Town of Westport
Planning Board

TARGETED-INTEGRATED WATER RESOURCE MANAGEMENT PLAN

January 17, 2020

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PARE CORPORATION

TOWN OF WESTPORT, MASSACHUSETTS
TARGETED-INTEGRATED PLAN FOR WATER RESOURCES MANAGEMENT
WESTPORT, MA
KLEINFELDER PROJECT #20191827.001A

JANUARY 17, 2020

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TOWN OF WESTPORT, MASSACHUSETTS
TARGETED-INTEGRATED PLAN FOR WATER RESOURCES MANAGEMENT

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Acknowledgments

There were many committed individuals supporting the development of this Integrated Plan. The Kleinfelder/Pare team would like to express appreciation specifically to the Town of Westport Project Steering Committee who contributed significant time and technical expertise to completion of the Plan. The Steering Committee members included:

- Mr. Robert Daylor
- Mr. James Whitin
- Mr. David Cole
- Mr. Philip Weinberg
- Mr. James Hartnett, Town Planner

In addition, the team relied upon many citizens and interested parties who participated in project workshops and attended public meetings. Their input was critical to the process, and greatly appreciated.

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1 EXECUTIVE SUMMARY

Project Purpose

Water defines and influences much of the character of the Town of Westport. It establishes boundaries (Westport Harbor and Buzzards Bay); it provides the basis for a significant segment of the local economy (commercial fishing and shell fishing); it provides compelling recreational resources (boating, fishing and swimming); and along with rolling farmlands it is a defining feature of the landscape in the form of wetlands, coastal beaches, brooks and the Westport River. Local groundwater serves as the potable water supply for the private wells that predominate, and virtually all of the Town is serviced by septic systems which ultimately discharge to local waters. Preserving the quality of the water resources in the community, and therefore much of the quality of life in the community, is the objective pursued by the Town through this Integrated Plan (hereafter the “Plan” or “IP”) development and implementation.

The Town recognizes an array of challenges to local water quality, and the variable sources which contribute to those challenges. Westport was motivated to undertake this effort at this time, however, in large part due to the regulatory obligation associated with the April 2017 Total Maximum Daily Load (TMDL) for nitrogen. This limit was established by the Massachusetts Department of Environmental Protection (MassDEP) specific to the East Branch of the Westport River. The TMDL is the threshold concentration of a pollutant in water above which that receiving water can no longer achieve the beneficial uses (e.g. boating and fishing) for which it is classified under the Commonwealth water quality standards. As such, nitrogen reduction, and mitigation of impairments caused by nitrogen, is a project priority. The TMDL report cited agricultural land uses and septic effluent as the two primary controllable sources of nitrogen to the East Branch of the Westport River.

At a public meeting to kick off the project, residents were asked to identify additional concerns with respect to water resources within the community. Issues related to the local economy, environmental stewardship, public health and social equity were all noted. This Plan seeks to acknowledge all of these goals, and most urgently the public health risks associated with contaminated wells and the environmental health risks attributable to nutrient enrichment. In order to achieve this, the Town is seeking an action plan employing successive steps that advance the stated goals and do so in an affordable, practical and equitable manner.

The project was conducted with the assistance of a citizen stakeholder group. Over the course of three workshops, this advisory group provided essential input that informed the direction of the Plan and allowed the team to test certain assumptions about practicability and implementation. The team was guided by the Town’s Project Steering Committee, all of whom contributed significant technical and local expertise on water quality and environmental issues pertinent to the project purpose.

Project Approach

There are substantial existing data related to nutrients and other pollutants in local Westport waters, and many of the data sources available now are more current than that employed by MassDEP to model impacts and establish the TMDL. In order to fully understand the nature and scale of the challenges, the first project task re-evaluated the model inputs for updated local sources of nitrogen loading. The team utilized foundational data derived from the Massachusetts Estuaries Project (MEP) Report which informed the TMDL. In addition, the team used updated data from the Town's Board of Health and Agricultural Commission, and direct water quality sampling results provided by established non-governmental organizations and environmental advocacy groups, to update the current nitrogen loadings to, and concentrations in, the Westport River. The major conclusions from the analysis are as follows:

- The respective percent contribution of nitrogen from various land use sources has changed primarily due to changes in land use practices and new development;
- Overall nitrogen load has been reduced;
- Overall nitrogen concentration at downstream/in stream sampling locations has been reduced; and,
- Private well contamination hotspots were identified that correlate with denser development and/or non-compliant cesspool locations.

This data supports the local perception that ongoing Town initiatives and other outside regional factors have contributed to progress toward nutrient concentration reductions. Nonetheless, trends in population growth, land use transition, and climate change pose a threat to continued progress and further actions are warranted to advance the multiple objectives of the IP.

These initial tasks allowed the team to focus potential solutions on the most impactful contributing factors. This IP considered multiple solution categories to address identified challenges. Within these categories, alternatives were composed of capital projects, programs and public policies. Categories included:

- Wastewater Treatment
- Innovative Technology/Resource Management
- System Alteration
- Stormwater/Green Infrastructure
- Source Control
- Policy/Regulation
- Public Infrastructure

Agricultural land use, and runoff from these uses, is the overall greatest locally controllable contributor of nitrogen loads to the Westport River. It is noteworthy, however, that the updated baseline task demonstrated that contributions from this sector have been substantially reduced since the original MEP Report was issued. Proposed solutions to address this source focus primarily on stormwater management techniques, public policy initiatives and education and outreach.

While agricultural loadings have decreased, septic effluent is a growing component of the nitrogen load and is a reflection of the Town's population growth and residential development over the past decade. Proposed solutions to address this source were varied and reflected the degree of difficulty in implementing wastewater solutions where there is no current public infrastructure nor municipal administrative framework to operate and maintain it. Privately owned infrastructure is problematic due to the historic land development patterns in the community. Many of the parcels along both branches of the Westport River are small and these areas are densely developed. In many instances, properties rely upon cesspools or other legacy wastewater disposal practices that fail to meet current minimum Title V requirements for septic operation. Site constraints related to parcel size, private well locations, soil conditions, and groundwater depth make standard upgrades challenging, and advanced de-nitrification system installations even more so.

Initial brainstorming of potential solutions, and consideration of previously proposed solutions, generated a list of possible alternatives that could be implemented in phases, and varying scales (pilot to town-wide) over a prescribed duration. These solutions provide geographic distribution across the watershed and address one or more of the multiple objectives identified by stakeholders. Phasing of alternatives provides for potentially more affordable investments and allows monitoring of results to determine if the desired improvements are being measurably achieved. This approach is the hallmark of adaptive management and an integral element of a dynamic action plan. Initial recommended tasks are executed; results are evaluated; and subsequent actions are re-prioritized on the basis of realized progress and/or failure to achieve anticipated goals.

The final list of identified alternatives (shown without prioritization), to be implemented for short term as well as long term impact, is as follows:

Table ES.1. List of Alternative Projects and Programs

Category	Alternative	Benefits		
		Nitrogen Reduction	Public Health Benefits	Other (Economic, Resilience, Aesthetic, etc.)
Wastewater Treatment	Title V Upgrades	✓	✓	
Public Infrastructure	Sewer: Phase 1A	✓	✓	✓
Public Infrastructure	Sewer Phase 1B	✓	✓	✓
Wastewater Treatment	Cluster System with Denitrification	✓	✓	
Wastewater Treatment	Cluster System with Denitrification and Reclamation	✓	✓	✓
Innovative Technology	Permeable Reactive Barriers (PRB): Pilot	✓		
Policy, Wastewater	Denitrification Incentives for Existing Systems	✓	✓	
Stormwater/Green Infrastructure	Vegetative Buffer Strips	✓		✓
Source Control	Fertilizer Reduction	✓		
Outreach	Public Education Initiatives			✓
Policy, Wastewater	Denitrification for New Construction (Rural Services District)	✓	✓	

Category	Alternative	Benefits		
		Nitrogen Reduction	Public Health Benefits	Other (Economic, Resilience, Aesthetic, etc.)
Innovative Technology	Barrages/Constructed Wetland	✓	✓	✓
Public Infrastructure	Public Water Supply Development, the Let	✓	✓	
Policy	Regulation, Nutrient Reduction Overlay District	✓	✓	
Public Infrastructure	Sewer and Water (Phases 2-4)	✓	✓	✓
Wastewater Treatment	Additional Treatment Systems (Cluster, PRBs, etc.)	✓	✓	

The list of alternatives reflects local concerns and objectives. The implementation approach described below recognizes the resource constraints and practical implementation challenges inherent in the effort. It also recognizes that *any* positive action contributes to incremental improvement in the Westport River water quality and as such should be encouraged and supported by the community. Significant highlights include:

- While nitrogen reduction is one of the major goals of this report, the Plan was developed with a focus on achieving multiple goals - nitrogen reduction, public health benefits, economic growth, sustainability, and other secondary benefits;
- In addition to multiple goals, the Plan also emphasizes implementing a variety of alternatives to distribute the load reductions both in terms of geography and methodology;
- The recommended tiered approach gives Westport the flexibility to adapt to projects that are the most well suited to the character of the Town;
- A focus on monitoring and assessment will inform future implementation stages of the Plan; and,
- While there are areas of uncertainty or potential for projects to not perform as anticipated, the wide range of potential projects built into the implementation approach aims to reduce these inherent risks.

Recommended Plan

Implementation of this Plan is recommended in tiers:

- Tier 1: initial recommendations based on alternatives that garnered stakeholder support and have sufficient data to support pilot implementation in the **near term (defined as Years 1 – 10)**.
- Tier 2: expansions/modifications of select Tier 1 alternatives based on monitoring results from Tier 1 implementation, carried through the planning horizon (assumed to be 20 – 40 years).
- Contingency Tier: alternatives that are held as backup options in the event that projects in Tier 1 and Tier 2 do not perform as expected.

The proposed approach allows the Town to maximize benefits achieved by highly performing alternatives, or re-allocate resources to new alternatives in the event specific recommendations either cannot be executed (e.g. cannot achieve political support, or are determined technically infeasible), or upon execution have proven to be less successful than anticipated. Figure ES.1 below diagrams the process.

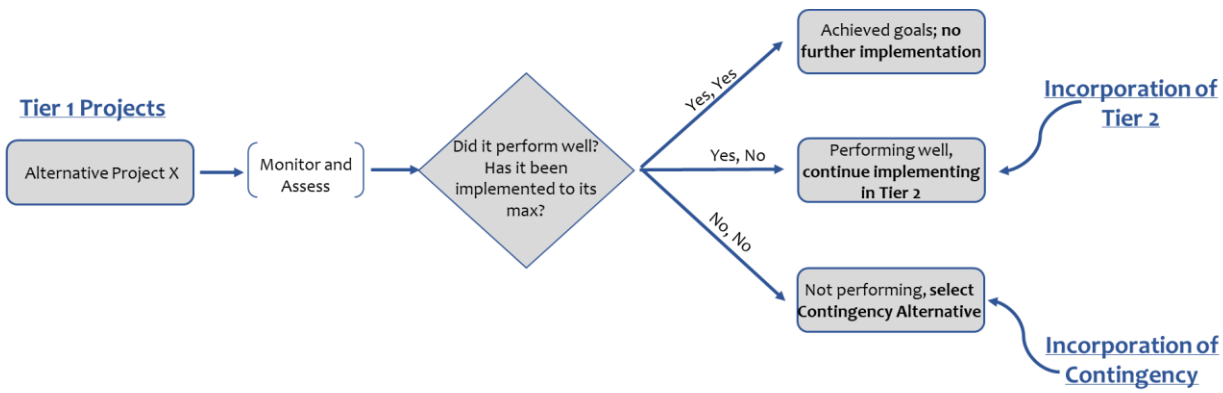

Figure ES.1. Decision Diagram

Based on literature reviews, discussions with stakeholders, preliminary geographic considerations, and cost effectiveness, the specific projects for each tier are organized as follows:

Table ES.2. Tiered Alternative Projects and Programs

Tier	Alternative
1	Sewer: Phase 1A
1	Sewer: Phase 1B
1	Cluster System with Denitrification: The Let
1	Cluster System with Denitrification and Reclamation: Cadman's Neck
1	Nutrient Reduction Regulatory Overlay District
1	Vegetative Buffer Strips, Pilots
1	Public Education & Outreach
1	Denitrification for New Construction (Rural Services District)
2	Sewer and Water (Phases 2-4)
2	Additional Treatment Cluster Systems
2	Additional Vegetative Buffer Strips
Contingency	Permeable Reactive Barriers (PRB): Pilot
Contingency	Barrages and Constructed Wetlands
Contingency	Public Water Supply Development, the Let and Route 6
Contingency	Enhanced MS4 Program, Green Infrastructure

Tier 1 recommends specific project installations or program implementation throughout the Town. The team evaluated sites for location-specific alternatives and predicted the success rates of more policy and Town-wide alternatives to develop more specific estimated benefits for each alternative. Combined, the Plan aims to estimate the short-term benefits of the recommended suite of Tier 1 alternatives across the entire East Branch. The team estimated projected nitrogen load-based reductions for each of the Tier 1 alternatives in sequence, showing the predicted initial nitrogen reduction across the East Branch as compared with the TMDL. The estimates are illustrated in Figure ES.2 below. Tier 1 is just the initial (often pilot scale) implementation of this Plan; therefore, it is not meant to achieve the TMDL alone. The initial progress demonstrated here – projected for the first five to ten years – lays the groundwork for the Town to continue implementing projects moving forward, continually addressing remaining loads as the plan progresses over the next 20-40 years.

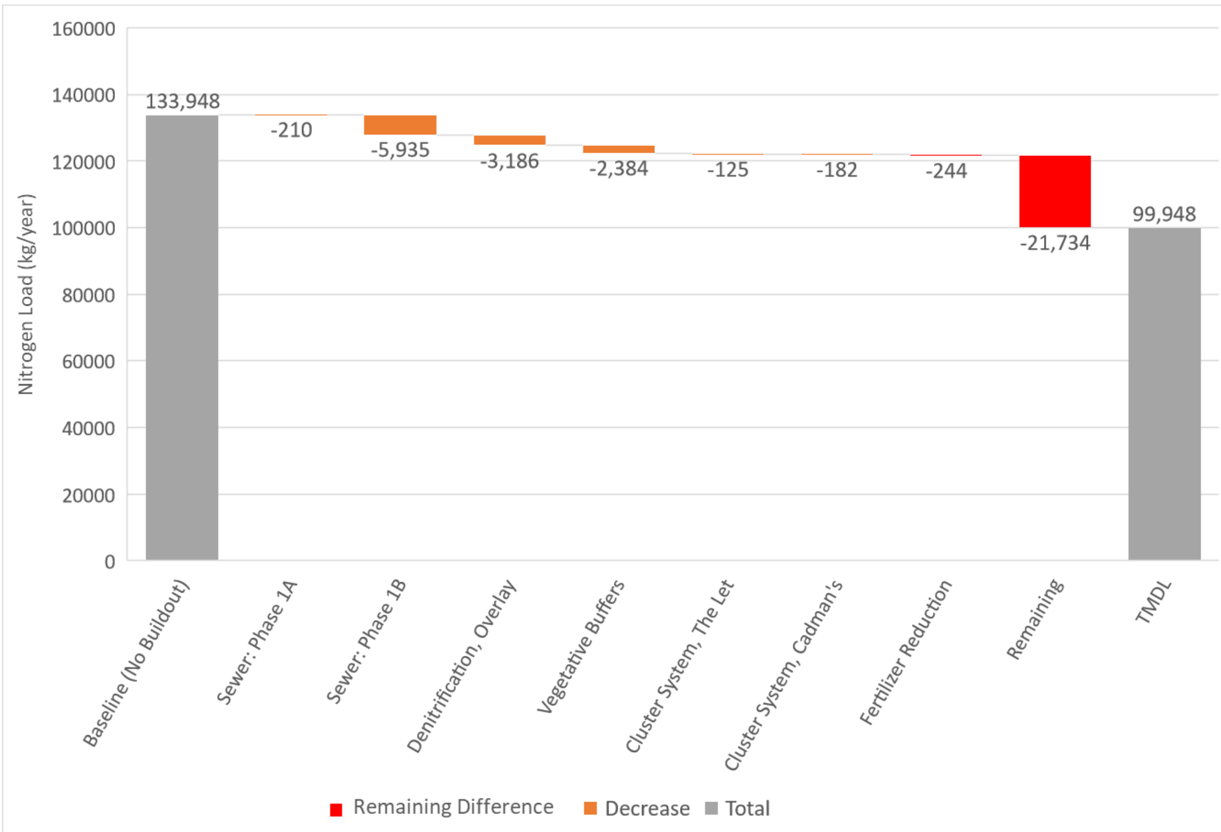

Figure ES.2 Estimated Nitrogen Load Reduction for Tier 1 Alternatives (Initial 5-10 Years)

These first steps allow the Town to make subsequent decisions based on the observed effectiveness of these initial actions. It is possible that not all alternatives will perform as estimated, and that observed effectiveness may vary from assumptions. This tiered plan aims to address these uncertainties, allowing the Town to flexibly choose subsequent paths of action that align with its goals and with the measured effectiveness and affordability of this first tier of implementation. Although not specifically quantified as part of the Town's action plan, there are other non-locally controlled factors that influence total nitrogen loading. Among these are atmospheric deposition directly to water bodies or to the ground surface, and actions taken by upstream communities. In-stream water quality monitoring over time will provide additional important data that will figure into future (Tier 2 and contingency) implementation strategies.

In addition to the nitrogen benefits, Tier 1 alternatives have significant impacts on the public health concerns through mitigating contaminated wells. Table ES.3 provides a summary of the public health benefits that can be achieved through this same suite of alternatives. These alternatives can address known wells with bacteria/nitrate contamination in various ways; sewering and cluster systems will remove septic systems from service, which will remove the risks associated with poorly performing septic systems or septic systems situated too close to water supplies. Septic upgrades – both to compliant Title V or to denitrification, will ensure that remaining septic systems are performing adequately and minimize contamination from in-service septic systems into drinking water sources.

Table ES.3. Summary of Public Health Benefits

Alternative	Estimated Number of Contaminated Wells Addressed (in Tier 1)
Sewer: Phase 1B	78
Cluster Systems (Cadman's Neck; The Let)	24
Denitrification Overlay District	55
Title V Upgrades	20
Total (without Sewer: Phase 1B)	**99**
Total (with Sewer: Phase 1B)	**177**
Current Number of Contaminated Wells	200

An integral component of this Plan is the framework for quantitatively measuring the actual impacts of each of these alternatives to determine their real effectiveness. The success of this Plan hinges upon realized in-stream water quality benefits, not just the modelled benefits. In order to determine if implemented alternatives are achieving the anticipated benefits, a monitoring program must be designed to track and evaluate success of respective projects/programs. The Plan recommends the following strategies for monitoring the actual benefits of each Tier 1 project, which is largely built off existing monitoring efforts:

- In-stream sampling: continue to partner with existing groups such as the Westport River Watershed Alliance (WRWA) and Buzzards Bay Coalition (BBC) to continue established river monitoring at existing sampling stations for parameters of concern.
- Private well monitoring: continue reviewing private well monitoring reports to track changes of bacteria and nitrogen presence in private wells.
- The Town may also choose to install and monitor groundwater monitoring wells proximate to known contaminated well "hot spots" for long-term monitoring of groundwater quality. Groundwater sampling downstream of cluster systems (if constructed) is also recommended.
- Targeted sampling: develop programs to sample nitrogen levels directly up- and downstream of vegetative filter strips and other treatment installations to derive more updated values for their removal efficiencies in Westport.

Over time, the Town will be able to track the progress of nitrogen reduction in the river, as well as estimated contributions from individual or categories of the implemented projects. This data will inform Tier 2 of the Plan, which will continue to make progress in reducing nitrogen and mitigating public health concerns. Figure 7.3 demonstrates an example path for Tier 2 implementations, representing the later years of this Plan. The framework presumes that successful Tier 1 alternatives at the initial implementation levels – sewering, vegetative filter strips, clusters, etc. – are expanded across more of the Town, and larger benefits are realized over the 20 – 40 year planning horizon. The cumulative benefits from Tier 1 are included, and Figure ES.4 shows how continued implementation will increase benefits.

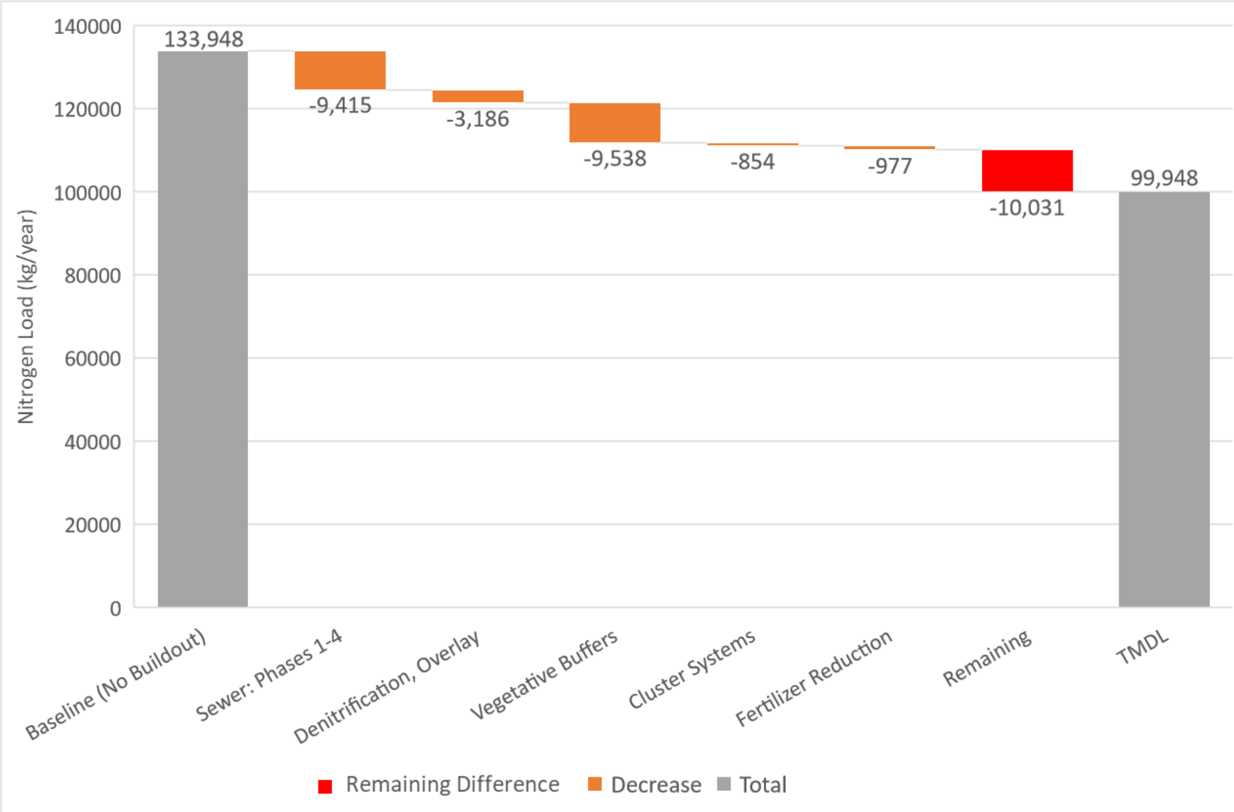

Figure ES.3. Estimated Nitrogen Load Reduction for Tier 2 Alternatives (20-40 Years)

Similar analyses were conducted to envision future impacts of build-out. The Plan recommends evaluating policies to address new construction and updated zoning that reflects any changes or growing character of the Town. While many sources of buildout are still unknown, Westport can be proactive in addressing projected buildout loads by incorporating policies in line with Tier 1 plans regarding septic maintenance and denitrification. Mandating or encouraging denitrification for new construction is one proactive step the Town can take to address new loads as they are introduced into the system.

Beyond Tier 2 projects, the Plan also designates some projects as “contingency” level projects. This means that they may not build directly off the results of Tier 1; however, they can fit into the decision tree in Figure ES.1 if initial projects do not perform as anticipated. The following projects are categorized as contingency projects:

- Permeable Reactive Barriers (PRB): Pilot
- Barrages/Constructed Wetlands
- Public Water Supply Development, the Let and Route 6
- Enhanced MS4 (Stormwater Management) Program and Green Infrastructure

Conclusion

The Town of Westport is committed to improving and preserving the water quality of the resources that surround and define the community. Through this IP, the Town has created an actionable plan of near-term practical strategies to sustain the momentum of recent documented improvements in the water quality of the Westport River East Branch. It also provides a longer term framework for prioritizing future actions based on measurable outcomes and realistic implementation schedules. It relies upon a partnership between community residents and local Town officials to establish a strategy for governance of the recommended capital, programmatic and policy initiatives that can jointly advance the stated goals for water resource management in Westport.

The Plan provides a significant opportunity for the Town to:

- Implement a plan that addresses the most urgent needs created by densely developed near-river neighborhoods through the introduction of regulatory controls (overlay district) that mitigate existing and future nitrogen impacts to receiving waters and private wells;
- Provide recourse to logistically constrained properties through shared/cluster system program development and new governance mechanisms;
- Advance economic development, environmental protection and public health goals through initiation of early phase sewer extensions in targeted areas; and
- Mitigate impacts from non-point source stormwater run-off from agricultural land uses.

2 BACKGROUND

2.1 WESTPORT AND ITS WATER INITIATIVE

The Town of Westport in Southeastern Massachusetts has organized a committee reporting to its Planning Board, and a supporting group of active stakeholders, to collaborate with a consultant team in the development of an Integrated Plan (hereafter “the Plan” or “IP”) for Water Resources in the community. This Plan is aimed at making progress in solving problems that have long affected the residents and businesses in Westport, as well as the very character of the Town. Westport is a coastal community with a multigenerational heritage as well as new or seasonal residents who appreciate the coastal climate and amenities. Westport is also a “Right-To-Farm” community, and supports numerous agricultural interests, also with a long heritage. Portions of the Town’s primary transportation corridors support small and moderately sized businesses, although much of the Town is characterized by a desirable rural charm. The Integrated Planning framework allows the Town to address the many competing interests and uses of the Westport River, as well as other key issues in a coherent and prioritized fashion.

All of these people and enterprises both rely upon, and affect, the waterways that flow through the Town. Specifically, the East and West Branches of the Westport River, its tributaries and ultimately its estuary, as well as the groundwater that flows into the system have long been integral aspects of daily life in Westport. The river and estuary offer a scenic backdrop from many points of view in the community, and also provide opportunities for swimming, boating, and fishing. Portions of the estuary have been used for shellfish harvesting. Residents, farms, and businesses draw their water from private wells and dispose of waste through onsite septic systems, which means that the groundwater serves as both the drinking water supply for the Town, and also its primary means of waste disposal. In addition to posing human health hazards via contaminated well water in certain areas, the groundwater and tributaries also convey organic and inorganic matter to the river and estuary, and this can create organic growth in the form of algae. This algae growth contributes to loss of eelgrass and saltmarsh habitat.

The Town was led in this effort by the Planning Board, and its designated Steering Committee. That core committee included James Hartnett, Westport Town Planner, James Whitin, Chair of the Planning Board, Robert Daylor, Vice-Chair of the Planning Board, David Cole, and Philip Weinberg, Chair of the Board of Health. A citizen stakeholder group (roster provided in Appendix B) participated in multiple workshops and Town Citizens expressed views in public meetings at multiple venues. This broad array of stakeholders agreed that now is the time to improve the water environment in Westport. For the health of the people, the quality of the environment, and continued opportunities for farms, land-based and water-based businesses to thrive, the Town of Westport developed this Plan collaboratively, with the team at Kleinfelder/Pare (the team) leading the technical analysis for this work. Its aim is to address nutrient enrichment of the waterways, well contamination, and the Town’s economic potential in a fair and cost-effective manner.

2.2 WATERSHED OVERVIEW

The Westport River system flows in two branches through the Town of Westport and surrounding communities, as illustrated in Figure 2.1. A recent report entitled “Westport River Estuarine

System Total Maximum Daily Loads for Total Nitrogen," (Massachusetts Executive Office of Energy and Environmental Affairs, and Massachusetts Department of Environmental Protection, April 2017) cites:

> "*The Westport River Estuarine System is located in southeastern Massachusetts on the Massachusetts- Rhode Island state boundary. The system is comprised of two river valley estuaries (east and west branches), a coastal lagoon (Westport Harbor) and a relict tidal inlet (The Let). Westport Harbor is situated at the confluence of the east and west branches and exchanges tidal waters with Buzzards Bay through a single tidal inlet to the southwest. The Westport River Estuary and much of its watershed are located primarily within the town of Westport."*

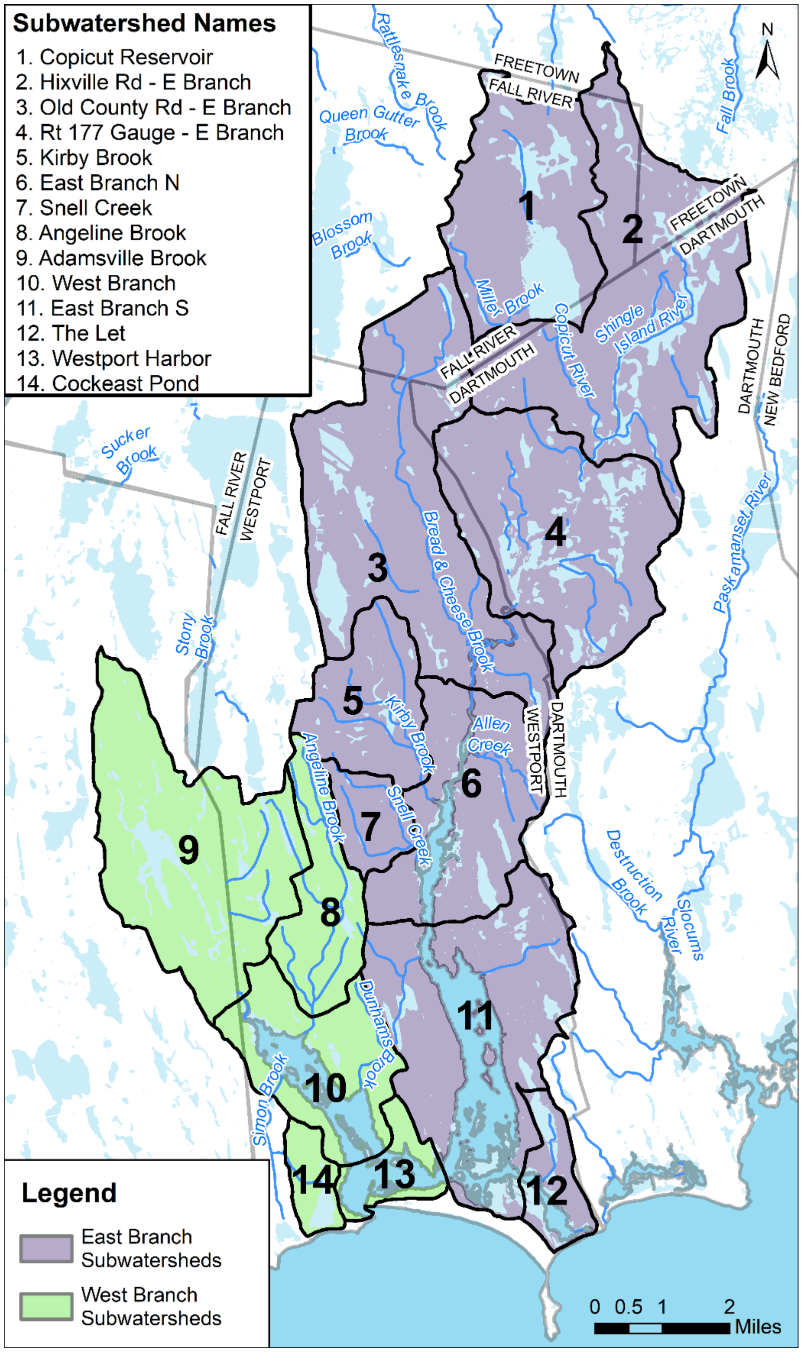

Figure 2.1. Westport River Watersheds

The watershed is dominated by semi-rural development patterns, with significant acreage devoted to agriculture as illustrated in Figure 2.2. Without public sewerage, residents and businesses dispose of waste via on-site septic systems, with a few exceptions in which private businesses at the Narrows pump wastewater to a neighboring community for treatment. Bacteria and nitrates from failing septic systems have contaminated numerous drinking water wells in the community. Likewise, nutrients, in the form of phosphorus and nitrogen, from both failing and operable septic systems flow via groundwater into the tributaries and river system, creating the potential for enrichment that can cause algae growth and loss of eel grass beds (important aquatic habitat and part of the aesthetic appeal of Westport). The nutrient loads are compounded by fertilizers and animal wastes associated with agricultural land use.

To address the nutrient issue, the above cited report, referred to as the "TMDL", for "Total Maximum Daily Load", estimated the amount of nitrogen that would need to be eliminated in order to reduce the risk of nutrient enrichment to tolerable levels. The TMDL identified targets for the watershed as a whole, as well as its subcatchments, and asserts that compliance will be determined when concentrations at downstream sampling stations reach target levels. While it recommended load reductions in the areas draining to the East Branch, it did not recommend load reductions in the West Branch. This planning enterprise, therefore, focuses on the East Branch for two reasons:

1. The East Branch represents a significant portion of the Town, and is a good trial space for this type of collaborative planning – in the future, work can certainly expand into the West Branch as needed; and,
2. The East Branch, by virtue of the TMDL, has specific numeric targets for nitrogen reduction, and as such, offers a measurable platform for water management.

During the roughly fifteen years between the time that data were collected to support the 2017 TMDL and today, the water quality in the Westport River system has exhibited improvements as measured by in-stream reductions in nitrogen concentrations. This is partially attributable to shifts in agricultural practices, which is recognized in a more current baseline assessment of the watershed's environmental health offered later in this report. The Board of Health has also facilitated continual upgrades of old septic systems and cesspools, which has an impact on water quality. It may also be attributable in part to reductions in atmospheric deposition of nitrogen from man-made sources (such as the combustion of fossil fuels), tracked through measurements of dissolved inorganic nitrogen (DIN) as shown in Section 4.2. Although relevant to the overall health of the watershed, this latter trend is not specifically addressed nor incorporated into this planning effort. As it is essentially outside of the Town's control, this category of load reduction is acknowledged, but is not the target of any Town actions proposed in plan recommendations.

The analyses to date represent current and historic land use practices but do not necessarily account for future development or land use shifts. This Plan will discuss the adaptability of its recommendations to help accommodate future changes in development patterns or environmental conditions (e.g. climate change impacts) within Westport's East Branch watershed.

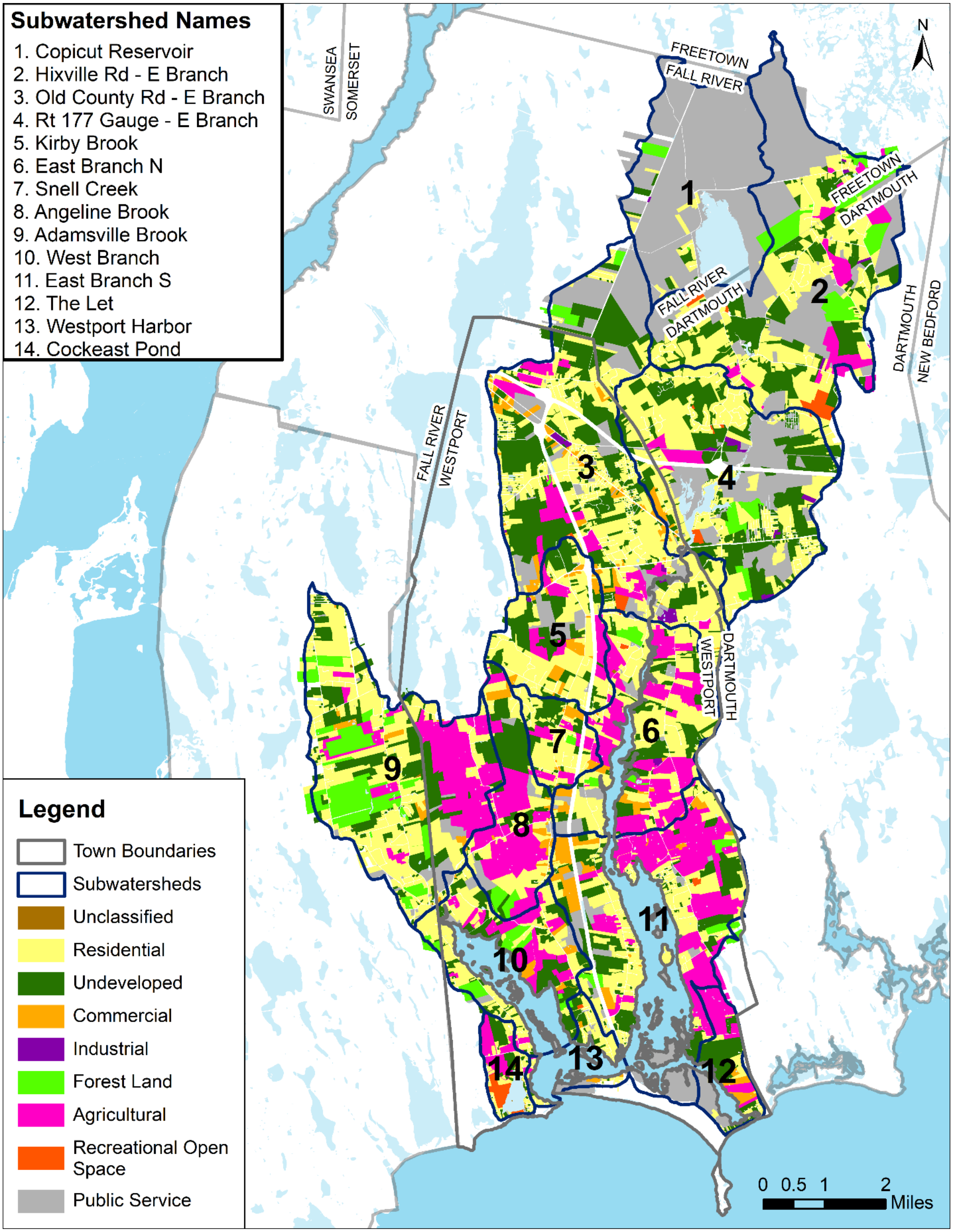

Figure 2.2. Westport River Watersheds with Land Use

2.3 ISSUES TO ADDRESS

This plan seeks to address both the public health risks associated with contaminated wells and the environmental health risks attributable to nutrient enrichment. Its aim is expanded into what is commonly known as the "Triple Bottom Line" framework, in which decisions are aimed at improving the Environmental, Social, and Economic health of a community or region. The following objectives were voiced by citizens of Westport during a public meeting early in this planning process, and helped guide decisions from that point forward:

INTEGRATED PROGRAM GOALS:

Environmental
- Satisfy **TMDL** requirements for nitrogen loads into receiving waters
- Influence measurable **reduction in nitrogen concentrations** at sampling points
- Increase **resiliency to climate change** and sea level rise

Social
- Promote **public health** with clean, secure water supply and stormwater practices
- Promote **recreation** on and in the Westport River and Estuary
- Maintain the **high quality of life**

Economic
- Promote **economic development**
- Promote **cost equity**
- **Increase agricultural output** with environmental responsibility
- **Reduce risk to shellfish** economy

Implementation
- Identify a **phased** suite of solutions that vary in scale and in timing
- Consider **regional** opportunities and benefits
- Develop an **implementable** plan

2.4 OTHER FACTORS AND CONSIDERATIONS

In addition to the explicit goals outlined in Section 2.3, the citizens and stakeholders recognized and emphasized the following as important factors for this plan:

- The agricultural community has made significant progress in reducing its contribution of nitrogen, by changing fertilizer use and farming practices. The Plan recognizes these improvements as part of a new set of baseline conditions.
- An ongoing initiative sponsored by the Massachusetts Association of Conservation Districts consists of a collaborative effort with local farmers to identify and implement conservation practices that may contribute to this trend in agricultural-sourced nutrient and/or bacteria reduction. Where possible, the Town would like to leverage these efforts for additional benefit.
- No constituency of the Town, either by geography or by demographic, will be unduly burdened by implementation of Plan recommendations.

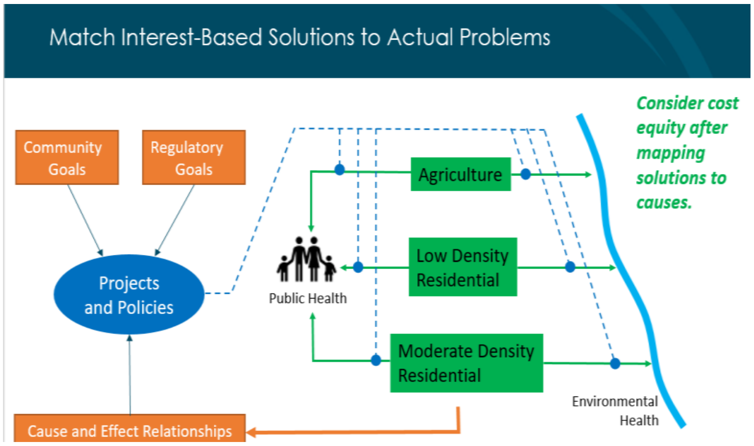

Figure 2.3.The Town's challenges and solutions are unique to Westport

Likewise, no constituency of the Town will be absolved of participating in the solution simply because the subwatershed in which they may be located has not been identified as needing reductions in nitrogen – in other words, the nitrogen reduction targets in the TMDL will be applied to the entire East Branch watershed, and not simply piece by piece.

- While nitrogen reduction is an important goal, this Plan is intended to address more than just TMDL compliance. Rather, it is an integrated plan that will help the Town to make significant and measurable progress toward the TMDL goals, while also addressing critical public health concerns that are not considered to be secondary in importance.
- The Plan will acknowledge and accentuate the fact that water quality in Westport has improved during the past fifteen to twenty years, as evidenced in subsequent sections of this report. Given this, the Plan represents a continuation of public and environmental stewardship, not a starting point.
- The Plan is adaptive and not overly prescriptive – that is, it does not simply schedule a series of investments and policy initiatives. Rather, it recommends a broad array of near-term technological, educational, and policy alternatives in measured doses, the performance of which will inform future adaptation to growth, climate, and environmental needs. Alternatives that perform well in the near term may be continued or expanded, while those that do not meet expectations, or which are applied to their maximum practical extent, can be substituted with other contingency actions.
- It is understood that each recommendation in this Plan is part of a larger integrated program aimed at providing multiple benefits and working together as a whole. However, implementation of the Plan is likely to be piece by piece, with individual measures approved or rejected by the Town and its voters. For this reason and the reason directly above, contingency alternatives will be just as important to identify as near-term alternatives for implementation.
- The Plan will provide the foundation for a partnership-oriented action plan that promotes private action and investment through complementary public policy, financial incentives, and program administration capacity that supports successful implementation and sustained progress.

2.5 FUNDING AND SUPPORT FOR THIS PLAN

This planning process was jointly funded by the Commonwealth of Massachusetts and Town of Westport. $150,000 of the project was funded by a State Revolving Fund (SRF) planning loan, while the balance of $30,000 was allocated by the Town of Westport's Community Preservation Funds specifically for public outreach and engagement. While the plan is not intended to constitute an official TMDL compliance plan (because it targets investments and policies at a broader range of goals), it is intended to take measured but significant steps toward TMDL compliance, and provide a roadmap for future decisions that will ultimately be aimed at full compliance.

For these reasons, the Massachusetts Department of Environmental Protection (MassDEP) was consulted at the outset of the planning process and will review this report. MassDEP agreed that this plan is not a Comprehensive Water Management Plan (CWMP); while the Plan is extensive and comprehensive in scope, it is not a CWMP in the regulatory meaning, and as such it is not subject to the specific approval process of a typical CWMP. Instead, it is a progressive plan that integrates environmental and public health issues to support community well-being and regulatory compliance, but not necessarily prescribe a compliance plan or schedule. It was agreed by the Town and by MassDEP that this plan should be adaptive, and that reasonable contingencies should be identified up front for alternatives whose feasibility and/or performance is marked by uncertainty as the Town continues its efforts to improve public and environmental health.

3 DATA COLLECTION SUMMARY

3.1 INTRODUCTION

The Town of Westport considers its waterways as significant recreational, aesthetic, scenic, historic, economic, and ecological assets to the community and the region. The Town's 2016 Master Plan cites that water quality is one of the top issues facing the Town, and as such, there is a significant amount of data and relevant reports related to water quality in Westport. Drinking water, stormwater, and wastewater concerns are described in the Master Plan with a description of plans to address issues in the future based on the alternatives recommended in recent water quality reports.

This Section presents the collective body of available water quality information referenced for the Plan, allowing the team to identify relationships between the causes of documented impairments and their impacts, and evaluate the findings and recommendations of prior reports relative to current conditions in the watershed. The needs analysis in Section 4 describes results of this evaluation. The team specifically looked at the Massachusetts Estuaries Project (MEP) Report, which presented an estimated nitrogen load for each of the Westport River's subwatersheds (see Figure 2.1). This report was the basis for the established Total Maximum Daily Load (TMDL) for nitrogen for the East Branch of the Westport River.

The team used more current data to update the nitrogen loading calculations developed in the MEP Report, which was published in 2013 and relied upon data from years prior to that. These calculations were used to update the baseline nitrogen load in the watershed. This nitrogen-loading baseline is paired with in-stream water quality data to provide a more current depiction of the current quality of Westport's waterbodies (see Section 4).

3.2 PRIOR STUDIES

Multiple sustained efforts to collect data related to the water quality and ecological health of the East Branch of the Westport River have been on-going since the early 1990s. Some of the more recent water quality data collection studies are shown in Figure 3.1, along with the year the corresponding data was collected. The methods and findings of major studies are described in more detail below.

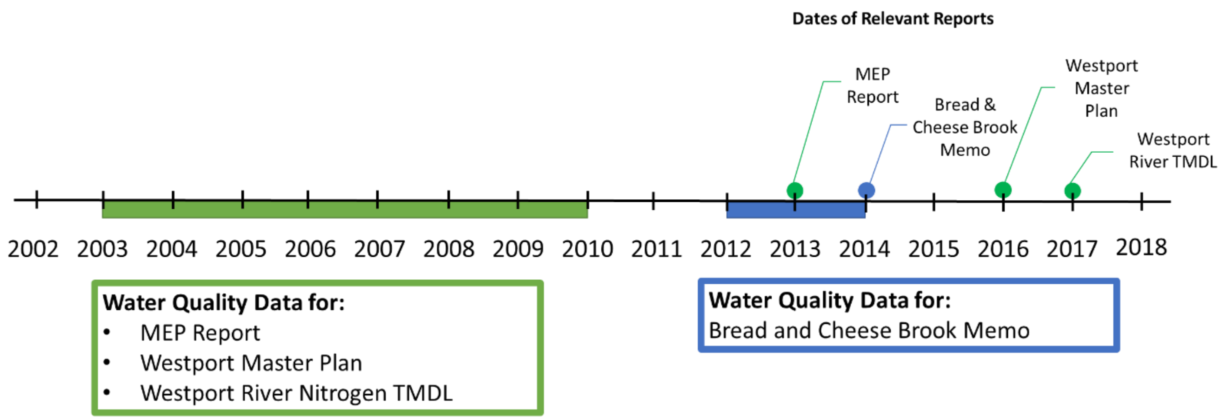

Figure 3.1. Water Quality Reports for the East Branch of the Westport River

3.2.1 Massachusetts Estuaries Project (MEP)

The MEP Report is the key report for the Westport River Estuary and was published in 2013. Data from this report informed several later reports. A hydrodynamic water quality model, called the "Linked Model," was developed to estimate nitrogen loading from each of 14 subwatersheds delineated in the Westport River Estuary. There are multiple key parameters used in this model, some of which are dynamic. Some of these key variables are described below:

- **Land use –** This report used land use data from 2005 to 2010.
- **Septic system locations and type –** The MEP Report used readily available data from the involved towns to estimate the location of septic systems.
- **Loading rates –** The MEP Report states the pollutant mass per unit of land area by land use type.
- **Fate and transport of pollutants** – the MEP Report incorporates assumptions about how pollutants move through the watershed.
- **In-stream concentration of pollutants** – Surface water quality data was used to calibrate the MEP model. These data were based on the results of Buzzards Bay Coalition (BBC) and Westport River Watershed Alliance (WRWA) water quality samples taken from 2003-2009.
- **Target nitrogen load and threshold nitrogen concentration** - The MEP Report states the loading rate, by subwatershed, to support overall ecological health. In general, the watershed was "supportive of many habitats… and shows signs of moderate to low impairment." However, eelgrass coverage in the region was not observed in more recent surveys. Values were developed to restore habitat for "eelgrass and infauna communities" and the values of these threshold nitrogen concentrations were based on the assimilative capacity of this system.

The MEP Report provides an estimate of the anthropogenic causes of nitrogen loading in the East Branch of the Westport River by source. The largest **controllable** contributions were listed as from agricultural runoff (57%) and wastewater (34%).

3.2.2 Streamflow and Water Quality Monitoring in Bread and Cheese Brook, 2012-2014 (Bread and Cheese Report)

This report further investigates Bread and Cheese Brook (subwatershed 3 in Figure 2.1), which was calculated in the MEP Report as having the largest contribution of nitrogen to the East Branch Watershed. In this study, stream flow and water quality measurements were collected from 2012-2014 at four sampling locations in Bread and Cheese Brook (WRWA-1, 2, 3, and 4) and three locations in the Upper Westport River (WRWA-6, 7, and 8). Figure 3.2 shows the study area. Note that sampling location WRWA-1 is upstream of WRWA-2 and sampling locations WRWA-2 and WRWA-4 are both upstream of WRWA-3. Sampling location WRWA-5 and 6 (not pictured) are both upstream of WRWA-7 and are on a separate stream path from the other sampling locations in Bread and Cheese Brook.

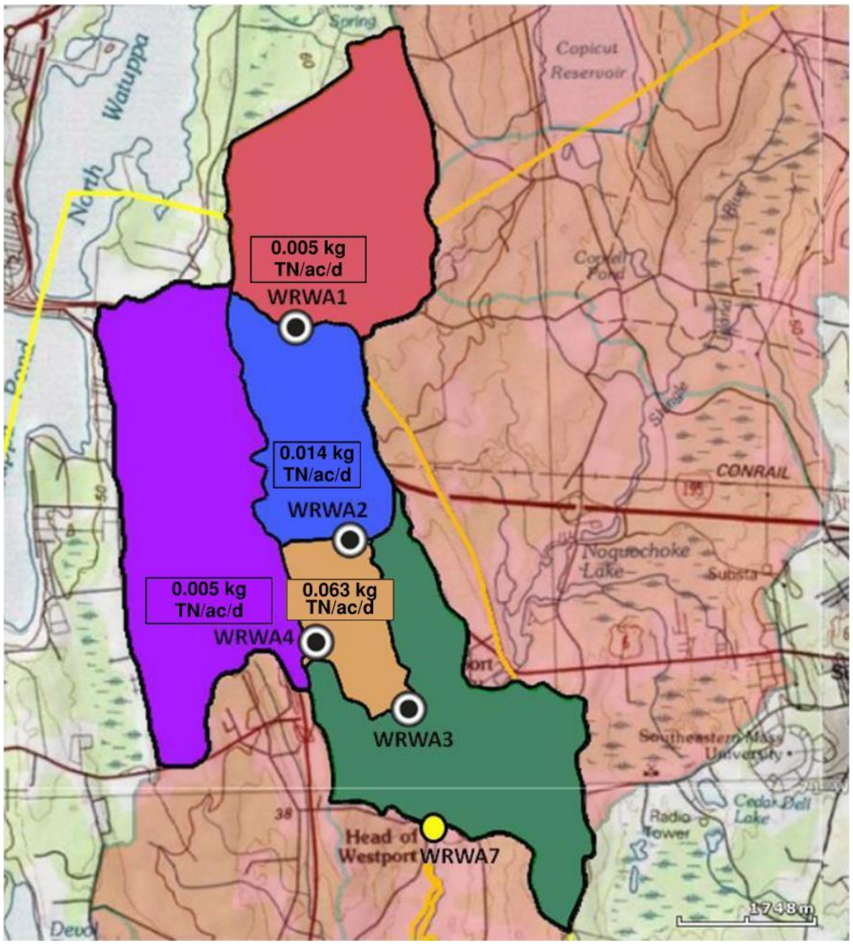

Figure 3.2. Land areas contributing runoff to each monitoring station (Source: Bread and Cheese Brook Report, Figure 19)

Analyses of forty in-stream sampling events from stations within Bread and Cheese Brook included nitrogen species (NH4, NOX, DIN, DON, PON), total nitrogen (TN), total phosphorus (TP), orthophosphate (PO4) and particulate organic carbon (POC). This report summarized an estimated nitrogen loading rate from the subwatershed areas of each sampling site, based on average measured nitrogen concentration and measured stream flow. The estimated total nitrogen loading rate, normalized for upstream subwatershed area, is presented in Table 3-1 along with the average TN concentration and measured stream flow. Note the bolded entries represent the "pick up" nitrogen load between gauge locations as opposed to considering all area upstream of a gauge location.

Table 3-1. Average Total Nitrogen Concentration and Loading by Station

Station Gauge Location	Station Name	Average TN Concentration at Gauge Location[1] (mg/L)	Flow[1] (m^3/year)	Area (acres)	Estimated TN Loading Rate[1] (kg/ac/year)
WRWA-1 (all upstream)	Old Bedford Road	0.774	4,488,794	1868	1.713
WRWA-2 (b/w WRWA-2 and WRWA-1 only)	**Route 6**	**1.055**	**4,761,728**	**1082**	**5.089**
WRWA-2 (all upstream)	Route 6	1.055	9,250,522	2950	2.951
WRWA-4 (all upstream)	Gifford Road (Hemlock Gutter)	2.431	3,166,011	2506	1.932
WRWA-3 (b/w WRWA-2, WRWA-4 and WRWA-1 only)	**Route 177**	**1.353**	**5,353,956**	**557**	**22.964**
WRWA-3 (all upstream)	Route 177	1.353	17,770,489	6013	4.380

[1]Note: Values presented are for the November 2012 to November 2013 hydrologic year

The Bread and Cheese Report recommends specific targeted areas to implement strategies that can reduce nitrogen loading. Namely, the areas upgradient of WRWA-3 (Rt. 177) between WRWA-2 (Route 6) and WRWA-4 (Gifford Road) and between WRWA-1 and WRWA-2 were calculated as generating the highest total nitrogen loading rate by land area at 22.964 kg/ac/year and 5.089 kg/ac/year, respectively, with aging septic systems as the leading potential contributor. In Figure 3.2 these are the areas in orange and blue, respectively, with nitrogen loads expressed in kg/ac/d.

3.2.3 Total Maximum Daily Load (TMDL) Reports:

A TMDL is a watershed plan that states the maximum contaminant loading a water body can receive and still achieve its designated water quality goals. States are required to develop a TMDL as a federal requirement of the Clean Water Act. Communities are required to take steps that achieve the goals stated in the Plan at a "reasonable pace," and MassDEP has enforcement authority through "the Massachusetts Clean Waters Act, the Massachusetts Water Quality Standards, and through point source discharge permits." The Westport community is closely tied to its water resources, using the Westport River for activities like fishing and swimming. Therefore, its water quality goals are tied to specific designated uses, including "fishing, swimming, or protection of aquatic biota." These uses drive the nutrient and pollutant concentrations the waterbody can support.

3.2.3.1 TMDL for Nitrogen

The TMDL for nitrogen, published in April 2017 by MassDEP, is one of the watershed's major planning documents and outlines the steps necessary to reduce "nitrogen loadings and subsequently the nitrogen concentrations in the water" to a level that would protect the estuarine system. This TMDL uses the MEP Report's "Linked Model" to attribute the sources of nitrogen loading. Despite reporting 34% of nitrogen loading from septic systems and 57% from agriculture (excluding non-controllable loads such as atmospheric deposition), the TMDL notes an apparent consensus from the Westport Town Agricultural Committee that the agricultural contribution is less than reported here. TMDL implementation plans discuss a recommended reduction of 71% of septic loading and 10% reduction from agriculture to achieve a target nitrogen concentration of 0.49 mg/L in the East Branch. Several alternatives are listed in this TMDL Plan, including installing sewers in portions of the Town.

3.2.3.2 Buzzards Bay Pathogen TMDL

While the focus of the Integrated Plan is on water quality related to nitrogen-loading, it is important to note that some of Westport's surface waters are also impaired for fecal coliform. Westport directly sees the upstream impacts of these impairments in their contaminated drinking water wells. Based on the 2014 Integrated List of Waters (303d list), Bread and Cheese Brook, Snell Creek, and the East Branch of the Westport River are all impaired for fecal coliform. To improve the quality of water entering Buzzards Bay, MassDEP also developed a TMDL with respect to bacteria and pathogens.

The pathogen TMDL is applicable for 52 waterbody segments in the Buzzards Bay watershed. Data from 2009 and earlier was used to compile information on the land use (1999), potential sources (animals, sewer leakages, failing septic systems), as well as develop the TMDLs for each segment. The East and West Branches of the Westport River, as well as Snell Creek, are included in this TMDL.

3.3 DATA COLLECTION

Tables 3.2 and 3.3 summarize the water quality data reviewed for this Integrated Plan.

Table 3-2. Literature Sources

Document Name	***Date of Publication***
Westport Master Plan	2016
Stream Flow and Water Quality Monitoring in Bread and Cheese Brook (2012-2014)	Dec 2014
Westport River Estuarine System TMDL for Total Nitrogen	Apr 2017
MEP Final Report	May 2013
Municipal Vulnerability Preparedness (MVP) Workshop Summary of Findings	Jun 2018
Drift Road Stormwater Plans	Jun 2014
Buzzards Bay Comprehensive Conservation and Management Plan	Nov 2013
Westport Noquochoke Village Study	Jun 2016
Archaeological Study	Dec 2013
MS4 Notice of Intent	Sep 2018
MassDEP Bacteria Source Identification Reports	Multiple (2008-onwards)

Table 3-3. Tabular and Spatially-Related Data

Document	Source	Description	Format	Date Range of Data
Surface Water Sampling Data	Buzzards Bay Coalition	Data for 15 sampling locations	Excel	1992-2017
Surface Water Sampling Data	Board of Health and MassDEP (Jennifer Shepard)	Multiple Locations on Dunham Brook (bacteria/pathogens)	Excel	2007, 2014, 2017
Surface Water Sampling Data	WRWA	20 locations	Excel	2000-2017
Nitrogen Loading Model and Calculations	MEP	Excel-based model and assumptions for nitrogen loading rates	Excel	2011
Public and Private Drinking Water Well	MassDEP	Locations of reported wells and their date of installation	GIS	1991-2018
Drinking Water Test Results for Public / Private Wells	Board of Health	Approximately 400 letters documenting the results of private well sampling data when results exceeded maximum contaminant limits (results were geocoded based on address)	Word documents	1991-2018
Drinking Water Test Results for Public / Private Wells	Board of Health	Approximately 270 Analytical Laboratory results documenting the results of private well sampling data	pdf	1991-2018
Septic System Activity	Board of Health	Record of repairs, variances, and small repairs by address and date	Excel	2000-2016
Cesspool Maintenance Records	Board of Health	Record of repairs and maintenance of cesspools by address and date	Pdf	2008-2018
Land Use Data:	MEP	Land use assumptions used in the MEP Report organized by subwatershed	Excel	2009
Land Use Data: Agricultural Inventory	Westport Agricultural Commission	Letter to authors of the MEP Report describing land use on agricultural parcels, fertilizer use and associated dataset.	Word Document & Excel	June 11, 2013
Land Use Data: Agricultural Inventory	E. M. Eichner	Response from Eichner regarding Agricultural land use assumptions	Excel	undated
Assessor's Data	MassGIS	Parcel-level data for communities within the East Branch Watershed	GIS	Varies
Location of Sewer Lines	Town of Dartmouth	AutoCAD Drawings of sewer lines	GIS	

Collection efforts focused on water quality data as well as historic and current land use (agriculture and septic). Data was collected from a variety of sources, primarily including the Town of Westport's Board of Health, Planning Department, and publicly available data from MassDEP. Additionally, water quality data was provided by multiple watershed organizations, including WRWA and BBC.

3.4 LAND USE DATA COLLECTION

For the Towns of Westport and Dartmouth, which make up a majority of the East Branch watershed, the team collected the most updated land use data from the MassGIS Standardized Assessors' Parcels database. The latest tax parcel data available for Westport and Dartmouth were from 2012 and 2018, respectively. Before retrieving updated land use parcel data for the remaining towns in the watershed, the team investigated the buildout analysis performed in the MEP Report to determine the significance of updating those adjacent towns. Both Fall River and Freetown to the north consist of largely undevelopable land, and the two Rhode Island towns (Tiverton and Little Compton) drain to the West Branch of the Westport River, which is not the focus of this IP. The land use data provided in the MEP Report was therefore used. Fall River and Freetown assessor's database information is from 2005, and the MEP Report used Rhode Island land use codes from 2009, supplemented with aerial imagery, for Tiverton and Little Compton. For consistency, the MEP Report manually converted these Rhode Island codes into corresponding Massachusetts codes, which this Plan also uses.

4 NEEDS ASSESSMENT

4.1 UPDATING LAND USE AND PRACTICES

The MEP Report employed land use-based loading rates to quantify the nitrogen loads to each of the East Branch subwatersheds. The MEP Report authors applied nitrogen loading estimates (factors) based on the land use types, with assumptions for lawn sizes, impervious area, septic contributions, etc. based on a review of current practices, literature, and discussions with Westport and the neighboring towns. The IP sought to replicate the MEP Report's methodology such that current data for land use, agriculture, and septic systems could be accurately incorporated into an updated baseline. All nitrogen loading rates, assumptions, and calculations from the MEP Report were kept constant when updating to the current baseline to maintain consistency between the reported values.

Wastewater effluent from septic systems is a major contributor of nitrogen to the Westport River. The MEP Report estimated nitrogen loads from septic systems using a water-use approach that aims to account for the seasonality of many of the neighborhoods within Westport. The team collected water and wastewater information on the parcel level to identify the parcels within the watershed that utilize septic systems. The team used this data set as a starting point, and then updated with additional Board of Health septic permit data from 2006 through 2016. Septic system counts were updated to account for newly constructed septic systems that were not included in the MEP Report. Keeping with the methodology of the MEP Report, parcels identified as containing a septic system were assigned a nitrogen loading rate for wastewater as well as the MEP-derived nitrogen loading rates for impervious roof and driveway area and for fertilized lawn area.

In addition to updating data on septic contributions, another goal of this effort was to update the data on agricultural practices, since Westport has a large agricultural community. The MEP Report included specific data on agricultural practices for some farms, including details of known crop types, livestock types and counts and information on fertilizer use. For these farms, nitrogen loading was calculated based on the specific data. Where specific data on agricultural practices was not available, parcels designated with an agricultural land use were assigned a standard nitrogen loading rate based on parcel area. The Westport Agricultural Commission provided updated specific data on the current agricultural practices for some farms, which were used to supersede the MEP Report where possible. The primary agricultural loading changes realized through this effort, and incorporated into the updated baseline, were:

- Reductions in fertilizer use, based on actual practices;
- Reductions in active agricultural land use for growing crops, based on actual practices; and,
- Changes in the number and type of livestock, which was driven by economic changes.

