# Cape Cod 208 Area Water Quality Planning
# Nauset and Cape Cod Bay Marsh Group Watershed Working Group

**Meeting Three**
**Draft Meeting Agenda**
**Wednesday, December 4, 2013**
**Eastham Town Hall, 2500 State Hwy, Eastham, MA 02642**
**8:30 am - 12:30 pm**

8:30 Welcome, Review 208 goals and Process and the Goals of today's meeting – *Cape Cod Commission Area Manager*

8:45 Introductions, Agenda Overview, Updates and Action Items– *Facilitator and Working Group*

9:00 Presentation of Initial Scenarios for each watershed – *Cape Cod Commission Technical Lead*

- Whole Watershed Conventional Scenarios
- Targeted Conventional Scenarios to meet the TMDLs (or expected TMDLs):
- Whole Watershed 7-Step Scenarios
- Working Group Reactions, Questions and Discussion

10:30 Break

10:45 Adaptive Management – *Cape Cod Commission and Working Group*

- Adaptive Management Sample Scenarios
- Key Adaptive Management Questions
- Defining Adaptive Management

11:30 Preparing for 2014 Jan-June – *Cape Cod Commission and Working Group*

- Triple Bottom Line approach
- Identify Shared Principles and Lessons Learned
- Describe Next Steps

12:15 Public Comments

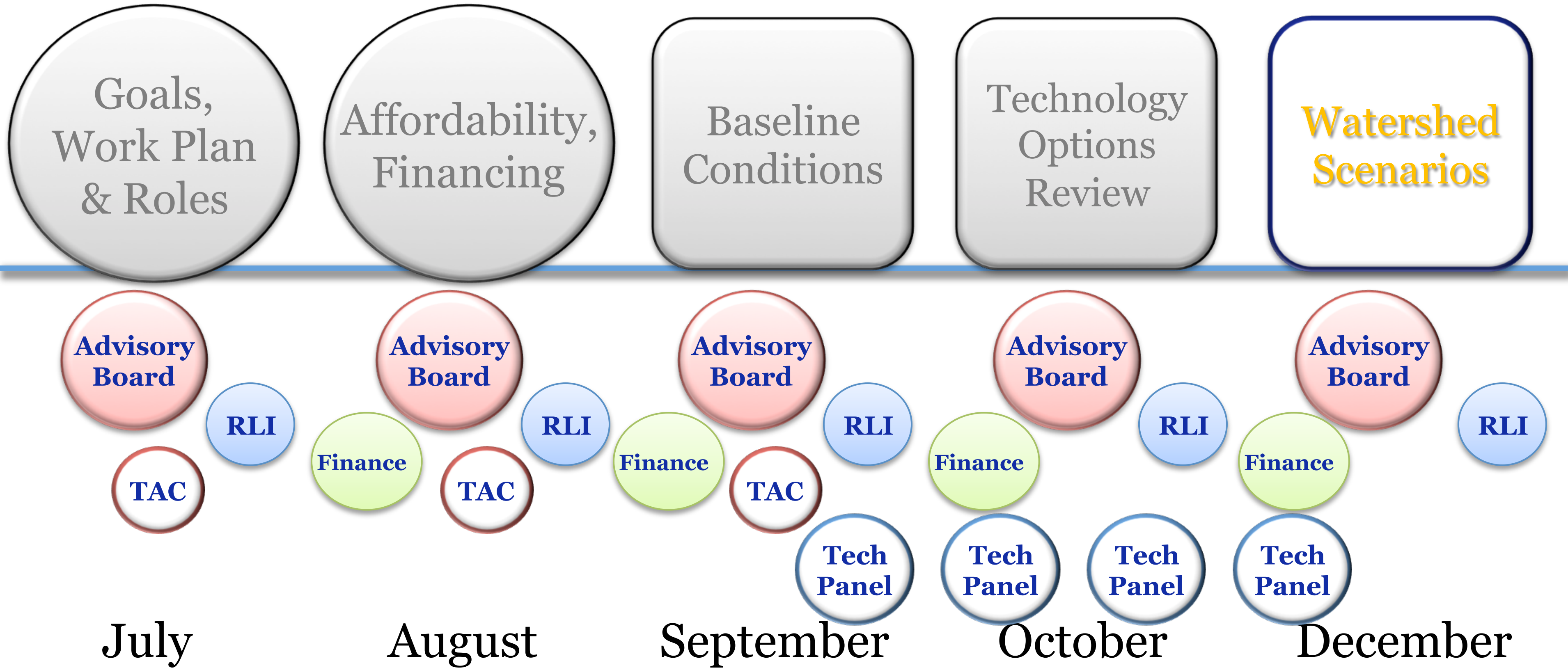
12:30 Adjourn

# Nauset & Cape Cod Bay Marsh Group

## Watershed Scenarios

## Public Meetings

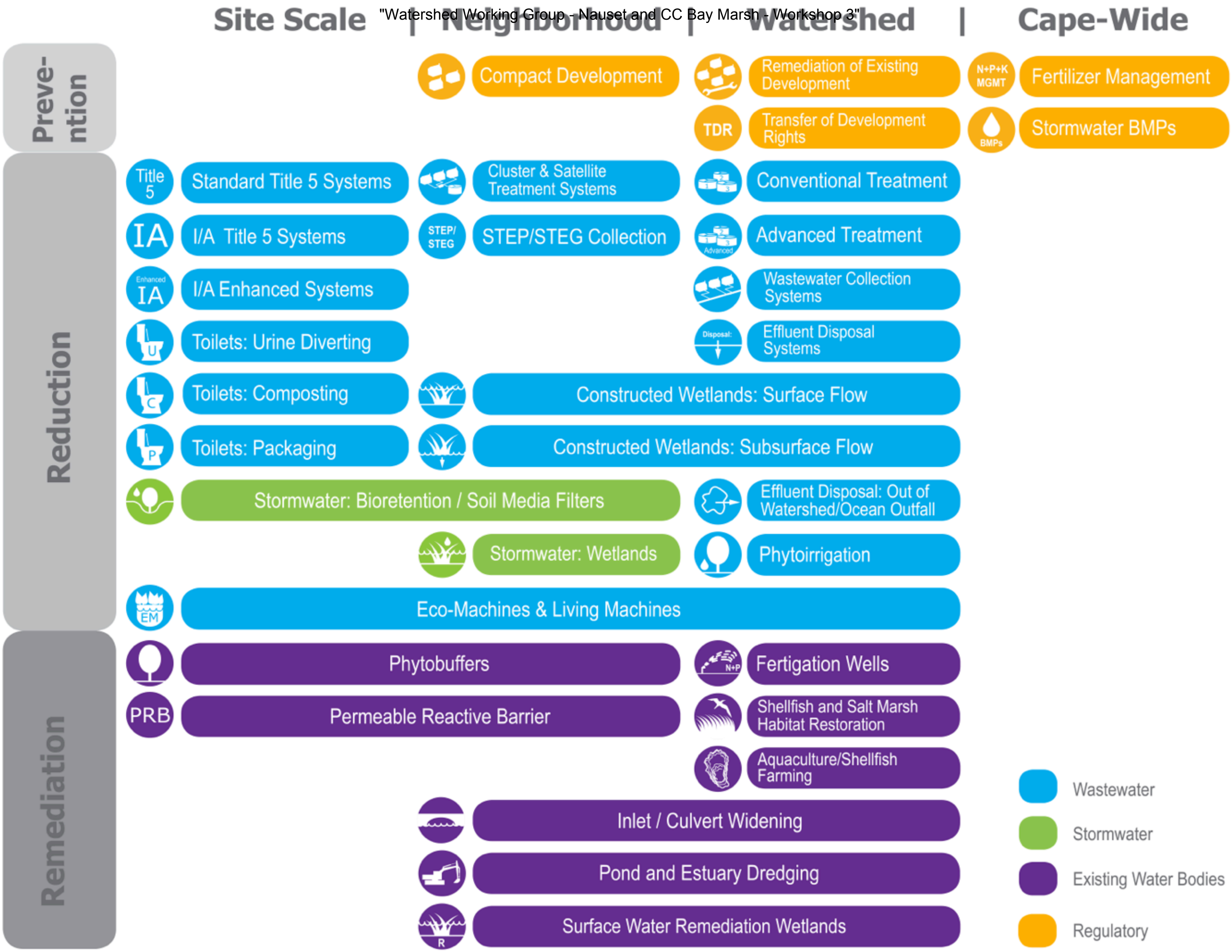
## Watershed Working Groups




RLI — Regulatory, Legal & Institutional Work Group

TAC — Technical Advisory Committee of Cape Cod Water Protection Collaborative

# 208 Planning Process


Site Scale | Neighborhood | Watershed | Cape-Wide
Prevention
Reduction
Remediation
Compact Development
Remediation of Existing Development
Fertilizer Management
N+P+K MGMT
TDR
Transfer of Development Rights
Stormwater BMPs
BMPs
Title 5
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Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/ STEG
STEP/STEG Collection
Advanced Treatment
Advanced
Enhanced IA
I/A Enhanced Systems
Wastewater Collection Systems
Toilets: Urine Diverting
Disposal:
Effluent Disposal Systems
Toilets: Composting
Constructed Wetlands: Surface Flow
Toilets: Packaging
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Eco-Machines & Living Machines
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PRB
Permeable Reactive Barrier
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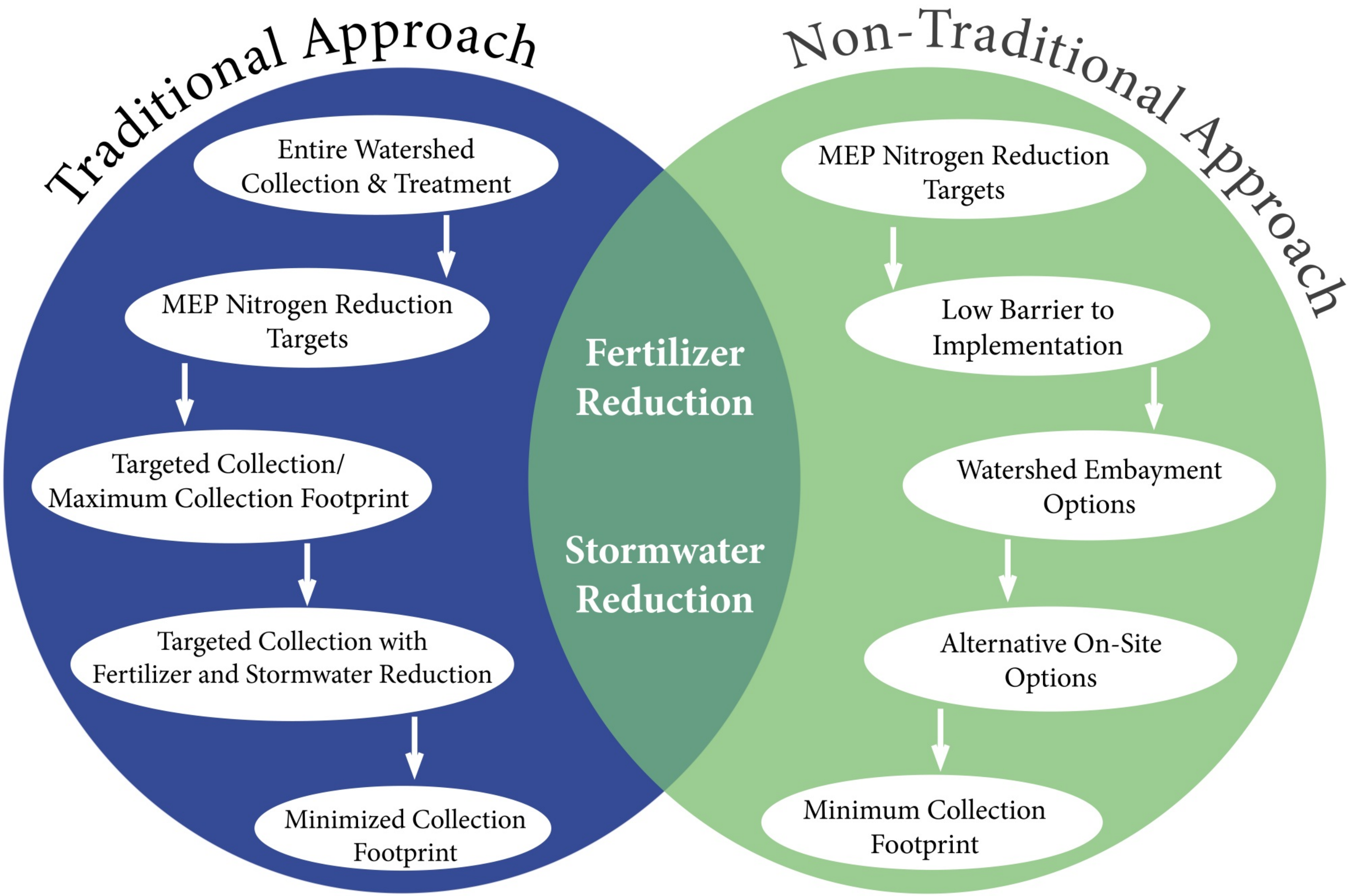
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

