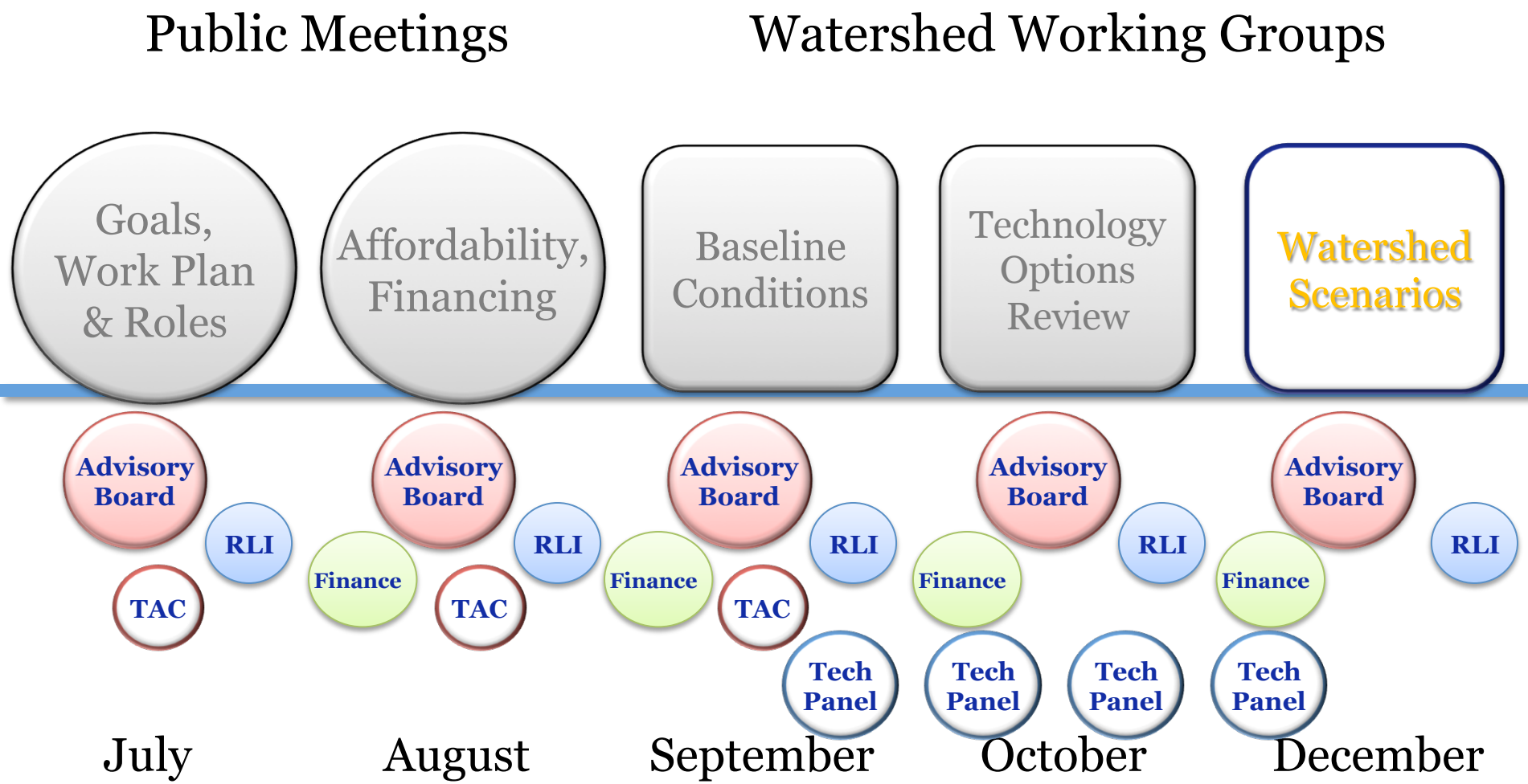
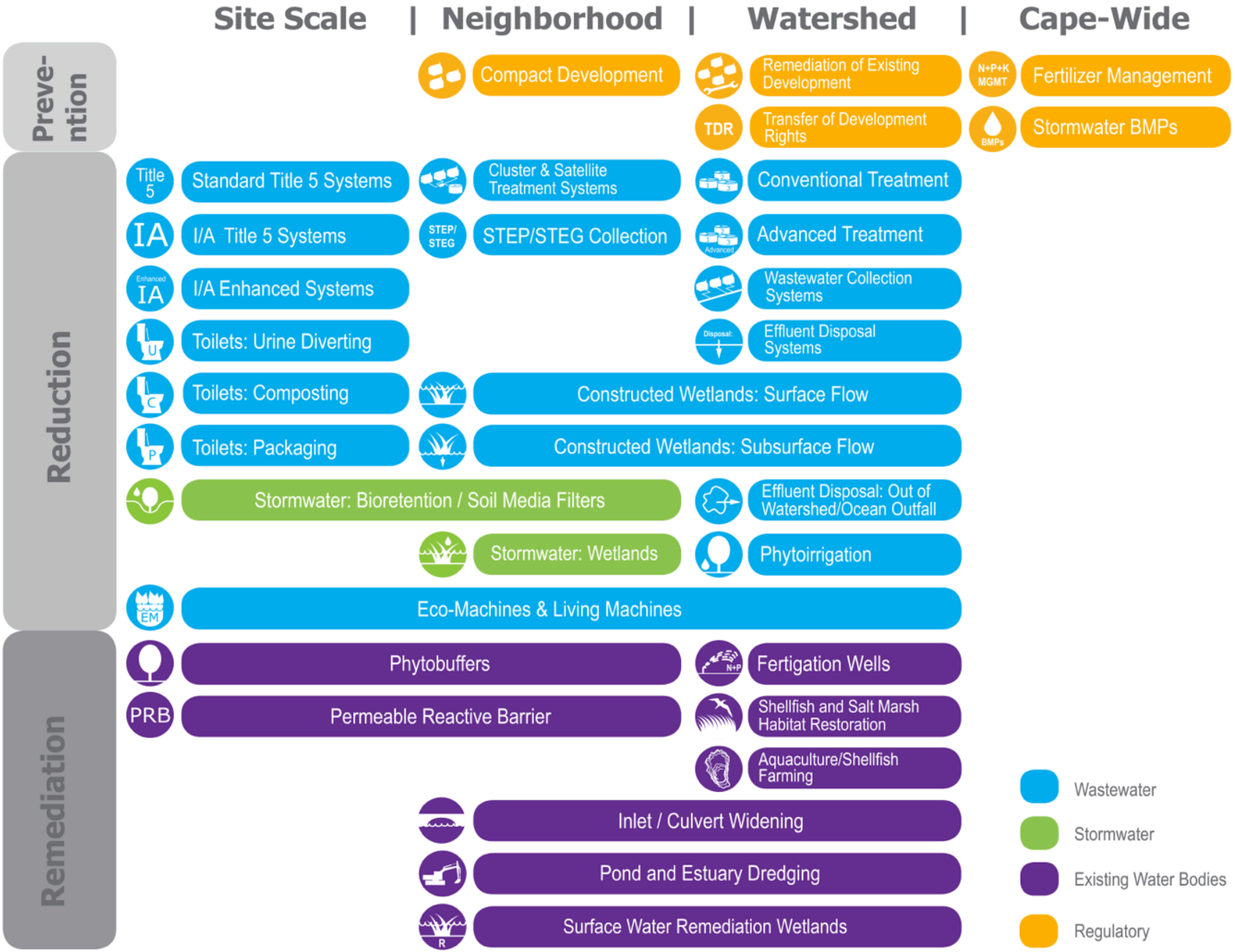
Three Bays & Centerville River Group

Watershed Scenarios



208 Planning Process


Site Scale | Neighborhood | Watershed | Cape-Wide
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Remediation
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
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Cluster & Satellite Treatment Systems
Conventional Treatment
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I/A Title 5 Systems
STEP/ STEG
STEP/STEG Collection
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Enhanced IA
I/A Enhanced Systems
Wastewater Collection Systems
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Toilets: Urine Diverting
Disposal:
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Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
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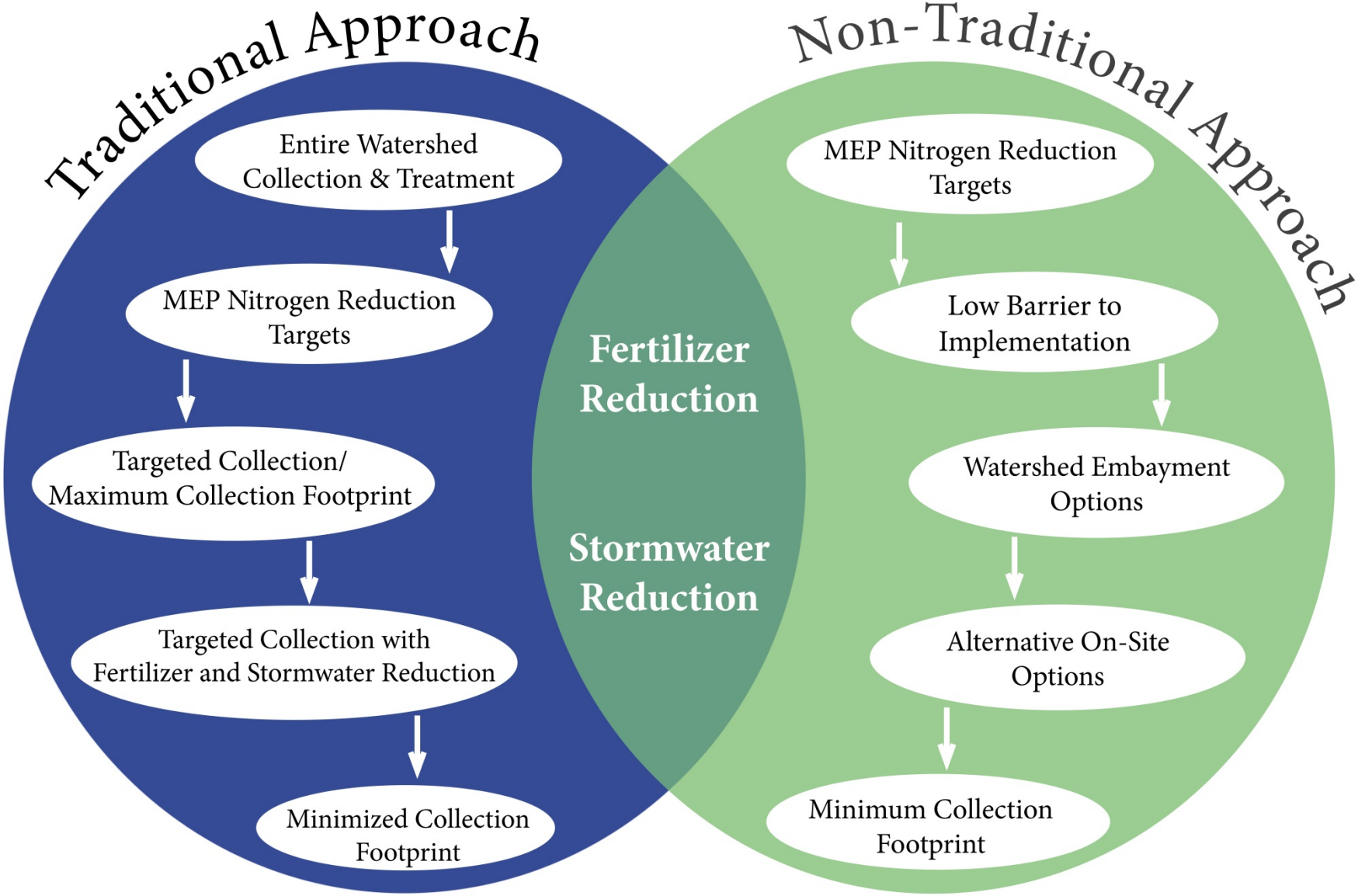
Existing Water Bodies
Regulatory

