



NEWEA – Small Communities

Watershed Nitrogen Management Planning and Implementation for the Town of Mashpee, MA

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July 15, 2016



Introduction

- Project background and chronology
- Outreach
- Plan development
- Recommended plan
- Implementation schedule
- Implementation summary
 - Current and ongoing efforts

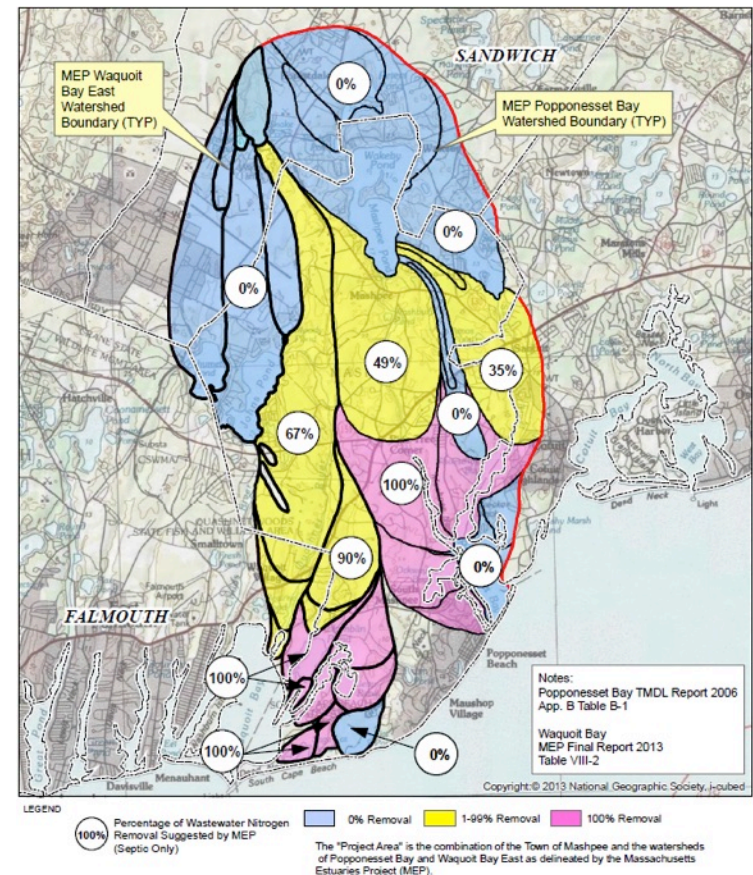
Background

About Mashpee

- Population estimate
 - 14,000 (year round)
 - 40,000 (summer)
- Located between two largest towns on Cape Cod

Problem

- Preserving Mashpee River
- Nitrogen impacts on the Town's embayments
- Nitrogen Total Maximum Daily Load (TMDL) requirements



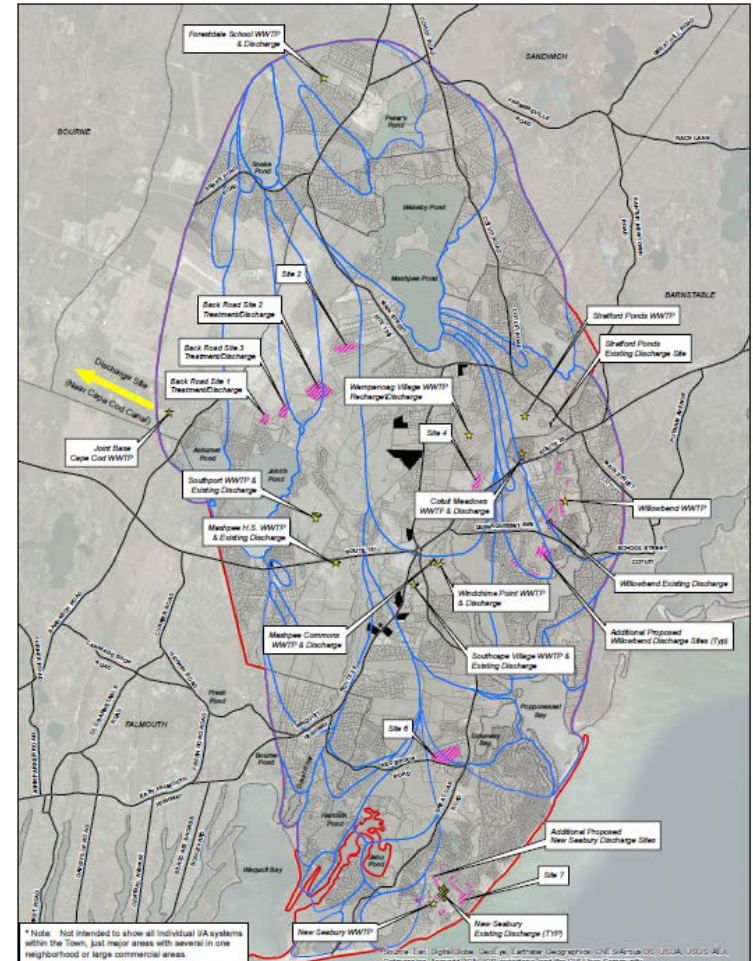
Background

Project planning area

- Town of Mashpee
- Waquoit Bay East Watershed
 - Including parts of Sandwich and Falmouth
- Popponesset Bay Watershed
 - Including parts of Sandwich and Barnstable
- Over 10 small WWTF located throughout the planning area
 - Sizes range from 12,000 gpd to 300,000 gpd

Watershed Nitrogen Management Plan

- Needs assessment
- Technology screening
- Alternatives analysis
- Recommended plan



Chronology

- 2001
 - Project ENF Filing
- 2004
 - MEP Final Report – Popponesset Bay (September)
- 2005
 - MEP Final Report – Waquoit Bay East (January)
- 2006
 - MassDEP TMDL – Waquoit Bay East (January)
 - MassDEP TMDL – Popponesset Bay (April)
- 2007
 - Needs Assessment Report (April)
 - Technology Screening Report (November)
 - MEPA Notice of Project Change (November)
- 2008
 - Draft Alternative Scenarios Analysis and Site Evaluation Report (March)
 - MassDEP – Pilot Project (November)

Chronology (cont'd)

- 2012
 - MEP Model Runs - Options 1A, 1B, and 1C (February)
 - MEPA Notice of Project Change (July)
- 2013
 - MEP Final Report – Waquoit Bay -Entire (March)
 - Draft Alternatives Screening Analysis Report (April)
 - Final Alternatives Screening Analysis Report (August)
- 2014
 - Draft Recommended Plan/Draft Environmental Impact Report (June)
- 2015
 - Final Recommended Plan/ Final Environmental Impact Report (May)
 - Final MEPA Certificate (July)
 - CCC Consistency Letter (October)
- 2016
 - Implementation
 - CCC DRI Approval (in process)

Public outreach

- Project description
- Public meetings
- Reports and documents
- Available at www.mashpeewaters.com



What's New

[Meetings & News](#)

Planning Area Communities

[Town of Mashpee](#)

[Town of Barnstable](#)

[Town of Falmouth](#)

[Town of Sandwich](#)

Links

[Mashpee Environmental Coalition](#)

[Cape Cod Commission](#)

[Waquoit Bay Reserve](#)

[Cape Cod Groundwater Guardian](#)

[Massachusetts Estuary Project](#)

[MassDEP TMDLs](#)

Mashpee

Watershed Nitrogen Management Plan

Welcome to the Town of Mashpee's Watershed Nitrogen Management Plan (WNMP) website. As a community, we treasure Mashpee's beautiful coastal ponds and *estuaries*, yet we are responsible for their poor water quality. Excess *nutrients* – *nitrogen*, in particular – come from septic systems and wastewater treatment plants, surface runoff after rain storms or snow melt, lawn fertilizer, stormwater drainage system discharges, and other sources. Nitrogen is present in the environment naturally, however, in excess, it is considered a pollutant.

