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implementing solutions for clean water

Scenario Planning

BREAKOUT SESSION | JUNE 24, 2016

Jay Detjens, Cape Cod Commission

Tom Cambareri, Cape Cod Commission

Heather McElroy, Cape Cod Commission

Scott Horsley, Consultant to Cape Cod Commission

Dave Mason, Town of Sandwich

Scenario Planning

BREAKOUT SESSION | JUNE 24, 2016

Jay Detjens, Cape Cod Commission

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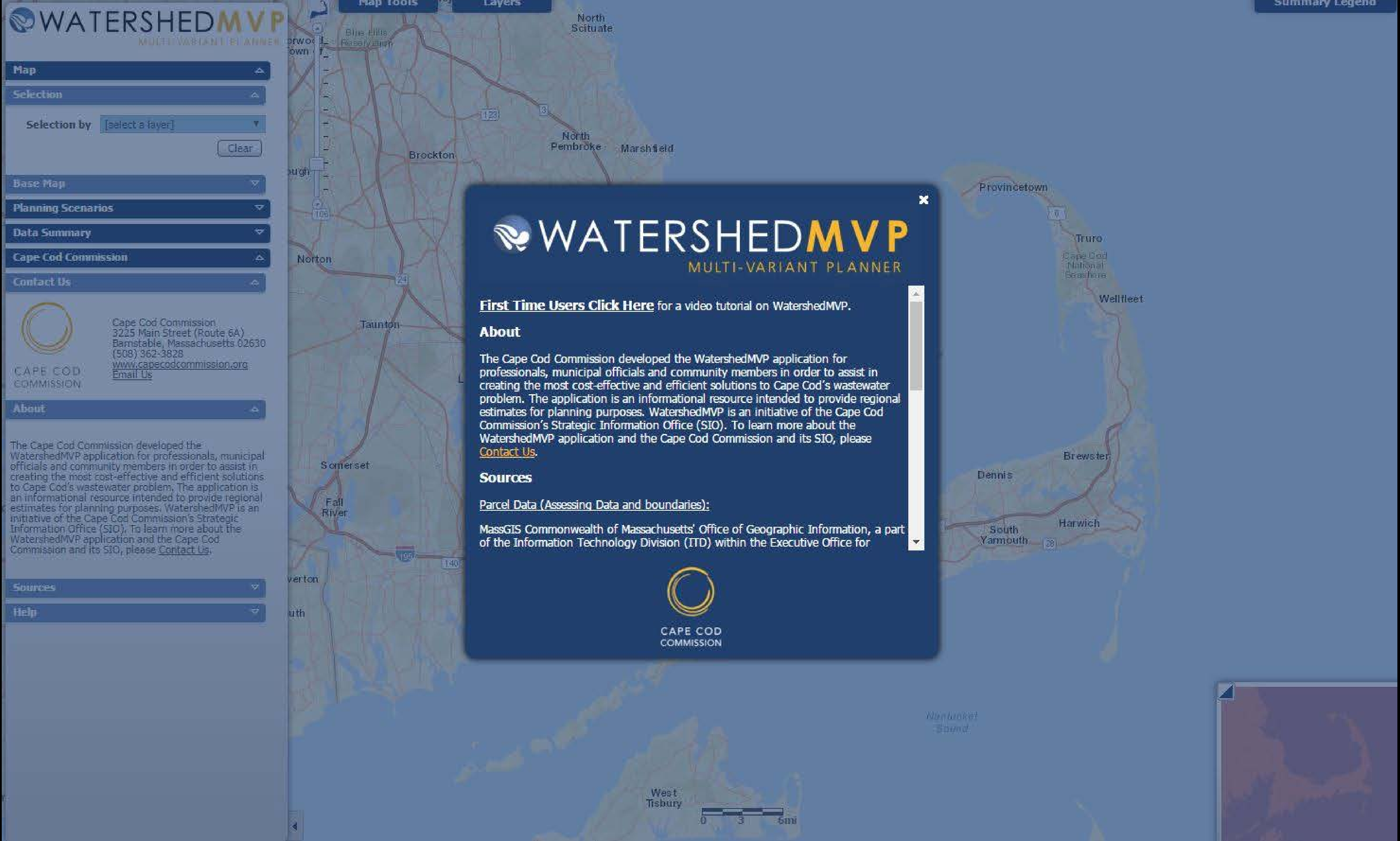
WATERSHEDMVP
MULTI-VARIANT PLANNER
Map Tools
Layers
Summary Legend
Map
Selection
Selection by
[select a layer]
Clear
Base Map
Planning Scenarios
Data Summary
Cape Cod Commission
Contact Us
CAPE COD COMMISSION
Cape Cod Commission
3225 Main Street (Route 6A)
Barnstable, Massachusetts 02630
(508) 362-3828
www.capecodcommission.org
Email Us
About
The Cape Cod Commission developed the WatershedMVP application for professionals, municipal officials and community members in order to assist in creating the most cost-effective and efficient solutions to Cape Cod's wastewater problem. The application is an informational resource intended to provide regional estimates for planning purposes. WatershedMVP is an initiative of the Cape Cod Commission's Strategic Information Office (SIO). To learn more about the WatershedMVP application and the Cape Cod Commission and its SIO, please Contact Us.
Sources
Help
WATERSHEDMVP
MULTI-VARIANT PLANNER
First Time Users Click Here for a video tutorial on WatershedMVP.
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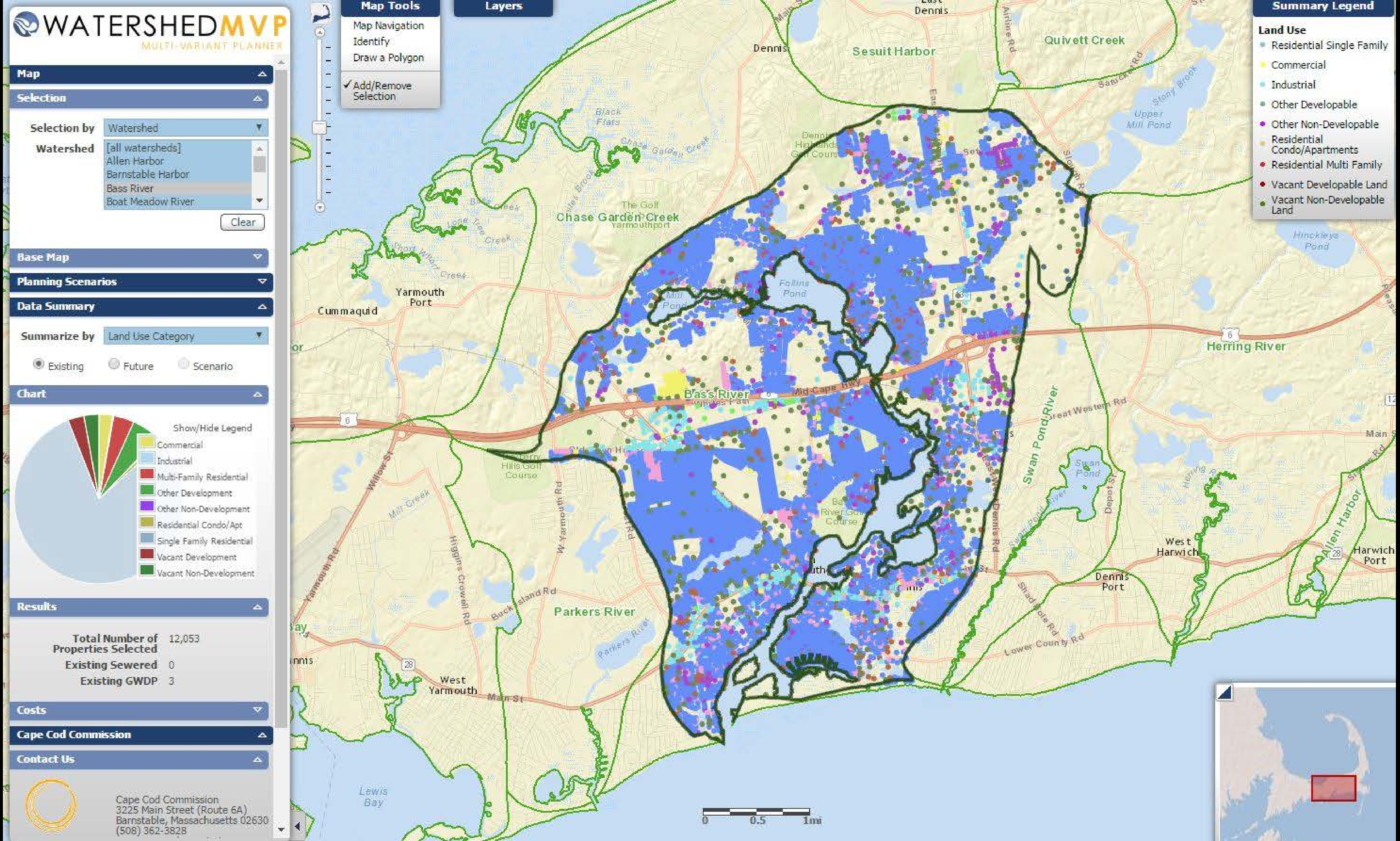
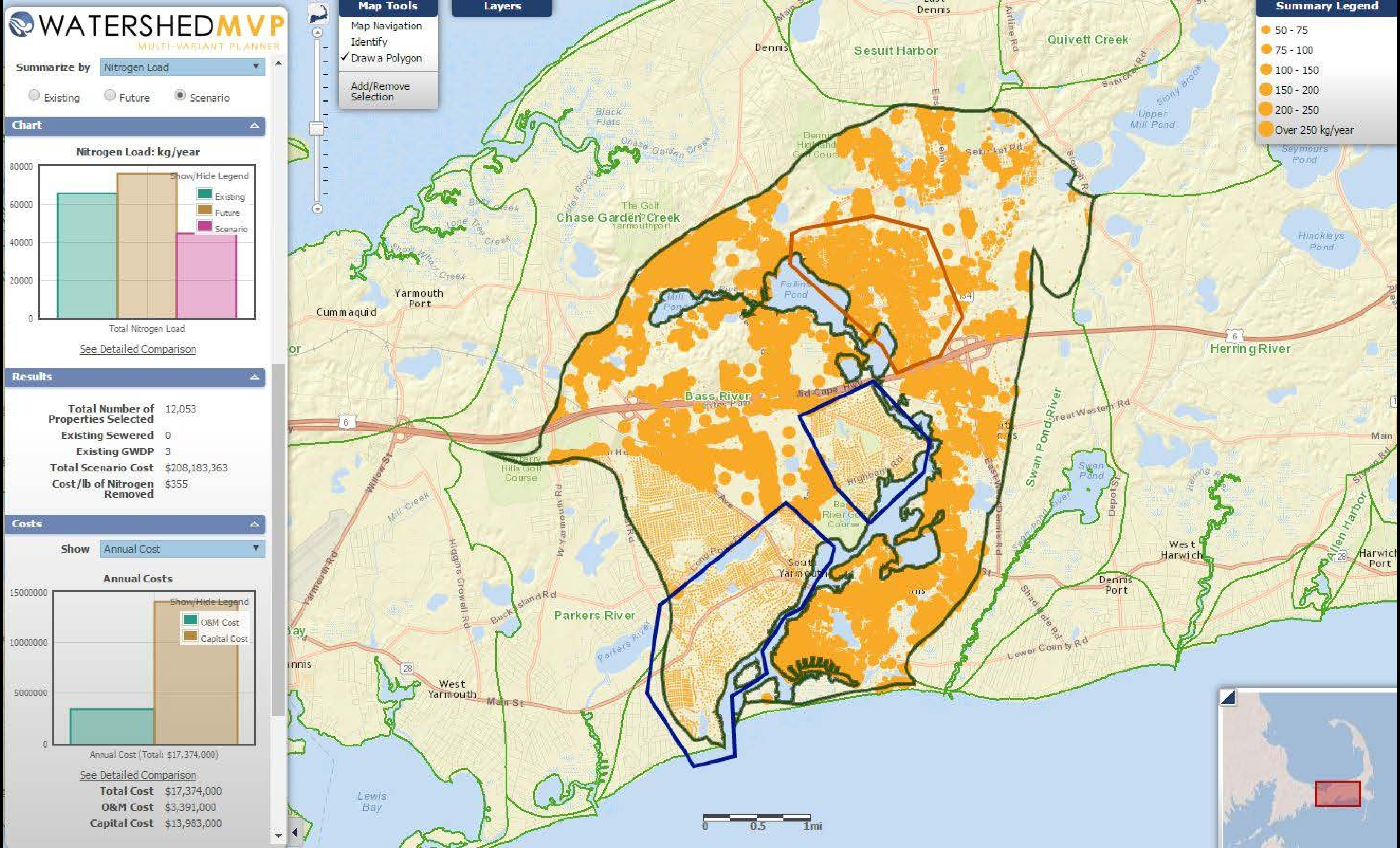
Sources
Parcel Data (Assessing Data and boundaries):
MassGIS Commonwealth of Massachusetts' Office of Geographic Information, a part of the Information Technology Division (ITD) within the Executive Office for
CAPE COD COMMISSION
North Scituate
North Pembroke
Marshfield
Brockton
Norton
Taunton
Somerset
Fall River
Provincetown
Truro
Cape Cod National Seashore
Wellfleet
Brewster
Dennis
Harwich
South Yarmouth
Nantucket Sound
West Tisbury
0
3
6mi