Note that there is a current program underway sponsored by the Massachusetts Association of Conservation Districts collaborating with several local farming interests. The program assists in the identification and implementation of conservation practices, which may result in further loading reductions. Projects are expected to be constructed in winter 2020. Potential benefits of those practices have not been incorporated into this analysis.

Nitrogen loads from landfill/solid waste sources and from atmospheric deposition on water body surface area were assumed to remain constant from the time of the MEP Report. Atmospheric deposition on water is a significant source of the overall load to the River. As noted previously, observed regional trends[1] show significant reduction in atmospheric deposition of nitrogen over the past decade and consequently this "constant" figure represents a conservative calculation. Nitrogen loads from natural surfaces increased slightly as agricultural area formerly used for growing crops or applying fertilizer was reclassified to "natural" area. Nitrogen loads from wastewater, lawn fertilizers and impervious surfaces all increased slightly due to new development from the time of the MEP Report, and nitrogen loads from agriculture decreased due to the updates explained above. Figure 4.1 presents the changes in nitrogen load by source between the original MEP analysis and the updated baseline. Refer to Appendix A – Updated Baseline Nitrogen Loads for tabulated values of nitrogen loads by source and subwatershed.

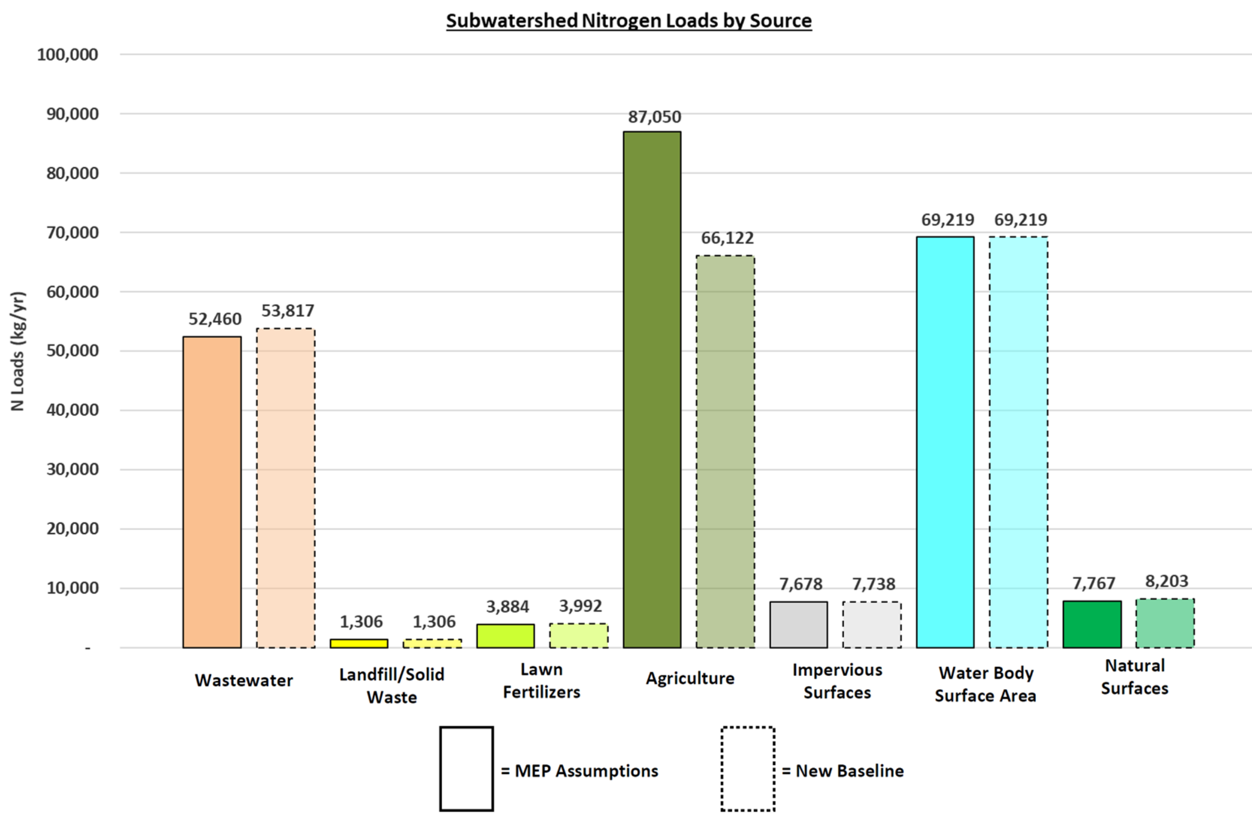

Figure 4.1. Comparison of Nitrogen Loads by Source from MEP to Updated Baseline

***Nitrogen loads in the MEP Report for lawn fertilizer and agriculture were modified slightly from published values. Some of the nitrogen load from agriculture was incorrectly classified as a nitrogen load from lawn fertilizer in subwatershed 8. Additionally, the data provided from MEP reported a higher nitrogen load from**

[1] *Detenbeck, N., M. You and D. Torre. Sources and Trends of Nitrogen Loading to New England Estuaries. New England Association of Environmental Biologists (NEAEB) Annual Conference, Devens, MA March 13 – 15, 2018.*

agriculture in subwatershed 11 than was published in the MEP Report. This larger value for nitrogen load was used in this analysis.

These calculated loads are predictive, meaning that they rely on available data to estimate nitrogen loadings that will theoretically reach the water each year. In practice, the resulting nitrogen concentrations actually measured in the river are the primary indicator of water quality, improvement of which is the ultimate objective of the Plan. As loads predicted by the model decrease, nitrogen concentrations measured in-stream are anticipated to decrease as well. The model is seen as a surrogate to predict trends in water quality, and a tool to test certain export reduction or mitigation techniques. The updated baseline shows that the water quality should be improving on the basis of reduced pollutant loads, as in fact it has (see Section 4.2). However, the model estimates and in-stream water quality are not one in the same. The following section describes the important trends that the Westport River has seen since the MEP Report data was collected, and how that compares to the load changes described here.

4.2 UPDATED POLLUTANT LOADS AND IN-STREAM CONCENTRATIONS

The Buzzards Bay Coalition (BBC) provided in-stream water quality sampling results dating between 1992-2017 for multiple monitoring stations in the Westport River. A subset of this data, from 2003 to 2009 was used in the MEP Report to calibrate the Linked Model. The locations of BBC's sampling stations in the East Branch are shown in Figure 4.2.

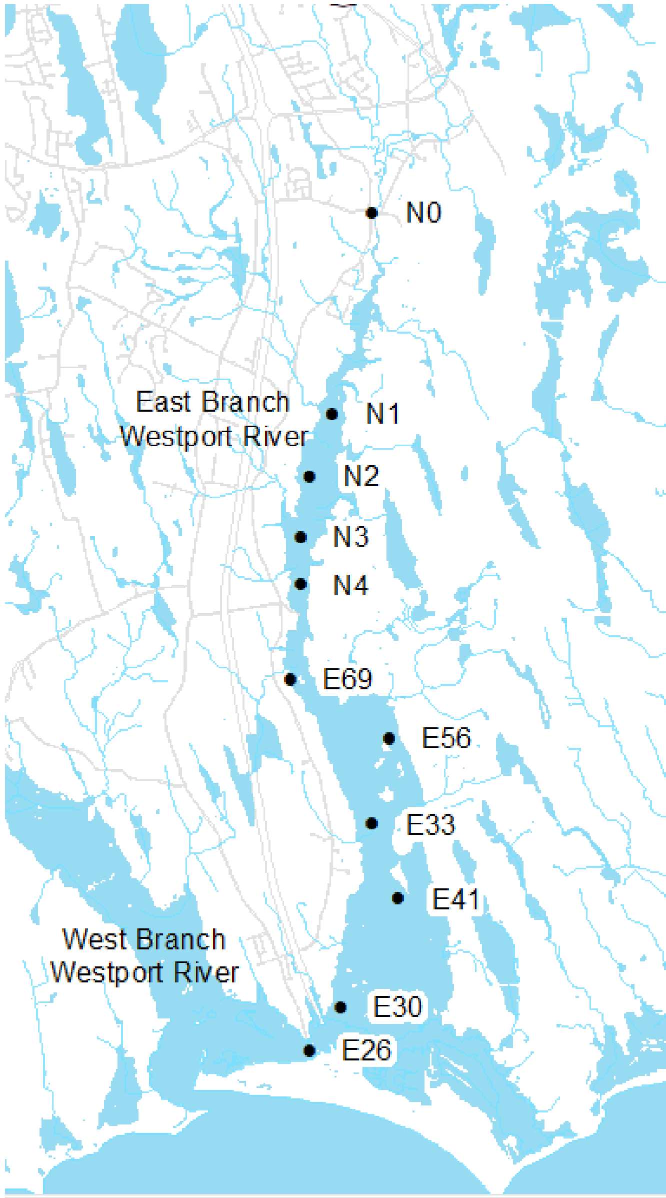

Figure 4.2. Buzzards Bay Coalition Westport River East Branch Sampling Stations

In Figure 4.3, total nitrogen sampling results from each station were compared during the MEP Report period (2003-2009) and a more recent period of the same duration, (2011-2017).

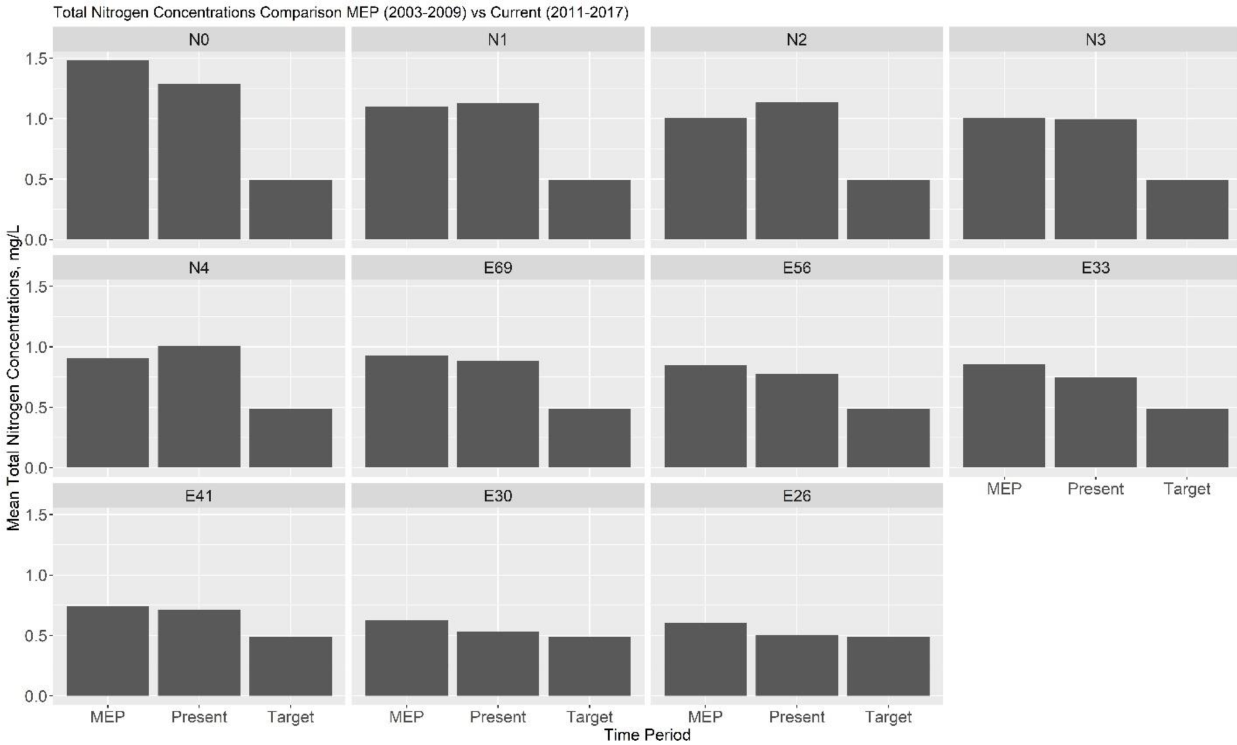

Figure 4.3. Comparison of Total Nitrogen Concentrations at East Branch Sampling Stations for MEP Report (2003-2009), Present (2011-2017), and Target (TMDL Concentration for the East Branch of 0.49 mg/L Total Nitrogen)

The mean concentration of total nitrogen decreased from the MEP Report to the Present dataset at each of the East Branch monitoring locations except for at upstream stations N2 (12.3% increase), N4 (10.8% increase), and N1 (2.4% increase). The stations with the largest percent decrease of mean nitrogen concentrations were E26 (17.1% decrease), E30 (15.5% decrease), N0 (12.9% decrease), and E33 (12.6% decrease). The most recent data for E33, the sentinel sampling station for the TMDL, shows continued decrease in total nitrogen concentration (0.51 mg/l). There are likely multiple factors contributing to the observed changes, some of which are due to local actions ("controllable" sources such as improved land management practices, active stormwater management for water quality, and continuous septic system upgrades driven by standard Title V requirements) and other regional factors such as partial sewer installation upgradient in the Town of Dartmouth or reduced atmospheric deposition based on air quality improvement (see further discussion below). Apart from the land use practice changes discussed in Section 4.1, most of these factors are not captured through the re-modeled baseline, but will be demonstrated through water quality sampling. This study did not attempt to quantify or attribute any portion of the observed pollutant concentration reductions to specific actions.

The highest mean concentration of total nitrogen from both the MEP and Present was located at station N0, which at current mean concentrations remains greater than double the target concentration. Each of the five stations in the Upper section of the East Branch (N0-N4) are furthest away from achieving target concentrations. These relatively high concentrations could be attributed to the relatively low flow rates at the headwaters of this branch, and the higher loads that are predicted in the Bread and Cheese Brook subwatershed. The mean present concentrations at E26 and E30 are closest to achieving water quality targets for nitrogen.

Data from the East Branch sampling stations over the full time period of record was aggregated by year and presented in the boxplot in Figure 4.4. In this figure, the mean total nitrogen concentrations across all sampling stations is shown as the horizontal line for each year. Outliers are shown as a red asterisk. This figure shows the results of approximately 960 samples for total nitrogen.

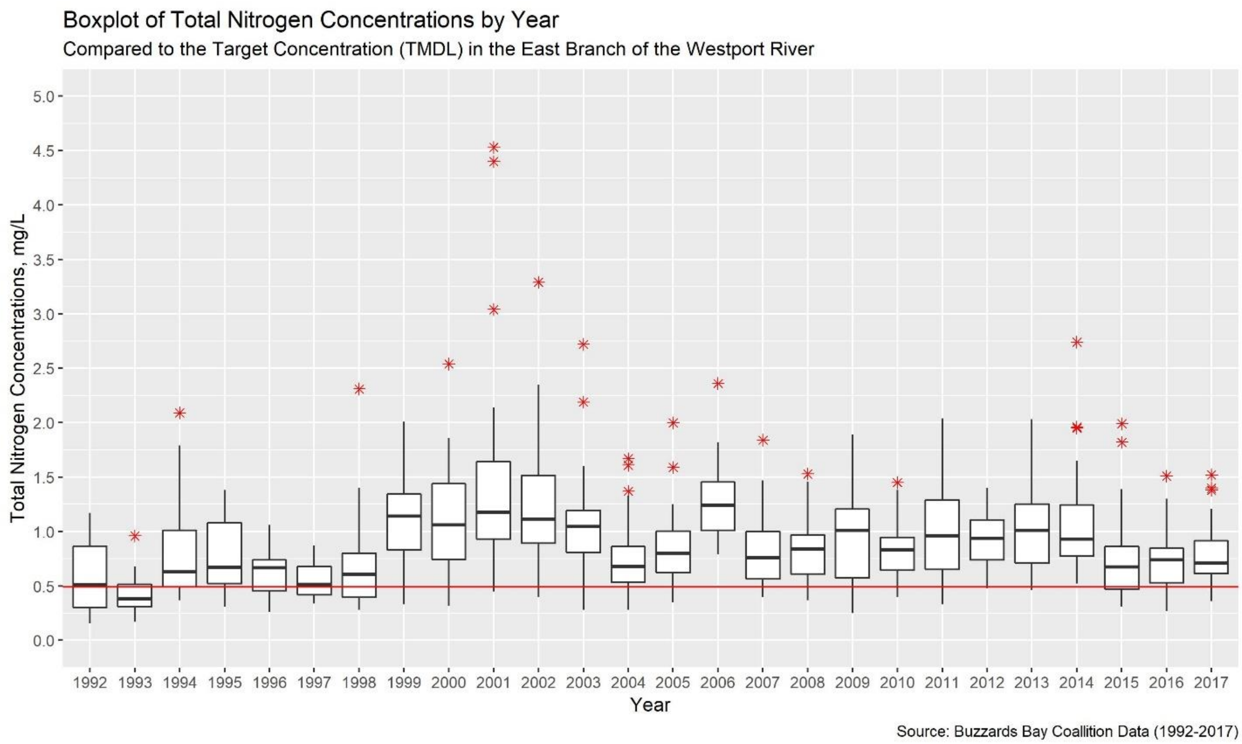

Figure 4.4. Boxplot of Total Nitrogen Concentration Compared to TMDL Target (0.49 mg/L)

The average concentration of total nitrogen exceeded the target concentration for the watershed (0.49 mg/L) in each year dating back to 1993. The year with the highest average concentration was 2006 at 1.25 mg/L. In the following years, the mean observed concentration ranged between 0.81 mg/L (multiple years) and 1.04 in 2013. An analysis of variance (ANOVA) was used to assess whether the observed differences between the most recent three years of data were significantly different than the prior years. The team used 2014 as the comparison year for this analysis because it represents a recent year with relatively low nitrogen values with which to compare the recent data. Table 4.1 shows the results of pairwise comparisons of the mean concentration of total nitrogen in each of the years 2015-2017 to 2014.

Table 4-1. Mean and Median Concentrations of Nitrogen 2014-2017

Year	Average Concentration of Total Nitrogen (mg/L)	Mean Difference Compared to 2014
2014	1.04	-
2015	0.66	0.32
2016	0.65	0.34
2017	0.70	0.27

BBC provided in-stream water quality sampling results in terms of total organic nitrogen (TON), dissolved inorganic nitrogen (DIN) and total nitrogen (TN) which is the sum of total organic nitrogen and dissolved inorganic nitrogen. TON consists of carbon-based nitrogen compounds from organic sources including septic system effluent, farm animal wastes and organic fertilizers. DIN consists of inorganic compounds such as ammonium, nitrate and nitrite. DIN can originate from gaseous nitrogen compounds generated from fossil fuel burning that are deposited into water bodies through atmospheric deposition. Additionally, DIN can originate from inorganic fertilizers or organic nitrogen that is converted to inorganic nitrogen by bacteria or fungi through the process of ammonification.

Water quality sampling results from BBC show a regional decrease in DIN concentration since 2015. DIN concentration for East Branch sampling station E33 over the full time period of record is presented in Figure 4.5. The reason for this decrease may be due to several factors. Reduced fossil fuel emissions resulting from Clean Air Act requirements or local power station closures have likely contributed to the decrease in DIN. A 2018 report on sources and trends of nitrogen loading in New England estuaries suggests that decline could be as much as 33% (see Section 4.1 footnote 1). Without further investigation, other possible influencing factors such as the astronomical tide cycle or tidal flushing due to increased sea level rise (SLR) cannot be quantified. Neither of these factors is realistically controllable by the actions of the community. Additionally, a decrease in the use of inorganic fertilizers for agriculture or residential lawns may also be contributing to the decrease in DIN concentration. It is unclear to what extent the decrease in DIN and overall TN concentration is due to uncontrollable factors and what is due to actions taken within the community and within the subwatershed boundaries. The general decreasing trend of TN concentration is a positive sign. The alternatives outlined in this plan are designed to continue this downward trend to further improve water quality and work towards achieving the TMDL through actions within the control of the community.

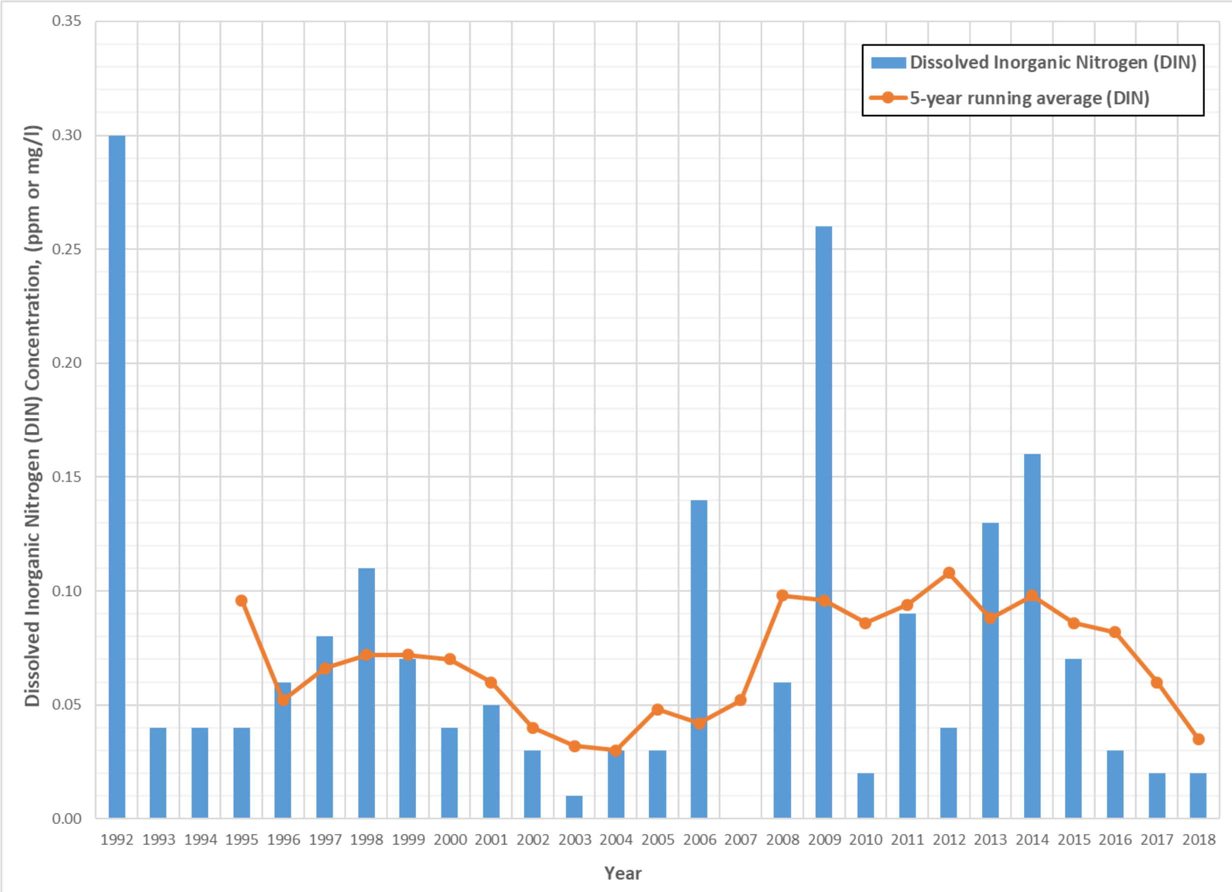

Figure 4.5. Dissolved Inorganic Nitrogen Concentration for Sampling Station E33

4.3 IDENTIFICATION OF CONTAMINATED WELLS

The proximity of private wells to cesspools and septic systems within Westport has resulted in private wells experiencing contamination from bacteria (E. coli), nitrates/nitrites or both contaminants. Private well contamination forces residents to install additional treatment measures or rely on bottled water for drinking and cooking. Private well testing data indicating wells experiencing contamination were provided by the Board of Health for the years from 2005-2018. Contaminated wells were mapped spatially to determine "hotspots" of contamination and assess the proximity of contaminated wells to known cesspool locations (Figure 4.6). Several "hotspot" areas were identified including portions along Route 6 and State Street as well as areas around Cadman's Neck, Westport Point, The Let and Pettey Lane. Many of the private wells with contamination are near a known cesspool location or in areas that are densely developed with many residential units and septic systems confined to a small area. Overall, 200 private wells with contamination issues from bacteria (E. coli), nitrates/nitrites or both contaminants have been identified based on Board of Health data.

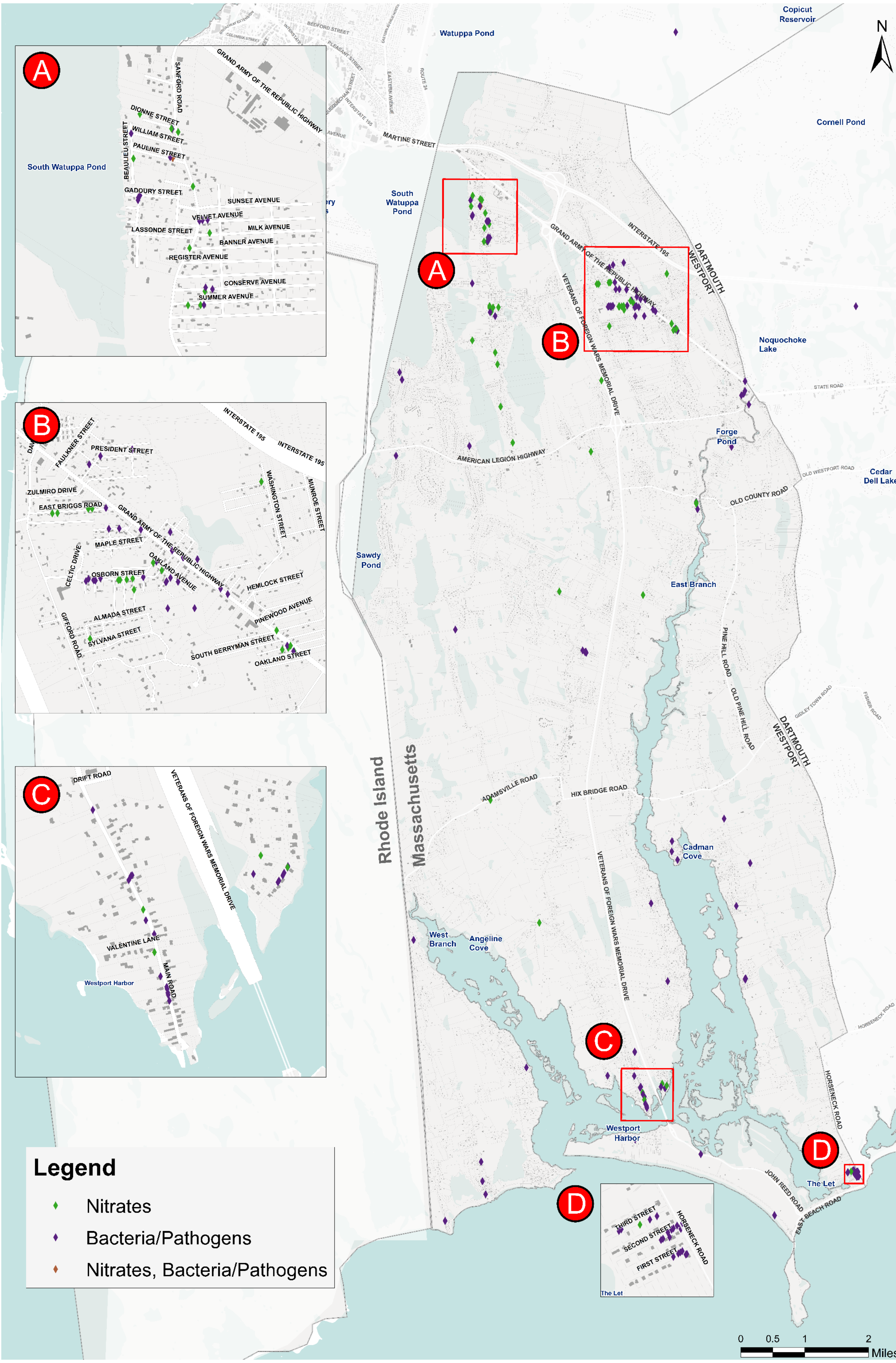

Figure 4.6. Private Well Contamination Issues in Westport

4.4 REVISIONS TO BUILDOUT POTENTIAL

Full buildout potential was estimated as part of the MEP Report analysis. Buildout is an analysis of the maximum capacity for future development in an area – it is typically seen as an upper bound to all future development. The buildout assumptions from the MEP Report were aggressive in terms of the number of units that could be developed on certain parcels as well as which parcels could potentially be developed. This buildout analysis overestimated the potential number of new dwelling units that would be feasible with current land use and wetland regulations, constraints based on shape and access of parcels, and the use of Community Preservation Act and Westport Land Trust funds to acquire public open space. A revised buildout analysis was conducted in 2015 for the Town to produce a more accurate estimate of buildout. Additionally, newly constructed dwelling units that had not previously been counted as part of the MEP Report or 2015 buildout analysis were removed from buildout counts to reflect the most recent available data (i.e. avoid double counting). The number of developable dwelling units within the watershed in Westport decreased approximately 23% from 2349 units in the MEP Report to 1809 units after incorporating the 2015 buildout estimate and accounting for newly constructed units. Consequently, the total watershed-wide nitrogen loading from buildout (including the West Branch) decreased approximately 9% from 57,205 kg/year in the MEP Report to 51,977 kg/year in the updated baseline. Nitrogen loading for residential buildout was calculated per new dwelling unit using the same methodology as the MEP Report with new nitrogen loads assigned for wastewater (septic), lawn fertilizer and impervious area (roof and driveway) and an adjustment applied for “natural” area converted to lawn and impervious area to avoid double counting. Figure 4.7 shows the breakdown of nitrogen loading by source for each subwatershed for both the MEP Report and the updated baseline compared to the TMDL threshold nitrogen loading.

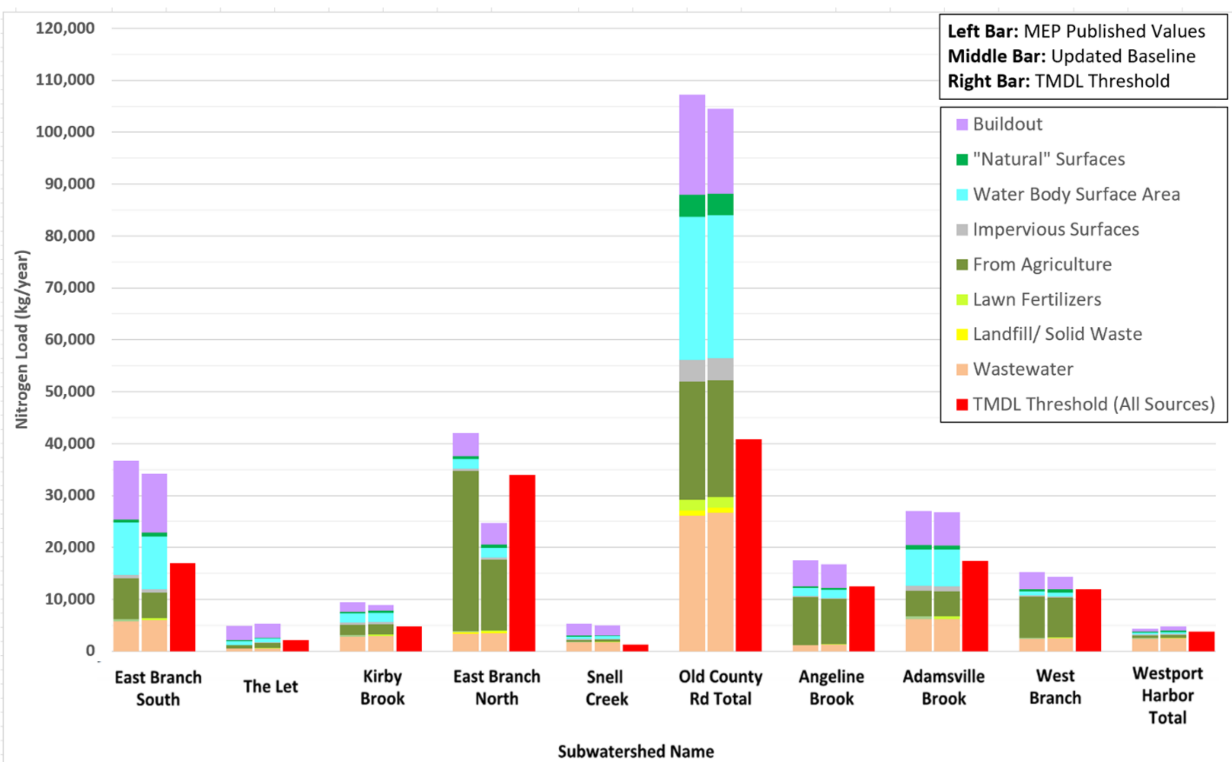

Figure 4.7. Comparison of Nitrogen Loads by Source for Each Subwatershed from MEP to Updated Baseline

4.5 SUMMARY

This IP utilized foundational data derived from the MEP Report, and direct water quality sampling, to update the current nitrogen loadings and concentrations in the Westport River. The major conclusions from the analysis were as follows:

- The respective percent contribution of nitrogen from various land use sources has changed due to changes in land use practices and new development;
- Overall nitrogen load has been reduced;
- Overall nitrogen concentration at downstream/in stream sampling locations has been reduced; and,
- Private well contamination hotspots were identified that correlate with denser development and/or non-compliant cesspool locations.

5 CONSENSUS-BUILDING PROCESS

5.1 PUBLIC ENGAGEMENT

Infrastructure plans are an extension of a broader shared vision of what a community wants to preserve or enhance with respect to quality of life and their daily local experience. That is frequently equated with a healthy environment, an affordable cost of living, robust economic activity and a collective appreciation of a community's unique character. An integrated (infrastructure) plan is designed to support and advance the vision and cannot stand alone without that framework to guide it. The consensus-building effort for this Integrated Plan, therefore, began with an effort to confirm the community's vision about the future of Westport, and residents' goals for a water resource-based approach to get there. With that as the foundation, defining how and to what extent infrastructure, public policy or best water management practices could advance those goals was the purpose.

The team referenced existing documents, including master plans, economic development studies and conceptual infrastructure plans to initially define the community framework. Then the team conducted a public meeting which focused on soliciting additional thoughts about appropriate objectives for the IP. Responses from the crowd of approximately 50 residents fell primarily into four categories which were also referenced in Section 1 of this report:

Environmental
- Satisfy **TMDL** requirements for nitrogen loads into receiving waters
- Influence measurable **reduction in nitrogen concentrations** at sampling points
- Increase **resiliency to climate change** and sea level rise

Social
- Promote **public health** with clean, secure water supply and stormwater practices
- Promote **recreation** on and in the Westport River and Estuary
- Maintain the **high quality of life**

Economic
- Promote **economic development**
- Promote **cost equity**
- **Increase agricultural output** with environmental responsibility
- **Reduce risk to shellfish** economy

Implementation
- Identify a **phased** suite of solutions that vary in scale and in timing
- Consider **regional** opportunities and benefits
- Develop an **implementable** plan

People attending the meeting represented a variety of neighborhoods and interests. Figure 5.1 shows a map of Westport on which many attendees placed a pin marking the general location of their home or business. The distribution reflected the diversity of voices in the room and the goals identified captured the concerns of the majority of those participating. These goals were revisited throughout the project to "calibrate" progress and focus solutions on those which could meet one or more of these objectives effectively.

Figure 5.1. Distribution of attendees at the project kick-off public meeting.

Notes summarizing the public meeting and copies of the press release advertising the meeting, the PowerPoint presentation, and the attendance sign-in sheet are provided in Appendix B – Public Meeting and Workshop Information.

5.2 PUBLIC OUTREACH APPROACH

An Integrated Plan is particularly suited to managing multiple objectives spanning several water resource infrastructures (built or natural). The foundation of a successfully implemented plan is consensus around the challenges to be addressed, the “solutions” proposed, and the manner of their execution (phases, cost, etc.). The public meeting feedback clearly suggested that there were multiple challenges that needed attention. While there were several areas of common interest, there was not consensus around what was most important or most urgent. As in all public planning enterprises, some compromise is necessary. Compromise, much less consensus, cannot be achieved if all stakeholders are not represented at the table where decisions are made. The initial outreach task was to get people to that table.

The team worked with a Steering Committee (See Section 2) to identify and recruit stakeholders across the spectrum of town residents, businesses, environmental interests and local political jurisdictions.

The recruited stakeholder group included some individuals representing specific organizations, such as the Westport River Watershed Alliance or Buzzards Bay Coalition. Others, generally well known in the community, were invited to represent loosely affiliated groups with which they identified, such as farming and agricultural concerns or commercial fishermen. Yet others were invited to participate based on their respective roles with Boards or Departments wielding authority or responsibilities for public health, environmental protection or related areas. Finally, interested individuals operating “at large” were also welcomed.

This stakeholder group was invited to participate in multiple workshops scheduled at intervals during the planning process. Individuals were asked to speak on their own behalf, but also to consider the broader interests of the group (if any) with which they were affiliated or aligned. A roster of individuals who ultimately attended one or more of the workshops, and the interests they represented, is provided in Appendix B. The overall approach to the project execution, and the manner in which public involvement was incorporated into the project is illustrated in Figure 5.2.

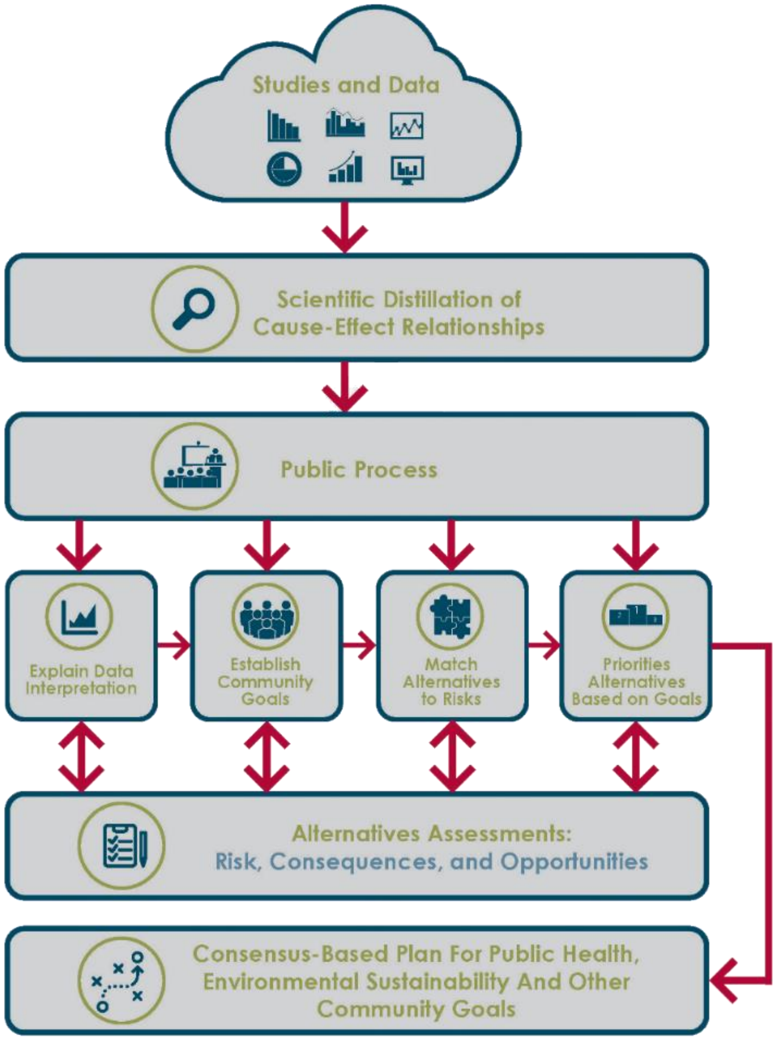

Figure 5.2. Integrated Planning Process to build consensus.

5.3 OUTREACH PROCESS AND FEEDBACK

Following the first public meeting, three stakeholder workshops were conducted. These were augmented by several working sessions with the Town's project Steering Committee, and meetings with a local business association and a neighborhood association. Participant feedback at these meetings contributed to the development and finalization of the proposed plan. The stakeholder workshops were as follows:

- Workshop No. 1 (March 20, 2019): Review the proposed technical approach; present current conditions based on existing data review and analysis; and, allow open discussion for questions and comment.
- Workshop No. 2 (May 29, 2019): Update on data development; present information on preliminary alternatives in development; and allow open discussion for questions and comment.
- Workshop No. 3 (September 25, 2019): Present preliminary Integrated Plan for discussion and comment.

All of the material from each of the workshops, including sign-in attendance sheets, presentations, and notes summarizing meeting outcomes is provided in Appendix B.

5.4 SUMMARY OF STAKEHOLDER PROCESS

The consultant team provided technical expertise; the stakeholder process was designed to access local knowledge, promote local vision, and amplify local voices in a manner that results in a recognizably consensus-based plan. Such a plan ultimately is more likely to be adopted and supported by a broad swath of the local citizenry. The relative success of that process was tested at Workshop No. 3 at which time the preliminary plan was presented to the stakeholders.

Feedback from attendees at the third workshop indicated that clarifying information to more fully present benefits and costs of the alternatives both for the East Branch watershed on which the plan focuses, but also in town-wide terms, would be helpful to the community. There was general agreement with the types of alternatives proposed and the framework of adaptive management as the guiding principle. Scale of implementation and phasing of different alternatives, however, was still unresolved among attending stakeholders. This feedback provided specific guidance to the team regarding refinements to the proposed program. These modifications and/or elaborations on certain alternatives were then addressed in the draft plan.

5.5 FINAL PUBLIC MEETING

A public meeting to present the draft plan was held on November 13, 2019. The process to understanding the challenges, identifying alternatives, and formulating the draft plan was described to Town residents. The proposed suite of solutions, and the implementation framework for adaptively managing the program over time was presented. There was general agreement that the approach reflected the Town's multiple objectives, and some support for various alternatives identified for near term implementation. There was also notable concern about obtaining adequate support to enact some of the regulatory alternatives, or sufficient incentives or authority to enforce others. The team understands that the step by step implementation will provide for some forward progress and some necessary re-routing.

Ultimately, the final program as proposed is the culmination of the technical analysis augmented by the public process and publicly expressed objectives.

6 ALTERNATIVES ASSESSMENT

6.1 ALTERNATIVES DEVELOPMENT

The team compiled a list of alternatives representing actions that could be implemented to address the primary goals expressed by the community, including improved public health protections (e.g. mitigate well contamination), and decreased nitrogen concentration in the East Branch of the Westport River. Other secondary benefits considered included economic development, climate resiliency, public education, and ecological and/or aesthetic improvements. The initial list of alternatives was meant to be an inclusive inventory, unconstrained by potential costs. Alternatives included known technologies and practices that have been implemented with measurable benefit in similar communities in the past. Alternatives comprise programs, policies or capital projects, and are classified generally into the following categories:

- Wastewater Treatment
- Innovative Technology/Resource Management
- System Alteration
- Stormwater/Green Infrastructure
- Source Control
- Policy/Regulation
- Public Infrastructure

Figure 6.1. Sample wastewater treatment alternative: cluster systems

Wastewater treatment alternatives address septic systems that contribute nitrogen and bacteria to groundwater and have the potential to contaminate nearby private wells and affect river (or other surface body) water quality.

Innovative technology and resource management alternatives, such as Permeable Reactive Barriers (PRB), attempt to remove nitrogen that has already been introduced into the environment from multiple sources.

System alteration alternatives include changes to the hydrology or hydraulics within a watershed, such as channel dredging or inlet alteration, to achieve nitrogen removal benefits or nitrogen concentration reductions.

Stormwater and green infrastructure alternatives address stormwater runoff from impervious and non-impervious areas which can carry pollutants and impair water quality of receiving water bodies.

Source control alternatives attempt to eliminate sources of pollutants (nitrogen, bacteria) to the environment or reduce the amount of pollutants introduced to the environment.

Policy and regulation alternatives attempt to address public health and nitrogen issues through the creation of new Town bylaws or other regulatory mechanisms.

Finally, *public infrastructure* alternatives address public health and nitrogen issues though the design and construction of new drinking water or wastewater infrastructure owned and operated either by the community or a group of cooperating property owners.

The initial list of alternatives generated through the preliminary evaluation is summarized in Table 6.1. It includes some alternatives identified in the TMDL, but it was not exclusive to that. The team summarized objectives, limitations, applicability and documented successes of each of these alternatives.

Table 6-1. List of Alternatives Considered for Implementation as Part of Integrated Plan

Alternative Category	Alternative	Public Health Benefits	Nitrogen Removal Benefits	Other Benefits
Wastewater Treatment	Innovative/Alternative (I/A) incentives	✓	✓	
Wastewater Treatment	Denitrification incentives	✓	✓	
Wastewater Treatment/Policy	Denitrification requirement for new construction	✓	✓	
Wastewater Treatment	Cluster treatment system	✓		
Wastewater Treatment	Cluster treatment system with denitrification	✓	✓	
Wastewater Treatment	Cluster treatment system with denitrification and irrigation reuse	✓	✓	✓
Public Infrastructure/ Wastewater Treatment	Public sewer infrastructure	✓	✓	✓
Public Infrastructure	Public water infrastructure	✓		✓
Innovative/ Resource Management	Permeable reactive barriers (PRBs)		✓	
Innovative/Resource Management	Aquaculture		✓	✓
Policy/ Regulation	Zoning	✓	✓	
Policy/ Regulation	Regulatory overlay district	✓	✓	
System Alteration	Channel dredging		✓	
System Alteration	Inlet alteration		✓	
System Alteration	Culvert design and improvements		✓	
System Alteration	Tributary water improvements		✓	✓
System Alteration	Constructed wetland in river tributary		✓	✓
System Alteration	Constructed wetland in river tributary with barrages/permeable reactive barriers		✓	✓
Stormwater/ Green Infrastructure	Stormwater wetland, detention/retention pond		✓	✓
Stormwater/ Green Infrastructure	Bioretention, rain gardens for existing impervious area runoff		✓	✓
Stormwater/ Green Infrastructure	Bioretention, rain gardens for new impervious area runoff		✓	✓
Stormwater/ Green Infrastructure	Porous pavement for existing impervious area runoff		✓	✓
Stormwater/ Green Infrastructure	Vegetative buffer strips, swales for existing impervious area runoff		✓	✓
Stormwater/ Green Infrastructure	Vegetative buffer strips for agricultural land use		✓	✓
Stormwater/ Green Infrastructure	Agricultural stormwater management practices		✓	✓
Stormwater/ Green Infrastructure	Other agricultural practices		✓	✓
Source Control	Fertilizer reduction (Agricultural)		✓	✓
Source Control	Fertilizer reduction (Residential)		✓	✓
Source Control	Reduce Water Use		✓	✓
Policy/ Regulation	N Trading within sub-watersheds		✓	
Policy/ Regulation	Open Space Planning	✓	✓	
Policy/ Regulation	Growth/Development Planning	✓	✓	
Policy/ Regulation	Nitrogen Credit Land	✓	✓	

6.2 STAKEHOLDER-SCREENED LIST OF ALTERNATIVES

The initial list of alternatives was updated following a stakeholder workshop where alternatives were discussed and vetted. Some original alternatives were eliminated (e.g. cluster systems without denitrification, aquaculture, dredging, inlet alteration). Others were added or modified (e.g. various zoning initiatives). Alternatives were screened based on their potential effectiveness in terms of providing one or multiple benefits and their applicability within Westport. In general, alternatives which posed significant regulatory or permitting challenges such as system alteration, were eliminated due to practicality. Others, such as cluster systems without de-nitrification were determined unsuitable for the water quality purpose of the Plan. Alternatives were not screened based on their estimated implementation costs. The screened alternative list is presented below:

- Title V upgrades
- Denitrification incentives for existing systems
- Denitrification regulatory overlay
- Denitrification for new construction (rural services district)
- Cluster system with denitrification
- Cluster system with denitrification and irrigation reuse
- Public sewer infrastructure
- Public water infrastructure
- Permeable reactive barriers (PRB)
- Barrages/constructed wetland
- Vegetative buffer strips for agriculture
- Green infrastructure (in coordination with MS4 requirements)
- Fertilizer reduction
- Public education initiatives

The team acknowledged the Town's likely incremental implementation approach, and subsequently broke these alternatives out into tiers representing prioritized implementation actions. Further description of the tiered approach is provided in Section 7.

6.3 POTENTIAL NITROGEN REMOVAL EFFECTIVENESS OF ALTERNATIVES

The MEP Report calculated nitrogen loading rates based on land use for individual subwatersheds. The team updated nitrogen loading rates using current land use, agricultural practices, septic records and buildout estimates as described in Section 4. Estimates of nitrogen removal efficiencies of screened alternatives were determined from research, published values and relevant case studies. Bacteria removal efficiencies to compare to existing bacteria TMDLs referenced in Section 3.2.3.2 are not as easily estimated within the MEP model framework; therefore, alternatives that address the bacteria and public health concerns are quantified in later sections based on the number of contaminated wells that can be mitigated, with the assumption that these alternatives produce bacterially safe effluent that discharges to the waterbodies. This section will focus on the nitrogen removal efficiencies calculated through the model.

Estimated feasible implementation levels for alternatives were determined based on engineering judgement and practicable goals for the Town of Westport. These implementation levels are not meant to be binding target values but were chosen to determine a realistic estimate of potential nitrogen removal benefits that could be achieved. For alternatives related to wastewater treatment, implementation levels were determined to ensure that the same septic systems were not addressed by multiple wastewater treatment alternatives which would cause an overestimation of nitrogen removal benefits. Table 6.2 summarizes the estimated nitrogen removal efficiencies and recommended implementation levels for selected alternatives used to estimate potential nitrogen removal benefits. As a conservative assumption, areas of the watershed in other towns (Dartmouth, Freetown, Fall River, Tiverton, Little Compton) were not considered applicable for implementation of alternatives as these areas are not controllable by the Town of Westport.

Table 6-2. Estimate of Nitrogen Removal Benefit and Recommended Level of Implementation for Potential Alternatives

Alternative	Nitrogen Removal Effectiveness used for Evaluation of Nitrogen Removal Benefits	Recommended Level of Implementation used for Evaluation of Nitrogen Removal Benefits
Title V upgrades*	• 25% removal of wastewater nitrogen load, corresponds to anticipated effluent nitrogen concentration of 26.25 mg/L	• as implemented by regulation as older systems fail, property ownership changes
Denitrification incentives for existing systems	• 66% removal of wastewater nitrogen load, corresponds to anticipated effluent nitrogen concentration of 11.81 mg/L	• as implemented through existing loan program
Denitrification regulatory overlay district	• 66% removal of wastewater nitrogen load, corresponds to anticipated effluent nitrogen concentration of 11.81 mg/L	• convert all septic systems installed prior to 1995 that intersect the overlay district zone
Denitrification for new construction (rural services district)	• 66% removal of wastewater nitrogen load, corresponds to anticipated effluent nitrogen concentration of 11.81 mg/L	•100% of new developments south of Route 177
Cluster treatment system with denitrification	• 66% removal of wastewater nitrogen load, corresponds to anticipated effluent nitrogen concentration of 11.81 mg/L	• 36 septic systems in The Let area
Cluster treatment system with denitrification and irrigation reuse	• 66% removal of wastewater nitrogen load, corresponds to anticipated effluent nitrogen concentration of 11.81 mg/L	• 51 septic systems in the Cadman's Neck area
Public sewer infrastructure	• 95% removal of wastewater nitrogen load, accounting for some exfiltration to groundwater	• Phase 1 sewer implementation from 2004 CDM report
Permeable reactive barriers (PRBs)	• 80% removal of wastewater, lawn fertilizer and impervious nitrogen load within capture zone	• three pilot implementation areas
Barrages/constructed wetland	• nitrogen removal could be highly variable and would require additional hydraulic/hydrologic analysis	• preliminary concept developed for implementation within Brookside Conservation Area
Vegetative buffer strips	• 50% removal of agricultural nitrogen load from fertilizer, livestock	• 50% of agricultural properties, including crop and animal loads
Fertilizer reduction	• 95% removal of fertilizer load by eliminating source	• 50% of residential properties

*Septic systems within the MEP watershed model are assumed to be functioning Title V systems within an effluent nitrogen concentration of 26.25 mg/L. No additional nitrogen removal benefit is assumed for upgrading cesspools, failing systems or non-compliant systems to Title V systems as these upgrades are already incorporated by the assumption of the watershed model. As noted previously, this represents a divergence from the practical effect of improved septic system operation with respect to in-stream pollutant concentrations.

The team calculated the potential effectiveness of various alternatives using updated nitrogen loads from the re-baselined MEP Report, estimated nitrogen removal efficiencies and estimated implementation levels. As stated above, these implementation levels are used as a suggested implementation target for initial benefits calculations. These assumptions were continually refined through the planning process to achieve targets that are attainable in Westport. More detail on the methodology for calculating these benefits is included in Appendix C – Nitrogen Removal Benefits Calculation. Note that all septic systems in the original MEP model were assumed to be functioning Title V systems with an effluent concentration of 26.25 mg/L based on a study conducted by the Buzzards Bay Project National Estuary Program where influent nitrogen concentrations were approximately 35 mg/L.[1] This assumption was maintained when determining the updated baseline nitrogen loads. As a result, the nitrogen removal benefits from updating failing septic systems and cesspools to Title V systems are already accounted for in the updated baseline nitrogen values and no additional nitrogen removal credit is assigned to these upgrades in the MEP model. In general, nitrogen removal percentages for various septic treatment systems can vary widely depending on the influent nitrogen concentration and the operations and maintenance of the systems. Evaluating septic alternatives in terms of effluent nitrogen concentration achieved instead of percent nitrogen removal allows for equal comparison for alternatives.

Based on the feedback from the stakeholder workshop, the team updated some of the implementation assumptions and goals to reflect potential for implementation in Westport. For example, based exclusively on a desktop analysis, the team identified a few viable locations for cluster systems in areas of greatest need. Feasibility was based on preliminary data for soils and parcel land use, as well as density of the proximate neighborhood (contributing households). It did not entail an evaluation of the administrative and operating governance issues that will arise. Initial benefits are based on these pilot locations and then scaled up to a Town-wide estimate, assuming that comparable areas of development density and compromised groundwater quality would be candidate locations. Individual septic-based alternatives – Title V upgrades, denitrification for existing and new construction – are further developed with the goal of maximizing benefits while creating programs that are likely to be successful. Since there are many septic systems in Town that are from before 1995, and not Title V compliant, one alternative involves developing a regulatory overlay to sunset these outdated systems to include denitrification. Due to the immediacy of nitrogen impacts associated with systems proximate to the river (i.e. shorter period of time for nutrient groundwater transport), the overlay is designed to achieve near term results for purposes of measuring in-stream benefits of the program that would be assessed through the adaptive management approach. Further information regarding formulation of the overlay zone is provided in Section 8.

6.4 FUTURE DEVELOPMENT OF DENITRIFICATION TECHNOLOGY

At the time this Plan was prepared, MassDEP has issued General Use Certifications for the following technologies to achieve Denitrification to varying levels of Effluent Total Nitrogen Load:

- Recirculating Sand Filter (non-proprietary) 25 mg/L TN
- Ruck up to 2,000 GPD 19 mg/L TN

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[1] *Costa, J.E, G. Heufelder, S. Foss, N.P. Millham, and B. Howes. 2002. Nitrogen removal efficiencies of three alternative septic technologies and a conventional septic system. Environment Cape Cod 5(1):15-24*

- Advantex 19 mg/L or 25 mg/L TN
- MicroFAST up to 2,000 GPD 19 mg/L or 25 mg/L TN
- Singulair DN 19 mg/L or 25 mg/L TN

MassDEP, Buzzards Bay Coalition and Barnstable County have been working together on a new non-proprietary Layer-Cake denitrification leaching area. The system utilizes a sand and wood chip mixture beneath a standard Title V leaching area to provide a carbon source in the anoxic zone beneath the leaching area to promote further nitrogen removal. A timed dose pressure distribution system is added to the leaching area to evenly disperse wastewater. In general, costs to construct these systems are less than most proprietary systems.

Preliminary results have shown a strong performance in denitrification. Supporters are hoping that these new alternative systems may be approved for General Use by MassDEP once the required testing is completed.

Recent installations in the Town of Westport have been approved by the Board of Health and are being monitored. The Town should continue to support construction of piloting technologies to advance the field of denitrification to provide better effluent quality and more cost-effective methods.

7 PLAN FORMULATION

7.1 APPROACH

The process of reviewing discrete potential projects and formulating a comprehensive plan to address Westport's broad ranging goals requires a multi-pronged planning approach. Through stakeholder engagement, the team aimed to learn which alternatives are relevant, feasible, and supported, and which are not. Through investigating associated benefits, the team looked for the alternatives that address multiple goals – targeting not only nitrogen reduction, but also addressing the public health concerns by focusing on contamination in private wells. An important feature of the plan is that it does not necessarily aim to distribute load reductions precisely as prescribed by the TMDL. Rather, it seeks to provide an equivalent end result by distributing load reductions more evenly throughout the community to achieve the in-stream target goals, while focusing on certain areas of known criticality. Selected alternatives are varied in project type as well; in addition to purely structural alternatives, this plan looks at alternatives that would increase community engagement and public education, and that were focused on economic growth and long-term sustainability.

There are many alternatives that can achieve the Town's goals with varying levels of potential effectiveness and cost. The team wanted to be cognizant of the uncertainty inherent in any pollution reduction measure by developing a plan that can be adaptively managed and updated with new information as it becomes available. The resulting proposed plan is organized into a tiered approach. Projects that fit the goals and framework stated above, that make progress toward the TMDL load levels, and that garnered stakeholder support, are recommended as a suite of alternatives to implement in the near term. Through monitoring the results of those first implemented alternatives, the Town will be equipped with a more detailed understanding of the benefits, limitations, and costs for each. The Town will use this information to inform future phases of the implementation plan, ensuring that the resulting plan will yield cost-effective results, and that it will continue to be well suited to meeting Westport's goals.

7.2 INITIAL ARRAY OF ALTERNATIVES

Section 6 summarizes the evaluated alternatives. The team reviewed the feasibility of all the alternatives and screened out, or de-prioritized, less technically or administratively feasible alternatives. Stakeholder engagement guided an understanding of how the Town of Westport would implement each project. Using this information, the team developed a final list of potential projects that merited further evaluation. These are listed in Table 7-1.

Table 7-1. Condensed List of Alternative Projects and Programs

Category	Alternative	Benefits		
		Nitrogen Reduction	Public Health Benefits	Other (Economic, Resilience, Aesthetic, etc.)
Wastewater Treatment	Title V upgrades	✓	✓	
Wastewater Treatment	Denitrification incentives for existing systems	✓	✓	
Wastewater Treatment and Policy	Denitrification regulatory overlay district	✓	✓	
Wastewater Treatment and Policy	Denitrification for new construction (rural services district)	✓	✓	
Wastewater Treatment	Cluster system with denitrification: The Let	✓	✓	
Wastewater Treatment	Cluster system with denitrification and irrigation reuse: Cadman's Neck	✓	✓	✓
Wastewater Treatment	Additional cluster systems with denitrification	✓	✓	
Public Infrastructure	Sewer: Phase 1A*	✓	✓	✓
Public Infrastructure	Sewer Phase 1B*	✓	✓	✓
Public Infrastructure	Sewer and Water (Phases 2-4)	✓	✓	✓
Public Infrastructure	Public water supply development: The Let and Route 6	✓	✓	
Innovative Technology	Permeable reactive barriers (PRB), pilot installations	✓		
Innovative Technology	Barrages/constructed wetland	✓	✓	✓
Stormwater/Green Infrastructure	Vegetative buffer strips, pilot installations	✓		✓
Stormwater/Green Infrastructure	Additional vegetative buffer strips	✓		✓
Source Control	Fertilizer reduction	✓		
Outreach	Public education initiatives			✓

* Note: CDM Sewer concept split into two sub-components. Details on Phase 1A and 1B in Section 8.2.

In prior reports focusing on the nitrogen impairments in the East Branch (and specifically the MEP Report), wastewater and agriculture were the two major contributors to the high nitrogen loading. Widespread sewering was cited as one possible solution. While sewering would significantly reduce or remove nitrogen load from sanitary wastes, there are both cost concerns and development implications associated with that approach that presented significant concerns to the community. This Plan aimed to look beyond just sewering to determine if other, more cost-effective alternatives were feasible, and even more so, to recommend a wide range of alternatives that could have varying multi-benefits.

Similarly, there are many agricultural practices that contribute to lower nitrogen runoff levels. The Environmental Protection Agency (EPA) recommends some including innovative fertilizer management, livestock best practices, infiltration systems, and more. The stakeholders have made it clear, however, that many of these recommended practices are already in use in Westport, and that making recommendations to further alter agricultural practices would be redundant. All this information was crucial in developing the narrowed-down list shown in Table 7-1. Alternatives that both reflected the current state of Westport, and that were wide ranging in their benefits, made it into this list for continued evaluation.

7.3 GEOGRAPHIC SCREENING OF ALTERNATIVES

Developing an implementation plan required determining not only what alternatives could be feasible and supported by the Town of Westport, but also where these alternatives could reasonably be incorporated in the Town. The team evaluated each of the alternatives in the condensed list of those supported by the stakeholders and/or identified by the Town as desirable and mapped each one to specific geographic locations in the Town. Alternatives that had compounding benefits for public health and eliminating contaminated wells were proposed for locations that had a high density of contaminated wells. Alternatives that intercepted groundwater discharges were sited in watersheds with high predicted loads. Where there seemed to be a geographic gap, the team evaluated what alternatives could fill those gaps and how they would work in concert with the other alternatives already mapped. Policy alternatives, like Title V upgrades and denitrification incentives, were initially proposed to be Town-wide to share the responsibility of reaching the water quality goals across the entire Town.

Figure 7.1 shows an interim work product which illustrates the geographic distribution of alternatives that were initially evaluated through this process. Not all of the alternatives in this figure were ultimately included in the recommended Tier 1 program.

