



DRAFT FOR PUBLIC REVIEW
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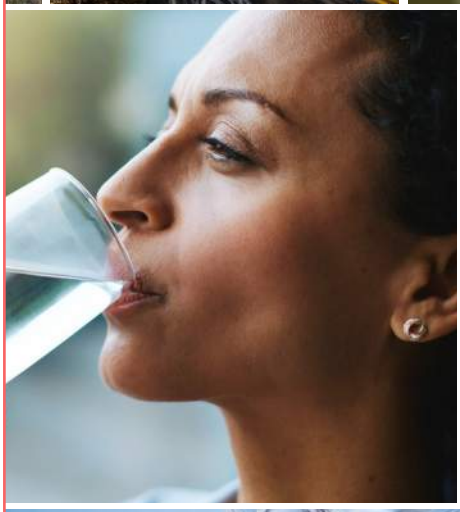
Please visit
www.oldcolonyplanning.org/waterplan
for public meeting dates and further information.


Regional Water Plan

REPORT 2025

In association with:

NARRAGANSETT BAY ESTUARY PROGRAM
EDA
Central Plymouth County Water District Commission
SOUTH SHORE CHAMBER OF COMMERCE

OLD COLONY PLANNING COUNCIL

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Acknowledgments

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Narragansett Bay Estuary Program and U.S. Environmental Protection Agency

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Foreword

Water sustains everything we value—our health, our homes, our environment, and the strength of our local economy. In the Old Colony region, reliable access to safe water is essential not only for daily life but also for the housing we build, the businesses we grow, and the industries we support. Yet, we face increasing pressure on this vital resource. Aging infrastructure, PFAS (per- and poly-fluoroalkyl substances, or "forever chemicals") contamination, climate variability, and ecological degradation are complex challenges—and no single municipality or organization can tackle them alone.

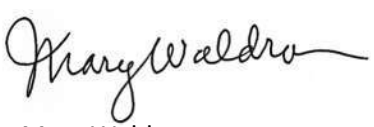
The Old Colony Regional Water Plan represents our collective response—a shared vision and action plan created by and for the region. Developed over more than a year of collaboration, it brings together the perspectives of 17 municipalities, the Herring Pond Wampanoag Tribe, watershed groups, water suppliers, private well owners, businesses, farmers, and residents. Input from these stakeholders, along with engineering analysis and public engagement, shaped a practical, forward-looking roadmap for water supply, efficiency, and environmental protection.

The plan outlines both immediate actions and long-term strategies. It addresses needs like PFAS treatment and new wells while preparing for future solutions, including desalinated water, MWRA connections, and coordination for droughts. It calls for more support for private well owners, improved ecosystem protections, and consistent public communication about water quality and conservation. It also recognizes the need for flexibility in the face of uncertainty by understanding vulnerabilities now and in the future, prioritizing adaptive management, regional coordination, and data-driven decision-making.

This plan reflects our region's readiness to act—together. With continued leadership, funding, and engagement, we can build a resilient, sustainable, and economically strong future for all who live and work here.

We also extend our appreciation to our staff. Joanne Zygmunt led this project with support from Bill Napolitano, Laurie Muncy, Don Sullivan, Megan Fournier, and Elise Prince. Their facilitation within OCPC and among our consultants at CDM Smith, the members of the Steering Committee, and the public fostered a transparent, collaborative environment for open and productive dialogue, which we hope will continue.

On behalf of the Old Colony Planning Council,



Mary Waldron
Executive Director

Rebecca Coletta
President

Executive Summary

ES.1 Why This Plan Matters

Water is essential for keeping our communities healthy, supporting local businesses and farms, and protecting our environment. However, throughout the Old Colony region, our water systems are under increasing pressure. Aging infrastructure, PFAS contamination, development pressures, climate variability, and stricter regulations make it more challenging to ensure safe, sustainable, and affordable water for everyone.

The Old Colony Regional Water Plan presents a regional strategy to confront these challenges directly. It offers a jointly developed roadmap—created by and for the region—to assist communities in protecting and managing water now and in the future.

The Steering Committee guiding this work agreed on six principles:

- Recommending sustainable water supply strategies that balance the social, environmental, and economic needs of the region.
- Aligning with values of good stewardship and wise use of water.
- Reflecting the limits of natural resources and current/anticipated regulations.
- Incorporating uncertainties so implementation of recommendations can adapt over time.
- Striving for fairness within and among communities.
- Producing a list of early-win projects that can be aligned with available outside funding.

ES.2 Listening to the Region

This plan was developed through over a year of collaboration with 17 cities and towns, tribal representatives, municipal water suppliers, environmental groups, regulators, businesses, farmers, and residents. It incorporates expert analysis, public input, and ideas from individuals who work with water every day.

This plan reflects more than just technical research—it reflects what we heard from the region. A Steering Committee with representatives from every community met monthly to shape the plan. In addition, we held:

- Interviews with city and town officials involved in decisions about water,
- Focus groups with private well owners, environmental advocates, and farmers; and,
- A public survey of households across the region.

These voices helped shape the plan's priorities and recommendations, as shown in **Figure ES-1**.

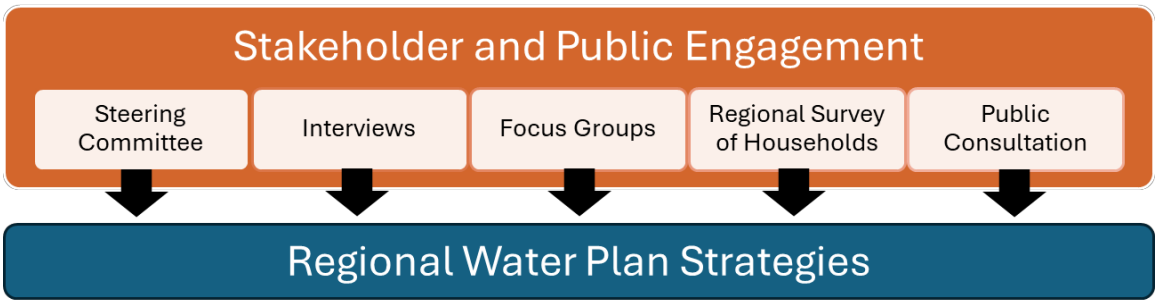


Figure ES-1: Summary Graphic of Stakeholder and Public Engagement

ES.3 What the Data Tells Us

Although the population is projected to increase in some communities while remaining stagnant or declining in others, water use per person is expected to decrease, primarily due to new regulations on the efficiency of water-using appliances. Therefore, while the region's population is anticipated to grow slightly, overall water demand will likely decrease. This finding, along with a hydrologic analysis showing that projected increases in precipitation will result in similar or higher low flows in the Jones River and Taunton River, respectively, suggests that there will likely be a sufficient water supply from a quantity perspective through 2050. **Figure ES-2** shows the municipal demand forecasts developed based on projections of population, climate, and water use efficiency.

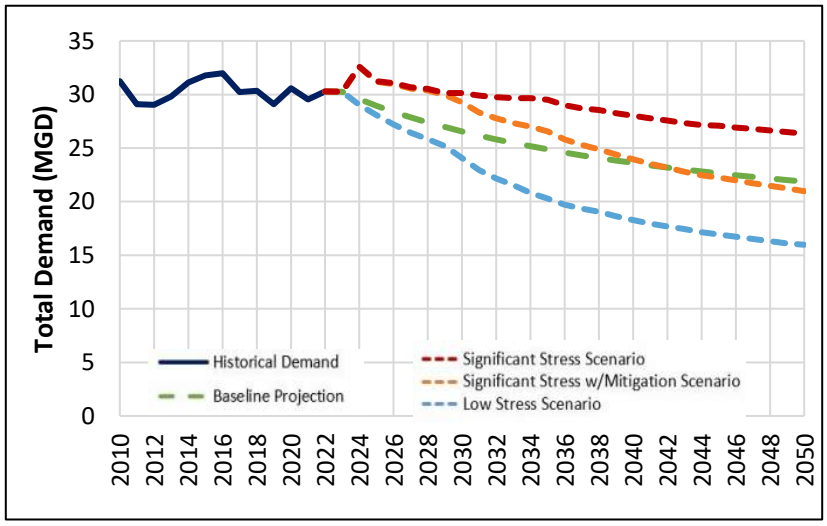


Figure ES-1: Historical and Projected Demand for Old Colony Planning Council Planning Area Under Various Future Scenarios
Note: MGD – million gallons per day

However, the demand projections do not consider water quality concerns, such as new water quality standards for per- and polyfluoroalkyl substances (PFAS), or ecological health concerns, such as reservoir management impacts on fish migration. The plan addresses these issues separately. Additional risks for water include aging infrastructure, uncertainties in permit renewals, and demand for new housing. While regional demand may decrease and naturally occurring flows may increase, these stressors on water resources highlight the need for strategies to ensure safe and plentiful water for the region now and in the future.

In short, we're likely to have enough water, but we still need a strong plan to protect it.

ES.4 What the Plan Recommends

The plan includes practical, flexible strategies that communities can pursue now and, in the future, (**Table ES-1**). These fall into five categories:

- New Water Supplies: Expanding wells, using desalinated water, connecting to the Massachusetts Water Resources Authority (MWRA), and sharing emergency supplies
- Water Efficiency: Upgrading aging systems, reducing waste, and reviewing rates
- Better Planning and Policy: Updating bylaws, coordinating drought responses, and improving data collection
- Healthy Ecosystems: Protecting streamflow, reconnecting rivers for fish, and planning development in balance with nature
- Public Education and Outreach: Increasing outreach about PFAS, helping well owners, and supporting water conservation

All recommended strategies are listed in **Table ES-1** and are not listed in order of priority.

Table ES-1: Consensus-Based Strategies for Implementation

Geographic Scale	Short-Term	Long-Term
Local	A. Support Public Health and Raise Awareness of Water Quality Among Private Well Owners B. Introduce Policies and Regulations to Reduce the Waste of Water and Improve Ecosystem Health C. Implement System-Wide Water and Energy Efficiency Strategies D. Install New Municipal Wells in the Short- Term E. Incorporate Municipal Level PFAS Treatment	P. Provide Access to Safe Water for Private Well Owners – Connections to Public Water Supply Q. Install New Municipal Wells R. Conduct Regular Rate Studies
Regional	F. Maximize Use of Desalinated Water Supply– Short-Term G. Improved Monitoring and Continued Education and Advocacy for Streamflow Protection and Drought Resiliency H. Improve Local Bylaws for Water Smart Land Use and Integrate into Planning Efforts I. Conduct an Integrated Ecological Assessment and Pursue Improvements J. Expand Water Education and Public Engagement Efforts K. Secure Redundant Water Supply for Agriculture L. Expand Support Agricultural Water Use Efficiency with Grants for Research and Implementation M. Coordinate Regionally on PFAS Management and Funding	S. Maximize Use of Desalinated Water Supply – Long-Term T. Create New Emergency Interconnections U. Connect OCPC Communities to MWRA through Weymouth V. Connect OCPC Communities to MWRA through Stoughton W. Collaborate Regionally on Communications X. Plan for Drought Regionally
State	N. Improve Water Loss Reporting O. Monitor and Update State Point-Of-Sale Requirements for Water-Using Fixtures	--

The plan encourages an adaptive approach so communities can adjust their strategies as conditions, funding, and technology change (**Figure ES-3**). With many municipalities considering significant investments in water infrastructure, there is a need to monitor and track trends in demand, climate, quality, and reliability of current supplies, as well as the status of larger regional projects as viable options. Implementing system-wide water efficiency strategies will be a critical aspect of adaptive management for communities, potentially enabling some to avoid large capital expenditures for additional water supplies in the long term through improved water efficiency.

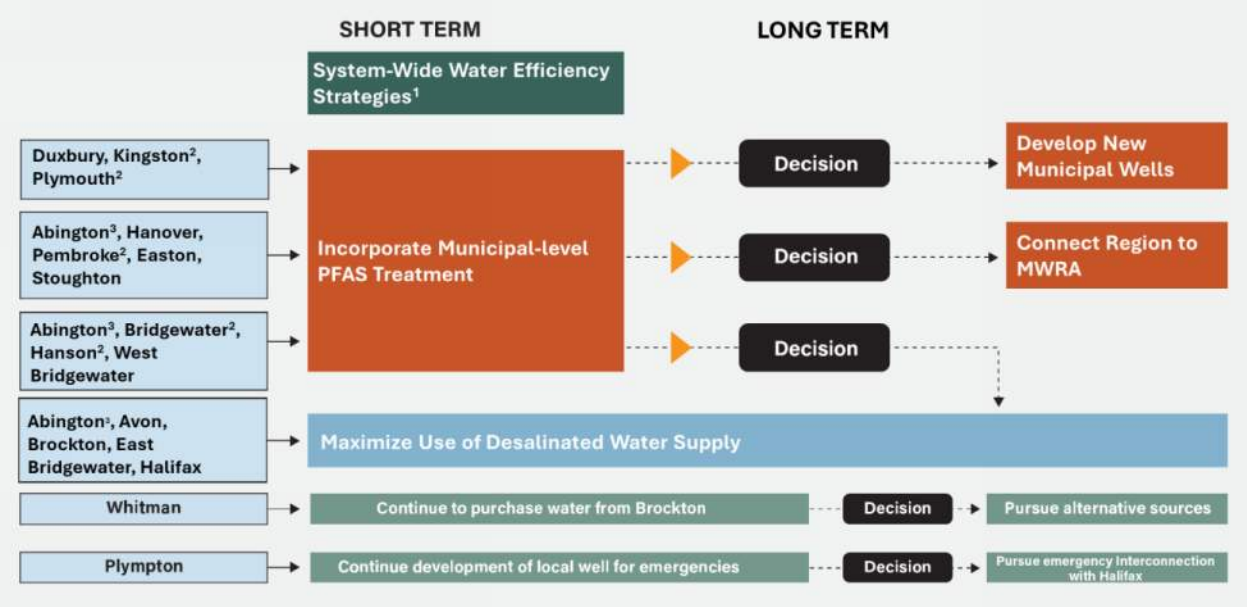


Figure ES-2: Regional Water Plan Adaptive Management Strategies for Municipal Water Suppliers

Notes:

[1] System-Wide Water Efficiency Strategies apply to all municipalities in the OCPC region with public distribution systems, which excludes only Plympton.

[2] Communities indicated are also already pursuing development of new municipal wells and will continue those efforts in the short term.

[3] Abington is included in three potential water adaptive management strategies: The town is interested in considering these potential strategies but will pick one as more details become available.

ES.5 What Happens Next

The plan outlines several next steps to move from planning to implementation:

- Establish a standing committee (Old Colony Regional Water Resources Committee) to drive implementation forward.
- Continue regulatory discussions and consultation of municipalities with regulators as they plan or consider new or alternate supplies.
- Pursue funding for near-term needs with support from Old Colony Planning Council.
- Pursue opportunities for regional demand management.
- Explore the feasibility of a tracking system for adaptive management.
- Inform private well owners about water quality risks and opportunities for testing and treatment of their wells.

This plan is not the end; it serves as a foundation for long-term collaboration. With leadership, funding, and continued partnership, the Old Colony region is prepared to create a water future that is safe, sustainable, and affordable for everyone.

Jones River Estuary at low tide running to Cape Cod Bay

Section 1.0

1.0 Planning for the Future

1.1 A Regional Collaboration

The Old Colony region encompasses 17 diverse municipalities in southeastern Massachusetts (**Figure 1-1**). Brockton, the region's largest city and commercial/industrial hub, has a population of over 100,000. Plympton, the smallest and most rural town, has about 3,000 residents. While many of the towns share water resources, they are regulated individually, with water withdrawal permits or registrations issued for individual towns. Part of the motivation for this plan was to determine if there are regional efficiencies to be realized in water management, as well as opportunities to improve the regional ecosystem, which is not delineated by town boundaries.

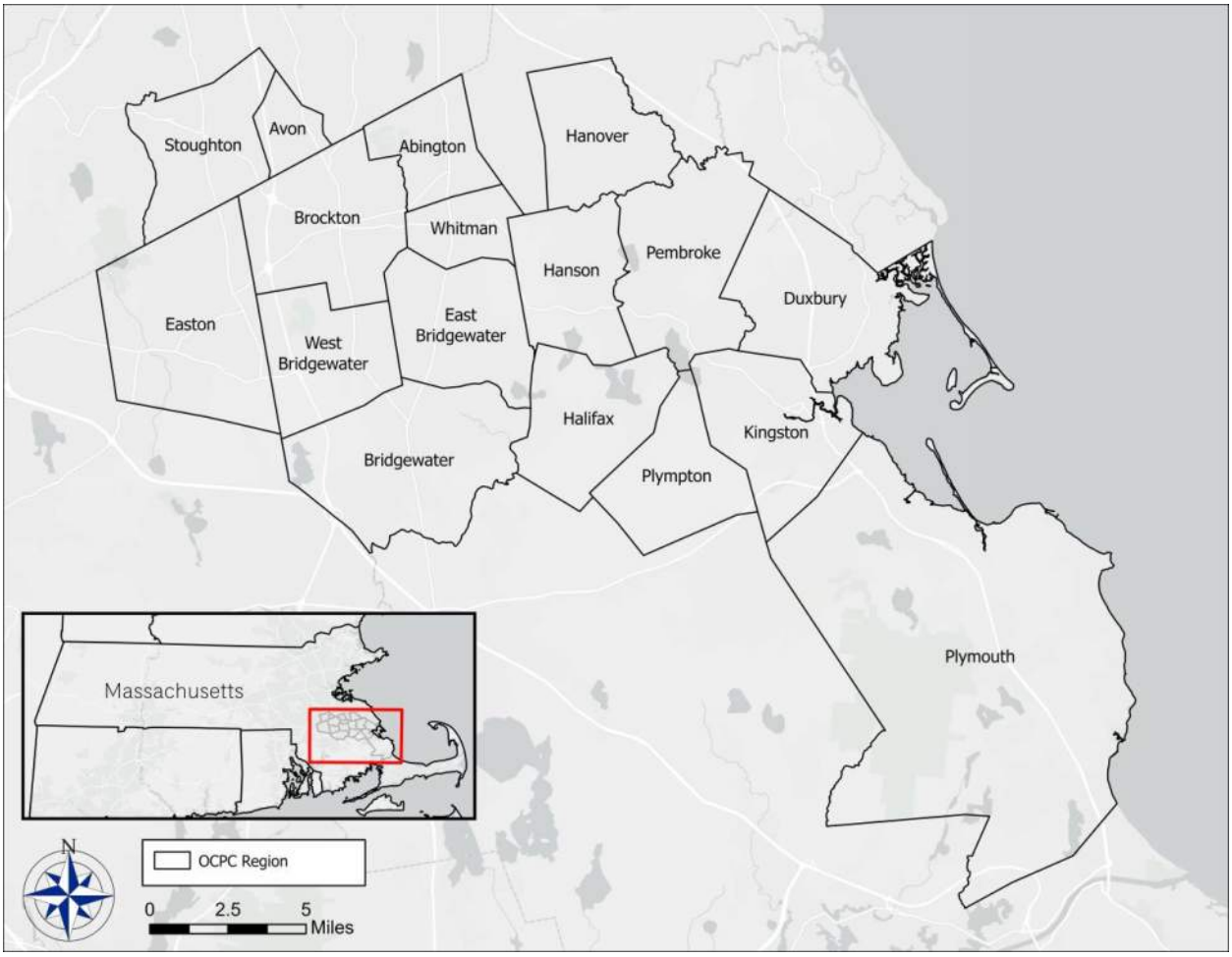


Figure 1-1: Old Colony Region

While much of the northeastern United States has long been considered water-rich, regulatory changes, water quality, environmental impacts, development, and climate pressures have compounded to threaten the long-term viability of water supplies. Aquatic ecosystems are at risk as water quality deteriorates and fish migration is impeded. The Old Colony region is no exception. Across all 17

communities, concern has been increasing about drinking water quality, water availability for housing and economic development, and the impacts of the water supplies on ecosystems.

In response to these concerns, Old Colony Planning Council launched a multi-year regional planning effort to help communities support continued access to safe, plentiful, affordable, and ecologically sustainable water supplies. An unprecedented partnership was formed among the following:

- All 17 municipalities in the region
- Central Plymouth County Water District Commission
- Metro South, Plymouth Area, and South Shore Chambers of Commerce; Plymouth Economic Development Foundation; and Cape Cod Cranberry Growers Association
- The Jones River, North and South Rivers, and Taunton River Watershed Associations; Watershed Action Alliance of Southeastern Massachusetts; and Narragansett Bay Estuary Program

Beginning in 2022, with the support of these partners and state legislators in the region, Old Colony Planning Council raised nearly $1 million to develop a Regional Water Plan. The U.S. Economic Development Administration invested $470,000 in the initiative, and additional contributions were made by the Central Plymouth County Water District Commission, state appropriation, South Shore Chamber of Commerce/South Shore Economic Development Corporation, and the Narragansett Bay Estuary Program.

1.2 Responding to Stressors

This Regional Water Plan responds to historical stressors on the region's water resources as well as foreseen future stressors currently emerging and with uncertain long-term impacts. Among the historical stressors, the following stand out as contributing drivers behind this plan:

- **Population changes:** The region’s population has increased by approximately 10% since 2010. Between 2020 and 2035, the population served by public water supply is expected to increase by 6.1%. From 2035 to 2050, the population is expected to decline by 1.1% (UMass Donahue Institute 2023).
- **Strained ecosystems:** Natural flows and fish migration pathways have been impeded due to the management of lakes and reservoirs for water supply and a lack of water passage downstream, which sometimes results.
- **Water quality degradation:** Nutrients originating from lawn fertilizers, septic systems, and other land-based sources have become an increasing concern in surface waters. These nutrients have caused harmful algal blooms, which can degrade aquatic habitats.

- **Uncertainty in water availability:** It is very difficult to distinguish between groundwater and surface runoff in streams in this region. Because of this, standard equations for estimating surface flows cannot be applied according to Massachusetts Department of Environmental Protection's (MassDEP's) 1996 guide on safe yield analysis (MassDEP, 1996). While this document has been replaced by other Water Management Act (WMA) revisions, it has always provided helpful context about the hydrologic uniqueness of this specific geographic region. Consequently, it has been difficult to predict natural water availability, safe yield, and overall long-term reliability of water supply sources.

Among the future stressors, the following stand out as contributing drivers behind this plan:

- **Climate variability:** Climate trends are expected to vary significantly by region throughout the United States. The consensus among predictive models is that the northeast will experience more yearly rainfall as the 21st century progresses. Rainfall will be redistributed into more highly concentrated storms. Droughts can significantly strain smaller water suppliers and ecosystems that depend on consistent water flows to maintain their natural functions.
- **Water Quality:** Per- and polyfluoroalkyl substances (PFAS), commonly called "forever chemicals," have been found in public and private water supplies above current regulatory thresholds for safe drinking water. Due to their extreme durability, these compounds migrate through water pathways above and below ground and are likely to contaminate more supplies. Many communities in this study area have begun installing expensive treatment systems for PFAS removal, but concerns remain over contaminants that have yet to emerge.
- **Future development:** While population projections help predict water demand, the implications of recent state and local changes seeking to encourage housing development are unclear and will likely vary by community. Many municipalities in the region are preemptively planning for higher-than-projected population growth. Concerns remain over increasing pressure on resources and the communities and ecosystems they serve.

1.3 Planning Goals

This plan aims to address these stressors and identify management strategies to help mitigate potential impacts. It was formulated with several goals that emerged through the planning process:

- Identify where regional collaboration can provide safe, reliable, cost-effective drinking water more confidently than individual municipal plans.
- Identify opportunities for stakeholder collaboration on shared water stewardship to improve public and ecological health.
- Review and assess ongoing or planned regional water projects against available options to help ensure the most suitable approaches are chosen and develop a framework for evaluating future adaptations of these projects.
- Develop roadmaps for each municipality and regional partnerships to advance initiatives, seek funding for priority regional water investments, and adapt to future conditions as they develop.

- Serve as a model for regional water planning in Massachusetts by including regulatory agencies in the regional stakeholder process to learn about stakeholder drivers and constraints, and to help explain regulatory processes and potential hurdles. A potential outcome of this project is that it becomes an example for more effective and collaborative regional water planning.

The region's municipalities rely on shared groundwater and surface water resources. They are generally regulated individually and plan and operate their resources and infrastructure accordingly. From the outset, this plan was not intended to supplant local water planning efforts with regional mandates. Instead, the aim is to augment local efforts and focus this work on issues that may benefit from regional collaboration. The roadmaps included later in this plan demonstrate how these efforts can be blended effectively.

1.4 How to Use This Plan

This plan recommends actions to enhance and protect water resources in the region. It serves as consensus-based guidance for coordinated water management investments, policies, and partnerships and as a roadmap for municipalities adapting to changing conditions. The Regional Water Plan is intended to be used regularly:

- **Old Colony Planning Council** will use this plan to inform its communication, planning, coordination, advocacy, and technical services in the region. OCPC will continue to build capacity and nurture partnerships in the region to initiate projects that support plan implementation. OCPC will also continue to advocate for investments in the region.
- **Municipalities in the region** may use this plan as an adaptive roadmap that lays out short- and long-term water management decisions both individually and collectively. The plan may be used to support local decision-making and facilitate regional partnerships, and to inform development of grant applications and projects.
- **State regulators, policymakers, and legislators** may use this plan to inform decision-making as they work with communities and water suppliers to regulate water supply and distribution system planning, design, and operation for the next 25 years.
- **Environmental organizations** may use this plan to identify opportunities for collaboration to improve ecological health in the region.
- **Chambers of commerce and the wider business community** may use this plan to advocate for investments in the region.
- **Residents in the region** may use this plan to improve their understanding of how water is governed and provided in their communities, and the challenges associated with such a complex and expensive system. The plan may be used to advocate for local and regional solutions. They may also learn about private well concerns and opportunities.
- **Other Regional Planning Agencies** may use this plan as inspiration for planning initiatives in their region and may choose to use the framework presented here.

- **The Standing Water Resources Committee**, which will be a continuation in some form of the steering committee, may use this plan to help guide implementation, adaptation, and data tracking for local and regional decisions around water.

This Regional Water Plan serves not only as a guide for investment, water resource management, and collaboration but also as a purposeful reminder that the communities of the Old Colony region share natural resources and must work together to ensure safe, reliable, and abundant water for both public and ecological health, wherever and whenever it is needed.

Mouth of Jones River at near full tide looking North from Kingston to Duxbury

Section 2.0

2.0 Regional Context

2.1 Water-related Concerns in the Region

Throughout the planning process, stakeholders raised many concerns about water in the region. These views were expressed through different avenues in stakeholder and public engagement activities including Steering Committee meetings, interviews, and focus groups. Further details of these activities are described in **Section 4.0**. **Table 2-1** summarizes some of the concerns heard most frequently. Individuals within these stakeholder groups may have opinions that differ from the themes listed here.

Table 2-1: Stakeholders' Concerns about Water

Stakeholder Group	Concerns Raised
Municipalities	Except for Plympton, whose residents rely on their own wells for water, municipalities in the region are responsible for providing safe drinking water to residents and other users in their communities. It is largely their responsibility to plan for long-term water supply. Concerns raised include **significant uncertainty about future demand** linked to population growth and the development of housing, changes to **drinking water quality standards**, and the **lack of sufficient funding** to make necessary infrastructure investments. Further concerns at the municipal level are detailed in **Appendix A**.
Residents with Municipal Water Supply	Residents on municipal water supply were most concerned about **water quality** and **aging water infrastructure.**
Residents with Private Wells	Residents relying on their own private wells were concerned about **water being used efficiently**, impacts on **water availability** during times of low precipitation, and **safe water quality** (especially concerned about PFAS and other emerging contaminants).
Business Community	For this group, there is concern about **water availability** to support existing businesses as well as **business development**. There is also concern about **affordability** and impacts to revenue from increased expense.
Herring Pond Wampanoag Tribe	For this indigenous group, water is life, alive and like a family member. There is no life without water. The Wampanoag people have been fishing for thousands of years for food, trade, art, and fertilizer. Concerns were expressed about **impediments to natural water flow** negatively impacting fisheries, **deteriorating water quality**, and **vanishing access to surface waters** due to privatization of land, and **damaging land uses** such as gravel and sand mining.
Watershed Associations and Environmental Organizations	This group viewed sufficient water quantity and good water quality as not only critical for public health but also for supporting ecosystem health, which we all rely on. Concerns centered around **impediments to natural water flow** in the region negatively impacting fisheries and water quality as well as **excessive withdrawals** being allowed by the state. Concerns were heard about **excessive nutrients and pollutants** entering waters from sources such as septic systems, stormwater runoff, and overuse of fertilizers and pesticides, resulting in harmful algal blooms in surface waters and impacting ecosystem and public health.
Agricultural Users	Agricultural operations in the region rely on surface water diversions, private wells, and municipal water supply. This industry is most concerned about a**ccess to water during droughts** and **water quality impacts to food safety** following PFAS regulation.

"Our ecosystem is in deep trouble with contaminants and loss of flow damaging the natural habitats and the species that once thrived in them. We must focus on recovering these resources before they are lost forever. People and our lifestyle have habituated to wasting the quality and diversity of the world around us. We need a reset. Less irrigation of unnatural landscapes, stop washing vehicles and other property with drinking water, stop flushing with wild abandon. We need to reign in our waste, use less, care more, and understand the interrelationships of life on earth if we are to have a future." – Jones River Watershed Association

"This regional water plan is a thoughtful look at our short and long-term challenges and solutions." – Steering Committee Member

"Culturally for the Herring Pond Wampanoag Tribe, our new year is based around the river herring. Spring is the start of the year when all life begins, as the river herring spawn. When I was a girl, the river used to run black with river herring." – Herring Pond Wampanoag Tribe chairwoman

2.1.1 Water Supply Availability

The region's stakeholders have consistently expressed concerns about the availability of water supply, both now and in the future, for various and often competing purposes. As part of the development of this Regional Water Plan, future availability of water supply in the region was examined as well as projected demand. Results, presented in detail in **Section 3.0**, suggest that groundwater levels will remain relatively stable over time, flows in the Taunton River will increase, and flows in the Jones River will likely continue to experience low periods. Public demand for water is expected to decrease as plumbing fixtures and fittings and appliances become more water efficient. Throughout the process of developing this plan, drought has been a concern for stakeholders.

2.1.1.1 Water Supply Availability for Municipal Water Suppliers

The state regulates how much water municipalities and other large users can take from the natural environment. MassDEP, through the Water Management Act (WMA), regulates water use for users that exceed an annual average of 100,000 gallons per day or 9 million gallons in any three-month period. The WMA was established to ensure adequate water supplies for current and future water needs.

Before January 4, 1988, large water users could register their water withdrawals based on their water use between 1981 and 1985. The registration program established the renewable right of previously existing water withdrawals for these users. After 1988, the permit program began, which regulates users who plan to withdraw water from ground or surface sources exceeding an annual average of 100,000 gallons per day or 9 million gallons in any 3-month period. These users, if not previously registered, must apply for a WMA permit. Water users that have a registration do not need a permit unless their withdrawals exceed their registered volumes, or they add new withdrawal points to their system. For new public water supply sources, both WMA permits, and new source approval are

required. Any new withdrawals or increased volumes from existing sources exceeding 100,000 gallons per day require a review under the WMA.

Amounts permitted are based on what the state's science-based data and modelling tools suggest for "Safe Yield." Safe yield, defined in 310 CMR 36.00 (Massachusetts Water Resources Management Program) is "the maximum dependable withdrawals that can be made continuously from a water source including ground or surface water during a period of years in which the probable driest period or period of greatest water deficiency is likely to occur; provided, however, that such dependability is relative and is a function of storage and drought probability." A challenge for this region is that Safe Yield is difficult to ascertain due to the complex relationships between ground and surface waters in this part of the state. Details related to permitted amounts and other system specifics for water suppliers are in **Appendix A**.

Water suppliers in the region were most concerned about their ability to meet demand, primarily due to new drinking water quality standards, infrastructure constraints, during periods of drought, and uncertainty about the amount of future housing development. Recent state efforts to increase housing availability have created more uncertainty about future water needs in the region.

In general, an increase in housing supply does not directly translate to an increase in population. It usually indicates a potential for population growth by providing more space for people to live, but the actual population increase depends on factors like migration and birth rates, not just the availability of housing alone. Some municipalities in the region are expected to grow in population, while others will remain stable or reduce (**Figure 2-1**). The relationship between housing availability, population growth, and water demand is complex and uncertain. Most public water suppliers, therefore, are conservatively planning for greater water demand. Analysis presented in **Section 3.1** looks at different scenarios for water demand, two of which account for potential increases in population greater than those projected that could be related to housing development.

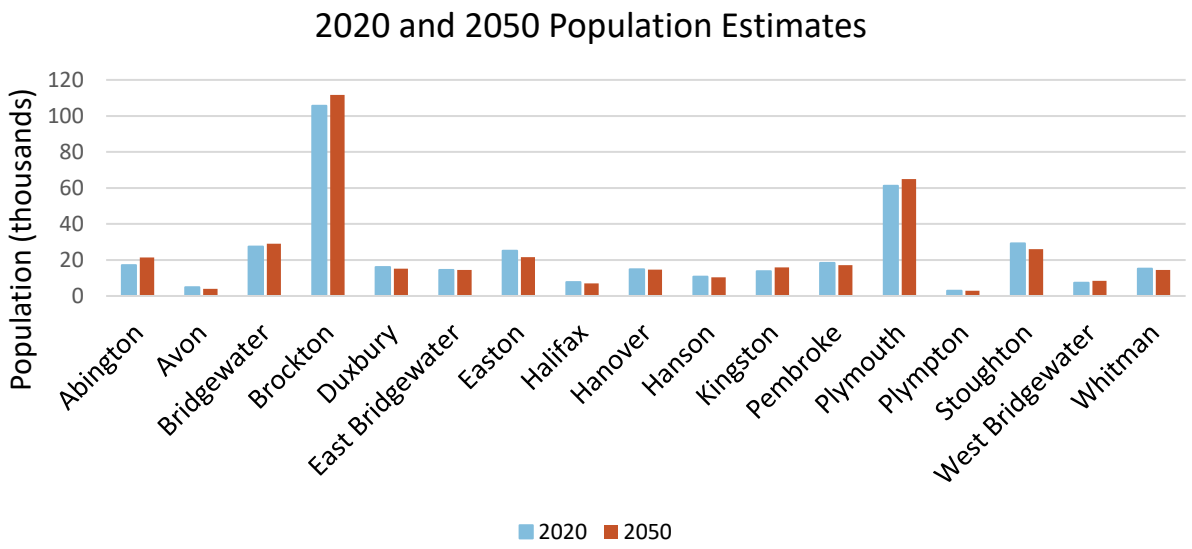


Figure 2-1: Population Estimates for 2020 and 2050
Sources: U.S. Census Bureau 2020; UMass Donahue Institute 2022.
Note: The 2020 population estimates are based on data from the 2020 census and 2050 data from UMass Donahue Institute V2022 analysis.

2.1.1.2 Water Availability for Private Well Owners

There were concerns among private well owners related to uncertainty over decreasing private well depths in the future. Analysis presented in **Section 3.4**. indicates that historically, groundwater levels do not show a decline. Additionally, future groundwater levels are not anticipated to decrease. Another concern held by private well owners was concern that their private wells would be impacted by the installation new wells for public water supplies in the future. It should be noted that when public water suppliers install new groundwater wells, impact assessments are required which would assess and adjust plans if there were impacts to nearby private wells. Other private well owners were concerned about the lack of water conservation required for their water sources. For example, their neighbors on public water supply were subject to outdoor water use restrictions when they were not. Private well owners also expressed concern about future impacted water availability during periods of droughts.

2.1.1.3 Water Availability for Ecosystem Health

Another concern among some stakeholders is adequate water availability for ecosystem function. Some stakeholders in the region question whether the state's permits allow too much withdrawal, and some are concerned about outdated WMA registrations that may no longer be sustainable. Stakeholders point to insufficient flow provided to the Jones River and to decreasing pond depths in Plymouth, both influenced by municipal water supply operations. In some areas of the region there appears to be a need to rebalance withdrawals (both the amount as well as the timing of withdrawals) with how much water remains available to sustain streamflow and surface water levels and support ecosystem health.

While MassDEP and the WMA aim to ensure adequate water supplies for current and future water needs, some stakeholders feel that the act does not do enough to protect water resources. Massachusetts Rivers Alliance, alongside other state environmental organizations and regional watershed associations, have been advocating for further regulations from MassDEP to protect water

resources. In October 2024, the U.S. Environmental Protection Agency (EPA) issued a letter to MassDEP recommending reworking the WMA due to concerns raised by the Ipswich River Watershed Alliance and the Parker Clean Water Association. In this letter, on Page 2, the EPA suggested that "discussions to improve the operation of the water withdrawal program could focus on: (1) use of annualized Q90 streamflows and flow data that do not recognize within-year variability of flows for setting Safe Yields; (2) use of river body-wide data rather than segment-specific data; and (3) use of Biological Category 4 and 5 safe yield criteria (McGuire 2024). The amount of water that should be retained during different times of year to support ecosystem health, as well as the regulation in place, presents additional uncertainty in planning for future water supply.