WATERSHED MVP
MULTI-VARIANT PLANNER
Map
Selection
Selection by
Watershed
Watershed
[all watersheds]
Allen Harbor
Barnstable Harbor
Bass River
Boat Meadow River
Clear
Base Map
Planning Scenarios
Data Summary
Summarize by
Land Use Category
Existing
Future
Scenario
Chart
Show/Hide Legend
Commercial
Industrial
Multi-Family Residential
Other Development
Other Non-Development
Residential Condo/Apt
Single Family Residential
Vacant Development
Vacant Non-Development
Results
Total Number of Properties Selected
12,053
Existing Sewered
0
Existing GWDP
3
Costs
Cape Cod Commission
Contact Us
Cape Cod Commission
3225 Main Street (Route 6A)
Barnstable, Massachusetts 02630
(508) 362-3828
Map Tools
Map Navigation
Identify
Draw a Polygon
✓Add/Remove Selection
Layers
Summary Legend
Land Use
Residential Single Family
Commercial
Industrial
Other Developable
Other Non-Developable
Residential Condo/Apartments
Residential Multi Family
Vacant Developable Land
Vacant Non-Developable Land
Sesuit Harbor
Quivett Creek
Chase Garden Creek
Bass River
Herring River
Parkers River
Swan Pond River
Allen Harbor
Dennis
Yarmouth Port
Cummaquid
West Yarmouth
West Harwich
Harwich Port
Dennis Port
Mid-Cape Hwy
Lewis Bay
0
0.5
1mi


WATERSHED MVP
MULTI-VARIANT PLANNER
Summarize by
Nitrogen Load
Existing
Future
Scenario
Chart
Nitrogen Load: kg/year
Show/Hide Legend
Existing
Future
Scenario
Total Nitrogen Load
See Detailed Comparison
Results
Total Number of Properties Selected 12,053
Existing Sewered 0
Existing GWDP 3
Total Scenario Cost $208,183,363
Cost/lb of Nitrogen Removed $355
Costs
Show
Annual Cost
Annual Costs
Show/Hide Legend
O&M Cost
Capital Cost
Annual Cost (Total: $17,374,000)
See Detailed Comparison
Total Cost $17,374,000
O&M Cost $3,391,000
Capital Cost $13,983,000
Map Tools
Map Navigation
Identify
Draw a Polygon
Add/Remove Selection
Layers
Summary Legend
50 - 75
75 - 100
100 - 150
150 - 200
200 - 250
Over 250 kg/year

WATERSHEDMVP
MULTI-VARIANT PLANNER

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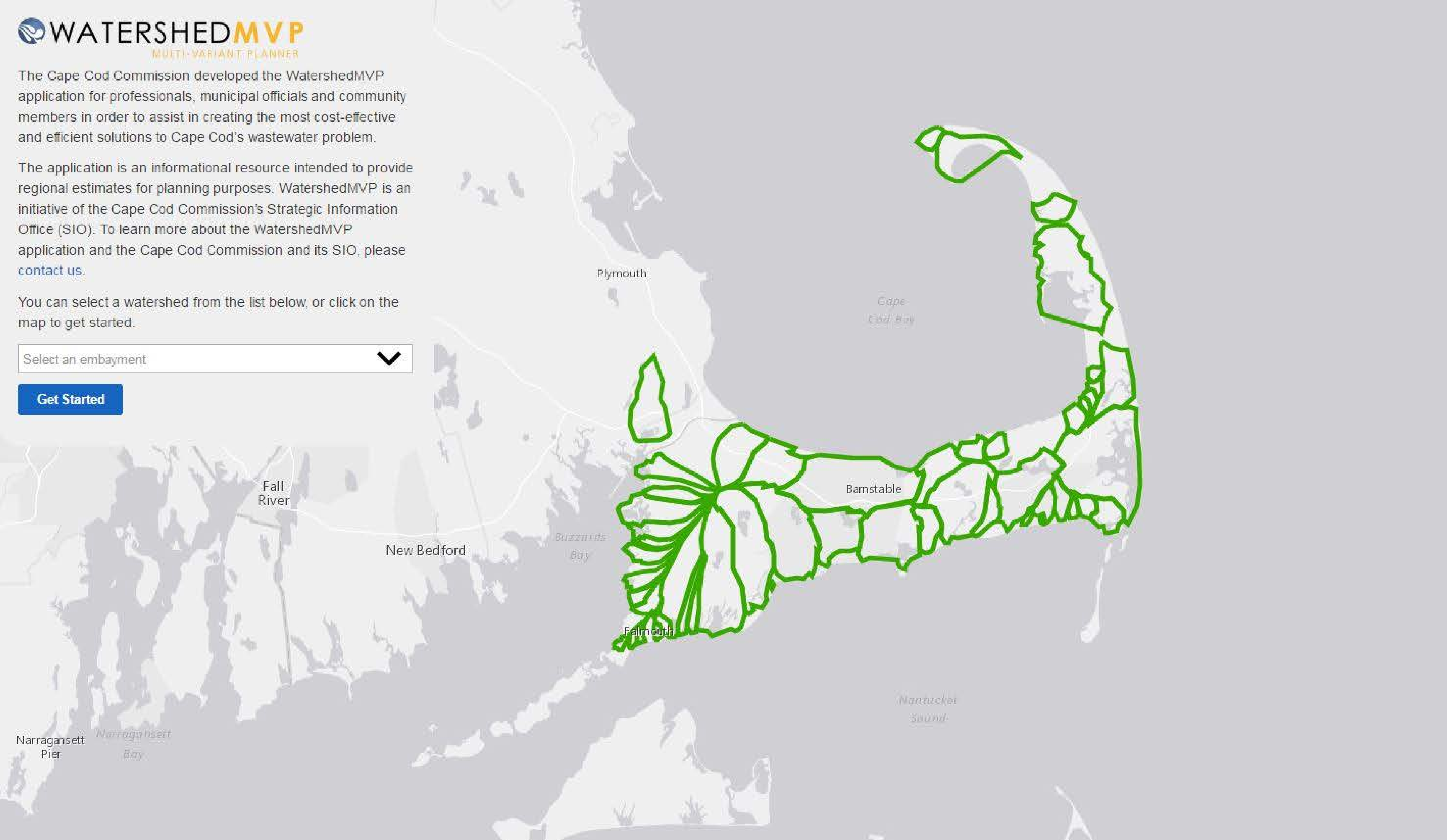
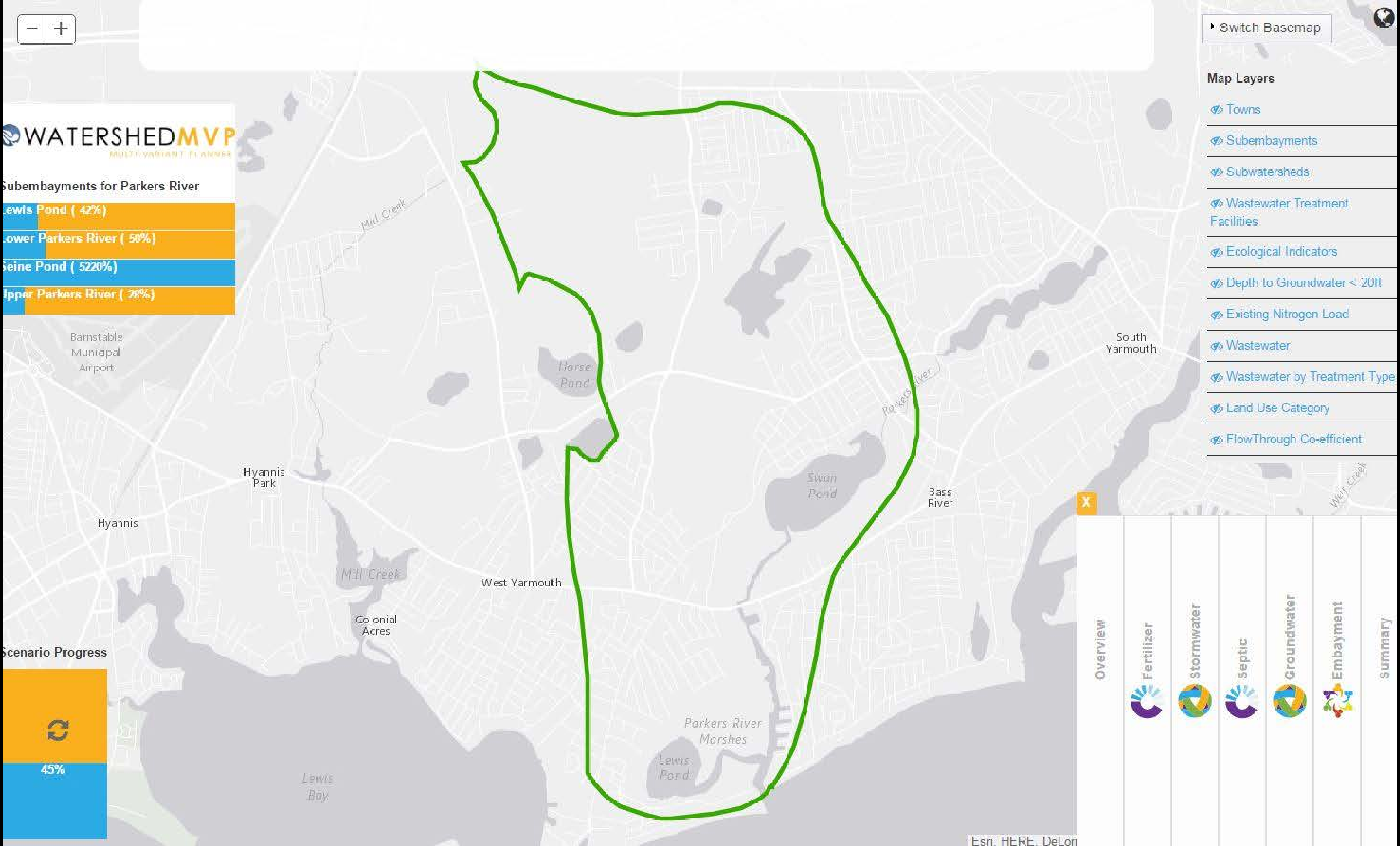
You can select a watershed from the list below, or click on the map to get started.

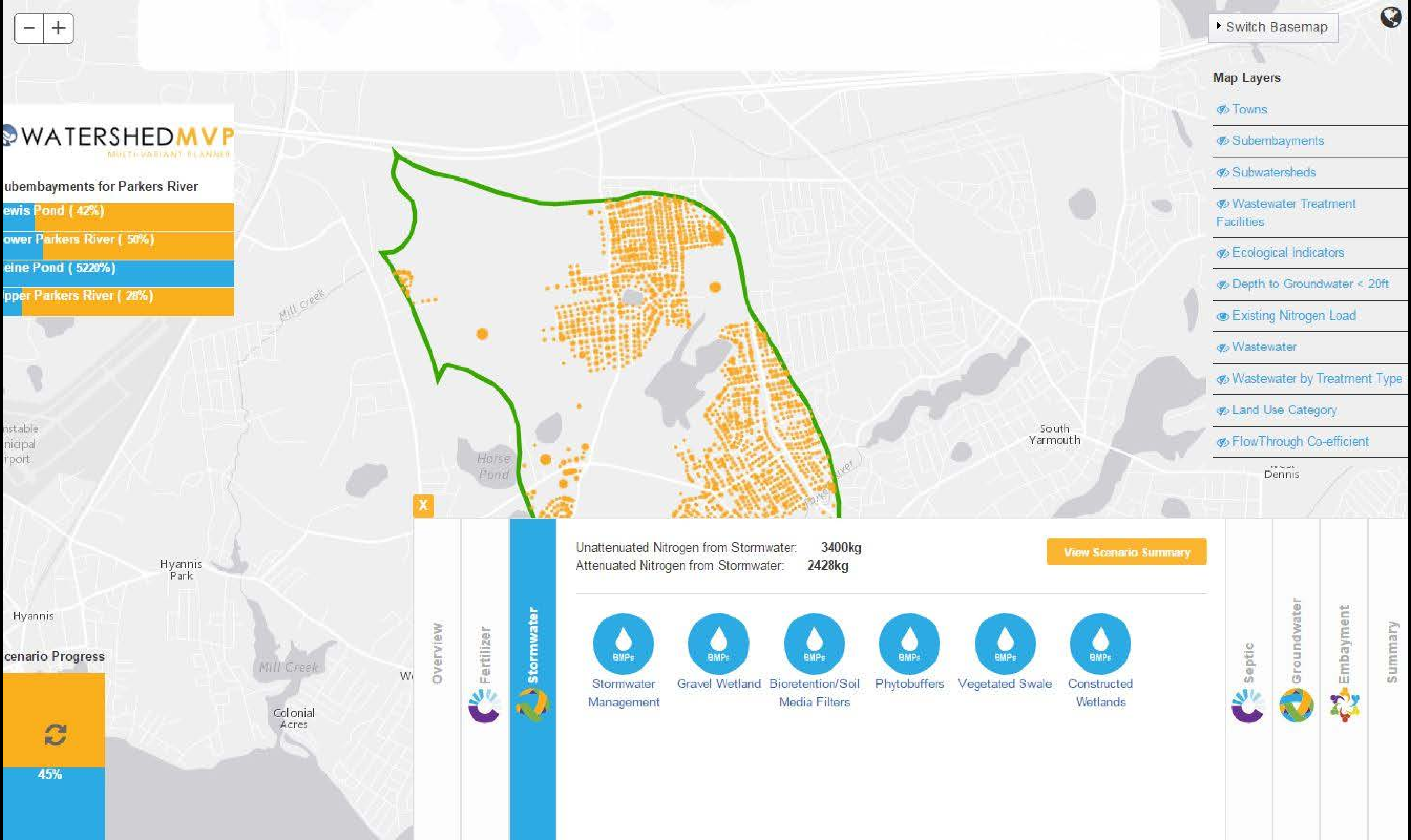
Select an embayment

Get Started





Switch Basemap
Map Layers
Towns
Subembayments
Subwatersheds
Wastewater Treatment Facilities
Ecological Indicators
Depth to Groundwater < 20ft
Existing Nitrogen Load
Wastewater
Wastewater by Treatment Type
Land Use Category
FlowThrough Co-efficient
WATERSHEDMVP
MULTI-VARIANT PLANNER
Subembayments for Parkers River
Lewis Pond (42%)
Lower Parkers River (50%)
Seine Pond (5220%)
Upper Parkers River (28%)
Scenario Progress
45%
Barnstable Municipal Airport
Mill Creek
Horse Pond
South Yarmouth
Parkers River
Hyannis Park
Hyannis
Swan Pond
Bass River
Mill Creek
West Yarmouth
Colonial Acres
Parkers River Marshes
Lewis Pond
Lewis Bay
X
Overview
Fertilizer
Stormwater
Septic
Groundwater
Embayment
Summary
Esri, HERE, DeLorme


