

# MWRA Water Supply Evaluation



Towns of:

Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset, and Scituate, MA

March 2025

PREPARED FOR:

Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset, and Scituate, MA



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## List of Abbreviations

<b>ADD</b>	Average-Day Demand
<b>ARJWW</b>	Abington-Rockland Joint Water Works
<b>ASR</b>	Annual Statistical Report
<b>BPS</b>	Booster Pumping Station
<b>FC</b>	Firm Capacity
<b>Gpm</b>	Gallons per Minute
<b>MassDEP</b>	Massachusetts Department of Environmental Protection
<b>MDD</b>	Maximum-Day Demand
<b>MGD</b>	Million Gallons per Day
<b>MWRA</b>	Massachusetts Water Resources Authority
<b>NAVD 88</b>	North American Vertical Datum of 1988
<b>OPPC</b>	Opinion of Probable Project Cost
<b>Psi</b>	Pounds per Square Inch
<b>RFI</b>	Request for Information
<b>WMA</b>	Water Management Act
<b>WRC</b>	Water Resources Commission
<b>WRWS</b>	Weir River Water System
<b>WTP</b>	Water Treatment Plant

# Executive Summary

This study evaluates the future water supply needs for the Towns of Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset, and Scituate (Towns) and how the Massachusetts Water Resource Authority (MWRA) may be able to assist with projected shortfalls. The eight Towns in this study span six water systems. The Weir River Water System (WRWS) serves Hingham and Hull. The Abington Rockland Joint Water Works (ARJWW) serves Abington and Rockland. Cohasset, Norwell, Hanover, and Scituate have their own municipal water supplies.

Apex met with representatives of each water system individually and collectively throughout the project duration to discuss preferences, limitations, and any additional design parameters specific to each water supplier. Apex reviewed historic and projected demands for each system against available water supplies to determine water needs through a 2045 planning horizon. Apex then combined water system hydraulic models for each system and analyzed various transmission alternatives to extend water from the MWRA distribution system to the Towns.

## Supply and Demand

The analysis revealed a regional average-day demand (ADD) deficit of 1.30 million gallons per day (MGD) between Hanover, ARJWW, WRWS, and Norwell when comparing to each Town's respective Water Management Act (WMA) withdrawal limits. Scituate and Cohasset both have small ADD surpluses totaling 0.22 MGD in comparison to current WMA limits. The resulting net deficit across all the Towns is 1.08 MGD. All of the Towns' WMA permits are up for renewal before the 2045 planning horizon, so WMA limits are subject to change. For all Towns, the projected ADD is below the safe yield of the respective supplies.

Apex also compared the historic and projected maximum-day demand (MDD) against the maximum available daily supply. The analysis indicates an MDD deficit of 2.16 MGD between Hanover, ARJWW, WRWS, and Norwell. Scituate and Cohasset both have MDD surpluses totaling 2.64 MGD. Thus the net surplus across all the Towns is 0.47 MGD. This implies that if all 6 communities purchased and sold all available supply optimally, the region would have a marginal surplus. However, this type of regional approach would require a complex scheme of "wheeling" water through different communities, mixing various water sources multiple times to ultimately meet the supply needs. After discussion with the Towns, Apex did not include a "wheeling" scenario as a supply alternative.

Lastly, Apex reviewed firm capacity, the supply capacity with the largest source offline. The largest firm capacity requirement is WRWS at 2.26 MGD. When completing the hydraulic analysis and sizing pipelines for the transmission alternatives, Apex assigned this firm capacity flow to the WRWS connection point while all other MDD flows were active. The pipelines must be designed appropriately to accommodate this peak flow rate without violating the design constraints and without generating adverse effects on the other water suppliers.

## Regional Supply Alternatives

Apex created a baseline condition serving the MDD needs of ARJWW, WRWS, Norwell, and Hanover, plus the potential additions of either Scituate, Cohasset, or both together, for a total of eight alternatives. The baseline MDD need is 2.16 MGD which increases to 5.53 MGD with the addition of Scituate and Cohasset. The baseline firm capacity requirement is 3.96 MGD, increasing to 7.33 MGD with the addition of Scituate and Cohasset.

Apex completed hydraulic modeling to approximate required pipeline lengths and diameters to deliver the required amount of water to each water system. Weymouth is pursuing its own potential MWRA connection; this analysis extends two potential transmission mains. For each of those starting points, Apex used the hydraulic

model to adjust pipe diameters to keep pipeline velocities below 3 ft/s and pressures above 20 pounds per square inch (psi). The tables below present the pipeline sizes and lengths required for each alternative.

Pipe Diameter (in)	Length by Alternative (miles)			
	1A	1B	1C	1D
12	3.18	2.83	2.83	2.83
16	0.21	-	-	-
24	3.68	9.38	9.84	2.99
30	-	-	-	3.19
36	0.54	0.54	0.54	4.22
<b>Total</b>	<b>7.61</b>	<b>12.75</b>	<b>13.21</b>	<b>13.23</b>

Pipe Diameter (in)	Length by Alternative (miles)			
	2A	2B	2C	2D
12	2.17	1.82	1.82	1.82
16	0.21	-	-	-
24	5.24	7.77	7.76	6.20
30	-	3.17	3.65	2.05
36	-	-	-	3.17
<b>Total</b>	<b>7.63</b>	<b>12.77</b>	<b>13.22</b>	<b>13.24</b>

Notably, each system likely requires a pumped connection to meet the system hydraulic grade line (HGL). However, larger pipeline diameters may allow for Cohasset to receive water by gravity. Similarly, Scituate may be able to accept gravity supply to their main service zone if the transmission main is extended further into town, through the high service zone.

There are many potential iterations and variations on the alternatives presented in this section, including relocating points of connection. Apex has included a partial list of alternatives for consideration in future studies in Section 5.

## Capital Costs

Apex developed opinions of probable project costs (OPPCs) for each alternative using an approximate price per linear foot to install new water main, plus additional lump sums for major crossings including railroads, major highways (Route 3), and water bodies. Estimates include pavement and relevant disciplines for the booster station/treatment station. These costs represent the current value of the project in 2025 dollars and should be compared to the ENR CCI from January 2025 of 17,850.68 when extrapolating to future value.

The table below presents each alternative with key design parameters and the resulting OPPC, including contingencies and fees. Transmission lengths shown exclude the 36-inch main serving Weymouth. All costs are rounded up to the nearest thousand dollars.

Alternative	Transmission Length (miles)	Connections	Subtotal	Contingencies and Fees (77%)	OPPC
1A	7.6	4	\$72,774,000	\$56,036,000	\$128,810,000
1B	12.8	5	\$118,993,000	\$91,625,000	\$210,618,000
1C	13.2	5	\$122,306,000	\$94,176,000	\$216,482,000
1D	13.2	6	\$137,807,000	\$106,112,000	\$243,919,000
2A	7.6	4	\$76,624,000	\$59,001,000	\$135,625,000
2B	12.8	5	\$125,529,000	\$96,658,000	\$222,187,000
2C	13.2	5	\$129,684,000	\$99,857,000	\$229,541,000
2D	13.2	6	\$135,370,000	\$104,235,000	\$239,605,000

Towns that pursue an MWRA connection will need to reach an agreement regarding how capital costs and operating costs (if applicable) will be shared between them. There are many important factors to consider in such an agreement, including equitability, environmental justice populations, and more. Further, the location of each connection and magnitude of the volume requested can have a disproportionate impact on the overall project design and cost, such as when the addition of one community drives an increase in all upstream pipe diameters. These considerations are not within the scope of this study and Apex recommends including them in future studies.

At the request of the Towns, Apex has allocated costs for each alternative according to only the percentage of the total maximum day demand needed by each Town. This may serve as a starting point for future discussions regarding cost sharing. The table below presents an example distribution of the OPPCs according to volume of water requested.

**Example Share of OPPCs by Volume Requested (\$M)**

Alternative	Total OPPC	ARJWW	WRWS	Norwell	Hanover	Scituate	Cohasset
1A	<b>128.81</b>	41.31	27.38	59.05	1.07	-	-
1B	<b>210.62</b>	39.70	26.31	56.74	1.03	86.83	-
1C	<b>216.48</b>	37.34	24.75	53.37	0.97	-	100.05
1D	<b>243.92</b>	30.55	20.24	43.66	0.79	66.82	81.85
2A	<b>135.63</b>	43.50	28.82	62.17	1.13	-	-
2B	<b>222.19</b>	41.88	27.75	59.86	1.09	91.60	-
2C	<b>229.54</b>	39.60	26.24	56.59	1.03	-	106.09
2D	<b>239.61</b>	30.01	19.89	42.89	0.78	65.63	80.40

## Recommendations for Future Studies

Extending supply from MWRA to the Towns would constitute an interbasin transfer. The Massachusetts Interbasin Transfer Act requires recipients to make reasonable efforts to identify and develop all viable sources in the receiving area of the proposed interbasin transfer. Apex recommends each of the Towns interested in pursuing a connection to the MWRA water system evaluate the viability of augmenting or securing supplies locally. Examples of in-basin alternatives that need to be evaluated to pursue MWRA supply include:

- Increases in allowable withdrawals under the WMA to meet projected average day demands.
- Securing additional groundwater or surface water supplies to meet projected maximum day demands.
- Infrastructure capital improvements such as increasing water treatment capacity or eliminating hydraulic restrictions to maximum day demands.

There exist many other possible alternatives as well as variations of the alternatives included in this study. Below is a list of considerations for future studies:

- The location of the ARJWW interconnection. System performance and the upstream MWRA transmission may differ between the two connection points.
- Analysis of Hanover purchasing water from Norwell. This may be more cost effective compared to installing a dedicated transmission main to the Hanover border.
- Scituate accepting water to the main zone rather than the boosted zone. This would include an analysis of decommissioning or reconfiguring/retrofitting the Mann Lot BPS.
- Supplying Cohasset through Hingham near the Whitney Crossing Station, particularly if Scituate is not being supplied but Cohasset is.
- Increasing transmission sizes to allow for gravity flow to Cohasset under all scenarios.
- Optimizing the length of 30-inch or 36-inch main required in Weymouth/Hingham for Alternatives 2B-2D (life cycle comparison of capital costs of larger diameter mains versus operational/energy requirements of higher pumping head)

# Section 1 Introduction

This study evaluates the future water supply needs for the Towns of Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset, and Scituate (Towns) and how the Massachusetts Water Resource Authority (MWRA) may be able to assist with projected shortfall. The intent of this study is to understand the water supply needs for each water system individually and as a region, and evaluate the feasibility of mitigating shortfalls with regional supply from the MWRA.

## Section 1.1 Background and Objective

The eight Towns in this study span six water systems. The Weir River Water System (WRWS) serves Hingham and Hull. The Abington Rockland Joint Water Works (ARJWW) serves Abington and Rockland. Cohasset, Norwell, Hanover, and Scituate have their own municipal water supplies.

The MWRA's entrance fee waiver and Weymouth's pursuit of an MWRA connection present a unique opportunity for the Towns to secure a regional water supply connection. Previous studies indicate the available maximum day supply to the region (including Weymouth) is approximately 7.5 million gallons per day (MGD). Weymouth is conducting a separate analysis regarding their future supply needs from the MWRA, which range from 2.77 MGD to 8.84 MGD maximum-day demand (MDD). The MWRA may increase available maximum day supply to the region up to 15.6 MGD with major system improvements, although the necessary improvements are not currently included in the MWRA's capital improvement plan.

The first objective of this study is to establish the supply needs for the Towns. Apex Companies, LLC (Apex) evaluated the projected supply and demand for each water system through the year 2045. Apex provided each water system with an individual technical memorandum reporting the findings of the supply and demand analysis in August 2024. These memos are included in Appendix A, and the results of this phase are summarized in Section 2 of this report.

With the established supply requirements for each of the Towns, Apex then used a combined water system hydraulic model to evaluate a series of supply alternatives to convey water from the MWRA to each of the Towns. This phase of the study established approximate water transmission main diameters and lengths, pumping requirements, and provided an opinion of probable project cost (OPPC) for each alternative. Each Town can use these estimates as an order-of-magnitude comparison to their respective alternatives to augment their water supply locally.

It is important to note that receiving water from the MWRA would constitute an interbasin transfer, as all six of the water systems currently draw from different water basins than the MWRA. The Massachusetts Interbasin Transfer Act requires the Water Resources Commission (WRC) to base decisions to approve interbasin transfers on several criteria. Two of these criteria are as follows:

1. All reasonable efforts have been made to identify and develop all viable sources in the receiving area of the proposed interbasin transfer;
2. All practical measures to conserve water have been taken in the receiving area.

These items are not included in this study. Apex recommends each of the Towns interested in pursuing a connection to the MWRA water system complete an evaluation of in-basin source viability.

## Section 1.2 Data Inputs

Apex issued RFIs to five of the six water suppliers in March 2024 (Apex was already in possession of the required information for Hanover). These RFIs included requests for key documents related to Annual Statistical Reports

(ASRs), known future developments, select record drawings, operational controls, Water Management Act (WMA) permits, and any relevant planning studies and capital plans. Apex also requested hydraulic modeling files from the Norwell, Hanover, and Scituate, to be combined with the models Apex already possessed for the other suppliers. Apex also sought input regarding preferences, limitations, and any additional design parameters specific to each water supplier at individual and joint meetings, discussed in the following section.

### Section 1.3 Community Input

Apex held individual kickoff meetings with each of the Towns spanning April and May of 2024 to review the scope of the study, discuss requests for information (RFIs), and establish any specific design parameters or requirements for each water system.

Following the completion of the supply and demand analysis, Apex provided each community with a technical memorandum in August 2024, followed by an opportunity to comment and revise the results.

Apex then hosted a joint meeting virtually for all the Towns on August 14, 2024 to discuss the results of the supply and demand analysis and establish an approach for the regional supply alternatives.

Finally, Apex hosted a joint meeting virtually for all the Towns on December 2, 2024 to discuss preliminary results of the regional supply alternatives and demonstrate the regional water system model.

## Section 2 Evaluation of Supply and Demand

This section provides an overview of the results of the supply and demand evaluation. Apex provided each water supplier with an individual Water Supply and Demand Evaluation in a technical memorandum in August 2024. Following a review period and the joint meetings on August 14, 2024 and December 2, 2024, Apex made adjustments to the evaluations. Appendix A includes the final version of the memos.

### Section 2.1 Summary of Supply and Demand

Apex reviewed historical demand for each water system based on pumping records and ASRs, and developed demand projections for each of the Towns in accordance with the WRC methodology. This analysis includes three primary conditions: Average-day demand (ADD), MDD, and Firm capacity (FC). Firm capacity is an MDD event during which the supplier's largest source is offline; designing around FC encourages resilient supply and decreases the risk of a water shortage.

#### Section 2.1.1 Average-Day Demand

Apex compared the historic and projected ADD against existing safe yield and WMA requirements for each water supplier. A community may be eligible for increased annual withdrawals through the WMA, especially if they meet the Massachusetts Department of Environmental Protection's (MassDEP's) performance criteria. Safe yield represents the annual volume that can be safely withdrawn from a water source, taking drought conditions into consideration.

**Table 1: 2045 ADD versus Allowed WMA Withdrawals**

Water System	WMA Limit (MGD)	Projected ADD (MGD)	WMA Surplus or (Deficit) (MGD)	Safe Yield <sup>1</sup> (MGD)
Scituate	1.85	1.76	0.09	2.63
Cohasset	0.95	0.82	0.13	4.06
Hanover	1.38	1.51	<b>(0.13)</b>	2.79
ARJWW	3.36	3.45	<b>(0.09)</b>	3.69
WRWS	3.51	4.31	<b>(0.80)</b>	7.11
Norwell	1.21	1.49	<b>(0.28)</b>	2.08
Net Surplus or (Deficit)			<b>(1.08)</b>	
Total Needs [Sum of Deficits]			<b>(1.30)</b>	

1. The Safe Yield limit is the WMA maximum day limit for groundwater sources plus the safe yield of surface water sources.

Table 1 shows the total ADD deficit of 1.30 MGD between Hanover, ARJWW, WRWS, and Norwell. Scituate and Cohasset both have small ADD surpluses totaling 0.22 MGD. Thus the net deficit across all the Towns is 1.08 MGD. This implies that if all 6 communities purchased and sold all surplus optimally, the region would still need to import 1.08 MGD. All of the Towns' WMA permits are up for renewal before the 2045 planning horizon, so WMA limits are subject to change.

The safe yields in Table 1 are the combination of approved maximum daily pumping rates for groundwater supplies and surface water supply firm yield (where applicable).

### Section 2.1.2 Maximum-Day Demand

Apex also compared the historic and projected MDD against the maximum available daily supply, determined by the lesser of any WMA restrictions or physical limitations on the supply itself. For many of the Towns, maximum daily withdrawals are physically limited by the treatment capacity, declining well yields, or raw or finished distribution infrastructure. As a goal of this study is to approximate the level of investment required to establish a regional supply, Apex incorporated these current restrictions so that each supplier can compare the capital investment of importing the regional supply to the viability of improving or augmenting their own sources locally.

**Table 2: 2045 MDD versus Supply Capacity**

<b>Water System</b>	<b>Current Maximum Day Supply (MGD)</b>	<b>Projected MDD (MGD)</b>	<b>Surplus or (Deficit) (MGD)</b>
Scituate	4.30	2.82	1.49
Cohasset	3.00	1.85	1.15
Hanover	2.51	2.52	<b>(0.02)</b>
ARJWW	3.75	4.44	<b>(0.69)</b>
WRWS	6.98	7.44	<b>(0.46)</b>
Norwell	1.67	2.66	<b>(0.99)</b>
Net Surplus or (Deficit)			<b>0.47</b>
Total Needs [Sum of Deficits]			<b>(2.16)</b>

Table 2 shows the total MDD deficit of 2.16 MGD between Hanover, ARJWW, WRWS, and Norwell. Scituate and Cohasset both have MDD surpluses totaling 2.64 MGD. Thus the net surplus across all the Towns is 0.47 MGD. This implies that if all 6 communities purchased and sold all available supply optimally, the region would have a marginal surplus. However, this type of regional approach would require a complex scheme of “wheeling” water through different communities, mixing various water sources multiple times to ultimately meet the supply needs. After discussion with the Towns, Apex did not include a “wheeling” scenario in the alternatives in Section 3.

#### Additional Supply Considerations

Table 2 indicates Scituate can supply sufficient water to meet the projected MDD. However, their surface water supply draws from the North and South Rivers Watershed, and their Interim Operational Plan from the North and South Rivers Watershed Association includes guidance for maintaining seasonal stream flows. Scituate’s WMA Permit references this Interim Operational Plan but places no restrictions as a result of the plan. It is unclear whether Scituate’s allowable withdrawal volumes will be reduced in future WMA permit renewals and as a result, Apex included alternatives with and without Scituate in the regional supply later in this report.

Similarly, Table 2 indicates Cohasset can supply sufficient water to meet the projected MDD. However, Cohasset has experienced declining water quality and may require significant treatment improvements to continue providing that water in the future. The Cohasset system is relatively small, serving a population of just over 7,500 people. As a result of the potential future treatment upgrades, Apex included alternatives with and without Cohasset in the regional supply later in this report.

These two conditional limitations form the basis of Apex’s supply alternatives discussed later in this report.

### Section 2.1.3 Firm Capacity

Below is a summary of the resulting firm capacity needs for each water supplier. Apex worked with each supplier to discuss which source to discount in the analysis. Not all analyses used the truly largest supply, such as when the largest supply was designed and installed with sufficient redundancy to make it a low probability event. Additional details are included in Appendix A.

**Table 3: 2045 MDD versus Firm Capacity**

<b>Water System</b>	<b>Firm Capacity (MGD)</b>	<b>Projected MDD (MGD)</b>	<b>Surplus or (Deficit) (MGD)</b>
Scituate	1.30	2.82	(1.51)
Cohasset	0.00	1.85	(1.85)
Hanover	2.12	2.52	(0.40)
ARJWW	3.51	4.44	(0.93)
WRWS	5.18	7.44	<b>(2.26)</b>
Norwell	1.27	2.66	(1.39)

The largest firm capacity requirement is WRWS at 2.26 MGD. When completing the hydraulic analysis and sizing pipelines for the transmission alternatives, Apex assigned this firm capacity flow to the WRWS connection point while all other MDD flows were active. This is discussed further in Section 3.

Note that the firm capacity is not a permanent supply condition. However, the pipelines must be sized appropriately to accommodate this peak flow rate without violating the design constraints and without generating adverse effects on the other water suppliers.

### Section 2.2 Revisions to August 2024 Memos

Apex made several revisions to the original supply and demand memos issued in August 2024 following discussions with the Towns at subsequent meetings. The memos included in Appendix A reflect these revisions.

## Section 3 MWRA Supply Alternatives

This section discusses the water transmission alternatives Apex analyzed, including hydraulic modeling results. Associated OPPCs are discussed in Section 4.

### Section 3.1 Background

The scope of this study included an analysis of up to six alternatives. As discussed in the previous sections, base supply requirements for the region include WRWS, ARJWW, Norwell, and Hanover. There is the possibility of extending service to Scituate individually, Cohasset individually, or both together. This amounts to four alternatives.

Weymouth is currently pursuing a connection to MWRA supply separately from this study. That effort is ongoing and includes four potential transmission alternatives. Combined with the four iterations introduced above, this would create a total of 16 alternatives.

Two of the four Weymouth supply alternatives follow a southerly alignment and connect near Weymouth's WTP. Both have comparable hydraulics and effectively the same connection point to extend to the Towns. Apex thus collapsed these into one alternative, labeled Alternative 1. Similarly, the two northerly Weymouth supply alignments have comparable hydraulics and connection points for the Towns.

Apex thus reduced the scope to two potential Weymouth supply transmission alignments, each with four alternatives to serve the Towns, for a total of eight alternatives.

### Section 3.2 Description of Alternatives

This section reviews transmission alignments and key challenges associated with each. Figures displaying the alignments, key connection points, and preliminary water main diameters are included in Appendix B.

#### Section 3.2.1 Alternative 1

Alternative 1 begins at the Blue Hills Reservoir in Quincy, extending through Braintree, following Grove Street to the Weymouth border, turning south toward Weymouth Great Pond where it connects to the Weymouth System. This portion of the Alternative is considered outside the scope of the present study, but the transmission main and Weymouth demands were included in the hydraulic model as they impact the overall design and feasibility.

##### Alternative 1A

After the Weymouth connection, Alternative 1A includes service to ARJWW, WRWS, Norwell, and Hanover.

Apex assumed a direct line south to ARJWW, connecting on Adams Street in Rockland, as it minimizes the pumping head requirements and connects closer to the center of ARJWW's system, which will result in a more even hydraulic grade in the system when operating. It should also interfere less with operation of the existing Hingham Street WTP.

Apex chose an alignment along Pond Street in Weymouth rather than Main Street to avoid railroad crossings and associated permits, minimize traffic interruptions, and reduce paving requirements.