A challenge with the WMA is that many water providers feel, conversely, that its current restrictions have made it more difficult to provide reliable supply. This implies that in many places, the total available water is marginal or insufficient to meet all needs, and that plans like this can augment the WMA by working to find effective and agreeable balances for all water needs

2.1.1.4 Water Availability for Agriculture

Stakeholders representing agricultural interests expressed the continued need for coordination around agricultural access to water, especially during times of drought. There are more than 13,000 acres of commercial cranberry bogs in the state, primarily in Plymouth, Bristol, and Barnstable counties. Cranberry production is a water-intensive and water-dependent industry, estimated across the state to need 41.3 to 44.9 billion gallons of water per year (Massachusetts Cranberries, 2024).

2.1.2 Water Quality

Surface water quality and groundwater quality was seen as important for residents and other stakeholders, both from a recreational point of view as well as ecosystem health. Stakeholders all agreed that drinking water quality was important, including residents that use municipal water supply and those with private wells. Stakeholders representing agricultural interests also expressed concern about water quality in relation to the safety of foods being produced.

2.1.2.1 Surface Water Quality

Surface water quality is important because it directly affects the health of ecosystems, public health, and water supplies. Clean surface water supports safe drinking water, aquatic life, and recreational and agricultural needs. Poor water quality in a surface water used as a water supply can lead to contamination, increased treatment costs, and harm to both public and ecosystem health, making its protection vital for sustainable resource management and community well-being. Stakeholders highlighted these concerns. Figure 2-2 shows an example of a harmful algal bloom in Monponsett Pond.

MassDEP's collects scientific data from lakes, rivers, and estuaries across Massachusetts to monitor surface water quality in support of multiple water quality management objectives. When a water body is found to be impaired, the federal Clean Water Act requires Total Maximum Daily Loads (TMDLs) to be developed. A TMDL is a calculation of the maximum amount of a pollutant that a water body can take in and still meet standards for healthy systems. Once a TMDL is developed, there are often legal requirements for those responsible for pollutant discharge to address the issue. TMDLs have been

developed for pathogens in the South Coastal and Taunton River watersheds and for phosphorous in the West and East Monponsett Pond System.

Figure 2-2: Photograph of Algal Bloom in Monponsett Pond, Summer 2024

Within the Old Colony region, there are dozens of impaired waters. MassDEP categorizes waterbodies into five categories, summarized in **Table 2-2**. Categories 4 and 5 indicate potential issues that could impact the designated uses, whether that be drinking water or recreational uses. The only surface body of water that has a TMDL that is a direct water supply source for OCPC communities is Silver Lake.

Table 2-2: MassDEP Categorization of Waterbodies Water Quality

Category	Definition
1	Waters attaining all designated uses
2	Attaining some uses; other uses not assessed
3	No uses assessed
4a	All TMDLs are completed
4b	Impairment controlled by alternative pollution control requirements
4c	Impairment not caused by a pollutant – TMDL not required
5	Waters requiring one or more TMDL(s)
5a	303(d)-listed waters for which alternative restoration plans have been completed

Source: MassDEP 2023

Figure 2-3 and **Table 2-3** provide details for Category 5 waters within the Old Colony region. Another resource for viewing impaired surface water quality is a MassDEP's Water Quality Data Viewer.[1]

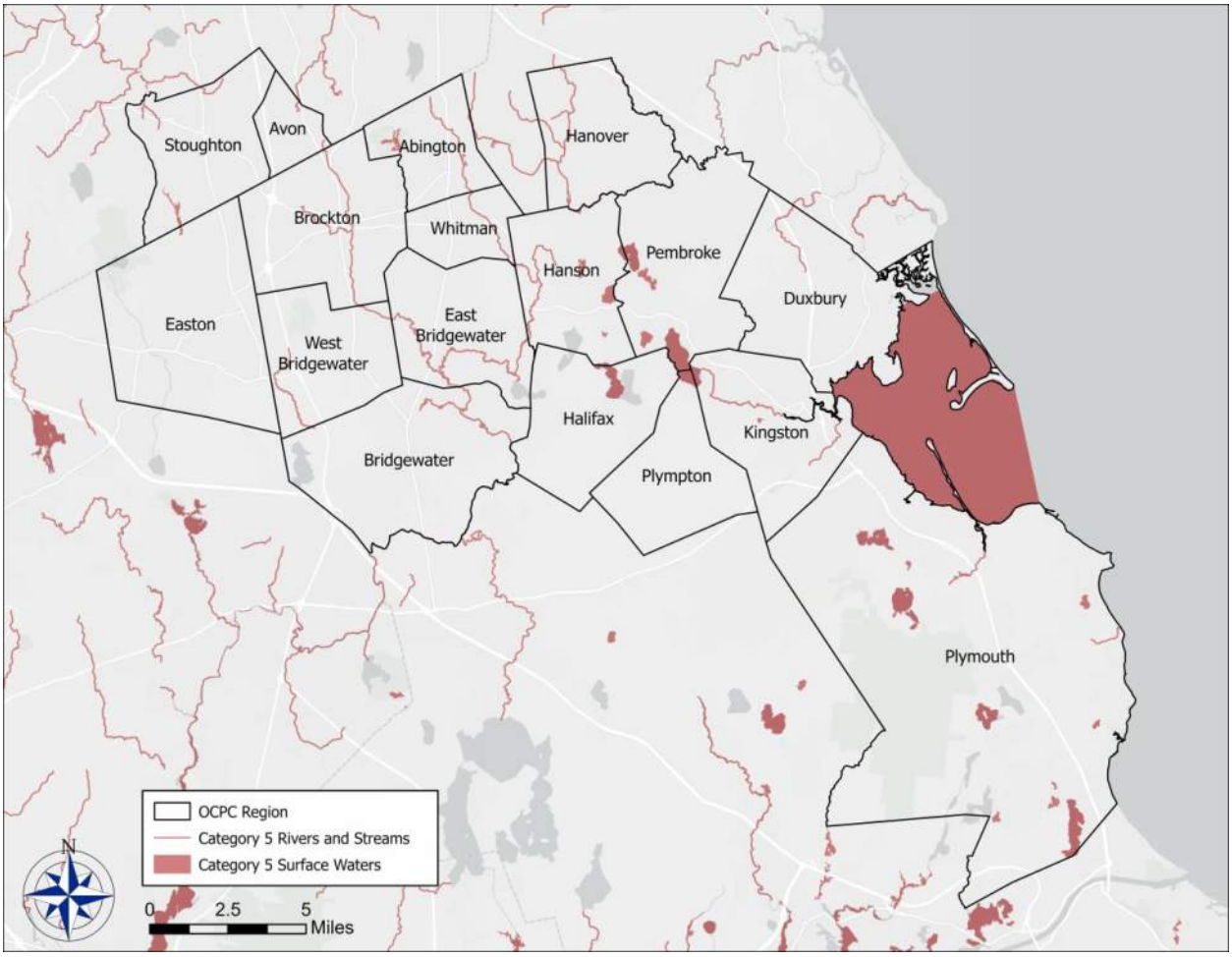


Figure 2-3: Category 5 Impaired Waterbodies in the Old Colony Planning Council Region
Source: MassDEP 2023

[1] https://arcgisserver.digital.mass.gov/MassDEPWaterQuality/Home/Index

Table 2-3: List of Impaired Waterbodies in the Old Colony Planning Council Region

Watershed	Impaired Waterbodies	
South Coastal Basin	Aaron River Billington Sea Boot Pond Bound Brook Cooks Pond Crossman Pond Cushing Brook Drinkwater River Duxbury Bay Eel River Factory Pond French Stream Fresh Pond Furnace Pond Great Herring Pond Great South Pond Indian Brook	Indian Head Pond Indian Head River Island Pond Jones River Longwater Brook Oldham Pond Plymouth Bay Plymouth Harbor Russell Millpond Savery Pond Silver Lake Smelt Brook South River Third Herring Brook Triangle Pond Wampatuck Pond
Taunton River	Ames Long Pond Cleveland Pond Hockomock River Island Grove Pond Matfield River Monponsett Pond (West Basin) Poor Meadow Brook Reservoir (White Oak Reservoir) Salisbury Brook	Salisbury Plain River Satucket River Shumatuscacant River Stetson Pond Taunton River Town River Trout Brook Three Mile River

2.1.2.2 Groundwater Water Quality

Groundwater quality is another concern for stakeholders in the region. Many communities solely depend on groundwater for their drinking water supply, so concerns listed in **Section 2.1.2.3**. carry for groundwater, such as the presence of PFAS, iron, and manganese. These water quality concerns can lead to increases in the cost of treating groundwater for drinking water. Other concerns for groundwater quality include impacts from untreated stormwater infiltrating, as well as impacts from sand mining. Sand mining is discussed in more detail in **Section 2.1.5**.

2.1.2.3 Drinking Water Quality

Public water suppliers are legally required to meet drinking water regulations set by the U.S. Environmental Protection Agency (EPA). MassDEP also has the Drinking Water List of Standards and Guidelines specific to Massachusetts. The EPA regulations set federal legal limits for over 90 contaminants in drinking water, referred to as Maximum Contaminant Levels. MassDEP's Massachusetts Maximum Contaminant Levels (MMCLs) listed in the drinking water regulations consist of EPA MCLs which have become effective, as well as a few additional MCLs set specifically by MassDEP. A new regulation that is important to the development of this plan is the EPA's announcement in April 2024, of additional regulation for per- and polyfluoroalkyl substances (PFAS). PFAS are defined as a group of man-made "forever chemicals" that have at least one fully fluorinated atom. These chemicals do not

break down in the environment and have the potential for adverse health and environmental effects. The EPA's regulation for PFAS establishes legally enforceable levels for six PFAS in drinking water (EPA, 2024). Public water suppliers have until 2029 to implement solutions that reduce PFAS, if monitoring shows that drinking water levels exceed the allowed amounts. This PFAS regulation impacts most water suppliers in the region, requiring the installation of additional treatment capabilities to existing water supplies. With the high costs associated with additional treatment, as well as the short time allowed for compliance, PFAS-related considerations have been a major part of discussions throughout the planning process for this regional plan. Strategies aimed at supporting public water supplied to adapt to PFAS regulations are discussed more in **Section 6.0**.

Another drinking water quality concern for the region is iron and manganese. Much of the groundwater in the region has high levels of both metals. Iron and manganese are included in EPA's National Secondary Drinking Water Regulations. Secondary standards are guidelines developed to support public water suppliers in managing drinking water for cosmetic and aesthetic considerations such as tooth discoloration, taste, color, and odor. EPA recommends secondary standards but does not require compliance. States may choose to adopt them as enforceable standards, but Massachusetts has not. Iron and manganese are included as secondary standards because the EPA does not consider the metals to present a risk to public health, but they do impact the aesthetics of drinking water quality. Public water suppliers can install additional treatment such as ion exchange, and oxidation and filtration to remove iron and manganese. Private well users can also install additional treatment at home to remove iron and manganese.

While these legally enforceable drinking water regulations only apply to public water suppliers, drinking water quality is also a concern for private well users, and some municipalities in Massachusetts are passing bylaws to enforce these standards at the point of a home sale or expansion. MassDEP provides resources for private well users interested in testing their well's water quality.[2] MassDEP also provides resources for private well users interested in installing point of entry or point of use drinking water treatment.[3]

In addition to existing water quality requirements, stakeholders were concerned about potential new regulations related to emerging contaminants. Examples of emerging contaminants identified by MassDEP's Emerging Contaminant Workgroup include 1,4-Dioxane, cyanobacteria, nanoparticles, perchlorate, pharmaceuticals, personal care products and endocrine blocking compounds, polybrominated diphenyl ethers, Royal Demolition Explosive, tetrachloroethylene, and trichloroethylene (MassDEP, 2014).

2.1.2.4 Water Quality Stressors

Some common water quality stressors for the region include stormwater, wastewater, pesticides, and fertilizers. **Figure 2-4** is a graphic of these water quality stressors.

[2] https://www.mass.gov/info-details/protect-your-family-a-guide-to-water-quality-testing-for-private-wells

[3] https://www.mass.gov/info-details/home-water-treatment-devices-point-of-entry-and-point-of-use-drinking-water-treatment

Figure 2-4 : Common water quality stressors for the region

Stormwater is rainwater that runs off streets, lawns or other land and makes its way into surface waters or groundwater. As this water lands on paved areas such as streets or parking lots, it picks up pollutants and carries it to surface water. In more developed areas in the region, there are stormwater collection systems, which collects rainwater through a network of storm drains and pipes, carrying water to surface waterways. These collection systems can carry the pollutants to surface waterways. One way to reduce degradation of water quality from stormwater is through implementing green infrastructure, such as rain gardens, bioswales, permeable pavements, rainwater harvesting, and green streets. MassDEP[4] offers resources for communities to adopt stormwater best management practices (BMPs), and local ordinances or bylaws that address stormwater management.

Another water quality stressor is wastewater originating from onsite wastewater systems (fully functioning Title 5 septic systems, cesspool systems, etc.). Much of this region is dependent on Title 5 septic systems for ground disposal, which do not treat for nutrients. In high population areas, excessive levels of nutrients, specifically nitrogen and phosphorus, can contribute to algal blooms in surface water bodies. The problems with Title 5 septic systems are generally encountered in areas with low permeability soils, small lots and high groundwater. A failing septic system can discharge untreated wastewater containing pathogens such as E. coli, nutrients and other harmful substances. These substances can migrate into groundwater or surface waters. One way to reduce negative impacts from a septic system is to maintain septic systems properly. The Environmental Protection Agency provides guidance how to care for your septic system[5]. In high pollutant areas, communities can evaluate wastewater treatment as an alternative to septic systems.

Pesticides and fertilizers can also pose a risk to water quality. A pesticide is used to kill or control pests to protect plants against insects, weeds, fungi, and other pests. A fertilizer is a chemical or natural substance that is added to soil to supply plants nutrients and increase plant growth. Pesticides and fertilizers can enter water by stormwater runoff carrying it to surface or groundwaters. Pesticides and fertilizers can negatively impact downstream waters through increasing nitrogen and phosphorus in lakes and rivers. This can stimulate algal blooms, which can cause conditions that are harmful to aquatic life. There are also health risks for drinking water from these substances. For residents reliant on private wells, pesticides and fertilizers can filter through the soil and make their way into the groundwater that

[4] https://www.mass.gov/info-details/stormwater-permitting
[5] https://www.epa.gov/septic/how-care-your-septic-system

is eventually used for drinking water. To reduce the environmental impacts of pesticides, households should refer to the EPA's tips[6]. Reducing fertilizer use, amending soil with compost, or using a fertilizer product with slow-release nitrogen can support improved ecosystem health.

To see ways that households can help protect water quality, refer to **Figure 2-5.**

[6] https://www.epa.gov/safepestcontrol/tips-reducing-pesticide-impacts-wildlife#household

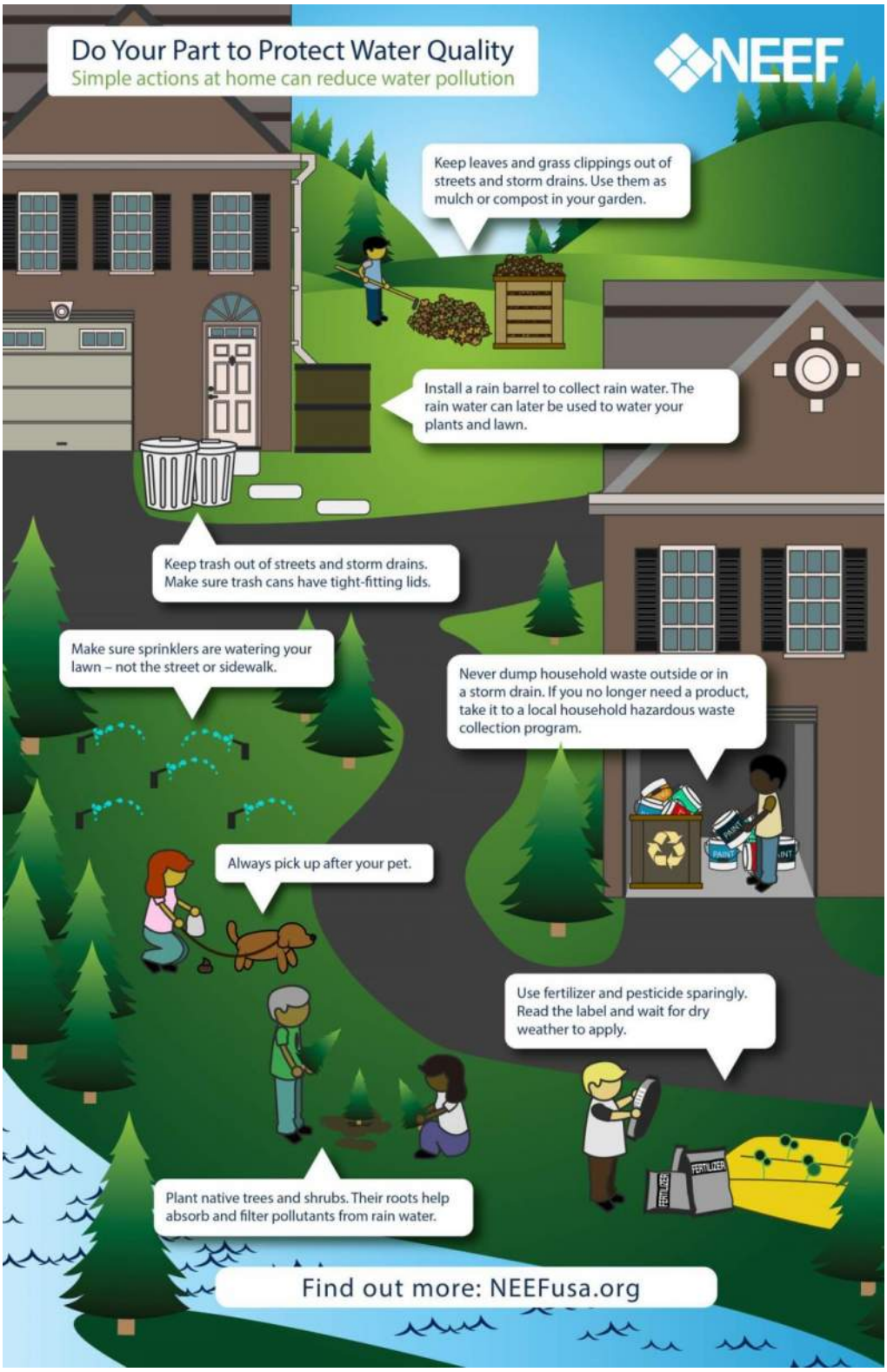


Figure 2-5: Household actions that can support improved water quality

2.1.3 Connectivity of Surface Waters

Another concern for water in the OCPC region is the connectivity of surface waters. Stream connectivity refers to the degree with which streams are interconnected, allowing for the natural movement of organisms, nutrients, and sediments through lakes, rivers, and streams. Culverts under roads, dams, and other structures can prevent stream connectivity, negatively impacting ecosystem health. Many different groups have been active in restoring stream connectivity in the region, including Mass Audubon, Taunton River Watershed Association, and the Jones River Watershed Association. One example of the lack of connectivity of surface waters negatively impacting ecosystem health is Forge Pond Dam in Silver Lake. Silver Lake is within Pembroke, Kingston, and Halifax and serves as a water supply for Brockton because of historic registrations written into Massachusetts law. This lake serves as the headwaters to the Jones River, and natural flows downstream are sometimes restricted because of the dam, a berm, and sedimentation downstream of the dam. The lack of connectivity impacts the migration of the river herring, a fish that migrates upstream to Silver Lake to spawn. Environmental advocates aim to help improve downstream conditions and have engaged with others in this planning process to discuss ways that this might happen. As part of this project, additional analysis has been conducted to assess different scenarios where additional water might be maintained within Silver Lake for availability to downstream needs, instead of being used by the City of Brockton for municipal water supply. This analysis is included in **Appendix J**. In addition to the concern of stream continuity at Forge Pond Dam, the *Stream Continuity Assessment in the Taunton Watershed* report identifies high priority sites for improving streamflow connectivity. **Table 2-4** includes results of this work, focusing on high priority sites for communities included in this plan.

Table 2-4: Highest Priority Sites for Ecological Restoration in the Taunton River within OCPC Region Previously Identified (Mass Audubon 2017)

Town	Road	Stream
Halifax	Franklin Street	Palmer Mill Brook
Easton	Mill Street	Poquanticut Brook

2.1.4 Affordability

Keeping water utility bills affordable is a concern as the cost of providing safe drinking water increases. This is of particular concern for low-income residents, veterans, and elderly residents living on a fixed income. Different communities experience water affordability more acutely than others. **Figure 2-6** shows the percentage of the population per community that is living in poverty. While it was outside the scope of this project to consider the impacts on water rates for customers as a result of water suppliers taking on these capital expenditures, this is a recommended strategy included in **Section 6.0**.

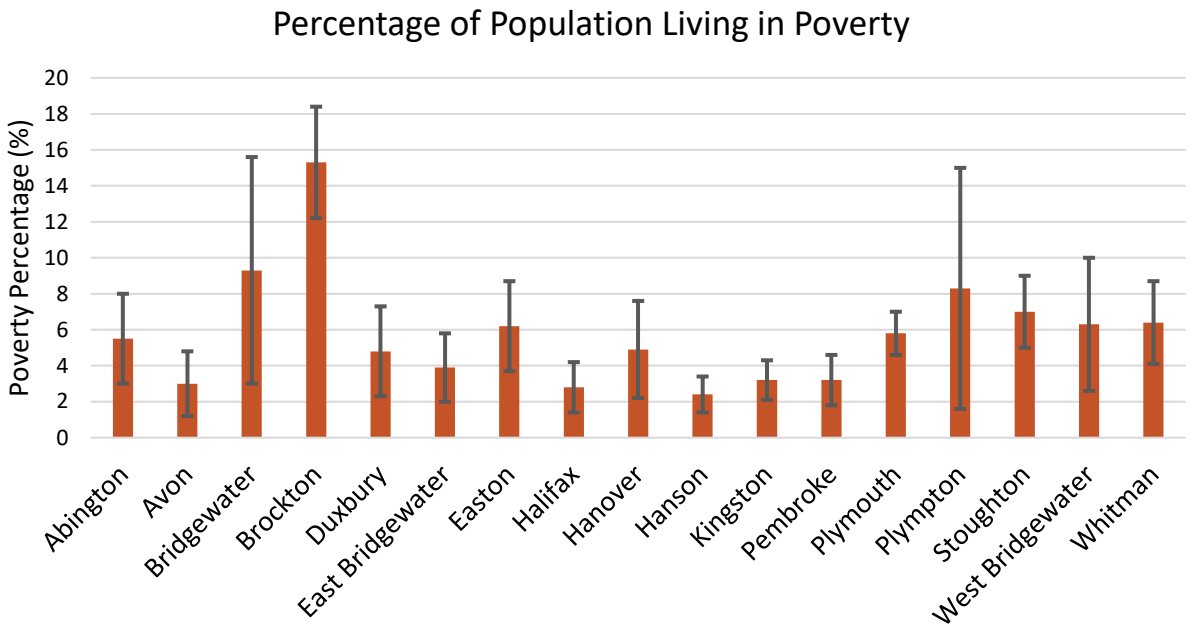


Figure 2-6: Percentage of Population in Each Community that is Living in Poverty
Source: U.S. Census Bureau 2020.
Note: Poverty is defined per the U.S. Census Bureau, which uses a set of money income thresholds that vary by family size and composition to determine who qualifies as living in poverty. Data were retrieved from the U.S. Census Bureau. The grey bars indicate the margin of error estimated by the U.S. Census Bureau. The margin of error measures the degree of uncertainty caused by sampling error.

The public survey conducted as part of this study, provided insight into how water affordability is viewed. Two notable findings are summarized here:

- Approximately 50% of residents on municipal water supply ranked affordability of water as "poor" or "fair"
- 22% of private well owners who had not conducted water quality testing on their well indicated it was due to the cost of testing.

In Massachusetts, residents who fall behind on paying water bills can face water shutoffs or liens on their property, but these measures are typically preceded by less severe means of penalties and late fees, which can compound the problem. A future study could track these financial penalties over time, consider any possible steps to increase access to affordable safe drinking water.

Section 5.0 implicitly considers affordability of water by including the cost of new infrastructure projects as one of the comparative metrics between alternatives. Additionally, major capital costs was noted as a risk for the alternatives, and the linked impact to affordability to residents.

2.1.5 Impact of Development on Water Resources

This section covers impacts beyond increased demand on water resources that accompanies increased development. Development, whether residential or commercial, can benefit municipalities economically by providing an increased tax base for municipalities, but environmental advocates highlight concern for the impact on the environment. Conversion of green space to buildings comes with an impact to water quantity and quality. Recharge of water to groundwater supplies is impacted by increased impervious areas. Water quality is impacted by increased potential for pollutant runoff from impervious areas. These impacts can be mitigated using green infrastructure, but there is concern about the loss of green space and natural ecosystems. One example of a concern is the increase in sand mining in the OCPC region. With increase in sand and gravel prices, landowners within the region have increased extraction of these resources for profit. There is local concern over impacts to water, the environment, and public health from sand and gravel mining, with a statewide coalition organizing on the grassroots level to prevent continuation of these practices (Yu 2024).

2.1.6 Summary of Water Resources Concerns and How They Are Addressed

This section summarizes concerns related to water in the OCPC region heard from different stakeholders, including concerns around water availability, water quality, connectivity of surface waters, affordability, and the impact of development on water resources. **Table 2-5** summarizes the concerns and how they were addressed in this plan.

Table 2-5: Summary of Water Resources Concerns in the Old Colony Planning Council Region and How This Regional Water Plan Addresses Them

Water Concern	How This Is Addressed in the Plan
Water availability	For public water suppliers: **Section 6.0** provides recommendations that are water supply strategies to address water availability for public water supply.
	For ecosystems: **Section 6.0** provides recommendations for the Old Colony Regional Water Resources Committee to conduct an integrated ecological assessment and improvements, as well as groups such as Massachusetts Rivers Alliance to continue their advocacy work to reform water regulations within the state.
	For private well owners: **Section 6.0** provides recommendations that include water efficiency strategies proposed for public water suppliers, considerations for public water suppliers to evaluate nearby private wells when developing new wells, and potential bylaws promoting reduced outdoor water use that support water availability for private well owners.
	For agriculture: **Section 6.0** provides recommendations that focus on agricultural water use efficiency and redundant supply during times of drought, which support water availability for agriculture.
Water quality	Drinking water: **Section 6.0** provides recommendations for water supply strategies that support safe drinking water.
	Surface water: **Section 6.0** provides recommendations for the Old Colony Regional Water Resources Committee to conduct integrated ecological assessment and improvements that will support improvements to water quality. Additionally, it is recommended that future regional stormwater and wastewater plans consider integrated water resources planning.
Connectivity of surface waters	**Section 6.0** provides recommendations for the Old Colony Regional Water Resources Committee to conduct integrated ecological assessment and improvements, part of which is focused on the identification and removal of migratory impediments.
Affordability	While this study did not examine the impacts to water rates associated with various alternatives, nor the ability to pay, overall unit costs of water was a critical factor in recommending water management strategies (**Section 5.0**). Additionally, reducing the potential of overburdening lower-income communities was an additional factor in evaluating and recommending strategies (**Section 5.0**).
Impact of development	**Section 6.0** provides a recommendation for OCPC to consider resources to support OCPC communities with more water smart planning.
Utility Communication	Stakeholder reliant on municipal water supplies highlight clear communication, transparent management of water resources, and increase in water conservation. **Section 6.0** provides recommendations for consistent messaging from utilities, as well as water efficiency strategies.

2.2 Water Resources in the Region

This section provides a brief overview of water resources in the region. Please refer to **Appendix B** for a detailed hydrologic assessment.

2.2.1 Watersheds

A watershed is a land area in which all water drains into common surface water bodies such as lakes and streams flowing to rivers, and eventually out to sea. Healthy watersheds naturally filter pollutants, regulate water flow, and support ecosystems, making them essential geographies for sustainable water supply planning. The Old Colony region spans four watersheds: South Coastal, Taunton River, Buzzards Bay, and Boston Harbor (**Figure 2-7**). Most of the region falls within the Taunton and South Coastal basins.

Under the Clean Water Act, Massachusetts conducts water quality assessments for each watershed, compiling data from various sources to evaluate water quality, track progress in maintaining and restoring it, and identify remaining challenges at the watershed level. The South Coastal and Taunton River watersheds are assessed for designated uses such as aquatic life, fish consumption, drinking water, shellfish harvesting, primary and secondary contact recreation, and aesthetics.

In addition, the Taunton River Watershed Alliance collects water samples from 20 sites on the Taunton River and its tributaries and conducts monthly tests for nitrate, total phosphorus, bacteria, dissolved oxygen, pH, and temperature (Taunton River Watershed Alliance, 2023). This data is available on their website.[7] The U.S. Geological Survey maintains two streamflow gages and four groundwater wells in the region (see **Table 2-6**, also **Figure 2-7** for locations).

[7] https://savethetaunton.org/water-quality-monitoring/

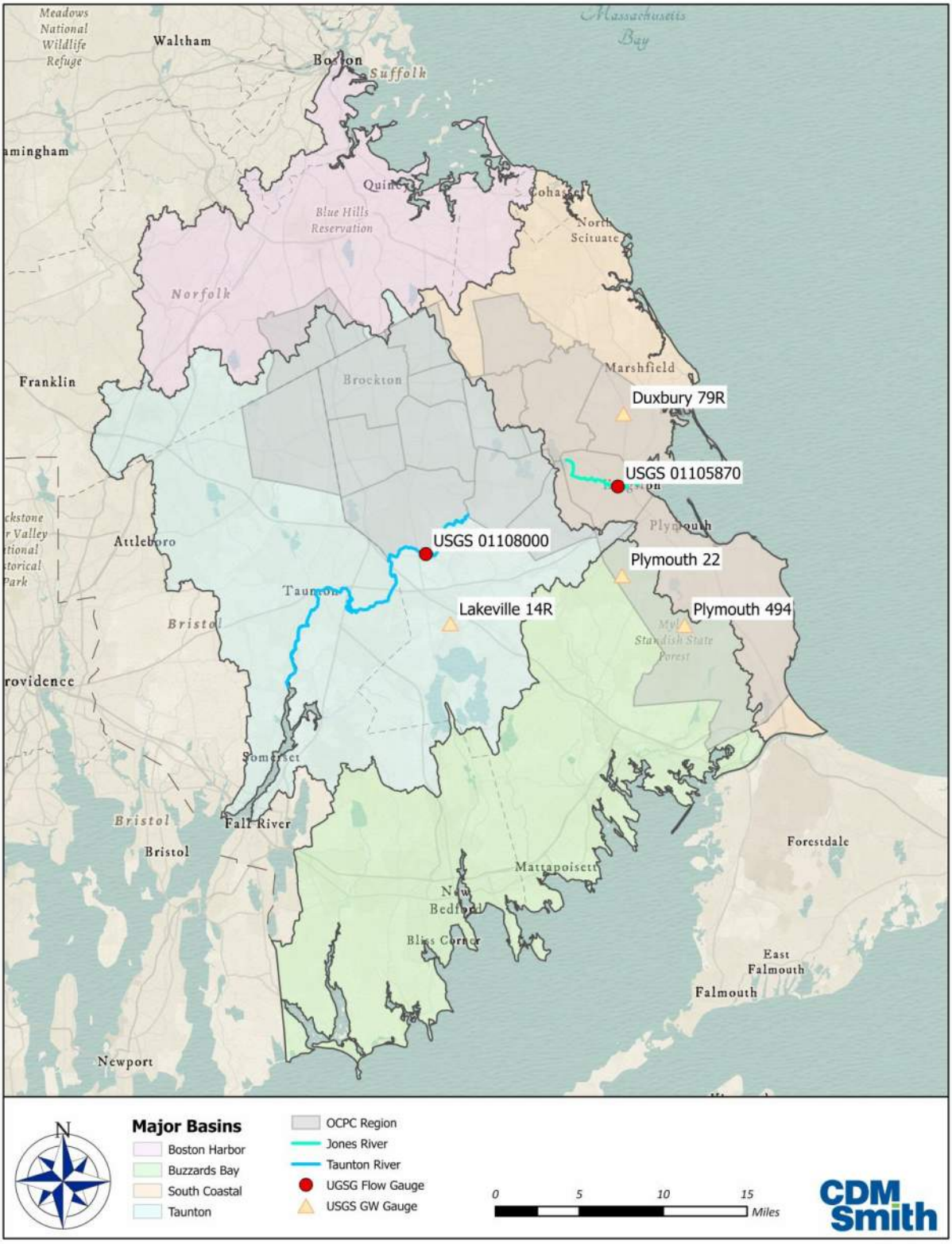


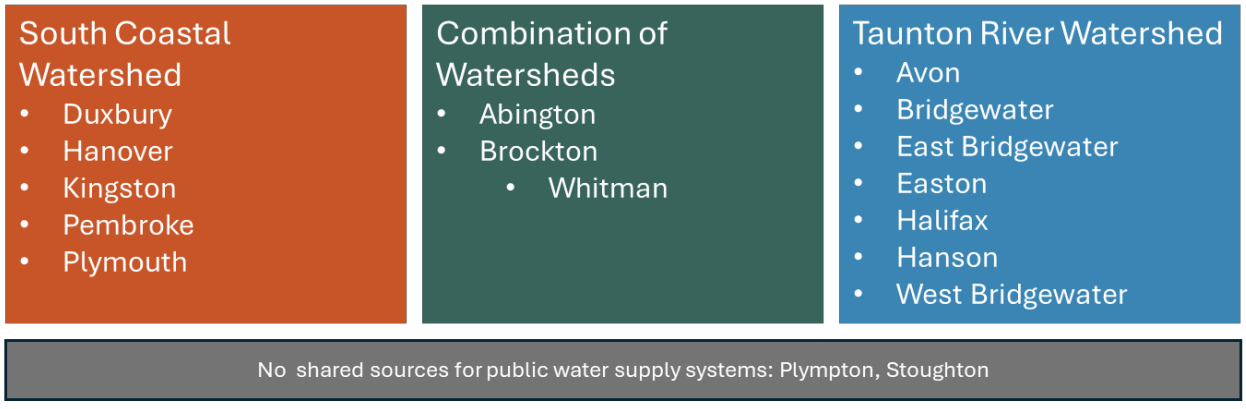
Figure 2-7: Watersheds and U.S. Geological Survey Streamflow and Groundwater Monitoring Gages in the Old Colony Region

Table 2-6: U.S. Geological Survey Monitoring Locations Within the Region

Gage Name	ID	Dates Available	Type
Taunton River near Bridgewater, MA	01108000	1929–1976, 1985–1988, 1996–2023	Streamflow
Jones River at Kingston, MA	01105870	1966–2023	Streamflow
MA-PWW 22 PLYMOUTH, MA	415453070434901	1956–2024	Groundwater
MA-PWW 494 PLYMOUTH, MA	415217070393102	1985–2024	Groundwater
MA-LKW 14R LAKEVILLE, MA	415229070554301	2018–2024	Groundwater
MA-D4W 79R DUXBURY, MA	420316070433501	1964–2024	Groundwater

2.2.2 Municipal Water Supply Sources

While most municipalities plan their public water supplies separately, it is important to remember that water is drawn from shared watersheds (**Figure 2-8**). Most public water suppliers in the region depend on groundwater wells for their primary source. Approximately 93% of the population relies on municipal water supply systems for their water. Brockton, Whitman (which purchases water from Brockton), and Abington rely on surface water sources (**Figure 2-9**). Brockton's surface water comes from Silver Lake and Registered diversions from Monponsett Pond[8] and Abington's comes from Great Sandy Bottom Pond. Abington has a joint water works with Rockland, which is located outside the OCPC Region. Brockton and Whitman also rely on brackish water desalinated by a plant in Dighton. Additional analysis that considers scenarios where Brockton uses 1.0, 1.5 and 2.0 MGD of desalinated water to allow for additional flexibility with withdrawals from Silver Lake is included in **Appendix J**. Stoughton shares no watersheds for its source water with the other OCPC communities, as it receives water from Boston Harbor watershed, and through a connection with the Massachusetts Water Resource Authority (MWRA). Plympton does not have a public water supply, with residents solely dependent on water from private wells within both the South Coastal Watershed and Taunton River Watershed. An important groundwater aquifer for the region is the Plymouth Carver Sole Source Aquifer, which covers 199 square miles, and is the principal source of water for Kingston, Plymouth, and Plympton, as well as communities outside the OCPC region (Bourne, Carver, Middleborough, and Wareham). For additional specifics on the municipal water supply sources, refer to **Appendix A**.



