

ATTACHMENT 13

CWMP Phase I – Needs Assessment,
Town of Bourne, March 2022



COMPREHENSIVE WASTEWATER MANAGEMENT PLAN

Phase I —Needs Assessment

Town of Bourne, MA

March 2022



— An Apex Company —

TABLE OF CONTENTS

LIST OF TABLES	IV
LIST OF FIGURES	V
LIST OF APPENDICIES	VI
REFERENCES.....	VII
EXECUTIVE SUMMARY	1
SECTION 1 INTRODUCTION.....	6
SECTION 1.1 PROJECT LOCATION	6
<i>Section 1.1.1 Village Centers.....</i>	<i>7</i>
SECTION 1.2 PURPOSE AND SCOPE	9
SECTION 2 PREVIOUS STUDIES AND REPORTS	10
SECTION 2.1 2007 WASTEWATER MANAGEMENT STUDY	10
SECTION 2.2 2012 DOWNTOWN BUZZARDS BAY STUDY	13
SECTION 2.3 2017-2020 BUZZARDS BAY COALITION STUDY.....	14
SECTION 3 LOCAL/REGIONAL PLANNING INITIATIVES	17
SECTION 3.1 LOCAL INITIATIVES	17
<i>Section 3.1.1 Local Comprehensive Plan</i>	<i>17</i>
<i>Section 3.1.2 Growth Incentive Zone</i>	<i>19</i>
SECTION 3.2 REGIONAL INITIATIVES	19
<i>Section 3.2.1 Section 208 Plan and 208 Plan Update</i>	<i>19</i>
<i>Section 3.2.2 Upper Bay Project.....</i>	<i>19</i>
<i>Section 3.2.3 Joint Base Cape Cod Shared Wastewater Management Study (SWMS).....</i>	<i>20</i>
SECTION 4 ENVIRONMENTAL AND WATER RESOURCES	22
SECTION 4.1 COASTAL EMBAYMENTS.....	22
SECTION 4.1 SOILS.....	22
SECTION 4.2 GROUNDWATER RESOURCES	23
<i>Section 4.2.1 Cape Cod Aquifer</i>	<i>23</i>
<i>Section 4.2.2 Plymouth-Carver Aquifer</i>	<i>24</i>
<i>Section 4.2.3 Groundwater Contaminants of Concern</i>	<i>26</i>

SECTION 4.3	WETLANDS AND FLOODPLAINS.....	28
Section 4.3.1	MassDEP Wetlands Mapping.....	28
Section 4.3.2	FEMA Floodplains	28
SECTION 4.4	ENDANGERED SPECIES.....	28
SECTION 4.5	EELGRASS	30
SECTION 5	BUILT SYSTEMS.....	32
SECTION 5.1	TOWN PLANNING DATA.....	32
Section 5.1.1	Parcel Density	32
Section 5.1.2	Land Use.....	32
Section 5.1.3	Zoning	32
SECTION 5.2	PRIVATE WATER SUPPLY WELLS AND TREATMENT	33
SECTION 5.3	MUNICIPAL WATER SUPPLIES.....	34
Section 5.3.1	Bourne Water District.....	34
Section 5.3.2	Buzzards Bay Water District.....	34
Section 5.3.3	North Sagamore Water District	35
Section 5.3.4	Summary of Water Usage.....	35
SECTION 5.4	EXISTING WASTEWATER MANAGEMENT.....	35
Section 5.4.1	Title 5 – State Environmental Code	36
Section 5.4.2	Health Department Data	36
Section 5.4.3	Areas of Known Title 5 Concerns	37
Section 5.4.4	Municipal Wastewater Infrastructure	38
Section 5.4.5	ISWM Leachate.....	41
Section 5.4.6	WWTF with Direct Discharge Permits	41
Section 5.4.7	WWTF with Groundwater Discharge Permits	42
Section 5.4.8	Summary of Wastewater Flows.....	44
SECTION 6	SURFACE WATER QUALITY AND NITROGEN LOADING	44
SECTION 6.1	BEACHES.....	45
SECTION 6.2	MASSDEP CLASSIFICATIONS OF SURFACE WATER QUALITY	46
Section 6.2.1	Bourne’s Impaired Waterways and Waterbodies	47
SECTION 6.3	MASSACHUSETTS ESTUARIES PROJECT (MEP).....	50
Section 6.3.1	Methodology	51
Section 6.3.2	Section 208 Plan Updates.....	51

SECTION 6.4	EMBAYMENTS WITH TMDLS	52
<i>Section 6.4.1</i>	<i>Fiddlers Cove and Rands Harbor</i>	52
<i>Section 6.4.2</i>	<i>Wild Harbor</i>	52
<i>Section 6.4.3</i>	<i>Megansett-Squeteague Harbor</i>	52
<i>Section 6.4.4</i>	<i>Phinneys Harbor</i>	54
SECTION 6.5	EMBAYMENTS WITH NO ESTABLISHED TMDLS	56
<i>Section 6.5.1</i>	<i>Buttermilk Bay</i>	57
<i>Section 6.5.2</i>	<i>Pocasset Harbor</i>	57
<i>Section 6.5.3</i>	<i>Pocasset River</i>	57
SECTION 6.6	DIRECT DISCHARGE WATERSHEDS	58
SECTION 6.7	SUMMARY OF WATERSHED NEEDS	59
SECTION 7	PUBLIC PARTICIPATION ACTIVITIES	61
SECTION 7.1	INTRODUCTION	61
SECTION 7.2	PUBLIC PRESENTATIONS AND HEARINGS	62

LIST OF TABLES

Table 1: Bourne Population Over Time	7
Table 2: 2007 Recommended Groundwater Discharge Sites.....	12
Table 3: Buzzards Bay Coalition Agawam River Nitrogen Reduction	14
Table 4: GHD Updated Anticipated Flows at Surface Water Outfalls (2021)	16
Table 5: Bourne SWOT Analysis.....	18
Table 6: BBGIZ Revised Threshold for DRI Review, 2019	19
Table 7: Decline of Eelgrass Populations in Selected Bourne Watersheds over Time.....	31
Table 8: Summary of Water District Usage	35
Table 9: MassDEP Groundwater Discharge Permitted Wastewater Treatment Plants	42
Table 10: Summary of Permit Limits, Technology, and Flows for WWTF's with.....	43
Table 11: Summary of Existing Wastewater Flows (2017)	44
Table 12: Summary of Bourne Swimming Beaches, 2016 - 2020	46
Table 13: 2018/2020 MassDEP Integrated List of Impaired Water Bodies in Bourne.....	49
Table 14: Bourne MEP Report Status.....	50
Table 15: MEP Determined Total Nitrogen Loading from TMDL Watersheds	52
Table 16: Megansett-Squeteague Nitrogen Loading Comparisons, Per MEP TMDL Report.....	53
Table 17: Phinneys Harbor MEP Table 4 (recreated), 2007	55
Table 18: 2007 Phinneys Harbor TMDL Table Loading Sources	56
Table 19: Total Nitrogen Removal from Bourne's MEP Embayments with TMDL	56
Table 20: CCC Determined Target Nitrogen Removal per non-TMDL Watershed.....	57
Table 21: Direct Discharge TN Loading Estimates	59
Table 22: Summary of Watershed Nitrogen Removal Requirement.....	60
Table 23: Stakeholder Meeting Schedule.....	61
Table 24: Public Participation Plan - Targeted Information Sharing Schedule	62

LIST OF FIGURES

Figure 1: Study Area.....	Appendix A
Figure 2: Village Centers.....	Appendix A
Figure 3: 2007 Wastewater Management Study Needs Areas.....	11
Figure 4: Shared Wastewater Management Study Candidate Plan.....	21
Figure 5: Soil Constraints.....	Appendix A
Figure 6: Groundwater Constraints.....	Appendix A
Figure 7: Cape Cod Aquifer Lenses, Cape Cod Commission.....	24
Figure 8: Plymouth-Carver Sole Source Aquifer, USGS.....	25
Figure 9: JBCC Groundwater Contaminant Monitoring Map.....	27
Figure 10: Water Resources.....	Appendix A
Figure 11: Bourne NHESP Species, by Type.....	29
Figure 12: Bourne NHESP Species Status.....	30
Figure 13: Environmental Resources.....	Appendix A
Figure 14: Parcel Density.....	Appendix A
Figure 15: Parcel Density with Zoning Districts.....	Appendix A
Figure 16: Land Use.....	Appendix A
Figure 17: Zoning	Appendix A
Figure 18: Water Districts.....	Appendix A
Figure 19: Existing Wastewater Treatment Facilities.....	Appendix A
Figure 20: Effluent Total Nitrogen from Bourne Existing IA Systems, over Time.....	37
Figure 21: 7-Day Moving Average Flow at Queen Sewell WWTF.....	39
Figure 22: Existing Sewered Parcels with Flow Being Diverted to New Queen Sewell Park WWTF.....	40
Figure 23: Bourne ISWM Leachate Flow and Rainfall over Time.....	41
Figure 24: 2020 MEP Loading Sources to Megansett-Squeteague System.....	53
Figure 25: 2007 MEP Loading Sources to Phinneys Harbor.....	55

LIST OF APPENDICIES

APPENDIX A.....	A
APPENDIX B.....	
APPENDIX C.....	
APPENDIX D.....	

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Terms and Acronyms

208 Plan	The Section 208 Area Wide Water Quality Management Plan, developed under Section 208 of the Clean Water Act in 1978 and updated in 2015, is a framework to restore embayment water quality on Cape Cod. See also CCC.
303(d) List	Massachusetts' list of impaired and threatened waters per Clean Water Act Section 303(d).
ACEC	Areas of Critical Environmental Concern
BBC	Buzzards Bay Coalition
BGS	Below Ground Surface
BMP	Best Management Practice can be used to describe a stormwater treatment system or standard of care
BOD5	5-Day Biochemical Oxygen Demand measures the organic strength of wastewater
BOH	Board of Health
CCC	Cape Cod Commission is the regional land use planning, economic development, and regulatory agency created in 1990 to serve the citizens and 15 towns of Barnstable County, Massachusetts.
CEC	Contaminants of Emerging Concern
CFR	Code of Federal Regulation
CMR	Code of Massachusetts Regulations
CWA	Clean Water Act
CWMP	Comprehensive Wastewater Management Plan; See Town Website "Frequently Asked Questions" Fact Sheet
DEIR	Draft Environmental Impact Report
DEP	Department of Environmental Protection
DO	Dissolved Oxygen
DRI	Development of Regional Impact
EIR	Environmental Impact Report
ENF	Environmental Notification Form
EOEEA	Executive Office of Energy and Environmental Affairs
EP or EPG	Environmental Partners Group, Inc.
FEIR	Final Environmental Impact Report
FEMA	Federal Emergency Management Agency
FIRM	Federal Insurance Rate Map
GIS	Geographic Information System
GWDP	Groundwater Discharge Permit
GPD or (gpd)	Gallons per Day
I/A	Innovative and Alternative Onsite System
I/I	Inflow and Infiltration, or uncontrolled flow sources into a sewer system. Typically from breaches in manholes, pipe joints, service connections or illegal connections.
IMA	Inter-municipal Agreement
IUP	Intended Use Plan
JBCC	Joint Base Cape Cod
LCP	Local Comprehensive Plan, completed in 2019 by Town of Bourne

Terms and Acronyms

LiDAR	Light Detection and Ranging; used for gathering terrain and elevation data, typically by drone or aircraft use.
MASSGIS	Massachusetts Office of Geographic Information Systems
MCL	Maximum Contaminant Level
MEP	Massachusetts Estuaries Project
MEPA	Massachusetts Environmental Policy Act, is a public review of potential environmental impacts of projects.
MESA	Massachusetts Endangered Species Act
mg/L	Milligrams per Liter
MMA	Massachusetts Maritime Academy
NEIWPCC	New England Interstate Water Pollution Control Commission is a regional commission that helps the states of the Northeast preserve and advance water quality.
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NHESP	National Heritage and Endangered Species Program
NOAA	National Oceanic and Atmospheric Administration, a federal department of the U.S. Department of Commerce
NPC	Notice of Project Change
NRCS	National Resources Conservation Service; a federal agency which provides soil data and regional agricultural support
NPS	Non-point source; describes water runoff which is collected from several sources (ground, street, roof) as opposed to a point source or single outlet (effluent pipe or groundwater discharge wick)
PPM	Parts Per Million; see also “mg/L”
PPY	Pounds per year; lbs./year
PRB	Permeable Reactive Barrier
SAS	Soil Absorption System also known as a leach field
SBR	Sequencing Batch Reactor; a technology used for wastewater treatment
SCADA	Supervisory Control and Data Acquisition; A process control and monitoring system for Water and Wastewater Treatment Facilities
SMAST	School of Marine Science and Technology, University of Massachusetts Dartmouth
SNEP	Southeast New England Program; A partnership of government and non-government organizations all collaborating to innovatively improve water quality and habitats within New England’s coastal watersheds.
SRF	State Revolving Fund
SSO	Sanitary Sewer Overflow
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TR-16	Technical Report No. 16—Guides for the Design of Wastewater Treatment Works by NEIWPCC; Used as guide by engineers and operators for design criteria
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency

Terms and Acronyms

USGS	United States Geologic Survey; A federal agency responsible for soil, groundwater, stream and environmental data collection.
UV	Ultraviolet; A method for disinfection of wastewater effluent prior to discharge.
WPA	Wetlands Protection Act
WQS	Water Quality Standard
WWTF or WWTP	Wastewater Treatment Facility or Wastewater Treatment Plant.

EXECUTIVE SUMMARY

The Town of Bourne is located at the head of Cape Cod, stretching from Buzzards Bay to Cape Cod Bay. The Cape Cod Canal splits the Town into Northern and Southern sections. Bourne has 10 villages and hosts the Massachusetts Maritime Academy, a secondary education complex located at the west end of the Cape Cod Canal. Joint Base Cape Cod (JBCC) Military Base, located in the southeastern portion of Town, owns over 40% of land area within Town boundaries. The Town's full-time population is approximately 20,500 increasing to 40,000 between the months of June through September.

In 2019, Bourne updated their Local Comprehensive Plan, through which the Town identified preserving and conserving water quality as the highest priority of Town development. In response, the Town embarked on preparing a 20-year Comprehensive Wastewater Management Plan (CWMP) that addresses this issue, with the goal of developing a comprehensive strategy for wastewater and nutrient management through 2040, the Plan considers both current conditions as well as future buildout of the community.

This Needs Assessment Report is Phase I of the four-phased approach for the CWMP, with a planning period of 2022 – 2042. The CWMP phases are:

- Phase I – Needs Assessment (this document)
- Phase II – Identification of Alternatives
- Phase III – Draft Recommended Plan
- Phase IV – Massachusetts Environmental Policy Act (MEPA) and Cape Cod Commission (CCC) 208 Plan Consistency Review

This Needs Assessment Report is organized into seven (7) sections as follows:

1. **Section 1 – Introduction** provides a historic context of the town of Bourne and a sense of the Villages north and south of the canal which make up the totality of the community.
2. **Section 2 – Previous Studies and Reports** Summarizes the findings of wastewater studies performed in the last 20 years. These studies focused on the wastewater needs of the Buzzards Bay economic hub of the community. The studies included the evaluation of a centralized wastewater solution for North of the Canal and highlighted additional needs areas in Monument Beach and Tahanto/Hen Cove areas South of the Canal. Previous studies indicated the need for wastewater management of approximately 2.3 MGD Town wide.
3. **Section 3 – Local/Regional Planning Initiatives** - Summarizes Bourne's local and regional planning initiatives conducted over the last 20 years. The outcomes of these initiatives were utilized as the baseline for this assessment. These previous regional plans concentrated on future growth and development in Buzzards Bay neighborhood and Village Centers, in keeping with existing historic character and buildout. The number one priority of Bourne

residents, continuously communicated in these planning studies, is protection and restoration of water quality to serve the coastal community.

4. **Section 4 – Environmental and Water Resources** describes the existing environmental and water resources within Bourne. This where the focus turns to watersheds. The remainder of this study and the CWMP will present current and future wastewater management needs by watershed within the community. This section describes the environmental and water resources within Bourne, including wetlands, endangered species, groundwater, soils, and a summary of MassDEP's Eelgrass study. According to residents. Bourne's single greatest natural resource is its coastline, which is one of the longest on Cape Cod. Their shared goal is to restore and protect the natural environment to the greatest extent possible while accommodating the needs of residents and visitors for housing, transportation, recreation and economic opportunity.
5. **Section 5 - Built Systems** begins with a description of the current town planning demographics (parcel density, land use and zoning) and presents information on existing water and wastewater infrastructure. There are over 500 people per square mile in Bourne with the largest land use of Public/Semi-Public and Tax Exempt properties due to Joint Base Cape Cod and other protected land areas associated with current and former base operations. The following land uses breakdown each area of Town:
 - Public/Semi-Public and Tax Exempt, 14,911 acres (47% of total area)
 - Joint Base Cape Cod, 10,238 acres (33% of total area)
 - Residential Land, 5,250 acres
 - Commercial/Industrial Land, 632 acres
 - Freshwater Area, 300 acres
 - Mixed Use Land Area, 61 acres

Existing infrastructure consists of a mix of public and private facilities. The Town has three water districts (Bourne, Buzzards Bay and North Sagamore) within its town limits. These Water Districts service approximately 98% of the population with the remaining 2% on private water systems. Current water usage total from all three water districts is 3 MGD

Wastewater infrastructure consists of gravity sewers, low pressure sewers, pump stations and one public wastewater treatment, Queen Sewell WWTF, all located north of the canal. All other built wastewater infrastructure is located south of the canal and consists of numerous private decentralized wastewater treatment facilities and associated infrastructure. Combined these built wastewater facilities provide permitted treatment capacity for up to 0.38 MGD for 8% of the population with the remaining 92% of the population on a combination of cesspools and Title 5 septic systems and I/A systems.

6. **Section 6 - Surface Water Quality and Nitrogen Loading** presents the current status of water quality in Bourne's nine (9) watersheds based on historical water quality data from Board of Health Beach Data, MassDEP 303d Impaired Water lists, Buzzards Bay Coalition monitoring data, Cape Cod Commission Watershed Reports, and Massachusetts Estuaries

Project study data. In Bourne, there are seven watersheds which drain into coastal embayment systems. The remaining two Bourne watersheds are where groundwater discharges directly into the open coastal waters of Cape Cod Canal, Cape Cod Bay and the Atlantic Ocean.

- Buttermilk Bay Basin
- Canal North and South Basins (Direct Discharge)
- Phinneys Harbor/Back River Basin
- Bourne Buzzard's Bay Basin (Direct Discharge)
- Megansett- Squeteague Harbor Basin
- Pocasset River Basin
- Pocasset Harbor Basin
- Rands Canal Basin
- Wild Harbor Basin

Two of the nine basins do not fall into the priority list categories. Bourne's land falling within the boundaries of Rands Canal and Wild Harbor basins is minimal as there is not any current or anticipated development in those portions of town. This section summarizes the impact of existing water quality and nitrogen loading and identification of priority watersheds for wastewater management. The needs area watersheds within Bourne are listed below in order of priority focus and summarizes the needs assessment evaluation and recommendations for next step Phase II – Alternatives Analysis.

- TMDL Watersheds
 - **Megansett-Squeteague Harbor:** While Megansett-Squeteague Harbor has a TMDL, the percentage share of removal combined with the overall controllable wastewater load reduce the removal requirement to below 600 kg N/year. Therefore, we recommend maximizing stormwater and downstream best management practices at this time. Future development of a watershed plan will require Bourne to coordinate with Falmouth to develop a shared approach to managing loads in the future.
 - **Phinneys Harbor:** As a TMDL watershed, the over 1,700 kg N/year removal requirement prioritizes Phinneys Harbor for wastewater management solution integration within the first five years of a recommended implementation plan. Identifying shared wastewater capacity to propose a centralized solution, investigating onsite alternatives for wastewater management in hard to reach areas, and maximizing shared stormwater improvement solutions will be critical in this area. The separation between the coastal and non-coastal community topography will be critical in managing alternatives, and the widespread area will need to consider costs of treatment.
- Non-TMDL Watersheds
 - **Buttermilk Bay, Pocasset Harbor and Pocasset River:** All three of these watersheds are non-TMDL watersheds but are determined to be high-priority for implementation according to the MassDEP/EPA joint-approved Impaired Water List. All three watersheds have documented

water quality concerns, including eutrophication and nitrogen loading concerns. Therefore, following the TMDL watersheds, these three watersheds are considered the next highest priority for determining solutions as part of the recommended plan. These watersheds will also need centralized, decentralized and non-traditional alternative analysis to determine the best possible combination of treatment technologies which maximize nitrogen removal, improve water quality, and are cost effective.

- **Buzzards Bay and Cape Cod Canal:** Both are direct discharges with no Nitrogen or Biological impairments as identified by MassDEP and EPA in the most recent list of Impaired Waters. Understanding that protection of both of these waterbodies regardless of Impairment status is highly prioritized by the Town of Bourne, EP recommends that long-term solutions be implemented in a phased approach for these waterbodies. This being said, EP expects that additional guidance and development of watershed specific plans will be made available after improvement is monitored and reported.

A summary table with the removal requirement for each watershed is provided in Table ES-1.

Table ES - 1: Summary of Watershed Nitrogen Removal Requirement

Embayment	Total Nitrogen Load Values (kg-N/yr.)		Total Load to Remove (kg-N/yr.)	Bourne's % Responsibility for Removal	Bourne Total Removal (kg-N/yr.)	Equivalent # of Septic Systems**
	Septic	Total Load				
Megansett-Squeteague Harbor	7,611	11,658	1,446	39%	564	113
Phinneys Harbor	5,948	8,730	1,706	100%	1,706	342
Buttermilk Bay	4,058	5,610	1,402*	100%	1,402*	280
Pocasset Harbor	7,958	12,479	3,120*	100%	3,120*	624
Pocasset River	3,762	5,157	1,289*	100%	1,289*	258
Buzzards Bay	16,830		4,208*	TBD	TBD	842
Cape Cod Canal	164,028		41,007*	TBD	TBD	8,202
Total					8,072	10,661

*Estimated 25% removal, subject to revision and MassDEP approval.

** Each septic system assumed to contribute 5 kg N per year per housing unit (2 kg N per capita per year and 2.49 average people per Bourne unit).

- Section 7 - Public Participation Activities** summarizes Public Participation activities conducted throughout Phase I of the CWMP. Bourne actively seeks to create opportunities for public education, outreach, and participation throughout the project.

- Events held or attended by EP Team Members:
 - Three Public Education workshops were held. Two were held virtually in May 2021 and one was hybrid (both virtual and in-person) in December 2021.
 - Three (3) Board of Sewer Commissioners meetings attended quarterly Zoom or in-person
 - An additional event included attendance at Cape Cod Canal Day, a community event held outdoors at the Canal Park, where EP team members and Town Staff answered questions about the first phase of the project.
- Materials distributed for the CWMP project:
 - Fact Sheets, including acronyms, frequently asked questions, and an “It’s All Connected” nitrogen removal primer
 - Public Workshop flyer advertisements
 - Quarterly Updates
 - Copies of deliverable reports and presentation slides

Materials are uploaded and distributed through the Comprehensive Wastewater Management Plan page of the Town Website, accessible through the Town Homepage via a single-click button.

SECTION 1 INTRODUCTION

During 2019, Bourne updated their Local Comprehensive Plan, through which the Town establishes and prioritizes several important goals for preserving the Town's quality of life. The Plan identifies the maintenance of high water quality as a fundamental aspect of the Town's character and designated as its highest priority. In response, the Town is preparing a Comprehensive Wastewater Management Plan (CWMP) that addresses this issue, with the goal of developing a comprehensive strategy for wastewater and nutrient management for the next 20 years through 2040, the Plan considers both current conditions as well as future buildout of the community over this time.

The first step in developing this Plan is to conduct an in depth Needs Assessment that describes the existing and future water quality conditions of the Town. Bourne has six coastal embayments and three direct discharge watersheds. On Cape Cod water quality in fresh and salt water resources are benchmarked by looking at nitrogen concentrations and discharges. Nitrogen most negatively affects eelgrass and supporting biological communities, as eelgrass are considered to be a keystone species, or a species which brings other crustacean, fish and bird populations to a habitat. Therefore, nitrogen is considered to be the focus of this CWMP.

This report describes the water quality of the Town's watersheds, identifies impacts associated with nitrogen loadings from wastewater disposal under existing and anticipated future population levels, and identifies areas of need for wastewater disposal solutions based on each watershed's TMDL goals. **Figure 1 in Appendix A** presents the study area which is the subject of this CWMP.

SECTION 1.1 PROJECT LOCATION

The Town of Bourne is located at the head of Cape Cod, stretching from Buzzards Bay to Cape Cod Bay. The Cape Cod Canal splits the Town into Northern and Southern sections, with an economic center in Buzzards Bay north of the canal and another economic center along MacArthur Boulevard south of the canal. The Town has 10 villages and hosts the Massachusetts Maritime Academy, a secondary education complex located at the west end of the Cape Cod Canal. Joint Base Cape Cod (JBCC) Military Base, located in the southeastern portion of Town, owns over 40% of land area within the limits of the Town line. The Town's full time population is approximately 20,500 (40,000 seasonally). Residents are converting summer homes into year-round residences and new subdivisions are highly desirable.

Table 1: Bourne Population over Time

Year	Town Report Population	% Change
2010	20,495	
2015	19,507	-4.8%
2016	20,185	3.5%
2017	20,987	4.0%
2018	20,501	-2.3%
2019	20,392	-0.5%
2020	20,452	

Data from Annual Town Reports and U.S. Census

Section 1.1.1 Village Centers

The Town of Bourne has ten village centers: four North of the Cape Cod Canal and six South of the Cape Cod Canal. The main features of each village are presented here. **Figure 2 in Appendix A** shows the Village Centers in Bourne.

Sagamore Beach, situated north of the Canal, this area is east of Route 3 and features residential development set up on cliffs overlooking the Sagamore Beach. Sagamore Bridge connects this village with the rest of the Town of Bourne. Scusset Beach State Reservation and several public beach access points are of local interest to the region.

Bournedale is north of the Canal and west of Sagamore Beach. Bournedale is characterized by its long span of views along the Northern Side of the Cape Cod Canal. Route 6 traverses between the Sagamore and Bourne bridges through this village and is dotted with businesses for its length. The village includes several neighborhoods located on either side of the route. This village is home to the Town's primary elementary school, Bournedale Elementary School. Several natural resource areas including the Herring River Watershed Area of Critical Concern, Nightingale Pond Conservation Land, Bourne Scenic Park (walking access along Cape Cod Canal), and Carter Beal Conservation Area are accessible in this village.

Buzzards Bay is located north of the Canal and west of Bournedale and Sagamore Beach. Buzzards Bay serves as the westernmost neighborhood in Bourne. It shares a border with Wareham and contains a scenic downtown waterfront park, seasonal rail service, walkable shops and businesses and is home to the Massachusetts Maritime Academy. At the intersection of Routes 6, 25, and 28, this region has rail access and has secured status as a Smart Growth Corridor. The Bourne public sewer system serves the downtown Buzzards Bay district and utilizes both Wareham public sewer and the newly built Queen Sewell WWTF to serve critical Police, fire station, public health and Town resources centered in Buzzards Bay.

Bourne Village is home to the scenic Midway Cape Cod Canal Recreation Park, Gallo Ice Arena and several public schools including: Bourne Middle School, Bourne Intermediate School, Bourne High

School, and Upper Cape Cod Regional Technical High School. Located south of the canal, there are several businesses and residential developments throughout this area, as well as the main access point to Joint Base Cape Cod (JBCC). The Route 28 corridor offers several business fronts, industrial entities and business parks. The Integrated Solid Waste Management (ISWM) Landfill operates adjacent to JBCC along Route 28.

North Sagamore is home to residential neighborhoods, several businesses and a Post Office. The main access is off of Route 3 on the mainland side of the bridge crossings. This area features public beach access through Sagamore Beach, Sagamore Highland viewing area and a spattering of kettle ponds. Geographically, this village features higher elevations and steep beach cliffs, with sweeping views of the Cape Cod Bay.

Sagamore is uniquely split between north and south of the Cape Cod Canal, with Sagamore Beach to the north, the Town of Sandwich to the southeast, and Joint Base Cape Cod to the south. Sagamore features one of the two vehicle crossings to Cape Cod, the Sagamore Bridge, and several businesses and shopping centers located near the junctions of Routes 3, 6 and 6A. Sagamore is served by its own Post Office, Cemetery, and some local shops and restaurants.

Gray Gables is located at the confluence of the Cape Cod Canal and Buzzards Bay. It contains the Bourne Back River Area of Critical Concern, including Back River and Eel Pond. There are several small businesses including restaurants, shops and markets located within this village area.

Monument Beach is set along Buzzards Bay in the Atlantic Ocean, the quiet Monument Beach residential neighborhood is popular for swimming at its sandy namesake beach. There are several playgrounds and parks, including the Bourne Back River Area of Critical Environmental Concern nature preserve. The Brookside Club features upscale golf facilities.

Pocasset is located in the southwestern part of the town of Bourne. It is bordered to the north by the villages of Gray Gables and Monument Beach, to the east by the Massachusetts Route 28 highway; to the south by the village of Cataumet and Red Brook Pond and Red Brook Harbor; and to the west by the northern end of Buzzards Bay.

Cataumet is the southernmost village in Bourne, sharing a border with North Falmouth. It is bounded to the east by Route 28 and traverses from approximately the intersection of Shore Road and County Road to Route 28A and Perry Road. Scraggy Neck Road provides access to the peninsula Scraggy Neck private neighborhood. Two conservation land parcels are in this village, Red Brook Harbor Road and Clifton Broyer Conservation Area and are divided by the former railroad tracks. Several businesses fill out both sides of Route 28A in this village, and its home to active Cranberry Bogs just south of Red Brook Pond.

