Cape Cod 208 Area Water Quality Planning
Cape Cod Bay Watershed Working Group

Meeting Three
Monday, December 9, 2013 | 8:30 am – 12:30 pm
Cape Cod Commission, 3225 Main Street, Barnstable

Meeting Agenda

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

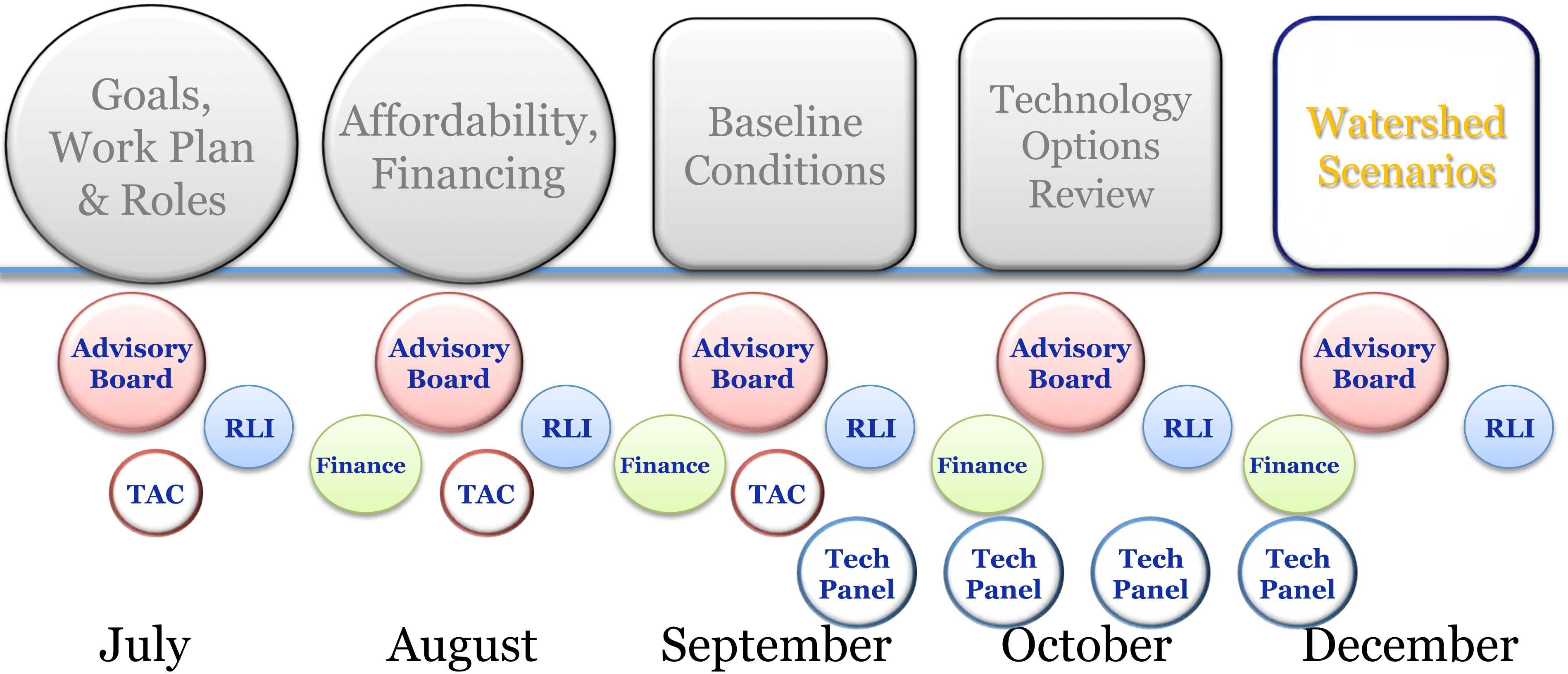
12:15 Public Comments

12:30 Adjourn

Cape Cod Bay Group

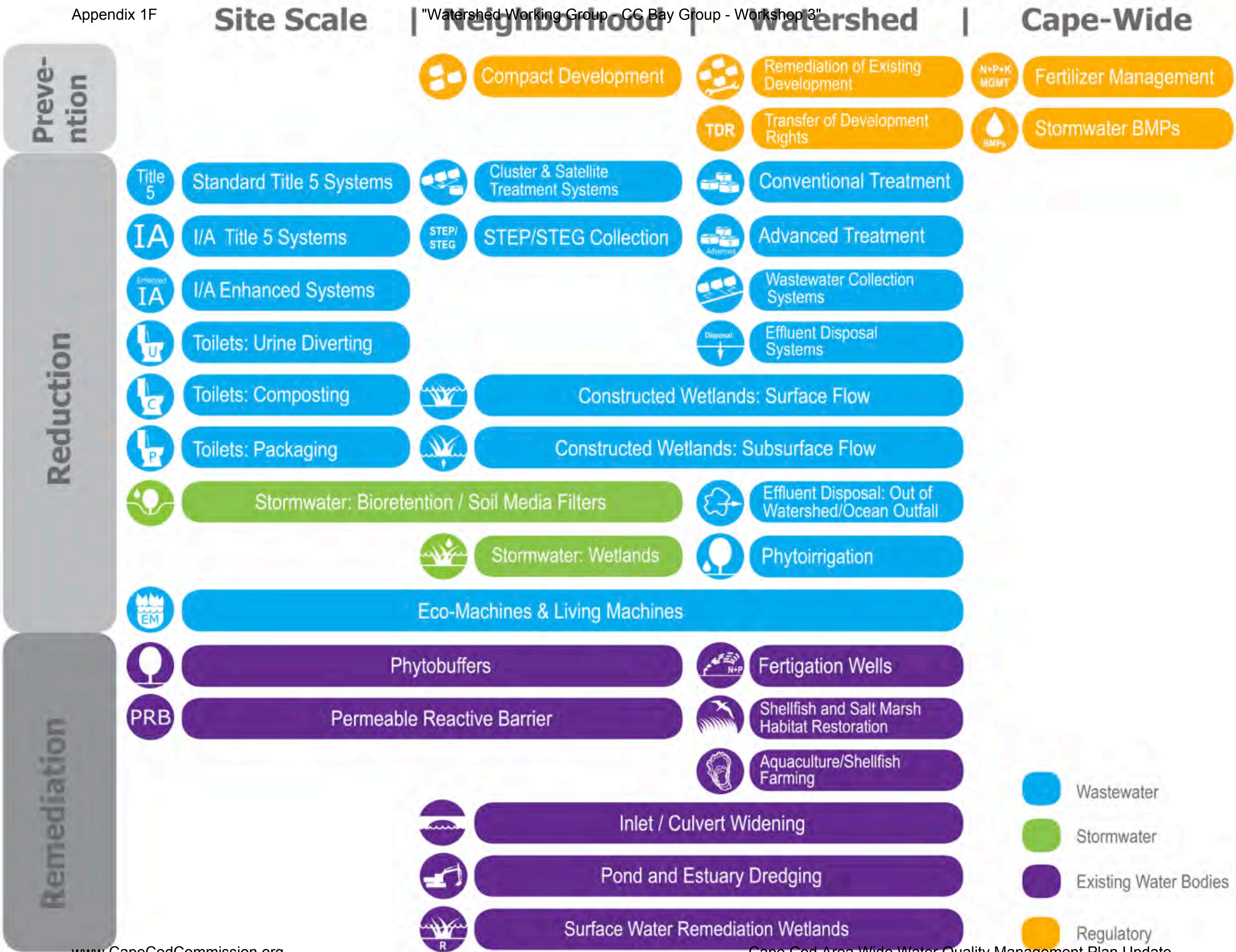
Watershed Scenarios

Public Meetings Watershed Working Groups



RLI Regulatory, Legal & Institutional Work Group

TAC Technical Advisory Committee of Cape Cod Water Protection Collaborative


Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-ntion
Reduction
Remediation
Compact Development
Remediation of Existing Development
Fertilizer Management
TDR
Transfer of Development Rights
Stormwater BMPs
Title 5
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Cluster & Satellite Treatment Systems
Conventional Treatment
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I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced Treatment
I/A Enhanced Systems
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PRB
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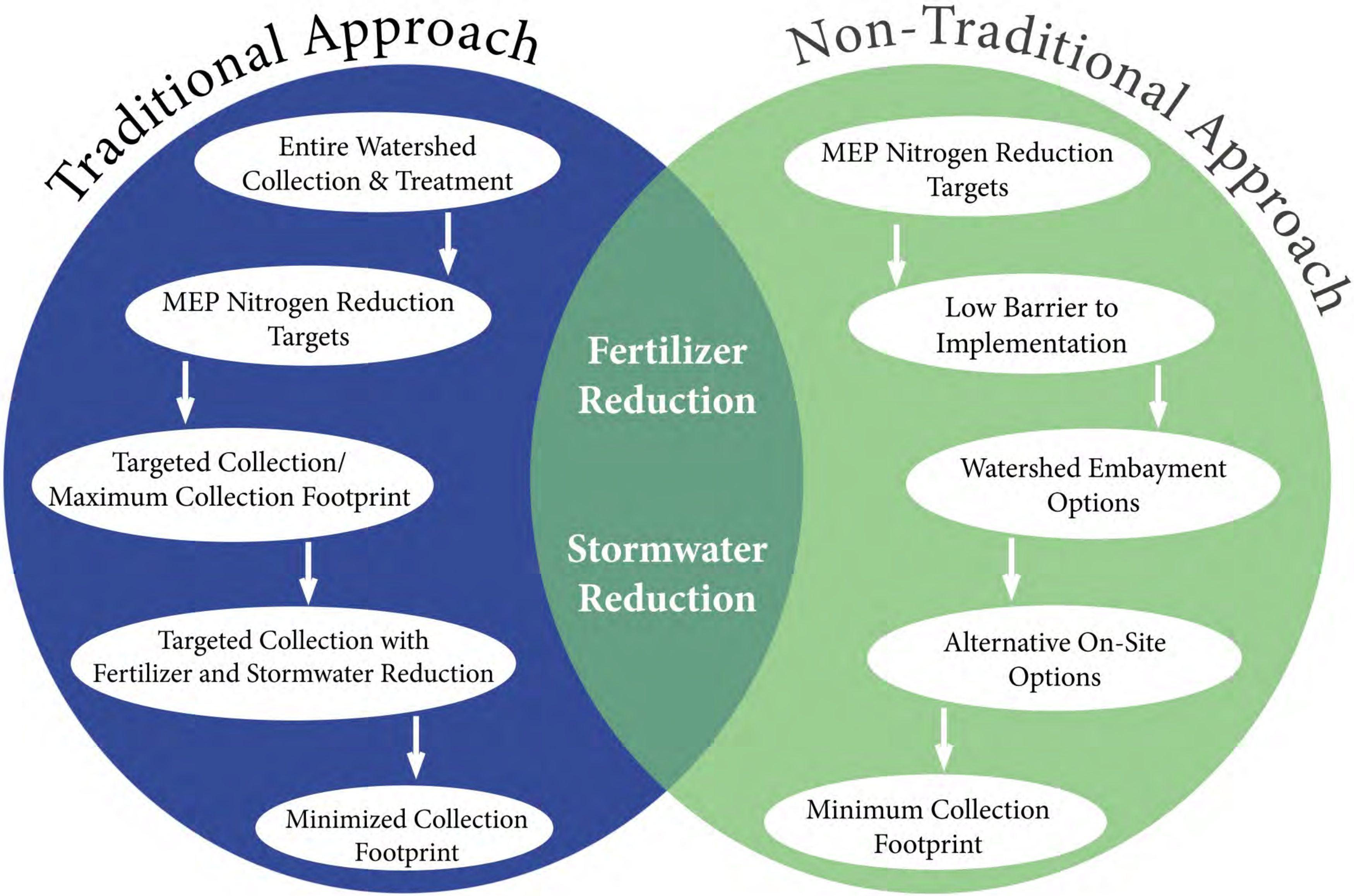
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