[8] Until 2018, Brockton also had registered diversions from Furnace Pond

Figure 2-8: Shared Watersheds from which Source Waters for Municipal Public Water Supplies are Drawn in the Old Colony Region.

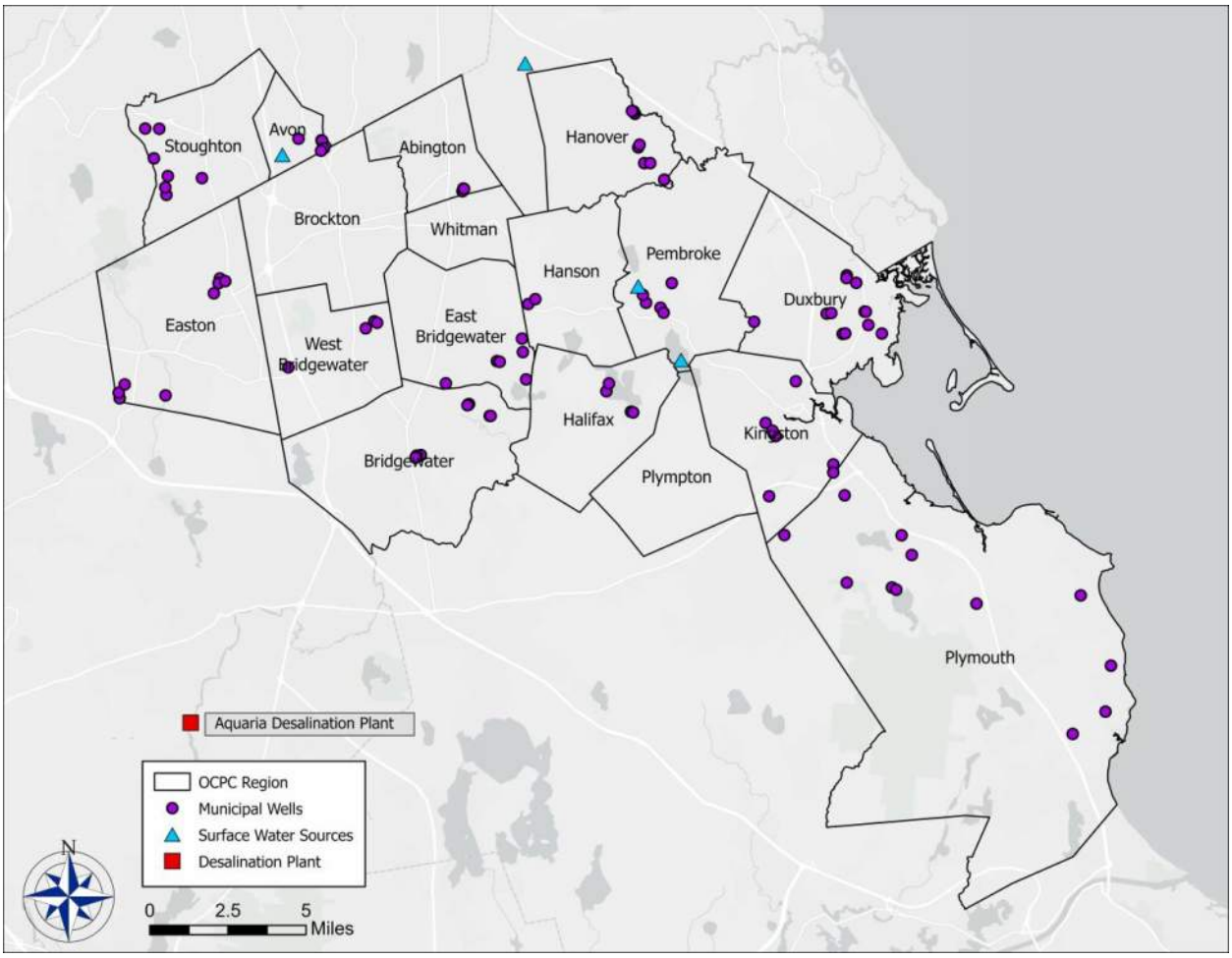


Figure 2-9: Municipal Wells and Surface Water Sources in the Old Colony Region
Note: For additional specifics on municipal water sources, please refer to Appendix A.

2.2.3 Private Wells

Plympton is the only community in the Old Colony region without a public water supply. Nearly 1,000 households in this town rely on private wells as their primary source of water. Other communities in the region also have residents reliant on private wells, totaling over 10,000 household wells (**Table 2-7**). It is estimated that approximately 7% of the population in the region relies on private wells. Data is not clear as to how many of these are used for drinking water and/or other uses only, such as outdoor irrigation. These wells are below the MassDEP's regulation threshold of 100,000 gallons per day. Wells below this threshold are not tracked by MassDEP and can belong to private residents, commercial businesses, and agricultural operations.

Table 2-7: Estimated Number of Private Wells in the Old Colony Region (Data from local Boards of Health and the Massachusetts Executive Office of Energy and Environmental Affairs)

Community	Estimate of Private Wells
Abington	183
Avon	48
Bridgewater	1,440
Brockton	921
Duxbury	105
East Bridgewater	50
Easton	253
Halifax	150
Hanover	930
Hanson	282
Kingston	464
Pembroke	801
Plymouth	2,280
Plympton	958 (all households)
Stoughton	1,421
West Bridgewater	52
Whitman	381
TOTAL	**10,719**

2.3 Municipal Water Supply and Demand in the Region

Appendix A presents a detailed review of municipal public water supplies in the region as well as a review of private well supplies in Plympton. It outlines each water supplier, focusing on aspects relevant to this plan. Descriptions of water sources, relevant permits and registrations, drinking water distribution infrastructures, historical water demand and usage, documented concerns and issues, and potential water supply or demand alternatives are included. Information was gathered through interviews with municipal staff, state data sources, and publicly available sources such as the following:

- Water supply master plans
- Annual statistics reports
- PFAS sampling data
- Consumer Confidence Reports
- WMA permits and registrations
- Regional reports and white papers
- Drought management plans
- Wastewater master plans
- Emergency response plan
- Capital improvement plans
- Environmental impact assessments
- Feasibility studies

Data from the 2022 Annual Statistics reports has been used to create a regional pie chart of the different water uses for public water supplies in the OCPC Region, shown in **Figure 2-10**.

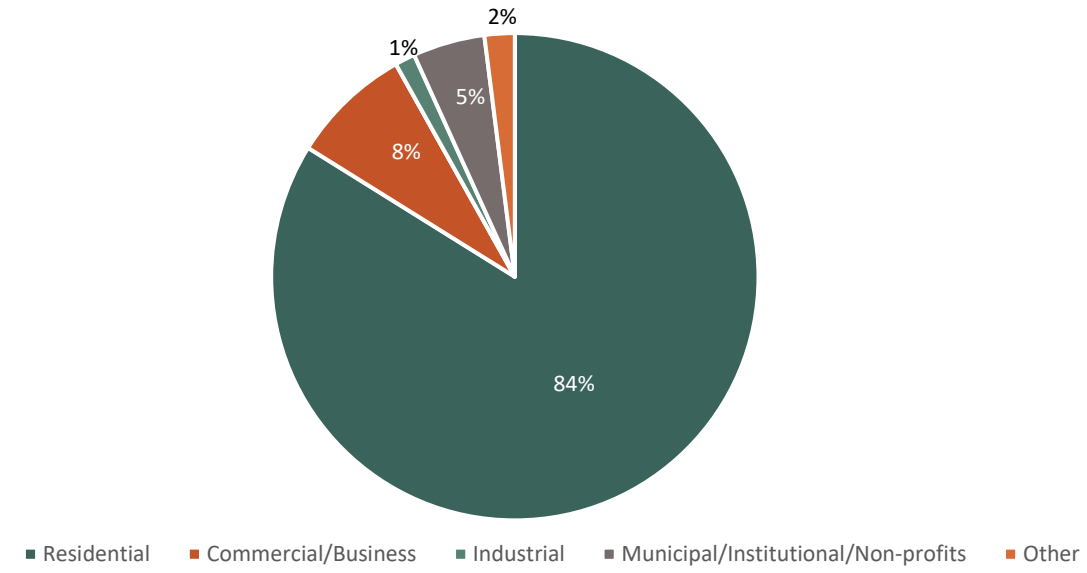


Figure 2-10: Water Use Categories for the OCPC Regions Municipal Water Supply for 2022

A current conditions analysis was conducted for each municipality to understand historical water demand and usage, forming a basis for projections and supply options in this plan (**Table 2-8**):

- **Column A** is the amount of finished water in millions of gallons per day (MGD) provided by the municipality to households, businesses, and other users in its supply area.
- **Column B** is the amount of water in MGD that the municipality is allowed by the state to withdraw from its water sources.
- **Column C** is the percentage of unaccounted for water (UAW) in the system. This number can vary significantly from year to year. UAW is a measure of how well a water supplier can account for all the water that it pumps into its distribution system. It is the percent of water entering the distribution system not accounted for from service meter readings or from unmetered municipal uses such as firefighting and street cleaning. UAW values may be high because water is lost through leaks in the distribution system, which may occur in older systems. UAW values may also be high if meters are incorrectly calibrated so that over-registration of water use occurs or if unmetered uses are not documented in the ASR. (MassDEP)
- **Column D** is water consumption rate as Residential Gallons Per Capita Per Day (RGPCPD). RGPCD is the number of gallons of water used, on average, each day by a resident for purposes such as washing clothes, flushing toilets, showering, and lawn watering. RGPCD is computed for a public water supplier by dividing the total metered residential use by the number of residents served by that system. Higher RGPCD values may indicate that residents of the system use substantial water for outdoor use, notably lawn watering. Lower RGPCD values may indicate that a community controls outdoor water uses or that the community is densely settled with small lawn areas (for example, cities). (MassDEP)
- **Column E** represents the volume of finished water supply currently or potentially testing for PFOS and PFAS concentrations exceeding 4 parts per trillion, the EPA's standard for these chemicals established in April 2024.

Table 2-8: Summary of Current Water Supply and Demands in the Old Colony Region

			A	B	C	D	E
Municipality	**Water Source**	**2022 Population Served[1]**	**2022 Annual Average Demand[1] (MGD)**	**2022 Authorized Annual Average Withdrawal[1] (MGD)**	**2022 UAW[2] (%)**	**2022 RGPCD[2] (GPCD)**	**Volume at Risk for PFAS (MGD)**
Abington (Abington and Rockland Joint Water Works)	Municipal wells and surface water	34,952	2.84	3.19	14	57	3.84
Avon	Municipal wells	4,794	0.35	0.61	13	50	0.25
Bridgewater	Municipal wells	28,531	1.63	1.86	7	46	3.06
Brockton	Surface water and desalination plant	104,713	8.35	16.05[4]	50[3]	24[3]	1.08
Duxbury	Municipal wells	16,090	1.61	1.43	7	85	0.79
East Bridgewater	Municipal wells	14,382	0.94	1.21	5	50	2.88
Easton	Municipal wells	25,021	1.80	2.21	9	61	1.69
Halifax	Municipal wells	7,728	0.47	0.68	8	50	0.72
Hanover	Municipal wells	14,820	1.20	1.38	10	53	2.51
Hanson	Municipal wells	10,319	0.59	0.78	1	61	1.08
Kingston	Municipal wells	13,702	1.60	1.33	4	61	0.00
Pembroke	Municipal wells	18,188	1.15	1.7	10	50	1.00
Plymouth	Municipal wells	44,419	4.11	5.04	12	60	
Plympton	Private wells	2,923[6]	—	—	—	—	—
Stoughton	Municipal wells and MWRA	29,051	1.89	2.48	9	44	1.95
West Bridgewater	Municipal wells	7,669	0.64	0.81	12	51	4.11
Whitman	Brockton	15,146	0.86	NA	10	46	0.00

Notes:

[1] Data gathered from the 2022 annual statistics reports are publicly available by request to MassDEP.

[2] RGPCPD and UAW were recalculated by MassDEP and are available at: https://www.mass.gov/info-details/public-water-supply-tools-resources-performance-standards.

[3] Brockton's UAW and RGPCD were reported for 2023 because the 2022 data were not available.

[4] Brockton's allowance from the Aquaria desalination plant was included in this amount.

[5] MWRA is the Massachusetts Water Resources Authority.

[6] The entire population of Plympton relies on water from private wells, so the population served is the population from the 2022 Census.

2024 king tide showing discontinued MBTA line to Plymouth.

Section 3.0

3.0 Water Demand and Availability

This section presents the analysis conducted to understand future municipal water supply demands and future water availability. **Section 3.1** presents demand projections for the region, developed based on drivers including population, climate, and water use efficiency. **Section 3.2** provides additional detail on water use efficiency, which was determined to be an influential variable in the demand projections. **Section 3.3** presents analysis on uncertainties and potential future trends in surface water and groundwater availability considering climate and drought trends.

3.1 Demand Projections for the Region

A key step in assessing water supply reliability for the 17 OCPC communities is projecting water demand in future years. CDM Smith conducted a water demand projection analysis as described in this section and more detailed in The Water Demand Projections Memorandum (**Appendix C**).

The methodology used for the demand projections, outlined in **Figure 3-1**, begins with the collection of historical water use, demographic, economic, and weather data for each municipality in the Old Colony region. Statistical data analysis was performed to determine the best mathematical function to describe historical demand. From this analysis, the key factors that influence demand are identified and their statistical relationships with water demand are established. Projected values for the demographic, economic, and weather variables are applied to the mathematical function, which results in projected water demand in future years for the OCPC planning area.

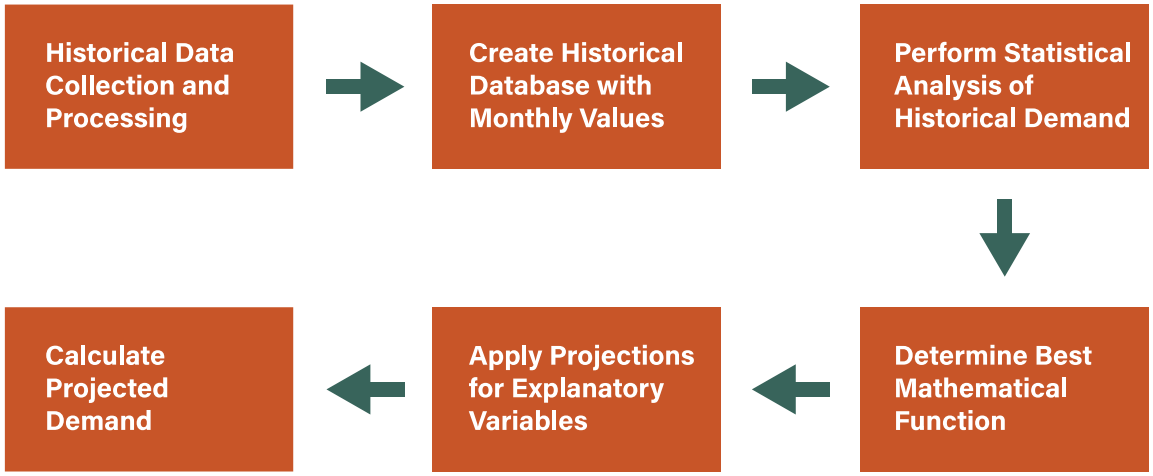


Figure 3-1: Overview of Demand Projection Analysis Process

Historical municipal public water use for the region, as shown in **Figure 3-2**, has ranged from a high of 11,674 million gallons (MG) in 2016 to a low of 10,599 MG in 2012. The unit use rate, expressed as gallons per capita per day (GPCD), has steadily decreased from a high of 86.5 GPCD in 2015 to 76 GPCD in 2021 for region. GPCD[9] in this analysis represents the total per capita usage, which includes residential and nonresidential consumption plus unaccounted for water (UAW) and is shown on the right-hand axis of **Figure 3-2**. Reductions in per capita water use have resulted in total demands being relatively consistent over the past several years despite increases in population served. Population served by municipal water supplies for the OCPC region was approximately 364,600 in 2010 and increased to approximately 379,800 by 2020, as shown in **Figure 3-3**.

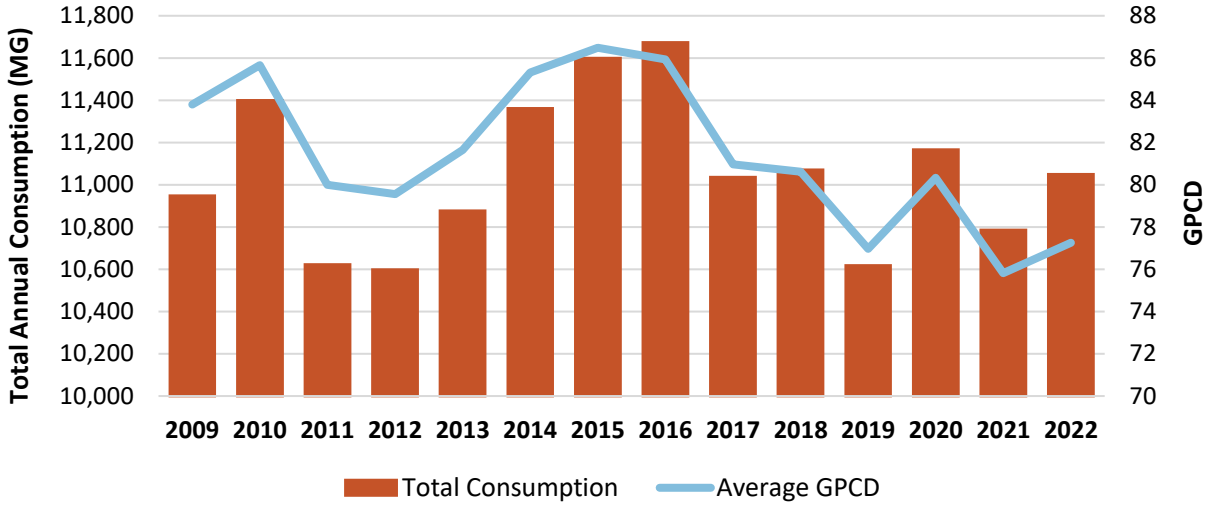


Figure 3-2: Historical Annual Consumption and Per Capita Use for the Old Colony Region, 2009 to 2022

[9] GPCD values in this analysis differ from DEP's definition for GPCD due to insufficient quality of data available for commercial/industrial water use. Additionally, UAW is incorporated in the calculations as this is commonly included in GPCD calculations in other regions of the country.

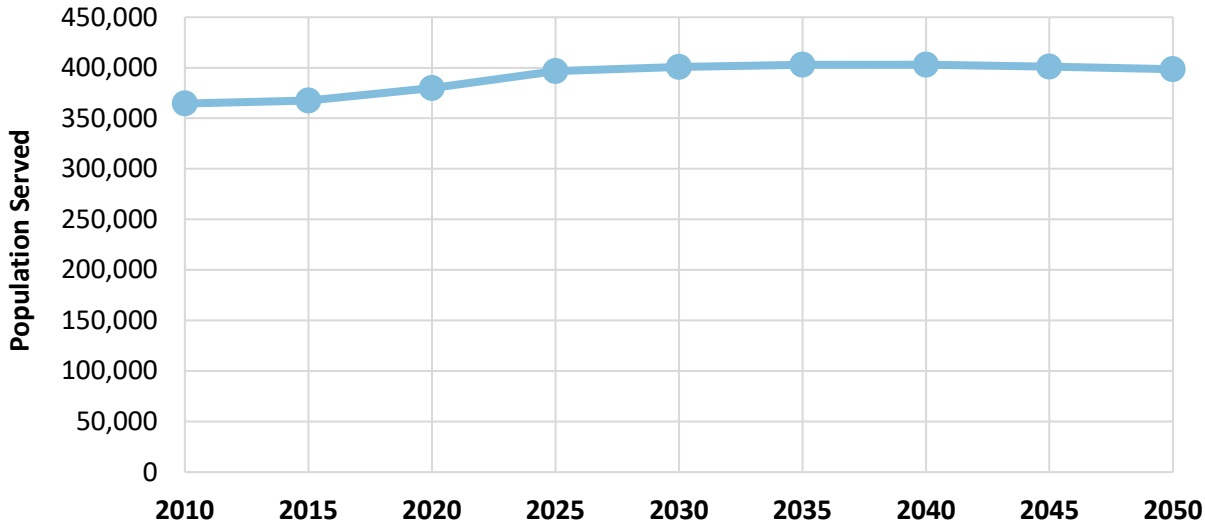


Figure 3-3: Population Served by Municipal Water Suppliers in the Old Colony Region
Note: Historical data comes from municipal reporting within annual statistic reports and future population projections from UMass Donahue Institute.

Statistical analysis of monthly demands was conducted using an econometric function. An econometric function is a specialized form of regression analysis that incorporates economic variables. The data provided by the communities for UAW was not viewed as generally reliable, therefore, the period of historical data included in the statistical analysis was reduced to 2016 through 2022.

Projected values for the independent variables were input into the econometric function to calculate projected GPCD across the planning horizon. The projected GPCD values were multiplied by projected population to calculate projected water consumption for the Old Colony region. Population projections vary by municipality with some like Kingston projected to experience population growth of up to 16% by 2050, while others such as Avon are projected to have population decline of -17% by 2050. Overall, the region's population is expected to increase by 6.1% between 2020 and 2035 and decrease by 1.1% between 2035 and 2050. Historical average volume of UAW was added to the projected consumption to determine projected total demand for the Old Colony region. Demands are projected to decrease across the planning horizon, as shown in **Figure 3-4**, because of continued improvements in water use efficiency and minimal population growth. This demand projection, called the baseline projection, uses historical averages for weather and projected population from UMass Donahue Institute.

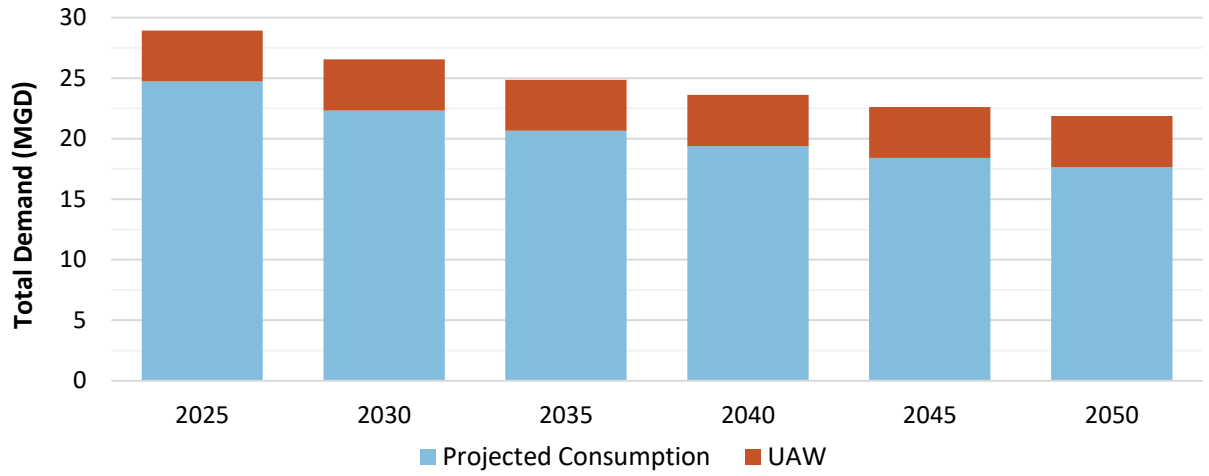


Figure 3-4: Projected Consumption and Unaccounted for Water for the Old Colony Region, 2025 to 2050

Per capita water demand is projected to decrease across the planning horizon because of improved efficiency of plumbing fixtures and appliances, a process called passive conservation. Recently enacted legislation in Massachusetts mandates minimum efficiency standards more stringent than the existing federal standards for various plumbing fixtures (Massachusetts Legislature 2021). Additional standards set by the U.S. Department of Energy for residential clothes washers will also reduce water demand over the planning horizon. Technological advances from manufacturers that reduce water consumption, even more than the state and federal standards, will continue to reduce per capita water demand as older, less efficient fixtures and appliances are phased out over time. Where similar efficiency measures have been adopted in other states, similar declines in per capita water use have been observed over recent 10- to 15-year periods.

Alternate projections were developed from the baseline projection to account for future scenarios that as shown in **Table 3-1**, incorporating different levels of population growth, climates, different rates of water use efficiency, changes in UAW over the historical average, and private well users switching to a public water supply. While the scenarios titled “Significant Stress” and “Significant Stress with Mitigation” capture future conditions with certain variables that may provide additional stress on water resources in the region, the demand projections decrease over time. These scenarios aim to capture some of the uncertainty around population growth related to state laws such as the Multi-Family Zoning Requirement for MBTA Communities and Section 8 of the Affordable Homes Act that allows accessory dwelling units to be built within single-family zoning districts.

Table 3-1: Alternate Future Scenario Parameters for the Old Colony Regional Water Plan

Planning Scenario	Population Growth	Future Climate	Water Use Efficiency (Passive Conservation)	Trend in UAW	Private Wells to Public Supply
Baseline	Expected	Historical average	Average increase in efficiency (current codes)	Constant	None
Low Stress	Expected	Cool/wet	Greater than average increase in efficiency (high efficiency)	Decrease	None
Significant Stress	10% greater than expected[1]	Hot/dry	Less than average increase in efficiency (slower rate of meeting current codes)	Increase	100%
Significant Stress with Mitigation	10% greater than expected	Hot/dry	Greater than average increase in efficiency (high efficiency)	Decrease	100%

Note:

[1] This 10% increase is included, in part, to provide a buffer against uncertain population and demand changes that may result from housing growth, which may increase population in some municipalities.

Projected demands decrease across the planning horizon under all future scenarios, as shown in **Figure 3-5**. The projected decrease in demand is due to efficiency improvements over time (i.e., passive conservation), which has a significant impact on overall water use for the Old Colony region, even in scenarios with significant population growth and changing climate.

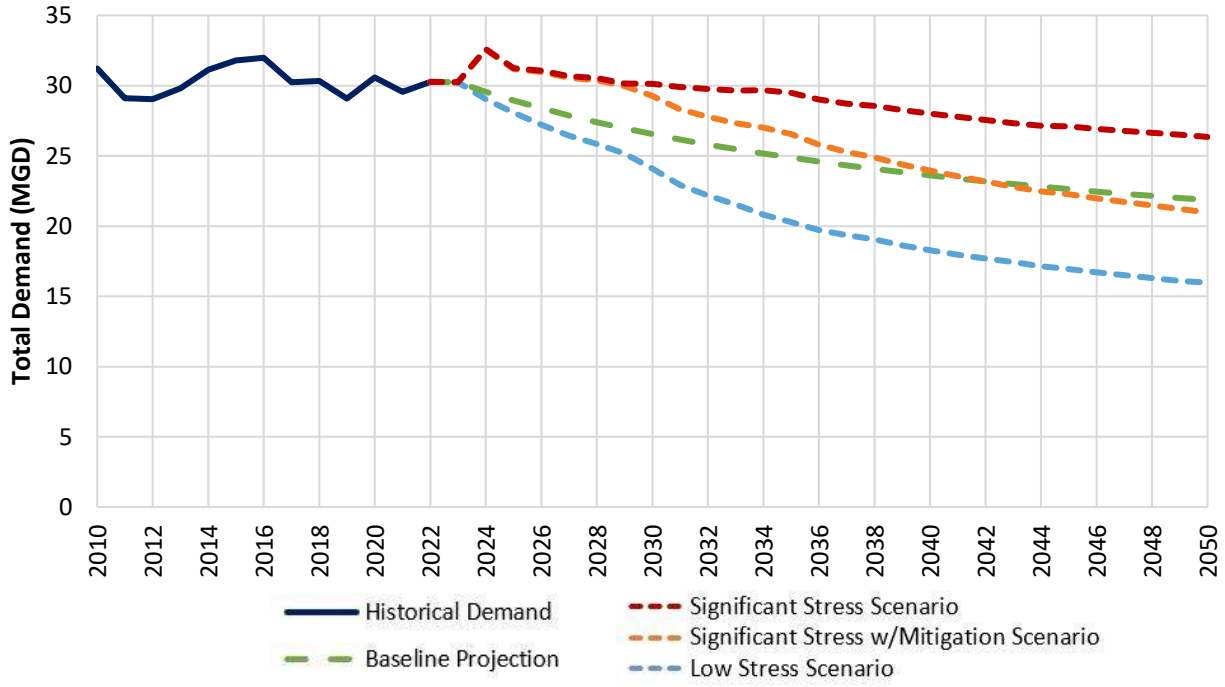


Figure 3-5: Historical and Projected Demand for the Old Colony Region Under Various Future Scenarios

As with any analysis involving projections, uncertainty must always be considered. State projections, which use the same populations projections from the UMass Donahue Institute used in this analysis, suggest increasing demand patterns, and water users generally use these projections for planning and permitting. However, the projections are nearly 10 years old and do not account for the climate or efficiency factors applied here. Therefore, for this nonregulatory analysis, the demand envelope presented in **Figure 3-5** is applied, with the caveat that it is well below values used by OCPC communities to plan and renew permits. The state projections are not included in this figure because they were developed on a community-by-community basis at different times and cannot be readily combined into a meaningful summary for the region.

3.2 Demand Projections at the Local Level

In addition to the regional demand projection analysis, municipality-specific demand projections were developed and are included in **Appendix C**. **Figure 3-6** provides a look at the municipality specific projections for each community, comparing historic 2022 demand to projected demand for 2050. Results on the municipality specific scale show the potential for slight reductions in demand for 2050 compared to 2022 values for all municipalities.

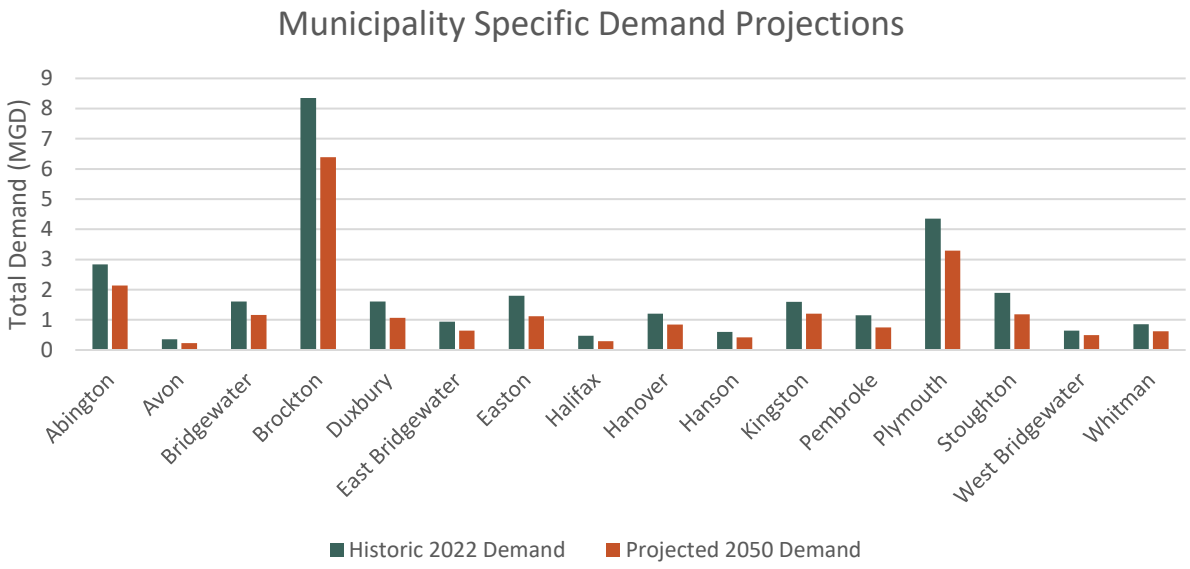


Figure 3-6: Historical and Projected Demand for Specific Municipalities for the Baseline Projection

3.3 Managing Demand through Water Efficiency

The Alliance for Water Efficiency, a national nonprofit organization that promotes the efficient and sustainable use of water, partnered on this work by studying water efficiency in the region and developing further recommendations for managing demand. **Appendix D** provides the Alliance for Water Efficiency's full report, summarized here.

The Alliance for Water Efficiency concluded that significant additional per capita water use reductions are expected over time based on both federal efficiency requirements for residential appliances and an efficiency law that recently took effect in Massachusetts. Passive water efficiency measures do not

require water users to change behavior and do not require action by water suppliers or the local governments. Massachusetts recently took action to require that only high-efficiency products be sold in the state. In *An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy*, Massachusetts established new requirements for water-efficient fixtures relevant to residential water use, as shown in **Table 3-2** (Massachusetts Legislature 2021). These requirements became effective on January 1, 2023.

Table 3-2: Massachusetts Requirements for Water-Efficient Fixtures for Residential Water Use

Plumbing Fixture	Federal Minimum Requirement	New 2023 Massachusetts Requirement
Bathroom faucet	2.2 gpm	1.5 gpm
Kitchen faucet	2.2 gpm	1.8 gpm
Showerheads	2.5 gpm	2.0 gpm
Toilets	1.6 gpf	1.28 gpf

Key: gpm – gallons per minute, gpf – gallons per flush

The Alliance for Water Efficiency developed a set of high-priority recommendations for additional, active efficiency that will lower long-term demands. These have been included as recommended strategies in **Section 6.0**. These were developed based on their potential to save water, as well as to provide co-benefits such as better data collection and decision-making, improved operations, and better customer service. Water efficiency is a critical aspect of municipal water management, with benefits including benefits to ecosystem health and potential prevention of large expenses for the development of new water supply infrastructure.

These high-priority recommendations have the potential to save significant amounts of water. If these recommendations were to be implemented through well-funded, carefully designed, and aggressively implemented efforts, savings could reach the amounts shown for the region in **Table 3-3**, measured on an average annual day basis in MGD. Water suppliers should consider the benefits and costs of each recommendation based on their unique circumstances.

Table 3-3: High-Priority Recommendations for Water Efficiency for Old Colony Region Water Suppliers

High-Priority Recommendations	High-End Estimate of Regional Water Savings (MGD)
Conduct, validate, and act on annual American Water Works Association (AWWA) water loss audits	1.0
Implement customer-side leak detection programs (customer-facing Advanced Metering Infrastructure (AMI) portal; 50% enrollment)	1.5
Implement customer-side leak detection program (AMI enabled and proactive)	0.3
Improve increasing block rate designs (with increasing block tariffs, the rate per unit of water increases as the volume of consumption increases)	3.0
Total	5.8

Key: AMI – Advanced Metering Infrastructure, AWWA – American Water Works Association

3.4 Future Water Availability

The objectives of the hydrology and climate assessment are to develop an analytical framework for hydrologic evaluation of the region's principal watersheds for future hydrologic trends and changing climate patterns. This analysis does not supplant any safe yield or regulatory assessments of water availability in the region, it simply aims to determine (1) if a changing climate poses likely risks to future surface water and groundwater availability and (2) if any such risks are significant enough to drive the recommendations in this plan.

The hydrology in this region has long been difficult to evaluate quantitatively because of the near homogeneity between surface water and shallow groundwater. Earlier versions of MassDEP guidance for safe yield analysis recommended against using statewide equations for streamflow estimation in this area of southeastern Massachusetts. This is the basis for the first objective of this analysis—developing a trustworthy analytical framework for hydrologic scenario evaluation.

Appendix B describes the development of a simulation model and its subsequent use in evaluating future risks to water availability. Results are summarized here with example outputs aimed at addressing the two objectives.

Figure 3-7 and **Figure 3-8** illustrate the results of calibrated streamflow models for the Taunton River and Jones River, which is located within the South Coastal Watershed. **Figure 3-7** illustrates surface streamflow at a monthly timestep and **Figure 3-8** compares simulated fluctuations in groundwater elevation with long-term monitoring wells. The models accept climate data as input in the form of monthly precipitation and monthly minimum and maximum air temperature. An assessment of the models is included in **Appendix B**.

Climate projections, and associated impacts, are inherently uncertain. Global climate models (or general circulation models) are the best available scientific tool to quantify plausible future patterns of air temperature and precipitation. However, as with weather forecasting, many models are available, and they do not always agree. General tendencies or agreement among models, ranges of possible outcomes, and the identification of weaknesses in the tools that translate future climate projections into future impacts are sought after. In this case, the tendencies and ranges can be used to make credible judgments about future climate risks. The results are subject to uncertainty in the hydrologic models developed as part of this study for the Taunton and Jones River watersheds. Many sets of parameters can produce similar results in a hydrologic model, and they may respond differently to climate inputs. However, the results suggest some clear guidance for current planning. As future decades unfold, climate tracking of both climate variables and their impacts on water availability will be an important element of the adaptive management plan outlined later in this plan.

Water plans frequently suggest that additional flow monitoring gauges and groundwater monitoring wells be developed. In this case, the hydrology of the regional hydrologic trends was able to be adequately characterized for planning purposes with the available flow gauges on the Taunton and Jones Rivers, and the four USGS monitoring wells. For future, more site-specific analysis, it could be helpful to install additional groundwater monitoring wells further west in the region, and around surface water bodies to help better characterize groundwater-surface water interactions. See Recommendation G in **Section 6.0** for additional context and next steps.

