section of the Master Plan is to estimate the amount of water that the Town requires to meet present and future water demands. To provide an estimate of future needs, water supply requirements are estimated through the year 2030. In order to accurately project future water supply requirements, it is necessary to analyze available water production and consumption records. Projections for the future water use are then calculated based upon the projected population to be served, per capita water usage, non-residential water usage and unaccounted for water (UAW) usage. The Town recently completed a report entitled "*Water Conservation Plan for the Town of Sharon*" (WCP). The WCP was prepared by the Department of Public Works, the Neponset River Watershed Association, and Nancy Hammett. *Chapter 5: Water Demand Forecasts* of the WCP included a detailed demand analysis. This Demand Analysis section of the Master Plan provides a summary of the information presented from Chapter 5 of the WCP. Also included is a summary of forecast information provided by the Massachusetts Department of Conservation and Recreation (DCR) to the Town in September 2009.

Population Forecast

The WCP provided a summary of previous population and water demand forecasts back to 1985. These are summarized in Figure 1-1. The forecasts are presented by including a "best-estimate" and high and low forecasts to present an envelope of future conditions. The MAPC MetroFuture projections developed in 2006 were used as a basis for the population projections. The forecasts are shown in Figure 1-2 and Table 1-1. The population forecast also includes the following assumptions:

- The high estimate for growth in single family residents is calculated as 10% higher than the MAPC forecast for each year.
- The low estimate assumes no growth in single family residents.
- Additional multi-family residents were estimated based on the pending projects, shown in Appendix 1-1, plus an additional number of residents assumed to be required to meet the town's affordable housing goal. The same forecast for multi-family residents was used for all forecasts.

Figure 1-1: Population - Actual vs Previous Projections

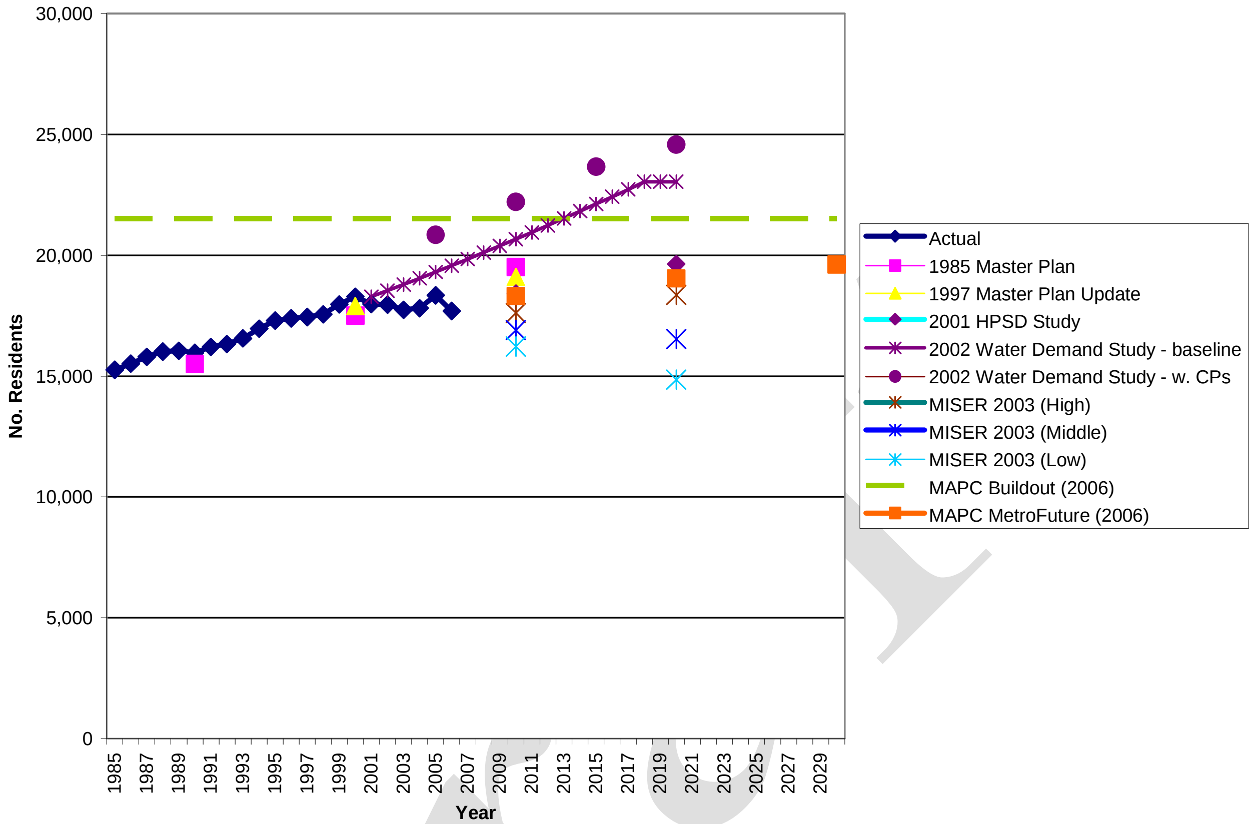


Figure 1-2: Population Forecast

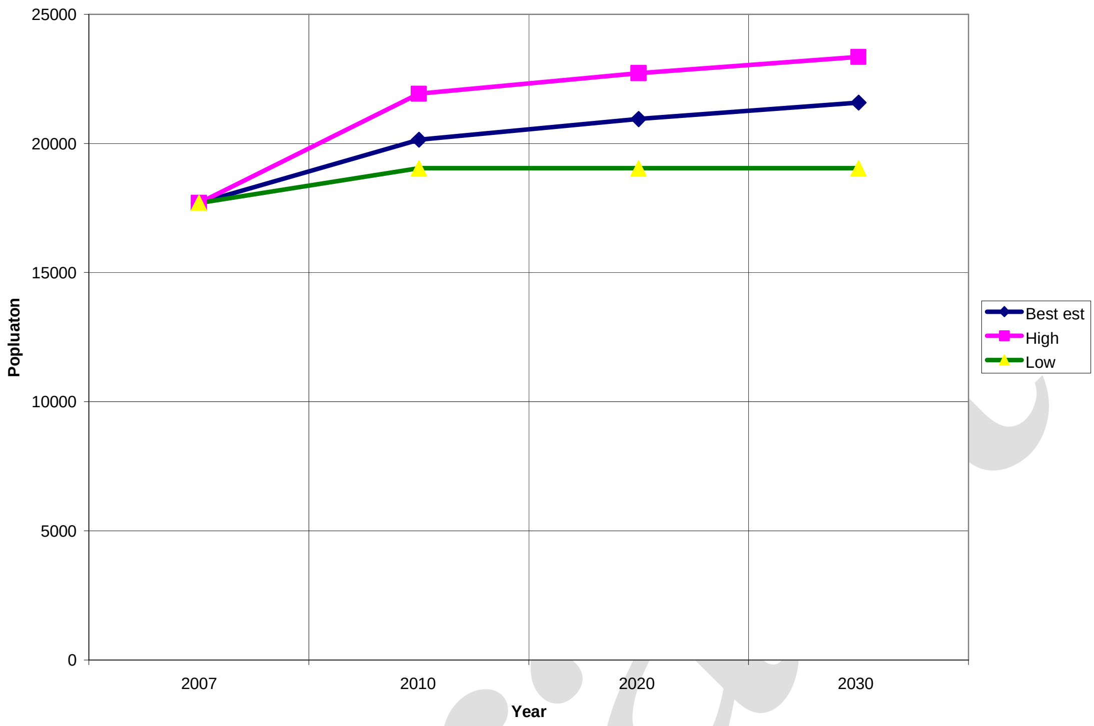


Table 1-1: Population Forecast

	2007	2010	2020	2030
Best Estimate				
MAPC baseline	17,259	18,315	19,041	19,616
Add'l multifamily		1,776	1,776	1,776
Total	**17,259**	**20,091**	**20,817**	**21,392**
High				
MAPC + 10%	17,259	20,147	20,945	21,578
Add'l multifamily		1,776	1,776	1,776
Total	**17,259**	**21,923**	**22,721**	**23,354**
Low				
No growth over 2007	17,259	17,259	17,259	17,259
Add'l multifamily		1,776	1,776	1,776
Total	**17,259**	**19,035**	**19,035**	**19,035**

Water Demand Forecast

Residential

In 2007 and 2008, Sharon's average residential water use was 68 and 67 gallons per capita day (gpcd), repectively. This residential use has been generally declining since the 1990s. Table 1-2 presents the best estimate, high and low forecasts for residential water demand, based on the population forecast presented and the following assumptions

- 65 gpcd for the low forecast
- 70 gpcd for the best estimate forecast
- 80 gpcd for the high forecast
- Excludes 440 residents currently using private wells

Table 1-2: Residential Water Demand Forecast

Best Estimate	**2010**	**2020**	**2030**
Population	20,091	20,817	21,392
Population served by town water*	19,651	20,377	20,952
Av gpd	70	70	70
MGY	**502.1**	**520.6**	**535.3**
High	**2010**	**2020**	**2030**
Population	21,923	22,721	23,354
Population served by town water*	21,483	22,281	22,914
Av gpd	80	80	80
MGY	**627.3**	**650.6**	**669.1**
Low	**2010**	**2020**	**2030**
Population	19,035	19,035	19,035
Population served by town water*	18,595	18,595	18,595
Av gpd	65	65	65
MGY	**441.2**	**441.2**	**441.2**
*excludes an estimated 440 residents currently using private wells.			

Non-Residential

Table 1-3 presents a range of forecasts for potential water demand, based on a range of assumptions about trends in non-residential water use. These forecasts make the following assumptions:

- There will be no change in the average water use per connection in each customer category.
- The number of connections (no change in agricultural connections) will increase by the following percentages:
  - High forecast: 25% by 2020 and 50% by 2030
  - Best estimate: 10% by 2020 and 20% by 2030
  - Low forecast: no change by 2020 and 5% by 2030.

Table 1-3: Forecast of Non-Residential Water Demand

2007 ASR:	**# connections**	**Av use (gpd)**	**Total ADD (gpd)**			
Non-resid institutions	21	814	17,093			
Retail	104	488	50,740			
Other commercial	8	942	7,534			
Agricultural	8	342	2,740			
Recreational	11	946	10,411			
Total	**152**		**88,518**			
Forecast:	**# Connections**			**ADD (gpd)**		
	High	**Best Est**	**Low**	**High**	**Best Est**	**Low**
2020	**25%**	**10%**	**0%**			
Non-resid institutions	26	23	21	21,163	18,721	17,093
Retail	130	114	104	63,425	55,619	50,740
Other commercial	10	9	8	9,418	8,476	7,534
Agricultural	8	8	8	2,740	2,740	2,740
Recreational	14	12	11	13,250	11,357	10,411
Total	**188**	**166**	**152**	**109,995**	**83,430**	**76,226**
Total Annual Use (mgy)				**40.15**	**35.37**	**32.31**
2030	**50%**	**20%**	**5%**			
Non-resid institutions	32	25	22	26,047	20,349	17,907
Retail	156	125	109	76,110	60,985	53,179
Other commercial	12	10	8	11,301	9,418	7,534
Agricultural	8	8	8	2,740	2,740	2,740
Recreational	16	13	12	15,133	12,304	11,357
Total	**224**	**181**	**159**	**131,341**	**105,796**	**92,718**
Total Annual Use (mgy)				**47.94**	**38.62**	**33.84**

Total Annual Water Use

Table 1-4 provides an overall forecast for water demand. The forecast is based on the component estimates developed previously and the following additional assumptions:

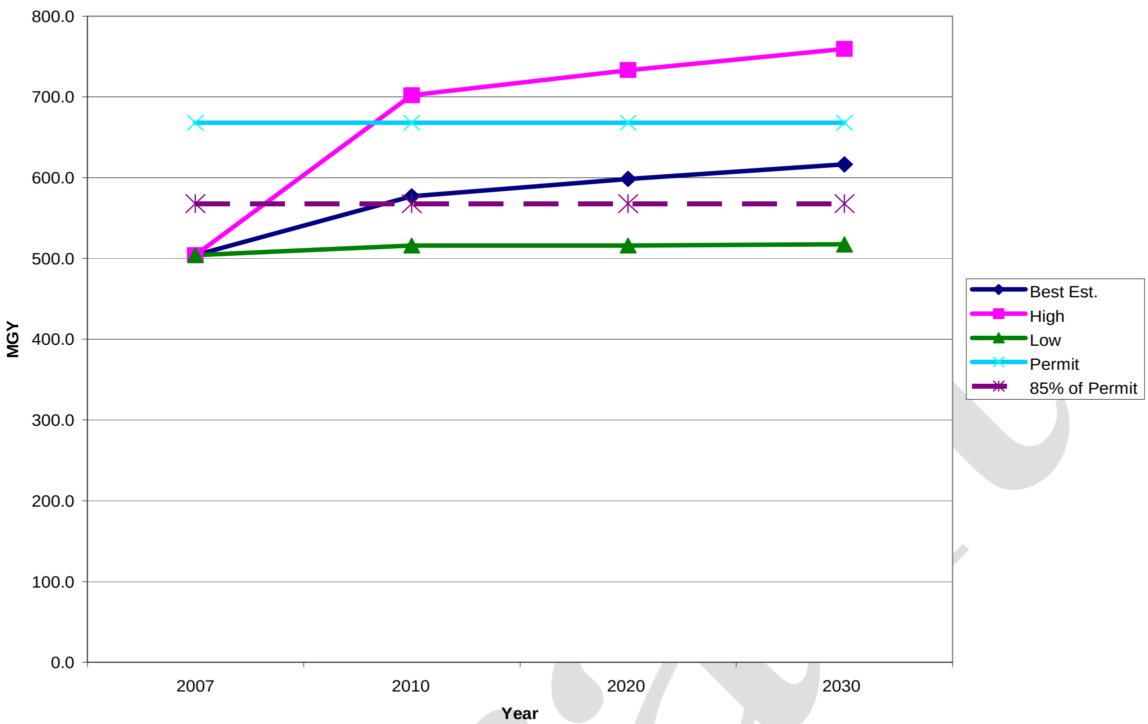
- 2010 non-residential demand per connection for each type of non-residential customer is assumed to be the same as in 2007 (as reported in Sharon's ASR).
- The total volume of municipal water use (metered and unmetered) and UAW are assumed to remain the same as reported in the 2007 ASR in all scenarios.

Table 1-4 Annual Water Demand Forecast

	Annual Water Use (mgy)			
	2007	**2010**	**2020**	**2030**
Best Estimate of Population and Business Growth				
Residential	429.4	502.1	520.6	535.3
Non-Residential	32.3	32.3	35.4	38.6
Municipal	12.0	12.0	12.0	12.0
UAW	30.4	30.4	30.4	30.4
Total	**504.0**	**576.8**	**598.3**	**616.3**
High Estimate of Population and Business Growth				
Residential	429.4	640.2	663.5	681.9
Non-Residential	32.3	32.3	40.2	47.9
Municipal	12.0	12.0	12.0	12.0
UAW	30.4	30.4	30.4	30.4
Total	**504.0**	**702.0**	**733.2**	**759.4**
Low Estimate of Population and Business Growth				
Residential	429.4	451.6	451.6	451.6
Non-Residential	32.3	32.3	32.3	33.8
Municipal	12.0	12.0	12.0	12.0
UAW	30.4	30.4	30.4	30.4
Total	**504.0**	**515.9**	**515.9**	**517.4**

Using the information from Table 1-4, Figure 1-3 shows total annual water demand for the three scenarios, compared with Sharon's current permit limit and 85% of the current limit. This figure shows that total water use would remain below Sharon's current annual permit limit through 2030, except in the high growth scenario. The best estimate forecast remains below the limit, but exceeds 85% of the current annual permit limit starting in 2010. Only the low growth scenario remains below the current permit limit and a 15% safety margin. Water conservation is therefore needed to avoid exceeding Sharon's current permit, if the town wants to accommodate growth in residential or commercial use and maintain a margin of safety.

Figure 1-3: Total Water Demand Forecast (mgy)



<u>State Forecast</u>

The Massachusetts DCR submitted a letter to the Town dated September 25, 2009 which provided the state's calculation for the total average water use forecast. The state provided two forecasts, the first using 65 gpcd for residential use and 10% UAW, the second using Sharon's current 68.2 gpcd for residential and 8.2% for UAW. Information from the 2004 through 2008 Annual Statistical Reports was used as a basis for these forecasts along with population and employment projects from the MAPC. This letter is attached in Appendix 1-2. The DCR forecasts for 2030 were 562 mgy with a 5% or 29 mgy buffer for 65/10 and 584 mgy with a 29 mgy buffer for 68.2/8.2. These forecasts fall between the WCP low and best estimate for annual water use.

The Town of Sharon responded to the DCR letter concerned that future planned large developments in the Town will not be supported by the 29 mgy (5 %) buffer.

<u>Maximum Day Demand</u>

Water conservation efforts need to address peak demand as well as total water use. A forecast of maximum day demand suggests that conservation to reduce peak day demand is necessary. Table 1-5 and Figure 1-4 present best estimate, high and low forecasts for maximum day demand. These forecasts were developed by applying a range of maximum-to-average day demand ratios to the total water demand forecasts. Sharon's data on trends in maximum-to-average day demand ratios generally decline over time. Forecasts for maximum day demand were developed assuming the following ratios:

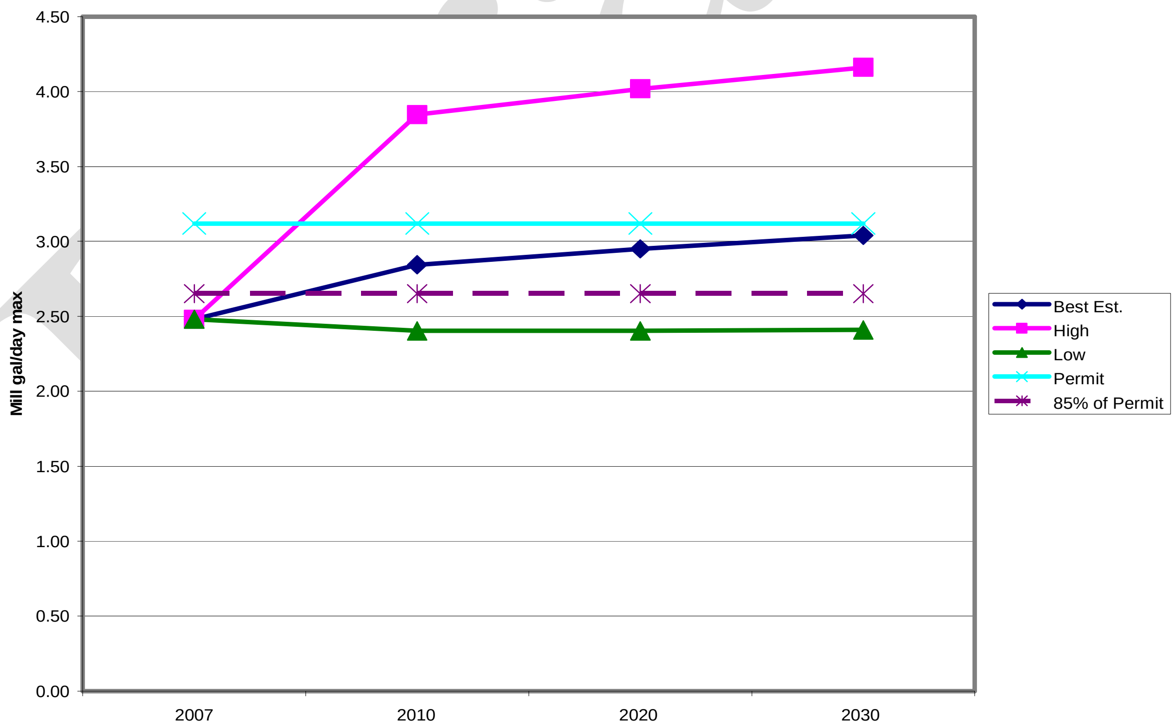
- **Best estimate**: MDD/ADD = 1.8 – equal to the ratio reported in the 2007
- **High estimate:** MDD/ADD = 2.0
- **Low estimate**: MDD/ADD = 1.7 – somewhat below recent experience

Table 1-5: Maximum Day Demand Forecast (mgd)

	Best Estimate	High	Low
Actual 2007	2.48	n/a	n/a
Estimated 2010	2.84	3.85	2.40
Estimated 2020	2.95	4.02	2.40
Estimated 2030	3.04	4.16	2.41

Figure 1-4 compares the forecasts of maximum day demand with Sharon's current permit limit on pumping in one day, and with 85% of the current daily limit. Sharon's maximum day use (2.48 mgd) is almost 80 percent of the permit limit on daily use (3.12 mgd). Therefore growth in overall water demand could easily approach or exceed the permit limit without efforts to reduce peak water use.

Figure 1-4: Maximum Day Demand Forecast (mgd)



Summary

The forecasts presented in this section indicate that:

- Sharon will need to achieve further reductions in annual per capita water use if the town wants to accommodate growth in the number of residents or commercial growth and still maintain a margin of safety within its current permit limits on water withdrawals.
- Reductions in peak day use are important, because the maximum day use is already 80 % of the current permit limit on maximum day pumping.

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Appendix 1-1: Water Use for Planned Developments

Project Name	Project Description	# Units	# Bedrooms	Conservative Water Use Projection	
				Max Day (gals)	Annual (mgy)
Sharon Hills	AQ: 624 units + 150 bed nursing facility	774	1217	116,100	31.8
Residences at Old Post Road 40B	AQ: applied for 66 units/approved for 48	48	98	7,200	2.0
Avalon Sharon 40B	rental apts – project completed	156	280	30,800	8.4
Hunters Ridge	AQ: 2 abutting homes & pool area. Future unit/BR #s not yet known.	51	102	8,994	2.5
Townsman Square V Subdivision	SF: #BRs/unit not known; worst-case assumption	6	29	3,190	0.9
Morse St. Ext. Subdivision	SF	2	8	880	0.2
King Phillip Estates	SF	2	8	880	0.2
"Residences at Sharon Commons"	168 apartments approved in MOU (currently planned for 2BR)	168	336	36,960	10.1
So. Main St. Business District – Lifestyle Center				60,000*	16.4
Apartments in Wilbur School	apts	79	129	18,145**	5.0
Total				283,149	77.5

* groundwater discharge permit approved for 60,000.
** abutter flow added to offset nitrates generated by development. (14,190 gpd for apts., 1,315 gpd Town Hall, & 2,640 gpd for abutters.
AQ = age qualified
SF = single family
Source: Communication with P. O'Cain, Sharon Town Engineer. Maximum day demand calculated based on conservative Title V assumptions – 110 gpd/unit or 150 gpd/unit for age-qualified – except where noted. Annual demand calculated assuming average day demand equal to 75% of maximum day demand.

dcr
Massachusetts

September 25, 2009

Eric Hooper
Department of Public Works
217 Rear South Main St.
Sharon, MA 02067

Dear Mr. Hooper,

The Department of Conservation and Recreation's Office of Water Resources (OWR) has developed draft water needs forecasts (demand projections) for your water supply system, using the water needs forecasting methodology adopted by the Water Resources Commission. These projections are based on information contained in the annual statistical reports (ASR) filed with the Massachusetts Department of Environmental Protection (DEP) for the years 2004 through 2008, employment and population projections prepared by the Metropolitan Area Regional Planning Council (MAPC), and information concerning water use patterns and service area obtained through conversations with you.

Two sets of projections are provided in this letter. The first assumes that throughout the 20-year permit period the residential water use for your water supply system will be 65 gallons per capita per day (RGPCD) and that unaccounted-for water (UAW) will be 10%. The second set of projections assumes that future residential water consumption and UAW will continue to reflect current trends. Working with you, DEP will select the appropriate projection scenario to use in your Water Management Act (WMA) permits. In addition, the methodology allows for a buffer of 5% of overall withdrawal volumes, to accommodate for uncertainty in growth projections. DEP will use its permitting discretion during its five year review process to determine if the additional 5% buffer is warranted for your system.

OWR and DEP invite you to an informational meeting on **September 29th, 2009**, where we will be describing the permit renewal process and discussing how the water needs forecasts will be applied. This public meeting will be held at **Borderland State Park Visitors Center** (http://www.mass.gov/dcr/parks/borderland) at **10:00 AM**.

Please bear in mind that this is a draft forecast. If, upon your review of these projections, you feel information relevant to these projections may have been omitted or additional information has arisen since you spoke with OWR staff, or if you have other questions about these projections, please contact Sara Cohen at (617) 626-1374 as soon as possible.

The following key assumptions were used in the development of the forecast:

BASELINE:
Base water use: 1.46 MGD
Base RGPCD: 65.7
Base UAW: 12.7%
Base Service Population: 17,799
Base Non-Residential Volume: 0.11MGD
Source: Calculated as averages from the Annual Statistical Reports (ASR) submitted to DEP, 2004 - 2008.

Base Employment (2008): 3,334
Source: Interpolated based on employment population recorded by MAPC for 2000 and projected for 2010.

GROWTH PROJECTIONS:

	2015	2020	2025	2030
Service Population Projections	18,506	18,804	19,131	19,457
Employment Projections	3,445	3,521	3,564	3,607

Source: DCR interpolation from population and employment projections developed by the Metropolitan Area Planning Council (MAPC). Service Population Projections are based on the assumption that 99% of the community is served by the Public Water Supply, in addition to 100 out-of-town residents.

The following two projections represent the draft forecast:

Assuming 65 RGPCD and 10% UAW:

	2015	2020	2025	2030
Projection (in MGD)	1.46	1.49	1.51	1.54
			Five Percent Buffer:	+ 0.08

Assuming water delivery continues at current RGPCD (68.2) and current UAW (8.2):

	2015	2020	2025	2030
Projection (in MGD)	1.52	1.55	1.57	1.60
			Five Percent Buffer:	+ 0.08

Water Sales and Purchases:
While Sharon has recorded sales to Stoughton and purchases from Stoughton and Foxborough, the sales refer to water sold directly to individual customers in Stoughton with individual service connections to Sharon's system, and the purchases refer to water sold directly to Sharon residents with individual service connections to Stoughton and Foxborough. The customers in the former category are accounted for in the needs forecast above. Those in the latter category are not expected to need water from the Sharon public water supply.

The permit renewal filing dates for the Taunton River basin are November 1st – 30th, 2009. DEP will discuss these projection scenarios with you during the permit renewal process.

Thank you for your cooperation with this process. As stated, if you have any questions concerning these projections, please contact Sara Cohen at the number listed above.

Sincerely,

Anne Monnelly
Acting Director
Office of Water Resources

cc: Sara Cohen, OWR
Kathleen Baskin, EOEEA
George Zoto, DEP SERO
Duane Levangie, MassDEP
Elizabeth McCann, MassDEP
Jennifer Pederson, MWWA (per request)
Carol Harris, Woodard and Curran (per request)

Chapter 2: Demand Reduction
Date: April 2, 2010

General

The purpose of this section of the Master Plan is to review and recommend water demand reduction measures. The Town recently completed a report entitled "*Water Conservation Plan for the Town of Sharon*" (WCP). The WCP was prepared by the Department of Public Works in conjunction with the Neponset River Watershed Association, and Nancy Hammett. The plan was very thorough in its review and recommendations of demand reduction strategies and identifying the impact of demand reduction on water supply requirements. This Demand Reduction, Section 2, of the Water System Master Plan represents a summary of the WCP report recommendations compiled with our recommendations for demand reduction strategies.

This Demand Reduction Section provides;

- Water Conservation Goals
- Water Demand Forecasts with and without Water Conservation
- Recommended Water Conservation Strategies
- Recommendations for Maintaining Low Unnacounted for Water Use
- Seasonal Water Rate Impacts on Water Conservation
- Guidance for Utilizing Drought Indicators
- A Summary for Implementing and Evaluating Water Conservation

The Town recognizes the need to reduce the impact of water use on local water resources and supply. Figure 1-3, Total Water Demand Forecast, compares the lowest, highest, and best estimates of water demand through 2030 with the maximum day safe yield of the water supplies (3.12 MGD) with an 85% safety factor. The 85% safety factor seems reasonable given the variability in any given year of the town being able to pump their sources at the theoretical maximum. The Figure demonstrates that if water conservation does not have a significant impact on future water demands, that the Town may not be able to serve 2030 projected water demands.

Water Conservation Goals

Section 1 of the Weston & Sampson Water Master Plan Demand Analysis indicates that the Town of Sharon should continue to target reductions in the annual per capita water use, as well as the peak day water use.

According to the 2009 WCP report, Sharon's water conservation goal is **"To reduce current water use sufficiently to accommodate projected population and commercial growth with <u>no</u> increase in total or peak day water use over 2007 levels**."

To meet the goal of maintaining 2007 water use through 2020 it is recommended that a *16 percent reduction in water use* be the target for both average annual per capita residential demand as well as peak day demand.

The benefits of achieving these water demand reduction goals through water conservation are far reaching. There will be savings in resources for pumping, treating, and distributing water as well as environmental health benefits to the wetlands that will be protected. In addition, costly water importing from MWRA, a new well source within Sharon, or a Well 6 treatment plant may be able to be avoided and capital requirements for water supply infrastructure may be able to be delayed and/or avoided.

Water conservation efforts will continue to be focused on the most significant water consumption demographic: single-family residential units. These units make up about 90% of the billed water use in Sharon. Another target of demand reduction is outdoor non-essential water use, specifically lawn and garden irrigation demands.

In recent years Sharon has begun to implement significant water conservation measures with the goal of lowering overall water consumption and reducing the summer peak demand. These measures include mandatory outdoor watering restrictions begun in 2001, public education and outreach efforts, leak detection and repair by the Water Department, as well as water main repairs. Several of these factors, along with the creation of a part-time Water Conservation Coordinator position contributed to reduced metered water use between the years 2007 and 2008. This success inspired the Water Conservation Plan in 2009.

The specific water conservation goals outlined in the WCP are as follows:

- *Consistently meet or exceed the Water Management Act permitting standard of no more than 65 rgpcd for residential water use and no more than 10% UAW.*
- *Accommodate new population growth within current annual and maximum day permit withdrawal limits, allowing a 15% safety margin.*
- *Accommodate population and business growth with no increase above current total pumping or maximum day use.*
- *Achieve maximum achievable residential water conservation.*

<u>Water Demand Forecasts with Water Conservation</u>

The WCP outlined several water demand projection scenarios with varying levels of water conservation. Table 2-1 shows the average indoor water use in conserving and non-conserving North American Single Family Homes.

Table 2-1
Average Indoor Water Use in Conserving and Non-Conserving North American Single-Family Homes

Conservation Level	**RGPCD**
Nonconserving Home	69.3
Conserving Home – 2001	45.2
Conserving Home – 2005	36.2

This Table summarized from the WCP Table 6-7 (Vickers, 2001, MA Water Conservation Standards)

The WCP estimated that outdoor residential water use in Sharon averages approximately 17% of total residential water use (Figure 2-4 WCP). When that percentage was applied to the 2007 average of 68.2 rgpcd it implied that the indoor water use was 56.6 rgpcd and the outdoor use was 11.6 rgpcd. The WCP estimated that with aggressive water conservation efforts targeting outdoor water use utilizing drought-tolerant landscaping and more efficient irrigation practices, the outdoor rgpcd could be dropped in half or two-thirds from 11.6 to between 4 and 6 rgpcd.

Figure 2-1 represents the range of water demand projections through 2030 that the Town of Sharon can expect. The projections are based on the best estimate of population growth, and holding UAW at 6% (current levels). The water demand estimates utilizing the most aggressive conservation efforts are based on reducing the residential water demand to 40 rgpcd by 2030. We are in agreement with the WCP that 40 rgpcd is obtainable with very strict water conservation efforts and that the Town of Sharon can do much to reduce their current residential demand.

Figure 2-1
Impacts of Water Conservation on Projected Water Demands

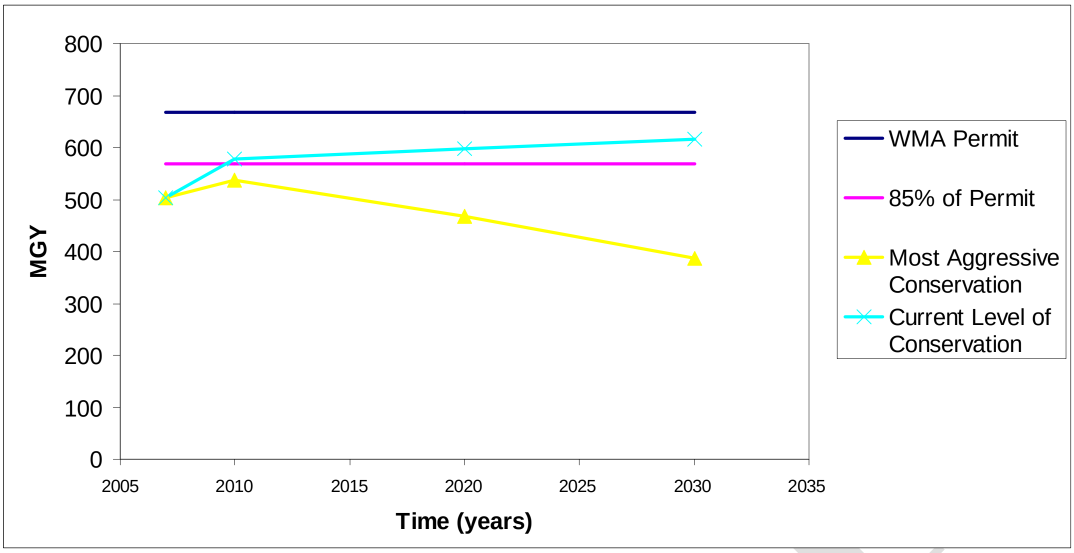


Figure 2-1 shows the projected water demands in Section 1, which assumes the current level of water conservation and the projected water demands summarized in the WCP (Goal 4) showing very aggressive water conservation efforts to get the residential demand to 40 gpcd. It should be a goal of the Town of Sharon to achieve the most aggressive water conservation demand estimates, however, it will be more likely that they will be somewhere in between the two estimates. Figure 2-1 demonstrates that if they can obtain water demand estimates somewhere in the middle of current conservation and maximum conservation levels that they will be able to meet their WMA permit with an 85% safety factor.

Recommended Water Conservation Strategies

As previously stated single-family residential development makes up the majority of water use in the town of Sharon. We recommend that water conservation efforts continue to be focused on this demographic in order to maximize the impact on water supply.

Reducing the rgpcd should be a major focus for the Town. This is most effectively done by reducing daily household water use and changing water use habits. Another major focus of the town should be to reduce the summer maximum day water use. This is best performed by targeting a reduction in outdoor water use. In order for water conservation to be successful at reducing the impact on water supply, the town will need to keep a very close watch for leaks and track the UAW regularly.

The water conservation strategies that the Town has employed since 2001 have been successful at lowering the Town's average daily and maximum daily water demands. However, the current levels of residential water use are still high compared with the published levels residential use indicating that there is significant room for improvement and further reductions. Major components of the current and recommended conservation strategies from the WCP are summarized in this section. The financial and quantity impact of each individual conservation effort is very difficult to quantify, however each of the following efforts will offer incremental improvement.

Water Conservation Coordinator

The creation of the Water Conservation Coordinator position has had a positive impact on the conservation efforts in Sharon. Maintaining the Water Conservation Coordinator position at least half time for the next 3 to 5 years will enable the Town to continue to focus on improving and increasing water conservation strategies. It will be necessary for the Town to provide clear, concise goals and expectations of the tasks that the Conservation Coordinator will need to perform to stay focused on the best efforts / strategies.

Customer Metering

- Automate data on water use by customer group using the automated billing software.
- Continue to investigate the costs and benefits of automated water service leak detection, as the technology develops.
- Discuss and potentially implement leak detection of water services (especially long services on private property) and a water service replacement program.

The new radio-read meter installation project was completed at the end of FY2009. These radio-read meters will allow for more accurate tracking of water use, more effective detection of internal plumbing leaks, and more frequent billing. These radio meters, combined with the more frequent billing, can allow for better monitoring of unaccounted for water (UAW). Increased monitoring will give the town the opportunity to discover and repair leaks in a much faster timeframe than currently possible.

Water Billing and Rates

- Continue to evaluate water rates annually, to ensure that revenues cover long-term supply costs, including the costs to continue the conservation program and attempt to increase the budget to include future capital (supply and distribution) requirements.
- Review how effective summer / seasonal rates and quarterly billing have been on summer peak and annual average water use.
- Provide information on water use history and comparison with targets in water bills, using automated billing software.

Seasonal rates will provide an effective means of reducing peak water consumption during summer months. The increased summer rates went into effect January 1, 2010. In addition, more frequent billing will keep customers up to date and aware of their water use and charges, which will encourage conservation as well as allow the Water Department to more closely and accurately track Department revenue. Monthly billing should be considered as an alternative to quarterly billing.

Tracking and Analysis of Water Use

- Conduct regular analysis of water bills to characterize trends and identify potential leaks. The automated billing software should be used to flag trends and leaks.
- Investigate trends in private well use (a cooperative effort by the Conservation Commission and the Board of Health). Inventory residences and businesses with private wells (including irrigation wells) with size and capacity data. Private wells have the potential to disrupt the overall water resources in Sharon and should be monitored and potentially regulated.
- Investigate high per capita use in multi-family buildings.
- Consider including information on the Town's Water Conservation website regarding water use and water conservation goals and data.

Regular tracking and analysis of water use is an instrumental step in insuring the success of any conservation measures, as well as for detecting leaks. This data must be analyzed on a frequent basis in order to determine the existence of trends. This will be made more effective by the increase in frequency of reading and billing. The Town's water system GIS is an ideal method for tracking and managing this type of data.

It is recommended that Sharon specifically monitor two areas: private well use and multi-family buildings exhibiting high per capita use. The multi-family buildings in Sharon have historically shown high per capita water usage. Although they represent a small fraction of the consumers (4% of total use) there is potential to have a significant impact due to possible unidentified leaks and wasteful use. The average per capita water use for these multi-family units is 88 gpcd, significantly higher than the state's targeted average of 65 gpcd. As these customers do not see the direct impact of their water use in their water bill, they will be a difficult group to target for conservation. It is important for these customers to see how much water they are utilizing even though they do not get a bill. This is a good group to target for education handouts and flyers.

Evaluating Potential Impacts of Pumping on Water Resources

- Continue to track groundwater levels and stream flow, and assess for evidence of impacts of pumping on local water resources.
- Build analysis of water resource impacts into all long-term Water Department planning.

There is limited information to date on the impact of the town's pumping activity on the local water resources. This is an area that requires more attention and study. In order to adequately plan for future regulations and development in Sharon there needs to be an understanding of the current impacts of pumping on the water resources. This issue is of high priority and is discussed in terms of sub-basin impacts in other Sections.

Public Outreach and Education

- Continue the programs begun in 2008 – the elementary school programs, the Energy and Water Fair, outreach through local media, water bill inserts, and the town's Water Conservation webpage.

- Continue to investigate resources and best practices used elsewhere, to identify the most effective education and outreach options.
- Develop a conservation program for the High School.

Public outreach and education is an integral part to water conservation efforts in Sharon. If the public is made aware of the situation they can begin to contribute to the solution. The current outreach and education programs should be sustained. Another avenue to approach this issue may be through local summer camps. It has been noted that approximately 2,500 residents are added to Sharon's population in the summer from camps (M&E, 2002). If these camps can be approached in a manner similar to elementary schools there may be potential to reduce the impact on demand during the peak season.

<u>Water Audits and Leak Detection</u>

- Investigate and select an alternative supplier for separate indoor and outdoor audits, as well as combined audits.
- Compile, analyze and publicize information on the results of audits.
- Scan account water use data regularly and notify customers of potential leaks.
- Target customers annually for water audits based on high volume water use and water use discrepancies. Link water use to customer account in the GIS to identify water use discrepancies based on building size, lot size and capita (if available). Download the Badger / Orion recorded hourly meter data to audit hourly water use and look for water use discrepancies.
- Monitor water use in large multi-unit residential complexes closely. Perform public education within these buildings to educate residents about their water use impacts.

<u>Distribution of Retrofit Kits</u>

It has been shown in the past that many of the freely distributed retrofit items are never installed or used and are thus ineffective at conserving water. However by implementing educational programs with the distribution of items may encourage participation. Instructions and information about potential water savings (as well as potential bill reduction) would be a wise addition to the program. Also, gauging public interest in a demonstration installation could indicate another way to encourage participation.

<u>Rebates</u>

- Continue the rebate program for high-efficiency toilets and washing machines.
- Target the rebates to older homes and fixtures/appliances.
- Compile and analyze information on the impacts of the rebates.
- Consider rebate programs for upgrades to irrigation systems to make them more water-wise.

According to the U.S. Census in 2000 72% of then-existing 5,934 housing units were built before 1980. Although many of these houses have likely been renovated since 2000, we estimate that continuing the rebate program will continue to be instrumental in getting many of the remaining old appliances and toilets replaced by higher efficiency models.

Demonstration Sites

- Complete planned installations of high-efficiency toilets and faucets in selected public buildings.
- Plant selected high-visibility public areas with water-efficient plantings, and demonstrate water-efficient irrigation techniques on the town's parks and playing fields.

Schools and playing fields are influential locations to implement well publicized water efficiency measures. These locations are not only significant water consumers but are also seen by a large percentage of the population on a regular basis. It is also crucial that the town's practices uphold the messages that are sent to residents about water conservation.

Outdoor Watering Restrictions and Advisories

- Continue current restrictions.
- Accompany with "When Not to Water" advisories.
- Look for opportunities for re-use of stormwater and potentially wastewater. Utilize rain-barrels and cisterns to help reduce the impact of outdoor irrigation on demands where appropriate.

The outdoor watering restrictions Sharon has had in place since 2001 should be upheld. Restrictions like these have been shown to reduce peak water use, but not necessarily total irrigation water use. To reduce total irrigation water use widespread planting of drought-tolerant landscaping should be advised by the town. Distribution and implementation of rain barrels will help to reduce the garden irrigation demand.

A "When Not to Water" advisory program could contribute to lower total irrigation water use levels if residents were encouraged to cut back on watering their lawns and gardens. The program can be supported by data generated at an off-site weather station recently acquired by the Sharon DPW.

Irrigation By-Law

- Develop a bylaw regulating automatic irrigation system installation, maintenance and use.

Enhanced regulation could contribute to a significant reduction in irrigation water use. Automatic irrigation systems are prevalent in Sharon and are suspect for wasteful operation. A bylaw could add a requirement for new systems to be properly installed and maintained and existing systems to be inspected and adjusted regularly. Another part of the regulation could include requiring rain shut-off switches or soil moisture or ET- controllers. Combining more efficient irrigation with the planting of drought resistant varieties of plants could reduce outdoor water use by a half or two-thirds of the 2007 average.

Unaccounted for Water (UAW)

Unaccounted for water is caused by leaks in water mains, and services, old meters not registering correctly, unauthorized hydrant openings, illegal connections, standpipe overflows, and data processing errors. Given that the residential and most production meters are new in Sharon, we estimate the largest source of UAW is leaks. Water main and water service leaks if left undetected for months, will significantly impact the total UAW, diminish the impacts of water conservation efforts on water demand, and cost thousands.

Sharon's goal for unaccounted for water is to maintain the level less than 10%. This will accomplish two things. First, it will allow Sharon to stay on track with their demand management efforts to stay within the existing source capacities and second to comply with the WMA permit. Sharon has reported an UAW of 6% and 3% in the 2007 and 2008 Annual Statistical Reports. These levels are excellent and are a tribute to water department personnel efforts. We recommend that the Town continue with annual leak detection efforts of the entire water distribution system. It is not likely nor expected that a significant improvement in UAW use can be achieved, however, maintaining low levels in the current vicinity will be deemed a success.

The new radio-read meter system allows water department personnel to read every meter in town in less than 3 days. Based on discussions with Water Department Personnel, the town is planning to read meters monthly and send bills quarterly. This will allow the town to perform monthly analysis of seasonal demand patterns, trends, and matching of water consumption to pumping data to track UAW. Leak detection efforts will become more focused as leaks occur and are discovered.

Seasonal Water Rates Impact on Water Conservation

Sharon has begun quarterly billing in 2010. The more frequent billing periods will allow for earlier detection of leaks, allow customers to review past years' data, and may make rate increases more palatable. More frequent billing may allow for anomalies to be detected from comparison to previous years' data. In addition, customers may be encouraged to conserve water if they notice an increase in their usage over previous years' bills. Sharon should consider monthly billing as an option for the future.

We estimate that many water utilities will begin shifting toward monthly bills over the next 5 to 10-years. For many customers, a correction in perception is required, that water is no longer an inexpensive commodity. Monthly bills may help customers realize the importance of water and help keep it in perspective with their other monthly utility bills. It will also allow water utilities to perform water rate increases keeping up with inflation, with lesser impact to customers.

Starting in FY2004 the Water Department experienced four consecutive years of revenue deficits. This resulted in a rate increase effective May 1, 2007. The 2007 rate increase built upon the increasing block rate structure by expanding the largest consumers' bills by the highest percentage (35%) while the lowest consumers saw a more modest increase of about 15%. This rate increase was successful and the Water Department showed surpluses in 2007 and 2008. As of January 1, 2010 another increased block rate went into effect in Sharon. This rate increase includes a higher seasonal rate for the summer irrigation season. The previous and current rate structure is as follows:

Table 2-2 Change in Sharon Residential Water Rates

Residential Water Rates			
	Fall / Winter		
	Price/1000 gals quarterly		
	Previous	Effective 1/1/2010	Increase/1000 gal
0-7,500 gals	$3.00	$3.00	$0.00
7,500-15,000	$3.50	$4.50	$1.00
15,000-22,500	$4.50	$6.00	$1.50
22,500+	$10.00	$10.00	$0.00
	Spring / Summer		
	Price/1000 gals quarterly		
	Previous	Effective 1/1/2010	Increase/1000 gal
0-7,500 gals	$3.00	$3.00	$0.00
7,500-15,000	$3.50	$5.00	$1.50
15,000-22,500	$4.50	$7.00	$2.50
22,500+	$10.00	$12.00	$2.00

The seasonal rates and increased block rate structure should both be maintained and monitored in the future to determine their impact on demand and revenues. Customers should be made aware of the pricing system through bill stuffers and educational flyers, in an effort to conserve water and reduce their bills.

One of the largest impacts of an increasing block water rate structure is water conservation. As rates increase, customers tend to use less water to reduce the impact of the increase. We suggest that the Town continue to monitor the impacts of the increasing tiered rates on water use. We expect that it will be successful at lowering the average water use (rgpcd) as well as reducing outdoor irrigation use. The water rate increases and tiered block rates are in-line with the Town's water conservation goals.

We recommend that the water rates be set to fund water capital expenses, both supply and distribution, in addition to operating expenses. If Sharon needs to construct a new well, or a treatment plant, or import MWRA water due to demand increases the pricing structure will again have to be updated.

Drought Indicators

The Executive Office of Environmental Affairs (EOEA) and the Massachusetts Emergency Management Agency (MEMA) prepared a statewide Drought Management Plan. The intent of the plan is to provide guidance during periods of drought and extended dry weather.

Although there are a variety of ways to formulate a drought management plan, two general types are discussed below:

- Operational Drought Management
- EOEA based

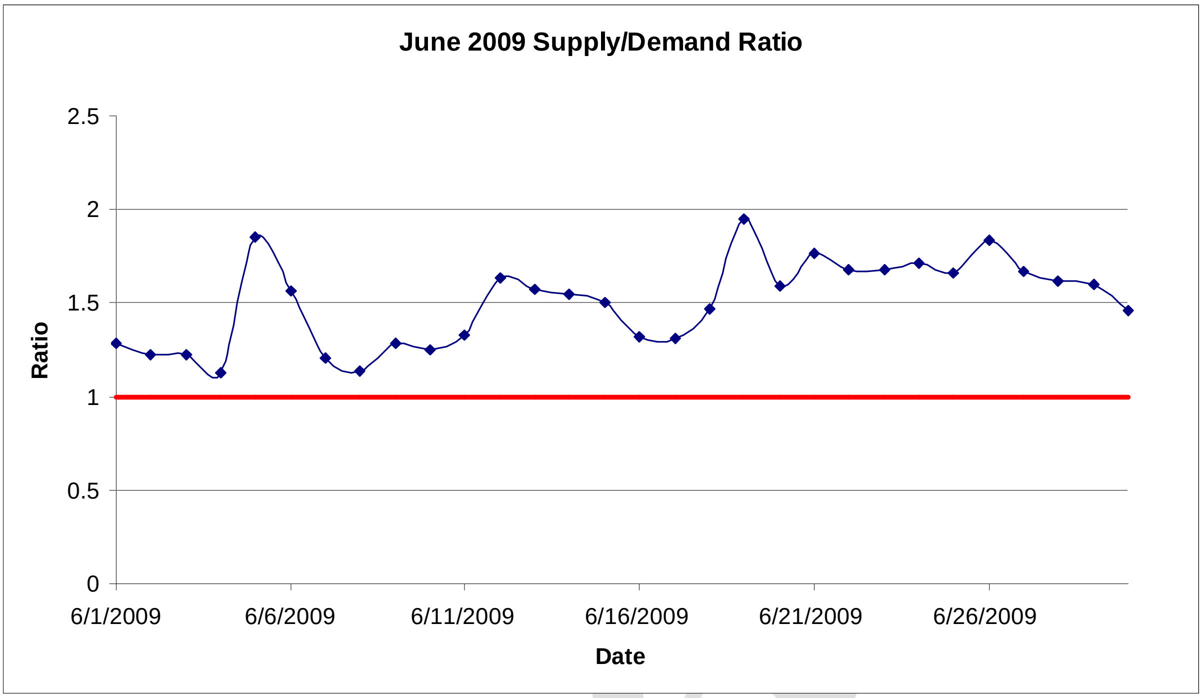
Operational Drought Management

Operationally, the effects of a drought may impact one municipal system differently from another. By developing a system specific method which provides more of a predictive methodology can help system operators manage their sources of supply and influence demand in a timely fashion. Most operationally based drought management plans are developed based on an understanding of a system's production capacity and comparing it to current or anticipated system demand. This is often done using a ratio between water supply capacity and demand values.

In Sharon's case historical system production capacity is a valid place to start. Either a theoretical safe yield for all sources of supply can be used (estimated at 3.12 MGD) or the actual production over a period of record. Based on production data from 1995 to 2008, Sharon's peak production values have been approximately 80 MG per month (July 1995 and June 1997). A safety factor of 15% can be applied to this value to approximate drought conditions. This is realistic as lower recharge rates and declining water table elevations would reduce well capacity. Thus 66 MG per month or a daily critical output of 2.12 MGD represents a realistic daily value during drought conditions.

Developing a warning or planning effort based on the relationship of system demand to this critical output value would be useful. As system demand approaches 2.12 MGD, the ratio of supply to demand will approach 1. This can be done on a weekly or daily basis with appropriate triggers for action enacted based on the ratio. It is helpful to look at an example of such a plan. Figure 2-2 shows the ratio for June 2009 water pumping data.

Figure 2-2
Water Supply / Demand Ratio



The creation of the Drought Management Task Force by the Department of Environmental Management (DEM) offers another way to monitor drought conditions as well as assess the severity of a drought. This assessment is based on regional conditions. The regions are divided into: Western, Connecticut River Valley, Central, Northeast, Southeast, and Cape and Islands. Sharon is in the Southeast region. DEM uses a variety of indices to determine the drought conditions for the state. Using these indices, they assess drought conditions according to the following severity: Normal, Advisory, Watch, Warning, and Emergency. These conditions are determined on a monthly basis. Data collection frequency should increase following an upgrade to the severity of the drought condition. This data collection should include factors like monthly demands, supply/demand ratio, and groundwater levels. Table 2-3 is a summary of the proposed MassDEP requirements to limit nonessential outdoor water use (e.g., lawn watering) from May 1 through September 30, based on the previous year's overall residential gallons per capita daily water usage.

Table 2-3
Proposed Limitations for Outdoor Water Use

Action Trigger	Required Water Use Restriction	
Permitees with prior year RGPCD of 65 or below		
Drought Advisory* OR Streamflow <=0.5cfsm**	No nonessential outdoor water use 9 am – 5 pm	
Permitees with prior year RGPCD of above 65		
	PWS in High Stress Basin	**PWS in Unassessed, Medium and Low Stress Basin**
Drought Advisory*	No nonessential outdoor water use	Nonessential outdoor water use allowed one day/week before 9 am and after 5 pm
Plus one of the following two options:		
Streamflow Trigger <=0.5cfsm**	No nonessential outdoor water use	Nonessential outdoor water use allowed one day/week before 9 am and after 5 pm
Calendar Trigger May 1- Sept 30	Nonessential outdoor water use allowed one day/week before 9 am and after 5 pm	Nonessential outdoor water use allowed two days/week before 9 am and after 5 pm
*or higher, declared by MA Drought Management Task Force. ** or other targets established and incorporated into WMA permits.		

MassDEP, draft dated 7/17/2008

Although the above table shows proposed requirements, the MADEP is issuing all new permits with a requirement that is "blind" to the basin stress level. Most likely Sharon's future permit will be conditional with the requirements for a drought management plan that uses the restrictions listed under low stress basins. Sharon can choose to adopt these, other restrictions that are considered functionally equivalent, or more strict limitations on water use during a drought.

Implementation and Evaluation

Predicted water savings contain substantial uncertainty and therefore there should be significant emphasis placed on the continued monitoring of the recommended conservation measures. In addition, conservation goals will change over time as Sharon's population grows. Conservation planning needs to be an ongoing effort.

A key component of the conservation effort is improving the town's ability to track and analyze water use. Identifying trends and data gaps is crucial to making the system as efficient as possible. The use of automated collection of data from radio-read meters will enhance the town's ability to track water use and improve accuracy and preparation of the Annual Statistical Report.

The town needs to continue to allocate adequate budget resources to water management. Grants and sponsorships should be sought as they have in the past as supplements to the budgeted amounts.

The progress toward achieving the goals outlined here should be evaluated on a regular basis. Water use profiles should be generated regularly, as well as analysis of trends in average and peak water use by sector. The rebate and water inventory programs should be monitored closely to determine their effectiveness.

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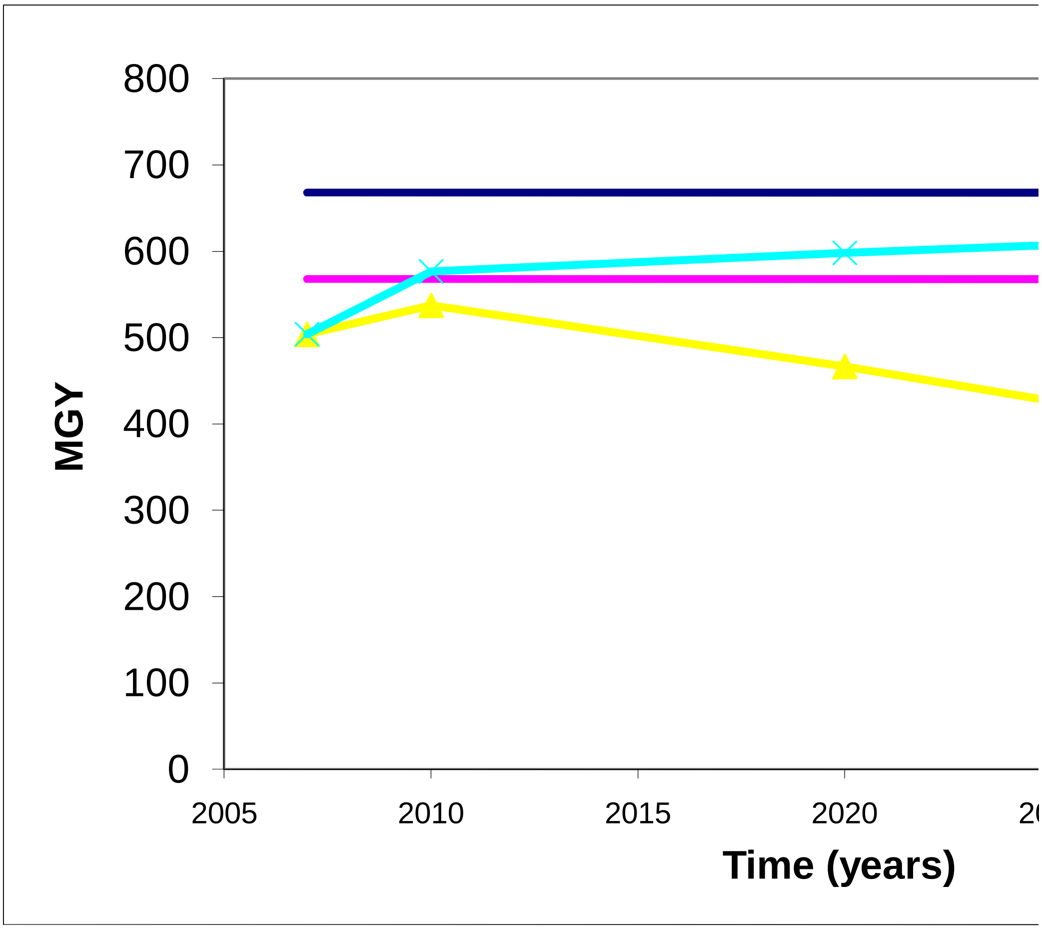
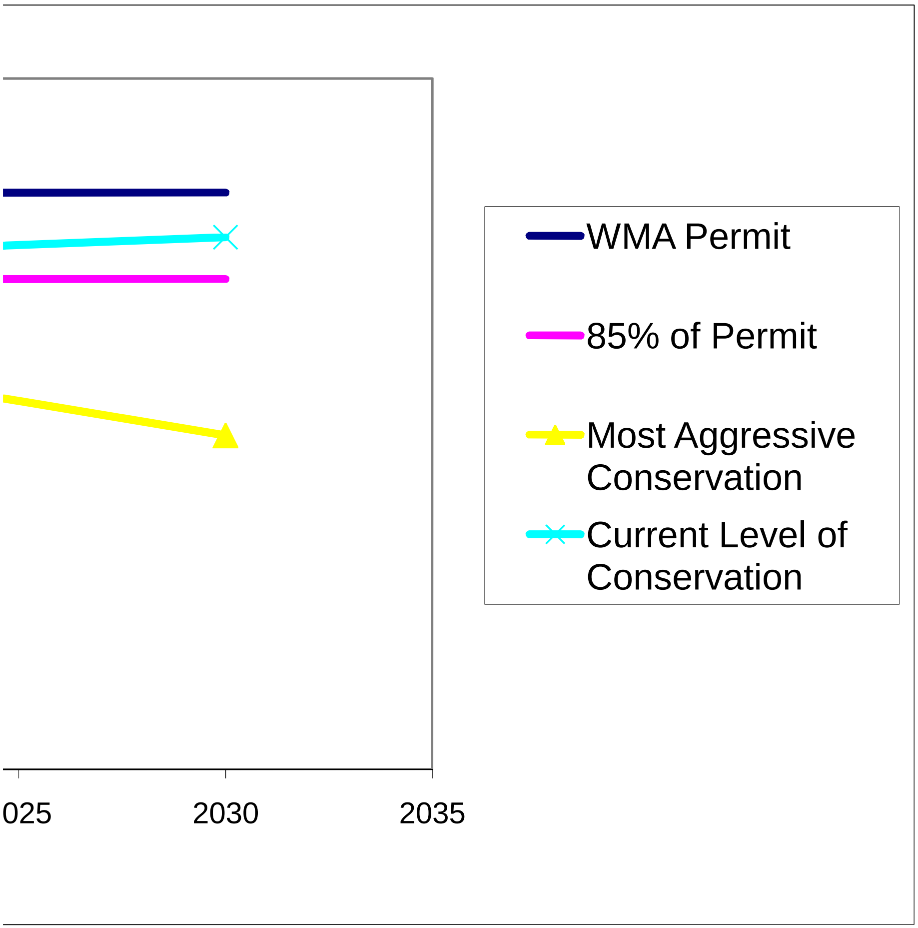
Uses Best Estimate of Population
Assumes UAW stays at 6%

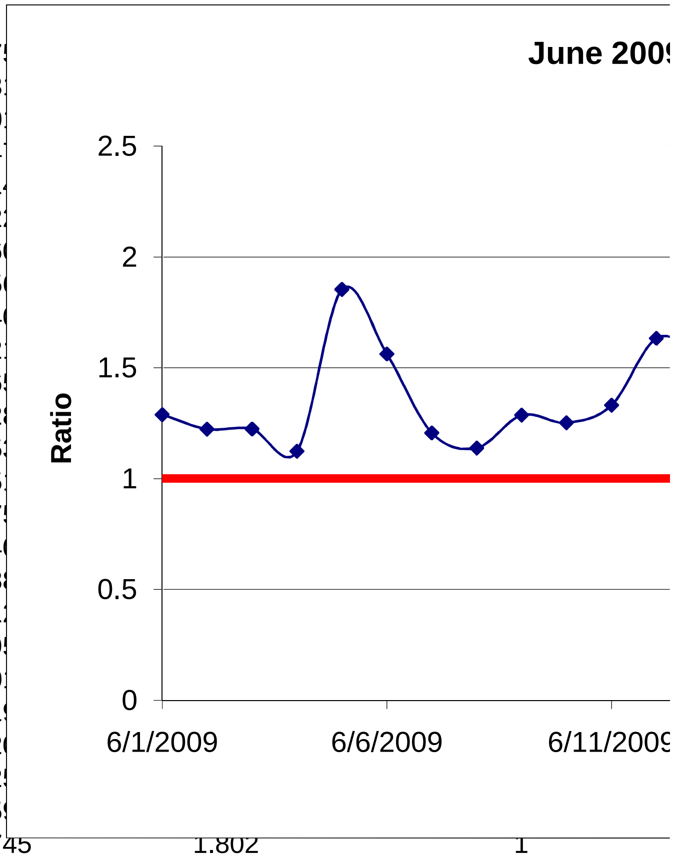
Year	WMA	85% of Per	Goal 4 40 GPCD by 2030	No Conservation	Goal 3 WCP Best Estimate
2007	667.95	567.7575	504.1	504	
2010	667.95	567.7575	537.5	576.8	
2020	667.95	567.7575	466.5	598.3	
2030	667.95	567.7575	386.9	616.3	

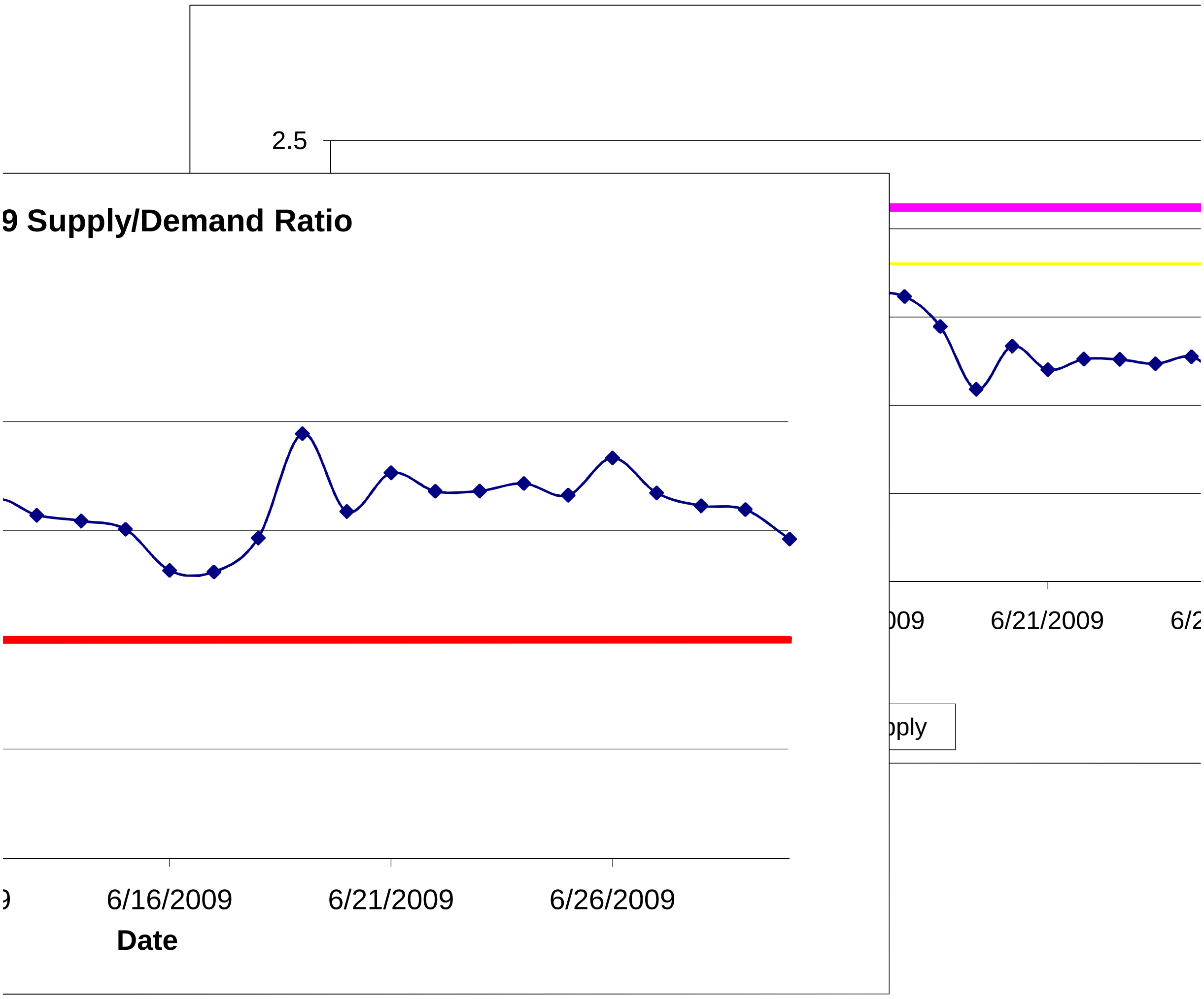



025
2030
2035
WMA Permit
85% of Permit
Most Aggressive Conservation
Current Level of Conservation

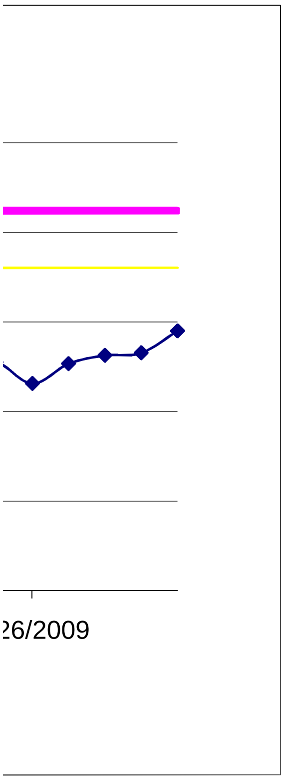
Jun-09

Day	Demand	Supply	Supply/Der	85% Supply	Weekly Average Supply/Demand	
June 1, 2009	1.645	2.12	1.2887			
June 2, 2009	1.733	2.12	1.2233			
June 3, 2009	1.732	2.12	1.2240			
June 4, 2009	1.887	2.12	1.1234			
June 5, 2009	1.144	2.12	1.8531			
June 6, 2009	1.357	2.12	1.562			
June 7, 2009	1.757	2.12	1.2066			
June 8, 2009	1.862	2.12	1.1385			
June 9, 2009	1.648	2.12	1.2864			
June 10, 2009	1.693	2.12	1.2522			
June 11, 2009	1.592	2.12	1.3316			
June 12, 2009	1.298	2.12	1.6332			
June 13, 2009	1.349	2.12	1.5715			
June 14, 2009	1.372	2.12	1.545			
June 15, 2009	1.407	2.12	1.5067			
June 16, 2009	1.608	2.12	1.3184			
June 17, 2009	1.616	2.12	1.3118			
June 18, 2009	1.445	2.12	1.4671			
June 19, 2009	1.09	2.12	1.9449			
June 20, 2009	1.335	2.12	1.5880			
June 21, 2009	1.201	2.12	1.7651			
June 22, 2009	1.261	2.12	1.6812			
June 23, 2009	1.26	2.12	1.682			
June 24, 2009	1.235	2.12	1.7165			
June 25, 2009	1.275	2.12	1.662745	1.802		1
June 26, 2009	1.156	2.12	1.83391	1.802		1
June 27, 2009	1.267	2.12	1.673244	1.802		1
June 28, 2009	1.313	2.12	1.614623	1.802	1.558094	1
June 29, 2009	1.327	2.12	1.597589	1.802		1
June 30, 2009	1.45	2.12	1.462069	1.802		1





2.5
9 Supply/Demand Ratio
)09
6/21/2009
6/2
pply
9
6/16/2009
6/21/2009
6/26/2009
Date


26/2009

Chapter 3: Existing Well Supplies and Well Pump Stations Evaluation
Date: February 11, 2010

Introduction

This draft technical memorandum includes the evaluation of the existing capacity of Sharon's current supply sources and a review of each of the well pump stations mechanical systems. Existing records for each supply were reviewed including a review of historical construction, cleaning, pumping, and water quality records. In addition, on-site inspections of the well pump stations and an interview with the Water Division Supervisor were conducted. In completing these tasks we have assessed the physical conditions at each well station and have attempted to:

- Document the history of the existing pumping stations
- Develop a list of improvements based on current conditions and current regulatory requirements
- Evaluate existing source yield and constraints on additional aquifer withdrawals at the six well systems

The following memorandum provides the results of this evaluation with a list of potential improvements. Attached to this memorandum are the following tables and figures:

- Equipment tables for each of the wells
- Well and pump station summary table
- Historical redevelopment summary tables for each of the wells
- Available recharge table for all wells
- Historical monthly well pumpage
- Historical yearly well pumpage
- Recommended improvements tables
- A figure showing the location of each well and its associated drainage basin

Background

The Town obtains it water supply from four gravel pack wells, Wells 3, 4, 5, and 6, and two well fields, Wells 2 and 7. These sources fall within two separate Basins regulated under the Water Management Act. The combined DEP approved Zone II pumping rate of the groundwater supplies from all the sources is 3.12 million gallons per day (mgd). However, Sharon is authorized to withdraw a registered volume of 0.55 mgd from both the Taunton and the Boston Harbor Basin. During the five-year period between 2005 and 2010, an additional withdrawal volume of 0.73 mgd has been authorized. This additional volume is not basin specific but each well source has an individual limit on the average daily withdrawal. These issues are discussed below for each well system.

Chemical Feed Systems

This description details the general chemical feed systems at all of the well stations. All wells are treated with sodium hypochlorite for disinfection, sodium fluoride for dental protection and potassium hydroxide for pH adjustment/corrosion control. Additional information is provided in the equipment tables for each of the well stations.

The chemicals are injected in the pump discharge piping before the pipe passes through the foundation. A 4,000-gallon bulk storage tank and containment for the potassium hydroxide chemical feed system is located in a separate building. Potassium hydroxide chemical feed systems are located in the well pump stations and include a 150-gallon day tank, transfer pump, one chemical feed pump, controls, valves and piping. For Wells 2, 6, and 7 the day tanks can be filled from the bulk tank by gravity through a bypass piping connection or with the transfer pump. For Wells 3, 4, and 5 the transfer pump is not used to fill the day tank, it is gravity fed from the bulk tank. Day tanks are contained in a concrete wall that provides 110-percent containment of the chemical should the tank fail. Currently there are no containment flood alarms. Each station is equipped with a pH analyzer to measure the pH of the water entering the distribution system. An alarm is generated for a high pH condition and reported back to main SCADA computer.

The sodium hypochlorite chemical feed systems are located in the pump stations and include a chemical feed pump, 110-gallon storage tank, and a make-up water line with a flow meter. The sodium hypochlorite solution that is feed into the system is diluted. The free chlorine residual goal is 0.45 to 0.50 mg/L. Free chlorine residual is measured daily from the 100-foot sample taps. The gradations on the day tanks are hard to read. The day tanks are contained in plastic basins that provide 110-percent containment of the chemical should the tanks fail. Currently there are no containment flood alarms.

The sodium fluoride chemical feed systems consist of a 50-gallon saturator, chemical feed pump, and a make-up water line with a flow meter. The fluoride dose is 1.0 mg/L and is measured daily from the 100-foot sample taps. There is no containment for the sodium fluoride systems.

All of the chemical feed pumps are interlocked with the remote contact in the PARCO valves in the pump stations. Based on this circuit, the outlet to which the chemical feed pump is plugged in is either energized or de-energized based on whether the PARCO valve is open. The chemical feed pumps are not currently flow paced based on flow signals from the flow meters. Spare chemical feed pumps are kept at the Water Department office.

SCADA System

The SCADA system was installed in 1997 at each of the well stations and water storage tanks. It is used by the Water Department to monitor and control well pumping and monitor water levels at each of the storage tanks. The pumps at wells 2, 3, 4, 6, and 7 are turned on based on the water storage tank levels. The pump at well 5 is operated 24 hours regardless of tank level. The system was upgraded in 2006 and includes a main controller at the Water Department office at Station 1, a new backup laptop computer, a satellite mirror computer at the DPW, new radio modules, antennas and system controllers, updated controller software and updated systems alarms and intrusion switches.

There are additional functionalities of a SCADA system that could be utilized by the Water Department if there is enough spare capacity in the current SCADA system. This includes flow pacing of the chemical feed pumps, monitoring chlorine residual at each station utilizing an on-line chlorine analyzer, and running the well station on standby power remotely. The SCADA system can be set up to allow different levels of controls for different department personnel from monitoring and viewing to full remote control. This would allow Water Division Supervisor, or other designated employee, the ability to remotely control a station in the event of an emergency or other event. In order to assess the ability of each station to handle additional alarms and controls the current Remote Telemetry Units (RTUs) and SCADA system would require further evaluation.

Ground Water Rule

The Environmental Protection Agency (EPA) promulgated the Groundwater Rule (GWR) in October 2006 to establish barriers to protect against bacteria and viruses in drinking water from groundwater sources and to establish a risk-based strategy to identify groundwater systems at a high risk for fecal contamination. The rule applies to public groundwater systems or to systems that have both groundwater and surface water sources providing that the groundwater sources pump to the distribution system directly without treatment. The compliance date for this Rule is December 1, 2009.

The requirements of the GWR are different depending on whether a system provides 4-log removal/inactivation of viruses, which can be accomplished by disinfection, membrane filtration or a state-approved alternative. Because ultraviolet light (UV) is not effective for the inactivation of certain viruses, it cannot be used without another disinfectant to meet the requirements of the GWR. Standard CT values for viruses can be followed for disinfectants as defined in the Surface Water Treatment Rule. For example, the required CT value for 4-log inactivation/removal of viruses for chlorine at a temperature of $15^{o}C$ for a pH range of 6 to 9 is 4 mg-min/L, while at a temperature of $10^{o}C$ the CT required is 6 mg-min/L. The CT required for similar parameters for chlorine dioxide are higher than chlorine and for ozone are lower than chlorine.

The four major requirements of the GWR, as described in the following text, are sanitary surveys, triggered source water monitoring, corrective action, and compliance monitoring.

Sanitary Surveys

Community water systems must have a sanitary survey completed once every three years. Non-community water systems and "outstanding performers" must have a survey completed once every five years. The purpose of the survey is to identify significant deficiencies within the eight critical elements of a water system, that include source, treatment, distribution system, finished water storage, pump stations/controls, monitoring/reporting, operations/management, and operator compliance with state requirements. States must complete the initial round of surveys for community water systems by December 31, 2012. For systems that are "outstanding performers" and non-community systems, states have until December 31, 2014.

Triggered Source Water Monitoring

Triggered source water monitoring is required for all systems that do not provide 4-log removal/inactivation for viruses. If a water system has a total coliform-positive routine distribution system sample under the Total Coliform Rule (TCR), the GWR requires source water sampling within 24 hours. If any of these source water samples are fecal indicator-positive, either five additional repeat samples must be taken at each source where there are fecal indicator-positive results over the next 24 hours or the system must take immediate corrective action (state's option). If any of the five repeat samples are fecal indicator-positive, then the system must take corrective action.

Massachusetts has selected enterococci as its selected fecal indicator. If the distribution system total coliform-positive sample can be traced to the distribution system, then source water monitoring is not required. The GWR also allows states to require systems to conduct optional source water monitoring at any time, this could include wells with a history of fecal contamination. The compliance date is December 1, 2009.

Triggered source water monitoring can be avoided by demonstrating that the system provides disinfection that ensures 4-log removal/inactivation of viruses, see compliance monitoring below.

Sharon has elected to conduct the triggered source water monitoring. At this time, based on Sharon's excellent history of meeting the requirements of the TCR, it was decided that this was the better method of monitoring options.

Corrective Action

Corrective action is required for any water system with a significant deficiency or source water fecal contamination. Systems must provide corrective action within 120 days or submit a plan and schedule for the corrective action to the state within 120 days. Corrective actions may include any combination of the following:

- Correct significant deficiencies (typically determined through the sanitary survey)
- Provide an alternate source of water
- Eliminate the source of contamination
- Provide treatment to achieve 4-log removal/inactivation of viruses

Compliance Monitoring
Systems that provide treatment and concentration-time (CT) must demonstrate that the consistently provide treatment to meet to ensure 4-log removal/inactivation of viruses. Massachusetts DEP is requiring all ground water systems using a chemical disinfectant to complete a Log Credit Determination Form to determine the viral log treatment currently achieved by the system and submit it to DEP by September 1, 2009. Sharon has not reported any total coliform-positive routine distribution system samples in the last several years, so even if 4-log removal/inactivation is not achieved through current disinfection practices the Town may not need to make any corrective actions, unless a future sample is total coliform positive.

<u>Well 2</u>

Well 2, accessed off of Moose Hill Parkway, is located on the west bank of Beaver Brook and is a well field consisting of nine 8-inch wells connected by a suction main to the pumping station. The pumping station and wells were constructed in 1915. The wells were abandoned in the 1960's. A new station was constructed in the1960s to pump water from a gravel pack well. However the gravel pack well was abandoned in the 1970s due to poor water quality. The original wells were reinstated in 1979 and redeveloped again in 1992 and 1998. Pump capacity for pump 1 and pump 2 are 250 gallons per minute (gpm) and 350 gpm, respectively. Current operating rate is approximately 250 to 320 gpm with monthly averages generally below 5MG over the last two years.

The well field is surrounded by Audubon Land and is accessed through a locked swing gate. There are three buildings on site, the current well pump station, potassium hydroxide storage facility and the abandoned gravel pack well building. The current well pump station building was rehabilitated in 1979 and is in good condition. The building is recessed into the ground. The potassium hydroxide storage building is also in good condition and is encompassed by a chain link fence.

<u>Mechanical Systems</u>

There is a working intrusion alarm system in the well station. The pump station does not have auxiliary power. The heating system in the station consists of two electric unit heaters, that appear to be properly sized and in good condition. The exhaust/intake ventilation system is reportedly in good working order. The plumbing system in the pump station consists of an emergency shower, sample sink sump pump and drain line. The building currently receives domestic water from a tap in the water line as it exits the building and is used to service the sampling sink and emergency shower. The sump pump discharges water from the building floor drains to a dry well located approximately 20 feet to the west of the pump station building.

Equipment in the station includes two horizontal multi-stage vertical turbine in-line pumps, a vacuum priming system, a PARCO valve and chemical feed equipment for potassium hydroxide, sodium hypochlorite and sodium fluoride. Water level in each well is measured manually.

Both pumps were replaced in 1998, 2001 and 2005. In 2007, pump 1 was replaced under warranty and downsized to a smaller capacity pump as summarized in the well equipment table, attached. Based on a review of data available from Boart Longyear (formerly D.L. Maher) the motors have had a history of shorting out, requiring them to be replaced. In February 2006 and November 2006 the motors were replaced due to failure. An inspection report from ITT Corporation showed that the thrust bearing assay was destroyed, and attributed this possibly to water hammer.

The pumps are operated at constant speed, and do not have variable frequency drives (VFDs). The pumps operate independently, and can not operate simultaneously. The pumps are controlled through the SCADA system based on water storage tank level. The operator must select which pump is to operate locally at the station.

The discharge piping and associated valves from each pump are operable and adequate, which was confirmed by the Water Division Supervisor. The epoxy paint coating does not show excessive signs of wear or coating failure. This is expected since this equipment was either installed new or was last rehabilitated in 1998. The flow meter, a venturi, is calibrated twice a year. The flow rate is recorded at the SCADA system.

Hydrogeological Assessment

The best information available for evaluating individual well hydraulics is provided by the 1992 well redevelopment data and the 1979 pumping test completed when the nine well, well field was reactivated. The 1979 pumping test indicated the well field readily pumped 650 gpm with little drawdown needed to withdraw this substantial volume. Similarly, the 1992 redevelopment data sheets provide the original, individual capacities for each well. The total of these individual well yields is in excess of 1,500 gpm. The minimum individual well yield was listed as 130 gpm with a maximum individual well yield of 200 gpm. Pre-redevelopment in 1992, the total of the individual well yields had declined to 481 gpm with 8-inch Well #2-3 representing 100 gpm of that total. The combined rate for all the other wells had decreased by 71%. These lower rates were also accompanied by excessive drawdown. This can be problematic for suction well fields. The excessive drawdown and the reduction in yield indicate a loss in hydraulic capability as represented by specific capacity. Changes in individual well specific capacity (losses) of upwards of 80% were noted in some wells. This loss in well efficiency is shown in attached tabulated redevelopment data.

Well Maintenance

The available data suggests standard chemical treatment and surging is effective. Other cleaning methods such as Aquafreed or Boreblast technologies are not required. However well cleaning represents a significant effort and cost with surging and developing requiring between 30 to 40 hours per well. To clean the entire well field could range from $50,000 to $70,000 if all the wells were redeveloped at once. A more frequent and regular cleaning cycle is warranted to minimize build up of permanent encrustation. This is particularly true as these wells age. However, to minimize yearly costs, a more realistic schedule would be to clean three wells each year. All nine wells would be redeveloped on a three-year cycle.

Historic records indicate the authorized withdrawal of 0.47 mgd is almost never realized at the well field. Under the current WMA permit, monthly withdrawals of upwards of 14 MG could be realized. Instead withdrawals from Well station 2 rarely exceed 10 MG per month since 1998 and have been below 5 MG per month over the last two years. Although the recharge area for this well field may somewhat overlap with wells 3 and 4, sustained recharge rates of 8-9 MG per month are available in this portion of the Beaver Brook aquifer.

A regular cleaning schedule along with pump replacement in the suction system would allow higher rates of withdrawal during the year and during peak demand periods for the system. As expanding the geographic location of the well field is unrealistic, maintenance and in kind replacement of the wells and pumping system are the best options.

<u>Recommended Improvements</u>

- VFD
- Remove PARCO
- Pump/motor trouble-shooting site visit and report
- Pump replacement options detailed below
- Float switch in the potassium hydroxide day tank and bulk storage containment areas and connection to the SCADA system to notify operators of a spill
- Float switch in the sodium hypochlorite supply tank containment area
- Remark gradations of sodium hypochlorite supply tank
- Containment for sodium fluoride system
- Secondary interlock for the well pumps using a flow sensor in the water line, so the chemical feed pumps shut off if no flow is sensed in the water line
- Magnetic flow meter to replace existing flow meter
- Chlorine analyzer to continuously monitor chlorine residual
- SCADA recommendations
    - Input for alarms from recommended float switches
    - Interlock for chemical feed pumps with flow sensor
    - Remote selection of which well pump to run
    - Flow pacing of chemical feed systems
    - Input from chlorine analyzer
    - Programming controls to shut of sodium hypochlorite chemical feed pump in the event of a high chlorine alarm
    - Programming controls to shut down potassium hydroxide chemical feed pump in the event of a high pH alarm

- Transducers to measure water levels at one-hour intervals in two or three select observation wells installed and compared on a bi-monthly basis to SCADA operating data. This data will allow evaluation of the rate of plugging and an appropriate maintenance schedule for each well.

A range in improvement options for pumps and motors are presented below. Initially we would recommend a trouble-shooting site visit and report to determine the solution to the problem. This may result in being able to avoid any pump replacement.

Option 1A - Replace Current Pumps In-Kind

Modifying the existing pumps with new thrust bearings or replacing them with a more durable pump may relieve the station from the motor failure problems it has been experiencing. With a better pumping system the nine wells should be maintained in an optimum condition through a regular cleaning regimen. Improved well efficiencies should also prove to have a cost savings in electric consumption in the main pumps. This is the recommended option, assuming this is the recommended solution after a trouble-shooting site visit.

Option 1B - Replace Pumps with Split Case Centrifugal Pumps

Modify the existing piping and the inline submersible pumps with a set of split case centrifugal pumps. This option will be more costly than Option 1A, because of the piping work that is necessary and potential relocation of other equipment in the station.

Option 2 - Create a New Vertical Turbine Gravel Pack Well and Suction System

Installing a gravel pack well would allow a more efficient pump arrangement as vertical turbines are generally several percent more efficient than submersible pumps. In addition, if the vertical well casing was used as the suction system with the other wells connected to the well casing, the vertical well pump could be used to draw water from the nine existing wells. Possible reuse of the vacuum priming system currently installed would help save in overall capital costs.

This system might have additional flexibility for pumping lower rates by operating the single gravel pack well without the other wells activated. Undoubtedly, this option and Option 3 below, require more substantial system modifications than either option 1A or 1B. This option is not recommended at this time.