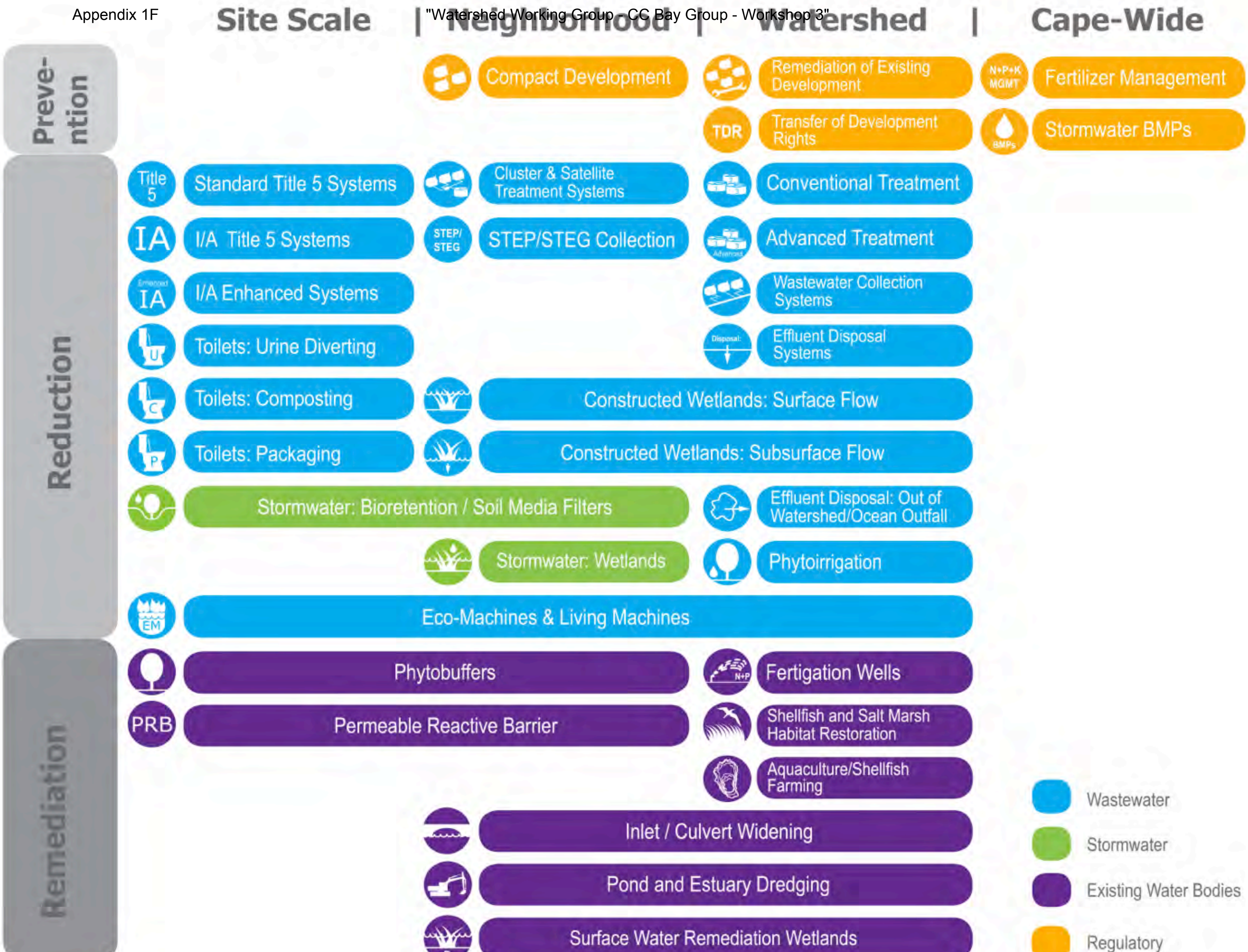
Watershed Scenarios

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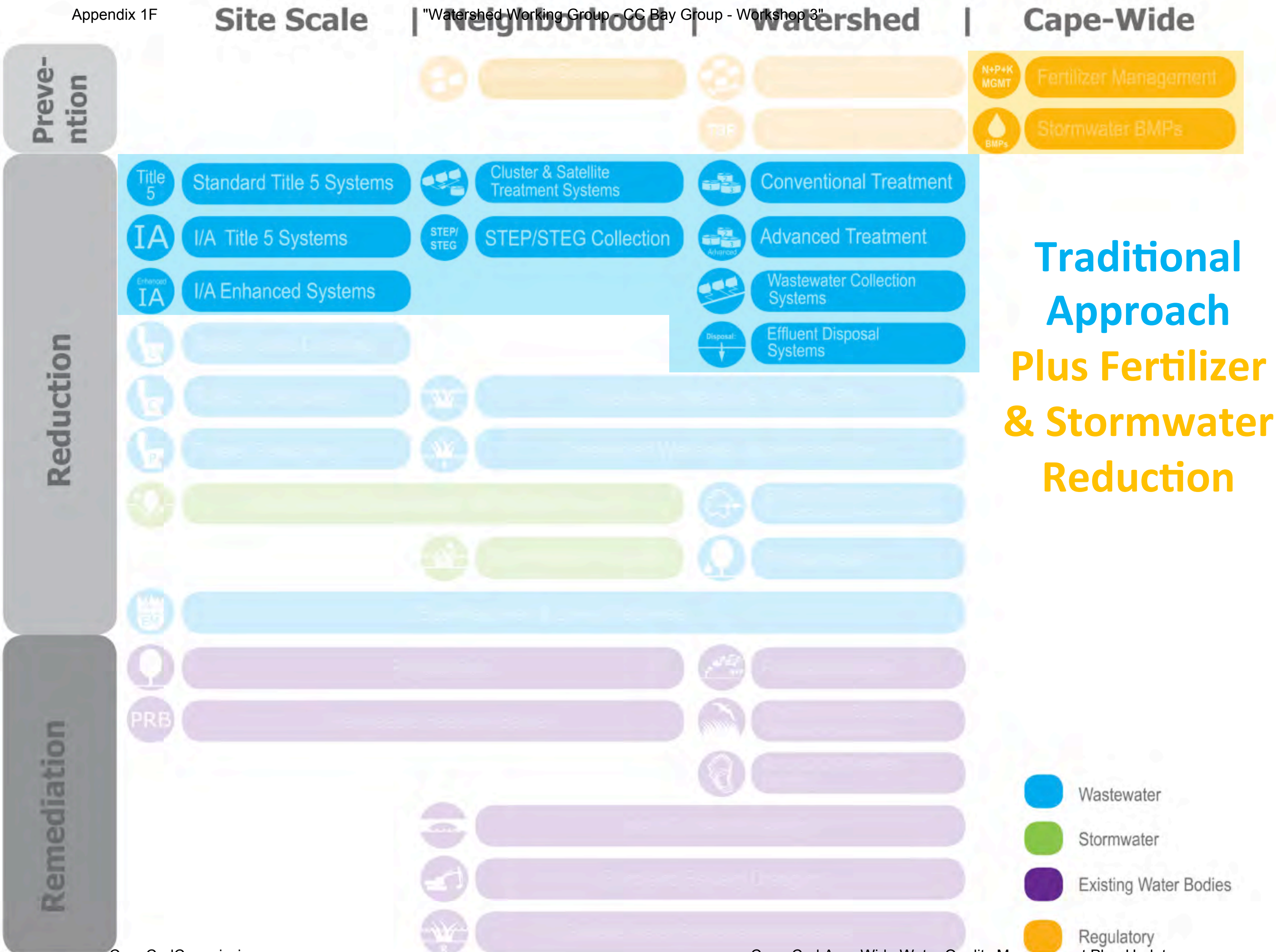
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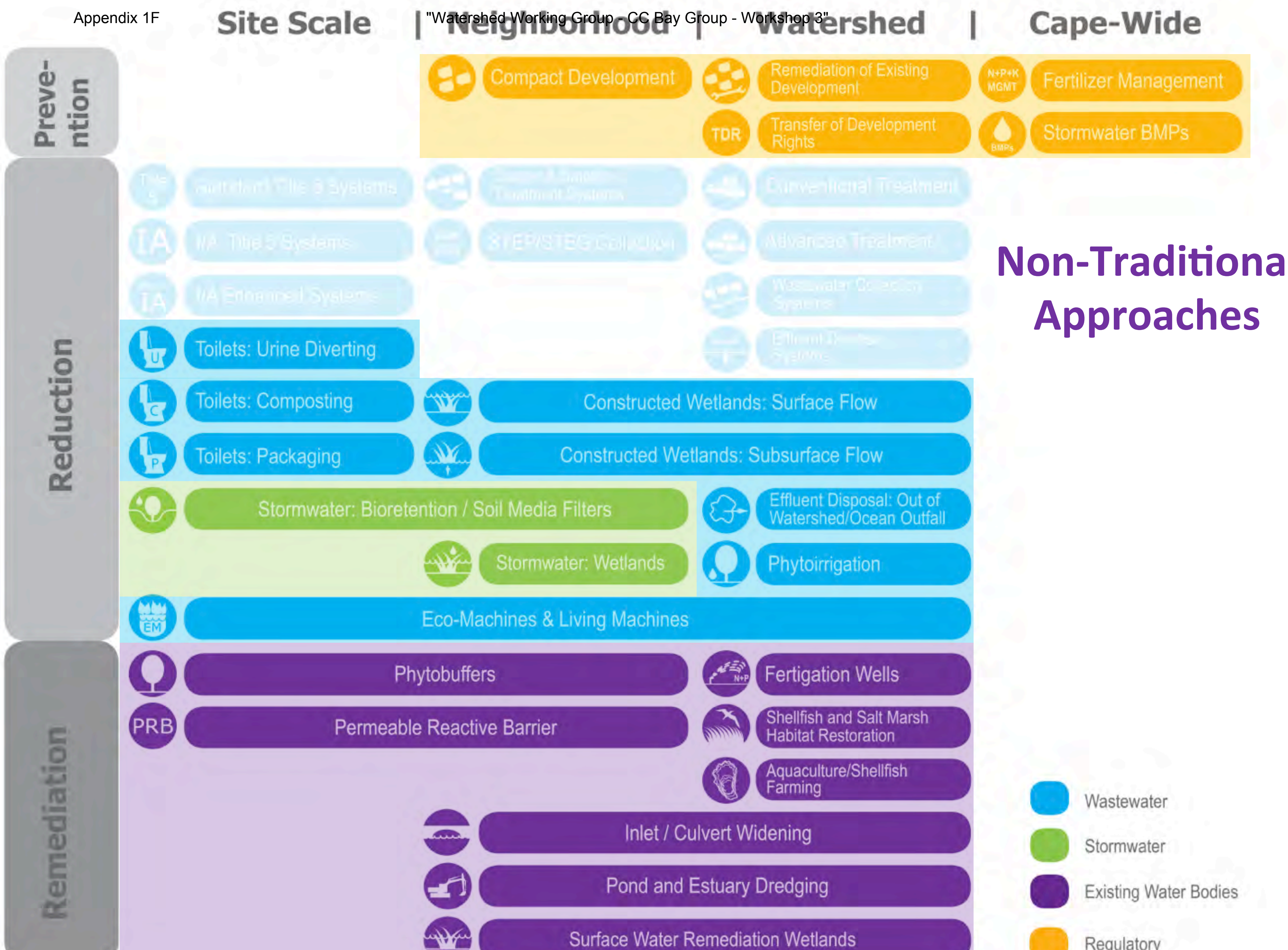
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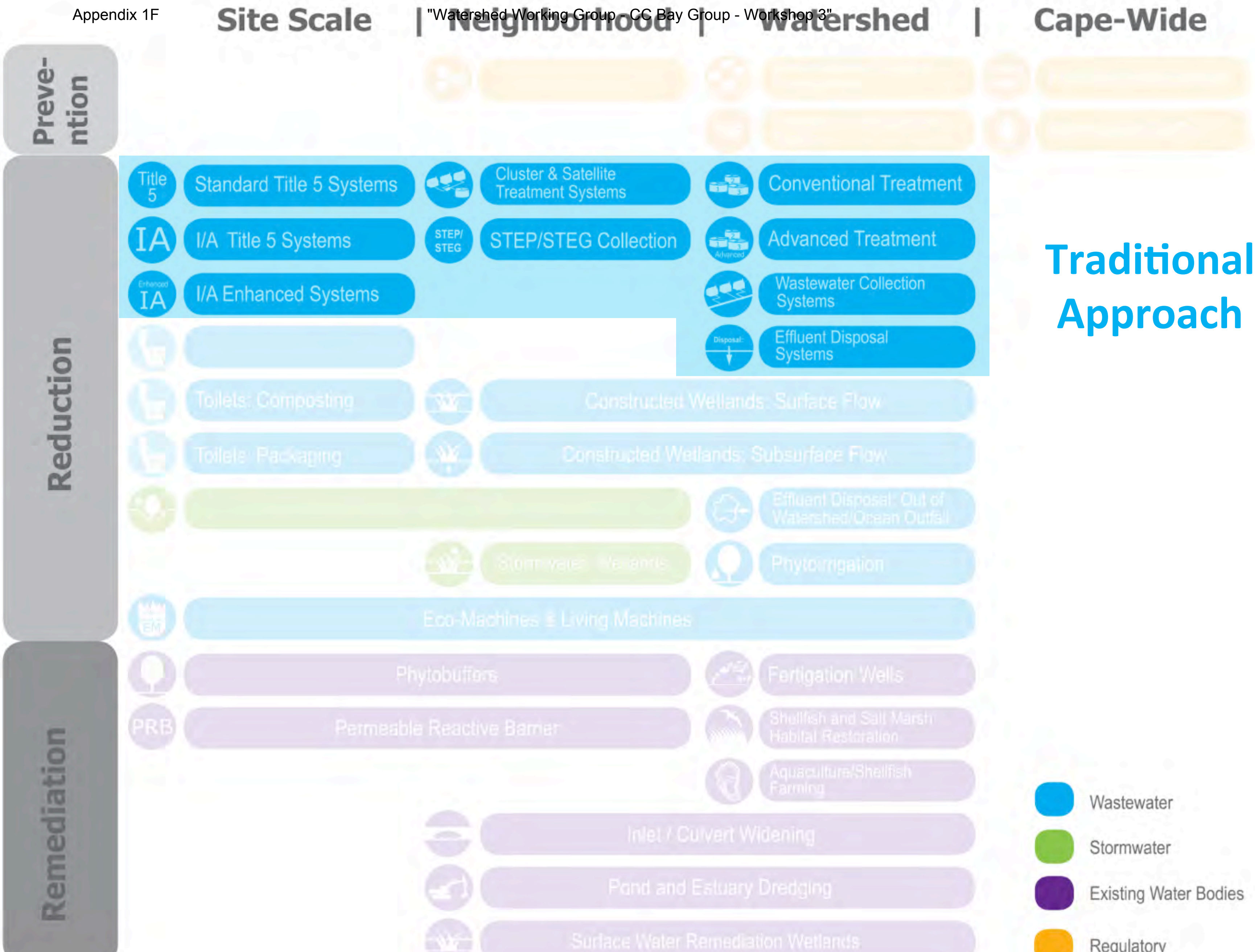