Switch Basemap
WATERSHEDMVP
MULTI-VARIANT PLANNER
ubembayments for Parkers River
ewis Pond (42%)
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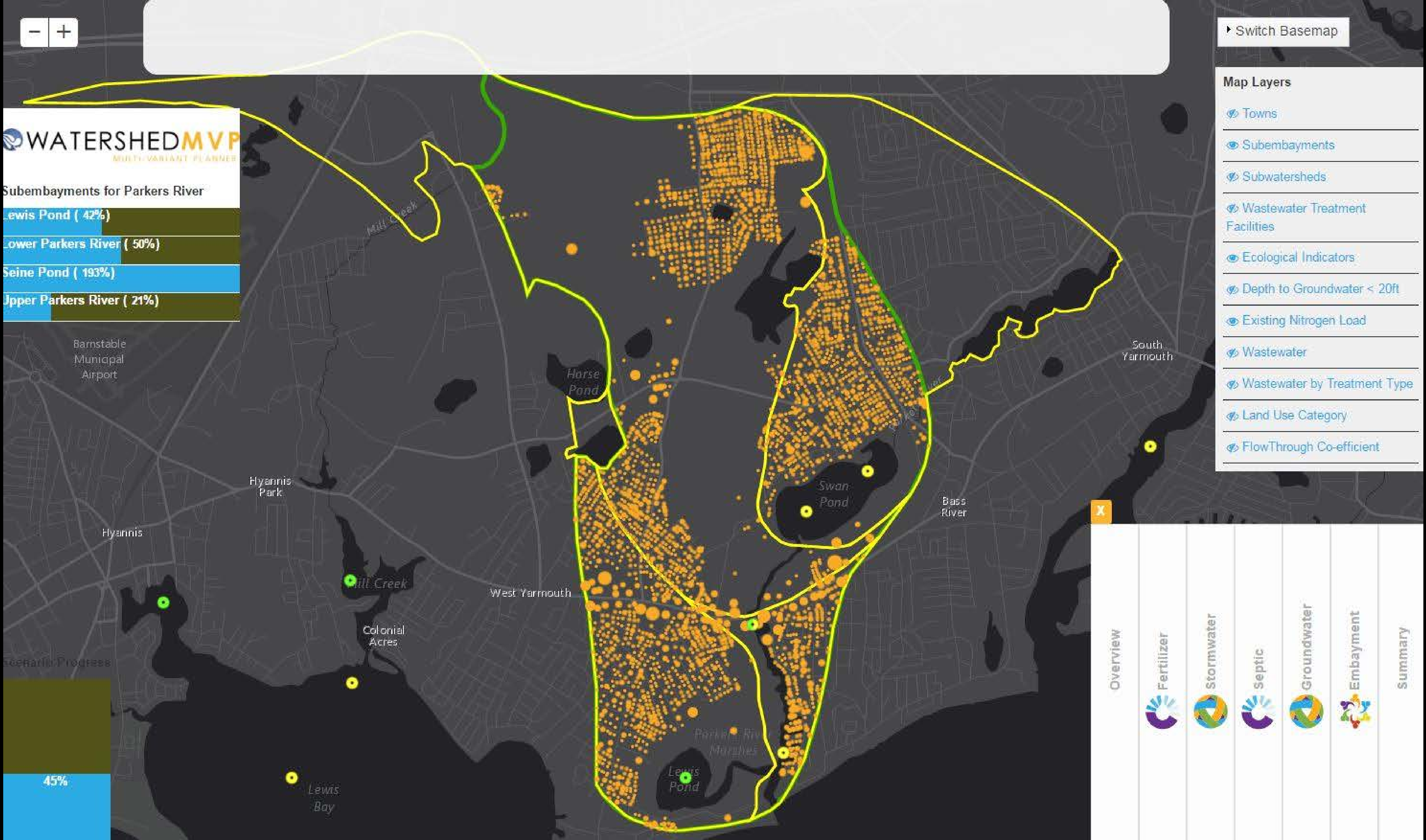
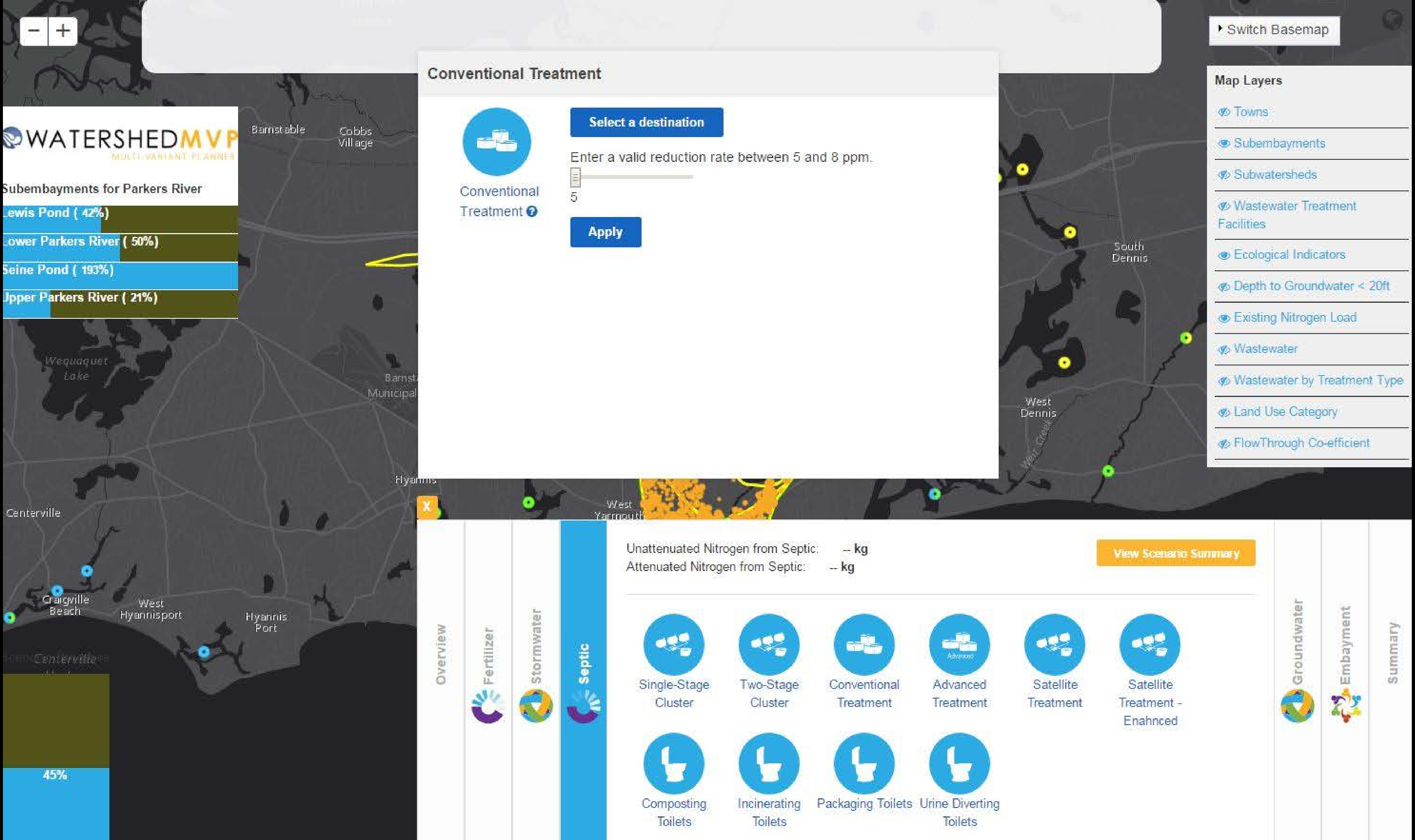
eine Pond (5220%)
pper Parkers River (28%)
Map Layers
Towns
Subembayments
Subwatersheds
Wastewater Treatment Facilities
Ecological Indicators
Depth to Groundwater < 20ft
Existing Nitrogen Load
Wastewater
Wastewater by Treatment Type
Land Use Category
FlowThrough Co-efficient
Mill Creek
Horse Pond
South Yarmouth
Dennis
nstable
nicipal
rport
Hyannis Park
Hyannis
Colonial Acres
cenario Progress
45%
X
Overview
Fertilizer
Stormwater
Unattenuated Nitrogen from Stormwater: 3400kg
Attenuated Nitrogen from Stormwater: 2428kg
View Scenario Summary
BMPs
Stormwater Management
Gravel Wetland
Bioretention/Soil Media Filters
Phytobuffers
Vegetated Swale
Constructed Wetlands
Septic
Groundwater
Embayment
Summary


Switch Basemap
WATERSHEDMVP
MULTI-VARIANT PLANNER
Subembayments for Parkers River
Lewis Pond (42%)
Lower Parkers River (50%)
Seine Pond (193%)
Upper Parkers River (21%)
Scenario Progress
45%
Map Layers
Towns
Subembayments
Subwatersheds
Wastewater Treatment Facilities
Ecological Indicators
Depth to Groundwater < 20ft
Existing Nitrogen Load
Wastewater
Wastewater by Treatment Type
Land Use Category
FlowThrough Co-efficient
Overview
Fertilizer
Stormwater
Septic
Groundwater
Embayment
Summary
Barnstable Municipal Airport
Hyannis Park
Hyannis
Mill Creek
West Yarmouth
Colonial Acres
Lewis Bay
Horse Pond
Swan Pond
Lewis Pond
Parkers River Marshes
Bass River
South Yarmouth



Switch Basemap
Conventional Treatment
Select a destination
Enter a valid reduction rate between 5 and 8 ppm.
5
Apply
Conventional Treatment
Map Layers
Towns
Subembayments
Subwatersheds
Wastewater Treatment Facilities
Ecological Indicators
Depth to Groundwater < 20ft
Existing Nitrogen Load
Wastewater
Wastewater by Treatment Type
Land Use Category
FlowThrough Co-efficient
WATERSHEDMVP
MULTI-VARIANT PLANNER
Subembayments for Parkers River
Lewis Pond (42%)
Lower Parkers River (50%)
Seine Pond (193%)
Upper Parkers River (21%)
Barnstable
Cobbs Village
South Dennis
West Dennis
Wequaquet Lake
Centerville
Craigville Beach
West Hyannisport
Hyannis Port
Hyannis
West Yarmouth
45%
X
Unattenuated Nitrogen from Septic: -- kg
Attenuated Nitrogen from Septic: -- kg
View Scenario Summary
Overview
Fertilizer
Stormwater
Septic
Groundwater
Embayment
Summary
Single-Stage Cluster
Two-Stage Cluster
Conventional Treatment
Advanced Treatment
Satellite Treatment
Satellite Treatment - Enahnced
Composting Toilets
Incinerating Toilets
Packaging Toilets
Urine Diverting Toilets

Scenario Planning

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Tom Cambareri, Cape Cod Commission