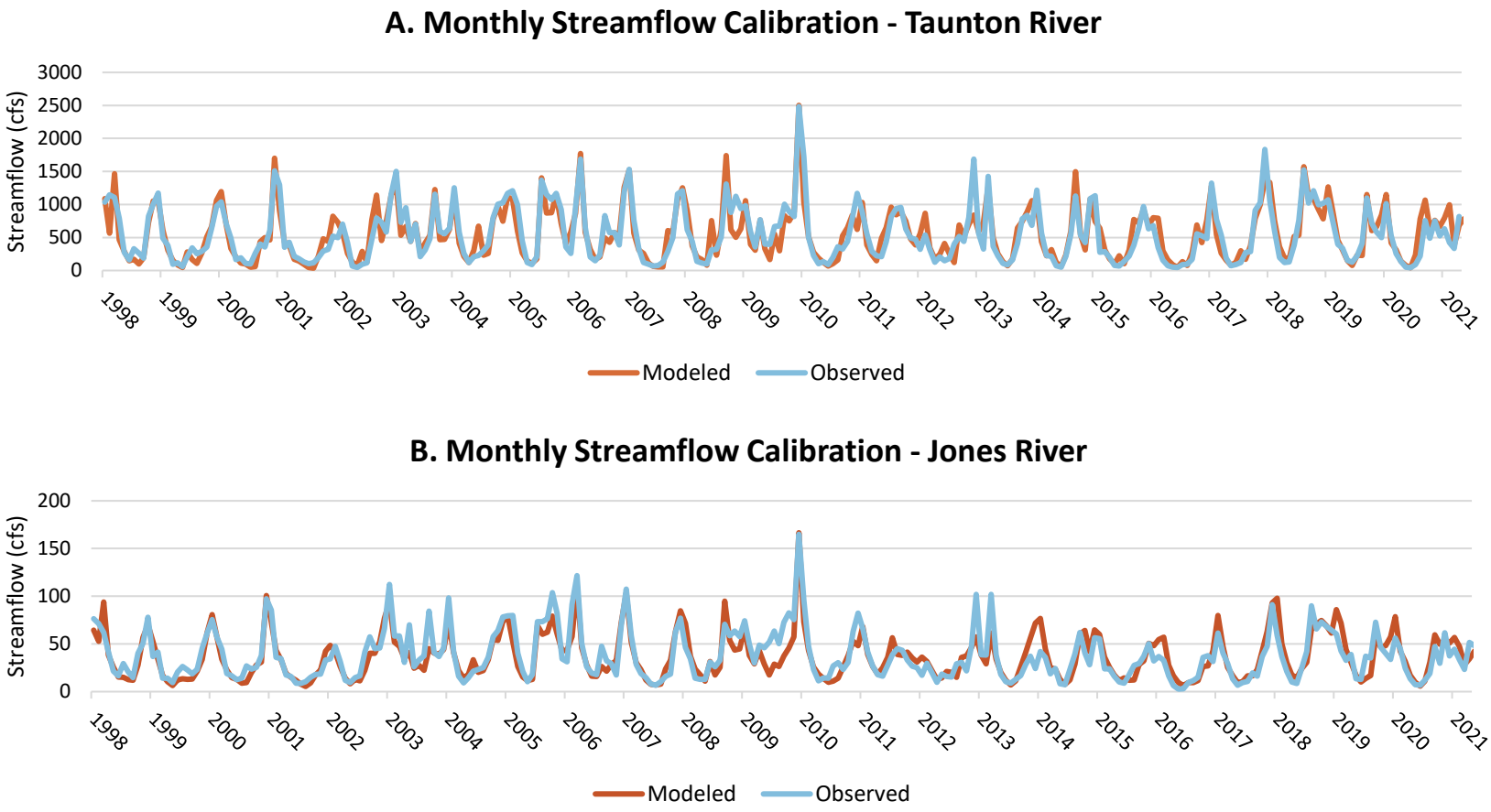


Figure 3-7: Water Balance Model Using Historical Precipitation, Temperature, and Demand to Reproduce Historical Surface Water Flows
Notes: A. shows the model for the Taunton River using the U.S. Geological Survey gage at Bridgeport. B. shows the model for the Jones River. The Jones River Gage is affected by release patterns from Silver Lake.

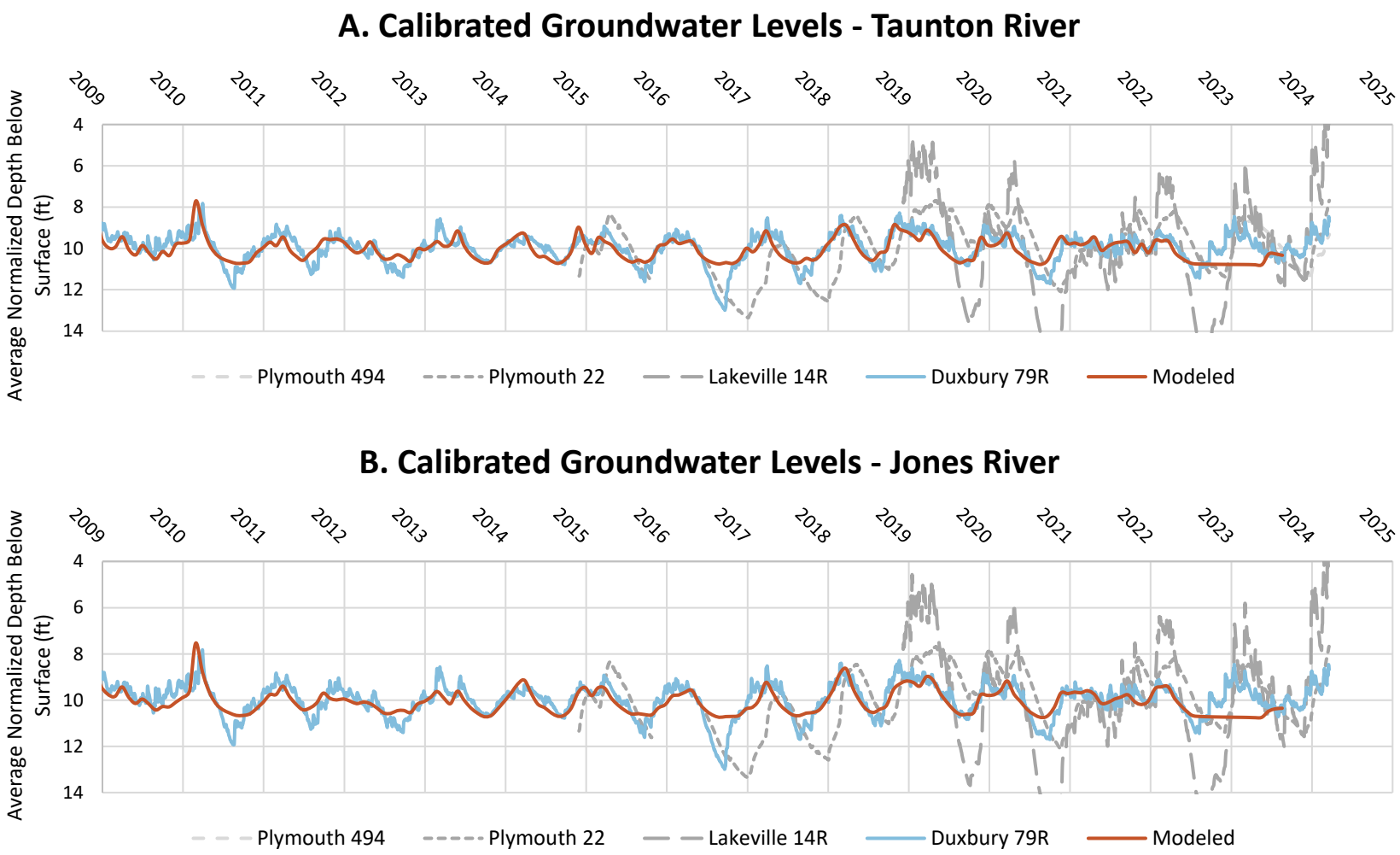


Figure 3-8: Calibrated Water Balance Model Using Historical Precipitation and Temperature to Reproduce Historical Groundwater Patterns
Notes: Values normalized to a single theoretical ground elevation for comparative purposes. The model was developed using only the Duxbury Well, but the other wells (Lakeville and Plymouth wells) are included for regional reference.

Once the modeling framework was established, it was used to examine potential future responses to climate trends. **Appendix B** also describes this detailed analysis, and results are summarized here. Publicly available data from 32 general circulation models were used, downscaled to the region of southeastern Massachusetts. The most conservative assumptions about future emissions, captured by Representative Concentration Pathway 8.5, were used in this assessment. Monthly timeseries of projected precipitation and temperature through 2100 were input into the calibrated models. Results are summarized statistically because the frequency of flow levels is a valid output, while the specific flow in July 2063, for example, is not.

The following conclusions were drawn from the simulated scenarios:

- Natural low flows (baseflow that would occur naturally regardless of upstream operations) in the Taunton River are likely to be higher in the future than they have been in the past, as indicated by **Figure 3-9**. Almost every one of the climate models, when processed through the hydrologic watershed models, suggests that flows that are exceeded between 90% and 100% of the time (up to the 10th percentile flow), will be higher in the future than they have been in the past. Approximately five of the 32 models suggest that the first percentile flows (99% exceedance) could be lower in the future, though not by as much as the potential flow increases that the remaining 27 of the 32 models suggest.
- In the Jones River Watershed, instead of observing a clear upward shift in expected future natural low baseflow conditions, the simulation models suggested that future baseflow is likely to remain relatively constant. **Figure 3-10** illustrates 5 representative climate models used to simulate the past 50 years and the future through 2100 with respect to natural baseflow in the Jones River Watershed (independent of upstream operations). Future projections bracket historic simulation of natural low flows.
- In slight contrast to the Taunton River, natural low flows in the Jones River are likely to remain relatively similar to those in the past. The future climate scenarios project similar statistical ranges of low flow that have been observed in the past.
- Groundwater fluctuations in both basins are likely to be slightly less pronounced (on average, a narrower band from annual high to low), and levels are not likely to frequently drop lower than historical levels. However, with the observed inability of the model to simulate extremely low groundwater levels, such patterns will need to be monitored closely as they develop.
- These results are consistent with observed trends in precipitation in the region and projected trends in precipitation through the 21st century, both of which suggest that precipitation in the region is increasing and will continue to increase.
- None of these conclusions rule out the future occurrence of short- or long-term droughts, which are evaluated and discussed in the following section, **Section 3.4.1**. However, the combined results of the analysis on water availability in this study suggest that future water availability is not currently a significant driver for this region when compared to other uncertainties such as PFAS, emerging drinking water regulations, and population growth. That said, climate patterns should be monitored and evaluated continually so that unforeseen changes can be recognized and addressed before they evolve into more serious risks to water supply.

Therefore, future water availability is not seen as a driving risk behind the recommendations in this plan. However, because of the inherent uncertainty in climate modeling and projections, actual climate patterns and their impacts on surface and groundwater should be tracked and compared to historical values as part of the adaptive management framework discussed in **Section 6.0** to determine when specific actions should be taken.

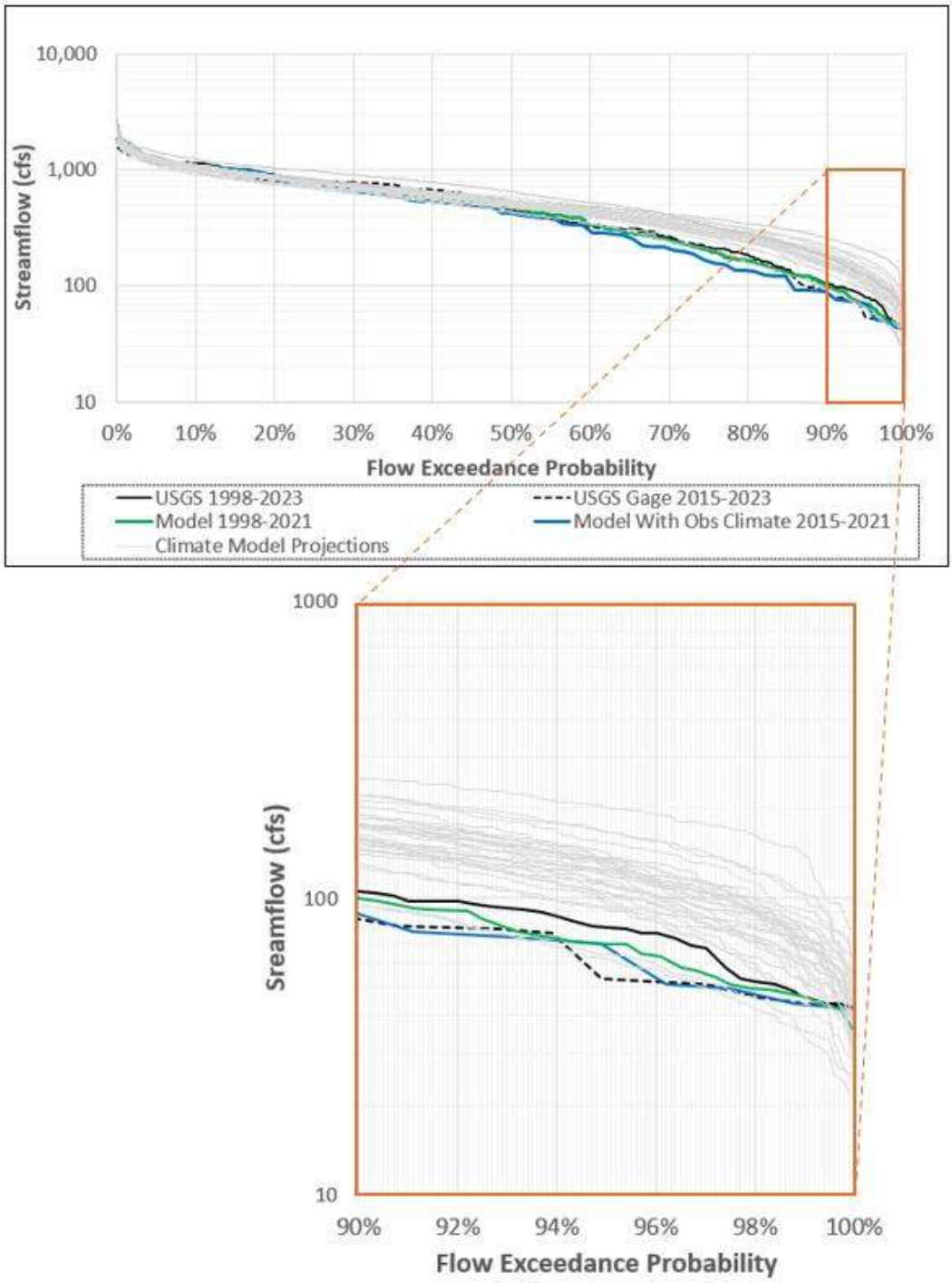


Figure 3-9: Future Projections of Climate-Induced Streamflow Changes in the Taunton River

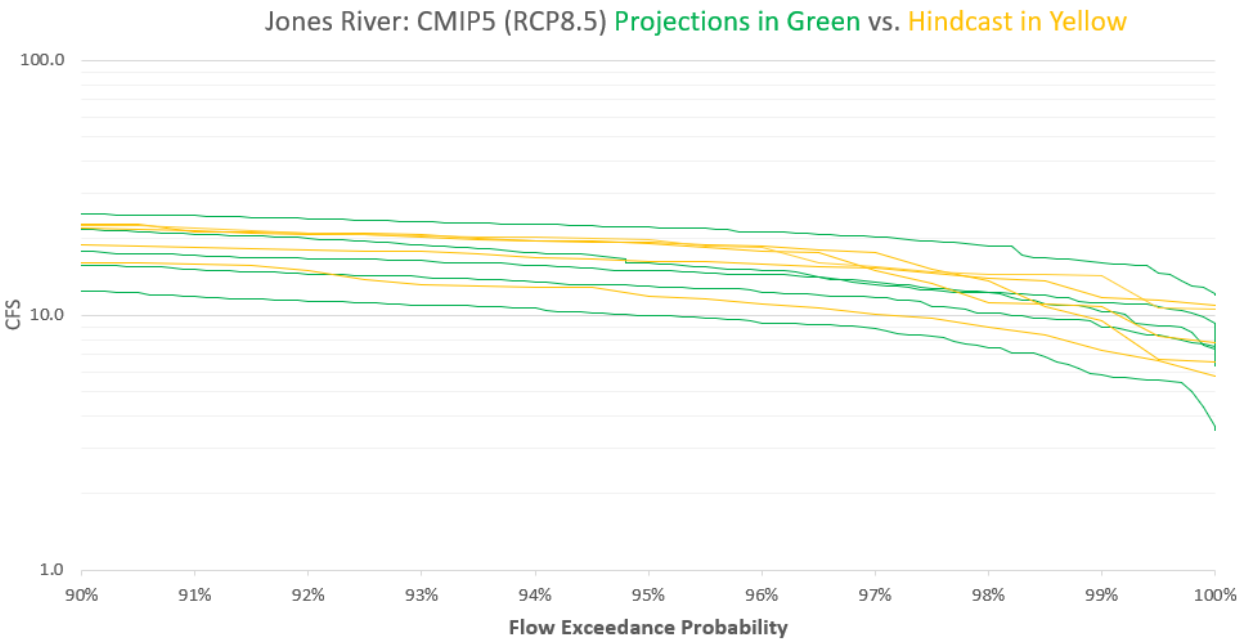


Figure 3-10: Future and Past Simulation of Climate-Induced Low Natural Baseflow in the Jones River

3.4.1 Future Drought

Drought is a concern for many of the stakeholders. Drought is a complex phenomenon that is difficult to monitor and define. In Massachusetts, the Drought Management Task Force monitors conditions within the state and assigns drought conditions by region. These different State assigned conditions are defined as listed in **Table 3-4**. MassDEP defines essential uses as using water a) for health or safety reasons; b) by regulation; c) to produce food and fiber; d) for the maintenance of livestock; or e) to meet the core functions of a business. Nonessential uses are those other than essential uses.

Table 3-4: Definitions of State Drought Conditions and the Associated Restrictions

State Drought Condition	Nonessential Outdoor Water-Use Restrictions
Level 1 (Mild Drought)	1 day per week watering, after 5 pm or before 9 am
Level 2 (Significant Drought)	Limit outdoor watering to handheld hoses or watering cans to be used only after 5 pm or before 9 am
Level 3 (Critical Drought)	Ban on all nonessential outdoor water use
Level 4 (Emergency Drought)	Ban on all nonessential outdoor water use

While the State's characterization of drought conditions are based off many different factors, droughts are typically characterized by prolonged periods of abnormally low rainfall. Additionally, increases in temperature can increase evaporation of water, so drought conditions can be exacerbated during summer months. In the development of this plan, it was deemed important to consider how drought conditions might affect the OCPC region in the future, and whether this is a major driver for future water supply planning. This section summarizes information provided by the National Climate Assessment as well as analysis conducted by CDM Smith.

The National Climate Assessment provides a comprehensive and authoritative overview of the current and projected impacts of a climate variability across the United States. This report indicates that the Northeast region of the US is anticipated to see more flooding due to high intensity rain events. It also cites that the frequency of droughts in the northeast has decreased from 1901 to 2015, although not as much as would have been expected given the region's increase in average precipitation (Krakauer et al. 2019). While drought frequency has decreased, average annual temperatures and days with extreme heat have increased. This report highlights the need for additional methods for being able to understand and estimate the intensity and frequency of droughts, as there is much uncertainty with projecting future droughts. As future temperatures increase, the water-carrying capacity of the atmosphere increases, changing rainfall patterns and intensifying rainfall events. This may mean that while there is a wetter future projected for this region, the cycle between flooding and droughts become more pronounced. There are other references that have developed future analysis for drought for Massachusetts including MA Drought Management Plan, NOAA State Climate Summary for MA, ResilientMass, and MA Climate Change Assessment. These reports indicate that there is large uncertainty and that droughts may get worse. The analysis for these reports focuses on the increase in temperature and less so the future increase in projected precipitation.

In addition to reviewing existing reports for future climate trends for drought, CDM Smith has applied a patent-pending statistical analysis to assess future likelihood of meteorological droughts. There are different definitions for droughts, including meteorological hydrological, agricultural and socioeconomic droughts. A meteorological drought can lead to these types of droughts and is associated with a period of dry weather that lasts longer than normal.

This section presents the results of CDM Smith's analysis. This analysis agrees with the National Climate Assessment, projecting that the region will experience a wetter future, with higher annual precipitation as well as more frequent intense rainstorms. It goes into more detail with projecting drought than the National Climate Assessment did, focusing specifically on this region as well as looking at the severity and the duration of different droughts. This analysis uses data from the National Oceanic and Atmospheric Administration's weather data gauge in Plymouth (USC00198367) along with hindcast and forecast from Coupled Model Intercomparison Project Phase 5 (CMIP5) general circulation models 5 to model changes to meteorological drought. Similar to the analysis of future water availability in **Section 3.4.1**, this analysis leveraged the future emission scenario described by Representative Concentration Pathway 8.5. Meteorological drought occurs when a region is dominated by reduced precipitation and there is a rainfall deficit. This analysis considers future drought frequency, duration, and severity of meteorological droughts, as defined:

- **Severity** is how intense a drought is, measured in inches of precipitation deficit compared to historically observed conditions.
- **Duration** is how long a meteorological drought lasts.

Different time horizons were used for this analysis, as shown in **Table 3-5**.

Table 3-5: Time Horizons Used in Drought Analysis

Time Horizon	Years
Historical	1950–1999
Future	2050–2099

For these time horizons, statistics were developed for different durations of meteorological droughts using stochastic timeseries. Results of future changes to meteorological droughts for different durations (3, 6, 12, and 24 months) are shown in **Figure 3-11**. The severity of meteorological droughts is anticipated to approximately halve for all the different durations. While there is much uncertainty with climate models, these results indicate that the risk from drought to water resources in the region is anticipated to decrease by the end of the planning horizon. This indicates that drought may not be a critical driver for future water supply planning.

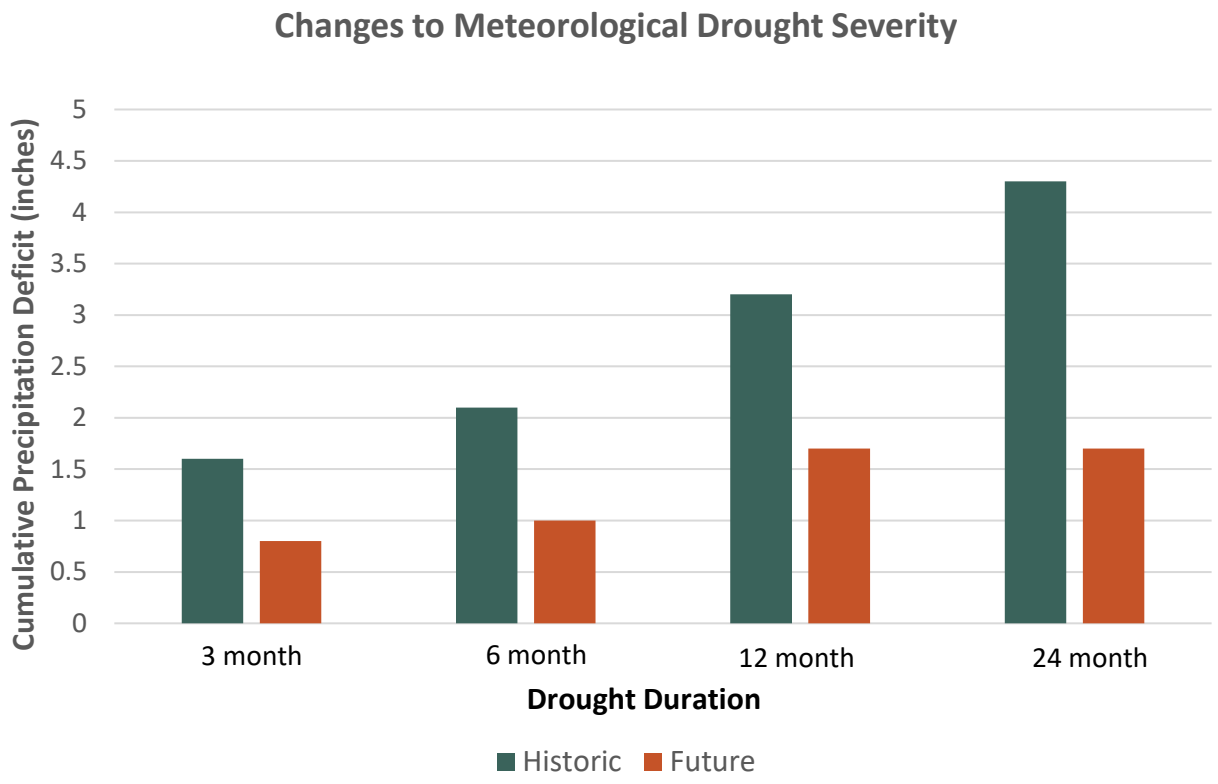


Figure 3-11: Changes to Meteorological Drought Severity in the Old Colony Region for Different Drought Durations

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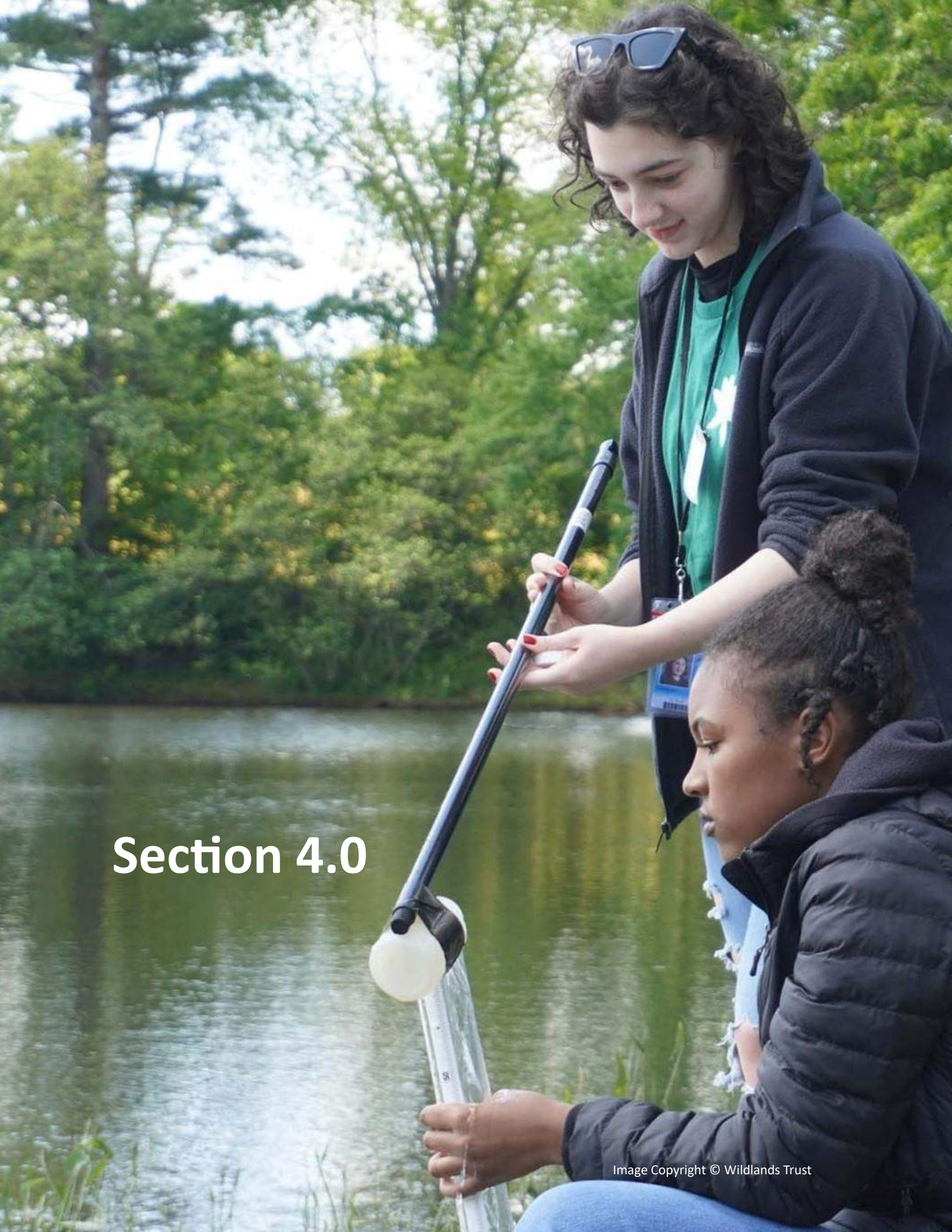

4.0 Stakeholder and Public Engagement

4.1 Collaborative Planning

The planning process for this Old Colony Regional Water Plan has been consensus-driven from the beginning, with active participation and collaboration from dozens of stakeholders who have contributed more than 1,500 hours of their time. In preparing its application to the U.S. Economic Development Administration for a planning grant, OCPC engaged stakeholders across the region who provided letters supporting the initiative:

- All 17 municipalities in the Old Colony region: Abington, Avon, Bridgewater, Brockton, Duxbury, East Bridgewater, Easton, Halifax, Hanover, Hanson, Kingston, Pembroke, Plymouth, Plympton, Stoughton, West Bridgewater, and Whitman
- The three largest watershed associations in the region: Taunton River Watershed Alliance, Jones River Watershed Association, and North and South Rivers Watershed Association
- The three largest chambers of commerce in the region: Metro South Chamber of Commerce, South Shore Chamber of Commerce, and Plymouth Area Chamber of Commerce
- Fifteen state legislators: Senator Michael Brady, Senator Susan Moran, Senator Patrick O'Connor, Senator Walter Timilty, Senator Marc Pacheco, Senator John Keenan, State Representative Matthew Muratore, State Representative Gerard Cassidy, State Representative Josh Cutler, State Representative William Galvin, State Representative Kathleen LaNatra, State Representative Joan Meschino, State Representative Carol Doherty, State Representative Allison Sullivan, State Representative Susan Williams Gifford
- Central Plymouth County Water District Commission
- Narraganset Bay Estuary Program
- Plymouth Economic Development Foundation
- Watershed Action Alliance of Southeastern Massachusetts

Once funding was secured, these partners were encouraged to collaborate with OCPC on the development of a scope of work that was included in the Request for Proposals from qualified consultants that was issued in August 2023. CDM Smith and their partners, Regina Villa Associates, Alliance for Water Efficiency, and University of Massachusetts at Amherst, were awarded the contract.

The planning process included monthly meetings and workshops with the Steering Committee (all open to the public) as well as interviews with municipal staff and other stakeholders, focus groups with stakeholders with common interests, a public survey of households in the region, and three public presentations at which the general public was consulted on the draft plan. A project webpage was created on OCPC's website and project updates were issued twice-a-month through OCPC's public newsletter. In addition, OCPC's governing Council, which is made up of appointed representatives from each municipality in the region, was regularly updated on project progress.

Figure 4-1 illustrates how the technical analysis and resulting plan were driven by and used to inform people making water management decisions.

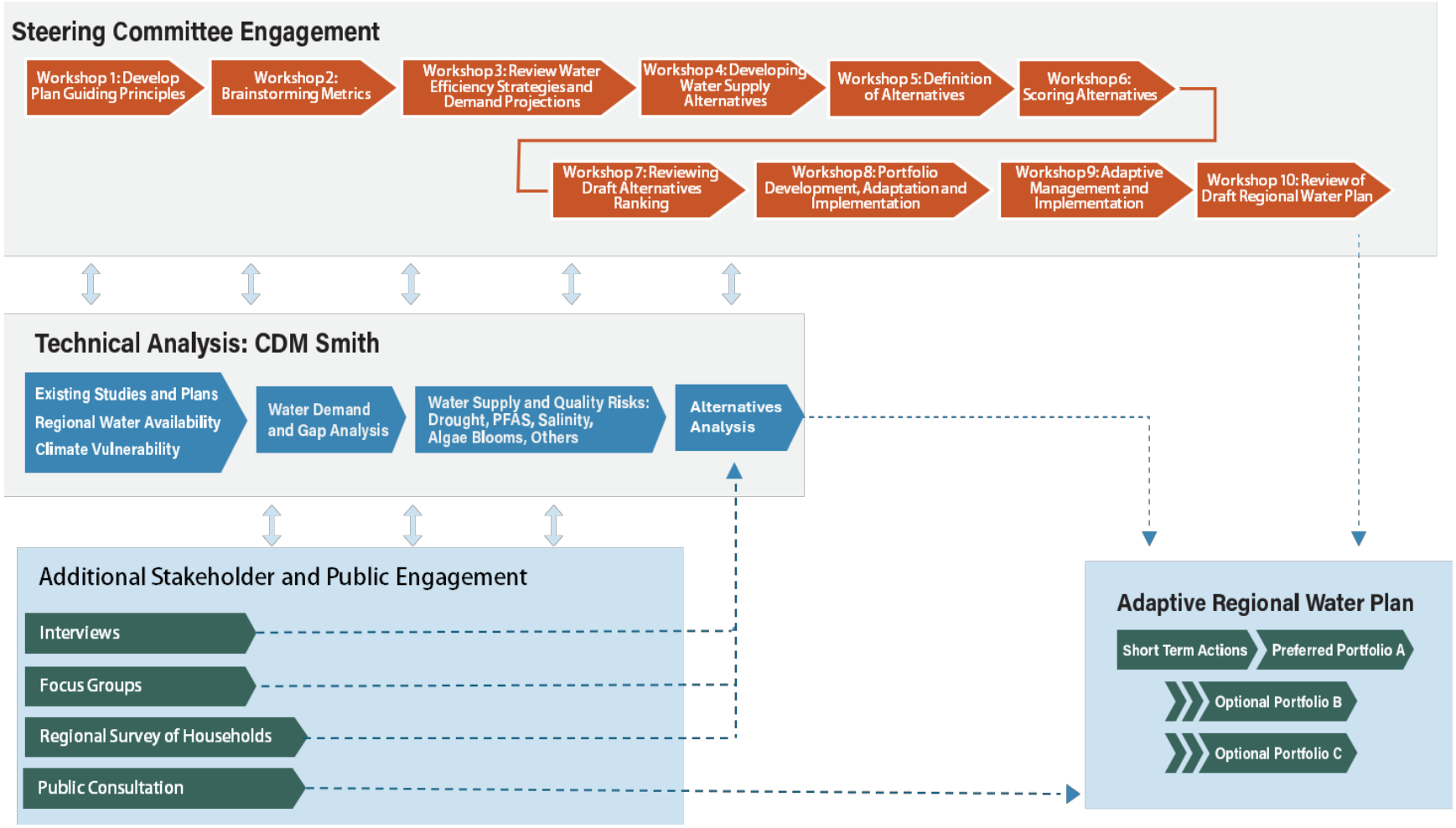

Figure 4-1: Old Colony Regional Water Plan Process

4.2 Steering Committee

A Steering Committee was formed to oversee the work of the consultants and participate actively in the development of the regional plan. The committee took no formal votes since the process was consensus-driven, meaning the group worked together to develop a plan that everyone could support. **Table 4-1** lists committee members and other participants who regularly collaborated with members at committee meetings. Minutes from these public meetings are included in **Appendix F**.