In response to long-standing concerns regarding nitrogen, Mashpee initiated the WNMP in 1999. The project will provide an environmentally and economically sound plan for nitrogen reduction and wastewater treatment. It will recommend areas appropriate for discharging treated wastewater into the ground. The project will culminate in a recommended plan to reduce the Town's nitrogen contributions - and those of its neighbors in the Popponesset Bay and Waquoit Bay *watersheds* - to coastal waters and to evaluate options for restoring these wonderful resources. By proactively addressing nutrient issues on its own, the Town hopes to avoid regulatory enforcement actions by state or county agencies or the courts.

To learn more about the problem with nutrients and how you both contribute to it and can be part of the solution, please visit the [What's the Problem](#) page. Links are provided throughout the site to the [Documents & Resources](#) page where you can find definitions of commonly used words and acronyms.

We hope you find this website helpful and look forward to your participation in the Town's planning process.

Plan development

- Evaluation of alternatives and technologies
- “No Action Alternative”
- Targeted evaluations
- Centralized vs. new cluster area treatment facilities
- Regional solutions (Joint Base Cape Cod - JBCC)
- Existing Wastewater Treatment Facilities (WWTFs)
- Additional traditional and hybrid solutions
 - Shellfish aquaculture
 - PRBs
 - Bog / wetland restoration
 - Onsite systems

Matrix evaluation and summary of findings

- Development of evaluation matrix
 - Compiled data from various different categories
 - General information about each area being evaluated
 - Wastewater generation estimates
 - Drinking water
 - Watershed
 - Proximity to existing infrastructure
 - Miscellaneous factors
 - Developments of interest
 - Mashpee River watershed considerations
- Each of the categories (except the general description data), were assigned points (most points, highest need)

Matrix evaluation and summary of findings (cont'd)

WASTEWATER GENERATION	Percent of flow existing vs. at future (weight)	5	30
	Est. Census Occupancy by planning area (% year round) (weight)	5	
	Existing Gal/Ac (Weight)	5	
	Future Gal/Ac (weight)	5	
	Est. Existing Attenuated load (kg/y per acre) (weight)	5	
	Est. Future attenuated load (kg/y per acre) (weight)	5	
DRINKING WATER	Percent of Subarea in Zone II (weight)	5	20
	Percent of Subarea in USGS Well Recharge Area (weight)	10	
	Estimated Percent on Private Wells (weight)	5	
WATERSHED	Watershed Attenuation (weight)	10	30
	In Subwatershed to Shellfish Propagation (weight)	5	
	Embayment Habitat Quality (weight)	10	
	Number of upgradient properties within 300ft Fresh Water (P) (weight)	5	
PROXIMITY TO INFRASTRUCTURE	Proximity to JBCC (weight)	3	20
	Proximity to "Closest" Existing WWTF (weight)	4	
	Proximity to "Closest" Potential New WWTF (weight)	3	
	Proximity to Potential Recharge - New Seabury (weight)	3	
	Proximity to Potential New Recharge - Back Road (weight)	2	
	Proximity to Potential New Recharge - Site 4 (weight)	2	
	Proximity to Potential New Recharge - Site 6 WWTF (weight)	1	
	Proximity to Potential New Recharge Willowbend (weight)	2	
BONUS	Subarea includes: Summerwood Condos, Sea Oaks Condos, Lake Side Estates, or South Cape Resort	+5	+10
	Subarea within Mashpee River Watershed	+5	

Matrix evaluation and summary of findings (cont'd)