Many potential paths to Hingham exist; Apex chose the most direct from this point, following Ralph Tabot Street/Derby Street to Whiting Street near Accord Pond. WRWS has the option to include a low-lift pump station to boost water directly into the High Service Area, or divert water into the existing raw water pumping station

near Accord Pond and into the WTP. Apex assumed the latter at the direction of WRWS, though this assumption may require upgrades to the WTP. WRWS is currently pursuing an evaluation of potential WTP upgrades separately.

Alternative 1A continues to Norwell, connecting near Washington Street. Lastly, water would divert south to Hanover. Notably, two 12-inch water mains already exist along High Street heading towards Hanover, and Hanover's demand requirements are under 0.5 MGD, which is relatively low flow for a main of that size. It may be more cost effective for Hanover to purchase water from Norwell rather than install a dedicated transmission main to the Hanover border. For the purposes of this study, Apex kept parity with assumptions for other communities and extended a dedicated line to Hanover in Alternative 1A.

#### Alternative 1B

Alternative 1B includes all of Alternative 1A plus service to Scituate to the east. Apex assumed an alignment through Norwell on Grove Street, School Street, Mount Blue Street, and Mount Hope Street, extending inside the Scituate border on Clapp Road.

This introduces water to Scituate's boosted pressure zone supplied by the Mann Lot Booster Pumping Station (BPS). Scituate could choose to boost the water directly at this station and convert the Mann Lot BPS to a valve station, or extend the water directly to the Main Zone and continue operating Mann Lot BPS as it currently does. Apex assumed the former, with a new BPS installed. This would allow Scituate to avoid blending as requested in the original joint meeting with the communities, with a reconfigured boosted zone being served by MWRA. This assumption should be included in future studies for Scituate's service from MWRA.

#### Alternative 1C

Alternative 1C includes Alternative 1B, minus service to Scituate, and extends the transmission main north along Summer Street to Cohasset. Notably, if Scituate is not included in the MWRA extension, Cohasset could instead be served from the northwest, near the existing Whitney Crossing station at the border with Hingham. However, because Alternative 1 passes through southern Weymouth and Hingham, this would require a longer dedicated line north through the entirety of Hingham and was not considered in this study.

#### Alternative 1D

Alternative 1D includes all of Alternatives 1A-1C together, with service to both Scituate and Cohasset. This nearly doubles the flow through the transmission main in Norwell, and represents the highest flow alternative. As discussed later in this section, the additional flows require higher pipe diameters.

### Section 3.2.2 Alternative 2

Alternative 2 taps into existing MWRA pipelines in Quincy near the intersection of Adams Street and Furnace Brook Parkway. The Weymouth transmission main proceeds down Quincy Avenue, entering Weymouth on Washington Street near Commercial Street. This portion of the Alternative is considered outside the scope of the present study, but the transmission main and Weymouth demands were included in the hydraulic model as they impact the overall design and feasibility.

#### Alternative 2A

After the Weymouth connection, Alternative 2A includes service to ARJWW, WRWS, Norwell, and Hanover. The transmission main proceeds through Weymouth on Washington Street, joining the Alternative 1 alignment on Whiting Street in Hingham. The WRWS, Norwell, and Hanover connections are the same as in Alternative 1.

In this alignment, a direct line south to ARJWW is significantly longer than in Alternative 1. Apex assumed ARJWW connects on the eastern edge of Rockland at the Norwell border on Hingham Street.

#### Alternatives 2B-2D

Alternatives 2B-2D follow the same alignments as their Alternative 1B-1D counterparts. Should the transmission main through Weymouth follow a more northerly alignment along Broad Street or Bridge Street into Hingham, extending a transmission main through Norwell into Scituate and Cohasset may not be necessary. It could be more cost effective to supply Cohasset through Hingham near the Whitney Crossing Station, particularly if Scituate is not being supplied. Apex recommends further consideration of this alternate route in further studies.

### Section 3.3 Hydraulic Modeling Analysis

Apex combined the six hydraulic models into one file using WaterCAD CONNECT Edition (version 24.00.01.05) by Bentley Systems, Inc, incorporating conceptual MWRA transmission alignments to Weymouth. Apex added each of the 8 alternative alignments discussed above and completed MDD and FC model runs to compare pressures, hydraulic grade lines (HGLs), and velocities across the alternatives. Apex made adjustments to the pipe diameters based on key performance criteria discussed below.

#### Section 3.3.1 Design Parameters

Apex used two primary design criteria for the MWRA transmission mains:

1. Maintain pressure above 20 psi.
2. Maintain velocities below 3 ft/s.

Apex assumed the transmission main serving Weymouth is a 36-inch diameter water main. It may be possible to serve Weymouth with a 30-inch main depending on the magnitude of their demand. A 30-inch main service Weymouth would result in low pressures just downstream of the Weymouth connection point and would likely require a BPS on the transmission main after the Weymouth connection to serve the Towns.

Table 4 below shows the total flows associated with each supply alternative.

**Table 4: MDD Flows for Supply Alternatives**

Alternative	MDD (MGD)	Firm Capacity Flow (MGD)
1A	2.16	3.96
1B	3.67	5.47
1C	4.01	5.81
1D	5.53	7.33
2A	2.16	3.96
2B	3.67	5.47
2C	4.01	5.81
2D	5.53	7.33

#### Section 3.3.2 Results of Hydraulic Modeling

Table 5 below shows the range of anticipated HGLs and resulting TDH pumping requirements at the connection point for each community across the alternatives, assuming an initial MWRA HGL of 275 ft on the North American Vertical Datum of 1988 (NAVD 88). The minimum HGL occurs during the WRWS FC event in all cases, and the maximum HGL would occur during the lower flow scenarios, when the fewest number of communities

are being served. Note that these results are for MDD only; an ADD scenario would likely result in higher HGLs and lower pumping requirements. Most communities except Cohasset and Scituate’s main zone are at or above the MWRA system HGL, so pumping would still be required for most of the Towns.

**Table 5: Hydraulic Model Results**

Water System	System MDD HGL (ft)	MDD from MWRA (MGD)	MWRA HGL (ft)		Required Additional TDH (ft)	
			Minimum	Maximum	Minimum	Maximum
ARJWW	278	0.692	226	251	25	55
WRWS	282	0.459	233	256	24	50
Norwell	274	0.989	226	253	17	50
Hanover	268	0.018	225	253	11	45
Scituate	301 <sup>1</sup>	1.514	223	241	58	90
Cohasset	214	1.854	219	238	-24	3
Total		5.526				

1. The HGL of Scituate’s main pressure zone is approximately 183 ft.

Table 5 shows that ARJWW, WRWS, Norwell, and Hanover would likely require pumping to bring MWRA water up to their system HGL. Scituate could likely accept gravity flow directly into the main service zone, but would require the highest lift pumping station to import into the boosted zone. Cohasset may require very low lift pumping during a WRWS firm capacity event, but can likely operate by gravity under all other conditions.

### Section 3.3.3 Transmission Main Sizing

This section discusses the transmission main sizes required to meet the design parameters in each alternative. The transmission mains are color coded by diameter in Appendix B.

#### Alternative 1

The baseline Alternative 1A transmission includes 36-inch main to Weymouth, 12-inch main to ARJWW, 24-inch main to WRWS, which can be reduced to 16-inch to Norwell, then 12-inch to Hanover. Adding service to Scituate or Cohasset in Alternatives 1B or 1C require extending the 24-inch main past WRWS to the point of the connection (for either Scituate or Cohasset).

Supplying both Scituate and Cohasset together requires extending the 36-inch main past Weymouth to WRWS, where it can reduce to a 30-inch main. After WRWS, some amount of 30-inch main is required in Norwell. Apex extended it about halfway to Cohasset as a baseline, though this can be optimized in a future design effort.

A summary of Alternative 1 pipe lengths by diameter is included in the table below.

**Table 6: Alternative 1 Pipe Lengths**

Pipe Diameter (in)	Length by Alternative (miles)			
	1A – Baseline Communities	1B - Baseline Communities + Scituate	1C -- Baseline Communities + Cohasset	1D - Baseline Communities + Scituate & Cohasset
12	3.18	2.83	2.83	2.83
16	0.21	-	-	-
24	3.68	9.38	9.84	2.99
30	-	-	-	3.19
36	0.54	0.54	0.54	4.22
<b>Total</b>	<b>7.61</b>	<b>12.75</b>	<b>13.21</b>	<b>13.23</b>

**Alternative 2**

Alternative 2A baseline uses the same diameter water main as Alternative 1A, with 36-inch to Weymouth, 24-inch to WRWS, 16-inch to Norwell, 12-inch to Hanover, and 12-inch to ARJWW. To extend service to Scituate would require upsizing the transmission main in Weymouth to 30-inch for some portion of the alignment. The 30-inch does not need to extend to WRWS, but some amount of headloss reduction is required to prevent pressures below 20 psi from forming at a high elevation point in Norwell. After the 30-inch segment, a 24-inch is required to the connection point at Scituate or Cohasset.

Serving both Scituate and Cohasset together requires increasing the 30-inch segment above to 36-inch diameter, followed by a 30-inch main to the WRWS connection point. Again, the critical pressure occurs at a high elevation section in Norwell, so larger upstream diameters are required to maintain acceptable HGLs.

A summary of Alternative 2 pipe lengths by diameter is included in the table below.

**Table 7: Alternative 2 Pipe Lengths**

Pipe Diameter (in)	Length by Alternative (miles)			
	2A - Baseline Communities	2B - Baseline Communities + Scituate	2C - Baseline Communities + Cohasset	2D - Baseline Communities + Scituate & Cohasset
12	2.17	1.82	1.82	1.82
16	0.21	-	-	-
24	5.24	7.77	7.76	6.20
30	-	3.17	3.65	2.05
36	-	-	-	3.17
<b>Total</b>	<b>7.63</b>	<b>12.77</b>	<b>13.22</b>	<b>13.24</b>

**Section 3.4 Additional Considerations**

Increased water main diameters will reduce headloss and thus require smaller pumps and lower energy consumption by all communities. Apex did not assess the life cycle costs of upgrading pipe diameters beyond those necessary to maintain pressures above 20 psi and velocities below 3 ft/s. In addition, with sufficiently large

diameters, both Cohasset and Scituate (main service zone only) could be served by gravity without pumping. However, larger pipe diameters will increase water age. Apex did not review water age as part of this analysis. Apex recommends these be revisited during further analyses as they may have beneficial life cycle costs compared to other alternatives.

There are many potential iterations and variations on the alternatives presented in this section, including relocating points of connection. Apex has included a partial list of alternatives for consideration in future studies in Section 5.

Section 4 presents OPPCs for the alternatives included in this study.

## Section 4 Capital Costs

This section presents OPPCs for each of the included alternatives and outlines their assumptions and basis.

### Section 4.1 Methodology and Approach

Apex approached the OPPCs by using an approximate price per linear foot to install new water main, plus additional lump sums for major crossings like railroads, major highways (Route 3), and water bodies. Apex assumed air valves and isolation valves every 2,500 feet, with additional air valves at high points. Apex approached these OPPCs bottom-up, adding key elements to the water main construction, such as mobilization, erosion control, dewatering, and traffic management. Apex assumed 4-inch pavement depth for local roads and 7-inch pavement depth for State roads, plus full-width mill and overlay.

Apex assumed the connection point to each water system would require a 1,800 square foot pump station building with chemical feed facilities for corrosion control and disinfection. Apex also assumed a bathroom would be required, plus mechanical room and generator. As the exact sites are unknown, Apex assumed no sewer is available and carried an assumed cost for a tight tank onsite. Apex also carried standard disciplines like electrical, HVAC and plumbing implicitly.

### Section 4.2 Unit Costs and Contingencies

For each alternative, Apex developed an OPPC that includes the construction cost, engineering design fee (25%), resident project representative fee (10%), police details (2%), and a planning contingency (40%) for a total contingency and fee scaling of 77%. These costs represent the current value of the project in 2025 dollars and should be compared to the ENR CCI from January 2025 of 17,850.68 when extrapolating to future value.

Conceptual costs per linear foot of ductile iron water main are shown in the table below. These linear foot costs exclude planning contingencies and engineering fees, which are applied separately in the project summaries below.

**Table 8: Linear Foot Water Main Costs**

Water Main Diameter	\$/lf to Install
12-inch	400
16-inch	600
24-inch	900
30-inch	1,200
36-inch	1,400

Apex's review of recent WTP construction projects ranged from \$1,763 to \$2,479 per square foot. Apex applied a unit cost of \$2,500 per square foot for the 1,800 sf building, yielding an OPPC of \$4.5M per water system connection.

Apex assumed round lump sum values for key crossings, including \$2.0M for each water body crossing and \$3.0M for railroad and major highway crossings.

### Section 4.3 Opinions of Probable Project Costs

The table below presents each alternative with key design parameters and the resulting OPPC, including contingencies and fees. Transmission lengths shown exclude the 36-inch main serving Weymouth. All costs are rounded up to the nearest thousand dollars.

**Table 9: OPPCs**

Alternative	Transmission Length (miles)	Connections	Subtotal	Contingencies and Fees (77%)	OPPC
1A	7.6	4	\$72,774,000	\$56,036,000	\$128,810,000
1B	12.8	5	\$118,993,000	\$91,625,000	\$210,618,000
1C	13.2	5	\$122,306,000	\$94,176,000	\$216,482,000
1D	13.2	6	\$137,807,000	\$106,112,000	\$243,919,000
2A	7.6	4	\$76,624,000	\$59,001,000	\$135,625,000
2B	12.8	5	\$125,529,000	\$96,658,000	\$222,187,000
2C	13.2	5	\$129,684,000	\$99,857,000	\$229,541,000
2D	13.2	6	\$135,370,000	\$104,235,000	\$239,605,000

While the overall length of water main is comparable between the two alternatives, Alternative 1 includes an early branch for ARJWW's connection, whereas Alternative 2 conveys this water further downstream before it branches off closer to Norwell. This increases the headloss in the trunk line and necessitates larger diameter water mains through Weymouth, as discussed in the previous section.

Alternative 1 includes a rail crossing in Weymouth and a bridge crossing over Route 3 in Hingham. Alternative 2 has no rail nor bridge crossings, but additional stream crossings compared to Alternative 1. Whether Alternative 1 or 2 is chosen will depend on the results of Weymouth's ongoing study to become an MWRA community.

Apex assumes any of the Towns that pursue an MWRA connection will need to reach an agreement regarding how capital costs and operating costs (if applicable) will be shared between them. There are many important factors to consider in such an agreement, including equitability, environmental justice populations, and more. Further, the location of each connection and magnitude of the volume requested can have a disproportionate impact on the overall project design and cost, such as when the addition of one community drives an increase in all upstream pipe diameters. These considerations are not within the scope of this study and Apex recommends including them in future studies.

At the request of the Towns, Apex has allocated costs for each alternative according to only the percentage of the total demand requested by each Town. This may serve as a starting point for future discussions regarding cost sharing. The table below shows the percentage of total volume requested by each Town in each alternative.

**Table 10: Percentage of Volume Requested by Alternative**

Alternative	ARJWW	WRWS	Norwell	Hanover	Scituate	Cohasset
1A	32.1	21.3	45.8	0.8	-	-
1B	18.9	12.5	26.9	0.5	41.2	-
1C	17.2	11.4	24.7	0.4	-	46.2
1D	12.5	8.3	17.9	0.3	27.4	33.6
2A	32.1	21.3	45.8	0.8	-	-
2B	18.9	12.5	26.9	0.5	41.2	-
2C	17.2	11.4	24.7	0.4	-	46.2
2D	12.5	8.3	17.9	0.3	27.4	33.6

The table below presents an example distribution of the OPPCs according to volume of water requested.

**Table 11: Example Share of OPPCs by Volume Requested (\$M)**

Alternative	Total OPPC	ARJWW	WRWS	Norwell	Hanover	Scituate	Cohasset
1A	<b>128.81</b>	41.31	27.38	59.05	1.07	-	-
1B	<b>210.62</b>	39.70	26.31	56.74	1.03	86.83	-
1C	<b>216.48</b>	37.34	24.75	53.37	0.97	-	100.05
1D	<b>243.92</b>	30.55	20.24	43.66	0.79	66.82	81.85
2A	<b>135.63</b>	43.50	28.82	62.17	1.13	-	-
2B	<b>222.19</b>	41.88	27.75	59.86	1.09	91.60	-
2C	<b>229.54</b>	39.60	26.24	56.59	1.03	-	106.09
2D	<b>239.61</b>	30.01	19.89	42.89	0.78	65.63	80.40

## Section 5 Conclusions and Recommendations

This study evaluated the future water supply needs for the Towns of Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset, and Scituate (Towns) and how the Massachusetts Water Resource Authority (MWRA) may be able to assist. Apex's review of demand projections through the year 2045 against available water supply reveals a baseline MDD need of 2.16 MGD to ARJWW, WRWS, Hanover, and Norwell, with a peak flow of 3.96 MGD during a firm capacity event for WRWS. Scituate and Cohasset both have conditional supply needs, which Apex included in subsequent iterations of the supply alternatives. Including all communities in the MDD flow alternative yields a daily requirement of 5.53 MGD with a peak flow of 7.33 MGD during a WRWS firm capacity event.

Apex reviewed four iterations each for two main transmission alternatives, totaling eight alternatives. Alternatives 1A-1D follow a southerly alignment through Weymouth, while Alternatives 2A-2D follow a northerly alignment through Weymouth. While both alternatives amount to comparable transmission main lengths overall, Alternative 2 requires larger water main diameters due to the connection to ARJWW being further downstream, which results in higher overall costs associated with this alternative. With either Alternative 1 or 2, extending service to either Scituate, Cohasset, or both incurs a cost approximately 60-85% higher than serving just the baseline systems (ARJWW, WRWS, Hanover, Norwell).

It is important to note that receiving water from the MWRA would constitute an interbasin transfer. The Massachusetts Interbasin Transfer Act requires recipients to make reasonable efforts to identify and develop all viable sources in the receiving area of the proposed interbasin transfer. Apex recommends each of the Towns interested in pursuing a connection to the MWRA water system complete an alternatives analysis for augmenting or securing supplies locally.

There exist many other possible alternatives as well as variations of the alternatives included in this study. Below is a list of possible considerations for future studies:

- The location of the ARJWW interconnection. System performance and the upstream MWRA transmission may differ between the two connection points.
- Analysis of Hanover purchasing water from Norwell. This may be more cost effective compared to installing a dedicated transmission main to the Hanover border.
- Scituate accepting water to the main zone rather than the boosted zone. This would include an analysis of decommissioning or reconfiguring/retrofitting the Mann Lot BPS.
- Supplying Cohasset through Hingham near the Whitney Crossing Station, particularly if Scituate is not being supplied but Cohasset is.
- Optimizing transmission sizes to allow for gravity flow to Cohasset under all scenarios.
- Optimizing the length of 30-inch or 36-inch main required in Weymouth/Hingham for Alternatives 2B-2D (life cycle comparison of capital costs of larger diameter mains versus operational/energy requirements of higher pumping head)

Available MWRA supply to the Towns is unknown. As the extension of a transmission main to the Towns is predicated upon extension of MWRA supply to Weymouth, Weymouth's interbasin transfer request must be finalized to established available MWRA supply to the Towns. The range of potential interbasin requests from Weymouth result in a range in available MWRA supply to the Towns of 0 – 4.73 MGD. In addition to the uncertainty in Weymouth's supply request, available supply could be affected by future improvements to the MWRA supply. However, the MWRA does not have any capital improvements planned that would increase available supply beyond the current maximum daily volume of 7.5 MGD. Apex recommends the Town's continue to evaluate the MWRA supply option as Weymouth's request is finalized.

Lastly, this study involved merging and combining the hydraulic models for six adjacent water systems. Apex encourages the Towns to leverage such a tool to improve resiliency and redundancy in the short term by examining available gravity flows between systems in emergency events and understanding temporary pumping requirements for emergency interconnections.

## Appendix A

### Water Supply and Demand Evaluation Technical Memoranda

## MEMORANDUM

**Date:** January 17, 2025

**To** Kristel Cameron, Water Superintendent  
Abington/Rockland Joint Water Works  
366 Centre Avenue  
Rockland, MA 02370

**From** Kevin Rathbun

**CC** Lauren E. Underwood, P.E.  
Ryan Allgrove, P.E.  
Tom Royal, Assistant Superintendent, ARJWW

**Subject** **MWRA Water Supply Needs Assessment**  
**Task 1 Summary - Water Supply and Demand Evaluation**  
**Abington-Rockland Joint Water Works**

### BACKGROUND

The Towns of Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset and Scituate (Towns) are embarking on a critical and challenging initiative to evaluate their future water supply needs and how the Massachusetts Water Resource Authority (MWRA) may be able to assist. The MWRA's entrance fee waiver and Weymouth's pursuit of an MWRA connection present a unique opportunity for the Towns to secure a regional water supply connection. The intent of this plan is to understand the water supply needs for each water system individually and as a region, and develop implementable recommendations to increase reliability and redundancy by utilizing the MWRA supply.

This memo was issued as a draft on August 5, 2024. Following review by ARJWW, the following revisions were made:

- Revised a statement of ARJWW's current treatment projects on Page 7 to specify that ARJWW are "...completing upgrades to both the Myers Avenue and Hingham Street sources."
- ARJWW indicated that Myers Avenue is limited to approximately 0.24 MGD due to water quality. This value has been reduced from 0.46 MGD in the supply tables.

- ARJWW indicated that the Great Sandy Bottom plant is limited by discharge pressures in the downstream transmission main. The plant is currently operating to keep discharge pressures below 135 pounds per square inch (psi) in the transmission main. While it may be possible to operate at a higher pressure and produce higher flows, 135 psi is already outside the MassDEP operating guidelines. It is unknown whether the water main could tolerate increased operating pressures. This restriction has been incorporated into the capacity calculations, as it is assumed some amount of improvements or upgrades would be required to increase yields at the plant. This change is reflected in Table 6, Chart 3, and the surrounding text on Pages 7 and 8 of the memo.

## Water System Information

The ARJWW serves approximately 33,152 customers via 10,997 service connections. Its water supply sources include the three active Myers Ave Wells which withdraw from the Taunton River Basin, and the Great Sandy Bottom and Hingham Street Reservoirs which withdraw from the South Coastal Basin. Myers Ave Well #4 is inactive. The average ratio of maximum day demand (MDD) to average day demand (ADD) is 1.29.