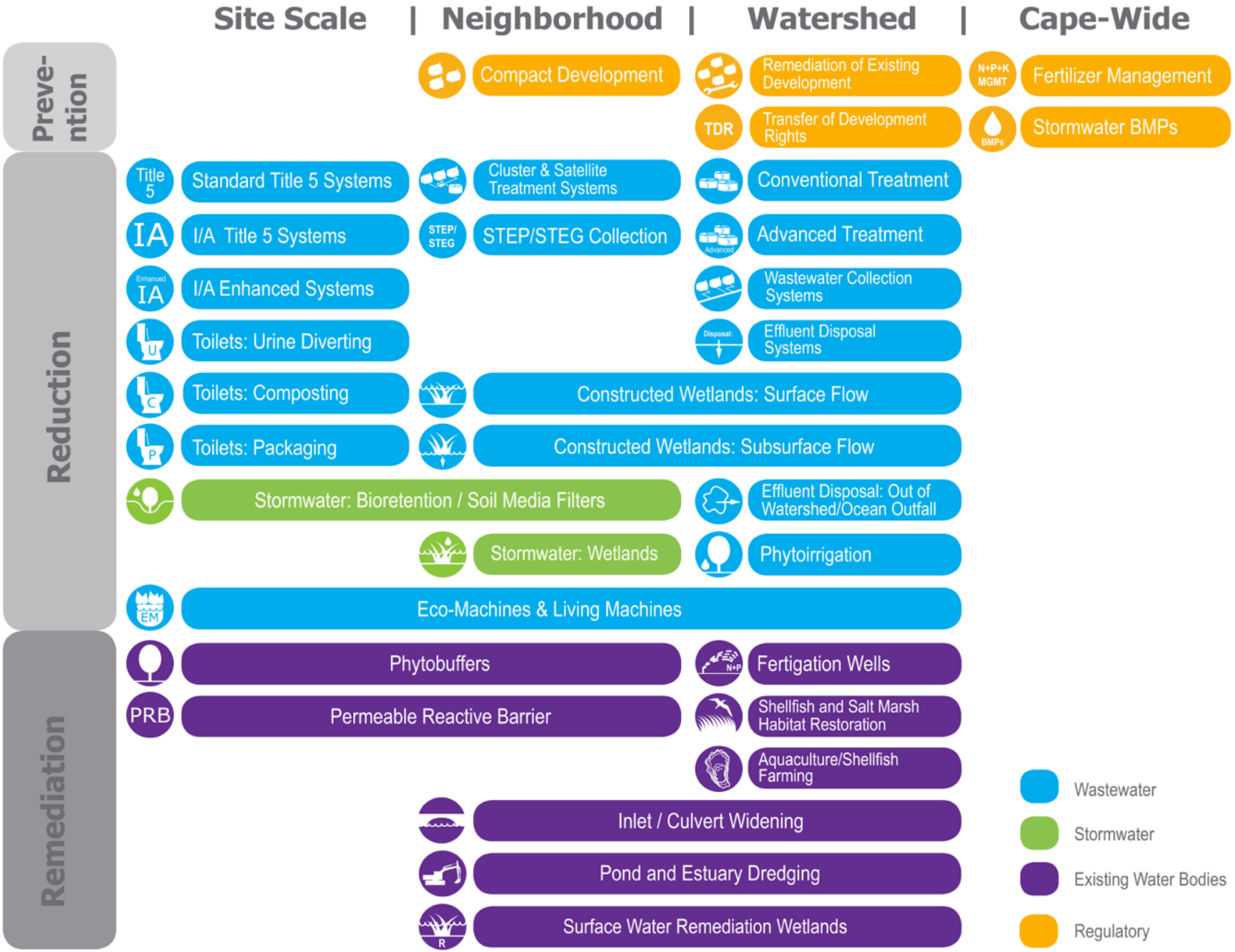
Watershed Scenarios

11 Working Group Meetings: Dec 2-11

Goal of Today's Meeting:

- To discuss the approach for developing watershed scenarios that will remediate water quality impairments in your watersheds.
- To identify preferences, advantages and disadvantages of a set of scenarios of different technologies and approaches, and
- To develop a set of adaptive management principles to guide sub-regional groups in refining scenarios for the 208 Plan.


