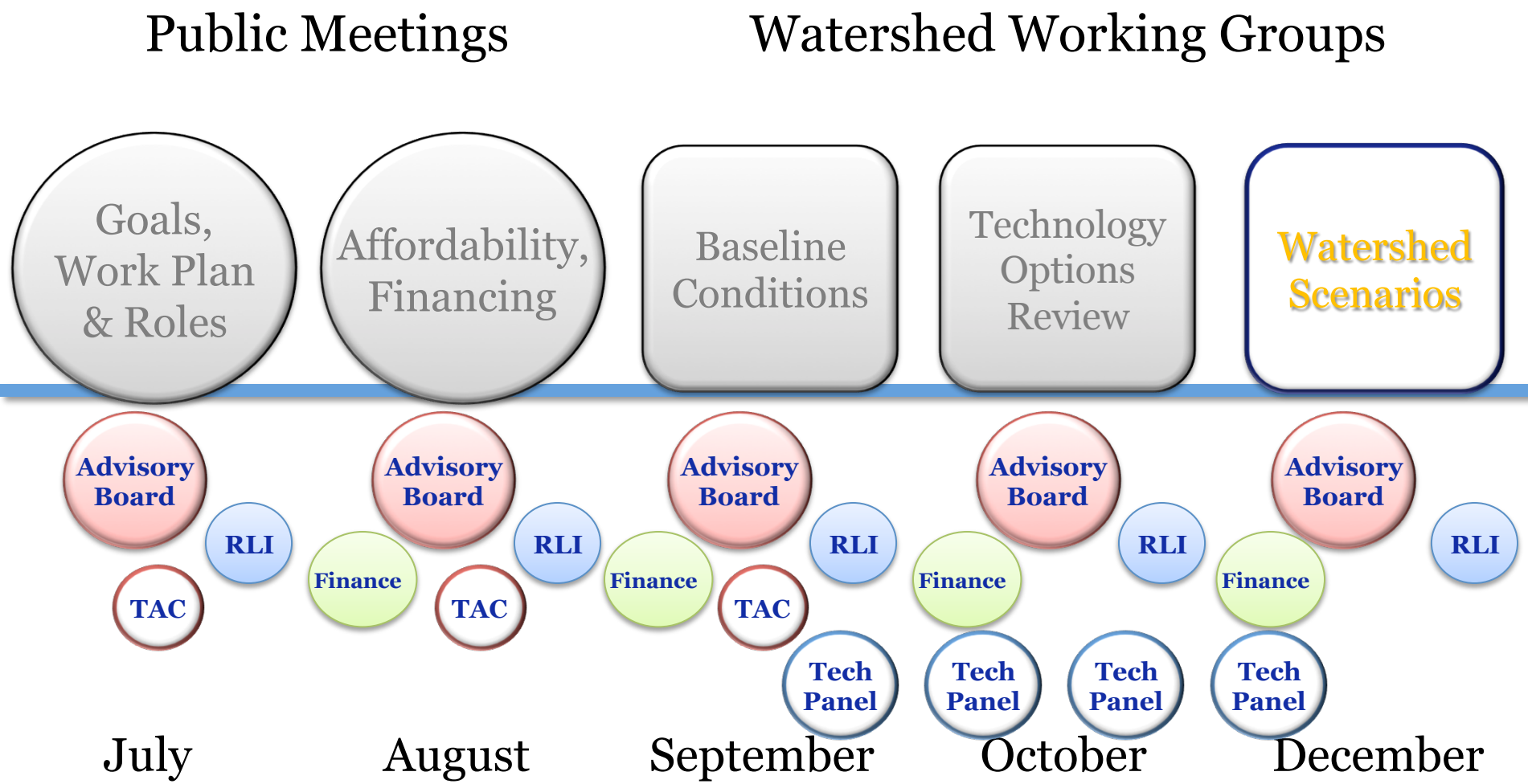
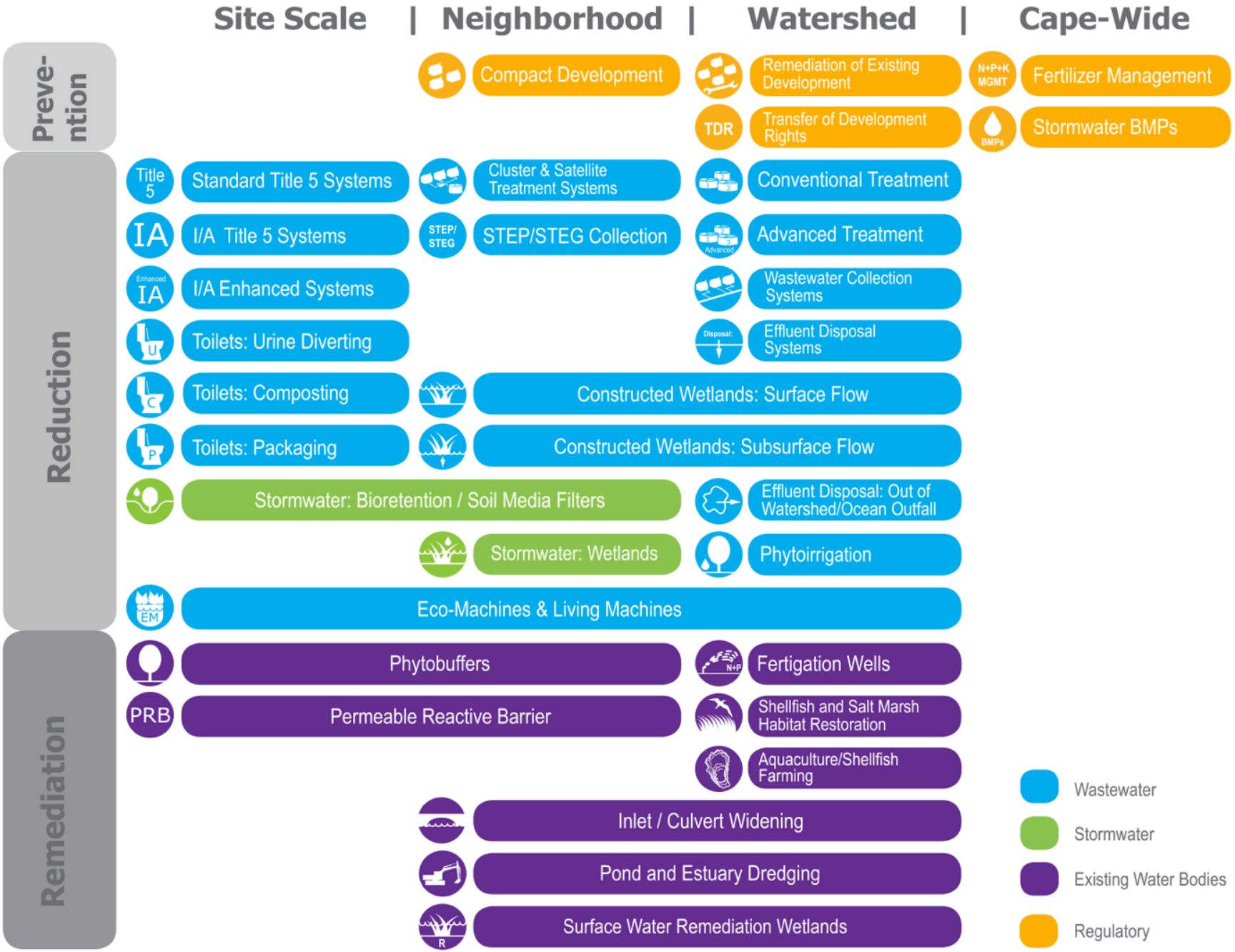
Nauset & Cape Cod Bay Marsh Group

Watershed Scenarios



208 Planning Process


Site Scale | Neighborhood | Watershed | Cape-Wide
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Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
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Pond and Estuary Dredging
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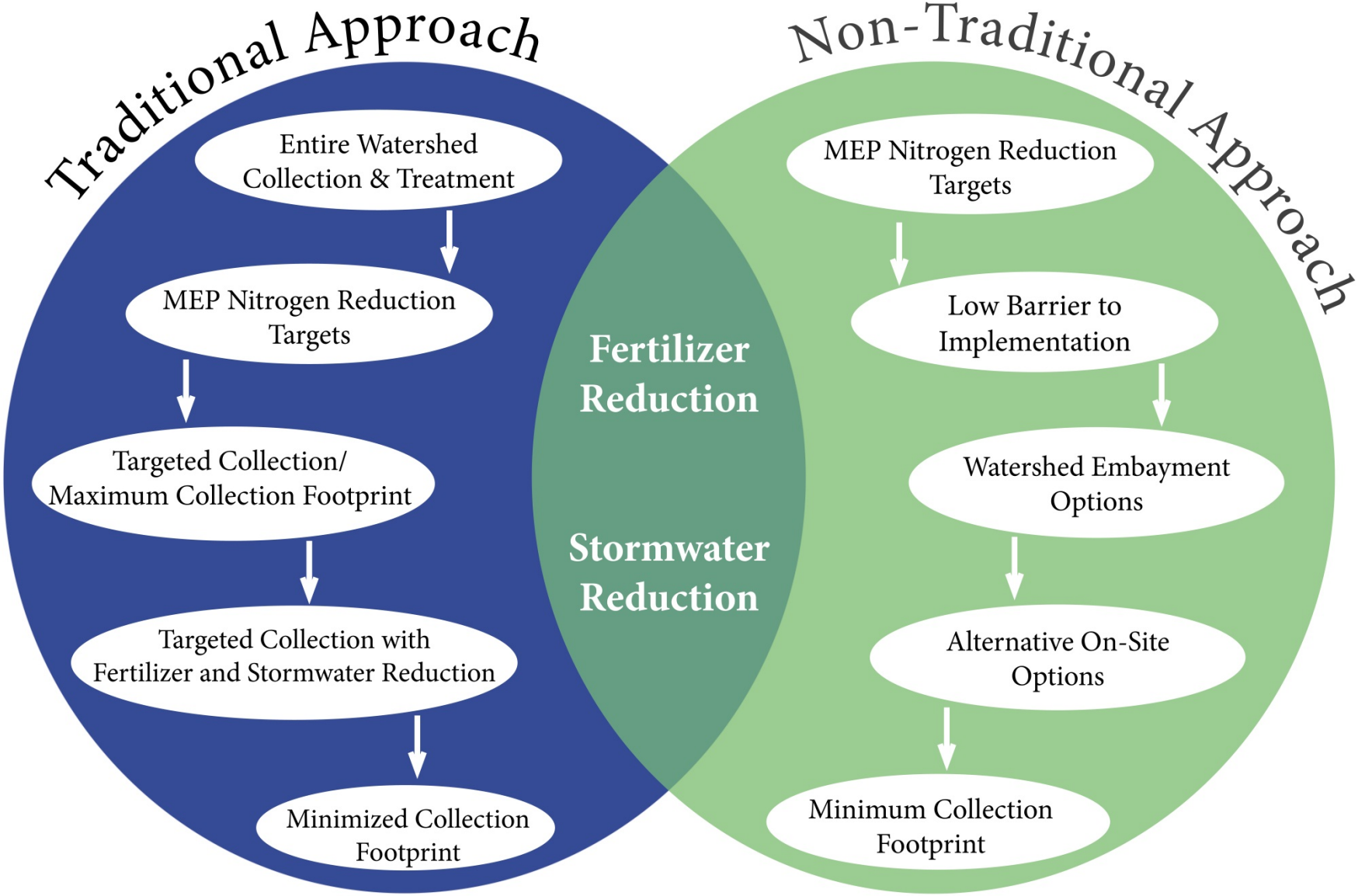
Existing Water Bodies
Regulatory

