



CAPE COASTAL CONFERENCE

*Linking Science with Local
Solutions and Decision-Making*

Shellfish and Water Quality Restoration in the Town of Mashpee, Massachusetts

Presented By
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Mashpee Shellfish Constable

Outline

- CWMP/WNMP Shellfish Option Background
- MEP/TMDL Reports
- Oyster Propagation/Eutrophication Mitigation
Mashpee Wampanoag Tribe's Oyster Farm
- Popponesset Bay Shellfish/Water Quality Plan
- Great River, Jehu Pond, Hamblin Pond/Little R.
(SC 16) Shellfish/Water Quality Plan

CWMP Shellfish Option Background

- EPA/DEP allow shellfish in CWMP

Conference: Sustainable Cape Cod – New Tools and Practices for Clean Water and Community Benefit October 22-23, 2012
Sponsored by USEPA, Cape Cod Commission and the Water Alliance.

EPA and Massachusetts DEP allow removal of nitrogen by shellfish to be included in CWMPs with a “Plan B” for backup.
Cost benefits and risks of interest. Adaptive Management required.

- Mashpee CWMP/WNMP to include shellfish

Draft plan in preparation

- Massachusetts White Paper on shellfish option due in 2013

Shellfish/Water Quality Restoration

- **Commercial Shellfish Aquaculture (Farming)**
 - Water Quality Improvement – Shellfish filter algae for food
 - Economic Development – Economic multiplier and jobs
 - Limited Potential - Limited to areas not naturally productive
 - User conflicts
- **Fisheries – Restoration of Shellfish Populations**
 - Water Quality Improvement – Shellfish filter algae for food
 - Economic Development - Commercial Shellfishing
 - Food for family fishing – Locally produced displaces N import
 - Less limited potential than farming - more / better areas

Shellfish Species Selection

- Low salinity ($< \sim 15$ PPT tidal average) – Oysters
 - Oyster diseases and most predators blocked in low sal.
 - Removes algae/N in upper estuary closer to N source
 - Salinity too low for quahogs to survive
- Higher salinity (> 20 PPT) – Quahogs
 - oysters risk disease, predation and fouling
 - No quahog disease in hot S. MA estuaries (> 25 C)
 - Quahogs dig in - no fouling
 - Large seed (> 25 mm) and littlenecks – good survival
 - Crab and waterfowl predation not a problem

Treatment Systems vs. Shellfish

- Land based
 - Storm resistant
 - Microbe Growth and Survival Dependent
 - Effluent naturally sand filtered (microbes removed)
 - Seasonal Load Issue
 - Works in all watersheds
 - Expensive
 - Nitrogen grab samples often monthly
 - Flow Rate monitored
- Estuary based
 - Storm resistant
 - Shellfish Growth and Survival Dependent
 - Septic effluent naturally sand filtered (microbes removed)
 - No Seasonal Load Issue
 - Some areas not suitable
 - Inexpensive – economic +
 - Harvests monitored Dealers electronic data
 - Total nitrogen removed calculated from total weight

Nitrogen Removal Required for TMDL

- Popponesset + Waquoit Bays ~ 30 tons N/yr
- Mashpee portion ~ 18 tons N/yr
 - 9 tons N/yr removal from Popponesset Bay area
 - ~ 9 tons N/yr removal from Waquoit Bay area
- (Based on Popponesset TMDL Report/EPA Pilot Study and Waquoit Bay MEP Report Draft)

Appendix B

Table B –1 Summarizes the present on-site subsurface wastewater disposal system loads, and the loading reductions that would be necessary to achieve the TMDL by reducing on-site subsurface wastewater disposal system loads, ignoring all other sources.