Traditional Approach
Entire Watershed Collection & Treatment
MEP Nitrogen Reduction Targets
Targeted Collection/ Maximum Collection Footprint
Targeted Collection with Fertilizer and Stormwater Reduction
Minimized Collection Footprint
Fertilizer Reduction
Stormwater Reduction
Non-Traditional Approach
MEP Nitrogen Reduction Targets
Low Barrier to Implementation
Watershed Embayment Options
Alternative On-Site Options
Minimum Collection Footprint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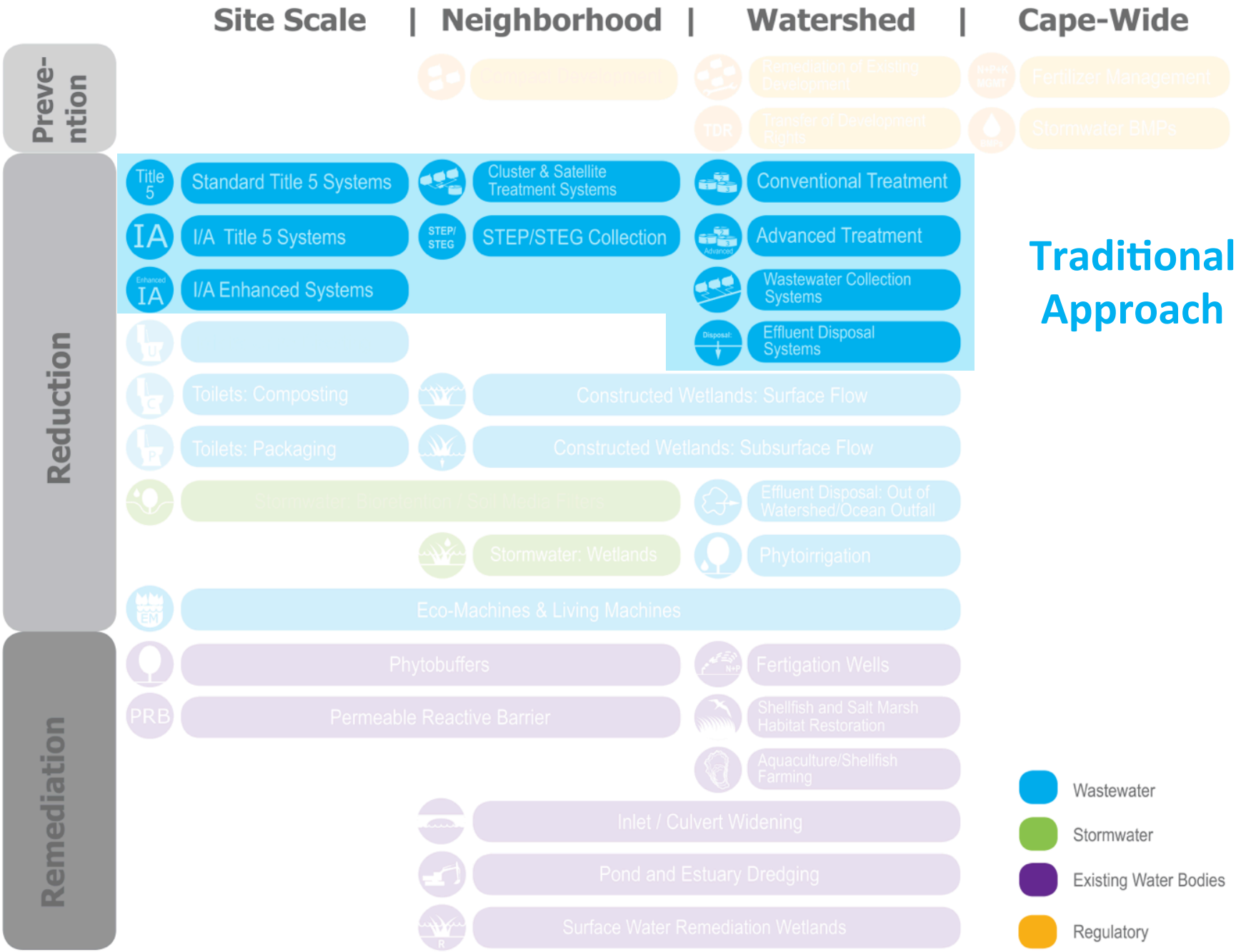