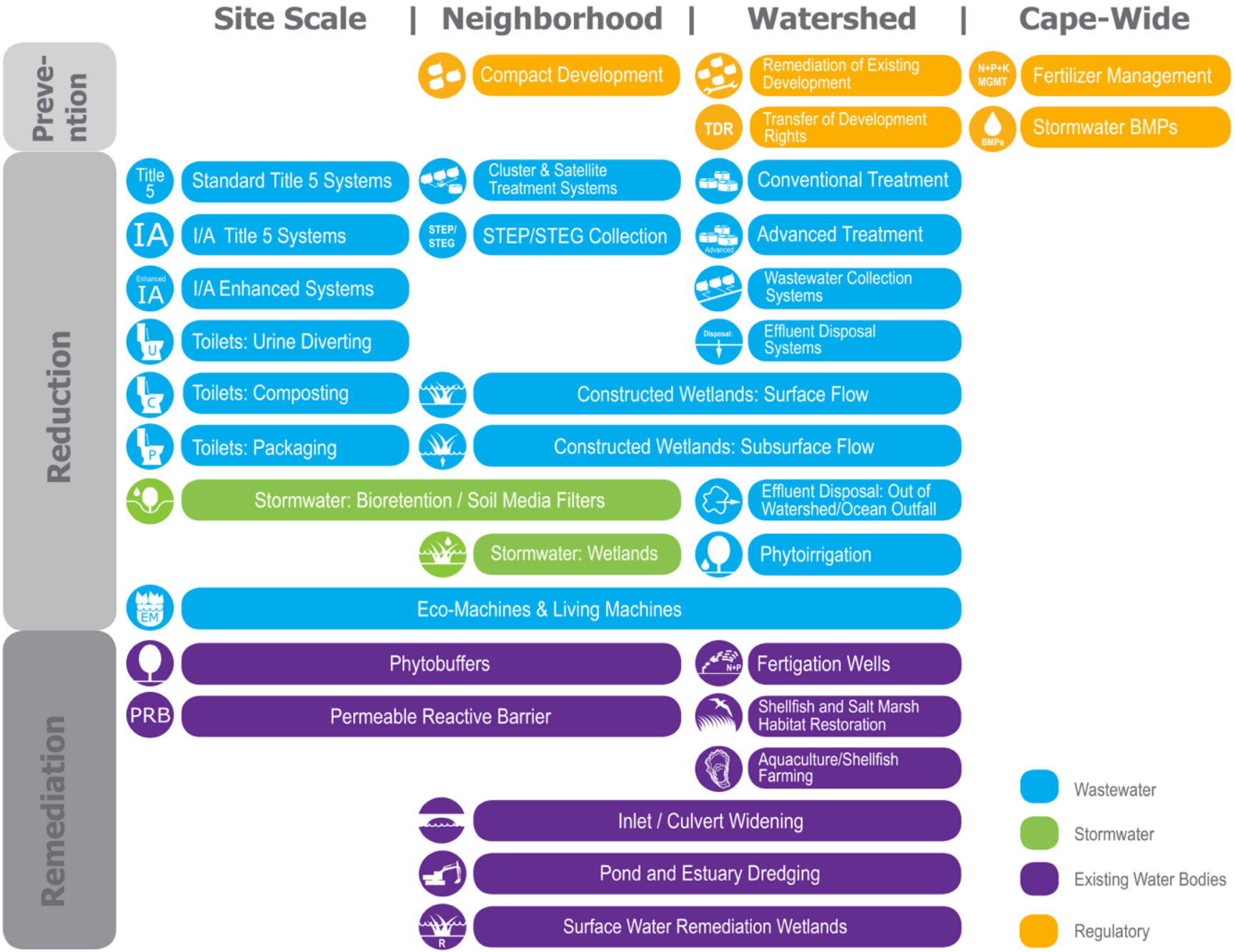
Watershed Scenarios

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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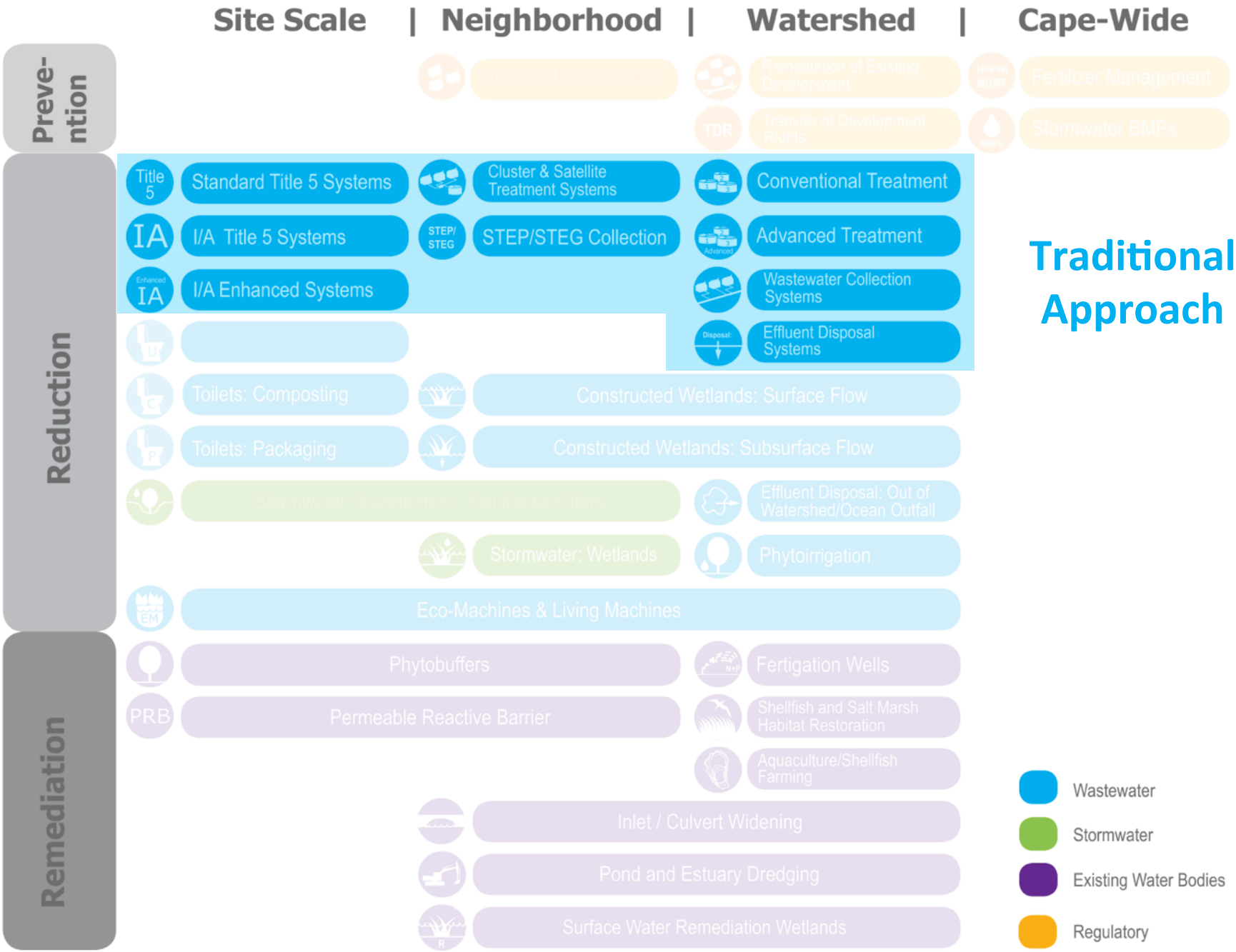
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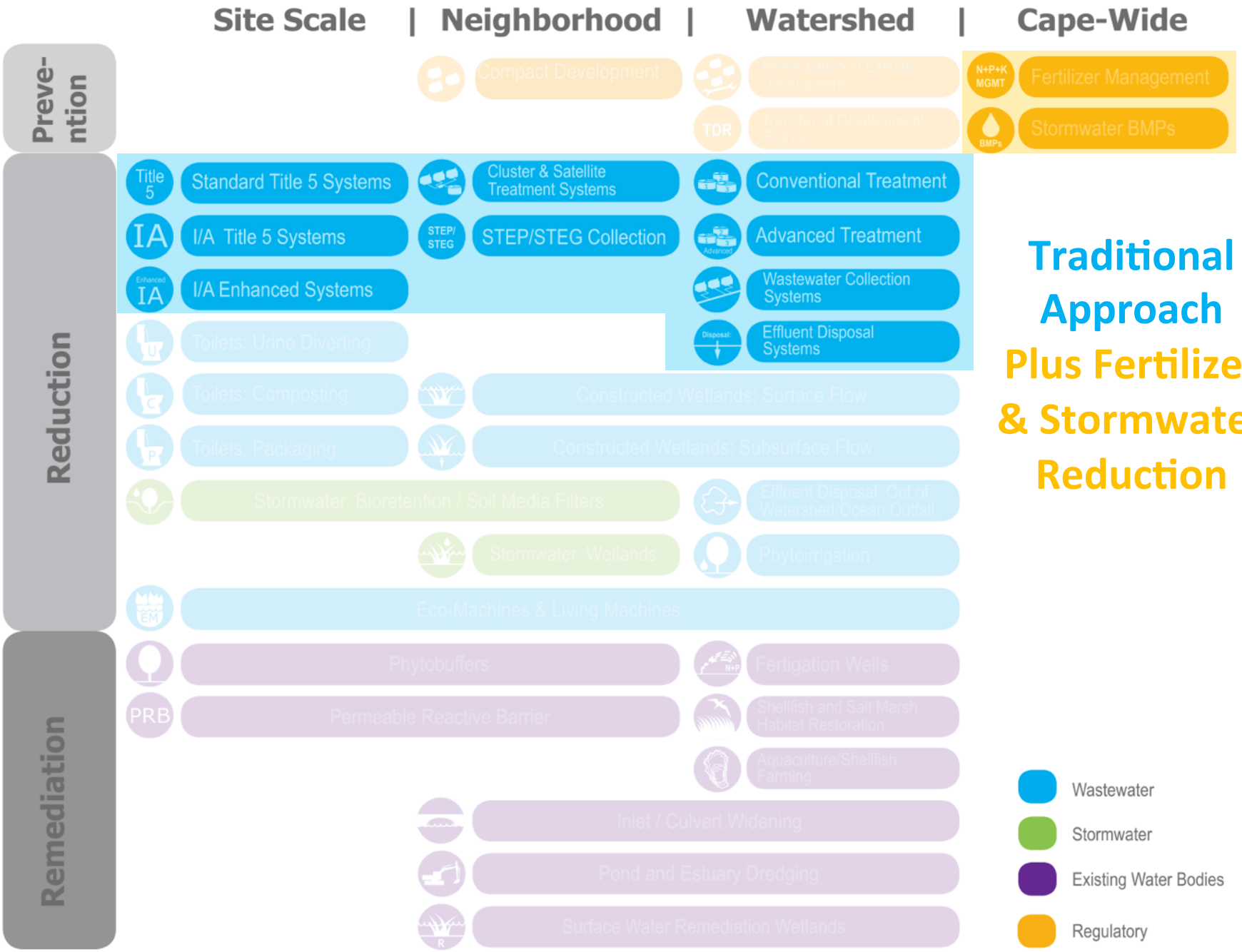
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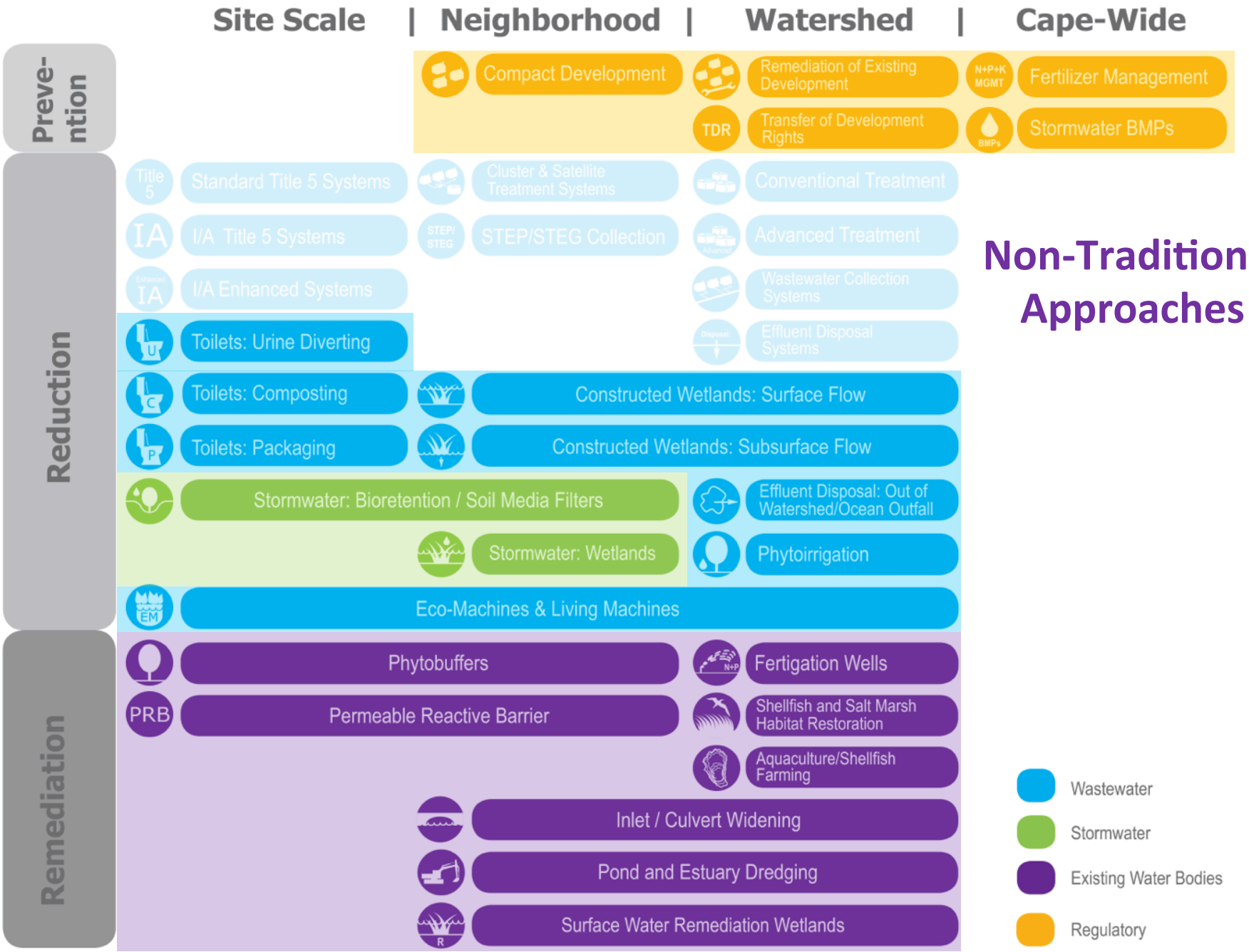