SECTION 1.2 PURPOSE AND SCOPE

Planning for wastewater management is a critical challenge for the Town of Bourne. The management of wastewater results in protection of public health and the protection of water resources. Bourne's comprehensive growth and development plans require the town to make difficult decisions on public funds among competing interests. This Comprehensive Wastewater Management Plan will ensure that decisions made on planning, design, construction and maintenance of wastewater management options will be the most environmentally sound and the most cost effective for the Town. It is designed to reflect the collective input of residents, local officials, and interested stakeholders who are empowered to manage the growth and development of Bourne now and in the future.

The Comprehensive Wastewater Management Plan (CWMP) process is a multi-phased project. In Phase I, current and future wastewater needs are evaluated, Phase I furthers the plan by presenting alternatives to management of the wastewater needs identified in Phase I. Phase III is the final step in the creation of a 20 year recommend plan for implementation of wastewater management. Phase IV is the regulatory process of finalizing the recommended plan.

This Needs Assessment Report is Phase I of the four-phased approach for the CWMP, with a planning period of 2022 – 2042. The CWMP phases are:

- Phase I – Needs Assessment (this document)
- Phase II – Identification of Alternatives
- Phase III – Draft Recommended Plan
- Phase IV – Massachusetts Environmental Policy Act (MEPA) and Cape Cod Commission (CCC) 208 Plan Consistency Review

Execution of this plan will be consistent with other local planning efforts including the Cape Cod Commission 208 Plan, the intermunicipal agreement between Bourne and Wareham associated with the wastewater treatment plant in Wareham, the Buzzards Bay Coalition Upper Bay Project, considerations of Joint Base Cape Cod proposals, and flow allocation to the new Buzzards Bay Wastewater Treatment Facility.

SECTION 2 PREVIOUS STUDIES AND REPORTS

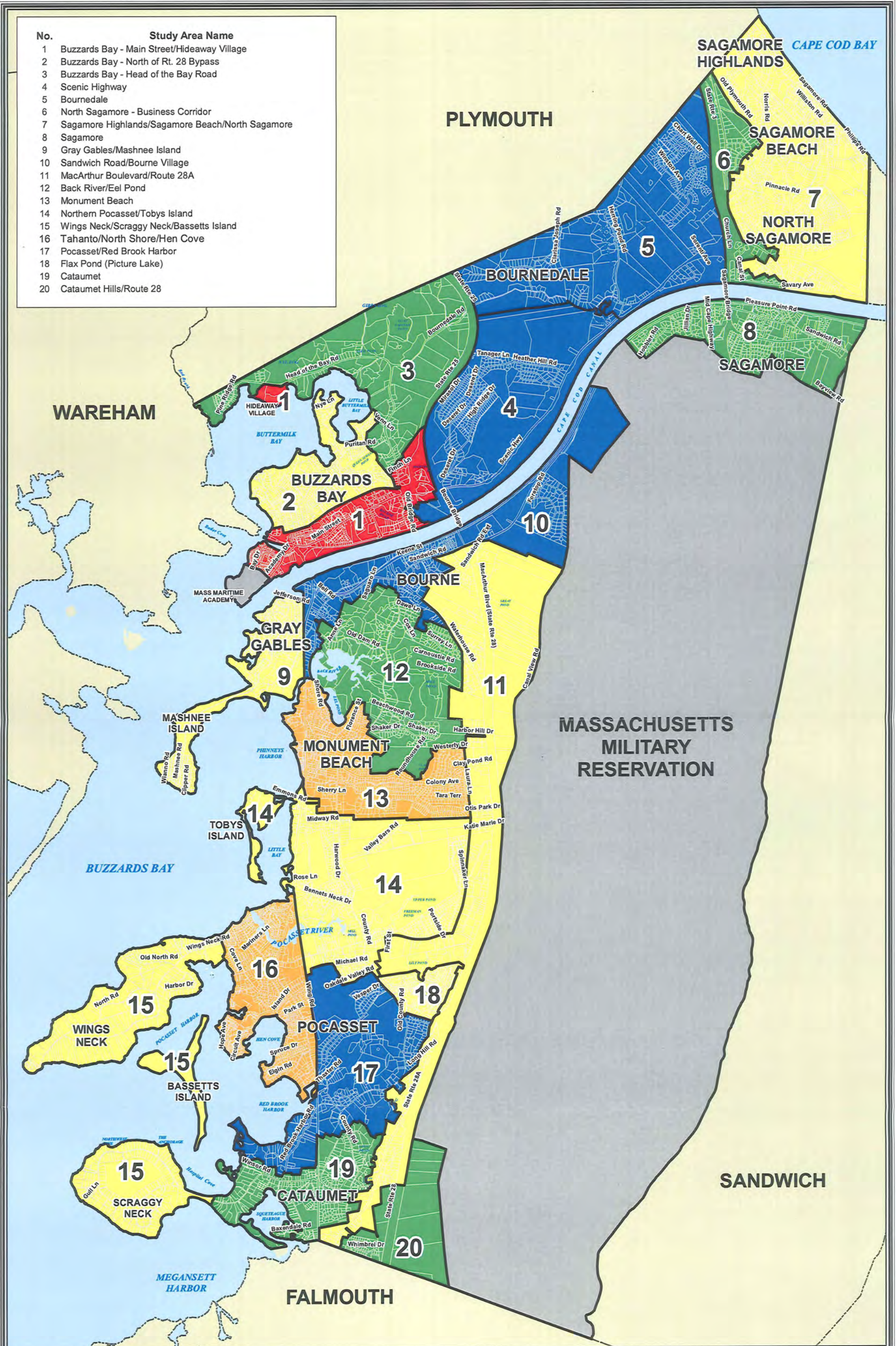
Bourne's history of wastewater planning has generally focused on the Buzzards Bay area. Areas south of the canal have been reviewed for wastewater needs, but further work to evaluate solutions has been limited to the Buzzards Bay area. Documenting this planning history is useful to catalogue the Town's efforts into one document for use in this CWMP and for future reference.

Between 1969 and 1980, Bourne completed several studies outlining the sewer capital needs of the community. Not until 1984, when a Draft 201 Facilities Plan proposed a centralized wastewater management for the downtown corridor, did the Town begin to implement wastewater infrastructure construction. The 1984 study recommended the construction of the centralized wastewater system in Downtown Buzzards Bay which was constructed in 1990. The remainder of the town would focus wastewater management on continuing with Title 5 systems under the supervision of the Board of Health.

SECTION 2.1 2007 WASTEWATER MANAGEMENT STUDY

A Bourne Wastewater Management Study, prepared by Tighe & Bond and dated October 2007, was developed for the Bourne Financial Development Corporation. The purpose of the report was, "to facilitate the revitalization of Main Street Buzzards Bay and provide a framework for long-term wastewater management in greater Bourne." The Plan segmented the town into 20 study areas that evaluated the wastewater needs in each area, as shown in Figure 3:

- | | |
|---|--|
| 1. Buzzards Bay – Main Street/Hideaway Village | 11. MacArthur Boulevard/Route 28A |
| 2. Buzzards Bay – North of Rt. 28 Bypass | 12. Back River/Eel Pond |
| 3. Buzzards Bay – Head of the Bay Road | 13. Monument Beach |
| 4. Scenic Highway | 14. Northern Pocasset/Toby's Island |
| 5. Bournedale | 15. Wings Neck/Scraggy Neck/Bassett's Island |
| 6. North Sagamore – Business Corridor | 16. Tahanto/North Shore/Hen Cove |
| 7. Sagamore Highlands/Sagamore Beach/North Sagamore | 17. Pocasset/Red Brook Harbor |
| 8. Sagamore | 18. Flax Pond (Picture Lake) |
| 9. Gray Gables/Mashnee Island | 19. Cataumet |
| 10. Sandwich Road/Bourne Village | 20. Cataumet Hills/Route 2 |



- | No. | Study Area Name |
|-----|--|
| 1 | Buzzards Bay - Main Street/Hideaway Village |
| 2 | Buzzards Bay - North of Rt. 28 Bypass |
| 3 | Buzzards Bay - Head of the Bay Road |
| 4 | Scenic Highway |
| 5 | Bournedale |
| 6 | North Sagamore - Business Corridor |
| 7 | Sagamore Highlands/Sagamore Beach/North Sagamore |
| 8 | Sagamore |
| 9 | Gray Gables/Mashnee Island |
| 10 | Sandwich Road/Bourne Village |
| 11 | MacArthur Boulevard/Route 28A |
| 12 | Back River/Eel Pond |
| 13 | Monument Beach |
| 14 | Northern Pocasset/Tobys Island |
| 15 | Wings Neck/Scraggy Neck/Bassetts Island |
| 16 | Tahanto/North Shore/Hen Cove |
| 17 | Pocasset/Red Brook Harbor |
| 18 | Flax Pond (Picture Lake) |
| 19 | Cataumet |
| 20 | Cataumet Hills/Route 28 |

Legend

- Imperative Need
- Near-Term Need
- Mid-Term Need
- Long-Term Need
- Low Need
- Parcel

--- Town Boundary
--- Rivers & Streams
--- Lake, Pond, Stream or other Fresh/Salt Water Feature
--- Fresh Water Wetlands
--- Salt Water Wetlands

0 2,000 4,000 Feet
1 inch equals 4,000 feet

Source: MassGIS and Town of Bourne, October 2006

**FIGURE 2-5 - STUDY AREA PRIORITIZATION
BASED ON NEED FOR SEWER SERVICE
BOURNE WASTEWATER MANAGEMENT STUDY
BOURNE, MASSACHUSETTS**

Each area was evaluated for several characteristics, which were assigned a weighted rankings scale to indicate the severity of the impact or constraints associated with the characteristic. Those criteria considered to be “critical” had a 15-point scale, criteria deemed “important” had a 10-point scale, and “significant” criteria had a 5-point scale. The criteria were:

- Physical Constraints
 - Poor Condition/Performance of Septic Systems (15-point scale)
 - Sewer Service Capacity Limitation (15-point scale)
 - 100-year Floodplain and High Groundwater (10-point scale)
 - Low Permeability Soils (10-point scale)
- Water Quality impacts
 - Estuaries/Coastal Embayment Watersheds (10-point scale)
 - Drinking Water Supply Areas (Zone II and IWPA) (10-point scale)
 - Freshwater Ponds (5-point scale)
 - ACEC or Outstanding Resource Water (5-point scale)
- Development Concerns
 - Concentration of Existing Development (15-point scale)
 - Targeted Areas for Moderate to High Density (10-point scale)

Based on the ranking and weighted scales, priorities were ranked in decreasing priority from Imperative through Near-Term, Mid-Term, Long-Term, and Low priority with respect to when the Town should prioritize implementation. The top three ranked areas are:

- | | |
|---|------------|
| • Buzzards Bay – Main Street / Hideaway Village | Imperative |
| • Monument Beach | Near-Term |
| • Tahanto/North Shore/Hen Cove | Near-Term |

Seven Study Areas were ranked as Mid-Term, six were ranked as Long-Term, and four were ranked as Low priority. The Report identified three parcels to be considered and rated as most favorable for subsurface discharge, shown in Table 2 , which may be useful in future evaluation of discharge locations. The current land use codes for two of the parcels are different the LUCs from 2007.

Table 2: 2007 Recommended Groundwater Discharge Sites

Parcel Owner	Map/Block	Address	LUC	Use	Acres
Town of Bourne Parcel	20.0_033.30	35-41 Ernest Valeri Rd	9340 903 ⁽¹⁾	Bourndale Elementary School	124
Ingersoll, Hope, Garland Parcel	10.0_009.00	0 Bourndale Rd	0471 717 ⁽¹⁾	Warehouse Chapter 61A - Agriculture	116
Cape Cod Aggregates Corp.	10.0_010.00	665 Scenic Highway	410	Sand and Gravel Supply	127

(1) Current LUC

The report reviewed four alternatives for wastewater service and discharge locations and recommended a centralized wastewater sewer collection and treatment system for the downtown area of Buzzards Bay (designated as Alternative 1B: Centralized Wastewater Treatment and Groundwater Discharge without MMA WWTP Expansion, with construction of sewers in Study Areas 1 and 2 only and a WWTF and disposal area on the Town of Bourne Parcel at 35-41 Ernest Valeri Road). Study Area 1 is the Main Street and Hideaway Village area currently sewered and the top ranked Needs Area. Study Area 2 is the area from the Route 28 bypass to Little Buttermilk Bay and Buttermilk Bay, ranked as a Mid-Term priority. The study did not evaluate potential wastewater discharge parcels south of the Canal, nor were centralized or decentralized solutions recommended for the watersheds south of the Canal.

SECTION 2.2 2012 DOWNTOWN BUZZARDS BAY STUDY

The Cape Cod Commission completed a study in 2012 focused on the Buzzards Bay/Main Street area, Hideaway Village, and the Bourne Development Campus. The report, "Wastewater Management Planning for Bourne's Downtown" (CH2M, June 2012) recommended that the Ingersoll property at 0 Bournedale Rd be targeted for disposal of up to 47,500 gpd of wastewater effluent.

The Buzzards Bay Water District currently supplies water to this study area from four groundwater wells, operating at or near their permitted capacity. The report reviews options for increasing the District's water supply capacity. These options will need to be considered in conjunction with any plans for wastewater expansion. The CH2M Study recommended that the Town support the Buzzards Bay Water District in planning and securing the additional water necessary for economic growth in Downtown Bourne. The Study determined that subsurface disposal of effluent is the preferred disposal mechanism for whichever system is chosen.

Regional wastewater management alternatives were considered, consisting of increasing wastewater flow to the Wareham treatment plant, sending wastewater to the Massachusetts Maritime Academy, or treatment and disposal at the Massachusetts Military Reservation (now JBCC). None of the regional options were considered feasible options within the downtown growth planning horizon.

Based on decision criteria established by the Bourne Wastewater Advisory Committee, 45 initial parcels were screened as potential sites for wastewater treatment and disposal. Five sites were selected for further analysis. These sites are located both within and outside the downtown area. Each of them is capable of accommodating the 335,000 GPD of wastewater flow projected for a 25 year practical buildout (2037). Two of these sites were preferred for siting a WWTF within the downtown area but one is state-owned and has a potential conflict with the possible Belmont Circle reconfiguration, and the second is privately owned. The preferred sites located outside of the downtown area are the Bournedale Elementary School (Site 16), and Queen Sewell Park (Site 19). The Town ultimately selected Site 19, targeting it to be the location of a 100,000 gpd Membrane Bioreactor (MBR) WWTF with subsurface disposal. The chosen alternative for wastewater flows from Hideaway Village is to continue pumping to the Wareham WWTF.

SECTION 2.3 2017-2020 BUZZARDS BAY COALITION STUDY

In 2017, the Buzzards Bay Coalition received grant funding to investigate strategies for reducing nitrogen loading into the Agawam River. The study concluded that Buttermilk Bay and Little Buttermilk Bay, listed in 2012 as impaired for estuarine bio assessment due to nutrient pollution, have sustained complete loss of their eelgrass population due to eutrophication from nitrogen pollution. The losses of eelgrass in the deep portions of the Bay and in some poorly flushed coves appear to be related to nutrient loading or increased turbidity. Densely developed homes in Bourne and Plymouth using septic systems and cesspools contribute significant amounts of nitrogen to Buttermilk and Little Buttermilk Bay. Expansion of the existing sewer infrastructure to approximately 800 homes in Bourne and 485 homes in south Plymouth could reduce nitrogen discharges to the estuary be approximately 45,163.54lbs/yr., which would reverse the loss of eelgrass habitat and restore the ecosystem.

The purpose of the study was to identify how nitrogen discharges could be reduced to the impaired estuaries of upper Buzzards Bay, with the goal of reducing discharges by 81,406.66 pounds of nitrogen per year into the Agawam River by expanded sewerage, discontinuing the current facility outfall pipe and relocating the outfall to the Massachusetts Maritime Academy outfall pipe. Table 3 summarizes the original estimates.

Table 3: Buzzards Bay Coalition Agawam River Nitrogen Reduction

Existing Nitrogen Load to Impaired Waterbodies		Total Nitrogen Load Reductions from Impaired Waterbodies
Relocate Wareham WWTP discharge from Agawam River to Cape Cod Canal. 1.56MGD at 3mg/L	14,241.27lbs/year	
Expand sewer to ~482 on-site systems in Gateway Shores. 159,060gpd at 35mg/L	16,940.72lbs/year	
Connect ~144 Mobile Home Units. 47,520gpd at 35mg/L	5,061.13lbs/year	
Total nitrogen reduction in Agawam River		36,243.12lbs/year
Expand sewer to ~485 on-site systems in south Plymouth. 160,050gpd at 35mg/L.	17,046.16lbs/year	
Expand sewer to ~800 on-site systems in Queen Sewell Park Neighborhood. 264,000gpd at 35mg/L.	28,117.38lbs/year	
Total nitrogen reduction for Buttermilk Bay		45,163.54lbs/year
Total Annual Nitrogen Load Removed from Impaired Estuaries		81,406.66lbs/year

Five tasks were completed to assess whether this regional concept had merit:

- Task 1 – Survey Railroad Right of Way to determine the feasibility of constructing a force main from Wareham to Bourne

- Task 2 – Sewer Needs Analysis to estimate the maximum volume of wastewater generated from each community.
- Task 3 – Wastewater Treatment Facility Upgrade Needs Assessment to evaluate upgrades necessary for accommodating increased wastewater volume while also maintaining excellent effluent quality.
- Task 4 – Deploy Water Quality Monitoring Buoy to collect baseline water quality data in Buzzards Bay and the Cape Cod Canal.
- Task 5 – Hydrodynamic modeling to understand the water quality impacts of increased effluent discharges into Buzzards Bay.

Conclusions from these evaluations are:

- Constructing a forcemain from Wareham to Bourne using trenchless technologies is feasible, but there are concerns about permanent access and ease of working within the railroad Right of Way.
- The needs analysis for expanding wastewater treatment for the towns of Wareham, Bourne, Plymouth and the Massachusetts Maritime Academy results in an estimated average daily wastewater flow of 3.5 million gallons per day. Combining the new flow with the existing flow of 1.56 million gallons per day at the Wareham WWTP produces a total average daily wastewater flow of 5,060,000 gallons per day.
- Water quality model was created by Woods Hole Oceanographic Institute (WHOI), and four additional water quality monitoring stations were launched to assess data immediately downstream of the MMA outfall. The model predicts that the increased discharge at the Cape Cod Canal will negligibly impact total nitrogen concentrations in Upper Buzzards Bay and its sub-estuaries. The average background nitrogen concentration at the location of the outfall today is 0.32mg/L. An increase of the effluent discharge rate at the MMA outfall to 10 million gallons per day will result in a 2.1% increase in the background total nitrogen concentration to 0.327mg/L.

The study, completed in 2020, provides the following recommendations for next steps if the MMA outfall concept is to be pursued further:

1. Work with MassDOT to secure permission to use the Railroad RROW.
2. Continue baseline monitoring.
3. Seek funding to conduct Massachusetts State Ocean Sanctuaries Act required, benthic and fisheries surveys.
4. Seek funding to commence the design of the force main for construction in the Railroad RROW.
5. Seek funding to design sewer expansion in impaired watersheds.
6. Seek funding to commence a needs analysis for construction of expanded sewers in impaired waterbodies.
7. Pursue permitting.

Table 4: GHD Updated Anticipated Flows at Surface Water Outfalls (2021)

Existing Condition	Nitrogen Loading	Flow (GPD)	Average Loading Rate (lb./day)
MMA outfall	Current MMWTF loading 100 mg/l	77,000	64.3
Future Regional Outfall	New WWTP result in loading of 4 mg/l	1,500,000	50.1

The Buzzards Bay Coalition presented the findings from this study to Bourne at presentations in January and February 2021. The concept of using the MMA outfall for increased discharges into Buzzards Bay is controversial to Bourne's residents. During November 2021 at a Special Town Meeting the Town considered a residential Warrant article, Article 11 voted on a non-binding article to restrict future effluent outfall projects from being constructed within the Town of Bourne. Town Moderator Amy B. Kullar told the audience that passage of Article 11 only required a simple majority. The resulting voice vote was overwhelmingly in favor.

Marion and Wareham are currently updating their CWMP's. These, in combination with Bourne's CWMP, will determine Bourne's approach to the Upper Cape Regional Outfall plan.

SECTION 3 LOCAL/REGIONAL PLANNING INITIATIVES

Bourne has been undergoing several planning projects over the course of the last seven years since the latest 208 Plan Update, including local economic planning and wastewater specific planning. There are also regional studies which other community stakeholders have brought forth that Bourne is a critical participant in. This section summarizes the local and regional initiative which Bourne has participated in that are relevant to wastewater planning.

SECTION 3.1 LOCAL INITIATIVES

Section 3.1.1 Local Comprehensive Plan

The Town completed its Local Comprehensive Plan (LCP) update in 2019, revising an original plan certified by Town Meeting in 2008. The goal of the 2019 LCP was to connect town planning priorities with ongoing regional projects. Bourne recognizes that it has a wealth of water sources and that protecting them is fundamental to the Town's future. The LCP succinctly states that the Town's challenge moving through a pending growth transition will be to "remain a delightful place to live and work". The LCP identifies a number of action items to meet this challenge. With water quality identified as its highest priority, a key action item is to:

"Identify, remediate, treat or contain identified sources of pollution in coastal embayments and estuaries to attain established TMDLs and create a comprehensive wastewater management plan to upgrade public and private wastewater treatment facilities and methods in appropriate areas especially in densely developed neighborhoods, and actively seek grants and other funding to carry out the plan."

The plan outlines a road map for the Town's collective development. During the public planning workshops and a publicly advertised survey, residents ranked Water Quality as the most important issue facing the Town. Specifically, residents identified the following areas as areas of high concern:

- Queen Sewell Area of Buzzards Bay Village (Buttermilk Bay Watershed)
- Gray Gables (north of Monument Beach, Cape Cod Canal Watershed)
- Tahanto (Pocasset, Pocasset River Watershed)
- Barlow's Landing (Pocasset, Pocasset Harbor Watershed)
- Pocasset Heights (Opposite Barlow's Landing, Pocasset Harbor Watershed)
- Patuisset (Directly south of Pocasset Heights, Pocasset Harbor Watershed)
- Cedar Point (Opposite Patuisset, Pocasset Harbor Watershed)
- Picture Lake (inland Pocasset, near Otis Rotary, Pocasset Harbor Watershed)

Residents ranked traffic and transportation concerns with a focus on bridge and traffic management including expanding bicycle infrastructure, and revitalization of Downtown Buzzards Bay as their second highest priority while addressing its coastal resiliency needs.

One of the high priority actions is to extend the Shining Sea Bicycle Trail from Falmouth to the Canal, which would help develop village centers, relieve traffic congestion, and possibly provide a pathway for future utilities. The potential development of village centers will be considered when estimating future wastewater needs.

The planning process included multiple resident workshops and public participation surveys. Information specific to the wastewater development, growth, and socioeconomic goals of the Town are summarized below. As part of a previous State Community Compact workshop, the Town developed the following economic development SWOT (strengths, weaknesses, opportunities, and threats) analysis. Table 4 below shows the results of that planning exercise.

Table 5: Bourne SWOT Analysis

Strengths	Weaknesses
• Coastline – its length, beauty, and opportunities for recreational use • Massachusetts Maritime Academy, as it makes Bourne a “college town” • Bourne’s location relative to Boston, Providence, and the airports • Volunteers who bring valuable skills and experience to town boards and committees • Revitalization efforts coming to fruition in Downtown Buzzards Bay	• Heavy traffic passing through town to other locations on the Cape and Islands • Narrow and aging bridges crossing the canal • Limited public transit • Limited amount of affordable and workforce housing • Antiquated zoning in village centers
Opportunities	Threats
• Excellent Access to metropolitan areas for commuters • Ideal location for hydro technology companies related to Woods Hole Institution • Possibility of better integration of town interests with those of MMA and UCT • Pent-up demand for development needing infrastructure • Underutilized commercial and industrial area	• Competition for housing by second home market • Increasing traffic volume and congestion year-round • Environmental threats from global climate change • Lack of local control over highways and the canal bridges • Potential loss of service from the electrical grid

As identified in the SWOT, the Growth Policy for the Town is to guide growth toward areas that are adequately supported by infrastructure and away from areas that must be protected for ecological, historical, or other reasons. The Growth Policy specifically focuses growth in the downtown area and seeks to protect the character of village centers by encouraging mixed uses development in the village centers to support the surrounding neighborhoods.

The Buzzards Bay area is designated a Growth Incentive Zone by the CCC and targeted for growth by the 2008 LCP. Outside of Buzzards Bay, the community is close to the practical buildout under current zoning.

Section 3.1.2 Growth Incentive Zone

In 2012, the Town submitted a Growth Incentive Zone (GIZ) economic development proposal to the Cape Cod Commission, to stimulate economic growth and development in the Downtown Buzzards Bay region of Bourne. The GIZ is bound by Buzzards Bay Bypass, the approach to the Bourne Bridge, Perry Avenue, along the Northern bank of the Cape Cod Canal, Academy Drive, Wright Lane, across Cohasset Narrows to Eldridge Avenue Ext., and back to the Bypass.

The GIZ operates by allowing for a limit of redevelopment and development to occur within this specific boundary area without triggering the Development of Regional Impact (DRI) review program. The Town of Bourne Planning Board requested a phased approach with goals in commercial and residential offsets to limit development potential elsewhere, and DRI permitting thresholds for commercial development potential and units of residential development in the GIZ for each phase. In 2019, the Town applied for a single threshold for DRI review, replacing the former phased growth model and eliminating the offsets. The revised threshold is summarized in Table 5.

Table 6: BBGIZ Revised Threshold for DRI Review, 2019

Description	Residential Units	Commercial Units
BBGIZ (All Zones)	360	650,000 sf

SECTION 3.2 REGIONAL INITIATIVES

The Town of Bourne collaborates regionally with several neighboring communities, Joint Base Cape Cod, and stakeholder groups such as the Cape Cod Commission and Buzzards Bay Coalition to identify potential synergies associated with nitrogen removal. These regional approaches potentially provide opportunities through the economy of scale of each project. Specific regional opportunities include: the CCC 208 Plan that was finalized in 1978, the Upper Bay Project and Upper Cape Cod Project.

Section 3.2.1 Section 208 Plan and 208 Plan Update

The Cape Cod Planning and Economic Development Commission finalized a plan in 1978 as required under Section 208 of the Clean Water Act. The Act is intended for communities to develop solutions for addressing water quality problems resulting from point-direct and non-point discharges to surface waters occurring within specified geographic regions of the state, one of them being the Cape Cod region. In 2015 the Cape Cod Commission updated the 208 Plan; the goal of the update was to provide a status report on the recommendations adopted in the 1978 plan. CCC continues to update the plan, using it as a measurement tool to identify the progress of its member communities towards implementation of the Plan.

Section 3.2.2 Upper Bay Project

The Upper Bay Project is being initiated and managed through the Buzzards Bay Coalition and the communities of Wareham, Marion, Bourne and Plymouth. This project was funded through several iterations of EPA grants to the Buzzards Bay Coalition and stakeholders, to determine the existing wastewater needs in Upper Buzzards Bay and to investigate alternatives for potentially mitigating these needs. One alternative outcome from this project is the Cape Cod Canal outfall proposal, which would divert effluent flow from the Wareham WWTF via a force main to the existing Massachusetts Maritime Academy outfall. This alternative continues to be discussed and debated.

Section 3.2.3 Joint Base Cape Cod Shared Wastewater Management Study (SWMS)

Beginning in 2017, the communities of Bourne, Falmouth, Mashpee, and Sandwich, Joint Base Cape Cod (JBCC), and MassDevelopment partnered in a study to evaluate the use of the JBCC wastewater treatment plant as a potential regional facility. In 2019, the town of Barnstable became interested in the potential regional use of the facility and was added to the analysis.

The 2017 project analyzed current and future treatment capacity and potential costs associated with expansion of the WWTF and the disposal beds from the current WWTF capacity of 0.36 MGD, with current flows of 0.14 MGD, and the current infiltration bed capacity of 0.36 MGD. In 2019, the concept was further focused on refining the approach and identifying permitting, funding, financing, and management development as well as potential effluent disposal methods and locations. The study basis included estimates of flow for Bourne (effluent and sewage), Falmouth (effluent) Mashpee (sewage), Sandwich (sewage) and Barnstable (sewage). The long-term capacity need for these communities is 4.55 MGD.

The conclusion of the report was that the JBCC facility has adequate land available for expansion of the treatment plant and sewer system. However, the current effluent infiltration basins are not adequate to support this major increase in flow. Additional effluent disposal capacity at another location will be required to expand the WWTF's capacity and provide wastewater treatment for these communities.

The 2019 JBCC SWMS Candidate Plan is to construct a new WWTF area on JBCC property, an additional effluent disposal area, and additional pumping and pipeline capacity to the additional disposal area while continuing to dispose 0.36 MGD to the existing infiltration basins. The Candidate Plan is shown in Figure 4. Three sites were ultimately identified as potential locations for the additional effluent disposal beds for further study. Two sites located on JBCC property, and one site located on the south side of the Cape Cod Canal. In addition to infiltration beds, a proposed location for a surface water discharge to the canal was also identified. The study provided an opinion of construction costs of \$155 million for the capital costs of the facilities (including new WWTF, expanded infiltration beds and construction of a surface water outfall). This capital construction cost did not include the additional costs of pipeline construction from each town to connect their wastewater infrastructure to the JBCC treatment facility.

Data obtained from Cape Cod Commission, Mass Development and JBCC.