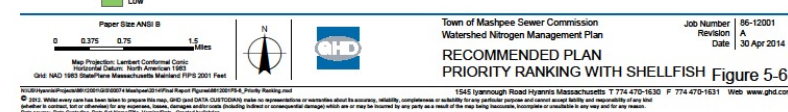
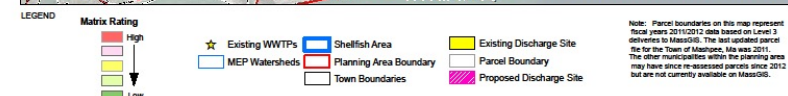
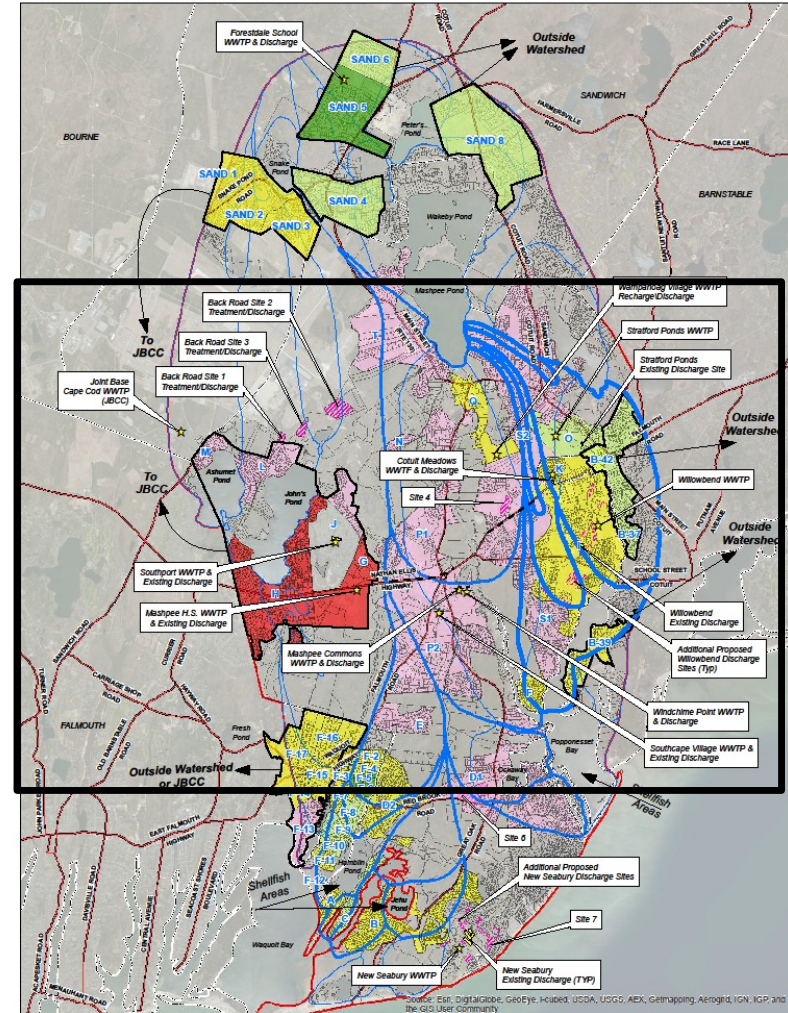
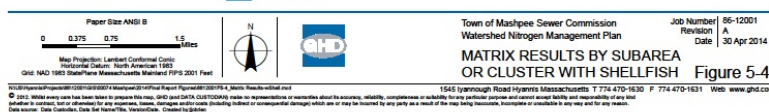
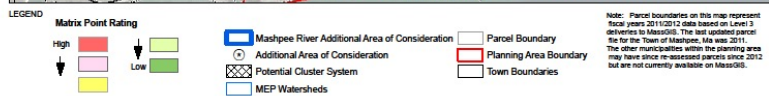
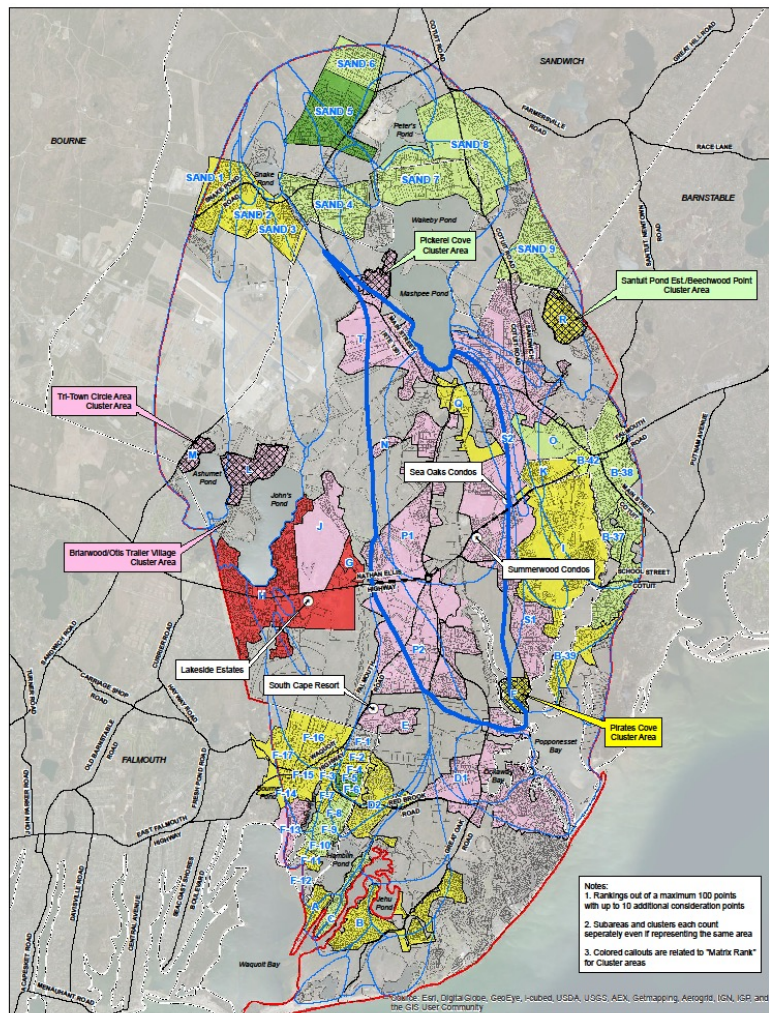
- Excerpt of the matrix evaluation table

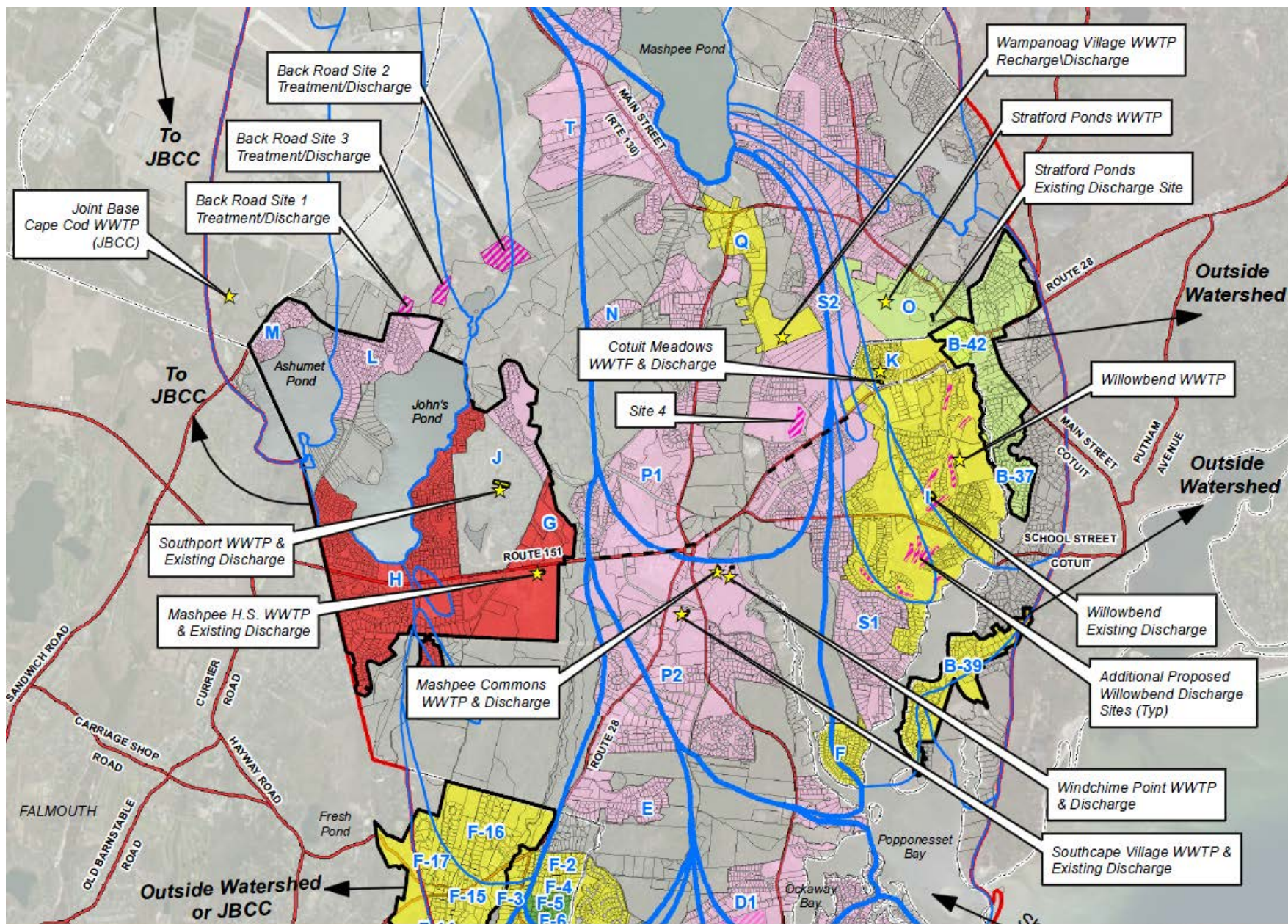
TABLE 4-22: MATRIX RANKING (ROUNDED)