Option 3 - Replace Suction System with Individual Submersible Pumps in Each Well

Individual well pumps controls and electrical would be required under this scenario. As each well sees a wide range of operating flow rates between cleanings, individual variable frequency drives would be recommended for each well pump. This option would be costly and may be problematic due to the wide range of flow each pump would need to operate at as the well capacity is diminished. This option is not recommended at this time

Well Replacement Plan

With each of the scenarios above, Sharon should develop a long term well replacement plan based on more discrete data collected over the next three years. Currently, data indicates rapid fouling and a substantial benefit to well replacement. A suggested replacement schedule includes replacing Wells #2-2, 2-8, and 2-9 in 2010, Wells 2-1 and 2-4 in 2012 and Wells 2-3, 2-5, 2-6 and 2-7 in 2014 depending on operating performance and redevelopment success.

Well 3

Well 3, on Farnham Road, is located east of Beaver Brook and consists of a gravel pack well, pumping station and potassium hydroxide storage building. The well was constructed in 1954. The well was redeveloped in 1994, 1997, 2000, 2006, and 2008. The design pumping capacity is 500 gpm; the operating rate after the 2008 redevelopment was 380 gpm and has since reduced to 162 gpm.

The well is located in residential neighborhood. There is a leaf composting facility located to the east of the well station. There are two buildings on site, the well pump station and the potassium hydroxide storage facility. The well pump station was constructed in 1954 and is in good condition. Both buildings are encompassed by a chain link fence.

Mechanical Systems

There is a working intrusion alarm system in the well station. The pump station does not have auxiliary power. The heating system in the station consists of an electric unit heater, that appears to be properly sized and in good condition. The ventilation system is not controlled via a thermostat, and during the summer months the station gets very warm. The plumbing system in the pump station consists of an emergency shower, sample sink and drain line. The building currently receives domestic water from a tap in the water line as it exits the building and is used to service the sampling sink and emergency shower. The floor drain discharges water outside the building on the north side of the pump station.

Equipment in the station includes a horizontal 8-stage vertical turbine in-line pump and chemical feed equipment for potassium hydroxide, sodium hypochlorite and sodium fluoride. Water level in the well is measured with a level sensor which is recorded by the SCADA system.

The pump was replaced in 1989. During the 2008 well redevelopment it was recommended that the pump, column pipe, shaft and head be replaced due to excessive corrosion. The pump is operated at constant speed, and does not have a VFD. Thus reduced pumping rates require control or restrictions using valves to create artificial pressure or head. This pumping condition, necessary when the well is plugged, is generally inefficient. The pump is controlled through the SCADA system based on water storage tank level.

The discharge piping and valving are operable and adequate, which was confirmed by the Water Division Supervisor. The epoxy paint coating appears to be in far condition with some signs of wear or coating failure. The flow meter, a 6-inch Badger mag meter, was installed in 2008. The flow rate is recorded by the SCADA system.

Hydrogeological Assessment

Like Well 2, Well 3 is located in the Beaver Brook sub watershed. The well is located up-gradient, and to the southwest of Well 2. Current WMA authorization allows 0.38 mgd from this source. In 1996 the Zone II delineation was completed with a safe sustained yield determined to be .40 MGD. Zone II and III areas for this well reach to the drainage divide between the Taunton and the Neponset River watersheds. This drainage divide corresponds with the divide between the Zone II areas for Wells 3 and 5. Calculated recharge rates indicate available recharge of .645 MGD within this area. Historical pumping records indicate maximum monthly withdrawals are generally below 9 MG equating to under 300,000 gpd. More recently these withdrawals have been at or below 5 MG per month.

Well Maintenance

The well, installed in 1954, by Layne New England, consists of a 24 by 36-inch diameter gravel packed well, 46 feet deep. The original design capacity was 500 gpm. Well cleanings/redevelopments appear to return the well to close if not equal to its original specific capacity. However, regular cleaning/redevelopment will be required for the foreseeable future of this well. Declines in specific capacity between well cleanings indicate severe plugging is occurring. This occurs generally over a two to three year period. Although production records shown in the attached monthly production graph indicate a wide fluctuation in monthly use for Well 3, no long-term decline in annual production is documented. Annually Well 3 produces between 40 and 50 million gallons and should continue to do so even of more frequent cleanings are required. Although additional short-term yields might be increased by satellite wells, at this time their cost is not warranted.

Instead, this well should be replaced when cleaning/redevelopment events become more frequent than once every 2 years. At that time, well options including dual well or multiple well systems to increase the pumping capacity and flexibility from this area should be examined. Close monitoring of the well fouling and plugging will dictate the replacement schedule as this well may be approaching the end of its useful life cycle.

Recommended Improvements

- VFD
- Remove PARCO
- Pump, column pipe, shaft, head and motor replacement
- Float switch in the potassium hydroxide day tank and bulk storage containment areas and connection to the SCADA system to notify operators of a spill
- Float switch in the sodium hypochlorite supply tank containment area
- Remark gradations of sodium hypochlorite supply tank
- Containment for sodium fluoride system

- Secondary interlock for the well pumps using a flow sensor in the water line, so the chemical feed pumps shut off if no flow is sensed in the water line
- Chlorine analyzer to continuously monitor chlorine residual
- SCADA recommendations
    - Input for alarms from recommended float switches
    - Interlock for chemical feed pumps with flow sensor
    - Remote selection of which well pump to run
    - Flow pacing of chemical feed systems
    - Input from chlorine analyzer
    - Programming controls to shut of sodium hypochlorite chemical feed pump in the event of a high chlorine alarm
    - Programming controls to shut down potassium hydroxide chemical feed pump in the event of a high pH alarm
- Automatic exhaust louvers
- Well replacement should be considered over the next 5 to 10 years based on an increased frequency of cleaning/redevelopment.

<u>Well 4</u>

Well 4, accessed off of Tree Lane, is west of Beaver Brook and consists of a gravel pack well, pumping station and potassium hydroxide storage building. The well was constructed in 1959. The well was redeveloped in 1977, 1981, and 1994. The current operating rate is 840 gpm, the same as the design capacity.

The well is located in a residential neighborhood and is accessed through a locked swing gate. There are two buildings on site, the well pump station and the potassium hydroxide storage facility. The potassium hydroxide building is encompassed by a chain link fence.

<u>Mechanical Systems</u>

There is a working intrusion alarm system in the well station. The heating system in the station consists of a gas unit heater that needs to be replaced. The exhaust/intake ventilation system needs repair, the power vent on the roof is not used and the wall vents are manually operated. The plumbing system in the pump station consists of an emergency shower and drain line. The building currently receives domestic water from a tap in the water line as it exits the building and is used to service the emergency shower. The floor drain on the north side of the pump station building discharges water to a dry well near the river.

Equipment in the station includes an electric motor driven 4-stage vertical turbine in-line pump, with a standby natural gas right angle engine drive and chemical feed equipment for potassium hydroxide, sodium hypochlorite and sodium fluoride. Water level in the well is measured with a level sensor which is recorded by the SCADA system.

The pump was rebuilt in 1994, including the removal of two intermediate stages and installation of a new 100 HP motor. The motor was replaced again in 2006. The pump is operated at constant speed, and does not have a VFD. The pump is controlled through the SCADA system based on water storage tank level. The standby right angle drive engine can run the pump in the event of a power failure, but not the chemical feed systems. The auxiliary power does not come on automatically in the event of a power failure.

The discharge piping and valving are operable and adequate, which was confirmed by the Water Division Supervisor. The epoxy paint coating appears to be in fair condition with some signs of wear or coating failure. The flow meter, a venturi, is calibrated twice a year. The flow rate is recorded by the SCADA system.

Hydrogeological Assessment

Well 4 is the most substantial single source of groundwater within the Sharon public water system. Well 4 is located down-gradient and to the northwest of Well 2 in the Beaver Brook watershed. In 1996 a Zone II study was completed and approved by the DEP. The well was originally installed in 1959 and is an 18- by 24-inch gravel packed well. The well is located in one of the deepest gravel aquifers in Sharon (approximately 85 feet deep). This prolific deposit has an aquifer transmissivity of approximately 100,000 gpd/ft. Using this information the Zone II areas were calculated and are shown in the attached water resource map. The Zone II for well 4 and the supporting upland recharge area and encompass approximately 1.0square miles. Safe sustained yield for this well is listed as 1.21 mgd. The safe sustained yield is above the permitted WMA withdrawal of 1.0 mgd. Well 4 is generally used to its full capacity. Annual withdrawals are close to 0 .8 mgd with peak monthly withdrawals close to 30 mg.

Well Maintenance

Well 4 continues to operate with a specific capacity of between 43 and 44 gpm/ft. Conventional redevelopment methods readily return this well to an optimum specific capacity of approximately 55 to 57 gpm/ft. Annual flow tests and pump inspections should be conducted on this well to closely monitor this well for loss in capacity. When specific capacities fall between 40 and 44 gpm/ft at flow rates of 600 to 800 gpm, the well should be redeveloped. Care should be taken to maintain this major production well within Sharon's system. Extended periods between redevelopments can cause from irreversible encrustation that would shorten the useful life of this well and cause premature replacement costs. This well should remain productive for the foreseeable future.

Recommended Improvements

- VFD
- Remove PARCO
- Float switch in the potassium hydroxide day tank and bulk storage containment areas and connection to the SCADA system to notify operators of a spill
- Float switch in the sodium hypochlorite supply tank containment area
- Remark gradations of sodium hypochlorite supply tank
- Containment for sodium fluoride system

- Secondary interlock for the well pumps using a flow sensor in the water line, so the chemical feed pumps shut off if no flow is sensed in the water line
- Magnetic flow meter to replace existing flow meter
- Chlorine analyzer to continuously monitor chlorine residual
- SCADA recommendations
    - Input for alarms from recommended float switches
    - Interlock for chemical feed pumps with flow sensor
    - Remote selection of which well pump to run
    - Flow pacing of chemical feed systems
    - Input from chlorine analyzer
    - Programming controls to shut of sodium hypochlorite chemical feed pump in the event of a high chlorine alarm
    - Programming controls to shut down potassium hydroxide chemical feed pump in the event of a high pH alarm
- Standby generator with automatic transfer switch to operate all station equipment in the event of a power failure
- Annual well flow tests consisting of 60 minute steps at 500, 600, 700, and 800 gpm should be conducted to identify redevelopment needs.

Well 5

Well 5, on Gavin's Pond Road, is located east of Billings Brook and consists of a gravel pack well, pumping station and potassium hydroxide storage building. The well was constructed in 1972. The well was redeveloped in 1982 and 1997. Design pumping capacity is currently 270 gpm, current operating rate is 300 gpm.

There are two buildings on site, the well pump station and the potassium hydroxide storage facility. Both buildings are encompassed by a chain link fence.

Mechanical Systems

There is a working intrusion alarm system in the well station. The heating system in the station consists of a gas unit heater, to be replaced in the first quarter of 2009. The exhaust/intake ventilation system is reportedly in good working order. The plumbing system in the pump station consists of an emergency shower, sample sink and drain line. The Water Division Supervisor reports a problem with building grounding. The building currently receives domestic water from a tap in the water line as it exits the building and is used to service the sampling sink and emergency shower. The floor drains discharge water to a dry well located approximately 100 feet to the east of the pump station building

Equipment in the station includes a horizontal multi-stage vertical turbine in-line pump, with a standby natural gas direct drive engine and chemical feed equipment for potassium hydroxide, sodium hypochlorite and sodium fluoride. Water level in each well is measured with a level sensor.

The pump was replaced in 2005, work was done on the right angle drive and motor in 2007. It was noted during the 2007 repairs that something appears to be attacking the metal on the drive, and that their may be potential grounding issues in the building. The pump is operated at constant speed, and does not have variable a VFD. The well is operated 24 hours per day regardless of tank levels.

The discharge piping and associated valves from each pump are operable and adequate, which was confirmed by the Water Division Supervisor. Since the pump is operated 24 hours a day the PARCO valve is not operated often. There is a waste line teed off the discharge line that was historically used to pump the well to waste. The waste water is discharged to the drywell on the east side of the building. The valve on the waste line leaks. The epoxy paint coating shows signs of wear. The meter, a Badger magnetic flow meter, was installed in 2008. The flow rate is recorded by the SCADA system.

<u>Hydrogeological Assessment</u>

Well 5 is located in the Billings Brook sub-watershed. This sub-watershed drains to the south joining the Rumford River in Foxboro. Well 5 is located above well station 7 and Gavin's Pond in the sub-watershed. This well is regulated under the WMA within the Taunton River watershed. Current WMA authorization allows a 0.47 mgd annual withdrawal rate for this source, while total authorized withdrawals from the Taunton river watershed in Sharon include 0.55 mgd registered volume and potentially up to 0.73 mgd of the remaining permitted volume. This includes Well 6 in the Canoe River basin. In 1992, Zone II boundaries and zone III recharge areas were delineated for Well 5. The northern boundary of the Zone II and III for Well 5 abut the Zone II and III for Well 3. The total recharge area for Well 5 is the largest of all the well sources in Sharon encompassing just over 3 square miles.

<u>Well Maintenance</u>

Original pumping test data could not be obtained for this well. However, well cleaning and redevelopment efforts in 1982 and 1997 indicate an original specific capacity of 14 gpm/ft at 500 gpm Pre-cleaning measurements indicate the well has had a reduction in specific capacity of greater than 50%. Conventional cleaning methods were successful, however, the well appears to decline in capacity over time. Long-term production records mimic this trend from 1997 to present. Monthly production volumes have steadily declined from 13 to 14 mg per month to generally less than 9 mg per month.

Well 5 has been subject to numerous water quality threats throughout the 1980s and 1990s. Therefore, investing in returning this well to full capacity or the WMA authorized volumes must be balanced against the current status of potential water quality threats in the aquifer. Although the pumping equipment was replaced in 1997, the well itself is limited. Additional capacity could be obtained through full replacement, or through the addition of satellite wells. Location of new or satellite wells may be constrained due to land ownership and availability.

Recommended Improvements

- VFD
- Remove PARCO
- Float switch in the potassium hydroxide day tank and bulk storage containment areas and connection to the SCADA system to notify operators of a spill
- Float switch in the sodium hypochlorite supply tank containment area
- Remark gradations of sodium hypochlorite supply tank
- Containment for sodium fluoride system
- Secondary interlock for the well pumps using a flow sensor in the water line, so the chemical feed pumps shut off if no flow is sensed in the water line
- Chlorine analyzer to continuously monitor chlorine residual
- SCADA recommendations
    - Input for alarms from recommended float switches
    - Interlock for chemical feed pumps with flow sensor
    - Remote selection of which well pump to run
    - Flow pacing of chemical feed systems
    - Input from chlorine analyzer
    - Programming controls to shut of sodium hypochlorite chemical feed pump in the event of a high chlorine alarm
    - Programming controls to shut down potassium hydroxide chemical feed pump in the event of a high pH alarm
- Standby generator with automatic transfer switch to operate all station equipment in the event of a power failure
- Fix building ground problem
- Well capacity should continue to be monitored on an annual basis
- The recharge area is sufficient to support additional withdrawals. Development of additional yield must be evaluated against land ownership and water quality threats.

Well 6

Well 6, on Wolomolopoag Street, is located west of the Canoe River and consists of a gravel pack well, pumping station and potassium hydroxide storage building. The well was constructed in 1976 and redeveloped in 1996. The current operating capacity is the design pumping capacity of 450 gpm. Because of elevated manganese levels this well is only used during peak water demands, typically during the summer months. A pilot study was conducted and is summarized in the pilot report from 2007. Estimated capital and operating costs for pressure filtration were developed in this report/

The well access road has a locking swing gate. There are two buildings on site, the well pump station and the potassium hydroxide storage facility. The potassium hydroxide storage facility is encompassed by a chain link fence.

Mechanical Systems

There is a working intrusion alarm system in the well station. The pump station is not serviced by a standby generator. The heating system in the station consists of an electric unit heater, that appears to be properly sized and in good condition. The exhaust/intake ventilation system is reportedly in good working order. The plumbing system in the pump station consists of an emergency shower, sample sink, sump pump, and drain line. The building currently receives domestic water from a tap in the water line as it exits the building and is used to service the sampling sink and emergency shower. The sump pump discharges water from the building floor drains to a dry well located approximately 150 feet from the pump station building.

Equipment in the station includes a multi-stage vertical turbine pump and chemical feed equipment for potassium hydroxide, sodium hypochlorite and sodium fluoride. Water level in each well is measured with a level sensor.

The pump and motor were replaced in 1996 as part of mechanical modifications to the well station. Other improvements included the installation of well level sensor and installation of pH analyzer. The pump is operated at constant speed, and does not have a VFD. The pump is controlled through the SCADA system based on water storage tank levels.

The discharge piping and associated valves from each pump are operable and adequate, which was confirmed by the Water Division Supervisor. The flow meter, a venturi, is plugged and needs to be cleaned. The epoxy paint coating does not show excessive signs of wear or coating failure. The flow rate is recorded by the SCADA system.

Hydrogeological Assessment

Well 6 is the only source located in the Canoe River sub-watershed. This source is located in the upper portion of the subbasin, approximately 1.1 miles south of the drainage divide for the Neponset River. The well was installed in 1976. The well is a 24- by 36-inch gravel packed well, 56.5 feet deep. Original design capacity was 450 gpm with a corresponding Zone II approved pumping rate of 450 gpm. However, the authorized withdrawal under the WMA is 0.35 mgd. Because of its location in the subbasin, overall recharge in this area is a limitation to water withdrawals. In 1996, the Zone II evaluation delineated the limited recharge area for this well. The calculated recharge values for this area including areas of upland recharge equate to approximately 0.5 square miles. Current WMA authorized withdrawal volumes are equivalent to the recharge anticipated for this area. Therefore, permitting additional yield and withdrawals from this source is unlikely.

Well Maintenance

As Well 6 has elevated manganese levels, annual withdrawal volumes have been consistently under 0.2 mgd. The well is typically only used in the warmer months to meet higher system demands. In addition to treatment costs and water quality concerns, elevated manganese levels represent a maintenance concern due to the increased rate of encrustation generally associated with these levels. Well cleaning frequencies for this well are currently low as the well remains off for a majority of the year.

Recommended Improvements

- VFD
- Remove PARCO
- Float switch in the potassium hydroxide day tank and bulk storage containment areas and connection to the SCADA system to notify operators of a spill
- Float switch in the sodium hypochlorite supply tank containment area
- Remark gradations of sodium hypochlorite supply tank
- Containment for sodium fluoride system
- Secondary interlock for the well pumps using a flow sensor in the water line, so the chemical feed pumps shut off if no flow is sensed in the water line
- Magnetic flow meter to replace existing flow meter
- Chlorine analyzer to continuously monitor chlorine residual
- SCADA recommendations
    - Input for alarms from recommended float switches
    - Interlock for chemical feed pumps with flow sensor
    - Remote selection of which well pump to run
    - Flow pacing of chemical feed systems
    - Input from chlorine analyzer
    - Programming controls to shut of sodium hypochlorite chemical feed pump in the event of a high chlorine alarm
    - Programming controls to shut down potassium hydroxide chemical feed pump in the event of a high pH alarm
- Pressure filtration to remove elevated manganese levels, if the well is operated more frequently
- Due to elevated manganese levels, current operation and maintenance efforts have been appropriate for this well system. Additional withdrawals volumes are not anticipated for this area above current WMA authorizations. More frequent or extended pumping of this well is only warranted if treatment options are considered.

Well 7

Well 7, on Gavin's Pond Road, is located northeast of Gavin's Pond and is a well field consisting of six 8-inch wells on site. The pumping station and wells were constructed in 1989 and are in good condition. The wells have not been cleaned since they were installed. There are concerns with microscopic particulate analysis (MPA) testing done, but the DEP has not issued a final ruling for this site. Design pumping capacity is currently 350 gpm, current operating rate is 320 gpm.

The well field is located in a residential area and is surrounded by conservation land; the site is accessed through a locked swing gate. There are two buildings on site, the well pump station and potassium hydroxide storage facility. There is a propane tank on site that is not currently being used. Both buildings are encompassed by a chain link fence.

Mechanical Systems

There is a working intrusion alarm system in the well station. The heating system in the station consists of a natural gas unit heater, that appears to be properly sized and in good condition. The exhaust/intake ventilation system is reportedly in good working order. The plumbing system in the pump station consists of an emergency shower, sample sink, and drain line. The building currently receives domestic water from a tap in the water line as it exits the building and is used to service the sampling sink and emergency shower. The building floor drain discharges water to a dry well located south of the pump station building.

Equipment in the station includes a nine-stage can-type vertical turbine pump, vacuum priming system, natural gas direct drive engine, and chemical feed equipment for potassium hydroxide, sodium hypochlorite and sodium fluoride. Water level in each well is measured manually once a month. The right angle drive powers the vacuum priming system, pump and chemical feed systems in the event of a power failure. The auxiliary power does not come on automatically in the event of a power failure.

The pump was installed in 1989. The shaft was replaced in 2007. The pump is operated at constant speed, and does not have a VFD. The pump is controlled through the SCADA system based on water storage tank levels.

The discharge piping and associated valves from each pump are operable and adequate, which was confirmed by the Water Division Supervisor. The epoxy paint coating does show signs of wear. The flow meter, a Badger turbine meter, is calibrated twice a year. The flow rate is recorded at the SCADA system.

Hydrogeologic Assessment

The Well 7 pumping station was first investigated in 1981 through a test drilling program. Additional 2.5-inch diameter wells were installed in 1984. A combined suction pumping test was conducted in February 1985. The test was conducted on five select wells and has a combined total pumping rate of 175 gpm. Data from this test led to an estimated safe yield of 300 to 350 gpm and recommendations for the construction of a final pumping system consisting of six 8-inch diameter naturally developed production wells. Test data from 1989 on the six 8-inch wells show a lack of stabilization at an initial pumping rate of 465 gpm and even at a reduced rate of 390 gpm. This indicates the potential for insufficient recharge to sustain higher pumping rates. A final safe sustained yield, or Zone II approved pumping rate was 313 gpm (0.45 mgd) based on a January 1996 DEP approval letter. Average day withdrawals since 1997 have been well below the 0.45 mgd Zone II rate. For Well 7, the Zone II approved rate is equal to the WMA authorized withdrawal of 0.45 mgd.

Well Maintenance

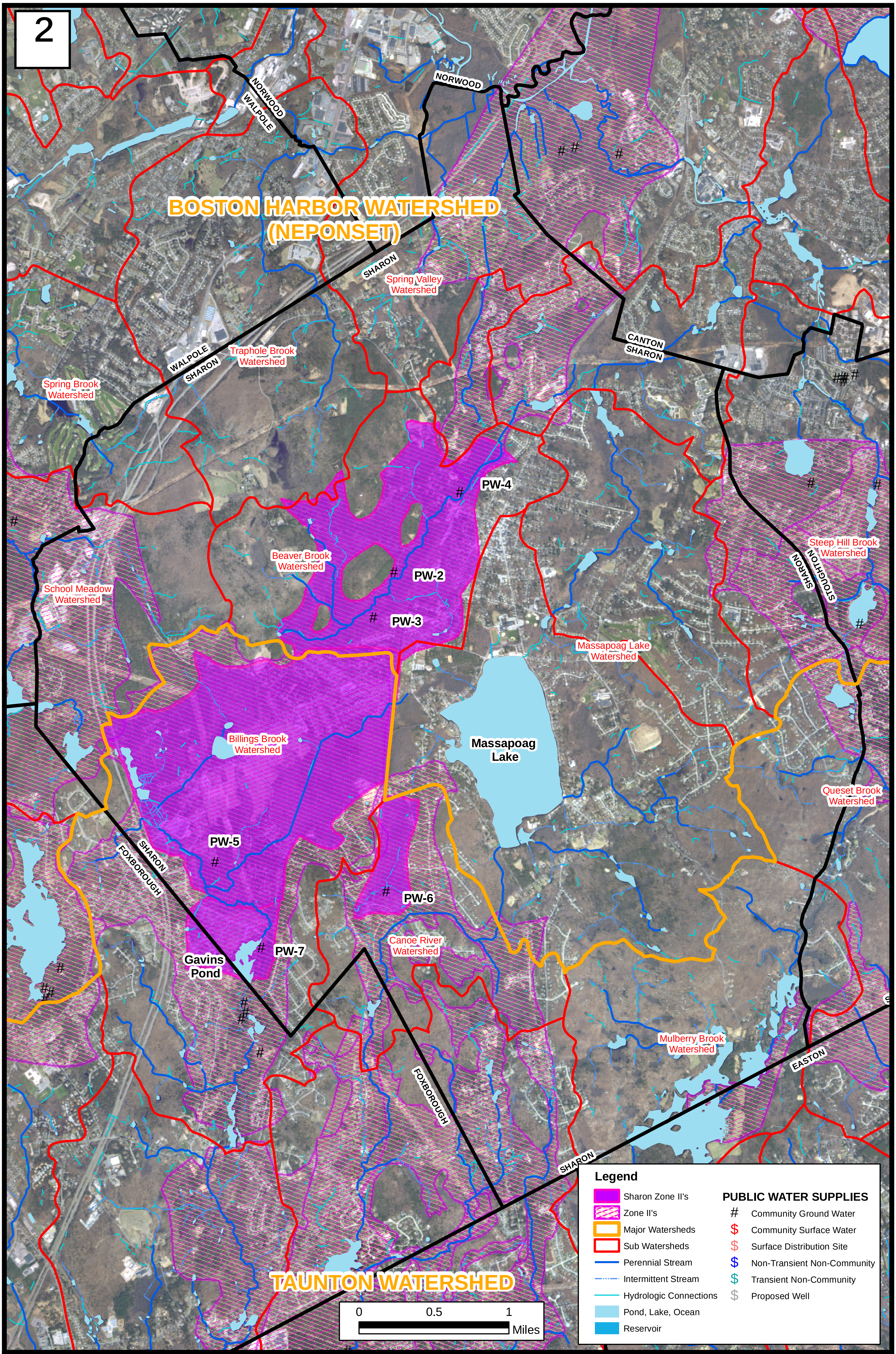
The only available information on well maintenance or cleanings is a 2001 inspection report by Maher Drilling indicating the pump (replaced in 2000) was in good working condition. At a combined pumping rate of 372 gpm, Maher reported an average drawdown at 5.63 feet which they equated to a general specific capacity of 66 gpm/ft.

Although this general information suggests general well plugging was not a concern at the time of the inspection, individual well performance or condition can not be determined from this information.

Recommended Improvements

- VFDs
- Remove PARCO
- Float switch in the potassium hydroxide day tank and bulk storage containment areas and connection to the SCADA system to notify operators of a spill
- Float switch in the sodium hypochlorite supply tank containment area
- Remark gradations of sodium hypochlorite supply tank
- Containment for sodium fluoride system
- Secondary interlock for the well pumps using a flow sensor in the water line, so the chemical feed pumps shut off if no flow is sensed in the water line
- Magnetic flow meter to replace existing flow meter
- Chlorine analyzer to continuously monitor chlorine residual
- SCADA recommendations
    - Input for alarms from recommended float switches
    - Interlock for chemical feed pumps with flow sensor
    - Remote selection of which well pump to run
    - Flow pacing of chemical feed systems
    - Input from chlorine analyzer
    - Programming controls to shut of sodium hypochlorite chemical feed pump in the event of a high chlorine alarm
    - Programming controls to shut down potassium hydroxide chemical feed pump in the event of a high pH alarm

A well field of this age should be flow tested annually. Daily operational levels in up to three observation wells should be recorded and compared against operational pumping records. At a minimum, the two wells closest to the suction pump should be disconnected, T.V. inspected and cleaned. Efficiency improvements should be measured and a redevelopment schedule for the well field developed from the data. Given the age of the well field, approximately 20 years, conventional redevelopment methods should be implemented as a preventative maintenance method.



Weston&Sampson ENGINEERS, INC.

Figure 1: Water Resources, Sharon, MA

Data Source:

Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Available Recharge for Public Water Supplies - Sharon, MA

Well	Till Recharge Area (ft^2)	Sand and Gravel Recharge Area (ft^2)	Available Recharge (GPD)	WMA Approval Rate (GPD)	Average Recharge over WMA (GPD)	Available Recharge (GPY)
2	1,210,205	7,666,806	295,211	470,000	-174,789	107,752,043
3	17,917,565	12,515,559	645,264	380,000	265,264	235,521,179
4	13,593,019	14,084,372	658,822	1,000,000	-341,178	240,469,876
5	24,286,361	61,244,740	2,508,028	470,000	2,038,028	915,430,170
6	7,692,553	5,598,610	285,342	350,000	-64,658	104,149,833
7	14,322,774	7,363,952	418,398	450,000	-31,602	152,715,424

Z:\Eric\Master Plan\Chapters\Chapter 3\[Available_Recharge_draft_2010_02_11(1).xls]Sheet3

Year	May-Sep Total	Preceding Nov-Mar Total	Summer to Winter Ratio	YTD
1995	339,051	N/A	N/A	575,354
1996	271,388	189,473	1.42	484,626
1997	323,624	165,823	1.93	538,406
1998	292,966	188,380	1.53	536,679
1999	278,285	195,124	1.41	505,717
2000	272,105	191,044	1.41	514,229
2001	301,737	195,221	1.53	547,279
2002	296,212	192,974	1.51	539,041
2003	273,982	203,673	1.33	523,607
2004	276,070	200,837	1.37	524,209
2005	297,945	202,826	1.45	548,830
2006	255,140	185,345	1.36	484,786
2007	258,540	176,216	1.45	471,129
2008	244,487	178,344	1.35	462,726

Town of Sharon
MONTHLY PUMPING TOTALS

Year: 1995

STATION:	#2	#3	#4	#5	#6	#7
January	5824	3047	6520	11590	4540	6425
February	5207	4573	6974	10411	3452	2652
March	4661	4593	7711	11334	3826	3860
April	6059	4790	7022	13438	5055	6082
May	6685	5143	11258	11658	5827	10889
June	9693	7787	20974	9359	9091	12022
July	9995	9372	28203	9904	9084	13560
August	4277	7775	26669	11649	9188	13787
September	110	6456	25515	11270	8906	12945
October	0	5012	13787	12223	5660	10504
November	0	3885	9596	11311	4686	9993
December	0	4505	9828	12771	5017	9660
Totals per well:	52511	66938	174057	136918	74332	112379
Overall total for the year:						1995
Daily Average year:	143.8658	183.3918	476.8685	375.1178	203.6493	307.8877
Monthly Average:	4375.917	5578.167	14504.75	11409.83	6194.333	9364.917

Total per month (gal)	Daily Average	Daily Average normalized by population	
37946	1224.1	72.2	7.2
33269	1188.2	70.1	5.1
35985	1160.8	68.5	3.5
42446	1414.9	83.4	18.4
51460	1660.0	97.9	32.9
68926	2297.5	135.5	70.5
80118	2584.5	152.4	87.4
73345	2366.0	139.5	74.5
65202	2173.4	128.2	63.2
47186	1522.1	89.8	24.8
39471	1315.7	77.6	12.6
41781	1347.8	79.5	14.5

617135 gal.

1690.780822 gal/day

1690.780822 gal/mth

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)

Year: 1996

STATION:	#2	#3	#4	#5	#6	#7	Total per m
January	2621	4544	6342	9539	7147	9324	39517
February	6508	4011	10	7281	4675	10344	32829
March	6753	4305	22	8353	5041	11401	35875
April	3899	3794	5331	7848	3189	10045	34106
May	7289	5145	13173	9843	968	11372	47790
June	7298	5626	16974	9188	11693	11529	62308
July	4623	4908	20535	9799	9778	11806	61449
August	5591	5219	22337	9361	3389	12146	58043
September	4559	3992	15162	7848	69	10168	41798
October	5272	3511	10595	7973	0	9158	36509
November	3740	2336	10840	9229	0	8257	34402
December	3956	2605	10117	8121	0	9442	34241
Totals per well:	62109	49996	131438	104383	45949	124992	
Overall total for the year:						1996	518867
Daily Average year:	170.1616	136.9753	360.1041	285.9808	125.8877	342.4438	1421.553
Monthly Average:	5175.75	4166.333	10953.17	8698.583	3829.083	10416	43238.92

ıonth (gal) Daily average normalized by population

1274.7	73.7	3.7
1132.0	65.4	-4.6
1157.3	66.9	-3.1
1136.9	65.7	-4.3
1541.6	89.1	19.1
2076.9	120.1	50.1
1982.2	114.6	44.6
1872.4	108.2	38.2
1393.3	80.5	10.5
1177.7	68.1	-1.9
1146.7	66.3	-3.7
1104.5	63.9	-6.1

gal.

gal/day

gal/mth

Town of Sharon
MONTHLY PUMPING TOTALS

Year: 1997

STATION:	#2	#3	#4	#5	#6	#7	Total per m
January	4170	2610	10190	6102	0	8905	31977
February	3382	841	10954	5374	14	7960	28525
March	4141	5339	8105	9976	0	9117	36678
April	3875	4857	9511	9872	0	8619	36734
May	4579	5770	22281	1296	0	11552	45478
June	8942	8838	31643	8523	6695	12526	77167
July	12376	10025	28811	12550	7903	12646	84311
August	2610	6697	26864	12944	4533	10493	64141
September	0	4897	23348	12924	3123	8235	52527
October	0	5263	17250	13651	990	6566	43720
November	0	5062	15339	13244	0	3503	37148
December	0	3521	18545	13524	0	2672	38262
Totals per well:	44075	63720	222841	119980	23258	102794	
Overall total for the year:						1997	576668
Daily Average year:	120.7534	174.5753	610.5233	328.7123	63.72055	281.6274	1579.912
Monthly Average:	3672.917	5310	18570.08	9998.333	1938.167	8566.167	1579.912

ıonth (gal) average daily normalized by population

1031.5	58.7	-11.3
1018.8	58.0	-12.0
1183.2	67.4	-2.6
1224.5	69.7	-0.3
1467.0	83.5	13.5
2572.2	146.5	76.5
2719.7	154.9	84.9
2069.1	117.8	47.8
1750.9	99.7	29.7
1410.3	80.3	10.3
1238.3	70.5	0.5
1234.3	70.3	0.3

gal.

gal/day

gal/mth

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)

Year: 1998

STATION:	#2	#3	#4	#5	#6	#7	Total per m
January	0	3602	19035	13337	0	2612	38586
February	0	3916	14772	11796	0	3166	33650
March	0	4203	20003	13422	0	3106	40734
April	0	4144	20850	13384	0	4068	42446
May	0	6768	24620	14214	1732	7996	55330
June	0	5851	26221	13527	2624	6893	55116
July	0	9491	25201	13786	6158	9884	64520
August	0	10023	22790	14367	6709	9446	63335
September	0	6017	26031	13565	28	9024	54665
October	0	4363	22639	13611	3	6045	46661
November	0	3566	18476	13322	865	5407	41636
December	0	4025	18147	14072	0	5058	41302
Totals per well:	0	65969	258785	162403	18119	72705	
Overall total for the year:						1998	577981
Daily Average year:	0	180.737	709	444.9397	49.6411	199.1918	1583.51
Monthly Average:	0	5497.417	21565.42	13533.58	1509.917	6058.75	1583.51

ıonth (gal)	Average daily normalized	py population
1244.7	71.4	1.4
1201.8	68.9	-1.1
1314.0	75.3	5.3
1414.9	81.1	11.1
1784.8	102.3	32.3
1837.2	105.3	35.3
2081.3	119.3	49.3
2043.1	117.1	47.1
1822.2	104.5	34.5
1505.2	86.3	16.3
1387.9	79.6	9.6
1332.3	76.4	6.4

gal.

gal/day

gal/mth

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)

Year: 1999

STATION:	#2	#3	#4	#5	#6	#7	Total per m
January	0	5231	17926	10483	0	5859	39499
February	0	3175	17005	9589	0	4335	34104
March	0	3260	20696	10616	0	4011	38583
April	0	2685	23055	3668	0	7994	37402
May	975	3507	26712	8470	4323	7125	51112
June	9529	4471	29683	10066	8710	11973	74432
July	3230	3909	22377	9369	6441	8518	53844
August	4676	3169	22670	10546	4811	7783	53655
September	1841	3873	18364	10067	3175	7922	45242
October	61	3192	20726	10390	0	7541	41910
November	0	2636	17274	9833	0	6191	35934
December	0	127	20423	10445	0	7444	38439
Totals per well:	20312	39235	256911	113542	27460	86696	
Overall total for the year:						1999	544156
Daily Average year:	55.64932	107.4932	703.8658	311.074	75.23288	237.5233	1490.838
Monthly Average:	1692.667	3269.583	21409.25	9461.833	2288.333	7224.667	1490.838

ıonth (gal)	average daily	normalized by population
1274.2	72.6	2.6
1218.0	69.4	-0.6
1244.6	70.9	0.9
1246.7	71.0	1.0
1648.8	93.9	23.9
2481.1	141.3	71.3
1736.9	98.9	28.9
1730.8	98.6	28.6
1508.1	85.9	15.9
1351.9	77.0	7.0
1197.8	68.2	-1.8
1240.0	70.6	0.6

gal.

gal/day

gal/mth

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)

Year: 2000

STATION:	#2	#3	#4	#5	#6	#7	Total per m
January	0	0	22105	10698	0	7413	40216
February	0	0	18868	9616	0	7741	36225
March	0	0	22262	10071	78	7819	40230
April	0	0	23447	9949	389	6867	40652
May	1332	0	27369	10401	3271	9365	51738
June	5891	0	26804	10544	7005	3198	53442
July	4335	5788	24022	11562	5684	9425	60816
August	3340	4579	25431	10705	3901	6423	54379
September	2927	6465	23134	10375	3510	5319	51730
October	2572	4658	21204	10861	1223	4829	45347
November	2105	1995	18237	10594	0	6523	39454
December	1946	0	21022	11364	0	6449	40781
Totals per well:	24448	23485	273905	126740	25061	81371	
Overall total for the year:						2000	555010
Daily Average year:	66.98082	64.34247	750.4247	347.2329	68.66027	222.9342	1520.575
Monthly Average:	2037.333	1957.083	22825.42	10561.67	2088.417	6780.917	1520.575

ıonth (gal)	average daily normalized by population	
1297.3	72.2	2.2
1293.8	72.0	2.0
1297.7	72.2	2.2
1355.1	75.4	5.4
1669.0	92.9	22.9
1781.4	99.2	29.2
1961.8	109.2	39.2
1754.2	97.7	27.7
1724.3	96.0	26.0
1462.8	81.4	11.4
1315.1	73.2	3.2
1315.5	73.2	3.2

gal.

gal/day

gal/mth

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)

Year: 2001

STATION:	#2	#3	#4	#5	#6	#7	Total per m
January	2128	32	20988	9813	26	7178	40165
February	2354	0	18168	8023	0	5713	34258
March	5355	27	18158	9541	55	7427	40563
April	4762	0	20918	9556	0	7937	43173
May	8035	5996	26190	8875	7504	10453	67053
June	4776	6288	26683	10015	4588	8031	60381
July	2613	6958	27227	10083	6257	6928	60066
August	5175	5548	27287	9764	4516	7113	59403
September	4262	6797	28046	9957	56	5716	54834
October	2688	3653	26144	9951	0	4738	47174
November	1794	3547	21631	9640	45	3552	40209
December	1378	2747	21718	9999	0	2833	38675
Totals per well:	45320	41593	283158	115217	23047	77619	
Overall total for the year:						2001	585954
Daily Average year:	124.1644	113.9534	775.7753	315.663	63.14247	212.6548	1605.353
Monthly Average:	3776.667	3466.083	23596.5	9601.417	1920.583	6468.25	1605.353

ıonth (gal)	average daily	normalized by population
1295.6	70.9	0.9
1223.5	66.9	-3.1
1308.5	71.6	1.6
1439.1	78.7	8.7
2163.0	118.3	48.3
2012.7	110.1	40.1
1937.6	106.0	36.0
1916.2	104.8	34.8
1827.8	100.0	30.0
1521.7	83.2	13.2
1340.3	73.3	3.3
1247.6	68.2	-1.8
	215883	

gal.

gal/day

gal/mth

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)

Year: 2002

STATION:	#2	#3	#4	#5	#6	#7	Total per m
January	1588	3074	21983	9988	0	2655	39288
February	1004	2783	19276	9017	0	2366	34446
March	1527	3265	22794	9970	0	2800	40356
April	2373	3447	21931	9675	0	3745	41171
May	4186	7464	24264	9984	0	6128	52026
June	6050	8906	22050	9414	963	8164	55547
July	7214	10489	26239	9978	6094	9964	69978
August	6786	10830	23411	9456	6070	9811	66364
September	5100	9675	20129	9449	0	7944	52297
October	5300	6807	17280	9626	501	7866	47380
November	4949	0	19174	9362	0	6703	40188
December	5181	0	19553	9509	0	6950	41193
Totals per well:	51258	66740	258084	115428	13628	75096	
Overall total for the year:						2002	580234
Daily Average year:	140.4329	182.8493	707.0795	316.2411	37.33699	205.7425	1589.682
Monthly Average:	4271.5	5561.667	21507	9619	1135.667	6258	4568

ıonth (gal)	average daily	normalized by population
1267.4	70.5	0.5
1230.2	68.4	-1.6
1301.8	72.4	2.4
1372.4	76.3	6.3
1678.3	93.3	23.3
1851.6	102.9	32.9
2257.4	125.5	55.5
2140.8	119.0	49.0
1743.2	96.9	26.9
1528.4	85.0	15.0
1339.6	74.5	4.5
1328.8	73.9	3.9

gal.

gal/day

gal/mth

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)

Year: 2003

STATION:	#2	#3	#4	#5	#6	#7	Total per m
January	5524	41	20544	9679	14	5833	41635
February	5373	0	17676	8738	0	6298	38085
March	6669	0	18792	9276	0	7835	42572
April	6526	0	22013	9185	0	6900	44624
May	7739	2888	24947	9533	0	8133	53240
June	6881	8261	22197	9082	797	5824	53042
July	6137	7019	24416	10469	4149	9160	61350
August	5634	6202	20895	10390	5357	7374	55852
September	4701	5789	21112	10230	1901	6765	50498
October	4064	5753.25	18400	9529	12	6180	43938.25
November	904	5635.5	18083	9076	3	5069	38770.5
December	0	5683.5	18484	9394	0	6283	39844.5
Totals per well:	60152	52963	247559	114581	12233	81654	569142
	60152	47272.25	247559	114581	12233	81654	563451.3
Overall total for the year:						2003	569142
Daily Average year:	164.8	145.1041	678.2438	313.9205	33.51507	223.7096	1559.293
Monthly Average:	5012.667	4413.583	20629.92	9548.417	1019.417	6804.5	1559.293

ıonth (gal) average daily normailzed by population

1343.1	74.8	4.8
1360.2	75.7	5.7
1373.3	76.5	6.5
1487.5	82.8	12.8
1717.4	95.6	25.6
1768.1	98.5	28.5
1979.0	110.2	40.2
1801.7	100.3	30.3
1683.3	93.7	23.7
1417.4	78.9	8.9
1292.4	72.0	2.0
1285.3	71.6	1.6
	5690.75	

gal.

gal/day

gal/mth

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)
Note: pumping data at Well #5 corrected for failing venturi according to calibration beginning (210 gpm)
Year: 2004 Note: PUMPING DATA AT Well #3 corrected for SCADA programming reporting

STATION:	#2	#3	#4	#5	#6	#7	Total per m
January	0	6510	19976	9188.4	0	6191	41865
February	42	5874.75	17770	8247.6	38	6012	37984
March	0	6135.75	21297	8444.4	0	6495	42372
April	93	6825	20660	7812	0	6877	42267
May	5745	7964.25	23792	7700.4	0	9306	54508
June	5763	8296.5	26312	7092	2408	10085	59957
July	5306	7096.5	23399	6956.4	5547	8082	56387
August	5177	6778	20904	6584.4	7057	8592	55092
September	4603	6705	19937	6012	4886	7984	50127
October	3816	5855	20068	5840.4	0	7188	42767
November	4346	6357	22199	5292	0	2688	40882
December	0	3690	23089	5096.4	5	6166	38046
Totals per well:	34891	78087.75	259403	84266.4	19941	85666	
Overall total for the year:						2004	562255.2
Daily Average year:	95	213	709	230	54	234	1536
Monthly Average:	2908	6507	21617	7022	1662	7139	46855

ı and end (110 gpm) points
ı error

ıonth (1000 average daily normalized by population

1350.5	76.1	6.1
1309.8	73.8	3.8
1366.8	77.1	7.1
1408.9	79.4	9.4
1758.3	99.1	29.1
1998.6	112.7	42.7
1818.9	102.5	32.5
1777.2	100.2	30.2
1670.9	94.2	24.2
1379.6	77.8	7.8
1362.7	76.8	6.8
1227.3	69.2	-0.8

1000 gal.

1000 gal/day

1000 gal/mth

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)

Year: 2005

STATION:	#2	#3	#4	#5	#6	#7	Total (1000 gal)	Daily Average	Daily Average Pop Adjusted	Summer Excess
January	0	4986	21785	4703	0	6518	37992	1225.5	68.8	-1.2
February	0	7238	23191	4200	0	5646	40275	1438.4	80.8	10.8
March	0	7236	25538	4182	55	8620	45630	1471.9	82.6	12.6
April	2638	7375	25490	4022	0	8687	48212	1607.1	90.2	20.2
May	7330	7951	27628	3855	0	9579	56342	1817.5	102.0	32.0
June	8156	9125	28321	3464	7433	10340	66839	2228.0	125.1	55.1
July	5845	7901	25263	4674	8467	8842	60992	1967.5	110.5	40.5
August	5494	8471	25614	3987	8996	8074	60636	1956.0	109.8	39.8
September	4372	6870	23061	3720	6357	8756	53136	1771.2	99.4	29.4
October	1642	5315	21537	3842	2440	7303	42078	1357.4	76.2	6.2
November	2799	5308	18676	3567	0	6348	36698	1223.3	68.7	-1.3
December	3351	210	23259	2697	3	7936	37456	1208.3	67.8	-2.2
Totals per well:	41627	77986	289363	46912	33751	96647				
Overall total for the year:						2005	586286	1000 gal.		
Daily Average year:	114	214	793	129	92	265	1606	1000 gal/day		
Monthly Average:	3469	6499	24114	3909	2813	8054	48857	1000 gal/mth		

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)
Year: 2006 Corrected for Mater Meter Recalibration
Well 3 June - November linear increase to correct for 10% under-reporting
Well 5 April - May linear increase to correct for 58,000 gpd under-reporting
Well 5 June - November increase 7% to correct for magmeter setup

STATION:	#2	#3	#4	#5	#6	#7	Total (1000 gal)	Daily Average	Daily Average Pop Adjusted
January	2944	3713	22986	657	0	8069	38369	1237.7	67.5
February	0	5459	21033	0	0	7503	33995	1214.1	66.2
March	412	5917	22678	1788	0	8032	38827	1252.5	68.3
April	1015	3807	21225	7178	0	7249	40474	1349.1	73.6
May	4464	1605	25038	8953	0	9032	49092	1583.6	86.3
June	3925	5911	23401	7831	0	8001	49069	1635.6	89.2
July	4139	6705	24676	8051	3064	9111	55746	1798.3	98.0
August	3808	6879	23210	8403	5955	6831	55085	1776.9	96.9
September	2920	5165	17725	8302	5911	6124	46147	1538.2	83.9
October	2831	5134	17777	8660	756	6179	41336	1333.4	72.7
November	570	4855	17031	8405	0	5784	36645	1221.5	66.6
December	0	4496	16670	8964	5	6117	36252	1169.4	63.8
Totals per well:	27028	59645.85	253450	77191	15691	88032			
Overall total for the year:						2006	521038	1000 gal.	
Daily Average year:	74	163	694	211	43	241	1428	1000 gal/day	
Monthly Average:	2252	4970	21121	6433	1308	7336	43420	1000 gal/mth	

Town of Sharon
MONTHLY PUMPING TOTALS Year: 2007 Corrected Pumping Totals
(in thousands of gallons)
Well #2 adjusted linearly by incremental -1.866% per month for total -18.66% for 10 month operation period
Well #3 adjusted linearly by incremental -4.01% per month for total -48.08%
Well #4 adjusted linearly by incremental -0.3475% per month for total -4.17%
Well #7 adjusted linearly by incremental 1.133% per month for total 13.6%

STATION:	#2	#3	#4	#5	#6	#7	Total (1000 gal)	Daily Average	Daily Average Pop Adjusted	Summer Excess
January	0	4123	16627	8848	0	6088	35,686	1151.2	65.0	-5.0
February	0	3461	14518	7957	0	5187	31,124	1111.6	62.8	-7.2
March	58	3926	17335	8772	23	6395	36,509	1177.7	66.5	-3.5
April	610	3626	18485	8449	0	4526	35,697	1189.9	67.2	-2.8
May	3969	4768	25107	8133	0	5843	47,820	1542.6	87.2	17.2
June	3506	4762	24175	8138	1109	9092	50,782	1692.7	95.6	25.6
July	3834	4724	22343	8314	5671	9372	54,258	1750.3	98.9	28.9
August	3631	4631	22099	8205	6358	9393	54,317	1752.2	99.0	29.0
September	3733	4446	20304	7729	5184	9966	51,363	1712.1	96.7	26.7
October	994	4183	21552	5115	0	9102	40,945	1320.8	74.6	4.6
November	292	3344	19354	972	0	8666	32,628	1087.6	61.4	-8.6
December	552	2491	16233	7677	0	6800	33,753	1088.8	61.5	-8.5
Totals per well:	21180	48485	238133	88309	18345	90430				
Overall total for the year:						2007	504882	1000 gal.		
Daily Average year:	58	133	652	242	50	248	1383	1000 gal/day		
Monthly Average:	1765	4040	19844	7359	1529	7536	42073	1000 gal/mth		

Town of Sharon
MONTHLY PUMPING TOTALS
(in thousands of gallons)
Year: 2008 Uncorrected pumping totals
Well #2 adjusted linearly by -18.66% for January and February
Well #3 adjusted linearly by -48.08% for January and February
Well #4 adjusted linearly by -4.17% for January and February
Well #7 adjusted linearly by 13.6% for January and February

STATION:	#2	#3	#4	#5	#6	#7	Total (1000 gal)
January	168	3013	19281	7135	0	7822	37419
February	0	1950	17487	7352	0	8297	35087
March	155	2698	20111	7762	28	8704	39458
April	2641	2549	19022	7603	0	8519	40334
May	4339	980	23296	7756	0	9412	45783
June	4429	4570	23014	7393	4560	9713	53679
July	4305	5224	21616	8427	6660	9529	55761
August	2178	3236	19037	7497	6224	8412	46584
September	0	1487	19835	6742	5960	8656	42680
October	0	4096	17065	6583	39	7392	35175
November	0	3318	14817	6500	0	6132	30767
December							0
Totals per well:	18215	33121	214581	80750	23471	92589	
Overall total for the year:						2008	462726
Daily Average year:	50	90	586	221	64	253	1264
Monthly Average:	1656	3011	19507	7341	2134	8417	38561

Daily Average	Daily Average Pop Adjusted		Summer Excess
1207.1	67.8		-2.2
1209.9	68.0		-2.0
1272.8	71.5		1.5
1344.5	75.5		5.5
1476.9	83.0		13.0
1789.3	100.5		30.5
1798.7	101.1		31.1
1502.7	84.4		14.4
1422.7	79.9		9.9
1134.7	63.8		-6.2
1025.6	57.6		-12.4
0.0	0.0		-70.0

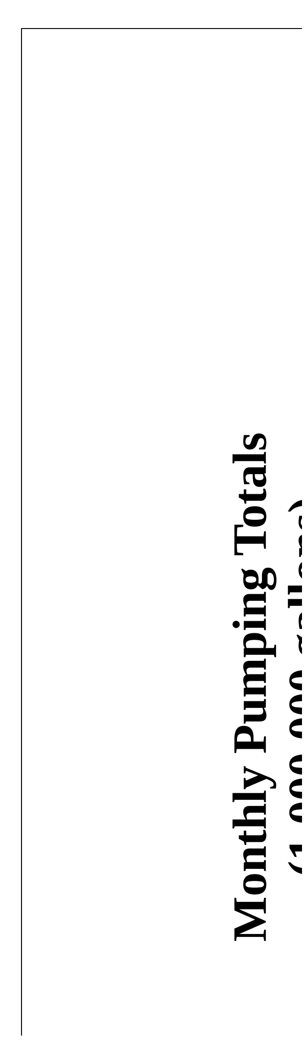
1000 gal.

1000 gal/day

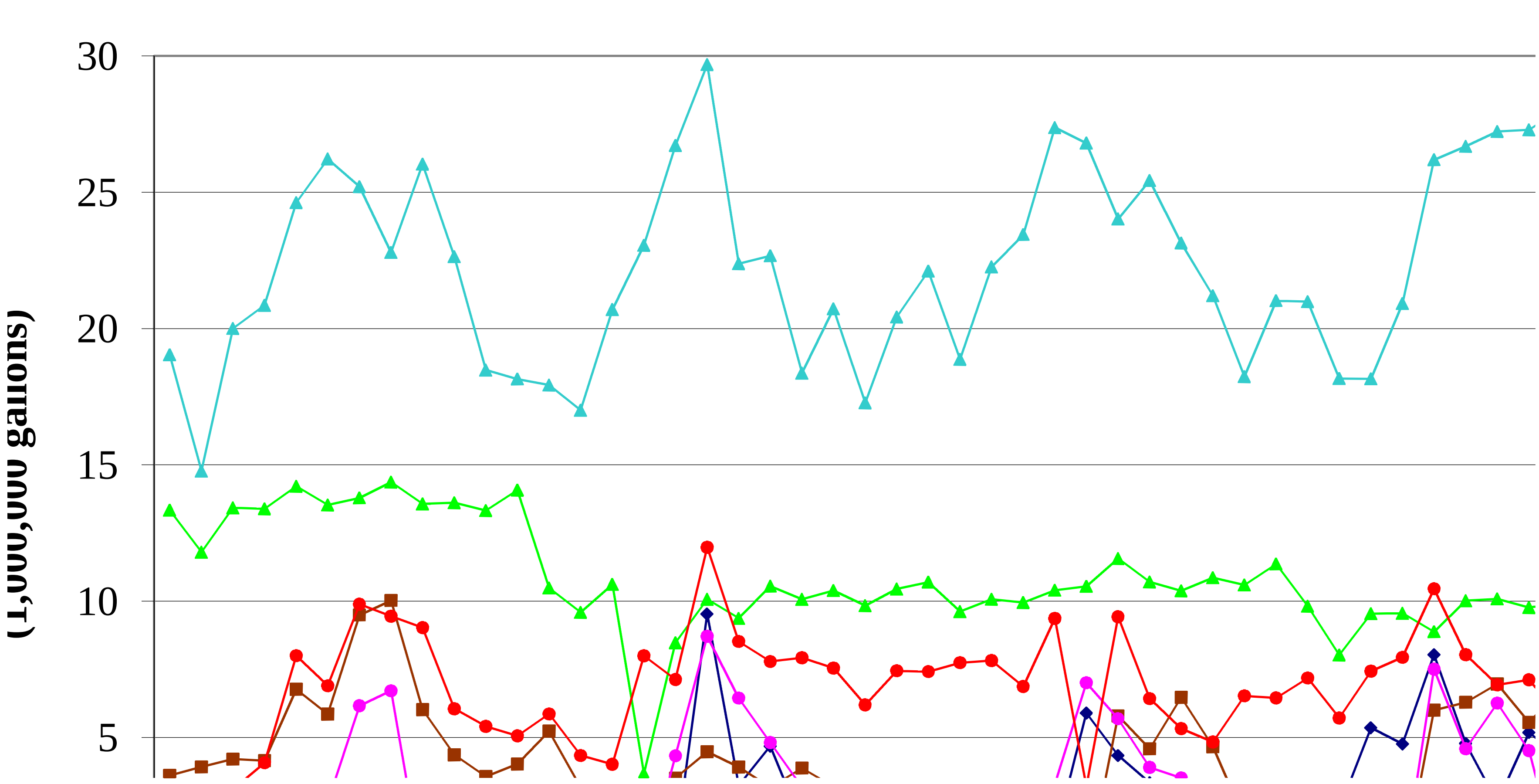
1000 gal/mth

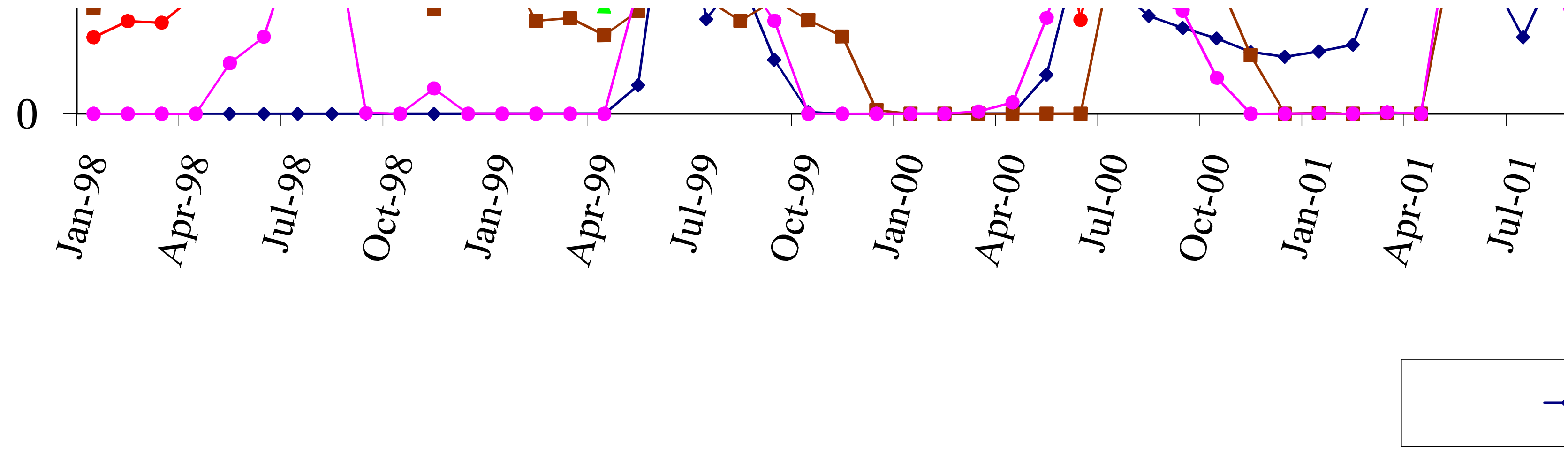
Sharon Master Plan Pumping Totals from 1998 to 2008
Wells #2-#7

STATION:	#2	#3	#4	#5	#6	#7
Jan-98	0	3602	19035	13337	0	2612
Feb-98	0	3916	14772	11796	0	3166
Mar-98	0	4203	20003	13422	0	3106
Apr-98	0	4144	20850	13384	0	4068
May-98	0	6768	24620	14214	1732	7996
Jun-98	0	5851	26221	13527	2624	6893
Jul-98	0	9491	25201	13786	6158	9884
Aug-98	0	10023	22790	14367	6709	9446
Sep-98	0	6017	26031	13565	28	9024
Oct-98	0	4363	22639	13611	3	6045
Nov-98	0	3566	18476	13322	865	5407
Dec-98	0	4025	18147	14072	0	5058
Jan-99	0	5231	17926	10483	0	5859
Feb-99	0	3175	17005	9589	0	4335
Mar-99	0	3260	20696	10616	0	4011
Apr-99	0	2685	23055	3668	0	7994
May-99	975	3507	26712	8470	4323	7125
Jun-99	9529	4471	29683	10066	8710	11973
Jul-99	3230	3909	22377	9369	6441	8518
Aug-99	4676	3169	22670	10546	4811	7783
Sep-99	1841	3873	18364	10067	3175	7922
Oct-99	61	3192	20726	10390	0	7541
Nov-99	0	2636	17274	9833	0	6191
Dec-99	0	127	20423	10445	0	7444
Jan-00	0	0	22105	10698	0	7413
Feb-00	0	0	18868	9616	0	7741
Mar-00	0	0	22262	10071	78	7819
Apr-00	0	0	23447	9949	389	6867
May-00	1332	0	27369	10401	3271	9365
Jun-00	5891	0	26804	10544	7005	3198
Jul-00	4335	5788	24022	11562	5684	9425
Aug-00	3340	4579	25431	10705	3901	6423
Sep-00	2927	6465	23134	10375	3510	5319
Oct-00	2572	4658	21204	10861	1223	4829
Nov-00	2105	1995	18237	10594	0	6523
Dec-00	1946	0	21022	11364	0	6449
Jan-01	2128	32	20988	9813	26	7178
Feb-01	2354	0	18168	8023	0	5713
Mar-01	5355	27	18158	9541	55	7427
Apr-01	4762	0	20918	9556	0	7937
May-01	8035	5996	26190	8875	7504	10453
Jun-01	4776	6288	26683	10015	4588	8031
Jul-01	2613	6958	27227	10083	6257	6928
Aug-01	5175	5548	27287	9764	4516	7113
Sep-01	4262	6797	28046	9957	56	5716
Oct-01	2688	3653	26144	9951	0	4738
Nov-01	1794	3547	21631	9640	45	3552
Dec-01	1378	2747	21718	9999	0	2833
Jan-02	1588	3074	21983	9988	0	2655
Feb-02	1004	2783	19276	9017	0	2366
Mar-02	1527	3265	22794	9970	0	2800
Apr-02	2373	3447	21931	9675	0	3745
May-02	4186	7464	24264	9984	0	6128
Jun-02	6050	8906	22050	9414	963	8164
Jul-02	7214	10489	26239	9978	6094	9964
Aug-02	6786	10830	23411	9456	6070	9811
Sep-02	5100	9675	20129	9449	0	7944
Oct-02	5300	6807	17280	9626	501	7866
Nov-02	4949	0	19174	9362	0	6703
Dec-02	5181	0	19553	9509	0	6950
Jan-03	5524	41	20544	9679	14	5833
Feb-03	5373	0	17676	8738	0	6298
Mar-03	6669	0	18792	9276	0	7835
Apr-03	6526	0	22013	9185	0	6900
May-03	7739	2888	24947	9533	0	8133
Jun-03	6881	8261	22197	9082	797	5824
Jul-03	6137	7019	24416	10469	4149	9160
Aug-03	5634	6202	20895	10390	5357	7374
Sep-03	4701	5789	21112	10230	1901	6765
Oct-03	4064	5753	18400	9529	12	6180
Nov-03	904	5636	18083	9076	3	5069
Dec-03	0	5684	18484	9394	0	6283
Jan-04	0	6510	19976	9188	0	6191
Feb-04	42	5875	17770	8248	38	6012
Mar-04	0	6136	21297	8444	0	6495
Apr-04	93	6825	20660	7812	0	6877
May-04	5745	7964	23792	7700	0	9306
Jun-04	5763	8297	26312	7092	2408	10085
Jul-04	5306	7097	23399	6956	5547	8082
Aug-04	5177	6778	20904	6584	7057	8592
Sep-04	4603	6705	19937	6012	4886	7984
Oct-04	3816	5855	20068	5840	0	7188
Nov-04	4346	6357	22199	5292	0	2688

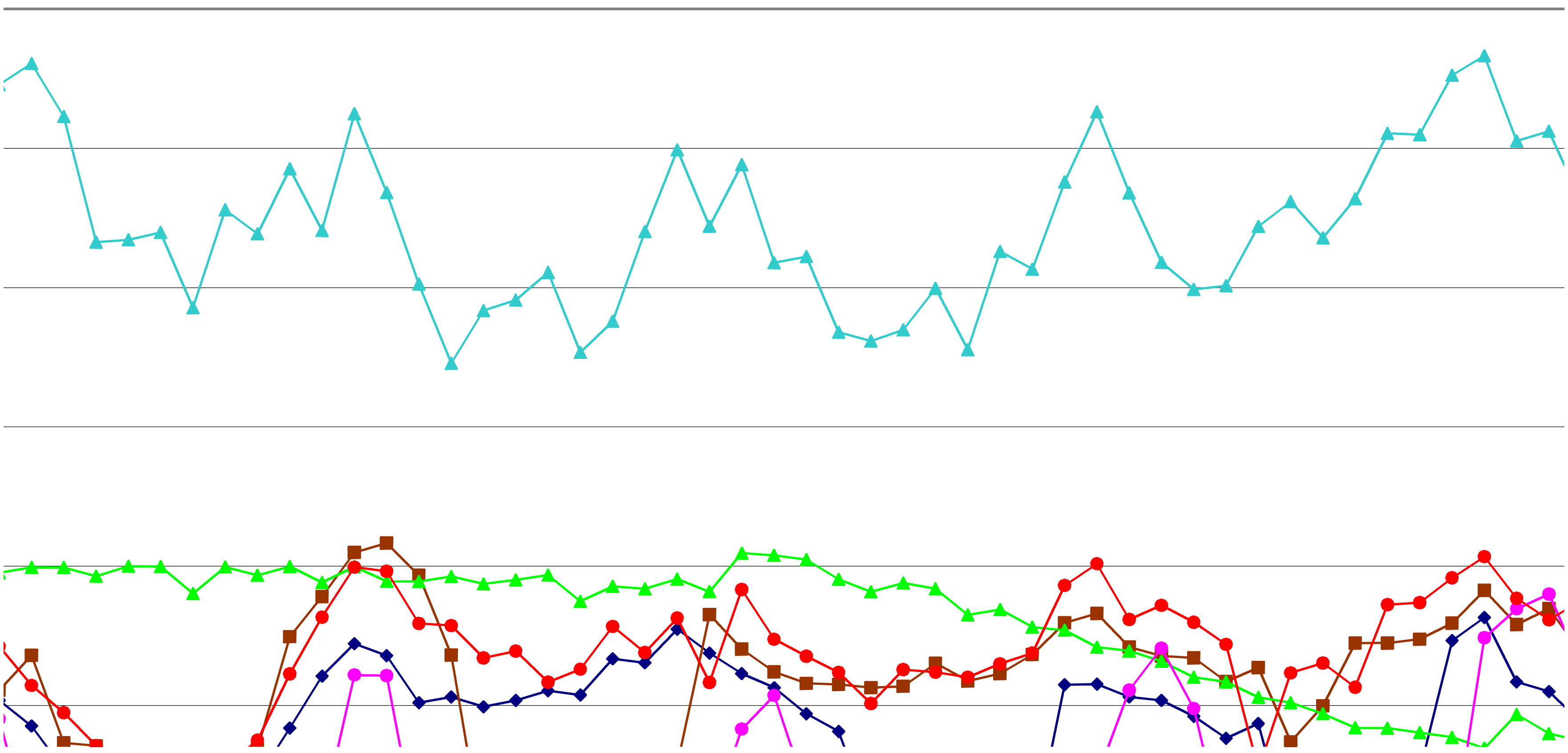


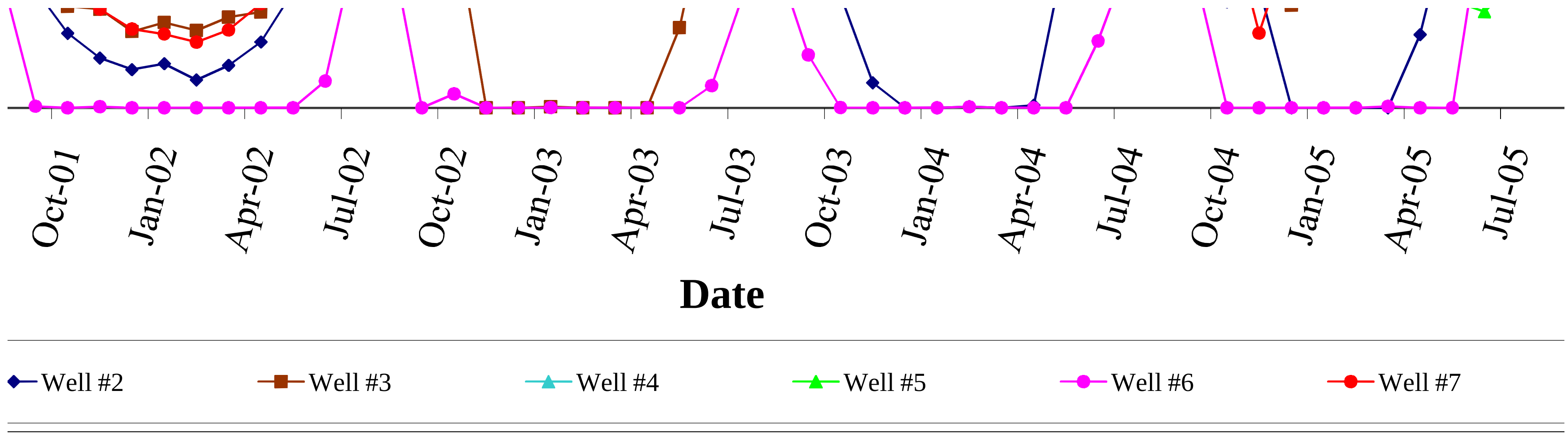
Dec-04	0	3690	23089	5096	5	6166
Jan-05	0	4986	21785	4703	0	6518
Feb-05	0	7238	23191	4200	0	5646
Mar-05	0	7236	25538	4182	55	8620
Apr-05	2638	7375	25490	4022	0	8687
May-05	7330	7951	27628	3855	0	9579
Jun-05	8156	9125	28321	3464	7433	10340
Jul-05	5845	7901	25263	4674	8467	8842
Aug-05	5494	8471	25614	3987	8996	8074
Sep-05	4372	6870	23061	3720	6357	8756
Oct-05	1642	5315	21537	3842	2440	7303
Nov-05	2799	5308	18676	3567	0	6348
Dec-05	3351	210	23259	2697	3	7936
Jan-06	2944	3713	22986	657	0	8069
Feb-06	0	5459	21033	0	0	7503
Mar-06	412	5917	22678	1788	0	8032
Apr-06	1015	3807	21225	7178	0	7249
May-06	4464	1605	25038	8953	0	9032
Jun-06	3925	5911	23401	7831	0	8001
Jul-06	4139	6705	24676	8051	3064	9111
Aug-06	3808	6879	23210	8403	5955	6831
Sep-06	2920	5165	17725	8302	5911	6124
Oct-06	2831	5134	17777	8660	756	6179
Nov-06	570	4855	17031	8405	0	5784
Dec-06	0	4496	16670	8964	5	6117
Jan-07	0	4123	16627	8848	0	6088
Feb-07	0	3461	14518	7957	0	5187
Mar-07	58	3926	17335	8772	23	6395
Apr-07	610	3626	18485	8449	0	4526
May-07	3969	4768	25107	8133	0	5843
Jun-07	3506	4762	24175	8138	1109	9092
Jul-07	3834	4724	22343	8314	5671	9372
Aug-07	3631	4631	22099	8205	6358	9393
Sep-07	3733	4446	20304	7729	5184	9966
Oct-07	994	4183	21552	5115	0	9102
Nov-07	292	3344	19354	972	0	8666
Dec-07	552	2491	16233	7677	0	6800
Jan-08	168	3013	19281	7135	0	7822
Feb-08	0	1950	17487	7352	0	8297
Mar-08	155	2698	20111	7762	28	8704
Apr-08	2641	2549	19022	7603	0	8519
May-08	4339	980	23296	7756	0	9412
Jun-08	4429	4570	23014	7393	4560	9713
Jul-08	4305	5224	21616	8427	6660	9529
Aug-08	2178	3236	19037	7497	6224	8412
Sep-08	0	1487	19835	6742	5960	8656
Oct-08	0	4096	17065	6583	39	7392
Nov-08	0	3318	14817	6500	0	6132
Dec-08						
Totals	344,431	581,620	2,833,332	1,125,339	230,747	928,505


30
25
20
15
10
5
(1,000,000 gallons)

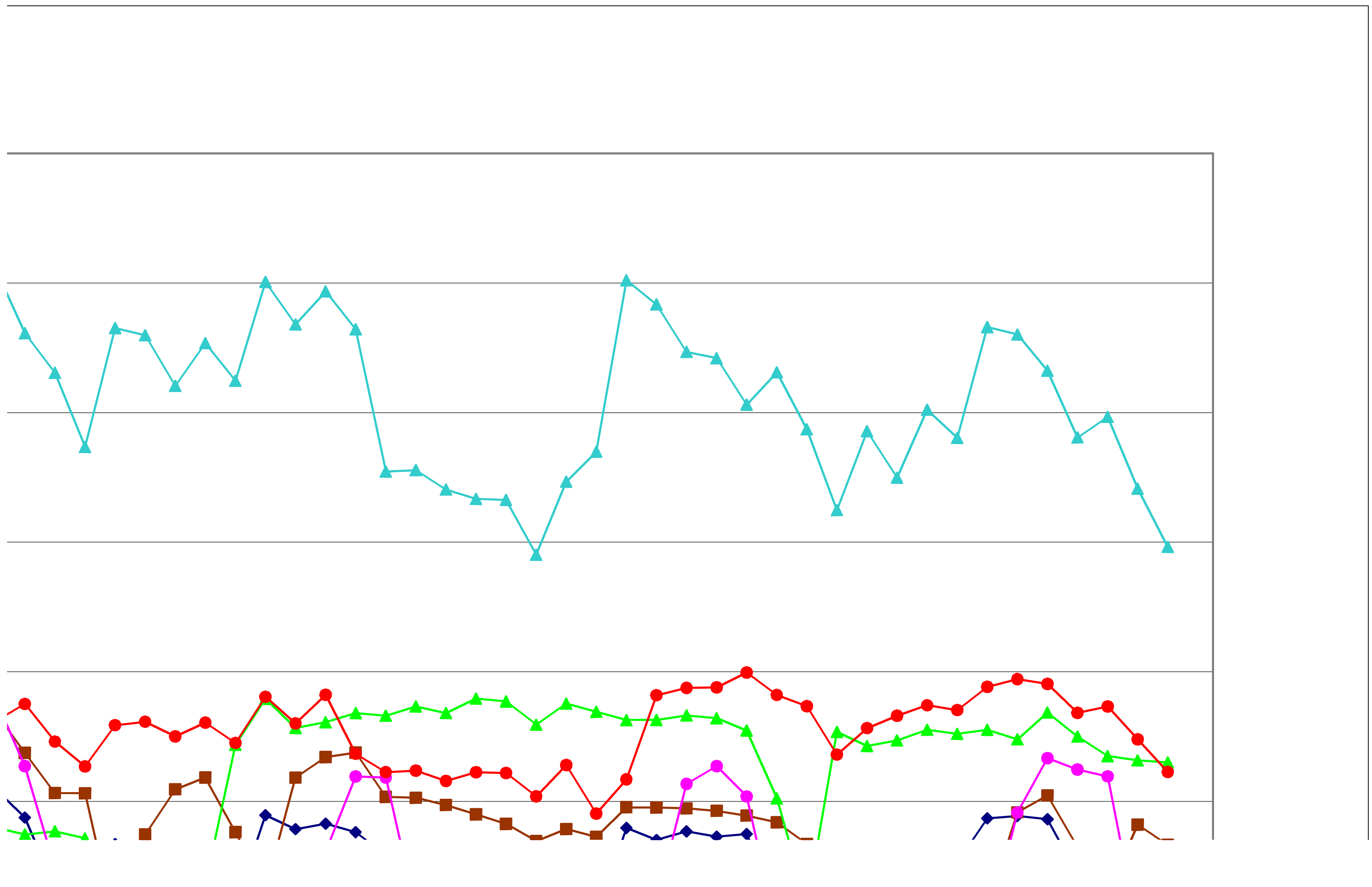

0
Jan-98
Apr-98
Jul-98
Oct-98
Jan-99
Apr-99
Jul-99
Oct-99
Jan-00
Apr-00
Jul-00
Oct-00
Jan-01
Apr-01
Jul-01

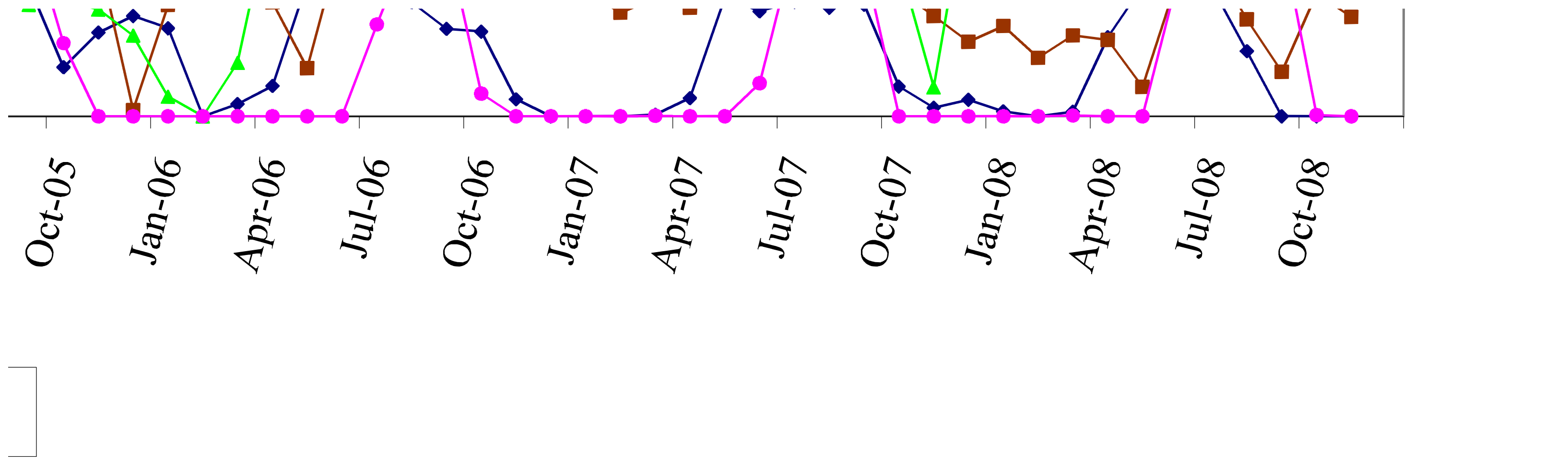
Sharon Monthly Well Pumpage Summary

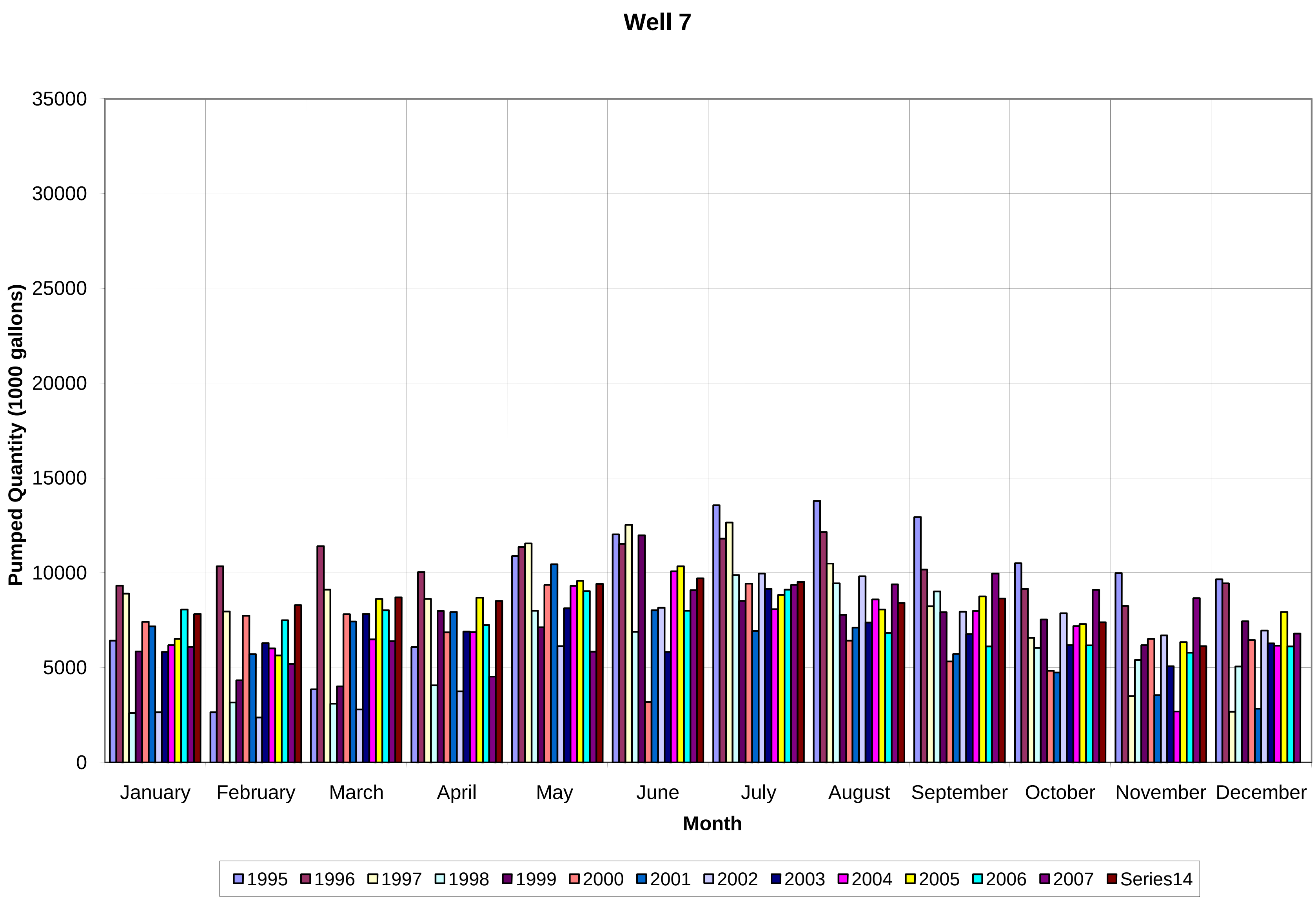




Oct-01
Jan-02
Apr-02
Jul-02
Oct-02
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05
Jul-05
Date
Well #2
Well #3
Well #4
Well #5
Well #6
Well #7

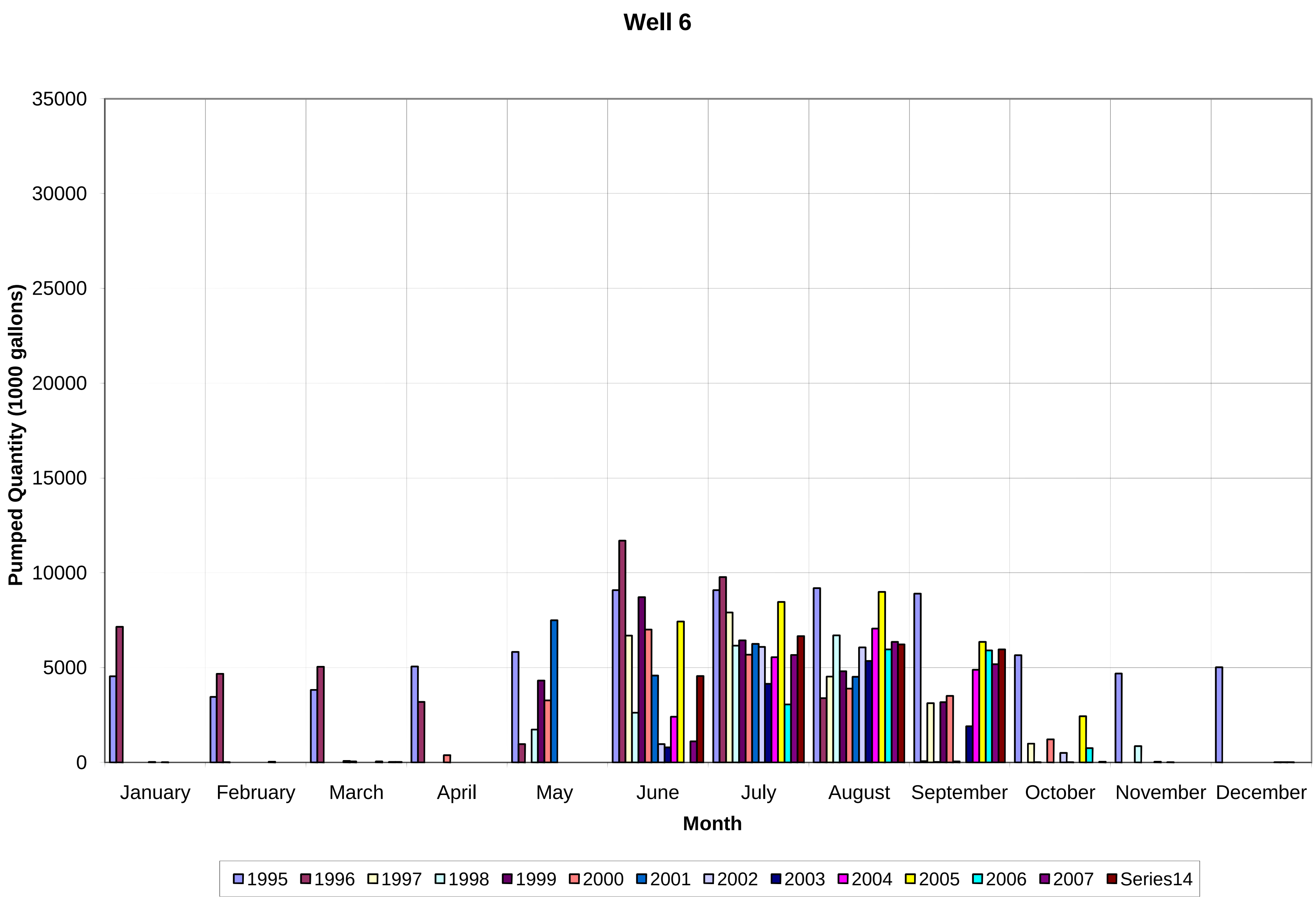



Oct-05
Jan-06
Apr-06
Jul-06
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08