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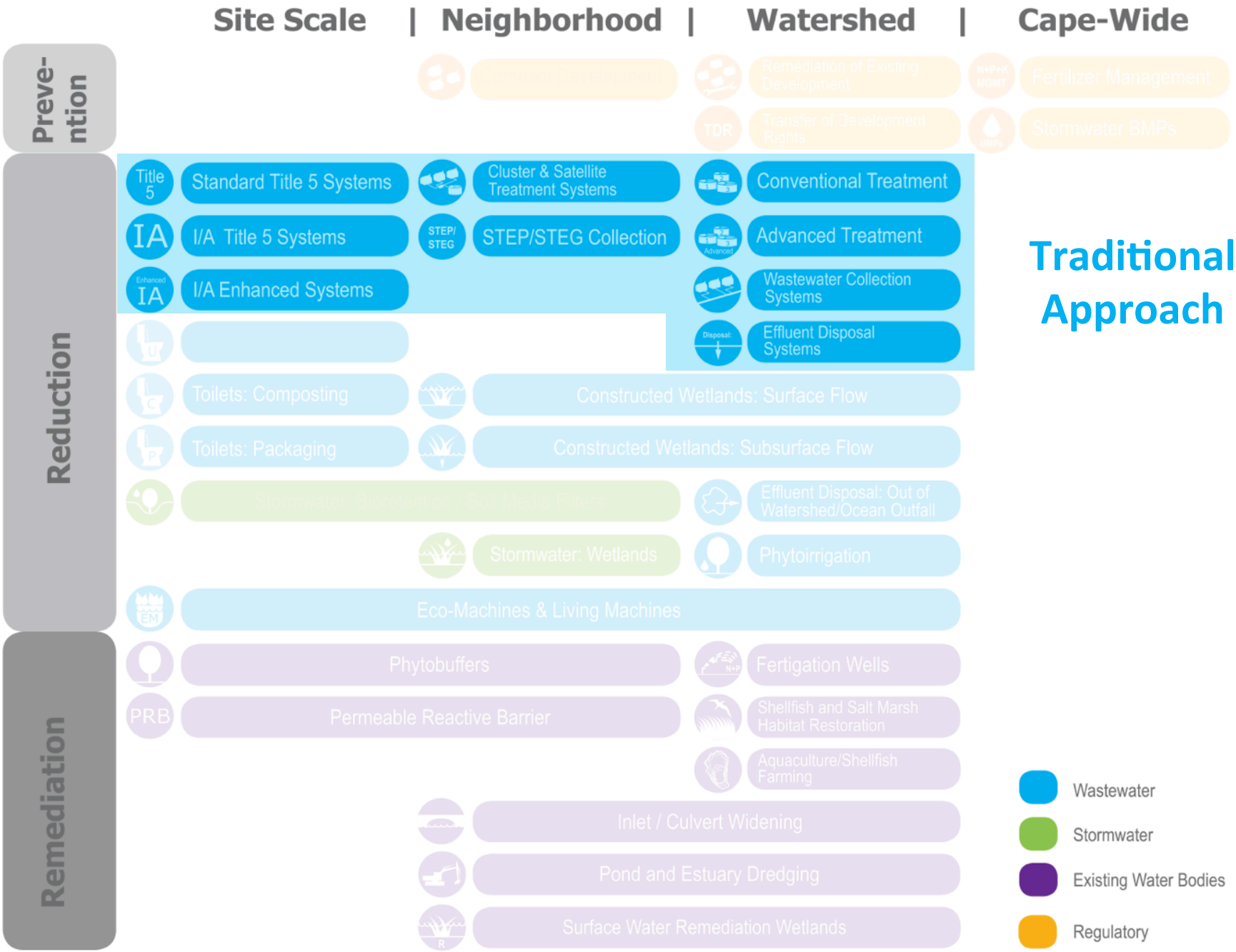
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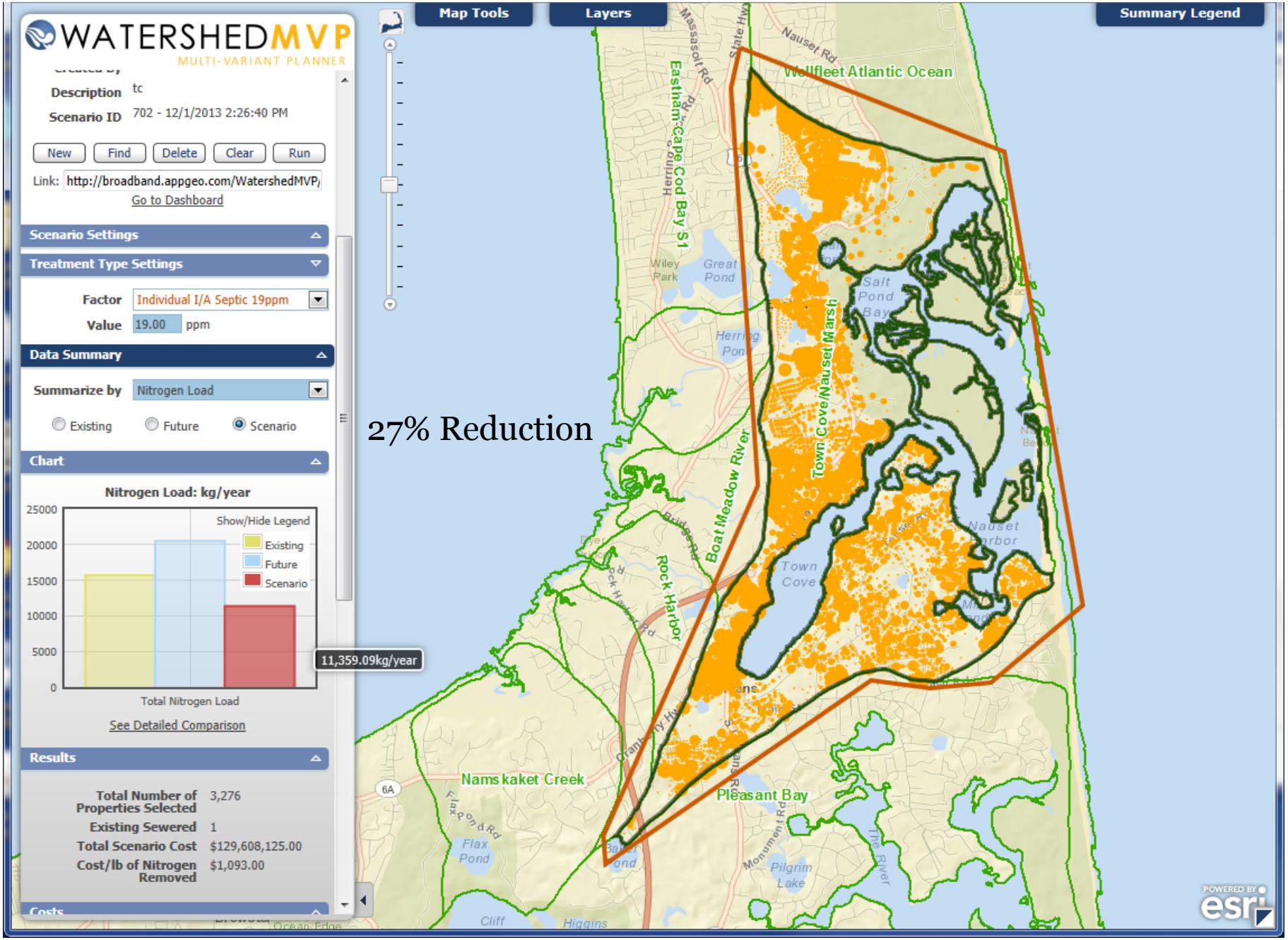
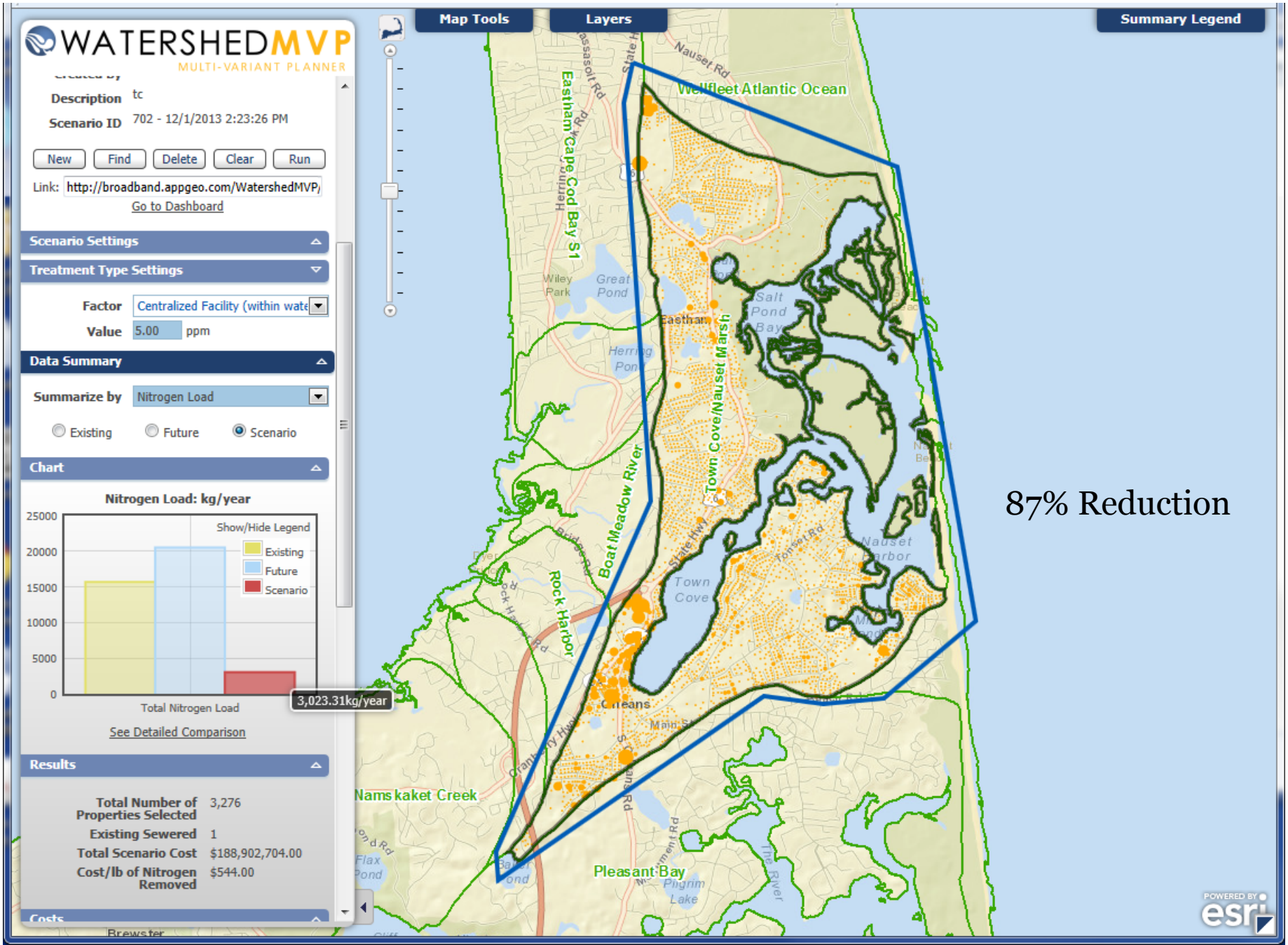
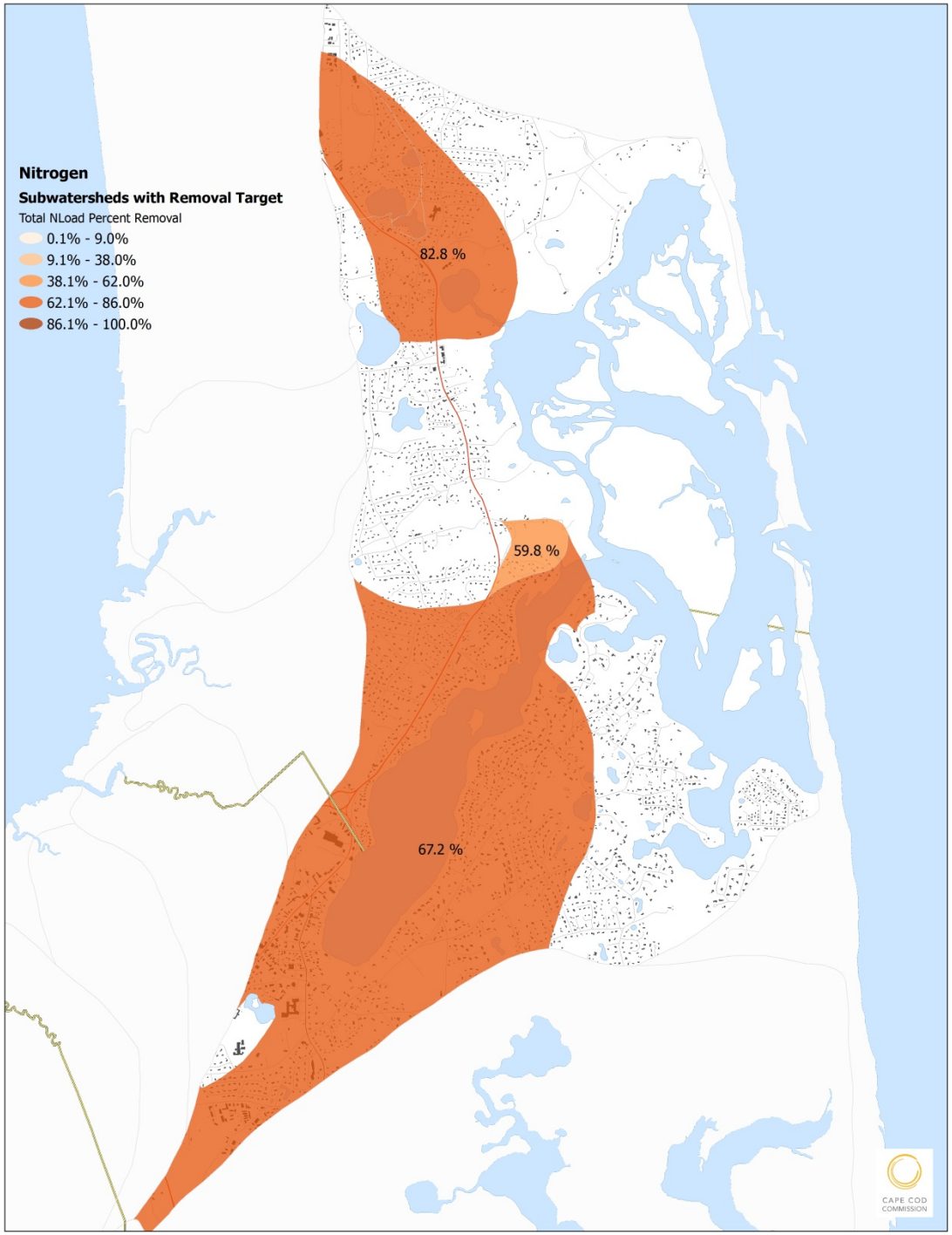
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems

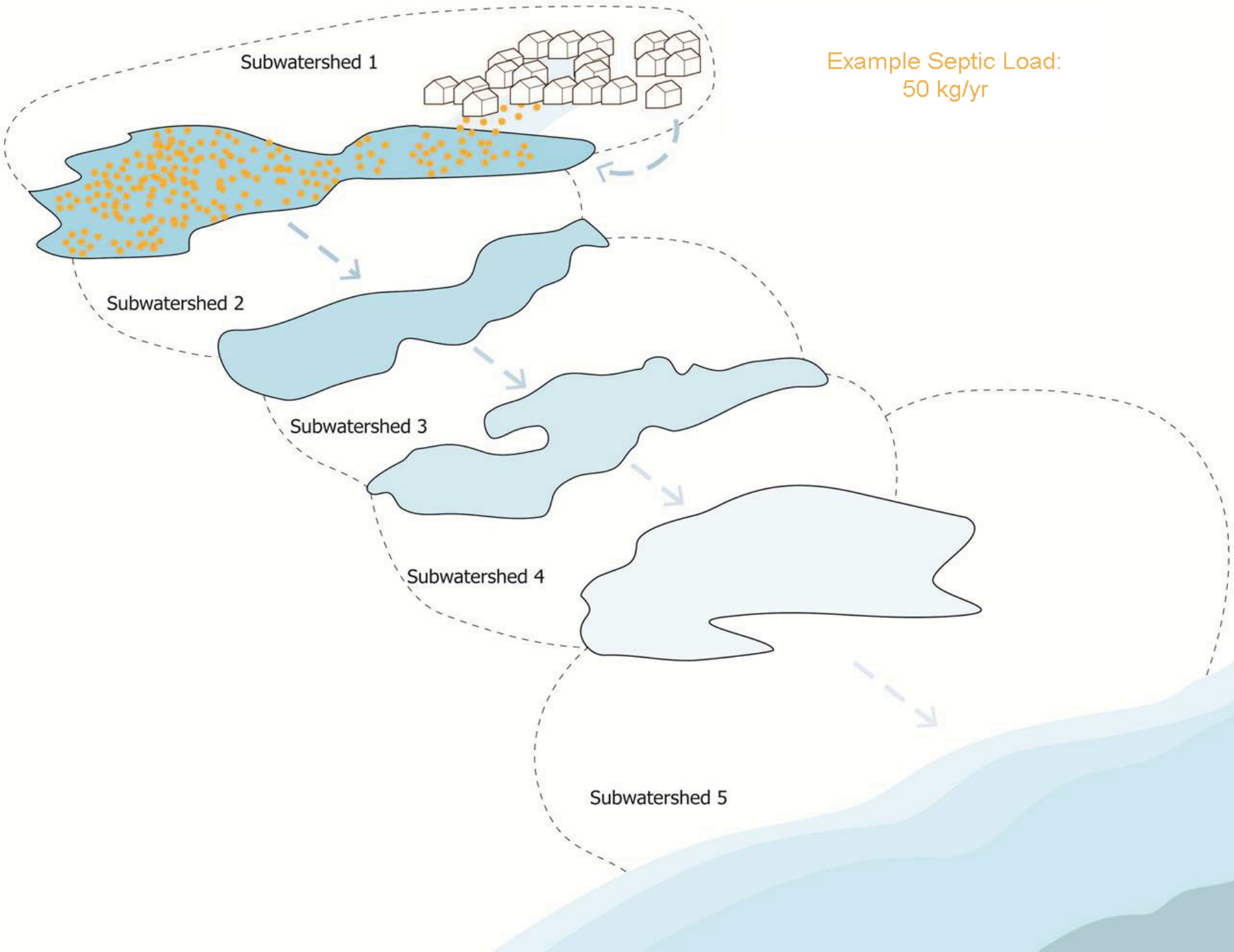


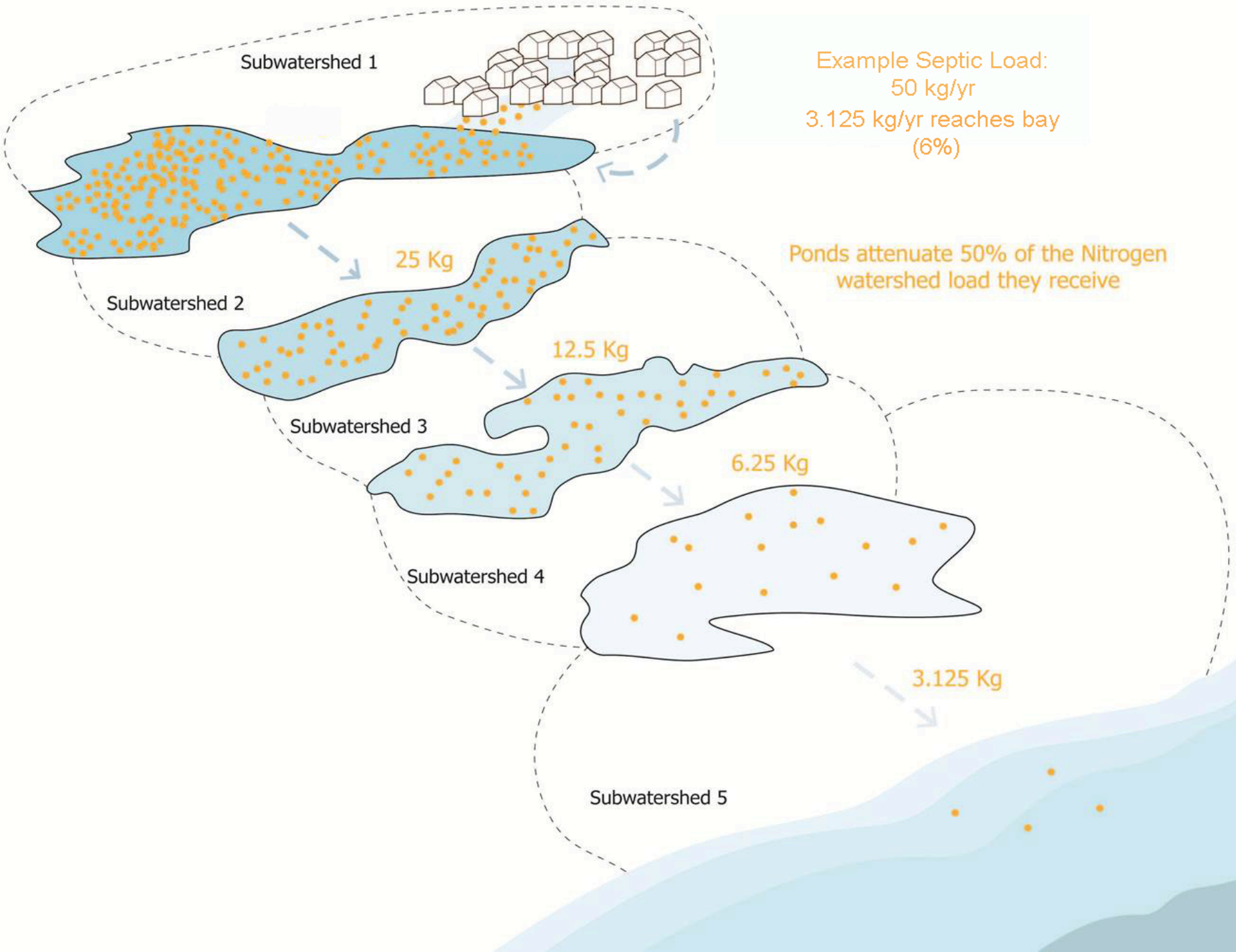
Watershed-Wide Centralized Treatment with Disposal Inside the Watershed

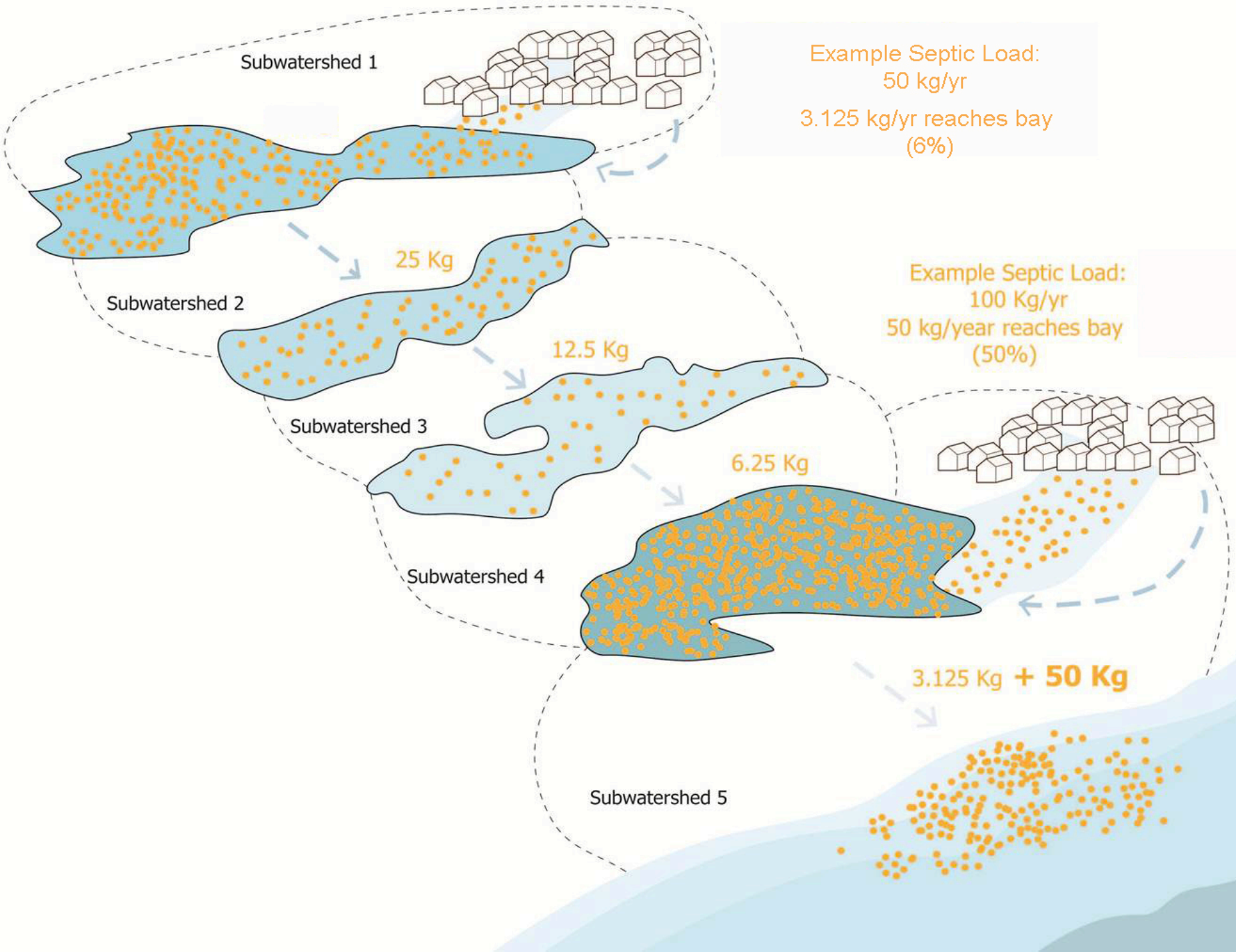


87% Reduction


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%
82.8 %
59.8 %
67.2 %
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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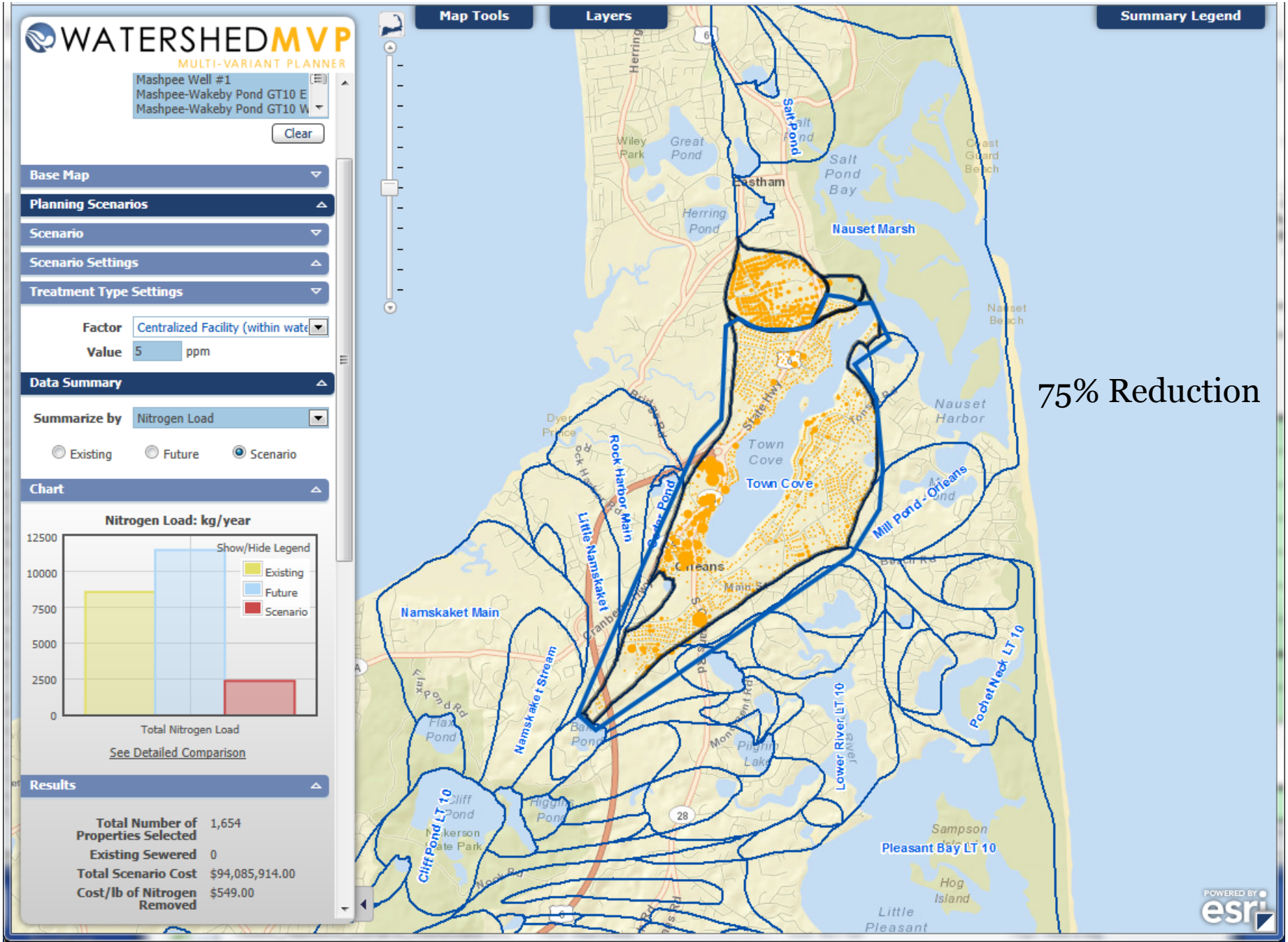
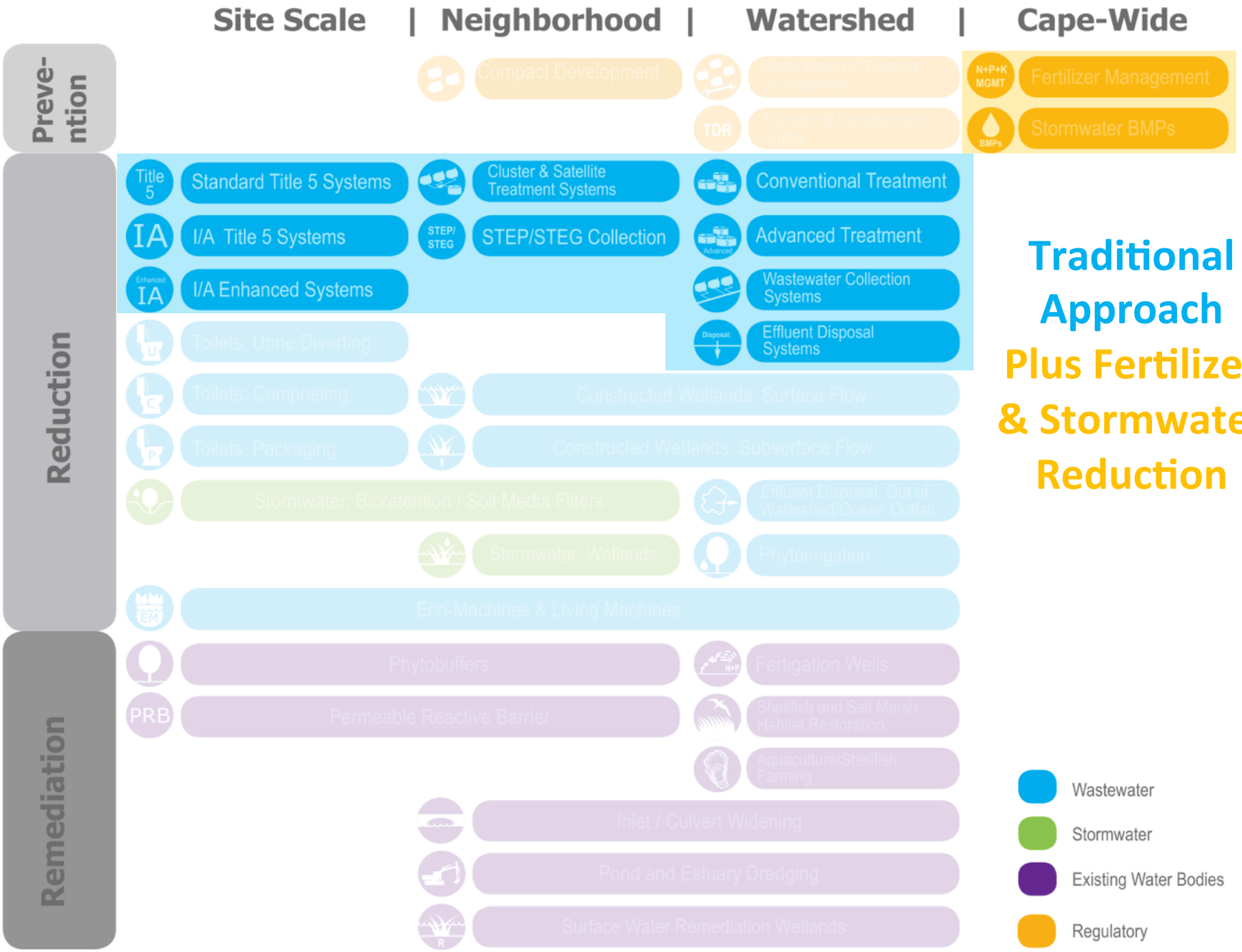
25 Kg
Subwatershed 2
Example Septic Load:
100 Kg/yr
50 kg/year reaches bay
(50%)
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg + 50 Kg
Subwatershed 5