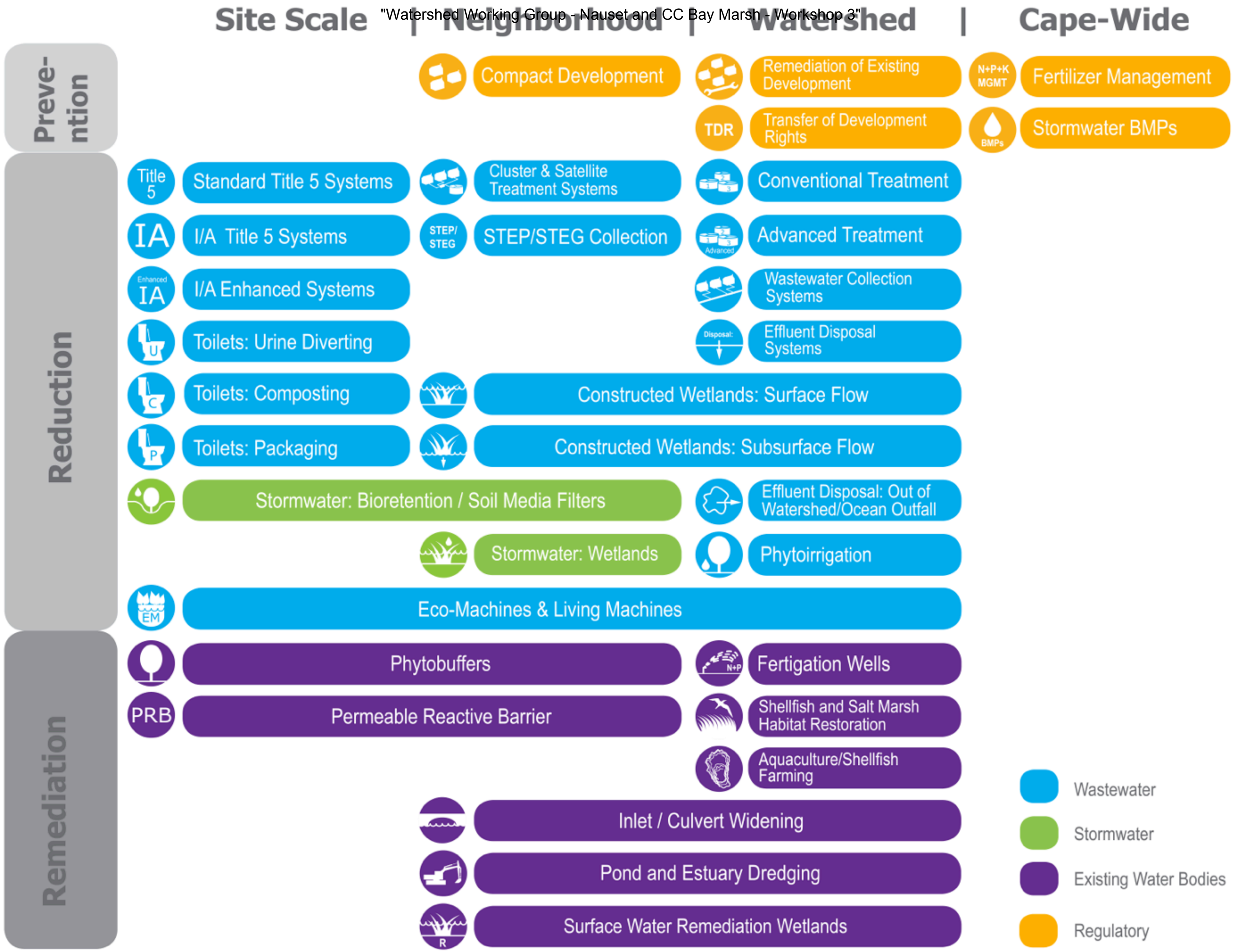
Watershed Scenarios

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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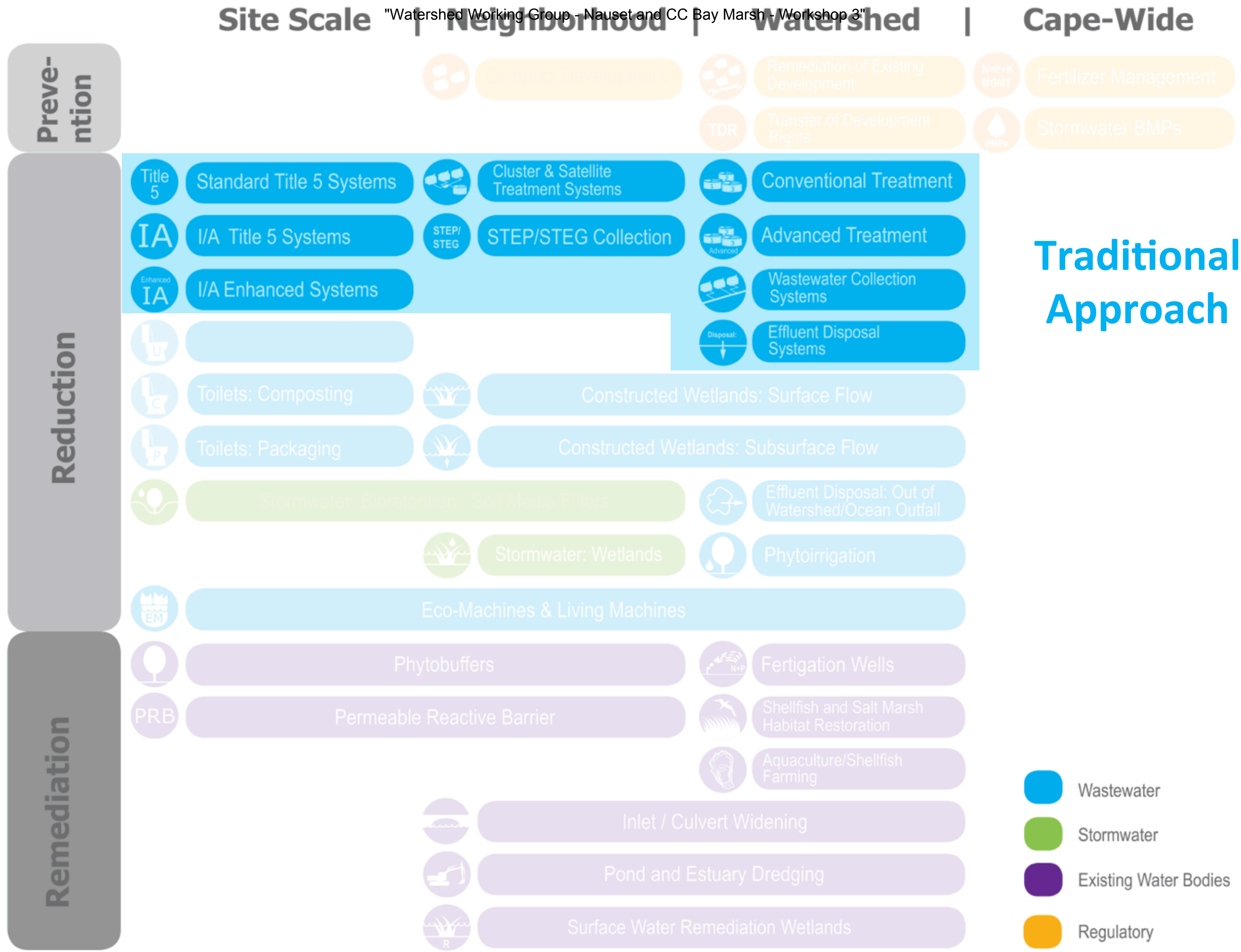
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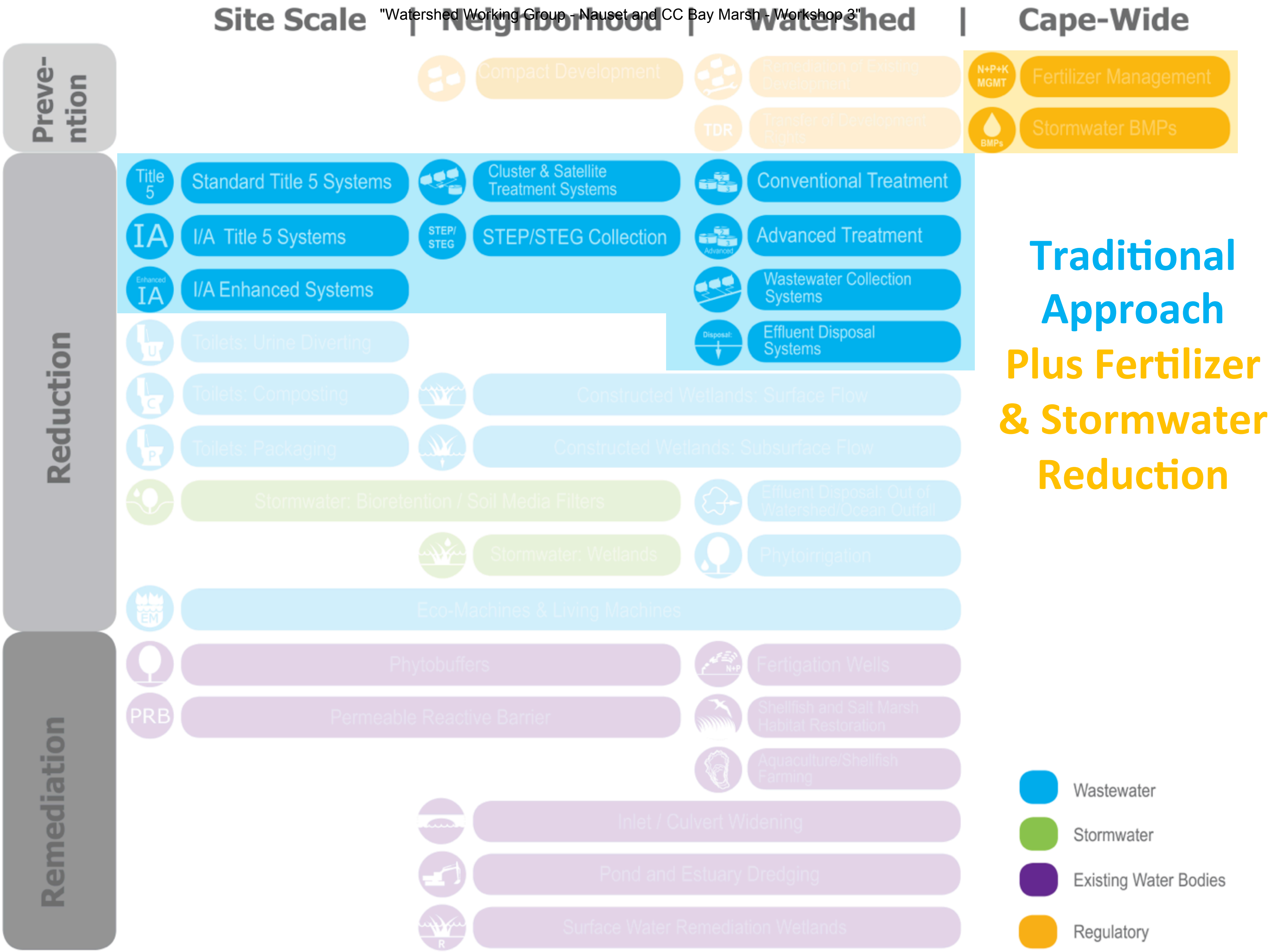
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Plus Fertilizer & Stormwater Reduction
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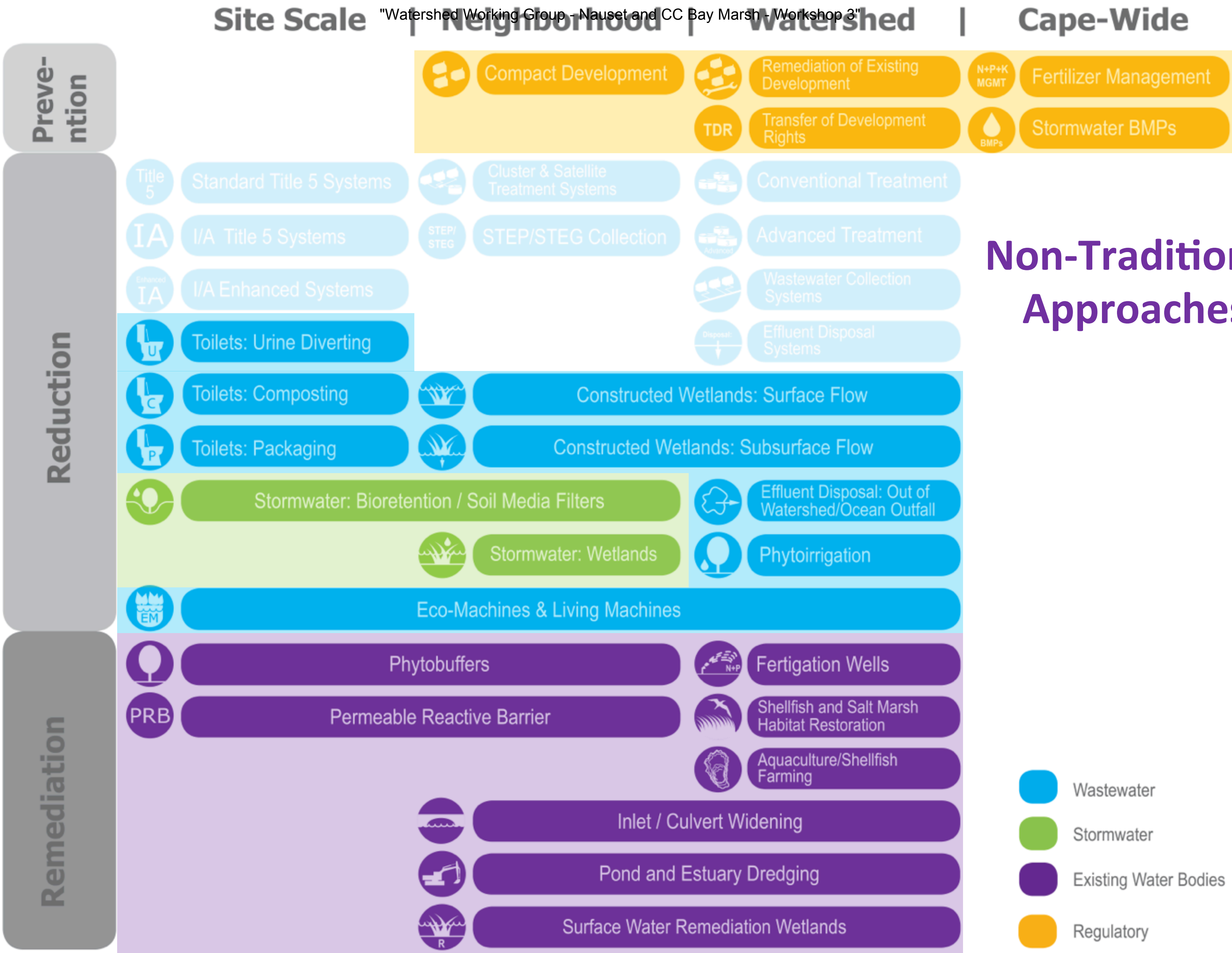
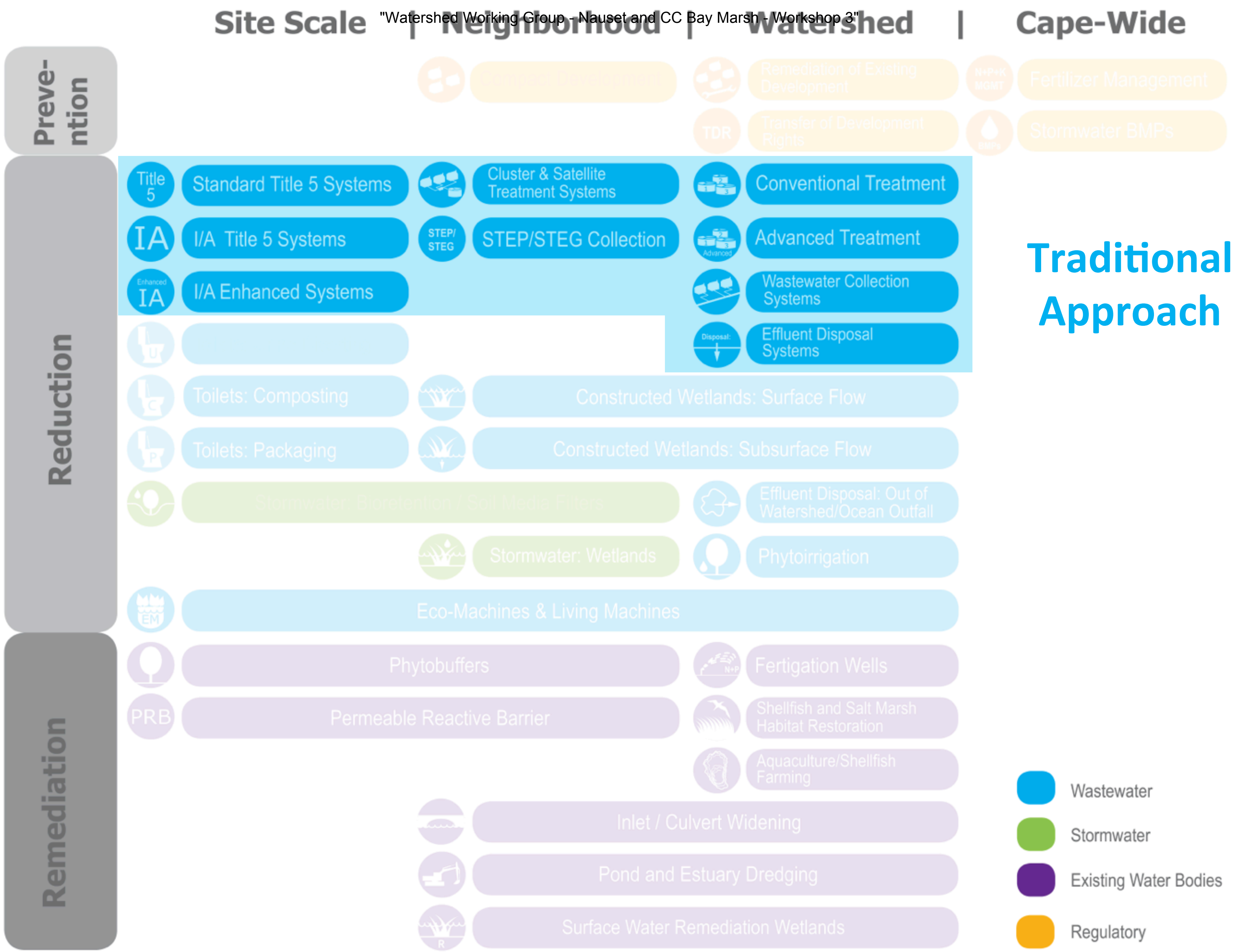
# Non-Traditional Approaches

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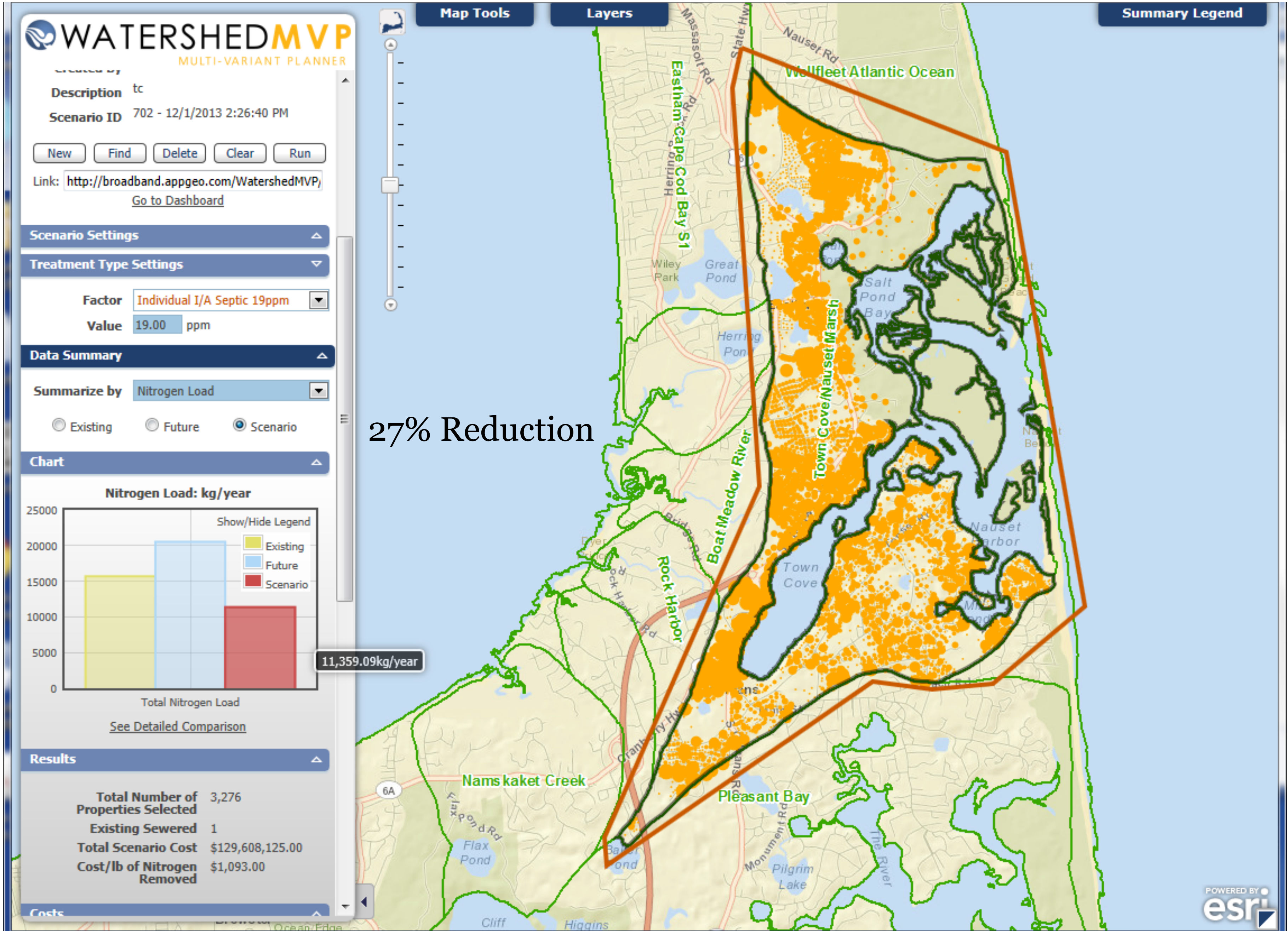
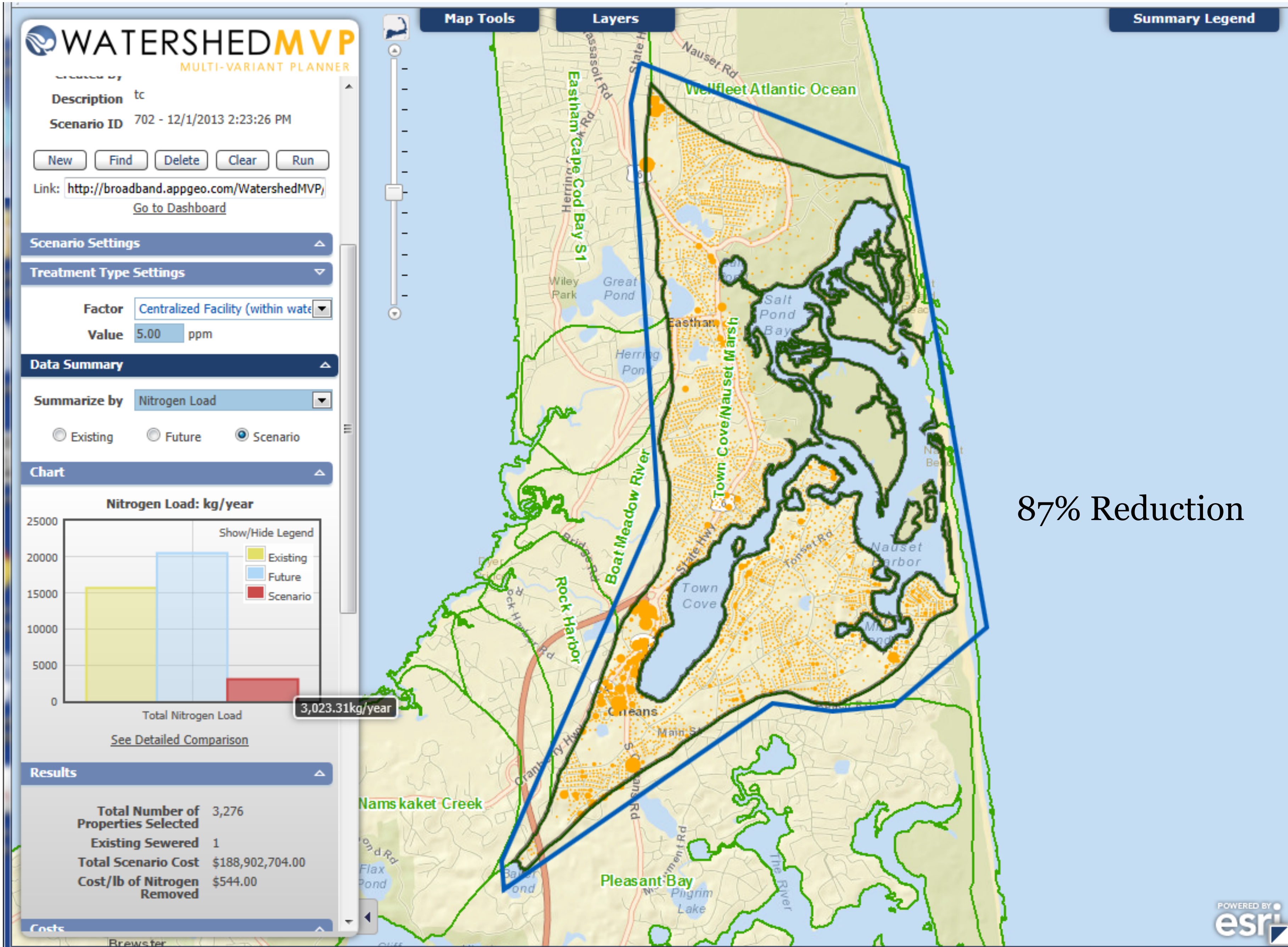
# Watershed-Wide Innovative/Alternative (I/A) Onsite Systems