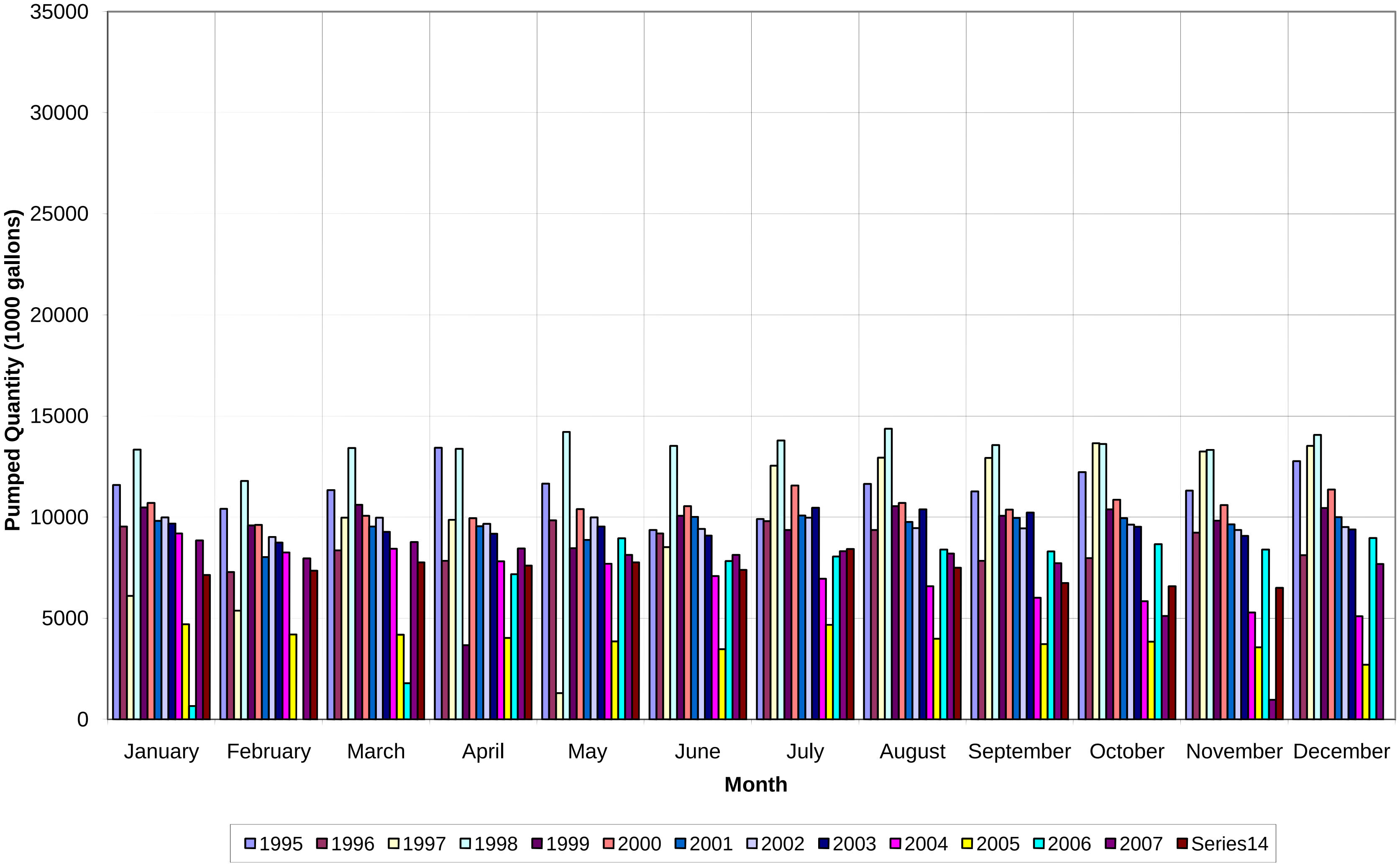
Well 7
Pumped Quantity (1000 gallons)
35000
30000
25000
20000
15000
10000
5000
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Series14

Well 6

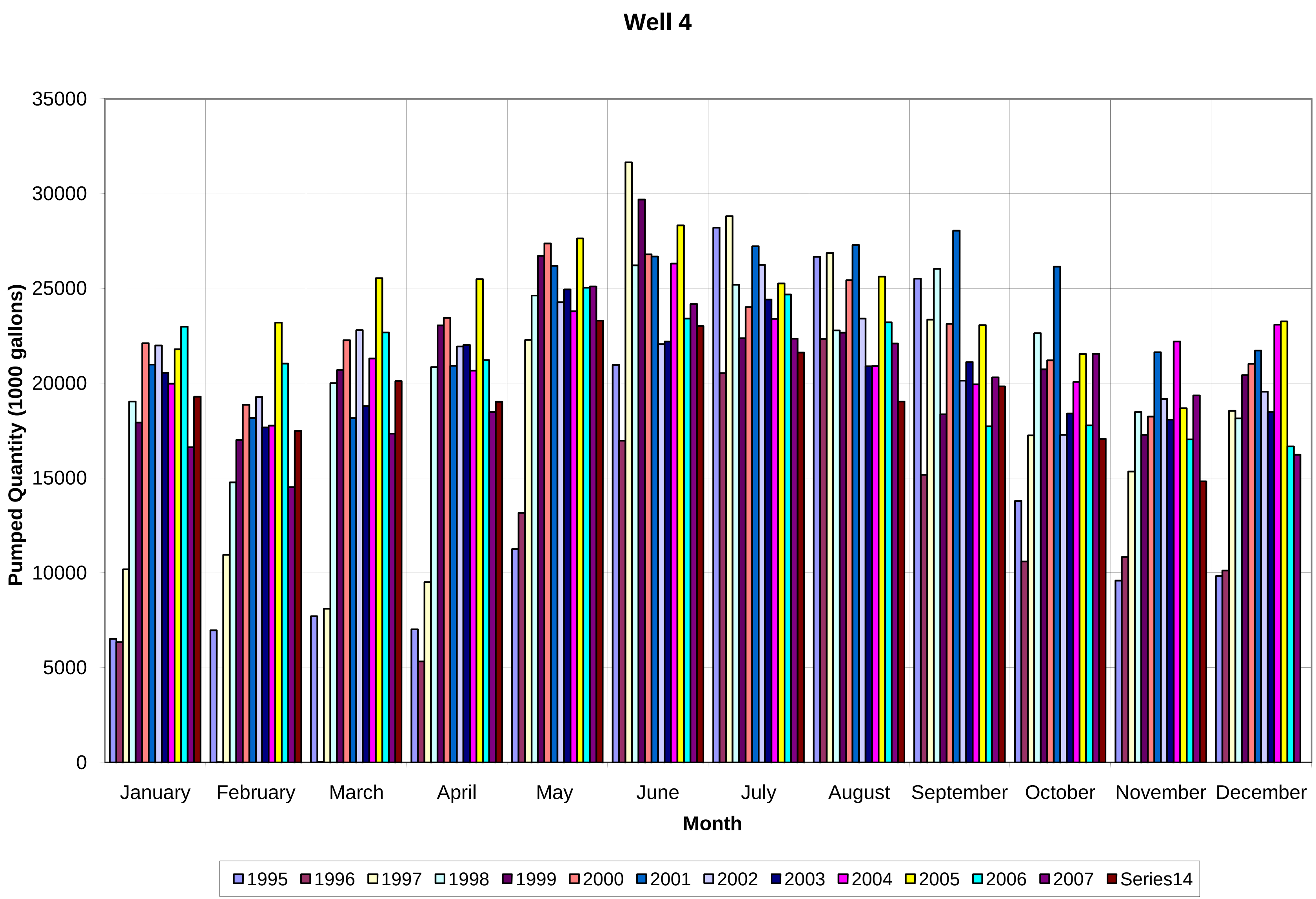


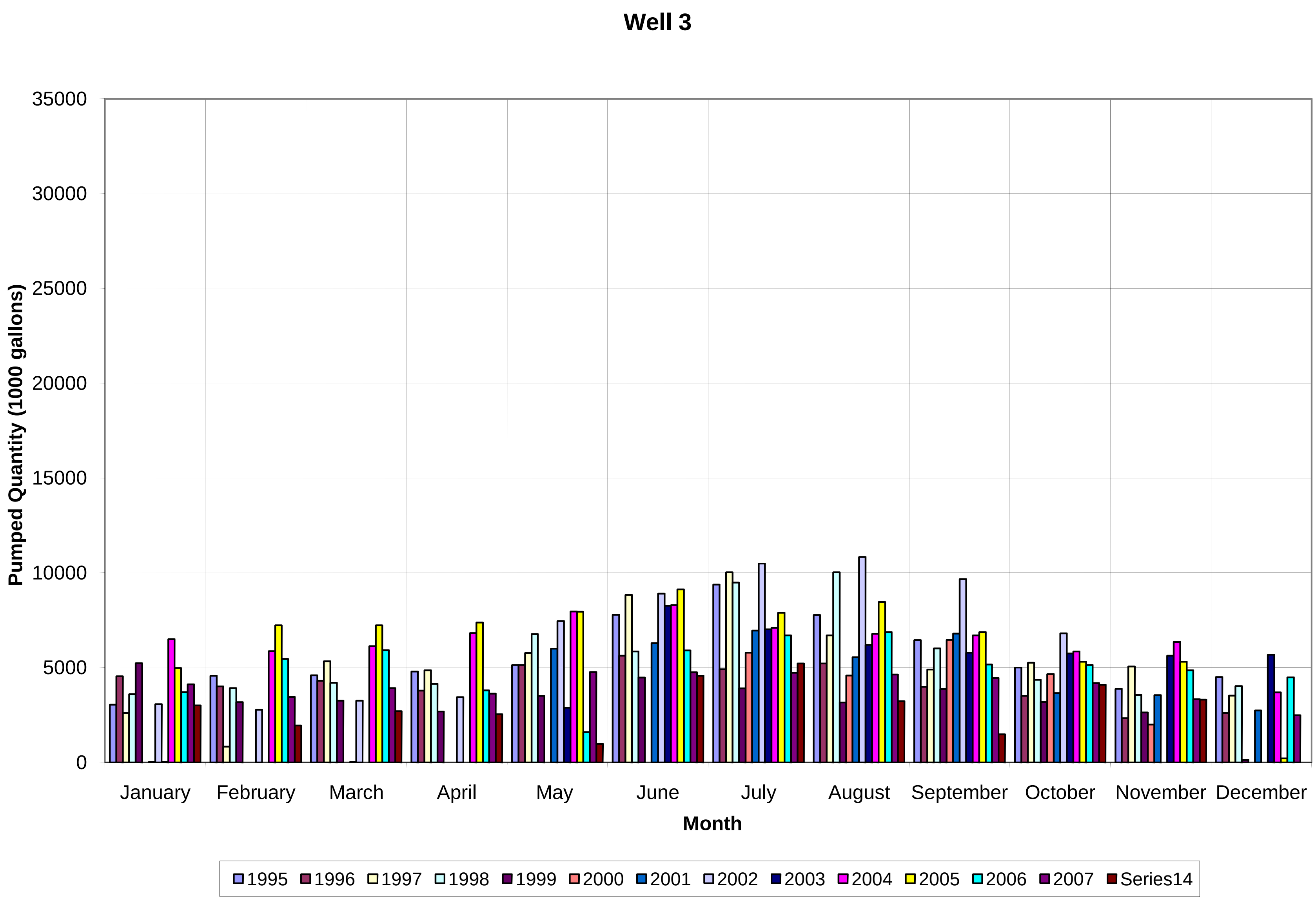
Well 6
35000
30000
25000
20000
15000
10000
5000
0
Pumped Quantity (1000 gallons)
January
February
March
April
May
June
July
August
September
October
November
December
Month
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Series14

Well 5

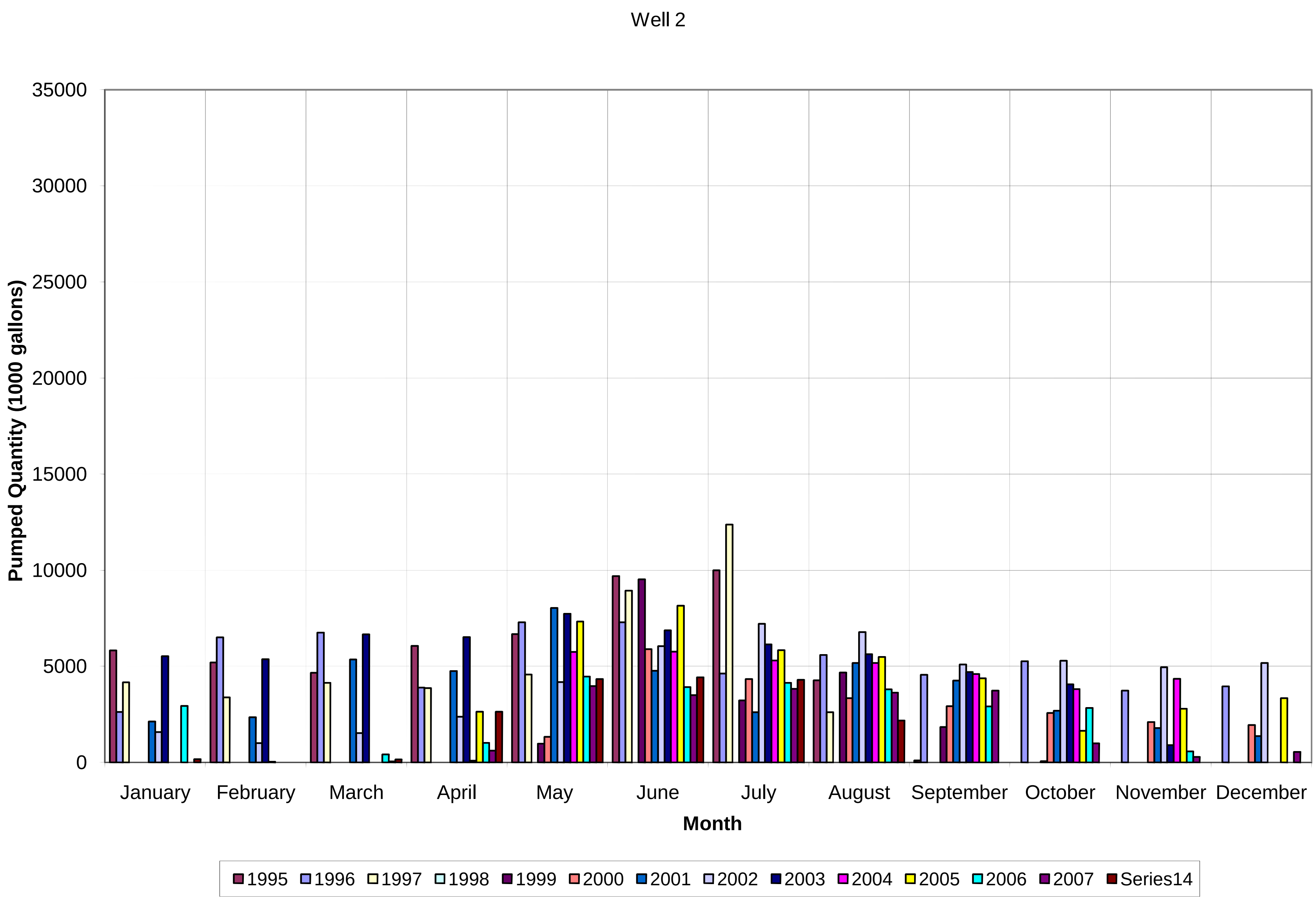


Well 5
35000
30000
25000
20000
15000
10000
5000
0
Pumped Quantity (1000 gallons)
January
February
March
April
May
June
July
August
September
October
November
December
Month
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Series14

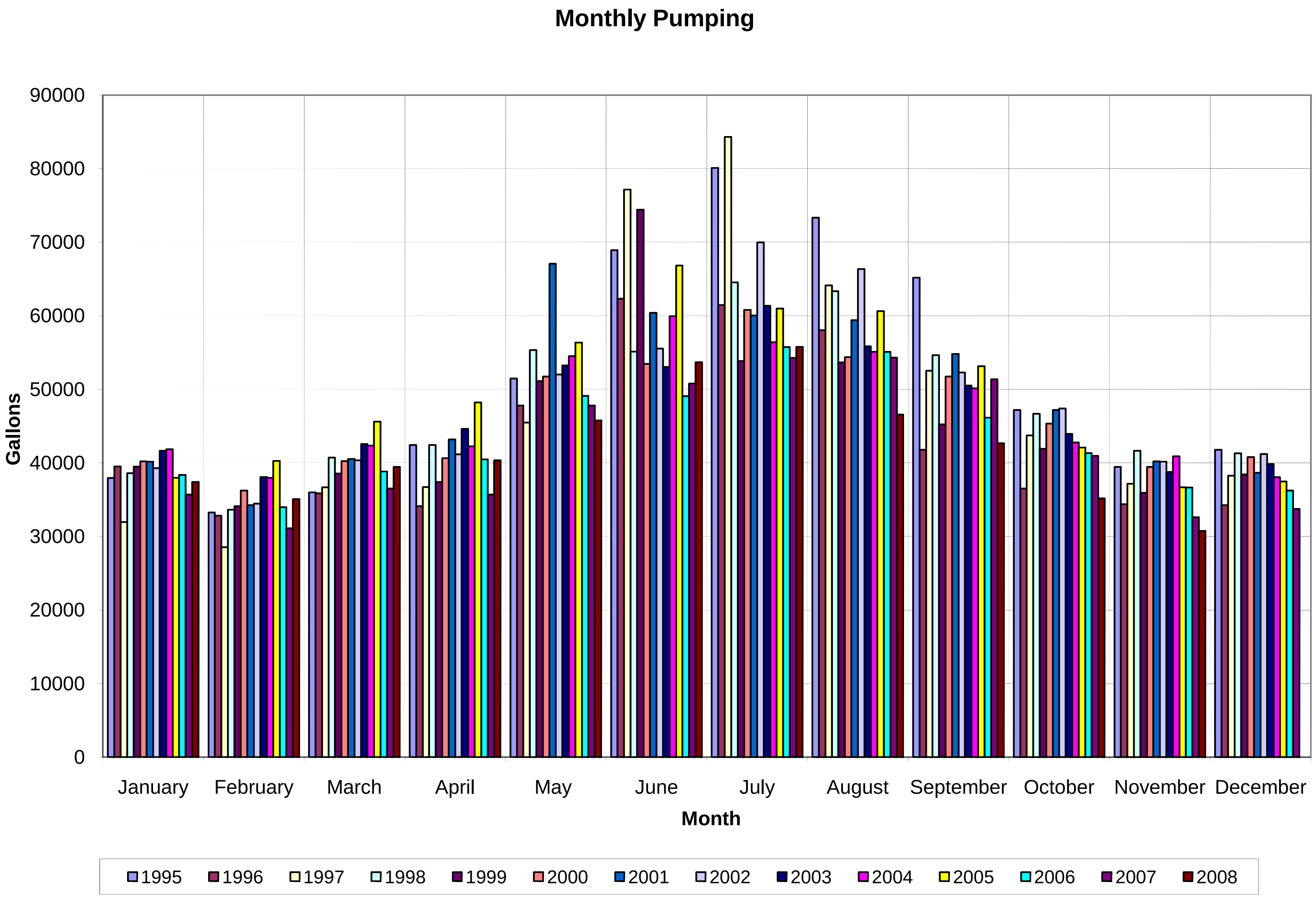

Well 4
Pumped Quantity (1000 gallons)
35000
30000
25000
20000
15000
10000
5000
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Series14



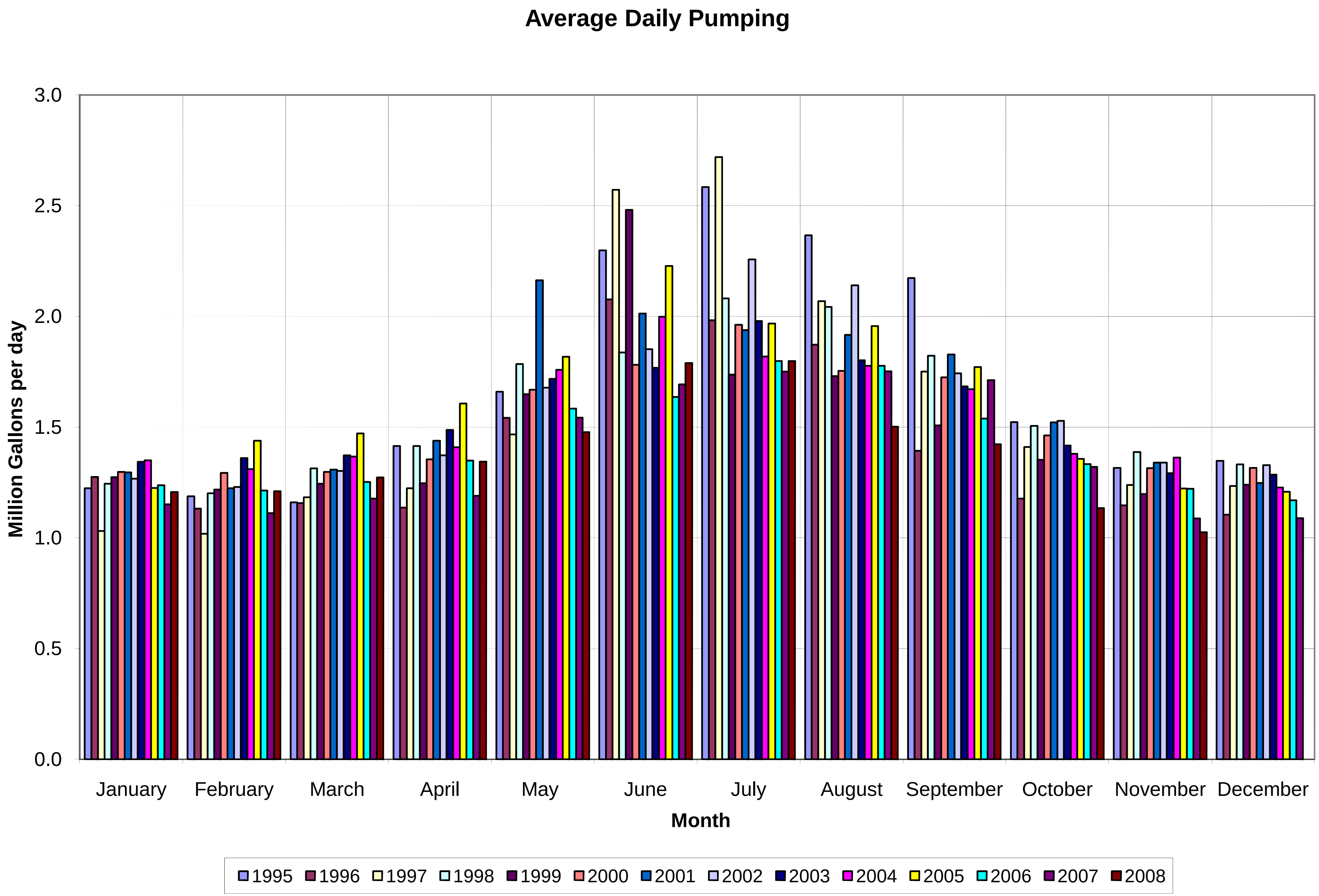
Well 3
Pumped Quantity (1000 gallons)
35000
30000
25000
20000
15000
10000
5000
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Series14



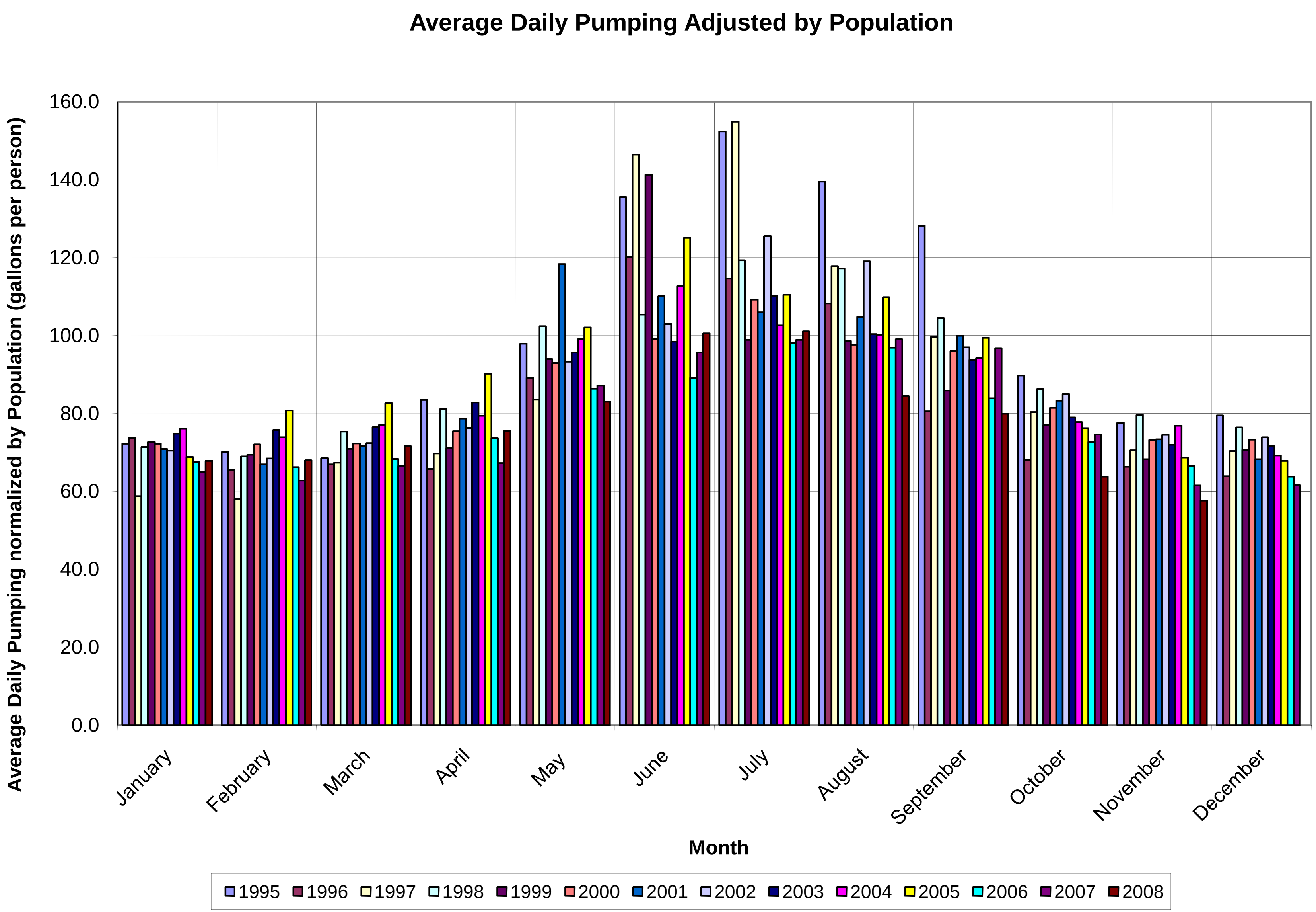
Well 2
Pumped Quantity (1000 gallons)
35000
30000
25000
20000
15000
10000
5000
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Series14

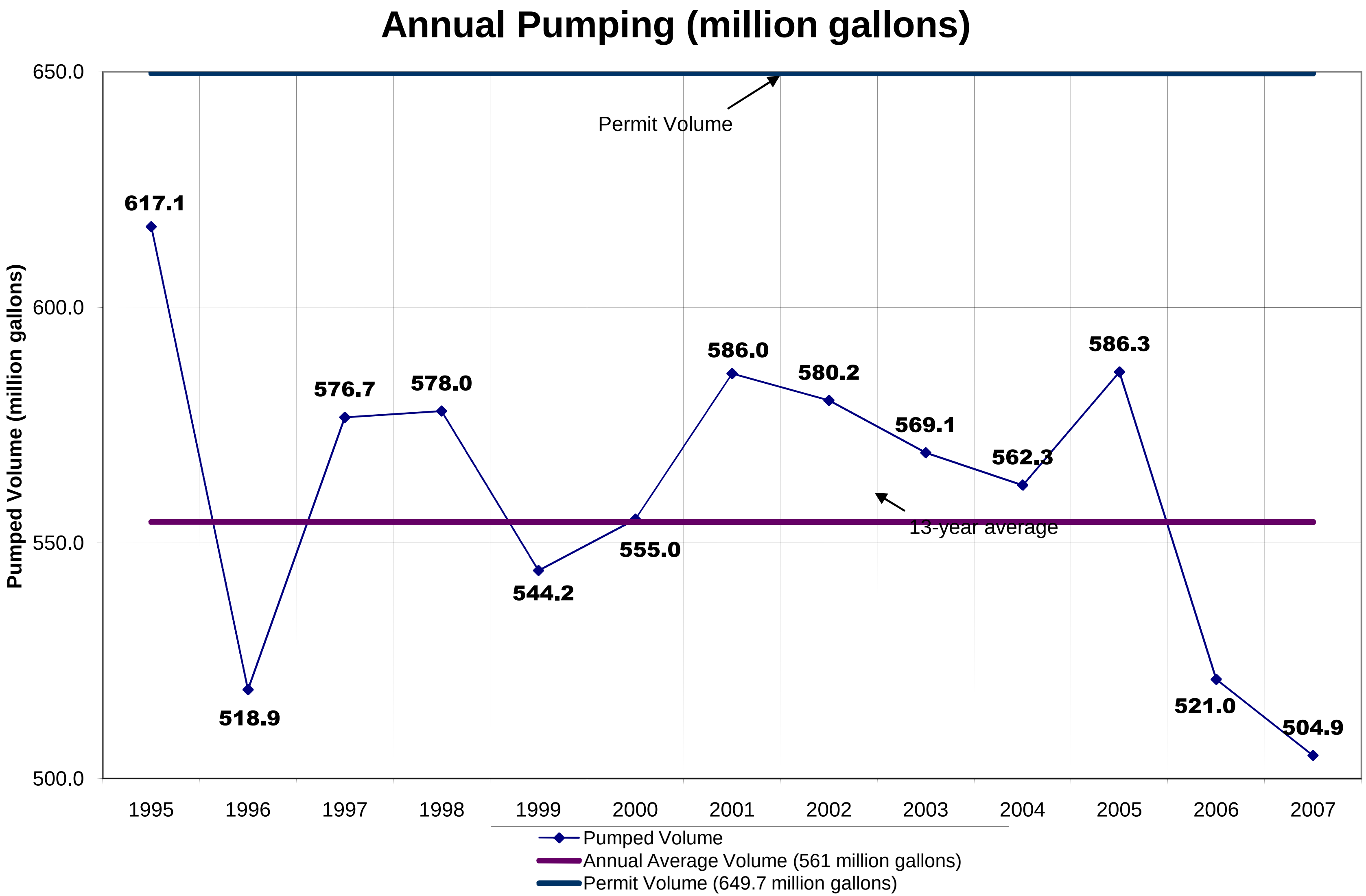


Monthly Pumping
Gallons
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008



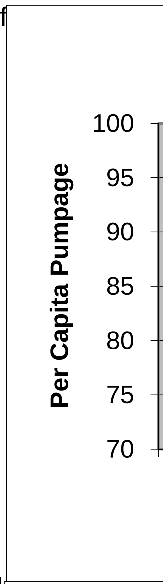
Average Daily Pumping
Million Gallons per day
3.0
2.5
2.0
1.5
1.0
0.5
0.0
January
February
March
April
May
June
July
August
September
October
November
December
Month
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008

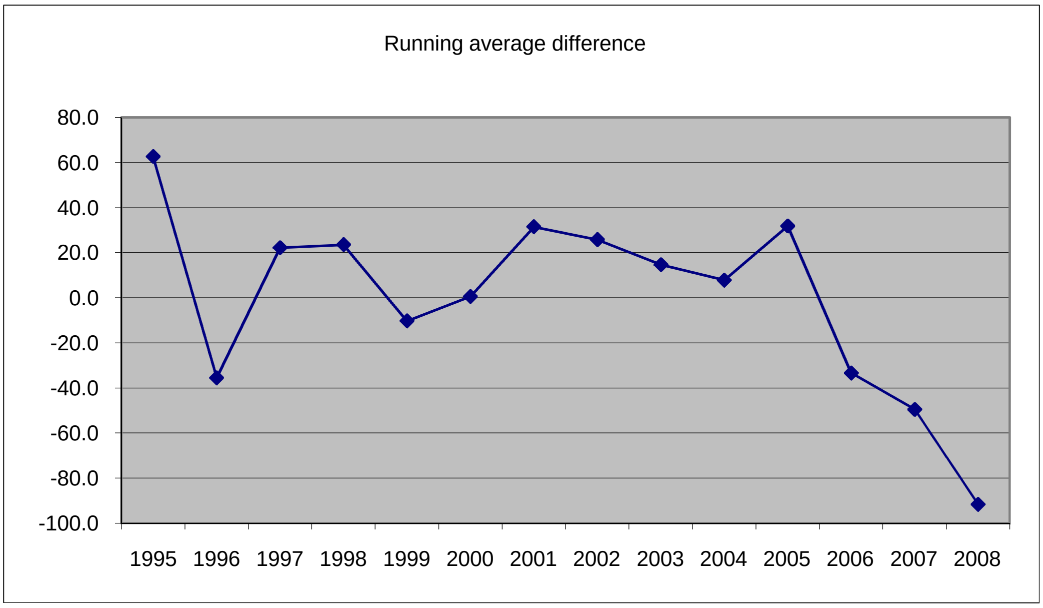

Average Daily Pumping Adjusted by Population
Average Daily Pumping normalized by Population (gallons per person)
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
January
February
March
April
May
June
July
August
September
October
November
December
Month
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008

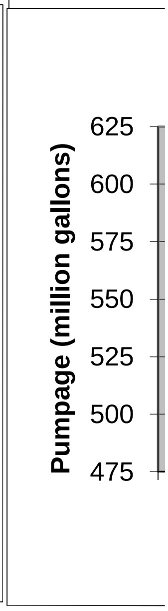


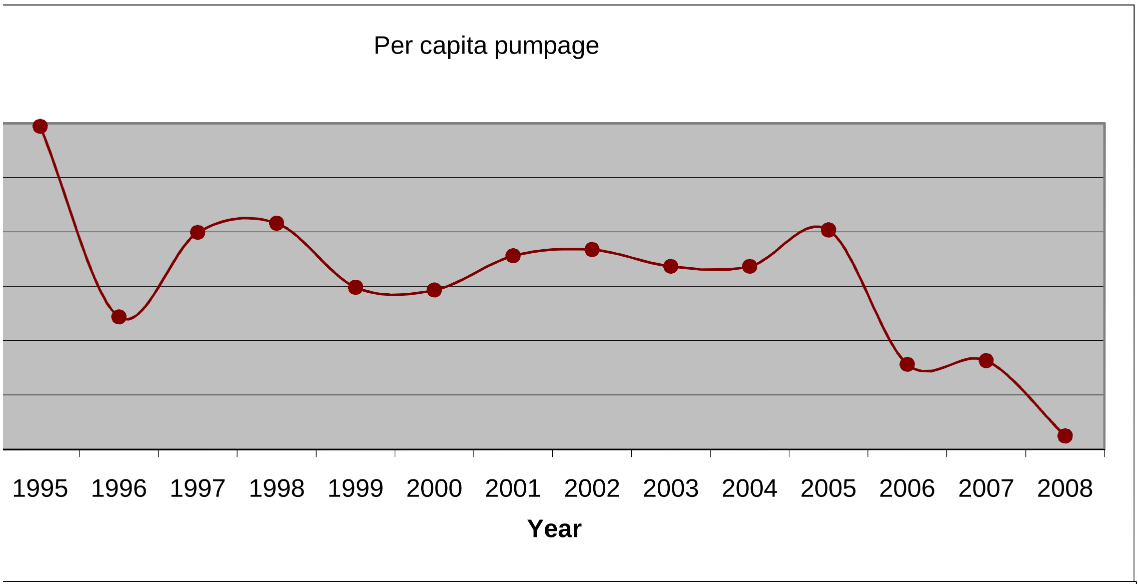
Annual Pumping (million gallons)
Pumped Volume (million gallons)
650.0
600.0
550.0
500.0
Permit Volume
617.1
518.9
576.7
578.0
544.2
555.0
586.0
580.2
569.1
562.3
586.3
521.0
504.9
13-year average
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Pumped Volume
Annual Average Volume (561 million gallons)
Permit Volume (649.7 million gallons)

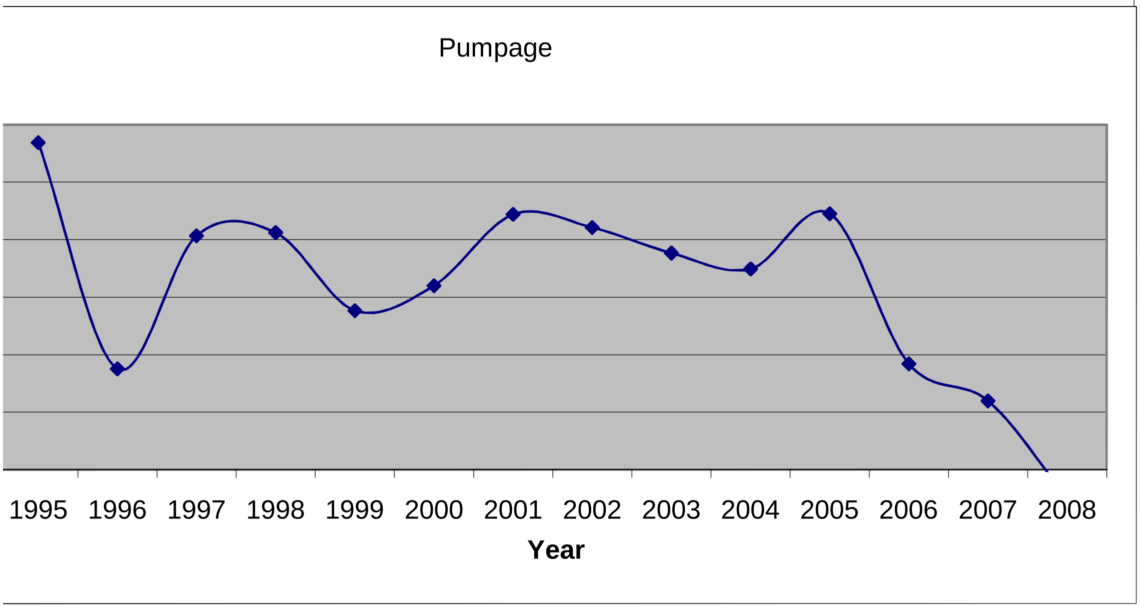
Year	Pumpage	14-yr ave	permit	population		Running average diff
1995	617.1	554.5	649.7	16957	99.7099	62.7
1996	518.9	554.5	649.7	17298	82.18022	-35.6
1997	576.7	554.5	649.7	17562	89.96198	22.2
1998	578.0	554.5	649.7	17441	90.79236	23.5
1999	544.2	554.5	649.7	17558	84.90935	-10.3
2000	555.0	554.5	649.7	17962	84.65512	0.6
2001	586.0	554.5	649.7	18283	87.8058	31.5
2002	580.2	554.5	649.7	17988	88.37459	25.8
2003	569.1	554.5	649.7	17957	86.83484	14.7
2004	562.3	554.5	649.7	17739	86.83833	7.8
2005	586.3	554.5	649.7	17812	90.17874	31.8
2006	521.0	554.5	649.7	18343	77.82269	-33.4
2007	504.9	554.5	649.7	17699	78.1534	-49.6
2008	462.7	554.5	649.7	17796	71.23755	-91.7








Per capita pumpage
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Year


Pumpage
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Year

Well 2 Equipment

Item	Type/Size	Manufacturer	Model or Serial No.	Notes
Pump 1	250 gpm, 255 TDH 4 Stage Submersible – horizontal application	Goulds	6 CHC	Installed 10/2007, replacement and downsizing of pump
Motor 1	25 HP, 3 Phase 60 Hertz Submersible	Centri Pro	6M254	New motor installed 10/2007
Pump 2	350 gpm, 280 TDH 3 stage Submersible – horizontal application	Goulds	Model - 7 CLC Serial No. - 422211	Installed January 2005
Motor 2	40 HP, 3 Phase 60 Hertz Submersible	Centri Pro	Serial No. – J05G26089E	New motor installed 11/2006 & 2/2006
Priming System	Vacuum 15 psi	Chicago Boiler	Serial No. – 796485	
Flow Meter	6-inch Venturi			Calibrated biannually
PARCO Valve	Good condition			Serviced in 2007
Auxiliary Power	None			
Potassium Hydroxide	45% solution 4,000-gallon bulk tank 150 gallon day tank 1 chemical feed pump	Chemical feed pump - LMI	Model - C111-71S Serial No. - 950618946	Feed rate adjusted as needed to maintain pH 7-7.5
Sodium Hypochlorite	110-gallon tank 1 chemical feed pump	Chemical feed pump - LMI	Model - C111-71S Serial No. - 2002041239	Goal of 0.45 – 0.50 mg/L residual, 5 gallons of 12.5% solution to 45 gallons of water
Sodium Fluoride System	50-gallon saturator 1 chemical feed pump	Chemical feed pump - LMI	Model - C111-71S Serial No. - 000715225	Dose - 1 mg/L
Building Floor Drains	Grating and drain to sump pump			Discharge to drywell approximately 20' NW of building
Building Sumps	Operational			
Fence at Site	Chain link around potassium hydroxide building			Swing gate at beginning of access road

Well 3 Equipment

Item	Type/Size	Manufacturer	Model or Serial No.	Notes
Pump	500 gpm 231 TDH Vertical turbine 8 stages	Layne head, Byron Jackson bowls	Model - 10MQ-H Serial No. - 891-W-0205	Cleaned in 2008
Motor	50HP 3 phase 60 hertz	US Motors	Serial No. - 326TP WPI	Design B
Flow Meter	6-inch mag meter	Badger		Installed 2008
PARCO Valve	Good condition			Serviced in 2007
Auxiliary Power	None			
Potassium Hydroxide	45% solution 4,000-gallon bulk tank 150-gallon day tank 1 chemical feed pump	Chemical feed pump - LMI	Model - C111-71S Serial No. - not visible	Feed rate adjusted as needed to maintain pH 7-7.5
Sodium Hypochlorite	110-gallon tank 1 chemical feed pump	Chemical feed pump - LMI	Model - C111-470SI Serial No. - 07092437411-1	Goal of 0.45-0.50 mg/L residual, 5 gallons of 12.5% solution to 45 gallons of water
Sodium Fluoride System	50-gallon saturator 1 chemical feed pump	Chemical feed pump - LMI	Model - C111-470SI Serial No. - 0312819349-2	Dose - 1 mg/L
Building Floor Drains	Floor grating to north of building			Discharge outside on north side of building
Building Sumps	None			
Fence at Site	Chain link around well pump station and potassium hydroxide building			

Well 4 Equipment

Item	Type/Size	Manufacturer	Model or Serial No.	Notes
Pump	840 gpm 285 TDH Vertical Turbine 4 stages	Johnson	Serial No.-30084	Rebuilt in 1994
Motor	100 HP 3 phase 60 hertz	U.S. Electric	Serial No. - HO100V2SLG	Motor replaced 2006
Flow Meter	8-inch Venturi			Calibrated biannually
PARCO Valve	Good condition			Serviced in 2007
Auxiliary Power	Direct Drive Engine– Natural Gas 1000 Watts		Model - R602 3423 Serial No. - 565	Not automatically controlled
Potassium Hydroxide	45% solution 4,000-gallon bulk tank 150 gallon day tank 1 chemical feed pump	Chemical feed pump - Walchem E	Model – E-Class Serial No. - EHE30E1-VE0710192246	Feed rate adjusted as needed to maintain pH 7-7.5
Sodium Hypochlorite	110-gallon day tank 1 chemical feed pump	Chemical feed pump - LMI	Model - C911 -470SI Serial No. - 07062388517-1	Goal of 0.45-0.50 mg/L residual, 5 gallons of 12.5% solution to 30 gallons of water
Sodium Fluoride System	50-gallon saturator 1 chemical feed pump	Chemical feed pump - Lesson Pump Series No. 2500	Model – 2541661 Serial No. – 6705076	Dose - 1 mg/L
Building Floor Drains	Floor grating on north side of building			Discharged to dry well near river
Fence at Site	Chain link around potassium hydroxide building			Swing gate at beginning of access road

Well 5 Equipment

Item	Type/Size	Manufacturer	Model or Serial No.	Notes
Pump	270 gpm 240 TDH 6 stages Vertical turbine	Johnston	Model – 10RAHC Serial No. – ME 509024	Installed 1997
Motor	25 HP 3 phase 60 hertz	GE	Model – 6ES Serial No. - RHP7176M301A	Motor installed 2007
Flow Meter	6-inch mag meter	Badger		Installed 2008
PARCO Valve	Not exercised			Serviced in 2007
Auxiliary Power	Direct Drive Engine - Natural gas – 60HP	Rudix E-550 Auto-Gen Mercantial	Model T-4000 Serial No: 407278	Installed 1970 Not automatically controlled
Potassium Hydroxide	45% solution 4,000-gallon bulk tank 150-gallon day tank	Chemical feed pump - LMI	Model - C111-470SI Serial No. - 0312816159-2	As needed to maintain pH 7-7.5
Sodium Hypochlorite	110-gallon tank 1 chemical feed pump	Chemical feed pump - LMI	Model - C111-470SI Serial No. - 20020812763	Goal of 0.45-0.50 mg/L residual, 5 gallons of 12.5% solution to 45 gallons of water
Sodium Fluoride System	50-gallon saturator 1 chemical feed pump	Chemical feed pump - LMI	Model - C911-470SI Serial No. - 07012304008-1	Dose - 1 mg/L
Building Floor Drains	Yes			Discharge to dry well 100' east of building
Building Sumps	None			
Fence at Site	Chain link around well pump station and potassium hydroxide building			

Well 6 Equipment

Item	Type/Size	Manufacturer	Model or Serial No.	Notes
Pump	450 gpm 215 TDH Vertical turbine 7 stages	Layne -Goulds	Model – 10RJLC Serial No. - 81655	Replaced in 1996
Motor	30 HP 3 phase 60 hertz	US Motors/G.E.	ID 606-02184412-6-1-01; H030V2BLE-C;	Replaced in 1996
Flow Meter	Venturi			plugged, needs cleaning
PARCO Valve	Good condition			Serviced in 2007
Auxiliary Power	None			
Potassium Hydroxide	45% solution 4,000-gallon bulk tank 150-gallon day tank 1 chemical feed pump	Chemical feed pump - LMI	Model - C470-71S Serial No. - 0311806864-2	As needed to maintain 7-7.5 pH
Sodium Hypochlorite	110-gallon tank 1 chemical feed pump	Chemical feed pump - LMI	Model - C111-470SI Serial No. - 0312816159-1	Goal of 0.45-0.50 mg/L residual, 5 gallons of 12.5% solution to 30 gallons of water
Sodium Fluoride System	50-gallon saturator 1 chemical feed pump	Chemical feed pump - LMI	Model - C911-470SI Serial No. - 20020712315	Dose- 1 mg/L
Building Floor Drains	Yes			Discharge to dry well up woods
Building Sumps	Operational			
Fence at Site	Chain link around potassium hydroxide building			Swing gate at beginning of access road

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Well 7 Equipment

Item	Type/Size	Manufacturer	Model or Serial No.	Notes
Pump	350 gpm 230 TDH Vertical turbine 9 stages	Byron Jackson	Model – 9MOH Serial No. - 113232	Installed 1989
Motor	30 HP 3 phase 60 Hertz	US Motors/G.E.	Serial No. - C08 H019090104 3505F	Replaced twice
Priming System	Vacuum	Ingersoll Rand	Model V255- Serial No. - 30T653003	
Flow Meter	Turbine meter	Badger		Calibrated biannually
PARCO Valve	Good condition			Serviced in 2007
Auxiliary Power	Natural gas 12 KW, 15 kV, 277-480 volts, 18 APM		Model – CSG 649 Serial No. - AD 123224-SLF	Not automatically controlled
Potassium Hydroxide	45% solution 4,000-gallon bulk tank 150-gallon day tank 1 chemical feed pump	Chemical feed pump - LMI	Model - C111-71S Serial No. - 950618948	As needed to maintain 7-7.5 pH
Sodium Hypochlorite	110-gallon tank 1 chemical feed pump	Chemical feed pump - LMI	Model - C111-470SI Serial No.- 20020712	Goal 0.45-0.50 mg/L residual, 5 gallons of 12.5% solution to 45 gallons of water
Sodium Fluoride System	50-gallon saturator 1 chemical feed pump	Chemical feed pump - LMI	Model - C911-470SI Serial No. - 0705376937-1	Dose - 1 mg/L
Building Floor Drains	Floor grating			Discharge to dry well south of building
Building Sumps	None			
Fence at Site	Chain link around both buildings			Swing gate at beginning of access road

Summary of Recommendations for Well and Well Pumping Station Improvements

Description	Well 2	Well 3	Well 4	Well 5	Well 6	Well 7
Safe Yield (gpm)	300	275	840	300	450	320
Year Pump Installed	2007/2006	1989	Pump rebuilt 1994 Motor 2006	Pump 1997 Motor 2007	1996	1989
Replace Pump	Yes	Yes	No	No	No	No
Replace PARCO Valve with VFD	Yes	Yes	Yes	Yes	Yes	Yes
Is There Currently a Manual Direct Drive Engine?	No	No	Yes	Yes	No	Yes-also runs chemicals and lights
Replace Direct Drive Engine with Standby Generator & Automatic Transfer Switch	N/A	N/A	Yes	Yes	N/A	No
Well Replacement	2010/2012/2014	In 5 to 10 years	No	No	No	No
Chemical Feed Improvements	Yes	Yes	Yes	Yes	Yes	Yes
Install Chlorine Analyzer	Yes	Yes	Yes	Yes	Yes	Yes
SCADA Improvements	Yes	Yes	Yes	Yes	Yes	Yes
Replace flow meter with a Mag Meter	Yes	Already has mag meter	Yes	Already has mag meter	Yes	Yes
Miscellaneous	Install transducers	Install automatic louvers		Building electrical ground issues	High manganese levels	

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Sharon, Massachusetts
Well and Pump Station Summary

Station Number	Year Built	Well Dimensions		Pumping Capacity		Current Pump Operating Rate[4] (gpm)	Safe Sustained Yield (Zone II) (mgd)	Safe Sustained Yield (Zone II) (gpm)	WMA Maximum Daily Rate (mgd)	WMA Maximum Daily Rate (gpm)	Last Redevelop-ment	Standby Power
		Inner Casing Diameter (inches)	Depth[2] (feet)	Flow (gpm)	Head (feet)							
2	1979[1]	9-8" wells	Varies from 28- to 42-ft below ground surface	P1 - 250 P2 - 350	P1 - 255 P2 - 280	275	0.44	300	0.47	325	1998	None
3	1954	24	46.25	500	231	275	0.40	275	0.38	265	2008	None
4	1959	18	85.3	840	285	840	1.21	840	1.00	695	1994	Natural gas engine
5	1972	36	58.6	270	235	300	0.43	300	0.47	325	1997	Natural gas engine
6	1976	24	56.5	450	215	450	0.65	450	0.35	245	1996	None
7	1989	6-8" wells	Varies from 37- to 44-ft. below ground surface	350	250	320	0.46	320	0.45	315	Tested in 2001	Natural gas engine
		TOTALS		**2,760 gpm[3]** **3.98 mgd**		**2,460 gpm** **3.58 mgd**	**3.59 mgd**	**2,485 gpm**	**3.12 mgd**	**2,170 gpm**		

1. Well Station 2 was originally a wellfield built in 1915. Use of wellfield was discontinued and single gravel pack well was constructed in the 1960s. In 1979, the single gravel pack well was abandoned and the wellfield was re-instated.
2. Except as noted, depth is below pumping station floor
3. Using Well 2 flow of 350 gpm
4. Highlighted areas need verification

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Historical Redevelopment Summary for Well 2

Well 2-1 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
1992	Pre	3.6	50	26.3	22.7	2.2	15
	Post	3.6	180	19.2	15.6	11.5	80
1998	Pre	3.1	100	9.6	6.5	15.3	106
	Post	3.4	160	13.9	10.5	15.2	105

1. Original specific capacity was 14.49 gpm/ft based on redevelopment reports.

Well 2-2 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
1992	Pre	5.0	18	24.0	19.0	0.9	7
	Post	5.0	190	20.6	15.6	12.2	93
1998	Pre	4.9	20	27.1	22.2	0.9	7
	Post	4.9	145	18.5	13.6	10.7	81

1. Original specific capacity was 13.16 gpm/ft based on redevelopment reports.

Well 2-3 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
1992	Pre	3.5	100	22.6	19.1	5.2	49
	Post	3.5	160	19.2	15.7	10.2	94
1998	Pre	3.3	100	15.1	11.8	8.5	79
	Post	3.3	150	19.2	15.9	9.4	87

1. Original specific capacity was 10.79 gpm/ft based on redevelopment reports.

Well 2-4 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
1992	Pre	4.8	40	20.0	15.3	2.6	28
	Post	4.8	97	19.1	14.4	6.8	73
1998	Pre	4.8	10	21.5	16.7	0.6	6
	Post	4.7	90	22.5	17.8	5.1	55

1. Original specific capacity was 9.22 gpm/ft based on redevelopment reports.

Well 2-5 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
1992	Pre	3.9	23	26.0	22.1	1.0	5
	Post	3.9	240	16.7	12.8	18.8	86
1998	Pre	3.7	20	21.9	18.2	1.1	5
	Post	3.7	187	14.2	10.5	17.8	82

1. Original specific capacity was 21.74 gpm/ft based on redevelopment reports.

Well 2-6 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]

Historical Redevelopment Summary for Well 2

1992	Pre	2.4	50	26.0	23.6	2.1	21
	Post	2.4	190	21.0	18.6	10.2	99
1998	Pre	2.4	15	27.4	25.0	0.6	6
	Post	1.5	160	18.4	16.9	9.5	92

1. Original specific capacity was 10.32 gpm/ft based on redevelopment reports.

Well 2-7 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
1992	Pre	3.2	50	26.0	22.8	2.2	10
	Post	3.2	260	16.3	13.1	19.8	92
1998	Pre	1.0	25	21.8	20.8	1.2	6
	Post	1.0	180	11.0	10.0	18.0	84

1. Original specific capacity was 21.51 gpm/ft based on redevelopment reports.

Well 2-8 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
1992	Pre	3.8	50	26.0	22.2	2.3	22
	Post	3.8	115	15.0	11.2	10.3	101
1998	Pre	2.6	10	22.6	20.0	0.5	5
	Post	2.6	155	17.7	15.1	10.3	101

1. Original specific capacity was 10.13 gpm/ft based on redevelopment reports.

Well 2-9 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
1992	Pre	4.1	50	24.5	20.4	2.5	23
	Post	4.1	136	16.6	12.5	10.9	102
1998	Pre	2.4	25	25.1	22.7	1.1	10
	Post	2.5	147	16.0	13.5	10.9	102

1. Original specific capacity was 10.63 gpm/ft based on redevelopment reports.

Combined Wells 2-1 through 2-9

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
2001	Pre	3.9	275	11.1	7.2	38.2	-
	-	-	-	-	-	-	-

1. Original combined wellfield specific capacity is not known.

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Historical Redevelopment Summary for Well 3*

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
1994	Pre	2.9	160	23.0	20.1	8.0	22
	Post	3.0	365	15.0	12.0	30.4	82
1997	Pre	2.4	110	26.0	23.6	4.7	13
	Post	2.3	310	9.0	6.7	46.3	125
2000	Pre	3.0	80	25.0	22.0	3.6	10
	Post	3.0	330	11.2	8.2	40.2	109
2001 [2]	Pre	4.8	546	19.0	14.2	38.5	104
	-	-	-	-	-	-	-
2006	Pre	2.8	200	22.8	20.0	10.0	27
	Post	2.9	400	12.9	10.0	40.0	108
2008 [3]	Pre	3.0	120	28.5	25.5	4.7	13
	Post	3.0	380	13.0	10.0	38.0	103

*Well was redeveloped in 1969, 1978, 1989 in addition to years shown. Data for the 1989 redevelopment is in library. A new pump and motor were installed in 1989.

1. Original Specific Capacity is based on the specific capacity after the well was redeveloped in 1989 and the pump & motor were replaced.

2. Well was tested, but not redeveloped in 2001.

3. In 2008, pump test recommended pump, column pipe, shafts, & head be replaced within the next few years due to excessive corrosion

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Historical Redevelopment Summary for Well 4

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[3]
1977	Pre	5.5	340	16.8	11.3	30.1	53
	Post	5.5	349	11.7	6.2	56.3	100
1981	Pre	7.0	1200	75.0	68.0	17.6	31
	Post	6.4	335	14.0	7.6	44.1	78
1990 [1]	Pre	14.0	850	28.7	14.7	57.9	103
	-	-	-	-	-	-	-
1993 [1]	Pre	11.5	723	25.5	14.0	51.6	92
	-	-	-	-	-	-	-
1994 [2]	Pre	6.3	566	19.3	13.0	43.5	77
	Post	6.3	800	23.7	17.4	45.9	82
	Post-Installation	6.3	1140	26.1	19.8	57.6	102

1. Well was tested, but not redeveloped in 1990 and 1993.

2. Pump was rebuilt, including removal of 2 intermediate stages, and the motor was replaced with a 100 hp premium efficient U.S. motor in 1994 during redevelopment process.

3. Original specific capacity based on the specific capacity post-redevelopment in 1977 of 56.3 gpm/ft.

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Historical Redevelopment Summary for Well 5

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[6]
1982 [1]	-	-	-	-	-	-	-
	Post	11.0	300	29.6	18.6	16.1	115
1997 [2]	Pre	10.9	160	39.3	28.4	5.6	40
	Post	10.9	310	43.2	32.3	9.6	69
	Post-Installation	11.0	345	44.3	33.3	10.4	74
1999 [3]	-	-	-	-	-	-	-
	Post-Installation	11.5	377	40.1	28.6	13.2	94
2001 [4]	Pre	12.0	345	48.5	36.5	9.5	68
	-	-	-	-	-	-	-
2007 [5]	-	-	-	-	-	-	-
	Post	12.0	160	25.1	13.1	12.2	87

1. Pre-redevelopment data for the testing done in 1982 is not included in the library report from which this information was collected.

2. Pump and motor replaced with Goulds 9RAHC pump and 25 HP GE Motor with redevelopment in 1997. Post-installation is test done after new pump and motor were installed.

3. Part of the pump was rebuilt in 1999 as the pump test was done "after installation" according to the report, but there is no mention of the well being redeveloped.

4. Well was tested, but not redeveloped in 2001.

5. Work done to shafts and column, and pump appears to have been replaced with Goulds 10RAHC, compare with Model No. from 1997. Test was completed after work.

6. Original specific capacity was 14 gpm/ft based on redevelopment reports.

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Historical Redevelopment Summary for Well 6

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[3]
1990 [1]	Pre	8.5	375	34.7	26.2	14.3	48
	-	-	-	-	-	-	-
1996 [2]	Pre	5.3	275	29.0	23.7	11.6	39
	Post	5.9	598	36.3	30.4	19.7	66
	Post-Installation	6.6	566	26.2	19.6	28.9	96
2001 [1]	Pre	9.0	464	30.4	21.5	21.6	72
	-	-	-	-	-	-	-
2002 [1]	Pre	7.5	192	16.9	9.5	20.3	68
	-	-	-	-	-	-	-

1. Well was tested, but not redeveloped in 1990, 2001 and 2002.

2. Pump and motor were replaced in 1996, Goulds 10RJLC pump and 30 hp GE VHS motor. Post-installation test was done after new pump and motor was installed.

3. Original specific capacity was 30 gpm/ft based on redevelopment reports.

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Historical Redevelopment Summary for Well 7

Well 7-1 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity

Well 7-2 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity

Well 7- 3 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity

Well 7-4 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity

Well 7-5 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity

Well 7-6 Summary

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity

Combined Wells 7-1 through 7-6

Year	Pre- or Post-Redevelopment	Static Level (ft)	Flowrate (gpm)	Pumping Level (ft)	Drawdown (ft)	Specific Capacity (gpm/ft)	% of Original Specific Capacity[1]
2001	Pre	5.1	372	10.7	5.6	66.1	-
	-	-	-	-	-	-	-

1. Original wellfield specific capacity is not known.

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Town of Sharon - Water Master Plan
Well Pump Station Improvements
Estimated Costs and Schedule

FY	Description	Well 2	Well 3	Well 4	Well 5	Well 6	Well 7	Total
2010	Install VFD	-	$18,000	$25,000	$15,000	$18,000	$18,000	$94,000
2010	Chemical Feed Improvements	$35,000	$31,000	$10,000	$25,000	$25,000	$25,000	$151,000
2010	SCADA Improvements - Phase 1	$32,000	$30,000	$32,000	$32,000	$30,000	$30,000	$186,000
	2010 Total							**$431,000**
2011	Well Replacement	$275,000	-	-	-	-	-	$275,000
2011	Transducers	$10,000	-	-	-	-	-	$10,000
2011	Investigate, Replace Pumps/Motors	$50,000						$50,000
2011	Install VFDs	$28,000						$28,000
	2011 Total							**$363,000**
2012	Automatic Louvers	-	$8,000	-	-	-	-	$8,000
2012	Replace Pump		$35,000	-	-	-	-	$35,000
	2012 Total							**$43,000**
2013	Standby Generator & ATS	-	-	$122,000	-	-	-	$122,000
2013	Well Replacement	$200,000	-	-	-	-	-	$200,000
	2013 Total							**$322,000**
2014	Remove PARCO and appurtenances	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$60,000
2014	Standby Generator & ATS	-	-	-	$78,000	-	-	$78,000
2014	SCADA Improvements - Phase 2	$11,000	$10,000	$11,000	$11,000	$10,000	$10,000	$63,000
2014	Replace flow meter with a Mag Meter	$6,000	-	$6,000	-	$6,000	$6,000	$24,000
	2014 Total							**$225,000**
2015	Well Replacement	$360,000	$240,000	-	-	-	-	$600,000
	2015 Total							**$600,000**
	Total	**$1,017,000**	**$382,000**	**$216,000**	**$171,000**	**$99,000**	**$99,000**	**$1,984,000**

Optional Well 6 WTP Alternative

FY	Description	Well 2	Well 3	Well 4	Well 5	Well 6	Well 7	Total
2016	Well 6 WTP Design & Construction	-	-	-	-	$360,000	-	**$360,000**
2017	Well 6 WTP Design & Construction	-	-	-	-	$1,450,000	-	**$1,450,000**
2018	Well 6 WTP Design & Construction	-	-	-	-	$1,450,000	-	**$1,450,000**
2019	Well 6 WTP Operations	-	-	-	-	$134,000	-	**$134,000**
	Total	**$1,017,000**	**$382,000**	**$216,000**	**$171,000**	**$3,592,000**	**$99,000**	**$5,477,000**

Costs are based on July 2009 data (Boston ENR 10775) and include construction costs and 15% contingency, with the exception of well replacment costs which also include design and permitting, and the WTP costs that include design and construction administration.

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Chapter 4: New Source Alternatives
DATE: April 16, 2010

This technical memorandum is part of the larger Sharon Water System Master Plan that discusses numerous water issues in the Town of Sharon, including water demand, demand reduction, supply analysis, wastewater/stormwater recharge, regional alternatives and infrastructure. This memorandum presents the town wide screening or the evaluation of potential alternative water supply sites in Sharon and is meant to supplement current or ongoing groundwater development activities at the NSTAR site.

Introduction

As part of the Water Supply Master Planning Effort, alternative new sources of water in the Town were evaluated. A properly sited new source is crucial to withdrawing water with the best possible water quality and to minimize permitting and construction costs. Ideally, withdrawals from the groundwater system should be conducted in sub-basins where development has created a positive water balance. These sub-basins exhibit a positive water balance when compared to pre-development conditions. Positive water balances are generally due to a large surplus of water due to septic system recharge and other larger water discharge sites (NPDES or GWDP sites) (Appendix A, Figure 4-1).

To aid in the siting of additional new source locations, a town-wide site-screening analysis was conducted for new source withdrawal. This effort was undertaken in conjunction with the general master planning efforts for the Sharon water system. This effort entails a large-scale analysis of the entire town, considering several variables that are influential in properly locating a new source, including potential aquifer yield, site development, permit restrictions, water quality, land cost, local watershed recharge issues and proximity to existing infrastructure. The goal of this evaluation was to review data for the entire town of Sharon and assess which areas in Sharon would be most favorable for investigating potential large volume new source withdrawal.

The town-wide site screening analysis included an independent review of data from published reports, drilling records, electronic maps, modeling results, town permits, and US census data.

This data was used to create various electronic maps in ArcView version 9.3, a Geographic Information System (GIS) software. These maps represent various local aquifer yield, site development, permit restrictions, water quality, land cost and water balance information associated with Sharon. These electronic maps were then “overlaid” on each other to create a final map that displayed potentially favorable new source sites in Sharon. Two different analysis were conducted, one site screening for sand and gravel wells and one site screening for bedrock wells.

To analyze the aquifer yield, site development, permit restrictions, water quality, land cost and proximity to roads in GIS, the entire town of Sharon was discretized into 35 by 35 meter cells, or blocks. A matrix was developed to assign values to the favorability of a criteria characteristic as it pertains to a potential well site. Each cell or block was assigned numeric values for each of the criteria evaluated, allowing for a numeric ranking of each cell in Sharon. These cells were then grouped according to level of favorability as a potential well site.

In addition to analyzing the aquifer yield, site development, permit restrictions, water quality, and land cost issues associated with siting a new source, the concept of water balance can be incorporated into the matrix analysis. A mass balance analysis was performed on a sub- watershed (HUC 14) level to calculate net additions or withdrawals of water in the sub-basins. This analysis calculated annual net water additions/subtractions and compared the sub-basin against natural, undeveloped conditions, all in Excel spreadsheets. The analysis provides an ability to compare sub-basins based on their water need (or net water balance). Once the percent change in net recharge for each sub-basin was determined in Excel, the sub-basins were grouped into large net water gain, neutral balance or large net water loss sub-basins. Each 35 x 35 meter box within a watershed was given the criteria value for that sub-watershed as it pertained to watershed balance. An overlay map was then produced concerning water balance in each local watershed in Sharon.

For each 35 x 35 meter cell in Sharon, the assigned value for each criteria were added together to get a final ranking for that cell. These final criteria values for each cell were then grouped according to level of favorability as a potential well site and mapped. The screening analysis was compared to the MODFLOW base input data that was developed in 1990 for a town-wide model. The culmination of this GIS-based analysis that grouped 35 x 35 meter cells by level of favorability as a potential well site resulted in a long list of proposed potential new source sites.

This analysis investigated two different typed of potential well sites: sand and gravel well site and bedrock well sites. The analysis for potential sand and gravel well sites included numerous town-wide electronic maps including information on potential aquifer yield, site development, permit restrictions, water quality, land cost, local watershed recharge issues and proximity to existing infrastructure. From these town-wide maps, specific, smaller areas were presented where further focus on potential sand and gravel sites may be conducted. The analysis for potential sand and gravel wells started of with identifying a number of sites to investigate based on local bedrock fractures and the interface of different bedrock types, as

Once a number of sites were identified, the criteria for land cost, site development and water quality for land use were then applied to these sites for evaluation.

Future efforts include verification of data with WMAC and DPW personnel to develop a short list of sites for an evaluation of costs for development and specifying a process and method of site specific investigation.

The following sections detail the site screening process, criteria description, water mass balance analysis, results of the matrix analysis, conclusions and recommendations.

Data Analysis

Two different analysis were conducted for the town-wide site screening for new groundwater supply sources. One analysis included investigating potential sites for sand and gravel wells, while the other analysis involved investigating potential sites for bedrock wells. A multitude of data is available in a variety of areas pertaining to both surficial geology (for sand and gravel wells) and bedrock geology (for bedrock wells) and groundwater supply development in each. The following section describes the process and criteria used for the siting of sand

and gravel wells, followed by the process and criteria used for siting bedrock wells.

Sand and Gravel Wells

To describe the process and criteria used for the site screening analysis for sand and gravel wells, a step-by-step description of what was done will be provided, followed by an in-depth description of each criteria used, its importance in relation to new source site screening, the source of information for the parameter, and matrix values assigned to each criteria.

A town-wide site screening study was conducted at a desk-top level to rank areas in Sharon according to favorability for new source sand and gravel wells. There are numerous criteria that can be considered when locating such sites. Of greatest importance for a new source location is the ability of the underlying aquifer to provide an adequate amount of water. To represent this factor, the aquifer yield was used as the criteria. Water quality concerns were represented by the presence of crops or pasture land and proximity to 21E sites, GWDP facilities and solid waste facilities. To represent permit restrictions, four Natural Heritage and Endangered Species Program (NHESP) areas, Areas of Critical Environmental Concern (ACECs), wetlands protection area, riverfront protection area and 100 year flood zone were used as criteria. Site development criteria included proximity from existing water main infrastructure. Land cost, associated with ownership, was a criteria as was the sub-watershed recharge as derived by an analysis of the mass balance of each local watershed. Finally, an absolute exclusion area based on proximity to roads was applied.

To represent these data on a large-scale town basis, the entire town of Sharon was discretized in to 35 x 35 meter cells or blocks in GIS. Numeric values regarding each criteria, including aquifer yield, water quality, permit restrictions, site development, land cost and local watershed recharge issues, was then assigned to each cell using a systematic procedure. A lower criteria value indicates a more favorable condition and a higher criteria value indicated a less favorable condition. The criteria values in each cell were then summed and cells were then grouped using the natural breaks between the highest ranking cells, medium ranking cells, and lowest ranking cells as a dividing point. These groups were then identified as Tier 1 sites (most favorable), Tier 2 sites, and Tier 3 sites (least favorable). The Tier 1 sites included cells with the lowest total criteria value and the Tier 3 sites included cells with the highest total criteria value.

An absolute exclusionary area (being within 400 feet of a road) was then applied to the Tier 1, 2 and 3 sites. The remaining Tier 1, 2 and 3 sites were then mapped in GIS using ArcView Version 9.3 to spatially represent varying levels of favorability as potential new sand and gravel well source. The most favorable sites that were at least 12 acres (400' diameter circle) in area were then identified as having the highest potential for siting future sand and gravel wells.

A more detailed description of each criteria, including its importance in relation to new source site screening, the source of information for the parameter, and matrix values assigned to each criteria, is presented next.

Criteria

Criteria information for the town of Sharon was obtained through numerous sources, including published reports, drilling records, electronic maps, modeling results, town permits, and US census data. Based in this data, a matrix was developed to represent the favorability of each criteria type as it pertains to a new source site using sand and gravel wells. These criteria represent aquifer yield, water quality, permit restrictions, site development issues, land cost issues, local watershed recharge and proximity to pervious roads. A more detailed description of each criteria is presented next.

Aquifer yield is an important criteria to site selection since it represents the sustainable amount of water that can be removed from the ground. If an area cannot produce the necessary amount of water, then it is of no use to further investigate the site as a new source since obtaining the desired amount of water is not possible. Aquifer yield values were mapped in GIS electronically using the MassGIS data layer "Aquifers_Poly" (updated July 2007). The most desirable aquifer yields, as mapped by MassGIS, area areas with an aquifer yield of greater than 300 gallons per minute (gpm). The least favorable areas were those with an aquifer yield of less than 100 gpm. The aquifer yield criteria range is presented in Table 1.

Table 4-1. Aquifer Yield Criteria Range

Criteria Value	Aquifer Yield
1	> 300 gpm
2	100 – 300 gpm
3	< 100 gpm

As is noted in the section below '*Results - Potential Well Sites, Unconsolidated Sand and Gravel Wells,'* the initial criteria values associated with aquifer yield needed to be changed since many favorable sites were located in areas with an aquifer yield of less than 100 gpm, which cannot allow for sustainable large volume withdrawals (Appendix A, Figure 4-2). Since it is imperative that there be adequate aquifer yield at any future source, the aquifer yield criteria values were weighted heavier than the other criteria values. This will allow for areas with an aquifer yield of < 100 gpm to fall out of consideration (Appendix A, Figure 4-3). The new aquifer yield criteria values are presented in Table 4-2, below.

Table 4-2. Aquifer Yield Criteria Range

Criteria Value	Aquifer Yield
1	> 300 gpm
5	100 – 300 gpm
10	< 100 gpm

Water quality concerns were considered at each site to understand the site's proximity to areas that may have water quality issues associated with them. These sites may be point and non-point sources and include land use mapped as crops or pasture (obtained from the MassGIS data layer "Landuse_Poly", updated January 2002), and areas within 400 feet of a groundwater discharge permit (obtained from the MassGIS data layer "GWP_PT", updated May 2009), solid waste facility (obtained from the MassGIS layer "SW_POLY", updated December 2007) or 21E sites (oil and hazardous release sites) (obtained from MassGIS layer "C21E_PT", updated December 2009). The lowest value (most favorable) was assigned to those cells not in any of the above- mentioned areas, and the highest value was assigned to known areas with water quality issues associated with them (21 E sites, GWDP facilities). Crop and pasture lands were assigned a middle value as is not immediately known if these areas are actively in use and have water quality concerns associated with them or not (Appendix A, Figure 4-4). The water quality criteria range is presented in Table 4-3.

Table 4-3. Water Quality Criteria Range

Criteria Value	Water Quality Class
1	Not in any area with water quality issues
2	Crop or pasture land use
3	Within 400' of 21E site, GWDP facility or solid waste facility

Permit restrictions is an important factor because a site may not be worth pursuing if extensive and restrictive permitting hurdles are associated with these sensitive environmental sites. Some sites, such as rare and endangered species, may create such a hurdle that, even after the permitting is submitted, the ability to construct a well at the site may still be refused. Sites considered for this criteria include areas within NHESP Priority Habitats of Rare Species, NHESP Estimated Habitats of Rare Wildlife, NHESP Certified and estimated vernal pools, ACECs, 100' wetland protection buffer, 200' riverfront protection area and 100 year flood zone. Data for these receptors were obtained from MassGIS data layers "Prihab_Poly" (updated October 2008), "Esthab_Poly" (updated October 2008), "CVP_PT" (updated January 2010), "PVP_PT" (updated December 2000), "ACECS_Poly" (updated April 2009), "WETLANDSDEP_POLY" (updated April 2007), "HYDRO25K_ARC" (updated March 2010), and "Q3FLOOD_POLY" (updated July 1997), respectively.

The lowest criteria value (most favorable) was assigned to areas that were in none of the above mentioned sensitive environmental sites (Appendix A, Figure 4-5). The highest criteria value (least favorable) was assigned to areas within NHESP sites since approval of the establishment of a new source in these areas are considered extremely difficult. The highest criteria value was also applied to land within 150 feet of a river or stream because these areas would need extra permitting and monitoring since a new source in this area may be drawing water from the surface water body. A medium criteria value was applied to areas that are within a 100' protective buffer of a wetlands resource area, within an ACEC, within a 100-year flood zone or within a 150' to 200' of a river or stream. Although sites in these areas would need additional permitting associated with the development of a new source, acquiring approval for such work is not prohibitive. The permit restrictions criteria range is presented in Table 4-4.

Table 4-4. Permit Restrictions Criteria Range

Criteria Value	Permit Restriction Class
1	Not in any sensitive environmental area needing permitting
2	Within 100' wetlands buffer, ACEC, 100-year flood zone, or 150' to 200' of river or stream

3	Within NHESP site or 150’ of river or stream

The **site development criterion refers** to the costs associated with infrastructure for a new source, including water main, access roads and utilities. These costs have been linked to the proximity to already existing water main. A site that is closer to existing water main will have less associated infrastructure costs and will be more favorable than sites that are further away and will be more costly. The existing water main infrastructure information used for this analysis was obtained in GIS format from the Town of Sharon in April 2009. The site development criteria range is presented in Table 4-5 and in Appendix A, Figure 4-6.

Table 4-5. Site Development Criteria Range

Criteria Value	Proximity to Existing Water Main
1	< 500 feet
2	Between 500 – 1,000 feet
3	> 1,000 feet

The **land cost** criteria was developed according to land ownership. The lowest criteria value (most favorable) was given to town owned land since cost to obtain this land is negligible. The highest criteria value (least favorable) was applied to land that is owned by the state, county, in a land trust or is a non-profit land since obtaining land from these owners is considered extremely difficult. An intermediate criteria value was applied to privately owned open space since it may be possible to obtain the land, but the costs would be greater than costs associated with town owned land. The land cost criteria range is presented in Table 6 and in Appendix A, Figure 4-7.

Table 4-6. Land Cost Criteria Range

Criteria Value	Ownership
1	Town
2	Private
3	State, county, land trust, non-profit

The **watershed recharge** of a local watershed is associated with the local watershed mass balance, represented as the percent change in net annual recharge for this analysis. This is a helpful siting factor since it helps identify which sub-basins in Sharon need additional water more than other sub-basins. A sub-basin with a large negative percent change in net annual recharge (large volumes of water leaving the sub-basin each year) would not be suited for additional water withdrawals. Large withdrawals would be better situated in a sub-basin that has a large positive percent change in net annual recharge (large volumes of water entering the sub- basin each year).

Understanding the water balance in a sub-basin is important because of its implications on stream flow and, by association, habitat health, since a reduction in baseflow could potentially result in ecological impacts. To better understand the net watershed recharge in Sharon, a water balance tool was developed. This tool endeavors to quantify annual sub-basin recharge to baseflow, and assess if additions and withdrawals of water are creating a net gain or loss of water in the sub-basins on an annual basis. Once completed, the recharge of each of the 15 sub-basins in Sharon was compared with each other in terms of the sub-basin water impairment. Further description of this mass balance is provided in the DRAFT Wastewater/Stormwater Recharge Alternatives Section (Weston & Sampson, March 25, 2010). The sub-basin water balance criteria range for is presented in Table 4-7 and Appendix A, Figure 4-8.

Table 4-7. Sub-Basin Watershed Recharge Criteria Range

Criteria Value	Percent Change in Recharge in Sub-Basin
1	> 5%
2	-12 – 5%
3	< -12%

After all of the criteria were summed in each cell, one final criteria, an absolute exclusionary criteria, was applied. This is the **proximity to road** criteria. Since vehicle transportation is not allowed within the Zone I of a source (usually 100’ radius from the well), a total exclusion zone of 400 feet around any road in Sharon was applied to the Tier 1, 2 and 3 sites. The road information used for this analysis was obtained from the MassGIS layer “EOTROADS_ARC”, updated October 2009. The proximity to roads criteria values is presented in Table 4-8, below, and in Appendix A, Figure 4-9.

Table 4-8. Proximity to Roads Criteria Range

Criteria Value	Proximity to Roads
1	> 400 feet
100	< 400 feet

Due to the large value associated with areas within 400 feet of a road, these areas were designated with extremely high total criteria scores (extremely unfavorable).

The results of the site screening analysis are presented below.

Results - Potential Well Sites, Unconsolidated Sand and Gravel Wells

Important new source sand and gravel well siting information was obtained from the aquifer yield, site development, permit restrictions, water quality, land cost, local watershed health and proximity to roads criteria. When all of the values for each of the criteria were added together in GIS for each 35 by 35 meter cell in Sharon, favorable new source locations were determined. Results of the step-by-step site screening analysis are presented below.

The results of the initial adding of the criteria values in each cell indicate that the most favorable locations for large scale recharge volumes are spread out in various central and eastern areas of Sharon (Appendix A, Figure 4-10). These majority of these Tier 1 and Tier 2 areas, however, are above low yield aquifers, which is impractical when siting a large scale new source. Of great importance is that any favorable area must be able to provide large sustainable quantities of water. To ensure that the most favorable areas are located in medium and high yield aquifers, the aquifer yield criterion was heavily weighted (see previous discussion on ‘*Criteria*’ and Table 4-2).

After summing the criteria values that now include heavier weighted aquifer yield criteria values, all Tier 1 site, and the vast majority of Tier 2 sites, are located above medium and high yield aquifer material (Appendix A, Figure 4-11). The Tier 1 and Tier 2 sites are now mostly in the central and south western portions of Sharon, where these medium and high yield aquifers are located. As a check on the GIS analysis, the locations of the current town wells (Well 2, 3, 4, 5, 6 and 7) were placed on the map to see if they were located in what the GIS analysis considers favorable or unfavorable areas. All six wells are mapped within Tier 1 (most favorable) or Tier 2 areas. This check helps confirm that this GIS based analysis is providing information that is in line with older information that was used to site the existing Sharon wells.

The application of the absolute exclusionary area (area within 400 feet of a road) resulted in the majority of Tier 1 and Tier 2 sites being removed from consideration (Appendix A, Figure 4-12). The remaining Tier 1 and Tier 2 areas are located in rural portions of Sharon with high or medium yield aquifers and rank favorably for the other criteria. As noted earlier, the Zone 1 protection area for a groundwater source, normally a 400-foot radius from the well, cannot contain roads, with the exception of access roads to the wells. To further site favorable new source sand and gravel well locations, circles with a 400-foot radius were placed over the remaining Tier 1 and Tier 2 sites where the where the circle border would not exist in any of the absolute exclusion areas. This resulted in 12 locations, named A – L, shown in Figure 4-1, as being the most favorable sites. Three other additional sites, named M-O, are also favorable sites, but whose area slightly infringes into the absolute exclusion area. These sites may be ideal for smaller scale source sand and gravel production wells. Sites A – L are grouped based on proximity to one another. Further discussion of these groups is presented below. Sites are presented alone if there is no other sited in close proximity. The matrix values for each site are provided in Table 4-9.

These 12 favorable sites and 3 marginal sites were also compared for field verification purposes using depth-to-bedrock, well yield and saturated thickness data from boring information from the 1987 Aquifer Protection Study by IEP, Inc., and from the DRAFT Request for Site Exam - Proposed Municipal Wellfield – NSTAR Property (undated). Appendix A, Figure 4-13 presents the locations of these borings. As there has been a long history of drilling in Sharon, some of the most favorable sites for potential sand and gravel well locations have already had drilling conducted within the sites border. These sites include Sites B, D, E, K and L. Other sites that have no boring information within their borders include Sites A, C, F, G, H, I, J, M, N, and O.

Table 4-9. Criteria Values for Possible New Source Sites

		Criteria Value								
Group	Site									
Northern	A	1	1	2	3	2	2	1	**12**	Boston

Areas	B	1	1	3	3	1	2	1	**12**	Harbor
	C	1	2	3	3	2	2	1	**14**	Watershed
	D	1	2	2	3	2	2	1	**13**	
Central Areas	E	5	2	1	2	2	3	1	**16**	
	F	1	2	2	2	1	3	1	**12**	
	G	1	2	3	2	1	3	1	**13**	
	H	5	1	3	2	3	3	1	**18**	
Southern Areas	I	5	1	2	2	1	1	1	**13**	
	J	5	2	2	2	1	1	1	**14**	
Marginal Sites	M	1	2	3	3	2	2	100	**113**	
	N	5	2	2	2	2	2	100	**115**	
	O	5	1	3	2	3	1	100	**115**	
	K	1	1	3	2	2	3	1	**13**	Taunton
	L	1	1	3	2	2	3	1	**13**	Watershed

<u>**Boston Harbor Basin Sites**</u>

Sites located in the Boston Harbor Basin were grouped into three different categories: Northern area sites, Central area sites, and Southern area sites. Three marginal sites were also identified. These Boston Harbor Basin sites are discussed in further detail below.

Northern Area Sites. The Northern area sites are comprised of sites A, B, C and D, are in the Boston Harbor watershed and fall within sub-basin BH-1. These sites all ranked well because they are located in a high yield aquifer, which is heavily weighted for this analysis. All four wells ranked low for the site development criteria as they are all more than 1,000 feet away from the closest water main. The closest water mains are 12-inch and 8-inch in diameter, which should be able to accommodate flows coming from a new source. Site A is furthest from an existing water main, being roughly 5,000 feet from an 8-inch main, while Site D is the closest, being roughly 1,100 feet from an 8-inch main.

Land costs for all sites are considered moderate as the land is privately owned, except for Site B, which is mostly located on Fowl Meadows Conservation Land, owned by the Town of Sharon. Although costs associated with acquiring the land may be less for Site B, actual approval for use may be impossible due to political/legal constraints.

These four sites are all located within a neutral water balance sub-basin. Although being located in a large net water gain sub-basin is optimal, the sub-basin BH-1 does have a +2.1% water balance as explained in section 2.1.1, Water Mass Balance. Also, BH-1 receives water from BH-3, which is a large net water gain sub-basin. The excess water in BH-3 will help counter balance large withdrawals from any new sources in BH- 1. If a new source were added to B-1 that withdrew same annual amount as Well #6 (roughly 22,000,000 gallons annually), the percent change in recharge would change from +2.1% to -4.2% and still be considered a net neutral sub-watershed.

The water quality at sites A and B is considered favorable since there are no crop or pasture land at these sites and there are no known point or non-point sources of contamination. Both sites C and D are in either crop or pasture land. The extent of any associated possible water quality issues at Sites C and D would need to be further investigated.

Permitting for wetlands may be an issue at all four sites, but sites B and C will require the assessment of potential influences of surface water since much of the land in these two sites are within 150 feet of a perennial stream. Potential new groundwater sources need to be investigated to determine if the neighboring surface water is impacting the groundwater in any way. If the neighboring surface water body is proven to impact the groundwater supply, the supply is considered “groundwater under the influence” (GWUI).