Targeted Centralized Treatment with Disposal Inside the Watershed

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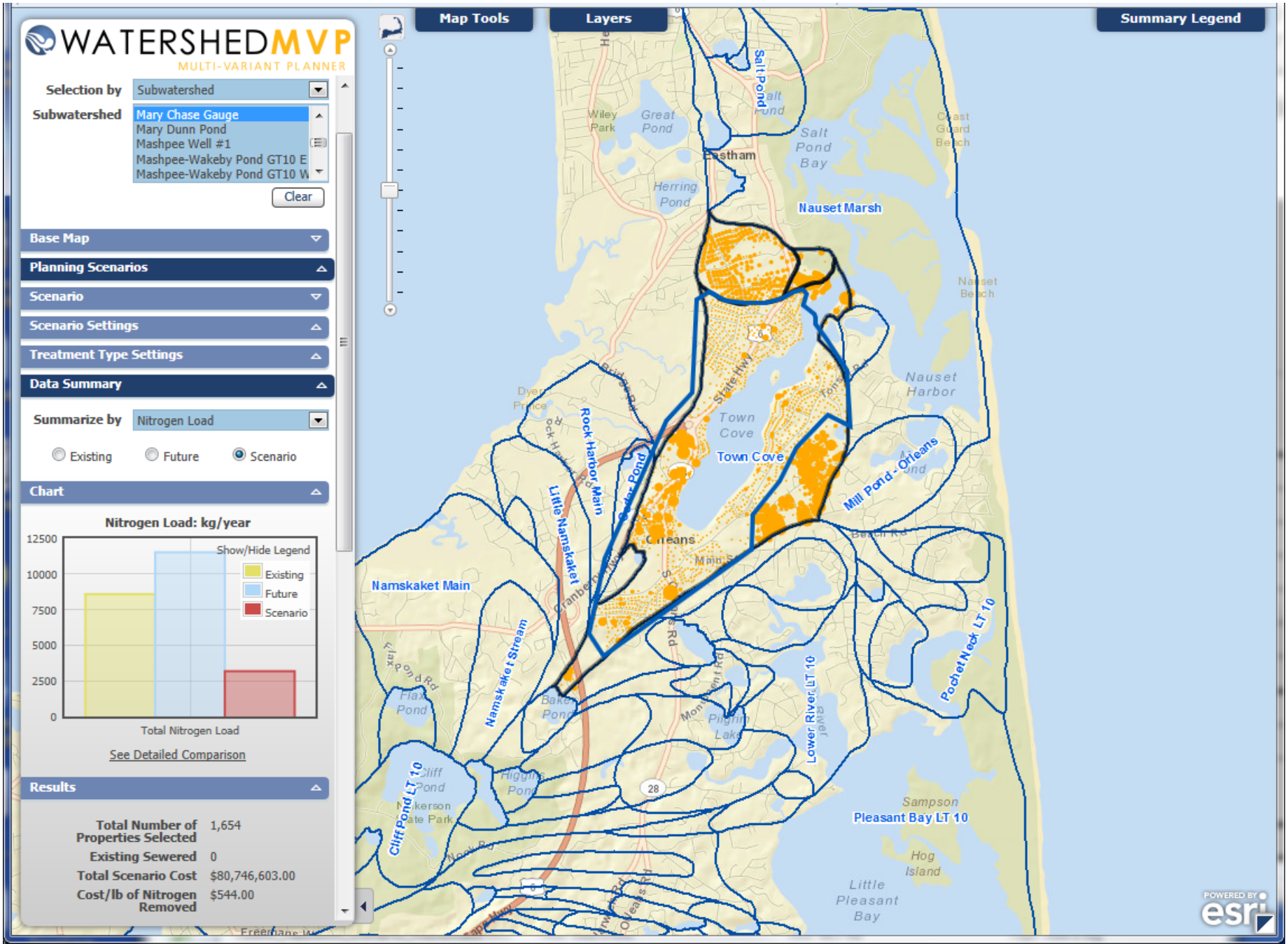
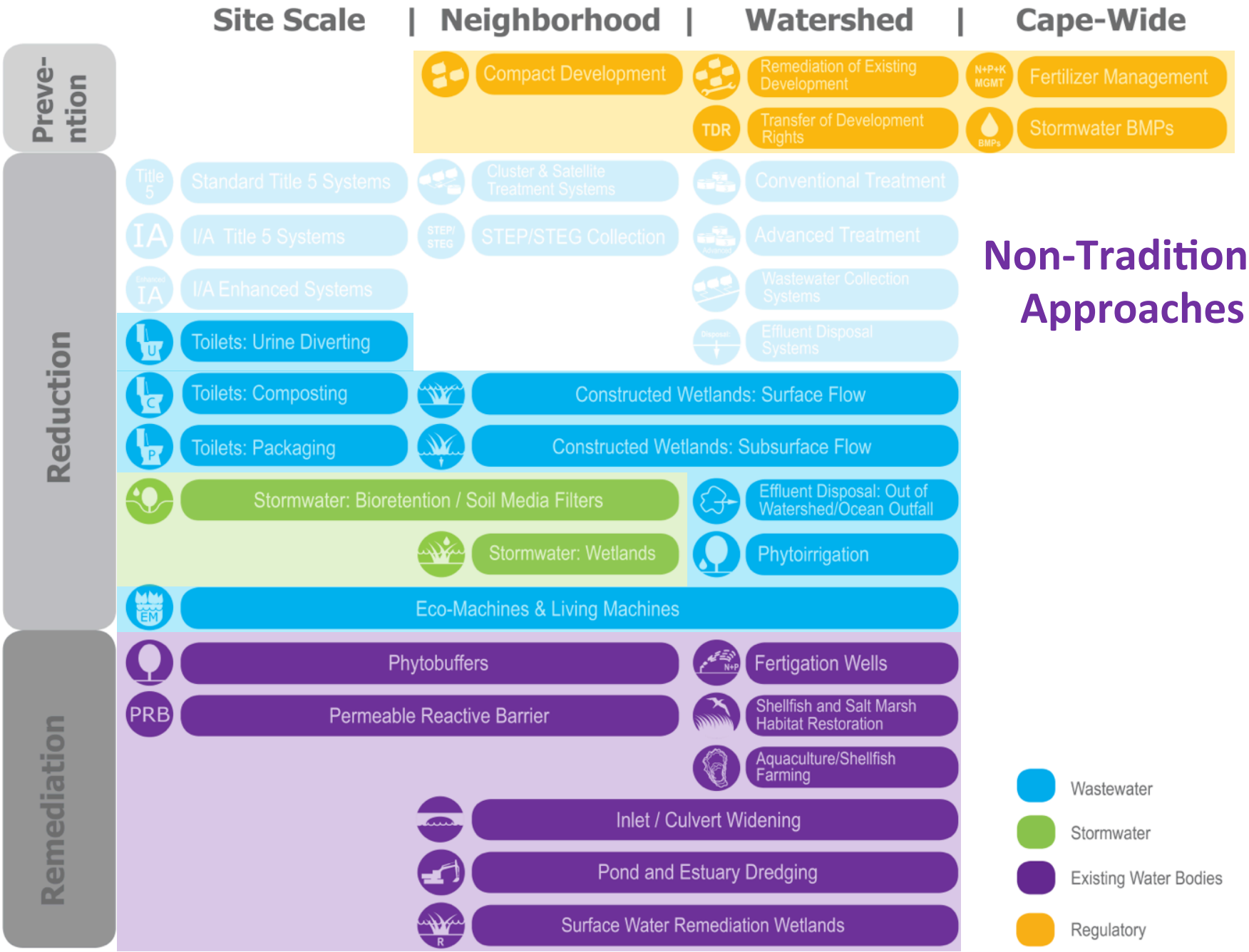
Targeted Centralized Treatment with a 50% Reduction in Fertilizer and Stormwater

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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

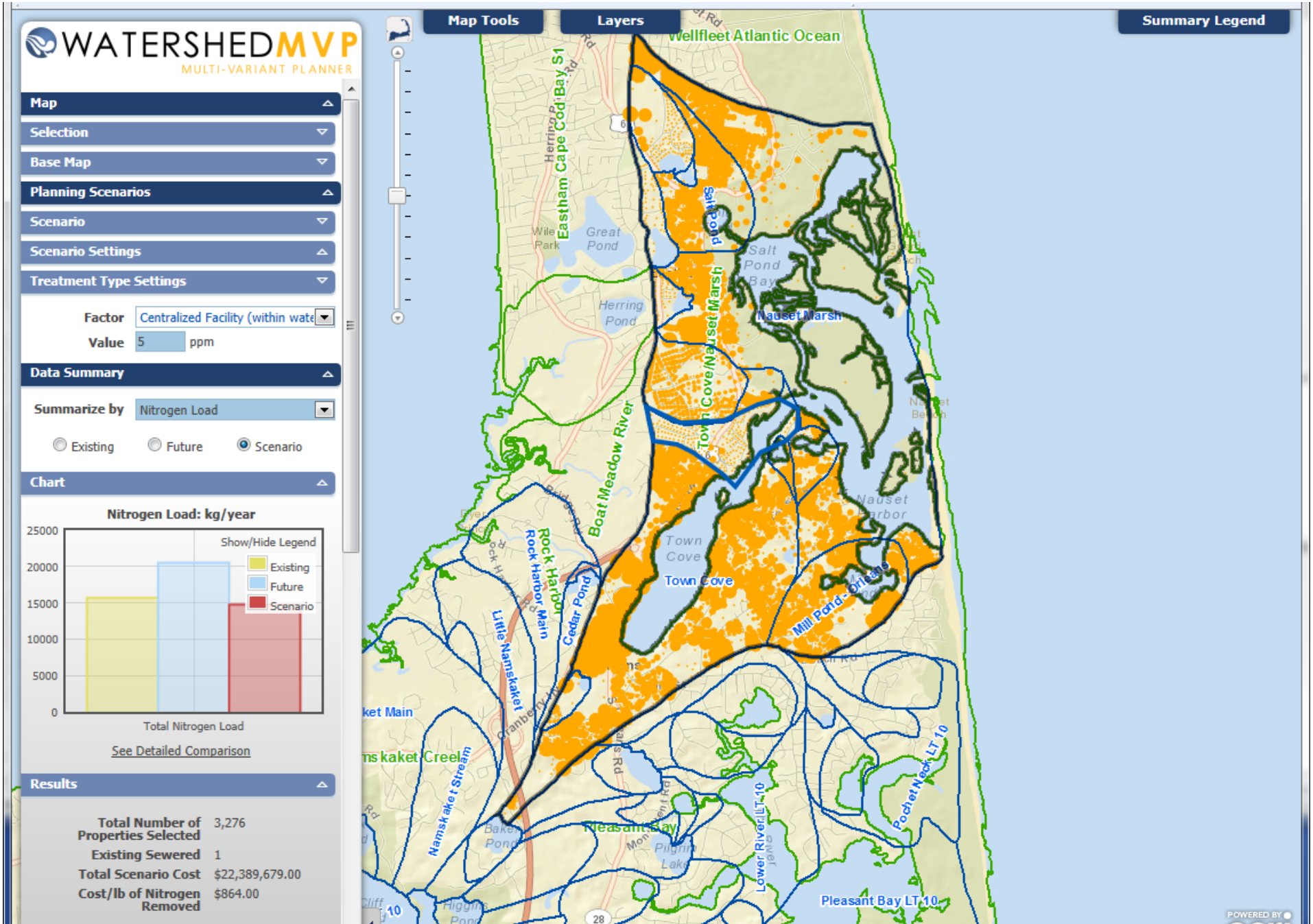
Supplemental Sewering

Watershed Calculator Nauset Marsh

MEP Targets and Goals:			kg/day	Nitrogen (kg/yr)
Present Total Nitrogen Load:			53.19	19,414
wastewater			42.915	15,664
fertilizer			4.4	1,594
stormwater			5.9	2,156
Target Nitrogen Load:			19.5	7,118
Nitrogen Removal Required:			**33.69**	**12,297**
Total Number of Properties:	3276			

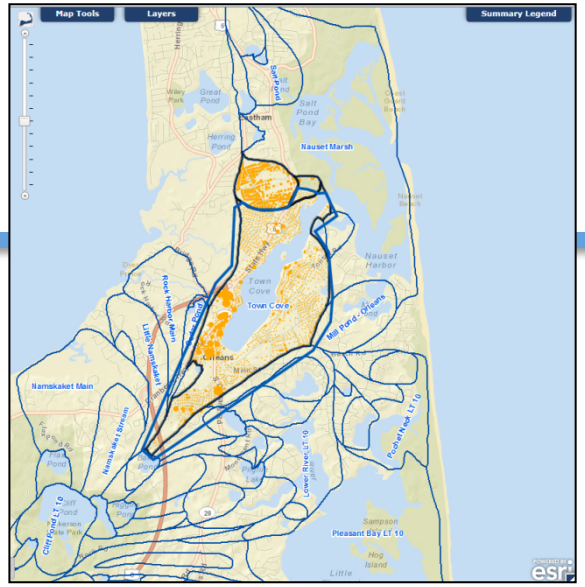
Other Wastewater Management Needs			Ponds	Title 5 Problem Areas	Growth Management
Low Barrier to Implementation			**Reduction by Technology (Kg/yr)**	**Remaining to Meet Target (Kg/yr)**	**Unit Cost ($/lb N)**
Fertilizer Management			797	11,500	
Stormwater Mitigation			1,078	10,422	
Watershed/Embayment Options:					
Permeable Reactive Barrier (PRB)	1200	Homes	4,752	6,726	$452
Oyster Beds/Aquaculture	11	Acres	2,750	3,976	$0
Floating Constructed Wetlands	4000	cu feet	1,800	2,176	$61
Alternative On-Site Options:					
Ecotoilets (UD & Compost)	25	homes	99.0	2,077	$1,265
I&A Technologies	185	homes	431.4	1,645	$1,607
Enhanced I&A	35	Homes	104.7	1,541	$2,855
Sewering	350	homes	1541	0	$1,000
			Total To Meet Goal (Kg/yr):	0	$361

Targeted Centralized Treatment after Applying Alternative Strategies (877 kg N/yr)