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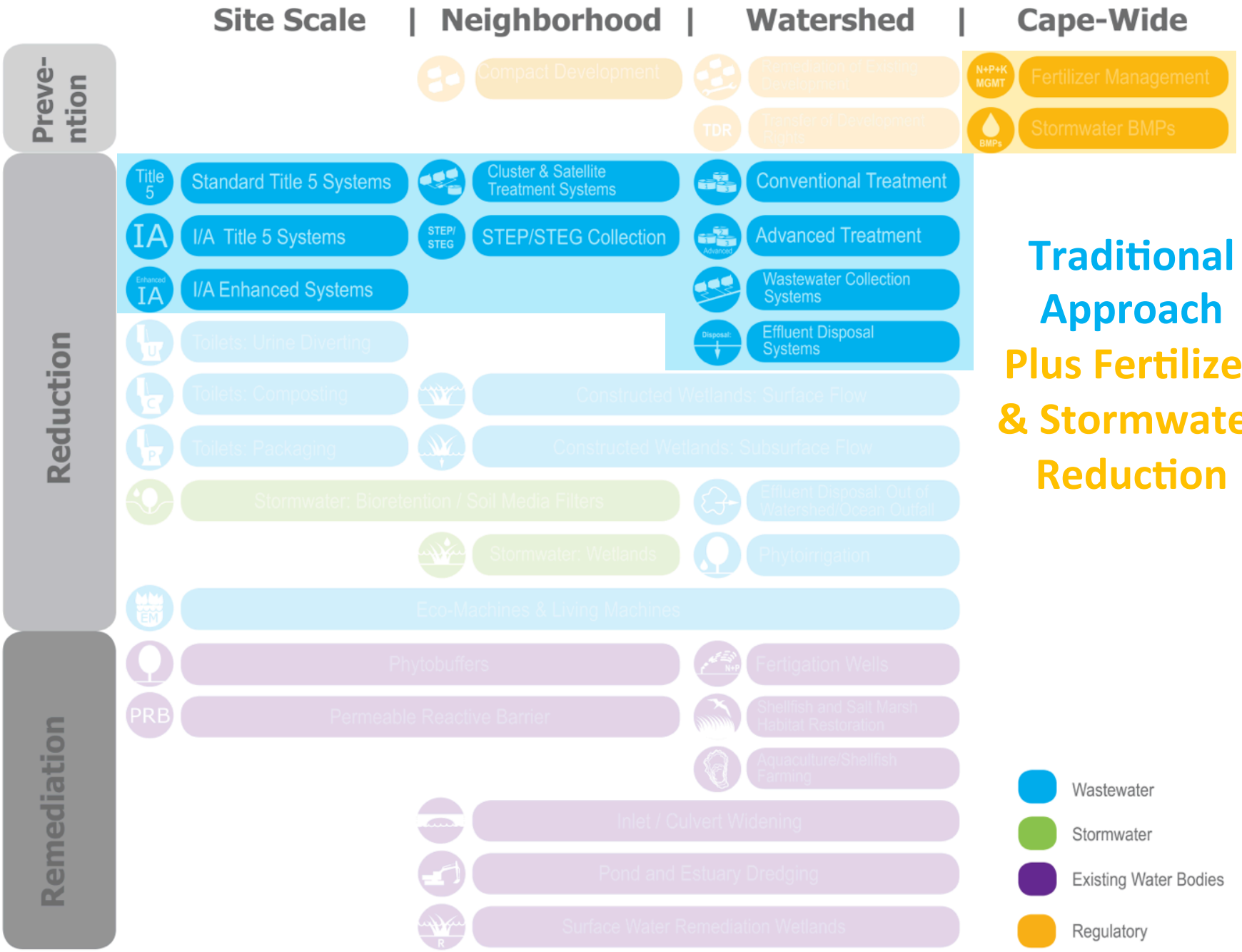
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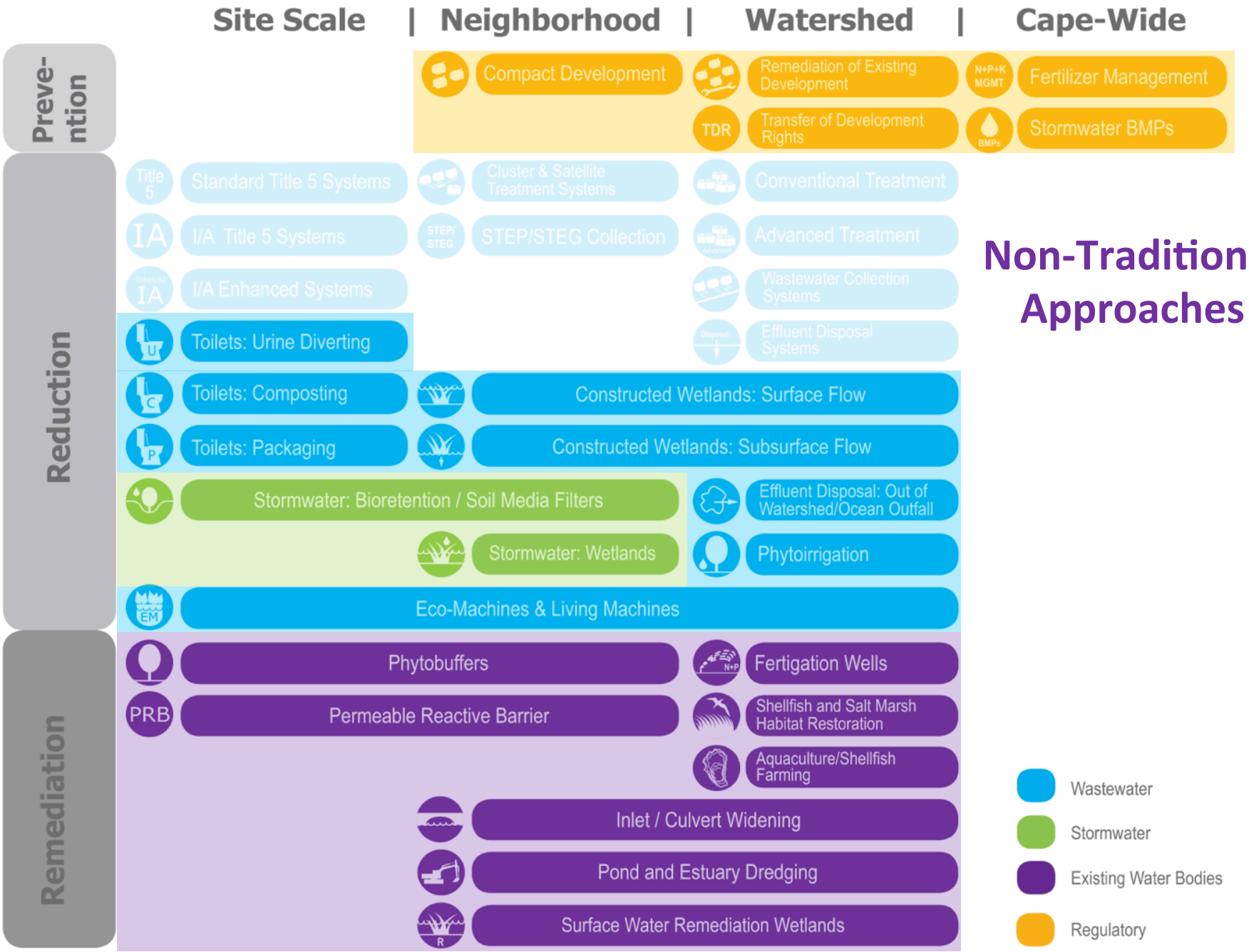
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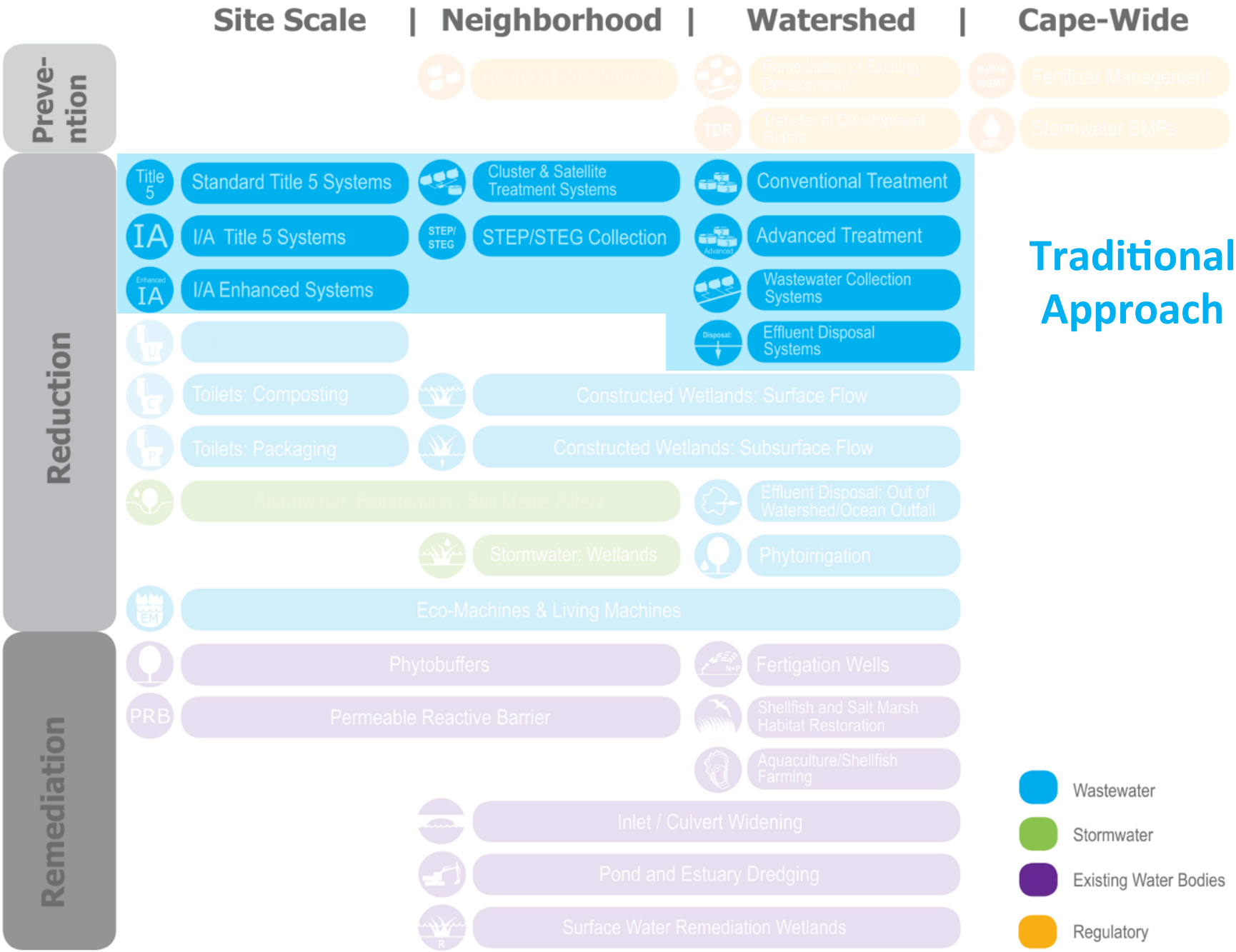
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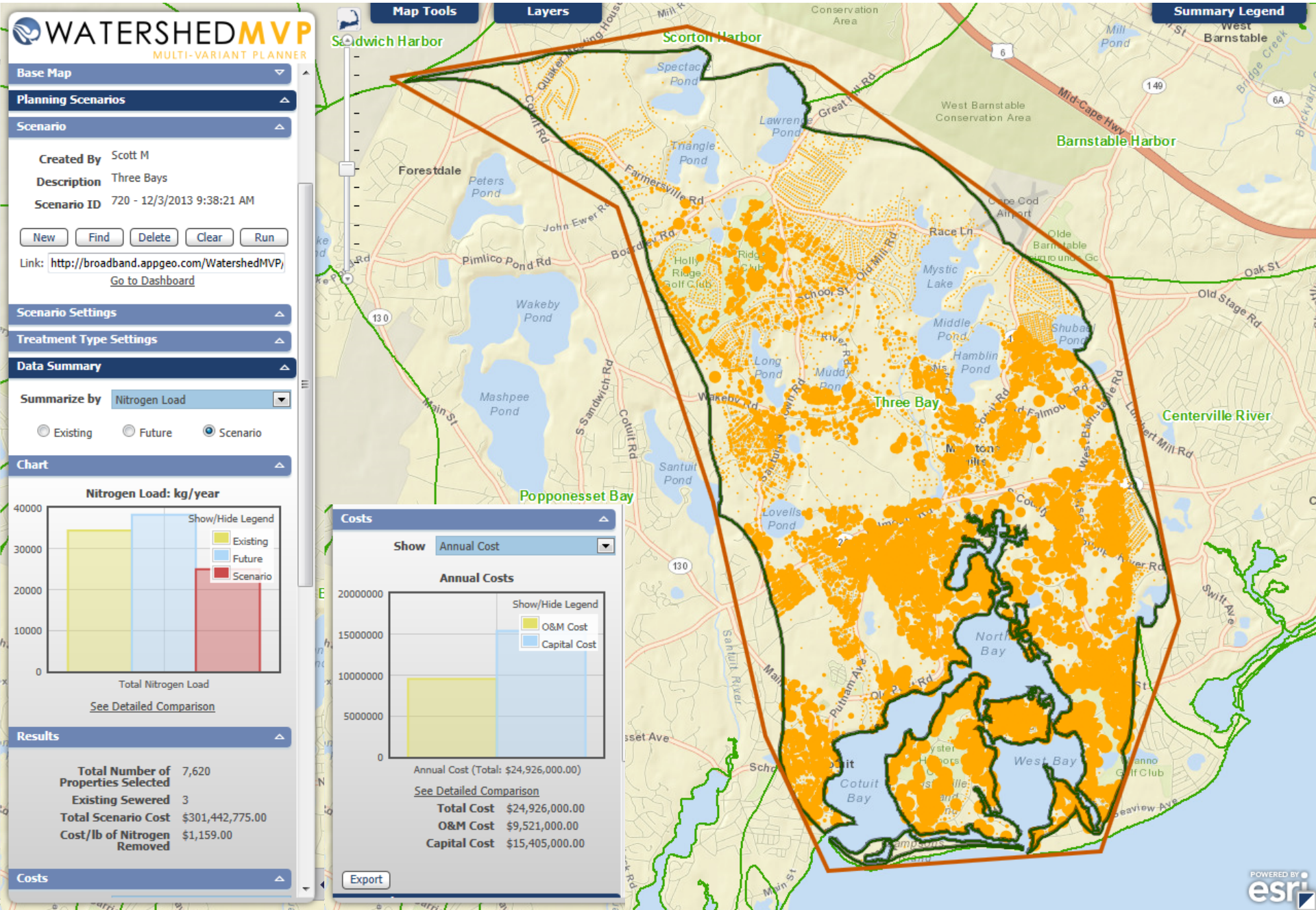
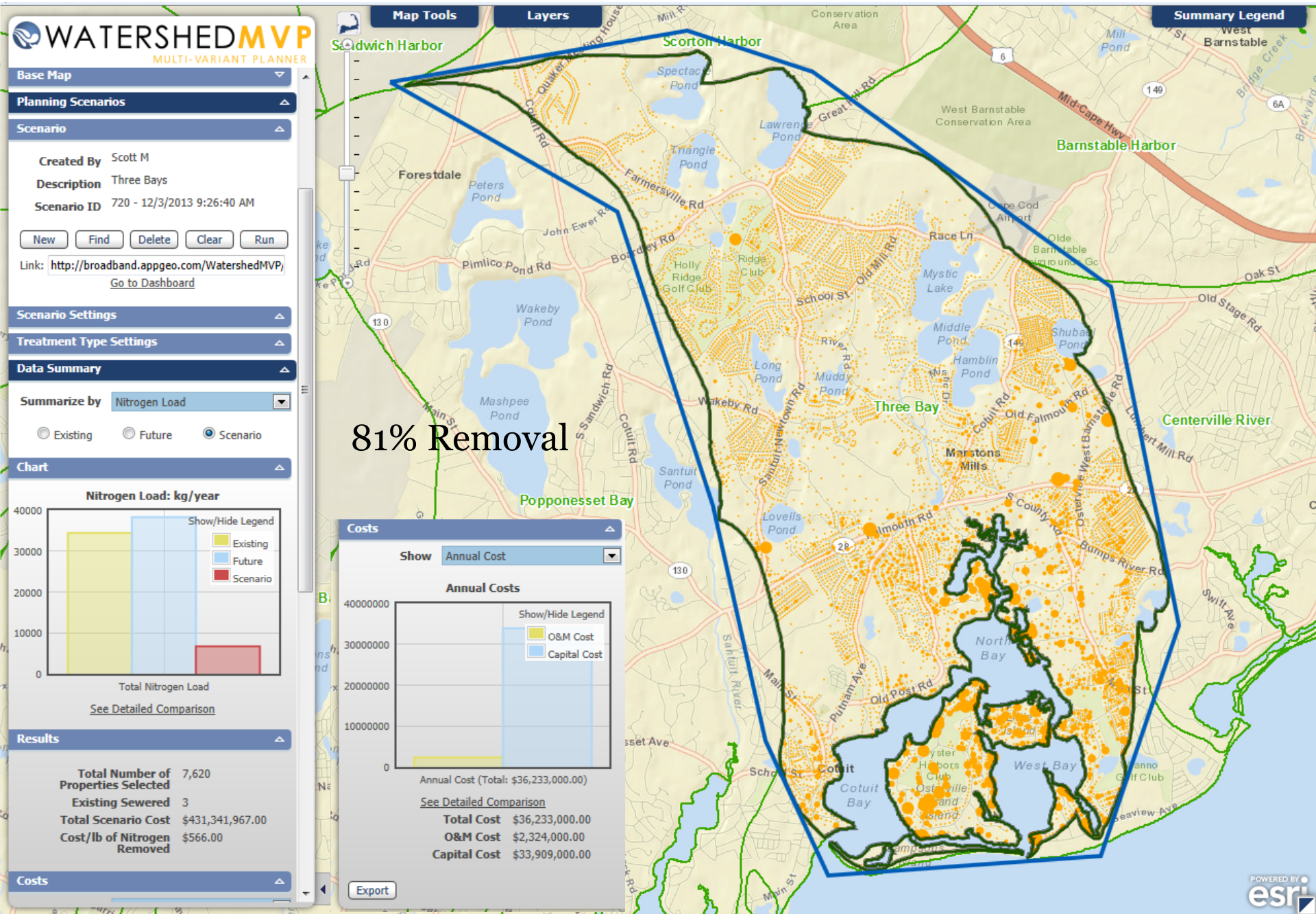
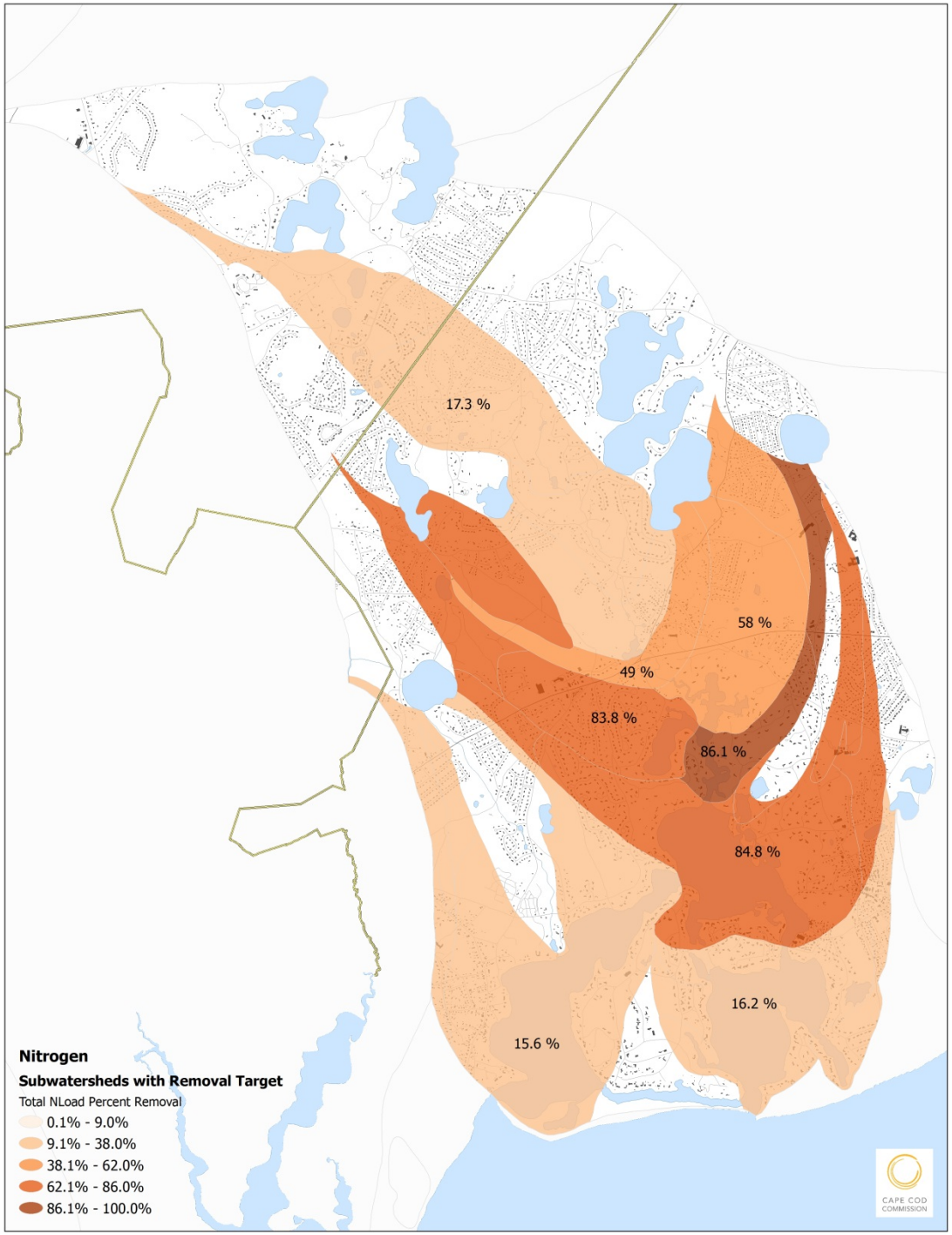
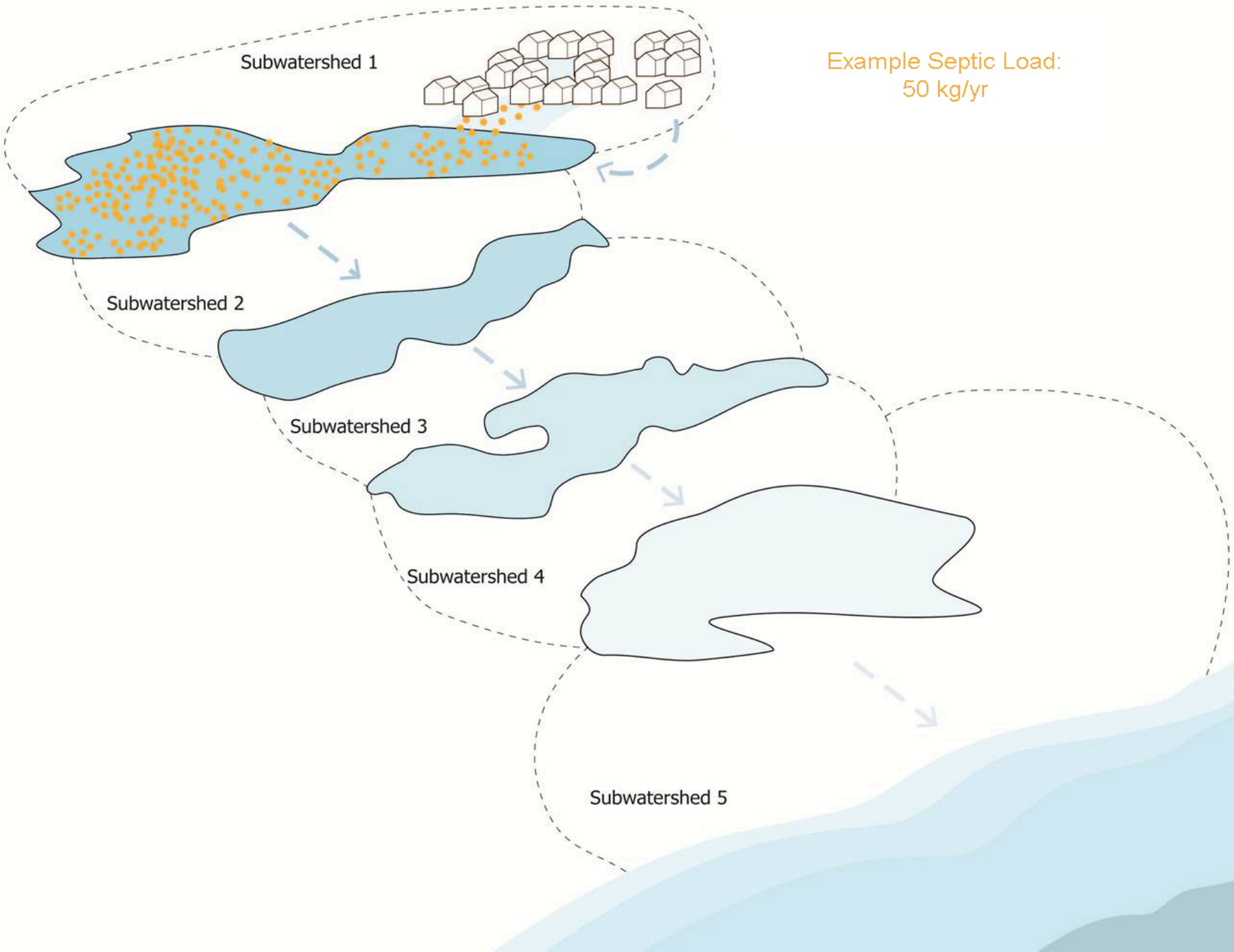
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems

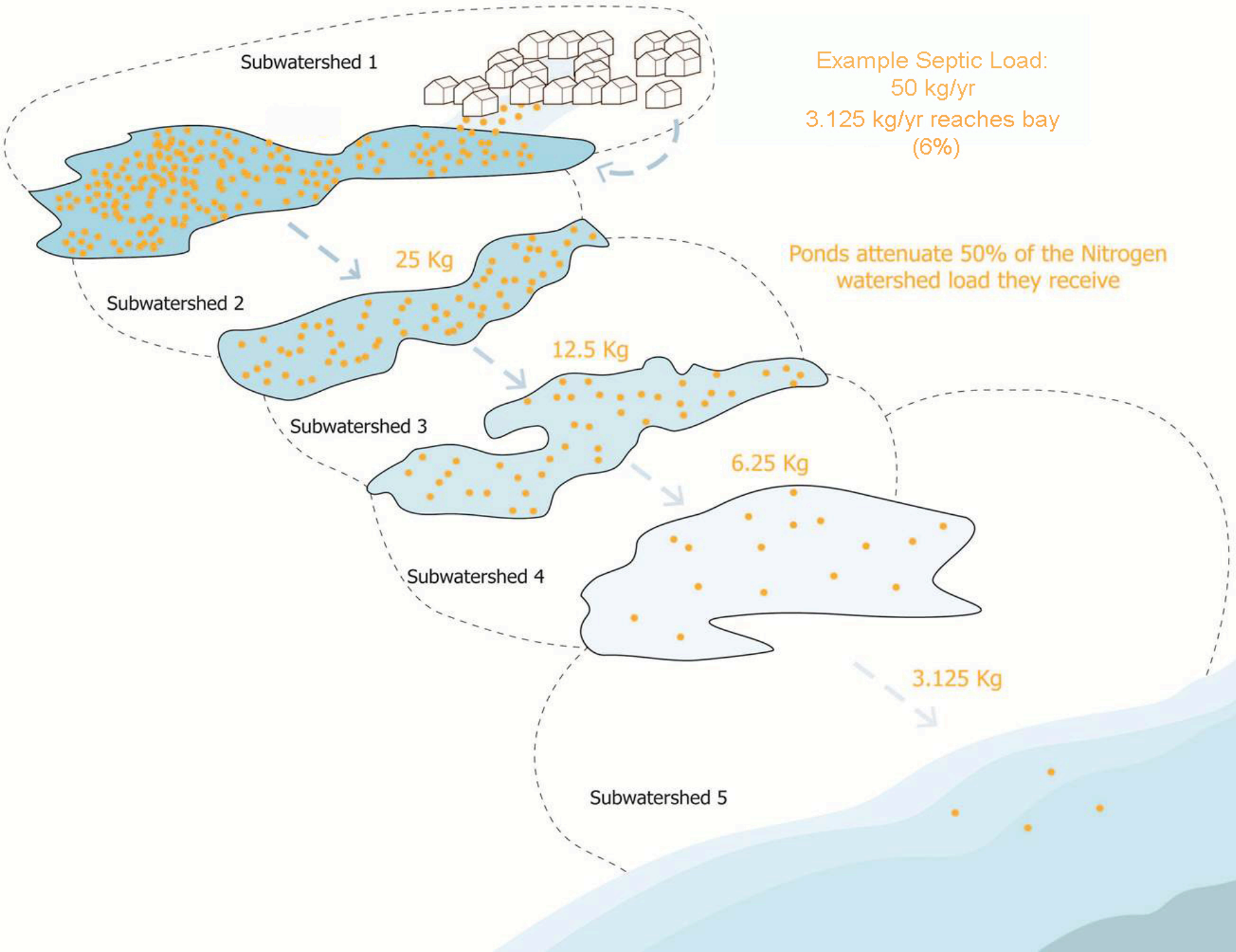


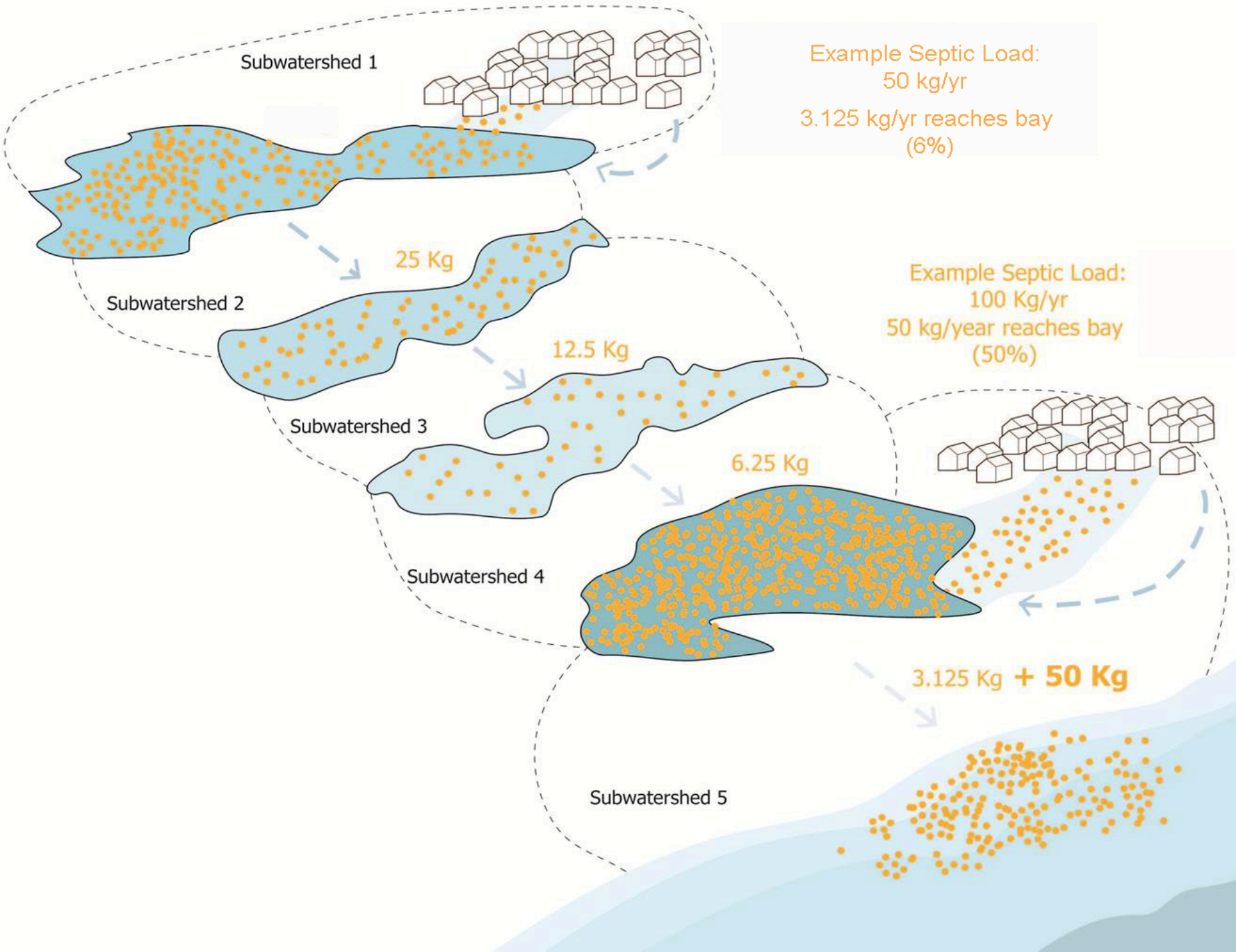
Watershed-Wide Centralized Treatment with Disposal Inside the Watershed




17.3 %
58 %
49 %
83.8 %
86.1 %
84.8 %
16.2 %
15.6 %
Nitrogen
Subwatersheds with Removal Target
Total NLoad Percent Removal
0.1% - 9.0%
9.1% - 38.0%
38.1% - 62.0%
62.1% - 86.0%
86.1% - 100.0%
CAPE COD COMMISSION


Subwatershed 1
Example Septic Load:
50 kg/yr
Subwatershed 2
Subwatershed 3
Subwatershed 4
Subwatershed 5


Subwatershed 1
Example Septic Load:
50 kg/yr
3.125 kg/yr reaches bay
(6%)
25 Kg
Subwatershed 2
Ponds attenuate 50% of the Nitrogen
watershed load they receive
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg
Subwatershed 5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Example Septic Load:
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3.125 kg/yr reaches bay
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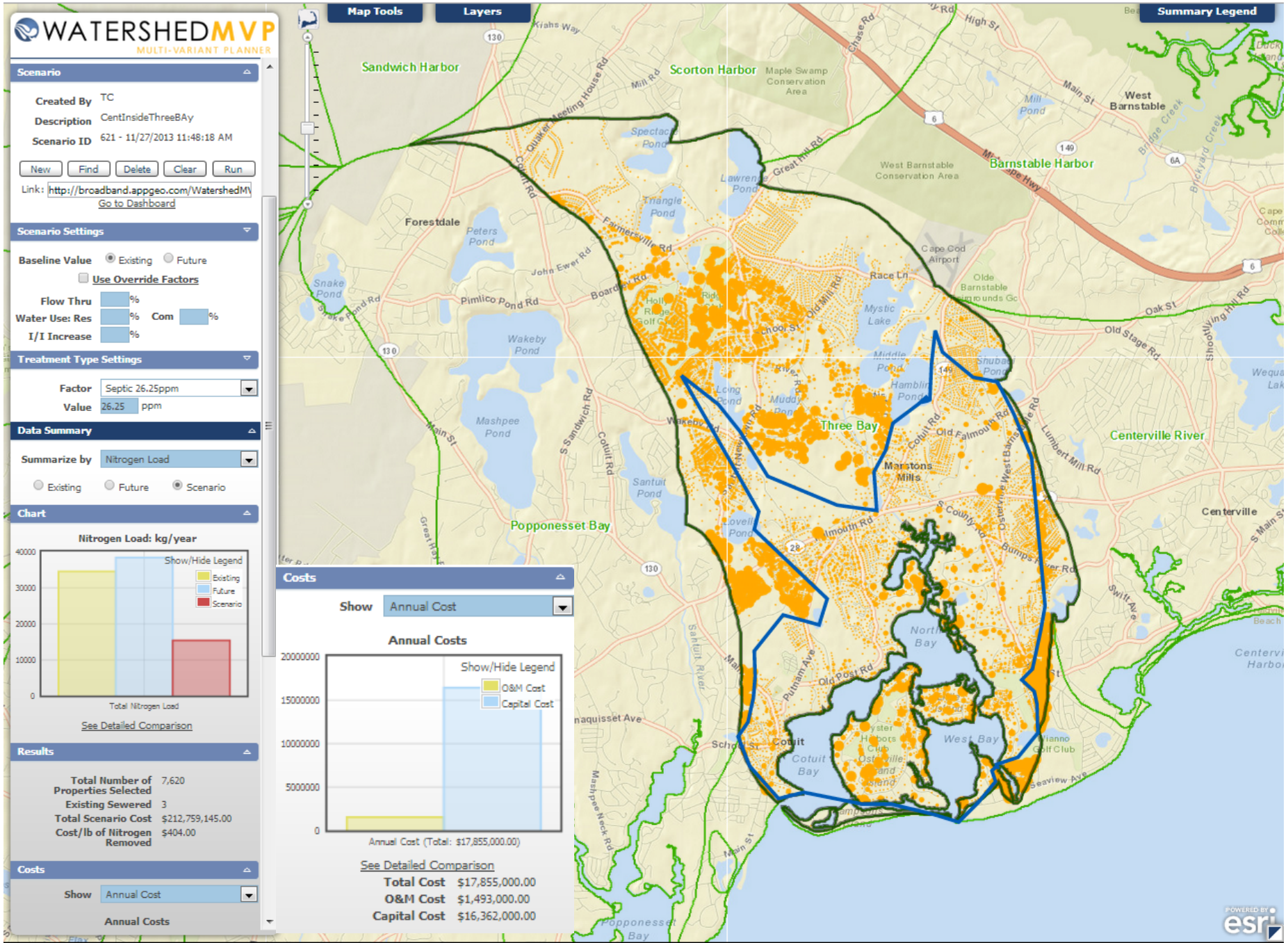
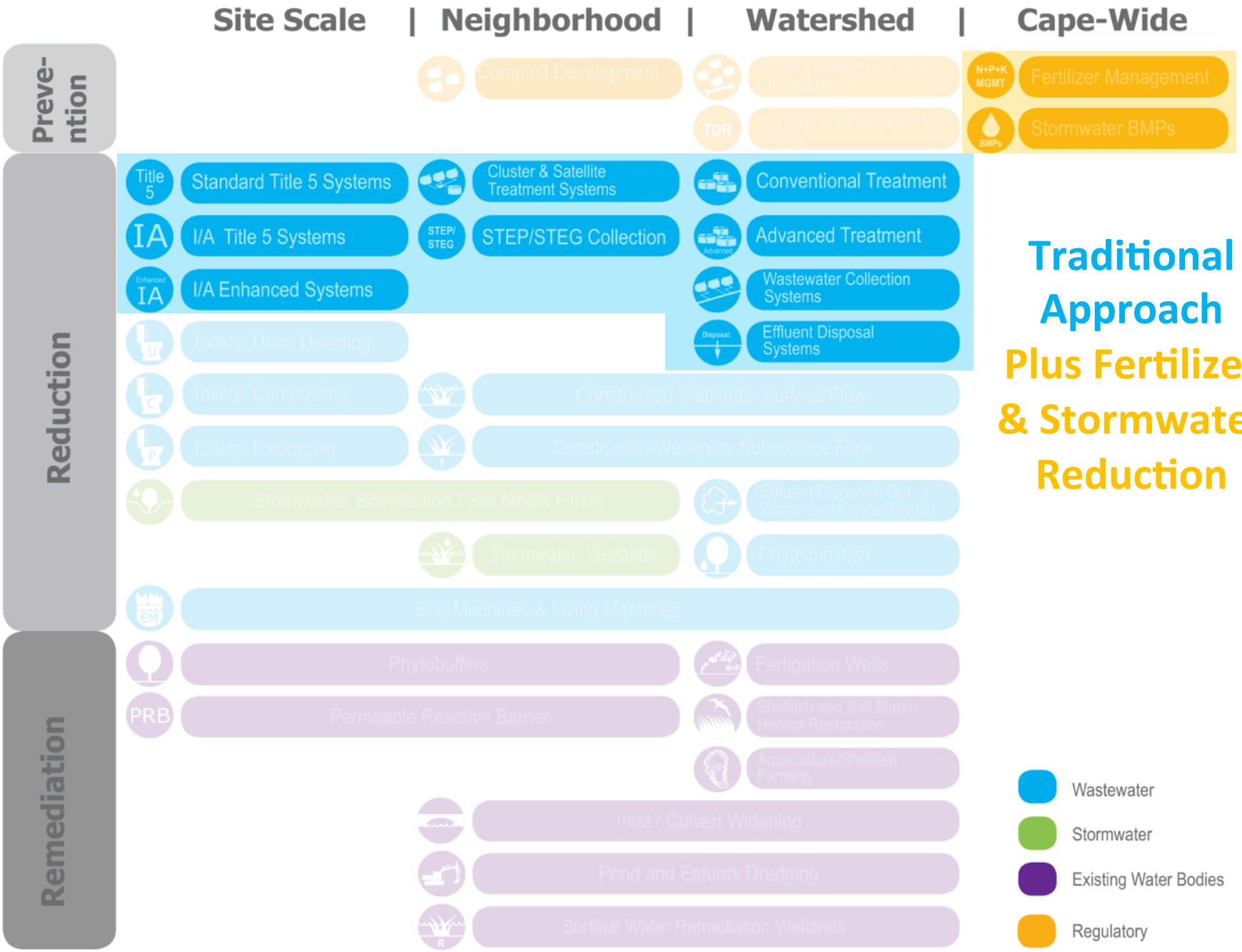
Subwatershed 2
Example Septic Load:
100 Kg/yr
50 kg/year reaches bay
(50%)
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg + 50 Kg
Subwatershed 5