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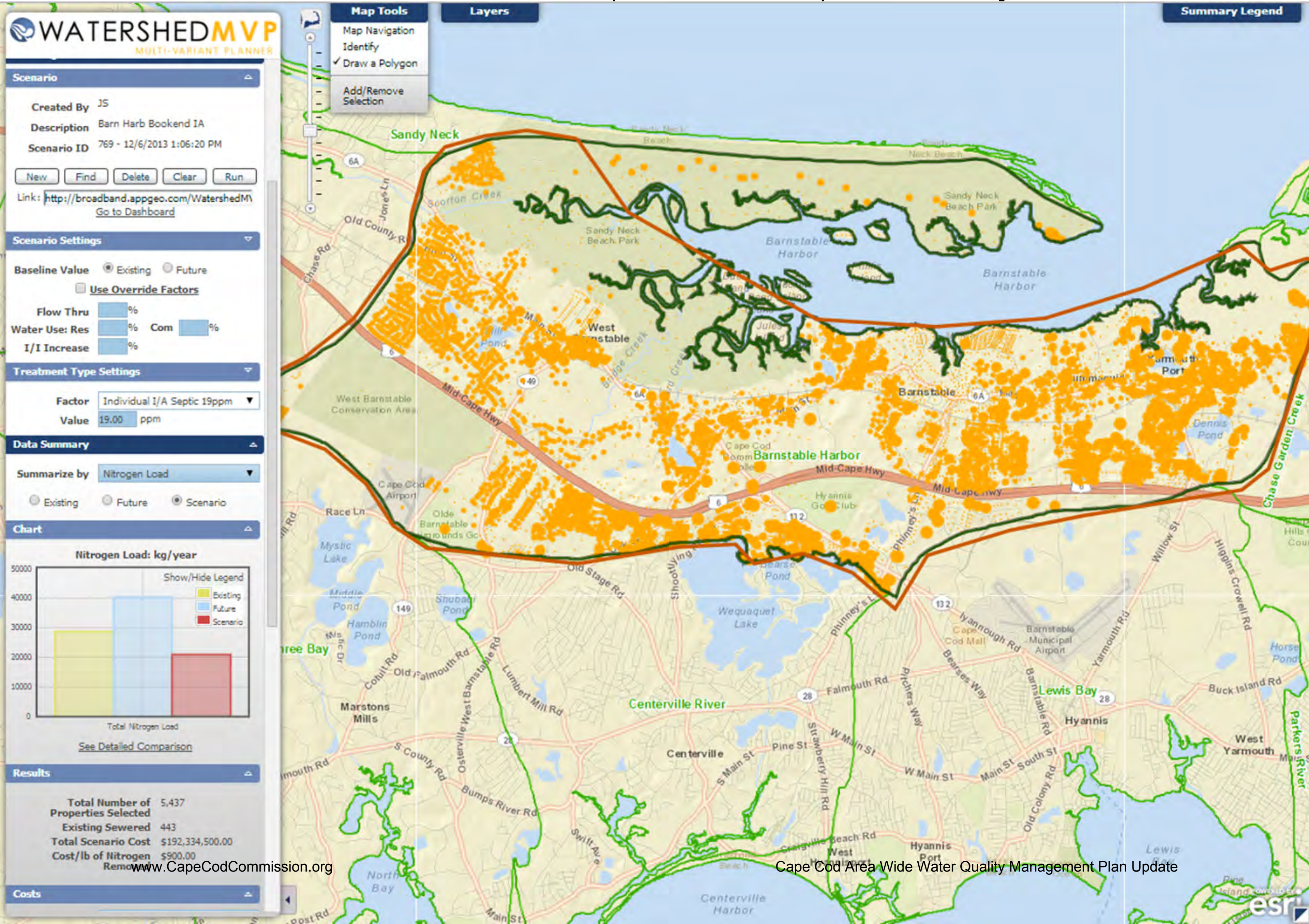
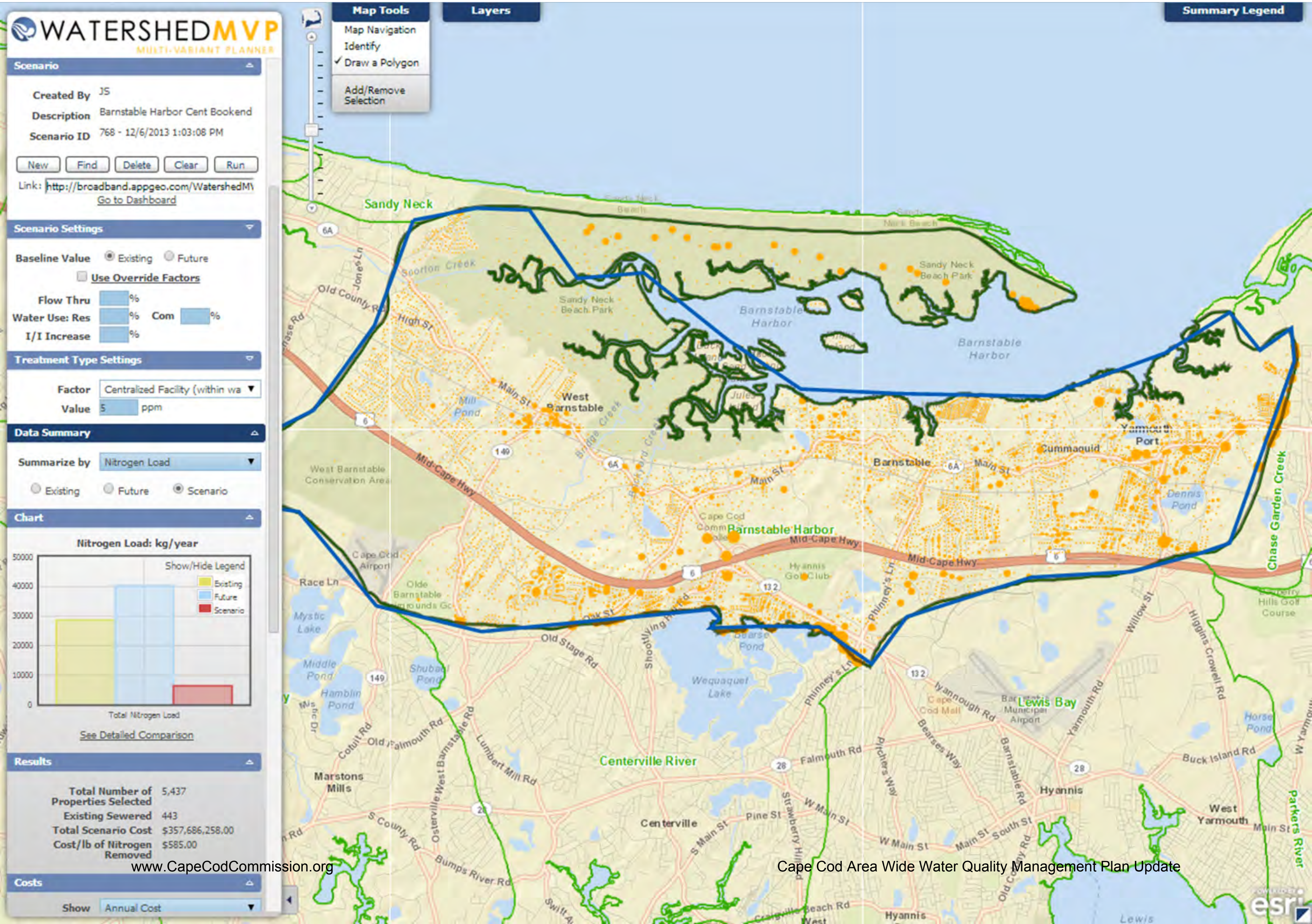
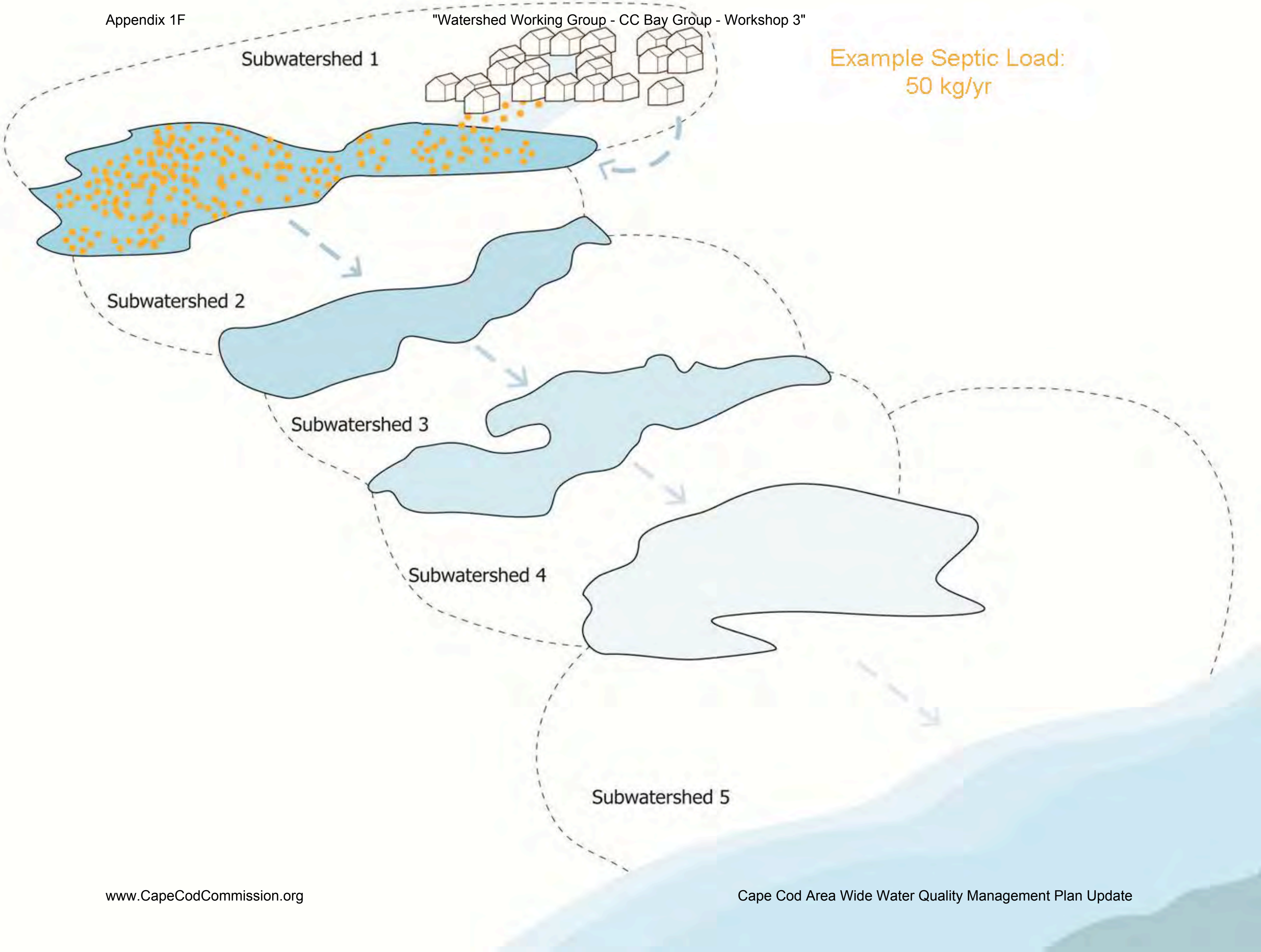
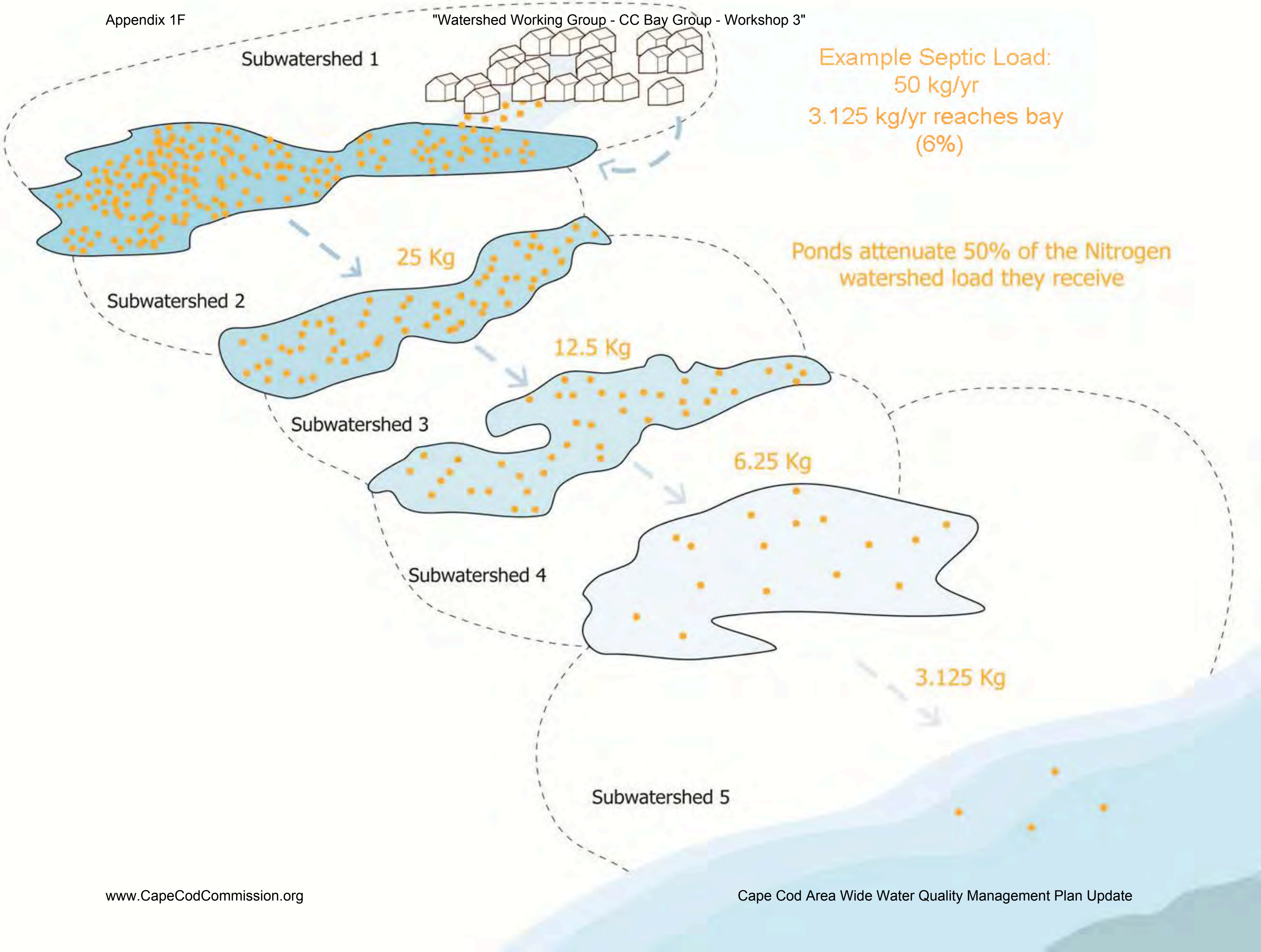
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems

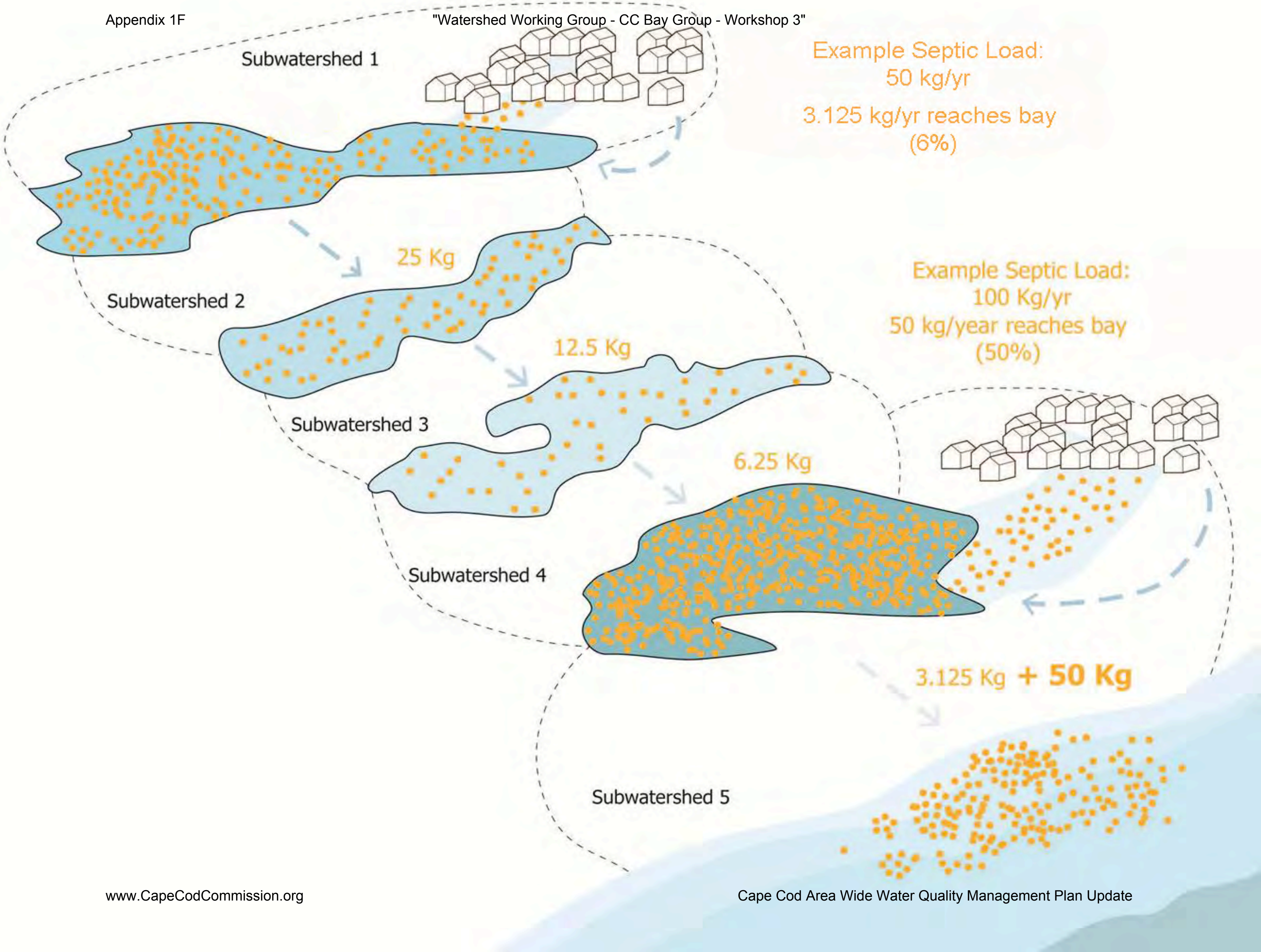


Watershed-Wide Centralized Treatment with Disposal Inside the Watershed




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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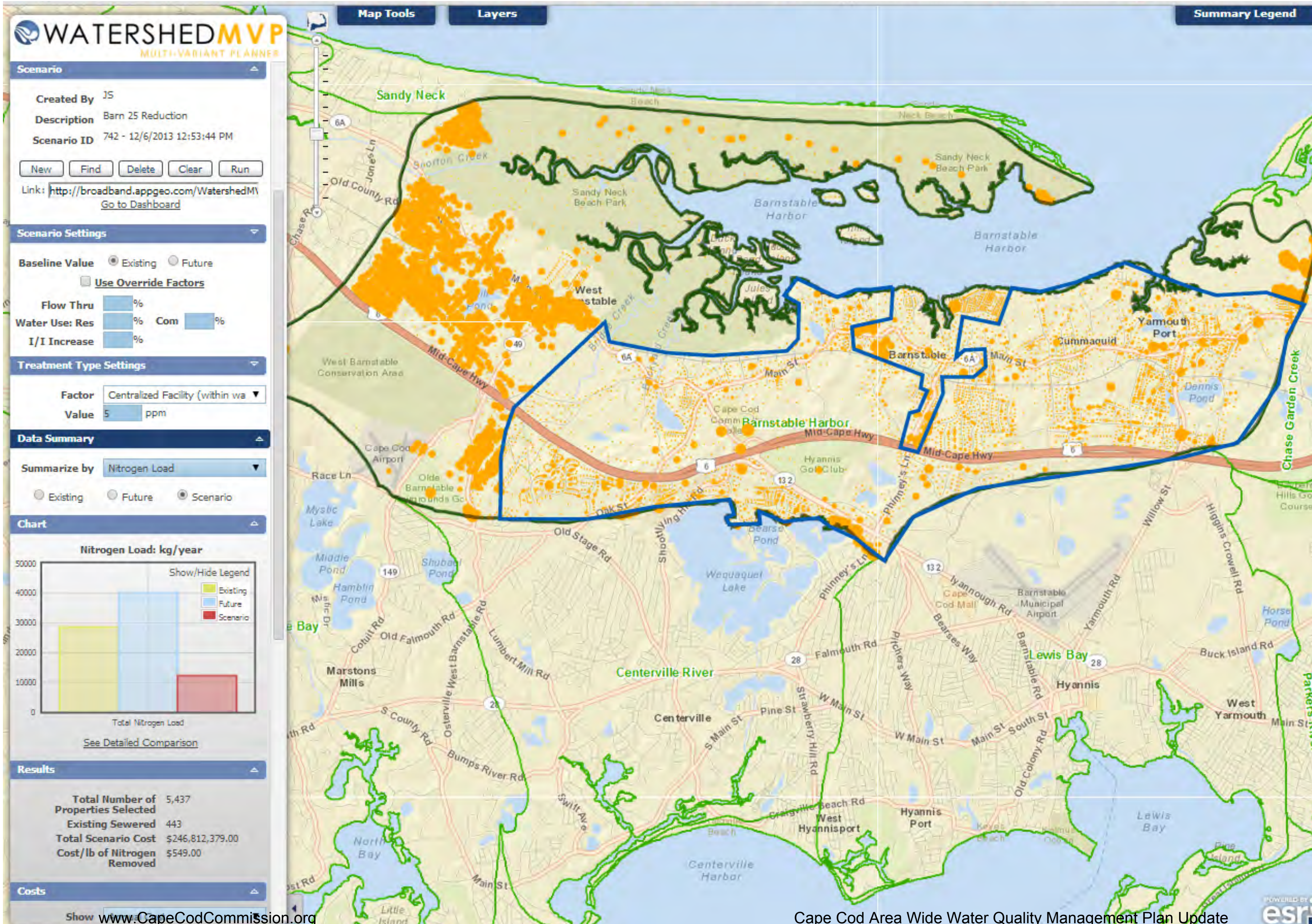
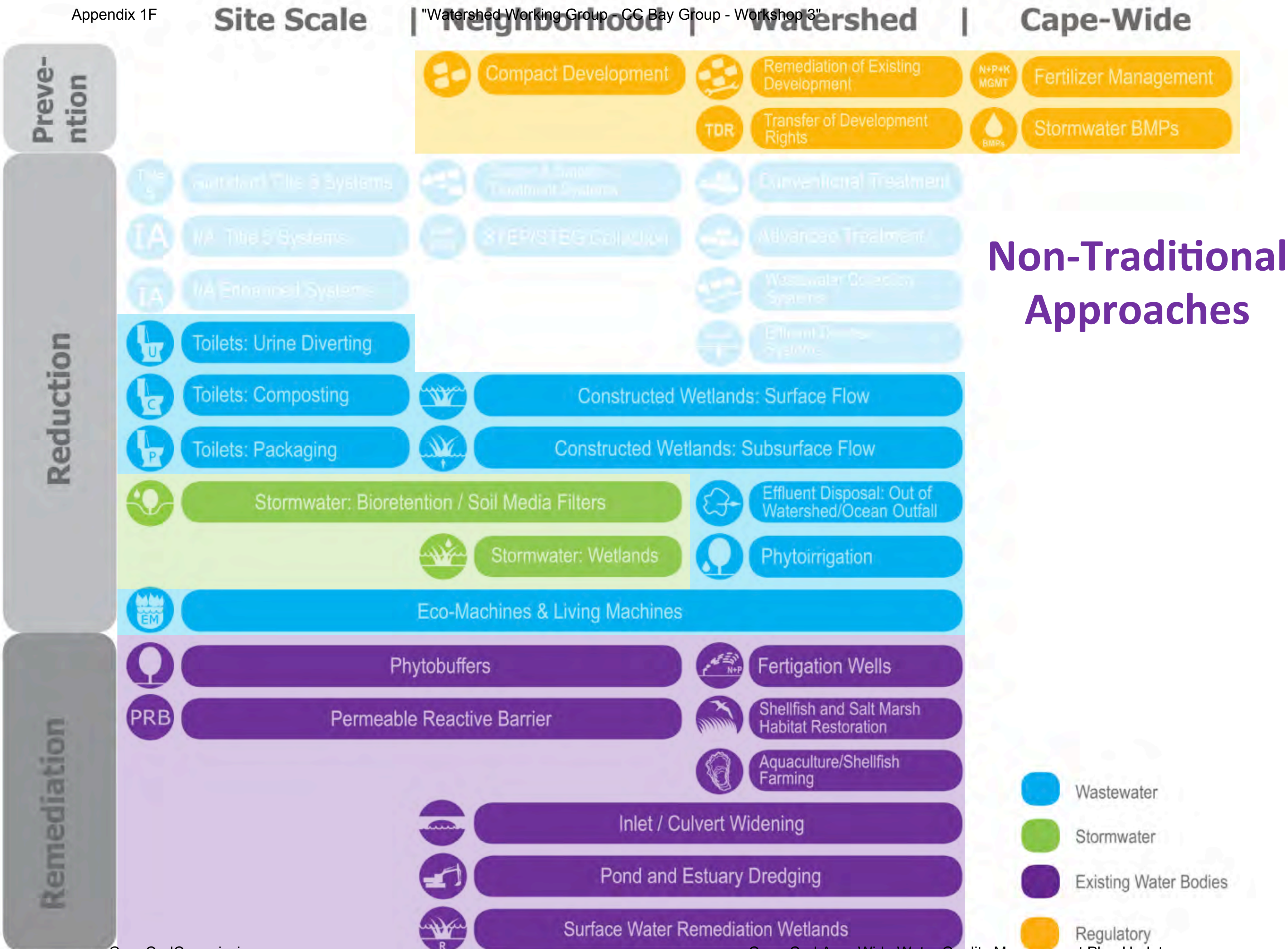
6.25 Kg
Subwatershed 4
3.125 Kg + 50 Kg
Subwatershed 5

Targeted Centralized Treatment to Achieve a 25% Reduction in Total Nitrogen Load[1]



[1] Cape Cod Surface Water Nutrient Management Study Final Report June, 2002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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 THREE BAYS

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
Present Total Nitrogen Load:		130.7	64,492
wastewater		0	23,923
fertilizer			9,243
stormwater			6,449
Target Nitrogen Load:		0	48,369
Nitrogen Removal Required:		**0**	**16,123**
Total Number of Properties:	5437		

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Stormwater Mitigation	3,225	8,277	

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Dredging		cu. yard	4,012	2,627	$0

Watershed Calculator — THREE BAYS

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Dredging		cu. yard	4,012	2,627	$0
Oyster Beds/Aquaculture	10	acres	2,500	127	$0
Alternative On-Site Options:					
Ecotoilets (UD & Compost)	272	homes	1,076.5	-949	$1,265

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Sewering	-216	homes	-949	0	$1,000

Adaptive Management:

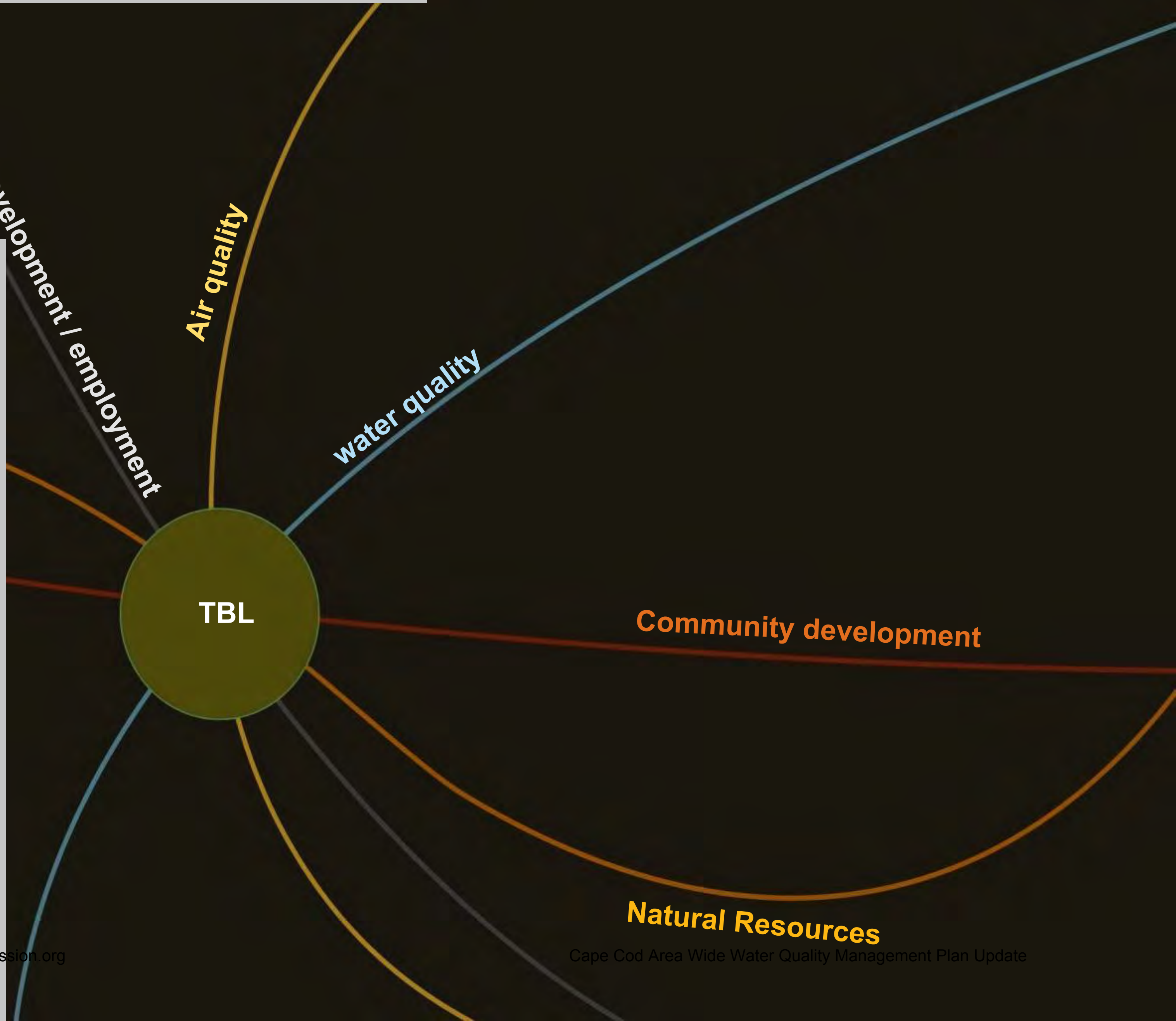
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient way.

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

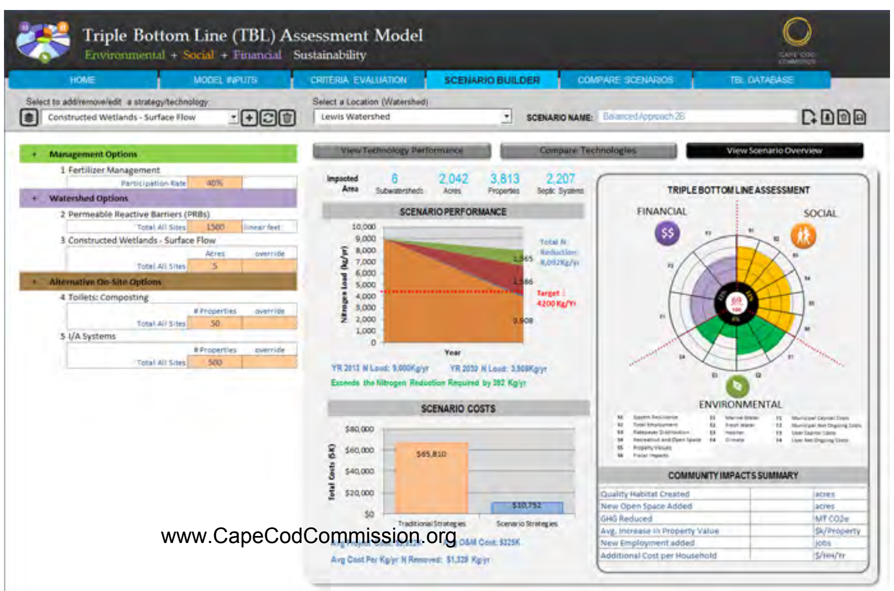
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

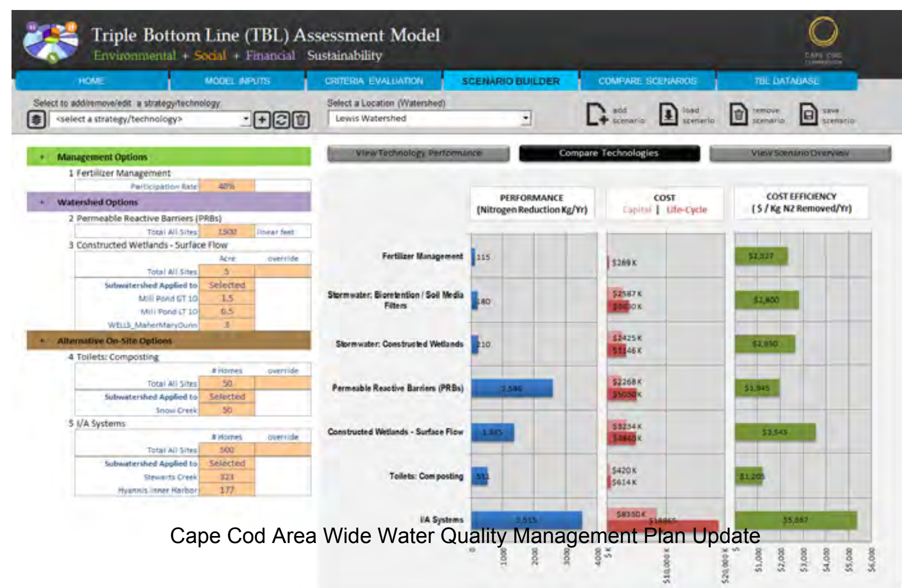


Why develop a TBL model?