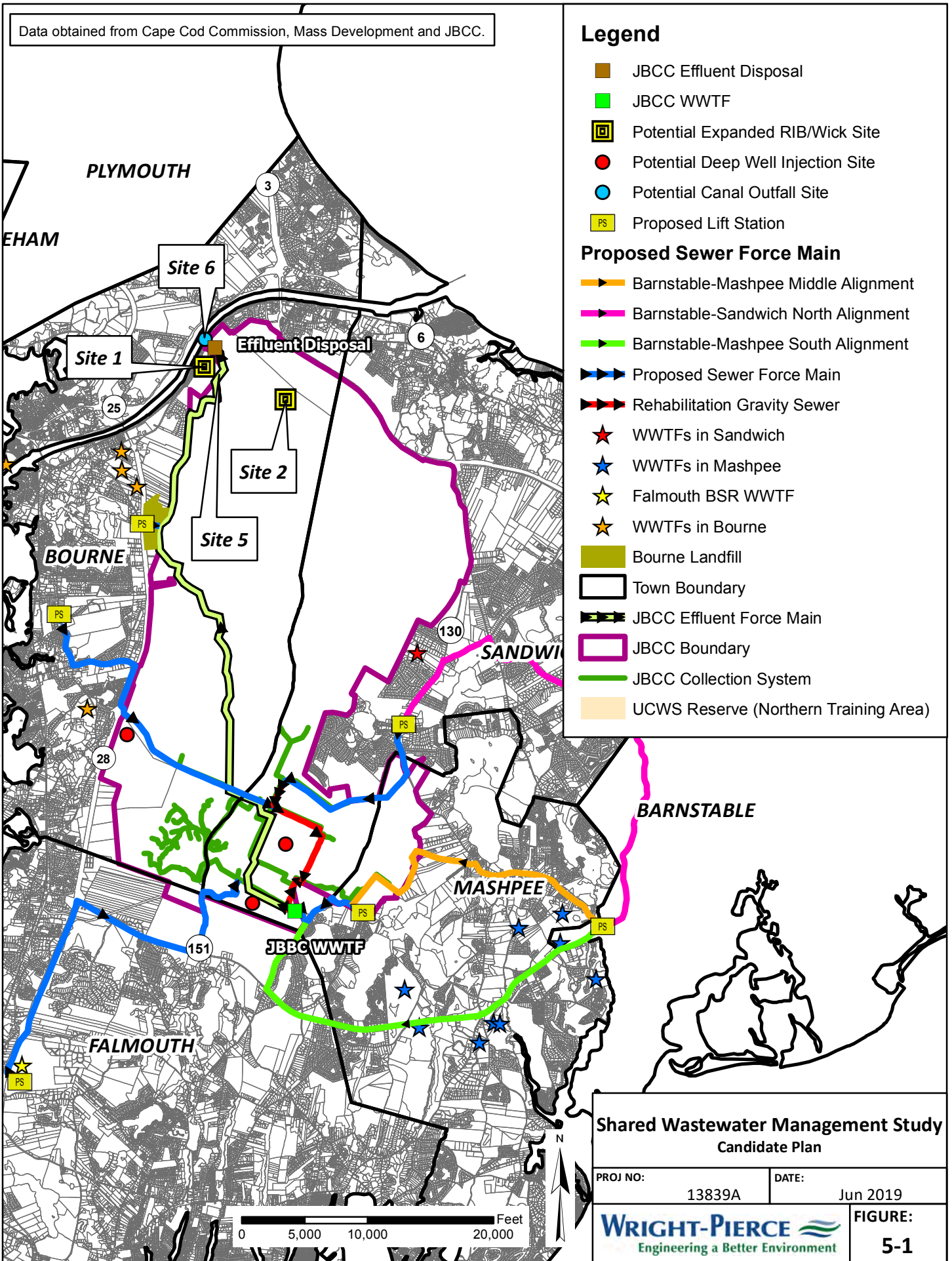
Legend

- JBCC Effluent Disposal
- JBCC WWTF
- Potential Expanded RIB/Wick Site
- Potential Deep Well Injection Site
- Potential Canal Outfall Site
- PS Proposed Lift Station

Proposed Sewer Force Main

- Barnstable-Mashpee Middle Alignment
- Barnstable-Sandwich North Alignment
- Barnstable-Mashpee South Alignment
- Proposed Sewer Force Main
- Rehabilitation Gravity Sewer
- WWTFs in Sandwich
- WWTFs in Mashpee
- Falmouth BSR WWTF
- WWTFs in Bourne
- Bourne Landfill
- Town Boundary
- JBCC Effluent Force Main
- JBCC Boundary
- JBCC Collection System
- UCWS Reserve (Northern Training Area)

TAH W:\GIS_Development\Projects\MA\Falmouth\13839A_WW_MgmtStudy-JBCC\MXD\Figure 5-1 Candidate Plan-v4-8x11-P.mxd



Shared Wastewater Management Study Candidate Plan

PROJ NO: 13839A DATE: Jun 2019

WRIGHT-PIERCE
Engineering a Better Environment

FIGURE:
5-1

SECTION 4 ENVIRONMENTAL AND WATER RESOURCES

According to the Local Comprehensive Plan, Water Quality is the highest priority issue ranked by Town residents. Bourne's single greatest natural resource is its coastline, which is one of the longest on Cape Cod. Pollution, flooding and rising sea levels have become widely recognized as threats to Bourne's coastline. Another goal from the Local Comprehensive Plan is to restore and protect the natural environment to the greatest extent possible while accommodating the needs of residents and visitors for housing, transportation, recreation and economic opportunity. The Town is in a period of planning and restoration, and balancing the preservation of abundant natural resources is part of their balanced development.

SECTION 4.1 COASTAL EMBAYMENTS

In Bourne, there are seven watersheds which drain into coastal embayment systems. The remaining two Bourne watersheds are where groundwater discharges directly into the open coastal waters of Cape Cod Canal, Cape Cod Bay and the Atlantic Ocean. In Bourne, the Cape Cod Commission embayment GIS polygon layers were used to delineate the boundaries of the Embayment Watersheds and Embayment Watershed Groupings, as used in the 208 Plan. The Dataset is a composite of individual watersheds, merged by GIS and Water Resources staff at the Cape Cod Commission.

SECTION 4.1 SOILS

USDA Natural Resources Conservation Service (NRCS) certified soils data for Bourne was downloaded from MassGIS. Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms. The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). **Figure 5 in Appendix A** shows the hydrologic soil groups for Bourne. The majority of the soils in Bourne are Group A, being soils having a high infiltration rate (low runoff potential) when thoroughly wet. Group A soils consist mainly of deep, well drained sands or gravelly sands. Their high permeability makes them highly susceptible to pollution, especially from septic systems. These soils have a high rate of water transmission.

The next most common groups include B, B/D, and A/D. Of these, the Soil Group B/D and A/D areas are the greatest risks for on-site wastewater systems as the undrained area or lowest layer is considered to be clay, which has very slow infiltration and is considered to be poorly draining. This could potentially lead to on-site system failures or poor nitrogen removal.

- Soil Group B areas are sprinkled across some southern areas in Bourne and a portion of the Buzzards Bay area (which is already sewerred, reducing any potential risks of poor drainage from onsite systems).

- Soil Group B/D have a moderate infiltration wet in drained areas and a very slow infiltration rate for undrained areas (indicating top soils are moderately well drained with a bottom clay layer). These areas are primarily in the Gray Gables/Monument Beach and Buttermilk Bay areas.
- Soil Group A/D have a well-drained top layer with a clay or poorly draining bottom layer. These areas are in North Sagamore and South of the canal. South of the canal, these soil groups are dispersed around the Monument Beach/Gray Gables areas within Phinney's Harbor watershed and further south in the Cataumet area of Pocasset Harbor watershed.

When investigating alternative technologies for treatment, areas with B/D or A/D soils will not be considered for onsite systems and alternative technologies.

SECTION 4.2 GROUNDWATER RESOURCES

Bourne has three water districts which serve over 25,000 year-round and seasonal customers. Bourne is located over two aquifers and has over 17 Zone 1 Wellhead protection areas. **Figure 6 in Appendix A** shows the groundwater constraints including wellhead protection zones and aquifer extents.

Section 4.2.1 Cape Cod Aquifer

The Cape Cod Aquifer provides 100% of the Cape's drinking water, and for this reason has been designated a Sole Source Aquifer under the Safe Drinking Water Act by the Environmental Protection Agency. The highly permeable aquifer deposits make the Cape Cod Aquifer one of the most productive groundwater systems in New England, but also mean water supplies are susceptible to impacts from development and land uses within their watersheds (e.g. residential septic systems). The Cape Cod aquifer system is comprised of six separate lenses, as shown in Figure 7 with the Sagamore lens underlying Bourne. The topographic lines of the aquifer are water table contours, which are used by hydrogeologists to show the flow direction of groundwater.



Figure 7: Cape Cod Aquifer Lenses, Cape Cod Commission

The Cape Cod Aquifer is recharged solely by precipitation, with approximately 60% of the annual rainfall and snowmelt volume becoming recharge to the aquifer (27 inches per year). Approximately 10% of that recharge volume is used for water supply, but an increasing year round population, decreasing land area suitable for water supply development, and the need to balance groundwater withdrawals with local effects on the aquifer's saltwater boundaries and surface water resources, will require careful planning for future water supply development.

Section 4.2.2 Plymouth-Carver Aquifer

The Plymouth/Carver Sole Source Aquifer (PCA) covers 199 square miles and spans six communities in Southern Massachusetts. It is the second largest sole surface aquifer in Massachusetts. The PCA

was created by glacial retreat 16,000 years ago. In 1989, EPA designated the PCA as a Sole Source Aquifer, containing an estimated 500 billion gallons of water. Plymouth, Carver, Buzzards Bay Water District, North Sagamore Water District, Plympton, Kingston and Wareham rely on the PCA for drinking water. The PCA is susceptible to pollution due to its permeable sand and gravel soil composition. A map of the PCA is in Figure 8 below.

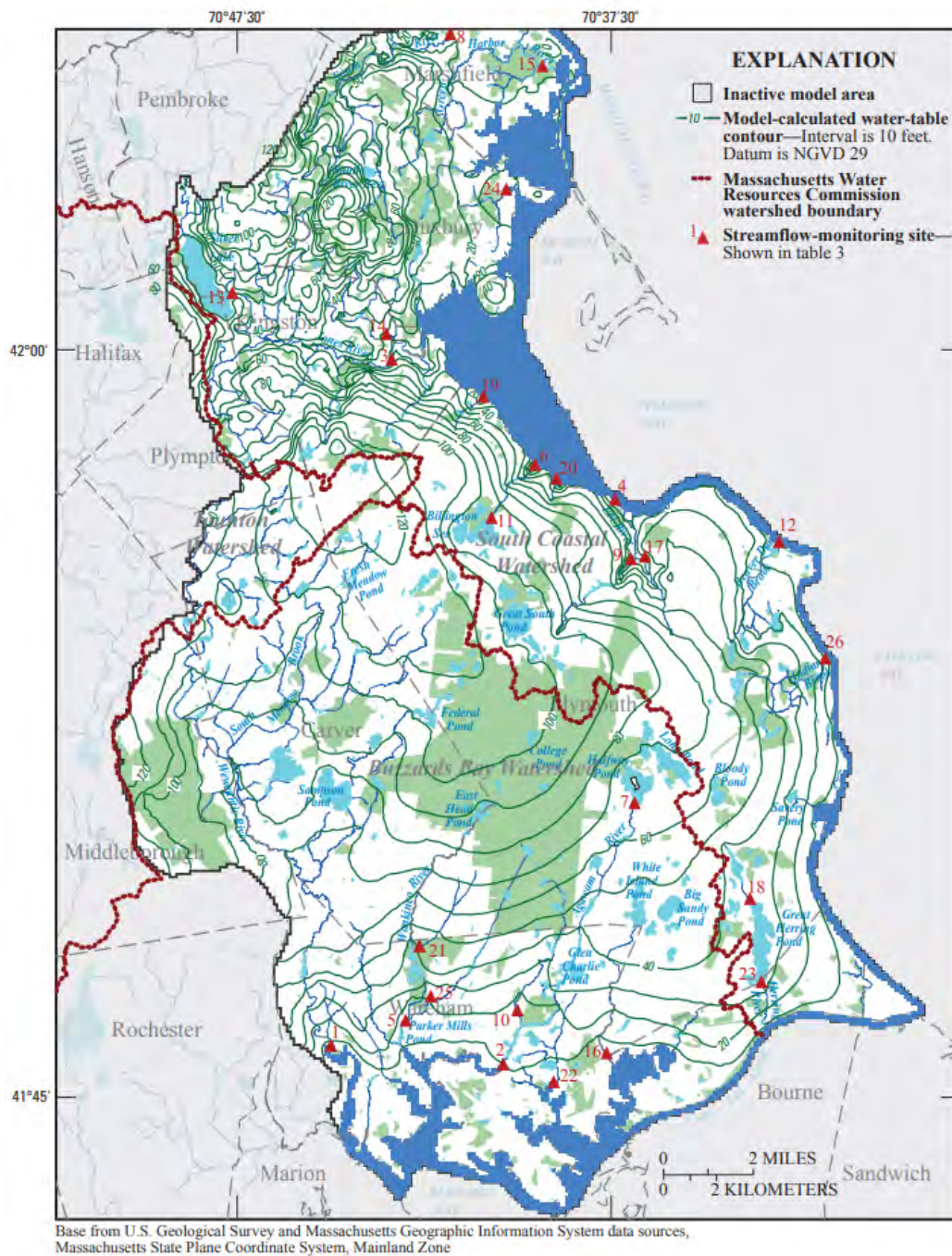


Figure 8: Plymouth-Carver Sole Source Aquifer, USGS

Section 4.2.3 Groundwater Contaminants of Concern

Both of the aquifers which Bourne contains are sole source aquifers generally comprised of sandy gravel soil that are highly susceptible to contaminants. There are several contaminants of concern relating to human growth and development within both aquifers. The presence of JBCC and the historic contamination remediation sites have ongoing treatment and there is sampling for a multitude of contaminants in and around the JBCC boundary. Below are several categories of contaminants of concern for the groundwater:

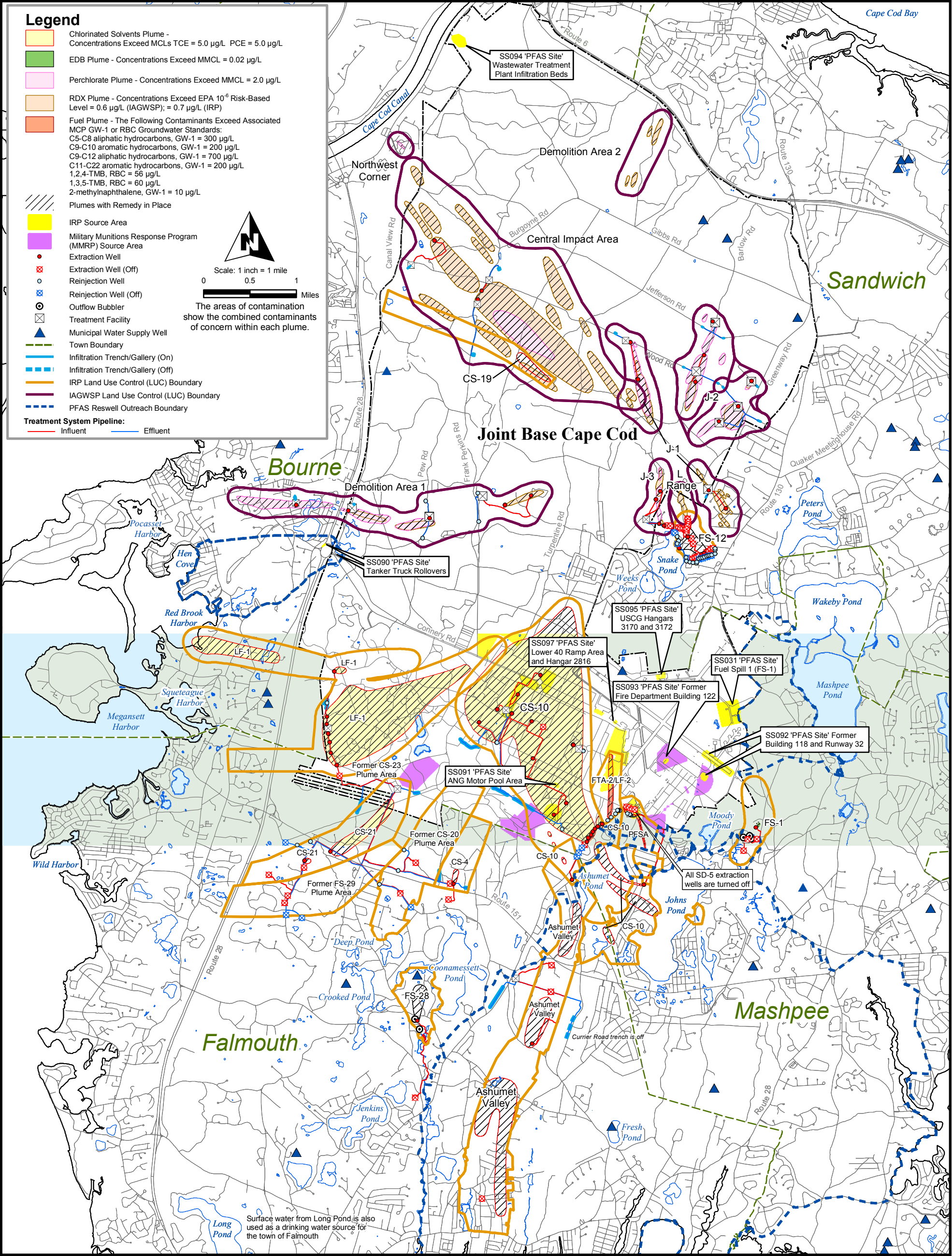
Organic chemical contaminants including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems. There are several areas of contamination within JBCC that are currently undergoing remediation. Most of the plumes are self-contained within the JBCC boundary. Below is a summary of the projects with plumes **outside** the JBCC boundary and within Bourne:

- Landfill-1(LF-1), 2 Areas
- Perchlorate Plumes (2 Areas)
- RDX Plumes (1)

Bourne has several ongoing PFAS investigation and ongoing groundwater cleanup projects at JBCC. PFAS remediation efforts at JBCC are associated with:

- Wastewater Treatment Plant Infiltration Beds
- Former Fire Department Building 122
- Fuel Spills
- USCG Hangers
- Lower 40 Ramp Area and Hanger
- Building 118 and Runway 32
- Tanker Truck Rollovers

These areas have groundwater monitoring wells, to track and report extents of existing contamination and to prevent additional spread of the plumes.



SECTION 4.3 WETLANDS AND FLOODPLAINS

Section 4.3.1 MassDEP Wetlands Mapping

Bourne has over 1,000 acres of Wetland Resource Areas, as defined by the Wetland Protection Act. These resources are important because they contribute to public health and safety by protecting drinking water, preventing storm damage, and providing critical habitats to fish, shellfish, and wildlife. Bourne also has over 740 acres of beach and dune coastal resources, protecting the coastline from storm damage, providing critical habitat, and offering places for recreation.

Figure 10 in Appendix A shows the 2005 MassDEP Wetlands layers, which provide a medium-scale representation of wetland areas of the state. Wetland areas consist of open water, vegetated wetlands, and coastal landforms. The wetlands and hydrologic connection information is for planning purposes only, as it is not field verified. For projects to be completed in the Town of Bourne, wetland flagging and resource buffer zones must be delineated as part of any future project work.

Section 4.3.2 FEMA Floodplains

Figure 10 in Appendix A shows the Flood Zones, concentrated near coastal resources and upland waterbodies, within the Town of Bourne. The Federal Emergency Management Agency (FEMA) Floodplains or the Flood Insurance Rate Maps (FIRMs) database is the digital, geospatial version of the flood hazard information. The FIRM Database is published by FEMA, and the data used in GIS mapping was collected in 2017. The FIRM Database depicts flood risk information and supporting data used to develop the risk data.

- The 1-percent annual chance flood is also referred to as the base flood or 100-year flood. Most of the flood zones within Bourne are located within this area (Zone A, Zone AE, Zone V and Zone VE).
- Moderate flood hazard areas, labeled Zone X (shaded) are also shown on the FIRM, and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood.

For wastewater planning, FEMA Flood zones indicate areas where onsite systems are most likely to fail due to surface and groundwater flooding events. These areas should be avoided for new onsite wastewater disposal systems.

SECTION 4.4 ENDANGERED SPECIES

The Natural Heritage & Endangered Species Program (NHESP) of the Massachusetts Division of Fish and Wildlife maintains an inventory and mapping of Endangered and Threatened species, and of species designated to be of Special Concern. Protection of these habitats is crucial to defending the coastal ecosystems and aligns with the water quality protection mission of the Plan. It is also important to understand potential impacts that construction may have when planning alternatives and solutions. Consideration of the species will be included in the alternatives analysis, in Phase II. The species designations are defined in accordance with the Massachusetts Endangered Species Act:

- **Endangered:** any species of plant or animal in danger of extinction throughout all or a significant portion of its range and species of plants or animals in danger of extirpation as documented by biological research and inventory.
- **Threatened:** any species of plant or animal likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and any species declining or rare as determined by biological research and inventory and likely to become endangered in the foreseeable future.
- **Species of Special Concern:** species documented by biological research and inventory to have suffered a decline that could threaten the species if allowed to continue unchecked.

NHESP lists 57 plant and animal species as Endangered, Threatened, or of Special Concern in Bourne. Figure 11 presents the relative percentage of species types in Bourne.

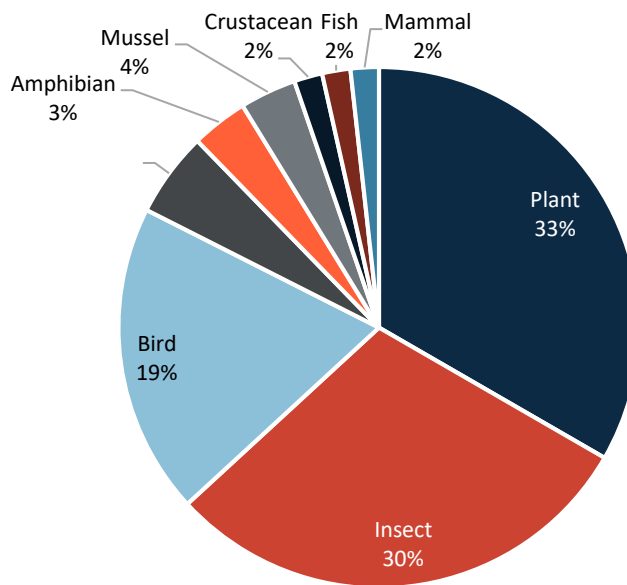


Figure 11: Bourne NHESP Species, by Type

37 of the 57 species have been observed since 2000, but because they are rare, many MESA-listed species are difficult to detect even when they are present. Figure 12 shows the breakdown of Bourne's NHESP species designation.

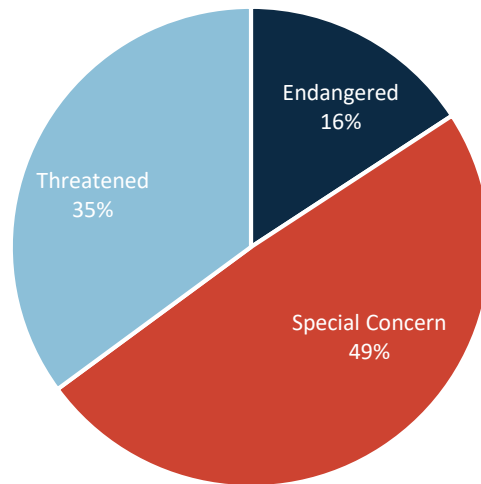


Figure 12: Bourne NHESP Species Status

Figure 13 in Appendix A shows the NHESP Estimated Habitats (e.g. where NHESP species are expected to exist) and Priority Habitats (e.g. where there known NHESP species activities).

SECTION 4.5 EELGRASS

The south coast of Massachusetts, especially the watersheds, communities, and shorelines on Cape Cod and Buzzards Bay, have experienced population growth and development which is providing excessive nutrients and land-derived runoff exceeding the capacity of the embayments to sustain eelgrass and resulting in eutrophication. According to the Buzzards Bay Coalition, more recent and wider scale assessments suggest that the mechanisms responsible for declines continue to have effects which are not yet sufficiently mitigated to reverse the previously reported trends from a few embayments. For example Buttermilk Bays has lost all of its eelgrass and 20% loss has been documented statewide, which may exacerbate the process of decline as fewer and fewer meadows are available to sustain the seagrass populations.

The Massachusetts statewide seagrass mapping effort was conducted in four phases beginning in 1994 and ending in 2012. The extent of loss prior to 1995 has not been quantified at this time.

1. 1995 - Entire Massachusetts coastline.
2. 2001 - Entire Massachusetts coastline, excepting Billingsgate Shoals and the Elizabeth Islands.
3. 2006 - Selected Embayments on Cape Cod, Buzzards Bay and Martha's Vineyard.
4. 2010 - Selected Embayments on Cape Cod and Buzzards Bay.
5. 2012 - Massachusetts Bay coastline, Ipswich Bay to Provincetown.

The analysis used combinations of aerial imaging, field analysis and known sample data to determine the change over a twelve year interval. In Buzzards Bay, the region saw a total decline of

11% over ten years, higher than the median rate for Massachusetts (2.9%). The following Bourne watersheds were monitored:

Table 7: Decline of Eelgrass Populations in Selected Bourne Watersheds over Time

Buzzards Bay	Hectares (ha) of Eelgrass Recorded *			% per year		
	t1	t2	t3			
	1994-1996	2000 - 2002	2006 - 2007	t1 - t2	t2 - t3	t1 - t3
Wild Harbor	8.31	7.04	5.46	-0.03	-5.09	-3.82
Pocasset Harbor	16.73	14.69	12.47	-0.02	-3.27	-2.67
West Cape Cod Canal	157.99	98.34	94	-0.08	-0.90	-4.72
Regional Subtotal	662.02	438.07	479.54			
	Regional Median Decline			-4.50%	-3.49	-3.51

(*) 1 hectare = 2.5 acres

SECTION 5 BUILT SYSTEMS

In the Local Comprehensive Plan, Built Systems were defined as Community Design, Coastal Resiliency, Capital Facilities and Infrastructure, Transportation, Energy and Waste Management. For the purposes of this study, we examined current development practices with Planning, Public and Private Utilities and existing wastewater management systems.

SECTION 5.1 TOWN PLANNING DATA

The Town Planning board reviews all commercial developments and subdivisions, with a nine elected board member Planning Board. The Town planner is designated as the single point of contact of development projects and has three staff. The Office of the Town Planner conducts project reviews and makes recommendations to the planning Board and other departments on development projects throughout Bourne.

Section 5.1.1 Parcel Density

Parcels are densest in the village centers and Downtown Districts. The parcel Density Map in **Figure 14 in Appendix A** shows the higher density areas as orange or red values, and the lower density areas as green. The majority of the Town of Bourne land area is considered low density. Specifically, districts B3, R40, R80 and some SDD districts are the lowest density, as shown in **Figure 15 in Appendix A**.

Section 5.1.2 Land Use

Existing land use in Bourne varies with several agricultural and open space areas designated for conservation. Agricultural purposes include cranberry bogs and other open farmland in the northern part of Bournedale. The largest parcel use is the Joint Base Cape Cod (JBCC) tax exempt use, which constitutes the major southeast portion of Town. As generated in the Local Comprehensive Plan and confirmed using GIS mapping, the greatest land uses by area include:

- Public/Semi-Public and Tax Exempt, 14,911 acres
- Joint Base Cape Cod, 10,238 acres
- Residential Land, 5,250 acres
- Commercial/Industrial Land, 632 acres
- Freshwater Area, 300 acres
- Mixed Use Land Area, 61 acres

Bourne also has 54 miles of shoreline. **Figure 16 in Appendix A** shows the existing land use by area in Bourne.

Section 5.1.3 Zoning

The Town has several overlay districts, which represent various interests including water quality, land management and land use. **Figure 17 in Appendix A** shows the zoning areas associated with the following overlay groups:

- Business (B)
 - B1: To provide high-intensity generally pedestrian-oriented activity concentrations at village centers
 - B2: to accommodate general business development in areas serviced by major traffic arteries, and where conflict with residential development will not be substantial
 - B3: To reserve areas for business development without single-family residential development, in areas of 10 acres or more well suited by utilities, access, topography, and surroundings for each use.
 - B4: To provide for business development along arterial routes with careful control over environmental and traffic impacts.
- Government District (GD): To provide for necessary governmental functions on publicly owned land
- Residential (R): To ensure continuance of a residential environment, with any development carefully related to environmental capacities and existing character.
 - Residential 40 (R40): Higher-Density Residential district with lower minimum lot size and frontage requirements.
 - Residential 80 (R80): Low Density residential district with higher minimum lot size and higher frontage requirements.
- Scenic Development District (SDD): To gain intensive use of land, while at the same time preserving or enhancing highway views of the canal, ocean, or bay, preserving or enhancing landscaping and tree cover, minimizing visibility of parked autos and the intrusion of commercial signs and avoiding creation of hazards or congestion. Each SDD created on the Zoning Map shall not be smaller than 0 acres in extent, shall be accessible directly via state-owned highway, and shall be so located that ocean or canal visibility exists or can reasonably be expected to be gained.
- Village Business (VB): to provide for village-oriented business compatible with small scale environs and nearby residences.

The Zoning Bylaw was amended at Town Meeting, October 2019 and ratified February 2020. The Zoning Board of Appeals is empowered to hear and decide applications for Variances, certain Special Permits and appeals from the decision of the Building Inspector. The Board of Appeals also reviews and grants Comprehensive Permits for Chapter 40B affordable housing developments.

SECTION 5.2 PRIVATE WATER SUPPLY WELLS AND TREATMENT

There are three main types of private wells:

- Dug well: The first type of well which was hand-dug. They are typically shallow and wider than a driven or drilled well, and offer the least amount of protection from contamination.

- Driven well: Typically involve physically hammering a well point into the ground. While deeper than a hand-dug well, they are susceptible to contamination.
- Drilled Well: offer the greatest level of protection from contamination. They are much deeper than hand-dug or driven wells and are therefore more resistant to contamination.