# Watershed-Wide Centralized Treatment with Disposal Inside the Watershed

"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 3"



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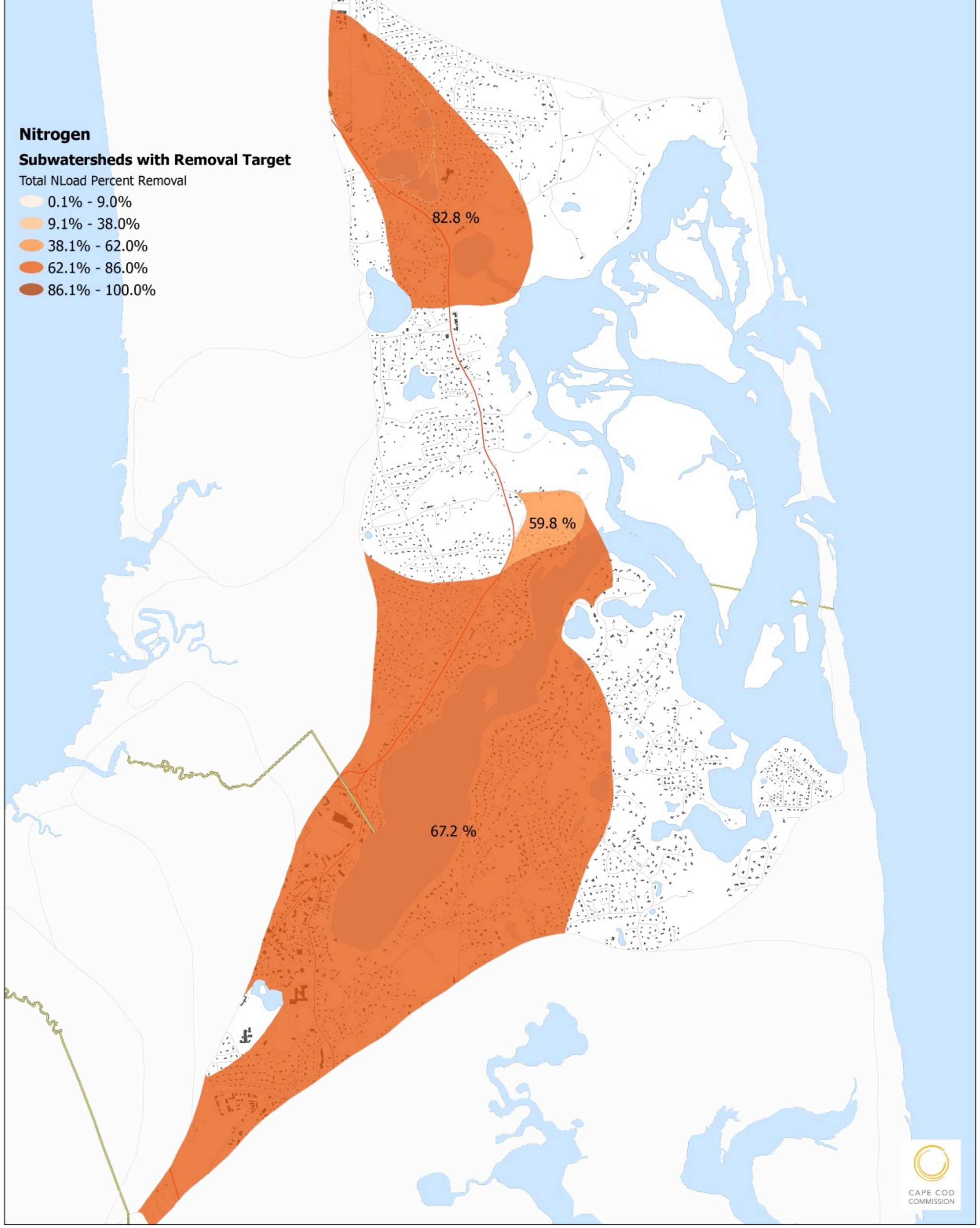
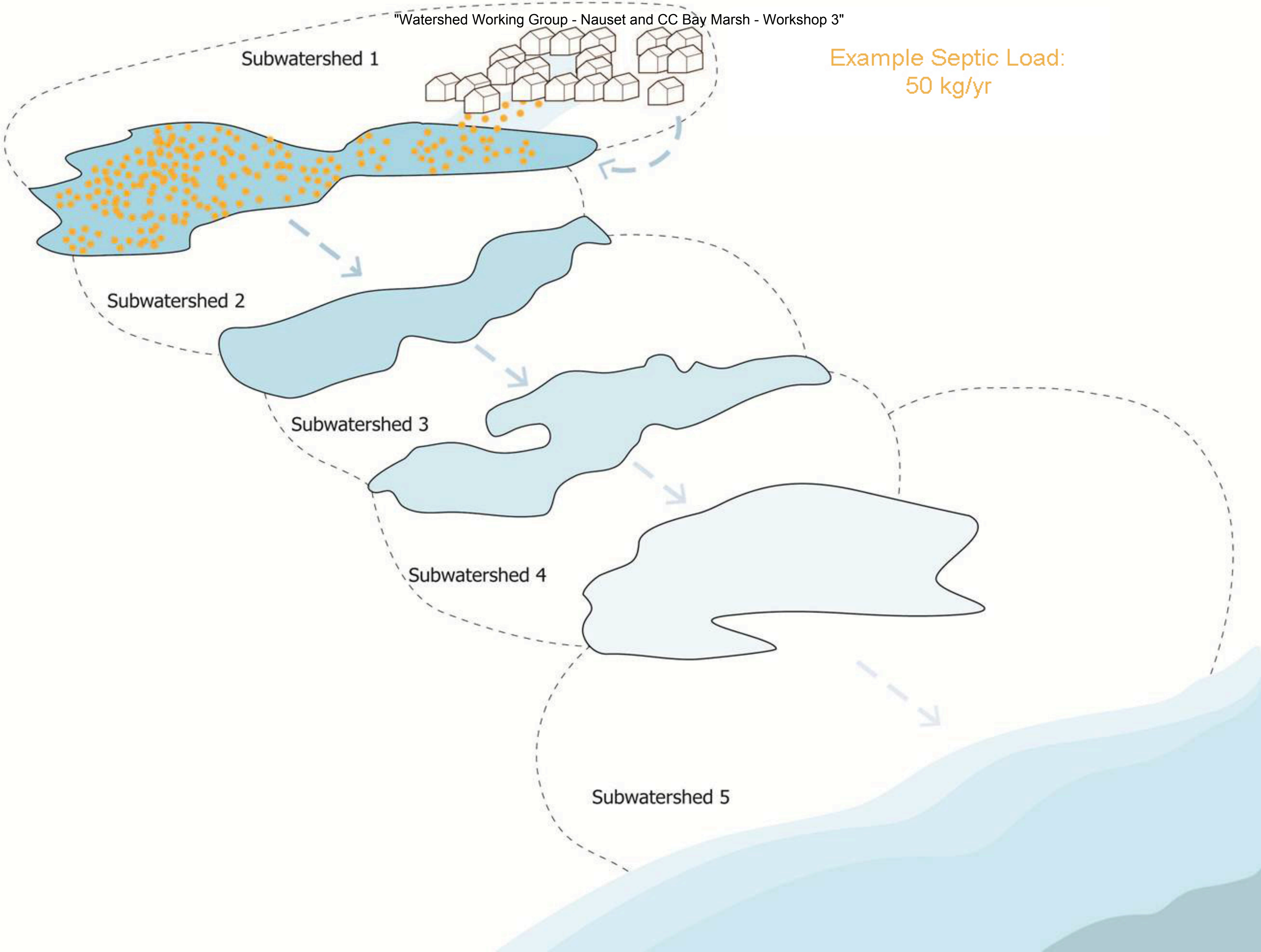
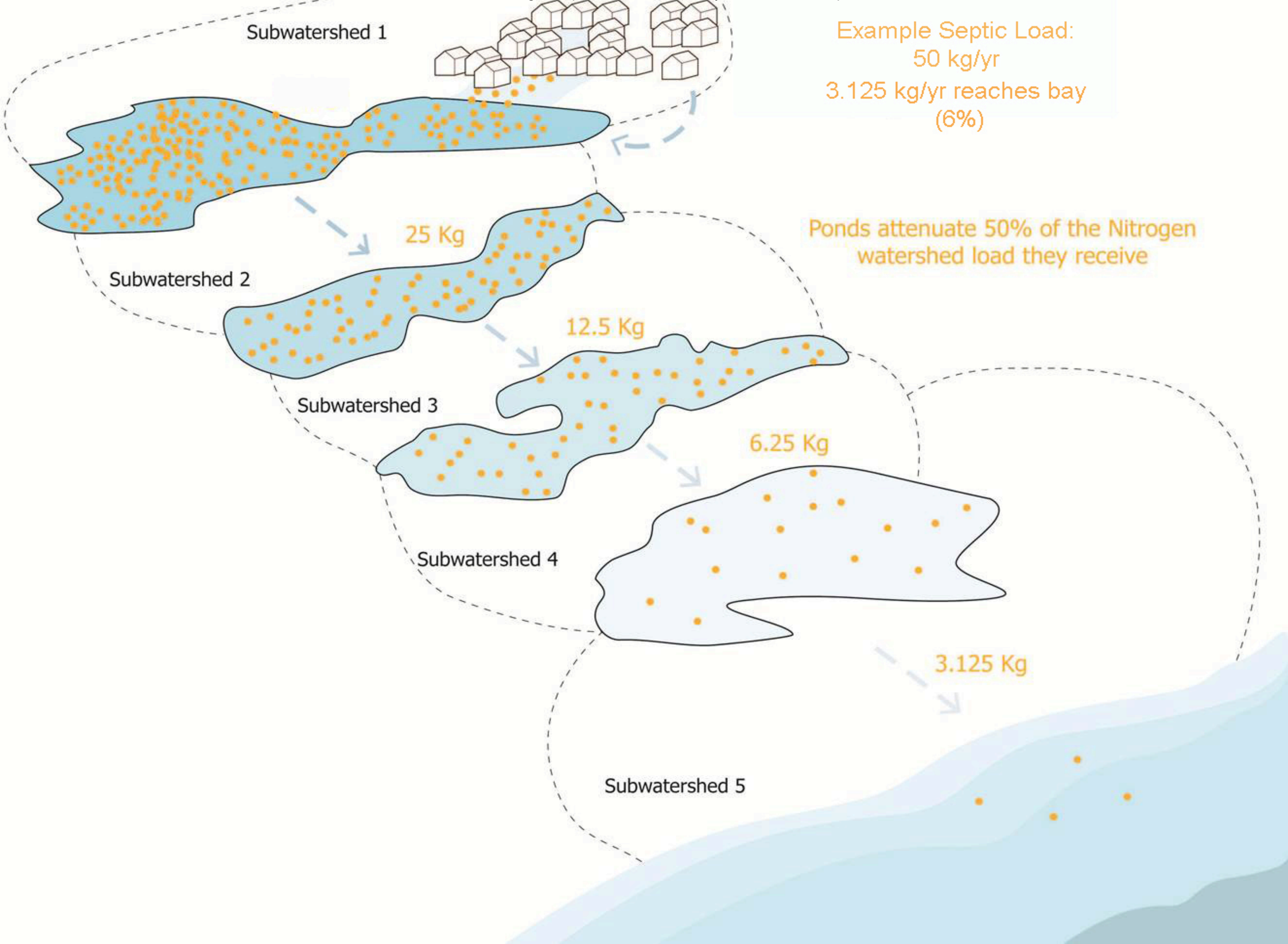
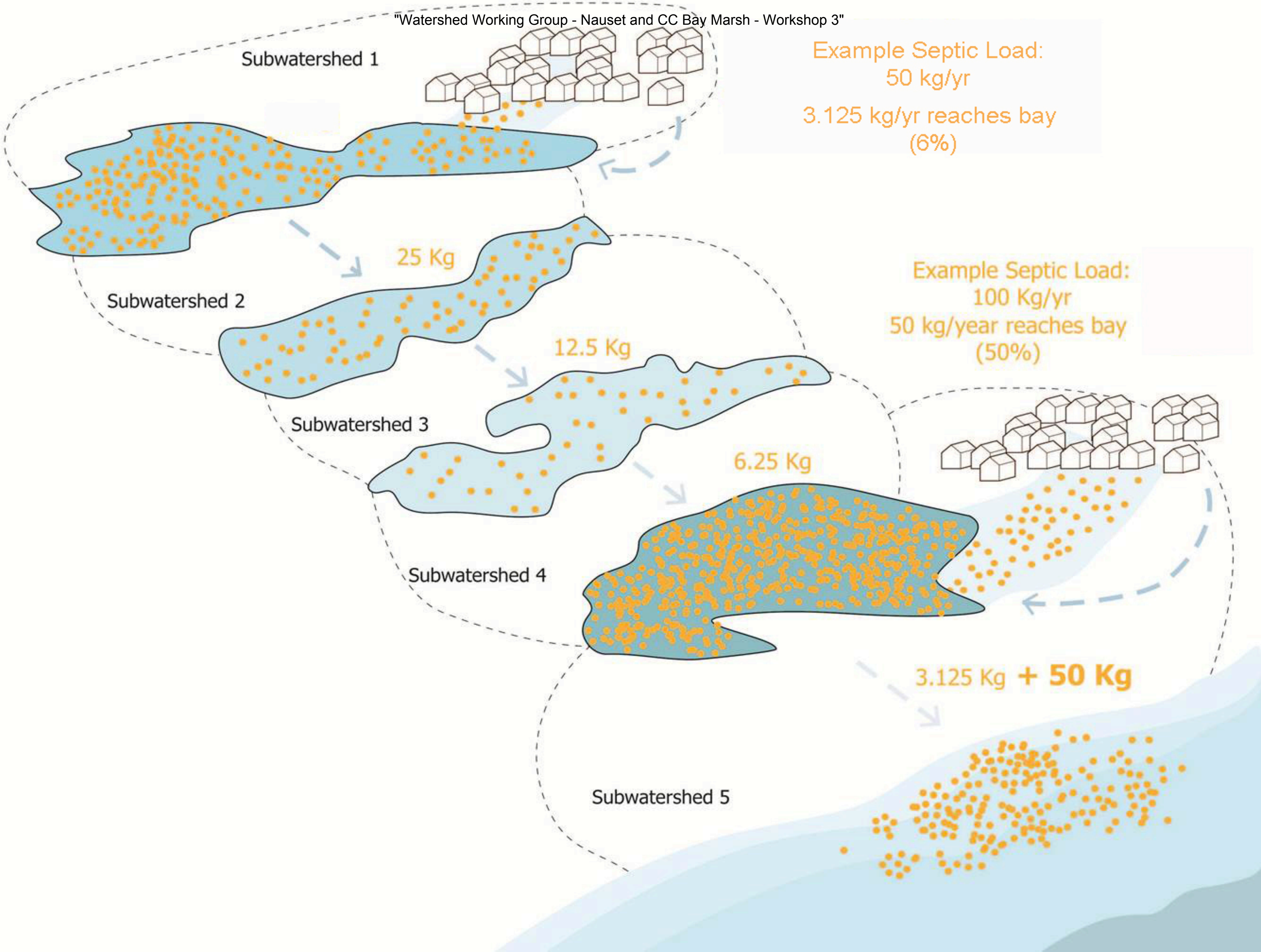



Subwatershed 1
Example Septic Load:
50 kg/yr
Subwatershed 2
Subwatershed 3
Subwatershed 4
Subwatershed 5