## Task 1 Scope

Under Task 1 – Evaluation of Water Supply and Demand, EP assessed the ability of the Abington-Rockland Joint Water Works (ARJWW) water supply sources to meet existing and projected water demands. This included:

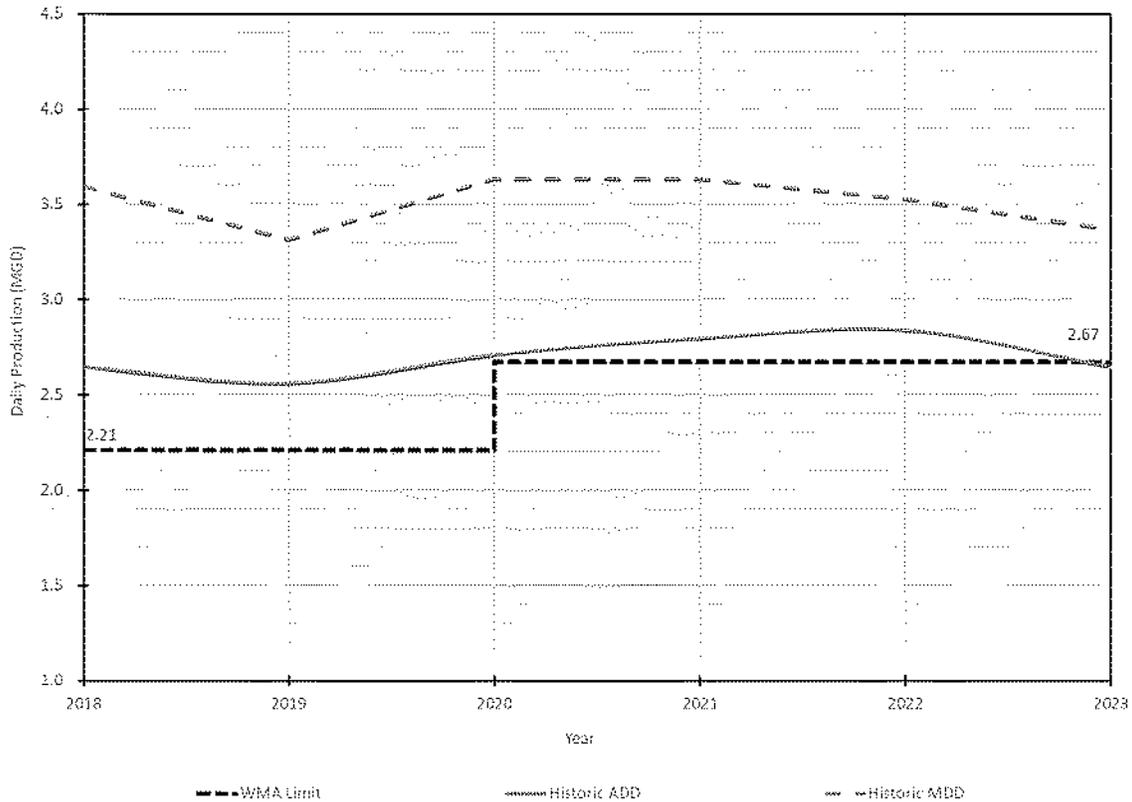
1. Reviewing existing available documentation.
2. Reviewing recent Annual Statistical Reports (ASRs) and historic consumption.
3. Projecting average day demand (ADD) and maximum day demand (MDD) through the planning period (2044) in accordance with the Water Resource Commission's Conservation Standards and the Water Management Act Performance Standards.
4. Comparing projected demands with maximum available water supply capacity as well as firm capacity (supply capacity with the largest source offline).

## SUPPLY AND DEMAND ANALYSIS

Below is a review of ARJWW's ability to meet current and future water demands. EP compiled and analyzed current registered, permitted, and operational capacities of all water supply sources, and historic and future demands to assess the ability of the water system to meet consumer needs through the 2044 planning period.

## Current Demands

Chart 1 below shows the historic ADD and MDD for the ARJWW water system plotted against the Water Management Act (WMA) withdrawal limit. Units are million gallons per day (MGD).



**Chart 1: ARJWW Historic Water Consumption**

As shown in Chart 1, the ARJWW annual average consumption trended just above the WMA withdrawal limit in recent years. Table 1 below shows the residential gallons per capita per day (RGPCD) and unaccounted for water (UAW) over the last 5 years.

Table 1: ARJWW 5-year RGPCD and UAW

Year	RGPCD	UAW (%)
2019	50.10	13.85
2020	57.00	13.52
2021	60.52	10.84
2022	56.92	8.98
2023	50.83	10.45
<b>Average</b>	<b>55.07</b>	<b>11.53</b>

The Massachusetts Department of Environmental Protection (MassDEP) performance standards are 65 RGPCD and 10% UAW. As shown above, ARJWW is below the RGPCD standard, and slightly above the UAW standard.

## Future Demands

EP completed future demand projections through 2045 following the Massachusetts Water Resources Commission (WRC) methodology. This includes population growth projections, employment projections, and known future developments discussed below.

### Population Projections

EP utilized population projections provided by the Metropolitan Area Planning Council (MAPC) and the University of Massachusetts Donahue Institute (UMass) for both Abington and Rockland. Table 2 below shows the combined historic data points and projections from both sources.

Table 2: Abington/Rockland Historic and Forecasted Population

Source	Historic		Projected					
	2010	2020	2025	2030	2035	2040	2045	2050
UMass	33,474	34,865	34,576	33,832	32,805	31,571	30,291	29,091
MAPC	<b>32,922</b>	<b>34,871</b>	-	<b>35,320</b>	-	<b>35,647</b>	-	<b>35,699</b>

As the intent of this study is to prepare for potential future requirements, EP elected to incorporate the higher of the two population projections to calculate future water demand. In this case, the MAPC projections demonstrate stronger anticipated growth through 2050.

### Employment Projections

EP utilized employment projections across all sectors provided by the MAPC, shown below.

Table 3: MAPC Employment Projections

MassDOT Projections				
2010	2020	2030	2040	2050
11,208	12,765	12,186	12,038	11,919

### Known Future Developments

The WRC demand projection methodology incorporates data on known future developments. This category is reserved for developments that have been filed with the Town and for which demands, occupancy, and/or number of housing units are available.

ARJWW provided EP with a list of approved and pending developments. EP assumed half of these would be approved by 2025, and the other half by 2030. ARJWW also provided a list of developments which had been waitlisted due to low marginal capacity against the WMA withdrawal limits, as shown in Chart 1 above. For the purposes of this analysis, EP assumed future water will be made available and the waitlisted projects could be completed by 2035.

Table 4 below shows the additional demand, in gallons per day (gpd), for the known developments in 5-year increments.

Table 4: Demand from Known Future Developments in Abington and Rockland

2025	2030	2035
49,260	49,260	22,880

In total, the additional demand from known developments is 121,4000 gpd.

## Projected Demand

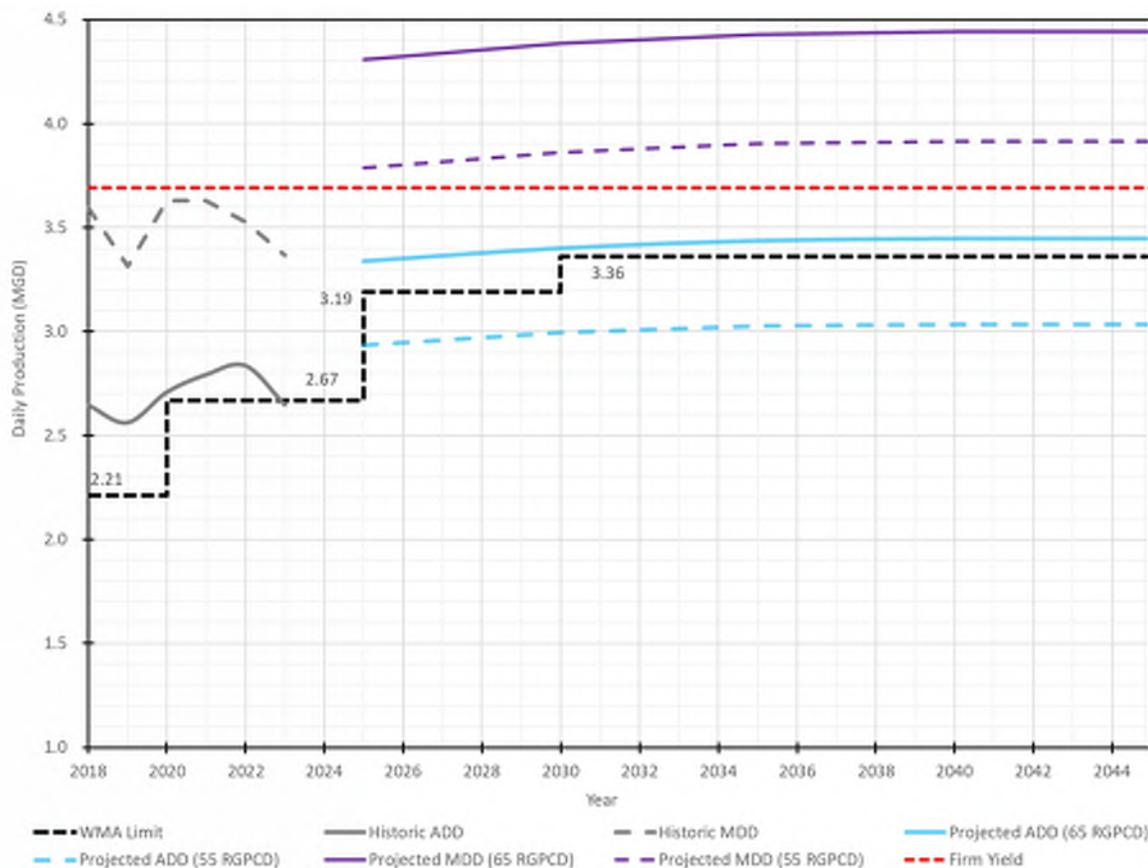
Incorporating the above projections and the performance standards of 65 RGPDC and 10% UAW, the resulting historic and projected demands are as follows:

Table 5: ARJWW Historic and Projection Demand

Year	ADD (MGD)	MDD (MGD) <sup>1</sup>
2019	2.56	3.31
2020	2.71	3.63
2021	2.79	3.63
2022	2.84	3.53
2023	2.65	3.37
2025	3.34	4.31
2030	3.40	4.38
2035	3.43	4.43
2040	3.44	4.44
2045	3.45	4.44

1. Assumes the 5-yr average MDD:ADD ratio of 1.29

Chart 2 below shows these projections against the WMA withdrawal limits.



**Chart 2: Historic and Projected Water Consumption**

As shown above, factoring in future population growth and known developments, demand growth is anticipated to surpass the planned increases in WMA withdrawal limits using the MassDEP performance standard of 65 RGPDC. However, if ARJWW is able to maintain its historical average RGPDC of 55 and completes the required mitigation to increase its WMA annual average withdrawal limits to 3.36, available water supply should be adequate to meet ADD.

The WMA permit includes the maximum annual average safe yield of the three sources, which total 3.69 MGD. There is sufficient safe yield in the basins to meet the projected ADD.

## Available Supply

A key service metric is the ability to meet maximum day demands with the largest source offline, known as firm capacity. EP reviewed ARJWW’s water sources and quantified the available water at all sources. The assumed quantity is the lesser of WMA restrictions and any operational restrictions. The table below shows the ARJWW’s sources and their maximum available supply in both MGD and gallons per minute (gpm).

Table 6: ARJWW Maximum Available Supply

Source Name	Maximum Daily Rate	
	gpm	MGD
Great Sandy Bottom	1,146	1.65*
Hingham Street	1,292	1.86
Myers Ave Well No. 1	167	0.24
Myers Ave Well No. 2		
Myers Ave Well No. 3		
Myers Ave Well No. 4		
Total	2,604	3.75
Firm Capacity	2,438	3.51

\*Limited by elevated discharge pressures in the downstream transmission main ARJWW reported the Myers Avenue yields are currently limited to 0.24 MGD due to water quality. This is below the WMA approved yield of 0.46 MGD. ARJWW also indicated that they are completing upgrades to both the Myers Avenue and Hingham Street sources. ARJWW elected to use the loss of the Myers Avenue wells as the firm capacity scenario, as the Hingham Street and Great Sandy Bottom plants have sufficient redundancy to consider their loss a low probability event.

The current maximum supply and firm capacity are 3.75 MGD and 3.51 MGD, below the projected MDD of 4.44 MGD. The projected supply and demand are shown in Chart 3 below.

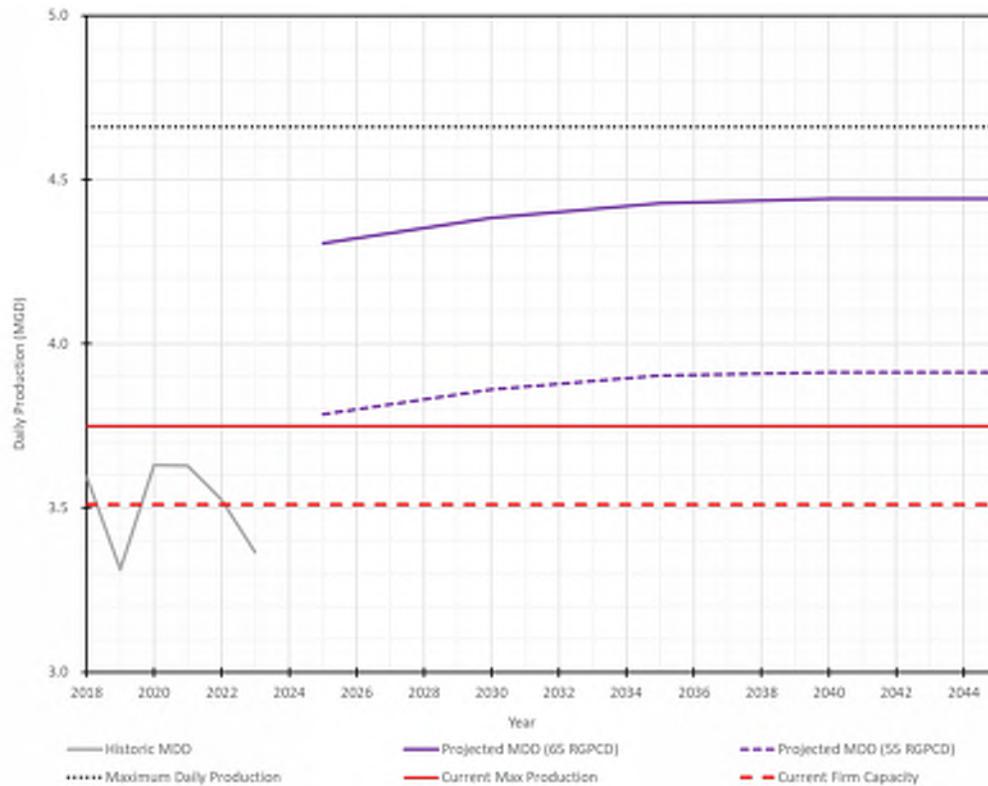


Chart 2: Projected MDD vs Supply and Firm Capacity

## CONCLUSIONS AND RECOMMENDATIONS

Using the loss of the Myers Ave Wells as the firm capacity scenario, EP's projections indicate the ARJWW will need to augment its supply to meet projected MDD demands. This includes currently known approved and waitlisted developments. This analysis assumes the Hingham Street and Great Sandy Bottom sources are reliable and have adequate redundancy. Notably, EP's preliminary review of the hydraulics around the Sandy Bottom WTP indicate significant capacity can be recovered through transmission main improvements. EP recommends ARJWW complete further analysis of alternatives to rehabilitate or upgrade the transmission main downstream of the WTP.

If the ARJWW is able to maintain its historic average 55 RGPCD, projected ADD is within the WMA annual average withdrawal limits. However, projections using the performance standard of 65 RGPCD exceed the WMA limits. It is important for ARJWW to monitor its RGPDC and encourage continued conservation and low residential consumption. It is also important for ARJWW to complete and submit all required mitigation to MassDEP to achieve the maximum potential value of 3.36 MGD by 2030. It is important to note that while the projected ADD at 65 RGPCD is above the permit value of 3.36 MGD, it is below the total safe yield of 3.69 MGD.

EP's analysis indicates that the ARJWW may surpass their average WMA withdrawal limit and may need to pursue an increase in their WMA limits in future renewals. It is important for the ARJWW to reduce UAW to meet or be below the 10% UAW performance standard, particularly when pursuing an increase in WMA permitted withdrawals.

## MEMORANDUM

**Date:** January 17, 2025

**To** Brian Joyce, Director  
Department of Public Works  
41 Highland Avenue  
Cohasset, MA 02025

**From** Kevin Rathbun

**CC** Lauren E. Underwood, P.E.  
Ryan Allgrove, P.E.

**Subject** **MWRA Water Supply Needs Assessment**  
**Task 1 Summary - Water Supply and Demand Evaluation**  
**Cohasset Water System**

### BACKGROUND

The Towns of Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset and Scituate (Towns) are embarking on a critical and challenging initiative to evaluate their future water supply needs and how the Massachusetts Water Resource Authority (MWRA) may be able to assist. The MWRA's entrance fee waiver and Weymouth's pursuit of an MWRA connection present a unique opportunity for the Towns to secure a regional water supply connection. The intent of this plan is to understand the water supply needs for each water system individually and as a region, and develop implementable recommendations to increase reliability and redundancy by utilizing the MWRA supply.

This memo was issued as a draft on August 5, 2024. Following review by the Town of Cohasset, the following revision was made:

- Revised Table 5 on Page 6 of the memo. The firm capacity was correctly displayed in MGD, but not in gallons per minute (gpm). The gpm value was adjusted to 115 gpm.

## Water System Information

The Department serves approximately 7,554 customers via 2,700 service connections. Its water supply sources include Lily Pond and the Elms Meadow Wellfield, both of which draw water from the South Coastal Basin. The average ratio of maximum day demand (MDD) to average day demand (ADD) is 2.25.

## Task 1 Scope

Under Task 1 – Evaluation of Water Supply and Demand, EP assessed the ability of the Cohasset Water Department (Department) water supply sources to meet existing and projected water demands. This included:

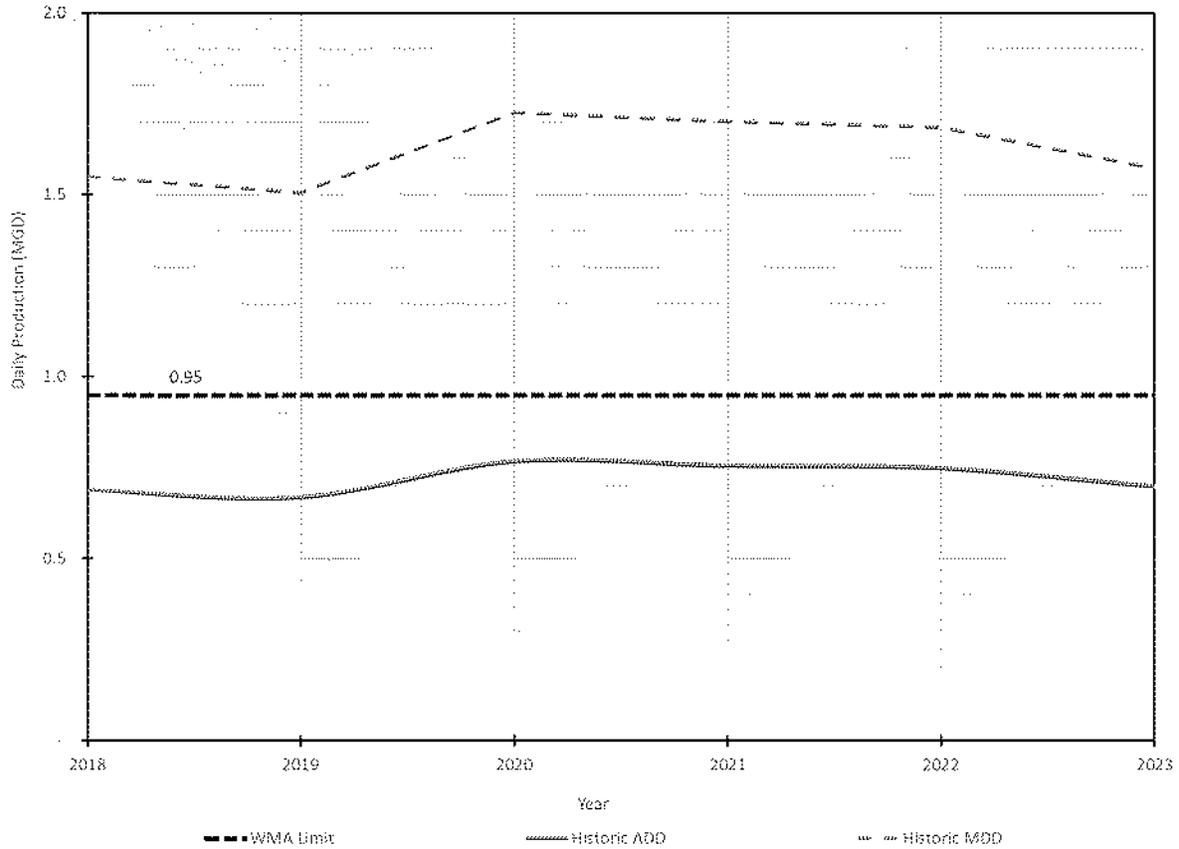
1. Reviewing existing available documentation.
2. Reviewing recent Annual Statistical Reports (ASRs) and historic consumption.
3. Projecting average day demand (ADD) and maximum day demand (MDD) through the 2044 planning period in accordance with the Water Resource Commission's Conservation Standards and the Water Management Act Performance Standards.
4. Comparing projected demands with maximum available water supply capacity as well as firm capacity (supply capacity with the largest source offline).

## SUPPLY AND DEMAND ANALYSIS

Below is a review of the Department's ability to meet current and future water demands. EP compiled and analyzed current registered, permitted, and operational capacities of all water supply sources, and historic and future demands to assess the ability of the water system to meet consumer needs through the 2044 planning period.

## Current Demands

Chart 1 below shows the historic ADD and MDD for the Cohasset water system plotted against the Water Management Act (WMA) withdrawal limit. Units are million gallons per day (MGD).



**Chart 1: Cohasset Historic Water Consumption**

As shown in Chart 1, the Department’s annual average consumption trended below the WMA withdrawal limit in recent years. Table 1 below shows the residential gallons per capita per day (RGPCD) and unaccounted for water (UAW) over the last 5 years.

Table 1: Cohasset 5-year RGPCD and UAW

Year	RGPCD	UAW (%)
2019	64.16	9.91
2020	78.43	12.34
2021	73.06	9.56
2022	81.52	9.63
2023	74.71	12.85
<b>Average</b>	<b>74.38</b>	<b>10.86</b>

The Massachusetts Department of Environmental Protection (MassDEP) performance standards are 65 RGPCD and 10% UAW. As shown above, the Department is above both performance standards in recent years.

## Future Demands

EP completed future demand projections through 2044 following the Massachusetts Water Resources Commission (WRC) methodology. This includes population growth projections, employment projections, and known future developments discussed below.

### Population Projections

EP utilized population projections provided by the Metropolitan Area Planning Council (MAPC) and the University of Massachusetts Donahue Institute (UMass) for Cohasset. Table 2 below shows the combined historic data points and projections from both sources.

Table 2: Cohasset Historic and Forecasted Population

	Historic		Projected					
Source	2010	2020	2025	2030	2035	2040	2045	2050
UMass	<b>7,542</b>	<b>8,381</b>	<b>8,700</b>	<b>9,021</b>	<b>9,533</b>	<b>10,087</b>	<b>10,566</b>	<b>11,072</b>
MAPC	7,327	8,293		8,499		8,591		8,732

As the intent of this study is to prepare for potential future requirements, EP elected to incorporate the higher of the two population projections to calculate future water demand. In this case, the UMass projections demonstrate stronger anticipated growth through 2050.