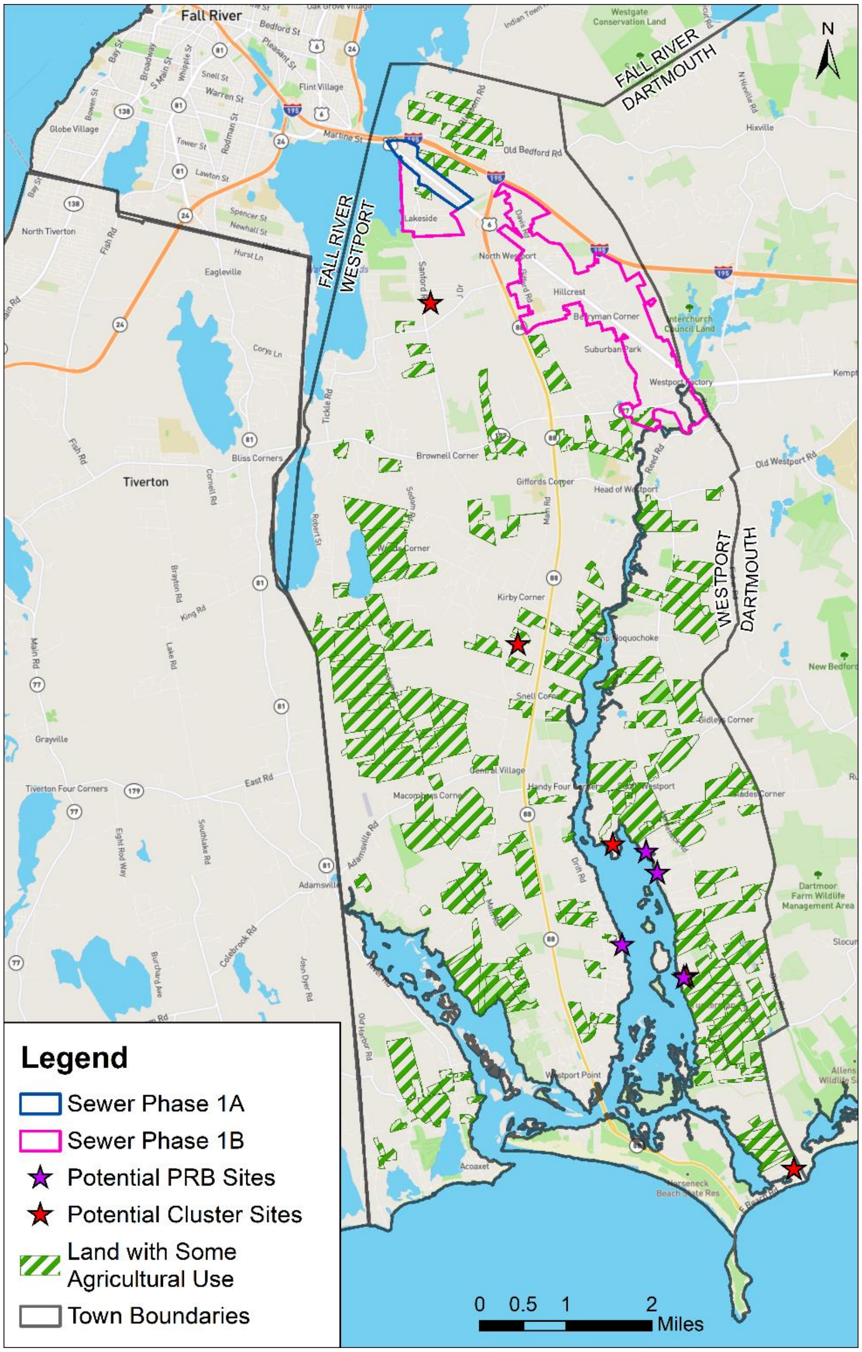

Figure 7.1 Map of Geographical Distribution of Potential Alternatives

While most alternatives on this map – sewer, PRBs, and cluster systems – are confined to very specific locations, the agricultural vegetative buffer strips are visualized here across the Town, anywhere where there is agricultural land. In principle, these buffer strips could be constructed at any agricultural land use boundary transition, and here, potential locations are shown in both the East Branch and West Branch watersheds. The proposed tiering and implementation plan shows that initial locations for this alternative should be selected from the areas in Figure 7.1 based on proximity to the River or other at risk water bodies. Benefits begin with pilot-level implementations, and then these assumptions are scaled up to more Town-wide implementations shown here. Since specific farms have not been selected for pilots at this time, Figure 7.1 maintains a high-level evaluation.

This diverse set of alternatives, in both geographic location and in type of project, addresses water quality issues throughout the Town and across all reaches of the East Branch. Those that made it onto this map were carried forward through the cost screening phase.

7.4 COST-SCREENING OF ALTERNATIVES

The alternatives above vary widely in scale, location, and potential levels of implementation, so understanding and comparing the costs of each is critical. The cost information in Table 7-2 is used to compare the projects in terms of both absolute dollars and how effective each is at achieving the nitrogen reduction and public health goals. Unitized costs are for comparison only. These planning level costs are benchmarked to the time period the costs were developed using the Engineering News Record (ENR) 20-City Construction Cost Index (CCI) for November 2019.

Table 7-2. Alternative Projects and Programs Cost Summary*

Alternative	Costs[1]	Cost Units	Unitized Costs ($/ kg N Removed)	Unitized Costs ($ / contaminated well Removed)
Title V upgrades	$18,000	Individual system	$11,700	Variable
Denitrification for existing systems	$21,000	Individual system	$11,400	Variable
Denitrification for new construction (rural services district)	$34,000	Individual system	$10,000	Variable
Cluster system with denitrification	$1,100,000	Implementation	$8,800	$52,400
Cluster system with denitrification and irrigation reuse	$1,300,000	Implementation	$7,200	$260,000
Sewer: Phase 1A	$2,510,000	Implementation	$12,000	N/A
Sewer: Phase 1B	$15,990,000	Implementation	$2,700	$204,000
Permeable reactive barriers (PRB), pilot installations	$6,700,000	Pilot implementation	$15,000	N/A
Vegetative buffer strips[2]	$300	Cost per acre-ft per year	$20	N/A
Public education initiatives	Negligible	N/A	N/A	N/A

[1]Cost of policy alternatives, such as a nitrogen reduction overlay district, is not reflected in the table as a separate element, but cost to individual property-owners is reflected under the denitrification costs for individual systems. Administration of the program (discussed elsewhere) would create costs to the Town directly.

[2]Negligible implementation costs compared to other alternatives; therefore, vegetative buffer strip costs are represented as an annual maintenance cost.

The non-unitized costs are important for understanding what the Town, either in common cause under tax-payer financed projects or individually for private systems, might expect in the near term. However, with such varying levels of implementation, unitized costs, on the basis of cost per kg nitrogen removed, were also critical for comparing and selecting projects. This allowed the team to compare larger scale alternatives, like sewering, to smaller pilot-scale projects like PRBs. While PRBs are generally promoted as a low-maintenance, easily implementable alternative, they are shown to have very high upfront costs, and therefore, at this stage, they may not be well suited to implementation in Westport. Additionally, PRBs require a sufficient drainage area of nitrogen-rich groundwater to intercept, and with the highly developed waterfront along most of the East Branch, there are not many ideal locations for implementation. This analysis helped to focus Tier 1 alternatives on options that were affordable, allowing for a deemphasis on more logistically challenging and/or less cost-efficient projects like PRBs. PRBs consequently were re-prioritized as a contingency alternative.

Table 7-2 also presents unitized costs for mitigating public health concerns. While these costs are much higher due to the more targeted levels of impact, the role of many of these projects in removing contaminated wells cannot be understated. The compounding benefits of both nitrogen and bacteria removal from the East Branch watershed goes beyond the simple dollars per unit of impact; it highlights the importance of creating a program that addresses all of the concerns of the Town.

7.5 TIERED IMPLEMENTATION OF ALTERNATIVES

Implementation of this Plan is recommended in tiers:

- Tier 1: initial recommendations for the Town based on alternatives that garnered stakeholder support and have sufficient data to support pilot implementation in the **near term**.
- Tier 2: expansions/modifications of select Tier 1 alternatives based on monitoring results from Tier 1 implementation, carried through the planning horizon.
- Contingency Tier: alternatives that are held as backup options in the event that projects in Tier 1 and Tier 2 do not perform as expected.

The purpose of these tiers, as described earlier, is to allow for a flexible and adaptable program that can use the results of early stages to inform future projects. Based on literature reviews, discussions with stakeholders, preliminary geographic considerations, and cost effectiveness, the specific projects for each tier are organized in Table 7-3 below.

Table 7-3. Tiered Alternative Projects and Programs

Tier	Alternative
1	Sewer: Phase 1A
1	Sewer: Phase 1B
1	Cluster System with Denitrification: The Let
1	Cluster System with Denitrification and Reclamation: Cadman's Neck
1	Nutrient Reduction Regulatory Overlay District
1	Vegetative Buffer Strips, Pilots
1	Public Education & Outreach
1	Denitrification for New Construction (Rural Services District)
2	Sewer and Water (Phases 2-4)
2	Additional Treatment Cluster Systems
2	Additional Vegetative Buffer Strips
Contingency	Permeable Reactive Barriers (PRB): Pilot
Contingency	Barrages and Constructed Wetlands
Contingency	Public Water Supply Development, the Let and Route 6
Contingency	Enhanced MS4 Program, Green Infrastructure

7.6 ASSESSMENT OF EFFECTIVENESS

7.6.1 Current Conditions – Water Quality Goals and Public Health Improvements

Tier 1 recommends specific project installations or program implementation throughout the Town. The team evaluated sites for location-specific alternatives and predicted the success rates of more policy and Town-wide alternatives to develop more specific estimated benefits for each alternative. Combined, the Plan aims to estimate the short-term benefits of the recommended suite of Tier 1 alternatives across the entire East Branch. Figure 7.2 estimates projected nitrogen load-based reductions for each of the Tier 1 alternatives in sequence, showing the predicted initial nitrogen reduction across the East Branch as compared with the TMDL. Tier 1 is just the initial, pilot scale, implementation of this Plan; therefore, it is not meant to achieve the TMDL alone. The initial progress demonstrated here – projected for the first five to ten years – lays the groundwork for the Town to continue implementing projects moving forward, continually addressing remaining loading as the plan progresses.

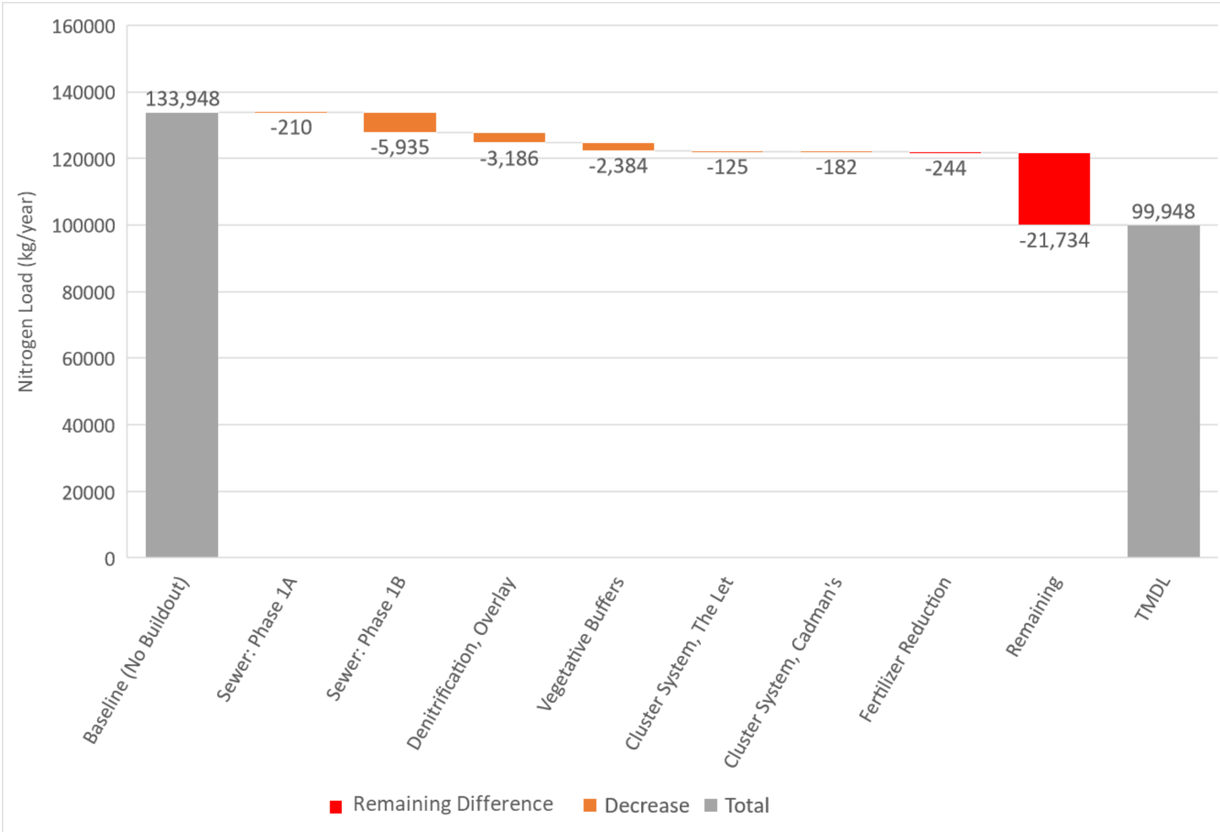

Figure 7.2 Estimated Nitrogen Load Reduction for Tier 1 Alternatives (Initial 5-10 Years)

While Figure 7.2 above and the other waterfall charts in this section show a remaining load to be removed, that should not be interpreted that the incremental measures are ineffective or insufficient. The remaining load is, of course, a function of how much is accomplished to reduce the load, but it is also a function of the model and the original MEP analysis that set the baseline condition. As we can see from Figure 4.3, at 8 of 11 sampling stations where MEP data is available, the river's TN concentrations are already below the MEP data. The 2018 and 2019 sampling at critical stations show that trend to continue. In fact, in the lower estuary the TMDL target is being met today. These water quality results demonstrate the success of the current regulatory environment administered by the Board of Health, Planning Board and Conservation Commission pertaining to wetland regulations, stormwater management, and Title V. Continued support of these regulations is contributing to development of actions making a measurable difference in river water quality.

Also, the inherent model characteristics may always produce a shortfall when we itemize potential load reduction benefits from given measures, because in the East Branch only 56% of the watershed is within the town of Westport so nothing being generated from the 44% is being affected by the actions the Town can take. While that 56% of the watershed produces 66% of the load, the model will always show a shortfall even if the entire 66% were addressed. Further, based upon current work by Woods Hole Oceanographic Institute and the Marine Biological Laboratory on Cape Cod water bodies regarding reduced nitrogen deposition from air sources, it is likely that the atmospheric nitrogen deposition is reducing here as well. That also contributes to the apparent discrepancy between the model output and the river observations.

In short, the use of the original MEP model allows direct comparison of forecasted benefits. Measures recommended in the report have proven effectiveness and should be implemented despite the resulting forecasted TMDL goal shortfall. As the recommendations get implemented river quality must continue to be measured to quantify the actual in stream benefits.

Figure 7.2 breaks out the first recommended phase of sewering into two components: a preliminary first action step, Phase 1A, and then the rest of the recommended Phase 1 sewer concept as introduced in the 2004 CDM Report. That balance of Phase 1 is hereafter referred to as Phase 1B to distinguish it from Phase 1A. More detail on what is included in the Phase 1A sewer concept is included in Section 8.2.

These first steps allow the Town to make subsequent decisions based on the observed effectiveness of these initial actions. It is possible that not all alternatives will perform as estimated, and that observed effectiveness may vary from assumptions. This tiered plan aims to address these uncertainties, allowing the Town to flexibly choose subsequent paths of action that align with its goals and with the measured effectiveness and affordability of this first tier of implementation.

In addition to the nitrogen benefits, Tier 1 alternatives have significant impacts on the public health concerns through mitigating contaminated wells. Table 7-4 provides a summary of the public health benefits that can be achieved through this same suite of alternatives. These alternatives can address known wells with bacteria/nitrate contamination in various ways; sewering and cluster systems will remove large quantities of septic systems from service, which will remove the risks associated with poorly performing septic systems or septic systems situated too close to water supplies. Septic upgrades – both to compliant Title V or to denitrification, will ensure that remaining septic systems are performing adequately and minimize contamination from in-service septic systems into drinking water sources.

Table 7-4. Summary of Public Health Benefits

Alternative	Estimated Number of Contaminated Wells Addressed (in Tier 1)
Sewer: Phase 1B	78
Cluster Systems (Cadman's Neck; The Let)	24
Denitrification Regulatory Overlay District	55
Title V Upgrades	20
Total (without Sewer: Phase 1B)	**99**
Total (with Sewer: Phase 1B)	**177**
Current Number of Contaminated Wells	200

7.6.2 Monitoring and Tier 2 Phasing

An integral component of this Plan is the framework for quantitatively measuring the actual impacts of each of these alternatives to determine their real effectiveness. Initial alternative evaluations and program development have been based primarily on modelled presumption of benefits from reduced nitrogen export. While the projected benefits in Figure 7.2 and Table 7-4 are compelling, the success of this Plan hinges upon actual realized in-stream water quality benefits, not just the modelled benefits. In order to determine if implemented alternatives are achieving the anticipated benefits, a monitoring program must be designed to track and evaluate success of respective projects/programs. The plan recommends the following strategies for monitoring the actual benefits of each Tier 1 project:

- In-stream sampling: continue to partner with existing groups such as the Westport River Watershed Alliance (WRWA) and Buzzards Bay Coalition (BBC) to continue river monitoring at existing sampling stations for parameters of concern.
- Private well monitoring: continue reviewing private well monitoring reports to track changes of bacteria and nitrogen presence in private wells.
- The Town may also choose to install and monitor groundwater monitoring wells proximate to known contaminated well "hot spots" for long-term monitoring of groundwater quality. Groundwater sampling downstream of cluster systems (if constructed) is also recommended.
- Targeted sampling: develop programs to sample nitrogen levels directly up- and downstream of vegetative filter strips and other treatment installations to derive more updated values for their removal efficiencies in Westport.

A finalized sampling and analysis plan for the comprehensive program should be developed to specify analytical parameters based on receiving waters, sampling frequency and other elements. Through these recommended monitoring strategies, the Town will collect valuable information on the performance of implemented alternatives. Over time, the Town will be able to track the progress of nitrogen reduction in the river, as well as estimated contributions from individual or categories of the implemented projects. This data will inform Tier 2 of the Plan, which will continue to make progress in reducing nitrogen and mitigating public health concerns. Figure 7.3 demonstrates an example path for Tier 2 implementations, representing the later years of this Plan. The framework presumes that successful Tier 1 alternatives at the initial implementation levels – sewering, vegetative filter strips, clusters, etc. – are expanded across more of the Town, and larger benefits are realized over the 20 – 40 year planning horizon. The cumulative benefits from Tier 1 are included, and Figure 7.3 shows how continued implementation will increase benefits.

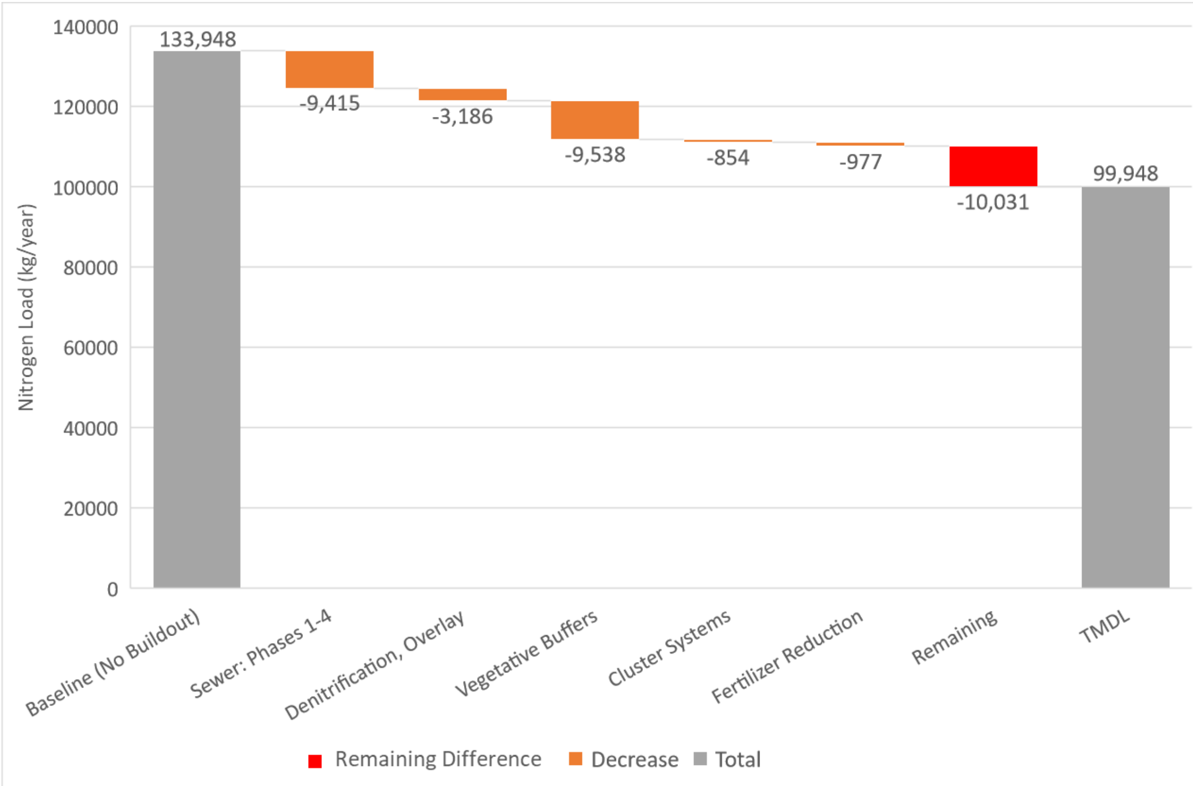

Figure 7.3 Estimated Nitrogen Load Reduction for Tier 2 Alternatives (20-40 Years)

The values shown here are just one path for reaching the Town's goals and getting closer to the TMDL. The path for making these decisions is described below.

7.6.3 Buildout Conditions - Water Quality Goals and Public Health Improvements

One goal of Tier 2 is to build off the successes and possible shortcomings of Tier 1, continuing to address both nitrogen loads into the river and any outstanding public health concerns. Another is to target buildout and future loads. The Plan recommends evaluating policies to address new construction and updated zoning that reflects any changes or growing character of the Town. While many sources of buildout are still unknown, Westport can be proactive in addressing projected buildout loads by incorporating policies in line with Tier 1 plans regarding septic maintenance and denitrification. Mandating or encouraging denitrification for new construction is one proactive step the Town can take to address new loads as they are introduced into the system. Figure 7.4 is a modification of the potential Tier 2 benefits in Figure 7.3 to include buildout and this one prescribed buildout-focused alternative.

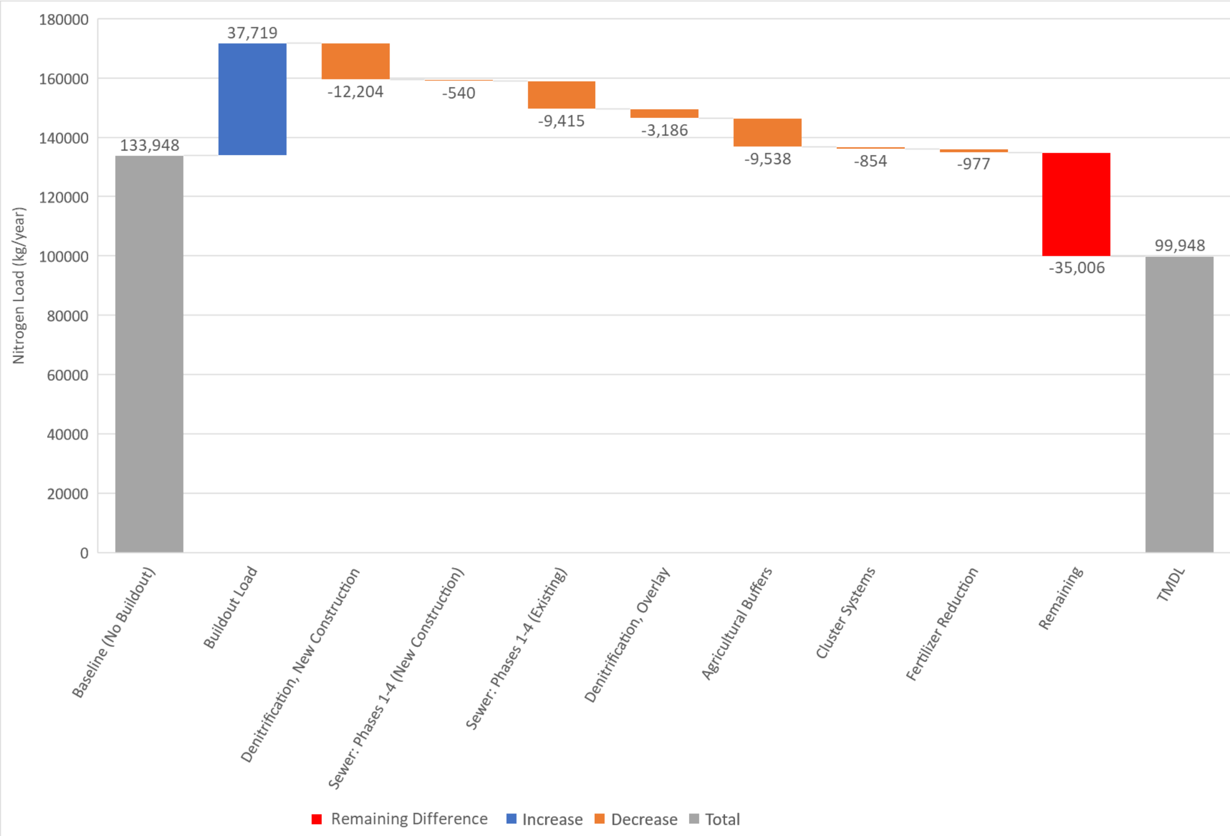

Figure 7.4 Estimated Nitrogen Load Reduction for Tier 2 Alternatives Including Buildout (20-40 Years)

The blue bar represents the maximum projected buildout in line with the buildout strategies discussed previously. Directly to the right, the new alternative labeled "Denitrification for New Construction" addresses 39% of this projected buildout load in the East Branch subwatersheds, which is a significant portion to mitigate with one proposed alternative. This reduction percentage is not as large as the nitrogen removal percentage achievable for an individual system partially because some of the buildout in the East Branch subwatersheds is outside of Westport and also because buildout loads include nitrogen loading from new impervious area and fertilized lawn area which is not addressed by denitrification systems. The remaining load not addressed by buildout or any of the Tier 1 alternatives, depicted as the red difference labeled "remaining," will be addressed with further implementations from Tier 2. The red bar of the remaining extra nitrogen load is larger in this figure than Figure 7.2 since it includes the unaddressed buildout load. However, this strategy allows the Town to be proactive, while also taking the time to determine best practices and the scale of buildout over a given timeframe before implementing projects. Note as well that the "buildout" load in reality will not be created in its totality at a single point in time. There is no timeframe associated with achieving full buildout, and it may never even be fully realized, since it is an upper limit. There are many variables associated with the development and buildout process that cannot be predicted, and this analysis of buildout loads aims to just show the capacity for this new construction denitrification alternative to address a portion of any future buildout that does occur.

7.7 FUTURE ADAPTATION AND CONTINGENCY PLANS

The following subsections review anticipated adaptations in the Plan. There are many decision points where the Town will have the flexibility to adjust the current framework to address actual conditions. This Plan does not contain prescribed steps for Tier 2 implementation; it instead recommends potential paths forward based on the data collected through monitoring Tier 1 and based on buildout developments. Potential alternatives to implement in Tier 2 are summarized in Table 7-5.

Table 7-5. Tier 2 Projects/Program Summary

Tier	Alternative	Benefits		
		Nitrogen Reduction	Public Health Benefits	Other (Economic, Sustainability, Resilience, Aesthetic, etc.)
2	Zoning (further development controls)	✓	✓	✓
2	Sewer and Water (Phases 2-4)	✓	✓	
2	Additional Treatment Systems (Cluster systems, etc.)	✓	✓	
2	Additional Vegetative Buffer Strips	✓		✓

These recommendations are largely built off Tier 1. Depending on the success of Tier 1 cluster systems and scale or failure to implement sewering, the Town may continue to sewer more of the Town or continue to expand cluster implementations. Tier 2 will be largely implemented as a decision tree, like the one shown in Figure 7.5, by selecting subsequent projects based on the progress the Town makes in Tier 1.

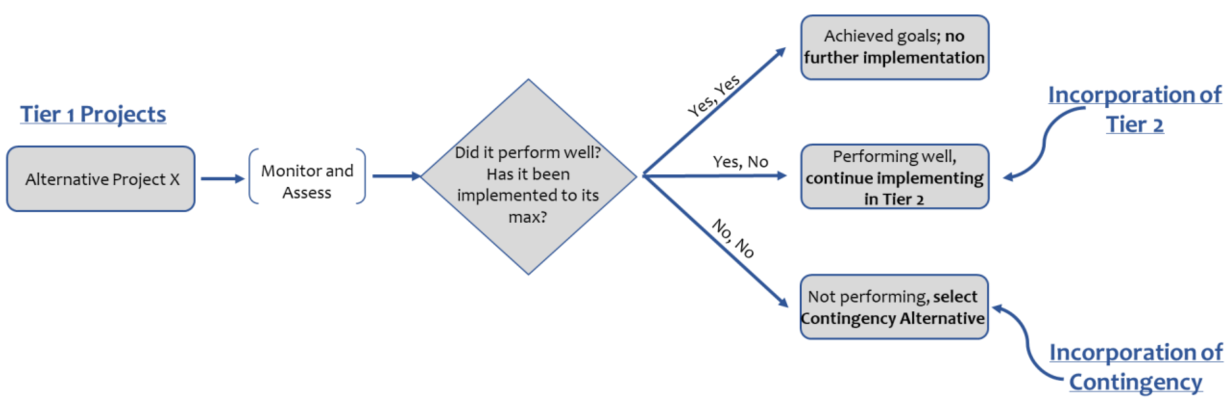

Figure 7.5. Decision Tree for Implementation Plan

Beyond Tier 2 projects, the Plan also designates some projects as "contingency" level projects. This means that they may not build directly off the results of Tier 1; however, they can fit into the decision tree above if initial projects do not perform as anticipated. The following projects are categorized as contingency projects:

- Permeable Reactive Barriers (PRB): Pilot
- Barrages/Constructed Wetlands
- Public Water Supply Development, the Let and Route 6

The following sections summarize how each of these contingency projects could be incorporated into the Plan based on monitoring results from Tier 1 and Tier 2.

7.7.1 Permeable Reactive Barriers (PRB): Pilot

PRBs likely represent the alternative with the most uncertainty in this Plan. While they have been successfully implemented in several communities on Cape Cod[2] and the surrounding areas, there are still questions of cost, efficiency, and applicability in Westport. Depending on the successes of the other projects in Tier 1, PRB pilots can be considered for similar data collection. If they prove to be successful, and cost effective, then they can be expanded and implemented more widely.

7.7.2 Barrages and Constructed Wetlands

Barrages and constructed wetlands work to enhance natural attenuation of nutrients like nitrogen and would be a feasible alternative to address high nitrogen loads already in the river system. Barrages are dams or shallow dikes in tributary streams that divert low flows into constructed wetlands for treatment. If the nitrogen and bacteria sources have been significantly mitigated, but there are still high in-stream concentrations measured, the Town can turn to projects like barrages and constructed wetlands to improve nitrogen attenuation and processing. For example, tributaries like Bread & Cheese Brook, which have high nitrogen concentrations, could be a good candidate for this type of project.

7.7.3 Public Water Supply Development, the Let and Route 6

The overarching goals of this plan are to address nitrogen and bacteria concerns in the East Branch of the Westport River. Sewering has been identified as one way to address both of these concerns. Past sewer investigations also included the simultaneous introduction of a public water system to the same areas. However, this is not explicitly recommended here because it does not directly achieve any of the targeted goals of the Plan. Introducing a public water supply to areas that see high contamination levels in their drinking water wells could alleviate some of the resulting public health issues; however, sewering those areas, and therefore removing the septic loads that cause the well contamination, also achieves this goal.

While introducing public water and sewer have redundant benefits, this Plan recommends evaluating the future economic and resilience benefits of public water along Route 6 during sewer construction in that area. The economic benefits realized by sewering will likely be magnified by also including water. Similarly, over time, coastal climate change impacts including flooding and saltwater intrusion could put wells near the waterfront at risk. The introduction of public water could mitigate these future climate impacts. Therefore, the Town should consider taking the steps to set up this connection and relationship at the same time as sewer construction; that way, if public water becomes more desirable in the future, the Town will be ready to implement without needing to tear up its streets again.

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[2] *CDM Smith. "Technical Memorandum No. 5b: Preliminary Design for the Three Potential Sites Selected for the Permeable Reactive Barrier (PRB) Demonstration Project – FINAL." Falmouth, MA, PRB Committee, 16 Dec. 2013.*

There may also be significant economic benefits to introducing a public water supply to the Let, which is an area currently recommended for implementing a Tier 1 cluster system. This water supply contingency plan is aimed also to mostly address public health concerns in that part of Town; depending on how the cluster system performs, introducing public water to the Let could contribute additional benefits. These could be smaller capacity community wells with water district management, not cross-town water main extensions from adjacent communities' public supplies.

7.7.4 Enhanced MS4 Program, Green Infrastructure

Only a small portion of the Town is technically subject to jurisdiction under the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) General Permit. Nevertheless, the benefits associated with elements of that program, particularly with respect to public education and outreach, can be leveraged within the broader IP program and implemented Town-wide. Other elements of the program, such as those relating to new and re-development design standards and development of policies to optimize green infrastructure and low-impact design, are entirely compatible with the objectives of the IP. These issues will be further evaluated by the Town in the course of MS4 program implementation.

7.8 BENEFITS AND UNCERTAINTIES OF THE PLAN

This tiered implementation plan affords Westport the flexibility to select alternatives and implementation levels that are best suited to progressing towards the TMDL, while also addressing public health concerns. The focus on monitoring, data collection, and phased implementation aims to create a more affordable plan that has support from the Town and its stakeholders and is not just focused on single-stream or common solutions.

To maintain flexibility, and to ensure that implemented alternatives remain relevant to Westport, the Plan's framework focuses on using current conditions and implementation success to select future actions. This strategy grants the Town the flexibility to reflect upon monitoring data results and continue implementing strategies that are producing the best results. This path to find the best solutions for Westport may not always be straightforward; however, with the built-in flexibility, and the varying array of alternatives, the intent is to have the resources and the wide berth of options to address any level of success realized in the early stages of this Plan.

7.9 SUMMARY

There are a few key takeaways that should be noted from the development of this proposed plan:

- While nitrogen reduction is one of the major goals of this report, the plan was developed with a focus on achieving multiple goals - nitrogen reduction, public health benefits, economic growth, sustainability, etc.;
- In addition to multiple goals, the Plan also emphasizes implementing a variety of alternatives to distribute the load reductions both in terms of geography and methodology;
- The tiered approach gives Westport the flexibility to adapt to projects that are the most well suited to the character of the Town;
- A focus on monitoring and assessment will inform future implementation stages of the Plan; and,

- While there are areas of uncertainty or potential for projects to not perform as anticipated, the wide range of potential projects both in Tiers 1 and 2, and also in the Contingency category, aims to reduce any of these inherent risks.

8 CONCEPTUAL DESIGN

8.1 DESIGN DEVELOPMENT

In addition to the longer term program to address nutrient reduction, this IP will serve as a near term action plan around which complementary tasks can be enacted to incrementally advance overall community objectives. The purpose of this section is to provide preliminary thoughts with respect to several of the most likely near-term actions recommended in this plan. Specifically, the section outlines the following:

- Initial phase of sewer extensions in the northern business district (Phases 1A and 1B)
- The potential extent of the nutrient reduction overlay district;
- Possible cluster septic system for Cadman's Neck and The Let
- Recommended locations for vegetative buffer strips

8.2 SEWER PHASE 1A AND PHASE 1B

The Town commissioned an engineering consulting firm (CDM) to perform a preliminary evaluation and feasibility study of sewering a portion of the northern part of the community. That plan was completed by CDM in 2004. Phase 1 of the plan encompassed the Route 6 area from South Watuppa Pond to Westport Factory as well as a short section of Route 177 east of Bread and Cheese Brook.

In late 2019, the Town was provided with a $50,000.00 state grant to be used for infrastructure improvement. In consideration of critical concerns for wastewater management along the Route 6 corridor from the Fall River line to Route 88 in Westport (a portion of the Phase 1 area and hereafter referred to as Phase 1A) the Town is moving forward to determine the feasibility of using existing infrastructure to accelerate construction of a preliminary Phase 1A sewer extension. This would provide sanitary sewer service to businesses currently constrained from growth due to inadequate wastewater disposal options. It is a necessary first step in the realization of more comprehensive sewering options for the areas in northern Westport as provided for in this Plan.

The Phase 1A scope of work (to be completed in Winter 2020) includes the following tasks:

1. Preliminary design of:
    a. Approximately 5,000 feet of gravity sewer from the Fall River line along Route 6 southeasterly to the Route 88 interchange.
    b. A pumping station (and force main) near Route 88.
    c. Capacity upgrade of the pumping station near the Fall River line (if necessary).
2. Capacity evaluation of the existing private pumping station near the Fall River line.
3. Gravity sewer will be sized for future flows to the extent practicable.
4. Pumping stations will be sized for near term flows.
5. The preliminary design will be based upon the April 2004 Route 6 and Route 177 Water and Sewer Concept Plan study by CDM and subsequent Route 6 Sewer Extension and Economic Development Analysis dated April 2018 by SRPEDD.

The Town intends to pursue various grants or loan opportunities to bring the design to 100% bidding documents and ultimately construction. In the course of that effort, the Town will also be exploring the challenges of long-term administration, operation and maintenance of this sewer and potential sewer extensions as proposed in the IP.

Phase 1B is the balance of the plan described by CDM as Phase 1. This complete phase is recommended for implementation within the first 5 – 10 year period of program execution. Further detail on schedule will be considered upon successful completion of Phase 1A. Figure 8.1 presents the approximate areas encompassed in Phase 1A and 1B.

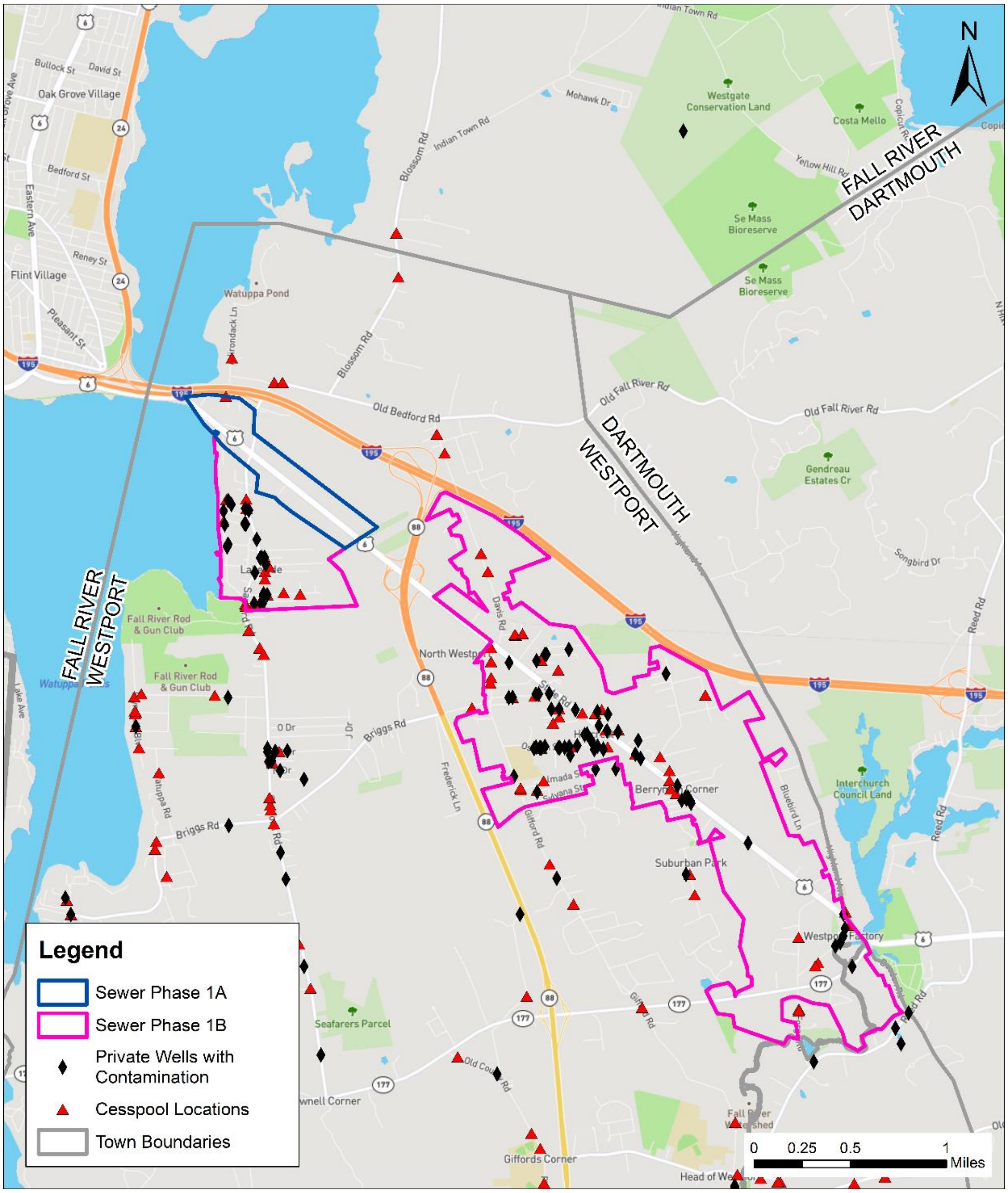


Figure 8.1. Phase 1A and Phase 1B Sewer Boundaries

8.3 NUTRIENT REDUCTION OVERLAY DISTRICT

The nutrient reduction overlay district is a defined area where cesspools and septic systems installed prior to 1995 will be required to upgrade to denitrification septic systems within a certain timeframe, preliminarily proposed to be 5-10 years. Septic systems installed prior to 1995 are non-Title V compliant and are more likely to be failing or towards the end of their useful life. These systems should be prioritized for improvements. In recommending a boundary for this overlay district, we considered the following:

1. The boundary should not include areas that may be addressed by other wastewater alternatives such as public sewer.
2. The boundary should be set to prioritize areas where septic system improvements are anticipated to result in significant reductions to in-stream nitrogen concentrations in a reasonably short amount of time.
3. The boundary should be set to include a significant number of cesspools and aging septic systems while not placing an unnecessary and unrealistic burden on individual homeowners.

To address the first item, the team removed all of the areas north of Route 177 in Town, as these areas are candidates to receive public sewer extensions in the future. In addition, the overlay district is envisioned to accommodate neighborhoods or discrete geographic areas that opt to communally address wastewater disposal needs through implementation of a cluster or shared system (see Section 8.4). The overlay may serve, in fact, as an incentive to encourage a communal approach which is generally less expensive per household, and more logistically practicable given the small lots and development density along the River.

Estimating in-stream nitrogen improvements over time requires an understanding of groundwater travel and transport rates in the areas surrounding the River. Septic systems discharge nitrogen into groundwater that travels eventually to the Westport River or its tributaries causing increases in the nitrogen concentration within the River. Several factors impact the speed at which groundwater travels towards a receiving water body, including the hydraulic conductivity of the soil it is traveling through and hydraulic gradient of groundwater which drives the flow. Groundwater travels faster through soils with higher hydraulic conductivity which is a physical property that measures the ability of the material to transmit fluid through pore spaces. Nitrogen discharged from septic systems located far away from a receiving water body will generally take longer to reach the receiving water body, but this is not always the case depending on the hydraulic gradient and hydraulic conductivity of subsurface soils.

The team used the USGS data reference depicted in Figure 8.2 to evaluate subsurface soil deposits in Westport. This reference indicates several areas within Westport where soils have higher hydraulic conductivity, including areas of northern Westport and areas along the East and West branches of the Westport River. The areas directly adjacent to the East and West branch of the Westport River are recommended as the areas where septic improvements should be prioritized through a nutrient reduction overlay district. These areas are not only located closer to the River resulting in shorter travel distances to the receiving water body and less opportunity for natural uptake/attenuation, but also have the most transmissive soils indicating faster travel of groundwater and subsequent impact to water quality in the River. Septic improvements in these areas are anticipated to show a measurable reduction in river nitrogen concentrations in a short amount of time.

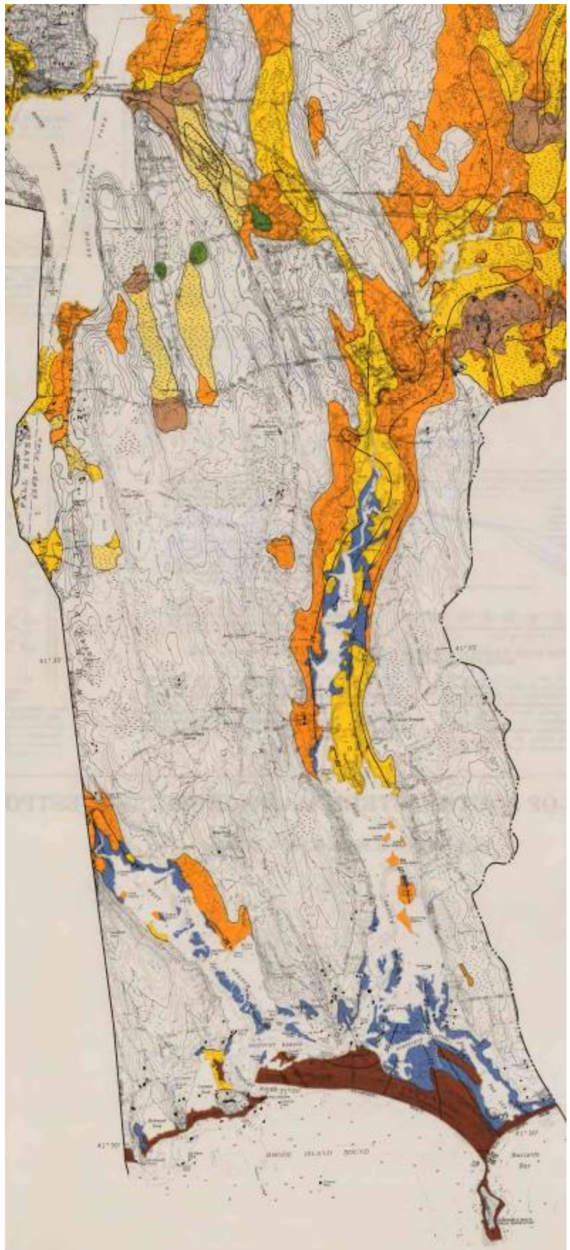


Figure 8.2. Subsurface Soil Conditions with Colored Areas Indicating the Most Transmissive Soils Reference

Finally, an important goal of this overlay is to reduce the hazards with contaminated drinking water wells; Table 8.1 shows a comparison of the varying benefits for the various offset distances evaluated, including the number of private wells with contamination issues that would be protected by this overlay. Starting at the 1,000 ft buffer distance, a significant number of wells are addressed. There are significantly diminishing returns after the 2,500 ft distance.

Table 8-1. Potential Benefits for Varying Offset Distances for Denitrification Overlay District*

Offset distance from River edge (feet)	Total septic system parcels intersecting offset zone	Estimate of pre-1995 septic system parcels intersecting offset zone	N removal assuming denitrification for estimate of pre-1995 septic system parcels intersecting offset zone (kg/year)	Private wells with contamination issues intersecting offset zone	Existing Cesspools intersecting offset zone
100	543	294	1125	0	3
500	985	534	2043	39	17
1000	1444	779	2976	71	55
2000	**1946**	**1044**	**3957**	**79**	**69**
2500	2108	1132	4277	84	77
5000	2901	1555	5763	92	97

*Note: Benefits calculated are inclusive of the proposed cluster system pilots discussed in Section 8.4 which otherwise fall within this delineated overlay.

Based on investigations into future wastewater disposal options, soil transmissivity, and private well impacts, a 2000-ft offset buffer from the edge of the East and West branches of the Westport River is recommended as the overlay district boundary. This encompasses areas of Westport with the most transmissive soils and the greatest proximity to the impaired receiving water body. Figure 8.3 compares the proposed overlay district (left) with locations of the most transmissive soils indicated by colored areas (right). It also shows that the nutrient reduction overlay district encompasses many private wells with documented contamination from bacteria or nitrates that could potentially be mitigated by septic system improvements.

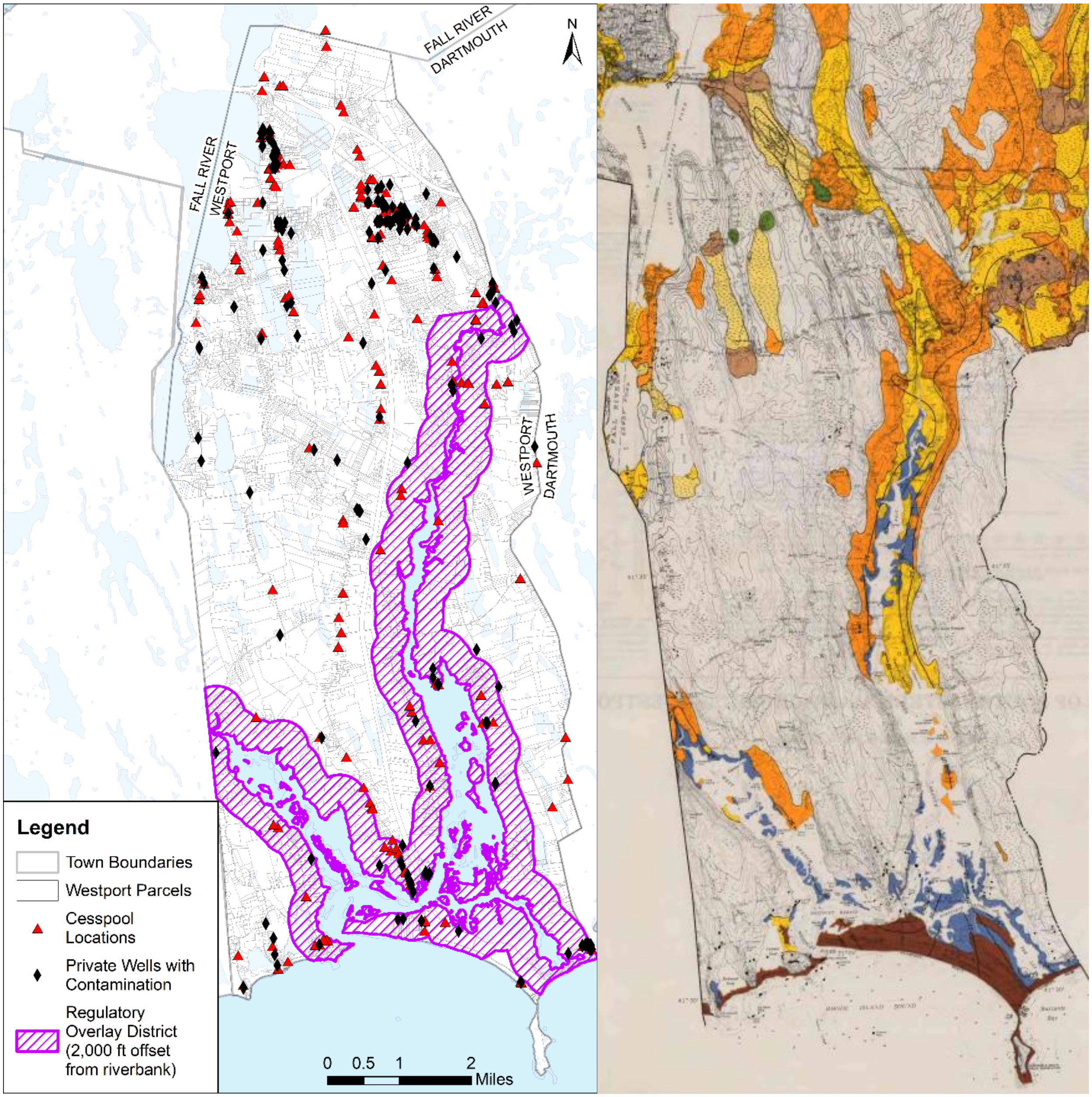


Figure 8.3. Proposed Denitrification Overlay District (left) Compared to Subsurface Soil Conditions with Colored Areas Indicating the Most Transmissive Soils (right)

This proposed overlay district is a recommendation that may be modified to reduce or increase the proposed offset distance from the edge of the River. Table 8.1 summarized the potential benefits in terms of number of septic systems, cesspools and private wells potentially addressed for varying offset buffer distances from the River. This proposed 2,000 ft buffer district would encompass an estimated 1044 septic systems installed prior to 1995 and 69 existing cesspools, and it would protect 79 contaminated private wells. This is a proposed framework; development of the specific regulatory language, administrative organization and potential variances, etc., must be further developed. For instance, the Town may choose to amend criteria for mandatory upgrades if system inspection demonstrates adequate performance meeting Title V effluent requirements. The manner in which the overlay is administered in tandem with cluster system retrofits must also be addressed. The Town has expressed the interest in developing a program that promotes both public and private investment in water quality improvement, and this is an area where Town-sponsored financial incentives or financing alternatives for private property owners would be appropriate.

The cost of upgrading an existing individual septic system to a denitrification septic system is typically around $21,000. The cost for installation of a new denitrification septic system is typically around $34,000. Upgrades to existing systems can incorporate the existing septic tank infrastructure and modify or add to the system thus reducing the overall cost compared to installing a new system. While cost is important, for many homeowners the greater hurdle may be physical constraints due to parcel size, depth to groundwater or other design standards that will make installation of de-nitrification systems highly problematic.

8.4 CLUSTER SEPTIC SYSTEMS

Cluster septic systems are wastewater treatment systems that collect wastewater flows from two or more properties (total flows less than 10,000 gallons per day) to be treated by a single treatment and dispersal system. Cluster systems represent an intermediate level of decentralized wastewater treatment between large centralized wastewater treatment facilities with a public sewer system and individual septic systems servicing individual households. Cluster septic systems can mitigate private well contamination issues caused by discharges from nearby septic systems by consolidating treated wastewater discharge to a single point source located a safe distance from nearby private wells. Cluster septic systems can be paired with different treatment and dispersal methods to reduce the amount of nitrogen in the treated effluent or even achieve water reuse standards so treated effluent can be reused for irrigation. Cluster septic systems can reduce per capita costs of wastewater treatment compared to individual septic systems but require upfront costs to construct the infrastructure and a governing entity to perform operations and maintenance. Cluster systems require adequate space for treatment structures, conveyance piping and leaching area. The feasibility and design of a cluster septic system installation is also informed by the site topography, soil and groundwater conditions, anticipated water use and anticipated characteristics of the influent wastewater, among other factors. Different types of modular and site-specific cluster systems may be designed for different conditions. A single cluster system may include multiple types of conveyance, treatment and dispersal. Some common types of cluster system conveyance, treatment and dispersal are described below.

Cluster system conveyance options:

- Gravity systems use gravity piping and collection tanks to convey sewage to a central treatment and/or dispersal system
- Pressure systems use pumps and pressure piping (force mains) to convey sewage to a central treatment and dispersal system
    - Grinder pump systems shred sewage solids at individual residences prior to pumping
    - Septic tank effluent pumping (STEP) systems use tanks at individual residences to remove solids, grit and grease prior to pumping
- Vacuum systems use suction to convey and break apart sewage from small holding tanks at individual residences to a central treatment and dispersal system

Cluster system treatment options:

- Collection tanks for solids settling and removal of grit and grease (primary treatment)
- Biological treatment with aeration for solids and nutrient removal (secondary treatment)

- Media/filter treatment for increased solids and nutrient removal
- Membrane treatment for increased solids and nutrient removal

Cluster system dispersal options:

- Gravel/stone or chamber dispersal
- Layer cake dispersal with layers of sand and sawdust/wood chips for increased nitrogen removal
- Shallow drip irrigation dispersal
- Recirculating sand filter dispersal

For clusters systems being implemented in an existing neighborhood, septic tank effluent pumping (STEP) systems are favorable from a cost perspective as there is some potential to reuse the existing septic tanks at each property depending on the condition of the tank. Under Title V regulations, MassDEP maintains a full list of innovative/alternative (I/A) septic system technologies for treatment and dispersal that have been approved for use in Massachusetts. Some piloted approaches, such as the layer cake systems discussed in Section 6.4, have achieved positive preliminary results with respect to nutrient reduction, however these are not yet approved for more general use. Buzzards Bay Coalition has worked with south coast and Cape Cod communities to advance the installation of the pilot systems. If monitoring continues to show favorable results, Westport may choose to partner with others to advocate for approval of such systems for wider use, or such local control that would allow for case-by-case evaluation for system permitting.

There are 10 – 12 small lot former campground or cottage colonies along the East Branch where having nitrogen reducing systems or perhaps even Title V compliant systems installed on each lot would be very difficult. For illustration purposes, the team created conceptual designs of cluster septic systems at two locations: Cadman's Neck and The Let (Figure 8.4 and 8.5). Both of these locations present the logistical problems noted, and have documented private well contamination issues. These locations are examples only, and are provided to demonstrate the principles of cluster system design and opportunity. On Cadman's Neck the proximity to active agriculture in orchards or the vineyards offers the potential to have the benefit of reuse of the cleaned effluent for drip irrigation. The Let lacks that agricultural adjacency and treatment or disposal considerations would therefore differ. Again, these locations, and the conceptual designs presented are for illustration only.

The Cadman's Neck design includes approximately 51 properties with septic systems and 5 documented private well contamination issues. The Let design includes approximately 36 properties with 21 documented private well issues. Both conceptual designs require easements and the acquisition of nearby land for treatment structures, conveyance piping and leaching area.

The two conceptual design examples are locations where the implementation of a cluster system could be suitable and potentially feasible. Site suitability and implementation feasibility was based on the density of private well contamination issues, density of properties with septic systems, general site topography and proximity to the receiving water body and to developable land area. These designs are purely conceptual and may be modified or deemed infeasible following additional investigation.

The estimated cost of design and construction of the proposed cluster system at Cadman's Neck is $1,300,000. This estimated cost does not include the cost of potential land acquisition to accommodate the treatment and dispersal system. The estimated cost was developed assuming a STEP system would be implemented with a septic tank and small pump at each residence with flows conveyed through small diameter force mains to a central denitrification treatment system with multiple tanks and a pressure dispersal system. For a “retrofit” cluster system being built in an existing neighborhood, a STEP or grinder pump system is more feasible than a system with primarily gravity piping as the existing grade may not be favorable to gravity conveyance. The estimated cost includes costs for road repair and construction contingency. The estimated cost of design and construction of the proposed cluster system at The Let is $1,100,00 determined by the same methodology.

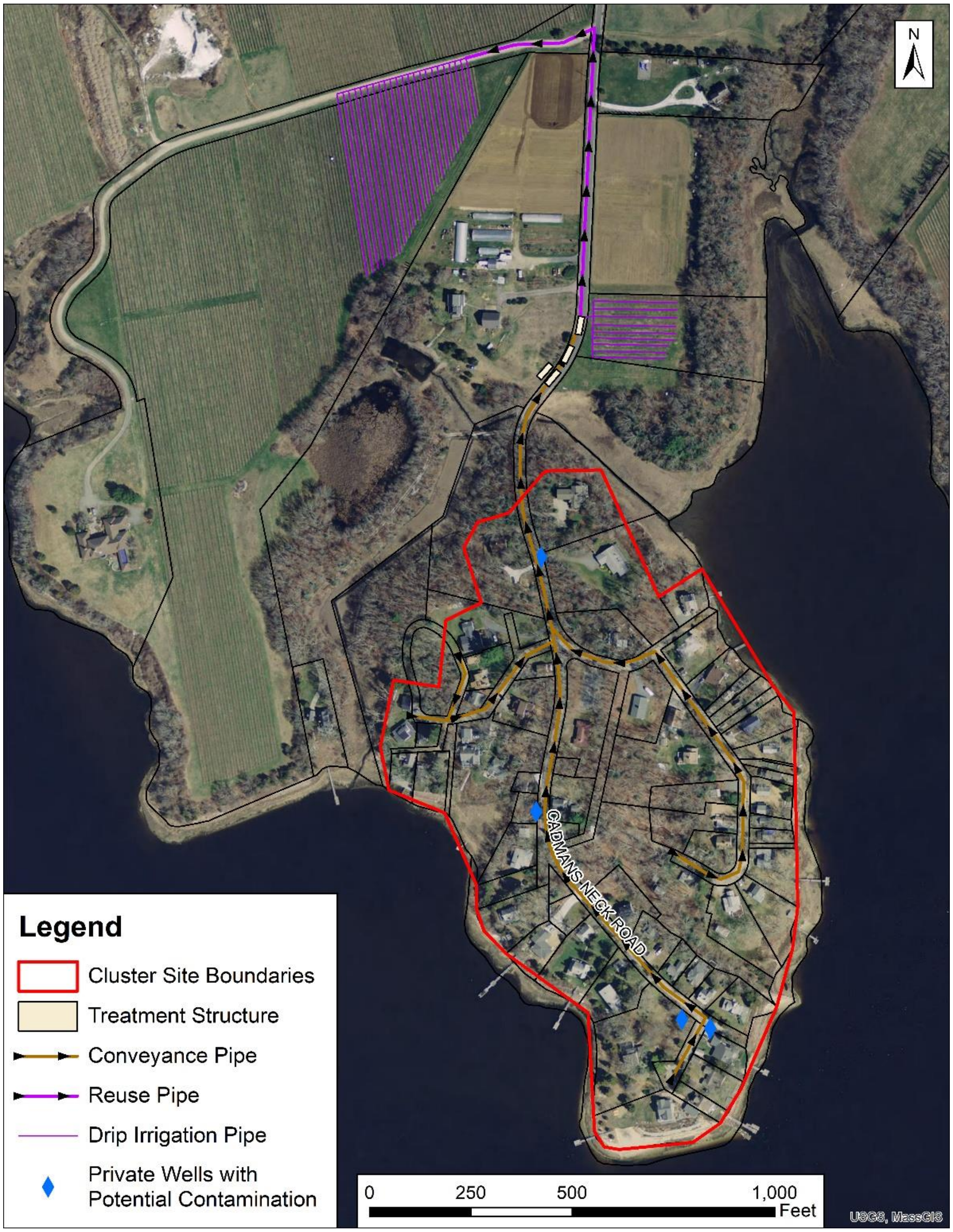


Figure 8.4. Conceptual Design for Cluster Septic Systems at Cadman’s Neck

Figure 8.5. Conceptual Design for Cluster Septic Systems at The Let

Among the last public comments we received was a suggestion combining the future sewer phases with a pressure sewer solution for the old cottage clusters on the west side of the East Branch where there are not large adjacent farm lands to acquire disposal areas as on the east shore. The concept would be to install a long force main in Drift Road running from the Point and connecting to the east end of the State Road sewer in a series of pumping stations. The cottage clusters could install grinder pump pressure sewer systems which would pump into the interconnected Drift Road force main. No evaluation was made about the feasibility of this late suggestion.

8.5 VEGETATIVE BUFFER STRIPS

Vegetative buffer strips are strategically planted, vegetative areas designed to provide treatment to surface runoff and shallow groundwater from upstream agricultural areas. Buffer strips are designed to intercept nitrogen in surface runoff and shallow groundwater from agriculture areas prior to nitrogen reaching a receiving water body, in this case the Westport River. The design width of buffer strips can vary depending on the type of buffer implemented. Buffers are often designed with a "zone" approach where the buffer consists of multiple adjacent buffer zones each with a specific width, vegetation type and density of vegetation often with vegetation increasing in size when moving towards the receiving water body. Figure 8.6 shows an example of a vegetative buffer strip with vegetation progressing from a short grass zone to mid-level grasses and vegetation zone to "forested" zone with large trees.