Finally, sites A-D are not in close proximity to any of Sharon’s existing water supply wells and are down gradient of the existing wells. Thus, any water extracted from sited A-D would not intercept base flow or recharge to the existing wells.

Since sites B and D have already been drilled, no further investigation at these sites is needed at this point in time. Site A and C should be further investigated as a potential new source by the town.

Central Area Sites. The Central sites area comprised of sites E, F, G and H, are located in the Boston Harbor watershed and in sub-basin BH-7. Sub-basin BH-7 is considered a large net water loss area.

Site E is located in a medium yield aquifer and who has a medium site development criteria (between 500 – 1,000 feet from a water main). Site E is located in either crop or pasture land. There are no permitting issues associated with Site E as there are no sensitive environmental receptors in or near Site E. Site E is the N-Star site that is already being investigated as a potential new source by the town.

Both Sites F and G received the next-to-lowest total criteria value rank (most favorable) with total criteria values of 13. These sites all ranked well because they are located in a high yield aquifer, which is heavily weighted for this analysis. Both Sites F and G ranked well for the site development criteria as they are all within 500 to 1,000 feet of the closet water main. According to the GIS data received from the Town of Sharon, the closest water mains are 10-inch in diameter.

Land costs for both sites F and G are considered to have favorable land costs as the land is in the Beaver Brook Watershed Land, owned by the Town of Sharon. However, proximity (400 feet or less) to existing Wells 2 and 3 may impact the current safe yield associated with these wells. Sites F and G should not be further considered as a possible new source location.

Site H has the highest total number of criteria points, and is thus considered the least favorable of the 12 sites. The site is located on medium yield aquifer material. Although a perennial stream may provide recharge through induced infiltration, there will be GWUI issues associated with this site. Land costs for this site are also prohibitive as it is mostly on the Moose Hill Wildlife Sanctuary, owned by the Massachusetts Audubon Society. The site is located in sub-basin BH-7, a large net water loss sub-basin. Thus additional withdrawals at this site would not be favorable for the overall water recharge of the sub-watershed. Also, the site is located near the major basin divide, which means that there would be little groundwater to pull from as the groundwater is flowing away from the major basin divide (and thus, away from site H). With all of these considerations, Site H should not be further considered as a possible new source location.

None of the sites in the central area (E, F, G or H) should be further considered as a possible new source location at this point in time.

Southern Area Sites. The Southern area sites are comprised of sites I and J, are located in the Boston Harbor watershed and in sub-basin BH-10. These sites ranked well even though the aquifer yield at the Southern group was medium yield, and the yield at the Northern group sites were high yield. If not for this difference, these sites would have ranked as the most favorable of the 12 sites. These sites both ranked well for land cost (land is in Cedar Swamp Wetlands, owned by the Town of Sharon), is in a sub watershed that has a large net water gain (BH-10), and is between 500 to 1,000 feet from an existing 10-inch water main. Past history indicates that permitting of a new source in the Cedar Swamps Wetlands will be extremely difficult, if not impossible, to accomplish. Sites I and J should not be further considered as a possible new source location.

Marginal Sites. The three marginal areas include Sites M, N and O, which are all located in the Boston Harbor watershed and in sub-basins BH-5 (site M), BH-9 (site N) and BH-10 (site O). Although these sites ranked well for the criteria used in this analysis, these areas appear to be too close to roadways. Physical on-site inspections should be made to verify the proximity to roads. If required protective radii can be developed, these sites should be reconsidered for groundwater development.

Site M is within a high yield aquifer and is within crop or pasture land. The site may be cost prohibitive to develop as the outer border is over 2,200 feet from an existing 12-inch water main. This existing main is on the western side of Route 95, as is Site M, so there is already water main in place that will pass under the highway. Since a perennial stream runs through this site, GWUI issues must be evaluated. Since this land is privately owned, the cost of this land may be high.

Site N is within a medium yield aquifer, with the center of the site being roughly 800 feet from a 12-inch water main. The land is privately owned, and therefore final cost is uncertain. The site is in sub-basin BH-9 which has a relatively neutral water balance. An additional removal equal to that at Well 6 (roughly 20,000,000 gallons per year) would result in a net water loss of 4.2%, which would still rank sub-basin BH-9 as having a neutral or slightly negative water balance. The site is located in crop or pasture land, with the extent of any water quality issues associated with this land use not currently known. Permitting may be an issue as approximately one-third of this site is comprised of wetlands. However, there are no NHESP lands or areas possibly under the influence of surface water at this site. There is only a very little amount of area in Site N that falls into the absolute restriction area. Since this is a large scale, coarse evaluation of sites, site N should be considered for further evaluation of groundwater yield and quality. Future analysis of this site will include site specific data collection including site visits, potential survey, and test drilling.

Site O is located above a medium yield aquifer with minimal water quality threats based on GIS information used in this analysis. However, land cost and permitting may prove to be prohibitive at this site. The site is owned by the non-profit organization Knights of Pythia and cost to acquire this land is not currently known. The majority of the site is within 150 feet of a perennial stream that flows to the Canoe River, which may increase permitting time and costs due to advocacy groups and potential GWUI. It is not recommended that this site be considered at this time.

Taunton Watershed Area Sites

Two sites were identified within the Taunton watershed. These sites initially appear favorable based on the GIS scoring criteria. This favorable ranking validates the GIS methodology for selecting sites based on physical characteristics. However, closer inspection and review of field data indicate that both sites not be considered at this time for groundwater development. Further discussion of the two Taunton Watershed sites follows.

Site K in located in the Taunton watershed in sub-basin T-1 within mapped high yield aquifer areas. The site does not have any water quality concerns according to this analysis as it is not located in crop or pasture land and is not within 400 feet of any GWDP facilities, solid waste facilities, or 21 E sites. The site is privately owned and the willingness of the owner to sell the land is not currently known. The site is within 500 to 1,000 feet of existing 10-inch and 12-inch water mains. However, the site is located in a large net water loss sub-basin (T-1), so withdrawal of water at this site would not be favorable for the overall water balance of the sub-basin. In general, the GIS criteria were favorable.

Site L is located in the Taunton watershed in sub-basin T-1 and initially scored or ranked comparably with site K. The positive aspects to site L are that it is located above a high yield aquifer with no water quality issues according to the parameters that were investigated for this analysis. The site is privately owned and the willingness of the owner to sell the land is not currently known. The site is within 500 to 1,000 feet of an existing 12-inch water main. Closer inspection of the site indicates that its proximity to well 5 would rely on the same sources of recharge as well 5. As this sub-basin already exhibits a negative water balance, additional withdrawals from this area are not warranted.

Bedrock Wells

The analysis to locate potential bedrock well locations in Sharon is different than the analysis to locate potential sand and gravel well locations. The analysis for potential sand and gravel well sites included numerous town-wide electronic maps including information on potential aquifer yield, site development, permit restrictions, water quality, land cost, local watershed recharge issues and proximity to existing infrastructure. From these town-wide maps, specific, smaller areas were presented where further focus on potential sand and gravel sites may be conducted. However, the analysis for potential sand and gravel wells is different in that the analysis started with identifying a number of small sites to investigate based on local bedrock fractures and the interface of different bedrock types, as these are the areas that will most commonly produce acceptable amounts of water for a source. Once a number of these localized sites were identified, the criteria for land cost, site development and water quality for land use were then applied to these sites for evaluation.

Bedrock wells can provide viable quantities of water when appropriately sited and favorable subsurface conditions exist. Groundwater flows through fractures, joints, and faults in bedrock. Well-fractured bedrock often allows more rapid recharge to the bedrock aquifer. Additionally, the more fractures present a particular portion of the bedrock aquifer, the easier it is to complete a high yielding well in that area. For this reason, it is important to identify where fractures occur in bedrock within Sharon, for it will be at these bedrock fractures that the highest yield of water will likely occur. The bedrock underlying Sharon is brittle and, when under pressure, can crack, thus creating a fracture.

Bedrock fracture and lithology information for Sharon was obtained from the Bedrock Geologic Map of Massachusetts, edited by E-an Zen, 1983. The majority of Sharon, to the west, falls within the Milford-Dedham Zone containing Proterozoic Z Dedham Granite, noted as being "equigranular to slightly porphyritic, variably altered". The east of Sharon is also in the Milford- Dedham Zone and contains Devonian granite of Rattlesnake Hill Pluton, described as "coarse grained biotite granite and fine grained riebeckite granite. The central portion of Sharon is underlain by Milford-Dedham Zone Proterozoic Z Diorite, described as "medium grained hornblende diorite metamorphosed in part to amphibolite and hornblende gneiss.

There are two major fracture features in Sharon noted on the Bedrock Geologic Map of Massachusetts. Both originate just north of Sharon and travel in a southerly direction through Sharon. One fracture is slightly west of the center of Sharon, while the second is slightly east of the center of Sharon. Appendix A, Figure 4-14, shows that the western fracture travels along the interface of the Dedham granite and Diorite. It is at these interfaces of different bedrock type that the largest, most productive water bearing zones are often found. Similarly, the eastern fracture runs along the interface of Diorite, Dedham and Devonian.

As noted on Appendix A, Figure 4-14, there are six sites that are most favorable as bedrock wells sites. These sites are names BR-A through BR-F.

Immediately, sites BR-B and BR-C are removed from consideration as they are in such close proximity to the already existing Wells 2, 3 and 4 and would rob these wells of recharge.

The remaining sites, BR-A, BR-D, BR-E and BR-F, were examined for land cost/ownership (Appendix A, Figure 4-15), distance from existing infrastructure (Appendix A, Figure 4-16) and water quality issues (as considered with the sand and gravel wells) (Appendix A, Figure 4-17).

Site BR-A is located on private land and the willingness of the owner(s) is currently unknown. The outer border of this site is an estimated 3,500 feet from a 12-inch water main. There are no water quality issues associated with this site.

Site BR-D contains mostly privately owned land, but there are parts of four town-owned land, including the Walter Griffin Playground, Bird Lane Land and Massapoag Trail and Brook land. There is existing 8-inch water main running through this site, so connection costs to the existing water main would be minimal. There are no current water quality concerns with this site.

Site BR-E is located on private land and the willingness of the owner(s) is currently unknown. There is 6-inch water main near this site, but, depending on the volume of water being pumped from the well, this diameter pipe may not be large enough to handle the flow. An 8-inch main is located 2,000 feet from this site. There are no current water quality concerns with this site.

Site BR-F is located on private land with a small, north-eastern portion being owned by DCR (Borderland State Park). There is 12-inch main in the center of the site and 8-inch main in the sides, so connection of well to the existing water main would be nominal. There are no current water quality concerns with this site.

Conclusions

The matrix analysis allows for a ranking of potential new source sites based on specific criteria, including aquifer yield, site development, permit restrictions, water quality, land cost, local watershed recharge issues and proximity to pervious roads. After discretizing Sharon into 35 x 35 meter blocks and ranking each block for each criteria and summing these values together, twelve most favorable sites, and three additional, marginal sites, ranked as areas that may be favorable for further investigation as a new source for Sharon. Upon closely examining each site's specific criteria rankings, three of the 12 favorable sites, and one of the marginal sites, rise to the top as the most favorable sites that should be more closely investigated as an area for a new source.

Of the Northern group sites, sites A and C are considered as sites to be further considered for future investigation as a new source, with site A being the most favorable. These sites are in a high yield aquifer, does not have permit issues that would be hard to overcome, and may not be too far away that new infrastructure costs associated with connecting to an existing water main would be cost prohibitive.

Both Southern group sites (Site I and J), were favorable because the Town of Sharon owns the land, is in a large net water gain sub basin, has adequate aquifer yield and is not cost prohibitively far from existing water main infrastructure and is not within 400 feet of a road. There are no known historic boring logs within 2,000 feet of site I. There is one historic boring log on the outside border of site J indicating that depth to bedrock is at 36 feet. However, past experience has proven that because these sites are located in the Cedar Swamp Wetlands, the approval of a new source in this area will be nearly impossible. As such, these sites are not recommended for further investigation.

The marginal site that deserves additional recognition is site N. Only a very small portion of site N is within 400 feet of a road. Because of the large scale, coarse level of examination, this site may actually be outside 400 feet of a road. The site has adequate aquifer yield, is within a neutral water balance sub basin, is not cost prohibitively far from existing water main infrastructure, and is not within 400 feet of a road. Future issues that need to be addressed with this site include water quality concerns associated with this site being crop or pasture land and the desirability (and thus, cost) of the current private land owner to sell the land. There is one historical boring log (boring located 250 feet from outside border of the site) indicating that depth to bedrock is at 18 feet.

The other sites were not as favorable since the sites were either too close to existing supply wells (sites F, G and L), too expensive to purchase with costly permitting issues (site H), in large net water loss basins with costly permitting issues (site K), is already under investigation (Site E) or were already investigated (Sites B and D).

Of the six bedrock well sites, only three sites bear further investigation at this time. These sites are BR-D, BR-E and BR-F. Of these three sites, BR-D is the most favorable site since there is already existing water main in this site, there are no current water quality concerns, and there are four town owned parcels in the area. Site E is a possible site, depending on the volume of water to be withdrawn from the well. A lesser withdrawal would make this site more favorable because of the existing 6-inch main at the site. However, if a large volume of water is planned over the capacity of the 6-inch main, the closest 8-inch main is 2,000 feet from the site, which would add cost to the project. BR-E is also near the eastern edge of Massapoag Lake, thus any bedrock well in this area should be 150 feet from the water body to minimize the influence of surface water.

Although sited in faults at the intersection of different bedrock material, bedrock well sites BR-B and BR-C are not considered a viable option as a bedrock well source since they are so close in proximity to existing wells and would interfere with the supply of water that these wells draw from. Site BR A is not considered a viable option at this time due to the considerable cost associated with connection to the existing water main.

Recommendations

This screening level analysis of alternative new source sites should be considered an available planning tool for analysis of future new source sites. Additional information should be considered when siting these new source areas. Of specific interest would be final source pumping rate, ownership of land, desirability of owner to sell land (cost of land), and water quality considerations for land notes as crop or pasture.

Final source site design will depend on volume of water withdrawn from the site and distance from existing water main. This volume may also be linked to future stormwater and/or wastewater recharge sites in Sharon since additional recharge sites may allow for additional water to be withdrawn in Sharon. Coordination of the new source and recharge site should be coordinated to be able to maximize water withdrawal once the towns Water Management Act permit has been updated for additional allowable water to be withdrawn.

Upon review of this technical memorandum, the DPW, WMAC and Weston & Sampson should meet for a working session to discuss and prioritize potential new source sites put forth in this memorandum. Costs and processes associated with a new source at each site should be discussed to rank the potential new source sites and select the top sites for future investigation. Once locations have been selected for as a new source, field verification of screening factors used for this desk top analysis should be conducted.

For the bedrock well sites, further information on land ownership and willingness to sell (or costs associated with acquiring the land) will need to be further investigated for sites BR D, E and F. The desired volume of water to be withdrawn will need to be identified to decide if the existing 6-inch water main at BR-E will be capable of servicing the flow, of if connection to an 8-inch main will be needed.

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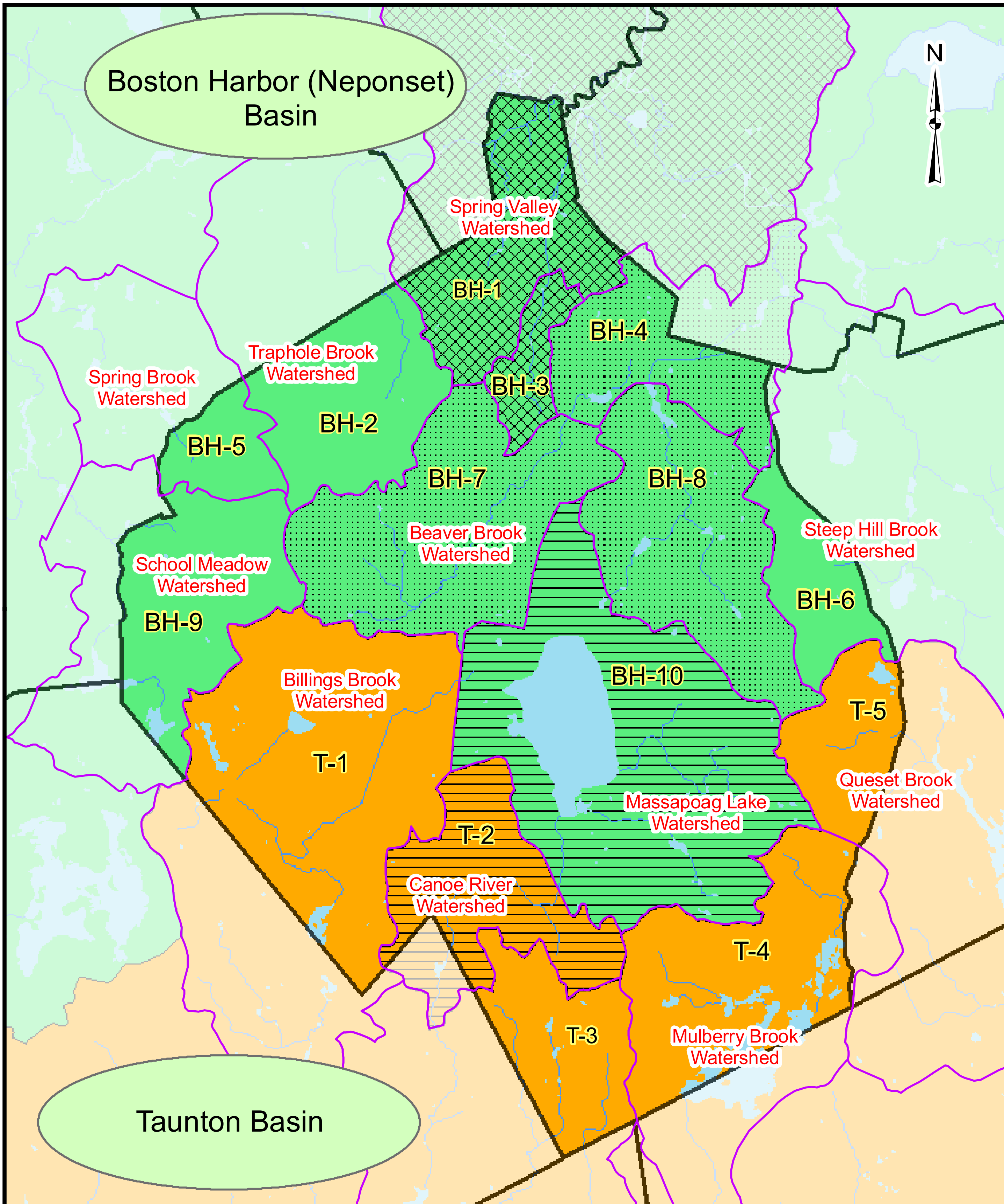

- Perennial Stream
- Pond, Lake, Ocean
- Reservoir
- MA Town Boundaries
- Local Basins

Regional Basins

- BOSTON HARBOR BASIN
- TAUNTON RIVER BASIN

FIGURE 1
SHARON, MA

Regional and Local Basin Divisions

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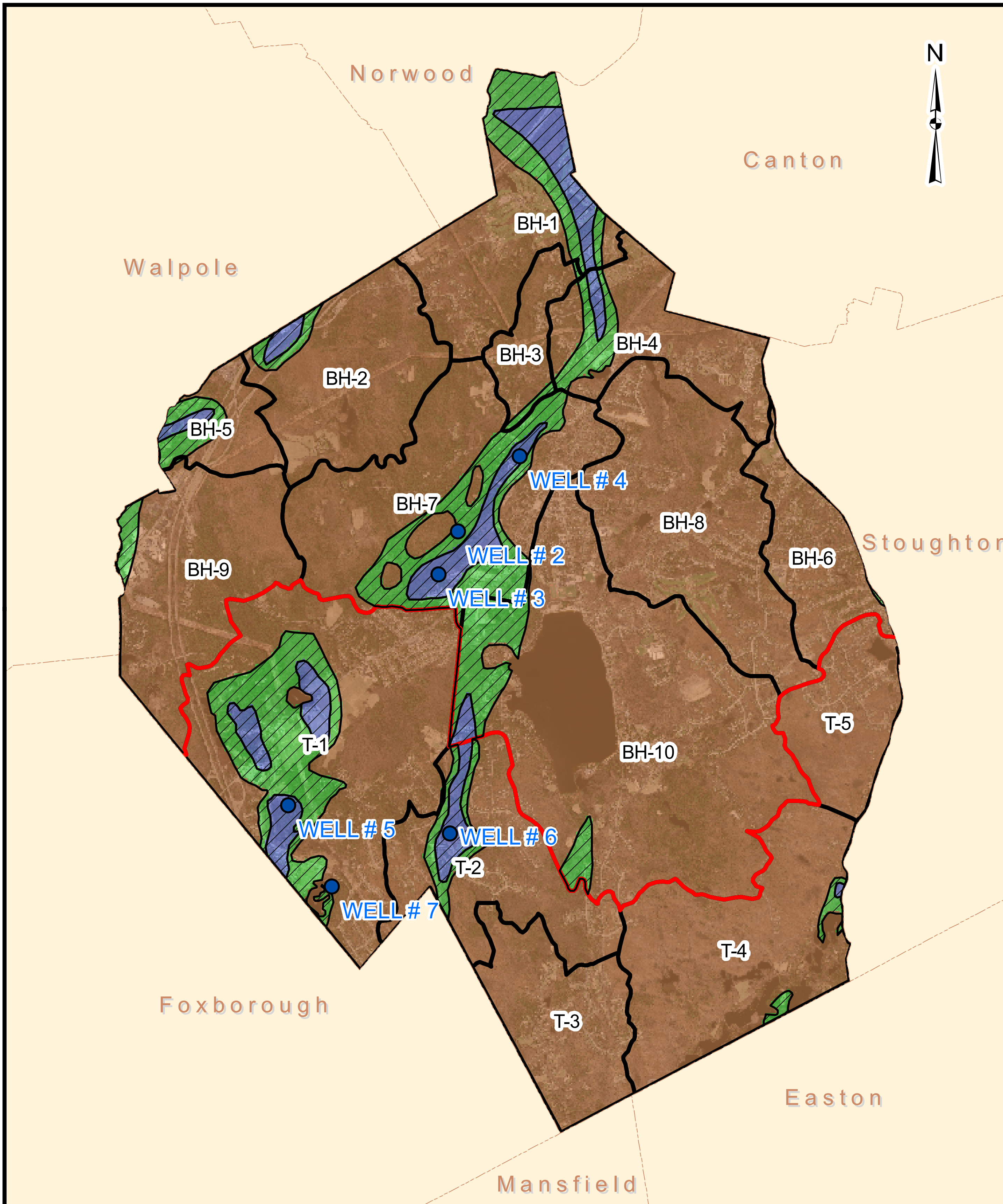

Medium and High Yield Aquifer
MAJOR BASIN DIVIDE
Sub-Basins

Aquifer Yield Criteria Value

1 (most favorable)
2
3 (least favorable)

FIGURE 2
SHARON, MA

Aquifer Yield Criteria (unweighted)

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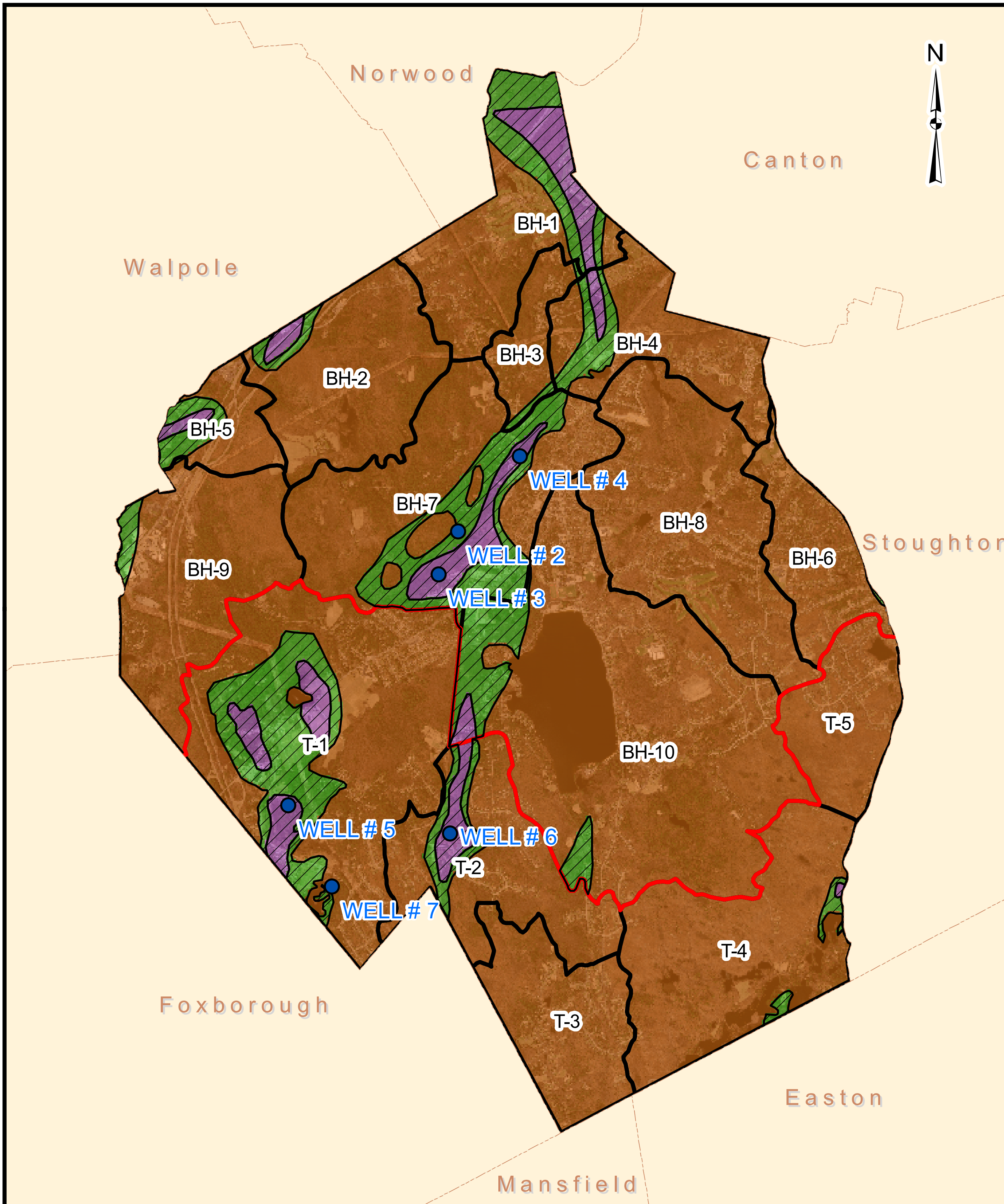

Medium and High Yield Aquifer

MAJOR BASIN DIVIDE

Sub-Basins

Aquifer Yield Criteria Value (weighted)

1 (most favorable)

5

10 (least favorable)

FIGURE 3
SHARON, MA

Aquifer Yield Criteria (weighted)

5,000 0 5,000

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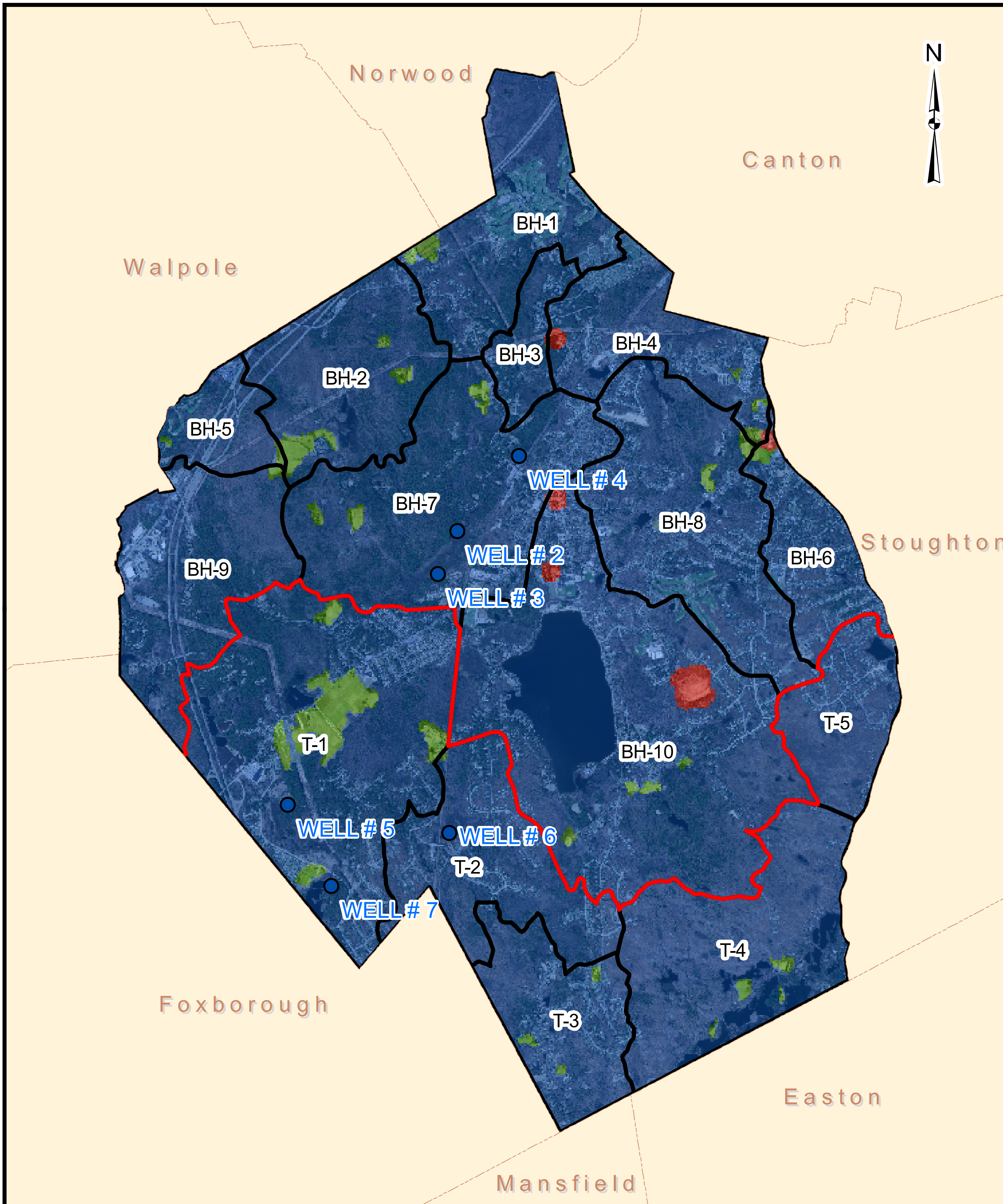

MAJOR BASIN DIVIDE
Sub-Basins

Water Quality Criteria
- 1 (most favorable)
- 2
- 3 (least favorable)

FIGURE 4
SHARON, MA

Water Quality Criteria

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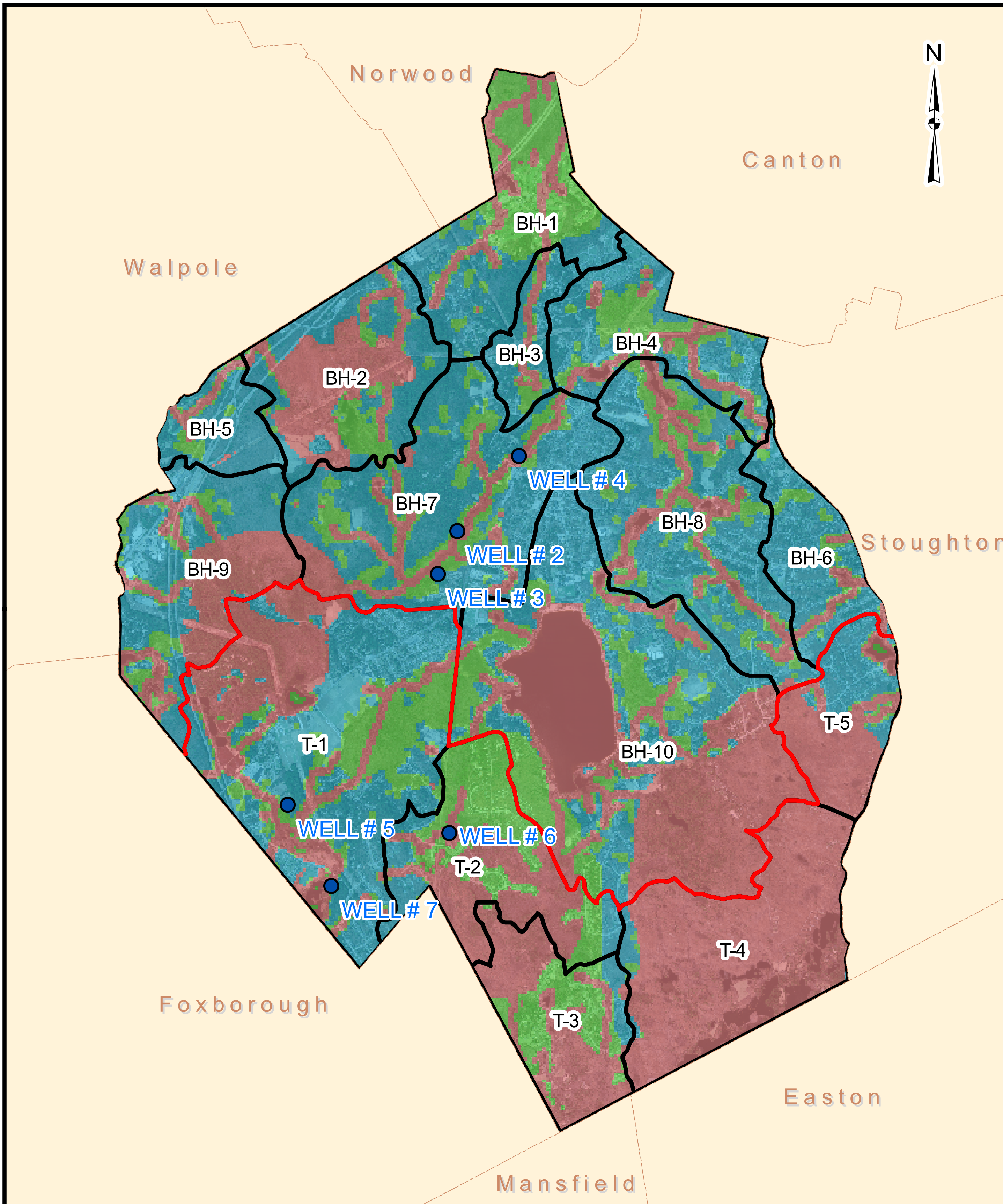

FIGURE 5
SHARON, MA

Environmental Restrictions Criteria

MAJOR BASIN DIVIDE

Sub-Basins

Environmental Restrictions Criteria Value

1 (most favorable)

2

3 (least favorable)

5,000 0 5,000

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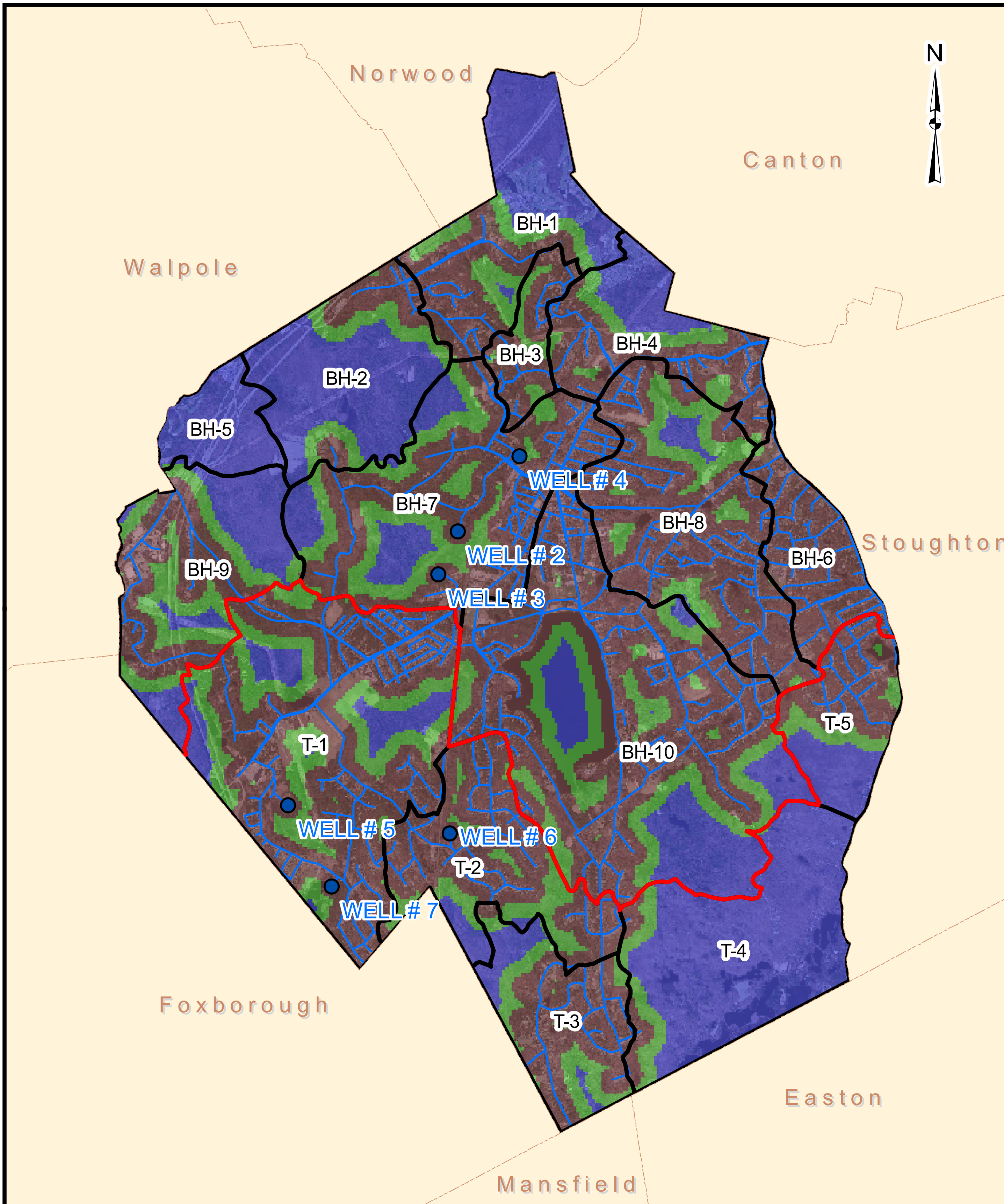

Water Main

MAJOR BASIN DIVIDE

Sub-Basins

Site Development Criteria Value

1 (most favorable)

2

3 (least favorable)

FIGURE 6
SHARON, MA

Site Development Criteria

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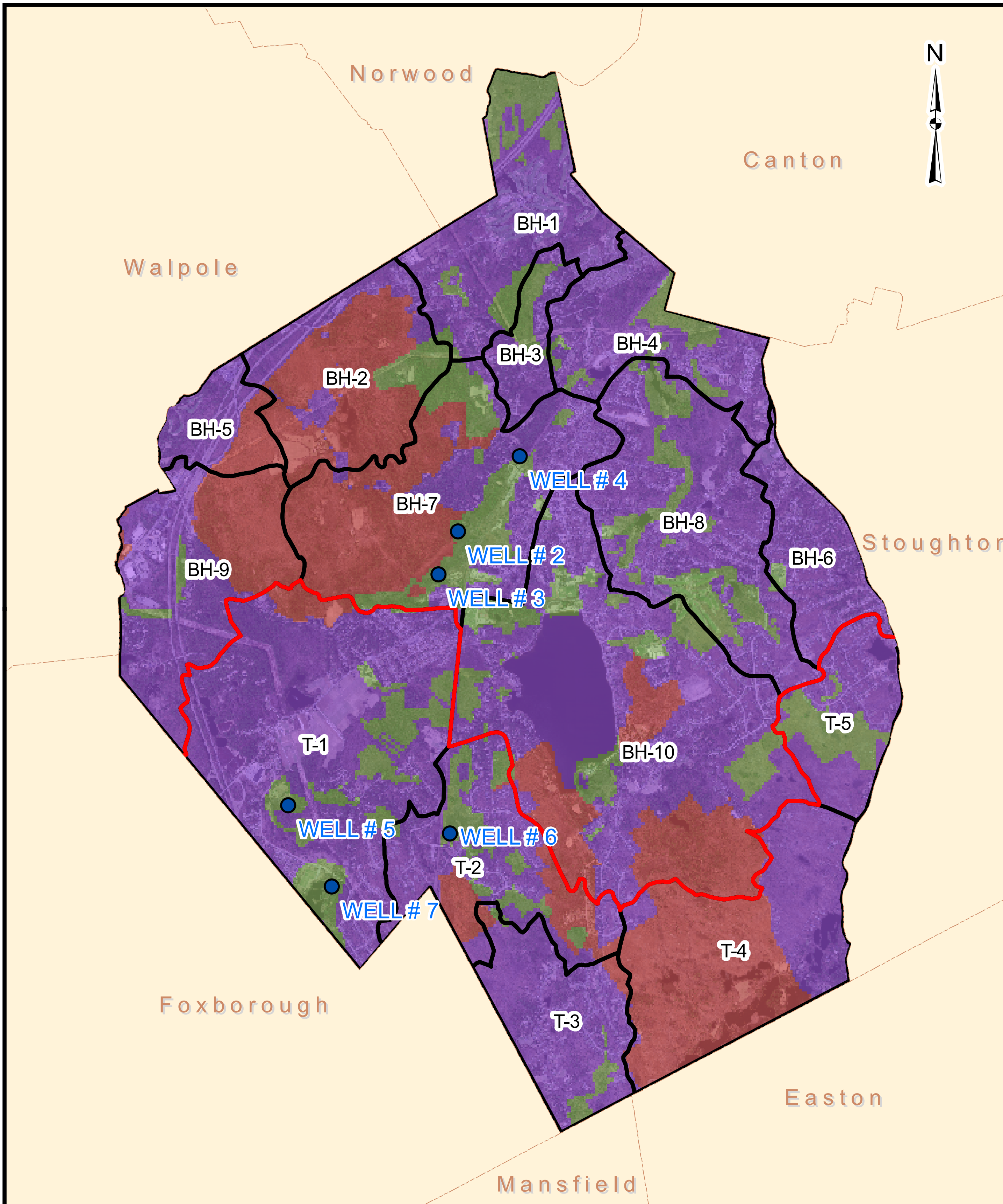

MAJOR BASIN DIVIDE

Sub-Basins

Land Ownership Criteria Value

1 (most favorable)

2

3 (least favorable)

FIGURE 7
SHARON, MA

Land Ownership Criteria

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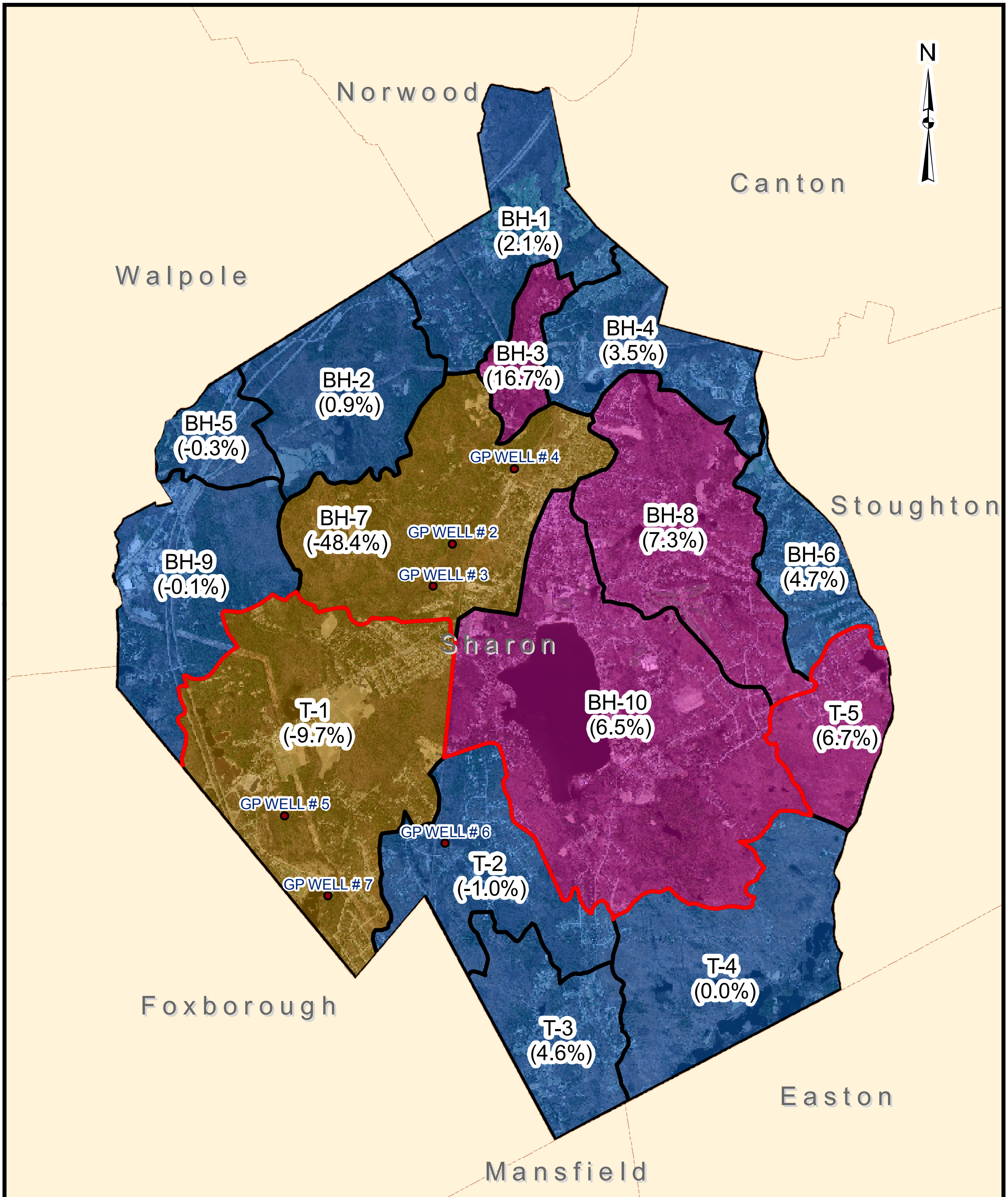

FIGURE 8
SHARON, MA

Sub-Basin Water Balance

- Public Water Supply
- MAJOR BASIN DIVIDE
- Large Net Water Gain
- Neutral Water Balance
- Large Net Water Loss

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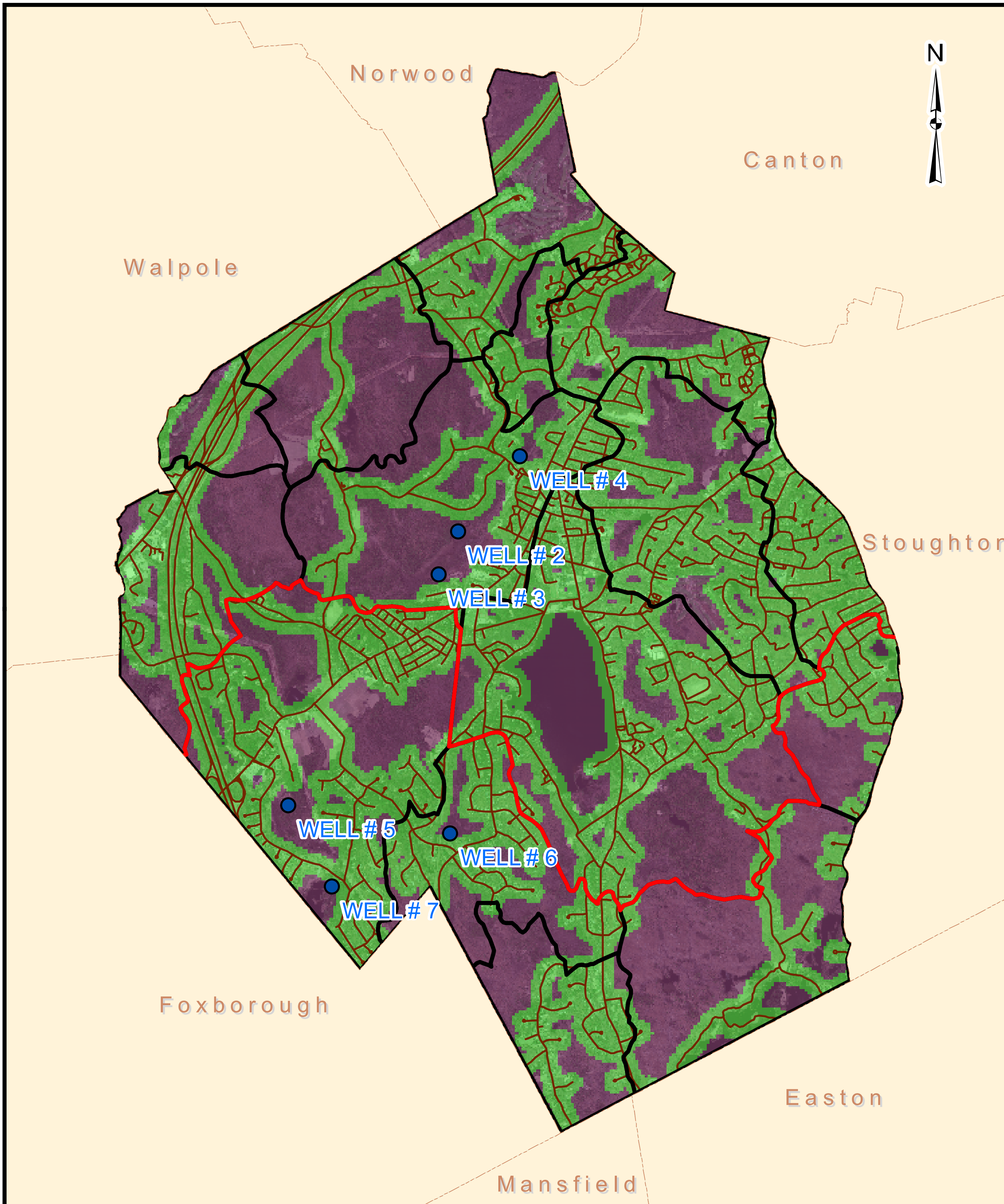

FIGURE 9
SHARON, MA

Road Proximity Criteria (400' exclusion area)

MAJOR BASIN DIVIDE

Sub-Basins

Road Proximity Criteria Value

1 (most favorable)

100 (least favorable)

5,000 0 5,000

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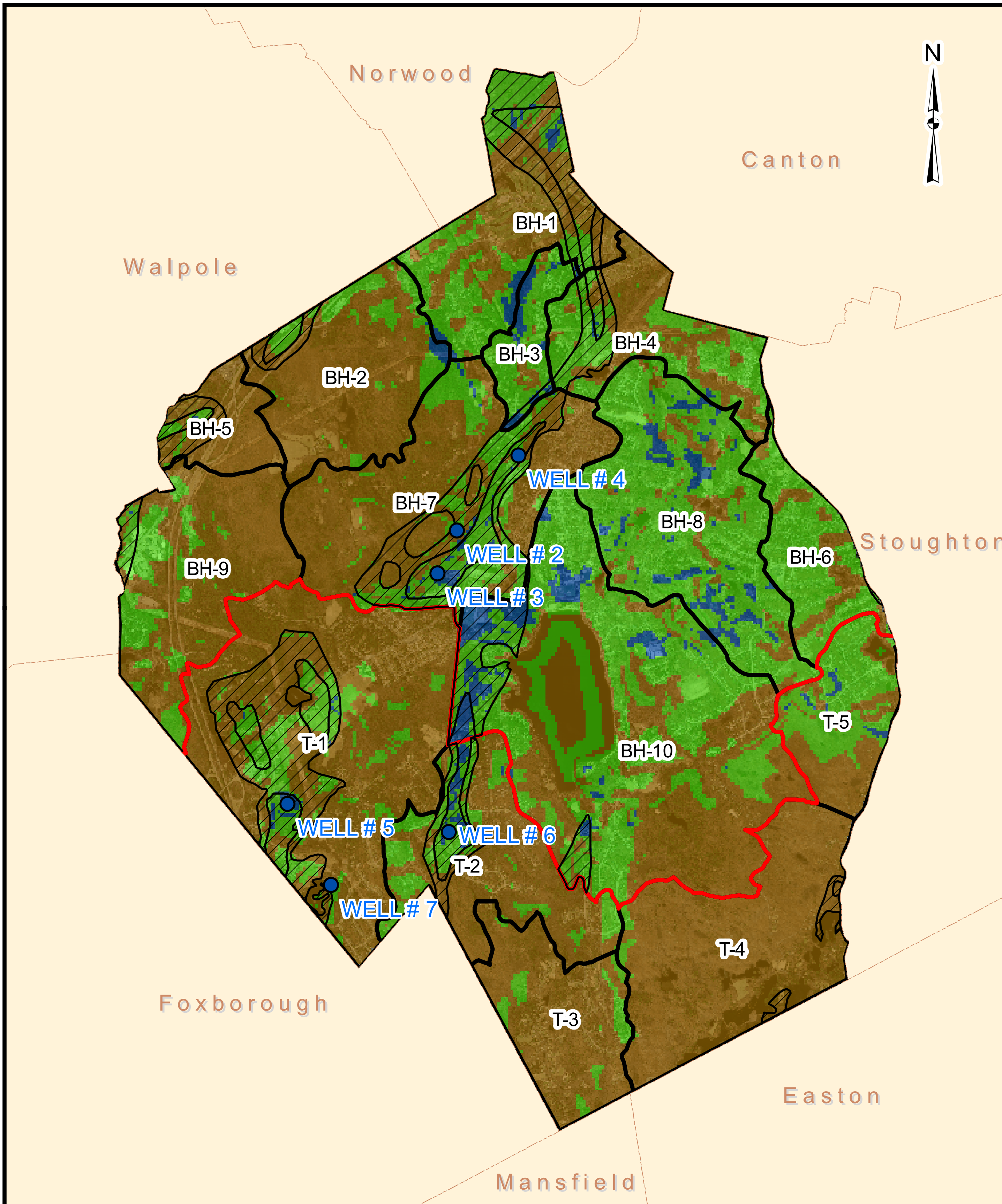

FIGURE 10
SHARON, MA
Potential Water Supply Areas Based on Multiple Criteria

Combined Aquifer Yield, Water Quality, Permit Restrictions, Site Development, Land Cost and Watershed Health Criteria

Weston&Sampson

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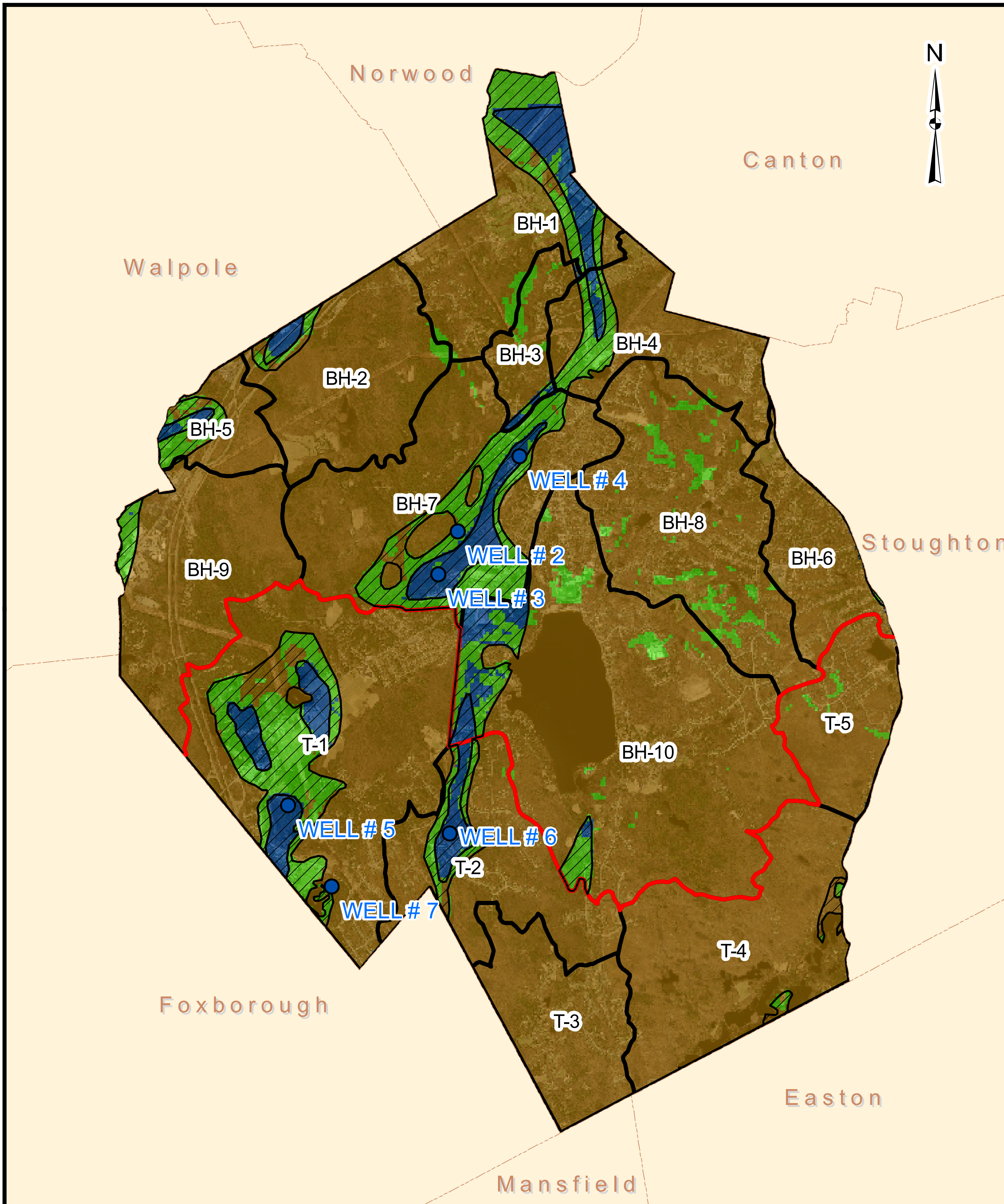

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Medium and High Yield Aquifer
MAJOR BASIN DIVIDE
Sub-Basins
Tier 1 (most favorable)
Tier 2
Tier 3 (least favorable)

FIGURE 11
SHARON, MA
Potential Water Supply Development Areas Based on Multiple Criteria

Combined Weighted Aquifer Yield, Water Quality, Permit Restrictions, Site Development, Land Cost and Watershed Health Criteria

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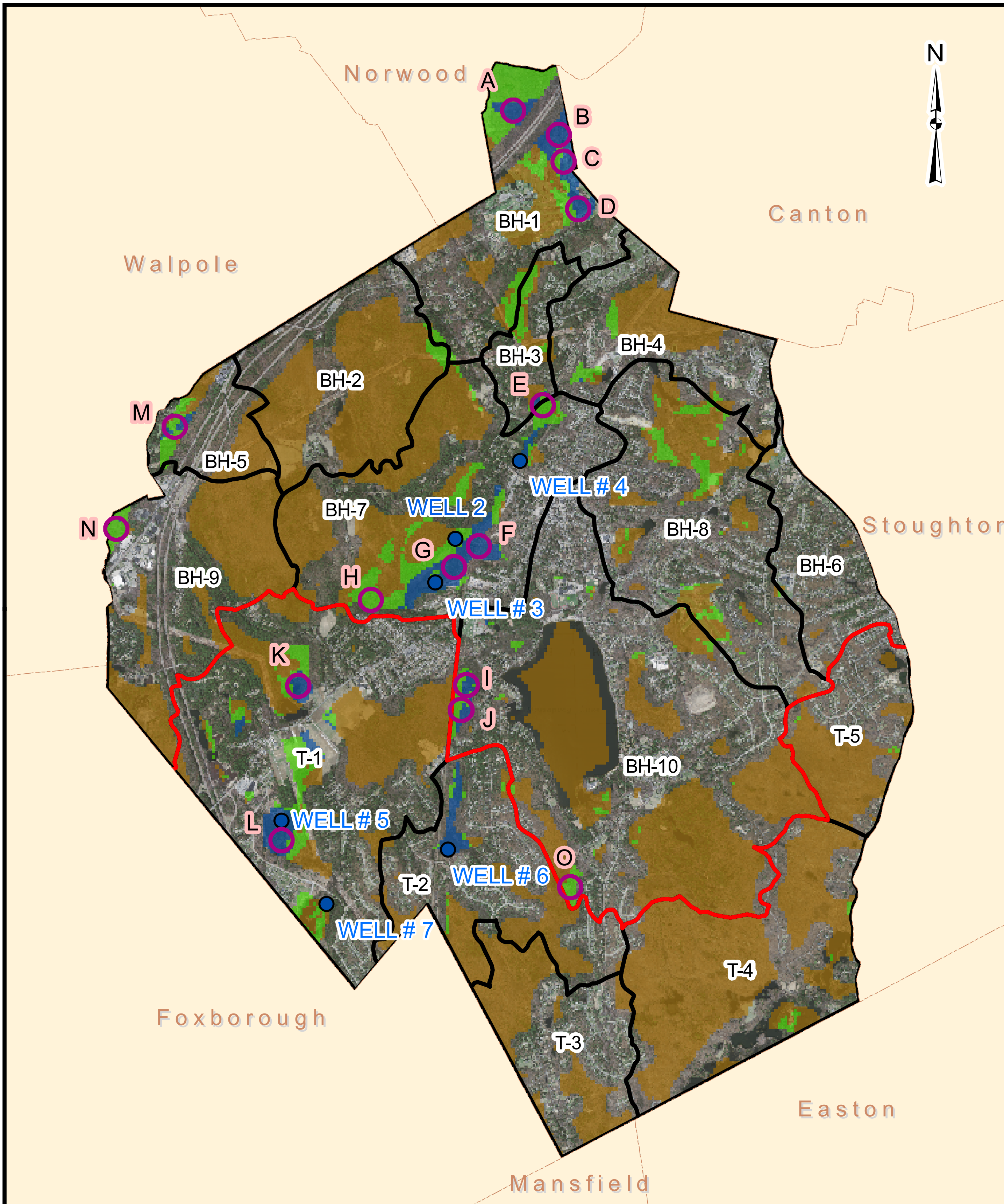

Possible New Source (S & G well)

MAJOR BASIN DIVIDE

Sub-Basins

Tier 1 (most favorable)

Tier 2

Tier 3 (least favorable)

FIGURE 12
SHARON, MA

Potential Sand and Gravel Well Development Sites

Combined Weighted Aquifer Yield, Water Quality,
Permit Restrictions, Site Development, Land Cost,
Watershed Health Criteria and Road Exclusion Criteria

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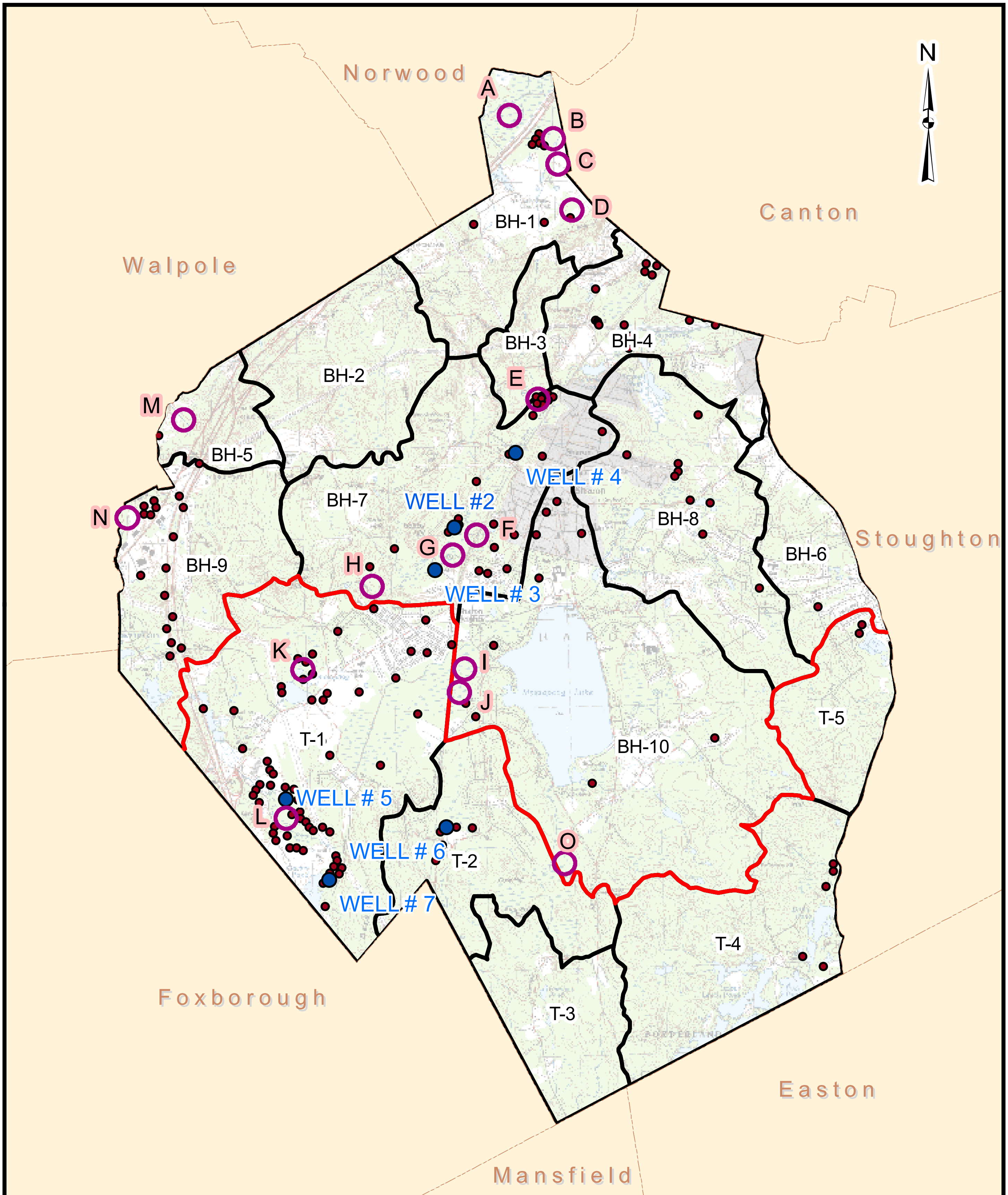

Possible New Source (S & G well)

Historical Borings

MAJOR BASIN DIVIDE

Sub-Basins

FIGURE 13
SHARON, MA

Historic Boring Locations

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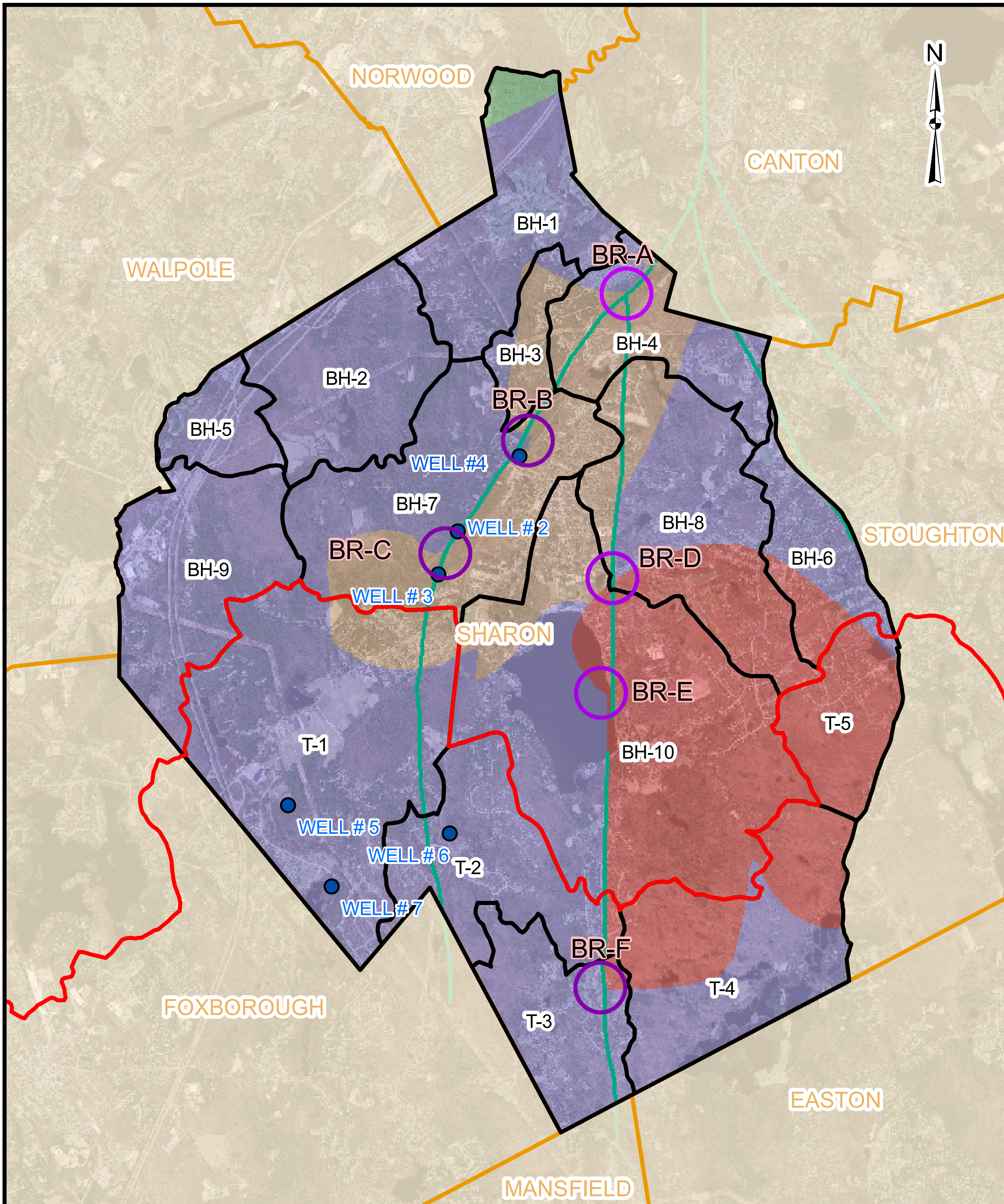

Area for further investigation of bedrock wells
MAJOR BASIN DIVIDE
Sub-Basins
Bedrock Fractures
MA Town Boundaries

FIGURE 14
SHARON, MA

Bedrock Lithology and Fractures

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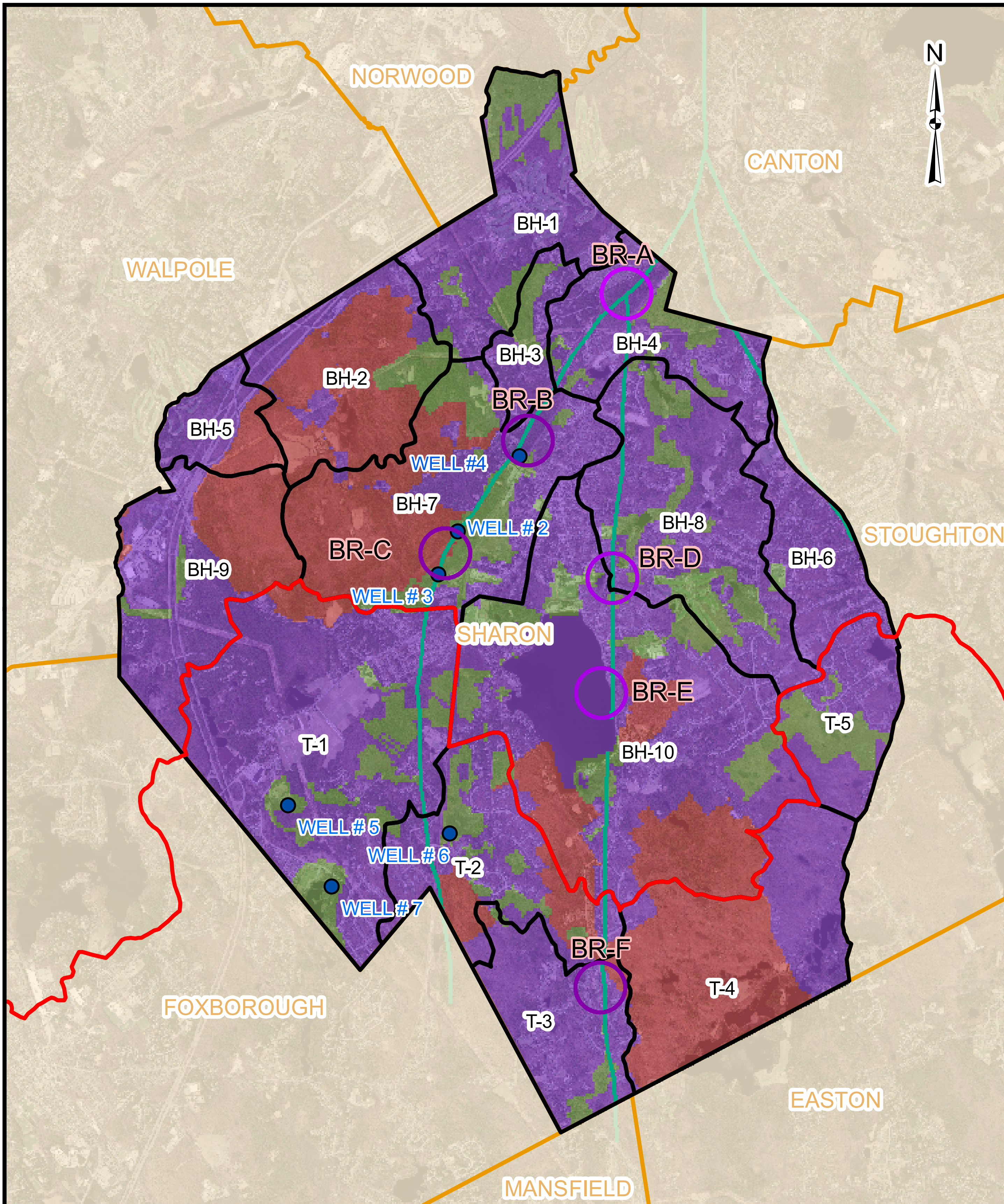

Area for further investigation of bedrock wells

MAJOR BASIN DIVIDE

Sub-Basins

MA Town Boundaries

Bedrock Fractures

Land Cost Criteria Value

1 (most favorable)

2

3 (least favorable)

FIGURE 15
SHARON, MA

Land Cost Criteria

5,000 0 5,000

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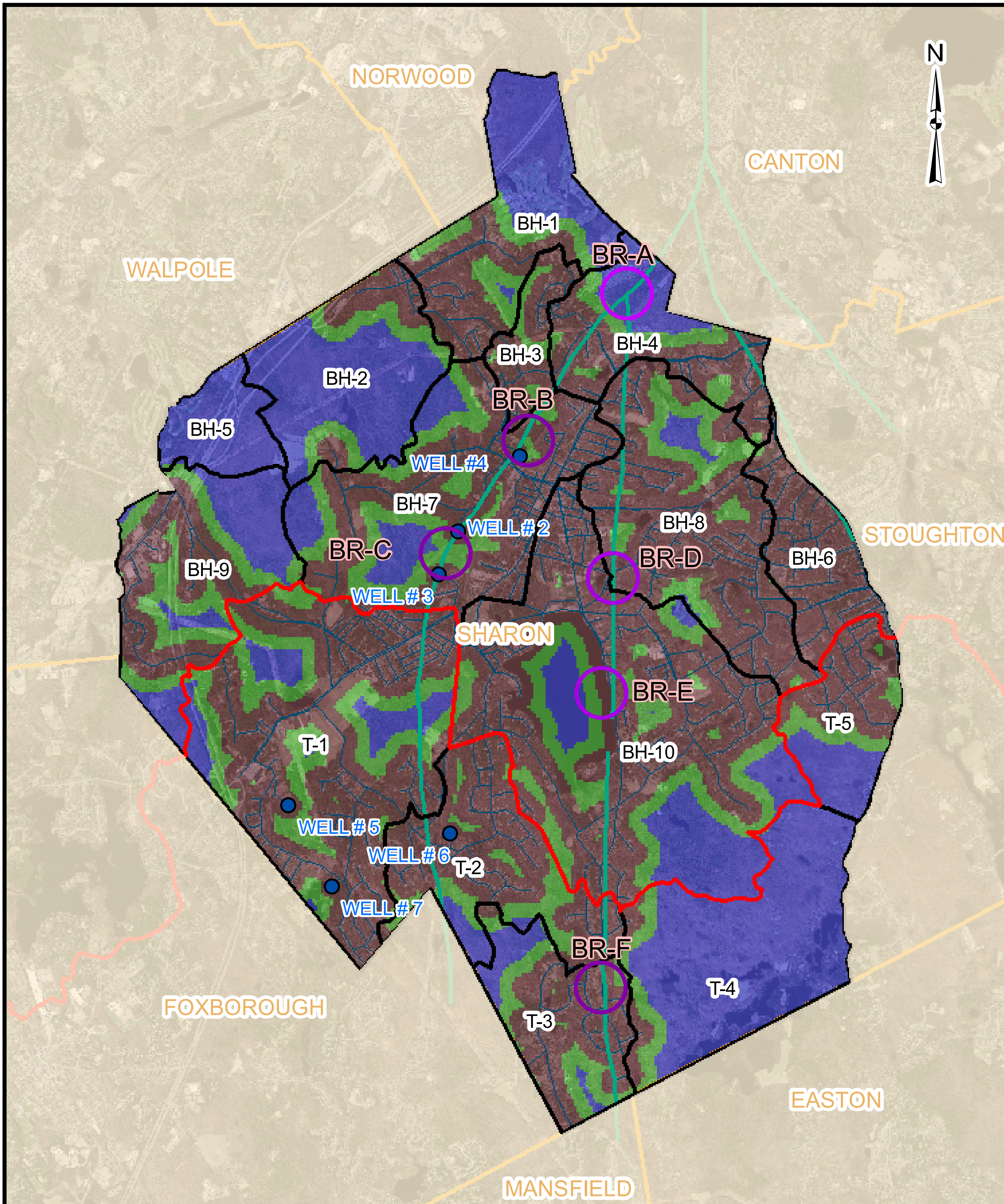

Area for further investigation of bedrock wells
MAJOR BASIN DIVIDE
Sub-Basins
MA Town Boundaries
Bedrock Fractures
Water Main

Site Development Criteria Value

1 (most favorable)
2
3 (least favorable)

FIGURE 16
SHARON, MA

Site Development Criteria

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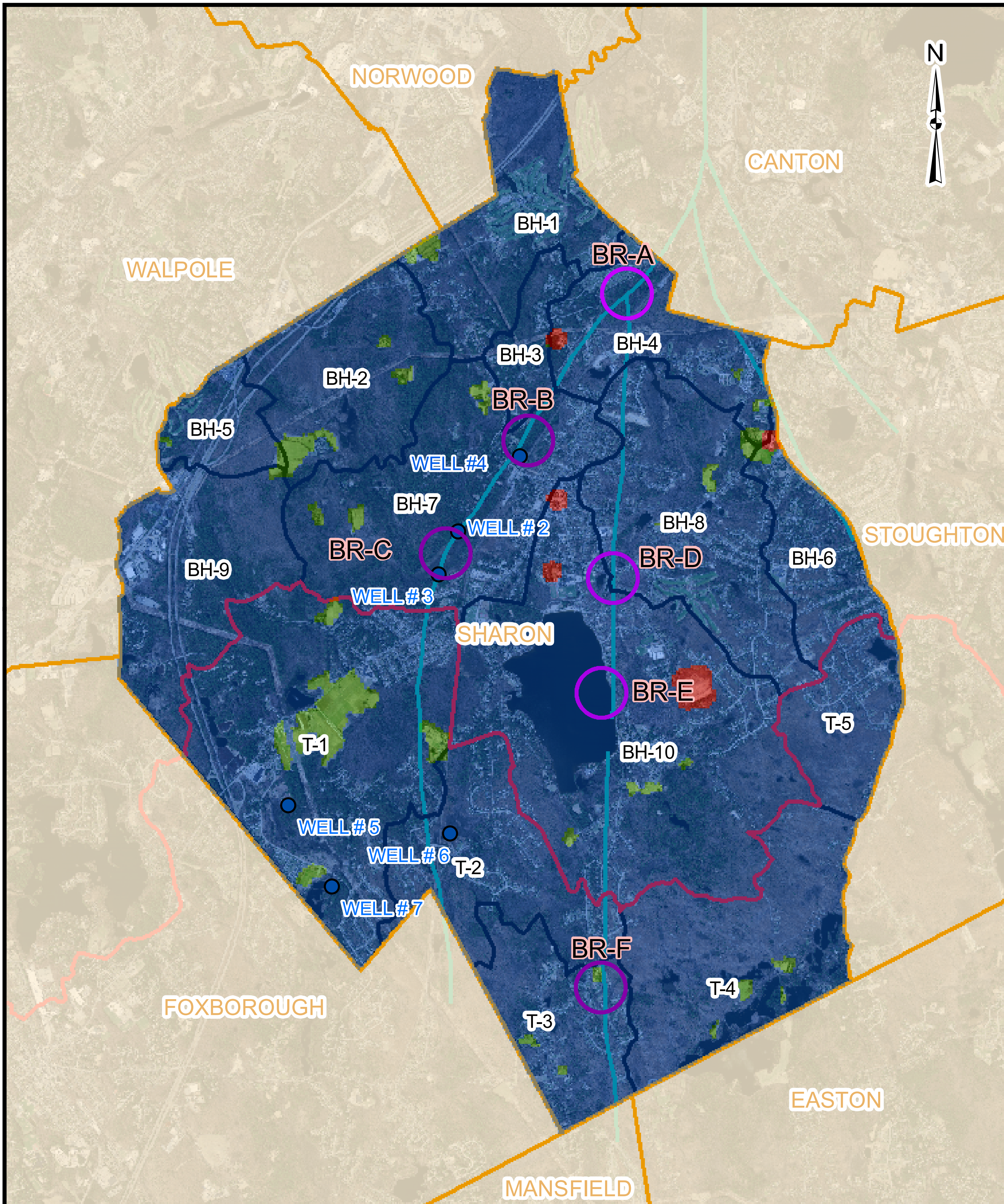

FIGURE 17
SHARON, MA

Water Quality

Area for further investigation of bedrock wells

Water Quality Criteria

- 1 (most favorable)
- 2
- 3 (least favorable)
- MA Town Boundaries
- MAJOR BASIN DIVIDE
- Sub-Basins
- Bedrock Fractures

5,000 0 5,000

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Chapter 5: Regional Water Supply Alternatives
Date: May 13, 2010

Background

The Town of Sharon has been examining alternatives for an additional / supplemental water source of between 0.25 to 0.5 mgd for more than a decade. Since the start of the Water Conservation Program, Town efforts have been instrumental in reducing water demands significantly, such that the projected water supply deficit has been greatly reduced. The additional water supply alternatives include a new in-town groundwater source, treatment of Well 6, or a connection that would provide water supply in the event that the Town's largest well (Well 4) is out of service.

The Town of Sharon has evaluated emergency connections for water supply alternatives from surrounding communities, the MWRA, and Aquaria through the Taunton River Desalination Plant. Cost estimates for these alternatives were prepared as part of the Supplemental Water Supply Feasibility Study performed in 2005 that identified the MWRA as the most economical emergency connection alternative.

The Supplemental Water Supply Stoughton / MWRA Connection Evaluation Site Suitability Assessment prepared in 2006 identified three potential locations (Cobb Corner, Bay Road at Plain Street and Bay Road at Chemung Street) to interconnect to the Town of Stoughton and purchase MWRA water that is wheeled through Stoughton. As part of that evaluation, the Chemung Street connection was identified as the best connection. Since this report, the economics of an interconnection with Stoughton have become unfavorable and Sharon has begun negotiations with the Town of Norwood for an connection with the MWRA as an alternative.

MWRA Water Supply

Previous reports for the Town have included detailed information regarding emergency and permanent connections to the MWRA. MWRA maintains Operating Policies 5 and 10 for emergency and permanent connections to their system, respectively. There are requirements for an emergency connection including that the DEP must declare a "State of Water Supply Emergency" and that the connection may only be used up to 6 months of the year. Each year a new emergency connection activation would be required. The permanent connection requires a significant level of permitting. Both the emergency and permanent connections require a substantial financial commitment. However, the emergency connection is less costly.

MWRA-Norwood Connection

The MWRA-Norwood connection has been evaluated by engineering consultants representing both Norwood and Sharon. The proposed connection would be located near Union Street in Norwood and utilize a pump station to feed water into the Sharon system at Tiot Street. The results indicate that the Norwood connection is capable of sustaining up to 0.5 mgd of water to the town of Sharon with minimal drop in pressure.

The new pump station would take water from the Norwood hydraulic grade line (HGL) of approximately 315 feet and pump it to the Sharon hydraulic grade line of approximately 426 feet. Based on the proposed flow of 0.5 mgd and the difference in water pressure, the pumps would likely be 15 to 20 hp depending on the friction losses in the system. We recommend that the Town construct a pump station with two pumps with variable frequency drives capable of pumping 350 gpm each with one acting as a spare. The pump station would be located in an above ground building and would be equipped with an exterior diesel generator.