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Book End Scenarios

Popponesset Bay
Waquoit Bay

Effluent Disposal Inside Watershed
&
Effluent Disposal Outside Watershed

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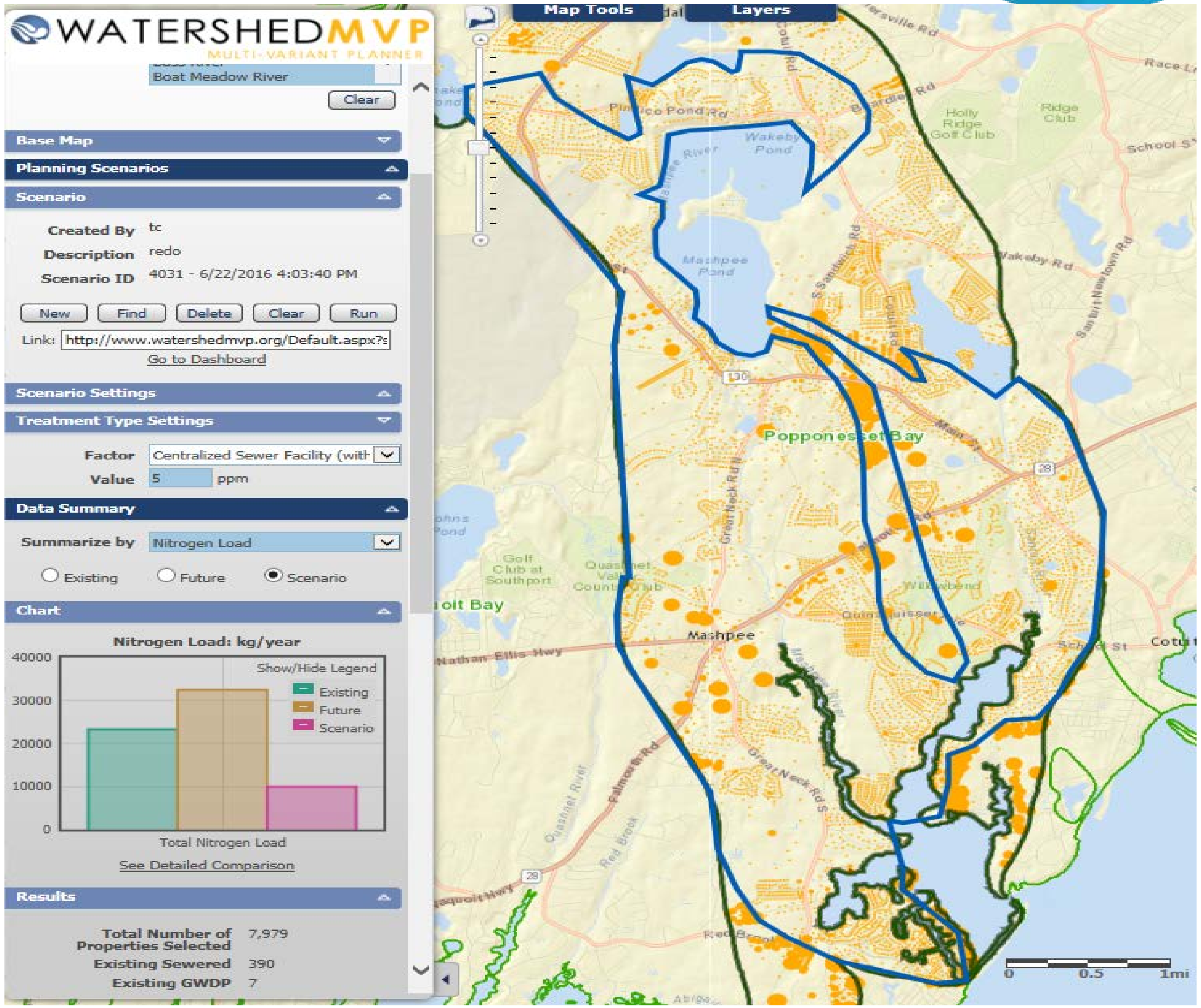
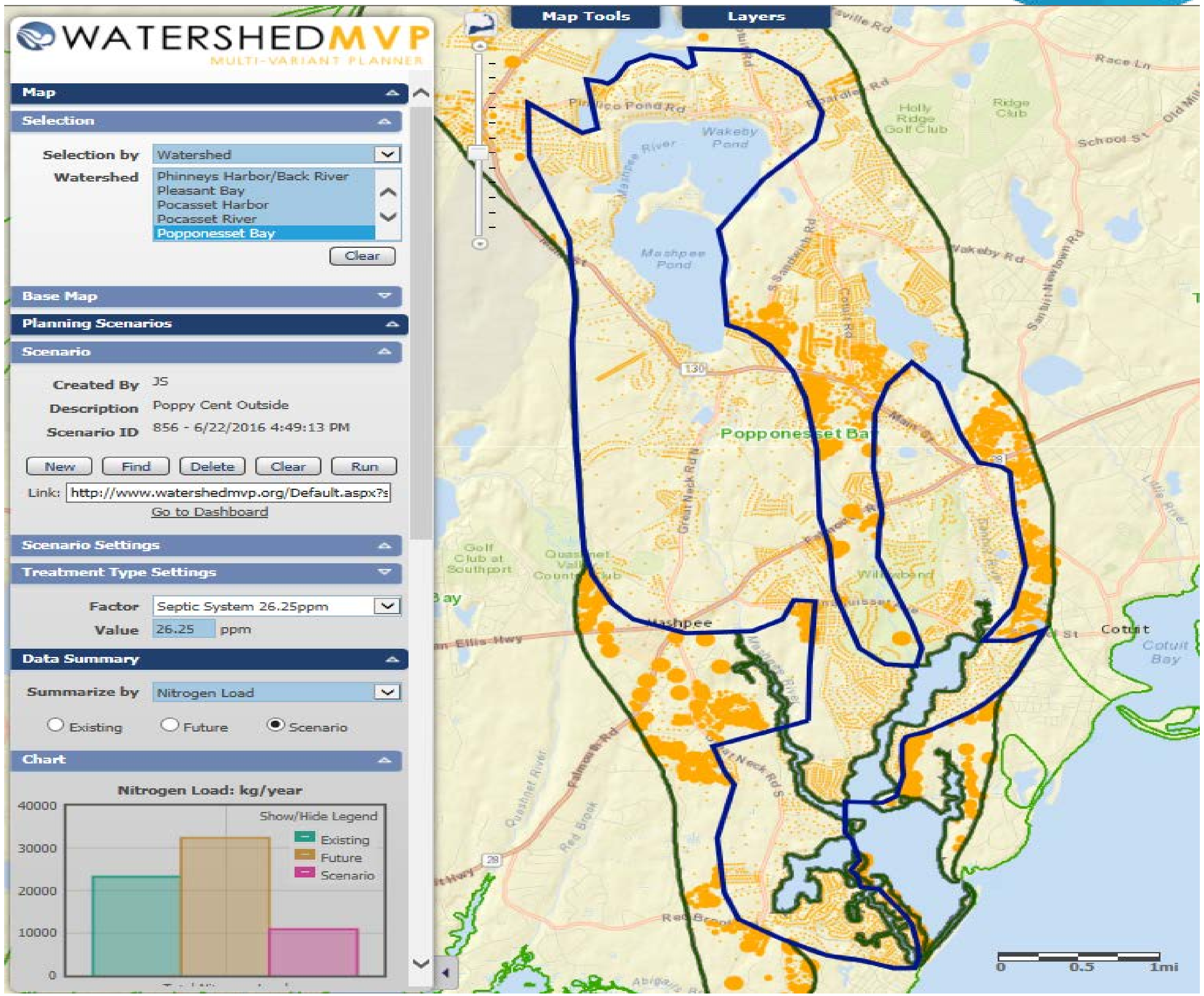


Bookend
Centralized Treatment Approaching the TMDL Compliance

Inside Effluent Disposal



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Bookend
Centralized Treatment
Achieving TMDL Compliance

Outside Effluent Disposal

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Mashpee Scenarios

208 Plan Appendix 8C Allocation of Responsibility for

- Popponesset Bay (79% Existing Load)
- Waquoit Bay (43% Existing Load)
- Three Bays (de minimus)
- Green Pond (de minimus)
- Bournes Pond (de minimus)

208 Plan Appendix 8C Allocation of Responsibility for Existing Attenuated Load

POPPONESSET BAY

SUBEMBAYMENT: LOWER MASHPEE RIVER

Unattenuated Load (kg.)	Attenuated Load (kg.)	Threshold (kg.)	Reduction Target (kg.)	Percent Contribution	Kilogram Responsibility	Additional Contributing Towns
19,624	10,869	5,092	5,777	91%	5,243	Sandwich (9%)

SUBEMBAYMENT: OCKWAY BAY

Unattenuated Load (kg.)	Attenuated Load (kg.)	Threshold (kg.)	Reduction Target (kg.)	Percent Contribution	Kilogram Responsibility	Additional Contributing Towns
1,240	1,240	277	963	100%	963	N/A

SUBEMBAYMENT: POPPONESSET BAY

Unattenuated Load (kg.)	Attenuated Load (kg.)	Threshold (kg.)	Reduction Target (kg.)	Percent Contribution	Kilogram Responsibility	Additional Contributing Towns
630	630	664	N/A	65%	N/A	Barnstable (35%)

MASHPEE: Subembayment Watersheds

SUBEMBAYMENT: POPPONESSET CREEK

Unattenuated Load (kg.)	Attenuated Load (kg.)	Threshold (kg.)	Reduction Target (kg.)	Percent Contribution	Kilogram Responsibility	Additional Contributing Towns
1,892	1,892	347	1,545	100%	1,545	N/A

SUBEMBAYMENT: SHOESTRING BAY

Unattenuated Load (kg.)	Attenuated Load (kg.)	Threshold (kg.)	Reduction Target (kg.)	Percent Contribution	Kilogram Responsibility	Additional Contributing Towns
22,931	12,947	7,194	5,753	59%	3,386	Barnstable (32%), Sandwich (9%)

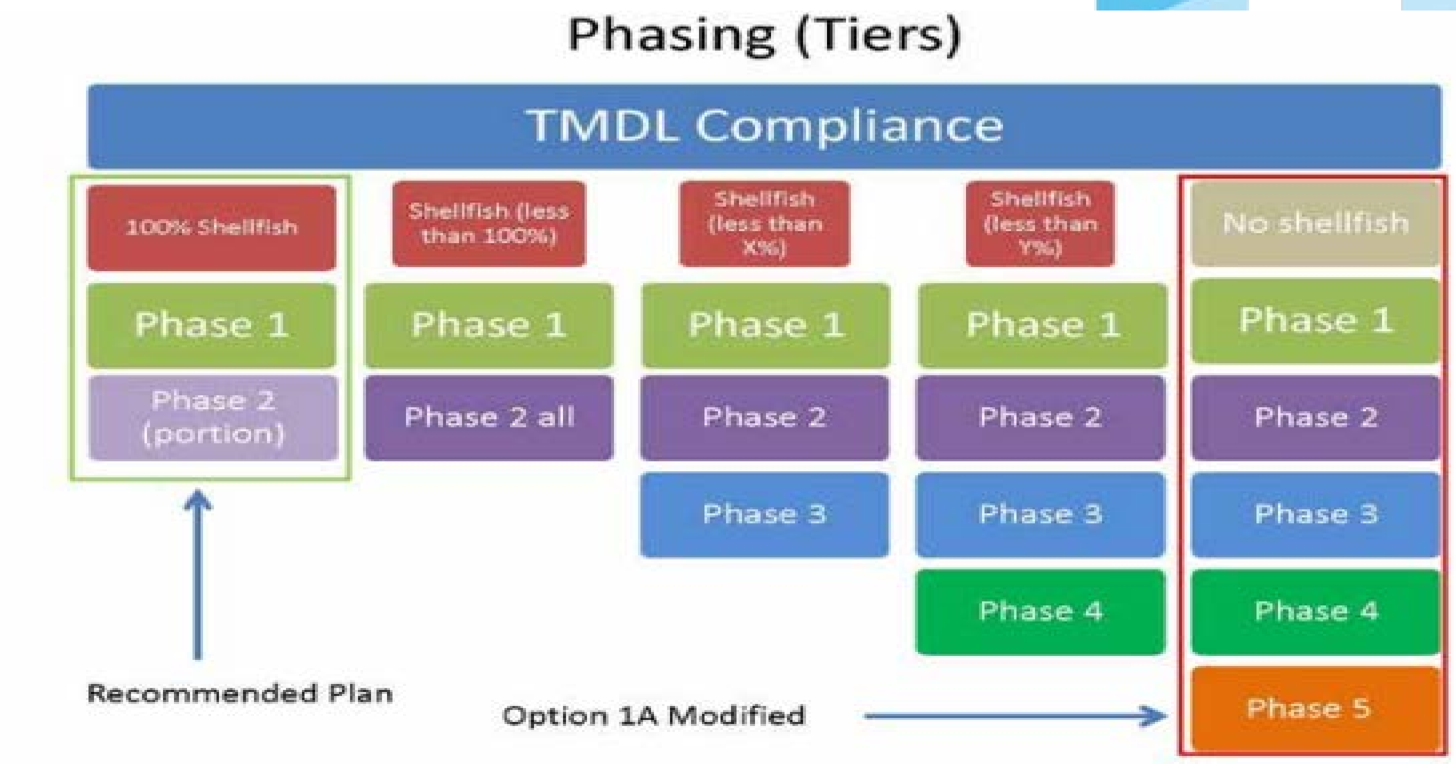

Figure 9-3 Implementation Plan Phasing to Achieve TMDLs

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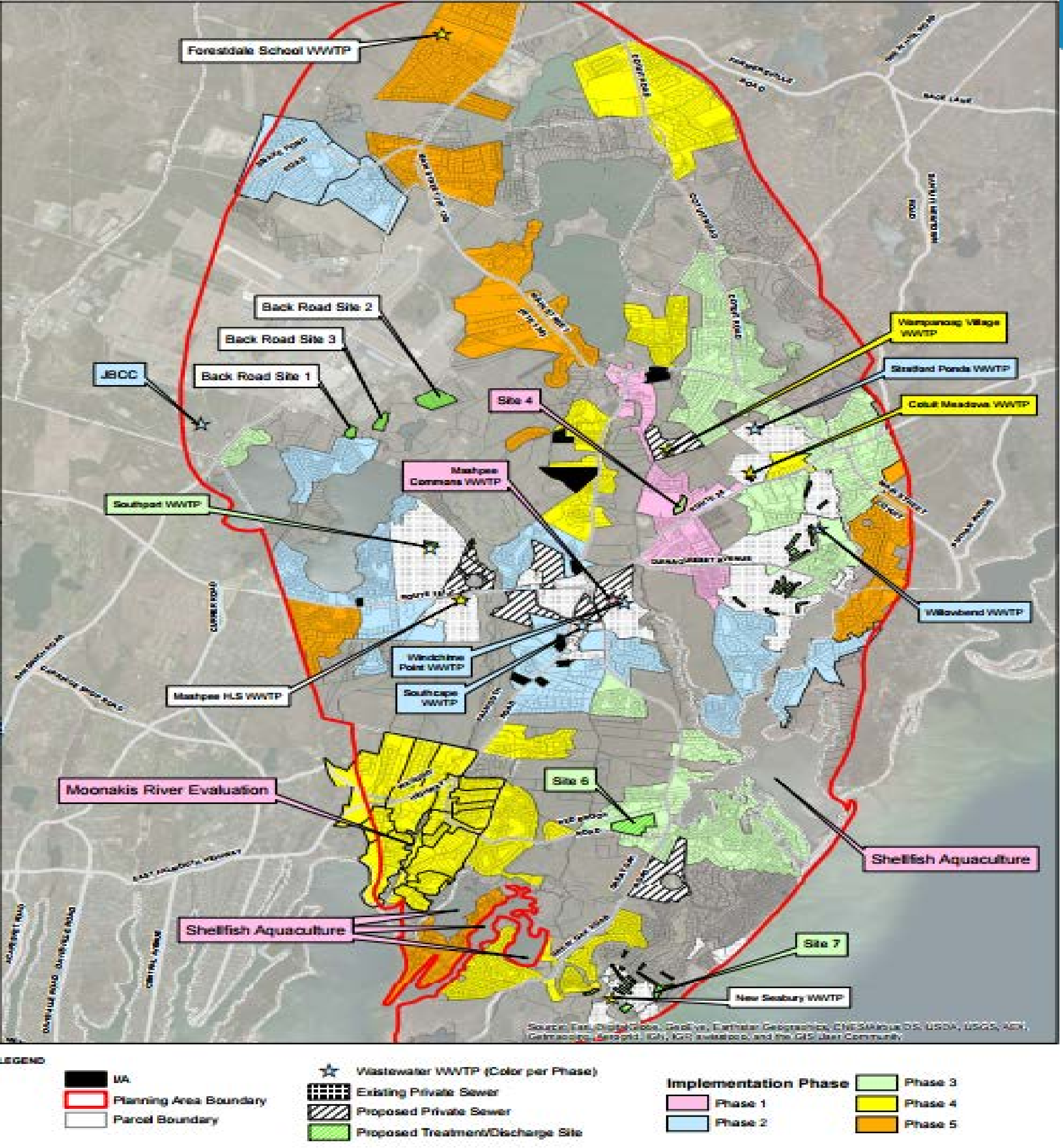
Mashpee CWMP Recommended Plan