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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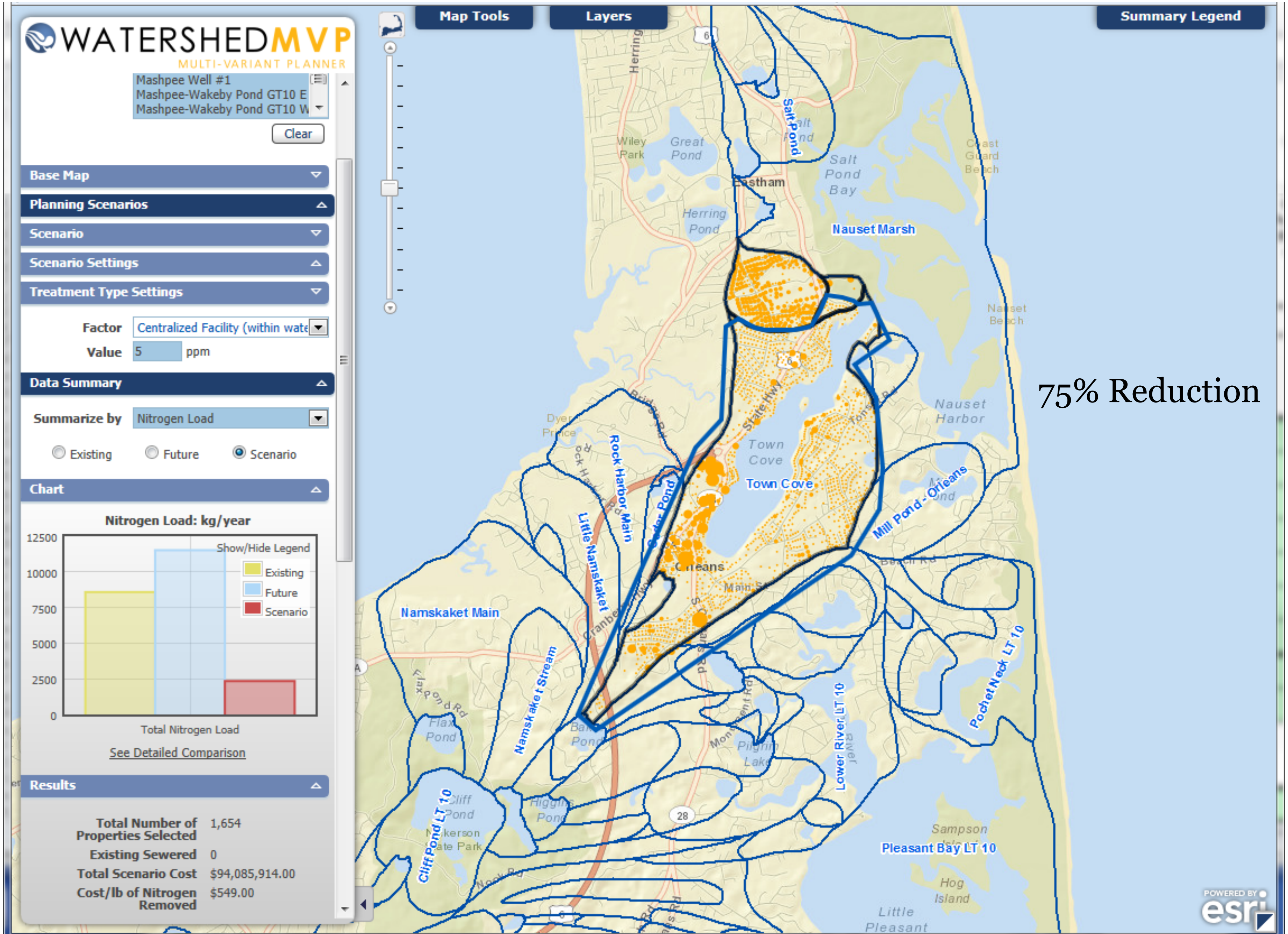
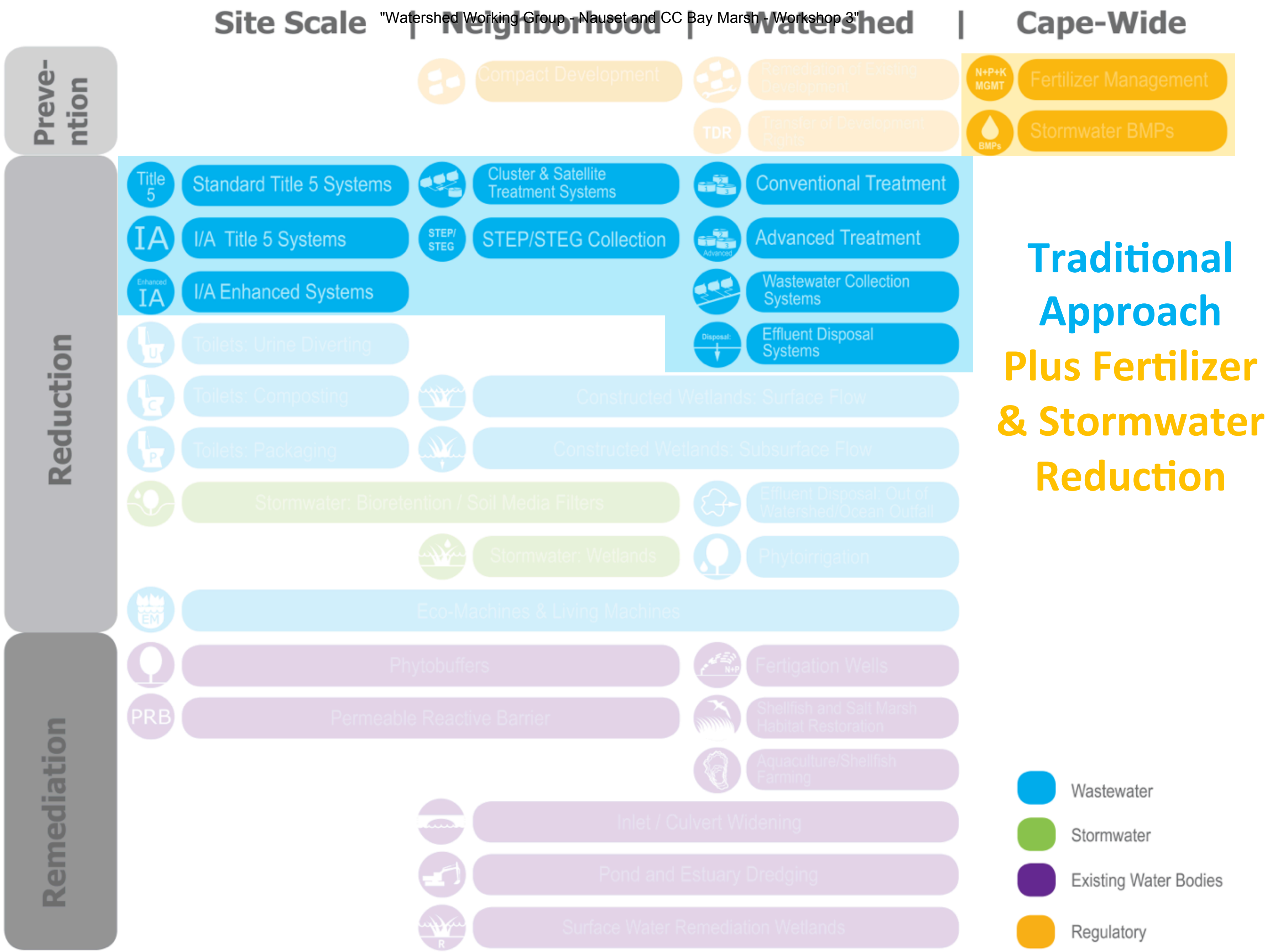
3.125 kg/yr reaches bay
(6%)
25 Kg
Subwatershed 2
Example Septic Load:
100 Kg/yr
50 kg/year reaches bay
(50%)
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg + 50 Kg
Subwatershed 5

# Targeted Centralized Treatment with Disposal Inside the Watershed

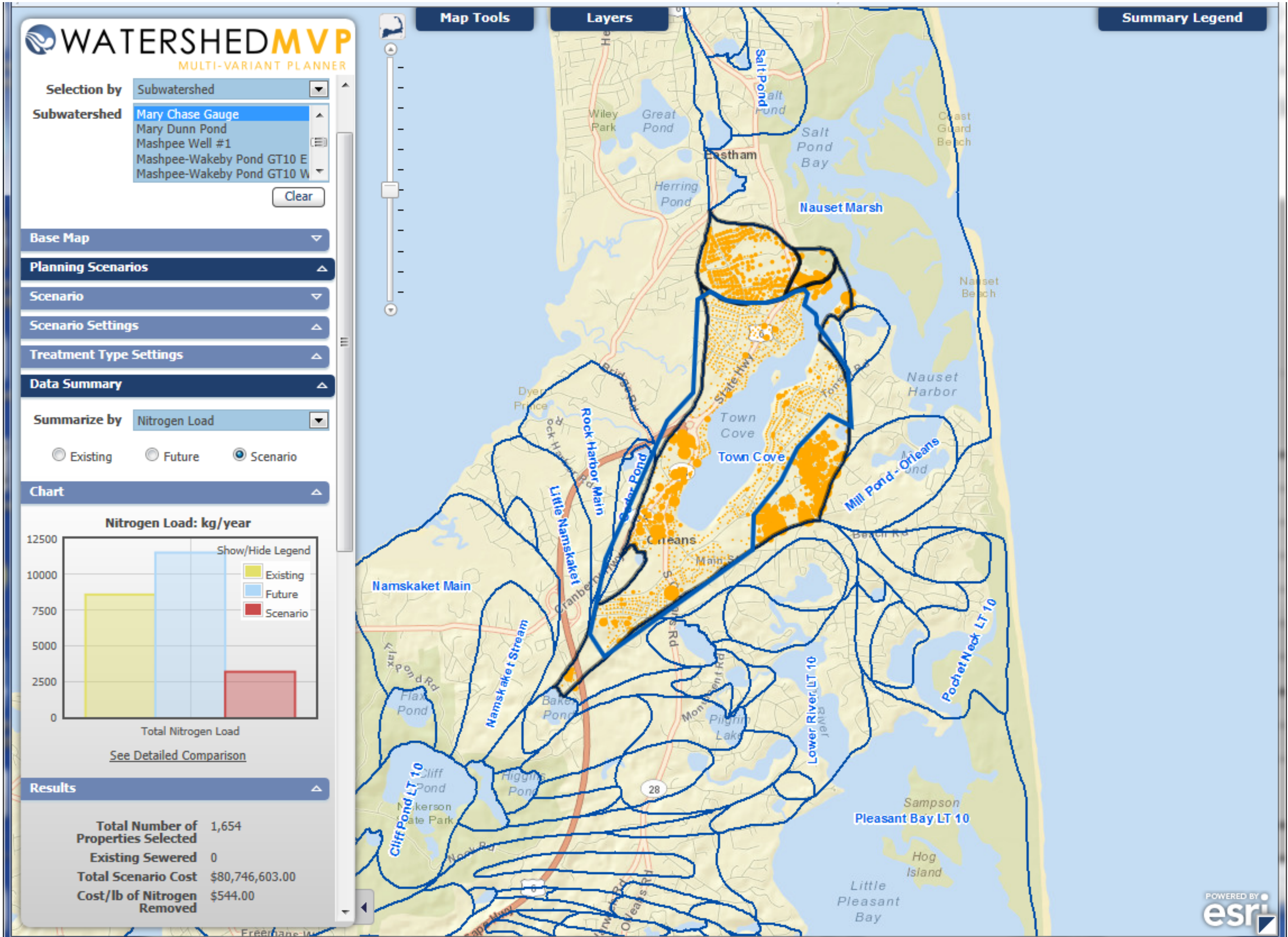



75% Reduction

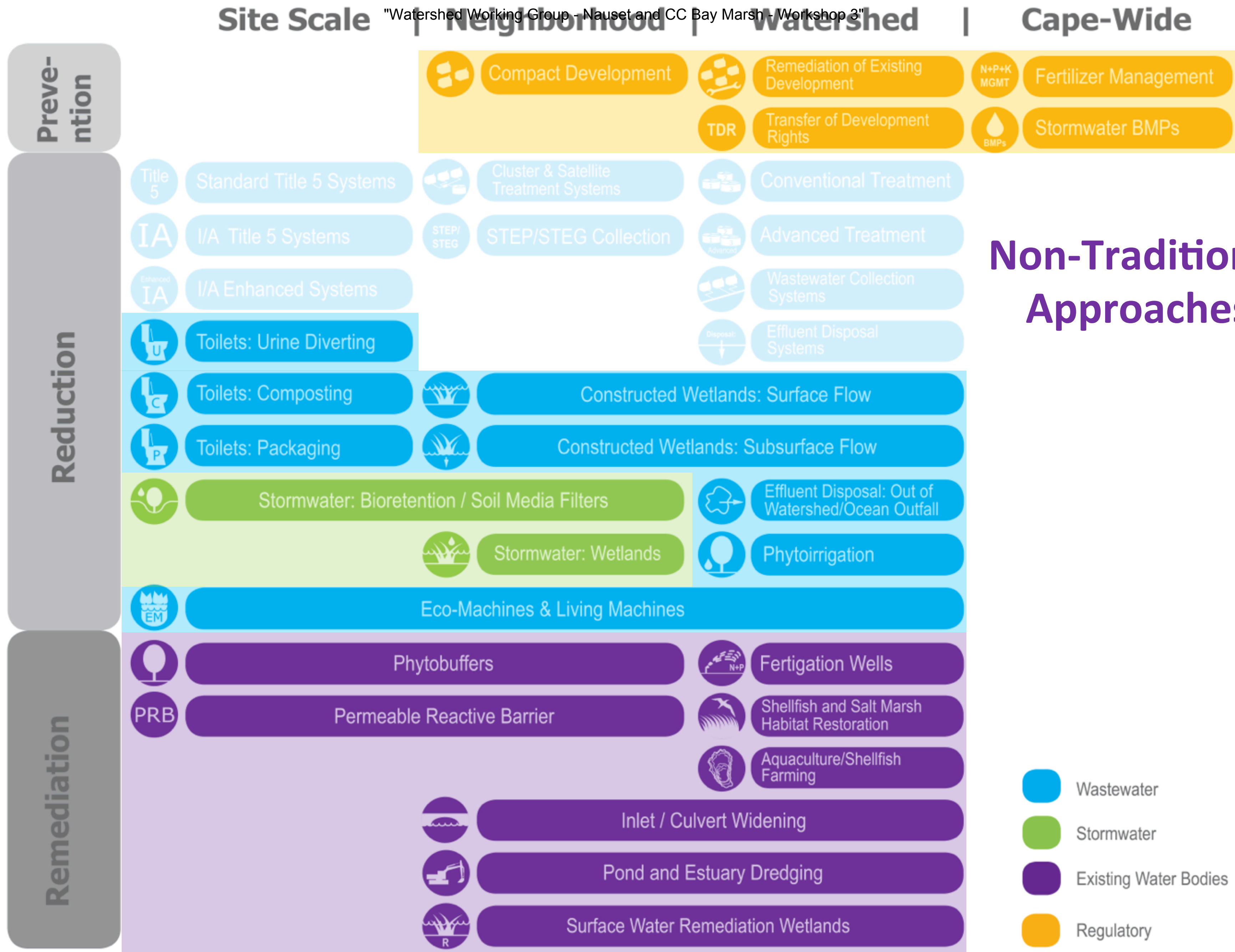
"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 3"



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



# Non-Traditional Approaches



Wastewater | Existing Water Bodies | Regulatory

# Problem Solving Approach

## 1 Targets/Reduction Goals

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

## 2 Other Wastewater Management Needs

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

## 3 Low Barrier to Implementation

A. Fertilizer Management
B. Stormwater Mitigation

## 4 Watershed/Embayment Options

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

## 5 Alternative On-Site Options

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

## 6 Priority Collection/High-Density Areas

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

## 7 Supplemental Sewering

**Watershed Calculator Nauset Marsh** "Watershed Working Group - Nauset and CC Bay Marsh - Workshop 3"

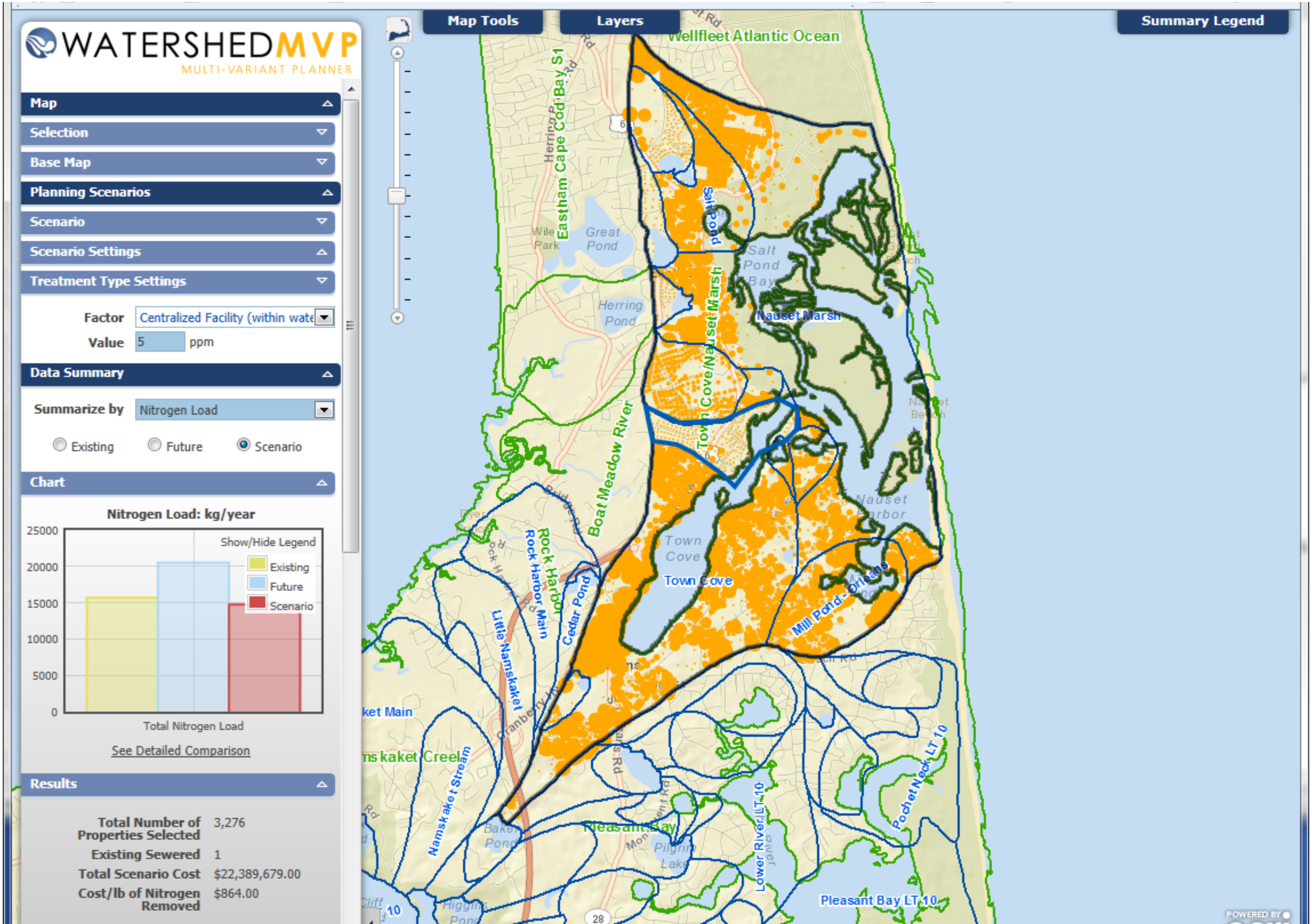
| **MEP Targets and Goals:** | | **kg/day** | **Nitrogen (kg/yr)** | |
|---|---|---|---|---|
| Present Total Nitrogen Load: | | 53.19 | 19,414 | |
| wastewater | | 42.915 | 15,664 | |
| fertilizer | | 4.4 | 1,594 | |
| stormwater | | 5.9 | 2,156 | |
| Target Nitrogen Load: | | 19.5 | 7,118 | |
| Nitrogen 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 |

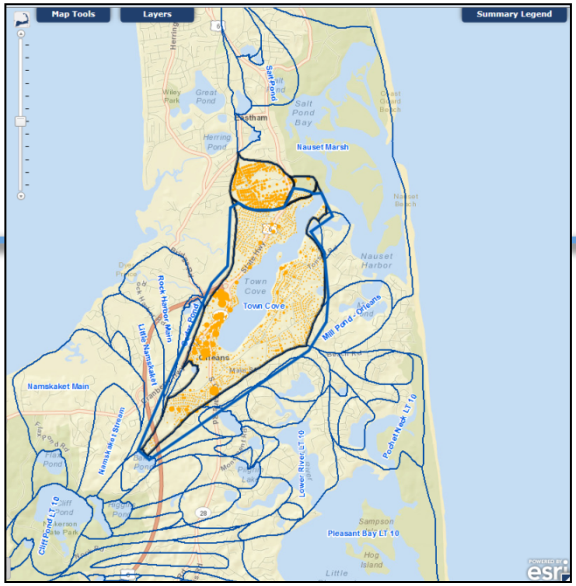
# Targeted Centralized Treatment after Applying Alternative Strategies (877 kg N/yr)