- 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

HOME | MODEL INPUTS | CRITERIA EVALUATION | SCENARIO BUILDER | COMPARE SCENARIOS | TBL DATABASE

Alternative Definition | Alternative Results | Alternative Scoring Rules

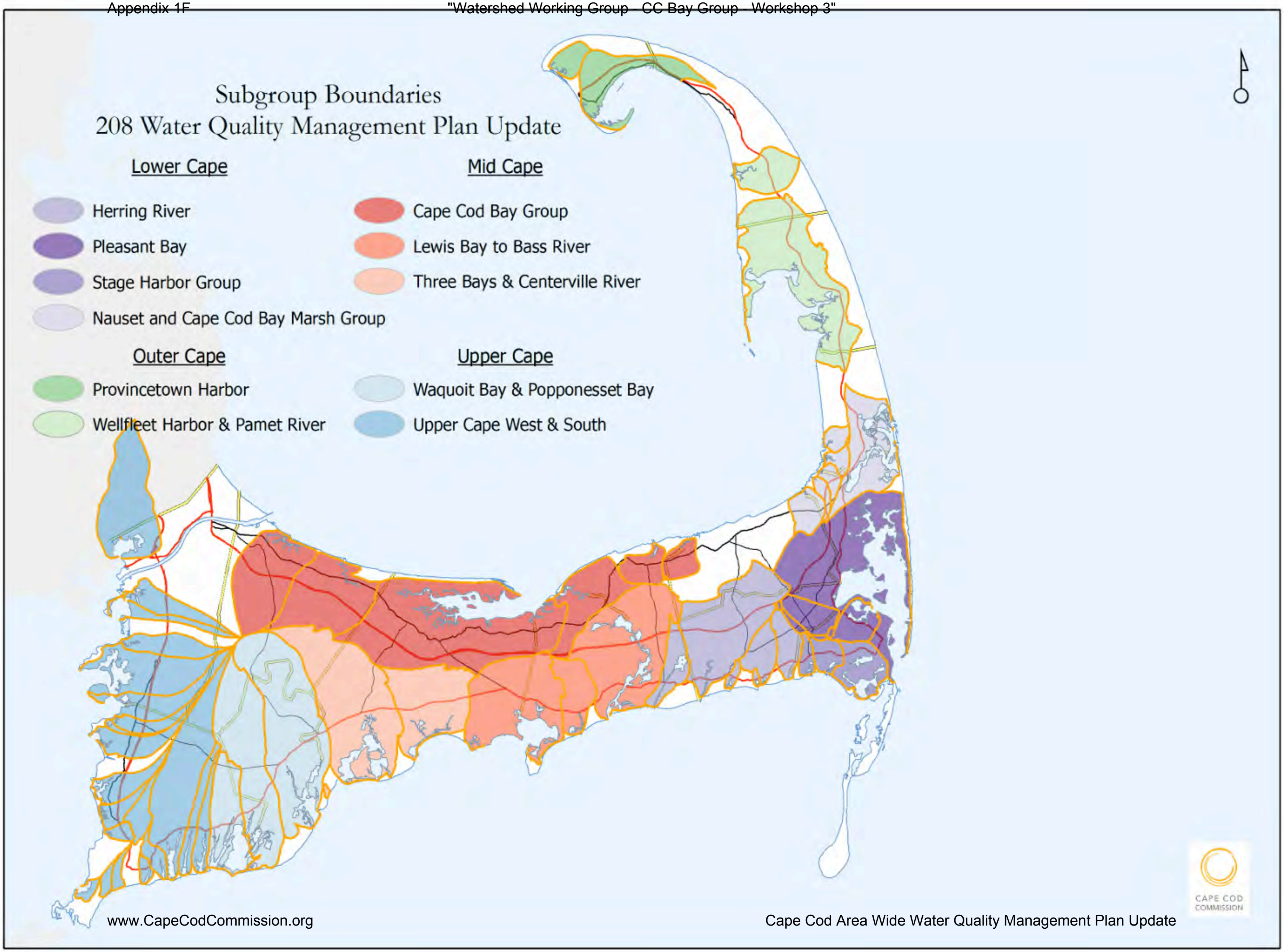
	Scenario 1	Scenario 2	Scenario 3
	Minimum Cost	Cost Effective	Maximum Performance

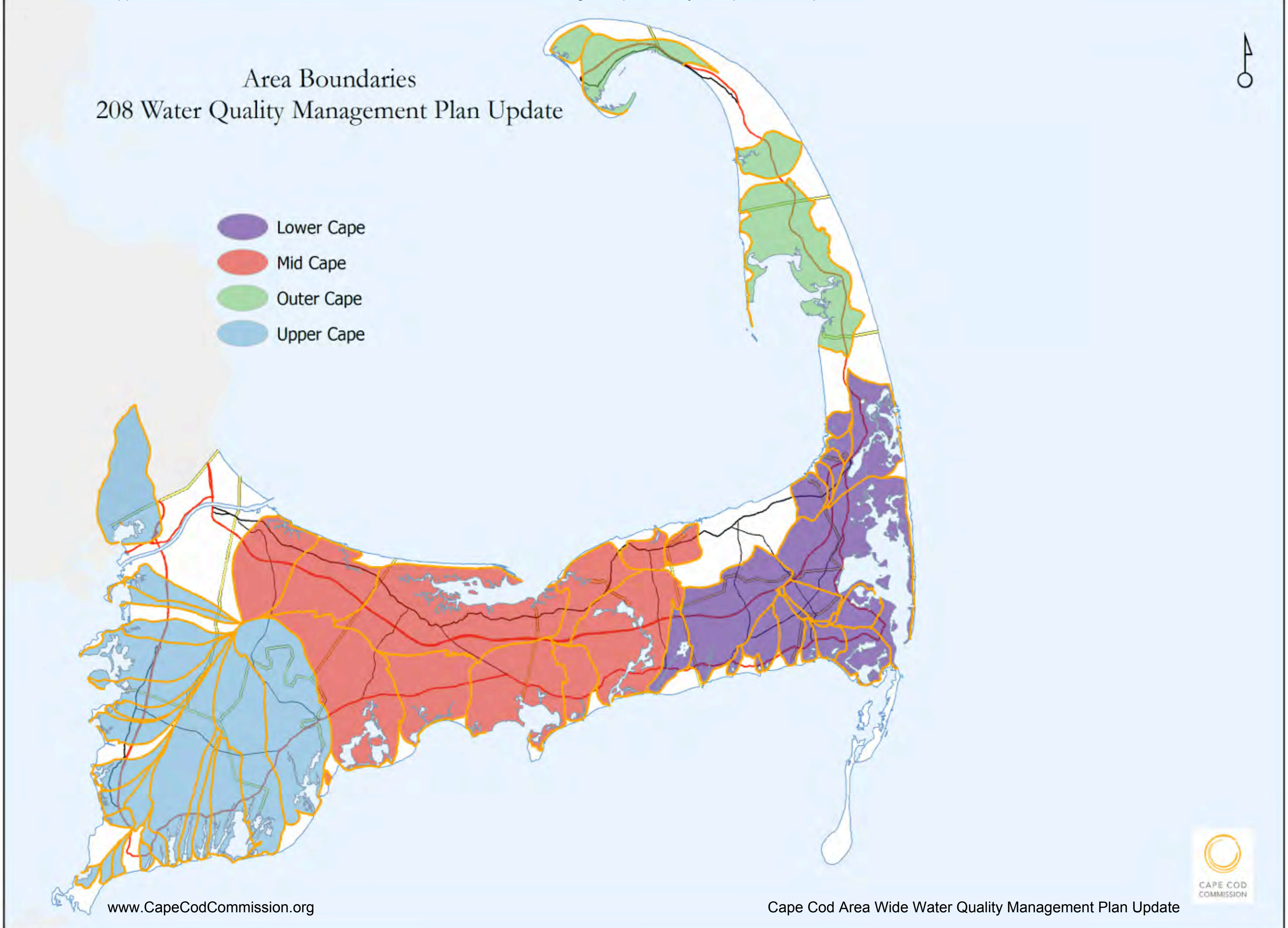
Criterion Scores

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. Increa[illegible]	$200	[illegible]	[illegible]
New Employment Added (jobs)	152	188	252
Additional Cost per Household ($/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
Cape Cod Bay Watershed Working Group

Meeting Three
Monday, December 9, 2013
8:30 am to 12:30 PM
Cape Cod Commission
3225 Main Street, Barnstable, Massachusetts 02630

Meeting Summary Prepared by the Consensus Building Institute

I. ACTION ITEMS

Working Group

- Provide comments or revisions to the Meeting 2 draft notes to Carri Hulet
- Notify Carri Hulet if you'd like to volunteer or nominate someone else to represent this working group in the larger sub-basin working group meeting over the next several months.

Consensus Building Institute

- Extract the map images of the scenarios from the presentation and send to the group as a PDF.
- Distribute Alex Marx's research on Barnstable Harbor.

Cape Cod Commission

- Include the opportunity for fertigation wells at both golf courses in the alternative technologies scenario.
- Eliminate dredging from the alternative technologies scenario.

II. WELCOME AND OVERVIEW

Ms. Carri Hulet, the facilitator from the Consensus Building Institute, welcomed the participants and led introductions. Appendix A includes a list of attendees. The meeting was filmed by a representative from the Cape Cod Commission. Portions of the film may be used in the Cape Cod Commission's outreach process. Ms. Hulet then reviewed the meeting agenda and goals:

- To discuss the approach for developing watershed scenarios that will remediate water quality impairments in the Cape Cod Bay 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.

She explained that the Working Group would be asked to provide input on possible approaches/scenarios for wastewater management in the watershed study area but would not be asked to "vote" on a specific approach.

Mr. Scott Horsley, Area Manager and Consultant to the Cape Cod Commission, welcomed participants and offered an overview of the 208 Update stakeholder process.[1] 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 are focused on exploring technology options and approaches. These third meetings of the Watershed Working Groups will focus on evaluating watershed scenarios. These scenarios are informed by Working Groups' discussions at previous meetings about baseline conditions, priority areas, and technology options/approaches.

Mr. Horsley said the Advisory Board continues to provide guidance to the process and the Regulatory, Legal, and Institutional Work Group is interfacing with the state. These groups have also been engaged in discussions about adaptive management.

III. INITIAL SCENARIOS FOR BARNSTABLE HARBOR WATERSHED

Scott Horsley explained the Commission's process to develop watershed scenarios. Two teams were formed: one team is exploring "conventional" technologies and approaches (e.g. sewering and I/A systems) and another team is exploring "alternative" technologies and approaches. The teams are both working under the assumption that fertilizer and stormwater reductions will be incorporated into all of the scenarios.

Conventional Scenarios

James Sherrard, Hydrologist in the Water Resources Department at the Cape Cod Commission, led the discussion of "conventional" technologies and approaches. He explained that the scenarios were developed using the Commission's Watershed MVP Tool. This tool allows the user to determine how much nitrogen is in a specific geographic area, then apply specific technologies to discover the approximate reduction in the overall nitrogen load for the area. The tool can show costs, but costs were not the focus of the presentation. He described the following scenarios, all of which estimate the total existing nitrogen load in the Barnstable Harbor Watershed to be approximately 30,000 kg/year:

- Watershed-wide/Alternative (I/A) Onsite Systems: Implementation of the Alternative I/A systems throughout the watershed is estimated to reduce the total nitrogen load to approximately 20,000 kg/per year
- Watershed-wide Centralized Treatment and Disposal Inside the Watershed: Implementation of watershed wide centralized treatment and disposal inside the

[1] The PowerPoint Presentation made at this meeting is available at: http://watersheds.capecodcommission.org/index.php/watersheds/mid-cape/cape-cod-bay-group

watershed is estimated to reduce the total nitrogen load to approximately 6,500 kg/year.

- Targeted collection and treatment to achieve a 25% reduction in nitrogen: This scenario is estimated to reduce the total nitrogen load to approximately 11,000 kg/year by focusing on the areas delineated by the blue line on the map. This delineated area avoids the areas that are already sewered. The 25% reduction target is from the 2002 Cape Cod Commission Surface Water Nutrient Management Study Final Report.

Mr. Sherrard briefly talked about attenuation in freshwater ponds. He said that ponds attenuate approximately 50% of the nitrogen entering the pond ecosystem and the remaining nitrogen eventually flows to the bay. Therefore, it would not be ideal to construct sewers in areas with high amounts of attenuation. The scenarios he described focus on areas of the watershed with little to no attenuation.

Ms. Hulet clarified that the goal of this exercise was to create a spectrum of options whereby the scenarios created by the Cape Cod Commission serve as bookends. Traditional technologies are utilized on one end of the spectrum. Newer technologies could be added to the traditional technologies until ultimately reaching the other bookend, where the issue is addressed primarily through new, innovative technologies. Mr. Horsely said similar scenarios will be created for the watersheds in the vicinity of Brewster, Sandwich, and Dennis.

Working Group members had the following questions and comments about the conventional scenarios are below (italicized):

- *How many options or treatment technologies can you build into the maps and analysis with MVP?* Mr. Sherrard said multiple scenarios can be ran simultaneously with multiple treatment technologies in each.
- *The number of people on Title V systems and the number of new systems added to Title V might play a role in the management discussion. Does anyone know what percentage of the houses actually have Title V systems, or the percentage of those that do not?* Mr. Sherrard said they knew the locations that are sewered (not on Title V) but the data on cess pools is less certain. Mr. Tom Cambareri, Cape Cod Commission Water Resources Program Manager, said approximately 133,000 systems are not on the sewer system and are likely on Title V or using cess pools; however an exact percentage is not known. He noted that the majority of systems were upgraded to Title V in 1995.
- *Would it make sense for the Cape Cod Commission to inventory the number or percentage of systems that are Title V?* Mr. Sherrard explained that the Cape Cod Commission has acquired this data from approximately half of the towns; but much of the data is not in digital format. Some towns have hard copies while other towns do not have any records.
- *It is concerning that the Cape Cod Commission says there is no TMDL for Bar Harbor, but we know the TMDL is under development and we have been promised we will receive it. It is worth noting that the entire area of Barnstable Harbor is not part of Barnstable's*

Comprehensive Wastewater Management Plan (CWMP). Finally, it is concerning that alternative systems may become the only alternative because so much of the area is in one acre zoning and being developed and subdivided rapidly. Mr. Sherrard said the MEP reports came out in relation to the need or priority, so the TMDL is not crucial although it will certainly be reviewed once it is released to the public. The member responded that market changes in the past 10 years may indicated that tidal flush is not sufficient for the amount of discharge entering Barnstable Harbor.

Alternative Technology and Approaches

Mr. Horsley 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. Lastly, traditional sewering options were added. The MVP was not used for this analysis because it was not set up for all the alternative technologies.

He offered the following scenario for Barnstable Harbor:

- Nitrogen reduction goals: The analysis started with an assumed 25% reduction target in the absence of a final MEP report. In this particular scenario, the estimated initial nitrogen loading was 48,369 kg/year. The 25% target was 16,123 kg of nitrogen per year.
- Low barrier options: After implementing fertilizer management and stormwater mitigation, 8,277 kg per year of nitrogen would need to be eliminated to achieve the target.
- Watershed/embayment options: A mixture of permeable reactive barriers, constructed wetlands, fertigation wells, dredging, and oyster beds/aquaculture reefs reduced the remaining target to an estimated 127 kg/year.

  The yellow lines on the map represent the areas where PRBs are feasible due to water table levels at a depth of 20 feet or less. Areas where PRBs are feasible but sewers are already constructed were not included.

  Areas for potential constructed wetlands were screened by criteria including depth to ground water greater than four feet, protected habitat areas, parcels greater than five acres, and parcel cent not in the 100-year floodplain.

  Mr. Horsley pointed out one particular site that could be ideal for a constructed wetland. In response to a group member question, he said the municipality owns the land. He noted that a two-acre wetland is estimated to reduce nitrogen by approximately 1000 kg/year.

Mr. Horsley commented that the golf courses in the area already were, or were planning, to utilize fertigation wells.

Mr. Horsley said there is a lot of shellfish and aquaculture projects already operating in Barnstable Harbor and that the addition of a 10-acre oyster bed could reduce nitrogen by approximately 2,500 kg/year.

- Alternative on-site options (description and figures summary): the addition of ecotoilets (Urine Diversion and Composting) is estimated to surpass the target and reach -949 kg/year. Mr. Horsley noted this assumed an adoption rate of five percent in the next 10-20 years.

Mr. Horsley explained that this analysis is still preliminary and would require further detailed site reconnaissance and verification. Average nitrogen removal rates were used for some of the technologies while the lowest recorded removal rate was utilized for others in the analysis. Mr. Horsley said this scenario illustrates a possible opportunity to undertake watershed transfers of treated wastewater from Hyannis since the measures surpass the nitrogen reduction target.

Working Group members had the following questions and comments about this Barnstable Harbor scenario (italicized):

- *Natural attenuation enters the equation in step four, the watershed and embayment option. Since each town has a specific amount of land area available for natural attenuation, is it intended that the town that has the most natural attenuation will get the benefit of all the natural attenuation? There are talks of sharing attenuation in the Popponessett Bay.* Mr. Horsley said this would be a possibility and that constructed wetlands could enhance attenuation.
- *How many people voluntarily add the I/A portion of systems today?* Mr. Horsley said very few. In most cases these technologie are added as a result of the regulatory process that require them.
- *Although this scenario surpasses the target, it does not surpass the target by a very large number. This should be considered if thinking about watershed transfer.*
- *Utility corridors such as the places where NSTAR has their power lines could be good candidates for PRB locations or other technologies. Since NSTAR is attuned to the pesticide issue at this time, it may be worth reaching out to them. Another member noted that the land in the right of way is not owned by NSTAR.*
- *The Town of Sandwich is supportive of the nontraditional approaches used in the scenarios.*
- *These technologies are good for general reduction of nitrogen, but the towns have some areas of special concern, one in particular which has tight tank system instead of sewers. Complicating the issue is that land in the area is rapidly developing through subdivisions. How does this scenario solve targeted problems like this?* Mr. Horsley said this would mostly likely be addressed through a satellite system, Title 5, or growth management. In

response to the initial comment, another group member said *this type of issue highlighted the amount of worker hours that will be required to address these issues on a site-specific basis.*

Mr. Horsley asked the group if transferring treated wastewater from Hyannis to Cape Cod Bay watershed is an idea the stakeholders would entertain. Group members made the following comments:

- *The towns must work with the water districts down gradient of the land areas and be mindful of dispersing nutrients into the watershed which is currently dependent upon private wells as a drinking water source. Conversations with the fire district and rigid monitoring would be required, too.*
- *Transfer should be kept on the table as a potential option to negotiate.*
- *Transferring this water to the north side will cause some distress among the people living there and this will cause political challenges.*
- *This idea is currently proposed with the McMannis property.*
- *Flame retardents such as Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic Acid (PFOS) were detected in some Cape Cod water supplies by the Silent Spring Institute and might be in the water and would be of great concern if transferred to the north side.*
- *We should not put it into the scenario now, but we should not discourage it from being a potential option either.*

Carri Hulet 1/13/14 11:31 AM
Comment [1]: Is this the correct spelling?