Table VIII-1. Comparison of sub-embayment watershed <i>septic loads</i> (attenuated) used for modeling of present and threshold loading scenarios of the Popponesset Bay system. These loads do not include direct atmospheric deposition (onto the sub-embayment surface), benthic flux, runoff, or fertilizer loading terms.			
sub-embayment	present septic load (kg/day)	threshold septic load (kg/day)	threshold septic load % change
Popponesset Bay	1.58	1.58	0.0%
Popponesset Creek	4.00	0.00	-100.0%
Pinquickset Cove	0.58	0.58	0.0%
Ockway Bay	2.39	0.00	-100.0%
Mashpee River	9.61	0.00	-100.0%
Shoestring Bay	6.94	0.00	-100.0%
Surface Water Sources			
Mashpee River	9.96	5.85	-41.3%
Santuit River (Shoestring Bay)	11.69	7.58	-35.2%
Quaker Run River (Shoestring Bay)	4.69	4.69	0.0%
TOTAL	51.12	19.96	-61.0%

Popponesset Bay TMDL Report

Final Popponesset Bay Total Maximum Daily Loads for Total Nitrogen

Report # 96-TMDL-4

Popponesset Bay TMDL

- 11.4 tons N/yr reduction required for TMDL
Mashpee portion 8.6 tons N/yr reduction

Mashpee River	5.0 tons N/yr reduction
Ockway Bay	0.9 tons N/yr reduction
Popponesset Bay	1.5 tons N/yr reduction
Shoestring Bay	4.0 tons N/yr reduction