Figure 8.6. Example of a Vegetative Buffer Strip with Multiple Zones

Buffer strips are generally better suited in areas where subsurface soils are less transmissive, thus reducing infiltration capacity and increasing surface runoff potential. Figure 8.2 demonstrated that most of the Town, aside from the areas nearest to the River, consist of soils with low transmissivity. These areas are also where primary farmlands are located, making buffers for cultivated fields and pastures quite effective. Regardless, buffer strips in the more transmissive areas are still able to capture some nitrogen in shallow groundwater, and they therefore do not have to be located solely in areas where subsurface soils have less infiltration capacity. Additionally, agricultural and residential areas closer to the River should be prioritized to see measurable benefits to in-stream nitrogen concentrations in a shorter amount of time. The total agricultural area and nitrogen load from agriculture was quantified as part of updating the baseline nitrogen loads using the same assumptions and nitrogen loading factors from the MEP Report.

Notably, the nitrogen load from farm animals (specifically dairy and beef cows) represents the largest portion of the calculated nitrogen load, more than the load from fertilized crop area. Implementation of buffer strips at farms with the largest quantities of animals could be one strategy to address a larger portion of the agricultural nitrogen load with each buffer installations.

The program is envisioned as a voluntary initiative that is likely to require an economic or other incentive to participants. The form in which such incentives would be provided has not been determined. Monitoring and inspection to assure buffers are maintained in an appropriate manner would be a required element of the program. Town-funded guidance with respect to suitable plantings and design would also be recommended. It is possible that the Conservation Commission has the skill set necessary to provide these services with existing resources. The ongoing Massachusetts Association of Conservation Districts program to implement multiple best management practices would be a good template for an approach to the farming community.
The nitrogen removal effectiveness of a vegetative buffer strip can vary widely depending on the width of the buffer strip, species of vegetation planted, density and order of vegetation planted as well as topography, size and shape of the agricultural area and soil/groundwater conditions, among other parameters. Refer to Appendix C for more details on the assumptions and calculations used to estimate nitrogen removal effectiveness for vegetative buffer strips.

8.6 CLIMATE CHANGE CONSIDERATIONS

As a coastal community, Westport is vulnerable to storm surge and sea level rise (SS/SLR) impacts from climate change. The most recent SS/SLR modeling was performed by Woods Hole Group in coordination with the Massachusetts Department of Transportation (MassDOT). Model results indicate areas within Westport that are most vulnerable to SS/SLR flooding. Figure 8.7 shows the probability of flooding in 2050. Flooding from SS/SLR has the potential to cause damage to individual properties and homes, saltwater intrusion into private wells and septic systems and disruption of utilities. Flooding from SS/SLR should be taken into consideration when determining where alternatives should be located. Vegetative filter strips may be better suited for areas outside of the SS/SLR flood zone or if implemented within the flood zone, contain plant species resistant to flooding impacts. Potential PRBs should be located outside of the flood zone to avoid tidally influenced groundwater which can reduce their nitrogen removal effectiveness. Additionally, individual and cluster septic systems should consider the possibility of damage or negative performance from SS/SLR impacts.

River system alteration (such as dredging) as an alternative for nutrient reduction was initially considered in this Plan, however there are significant permitting and regulatory hurdles as well as technical challenges. The question was raised at a public meeting as to whether climate change might have some impact on the behavior of nitrogen in the environment. It was suggested that increased tidal flushing from SS/SLR (comparable but not equivalent to the designed system alteration alternatives) could result in lower in-stream nitrogen concentrations. As indicated in Figure 8.6, frequent overtopping and inundation of low spots in the barrier beach systems will undoubtedly affect the hydrology and ecology of the system. However, the potential impacts of SS/SLR on instream nitrogen concentrations are still unknown and could be positive or negative. While there is ongoing research regarding the impacts of warming waters, no assumptions regarding either positive or negative impacts with respect to nutrient reduction are included in this Plan.

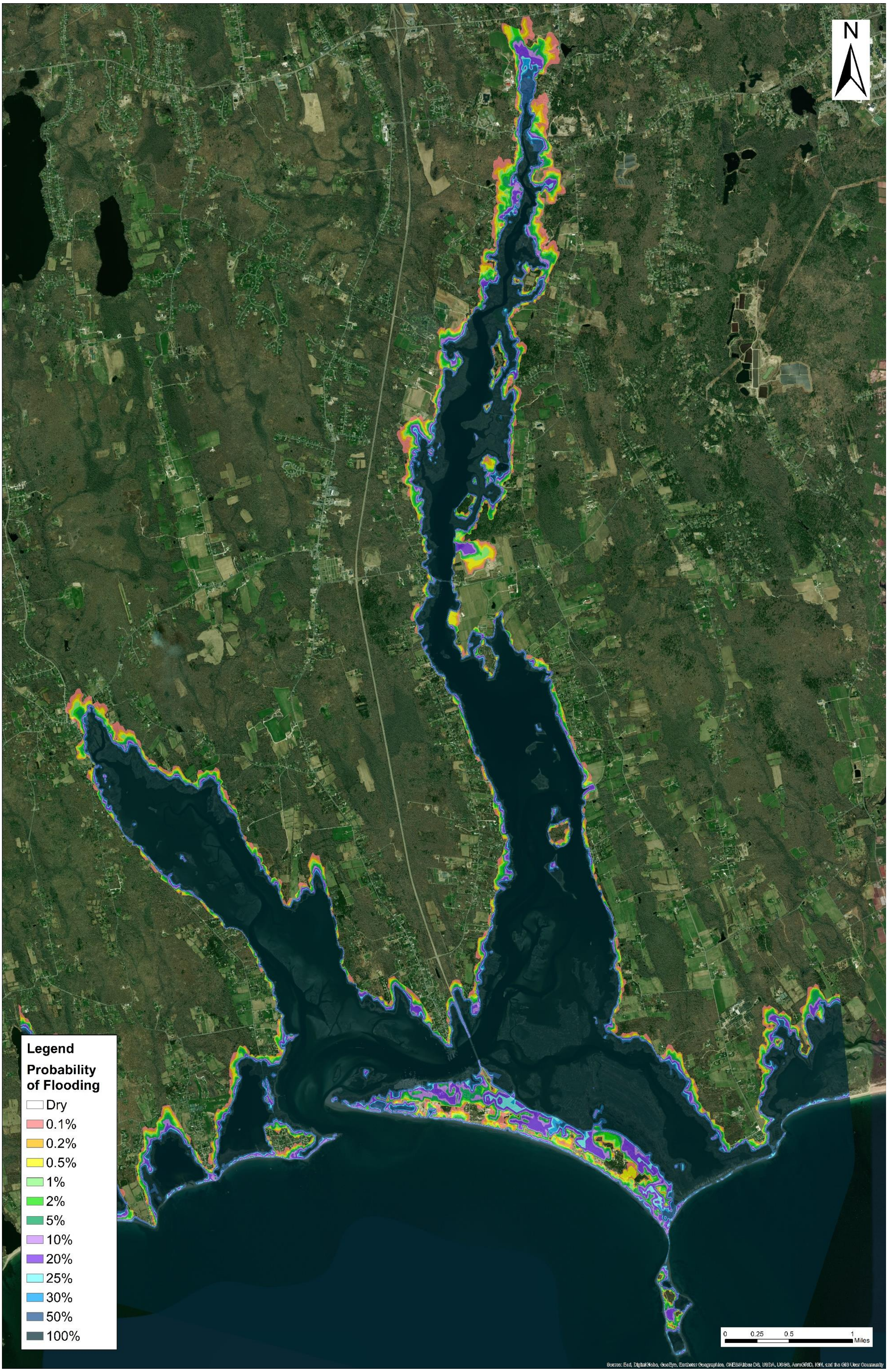


Figure 8.7. Annual Probability of Flooding in 2050

9 FINANCIAL ANALYSIS

9.1 INTRODUCTION

As part of the Plan development, planning level costs were developed for Tier 1 alternatives. They are summarized in Table 9.1. Estimates were based on conceptual design of proposed approaches or program development start-up costs. At this conceptual level, important project specifics cannot be fully understood. For instance, land acquisition will most likely be necessary to implement decentralized wastewater management options (cluster or shared systems) and those costs are not included with these estimates. The Plan as proposed presents a variety of alternatives that differ with respect to scale, technical or administrative complexity, and implementation phasing. As such, it will require an investment in staffing, equipment and administrative resources that has not been estimated at this time.

For sewer alternatives, the costs include design and construction of wastewater collection and conveyance to Fall River, inclusive of anticipated pump stations. For cluster system alternatives, costs include wastewater collection and conveyance to treatment which is assumed to be an enhanced de-nitrification system. As stated, no land acquisition or easement procurement costs have been included. For alternatives that require private homeowners to upgrade existing septic systems or install new de-nitrification systems for new or significant re-construction, costs are based on typical individual septic installation costs.

Table 9-1. Alternatives Cost Summary*

Alternative	Costs[1]	Cost Units
Sewer: Phase 1A	$2,510,000	Implementation
Sewer: Phase 1B	$15,990,000	Implementation
Cluster System with Denitrification	$1,100,000	Implementation
Cluster System with Denitrification and Irrigation Reuse	$1,300,000	Implementation
Denitrification Regulatory Overlay District	$21,000	Individual system
Vegetative Buffer Strips[2]	$300	Cost per acre-ft per year
Public Education & Outreach	Negligible	N/A
Denitrification for New Construction	$34,000	Individual system

[1]Cost of policy alternatives, such as a nitrogen reduction overlay district, is not reflected in the table as a separate element, but cost to individual property-owners is reflected under the denitrification costs for individual systems.

[2]Negligible implementation costs compared to other alternatives; therefore, vegetative buffer strip costs are represented as an annual maintenance cost.

9.2 POTENTIAL FUNDING OPTIONS

The plan as proposed includes several elements or alternatives that may end up being primarily privately funded (such as required upgrades to privately owned systems). The Town may choose to develop a local financing subsidy or enhanced revolving fund for private homeowners; those options are not addressed here. This section is intended to provide a general description of available funding strategies for the community, exclusive of traditional general fund (property tax) financing.

Traditional Grants and Loans:

- Clean Water State Revolving Loan Fund (SRF): This program is administered by Massachusetts Department of Environmental Protection and the Water Pollution Abatement Trust. Typically, the program provides low interest loans for water resources infrastructure planning and construction. Loans are usually for a 20-year period at 2% interest but may be awarded at 0% interest for nutrient management related projects. There are multiple steps required to qualify for the 0% program, including completion of a Comprehensive Wastewater Management Plan approved by DEP. The current Plan does not qualify as that plan, although additional study pursuant to the Plan could obtain such approval. This initial planning effort was funded in part through SRF.
- Massachusetts DEP Section 319 Non-Point Source Grants and Section 604b Water Quality Management Planning Grants: Specific components of the program may be eligible for grant funding under either of these competitive grant programs. The former program is targeted to non-point sources of pollution and may be a vehicle for addressing the large pollutant loads generated by agricultural land uses in the community. The latter program generally provides smaller grants but could be a means to advance opportunities for green infrastructure and Low Impact Design (LID) development within the community.
- MassWorks Infrastructure Program: This competitive grant program is administered by the MA Executive Office of Housing and Economic Development (EOHED). This is a particularly attractive possibility for Westport as several of the alternatives are specifically designed to support economic development and sustainable housing opportunities which are key elements of the program objectives. Awards are variable but can be substantial (in the hundreds of thousands to millions of dollars).
- Rural Development Grant and Loan Program: This is a U.S. Department of Agriculture program for planning, design and construction of municipal wastewater infrastructure for communities of less than 10,000 in population. Although Westport is larger than the current threshold, applicants have successfully been awarded grants on the basis of a "service population" that is below the threshold. Eligibility and percent grant funding is based on mean household income and further analysis would be required to determine if there are portions of Westport that would be candidate geographies for this program.

Other Options:

- Sewer User Fee/Enterprise Fund: Public wastewater infrastructure has traditionally been funded by user fees. Those who benefit from the system fund the cost of operation and maintenance. Connection fees, rate setting and any additional fees for specific activities would be developed in the course of Sewer Use Regulations development.
- Municipal Water Infrastructure Investment Fund (WIIF): MGL Chapter 40, Section 39M describes provisions of the WIIF which allows Westport to establish a special revenue fund for expenditures for maintenance, improvements and investments to municipal drinking, wastewater and stormwater infrastructure. The fund is generated by a property tax surcharge of up to three percent and is not subject to levy limitations of Proposition 2 ½.

- Environmental Quality Incentives Program (EQIP): This program is not available to the community at large, but is an individual grant and technical assistance program available to farmers exclusively to implement conservation practices for air and water quality improvement. The Town may want to explore an opportunity to provide application assistance to farmers to apply for financial assistance to build and maintain vegetated buffer/filter strips.
- Partnership with private non-governmental organizations or regional planning agencies: The Town has successfully worked with partners such as Buzzards Bay Coalition to seek and obtain funding for specific projects in the past and is preparing to so currently for initial actions under this plan.

The options listed are only a partial inventory of funding avenues available to the community but represent some of the most successful strategies employed by other communities to fund water resource infrastructure.

10 ACTION PLAN

10.1 BASIS OF IMPLEMENTATION

Due to the nature of this tiered Plan, its implementation strategy is less prescriptive than a traditional improvements plan. Regardless, to initiate progress with the initial Tier 1 suite of alternatives, there are some discrete actionable steps that the Town needs to take. This section, building off the information provided above, especially in the Plan Formulation and Conceptual Design sections, will illustrate the steps towards successful implementation of the Plan.

Implementation begins with Tier 1. Many of the Tier 1 projects are recommended at the pilot scale to initiate progress, and to collect data on the efficacy of these alternatives. Phased implementation also allows for the necessary public dialogue around equity – in terms of both cost and realized benefits – to facilitate positive Town Meeting votes going forward. For each of these projects, there are critical discreet, short-term implementation actions that the Town will need to take. These steps may include:

- Determining governance structure(s) for those projects or programs that require public oversight or ownership;
- Establishing technical feasibility of site-specific projects such as cluster systems through site analysis and field investigation;
- Modifying or creating new Town by-laws or regulations to enact policy and programmatic alternatives.

10.2 GOVERNANCE AND ADMINISTRATIVE MANAGEMENT ISSUES

Many of the alternatives recommended in this plan will require significant oversight to plan, construct, operate, maintain, inspect and/or enforce compliance with anticipated performance thresholds. The Town of Westport does not currently have a Department of Public Works or comparable agency to whom these duties might naturally accrue. There are several optional administrative frameworks to be considered, including:

- Using formal homeowners' associations to operate and maintain smaller systems;
- Initially operating and maintaining larger community shared or public systems under a contract with qualified engineering companies;
- Enhancing responsibilities of an existing Town Department (e.g. Planning Department, Board of Health or Highway Department);
- Creating a new Town Department (e.g. Department of Public Services/Public Works)
- Creating a new quasi-municipal agency or district (e.g. a Sewer District, or Nutrient Reduction District).

The Board of Selectman (BOS) currently serve in an executive capacity as Water and Sewer Commissioners in the community, although only a very small portion of the Town is serviced by water and sewer. They may continue to serve in this capacity. Given the complexity of the administrative functions inherent in managing a larger public infrastructure, however, it is not feasible to consider that as a long-term option without a structure in place sufficiently resourced to undertake tasks delegated by the BOS/Commissioners.

Several alternatives, particularly the cluster system option and the agricultural buffer program, could be implemented as either a privately owned and operated or publicly owned and managed effort. No determination has been made at this time in this regard. If systems are to be under Town ownership, use regulations and a formal user charge system would have to be developed. Each of the Tier 1 projects/programs have been summarized in the following data sheets.

Westport Integrated Plan Project Data Sheet

Alternative Name: Sewer, Phase 1A
Project Cost: $2,510,000

Background

Load Targeted:

☒ Wastewater

☐ Stormwater

Category:

☐ Program

☒ Capital Project

☐ Policy

☐ Pilot Program

Goals Achieved:

☒ Nitrogen Reduction

☒ Mitigate Public Health Concerns

☒ Economic Growth

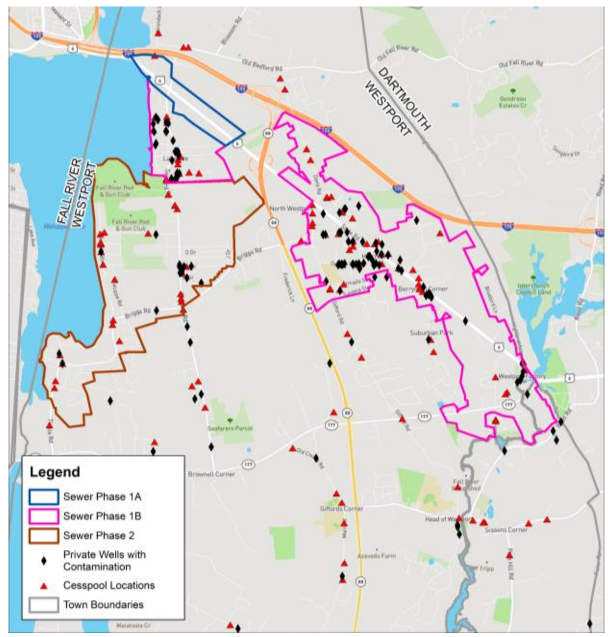
☐ Improved Aesthetics

☐ Climate Resiliency

Project Overview & Cost Description

This initial sewering step allows the Town to make tangible progress on a major capital project at reasonable scale and cost. It will serve as the basis for exploring the appropriate governance structure for new Town publicly-owned infrastructure (administration, rate structure, operation, etc.) which is critical for implementation of other IP alternatives. This small phase along Route 6, shown as Phase 1A in the blue polygon, includes the area identified by the Town for targeted economic development. Increased commercial tax revenue could also offset project long-term cost. While not expressly addressing significant public health issues, it will be a critical link for that effort going forward.

Planning level costs were developed based on the conceptual design scope of work developed by the Town. This cost will reduce the estimated Phase 1B (formerly just Phase 1) costs derived from the 2004 CDM report (updated to 2018 dollars).



Implementation

Governance: Currently the Town relies upon the Board of Selectmen to oversee management of the small public infrastructure in the community (primarily Route 6 water system). A comprehensive evaluation of the appropriate long-term administrative organization for a potentially expanded sewer and/or other water resource infrastructure is required.

Initial Steps:

- Determine governance structure as described above and modify the existing agreement with Fall River to accommodate increased flows from the Phase 1A sewer extension.
- Preliminary and final engineering design.
- Identify and pursue funding sources (e.g. MassWorks grant) for construction.
- Implement Phase 1A of sewer along Route 6.

Monitoring Requirements: Leverage existing in-stream sampling in the upper reaches of the river and monitor nearby drinking water wells that may be positively impacted. Fresh water monitoring in South Watuppa Pond may be longer term recommendation.

Scalability: Based on the success and affordability of this sewer phase, the Town can continue to implement additional components of this Phase 1 sewer alternative, with the option for moving beyond to Phases 2-4 that were recommended in the original report.

Westport Integrated Plan Project Data Sheet

Alternative Name: Sewer, Phase 1B
Project Cost: $15,990,000

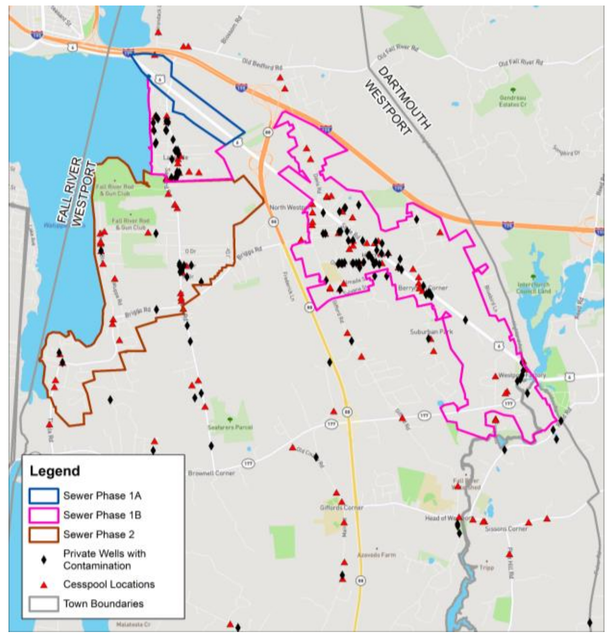
Background

Load Targeted:	*Category:*	*Goals Achieved:*
☒ Wastewater	☐ Program	☒ Nitrogen Reduction
☐ Stormwater	☒ Capital Project	☒ Mitigate Public Health Concerns
	☐ Policy	☒ Economic Growth
	☐ Pilot Program	☐ Improved Aesthetics
		☐ Climate Resiliency

Project Overview & Cost Description

This sewer project (outlined in pink polygon) extends the Phase 1A sewer to the entirety of the original Phase 1 delineated in the 2004 Report. It captures a significant number of recognized impaired private wells and known cesspool locations. It encompasses much of the Bread and Cheese Brook watershed, which is a major source of nitrogen to the River. While labeled as Phase 1B, this project can be carried out in several discreet steps, depending on the success of Phase 1A and what size project the Town is able to take on at the time. The figure shows the wells and cesspools that may be mitigated as a result of the proposed sewering. The proposed Phase 2 of the program (brown outline) encompasses much of the area proximate to South Watuppa Pond, which is also experiencing excessive nutrient loading.

Planning level costs were once again based on costs derived from the 2004 CDM report, updated to 2018 dollars.



Implementation

Governance: Governance decisions made during the Phase 1A sewer project will be extended to this project.

Initial Steps:

- Determine what portion (if not all) of Phase 1B to implement.
- Preliminary and final engineering design.
- Identify and pursue funding sources (e.g. MassWorks grant, SRF Loan) for construction.
- Implement Phase 1B of sewer along Route 6. Governance will be an extension of Phase 1A.

Monitoring Requirements: Leverage existing in-stream sampling in the upper reaches of the river and monitor nearby drinking water wells that may be positively impacted.

Scalability: Based on the success and affordability of this sewer phase, the Town can continue to implement additional components of this Phase 1B sewer alternative until complete, and then have the option to extend to Phases 2-4 that were recommended in the original report.

Westport Integrated Plan Project Data Sheet

Alternative Name: Cluster System Examples: Cadman's Neck and the Let
Project Cost: $1,300,000 and $1,100,000, respectively

Background

Load Targeted:

☒ Wastewater

☐ Stormwater

Category:

☐ Program

☐ Capital Project

☐ Policy

☒ Pilot Program

Goals Achieved:

☒ Nitrogen Reduction

☒ Mitigate Public Health Concerns

☐ Economic Growth

☐ Improved Aesthetics

☒ Climate Resiliency

Project Overview & Cost Description

Cluster (or shared) systems reduce the challenge that small lots and dense development impose on older neighborhoods that cannot meet standard Title V or enhanced denitrification system requirements. Cadman's Neck and the Let are representative of these conditions and were used *for illustration purposes only* as the basis for a GIS desktop analysis of cluster system suitability. Proposed systems will be cluster septic systems with denitrification, which will mitigate contamination to private well sources as well as reduce nitrogen to the Westport River. In Tier 1, these pilot clusters will allow exploration of governance and financing options for the larger scale program of implementing cluster systems at appropriate areas elsewhere in the community.

Costs are developed based on a septic tank effluent pumping (STEP) type of cluster system with denitrification treatment. These costs are inclusive of design and construction. Land acquisition costs not included.

Implementation

Governance: No determination has been made at this time as to whether the cluster systems should be privately constructed, owned and operated by a homeowners association-type entity or by the Town. Under either scenario, operation and maintenance of the system could be contracted to a third party private entity.

Initial Steps: Review two proposed locations – Cadman's Neck and the Let*

- Establish technical feasibility.
- Conduct public education and outreach effort to effected property owners.
- Confirm preferred governance structure (including financing strategy, easements/takings, etc.).
- Contract for design and construction of cluster systems.

Monitoring Requirements: Leverage existing in-stream sampling, regulatory monitoring for cluster systems. Installation of downgradient groundwater monitoring well sampling station recommended.

Scalability: Can implement as a program over the 20-30 year planning horizon, based on success of Tier 1.

***Note: Steps are already underway to jointly pursue grant funding with Buzzards Bay Coalition to explore feasibility and governance of potential cluster systems or districts.**

Westport Integrated Plan Project Data Sheet

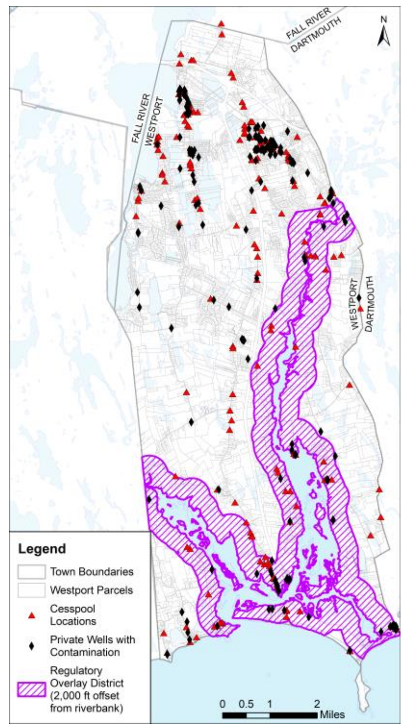
Alternative Name: Nutrient Reduction Regulatory Overlay District
Project Cost: N/A

Background

Load Targeted:	*Category:*	*Goals Achieved:*
☒ Wastewater	☐ Program	☒ Nitrogen Reduction
☐ Stormwater	☐ Capital Project	☒ Mitigate Public Health Concerns
	☒ Policy	☐ Economic Growth
	☐ Pilot Program	☐ Improved Aesthetics
		☐ Climate Resiliency

Project Overview & Cost Description

A significant portion of the wastewater nitrogen load, and public health impacts, are due to older failing septics or cesspools prevalent in the neighborhoods proximate to the Westport River or its tributaries. This alternative would address this source by requiring cesspools or pre-1995 septic systems to upgrade to a denitrification system within 5-10 years. The Town may choose to allow waivers on functional septic systems which pass a Town inspection, or establish a moratorium on building structure expansions until such time as systems are upgraded. It could also provide an incentive to property-owners to form associations or other legal entities serviced by a proposed cluster system. The overlay proposed is a 2,000 ft buffer extending horizontally from the riverbank. The buffer is based in part on mapping of highly transmissive soils and proximity to the impacted river. This buffer also captures an area of well contaminant “hot spots” where improved septic functionality and nitrogen reduction will improve drinking water quality for proximate wells over the long term.



Implementation

Governance: This is a Town policy but cost of the upgrades are typically borne by the property owners. Individual upgrade costs are typically in the range of $21,000 - $34,000 for upgrading or installing new denitrification systems, respectively. The Town can offer incentive programs or financing options (such as the existing revolving fund loan program) to help homeowners manage costs, or include other incentives such as deadline extensions if a cluster system is actively pursued.

Initial Steps:

- Develop and implement necessary regulations to create overlay district to include jurisdiction, applicability, procedures, waivers, enforcement, etc.
- Develop programmatic framework for incentives and financing strategies for homeowners.

Monitoring Requirements: Leverage existing in-stream sampling, regulatory monitoring for septic systems.

Scalability: This is likely the full implementation scale of this alternative; however, similar overlay districts can be replicated farther out from the river down the line as needed and if there is support.

Westport Integrated Plan Project Data Sheet

Alternative Name: Vegetative Buffer Strips
Project Cost: $300 / acre-foot / year to maintain

Background

Load Targeted:

☐ Wastewater

☒ Stormwater

Category:

☐ Program

☐ Capital Project

☐ Policy

☒ Pilot Program

Goals Achieved:

☒ Nitrogen Reduction

☐ Mitigate Public Health Concerns

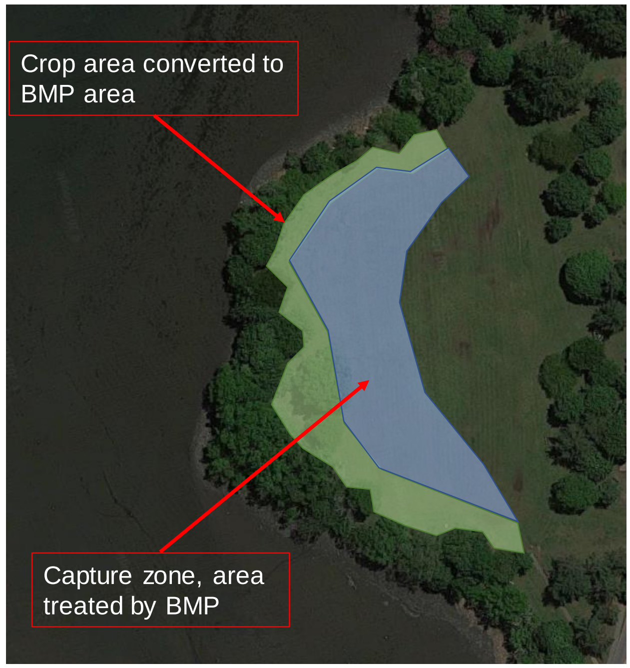
☐ Economic Growth

☒ Improved Aesthetics

☐ Climate Resiliency

Project Overview & Cost Description

This alternative consists of adding vegetative buffer zones surrounding agricultural land to intercept nitrogen-rich runoff and process some of the nitrogen before it leaves the land and can travel to the river. The buffer zone consists of different vegetation, typically gradually increasing in size and nitrogen processing capacity, as it progresses out from the agricultural site. The Town will solicit participants from the agricultural community on an annual basis.



This is a programmatic effort which will be developed in collaboration with potential participating landowners. The purpose is to establish preferred management approaches (e.g. Town or landowner maintenance, easement or legal mechanism to allow access, etc.) that are acceptable to the landowners and still provide the Town with necessary oversight authority.

The costs shown above are currently based on annual maintenance costs. After initial implementation, maintaining the buffers will be a critical step in the success of this pilot and program. Initial installation costs will vary widely based on property.

Implementation

Governance: The program should be collaboratively developed as this is a voluntary initiative and should be in large part reflective of landowner considerations. The Massachusetts Association Soil Conservation District (MASCD) program should serve as a model for the effort.

Initial Steps:

- Set up governance pathways for either Town ownership or landowner ownership.
- Work with agricultural community and Agricultural Commission to find pilot sites.
- Create program to support individual farmers obtaining funding through NRCS (EQIP) or other sources; Implement buffer strips on pilot lands.

Monitoring Requirements: In addition to existing in-stream sampling, select pilot monitoring stations to measure nitrogen concentrations of water upstream and downstream of buffer strips to track efficacy and progress.

Scalability: Based on the success of the pilot, continue to implement across additional agricultural land annually.

Westport Integrated Plan Project Data Sheet

Alternative Name: Public Education: Fertilizer
Project Cost: N/A

Background

Load Targeted:

☐ Wastewater

☒ Stormwater

Category:

☒ Program

☐ Capital Project

☐ Policy

☐ Pilot Program

Goals Achieved:

☒ Nitrogen Reduction

☐ Mitigate Public Health Concerns

☐ Economic Growth

☐ Improved Aesthetics

☐ Climate Resiliency

Project Overview & Cost Description

Stormwater runoff contributes to the river's nitrogen loading in areas with high fertilizer uses. In addition to addressing these loads through the agricultural community, this alternative will educate residents about fertilizer use and others stormwater and lawn maintenance best practices. The goal will be to encourage fertilizer reduction across the residential areas of Town. Initial outreach efforts will begin in Tier 1, through leveraging existing materials, working with the Buzzards Bay Coalition, Westport River Watershed Alliance and any other groups creating outreach materials, to begin to bolster that program.

The program should leverage the public education and outreach efforts required under the Town NPDES Municipal Separate Storm Sewer System (MS4) permit for stormwater discharges.

In addition to fertilizer, the program can encourage low impact landscape design to promote nitrogen update and reduce non-point source discharge from residential property directly into the river.

Implementation

Governance: No governance issues to address.

Initial Steps:

- Review in-house public outreach efforts, including MS4 and other regulatory work.
- Coordinate with BBC and WRWA (and other outreach groups) for existing materials the Town can leverage.
- Consolidate and create distribution plan.
- Distribute.

Monitoring Requirements: Leverage existing in-stream sampling.

Scalability: Can implement as a program and grow or add new outreach efforts as data becomes available, based on what is well received.

Westport Integrated Plan Project Data Sheet

Alternative Name: Denitrification for New Construction: Rural Services District
Project Cost: $34,000/household

Background

Load Targeted:

☒ Wastewater

☐ Stormwater

Category:

☐ Program

☐ Capital Project

☒ Policy

☐ Pilot Program

Goals Achieved:

☒ Nitrogen Reduction

☒ Mitigate Public Health Concerns

☐ Economic Growth

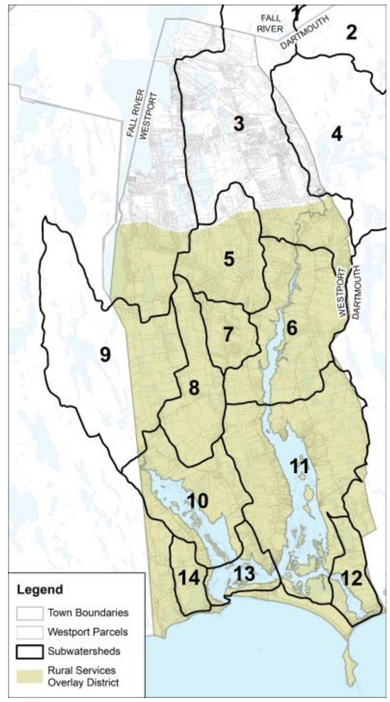
☐ Improved Aesthetics

☐ Climate Resiliency

Project Overview & Cost Description

To reduce future impacts to the Westport River from anticipated growth, this alternative will require denitrification systems for new construction or significant reconstruction within a delineated overlay district. The district covers the balance of the community not otherwise expected to see sewer installation through any of the 4 phases currently laid out in the 2004 study. This will cut down on future nitrogen loads that the Westport River would experience if these new homes were built with traditional septic systems.

The cost shown above represents the approximate cost for installing a new denitrification system at the time of construction for an individual home. It should be noted, however, that any new construction would require a septic system, and consequently the true cost of this alternative is the incremental difference between a standard Title V system and a de-nitrification system. That incremental difference may decrease over time as technologies evolve. In addition, multi-unit developments may install a de-nitrification cluster system at time of construction (e.g. Noquochoke Village) which would also be more cost-effective.



Implementation

Governance: This district could be administered through the Board of Health and existing Departments already tasked with permitting and approvals required for new development.

Initial Steps:

- Review existing denitrification incentives and governance plans for the district.
- Enact overlay district.

Monitoring Requirements: Leverage existing in-stream sampling, regulatory monitoring for septic systems.

Scalability: Policy is likely enacted to its full extent as recommended here. Review progress and opportunities for continuing to address new nitrogen loads.

APPENDIX A – UPDATED BASELINE NITROGEN LOADS

		Westport River N Loads by Input (kg/y):								Present N Loads			Buildout N Loads		
Watershed Name	**shed ID#**	**Wastewater Sensitivity**	**Landfill/ Solid Waste Sensitivity**	**Lawn Fertilizers Sensitivity**	**From Agriculture Sensitivity**	**Impervious Surfaces Sensitivity**	**Water Body Surface Area Sensitivity**	**"Natural" Surfaces Sensitivity**	**Buildout Sensitivity**	**UnAtten N Load Sensitivity**	**Atten %**	**Atten N Load Sensitivity**	**Buildout UnAtten N Load Sensitivity**	**Atten %**	**Buildout Atten N Load Sensitivity**
Westport River System		53,817	1,306	3,992	66,122	7,738	69,219	8,203	51,977	210,397		198,215	262,374		246,769
East Branch Total		41,378	1,306	3,138	44,305	6,060	42,543	6,259	37,719	144,988		135,860	182,707		171,125
East Branch S Total		6,542	-	440	5,921	753	10,915	888	14,071	25,459		25,459	39,530		39,530
East Branch S	11	5989	0	403	4,912	685	10,113	759	11,304	22,861		22,861	34,165		34,165
The Let	12	552	0	37	1,010	68	802	130	2,767	2,598		2,598	5,366		5,366
East Branch N Total		34,836	1,306	2,698	38,383	5,307	31,628	5,370	23,648	119,529		110,401	143,177		131,595
Kirby Brook	5	2958	0	247	1,979	459	1,745	393	1,136	7,781		7,781	8,917		8,917
East Branch N	6	3504	277	239	13,595	441	1,835	646	4,226	20,537		20,537	24,763		24,763
Snell Creek	7	1743	0	122	350	201	487	165	1,926	3,067		3,067	4,993		4,993
Old County Rd Gauge Total		26,631	1,029	2,091	22,459	4,207	27,562	4,166	16,360	88,144	15%	79,016	104,505	15%	92,923
Copicut Reservoir	1	325	0	26	-	157	6,043	713	116	7,264		7,135	7,381		7,251
Hixville Rd - E Branch	2	5161	643	390	3,119	748	7,999	1273	4,106	19,333		19,333	23,439		23,439
Old County Rd - E Branch	3	15480	387	1009	16,306	1893	7,031	1269	7,508	43,375		43,375	50,883		50,883
Rt 177 Gauge - E Branch	4	5664	0	666	3,033	1409	6,488	912	4,629	18,172		18,172	22,802		22,802
West Branch Total		9,997	-	687	21,268	1,446	9,355	1,651	13,492	44,405		41,351	57,896		53,874
Angeline Brook	8	1258	0	75	8,756	168	1,597	272	4,619	12,126		12,126	16,745		16,745
Adamsville Brook	9	6235	0	449	4,861	1014	6,996	808	6,455	20,362	15%	17,308	26,816	15%	22,794
West Branch	10	2504	0	163	7,652	265	762	572	2,418	11,917		11,917	14,335		14,335
Westport Harbor Total		2,442	-	167	549	231	301	293	766	3,984		3,984	4,750		4,750
Westport Harbor	13	1589	0	103	47	123	85	199	383	2,147		2,147	2,530		2,530
Cockeast Pond	14	853	0	64	502	108	216	94	383	1,837		1,837	2,220		2,220
East Branch N Estuary Surface	6						1,591			1,591		1,591	1,591		1,591
West Branch Estuary Surface	10						4,071			4,071		4,071	4,071		4,071
East Branch S Estuary Surface	11						7,636			7,636		7,636	7,636		7,636
The Let Estuary Surface	12						718			718		718	718		718
Westport Harbor Estuary Surface	13						2,477			2,477		2,477	2,477		2,477
Cockeast Pond Estuary Surface	14						526			526		526	526		526

APPENDIX B – PUBLIC MEETING AND WORKSHOP INFORMATION

MEETING AGENDA

WESTPORT TARGETED INTEGRATED WATER RESOURCES MANAGEMENT PLAN

TOWN HALL ANNEX **October 3, 2018**

INTRODUCTION TO THE PROJECT.. PLANNING BOARD

Introductory Remarks from the Working Group
Introduction of the Project Technical Team

SURVEY OF THE AUDIENCE IN ATTENDANCE ....TECHNICAL TEAM

Self-identify with respect to primary stakeholder interest – private citizen, environmental advocate, commercial owner/operator, etc.
How many have septic systems, private wells, or public utilities
Do you live in the Study Area

TECHNICAL PRESENTATION .... KIRK W./DAVID P.

Background – why we need this work
Prior Studies – acknowledgement of existing data, opinions and regulatory findings
Study methodology – causes, impacts, solution/alternatives development

COMMUNITY GOALS FOR THE STUDY .... ALL

Seeking input on your goals/objectives for the study (focus on the challenges you feel need to be resolved – economic, environmental, public health, etc.)

STEERING COMMITTEE ROLES AND RESPONSIBILITIES .... BETSY F.

Workshops to advise on metrics, alternatives, and screening
Any Volunteers?

OPEN DISCUSSION

NEXT STEPS..KIRK/BETSY

PUBLIC MEETING NO. 1 T- IWRMP NOTES

DATE OF MEETING:	October 3, 2018
FACILITATORS:	Robert Daylor, Town of Westport**;** Betsy Frederick, Kleinfelder; Kirk Westphal, Kleinfelder, David Potter, Pare Corp.
RECORDED BY:	Victoria Howland, Pare Corp.
CC:	File
SUBJECT:	Public Meeting No. 1 – Targeted IWRMP
KLEINFELDER NO.:	20191827.001A

Robert Daylor made introductory remarks regarding the background to the current project and the technical team selected to advance the Town's Targeted – Integrated Water Resources Management Plan (T-IWRMP). The Team thereafter facilitated the presentation and solicited feedback on objectives for the project.

Summary of Audience Response to Survey Questions:

- Majority of attendees live in Westport.
- Approximately 80% of attendants live within the target watershed (Westport River East Branch).
- Several business owners were in attendance including a catering/farm business, builder, engineer/contractor and a representative of Westport Business to Business (B2B) networking association.
- One resident identified as a "water-dependent" business (and member of the Shellfish Advisory Committee).
- Several farmers in attendance, including a "3rd generation" farmer in the Town of Westport.
- Several identified as representing "environmental stewardship" or specific organizations with an environmentally derived mission, including the Westport River Watershed Alliance, Audubon Society, and Estuary Committee.
- 100% of the attendees are on septic systems and private wells.
- Approximately 80% were familiar with the concept of a Total Maximum Daily Load (TMDL) and how it applied to the Westport River.

The Team provided a presentation on the technical approach to the project, the methodology, schedule and opportunity for public involvement and comment. The presentation was followed by a question and answer period and a request to hear from attendees regarding their objectives for this project.

Audience Questions

Prior to requesting that the audience provide specific objectives for the plan, a series of questions were posed by residents. They were related to project scope, ongoing public outreach and a variety of technical issues. A representative sample includes the following:

Q: Focus has been on Nitrogen. Appears there are other issues with the watershed, such as groundwater quality. Can we tackle all of that with this project?
A: Project objectives will be defined by the Town. Prioritized actions and schedule of implementation will be a function of those objectives.

Q: Sea level will rise significantly by end of century. How will the TIWRMP integrate sea level rise?
A: Metrics and criteria for projects resulting from the plan are established by the community. If adaptation and climate resiliency are rated highly in terms of project value, projects that contribute to resiliency will be prioritized.

Q: Interest in swimming/boating/kayaking on the Westport River. Will this project improve swimmability/navigability/clarity of the river?
A: Objectives such as these will be the basis for project selection and prioritization.

Q: Why is just the East Branch the focus of this project?
A: The Town chose to focus on the East Branch as it includes the majority of the Town, shows the greater level of contamination and the most serious water and wastewater related issues in addition to the Nitrogen TMDL. The expectation is that many of the solutions proposed for challenges in the East Branch watershed might be applicable to the West Branch watershed. Even if they are not entirely compatible, phasing the project in this manner allows for the biggest "bang for the buck" with respect to water quality improvement.

Q: How will the community be engaged and what will the methods of engagement involve?
A: This is not entirely fleshed out as yet, although materials at a minimum will be uploaded to the Town's website for use by the public. Additional public meetings and workshops are slated for later in the fall and winter.

Q: There are other problematic water related issues in town. Drainage issues from private properties impact abutters as well as the river. Does this project take precedence over these other issues, and if so, why?

A: This project will be limited to the water quality related issues of the East Branch of the Westport River. Other issues will be dealt with through a different forum.

Q: Who sets the timeline for "fixing" the river?
A: To some degree this is a regulatory matter, although the Town does have some latitude to enact projects of local priority earlier in the implementation timeline.

Q: The Town needs to implement action items from the plan and figure out the means to provide financing.
A: Agreed.

Q: What is "fixed" and who defines that?
A: The stakeholders will define objectives and ways to measure success, and ultimately it will be progress toward these goals and regulatory approvals that will define success.

Audience Objectives

There was a robust discussion among participants regarding specific concerns and desired outcomes. When asked to provide one or two objectives they would like to see for the plan, the responses generally fell into one of four general areas, and are summarized below.

Economic
- Promote **economic development** with minimal environmental impact
- Promote **cost equity** in distributed solutions
- Increase **agricultural output** with environmental responsibility
- Reduce risk to **shellfish economy**

Environmental
- Satisfy TMDL requirements (now and in the future) for **ecological health**
- Increase **resiliency** to climate change and sea level rise

Social
- Promote **public health** with clean, secure water supply and stormwater practices
- Promote **recreation** on and in the water
- Maintain and improve the **high quality of life** enjoyed by Westport residents

Implementation
- Identify a **phased** suite of solutions that vary in scale and in timing
- Consider **regional** opportunities and benefits
- Develop an **implementable** plan

Targeted-Integrated Water Resource Management Plan

Public Meeting #1

TOWN OF WESTPORT
October 3, 2018

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Public Meeting Agenda

• Introduction to the Project:	*Planning Board*
• Participant Survey	*Project Team*
– *Interests*	
– *Home/Business water facts*	
– *Land Use Changes*	
• Overview of Approach	*Project Team*
– *Background*	
– *Prior Studies*	
– *Study Methodology*	
• Discussion of Community Goals	*All*
• Stakeholder Roles	*Project Team*
• Open Discussion	*All*
• Next Steps	*Project Team*

INTRODUCTION TO THE INTEGRATED PLAN
Westport Planning Board

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PARTICIPANT SURVEY

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Questions for Participants

- Which best describes you in the context of this work:
  - Private citizen
  - Business owner
  - Farming community
  - Fishing community
  - Environmental advocate
  - Other
- How many of you have:
  - Septic systems
  - Private wells
  - Public water
  - Public sewer

Questions for Participants (Continued)

- Do you live or work in the study area (East Branch Watershed)?
- How would you characterize the land use changes in Westport over the past decade?
  - Economic development
  - Housing development
  - Agricultural use changes – either from/to or different ag use

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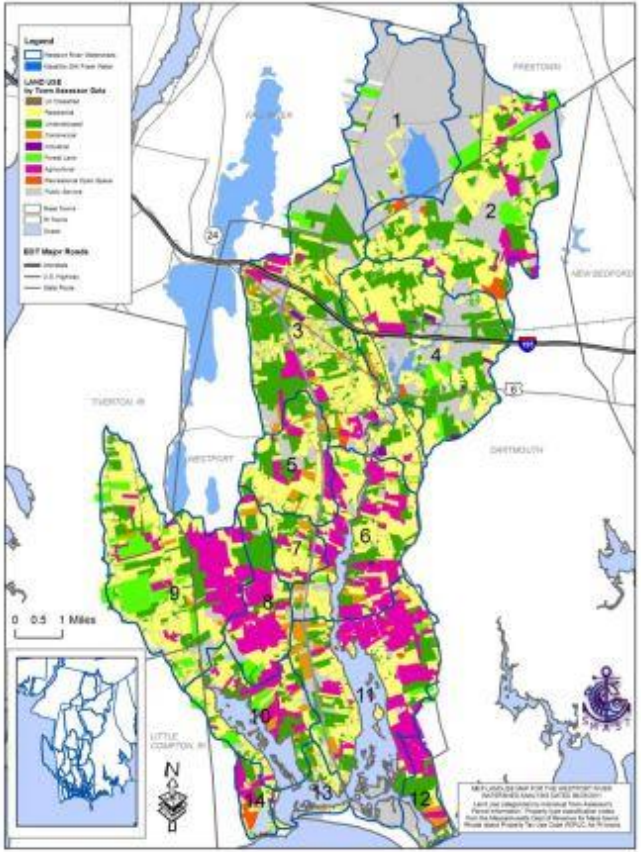
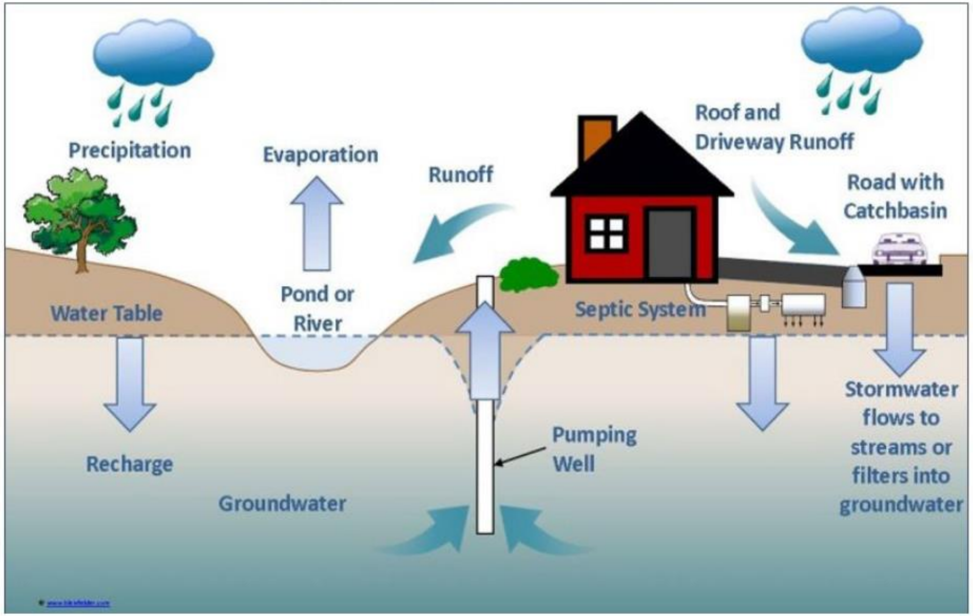
Geographic Setting

Land Use

- Low and Medium Density Residential
- Agricultural
- Minor Business and Commercial



Known Issues in the Watershed



- Failing septic systems:
  - Release nutrients and bacteria to the environment
  - Can contaminate nearby wells
- Functioning septic system:
  - Release nutrients through groundwater
- Stormwater:
  - Transport nutrients and bacteria to rivers and streams
  - All land use types can contribute

What are the risks of excessive nutrients and bacteria?

Excess Nutrients

Risk to Waterbodies:

- Suffocate ecosystem
- Algae growth
- Oxygen depletion in the water
- Loss of eelgrass
- Reduction in benthic animal diversity

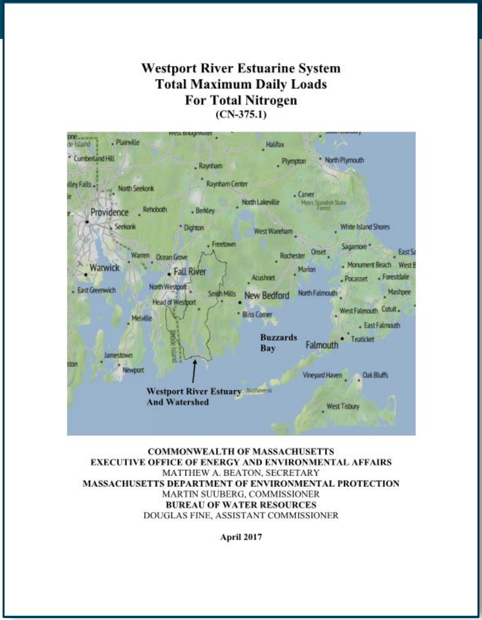
Excess Bacteria

Risk to Human Health:

- Can accumulate in shellfish
- Restricted access for water recreation (swimming, kayaking, etc.)
- Can affect drinking water wells

Foundational Study: TOTAL MAXIMUM DAILY LOAD (TMDL)

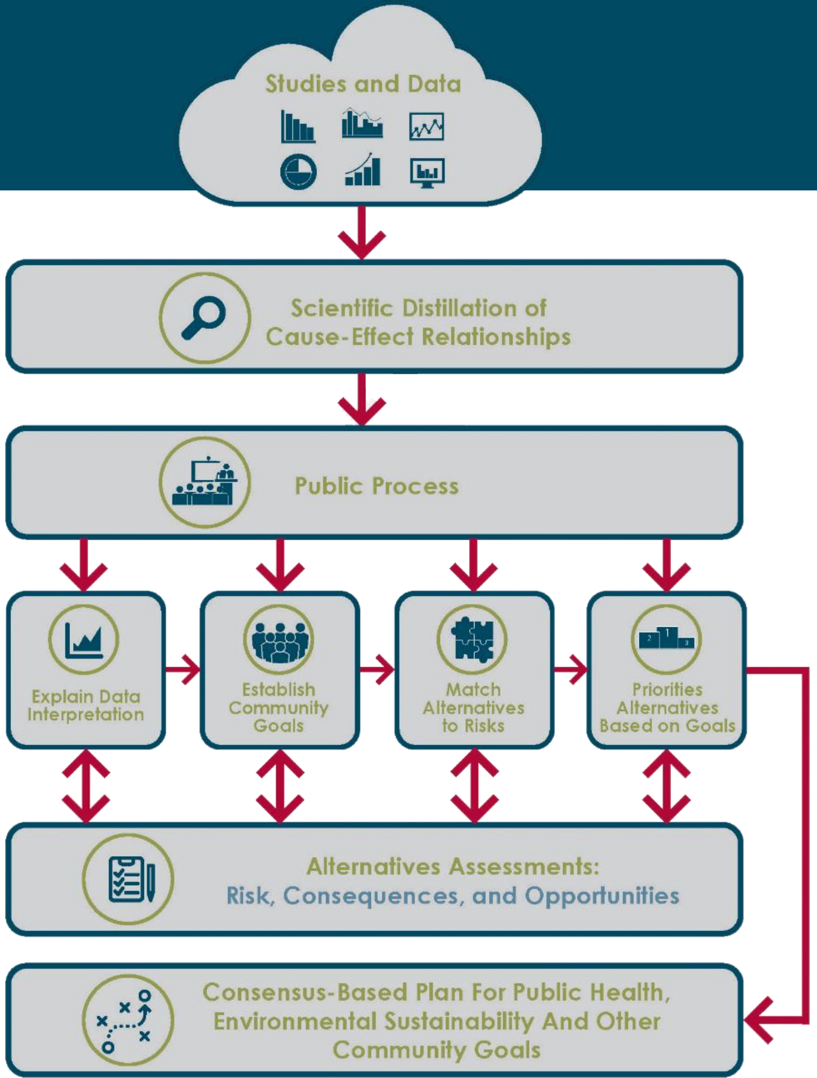
- Common approach to quantify pollutant loads
- Leads to informed decisions on abatement plans
- Helps balance pollution reduction responsibilities
- Conclusions:
  - Nitrogen in the East Branch to be reduced by ~18%
  - Agriculture may produce up to 57% of the nitrogen
  - Assumption that entire community would be sewered
- Critiques:
  - Data is old (15 – 20 years?)
  - Land use / farming practices have changed
  - Solutions should equitably focus on sources
- Our job is NOT to redo the work, but to evaluate alternative means of reaching the goal of 18% reduction along with other community goals.


Westport River Estuarine System
Total Maximum Daily Loads
For Total Nitrogen
(CN-375.1)

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
MATTHEW A. BEATON, SECRETARY
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
MARTIN SUUBERG, COMMISSIONER
BUREAU OF WATER RESOURCES
DOUGLAS FINE, ASSISTANT COMMISSIONER

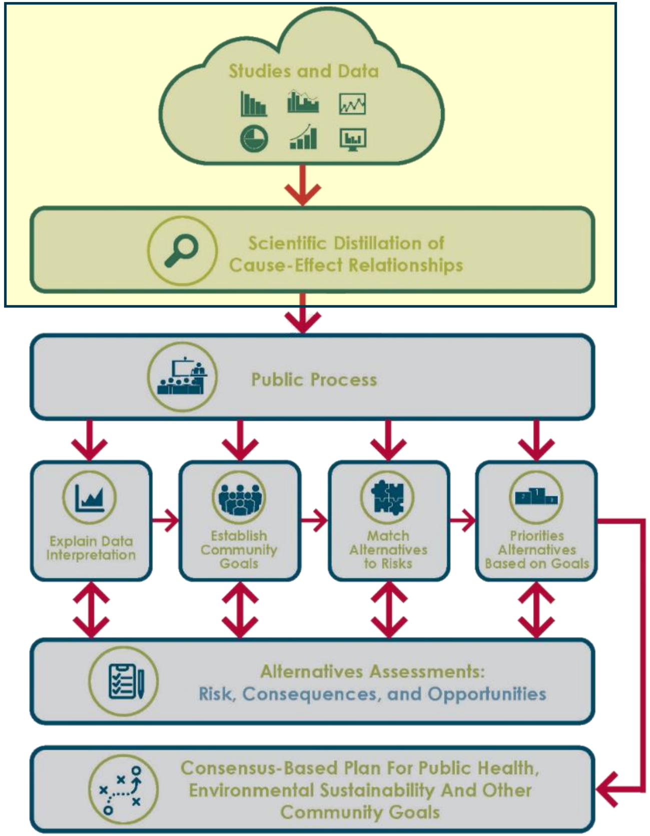
April 2017

Our Process



Studies and Data
Scientific Distillation of Cause-Effect Relationships
Public Process
Explain Data Interpretation
Establish Community Goals
Match Alternatives to Risks
Priorities Alternatives Based on Goals
Alternatives Assessments: Risk, Consequences, and Opportunities
Consensus-Based Plan For Public Health, Environmental Sustainability And Other Community Goals

Data Evaluation



- Land use changes
- Board of Health records:
  - Septic system installation dates
  - Septic system failures
- Public water supply data
- Stormwater outfall locations
- Water quality measurements

Cause-Effect Relationships
"Hot Spots" for specific issues
Opportunities for management

Data Compilation

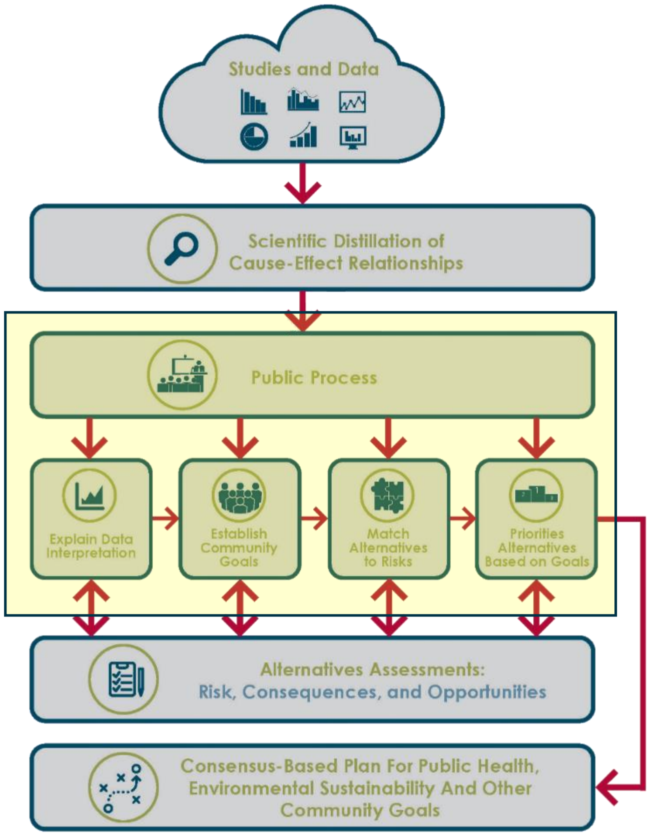
Plans & Reports:

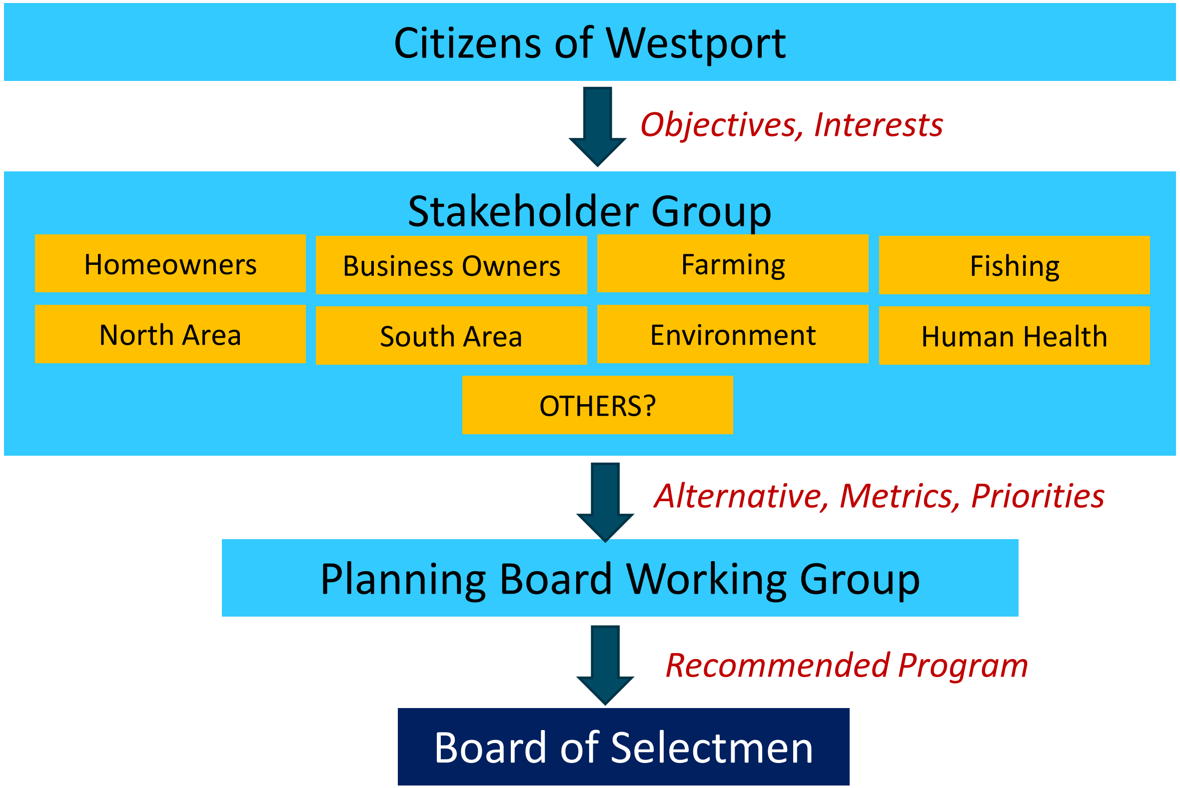
- Westport Master Plan
- Integrated Municipal Stormwater and Wastewater Planning Approach Framework
- Stream Flow and Water Quality Monitoring in Bread and Cheese Brook
- MEP Final
- Municipal Vulnerability Preparedness (MVP) Workshop Summary of Findings
- Drift Road Stormwater Plans
- Buzzards Bay Comprehensive Conservation and Management Plan
- Westport Noquochoke Village
- Archaeological Study
- Dartmouth Lake Noquochoke Sewer Plans
- Westport Housing Production Plan
- Westport Sewer & Water Concept Plan 2004

Raw Data:

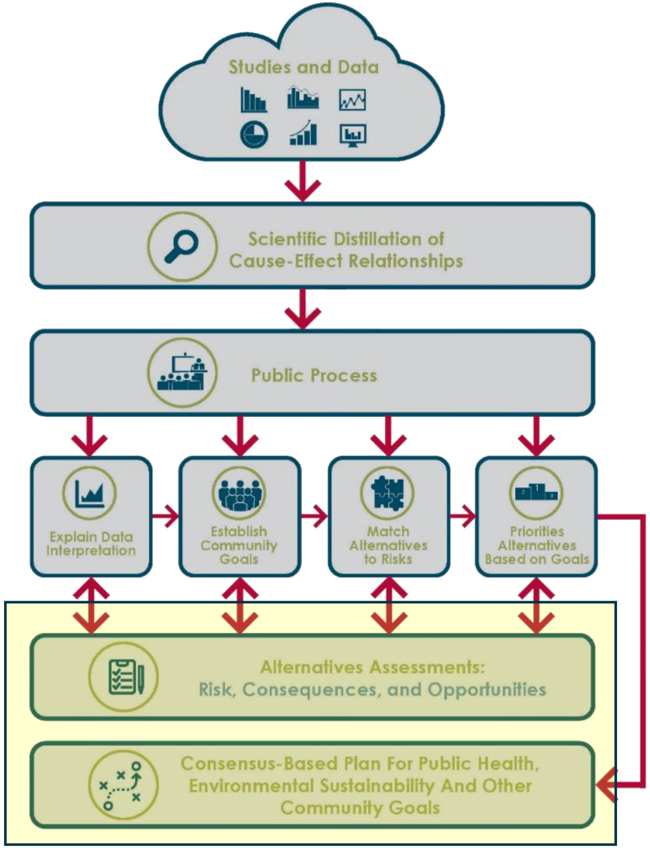
- 2006-2016 Septic system activity
- Build out analysis
- Public water supply well test data
- Public water supply well depths
- Drainage network and outfall locations
- Buzzards Bay Coalition raw data (total nitrogen, salinity, dissolved oxygen, phosphorous)
- WRWA raw data (fecal coliform, pH, turbidity, salinity)
- MEP raw data (wastewater generation, nitrogen loads, land use

Stakeholder Process and Public Engagement





Alternatives Evaluation



	Priority Ranking				
Alternative Name	**Equal Weights**	**Lowest Cost**	**Most Environmental Benefit**	**Lowest Health Risk**	**Planning Board Weights**
Alt A	1	4	1	2	1
Alt B	2	9	4	1	2
Alt C	3	3	2	3	13
Alt D	4	16	6	5	9
Alt E	5	8	15	4	7
Alt F	6	1	11	6	4
Alt G	7	7	5	8	14
Alt H	8	15	3	16	15
Alt I	9	14	9	7	5
Alt J	10	11	8	12	11
Alt K	11	2	7	15	16
Alt L	12	19	10	13	12
Alt M	13	18	17	9	17
Alt N	14	10	14	10	8
Alt O	15	17	16	11	3
Alt P	16	6	12	18	18
Alt Q	17	13	18	17	10
Alt R	18	20	20	14	6
Alt S	19	5	13	19	19
Alt T	20	12	19	20	20

Schedule

May 2018
IWRMP Authorization

August 2018
Kickoff

October 2018
Public Meeting
- Overview
- Community Goals

November 2018
Workshop: Identify Alternatives

February 2019
Workshop: Prioritize Alternatives

May/June 2019
Public Meeting: Recommendations

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WESTPORT, MA INTEGRATED WATER RESOURCES MANAGEMENT PLAN
PUBLIC MEETING NO. 1
SIGN-IN SHEET

Name	Email	Affiliation - Voluntary (e.g. resident, business owner, farmer)
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David Cole	" "	Planning board
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Matt Armando	Armendom@westport-MA.gov	employee
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Shana Shufelt	shufeltshana@me.com	Selectman
Terry Sullivan	Tsullivan@fallriverma.ORG	FR Sewer Dept.
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JIM WHITIN	JIMWHITIN@ME.COM	Planning Board.
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U. Fuld		propertyowner
B. Harkins	billharkins@charter.net	" "
Jeff Cantin	cantinjeff@gmail.com	"
Phil Weinberg	philipmitchellw@gmail	resident - BOH
RICK + SHANNON GERHARDT	MEETEX@AOL.com	property owner
Mike + Jennifer Coye	jennifer@coye.net	" "
Jeel [illegible]	Tuppfarm@MSN.com	farm
Len Potter	Lenfp2@aol.com	Property Owner

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PUBLIC MEETING NO. 1
SIGN-IN SHEET

Name	Email	Affiliation - Voluntary (e.g. resident, business owner, farmer)
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Sue + Bob Daylor	srdaylor@comcast.net	resident
Tony Vieira	avieira@umassd.edu	resident
JOHN BULLARD	johnkbullard@gmail.com	resident
Frank McDonough	FJM7@CHARTER.NET	resident
John Borden	Shellfish advisory	resident
Jay Gillespie	j.gillespie@wrwa.com WRWA	resident
Jane Loos		"
Jim Watterson		"
Ned Lawrence	nedlaw1@gmail.com	Property owner
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Constance Gee		resident
Dale Weber	drw16@charter.net	
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SEAN LEACH	SEAVAL@PRODIGY.NET	

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Name	Email	Affiliation - Voluntary (e.g. resident, business owner, farmer)
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KLEINFELDER 16 Commerce Drive, Suite 2, Augusta, ME 04330 p | 207.623.0648 f | 207.623.0486

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MEETING AGENDA – WORKSHOP NO. 1

WESTPORT TARGETED INTEGRATED WATER RESOURCES MANAGEMENT PLAN

TOWN HALL ANNEX **March 20, 2019**

INTRODUCTIONS .... ALL

WORKSHOP GOALS .... BETSY/KIRK

- Consensus around Revised Baseline
- Consensus/Agreement on Interpretation of Data Analysis Results
- Identification of Date Gaps
- Preliminary Discussion on Alternatives (if time)

REVIEW OF TECHNICAL APPROACH .... KIRK

SUMMARY OF FINDINGS TO DATE .... ANDREW

- Creating a New Baseline for Nitrogen Loading
- Summary of Load Changes (vs. MEP)
- Summary of Load Sources
- Water Quality Hot Spots
- Discussion on Causal Relationships

OPEN DISCUSSION .... TEAM

NEXT STEPS .... TEAM

ABOUT THE WORKSHOP

The end goal of the Targeted-Integrated Water Resources Management Plan process is to properly frame the water quality challenges within the East Branch of the Westport River and identify alternatives to meet community objectives and obligations.