Table 4-1: Steering Committee

Affiliation	Title	Name
Municipalities (Members)		
Abington	Town Planner	Liz Shea
	Town Manager	Scott Lambiase
Avon	Town Administrator	Jonathan Beder
Bridgewater	Town Planner	Shane O'Brien
	Town Engineer	Greg Tansey
Brockton	Commissioner, Department of Public Works	Pat Hill
Duxbury	*Vacant*	
East Bridgewater	Director of Public Works	John Haines
Easton	Deputy Director of Public Works	Greg Swan
Halifax	*Vacant*	
Hanover	*Vacant*	
Hanson	*Vacant*	
Kingston	Town Planner	Val Massard
	Town Administrator	Keith Hickey
	Vice Chairman, Kingston Water Commission	Bob Erlandsen
	Water Superintendent	Chris Veracka
Pembroke	Water Superintendent	Dan Sullivan
Plymouth	Water Superintendent	Peter Gordon
	Water and Wastewater Engineer	Kendra Martin
Plympton	Open Space Committee Member	Gavin Murphy
	Conservation Agent	Brian Vasa
Stoughton	Water and Sewer Superintendent	Phil McNulty
West Bridgewater	Water Superintendent	Wayne Parks
Whitman	Water/Sewer Superintendent	David Lemay

Affiliation	Title	Name
Funding Partners (Members)		
Central Plymouth County Water District Commission	Commissioner	Art Egerton
	Consultant to the Commission	Kim Groff
State Senator Michael Brady, representing state legislators in the region who helped secure a state appropriation	State Senator	Michael Brady
	Chief of Staff	Al DeGirolamo
South Shore Chamber of Commerce/South Shore Economic Development Corporation	Executive Director (retired)	Peter Forman
Narragansett Bay Estuary Program	Executive Director	Darcy Young
Other Members		
Jones River Watershed Association, representing watershed and environmental organization interests	Executive Director	Pine duBois
	Ecology Program Director	Jimmy Powell
Massachusetts Cranberries (Cape Cod Cranberry Growers Association), representing agricultural interests	Executive Director	Brian Wick
Old Colony Planning Council	Resilience and Sustainability Planner	Bill Napolitano
	Director of Economic Development	Don Sullivan
	Senior Planner, Comprehensive Planning and Sustainability	Joanne Zygmunt
Other Participants (Non-members)		
Massachusetts Department of Conservation and Recreation	Water Resources Planner	Jason Duff
Massachusetts Department of Environmental Protection	Program Chief, Water Management Program	Duane LeVangie
	Regional Engineer, Bureau of Water Resources	Jon Hobill
Massachusetts Division of Marine Fisheries	Diadromous Fish Project Leader	Brad Chase
	Marine Fisheries Research Biologist	John Sheppard
U.S. Environmental Protection Agency	Region 1 New England	Margherita Pryor
Metropolitan Area Planning Council	Environmental Planning Director	Martin Pillsbury
Southeastern Regional Planning and Economic Development District	Environmental Planning Manager	Danica Belknap

The Steering Committee collaborated on the development of this plan through a structured process of identifying high priority actions for the short- and long-term, both for the region and for individual municipalities. Through meetings and workshops, members helped:

- Develop the guiding principles, objectives, and metrics that make up the alternatives decision framework.
- Identify and define alternatives and variations.
- Evaluate and compare local and regional water management alternatives.
- Provide input on implementation, decision points, and monitoring data available to support future decisions.

4.3 Interviews

Interviews were conducted with municipal staff and other stakeholders to collect additional data and discuss their views, needs, and concerns related to water (**Table 4-2**). Among the topics discussed were with municipal staff were the following:

- Water supply vulnerabilities
- Challenges with regulatory compliance
- Projects underway, planned, or thought about
- Perception and knowledge of water availability and demand
- Water as a priority in the community
- Operational and staffing limitations
- Financial and other constraints

Table 4-2: Interviews with Municipal Staff

Affiliation	Title	Name	Date of Interview
Town of Abington	Town Manager	Scott Lambiase	May 16, 2024
	Town Planner	Liz Shea	
Town of Avon	Town Administrator	Jonathan Beder	May 17, 2024
Town of Bridgewater	Town Planner	Shane O'Brien	May 24, 2024
	Town Engineer	Greg Tansey	
City of Brockton	City Mayor	Robert Sullivan	July 30, 2024
	Director of Government Affairs	Celia H. Canavan	
	Director of Public Works	Pat Hill	
Town of Duxbury	Director of Public Works	Sheila Sgarzi	May 21, 2024
	Water and Wastewater Superintendent	Mark Cloud	
	Town Manager	Rene Read	
Town of East Bridgewater	Director of Public Works	John Haines	June 14, 2024
	Town Administrator	Charlie Seelig	
	Water Superintendent	Jason Trepanier	
Town of Easton	Deputy Director of Public Works	Gregory Swan	July 23, 2024
	Director of Public Works	David Field	
	Operations Manager	Richard Tierney	
Town of Halifax	Town Administrator	Town Administrator	May 10, 2024
	Water Superintendent	Bill Lindsey	
Town of Hanover	Deputy Water Superintendent	Neal Merritt	May 23, 2024
Town of Hanson	Water Superintendent	Jerry Davis	July 17, 2024
Town of Kingston	Water Commissioner	Bob Erlandsen	July 23, 2024
Town of Pembroke	Water Superintendent	Dan Sullivan	May 22, 2024
	Town Manager	Bill Chenard	

Affiliation	Title	Name	Date of Interview
Town of Plymouth	Water and Wastewater Engineer	Kendra Martin	May 29, 2024
	Water Superintendent	Peter Gordon	
Town of Plympton	Town Conservation Agent	Brian Vasa	May 28, 2024
	Town Conservation Agent	Gavin Murphy	
Town of Stoughton	Water and Wastewater Superintendent	Phil McNulty	June 5, 2024
	Assistant Town Engineer	Craig Horsfall	
Town of West Bridgewater	Water Superintendent	Wayne Parks	May 24, 2024
Town of Whitman	Town Administrator	Kathy Keefe	June 26, 2024
	Water and Wastewater Superintendent	David Lemay	

Findings from these interviews reveal that municipalities within the Old Colony region are facing significant water-related challenges, some of which are shared across multiple municipalities while others are locally unique. Most interviewees expressed concern about PFAS, with several towns already taking proactive measures to remove PFAS. Some interviewees highlighted their concerns of the rising costs associated with treatment.

Other key concerns raised during the interviews included the impacts of a changing climate, state laws and regulations seeking to increase housing development, aging infrastructure, and population growth. Several communities expressed concern about water availability as the population increases, with a small number indicating a desire to limit future growth to manage water demand. To address ongoing trends in rising water demand and potential for future increases, some municipalities are developing additional wells or planning to soon. A few interviewees raised concerns about the potential impact of Multi-Family Zoning Requirement for MBTA Communities, although the majority did not foresee significant effects on water usage.

Regional collaboration through interconnections with neighboring municipalities or purchasing desalinated water from Brockton or water from the MWRA emerged as a recurring theme among interviewees seeking long-term water security. However, several communities indicated satisfaction with their current operations and did not anticipate pursuing regional water supply or interconnections soon.

Additional stakeholders were interviewed for this project, listed in **Table 4-3**. These included interviews with state regulators, MassDEP and DCR, with conversations focused on understanding existing regulations, methodologies used for DCR's water needs forecasts, and grant opportunities for water suppliers. Massachusetts Cranberries was also interviewed, to understand cranberries growers typical water needs and interest in the plan. A chairlady from the Herring Pond & Wampanoag Tribe was interviewed to understand the cultural significance of water and ecosystem health of the region to the tribe.

Table 4-3: Additional Stakeholders Interviewed

Affiliation	Title	Name(s)	Date of Interview
Massachusetts Department of Environmental Protection	Water Management Act Program Chief	Duane LeVangie	March 26, 2024, June 12, 2024, and July 15, 2024
Massachusetts Department of Conservation & Recreation	Office of Water Resources	Jason Duff, Erin Graham, Sara Cohen, Anne Carroll	March 26, 2024, and July 15, 2024
Massachusetts Cranberries	Executive Director	Brian Wick	August 7, 2024
Herring Pond Wampanoag Tribe	Chairlady	Melissa (Harding) Ferretti	October 2, 2024

4.4 Focus Groups

Focus groups were held with private well owners, watershed and environmental organizations, and agricultural interests to inform development of this plan. **Table 4-4** summarizes major themes arising from the focus groups and how these have been addressed within the plan. As a result of these themes, six specific additional strategies have been added to **Section 6.0**:

- Support Public Health and Raise Awareness
- Provide Access to Safe Water for Private Well Owners – Connections to Public Water Supply
- Improved Monitoring and Continued Education and Advocacy for Streamflow Protection and Drought Resiliency
- Conduct an Integrated Ecological Assessment and Pursue Improvements
- Secure Redundant Water Supplies for Agriculture
- Expand Support for Agricultural Water Use Efficiency with Grants for Research and Implementation

Further details for each of these strategies are included in **Section 6.0**.

Table 4-4: Major Themes from Focus Group Discussions

Date	Major Themes	How this was Incorporated into the Plan
Private Well Owners in Plymouth and Plympton		
June 15, 2024	Attendees requested that water conservation and demand management be included as a goal of the plan.	Water conservation and demand management are included as recommendations in this plan.
	Attendees felt that the water plan needs to acknowledge the age of infrastructure and the impact new municipal well installation may have on private well owners.	With reference to new municipal wells, language has been included to acknowledge the need for assessing impacts to private wells since both draw from the same source.
	Attendees highlighted the need to understand how much flushing is happening in ponds and the link between nutrients and harmful algal blooms.	This is identified as a data gap, and a recommendation is included to address it.
	Attendees requested more PFAS education for town officials and residents, and mentioned they were not receiving any information about PFAS from their towns.	This has been included as a recommendation: Access to Safe Water for Private Well Owners – Education.
	Attendees recommended towns enforce outdoor water use restrictions for private well users since straws were being dipped into the same cup.	This has been included as a recommendation for municipalities to consider Registration Holders and Private Well Outdoor Water Use Restrictions Local Bylaws.
Watershed and Environmental Organizations		
July 31, 2024	Attendees recommended continuations of a regional approach to water management moving forward.	This is addressed by the formation of the Old Colony Regional Water Resources Committee that will support the implementation of this plan.
	Attendees recommended that restoration be pursued using multiple avenues, including prioritizing native plantings and increasing connectivity.	This is addressed by the recommendation for municipalities to consider Water Efficiency and Ecosystem Health Bylaws.
	Attendees identified a data gap: tracking unique microspecies in Plymouth ponds and the impacts of new development on these microspecies.	This was not included in the plan because it was thought to be beyond its scope.
	Attendees requested that water conservation and demand management be included as a goal of the plan and felt there is a need for more public education.	Water conservation and demand management are included as recommendations in this plan.
	Attendees felt there is a need to change the Water Management Act (WMA) to prevent overuse of water.	It was noted that Massachusetts Rivers Alliance is actively advocating for changes. This was not included as a recommendation in this plan because the Steering Committee and consultants did not undertake any in-depth analysis of the WMA in relation to this region.
	Attendees highlighted the need for municipalities to promote green infrastructure and low impact development to reduce impervious areas, minimize pollution of surface waters, and help alleviate flooding.	Recommendations are included in the plan.
	Attendees recommended more public education, including non-municipal events where the public can learn about the environment and water resources and talk about concerns.	Recommendations are included in the plan.

Date	Major Themes	How this was Incorporated into the Plan
Agricultural Interests		
September 18, 2024	Attendees noted concern over changes to the water cycle impacting agriculture, including increased extreme rainfall and recent droughts.	This has been included in the plan: Redundant Water Supply for Agriculture.
	Attendees shared many relevant resources for the plan: ▪ Natural Resources Conservation Service provides financial assistance for projects for farmers. ▪ UMass Extension Vegetable Program as a great resource for cover cropping and low-till farming. ▪ U.S. Department of Agriculture offers funding for wells, though typically only for new irrigation systems. ▪ U.S. Department of Agriculture Farm Services Agency helps with water for livestock when droughts are declared.	These resources have been included in **Section 6.**
	Attendees highlighted the need to consider food safety regulations when considering additional water supplies for agriculture.	These considerations have been incorporated into the Redundant Water Supply for Agriculture Strategy.
	Attendees highlighted innovative agricultural practices that could be mentioned in the plan: ▪ Micro-irrigation and soil moisture sensors to efficiently use water. ▪ Cover cropping and low-till farming.	This information has been incorporated into the Support Agricultural Water Use Efficiency Strategy.
	Attendees discussed different considerations for redundant water supplies for agricultural users, including surface water, groundwater, tailwater recovery ponds, and connections to municipal water. Attendees felt that specific water supply will be case dependent for each agricultural operation.	This information has been incorporated into the Redundant Water Supply for Agriculture Strategy.

4.5 Regional Survey of Households

Between October 2024 and January 2025, OCPC conducted a survey of households in the region asking about water use and related opinions. Questions were both broad—for example, asking participants whether they use private well water or municipal supply—and more specific, such as personal opinions about whether water suppliers and the state are doing enough on water. The goals of the survey were to help characterize public perceptions of local and regional water issues so that future outreach can be more targeted, and to help the Steering Committee formulate or justify strategies for addressing public concerns.

The questionnaire (**Appendix G**) was made available online through SurveyMonkey in English, Cape Verdean Creole, Haitian Creole, Spanish, and Portuguese. Participation was encouraged through traditional media and social media, physical flyers in municipal buildings in the region, other outlets, and word of mouth. **Figure 4-2** shows the flyer used to promote the public survey.

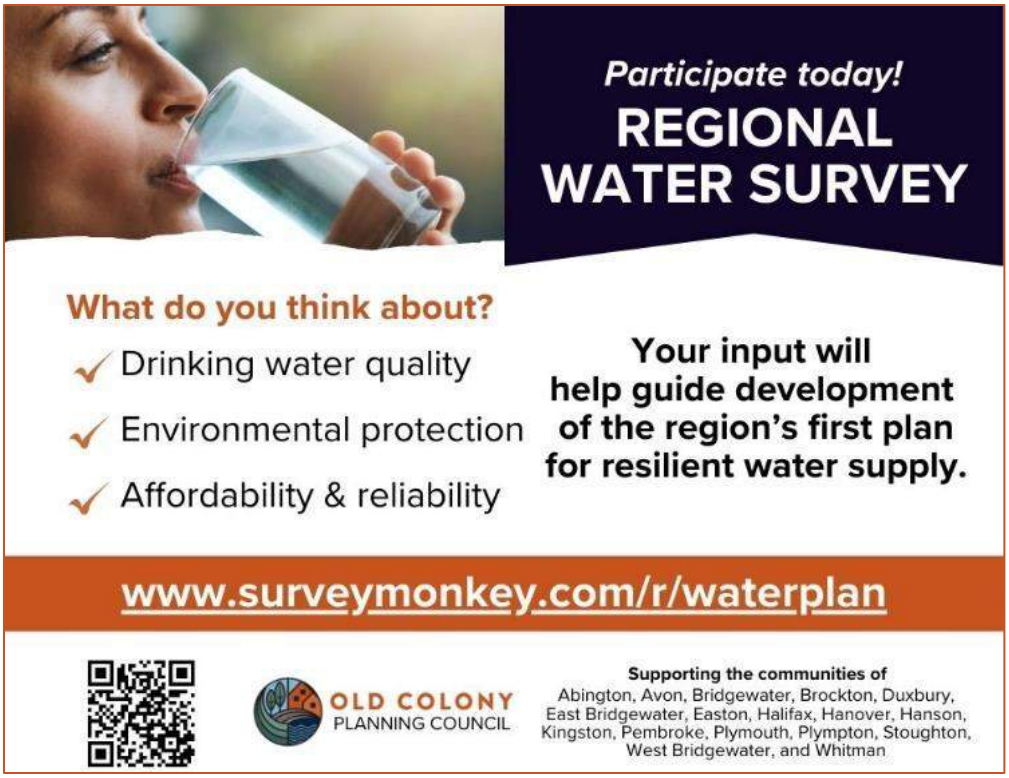

Figure 4-2: Regional Water Plan Survey Promotional Flyer

The full list of questions asked in the survey, along with specific details for every question are included in **Appendix G**. This section provides an overview of the findings, starting with the demographics of survey respondents, then detailing the results for households using public water supply and private wells, and concluding with analysis of general survey comments.

4.5.1 Demographics of Survey Respondents

In total, 1,526 responses were received across various demographic groups. Included is a summary of key demographic information of the respondents.

- **Age Distribution:** A significant portion of respondents (41%) were above the age of 65, followed by age ranges 55-64 (21%), 45-54 (15%), 35-44 (13%), 25-34 (5%), with the remainder preferring not to disclose their age.
- **Living situation:** The majority of participants were homeowners (92%), with the remainder being renters (5%), preferring not to say (2%), or having some other living situation (1%).
- **Living with children:** Most respondents do not live with any children under the age of 18 (69%), while 28% do live with children and 3% prefer not to say.
- **Race:** The majority of respondents were white (83%), followed by those preferring not to say (13%), multiracial respondents, (1%), Hispanic respondents (1%), Black respondents (1%), and less than 1% of respondents identifying as Asian or Pacific Islander, Native American or Alaskan Native or listing a race that was not listed.

- **Gender:** A significant portion of participants were women (63%), followed by men (28%), those preferring not to say (8%), and less than 1% of those preferring to self-identify or as non-binary participants.
- **Annual Household Income:** A significant number of participants preferred not to say their annual household income before taxes (29%), followed by those making between $100,000 and $199,000 (18%), between $50,000 and $99,999 (18%), more than $200,000 (14%), between $150,000 to $200,000 (13%), between $25,000 and $49,999 (7%), and those making less than $25,000 (2%).
- **Source of water:** 91% of respondents use water supplied by their municipality, while 9% rely on private well water. Since these different groups have different concerns, and responded to different questions, results are presented in separate subsections, **Section 4.5.2** for households on public water supply and **Section 4.5.3** for households on private wells. The responses closely mirror the actual trends in source of water for residents, with 93% of the population estimated to rely on municipal water and 7% to rely on private well water.
- **Geographic Location:** The survey respondents were primarily from Bridgewater (261 participants), Plymouth (223 participants), and Duxbury (183 participants). Other notable locations included Abington (129), Pembroke (127), Easton (113), Brockton (98), and East Bridgewater (93). Smaller numbers of respondents were from Stoughton (51), Halifax (49), Plympton (33), Kingston (31), Hanson (30), Avon (14), Whitman (14), West Bridgewater (8), and Hanover (4). Additionally, 65 respondents specified other locations. **Figure 4-3** shows the geographic locations of survey participants visually.

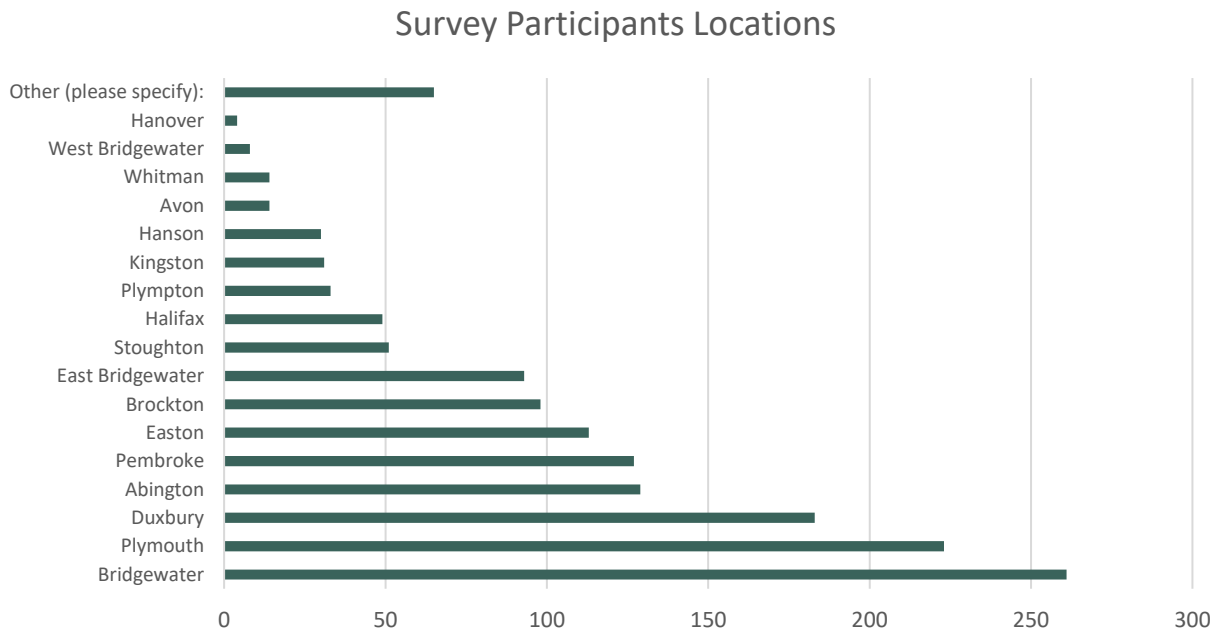

Figure 4-3: Survey Participants Locations

4.5.2 Results for Households on Municipal Water Supply

A total of 1393 survey participants, or 91%, rely on municipal water supply as their source of water. This section presents the results for these participants.

Additional home filtration and treatment - In Massachusetts, public water suppliers must inform residents if their water doesn't meet safety standards and provide annual water quality reports. If there are no notifications, the water is safe to drink. Some homeowners choose to add extra filtration or treatment to improve taste, odor, color, hardness, or softness. Survey results showed:

- 36% use a fridge with a filtered water dispenser.
- 32% don't use additional filtration.
- 24% use a water filtering pitcher.
- 13% have a kitchen sink filtration system.
- 8% have a whole home filtration system.
- 4% use other treatments
- 2% have a whole home water softener.
- 1% don't know if they have additional treatment.

Some participants use multiple filtration devices. Out of 1393 survey participants on public water supply, 854 use additional filtration or treatment. Most (78%) do this for safety or health reasons, 55% for taste, 29% for smell, 28% for color or clarity, and 19% to reduce hardness.

Communications from Public Water Suppliers - The two primary communications from public water suppliers to their customers are the Annual Water Quality Report and water bills. 56% of respondents using public water supply indicated that they received, read, and understood their Annual Water Quality Report, while 22% didn’t receive it or were not sure if they saw it, 16% received and read it but didn’t understand it, and 6% received it but didn’t read it. Another question asked about water billing for residents, about specific statements shown in **Figure 4-4.** A majority (53%) tended to agree or strongly agreed that they would pay more for their water utility bill to protect and improve the environmental health of their water supplies.

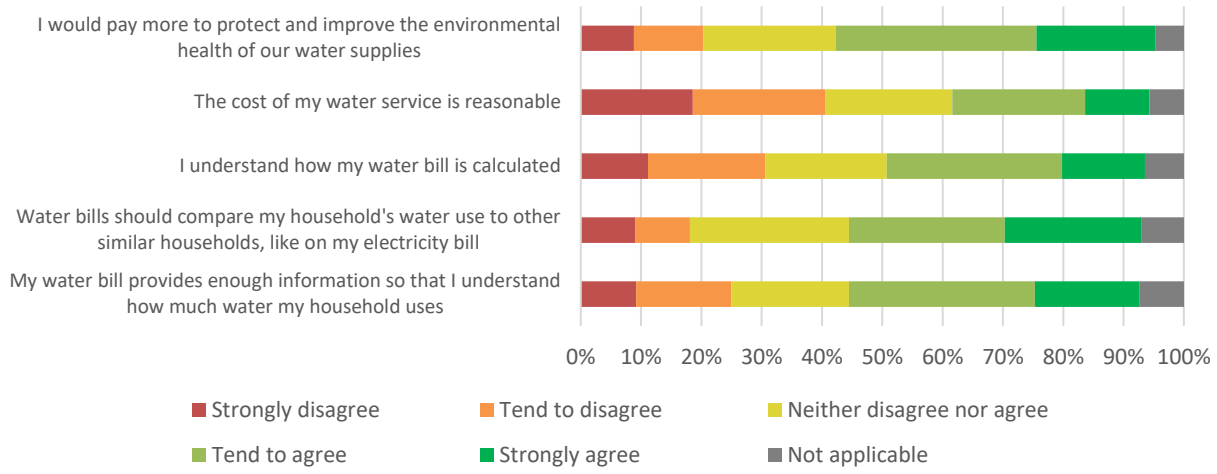

Figure 4-4: Results for survey question on water billing

Water Quality, Reliability and Affordability –Residents on public water supply rated their tap water's affordability, reliability, and quality, as shown in **Figure 4-5**. Reliability received the highest ratings, with 67% rating it as good, very good, or excellent. Water quality received the lowest ratings, with 60% rating it as poor or fair. In another survey question, 42% of participants believed water quality had worsened over the past three years, while 40% thought it had stayed the same. Residents can contact their municipalities about water-related issues. In the past year, 80% had not contacted their municipalities, 18% had, and 2% were unsure. Of those who contacted their municipality, 62% did so due to water quality issues.

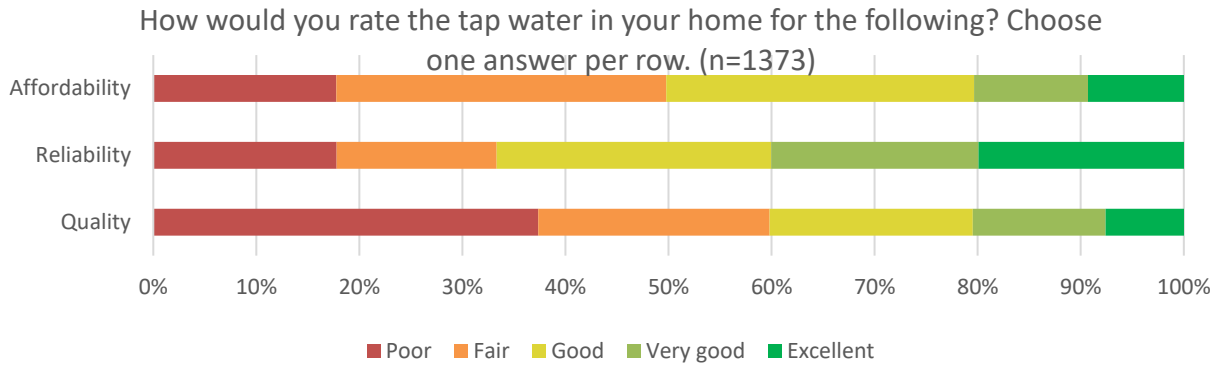

Figure 4-5: Resident's on public water supply survey responses to ranking affordability, reliability and quality

Main concerns with water – when asked how concerned they were about different water related issues, respondents highlighted most concern about the contamination of water sources and aging water infrastructure. Detailed results can be seen in **Figure 4-6**.

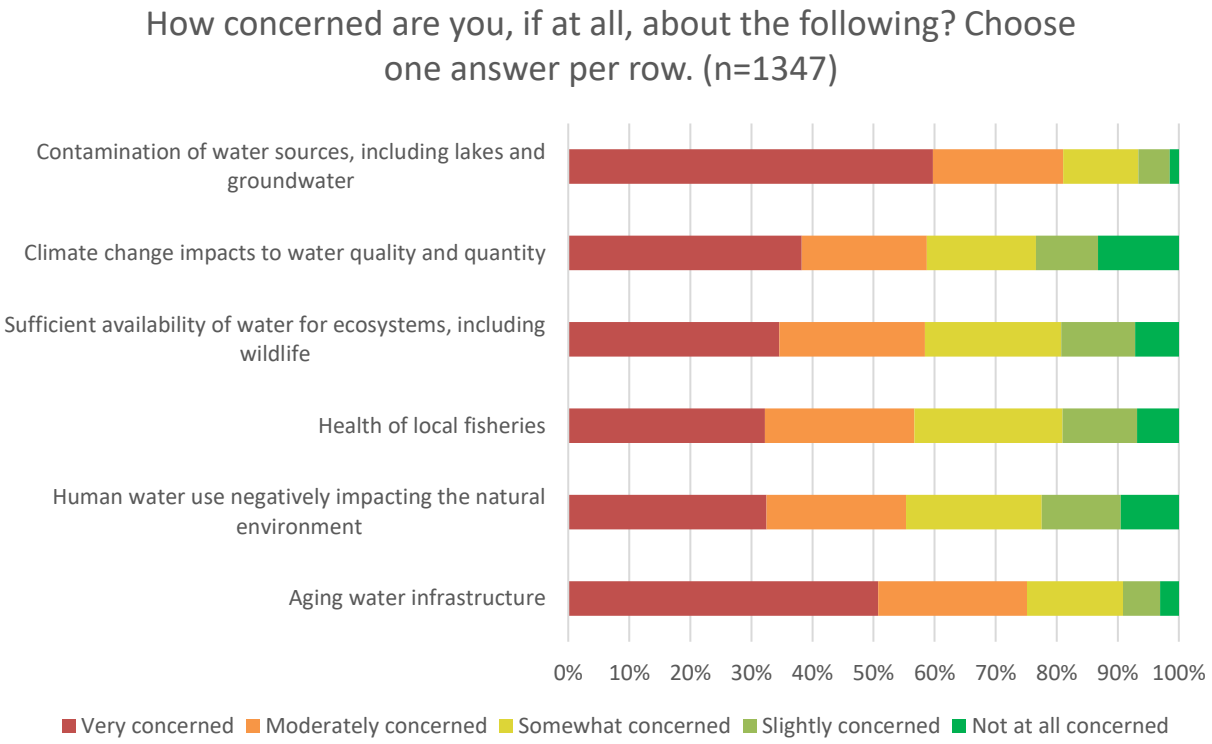

Figure 4-6: Resident's concern over different water related issues.

Government Action – Many residents on public water supply believe their municipality isn't doing enough to protect natural water sources (44%), help households conserve water (48%), or repair and upgrade aging water infrastructure (51%). Regarding the state government, 56% of respondents think it's not doing enough to protect natural water sources, 55% believe it's not helping households conserve water adequately, and 63% feel the state isn't sufficiently repairing and upgrading aging infrastructure.

Table 4-5 synthesizes major themes from the survey results for residents that are on public water supply and outlines how these themes are addressed in this Regional Water Plan.

Table 4-5: Major Themes from Resident's on Public Water Supply Survey Responses and Incorporation Into this Plan

Major Themes	How this was Incorporated into the Plan
A majority (53%) agreed that they would pay more for their water utility bill to protect and improve the environmental health of their water supplies.	Integrated planning such as that outlined in the Integrated Ecological Assessment and Improvements strategy in **Section 6.0** has been included.
Public perception of water quality is low, with 42% of survey participants believing water quality had worsened over the past three years.	There is a need for clear communication from public water suppliers about water quality to rebuild public perception for water quality. The Collaborate Regionally on Communications strategy in **Section 6.0** has been included.
Residents expressed concern around contamination of water resources and aging water infrastructure.	**Section 6.0** includes strategies for the region to address contamination concerns, i.e. treatment upgrades, new wells. Additionally, the success of the regional plan will rely on individual municipalities maintaining their own water infrastructure to adequately serve their community.
Residents expressed concern that local and state government was not doing enough to protect water resources or conserve water.	**Section 6.0** provides strategies for the local and state government to implement and further address these themes: Conservation (Water Efficiency Strategies, Water Loss Reporting, Water Education, Rate Studies) and Protection of Water Resources (New Wells, PFAS Treatment, Use of Desalinated Water, Improved Monitoring and Continued Education and Advocacy for Streamflow Protection and Drought Resiliency)

4.5.3 Results for Households on Private Wells

A total of 133 survey participants, or 9%, rely on private wells as their source of water. This section presents the results for these participants.

Sources of water – responses from private well users that participated in the study show that a majority of private well owners (82%) use their private well water for all activities including drinking, cooking, other indoor uses, outdoor watering, and other outdoor uses. Some private well owners used purchased bottled water for drinking (28%) and for cooking (10%). Additionally, some private well owners (14%) use collected rainwater for outdoor watering. Some survey participants indicated that they use multiple sources for activities.

Well Water Quality – 32% of private well owner survey participants had tested their water more than 3 years ago, 16% had tested 1 to 3 years ago, 22% had tested it within the last year, 15% had not tested their well, and 15% weren't sure if their well water quality had been tested. For those who indicated they had not tested their well water quality, 33% hadn't tested it because they were unsure who to contact, 22% felt that testing/treatment was too expensive, 17% were not concerned about quality or safety, 17% had other reasons and 11% were planning to but hadn't gotten around to it. The majority of survey participants with private wells had not tested for PFAS (40%) or didn't know if they had (37%). 17% had tested for PFAS and 6% were planning to. The survey did not ask for the results of PFAS testing and whether values exceeded state PFAS standards.

Well Water Availability – Private well owners were asked if they had observed changes in the volume of water available, and 31% indicated that they had. **Figure 4-7**. includes some descriptions.

Connection to Public Water Supply – many private well owners are not interested in connecting to public water supply (43%), while 27% indicated they would be interested if it was available at a reasonable cost, and 24% indicted that they might consider it. 6% weren't sure if they would consider connecting to public water supply.

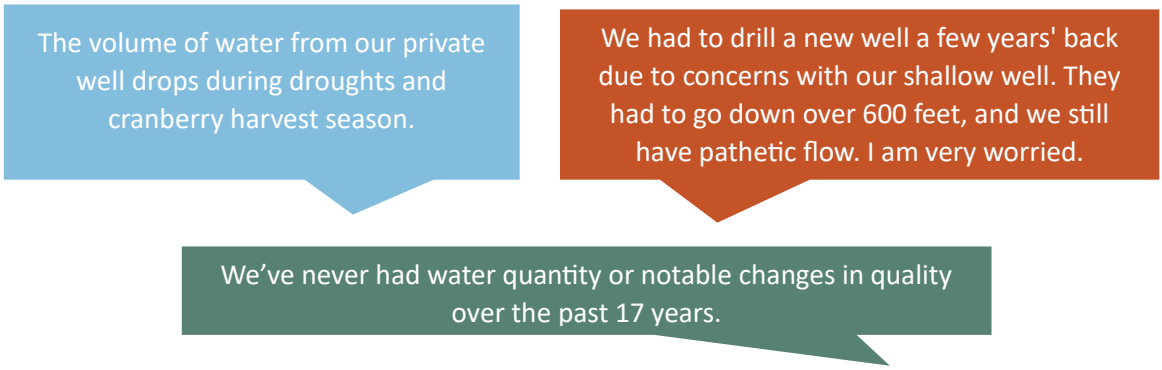

Figure 4-7: Quotes from private well owners who participated in the survey when asked about changes to the volume of water from their private well.

The survey results from the private well owners were used to inform the recommended strategies in **Section 6.0** of this Regional Water Plan. **Table 4-6** highlights themes from private well owners and how they were incorporated into this plan.

Table 4-6: Major Themes from Private Well Owner's Survey Responses and Incorporation Into this Plan

Major Themes	How this was Incorporated into the Plan
Survey participants highlighted the need for clear communication about water quality testing resources and potential financial support for testing and home treatment, especially for PFAS with 77% having not tested or unsure if they had tested for PFAS.	**The Supporting Public Health and Awareness for Drinking Water Quality in Wells strategy included in Section 6.0 focuses on increasing awareness for drinking water quality for private well owners.**
There is a need to consider some number of private well owners transferring to public water supply, as 17% indicated they would be interested and 31% have noticed changes in volume of water from their private wells.	**Section 6.0 discusses a strategy for Access to Safe Water for Private Well Owners- Connection to Public Water Supply which provides details for municipalities to prepare for potentially increasing number of service connections to support private well owners access public water supply.**

4.5.4 Qualitative Analysis of Resident Concerns

Survey participants, including both residents on public water supply and those on private well water, were asked to share any other concerns they had related to water. 486 survey participants responded to this open ended question, with recurring themes such as water quality, infrastructure and maintenance failures, overdevelopment of water resources, regulatory and government accountability issues, and solutions presented by participants. More details for each of these themes are provided.

4.5.4.1 Water Quality and Safety Concerns

- PFAS Contamination is a top concern, with residents from multiple municipalities reporting being advised not to drink their tap water. Many are forced to buy bottled water despite paying for municipal water.
- Brown, rusty, or discolored water is another concern, with residents complaining of ruined laundry, staining, and sediment buildup in plumbing.
- Strong chlorine smells and chemical-like tastes were reported, leading to concerns about over-treatment and whether the water is safe to consume.
- Lead and other harmful contaminants were reported in older water supplies. Some municipalities sent warnings about possible lead pipes but offered no solutions.
- Odors and bacterial issues were reported, including sulfur smells, iron bacteria, and algae growth in home water supplies.

4.5.4.2 Infrastructure and Maintenance Failures

- Residents report concerns that aging water mains and pipes are failing, contributing to frequent brown water issues and water main breaks. Many municipalities have not replaced old infrastructure despite rising water bills.
- Hydrant flushing was cited as a major cause of discolored water, with residents complaining about a lack of notice before flushing events.
- High water bills despite poor quality service is a recurring frustration, with some residents demanding refunds or bill reductions.
- Low water pressure in certain neighborhoods and supply disruptions due to system failures were reported.

4.5.4.3 Overdevelopment and Water Resource Protection

- Overdevelopment is a significant concern from survey respondents. Many fear that new housing developments (especially under MBTA/3A mandates and 40B laws) are overburdening already strained water supplies.
- Residents in rural areas worry that large cities extracting water from shared resources (e.g., Brockton using Silver Lake) are draining local aquifers.
- Sand mining and deforestation were repeatedly mentioned as threats to aquifers, with concerns that these activities reduce natural water filtration and increase pollution risks.
- Calls for stricter zoning and conservation policies to protect water resources, including limits on new wells, irrigation systems, and commercial water extraction.

4.5.4.4 Regulatory and Government Accountability Issues

- Frustration with state and municipal inaction—many feel their municipalities are not addressing water safety concerns and lack transparency about testing results and contamination levels.
- Concerns over misleading public communication, particularly around water safety notices and policies. Some municipalities advised that water is safe while simultaneously issuing PFAS warnings.
- Requests for better enforcement of environmental laws, particularly around septic system failures, illegal sand mining, and industrial pollution.
- Concerns over fairness—some residents pay high taxes but receive no water service, rely on wells, or are forced to buy bottled water due to contamination.