Nitrogen Reduction Required
11.38 Tons N/yr

Mashpee R.
5.01 T N/yr

Shoestring Bay
4.04 T N/yr

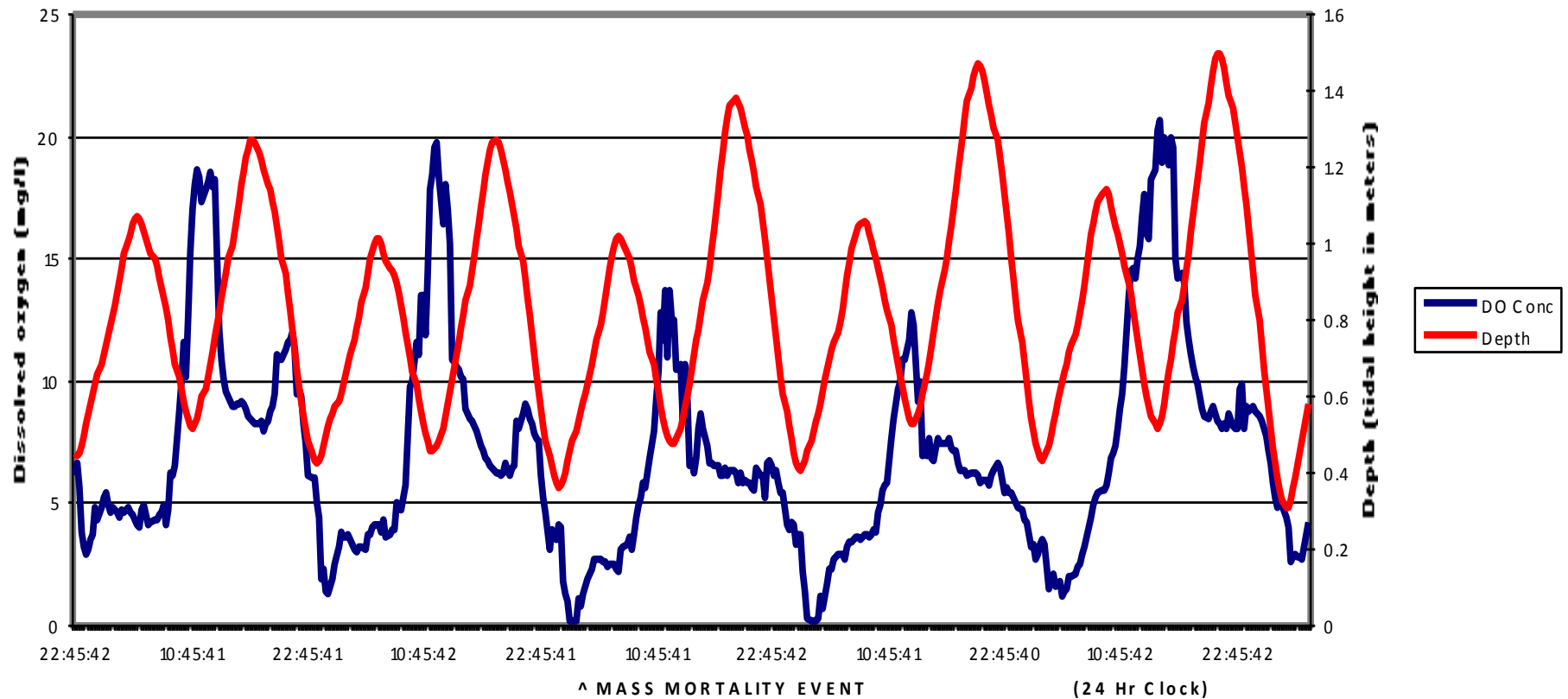
Popponesset Bay
1.46 T N/yr

Ockway Bay
0.87 T N/yr

Mass Mortality Event

Oxygen Depletion by Algae

Mashpee River DO 8/11-8/17/05





Waquoit Bay MEP Report Draft