### Employment Projections

EP utilized employment projections across all sectors provided by the MAPC, shown below.

Table 3: MAPC Employment Projections

MassDOT Projections				
2010	2020	2030	2040	2050
2,846	3,288	2,930	2,862	2,804

### Known Future Developments

The WRC demand projection methodology incorporates data on known future developments. This category is reserved for developments that have been filed with the Department and for which demands, occupancy, and/or number of housing units are available. The Department did not provide any known developments, so EP has not carried any demand in this category.

### Projected Demand

Incorporating the above projections and the performance standards of 65 RGPDC and 10% UAW, the resulting historic and projected demands are as follows:

Table 4: Cohasset Historic and Projected Demand

Year	ADD (MGD)	MDD (MGD) <sup>1</sup>
2019	0.67	1.51
2020	0.77	1.73
2021	0.76	1.70
2022	0.75	1.69
2023	0.70	1.57
2025	0.71	1.58
2030	0.72	1.63
2035	0.76	1.70
2040	0.79	1.78
2045	0.82	1.85

1. Assumes the 5-yr average MDD:ADD ratio of 2.25

As noted previously, the 5-year average RGPCD is currently 74.38 and UAW is 10.86%. The above projected demands assume the Department successfully meets the MassDEP performance standards. Chart 2 below shows these projections against the WMA withdrawal limits.

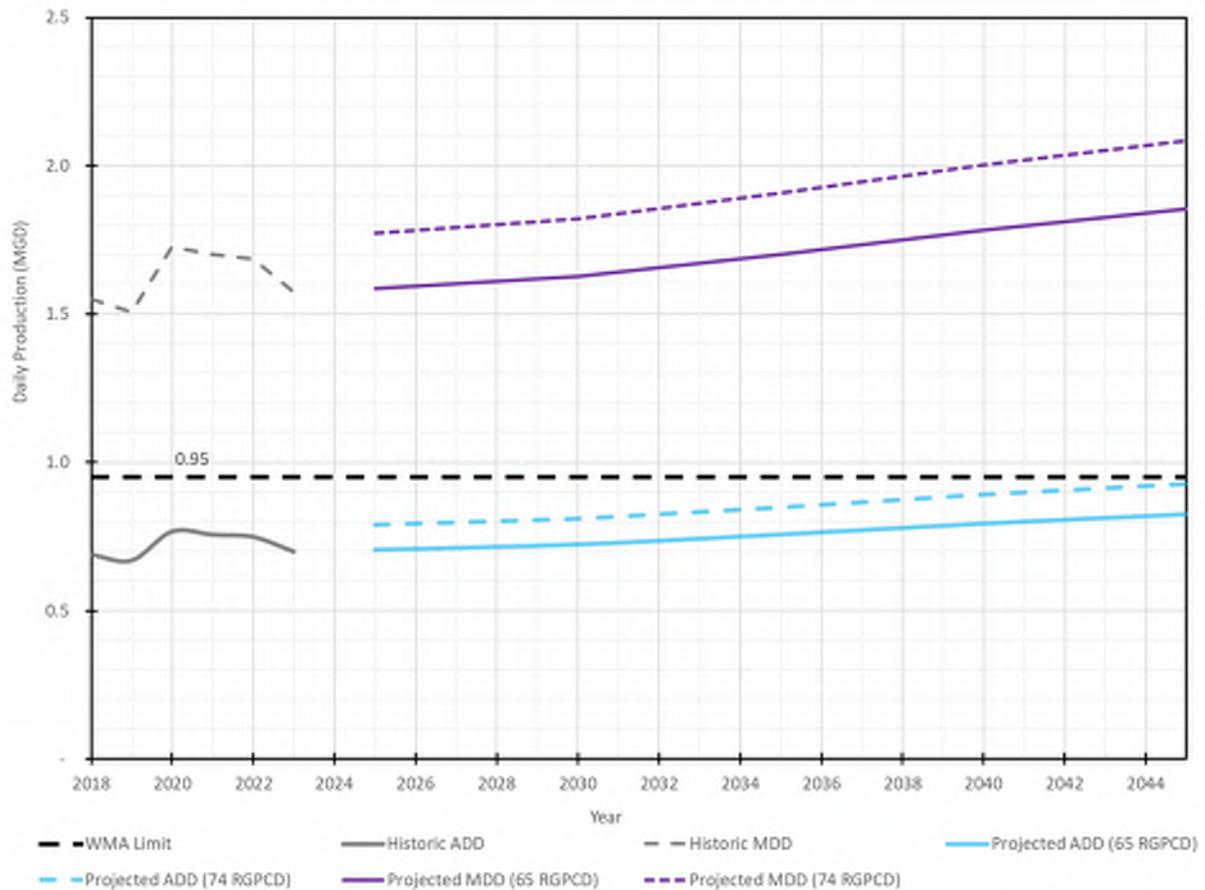


Chart 2: Historic and Projected Water Consumption

As shown above, the WMA average annual withdrawal limits appear to be sufficient to provide for Cohasset's ADD through the planning period. As mentioned above, these projections assume the Department is able to meet the MassDEP performance standards, which require a reduction in both RGPDC and UAW. EP also projected demands using the current average of 74.38 RGPDC, which approaches the WMA limit at the end of the 2044 planning period, but is still below.

## Available Supply

A key service metric is the ability to meet maximum day demands with the largest source offline, known as firm capacity. EP reviewed the Department's water sources and quantified the available water at all sources. The assumed quantity is the lesser of WMA restrictions and any operational restrictions. The table below shows the Department's sources and their maximum available supply in both MGD and gallons per minute (gpm).

Table 5: Cohasset Maximum Available Supply

Source Name	Maximum Daily Rate	
	gpm	MGD
Elms Meadow Wellfield	115	0.17
Lily Pond	2,083	3.00 <sup>1</sup>
Total	2,198	3.17
Firm Capacity	115	0.17

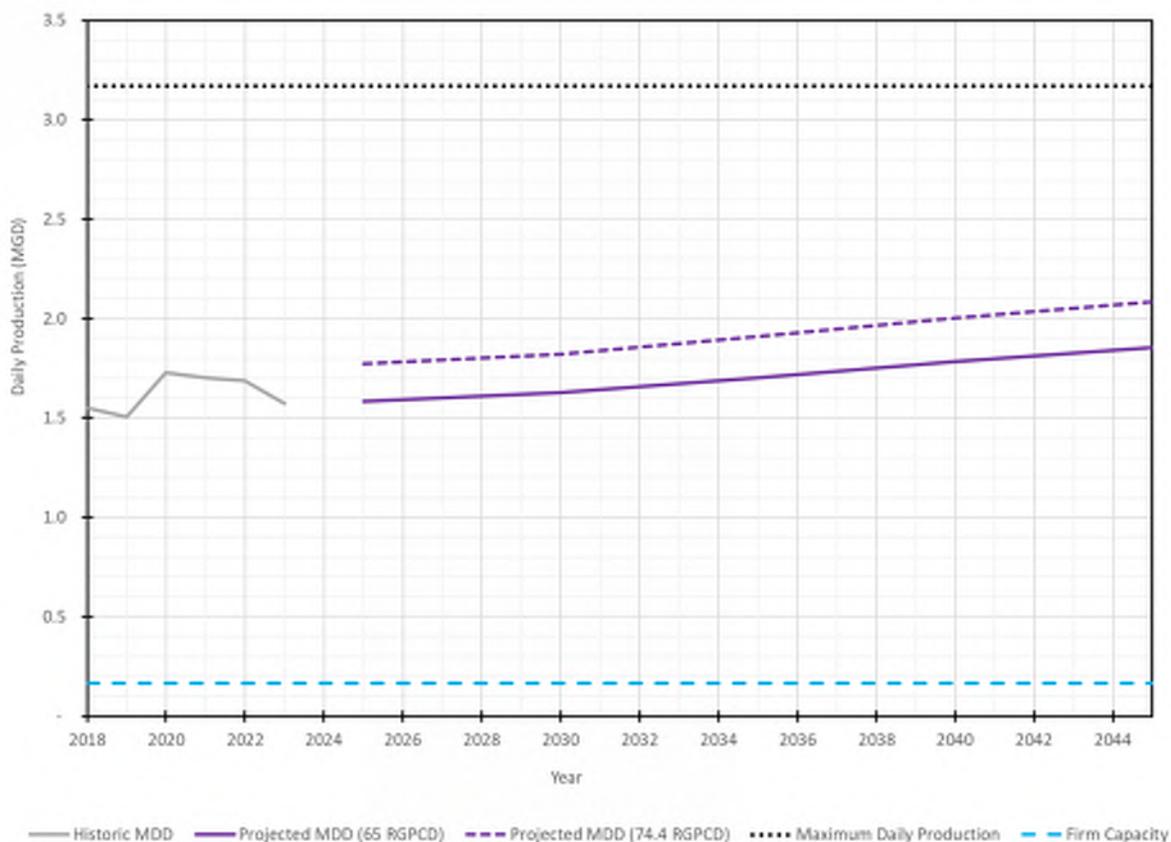
1. Limited by the MassDEP approved design capacity of the WTP. The recorded firm yield of the source water is 3.5 MGD. Achieving this value would require WTP upgrades.

As shown in the table, the total available supply for MDD is 3.17 MGD. The majority of the Department's water is from a single surface water source. While the WTP is constructed with redundant equipment, a compromised source water supply could result in temporary loss of the plant until WTP upgrades could be completed.

In addition, the Department has expressed water quality concerns, including PFAS at Lily Pond, and is interested in exploring alternative supply solutions. As a smaller system, the required upgrades to address water quality concerns may be cost prohibitive when compared to a regional water supply.

Should the Department lose the Lily Pond source, the resulting supply capacity would be approximately 0.17 MGD.

The projected supply and demand are shown in Chart 3 below.



**Chart 2: Projected MDD vs Supply and Firm Capacity**

## CONCLUSIONS AND RECOMMENDATIONS

EP’s projections indicate the Department has adequate capacity to meet ADD and MDD through the 2044 planning period. However, most of the Department’s supply comes from a sole surface water source. EP recommends the Department consider an emergency interconnection to add redundancy to their supply. MWRA supply is one alternative for achieving redundancy. In addition, it may be advantageous to replace the Lily Pond source should the required treatment upgrades prove cost prohibitive.

It is important for the Department to reduce RGPCD to meet the 65 RGPCD performance standard. If demands continue at the historic average of 74.4 RGPCD, demands will approach the WMA limit near the end of the planning period. Reducing RGPCD will increase the supply margin and reduce the risk of exceeding the permitted value.

## MEMORANDUM

**Date:** August 5, 2024

**To** Neal Merritt  
Hanover Department of Public Works Water Division  
495 Hanover Street  
Hanover, MA 02339

**From** Kevin Rathbun

**CC** Lauren E. Underwood, P.E.  
Ryan Allgrove, P.E.

**Subject** **MWRA Water Supply Needs Assessment**  
**Task 1 Summary - Water Supply and Demand Evaluation**  
**Hanover Water Division**

### BACKGROUND

The Towns of Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset and Scituate (Towns) are embarking on a critical and challenging initiative to evaluate their future water supply needs and how the Massachusetts Water Resource Authority (MWRA) may be able to assist. The MWRA's entrance fee waiver and Weymouth's pursuit of an MWRA connection present a unique opportunity for the Towns to secure a regional water supply connection. The intent of this plan is to understand the water supply needs for each water system individually and as a region, and develop implementable recommendations to increase reliability and redundancy by utilizing the MWRA supply.

### Water System Information

The Hanover Water Division (Division) serves approximately 14,893 customers via 5,142 service connections. Its water supply sources include 8 active wells: Broadway Wells 1 and 2, Philip C. Beal Wells 1 and 2, Pond Street Wells 1, 2, and 3, and Hanover Street Well 1. Hanover Street Well 2 is inactive. The average ratio of maximum day demand (MDD) to average day demand (ADD) is 1.67.

## Task 1 Scope

Under Task 1 – Evaluation of Water Supply and Demand, EP assessed the ability of the Division water supply sources to meet existing and projected water demands. This included:

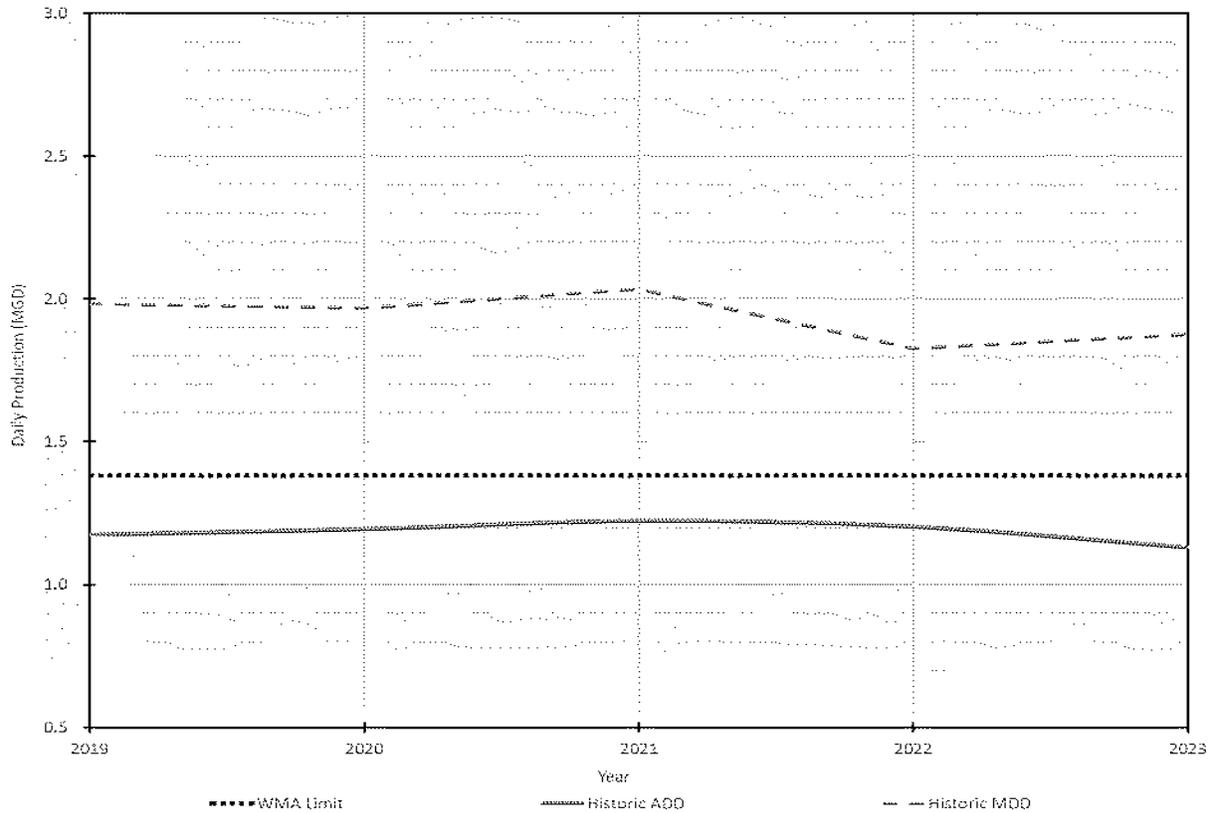
1. Reviewing existing available documentation.
2. Reviewing recent Annual Statistical Reports (ASRs) and historic consumption.
3. Projecting average day demand (ADD) and maximum day demand (MDD) through the planning period (2044) in accordance with the Water Resource Commission's Conservation Standards and the Water Management Act Performance Standards.
4. Comparing projected demands with maximum available water supply capacity as well as firm capacity (supply capacity with the largest source offline).

## SUPPLY AND DEMAND ANALYSIS

Below is a review of the Division's ability to meet current and future water demands. EP compiled and analyzed current registered, permitted, and operational capacities of all water supply sources, and historic and future demands to assess the ability of the water system to meet consumer needs through the 2044 planning period.

### Current Demands

Chart 1 below shows the historic ADD and MDD for Hanover's water system plotted against the Water Management Act (WMA) withdrawal limit. Units are million gallons per day (MGD).



**Chart 1: Hanover Historic Water Consumption**

As shown in Chart 1, the Division’s annual average consumption trended below the WMA withdrawal limit in recent years. Table 1 below shows the residential gallons per capita per day (RGPCD) and unaccounted for water (UAW) over the last 5 years.

Table 1: Hanover 5-year RGPCD and UAW

Year	RGPCD	UAW (%)
2019	47.94	7.87
2020	57.28	5.30
2021	52.25	12.40
2022	53.10	9.40
2023	52.94	4.36
<b>Average</b>	<b>52.70</b>	<b>7.87</b>

The Massachusetts Department of Environmental Protection (MassDEP) performance standards are 65 RGPCD and 10% UAW. As shown above, the Division is below both standards on average.

## Future Demands

EP completed future demand projections through 2045 following the Massachusetts Water Resources Commission (WRC) methodology. This includes population growth projections, employment projections, and known future developments discussed below.

### Population Projections

EP utilized population projections provided by the Metropolitan Area Planning Council (MAPC) and the University of Massachusetts Donahue Institute (UMass) for Hanover. Table 2 below shows the combined historic data points and projections from both sources.

Table 2: Hanover Historic and Forecasted Population

Source	Historic		Projected					
	2010	2020	2025	2030	2035	2040	2045	2050
UMass	13,879	14,833	14,919	15,146	15,413	15,588	15,644	15,675
MAPC	13,706	15,099		15,099		14,895		14,171

As the intent of this study is to prepare for potential future requirements, EP elected to incorporate the higher of the two population projections to calculate future water demand. In this case, the UMass projections demonstrate stronger anticipated growth through 2050.

### Employment Projections

EP utilized employment projections across all sectors provided by the MAPC, shown below.

Table 3: MAPC Employment Projections

MassDOT Projections				
2010	2020	2030	2040	2050
6,792	6,511	5,722	5,505	5,266

### Known Future Developments

The WRC demand projection methodology incorporates data on known future developments. This category is reserved for developments that have been filed with the Town and for which demands, occupancy, and/or number of housing units are available.

The Division provided EP with one anticipated development before 2025. In addition, recent zoning changes allow for construction of accessory dwelling units (Accessory Dwelling Units). EP assumed 1 percent growth in residential demand to accommodate potential ADUs. Table 4 below shows the additional demand, in gallons per day (gpd), for the known developments in 5-year increments.

Table 4: Demand from Known Future Developments in Hanover (gpd)

2025	2030	2035	2040	2045
2,312	1,312	1,312	1,312	1,312

In total, the additional demand from known developments and expansion from ADUs is 7,559 gpd.

## Projected Demand

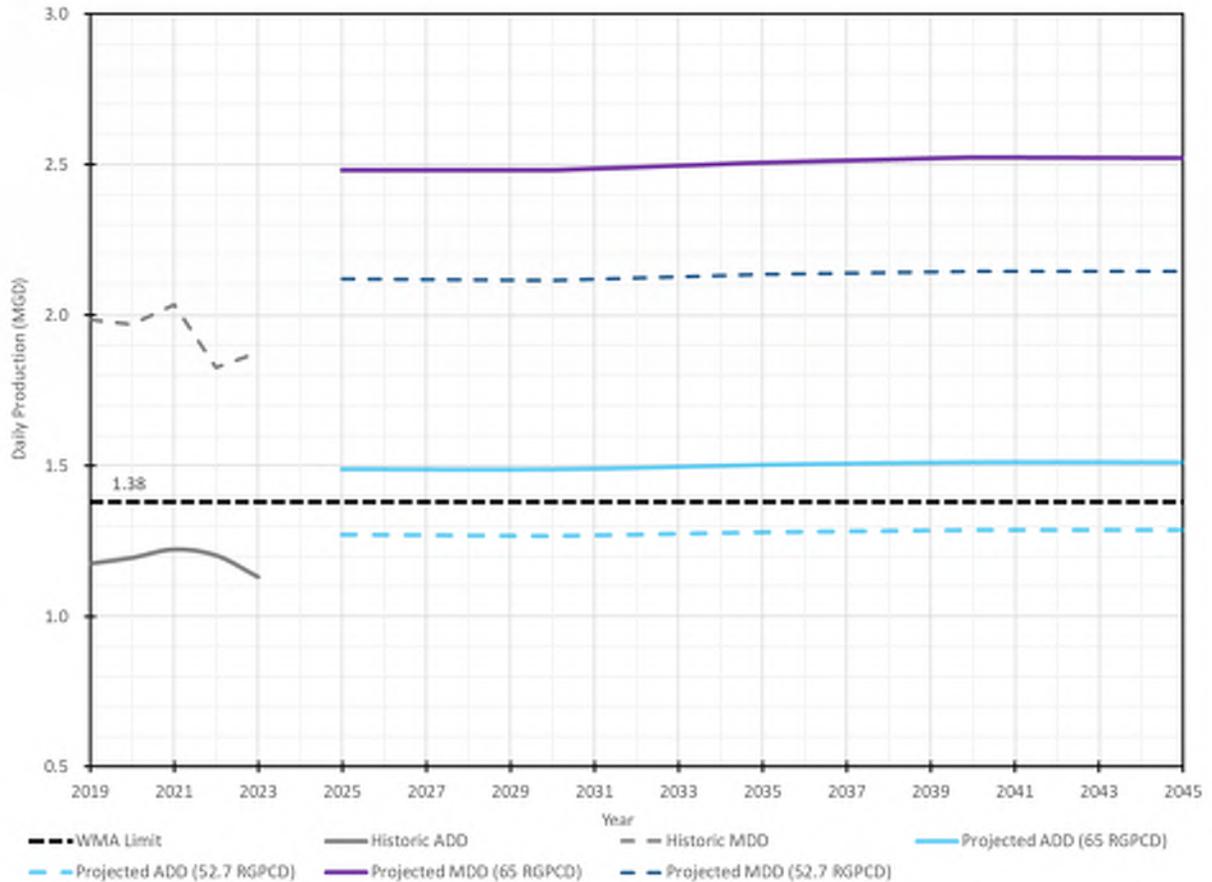
Incorporating the above projections and the performance standards of 65 RGPDC and 10% UAW, the resulting historic and projected demands are as follows:

Table 5: Hanover Historic and Projection Demand

Year	ADD (MGD)	MDD (MGD) <sup>1</sup>
2019	1.18	1.98
2020	1.19	1.97
2021	1.22	2.04
2022	1.20	1.83
2023	1.13	1.88
2025	1.49	2.48
2030	1.49	2.48
2035	1.50	2.51
2040	1.51	2.52
2045	1.51	2.52

1. Assumes the 5-yr average MDD:ADD ratio of 1.67

Chart 2 below shows these projections against the WMA withdrawal limits.