GENERAL INFORMATION									WASTEWATER GENERATION							DRINKING WATER SUPPLY			WATERSHED				PROXIMITY TO INFRASTRUCTURE										OTHER	
Subarea ID	Subarea Description	Primary MEP Watershed	Subarea Size (Acres)	Existing gpd	Future gpd	Total number of parcels	Number "existing" developed	Number of developed / developable parcels	Percent of flow existing vs. all future (weight)	Est. Current Occupancy by planning area (% year round) (weight)	Existing gal/Ac (Weight)	Future gal/Ac (weight)	Est. Existing Attenuated load (kg/year acre) (weight)	Est. Future attenuated load (kg/year acre) (weight)	Percent of Subarea in Zone II (weight)	Percent of Subarea in USGS Well Recharge Area (weight)	Estimated Percent on Private Wells (weight)	Watershed Attenuation (weight)	In Subwatershed to Shellfish Propagation (weight)	Employment Habitat Quality (weight)	Number of upgradient properties within 100ft Fresh Water (P) (weight)	Proximity to BIOC (weight)	Proximity to "Closest" Existing WWTF (weight)	Proximity to "Closest" Potential New WWTF (weight)	Proximity to Potential Recharge - New Seabury (weight)	Proximity to Potential New Recharge - Back Road (weight)	Proximity to Potential New Recharge - Site 4 (weight)	Proximity to Potential New Recharge - Site 5 WWTF (weight)	Proximity to Potential New Recharge - W Roadend (weight)	PLUS (With in Mashpee River Watershed up to +5, Summerwood Condos, etc +5)	VALUE TOTAL	RANK		
Points per Category									5	5	5	5	5	5	5	10	5	10	5	10	5	3	4	3	3	2	2	1	2	up to 10+	100			
GENERAL INFORMATION									WASTEWATER GENERATION							WATER SUPPLY			WATERSHED				INFRASTRUCTURE										OTHER	
(alpha#)	(Desc.)	(Poppy / Waquoit / Both)	(#)	(#)	(#)	(#)	(#)	(#)	WEIGHT							WEIGHT			WEIGHT				WEIGHT										WEIGHT	RANK
H-Only	H. Without HS or MC or I/A	Waquoit	350	71,000	120,000	570	450	530	3	5	2	3	2	2	5	1	1	10	5	10	1	2	4	3	0	1	1	0	0	5	66	1		
G	G. Mashpee Village	Waquoit	30	13,000	20,000	0	0	0	4	5	3	4	3	5	2	0	0	10	5	10	0	2	4	2	0	1	1	0	1	0	62	2		
H	H. Areas south of Johns Pond (including the High School)	Waquoit	540	73,000	140,000	580	450	540	3	5	1	2	0	0	5	1	1	10	5	10	1	2	4	3	0	1	1	0	0	5	60	3		
S	S. West of Santuit Pond (south picking up neighborhoods west and south of Willowbend)	Popponessett	1,260	200,000	260,000	1,900	1,400	1,700	4	5	2	2	1	2	3	1	1	8	0	7	1	1	4	3	0	0	2	0	1	6	54	4		
P-only	P Without Mashpee Commons/South Cape/Windchime Point/I/A	Both	840	130,000	220,000	700	480	650	3	4	2	2	2	2	2	0	1	10	0	8	0	2	4	3	1	1	1	1	1	4	54	4		
P1	Subset of P (north of Nathan Ellis)	Popponessett	420	72,100	110,000	330	220	320	4	4	2	2	2	2	1	0	1	9	0	9	0	1	4	3	0	1	2	0	1	5	53	6		
J-only	J. Without Southport	Waquoit	80	140	50,000	10	0	10	1	3	1	5	1	5	0	0	0	10	5	10	0	2	4	3	0	2	1	0	0	0	53	6		
S1	Subset of S (south of Falmouth Rd)	Popponessett	400	67,000	89,000	630	430	540	4	4	2	2	2	2	1	0	1	10	0	7	0	0	3	3	1	0	2	0	2	6	52	8		
N	N. Steeplechase	Popponessett	20	4,200	4,100	30	30	30	5	5	2	2	2	2	4	0	0	7	0	9	0	2	2	2	0	1	1	0	1	5	52	8		
P	P. Area around Mashpee Rotary north along Great Neck Road	Both	1,130	190,000	370,000	730	490	670	3	3	2	3	0	0	2	0	1	10	0	8	0	2	4	3	1	1	1	1	1	4	50	10		

Matrix evaluation and summary of findings (cont'd)

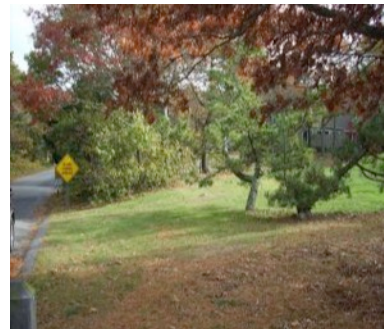
- Matrix evaluations
 - High Priority Areas based on the criteria were highlighted in **RED** and **PINK**
 - Medium Priority Areas were highlighted in **YELLOW**
 - Lower Priority Areas were highlighted in Greens (**LIGHT** and **DARK**)
- These priority areas were considered with and without the use of shellfish aquaculture and assigned based on various service areas throughout the four communities





Recommended plan components

Source removal	Direct environmental mitigation	Land management strategies
<ul style="list-style-type: none">• Wastewater management<ul style="list-style-type: none">- Regional facilities (JBCC)- New facilities- Improvements to existing private WWTF- Onsite systems• Stormwater management<ul style="list-style-type: none">- BMPs• Fertilizer management<ul style="list-style-type: none">- Bylaws	<ul style="list-style-type: none">• Shellfish aquaculture<ul style="list-style-type: none">- Popponesset Bay (and associated embayments)- Jehu Pond- Hamblin Pond (including Great and Little River)• Other adaptive approaches	<ul style="list-style-type: none">• Landuse/zoning• Open space• Recharge and water resource sites• Seasonal/year round use



Summary of recommended plan approach

Plan components

- Shellfish aquaculture/propagation/restoration
- Site 4 (treatment and recharge) – initial small service area around Route 28
- System evaluations and collection system extensions for Mashpee Commons and Wampanoag WWTF

Plan components

- Quashnet/Moonakis River evaluation
 - Possible soft solution – improved flushing
 - Joint Base Cape Cod (JBCC) - Fallback site at Back Road/High school