- Total Load 38 tons N/yr

42 watershed/atmospheric on estuary - 4 benthic uptake =
38

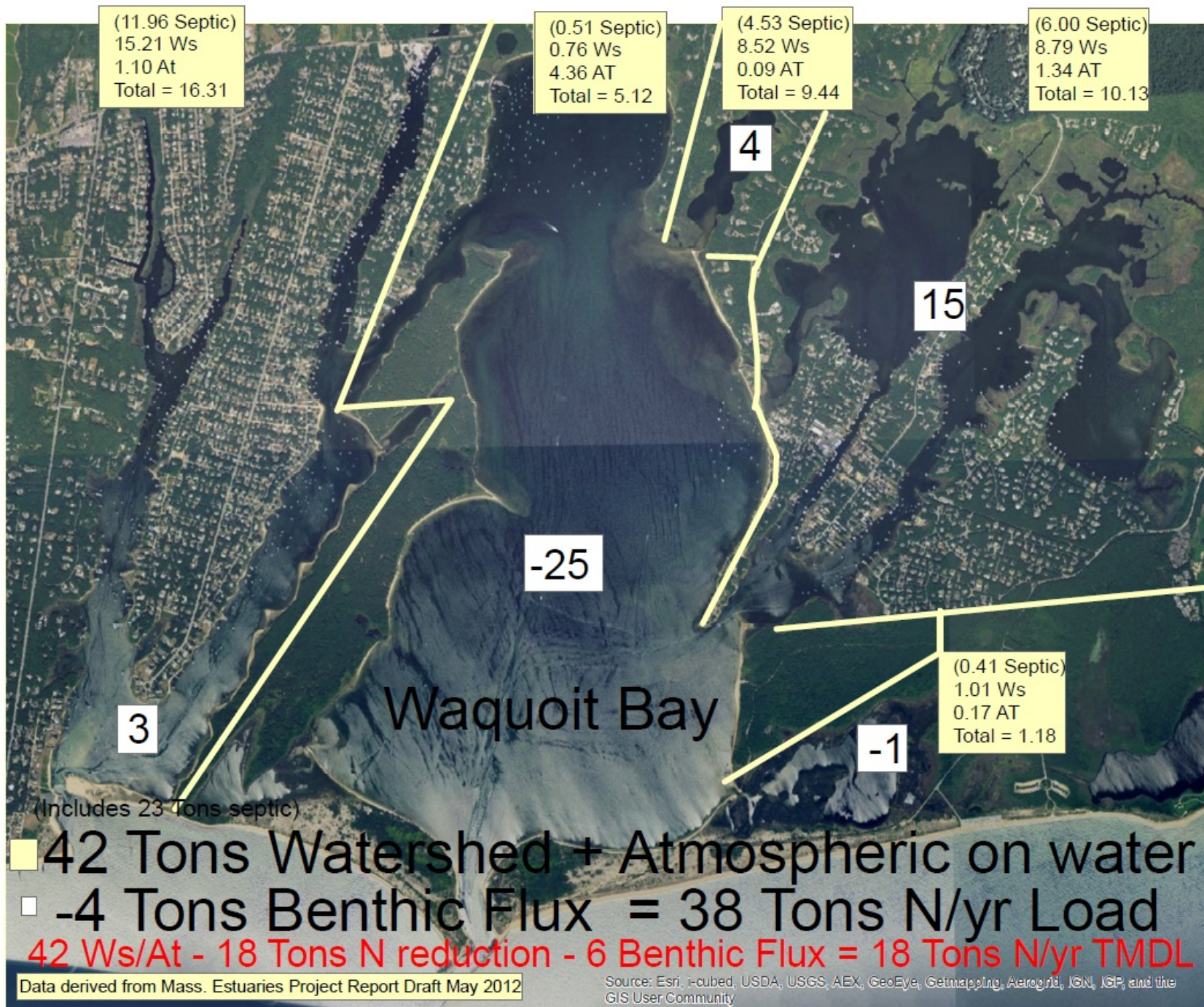
- TMDL 18 tons N/yr

- Removal Required 18 tons N/yr

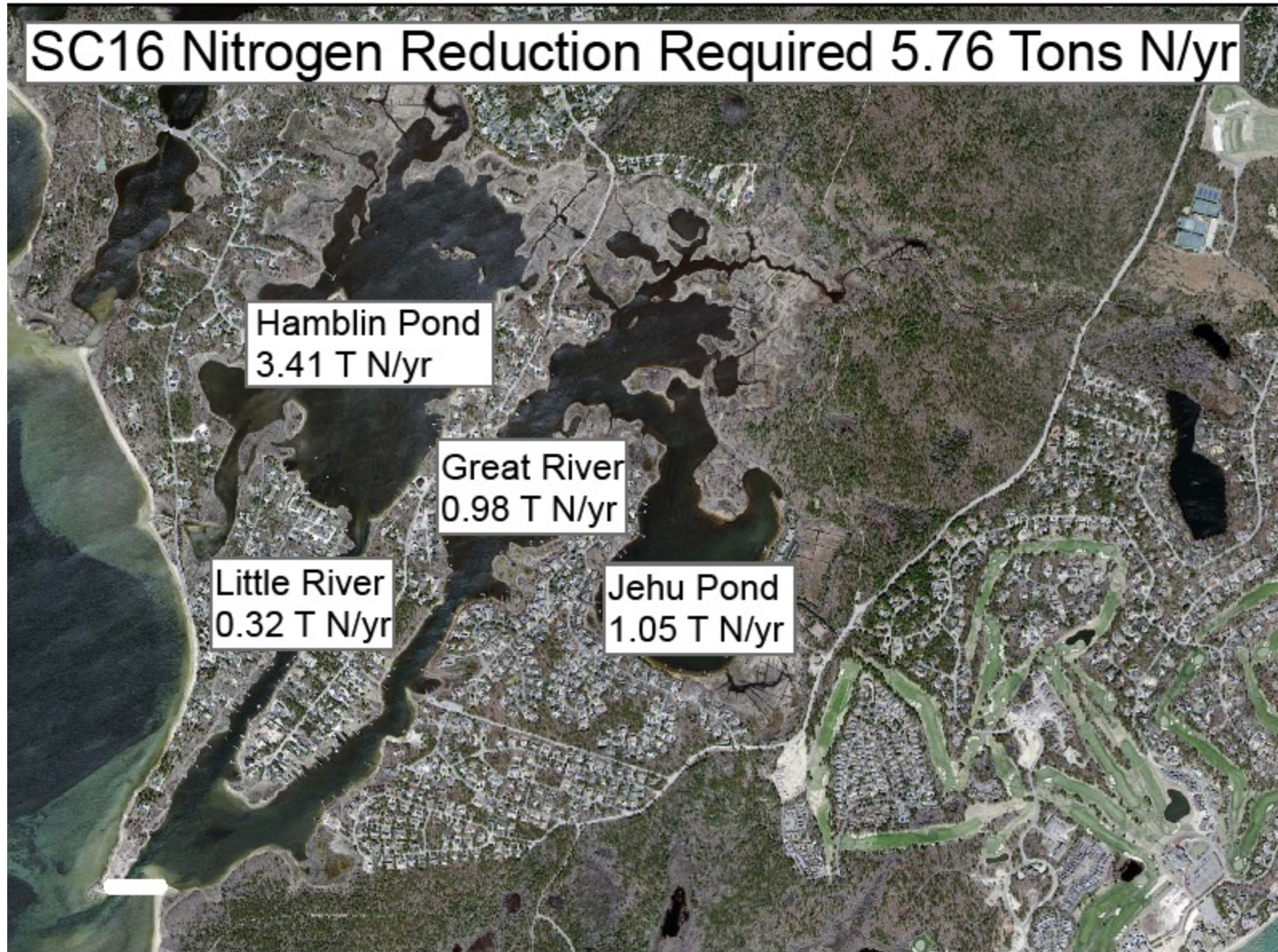
42 watershed/atmosph. -18 reduction -6 benthic uptake = 18