**Chart 2: Historic and Projected Water Consumption**

As shown above, factoring in future population growth and known developments, demand growth is anticipated to surpass the planned increases in WMA withdrawal limits using the MassDEP performance standard of 65 RGPDC. However, if the Division is able to maintain its historical average RGPDC of 52.7, available water supply should be adequate to meet ADD.

### Available Supply

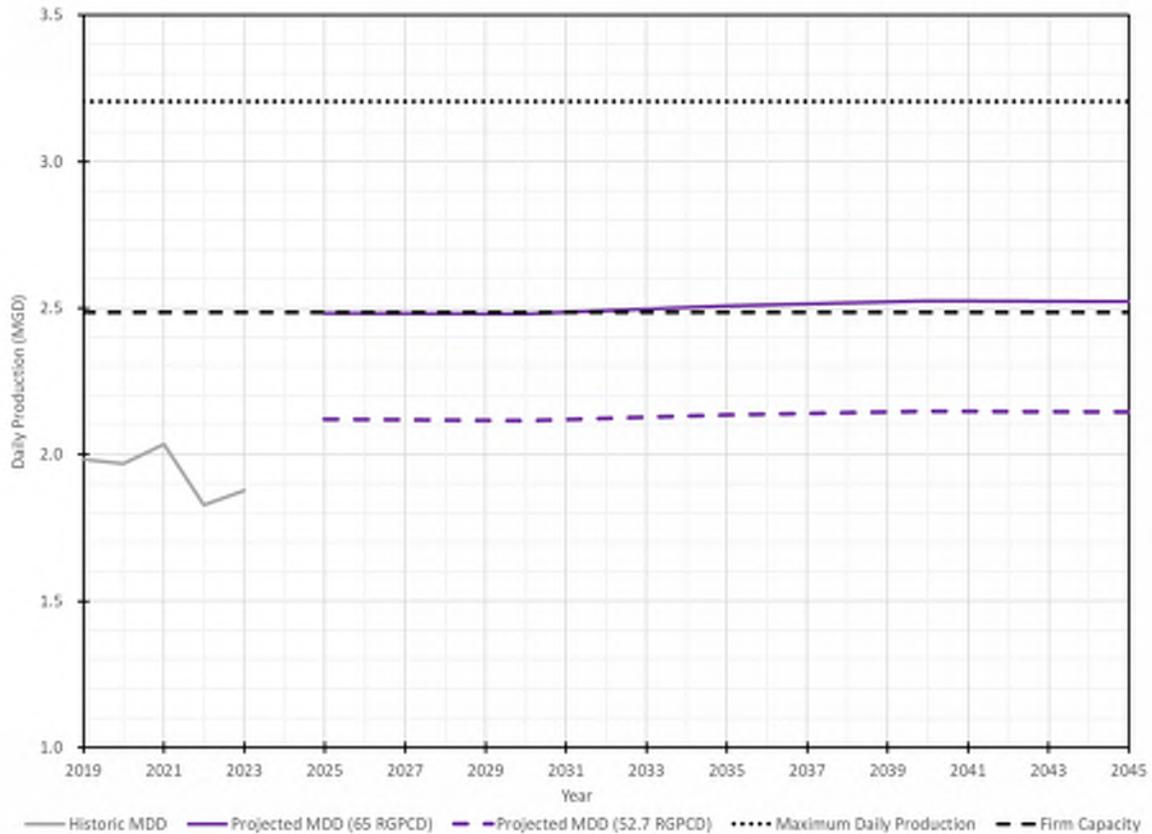
A key service metric is the ability to meet maximum day demands with the largest source offline, known as firm capacity. EP reviewed the Division’s water sources and quantified the available water at all sources. The assumed quantity is the lesser of WMA restrictions and any operational restrictions. The table below shows the Division’s sources and their maximum available supply in both MGD and gallons per minute (gpm).

Table 6: Hanover Maximum Available Supply

Source Name	Maximum Daily Rate	
	gpm	MGD
Phillip C. Beal 1	576	0.830
Phillip C. Beal 2		
Pond Street 1	175	0.252
Pond Street 2	500	0.720
Pond Street 3	450	0.648
Hanover Street 1	250	0.360
Broadway 1	175	0.252
Broadway 2	150	0.216
Total	2,226	3.21
Firm Capacity	1,726	2.49

The Philip C. Beal Wells are limited to a combined rate of 576 gpm or 0.830 MGD. However, the Division indicated the yield of Philip C. Beal 2 is approximately 600 gpm and Philip C. Beal Well 1 is approximately 125 gpm. While this makes Philip C. Beal 2 the largest overall well, the loss of this well would only reduce the total output of the station by 451 gpm (576 gpm minus 125 gpm). Thus, the loss of Pond Street Well 2 is a larger overall reduction in output. EP used Pond Street Well 2 as the firm capacity scenario.

The resulting maximum available supply and firm capacity are 3.21 MGD and 2.49 MGD, respectively. This firm capacity is below the projected MDD of 2.52 MGD, indicating the Division should be able to meet future MDD with all sources, but would experience a deficit with the loss of Pond Street Well 2. However, if the Division is able to maintain its historic average RGPCD of 52.7, they will have adequate firm capacity. The projected supply and demand are shown in Chart 3 below.



**Chart 2: Projected MDD vs Supply and Firm Capacity**

## CONCLUSIONS AND RECOMMENDATIONS

EP's projections indicate the Division has adequate maximum supply capacity to meet projected MDD demands. Using the loss of the Pond Street Well 2 as the firm capacity scenario, EP's projections show a minor firm capacity deficit of 0.038 MGD. However, if the Division can maintain its historic average RGPDC of 52.7 (below the performance standard of 65 used in the projections), it will have adequate firm capacity.

EP's projections indicate the WMA limit is sufficient to meet projected ADD through 2044.

## MEMORANDUM

**Date:** August 5, 2024

**To** Jason Federico, Water Superintendent  
Norwell Water Department  
345 Main Street  
Norwell, MA 02061

**From** Kevin Rathbun

**CC** Lauren E. Underwood, P.E.  
Ryan Allgrove, P.E.

**Subject** **MWRA Water Supply Needs Assessment**  
**Task 1 Summary - Water Supply and Demand Evaluation**  
**Norwell Water Department**

### BACKGROUND

The Towns of Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset and Scituate (Towns) are embarking on a critical and challenging initiative to evaluate their future water supply needs and how the Massachusetts Water Resource Authority (MWRA) may be able to assist. The MWRA's entrance fee waiver and Weymouth's pursuit of an MWRA connection present a unique opportunity for the Towns to secure a regional water supply connection. The intent of this plan is to understand the water supply needs for each water system individually and as a region, and develop implementable recommendations to increase reliability and redundancy by utilizing the MWRA supply.

### Water System Information

The Norwell Water Department (Department) serves approximately 11,495 customers via 3,798 service connections. Its water supply sources include the four Grove Street Wells (Wells 2, 3, 5, and 10) in the Boston Harbor Basin, the Washington Street Well in the South Coastal Basin, and four active South Street Wells (Wells 1, 4R, 6R, and 8) also in the South Coastal Basin. South Street Well 9 is inactive. The average ratio of maximum day demand (MDD) to average day demand (ADD) is 1.78.

## Task 1 Scope

Under Task 1 – Evaluation of Water Supply and Demand, EP assessed the ability of the Department’s water supply sources to meet existing and projected water demands. This included:

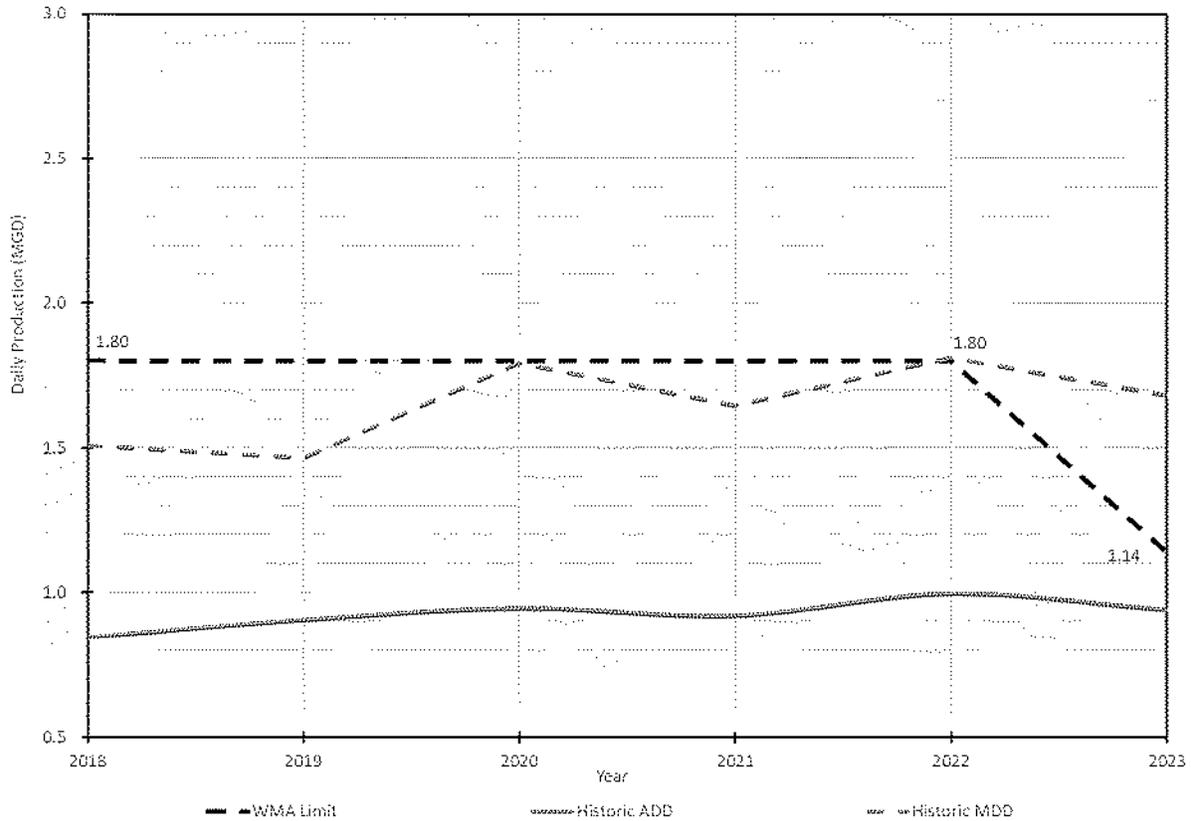
1. Reviewing existing available documentation.
2. Reviewing recent Annual Statistical Reports (ASRs) and historic consumption.
3. Projecting average day demand (ADD) and maximum day demand (MDD) through the planning period (2044) in accordance with the Water Resource Commission’s Conservation Standards and the Water Management Act Performance Standards.
4. Comparing projected demands with maximum available water supply capacity as well as firm capacity (supply capacity with the largest source offline).

## SUPPLY AND DEMAND ANALYSIS

Below is a review of the Department’s ability to meet current and future water demands. EP compiled and analyzed current registered, permitted, and operational capacities of all water supply sources, and historic and future demands to assess the ability of the water system to meet consumer needs through the 2044 planning period.

### Current Demands

Chart 1 below shows the historic ADD and MDD for the Norwell water system plotted against the Water Management Act (WMA) withdrawal limit. Units are million gallons per day (MGD).



**Chart 1: Norwell Historic Water Consumption**

As shown in Chart 1, the Department’s annual average consumption trended below the WMA withdrawal limit in recent years, including the revised WMA limits in 2023. Table 1 below shows the residential gallons per capita per day (RGPCD) and unaccounted for water (UAW) over the last 5 years.

Table 1: Norwell’s 5-year RGPCD and UAW

Year	RGPCD	UAW (%)
2019	58.04	5.14
2020	60.94	9.06
2021	51.71	16.00
2022	60.09	7.00
2023	51.14	12.52
<b>Average</b>	<b>56.38</b>	<b>9.94</b>

The Massachusetts Department of Environmental Protection (MassDEP) performance standards are 65 RGPCD and 10% UAW. As shown above, the Department has met both standards on average in the last five years.

## Future Demands

EP completed future demand projections through 2045 following the Massachusetts Water Resources Commission (WRC) methodology. This includes population growth projections, employment projections, and known future developments discussed below.

### Population Projections

EP utilized population projections provided by the Metropolitan Area Planning Council (MAPC) and the University of Massachusetts Donahue Institute (UMass) for both Abington and Rockland. Table 2 below shows the combined historic data points and projections from both sources.

Table 2: Norwell Historic and Forecasted Population

Source	Historic		Projected					
	2010	2020	2025	2030	2035	2040	2045	2050
UMass	10,506	11,351	11,859	12,582	13,627	14,712	15,597	16,405
MAPC	10,041	10,437		10,473		10,419		10,649

As the intent of this study is to prepare for potential future requirements, EP elected to incorporate the higher of the two population projections to calculate future water demand. In this case, the UMass projections demonstrate stronger anticipated growth through 2050.

### Employment Projections

EP utilized employment projections across all sectors provided by the MAPC, shown below.

Table 3: MAPC Employment Projections

MassDOT Projections				
2010	2020	2030	2040	2050
8,139	8,201	7,805	7,774	7,786

### Known Future Developments

The WRC demand projection methodology incorporates data on known future developments. This category is reserved for developments that have been filed with the Town and for which demands, occupancy, and/or number of housing units are available.

The Department provided EP with a list of approved and pending developments. These included projects already underway, which may be partially occupied by 2025, likely complete by 2030. EP assumed half of these development demands in 2025 and the other half in 2030. The Department also noted four developments that have not yet begun; EP assumed these would be complete by 2030. Lastly, the Department the MBTA Adjacent Community housing requirement of approximately 750 units. EP assumed completion by 2035.

Table 4 below shows the additional demand, in gallons per day (gpd), for the known developments in 5-year increments.

Table 4: Demand from Known Future Developments in Norwell (gpd)

2025	2030	2035
8,525	38,445	82,500

In total, the additional demand from known developments is 129,470 gpd.

## Projected Demand

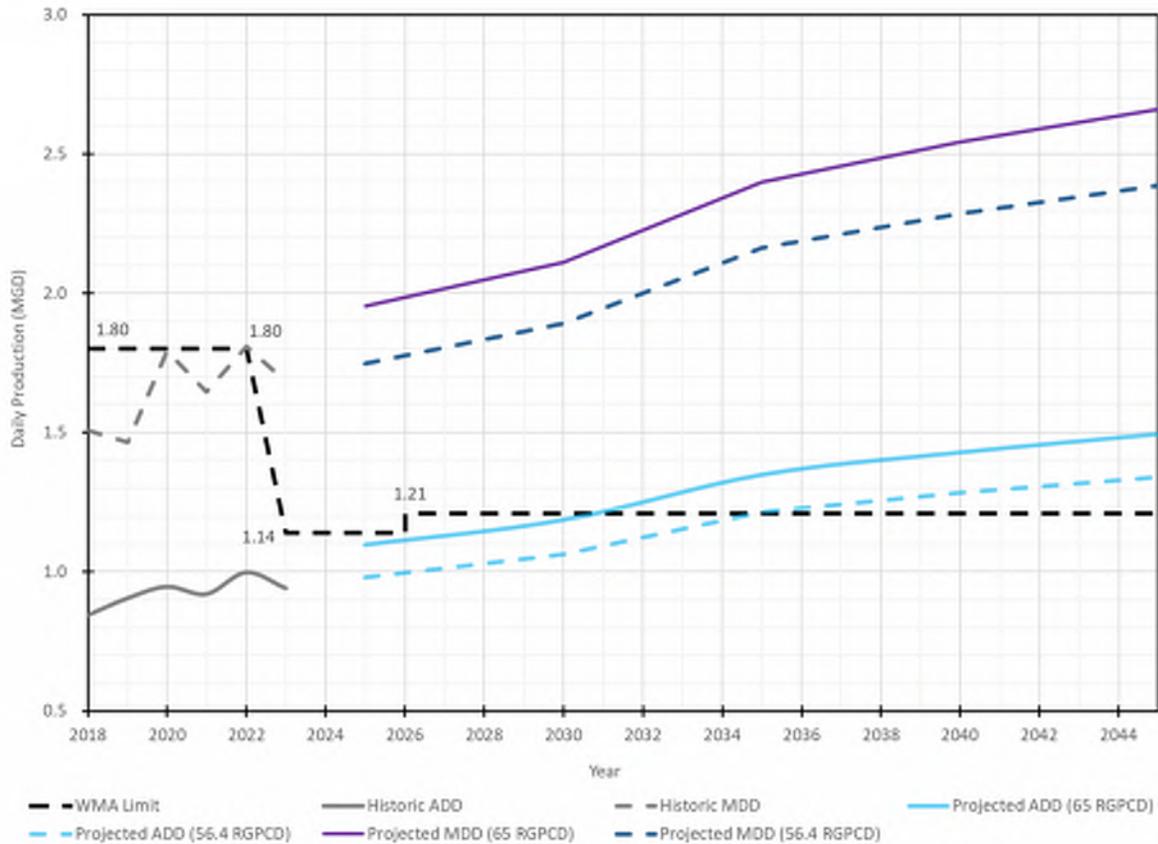
Incorporating the above projections and the performance standards of 65 RGPDC and 10% UAW, the resulting historic and projected demands are as follows:

Table 5: Norwell Historic and Projection Demand

Year	ADD (MGD)	MDD (MGD) <sup>1</sup>
2019	0.84	1.51
2020	0.91	1.47
2021	0.95	1.79
2022	0.92	1.65
2023	1.00	1.81
2025	1.10	1.95
2030	1.19	2.11
2035	1.35	2.40
2040	1.43	2.54
2045	1.49	2.66

1. Assumes the 5-yr average MDD:ADD ratio of 1.78

Chart 2 below shows these projections against the WMA withdrawal limits.



**Chart 2: Historic and Projected Water Consumption**

As shown above, factoring in future population growth and known developments, demand growth is anticipated to surpass the WMA withdrawal limits between 2030 and 2035, depending on the actual RGPCD and the rate of development. If the Department is unable to secure additional water volumes through their WMA permit, they may need to secure approximately 0.283 MGD in additional volumes to supply their anticipated ADD.

### Available Supply

A key service metric is the ability to meet maximum day demands with the largest source offline, known as firm capacity. EP reviewed the Department’s water sources and quantified the available water at all sources. The assumed quantity is the lesser of WMA restrictions and any operational restrictions. The table below shows the Department’s sources and their maximum available supply in both MGD and gallons per minute (gpm).

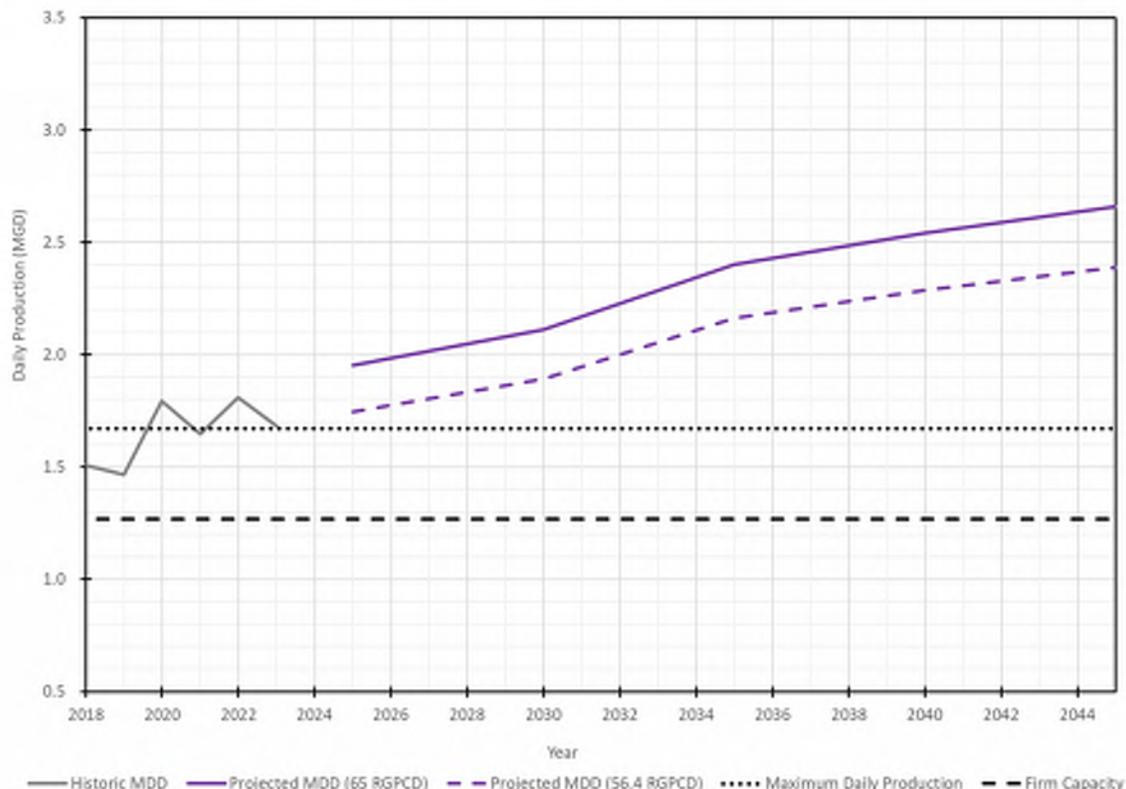
Table 6: Norwell Maximum Available Supply

Source Name	Maximum Daily Rate	
	gpm	MGD
Grove Street Well 2	83	0.12
Grove Street Well 3 <sup>1</sup>	-	-
Grove Street Well 5	83	0.12
Grove Street Well 10	139	0.20
South Street Well 1	278	0.40
South Street Well 4R	153	0.22
South Street Well 6R	278	0.40
South Street Well 8	49	0.07
Washington Street Well	97	0.14
Total	1,160	1.67
Firm Capacity	882	1.27

1. Well 3 currently not in use.

The resulting maximum available supply and firm capacity are 1.67 MGD and 1.27 MGD, respectively. These values are below the projected MDD of 2.66 MGD, indicating the Department lacks sufficient capacity to meet MDD within the current operational constraints and permit structure. The projected supply deficit is approximately 0.989 MGD. The projected firm capacity deficit is 1.389 MGD.

The projected supply and demand are shown in Chart 3 below.



**Chart 2: Projected MDD vs Supply and Firm Capacity**

## CONCLUSIONS AND RECOMMENDATIONS

EP’s projections indicate ADD will surpass the WMA limits between 2030 and 2035, depending on the actual RGPDC and the rate of development. The projections also indicate an MDD shortfall of approximately 0.989 MGD against the WMA maximum daily withdrawal limitations, which increases to 1.389 MGD during the loss of the largest well (South Street Wells 1 or 6R).

The Department indicated they are pursuing treatment improvements for the Grove Street and Washington Street Wells. This will not significantly impact the ADD supply, as these sources are currently limited by the WMA permit. Restoring Well 6R to its full permitted capacity of 0.65 MGD (451 gpm) may be sufficient to meet projected ADD through the 2044 planning period.