- Long-term monitoring, modeling and reporting of water quality

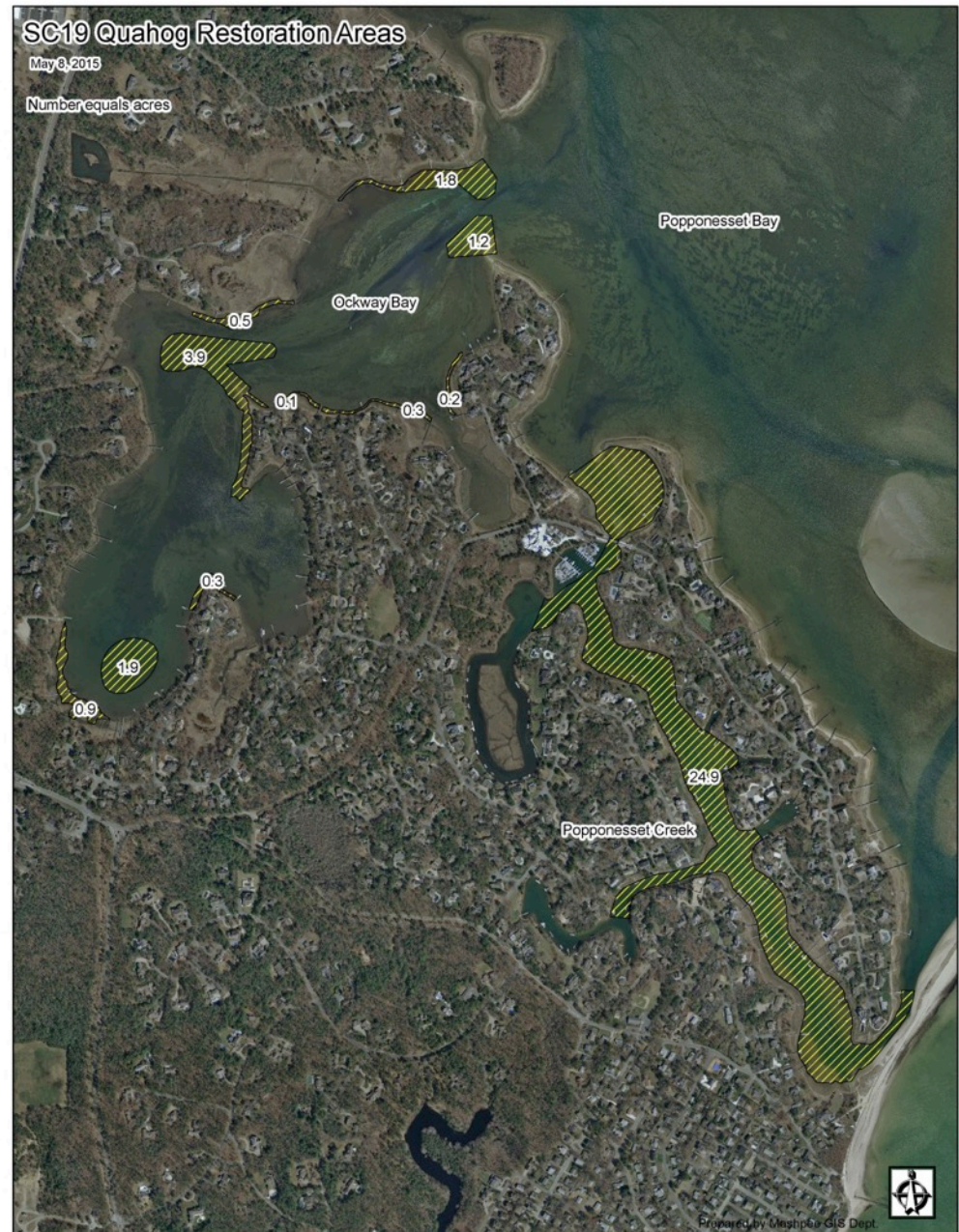
Balance of TMDL compliance depends on shellfish performance

- Potential new WWTF (site 6) and recharge sites (New Seabury/Willowbend)
- Improvements/modifications (existing WWTFs)
- Continued Town coordination (Sandwich, Falmouth, Barnstable)
- Maintain a level of existing onsite systems
- Cape Cod Commission 208 planning and adaptive management

Projected shellfish excess nitrogen removal rates

Watershed ⁽³⁾	Estimated existing attenuated nitrogen to be removed to meet TMDLs (m ton/yr)	Estimated nitrogen removal by shellfish (m ton/yr)	Shellfish type	Potential % of existing WW nitrogen removal with shellfish
Mashpee River	5.0	2.5	Oysters	50%
Popponesset ⁽¹⁾	1.5	1.5	Quahogs	100%
Ockway Bay	0.9	0.9	Quahogs	100%
Shoestring Bay	4.0	2.0	Oysters	50%
Great River	1.0	1.0	Quahogs	100%
Jehu Pond	1.0	1.0	Quahogs	100%
Hamblin Pond ⁽²⁾	3.7	3.7	Quahogs	100%
Quashnet River	3.0	0	0	0%

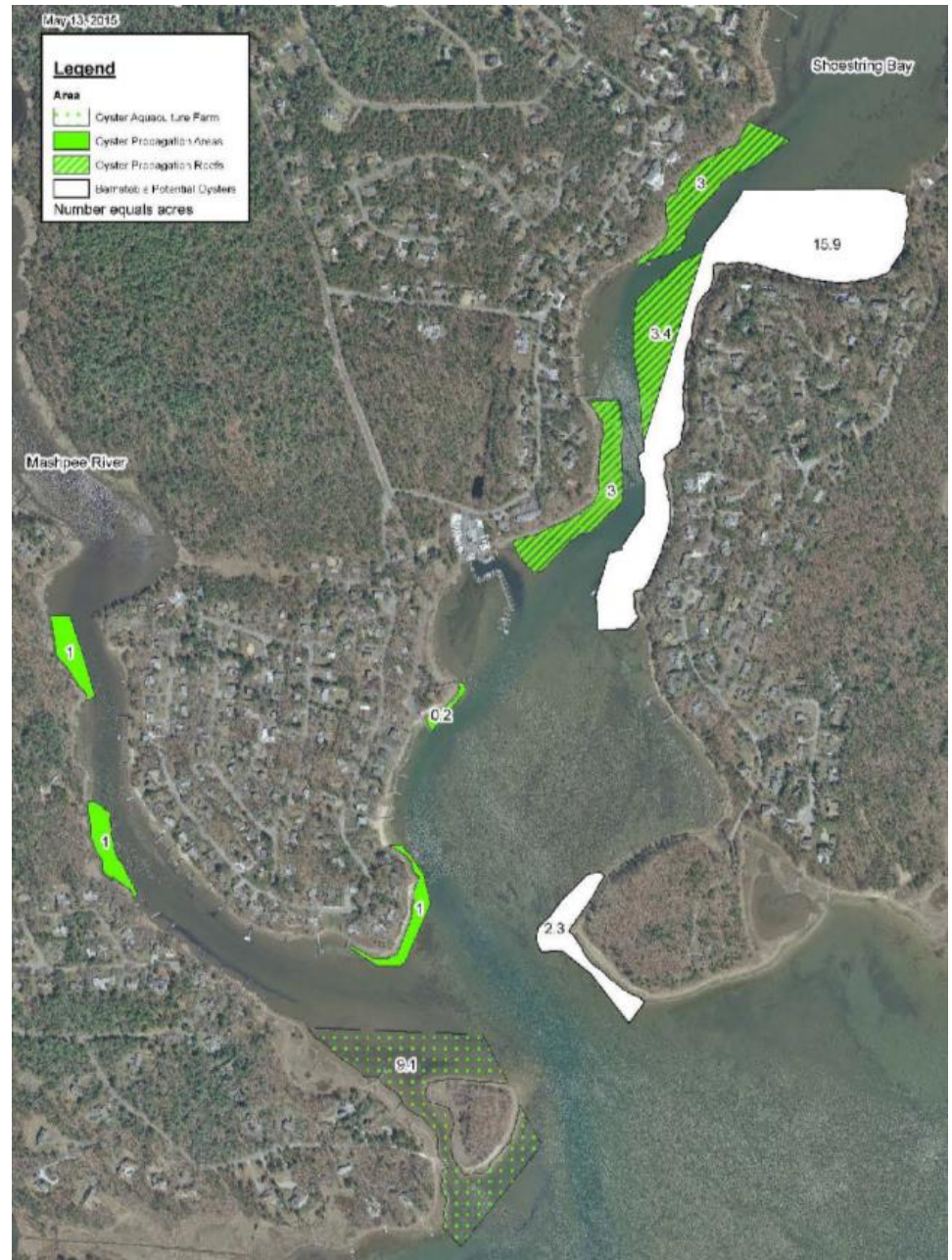
1. Includes Popponesset Creek
2. Includes both Red Brook and Little River watersheds
3. Watersheds are made up of multiple subwatersheds
4. Values based on MEP 2001 wastewater flow estimates
5. All values based on "existing" conditions from MEP reports