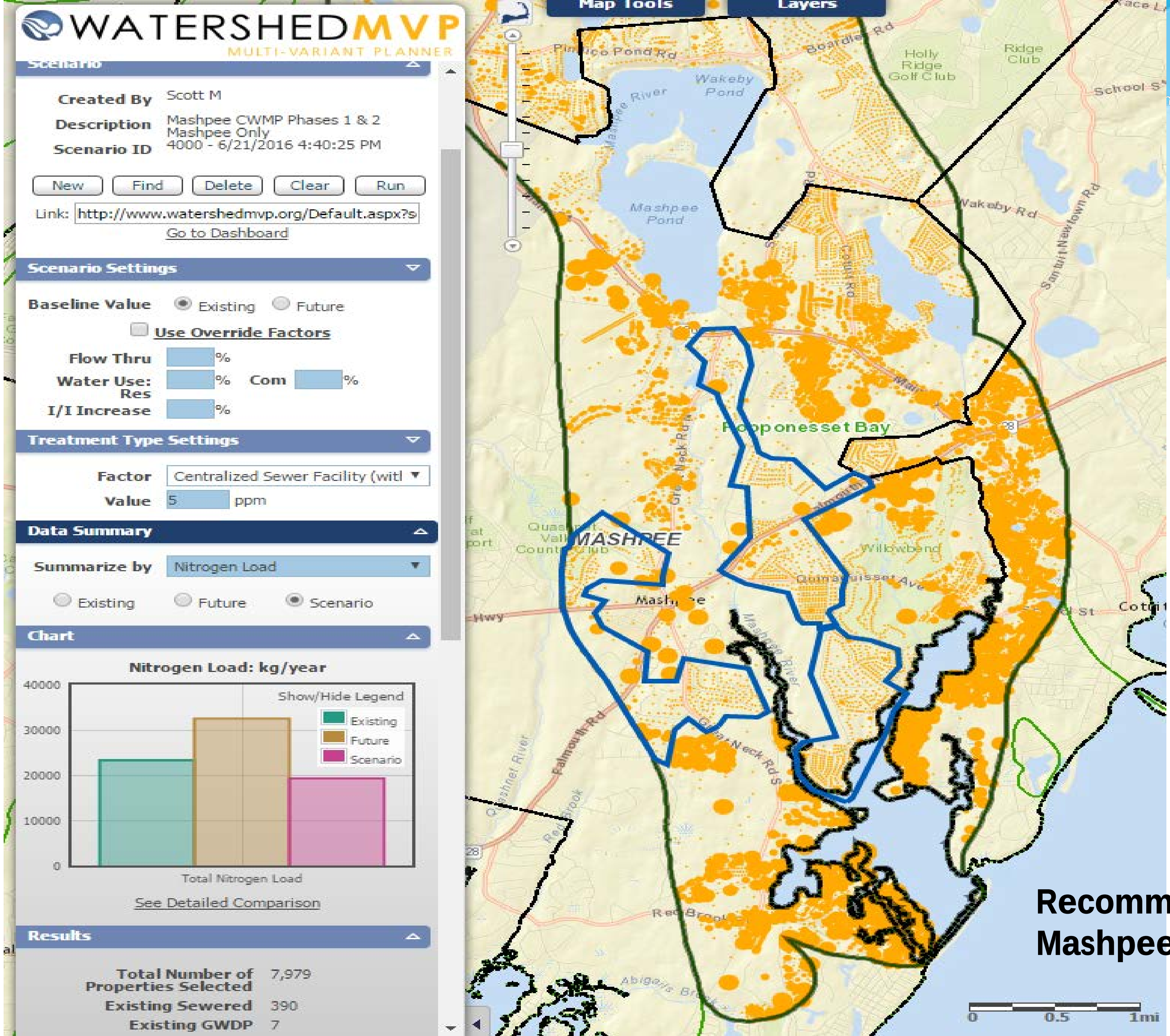
- **Aquaculture,**
- **Phases 1 Sewering, and**
- **Phase 2 Sewering (portion)**



Example Watershed Tracker

Poppy	
% Method	**Kg/Yr**
Septic WW Load	24,117
Excess Nitrogen	13,892
Goal Net Reduction	10,224
Scenario N after EA	18,281
Remaing Excess	8,056
% Remaining	58%
Kg Method	
Septic WW Load	24,117
Excess Nitrogen	16,715
Goal Net Reduction	7,402
Scenario N after EA	18,281
Remaing Excess	10,879
% Remaining	65%
Mashpee River	%
MEP Septic Target	100%
Septic WW Load	3,672
Excess Septic	3,672
Goal Net Reduction	0
Scenario WW after EA	1,944
Remaing Excess	1,944
	Kg
MEP Septic Target	0
Septic WW Load	3,672
Excess Septic	3,672
Goal Net Reduction	0
Scenario WW after EA	1,944
Remaing Excess	1,944
Quaker Run	%
MEP Septic Target	0%
Septic WW Load	2,362
Excess Septic	0
Goal Net Reduction	2,362
Scenario WW after EA	2,306
Remaing Excess	-56
	Kg
MEP Septic Target	1,712
Septic WW Load	2,362
Excess Septic	651
Goal Net Reduction	1,712
Scenario WW after EA	2,306
Remaing Excess	595

Sub-Watershed (Disposal Sites Highlighted)		Flow Through Coeff.	Development of WW Load: Existing Unattenuated Septic Load kg-N/yr *#from MVP*	Development of WW Load: WW Load kg-N/yr	Treated WW Return Load kg-N/yr	Wastewater-Phase 1: Collected WW Load for Export kg-N/yr	Wastewater-Phase 2: Collected WW Load for Export kg-N/yr	Wastewater-Phase 3: Collected WW Load for Export kg-N/yr	Wastewater-Phase 4: Collected WW Load for Export kg-N/yr	Wastewater-Phase 5: Collected WW Load for Export kg-N/yr
						Unattenuated 2,615.00	Unattenuated 3,953.00	Unattenuated 0.00	Unattenuated 0.00	Unattenuated 0.00
Lower Mashpee River LT10	Atten	1.000		2,066	0.0	254	612	0	0	0
	UnAtten		2,066	2,066	0.0	254	612			
Lower Mashpee River GT10	Atten	1.000		1,606	0.0	0	862	0	0	0
	UnAtten		1,606	1,606	0.0		862			
Snake Pond LT10	Atten	0.004		0	0.0	0	0	0	0	0
	UnAtten		102	102	0.0					
Snake Pond GT10	Atten	0.004		0	0.0	0	0	0	0	0
	UnAtten		0	0	0.0					
Pimlico Pond LT10	Atten	0.013		6	0.0	0	0	0	0	0
	UnAtten		445	445	0.0					
Pimlico Pond GT10	Atten	0.013		13	0.0	0	0	0	0	0
	UnAtten		1,005	1,005	0.0					
Peters Pond LT10	Atten	0.013		7	0.0	0	0	0	0	0
	UnAtten		595	595	0.0					
Peters Pond GT10	Atten	0.013		20	0.0	0	0	0	0	0
	UnAtten		1,583	1,583	0.0					
Mashpee-Wakeby Pond LT10	Atten	0.025		76	0.0	0	0	0	0	0
	UnAtten		3,047	3,047	0.0					
Mashpee-Wakeby Pond GT10 E	Atten	0.025		26	0.0	0	0	0	0	0
	UnAtten		1,039	1,039	0.0					
Mashpee-Wakeby Pond GT10 W	Atten	0.025		43	0.0	0	0	0	0	0
	UnAtten		1,722	1,722	0.0					
Quaker Run	Atten	1.000		1,486	0.0	56	0	0	0	0
	UnAtten		1,486	1,486	0.0	56				
Quaker Run Wells	Atten	1.000		685	0.0	0	0	0	0	0
	UnAtten		685	685	0.0	0				



Recommended Plan
Mashpee Phases I & II

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Phase 1 & 2 Sewering Only plus Aquaculture Effluent Disposal Inside Watersheds

	208 Plan Reduction Targets	Septic Load Reduction	Aquaculture Load Reduction	Remaining Reduction Targets after Mashpee CWMP Interventions (kg/yr)	% Change
Popponesset Bay					
Mashpee River	5,243	2,783	2,500	-40	101%
Ockway Bay	963	0	870	93	90%
Popponesset Bay	0	61	0	-61	0%
Popponesset Creek	1,545	0	1,460	85	94%
Shoestring Bay	3,386	1,404	2,000	-18	101%
Popponesset System Totals	**11,137**	**4,248**	**6,830**	**59**	**99%**

Back pocket

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Watershed Name: **POPPONESSETBAY-MASHPEE**

Existing flow in MGD	0.69	wastewater from wMVP3.0 database (Mashpee only)
Existing attenuated nitrogen load in kg/	21100	attenuated from Appendix 8C (Mashpee only)
Buildout flow in MGD	0.97	wastewater from wMVP3.0 database (Mashpee only)
Buildout attenuated nitrogen load in kg	28400	existing load plus future septic additions (using wMVP 2.0; no future fertilizer/stormwater additions)

Scenario Name	Name of Technology	Credits: % Reduction	Credits: Nitrogen kg/year removal	Traditional Technologies: Number of properties sewered	Traditional Technologies: Flow Collected in MGD	Traditional Technologies: Nitrogen kg/year removal (attenuated)	Traditional Technologies: Cost per kilogram	Traditional Technologies: Total 20 year Present Worth ($ million)~~cost~~	Non-Traditional Technologies: Amount of tech applied	Non-Traditional Technologies: Unit metric	Non-Traditional Technologies: Nitrogen kg/year removal	Non-Traditional Technologies: Cost per kilogram	Non-Traditional Technologies: Total 20 year cost ($million)	Notes
				Phases I & II sewering, aquaculture only										
TRADITIONAL SCENARIO IN														
Traditional Technology 1:	Centralized Sewer (with disposal inside the watershed)	134	gpd/property	1170	0.157	4,110	1,170	95.9						Prorata buildout cost, Mashpee only; cost from CWMP, prorated us
Traditional Technology etc:						4,048		94.7						Treatment capital cost and O&M Present Worth (5% discount) calcu
						MVP Phases I & II polygons Δ < 5%								
TRADITIONAL SCENARIO OUT														
Traditional Technology 1:	Centralized Sewer (with disposal outside the watershed)													
Traditional Technology etc:														
NON-TRADITIONAL SCENARIO														
Credit:	Fertilizer													
Credit:	Stormwater													
Non-Traditional Technology 1:	Fertigation - Golf Course													
Non-Traditional Technology 2:	PRB													
Non-Traditional Technology 3:	Urine Diverting Toilets													
Non-Traditional Technology 4:	Aquaculture								16.32 mil.	# shellfish	6,830	$126	17.17	
Non-Traditional Technology 5:									16.32				1.38	
Non-Traditional Technology 6:														
Non-Traditional Technology 7:														
Non-Traditional Technology 8:														
											Phase1_wAquaculture_PoppyTracker.x			
Mashpee CWMP Recommended Plan (Phase I & II aquaculture hybrid)														
						11,080	510	113.1						Mashpee CWMP Capital cost and O&M Aquaculture Present Worth
							439	97.3						1st Year Aquaculture Cost Only

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Heather McElroy, Cape Cod Commission

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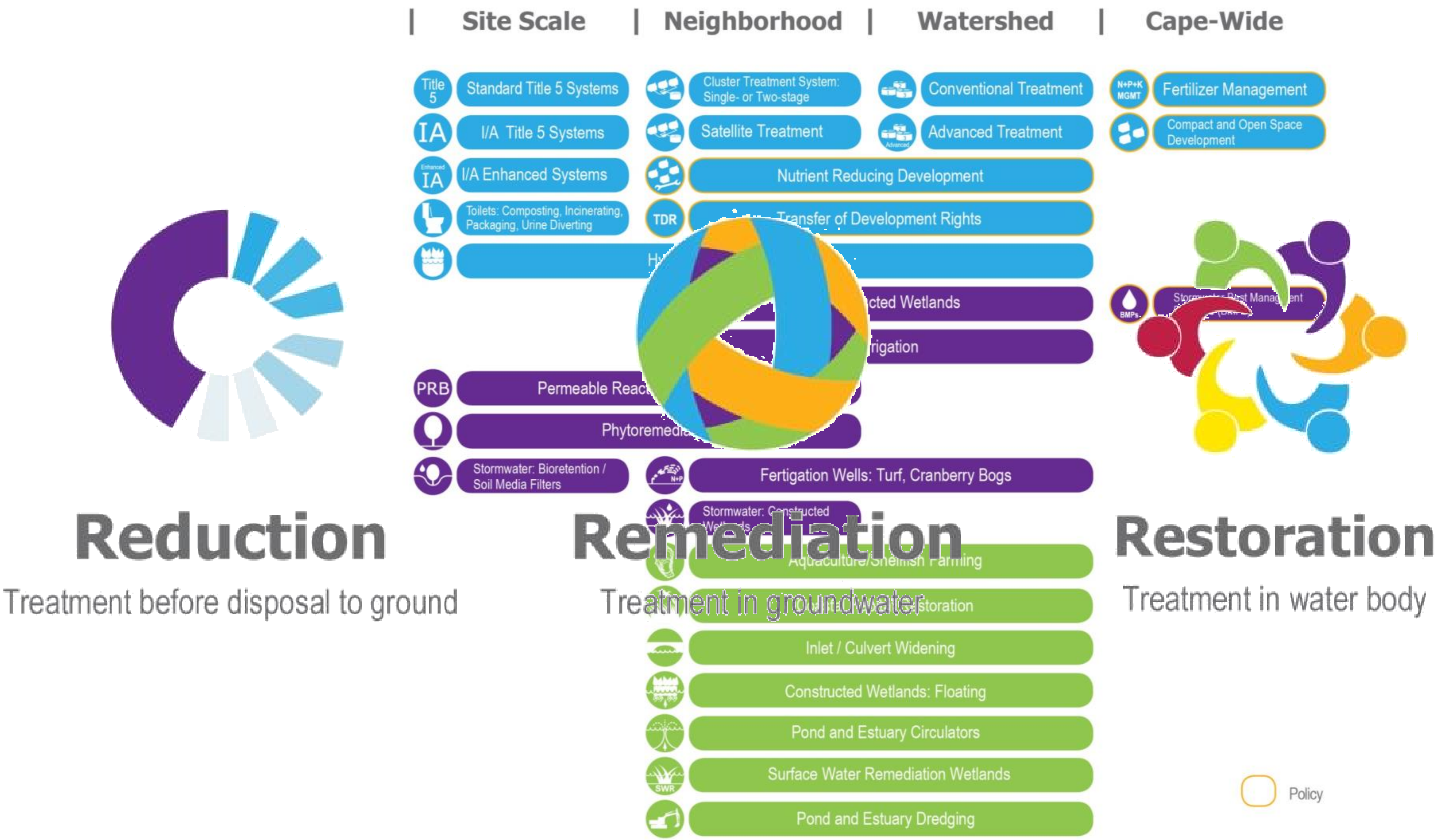
CAPE COD