Mashpee portion < 9 tons N/yr removal

SC16 (Great River, Little River, Hamblin and Jehu Ponds) =
6



SC16 Nitrogen Reduction Required 5.76 Tons N/yr



Oyster Propagation/Eutrophication Mitigation Project

Restoration of the oyster fishery lost in 1980s.

Mitigation of eutrophication from nitrogen loading.

Low salinity Mashpee R. blocks diseases, predators.

520,000 oysters harvested in 2008 contained 260
kg of nitrogen = 5 % of 5,000 kg nitrogen
reduction needed to meet TMDL for the river.

No fish kills since large oyster bed established.

Oysters filter algae that blooms on excess nitrogen.

Denitrifying bacteria convert oyster waste to N_2

Mashpee Wampanoag Tribe's Oyster Farm

- Oysters grown commercially on the Mashpee Wampanoag Tribe's Oyster Farm at the mouth of the Mashpee River also filter algae and remove nitrogen.
- Seeding and harvest increasing in recent years
- "First Light Oysters" high quality/price

COVER STORY

First Light Oysters

We strive for a premium oyster in quality; Mother Nature takes care of the taste. Oysters take on a distinct flavor imparted by the area in which they are cultured. First Light Oysters have ranked high in the evaluations of experienced oyster tasters – not only our local oyster aficionados but also chefs and customers in New York City. We hear responses like: "... 2 thumbs up for appearance, quality, and taste. Spectacular!"

After the oysters are harvested, evaluated and cleaned, permitted wholesalers sell our oysters to choice seafood markets and fine restaurants in Boston and New York. Meanwhile, the Tribe is taking the steps needed to build a state-certified facility that will enable our staff to sell oysters directly to the public at the Tribe's Farm on 213 Sampson's Mill Road, Mashpee.

Our First Light Oysters are the pride of the Mashpee Wampanoag Tribe, bringing the taste of Mashpee to the table and a bright future to the People of the First Light.

For information, please contact:

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Office Location: 213 Sampson's Mill Road, Mashpee, MA

Mailing Address: 483 Great Neck Road South, Mashpee, MA 02649



The Mashpee Wampanoag Tribe has a long history of farming oysters in Mashpee

Two Mashpee Wampanoag, Silas Pells and Horatio Amos, each had their own oyster companies in the 19th and 20th centuries. Horatio Amos' oyster shack stood on Daniel's Island in Popponesset Bay for more than 60 years. Shells from shucked oysters were used to pave Redbrook Road where Mr. Amos and his wife Ella operated their business and a guest house, which still stands to this day.



"Our First Light Oysters are the pride of the Mashpee Wampanoag Tribe, bringing the taste of Mashpee to the table and a bright future to the People of the First Light."