SC16 & SC19
quahog restoration areas

SC20

oyster propagation
areas



Implementation schedule

The implementation is envisioned in the following three categories

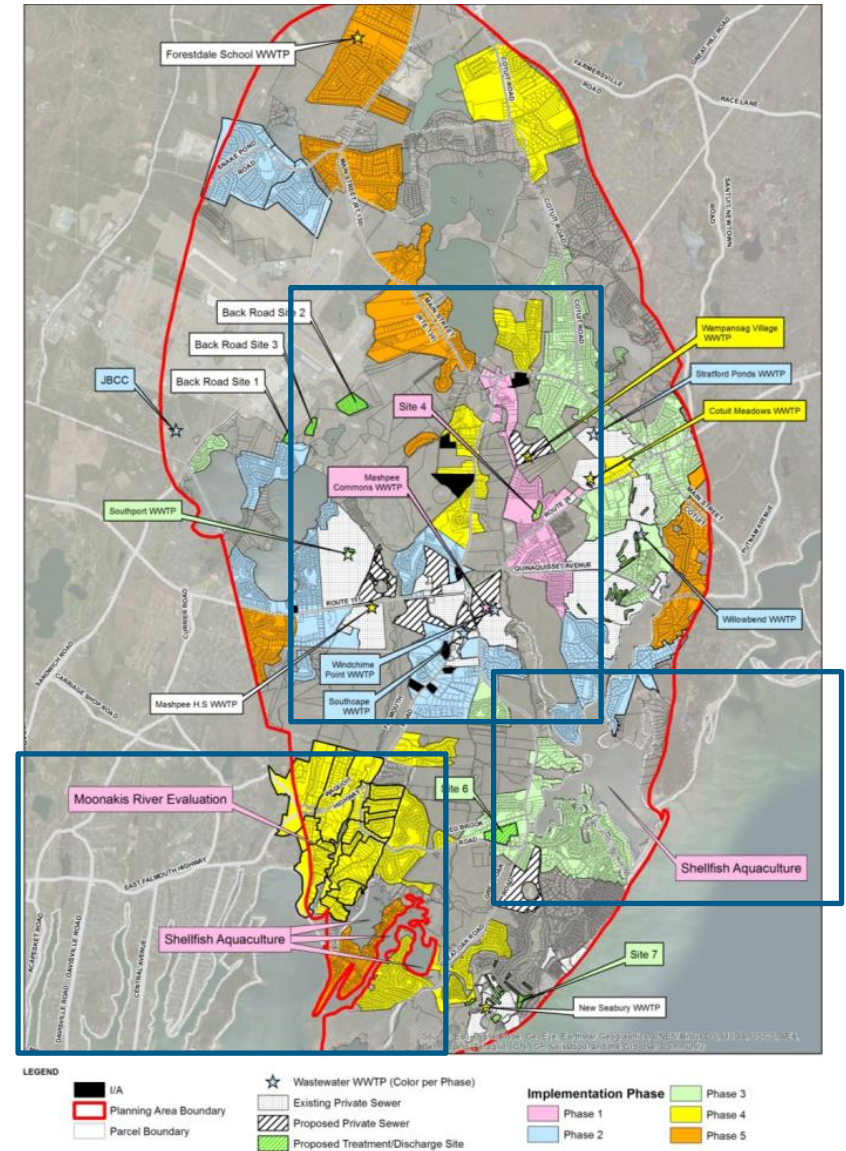
- Short-term initiatives
 - Current (2015-2016)
- Phase 1 implementation (5 year)
 - Approximately 2017 to 2021
- Long-term implementation and adaptive management
 - 2022 to 2041 and beyond
- Plan outlines five “major” phases over the planning period: Implementation will likely be split into much smaller “phases” based on design and construction schedules