Private well records from the Bourne Board of Health shows that there are less than 50 private drinking water wells sporadically located in Town. The majority of wells in Bourne are for irrigation or agricultural uses. Between 1988 and 2020, there were over 80 applications for new private wells (both agricultural and irrigation uses). Property owners with private wells do not have water quality monitoring programs. Homeowners are not required to test for bacteria, pH, metals and volatile organic compounds (VOCs) unless they have a property sale. The Board of Health has a program for tracking and inspecting newly installed wells, but does not maintain water quality records for the wells after installation.

SECTION 5.3 MUNICIPAL WATER SUPPLIES

The Town of Bourne is served by three water districts; two on the North side of the Canal and one on the South side of the Canal. The following subsections outline the District size, operating principles and overall delivery capacity. **Figure 18 in Appendix A** shows the three districts and the protected wellhead areas.

Section 5.3.1 Bourne Water District

The Bourne Water District (BWD), established in 1939, is the largest of the three water districts, covering an area from the Sandwich town line to the Falmouth town line on the south side of the Canal. BWD's annual water supply production averages 390 million gallons per year. It has 6,058 service connections serving a population of 11,500 in the winter and over 35,000 in the summer. The water system consists of the following infrastructure:

- 7 well pumping stations
- 2 booster pump stations
- 8 lime treatment stations
- 4 water storage tanks
- 115 miles of water main, ranging in size from 2" to 20"

The BWD is independently managed by a Board of Water Commissioners elected by the registered voters of the District.

Section 5.3.2 Buzzards Bay Water District

The Buzzards Bay Water District (BBWD), established in 1937, is the oldest of the three water districts in Bourne. BBWD spans from Bournedale covering from Bournedale to the eastern end of North Bourne all the way to Taylor's Point and Massachusetts Maritime Academy at the West end of North Bourne. BBWD's annual water supply production averages 180,000,000 gallons per year. The district serves over 5,830 customers in winter and over 7,700 in the summer.

The water system consists of the following infrastructure:

- Five groundwater supplies, and each well has its own pump station and chemical feed
- One chemical injection facility
- Two water storage tanks
- 45 miles of water main, ranging in size from 4" to 16"

The water district is overseen by a five person Board of Commissioners. There are four administrative staff and three operations staff which serve 1,491 active accounts.

Section 5.3.3 North Sagamore Water District

The North Sagamore Water District (NSWD) was founded in 1939 and is governed by a Board of Commissioners. NSWDP pumps approximately 160,000,000 gallons per year. The water system consists of the following infrastructure:

- Three groundwater wells
- Two standpipes and
- One storage tank

The water district is overseen by a three person Board of Commissioners. There are two administrative staff and two operations staff which serve over 1,800 accounts.

Section 5.3.4 Summary of Water Usage

The overall water usage between Buzzards Bay and North Sagamore water districts has been fluctuating slightly but maintaining greater than 900,000 gallons per day for the last five years. Bourne Water District was unable to provide historic usage but they provided the total consumption for 2020. The average water consumption across all districts is around 1 MGD.

Table 8: Summary of Water District Usage

Water District	Daily Water Usage (GPD)					Average
	2016	2017	2018	2019	2020	
Buzzards Bay	1,080,875	975,265	1,022,378	972,303	1,074,210	1,025,006
North Sagamore	1,026,986	959,586	992,545	943,570	1,100,024	1,004,542
Bourne	No Data Available				1,086,241	1,086,241
Total	2,107,861	1,934,851	2,014,923	1,915,873	3,260,475	3,115,790

SECTION 5.4 EXISTING WASTEWATER MANAGEMENT

This section presents information on the Massachusetts Title 5 regulation (State Environmental Code, 310 CMR 15.00) of onsite systems and the Town of Bourne's Health Department management of this data, and summarizes package treatment plants located throughout Bourne. Based on the 2020 census, Bourne consists of 20,500 people of which approximately 658 have connections to municipal sewer, about 1,000 people have connections to privately owned decentralized systems,

175 have innovative/alternative Title 5 systems and the rest remain on septic systems or cesspools. **Figure 19 in Appendix A** shows the locations of current wastewater treatment sites within each watershed.

As a part of the implementation of the CWMP, we will make several policy or departmental based recommendations, and implementing a regular frequency of inspection and maintaining an electronic record keeping system are recommended.

Section 5.4.1 Title 5 – State Environmental Code

The current Title 5 was most recently updated in 2015. However, the main body of the regulations were updated in 1998. Several properties within the Town of Bourne have not had a point of sale after the 1998 Title 5 regulations have been enacted, putting them at risk of being in non-compliance with Title 5.

Design and construction of Title 5 systems has four main components: Soil Type, Drainage Slope, Capacity, and System Type-regulations. The soil for each property seeking a Title 5 system must undergo soil testing, by a State Certified Soil Evaluator, to determine appropriateness of soil for drainage, absorption, capacity for flow and suitability for supporting the proposed type of usage. For example, poorly draining soils or soils which are already saturated with high groundwater table may not be considered suitable for use. The Certified Soil Evaluator typically performs a percolation, or flow rate test, to determine if the groundwater elevation in the area for a proposed system is acceptable.

The Soil Evaluator also researches soil slope. Slopes as determined by soil classifications A – E in National Conservation Resource Service (NRCS) Soil Type Name typically determine this value. Soil Types with slope greater than 20% (Type D and up) are unsuitable for Title 5 systems. Adsorption capacity for soil is typically associated with the density and porosity of the soil components. For example, clays are not typically applicable for a Title 5 system without appropriate modifications or subsurface amendments (additives of clay and gravel).

Section 5.4.2 Health Department Data

The Health Department maintains inspection data in accordance with Title 5 requirements and works with the Barnstable County Department of Health and Environment to execute inspections of the Innovative and Alternative (IA) septic systems. There are several gaps in data prior to the 1998 amendments to Title 5, and several properties have not had a real estate transaction within the last 25 years. The Health Department's records include data for approximately 175 IA systems and over 7,000 onsite systems. The first IA system was installed in 1995 with most of the systems installed after 2002. According to data available for the existing IA systems, reported Effluent Total Nitrogen has been consistently above 25 mg/L. There are some spikes upwards of 100 mg/L Total Nitrogen in the effluent, which suggests that some systems need replacement. Figure 20 below shows the existing IA system performance over time (collectively, across all systems which submit data).

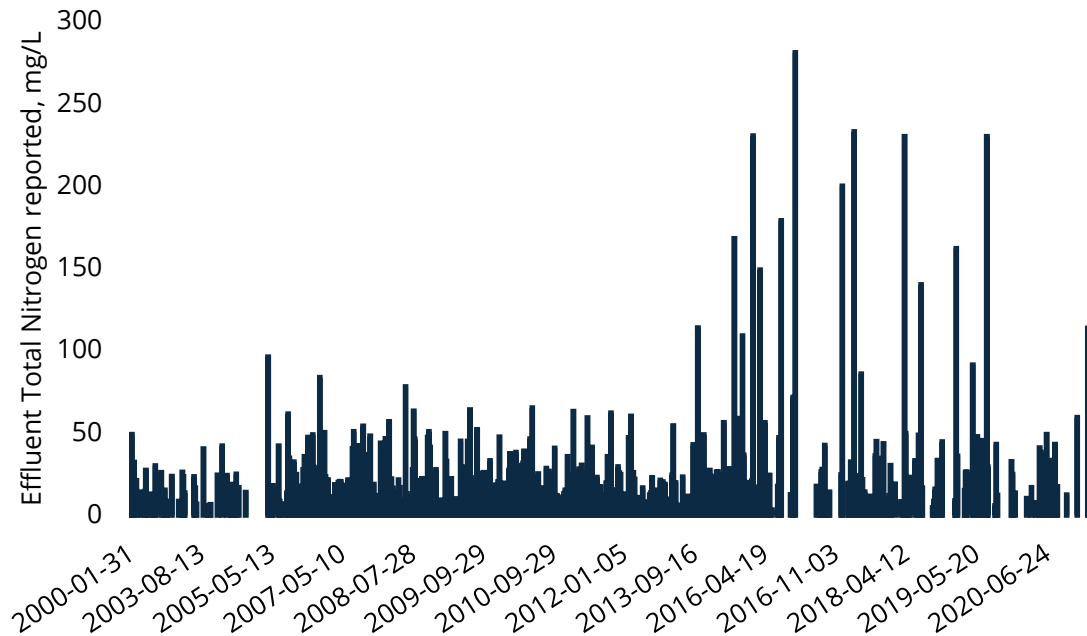


Figure 20: Effluent Total Nitrogen from Bourne Existing IA Systems, over Time

For the purposes of this Needs Assessment, EP assumed that all parcels the Town's Assessor's data list as currently occupied (developed and have buildings) or have water use bills and are not connected to municipal sewer, and do NOT have an IA system, according to Health Department records, have a Title 5 system.

Section 5.4.3 Areas of Known Title 5 Concerns

The Health Inspector regularly monitors properties which frequently require pump outs, and keeps track of properties which have failed inspections. There are no general trends or areas which have required frequent pump-outs nor failed septic systems over the last 10 years. For the few properties which have identified failures, the issue was resolved by repairing, replacing or upgrading their septic systems to an IA system. Several property owners utilized the Community Septic Management funding loans provided by Barnstable County to fund their repairs. However, for systems which have not required frequent pump outs nor have had a real estate transaction inspection in accordance with Title 5, there are limited or no records of improvements made to onsite systems.

There are also cesspool concerns for homes which have not been sold nor undergone significant building changes within the last 35 years. There is no program for identifying cesspools and requiring upgrades unless the home is sold or significant upgrades to the home are proposed. For homes which have not undergone any changes since the mid 1980's, it is likely that the home is operating with a cesspool unless upgraded by choice.

Section 5.4.4 Municipal Wastewater Infrastructure

The Town of Bourne owns and operates a sewer system in the Buzzards Bay village, serving 150 residences or approximately 400 people (see **Figure 19 in Appendix A**). The flow has historically been pumped to the Wareham WWTF through an Intermunicipal Agreement (IMA).

The existing sanitary sewer collection system consists of approximately 3.5 miles (over 17,000 linear feet (LF)) of gravity sewer, approximately 9,500 LF of force main, over 90 manholes, and 2 municipally owned and operated wastewater pumping stations. Several low pressure sewer areas exist within the existing sewer system, including a privately operated low-pressure system in Hideaway Village on the north side of Buttermilk Bay. The remaining low pressure systems in Buzzards Bay discharge into the gravity collection system.

The Town's sanitary sewer system collects an average wastewater flow of 0.11 million gallons per day (MGD). Wastewater from the collection system discharges from the Town at the Hideaway Village Pump Station and the Main Street Pump Station both via 6-inch force mains to the Town of Wareham Collection System and treatment plant. The Town's new Queen Sewell Treatment Plant collects flow from a pump station opposite the existing Main Street Pump Station.

The system has no known sewer system overflows or bypasses. The Town Operations Staff indicates that significant surcharging events related to maintenance issues (i.e. clogs, blockages) are infrequent. There are no areas of the collection system that experience chronic surcharging/SSOs due to hydraulic restrictions or poor condition of the sewer infrastructure.

The CCC assisted Bourne in applying for a \$2.3 million Economic Development Administration grant for the construction of the new municipal Wastewater Treatment Facility (WWTF) in Buzzards Bay at Queen Sewell Park, awarded in February 2019. The new treatment facility was meant to help economic growth in the downtown Buzzards Bay region while decreasing additional flow to the Wareham WWTF. The wastewater treatment facility has a total permitted capacity of 100,000 GPD. Since operations began in August 2021, the Town has diverted flow from portions of the existing sewer system to the WWTF. Figure 21 shows the flow data from August – November 2021. The average daily flow is 36,340 gpd during the first four months of operation, with a peak daily flow of 118,237 gpd.

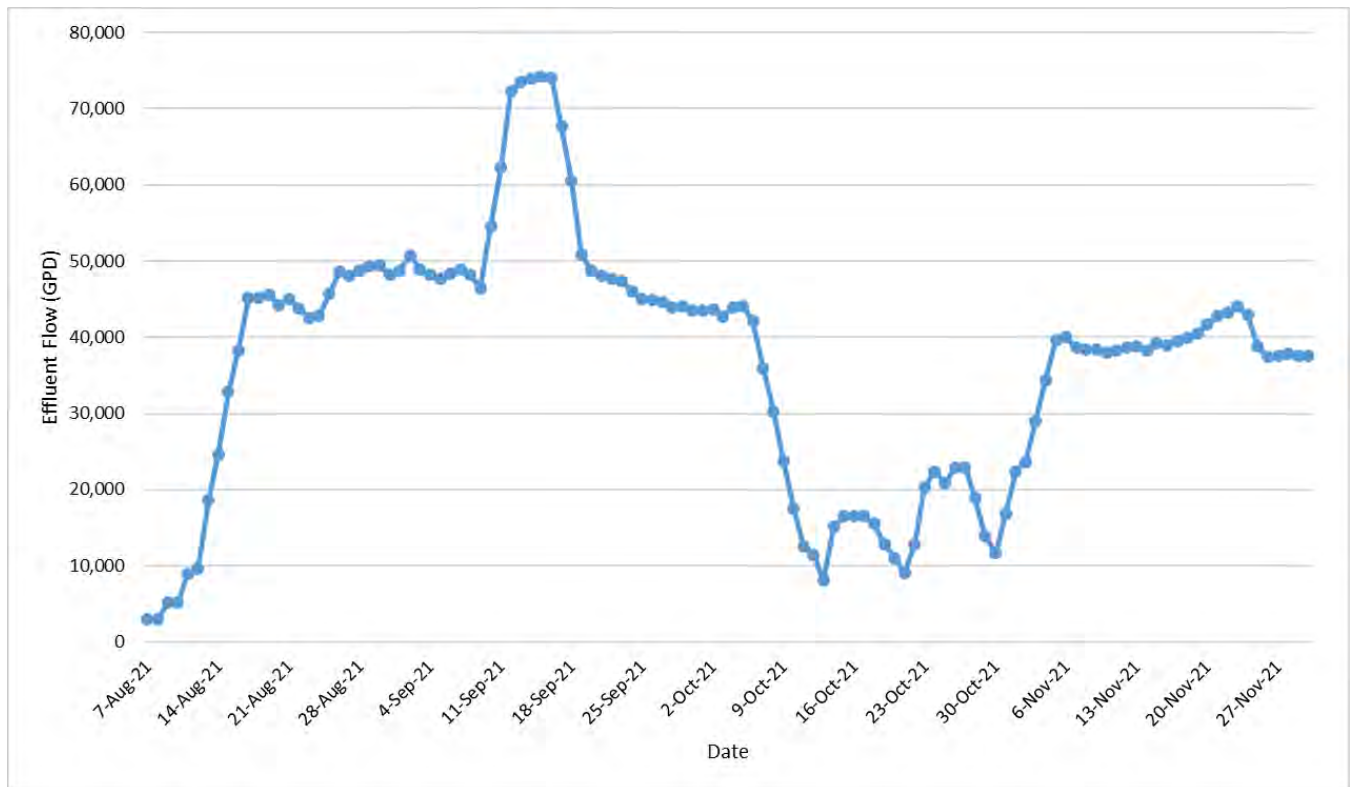


Figure 21: 7-Day Moving Average Flow at Queen Sewell WWTF

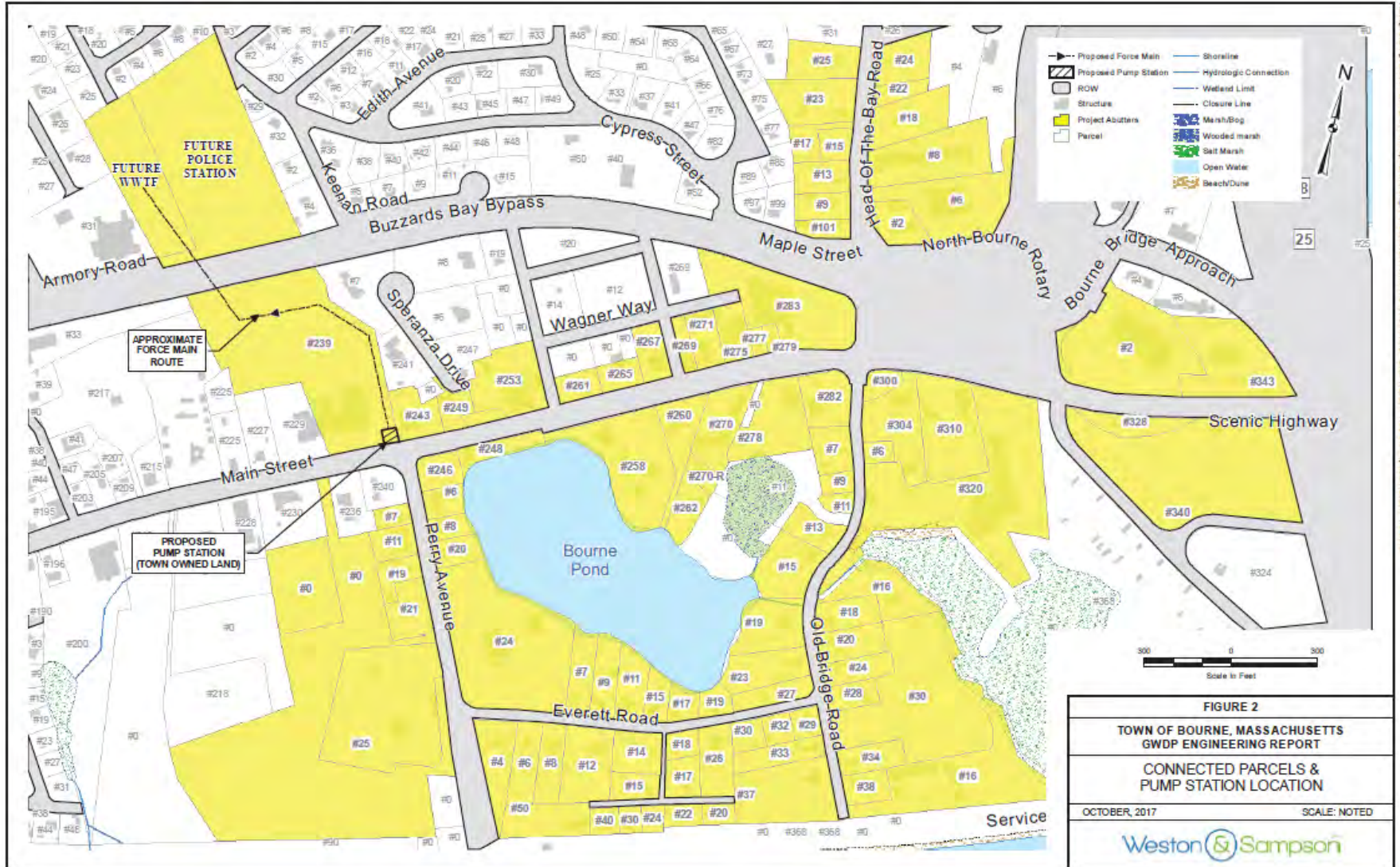


Figure 22: Existing Sewered Parcels with Flow Being Diverted to New Queen Sewell Park WWTF (2017)

Section 5.4.5 ISWM Leachate

Bourne began operations of its own Integrated Solid Waste Management (ISWM) Landfill at its present location on MacArthur Boulevard in 1967 in an area which is now known as Phases 1A – 1C. They receive municipal solid waste (MSW) or household trash. In 1999, Phase 1 was capped and Phase 2, the first lined landfill cell, began receiving non-MSW. The facility is currently in Phase 4 development, seeking to build on top of formerly capped areas of landfill on the existing site.

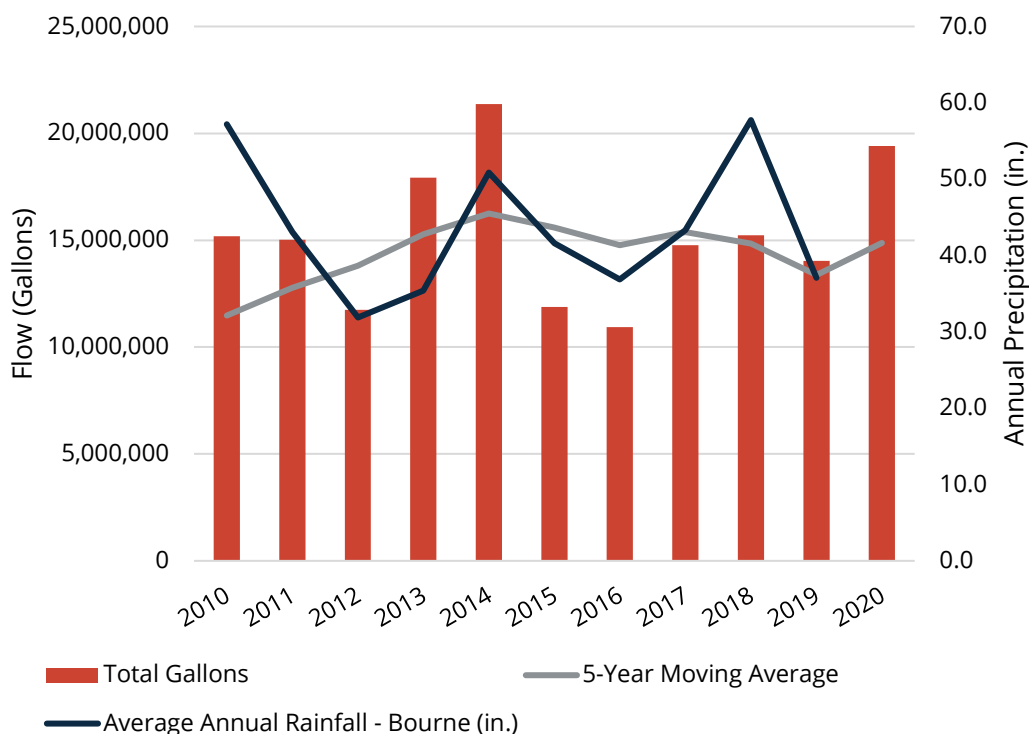


Figure 23: Bourne ISWM Leachate Flow and Rainfall over Time

ISWM is a separate, fully self-funded department of the Town. Finances are managed through an Enterprise Fund, deriving revenue from customers using the facility who pay a tip fee per ton, as well as through the sale of recyclables, grants and interest income. They are currently trucking leachate to the Town of Wareham for treatment and disposal, but future forcemain connections to the JBCC privately-operated facility may be used in the future.

Section 5.4.6 WWTF with Direct Discharge Permits

In Bourne, the Massachusetts Maritime Academy has its own private wastewater treatment system which discharges via direct outfall to the Cape Cod Canal. Their NPDES Permit MA0024368 is a 30 mg/L BOD monthly maximum limit and there is no Total Nitrogen Limit. The treatment facility has a daily operating flow limit of 77,000 gallons per day, offers secondary treatment, and does not have any nutrient treatment or removal. A new draft permit was issued and is available for public comment until February 28, 2022, including a new Phosphorus compound sampling requirement.

Section 5.4.7 WWTF with Groundwater Discharge Permits

In addition to the Queen Sewell Part WWTF, there are ten permitted groundwater discharge wastewater treatment facilities, which serve a mix of public and private entities within Bourne. These treatment systems are self-contained wastewater systems that serve a small user base (typically, the business or school where they are located).

Table 7 includes a list of the treatment plant locations, including their watershed and permitted flow in gallons per day (GPD). The Bourne Laundromat's permitted flow is for gray water from the laundromat and a separate septic tank handles wastewater. The Canal Street Crossing facility has not begun operations.

Table 9: MassDEP Groundwater Discharge Permitted Wastewater Treatment Plants

Permittee	Watershed	Permit Number	Facility Type	Permitted Flow (GPD)
Queen Sewell Park	Buzzards Bay	974	Residential	100,000
Bourne Laundromat	Cape Cod Canal	164	Laundromat	9,600
Villages at Brookside	Phinneys Harbor	415	Residential	60,000
Bourne Middle School	Cape Cod Canal	670	Public School	35,400
Pocasset Assisted Living	Pocasset Harbor	778	Senior Living Facility	16,350
The Park at Pocasset	Pocasset River	830	Mobile Home Park	38,605
Bourne Manor Extended Care Facility	Cape Cod Canal	848	Senior Living Facility	22,000
Residences at Canal Bluffs	Phinneys Harbor	852	Senior Living Facility	31,994
Upper Cape Cod Regional Technical School	Cape Cod Canal	939	Public School	18,000
Cataumet Harbor WWTF	Pocasset Harbor	954	Marina, Restaurant and Residential	32,430
Canal Street Crossing (pending construction)	Cape Cod Canal	990	Senior Housing and Medical Complex	22,850
			Total	387,229

The total permitted flow excluding the Bourne Laundromat permitted flow, for wastewater only, is 377,699 gpd.

The following Table 9 summarizes the type of treatment, the groundwater discharge permit limits, and compares the existing maximum monthly flow to the permitted flow for each of the wastewater treatment facilities listed in Table 8.

Table 10: Summary of Permit Limits, Technology, and Flows for WWTF's with Groundwater Discharge Permits

Permittee	WWTF	Permit Limits BOD/TSS/TN (mg/l)	Maximum Flow 2018-2021 (Date)	Permitted Wastewater Flow (GPD)	Maximum Flow compared to Permitted Maximum Flow
Queen Sewell Park	MBR	30/30/10	118,237 (09/21)	100,000	Over
Bourne Laundromat	Sand Filters for Laundry	N/A	Not Monitored	N/A	N/A
Villages at Brookside	Amphidrome +	30/30/10; best efforts to reach TN=5 mg/l (911 pounds per year)	37,371 (08/18)	60,000	Under
Bourne Middle School	RBCs with Sand Filter	30/30/10	16,406 (09/18)	35,400	Under
Pocasset Assisted Living	Bioclere 30/32 (2)	30/30/10	5,280 (12/19)	16,350	Under
The Park at Pocasset	Unknown	30/30/10; best efforts to reach TN=5 mg/l (587 ppy)	13,417 (12/19)	38,605	Under
Bourne Manor Extended Care Facility	Amphidrome	30/30/10	20,050 (08/19)	22,000	Under
Residences at Canal Bluffs	Bioclere 36/30 (2) and 36/24(2) & UV	30/10/10	16,200 (10/19)	31,994	Under
Upper Cape Cod Regional Technical School	Amphidrome +	30/30/10	13,244 (10/19)	18,000	Under
Cataumet Harbor WWTF	Unknown	30/30/10	12,346 (07/19)	32,430	Under
Canal Street Crossing	Unknown	30/30/10	N/A	22,850	N/A
			Total	377,699	

Table Notes:

- The Park at Pocasset had one anomalous flow of 43,488 gpd in November 2020.
- The Upper Cape Cod Regional Technical School had two excursions above permitted flow: 18,972 gpd in December 2018 and 25,616 gpd in March 2020.
- The permit (#852) for the Residences at Canal Bluffs has 7,528 gpd set aside for an adjoining parcel to be used for a nitrogen offset in the Phinneys Harbor watershed.
- The permit (#954) for the Cataumet Harbor WWTF has 19,945 gpd reserved for nearby residential buildings. The total nitrogen load is limited to 2,770 ppy for less than 13,000 gpd annually, and 494 ppy for 13,000 gpd or more annual flow.

Section 5.4.8 Summary of Wastewater Flows

Based on Cape Cod Commission 2017 Watershed MVP updates to the 208 Plan by watershed, onsite system estimated flows and centralized treatment is currently 2.3 MGD in Bourne. Historic population growth has been modest over the last five to ten years in Bourne, so it is expected that future wastewater flow needs will be within 2.5 MGD over the next twenty years. Table 11 summarizes these watershed wide findings with up to date information if updates have been made to the information. As parcel-by-parcel consumption data was unavailable for Bourne Water Districts, several of the watersheds south of the canal could not be updated from the 2017 estimates.

Table 11: Summary of Existing Wastewater Flows (2017)

Embayment	Onsite Systems		Centralized Treatment		Total	
	MGY	GPD	MGY	GPD	MGY	GPD
Buttermilk Bay ¹	41	112,329	1	2,740	42	115,068
Pocasset Harbor	79	216,438	2	5,479	81	221,918
Pocasset River	38	104,110	0	0	38	104,110
Megansett-Squeteague	41	112,329	0	0	41	112,329
Phinney's Harbor	35	95,890	0	0	35	95,890
Buzzards Bay ¹	38	104,110	425	1,164,384	463	1,268,493
Cape Cod Canal ²	50	136,986	80	219,178	130	356,164
Total	322	882,192	508	1,391,781	830	2,273,973

All values from CCC 2017 Watershed Updates except where noted.

1. Buzzards Bay Coalition/GHD Sewer Needs Assessment from 2015, updated in 2021.

2. Joint Base Cape Cod Shared Wastewater Management Study, 2019

SECTION 6 SURFACE WATER QUALITY AND NITROGEN LOADING

This section summarizes surface water quality (through beach monitoring and State water quality monitoring), and nitrogen removal goals as set by state and regional organizations. This section also includes summary of comparison data from this study to set the most up-to-date removal goal based on development updates. The goal is to use data from various programs that provide surface water quality overviews of each water shed and review goals that have been set for each watershed. Goals are adjusted and updated with better available data, as applicable, and the identified reduction in nitrogen loads and approximate flow allocation is summarized by each watershed.

SECTION 6.1 BEACHES

In Massachusetts, 105 CMR 445.000 Minimum Standards for Bathing Beaches (State Sanitary Code, Chapter VII) regulates bathing beach water quality standards, frequency and location of sampling, and provides local regulatory authority through the Board of Health. For marine waters, the maximum allowable number of Enterococci colony forming units per 100ml sample are 104. For fresh water beaches, the maximum allowable number of E. coli colony forming units per 100ml sample are 235.