EP recommends the Department continue to pursue potential supply augments through the potential MWRA regional supply project to support MDD and to provide adequate firm capacity. The Department may also need to increase its annual average WMA limits to provide for projected ADD without violating the permit requirements.

## MEMORANDUM

**Date:** January 17, 2025

**To** Kevin Cafferty, Director  
Scituate Department of Public Works  
600 Chief Justice Cushing Highway  
Scituate, Massachusetts 02066

**From** Kevin Rathbun

**CC** Lauren E. Underwood, P.E.  
Ryan Allgrove, P.E.  
Jeffrey Chessia, Scituate Engineer  
Eric Langlan, Scituate Water Superintendent  
Katherine Kelley, Scituate Water Assistant Superintendent

**Subject** **MWRA Water Supply Needs Assessment  
Task 1 Summary - Water Supply and Demand Evaluation  
Scituate Water System**

### BACKGROUND

The Towns of Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset and Scituate (Towns) are embarking on a critical and challenging initiative to evaluate their future water supply needs and how the Massachusetts Water Resource Authority (MWRA) may be able to assist. The MWRA's entrance fee waiver and Weymouth's pursuit of an MWRA connection present a unique opportunity for the Towns to secure a regional water supply connection. The intent of this plan is to understand the water supply needs for each water system individually and as a region, and develop implementable recommendations to increase reliability and redundancy by utilizing the MWRA supply.

This memo was issued as a draft on August 5, 2024. Following review by the Town of Scituate, the following revisions were made:

- Revised text regarding out of service wells in the “Water System Information” section. The sentence was revised from “Wells 18 and 22 were not in use in recent years.” to “Well 18 was not in use in recent years.”
- Revised the firm capacity scenario to include the loss of Old Oaken Bucket Pond to account for potential restrictions based on impact to the watershed. The revised memo includes changes to the table, chart, and text on Pages 7 and 8 of the memo.

## Water System Information

The Scituate Water Division (Division) serves approximately 19,760 customers via 8,397 service connections. Its water supply sources include 7 groundwater wells, the Old Oaken Bucket Pond surface water source, and purchased finished water from Marshfield. Well 18 was not in use in recent years. All sources withdraw from the South Coastal Basin. The average ratio of maximum day demand (MDD) to average day demand (ADD) is 1.61.

## Task 1 Scope

Under Task 1 – Evaluation of Water Supply and Demand, EP assessed the ability of the Division’s water supply sources to meet existing and projected water demands. This included:

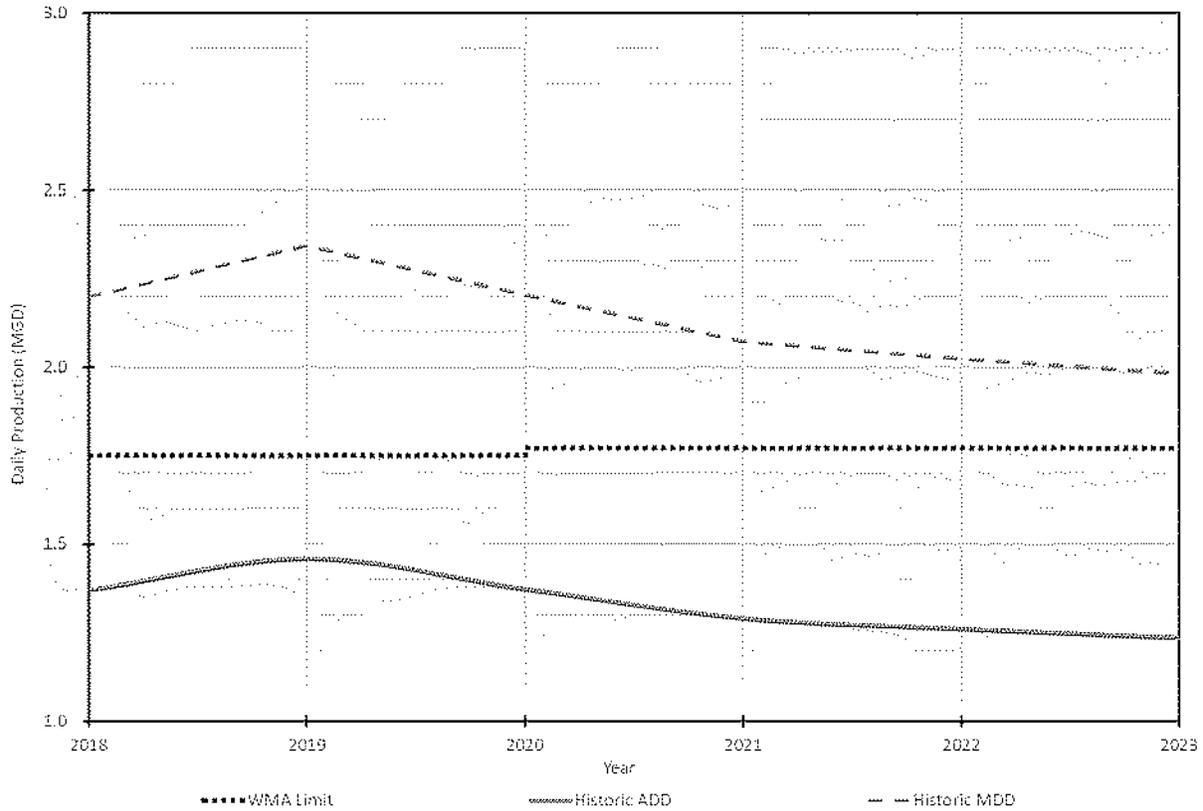
1. Reviewing existing available documentation.
2. Reviewing recent Annual Statistical Reports (ASRs) and historic consumption.
3. Projecting average day demand (ADD) and maximum day demand (MDD) through the planning period (2044) in accordance with the Water Resource Commission’s Conservation Standards and the Water Management Act Performance Standards.
4. Comparing projected demands with maximum available water supply capacity as well as firm capacity (supply capacity with the largest source offline).

## SUPPLY AND DEMAND ANALYSIS

Below is a review of the Division’s ability to meet current and future water demands. EP compiled and analyzed current registered, permitted, and operational capacities of all water supply sources, and historic and future demands to assess the ability of the water system to meet consumer needs through the 2044 planning period.

## Current Demands

Chart 1 below shows the historic ADD and MDD for the Scituate water system plotted against the Water Management Act (WMA) withdrawal limit. Units are million gallons per day (MGD).



**Chart 1: Scituate Historic Water Consumption**

As shown in Chart 1, the Division’s annual average consumption trended below the WMA withdrawal limit in recent years. Table 1 below shows the residential gallons per capita per day (RGPCD) and unaccounted for water (UAW) over the last 5 years.

Table 1: Scituate 5-year RGPCD and UAW

Year	RGPCD	UAW (%)
2019	52.99	11.72
2020	57.27	9.16
2021	23.24	9.60
2022	21.18	15.81
2023	49.72	15.13
<b>Average</b>	<b>52.88</b>	<b>12.29</b>

The Massachusetts Department of Environmental Protection (MassDEP) performance standards are 65 RGPCD and 10% UAW. As shown above, the Division is below the RGPCD standard, and above the UAW standard.

## Future Demands

EP completed future demand projections through 2045 following the Massachusetts Water Resources Commission (WRC) methodology. This includes population growth projections, employment projections, and known future developments discussed below.

### Population Projections

EP utilized population projections provided by the Metropolitan Area Planning Council (MAPC) and the University of Massachusetts Donahue Institute (UMass) for Scituate. Table 2 below shows the combined historic data points and projections from both sources.

Table 2: Scituate Historic and Forecasted Population

Source	Historic		Projected					
	2010	2020	2025	2030	2035	2040	2045	2050
UMass	<b>18,133</b>	<b>19,063</b>	<b>19,360</b>	<b>19,623</b>	<b>19,997</b>	<b>20,182</b>	<b>20,088</b>	<b>20,011</b>
MAPC	17,634	18,452		18,886		19,170		19,504

As the intent of this study is to prepare for potential future requirements, EP elected to incorporate the higher of the two population projections to calculate future water demand. In this case, the UMass projections demonstrate stronger anticipated growth through 2050.

### Employment Projections

EP utilized employment projections across all sectors provided by the MAPC, shown below.

Table 3: MAPC Employment Projections

MassDOT Projections				
2010	2020	2030	2040	2050
4,153	4,822	5,161	5,410	5,755

### Known Future Developments

The WRC demand projection methodology incorporates data on known future developments. This category is reserved for developments that have been filed with the Town and for which demands, occupancy, and/or number of housing units are available.

The Division provided EP with a list of approved and pending developments. This included two developments anticipated to be completed by 2030, and a long-term project on Route 3A, estimated to be completed by 2040.

Table 4 below shows the additional demand, in gallons per day (gpd), for the known developments in 5-year increments.

Table 4: Demand from Known Future Developments in Scituate

2030	2035	2040
6,380	-	29,480

In total, the additional demand from known developments is 35,860 gpd.

## Projected Demand

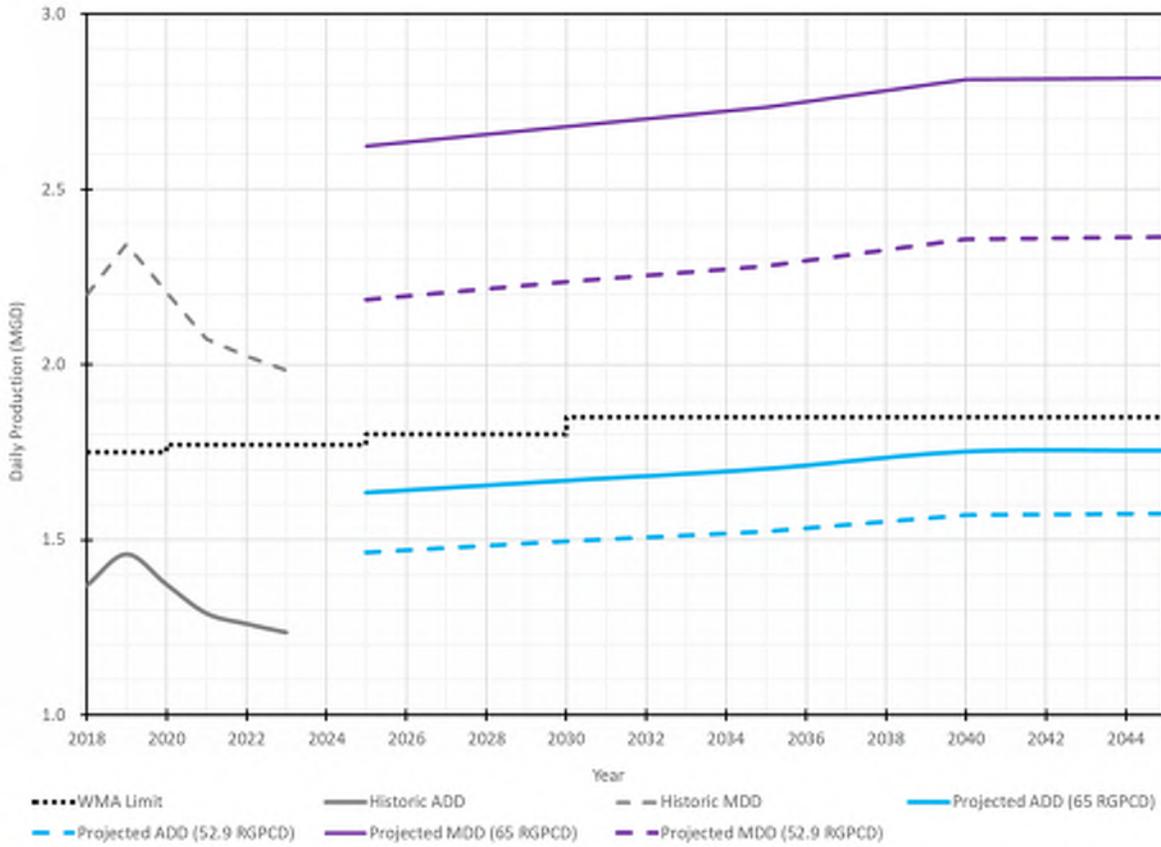
Incorporating the above projections and the performance standards of 65 RGPDC and 10% UAW, the resulting historic and projected demands are as follows:

Table 5: Scituate Historic and Projection Demand

Year	ADD (MGD)	MDD (MGD) <sup>1</sup>
2019	1.46	2.34
2020	1.37	2.20
2021	1.29	2.07
2022	1.26	2.02
2023	1.24	1.98
2025	1.63	2.62
2030	1.67	2.68
2035	1.70	2.73
2040	1.75	2.81
2045	1.76	2.82

1. Assumes the 5-yr average MDD:ADD ratio of 1.61

Chart 2 below shows these projections against the WMA withdrawal limits.



**Chart 2: Historic and Projected Water Consumption**

As shown above, factoring in future population growth and known developments, the WMA annual average withdrawal limits are sufficient to provide for projected demand growth with either the 65 RGPCD performance standard or Scituate’s historic average of 52.9.

### Available Supply

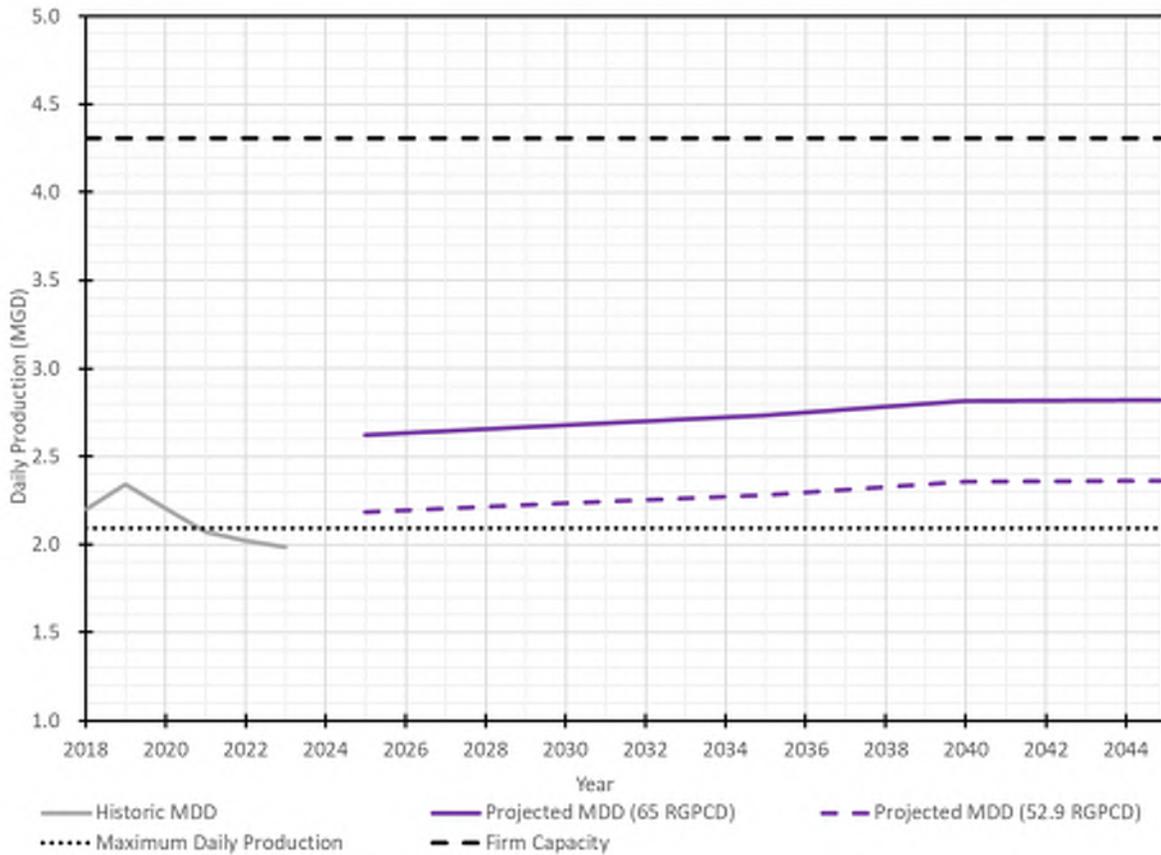
A key service metric is the ability to meet maximum day demands with the largest source offline, known as firm capacity. EP reviewed the Division’s water sources and quantified the available water at all sources. The assumed quantity is the lesser of WMA restrictions and any operational restrictions. The table below shows the Division’s sources and their maximum available supply in both MGD and gallons per minute (gpm).

Table 6: Scituate Maximum Available Supply

Source Name	Maximum Daily Rate	
	gpm	MGD
Webster 10	90	0.13
Webster 11	50	0.07
Stearns 17A	271	0.39
Edison 19	285	0.41
Well 22R	210	0.30
Well 18B	-	0
Old Oaken Bucket Pond <sup>1</sup>	2,083	3.00
Total	2,989	4.30
Firm Capacity	906	1.30

The resulting maximum available supply and firm capacity are 4.30 MGD and 1.30 MGD, respectively. The maximum supply capacity is above the projected MDD of 2.82 MGD, indicating the Division should have sufficient supply to meet projected MDD. The loss of the Old Oaken Bucket Pond source would result in a firm capacity deficit.

The projected supply and demand are shown in Chart 3 below.



**Chart 2: Projected MDD vs Supply and Firm Capacity**

## CONCLUSIONS AND RECOMMENDATIONS

To provide supply redundancy for the Old Oaken Bucket Pond source, the Division would need to secure approximately 1.52 MGD of emergency supply. With all sources operating at their current documented capacity, the analysis indicates the Division has adequate capacity to meet projected ADD and MDD.

## MEMORANDUM

**Date:** January 17, 2025

**To** Russell Tierney, Managing Director/Superintendent  
Weir River Water System  
25 Bare Cove Park Drive  
Hingham, MA 02043

**From** Kevin Rathbun

**CC** Lauren E. Underwood, P.E.  
Ryan Allgrove, P.E.

**Subject** **MWRA Water Supply Needs Assessment**  
**Task 1 Summary - Water Supply and Demand Evaluation**  
**Weir River Water System**

### BACKGROUND

The Towns of Hingham, Hull, Abington, Rockland, Norwell, Hanover, Cohasset and Scituate (Towns) are embarking on a critical and challenging initiative to evaluate their future water supply needs and how the Massachusetts Water Resource Authority (MWRA) may be able to assist. The MWRA's entrance fee waiver and Weymouth's pursuit of an MWRA connection present a unique opportunity for the Towns to secure a regional water supply connection. The intent of this plan is to understand the water supply needs for each water system individually and as a region, and develop implementable recommendations to increase reliability and redundancy by utilizing the MWRA supply.

This memo was issued as a draft on August 5, 2024. Following review by WRWS, the following revisions were made:

- WRWS provided preliminary layouts for a redevelopment effort in the southwest corner of Hingham, which were incorporated into the demand projections. This resulted in a revised Table 5 and Chart 2 on Page 5.

- Revised the maximum daily rate for Free Street Well 4 and Accord Pond. These changes are reflected in Table 6 on Page 6 of the memo. In addition, WRWS reported that the WTP peak flow rate has reached 4,850 gpm, which is slightly more than the sum of the individual flow rates recorded currently. Following discussions with WRWS, the 4,850 gpm flow rate was incorporated as the maximum flow rate, with the assumption that annual well maintenance may restore this value. Chart 3 on Page 7 and surrounding text were revised to reflect these new values.

## Water System Information

The Weir River Water System (WRWS) serves approximately 33,739 customers in the winter and 45,339 customers in the summer via 12,755 service connections. Its water supply sources include 10 active groundwater wells, Accord Pond, and the Fulling Mill Collection System. WRWS also purchases water from Cohasset. All raw water is treated at a sole water treatment plant. The average ratio of maximum day demand (MDD) to average day demand (ADD) is 1.73.

## Task 1 Scope

Under Task 1 – Evaluation of Water Supply and Demand, EP assessed the ability of the WRWS water supply sources to meet existing and projected water demands. This included:

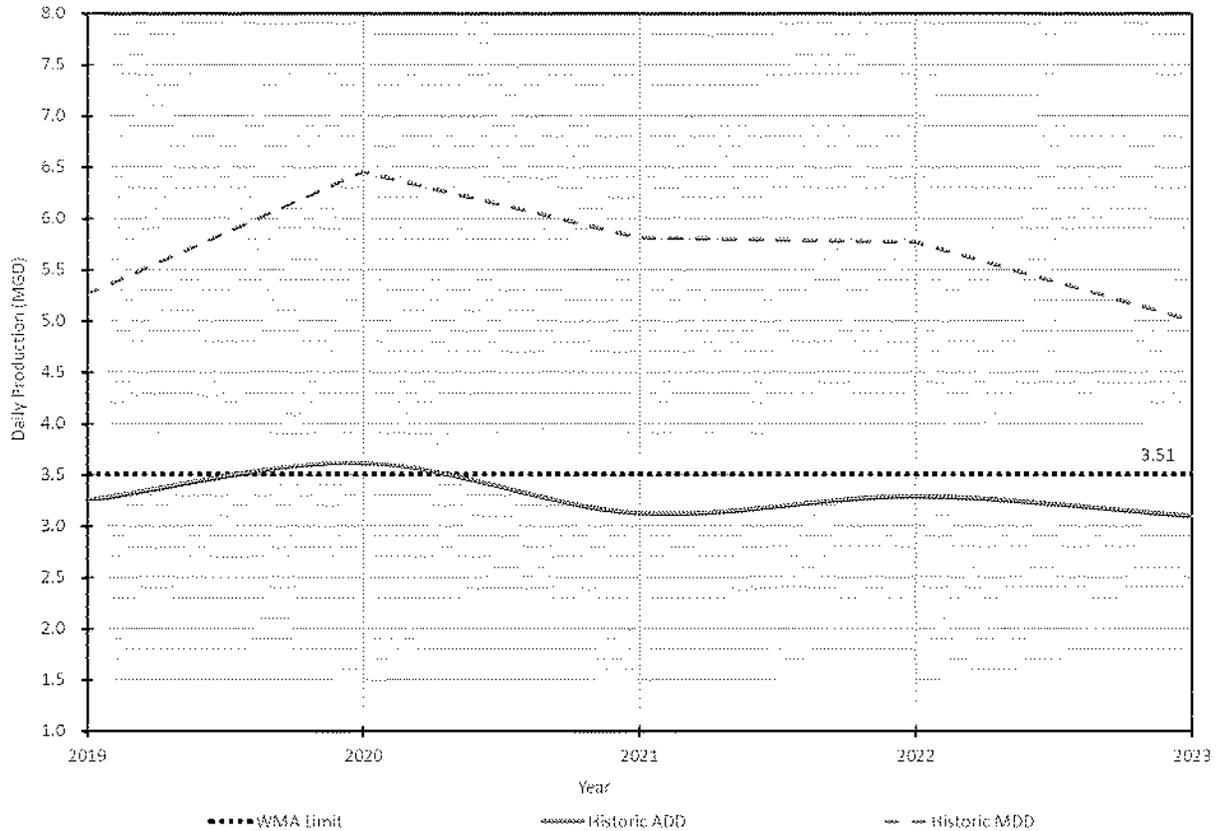
1. Reviewing existing available documentation.
2. Reviewing recent Annual Statistical Reports (ASRs) and historic consumption.
3. Projecting average day demand (ADD) and maximum day demand (MDD) through the planning period (2044) in accordance with the Water Resource Commission's Conservation Standards and the Water Management Act Performance Standards.
4. Comparing projected demands with maximum available water supply capacity as well as firm capacity (supply capacity with the largest source offline).