2015-2016 short-term initiative

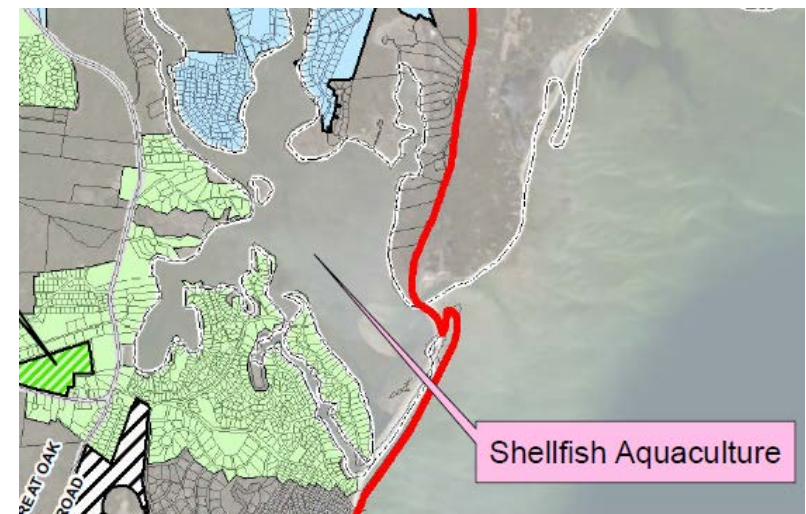
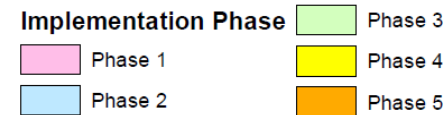
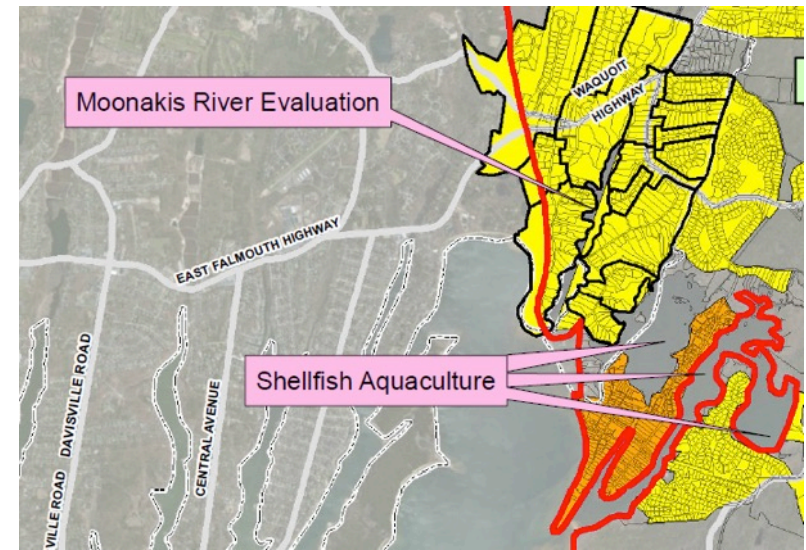
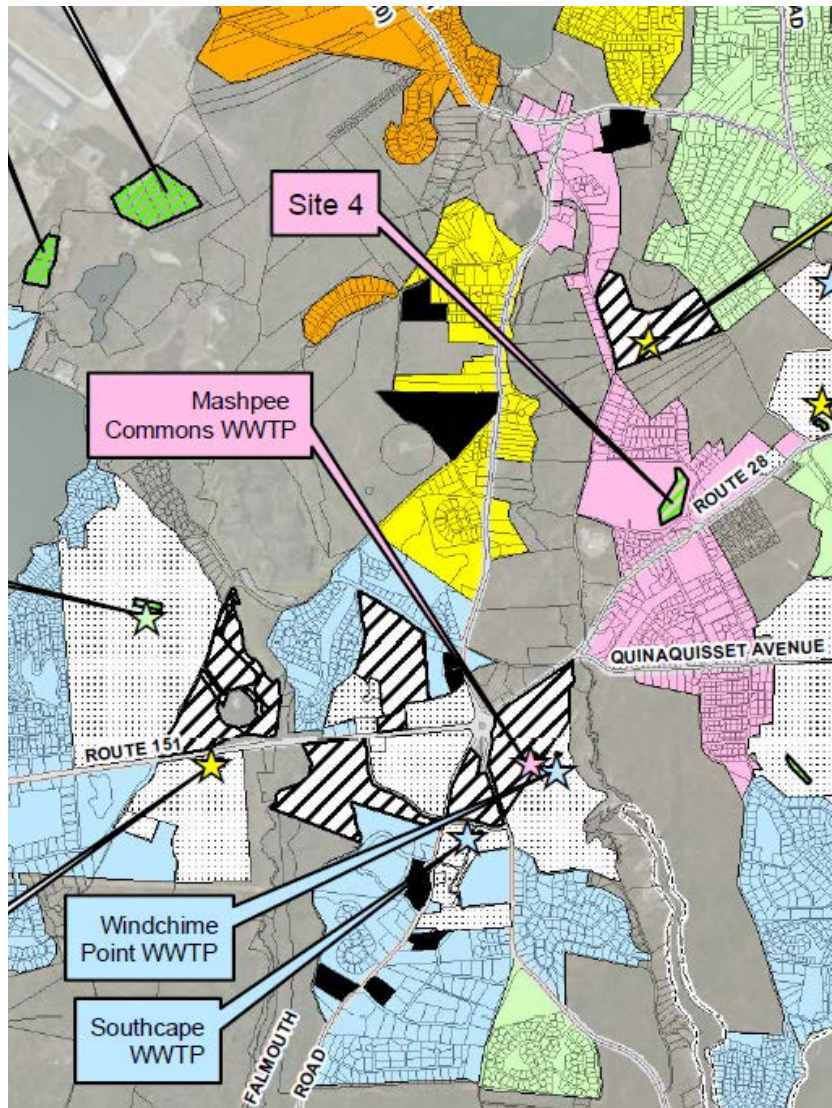
- Development of
 - Watershed permit(s)
 - Management structure for facilities
 - MOU/IMAs with neighbors
- Continuation of
 - Shellfish aquaculture/propagation/restoration
 - WWTF ownership discussions
 - Fertilizer and storm water BMPs
- Coordination with
 - Joint Base Cape Cod/MassDevelopment
 - Private WWTF facilities (use and expansion)

Proposed phasing map

- Phase 1 (2017-2021)
- Phase 2 (2022-2026)
- Phase 3 (2027-2031)
- Phase 4 (2032-2036)
- Phase 5 (2037-2041)



Proposed phasing map



Implementation schedule (cont'd)

2017-2021 – Phase 1

- File notices of project change and Development of Regional Impact (DRI) modifications as required
- Shellfish Program (expanded Popponesset Bay (inclusive), new Jehu Pond, new Hamblin Pond/Little River)
- Mashpee River watershed improvements
 - Design and construction of site 4 WWTF
 - Design and construction of site 4 initial service area
 - Sewer Extension to Wampanoag WWTF
- Feasibility studies (initiated in 2016)
 - Mashpee Commons sewer connection
 - Wampanoag WWTF
 - Quashnet/Moonakis River flushing evaluation

Design and construction in phase 1

- Mashpee River watershed improvements
 - Design and construction of site 4 WWTF
 - Modular facility for expansion for future phases
 - Technology selection/siting and design
 - Design and construction of site 4 initial service area
 - Collection system technology, routing, pumping station siting (if necessary)
 - Wampanoag WWTF sewer extension (following study)
 - A follow up to the evaluations discussed previously if not feasible, will likely be connected to site 4 facility

Estimated phase 1 capital costs (1,2,5)

Estimated capital costs	Recommended plan phase 1 with shellfish aquaculture
Shellfish aquaculture (yr 1)	\$1,500,000
Collection system	\$ 20,000,000
Treatment system (3,4)	\$11,000,000
Recharge facility (3,4)	\$ 1,500,000
Total	\$ 34,000,000

1. Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services and contingency.
2. Values based on an ENR index year of 2017
3. Treatment costs include new facilities and improvements/upgrades to existing facilities
4. Estimated costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach
5. Costs do not include additional studies and evaluations (for example Moonakis River flushing evaluation)

Estimated phase 1 total present worth costs

Total present worth	Phase 1 with shellfish aquaculture
Total capital cost	\$ 34,000,000
<i>O&M annual total</i>	\$ 2,900,000
Total present worth O&M	\$ 44,000,000
Total present worth	\$ 78,000,000
<div><div>1.</div><div>Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency</div></div> <div><div>2.</div><div>Treatment O&M costs include new facilities and improvements/upgrades to existing facilities</div></div> <div><div>3.</div><div>Estimated annual costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach</div></div> <div><div>4.</div><div>Total capital costs based on an ENR index year of 2017</div></div> <div><div>5.</div><div>Cost does not include Town staff, which is currently funded by the Town through their existing program</div></div>	