Bourne has nine public bathing beaches which operate from Memorial Day through Labor Day. Beaches are sampled weekly, except for beaches which have at least two or more years of clean data, which are sampled monthly. Barnstable County collects samples and performs water quality analysis to determine whether samples pass or fail for public safety. If the samples from two consecutive days both exceed the water quality standards, the health agent is notified and the beach must be closed to swimming within 24 hours. A closed beach cannot re-open unless sample tests show bacteria levels are below the water quality standards.

Freshwater ponds including Picture Lake and Queen Sewell Pond have had closures in the past five years due to presence of cyanobacteria from nutrient pollution. In 2019 and 2021, Queen Sewell Pond had cyanobacteria, causing the beach to close earlier than the end of the beach season. Also in 2021, Picture Lake had about a two-week closure in late July/early August due to bacteria. Coastal beaches such as Monument Beach have also had recent health advisories, including a recent outbreak of Swimmer's Itch (also called cercarial dermatitis) in August 2019. While the outbreak of Swimmer's Itch is typically due to non-point runoff and animal contamination, the overall consensus is that the freshwater swimming beaches have overall nutrient loading concerns as opposed to the coastal beaches. The following table shows a summary of the beach names, type, sampling frequency and total number of beach closures in the last five years (2016 – 2020).

Table 12: Summary of Bourne Swimming Beaches, 2016 - 2020

Beach Name	Type	Watershed	Sampling Frequency	Beach Sample Failures	Beach Closures
Barlows Landing	Marine	Pocasset Harbor	Weekly	1	
Cataumet Harbor	Marine	Pocasset Harbor	Weekly	3	
Electric Avenue	Marine	Buttermilk Bay	Monthly	0	
Gilder Road	Marine	Cape Cod Canal	Weekly	3	
Monument	Marine	Phinneys Harbor	Monthly	0	
Patuisset Road	Marine	Pocasset Harbor	Weekly	4	
Picture Lake	Fresh	Pond	Weekly	2	1 Closure (2021)
Queen Sewell	Fresh	Pond	Weekly	5	2 Closures (2019, 2021)
Sagamore	Marine	Cape Cod Canal	Monthly	0	
Total				18	3

All closures and sample failures were due to bacteria, except the Queen Sewell closures which were caused by cyanobacteria (harmful algal blooms). Over the last five years at least three freshwater pond closures were experienced in Bourne while coastal beaches did not experience closures during the same period. There were over 15 sampling failures over the last five years, including coastal beaches, but the lack of beach closures indicates sufficient flushing by tidal influence or dissipation of the bacteria source.

SECTION 6.2 MASSDEP CLASSIFICATIONS OF SURFACE WATER QUALITY

MassDEP released its Final 2018/2020 Integrated List of Waters (Integrated Report) in February 2022 and represents the most recent update on the status of Massachusetts' waters. The goal of this Integrated Report is to identify waterbodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and to prioritize and schedule them for the development of a total maximum daily load (TMDL). The list is developed by MassDEP and includes a public review and comment process, and the final version of the list is approved by the EPA. MassDEP assigns the following categories for waterbodies assessed, indicating whether there are impairments against designated uses and the extent of implementation programs to improve quality for these uses:

- Category 1 – “Waters attaining all designated uses”: There are no waterbodies in the Commonwealth that meet this designation.
- Category 2 – “Attaining some uses; other uses not assessed” is the only list that presents the individual designated uses that are attained by each waterbody. However, it should be noted

that waters appearing in categories 4a, 4c and 5, while impaired for one or more uses, may also be attaining some uses.

- Category 3 – “No uses assessed”: These waterbodies were not assessed for any of their individual designated uses for the 2018/20 listing cycle.
- Category 4a – “All TMDLs are completed”: Waterbodies are 4a if all pollutants contributing to their impairment are addressed by one or more EPA-approved TMDLs. Impaired waters for which some TMDLs have been approved, but others are still needed, remain in Category 5 until TMDLs are completed for all pollutants
- Category 4b – “Impairment controlled by alternative pollution control requirements”: Reserved for waters impaired by one or more pollutants that are expected to attain their designated uses without TMDL implementation; however, Massachusetts is not including any waters in Category 4b for the 2018/2020 listing cycle.
- Category 4c – “Impairment not caused by a pollutant – TMDL not required”
- Category 5 – “Waters requiring one or more TMDL(s)” (i.e., the 303(d) List)
- Category 5a – “303(d)-listed waters for which Alternative Restoration Plans have been completed”: This category is an organizing tool to clearly articulate which listed waters have Alternative Control Plans, and to provide transparency to the public.

Through 2020, a total of 144 individual nitrogen TMDLs within 50 estuarine systems in the Buzzards Bay, Islands and Cape Cod coastal drainage systems have been approved by the EPA. MassDEP is currently working to identify data needs and funding to address an additional 16 to 20 estuaries in the coming years.

It is also important to note that in the EPA’s review of the MassDEP Integrated list, the EPA would like to work with MassDEP to develop a better eelgrass assessment methodology for future lists. While the 1995 statewide eelgrass study supports a reasonable baseline, EPA wonders what habitat was lost between 1976 and 1995. Other data that may suggest earlier indicators of declining water quality and bed impacts, such as depth distribution, shoot density and/or aboveground biomass of eelgrass beds for future iterations of Consolidated Assessment and Listing Methodology (CALM) guidance related to eelgrass bed habitat.

Section 6.2.1 Bourne’s Impaired Waterways and Waterbodies

Bourne has fifteen impaired watersheds according to the 2018/2020 Final Integrated list. There were no waterbodies or waterways listed in Bourne for 4b, 4c, or 5a.

- Herring River (MA94-44) is Category 2, which means it is attaining water quality for fish, other aquatic life and wildlife uses, deeming no action for ecological improvement necessary.
- Flax Pond (MA95-96087) is Category 3, which means it was not assessed this cycle.

Categories 4 and 5 contain waterbodies that are impaired by one or more pollutants, requiring the development and implementation of TMDLs to restore them (listed in Category 5 – “303(d) List”). Category 4a has completed TMDL assessments and Category 5 requires a future TMDL assessment.

The following watersheds were assessed with Category 4a, where TMDL studies and removal goals have been investigated and applied.

- **Back River (MA95-47)** - Fecal Coliform TMDL
- **Cape Cod Canal (MA95-14)** - Fecal Coliform TMDL
- **Eel Pond (MA95-48)** - Fecal Coliform TMDL
- **Phinneys Harbor (MA95-15)** - Fecal Coliform and Total Nitrogen TMDLs, Estuarine Bioassessments,
- **Pocasset River (MA95-16)** - Fecal Coliform TMDL

The following waterbodies have been identified as requiring additional TMDL assessment, which MassDEP is planning to assess over the next five years. Therefore, while these waterbodies do not yet have a TMDL it can be expected that they will be receiving one within the next ten years. For the needs assessment purposes, these watersheds will be considered the next highest priority after the TMDL watersheds.

- **Buttermilk Bay (MA95-01)** – Has Fecal Coliform TMDL, but needs Estuarine Bioassessments and Total Nitrogen TMDLs
- **Buzzards Bay (MA95-62)** – has Fecal Coliform TMDL but requires action towards the PCB in Fish Tissue impairment
- **Little Buttermilk Bay (MA95-76)** – needs Estuarine Bioassessments, Nutrient/Eutrophication Biological Indicators impairment action
- **Pocasset Harbor (MA95-17)** – has Fecal Coliform TMDL but needs Estuarine Bioassessments impairment action
- **Queen Sewell Pond (MA95-180)** Harmful Algal Blooms
- **Red Brook Harbor (MA95-18)** – Has a Fecal Coliform TMDL, but needs Estuarine Bioassessments and Nutrient/Eutrophication impairment actions. This watershed would likely be paired with Pocasset Harbor for future Total Nitrogen TMDL considerations, as it is upstream of the Pocasset Harbor system.
- **Squeteague Harbor (MA95-55)** - Nutrient/Eutrophication Biological Indicators

The following table summarizes Bourne waterbodies on the 2018/2020 Integrated List.

Table 13: 2018/2020 MassDEP Integrated List of Impaired Water Bodies in Bourne

Impairment Category	Waterbody and Impairment	Class
Category 2 – “Attaining some uses; other uses not assessed”	South Coastal – Herring River (MA94-44)	SA, B (Shell fishing, ORW)
Category 3 – “No uses assessed”	Flax Pond, MA95-96087	
Category 4a – “All TMDLs are completed”	Back River, MA95-47 (Fecal Coliform)	
	Broad River Marsh, MA95-58 (Fecal Coliform)	
	Cape Cod Canal, MA95-14 (Fecal Coliform)	SB (Shell fishing)
	Eel Pond, MA95-48 (Fecal Coliform)	
	Phinneys Harbor, MA95-15 (Estuarine Bioassessments, Fecal Coliform, Total Nitrogen)	
	Pocasset River, MA95-16 (Fecal Coliform)	SA (Shell fishing, ORW)
Category 5 – “Waters requiring one or more TMDL(s)” (i.e., the 303(d) List)	Buttermilk Bay, MA95-01 (Estuarine Bioassessments, Fecal Coliform, Total Nitrogen)	SA (Shell fishing)
	Little Buttermilk Bay, MA95-76 (Estuarine Bioassessments, Nutrient/Eutrophication Biological Indicators)	SA (Shell fishing)
	Great Herring Pond, MA94050 (DO & Mercury in Fish Tissue)	
	Pocasset Harbor, MA95-17, (Estuarine Bioassessments, Fecal Coliform)	
	Queen Sewell Pond, MA95180, Harmful Algal Blooms	
	Red Brook Harbor, MA95-18 (Estuarine Bioassessments, Fecal Coliform, Nutrient/Eutrophication Biological Indicators)	
	Squeteague Harbor, MA95-55 (Nutrient/Eutrophication Biological Indicators)	

SECTION 6.3 MASSACHUSETTS ESTUARIES PROJECT (MEP)

In 2001, the Massachusetts Estuaries Project (MEP) was created to help determine current nitrogen loads to southeastern Massachusetts estuaries, identify nitrogen thresholds, and evaluate reductions that would be necessary to support healthy ecosystems. The MEP is a collaborative effort between MassDEP, USGS, UMass Dartmouth, and southern Massachusetts communities. The MEP uses a linked watershed-embayment model to evaluate nitrogen inputs to estuaries. This information is used by MassDEP to develop Total Maximum Daily Loads (TMDLs) for each estuary studied. TMDLs calculate the maximum amount of a pollutant (nitrogen in this case) that a waterbody can assimilate and still support a healthy ecosystem (i.e., meet surface water quality standards and support public health). MEP has established four TMDLs for Total Nitrogen in Bourne:

- Fiddlers Cove and Rands Harbor
- Wild Harbor
- Phinneys Harbor (incl. Eel Pond and Back River)
- Megansett-Squeteague Harbors.

The Town continues to work with the Buzzards Bay Coalition to collect water quality monitoring data for those embayments that the MEP has no immediate plans to study, including:

- Buttermilk Bay
- Pocasset River
- Pocasset Harbor System (incl. Hen Cove and Red Brook Harbor)

The calculated nitrogen loads and required load reductions developed through the MEP program and described in the MEP reports will be used for those watersheds that have been evaluated.

Table 14: Bourne MEP Report Status

Estuaries / Embayments	MEP Evaluation	TMDL
Buttermilk & Little Buttermilk Bays	Incomplete (Future Study)	TBD
Fiddlers Cove/Rand Harbor	Completed 2013	Completed 2017
Megansett-Squeteague Harbor	Completed 2015	Complete 2020
Phinneys Harbor/Back River/Eel Pond	Completed 2006	Complete 2007
Pocasset Harbor/Hen Cove/Red Brook Harbor	Incomplete (Future Study)	TBD
Pocasset River	Incomplete (Future Study)	TBD
Wild Harbor	Completed 2013	Completed 2017

TBD = To Be Determined

Buzzards Bay and Cape Cod Canal are not included in the study area for Massachusetts Estuaries Projects, as they are direct discharges and not considered an Estuary/Embayment. Buzzards Bay has an existing Pathogen TMDL.

Section 6.3.1 Methodology

The core of the Massachusetts Estuaries Project analytical method is the Linked Watershed-Embayment Management Modeling Approach. It connects watershed inputs with embayment circulation and nitrogen characteristics.

The Linked Model has been applied previously to watershed N management in over 15 embayments throughout Southeastern Massachusetts. The Linked Model provides a quantitative approach for determining an embayment's: N sensitivity, N threshold loading levels (TMDL) and response to changes in loading rate. The approach is fully field validated and unlike many approaches, accounts for nutrient sources, attenuation, and recycling and variations in tidal hydrodynamics. This methodology integrates a variety of field data and models, specifically:

- Monitoring - multi-year embayment nutrient sampling
- Hydrodynamics -including bathymetry and hydrodynamics
- Watershed Nitrogen Loading
- Embayment TMDL model scenarios

The Linked Model uses a holistic approach that incorporates the entire watershed, embayment and tidal source waters, so it can be used to evaluate all projects as they relate directly or indirectly to water quality conditions within its geographic boundaries. It should be noted that this approach includes high-order, watershed and sub-watershed scale modeling necessary to develop critical nitrogen targets for each major sub-embayment. The Linked Model process does not contain the type of data or level and scale of analysis necessary to predict the fate and transport of nitrogen through groundwater from specific sources nor does it make any determinations directly related to surface water outfalls.

MEP also uses the linked model to distinguish between controllable and uncontrollable types of nitrogen, to distinguish the types of action that can be taken. For example, land use and wastewater sources can be controlled to some extent but some atmospheric and sediment sources cannot.

Section 6.3.2 Section 208 Plan Updates

The Cape Cod 208 Plan Update, certified and approved by the Governor of the Commonwealth of Massachusetts and the US EPA in 2015, provides an opportunity and a path forward to implement responsible plans for the restoration of the waters that define Cape Cod. The 208 Plan Update directs Waste Treatment Management Agencies (WMAs) to develop watershed reports within 12 months of certification of the Plan Update.

As part of the 208 Update, the Cape Cod Commission developed a regionally consistent database of nitrogen loadings across each watershed. The data set, which considers wastewater, stormwater, and fertilizer load estimates, was combined into a regionally-consistent tool called the Watershed MVP tool (wMVP). The goal in developing the Similar to MEP, da load entering each watershed. This data set includes estimates of wastewater, stormwater and fertilizer loads - similar to methodologies used by the MEP. Using this regionally consistent database, the Watershed MVP tool (wMVP) was developed so that different strategies (i.e., bookend scenarios) to reduce excess nitrogen load could

be evaluated. There are variations of load between the MEP and wMVP, primarily due to differences in comparing older and newer databases.

SECTION 6.4 EMBAYMENTS WITH TMDLS

There are four embayment TMDL's with at least part of the watershed located within Bourne: Fiddlers Cove and Rands Harbor, Wild Harbor, Megansett-Squeteague Harbor, and Phinneys Harbor.

Table 15: MEP Determined Total Nitrogen Loading from TMDL Watersheds

Embayment System	Septic System Load (lbs./day)	Total Watershed N Load from all sources (lbs./day)	Percent of Total Watershed N Load from Septic Systems
Fiddlers Cove and Rand Harbor	17.33	27.91	62%
Wild Harbor	38.27	55.42	69%
Megansett-Squeteague Harbor	45.97	86.05	53%
Phinneys Harbor	48.59	116.27	42%
Total			53%

Section 6.4.1 Fiddlers Cove and Rands Harbor

The MEP team delineated a watershed area of approximately 1,536 acres for the combined Fiddlers Cove and Rands Harbor estuarine systems. The developed regions of the watersheds to Fiddlers Cove and Rands Harbor are almost entirely within the town of Falmouth. The upper most portion of the watershed also falls within Sandwich and Bourne, however this portion of the watershed is mostly undeveloped. The upper watershed within the JBCC (about 1/4 of watershed) is mainly undeveloped and what is developed is sewered and does not contribute a significant N load to the estuaries. The major stakeholder for management and restoration of Fiddlers Cove and Rands Harbor is the town of Falmouth.

Therefore, Fiddlers Cove and Rand Harbor are not included in Bourne's Comprehensive Wastewater Management Plan.

Section 6.4.2 Wild Harbor

The MEP team delineated the watershed area of Wild Harbor to be 2,117 acres. The developed regions of the watershed are 100% within the town of Falmouth. The land area in Bourne and Sandwich, and a portion of the land area in Falmouth, is not in control of the towns as it is a part of JBCC, which is served by a wastewater treatment facility and discharged outside of the watershed. Therefore, Wild Harbor is not included in Bourne's Comprehensive Wastewater Management Plan.

Section 6.4.3 Megansett-Squeteague Harbor

The Megansett Harbor System includes 2,739 acres located within Bourne and Falmouth. It receives tidal flow from Buzzards Bay and is defined by its two main harbors: Megansett and Squeteague.

According to the CCC's 2017 Watershed Report for Megansett Harbor, there are 945 parcels, 77% of which are developed residential parcels with an average parcel density of 2.9 acres per parcel, approximately. Based on land area, the Town of Bourne is responsible for 39% of the load allocation, with Falmouth responsible for the remaining 61%. While CCC indicates the water threat level is low for the Megansett-Squeteague System, total nitrogen concentrations exceed the 0.35 mg/L concentration at the sentinel water-quality monitoring station. Watershed nitrogen load characteristics indicate healthy to moderately impaired ecological conditions, with 6 total surface waters and 4 freshwater ponds (1 of which has preliminary trophic characterization).

The CCC watershed monitoring report indicated no need to reduce current loading to Megansett harbor as the current watershed wastewater load is within the total watershed load. However, MEP's final TMDL study indicates otherwise.

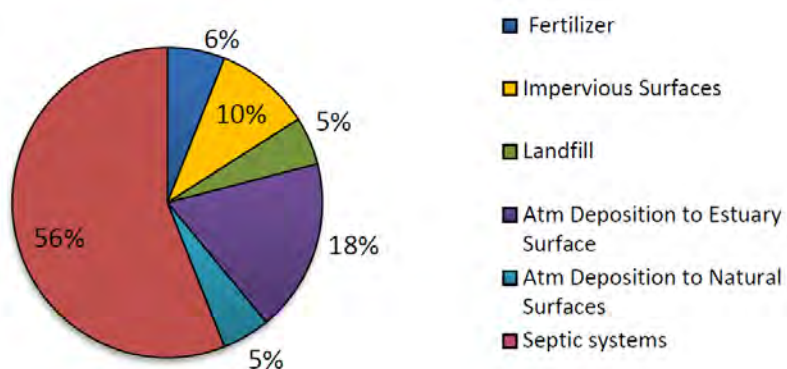


Figure 24: 2020 MEP Loading Sources to Megansett-Squeteague System

Current septic system loading accounts for 56% of the total loading to the Megansett Harbor System. MEP projected that a 19.3% reduction in present septic loading achieved the target threshold for nitrogen removal. The septic load change results in a 12.6% decrease in total load to the watershed System. Table 16 summarizes these two reduction calculations for setting the TMDL removal goals.

Table 16: Megansett-Squeteague Nitrogen Loading Comparisons, Per MEP TMDL Report

	Per TMDL Table 6: Watershed	Per TMDL Table 8: Septic Systems
Present N Load (kg N/day)	31.940	20.852
Threshold N Load (kg N/day)	27.924	16.836
Threshold Load % Change	-12.6%	-19.3%

This decrease results in a 1,446 kg N/year reduction in septic system loadings. The CCC wMVP watershed loading data is significantly less than that determined in the MEP report. Regional data

from wMVP indicates no need to reduce current loading to Megansett Harbor at this time; however, MEP indicates otherwise; therefore, the percent reduction required (6%) for Megansett Harbor only (excluding Rands Harbor and Fiddlers Cove).

Section 6.4.4 Phinneys Harbor

CCC indicates the water threat level for Phinneys Harbor to be moderate, showing an immediate need for nitrogen treatment. The watershed land area is 1,116 acres, encompassing 798 parcels with the highest watershed density of 1.4 acres per parcel. Over 87% of the parcels are developed as residential parcels, contributing about 100,000 GPD of septic wastewater flow. The Town of Bourne is 100% responsible for load allocation of nitrogen within Phinneys Harbor. The land area in Sandwich, and a portion of the land area in Bourne, is not in the control of the town as it is part of Joint Base Cape Cod (JBCC), which is served by a wastewater treatment facility and discharged outside of the watershed.

Unlike many estuaries where the greatest nitrogen loading is in the inner basins, in the Phinneys Harbor system, most of the nitrogen loading is focused on the outer basin of the Harbor, as is the impairment. It is the outer basin which is capable of supporting eelgrass and which presently contains little eelgrass habitat. Since 1951, more than 88 historic acres of eelgrass have disappeared, making eelgrass restoration in this basin the primary nitrogen management goal for the embayment.

The threshold level to restore eelgrass within the outer basin of Phinneys Harbor was set at 0.35 mg /L N based upon the detailed quantitative analysis of nearby West Falmouth Harbor where both temporal nitrogen and eelgrass distribution trends could be assessed as well as comparative analysis of total nitrogen levels within healthy eelgrass beds.

The MEP TMDL Report states that load reductions can be “through reduction of any or all sources of [nitrogen], potentially increasing the natural attenuation of nitrogen within the freshwater systems to the embayment, and/or modifying the tidal flushing through inlet reconfiguration (where appropriate). The load reductions presented [in below...represent only one of a suite of potential reduction approaches that need to be evaluated by the communities involved.”

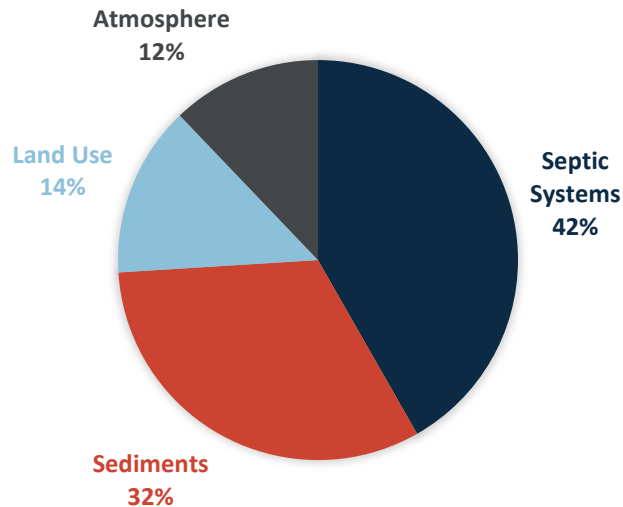


Figure 25: 2007 MEP Loading Sources to Phinneys Harbor

Based on the MEP scenario as calculated in 2007, 68% of controllable loads need to be reduced in order to meet threshold loads in Phinneys Harbor.

Table 17: Phinneys Harbor MEP Table 4 (recreated), 2007

Embayments	Present controllable load ¹ . (kg/day)	Target Threshold Load ² . (kg/day)	Percent Controllable Load Reductions needed to achieve threshold loads (%)
Phinneys Harbor	14.75	4.69	68
Back River	9.63	9.63	0
Eel Pond	4.89	4.89	0

1. Composed of controllable land use and septic system loadings

2. Target threshold watershed load is the load from the watershed needed to meet the embayment target threshold N concentrations as described in the MEP TMDL Report.

The Septic System load to be reduced in Phinneys Harbor is calculated by the present controllable load divided by the present septic system load, or controllable septic ratio, multiplied by the percent of controllable loads to be reduced or 68%. The ratio (14.75 kg/day total load divided by 12.61 kg/day septic load) multiplied by 68% equals a 79.5% of septic system load reduction in Phinneys Harbor. The total watershed load reduction is 28.4% reduction of all sources. Compared to the total nitrogen load, which only requires a 36.85% total reduction.

Table 18: 2007 Phinneys Harbor TMDL Table Loading Sources

	Total nitrogen load from all sources (kg N/day)	Septic system load (kg N/day)	Septic system load / total load
Phinneys Harbor	35.47	12.61	35.6%
Back River	12.14	5.19	42.8%
Eel Pond	5.13	4.24	82.7%
Total	52.74	22.04	41.8%

Table 19 shows the total Nitrogen Load values and the approximate Bourne Removal Total for both of the MEP watersheds. The CCC updated the MEP future development and current parcel use data for Phinneys Harbor, which uses more current values for water use than what the MEP data showed. This update in parcel data updates the total septic removal required in this watershed, which is less than the MEP removal requirement (although the Watershed Threshold is comparable). For Megansett-Squeteague, the CCC calculated a much lower removal value than the MEP threshold calculated. As Bourne is responsible for 39% of the Megansett-Squeteague Harbor septic system removal, the value is less than 600 kg N per year removal or less than 120 septic systems.

Table 19: Total Nitrogen Removal from Bourne's MEP Embayments with TMDL

Embayment	Source (Year)	Total Nitrogen Load Values, kg-N/year		Total Watershed Threshold (kg-N/year)	Total Load to Remove (kg-N/year)
		Septic Loads	Total Load		
Megansett-Squeteague Harbor	CCC (2017)	4,615	6,193	5,794	399 (6%)
	MEP (2020)	7,611	11,658	10,192	1,446 (19%)
Phinneys Harbor	MEP (2007)	8,044	10,706	7,011	3,362
	CCC (2017)	5,948	8,730	7,024	1,706

SECTION 6.5 EMBAYMENTS WITH NO ESTABLISHED TMDLS

The following watersheds have not been studied by the MEP program, so current wastewater nitrogen loading rates and septage/wastewater flows were estimated based on 208 Plan Updates through Cape Cod Commission (CCC) Watershed Reports and updated using available parcel and water use data where available. Assessor's data provided by the Town describes updates to the CCC estimates based on updates to residential, commercial, and industrial uses, seasonal and year-round property uses.

The 208 Plan Update by the CCC used a 25% removal requirement assumption for watersheds without a nitrogen TMDL. This percentage is represented as the Total Watershed Threshold value in Table 20 below. All three of the watersheds are 100% Bourne's responsibility to remove nitrogen (there are no shared Town responsibilities in these watersheds).

Table 20: CCC Determined Target Nitrogen Removal per non-TMDL Watershed

Embayment	Total Nitrogen Load Values, kg-N/year		Total Watershed Threshold kg-N/year	Total Load to Remove kg-N/year
	Wastewater	Total Load		
Buttermilk Bay	4,058	5,610	4,208	1,402
Pocasset Harbor	7,958	12,479	9,359	3,120
Pocasset River	3,762	5,157	3,868	1,289

Section 6.5.1 Buttermilk Bay

In the 2017, CCC indicated that the water threat level to Buttermilk Bay was low, but the Buzzards Bay Coalition has since provided water quality data which indicates conditions are worsening and that a moderate threat is posed to water quality health, with a 66 out of 100 Water Quality Score. The watershed area is 6,916 acres, including approximately 824 parcels. 85% of the parcels are developed as residential with a parcel density of 8.4 acres per parcel. From the 2019 Local Comprehensive Plan, Queen Sewell Pond and surrounding neighborhoods were identified as a critical area of wastewater need, which is located within the Buttermilk Bay watershed.

The loads and threshold presented here only represent Bourne's contribution to the watershed (excludes loads from Plymouth). Therefore, the load to be removed is Bourne's allocation only.

Section 6.5.2 Pocasset Harbor

Pocasset Harbor is also known as Red Brook Harbor. The Cape Cod Commission has indicated that the water threat level to Pocasset Harbor is low. Over 74% of the 2,060 parcels are developed, with a parcel density of 2.3 acres per parcel. The overall watershed land area is 4,718 acres. From the Local Comprehensive Plan, the high-density neighborhoods of Barlow's Landing, Patuisset, Picture Lake, and Pocasset Heights are located in Pocasset Harbor watershed.

The Town of Bourne is allocated 100% of land area within the watershed as the land area in Sandwich, and a portion of the land area in Bourne, is not in the control of the town as it is part of Joint Base Cape Cod (JBCC), which is served by a wastewater treatment facility and discharged outside of the watershed. The Buzzards Bay Coalition scores for water quality for Pocasset Harbor are 50 out of 100 for the Inner Harbor and 73 out of 100 for the Outer Harbor. These scores have data from six sampling stations over the last five years of monitoring data.

Section 6.5.3 Pocasset River

The Pocasset River estuary receives freshwater from upper reaches and surface overland flow. Background nitrate concentrations indicate evidence of non-point source pollution (as corroborated with data from nearby public water supply wells). The Pocasset River is located within the Bourne Water District and the watershed is 2,143 acres with approximately 809 parcels. The watershed is 80% developed residentially and the parcel density is 2.6 acres per parcel. From the Local Comprehensive Plan, the neighborhood of Tahanto was identified as a critical area of wastewater concern and is located within the Pocasset River Watershed.

There is no significant evidence of water quality impairment according to the Cape Cod Commission and Massachusetts Estuaries Programs. However, the Buzzards Bay Coalition Bay Health Index rates the Pocasset River at a 53 out of 100 Water Quality Index, which has been declining over the last 25 years. While the Pocasset River has a Fecal Coliform TMDL, MEP and CCC did not deem the Pocasset River a priority for receiving a TMDL. Therefore, this watershed is not in priority order for receiving a Total Maximum Daily Limit for Total Nitrogen. The Pocasset River already has a Fecal Coliform TMDL.

The 2017 Cape Cod Commission Watershed Report Update stated that the Pocasset River has approximately 5,157 kg-N/year total watershed TN loading. The Cape Cod Commission recommended a 25% reduction in nitrogen, resulting in approximately 1,289 kg-N/year to be removed. The watershed allocation of removal is 100% Bourne's responsibility, as the land area in Sandwich, and a portion of the land area in Bourne, is not in control of the town as it is part of JBCC.

SECTION 6.6 DIRECT DISCHARGE WATERSHEDS

The remaining two watersheds, Buzzards Bay and Cape Cod Canal, do not have Total Nitrogen TMDL's nor have they been studied by the MEP. Buzzards Bay has an existing Pathogen TMDL, but there is no plan to study either of these waterbodies for TN removal, as they have considerably greater flushing than smaller embayment systems. By reducing nitrogen to the estuary systems, the hope and goal is to reduce overall loading to these watersheds.