The desired outcomes of the first Stakeholder Workshop were:

- Consensus around Revised Baseline Conditions
- Consensus/Agreement on Interpretation of Data Analysis Results
- Identification of Data Gaps
- Preliminary Discussion on Alternatives (if time)

Attendees

See **Attachment A** for stakeholder roster and attendance.

Actions

The Project Team will synthesize the feedback provided during the stakeholder workshop and incorporate that information into conceptual alternatives development in the next phase.

Notes (Per Agenda Items)

INTRODUCTIONS

- Robert Daylor made introductory remarks and briefly discussed the background of the Town's Targeted – Integrated Water Resources Management Plan (T-IWRMP). Attendees were invited to introduce themselves and provide any voluntary information regarding specific interests they may represent.

WORKSHOP GOALS

- The Consulting Team (Kleinfelder/Pare) gave an overview of the progress made in the months since the first public meeting. Remarks emphasized the purpose of this meeting: to present the current data and findings to the stakeholders and to receive feedback from involved parties to help develop a cohesive and correct problem statement. Specific goals for the workshop were outlined (see above) and were the basis for the technical presentation that followed.

REVIEW OF TECHNICAL APPROACH

- In order to provide consistency with regulatory and academic efforts upon which "existing baseline" conditions had been characterized, the project team worked within the methodology/model developed by the Massachusetts Estuaries Project (MEP) to calculate nitrogen loading in the Westport River.
- The project team did not change assumptions or calculations from the model, rather the team updated data from land use practices, Board of Health specific parcel data (e.g. new, upgraded or failed septic systems), water supply/water quality data, and updated Nitrogen concentrations for sampling locations in the river. This updated model will serve as the current baseline ("new baseline") for which alternatives will be evaluated.
- A Geographic Information Systems (GIS) database provided for spatial analyses to infer cause-effect relationships, "hot spots" for specific issues and opportunities for management.

SUMMARY OF FINDINGS TO DATE

- New Baseline for Nitrogen Loading Rates/Summary of Load Changes – the analysis shows an overall increase in nitrogen load from septic systems due to new septic installations and inclusion of systems that had been omitted from the MEP baseline. There is an overall decrease in nitrogen load from agricultural land uses based on more accurate and current (2017) data. As a result, some areas are demonstrated to have met the Total Maximum Daily Load on a sub-watershed basis. (See slides 6–11 of PowerPoint presentation provided as **Attachment B**).
- Summary of Load Sources – New Septic systems correspond to increased loadings and the northern part of Town has the greatest number/density of new systems. Agricultural loadings were impacted/reduced on the basis of best management practices rather than number of parcels under agricultural use. Data was updated using tax assessor and Westport Agricultural Committee data. (Slides 13-14.)
- Water Quality Hot Spots – Town data was used to determine where private wells have experienced high levels of nitrates and bacteria/pathogens. For comparison purposes, these identified hot spots were overlaid with a map layer showing where parcel sizes were smaller than Title V standards with respect to number of bedrooms (proxy for wastewater generation) per square feet of parcel. While causality was not definitively determined, initial observation suggest some correlation. (Slide 15.)

OPEN DISCUSSION

- Several questions were posed during the course of the presentation on a variety of topics, including:
    - Sources and quality of data: the team reported confidence in the data sources and quality;
    - Contribution of water fowl to pollutant loads: contribution is captured in the "natural surfaces" loading category. As the contribution is relatively small, the future solutions are unlikely to focus on this source;
    - Impervious surface loading contribution shows as a decrease when the Town has clearly experienced development: the Team did not have an immediate explanation for that finding and will research further;
    - In-stream concentrations of Nitrogen at some sampling locations higher than the loading rates from that stretch of river: upstream watersheds are contributing to

the in-stream concentrations which suggests a watershed-wide approach may be appropriate rather than a sub-watershed by sub-watershed effort;
    - Observed conditions in the river (i.e. still appears "dirty") don't appear to correspond to the trend of decreased Nitrogen loads over the past decade: different pollutants (or climate trends/conditions) can have different impacts and right now we are focusing primarily on Nitrogen. The Nitrogen TMDL is a target, but not a definite or comprehensive solution to water quality and habitat health for the river;
    - Shallow wells would be more vulnerable to contamination than deep bedrock wells: the Team did not have data regarding depth of wells.

NEXT STEPS

- The team acknowledged the value of the group's input and our understanding that both the environmental and public health issues are important to consider when addressing these water quality issues.
- Issues and questions raised in this workshop will be addressed in Workshop 2 (now scheduled for May 29th).

ATTACHMENTS
Roster of Attendees
Powerpoint Presentation

Attachment A
Attendance Roster

Westport Stakeholder Roster – Meeting 1			
Name	**Group Represented**	**Contact email**	**Attending (Y/N)**
Maury May	Social/Citizen	maurymay@hotmail.com	Y
Dora Milliken	Social/Citizen	wyndfieldfarm@mac.com	N
Steve Oellette	Social/Citizen	WPT02790@yahoo.com	Message
Len Potter	Social/Citizen	Lenfp1@aol.com	Y
Betty Slade	Social/Citizen	dcolebslade@aol.com	Y
John Bullard	Social/Citizen	johnkbullard@gmail.com	Y
Bob Carrigg	Economic Dev.	Bobbyca878@aol.com	Y
Arlene Cloutier	Economic Dev.	arlene@southcoastalrealty.com	Y
Sean LaFrance	Economic Dev.	SRLafrance@gmail.com	Y
Sean Leach	Economic Dev.	sleach@sitec-engineering.com	Y
Tanja Ryden	Economic Dev.	wfa@westportriver.org Tanja.ryden@gmail.com	Y
Lee Tripp	Economic Dev.	trippfarm@msn.com	Y
Chris Capone	Environmental/concom	ccagent@westport-ma.gov	N
Ross Moran Jennifer Dubois	Environmental/land trust	ross@westportlandtrust.org jennifer@westportlandtrust.org	N Y
Korrin Petersen	Environmental/BBC	petersen@savebuzzardsbay.org	Y
Tom Schmitt	Environmental/WRWA	Schmitt23@yahoo.com	Y
Phil Weinberg	At Large		Y
Bob Daylor	At Large		Y
Jim Hartnett	At Large		Y
David Cole	At Large	johnwilbour@gmail.com	Y
Tim Gillespie	At Large	TGillespie@charter.net	Y
Rich Castenson	At Large	RCastenson@cox.net	Y
Roberta Carvalho	WRWA	water@wrwa.com	(added for WS2)
Deborah Weaver	WRWA	director@wrwa.com	(added for WS2)

Attachment B
PowerPoint Presentation

Targeted-Integrated Water Resource Management Plan

Workshop #1

TOWN OF WESTPORT
March 20, 2019

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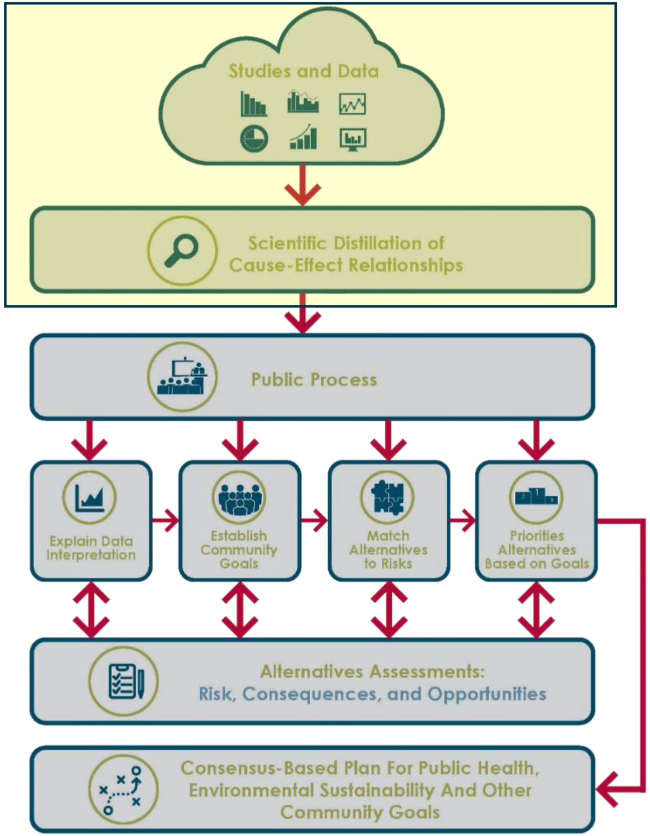
Workshop #1 Agenda

- Introductions
- Goals of the Workshop
- Review of Technical Approach
- Summary of Data Analysis Task
- Open Discussion/Preliminary Alternatives
- Next Steps

Goals For Today

- Consensus around Revised Baseline
- Consensus/Agreement on Interpretation of Data Analysis Results
- Identification of Date Gaps
- Preliminary Discussion on Alternatives (if time)

Data Evaluation – Technical Approach



- Land use changes
- Agricultural practices changes
- Board of Health records:
  - Septic system installation dates
  - Septic system failures
- Public water supply data
- Water quality data (various sources)

Cause-Effect Relationships
"Hot Spots" for specific issues
Opportunities for management

Summary of Data Analysis Findings

- Creating a New Baseline for Nitrogen Loading
- Summary of Load Changes (vs. MEP)
- Summary of Load Sources
- Water Quality Hot Spots
- Discussion on Causal Relationships

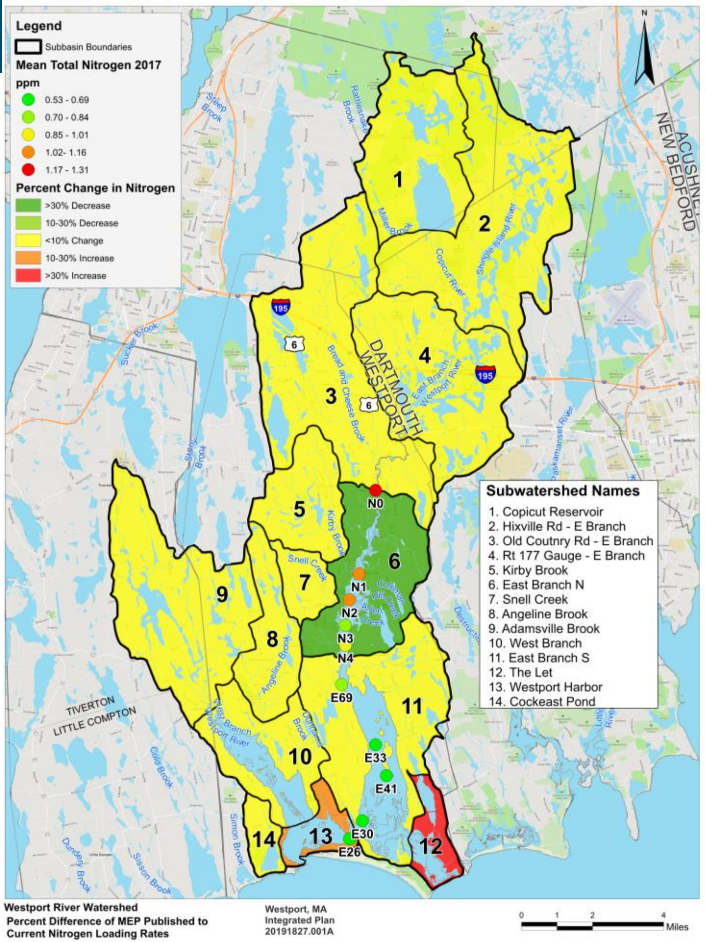
Nitrogen Loading Calculations

Nitrogen Load	Subwatershed Name and Number(s)									
	11	12	5	6	7	1, 2, 3, 4	8	9	10	13, 14
	East Branch S	The Let	Kirby Brook	East Branch N	Snell Creek	Old County Rd Total	Angeline Brook	Adamsville Brook	West Branch	Westport Harbor Total
Published MEP (kg/day)	69.37	5.76	20.95	103.09	8.14	240.98	34.30	56.03	32.90	10.25
New Baseline (kg/day)	63.51	7.94	22.36	56.80	8.68	259.02	33.50	58.79	32.62	11.28
TMDL (kg/day)	46.48	5.76	13.17	93.03	3.58	111.82	34.30	47.62	32.90	10.25
Percent Reduction Required MEP to TMDL	33%	0%	37%	10%	56%	54%	0%	15%	0%	0%
Percent Reduction Required New Baseline to TMDL	27%	27%	41%	0%	59%	57%	0%	19%	0%	9%

Creating a New Baseline: Updated Land Use for Updated Nitrogen Loads

- Updated MEP Report calculations with more current and specific data on:
  - Land Use (from MA Assessors Data)
  - Septic systems (from Westport Board of Health)
  - Agriculture (from Westport Agricultural Committee)
- These updates contribute to both increases and decreases in N loadings

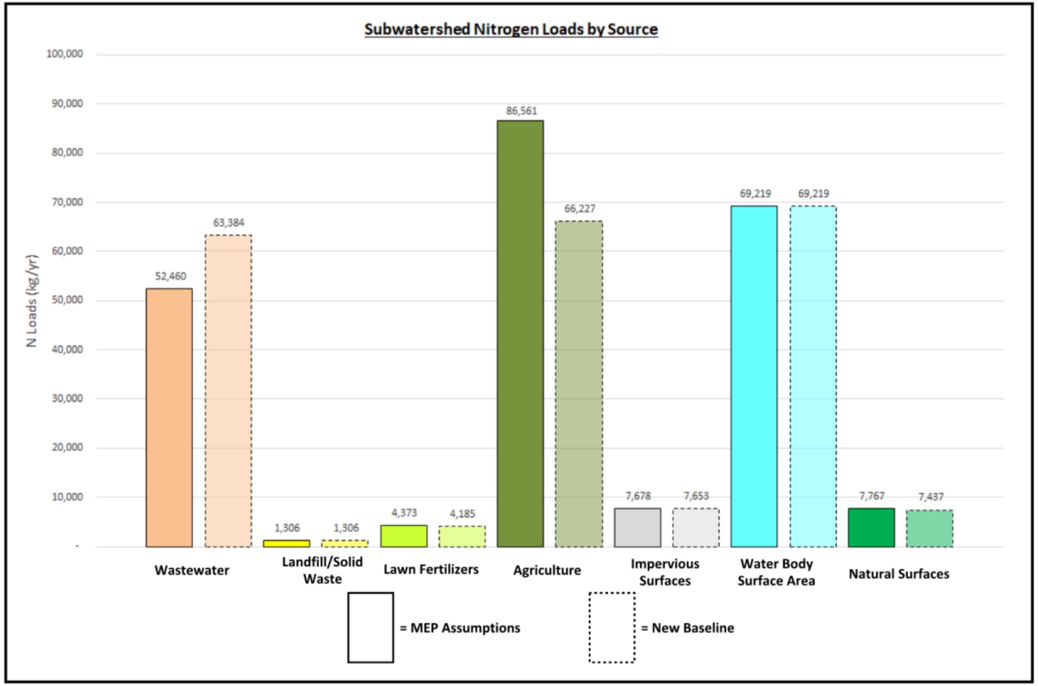
(Refer to Hard Copy Handouts)



Review of Loading Changes: Entire Westport River System

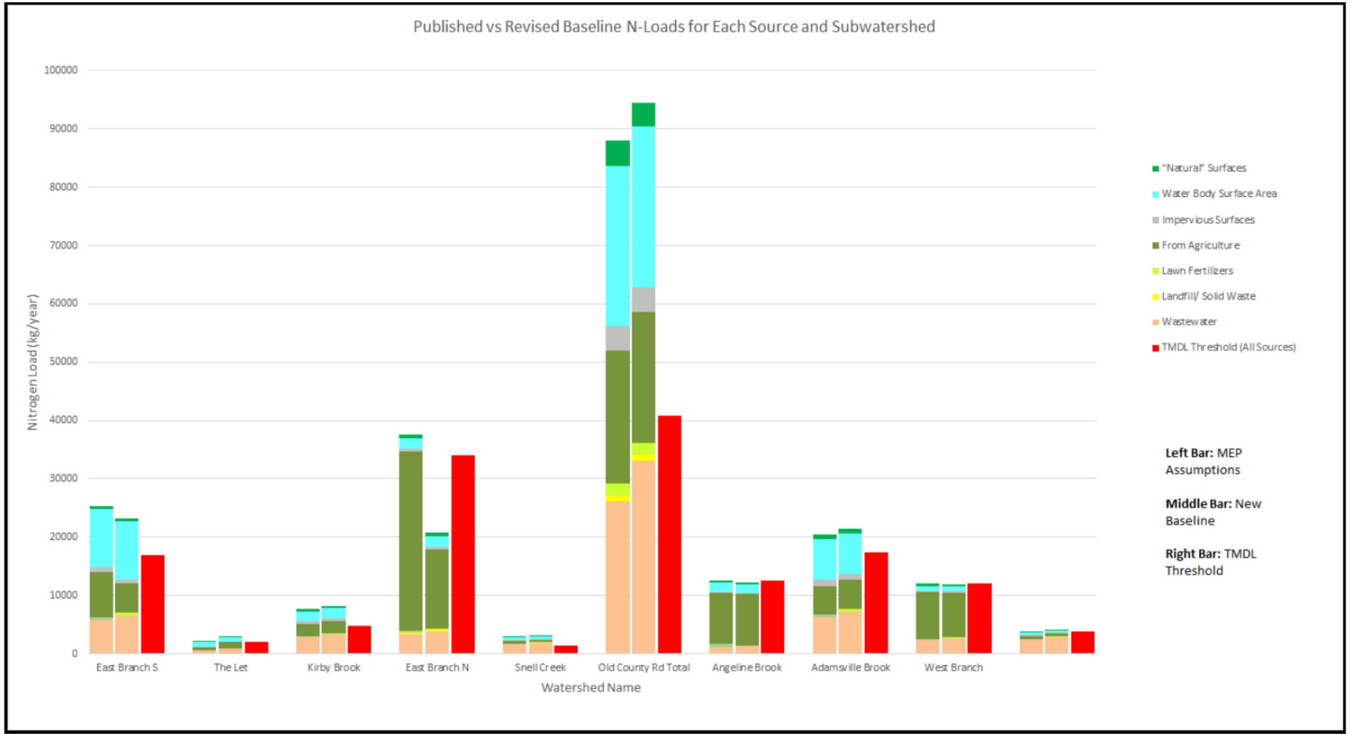
- Overall increase in septic loads due to new septic systems & addition of undercounted systems omitted by MEP
- Overall decrease in agriculture loads due to more accurate agriculture data

(Refer to Hard Copy Handouts)

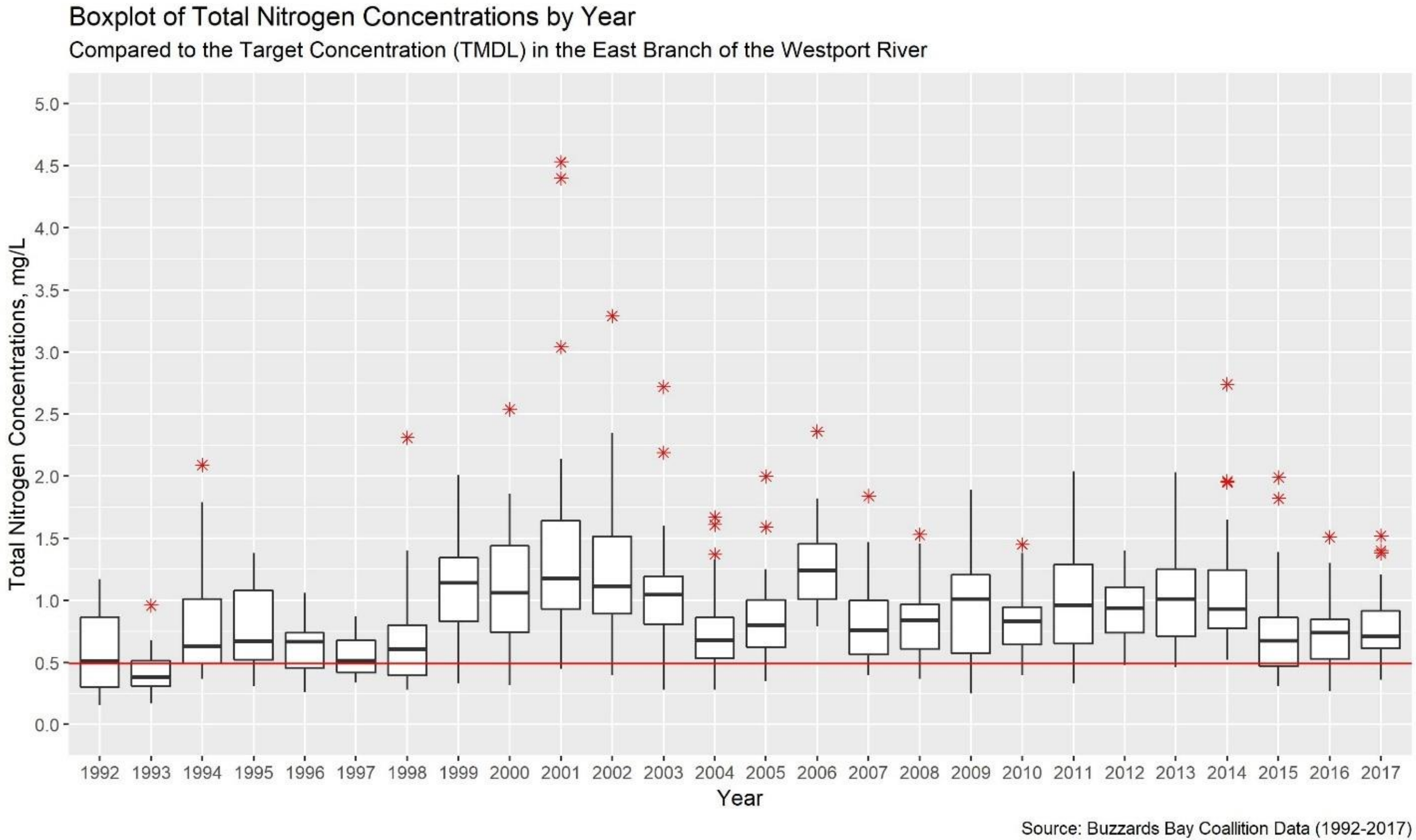


Loadings by Subwatershed

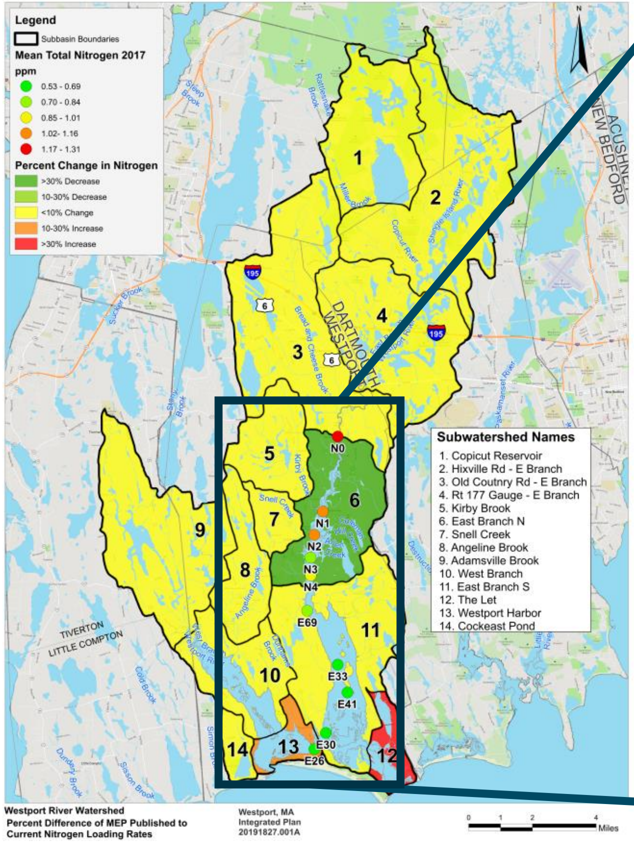
- Compare new baseline to published MEP data and TMDL values
- Simply updating loads has achieved the TMDL in some areas (see handouts)

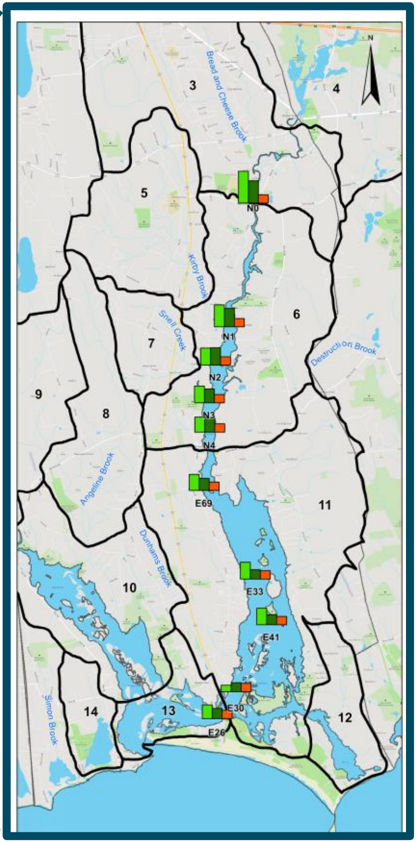


Validating the Baseline: Water quality data (Mean Total Nitrogen)



Validating the Baseline: Comparing Nitrogen Loads to In-stream Concentrations (2017)





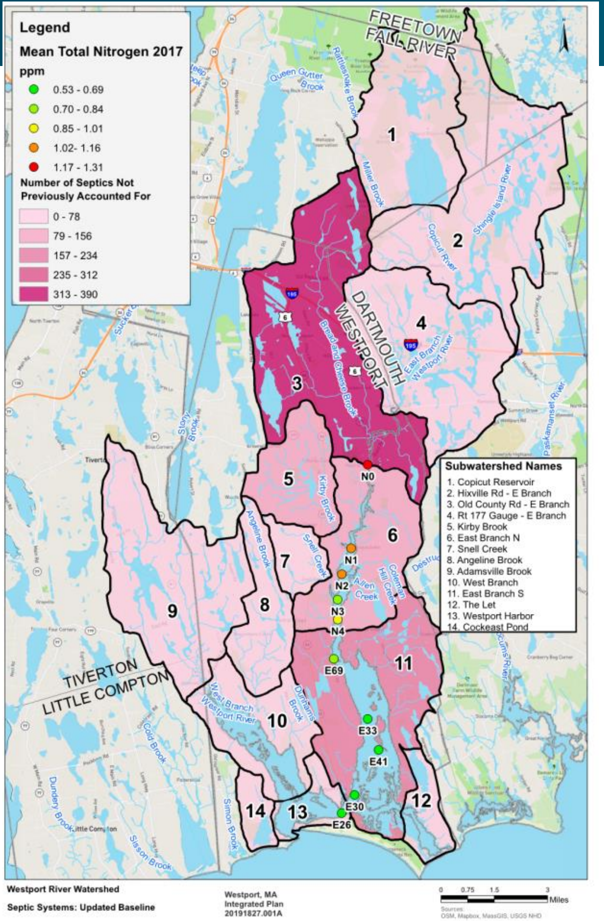
Individual Nitrogen Contribution Changes

1. Septic Systems
2. Agriculture
3. Private Well Reporting
   - Hotspot / prioritization

Updated Septic Information

- New septic systems across Westport correspond with increased loadings in particular areas
- Northern part of Town has the greatest increase in septic systems
- Updated wastewater data from Town of Westport only

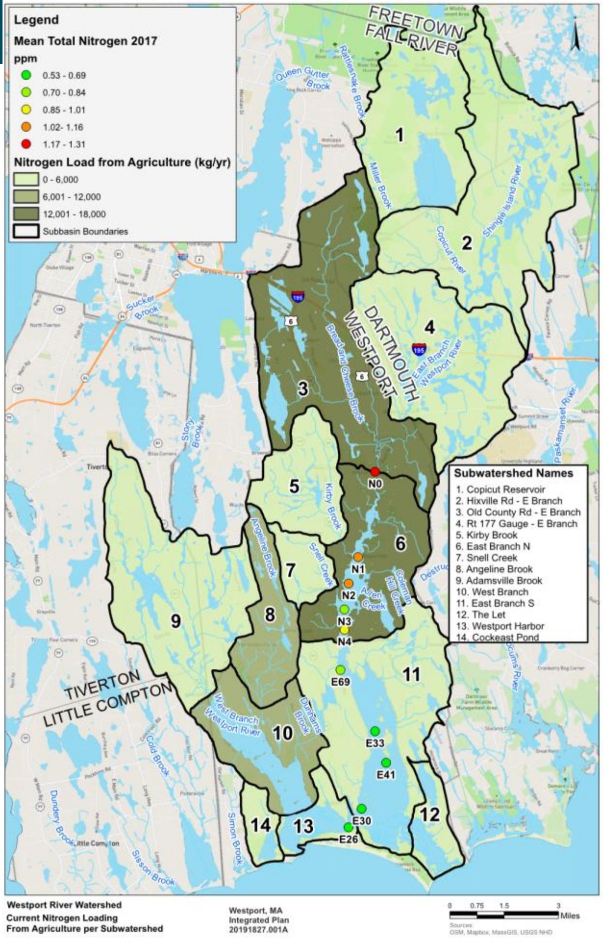
(See Hard Copy Handouts)



Agricultural Changes

- Updated Agriculture land use from Tax Assessors and Westport Agricultural Committee
- Not much change in the number of agricultural parcels, but instead in the agricultural practices.

(See Hard Copy Handouts)

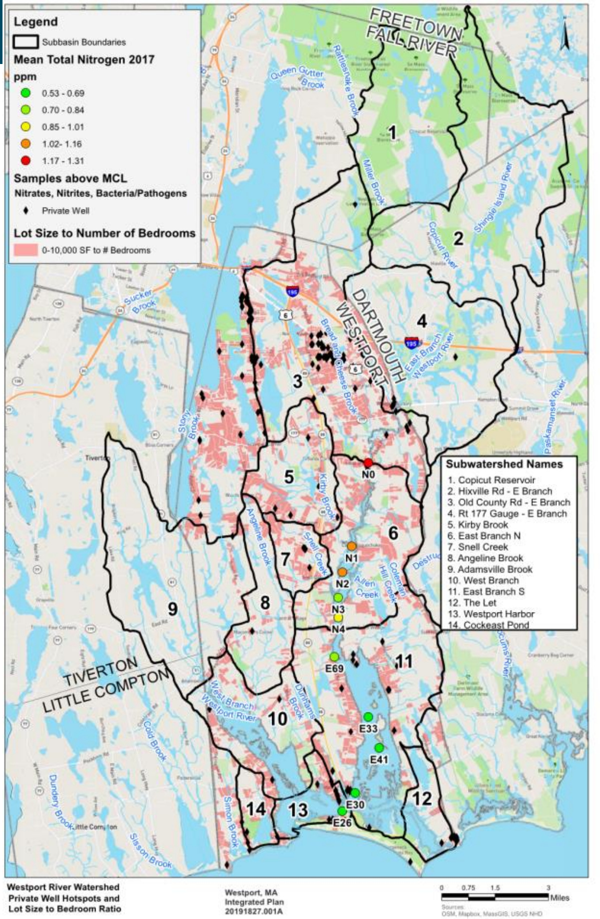


Private Wells: Nitrates and Bacteria/Pathogens Contamination and Lot Size to Number of Bedrooms

- Town data on where private wells have experienced high level sampling results for Nitrates and/or Bacteria

- Title V Compliance indicates the ratio of bedrooms to lot size must be >10,000

(See Hard Copy Handouts)



Other Considerations

- Dartmouth Sewer Line Data
  - Incorporating the locations of recently installed sewer lines in the Town of Dartmouth (decreases to nitrogen loading rates in subwatershed #4)
- Updated monitoring data
  - Preliminary 2018 nitrogen sampling results for sentinel station
- Others?

Alternatives: Preliminary introduction of topics for next workshop

- Recommendations from existing studies:
  - land use planning and policy, wastewater treatment, stormwater management, and other innovative solutions
- Scale of solutions:
  - site/neighborhood, Town-wide, watershed-wide

Open Discussion

- Questions?

Thank You!

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WESTPORT, MA INTEGRATED WATER RESOURCES MANAGEMENT PLAN
WORKSHOP NO. 1 – MARCH 20, 2019
SIGN-IN SHEET

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Len Potter	LENFP1@aol.com	508-636-2554
	"	889-4890
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MEETING AGENDA – WORKSHOP NO. 2

WESTPORT TARGETED INTEGRATED WATER RESOURCES MANAGEMENT PLAN

TOWN HALL ANNEX **May 29, 2019**

INTRODUCTIONS .... ALL

WORKSHOP GOALS .... BETSY/KIRK

- Understand Types of Alternatives Under Consideration
- Understand Implementation Applicability at Watershed and Sub-Watershed Scale
- Recognize Benefits Achieved Through Alternative Types
- Achieve General Agreement on Strategies for Further Development of Conceptual Alternatives

BRIEF UPDATE ON DATA DEVELOPMENT & PREVIOUS WORK .... KIRK

ALTERNATIVES DISCUSSION .... DAVE P./KIRK

- Categories of Alternatives
- Specific Alternatives (Generically Applied)
- Benefits Achieved

OPEN DISCUSSION.. TEAM

NEXT STEPS.. TEAM

TARGETED INTEGRATED WATER RESOURCES MANAGEMENT PLAN: WORKSHOP NO. 2/MAY 29, 2019

ABOUT THE WORKSHOP

The end goal of the Targeted-Integrated Water Resources Management Plan process is to properly frame the water quality challenges within the East Branch of the Westport River and identify alternatives to meet community objectives and obligations.

The desired outcomes of the second Stakeholder Workshop were:

- Understand Types of Alternatives Under Consideration
- Understand Implementation Applicability at Watershed and Sub-Watershed Scale
- Recognize Benefits Achieved Through Alternative Types
- Achieve General Agreement on Strategies for Further Development of Conceptual Alternatives

Attendees

See **Attachment A** for stakeholder roster and attendance.

Actions

Information developed during the workshop will be incorporated into the further development of specific alternatives, and program of alternatives, to be presented in draft form to the community. Next steps include conceptual design of several specific alternatives, financial analysis of proposed program and implementation plan development. These elements will be incorporated into a draft and final report.

Notes (Per Agenda Items)

INTRODUCTIONS

- Robert Daylor made introductory remarks and briefly discussed the background of the Town's Targeted – Integrated Water Resources Management Plan (T-IWRMP). Mr. Daylor reiterated that this effort was to ensure the stakeholders agree on the challenges posed to water resources in the community and seek to find acceptable solutions. Attendees were invited to re-introduce themselves and provide any voluntary information regarding specific interests they may represent.

WORKSHOP GOALS

- The Consulting Team (Kleinfelder/Pare) gave an overview of the progress made in the months since the first public meeting and subsequent Stakeholder Workshop No.1. Remarks focused on ultimate goal of producing a plan that addresses the water quality issues (particularly related to the Nitrogen Total Maximum Daily Load or TMDL), public health (primarily related to nitrates and bacteria in private drinking water wells) and affordability and sustainability of a proposed plan.

Specific goals for the workshop were outlined (see above) and were the basis for the technical presentation that followed.

REVIEW OF TECHNICAL APPROACH

- In order to provide consistency with regulatory and academic efforts upon which "existing baseline" conditions had been characterized, the project team worked within the methodology/model developed by the Massachusetts Estuaries Project (MEP) to calculate nitrogen loading in the Westport River.
- The project team did not change assumptions or calculations from the model, rather the team updated data from land use practices, Board of Health specific parcel data (e.g. new, upgraded or failed septic systems), water supply/water quality data, and updated Nitrogen concentrations for sampling locations in the river. This updated model will serve as the current baseline ("new baseline") for which alternatives will be evaluated.
- A Geographic Information Systems (GIS) database provided for spatial analyses to infer cause-effect relationships, "hot spots" for specific issues and opportunities for management.

SUMMARY OF FINDINGS TO DATE

- New Baseline for Nitrogen Loading Rates/Summary of Load Changes – the analysis shows an overall increase in nitrogen load from septic systems due to new septic installations and inclusion of systems that had been omitted from the MEP baseline. There is an overall decrease in nitrogen load from agricultural land uses based on more accurate and current (2017) data. As a result, some areas are demonstrated to have met the Total Maximum Daily Load on a sub-watershed basis. (See slides 6–11 of PowerPoint presentation provided as **Attachment B**).
- Summary of Load Sources – New Septic systems correspond to increased loadings and the northern part of Town has the greatest number/density of new systems. Agricultural loadings were impacted/reduced on the basis of best management practices rather than significant change in number of parcels in agricultural use. Dat a was updated using tax assessor and Westport Agricultural Committee data. (Slides 13-14.)
- Water Quality Hot Spots – Town data was used to determine where private wells have experienced high levels of nitrates and bacteria/pathogens. For comparison purposes, these identified hot spots were overlaid with a map layer showing where parcel sizes were smaller than Title V standards with respect to number of bedrooms (proxy for wastewater generation) per square feet of parcel. While causality was not definitively determined, initial observation suggest some correlation. (Slide 15.)

OPEN DISCUSSION

- Several questions were posed during the course of the presentation on a variety of topics, including:
    - Sources and quality of data: the team reported confidence in the data sources and quality;

- Contribution of water fowl to pollutant loads: contribution is captured in the “natural surfaces” loading category. As the contribution is relatively small, the future solutions are unlikely to focus on this source;
- Impervious surface loading contribution shows as a decrease when the Town has clearly experienced development: the Team did not have an immediate explanation for that finding and will research further;
- In-stream concentrations of Nitrogen at some sampling locations higher than the loading rates from that stretch of river: upstream watersheds are contributing to the in-stream concentrations which suggests a watershed-wide approach may be appropriate rather than a sub-watershed by sub-watershed effort;
- Observed conditions in the river (i.e. still appears “dirty”) don’t appear to correspond to the trend of decreased Nitrogen loads over the past decade: different pollutants (or climate trends/conditions) can have different impacts and right now we are focusing primarily on Nitrogen. The Nitrogen TMDL is a target, but not a definite or comprehensive solution to water quality and habitat health for the river;
- Shallow wells would be more vulnerable to contamination than deep bedrock wells: the Team did not have data regarding depth of wells.

NEXT STEPS

- The team acknowledged the value of the group’s input and our understanding that both the environmental and public health issues are important to consider when addressing these water quality issues.
- Issues and questions raised in this workshop will be addressed in Workshop 2 (now scheduled for May 29th).

ATTACHMENTS

Roster of Attendees
Powerpoint Presentation

Attachment A
Attendance Roster

Westport Stakeholder Roster – Meeting 1			
Name	**Group Represented**	**Contact email**	**Attending (Y/N)**
Maury May	Social/Citizen	maurymay@hotmail.com	Y
Dora Milliken	Social/Citizen	wyndfieldfarm@mac.com	N
Steve Oellette	Social/Citizen	WPT02790@yahoo.com	Message
Len Potter	Social/Citizen	Lenfp1@aol.com	Y
Betty Slade	Social/Citizen	dcolebslade@aol.com	Y
John Bullard	Social/Citizen	johnkbullard@gmail.com	Y
Bob Carrigg	Economic Dev.	Bobbyca878@aol.com	Y
Arlene Cloutier	Economic Dev.	arlene@southcoastalrealty.com	Y
Sean LaFrance	Economic Dev.	SRLafrance@gmail.com	Y
Sean Leach	Economic Dev.	sleach@sitec-engineering.com	Y
Tanja Ryden	Economic Dev.	wfa@westportriver.org Tanja.ryden@gmail.com	Y
Lee Tripp	Economic Dev.	trippfarm@msn.com	Y
Chris Capone	Environmental/concom	ccagent@westport-ma.gov	N
Ross Moran Jennifer Dubois	Environmental/land trust	ross@westportlandtrust.org jennifer@westportlandtrust.org	N Y
Korrin Petersen	Environmental/BBC	petersen@savebuzzardsbay.org	Y
Tom Schmitt	Environmental/WRWA	Schmitt23@yahoo.com	Y
Phil Weinberg	At Large		Y
Bob Daylor	At Large		Y
Jim Hartnett	At Large		Y
David Cole	At Large	johnwilbour@gmail.com	Y
Tim Gillespie	At Large	TGillespie@charter.net	Y
Rich Castenson	At Large	RCastenson@cox.net	Y
Roberta Carvalho	WRWA	water@wrwa.com	(added for WS2)
Deborah Weaver	WRWA	director@wrwa.com	(added for WS2)

Attachment B
PowerPoint Presentation

Targeted-Integrated Water Resource Management Plan

Workshop #2

TOWN OF WESTPORT
May 29, 2019

Workshop #2 Agenda

- Introductions
- Workshop Goals
- Brief Update on Data Development & Previous Work
- Alternatives Discussion
- Open Discussion
- Next Steps

Goals For Today

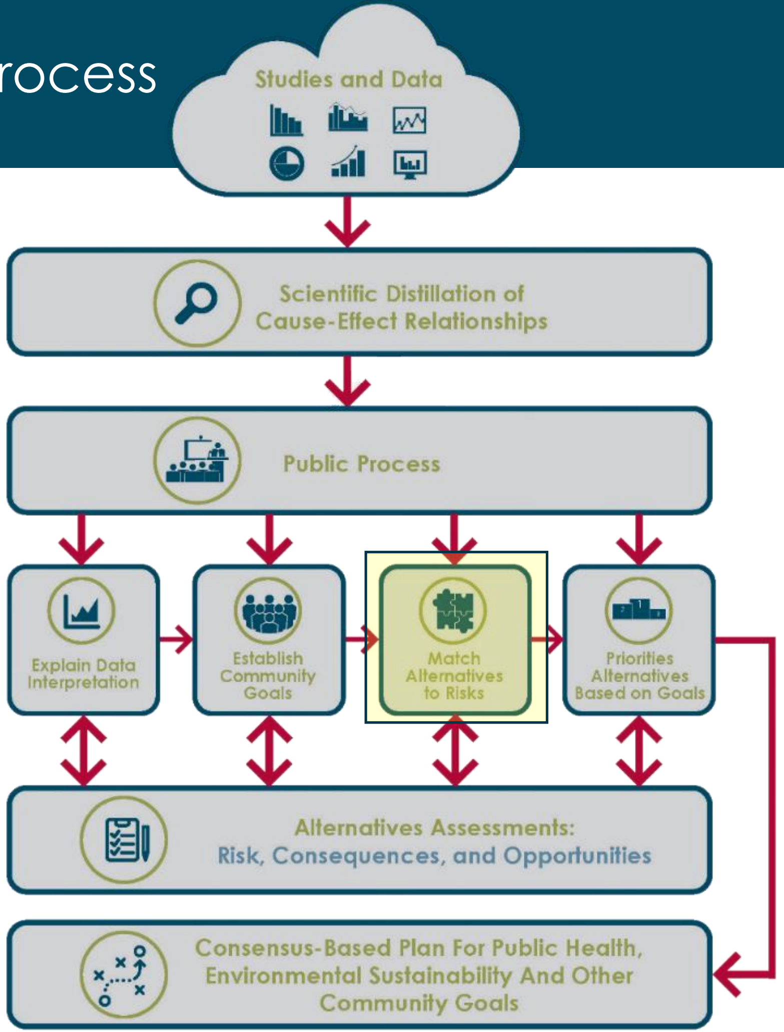
- Understand Types of Alternatives Under Consideration
- Understand Implementation Applicability at Watershed and Sub-Watershed Scale
- Recognize Benefits Achieved Through Alternative Types
- Achieve General Agreement on Strategies for Further Development of Conceptual Alternatives

REVIEW:
DATA DEVELOPMENT AND PREVIOUS WORK

Planning Goals

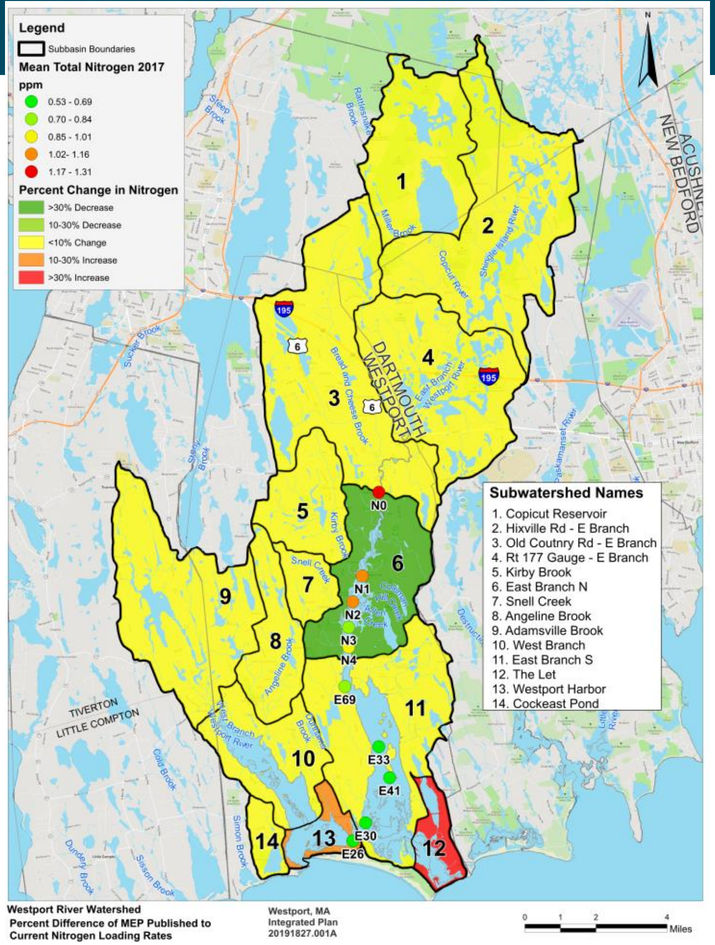
- Achieve water quality goals for nitrogen per the TMDL report
- Address public health concerns from contaminated private wells
  - Bacteria
  - Nitrates
- Assure that recommendations are affordable

Where We Are in the Process



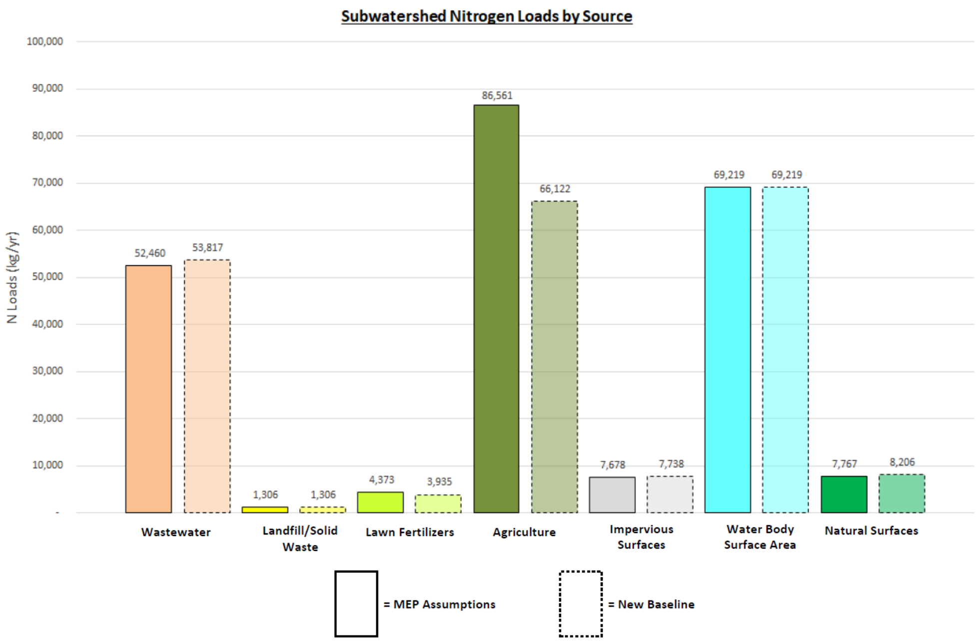
Creating a New Baseline: Updated Land Use for Updated Nitrogen Loads

- Updated MEP Report calculations with more current and specific data on:
  - Land Use (from MA Assessors Data)
  - Septic systems (from Westport Board of Health)
  - Agriculture (from Westport Agricultural Committee)
- These updates contribute to both increases and decreases in N loadings



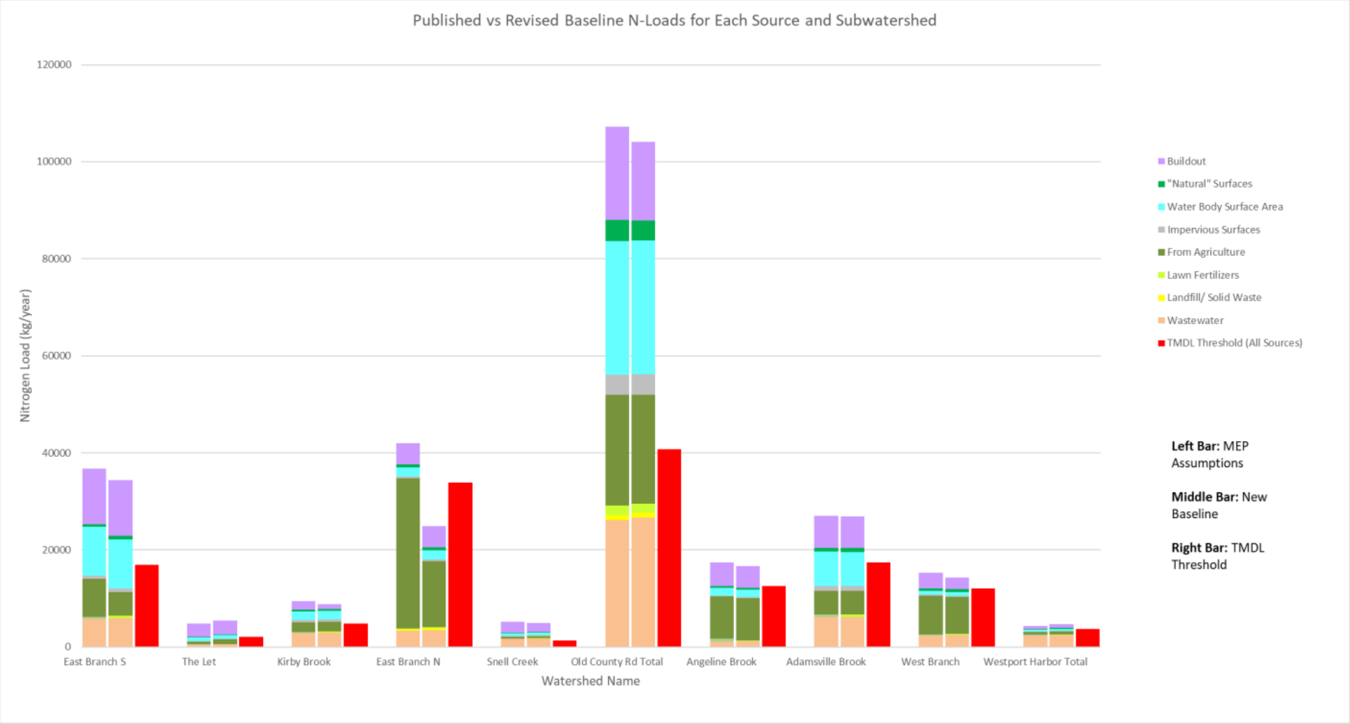
Review of Loading Changes: Entire Westport River System

- Overall increase in septic loads due to new septic systems & addition of undercounted systems omitted by MEP
- Overall decrease in agriculture loads due to more accurate agriculture data

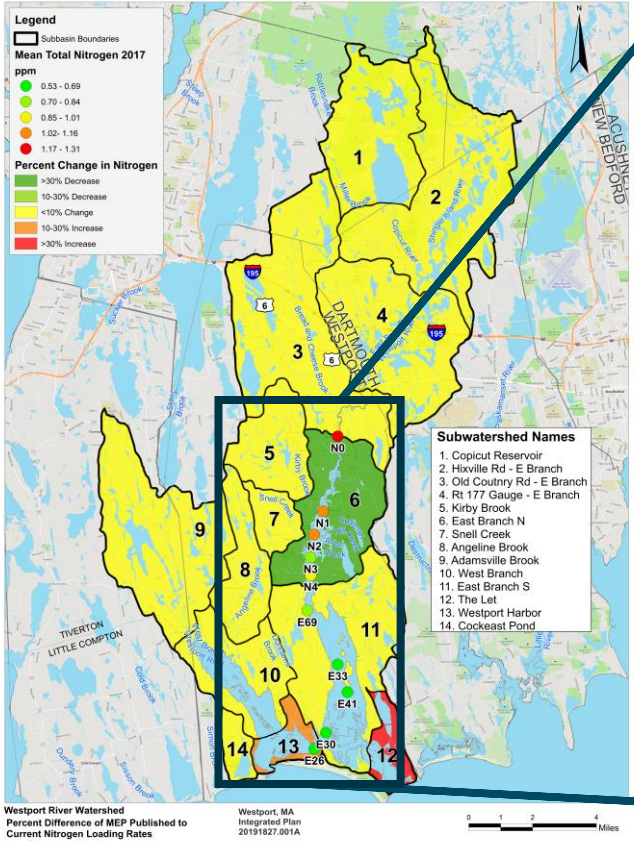


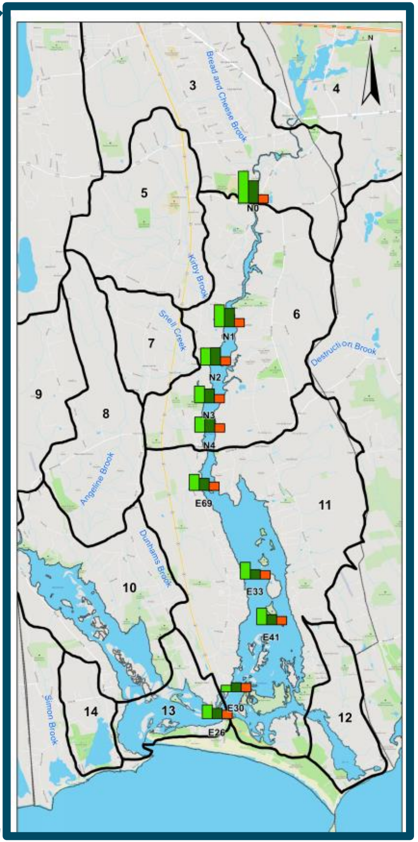
Nitrogen Loadings by Subwatershed

- Compare new baseline to published MEP data and TMDL values
- Simply updating loads has achieved the TMDL in some areas



Recent Improvements in Water Quality

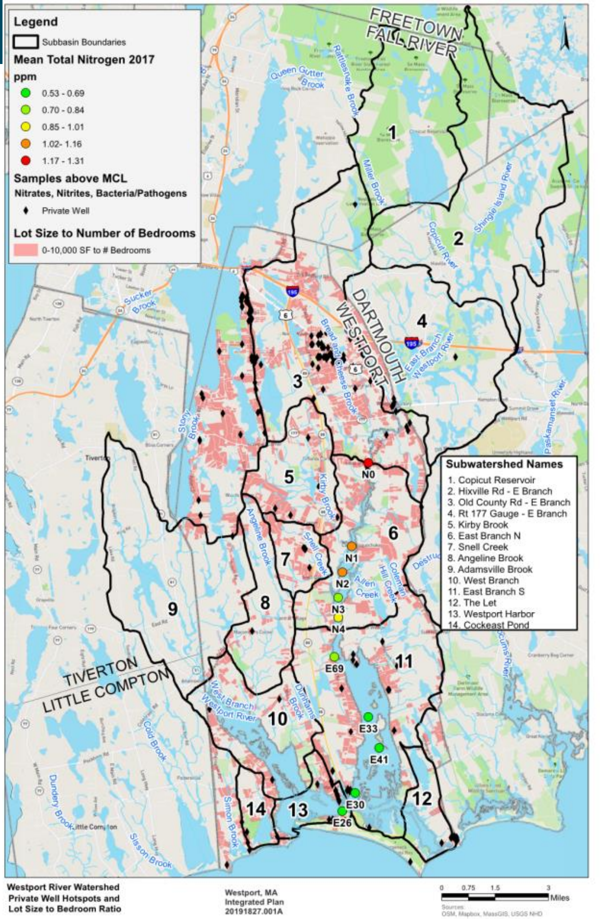




Private Wells: Nitrates and Bacteria/Pathogens Contamination and Lot Size to Number of Bedrooms

- Town data on where private wells have experienced high level sampling results for Nitrates and/or Bacteria