TECHNOLOGIES MATRIX

Heather McElroy
Natural Resources Specialist, Cape Cod Commission


| Site Scale | Neighborhood | Watershed | Cape-Wide
Title 5
Standard Title 5 Systems
IA
I/A Title 5 Systems
Enhanced IA
I/A Enhanced Systems
Toilets: Composting, Incinerating, Packaging, Urine Diverting
Cluster Treatment System: Single- or Two-stage
Satellite Treatment
Nutrient Reducing Development
TDR
Transfer of Development Rights
Conventional Treatment
Advanced
Advanced Treatment
N+P+K MGMT
Fertilizer Management
Compact and Open Space Development
cted Wetlands
rigation
BMPs
PRB
Permeable Reac
Phytoremedia
Stormwater: Bioretention / Soil Media Filters
N+P
Fertigation Wells: Turf, Cranberry Bogs
Stormwater: Constructed
Aquaculture/Shellfish Farming
storation
Inlet / Culvert Widening
Constructed Wetlands: Floating
Pond and Estuary Circulators
SWR
Surface Water Remediation Wetlands
Pond and Estuary Dredging
Reduction
Treatment before disposal to ground
Remediation
Treatment in groundwater
Restoration
Treatment in water body
Policy

TECHNOLOGIES MATRIX

EXPLORE

Instructions: Select a category to filter the technologies. Drag treatments to the Compare box to compare technologies. Click on a technology to see details.

Filter by Scale

Site | Neighborhood | Watershed | Cape-Wide

Clear Filters to View All

Drag treatments to compare

Compare

Reset

Reduction
Treatment before disposal to ground

- Hydroponic Treatment
- Toilets: Composting
- Toilets: Incinerating
- Toilets: Packaging
- Toilets: Urine Diverting
- Fertilizer Management
- Remediation of Existing Development
- Compact and Open Space Development
- Transfer of Development Rights
- Title 5 Septic System Replacement (Base Line Condition)
- Innovative/Alternative (I/A) Systems
- Innovative/Alternative (I/A) Enhanced Systems
- Cluster Treatment System - Single-stage
- Cluster Treatment System - Two-stage
- Conventional Treatment
- Advanced Treatment
- Satellite Treatment
- Satellite Treatment - Enhanced

Remediation
Treatment in groundwater

- Constructed Wetlands - Surface Flow
- Constructed Wetlands - Subsurface Flow
- Constructed Wetlands - Groundwater Treatment
- Phytoirrigation
- Stormwater BMP Phytobuffers
- Stormwater BMP - Vegetated Swale
- Stormwater BMP - Gravel Wetland
- Stormwater: Bioretention / Soil Media Filters
- Stormwater: Constructed Wetlands
- Phytoremediation
- Permeable Reactive Barriers (PRBs) - Trench Method(Aquifer Thickness - 30 feet)
- Permeable Reactive Barriers (PRBs) - Injection Well Method(Aquifer Thickness - 30 feet)
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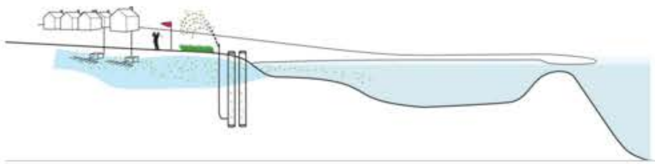
- Permeable Reactive Barriers (PRBs) - Injection Well Method(Aquifer Thickness - 60 feet)
- Fertigation Wells - Turf
- Fertigation Wells - Cranberry Bogs
- Stormwater BMPs

Restoration
Treatment in water body

- Aquaculture - Shellfish Cultivated in Estuary Bed
- Aquaculture - Shellfish Cultivated Above Estuary Bed
- Aquaculture - Mariculture
- Inlet / Culvert Widening
- Coastal Habitat Restoration
- Floating Constructed Wetlands
- Pond and Estuary Circulators
- Surface Water Remediation Wetlands
- Pond and Estuary Dredging

Fertigation Wells - Turf



Innovative and Resource-Management Technologies

Scale: Neighborhood, Watershed

Nitrogen Removal

Phosphorus Removal

Description

Fertigation consists of capturing nitrogen enriched groundwater using irrigation wells and using it to irrigate plants that use the nitrogen. Fertigation wells can capture nutrient enriched groundwater, typically from a WWTF discharge, and recycle it back to irrigated and fertilized turf grass areas. These irrigated areas include golf courses, athletic fields and lawns. Fertigation can significantly reduce nutrient loads to down-gradient surface waters while reducing fertilizer costs to the irrigated areas.

Advantages/Disadvantages

Monitoring

Other Characteristics

TECHNOLOGIES MATRIX

CAPE COD COMMISSION

EXPLORE

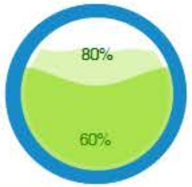
- Const. Wetland
- Aquaculture
- Turf Fert. Well
- I/A System

Fertigation Wells - Turf

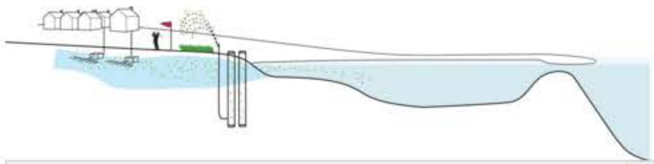
Innovative and Resource-Management Technologies

Scale: Neighborhood, Watershed

Nitrogen Removal



Phosphorus Removal



Description

Advantages/Disadvantages

Advantages

- Relatively low capital and operating cost.
- Very little to no above ground structures.
- High removal efficiency.
- Promotes Green Space / Conservation / Recreation.
- Improves Energy Savings / Nutrient Recovery / Recycling.

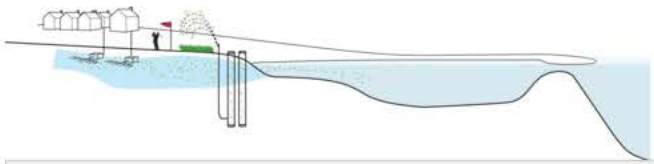
Disadvantages

- Seasonal technology potentially requiring several capture wells to capture entire nutrient plume.
- Most effective in areas where groundwater contains a ""plume"" of high concentration of nutrients (i.e. down gradient of a WWTF discharge, etc.).
- Need an area to irrigate for nutrient uptake.
- May require monitoring.

Monitoring

Other Characteristics

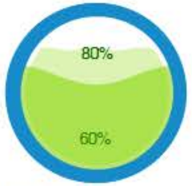
Fertigation Wells - Turf



Innovative and Resource-Management Technologies

Scale: Neighborhood, Watershed

Nitrogen Removal



Phosphorus Removal

Description

Advantages/Disadvantages

Monitoring

Est. Monitoring Eval Cost: $10,000 to $15,000

Est. Monitoring OM Cost: $2,500 to $5,000

Est. Monitoring Years: 2 to 4

Other Characteristics

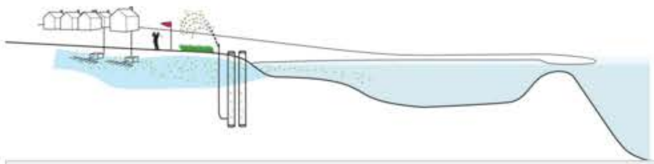
Const. Wetland

Aquaculture

Turf Fert. Well

I/A System

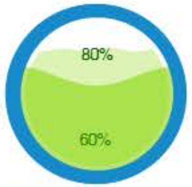
Fertigation Wells - Turf



Innovative and Resource-Management Technologies

Scale: Neighborhood, Watershed

Nitrogen Removal



Phosphorus Removal

Description

Advantages/Disadvantages

Monitoring

Other Characteristics

Siting Requirements:

Fertigation wells should be located down gradient of nutrient source areas such as wastewater treatment plant disposal fields and compact development.

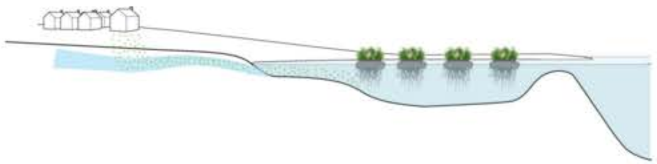
They can also be positioned down gradient of high-density subdivisions where they might capture nutrients derived from both septic systems and residential lawns.

The specific locations, depths and diameters can be optimized using standard hydrogeologic principles.

Useful Life (Years): 20

Time for Results (Years): 1 to 10

Floating Constructed Wetlands



System Alterations

Scale: Neighborhood, Watershed

Nitrogen Removal

Phosphorus Removal

Description

FCWs are manmade floating islands that act as floating wetlands that treat waters within ponds and estuaries. The islands are made of recycled materials that float on ponds or estuaries, exposing the plant's roots to the pond and estuarine waters. The root zones provide habitat for fish and microorganisms while reducing nitrogen and phosphorus levels. The floating islands can also be designed to allow shellfish and seaweed to grow which can be harvested, offsetting some of the systems costs. Some systems circulate surface water through the island, exposing the water to the root zones of the plants. The islands can be installed with shellfish beds and/or salt marsh grasses potentially assisting with their establishment. The islands are generally stationary and can be installed with walkways to access and maintain the plants growing on the islands. The islands require little O&M and do not need to be removed during the winter months, even if freezing water is a concern.

Advantages/Disadvantages

Monitoring

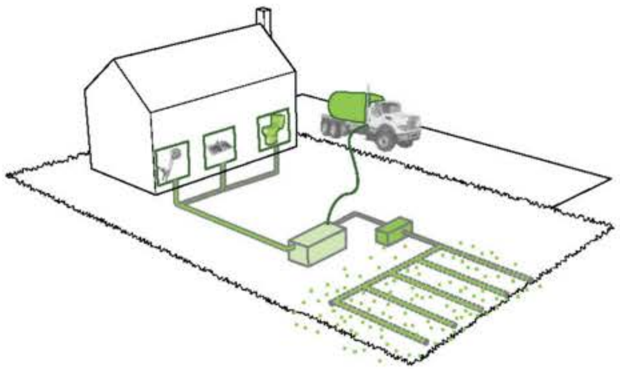
Other Characteristics

Innovative/Alternative (I/A) Enhanced Systems

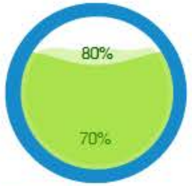
Enhanced IA

On-Site Treatment Systems

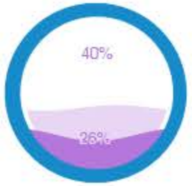
Scale: Site



Nitrogen Removal



Phosphorus Removal



Description

Enhanced I/A systems for TMDL compliance. Enhanced I/A (RSF Equivalent) to achieve 50% would definitely require chemical systems to reliably meet such limits that would target near 10 mg/L for TN to consistently meet design of 13 mg/L. Nitrogen levels are typically treated to 10 to 13 mg/L.

Advantages/Disadvantages

Monitoring

Other Characteristics

TECHNOLOGIES MATRIX

EXPLORE

Instructions: Select a category to filter the technologies. Drag treatments to the Compare box to compare technologies. Click on a technology to see details.