Ms. Hulet asked the participants what types of issues might arise if the transfer scenario created beneficial outcomes such as the use of nitrogen rich water for fertilizer. Alex Marx, an MIT student visiting as a member of the public, questioned if there might be other groundwater recharge areas that need extra water and suggested considering this as another variable. Group members made the following comments:

- *Will the transfer tilt eh balance so that flushing could not handle the flux from the south side?* Mr. Horsley said restoration of salt marsh habitat could be possible, but restoration is probably less likely in this part of the Cape due to its decent quality.
- *A member said that Barnstable is considering restoration of Hinckley Pond.*

Ms. Hulet asked the participants if there were any technologies not included in the scenarios that they thought should have been included. Participants made the following comments.

- *A member suggested looking at the Cape Cod Village Condominium situation as a satellite system in MVP.*
- *Expansion of oyster beds by Wianno and Barnstable Seafarms could be included.*
- *Extension of public water supply to the well systems on the north side of Route 6A could also be included. It might help remove some of the politics of effluent discharge.*

Mr. Alex Marx, graduate student at MIT's Department of Urban Studies and Planning, briefly presented some of the findings of his research on Barnstable Harbor. His final report reviewed the hydrologic budget, estimated current conditions, current loadings, and also proposed long term strategies. One of his proposed strategies was to construct a wetland in the same spot as the potential area identified by the Cape Cod Commission. He also commented that finding the right balance of salt marsh loading would be necessary given that marshes comprise 20% of the sub watershed. Regarding climate change and sea level rise, Mr. Marx commented that many of the salt marshes may migrate with sea level rise. Group members made the following comments:

- *It sounds like we do not want to change the balance between attenuation and flushing.*

IV. ADAPTIVE MANAGEMENT

Mr. Horsley defined adaptive management as a structured approach for addressing uncertainty 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 way. He said adaptive management is not waiting longer to review more data. He asked working group members to help the Commission to think through what an adaptive management plan for this watershed might look like. In response to a question from a group member, Mr. Horsley said the group could also consider the adverse effects of sewering or the impacts of disposing nitrogen rich water in a particular location. Mr. Horsley asked the group to to consider the set of prioritized actions they would promote if they were to present a plan to the DEP next week. Group members suggested the following prioritization:

1. Oysters and Aquaculture - A participant suggested that a first priority might be to install more oysters and aquaculture projects and noted that implementing this would require establishing a baseline, developing partnerships with people in the aquaculture field, and regulatory changes to promote it.
2. Targeted analysis of the area would be required to identify specific areas that may be more adaptable to the different alternatives.
3. Constructed wetlands
4. PRBs
5. I/A and cluster systems
6. Targeted sewering

Group members then commented on the actions that could be done simultaneously and the timeline. One member said oysters and wetland construction could be done in year one. Another participant said none of the options are mutually exclusive. A member said Sandwich was looking to implement their projects over a 40-year time horizon. In response, another member commented that it might take 40 years to achieve the results, but 7 years would be more realistic for implementation because new technologies and refinements to models are certain to happen over a 40 year time period.

Group members identified the following adaptive management considerations:

- Centralized management – Group members suggested that adaptive management would require a centralized management structure to know if the systems were operating as intended.

- Inter municipal data sharing – Group members commented on the usefulness of a technology clearinghouse that could possibly help monitor the performance of technologies and share lessons learned across the Cape. A member also suggested that a centralized 'technology clearinghouse' utilized by all the towns on the Cape may attract more funding than individual, town-by-town monitoring programs for installed technologies.
- Continuing resolution of the issues – A group member suggested that the selected approach should not simply attempt to meet the target of the MEP. Instead, the approach should proactively anticipate the need for further reductions and strive for more nitrogen reduction than initially targeted.
- Continuing scientific data collection and monitoring – Group members noted that the targets will be based on the best science to date, but data collection to monitoring the effectiveness of the approaches will be required.
- Integration with growth management – A participant questioned how growth management strategies would be integrated with a selected approach and adaptive management strategy. Mr. Horsley replied that the current scenarios only address existing conditions, but the issue of growth management will be addressed in more detail in January.

DEP oversight was briefly discussed as a related piece of management considerations. Group members suggested the DEP approval would be dependent on the towns' or any other managing organization's capacity to implement and monitoring a proposed approach. Financing the adaptive management and monitoring program was identified as another potential key concern of the DEP.

Group members also identified the following topics of consideration:

- Growth management
- Contaminants of emerging concern
- Fertilizer and stormwater management
- Relationships between local and regional water quality plans
- Variability of a technology's effectiveness – for example, ocean acidification may reduce the ability of oysters to reduce nitrogen levels in the long term
- Models will become more precise over the next 40 years and as data is collected, nutrient management approaches will need to adapt
- Rising sea levels and water tables which might cause salt marsh migration, Title 5 compliance issues, or other unforeseen complications
- Specific and detailed plans will increase potential for funding

A group member asked if what is ultimately presented to the DEP will become an obligation for the town and enforced by Cape Cod Commission. Mr. Horsley said the Cape Cod Commission does not have the ability to require the adoption of the plans.

V. PREPARING FOR 2014 JAN-JUNE
Ms. Kristy Senatori, Cape Cod Commission Deputy Director of Administration, shared the Commission's plans for a triple bottom line analysis and continuing stakeholder engagement into 2014.

The Cape Cod Commission is collaborating with AECOM to develop a triple bottom line (TBL) model that will analyze the social, environmental, and economic impacts of a proposed water quality plan. A stakeholder group will inform the selection of criteria used to rank the models, as will information collected during the watershed working group meetings. After the approaches are developed in each of the 57 watersheds, the approaches will be evaluated with the TBL model. The TBL will model three particular scenarios: the minimum cost scenario, the most cost effect scenario, and a scenario focused on maximum performance. The model is expected to be complete in January.

Ms. Senatori described the anticipated process over the next six months. After this third round of meetings with the watershed working groups, the groups will be condensed into four working groups. A stakeholder summit will be held in January and all 175 stakeholders will be invited to participate. At this meeting, the Cape Cod Commission will present lessons learned from the process thus far, share principles and ideas from across the watershed working groups, and discuss the TBL criteria in more depth. The four working groups will meet in February, March, and April to continue refining and developing the update. These groups will tackle some of the regulatory, institutional, and legal framework questions, as well as the financing and affordability questions. The DEP and EPA will also be more involved in these discussions.

A group member asked if the Cape Cod Commission will have the authority to establish the program and require the towns to implement it. Ms. Sentori said the Commission does not have this authority.

VI. PUBLIC COMMENTS
No public comments were made.

APPENDIX A: MEETING PARTICIPANTS

Name	**Affiliation**
Working Group Members	
Ann Canedy	Barnstable Town Council
Elizabeth Jenkins	Principle Planner, Town of Barnstable
David Mason	Sandwich Public Health Department
Peter McDowell	Dennis Water District Wastewater Committee
Sue Phelan	Barnstable
Charles Spooner	Yarmouth Port
Public Observers	
Alex Marks	Tufts University
Staff and Consultants	
Scott Horsley	Area Manager for the Mid Cape Groups and Consultant to the Cape Cod Commission
Kristy Senatori	Cape Cod Commission
Sean Goulet	Cape Cod Commission
James Sherrard	Cape Cod Commission
Carri Hulet	Consensus Building Institute
Eric Roberts	Consensus Building Institute

Cape Cod 208 Area Water Quality Planning
Upper Cape West and South Watershed Working Group

Meeting Three Agenda
Falmouth Town Hall
59 Town Hall Square, Falmouth, MA
Monday, December 2, 2013
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*

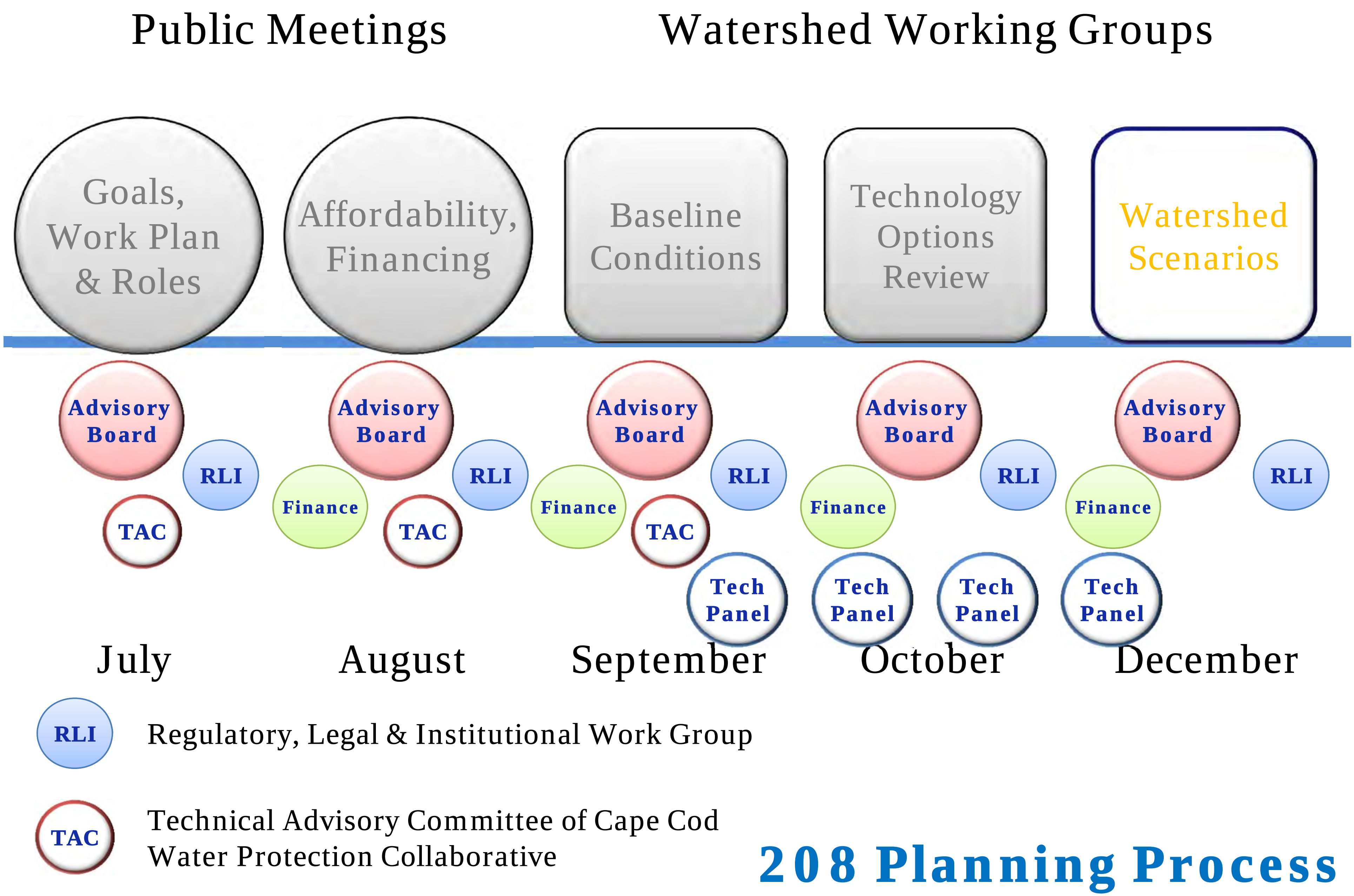
- Triple Bottom Line approach
- Identify Shared Principles and Lessons Learned
- Describe Next Steps

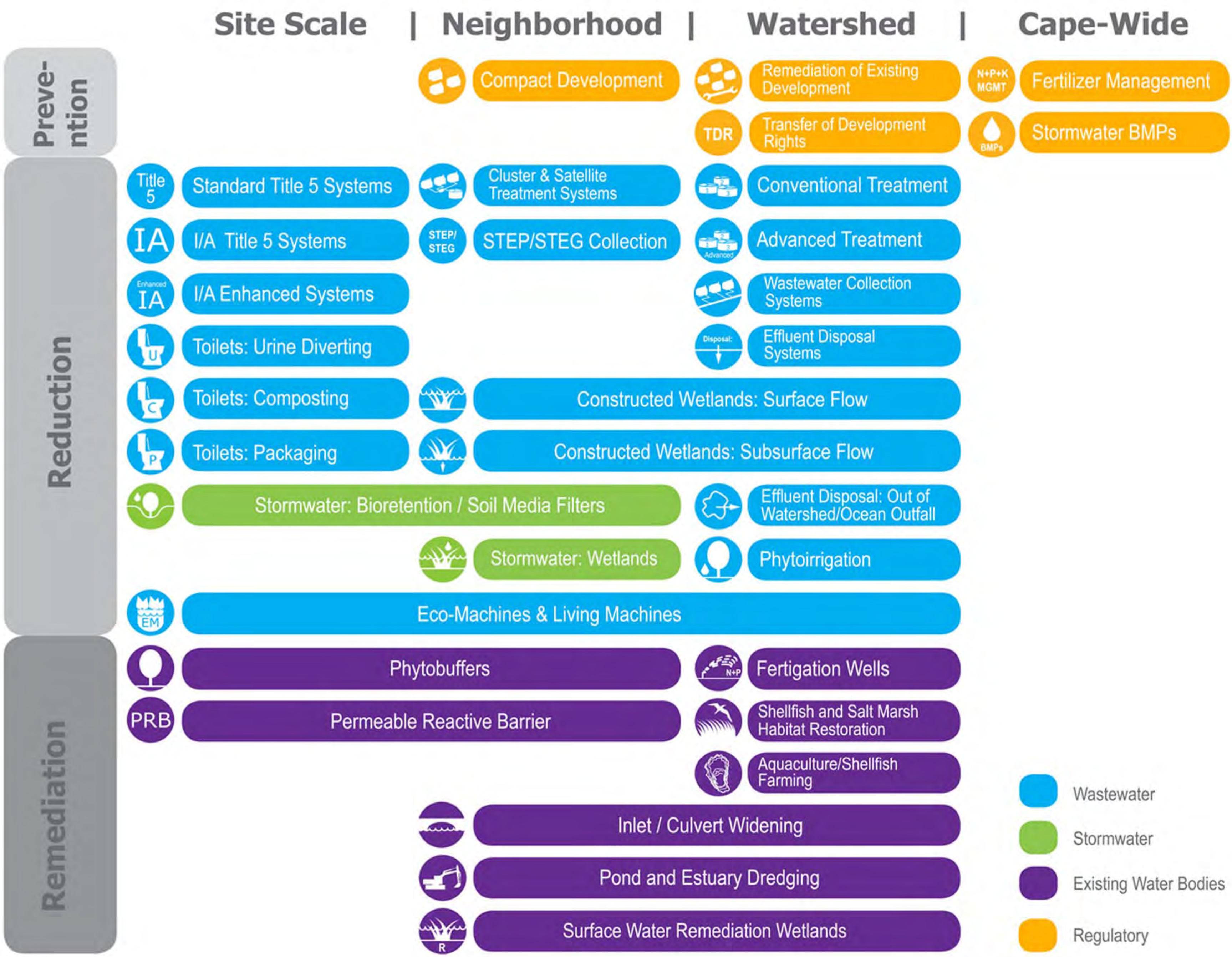
12:15 Public Comments

12:30 Adjourn

Upper Cape West & South Group

Watershed Scenarios


Public Meetings
Watershed Working Groups
Goals, Work Plan & Roles
Affordability, Financing
Baseline Conditions
Technology Options Review
Watershed Scenarios
Advisory Board
RLI
TAC
Finance
Tech Panel
July
August
September
October
December
RLI Regulatory, Legal & Institutional Work Group
TAC Technical Advisory Committee of Cape Cod Water Protection Collaborative
208 Planning Process