- Title V Compliance indicates the ratio of bedrooms to lot size must be >10,000



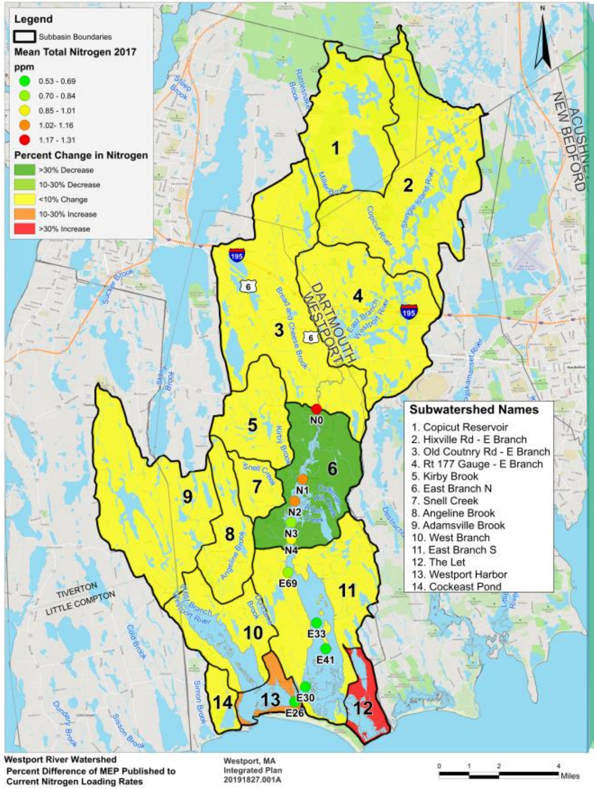
A Pause – and Reactions

- Your takeaways from Workshop 1 and/or this review?
- This is what I heard from you…

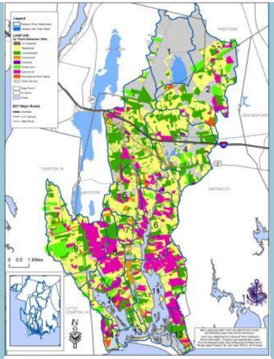
ALTERNATIVES

Examine the Issues at Two Scales:

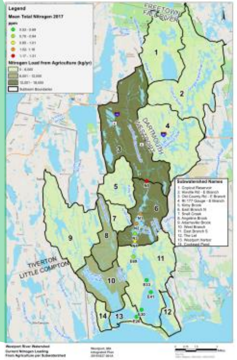
Environmental Health



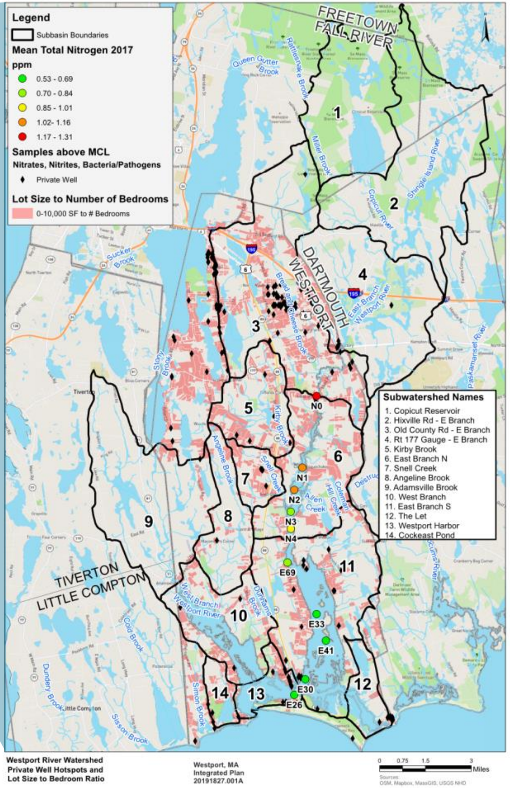
Town-wide



Subwatersheds



Public Health



Alternatives

Stormwater

System Alteration

Source Control

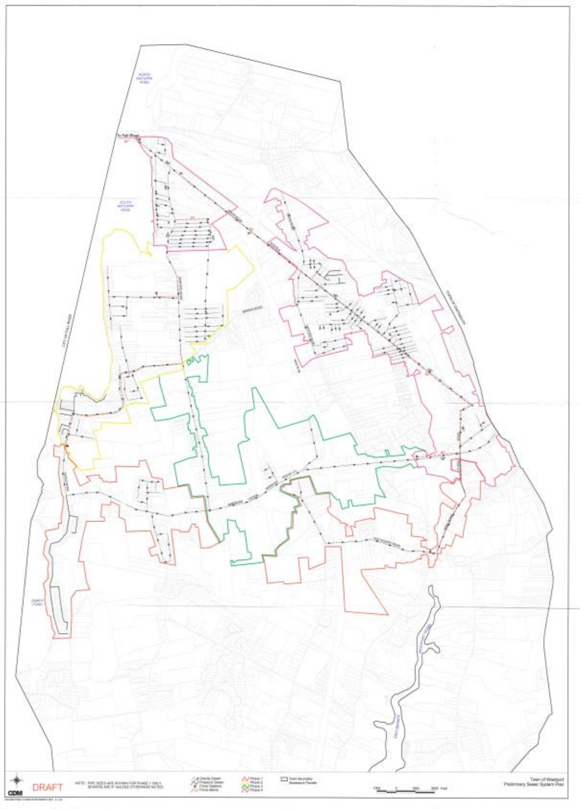
Innovative Technology

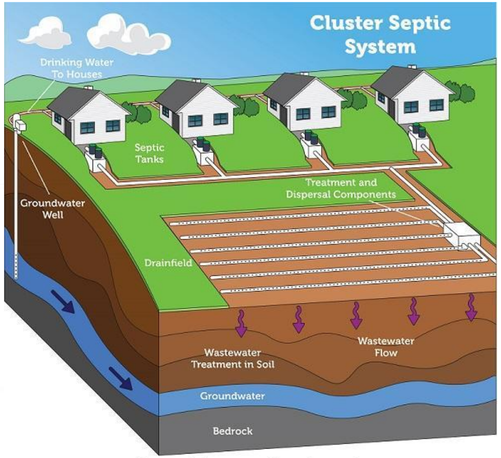
Wastewater Treatment

Regulations/Policies/Guidance

Wastewater Treatment

- Public Sewer
- On-site Wastewater Treatment Systems
  - Conventional (Title V Compliant)
  - Innovative/Alternative Systems
  - Denitrification Systems



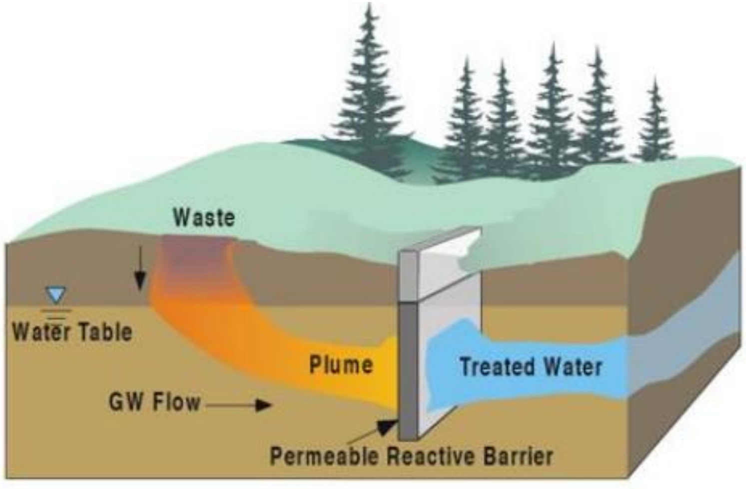


System Alteration

- Channel Dredging
- Improve Flushing
    - Inlet Alteration
    - Culvert Improvements
    - Tributary Improvements
- Constructed Wetlands

Innovative Technology

- Permeable Reactive Barriers (PRB)
- Aquaculture



Stormwater

- Non-Structural Best Management Practices
  - Low Impact Development

- Structural Best Management Practices
  - Bioretention (rain gardens)
  - Dry wells and Infiltration
  - Porous Pavement
  - Vegetative Buffer Strips
  - Wet and Dry Swales
  - Constructed Wetlands

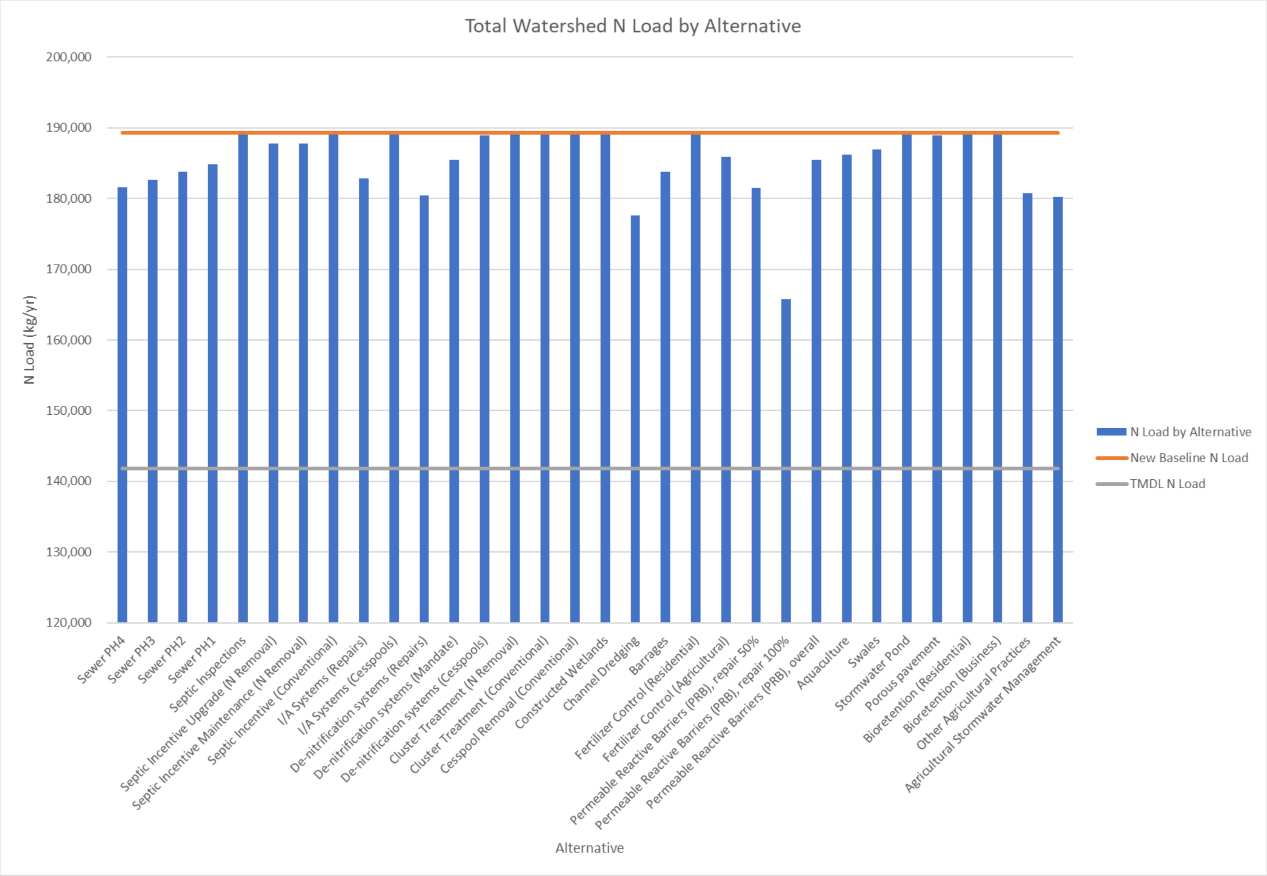
Policy, Regulation, and Source Control

- Zoning
- Planning
- Open Space Planning
- Nitrogen Credit (Trading)
- Fertilizer Reduction
- Water Use

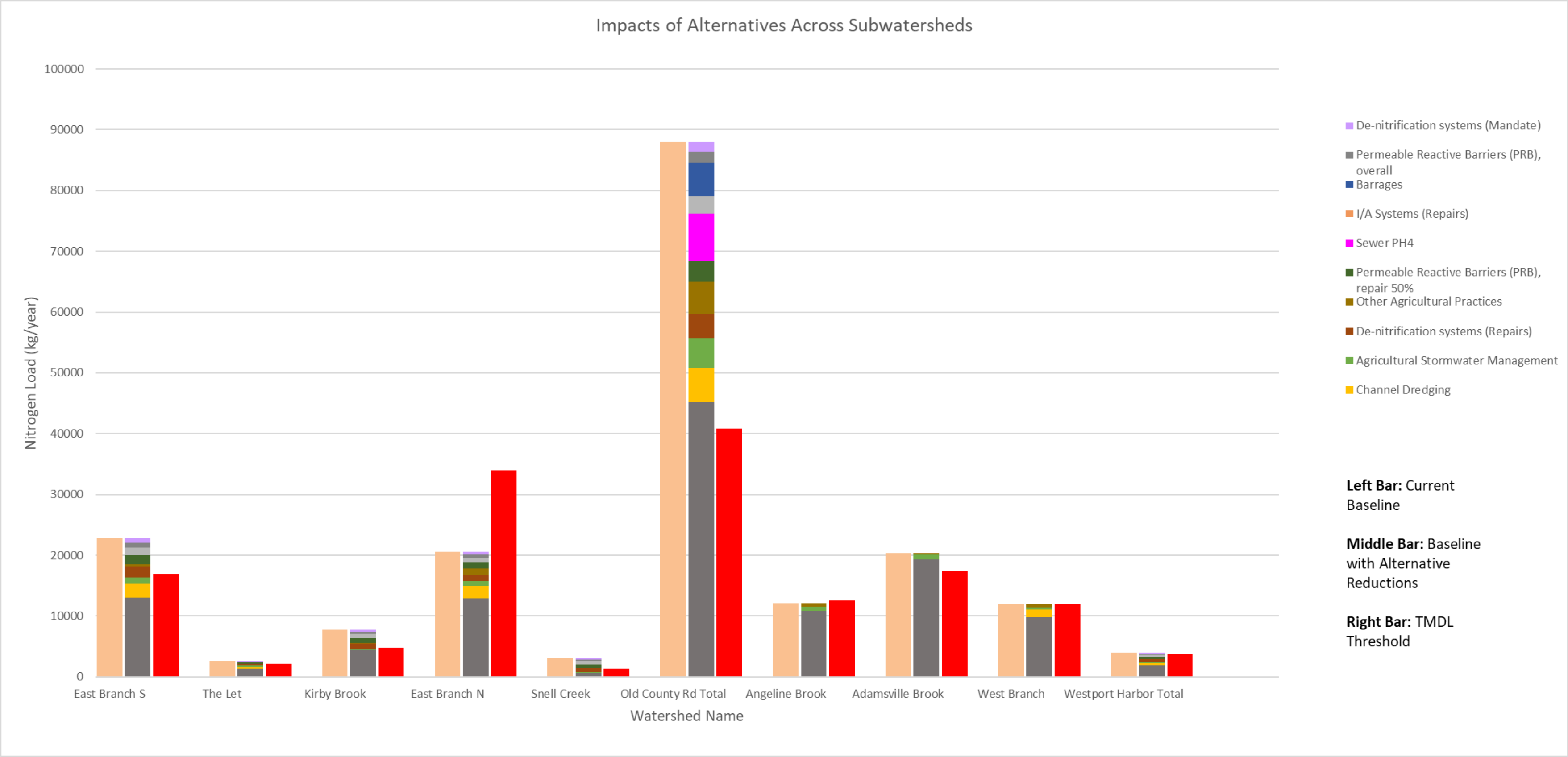
Pause No. 2

- Further questions?
- This is what I heard from you…

Relative Effectiveness of Alternatives for Nitrogen Removal



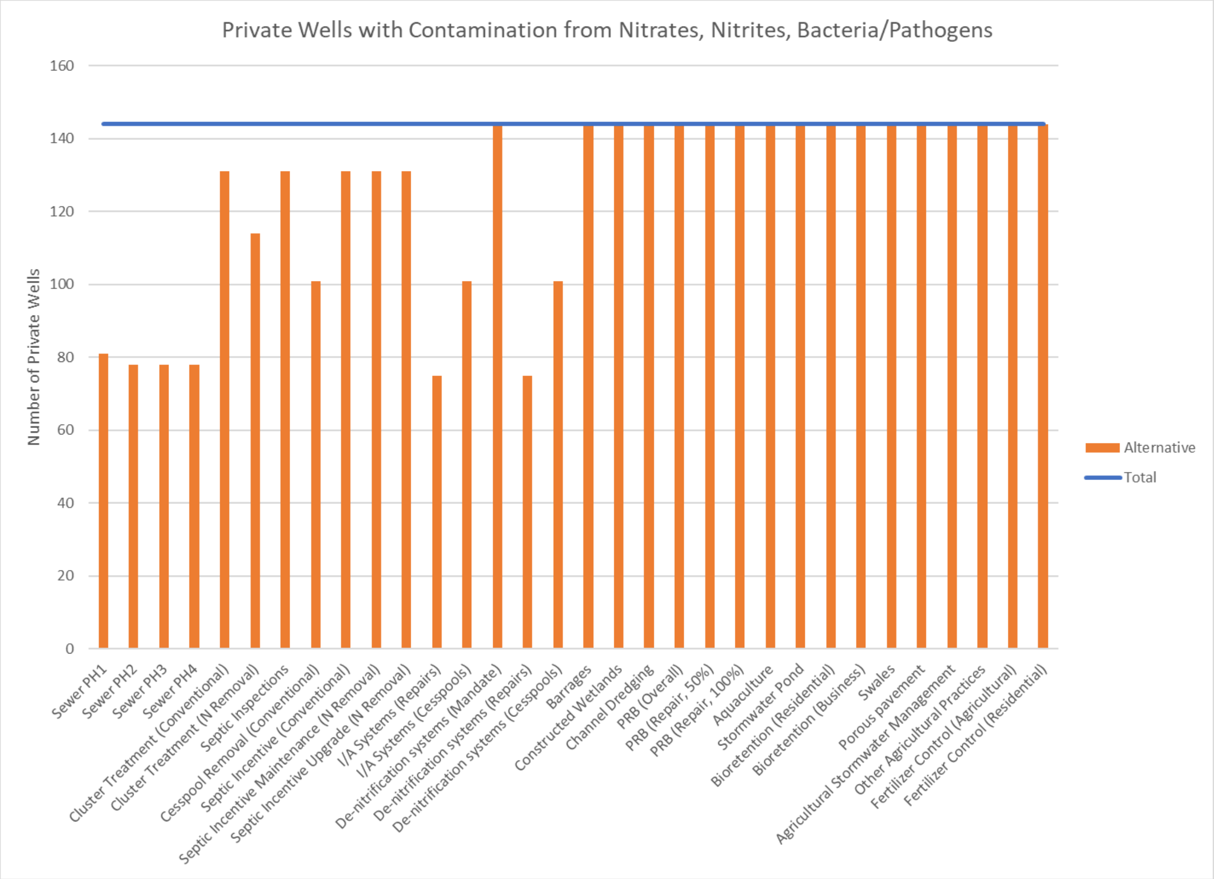
Relative Effectiveness of Alternatives for Nitrogen Removal



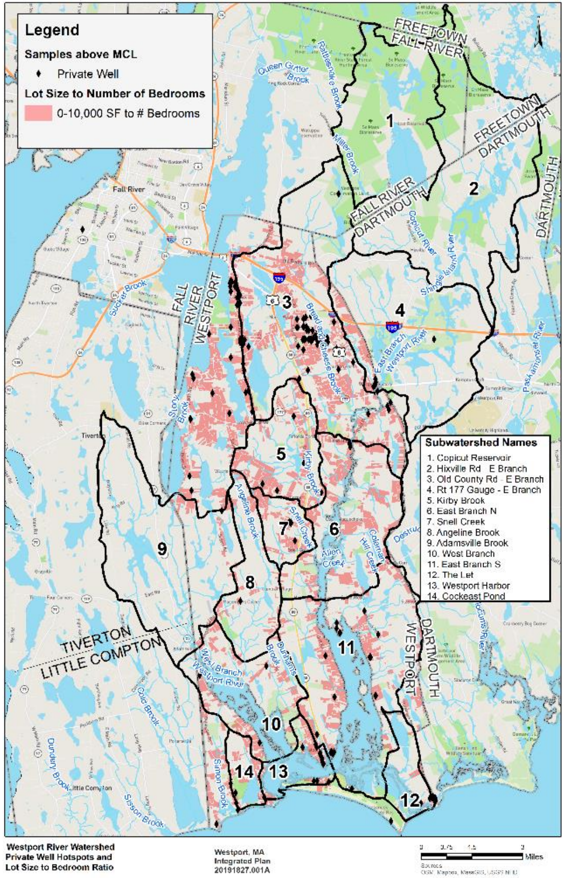
Top Nitrogen Removal Alternatives – Preliminary Findings

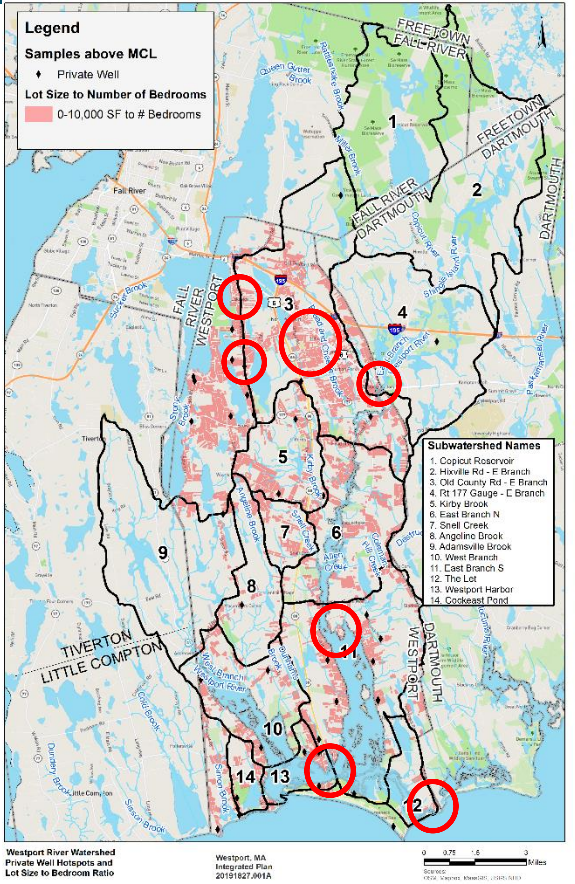
1. Agricultural Stormwater Management
2. De-nitrification
3. Sewer
4. Permeable Reactive Barriers
5. Channel Dredging

Relative Effectiveness of Alternatives for Public Health



Reduction of Public Health Risks





Top Public Health Alternatives – Preliminary Findings

1. Sewer
2. Denitrification
3. I/A Systems
4. Cesspool Removal
5. Cluster Systems

Pause No. 3 – That was a lot of Information!

- What did we miss?

- This is what I heard from you…

NEXT STEPS TOWARD COMPLETION

Steps Toward Completion

- Compile consensus-based recommendations from this group
- Preliminary cost evaluation of preferred alternatives
- Grouping of alternatives
  - subwatershed programs
  - town-wide program
- Funding / Affordability evaluation
- Review with Mass DEP
- Conceptual design
- Recommended Path Forward

Open Discussion

- Questions?

Thank You!

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Westport, MA Integrated Water Resources Management Plan
Workshop No. 2 – May 29, 2019
Sign-In Sheet

Name	Email	Telephone
Betsy Frederick	bfrederick@kleinfelder.com	617-498-4603
Phil Weinberg		
Alex Silveri	ASilveri@kleinfelder.com	617 498 4644
Kirk Westphal	KWESTPHAL@KLEINFELDER.COM	617.947.2652
David Potter	DPOTTER@PARECORP.COM	401 334.4100
John Ballard	johnkballard@gmail.com	508 951.6569
Len Potter	LENEP1@aol.com	508-889-4890
Arlene Cloutier	Arlene@southcoastalrealty.com	508-577-5797
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Betty Slade		
Roberta Carvalho	water@wrwa.com	508-636-3016
Lee Tripp	trippfarm@msn.com	2404781460
Korrin Petersen	petersen@savebuzzardsbay.org	508 999 6363 x206
Chris Capone	ccagent@westport-ma.gov	508 636-1019
Tanja Ryden	tanja.ryden@gmail.com	508-636-7399
Jim Whitin	JIMWHITIN@ME.COM	774-930-5801

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WESTPORT, MA INTEGRATED WATER RESOURCES MANAGEMENT PLAN
WORKSHOP NO. 2 – MAY 29, 2019
SIGN-IN SHEET

Name	Email	Telephone
Jennifer Dubois	jennifer@westportlandtrust.org	508 636 9228

TARGETED INTEGRATED WATER RESOURCES MANAGEMENT PLAN: WORKSHOP NO. 3/SEP. 25, 2019

ABOUT THE WORKSHOP

The end goal of the Targeted-Integrated Water Resources Management Plan process is to properly frame the water quality challenges within the East Branch of the Westport River and identify alternatives to meet community objectives and obligations.

The desired outcomes of the Third Stakeholder Workshop were:

- Understand proposed alternatives comprising the Integrated Plan
- Achieve general agreement (consensus) on array of alternatives proposed, approach and likely scale of implementation

Attendees

See **Attachment A** for stakeholder roster and attendance.

Actions

Feedback from attendees at the workshop indicated that clarifying information is desirable to more fully present benefits and costs of the alternatives both for the East Branch watershed on which the plan focuses, but also in town-wide terms. There was general agreement with the types of alternatives proposed and the framework of adaptive management as the guiding principle, however, scale of implementation and phasing of different alternatives was still in debate. Next steps include refining proposed program to resolve questions on benefits phasing specifically. This will be incorporated prior to presentation of the plan at a public meeting next month.

Notes

INTRODUCTIONS

- Robert Daylor made introductory remarks and briefly discussed the background of the Town's Targeted – Integrated Water Resources Management Plan (T-IWRMP). Mr. Daylor reiterated that this effort was to ensure the stakeholders agree on the challenges posed to water resources in the community and seek to find acceptable solutions. Attendees were invited to re-introduce themselves and provide any voluntary information regarding specific interests they may represent.

OVERVIEW OF THE PROPOSED INTEGRATED PLAN

- The Consulting Team (Kleinfelder/Pare) gave an overview of the proposed program of capital and programmatic alternatives which were developed, in part, on the basis of criteria established through the public process. Regulatory drivers additionally influenced alternative development. As has been the guidance from the initial meeting, the plan focuses on addressing the water quality issues (particularly related to the Nitrogen Total Maximum Daily Load or TMDL), public health (primarily related to nitrates and bacteria in private drinking water wells) and affordability and sustainability of a proposed plan. The outline of the tiered approach for program implementation is provided in the PowerPoint Presentation provided in **Attachment B**.

FACILITATED DISCUSSION

- A robust discussion followed presentation of the proposed plan. Questions and comments fell into several primary areas of interest, including:
    - Are we solving the "right problem"?
        - Should we consider potable water solutions more broadly (and not introduce problematic sewering impacts)?
        - Take advantage of street opening to install both water and sewer for future activation;
        - Don't limit solutions to East Branch only – other water resources will benefit
        - Will solutions survive changes due to climate impacts?
        - Status quo is not a realistic approach – must plan for success of this effort recognizing that it will not fix itself
    - Are the solutions affordable?
        - Can we see the cost on a Nitrogen reduction basis?
        - Presentation needs to show more "bang for the buck" in environmental benefit
        - Individual cost of de-nitrification upgrades compare well to potential betterment costs (in general)
        - We need to seek out funding sources to complement private investment
        - Sewer is a town-wide benefit (economic development and environmental protection) and should be financed through general obligation bonds
        - Look at other funding methods such as just enacted by Sandwich (real estate surcharge to pay for infrastructure)
    - How do we manage and operate public infrastructure?
        - Governance issues must be addressed for many of the alternatives to be successfully realized
        - There are some existing controls through BOH and Planning regulation, but they are not consistently enforced
    - Technical considerations
        - Mandatory de-nitrification systems for all new and significant re-construction is generally, but not universally supported
        - Focus solutions on areas generating the greatest pollutant load
        - Current BOH efforts have met resistance, and they would support a universal requirement to eliminate need for exclusionary criteria
        - There should be greater emphasis on stormwater management
        - Provide best practices guidance for homeowner landscaping near water's edge – not only limited to agricultural land use
        - Costs are site specific so be cautious about how they are represented in the report
    - Conveying the right message
        - Important that people hear the right message and framed for easier understanding

- Make the case that status quo is not okay

The questions and comments recorded here were not intended to represent general consensus or a common statement from stakeholders regarding the proposed IP, but rather were part of a dialogue to help understand the proposed program and reiterate concerns. These comments were taken into consideration in development of the draft report.

ATTACHMENTS
Roster of Attendees
Powerpoint Presentation

Attachment A
Attendance Roster

Westport Stakeholder Roster – Meeting 1			
Name	**Group Represented**	**Contact email**	**Attending (Y/N)**
Maury May	Social/Citizen	maurymay@hotmail.com	Y
Dora Milliken	Social/Citizen	wyndfieldfarm@mac.com	N
Steve Oellette	Social/Citizen	WPT02790@yahoo.com	Message
Len Potter	Social/Citizen	Lenfp1@aol.com	Y
Betty Slade	Social/Citizen	dcolebslade@aol.com	Y
John Bullard	Social/Citizen	johnkbullard@gmail.com	Y
Bob Carrigg	Economic Dev.	Bobbyca878@aol.com	Y
Arlene Cloutier	Economic Dev.	arlene@southcoastalrealty.com	Y
Sean LaFrance	Economic Dev.	SRLafrance@gmail.com	Y
Sean Leach	Economic Dev.	sleach@sitec-engineering.com	Y
Tanja Ryden	Economic Dev.	wfa@westportriver.org Tanja.ryden@gmail.com	Y
Lee Tripp	Economic Dev.	trippfarm@msn.com	Y
Chris Capone	Environmental/concom	ccagent@westport-ma.gov	N
Ross Moran Jennifer Dubois	Environmental/land trust	ross@westportlandtrust.org jennifer@westportlandtrust.org	N Y
Korrin Petersen	Environmental/BBC	petersen@savebuzzardsbay.org	Y
Tom Schmitt	Environmental/WRWA	Schmitt23@yahoo.com	Y
Phil Weinberg	At Large		Y
Bob Daylor	At Large		Y
Jim Hartnett	At Large		Y
David Cole	At Large	johnwilbour@gmail.com	Y
Tim Gillespie	At Large	TGillespie@charter.net	Y
Rich Castenson	At Large	RCastenson@cox.net	Y
Roberta Carvalho	WRWA	water@wrwa.com	(added for WS2)
Deborah Weaver	WRWA	director@wrwa.com	(added for WS2)

Attachment B
PowerPoint Presentation

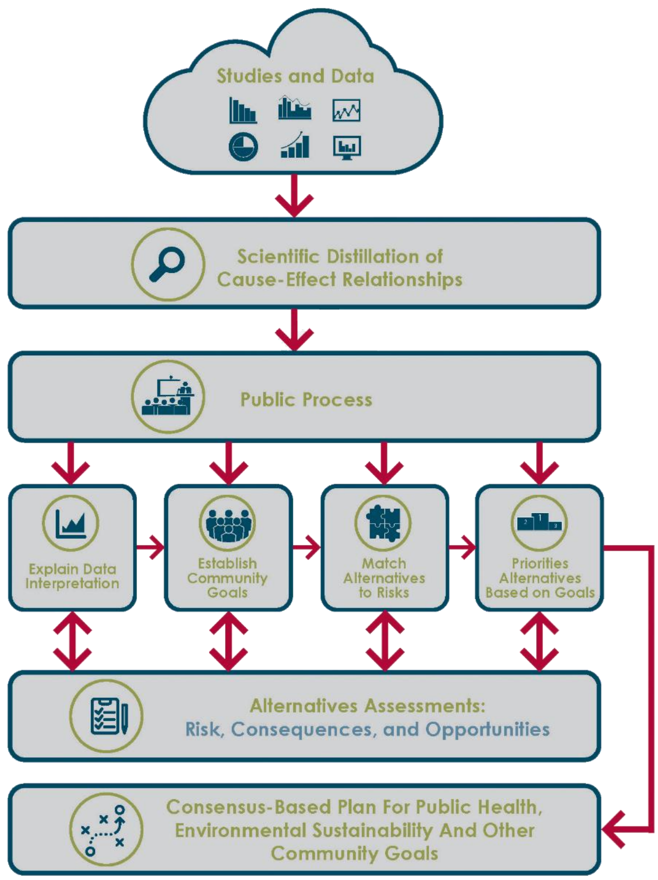
Targeted Integrated Water Resources Management Plan Fact Sheet

Town of Westport, MA

September 25, 2019

OVERVIEW

This fact sheet is intended to summarize the process and recommendations of the Integrated Plan for the Water Resources of Westport, MA. These recommendations are **not final**, but are summarized herein to help promote informed discussion as the Town works with its stakeholders toward an agreeable path forward.



SUMMARY OF PROGRAM OBJECTIVES

Environmental

- Satisfy **TMDL** requirements (MEP Land Use Model)
- Influence measurable reduction in nitrogen concentrations at sampling points
- Increase **resiliency to climate change** and sea level rise

Social

- Promote **public health** with clean, secure water supply and stormwater practices
- Promote **recreation** on and in the water
- Maintain and improve the **quality of life**

Economic

- Promote **economic development**
- Promote **cost equity** in distributed solutions
- Employ **effective** investments
- **Increase agricultural output** with environmental responsibility
- **Reduce risk to shellfish** economy

Implementation

- Identify a **phased** suite of solutions that vary in scale and in timing
- Consider **regional** opportunities and benefits
- Develop an **implementable** plan
- Establish a **realistic timeline** linked to **measurable metrics** for success and **future adjustments** to the Plan

SEVERAL KEY STAKEHOLDER THEMES

Recurrent Stakeholder Themes	Impact on Draft Plan
While focusing on Nitrogen reduction, we must not lose sight of the need for clean drinking water.	Plan addresses contaminated wells with selective sewering, cluster septic systems, and public water supply as contingency.
Ensure that the Plan addresses issues regionally, and does not overburden specific neighborhoods (equity).	Plan focused on watershed-wide loads and targets, and not just in areas that have non-zero TMDL targets for load reduction.
Do not over-burden the agricultural community after the study showed the successful impact of recent load reduction.	Plan recommends low capital cost alternative (vegetative buffers) consistent with or complementary to existing land uses.
Denitrifying septic systems may play a role in reducing nitrogen in the river.	Multiple means to expand use of denitrification across the Town are provided for consideration.
Economic Development in targeted zones will likely require a sewering option**.**	Some sewering is recommended in areas where it can serve double duty for commercial development and mitigation of potable water well contamination in residential neighborhoods.

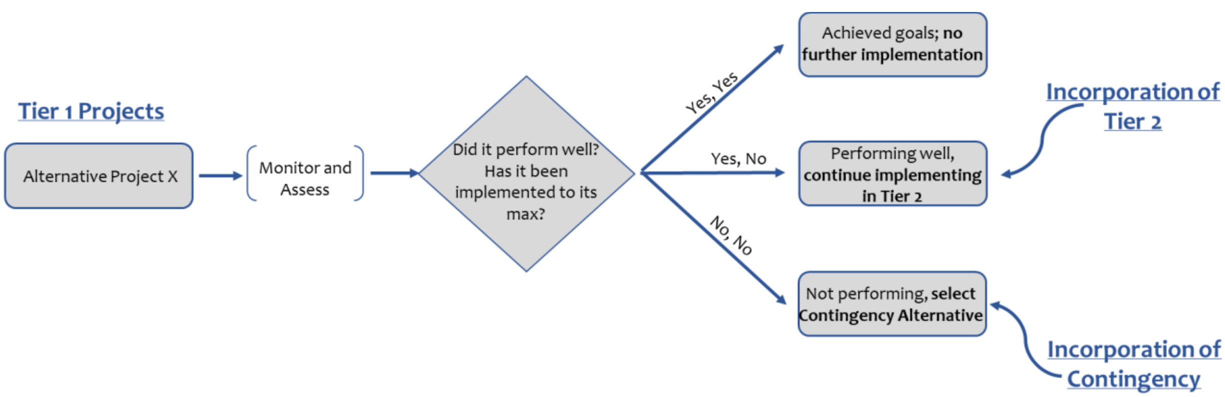
SUMMARY OF DRAFT PLAN: Tiered Alternatives for Phased Implementation

Based on expressed goals and stakeholder input, the planning team compiled, screened and ultimately proposes this draft program of alternatives that provide impactful improvements to local water quality and/or address localized drinking water concerns. Implementation is recommended in tiers as follows and as represented in the figure below:

Tier 1: initial recommendations for near term implementation
Tier 2: expansion/modifications of select alternatives based on Tier 1 implementation results
Contingency: alternatives for consideration during adaptive management process

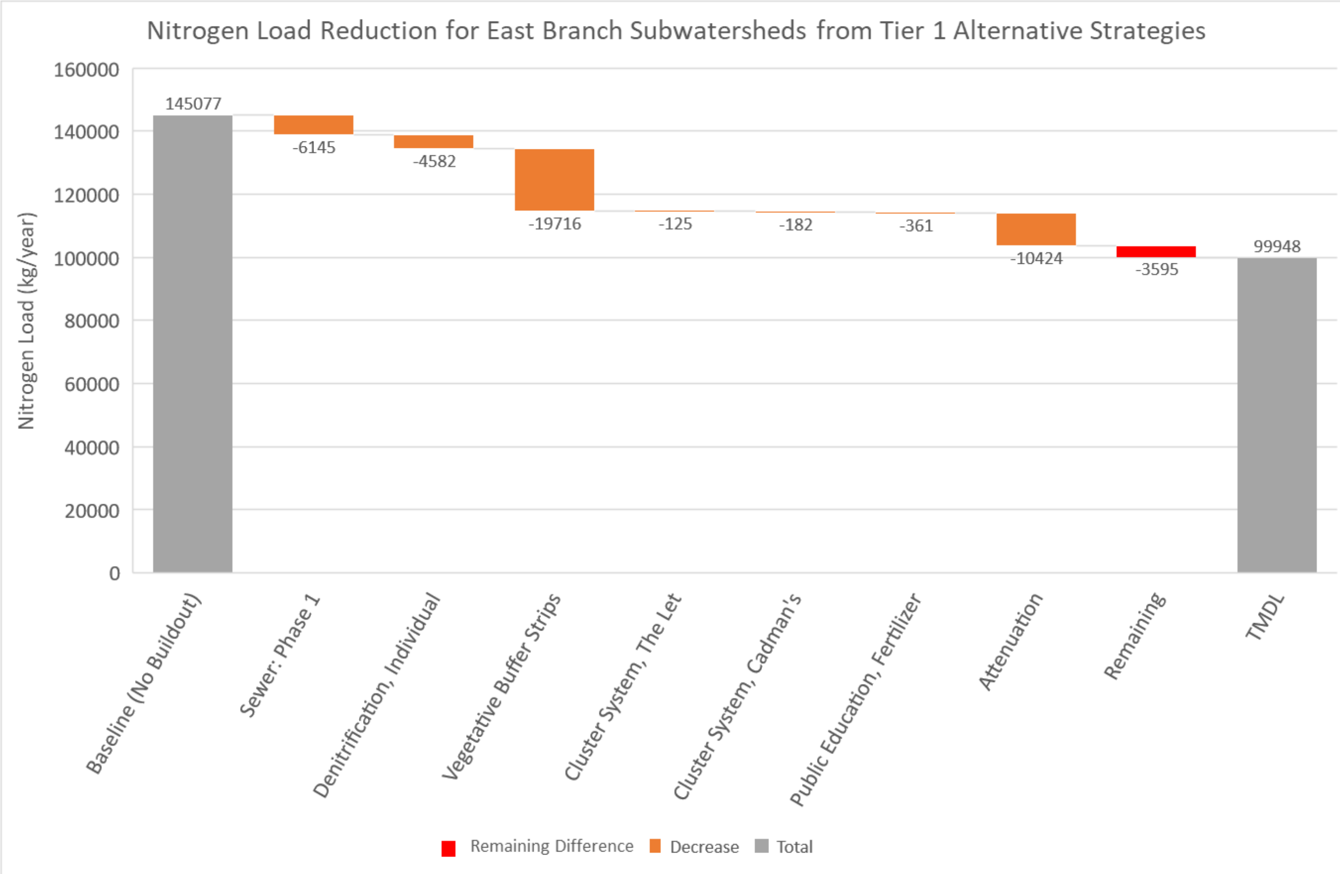
Tier/ Recommended Action	Area/Scale	Estimated Cost	Benefits/Notes
1/Sewer: Phase 1	Primarily Rt. 6 corridor and private well "hot spots"	$18,400,000	Reduce nitrogen in the watershed, improve water quality of proximate drinking wells and support economic development in targeted area.
1/Cluster System with Denitrification	The Let	$400,000* *design & construction only; no land acquisition $	Serves neighborhood with drinking water quality concerns from septic density, and which is vulnerable to impacts of sea level rise/climate change through salt water intrusion and higher groundwater.
1/Cluster System with Denitrification and Reclamation	Cadman's Neck	$570,000* *no land acquisition $	Same as above. In addition, area is proximate to possible "reclaimed" water customer contributing to resiliency.
1/Denitrification Incentives	All existing systems	variable	Purpose is to provide homeowners with financial incentive to upgrade to denite in advance of obligatory upgrades triggered by Title V regulations.
1/Vegetative Buffer Strips	Pilot Areas (voluntary)	$300/ac-ft/year	This alternative is less technologically complex and capital intensive than most, but does require active management/monitoring of the buffer areas. Whether that is a public function or a private responsibility is not determined.

Tier/ Recommended Action	Area/Scale	Estimated Cost	Benefits/Notes
1/Public Education: Fertilizer Use, etc.	Town-wide	Negligible	Encourages town-wide ownership of the water quality protection mission.
1/Denitrification Systems	New Construction	$34,000	Recognition of town-wide obligations for long term water quality health.
2/Zoning Modifications	Rural Services zoning district	negligible	Intent is to reduce water quality impact of future buildout.
2/Sewer and Public Water	CDM Phases 2 - 4	TBD – further analysis required	Future phases for sewering were identified by CDM; assumptions should be revisited prior to reconsideration.
2/Additional Treatment Systems	Well Contamination "hot spots"	TBD – site specific	To serve areas not otherwise contained within existing proposed sewer areas.
Contingency/PRBs	Pilot Areas	avg. $3,200/LF	Low maintenance costs but high upfront costs; proven effective in other areas.
Contingency/Barrages (w/Constructed Wetlands), stormwater BMPs, Green Infra.	Bread and Cheese Brook Catchment	TBD – requires further analysis	Use of natural treatment systems maintains open space and rural character, provides aesthetic and resiliency benefits as well as nutrient reduction.
Contingency/Public Water Supply	The Let, Route 6	$24,000,000+ (based in part on CDM estimates)	Water supplies in shallow aquifers may be vulnerable to climate impacts. This alternative provides resiliency (re the Let) as well as potential economic development opportunities (Route 6).



POTENTIAL COMPLIANCE WITH TMDL TARGETS

Westport has identified several water resource challenges which this integrated plan addresses. Among them, however, is a regulatory priority that serves as a benchmark against which program effectiveness is measured by regulators. The Total Maximum Daily Load (TMDL) is the calculated maximum amount of a specific pollutant which a water body can accommodate and still meet water quality standards. For the East Branch of the Westport River, the pollutant of greatest concern is Nitrogen. Reducing the amount of Nitrogen discharged to the river is an important objective of the plan. The "Tier 1" suite of alternatives proposed in the plan will allow Westport to make great strides towards meeting that pollutant reduction goal under existing conditions. Additional ("Tier 2" and contingency) alternatives will provide options to adapt the program in the future based on real-world results of program implementation. The graph below demonstrates how a combination of alternatives (described in the table above) may result in potential improvements if applied to their maximum potential.



FREQUENTLY ASKED QUESTIONS

Q. Will the plan allow the Town to achieve the TMDL?

A. The IP is not intended to be a TMDL Implementation Plan. It will allow the Town to make continuous and incremental progress towards the TMDL while simultaneously addressing other pressing local needs.

Q. Why are you recommending all new construction require denitrification septic systems?

A. The Town expressed the desire to equally share the burden and the benefits of the IP. Future construction will contribute to nitrogen loads. While not all systems contribute equally (e.g. proximity to water bodies) over the longer term, reducing the nitrogen load to local groundwater will contribute to continued water quality improvement.

Q. Why aren't farmers asked to do more?

A. Some reductions in nitrogen loading from agricultural land uses have already been achieved. Continued education and outreach in addition to implementation of best practices and vegetative buffer strips at agricultural boundaries has significant potential to reduce nitrogen loads. Balancing the rural/agricultural character of the community with improved water quality was a strong theme expressed by the community.

Q. How will the implementation be funded?

A. The variety of alternatives will influence funding options. Some of the alternatives (such as denitrification systems in new construction) may be privately funded. Some may be privately funded but subsidized (such as voluntary upgrades of compliance systems). Others may be publicly funded (such as sewer) with partial funding through sewer assessments to serviced properties. Specific funding strategies will be determined through local determination.

Targeted-Integrated Water Resource Management Plan

Workshop No. 3
Draft Integrated Plan

TOWN OF WESTPORT
September 25, 2019

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Workshop #3 Agenda

- Brief Team Presentation on Recommended IP Components
- Facilitated Discussion – this is YOUR plan
  - Is this the right plan?
  - Is it the right scale?
  - Where do you see challenges?
  - What more do you need to see or know?

Goals For Today

- Understand the IP as currently proposed

- Achieve general agreement on Tier 1 program

Schedule for Near Term Project Milestones

- Seeking Consensus – Workshop No. 3 (Today)
- General Public Meeting – Mid-October
- Brief MassDEP on the Town's Action Plan – October/November
- Publish the Targeted-Integrated Water Resources Management Plan – November/December
- Work with Board of Selectmen on implementation through development of warrant articles

Integrated Plan Approach

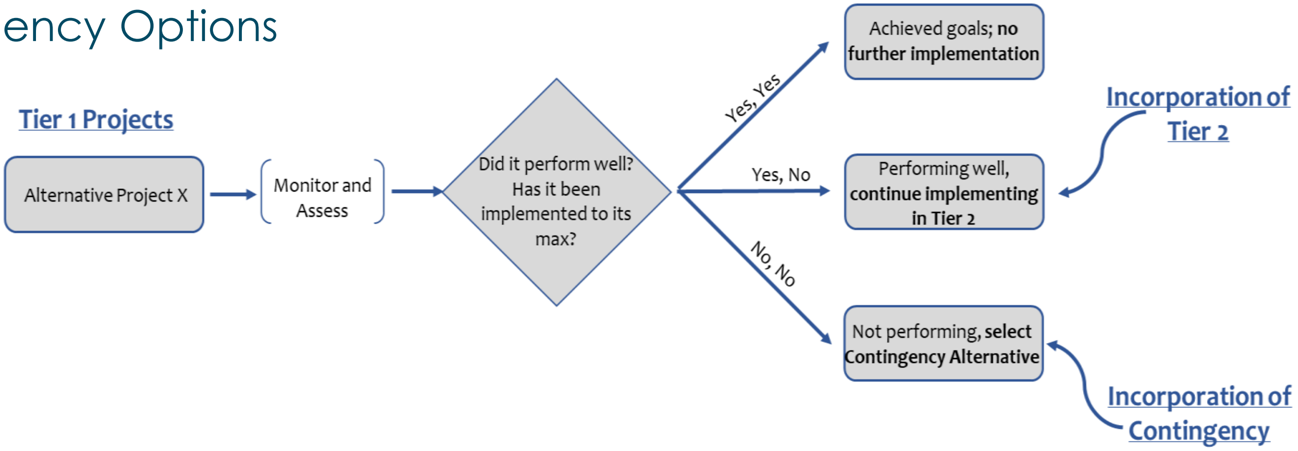
- Parallel Paths and Complementary Purposes:
  - Focus on nitrogen reduction and public health improvements
  - Incorporate economics, sustainability, and resilience into plan
  - Support community engagement and education
  - Continue and enhance data collection and monitoring for adaptive management decision-making

Integrated Plan Progression

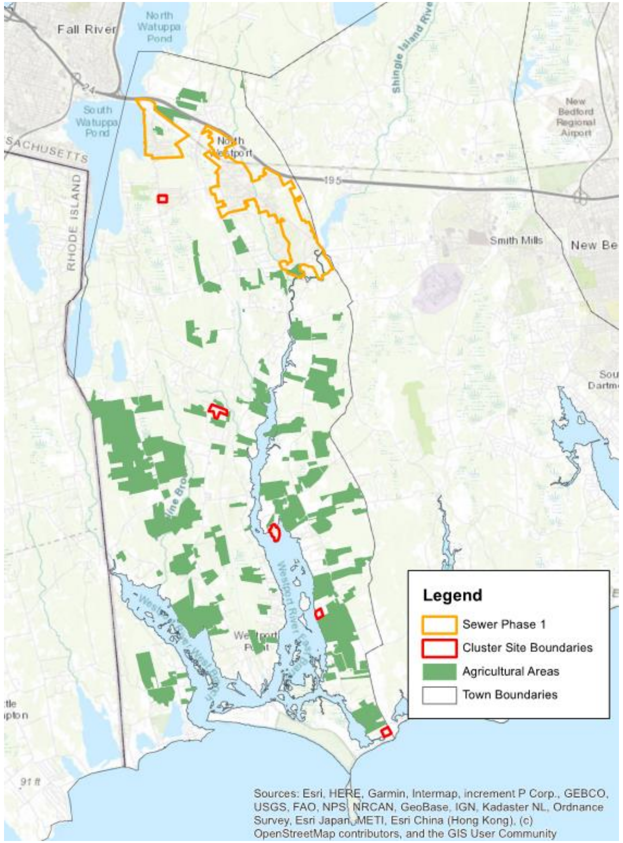
- Public Meeting: establish common goals
- Workshop 1: share what we were learning and ground truth data
- Workshop 2: gather feedback on proposed alternatives
- Internal Working Session: match proposed alternative to identified areas of public health (water) issues and pollutant loading
- Cost Screening: eliminate or defer alternatives based on cost
- Geographic Distribution: implement watershed-wide, not just hot spots
- Land Use Basis: acknowledge agricultural load reduction achieved in past decade
- Adaptive Plan: include hard infrastructure, policies, and mix of public and private infrastructure solutions

Approach

- Phased Plan:
  - Ongoing efforts
  - Tier 1 Recommendations
    - Initial Projects (capital projects)
    - Programs
  - Tier 2 Alternatives
  - Contingency Options



Overview of Integrated Plan – Tiered Alternatives

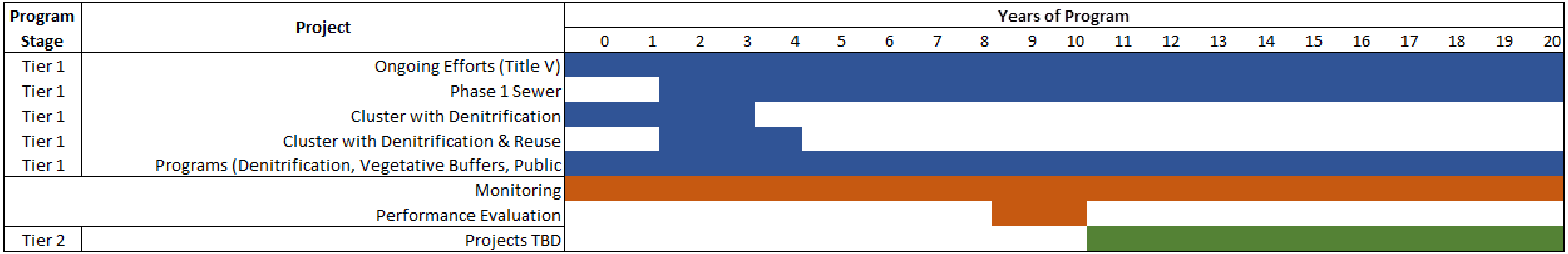


Tier/Category	Alternative	Benefits		
		Nitrogen Reduction	Public Health Benefits	Other (Economic, Sustainability Resilience, Aesthetic)
Ongoing/ Wastewater Treatment	Title V Upgrades	✔	✔	
1/ Public Infrastructure	Sewer: Phase 1	✔	✔	✔
1/ Wastewater Treatment	Cluster System with Denitrification: The Let	✔	✔	
1/ Wastewater Treatment	Cluster System with Denitrification and Reclamation: Cadman's Neck	✔	✔	✔
1/ Policy, Wastewater	Denitrification Incentives, Existing Systems	✔	✔	
1/ Stormwater/Green Infrastructure	Vegetative Buffer Strips	✔		✔
1/ Outreach	Public Education: Fertilizer	✔		
1/ Policy, Wastewater	Denitrification for New Construction	✔	✔	
2/ Policy	Zoning: Rural Services District	✔	✔	✔
2/ Public Infrastructure	Sewer and Water (Phases 2-4)	✔	✔	
2/ Wastewater Treatment	Additional Treatment Systems (Cluster, IA, etc.)	✔	✔	
Contingency/ Innovative Technology	Barrages & Constructed Wetlands; Green Infrastructure	✔	✔	✔
Contingency/ Innovative Technology	Permeable Reactive Barriers (PRB): Pilot	✔		
Contingency/ Public Infrastructure	Public Water Supply Development, the Let, North Westport (well hotspots)	✔	✔	

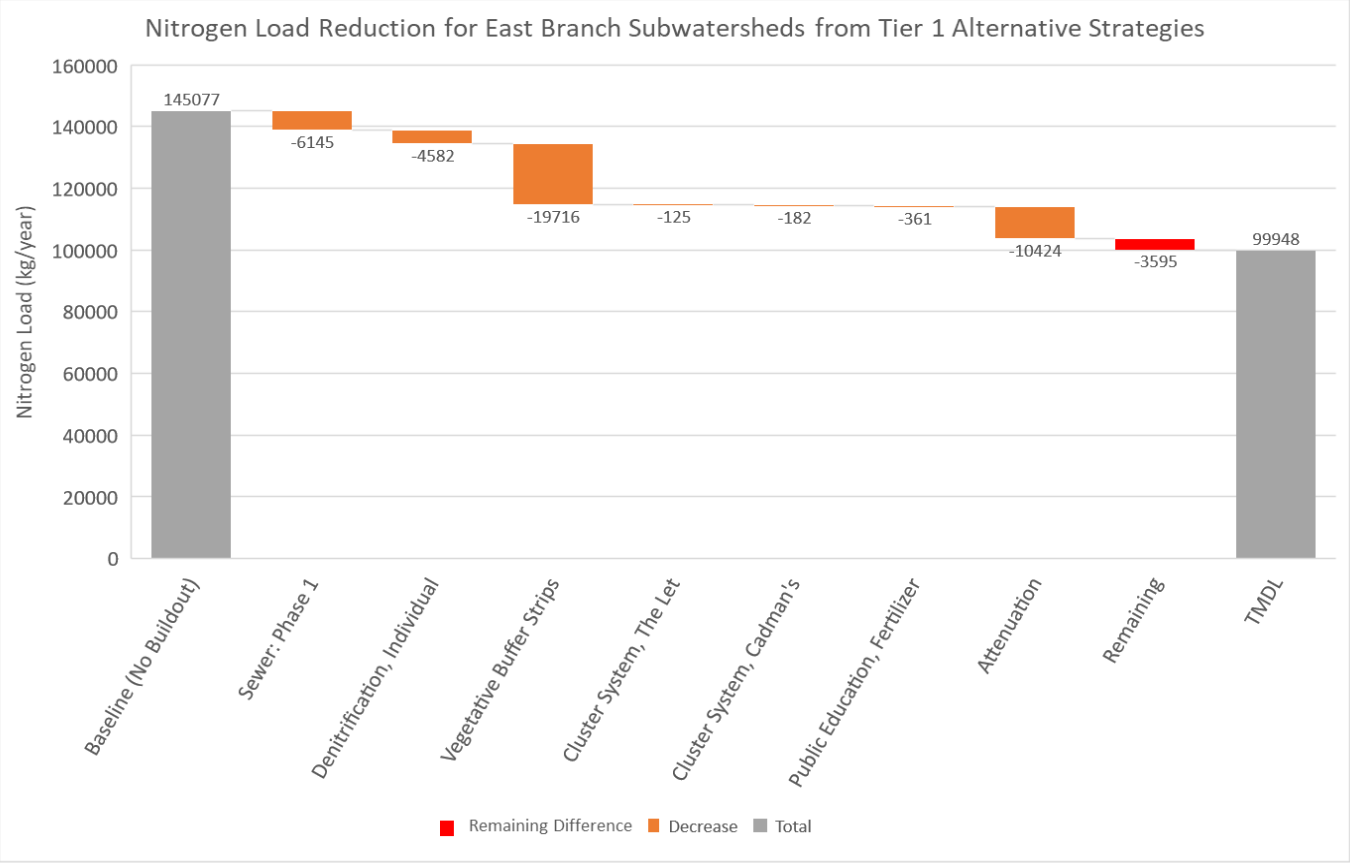
Proposed Timeline*

- Proposed timeframe for various program phases
- Performance evaluation to determine Tier 2 projects

*program intended to be adaptive and responsive to results; timeline for demonstration only

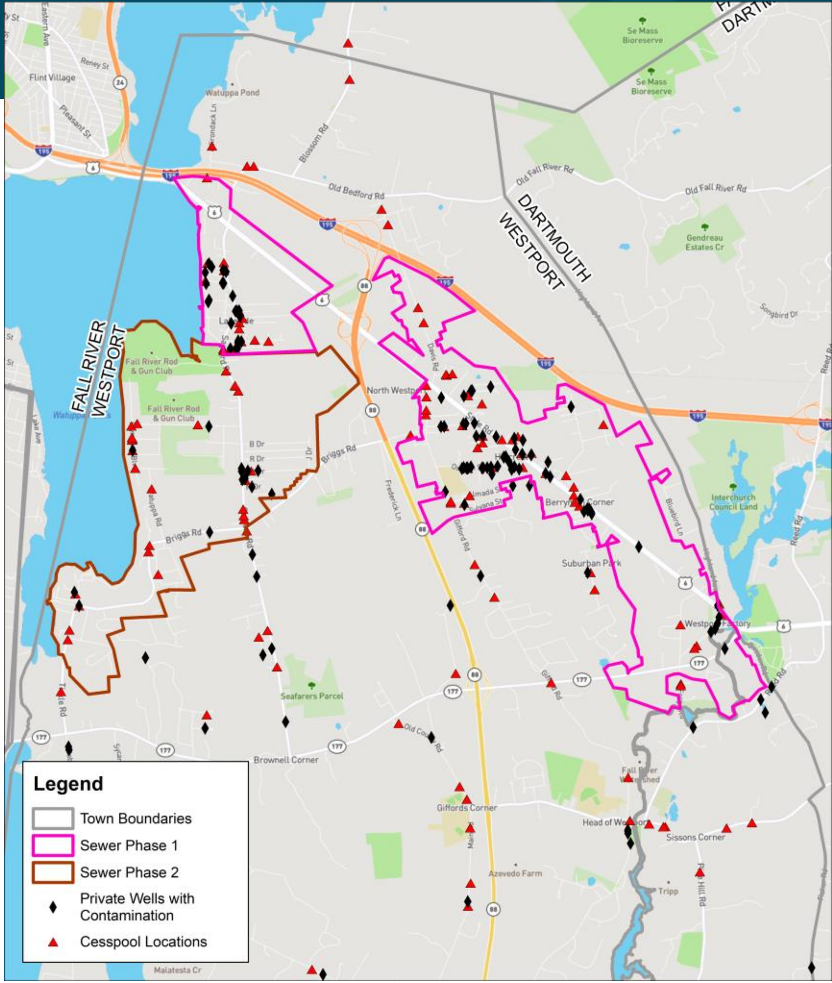


Overview of Integrated Plan – Approaching the TMDL



Tier 1: Sewer along Route 6 (Phase 1)

- Based on 2004 CDM Report: Phase 1 Sewer
- Mitigate public health hazards and reduce nitrogen load
- Approximately 977 properties converted from septic to sewer
- Estimated implementation cost: $18,400,000
- Concurrent Water System installation
- Administrative Management TBD



Tier 1: Cluster system with denitrification: The Let

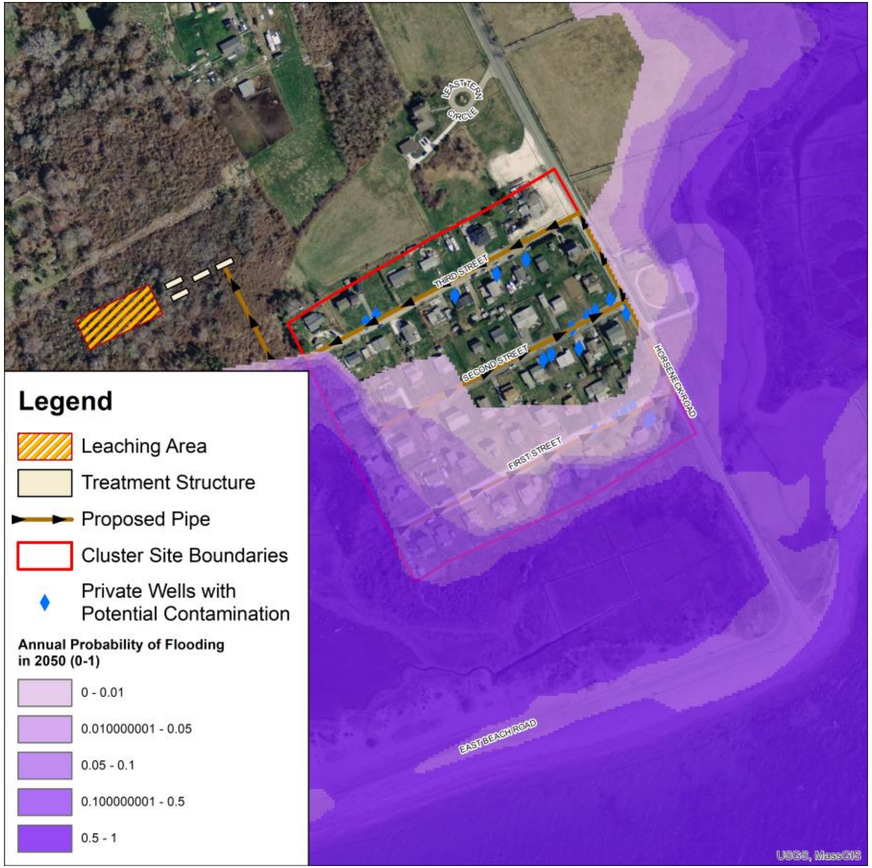
- Mitigate public health hazards and reduce nitrogen load
- Approximately 34 properties, 21 documented private well contamination issues
- Estimated construction costs
  - The Let: $400,000

- Ownership/Operation Management TBD

An Adaptive Management Advantage – Climate Impacts

- Preliminary 2050 coastal flooding estimates (combination of sea level rise estimates and coastal storm climate scenarios)
- Surficial flooding results only – groundwater impacts unknown
- Vulnerabilities for public or private Infrastructure

*Derived from output of the MC-FRM to be released in 2019



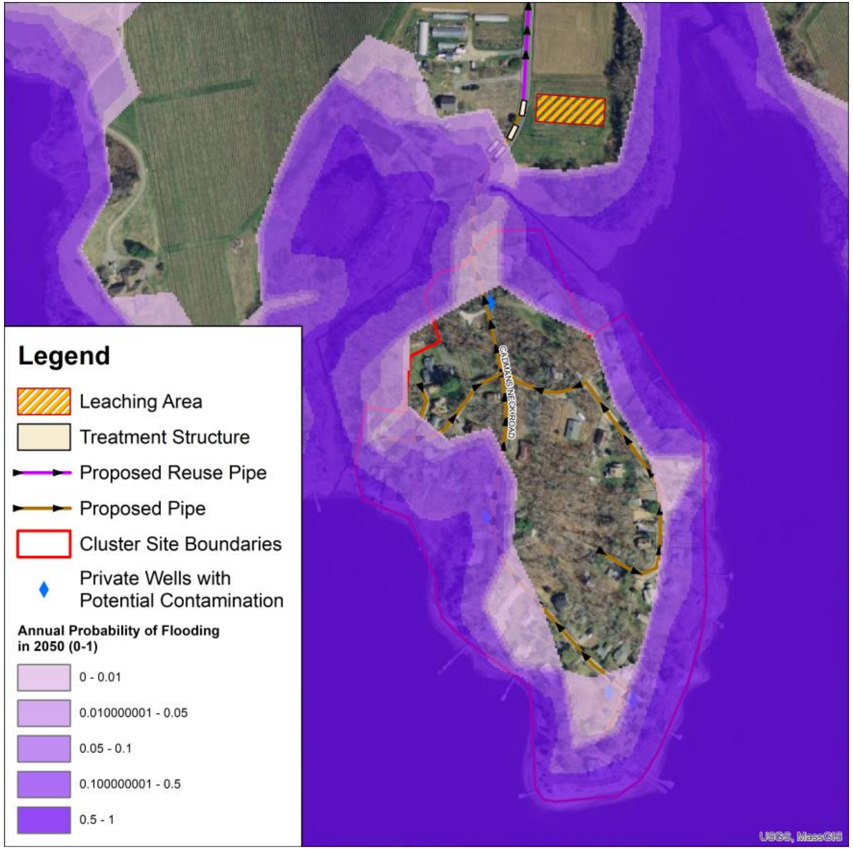
Tier 1: Cluster system with denitrification and re-use feasibility study

- Mitigate public health hazards and reduce nitrogen load
- Re-use in the form of irrigation offers additional economic, sustainability benefits
- Approximately 51 properties, 5 documented private well contamination issues
- Estimated construction costs
  - Cadman's Neck: $570,000
- Ownership/Operation Management TBD

Cadman’s Neck – Climate Impacts

- Similar to the Let; 2050 Coastal Flooding probabilities

*Derived from output of the MC-FRM to be released in 2019

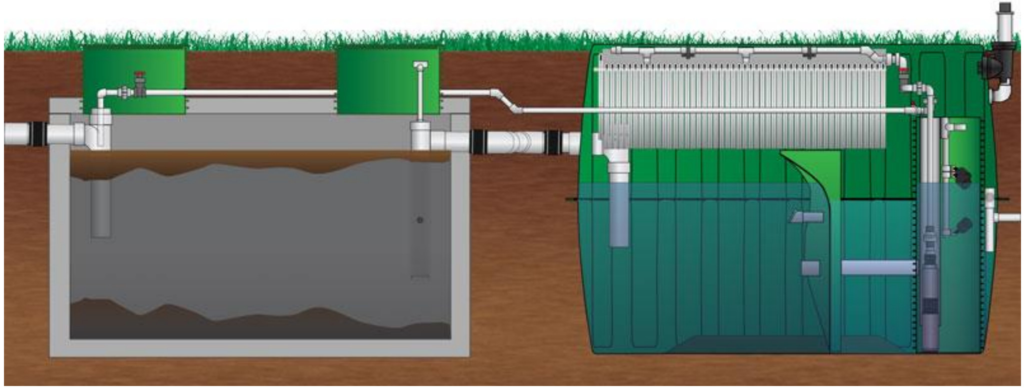


Integrated Plan: Additional Tier 1 Programs

- **Programmatic Recommendations: implement programs with proven benefits**
  - Denitrification incentives for individual existing systems
  - Denitrification for new construction
  - Vegetative filter strips for agriculture
  - Public education
    - Residential fertilizer reduction
    - Septic System Maintenance
    - Low Impact landscaping
    - Advertise Town-sponsored incentives

Tier 1: Denitrification incentives for individual existing systems

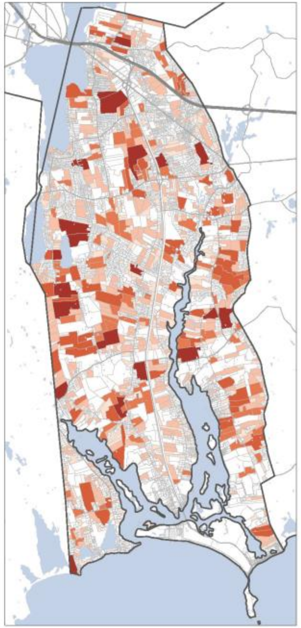
- Typical implementation cost: $21,000 (based on **upgrade from existing conventional** system)
- Potential incentive ideas:
  - Low or no interest loans
  - Town pays for X% of implementation cost
  - Yearly $ amount allocated for whole Town, first come first serve
  - Tax breaks
  - Zoning relaxations



Tier 1: Denitrification for new construction

- Various strategies and levels of implementation
  - All new construction
  - **New construction in East Branch (would reduce N load from buildout by approximately 39%)**
  - New construction within certain proximity to East Branch
  - New construction above a design wastewater load threshold
  - Cluster denitrification for new construction above a design wastewater load

Westport contains an estimated 3,633 Buildable Lots



Buildable Lots Per Parcel

- 0
- 1
- 2 - 5
- 6 - 10
- 11 - 20
- 21 - 88

Scope of the GIS Anlysis

8,973	Total Parcels
- 7,608	Parcels with No Building Potential
1,365	Build-out Parcels

Scope of the Parcel-by-Parcel Review

880	Modified Parcels
+ 485	Unchanged Parcels
1,365	Build-out Parcels

Westport Build-Out Summary Table

Buildable Lots Per Parcel	Number of Parcels	Number of Buildable Lots	Percent of Buildable Lots	Total Area (Acres)	Percent of Area
0	7,985	0	0.0%	19,431	58.4%
1	541	541	14.9%	2,883	8.7%
2 - 5	290	860	23.7%	4,403	13.2%
6 - 10	82	629	17.3%	2,380	7.2%
11 - 20	54	816	22.5%	2,599	7.8%
21 - 88	21	787	21.7%	1,550	4.7%
	8,973	**3,633**	**100%**	**33,247**	**100%**

Tier 1: Vegetative filter strips for agriculture

- Annual cost: $300 per acre, per year
- Implement as a program: annually convert pre-determined acreage to filter strips
- Prioritize high-risk areas at the start
- Town/individual financing, easements

Integrated Plan: Tier 2

- **Tier 2, and Future Considerations/Contingencies: investigate projects after evaluating the success of initial implementation projects**
  - Barrages (constructed wetland)
  - Zoning (rural services, flood inundation zones)
  - Public Water Supply Development (The Let)
  - Sewer and Public Water (Phases 2-4)
  - Additional Treatment Systems (Cluster, PRBs, etc.)