Targeted Centralized Treatment with Disposal Inside the Watershed

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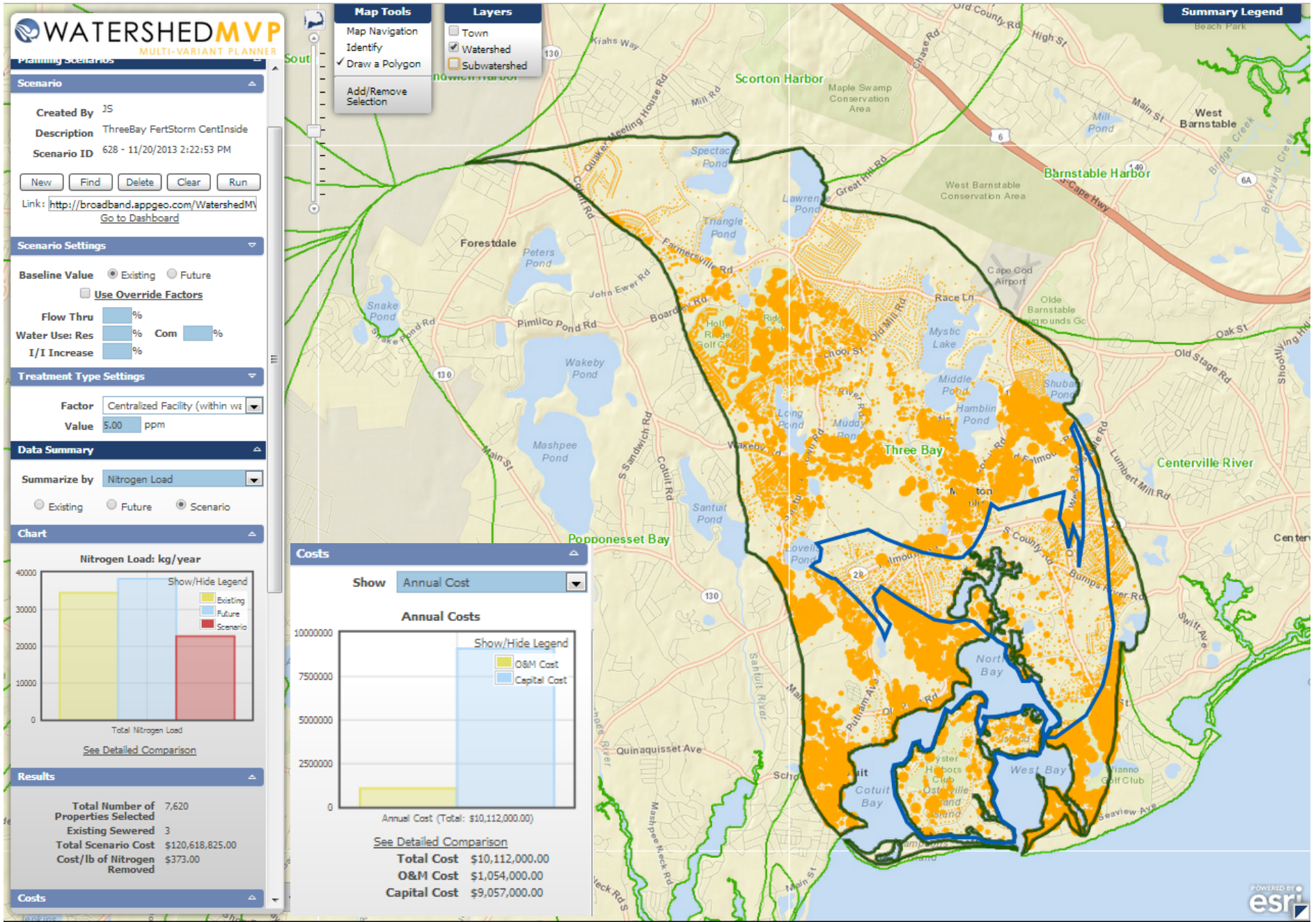
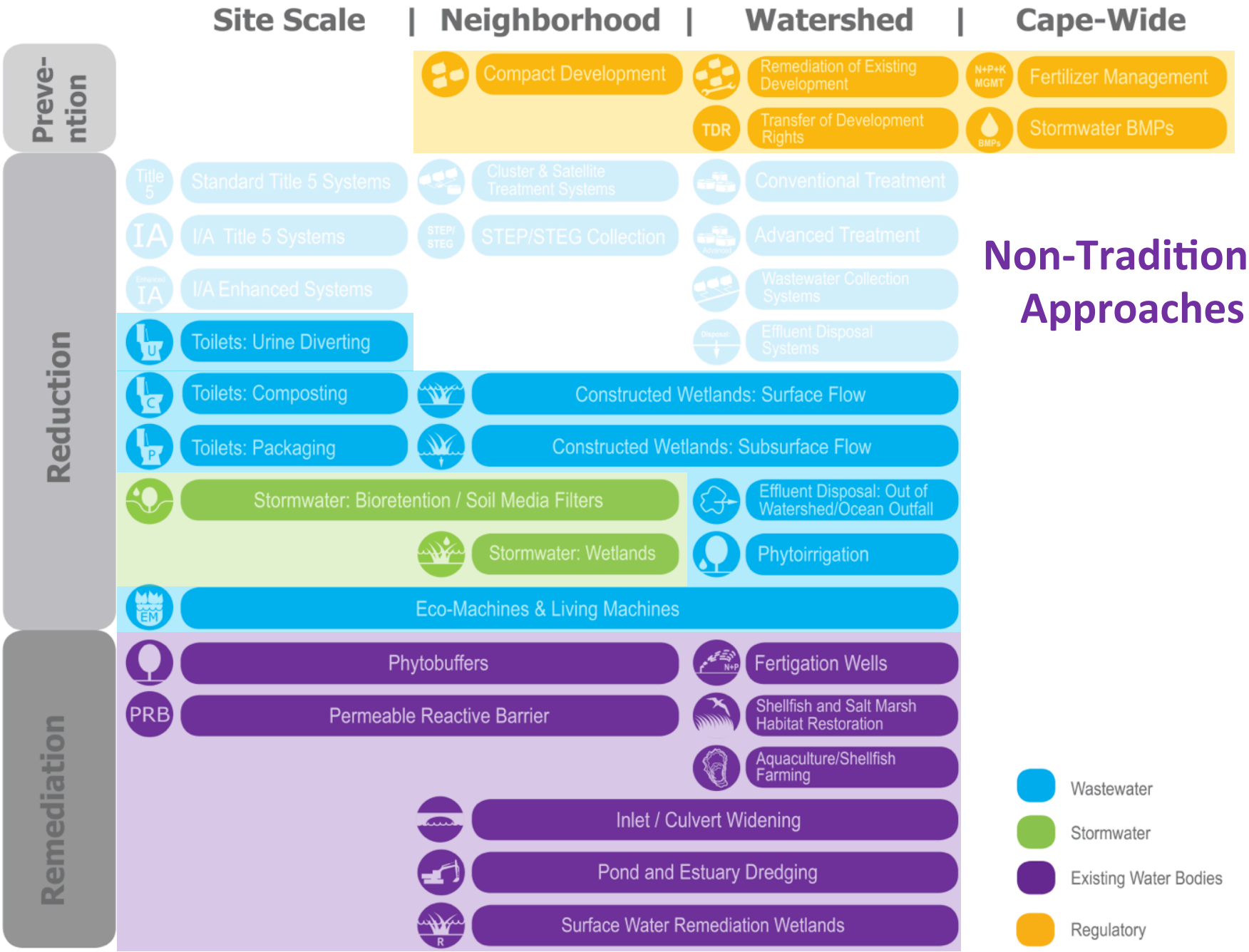
Targeted Centralized Treatment with a 50% Reduction in Fertilizer and Stormwater

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Problem Solving Approach

Wastewater | Existing Water Bodies | Regulatory

1 2 3 4 5 6 7

Targets/Reduction Goals

Present Load: X kg/day — **Target:** Y kg/day = **Reduction Required:** N kg/day

Other Wastewater Management Needs

A. Title 5 Problem Areas
B. Pond Recharge Areas
C. Growth Management

Low Barrier to Implementation

A. Fertilizer Management
B. Stormwater Mitigation

Watershed/Embayment Options

A. Permeable Reactive Barriers
B. Inlet/Culvert Openings
C. Constructed Wetlands
D. Aquaculture

Alternative On-Site Options

A. Eco-toilets (UD & Compost)
B. I/A Technologies
C. Enhanced I/A Technologies
D. Shared Systems

Priority Collection/High-Density Areas

A. Greater Than 1 Dwelling Unit/acre
B. Village Centers
C. Economic Centers
D. Growth Incentive Zones

Supplemental Sewering

Watershed Calculator THREE BAYS

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
Present Total Nitrogen Load:		130.7	47,706
wastewater		0	36,573
fertilizer			8,213
stormwater			2,920
Target Nitrogen Load:		0	25,696
Nitrogen Removal Required:		**0**	**22,010**
Total Number of Properties:	9153		

Watershed Calculator THREE BAYS

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Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

Watershed Calculator THREE BAYS

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Other Wastewater Management Needs Ponds Title 5 Problem Areas Growth Management

Low Barrier to Implementation:	Reduction by Technology (Kg/yr)	Remaining to Meet Target (Kg/yr)	Unit Cost ($/lb N)
Fertilizer Management	4,107	17,904	
Stormwater Mitigation	1,460	16,444	

Watershed Calculator THREE BAYS

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Fertilizer Management		4,107	17,904		
Stormwater Mitigation		1,460	16,444		
Watershed/Embayment Options:					
Permeable Reactive Barrier (PRB)	100 Homes	308.0	16,136	$452	$306,275
Permeable Reactive Barrier (PRB)	140 Homes	431.2	15,704	$452	$428,785

Watershed Calculator THREE BAYS

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Other Wastewater Management Needs Ponds Title 5 Problem Areas Growth Management

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Permeable Reactive Barrier (PRB)	140 Homes	431.2	15,704	$452	$428,785
Constructed Wetlands	3 Acres	1,698	14,438	$521	$1,946,248

Watershed Calculator THREE BAYS

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Permeable Reactive Barrier (PRB)	140	Homes	431.2	15,704	$452	$428,785
Constructed Wetlands	3	Acres	1,698	14,438	$521	$1,946,248
Fertigation Wells	4	Golf course	544	13,894	$438	$524,198

Watershed Calculator THREE BAYS

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Permeable Reactive Barrier (PRB)	100	Homes	308.0	16,136	$452	$306,275
Permeable Reactive Barrier (PRB)	140	Homes	431.2	15,704	$452	$428,785
Constructed Wetlands	3	Acres	1,698	14,438	$521	$1,946,248
Fertigation Wells	4	Golf course	544	13,894	$438	$524,198
Dredging	66000	cu. Yard	4,012	9,882	$7	$66,000

Watershed Calculator THREE BAYS

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
Present Total Nitrogen Load:		130.7	47,706
wastewater		0	36,573
fertilizer			8,213
stormwater			2,920
Target Nitrogen Load:		0	25,696
Nitrogen Removal Required:		**0**	**22,010**
Total Number of Properties:	9153		

Other Wastewater Management Needs Ponds Title 5 Problem Areas Growth Management

Low Barrier to Implementation:			**Reduction by Technology (Kg/yr)**	**Remaining to Meet Target (Kg/yr)**	**Unit Cost ($/lb N)**	**Total Annual Cost**
Fertilizer Management			4,107	17,904		
Stormwater Mitigation			1,460	16,444		
Watershed/Embayment Options:						
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Watershed Calculator THREE BAYS

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Alternative On-Site Options:						
Ecotoilets (UD & Compost)	458	Homes	1,812.3	1,069	$1,265	$5,043,614

Watershed Calculator THREE BAYS

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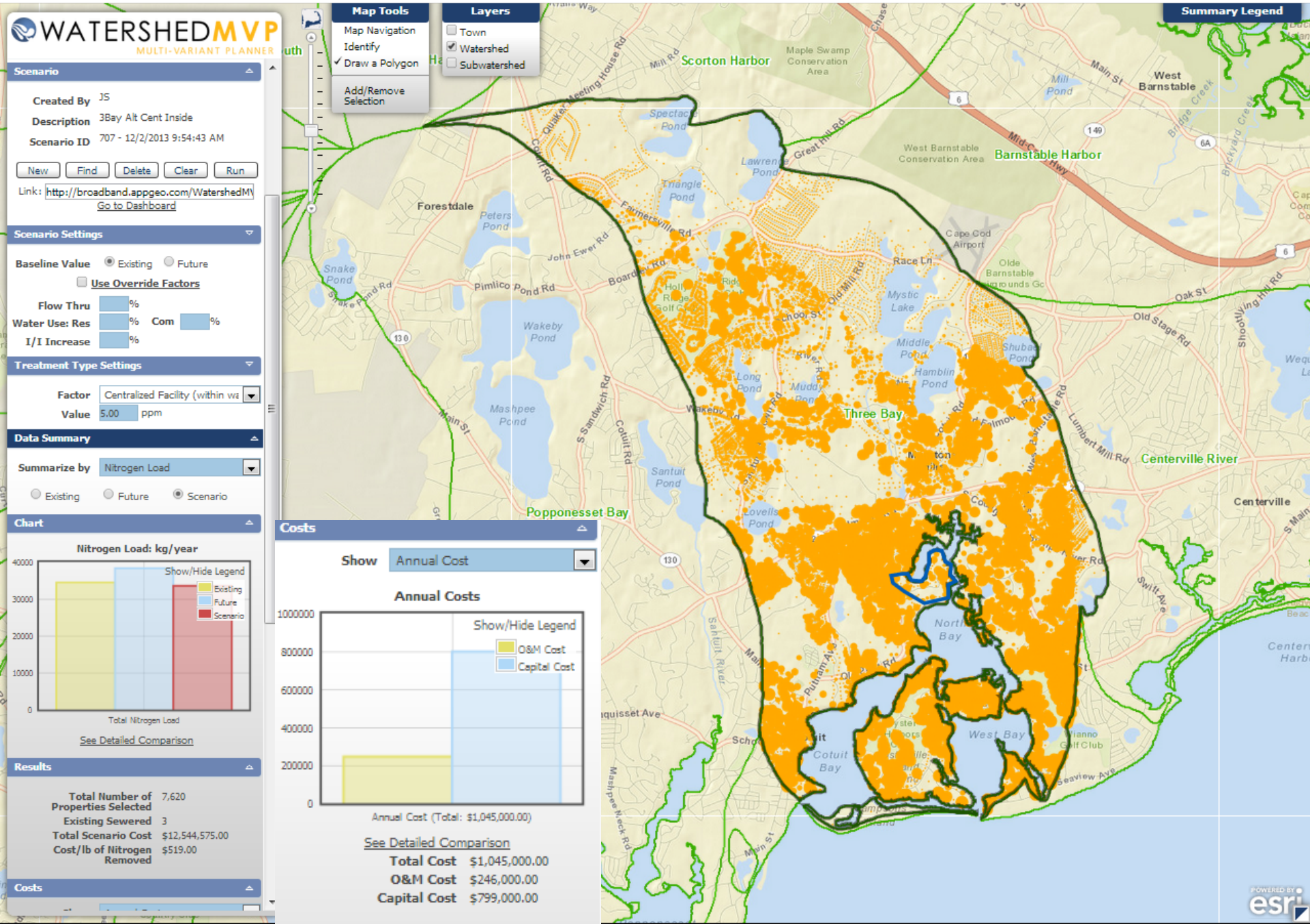
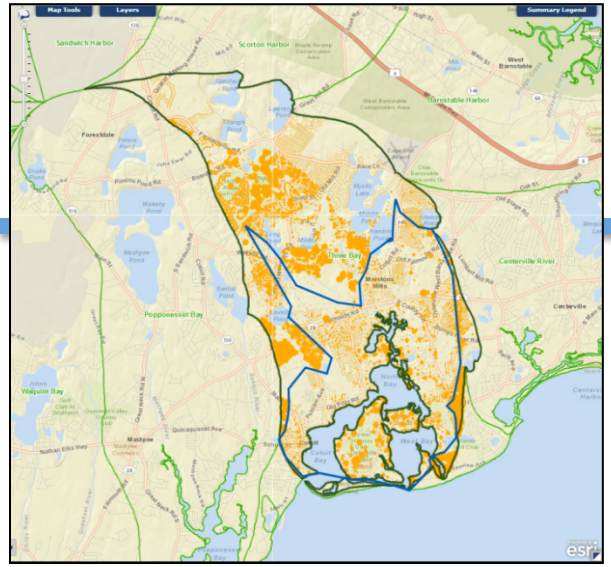
Alternative On-Site Options:						
Ecotoilets (UD & Compost)	458	Homes	1,812.3	1,069	$1,265	$5,043,614
Sewering	243	Homes	1069	0	$1,000	$2,352,253
		Total To Meet Goal (Kg/yr):		0	$295	$10,667,374
			Comparison to Conventional		$1,000	$48,422,000