Sharon's water system includes a pressure reducing valve (PRV) located in a valve vault at the intersection of Norwood Street and Edge Hill Road that reduces the HGL in the Sharon system from 426 to 315 feet. The residents along Edge Hill Road and Tiot Street receive water at the reduced grade line. In order to feed water from the Norwood connection to the Sharon Main Service System, a new pipeline would need to be constructed down Tiot Street and Edge Hill Road (4,700 feet) to connect to Norwood Street after the PRV. Option 1 in Table 5-1 summarizes the cost of this work at approximately $1.5 million. If Sharon constructs the emergency connection with Norwood, we recommend that Sharon consider replacing the 6-inch cast iron pipe in Norwood Street between Cobbler Lane and Maskwonicut Street to strengthen the Town's transmission system at an additional cost of $380,000.

The length of water main required to feed water from the Norwood connection to Sharon's system can be reduced by 1,200 feet if the PRV is moved up Edge Hill Road to the Avalon Development entrance (Option 2). The cost for Option 2 is outlined in Table 5-1 and is estimated at $1.4 million, plus an additional cost of $380,000 to replace the 6-inch water main in Norwood Street between Cobbler Lane and Maskwonicut Street.

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Table 5-1
Regional Alternatives- MWRA - Norwood Connection

Option	Description	Estimated Cost 2010
1	**Sharon PRV is maintained in existing location**	
	12-inch DI High Pressure Water Main - Tiot Street (1,350')	$250,000
	12-inch DI High Pressure Water Main - Edge Hill Road (3,350') (Tiot Street to Norwood Road)	$620,000
	Pump Station Cost 2 Pumps with VFDs (15-20 hp) Above Ground Building Exterior Diesel Generator	$650,000
	Total	**$1,520,000**
2	**Sharon PRV is moved up Edge Hill Road to reduce water main installation costs**	
	12-inch DI High Pressure Water Main - Tiot Street (1,350')	$250,000
	12-inch DI High Pressure Water Main - Edge Hill Road (2,150') (Tiot Street to Avalon Bay Entrance)	$398,000
	Pump Station Cost 2 Pumps with VFDs (15-20 hp) Above Ground Building Exterior Diesel Generator	$650,000
	Move Sharon PRV & Vault up Edge Hill Road	$50,000
	Install PRVs for 16 to 18 Houses on Edge Hill Road	$4,000
	Total	**$1,352,000**

Note: 1) Pump Station includes limited sitework and doesn’t include cost for land aquisition/purchase.
2) We recommend including Norwood Street transmission main ($380,000) improvement along with the Norwood connection work to strengthen Sharon's system distribution.

Z:\Eric\Master Plan\Chapters\Chapter 5\[Table_5-1(1).xls]Regional Alt

Chapter 6: Water Distribution System Infrastructure
Date: February 25, 2010

General

The purpose of this section of the report was to utilize the water system hydraulic model to identify future infrastructure requirements, both to meet development needs and to update aging infrastructure.

Water System GIS Update

In order to utilize Sharon's hydraulic model and water system GIS to create an asset management CIP, it was critical that the water system GIS and hydraulic model be utilizing the same pipe network and database. After reviewing Sharon's datasets, it was identified that they were completely independent pipe network sets and did not have common attributes (i.e. pipe IDs). We compared the pipe network sets and prepared a listing of discrepancies related to the pipe diameter, material, and distribution system loops.

Weston & Sampson met with the Town's GIS coordinator, and Water Department personnel to discuss the areas of discrepancies. Record drawings and recent improvements to the water system were obtained from the Town. Based on the record drawings, the discrepancies were fixed in the water system GIS, and new pipe ID's were assigned to each pipe segment in the GIS. The updated water system GIS pipe network included attribute information on pipe ID's, length, diameter, material, and install year. Water system record drawings when provided were scanned and saved to the Town's on-line library.

Hydraulic Model Update

The updated GIS pipe network was utilized to update the water system hydraulic model pipe network. Nodes were created at the intersections in the GIS pipe network. Water demands and elevations were assigned to the nodes. The water distribution system GIS pipe network and nodes were imported in the hydraulic modeling software, H2Onet version 8.5.

Weston & Sampson, along with the Town's Water Department personnel, performed 16 fire hydrant flow tests at key locations throughout the water distribution system. The field test results and conditions were simulated in the hydraulic model and used for calibration. Scenarios were created in the calibrated model for obtaining the results on flows and pressures during average day and maximum day demands. (Figure 6-1 and Appendix 6-A).

Asset Management

Weston and Sampson created a water distribution system asset management program for the Town of Sharon combining the water system GIS and hydraulic model results to create a database for asset management. The database for water distribution system asset management was constructed using information associated with the pipe segment, such as:

- Material of construction,
- Installation year,
- Break history/customer complaints,
- Soil type around the pipe,
- Customer type served,
- Roadway type,
- Critical / non-critical transmission mains,
- Available fire flows,
- Current roadway surface status in Town's Pavement management program.

Using the water system GIS information and hydraulic model results, a database (MS Excel spreadsheet) for a water distribution system asset management was created. For each pipe segment, priority of replacement ratings were assigned based on the criteria listed above. The pavement management ratings were assigned based on the Town's road surface ratings and recent paving improvements. The total ratings were compiled in the spreadsheet and sorted based on the lowest pipe segment ratings (Table 6-2). The pipe segments with lower ratings were identified as the water mains in need of replacement / rehabilitation with the highest priority.

Capital Improvement Plan

Based on the asset management net pipe ratings, a water distribution system, 20-year phased capital improvement plan (CIP) was created. The total estimated project cost of water distribution system improvements of $15,215,000 (year 2010 costs) will require the Town to spend an average of approximately $761,000 per year (increasing to keep up with inflation). The CIP was prioritized into Phase A and Phase B improvements. Figure 6-4 shows the recommended improvements with priority.

The Town's water system includes old, unlined cast iron water mains that run parallel to newer cement lined or large diameter water mains, which are still in service. These smaller, older mains are a detriment to the system for many reasons:

- The extensive amount of tuberculation in the small diameter, unlined mains often results in poor water quality to the residents and plugged services to customers that are still connected to these older mains.
- These older mains can be difficult to flush because of cross connections to the parallel mains and because often the hydrants are connected to the large diameter mains.
- Chlorine residuals are harder to maintain and bacterial outbreaks can occur in these smaller unlined parallel mains.

- These older mains tend to experience more leakage and breaks.

For these reasons, we recommend that the older mains be abandoned, and all services and hydrants be transferred to the newer water main in the street.

There are several options for the implementation of Phase A and Phase B improvements. Some important factors that were kept in mind while designing and phasing the plan were:

- It is more efficient and cost effective to keep the improvement program ahead of system deterioration.
- Work should be scheduled and grouped together so that all utility work needed within a certain neighborhood, can be completed all at once even if it means skipping 1 year to construct larger project.

Water Storage

The Town maintains four water storage tanks (Table 6-4) with a total volume of 3 MG. The Hampton Road, Massapoag Avenue, and Upland Road tank are steel tanks that were re-painted (interior and exterior) between 1995 and 1997. The cost of maintaining steel water tanks has increased significantly over the last ten years, to the extent that in some instances the cost of rehabilitating and painting these structures can approach the replacement cost. The high cost of repainting these structures has fueled a transition toward constructing lower maintenance material tanks, such as pre-stressed concrete tanks when possible. Although the 2008 inspection reports prepared by Merithew identified that the coating systems of the three steel tanks are still in good to excellent condition, they will likely need full rehabilitation within the next 10 years at a significant cost to the town.

The Moose Hill concrete tank was constructed in 1954 and based on the R.L. Merithew inspection report in 2008 is showing signs of deterioration. We recommend that the Town contract with a concrete tank repair inspection and repair specialist to make repairs to this tank to halt further deterioration.

We reviewed the historical water storage evaluation reports to identify if additional storage is required in Sharon. Based on the M&E 2004 report, the town has a minor deficiency in storage volume. Although, this evaluation appears to be overly conservative in it's approach, construction of a new water tank in the High Pressure Service area would alleviate this deficiency.

We recommend that the Town continue with the water tank inspections every 3 to 5 years of all the tanks. The Moose Hill concrete tank structural improvements should be scheduled as soon as possible. It may be possible to perform interior and exterior overcoats of the coating system (at reduced cost) to some of the steel tanks to extend the life of these coating systems. If possible, it would be good to get the tanks on a staggered painting schedule so the coating systems are not deteriorating at the same time. The next time it is time for the Upland Road tank to be repainted, we suggest that the town compare the cost of constructing a new concrete tank in the same location. It will be important to review the water storage volume requirements as well as a comprehensive evaluation of system hydraulics at that time to identify if a large tank can be constructed at the Upland Road site and one of the other steel tanks can be abandoned from service.

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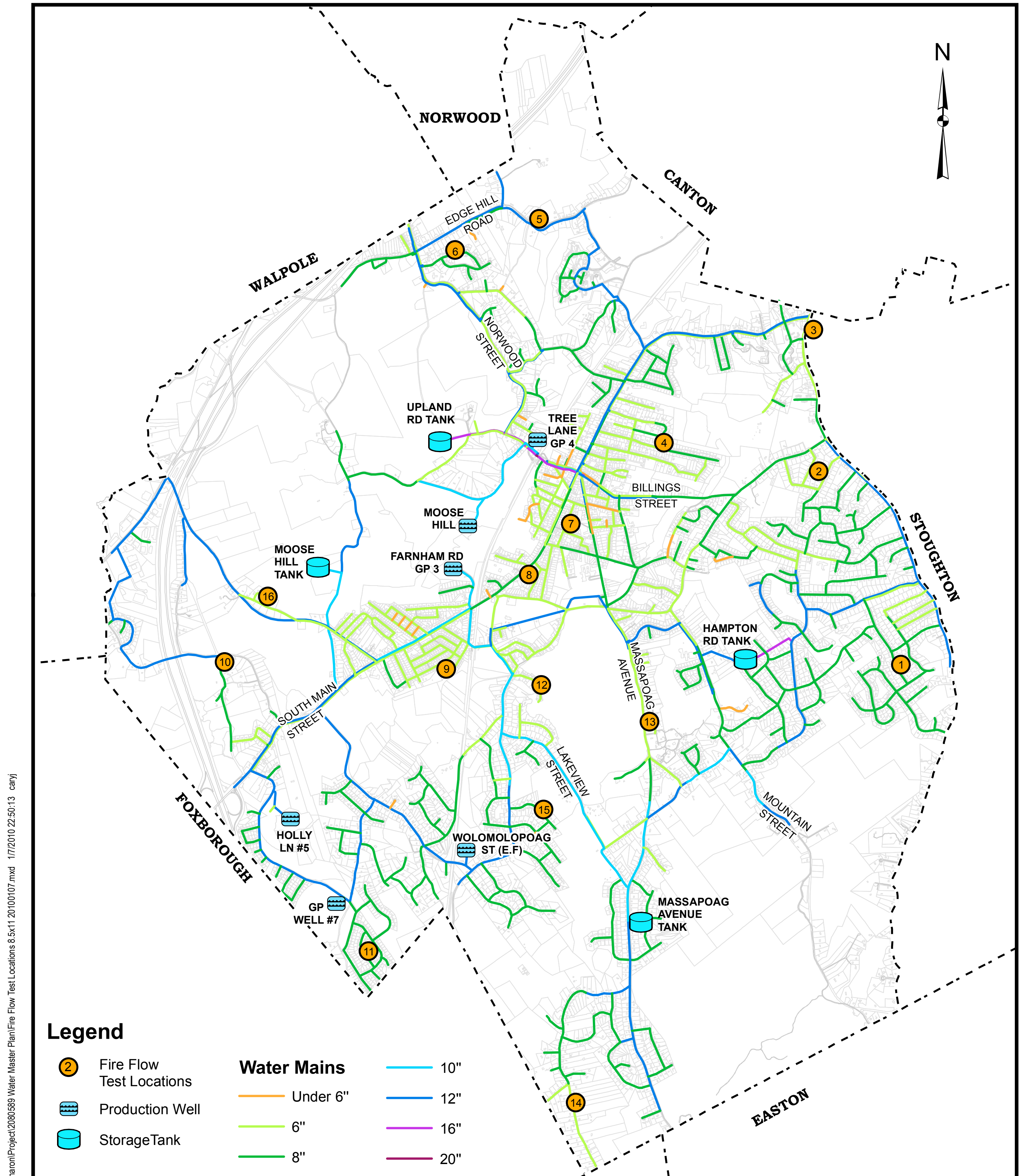

FIGURE 6-1
TOWN OF SHARON, MASSACHUSETTS

FIRE FLOW TEST LOCATIONS

4,500 0 4,500
SCALE IN FEET

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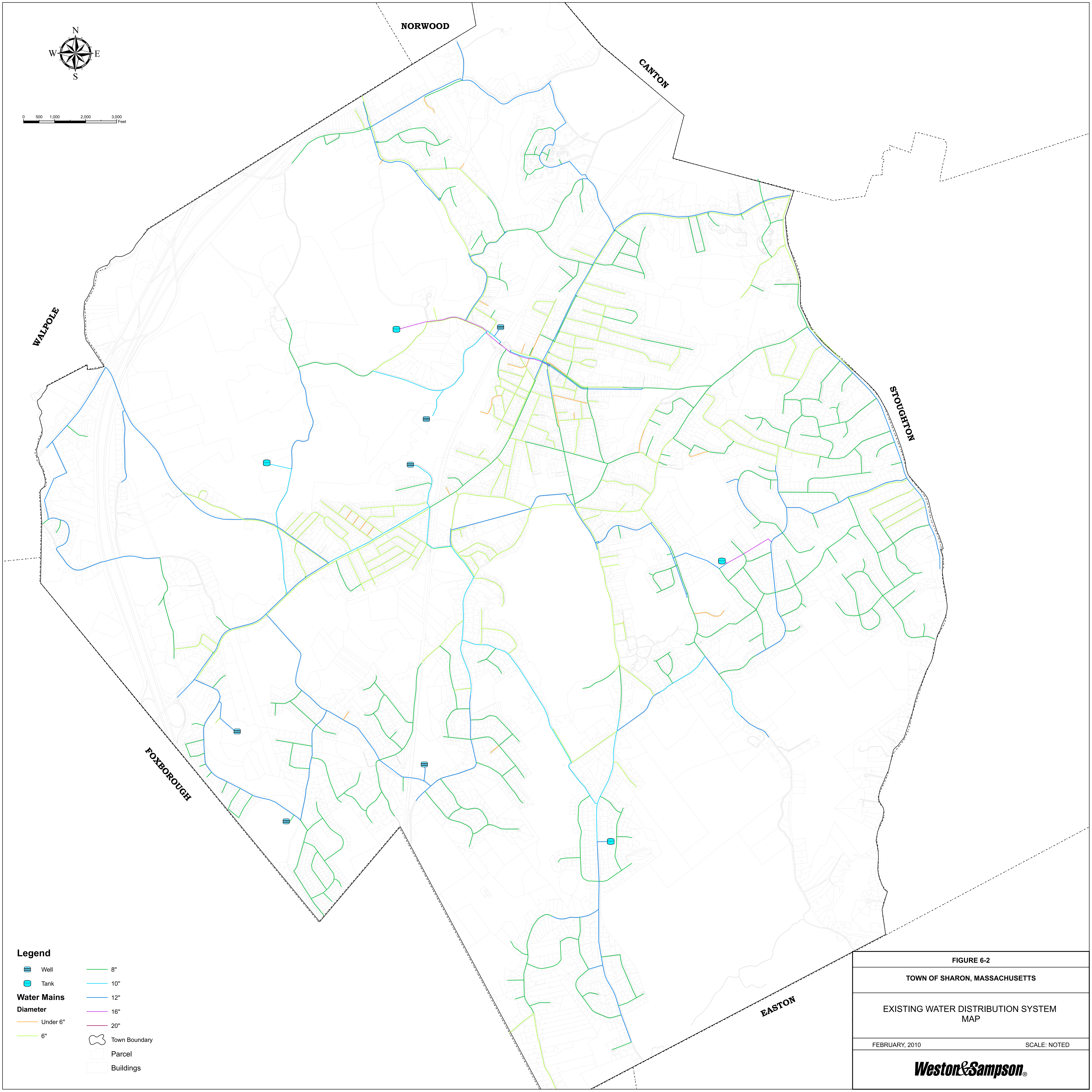

FIGURE 6-2

TOWN OF SHARON, MASSACHUSETTS

EXISTING WATER DISTRIBUTION SYSTEM MAP

FEBRUARY, 2010

SCALE: NOTED

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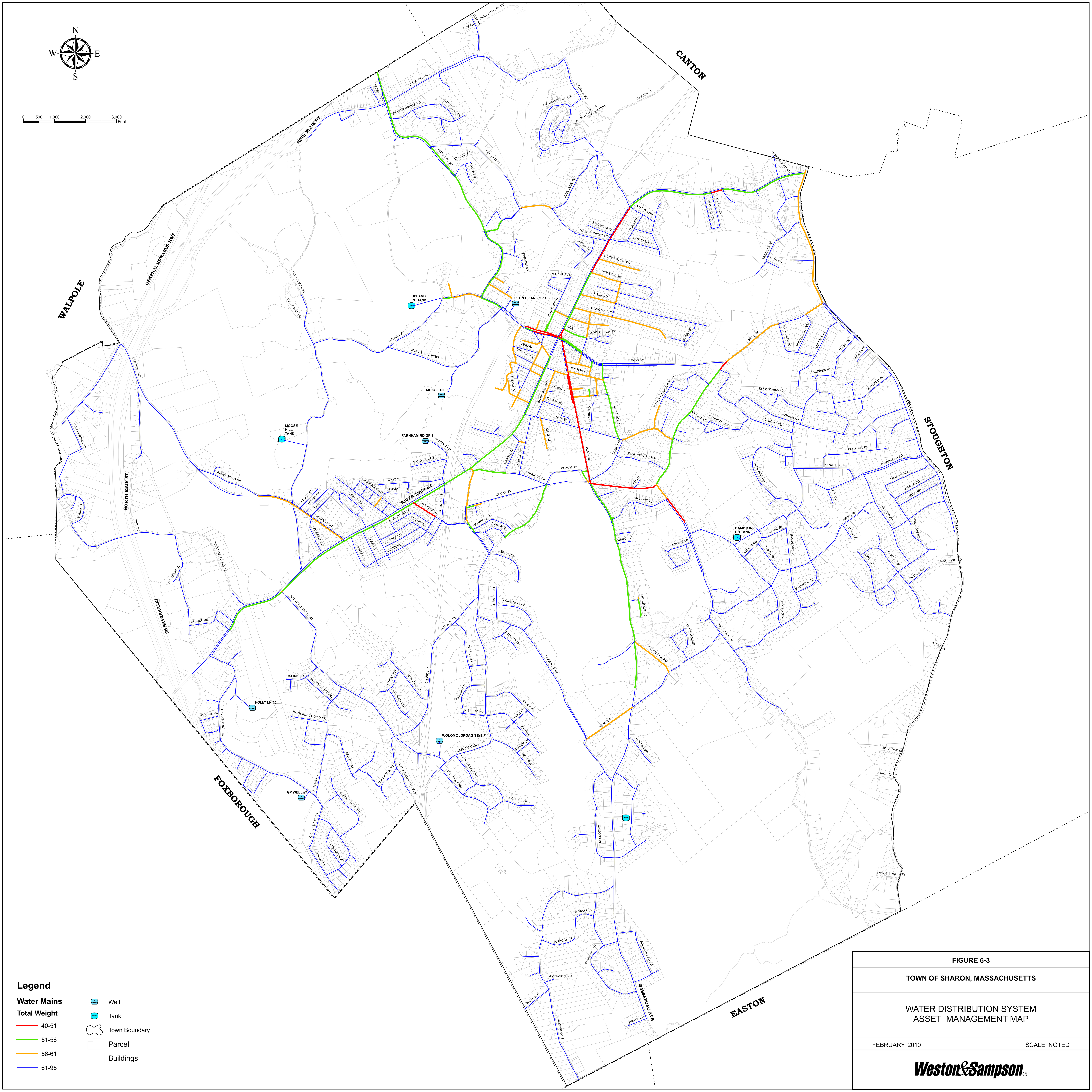

FIGURE 6-3

TOWN OF SHARON, MASSACHUSETTS

WATER DISTRIBUTION SYSTEM
ASSET MANAGEMENT MAP

FEBRUARY, 2010 | SCALE: NOTED

Weston&Sampson

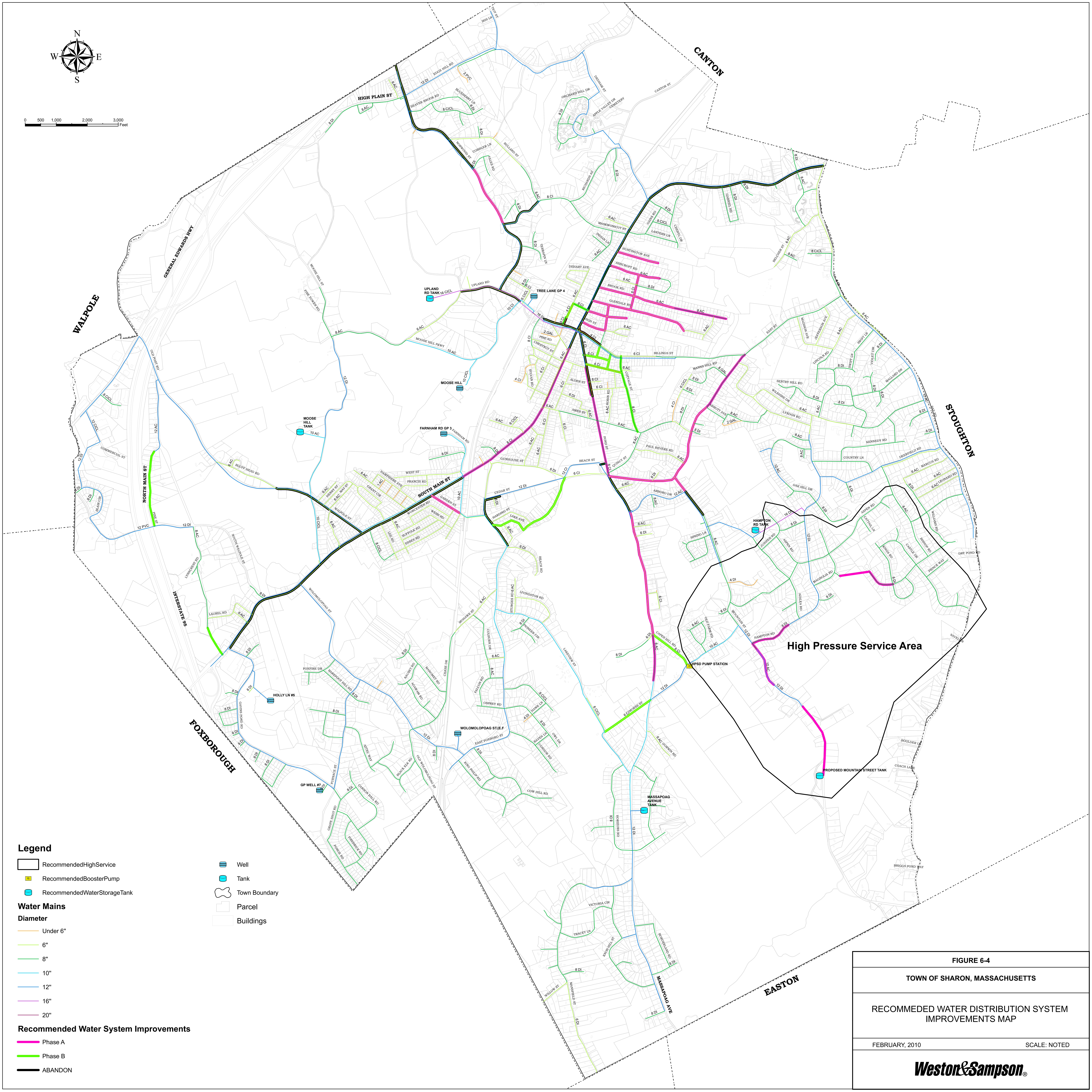
FIGURE 6-4
TOWN OF SHARON, MASSACHUSETTS
RECOMMEDED WATER DISTRIBUTION SYSTEM IMPROVEMENTS MAP
FEBRUARY, 2010
SCALE: NOTED
Weston&Sampson
Legend
RecommendedHighService
RecommendedBoosterPump
RecommendedWaterStorageTank
Well
Tank
Town Boundary
Parcel
Buildings
Water Mains
Diameter
Under 6"
6"
8"
10"
12"
16"
20"
Recommended Water System Improvements
Phase A
Phase B
ABANDON
High Pressure Service Area
CANTON
WALPOLE
STOUGHTON
FOXBOROUGH
EASTON
N
S
E
W
0
500
1,000
2,000
3,000
Feet

Material / Size	AC	Unlined	Cement Lined	Total
(inch)	(ft)	(ft)	(ft)	(ft)
< 4	361	2,547	2,783	**5,691**
4	0	5,772	1,438	**7,210**
6	84,148	104,937	13,237	**202,322**
8	78,746	21,828	166,953	**267,527**
10	30,830	3,716	5,719	**40,265**
12	21,808	3,581	127,720	**153,109**
16	0	0	3,784	**3,784**
Total	**215,893**	**142,381**	**321,634**	**679,907**
Percentage	**32**	**21**	**47**	**100**

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TOWN OF SHARON
Pipe Material Inventory

Main Size (inches)	AC pipe (ft)	CI (ft)	GAL (ft)	PVC (ft)	CICL (ft)	DI Lined (ft)	Copper (ft)	Total (ft)
< 4	361	327	2,220	652	0	0	2,131	5,691
4	0	5,772	0	0	0	1,438	0	7,210
6	84,148	104,937	0	0	3,580	9,657	0	202,322
8	78,746	21,018	810	0	14,350	152,603	0	267,527
10	30,830	3,716	0	0	5,719	0	0	40,265
12	21,808	3,581	0	338	21,600	105,782	0	153,109
≥16	0	0	0	0	3,680	104	0	3,784
Total	**215,893**	**139,350**	**3,030**	**990**	**48,929**	**269,584**	**2,131**	**679,907**
								679,907

129

679909.6

129

Main Size (inches)	AC pipe (ft)	Unlined (ft)	Lined (ft)	Total (ft)
< 4	361	2,547	2,783	5,691
4	0	5,772	1,438	7,210
6	84,148	104,937	13,237	202,322
8	78,746	21,828	166,953	267,527
10	30,830	3,716	5,719	40,265
12	21,808	3,581	127,720	153,109
≥16	0	0	3,784	3,784

#REF!

ASSET MANAGEMENT

TOWN OF SHARON,MA

Water Main Information				Likelihood factors								Consequence factors								Other factors		Risk
Pipe ID	Street Name	Diameter (inches)	Length (feet)	Install Year	Weight	Material	Weight	Soil Type	Weight	History/ Complaints	Weight	Customer Type	Weight	Road Type	Weight	Critical Mains	Weight	Available Flow	Weight	Paving RSR	Weight	Total Weight
1	Billings St.	12	94	9999	10	DI	20	602	6	0	15	DC	3	ARTERIAL	1	311	5	Superior	10	93.68	10	80
2	Upland Rd.	16	1231	1936	3	CICL	17	253D	3	0	15	RS	10	LOCAL	5	151	8	Superior	10	92.67	10	81
3	Maskwonicut St.	12	1451	9999	10	DI	20	253D	3	0	15	RS	10	LOCAL	5	100	8	Superior	10	78.64	10	91
4	Norwood St.	12	2475	9999	10	DI	20	254A	5	0	15	RS	10	ARTERIAL	1	139	8	Superior	10	93.67	5	84
5	Norwood St.	12	112	9999	10	DI	20	253D	3	0	15	RS	10	ARTERIAL	1	0	10	Superior	10	91.67	5	84
6	Canton St.	12	1898	1979	6	DI	20	653	6	0	15	RS	10	LOCAL	5	26	10	Superior	10	42.64	2	84
7	Moose Hill St.	12	3694	1945	5	DI	20	310B	5	0	15	RS	10	LOCAL	5	130	8	Deficient	3	57.67	10	81
8	General Edwards HWY	12	268	1963	6	CICL	17	602	6	0	15	RS	10	LOCAL	5	0	10	Deficient	3	150.00	10	82
9	Old Post Rd.	12	1538	1963	6	CICL	17	602	6	0	15	RS	10	LOCAL	5	5	10	Adequate	5	150.00	10	84
10	South Main St.	12	800	9997	10	CICL	17	602	6	0	15	RS	10	ARTERIAL	1	1	10	Adequate	5	49.68	2	76
11	Massapoag Ave.	12	232	1897	1	CI	1	1	6	0	15	RS	10	ARTERIAL	1	0	10	Superior	10	91.52	10	64
12	Hampton Rd Tank Access Way	12	321	9999	10	DI	20	424B	5	0	15	RS	10	LOCAL	5	548	1	Superior	10	93.57	10	86
13	Mountain St.	12	1220	1974	6	DI	20	254B	5	0	15	CR	1	ARTERIAL	1	121	8	Superior	10	63.52	2	68
14	Azalea Road	12	1638	9999	10	DI	20	424B	5	0	15	RS	10	LOCAL	5	343	5	Superior	10	93.57	5	85
15	Mountain St.	12	728	1974	6	DI	20	254B	5	0	15	RS	10	LOCAL	5	30	10	Superior	10	86.52	5	86
16	Mountain St.	12	1164	1974	6	DI	20	422B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	70.52	10	86
17	Knob Hill St.	12	472	9999	10	DI	20	73A	5	0	15	RS	10	LOCAL	5	11	10	Superior	10	92.51	10	95
18	Moose Tank Access Way	10	841	9998	10	AC	15	424C	5	0	15	RS	10	LOCAL	5	258	5	Adequate	5	150.00	10	80
19	Moose Hill St.	10	1969	1962	6	CICL	17	317B	5	0	15	RS	10	LOCAL	5	128	8	Superior	10	81.67	10	86
20	Moose Hill St.	10	2184	1962	6	CICL	17	254A	5	0	15	RS	10	LOCAL	5	66	8	Superior	10	75.67	10	86
21	Moosehill Pkwy.	10	2392	1949	5	AC	15	254C	5	0	15	RS	10	LOCAL	5	169	8	Adequate	5	92.67	10	78
22	Walpole St.	12	2011	9997	10	CICL	17	254A	5	0	15	RS	10	LOCAL	5	77	8	Superior	10	90.67	5	85
23	South Main St.	12	845	9997	10	CICL	17	254A	5	0	15	CR	1	ARTERIAL	1	76	8	Superior	10	92.68	10	77
24	Massapoag Ave Tank Access W	12	430	9999	10	DI	20	424D	5	0	15	RS	10	LOCAL	5	8	10	Superior	10	93.51	5	90
25	Massapoag Ave.	10	1228	1943	5	AC	15	245C	6	0	15	RS	10	ARTERIAL	1	62	8	Superior	10	51.52	2	72
26	South Main St.	12	629	1979	6	DI	20	602	6	0	15	DC	3	ARTERIAL	1	8	10	Superior	10	93.68	5	76
27	Well # 4 Access Way	12	265	9997	10	CICL	17	51	1	0	15	RS	10	LOCAL	5	720	1	Superior	10	150.00	10	79
28	Upland Rd.	10	277	1936	3	CICL	17	254C	5	0	15	RS	10	ARTERIAL	1	673	1	Superior	10	93.67	10	72
29	Well # 2 Access Way	10	953	9997	10	CICL	17	53	1	0	15	RS	10	LOCAL	5	152	8	Adequate	5	150.00	10	81
30	Gavins Pond Rd.	12	437	9999	10	DI	20	245C	6	0	15	RS	10	LOCAL	5	32	10	Superior	10	84.50	5	91
31	Gavins Pond Rd.	12	452	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	47	10	Superior	10	91.50	5	91
32	East Foxboro St.	12	247	1974	6	DI	20	254A	5	0	15	RS	10	ARTERIAL	1	15	10	Superior	10	90.49	10	87
33	East Foxboro St.	12	422	1974	6	DI	20	254A	5	0	15	RS	10	ARTERIAL	1	1	10	Superior	10	91.49	10	87
34	Chase Dr.	8	1970	1978	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	12	10	Adequate	5	49.51	2	78
35	East Foxboro St.	12	774	1974	6	DI	20	424C	5	0	15	RS	10	ARTERIAL	1	35	10	Adequate	5	92.49	10	82
36	East Foxboro St.	12	630	1974	6	DI	20	424B	5	0	15	RS	10	ARTERIAL	1	19	10	Adequate	5	92.49	10	82
37	Owl Dr.	8	1022	1972	6	DI	20	302C	3	0	15	RS	10	LOCAL	5	6	10	Adequate	5	92.49	10	84
38	Lakeview St.	10	373	1954	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	4	10	Superior	10	78.51	5	80
39	Massapoag Ave.	10	250	1943	5	AC	15	104C	5	0	15	RS	10	ARTERIAL	1	69	8	Superior	10	51.52	2	71
40	Sunset Dr.	8	1506	1969	6	CICL	17	254A	5	0	15	RS	10	LOCAL	5	7	10	Adequate	5	62.59	2	75
41	Moose Hill Pkwy.	8	2590	9998	10	AC	15	245C	6	0	15	RS	10	LOCAL	5	132	8	Deficient	3	92.67	5	77
42	Hampton Rd.	12	556	1963	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	381	3	Superior	10	83.57	10	79
43	Country Ln.	8	1186	1960	6	AC	15	422B	5	0	15	RS	10	LOCAL	5	119	8	Adequate	5	93.58	10	79
44	Country Ln.	8	946	1960	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	243	5	Adequate	5	93.58	10	76
45	Whilshire	8	1308	1966	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	133	8	Superior	10	92.58	10	85
46	Swift Lane	8	1510	1995	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	44	10	Adequate	5	85.49	5	83
47	Sandpiper Hill	8	638	1996	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	48	10	Adequate	5	87.49	5	83
48	Sandpiper Hill	8	128	1996	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	85.49	5	83
49	Bay Rd.	12	1154	1929	3	AC	15	654	6	0	15	RS	10	ARTERIAL	1	278	5	Superior	10	92.60	10	75
50	West Ridge Dr.	8	463	1967	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	46	10	Adequate	5	92.49	10	81
51	West Ridge Dr.	8	779	1967	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	60	8	Adequate	5	93.49	10	79
52	Deerfield Rd.	12	349	1962	6	AC	15	422B	5	0	15	RS	10	LOCAL	5	739	1	Superior	10	92.58	10	77

53	Deerfield Rd.	12	2004	1962	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	504	1	Superior	10	92.58	10	77
54	Eisenhower Dr.	8	519	1971	6	DI	20	424D	5	0	15	RS	10	LOCAL	5	4	10	Deficient	3	91.57	5	79
55	Eisenhower Dr.	8	540	1971	6	DI	20	424B	5	0	15	RS	10	LOCAL	5	13	10	Adequate	5	88.57	5	81
56	Eisenhower Dr.	8	465	1971	6	DI	20	424B	5	0	15	RS	10	LOCAL	5	6	10	Adequate	5	90.57	5	81
57	Queens Cir.	8	1612	1978	6	DI	20	424B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	69.57	2	78
58	Eisenhower Dr.	8	468	1971	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	38	10	Adequate	5	88.57	5	81
59	Bishop Rd	8	1265	1971	6	AC	15	424D	5	0	15	RS	10	LOCAL	5	146	8	Adequate	5	80.57	10	79
60	Chessman Dr.	8	601	1969	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	300	5	Adequate	5	93.57	10	76
61	Bay Rd.	12	1472	1929	3	AC	15	245B	6	0	15	RS	10	ARTERIAL	1	2	10	Adequate	5	92.60	10	75
62	Chessman Dr.	8	1337	1969	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	301	5	Adequate	5	88.57	10	76
63	Hampton Rd.	12	854	1963	6	AC	15	424B	5	0	15	RS	10	LOCAL	5	1011	1	Superior	10	67.57	10	77
64	Hampton Rd.	12	472	1976	6	DI	20	424B	5	0	15	RS	10	LOCAL	5	1034	1	Superior	10	52.57	2	74
65	Hampton Rd Tank Access Way	16	1082	9999	10	DI	20	424C	5	0	15	RS	10	LOCAL	5	1053	1	Superior	10	150.00	10	86
66	Hampton Rd Tank Access Way	16	590	9999	10	DI	20	424B	5	0	15	RS	10	LOCAL	5	1263	1	Superior	10	93.57	10	86
67	Lilac St.	8	869	1986	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	154	8	Superior	10	89.57	5	86
68	Juniper Rd.	8	250	1985	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	207	5	Superior	10	77.57	5	83
69	Juniper Rd.	8	234	1985	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	52	8	Superior	10	77.57	5	86
70	Aspen Rd.	8	1100	1984	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	124	8	Superior	10	83.57	5	86
71	Heather Way	8	573	1984	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	22	10	Superior	10	83.57	5	88
72	Hampton Rd.	12	390	1976	6	DI	20	420B	5	0	15	RS	10	LOCAL	5	48	10	Superior	10	57.57	2	83
73	Hampton Rd.	8	1388	9999	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	43	10	Superior	10	57.57	2	87
74	Cedar St.	12	2682	9999	10	DI	20	254A	5	0	15	RS	10	LOCAL	5	16	10	Superior	10	89.59	10	95
75	Quincy St.	8	1187	1941	5	AC	15	31A	5	0	15	RS	10	LOCAL	5	58	8	Adequate	5	77.60	10	78
76	Paul Revere Rd.	6	1705	1955	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	11	10	Adequate	5	91.60	10	80
77	Massapoag Ave.	10	640	1943	5	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	9	10	Superior	10	85.52	5	76
78	East St.	8	2095	1942	5	AC	15	254B	5	Yes	1	RS	10	ARTERIAL	1	169	8	Adequate	5	92.60	10	60
79	Ames St.	8	118	99	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	92.60	10	62
80	Quincy St.	8	560	1941	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	40	10	Adequate	5	87.60	10	80
81	Ames St.	8	1076	99	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	35	10	Deficient	3	79.60	10	60
82	Morse St.	12	239	2004	10	DI	20	254B	5	0	15	RS	10	ARTERIAL	1	122	8	Superior	10	80.52	10	89
83	Morse St.	12	1677	2004	10	DI	20	260B	5	0	15	RS	10	ARTERIAL	1	111	8	Superior	10	52.52	2	81
84	Capenhill Rd.	6	1512	1902	2	CI	1	254B	5	0	15	RS	10	LOCAL	5	7	10	Deficient	3	87.52	10	61
85	South Main St.	10	1203	9998	10	AC	15	254A	5	0	15	RS	10	ARTERIAL	1	128	8	Superior	10	93.68	10	84
86	East Foxboro St.	10	650	1956	5	AC	15	424B	5	0	15	RS	10	ARTERIAL	1	39	10	Superior	10	91.51	10	81
87	Mohawk St.	6	1131	1952	5	AC	15	254B	5	0	15	CR	1	LOCAL	5	4	10	Adequate	5	72.51	10	71
88	Mohawk St.	6	801	1952	5	AC	15	254A	5	0	15	CR	1	LOCAL	5	11	10	Adequate	5	88.51	10	71
89	Harding St.	6	1477	1925	3	CI	1	422C	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	91.59	10	62
90	East Foxboro St.	6	107	1921	3	CI	1	52	1	0	15	RS	10	LOCAL	5	14	10	Adequate	5	83.59	5	55
91	East Foxboro St.	6	818	1921	3	CI	1	422C	5	0	15	RS	10	LOCAL	5	7	10	Adequate	5	85.59	10	64
92	South Main St.	8	956	1885	1	CI	1	305B	5	0	15	RS	10	ARTERIAL	1	5	10	Deficient	3	89.68	5	51
93	South Main St.	8	389	1885	1	CI	1	305B	5	0	15	RS	10	ARTERIAL	1	4	10	Adequate	5	93.68	5	53
94	Chestnut St.	6	699	1885	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	8	10	Deficient	3	90.65	10	62
95	Depot St.	10	277	1885	1	CI	1	253D	3	0	15	RS	10	ARTERIAL	1	75	8	Superior	10	91.67	5	54
96	East St.	6	538	1892	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	16	10	Deficient	3	79.52	10	56
97	Beach St.	12	1424	1886	1	CI	1	654	6	0	15	RS	10	ARTERIAL	1	69	8	Superior	10	90.59	10	62
98	Massapoag Ave.	12	1386	1897	1	CI	1	1	6	0	15	RS	10	ARTERIAL	1	126	8	Superior	10	89.52	10	62
99	Off Cedar Street	6	1415	99	1	CI	1	654	6	0	15	RS	10	LOCAL	5	7	10	Adequate	5	150.00	10	63
100	Hampton Rd.	12	400	1963	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	136	8	Superior	10	76.57	10	84
101	Oak Hill Dr.	12	1231	1968	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	7	10	Adequate	5	54.58	10	81
102	Tamarack Way	12	416	1965	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	93.58	10	81
103	Cottage St.	8	1485	1887	1	CI	1	312B	5	0	15	CR	1	LOCAL	5	9	10	Deficient	3	64.59	10	51
104	Ashcroft Rd.	6	972	1907	2	CI	1	305B	5	0	15	RS	10	LOCAL	5	15	10	Severely Deficient	1	88.64	10	59
105	Ashcroft Rd.	6	683	9998	10	AC	15	305B	5	0	15	RS	10	LOCAL	5	9	10	Severely Deficient	1	55.64	10	81
106	Crest Rd.	6	333	1909	2	CI	1	305B	5	0	15	RS	10	LOCAL	5	3	10	Severely Deficient	1	87.64	10	59
107	Crest Rd.	6	457	1909	2	CI	1	312B	5	0	15	RS	10	LOCAL	5	8	10	Deficient	3	88.64	10	61
108	Crest Rd. Way	6	688	1946	5	AC	15	310B	5	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	150.00	10	76
109	Brook Rd.	6	1169	1889	1	CI	1	310B	5	0	15	RS	10	LOCAL	5	17	10	Deficient	3	79.64	10	60
110	Robs Lane	6	180	1959	5	AC	15	245B	6	0	15	RS	10	LOCAL	5	1	10	Deficient	3	86.64	5	74
111	Robs Lane	6	420	1959	5	AC	15	245B	6	0	15	RS	10	LOCAL	5	6	10	Deficient	3	80.64	10	79
112	High St.	6	569	1950	5	AC	15	623C	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	85.60	5	73

113	High St.	6	490	1950	5	AC	15	623C	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	85.60	5	73
114	South Pleasant St.	6	242	1895	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	6	10	Deficient	3	92.65	5	57
115	Walnut St.	6	429	1894	1	CI	1	305B	5	0	15	RS	10	LOCAL	5	4	10	Deficient	3	91.65	10	60
116	Walnut St.	6	365	1894	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	3	10	Deficient	3	92.65	10	62
117	Walnut St.	6	130	1894	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	7	10	Deficient	3	92.65	10	62
118	Walnut St.	6	326	1894	1	CI	1	245C	6	0	15	RS	10	LOCAL	5	11	10	Deficient	3	91.65	10	61
119	Chestnut St.	8	242	1885	1	CI	1	253D	3	0	15	RS	10	LOCAL	5	20	10	Adequate	5	91.65	10	60
120	Upland Rd.	16	270	1936	3	CICL	17	254C	5	0	15	RS	10	ARTERIAL	1	9	10	Superior	10	93.67	10	81
121	Chestnut St.	8	731	1885	1	CI	1	253D	3	0	15	RS	10	LOCAL	5	29	10	Adequate	5	93.65	10	60
122	South Pleasant St.	6	370	1895	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	6	10	Deficient	3	93.65	5	57
123	South Pleasant St.	6	283	1895	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	2	10	Deficient	3	93.65	5	57
124	Ridge Rd.	6	506	1895	1	CI	1	245C	6	0	15	RS	10	LOCAL	5	4	10	Severely Deficient	1	92.65	10	59
125	South Pleasant St.	6	704	1895	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	3	10	Deficient	3	92.65	10	62
126	Oakland Rd.	6	34	1895	1	CI	1	305B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	93.68	5	55
127	Oakland Rd.	6	437	1895	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	92.65	10	60
128	South Pleasant St.	6	251	1895	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	3	10	Deficient	3	92.65	10	60
129	South Pleasant St.	6	358	1895	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	93.65	10	58
130	Sylvan Rd.	6	711	1929	3	CI	1	245C	6	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	91.65	10	61
131	Pine Rd.	6	838	1910	2	CI	1	251A	7	0	15	RS	10	LOCAL	5	7	10	Deficient	3	92.65	10	63
132	Station St.	6	425	1897	1	CI	1	602	6	0	15	RS	10	LOCAL	5	7	10	Deficient	3	91.65	10	61
133	Chestnut St.	6	417	1885	1	CI	1	305B	5	0	15	RS	10	LOCAL	5	6	10	Deficient	3	89.65	10	60
134	North Main St.	6	398	1885	1	CI	1	623C	5	0	15	RS	10	ARTERIAL	1	10	10	Adequate	5	93.68	5	53
135	East Foxboro St.	6	120	1921	3	CI	1	254A	5	0	15	RS	10	LOCAL	5	8	10	Adequate	5	93.59	5	59
136	South Main St.	6	481	1889	1	CI	1	626B	5	0	15	LC	6	ARTERIAL	1	2	10	Deficient	3	92.68	10	52
137	South Main St.	6	1167	1889	1	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	12	10	Deficient	3	93.68	10	56
138	Garden St.	6	834	1910	2	CI	1	626B	5	Yes	1	RS	10	LOCAL	5	5	10	Deficient	3	80.59	10	47
139	Walpole St.	12	3262	9997	10	CICL	17	251B	7	0	15	RS	10	LOCAL	5	6	10	Adequate	5	84.67	10	89
140	Walpole St.	12	2241	9997	10	CICL	17	251B	7	0	15	RS	10	LOCAL	5	10	10	Adequate	5	80.67	10	89
141	Walpole St.	12	1166	9997	10	CICL	17	251B	7	0	15	RS	10	LOCAL	5	13	10	Adequate	5	88.67	5	84
142	Gertrude Ave.	6	327	1921	3	CI	1	254B	5	0	15	RS	10	LOCAL	5	8	10	Adequate	5	91.59	10	64
143	Gertrude Ave.	6	211	1921	3	CI	1	254B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	93.59	5	59
144	Harold St.	6	1039	1942	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	15	10	Adequate	5	91.59	10	80
145	Marie Ave.	6	1113	1949	5	AC	15	254C	5	0	15	RS	10	LOCAL	5	11	10	Adequate	5	90.59	10	80
146	Ames St.	6	213	9998	10	AC	15	254B	5	0	15	RS	10	LOCAL	5	21	10	Adequate	5	89.60	10	85
147	Ames St.	6	172	9998	10	AC	15	305B	5	0	15	RS	10	LOCAL	5	25	10	Adequate	5	83.60	10	85
148	Ames St.	6	135	9998	10	AC	15	305B	5	0	15	RS	10	LOCAL	5	19	10	Adequate	5	79.60	10	85
149	Harold St.	6	887	1927	3	CI	1	254B	5	0	15	RS	10	LOCAL	5	7	10	Adequate	5	88.59	10	64
150	Ames Ct.	6	999	1924	3	CI	1	312B	5	0	15	RS	10	LOCAL	5	3	10	Severely Deficient	1	90.59	10	60
151	South Main St.	6	957	1956	5	AC	15	305B	5	0	15	RS	10	ARTERIAL	1	2	10	Deficient	3	89.68	5	69
152	South Main St.	8	61	1885	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	17	10	Adequate	5	91.68	5	53
153	South Main St.	8	691	1885	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	24	10	Adequate	5	91.68	5	53
154	South Main St.	6	457	1956	5	AC	15	305B	5	0	15	RS	10	ARTERIAL	1	4	10	Adequate	5	93.68	5	71
155	Cottage St.	8	489	1887	1	CI	1	623C	5	0	15	CR	1	LOCAL	5	9	10	Deficient	3	86.59	10	51
156	Woodland	6	340	1889	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	93.59	10	62
157	Summer St.	6	555	1894	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	3	10	Deficient	3	92.59	10	60
158	Tolman St.	4	230	99	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	91.59	10	58
159	Maple Ave.	6	418	1892	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	7	10	Deficient	3	92.60	10	60
160	Pond St.	12	678	9999	10	DI	20	602	6	0	15	DC	3	ARTERIAL	1	45	10	Superior	10	81.60	5	80
161	Pond St.	12	409	9999	10	DI	20	602	6	0	15	RS	10	ARTERIAL	1	31	10	Superior	10	83.60	5	87
162	Maple Ave.	6	433	1892	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	11	10	Deficient	3	92.60	10	60
163	North Main St.	6	507	1885	1	CI	1	310B	5	0	15	CR	1	ARTERIAL	1	11	10	Deficient	3	92.68	5	42
164	Belcher St.	6	594	1929	3	CI	1	254B	5	0	15	RS	10	LOCAL	5	17	10	Adequate	5	88.58	10	64
165	North Main St.	6	251	1885	1	CI	1	420B	5	0	15	RS	10	ARTERIAL	1	6	10	Adequate	5	91.68	5	53
166	Gabriel Rd.	8	836	2003	10	DI	20	420B	5	0	15	RS	10	LOCAL	5	15	10	Adequate	5	83.58	10	90
167	Winslow Rd.	8	1768	2003	10	DI	20	420B	5	0	15	RS	10	LOCAL	5	8	10	Adequate	5	87.58	10	90
168	North Main St.	6	385	1885	1	CI	1	51	1	0	15	RS	10	ARTERIAL	1	5	10	Adequate	5	91.68	5	49
169	Huntington Rd.	6	1372	1907	2	CI	1	305B	5	0	15	RS	10	LOCAL	5	4	10	Severely Deficient	1	76.64	10	59
170	Deborah Sampson St.	6	377	1937	3	CICL	17	254B	5	0	15	RS	10	LOCAL	5	6	10	Deficient	3	83.58	10	78
171	Deborah Sampson St.	6	342	1937	3	CICL	17	254B	5	0	15	RS	10	LOCAL	5	10	10	Deficient	3	87.58	10	78
172	Ames St.	6	258	1887	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	20	10	Deficient	3	80.60	10	60

173	Ames St.	6	456	1887	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	16	10	Deficient	3	85.60	10	60
174	Massapoag Ave.	6	1297	1897	1	CI	1	223B	5	0	15	RS	10	ARTERIAL	1	8	10	Deficient	3	92.52	10	56
175	Decatur Ave.	6	318	1948	5	CICL	17	254C	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	90.52	10	80
176	Highland Ave.	2	57	1989	8	GAL	1	254C	5	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	92.52	5	60
177	Highland Ave.	6	540	99	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	92.52	5	53
178	Lakeview St.	10	634	1954	5	AC	15	424B	5	0	15	RS	10	ARTERIAL	1	45	10	Superior	10	80.51	5	76
179	Lakeview St.	10	499	1954	5	AC	15	424B	5	0	15	RS	10	ARTERIAL	1	34	10	Superior	10	75.51	5	76
180	Lakeview St.	10	454	1954	5	AC	15	424B	5	0	15	RS	10	ARTERIAL	1	27	10	Superior	10	77.51	5	76
181	Sturges Rd.	6	530	1960	6	AC	15	424B	5	0	15	RS	10	LOCAL	5	9	10	Adequate	5	89.51	5	76
182	Sturges Rd.	6	611	1960	6	AC	15	424B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	73.51	2	73
183	Livingston Rd.	6	1727	1960	6	AC	15	424B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	87.51	5	76
184	Gunhouse St.	6	1080	1905	2	CI	1	254A	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	74.59	2	55
185	Gunhouse St.	6	428	1991	8	DI	20	254A	5	0	15	RS	10	LOCAL	5	17	10	Adequate	5	91.59	5	83
186	Gunhouse St.	6	924	1991	8	DI	20	254A	5	0	15	RS	10	LOCAL	5	36	10	Adequate	5	90.59	5	83
187	Lake Ave.	6	344	1925	3	CI	1	422C	5	0	15	RS	10	LOCAL	5	8	10	Adequate	5	93.59	10	64
188	Lake Ave.	6	810	1925	3	CI	1	422C	5	0	15	RS	10	LOCAL	5	7	10	Deficient	3	92.59	10	62
189	Grove Ave.	6	806	1965	6	AC	15	422C	5	0	15	RS	10	ARTERIAL	1	20	10	Adequate	5	92.59	5	72
190	East Foxboro St.	10	1426	1956	5	AC	15	422C	5	0	15	RS	10	ARTERIAL	1	48	10	Superior	10	92.51	10	81
191	Beach Rd.	6	1616	1988	8	DI	20	260B	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	150.00	10	88
192	Everett St.	6	459	1905	2	CI	1	254B	5	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	150.00	10	59
193	Upland Rd.	6	2300	1947	5	AC	15	424C	5	0	15	RS	10	LOCAL	5	34	10	Adequate	5	93.67	10	80
194	South Main St.	6	408	1889	1	CI	1	254A	5	0	15	CR	1	ARTERIAL	1	2	10	Adequate	5	93.68	10	49
195	South Main St.	6	372	1889	1	CI	1	626B	5	0	15	LC	6	ARTERIAL	1	0	10	Deficient	3	93.68	10	52
196	South Main St.	6	543	1889	1	CI	1	626B	5	0	15	LC	6	ARTERIAL	1	1	10	Deficient	3	93.68	10	52
197	Essex Rd.	6	271	1950	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	4	10	Adequate	5	81.59	10	66
198	Essex Rd.	6	274	1950	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	5	10	Adequate	5	84.59	10	66
199	Essex Rd.	6	1488	1950	5	AC	15	260B	5	Yes	1	RS	10	LOCAL	5	4	10	Adequate	5	75.59	10	66
200	Essex Rd.	6	399	1950	5	AC	15	260B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	87.59	10	80
201	Lee Rd.	6	1036	1949	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	82.59	10	80
202	Norfolk Place	6	566	1949	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	41	10	Adequate	5	68.59	10	66
203	Norfolk Place	6	266	1949	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	24	10	Adequate	5	89.59	10	66
204	Norfolk Place	6	270	1949	5	AC	15	260B	5	Yes	1	RS	10	LOCAL	5	14	10	Adequate	5	89.59	10	66
205	Norfolk Place	6	212	1949	5	AC	15	260B	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	89.59	10	80
206	Middlesex	6	575	1950	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	14	10	Adequate	5	82.59	10	66
207	Mark Rd.	6	273	1953	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	0	10	Deficient	3	66.59	10	64
208	Worcester Rd.	6	1464	1953	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	3	10	Deficient	3	68.59	10	64
209	Middlesex	6	606	1950	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	10	10	Adequate	5	88.59	10	66
210	Webb Rd.	6	316	1951	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	7	10	Adequate	5	75.59	10	66
211	Suffolk Rd.	6	1350	1950	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	5	10	Adequate	5	85.59	10	66
212	Webb Rd.	6	239	1951	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	7	10	Adequate	5	73.59	10	66
213	Webb Rd.	6	269	1951	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	86.59	10	80
214	Clarke Ct.	6	407	1951	5	AC	15	260B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	86.59	5	75
215	Lee Rd.	6	241	1949	5	AC	15	260B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	82.59	5	75
216	Garden St.	6	231	1910	2	CI	1	626B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	91.59	10	63
217	Garden Ct.	6	897	1953	5	AC	15	254A	5	0	15	RS	10	LOCAL	5	10	10	Adequate	5	93.59	10	80
218	Clarke Ct.	6	550	1951	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	5	10	Adequate	5	87.59	5	75
219	East Foxboro St.	6	1210	1921	3	CI	1	654	6	0	15	RS	10	LOCAL	5	7	10	Deficient	3	88.59	5	58
220	East Foxboro St.	6	501	1921	3	CI	1	254A	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	90.59	5	57
221	Cedar St.	6	276	1896	1	CI	1	254A	5	0	15	RS	10	LOCAL	5	4	10	Severely Deficient	1	91.59	5	53
222	Cedar St.	6	229	1896	1	CI	1	254A	5	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	92.59	10	58
223	Cedar Park Rd.	6	267	1980	8	DI	20	254A	5	0	15	RS	10	LOCAL	5	3	10	Severely Deficient	1	92.59	10	84
224	Walpole St.	6	1432	1919	2	CI	1	251B	7	0	15	RS	10	LOCAL	5	0	10	Deficient	3	88.67	5	58
225	Walpole St.	6	220	1919	2	CI	1	254A	5	0	15	RS	10	LOCAL	5	6	10	Adequate	5	87.67	5	58
226	Walpole St.	6	220	1919	2	CI	1	254A	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	88.67	5	58
227	Walpole St.	6	84	1919	2	CI	1	254A	5	0	15	RS	10	LOCAL	5	11	10	Adequate	5	80.65	10	63
228	South Main St.	6	1914	1889	1	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	3	10	Adequate	5	93.68	10	58
229	South Main St.	6	991	1889	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	1	10	Superior	10	69.68	10	63
230	South Main St.	6	296	1889	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	11	10	Adequate	5	83.68	5	53
231	Laurel Rd.	6	906	1955	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	39	10	Adequate	5	85.65	5	75
232	Laurel Rd.	6	910	1955	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	5	10	Adequate	5	87.65	5	75

233	Mitchell St.	6	528	1953	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	38	10	Adequate	5	88.65	5	75
234	Gavins Pond Rd.	12	649	9999	10	DI	20	602	6	0	15	RS	10	LOCAL	5	181	8	Superior	10	72.50	2	86
235	Gavins Pond Rd.	12	560	9999	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	185	8	Superior	10	65.50	2	85
236	Colonel Gridley Rd.	8	573	1986	8	DI	20	254A	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	87.50	5	83
237	Well # 5 Access Way	12	564	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	153	8	Superior	10	93.50	5	89
238	Well # 5 Access Way	12	571	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	153	8	Superior	10	93.50	5	89
239	Well # 5 Access Way	6	230	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	0	10	Adequate	5	93.50	5	86
240	Roberta Rd.	6	1210	1954	5	AC	15	254A	5	0	15	RS	10	LOCAL	5	14	10	Adequate	5	80.65	10	80
241	South Main St.	10	805	9998	10	AC	15	254A	5	0	15	CR	1	ARTERIAL	1	18	10	Superior	10	93.68	10	77
242	Elliot St.	6	861	1953	5	AC	15	251A	7	0	15	RS	10	LOCAL	5	2	10	Deficient	3	88.65	10	80
243	Henry St.	6	1292	1941	5	AC	15	251B	7	0	15	RS	10	LOCAL	5	6	10	Adequate	5	91.65	10	82
244	Pole Plain Rd.	6	197	1944	5	AC	15	251B	7	0	15	RS	10	LOCAL	5	8	10	Adequate	5	92.65	5	77
245	Grant Cir.	6	1220	1952	5	AC	15	251A	7	0	15	RS	10	LOCAL	5	7	10	Adequate	5	92.65	10	82
246	Pole Plain Rd.	6	930	1944	5	AC	15	251A	7	0	15	RS	10	LOCAL	5	8	10	Adequate	5	86.65	10	82
247	May St.	6	1140	1941	5	AC	15	251B	7	0	15	RS	10	LOCAL	5	3	10	Adequate	5	91.65	10	82
248	Pole Plain Rd.	6	496	1944	5	AC	15	251A	7	0	15	RS	10	LOCAL	5	21	10	Adequate	5	80.65	10	82
249	South Main St.	6	57	1889	1	CI	1	626B	5	0	15	RS	10	ARTERIAL	1	2	10	Deficient	3	84.59	10	56
250	South Main St.	6	433	1889	1	CI	1	626B	5	0	15	LC	6	ARTERIAL	1	1	10	Deficient	3	92.68	10	52
251	Berkshire Ave.	6	286	1951	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	1	10	Deficient	3	93.65	10	64
252	Berkshire Ave.	6	300	1951	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	3	10	Deficient	3	92.65	10	64
253	Berkshire Ave.	6	282	1951	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	5	10	Deficient	3	91.65	10	64
254	Berkshire Ave.	6	285	1951	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	7	10	Adequate	5	91.65	10	66
255	Berkshire Ave.	6	299	1951	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	9	10	Adequate	5	92.65	10	66
256	Berkshire Ave.	6	697	1951	5	AC	15	251B	7	Yes	1	RS	10	LOCAL	5	2	10	Deficient	3	89.65	10	66
257	Farnhum Rd.	10	160	1955	5	AC	15	254A	5	0	15	RS	10	LOCAL	5	270	5	Superior	10	62.65	10	80
258	South Main St.	10	958	9998	10	AC	15	626B	5	0	15	LC	6	ARTERIAL	1	83	8	Superior	10	93.68	10	80
259	South Main St.	10	530	9998	10	AC	15	626B	5	0	15	LC	6	ARTERIAL	1	126	8	Superior	10	92.68	10	80
260	Hampshire Ave	6	365	1952	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	41	10	Adequate	5	92.65	5	75
261	Hampshire Ave	6	300	1952	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	38	10	Adequate	5	92.65	10	66
262	Hampshire Ave	6	293	1952	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	22	10	Adequate	5	93.65	10	66
263	Hampshire Ave	6	285	1952	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	19	10	Adequate	5	93.65	10	66
264	West St.	6	1113	1953	5	AC	15	251A	7	Yes	1	RS	10	LOCAL	5	0	10	Deficient	3	91.65	10	66
265	Farnhum Rd.	10	1044	1955	5	AC	15	654	6	0	15	RS	10	LOCAL	5	281	5	Superior	10	62.65	10	81
266	Farnhum Rd.	10	588	1955	5	AC	15	253D	3	0	15	RS	10	LOCAL	5	273	5	Superior	10	62.65	10	78
267	West St.	6	1046	1953	5	AC	15	251A	7	Yes	1	RS	10	LOCAL	5	3	10	Deficient	3	91.65	10	66
268	Beach St.	6	1942	1886	1	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	7	10	Deficient	3	92.59	10	56
269	Beach St.	6	314	1886	1	CI	1	260B	5	0	15	RS	10	ARTERIAL	1	4	10	Deficient	3	92.59	10	56
270	East St.	6	109	1892	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	20	10	Deficient	3	78.60	10	56
271	East St.	6	921	1892	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	21	10	Deficient	3	89.60	10	56
272	Massapoag Ave.	6	500	1897	1	CI	1	223B	5	0	15	RS	10	ARTERIAL	1	21	10	Deficient	3	89.52	10	56
273	Massapoag Lane	6	541	1952	5	AC	15	223B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	80.52	5	73
274	Massapoag Ave.	6	861	1897	1	CI	1	1	6	0	15	RS	10	ARTERIAL	1	26	10	Deficient	3	89.52	10	57
275	Massapoag Ave.	6	478	1897	1	CI	1	223B	5	0	15	RS	10	ARTERIAL	1	29	10	Adequate	5	91.52	10	58
276	Franklin Rd.	6	582	1955	5	AC	15	223B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	92.52	10	78
277	Bay Rd.	12	56	1929	3	AC	15	254B	5	0	15	RS	10	LOCAL	5	906	1	Superior	10	92.58	10	74
278	Deerfield Rd.	8	56	1959	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	232	5	Superior	10	92.58	10	80
279	Bishop Rd	8	1052	1971	6	AC	15	424C	5	0	15	RS	10	LOCAL	5	451	3	Adequate	5	77.57	10	74
280	Deerfield Rd.	6	2010	1954	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	83	8	Adequate	5	92.58	10	78
281	Bay Rd.	12	588	1929	3	AC	15	245B	6	0	15	RS	10	ARTERIAL	1	307	5	Superior	10	91.60	10	75
282	Bay Rd.	12	309	1929	3	AC	15	626B	5	0	15	RS	10	ARTERIAL	1	547	1	Superior	10	92.60	10	70
283	Bay Rd.	12	349	1929	3	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	987	1	Superior	10	88.60	10	70
284	Bay Rd.	12	419	1929	3	AC	15	626B	5	0	15	RS	10	ARTERIAL	1	772	1	Superior	10	88.60	10	70
285	Williams Rd.	8	330	1971	6	DI	20	626B	5	0	15	RS	10	LOCAL	5	208	5	Adequate	5	74.57	10	81
286	Williams Rd.	8	260	1971	6	DI	20	626B	5	0	15	RS	10	LOCAL	5	425	3	Adequate	5	81.57	5	74
287	Williams Rd.	8	539	1969	6	AC	15	104C	5	0	15	RS	10	LOCAL	5	694	1	Adequate	5	80.57	5	67
288	Margaret Rd.	6	1594	1953	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	220	5	Adequate	5	87.57	10	75
289	Leonard Rd.	6	1530	1953	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	236	5	Adequate	5	93.57	10	75
290	Bay Rd.	12	498	1929	3	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	193	8	Superior	10	92.60	10	77
291	Bay Rd.	12	1114	1929	3	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	212	5	Superior	10	92.60	10	74
292	Lincoln Rd.	8	848	1967	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	8	10	Adequate	5	92.49	10	82

293	West Ridge Dr.	8	517	1967	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	4	10	Adequate	5	93.49	10	82
294	Madison Ave.	6	1266	1960	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	47	10	Adequate	5	92.49	10	81
295	Madison Ave.	6	574	1960	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	47	10	Adequate	5	93.49	10	81
296	East St.	8	944	1942	5	AC	15	254C	5	0	15	RS	10	ARTERIAL	1	115	8	Adequate	5	92.60	10	74
297	East St.	8	635	1942	5	AC	15	254B	5	Yes	1	RS	10	ARTERIAL	1	106	8	Adequate	5	92.60	10	60
298	Jefferson Ave.	6	1378	1960	6	AC	15	254B	5	Yes	1	RS	10	LOCAL	5	5	10	Adequate	5	93.49	10	67
299	Bay Rd.	12	766	1929	3	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	119	8	Superior	10	88.60	10	77
300	Bay Rd.	12	753	1929	3	AC	15	626B	5	0	15	RS	10	ARTERIAL	1	150	8	Superior	10	93.60	10	77
301	Lincoln Rd.	6	1366	1961	6	AC	15	626B	5	0	15	RS	10	LOCAL	5	35	10	Adequate	5	93.49	10	81
302	East St.	8	335	1942	5	AC	15	253D	3	Yes	1	RS	10	ARTERIAL	1	58	8	Adequate	5	50.60	2	50
303	Hampton Rd.	12	199	1963	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	131	8	Superior	10	73.57	10	84
304	Hampton Rd.	12	296	1963	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	135	8	Superior	10	91.57	10	84
305	Lyndon Rd.	6	1720	1953	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	30	10	Adequate	5	86.58	10	80
306	Whilshire	6	2209	1956	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	47	10	Adequate	5	89.58	10	80
307	Hampton Rd.	6	347	1955	5	AC	15	626B	5	0	15	CR	1	LOCAL	5	133	8	Adequate	5	90.57	10	69
308	Lyndon Rd.	6	1482	1953	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	6	10	Adequate	5	84.58	10	80
309	Lyndon Rd.	6	627	1953	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	26	10	Adequate	5	84.58	10	80
310	Hampton Rd.	6	269	1955	5	AC	15	254B	5	0	15	CR	1	LOCAL	5	130	8	Adequate	5	73.57	10	69
311	Whilshire	6	230	1956	5	AC	15	626B	5	0	15	CR	1	LOCAL	5	176	8	Adequate	5	87.58	10	69
312	Whilshire	6	1159	1956	5	AC	15	626B	5	0	15	CR	1	LOCAL	5	57	8	Adequate	5	92.58	10	69
313	Whilshire	8	969	1966	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	27	10	Adequate	5	89.58	10	82
314	South Main St.	6	706	1956	5	AC	15	602	6	0	15	RS	10	ARTERIAL	1	3	10	Deficient	3	93.68	5	70
315	East Chestnut	6	315	1889	1	CI	1	602	6	0	15	RS	10	LOCAL	5	0	10	Adequate	5	90.60	10	63
316	East Chestnut	6	419	1889	1	CI	1	305B	5	0	15	RS	10	LOCAL	5	10	10	Deficient	3	91.60	10	60
317	Bradford Ave.	6	562	1894	1	CI	1	305B	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	93.59	10	62
318	Woodland	6	116	1889	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	8	10	Adequate	5	93.59	10	62
319	Robin Rd.	6	1149	1959	5	AC	15	312B	5	0	15	RS	10	LOCAL	5	13	10	Adequate	5	86.59	10	80
320	Woodland	6	534	1889	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	93.59	10	58
321	Woodland	6	133	1889	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	93.59	10	60
322	Pond St.	8	481	1891	1	CI	1	623C	5	0	15	RS	10	ARTERIAL	1	19	10	Adequate	5	50.60	2	50
323	Pond St.	8	263	1891	1	CI	1	305B	5	0	15	RS	10	ARTERIAL	1	15	10	Adequate	5	70.60	2	50
324	Goodrich Pl.	6	394	1929	3	CI	1	623C	5	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	150.00	10	60
325	Cottage St.	8	94	1887	1	CI	1	623C	5	0	15	CR	1	LOCAL	5	9	10	Adequate	5	91.59	10	53
326	Glenview Rd.	6	331	1959	5	AC	15	623C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	70.59	10	80
327	Bradford Ave.	6	346	1894	1	CI	1	305B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	91.59	10	60
328	Bradford Ave.	6	693	1894	1	CI	1	305B	5	0	15	RS	10	LOCAL	5	7	10	Deficient	3	93.59	10	60
329	Aldan St.	6	206	1956	5	AC	15	305B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	82.59	10	78
330	South Main St.	8	291	1885	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	19	10	Adequate	5	93.68	5	53
331	Pleasant Park Rd.	6	471	1954	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	8	10	Adequate	5	91.65	10	80
332	Pleasant Park Rd.	6	746	1954	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	3	10	Deficient	3	92.65	10	78
333	Pleasant Park Cir.	6	324	1965	6	CICL	17	254B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	84.65	10	83
334	Upland Rd.	10	180	1936	3	CICL	17	260B	5	0	15	RS	10	ARTERIAL	1	47	10	Superior	10	93.67	10	81
335	Moosehill Pkwy.	10	2483	1929	3	CI	1	253D	3	0	15	RS	10	LOCAL	5	19	10	Adequate	5	89.67	10	62
336	Upland Rd.	16	175	1936	3	CICL	17	260B	5	0	15	RS	10	ARTERIAL	1	9	10	Superior	10	93.67	10	81
337	Upland Rd.	16	891	1936	3	CICL	17	254A	5	0	15	RS	10	ARTERIAL	1	11	10	Superior	10	90.67	10	81
338	Tree Lane	6	87	1939	3	CICL	17	260B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	93.67	5	75
339	Norwood St.	6	501	1910	2	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	15	10	Deficient	3	92.67	5	52
340	Upland Rd.	6	737	1888	1	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	24	10	Deficient	3	90.67	10	56
341	Upland Rd.	6	992	1888	1	CI	1	253D	3	0	15	RS	10	LOCAL	5	8	10	Deficient	3	92.67	10	58
342	Dehart Ave.	6	1417	1953	5	AC	15	305D	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	92.65	10	78
343	Norwood St.	6	274	1910	2	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	10	10	Deficient	3	93.67	5	52
344	Norwood St.	6	892	1910	2	CI	1	253D	3	0	15	RS	10	ARTERIAL	1	2	10	Adequate	5	92.67	5	52
345	Norwood St.	6	545	1910	2	CI	1	300B	3	0	15	RS	10	ARTERIAL	1	3	10	Adequate	5	93.64	10	57
346	Norwood St.	6	578	1910	2	CI	1	300B	3	0	15	RS	10	ARTERIAL	1	0	10	Deficient	3	92.64	10	55
347	Norwood St.	6	1175	1910	2	CI	1	300B	3	0	15	RS	10	ARTERIAL	1	0	10	Severely Deficient	1	93.64	10	53
348	Norwood St.	6	1239	1910	2	CI	1	307D	5	0	15	RS	10	ARTERIAL	1	3	10	Deficient	3	86.64	5	52
349	Norwood St.	6	2037	1910	2	CI	1	420D	5	0	15	RS	10	ARTERIAL	1	41	10	Adequate	5	80.64	5	54
350	Bullard St.	6	1263	1925	3	CI	1	420D	5	0	15	RS	10	LOCAL	5	40	10	Adequate	5	64.64	10	64
351	Norwood St.	6	1021	1910	2	CI	1	300B	3	0	15	RS	10	ARTERIAL	1	1	10	Adequate	5	85.64	5	52
352	Cedrus St.	6	690	1950	5	AC	15	260B	5	0	15	RS	10	LOCAL	5	4	10	Deficient	3	92.64	10	78

353	Maskwonicut St.	6	727	1913	2	CI	1	422C	5	0	15	RS	10	LOCAL	5	6	10	Deficient	3	89.64	10	61
354	North Main St.	12	37	1979	6	DI	20	422C	5	0	15	RS	10	ARTERIAL	1	10	10	Superior	10	93.68	5	82
355	Richards Ave	12	168	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	37	10	Superior	10	87.64	5	91
356	Richards Ave	12	131	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	40	10	Superior	10	87.64	10	96
357	North Main St.	6	650	1885	1	CI	1	310B	5	0	15	CR	1	ARTERIAL	1	3	10	Deficient	3	91.68	5	42
358	North Main St.	6	78	1885	1	CI	1	310B	5	0	15	CR	1	ARTERIAL	1	26	10	Deficient	3	92.68	5	42
359	North Main St.	6	138	1885	1	CI	1	310B	5	0	15	CR	1	ARTERIAL	1	7	10	Adequate	5	92.68	5	44
360	Rhodes Ave.	6	220	1950	5	AC	15	310B	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	79.64	10	80
361	North Main St.	6	1068	1885	1	CI	1	310B	5	0	15	CR	1	ARTERIAL	1	2	10	Adequate	5	93.68	5	44
362	North Main St.	6	2527	1885	1	CI	1	420B	5	0	15	RS	10	ARTERIAL	1	9	10	Adequate	5	85.68	5	53
363	North Main St.	6	859	1885	1	CI	1	420B	5	0	15	RS	10	ARTERIAL	1	4	10	Adequate	5	92.68	5	53
364	North Main St.	6	1926	1885	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	8	10	Adequate	5	92.68	5	53
365	North Main St.	12	889	1979	6	DI	20	420B	5	0	15	RS	10	ARTERIAL	1	14	10	Adequate	5	92.68	5	77
366	North Main St.	12	2553	1979	6	DI	20	10	5	0	15	RS	10	ARTERIAL	1	133	8	Superior	10	85.68	5	80
367	Belcher St.	6	1176	1949	5	AC	15	420B	5	Yes	1	RS	10	LOCAL	5	4	10	Deficient	3	72.58	10	64
368	Belcher St.	6	535	1949	5	AC	15	420C	5	0	15	RS	10	LOCAL	5	0	10	Deficient	3	89.58	10	78
369	Billings St.	12	1805	9999	10	DI	20	312B	5	0	15	RS	10	LOCAL	5	227	5	Superior	10	86.60	10	90
370	Billings St.	8	2217	1942	5	AC	15	253D	3	Yes	1	RS	10	LOCAL	5	230	5	Superior	10	86.60	10	64
371	Lothrup Way	8	390	1992	8	DI	20	245C	6	0	15	RS	10	LOCAL	5	2	10	Deficient	3	84.58	5	82
372	Knife Shop Lane	8	668	9999	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	91.58	5	83
373	Bullard St.	8	1279	1959	5	AC	15	422D	5	0	15	RS	10	LOCAL	5	42	10	Adequate	5	64.64	10	80
374	Walter Griffen Rd.	8	355	1996	8	DI	20	422C	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	150.00	10	86
375	Baldhill Rd.	8	595	9999	10	DI	20	422C	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	150.00	10	88
376	Walter Griffen Rd.	8	125	1996	8	DI	20	422C	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	150.00	10	86
377	Cobbler Ln.	8	486	9999	10	DI	20	626B	5	0	15	RS	10	LOCAL	5	3	10	Deficient	3	85.64	5	83
378	Fales Rd.	8	655	1997	8	DI	20	420D	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	89.64	5	81
379	Cobbler Ln.	8	183	9999	10	DI	20	420D	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	89.64	5	83
380	Beaver Brook Rd.	8	705	1964	6	CICL	17	300B	3	0	15	RS	10	LOCAL	5	16	10	Adequate	5	89.64	10	81
381	Pheasant Wood Rd.	8	1076	1970	6	CICL	17	300B	3	0	15	RS	10	LOCAL	5	4	10	Adequate	5	85.64	10	81
382	Pheasant Wood Rd.	8	441	1970	6	CICL	17	315B	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	85.64	10	83
383	Blueberry Ln.	8	429	1976	6	DI	20	315B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	86.64	10	86
384	Pheasant Wood Rd.	8	349	1970	6	CICL	17	260B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	91.64	10	83
385	Huckleberry Lane	8	458	9997	10	CICL	17	315B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	84.64	10	85
386	Edge Hill Rd.	12	241	1949	5	DI	20	31A	5	0	15	RS	10	ARTERIAL	1	16	10	Superior	10	93.64	10	86
387	Edge Hill Rd.	12	3335	1949	5	DI	20	71B	5	0	15	RS	10	LOCAL	5	24	10	Adequate	5	81.64	10	85
388	Edge Hill Rd.	12	2967	2004	10	DI	20	103D	5	0	15	RS	10	ARTERIAL	1	11	10	Superior	10	93.64	10	91
389	Tiot St.	12	1278	2004	10	DI	20	260B	5	0	15	RS	10	LOCAL	5	1	10	Superior	10	23.64	10	95
390	Apple Valley Dr.	12	377	9999	10	DI	20	104C	5	0	15	RS	10	LOCAL	5	37	10	Adequate	5	150.00	10	90
391	Apple Valley Dr.	12	118	9999	10	DI	20	104C	5	0	15	RS	10	LOCAL	5	25	10	Adequate	5	150.00	10	90
392	Apple Valley Dr.	12	582	9999	10	DI	20	422D	5	0	15	RS	10	LOCAL	5	55	8	Adequate	5	150.00	10	88
393	Baldwin Dr.	8	645	9999	10	DI	20	104C	5	0	15	RS	10	LOCAL	5	12	10	Adequate	5	150.00	10	90
394	Baldwin Dr.	8	667	9999	10	DI	20	420C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	150.00	10	90
395	Courtland Dr.	8	324	9999	10	DI	20	420C	5	0	15	RS	10	LOCAL	5	7	10	Adequate	5	150.00	10	90
396	Courtland Dr.	8	173	9999	10	DI	20	104C	5	0	15	RS	10	LOCAL	5	11	10	Adequate	5	150.00	10	90
397	Orchard Hill	8	1505	9999	10	DI	20	420B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	150.00	10	90
398	High Plain St.	8	180	1948	5	AC	15	300B	3	0	15	RS	10	LOCAL	5	30	10	Adequate	5	93.64	10	78
399	Rhodes Ave.	6	660	1950	5	AC	15	422B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	79.64	10	80
400	Maskwonicut St.	8	1069	1913	2	CI	1	51	1	0	15	RS	10	LOCAL	5	49	10	Adequate	5	86.64	10	59
401	Maskwonicut St.	8	1738	1948	5	AC	15	245C	6	0	15	RS	10	LOCAL	5	2	10	Adequate	5	73.64	10	81
402	Greewood Rd.	8	582	1967	6	AC	15	310B	5	0	15	RS	10	LOCAL	5	9	10	Adequate	5	92.64	10	81
403	Indian Lane	8	587	1969	6	AC	15	626B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	84.64	10	81
404	Greewood Rd.	8	641	1967	6	AC	15	623C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	86.64	10	81
405	Maskwonicut St.	8	429	1948	5	AC	15	310B	5	0	15	RS	10	LOCAL	5	15	10	Adequate	5	72.64	10	80
406	Lantern Lane	8	558	1962	6	CICL	17	310B	5	0	15	RS	10	LOCAL	5	19	10	Adequate	5	57.58	2	75
407	Lantern Lane	8	1072	1962	6	CICL	17	305B	5	0	15	RS	10	LOCAL	5	6	10	Adequate	5	80.58	5	78
408	Pondview Cir.	8	168	9997	10	CICL	17	422D	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	80.58	5	82
409	Pondview Cir.	8	572	9997	10	CICL	17	422D	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	82.58	5	82
410	Fisher Rd.	8	577	1966	6	CICL	17	103C	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	65.58	2	75
411	Gaines Rd.	8	537	1964	6	CICL	17	103C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	61.58	2	75
412	Cheryle Dr.	8	440	1965	6	DI	20	103C	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	77.58	5	81

413	Pondview Cir.	8	653	9997	10	CICL	17	422B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	81.58	5	82
414	Pondview Cir.	8	379	9997	10	CICL	17	103C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	65.58	2	79
415	Cheryle Dr.	8	508	1965	6	DI	20	422C	5	0	15	RS	10	LOCAL	5	6	10	Superior	10	71.58	2	83
416	Gaines Rd.	8	463	1964	6	CICL	17	305B	5	0	15	RS	10	LOCAL	5	8	10	Adequate	5	80.58	5	78
417	Richards Ave.	8	2259	1954	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	44	10	Adequate	5	87.64	10	80
418	Saw Mill Pond Rd.	8	1104	1987	8	DI	20	653	6	0	15	RS	10	LOCAL	5	2	10	Adequate	5	150.00	10	89
419	Hixson Farm Rd.	8	545	9999	10	DI	20	654	6	0	15	RS	10	LOCAL	5	0	10	Adequate	5	150.00	10	91
420	Nasir Ahmao Rd.	8	749	1991	8	DI	20	420B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	88.58	10	88
421	Bayberry Dr.	8	704	9998	10	AC	15	654	6	0	15	RS	10	LOCAL	5	80	8	Adequate	5	150.00	10	84
422	Bayberry Dr.	8	1257	9998	10	AC	15	654	6	0	15	RS	10	LOCAL	5	39	10	Adequate	5	150.00	10	86
423	Bay Rd.	6	778	1929	3	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	15	10	Adequate	5	84.60	10	60
424	Bay Rd.	6	827	1929	3	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	31	10	Adequate	5	87.60	10	60
425	Bayberry Dr.	8	433	9998	10	AC	15	654	6	0	15	RS	10	LOCAL	5	22	10	Adequate	5	150.00	10	86
426	Apple Valley Dr.	8	232	9999	10	DI	20	104C	5	0	15	RS	10	LOCAL	5	7	10	Adequate	5	150.00	10	90
427	Depot St.	6	31	1885	1	CI	1	245C	6	0	15	DC	3	ARTERIAL	1	8	10	Deficient	3	93.65	5	45
428	Pleasant St.	8	297	1885	1	CI	1	245C	6	0	15	RS	10	LOCAL	5	6	10	Deficient	3	92.65	5	56
429	North Main St.	12	1326	1979	6	DI	20	310B	5	0	15	CR	1	ARTERIAL	1	178	8	Superior	10	93.68	5	71
430	School St.	8	465	1910	2	CI	1	623C	5	0	15	RS	10	LOCAL	5	7	10	Deficient	3	91.65	10	61
431	North Main St.	8	349	1886	1	CI	1	623C	5	0	15	RS	10	ARTERIAL	1	21	10	Adequate	5	93.68	5	53
432	North Main St.	8	479	1886	1	CI	1	310B	5	0	15	RS	10	ARTERIAL	1	32	10	Adequate	5	93.68	5	53
433	North Main St.	8	780	1886	1	CI	1	310B	5	0	15	RS	10	ARTERIAL	1	10	10	Adequate	5	93.68	5	53
434	Crest Rd.	6	18	1909	2	CI	1	310B	5	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	90.64	10	59
435	Crest Rd.	6	353	1909	2	CI	1	310B	5	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	90.64	10	59
436	Ashcroft Rd.	8	1724	9999	10	DI	20	305B	5	0	15	RS	10	LOCAL	5	3	10	Severely Deficient	1	150.00	10	86
437	North Main St.	12	403	1979	6	DI	20	623C	5	0	15	RS	10	ARTERIAL	1	292	5	Superior	10	93.68	5	77
438	South Main St.	12	36	1979	6	DI	20	602	6	0	15	DC	3	ARTERIAL	1	303	5	Superior	10	93.68	5	71
439	Billings St.	8	785	1885	1	CI	1	623C	5	0	15	DC	3	LOCAL	5	18	10	Adequate	5	89.60	10	55
440	Stone St.	6	197	1915	2	CI	1	623C	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	93.60	5	56
441	Glen Dale Rd.	6	530	1893	1	CI	1	310B	5	0	15	RS	10	LOCAL	5	11	10	Deficient	3	88.64	10	60
442	Glen Dale Rd.	6	715	1893	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	20	10	Deficient	3	73.64	10	60
443	Highland St.	6	647	1885	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	7	10	Deficient	3	81.64	10	60
444	Highland St.	6	631	1885	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	150.00	10	58
445	High St.	6	775	1889	1	CI	1	623C	5	0	15	DC	3	LOCAL	5	5	10	Adequate	5	66.60	10	55
446	High St.	6	258	1950	5	AC	15	623C	5	0	15	RS	10	LOCAL	5	6	10	Deficient	3	66.60	10	78
447	Billings St.	6	1132	1909	2	CI	1	312B	5	0	15	RS	10	LOCAL	5	10	10	Adequate	5	86.60	10	63
448	Billings St.	12	654	9999	10	DI	20	623C	5	0	15	DC	3	LOCAL	5	242	5	Superior	10	89.60	10	83
449	Billings St.	12	430	9999	10	DI	20	623C	5	0	15	RS	10	LOCAL	5	217	5	Superior	10	91.60	10	90
450	Summit Ave.	6	355	1886	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	0	10	Deficient	3	93.60	10	60
451	Summit Ave.	6	31	1886	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	22	10	Deficient	3	93.60	5	55
452	Summit Ave.	8	33	1886	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	25	10	Adequate	5	93.60	5	57
453	Summit Ave.	8	483	1886	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	17	10	Adequate	5	92.60	10	62
454	Summit Ave.	6	450	1886	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	12	10	Deficient	3	91.60	10	60
455	Summit Ave.	6	382	1886	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	13	10	Deficient	3	90.60	10	60
456	South Main St.	8	350	1885	1	CI	1	602	6	0	15	RS	10	ARTERIAL	1	1	10	Deficient	3	93.68	5	52
457	South Main St.	8	60	1885	1	CI	1	602	6	0	15	RS	10	ARTERIAL	1	2	10	Deficient	3	93.68	5	52
458	Pond St.	8	1408	1891	1	CI	1	310B	5	0	15	CR	1	ARTERIAL	1	21	10	Adequate	5	71.60	2	41
459	Ames St.	8	1015	9998	10	AC	15	310B	5	0	15	CR	1	LOCAL	5	13	10	Adequate	5	92.60	10	76
460	Ames St.	8	329	9998	10	AC	15	312B	5	0	15	CR	1	LOCAL	5	30	10	Adequate	5	92.60	10	76
461	Ames St.	8	295	9998	10	AC	15	312B	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	89.60	10	85
462	Ames St.	8	989	9998	10	AC	15	312B	5	0	15	RS	10	LOCAL	5	11	10	Adequate	5	89.60	10	85
463	East St.	6	678	1892	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	31	10	Deficient	3	78.60	10	56
464	East St.	6	48	1892	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	35	10	Deficient	3	85.60	10	56
465	Fairway Ln.	8	301	1985	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	150.00	10	86
466	Abbot Ave.	8	704	1953	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	46	10	Adequate	5	91.58	10	80
467	Gannet Ter.	8	144	1953	5	AC	15	422B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	91.58	10	80
468	Carbrey Ave	8	1026	1953	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	37	10	Adequate	5	89.58	10	80
469	Gannet Ter.	8	703	1953	5	AC	15	422B	5	0	15	RS	10	LOCAL	5	42	10	Adequate	5	88.58	10	80
470	East St.	8	585	1942	5	AC	15	626B	5	Yes	1	RS	10	ARTERIAL	1	23	10	Adequate	5	50.60	2	54
471	East St.	8	1146	1942	5	AC	15	245C	6	Yes	1	RS	10	ARTERIAL	1	19	10	Adequate	5	68.60	2	55
472	East St.	8	20	1942	5	AC	15	253D	3	0	15	RS	10	LOCAL	5	21	10	Adequate	5	68.60	2	70