Let's Revisit YOUR Plan

- Is this the right plan?
- Is it the right scale?
- Where do you see challenges?
- What more do you need to see or know?

Open Discussion

- Questions?

Thank You!

Targeted-Integrated Water Resource Management Plan

Public Meeting
Draft Integrated Plan

TOWN OF WESTPORT

November 13, 2019

KLEINFELDER
Bright People. Right Solutions.

PARE CORPORATION

Planning for Westport's Future – Starting Today

- **PROJECT OBJECTIVES:** What we heard from **you** about what makes Westport special and this project important
- **BASELINING:** How we got here – past and present conditions
  - What has changed & why does it matter
- **ALTERNATIVES:** Identifying challenges and proposing solutions
- **RECOMMENDED PROGRAM:** How will this work?

What does Westport strive to accomplish?

Environmental

- Satisfy **Total Maximum Daily Load** requirements for nitrogen loads into receiving waters
- Increase **resiliency to climate change** and sea level rise

Social

- Promote **public health** with clean, secure water supply and stormwater practices
- Maintain and improve the **high quality of life**

Economic

- Promote **economic development**
- Promote **cost equity** in distributed solutions
- **Increase agricultural output** with environmental responsibility
- **Reduce risk to shellfish** economy

Implementation

- Identify a **phased** suite of solutions that vary in scale and in timing
- Develop an **implementable** plan

What does Westport strive to accomplish?

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- **Reduce risk to shellfish** economy

Implementation

- Identify a **phased** suite of solutions that vary in scale and in timing
- Develop an **implementable** plan

Only one is “regulatory” in nature. It is important, but only part of the picture.

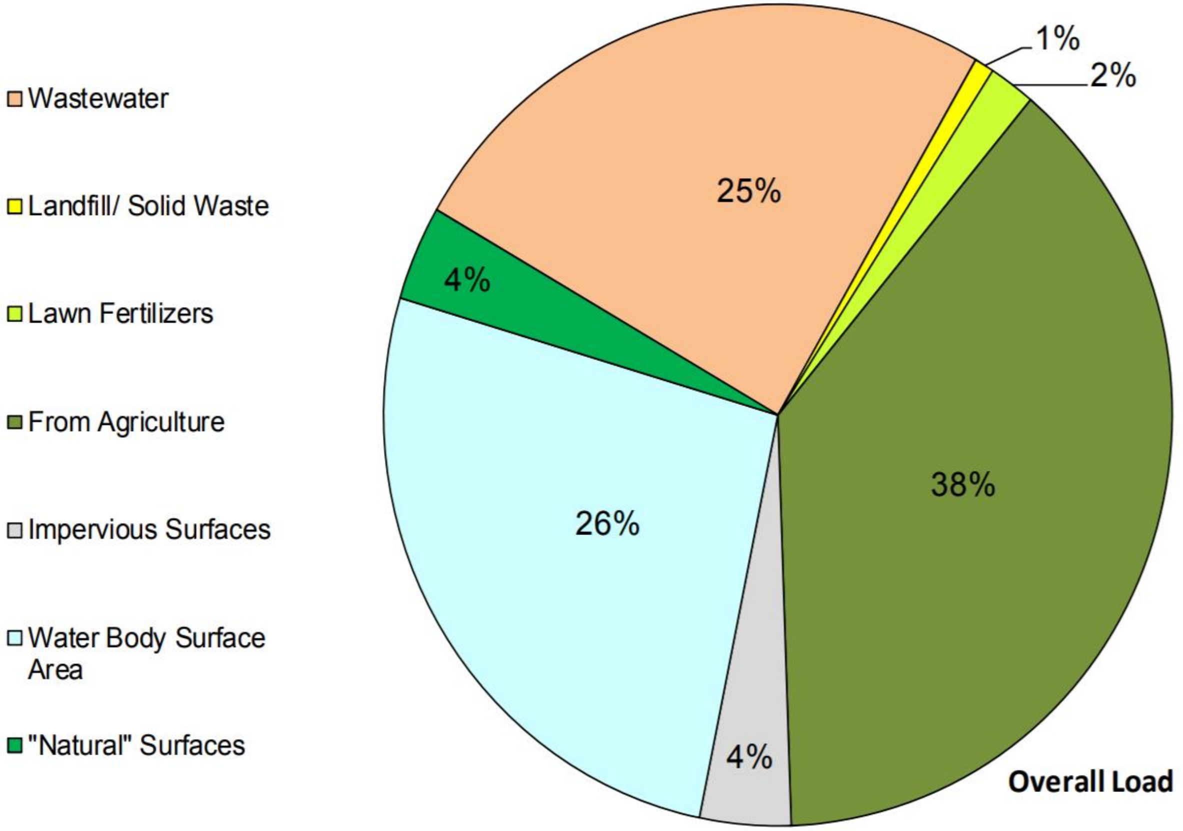
Water Quality: Driving the Bus

- Nutrients (nitrogen) in Westport River impact fishing, shellfishing, eelgrass health, algal growth, which further impact:
  - Economic growth
  - Public Health
  - Environmental Resiliency
  - Recreation/Aesthetics
- Nitrogen and bacteria in groundwater impact drinking water wells and receiving waters (surface water), which negatively affect:
  - Public Health
  - Environmental Resiliency

Enter the Regulators: Total Maximum Daily Loads (TMDL)

Massachusetts Estuaries Partnership (MEP) developed the TMDL goals for the Westport River in 2013

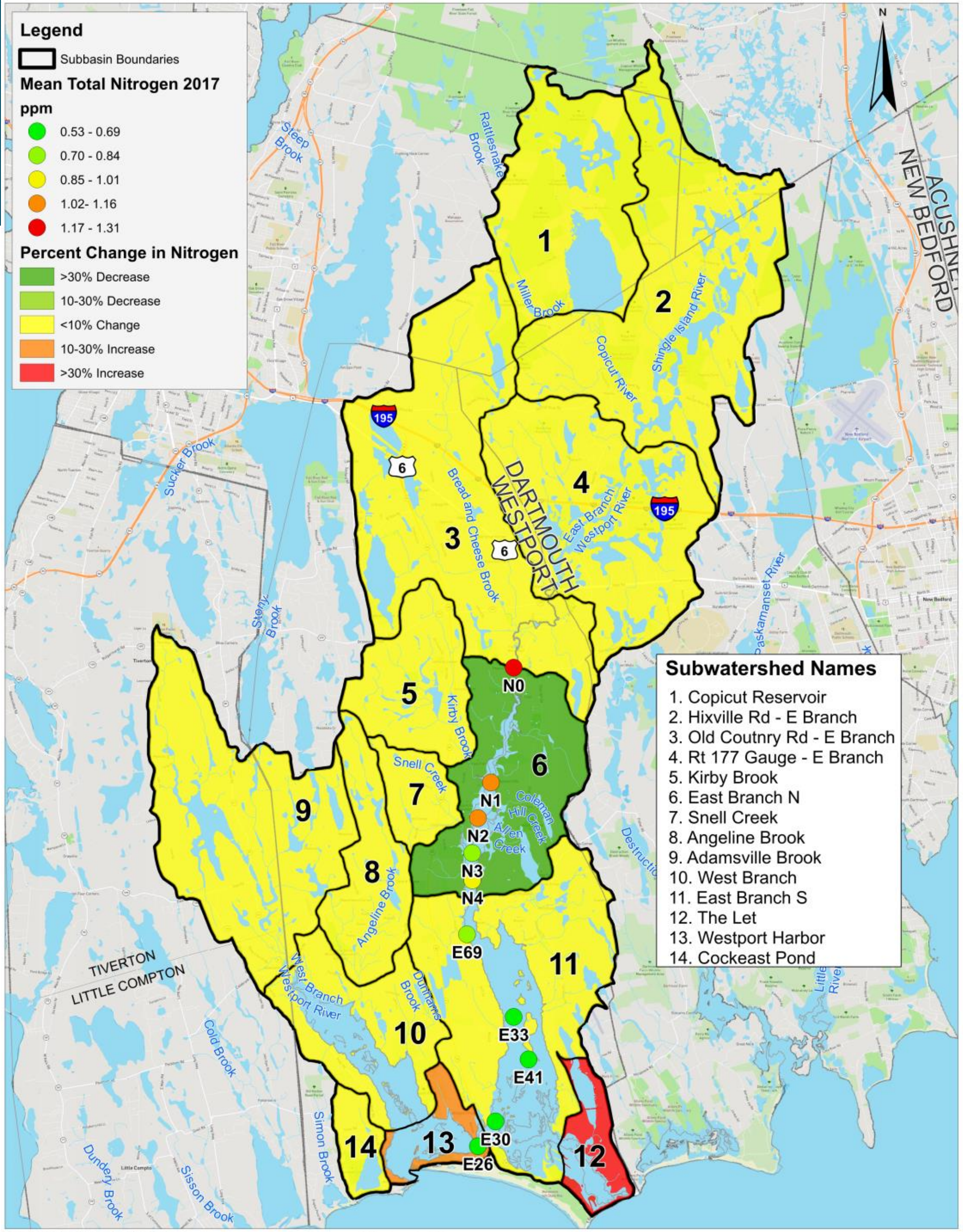
- Watershed divided into sub-watersheds, each with specific load assumptions
- These are land-use based export loads (as distinct from in-stream pollutant concentrations)
- The model suggests where strategies to reduce nitrogen will provide greatest "bang for the buck"



B. East Branch: Westport River Estuary

Updating the Baseline – What are the current reductions required to meet TMDL Goals?

- MEP data (2003-2010) was outdated and did not reflect current conditions
- We updated model inputs for the following:
  - Land Use (from MA Assessors Data)
  - Septic systems (from Westport Board of Health)
  - Agricultural practices (from Westport Agricultural Committee)

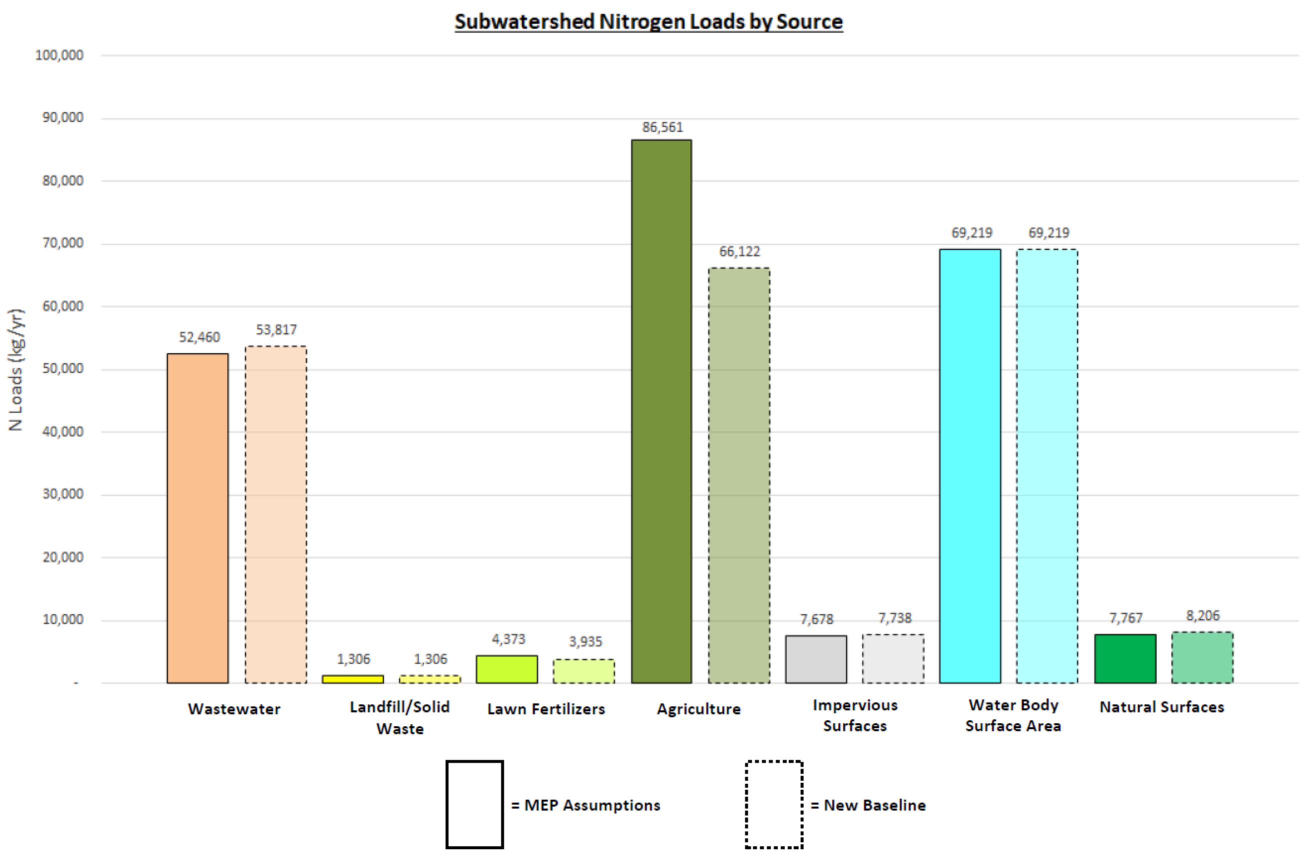


Westport River Watershed
Percent Difference of MEP Published to Current Nitrogen Loading Rates

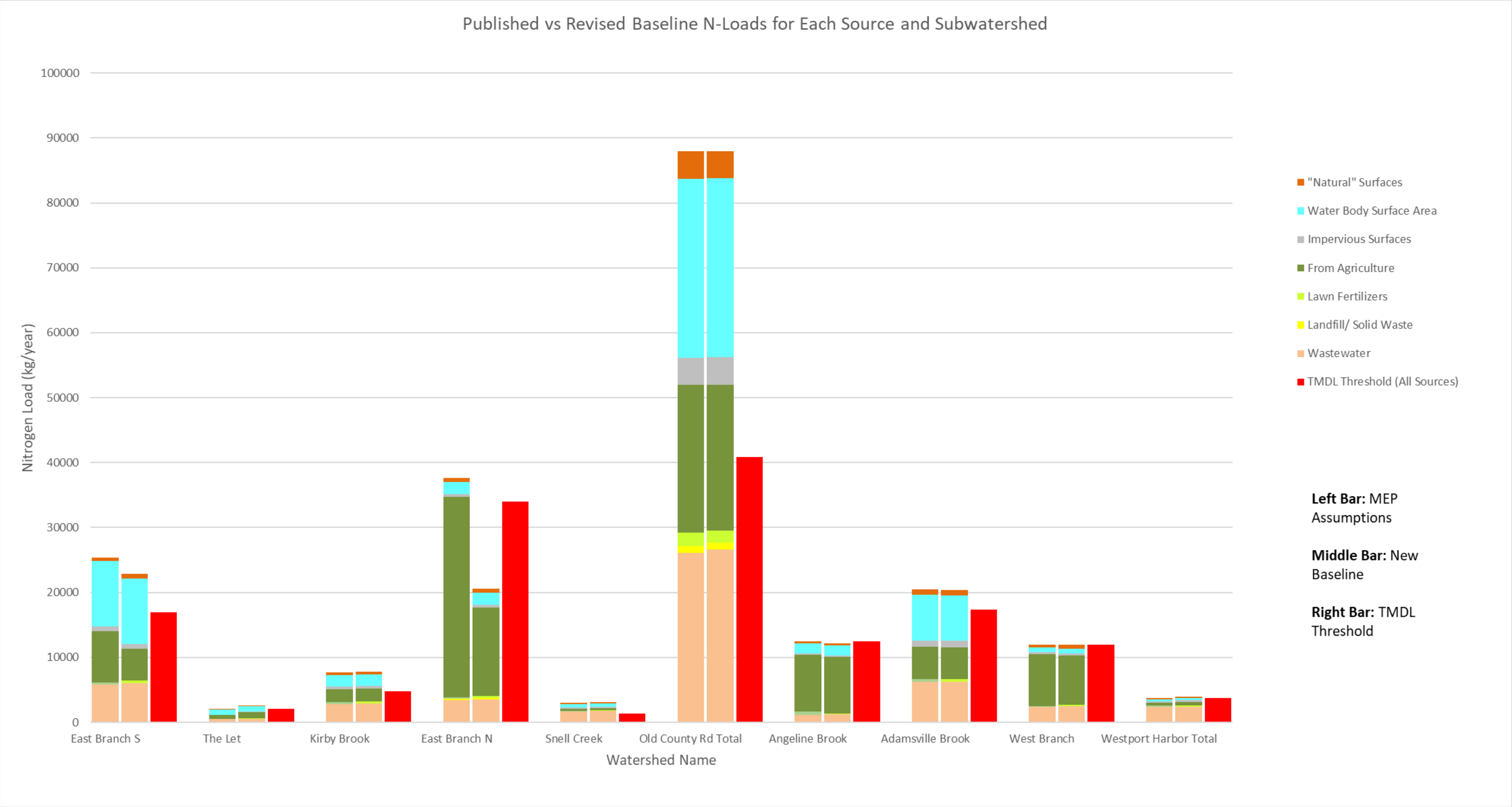
Westport, MA
Integrated Plan
20191827.001A

Loading Changes for Entire Westport River System

- Overall increase in septic loads: negative impact
  - Increases nitrogen burden
- Overall decrease in agriculture loads: positive impact
  - Lowers nitrogen burden significantly
- Atmospheric deposition on water body surfaces is likely also decreasing significantly (not reflected here)



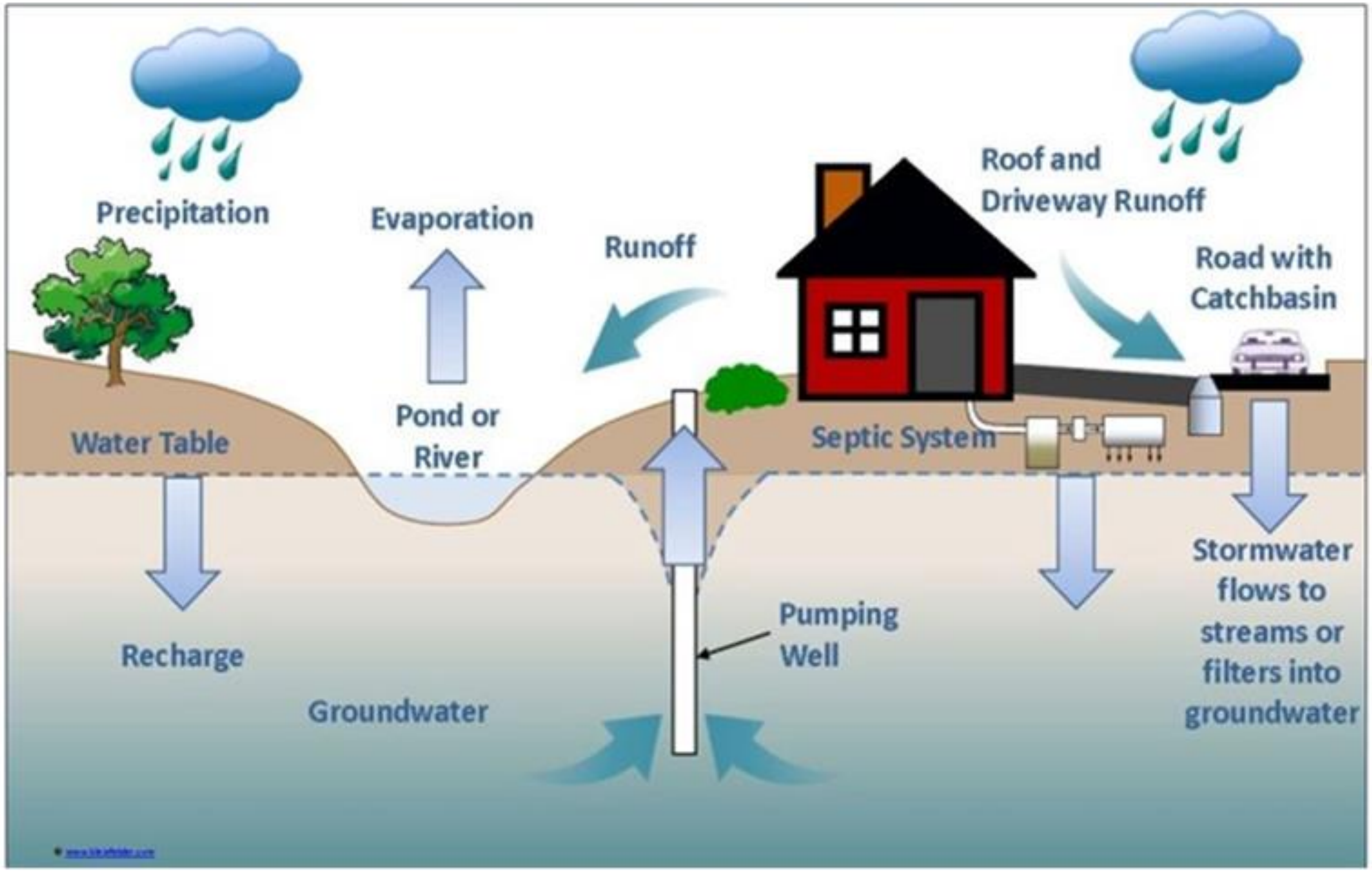
Updated Nitrogen Loadings by Subwatershed



What Changed In the Past Two Decades?

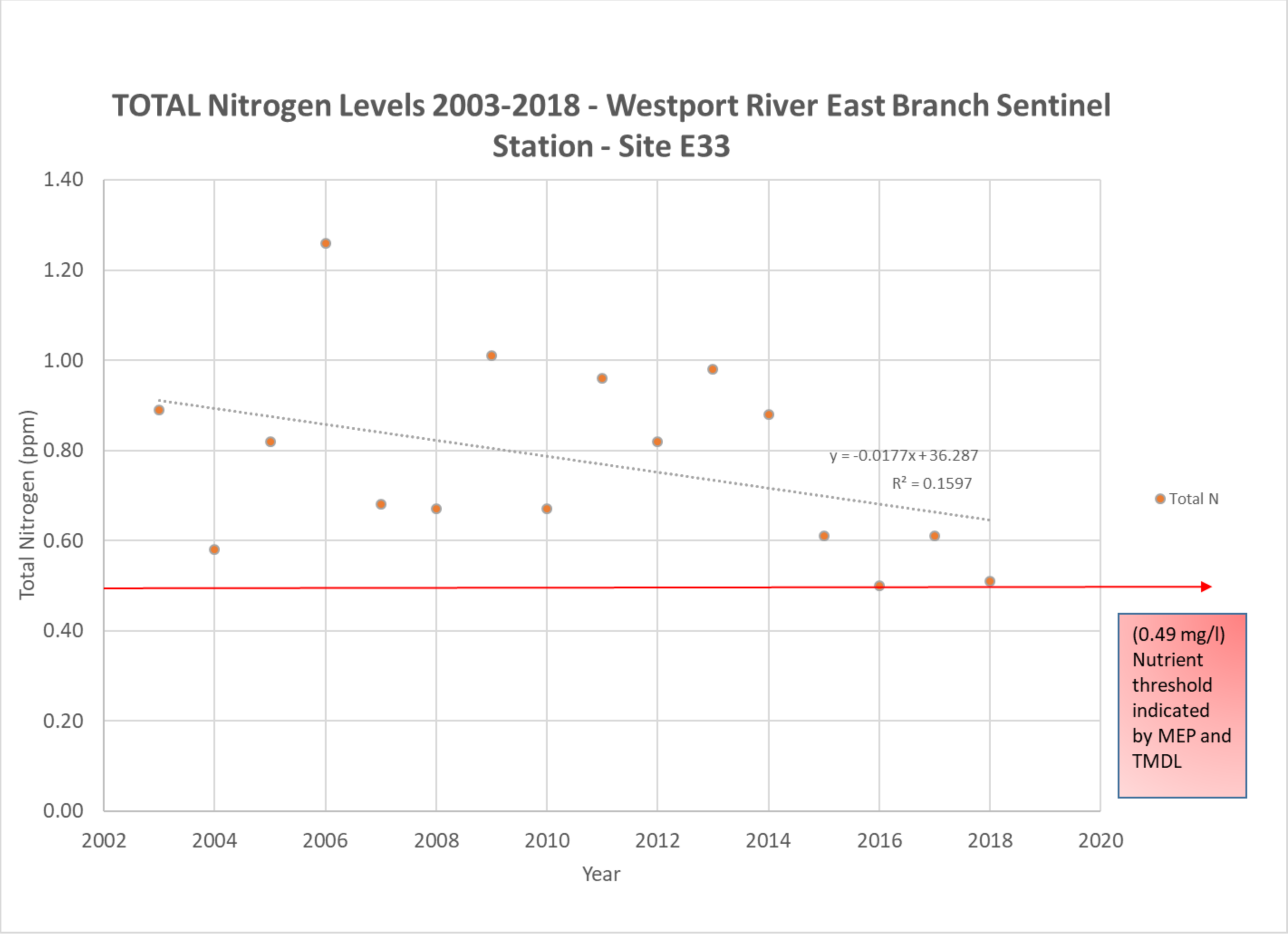
- Land Use Evolved: Development Happens
  - Agricultural – similar uses but practices change
  - Residential – what was seasonal becomes year-round
  - Residential – what was mostly rural becomes more suburban

- On-site wastewater disposal (septics) and on-site drinking wells sharing space in a more densely developed environment



Water Quality Sampling – Telling a Compelling Story

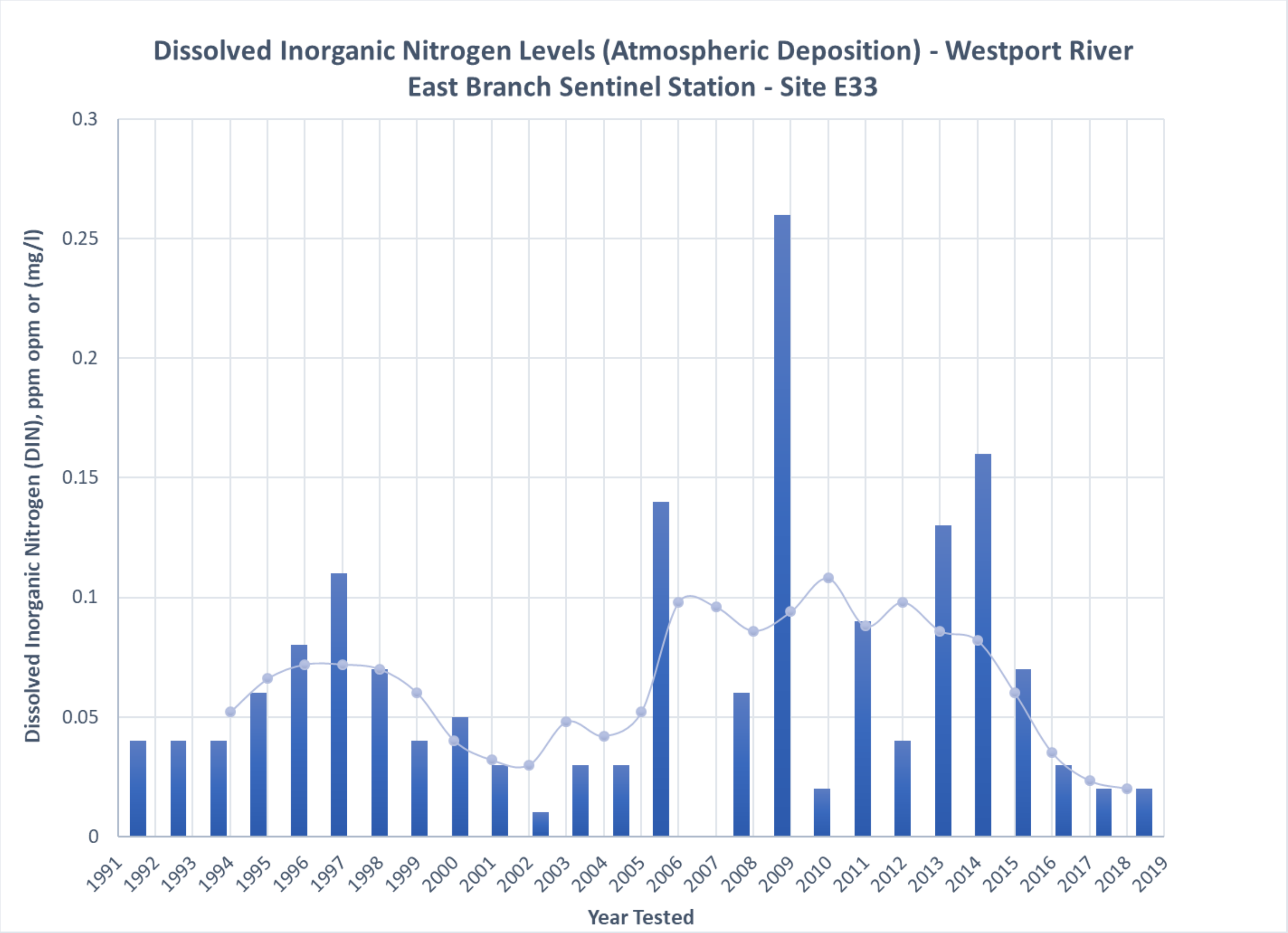
- Despite high loads demonstrated by the MEP model, nitrogen concentrations in the river have gone **down**
- Promising trend toward achieving water quality goals
- What is contributing to this?



Nitrogen Profile Changing in the River

- Land-based load changes are reflected in the River
- Other regional impacts outside of our control:
  - Attenuation
  - Atmospheric deposition
  - Climate change

In-stream water quality is our ultimate priority



What Do These Changes Mean?

- Our starting line is closer to the nitrogen TMDL goal than we originally thought
- Not everything that is happening in the watershed is captured by the model
- Land-use loads and in-stream concentrations are related but not equivalent, and program success should be measured by monitoring both

Integrated Plan – Integrated Goals – Integrated Solutions

Environmental

- Climate resiliency means any of the existing trends could change

Social

- Pervasive public health concerns with contaminated wells

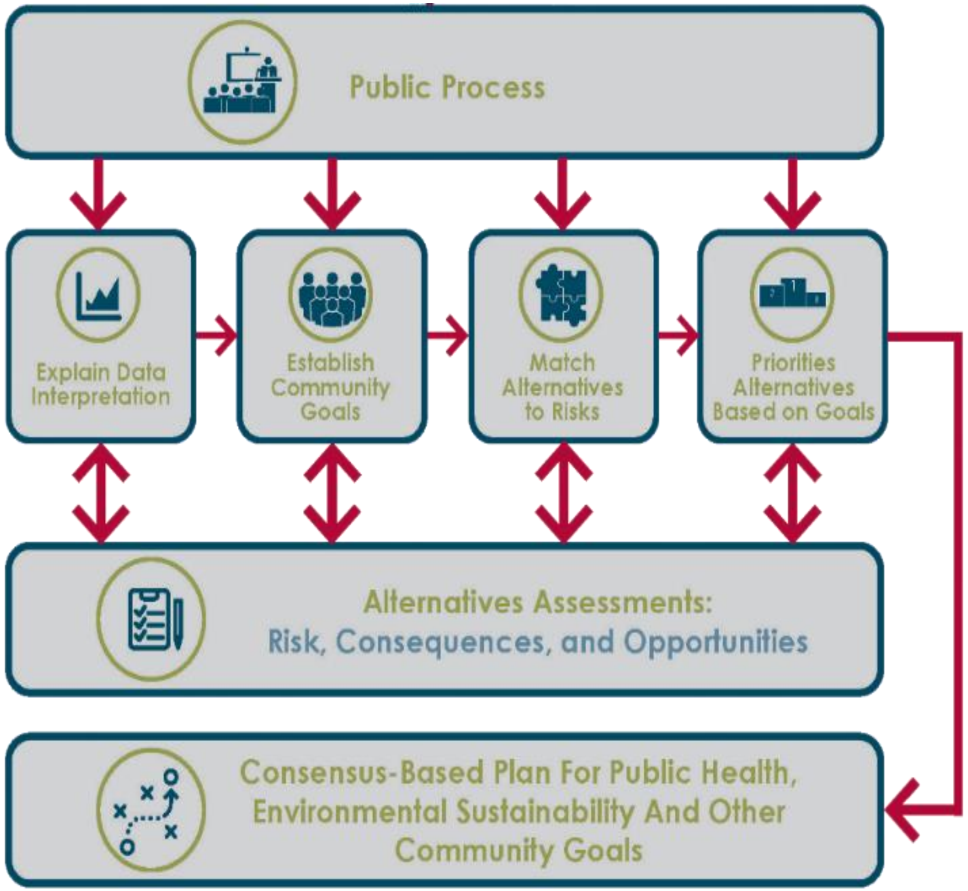
Economic

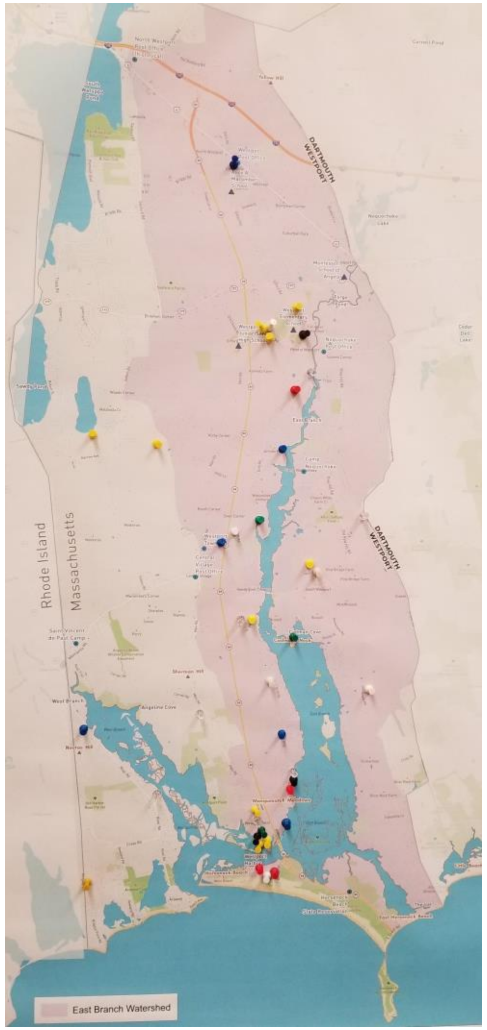
- Seek out alternatives that preserve agricultural character while encouraging economic growth

Implementation

- Develop a plan that accounts for changing characteristics and can be updated accordingly

Public Involvement: Role of the Stakeholder Working Group





Workshops and Progress of the Work

- Stakeholder-defined goals
- Agreement on updated baseline methodology and findings, feedback on current practices
- Role in alternatives development and screening

Identifying and Screening Alternatives

Stormwater

System Alteration

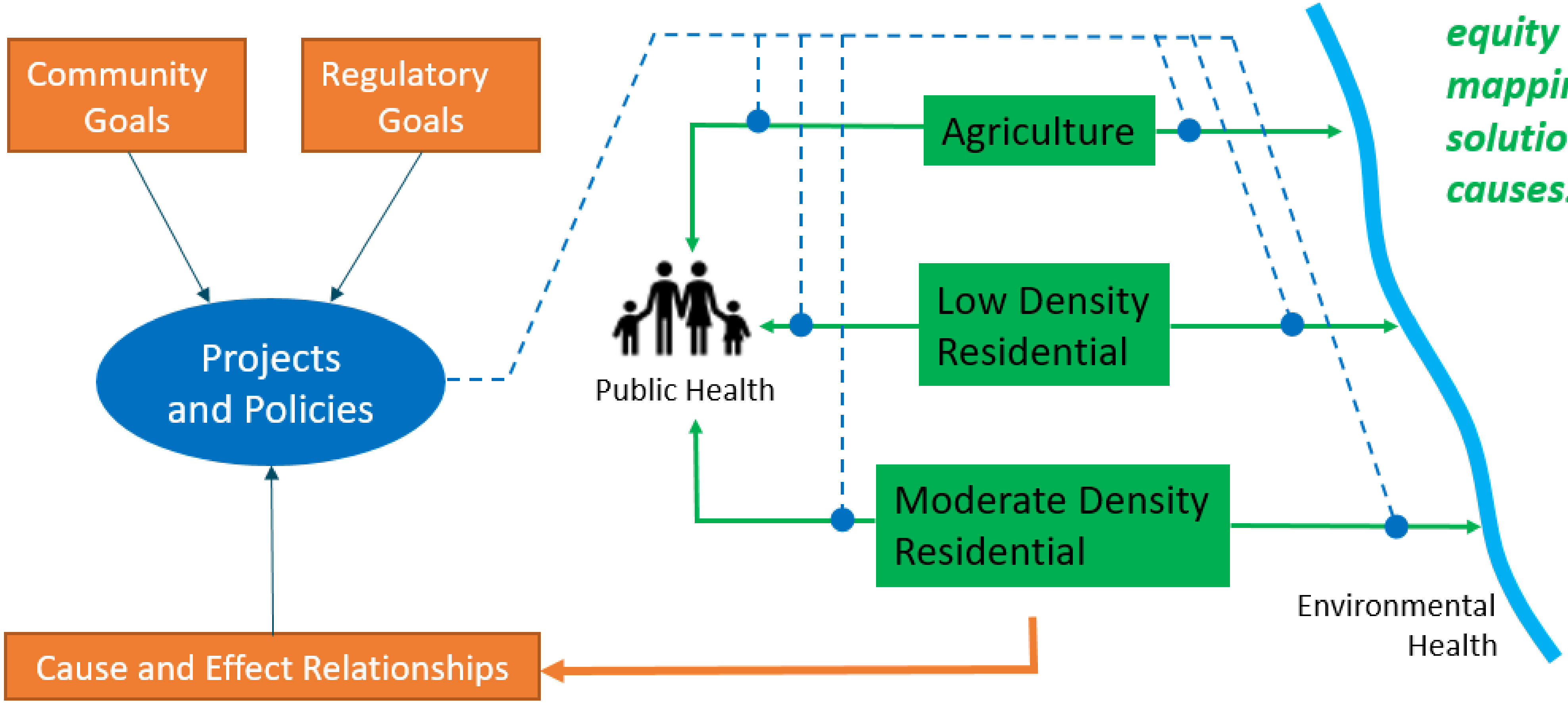
Source Control

Innovative Technology

Wastewater Treatment

Regulations/Policies

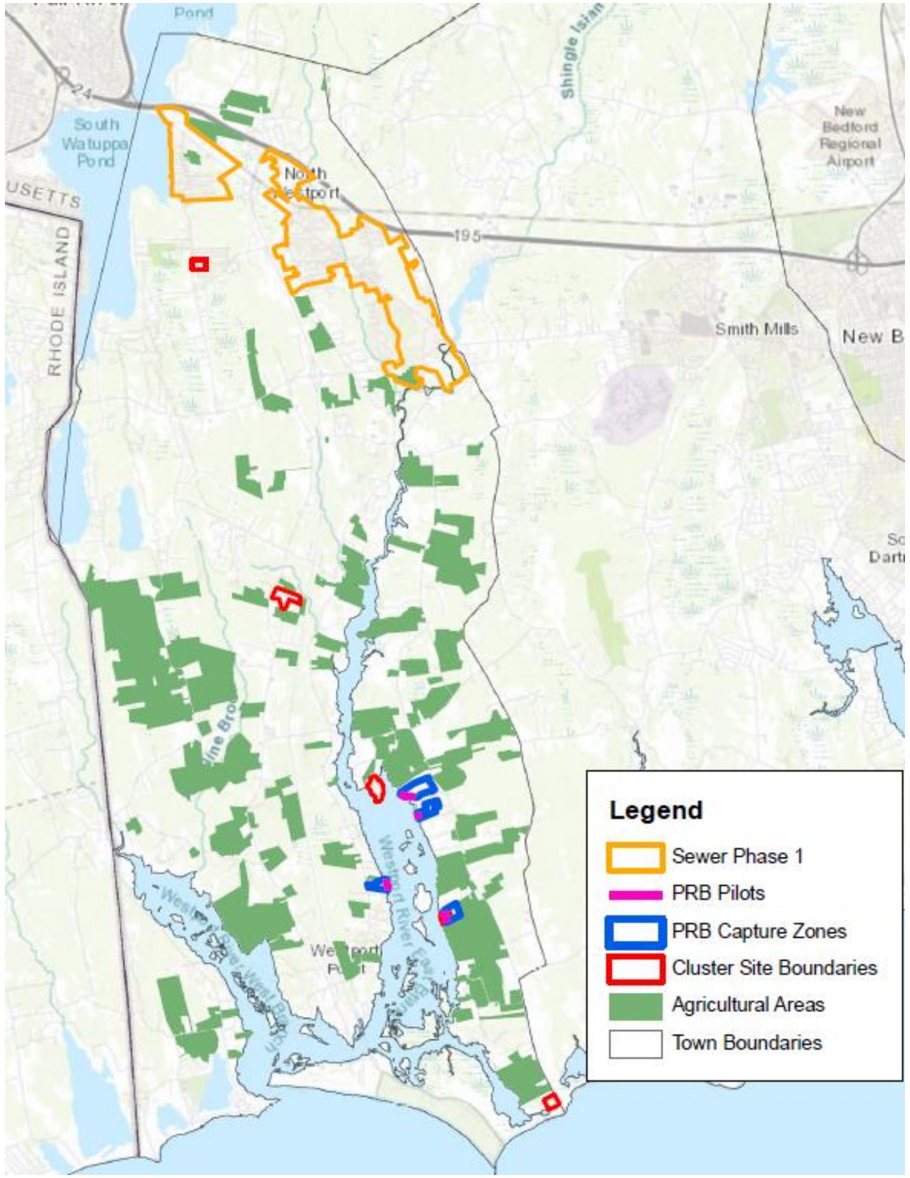
Matching Solutions to the Challenges That Matter Most



Consider cost equity after mapping solutions to causes.

Plan Methodology

- Stakeholders collaborated on which alternatives would be feasible in Westport
- Steering committee further evaluated on geography, diversity of options, and costs

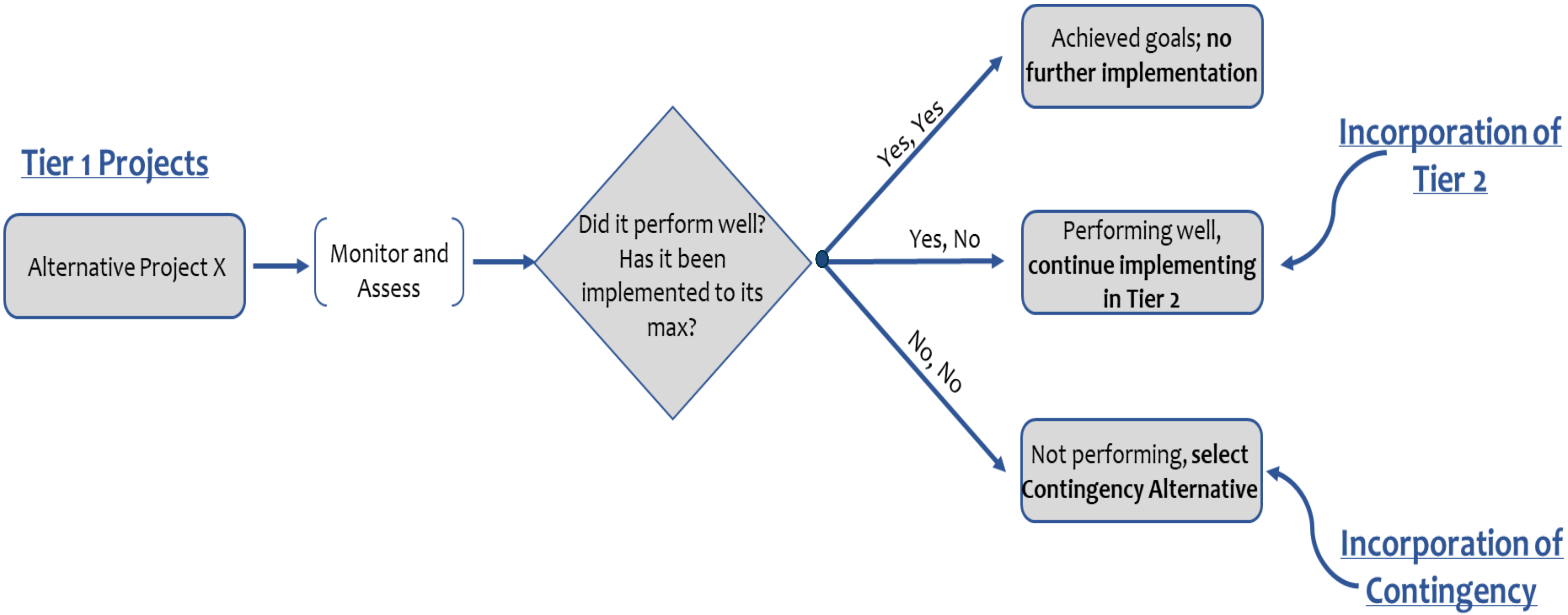


Compiling the Plan

Phased Plan: Multiple tiers to achieve goals over 20 - 30 year timeframe

Tier	Alternative	Benefits		
		Nitrogen Reduction	Public Health Benefits	Other (Economic, Resilience, Aesthetic, etc.)
1	Sewer: Phase 1A	✔	✔	✔
1	Sewer: Phase 1B	✔	✔	✔
1	Cluster System with Denitrification	✔	✔	
1	Cluster System with Denitrification and Reclamation	✔	✔	✔
1	Regulatory Overlay District, Denitrification	✔	✔	
1	Vegetative Buffer Strips	✔		✔
1	Public Education: Fertilizer	✔		
1	Denitrification for New Construction	✔	✔	
2	Zoning	✔	✔	✔
2	Sewer and Water (Phases 2-4)	✔	✔	
2	Additional Treatment Systems (Cluster, PRBs, etc.)	✔	✔	
Contingency	Barrages and Constructed Wetlands	✔	✔	✔
Contingency	Public Water Supply Development, the Let	✔	✔	
Contingency	Permeable Reactive Barriers (PRB): Pilot	✔		
Contingency	Enhanced MS4 Program, Green Infrastructure	✔		✔

Adaptive Management Strategy

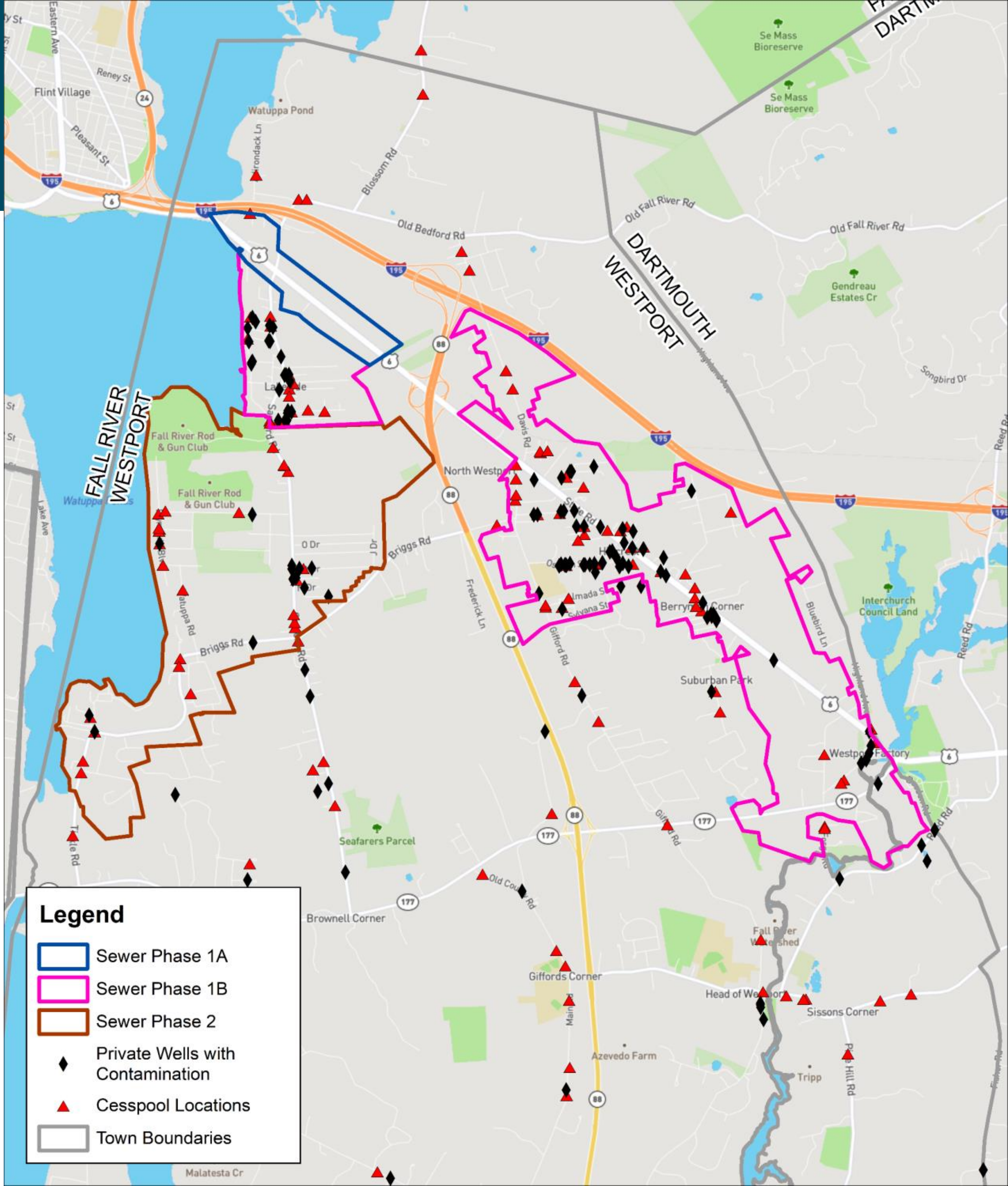


Overview of Recommended Tier 1 Alternatives

Tier	Alternative	Benefits		
		Nitrogen Reduction	Public Health Benefits	Other (Economic, Resilience, Aesthetic, etc.)
1	Sewer: Phase 1A	✓	✓	✓
1	Sewer: Phase 1B	✓	✓	✓
1	Cluster System with Denitrification	✓	✓	
1	Cluster System with Denitrification and Reclamation	✓	✓	✓
1	Regulatory Overlay District, Denitrification	✓	✓	
1	Vegetative Buffer Strips	✓		✓
1	Public Education: Fertilizer	✓		
1	Denitrification for New Construction	✓	✓	
2	Zoning	✓	✓	✓
2	Sewer and Water (Phases 2-4)	✓	✓	
2	Additional Treatment Systems (Cluster, PRBs, etc.)	✓	✓	
Contingency	Barrages and Constructed Wetlands	✓	✓	✓
Contingency	Public Water Supply Development, the Let	✓	✓	
Contingency	Permeable Reactive Barriers (PRB): Pilot	✓		
Contingency	Enhanced MS4 Program, Green Infrastructure	✓		✓

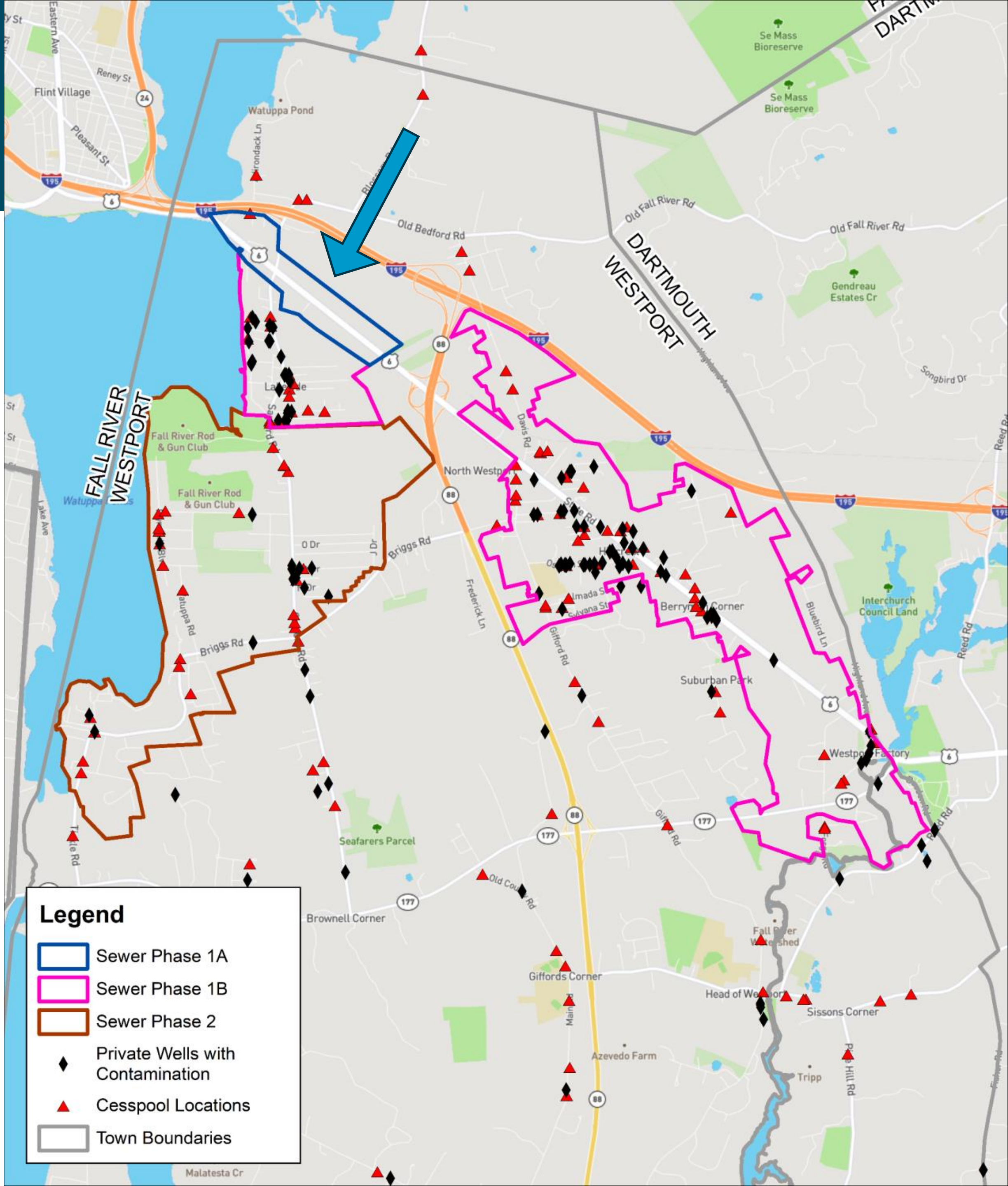
Tier 1: Sewer along Route 6 (Phase 1)

- Based on 2004 Report: Phase 1 Sewer
- Goals
  - Mitigate public health hazards and reduce nitrogen load
  - Approximately 977 properties converted from septic to sewer over entire Phase 1
- Estimated implementation cost: $15,900,000 (overall Phase 1 minus early action Phase 1A costs)
- Potential for concurrent Water System installation



Tier 1: Sewer Phase 1A (Route 6 to Route 88)

- Early Action to achieve economic development potential in commercial corridor
- Additional Advantages:
  - Catalyst for establishing governance framework for this and future public infrastructures
  - Steps towards sewer district and system financing
- Estimated implementation cost: $2,500,000



Tier 1: Example cluster system with denitrification: The Let

- Mitigate public health hazards and reduce nitrogen load
- Approximately 34 properties, 21 documented private well contamination issues
- Estimated construction cost: $400,000
- Ownership/Operation Management TBD
- Possible Contingency: Public Water option