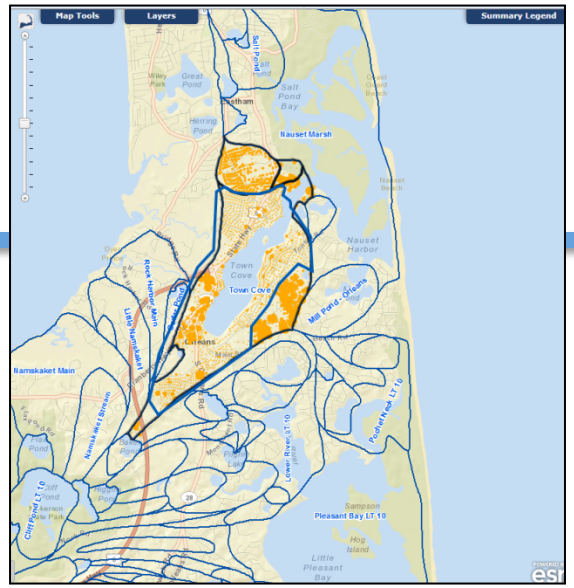
Scenario Comparison

Targeted Collection



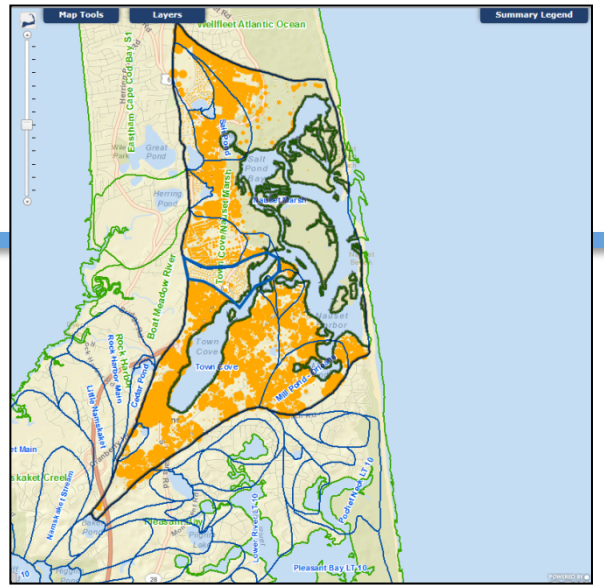
- Achieves TMDL[1]
- Total Cost = $94 Million
- Cost/lb N = $549
- Treated Flow = 212,000 gpd

Targeted Collection after a 50% reduction in fertilizer and stormwater



- Achieves TMDL[1]
- Total Cost = $80 Million
- Cost/lb N = $544
- Treated Flow = 204,000 gpd

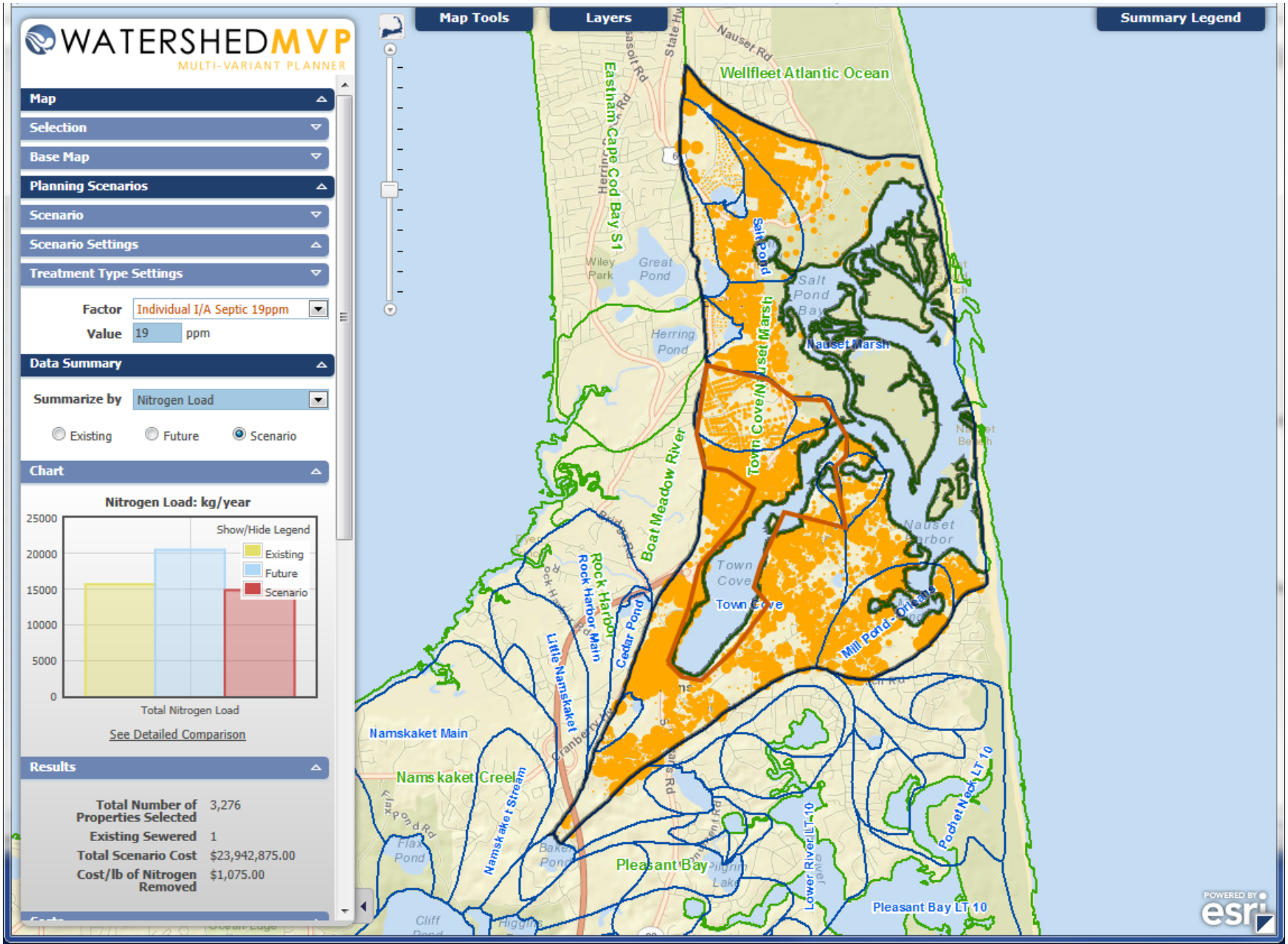
Targeted Collection after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



- Achieves TMDL[1]
- Total Cost = $21 Million
- Cost/lb N = $874
- Treated Flow = 30,000 gpd

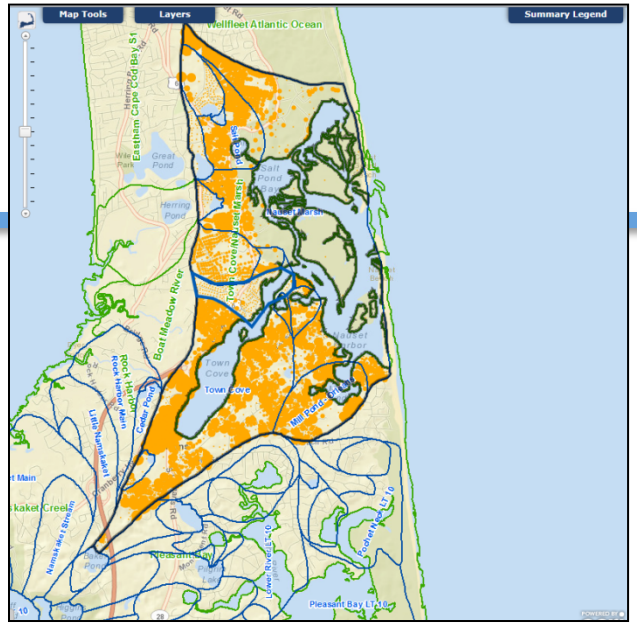
[1] within 5% of goal

Innovative/Alternative On-Site Systems after Applying Alternative Strategies (877 kg N/yr)



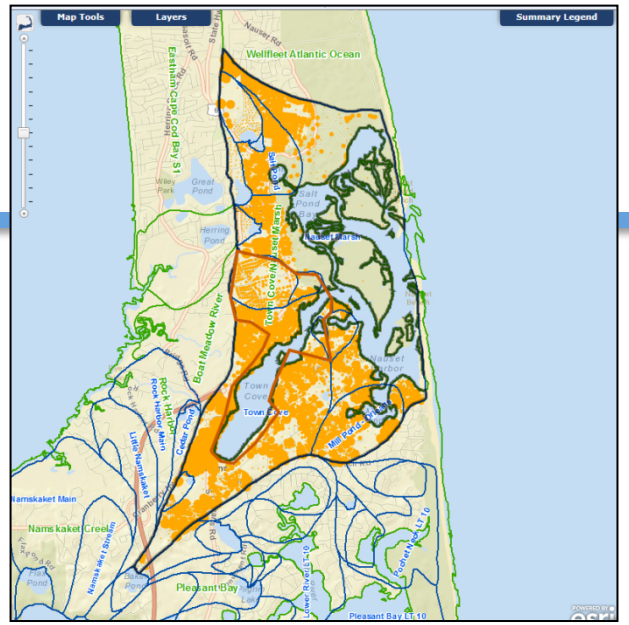
Scenario Comparison

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



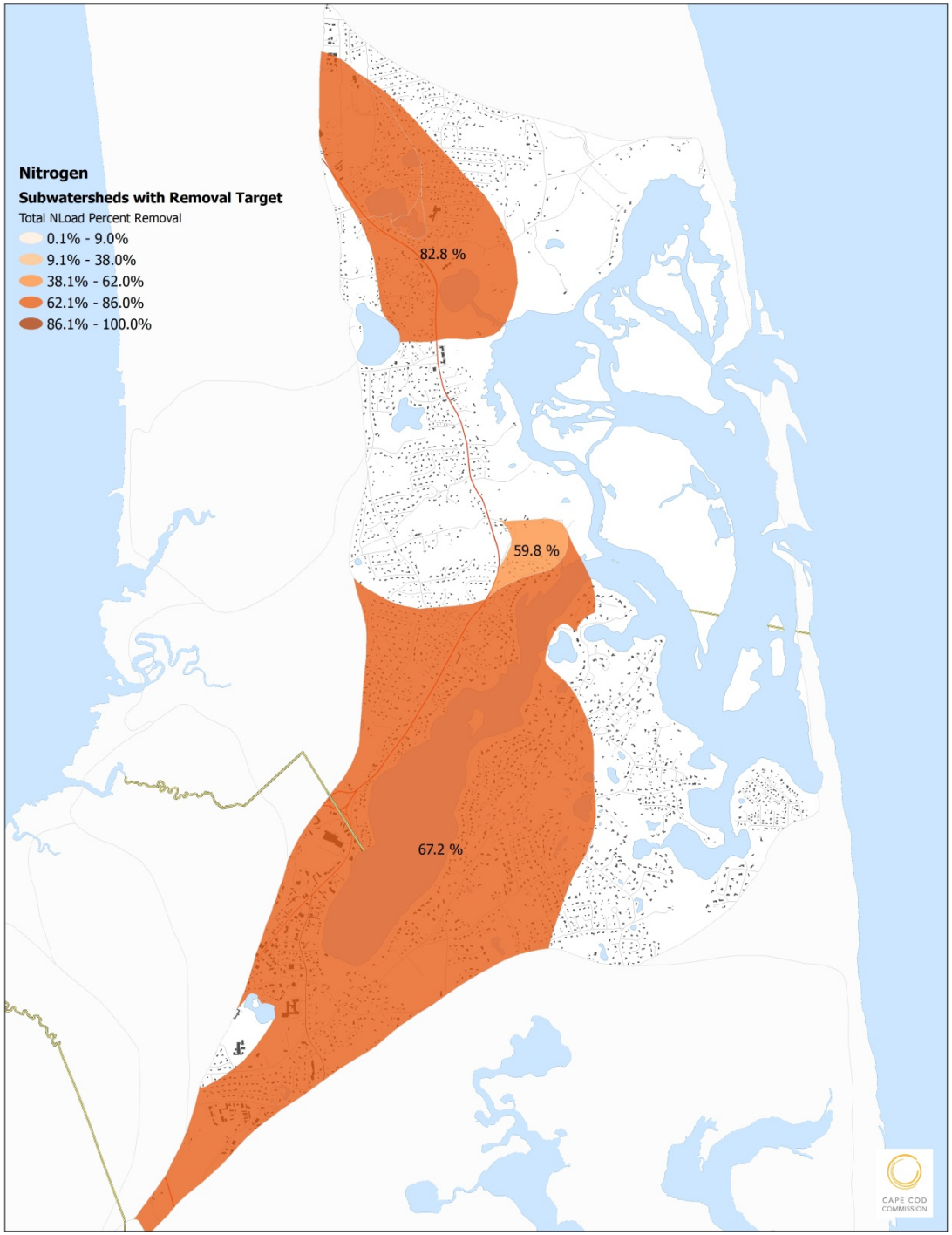
- Achieves TMDL[1]
- Total Cost = $21 Million
- Cost/lb N = $874
- Treated Flow = 30,000 gpd

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



- Achieves TMDL[1]
- Total Cost = $27 Million
- Cost/lb N = $1390
- Treated Flow = 104,000 gpd