## SUPPLY AND DEMAND ANALYSIS

Below is a review of WRWS's ability to meet current and future water demands. EP compiled and analyzed current registered, permitted, and operational capacities of all water supply sources, and historic and future demands to assess the ability of the water system to meet consumer needs through the 2044 planning period.

## Current Demands

Chart 1 below shows the historic ADD and MDD for the WRWS plotted against the Water Management Act (WMA) withdrawal limit. Units are million gallons per day (MGD).



**Chart 1: WRWS Historic Water Consumption**

As shown in Chart 1, the WRWS annual average consumption surpassed the WMA withdrawal limit in 2020, but was below in the other four years. These numbers are derived from raw water pumping and are not influenced by purchases from Cohasset. Table 1 below shows the residential gallons per capita per day (RGPCD) and unaccounted for water (UAW) over the last 5 years.

Table 1: WRWS 5-year RGPCD and UAW

Year	RGPCD	UAW (%)
2019	58.53	20.31
2020	66.87	22.94
2021	56.77	20.15
2022	55.19	17.96
2023	51.51	17.26
<b>Average</b>	<b>57.78</b>	<b>19.72</b>

The Massachusetts Department of Environmental Protection (MassDEP) performance standards are 65 RGPCD and 10% UAW. As shown above, WRWS is below the RGPCD standard and above the UAW standard. These numbers do include finished water purchased from Cohasset.

## Future Demands

EP completed future demand projections through 2045 following the Massachusetts Water Resources Commission (WRC) methodology. This includes population growth projections, employment projections, and known future developments discussed below.

### Population Projections

EP utilized population projections provided by the Metropolitan Area Planning Council (MAPC) and the University of Massachusetts Donahue Institute (UMass) for both Hingham and Hull. Table 2 below shows the combined historic data points and projections from both sources.

Table 2: WRWS Historic and Forecasted Average Population

Source	Historic		Projected					
	2010	2020	2025	2030	2035	2040	2045	2050
UMass	32,450	34,356	34,440	34,474	34,715	35,029	35,279	35,376
MAPC	<b>32,240</b>	<b>34,341</b>	-	<b>35,040</b>	-	<b>35,512</b>	-	<b>35,915</b>

As the intent of this study is to prepare for potential future requirements, EP elected to incorporate the higher of the two population projections to calculate future water demand. In this case, the MAPC projections demonstrate stronger anticipated growth through 2050.

### Employment Projections

EP utilized employment projections across all sectors provided by the MAPC, shown below.

Table 3: MAPC Employment Projections

MAPC Projections				
2010	2020	2030	2040	2050
15,456	16,661	15,663	15,606	15,617

### Known Future Developments

The WRC demand projection methodology incorporates data on known future developments. This category is reserved for developments that have been filed with the Town and for which demands, occupancy, and/or number of housing units are available.

WRWS is aware of two large-scale developments near the borders with Weymouth and Abington. These are known as the Bristol Holdings development and the South Shore Park development. Both developments contain a mixture of uses including significant residential housing. Preliminary estimates for the Bristol Holdings development indicate a water consumption of roughly 95,000 gpd. Estimates for the South Shore Park development are approximately 245,000 gpd, for a total of 340,000 gpd.

Based on discussions with WRWS, EP assumes completion between 2030 and 2035. EP thus carried 170,000 gpd in 2030 and 170,000 gpd in 2035 for future development demands.

## Projected Demand

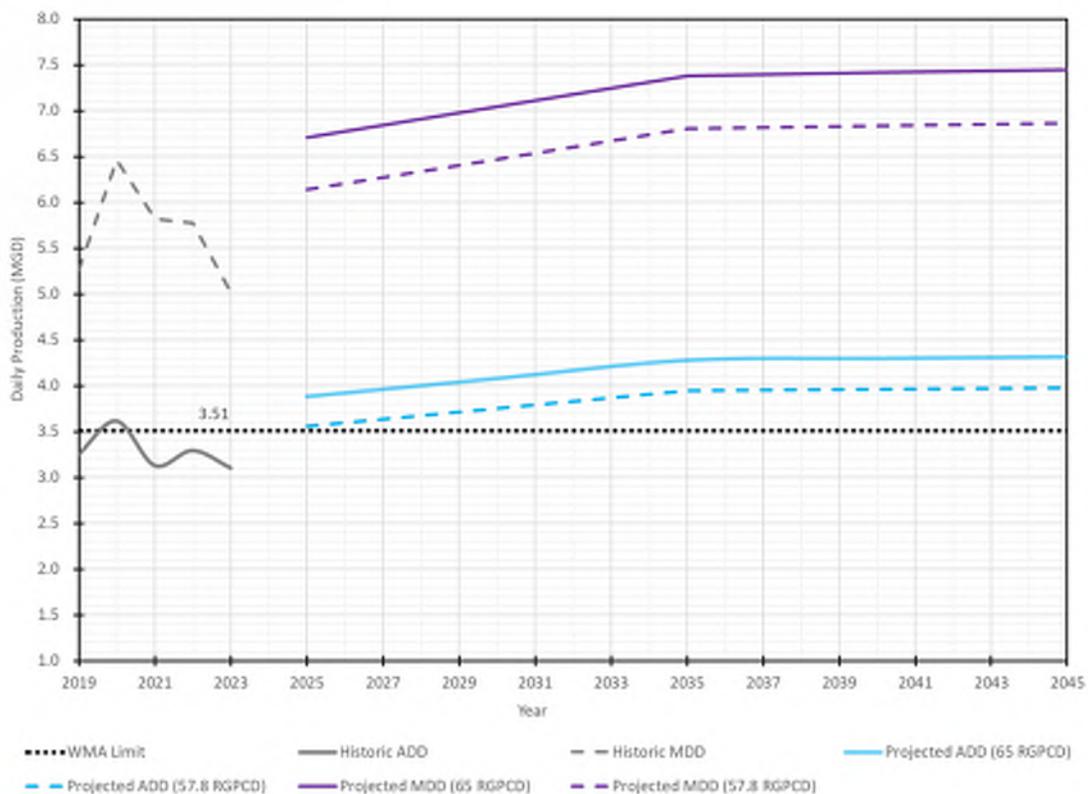
Incorporating the above projections and the performance standards of 65 RGPDC and 10% UAW, the resulting historic and projected demands are as follows:

Table 5: WRWS Historic and Projection Demand

Year	ADD (MGD)	MDD (MGD) <sup>1</sup>
2019	3.25	5.27
2020	3.61	6.46
2021	3.13	5.82
2022	3.29	5.77
2023	3.10	5.01
2025	3.88	6.71
2030	4.08	7.04
2035	4.27	7.38
2040	4.29	7.41
2045	4.31	7.44

1. Assumes the 5-yr average MDD:ADD ratio of 1.73

Chart 2 below shows these projections against the WMA withdrawal limits.



**Chart 2: Historic and Projected Water Consumption**

As shown above, factoring in future population growth and known developments, demand growth is anticipated to surpass the WMA withdrawal limits using either the MassDEP performance standard of 65 RGPDC or the historic average RGPDC of 57.8. This indicates WRWS will need to secure

additional sources of their own or supplement their sources from elsewhere, as they have historically done via purchases from Cohasset.

## Available Supply

A key service metric is the ability to meet maximum day demands with the largest source offline, known as firm capacity. EP reviewed WRWS's water sources and quantified the available water at all sources. The assumed quantity is the lesser of safe yield and any operational restrictions. The table below shows the WRWS's sources and their maximum available supply in both MGD and gallons per minute (gpm).

Table 6: WRWS Maximum Available Supply

Source Name	Maximum Daily Rate	
	gpm	MGD
Scotland Well	600	0.864
Prospect St	271	0.390
Fulling Mill 1	450	0.648
Fulling Mill 2	175	0.252
Fulling Mill Basins	320	0.461
Accord Pond	1000	1.440
Free St 2	1,250	1.800
Free St 2A		
Free St 5	200	0.288
Free St 4	400	0.576
Total	4,666*	6.719*
Firm Capacity	3,416*	4.919*

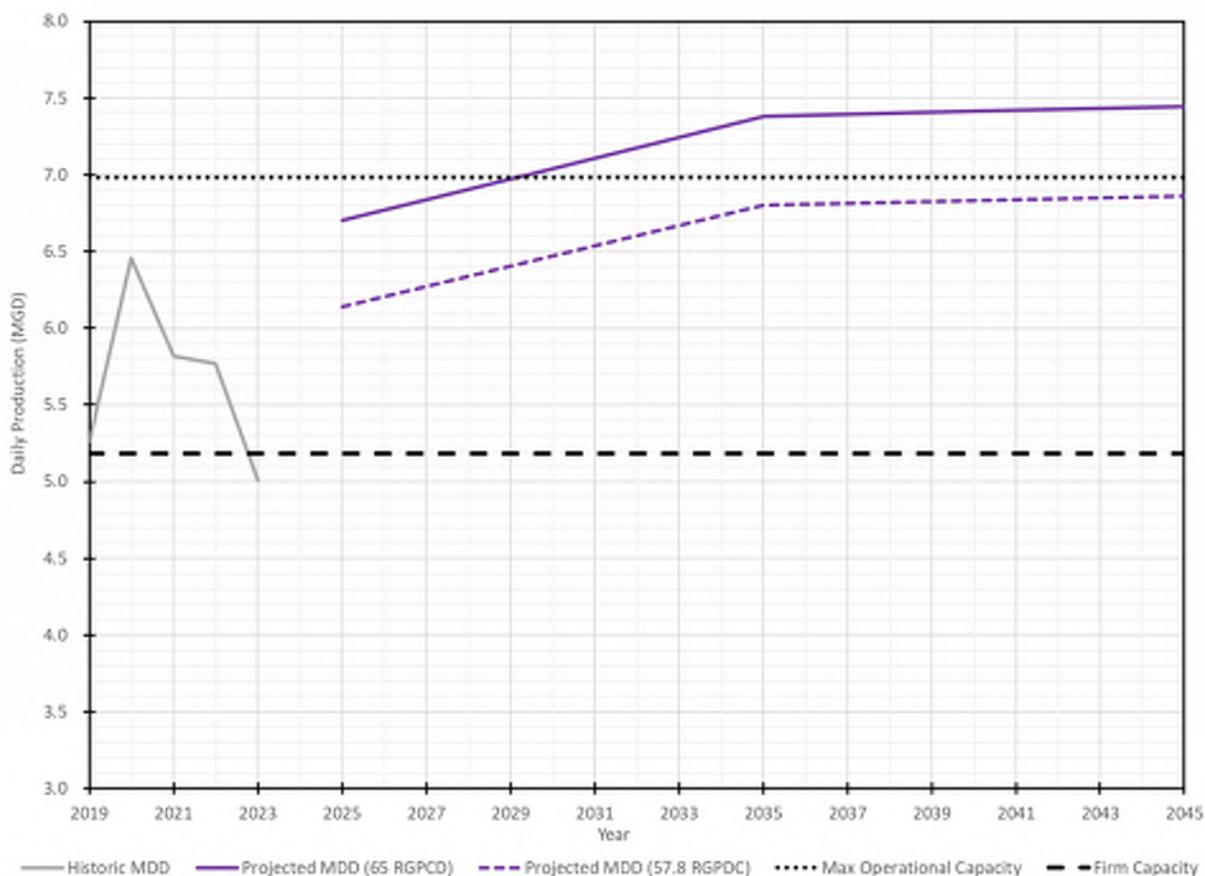
\*See adjusted values below.

WRWS indicated the combined max flow rate at the WTP can reach 4,850 gpm. Apex assumes some well flow rate estimates may either be inaccurate, or with annual redevelopment efforts, the combined rate may be restored to 4,850 gpm. The maximum capacity and firm capacity used in this study reflect the 4,850 gpm number.

While WRWS's supply is concentrated at one water treatment plant (WTP), WRWS indicated the WTP has sufficient redundancy and wished to consider the loss of the Free Street Wells as the firm capacity scenario. The maximum available supply is currently 4,850 gpm or 6.984 MGD, making the firm capacity 3.600 MGD.

The projected MDD of 7.44 MGD is above the maximum production capacity and the firm capacity. To meet projected demands without exceeding the safe yield of existing sources, WRWS will need to recover lost capacity at existing sources or secure additional supply with new sources or a regional supply such as MWRA.

The projected supply and demand are shown in Chart 3 below.



**Chart 2: Projected MDD vs Supply and Firm Capacity**

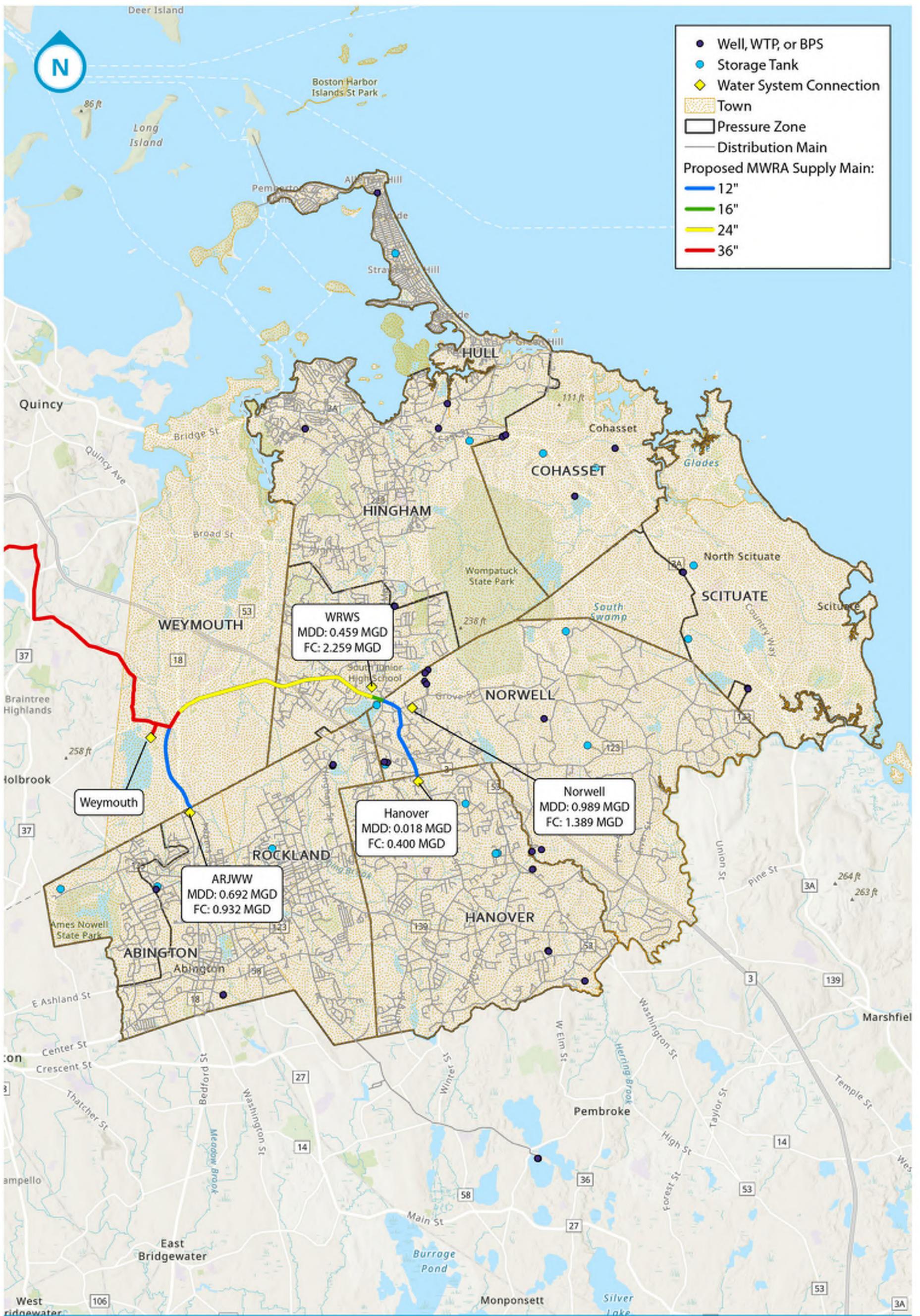
## CONCLUSIONS AND RECOMMENDATIONS

EP’s projections indicate average day demand growth is anticipated to surpass the WMA withdrawal limits using either the MassDEP performance standard of 65 RGPDC or the historic average RGPDC of 57.8. This indicates WRWS will need to increase the average annual withdrawals with additional permitted volumes or secure additional sources.

EP’s projections indicate WRWS has insufficient peak flow capacity to meet projected MDD. WRWS will need to secure approximately 0.46 MGD of additional supply to meet projected demands, and a total of 2.26 MGD to provide sufficient redundancy to protect against the loss of the Free Street 2/2A wells in a firm capacity event. EP recommends WRWS further investigate additional sources to provide supply redundancy.

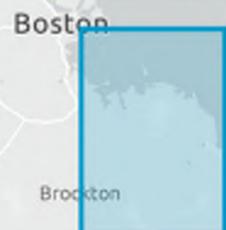
WRWS will also need to secure additional supply volumes or recover lost capacity at existing sources to meet projected ADD without exceeding the safe yield of its operational sources.

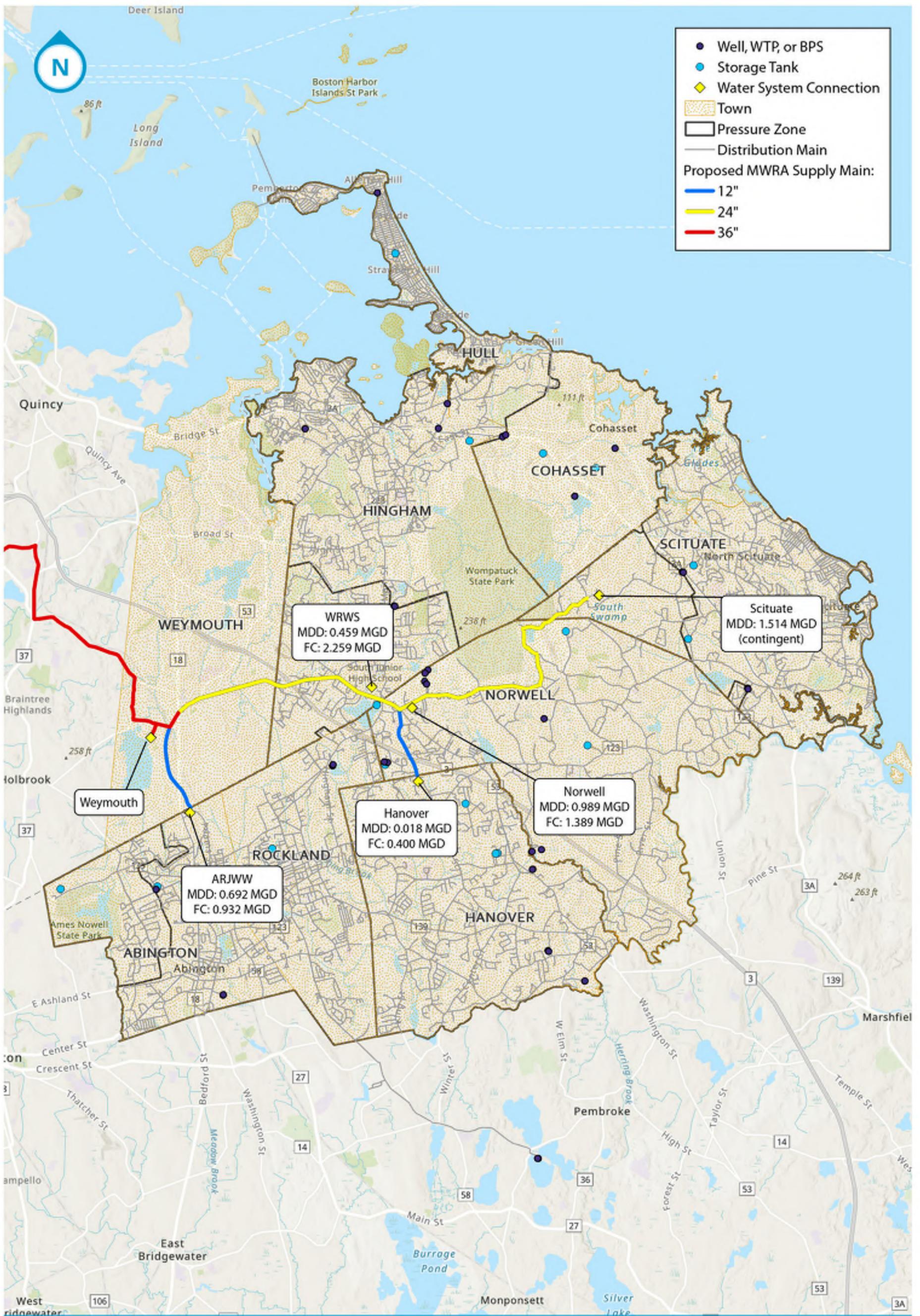
Appendix B  
MWRA Regional Supply Alternatives Figures