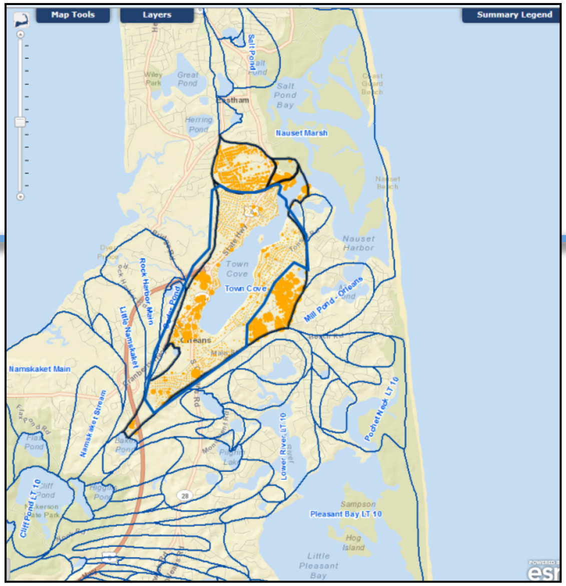
# Scenario Comparison

## Targeted Collection



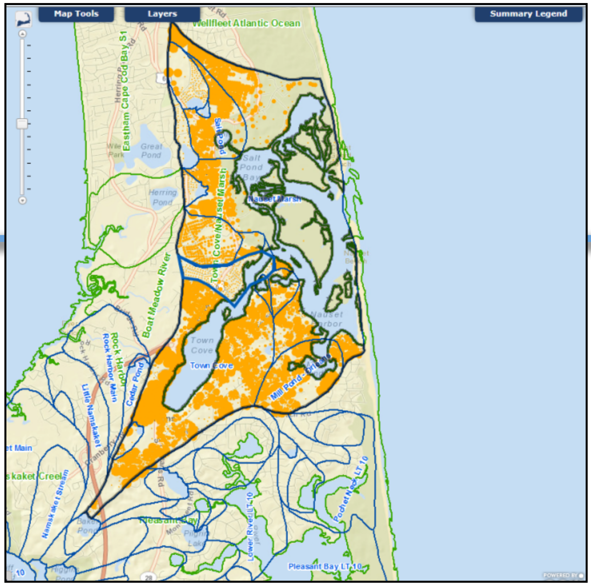
- Achieves TMDL[1]
- Total Cost = $94 Million
- Cost/lb N = $549
- Treated Flow = 212,000 gpd

## 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

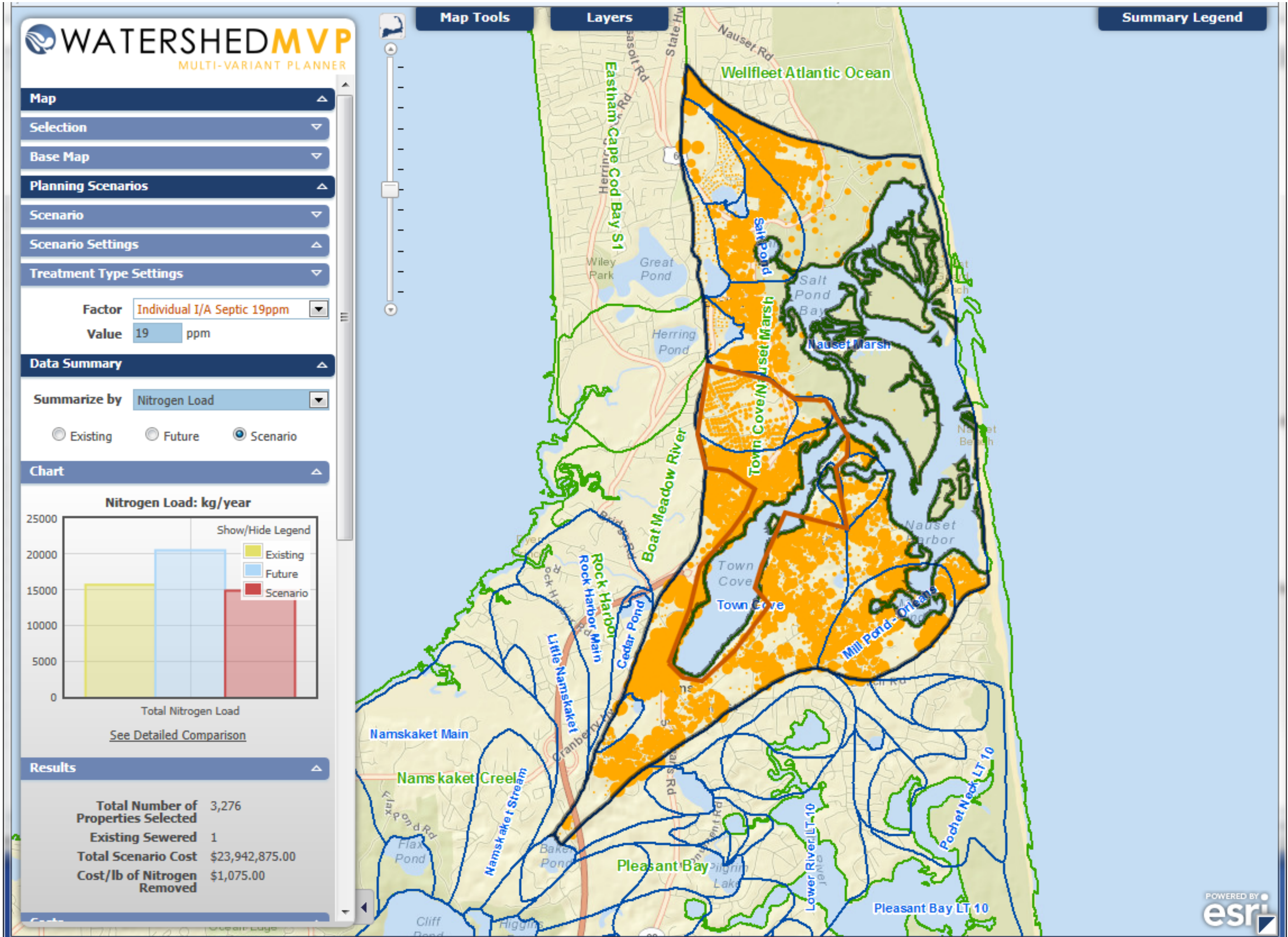
## Targeted Collection after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



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

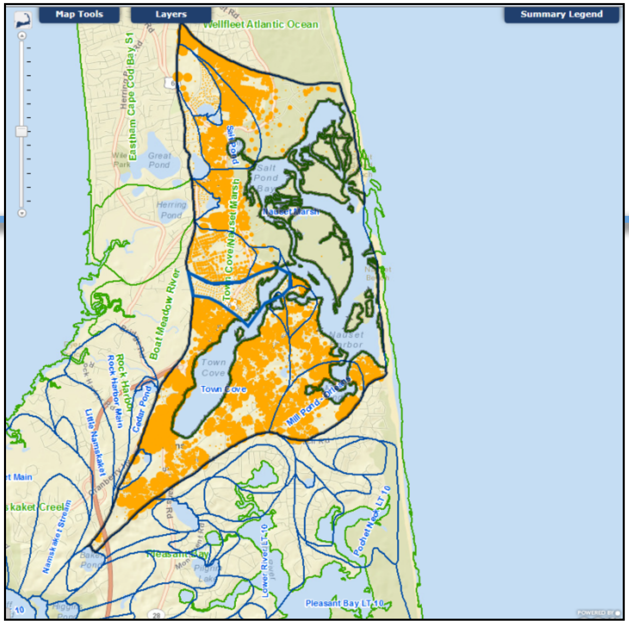
[1] within 5% of goal

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



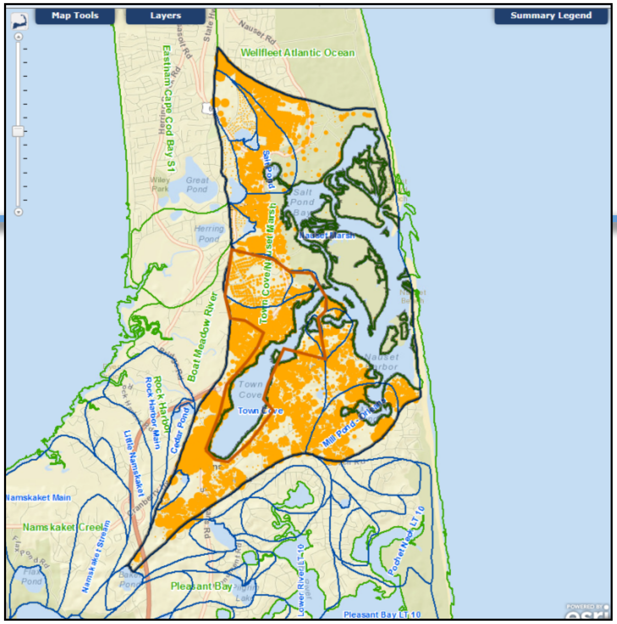
# Scenario Comparison

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



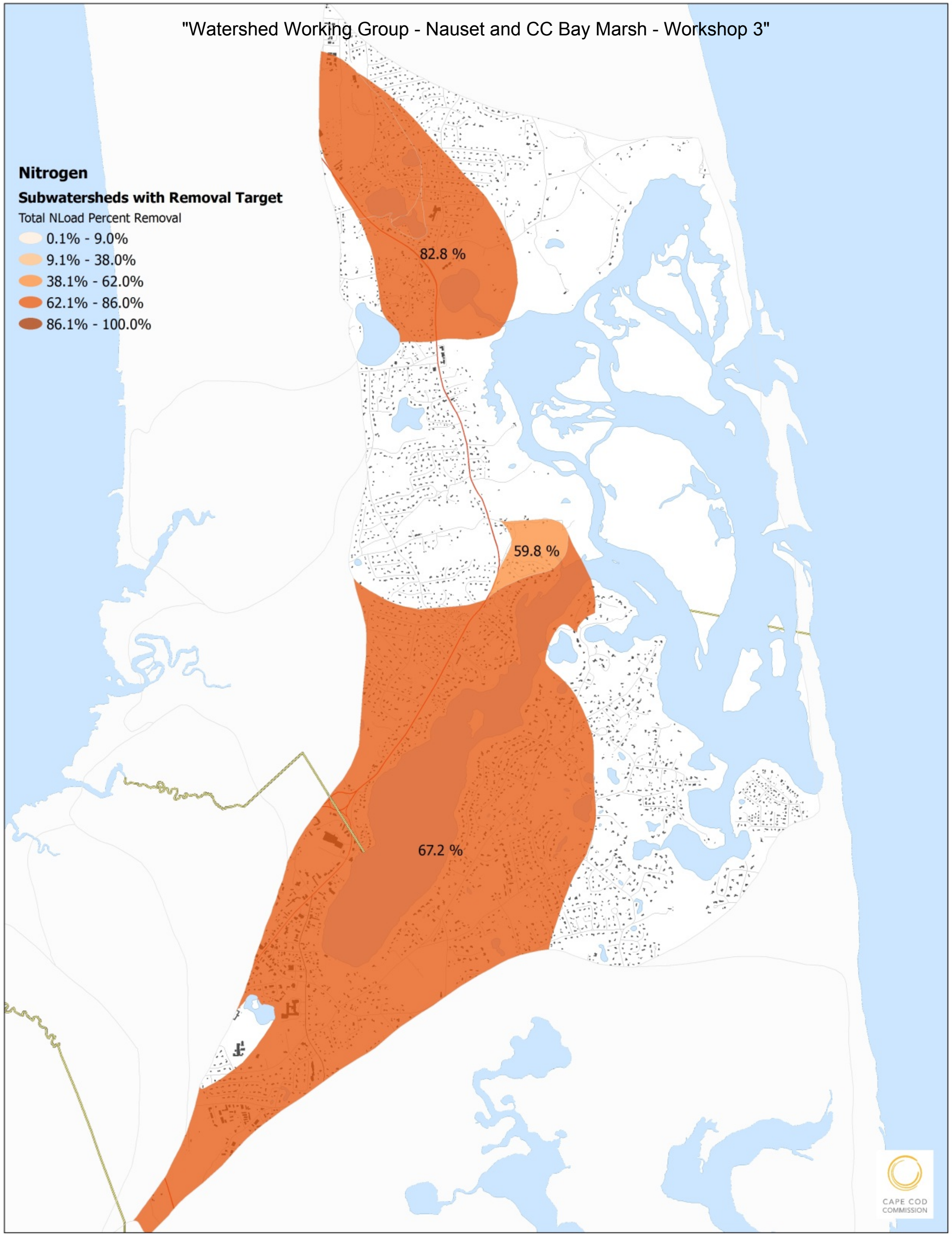

- Achieves TMDL[1]
- Total Cost = $21 Million
- Cost/lb N = $874
- Treated Flow = 30,000 gpd

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

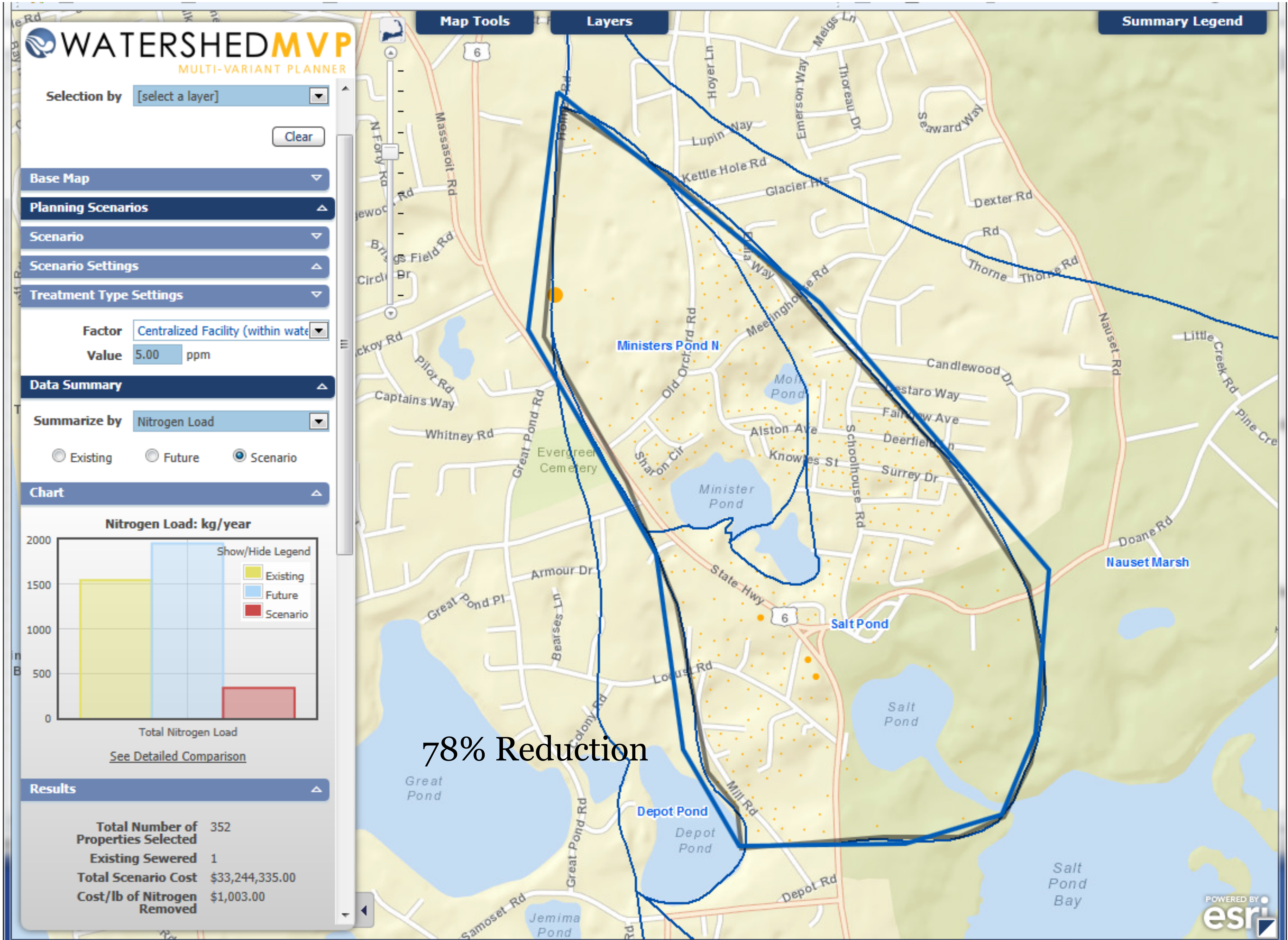



- Achieves TMDL[1]
- Total Cost = $27 Million
- Cost/lb N = $1390
- Treated Flow = 104,000 gpd

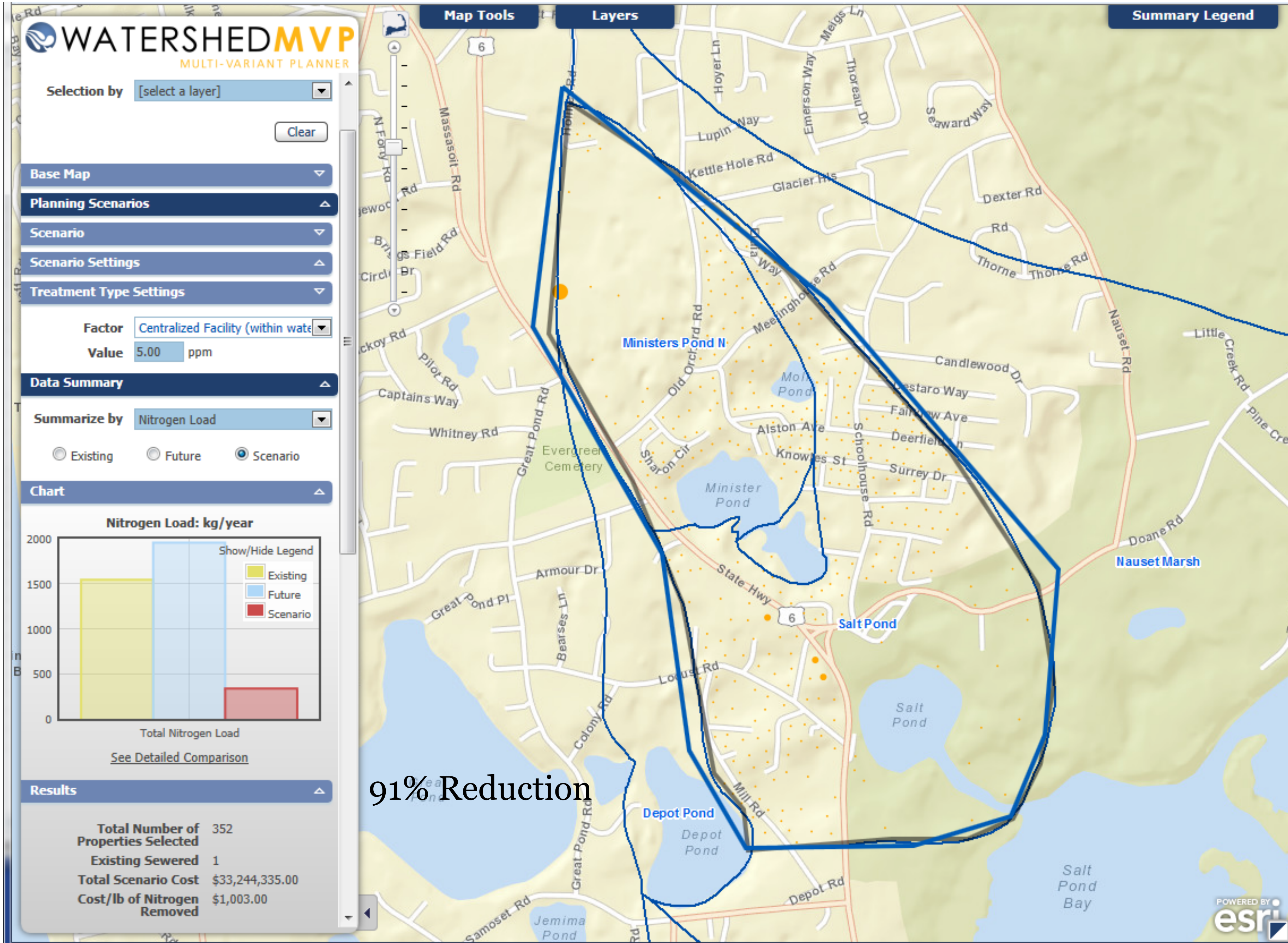
[1] within 5% of goal


"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 3"
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