Due to its unique topography and the division of the Town by the Cape Cod Canal, Bourne has several areas of direct dischargers to the Cape Cod Canal and Buzzards Bay waterbodies, which requires a look at the watershed loadings for the areas located within direct discharge. The largest area, Canal North, features the entire North Sagamore and most of the Bournedale communities. The second largest discharge area, Canal South, encompasses direct dischargers along the Sagamore, Bourne and Gray Gables communities. The Buzzards Bay direct discharge areas in Bourne include a small number of parcels North of the Canal, but more significant pockets south of the Canal.

Again, these watersheds are the lowest priority for direct discharge areas because of the greatest flushing ability, overall tidal fluctuation and mixing capabilities. We recommend carrying an initial 25% reduction in current nitrogen loading estimates and phasing out project work until the second half of the Plan Implementation. It is expected that more detailed monitoring reports will become available for these waterbodies in the future, and to expect to adapt the proposed removal goals

accordingly. Table 21 estimates a 25% Nitrogen Reduction load based on existing loading, and estimates the total load to remove.

Table 21: Direct Discharge TN Loading Estimates

Watershed	Existing Approx. Septic System Loading (kg N/year)	Future Approx. Septic System Loading (kg N/year)(kg N/year)	25% Nitrogen Reduction Goal (kg N/year)	Total Load to Remove (kg N/year)
Buzzards Bay	14,300	16,830	12,623	4,208
Canal North	110,053	120,010	90,009	30,001
Canal South	40,885	44,018	33,013	11,005

SECTION 6.7 SUMMARY OF WATERSHED NEEDS

The following recommendations are for the next phase of study, to identify and evaluate alternative technologies and solutions which can reduce nitrogen and improve water quality in each watershed. These recommendations are meant to be general guiding principles for the next phase of work where detailed criteria and evaluation protocols will be developed and exercised.

Overall, Bourne is responsible for an estimated 13,000 kg N/year, which is expected to increase as additional MEP studies are performed for Buttermilk Bay, Pocasset Harbor, and Pocasset River watersheds over the next few years. While MassDEP has not expressed a specific timeline, we can expect Bourne to adapt their management strategies accordingly within the first half of the recommended plan implementation timeline (between 2024 and 2034).

The following bullets summarize the findings and recommendations for next steps, *in order of timeline priority*.

- TMDL Watersheds
 - **Megansett-Squeteague Harbor:** While Megansett-Squeteague Harbor has a TMDL, the percentage share of removal combined with the overall controllable wastewater load reduce the removal requirement to below 200 kg N/year. Therefore, we recommend maximizing stormwater and downstream best management practices at this time. Future development of a watershed plan will require Bourne to coordinate with Falmouth to develop a shared approach to managing loads in the future.
 - **Phinneys Harbor:** As a TMDL watershed, the over 1,700 kg N/year removal requirement prioritizes Phinneys Harbor for wastewater management solution integration within the first five years of a recommended implementation plan. Identifying shared wastewater capacity to propose a centralized solution, investigating onsite alternatives for wastewater management in hard to reach areas, and maximizing shared stormwater improvement solutions will be critical in

this area. The separation between the coastal and non-coastal community topography will be critical in managing alternatives, and the widespread area will need to consider costs of treatment.

- Non-TMDL Watersheds
 - **Buttermilk Bay, Pocasset Harbor and Pocasset River:** All three of these watersheds are non-TMDL watersheds but are determined to be high-priority for implementation according to the MassDEP/EPA joint-approved Impaired Water List. All three watersheds have documented water quality concerns, including eutrophication and nitrogen loading concerns. Therefore, following the TMDL watersheds, these three watersheds are considered the next highest priority for determining solutions as part of the recommended plan. These watersheds will also need centralized, decentralized and non-traditional alternative analysis to determine the best possible combination of treatment technologies which maximize nitrogen removal, improve water quality, and are cost effective.
 - **Buzzards Bay and Cape Cod Canal:** Both are direct discharges with no Nitrogen or Biological impairments as identified by MassDEP and EPA in the most recent list of Impaired Waters. Understanding that protection of both of these waterbodies regardless of Impairment status is highly prioritized by the Town of Bourne, we recommend that long-term solutions be implemented in a phased approach for these waterbodies. This being said, we expect that additional guidance and development of watershed specific plans will be made available after improvement is monitored and reported.

A summary table with the removal requirement for each watershed is provided in Table 22.

Table 22: Summary of Watershed Nitrogen Removal Requirement

Embayment	Total Nitrogen Load Values, kg-N/year		Total Watershed Threshold kg-N/year	Total Load to Remove kg-N/yr.	Bourne's % Responsibility for Removal	Bourne Total Removal (kg-N/yr.)
	Wastewater	Total Load				
Megansett-Squeteague Harbor	7,611	11,658	10,192	1,446	39%	564
Phinneys Harbor	5,948	8,730	7,024	1,706	100%	1,706
Buttermilk Bay	4,058	5,610	4,208	1,402*	100%	1,402
Pocasset Harbor	7,958	12,479	9,359	3,120*	100%	3,120
Pocasset River	3,762	5,157	3,868	1,289*	100%	1,289
Buzzards Bay	16,830			4,208*	TBD	TBD
Cape Cod Canal	164,028			41,007*	TBD	TBD
Total						8,072

*Estimated 25% removal, subject to revision and MassDEP approval.

SECTION 7 PUBLIC PARTICIPATION ACTIVITIES

SECTION 7.1 INTRODUCTION

Public Participation was initiated at the start of the project and will continue throughout the development of the CWMP. Bourne actively seeks to create opportunities for public education, outreach and participation throughout the project. The public workshops/meetings began in May 2021. Announcements related to public participation opportunities are posted on the town's CWMP website page (<https://www.townofbourne.com/comprehensive-wastewater-management-plan-cwmp>), and are also distributed by email to stakeholders using a list compiled by the Town Staff Working Group for the CWMP together with Environmental Partners. The list of Stakeholders is included in **Appendix C**. The Town prefers structuring workshops to ensure engagement and opportunities for interaction where concepts and ideas can be shared. Based on the COVID-19 pandemic response and the shift to virtual meetings, the first of these workshops were held virtually. The goal for remaining public workshops is to host hybrid options, including Zoom Links for in-person meetings, to optimize accessibility to all community members.

Toward the end of Phase IV where the comprehensive management strategy is articulated the Town plans to host three public hearings for presentation of the Recommended Plan, one with the Town and two with the Cape Cod Commission, to meet the requirements of the CWMP process. The Town will also prepare a summary report on the public participation activities of Phases I, II and III to be included in the final CWMP and Environmental Impact Report (FEIR). Table 23 shows a preliminary schedule for the public participation activities associated with Phase I, II III and IV.

Table 23: Stakeholder Meeting Schedule

Scope of Work Task	Town wide Meeting Date
Phase I - Needs Assessment (Year 1)	
a. Wastewater Conditions	May 2021
b. Wastewater Needs and Problem Identification	December 2021
Phase II - Identification and Screening of Alternatives (Year 2)	
a. Proposed Criteria	Planned Winter 2022
b. Refine criteria and matrix	Planned Spring 2022
c. Present Refinement	Planned Summer 2022
Phase III - Formulation of Plan (Year 3)	
a. Cost Allocation Discussion	One* (TBD)
b. Review the evaluation results and the plan	One (TBD)
c. Public Hearing	One (TBD)
Phase IV - MEPA & CCC DRI Reviews (Year 4)	One** (TBD)

*Presented with Board of Sewer Commissioners, a public meeting.

**Considered Public Hearings, in accordance with CWMP process requirements. Two meetings will be held with the Cape Cod Commission.

The Town has a page on the Town's website specifically for the CWMP project, where information is regularly uploaded and shared with the public. This website information includes meeting and

workshop agendas and minutes, presentations, deliverables, background documents, specific public information content related to the CWMP, and recordings of public meetings and hearings, and regular updates.

Quarterly meetings with the Board of Sewer Commissioners are to be held that will provide an opportunity for communication among the project team and town leaders, and a forum for the public to gain insight on the project and how it is progressing. A preliminary schedule for the deliverables to be shared to the Town CWMP website associated with public participation activities is provided in Table 24.

Table 24: Public Participation Plan - Targeted Information Sharing Schedule

Scope of Work Task	Type of Document Shared			
	Public Notice and Agenda	Workshop Findings	Summary Document	Other
All Tasks				Monthly Progress Update
1. Project Startup & Plan Review				Project Introduction
4. Needs Assessment				
a. Wastewater Issues	Two	One		
b. Wastewater Needs and Problem Identification	One	One	Needs Assessment	Task 4 Scope of Work
5. Identification of Alternatives				
a. Proposed Criteria	One	One		
b. Refine criteria and matrix	One*			
c. Present Refinement	One	One	Alternatives Matrix	Task 5 Scope of Work
6. Formulation of Plan				
a. Cost Allocation Discussion	One*			
b. Review the evaluation results and the plan	One	One	Evaluation results	Plan Draft
c. Public Hearing	One	One	Response to Comment	Final Draft
7. Completion of MEPA & CCC DRI	Two		Final CWMP	

Notes: *Document will be part of regularly scheduled Board of Sewer Commissioners meeting.

SECTION 7.2 PUBLIC PRESENTATIONS AND HEARINGS

Public Participation initiated at the start of the project with the following intended to create an opportunity for public education, outreach and participation throughout the execution of the project. The public workshops/meetings begin with an announcement of the meeting date, location and agenda. Announcements on the town website, local cable channel, and other outlets for distribution as chosen by the Town informing participants of upcoming meetings and workshops.

The first public participation events planned for the Needs Assessment work were held remotely on May 26, May 27, and December 2, 2021. The first two events were conducted prior to the Needs Assessment, to gather feedback from the community members North of the Canal and South of the Canal. Participants shared water quality concerns and areas of focus or improvement that needed to be met. The third meeting was held during the December Board of Sewer Commissioner's Meeting to share findings from the Needs Assessment. All three meetings were recorded and materials uploaded to the CWMP website (<https://www.townofbourne.com/comprehensive-wastewater-management-plan-cwmp>).

A formal presentation was made by the Town and Environmental Partners at each event discussing the needs analysis conducted to date. The presentation was followed by breakout sessions with smaller groups of individuals to provide an opportunity for interaction and sharing of opinions and ideas from all attendees at the workshop. Presentation materials are included in **Appendix D**. These presentations were provided virtually to both the communities North and South of the Canal, and held a workshop with Town wide participants to share the overall needs assessment. These presentations were recorded and materials were uploaded to the CWMP website.

APPENDIX A

GIS Figures

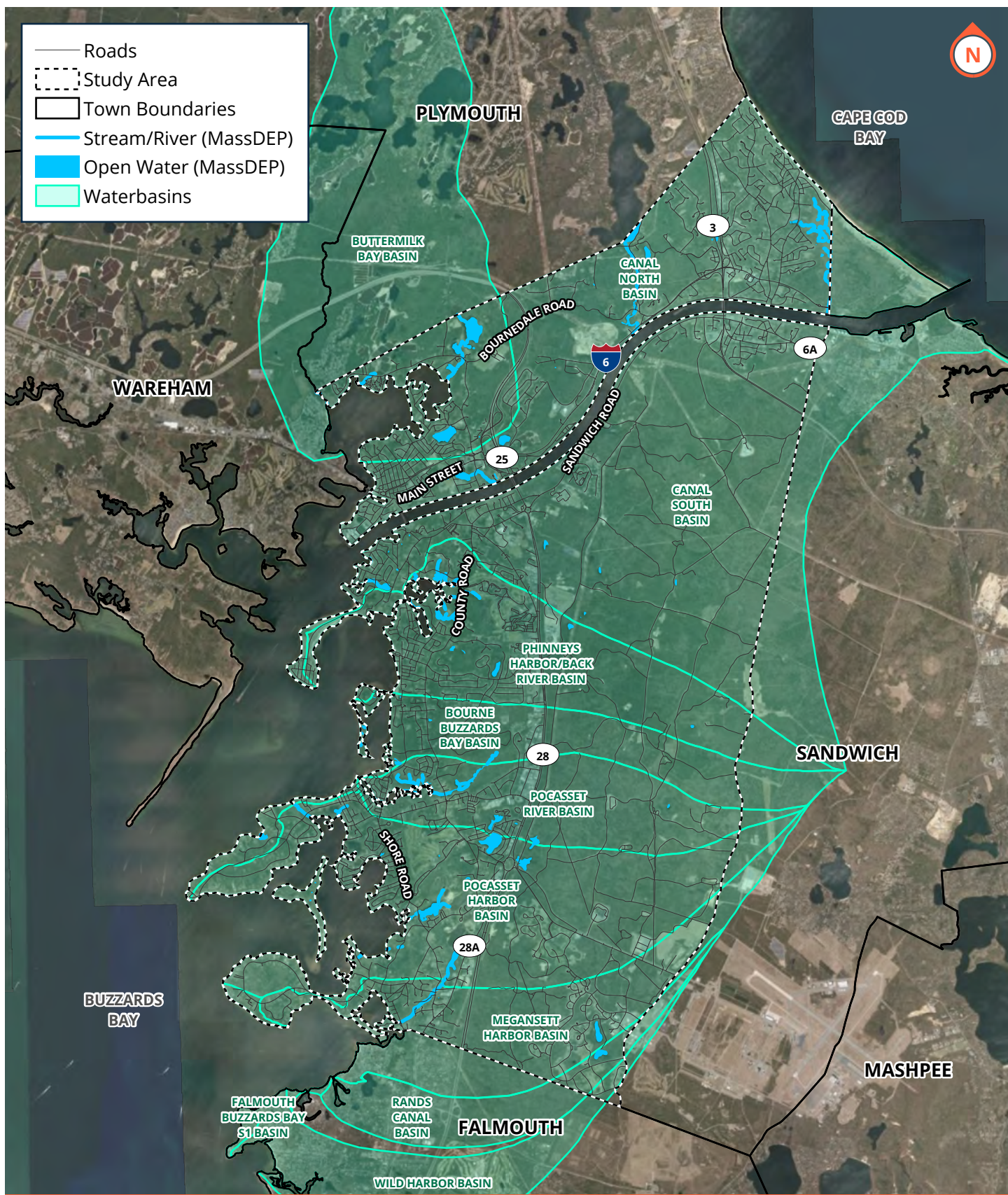


Figure 1
CWMP - Study Area

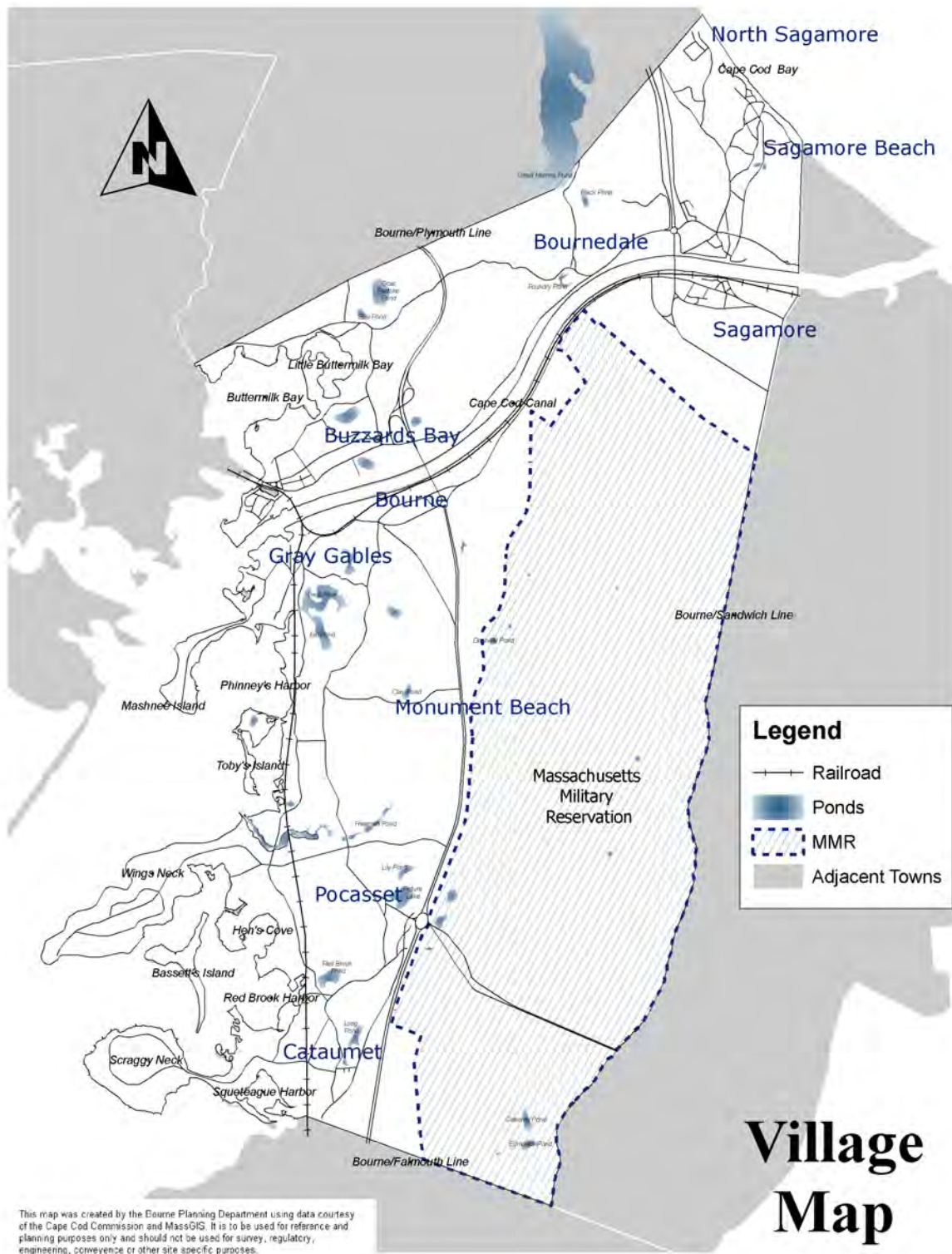
Bourne, Massachusetts

9/17/2021

ENVIRONMENTAL
PARTNERS

— An Apex Company —

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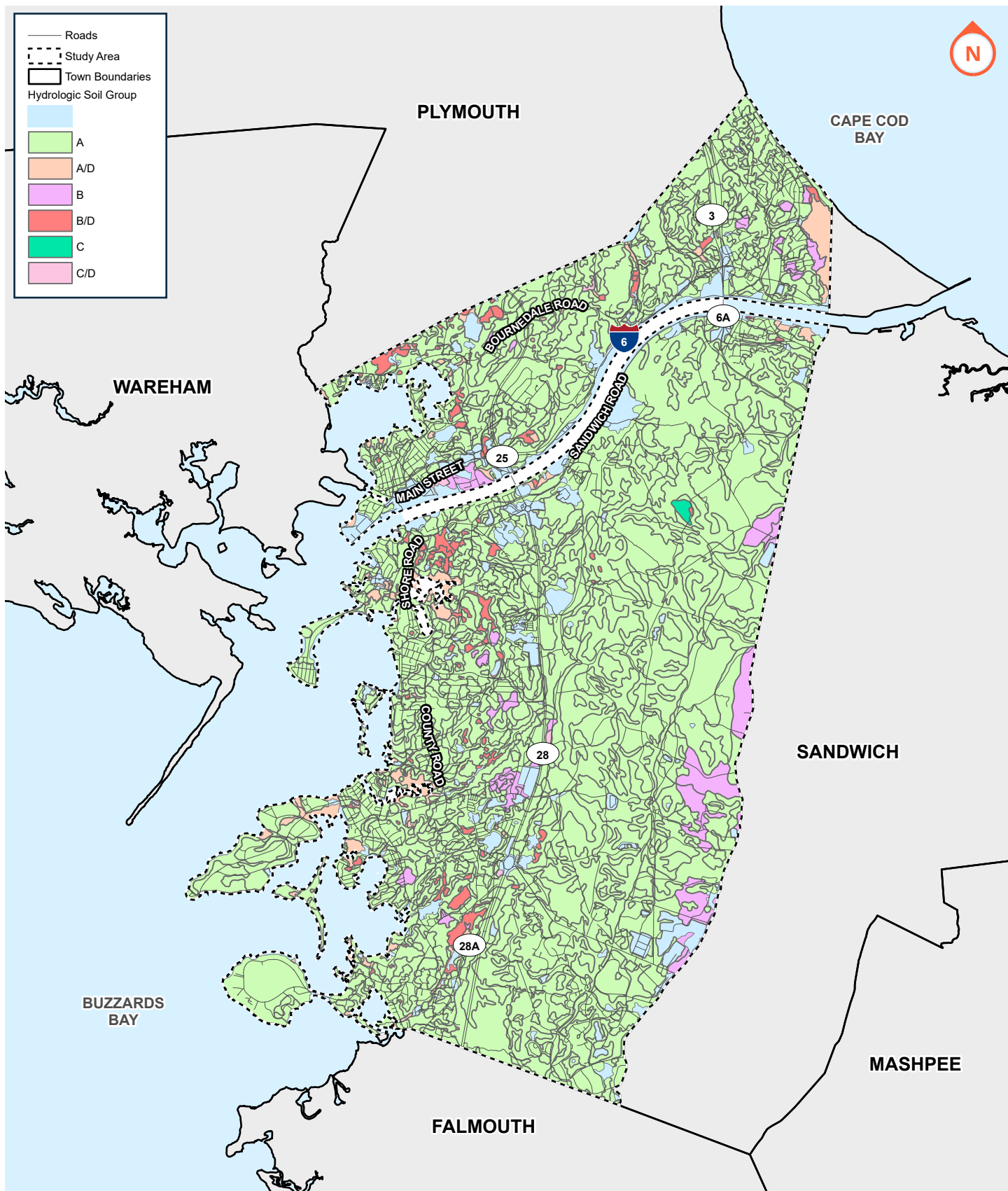