[1] within 5% of goal


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%
82.8 %
59.8 %
67.2 %
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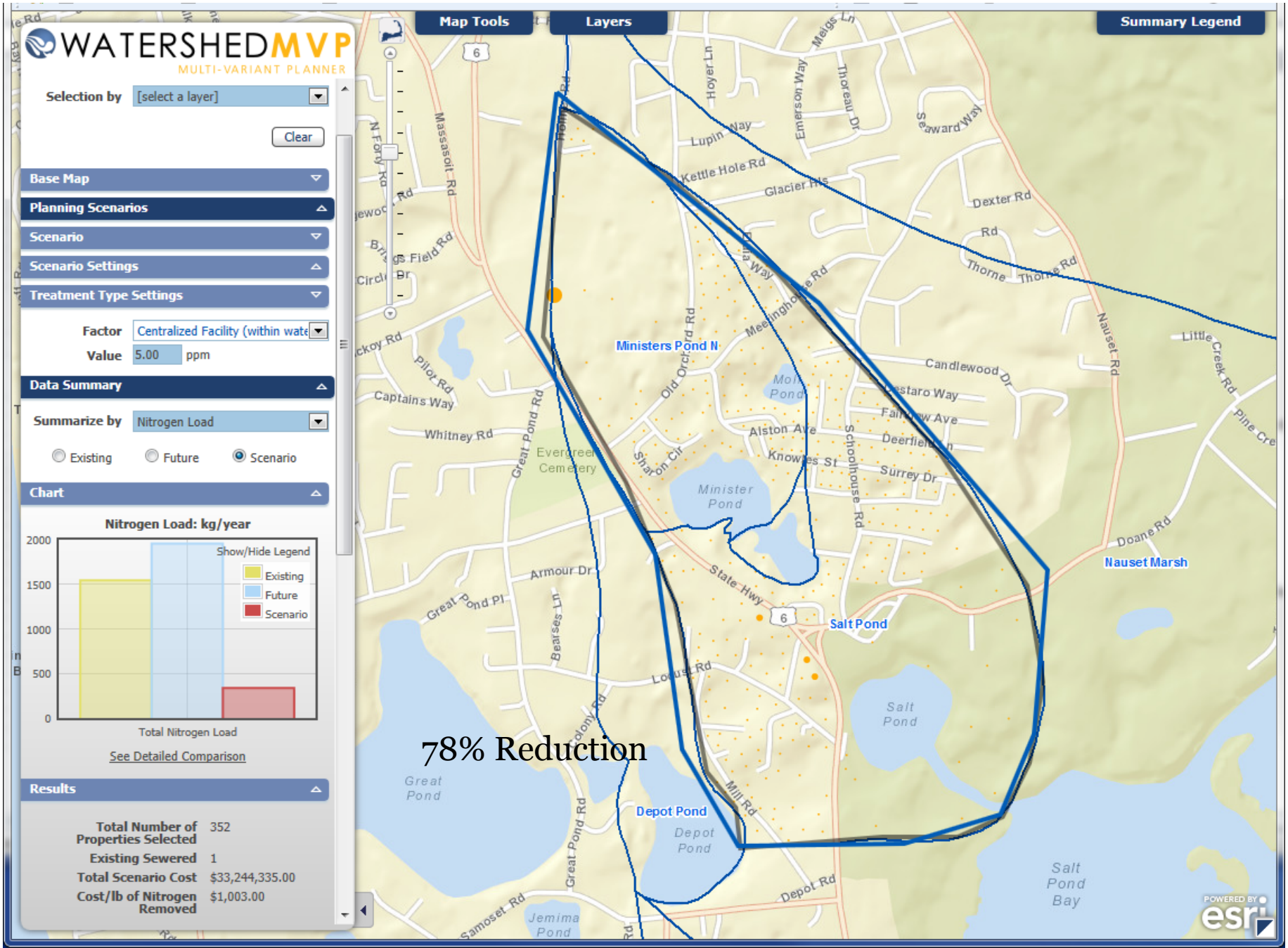
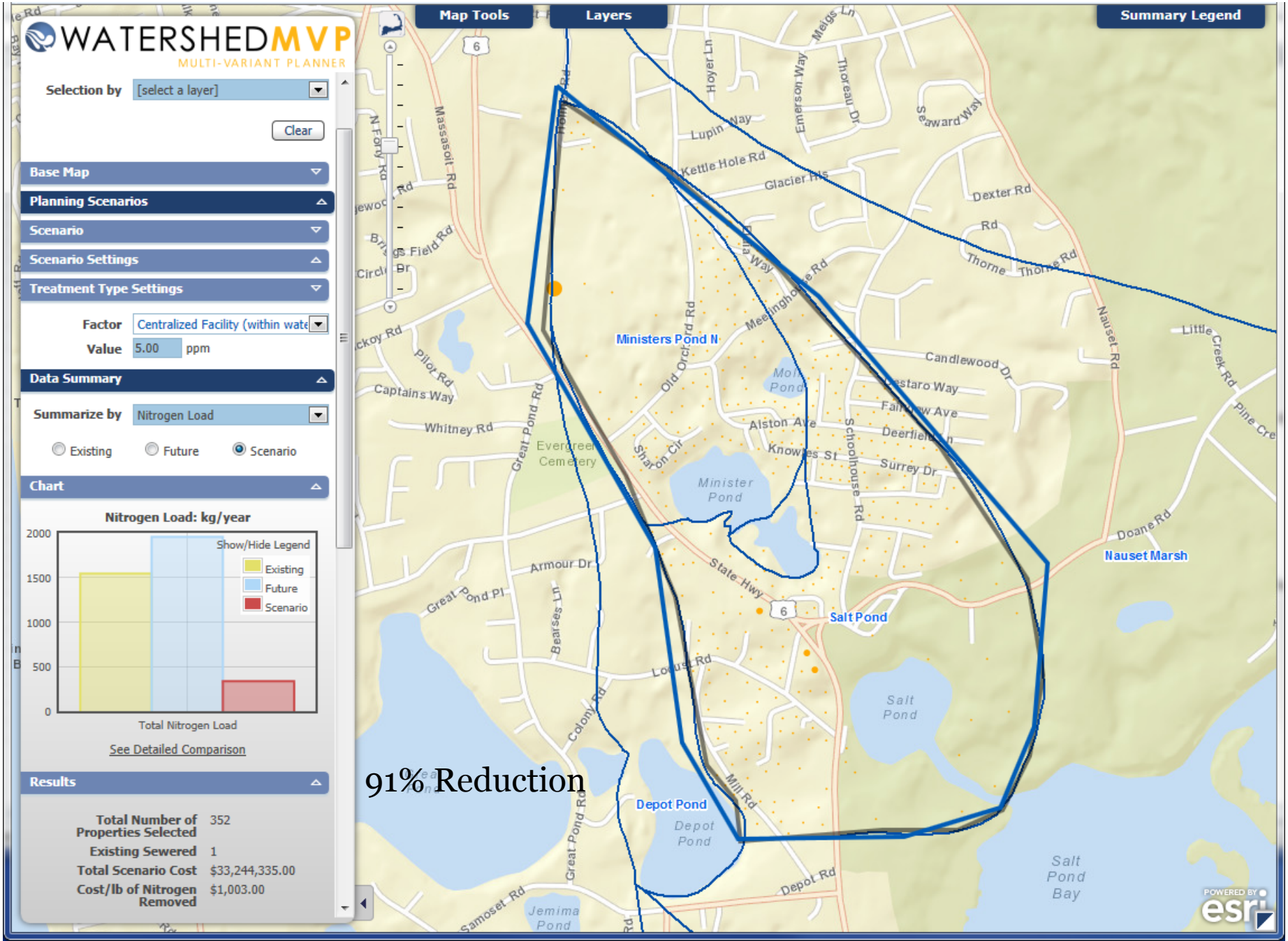
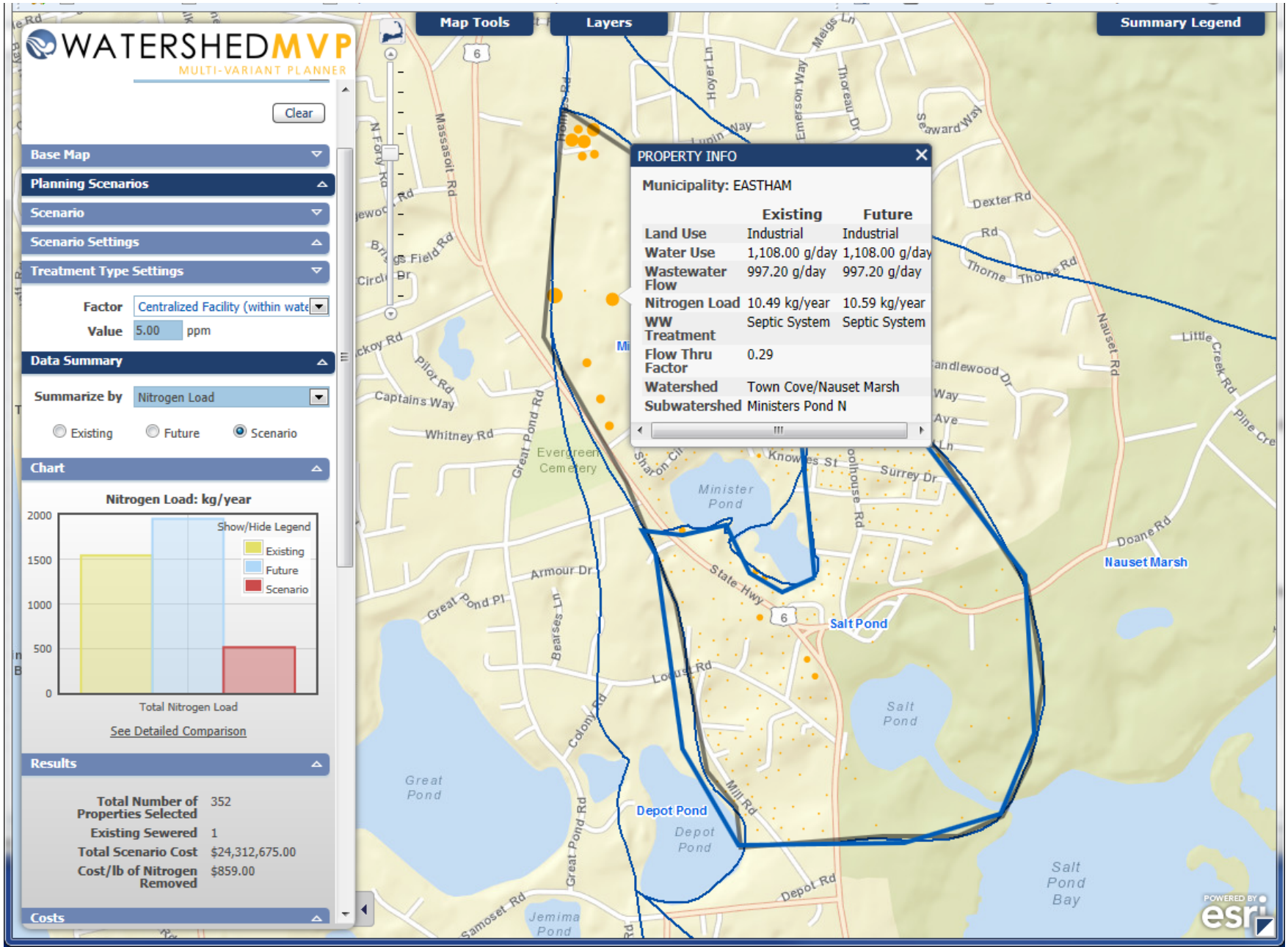
Centralized Treatment with Disposal Inside the Watershed



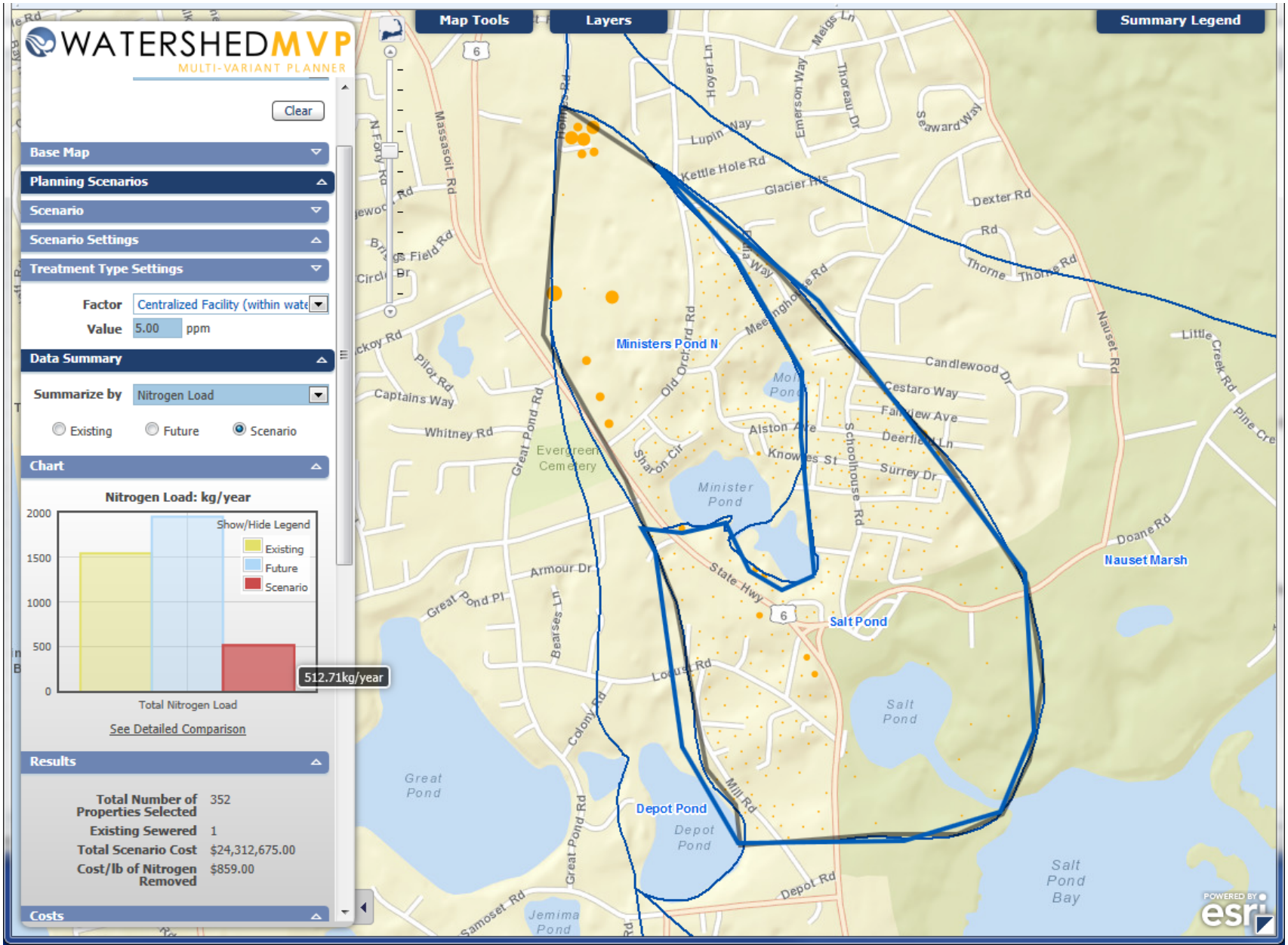
Centralized Treatment with a 50% Reduction in Fertilizer and Stormwater