Filter by Scale

Site | Neighborhood | Watershed | Cape-Wide

Clear Filters to View All

Drag treatments to compare

Compare

Reset

Reduction

Treatment before disposal to ground

- Hydroponic Treatment
- Toilets: Composting
- Toilets: Incinerating
- Toilets: Packaging
- Toilets: Urine Diverting
- Fertilizer Management
- Remediation of Existing Development
- Compact and Open Space Development
- Transfer of Development Rights
- Title 5 Septic System Replacement (Base Line Condition)
- Innovative/Alternative (I/A) Systems
- Innovative/Alternative (I/A) Enhanced Systems
- Cluster Treatment System - Single-stage
- Cluster Treatment System - Two-stage
- Conventional Treatment
- Advanced Treatment
- Satellite Treatment
- Satellite Treatment - Enhanced

Remediation

Treatment in groundwater

- Constructed Wetlands - Surface Flow
- Constructed Wetlands - Subsurface Flow
- Constructed Wetlands - Groundwater Treatment
- Phytoirrigation
- Stormwater BMP Phytobuffers
- Stormwater BMP - Vegetated Swale
- Stormwater BMP - Gravel Wetland
- Stormwater: Bioretention / Soil Media Filters
- Stormwater: Constructed Wetlands
- Phytoremediation
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- Surface Water Remediation Wetlands
- Pond and Estuary Dredging

Scenario Planning

BREAKOUT SESSION | JUNE 24, 2016

Scott Horsley, Consultant to Cape Cod Commission

Three Bays Non-Traditional Approaches

NITROGEN REDUCTION CALCULATOR

(MEP Watershed) **Name of Estuary** **Three Bay**

MEP Targets and Goals		kg/year	kg/day	kg/day	Nitrogen (kg/yr)
Present Total Nitrogen Load				105.6	38,547
	Controllable Nitrogen Load				
	Wastewater	34,245	93.8		
	Fertilizer	2,868	7.9		
	Stormwater	1,434	3.9		
Target Nitrogen Load				39.3	14,349
Nitrogen Removal Required				**54.5**	**19,896**
Total Number of Properties	9,153				

Low Barrier to Implementation	Percent of Total Removed	Reduction by Technology (Kg/yr)	Remaining to Meet Target (Kg/yr)	Average 20-Year Life Cycle Cost ($/kg N)	Amortized Annual Life Cycle Cost* ($/kg	Total 20-Year Cost (5% interest)
A) Fertilizer Management	25	717	19,179	$483	$39	$346,270
B) Stormwater Mitigation	25	358	18,821	$7,800	$626	$2,795,967

Watershed/Embayment Options	Quantity	Reduction by Technology (Kg/yr)	Remaining to Meet Target (Kg/yr)	Average 20-Year Life Cycle Cost ($/kg N)	Amortized Annual Life Cycle Cost* ($/kg	Total 20-Year Cost (5% interest)
A) Permeable Reactive Barrier (PRB)	5,500 linear feet	3,351	15,470	$7,222	$580	$24,200,000
B) Constructed Wetlands (No Collection System)	4 acres	1,700	13,770	$1,371	$110	$2,330,020
C) Constructed Wetlands (With Collection System)	0 acres	0	13,770	$0	$0	$0
D) Phytoirrigation	0 acres	0	13,770	$32,197	$2,584	$0
E) Phytobuffers	0 acres	0	13,770	$70,349	$5,646	$0
F) Fertigation - Turf	113 acres	326	13,444	$2,978	$239	$971,553
G) Fertigation - Cranberry Bogs	0 acres	0	13,444	$2,604	$209	$0
H) Surface Water Remediation Wetland	0 acres	0	13,444	$12,560	$1,008	$0
I) Dredging/Inlet Widening	66,000 cu. yard	4,012	9,432	$0	$0	$0
J) Phytoremediation	0 acres	0	9,432	$4,249	$341	$0
K) Aquaculture/Oyster Beds	41 acres	10,250	-818	$897	$72	$9,195,480
L) Coastal Habitat Restoration	17 acres	1,404	-2,222	$2,280	$183	$3,201,829
M) Floating Constructed Wetlands	0 cu feet	1,312	-3,534	$162	$13	$212,518

Alternative On-Site Options	Quantity	Reduction by Technology (Kg/yr)	Remaining to Meet Target (Kg/yr)	Average 20-Year Life Cycle Cost ($/kg N)	Amortized Annual Life Cycle Cost* ($/kg	Total 20-Year Cost (5% interest)
A) Ecotoilets (UD & Compost)	88 homes	528	-4,062	$2,928	$235	$1,546,037
B) UD School or Public Facility	0 people	0	-4,062	$2,928	$235	$0
C) I & A Systems	0 homes	0	-4,062	$8,523	$684	$0
D) Enhanced I & A Systems	0 homes	0	-4,062	$13,482	$1,082	$0

	Quantity	Reduction by Technology (Kg/yr)	Remaining to Meet Target (Kg/yr)	Average 20-Year Life Cycle Cost ($/kg N)	Amortized Annual Life Cycle Cost* ($/kg	Total 20-Year Cost (5% interest)
Unattenuated Load Remainder***	0 homes	0	-4,062	0	0	$0

Costs Using Non-Traditional Method	$1,870	$150	$44,799,673

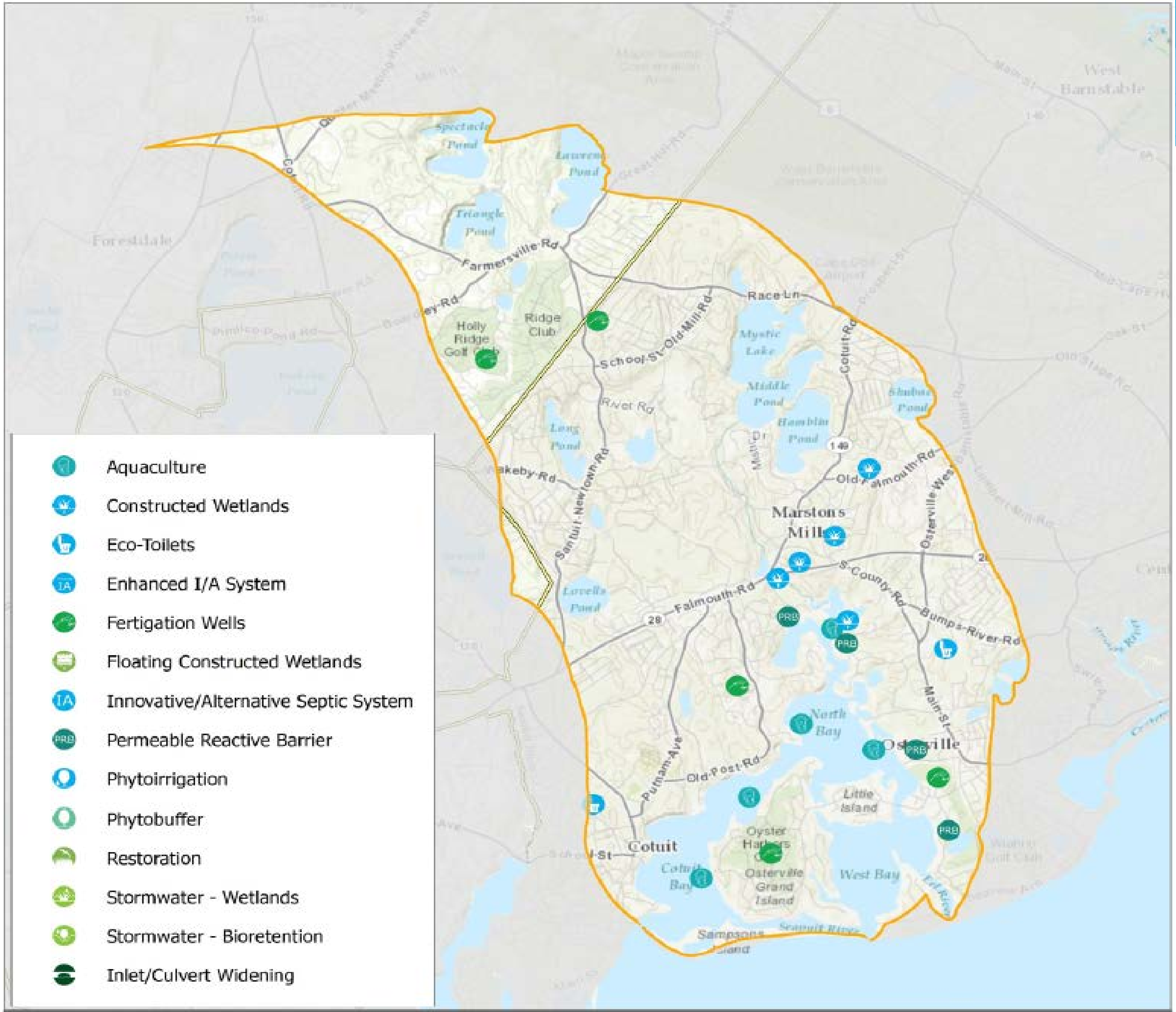
* Amortized at 5% annual interest over 20 years.

** At the time of the report, dredging and/or inlet widening was proposed for Muddy Creek, Parkers River and Three Bays. Costs for these projects were preliminary and should be obtained from the Towns.

SharePoint

one cape

mplementing solutions for clean water



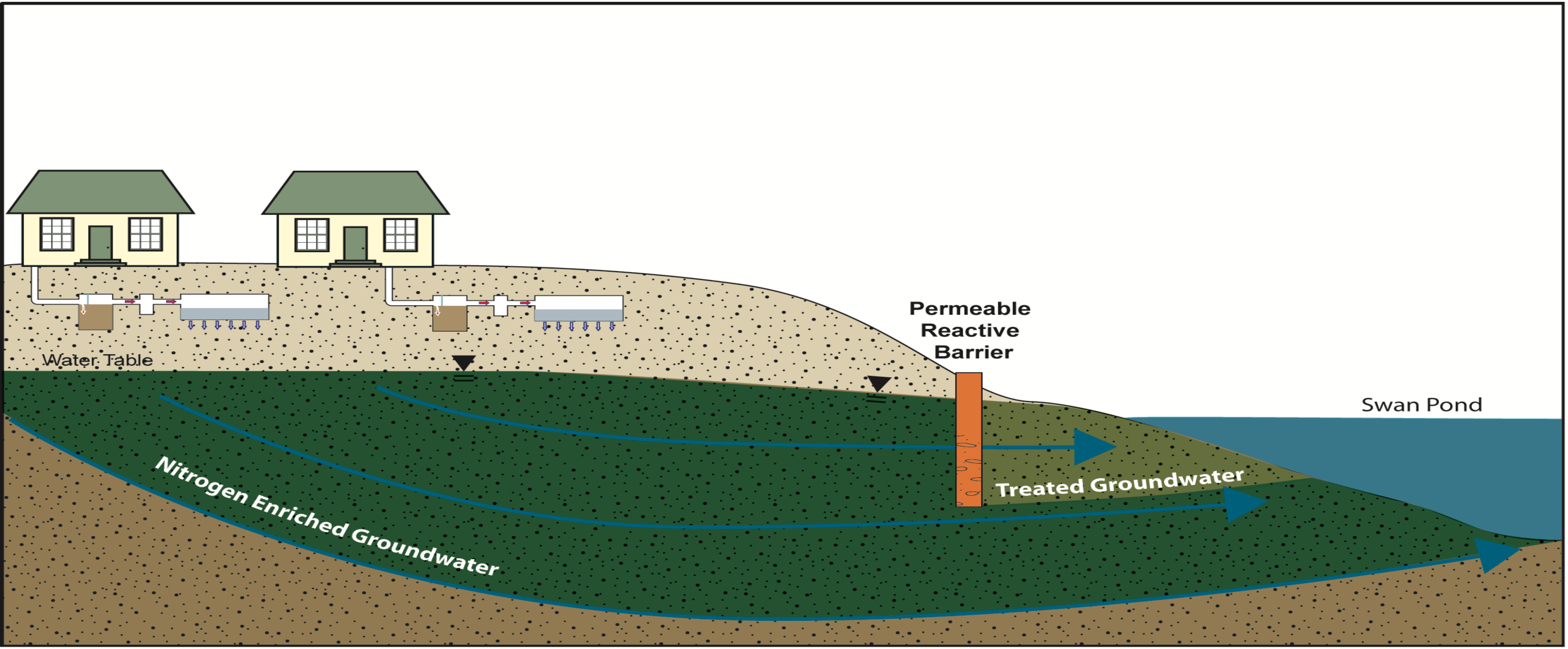
Three Bays -
Non-Traditional Solutions Scenario

Cape-Wide Site Screening Criteria - GIS analysis

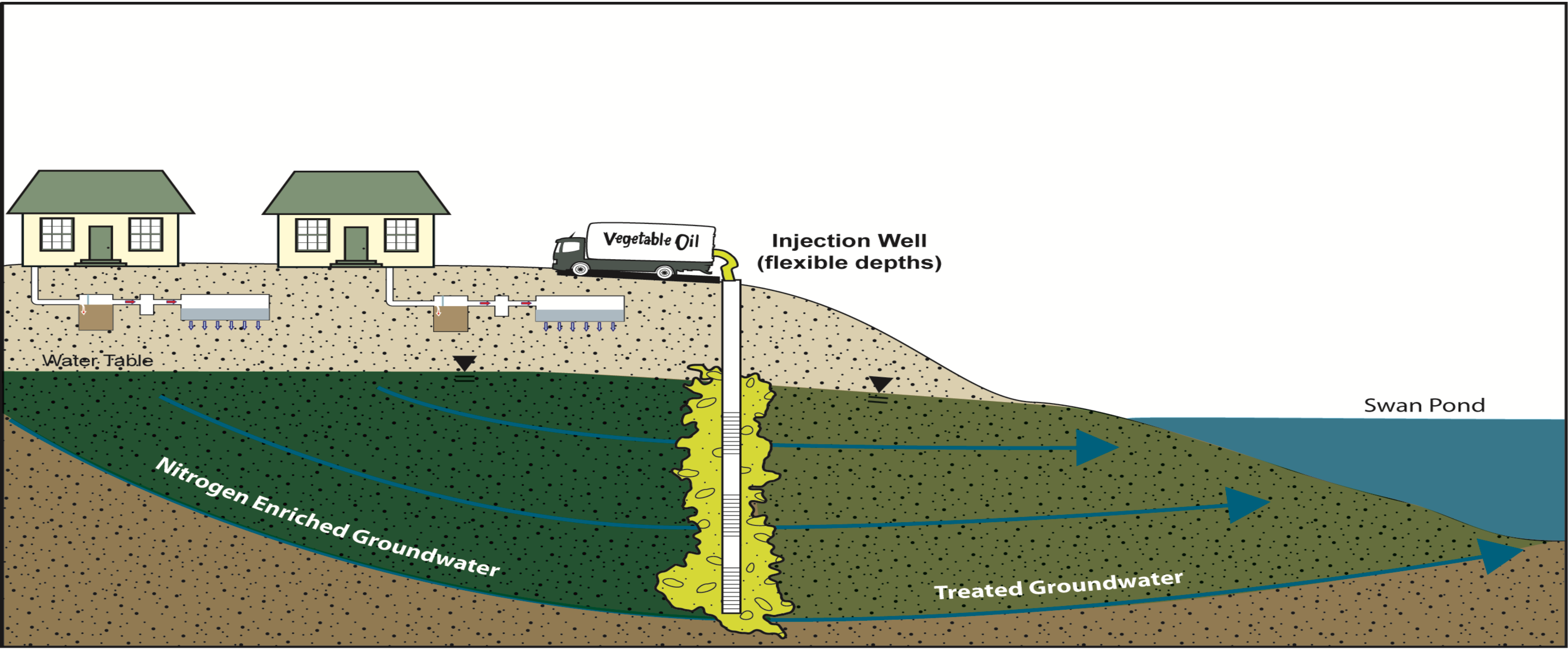
- Criteria developed for several technologies
- Criteria include siting characteristics
- Land use, soil requirements, natural resource considerations, ownership
- Results of screening show areas within a watershed that may be suitable for that technology