473	Johnson Rd.	8	877	1966	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	112	8	Adequate	5	92.57	10	80
474	Kennedy Rd.	8	2124	1968	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	118	8	Adequate	5	93.57	10	79
475	Birchwood cir.	8	571	1963	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	93.58	10	81
476	Deerfield Rd.	12	878	1962	6	AC	15	422B	5	0	15	RS	10	LOCAL	5	629	1	Superior	10	91.58	10	77
477	Deerfield Rd.	12	921	1962	6	AC	15	422B	5	0	15	RS	10	LOCAL	5	623	1	Superior	10	93.58	10	77
478	Kennedy Rd.	8	306	1968	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	1	10	Adequate	5	93.57	10	82
479	Whilshire	8	251	1966	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	54	8	Adequate	5	92.58	5	74
480	Peacock Hill	8	377	1967	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	85.57	10	79
481	Mallard Dr.	8	1252	1970	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	69	8	Adequate	5	70.49	2	72
482	Fox Hollow Ln.	8	559	1975	6	DI	20	245C	6	0	15	RS	10	LOCAL	5	1	10	Adequate	5	69.49	2	79
483	Mallard Dr.	8	680	1970	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	77	8	Adequate	5	74.49	2	71
484	Mallard Dr.	8	209	1970	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	73	8	Adequate	5	74.49	2	72
485	Manning Way	8	492	1995	8	DI	20	245C	6	0	15	RS	10	LOCAL	5	3	10	Adequate	5	90.49	5	84
486	Manning Way	8	244	1995	8	DI	20	245C	6	0	15	RS	10	LOCAL	5	1	10	Adequate	5	87.49	5	84
487	Manning Way	8	172	1995	8	DI	20	245C	6	0	15	RS	10	LOCAL	5	2	10	Adequate	5	89.49	5	84
488	Violet Cir.	8	734	1982	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	72.49	2	80
489	Lincoln Rd.	8	458	1967	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	2	10	Adequate	5	93.49	10	82
490	Partridge Hill	8	752	1972	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	108	8	Adequate	5	78.49	10	80
491	Partridge Hill	8	500	1972	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	117	8	Adequate	5	90.49	5	75
492	Sentry Hill	8	995	1979	6	DI	20	245C	6	0	15	RS	10	LOCAL	5	5	10	Adequate	5	78.49	5	82
493	Sentry Hill	8	610	1979	6	DI	20	245C	6	0	15	RS	10	LOCAL	5	1	10	Adequate	5	76.49	5	82
494	Old Bridge Lane	8	425	1987	8	DI	20	245C	6	0	15	RS	10	LOCAL	5	1	10	Adequate	5	89.49	5	84
495	West Ridge Dr.	8	293	1967	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	19	10	Adequate	5	92.49	10	82
496	West Ridge Dr.	8	980	1967	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	24	10	Adequate	5	88.49	10	82
497	Meadow Lark Lane	8	654	1983	8	DI	20	245C	6	0	15	RS	10	LOCAL	5	2	10	Adequate	5	77.49	5	84
498	Oak Hill Dr.	8	230	1973	6	AC	15	254B	5	Yes	1	RS	10	LOCAL	5	0	10	Adequate	5	86.58	10	67
499	Oak Hill Dr.	8	1252	1973	6	AC	15	254B	5	Yes	1	RS	10	LOCAL	5	1	10	Adequate	5	82.58	10	67
500	Spruce Way	8	297	1964	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	93.58	10	81
501	Williams Rd.	8	944	1969	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	98	8	Adequate	5	52.57	10	79
502	Eisenhower Dr.	8	793	1971	6	DI	20	424B	5	0	15	RS	10	LOCAL	5	104	8	Adequate	5	87.57	5	79
503	Williams Rd.	8	348	9999	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	100	8	Adequate	5	52.57	10	88
504	Kings Rd.	8	1274	1983	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	0	10	Deficient	3	90.57	5	81
505	Castle Dr.	8	1012	1981	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	9	10	Deficient	3	69.57	2	78
506	Castle Dr.	8	622	1981	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	5	10	Deficient	3	65.57	2	78
507	Kings Rd.	8	195	1983	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	0	10	Deficient	3	81.57	5	81
508	Knife Shop Lane	8	428	9999	10	DI	20	424C	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	80.57	5	83
509	Castle Dr.	8	520	1981	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	13	10	Adequate	5	87.57	5	83
510	Prince Way	8	901	1984	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	87.57	5	83
511	Oak Hill Dr.	8	383	1973	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	12	10	Adequate	5	54.58	10	86
512	Oak Hill Dr.	8	845	1973	6	DI	20	424B	5	Yes	1	RS	10	LOCAL	5	16	10	Adequate	5	76.58	10	72
513	Juniper Rd.	8	564	1985	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	92.57	5	83
514	Juniper Rd.	8	650	1985	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	75	8	Superior	10	84.57	5	86
515	Azelea Rd.	8	1296	1984	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	126	8	Superior	10	83.57	5	86
516	Hampton Rd.	12	492	1976	6	DI	20	424B	5	0	15	RS	10	LOCAL	5	22	10	Superior	10	80.57	5	86
517	Hampton Rd.	12	905	1976	6	DI	20	424B	5	0	15	RS	10	LOCAL	5	26	10	Superior	10	85.57	5	86
518	Dogwood Rd.	8	523	1984	8	DI	20	424D	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	81.49	5	83
519	Azelea Rd.	8	798	1984	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	80	8	Superior	10	83.57	5	86
520	Azelea Rd.	8	547	1984	8	DI	20	71B	5	0	15	RS	10	LOCAL	5	76	8	Superior	10	87.57	5	86
521	Forsynthia Cir.	8	521	1984	8	DI	20	245C	6	0	15	RS	10	LOCAL	5	2	10	Adequate	5	88.57	5	84
522	Aspen Rd.	8	1590	1984	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	315	5	Adequate	5	93.49	5	78
523	Magnolia Ave.	8	840	9999	10	DI	20	424B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	71.49	2	82
524	Magnolia Ave.	8	662	9999	10	DI	20	424B	5	0	15	RS	10	LOCAL	5	126	8	Adequate	5	84.49	5	83
525	Magnolia Ave.	8	801	9999	10	DI	20	424B	5	0	15	RS	10	LOCAL	5	129	8	Adequate	5	71.49	2	80
526	Michael Lane	8	197	9999	10	DI	20	424B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	71.49	2	82
527	Azelea Rd.	8	490	1984	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	203	5	Superior	10	88.57	5	83
528	Mountain St.	8	295	1953	5	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	109	8	Superior	10	73.52	2	71
529	Mountain St.	8	579	1953	5	AC	15	245B	6	0	15	RS	10	ARTERIAL	1	107	8	Superior	10	91.52	5	75
530	Tisdale Rd.	8	318	1992	8	DI	20	245B	6	0	15	RS	10	LOCAL	5	1	10	Adequate	5	88.52	5	84
531	Mountain St.	8	639	1953	5	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	97	8	Superior	10	73.52	2	71
532	Mountain St.	8	959	1953	5	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	20	10	Deficient	3	63.52	2	66

533	Mountain St.	8	669	1953	5	AC	15	654	6	0	15	CR	1	ARTERIAL	1	8	10	Deficient	3	90.52	10	66
534	Spring Lane	8	232	1964	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	11	10	Adequate	5	91.52	5	76
535	Tall Tree Lane	8	979	1965	6	AC	15	254C	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	85.52	5	76
536	Spring Lane	8	579	1964	6	AC	15	254C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	90.52	5	76
537	Spring Lane	8	623	1964	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	5	10	Adequate	5	90.52	5	76
538	Spring Lane	8	147	1964	6	AC	15	254C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	90.52	5	76
539	Tall Tree Lane	8	175	1965	6	AC	15	254C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	85.52	5	76
540	Mountain St.	12	1188	1974	6	DI	20	654	6	0	15	CR	1	ARTERIAL	1	220	5	Superior	10	90.52	10	74
541	Mountain St.	12	152	1974	6	DI	20	654	6	0	15	CR	1	ARTERIAL	1	220	5	Superior	10	90.52	10	74
542	Off Mountain Street	8	149	9998	10	AC	15	654	6	0	15	CR	1	LOCAL	5	0	10	Superior	10	150.00	10	82
543	Morse St.	10	1380	1945	5	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	136	8	Superior	10	90.52	10	79
544	Morse St.	10	498	1945	5	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	123	8	Superior	10	80.52	10	79
545	Long Meadow Lane	8	292	1968	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	9	10	Adequate	5	91.49	10	81
546	Old Farm Rd.	8	792	1968	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	86.49	10	81
547	Long Meadow Lane	8	444	1968	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	89.49	10	81
548	Long Meadow Lane	8	601	1968	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	82.49	10	81
549	Long Meadow Lane	8	73	1968	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	82.49	10	81
550	Long Meadow Lane	8	87	1968	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	89.49	5	76
551	Massapoag Ave.	8	1500	1949	5	AC	15	254C	5	Yes	1	RS	10	ARTERIAL	1	12	10	Deficient	3	85.52	5	55
552	Community Center Drive	6	24	99	1	CI	1	254C	5	0	15	RS	10	ARTERIAL	1	13	10	Deficient	3	85.52	10	56
553	Community Center Drive	6	237	9999	10	DI	20	223B	5	0	15	RS	10	LOCAL	5	0	10	Deficient	3	150.00	10	88
554	Arboro Dr.	12	1126	1969	6	AC	15	655	6	0	15	RS	10	LOCAL	5	195	8	Superior	10	88.52	5	80
555	Circle Way	8	413	1969	6	AC	15	245B	6	0	15	RS	10	LOCAL	5	2	10	Adequate	5	87.52	5	77
556	Tanglewood Rd.	8	878	1986	8	DI	20	104C	5	0	15	RS	10	LOCAL	5	30	10	Adequate	5	85.51	5	83
557	Briar Hill Rd.	8	167	9999	10	DI	20	104C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	91.51	5	85
558	Briar Hill Rd.	8	1139	9999	10	DI	20	104C	5	0	15	RS	10	LOCAL	5	23	10	Adequate	5	83.51	5	85
559	Thorny Lea Rd.	8	400	1989	8	DI	20	104C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	89.51	5	83
560	Horizons Rd.	8	2181	9999	10	DI	20	245C	6	0	15	RS	10	LOCAL	5	26	10	Adequate	5	87.51	5	86
561	Wadsworth Way	8	770	1996	8	DI	20	422D	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	89.51	5	83
562	Mansfield St.	12	670	1971	6	DI	20	245B	6	0	15	RS	10	LOCAL	5	40	10	Superior	10	93.51	10	92
563	Mansfield St.	12	918	1971	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	20	10	Superior	10	91.51	10	91
564	Howard Farm Rd.	8	734	1982	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	17	10	Superior	10	93.51	5	88
565	Mansfield St.	8	771	2007	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	18	10	Adequate	5	91.51	10	90
566	Mansfield St.	8	970	2007	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	15	10	Adequate	5	91.51	10	90
567	Howard Farm Rd.	8	1024	1982	8	DI	20	73A	5	0	15	RS	10	LOCAL	5	2	10	Superior	10	93.51	10	93
568	Knob Hill St.	8	1125	9999	10	DI	20	424D	5	0	15	RS	10	LOCAL	5	5	10	Adequate	5	93.51	5	85
569	Mattakesett Lane	8	552	1985	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	89.51	5	83
570	Knob Hill St.	8	1537	9999	10	DI	20	424C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	76.51	5	85
571	Mansfield St.	6	3096	1995	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	70.51	10	88
572	Massapoag Ave.	12	937	1982	8	DI	20	307B	5	0	15	RS	10	ARTERIAL	1	4	10	Adequate	5	93.52	10	84
573	Drake Cir.	8	665	1990	8	DI	20	307C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	72.51	2	80
574	Massapoag Ave.	12	266	1982	8	DI	20	73A	5	0	15	RS	10	ARTERIAL	1	28	10	Superior	10	30.52	10	89
575	Massapoag Ave.	12	1540	1982	8	DI	20	245B	6	0	15	RS	10	ARTERIAL	1	40	10	Superior	10	30.52	10	90
576	Massapoag Ave.	12	305	1982	8	DI	20	307B	5	0	15	RS	10	ARTERIAL	1	9	10	Adequate	5	93.52	10	84
577	Massapoag Ave.	12	1419	1982	8	DI	20	73A	5	0	15	RS	10	ARTERIAL	1	13	10	Superior	10	93.52	10	89
578	Cheshire Rd.	8	645	1983	8	DI	20	307B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	84.51	5	83
579	Cheshire Rd.	8	257	1983	8	DI	20	307B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	90.51	5	83
580	Willow St.	6	1019	1994	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	84.51	10	88
581	Massapoag Ave.	10	1001	1943	5	AC	15	424C	5	0	15	RS	10	ARTERIAL	1	109	8	Superior	10	61.52	2	71
582	Massapoag Ave.	10	1205	1943	5	AC	15	424B	5	0	15	RS	10	ARTERIAL	1	102	8	Superior	10	64.52	2	71
583	Gorwin Dr.	6	1108	1953	5	AC	15	103B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	91.52	10	78
584	Lakeview St.	10	2835	1954	5	AC	15	424C	5	0	15	RS	10	ARTERIAL	1	24	10	Superior	10	74.51	2	73
585	Lakeview St.	10	1322	1954	5	AC	15	254A	5	0	15	RS	10	LOCAL	5	28	10	Superior	10	79.51	5	80
586	King Philip	8	1159	1984	8	DI	20	51	1	0	15	RS	10	LOCAL	5	12	10	Adequate	5	77.49	5	79
587	King Philip	8	987	1984	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	5	10	Adequate	5	82.49	5	83
588	Cow Hill Rd.	8	579	1985	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	83.49	5	83
589	Cow Hill Rd.	8	999	1985	8	DI	20	424D	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	80.49	5	83
590	East Foxboro St.	12	395	1974	6	DI	20	254A	5	0	15	RS	10	ARTERIAL	1	59	8	Superior	10	92.49	10	85
591	East Foxboro St.	12	1311	1974	6	DI	20	254A	5	0	15	RS	10	ARTERIAL	1	51	8	Superior	10	91.49	10	85
592	Condor Rd.	8	954	1974	6	DI	20	302B	3	0	15	RS	10	LOCAL	5	13	10	Adequate	5	91.49	10	84

593	Raven Lane	8	561	1974	6	DI	20	302B	3	0	15	RS	10	LOCAL	5	2	10	Adequate	5	92.49	10	84
594	Owl Dr.	8	837	1972	6	DI	20	302B	3	0	15	RS	10	LOCAL	5	1	10	Adequate	5	92.49	10	84
595	Eagle Dr.	8	1630	1970	6	CICL	17	302B	3	0	15	RS	10	LOCAL	5	4	10	Adequate	5	91.49	10	81
596	Hawk Ln.	8	576	1972	6	DI	20	302B	3	0	15	RS	10	LOCAL	5	1	10	Adequate	5	91.49	10	84
597	East Foxboro St.	12	363	1974	6	DI	20	424B	5	0	15	RS	10	ARTERIAL	1	10	10	Adequate	5	92.51	10	82
598	East Foxboro St.	12	457	1974	6	DI	20	424B	5	0	15	RS	10	ARTERIAL	1	10	10	Adequate	5	91.51	10	82
599	Osprey Rd.	8	722	1972	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	6	10	Adequate	5	82.51	5	81
600	Falcon Rd.	8	1067	9999	10	DI	20	424C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	70.51	2	82
601	Prescott Rd.	8	620	1966	6	AC	15	424C	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	91.51	5	76
602	Prescott Rd.	8	1594	1966	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	9	10	Adequate	5	89.51	5	76
603	Wolomolopoag	12	1042	1974	6	DI	20	260B	5	0	15	RS	10	LOCAL	5	27	10	Superior	10	82.50	10	91
604	Wolomolopoag	12	2922	1974	6	DI	20	254A	5	0	15	RS	10	LOCAL	5	44	10	Superior	10	56.50	10	91
605	Furnace St.	12	579	1975	6	DI	20	260B	5	0	15	RS	10	LOCAL	5	126	8	Superior	10	93.50	10	89
606	Furnace St.	12	728	1975	6	DI	20	254A	5	0	15	RS	10	LOCAL	5	164	8	Superior	10	93.50	10	89
607	Gavins Pond Rd.	12	1505	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	58	8	Superior	10	79.50	5	89
608	Gavins Pond Rd.	12	263	9999	10	DI	20	424C	5	0	15	RS	10	LOCAL	5	264	5	Superior	10	79.50	5	85
609	Furnace St.	12	1687	1975	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	220	5	Superior	10	93.50	10	86
610	Furnace St.	12	374	1975	6	DI	20	254A	5	0	15	RS	10	LOCAL	5	137	8	Superior	10	93.50	10	89
611	Wolomolopoag	12	945	1974	6	DI	20	422D	5	0	15	RS	10	LOCAL	5	79	8	Superior	10	64.50	2	81
612	Wolomolopoag	12	272	1974	6	DI	20	254A	5	0	15	RS	10	LOCAL	5	75	8	Superior	10	64.50	2	81
613	Gavins Pond Rd.	12	354	9999	10	DI	20	253D	3	0	15	RS	10	LOCAL	5	42	10	Superior	10	85.50	5	88
614	Gavins Pond Rd.	12	322	9999	10	DI	20	253D	3	0	15	RS	10	LOCAL	5	44	10	Superior	10	85.50	5	88
615	Gavins Pond Rd.	12	589	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	46	10	Superior	10	86.50	5	91
616	Gavins Pond Rd.	12	478	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	49	10	Superior	10	87.50	5	91
617	Gavins Pond Rd.	12	917	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	33	10	Superior	10	65.50	2	88
618	Gavins Pond Rd.	12	449	9999	10	DI	20	424D	5	0	15	RS	10	LOCAL	5	33	10	Superior	10	82.50	5	90
619	Manomet Rd.	8	1348	1979	6	DI	20	104D	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	66.51	2	78
620	Nauset Rd.	8	719	1980	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	6	10	Adequate	5	150.00	10	88
621	Nauset Rd.	8	308	1980	8	DI	20	103D	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	150.00	10	88
622	Manomet Rd.	8	501	1979	6	DI	20	104C	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	89.51	5	81
623	Niantic Rd.	8	448	1985	8	DI	20	104C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	75.51	5	83
624	Niantic Rd.	8	238	1985	8	DI	20	104C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	76.51	5	83
625	Agawam Rd.	8	982	1978	6	DI	20	103D	5	0	15	RS	10	LOCAL	5	10	10	Adequate	5	63.50	2	78
626	Agawam Rd.	8	534	1978	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	14	10	Adequate	5	78.50	5	81
627	Chase Dr.	8	956	1978	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	16	10	Adequate	5	61.51	2	78
628	Pequot Cir.	8	298	1980	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	75.50	5	83
629	Chase Dr.	8	818	1978	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	33	10	Adequate	5	50.51	2	78
630	Old Wolomolopoag St.	8	1106	1978	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	28	10	Adequate	5	81.51	5	81
631	Well Access Way	12	487	9999	10	DI	20	254A	5	0	15	RS	10	LOCAL	5	0	10	Superior	10	150.00	10	95
632	Canoe River Rd.	8	1141	1984	8	DI	20	254A	5	0	15	RS	10	LOCAL	5	5	10	Adequate	5	74.49	2	80
633	Canoe River Rd.	8	1199	1984	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	80.49	5	83
634	Wampanoag Rd.	8	569	1984	8	DI	20	71B	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	72.49	2	80
635	King Philip	8	443	1984	8	DI	20	71B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	83.49	5	83
636	Condor Rd.	8	1100	1974	6	DI	20	71B	5	0	15	RS	10	LOCAL	5	5	10	Adequate	5	84.49	10	86
637	Owl Dr.	8	476	1972	6	DI	20	302B	3	0	15	RS	10	LOCAL	5	1	10	Adequate	5	92.49	10	84
638	Hawk Ln.	4	358	1980	8	DI	20	302C	3	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	93.49	10	82
639	Eagle Dr.	8	326	1970	6	CICL	17	302B	3	0	15	RS	10	LOCAL	5	1	10	Adequate	5	91.49	10	81
640	Well # 7 Access Way	8	323	9999	10	DI	20	245B	6	0	15	RS	10	LOCAL	5	323	5	Superior	10	150.00	10	91
641	Gavins Pond Rd.	8	406	1990	8	DI	20	253D	3	0	15	RS	10	LOCAL	5	43	10	Adequate	5	86.50	5	81
642	Grapeshot Rd.	8	635	1993	8	DI	20	424D	5	0	15	RS	10	LOCAL	5	17	10	Adequate	5	92.49	5	83
643	Cannon Ball Rd.	8	580	1991	8	DI	20	424D	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	88.49	5	83
644	Cannon Ball Rd.	8	1945	1991	8	DI	20	307B	5	0	15	RS	10	LOCAL	5	9	10	Adequate	5	89.49	5	83
645	Foundry Rd.	8	681	1993	8	DI	20	307B	5	0	15	RS	10	LOCAL	5	6	10	Adequate	5	88.49	5	83
646	Foundry Rd.	8	428	1993	8	DI	20	105D	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	92.49	5	83
647	Fire Brick Rd.	8	1435	1993	8	DI	20	307C	5	0	15	RS	10	LOCAL	5	8	10	Adequate	5	91.49	5	83
648	Foundry Rd.	8	364	1993	8	DI	20	307B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	88.49	5	83
649	Foundry Rd.	8	569	1993	8	DI	20	307C	5	0	15	RS	10	LOCAL	5	14	10	Adequate	5	91.49	5	83
650	Grapeshot Rd.	8	389	1993	8	DI	20	253D	3	0	15	RS	10	LOCAL	5	25	10	Adequate	5	90.49	5	81
651	Grapeshot Rd.	8	997	1993	8	DI	20	253D	3	0	15	RS	10	LOCAL	5	9	10	Adequate	5	82.49	5	81
652	Forge Rd.	8	1051	1993	8	DI	20	245B	6	0	15	RS	10	LOCAL	5	6	10	Adequate	5	83.49	5	84

653	Foundry Rd.	8	437	1993	8	DI	20	105D	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	86.49	5	83
654	Foundry Rd.	8	149	1993	8	DI	20	307C	5	0	15	RS	10	LOCAL	5	4	10	Adequate	5	86.49	5	83
655	Fairbanks Rd.	8	396	1992	8	DI	20	105D	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	91.49	5	83
656	Triphammer Rd.	8	371	1939	3	DI	20	105D	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	91.49	5	78
657	Forge Rd.	8	675	1993	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	89.49	5	83
658	Nathaniel Guild Rd.	8	618	9999	10	DI	20	254A	5	0	15	RS	10	LOCAL	5	28	10	Adequate	5	88.50	5	85
659	Mink Trap	8	1387	9999	10	DI	20	254A	5	0	15	RS	10	LOCAL	5	34	10	Adequate	5	90.50	5	85
660	Nathaniel Guild Rd.	8	549	9999	10	DI	20	254A	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	90.50	5	85
661	Foxfire Dr.	8	520	1975	6	DI	20	254B	5	0	15	RS	10	LOCAL	5	20	10	Superior	10	85.50	5	86
662	Foxfire Dr.	8	479	1975	6	DI	20	254B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	85.50	5	81
663	Foxfire Dr.	8	153	1975	6	DI	20	254B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	85.50	5	81
664	Samoset Lane	8	385	1976	6	DI	20	254B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	77.50	5	81
665	Barefoot Hill Rd.	8	1144	1975	6	DI	20	254B	5	0	15	RS	10	LOCAL	5	28	10	Superior	10	58.50	2	83
666	Barefoot Hill Rd.	8	714	1975	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	61.50	2	78
667	Weyman Lane	8	219	9999	10	DI	20	253D	3	0	15	RS	10	LOCAL	5	1	10	Adequate	5	150.00	10	88
668	Atherton Ln.	8	222	9999	10	DI	20	253D	3	0	15	RS	10	LOCAL	5	1	10	Adequate	5	150.00	10	88
669	Matross Lane	8	389	1993	8	DI	20	653	6	0	15	RS	10	LOCAL	5	1	10	Adequate	5	91.50	5	84
670	Tory Treasure Lane	8	416	1993	8	DI	20	424D	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	90.50	5	83
671	Old Post Rd.	8	301	1967	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	150.00	10	81
672	Bluff Rd.	6	534	1919	2	CI	1	251B	7	0	15	RS	10	LOCAL	5	2	10	Deficient	3	92.65	10	63
673	Bluff Rd.	6	1597	1919	2	CI	1	251B	7	0	15	RS	10	LOCAL	5	2	10	Deficient	3	90.65	10	63
674	Bluffhead Cir.	6	404	1949	5	AC	15	251B	7	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	150.00	10	78
675	Moose Hill St.	8	85	1945	5	AC	15	305B	5	0	15	RS	10	LOCAL	5	130	8	Deficient	3	57.67	10	76
676	Moose Hill St.	8	1702	1945	5	AC	15	305B	5	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	14.64	10	76
677	Oak Hill Dr.	8	492	1973	6	DI	20	317B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	78.57	10	86
678	Hickory Way	8	315	1973	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	93.58	10	86
679	Bay Rd.	12	530	1929	3	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	404	3	Superior	10	93.60	10	72
680	Gay Dr.	8	352	1972	6	DI	20	254B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	73.58	2	78
681	Farnhum Rd.	10	39	1955	5	AC	15	254A	5	0	15	RS	10	ARTERIAL	1	141	8	Superior	10	93.68	5	74
682	Clarke St.	10	25	1972	6	AC	15	254A	5	0	15	RS	10	ARTERIAL	1	94	8	Superior	10	80.59	10	80
683	Sandy Ridge Cir.	8	1189	1973	6	DI	20	654	6	0	15	RS	10	LOCAL	5	4	10	Adequate	5	69.65	2	79
684	Atlas Rd.	8	447	1968	6	AC	15	420B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	68.58	2	71
685	Bay Rd.	6	1338	1929	3	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	46	10	Adequate	5	88.60	10	60
686	Bay Rd.	8	1435	1929	3	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	38	10	Adequate	5	84.60	10	60
687	Lantern Lane	8	780	1962	6	CICL	17	254B	5	0	15	RS	10	LOCAL	5	4	10	Deficient	3	150.00	10	81
688	Edge Hill Rd.	12	111	1949	5	DI	20	255B	5	0	15	RS	10	LOCAL	5	4	10	Superior	10	68.64	10	90
689	Bay Rd.	6	49	1929	3	CI	1	602	6	0	15	RS	10	LOCAL	5	13	10	Adequate	5	92.68	5	60
690	Bay Rd.	6	48	1929	3	CI	1	602	6	0	15	RS	10	LOCAL	5	0	10	Adequate	5	92.68	5	60
691	East Foxboro St.	10	1604	1956	5	AC	15	424B	5	0	15	RS	10	ARTERIAL	1	9	10	Superior	10	86.51	10	81
692	East Foxboro St.	10	207	1956	5	AC	15	424B	5	0	15	RS	10	ARTERIAL	1	9	10	Adequate	5	91.51	10	76
693	Colburn Dr.	6	553	1962	6	AC	15	424C	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	90.51	5	76
694	Falcon Rd.	8	407	9999	10	DI	20	424C	5	0	15	RS	10	LOCAL	5	1	10	Superior	10	70.51	2	87
695	Osprey Rd.	8	169	1972	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	89.51	5	81
696	Pilgrim Dr.	8	454	1978	6	DI	20	302B	3	0	15	RS	10	LOCAL	5	5	10	Adequate	5	89.51	5	79
697	Pilgrim Dr.	8	297	1978	6	DI	20	302B	3	0	15	RS	10	LOCAL	5	2	10	Adequate	5	75.51	5	79
698	Pioneer Cir.	8	685	1978	6	DI	20	302B	3	0	15	RS	10	LOCAL	5	2	10	Adequate	5	75.51	5	79
699	Well # 5 Access Way	12	130	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	153	8	Superior	10	93.50	5	89
700	General Edwards HWY	12	703	1963	6	CICL	17	602	6	0	15	RS	10	LOCAL	5	11	10	Deficient	3	150.00	10	82
701	Merchant St.	8	765	1968	6	CICL	17	602	6	0	15	RS	10	LOCAL	5	2	10	Adequate	5	53.67	2	76
702	Pond St.	8	74	1891	1	CI	1	654	6	0	15	CR	1	ARTERIAL	1	21	10	Adequate	5	87.52	5	45
703	Blair Cir.	12	1367	1979	6	DI	20	420B	5	0	15	RS	10	LOCAL	5	23	10	Adequate	5	56.65	2	78
704	Blair Cir.	12	412	1979	6	DI	20	420B	5	0	15	RS	10	LOCAL	5	16	10	Adequate	5	68.65	2	78
705	Blair Cir.	8	226	1979	6	DI	20	420B	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	68.65	2	78
706	Plimpton Rd.	8	444	1978	6	DI	20	420B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	71.65	2	78
707	Courtland Dr.	8	263	9999	10	DI	20	104C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	150.00	10	90
708	Apple Valley Dr.	8	201	9999	10	DI	20	104C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	150.00	10	90
709	Apple Valley Dr.	8	168	9999	10	DI	20	104C	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	150.00	10	90
710	Apple Valley Dr.	8	177	9999	10	DI	20	422D	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	150.00	10	90
711	Pff Baldwin Drive	8	209	9999	10	DI	20	420C	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	150.00	10	90
712	Off Norwood Street	2	333	97	1	GAL	1	254A	5	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	150.00	10	58

713	Turner Mil Rd.	8	1216	1993	8	DI	20	653	6	0	15	RS	10	LOCAL	5	5	10	Adequate	5	86.50	5	84
714	Iron Hollow Rd.	8	856	1992	8	DI	20	653	6	0	15	RS	10	LOCAL	5	9	10	Adequate	5	86.50	5	84
715	Heather Way	8	1034	1984	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	19	10	Adequate	5	82.57	5	83
716	Sherwood Cir.	8	1200	1975	6	DI	20	254B	5	0	15	RS	10	LOCAL	5	15	10	Adequate	5	82.57	5	81
717	Glen Dale Rd.	6	1905	1893	1	CI	1	312B	5	0	15	RS	10	LOCAL	5	5	10	Deficient	3	64.64	10	60
718	Glenview Rd.	6	679	1959	5	AC	15	424C	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	73.64	10	78
719	East Foxboro St.	10	1237	1956	5	AC	15	52	1	0	15	RS	10	LOCAL	5	88	8	Superior	10	85.59	10	79
720	Garden St.	10	568	9998	10	AC	15	254A	5	0	15	RS	10	LOCAL	5	76	8	Superior	10	93.59	10	88
721	Garden Ct.	10	306	9998	10	AC	15	254A	5	0	15	RS	10	LOCAL	5	76	8	Superior	10	150.00	10	88
722	Clarke St.	10	1103	1972	6	AC	15	254A	5	0	15	RS	10	LOCAL	5	79	8	Superior	10	80.59	10	84
723	Francis Rd.	6	964	1953	5	AC	15	251A	7	Yes	1	RS	10	LOCAL	5	11	10	Deficient	3	92.65	10	66
724	Bruce Ave	6	334	1953	5	AC	15	251A	7	Yes	1	RS	10	LOCAL	5	7	10	Deficient	3	87.65	10	66
725	Park Rd.	6	490	1952	5	AC	15	312B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	89.59	10	80
726	Dunbar St.	6	933	1972	6	DI	20	305B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	90.59	10	86
727	Tree Lane	6	412	1939	3	CICL	17	253D	3	0	15	RS	10	LOCAL	5	1	10	Adequate	5	92.67	10	78
728	Pine Grove Ave.	6	633	1910	2	CI	1	254A	5	0	15	RS	10	LOCAL	5	3	10	Deficient	3	92.67	10	61
729	Blueberry Ln.	8	307	1976	6	DI	20	315B	5	0	15	RS	10	LOCAL	5	5	10	Adequate	5	86.64	10	86
730	Beaver Brook Rd.	8	897	1964	6	CICL	17	315B	5	0	15	RS	10	LOCAL	5	7	10	Adequate	5	92.64	10	83
731	Billings St.	8	790	1885	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	15	10	Adequate	5	91.60	10	62
732	Cottage St.	8	381	1887	1	CI	1	623C	5	0	15	CR	1	LOCAL	5	5	10	Adequate	5	85.59	10	53
733	South Main St.	6	64	1956	5	AC	15	602	6	0	15	DC	3	ARTERIAL	1	8	10	Adequate	5	93.68	5	65
734	Billings St.	4	802	1909	2	CI	1	623C	5	0	15	DC	3	LOCAL	5	1	10	Severely Deficient	1	89.60	10	52
735	Lois Lane	8	491	1978	6	DI	20	422B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	6.58	10	86
736	Horizons Rd.	8	1219	9999	10	DI	20	245C	6	0	15	RS	10	LOCAL	5	18	10	Adequate	5	86.51	5	86
737	Thorny Lea Rd.	8	830	1989	8	DI	20	424D	5	0	15	RS	10	LOCAL	5	19	10	Adequate	5	90.51	5	83
738	Tamworth Rd.	8	609	1983	8	DI	20	73A	5	0	15	RS	10	LOCAL	5	8	10	Adequate	5	90.51	5	83
739	Borderland Rd.	8	1496	1983	8	DI	20	307B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	86.51	5	83
740	Montaup Rd.	12	390	1978	6	DI	20	422C	5	0	15	RS	10	LOCAL	5	15	10	Adequate	5	69.65	2	78
741	Montaup Road	12	1452	9999	10	DI	20	253D	3	0	15	RS	10	LOCAL	5	13	10	Adequate	5	84.67	5	83
742	Commercial St.	12	1103	1968	6	CICL	17	653	6	0	15	RS	10	LOCAL	5	12	10	Adequate	5	92.67	10	84
743	Reeves Rd.	8	605	1992	8	DI	20	245C	6	0	15	RS	10	LOCAL	5	3	10	Adequate	5	87.50	5	84
744	Off Reeves Road	8	432	9999	10	DI	20	245C	6	0	15	RS	10	LOCAL	5	5	10	Adequate	5	150.00	10	91
745	Boyden Ln.	8	470	1991	8	DI	20	245C	6	0	15	RS	10	LOCAL	5	8	10	Adequate	5	85.50	5	84
746	Tolman St.	4	234	99	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	92.59	10	58
747	Stone St.	6	286	1915	2	CI	1	623C	5	0	15	RS	10	LOCAL	5	4	10	Deficient	3	92.60	10	61
750	South Main St.	6	879	1889	1	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	6	10	Superior	10	93.68	10	63
751	South Main St.	6	854	1889	1	CI	1	254A	5	0	15	CR	1	ARTERIAL	1	5	10	Superior	10	93.68	10	54
752	Moose Hill St.	6	158	1939	3	CICL	17	254A	5	0	15	RS	10	LOCAL	5	0	10	Superior	10	93.68	10	85
753	Upland Rd.	6	105	1936	3	CICL	17	245C	6	0	15	RS	10	LOCAL	5	36	10	Adequate	5	93.67	10	81
754	South Main St.	6	866	1889	1	CI	1	254A	5	0	15	CR	1	ARTERIAL	1	4	10	Superior	10	92.68	10	54
755	South Main St.	6	259	1889	1	CI	1	254A	5	0	15	CR	1	ARTERIAL	1	13	10	Superior	10	93.68	10	54
756	Walpole St.	6	1192	1919	2	CI	1	254A	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	90.67	5	58
757	General Edwards HWY	12	2262	1963	6	CICL	17	602	6	0	15	RS	10	LOCAL	5	7	10	Deficient	3	150.00	10	82
758	Old Post Rd.	12	2207	1962	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	7	10	Adequate	5	65.67	2	73
759	Old Post Rd.	12	227	1962	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	6	10	Adequate	5	12.67	1	73
760	Maskwonicut St.	6	713	1913	2	CI	1	253D	3	0	15	RS	10	LOCAL	5	3	10	Deficient	3	78.64	5	54
761	Dedham St.	12	1404	9999	10	DI	20	420B	5	0	15	RS	10	LOCAL	5	2	10	Superior	10	68.64	10	95
762	Dedham St.	12	441	9999	10	DI	20	255B	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	150.00	10	90
763	Orchard Hill	12	481	9999	10	DI	20	255B	5	0	15	RS	10	LOCAL	5	12	10	Adequate	5	150.00	10	90
764	Apple Valley Dr.	12	495	9999	10	DI	20	420C	5	0	15	RS	10	LOCAL	5	16	10	Adequate	5	150.00	10	90
765	Apple Valley Dr.	12	272	9999	10	DI	20	422D	5	0	15	RS	10	LOCAL	5	58	8	Adequate	5	150.00	10	88
766	Off Canton Street	12	874	9999	10	DI	20	253D	3	0	15	RS	10	LOCAL	5	61	8	Superior	10	150.00	10	91
767	Upland Rd.	10	98	1936	3	CICL	17	260B	5	0	15	RS	10	ARTERIAL	1	47	10	Superior	10	93.67	10	81
768	Moose Hill St.	10	57	1962	6	CICL	17	253D	3	0	15	RS	10	ARTERIAL	1	47	10	Superior	10	89.67	10	82
769	Pleasant St.	4	269	1885	1	CI	1	245C	6	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	92.65	5	54
770	Pleasant St.	4	493	1885	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	4	10	Severely Deficient	1	92.65	5	53
771	Pleasant St.	6	647	1950	5	AC	15	623C	5	0	15	RS	10	LOCAL	5	8	10	Deficient	3	92.65	10	78
772	Pleasant St.	6	497	1950	5	AC	15	623C	5	0	15	RS	10	LOCAL	5	3	10	Deficient	3	93.65	10	78
773	Pleasant St.	6	92	1950	5	AC	15	305D	5	0	15	RS	10	LOCAL	5	0	10	Deficient	3	93.65	10	78
774	Depot St.	6	475	1885	1	CI	1	602	6	0	15	DC	3	ARTERIAL	1	7	10	Deficient	3	93.67	5	45

775	Edgewood Rd.	6	230	99	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	4	10	Deficient	3	92.65	10	62
776	Edgewood Rd.	6	590	99	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	3	10	Deficient	3	93.65	10	62
777	Valley Rd.	4	150	1900	2	CI	1	251A	7	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	92.65	10	61
778	Valley Rd.	4	341	1900	2	CI	1	245C	6	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	92.65	10	60
779	Valley Rd.	4	362	1900	2	CI	1	245C	6	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	93.65	10	60
780	Oakland Rd.	4	244	1895	1	CI	1	253D	3	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	93.65	10	56
781	Pond St.	8	225	1891	1	CI	1	623C	5	0	15	RS	10	ARTERIAL	1	15	10	Adequate	5	67.60	2	50
782	Pond St.	8	799	1891	1	CI	1	312B	5	0	15	RS	10	ARTERIAL	1	9	10	Adequate	5	67.60	2	50
783	North Main St.	6	196	1885	1	CI	1	602	6	0	15	DC	3	ARTERIAL	1	8	10	Adequate	5	93.68	5	47
784	North Main St.	6	37	1885	1	CI	1	602	6	0	15	DC	3	ARTERIAL	1	12	10	Adequate	5	92.60	5	47
785	Pond St.	6	1052	1885	1	CI	1	602	6	0	15	DC	3	ARTERIAL	1	2	10	Severely Deficient	1	81.60	5	43
786	Pond St.	4	846	1885	1	CI	1	623C	5	0	15	RS	10	ARTERIAL	1	1	10	Severely Deficient	1	50.60	2	46
787	Pond St.	4	205	1885	1	CI	1	623C	5	0	15	RS	10	ARTERIAL	1	3	10	Severely Deficient	1	67.60	2	46
788	Tolman St.	4	688	1885	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	89.59	10	58
789	Manns Hill Rd.	8	810	1935	3	GAL	1	254B	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	93.58	10	64
790	Deborah Sampson St.	4	770	1899	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	11	10	Severely Deficient	1	87.58	10	58
791	Gannet Ter.	2	708	1953	5	GAL	1	422B	5	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	91.58	10	62
792	Whippoorwill Rd.	4	1080	9999	10	DI	20	245C	6	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	150.00	10	87
793	Leo Rd.	1	361	1952	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	0	10	Severely Deficient	1	92.65	10	62
794	Marbet Rd.	1	363	1953	5	Copper	15	626B	5	Yes	1	RS	10	LOCAL	5	0	10	Severely Deficient	1	93.65	10	62
795	Francis Rd.	1	364	98	1	Copper	15	626B	5	Yes	1	RS	10	LOCAL	5	0	10	Severely Deficient	1	92.65	10	58
796	Carlton Rd.	1	364	1952	5	Copper	15	626B	5	Yes	1	RS	10	LOCAL	5	0	10	Severely Deficient	1	92.65	10	62
797	Mont Fern Ave.	2	235	1941	5	Copper	15	626B	5	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	64.64	10	76
798	Station St.	6	67	1897	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	10	10	Deficient	3	93.65	10	62
799	Station St.	6	49	1897	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	10	10	Deficient	3	91.65	10	62
800	Station St.	6	427	1897	1	CI	1	251A	7	0	15	RS	10	LOCAL	5	12	10	Deficient	3	91.65	10	62
801	Depot St.	6	356	1885	1	CI	1	253D	3	0	15	RS	10	ARTERIAL	1	15	10	Deficient	3	91.67	5	49
802	Depot St.	6	269	1885	1	CI	1	245C	6	0	15	DC	3	ARTERIAL	1	14	10	Deficient	3	91.67	5	45
803	Depot St.	10	456	1885	1	CI	1	602	6	0	15	DC	3	ARTERIAL	1	60	8	Adequate	5	93.67	5	45
804	Depot St.	10	363	1885	1	CI	1	245C	6	0	15	DC	3	ARTERIAL	1	61	8	Adequate	5	91.67	5	45
805	Forest Rd.	2	599	1911	2	GAL	1	251A	7	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	93.65	10	61
806	Pleasant St.	2	327	1925	3	CI	1	251A	7	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	93.65	10	62
807	Hill Side Ave.	2	310	1969	6	GAL	1	253D	3	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	93.65	10	61
808	Grove St.	2	214	1911	2	GAL	1	623C	5	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	91.59	5	54
809	East St.	6	763	1892	1	CI	1	223B	5	0	15	RS	10	ARTERIAL	1	8	10	Severely Deficient	1	79.52	5	49
810	East St.	6	1403	1892	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	3	10	Severely Deficient	1	89.52	5	49
811	Bird Ln.	6	341	1981	8	DI	20	223B	5	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	55.52	2	76
812	Off Norwood Street	1	214	98	1	Copper	15	300B	3	0	15	RS	10	LOCAL	5	0	10	Severely Deficient	1	150.00	10	70
813	Arboro Dr.	12	145	1897	1	CI	1	223B	5	0	15	RS	10	ARTERIAL	1	127	8	Superior	10	91.52	5	56
814	Arboro Dr.	12	864	1969	6	AC	15	655	6	0	15	RS	10	LOCAL	5	187	8	Superior	10	90.52	5	80
815	Arboro Dr.	12	75	1969	6	AC	15	223B	5	0	15	RS	10	LOCAL	5	57	8	Superior	10	90.52	5	79
816	Mountain St.	6	582	1915	2	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	26	10	Deficient	3	91.52	10	57
817	Mountain St.	6	940	1915	2	CI	1	654	6	0	15	CR	1	ARTERIAL	1	7	10	Deficient	3	90.52	10	49
818	Arboro Dr.	12	52	1969	6	AC	15	654	6	0	15	RS	10	LOCAL	5	21	10	Superior	10	88.52	5	82
819	Brook Rd.	6	1365	1953	5	AC	15	312B	5	0	15	RS	10	LOCAL	5	20	10	Deficient	3	56.64	10	78
820	Brook Rd.	8	1294	1968	6	AC	15	307C	5	0	15	RS	10	LOCAL	5	14	10	Deficient	3	56.64	10	79
821	Mountain St.	8	251	1953	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	9	10	Adequate	5	70.52	10	80
822	Mountain St.	10	1300	1961	6	AC	15	422B	5	0	15	RS	10	LOCAL	5	6	10	Adequate	5	70.52	10	81
823	Morse St.	6	12	1914	2	CI	1	254A	5	0	15	RS	10	LOCAL	5	8	10	Deficient	3	52.52	10	61
824	Morse St.	6	1774	1914	2	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	7	10	Deficient	3	52.52	10	57
825	Lakeview St.	6	1271	1936	3	CICL	17	254A	5	0	15	RS	10	ARTERIAL	1	4	10	Adequate	5	74.51	2	68
826	Massapoag Ave.	12	899	1982	8	DI	20	245C	6	0	15	RS	10	ARTERIAL	1	82	8	Superior	10	63.52	10	88
827	Massapoag Ave.	12	1276	1982	8	DI	20	245C	6	0	15	RS	10	ARTERIAL	1	50	8	Superior	10	50.52	2	80
828	South Main St.	8	1131	1885	1	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	30	10	Adequate	5	93.68	5	53
829	South Main St.	8	298	1885	1	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	36	10	Adequate	5	93.68	5	53
830	Flintlock Rd.	8	603	1981	8	DI	20	654	6	0	15	RS	10	LOCAL	5	3	10	Adequate	5	35.65	10	89
831	South Main St.	8	767	1885	1	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	46	10	Adequate	5	77.68	5	53
832	South Main St.	8	218	1885	1	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	44	10	Adequate	5	93.68	5	53
833	Musket Lane	2	278	1981	8	Copper	15	254A	5	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	150.00	10	79
834	South Main St.	12	1046	9997	10	CICL	17	254B	5	0	15	RS	10	ARTERIAL	1	179	8	Superior	10	69.68	10	86

835	South Main St.	12	1262	9997	10	CICL	17	254A	5	0	15	RS	10	ARTERIAL	1	123	8	Superior	10	93.68	10	86
836	South Walpole St.	8	622	1998	8	DI	20	260B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	81.65	10	88
837	South Walpole St.	12	1845	1999	8	DI	20	420B	5	0	15	RS	10	LOCAL	5	28	10	Adequate	5	65.65	10	88
838	South Walpole St.	12	338	9996	10	PVC	20	253D	3	0	15	RS	10	LOCAL	5	29	10	Adequate	5	65.65	10	88
839	South Walpole St.	12	1451	1999	8	DI	20	253D	3	0	15	RS	10	LOCAL	5	31	10	Adequate	5	92.65	10	86
840	Massapoag Ave.	6	1905	1897	1	CI	1	223B	5	0	15	RS	10	ARTERIAL	1	15	10	Deficient	3	89.52	10	56
841	Massapoag Ave.	6	306	1897	1	CI	1	223B	5	0	15	RS	10	ARTERIAL	1	23	10	Deficient	3	87.52	10	56
842	Manor Lane	6	545	1990	8	DI	20	223B	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	150.00	10	86
843	Edge Hill Rd.	8	1345	1949	5	AC	15	71B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	85.64	5	75
844	Glen Hill Rd.	2	652	9996	10	PVC	20	71B	5	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	150.00	10	86
845	East Foxboro St.	10	40	1956	5	AC	15	422C	5	0	15	RS	10	ARTERIAL	1	28	10	Superior	10	85.59	5	76
846	East Foxboro St.	10	29	1956	5	AC	15	422C	5	0	15	RS	10	ARTERIAL	1	59	8	Superior	10	92.51	10	79
847	Hampton Rd.	12	1311	1976	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	167	8	Superior	10	78.57	5	84
848	Hampton Rd.	12	808	1976	6	DI	20	424B	5	0	15	RS	10	LOCAL	5	111	8	Superior	10	79.57	5	84
849	Aspen Rd.	8	363	1984	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	143	8	Superior	10	86.57	5	86
850	Aspen Rd.	8	705	1984	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	195	8	Adequate	5	82.49	5	81
851	High Plain St.	8	441	1948	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	3	10	Deficient	3	66.64	10	78
852	High Plain St.	8	838	1948	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	8	10	Adequate	5	36.64	10	80
853	High Plain St.	8	498	1948	5	AC	15	254B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	52.64	10	80
854	High Plain Cir.	8	881	1973	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	150.00	10	81
855	Bullard St.	6	951	1925	3	CI	1	260B	5	0	15	RS	10	LOCAL	5	32	10	Adequate	5	83.64	10	64
856	Bullard St.	6	427	1925	3	CI	1	626B	5	0	15	RS	10	LOCAL	5	35	10	Adequate	5	64.64	10	64
857	Hurley Lane	8	377	9999	10	DI	20	626B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	150.00	10	90
858	Hampshire Ave	6	290	1952	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	17	10	Adequate	5	92.65	10	66
859	James Rd.	6	360	1953	5	AC	15	626B	5	Yes	1	RS	10	LOCAL	5	15	10	Adequate	5	92.65	10	66
860	Old Post Rd.	8	1738	1967	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	37	10	Adequate	5	150.00	10	82
861	Old Post Rd.	8	1332	1967	6	AC	15	253D	3	0	15	RS	10	LOCAL	5	33	10	Adequate	5	88.67	5	74
862	Lynncrest Rd.	8	327	1970	6	AC	15	245C	6	0	15	RS	10	LOCAL	5	0	10	Adequate	5	88.67	5	77
863	Deborah Sampson St.	6	185	1937	3	CICL	17	254B	5	0	15	RS	10	LOCAL	5	0	10	Deficient	3	92.58	5	73
864	Manns Hill Cresent	6	21	1988	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	93.58	5	83
865	Manns Hill Cresent	8	883	1988	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	48.58	2	80
866	Mansfield St.	8	265	2007	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	11	10	Adequate	5	93.51	10	90
867	Mansfield St.	8	543	2007	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	19	10	Adequate	5	93.51	10	90
868	Mansfield St.	8	357	2007	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	15	10	Adequate	5	93.51	10	90
869	Mayflower Lane	8	695	1984	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	3	10	Adequate	5	150.00	10	88
870	Bay Rd.	12	378	1929	3	AC	15	253D	3	0	15	RS	10	ARTERIAL	1	409	3	Superior	10	91.60	5	65
871	Bay Rd.	12	693	1929	3	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	406	3	Superior	10	93.60	10	72
872	Mayflower Lane	8	809	9999	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	150.00	10	90
873	Castle Dr.	8	1539	1981	8	DI	20	424B	5	0	15	RS	10	LOCAL	5	7	10	Adequate	5	84.57	5	83
874	Castle Dr.	8	388	1981	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	91.57	5	83
875	Penny Brook Lane	8	417	9999	10	DI	20	302B	3	0	15	RS	10	LOCAL	5	2	10	Adequate	5	83.57	5	83
876	Red Fox Run	8	319	1998	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	150.00	10	88
877	Wolomolopoag	12	612	1974	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	97	8	Superior	10	67.50	2	81
878	Wolomolopoag	12	1783	1974	6	DI	20	424C	5	0	15	RS	10	LOCAL	5	90	8	Superior	10	67.50	2	81
879	Seminole Cir.	2	313	1979	6	Copper	15	424C	5	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	76.50	5	72
880	Station St.	6	44	1897	1	CI	1	602	6	0	15	RS	10	ARTERIAL	1	14	10	Deficient	3	93.68	5	52
881	Victoria Cir.	8	630	1983	8	DI	20	424D	5	0	15	RS	10	LOCAL	5	14	10	Adequate	5	93.51	10	88
882	Off Victoria Circle	8	587	9999	10	DI	20	424D	5	0	15	RS	10	LOCAL	5	12	10	Adequate	5	150.00	10	90
883	Tracey Lane	8	1230	1997	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	9	10	Adequate	5	90.51	5	83
884	Williams Rd.	6	197	1954	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	209	5	Adequate	5	74.57	10	75
885	Marcus Rd.	6	1608	1954	5	AC	15	626B	5	0	15	RS	10	LOCAL	5	212	5	Adequate	5	92.57	10	75
886	Aztec Way	8	1683	9999	10	DI	20	103C	5	0	15	RS	10	LOCAL	5	42	10	Adequate	5	91.50	5	85
887	Inca Trail	8	894	9999	10	DI	20	103C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	92.50	5	85
888	Off Inca Trail	8	952	9999	10	DI	20	103C	5	0	15	RS	10	LOCAL	5	36	10	Adequate	5	150.00	10	90
889	Black Elk Road	8	807	9999	10	DI	20	104D	5	0	15	RS	10	LOCAL	5	33	10	Adequate	5	90.50	5	85
890	Sumac Lane	8	347	9999	10	DI	20	424C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	90.49	5	85
891	Robs Ln.	6	267	9998	10	AC	15	253D	3	0	15	RS	10	LOCAL	5	7	10	Deficient	3	80.64	10	81
892	Oak Hill Drive Extension	8	899	9999	10	DI	20	424B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	150.00	10	90
893	Cattail Lane	8	552	9999	10	DI	20	424D	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	150.00	10	90
894	Eisenhower Dr.	8	427	9999	10	DI	20	424B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	91.57	5	83

895	High Plain St.	8	949	9999	10	DI	20	255B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	66.64	10	88
896	Woods Way	8	282	9999	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	150.00	10	88
897	Upland Road	6	25	99	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	38	10	Deficient	3	93.67	10	60
898	Community Center Drive	8	1199	9999	10	DI	20	254A	5	0	15	RS	10	LOCAL	5	0	10	Deficient	3	150.00	10	88
899	Terrapin Lane	8	471	9999	10	DI	20	254A	5	0	15	RS	10	LOCAL	5	1	10	Severely Deficient	1	92.67	5	81
900	Salamander Street	8	561	9999	10	DI	20	253D	3	0	15	RS	10	LOCAL	5	2	10	Severely Deficient	1	92.67	5	79
901	Solstice Way	8	738	9999	10	DI	20	424D	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	150.00	10	90
902	Red Fox Run	8	526	9999	10	DI	20	424C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	93.51	5	85
903	Bramble Ln.	8	492	9999	10	DI	20	424D	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	92.51	5	85
904	Bramble Ln.	8	444	9999	10	DI	20	254A	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	92.51	5	85
905	Depot St.	12	75	9997	10	CICL	17	602	6	0	15	RS	10	ARTERIAL	1	673	1	Superior	10	93.67	10	80
906	Depot St.	20	104	9999	10	DI	20	602	6	0	15	RS	10	ARTERIAL	1	682	1	Superior	10	93.67	5	78
907	Depot St.	12	51	9999	10	DI	20	253D	3	0	15	RS	10	ARTERIAL	1	15	10	Superior	10	91.67	5	84
908	Pond St.	4	138	99	1	CI	1	602	6	0	15	DC	3	ARTERIAL	1	3	10	Severely Deficient	1	92.60	5	43
909	Depot St.	16	1096	2003	10	DI	20	245C	6	0	15	DC	3	ARTERIAL	1	560	1	Superior	10	150.00	10	76
910	Billings St.	16	210	9999	10	DI	20	602	6	0	15	DC	3	ARTERIAL	1	558	1	Superior	10	92.60	10	76
911	Billings St.	12	18	9999	10	DI	20	602	6	0	15	DC	3	LOCAL	5	46	10	Superior	10	81.60	5	84
912	Billings St.	12	24	9999	10	DI	20	602	6	0	15	DC	3	LOCAL	5	513	1	Superior	10	81.60	10	80
913	Billings St.	12	32	9999	10	DI	20	602	6	0	15	DC	3	ARTERIAL	1	42	10	Superior	10	92.60	10	85
914	Stoneview Lane	8	318	9997	10	CICL	17	254B	5	0	15	RS	10	LOCAL	5	1	10	Deficient	3	150.00	10	85
915	Hampton Rd Tank Access Way	16	188	9999	10	DI	20	424B	5	0	15	RS	10	LOCAL	5	1812	1	Superior	10	93.57	10	86
916	Bay Road	6	2081	9998	10	AC	15	626B	5	0	15	RS	10	ARTERIAL	1	24	10	Adequate	5	93.60	10	81
917	Chive Drive	8	207	9999	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	2	10	Deficient	3	150.00	10	88
918	Aztec Way	8	193	9999	10	DI	20	103C	5	0	15	RS	10	LOCAL	5	0	10	Adequate	5	91.50	5	85
919	Inca Trail	8	285	9999	10	DI	20	103C	5	0	15	RS	10	LOCAL	5	40	10	Adequate	5	92.50	5	85
920	Black Elk Road	8	446	9999	10	DI	20	103C	5	0	15	RS	10	LOCAL	5	2	10	Adequate	5	90.50	5	85
921	Old Wolomolopoag St.	8	902	1978	6	DI	20	422D	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	78.51	5	81
922	Furnace St.	12	357	1975	6	DI	20	254A	5	0	15	RS	10	LOCAL	5	182	8	Superior	10	93.50	10	89
923	North Main St.	6	69	1885	1	CI	1	602	6	0	15	DC	3	ARTERIAL	1	12	10	Adequate	5	93.68	5	47
924	Depot St.	6	79	1885	1	CI	1	602	6	0	15	DC	3	ARTERIAL	1	4	10	Deficient	3	92.60	10	50
925	Pond St.	6	33	1885	1	CI	1	602	6	0	15	DC	3	LOCAL	5	3	10	Severely Deficient	1	92.60	5	47
926	Depot St.	10	43	1885	1	CI	1	602	6	0	15	DC	3	ARTERIAL	1	18	10	Superior	10	92.60	10	57
927	Billings St.	16	58	9999	10	DI	20	602	6	0	15	DC	3	LOCAL	5	513	1	Superior	10	81.60	10	80
928	Billings St.	12	148	9999	10	DI	20	602	6	0	15	DC	3	ARTERIAL	1	270	5	Superior	10	81.60	10	80
929	Depot St.	10	94	1885	1	CI	1	602	6	0	15	DC	3	ARTERIAL	1	60	8	Superior	10	93.68	10	55
930	Depot St.	12	24	9999	10	DI	20	253D	3	0	15	RS	10	ARTERIAL	1	91	8	Superior	10	91.67	5	82
931	Depot St.	16	150	9999	10	DI	20	253D	3	0	15	RS	10	ARTERIAL	1	652	1	Superior	10	92.65	5	75
932	Depot St.	16	183	9999	10	DI	20	602	6	0	15	RS	10	ARTERIAL	1	682	1	Superior	10	93.67	5	78
933	Wolomolopoag	12	686	1974	6	DI	20	254A	5	0	15	RS	10	LOCAL	5	76	8	Superior	10	64.50	2	81
934	Mansfield St.	8	286	2007	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	12	10	Adequate	5	91.51	10	90
935	Mansfield St.	8	521	2007	10	DI	20	254B	5	0	15	RS	10	LOCAL	5	16	10	Adequate	5	93.51	10	90
936	Briar Hill Rd.	8	796	9999	10	DI	20	424D	5	0	15	RS	10	LOCAL	5	27	10	Adequate	5	83.51	5	85
937	Aspen Rd.	8	495	1984	8	DI	20	254B	5	0	15	RS	10	LOCAL	5	308	5	Adequate	5	150.00	10	83
938	Aspen Rd.	8	814	1984	8	DI	20	424C	5	0	15	RS	10	LOCAL	5	310	5	Adequate	5	150.00	10	83
939	Brook Rd.	8	402	1968	6	AC	15	245B	6	0	15	RS	10	LOCAL	5	1	10	Deficient	3	56.64	10	80
940	Terrapin Lane	8	403	9999	10	DI	20	253D	3	0	15	RS	10	LOCAL	5	3	10	Severely Deficient	1	93.67	5	79
941	Norwood St.	6	837	1910	2	CI	1	254A	5	0	15	RS	10	ARTERIAL	1	6	10	Deficient	3	93.67	5	52
942	Pine Grove Ave.	6	221	1910	2	CI	1	254B	5	0	15	RS	10	LOCAL	5	0	10	Deficient	3	92.67	10	61
943	Upland Rd.	6	42	1888	1	CI	1	245C	6	0	15	RS	10	LOCAL	5	33	10	Adequate	5	93.67	10	63
944	Upland Rd.	6	269	1888	1	CI	1	254B	5	0	15	RS	10	LOCAL	5	6	10	Deficient	3	92.67	5	55
945	Upland Rd.	16	1075	1936	3	CICL	17	245C	6	0	15	RS	10	LOCAL	5	113	8	Superior	10	150.00	10	84
946	Billings St.	12	28	9999	10	DI	20	602	6	0	15	DC	3	ARTERIAL	1	270	5	Superior	10	92.60	5	75
947	East St.	6	268	1892	1	CI	1	254B	5	0	15	RS	10	ARTERIAL	1	34	10	Deficient	3	78.60	10	56
948	Bay Rd.	12	74	1929	3	AC	15	254B	5	0	15	RS	10	LOCAL	5	216	5	Superior	10	72.49	2	70
949	North Main St.	12	827	1979	6	DI	20	254B	5	0	15	RS	10	ARTERIAL	1	105	8	Adequate	5	93.68	5	75
950	Williams Rd.	8	232	9999	10	DI	20	653	6	0	15	RS	10	LOCAL	5	2	10	Adequate	5	52.57	10	91
951	Bishop Rd	8	932	1971	6	AC	15	254B	5	0	15	RS	10	LOCAL	5	147	8	Superior	10	80.57	10	84
952	Mountain St.	8	704	1953	5	AC	15	10	5	0	15	RS	10	ARTERIAL	1	100	8	Superior	10	63.52	2	71
953	Mountain St.	12	135	1974	6	DI	20	654	6	0	15	RS	10	ARTERIAL	1	0	10	Superior	10	63.52	2	80
954	Mountain St.	12	43	1974	6	DI	20	654	6	0	15	RS	10	ARTERIAL	1	120	8	Superior	10	63.52	2	78

955	Billings St.	8	650	1942	5	AC	15	307C	5	Yes	1	RS	10	LOCAL	5	9	10	Adequate	5	86.60	10	66
956	Billings St.	12	368	9999	10	DI	20	623C	5	0	15	RS	10	LOCAL	5	217	5	Superior	10	92.60	10	90
957	Cottage St.	8	33	1887	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	9	10	Adequate	5	85.59	5	57
958	Lakeview St.	10	1233	1954	5	AC	15	254A	5	0	15	RS	10	ARTERIAL	1	20	10	Superior	10	74.51	2	73
959	Norwood St.	6	44	1910	2	CI	1	253D	3	0	15	RS	10	ARTERIAL	1	39	10	Adequate	5	92.67	5	52
960	Maskwonicut St.	12	31	9999	10	DI	20	253D	3	0	15	RS	10	LOCAL	5	137	8	Superior	10	92.67	5	86
961	Billings St.	6	780	1909	2	CI	1	623C	5	0	15	RS	10	LOCAL	5	6	10	Adequate	5	91.60	10	63
962	Cottage St.	8	33	1887	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	7	10	Adequate	5	92.60	5	57
963	Upland Rd.	16	38	1936	3	CICL	17	254A	5	0	15	RS	10	LOCAL	5	11	10	Superior	10	92.67	5	80
964	Norwood St.	6	14	1910	2	CI	1	254A	5	0	15	RS	10	LOCAL	5	15	10	Deficient	3	90.67	5	56
965	South Main St.	12	41	9997	10	CICL	17	254A	5	0	15	RS	10	ARTERIAL	1	63	8	Superior	10	93.68	5	81
966	Walpole St.	6	65	1919	2	CI	1	254A	5	0	15	RS	10	LOCAL	5	9	10	Adequate	5	92.68	10	63
967	Maskwonicut St.	12	55	9999	10	DI	20	51	1	0	15	RS	10	LOCAL	5	0	10	Superior	10	89.64	5	86
968	Bullard St.	8	14	1959	5	AC	15	51	1	0	15	RS	10	LOCAL	5	56	8	Superior	10	89.64	5	74
969	Maskwonicut St.	12	38	9999	10	DI	20	51	1	0	15	RS	10	LOCAL	5	99	8	Superior	10	89.64	5	84
970	South Main St.	10	224	9998	10	AC	15	626B	5	0	15	LC	6	ARTERIAL	1	41	10	Superior	10	93.68	10	82
971	Tolman St.	6	21	99	1	CI	1	623C	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	91.59	5	57
972	Pond St.	8	317	1891	1	CI	1	310B	5	0	15	CR	1	ARTERIAL	1	31	10	Adequate	5	87.60	5	44
973	Pond St.	8	33	1891	1	CI	1	654	6	0	15	CR	1	ARTERIAL	1	27	10	Adequate	5	87.52	5	45
974	Massapoag Ave.	12	106	1897	1	CI	1	654	6	0	15	RS	10	LOCAL	5	124	8	Superior	10	58.60	2	58
975	East Foxboro St.	6	265	1921	3	CI	1	52	1	0	15	RS	10	LOCAL	5	10	10	Adequate	5	83.59	5	55
976	Cedar St.	12	48	9999	10	DI	20	254A	5	0	15	RS	10	LOCAL	5	0	10	Superior	10	88.59	5	90
977	Nasir Ahmao Rd.	8	41	1991	8	DI	20	654	6	0	15	RS	10	ARTERIAL	1	88	8	Adequate	5	93.68	5	78
978	North Main St.	12	351	1979	6	DI	20	602	6	0	15	DC	3	ARTERIAL	1	302	5	Superior	10	93.68	5	71
979	High St.	6	23	1889	1	CI	1	602	6	0	15	DC	3	LOCAL	5	2	10	Adequate	5	93.68	5	51
980	High St.	12	81	1979	6	DI	20	602	6	0	15	DC	3	ARTERIAL	1	9	10	Superior	10	93.68	5	76
981	School St.	8	25	1979	6	DI	20	623C	5	0	15	RS	10	LOCAL	5	28	10	Superior	10	91.65	10	91
982	North Main St.	8	14	1886	1	CI	1	623C	5	0	15	RS	10	ARTERIAL	1	2	10	Adequate	5	93.68	5	53
983	School St.	8	61	1910	2	CI	1	623C	5	0	15	RS	10	ARTERIAL	1	20	10	Adequate	5	93.68	5	54
984	North Main St.	12	812	1979	6	DI	20	310B	5	0	15	RS	10	ARTERIAL	1	240	5	Superior	10	93.68	5	77
985	Ashcroft Rd.	6	27	1907	2	CI	1	310B	5	0	15	RS	10	LOCAL	5	1	10	Adequate	5	93.68	5	58
986	North Main St.	12	82	1979	6	DI	20	310B	5	0	15	RS	10	ARTERIAL	1	19	10	Superior	10	93.68	5	82
987	North Main St.	12	1116	1979	6	DI	20	310B	5	0	15	CR	1	ARTERIAL	1	219	5	Superior	10	91.68	5	68
988	Maskwonicut St.	8	52	1948	5	AC	15	310B	5	0	15	RS	10	ARTERIAL	1	24	10	Superior	10	91.68	5	76
989	Maskwonicut St.	8	38	1979	6	DI	20	310B	5	0	15	RS	10	LOCAL	5	39	10	Superior	10	91.68	5	86
990	North Main St.	6	25	1885	1	CI	1	422C	5	0	15	RS	10	ARTERIAL	1	10	10	Adequate	5	93.68	5	53
991	North Main St.	12	1077	1979	6	DI	20	254B	5	0	15	RS	10	ARTERIAL	1	110	8	Adequate	5	92.68	5	75
992	North Main St.	8	43	2003	10	DI	20	420B	5	0	15	RS	10	ARTERIAL	1	17	10	Superior	10	83.58	10	91
993	North Main St.	12	401	1979	6	DI	20	51	1	0	15	RS	10	ARTERIAL	1	117	8	Superior	10	91.68	5	76
994	Hixson Farm Rd.	8	28	9999	10	DI	20	654	6	0	15	RS	10	LOCAL	5	5	10	Superior	10	91.68	5	91
995	North Main St.	12	87	1979	6	DI	20	654	6	0	15	RS	10	ARTERIAL	1	5	10	Superior	10	91.68	5	83
996	Pond St.	8	191	1891	1	CI	1	310B	5	0	15	RS	10	LOCAL	5	54	8	Adequate	5	91.59	5	55
997	Beach St.	12	288	1886	1	CI	1	654	6	0	15	RS	10	ARTERIAL	1	124	8	Superior	10	58.60	2	54
998	North Main St.	12	478	1979	6	DI	20	310B	5	0	15	RS	10	ARTERIAL	1	241	5	Superior	10	93.68	5	77
999	North Main St.	12	327	1979	6	DI	20	623C	5	0	15	RS	10	ARTERIAL	1	264	5	Superior	10	93.68	5	77
1000	Glen Dale Rd.	6	18	1893	1	CI	1	310B	5	0	15	RS	10	LOCAL	5	11	10	Deficient	3	93.68	5	55
1001	North Main St.	8	57	1979	6	DI	20	310B	5	0	15	RS	10	ARTERIAL	1	22	10	Superior	10	93.68	5	82
1002	South Main St.	6	606	1956	5	AC	15	602	6	0	15	DC	3	ARTERIAL	1	9	10	Adequate	5	93.68	5	65
1003	South Main St.	8	49	1885	1	CI	1	602	6	0	15	RS	10	ARTERIAL	1	14	10	Adequate	5	93.68	5	54
1004	South Main St.	8	245	1885	1	CI	1	305B	5	0	15	RS	10	ARTERIAL	1	4	10	Deficient	3	93.68	5	51
1005	North Main St.	12	19	1979	6	DI	20	422C	5	0	15	RS	10	ARTERIAL	1	141	8	Superior	10	93.68	5	80
1006	South Main St.	12	945	9997	10	CICL	17	254A	5	0	15	RS	10	ARTERIAL	1	162	8	Superior	10	93.68	10	86
1007	South Main St.	12	976	9997	10	CICL	17	254B	5	0	15	RS	10	ARTERIAL	1	126	8	Superior	10	93.68	10	86
1008	Mitchell St.	6	70	1953	5	AC	15	254B	5	0	15	RS	10	ARTERIAL	1	13	10	Adequate	5	69.68	2	68
1009	South Main St.	8	38	9999	10	DI	20	254B	5	0	15	RS	10	ARTERIAL	1	52	8	Superior	10	88.65	5	84
1010	South Main St.	8	56	9997	10	CICL	17	254A	5	0	15	RS	10	ARTERIAL	1	16	10	Superior	10	93.68	5	83
1011	South Main St.	12	794	9997	10	CICL	17	254A	5	0	15	CR	1	ARTERIAL	1	94	8	Superior	10	93.68	10	77
1012	Roberta Rd.	6	87	1954	5	AC	15	254A	5	0	15	RS	10	ARTERIAL	1	1	10	Adequate	5	93.68	5	71
1013	Wolomolopoag	12	55	1974	6	DI	20	245B	6	0	15	RS	10	ARTERIAL	1	41	10	Superior	10	56.50	10	88
1014	South Main St.	6	10	1889	1	CI	1	245B	6	0	15	RS	10	LOCAL	5	3	10	Deficient	3	56.50	10	61

1015	Hampton Rd.	12	323	1976	6	DI	20	73A	5	0	15	RS	10	LOCAL	5	17	10	Superior	10	52.57	2	83
1016	North Main St.	12	251	1979	6	DI	20	420B	5	0	15	RS	10	ARTERIAL	1	114	8	Superior	10	91.68	5	80
1017	Norwood Street	12	49	2008	10	DI	20	260B	5	0	15	RS	10	ARTERIAL	1	0	10	Adequate	5	80.64	5	81
1018	Cobbler Ln.	8	48	9999	10	DI	20	260B	5	0	15	RS	10	LOCAL	5	42	10	Adequate	5	80.64	5	85
1019	Norwood Street	12	105	2008	10	DI	20	260B	5	0	15	RS	10	ARTERIAL	1	39	10	Adequate	5	80.64	5	81
1020	Norwood Street	12	1194	2008	10	DI	20	307D	5	0	15	RS	10	ARTERIAL	1	39	10	Deficient	3	86.64	5	79
1021	Bullard St.	6	46	1925	3	CI	1	307D	5	0	15	RS	10	LOCAL	5	4	10	Deficient	3	86.64	5	57
1022	Norwood Street	12	105	2008	10	DI	20	307D	5	0	15	RS	10	ARTERIAL	1	27	10	Deficient	3	86.64	5	79
1023	Norwood Street	12	1812	2008	10	DI	20	307D	5	0	15	RS	10	ARTERIAL	1	66	8	Deficient	3	93.64	10	82
1024	Beaver Brook Rd.	8	65	1964	6	CICL	17	300B	3	0	15	RS	10	ARTERIAL	1	3	10	Adequate	5	92.64	5	72
1025	Norwood Street	12	143	2008	10	DI	20	300B	3	0	15	RS	10	ARTERIAL	1	20	10	Adequate	5	92.64	5	79
1026	High Plain St.	8	68	1948	5	AC	15	260B	5	0	15	RS	10	LOCAL	5	13	10	Adequate	5	36.64	1	71
1027	Norwood Street	12	463	2008	10	DI	20	300B	3	0	15	RS	10	ARTERIAL	1	46	10	Adequate	5	93.64	10	84
1028	Norwood Street	12	897	2008	10	DI	20	300B	3	0	15	RS	10	ARTERIAL	1	1	10	Adequate	5	85.64	5	79
1029	High Plain St.	8	171	1948	5	AC	15	300B	3	0	15	RS	10	LOCAL	5	44	10	Adequate	5	93.64	10	78
1030	Beach St.	6	19	1886	1	CI	1	654	6	0	15	RS	10	LOCAL	5	16	10	Adequate	5	89.59	10	63
1031	Cedar St.	12	532	9999	10	DI	20	254A	5	0	15	RS	10	LOCAL	5	14	10	Superior	10	90.59	5	90

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Install Date	Rating #
1897 to 1899	1
1900 to 1919	2
1920 to 1939	3
1940 to 1959	5
1960 to 1979	6
1980 to 1999	8
2000 to 2015	10
9996 to 9999	10

Material	Material Rating
CI	1
GAL	1
AC	15
Copper	15
CICL	17
PVC	20
DI	20

Soil Reaction	Average Reaction	Reaction Code	Soil Rating
Extremely Acid	Extremely Acid	E	1
Extremely-Strongly Acid	Very Strongly Acid	V	3
Extremely-Moderately Acid	Very Strongly Acid	V	3
Very Strongly-Moderately Acid	Strongly Acid	S	5
Very Strongly-Slightly Acid	Strongly Acid	S	5
Strongly Acid-Moderately Acid	Strongly Acid	S	5
Strongly Acid-Slight Acid	Moderately Acid	M	7

1) Soil reaction for specific soil types adapted from regional soil survey online at nesoil.com
2)Where avgerage soil reaction falls between digits, rounded conservatively.

Number of Breaks/ Customer Complaints	Condition Rating
Yes	1
0	15

Customer Type	Customer Type	Points
Critical (Schools, Hospitals)	CR	1
Dense Commercial	DC	3
Light Commercial	LC	6
Residential	RS	10

Roadway Type	
Type of Road	**Consequence Ranking**
Arterial	1
Local	5

Max Flow Through Main	Range	Criticality Rating
Very High Flow	500+	1
High Flow	350-499	3
Moderate Flow	200-349	5
Low Flow	50-199	8
Very Low Flow	0-49	10

Fire Flow	Deficiency Rating
Severely Deficient	1
Deficient	3
Adequate	5
Superior	10

RSR RANGE	RATINGS	
0-20	1	RECONSTRUCT
21-40	1	RECLAIM
40-65	2	GRIND/OVERLAY
66-75	2	LEVEL/OVERLAY
76-100	5	CRACK/SEAL/NOTHING
150	10	NO RSR
RECENTLY PAVED	10	RECENTLY PAVED

TABLE 6-3

PHASE A IMPROVEMENTS

Priority	Description	2010 Project Cost
1	Water Main Improvements • Pond Street (3,600’→$670,000) • Abandon 4” and 6” water main in Pond Street (2,465’→$125,000)	$795,000
2	Water Main Improvements • South Main Street Area (6,610’→$1,205,000)	$1,205,000
3	Water Main Improvements • Norwood Street (2,050’→$340,000) • Abandon 6” water main in Maskwonicut St and Norwood St (4,000’→$200,000)	$540,000
4	Water Main Improvements • Massapoag Ave Area (5,500’→$1,020,000) • Abandon 6” water main in Massapoag Ave (1,400’→$70,000)	$1,090,000
5	Water Main Improvements • East Street Area (7,400’→$1,220,000) • Abandon 6”water main in Mountain St (950’→$50,000)	$1,270,000
6	Water Main Improvements • Brook Road Area (9,000’→1,500,000) • Glen Dale Road Area (4,800’→$800,000)	$2,300,000
Priortize as necessary	High Pressure Service District (From M&E 2004 Report) • Mountain Street Tank ($1,415,000) • Booster Pumping Station ($760,000) • Mountain Street (4,200’→$810,000) • Hampton Road (1,600’→$270,000) • Michael Lane to Eisenhower Drive (1,100’→$170,000)	$3,425,000
	Total	**$10,625,000**

TABLE 6-3 (Continued)

PHASE B IMPROVEMENTS

Priority	**Description**	**2010 Project Cost**
1	Water Main Improvements • Pleasant Street Area (1,350'→$220,000) • Abandon 4" and 6" water main in North Main St (11,000'→$550,000) • Capenhill Road (1,500'→ $250,000)	$1,020,000
2	Water Main Improvements • Cottage Street Area (5,400')	$890,000
3	Water Main Improvements • Beach St Area (3,425'→$565,000) • Abandon 6" water main in Cedar St and East Foxboro St (2,200'→ $110,000) • Abandon 4" and 6" water main in Billings St, Depot St, and South Main St (12,150'→$610,000)	$1,285,000
4	Water Main Improvements • Morse Street (1780'→ $295,000) • Abandon 6" in Walpole St (3,100'→$155,000) • Abandon 6" water main in Norwood St and Upland Rd. (6,600'→$330,000)	$780,000
5	Water Main Improvements • Pine Street (2,300'→$380,000) • Old Post Street (1,400'→$235,000)	$615,000
	Total	**$4,590,000**

O:\Sharon MA\Water Master Plan 2080589\Temp Online Library W&S Water System Master Plan\Chap 6 - Infrastructure\tables\Table 6-3 Water System CIP.doc

Table 6-4
Water Storage Tank Evaluations

Tank Name	Type	Install Year	Diameter (ft)	Height (ft)	Overflow Elev (ft)	Capacity (MG)	Date of last Inspection
Hampton Road	Steel Elevated	1964	62	25	426.83	0.5	2008
Massapoag Avenue	Steel Elevated	1955	48	75	426.83	1	2008
Moose Hill	Concrete	1952	65	21	426.83	0.5	2008
Upland Road	Bolted Steel Res.	1935	56	55	426.83	1	2008

Adequacy of Distril

Entire System (all volume in Mgal)

A	Fire Flow Volume (assuming 4,000 gpm for four hours)
B	Generak Service use during fire at Maximum Day Demand
C	Delpetion due to Peak Hour Demand
D	Total supply required (A+B+C)
E	Less Pumpage during fire
F	Supply required from storage (D-E)
G	Total Storage available
H	Estimates excess (+) or deficiency (-) (G-F)

bution Storage Volume-From M&E 2004 Report

2010		2020	
I	II	I	II
0.63	0.96	0.96	0.96
0.58	0.58	0.65	0.65
0.88	0.88	0.98	0.98
2.09	2.42	2.59	2.59
0.4	0.55	0.4	0.55
1.69	1.87	2.19	2.04
1.56			
-0.13	-1.87	-2.19	-2.04

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Hydrant Test Report

Project: Sharon Master Plan

Date: 06/24/09 Time: 9:15 A.M.

Test Number: 1

Inspector: YKT

City: Sharon

State: MA

Location

Zone:

Streets: Williams Road

Weather:

Sources of supply in operations and rates:

Tank levels:

Type of development in the area:

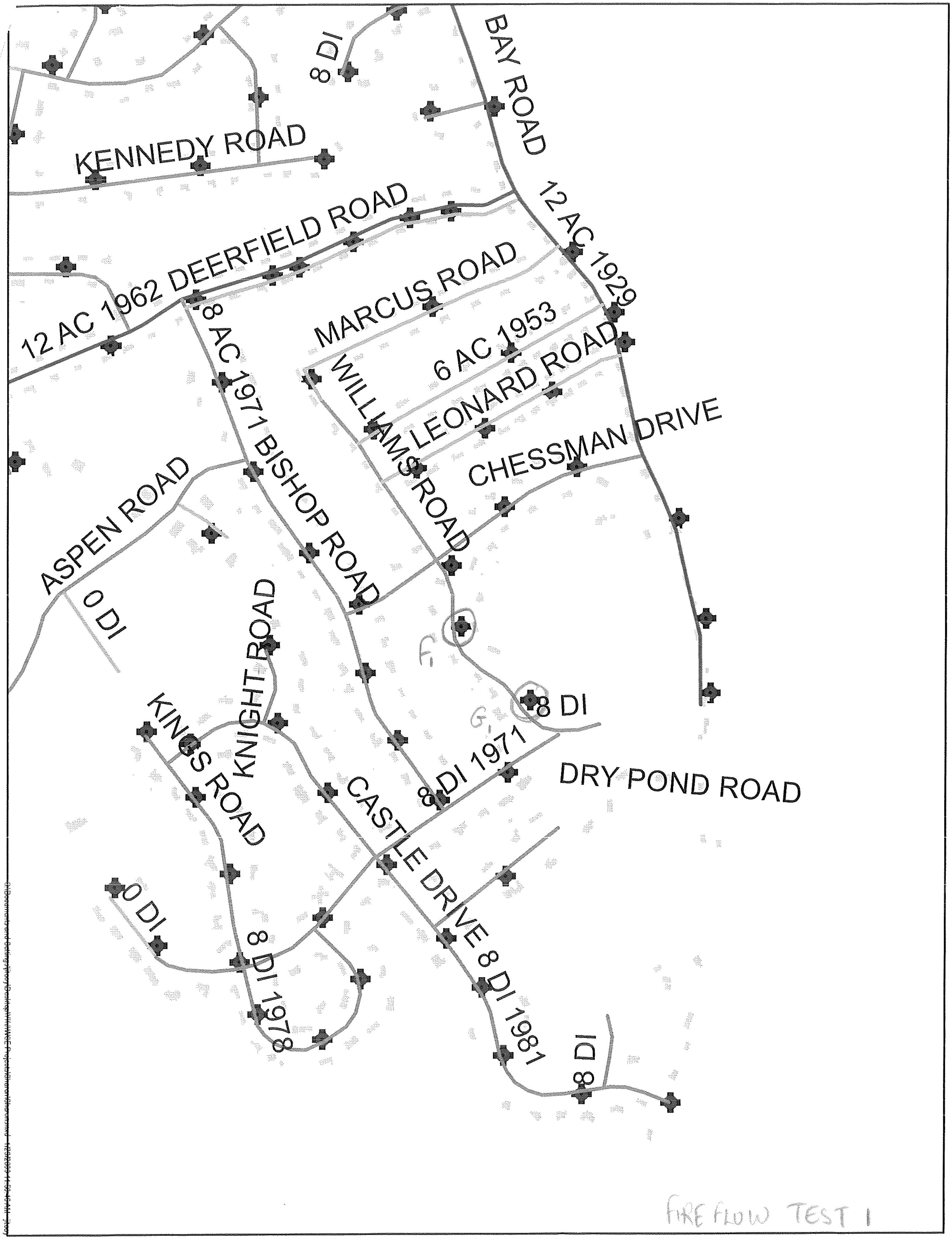
Required Flow:

Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Static	Static:	83	Static:	
	Residual:	75	Residual:	
Flow	Static:	84	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
	2.5					1350 gpm

Flow available at 20 psi ______ gpm.