Implementation schedule (cont'd)

- In general for all phases
- File notices of project change and DRI modifications (as needed)
- Shellfish aquaculture/propagation/restoration (continuation and future expansion)
- Water quality data collection
- Compliance reporting and MEP model runs
- Neighboring communities addressing their areas of need in conjunction with their planning efforts
 - Outlined implementation dependent on performance

Implementation schedule (cont'd)

2022-2026 – Phase 2

- JBCC facility expansion
- Mashpee Commons sewer extension

If shellfish propagation is not advancing as fast or to the levels anticipated

- Site 4 facility expansion
- Willowbend facility improvements and expanded recharge area
- Upgrade of Stratford Ponds, South Cape Village and Windchime Point
 - In order to improve nitrogen removal performance
- Work with Barnstable to initiate efforts in area of Popponesset Bay

2027-2031 – Phase 3

- Popponesset Bay (Mashpee River, Shoestring Bay and Ockway Bay focus)

2032-2036 – Phase 4

- Hamblin Pond and Jehu Pond focus
- Additional Popponesset Bay extensions

2037-2041 – Phase 5

- Address balance of TMDL compliance issues based on monitoring

Estimated project build-out capital costs at build-out^(1,2)

Estimated capital costs	Recommended plan TMDL compliance with shellfish aquaculture	Recommended plan TMDL compliance without shellfish aquaculture
<i>Mashpee</i>		
Shellfish aquaculture (year 1)	\$1,500,000	\$0
Collection system	\$ 120,000,000	\$ 170,000,000
Treatment system ^(3,4)	\$ 32,000,000	\$ 66,000,000
Recharge facility ^(3,4)	\$ 5,400,000	\$ 13,000,000
Mashpee total (rounded)	\$ 160,000,000	\$ 250,000,000

1. Values rounded to two significant figures and include allowances for fiscal, legal and engineering services and contingency.
2. Values based on an ENR index year of 2017
3. Treatment costs include new facilities and improvements/upgrades to existing facilities
4. Estimated costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach and Joint Base Cape Cod is available and no additional recharge capacity is required at JBCC

Estimated Mashpee Build-out Total Present Worth Costs^(1,2)

Estimated costs (rounded)	Recommended plan TMDL compliance with shellfish aquaculture	Recommended plan TMDL compliance without shellfish aquaculture
Mashpee O&M costs		
Collection system O&M	\$ 540,000	\$ 1,000,000
Treatment system O&M	\$ 3,100,000	\$ 4,600,000
Recharge facility O&M	\$ 530,000	\$ 1,200,000
Shellfish annual seeding	\$ 1,300,000	\$ 0
Total Mashpee O&M	\$ 5,500,000	\$ 6,800,000
Present worth O&M	\$84,000,000	\$104,000,000
<i>Mashpee total capital cost</i>	<i>\$ 160,000,000</i>	<i>\$ 250,000,000</i>
Mashpee total present worth	\$244,000,000	\$354,000,000
<ol style="list-style-type: none"> 1. Values rounded and include allowances for fiscal, legal and engineering services and contingency 2. Values based on an ENR index year of 2017 3. Includes \$1,500,000 for shellfish aquaculture 		

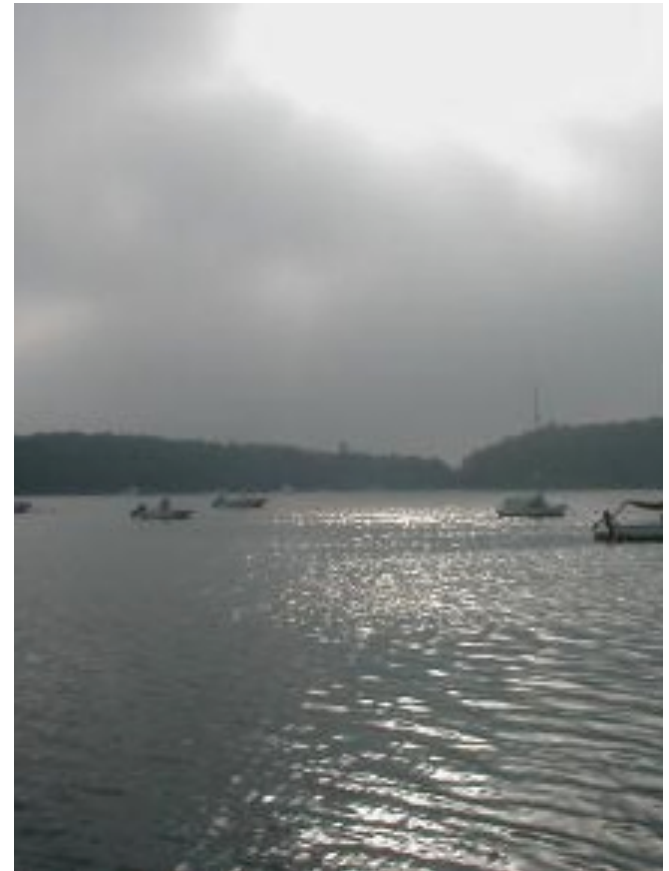
Implementation

- Cape Cod Commission Development of Regional Impact (DRI) Review
- Secure treatment and discharge locations (MOUs and ownership transfers)
- Evaluations
- Continue to coordinate with surrounding Towns (MOUs/IMAs)
- Continue shellfish aquaculture work
- Adaptive management and compliance monitoring



Implementation watershed permit

- Development of draft watershed permit
 - Discussions with Sandwich and Barnstable on potential (MOUs/IMAs)
 - Nitrogen load allocation
 - Pilot Project method
 - CCC 208 method
 - WNMP method
 - Comparison of each
 - Nitrogen trading potential
 - Sharing of resources



Implementation feasibility studies

- Feasibility studies
 - Wampanoag WWTF
 - Consider the connection of neighboring parcels
 - Assessment of projected RBC performance
 - Future expansion potential
 - Collection system routing and capacity
 - Mashpee Commons sewer connection
 - Evaluate the connection of schools and adjacent neighborhoods
 - Assessment of performance of new MBR
 - Future expansion potential
 - Collection system routing and capacity
 - Quashnet/Moonakis River flushing evaluation
 - Improved flushing to reduce nitrogen
 - Parallel evaluation to consider shellfish and finfish restoration

Implementation shellfish

- Oyster bed restoration – Shoestring Bay
- Reconstruction – Little River Town Dock Floats
- Shellfish upwellers
- Expanded staff
- Predator control - crab traps
- Closed area rotation
 - Seed areas closed for up to 3 years
 - Other areas seeded and opened for harvest annually



Implementation shellfish (cont'd)

- Monitoring
 - Summer sampling protocols used as part of MEP
 - Deployed meters in Little River/ Mashpee River and Popponesset Bay in addition to new meter for Shoestring Bay (funded by Tribe)
 - Water samples collected monthly for lab analysis



Questions



www.ghd.com