Figure 5
CWMP - Soil Constraints

Bourne, Massachusetts

3/17/2022

ENVIRONMENTAL
PARTNERS

— An Apex Company —



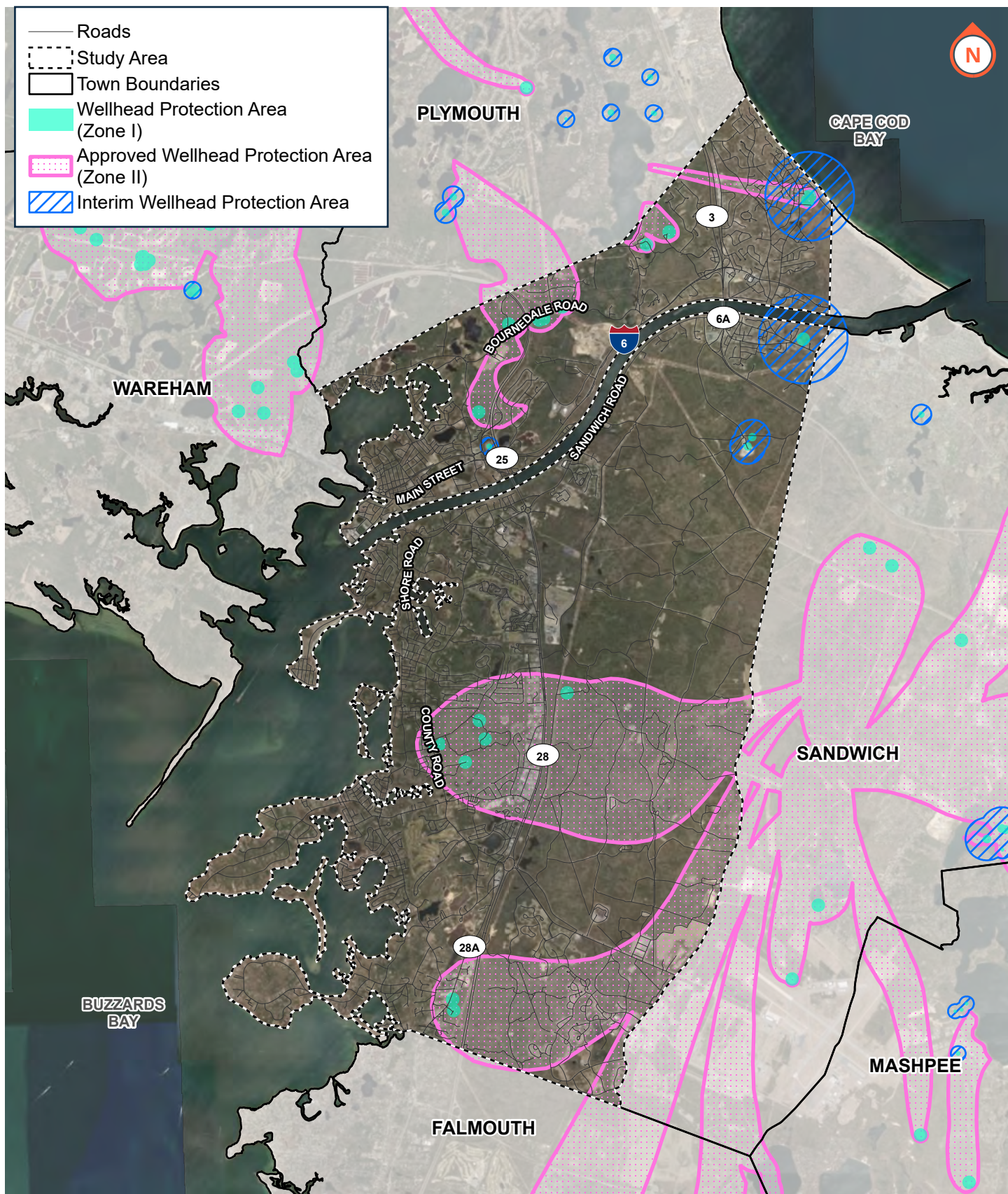


Figure 6
CWMP - Groundwater Constraints
 Bourne, Massachusetts
 3/17/2022

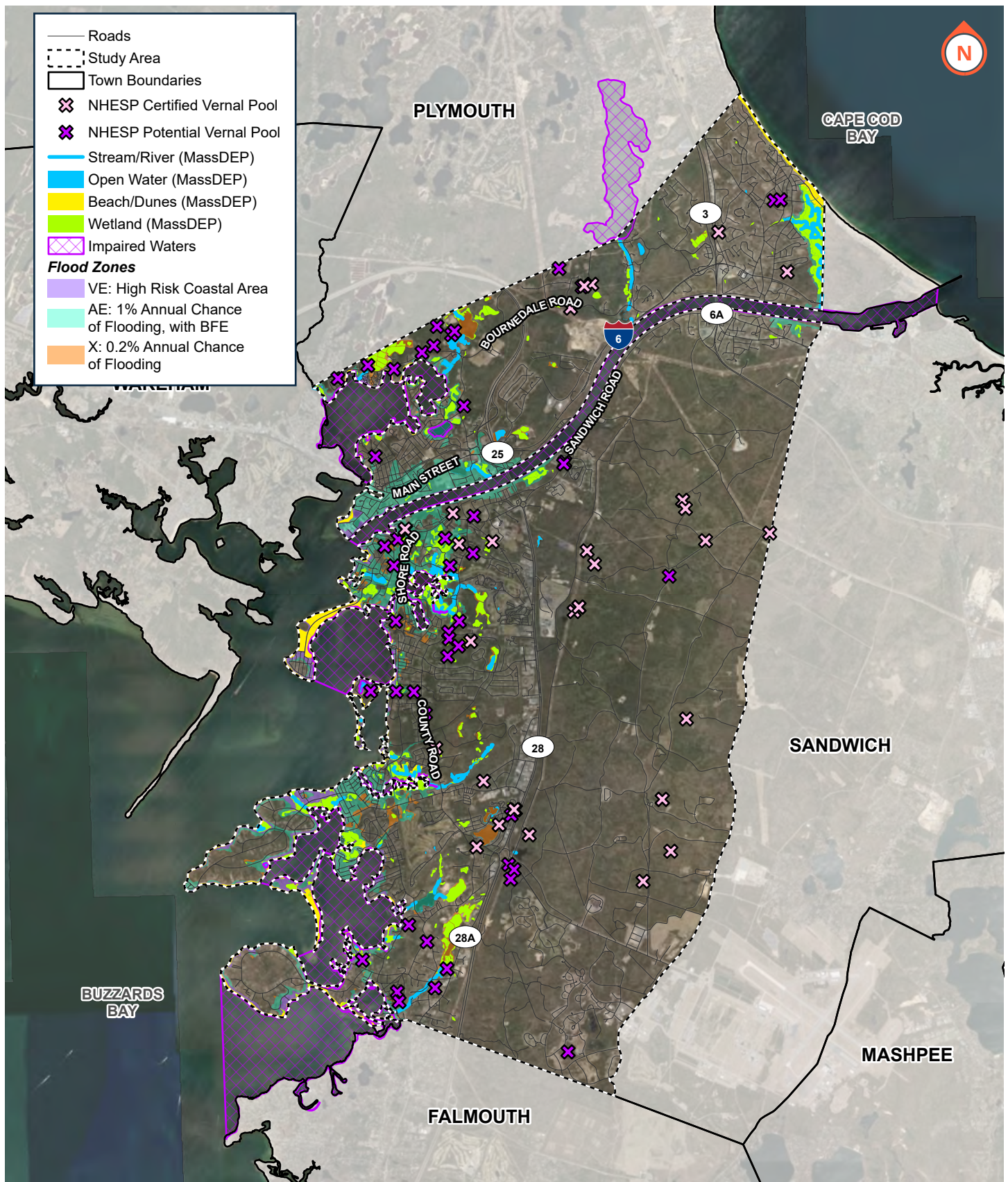


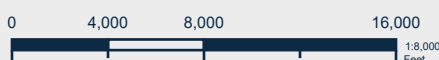
Figure 10
CWMP - Water Resources

Bourne, Massachusetts

3/17/2022

ENVIRONMENTAL
PARTNERS

— An Apex Company —



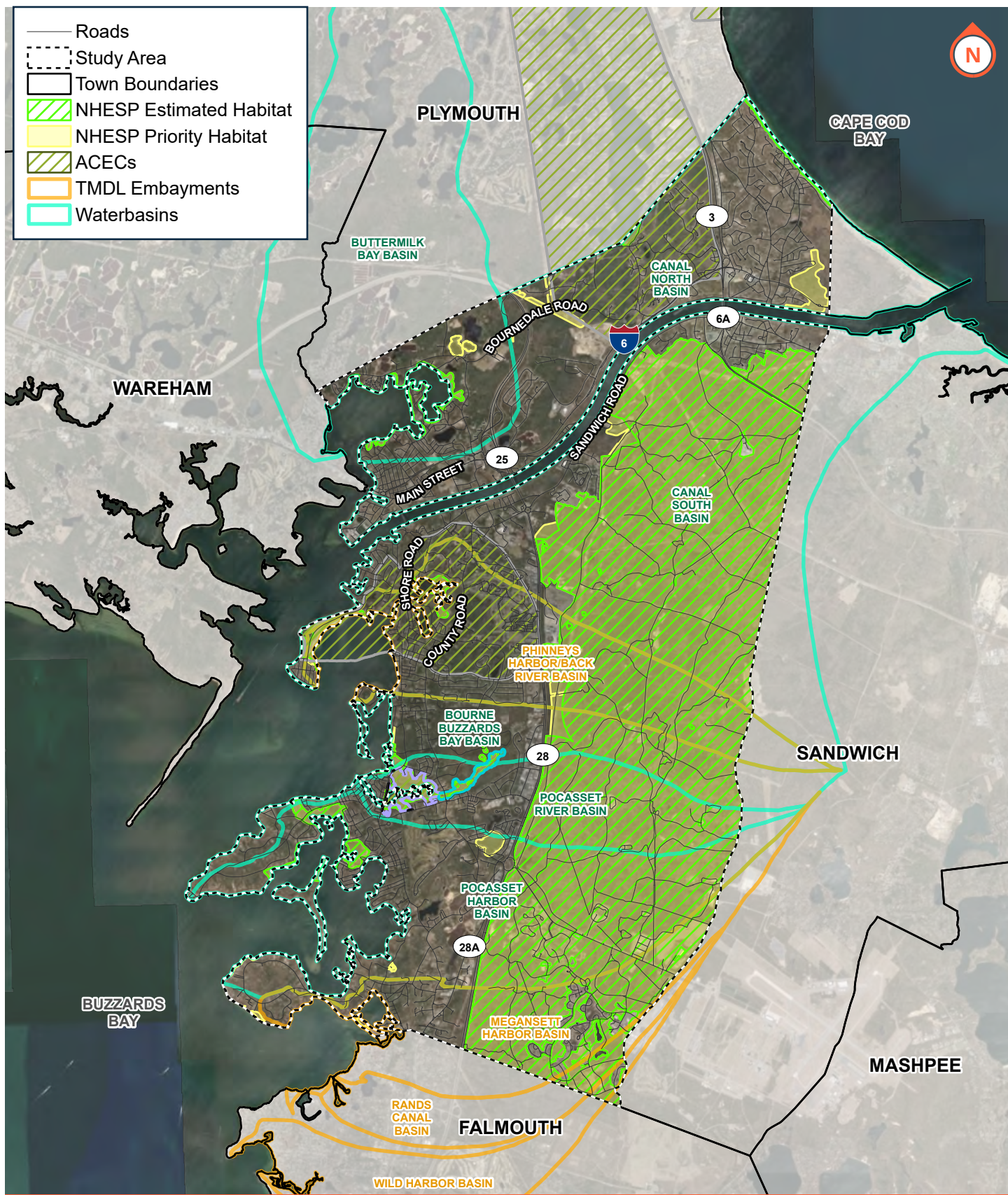


Figure 13
CWMP - Environmental Resources

Bourne, Massachusetts

3/17/2022

ENVIRONMENTAL
PARTNERS

— An Apex Company —



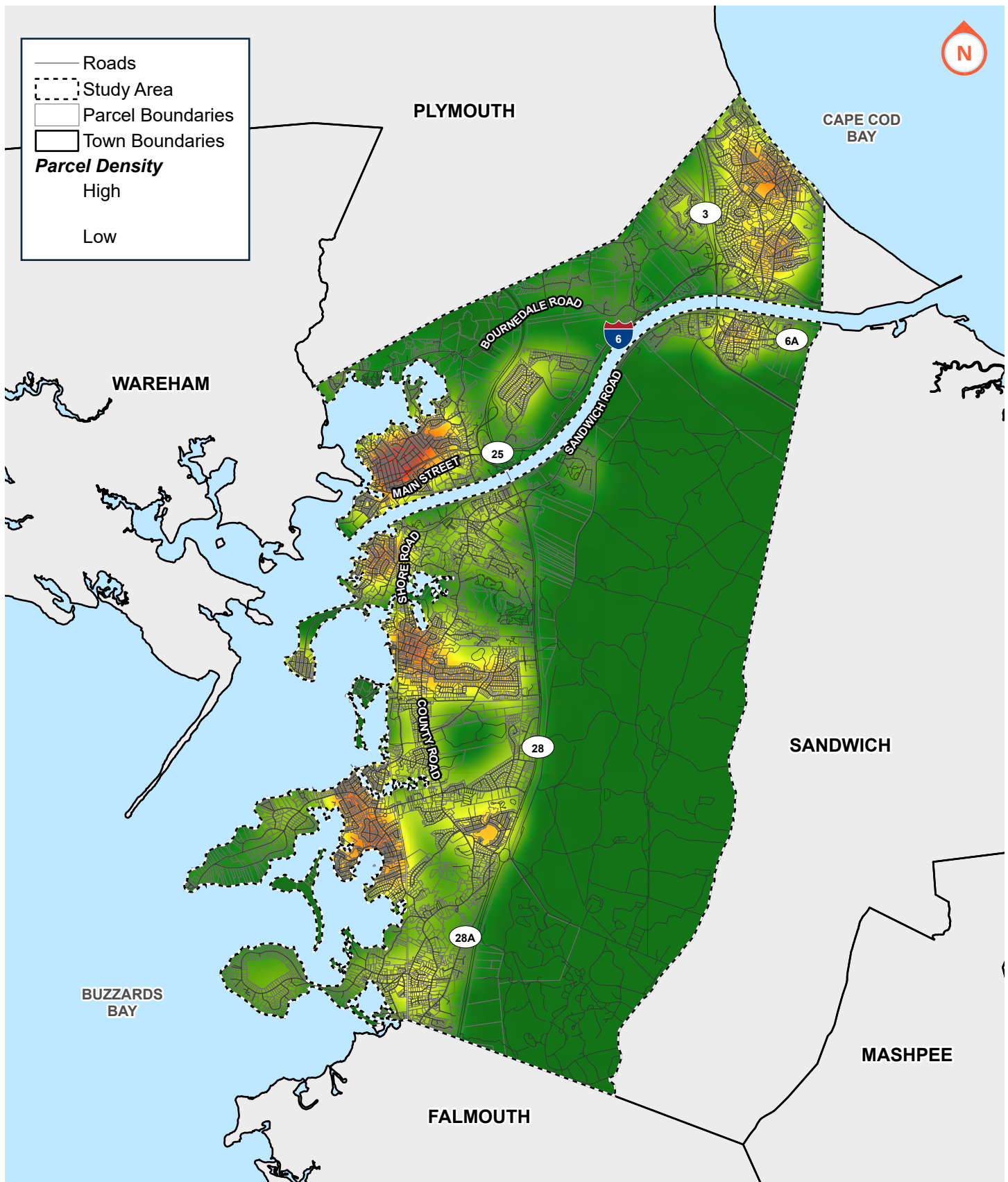


Figure 14
CWMP - Parcel Density

Bourne, Massachusetts

3/17/2022

ENVIRONMENTAL
PARTNERS

— An Apex Company —



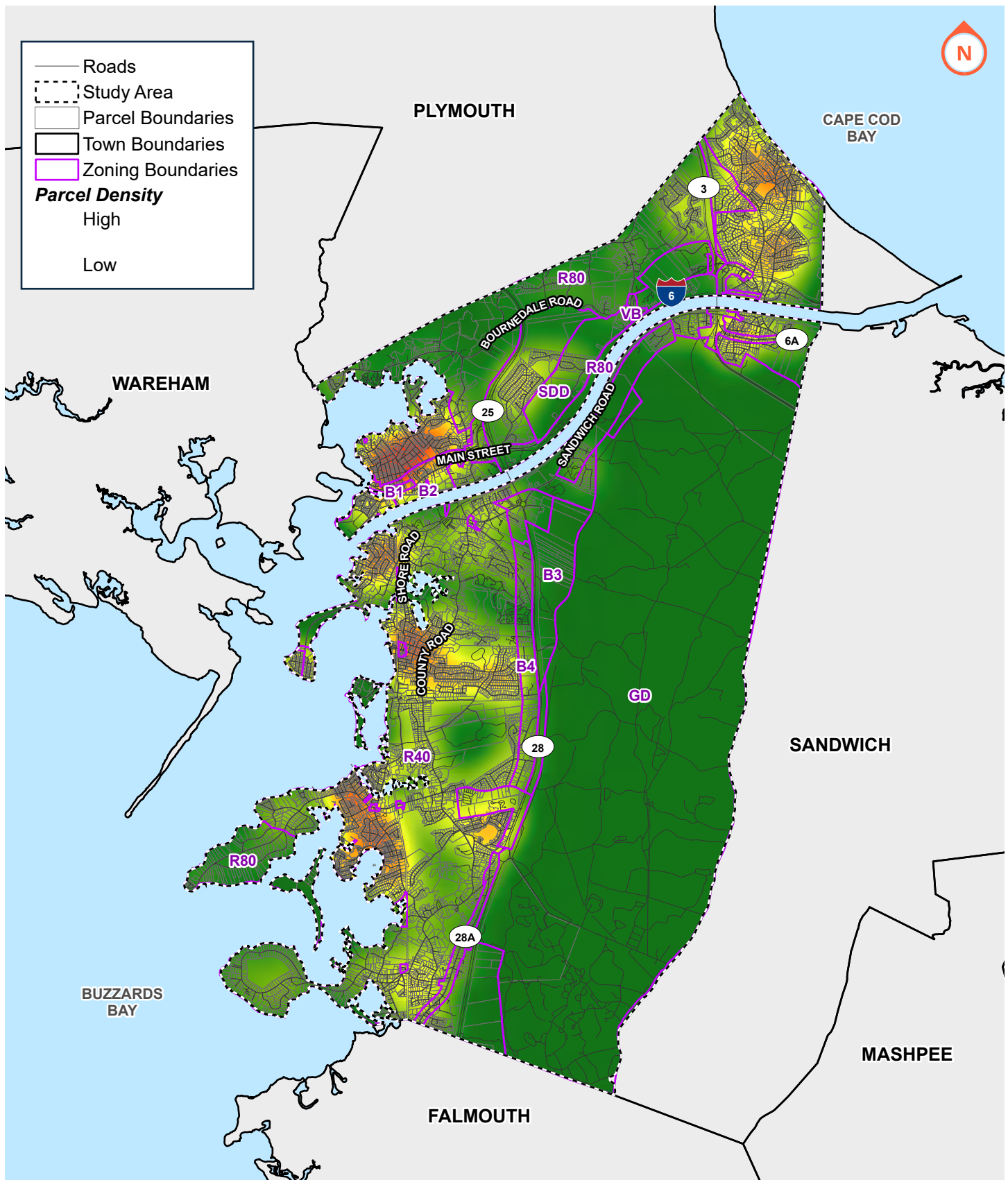


Figure 15
CWMP - Parcel Density & Zoning Districts
 Bourne, Massachusetts
 3/17/2022

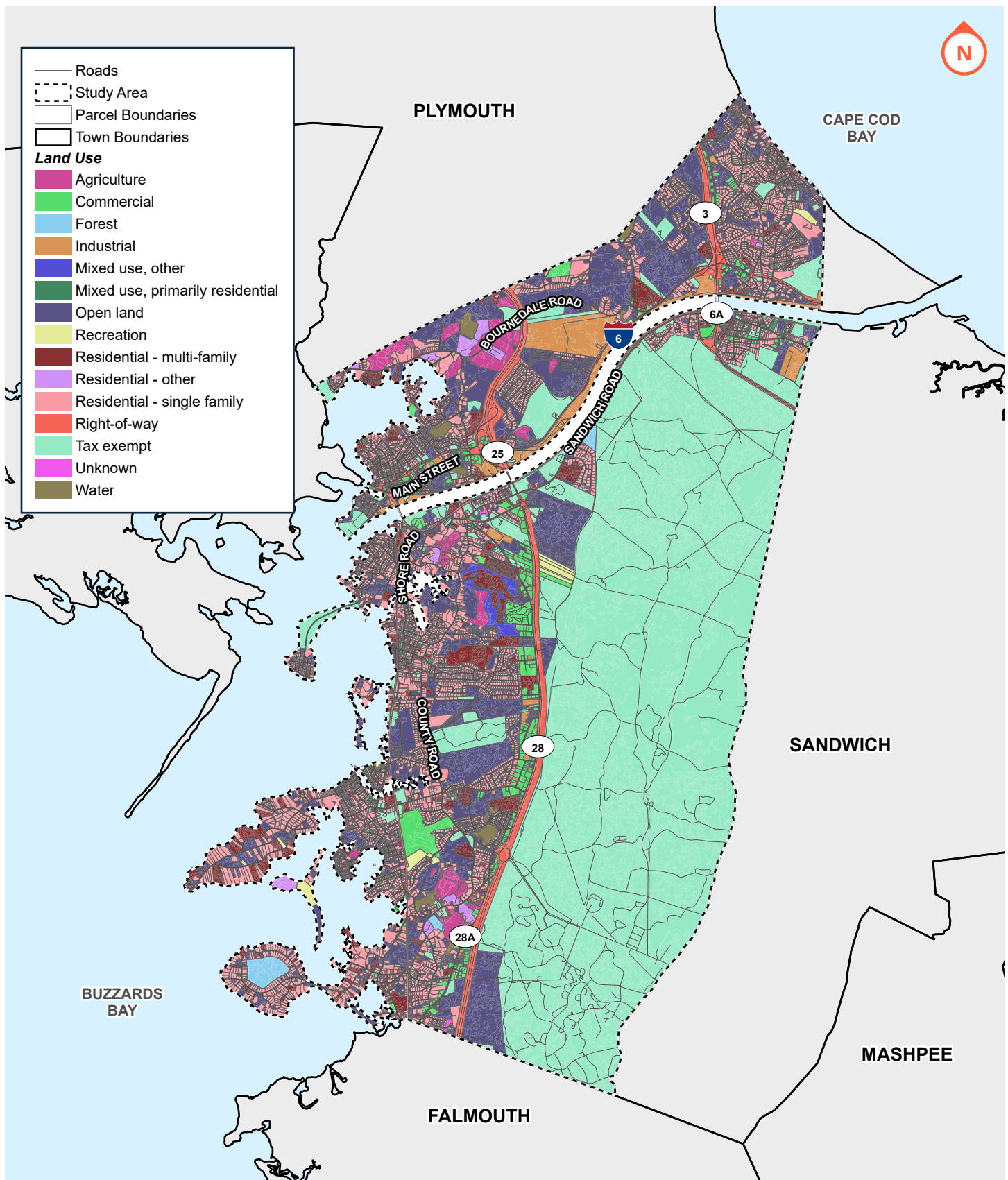


Figure 16
CWMP - Land Use
 Bourne, Massachusetts
 3/17/2022

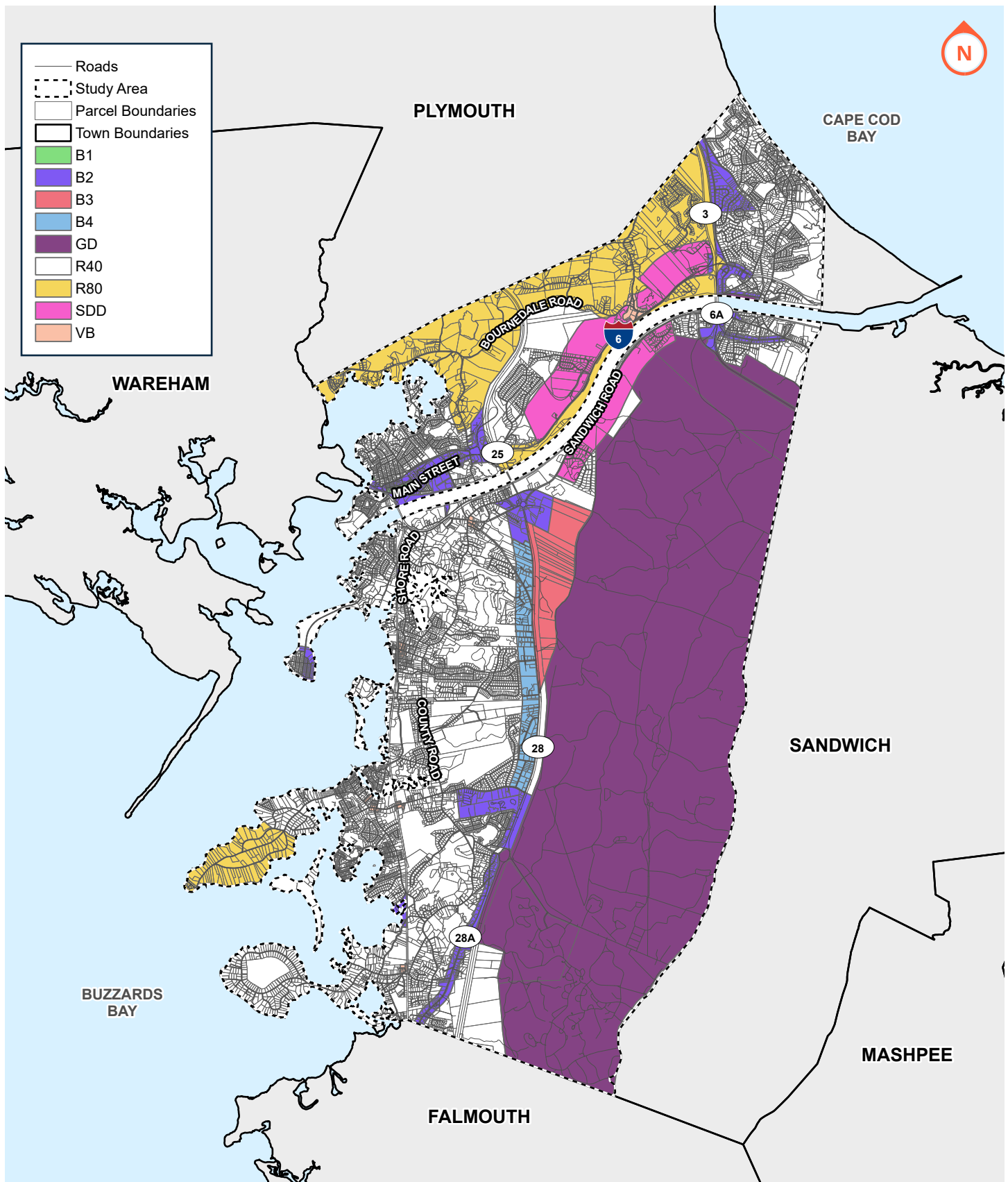


Figure 17
CWMP - Zoning
 Bourne, Massachusetts
 3/17/2022

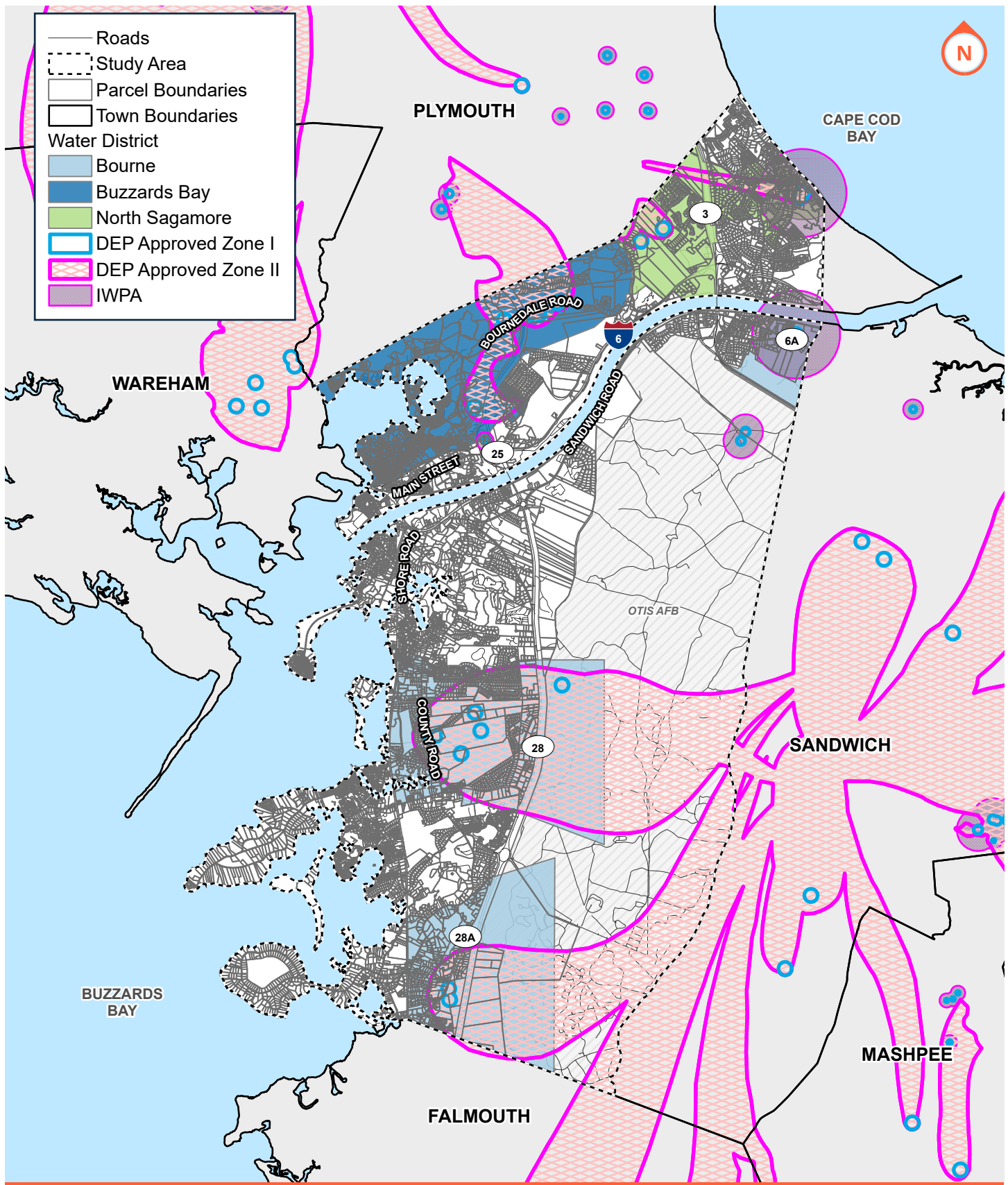


Figure 18
 CWMP - Water Districts & Wellhead Protection Areas
 Bourne, Massachusetts
 3/17/2022

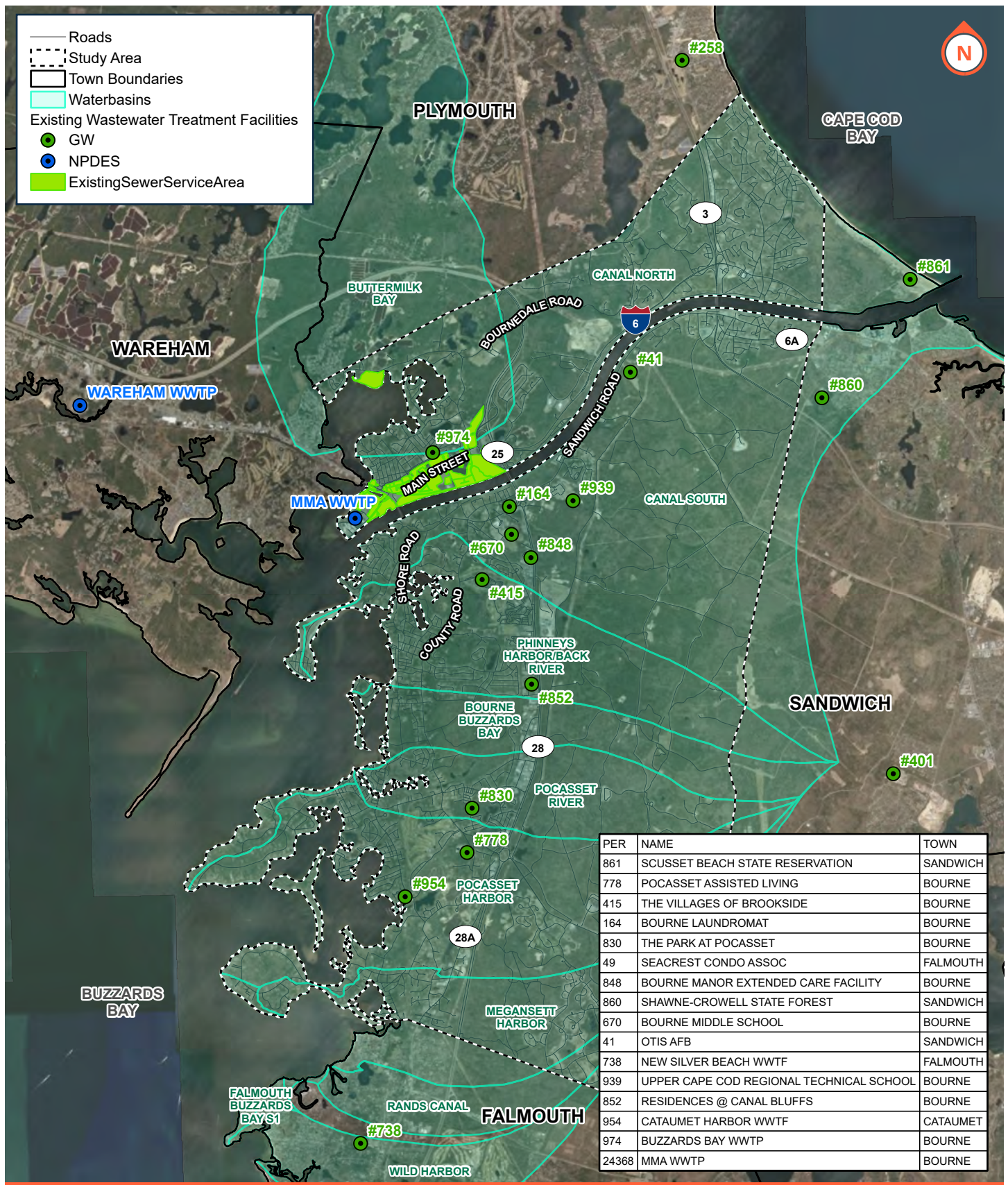


Figure 19
CWMP - Existing Wastewater Treatment Facilities

Bourne, Massachusetts

3/17/2022

APPENDIX B

Plan of Study

See revised Plan of Study (Attachment 12).