# Centralized Treatment with Disposal Inside the Watershed

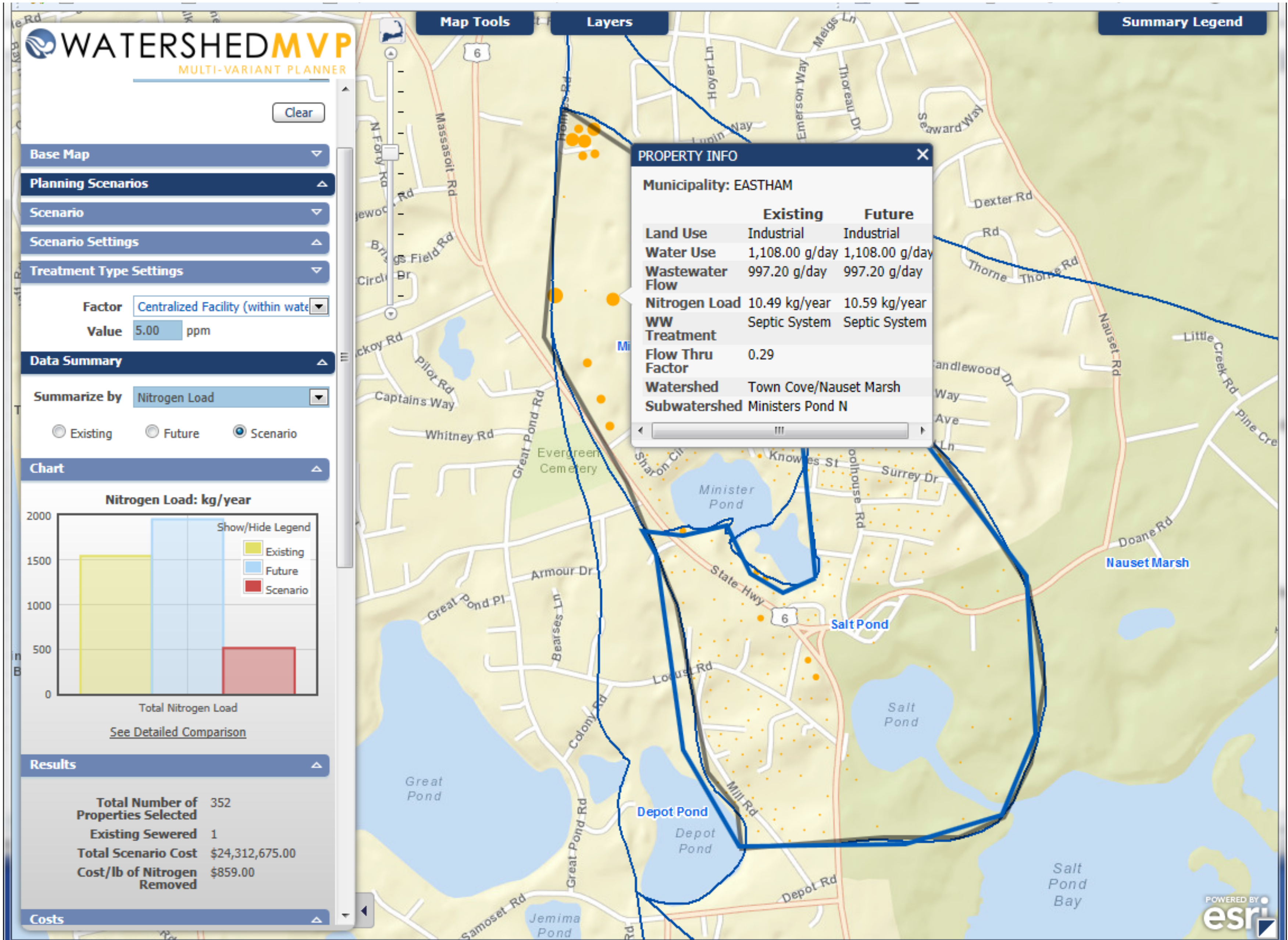


# Centralized Treatment with a 50% Reduction in Fertilizer and Stormwater

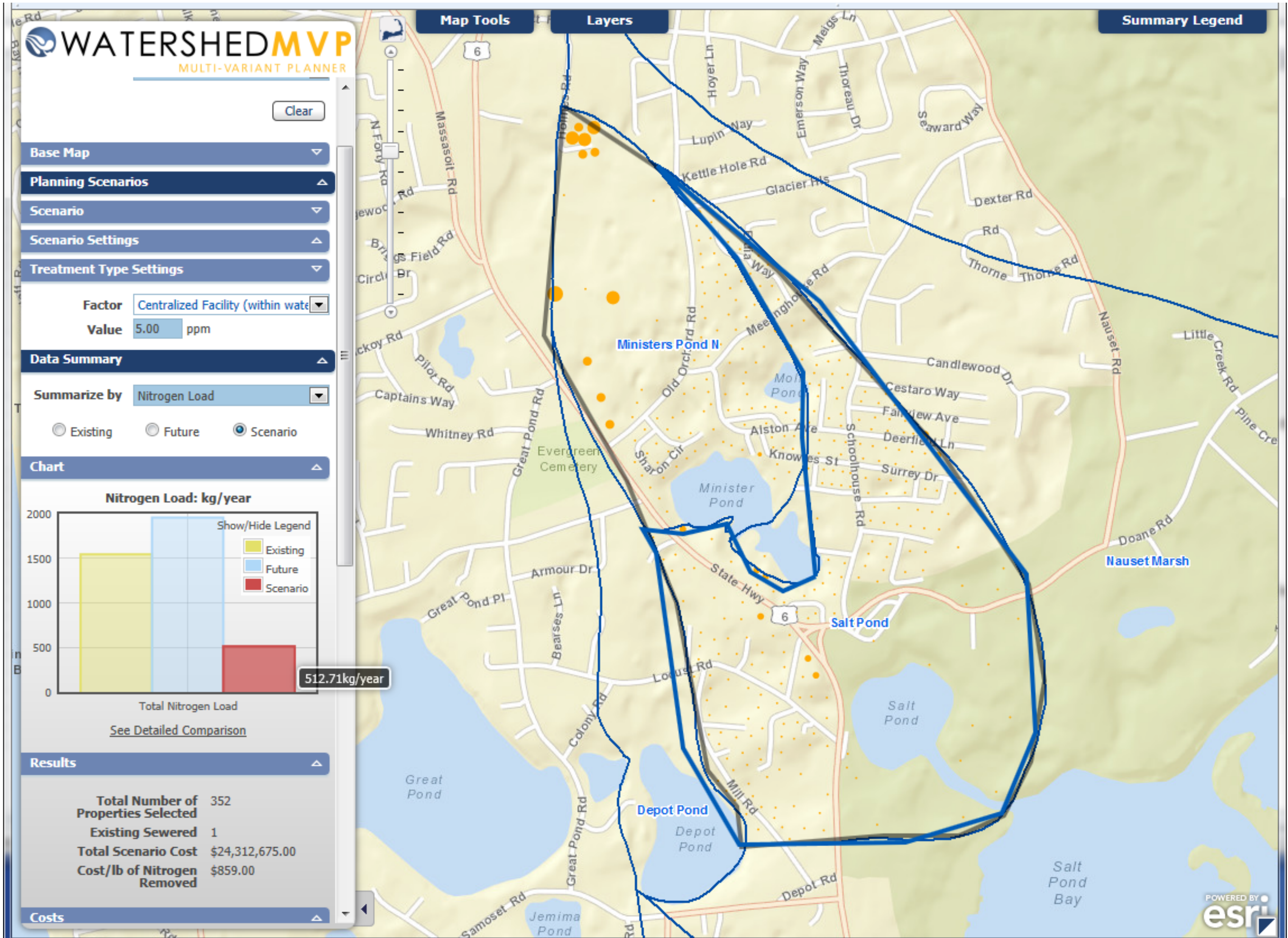



91% Reduction

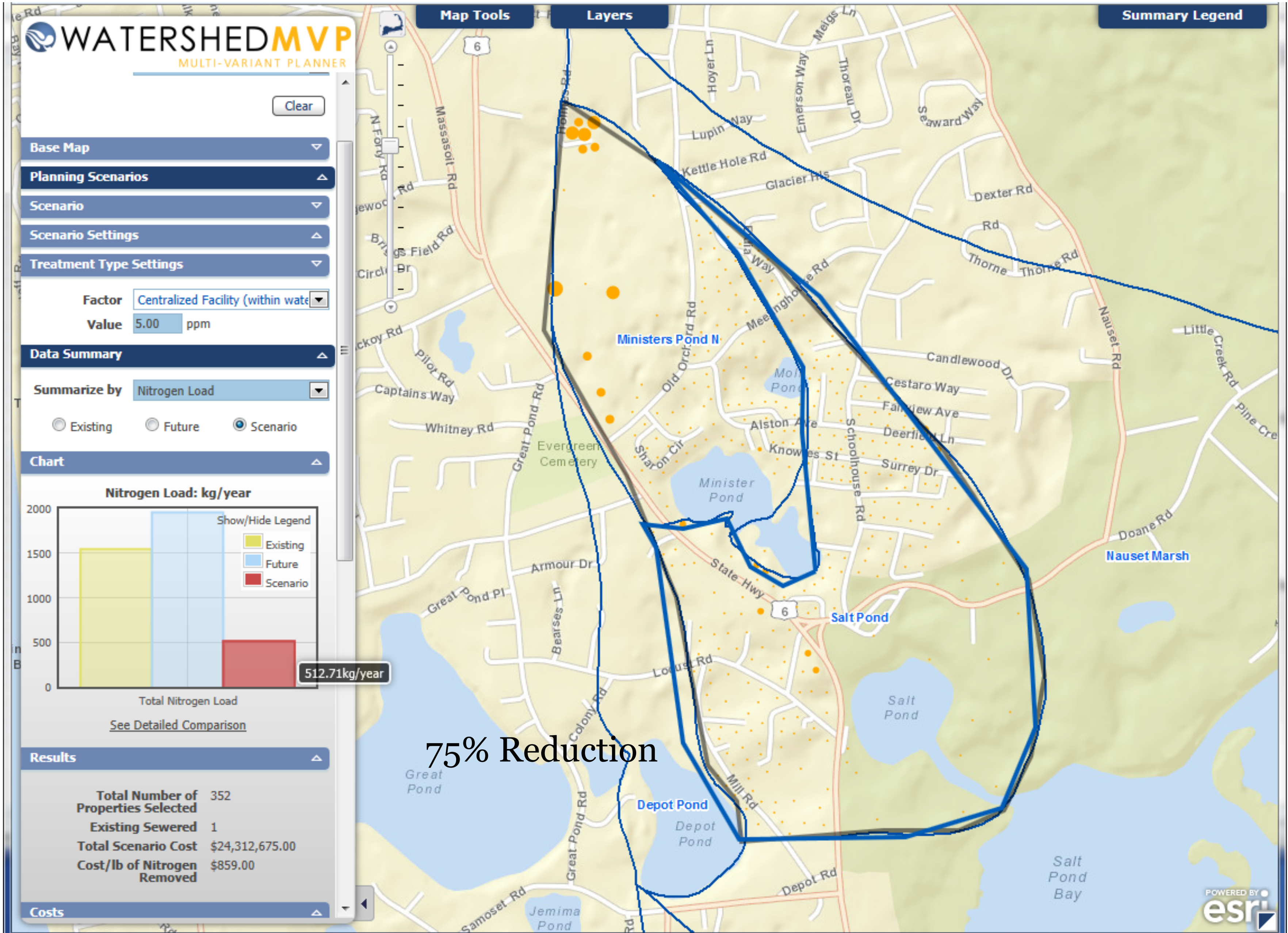
# 71% of the loads in the Upper Watershed are naturally attenuated



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** "Watershed Working Group - Nauset and CC Bay Marsh - Workshop 3"

| **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 |

"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 3"

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"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 3"

# *Adaptive Management:*

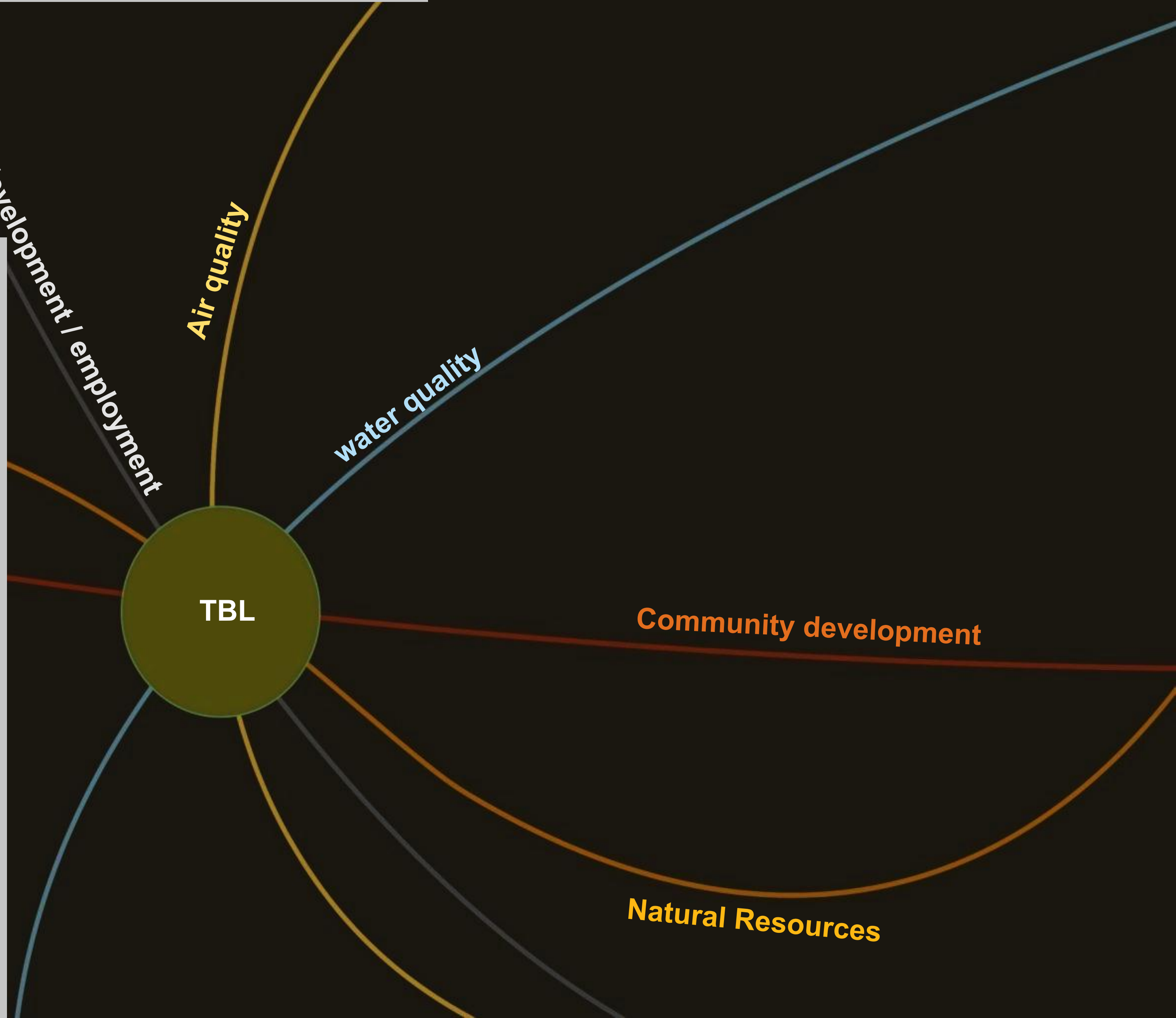
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient ways.