Sketch & Remarks


KENNEDY ROAD
BAY ROAD
8 DI
12 AC 1962 DEERFIELD ROAD
12 AC 1929
MARCUS ROAD
6 AC 1953
LEONARD ROAD
8 AC 1971 BISHOP ROAD
WILLIAMS ROAD
CHESSMAN DRIVE
ASPEN ROAD
0 DI
KNIGHT ROAD
KINGS ROAD
F.
G.
8 DI
8 DI 1971
DRY POND ROAD
CASTLE DRIVE 8 DI 1981
0 DI
8 DI 1978
8 DI
FIRE FLOW TEST 1

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Hydrant Test Report

Project: Sharon Master Plan Date: 06/24/09 Time: 9:30
Test Number: 2 Inspector: YKJ
City: ________ State: MA
Location
Zone: ________
Streets: Lincoln Road
Weather: ________
Sources of supply in operations and rates: ________
Tank levels: ________
Type of development in the area: ________
Required Flow: ________

Hydrant No.	Observed Pressure (psi)	Corrected Pressure (psi)
Static	Static: 75 Residual: 69	Static: Residual:
Flow	Static: 80 Residual:	Static: Residual:
	Static: Residual:	Static: Residual:

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
	2.5"					1275 gpm.

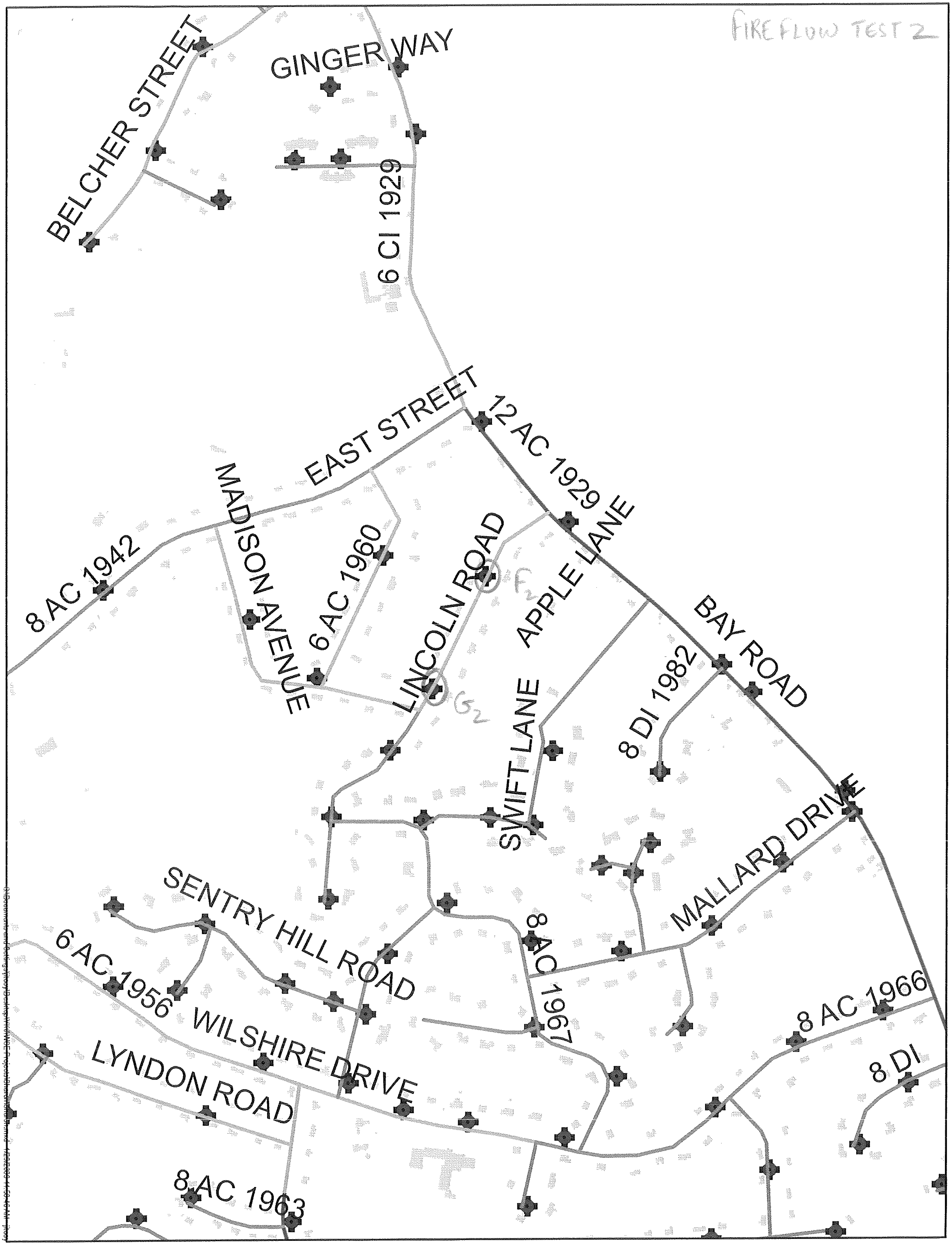
1/4 of flow.

Flow available at 20 psi ________ gpm.

Sketch & Remarks

A-C pipe probably that's why only 6 psi drop.

FIRE FLOW TEST 2



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Hydrant Test Report

Project: Sharon Master Plan. Date: 06/24/09 Time: 9:50
Test Number: 3. Inspector: YKJ
City: State:
Location
Zone:
Streets: Bay Road
Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Static	Static:	102	Static:	
	Residual:	93	Residual:	
Flow	Static:	106	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

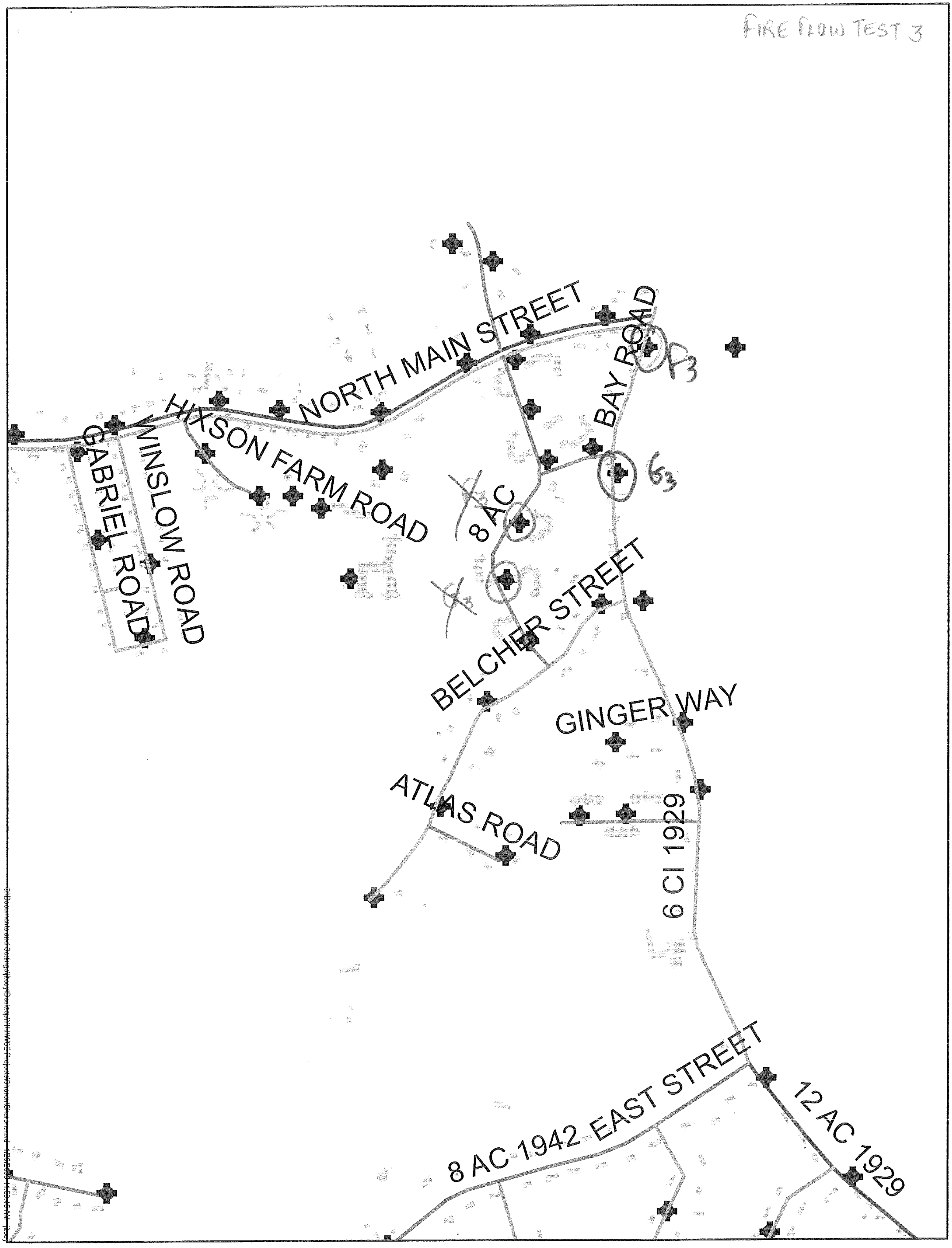
Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						1700

(8 fluctuating to the middle 1375?)

Flow available at 20 psi ______ gpm.

Sketch & Remarks

(Town diffuser incorrect Pitot adjustment


FIRE FLOW TEST 3
NORTH MAIN STREET
BAY ROAD
F3
G3
HIXSON FARM ROAD
WINSLOW ROAD
GABRIEL ROAD
8 AC
BELCHER STREET
GINGER WAY
ATLAS ROAD
6 CI 1929
8 AC 1942 EAST STREET
12 AC 1929

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Hydrant Test Report

Project: Sharon Master Plan Date: 06/24/09 Time: 10:20
Test Number: 4 Inspector: YKJ
City: State:
Location
Zone:
Streets: Brook Road
Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

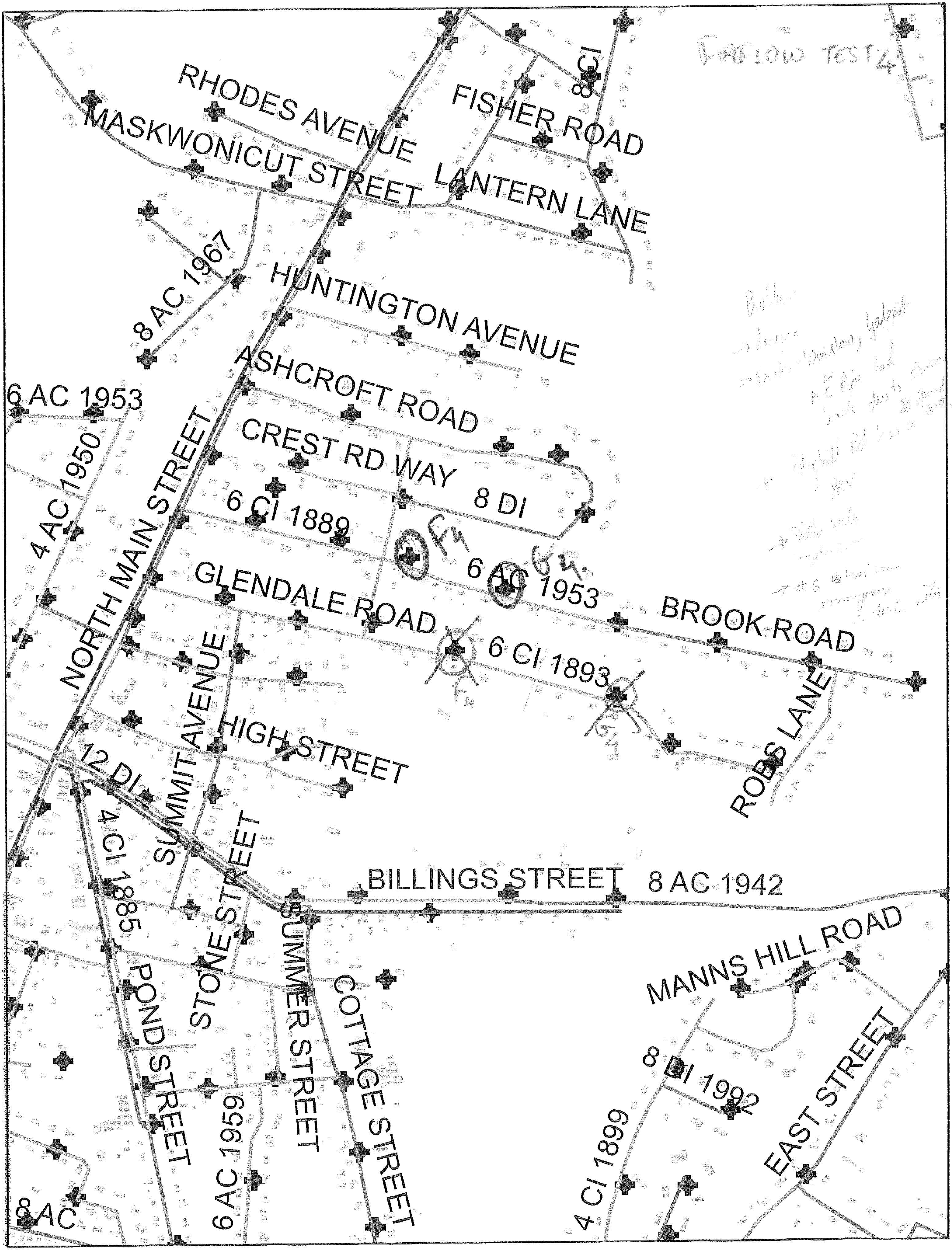
Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Static	Static:	57	Static:	
	Residual:	30	Residual:	
Flow	Static:	50	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
	2.5"					590

12.5 psi

Flow available at 20 psi ________ gpm.

Sketch & Remarks



FIREFLOW TEST 4
RHODES AVENUE
MASKWONICUT STREET
FISHER ROAD
8 CI
LANTERN LANE
8 AC 1967
HUNTINGTON AVENUE
ASHCROFT ROAD
6 AC 1953
CREST RD WAY
8 DI
4 AC 1950
NORTH MAIN STREET
6 CI 1889
6 AC 1953
GLENDALE ROAD
BROOK ROAD
6 CI 1893
SUMMIT AVENUE
HIGH STREET
ROBS LANE
12 DI
4 CI 1885
STONE STREET
BILLINGS STREET
8 AC 1942
SUMMER STREET
COTTAGE STREET
POND STREET
MANNS HILL ROAD
8 DI 1992
EAST STREET
6 AC 1959
4 CI 1899
8 AC

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Hydrant Test Report

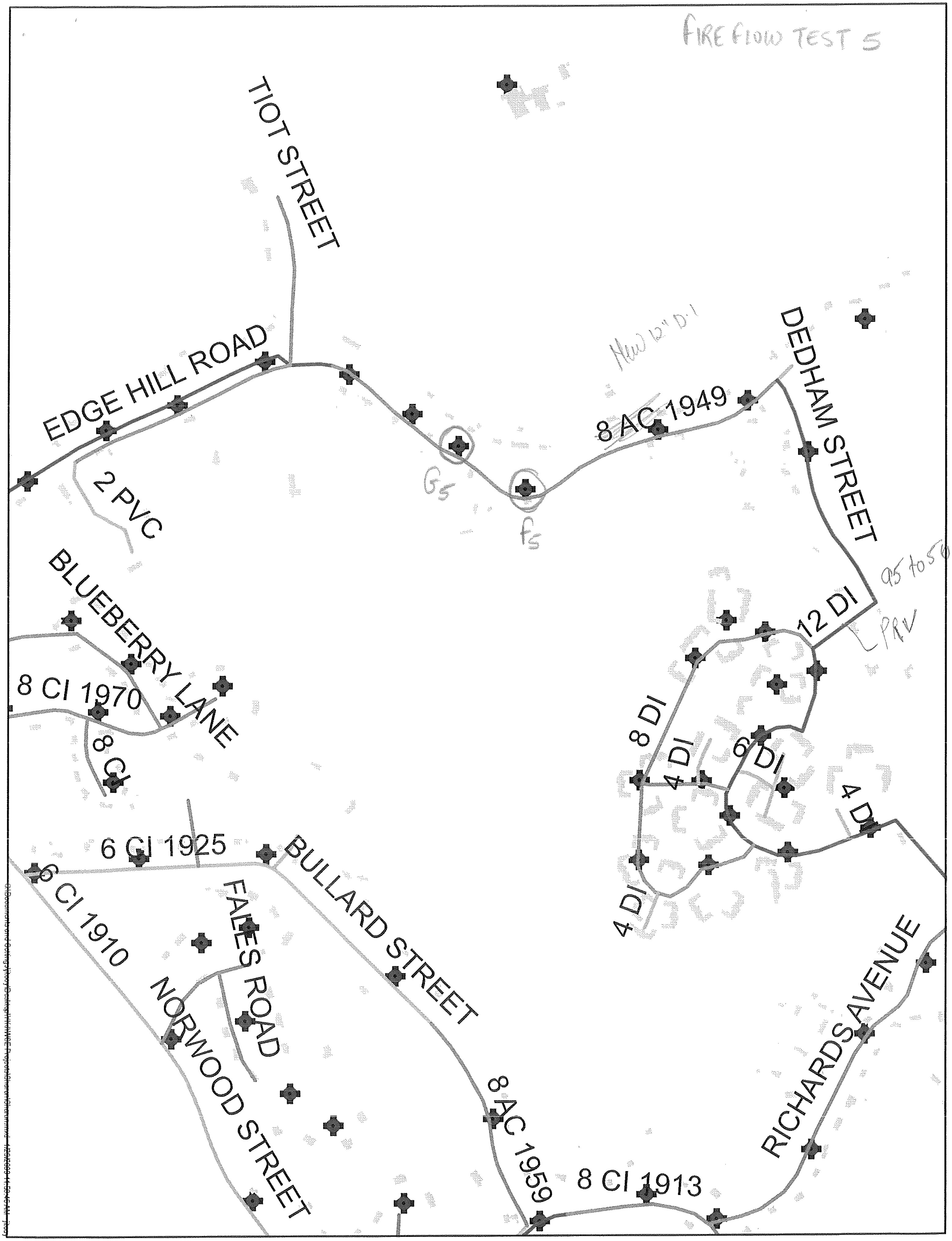
Project: Sharon Master Plan Date: 06/24/09 Time: 2:30
Test Number: 5 Inspector: YKJ
City: Sharon State:
Location
Zone:
Streets: Edge Hill Rd
Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
	Static:	102	Static:	
	Residual:	88	Residual:	
	Static:	98	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						1430

Flow available at 20 psi ______ gpm.

Sketch & Remarks


FIRE FLOW TEST 5
TIOT STREET
EDGE HILL ROAD
2 PVC
New 12" D.I
8 AC 1949
DEDHAM STREET
G5
F5
95 to 50 psi
PRV
12 DI
8 DI
4 DI
6 DI
4 DI
4 DI
BLUEBERRY LANE
8 CI 1970
8 CI
6 CI 1925
6 CI 1910
BULLARD STREET
FALES ROAD
NORWOOD STREET
8 AC 1959
8 CI 1913
RICHARDS AVENUE

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Hydrant Test Report

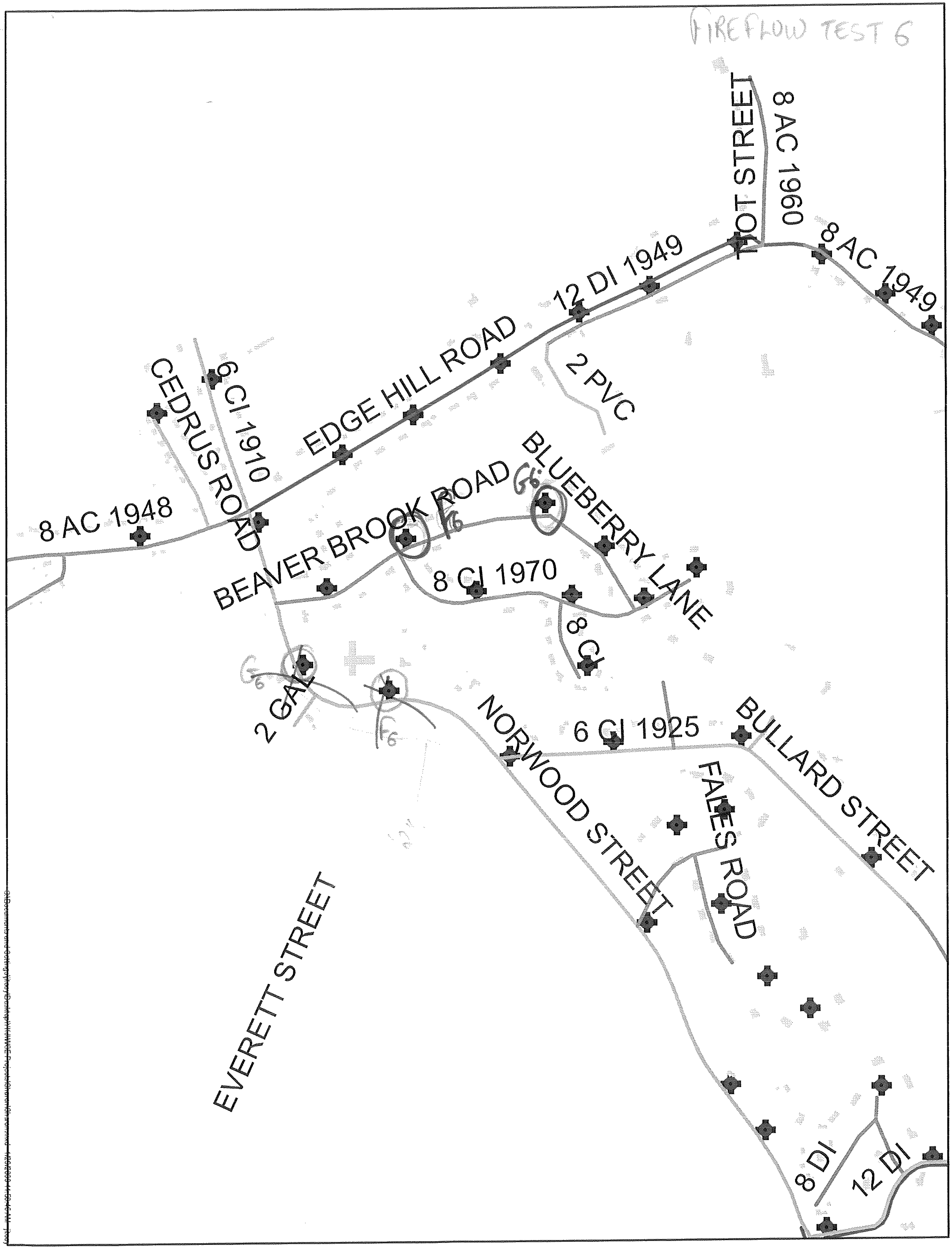
Project: Sharon Master Plan Date: 06/24/09 Time: 2:15
Test Number: 6 Inspector: YKJ
City: Sharon State: ______
Location
Zone: ______
Streets: Beaver Brook Rd
Weather: ______
Sources of supply in operations and rates: ______
Tank levels: ______
Type of development in the area: ______
Required Flow: ______

Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Static	Static:	104	Static:	
	Residual:	58	Residual:	
Flow	Static:	96	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						1060.

Flow available at 20 psi ______ gpm.

Sketch & Remarks


FIREFLOW TEST 6
8 AC 1948
CEDRUS ROAD
6 CI 1910
EDGE HILL ROAD
12 DI 1949
2 PVC
8 AC 1960
8 AC 1949
BEAVER BROOK ROAD
BLUEBERRY LANE
8 CI 1970
8 CI
2 GAL
NORWOOD STREET
6 CI 1925
BULLARD STREET
FALES ROAD
EVERETT STREET
8 DI
12 DI

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Hydrant Test Report

Project: Sharon Master Plan Date: 06/24/09 Time: 10:35
Test Number: 7 Inspector: YKJ
City: Sharon State: MA
Location
Zone:
Streets: Bradford Ave
Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Static	Static:	63	Static:	
	Residual:	58	Residual:	
Flow	Static:	58	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

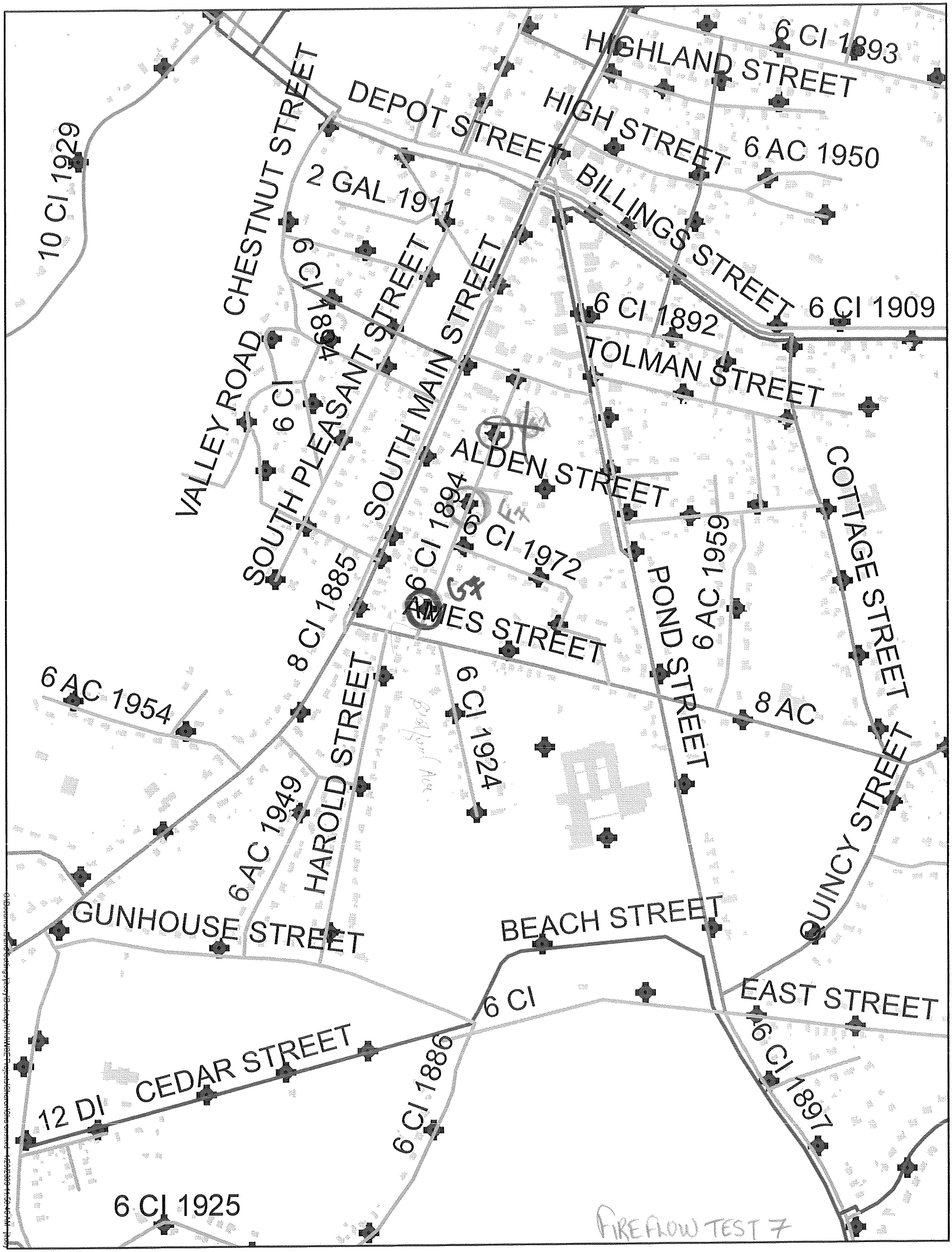
Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						840

Flow available at 20 psi ______________ gpm.

Sketch & Remarks Dirty Water Initially

→ drop wasn't enough so thought of opening 4.5" port but didn't open it as the town personnel thought it would create dirty water in plant.

Notes
→ gauge diffs by 2 psi
→ diffuser needs a gasket & bearings


HIGHLAND STREET
6 CI 1893
DEPOT STREET
HIGH STREET
6 AC 1950
BILLINGS STREET
10 CI 1929
CHESTNUT STREET
2 GAL 1911
6 CI 1894
SOUTH PLEASANT STREET
SOUTH MAIN STREET
6 CI 1892
6 CI 1909
TOLMAN STREET
VALLEY ROAD
6 CI
ALDEN STREET
COTTAGE STREET
6 CI 1894
6 CI 1972
6 CI
AMES STREET
8 CI 1885
POND STREET
6 AC 1959
8 AC
6 AC 1954
6 CI 1924
HAROLD STREET
6 AC 1949
QUINCY STREET
GUNHOUSE STREET
BEACH STREET
6 CI
EAST STREET
CEDAR STREET
6 CI 1886
6 CI 1897
12 DI
6 CI 1925
FIREFLOW TEST 7

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Hydrant Test Report

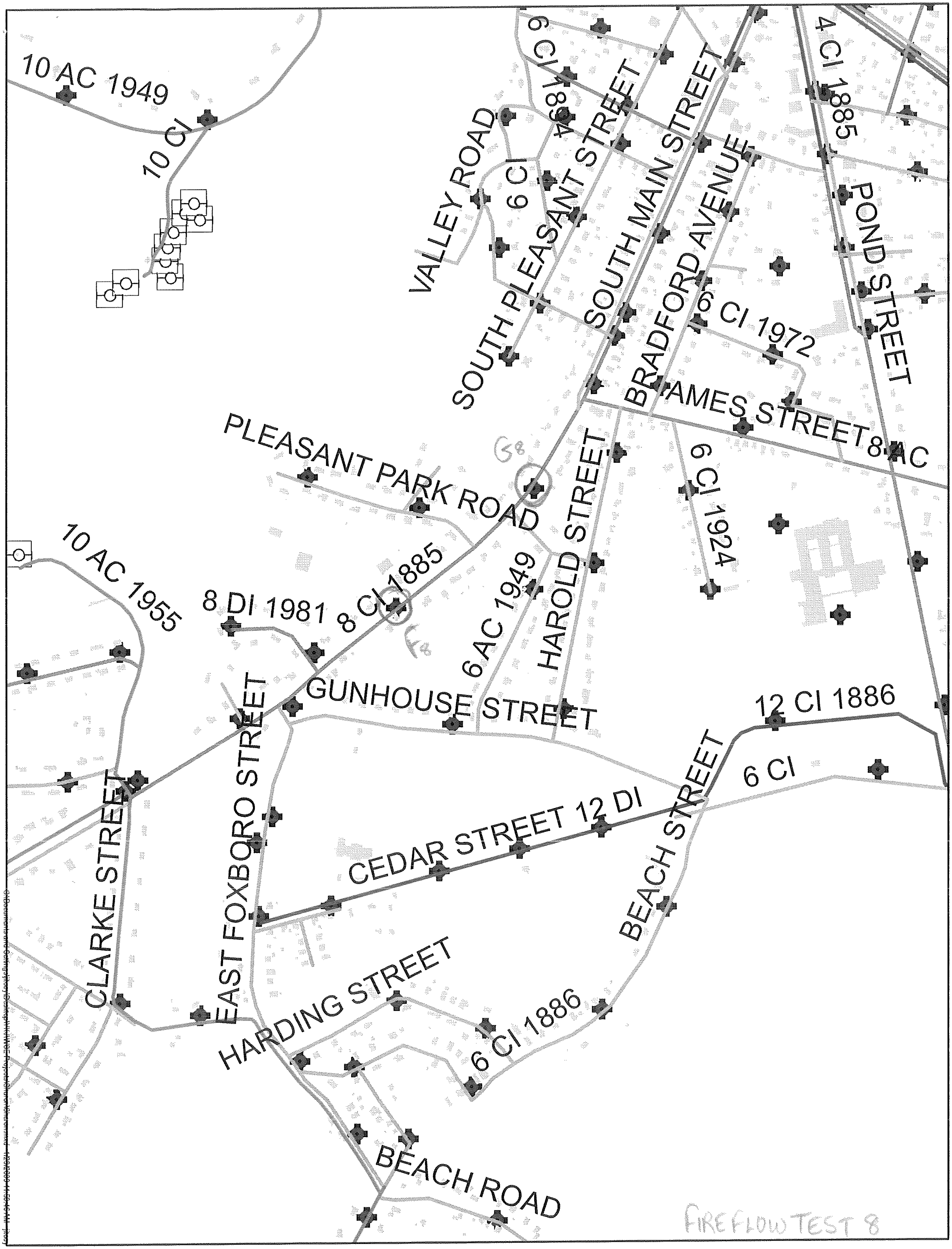
Project: Sharon Master Plan Date: 06/24/09 Time: 10:55
Test Number: 8 Inspector: YKJ
City: Sharon State: MA
Location
Zone:
Streets: South Main Street
Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Gauge	Static:	72	Static:	
	Residual:	66	Residual:	
Flow	Static:	64	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						1130

Flow available at 20 psi ____________ gpm.

Sketch & Remarks


10 AC 1949
10 CI
10 CI
6 CI 1884
VALLEY ROAD
6 CI
SOUTH PLEASANT STREET
SOUTH MAIN STREET
BRADFORD AVENUE
4 CI 1885
POND STREET
6 CI 1972
SOUTH PLEASANT
JAMES STREET 8 AC
PLEASANT PARK ROAD
G8
HAROLD STREET
6 CI 1924
10 AC 1955
8 DI 1981
8 CI 1885
F8
6AC 1949
GUNHOUSE STREET
12 CI 1886
6 CI
EAST FOXBORO STREET
CEDAR STREET 12 DI
BEACH STREET
CLARKE STREET
HARDING STREET
6 CI 1886
BEACH ROAD
FIRE FLOW TEST 8

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Hydrant Test Report

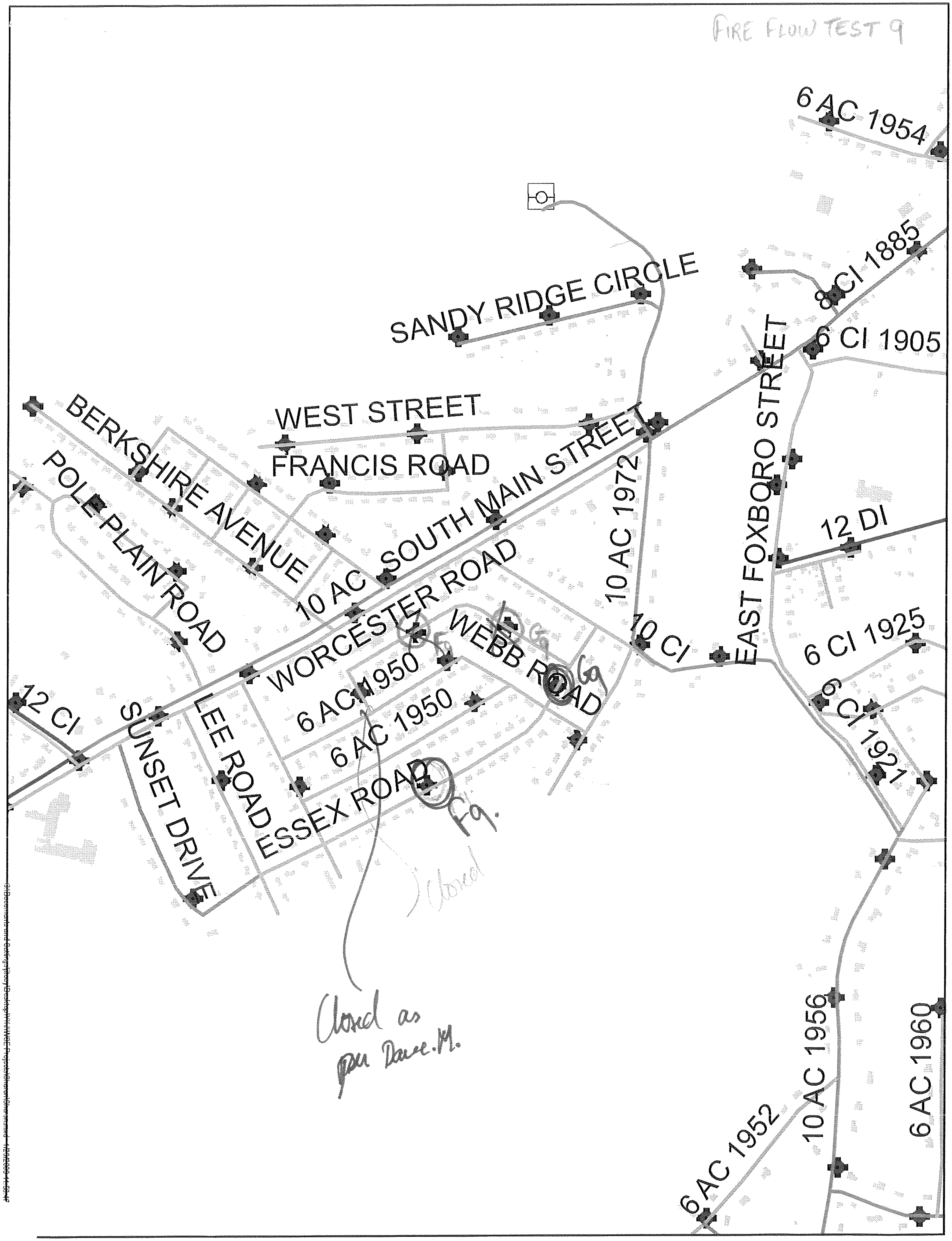
Project: Sharon Master Plan. Date: 04/24/09 Time: 12:15
Test Number: 9 Inspector: YKJ
City: Sharon. State: MA
Location
Zone:
Streets: Essex Road.
Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Static	Static:	68	Static:	
	Residual:	63	Residual:	
Flow	Static:	68	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						1030

Flow available at 20 psi ______ gpm.

Sketch & Remarks



FIRE FLOW TEST 9
6 AC 1954
SANDY RIDGE CIRCLE
8 CI 1885
6 CI 1905
WEST STREET
FRANCIS ROAD
BERKSHIRE AVENUE
POLE PLAIN ROAD
SOUTH MAIN STREET
10 AC
10 AC 1972
EAST FOXBORO STREET
12 DI
WORCESTER ROAD
WEBB ROAD
10 CI
6 CI 1925
6 CI 1921
12 CI
SUNSET DRIVE
LEE ROAD
6 AC 1950
6 AC 1950
ESSEX ROAD
Closed as per Dave M.
10 AC 1956
6 AC 1960
6 AC 1952

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Hydrant Test Report

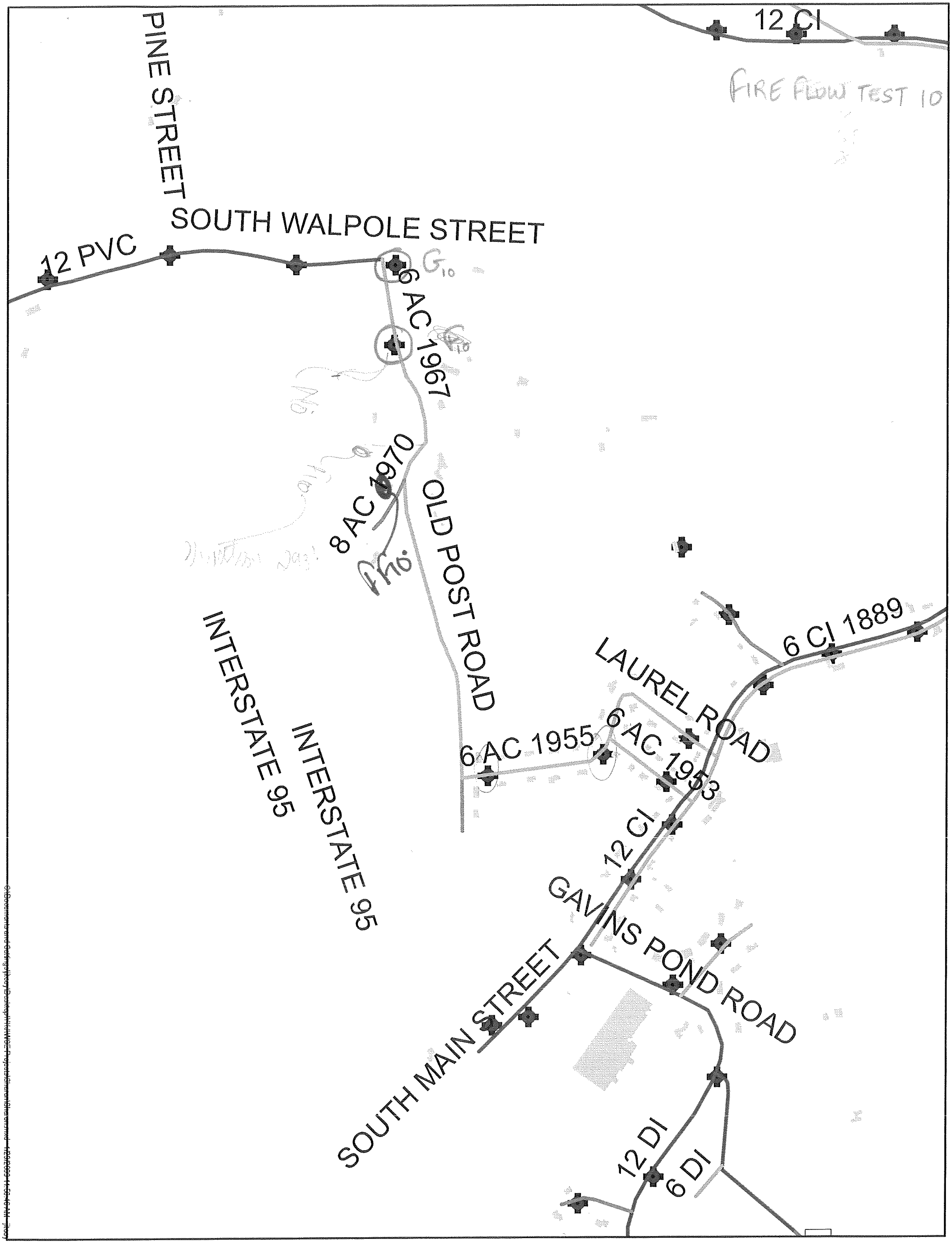
Project: Sharon Master Plan
Date: 06/24/09 Time: 1:15
Test Number: 10
Inspector: YKJ
City: Sharon.
State: MA.
Location
Zone: ______
Streets: Old Post Road.
Weather: ______
Sources of supply in operations and rates: ______
Tank levels: ______
Type of development in the area: ______
Required Flow: ______

Hydrant No.	Observed Pressure (psi)	Corrected Pressure (psi)
Gauge	Static: 44	Static:
	Residual: 35	Residual:
Flow	Static: 56	Static:
	Residual:	Residual:
	Static:	Static:
	Residual:	Residual:

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						1070

Flow available at 20 psi ______ gpm.

Sketch & Remarks Flow Hydrant location changed


12 CI
FIRE FLOW TEST 10
PINE STREET
SOUTH WALPOLE STREET
12 PVC
6 AC 1967
8 AC 1970
OLD POST ROAD
INTERSTATE 95
INTERSTATE 95
6 CI 1889
LAUREL ROAD
6 AC 1955
6 AC 1953
12 CI
GAVINS POND ROAD
SOUTH MAIN STREET
12 DI
6 DI

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Hydrant Test Report

Project: Sharon Master Plan
Date: 06/24/09
Time: 1:35 p.m
Test Number: 11
Inspector: YKJ
City: Sharon
State: MA
Location
Zone:
Streets: Firebrick Road
Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

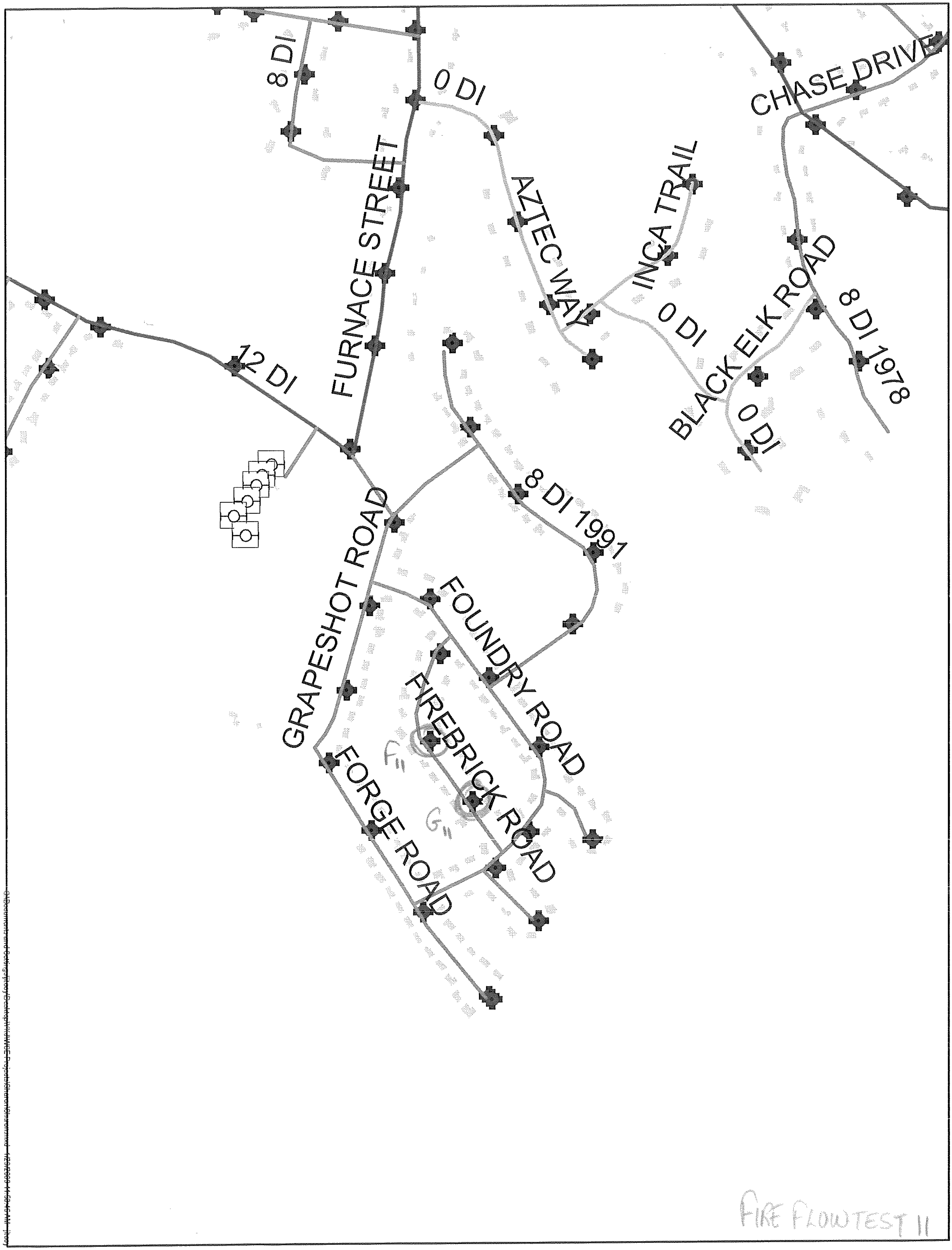
Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Static	Static:	50	Static:	
	Residual:	36	Residual:	
Flow	Static:	52	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						920 + 200 or 300 gpm

Flow available at 20 psi ______________ gpm.

Sketch & Remarks
Rock found.

- Beach - Rock
- Mansfield - Rock
- South Main St


8 DI
0 DI
CHASE DRIVE
FURNACE STREET
AZTEC WAY
INCA TRAIL
0 DI
BLACK ELK ROAD
8 DI 1978
0 DI
12 DI
8 DI 1991
GRAPESHOT ROAD
FOUNDRY ROAD
FIREBRICK ROAD
FORGE ROAD
FIRE FLOWTEST 11

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Hydrant Test Report

Project: Andover Martin Pump
Date: 06/24/09
Time: 12:30
Test Number: 12
Inspector: YKJ
City: Andover
State: MA

Location
Zone:
Streets: Beach Road

Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

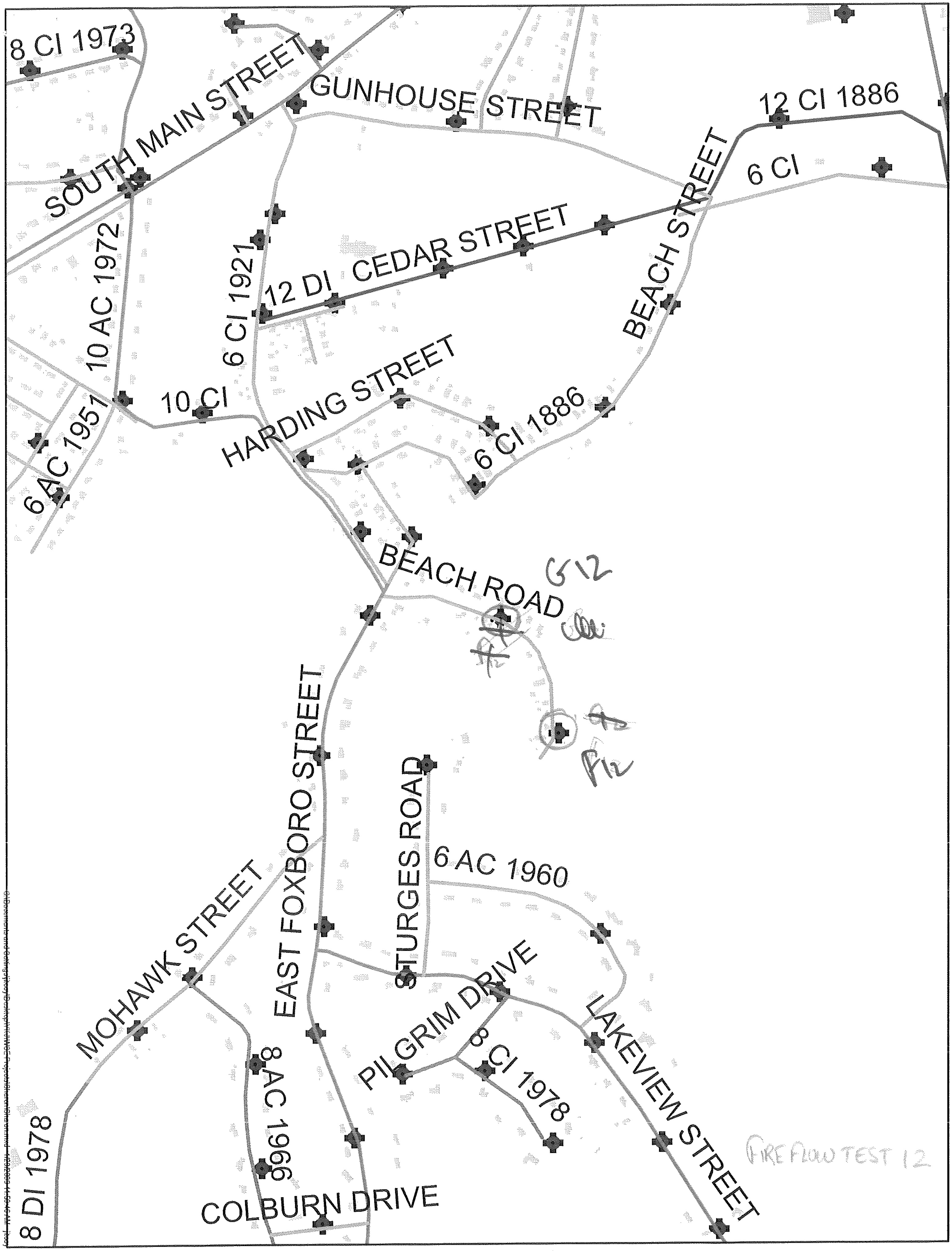
Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Gauge	Static:	71	Static:	
	Residual:	52	Residual:	
Flow	Static:	71	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						960

Flow available at 20 psi ______ gpm.

Broke a pitot tube on diffuser (Rock probably)

Sketch & Remarks


8 CI 1973
SOUTH MAIN STREET
GUNHOUSE STREET
12 CI 1886
6 CI
BEACH STREET
12 DI
CEDAR STREET
6 CI 1921
10 AC 1972
HARDING STREET
10 CI
6 CI 1886
6 AC 1951
BEACH ROAD
G12
P12
EAST FOXBORO STREET
STURGES ROAD
6 AC 1960
MOHAWK STREET
PILGRIM DRIVE
LAKEVIEW STREET
8 CI 1978
8 AC 1966
8 DI 1978
COLBURN DRIVE
FIRE FLOW TEST 12

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Hydrant Test Report

Project: Sharon Master Plan Date: 06/24/09 Time: 11:15
Test Number: 13 Inspector: YKJ
City: Sharon State: MA
Location
Zone:
Streets: Massapoag Ave
Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

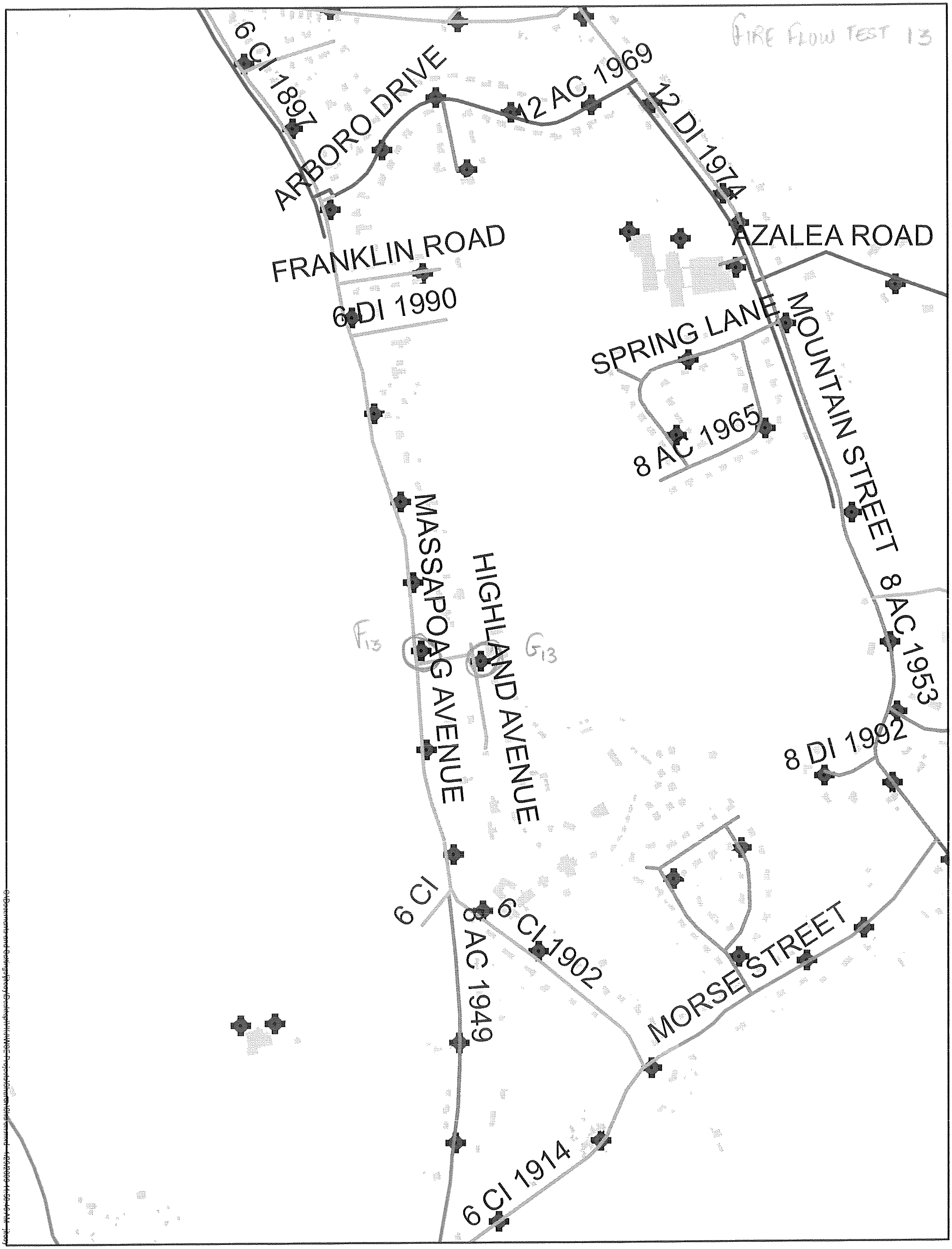
Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Gauge	Static:	61	Static:	
	Residual:	27	Residual:	
Flow	Static:	70	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						520 gpm : 650 gpm

Nozzle indicator

Flow available at 20 psi ____________ gpm.

Sketch & Remarks


FIRE FLOW TEST 13
6 CI 1897
ARBORO DRIVE
12 AC 1969
12 DI 1974
AZALEA ROAD
FRANKLIN ROAD
6 DI 1990
SPRING LANE
MOUNTAIN STREET
8 AC 1965
MASSAPOAG AVENUE
HIGHLAND AVENUE
F13
G13
8 AC 1953
8 DI 1992
6 CI
8 AC 1949
6 CI 1902
MORSE STREET
6 CI 1914

Weston & Sampson Engineers, Inc.
5 Centennial Drive
Peabody, Massachusetts 01960-7906
Tel: (978-532-1900 Fax: (978)977-0100

Hydrant Test Report

Project: Sharon Martin Plan. Date: 06/24/09 Time: 11:30 A.M.
Test Number: 4 Inspector: YKJ
City: Sharon. State:
Location
Zone:
Streets: Mass field Street
Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

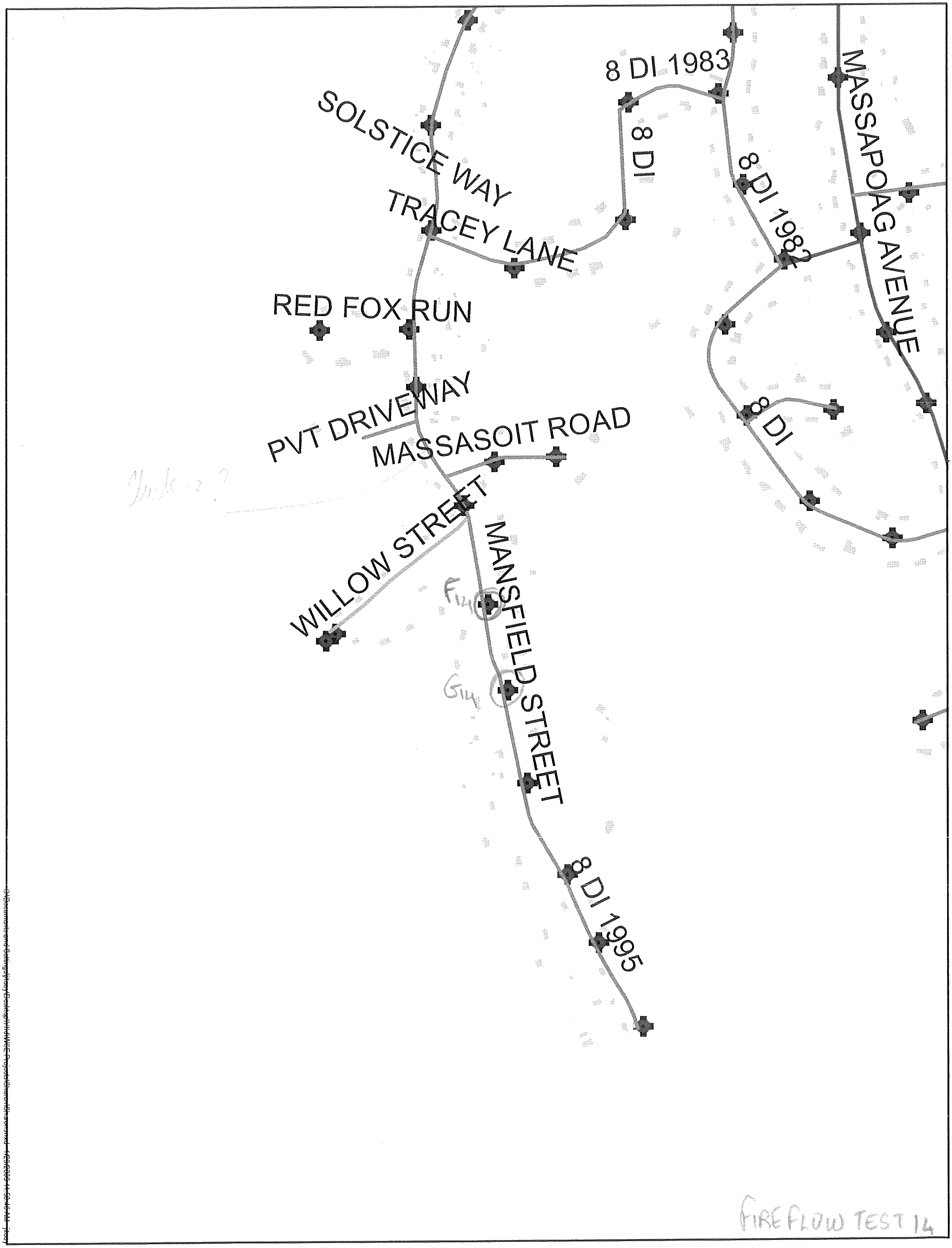
Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
	Static:	72	Static:	
	Residual:	64	Residual:	
(flow)	Static:	26	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						1220

525

Flow available at 20 psi ______ gpm.

Sketch & Remarks



8 DI 1983
MASSAPOAG AVENUE
SOLSTICE WAY
8 DI
8 DI 1982
TRACEY LANE
RED FOX RUN
PVT DRIVEWAY
MASSASOIT ROAD
8 DI
WILLOW STREET
MANSFIELD STREET
F14
G14
8 DI 1995
FIRE FLOW TEST 14

Weston & Sampson Engineers, Inc.
5 Centennial Drive
Peabody, Massachusetts 01960-7906
Tel: (978-532-1900 Fax: (978)977-0100

Hydrant Test Report

Project: Salem Master Plan
Date: 06/24/09
Time: 1:55
Test Number: 15
Inspector: MKT
City: Salem
State:
Location
Zone:
Streets: Eagle drive
Weather:
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

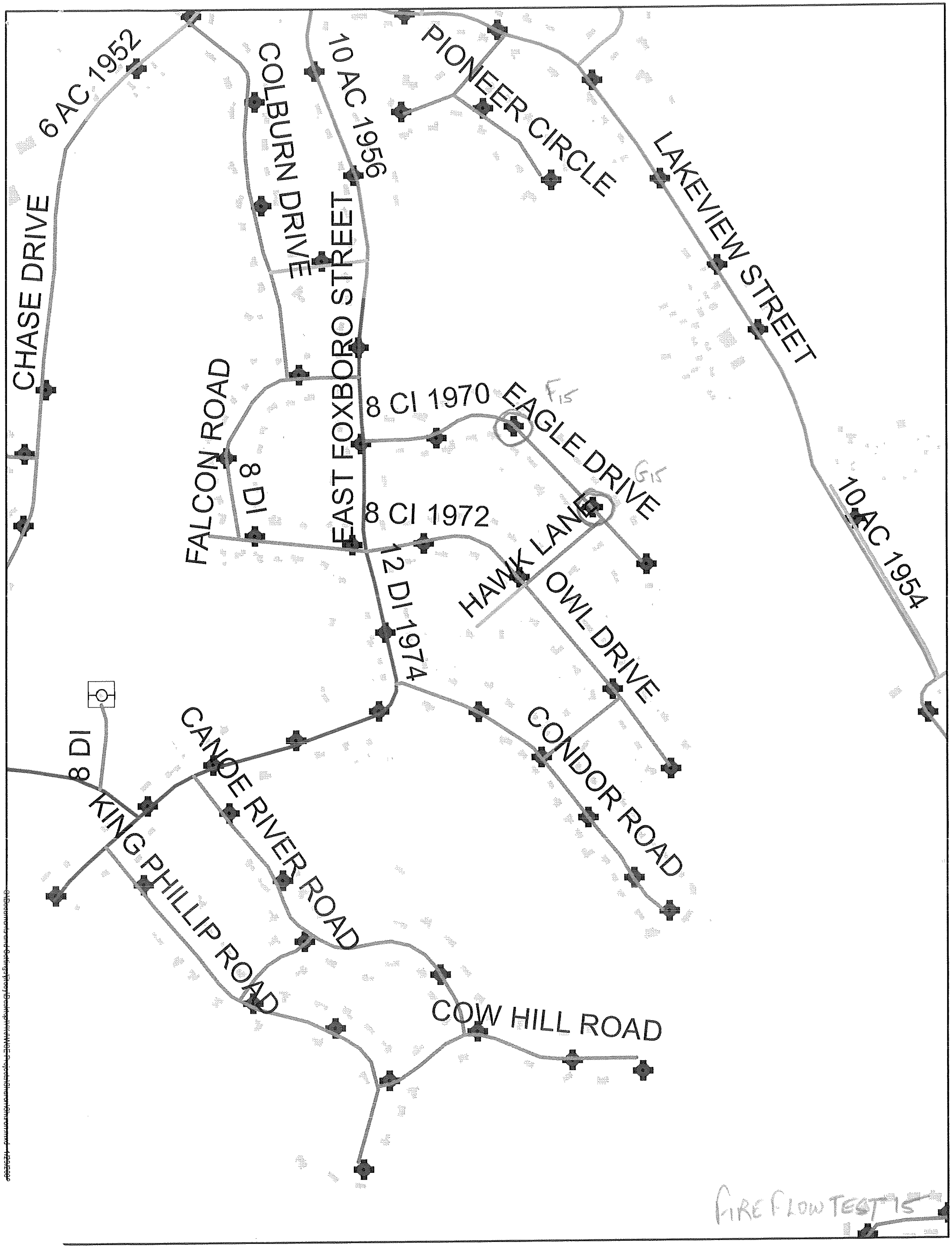
Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
[illegible]	Static:	55	Static:	
	Residual:	52	Residual:	
Flow	Static:	52	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

5 psi diff but it's not that [illegible] 8 [illegible] seems like big [illegible] difference

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						1060

Flow available at 20 psi ______________ gpm.

Sketch & Remarks Static gauge ~~at~~ static found to be off by 2psi


6 AC 1952
CHASE DRIVE
COLBURN DRIVE
10 AC 1956
PIONEER CIRCLE
LAKEVIEW STREET
EAST FOXBORO STREET
FALCON ROAD
8 DI
8 CI 1970
EAGLE DRIVE
F15
G15
8 CI 1972
HAWK LANE
10 AC 1954
12 DI 1974
OWL DRIVE
CONDOR ROAD
8 DI
CANOE RIVER ROAD
KING PHILLIP ROAD
COW HILL ROAD
FIRE FLOW TEST 15

Weston & Sampson Engineers, Inc.
5 Centennial Drive
Peabody, Massachusetts 01960-7906
Tel: (978-532-1900 Fax: (978)977-0100

Hydrant Test Report

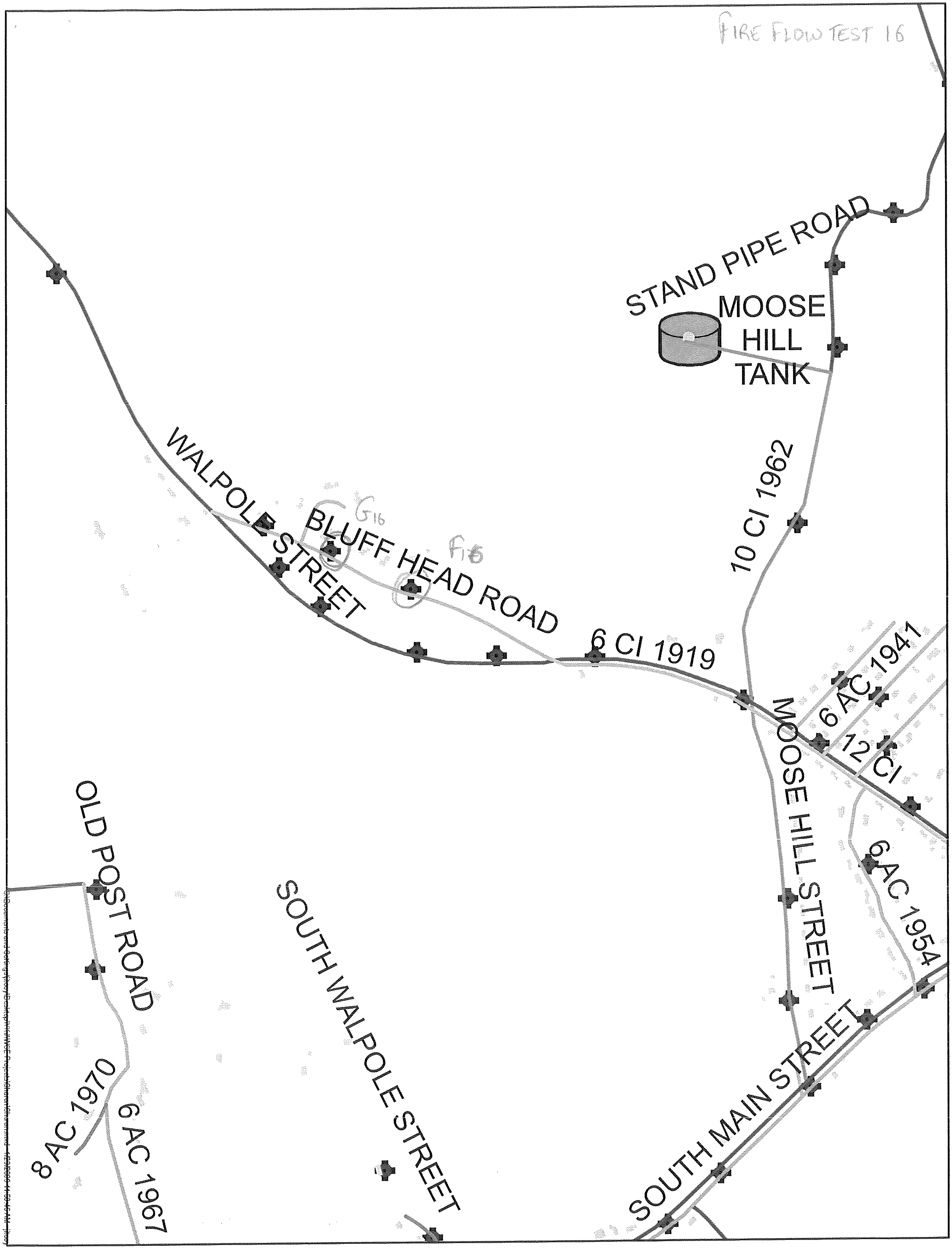
Project: Sharon Master Plan
Date: 06/24/09 Time: 12:50
Test Number: 16
Inspector: YKJ
City: Sharon
State:
Location
Zone:
Streets: Bluff Head Road
Weather: 90
Sources of supply in operations and rates:
Tank levels:
Type of development in the area:
Required Flow:

Hydrant No.	Observed Pressure (psi)		Corrected Pressure (psi)	
Gauge	Static:	54	Static:	
	Residual:	30	Residual:	
Flow	Static:	54	Static:	
	Residual:		Residual:	
	Static:		Static:	
	Residual:		Residual:	

Hyd. No.	Outlet Diam	Coeff.	Main Size	Static Pressure	Pitot Pressure	Flow (gpm)
						600gpm

Flow available at 20 psi ______ gpm.

Sketch & Remarks


FIRE FLOW TEST 16
STAND PIPE ROAD
MOOSE HILL TANK
10 CI 1962
WALPOLE STREET
G16
BLUFF HEAD ROAD
F16
6 CI 1919
6 AC 1941
12 CI
MOOSE HILL STREET
6AC 1954
OLD POST ROAD
SOUTH WALPOLE STREET
SOUTH MAIN STREET
8 AC 1970
6 AC 1967

Chapter 7: Wastewater/Stormwater Recharge Alternatives

Date: 3/25/2010

Introduction

Because of the ever-increasing population in southeastern Massachusetts, including the Town of Sharon, it is prudent to understand the limitations of existing water resources and develop future sustainable wastewater and stormwater management practices. Sharon's Water Management Act (WMA) permit limits the amount of water that can be pumped from the water supply wells in town. The limit of water allowed to be pumped from the underlying aquifer is in place so the groundwater aquifer does not become overly stressed. Recent changes in the regulatory process indicates properly located wastewater and/or stormwater recharge areas could be used as offsets to water withdrawals. In other words, recharge can be used to increase the permitted water withdrawal.

A properly sited disposal area is crucial to provide appropriate recharge to maintain baseflow within a watershed, protect against impacts to human and ecological receptors and to avoid future engineering/constructability issues such as side slope breakout or excessive mounding beneath discharge areas. Effluent or stormwater additions to the groundwater system would be beneficial to sub-basins that may be hydrologically stressed due to man-made withdrawals from either public (Town) or private (home) drinking water supply wells.

To aid in the siting of additional wastewater and stormwater recharge locations, a town-wide site-screening analysis was conducted for wastewater and stormwater disposal. This effort was undertaken in conjunction with the general master planning efforts for the Sharon water system. This effort entails a large-scale analysis of the entire town, considering several variables that are influential in properly locating a recharge area, including hydrogeologic information, sensitive environmental and human receptors, and local water budget issues. The goal of this investigation is to consider a large area (the town of Sharon) and conclude which general areas in Sharon would be most favorable for significant (ie large volume) recharge. Screening criteria are used to further focus in on specific sites in town where more detailed analysis of soils, site topography, accessibility, etc. would identify possible future concerns for stormwater or wastewater discharge.

The town-wide site screening analysis included data from published reports, drilling records, electronic maps, modeling results, town permits, and US census data. This data was used to create various electronic maps in a Geographic Information System (GIS) software. These maps represent various local hydrogeologic, environmental and water balance information associated with Sharon. These electronic maps were then "overlaid" on each other to create a final map that displayed the most favorable recharge sites in Sharon based on the sum of the most favorable criteria.

To analyze the hydrogeologic, environmental and water balance data in GIS, the entire town of Sharon was discretized into 35 by 35 meter cells, or blocks. A matrix was developed to assign values to the favorability of a criteria characteristic as it pertains to a recharge site. Each cell or block was assigned numeric values for each of the criteria evaluated, allowing for a numeric ranking of each cell in Sharon. These cells were then grouped according to level of favorability as a recharge site.

Initially, key hydrogeologic characteristics in Sharon, including depth-to-water, soil permeability and transmissivity, were assigned to each cell, ranked and mapped in GIS. An overlay map showing sensitive environmental areas was then produced, allowing for the next level of analysis. A second overlay map concerning wetland resource areas was then produced.

In addition to the hydrogeologic and environmental conditions, the concept of water balance can be incorporated into the matrix analysis. A mass balance analysis was performed on a sub- watershed (HUC 14) level to calculate net additions or withdrawals of water in the sub-basins. This analysis calculated annual net water additions/subtractions and compared the sub-basin against natural, undeveloped conditions. The analysis provides an ability to compare sub-basins based on their water need (or net water balance). Each cell in a given sub-basin was then assigned a mass balance value for areas with positive or negative mass balance. A final overlay map was then produced concerning water balance in each local watershed in Sharon.

For each 35 x 35 meter cell in Sharon, the assigned value for each criteria were added together to get a final ranking for that cell. These cells were then grouped according to level of favorability as a recharge site and mapped. The largest, most favorable sites were then identified as areas that should be further investigated on a micro-scale level, as opposed the macro-level scale of this analysis.

The following sections of this memo details the site screening process, criteria description, water mass balance analysis, results of the matrix analysis, conclusions and recommendations.

<u>Site Screening Process</u>

To describe the process and criteria used for the site screening analysis, a step-by-step description of what was done will be provided, followed by an in-depth description of each criteria used, its importance in relation to recharge site screening, the source of information for the parameter, and matrix values assigned to each criteria.

A town-wide site screening study was conducted at a desk-top level to rank areas in Sharon according to favorability for the recharge of treated effluent or stormwater. There are numerous criteria that can be considered when locating a recharge area. To represent the hydrogeologic characteristics in Sharon, depth to water, soil permeability and transmissivity were used as criteria. To represent sensitive environmental receptors, four Natural Heritage and Endangered Species Program (NHESP) areas and Areas of Critical Environmental Concern (ACECs) were used as criteria. Proximity to wetland resource areas were also used as a criteria. The final criteria used for this analysis is the mass balance of each local watershed.

To represent these data on a large-scale, town basis, the entire town of Sharon was discretized in to 35 x 35 meter cell blocks. Numeric values regarding each criteria was the assigned to each cell using a systematic procedure. First, the hydrogeologic data, including depth to water, soil permeability and transmissivity, were used to create a matrix that would rank each cell according to its favorability in relation to a recharge site. These values were added together in each cell and ranked. The higher the sum score, the more favorable the cell. The cells were then grouped using the natural breaks between the highest ranking cells, medium ranking cells, and lowest ranking cells as a dividing point. These groups were then identified as Tier 1 sites (most favorable), Tier 2 sites, and Tier 3 sites (least favorable). The hydrogeologic Tier 1, 2 and 3 sites were then mapped in GIS using ArcView Version 9.3 to spatially represent varying levels of favorability in Sharon as recharge sites when considering hydrogeologic conditions.

A matrix concerning sensitive, protected environmental areas was then developed to display which areas may need to be avoided due to the presence of these sensitive and protected areas. Areas used to establish this criteria include NHESP and ACECs. An overlay map containing criteria values for each cell in Sharon was created in GIS. These values were then added to the hydrogeologic criteria to create a further level of analysis, ranking and grouping each cell to create new Tier 1 sites (most favorable), Tier 2 sites, and Tier 3 sites (least favorable). The cells were grouped into these tiers using the natural breaks between the highest ranking cells, medium ranking cells, and lowest ranking cells as a dividing point.

Another matrix was developed to represent proximity to wetland resource areas. Two different matrices were developed for this criteria based on if the source of recharge is from wastewater or stormwater. These matrices were then used to create a set of two more overlay layers (one for wastewater and one for stormwater) which represents if a cell is favorable as a recharge area based on its proximity to wetland resource areas. The overlay maps were then added to the previous criteria maps to develop two new sets of Tier 1 sites (most favorable), Tier 2 sites, and Tier 3 sites (least favorable) (one set or tiers for stormwater recharge and one set of tiers for wastewater recharge) based on the areas hydrogeologic criteria, sensitive environmental criteria, and proximity to wetlands criteria. The cells were grouped into these tiers using the natural breaks between the highest ranking cells, medium ranking cells, and lowest ranking cells as a dividing point.

A final matrix was developed based on each sub-basins' change in net water recharge. To create this matrix, a mass balance analysis was conducted, resulting in the assignment of a criteria value for each sub-basin, based on whether the sub basin has a large net water gain, a neutral water balance, or a large net water loss. An overlay layer was created with each cell being assigned a value based on its sub-basin mass balance criteria value. This criteria overlay layer was then added to the hydrogeologic criteria, sensitive environmental criteria, and proximity to wetlands criteria layers. The value of each criteria in each cell was then added together. The cells were grouped into Tier 1 sites (most favorable), Tier 2 sites, and Tier 3 sites (least favorable) using the natural breaks between the highest ranking cells, medium ranking cells, and lowest ranking cells as a dividing point. Two maps were created, representing Tiers 1, 2 and 3, for wastewater recharge sites and stormwater sites. The largest Tier 1 sites from this final map were used to identify the sites that would merit further investigation as a wastewater or stormwater site.

A more detailed description of each criteria, including its importance in relation to recharge site screening, the source of information for the parameter, and matrix values assigned to each criteria is presented next.

Criteria

Criteria information for the town of Sharon was obtained through numerous sources, including published reports, drilling records, electronic maps, modeling results, town permits, and US census data. Based in this data, various matrices were developed to represent the favorability of each criteria type as it pertains to a wastewater or stormwater recharge site. These criteria represent hydrogeologic characteristics, sensitive environmental areas, proximity to wetlands, and sub-basin mass balance. A more detailed description of each criteria is presented next.

Depth-to-water is important to site selection due to groundwater mounding affects that arise due to additions to the groundwater table. As effluent or stormwater is added to the groundwater table at a specific site, the groundwater levels underneath the discharge site will naturally rise in response to infiltration. If the groundwater table were close to the ground surface, the possibility of the groundwater table rising to the surface and flooding the ground will be greater than if the groundwater table is much deeper and further from the ground surface. Thus, a greater depth-towater measurement is deemed more favorable. Groundwater elevations from 47 town monitoring wells, taken on October 29, 2008, were converted to static water elevation and used with numerous surface water elevations taken from MassGIS Digital Elevation Model (DEM) data (from February 2005) to create a static water level map in GIS. This static water elevation map values were then subtracted from the MassGIS Digital Elevation Model (DEM) data (from February 2005) to create a depth to water map. Additionally, depth-to-water values were determined using output data from a town-wide groundwater model that was created in 1990 by Weston & Sampson, Inc. conducted in Visual MODFLOW. These values were used to corroborate the depth to water map created using data from the monitoring wells and surface water elevations.

Since large volumes of recharge could not be discharged into areas where depth to water is very limited without groundwater levels underneath the discharge rising and most likely flooding the area, the lowest criteria value (1) was assigned to cells whose depth to water is between 0 – 5 feet. The most favorable sites would have a depth to water of greater than 45 feet, thus allowing for greater mounding height with less threat of flooding. The depth to water criteria range is presented in Table 1.

Table 1. Depth-to-Water Criteria Range

Criteria Value	Depth-to-Water
1	0 – 5 feet
2	5 – 25 feet
3	25 – 45 feet
4	> 45 feet

Soil permeability was considered at each site to understand the site's ability to transmit water, or the rate at which liquid can move through pore spaces in the soil. If soil permeability is relatively low, then the mounding affect will be more dramatic since water will not be able to disperse as quickly when compared to soils of greater permeability. For this, soils types were mapped electronically using the MassGIS data layer "Soils_Poly" (updated October 2008). A soil permeability class was assigned to each soil according to the soil descriptions provided by the USGS publication "Soil Survey of Norfolk and Suffolk Counties Soil Survey – 1989". These soil types all have soil permeability classes, ranging from very slow (<0.06 in/hr) to very rapid (>20 in/hr). The soil permeability criteria range is presented in Table 2.

Table 2 Soil Permeability Criteria Range

Criteria Value	Soil Permeability Class
1	Very slow - moderate
2	Moderately rapid
3	Rapid
4	Very rapid

Transmissivity is an important factor to understand since it is the product of saturated thickness and hydraulic conductivity. The transmissivity value is the volume of water that can flow through an area (1-foot wide by the aquifer thickness) during a time period. Transmissivity is often expressed in units of ft^2/day. Transmissivity values were obtained through MassGIS data layer "Aquifer_Poly" (updated July 2007). This data layer was created by MassGIS using the 1:48,000 hydrologic atlas series on groundwater favorability for all of Massachusetts. These estimates were confirmed through saturated thickness and hydraulic conductivity values obtained through a 1990 town-wide groundwater model conducted in Visual MODFLOW. Boring log information was also used to corroborate MassGIS transmissivity values as the boring logs had saturated thickness information and soil information that can be used to calculate hydraulic conductivity. The transmissivity criteria range is presented in Table 3.

Table 3 Transmissivity Criteria Range

Criteria Value	Soil Permeability Class
1	Low (< 1,400 ft^2/day)
3	Medium (1,400 – 4,000 ft^2/day)
5	High (> 4,000 ft^2/day)

Sensitive environmental receptors include NHESP Priority Habitats of Rare Species, NHESP Estimated Habitats of Rare Wildlife, NHESP Certified and estimated vernal pools, and ACECs. Data for these receptors were obtained from MassGIS data layers "Prihab_Poly" (updated October 2008), "Esthab_Poly" (updated October 2008), "CVP_PT" (updated January 2010), "PVP_PT" (updated December 2000), and "ACECS_Poly" (updated April 2009), respectively. It is important to understand where these areas are located in Sharon because siting projects in these protected areas prove to be more difficult and costly that in areas that do not have such constraints. To discharge water in these areas would include additional effort and expense in permitting. Ultimately, permission may not be granted to projects in these protected areas. The highest value (10) was given to an area not in either NHESP or ACEC areas, while the lowest value (0) was given to areas that are located in both NHESP and ACEC areas. The sensitive environmental receptors criteria range is presented in Table 4.

Table 4 Sensitive Environmental Receptors Criteria Range

Criteria Value	Sensitive Environmental Receptor

0	In both NHESP and ACEC
5	In either NHES or ACEC
10	Not in either NHESP or ACEC

The favorability of an area's **proximity to wetlands** will differ depending the source of recharge. It would not be advisable to discharge wastewater close to a wetlands area due to the water quality of that water. Discharge from stormwater, however, may be beneficial near wetlands because of the wetlands capacity to assimilate contaminants that may be in the stormwater. Because of this, a different matrix was developed for wastewater recharge and stormwater recharge. Wetlands data was obtained from the MassGIS data layer "WetlandsDEP_Poly" (updated April 2007). Because it is not favorable to have wastewater discharging close to wetlands, a value of "0" was given to areas within 100 feet of wetlands, and a value of "10" was assigned to cells greater than 100 feet of wetlands. The proximity to wetlands criteria range for stormwater is presented in Table 5.