APPENDIX C

Community Stakeholder List

Group Name	Contact Name	Contact Role	Website	Neighborhood	Category
Association to Preserve Cape Cod	Andrew Gottlieb	Executive Director		Region	Regional Group
Barnstable Clean Water Coalition	Jennifer Loughran	Community Outreach and Engagement		Region	Regional Group
Bourne Conservation Trust				Town	Regional Group
Bourne Public Library	Patrick Marshall	Director		Town	Town Department
Buzzards Bay Action Committee	Elizabeth Leidhold	Exec. Director		Region	Regional Group
Buzzards Bay Coalition	Mark Rasmussen	President		Region	Regional Group
Buzzards Bay Coalition	Korrin Petersen	Senior Attorney		Region	Regional Group
Buzzards Bay National Estuary Program	Dr. Joe Costa	Exec. Director		Region	Regional Group
Cape Cod Canal Region Chamber of Commerce	Marie Oliva	President		Region	Regional Group
Cape Cod Chamber of Commerce	Wendy Northcross	CEO		Region	Regional Group
Cape Cod Climate Change Collaborative				Region	Regional Group
Cape Cod Commission	Erin Perry			Region	Regulator
Cape Cod Conservation District	Mark Forest	Board Chair		Region	Regional Group
Cataumet Village Association	Pam Pollock	Treasurer		Cataumet	Neighborhood Group
Community Land and Water Coalition	Sharl Heller	Director	environmentwatchesoutheasternma@gmail.com	Region	Regional Group
Gray Gables Neighborhood Association	Kathy Fox Alfano	President	https://www.facebook.com/Gray-Gables-Association-115492365198016	Gray Gables	Neighborhood Group
Herring Pond Wampanoag Tribe	Melissa Ferretti	President		Region	Regional Group
Mashpee Wampanoag Tribe	Jessie Little Doe Baird	Vice Chairwoman		Region	Regional Group
Massachusetts Maritime Academy	Alan Metcalfe	Operations/Vice President		Region	Regional Group
MassDEP	Brian Dudley	Section Chief		Region	Regulator
MassDEP	Drew Osei	Assistant Section Chief		Region	Regulator
Native Land Conservancy	Ramona Peters	Chairwoman		Region	Regional Group
Pocasset Water Quality Coalition	Keith Barber	President	https://www.pocassetwaterquality.org	Pocasset	Neighborhood Group
Pocasset Village Foundation	Bob Dwyer	President	https://www.facebook.com/pages/category/Community/Pocasset-Village-Association-1125431187593417	Pocasset	Neighborhood Group
Pocasset Heights Improvement Association	Martha Hoefer	President		Pocasset	Neighborhood Group
Sagamore Highland Association	Marcia Rothwell	President		Sagamore	Neighborhood Group
Save the Cape Cod Canal Committee			https://www.facebook.com/Save-the-Cape-Cod-Canal-Committee-101081105433298/	Region	Neighborhood Group
Scraggy Neck Recreation Association	Bernadette Sullivan Ericson	President		Cataumet	Neighborhood Group
Taylor's Point Improvement Association	Peter Meier	Director		Buzzards Bay	Neighborhood Group
Town of Bourne Conservation Department	Sam Haines	Conservation Agent		Town	Town Department
Town of Bourne Department of Natural Resources	Chris Southwood	Director		Town	Town Department
Town of Bourne Engineering Department	Tim Lydon	Engineering Technician II		Town	Town Department
Town of Bourne Health Department	Terri Guarino	Health Agent		Town	Town Department
Town of Bourne Planning Department	Coreen Moore	Town Planner		Town	Town Department
Town of Bourne Public Works Department	Shawn Patterson	Director		Town	Town Department
Wildlands Trust	Karen Grey	Executive Director		Region	Regional Group
Wing's Neck Trust Association	David Modest	Trustee		Pocasset	Neighborhood Group

APPENDIX D

Public Participation Workshop Presentations



Town of Bourne Comprehensive Wastewater Management Plan

North of Canal Workshop



In the Zoom Chat:

Please type the Village where you live:

1. Bournedale
2. Buzzards Bay
3. North Sagamore/Sagamore Highlands
4. Sagamore Beach
5. Other

Workshop Goals

- Introduce residents to the Comprehensive Wastewater Management Planning process
- Gather existing community stories about watershed needs



Project Team

Core Working Group

- Town of Bourne
 - Office of Town Administrator
 - Departments:
 - Conservation
 - Natural Resources
 - Engineering
 - Planning
 - Public Works
- Environmental Partners, Consultant

Regulatory Agencies

- Cape Cod Commission
- Massachusetts Department of Environmental Protection (MassDEP)
- Massachusetts Environmental Policy Act (MEPA) Office
 - Executive Office of Energy and Environmental Affairs (EEA)



Invited Stakeholder Groups

- Association to Preserve Cape Cod
- Barnstable Clean Water Coalition
- Bourne Conservation Trust
- Bourne Public Library
- Buzzards Bay Action Committee
- Buzzards Bay Coalition
- Buzzards Bay National Estuary Program
- Cape Cod Canal Region Chamber of Commerce
- Cape Cod Chamber of Commerce
- Cape Cod Conservation District
- Cataumet Village Association
- Community Land and Water Coalition
- Gray Gables Neighborhood Association
- Herring Pond Wampanoag Tribe
- Native Land Conservancy
- Pocasset Water Quality Coalition
- Pocasset Village Foundation
- Sagamore Highland Association
- Scraggy Neck Recreation Association
- Wildlands Trust
- Wing's Neck Trust Association



What is a Comprehensive Wastewater Management Plan?

- Town-wide water quality assessment and solutions
- Aligns with 2019 Local Comprehensive Plan Goals for growth and development
- 20-year planning to meet water quality goals



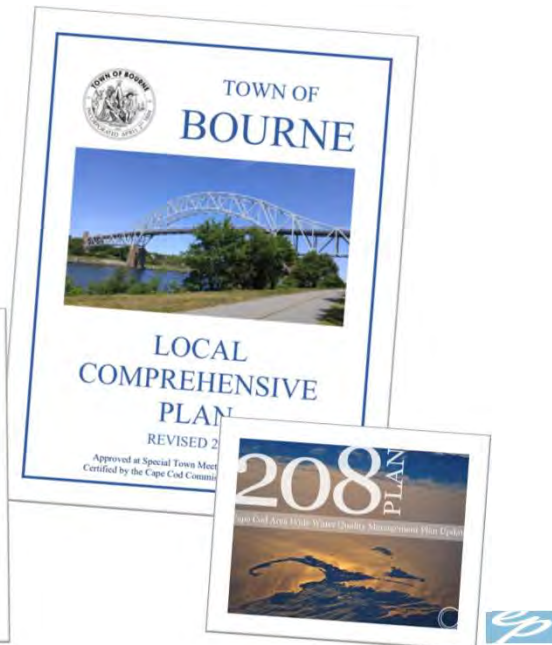
Why does Bourne need a CWMP?

- Water Quality is the highest priority of the Bourne Local Comprehensive Plan
- We need to remove nitrogen to meet regulatory thresholds and improve water quality

Highest Priority Issues

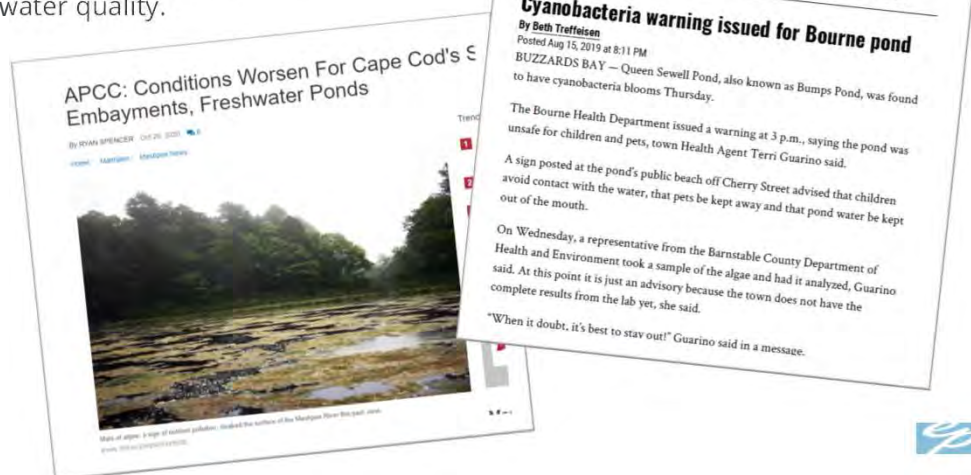
Water Quality is the highest priority issue facing the Town of Bourne in the opinion of Town residents, as reflected in both the planning workshop and the community survey conducted in preparation of this Local Comprehensive Plan. The key element of water quality protection is reduction of total nitrogen flowing into salt water wetlands, estuaries, and embayments; and phosphorus entering fresh water ponds, streams, and aquifers.

The primary source of nitrogen and phosphorus in waterways comes from cesspools and septic systems. It is essential, therefore, that Bourne continue to actively expand wastewater collection and treatment systems and other options, especially in densely developed coastal areas. The Queen Sewell area of Buzzards Bay Village, Gray Gables, Tahanto, Barlows Landing, Pocasset Heights, Patuisset, Cedar Point, and Picture Lake are all areas of critical concern.

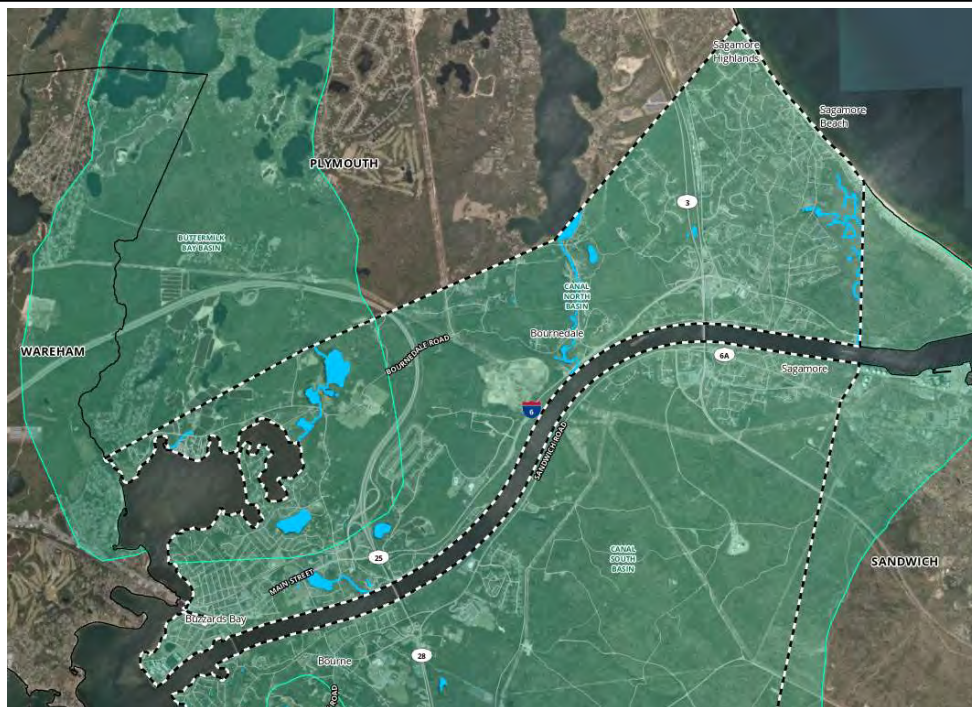
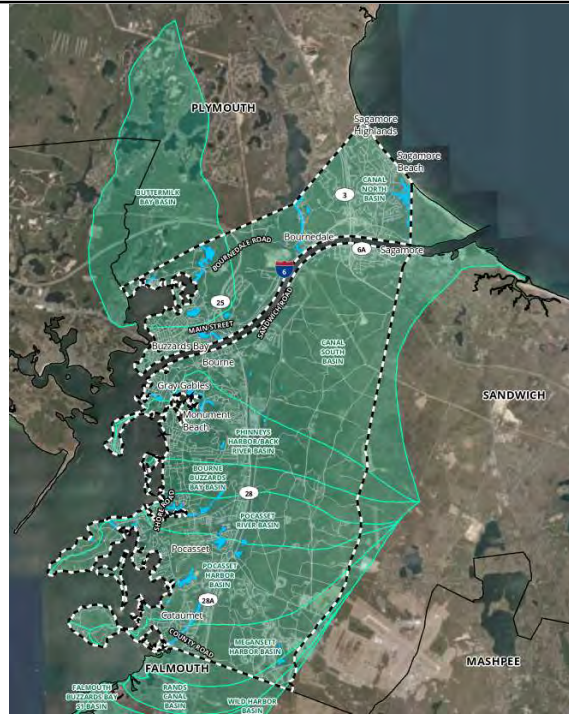


Why does Bourne need a CWMP? (continued)

- Targets preservation of all Bourne's watersheds
- Articulates the Town's plan for sustaining water quality.



Bourne's Watersheds



Breakout Groups

- Goal: Gather existing community stories about watershed needs
- For example:
 - From LCP, "Large areas of the intertidal zone have been closed to shell fishing by state mandate because of pollution."
 - From LCP, "Beaches have from time to time been closed to swimming for the same reason."
 - From MVP, "Many businesses and homes rely on septic systems, which are vulnerable to storm impacts and erosion."



Breakout Groups

Report Out:

1. Bournedale – Kate Roosa
2. Buzzards Bay – Helen Gordon
3. North Sagamore/Sagamore Highlands – Bob Rafferty
4. Sagamore Beach – Mark White

Next Steps: Residents & Stakeholders

- Add comments to Public Comment Map
 - <https://arcg.is/1Pz5mv>
- Email questions, concerns and feedback
 - Bourne.CWMP@envpartners.com
- Bookmark and visit Town CWMP Page
 - <https://www.townofbourne.com/comprehensive-wastewater-management-plan-cwmp>



Next Steps: Project Team

May 2021	• North and South of Canal Workshops
June 2021	• Public Comment Map Closes • Update to Sewer Commission
September 2021	• Update to Sewer Commission
October 2021	• Public Presentation of Existing and Future Needs Assessment



THANK YOU

Questions/comments?

Bourne.CWMP@envpartners.com

ENVIRONMENTAL
 PARTNERS



Town of Bourne Comprehensive Wastewater Management Plan

South of Canal Workshop



In the Zoom Chat:

Please type the Village where you live:

1. Bourne
2. Cataumet
3. Gray Gables
4. Monument Beach
5. Pocasset
6. Sagamore
7. Other

Workshop Goals

- Introduce residents to the Comprehensive Wastewater Management Planning process
- Gather existing community stories about watershed needs



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 - Departments:
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Invited Stakeholder Groups

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- Bourne Conservation Trust
- Bourne Public Library
- Buzzards Bay Action Committee
- Buzzards Bay Coalition
- Buzzards Bay National Estuary Program
- Cape Cod Canal Region Chamber of Commerce
- Cape Cod Chamber of Commerce
- Cape Cod Conservation District
- Cataumet Village Association
- Community Land and Water Coalition
- Gray Gables Neighborhood Association
- Herring Pond Wampanoag Tribe
- Native Land Conservancy
- Pocasset Water Quality Coalition
- Pocasset Village Foundation
- Sagamore Highland Association
- Scraggy Neck Recreation Association
- Wildlands Trust
- Wing's Neck Trust Association



What is a Comprehensive Wastewater Management Plan?

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- Aligns with 2019 Local Comprehensive Plan Goals for growth and development
- 20-year planning to meet water quality goals



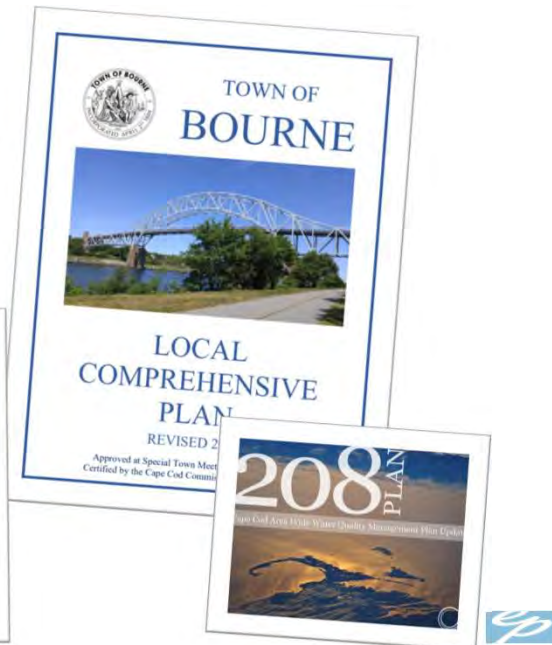
Why does Bourne need a CWMP?

- Water Quality is the number 1 priority of the Bourne Local Comprehensive Plan
- We need to remove nitrogen to meet regulatory thresholds and improve water quality

Highest Priority Issues

Water Quality is the highest priority issue facing the Town of Bourne in the opinion of Town residents, as reflected in both the planning workshop and the community survey conducted in preparation of this Local Comprehensive Plan. The key element of water quality protection is reduction of total nitrogen flowing into salt water wetlands, estuaries, and embayments; and phosphorus entering fresh water ponds, streams, and aquifers.

The primary source of nitrogen and phosphorus in waterways comes from cesspools and septic systems. It is essential, therefore, that Bourne continue to actively expand wastewater collection and treatment systems and other options, especially in densely developed coastal areas. The Queen Sewell area of Buzzards Bay Village, Gray Gables, Tahanto, Barlows Landing, Pocasset Heights, Patuisset, Cedar Point, and Picture Lake are all areas of critical concern.



Why does Bourne need a CWMP? (continued)

- All of Bourne's watersheds can benefit from lower pollution





Breakout Groups

- Goal: Gather existing community stories about watershed needs
- For example:
 - From LCP, "Large areas of the intertidal zone have been closed to shell fishing by state mandate because of pollution."
 - From LCP, "Beaches have from time to time been closed to swimming [because of pollution]."
 - From MVP, "Many businesses and homes rely on septic systems, which are vulnerable to storm impacts and erosion."



Breakout Groups

Report Out

1. Bourne – Tim Lydon
2. Cataumet – Sam Haines
3. Gray Gables – Chris Southwood
4. Monument Beach – Shawn Patterson
5. Pocasset – Glenn Cannon
6. Sagamore – Scott Turner

Next Steps: Residents & Stakeholders

- Add comments to Public Comment Map
 - <https://arcg.is/1Pz5mv>
- Email questions, concerns and feedback
 - Bourne.CWMP@envpartners.com
- Bookmark and visit Town CWMP Page
 - <https://www.townofbourne.com/comprehensive-wastewater-management-plan-cwmp>



Next Steps: Project Team

May 2021	• North and South of Canal Workshops
June 2021	• Public Comment Map Closes • Update to Sewer Commission
September 2021	• Update to Sewer Commission
October 2021	• Public Presentation of Existing and Future Needs Assessment



THANK YOU

Questions/comments?

Bourne.CWMP@envpartners.com





Town of Bourne Comprehensive Wastewater Management Plan

Needs Assessment Workshop



Breakout Group Selection – Zoom Participants Only Enter your Preferred Group Number in the Chat

1. Buttermilk Bay and Canal North
2. Canal South and Phinney's Harbor
3. Buzzards Bay South and Pocasset River
4. Pocasset Harbor and Megansett-Squeteague Harbor

Agenda

- Review Workshop Goals
- Provide Needs Assessment Summary by Watershed
- Breakout Groups
 - By watershed
- Breakout Group Report Out
- Next Steps & Closing



Workshop Goals

- Provide Existing and Future Needs Overview
- Introduce Nitrogen Removal Goals by Watershed
- Gather priority evaluation concerns for Alternatives Analysis (next phase of work)



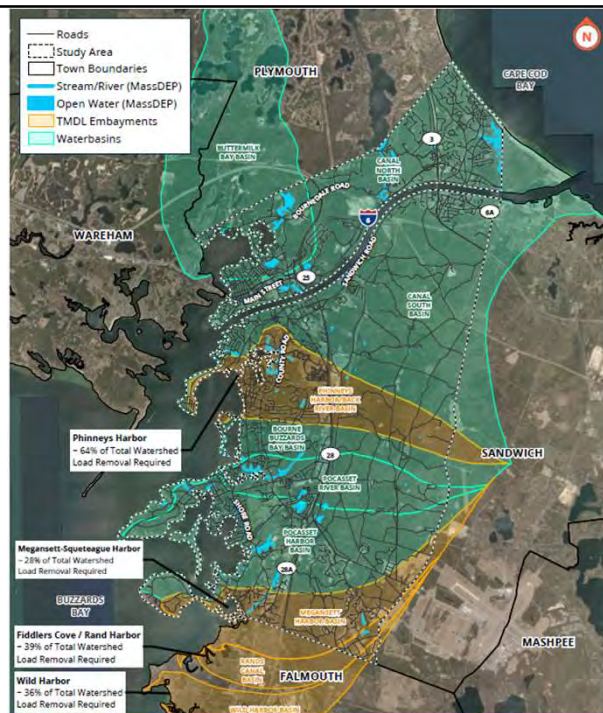
Refresher: What is a Comprehensive Wastewater Management Plan?

- Town-wide water quality assessment and solutions
- Aligns with 2019 Local Comprehensive Plan Goals for growth and development
- 20-year planning to meet water quality goals



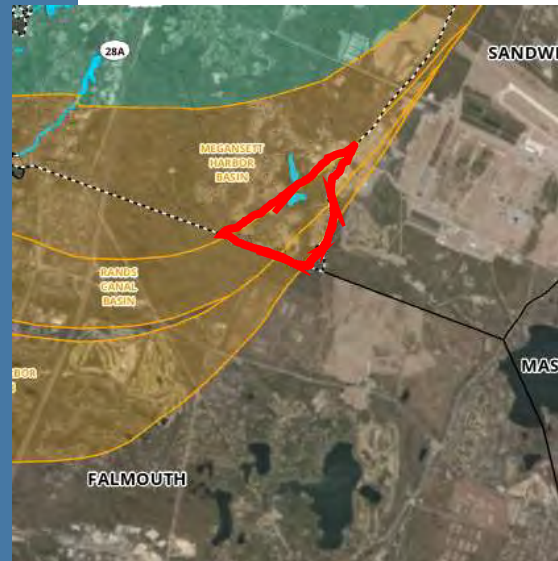
Bourne's Watersheds

- We are developing management plans for all eight watersheds within Bourne
- Two of these watersheds have Nitrogen Removal Requirements established by MassDEP (TMDLs)
 - Phinney's Harbor
 - Megansett-Squeteague Harbor
- MassDEP is developing TMDLs for additional watersheds (MEP Phase 2)
 - Buttermilk Bay
 - Pocasset River
 - Pocasset Harbor



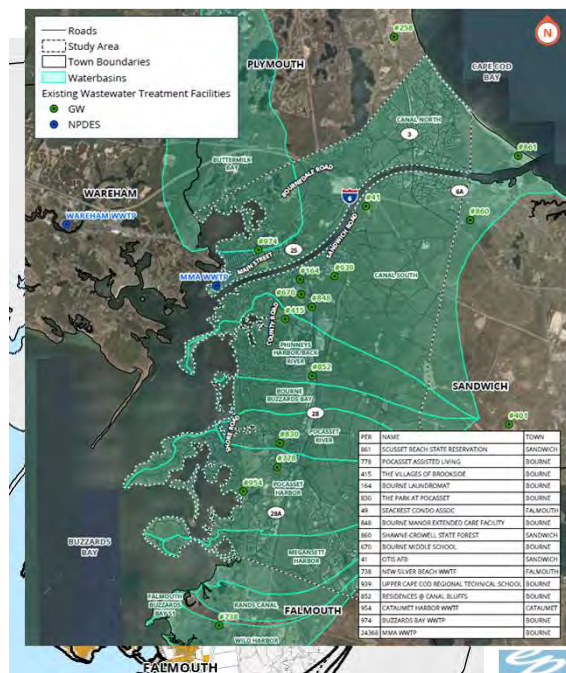
Wild Harbor & Rand's Canal: Watersheds Mostly Outside Bourne

- Wild Harbor and Rand's Canal watersheds are mostly outside Bourne
 - Only 250 acres are within the Town boundary, of which is in Joint Base Cape Cod
- These watersheds are not being considered for wastewater management programs
- Bourne will coordinate with Falmouth if they develop watershed action items



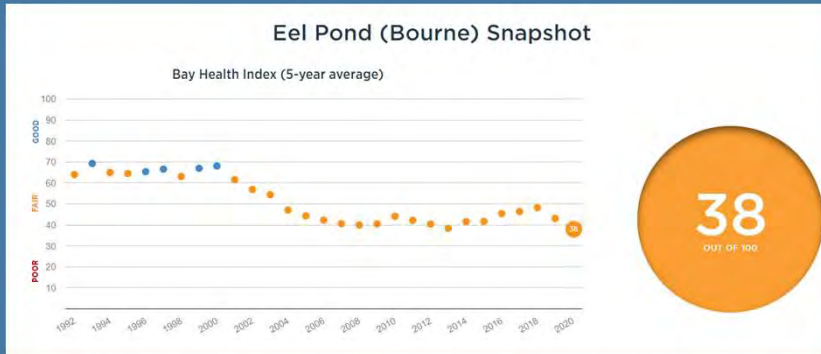
Town Wide – Existing Conditions

- Current Septic Systems:
 - Majority are conventional Title 5 systems (over 7,000)
 - Town has over 175 existing Innovative/Alternative Onsite Systems
- Current Wastewater Treatment Systems:
 - 10 Privately-Owned
 - 2 Town-Owned
 - Buzzards Bay WWTP (New)
 - Bourne Public Schools - Middle School



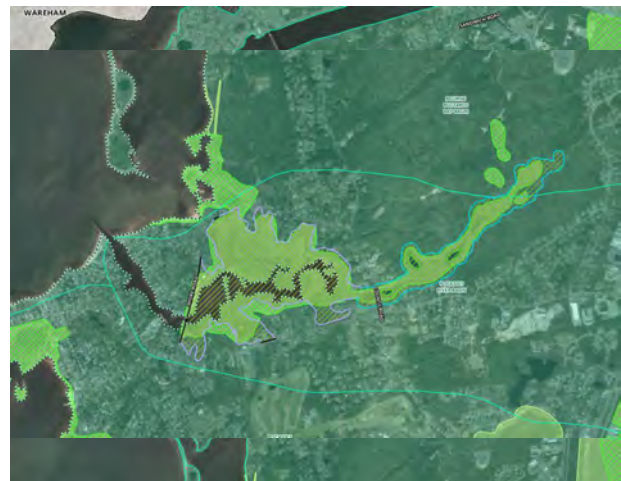
Town Wide – Existing Conditions, continued

- Over 1,000 acres of wetlands and 740 acres of coastal dunes/beaches
 - Water Quality-related Beach Closures
 - Eel Grass loss



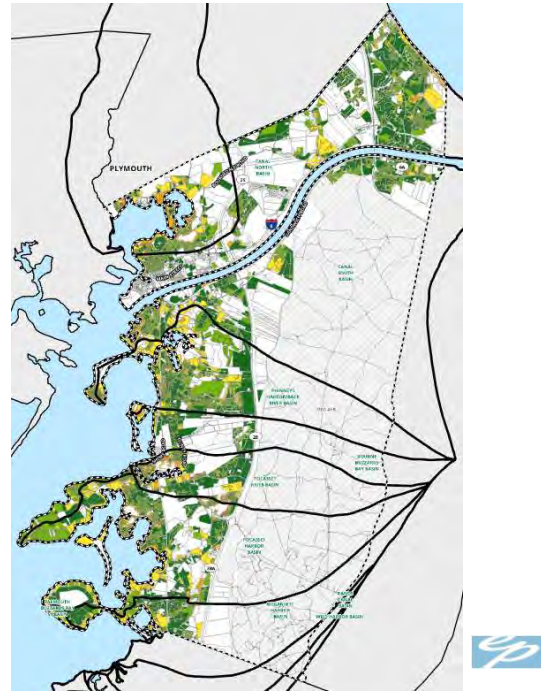
Town Wide – Existing Conditions, continued

- Three Areas of Critical Environmental Concern
 - Herring Pond
 - Bourne Back River
 - Intersects with Phinney's Harbor, a TMDL Watershed
 - Pocasset River
 - Intersects with future Pocasset River TMDL



Town Wide – Future Conditions

- Buttermilk Bay, Phinney's Harbor, Pocasset River Basin and Canal South have constraints to accommodate onsite systems
- Most of the constraints within the Bourne 150-ft. water resource setback
- Looking to alternatives analysis, what are top factors for residents in deciding **which solutions fit best for Bourne?**



Watersheds with Nitrogen Limits (TMDLs) – MEP Phase 1

Watershed	Existing Septic System Loading (lbs./year)	Nitrogen Limit (lbs./year)	Removal to Meet Nitrogen Limit (lbs./year)	Removal to Meet Nitrogen Limit
Phinney's Harbor (incl. Back River and Eel Pond)	23,600	15,500	8,000	67%
Megansett-Squeteague Harbor	16,800	13,500	3,200	19%

Source: Massachusetts Estuaries Project (MEP) TMDL Reports



Watersheds with Nitrogen Limits to be determined – MEP Phase 2

Watershed	Existing Approx. Septic System Loading (lbs./year)	Future Approx. Septic System Loading (lbs./year)	Nitrogen Reduction Goal (lbs./year)
Buttermilk Bay	10,713	11,580	TBD
Pocasset River	7,312	8,082	TBD
Pocasset Harbor	16,034	18,910	TBD



Remaining Watersheds

Buzzards Bay (Bourne and Falmouth)	6,500	7,650	TBD
Canal North	50,024	54,550	TBD
Canal South	18,584	20,008	TBD



Looking Ahead to Next CWMP Phase – Alternative Strategies

- Onsite Systems
 - Conventional Title 5 Systems
 - Innovative Alternative (IA) Onsite Systems
 - Cluster Systems
- Traditional Wastewater Treatment and Sewer Collection Systems
- Stormwater Controls
- Permeable Reactive Barriers
- Aquaculture

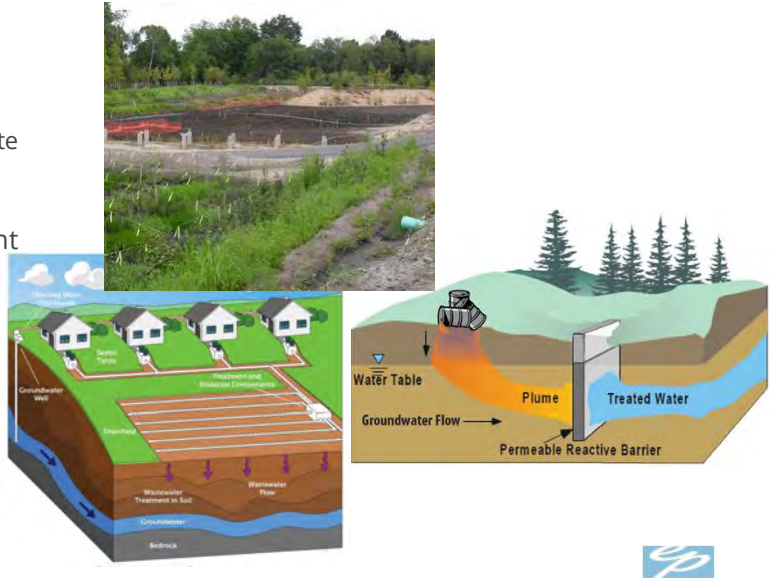


Image Sources: EPA, City of Cambridge MA

Breakout Group Goal

- Gather priority concerns for Alternatives Analysis
- For Example:
 - Community-Based vs Individual
 - Traditional vs. Innovative
 - Costs and Municipal Financing
 - Location/Land Area Requirements
 - Preservation of water resources
 - Protection of water quality



Breakout Groups

Report Out

Next Steps: Residents & Stakeholders

- Email questions, concerns and feedback
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 - <https://www.townofbourne.com/comprehensive-wastewater-management-plan-cwmp>



Next Steps: Project Team

December 2021	• Town wide Workshop • Prepare Draft Needs Assessment Report
Winter 2022	• Quarterly Updates to Sewer Commission • Kickoff Phase II – Alternatives Analysis
Spring 2022	• Quarterly Updates to Sewer Commission • Public Presentation of Alternatives Evaluation Criteria



THANK YOU

Questions/comments?

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