Tier 1: Example cluster system with denitrification : Cadman's Neck

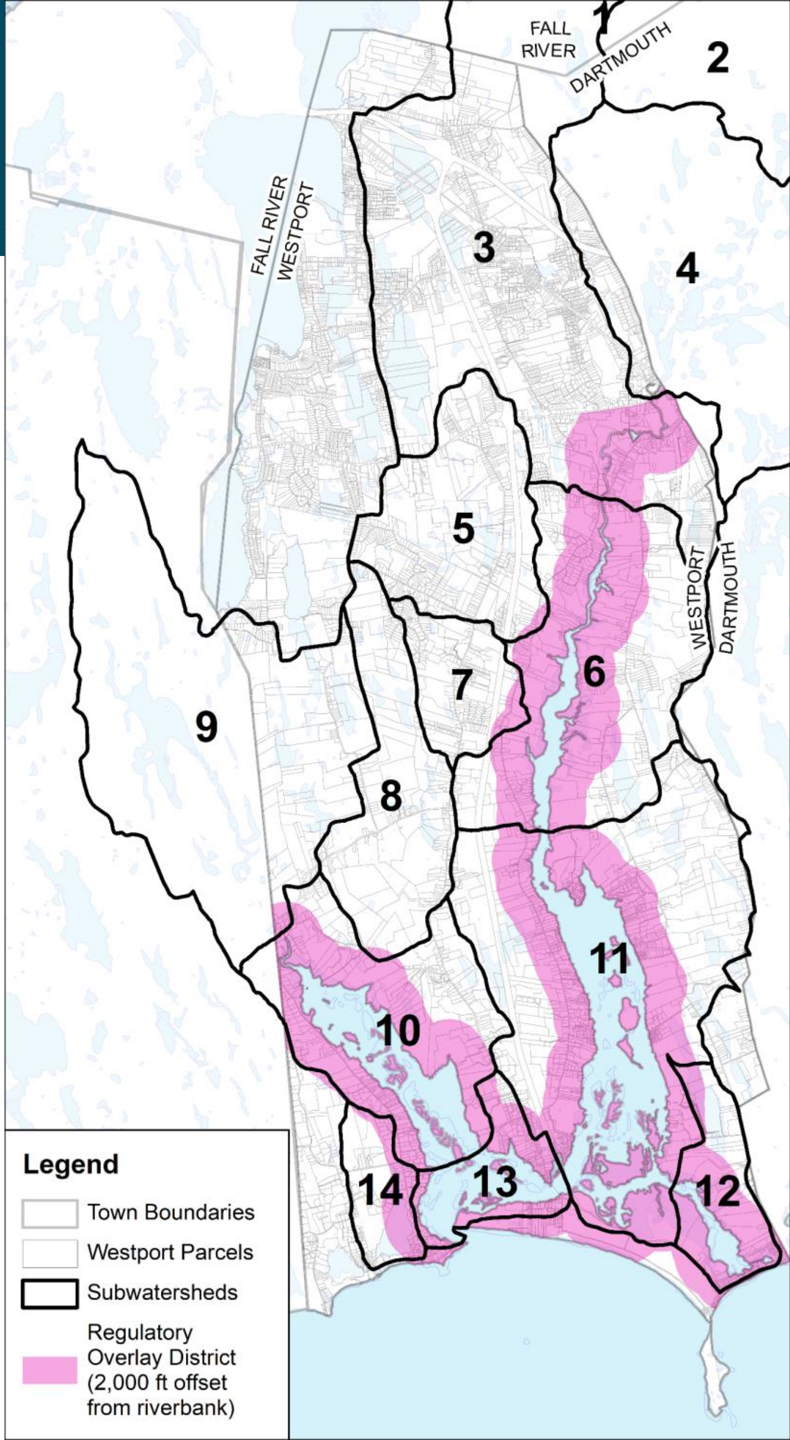
- Mitigate public health hazards and reduce nitrogen load
- Re-use in the form of irrigation offers additional economic, sustainability benefits
- Approximately 51 properties, 5 documented private well contamination issues
- Estimated construction cost: $570,000
- Ownership/Operation Management TBD

Tier 1: Vegetative buffer strips for agriculture

- Annual cost: $300 per acre, per year
- Implement as a program: annually convert pre-determined acreage to buffer strips
- Prioritize high-risk areas at the start
- Town/individual financing, easements
- Green infrastructure for residential

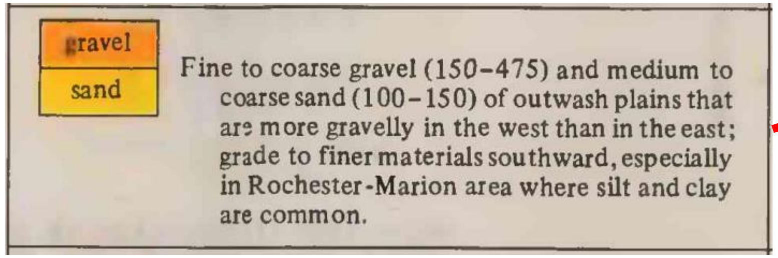
Tier 1: Nutrient Reduction Regulatory Overlay District

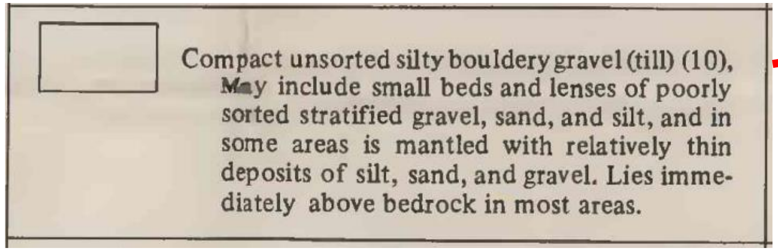
- District extends 2,000 ft from riverbank
- Includes both East and West Branches
- Within the District:
  - all septic systems installed before 1995 (non-Title V compliant) must be replaced with denitrification systems within 5 – 10 years of zoning by-law effective date
- The District will:
  - Encompass approx.1044 septic systems installed before 1995
  - Remove approx. 4,000 kg/year nitrogen
  - Protect 79 known impaired private wells
  - Include properties primarily in the most transmissive soils (i.e., travels faster from source to river)

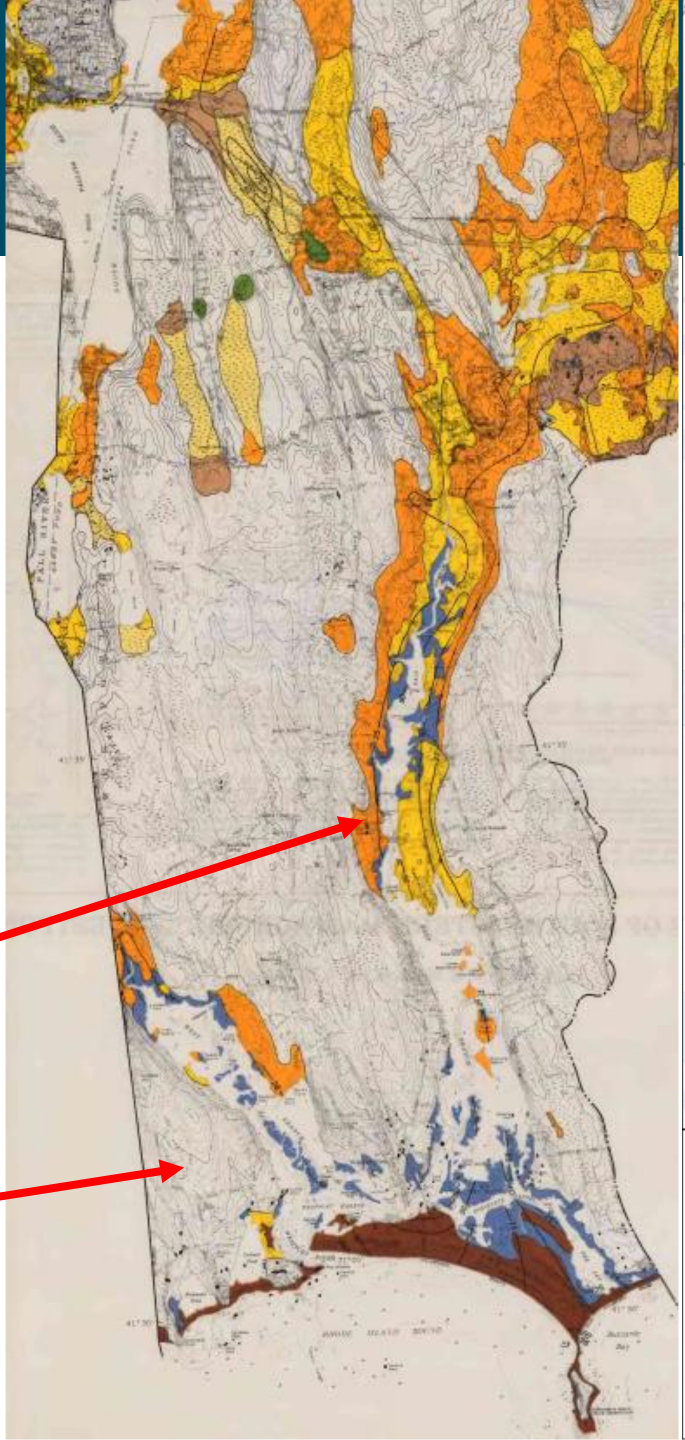


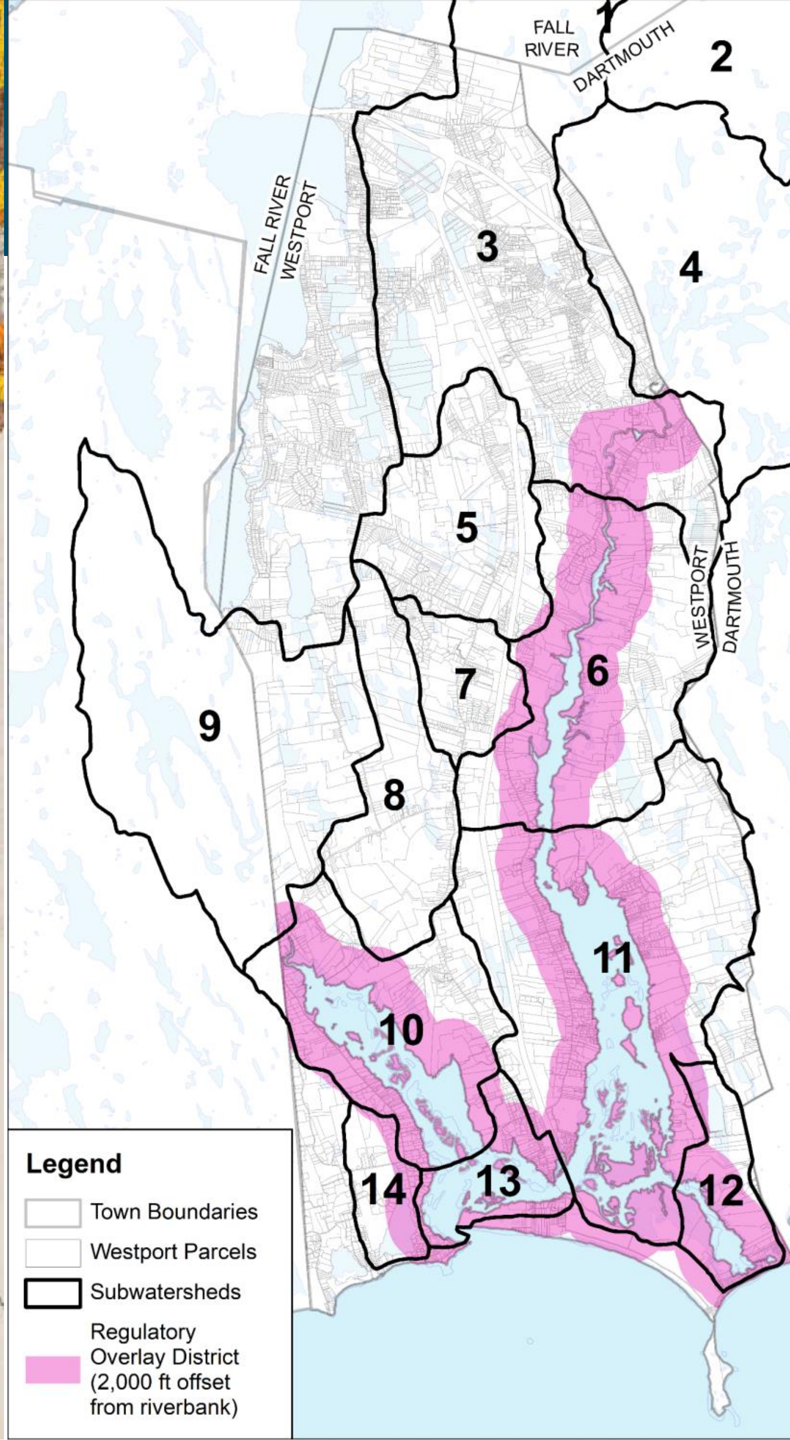
Basis for Regulatory Overlay District

- District boundary encompasses areas with most transmissive soils (colored areas)
- Groundwater and nitrogen travel faster in these areas
- Improvements made in District expected to decrease river nitrogen concentrations faster



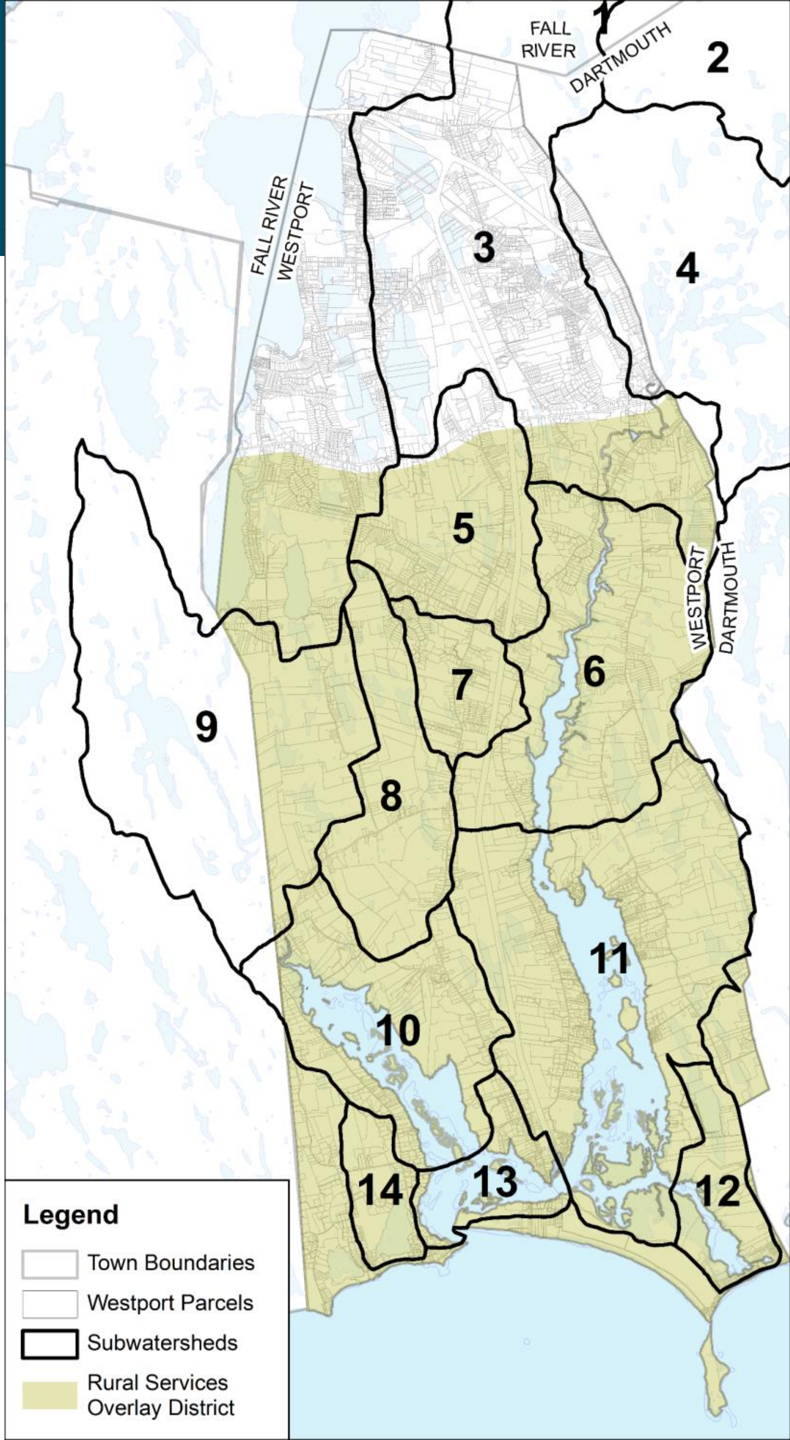






Tier 1: Rural Services District

- Keeping up with future growth:
  - New district (covers areas not otherwise to be sewered)
  - New construction or significant reconstruction
    - Requires de-nitrification system
    - Reduces impact of new loads
    - Reduces impact of additional loads in already stressed areas



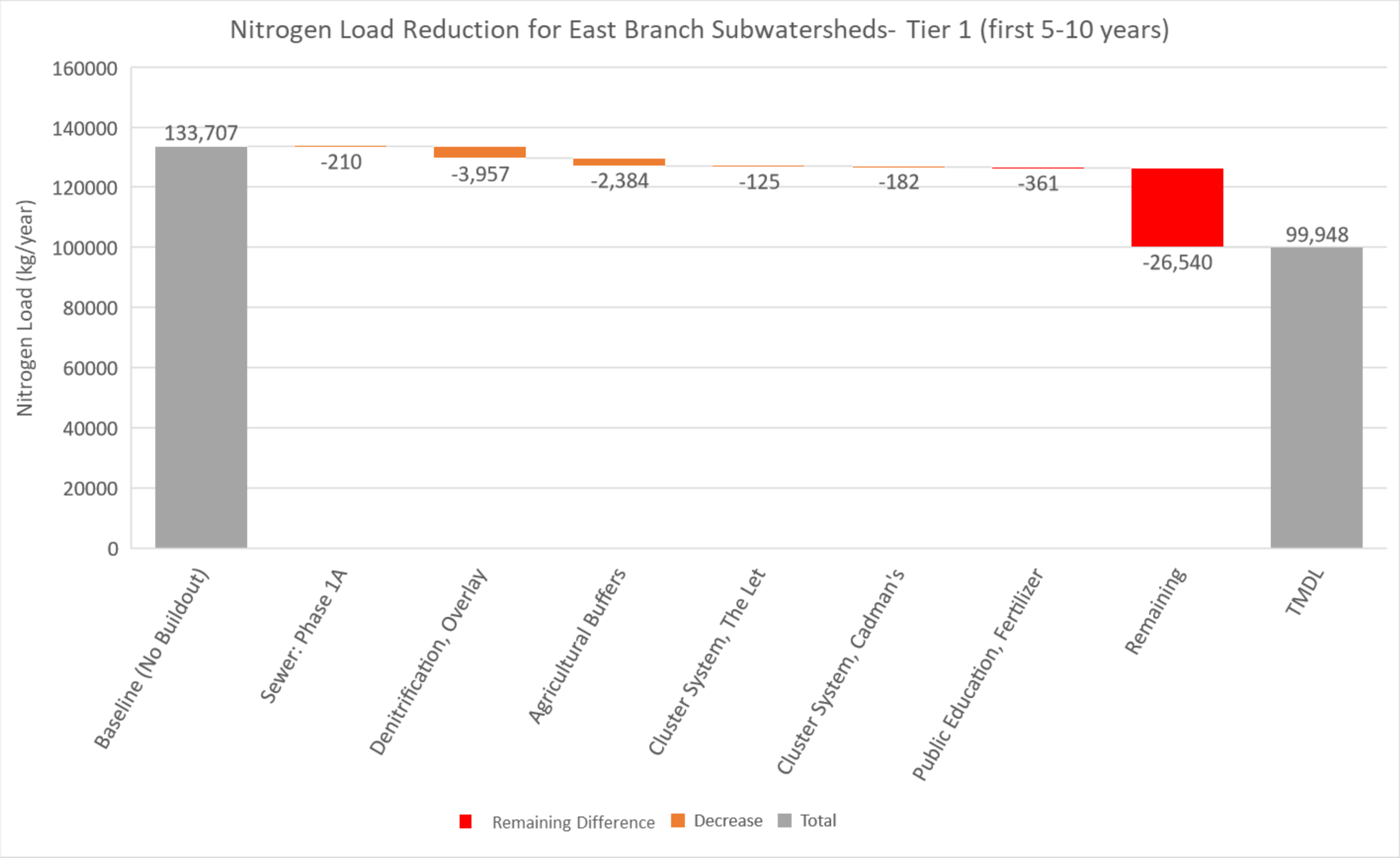
Tier 1: Public Education

Core Messages:

- Residential fertilizer reduction
- Septic system maintenance
- Low-impact landscaping
- Advertise Town-sponsored incentives

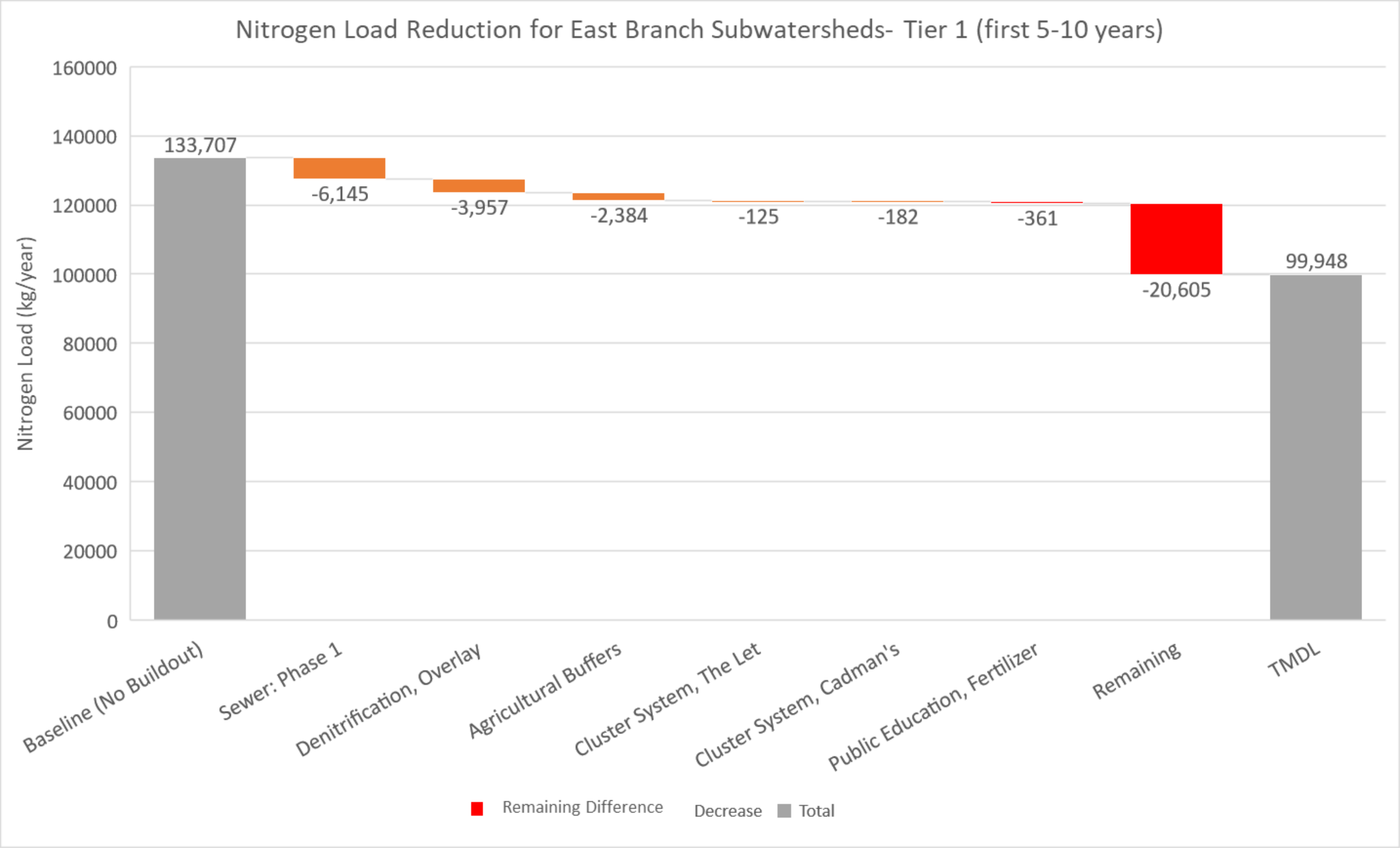
Tier 1 Benefits – the first 5 – 10 years

- If only Phase 1A sewer implemented



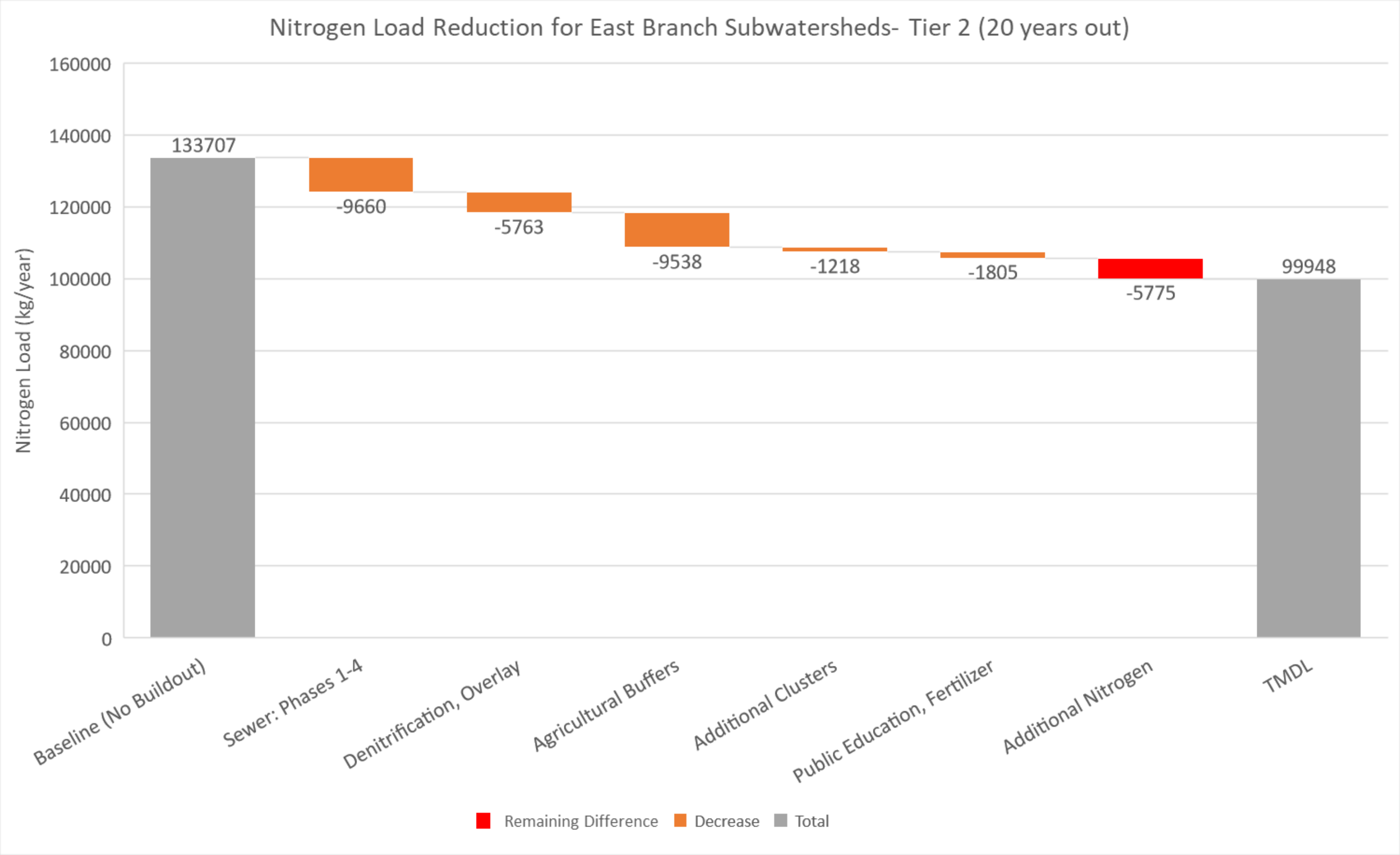
Tier 1 Benefits – the first 5 – 10 years

- This is **just** a starting point
- Initial implementation levels for data gathering



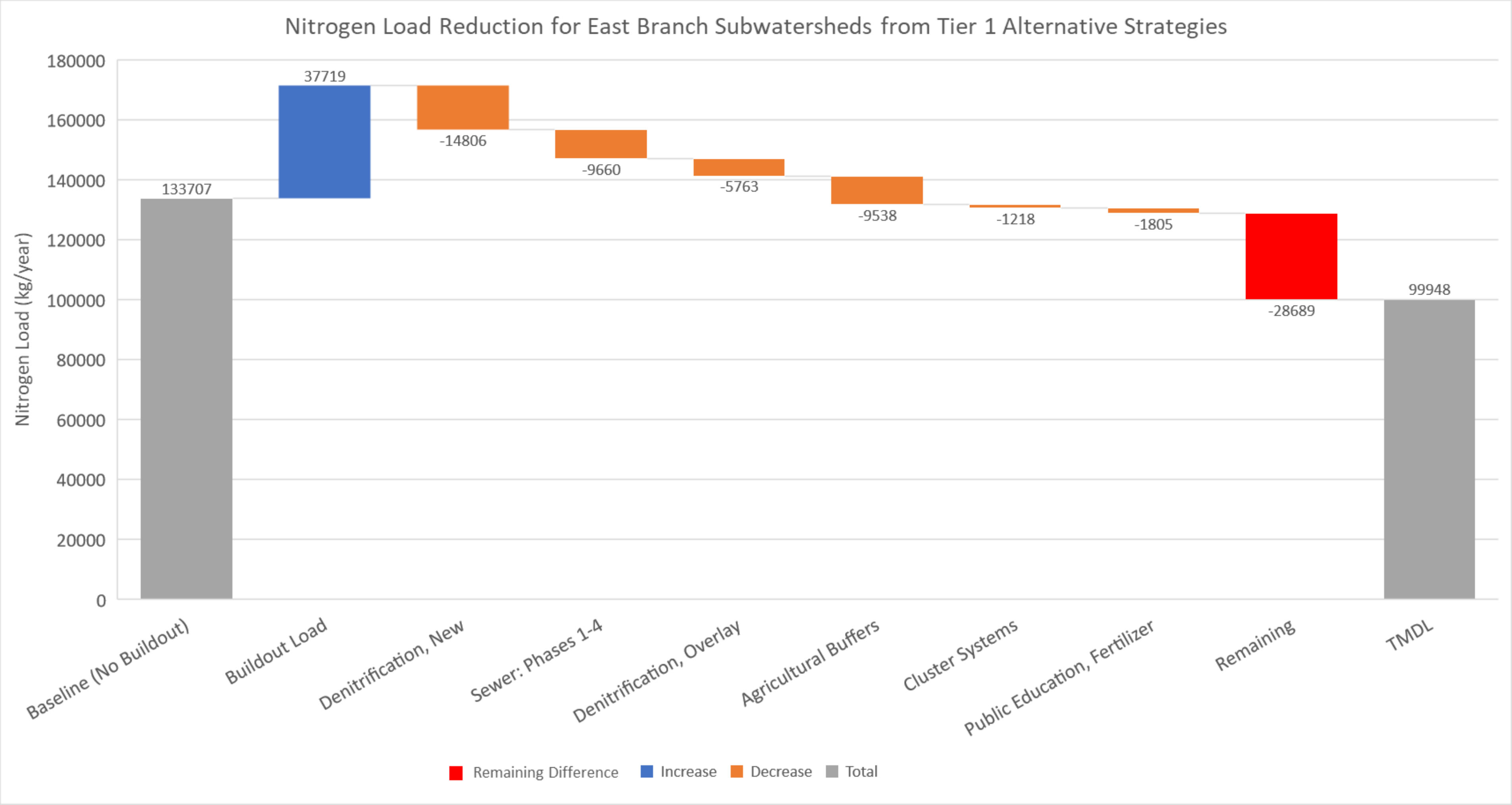
Potential Tier 2 benefits – one path forward

- Actual Tier 2 contingent upon Tier 1 results
- Recall – in-stream sampling may drive changes in remaining nitrogen



Tier 1 Benefits – Looking at the Future

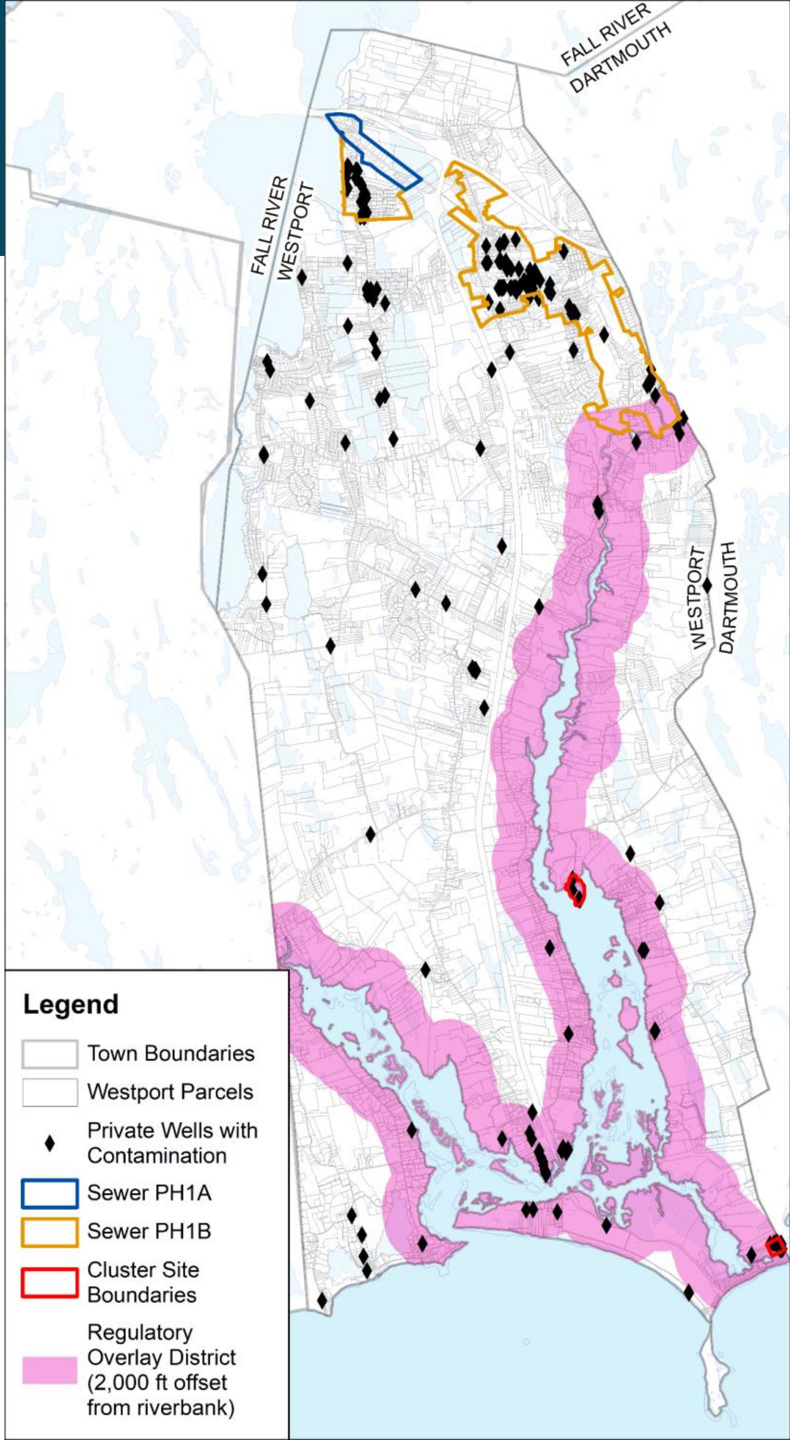
- Accounting for future build-out



Other Tier 1 Benefits – Public Health

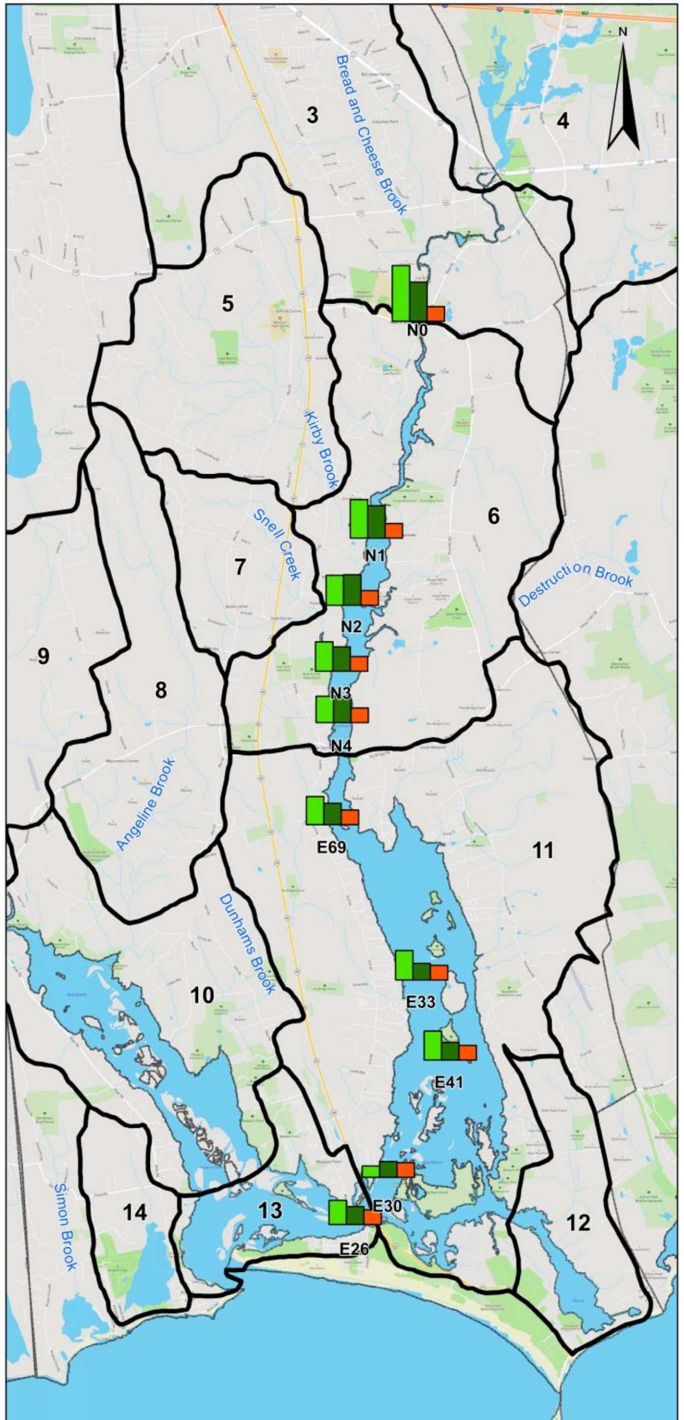
- Tier 1 addresses ~50% of contaminated wells if Sewer: Phase 1B is **not** included
- Tier 1 addresses more than 85% of contaminated wells if Sewer: Phase 1B is included

Alternative	Estimated Number of Contaminated Wells Addressed (in Tier 1)
Sewer: Phase 1B	78
Cluster Systems (Cadman's Neck; The Let)	24
Denitrification Overlay District	55
Title V Upgrades	20
Total (without Sewer: Phase 1B)	**99**
Total (with Sewer: Phase 1B)	**177**
Current Number of Contaminated Wells	200



Monitoring: Progress from Tier 1 to Tier 2

- Continue river monitoring at sampling stations (WRWA/BBC)
  - Understand what is happening upstream & regionally
- Continue private well monitoring for bacteria, nitrogen
- Regulatory monitoring for denitrification systems, Title V
- Vegetative buffer strip monitoring directly upstream and downstream



Review of Tier 2 and Contingency Alternatives

- Tier 2 as an extension of Tier 1
  - Additional implementation of:
    - Sewer
    - Cluster Systems
    - Vegetative Filter Strips
    - Additional Denitrification Incentives
- Contingency Alternatives
  - New alternatives to assess and implement the following:
    - Barrages and Constructed Wetlands
    - Enhanced MS4 Program, Green Infrastructure Projects
    - Permeable Reactive Barriers (PRBs)
    - Additional Zoning Policies

Project Costs

Implementation and system costs

Tier	Alternative	Costs	Cost Units
1	Sewer: Phase 1A	$2,500,000	Implementation
1	Sewer: Phase 1B	$15,900,000	Implementation
1	Cluster System with Denitrification	$400,000	Implementation
1	Cluster System with Denitrification and Reclamation	$570,000	Implementation
1	Regulatory Overlay District, Denitrification	$21,000	Individual system
1	Vegetative Buffer Strips	$300	Cost per acre-ft per Year
1	Public Education: Fertilizer	Negligible	-
1	Denitrification for New Construction	$34,000	Individual system

Implications – Governance Issues

- Many of the proposed alternatives will require greater town administrative responsibility and involvement
- Updates to existing agreements with Fall River required
- Cost estimates do not include expanded administrative level of effort

Questions?

Thank You!

FOR IMMEDIATE RELEASE

Westport Public Meeting to Kick-Off Water Resource Planning Effort

Public invited to attend October 3rd meeting to learn about the project and share ideas.

Westport, MA September 19, 2018

On Wednesday, October 3rd from 6:30 p.m – 8:30 p.m. at the Town Hall Annex (856 Main Road), the Town of Westport and their planning consultants will be hosting a public meeting to kick-off the Integrated Water Resources Management Plan (IWRMP) project. The meeting purpose is to provide information regarding the project scope and schedule but also importantly it is to listen and to hear from the citizens and stakeholders in the community regarding common goals and objectives for the study.

The Targeted-IWRMP is specifically focused on water quality challenges within the East Branch of the Westport River and its surrounding watershed. The project will use a variety of water quality, land use and existing conditions data as a foundation for the effort. These will be derived from local, state and national sources to establish relationships between cause and effect of impairments, and work with the community to identify a variety of alternatives to meet agreed upon goals.

"Receiving public input at the initial kick-off meeting on October 3rd is the critical starting point in defining the water problems people are actually experiencing. That public input is one of the important building blocks in creating a foundation for integrated water resources management planning and for reaching consensus regarding which problems are most critical to address. The public's definition of water problems should encompass the broadest spectrum from the lack of public sewerage and water in commercial and densely- developed residential areas, excess nitrogen inputs into the Westport River estuary to fisheries and shellfisheries threats. Your Town officials and their consultants want and need your input regarding actual problems people are experiencing in order that we prepare a plan that offers practical and economic solutions to them. "

Bob Daylor, Chair, the IWRMP Working Committee

For further information regarding this meeting, please contact James Hartnett, Town Planner, at 508-636-1037 or hartnettj@westport-ma.gov; or Betsy Frederick, Project Manager, Kleinfelder, at 617-498-4603, or bfrederick@kleinfelder.com.

FOR IMMEDIATE RELEASE

Westport Public Meeting to Present Proposed Targeted-Integrated Water Resource Management Plan

Public invited to attend November 13th meeting to hear about the plan components and anticipated outcomes.

Westport, MA October 24, 2019

On Wednesday, November 13th from 6:30 p.m – 8:30 p.m. at the Town Hall Annex (856 Main Road), the Town of Westport and their planning consultants will be hosting a public meeting to present the DRAFT Targeted-Integrated Water Resources Management Plan (T-IWRMP). The T-IWRMP is the product of months of effort by Town officials, a dedicated group of local stakeholders, and the Town's consultant team. The meeting purpose is to report on the proposed program of alternatives to address the goals of the plan as identified by the community at the project outset.

The T-IWRMP is specifically focused on water quality challenges within the East Branch of the Westport River and its surrounding watershed. The project used a variety of water quality, land use and existing conditions data as a foundation for the effort. Based on those findings around need, alternatives to address existing and anticipated future conditions were developed in collaboration with stakeholders. These alternatives were considered within the framework of environmental and public health benefits, synergy with local economic development initiatives, and cost among other criteria.

This plan provides a path forward to meet the water quality challenges faced by the community, and when implemented will have far reaching impact. It is important that residents understand the issues addressed, benefits provided, and potential costs generated by this program. We want all residents to be informed on the merits of the program and have the opportunity to comment on the draft plan as proposed. Please join us on November 13th.

"Our activities on the land continue to increase the loads on the river, but the river's capacity to handle those loads has not increased. In fact, the river shows its stress in seasonal algal growth, eroded salt marshes, retreating sea grass beds and reduced shellfishing areas. The river has changed and we need to change how we use the land to reverse those stresses and help it regain its health." Robert Daylor, Chair, IWRMP Working Committee.

For further information regarding this meeting, please contact James Hartnett, Town Planner, at 508-636-1037 or hartnettj@westport-ma.gov; or Betsy Frederick, Project Manager, Kleinfelder, at 617-498-4603, or bfrederick@kleinfelder.com.

APPENDIX C – NITROGEN REMOVAL BENEFITS CALCULATIONS

All nitrogen loading factors, assumptions and calculations from the MEP Report were kept constant when updating to the current baseline nitrogen loads and estimating potential nitrogen removal benefits of alternatives. Table A.1 (Table IV-1 from the MEP Report) summarizes primary nitrogen loading factors. Total nitrogen loads from landfill/solid waste and water body surface area (atmospheric deposition) remain the same in the updated baseline at 1,306 kg/year and 69,219 kg/year, respectively. This assumption for water body surface area is a conservative assumption and was discussed further in the Section 4.2 of the Plan. The calculation of estimated nitrogen reduction of alternatives is presented in this Appendix.

Table A.1 – Primary Nitrogen Loading Factors

Nitrogen Concentrations:	mg/l	Recharge Rates:[2]	in/yr
Road Run-off	1.5	Impervious Surfaces	45.7
Roof Run-off	0.75	Natural and Lawn Areas	30.46
Direct Precipitation on Embayments and Ponds	1.09	Water Use/Wastewater:	
Natural Area Recharge	0.072	Existing developed parcels wo/water accounts and buildout residential parcels	188 gpd[3]
Wastewater Coefficient	23.63		
Town of Westport Landfill Load (kg/yr)	277		
Crapo Hill Landfill Load (kg/yr)	643	Multi-family residential parcels	376 gpd
Jarabeck Farm Landfill Load (kg/yr)	387	Existing developed parcels w/water accounts:	Measured annual water use
Fertilizers:		Commercial and Industrial Buildings buildout additions[4]	
Average Residential Lawn Size (sq ft)[1]	5,000	Commercial	
Residential Watershed Nitrogen Rate (lbs/lawn)[1]	1.08	Wastewater flow (gpd/1,000 ft2 of building):	180
Nitrogen leaching rate	20%	Building coverage:	15%
Average Single Family Residence Building Size (based on other towns; sq ft)	1,500	Industrial	
		Wastewater flow (gpd/1,000 ft2 of building):	44
Farm Animals	kg/yr /animal	Building coverage:	5%
Horse	32.4	Crops	kg/ha/yr
Cow/Steer	55.8	Hay, Pasture	5
Goats	7.3	Corn, Vegetables, Vineyard, Fruit	34
Hogs	14.5	Crop N leaching rate	30%
Chickens	0.4	Cranberry Bog (leaching included)	6.9
Animal N leaching rate	40%		

Notes:
1) Data from MEP lawn study in Falmouth, Mashpee & Barnstable 2001.
2) Based on precipitation rate of 50.77 inches per year (1971-2000 NOAA average for closest long-term precipitation gauge (New Bedford))
3) average based on all Town of Dartmouth municipal water accounts measured flow in all single-family residences in the watershed
4) Based on characteristics of Town of Falmouth land uses: existing water use and building coverage for similarly classified properties

Estimate of Septic Systems Installed Prior to 1995

The nitrogen load reduction benefits of upgrading septic systems installed prior to 1995 was determined by first estimating this number of septic systems on a subwatershed basis. The year 1995 marks the introduction of Title V septic regulations and it is assumed that septic systems installed after this date are compliant with Title V regulations. Board of Health records of septic repairs, upgrades and new installations for the Town of Westport was provided for the years from 2006-2016. The number of Title V compliant septic systems installed after 1995 was estimated by assuming that the same rate of septic repairs, upgrades and new installations occurred in the past 24 years (1995-2019) as occurred in the 10 years where data is available (2006-2016). The number of septic repairs, upgrades and new installations that occurred in the 24 years from 1995-2019 was estimated by simply scaling proportionally by the number of years considered as detailed in the following calculation.

$$(\#\ of\ septic\ systems\ in\ 24\ years) = (\#\ of\ septic\ systems\ in\ 10\ years)\left(\frac{24\ years}{10\ years}\right)$$

The number of septic systems installed prior to 1995 was then estimated by subtracting this value from the total number of septic systems on record as detailed in the following calculation.

$$(\#\ of\ septic\ systems\ installed\ prior\ to\ 1995) = (Total\ \#\ of\ septic\ systems) - (\#\ of\ septic\ systems\ in\ 24\ years)$$

These calculations were performed on a subwatershed basis to estimate the percentage of Town of Westport septic systems in each subwatershed installed prior to 1995.

$$(\%\ of\ septic\ systems\ installed\ prior\ to\ 1995) = \frac{(\#\ of\ septic\ systems\ installed\ prior\ to\ 1995)}{(Total\ \#\ of\ septic\ systems)}$$

Table A.2 summarizes the estimated number and percentage of septic systems in Westport installed prior to 1995 for each subwatershed. The percentage values were used to estimate the number of pre-1995 septic systems for potential denitrification overlay district offset distances presented in Table 8.1 of the Plan.

Table A.2 Estimated Number and Percentage of Septic Systems installed prior to 1995

Subwatershed	Total updated baseline septic systems within Westport	Documented septic systems installed or repaired from 2006-2016	Estimated septic systems installed or repaired from 1995-2019	Estimated septic systems installed or repaired prior to 1995	Estimated percentage of septic systems installed or repaired prior to 1995 (%)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	1971	390	936	1035	55%
4	168	24	58	110	69%
5	433	86	206	227	55%
6	536	101	242	294	57%
7	272	43	103	169	65%
8	191	41	98	93	55%
9	125	13	31	94	76%
10	332	61	146	186	59%
11	877	176	422	455	54%
12	88	18	43	45	54%
13	233	43	103	130	57%
14	129	34	82	47	37%

Nitrogen Removal from Conventional Septic System Converted to Individual Denitrification Septic System or Cluster Denitrification System

A study conducted at the Massachusetts Alternative Septic System Test Center found that conventional Title V septic systems were capable of 21-25% removal of influent nitrogen through the soil absorption system (leaching field).[1] The study observed a typical wastewater influent nitrogen concentration of 35 mg/L which was reduced to approximately 26.25 mg/L. This effluent concentration of 26.25 mg/L was used in the MEP watershed model to calculate the nitrogen load for a typical residential septic system. The MEP calculation used a 188 gallons per day water use and a consumptive use factor of 0.9 to calculate the nitrogen load as presented below.

$$(N\ load\ from\ 1\ residential\ septic) = \left(\frac{26.25\ mg\ N}{L}\right)\left(\frac{188\ gal}{day}\right)(0.9)\left(\frac{3.78541\ L}{1\ gal}\right)\left(\frac{1\ kg}{10^6\ mg}\right)$$
$$= \frac{6.137\ kg\ N}{year}$$

The estimated nitrogen removal benefit from converting conventional septic systems to denitrification septic systems was calculated by applying a 55% reduction to the nitrogen load from conventional septic systems as calculated in the MEP Report. Here it must be noted that percent reduction from a conventional septic system effluent is different than total percent removal of influent nitrogen. A 55% reduction in nitrogen from a conventional system corresponds to a concentration 11.81 mg/L or approximately 66% removal of influent nitrogen, assuming a typical wastewater influent nitrogen concentration of 35 mg/L. This is a slightly conservative assumption

[1] *Costa, J.E, G. Heufelder, S. Foss, N.P. Millham, and B. Howes. 2002. Nitrogen removal efficiencies of three alternative septic technologies and a conventional septic system. Environment Cape Cod 5(1):15-24*

as denitrification systems often have a target nitrogen effluent concentration of 10 mg/L or lower. In general, nitrogen removal percentages for various septic treatment systems can vary widely depending on the influent nitrogen concentration and the operations and maintenance of the systems. Evaluating septic alternatives in terms of effluent nitrogen concentration achieved instead of percent nitrogen removal allows for equal comparison for alternatives.

The MEP Report classified individual conventional septic systems as either average water use systems or systems with twice the average water use based on parcel land use. The nitrogen load and removal for a single septic system (of either water use type) converted to denitrification (DN) is detailed in the following calculations.

$$(N\ load\ from\ 1\ average\ water\ use\ system) = \frac{6.137\ kg\ N}{year}$$

$$(N\ load\ from\ 1\ system\ with\ 2x\ average\ water\ use) = (2)\left(\frac{6.137\ kg\ N}{year}\right) = \frac{12.27\ kg\ N}{year}$$

$$(N\ removal\ from\ 1\ average\ water\ use\ system\ converted\ to\ DN) = \left(\frac{6.137\ kg\ N}{year}\right)(55\%) = \frac{3.375\ kg\ N}{year}$$

$$(N\ removal\ from\ 1\ system\ with\ 2x\ average\ water\ use\ converted\ to\ DN) = (2)\left(\frac{6.137\ kg\ N}{year}\right)(55\%) = \frac{6.75\ kg\ N}{year}$$

The same 55% reduction was applied for calculating the benefits of converting multiple conventional septic systems to a cluster septic system with denitrification. The total nitrogen removal for a cluster system was calculated as the sum of nitrogen removal for the individual septic systems converted to a cluster septic system with denitrification.

Nitrogen Removal from Conventional Septic System Converted to Sewer

The estimated nitrogen removal benefit from converting conventional septic systems to sewer was calculated by applying a 95% nitrogen removal efficiency to the nitrogen load from conventional septic systems as calculated in the MEP Report. A 95% removal efficiency was chosen as a conservative assumption instead of 100% to account for potential exfiltration from sewer pipes which would result in some discharge of nitrogen in wastewater to groundwater.

$$(N\ removal\ from\ 1\ average\ water\ use\ system\ converted\ to\ DN) = \left(\frac{6.137\ kg\ N}{year}\right)(95\%) = 5.83\frac{kg\ N}{year}$$

$$(N\ removal\ from\ 1\ system\ with\ 2x\ average\ water\ use\ converted\ to\ DN) = (2)\left(\frac{6.137\ kg\ N}{year}\right)(95\%) = 11.66\frac{kg\ N}{year}$$

Total Nitrogen Removal from All Wastewater Alternatives

Table B.2 summarizes the number of conventional septic systems (of average or twice average water use) addressed by one of the wastewater alternatives and the expected nitrogen removal associated with each alternative. The number of septic systems converted to sewer or cluster was determined by selecting all septic systems within the defined sewer or cluster boundaries as shown in Figure 8.1, 8.3, 8.4 and 8.5 of the Plan. The number of septic systems converted to individual denitrification systems as part of the denitrification overlay was determined by selecting all septic systems with property boundaries intersecting the defined overlay boundary which includes all land area within 2000 feet of the Westport River (East and West branches). Septic system counts and estimated benefits for the denitrification overlay exclude septic systems counted under the cluster alternative to avoid double counting of benefits. Additionally, the values reported for the denitrification overlay are only for the East Branch subwatersheds. Values for the denitrification overlay alternative in Table A.3 are slightly different than values presented in Table 8.1 of the Plan due to these adjustments.

Table A.3 Estimated Nitrogen Removal from All Wastewater Alternatives

Alternative	Conventional septic systems addressed (188 gpd water use)	Conventional septic systems addressed (376 gpd water use)	Estimated nitrogen reduction benefit (kg/y)
Sewer PH 1A	32	2	210
Sewer PH 1B	868	75	5935
Cluster system, The Let	35	1	125
Cluster system, Cadman's Neck	48	3	182
Denitrification Overlay (2,000 ft)	740	102	3186

Nitrogen Removal from Vegetative Buffer Strips for Agricultural Land Use

Nitrogen loading from agriculture was calculated in the MEP Report based on agricultural area and crop types, as well as type and number of farm animals. Different nitrogen loading and soil leaching factors from scientific literature where applied for different crop and animal types. In general nitrogen loads are proportional to the amount crop area and number of animals. For more information on specific on nitrogen loading factors, refer to the MEP Report.

Nitrogen removal from the installation of vegetative buffer strips can occur in two ways:

1. Nitrogen removal from the effectiveness of the vegetative buffer
2. Nitrogen removal from the reduction in agricultural land use cover to accommodate the installation of vegetative buffer strips

The nitrogen removal effectiveness of a vegetative buffer can vary widely depending on the width of the buffer strip, species of vegetation planted, density and order of vegetation planted as well as topography, size and shape of the agricultural area and soil/groundwater conditions, among other parameters. The nitrogen removal effectiveness depends on the percentage of agricultural nitrogen load treated by the buffer and the percentage of nitrogen removal achieved. This calculation is presented below.

$$(N\ removal\ from\ effectiveness\ of\ buffer) \\ = (N\ load\ from\ Crops\ and\ Animals)(\%\ Argicultural\ Load\ Treated)(\%\ N\ removal\ effectiveness)$$

Vegetative buffer strips can remove nitrogen from surface flow of agricultural runoff and can also remove nitrogen from subsurface groundwater flow through nutrient uptake from root structures and through microbial denitrification. An EPA review of 66 studies evaluating different types vegetative cover and removal from both surface and subsurface flow found a mean nitrogen removal percentage of 74.2% with nitrogen removal for grass buffers ranging from 27-89% for the two central quartiles.[2]

The second type of nitrogen removal does not occur if agricultural buffer strips are installed on area that was not previously occupied by agricultural area. The second type of nitrogen removal only occurs if agricultural buffer strips replace area previously occupied by agriculture. Reducing the agricultural area reduces the initial source nitrogen loading from agriculture which is proportional to the total amount of agricultural area.

$$(N\ removal\ from\ land\ use\ reduction) = (crop\ area\ converted\ to\ buffer)(N\ loading\ rate\ for\ crop\ area) - (crop\ area\ converted\ to\ buffer)(N\ loading\ rate\ for\ \text{"}natural\text{"}\ buffer\ strip\ area)$$

For the purposes of this analysis, the second type of nitrogen removal was not considered when estimating nitrogen removal benefits on a subwatershed and town wide scale. This method can still be used to estimate nitrogen removal for a specific implementation site where the area of proposed buffer strips replacing area previously occupied by agriculture is known.

A standard nitrogen removal effectiveness of 50% was chosen based on an EPA review of nitrogen removal effectiveness and to account for variations in the parameters that affect nitrogen removal. The maximum feasible percentage of agricultural nitrogen load treated by vegetative buffers, within the town boundary of Westport only, was chosen to be 50%. This is an optimistic level of implementation to be achieved over a period of time. As stated previously, the percentage of agricultural nitrogen load treated on an individual farm site will vary based on the topography, size and shape of the agricultural area and soil/groundwater conditions, among other parameters. Also note that most of the agricultural nitrogen load town wide, as calculated using the MEP methodology, is from farm animals (specifically dairy and beef cows) as opposed to fertilized crop area. This means that implementation of buffer strips at farms with animals will address a greater portion of the agricultural nitrogen load. In this sense, the 50% of agricultural load treated does not mean that 50% of total farms or 50% of the agricultural area town wide will need to be treated by buffer strips. The nitrogen removal in the East Branch for this maximum implementation level (50% of total load treated) and for a pilot level of implementation (12.5% of total load treated) are presented below. For reference, the pilot level of implementation corresponds approximately to treating the nitrogen load from 200 dairy or beef cows and 100 acres of corn, vegetable, vineyard of fruit crops.

$$(N\ removal\ for\ maximum\ implementation) = \left(38{,}152\frac{kg\ N}{year}\right)(50\%)(50\%) = 9538\frac{kg\ N}{year}$$

$$(N\ removal\ for\ pilot\ implementation) = \left(38{,}152\frac{kg\ N}{year}\right)(12.5\%)(50\%) = 2384\frac{kg\ N}{year}$$

[2] *Mayer, P. M., S. Reynolds, Tim Canfield, AND M. McCutchen. Riparian Buffer Width, Vegetative Cover, and Nitrogen Removal Effectiveness: A Review of Current Science and Regulations. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-05/118, 2005.*

Nitrogen Removal from Reducing Residential Fertilizer

Nitrogen removal from reducing or eliminating residential fertilizer use is a source control measure that stops the introduction of fertilizer containing nitrogen into the environment. Reducing the amount of fertilizer applied to a residential lawn can ensure that all or most of the fertilizer is taken up by grass and vegetation. A 95% removal effectiveness was assumed for individual residential parcels where lawn fertilizer would be reduced or eliminated. A percentage of 95% was chosen as opposed to 100% to account for the conversion of fertilized lawn area to "natural" area which still has a small nitrogen load contribution. A maximum implementation level of 50% of residential properties was chosen to estimate the potential nitrogen removal from reducing residential fertilizer. The calculation of the nitrogen removal for the East Branch is presented below.

$$(N\ removal\ from\ lawn\ fertilizer\ reduction) = (N\ load\ from\ lawn\ fertilizer)(\%\ removal\ effectiveness)(\%\ residential\ parcels)$$

$$(N\ removal\ from\ lawn\ fertilizer\ reduction) = \left(2{,}056\frac{kg\ N}{year}\right)(95\%)(50\%) = 978\frac{kg\ N}{year}$$

Nitrogen Removal from Natural Attenuation

Attenuation of nitrogen occurs when nitrogen introduced into the environment passes through surface water ecosystems (ponds, wetlands, streams) and is removed by natural biological processes before reaching a receiving water body, in this case the Westport River. This removal of nitrogen is largely uncontrollable and can vary temporally with and with varying precipitation. Alterations to the hydrology of the watershed such as constructed wetlands can create new surface ecosystems that can increase attenuation.

The MEP Report presents unattenuated and attenuated nitrogen loads by source for each subwatershed. Unattenuated loads were determined directly from nitrogen loading calculations based on land use. Attenuated nitrogen loads were determined by applying attenuation factors to unattenuated loads in specific subwatesheds with surface water ecosystems. Attenuation factors were determined by measuring the flow and nitrogen concentrations at major surface water discharge locations within the watershed and comparing to predicted nitrogen loading from the land-use based model. The attenuation factor is the percent reduction in nitrogen loading between observed and predicted nitrogen load.

When evaluating nitrogen reduction benefits of proposed alternatives, the assumptions for attenuation from the MEP Report were not modified. A 15% attenuation factor was applied to the revised unattenuated nitrogen load values for the Old County Road Gauge Total (subwatersheds 1-4) and the Adamsville Brook (subwatershed 9). The 15% nitrogen removal from attenuation was applied after including estimated nitrogen load reductions from proposed alternatives. The reduction from attenuation was incorporated into the baseline nitrogen load when presented in Figures 7.2-7.4 of the Plan. The nitrogen load was presented this way to avoid confusion between estimated nitrogen removal from implemented alternatives and estimated nitrogen removal from natural attenuation which is largely uncontrollable. The value of the baseline load varies slightly in these charts because the removal from attenuation is applied after implemented alternatives or buildout loading is applied.