4.5.5 Qualitative Analysis of Resident Recommendations

Residents also provided recommendations for solutions to some of their concerns in the open ended question in the survey. A qualitative analysis of recommendations resulted in the following synthesized list:

- Better testing and transparency, including frequent public updates on water safety, PFAS mitigation, and infrastructure projects.
- More funding for infrastructure upgrades, including lead pipe replacements, water filtration improvements, and aging pipe replacements.
- Increased access to safe drinking water stations, with expanded hours to serve residents who work standard shifts.
- State intervention in regional water issues, including coordinating municipal water supplies, limiting excessive withdrawals, and investigating pollution sources.
- More incentives for water conservation, such as tax breaks for homeowners installing infiltration systems or rainwater collection.
- Greater accountability for polluters, including businesses contributing to PFAS contamination and companies engaged in excessive groundwater extraction.

4.6 Public Consultation

Three public presentations of the draft Regional Water Plan were made:

- April 28, 2025, 6:30 to 8 pm, in person in at Plymouth Town Hall, XX members of the public attended.
- May 1, 2025, 6:30 to 8 pm, virtual, XX members of the public attended
- May 6, 2025, 6:30 to 8 pm, XX members of the public attended.

This section will summarize key takeaways from these public discussions and document how recommendations and requests were incorporated into the final plan.

Mouth of Jones River at low tide looking South.

Section 5.0

5.0 Water Supply and Water Efficiency Alternatives and Recommended Best Practices

Some public water suppliers assumed water demands would increase in the future prior to the start of this project. However, the demand analysis conducted and summarized in **Section 3.0** projected that water demand across the Old Colony region will decrease between 2025 and 2050. Despite this projected decrease, the Steering Committee identified risks to the security of water supply in the region that needed addressing. These risks include water quality impairments such as PFAS, climate impacts, deterioration of ecological health, sea level rise, aging infrastructure, housing development, uncertainties in Water Management Act permit renewals, and uncertainties in future regulations. Coupled with official state-issued demand projections, some of which have not been updated since 2015, that indicate the potential for increased demands, these risks require water suppliers in the region to take individual and coordinated action to improve water security. This section describes the decision-making process the Steering Committee underwent to identify, analyze, and develop alternatives to improve water security in the Old Colony region.

A decision-making framework was used to evaluate the alternatives relative to stakeholder-defined objectives, risks, and municipal preferences. The Steering Committee met monthly over a year and participated in facilitated workshops. Through consensus, the Steering Committee identified goals and objectives, created metrics to measure these, developed alternatives, applied the framework to identify preferred alternatives, and then combined preferred alternatives into implementation and adaptation plans. **Figure 5-1** summarizes workshop themes:

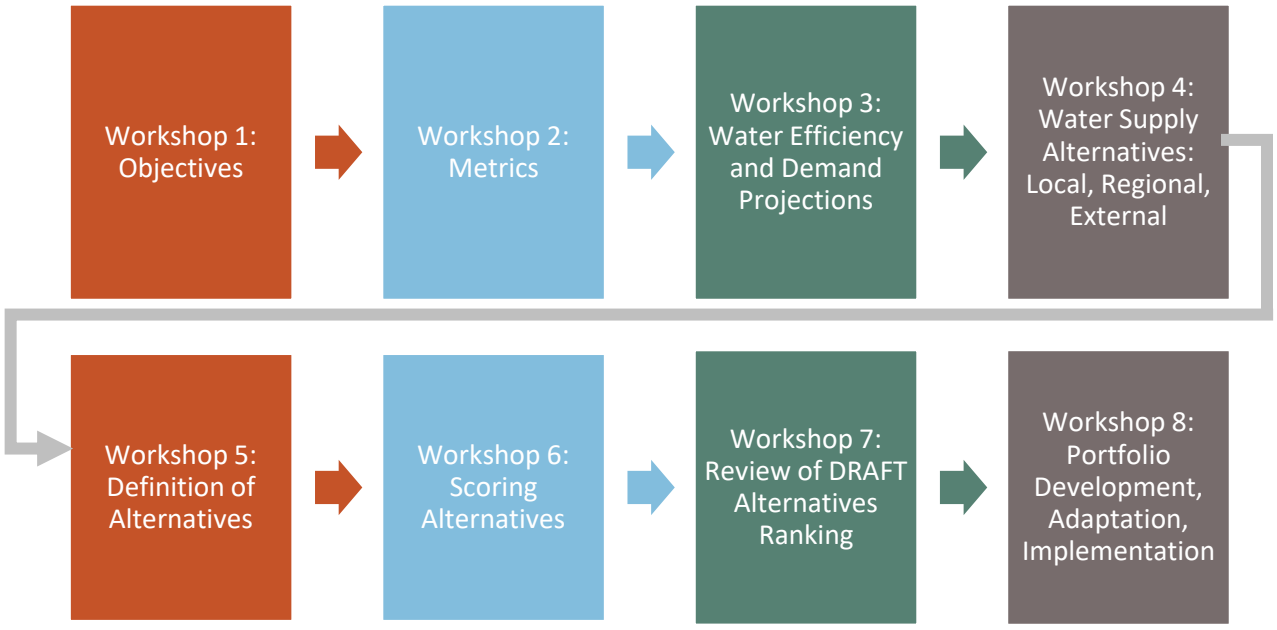

Figure 5-1: Workshops to Develop a Decision-making Framework

Guiding principles were developed that represented stakeholders' core values for the plan. The Steering Committee's guiding principles include:

- Recommend sustainable water supply strategies that balance the social, environmental, and economic needs of the region.
- Align with values of good stewardship and wise use of water.
- Reflect the limits of natural resources and current/anticipated regulations.
- Incorporate uncertainties so implementation of recommendations can adapt over time.
- Strive for fairness within and among communities.
- Produce a list of early-win projects that can be aligned with available outside funding.

The guiding principles, objectives, metrics, and weightings make up the decision framework used to compare alternatives. The decision framework was developed prior to developing alternatives, helping to understand what a successful alternative would accomplish without being biased to specific projects. The evaluation of alternatives requires an objective, transparent, and repeatable process. The approach used to score alternatives for this plan is based on multi-criteria decision analysis (MCDA), a proven method to clearly see performance and trade-offs. The following terms are often associated with this ranking method:

- **Alternatives**: Represents either individual options or portfolios of options
- **Objectives**: The collective standard by which alternatives can be compared and ranked, directly representing the stated objectives of the stakeholders
- **Metrics**: Indices, aligned to the objectives, that indicate performance of alternatives, or potential progress toward objectives
- **Weights**: Importance of objectives relative to each other

In addition to the MCDA analysis, a risk assessment and interviews with municipal staff influenced the decision-making process for which alternatives are recommended in the Regional Water Plan. The schematic in **Figure 5-2** summarizes these three pillars of decision making used in the selection of alternatives.

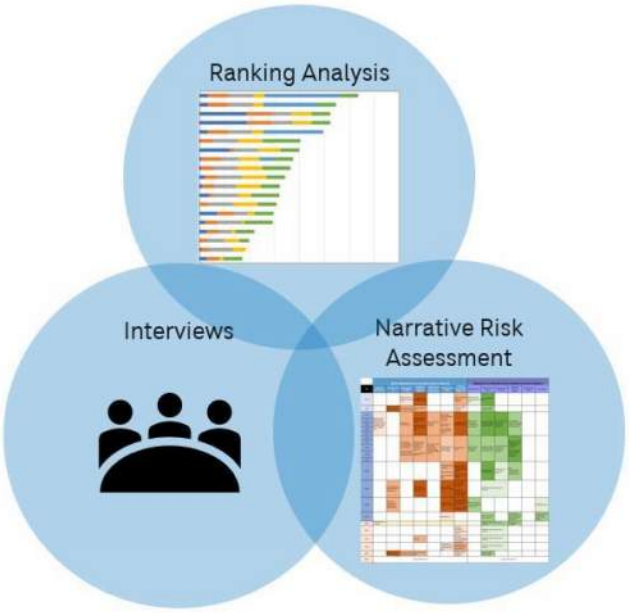

Figure 5-2: Decision Making Process

5.1 Objectives and Metrics

The Steering Committee developed objectives that alternatives in this plan should aim to meet (which are derived, in part, from the objectives for the planning process itself, explained in **Section 1.3**). One or more metrics were assigned to each objective to gauge performance of the alternatives. The metrics had to be measurable either quantitatively or qualitatively. Values for the quantitative metrics were calculated and the committee developed qualitative scores for each alternative as part of Workshop 5. **Table 5-1** presents the objectives and metrics used to evaluate alternatives for this plan. **Appendix E** presents the metric scores for each alternative.

Table 5-1: Objectives and Metrics Used to Evaluate Alternatives

Objective		Metric	Metric Measurement
Reliable municipal supply	Meet all current and future peak water demands with strategies for climate resilient supply and demand.	Annual average new supply added, or demand reduced	Quantified MGD yield (highest = best score)
Ecological health	Improve ecosystem health.	Connectivity of natural waters	1–5 score (1 = worst and 5 = best) 1 = major detrimental impact, 2 = minor detrimental impact, 3 = neutral impact, 4 = minor positive impact, and 5 = major positive impact
		Quantity and/or quality of natural waters at the right time for ecological needs	
		Reduction in withdrawal from Silver Lake	0/1 binary score (0 = worst and 1 = best) 0 = no reduction and 1 = reduction
Cost-effectiveness	High benefit to cost value.	Unit capital cost per volume of water provided or demand reduced	$/1,000 gallons (lowest = best score)
Innovation	Consider innovative and alternative solutions such as stormwater capture, wastewater reuse, and water use efficiency.	Volume supplied or demand reduced that is considered innovative	Quantified MGD yield (highest = best score)
Fairness	Promote fairness between communities.	Percentage of EJ census block groups served by alternative	Quantified percentage (0 = worst and 100 = best)
		Percentage of EJ census block groups impacted by construction	
Drinking water quality	Meet current and future drinking water quality standards.	Volume of PFAS-impacted supply reduced	Quantified MGD yield (highest = best score)
		Reduction in long-term water quality risk	1–3 score (1 = worst and 3 = best) 1 = high uncertainty for long-term risk of quality with emerging contaminants, 2 = neutral risk, and 3 = low risk of future water quality concerns (MWRA and desalination)
Efficiency and adaptability	Encourage sustainable water use to meet the needs for housing and economic prosperity.	Flexibility in phasing and supply capacity	1–3 score (1 = worst and 3 = best) 1 = low flexibility in time or volume, 2 = high flexibility in time or volume, and 3 = fully able to meet anticipate future needs
		Implementation feasibility	1–3 score (1 = worst and 3 = best) 1 = high difficulty in implementation, 2 = moderate difficulty in implementation, and 3 = high difficulty in implementation

5.2 Alternatives and Best Practices

To improve water security in the region, the Steering Committee developed a suite of alternatives that include new supplies, water efficiency strategies, policies, ecosystem health projects, and education and outreach. In this report, an alternative represents either individual options or portfolios of options. Alternatives were developed based on learnings from the interviews, recommendations from past studies and reports (**Appendix A**), and a workshop in June 2024 at which committee members answered the following questions:

1) What are you committed to right now and in the next five years?
2) Longer term, do you feel there is a need for water redundancy for drought, cybersecurity, short-term issues, or other concerns? Are you open to the following?
    a) Purchasing water from the Massachusetts Water Resources Authority
    b) Water from the desalinization plan in Dighton
    c) Municipal interconnections
    d) Reclaimed water for non-potable use
    e) Other
3) What are actions that your organization would like to see included in this regional water plan?

The Steering Committee refined the alternatives through discussions at the next two workshops. Through discussions, the Steering Committee agreed that some alternatives were better described as best practices that should be recommended in this plan without the need for prioritization or comparison to other alternatives. Best Practice Recommendations are presented in **Section 5.2.1**.

Alternatives were grouped into short-term or long-term based on whether they could realistically be implemented in the next five years. The focus of the alternatives is on the addition of water supply or the reduction in demand for water in the region. These are included in **Section 5.2**.

5.2.1 Best Practice Recommendations

The Steering Committee determined that some alternatives were better described as best practices that should be recommended in this plan without the need for prioritization or comparison to other alternatives. Each of these best practices could be pursued simultaneously and would not conflict with one another. **Table 5-2** summarizes these recommendations, which are further detailed in **Section 6.0**.

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Table 5-2: Best Practice Recommendations

Best Practice	Report Section	Brief Description
Support Public Health and Raise Awareness of Water Quality among Private Well Owners	6.1.A.	Implementation of this strategy could include a public education and awareness campaign with voluntary testing. Municipal policies and regulations could apply to properties that are redrilling wells, conducting significant renovations, being newly developed, or being sold.
Introduce Policies and Regulations to Reduce the Waste of Water and Improve Ecosystem Health	6.1.B.	This strategy includes consideration of several policies and regulations that could be implemented locally: ▪ Native, drought-resistant landscaping policies and regulations. ▪ Non-essential outdoor water use restrictions for municipalities with registrations and private well owners ▪ Water demand offset requirements and/or mitigation programs for new development
Improve Local Bylaws for Water Smart Land Use and Integrate into Planning Efforts	6.2.H.	Decisions that planning staff and boards make about land use have a profound effect on water availability and quality. Mass Audubon's free Bylaw Review Tool helps municipalities evaluate local zoning, site plan review, subdivision rules and regulations, stormwater and/or low-impact development bylaws, and cluster or open space residential design bylaws.
Conduct an Integrated Ecological Assessment and Pursue Improvements	6.2.I.	An integrated ecological assessment to identify the primary ecological and flow needs within the Old Colony region would help address the balance between water resources, ecosystem health, and the sustainable management of aquatic habitats. Specific areas of focus would include: ▪ Ecosystem evaluation and ecological flow needs ▪ Lake and reservoir management strategies ▪ Identification and removal of migratory impediments
Secure Redundant Water Supplies for Agriculture	6.2.K.	This strategy involves implementing any combination of alternative water supply options for agricultural use to support the long-term goal of offering farmers redundant water supplies to ensure resiliency during drought and other unexpected events.
Expand Support Agricultural Water Use Efficiency with Grants for Research and Implementation	6.2.L.	This strategy uses grants to research and implement improvements to agricultural water demand management to increase the resilience of local agricultural operations while minimizing the impact on water resources quantity and quality.
Regional Coordination on PFAS Management and Funding	6.2.M.	This strategy seeks to support municipalities with compliance for PFAS regulation applicable to municipal water supplies and boards of health supporting private well owners dealing with PFAS.
Conduct Regular Rate Studies	6.4.R	This strategy was based on recommendations made by the Alliance for Water Efficiency as part of the development of this Regional Water Plan. To sustain operations, finance system expansion, upgrade infrastructure, and ensure equitable cost distribution, water rates should be reviewed and adjusted regularly, every 3-5 years.

5.2.2 Alternatives

Table 5-3 summarizes the alternatives considered and the municipalities they apply to. Local alternatives are those that would be implemented by individual organizations; regional alternatives would require collaboration between two or more organizations. Full details of each alternative are presented in **Appendix E**, which includes a description of the alternative, key assumptions, yield (in terms of new supply or demand reduced), cost, and risk considerations. It should be noted that there are multiple alternatives considering different communities accessing Aquaria desalination water, Alternatives ST-6 through ST-8. The difference in these alternatives is the communities served by the alternative. Additionally, there is a short-term alternative for installation of new municipal wells (ST-5) as well as a long-term alternative (LT-2). The short-term alternative (ST-5) includes communities that are in the process of developing a new well, while the long-term alternative (LT-2) considers any communities that might implement an additional well in the future. These alternatives were evaluated using the objectives and metrics developed by the Steering Committee. Results for the scoring analysis is presented in **Section 5.3**.

5.3 Scoring Process

With support from the Steering Committee, CDM Smith evaluated how the alternatives scored for each of the objectives and metrics. Results of this analysis are presented in **Table 5-4**.

Table 5-3: Summary of Alternatives Explored by the Steering Committee

Category	ID	Alternative	Possible Applicability To	Alternative Description
SHORT-TERM ALTERNATIVES (Implementable within five years)				
Local	ST-1	Conduct, Validate, and Act on Annual American Water Works Association Water Loss Audits	All municipalities except Plympton (where there is no municipal supply)	This option improves understanding of water supplier water losses through the adoption of the American Water Works Association's (AWWA) water audit method, which may be an improvement over the unaccounted-for water (UAW) methodology used by the State of Massachusetts. It involves conducting water loss audits through the AWWA M36 methodology and free water loss audit software, verifying results through trained third parties, and establishing performance metrics to reduce actual water losses. Municipalities will take corrective actions to address losses identified in the audit.
	ST-2	Offer Rebates to Customers for Leak Detection Devices	All municipalities except Plympton (where there is no municipal supply)	For utilities without AMI or seeking further customer-side leak reduction solutions, this option offers rebates or discounts for leak detection devices, such as flow measurement attachments, utility meter attachments, and in-line monitoring systems like Droplet, Flume, and Flo.
	ST-3	Install Advanced Metering Infrastructure (AMI)	All municipalities except Plympton (where there is no municipal supply)	This option promotes Advanced Metering Infrastructure (AMI) adoption to improve utility programs for reducing resident-side leaks. AMI enables a resident portal with analytics, leak notifications, and bill payments, along with a separate leak notification program through email or text.
	ST-4	Improve Water Billing through Increasing Block Rate Designs or Billing Intervals	Abington, East Bridgewater, Halifax, and Whitman	This option adjusts increasing block rates with monthly billing to reflect peak demand costs better and promote sustainable water use. Updated pricing and block structures, tailored to each utility's demand profile, will help capture usage patterns and benefit low- and moderate-income customers. A rate consultant is recommended for the transition.
	ST-5	Install New Municipal Wells for Public Supply	Bridgewater, Hanson, Kingston, Pembroke, and Plymouth	This alternative considered the work already being done by Bridgewater, Kinston, Hanson, Pembroke, and Plymouth to develop new wells. These municipalities have identified one or more potential well sites and have commenced the surveying of each site and/or acquiring permits from MassDEP. The anticipated completion of these wells is within three to 10 years. The next steps are for these municipalities to continue with permitting, well testing, environmental impact assessments, design, and construction.

Category	ID	Alternative	Possible Applicability To	Alternative Description
Regional	ST-6	Aquaria Desalination 1	Abington, Avon, Brockton, Easton, and Hanson	The Aquaria Desalination Plant in Dighton is currently contracted to supply water to the City of Brockton, which draws occasionally on this regional resource. The plant is estimated to generate up to five million gallons of PFAS-free water daily, with the potential for increased output after additional investments. The full production capacity of this plant is not utilized and could be leveraged by other municipalities as a new supply option to offset the need for further investment in PFAS treatment. This alternative considered the use of Aquaria Desalination water for Abington, Avon, Brockton, Easton, and Hanson.
	ST-7	Aquaria Desalination 2	Avon, Bridgewater, Brockton, and West Bridgewater	This alternative is the same as ST-6 but considered different communities. In this alternative, Aquaria Desalination water was evaluated for Avon, Bridgewater, Brockton, and West Bridgewater.
Regional	ST-8	Aquaria Desalination 3	Brockton, Duxbury, Halifax, Hanson, and Pembroke	This alternative is the same as ST-6 but considered different communities. In this alternative, Aquaria Desalination water was evaluated for Brockton, Duxbury, Halifax, Hanson, and Pembroke.
LONG-TERM ALTERNATIVES (Implementation beyond five years)				
Local	LT-1	Connect Private Well Owners to Municipal Public Water Supply	All municipalities except Plympton	This strategy seeks to provide support for private well owners facing groundwater contamination, including PFAS and other pollutants. As awareness of these contaminants grows, many well owners may contemplate connecting to their local water distribution systems. Therefore, it is important to assess the potential impacts of these new service connections on water suppliers as this strategy is contingent upon each community water department having enough capacity to supply the new customers. Based on findings from the private well owner focus group and public survey, a complete transition is unlikely, but a partial transition may benefit private well owners facing contamination.
	LT-2	Install New Municipal Wells for Public Supply	Abington, Bridgewater, Brockton, Duxbury, East Bridgewater, Easton, Halifax, Hanover, Kingston, Pembroke, Plymouth, and West Bridgewater	This alternative considers constructing new municipal wells allows communities to grow their water supply capacity or to replace contaminated sources. Steps for well development include land planning and acquisition, site surveying, permitting, well testing, environmental impact assessment, and design and construction. This alternative is considered for Abington, Bridgewater, Brockton, Duxbury, East Bridgewater, Easton, Halifax, Hanover, Kingston, Pembroke, Plymouth, and West Bridgewater.
Regional	LT-3	Massachusetts Water Resources Authority (MWRA) for Entire Old Colony Region with Public Water Supply – Replacing Entire Permitted Amount	All municipalities except Plympton	This alternative proposes connecting the OCPC region to the Massachusetts Water Resources Authority (MWRA) distribution system to provide the entire amount of water permitted under existing Water Management Act (WMA) permits to the communities in the OCPC Region. While this alternative is likely cost prohibitive, it serves as a comparison point for other regional water supply alternatives.
	LT-4	Massachusetts Water Resources Authority	All municipalities except Plympton	This alternative proposes connecting the OCPC region to the Massachusetts Water Resources Authority (MWRA) distribution system to provide the amount of water requested

Category	ID	Alternative	Possible Applicability To	Alternative Description
		(MWRA) for Entire Old Colony Region with Public Water Supply – Supplying Requested Amount		by communities in the OCPC Region. For communities which had not provided a specific request, an estimate was made of their desired amount based on their current use and available sources. While this alternative is likely cost prohibitive, it serves as a comparison point for other regional water supply alternatives.
	LT-5	Massachusetts Water Resources Authority (MWRA) for Municipalities who Indicated Openness to MWRA[1]	Abington, Avon, Bridgewater, Easton, Pembroke, Plympton, and West Bridgewater	This alternative proposes connecting the OCPC region to the Massachusetts Water Resources Authority (MWRA) distribution system to provide water to communities in the OCPC Region which indicated openness to receiving water from MWRA, Abington, Avon, Bridgewater, Easton, Pembroke, Plympton, and West Bridgewater. This alternative would supply the amount of water requested by these communities. For communities which had not provided a specific request, an estimate was made of their desired amount based off their current use and available sources.
Regional	LT-6	Massachusetts Water Resources Authority (MWRA) for Municipalities Actively Exploring MWRA Connection	Abington, Avon, and Hanover	This alternative proposes connecting the OCPC region to the Massachusetts Water Resources Authority (MWRA) distribution system to provide water to communities in the OCPC Region which are actively exploring receiving water from MWRA, Abington, Avon, and Hanover. This alternative would supply the amount of water requested by these communities. For communities which had not provided a specific request, an estimate was made of their desired amount based off their current use and available sources.
	LT-7	Massachusetts Water Resources Authority (MWRA) for Municipalities Bordering Existing MWRA Connection	Avon and Easton	This alternative proposes connecting the OCPC region to the Massachusetts Water Resources Authority (MWRA) distribution system to provide water to communities in the OCPC Region which border an existing connection to MWRA in Stoughton, Avon and Easton. This alternative would supply the amount of water requested by these communities. For communities which had not provided a specific request, an estimate was made of their desired amount based off their current use and available sources.
	LT-8	New Emergency Interconnections	Easton, Plympton, and West Bridgewater	This alternative promotes redundancy and resilience of supply through the addition of new emergency interconnections amongst OCPC neighboring municipalities. By establishing interconnections, neighboring public water suppliers can offer each other additional supply during periods of critical need. This collaboration enhances water security, optimizes resource utilization, and mitigates the risks associated with localized shortages.
	LT-9	Reclaimed Water for Non-Potable Uses	Bridgewater, Easton, Kingston, Plymouth, and agricultural users in all municipalities	This alternative involves communities with existing wastewater treatment plants upgrading their treatment processes to provide advanced water treatment to produce water of suitable quality for non-potable uses. Bridgewater, Easton, Kingston, and Plymouth were among communities who indicated interest in this alternative and have local wastewater treatment. Massachusetts approves the use of reclaimed wastewater for commercial and non-potable application including, but not limited to, toilet flushing, snowmaking, fire protection, car washes, commercial laundries, dust control and street cleaning (MassDEP 2009). Non-potable water may be able to be used for irrigation.

Note:

[1] These municipalities indicated openness to MWRA at Workshop 5. Not every municipality was represented at this workshop, so this alternative may not be inclusive of all municipalities open to MWRA.

Table 5-4: Scoring of Alternatives for each Objective and Metric

Category	Alternative		Applicability to	Reliable Municipal Supply	Ecological Health			Cost Effectiveness	Innovation	Fairness		Drinking Water Quality		Efficiency and Adaptability	
				New Supply Added or Demand Reduced	Connectivity of Natural Waters	Natural Waters at the Right Time for Ecological Needs	Reduction In Withdrawal from Silver Lake	Volume Of Supply Gap Reduced Per Unit Cost	Volume Supplied or Demand Reduced Considered Innovative	% Of EJ Census Block Groups Served	% Of EJ Census Block Groups Impacted	Volume Of PFAS Impacted Supply Reduced	Long-Term Water Quality Risk Reduction	Flexibility	Feasibility
				MGD	Qual 1-5	Qual 1-5	Binary 0/1	$/1,000gal	MGD	%	%	MGD	Qual 1-3	Qual 1-3	Qual 1-3
Long-Term Local Alternatives	LT-1	Access to Clean Water for Private Well Owners – Connection to Public Water Supply	All OCPC communities except Plympton	0	3	3	0	$0.0	0	100	0	0	2	3	1
	LT-2	New Public Wells	Abington, Bridgewater, Brockton, Duxbury, East Bridgewater, Easton, Halifax, Hanover, Kingston, Pembroke, Plymouth, West Bridgewater	17.8	2	2	0	$2.1	0	83	0	0	1	3	1
Long-Term Regional Alternatives	LT-3	MWRA For Entire OCPC Region with Public Water Supply – Replacing Entire Permitted Amount	All OCPC communities except Plympton	42.7	5	5	1	$3.7	0	100	32	0	3	3	1
	LT-4	MWRA For Entire OCPC Region with Public Water Supply – Supplying Requested Amount	All OCPC communities except Plympton	28.4	5	5	1	$4.0	0	100	48	0	3	3	1
	LT-5	MWRA for Communities Who Indicated Openness to MWRA	Abington, Avon, Bridgewater, Easton, Pembroke, Plympton, West Bridgewater	10.4	5	5	0	$4.2	0	7	53	0	3	3	1
	LT-6	MWRA For Communities Actively Exploring MWRA Connection	Abington, Avon, Hanover	4.3	4	4	0	$3.9	0	0	63	0	3	3	1
	LT-7	MWRA For Communities Bordering Existing MWRA Connection	Avon, Easton	3.3	4	4	0	$0.61	0	4	83	0	3	3	2
	LT-8	Interconnections	Easton, Plympton, West Bridgewater	0.0	3	3	0	$3.3	0	21	0	0	2	1	2
	LT-9	Reclaimed Water for Non-Potable Uses	Bridgewater, Easton, Kingston, Plymouth, Agriculture Users in all OCPC communities	1.1	3	3	0	$2.7	1.1	7	0	0	2	1	1

Category	Alternative		Applicability to	Reliable Municipal Supply	Ecological Health			Cost Effectiveness	Innovation	Fairness		Drinking Water Quality		Efficiency and Adaptability	
				New Supply Added or Demand Reduced	Connectivity of Natural Waters	Natural Waters at the Right Time for Ecological Needs	Reduction In Withdrawal from Silver Lake	Volume Of Supply Gap Reduced Per Unit Cost	Volume Supplied or Demand Reduced Considered Innovative	% Of EJ Census Block Groups Served	% Of EJ Census Block Groups Impacted	Volume Of PFAS Impacted Supply Reduced	Long-Term Water Quality Risk Reduction	Flexibility	Feasibility
				MGD	Qual 1-5	Qual 1-5	Binary 0/1	$/1,000gal	MGD	%	%	MGD	Qual 1-3	Qual 1-3	Qual 1-3
Short-Term Local Alternatives	ST-1	Conduct, Validate and Act on Annual American Water Works Association Water Loss Audits	All OCPC communities except Plympton	1.0	4	4	0	$3.2	1.0	100	0	0	2	3	2
	ST-2	Rebates for Leak Detection Devices for Customer-Side Leak Detection	All OCPC communities except Plympton	3.0	4	4	0	$0.58	3.0	100	0	0	2	2	2
	ST-3	Advanced Metering Infrastructure (AMI)	All OCPC communities except Plympton	1.5	4	4	0	$4.7	1.5	100	0	0	2	2	2
	ST-4	Improve Increasing Block Rate Designs or Billing Intervals	Abington, East Bridgewater, Halifax, Whitman	0.51	4	4	0	$0.043	0.51	100	0	0	2	3	3
	ST-5	New Public Wells	Bridgewater, Hanson, Kingston, Pembroke, Plymouth	4.8	2	2	0	$2.7	0	7	0	0	1	3	2
Short-Term Regional Alternatives	ST-6	Aquaria Desalination 1	Abington, Avon, Brockton, Easton, Hanson	5.0	4	4	1	$1.6	5.0	74	83	4.02	3	1	1
	ST-7	Aquaria Desalination 2	Avon, Brockton, Bridgewater, West Bridgewater	5.0	4	4	1	$1.6	5.0	77	87	5.00	3	3	1
	ST-8	Aquaria Desalination 3	Brockton, Duxbury, Halifax, Hanson, Pembroke	5.0	4	4	1	$1.4	5.0	71	89	4.67	3	3	1

Following the scoring of each alternative for each metric, Steering Committee members assigned weights to the objectives. This allowed for comparison of how favorable or unfavorable various alternatives are with respect to each committee member's weightings. This supports the goal of identifying alternatives that address multiple objectives versus those that address a more limited subset of objectives only, or which offer very little progress toward any objectives. The weighting responses were anonymized and summarized in **Table 5-5**. Not every committee member submitted weights. A regional representative score, shown in the far-right column of **Table 5-5**, was developed based on the average of responses received. **Figure 5-3** illustrates the distribution of weightings. While there was general agreement on weightings for ecological health and fairness, there was greater variation in weightings for drinking water quality and reliable municipal supply.

Table 5-5: Objective Weightings

Stakeholders	A	B	C	D	E1	F	G	H1	I	J	K	L	M	N	Representative
Reliable Municipal Supply	35	20	16	0	30/33	25	40	30/27	25	20	25	0	15	20	20
Ecological Health	5	10	10	0	10/11	5	3	10/9	5	10	5	37	5	40	10
Cost-Effectiveness	7	15	23	0	10/11	20	8	10/9	25	10	10	0	15	5	10
Innovation	3	10	6	0	5/6	5	3	15/14	5	5	5	5	5	5	5
Fairness	10	5	11	0	5/6	5	3	13/12	0	14	10	3	5	10	10
Drinking Water Quality	20	20	19	100	20/22	25	40	12/11	25	27	25	47	50	10	30
Efficiency and Adaptability	20	20	15	0	10/11	15	3	20/18	15	14	20	8	5	10	15
TOTAL	**100**	**100**	**100**	**100**	**90/100**	**100**	**100**	**110/100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Note: Two communities' scores did not sum to 100 and were subsequently scaled in the entries to the right.

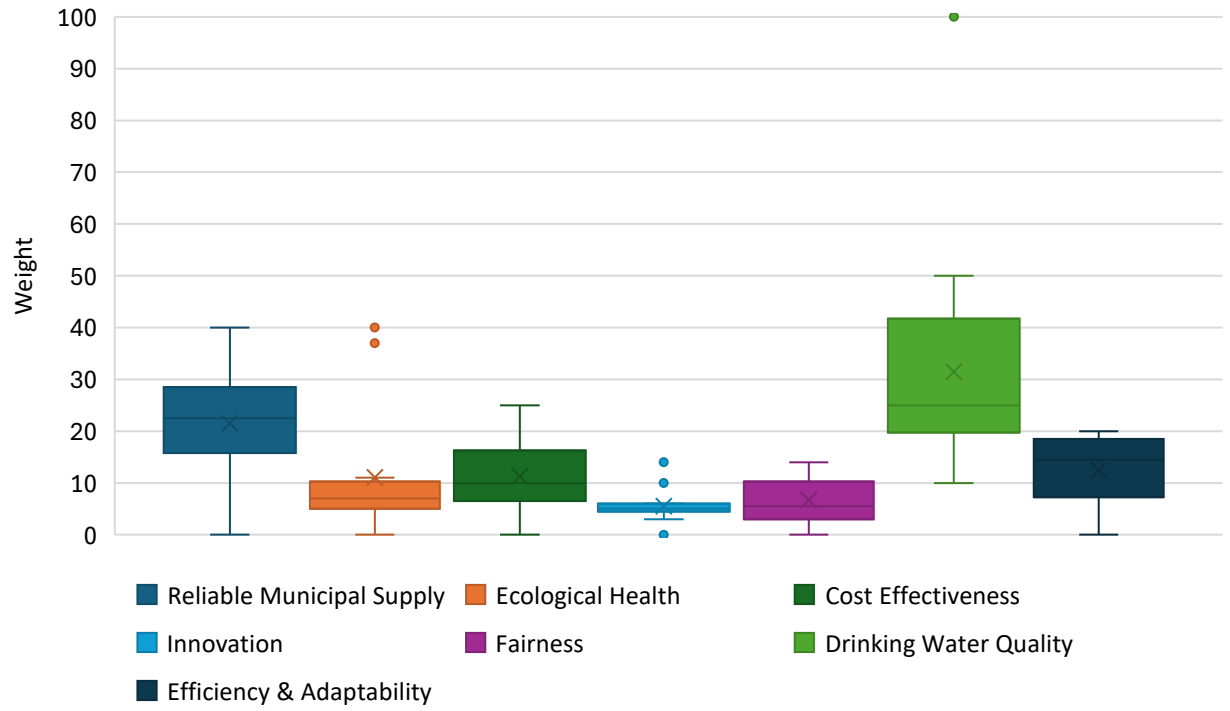

Figure 5-3: Distribution of Steering Committee's Weightings of the Objectives

5.4 Results of Analysis

The metric scores (**Appendix E**) were combined with objective weights shown in **Table 5-5** to develop overall scores for the alternatives using multi criterion decision analysis (MCDA). **Figure 5-4** illustrates the performance of alternatives using the regional representative weighting of objectives shown in the last column of **Table 5-5**. Each bar illustrates the alternative's composite score relative to each objective (shown in separate colors), where the longer the bar the better the performance. The best possible composite score for each objective using the representative weighting is shown in parentheses in the legend, with a maximum total possible score for each alternative of 1.0. The benefit of MCDA is it not only shows the overall rank score but the trade-offs between objectives. For example, Aquaria Desalination 2 and 3 have similar scores as MWRA for All – Permitted Amount, but for different reasons. MWRA for All – Permitted Amount excels in reliable municipal supply because it provides the largest yield of new supply, whereas Aquaria Desalination 2 and 3 excel in drinking water quality because they provide an alternative to local PFAS treatment for participating water supplies and have low long-term water quality risks.

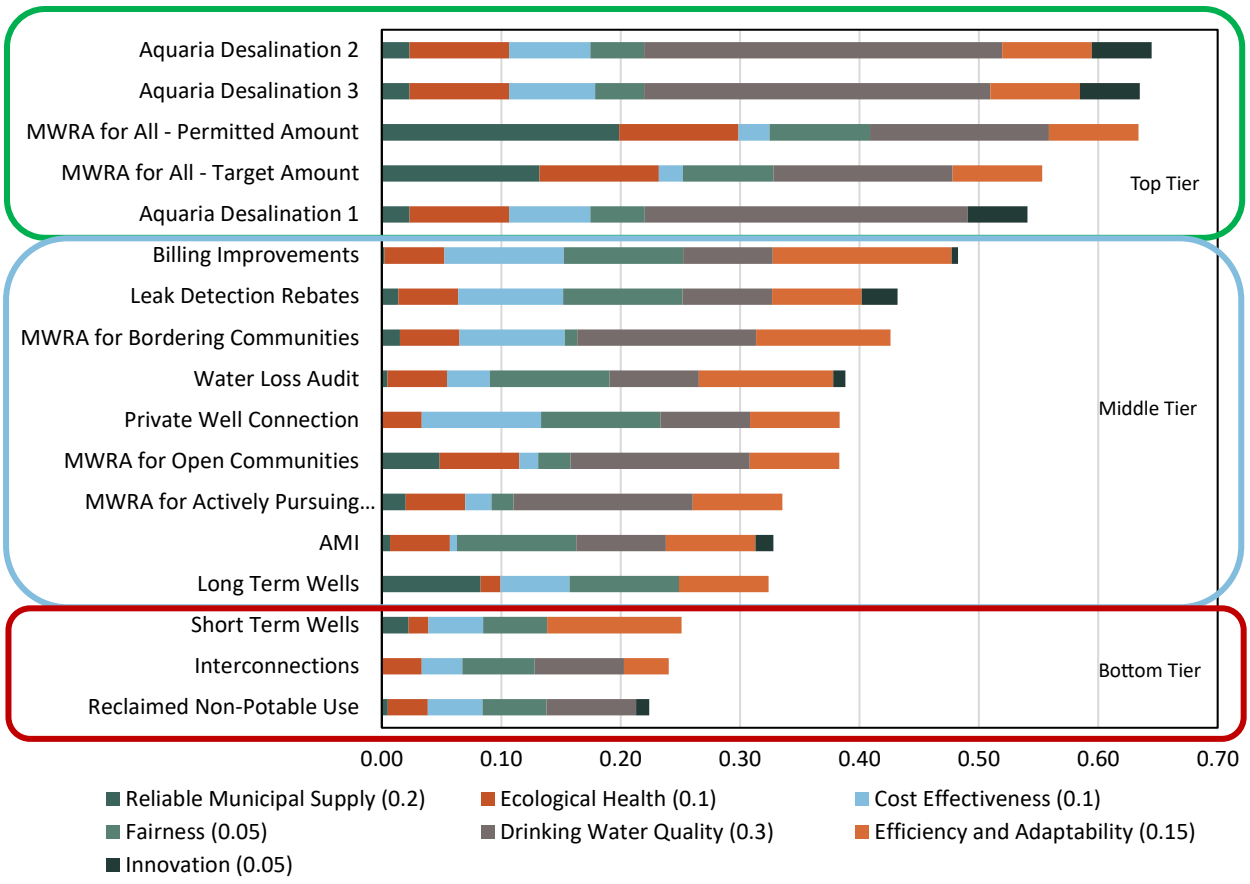

Figure 5-4: Scores of Alternatives Using Representative Objective Weighting

The green box on **Figure 5-4** highlights alternatives that score in the top tier based on the representative weightings of objectives. All three Aquaria desalination alternatives and the MWRA alternatives with higher yields fall within this category in part because they score well on the reliable municipal supply and drinking water quality objectives, to which stakeholders generally gave high weights and influence.