Table 5 Proximity to Wetlands Criteria Range (For Stormwater)

Criteria Value	Proximity to Wetland Resource Area
0	Within wetlands resource area, or >800 feet
1	400 – 800 feet
3	0-400 feet

The **water balance** of a local watershed, represented as the percent change in net annual recharge for this analysis, is a helpful siting factor since it helps identify which sub-basins in Sharon need additional water more than other sub-basins. A sub-basin with a large negative percent change in net annual recharge (large volumes of water leaving the sub-basin each year) would benefit more than a sub-basin that has a large positive percent change in net annual recharge (large volumes of water entering the sub-basin each year). By locating a recharge site in a sub-basin with greater water need, the overall water availability of the basin (and water availability in town) will be improved. HUC-14 level watersheds were used as the local level sub-watershed because of its relatively small size. There are 15 total sub-watershed that are all, or partly, in Sharon. Ten of these sub-watersheds are in the Boston Harbor (Neponset) watershed, making up the northern two thirds of Sharon, while five sub-watersheds are in the southern Taunton watershed. The sub-basin water balance criteria range for is presented in Table 6, while a further description of the water balance analysis follows.

Table 6 Sub-Basin % Recharge Criteria Range

Criteria Value	Percent Change in Recharge in Sub-Basin
0	> 5%
5	-12 – 5%
10	< 12%

<u>**Water Mass Balance Analysis**</u>

Understanding the water balance in a sub-basin is important because of its implications on stream flow and, by association, habitat health, since a reduction in baseflow could potentially result in a ecological impacts. To better understand the health of water resources in Sharon, a water balance tool was developed. This tool endeavors to quantify annual sub-basin recharge to baseflow, and assess if additions and withdrawals of water are creating a net gain or loss of water in the sub-basins on an annual basis. Once completed, the recharge of each of the 15 sub-basins in Sharon was compared with each other in terms of the sub-basin water impairment.

The mass balance analysis was conducted on a Hydrologic Unit Code (HUC) 14 sub-basin scale. This scale is advantageous for this type of analysis because the relatively small area size of these sub-basins allows for more localized analysis. Fifteen HUC 14 sub-basins were identified and delineated in Sharon using MassGIS data (Figure 1). While portions of many of the sub-basins are located outside of the Town, only the water balance for the portion of the sub-basin inside Sharon was considered. By confining the analysis of water inputs and outputs to land within the Town of Sharon, the mass balance tool can identify Sharon's role in each sub-basin water availability.

The input and output included in the mass balance calculation are identified in the mathematical formula, below.

$$R_{(net)} = (R_{(nat)} + R_{(GWDP)} + R_{(ss)} + R_{(NPDES)}) - (W_{(pw)} + W_{(WMA)}), \text{ where,}$$

$R_{(net)}$ = net existing annual
recharge $R_{(nat)}$ = natural recharge
$R_{(GWDP)}$ = recharge from GWDP
facilities $R_{(ss)}$ = recharge from septic
systems
$R_{(NPDES)}$ = recharge from NPDES permit facilities
$W_{(pw)}$ = withdrawal from private wells
$W_{(WMA)}$ = withdrawal from public wells permitted under the WMA

Natural recharge $_{(R(nat))}$ is the amount of precipitation that enters the groundwater per year via pervious ground cover. The amount of water infiltratrating to the groundwater will depend on surficial geology. For each sub-basin, the area of surficial geology type (sand and gravel, till or bedrock, or floodplain alluvium) was multiplied by the infiltration rate associated with the surficial geology type, resulting in a volume of precipitation infiltrated annually for each surficial geology type in each sub-watershed. The infiltration rates used for each surficial geology type were reported in USGS WRI # 03-4320 "Delineation of Areas Contributing Water to the Dry Brook Public-Supply Well, South Hadley, Massachusetts".

Groundwater discharge permit facilities were located in sub-basins BH-3 (Macintosh Farm Community Association) and BH-10 (Sharon Public Schools). The most recent data for these facilities, specifically location of outfall and permitted daily flow values, were obtained from the MassDEP website.

Recharge from septic systems $_{(R(ss))}$ was evaluated on a residence by residence basis. Initially, a unit wastewater flow was calculated by first multiplying the number persons per house (taken from 2000 Census data) by the wastewater disposal per capita (from the 2006 "Water Assets Study: Regional Summary Report:Taunton River Watershed". This provides the wastewater disposal per house in Sharon. The total number of homes per sub-basin was calculated by visually interpretating the number of homes per sub-basin from 2008 aerial photographs in MassGIS. The number of homes per sub-basin multiplied by the waste water disposal per home resulted in wastewater disposal per sub-basin. It was assumed that all residential sites are serviced by septic systems, with the exception of large combined systems regulated under the GWDP.

Withdrawal from private wells $_{(W(pw)),}$ was calculated using visual photo-interpretation. The existing water infrastructure was mapped in GIS over a 2008 aerial photograph. After comparison of homes and their location to the water main, it was estimated that 147 homes were not on town water. This assumption was confirmed by the Sharon DPW, who reported 149 private drinking water wells in town. The water withdrawal rate was calculated to be 66.8 gallons per capita per day, as averaged by the 2000 – 2008 average daily use reported in the 2009 Sharon Water Conservation Plan. Using the occupancy per home from the 2000 Census data, and multiplying this value by the water use per capita in Sharon, the water use per home in Sharon was calculated. The number of homes with private drinking water wells per sub-basin was then multiplied by the water use per home to calculate the water use from private drinking water wells per sub-basin.

Quantifying large water withdrawals is integral to defining basin inputs. To estimate withdrawal from public wells per sub-basin $_{(W(WMA)),}$ the average annual pumping volume for each well during 2004 – 2008, as reported in the Town of Sharon's Annual Statistical Reports (ASRs), was used. The volumes of each well in the same sub-basin were then combined to calculate the withdrawal from public wells per sub-basin ($W_{(WMA)}$).

The annual natural conditions recharge was calculated so it could be compared with the existing net annual recharge, thereby determining the affects of human influences at each sub-watershed. The annual natural conditions recharge was calculated by multiplying the area of each surficial geology type for each sub-basin by the recharge rate per surficial geology type (with the wetland resource area subtracted from each surficial geology type per sub-basin). The recharge for each surficial geology type was then added together for each sub-basin to calculate the net annual natural conditions recharge for each sub-basin.

The results of the site screening analysis are presented below.

Results

Important recharge siting information was obtained from the hydrogeologic criteria, sensitive environmental area criteria, proximity to wetlands criteria, and sub-basin water balance criteria. When all of the values for each of the criteria were added together in GIS for each 35 by 35 meter cell in Sharon, favorable recharge locations for wastewater and stormwater recharge were determined. Results of the step-by-step site screening analysis are presented below.

The results of the hydrogeologic criteria are presented in Figure 2 (depth to water), Figure 3 (soil permeability), Figure 4 (transmissivity), and Figure 5 (summed hydrologic criteria). Figure 5 indicates that the most favorable locations for large scale recharge volumes are located in the north and western locations of Sharon. The oblong Tier 1 and Tier 2 polygons in the southwest part of the town, as well as the Tier 1 sites in the middle and north of the town, are likely due to the large aquifer thickness in these areas, as substantiated by the hydraulic atlases HA-460 and HA-484.

The next level of matrix analysis included adding the proximity to sensitive areas criteria to the hydrogeologic criteria. These areas include Natural Heritage and ACEC sites (Figure 6). GIS was used to show if a cell was inside a sensitive area (less favorable) or outside a sensitive area (more favorable). The combined values of the hydrologic criteria and proximity to sensitive environmental areas were grouped by level of favorability and presented in Figure 7. Small

changes in Tier 1 and Tier 2 areas are noted as areas that were initially considered Tier 1 or Tier 2 areas for the hydrogeologic criteria but are in these sensitive environmental areas will be removed and changed to Tier 3 (least favorable) areas. Of interest here is that much of the original Tier 1 and Tier 2 area in the Canoe River (T-2) is changed to Tier 3 area due to the amount of NHESP and ACEC area in this sub-basin

The proximity to wetland resource areas for wastetwater recharge and stormwater recharge are presented in Figures 8 and 9, respectively. Again, small changes in the Tier 1 and Tier 2 areas are noted due to their location to wetlands. Total area for Tier 1 and Tier 2 areas again are decreased. Figure 10 and Figure 11 present Tier 1, 2 and 3 areas when considering the hydrogeologic, environmental and proximity to wetlands criteria for wastewater and stormwater recharge, respectively.

The mass balance matrix is represented in Figure 12. The percent change in existing water recharge versus the natural conditions recharge was then calculated to demonstrate difference between predevelopment and current conditions in each sub-basin. The sub-basins with the largest net water loss are BH-7 and T-1, with a percent change in recharge of -48.4% and -9.7%, respectively. It should be noted that these two sub-basins have public supply wells in them. The sub-basins with the largest net water gain were BH-3, BH-8, T-5, and BH-10 with a percent change in recharge of +16.7%, +7.3, +6.7% and +6.5%, respectively.

By adding the criteria for hydrogeologic, environmental, proximity to wetlands and sub-basin water balance criteria, final maps showing Tier 1, 2 and 3 sites for wastewater and stormwater recharge are presented in Figures 13 and 14, respectively. Figures 13 and 14, while slightly different due to the different criteria ranking in proximity to wetlands, generally shows that the most favorable recharge sites are in western Sharon, in sub-basins BH-7 and T- 1.

Conclusions

The matrix analysis allows for a ranking of potential wastewater and stormwater recharge sites based on specific hydrogeologic properties. The depth to water, soil permeability and transmissivity at various sites in the mid and western part of Sharon favor the practice of recharging large volumes of treated effluent or stormwater based on the initial hydrogeologic matrix desktop analysis. The eastern side of the Town is less favorable for such large volume discharge facilities, but may be adequate for smaller scale, local recharge sites (eg residential systems).

The ACEC area in the north and south of Sharon, combined with the Natural Heritage sites located in the south-east, middle and western portion of the town decreased the Tier 1 and Tier 2 sites. Additionally, the proximity of some of the Tier 1 and Tier 2 sites to wetlands decreased the total area of these Tier 1 and 2 sites. This change is most dramatically seen in sub-basin T-1, known as the Canoe River basin.

When considering the change in net recharge per sub-basin, the Tier 1 and Tier 2 sites in BH-7 and T- 1 would be most favorably considered since these sub-basins could benefit most from an addition of water. Most of the favorable sites, and the largest areas, are located in these two sub-basins. Although sub-basin BH-7 reveals a large net water loss, the connected, downstream sub basins (BH-4 and BH-8) are neutral and large net water gain sub-basins, respectively (sub-basin connections noted in Figure 1, with sub-basins with same pattern being connected). As such, the downstream gains will help to off-set the large losses occurring in BH-7.

Specifically, the largest Tier 1 areas in sub-basin BH-7 are off of Pleasant Road (see Figure 15). Recharge in these areas should not be made in close proximity to the groundwater wells or upgradient of these wells for concern of possible impacts to water quality. As is noted in Figure 15, a Zone II covers most of this area, with the exception of the northern side of the knoll. This northern side may be an area of interest for recharge, as well as the area just off of Pleasant Park Road. These areas seem to have sufficient distance from the groundwater wells to minimize water quality threats.

The largest Tier 1 areas in sub-basin T-1 are near the intersection of South Main Street and Wolomolopoag Road and at the intersection of Old Post Road and Laurel Road (see Figure 16). These sites are in a Zone II, and are upgradient of groundwater wells as noted in Figure 16.

Recommendations

This screening level analysis of alternative wastewater and stormwater recharge sites should be considered an available planning tool for analysis of future recharge sites. Additional information should be considered when siting these recharge areas. Of specific interest would be final recharge site size, parcels in the Tier I site areas and ownership of land.

Final recharge site design will depend on flows estimated to be discharged at the site. Site design will allow for a further investigation of where Tier 1 area in Sharon would be large enough to accommodate such a site. Parcels could then be investigated to see who owns the parcels in the areas of interest. The most favorable sites would be those Tier 1 sites that are large enough to accommodate final site area and are on town owned land.

Additional analysis should consider Tier 1 sites and the proximity to nearest proposed or existing WWTF, as well as feasibility to increase and existing WWTF. This analysis will allow determination of costs that may be associated with wastewater disposal site location.

Once locations have been selected for either wastewater or stormwater disposal sites, field verification of screening factors used for this desk top analysis should be conducted.

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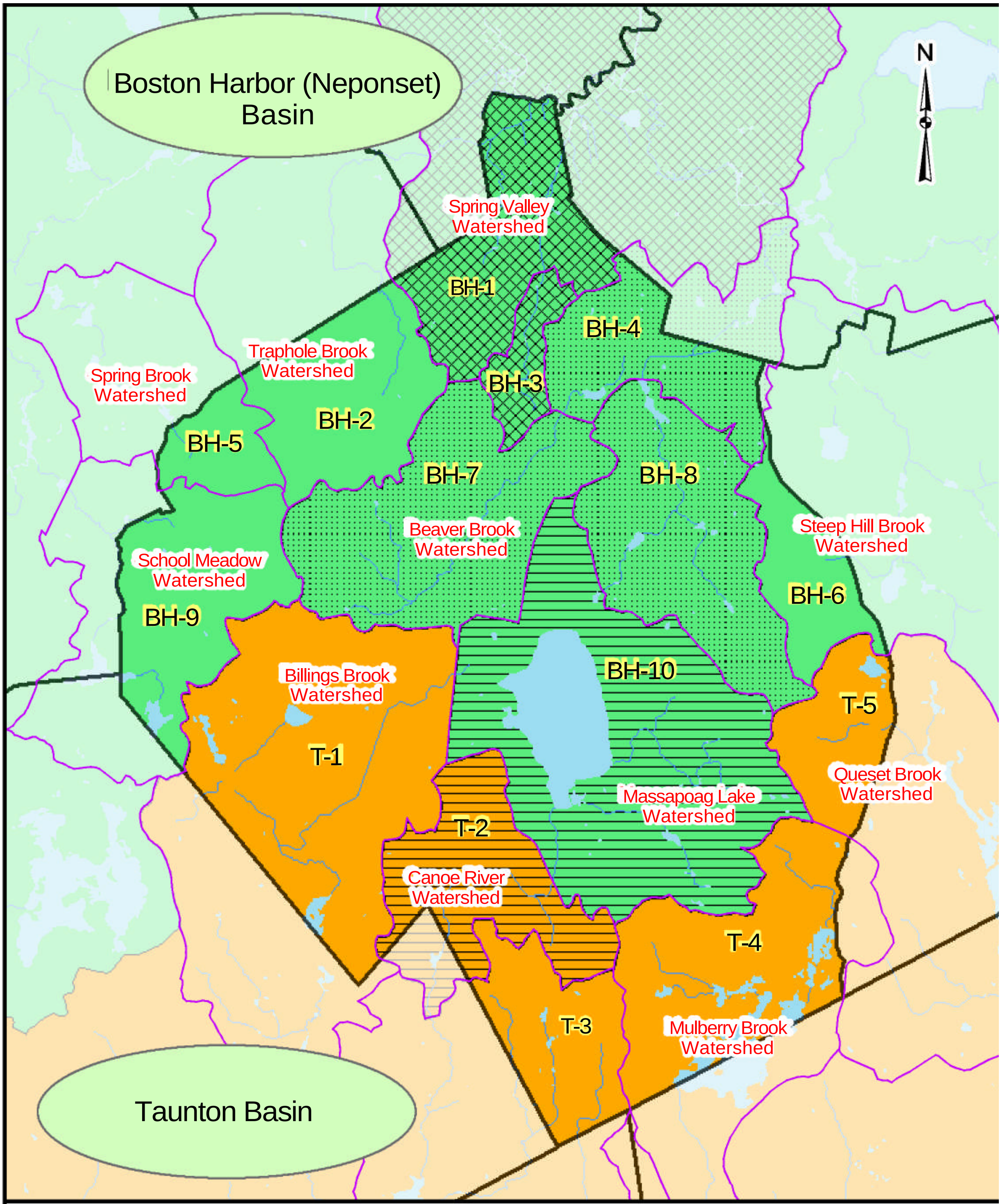


Perennial Stream
Pond, Lake, Ocean
Reservoir
MA Town Boundaries
Local Basins

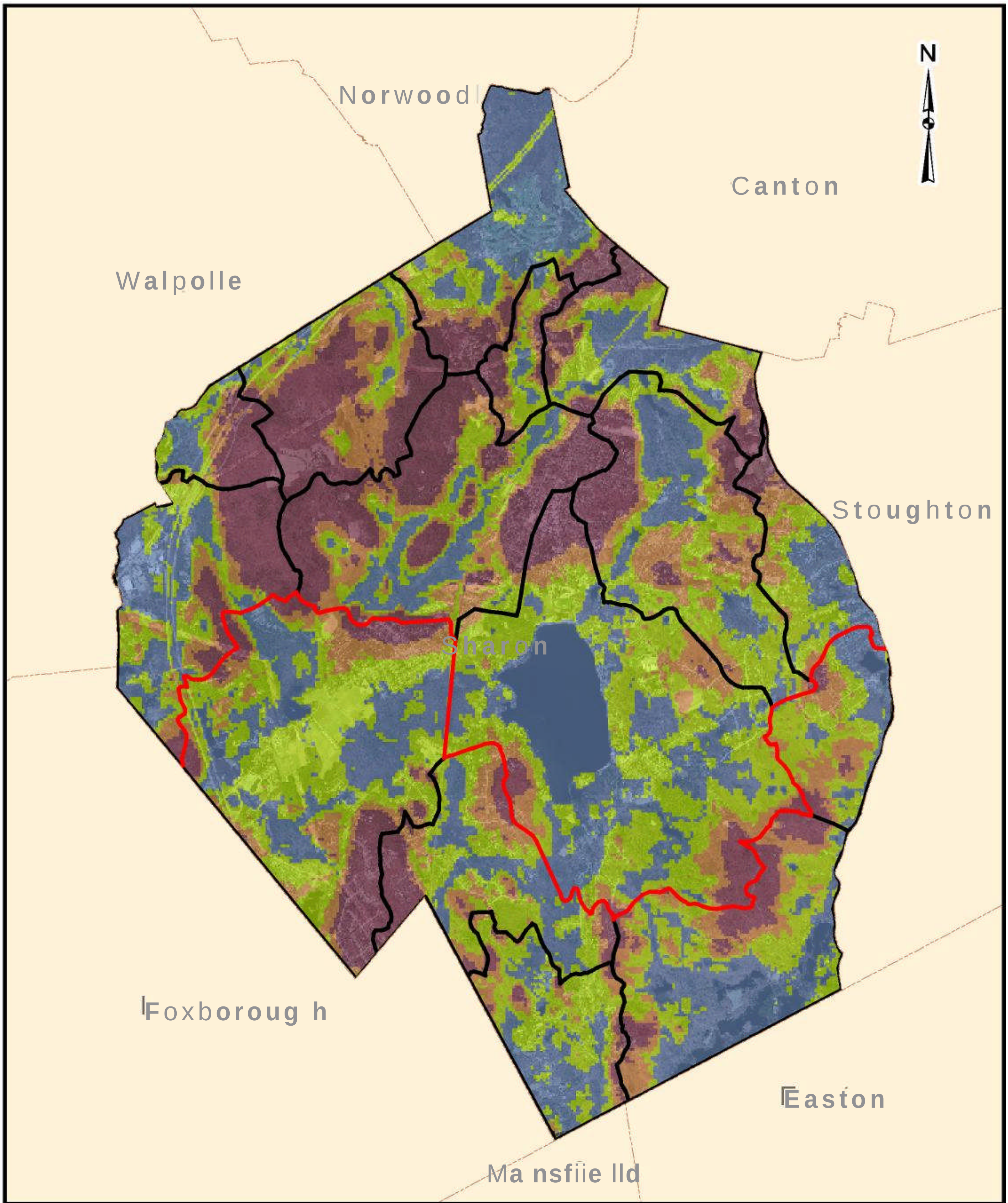
Regional Basins
BOSTON HARBOR BASIN
TAUNTON RIVER BASIN

FIGURE 1
SHARON, MA

Regional and Local Basin Divisions

5,000 0 5,000
SCALE IN FEET

Weston&Sampson



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MAJOR BASIN DIVIDE
Sub-Basins

Depth to water

< 5 feet 5-
25 feet 25-
45 feet >
45 feet

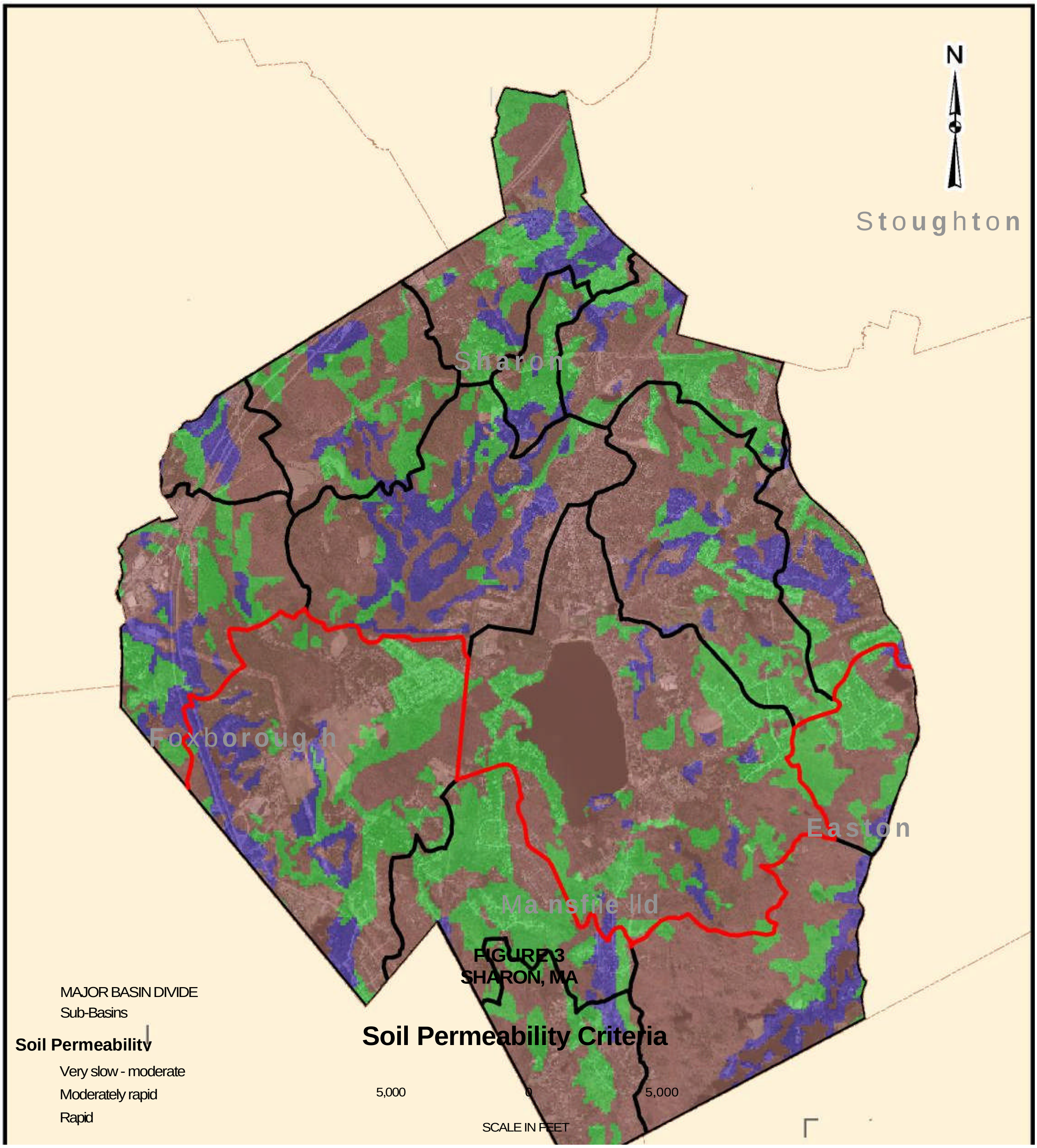
FIGURE 2
SHARON, MA

Depth to Water Criteria

5,000 0 5,000
SCALE IN FEET

Weston&Sampson

Walpolle Norwood Canton



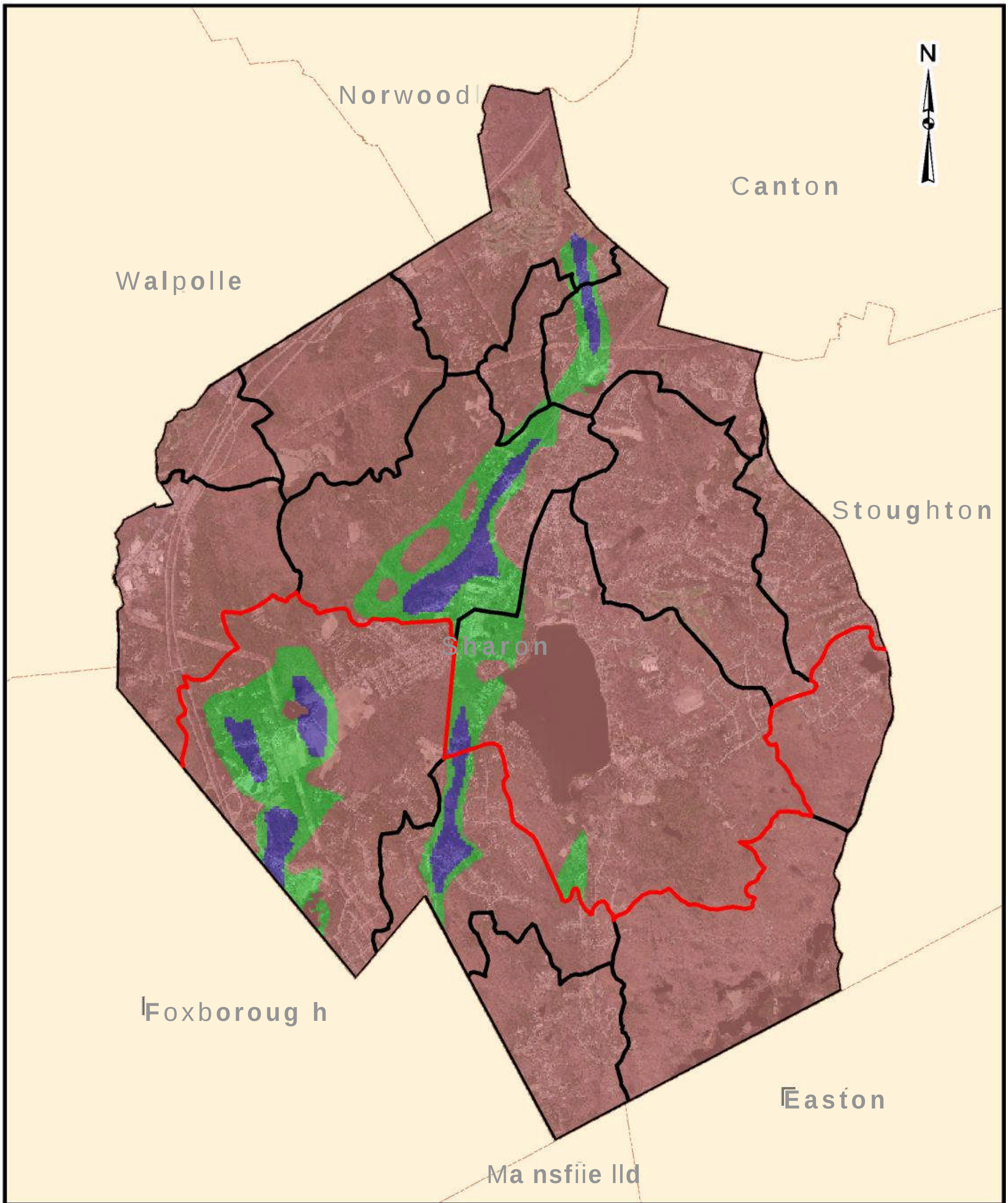


FIGURE 4
SHARON, MA

MAJOR BASIN DIVIDE
Sub-Basins
< 1,400 ft2/day
1,400 - 4,000 ft2/day
> 4,000 ft2/day

Transmissivity Criteria

5,000 0 5,000
SCALE IN FEET

Weston&Sampson

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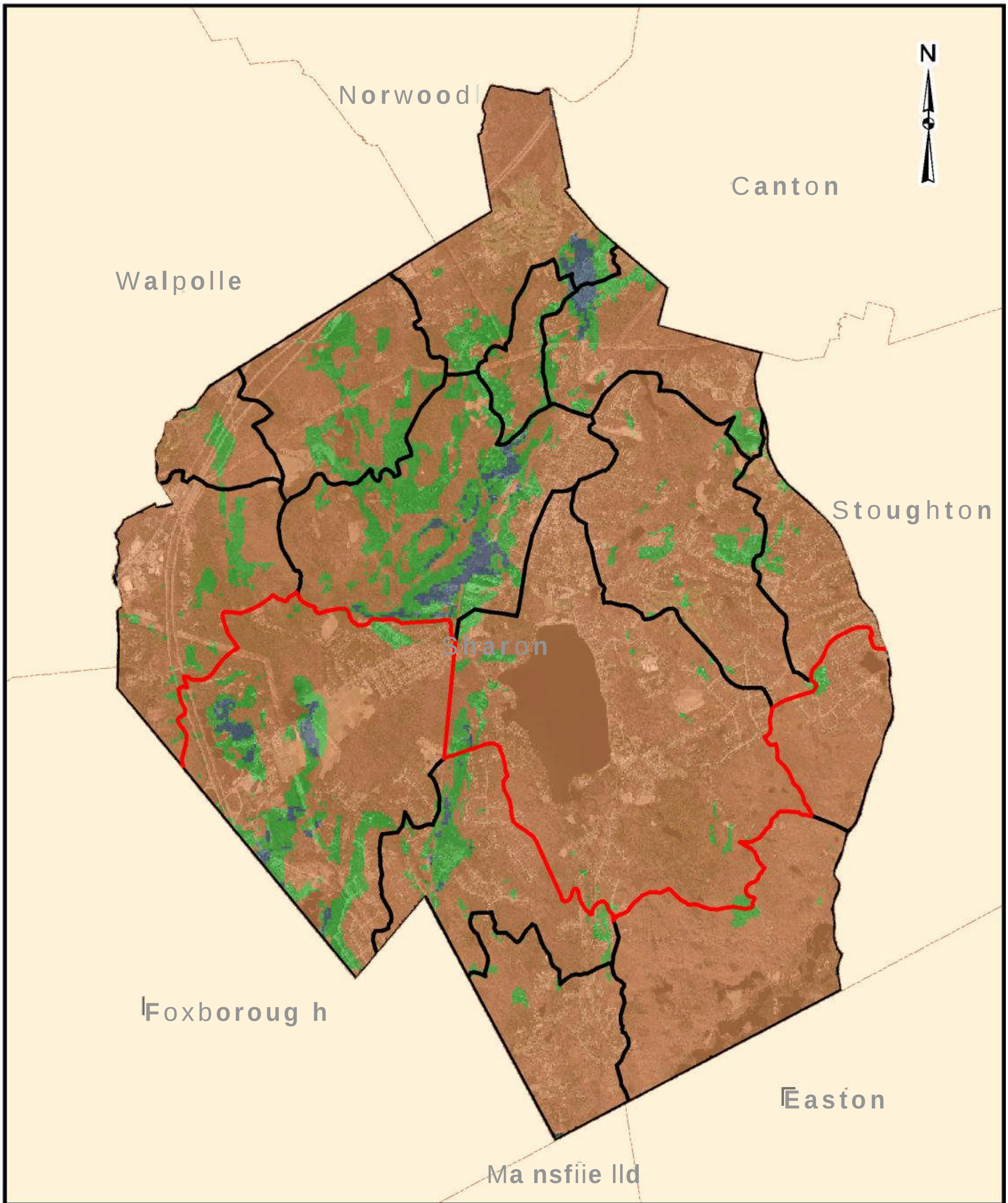


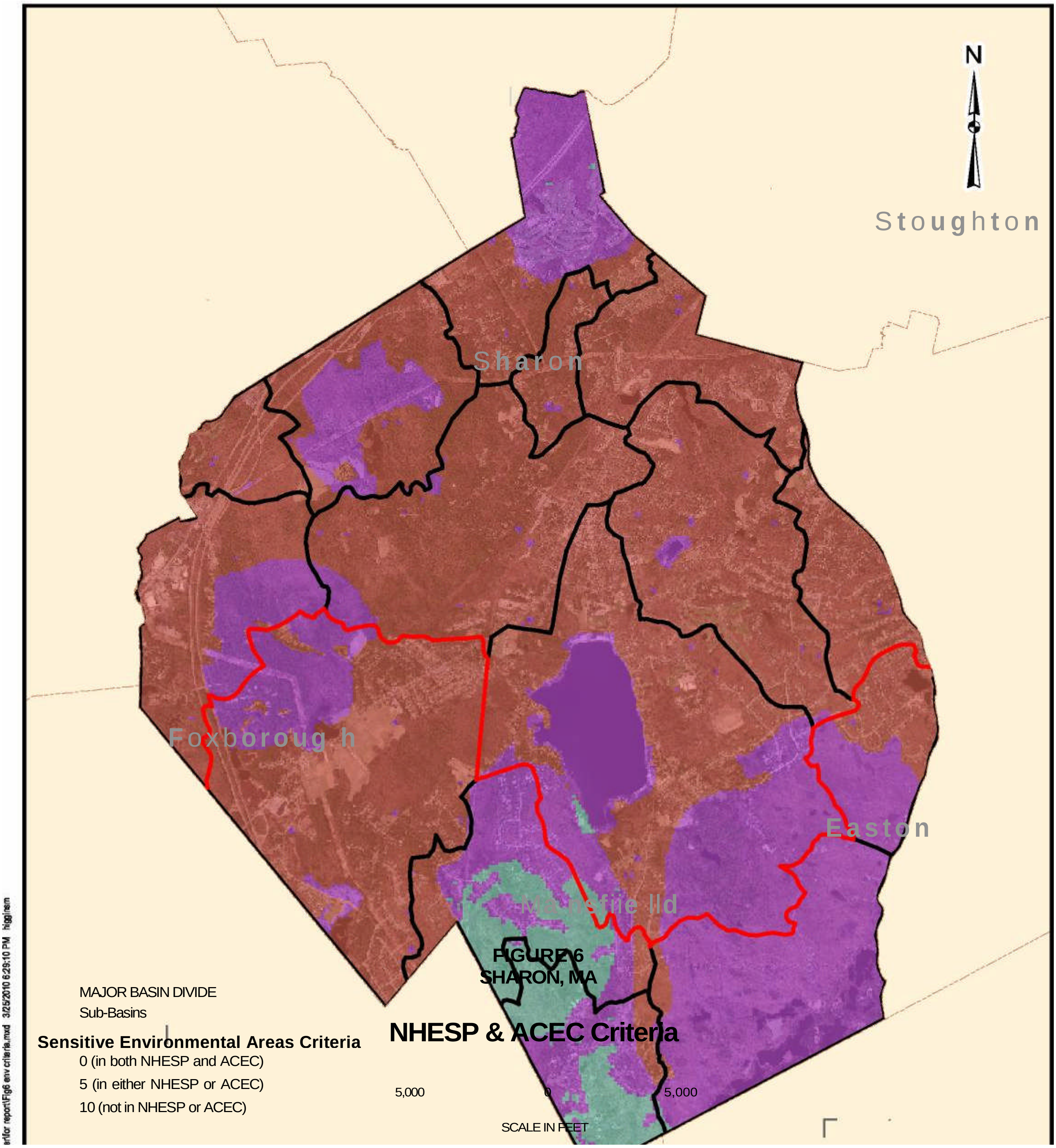
FIGURE 5
SHARON, MA

MAJOR BASIN DIVIDE
Sub-Basins
Tier 1 (most favorable)
Tier 2
Tier 3 (least favorable)

Hydrogeologic Siting Criteria

5,000 0 5,000
SCALE IN FEET

Weston&Sampson


N
Stoughton
Sharon
Foxborough
Easton
Mansfield
FIGURE 6
SHARON, MA
NHESP & ACEC Criteria
MAJOR BASIN DIVIDE
Sub-Basins
Sensitive Environmental Areas Criteria
0 (in both NHESP and ACEC)
5 (in either NHESP or ACEC)
10 (not in NHESP or ACEC)
5,000
0
5,000
SCALE IN FEET
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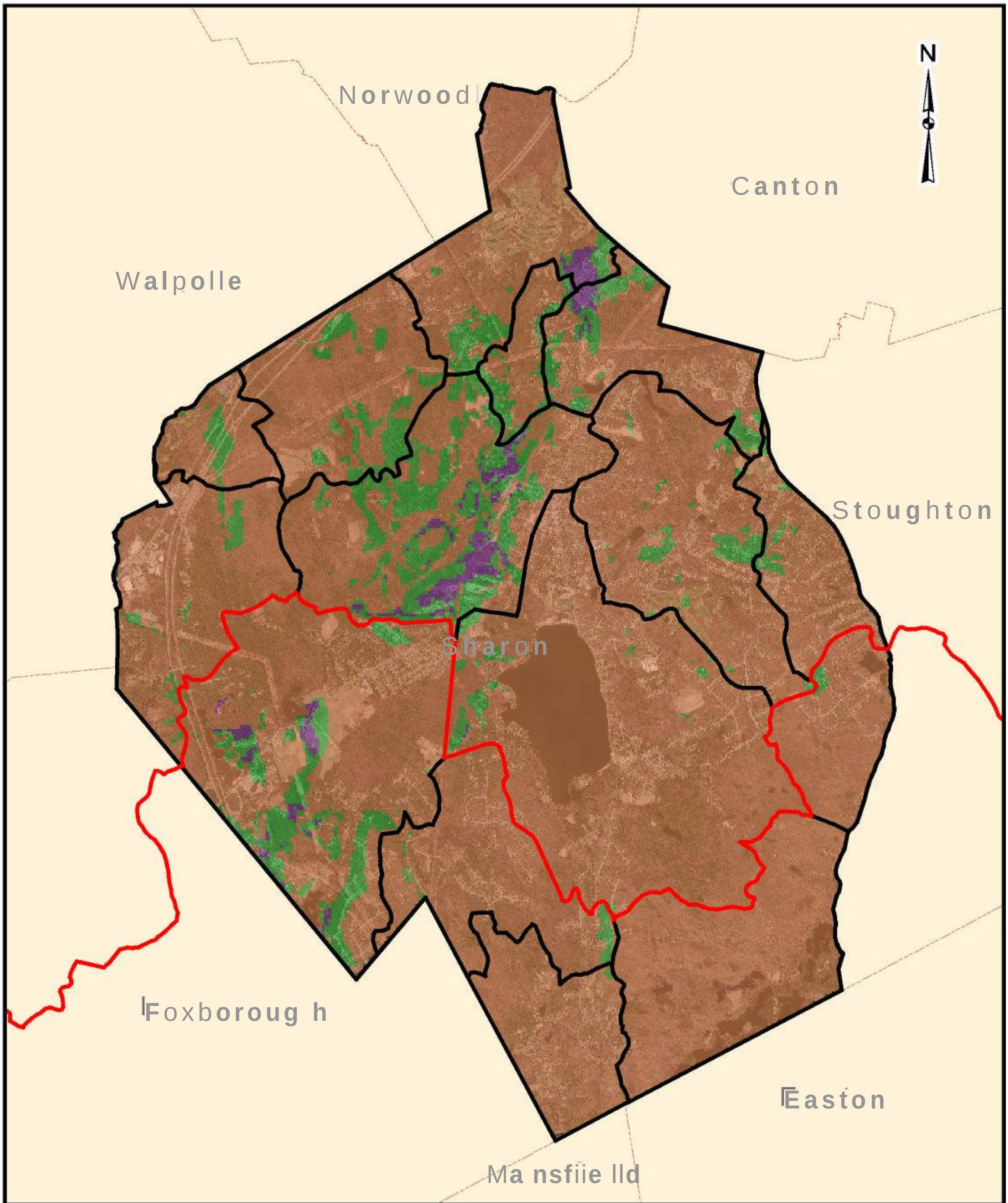

FIGURE 7
SHARON, MA

Combination of Hydrogeologic and Sensitive Environmental Areas Criteria

MAJOR BASIN DIVIDE
Sub-Basins

Criteria Ranking
Tier 1 (most favorable)
Tier 2

5,000 0 5,000

Weston&Sampson

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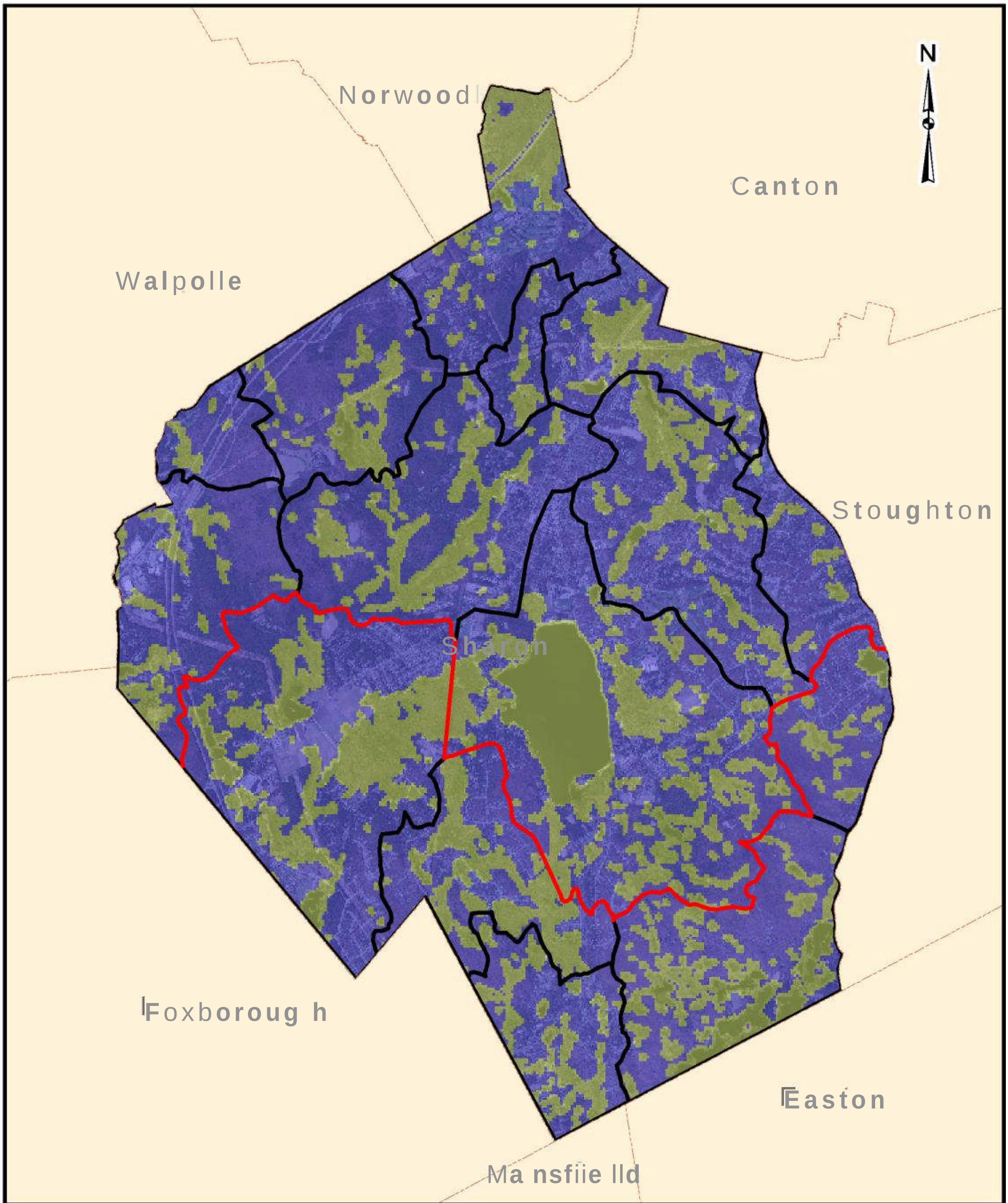

FIGURE 8
SHARON, MA

Wetlands Proximity Criteria (Wastewater)

MAJOR BASIN DIVIDE
Sub-Basins

Wetlands Criteria (Wastewater)
0 (within 100' of wetlands)
10 (> 100' of wetlands)

5,000 0 5,000
SCALE IN FEET

Weston&Sampson®

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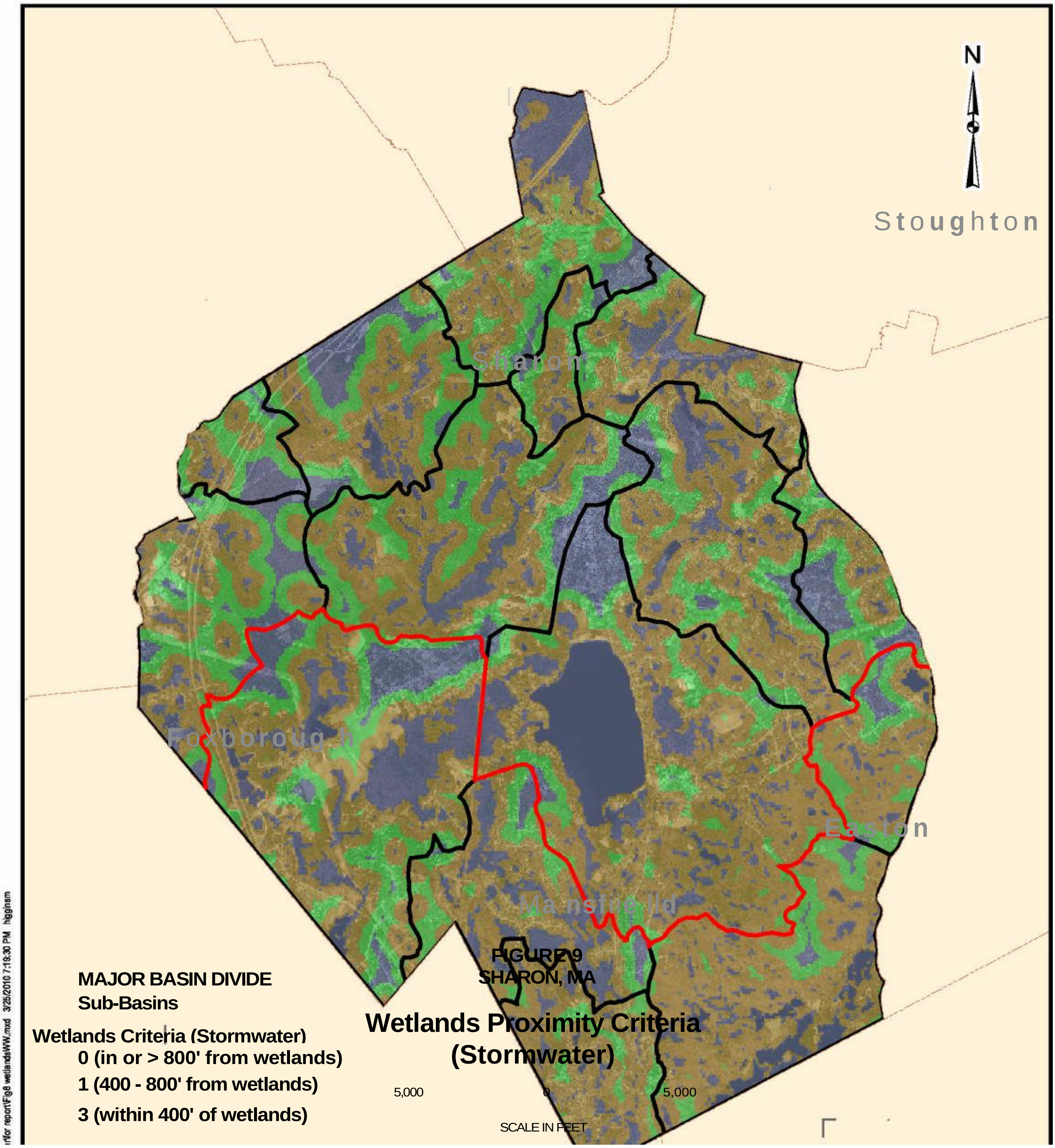

Stoughton
Sharon
Foxborough
Easton
Mansfield
FIGURE 9
SHARON, MA
MAJOR BASIN DIVIDE
Sub-Basins
Wetlands Criteria (Stormwater)
0 (in or > 800' from wetlands)
1 (400 - 800' from wetlands)
3 (within 400' of wetlands)
Wetlands Proximity Criteria
(Stormwater)
5,000
0
5,000
SCALE IN FEET
N

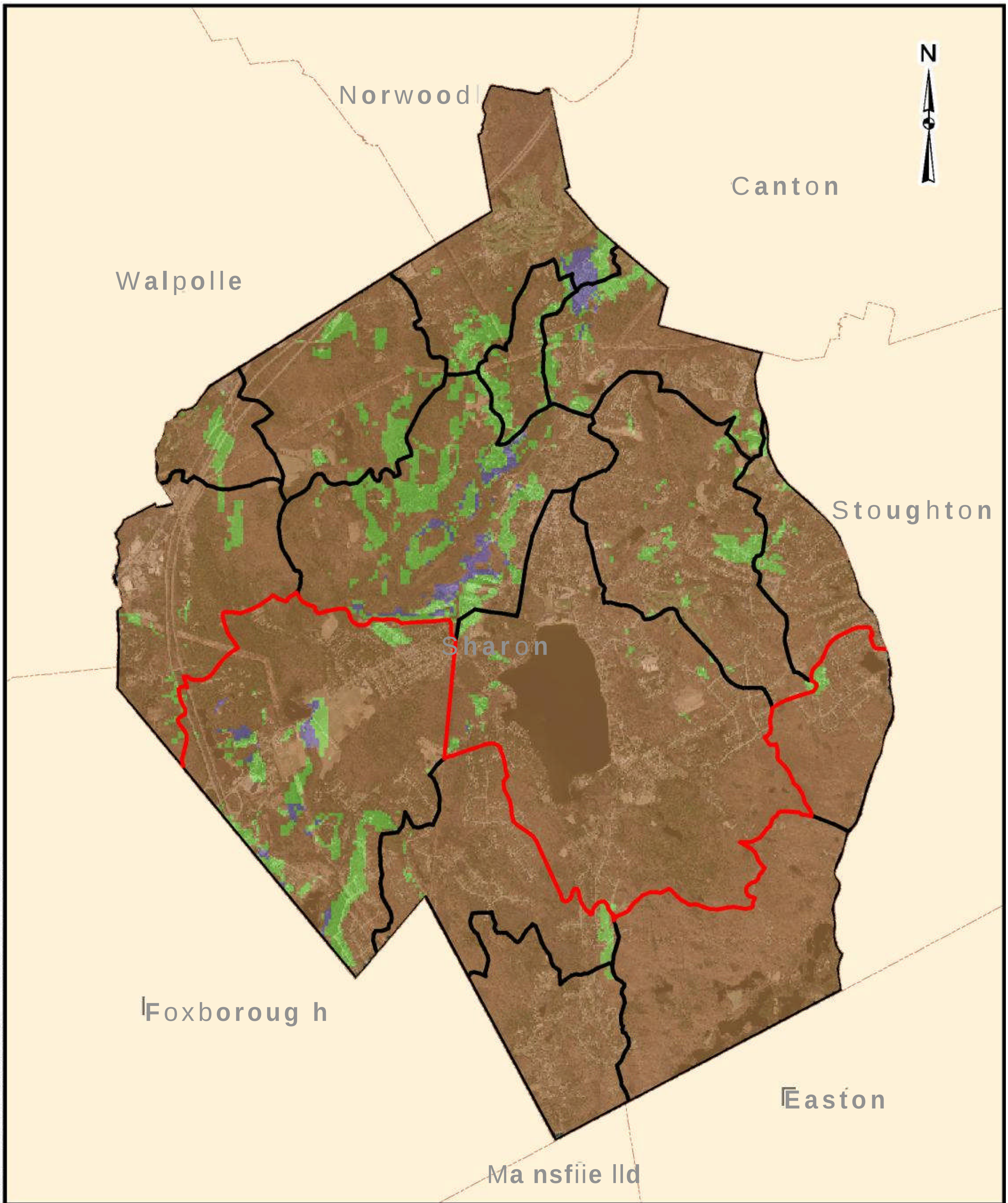


FIGURE 10
SHARON, MA

Hydrogeo/Environmental/Wetlands Criteria (Wastewater)

- MAJOR BASIN DIVIDE
- Sub-Basins

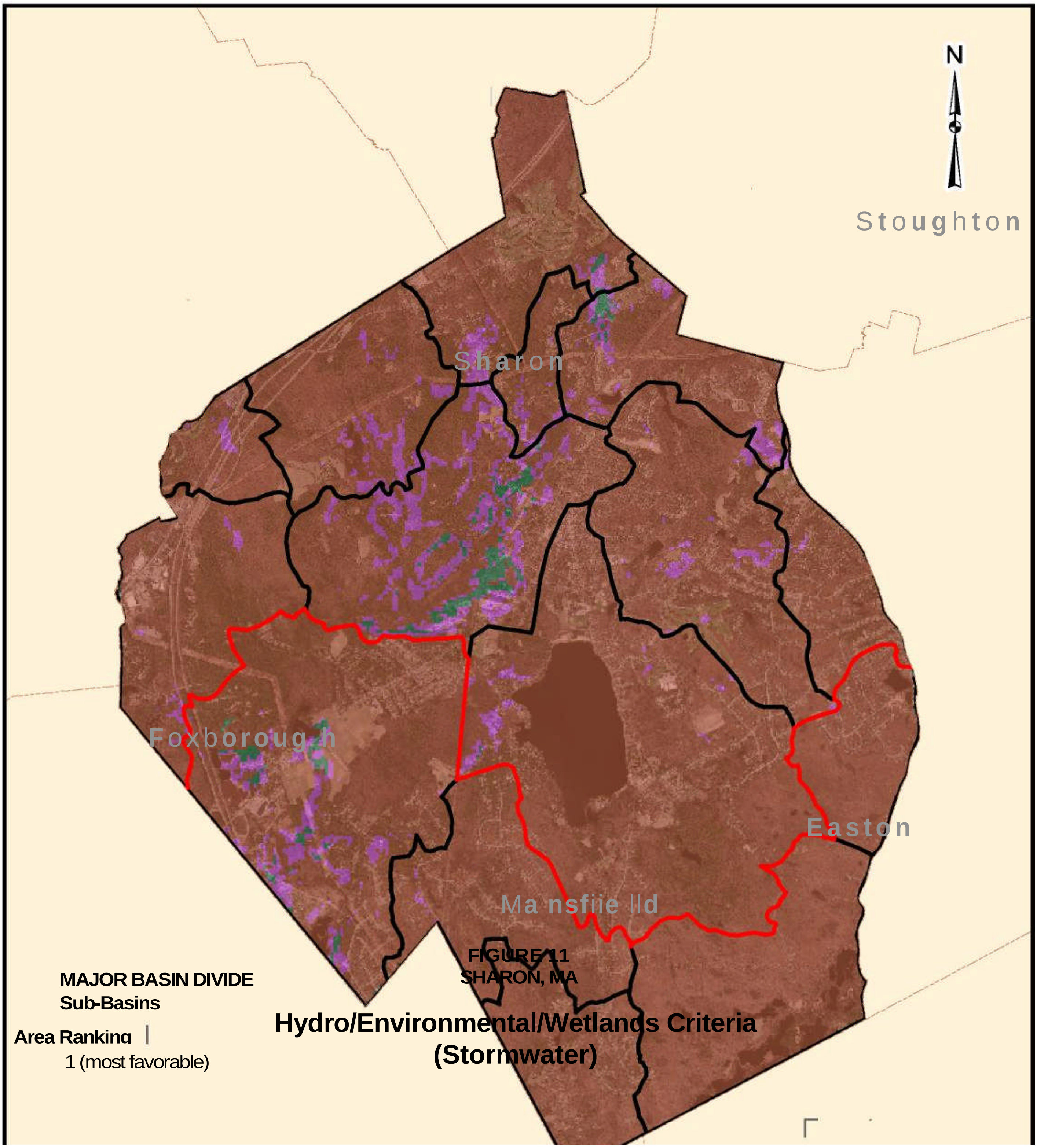
Area Ranking

- 1 (most favorable)
- 2
- 3 (least favorable)

5,000 0 5,000

SCALE IN FEET

Weston&Sampson



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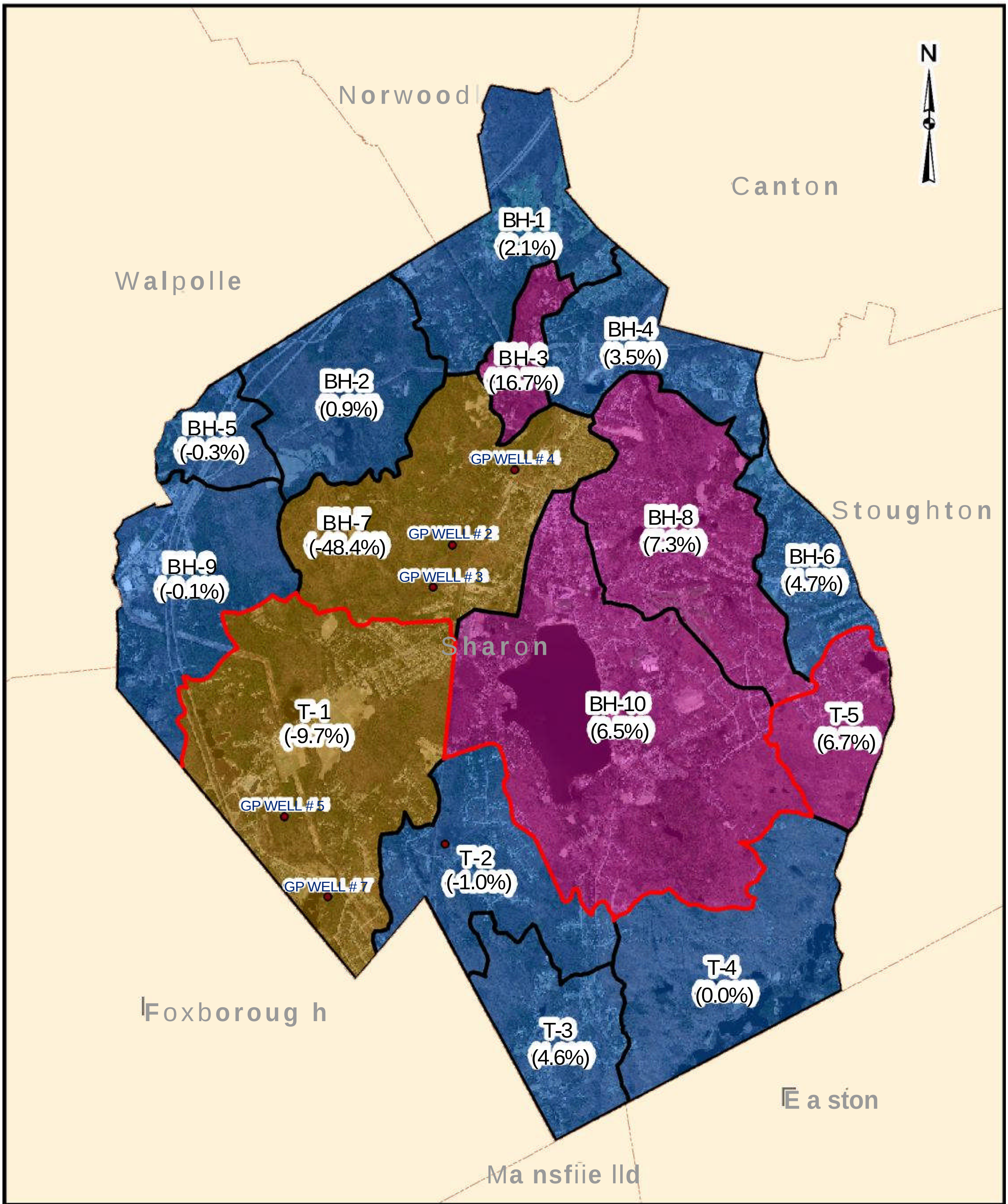

FIGURE 12
SHARON, MA

Sub-Basin Water Balance

- pws_sharon
- MAJOR BASIN DIVIDE
- Large Net Water Gain
- Neutral Water Balance
- Large Net Water Loss

5,000 0 5,000
SCALE IN FEET

Weston&Sampson

3 (least favorable)SCALE IN FEET

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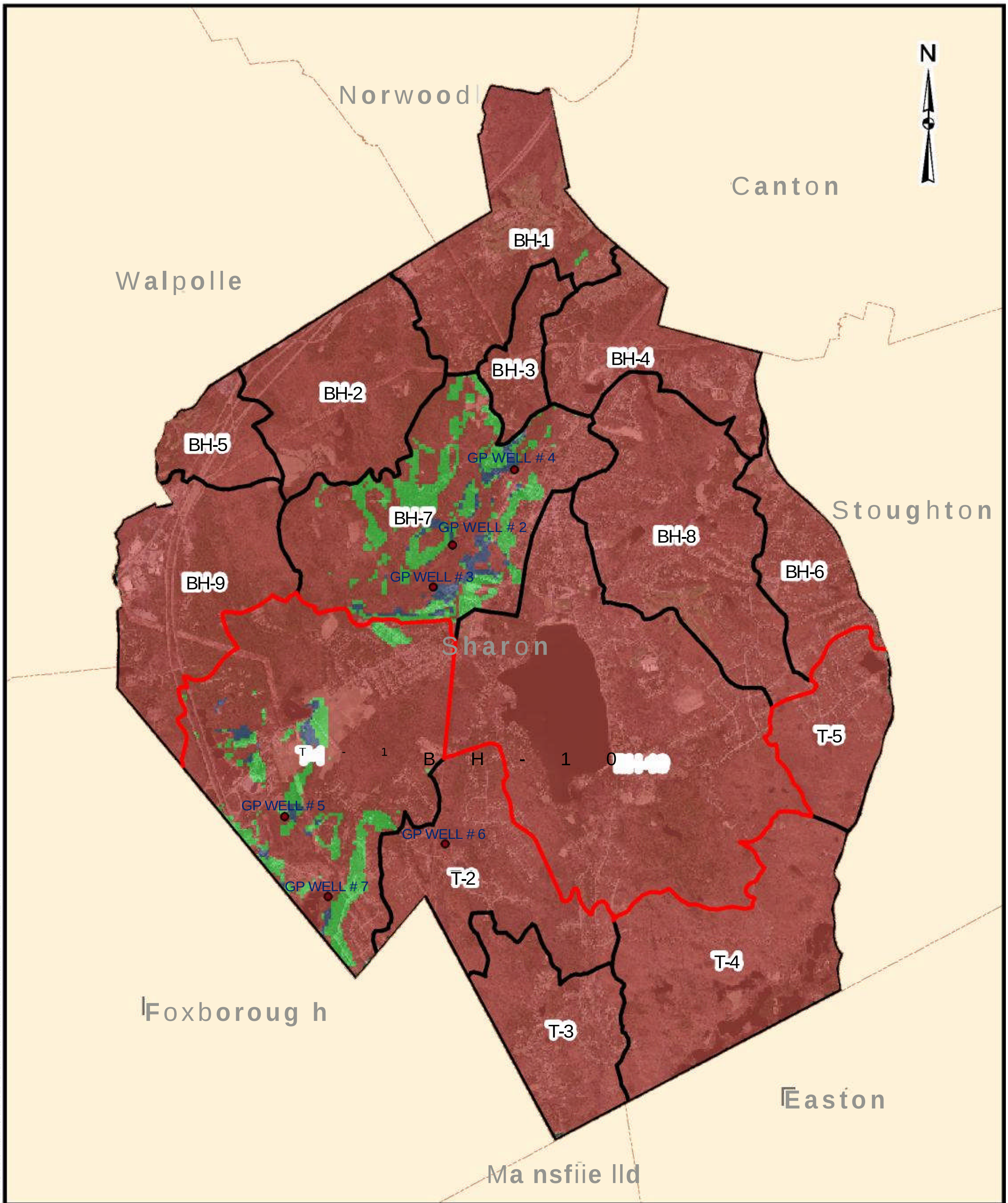

MAJOR BASIN DIVIDE
Sub-Basins
1 (most favorable)
2
3 (least favorable)

FIGURE 13
SHARON, MA

Combined Hydrogeo/Environmental/Wetlands/ Water Ballance Criteria (Wastewater)

5,000 0 5,000
SCALE IN FEET

Weston&Sampson

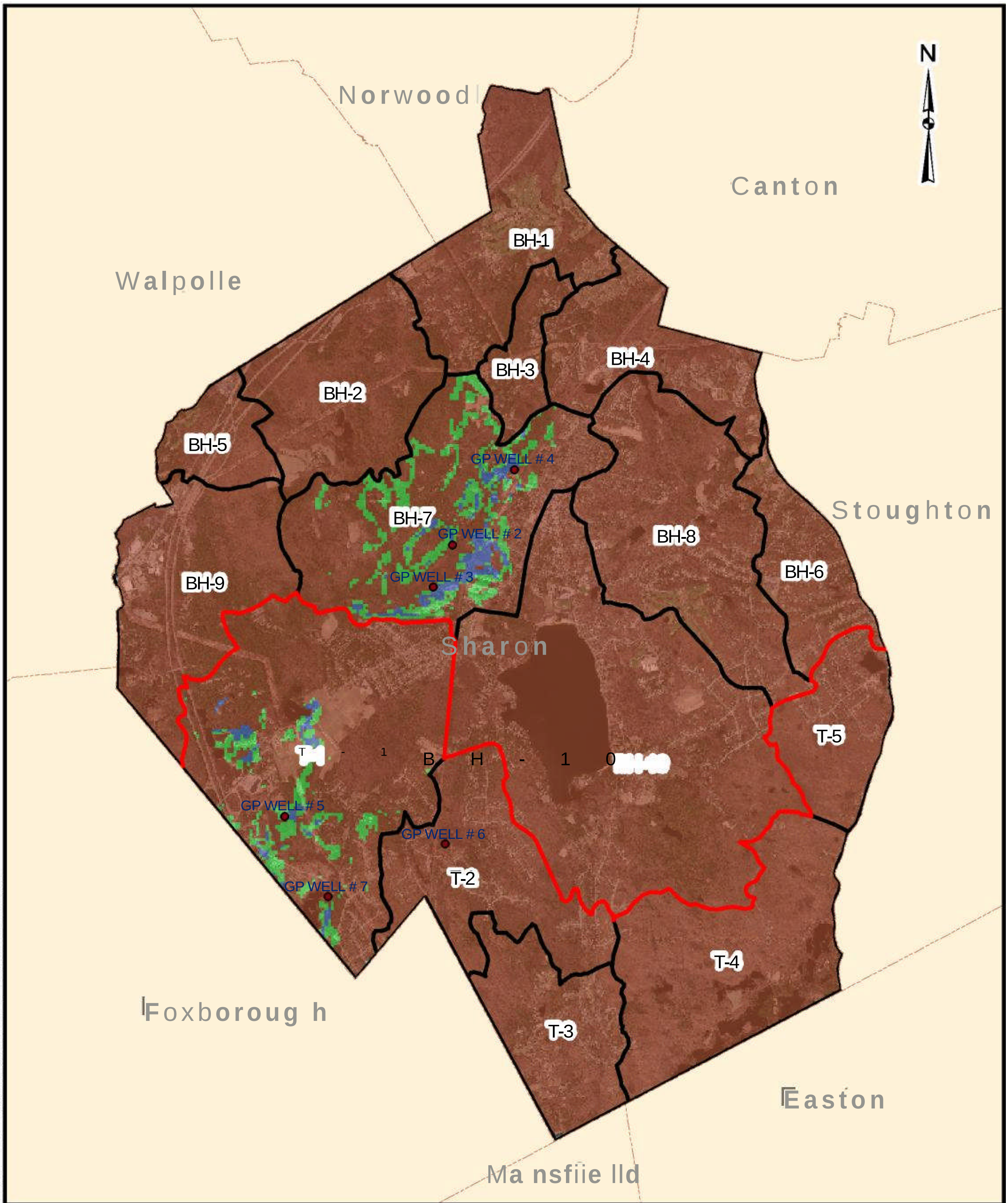

FIGURE 14
SHARON, MA

MAJOR BASIN DIVIDE
Sub-Basins
1 (most favorable)
3 (least favorable)

Combined Hydrogeo/Environmental/Wetlands/ Water Ballance Criteria (Stormwater)

SCALE IN FEET

Weston&Sampson

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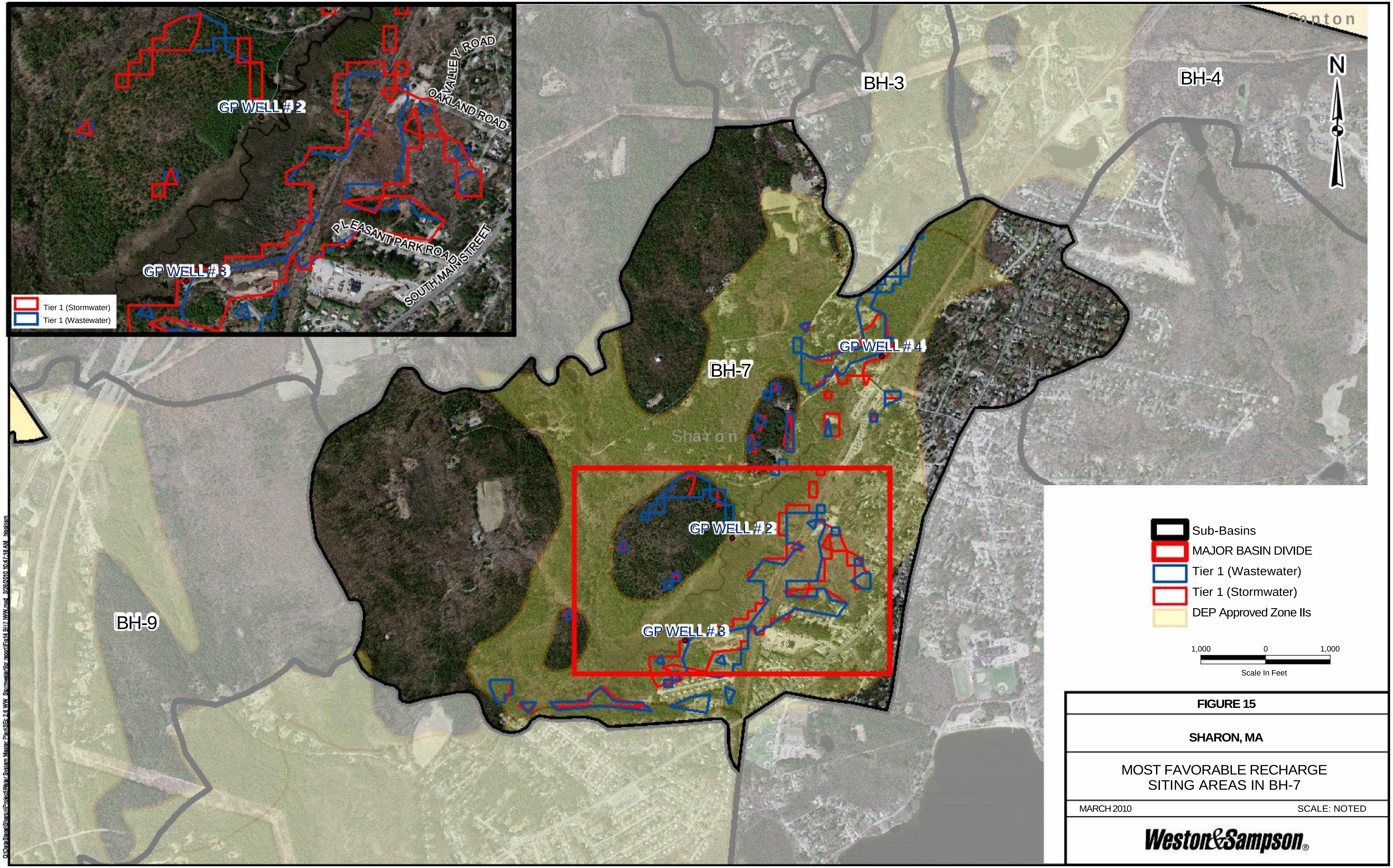


FIGURE 15

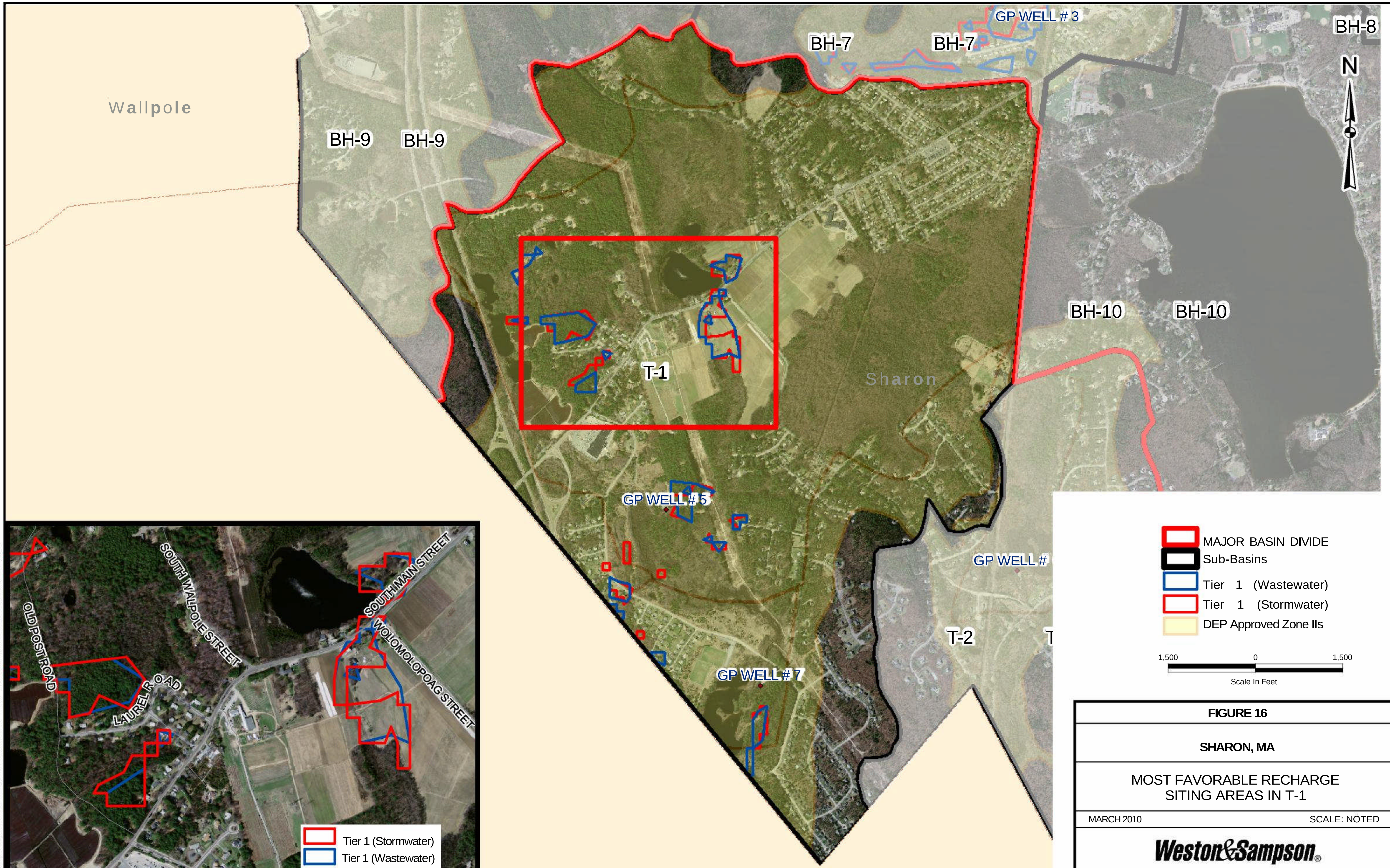
SHARON, MA

MOST FAVORABLE RECHARGE SITING AREAS IN BH-7

MARCH 2010 | SCALE: NOTED

Weston&Sampson®

25,000 0 5,000
3 (least favorable) SCALE IN FEET



75,000 0 5,000

3 (least favorable)SCALE IN FEET

No.	Priority	Improvement Type	Description	Reason	Project Cost	Cost Notes
1		Water Main	Pond Street (3,600'@ $670,000) Abandon 4" and 6" water main in Pond Street (2,465'@ $125,000)	Transmission Main Parallel Main	$795,000	
2		Water Main	South Main Street Area (6,610'@ $1,205,000)	Transmission Main	$1,205,000	
3		Water Main	Norwood Street (2,050 @ $380,000) Abandon 6" water main in Maskwonicut St and Norwood St (4,000'@ $200,000)	Transmission Main Parallel Main	$580,000	
4		Water Main	Massapoag Ave Area (5,500' @ $1,020,000) Abandon 6" water main in Massapoag Ave (1,400' @ $70,000)	Transmission Main Parallel Main	$1,090,000	
5		Water Main	East Street Area (7,400'@ $1,220,000) Abandon 6" water main in Mountain St (950'@ $50,000)	Transmission Main Parallel Main	$1,270,000	
6		Water Main	Brook Road Area (9,000' @ 1,500,000) Glen Dale Road Area (4,800' @ $800,000)	Fire Flow Fire Flow	$2,300,000	
7		Water Main	Pleasant Street Area (1,350' @ $220,000) Abandon 4" and 6" water main in North Main St (11,000' @ $550,000) Capenhill Road (1,500' @ $250,000)	Fire Flow Parallel Main	$1,020,000	
8		Water Main	Cottage Street Area (5,400')	Fire Flow	$890,000	
9		Water Main	Beach St Area (3,425' @ $565,000) Abandon 6" water main in Cedar St and East Foxboro St (2,200' @ $110,000) Abandon 4" and 6" water main in Billings St, Depot St, and South Main St (12,150' @ $610,000)	Looping Parallel Main Parallel Main	$1,285,000	
10		Water Main	Morse Street (1780' @ $295,000) Abandon 6" in Walpole St (3,100' @ $155,000) Abandon 6" water main in Norwood St and Upland Rd. (6,600'@ $330,000)	Looping Parallel Main Parallel Main	$780,000	
11		Water Main	Pine Street (2,300'@ $380,000) Old Post Street (1,400'@ $235,000)	Looping Looping	$615,000	
12		High Pressure Service Area	High Pressure Service District (From M&E 2004 Report) Mountain Street Tank ($1,415,000) Booster Pumping Station ($760,000) Mountain Street (4,200' @ $810,000) Hampton Road (1,600' @ $270,000) Michael Lane to Eisenhower Drive (1,100'@ $170,000)	High Pressure Service Area	$3,425,000	
13		Storage Tank Rehabilitation	Moose Hill Concrete Storage Tank	Structural Upgrades	$75,000	
14		Well Pump Station	Install VFD, Well 3	Reduced Power Costs	$18,000	
15		Well Pump Station	Install VFD, Well 4	Reduced Power Costs	$25,000	
16		Well Pump Station	Install VFD, Well 5	Reduced Power Costs	$15,000	
17		Well Pump Station	Install VFD, Well 6	Reduced Power Costs	$18,000	
18		Well Pump Station	Install VFD, Well 7	Reduced Power Costs	$18,000	
19		Well Pump Station	Chemical Feed Improvements, Well 2	DEP Required	$35,000	
20		Well Pump Station	Chemical Feed Improvements, Well 3	DEP Required	$31,000	
21		Well Pump Station	Chemical Feed Improvements, Well 4	DEP Required	$10,000	
22		Well Pump Station	Chemical Feed Improvements, Well 5	DEP Required	$25,000	
23		Well Pump Station	Chemical Feed Improvements, Well 6	DEP Required	$25,000	
24		Well Pump Station	Chemical Feed Improvements, Well 7	DEP Required	$25,000	
25		Well Pump Station	SCADA Improvements - Phase 1, Well 2	DEP Required & Modernization	$32,000	
26		Well Pump Station	SCADA Improvements - Phase 1, Well 3	DEP Required & Modernization	$30,000	
27		Well Pump Station	SCADA Improvements - Phase 1, Well 4	DEP Required & Modernization	$32,000	
28		Well Pump Station	SCADA Improvements - Phase 1, Well 5	DEP Required & Modernization	$32,000	
29		Well Pump Station	SCADA Improvements - Phase 1, Well 6	DEP Required & Modernization	$30,000	
30		Well Pump Station	SCADA Improvements - Phase 1, Well 7	DEP Required & Modernization	$30,000	
31		Well Pump Station	Well Replacement (three), Well 2	Rapid Fouling & Cost/Benefit	$275,000	
32		Well Pump Station	Install Transducers in All Nine Wells at Well 2	Better Maintenance	$10,000	
33		Well Pump Station	Replace Two Pumps with Single Split Case Pump and VFD at Well 2	Reduced Maintenance Cost	$100,000	
34		Well Pump Station	Install Automatic Exhaust Louvers at Well 3	Better Ventilation	$8,000	
35		Well Pump Station	Replace Pump at Well 3	Age of Pump (1989)	$35,000	
36		Well Pump Station	Install Standby Generator and Automatic Transfer Switch at Well 4	Greater Reliability	$122,000	
37		Well Pump Station	Well Replacement (two), Well 2	Rapid Fouling & Cost/Benefit	$200,000	
38		Well Pump Station	Remove PARCO Valves and Appurtenances at all 6 Well Stations	Obsolete Equipment	$60,000	
39		Well Pump Station	Install Standby Generator and Automatic Transfer Switch at Well 5	Greater Reliability	$78,000	
40		Well Pump Station	SCADA Improvements - Phase 2, All Wells	Modernization	$63,000	
41		Well Pump Station	Replace Flow Meter with a Mag Meter, Wells 2, 4, 6, and 7	Better Accuracy	$24,000	
42		Well Pump Station	Well Replacement (four), Well 2	Rapid Fouling & Cost/Benefit	$360,000	
43		Well Pump Station	Well Replacement, Well 3	Well Age	$360,000	
44		Stormwater/Wastewater	Development of Stormwater Utility	Revenue Generation	$60,000	
45		Stormwater/Wastewater	Find and Implement Projects	Watershed Withdrawal Offsets	$80,000	
46		Stormwater/Wastewater	Water Management Act Coordination/Modification	DEP requirement	$30,000	Annual Cost
47		Demand Management	Water Conservation Program	Demand Control	$70,000	Annual Cost
48		Bedrock Well Investigation	Annual Search for Bedrock/Groundwater Supply	Additional/Redundant Supply	$40,000	Annual Cost
49		NSTAR Well	New Source - NSTAR Well	Additional/Redundant Supply	$2,000,000	Per ESS estimate
50		Well 6 WTP	Well 6 WTP Design and Construction (3-4 years)	Additional/Redundant Supply	$2,600,000	Reduced from previous estimate
51		Well 6 WTP	Well 6 WTP Operations & Maintenance	WTP O&M	$110,000	Annual - Additional Cost
52		MWRA - Norwood Connection Option 1	Sharon PRV is maintained in the existing location. 12" High Pressure Main - Tiot Street (1,350' @ $250,000) 12" High Pressure Main - Edge Hill Road (Tiot Street to Norwood Road) (3,350' @ $620,000) Pump Station (2 Pumps with VFDs), Above Ground Building, Exterior Diesel Generator ($650,000)	Additional/Redundant Supply	$1,520,000	Does not include MWRA fee
53		MWRA - Norwood Connection Option 2	Sharon PRV is moved up Edge Hill Road to reduce water main installation costs. 12" High Pressure Main - Tiot Street (1,350' @ $250,000) 12" High Pressure Main - Edge Hill Road (Tiot Street to Avalon Bay Entrance) (2,150' @ $398,000) Pump Station (2 Pumps with VFDs), Above Ground Building, Exterior Diesel Generator ($650,000) Move Sharon PRV and Vault up Edge Hill Road ($50,000) Install PRVs for 16 to 18 Houses on Edge Hill Road ($4,000)	Additional/Redundant Supply	$1,352,000	Does not include MWRA fee

1. Please note that additional detail on the description of the project and the reason for the project can be found in the text of the Master Plan
2. Priority levels were included as presented in the individual chapters. For those items without a priority assigned this is to be determined.

Sharon Water System Master Plan Update **May 11, 2010**

Draft Improvement Summary Table - Subtotals

No.	Improvement Type	Project Cost	Cost Notes
1 to 11	Water Main	$11,830,000	
12	High Pressure Service Area	$3,425,000	
13	Storage Tank Rehabilitation	$75,000	
14 to 43	Well Pump Station	$2,126,000	
44 and 46	Stormwater/Wastewater	$90,000	
45	Stormwater/Wastewater - Find & Implement Projects	$80,000	Annual Cost
47	Demand Management	$70,000	Annual Cost
48	Bedrock Well Investigation	$40,000	Annual Cost
49	NSTAR Well	$2,000,000	Per ESS estimate
50	Well 6 WTP Design and Construction (3-4 years)	$2,600,000	Reduced from previous estimate
51	Well 6 WTP Operations & Maintenance	$110,000	Annual - Additional Cost
52	MWRA - Norwood Interconnection - Option 1	$1,512,000	Does not include MWRA fee
53	MWRA - Norwood Interconnection - Option 2	$1,344,000	Does not include MWRA fee

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