Rain Garden

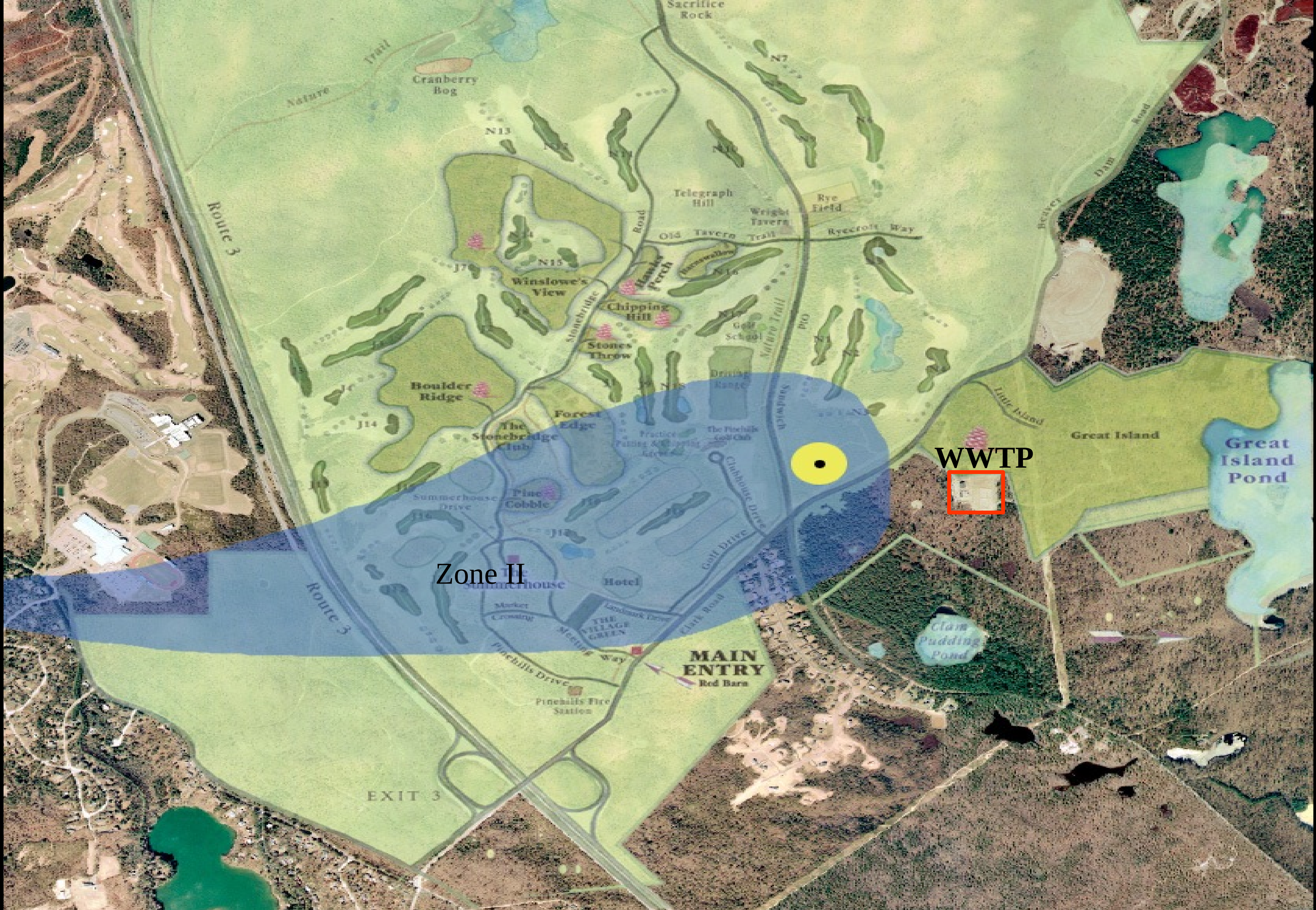
Permeable Reactive Barriers



Permeable Reactive Barriers



Zone II
Sacrifice Rock
Cranberry Bog
Nature Trail
Route 3
Telegraph Hill
Wright Tavern
Rye Field
Old Tavern Trail
Ryecroft Way
Winslowe's View
Chipping Hill
Stones Throw
Boulder Ridge
Forest Edge
The Stonebridge Club
Pine Cobble
Summerhouse Drive
The Summerhouse
Hotel
Market Crossing
Landmark Drive
The Village Green
Meeting Way
Clark Road
Golf Drive
Clubhouse Drive
Pinehills Drive
Pinehills Fire Station
MAIN ENTRY
Red Barn
EXIT 3
Great Island
Little Island
Great Island Pond
Clam Pudding Pond
Beaver Dam Road



WWTP
Zone II
Great Island Pond
Great Island
Clam Pudding Pond
MAIN ENTRY
Red Barn
Route 3
EXIT 3
Boulder Ridge
Forest Edge
The Stonebridge Club
Pine Cobble
Hotel
The Summerhouse
Summerhouse Drive
Clubhouse Drive
Golf Drive
Clark Road
Pinehills Drive
Pinehills Fire Station
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Rye Field
Old Tavern Trail
Ryecroft Way
Cranberry Bog
Nature Trail
Sacrifice Rock
Beaver Dam Road
Little Island
Golf School
Driving Range

Interceptor/Irrigation Wells
WWTP
Zone II
Great Island Pond
Great Island
Route 3
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Sacrifice Rock
Telegraph Hill
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Winslowe's View
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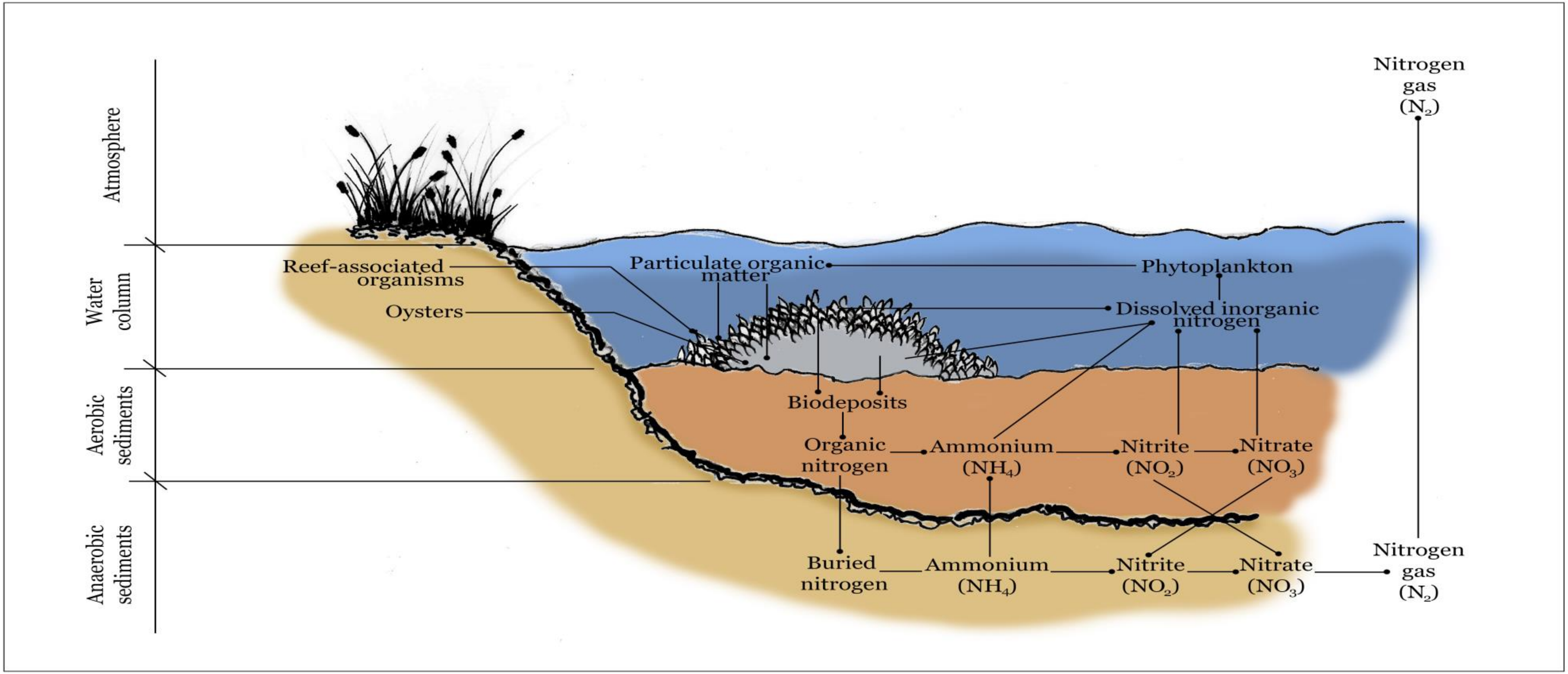
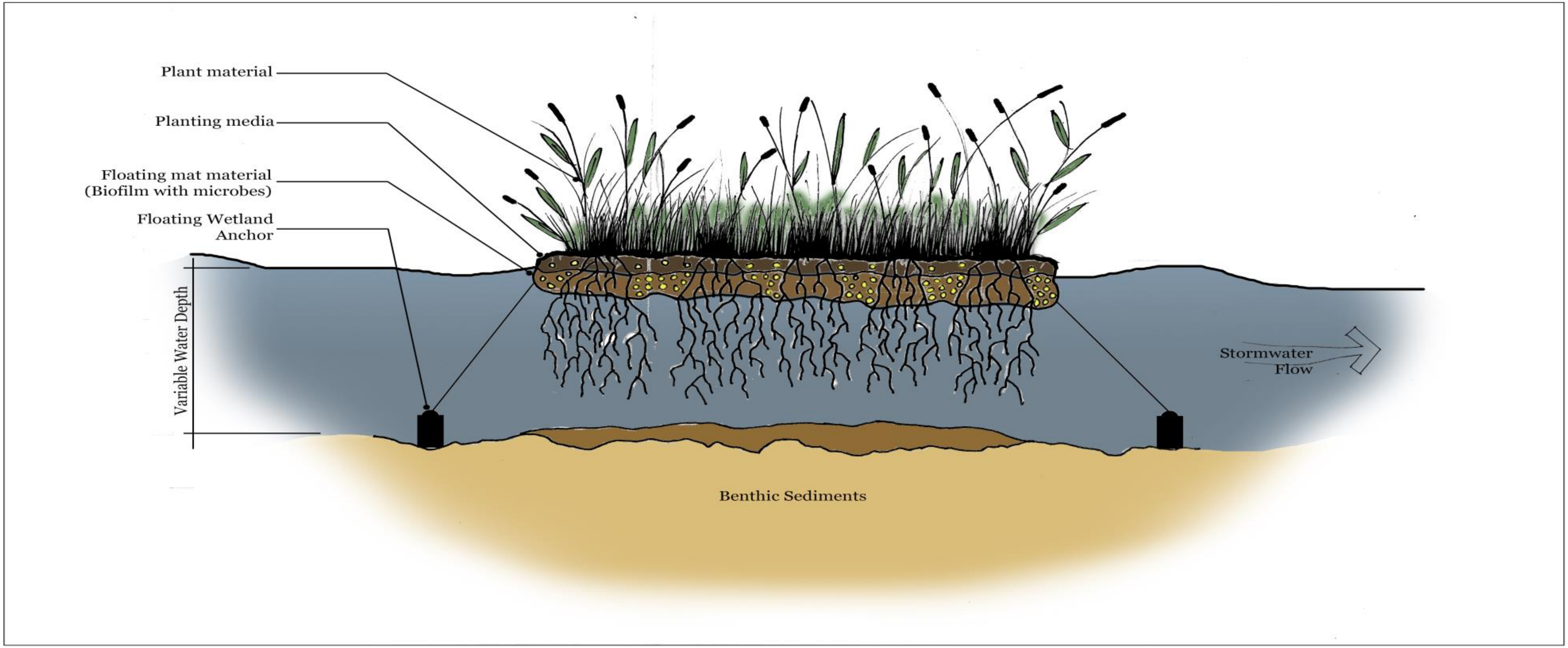

Atmosphere
Water column
Aerobic sediments
Anaerobic sediments
Nitrogen gas (N_2)
Reef-associated organisms
Particulate organic matter
Phytoplankton
Oysters
Dissolved inorganic nitrogen
Biodeposits
Organic nitrogen
Ammonium (NH_4)
Nitrite (NO_2)
Nitrate (NO_3)
Buried nitrogen
Ammonium (NH_4)
Nitrite (NO_2)
Nitrate (NO_3)
Nitrogen gas (N_2)



Plant material
Planting media
Floating mat material
(Biofilm with microbes)
Floating Wetland
Anchor
Variable Water Depth
Stormwater
Flow
Benthic Sediments

Scenario Planning

BREAKOUT SESSION | JUNE 24, 2016

Dave Mason, Town of Sandwich

...

one cape

implementing solutions for clean water

June 23-24 | Resort and Conference Center at Hyannis