The mid-tier alternatives, shown in the blue box, include the demand management alternatives. Although these alternatives have smaller yields and have low scores on reliable municipal supply, they have among the highest composite scores for fairness, as they offer benefits to EJ communities without negative construction impacts, and efficiency and adaptability, as they have the flexibility to be scaled. The smaller iterations of the MWRA alternatives also fall in the middle tier as they have lower composite scores associated with reliable municipal supply, ecological health, and fairness than their higher yield counterparts. Long-Term Wells and Short-Term Wells, which fall in the lower tier, largely because these alternatives serve individual communities needs providing small benefit to the region as a whole.

Among the lower-tier alternatives are the emergency interconnections and Reclaimed Non-Potable Use alternatives. In general, wells score poorly with respect to the committee-defined objectives of ecological health, drinking water quality, and innovation. However, wells may offer benefits not captured in the metrics, and help to counter risks, that continue to make them attractive options to some communities. For example, water suppliers will maintain complete control over their water supplies and not have any risks associated with blending water from alternative sources.

Scores were also computed individually according to the weightings assigned by each municipality. **Table 5-6** summarizes the overall scores. The scores are color-coded with the higher-scoring alternatives in dark green and the lower-scoring alternatives in red, with gradations of color in between. The alternatives are listed in order of the composite scores using the regional representative weightings. Trends in colors of the alternatives show general agreement in which alternatives satisfy the objective most broadly (in green) versus those that do not (in orange/red). This suggests the scoring methodology is not particularly sensitive to the weightings assigned. In other words, alternatives score poorly or well regardless of a community's individual weightings because of how many objectives are either addressed or not. The desalination and MWRA alternatives with higher yields generally score well, in part owing to high scores in the reliable municipal supply and drinking water quality objectives, to which municipalities often assigned higher weights. It can also be noted that the MWRA and desalination alternatives with lower yields, including MWRA for Open Communities (LT-5) and MWRA for Actively Pursuing Communities (LT-6) generally score more poorly than their counterparts with higher yields, suggesting these larger infrastructure projects become more favorable as more communities' needs are met.

The ranking of alternatives using the MCDA analysis provides insight into whether an alternative addresses many stakeholder-defined objectives, a subset of objectives, or none at all. These answers may or may not align with stakeholders' intuitive sense of what alternatives are most preferable. The MCDA analysis is not intended to result in an answer or even a prioritized list of recommendations for each municipality or the region. Rather, municipalities can use these results to guide and justify plans and OCPC and other stakeholders can use these results as a guide for prioritizing next steps, coordinating with municipalities, identifying opportunities for partnerships, and seeking funding for implementation.

Table 5-6: Composite Scores for Alternatives Based on Each Steering Committee Member's Weightings

Alternative		A	B	C	D	E	F	G	H	I	J	K	L	M	N
Aquaria Desalination 2	ST-7	0.50	0.63	0.63	1.00	0.57	0.60	0.58	0.56	0.62	0.63	0.58	0.88	0.76	0.64
Aquaria Desalination 3	ST-8	0.50	0.63	0.63	0.97	0.56	0.60	0.57	0.56	0.62	0.62	0.58	0.87	0.75	0.63
MWRA for All – Permitted Amount	LT-3	0.70	0.58	0.58	0.50	0.68	0.59	0.69	0.63	0.56	0.65	0.63	0.67	0.56	0.80
MWRA for All – Target Amount	LT-4	0.57	0.50	0.51	0.50	0.56	0.49	0.55	0.52	0.46	0.56	0.54	0.67	0.49	0.72
Aquaria Desalination 1	ST-6	0.39	0.51	0.54	0.90	0.49	0.50	0.53	0.46	0.52	0.53	0.46	0.80	0.68	0.58
Billing Improvements	ST-4	0.45	0.51	0.60	0.25	0.40	0.50	0.26	0.48	0.50	0.50	0.50	0.42	0.41	0.48
Leak Detection Rebates	ST-2	0.38	0.46	0.53	0.25	0.38	0.44	0.28	0.46	0.43	0.46	0.42	0.40	0.40	0.46
MWRA for Bordering Communities	LT-7	0.37	0.45	0.48	0.50	0.38	0.46	0.34	0.35	0.50	0.41	0.42	0.48	0.46	0.39
AWWA Water Loss Audits	ST-1	0.36	0.38	0.42	0.25	0.31	0.34	0.21	0.39	0.31	0.41	0.39	0.40	0.30	0.43
Private Well Connections	LT-1	0.34	0.38	0.50	0.25	0.32	0.40	0.23	0.36	0.40	0.41	0.38	0.31	0.37	0.36
MWRA for Open Communities	LT-5	0.36	0.35	0.34	0.50	0.35	0.34	0.35	0.32	0.33	0.37	0.36	0.53	0.38	0.45
MWRA for Actively Pursuing Communities	LT-6	0.29	0.31	0.31	0.50	0.29	0.30	0.29	0.26	0.30	0.32	0.32	0.47	0.36	0.35
AMI	ST-3	0.30	0.30	0.32	0.25	0.26	0.25	0.19	0.34	0.20	0.36	0.32	0.39	0.25	0.40
Long-Term Wells	LT-2	0.39	0.33	0.39	0.00	0.33	0.35	0.26	0.38	0.33	0.36	0.36	0.13	0.23	0.32
Short-Term Wells	ST-5	0.28	0.28	0.31	0.00	0.22	0.27	0.12	0.29	0.26	0.26	0.29	0.14	0.16	0.24
Emergency Interconnections	LT-8	0.20	0.21	0.26	0.25	0.19	0.22	0.16	0.21	0.20	0.25	0.22	0.28	0.24	0.26
Reclaimed Non-Potable Use	LT-9	0.17	0.21	0.26	0.25	0.20	0.22	0.18	0.20	0.21	0.24	0.20	0.27	0.25	0.25

Note: Cost was included by the steering committee as an objective, with a comparatively low weight with respect to the other objectives. **Cost is a constraint, and the formulation of portfolios will not assume that just because an alternative ranked high, it is affordable or feasible**. The ranking shown in this table is intended to be used as guidance, supplemented with additional information, and not as a recommendation on its own.

5.4.1 Risk Assessment

While the decision-making framework provides an objective analysis of how each alternative meets Steering Committee-defined objectives, alternatives may have risks or vulnerabilities not captured by these objectives. The committee identified potential alternative risks and vulnerabilities, categorized into seven key groups: climate uncertainty, water quality, environmental risks, funding or funding delays, control over resources and systems, operational risks, and actual practicality. **Table 5-7** shows the risk matrix. Similar alternatives with similar risks were grouped together (e.g., the three desalination alternatives were grouped as one).

This risk matrix is not intended to be exhaustive or reflect the numerical probabilities or the full potential breadth of impacts. Rather, it is intended to add narrative qualifications or support to alternatives of perceived value to the region. The risks identified are also those that should be tracked as part of the adaptive management process and used to help guide future decisions.

From a risk perspective, an important consideration about project cost is its relationship to affordability. Major capital investments typically increase the cost of water delivery and water prices, which can lead to a decline in water demand, requiring further water price increases. Capital costs may increase due to PFAS treatment requirements or through additional water supplies. Likewise, the emphasis on water conservation may require price increases as water use declines. The pricing structure may need to adapt to include a larger fixed price versus variable pricing based on use. It is recommended that assessment of affordability be included in subsequent regional studies and further development of individual alternatives during implementation phases. Another overarching concern is the loss of public capacity, which could affect water suppliers' ability to provide safe water for the different alternatives.

Table 5-7: Alternative Risk Matrix

Legend

- Low or low probability of significant risk
- Moderate or moderate probability of significant risk
- High or high probability of significant risk

Alternative	Climate Uncertainty	Contamination	Environmental Risks	Funding or Funding Delays	Control over Resources and Systems	Operational Risks	Actual Practicality (Physical, Political, Regulatory, etc.)
LT-1: Private Well Connections	—	—	Potential increased drawdown	High cost of easements	Homeowner yields control to utility	—	Limited public water supply capacity Future legislation Hydraulic feasibility
LT-2 and ST-5: New Public Wells (Short- term and Long-term)	Extreme drought	Future contamination	Potential reduced streamflow Potential increased drawdown	High cost Limited land	—	—	Evolving regulations EJ standards Zoning requirements
LT-3 through LT-6: MWRA	Extreme drought	—	Major construction Stress on Quabbin Reservoir Interbasin transfer	High cost Uncertain cost models	Abandonment of local resources Supplier outside of the OCPC region	Increased vulnerability to cyberattack Reliance on single source Potential blending issues	Interbasin transfer permitting Lack of political will Design complications Not having control over setting rates
ST-6 through ST-8: Aquaria Desalination	Sea level rise and flooding potentially impacting plant	—	Future brine disposal Fish spawning High greenhouse gas emissions	Complicated to fund Cost structures	Abandonment of local resources	Potential blending issues Aging infrastructure Potential increase in electricity costs	Uncertainty about reliable supply year-round Lack of public support for high energy intensity water source Cost of energy

Alternative	Climate Uncertainty	Contamination	Environmental Risks	Funding or Funding Delays	Control over Resources and Systems	Operational Risks	Actual Practicality (Physical, Political, Regulatory, etc.)
LT-8: Emergency Interconnections	—	—	—	—	—	Potential blending issues Hydraulic feasibility	Reliability Lack of political will
LT-9: Reclaimed Non-Potable Uses	—	PFAS cross contamination Uncertainty about water quality standards	—	Few grant opportunities Not a regional priority	—	New separate distribution system	Negative public perception Permitting uncertainty Potential complications during installation Limited staffing and administrative resources
ST-1: AWWA Water Loss Audits	—	—	—	—	—	—	Limited staffing and administrative resources
ST-2: Leak Detection Rebates	—	—	—	—	—	—	Perception of increased government scrutiny Limited staffing and administrative resources
ST-3: AMI	—	—	—	High cost	—	Autopay reduces customer involvement	Increased vulnerability to cyberattack Potential damage to property during installation Limited staffing and administrative resources
ST-4: Billing Improvements	—	—	—	—	—	—	Limited staffing and administrative resources Lack of support from ratepayers Lack of political will

5.4.2 Decision-Making

To make decisions, the MCDA analysis was combined with an independent risk assessment and insights from interviews with Steering Committee members. Together, these sources of information and analysis were used to develop an adaptive management strategy consisting of short- and long-term investments for each Old Colony municipality. Additionally, the process itself of alternative assessment promoted collaboration and transparency between municipalities and other stakeholders.

These analyses led to refinement of the alternatives into the final recommended strategies included in **Section 6.0**. **Table 5-8** summarizes the alternatives that are carried forward into the recommended Regional Water Plan and includes details of how these were further refined following the MCDA analysis, risk assessment, and input from the Steering Committee. Full details of these recommended strategies, along with the best practice recommendations are included in **Section 6.0**.

Table 5-8: Alternatives included as Recommended Strategies in the Regional Water Plan

Category	ID	Alternative	Possible Applicability To	Changes made for Final Recommendation
SHORT-TERM ALTERNATIVES (Implementable within five years)				
Local	ST-1	Conduct, Validate, and Act on Annual American Water Works Association Water Loss Audits	All municipalities except Plympton (where there is no municipal supply)	ST-1, ST-2, ST-3, and ST-4 were combined into one strategy in **Section 6.0**, Implement System Wide Water Efficiency Strategies.
	ST-2	Offer Rebates to Customers for Leak Detection Devices	All municipalities except Plympton (where there is no municipal supply)	
	ST-3	Install Advanced Metering Infrastructure (AMI)	All municipalities except Plympton (where there is no municipal supply)	
	ST-4	Improve Water Billing through Increasing Block Rate Designs or Billing Intervals	Abington, East Bridgewater, Halifax, and Whitman	
	ST-5	Install New Municipal Wells for Public Supply	Bridgewater, Hanson, Kingston, Pembroke, and Plymouth	This has been included as a strategy with no changes. This is included in **Section 6.0** in the Install New Municipal Wells in the Short- Term strategy.
Regional	ST-6	Aquaria Desalination 1	Abington, Avon, Brockton, Easton, and Hanson	With input from the Steering Committee, the municipalities interested in pursuing Aquaria desalination water in the short term include Abington, Avon, Brockton, East Bridgewater, Halifax, and Whitman. This is included in **Section 6.0** in the Maximize Use of Desalinated Water Supply – Short-Term strategy.
	ST-7	Aquaria Desalination 2	Avon, Bridgewater, Brockton, and West Bridgewater	
	ST-8	Aquaria Desalination 3	Brockton, Duxbury, Halifax, Hanson, and Pembroke	
LONG-TERM ALTERNATIVES (Implementation beyond five years)				
Local	LT-1	Connect Private Well Owners to Municipal Public Water Supply	All municipalities except Plympton	This has been included as a strategy with no changes. This is included in **Section 6.0** in the Provide Access to Safe Water for Private Well Owners – Connections to Public Water Supply strategy.
	LT-2	Install New Municipal Wells for Public Supply	Abington, Bridgewater, Brockton, Duxbury, East Bridgewater, Easton, Halifax, Hanover, Kingston, Pembroke, Plymouth, and West Bridgewater	With input from the Steering Committee, the municipalities interested in considering additional groundwater wells in the future include Duxbury, Kingston, and Plymouth. This is included in **Section 6.0** in the Install New Municipal Wells in the Long- Term strategy.

Category	ID	Alternative	Possible Applicability To	Changes made for Final Recommendation
Regional	LT-5	Massachusetts Water Resources Authority (MWRA) for Municipalities who Indicated Openness to MWRA[1]	Abington, Avon, Bridgewater, Easton, Pembroke, Plympton, and West Bridgewater	Based off input from the Steering Committee, there are two MWRA strategies leveraging a future connection through Weymouth and the existing connection through Stoughton to serve Abington, Hanover, Pembroke, Stoughton and Easton. These are included in **Section 6.0**.
	LT-8	New Emergency Interconnections	Easton, Plympton, and West Bridgewater	Based off input from Steering Committee and analysis of existing interconnections, interconnections for West Bridgewater Easton, West Bridgewater, and Plympton are recommended. This is included in **Section 6.0**.

Jones River flowing north to estuary within tidal reach

Section 6.0

6.0 Recommended Regional Water Plan

The Regional Water Plan was developed by consensus with the Steering Committee and informed by results from the public survey, municipal interviews, focus groups, and other stakeholder and public outreach activities. The strategies and projects identified address concerns in the region on drinking water quality, water availability for housing and economic development, and the impacts of the water supplies on ecosystems. The projects in the Regional Water Plan do not include ongoing maintenance and other Master Plan recommendations that are required on an individual municipality basis. Ongoing standard maintenance is a vital part of every water supplier's plan in order to maintain existing infrastructure.

Projects have been developed for implementation for different time frames (short and long-term) and different geographic scales (local and regional), as defined in **Table 6-1**. Twenty-two short- and long-term strategies for implementation at the local and regional scales are presented (**Table 6-2**), with additional recommendations specific to municipalities, implementation and immediate next steps also discussed. These strategies are not prioritized or presented in order of importance. Municipalities and organizations should select what their priorities are considering affordability (including funding opportunities) and relative importance.

Table 6-1: Different Time Frames and Spatial Scales used in the Regional Water Plan

Time Frames Included in the Regional Water Plan	Geographic Scales for Projects
▪ **Short-term:** Next 5 years (2025–2030) ▪ **Long-term:** 5–25 years (2030–2050)	▪ **Local:** Project does not require coordination with other municipalities. ▪ **Regional:** Project requires coordination with other municipalities. ▪ **State:** Project is led by state government agencies.

Table 6-2: Consensus-Based Strategies for Implementation

Geographic Scale	Short-Term	Long-Term
Local	A. Support Public Health and Raise Awareness of Water Quality Among Private Well Owners B. Introduce Policies and Regulations to Reduce the Waste of Water and Improve Ecosystem Health C. Implement System-Wide Water and Energy Efficiency Strategies D. Install New Municipal Wells in the Short- Term E. Incorporate Municipal Level PFAS Treatment	P. Provide Access to Safe Water for Private Well Owners – Connections to Public Water Supply Q. Install New Municipal Wells R. Conduct Regular Rate Studies
Regional	F. Maximize Use of Desalinated Water Supply– Short-Term G. Improved Monitoring and Continued Education and Advocacy for Streamflow Protection and Drought Resiliency H. Improve Local Bylaws for Water Smart Land Use and Integrate into Planning Efforts I. Conduct an Integrated Ecological Assessment and Pursue Improvements J. Expand Water Education and Public Engagement Efforts K. Secure Redundant Water Supply for Agriculture L. Expand Support Agricultural Water Use Efficiency with Grants for Research and Implementation M. Coordinate Regionally on PFAS Management and Funding	S. Maximize Use of Desalinated Water Supply – Long-Term T. Create New Emergency Interconnections U. Connect OCPC Communities to MWRA through Weymouth V. Connect OCPC Communities to MWRA through Stoughton W. Collaborate Regionally on Communications X. Plan for Drought Regionally
State	N. Improve Water Loss Reporting O. Monitor and Update State Point-Of-Sale Requirements for Water-Using Fixtures	--

6.1 Short-Term (2025-2030) Local Strategies

A. Support Public Health and Raise Awareness of Water Quality Among Private Well Owners

Applicability	All municipalities
Lead	Municipalities' Boards of Health
Partners	Old Colony Planning Council and the state's Department of Public Health
Resources Needed	Consistent educational materials (digital and print), communication plan (marketing and outreach), and staff time
Funding Possibilities	4, 5, 7, 8, 11, 25 in **Appendix H**

The goal of this strategy is to support public health in the region. Thousands of residents in the Old Colony region rely on private wells for drinking water. State and federal regulations apply to municipal water supply, but there are few safeguards in place for private well water.

Implementation of this strategy could include a public education and awareness campaign with voluntary testing. The appropriateness of enacting municipal policies and regulations mandating water quality testing for private wells before selling a home could be explored. Municipal policies and regulations could apply to properties that are re-drilling wells, conducting significant renovations, being newly developed, or being sold. The water quality test should screen for potential contaminants included in MassDEP/EPA drinking water standards. If testing reveals contaminants exceeding drinking water standards, the homeowner, developer, or seller would need to take appropriate action to install treatment for the private well to make drinking water safe before finalizing the sale of the property or receiving permits for significant construction. This would ensure that buyers are not inheriting potential health risks related to water quality.

The next steps would likely include the following:

- Old Colony Planning Council would develop a project brief to share with municipal boards of health to gauge interest in a regional collaboration.
- Old Colony Planning Council would engage the realtor community to consider well testing during home purchase.
- Funding would have to be secured to support the development of educational materials, marketing of these materials to residential private well owners, additional educational outreach activities, and the study of opportunities for a voluntary testing program and/or new local policies and regulations.

B. Introduce Policies and Regulations to Reduce the Waste of Water and Improve Ecosystem Health

Applicability	All municipalities
Lead	Various municipal-level departments, boards, and commissions
Partners	Old Colony Planning Council, watershed associations, environmental organizations, MassDEP
Resources Needed	Review of existing policies and regulations, model policies and regulations, staff time
Funding Possibilities	3, 7, 8, 11, 15, 25, 32, 33, 35 in **Appendix H**

Significant action may be taken at the municipal level to improve water efficiency and ecosystem health. This strategy includes consideration of several policies and regulations that could be implemented locally (further described in **Appendix I**):

- Native, drought-resistant landscaping policies and regulations. Native Landscaping is the practice of using plants that naturally occur in a specific region to create a landscape.

- Non-essential outdoor water use restrictions for municipalities with registrations and private well owners
- Water demand offset requirements and/or mitigation programs for new development. Water demand offset policies focus on reducing water use from new development. Water demand offset policies require action on the part of developers to limit the impact that new development has on overall water demands.

Each municipality would need to consider its specific circumstances when considering new policies and regulations. The goal is to reduce strain on the municipal water supply during the hot summer months and increase the resilience of shared water resources. Implementation would result in multiple co-benefits, including enhanced biodiversity and decreased flooding and erosion.

The next step would likely include Old Colony Planning Council working with partners to develop a checklist with resources, including model policies and regulations, for review and use by each municipality.

C. Implement System-Wide Water and Energy Efficiency Strategies

Applicability	All municipalities except Plympton (no public supply)
Lead	Municipal departments of public works/water
Partners	Old Colony Planning Council and the state
Resources Needed	Funding for technical consultants, staff time
Funding Possibilities	3, 4, 8, 12, 13 in **Appendix H**

This five-part strategy was based on recommendations made by the Alliance for Water Efficiency and UMass Amherst (**Appendix D**) as part of the development of this Regional Water Plan. Municipalities would need to consider which part or combination of parts would result in the most significant benefit locally. Some municipalities, for example, are well below the 10% good practice standard for unaccounted-for water (UAW) and, therefore, would not need to pursue water loss audits in the short term. Improving water efficiency and reducing water waste may prevent the need for expanding municipal water supply sources, preventing or delaying water rate increases associated with significant capital expenses. Delaying or preventing large capital expenses can support more affordable water rates for residents.

1. **Conduct, Validate, and Act on Annual American Water Works Association Water Loss Audits**
   This option improves understanding of supplier-side water losses through the adoption of the American Water Works Association's (AWWA) water audit method. It involves conducting water loss audits through the AWWA M36 methodology and free water loss audit software,[10] verifying results through trained third parties, and establishing performance metrics to reduce actual water losses. Water suppliers will take corrective actions to address losses identified in the audit.

[10] More information at: https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control

2. **Implement Advanced Metering Infrastructure**
   This option promotes Advanced Metering Infrastructure (AMI) adoption to improve utility programs for reducing resident-side leaks. AMI can be paired with a resident portal with analytics, leak notifications, and bill payments, along with a separate leak notification program through email or text.

3. **Rebates for Leak Detection Devices for Resident-Side Leak Detection**
   For utilities without AMI or seeking further customer-side leak reduction solutions, this option offers rebates or discounts for leak detection devices for residents to install on the customer side of their service connection, such as flow measurement attachments, utility meter attachments, and in-line monitoring systems like Droplet, Flume, and Flo.

4. **Improve Increasing Block Rate Designs or Billing Intervals**
   A water block rate is a utility pricing structure where the cost of water varies in steps based on the amount of water consumed, with each block having a different unit price. This option adjusts increasing block rates to reflect peak demand costs better and promote sustainable water use. Updated pricing and block structures, tailored to each utility's demand profile, will help capture usage patterns and benefit low- and moderate-income customers. A rate consultant is recommended for the transition. Additionally, increased frequency of billing can support more efficient water use from residents. Currently some OCPC municipalities only provide water bills twice a year.

5. **Pursue Energy Efficient Upgrades**
   Providing safe drinking water can be energy intensive, with energy needs for pumping water, treating water and distributing water to customers. One aspect utility's could consider for reducing operating costs is energy efficiency upgrades or supplementing existing energy sources with clean energy projects.

The next steps could include the following:

- For those water suppliers with UAW above 10%, pursue funding for water loss audits
- For those water suppliers without capital plans that include AMI, consider planning for the transition to all AMI over the next several years
- For those water suppliers that have not recently reviewed their water rate structures, consider the benefits of doing so and pursue funding for rate studies
- For water utilities with high energy costs, consider pursuing energy efficiency projects.

Residential rebates at the municipal level would likely be challenging to fund and administer. Such a program could be explored at the regional level, led by Old Colony Planning Council, or at the state level, perhaps as part of existing energy efficiency programs.

D. Install New Municipal Wells in the Short Term

Applicability	Bridgewater, Kingston, Hanson, Pembroke, and Plymouth
Lead	Municipal departments of public works/water
Partners	The state
Resources Needed	Funding for preparations and construction
Funding Possibilities	4, 5, 8, 11, 16, 19, 25, 29 in **Appendix H**

New groundwater wells can be advantageous as they have the potential to increase a town's permitted capacity, if not its operational capacity. Increased capacity supports meeting current and future demands, including housing and economic development. However, it is important to note that there is no assurance that new wells will be free from PFAS contamination; therefore, treatment is still recommended for new wells.

Bridgewater, Kingston, Hanson, Pembroke, and Plymouth have begun the process of developing new municipal wells, which should be continued. These water suppliers have identified one or more potential well sites and have commenced the surveying of each site and/or acquiring permits from MassDEP. The anticipated completion of these wells is within three to 10 years (**Table 6-3**).

Table 6-3: Short-Term Development of Municipal Wells in the Region

Community	Site Location	Potential Water Supplied (Million Gallons Per Day)
Bridgewater	Vernon Street	0.56
Kingston	Unknown	0.79
Hanson	Old Pine Drive	0.34 (Site was developed to supply 0.43 MGD, but permit limits use to 0.34 MGD)
Pembroke	Swanberg Property	0.35
	Elm Street	0.75
Plymouth	Various	2

The next steps are for these water suppliers to continue with permitting, well testing, environmental impact assessments, design, and construction.

E. Incorporate Municipal-level PFAS Treatment

Applicability	Abington, Bridgewater, Duxbury, Easton, Halifax, Hanover, Hanson, Kingston, Pembroke, Plymouth, Stoughton, West Bridgewater
Lead	Municipal departments of public works/water
Partners	The state
Resources Needed	Funding for treatment upgrades and/or new facilities
Funding Possibilities	4, 5, 7, 8, 11, 16, 17, 19, 20, 25, 29, 37 in **Appendix H**

Municipal water supplies must comply with new federal drinking water standards for PFAS by 2029. Municipalities listed above are currently experiencing or likely to experience PFAS sample concentrations above the new action limit established by the EPA. To comply, these municipalities' best

options are to upgrade existing and/or build new treatment facilities. At the time of this plan, the listed municipalities were at various stages of planning, designing, or constructing new treatment plants. This work should continue. This can be challenging, with simultaneous compliance required for both PFAS and lead and copper.

6.2 Short-Term Regional Strategies

F. Maximize Use of Desalinated Water Supply – Short-Term

Applicability	Abington, Avon, Brockton, East Bridgewater, Halifax, and Whitman
Lead	Municipal departments of public works/water
Partners	Old Colony Planning Council, the state, chambers of commerce, and watershed associations
Resources Needed	To be determined
Funding Possibilities	4, 5, 7, 8, 11, 16, 17, 19, 20, 25, 29, 37 in **Appendix H**

The Aquaria Desalination Plant in Dighton is currently contracted to supply water to the City of Brockton, which draws occasionally on this regional resource. The plant is estimated to generate up to five million gallons of PFAS-free water daily, with the potential for increased output after additional investments. The full production capacity of this plant is not utilized and should be used by Brockton to reduce reliance on Silver Lake. Additional analysis that considers scenarios where Brockton uses 1.0, 1.5 and 2.0 MGD of desalinated water to allow for additional flexibility with withdrawals from Silver Lake is included in **Appendix J**. It may also be used by other water suppliers as a new supply option to offset the need for further investment in PFAS treatment. Increased water supply supports meeting current and future demands, including housing and economic development. The state is considered a valuable partner in this strategy.

For municipalities considering the purchase of desalinated water, the next step would be to explore the costs and benefits of such an ongoing purchase compared to developing a new supply and/or PFAS treatment. Additionally, the connection to desalination water would need to be studied from both a hydraulics perspective and a distribution system quality (blending) perspective for each municipality. For the City of Brockton, the city must decide whether to continue its contract with Aquaria or purchase the plant. Whichever arrangement the city pursues will affect any inter-municipal agreements it may be able to make to share this regional resource with other municipalities. Other ownership models could also be investigated, such as the purchase of the plant by the Massachusetts Water Resources Authority (MWRA), a collective of municipalities, continued private ownership, or a newly formed public authority for the region.

Another consideration for the use of desalination water is the high energy use required for operation. Considerations in the short term should be made for transitioning to renewable energy to support cost effective and energy efficient water supplies. In the long term, public opinion may turn against energy intensive water sources like desalination. There are resources and grants available from MassDEP to support water utilities pursuing energy efficiency.

G. Improved Monitoring and Continued Education and Advocacy for Streamflow Protection and Drought Resiliency

Applicability	Region-wide
Lead	Watershed Action Alliance of Southeast Massachusetts
Partners	Massachusetts Rivers Alliance, watershed associations, U.S. Geological Survey, state agencies (DER, DCR, and DEP), Old Colony Planning Council, colleges and universities, and citizen scientists
Resources Needed	Funding for monitoring equipment and volunteers for data collection and reporting.
Funding Possibilities	16, 17, 18, 19, 21, 22, 23, 24 in **Appendix H**

Throughout the collaborative planning process, several stakeholders raised concerns about the ecological impact of water supply withdrawals. Impacts on the ecosystems of Silver Lake and some Plymouth kettle ponds are well-documented, but overall, there is limited monitoring data available for surface and groundwater flows in the region and water withdrawal impacts, especially during drought.

This strategy calls for an improved regional monitoring program to improve data availability and understanding of the ecological impacts of public water supply. Monitoring results would then further inform education and advocacy efforts to protect streamflow, including through the Water Management Act (M.G.L. c. 21G) Program, improve water demand management, and develop robust drought management plans.

The next steps would be to identify site-specific areas where additional monitoring would be useful, either to guide decisions or measure progress. Examples might include groundwater monitoring wells near surface water bodies to better understand groundwater-surface water interactions, and lake and reservoir inflow/outflow reversal patterns during dry periods. Additional groundwater monitoring wells further west in the OCPC region would also be helpful, but with site-specific intent, since the active USGS monitoring wells are clustered further east. Additionally, alternative funding sources may need to be explored to maintain existing USGS monitoring wells.

H. Improve Local Bylaws for Water Smart Land Use and Integrate into Planning Efforts

Applicability	All municipalities in the region
Lead	Municipal departments of planning, zoning, and conservation, and local elected officials
Partners	Mass Audubon, Old Colony Planning Council, and the state
Resources Needed	Mass Audubon's free Bylaw Review Tool[11] and resources from the state,[12] municipal staff time and technical assistance from OCPC or consultants
Funding Possibilities	14, 16, 17, 20, 21, 22, 23, 24, 25, 30, 31 in **Appendix H**

[11] https://www.massaudubon.org/our-work/climate-change/local-climate-resilient-communities/land-use-rules, accessed March 18, 2025

[12] https://www.mass.gov/guides/planners-conservation-commissions-land-use-boards, accessed March 18, 2025

Planning and Zoning Boards, Conservation Commissions, supporting municipal staff, and local elected officials all have an essential role in ensuring enough safe water is available in their communities – for both people and the environment. Decisions that planning staff and boards make about land use have a profound effect on water availability and quality.

Mass Audubon's free Bylaw Review Tool helps municipalities evaluate local zoning, site plan review, subdivision rules and regulations, stormwater and/or low-impact development bylaws, and cluster or open space residential design bylaws. While the focus is primarily on residential development, the concepts also apply to other forms of development and redevelopment. The state also provides supporting and additional resources online, including examples of municipal bylaws implemented throughout the state.

Municipalities should also seek to integrate water-smart land use into their planning efforts, especially when developing comprehensive master plans and open space plans. For municipalities with staff able to pursue this strategy, the Southeast New England Program (SNEP) Network provides online training on using the Bylaw Review Tool.[13] For municipalities needing additional help, Regional Planning Agencies, including Old Colony Planning Council, may have technical assistance programs and can recommend funding sources.

I. Conduct an Integrated Ecological Assessment and Pursue Improvements

Applicability	Region-wide or at subwatershed scale
Lead	Old Colony Planning Council
Partners	Watershed Action Alliance of Southeastern Massachusetts, watershed associations, Herring Pond Wampanoag Tribe, colleges on the south shore, and municipalities
Resources Needed	Consistent educational materials (digital and print), communication plan (marketing and outreach), and staff time
Funding Possibilities	4, 7, 11, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 in **Appendix H**

An integrated ecological assessment to identify the primary ecological and flow needs within the Old Colony region would help address the balance between water resources, ecosystem health, and the sustainable management of aquatic habitats. Funding opportunities for initiatives aimed at improving ecological integrity and water management would be pursued once the assessment is complete. The long-term objective would be to ensure ecosystem needs are accounted for in planning efforts and that migratory obstacles are removed.

Specific areas of focus would include:

- Ecosystem evaluation and ecological flow needs

[13] https://storymaps.arcgis.com/stories/e37dbafd001a401c8f56b99708f25636, accessed March 18, 2025

- Lake and reservoir management strategies
- Identification and removal of migratory impediments

Details for each of these focus areas are provided in **Appendix I**. A key objective would be to explore areas where the interconnectivity of lakes, reservoirs, streams, and migratory pathways may have been disrupted historically, creating ecological imbalances. These identified areas would serve as opportunities for targeted interventions to restore natural flow and improve ecosystem health.

- Jones River downstream of Silver Lake
- Stump Brook downstream of West Monponsett Pond (eventually flowing into the Taunton River) and Monponsett Pond itself for nutrient water quality issues
- Great Sandy Bottom Pond for nutrient water quality issues

Next steps would include the following:

- Choosing from different options for assessing ecological flow needs
- Securing funding for assessment
- Creating a plan with stakeholders to meet ecological flow needs

J. Expand Water Education and Public Engagement Efforts

Applicability	All municipalities in the region
Lead	Watershed associations
Partners	The state, municipalities, including schools, Herring Pond Wampanoag Tribe, and other environmental organizations
Resources Needed	Staff or volunteer time to organize events and funding to provide materials and locations for events.
Funding Possibilities	3, 7, 15, 23, 24, 25 in **Appendix H**

Throughout the planning process for this project, participants agreed that education and outreach were critical in achieving a sustainable water future. Initiatives such as school-based water education programs, business water audits, landscaper training, and public events like gardening expositions are all important in raising awareness of water resources and nurturing a cultural shift toward more efficient and less wasteful use of water, especially outdoors.

One model to consider is the North and South Rivers Watershed Association's (NSRWA) WaterSmart program. This nonprofit partnership between NSRWA and 12 towns on the South Shore—Cohasset, Duxbury, Hanover, Hingham, Hull, Kingston, Marshfield, Norwell, Pembroke, Rockland, Scituate, and Weymouth—has educated thousands of local school-age children, adults, and businesses on water conservation, stormwater pollution, where their water comes from, and how to care for it. This program could be expanded to other municipalities in the region. Another program to look to would be Neponset River Watershed Association's, which currently encompasses Stoughton only within the Old Colony region.

The next steps could include:

- Identification of staff or volunteers to lead on public engagement
- Contacting NSRWA WaterSmart and Neponset River Watershed Association for ideas on best practices for public engagement
- Develop and plan public engagement activities

These next steps could support the organization of public engagement activities.

K. Secure Redundant Water Supplies for Agriculture

Applicability	All municipalities in the region with large agricultural water users
Lead	Old Colony Planning Council
Partners	Massachusetts Department of Agricultural Resources (MDAR), the Massachusetts Food Policy Council, Massachusetts Cranberries, Massachusetts Farm Bureau Federation, and municipalities
Resources Needed	Funding to support grants for agricultural operations pursuing redundant water supplies and staff time to prepare detailed guidance on pursuing different water supply options.
Funding Possibilities	32, 33, 34, 35, 36 in **Appendix H**

The increasing frequency of compound drought and extreme precipitation underscores the necessity for reliable water supplies to mitigate the impacts of such climate events. These can involve extreme dry conditions and periods of excessive rainfall that may require pumping. In addition to the concern of water availability for agriculture, there is concern around water quality. In certain states, such as Maine, there are increasing state regulations for food safe water practices in response to PFAS impacting soil, surface water, groundwater and drinking water. It is anticipated that there may be more extensive testing of water quality and agricultural products in the future, which may lead to the need for alternative water sources for use in agriculture. This strategy involves implementing any combination of alternative water supply options for agricultural use outlined in **Table 6-4**. The long-term goal is to support farmers with redundant water supplies to ensure resiliency during drought and other unexpected events. Increased capacity supports economic development in agriculture. The higher the food ranking listed in **Table 6-4**, the higher likelihood that the water supply would provide safe water for agricultural production. Municipal water is the safest, as utilities provide treatment to ensure safe drinking water standards are met. Groundwater tends to have lower food safety risks than surface water (Haley et al, 2022). Water reused from tailwater recovery ponds may be lower quality than the source water but provides a benefit to downstream water quality by reusing agricultural runoff.