**Figure 1A**  
**Scenario 1 - Baseline Communities**

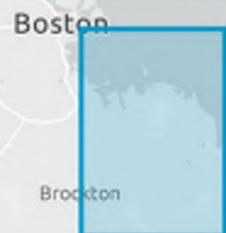
Hingham, MA  
 January 2025

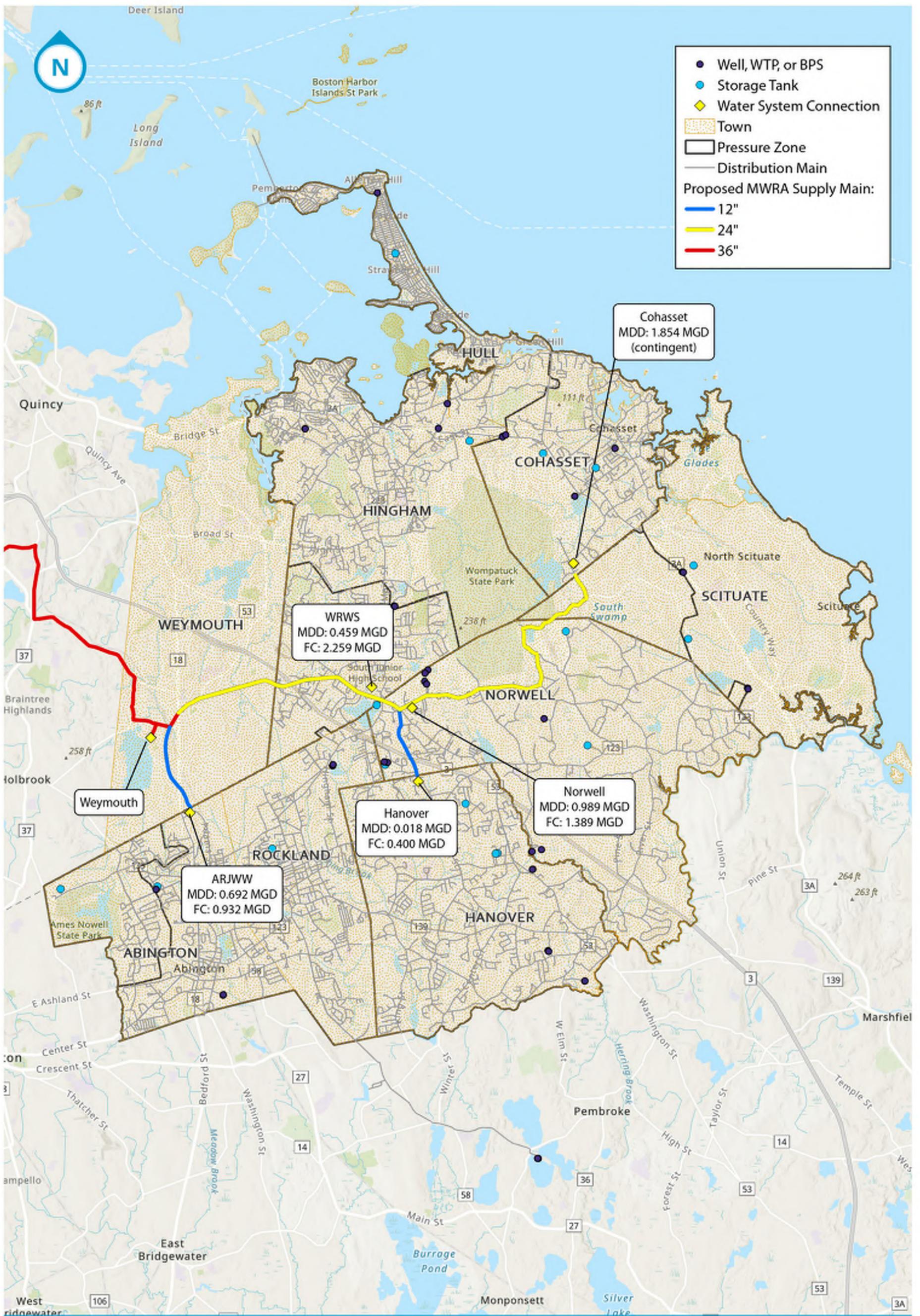




**Figure 1B**  
**Scenario 1 - Baseline Communities & Scituate**

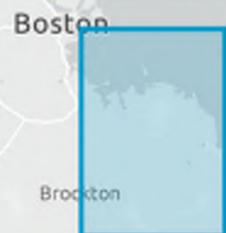
Hingham, MA  
 January 2025

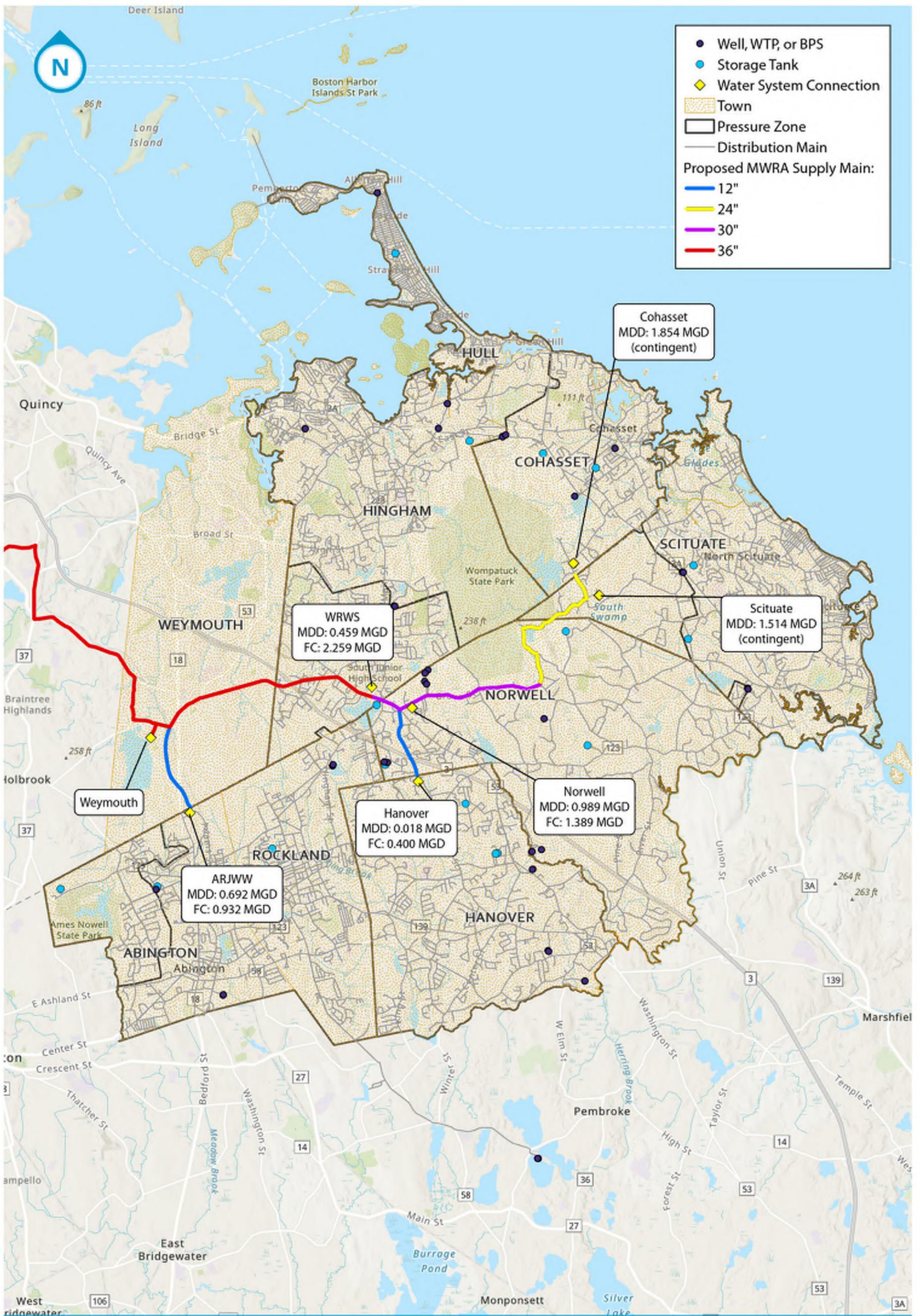




**Figure 1C**  
**Scenario 1 - Baseline Communities & Cohasset**

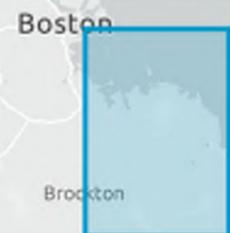
Hingham, MA  
 January 2025

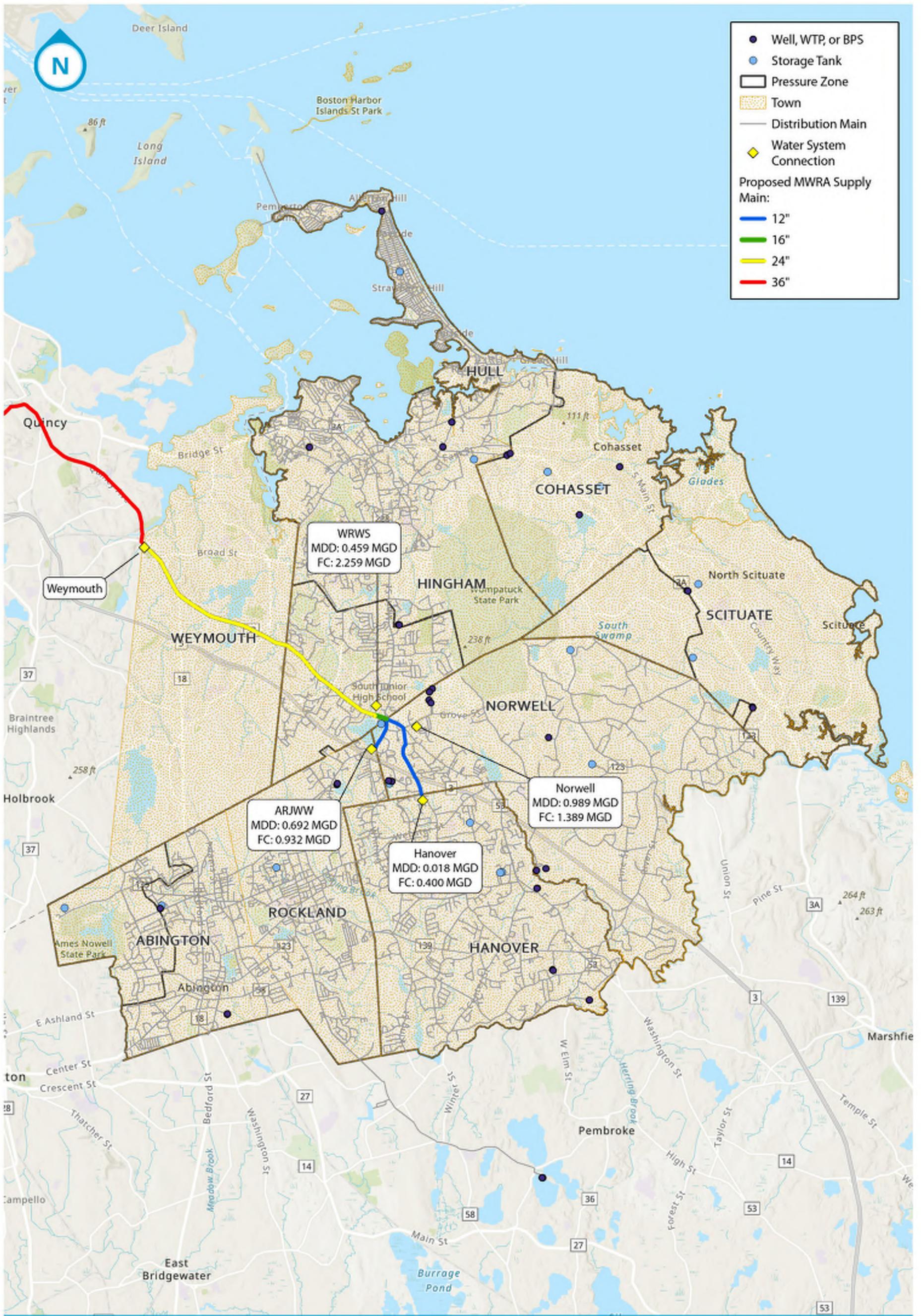




**Figure 1D**  
**Scenario 1 - Baseline Communities, Scituate & Cohasset**

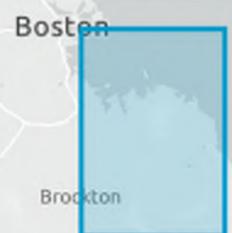
Hingham, MA  
 January 2025

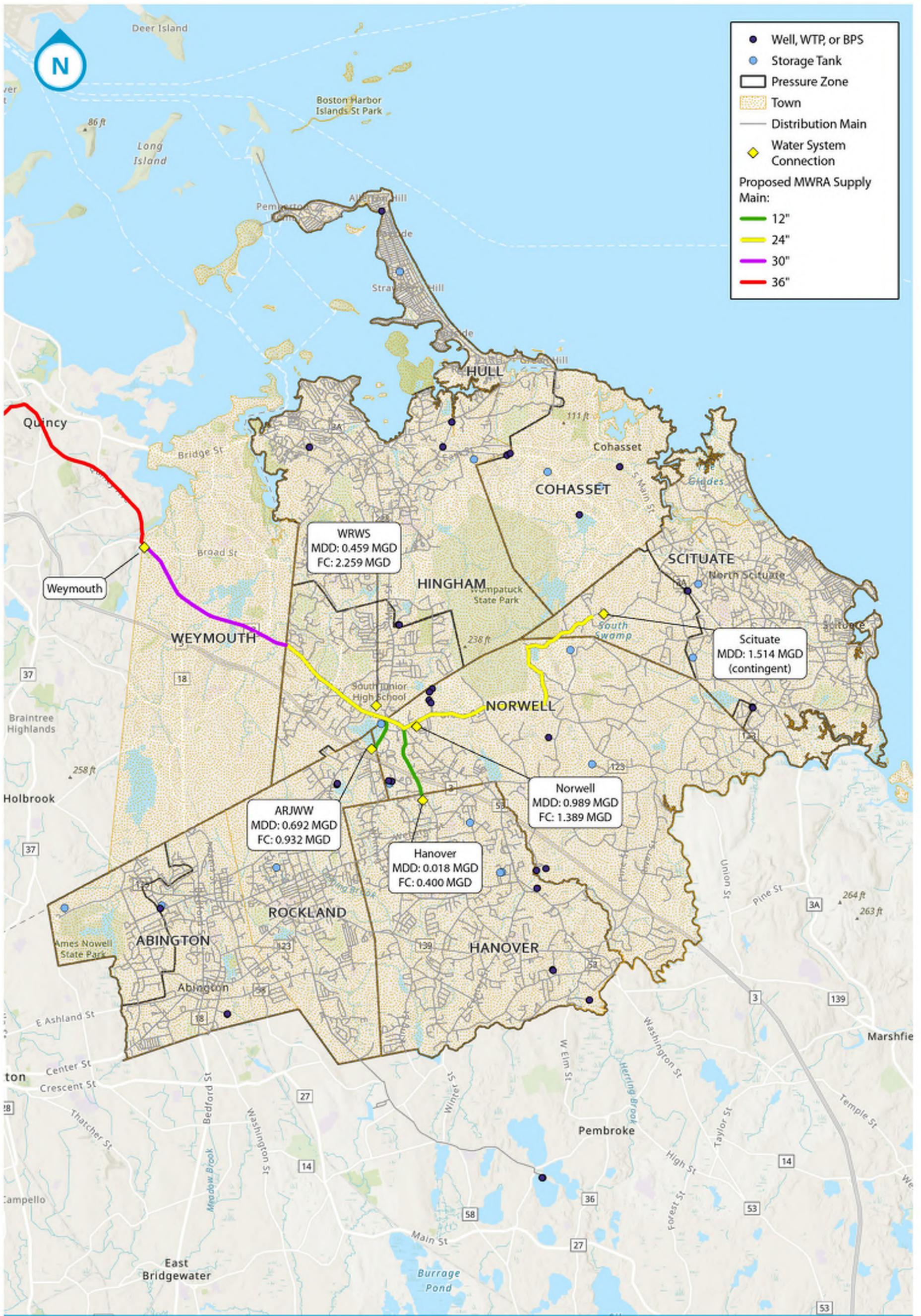




**Figure 2A**  
**Scenario 2- Baseline Communities**

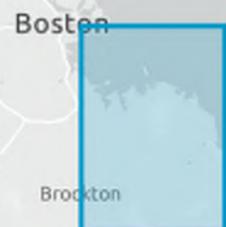
Hingham, MA  
 January 2025

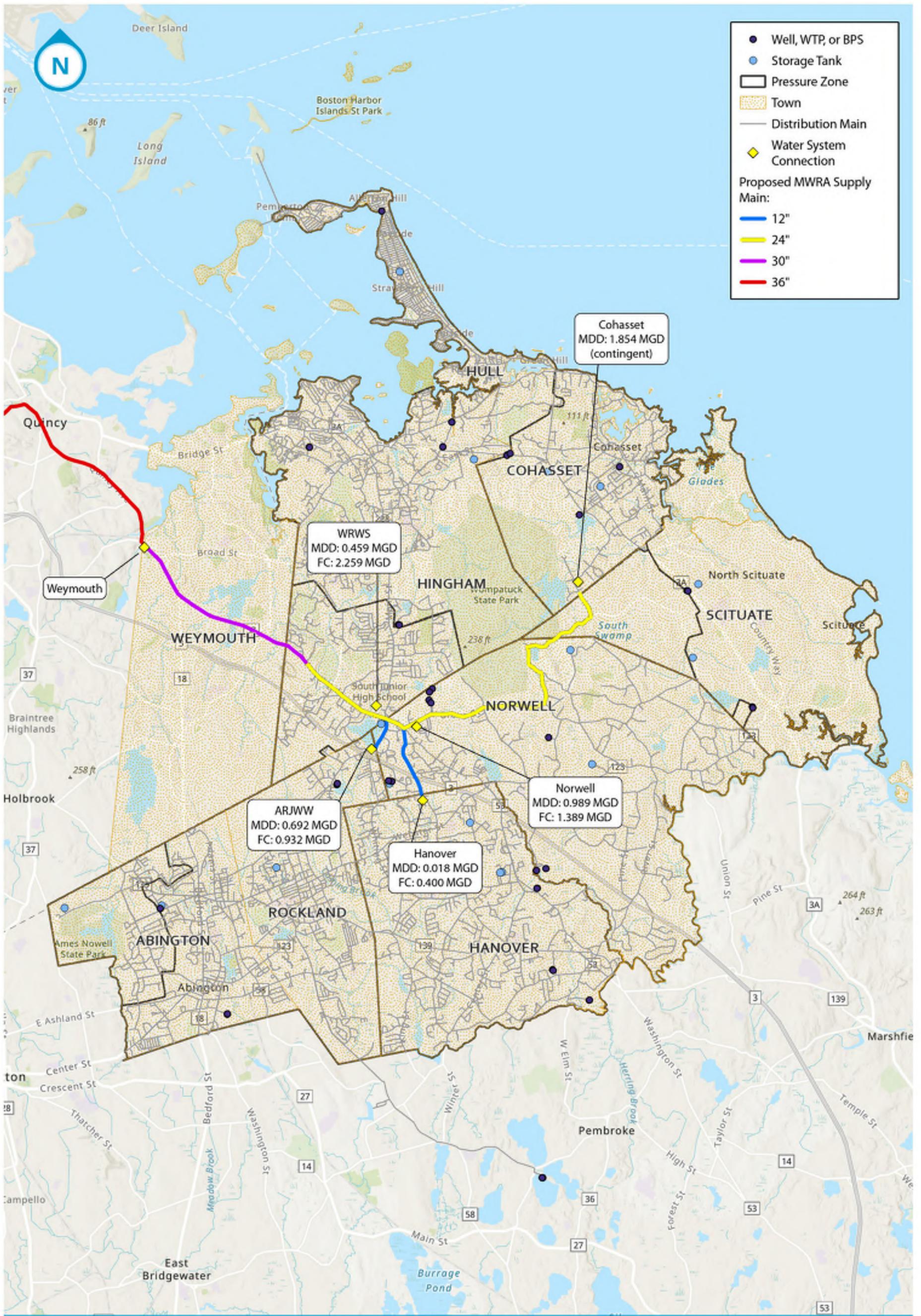




**Figure 2B**  
**Scenario 2- Baseline Communities & Scituate**

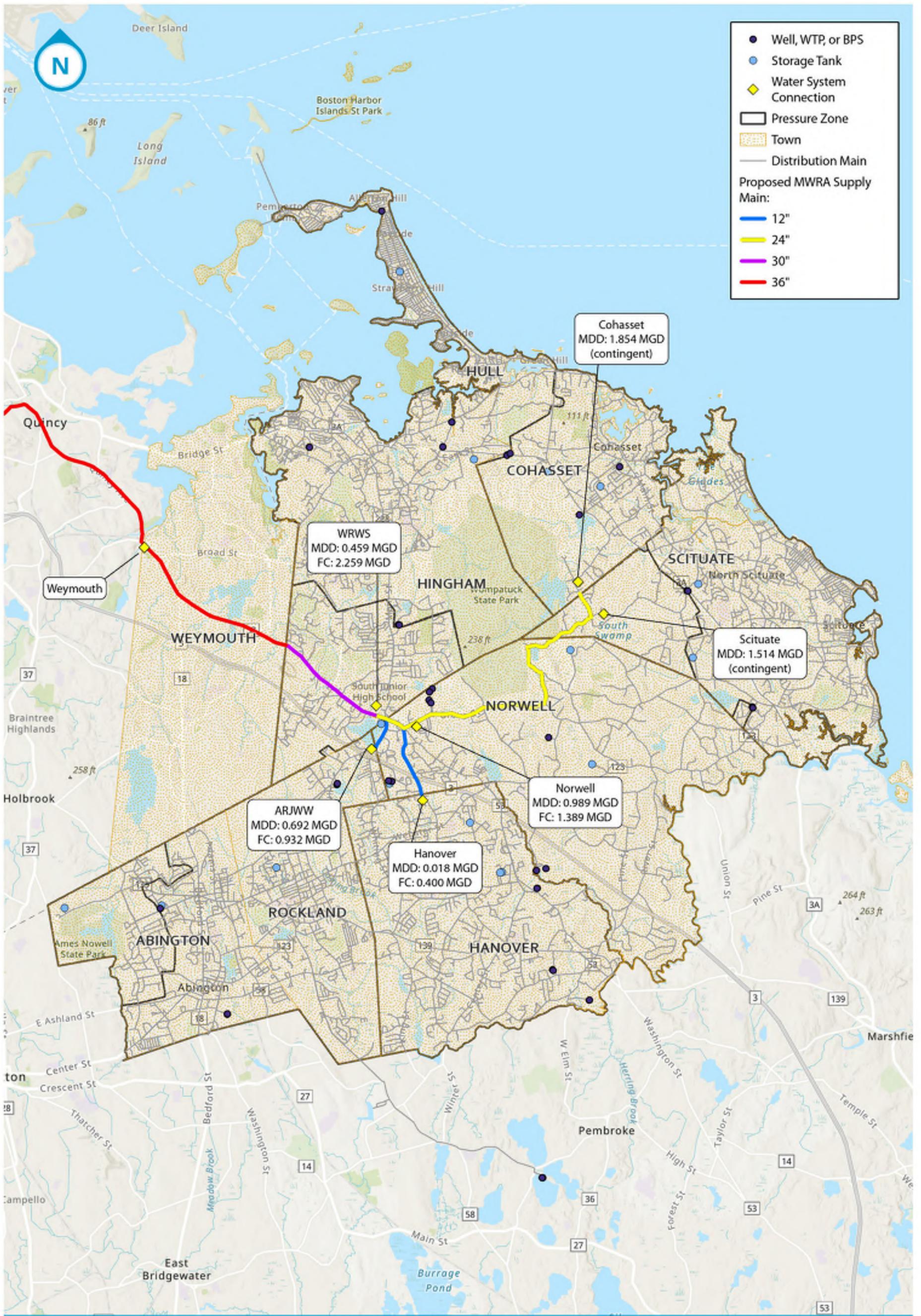
Hingham, MA  
 January 2025





**Figure 2C**  
**Scenario 2- Baseline Communities & Cohasset**  
 Hingham, MA  
 January 2025





**Figure 2D**  
**Scenario 2- Baseline Communities, Scituate & Cohasset**

Hingham, MA  
 January 2025