Mashpee Magazine 2013

Mashpee Chamber of Commerce

Popponesset Bay Shellfish N Plan

- Increase Town shellfish propagation for fishery and Tribe's farm commercial shellfish production
- Mashpee River 50% of nitrogen removal required = 2.5 metric tons
Town family oyster harvest = 0.5 mt N
Tribe's farm oyster production = 2.0 mt N
Total 2.5 mt N

Popponesset Bay 100% of nitrogen removal required = 1.5 mt N
Tribe's farm oyster and quahog production = 1.5 mt N

Ockway Bay 100% of nitrogen removal required = 0.9 mt N
Town commercial quahog harvest = 0.9 mt N

SC16 Quahog Plan

- Increase quahog seeding in Great R, Little R, Hamblin and Jehu Ponds (Shellfish Area SC16)
- Goal: Quahog harvest increase to 1575 tons (1432 mt) 24 million littlenecks/year

Estimated removal 5.76 mt of nitrogen/yr

100 % N removal required for SC16

2013 Shellfish Propagation/Estuary Restoration Plan

- Double oyster seeding in the Mashpee River
 - 2,200 bags of remote set oyster seed from ARC hatchery
 - Projected future harvest of > 600,000 oysters
- Increase quahog seeding in Great River
 - 6,000,000 quahog seed, 2 mm size from ARC hatchery
 - Projected future harvest of 4,200,000 quahogs

Shellfish Plan for Nitrogen Removal

<u>Area</u>	<u>N Removal Required (MEP) metric tons N/year</u>	<u>Removal by Shellfish mt N/yr</u>	<u>Shellfish Harvest</u> <u>Harvest (English</u> <u>mt live/yr tons live)</u>		<u>number</u> <u>million</u>	<u>type</u>
Mashpee R.	5.01	0.50 Town <u>2.00</u> Tribe 2.50 (total)	125 500	(138) (550)	1.25	oysters* oysters
Popponesset Bay	1.46	1.46 Tribe	365	(402)	6.08	quahogs**
Ockway Bay	0.87	0.87 Town	218	(240)	3.63	quahogs**
Great River	0.98	1.00 Town	250	(275)	4.17	quahogs**
Jehu Pond	1.05	1.00 Town	250	(275)	4.17	quahogs**
Hamblin Pond/ Little River	3.41 <u>0.32</u> 3.73	3.73 Town	932	(1025)	15.53	quahogs**
TOTAL		10.54	2640	(2905)		

Notes: * oysters @ 100 g. Nitrogen content from analysis of total nitrogen in meat and shell of Mashpee River oysters.

** littleneck quahogs @ 60 g. Nitrogen content from analysis of Mashpee littlenecks (Barnstable County Cooperative Extension 2012)

(Total 33.58 million littlenecks = \$5,037,000 @ \$0.15 each)

Nitrogen Removals Required calculated from:

Final Popponesset Bay Total Daily Maximum Loads for Total Nitrogen (Report # 96-TMDL-4). Commonwealth of Massachusetts, EOE, DEP, BRP December 5, 2006
p. 25. Appendix B. Table B-1 (MEP Popponesset Bay Report Table VIII-I).

Massachusetts Estuaries Project, Linked Watershed-Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Systems Towns of Falmouth and Mashpee, Massachusetts. Revised Draft Report May 2012. U. Mass. Dartmouth SMAST, Applied Coastal Research and Engineering, Cape Cod Commission, USGS, Mass. DEP. p. ES 13 Table ES-2.



Oyster seed bags

ARC Hatchery - Dennis, MA



AmeriCorps spreading out oyster seed

Mashpee River



Oysters at harvest size

Mashpee River





Shellfish Seed Upweller

Little River Town Dock



Quahog seed tray

1" seed



Great River Quahog Seeding Plan

2013

Monitoring/quantification

- Town monitors shellfish harvesting.
- Tribe reports oyster harvests annually.
- Commercial shellfish harvests recorded electronically when sold to shellfish dealers and automatically reported to DMF.
- Continued water quality monitoring required by DEP/EPA – Town/Tribe/SMAST

Acknowledgements

- AmeriCorps Cape Cod
- Barnstable County Cooperative Extension
- Mashpee Wampanoag Tribe
- Massachusetts Division of Marine Fisheries
- Town of Mashpee
- University of Massachusetts Dartmouth,
SMAST