# 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

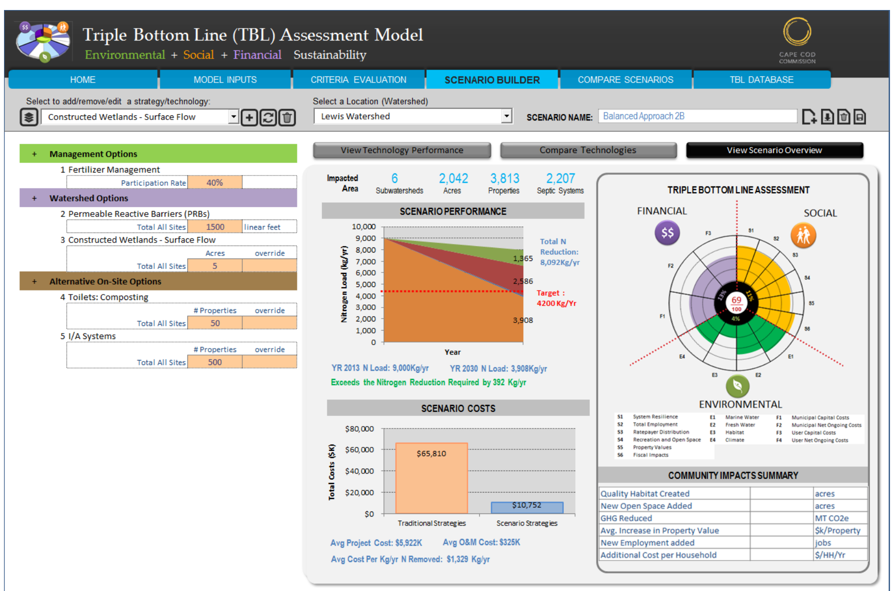
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

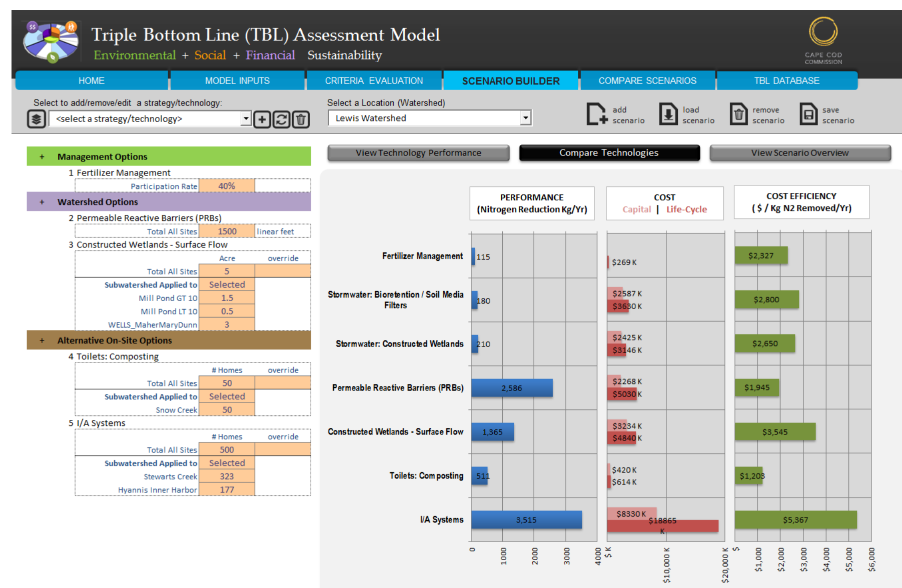


# Why develop a TBL model?

- 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

"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 3"

Environmental + Social + Financial Sustainability

CAPE COD COMMISSION



| | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| | Minimum Cost | Cost Effective | Maximum Performance |

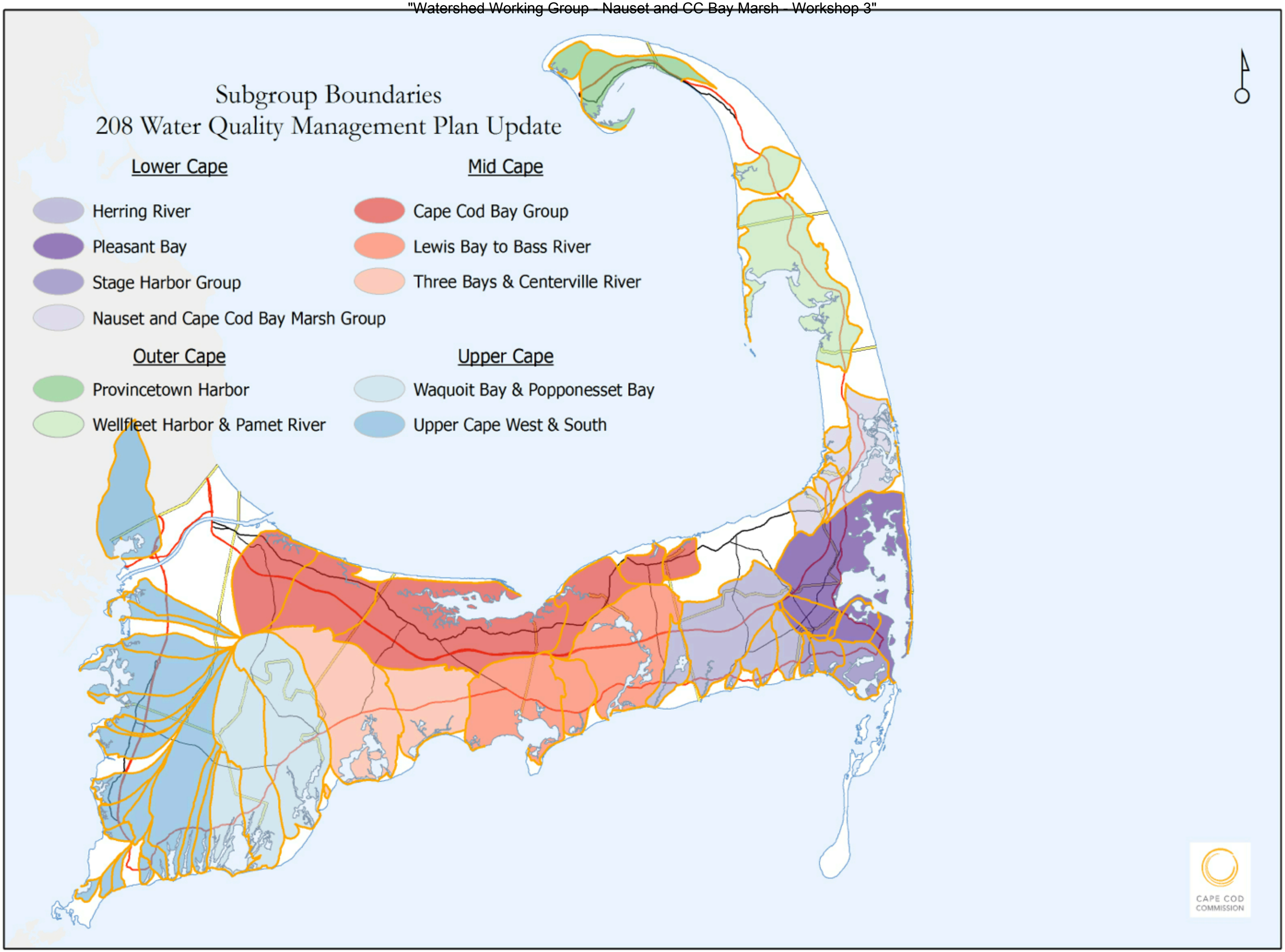
## Criterion Scores

| | |
|---|---|
| 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 |

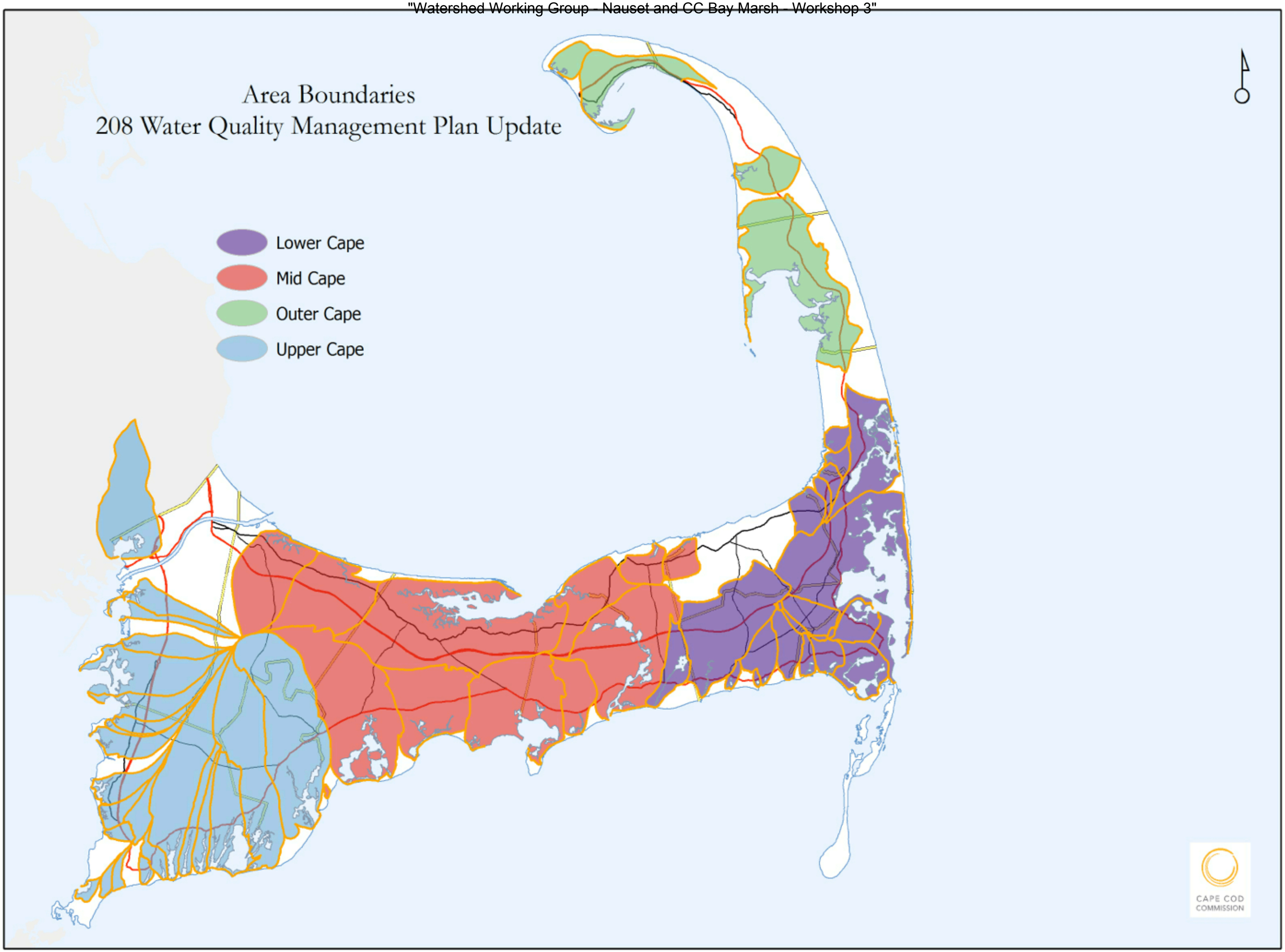



## Strategy/Technology Distribution

| COST & PERFORMANCE | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| 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
Lower Cape
Mid Cape
Outer Cape
Upper Cape
CAPE COD COMMISSION

**Cape Cod 208 Area Water Quality Planning**
**Nauset and Cape Cod Bay Marsh Watershed Working Group**

**Meeting Three**
**Wednesday, December 4, 2013**
**8:30 – 12:20 AM**
**Eastham Town Hall, 2500 State Highway**
**Eastham, Massachusetts 02642**

**Meeting Summary Prepared by the Consensus Building Institute**

## I. ACTION ITEMS

Working Group

- 208 Plan Stakeholders Summit meeting date and location to be announced soon.

Consensus Building Institute

- Draft and solicit feedback from Working Group on Meeting Three summary

Cape Cod Commission

- Finalize updates to technology factsheets
- Share specific numbers (and sources) for the stormwater, wastewater, and fertilizer nitrogen loads in the watershed
- Fix cost of nitrogen figure on alternative technology scenario slide
- Share information about date and time of the January stakeholder meeting[1] with the Working Group when decided

## II. WELCOME AND OVERVIEW

Patty Daley, Cape Cod Commission Deputy Director, welcomed participants and offered an overview of the 208 Update stakeholder process.[2] In July, public meetings were held across the Cape to present the 208 Plan Update goals, work plan, and participant roles. Public meetings were also held in August to present information on the affordability and financing of the updated comprehensive 208 Plan. The first meetings of the eleven Watershed Working Groups were held in September and focused on baseline conditions in each of the watersheds. The second meetings of the Watershed Working Groups were held in October and early November and focused on exploring technology options and approaches. These third meetings of the Watershed Working Groups focus on evaluating watershed scenarios. These scenarios are

[1] That meeting, a 208 Stakeholder Summit, is now scheduled for February 6 8:00 am – 2:00 pm at the Resort and Conference Center at Hyannis.

[2] The PowerPoint Presentation made at this meeting is available at: http://watersheds.capecodcommission.org/index.php/watersheds/lower-cape/nauset-and-cape-cod-bay

informed by Working Groups' discussions at previous meetings about baseline conditions, priority areas, and technology options/approaches.

Ms. Daley reviewed the goal of the 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 subregional groups in refining scenarios for the 208 Plan.

Stacie Smith, the facilitator from the Consensus Building Institute, reviewed the agenda and led introductions. A participant list can be found in Appendix A. She explained that the Working Group would be asked to provide input on possible approaches/scenarios for wastewater management in the watershed study area, including adaptive management applications. She also told the Working Group they would be expanding and reviewing their criteria for selecting scenarios, which they started in prior meetings. She also reviewed action items, noting that they were all completed except for revision of the technology fact sheets, which are still underway.

**III. INITIAL SCENARIOS FOR THE NAUSET AND CAPE COD BAY MARSH WATERSHED**

Patty Daley explained the Commission's process for developing watershed scenarios. The Commission formed two teams from among their staff and consultants: one team is exploring "traditional" technologies and approaches (e.g. permitted technologies such as sewering and I/A systems) and another team is exploring "alternative" or "non-traditional" technologies and approaches. The goal in employing both traditional and nontraditional approaches is to reduce the project's footprint and reduce the ultimate cost to the Cape's taxpayers. The teams are both working under the assumption that fertilizer and stormwater reductions will further reduce the infrastructure footprint required to meet TMDLs.

The Cape Cod Commission used comparative analysis to provide an "apples to apples" comparison for the cost of removing a pound of nitrogen. The costs are derived from the Barnstable County 2010 Cost Report and the Technologies Matrix, and include a lifecycle analysis based on 20 years. This cost data is for comparative purposes. In response to a question, Ms. Daley clarified that the thorough comments on the online technology matrix came from stakeholders, to which the Commission responded in a single document.

**<u>Whole Watershed Conventional Scenarios</u>**

Tom Cambareri, Director of the Water Resources Program at the Cape Cod Commission, led the discussion of "traditional" technologies and approaches. He explained that the scenarios were developed using the Commission's Watershed MVP Tool. This web-based tool models different technology scenarios by incorporating parcel and water data, build out analysis, technology costs, and other factors. He offered three main scenarios:

The aggregated overall wastewater nitrogen reduction goal for Nauset Bay, Town Cove and Salt Pond watersheds is 55%.

- Comparative I/A scenario
  - Installation of I/A systems for all properties in the watershed. This would remove 27% of the system's nitrogen. Not enough to meet the aggregated overall nitrogen reduction goal of 55% for the Nauset Bay, Town Cove and Salt Pond watersheds.
- Centralized treatment scenario
  - Modeled scenario in which all properties are sewered and treated water is put back into the watershed with nitrogen levels of 5 parts per million, resulting in an 81% nitrogen level reduction. This scenario over-achieves nitrogen removal for the Nauset Bay, Town Cove and Salt Pond watersheds.
  - Mr. Cambareri noted that there are various nitrogen reduction targets within sub-watersheds across this watershed (e.g. 83% for Salt Pond), but the 81% represents a removal rate for the entire watershed.

**Targeted Watershed Conventional Scenarios**

- Targeted collection and treatment scenario
  - Mr. Cambareri explained that, the MEP generally assumes 50% of nitrogen is attenuated when passing through a pond or lake and 30% when passing through a stream or river, which can be modeled to find more effective remediation scenarios by focusing on downstream watersheds.
  - Mr. Cambareri also noted that fertilizer and stormwater runoff accounts for 20% of the watershed's nitrogen load, so reducing this would minimize the amount of wastewater needing collection and treatment.
  - When fertilizer and stormwater runoff are reduced by 50% and attenuation is used advantageously, the footprint of the proposed centralized system could be reduced.

Working Group members had the following questions and comments about the conventional scenarios (Working Group questions and comments in italics):

- *If you remove 50% of fertilizer runoff, why do you still need septic systems?* It was explained that fertilizer runoff control is not sufficient alone but can be used to offset the amount of septic nitrogen needing reduction. Mr. Cambareri clarified that nitrogen comes from wastewater, stormwater, and fertilizer. By decreasing the fertilizer load by 50%, wastewater reduction required to meet standards can be minimized. Mr. Cambareri said the Commission could get specific numbers on these categories if desired, but the non-traditional approach presentation should give the Working Group a better sense of these numbers.
- *Why were there a different number of properties in the different centralized scenarios?* The same number of properties was selected but less needed to be sewered in the

targeted approach.

- *In your I/A scenario, how much nitrogen did you model these systems removing?* We chose a permitted system that releases nitrogen at 19 parts per million.
- *If I were to install an I/A system, I would buy one that released nitrogen at 5 parts per million.* Our calculation was just for comparative purposes at this point. The 19 ppm effluent nitrogen concentration assumed for denitrifying I/A systems is used because these systems are permitted by DEP to treat to this level. The Commission acknowledges that examples of I/A systems that treat to below 19 ppm exist.
- *What data did you use for build out calculations?* This only models existing development; there is no buildout.

**<u>Whole Watershed 7-Step Scenarios (Non-Traditional Alternative Technology and Approaches)</u>**
Mark Owen, Project Director at AECOM and consultant to the Cape Cod Commission, led the discussion of "alternative" technologies and approaches. He explained that the scenarios were developed for discussion purposes and encouraged Working Group members to offer their own modifications and suggestions. The scenarios follow the whole watershed 7-step process, which targets fertilizer and stormwater reductions first, then explores watershed/embayment options, and then alternative on-site options.

Mr. Owen walked the Working Group through both the Nauset Bay and Salt Pond watersheds. (For time purposes, only one sample sub-watershed was used for illustration of the approach.) Using a calculator slide, he showed the group the subsequent reductions in nitrogen levels for each additional technology used to eventually achieve the reduction targets mandated by the MEP and TMDLs. Mr. Owen and Ms. Daley compared the effectiveness and cost of several different watershed scenarios, which demonstrated decreased nitrogen reduction costs when reducing stormwater and fertilizer runoff and using alternative technologies in conjunction with traditional approaches. The use of alternative approaches would also reduce the footprint of any necessary sewering.

He offered the following scenario for <u>Nauset Bay:</u>

- Nitrogen reduction goals: 12,297 kg of nitrogen per year
- Low barrier options: assumes 50% reduction of nitrogen in fertilizer and stormwater runoff
  - Fertilizer nitrogen reduction: 631 kg/year
  - Stormwater nitrogen reduction: 652 kg/year
- Watershed/embayment options:
  - PRBs around Town Cove and Salt Pond: 4,752 kg/year
  - 11 acres Oyster beds/aquaculture: 2,750 kg/year
    - Mr. Owen noted the cost for aquaculture could be zero due to harvest and permitting revenue potential.
  - Floating constructed wetlands in Salt Pond: 1,800 kg/year
    - These are floating mats with plants that uptake some nitrogen and provide a habitat for microbes that remove nitrogen

- Alternative on-site options:
  - Ecotoilets toilets: 25 homes = 99 kg/year
  - I/A technologies: 185 homes = 431.4 kg/year
  - Enhanced I/A: 35 homes 104.7 kg/year
- Sewering:
  - 199 homes = 877 kg/year
  - Mr. Owen noted more I/A technologies could be used instead to reduce the cost of sewering. This would likely raise the total cost of the scenario.
- This combination of actions is estimated to reduce the full amount of required nitrogen. Total unit cost of removing a pound of nitrogen: $346

Working Group members had the following questions and comments about the Nauset Bay scenario (Working Group questions and comments in italics).