Targeted Centralized Treatment after Applying Alternative Strategies (1069 kg N/yr)



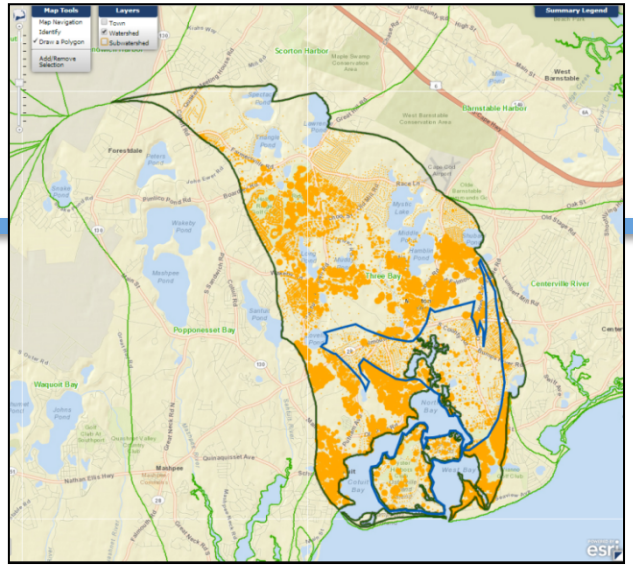
Scenario Comparison

Targeted Collection



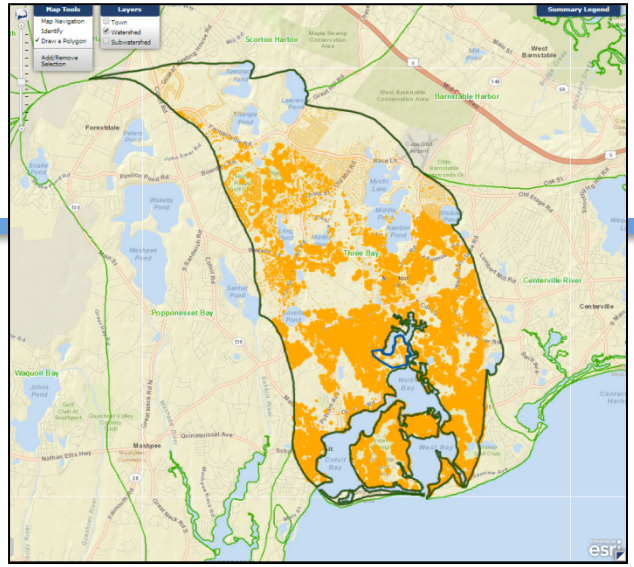
- Achieves TMDL[1]
- Cost/lb N = $405
- Treated Flow = 667,000 gpd

Targeted Collection after a 50% reduction in fertilizer and stormwater



- Achieves TMDL[1]
- Cost/lb N = $373
- Treated Flow = 440,000 gpd

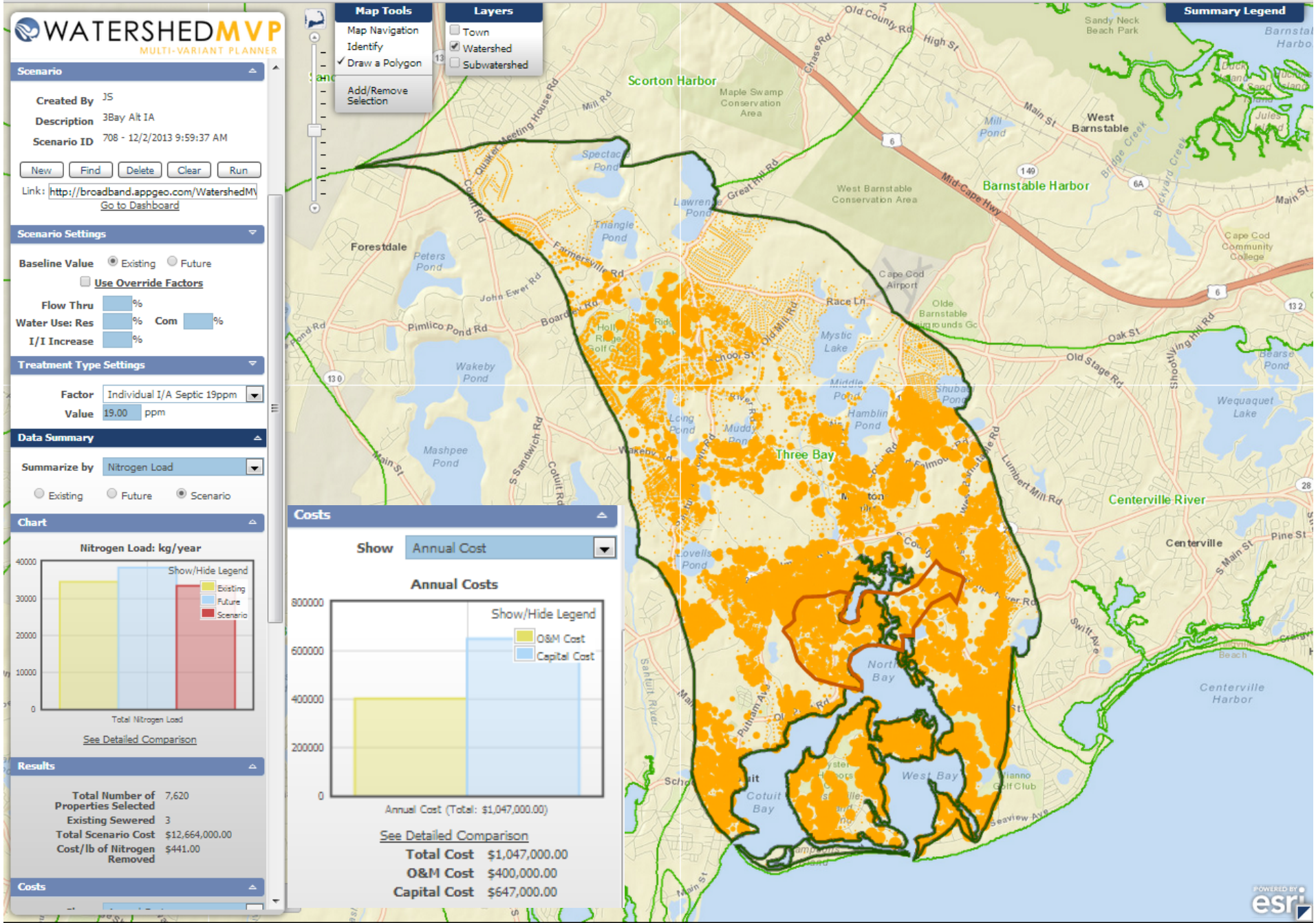
Targeted Collection after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



- Achieves TMDL[1]
- Cost/lb N = $519
- Treated Flow = 24,000 gpd

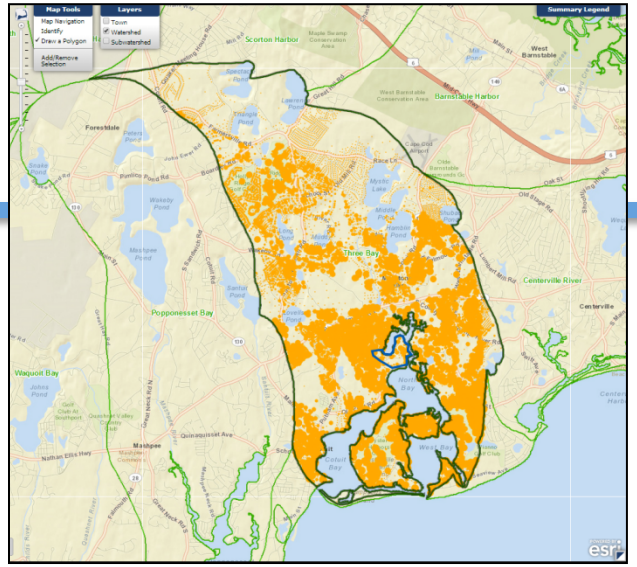
[1] within 5% of goal

Innovative/Alternative On-Site Systems after Applying Alternative Strategies (1069 kg N/yr)



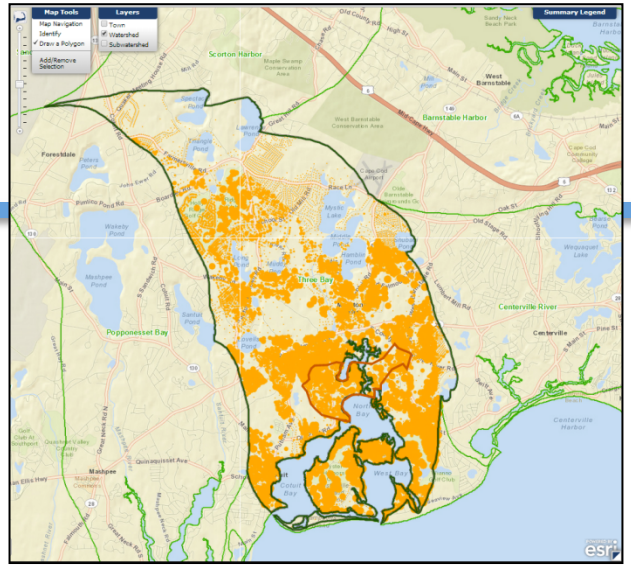
Scenario Comparison

Targeted Collection after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



- Achieves TMDL[1]
- Cost/lb N = $519
- Treated Flow = 24,000 gpd

Innovative/alternative on-site systems after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



- Achieves TMDL[1]
- Cost/lb N = $441
- Treated Flow = 92,000 gpd

[1] within 5% of goal

Adaptive Management:

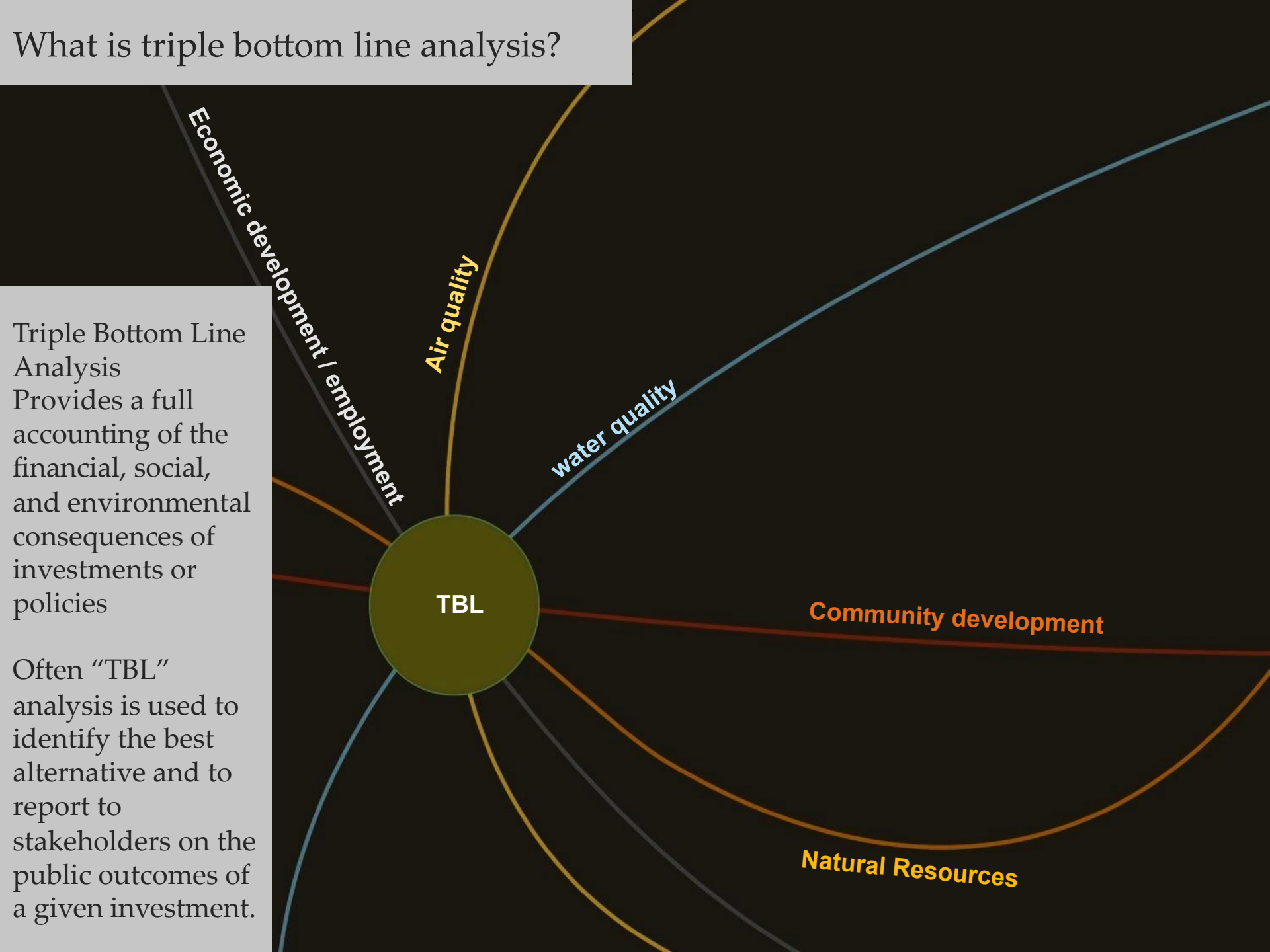
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient ways.

Triple Bottom Line (TBL) Introduction

What is triple bottom line analysis?

Triple Bottom Line Analysis Provides a full accounting of the financial, social, and environmental consequences of investments or policies

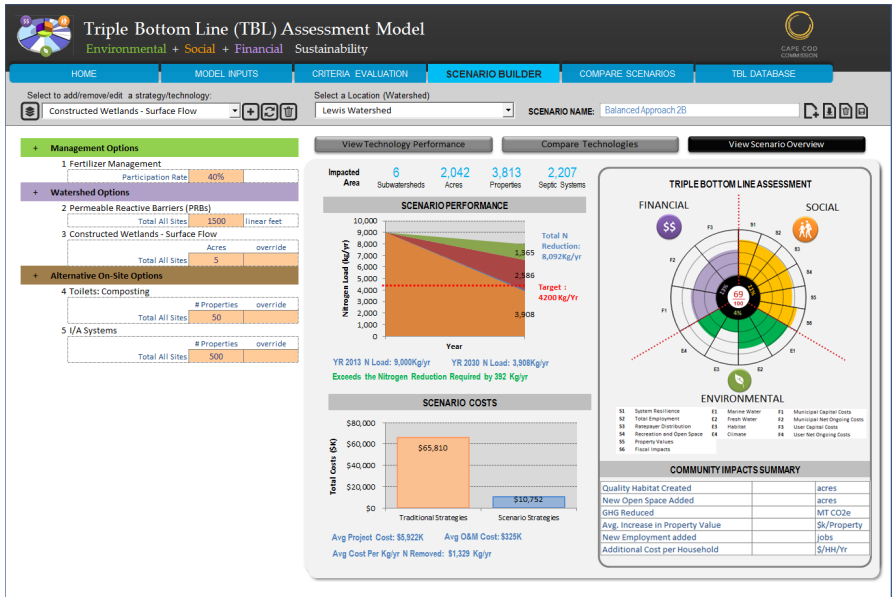
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

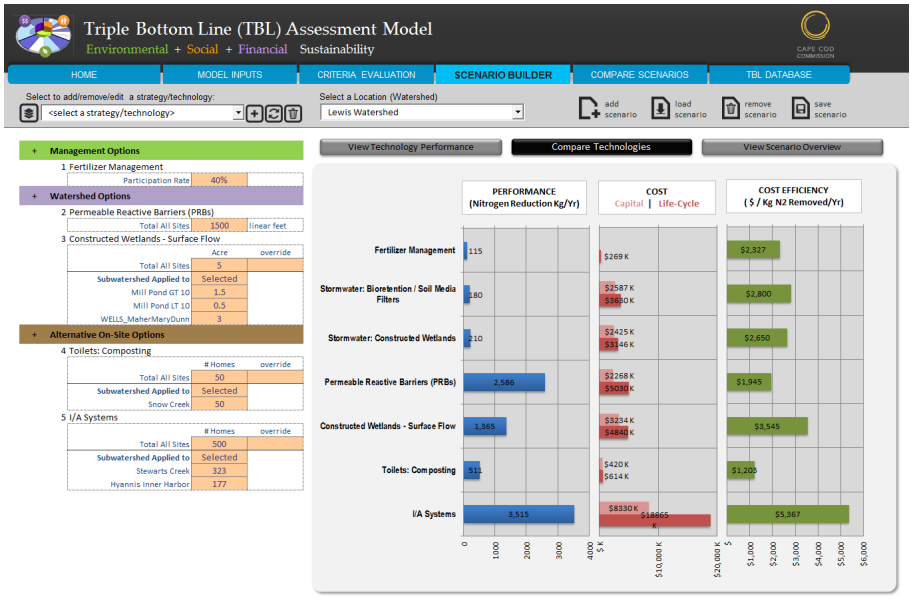


Why develop a TBL model?

- To consider the financial, environmental, and social consequences of water quality investments and policies in Cape Cod.

- TBL Model evaluates the “ancillary” or downstream consequences of water quality investments not the direct Phosphorous or Nitrogen levels.





Triple Bottom Line (TBL) Assessment Model

Environmental + Social + Financial Sustainability

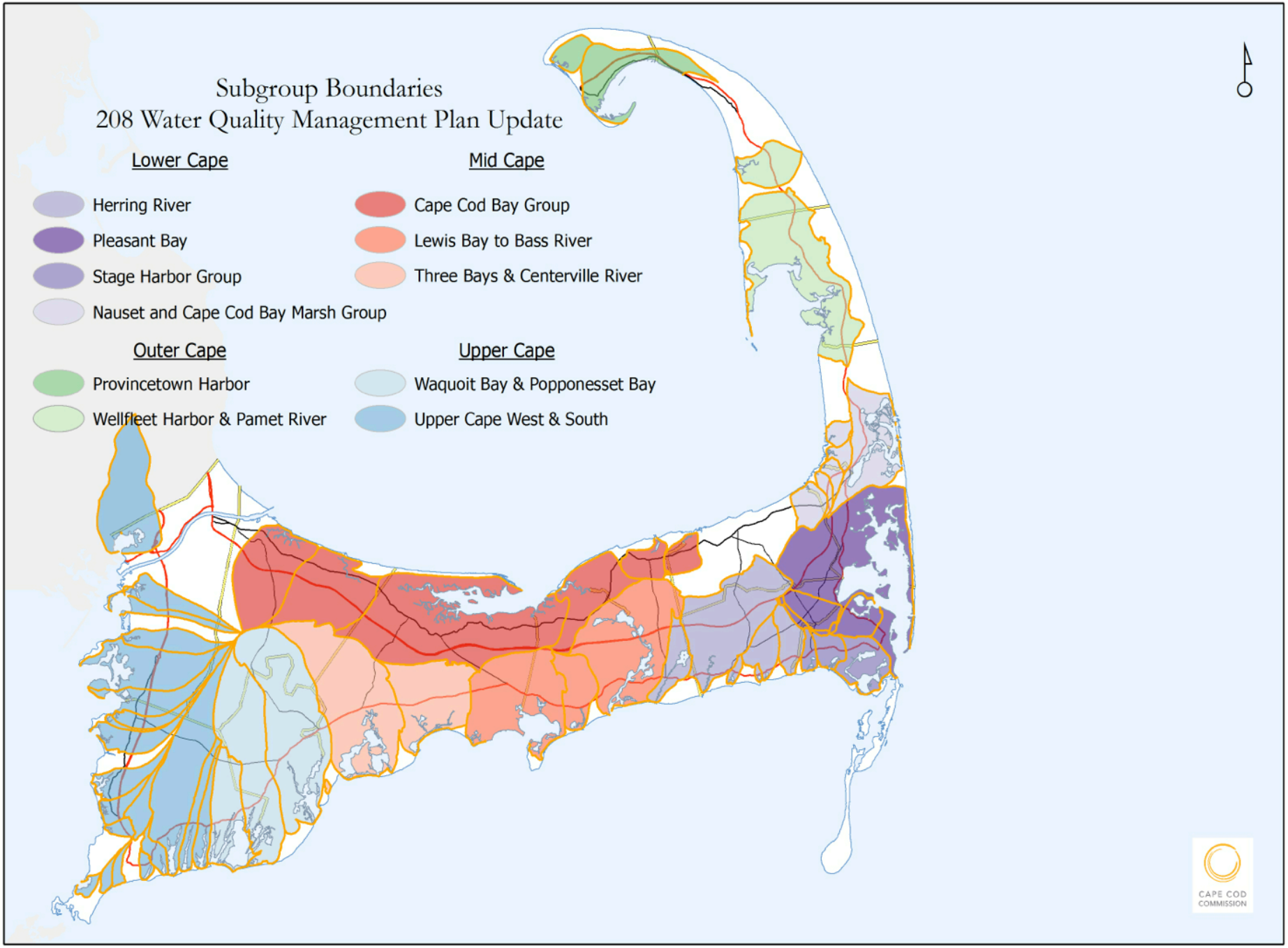
CAPE COD COMMISSION

Criterion Scores

SOCIAL	
System Resilience	S1
Employment	S2
Ratepayer Distribution	S3
Recreation and Open Space	S4
Property Values	S5
Fiscal Impacts	S6
ENVIRONMENTAL	
Marine Water	E1
Fresh Water	E2
Habitat	E3
Climate	E4
FINANCIAL	
Municipal Capital Costs	F1
Municipal Other Costs	F2
Property Owner Capital Costs	F3
Property Owner Other Costs	F4

Strategy/Technology Distribution

	Scenario 1	Scenario 2	Scenario 3
	Minimum Cost	Cost Effective	Maximum Performance
			
			
COST & PERFORMANCE			
Nitrogen Reduction %	30%	52%	61%
Remaining Nitrogen Load (Kg N)	8,400	5,760	4,680
Life Cycle Costs ($K)	$5,922	$7,350	$9,800
Municipal O&M Cost ($K)	$325	$425	$610
Municipal Project Cost ($K)	$1,329	$1,600	$1,800
Property Owner O&M Cost ($K)	$98	$128	$183
Property Owner Project Cost ($K)	$397	$480	$540
COMMUNITY BENEFITS			
Quality Habitat (acres)	0.5	1.8	2.4
New Open Space Added (acres)	1.5	4.6	5.0
GHG Reduced (MT CO2e/yr)	2.1	3.1	3.3
Avg. Increase in Property Value ($/pty)	$200	$1,200	$2,000
New Employment Added (jobs)	152	188	252
Additional Cost per Household ($/HH/yr)	$20	$26	$37


Subgroup Boundaries
208 Water Quality Management Plan Update
Lower Cape
Herring River
Pleasant Bay
Stage Harbor Group
Nauset and Cape Cod Bay Marsh Group
Mid Cape
Cape Cod Bay Group
Lewis Bay to Bass River
Three Bays & Centerville River
Outer Cape
Provincetown Harbor
Wellfleet Harbor & Pamet River
Upper Cape
Waquoit Bay & Popponesset Bay
Upper Cape West & South
CAPE COD COMMISSION

Area Boundaries
208 Water Quality Management Plan Update