Table 6-4: Possible Redundant Water Supply Options for Agriculture

Water Supply Option	Food Safety Ranking	Considerations for Implementation
Municipal water	1	▪ - Proximity to an existing water main ▪ - High price point ▪ - Obtaining a permit
Groundwater	2	▪ - Groundwater availability (water table level and seasonal variability) ▪ - Aquifer conditions ▪ - Water quality ▪ - Cost of well installation ▪ - Operation and maintenance of equipment ▪ - Compliance with regulatory standards
Surface Water	3	▪ - Proximity to a water body ▪ - Climate variability (drought) ▪ - Water quality ▪ - Operation and maintenance of equipment ▪ - Compliance with regulatory standards
Reuse via Tailwater Recovery Ponds[1]	4	▪ - Space availability on site ▪ - Co-benefit of improvements to downstream water quality ▪ - Cost of installation ▪ - Compliance with regulatory standards

Note:

[1] Tailwater recovery ponds offer an effective solution for capturing excess rainwater and irrigation runoff, allowing it to be cycled back through the irrigation system.

Each agricultural operation will have different needs, so decisions for redundant water supply must be made at the farm and municipal levels. Considerations for implementing different water supply options are included in **Table 6-4**, which also includes considerations for food safety. Old Colony Planning Council, in partnership with Plymouth County, was awarded a Municipal Vulnerability Preparedness grant in 2024 to assess the climate vulnerability of the regional food system and develop a resilience action plan. This Regional Water Plan will inform the development and implementation of that project, which intends to explore agricultural water issues in more depth.

The next step would be for participants of this Regional Water Plan who have an interest in this strategy participate in OCPC's food system planning process.

L. Expand Support for Agricultural Water Use Efficiency with Grants for Research and Implementation

Applicability	State- or region-wide
Lead	Massachusetts Department of Agricultural Resources (MDAR)
Partners	Massachusetts Department of Agricultural Resources (MDAR), the Massachusetts Food Policy Council, Massachusetts Cranberries, and Massachusetts Farm Bureau Federation, and colleges and universities
Resources Needed	Funding for additional agricultural grants and staff time for grant management.
Funding Possibilities	32, 33, 34, 35, 36 in **Appendix H**

This strategy uses grants to research and implement improvements to agricultural water demand management to increase the resilience of local agricultural operations while minimizing the impact on water resources quantity and quality. This supports economic development in agriculture, as well. The strategy also calls for increased grant funding to expedite and expand efforts. There is concern for crop resilience to "weather whiplash" (the cycling between flooding and drought), which is projected to become more common in Massachusetts.

Examples of relevant local research include the following:

- Climate Adaptation Resources for Northern New England Farmers, U.S. Department of Agriculture, 2022[14]—"Based on farmer and agricultural expert interviews, farmer feedback from the focus groups, a review of New England farmers' plans and needs for climate change adaptation, and an assessment of available climate change adaptation resources, the research team identified three agricultural practices (silvopasture, irrigation, and tarping) and two tools (visualizations and economic tool) that are of particular need and interest to New England farmers."
- A New Shallow Groundwater Well for Small Agriculture Supply, U.S. Department of Agriculture Northeast Climate Hub, 2021[15]—"This shallow well design is an innovative technique for adapting to drought conditions, which are becoming more frequent with the changing climate in glacial till areas that are hydrologically favorable for shallow well development."
- Finding Solutions to Reduce the Impact of PFAS Contamination on Agriculture and Food Systems, New England Plant, Soil and Water Research Laboratory, Orono ME, 2024-2025[16]—"The objectives will be to evaluate the transfers of PFAS in agricultural soils and waters in order to leverage opportunities to interrupt or optimize those processes to mitigate and remediate contamination, evaluate the uptake of PFAS by different varieties of the common crops, to evaluate if some varieties offer resilience to PFAS uptake into edible tissues."

Participants in the agricultural water use focus group suggested the following areas for research and implementation within the region:

- One promising area is tailwater recovery ponds, which could be crucial in agricultural water management, especially for cranberry growers. These ponds capture water for reuse from irrigation runoff, rainfall, and other drainage sources. Preliminary studies suggest that tailwater recovery ponds can enhance water quality by improving downstream water quality, as demonstrated by the White Island Pond in Plymouth, Massachusetts.

Expanding support for ongoing and future research to support efficient agricultural water use could support the sustainability of water resources in the region. This strategy should focus on improvements to maximize efficiency and reduce negative impacts to quality and quantity of flowing waters and species within.

[14] https://nefarmclimate.com/research

[15] https://conservationwebinars.net/webinars/a-new-shallow-groundwater-well-for-small-agriculture-supply

[16] https://www.ars.usda.gov/research/project/?accnNo=447156

M. Regional Coordination for PFAS Management and Funding

Applicability	Region-wide
Lead	Old Colony Planning Council
Partners	Municipal departments of public works/water, Municipal boards of health and the state (MassDEP)
Resources Needed	Staff time to monitor opportunities for coordination and apply for grants.
Funding Possibilities	4, 7, 8, 11, 14, 19, 20, 25, 29 in **Appendix H**

This strategy seeks to support municipalities with compliance for PFAS regulation applicable to municipal water supplies and boards of health supporting private well owners dealing with PFAS. It may be useful to collaborate across the region on treatment methods, staff training for operating new treatment processes, disposal processes for treatment media, and funding opportunities.

Recommended actions for the next five years:

- OCPC should monitor regional funding opportunities and support grant applications.
- Municipalities should share any opportunities for collaboration on PFAS with OCPC.
- OCPC should investigate regional solutions to disposal processes of treatment media.

6.3 Short-Term State Strategies

N. Improve Water Loss Reporting

Applicability	State-wide
Lead	Massachusetts Department of Environmental Protection (MassDEP)
Partners	State legislators, municipal departments of public works/water, Massachusetts Rivers Alliance, watershed associations, and the civil engineering community
Resources Needed	Staff time to investigate possibility of requiring AWWA water loss audits and funding to support development and implementation of training for water utilities.
Funding Possibilities	8, 12, 13 in **Appendix H**

This strategy was based on recommendations made by the Alliance for Water Efficiency as part of the development of this Regional Water Plan. Currently, MassDEP requires public water suppliers to calculate unaccounted for water and report it in their Annual Statistical Reports. UAW refers to water entering the distribution system that isn't accounted for through service meter readings or unmetered municipal uses and is commonly expressed as a percentage of total water withdrawn. MassDEP is ahead of many other state regulators in requiring water loss reporting. However, the UAW approach has several shortcomings.

Using a percentage indicator such as UAW is not recommended by the Alliance for Water Efficiency or the American Water Works Association (AWWA) for the following reasons:

- This type of performance indicator is mathematically skewed because it is unduly affected by varying levels of customer consumption.
- It is impossible to reliably represent multiple types of non-revenue water typically occurring in a water utility with a single simplistic percentage.
- Simple percentage reveals nothing about water volumes and costs, the two most important factors in water loss assessments of water utilities.

Therefore, this plan recommends that MassDEP consider changing the requirement from UAW to AWWA water loss audits, using AWWA M36 methodology and free water loss audit software, as was recommended by the Alliance for Water Efficiency during this regional water planning process (see **Appendix D**). These audits help identify water losses in the water supplier's system, and support understanding of supplementary actions that can be taken to reduce water losses. MassDEP could first consult with other states that rely on AWWA water loss audits to learn about benefits and any challenges experienced. If the change remains favorable, a business and environmental case for adoption could be formed based on costs avoided, enforcement avoided, and burden on utilities lessened.

Improved data collection would improve water loss over time. Public water suppliers would conduct water loss audits using AWWA M36 methodology and free water loss audit software, validate water loss audits using a third party with relevant training and experience, and then act on the results by improving data validity scoring and reducing real losses.

O. Monitor and Update State Point-Of-Sale Requirements for Water-Using Fixtures

Applicability	State-wide
Lead	Massachusetts Department of Environmental Protection (MassDEP)
Partners	State legislators, business community, municipalities, Massachusetts Association of Regional Planning Agencies, Massachusetts Rivers Alliance, watershed associations, and environmental organizations
Resources Needed	Staff time to monitor effectiveness of current point-of-sale regulations and keep up to date with new developments in water efficient fixtures.
Funding Possibilities	3, 7, 8, 15 in **Appendix H**

This strategy was based on recommendations made by the Alliance for Water Efficiency as part of the development of this Regional Water Plan. Massachusetts has requirements for water-efficient residential fixtures that became effective on January 1, 2023 (An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy (2021)). Plumbing fixtures in **Table 6-5** that are sold within Massachusetts must meet certain water efficiency standards. This type of requirement is called a "point-of-sale" requirement. These state requirements are more efficient than federal requirements.

Table 6-5: Massachusetts requirements for water-efficient fixtures for residential water use.

Plumbing Fixture	Federal Minimum Requirement	New 2023 MA Requirement
Bathroom Faucet	2.2 gallons per minute (gpm)	1.5 gpm
Kitchen Faucet	2.2 gpm	1.8 gpm
Showerhead	2.5 gpm	2.0 gpm
Toilet	1.6 gallons per flush (gpf)	1.28 gpf

The state should continue to monitor developments in water-efficient fixtures listed in **Table 6-5** and consider revising requirements for other water efficient fixtures such as spray sprinkler nozzles and point-of-use reverse osmosis systems.

6.4 Long-Term (2030-2050) Local Strategies

P. Provide Access to Safe Water for Private Well Owners – Connections to Public Water Supply

Applicability	All municipalities in the region
Lead	Municipal departments of public works/water
Partners	Municipal boards of health and the state (MassDEP)
Resources Needed	Minimal staff time for monitoring trends in connections.
Funding Possibilities	4, 5, 7, 8, 11, 25 in **Appendix H**

This strategy seeks to provide support for private well owners facing groundwater contamination, including PFAS and other pollutants. As awareness of these contaminants grow, many well owners may contemplate connecting to their local water distribution systems. Therefore, it is important to assess the potential impacts of these new service connections on water suppliers as this strategy is contingent upon each community water department having enough capacity to supply the new customers. Based on findings from the private well owner focus group and public survey, a complete transition is unlikely, but a partial transition may benefit private well owners facing contamination.

Recommended actions for the next five years:

- Municipalities should monitor trends in private well users connecting to public water supply.
- Municipalities should assess their ability to meet expanded demand when accounting for private wells.

This may be particularly important for municipalities with many private well users in proximity to the municipal water supply distribution system. Additional considerations may also be relevant if there are large developments occurring near homes reliant on private wells.

Q. Install New Municipal Wells – Long-Term

Applicability	Duxbury, Kingston, and Plymouth
Lead	Municipal departments of public works/water
Partners	State (MassDEP)
Resources Needed	Staff time in the short term to monitor demand trends. In the long term, funding for land acquisition, studies and construction as well as staff time for implementation.
Funding Possibilities	4, 5, 7, 8, 11, 16, 17, 19, 20, 25, 29 in **Appendix H**

Additional water supply strategies have been identified for OCPC communities to be resilient to future risk of water quality impairment or droughts. This strategy for Duxbury, Plymouth, and Kingston was discussed during Steering Committee meetings as well as during interviews with municipal staff. New municipal wells would increase water supply capacity, replace aging or contaminated water sources, and support economic development. Each municipality must comply with the Environmental Protection Agency's PFAS guidelines by the time the new wells are operational. These communities should monitor their ability to meet current and future demands before deciding if an additional well is a necessary investment for their water supply. Next steps include:

- Monitoring of demand trends
- Monitoring of potential large impacts to demand, such as changes in population or large developments
- Municipalities should prioritize water efficiency, as they could potentially prevent the need for the development of new water supplies. Affordability of water for existing customers will be impacted by large capital costs such as the installation of new wells, and priority should be placed on avoiding expenditure if possible.

If any of these municipalities need an additional municipal well, the development of a new well would require land planning and acquisition, site surveying, permitting, well testing, environmental impact assessment, followed by design and construction.

R. Conduct Regular Rate Studies

Applicability	All municipalities in the region
Lead	Municipal departments of public works/water
Partners	N/A
Resources Needed	Funding for hiring consultant to conduct rate studies.
Funding Possibilities	7, 8, 12, 13, 25 in **Appendix H**

This strategy was based on recommendations made by the Alliance for Water Efficiency as part of the development of this Regional Water Plan. To sustain operations, finance system expansion, upgrade infrastructure, and ensure equitable cost distribution, water rates should be reviewed and adjusted regularly, every 3-5 years. Many water suppliers are implementing incremental rate increases to manage rising costs. It is recommended that all water suppliers conduct periodic rate studies, particularly in

response to unforeseen capital expenses. It was outside the scope of this project to consider the impacts on water rates for customers as a result of municipalities taking on capital expenditures, but when considering future capital investments, affordability of water rates should be considered.

To improve affordability for low-income customers, water suppliers should consider:

- Income-Based Discounts: Lifeline rates for essential water needs
- Senior/Disabled Discounts: Targeted discounts for vulnerable groups

To incorporate conservation incentives to encourage responsible water use, water suppliers should consider:

- Seasonal Rates: Higher charges during peak demand seasons
- Tiered/Block Rates: Increasing charges as usage exceeds thresholds
- Sliding Scale: Prices rise with average daily consumption
- Drought/Scarcity Rates: Increased charges during droughts or resource stress
- Excess Use Charges: Higher rates for usage above average, based on winter consumption
- Indoor/Outdoor Rates: Lower rates for indoor versus outdoor use
- Water Budgeting: Allocated budgets based on household size or property dimensions

The Alliance for Water Efficiency (AWE) provides several resources that support this strategy, such as *Building Better Water Rates for an Uncertain World* (AWE 2014) and *Sales Forecasting and Rate Model Analytical Tool* (AWE n.d.). The American Water Works Association (AWWA) also offers guidance, including *M1 Principles of* Water *Rates, Fees and Charges* (AWWA 2017) and *M54 Developing Rates for Small Systems* (AWWA 2016). For municipalities interested in pursuing this strategy, recommended actions for the next five years include:

- Assess ability to meet operating costs and cover planned capital costs
- Apply for grant funding to conduct rate studies using a consultant
- Or use AWE and AWWA guidance to establish updated rates
- Implement updated rates

This strategy will support municipalities appropriately charging residents for the cost of providing water.

6.5 Long-Term (2030-2050) Regional Strategies

S. Maximize Use of Desalinated Water Supply – Long-Term

Applicability	Abington, Bridgewater, Hanson, and West Bridgewater; possibly Easton
Lead	Municipal departments of public works/water
Partners	The state (MassDEP)
Resources Needed	Consistent educational materials (digital and print), communication plan (marketing and outreach), and staff time
Funding Possibilities	4, 5, 7, 8, 11, 16, 17, 19, 20, 25, 29 in **Appendix H**

This strategy focuses on adding these additional communities to using desalinated water and assumes that communities included in the short-term strategy (Strategy F) would continue to utilize desalinated water. Bridgewater, Hanson, and West Bridgewater are addressing PFAS treatment locally in the short term but may have to consider purchasing desalinated water in the long term if sufficient capacity is available. Easton has sufficient supply in the short term and may not need additional supply if water efficiency measures are effective. Abington is interested in considering all options available and may pursue short-term treatment of PFAS and connection to Aquaria in the long term. Additional water supply may be pursued to improve resiliency to risks such as water quality deterioration and drought.

It is recommended that these water suppliers reassess their conditions in five years to determine whether additional supply is needed. Over the next five years, these water suppliers should:

- Monitor water demand trends
- Assess the need for additional water supply
- Feasibility study on utilizing desalination water from both a hydraulics perspective and a distribution system quality (blending) perspective for each municipality.
- Initiate discussions with the operating body of the desalination plant in the case additional supply needed for the municipality
- Municipalities should prioritize water efficiency, as they could potentially prevent the need for the development of new water supplies. Affordability of water for existing customers will be impacted by large capital costs such as connection and purchase of desalinated water, and priority should be placed on avoiding expenditure if possible.

This strategy will support future water security for these municipalities, while supporting current and future demands for housing and economic development. The high energy use for desalinated water should be considered in the long term. Steps should be taken in the short term to transition to renewable energy to support cost effective and energy efficient water supplies. In the long term, public opinion may turn against energy intensive water sources like desalination. There are resources and grants available from MassDEP to support water utilities pursuing energy efficiency.

T. Create New Emergency Interconnections

Applicability	Brockton, Easton, Halifax, Plympton, and West Bridgewater
Lead	Municipal departments of public works/water; Plympton Conservation Commission
Partners	Neighboring departments of public works/water
Resources Needed	Political support from neighboring communities as well as funding for planning, design and construction of interconnections.
Funding Possibilities	4, 5, 7, 8, 11, 16, 17, 19, 24, 25, 28, 29, 37 in **Appendix H**

This strategy enhances redundancy and supply resilience by establishing new emergency interconnections between neighboring municipalities in the Old Colony region. These interconnections provide extra supply during critical periods, such as droughts or water main breaks, and improve water security, optimize resource use, and reduce risks linked to localized shortages.

The following opportunities for interconnections were identified:

- Brockton and West Bridgewater
- Brockton and Easton
- Easton and West Bridgewater
- Halifax and Plympton

Easton, Halifax, Plympton, and West Bridgewater have few to no existing interconnections. Adding interconnections would significantly increase the resiliency of their supplies.

Recommended actions for the next five years include:

- Plympton should monitor any progress towards development of local well for emergency purposes
- Municipalities should discuss feasibility of interconnections with neighboring municipality
- Municipalities should identify funding for feasibility study and design of interconnection, considering both hydraulics and distribution system quality (blending).

U. Connect OCPC Communities to Massachusetts Water Resources Authority (MWRA) through Weymouth

Applicability	Abington, Hanover, and Pembroke
Lead	Municipal planning departments and departments of public works/water
Partners	MWRA, the state, Old Colony Planning Council, Metropolitan Area Planning Council, and watershed associations
Resources Needed	Staff time in Abington, Hanover and Pembroke to monitor trends in municipal demand. If this strategy becomes necessary, there will need to be funding and political support in Weymouth for interconnections to these municipalities.
Funding Possibilities	4, 5, 7, 8, 11, 16, 17, 19, 24, 25, 28, 29 in **Appendix H**

Abington, Hanover, and Pembroke could benefit from connecting to MWRA through Weymouth (CDM Smith 2022). MWRA connections to the Old Colony region would help ensure water security and resiliency over the long term. This is a long-term strategy because the expansion approval process led by Weymouth may take up to a year, followed by several years for the design and construction of the expansion, including any connections to municipalities in the Old Colony Region. In the short term, it is recommended that these municipalities focus on implementing local PFAS treatment and demand-side management strategies.

For these municipalities, recommended actions for the next five years include:

- Monitoring progress towards the Weymouth MWRA connection
- Staying engaged in studies and meetings happening at the local, regional, and state levels, both to express interest in connecting as well as ensure pipe size has the capacity to meet additional water supply needs
- Monitoring trends in municipal demand and assessing the preferred volume of MWRA water needed to meet demand and provide redundancy
- Municipalities should prioritize water efficiency, as they could potentially prevent the need for the development of new water supplies. Affordability of water for existing customers will be impacted by large capital costs such as connection to the MWRA, and priority should be placed on avoiding expenditure if possible.

If a connection to the MWRA is determined to be necessary, it is important that each municipality further assess the feasibility considering both hydraulics and distribution system quality (blending). If determined to be feasible, this strategy will support future water security for these municipalities, while supporting current and future demands for housing and economic development.

V. Connect OCPC Communities to Massachusetts Water Resources Authority (MWRA) through Stoughton

Applicability	Stoughton and Easton
Lead	Municipal departments of public works/water
Partners	MWRA, the state, Old Colony Planning Council, Metropolitan Area Planning Council, and watershed associations
Resources Needed	Staff time in Easton to monitor trends in municipal demand. If this strategy becomes necessary for Easton, there will need to be funding and political support in Stoughton for an interconnection with Easton.
Funding Possibilities	4, 7, 19, 29, in **Appendix H**

Stoughton and Easton could benefit from enhancing connections to the MWRA. Stoughton draws approximately 1% of its annual water supply from the MWRA. Easton could supplement its municipal water supplies by leveraging Stoughton's existing connection to MWRA. This is a long-term strategy, as there would need to be studies of the feasibility of the connection to Easton. In the short term, it is

recommended that these water suppliers focus on implementing local PFAS treatment and demand-side management strategies.

Recommended actions for the next five years include:

- Monitoring trends in municipal demand and assessing the preferred volume of MWRA water needed to meet demand and provide redundancy
- Continue engaging in inter-municipal discussions as to the feasibility of accessing MWRA water with Stoughton
- Municipalities should prioritize water efficiency, as they could potentially prevent the need for the development of new water supplies. Affordability of water for existing customers will be impacted by large capital costs such as connection to the MWRA, and priority should be placed on avoiding expenditure if possible.

If a connection to the MWRA is determined to be necessary, it is important that each municipality further assess the feasibility considering both hydraulics and distribution system quality (blending). If determined to be feasible, this strategy will support future water security for these municipalities, while supporting current and future demands for housing and economic development.

W. Collaborate Regionally on Communications

Applicability	Region-wide
Lead	Old Colony Regional Water Resources Committee
Partners	OCPC, municipalities
Resources Needed	Committee member time to develop consistent communications
Funding Possibilities	7, 8, 15, 21, 24, 25, 28, 33, 35, 36 in **Appendix H**

This strategy was based on survey results indicating concern from stakeholders around water quality in the region, and recommendations made by the Alliance for Water Efficiency. The Old Colony Regional Water Resources Committee will take the lead in developing clear, consistent communication efforts across the region to support stakeholders understanding issues related to water resources, such as water quality and droughts. Activities will include the development and distribution of consistent messaging, as well as ensuring that the communication efforts are inclusive and accessible to all communities. Through regional collaboration, the committee will work to enhance preparedness, build resilience, and ensure that all stakeholders are equipped with the necessary information to respond to water resources issues.

Recommended actions for the next five years include:

- Develop a clear, consistent messaging framework for water quality and drought events that can be used across multiple platforms (websites, social media, printed materials, etc.).
- Get approval from water department staff on messaging
- Create templates for a variety of communication needs, such as emergency alerts, seasonal forecasts, and conservation tips.

- Translate communication materials into Spanish, Portuguese, Haitian Creole and Cape Verdean Creole and other languages as needed
- Work with local water department staff to ensure that the messaging is technically accurate, aligns with existing water management strategies, and reflects current risks
- Provide/distribute communication materials to communities

The goal of these actions is to develop consistent messaging around water resources concerns that is available in multiple languages for the OCPC region.

X. Plan for Drought Regionally

Applicability	Region-wide
Lead	Old Colony Regional Water Resources Committee
Partners	Old Colony Planning Council, municipal departments of public works/water agricultural stakeholders, watershed associations
Resources Needed	Time for committee members to coordinate on drought planning and consult with MassDEP.
Funding Possibilities	8, 11, 24, 28, 33 in **Appendix H**

This strategy was proposed by the Steering Committee with the goal of having a comprehensive approach for periods of drought across neighboring municipalities that draw from the same water resources. Recommended actions for the next five years include:

- Adjacent municipalities or those that rely on the same water resources should coordinate on the timing and levels of water use restrictions.
- All municipalities should have a Drought Management Plan (DMP) approved by the Massachusetts Water Resources Commission. These should include modelling of hydrologic trends into the future, clear drought triggers, and response measures in the form of both supply and demand management measures.

The Old Colony Regional Water Resources Committee should encourage collaboration in the development of drought management plans in neighboring municipalities and municipalities that rely on the same water resources.

6.6 Plan Implementation

The long planning horizon for this project, which spans from 2025 to 2050, comes with considerable uncertainty regarding long-term strategies. Some uncertainties include future population, water demand, natural water availability, and regulations for water quantity and water quality. Adaptive management is one way to address uncertainty. The regional water plan has been developed using adaptive management principles.

Adaptive management plans include understanding future project options, defining decision points, and recognizing which data should be monitored to determine when decision points are nearing. Many long-term water supply strategies might be unnecessary if municipalities and other stakeholders act

proactively with short-term water efficiency strategies. Tracking trends in water demand, as part of adaptive management, can aid the municipalities in the Old Colony region in understanding how and when various decisions should be made. **Figure 6-1** presents a schematic example of an adaptive management plan. The actions related to water efficiency and supply have been integrated into adaptive management schematics for each municipality, included in **Appendix G**. **Figure 6-2** illustrates the adaptive management plan on a regional scale.

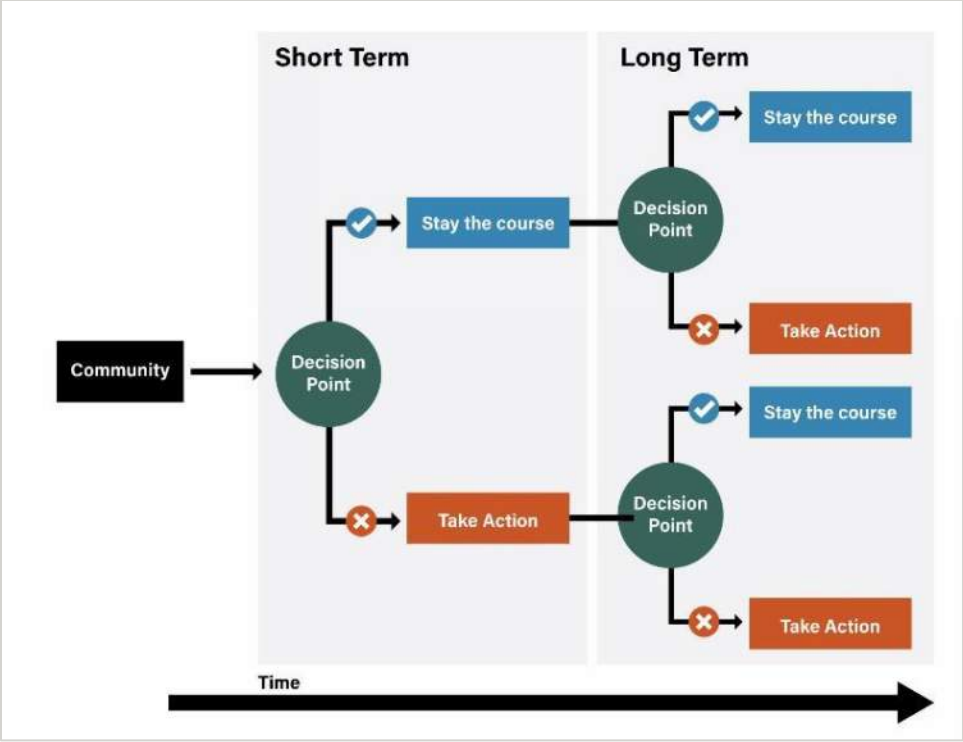

Figure 6-1: Example of an Adaptive Management Plan for a Community

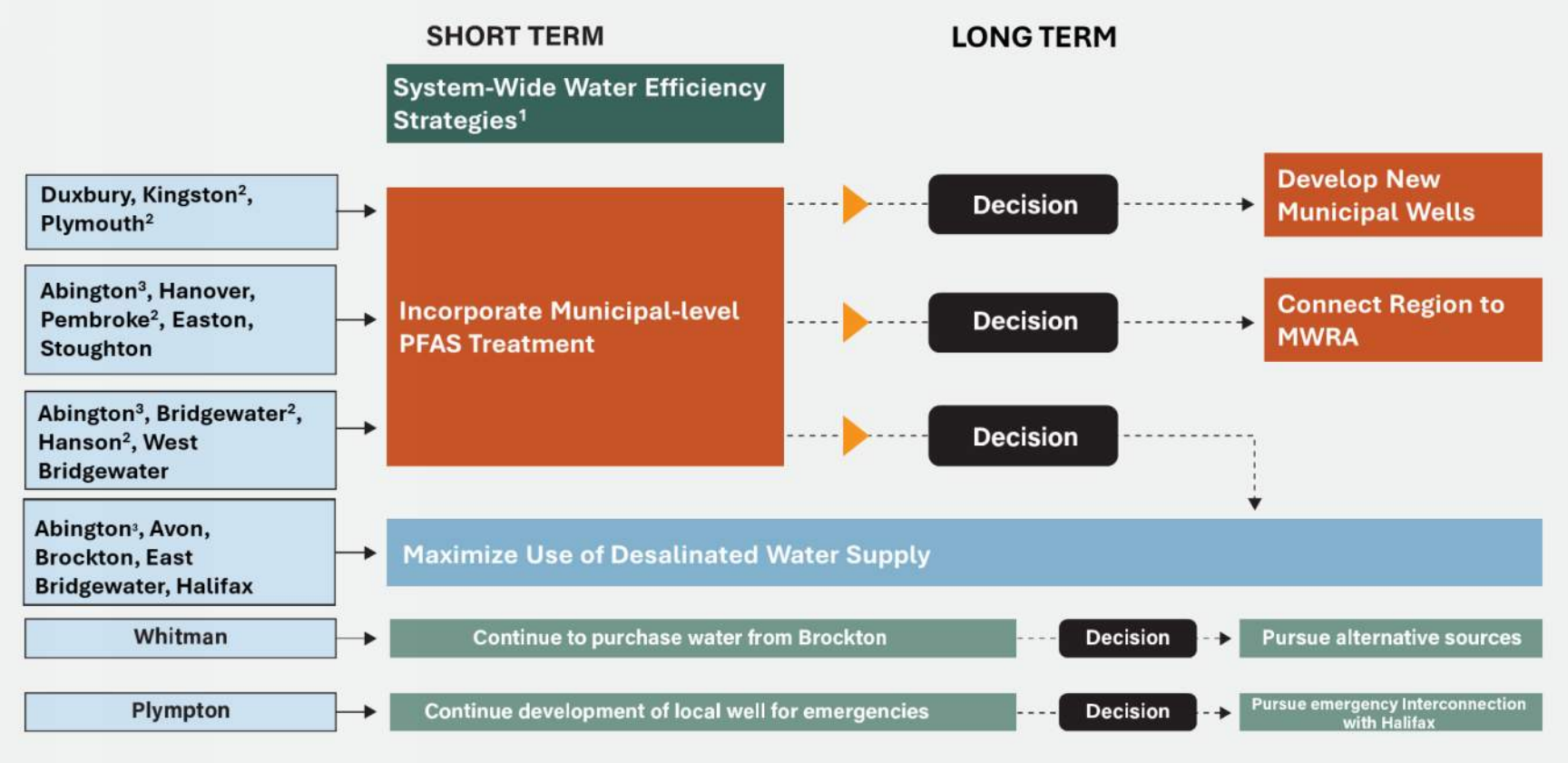

Figure 6-2: Regional Water Supply Adaptive Management Plan for Municipalities' Water Efficiency and Supply Strategies

Notes:

1 System-Wide Water Efficiency Strategies apply to all municipalities in the OCPC region with public distribution systems, which excludes only Plympton.

2 Communities indicated are also already pursuing development of new municipal wells and will continue those efforts in the short term.

3 Abington is included in three potential water adaptive management strategies: 1) short-term strategy that focuses on incorporating municipal level PFAS treatment followed by potentially connecting to MWRA in the long term, 2) short-term strategy that focuses on incorporating municipal level PFAS treatment followed by potentially connecting to desalination water, and 3) maximizing the use of the desalinated water supply in the short term. The town is interested in considering these potential strategies but will pick one as more details become available.

To make adaptive decisions, two categories of data must be tracked:

- Trends in conditions that affect water security
- Effectiveness of short-term strategies

In implementing this plan, decisions need to be made about the information needed for future decision-making, sources, responsible parties for collection and tracking, and processes for disseminating data that will help at the identified decision points in the municipal-level and regional adaptive plans. Information that could be useful to understand conditions that affect water security include the following:

- Population trends (general)
- Population trends in response to federal and state housing policies and regulations
- Actual water demand by volume and as GPCD (gallons per capita per day)
- Changes and trends in UAW (unaccounted for water)
- Climate patterns (monthly precipitation and temperature) and the frequency of impacts
- Streamflow patterns
- Groundwater levels
- PFAS occurrence, concentration patterns, migration patterns, and treatment effectiveness
- Status of inter-municipal interconnections and agreements
- Emerging regulations on new or unforeseen contaminants

This list is not exhaustive, and some information will already be tracked by municipalities for compliance with permits but centralizing the data in a way that supports future adaptation decisions for municipalities, the Old Colony region, or watersheds is recommended.

While municipalities have implementation responsibilities for many, but not all, strategies in this plan, the sharing of knowledge, experience, and resources between municipalities and the possible efficiencies of regional coordination should be pursued. To this end, the recommendation of this project's Steering Committee is for Old Colony Planning Council to establish a permanent Water Resources Committee, which would play a pivotal role in regional coordination for water resources. Responsibilities for this committee would likely include:

- Tracking implementation of strategies in the Regional Water Plan
- Tracking data necessary for decision-making
- Monitoring the approach of decision points

Lastly, full preparedness is recommended so that when decisions need to be made, information is readily available. This may require some up-front investment in researching permitting needs, conducting feasibility studies, and determining lead time for project development. Compared with design and construction costs, these up-front evaluations are much less costly, and often considered "no regret" investments, since they can provide clarity when decisions are needed, reduce project schedules

by answering key questions before needs arise, possibly initiate permitting processes, and also rule-out long-term concepts that may not be viable, so that other long-term adaptive options can be identified before they are needed.

6.7 Next Steps

The following recommendations aim to sustain momentum and take critical first steps toward implementing strategies identified in this plan.

A. **Establish a standing committee (Old Colony Regional Water Resources Committee) to drive implementation forward:** This plan forms the basis of a charter for the committee, which would continue to facilitate water resources collaboration in the region and direct implementation of this Regional Water Plan.

B. **Continue regulatory discussions:** Beyond permitting issues, the implementation of this plan will require coordination among municipalities regarding future water use and allocations. The Massachusetts Department of Environmental Protection (MassDEP), which participated in the planning process for this Regional Water Plan, should be consulted about the steps individual municipalities may need to take as they plan or consider new or alternate supplies. Through the Old Colony Regional Water Resources Committee, municipalities and other regional stakeholders will continue to collaborate on the future regulation of waters in the region, ultimately striving for a more holistic, flexible, and adaptive approach.

C. **Pursue funding for near-term needs:** Old Colony Planning Council will continue collaborating with regional stakeholders to pursue funding and other opportunities to implement strategies in this plan. Priority areas include the following, which will be refined once a standing committee is established:

    a. Formation and facilitation of the aforementioned Old Colony Regional Water Resources Committee.

    b. Conducting an integrated ecological assessment, beginning with a flow study, to identify locations in the region that are known to have histories of natural flow depletion, then establish natural flow targets with timing and work with water providers to determine how progress can be made toward these goals in light of access to water sources outside the region.

    c. Maximizing the effective use of desalinated water in the region. Desalinated water can help address PFAS contamination problems and ease funding pressures on municipalities and the state for PFAS remediation.

    d. As some communities aim for connection to the Massachusetts Water Resources Authority (MWRA) or desalinated water in the near term, it is advisable to convert the high-level comparative planning costs for pipeline extensions in this plan into more detailed opinions of probable cost for engineering and design, including capital, operations and maintenance, funding and debt strategies, etc.

D. **Pursue opportunities for regional demand management:** While many demand management strategies are typically implemented by individual municipalities, opportunities for coordination on drought protocols do exist. The likely cost-efficiencies of pursuing other activities (e.g., billing structure assessments, and metering cost estimates) regionally are also worth considering. This is a possible topic for near-term deliberation with the standing committee.

E. **Explore the feasibility of a tracking system for adaptive management**: It is essential to define information needs, identify sources, and establish processes for collecting and disseminating data that will assist at the identified decision points in this plan. Information could be presented through an accessible dashboard, protocols for individual municipalities, or a centralized hub of information (for example, OCPC) that would include valuable information over both the short- and long-term, such as the following:

   a. Population trends

   b. Actual water demand by volume and as gallons per capita per day (GPCD)

   c. Climate patterns and the frequency of their impacts on water systems

   d. PFAS occurrence, concentration patterns, migration patterns

   e. Trends in unaccounted-for water (UAW)

   f. Emerging regulations on new or unforeseen contaminants

F. **Inform private well owners**: Though addressed in other prioritization efforts, outreach to private well owners to educate them about water quality risks, opportunities they may have as a result of this plan, and information about what they can do in their own homes to test and treat for PFAS should be a key priority of the Old Colony Regional Water Resources Committee.

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