- *Does the cost of nitrogen need to be recalculated on the scenario figure?* Yes, it does.
- *Why would we use floating bag aquaculture versus reefs like in Wellfleet?* You could use either approach. They both reduce similar amounts of nitrogen. Reefs are more resilient in storms but can cost more depending on the sediment.
- *Why would we not expand aquaculture to reduce more nitrogen and get more money?* It produces nitrites, which you do not want an excess of, so you need to weight this. There are also other impacts of aquaculture, such as compatibility with other uses, and uncertainties since they are living organisms, so there is risk in relying on shellfish for the full solution.
- *Why does the sewering system get bigger when more I/A is used in the calculator?* Since I/A is calculated here at 19 parts per million, sewering is more effective. He also noted that systems with lower rates might have greater costs. Ms. Smith responded to group questions about whether 19 parts per million is the right assumption by acknowledging different assumptions for the average reduction rates of I/A systems are contained in the technology matrix.
- *Are the cost savings from not having to pump or replace failed septic systems included in the cost of sewering?* Not at this point, this is just for comparative use.
- *There are some large septic systems that need to be replaced. A PRB does take away the need to fix these systems.*
- *What is the timeframe for these costs?* We used a 20-year timeframe to look at replacement costs and for wastewater treatment facility expenses, which also typically require updating after 20 years.
- *There is a pond in the area that is in bad shape. We have not talked too much about ponds. If we put a PRB north of this pond, could it also protect it from phosphorous instead of just nitrogen?* PRBs can be designed to take out phosphorous as well.
- *That pond is also by our landfill. If used up gradient of 2 or 3 ponds, we could get the benefit of both nitrogen and phosphorous removal for the ponds and the watershed. This provides more "bang for the buck."*

- Mr. Cambareri noted that, due to attenuation rates, only 30% of the load from this particular watershed passes into Salt Pond, and this should be considered for cost effectiveness of solutions.
- *Orleans sewered homes 300 feet up gradient of ponds to capture the equivalent of 100 years of phosphorous.* Ms. Daley pointed out that the Commission's GIS maps have layers that can be used as screening criteria for various alternative technologies.

A preliminary comparison of costs for the three approaches in Nauset Bay was presented, all of which are designed to meet the TMDLs, showed the following:

| | Targeted collection | Targeted collection after 50% reduction in fertilizer and stormwater nitrogen | Targeted collection after 50% reduction in fertilizer and stormwater nitrogen and alternative approaches |
|---|---|---|---|
| Total Cost | $94 Million | $80 Million | $21 Million |
| Cost/lb N | $549 | $544 | $874 |
| Treated Flow | 212,000 gpd | 204,000 gpd | 30,000 gpd |

*The Commission subsequently removed Total Cost from Watershed presentations, due to modifications of the fertilizer, stormwater and attenuation factors that will change the extent and costs of the preliminary scenarios.* ***As a result, the above numbers are to be considered illustrative only.***

**Working Group Reactions, Questions, and Discussion**

Ms. Smith reminded participants of the priorities and concerns that they had raised at past Working Group meetings. She explained that the scenarios they saw were still somewhat hypothetical, but the key question involves the approach, how the planning will be undertaken, and the differences of the 7-step to a more traditional one. Ms. Smith asked for the group's thoughts about the 7-step approach and if they had suggestions on additional technologies or approaches that might be appropriate for this watershed. Group members discussed several major process and technological subjects.

The 7-Step Approach

Working Group members appreciated that the process leads towards targeting low-hanging fruit, which will involve alternative technologies. Others liked that this format provides a useful tool for clarifying the process and engaging the public by showing that a 'one size fit all approach' is not necessarily the only or best. Many agreed that the 7-step approach should be used for educating the public to tackle misinformation and help the process politically. Some members appreciated the combination between traditional and nontraditional approaches and asked who designed it (Designed by: The Cape Cod Commission, Scott Horsley, and AECOM).

Others noted that, despite the benefits of this process, there are still costs and political problems among the towns, which are not addressed in this process. Some worried that the process does not adequately deal with regulatory requirements. Ms. Daley responded to these concerns by explaining that the Commission would still have a traditional plan behind the 7-step approach to present to the DEP, which might require expanding the sewer footprint. Ms. Smith added that regulatory agencies are being engaged throughout this process and will be brought in more directly in the next stages of the 208 Planning, and having an agreed-upon Plan B is part of the approach.

Aquaculture

The Working Group discussed the issue of aquaculture in depth, focusing on oysters, and going through the pros and cons while exploring the reliability of the technology. A Working Group member expressed concern about the regulatory component of aquaculture, as Eastham does not give permits for it anymore because of aesthetic complaints from local landowners, though he acknowledged it could work in remote areas. A member from Orleans said that, while they do not have any shellfish grants within the town proper, the town is expanding the total number of grants and has not had any complaints, though she added that there are many places with high nitrogen levels that also have many pathogens where oysters cannot be harvested and stated that aquaculture will not be a magic bullet for reducing nitrogen loads. Another member noted there is a spectrum of attitudes towards and effectiveness of aquaculture but a two-acre pilot project in Falmouth cleaned up very dirty water and stopped fish kills. A Group member asked if Falmouth could harvest these oysters; it was explained that they are harvested after they are placed in a clean water body for purification before sale and consumption.

Members continued the discussion mentioning additional pros of oyster projects, including low costs, revenue potential, public approval, and oysters having their highest biological activity during summer months when nitrogen levels are highest; and cons, such as their vulnerability, a need for a backup plan if they die, site specific considerations, intensive labor requirements, year to year variability of nitrogen removal rates, oyster drill attacks, and poaching of contaminated oysters.

Ms. Smith noted the Working Group's many considerations about this technology, both pro and con. Ms. Smith checked with Mr. Owen about the assumptions used for modeling aquaculture in the watershed. He noted that, at this point, the Commission had just focused on water bodies that need to reduce nitrogen loads, but the data came from studies done on the Cape and the Chesapeake and are conservative estimates for nitrogen reduction, though monitoring and permitting will be needed to figure out the details. The cost estimates used factored in the costs of monitoring by paid employees. Ms. Smith reflected that she had heard participants mention Nauset Estuary and Salt Pond as possible locations for aquaculture. A Working Group member noted there are some oyster operations already in Salt Pond as well as Town Cove, which seems to be good habitats for them. Working Group members expressed mixed levels of optimism at the idea, but also acknowledged that 11 acres for aquaculture is probably a high estimate.

Permeable Reactive Barriers

In response to Working Group questions, Mr. Owen elaborated on the use of PRBs for the watershed. They can remove both nitrogen and phosphorous. It is unclear if they remove personal care products and pharmaceuticals, but this could be monitored. The Commission looked at two types for Town Cove: one is a large ditch filled with compostable materials that can be placed within 10 to 15 feet of the water table and the other is a series of wells filled with substrate that merges together to form a liquid barrier. The wells can go deeper into the water table but requires the substrate to be occasionally replaced. Mr. Owen explained that these systems typically last 20 to 30 years but preliminary monitoring would be required to test this. He pointed to their locations on the map and noted that the lifecycle, construction, homeowner disruption, and O & M costs were included in the total cost. The $452 cost per pound of nitrogen per foot shown in the presentation is an average between the trench and well approaches, with the wells typically less expensive initially but requiring greater operation and maintenance costs.

Mr. Owen noted there could be issues dealing with utility lines during installation, especially for the trenching method. Pipes need to be removed to install PRBs and then replaced in the ground. A Working Group member noted that PRBs can typically be built within road rights-of-way, so homeowners do not need to provide legal access to right-of- way for construction.

Mr. Owen agreed that PRBs should not be placed too close to water bodies to avoid anoxic conditions and changes in the pH form affecting shellfish. There would also be less likelihood of the PRB being inundated with salt water during a significant storm, but noted that PRBs farther away from the resource may need to be placed deeper in the ground to hit the groundwater, which potentially makes them more expensive and, with the nitrogen travel time, delays the measurable impact of the technology. A working group member noted that PRBs located farther from an estuary would be more likely to be up gradient of drinking wells. The member also added that as PRBs sometimes use methanol or acetic acid as a carbon source, which if not fully consumed could be problematic. Mr. Owen agreed that other alternatives might work better than PRBs further away from water bodies. Jay Detjens, Cape Cod Commission GIS Analyst, noted that the displayed PRB placements are intended to start a conversation and elicit feedback and are not suggestions of a specific plan.

In response to Working Group concerns about regulation, Ms. Daley added that the National Park Service and other regulatory agencies are part of other Working Groups and will be brought further into the process later. Ms. Smith applauded the productive conversation about PRBs, noting that the Working Group could play with the scale of PRB implementation using the calculator and continue to nail down details to better understand and appraise the technology.

Floating Constructed Wetland

Mr. Owen told the Working Group that he did not know of any floating constructed wetlands on the Cape, but there are projects in similar environments off Cape that take seasonality into account. While they are more common in freshwater bodies, they could also work well in marine systems. In response to concerns about these systems shading Eel Grass, he explained that, although they shade the area below them, they do not take up much room and, by improving water quality, they might enhance the environment for both Eel Grass and aquaculture. The floating constructed wetlands could also be placed in deeper water to resolve the shading of eel grass. A member noted that floating constructed wetlands in deeper water could interfere with buoys and navigation. Another participant added that floating constructed wetlands could potentially be a better solution in fresh water bodies, and others noted that the success of this technology depends on finding suitable locations, given recreational and other uses of waterways.

Habitat Restoration

Working Group members suggested considering habitat restoration. Mr. Owen said the watershed has a large area of marshland, and there is a potential to create freshwater wetlands by restoring abandoned cranberry bogs, if zoning changes can be approved. Salt marsh could also be established. These restorations would not involve Eel Grass planting as it is difficult to reintroduce but could include aquaculture at reduced harvesting rates. Screening could identify areas for constructed wetlands, possibly near Salt Pond, by looking for undeveloped areas that are larger than 5 acres. Group members cautioned that, in Town Cove, there are many competing interests, and coastal restoration could negatively impact business, recreation, and navigation, and culvert openings could lead homeowners to complain about flooding. Mr. Owen explained that it would be helpful to look for areas that historically had marsh and shellfish that also do not interfere with other activities. A participant noted that Nauset Cove has a healthy marsh and that phytoremediation could also be considered in the area.

Fertigation

A Working Group member brought up fertigation as potentially cost effective solution given local ball and school fields, a cemetery, and a golf course. A member of the public explained that the groundwater near the golf course does not contain much nitrogen, so fertigation wells down gradient from it might be inefficient. Mr. Owen explained it is important to look for areas of groundwater with higher concentrations of nitrogen that will not disappear to pump back onto fields, adding that wastewater from local housing developments could potentially be pumped to the golf course.

Concluding Remarks

Ms. Smith noted that, while some of the numbers are estimates and the technology placements meant for discussion, these scenarios were based on initial screening criteria available in MVP and the GIS layers. A second layer of screening to create a more refined set of options would be the next step. A Working Group member stated that secondary benefits should be considered going forward (e.g. stormwater mitigation by Salt Pond could capture particulates coming off of route 6). Another member urged the group to come up with a scenario that will win approval at town meetings, suggesting that they be conservative in the estimates of the nitrogen removal rates of alternative technologies and focus on traditional technologies until more pilot projects can be tested. Another member added that, to win approval, they should look at tying in incentives. Others noted that people are in favor of reducing overall costs but will not agree with increasing personal costs. A participant said that, as these are site-specific technologies, engineering evaluations need to be the first step before going to town meetings to which Mr. Owen agreed.

Ms. Smith walked the group through the list of criteria and considerations developed from this and past group discussions to feed into secondary analysis going forward. These included:

- Land area/use (size and placement)
- Use/benefit natural systems
- Maximize economies of scale
- Lifecycle costs: minimize costs and be cost effective
- Robustness/vulnerability to failure
- Seasonality of problems and solutions
- Travel time, rate of improvement, and speed of implementation
- Adaptability
- Social acceptance
- Ease of use/implementation/success
- Secondary benefits
- Risks
- Prioritization
- Satisfaction of regulatory requirements and approval at town meetings
- Appropriate motivations for homeowners
- Splitting cost among towns
- Go for low hanging fruit

## IV. ADAPTIVE MANAGEMENT

Ms. Daley explained the concept of adaptive management, defining it as:

- 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.

### Working Group Reactions, Questions, and Discussion of Adaptive Management

Definition

Responding to questions from the group, Ms. Daley explained the term 'structured approach' means linking science, monitoring, and decision-making but asked the group's help in defining it and addressing adaptive management methodologies. She also clarified that the water quality goals referred to the TMDLs, which are regulatory requirements. Another member asked to include the health of the benthic environment as a goal. Another participant noted that adaptive management is too much of a complex code word, and that, for him, it just means finding efficient and effective ways of meeting the mandated water quality goals.  A group member agreed that the definition, as given, seemed too probabilistic.

Process Points and Feedback Loop

A Working Group member commented about confusion over the end and beginning of the process, asking if it makes sense to implement most of the technologies at once, especially traditional technologies to appease the DEP, or go through them sequentially to try to realize more cost savings.  Others agreed about uncertainty of how to start an adaptive management process, and some further noted the importance of starting the process with an appropriate understanding of the data and regulatory requirements.

Several members stated that a feedback loop after each phase could be used to direct subsequent efforts, which could be as simple as feedbacks in the construction process or include a timeline of expected water quality improvements.  Successful front-end efforts could then allow towns to skip later stage processes, or shift to more alternative approaches. Feedback loops would also engage the public by showing that their concerns are being considered and that the towns are learning from and effectively adapting in response to the success or failure of different projects.

Others worried that, as it might take some time to see changes in water quality given the travel time, it could be difficult to test the effectiveness of pilot programs immediately, and waiting for the feedback on all the pilot technologies, could delay the process.  Ms. Daley noted that understanding site-specific factors would also be important in a feedback process, and Ms. Smith concluded that there was clearly a call for a clarified understanding of what adaptive management and feedback loops would entail, especially regarding the timing of and immediacy of results from pilot projects.  Nonetheless, the group generally united around a concept of starting implementation with promising pilots as well as the most cost-effective traditional methods (such as areas of higher density, those closer to waterbodies, and those likely to benefit from sewering in any scenario), including monitoring and reasonable feedback loops, and adapting accordingly, without hitting a "pause" button.

Other Considerations

- **Town Dynamics:** A Working Group member noted that towns were not all in the same place in the planning process and those who were further behind would need to catch up to work on their shared watershed.  It was clarified that the next phase of 208 planning would help look at town-by-town and regional collaboration toward shared solutions.
- **Education:** A participant welcomed the positive energy and urged the group to spend just as much energy educating citizens about these conversations.  Another group member noted that none of these solutions will be considered immediately affordable to the public, with NIMBY issues also liable to arise.  Thus, the group needs to educate and sell the idea to the town voters.  Ms. Smith noted that it is easy to see disagreement as an information gap, but to remember that these issues involve people's legitimate

interests. Working Group members commented that there are citizens in the middle of the issue who may shift their views when provided more information and clarity on the issue and cited the change of opinion towards sewering on Cape Cod as an example.

## V. PREPARING FOR 2014 JANUARY-JUNE

Ms. Daley shared the Commission's plans for continuing stakeholder engagement into 2014.

### Triple Bottom Line approach

Ms. Daley explained that the Cape Cod Commission would use a Triple Bottom Line Approach model that considers the economic, social, and environmental impacts of each scenario, including a 'no action' plan to help the groups illustrate the pros and cons of the various approaches. She gave a brief introduction to the approach and walked the group through a sample triple bottom line diagram[3]. In response to questions from the Working Group, Ms. Daley and Ms. Smith read individual examples of the criteria in the three main categories and explained that all of the proposed scenarios will meet the water quality goals, and this is a tool for deciding among different scenarios that could all work on a regulatory level.

### Stakeholder Process: Summit and Working Groups

Ms. Daley explained that, going forward, the eleven Working Groups will be combined into four subregional groups after a full stakeholder Summit meeting (*now scheduled for February 6th*) to which all stakeholders are invited to share learning from the Watershed groups. Ms. Smith added that this meeting is the transition point for the groups to hear about the commonality between and perspective of the other groups. The subregional groups would focus on some of the sub- and regional-scale issues of financing, growth management, and affordability.

After this meeting, each watershed will be represented by a subregional group that will have meetings in February, March, and April. The Cape Cod Commission is looking for a range of interests to balance these groups and would like to be contacted by Working Group members interested in participating in these subregional groups, which will also be open to the public. Ms. Smith noted that more detail would be provided in the coming weeks.

## VI. GENERAL COMMENTS

### Working Group

(Working Group questions and comments in italics)

- *We have gone through three meetings together. Do we have a sense of our consensus or where to begin?* Ms. Smith responded that the group has developed a useful set of criteria and principles together and decided upon the need for public education, possible approaches to use (e.g low hanging approaches), and some important elements of adaptive management, all of which can be carried forward to the next stage of the

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[3] Time constraints and small font prevented participants from examining the diagrams in detail at the meeting. Please see presentation for diagrams at website.

process.

- Ms. Daley added that the group has provided the Commission with consensus for using both traditional and nontraditional approaches, which gives them support for further developing these technologies and discussing them with towns.
- Ms. Smith asked the group to continue its high level of engagement by acting as ambassadors to its constituents to give credibility to this approach.
- *We have moved from a posture of' either or' to 'both and,' and that is substantial progress.*
- *I learned a great deal. I was skeptical at first, but I now hope we can find consensus within our communities.*
- *We also agree that a combination of 'all the above' is the appropriate way forward.*
- *It is important that the 208 Plan allow local flexibility as we have failed before because we have not agreed on our needs. We must allow each watershed to find its starting point and allow them to pursue its goals flexibly.*

**Public**

- I would like to praise the process, though we have not discussed ACEC considerations. This issue is not one of 'not in my backyard;' rather we need to meet the needs of the earth and the ocean before our own needs.

## APPENDIX A: MEETING PARTICIPANTS

### Primary Members:

| | Name | Title |
|---|---|---|
| **Local Elected Official** | Sims McGrath | Orleans Selectman |
| | Martin McDonald | Eastham Selectman |
| **Appointed/Committee** | Charles Harris | Eastham, Chair, Water Management Committee |
| | Robert Donath | Orleans, Former Finance Committee/Former Wastewater Committee |
| | Judith Bruce | Orleans, Former Wastewater Committee |
| **Town Staff** | Jane Crowley | Eastham Health Agent |
| | Sue Leven | Brewster Planner |
| **Environmental and Civic Groups** | Ed Daly (for Paul Ammann) | Orleans Citizens Peer Review Group |
| | Charles Ketchuck (for Gary Furst) | Orleans Water Alliance |
| | Bruce Taub | Orleans Water Alliance |
| | Sandy Bayne | Eastham, Orleans Ponds Coalition |
| | Lynn Bruneau | Orleans Conservation Trust |
| | Doug Fromm | Orleans CAN |
| | Amy Costa | Eastham, PCCS |
| **Business** | Judy Scanlon | Orleans, Small Farm, Orleans Conservation Trust |
| | Sid Snow | Orleans Business Owner |
| **Open/Other** | Steven Kleinberg | Eastham |
| | Lori Roueche | Orleans |

### Primary Members:

### Alternates and Members of the Public:

| Name |
|---|
| Dan Milz |
| Ed Nash |
| Ginia Pati |