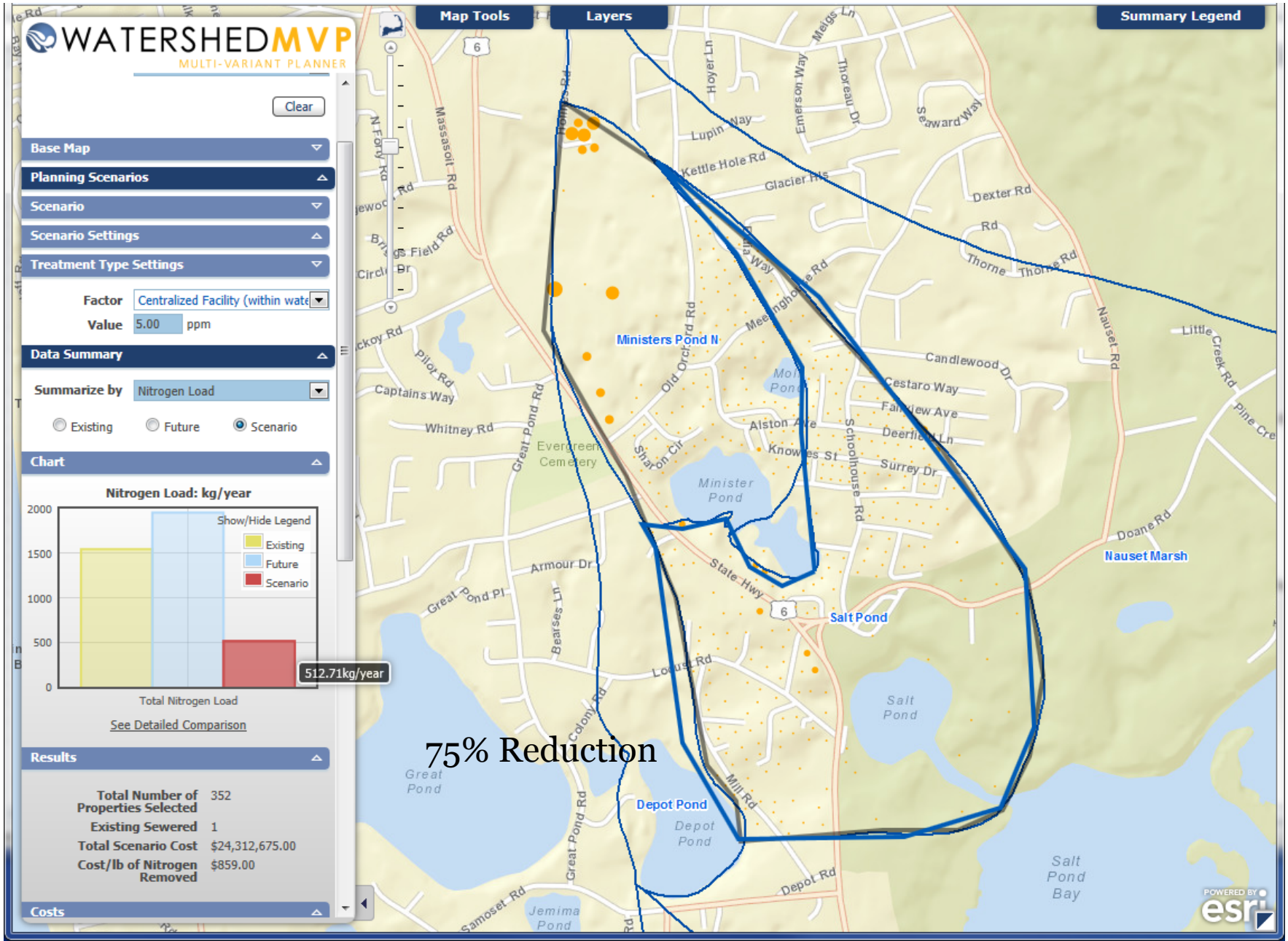
71% of the loads in the Upper Watershed are naturally attenuated



No scenario with disposal inside the watershed can achieve TMDL due to 100% requirement. This Smaller Centralized scenario, for $9 million less than complete collection and treatment, is only 12% less than the complete collection/treatment scenario



This shows a smaller collection and treatment scenario with Fertilizer & Stormwater reduction and is only 3% less of the complete collection/treatment scenario



Watershed Calculator Salt Pond

MEP Targets and Goals:	**kg/day**	**Nitrogen (kg/yr)**
Present Total Nitrogen Load:	5.01	1,829
wastewater	3.82	1,394
fertilizer		142
stormwater		217
Target Nitrogen Load:	6.07	0
Nitrogen Removal Required:	**5.01**	**1,829**
Total Number of Properties:		

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			71	1,758	
Stormwater Mitigation			109	1,649	
Watershed/Embayment Options:					
Permeable Reactive Barrier (PRB)	200	homes	792	857	$452
Oyster Beds/Aquaculture	1	Acres	250	607	$0
Floating Constructed Wetlands	1250	cu feet	562	45	$61
Alternative On-Site Options:					
I&A Technologies	35	homes	81.6	-37	$1,607
Sewering	-8	homes	-37	0	$1,000
		Total To Meet Goal (Kg/yr):		0	$266

Adaptive Management:

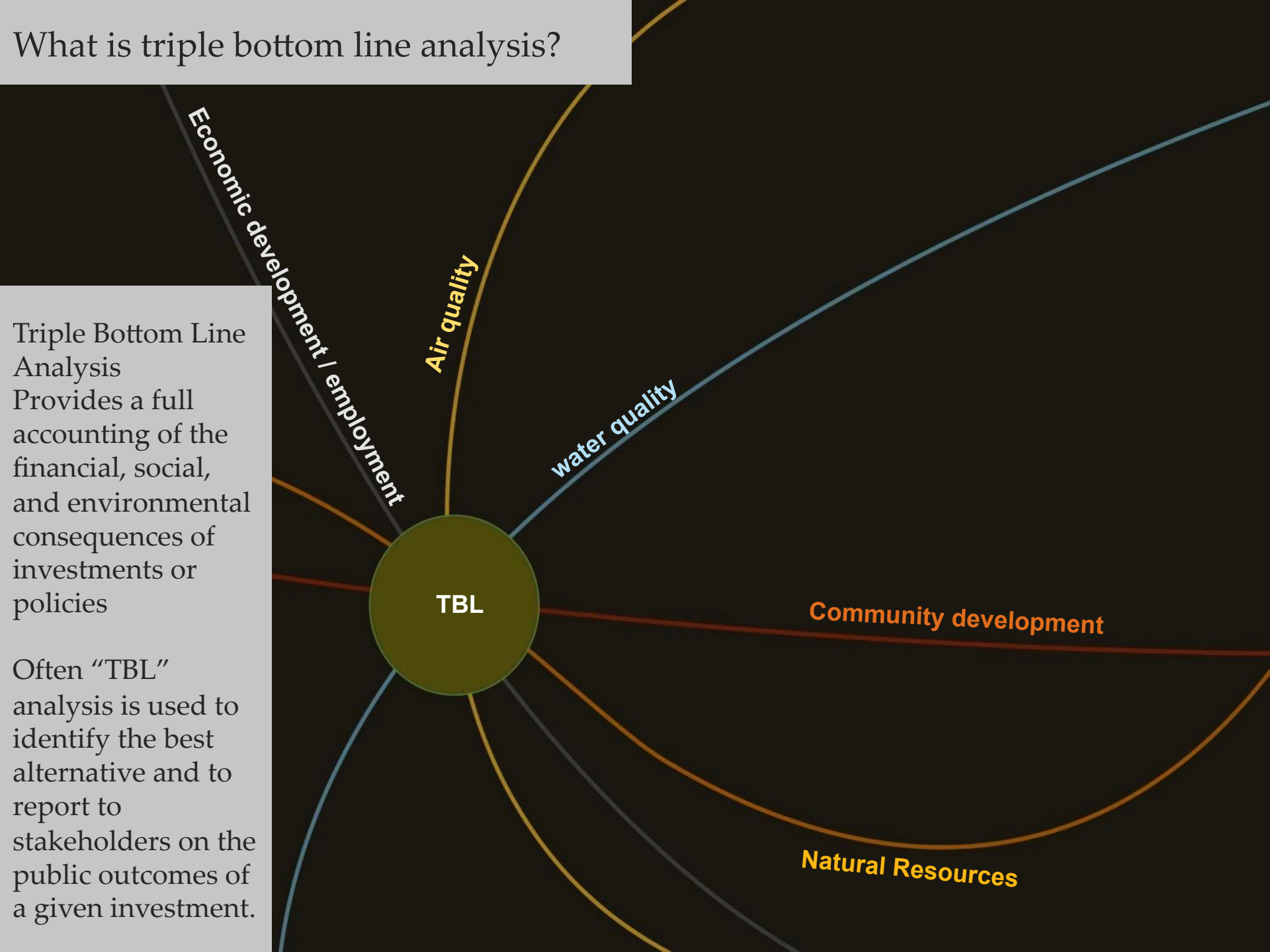
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient ways.

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

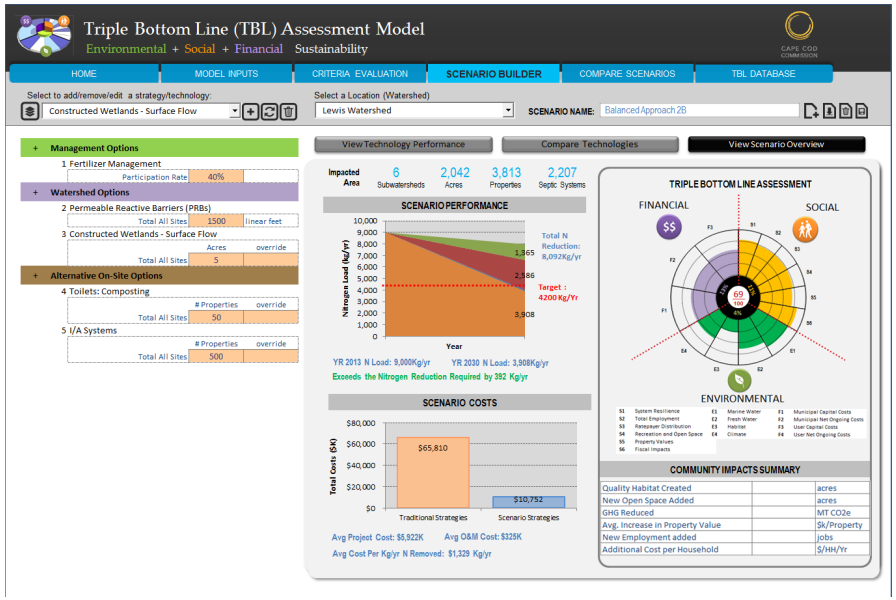
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

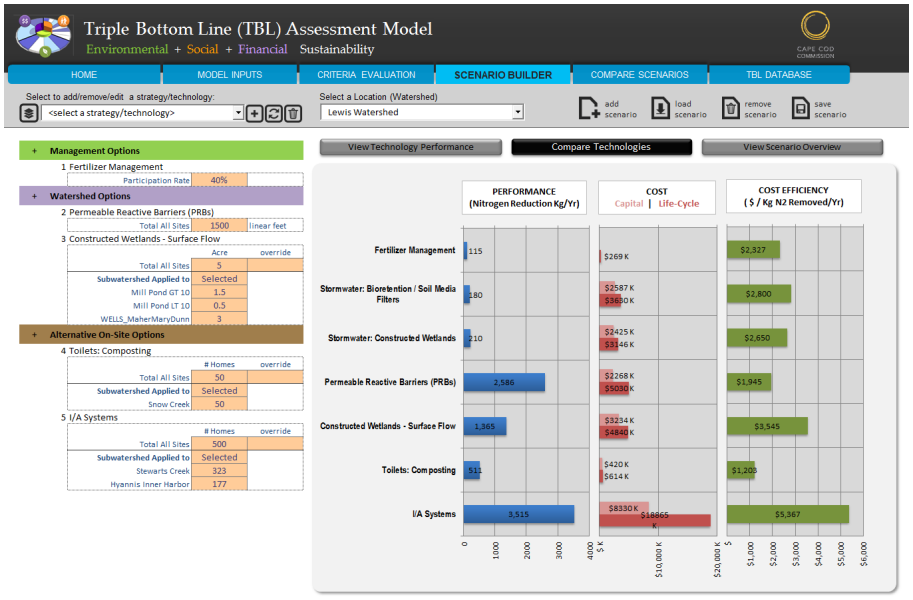


Why develop a TBL model?

- 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

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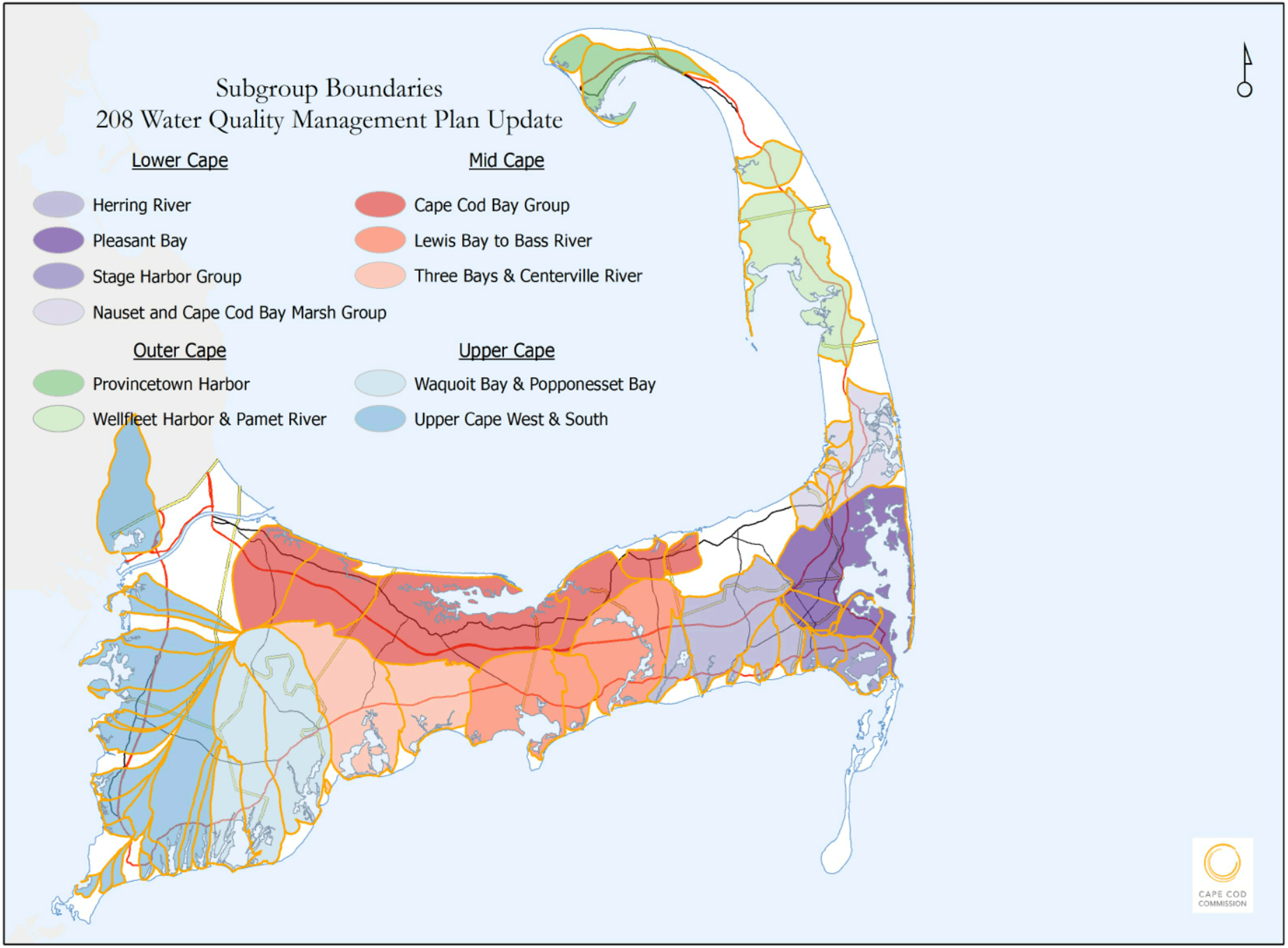
Criterion Scores

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
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Area Boundaries
208 Water Quality Management Plan Update