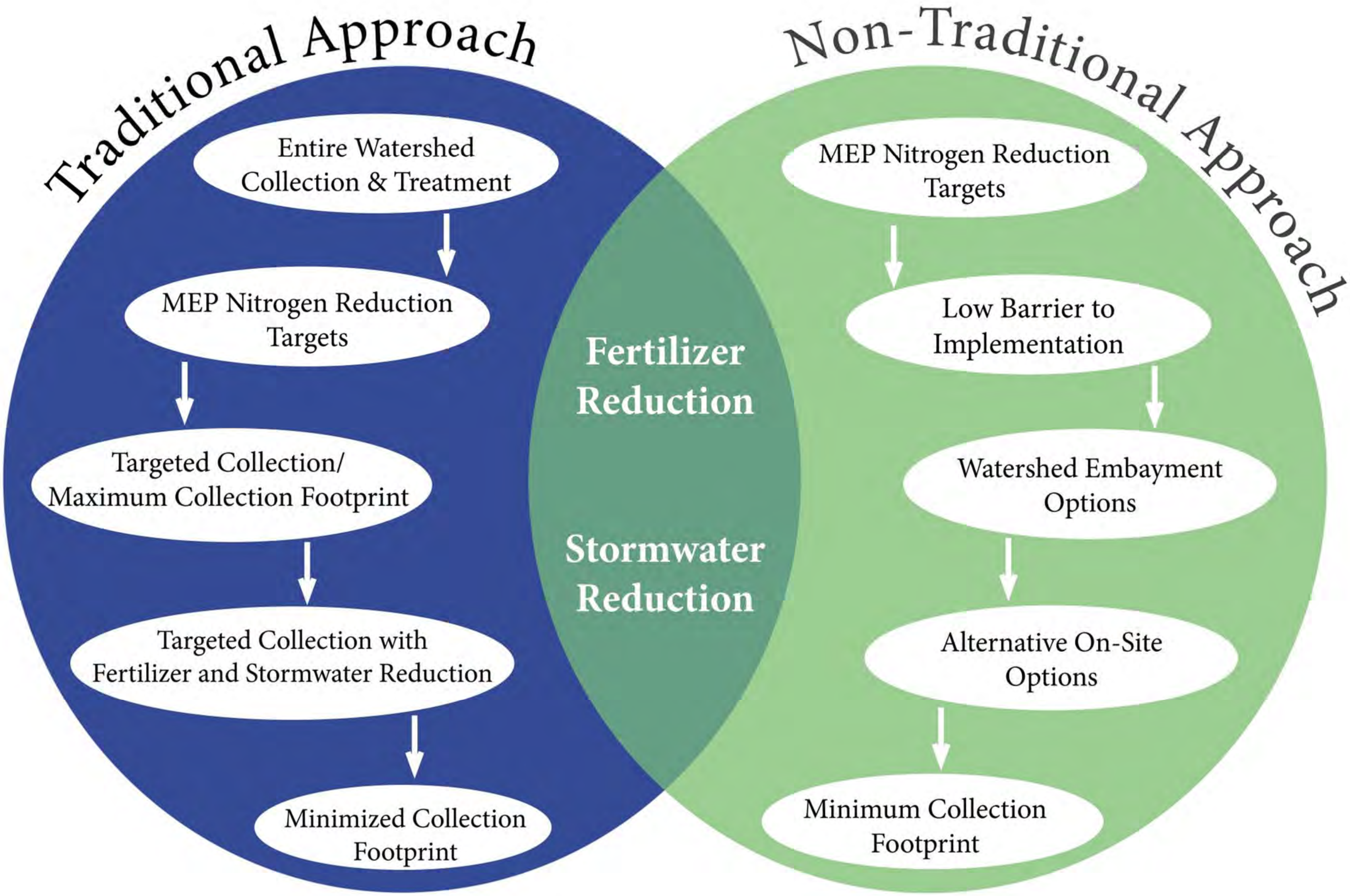

Site Scale
Neighborhood
Watershed
Cape-Wide
Preve-ntion
Reduction
Remediation
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/ STEG
STEP/STEG Collection
Advanced
Advanced Treatment
Enhanced IA
I/A Enhanced Systems
Wastewater Collection Systems
Toilets: Urine Diverting
Disposal
Effluent Disposal Systems
Toilets: Composting
Constructed Wetlands: Surface Flow
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

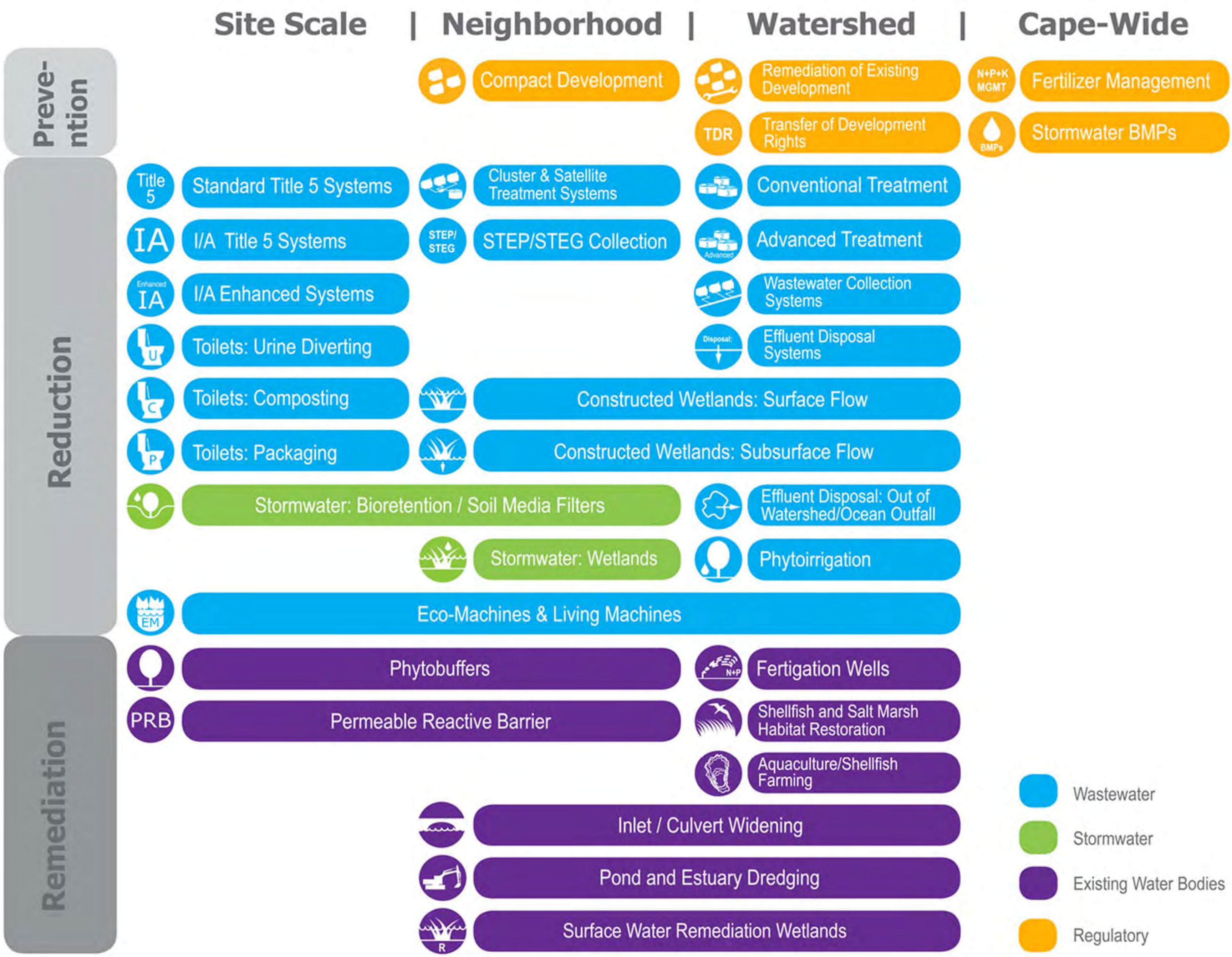
Watershed Scenarios

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


Site Scale
Neighborhood
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Cape-Wide
Preve-ntion
Reduction
Remediation
Compact Development
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I/A Title 5 Systems
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STEP/STEG Collection
Advanced
Advanced Treatment
Enhanced IA
I/A Enhanced Systems
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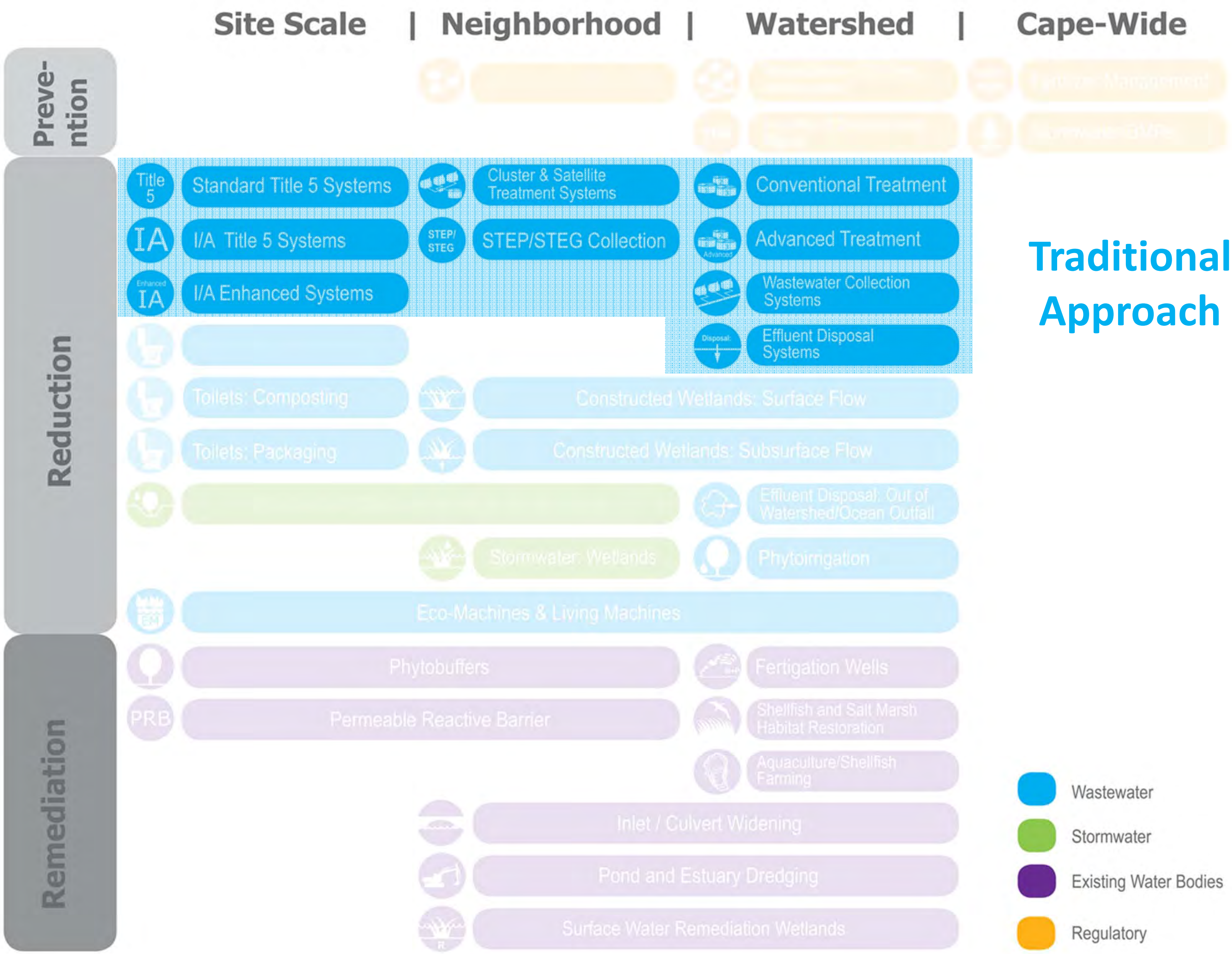
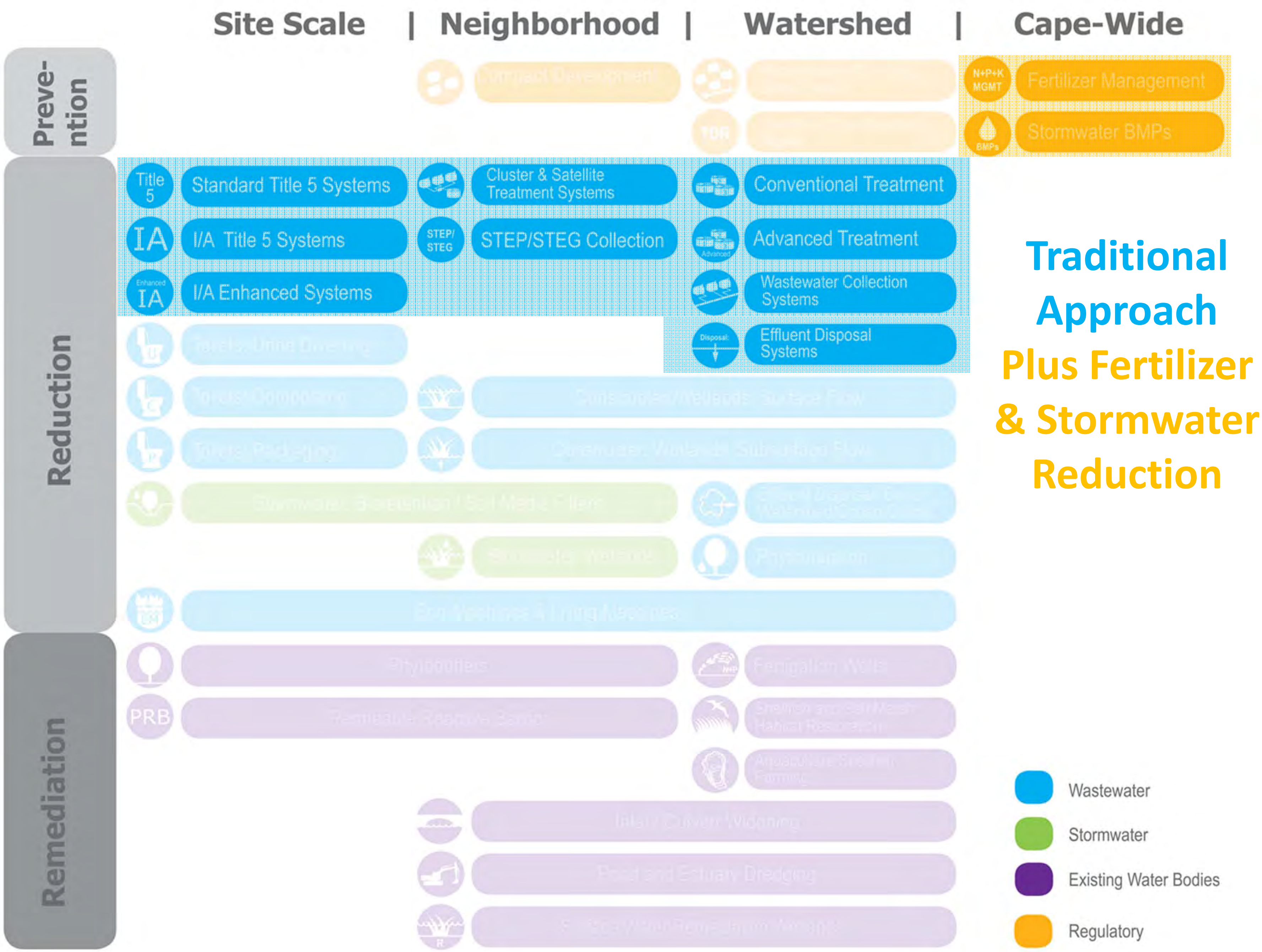
Disposal
Effluent Disposal Systems
C
Toilets: Composting
Constructed Wetlands: Surface Flow
P
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory


Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-ntion
Reduction
Remediation
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced Treatment
I/A Enhanced Systems
Wastewater Collection Systems
Effluent Disposal Systems
Toilets: Composting
Constructed Wetlands: Surface Flow
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
Eco-Machines & Living Machines
Phytobuffers
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
Surface Water Remediation Wetlands
Traditional Approach
Wastewater
Stormwater
Existing Water Bodies
Regulatory


Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-ntion
Reduction
Remediation
Fertilizer Management
Stormwater BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
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Wastewater Collection Systems
Disposal
Effluent Disposal Systems
PRB
Traditional Approach
Plus Fertilizer & Stormwater Reduction
Wastewater
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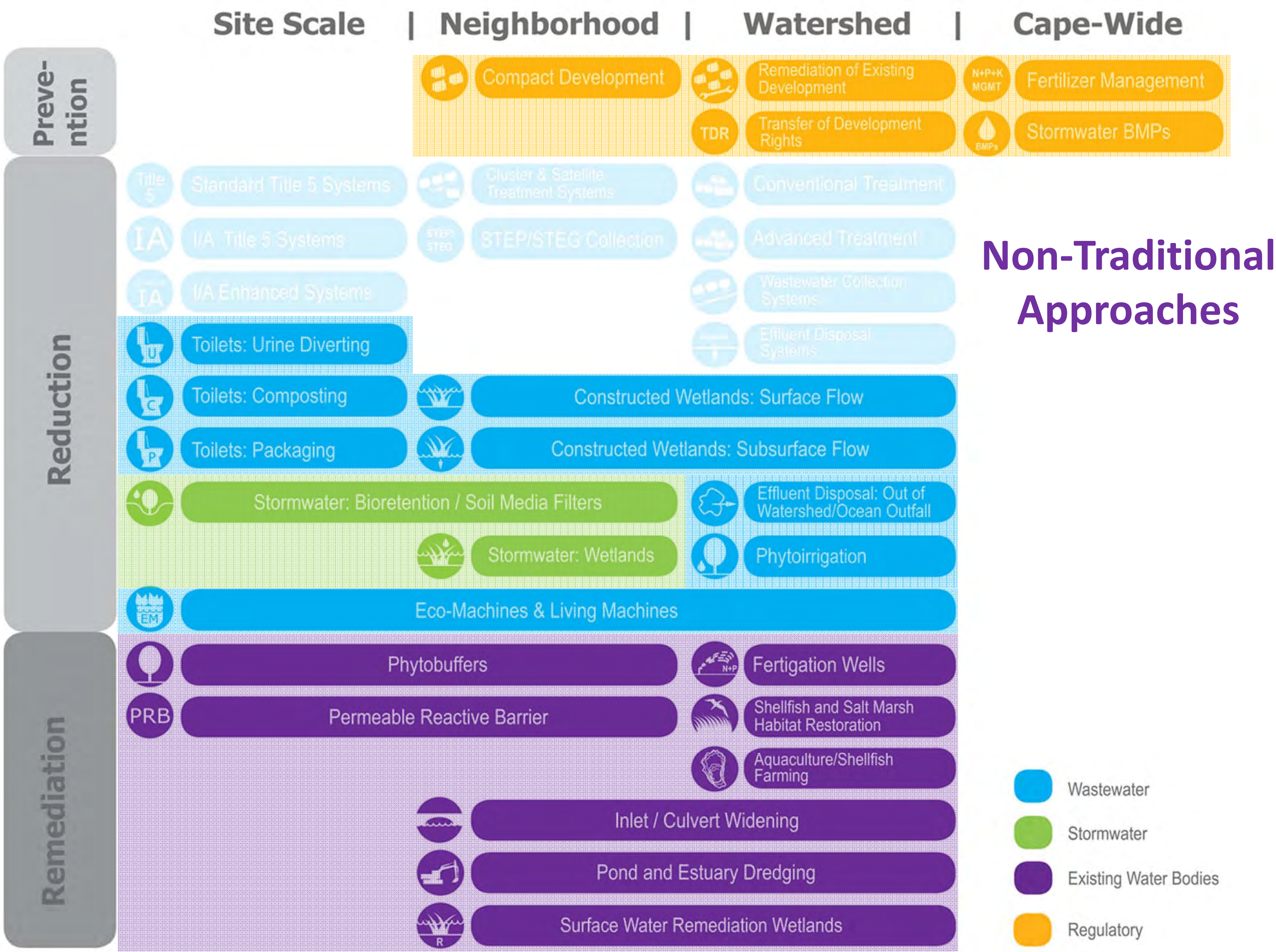
Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-ntion
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Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
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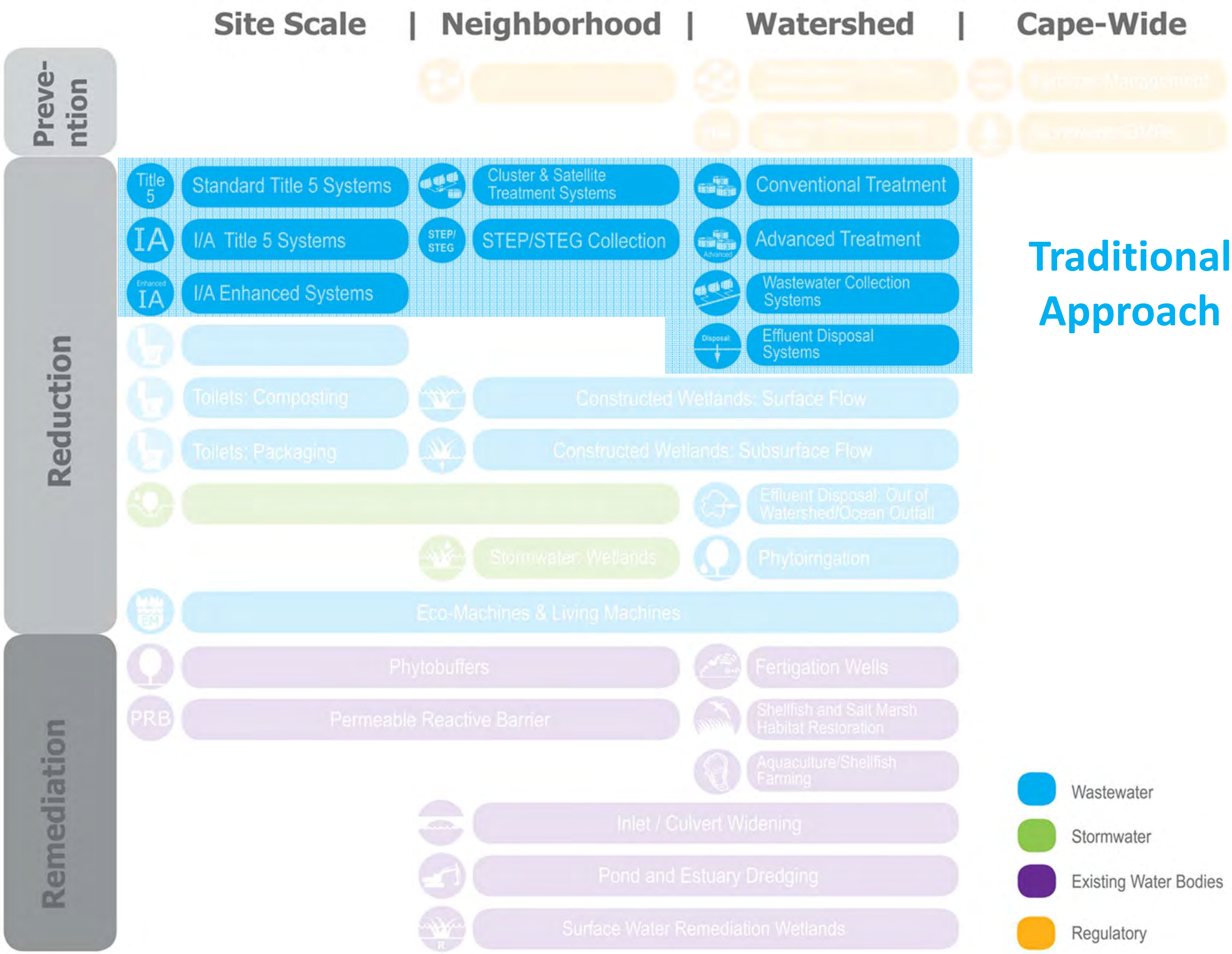
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Non-Traditional Approaches
Wastewater
Stormwater
Existing Water Bodies
Regulatory


Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-
ntion
Reduction
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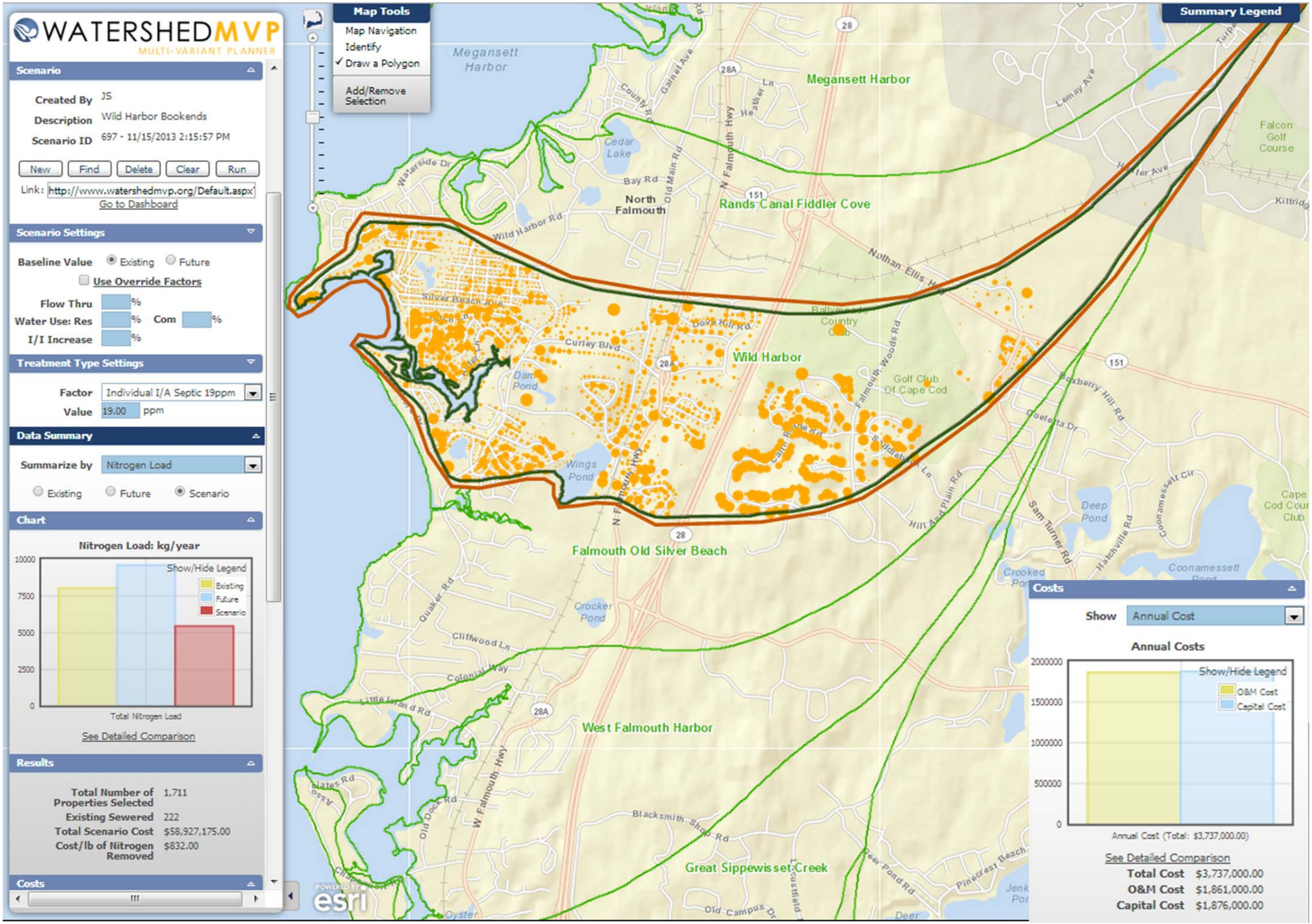
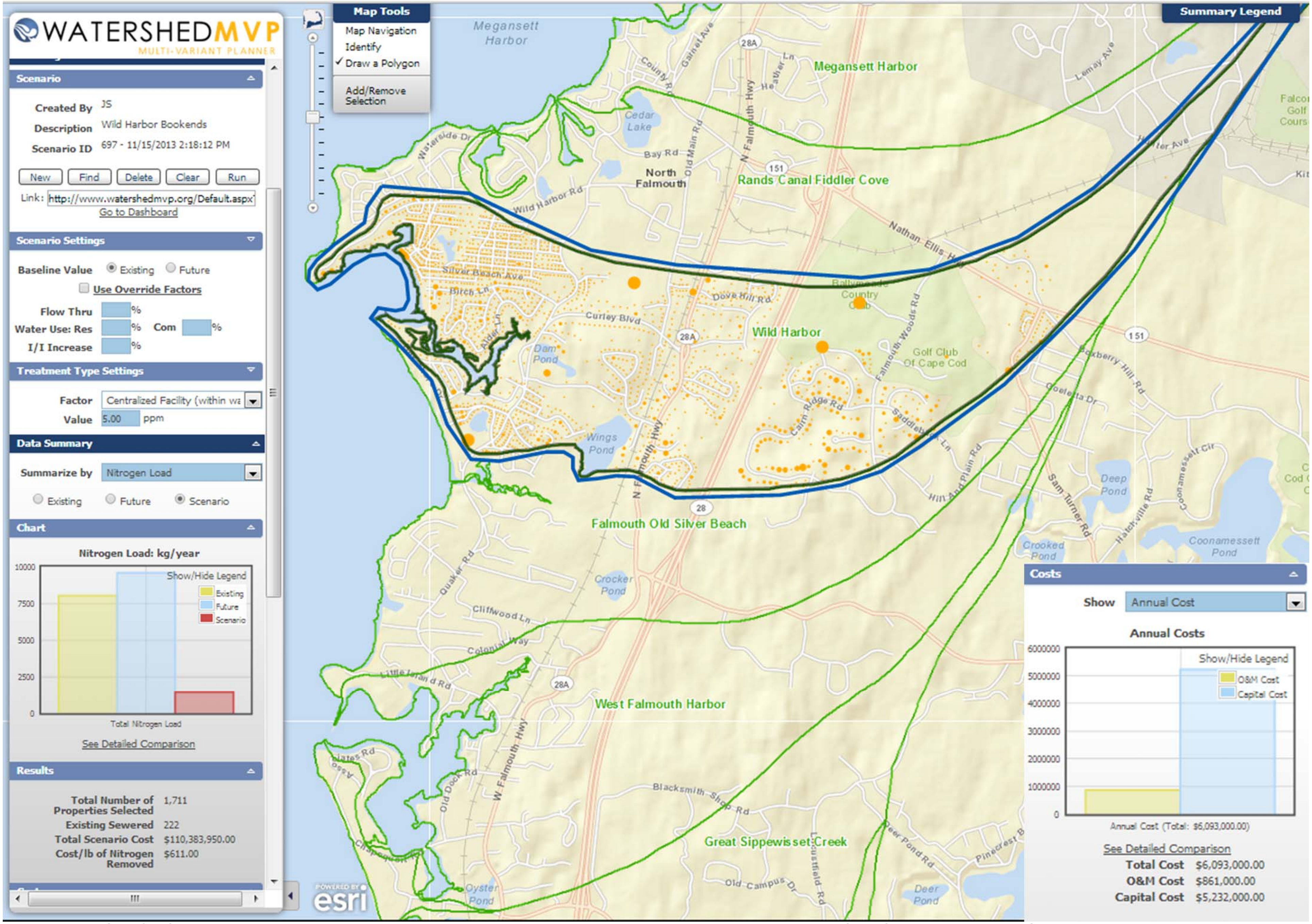
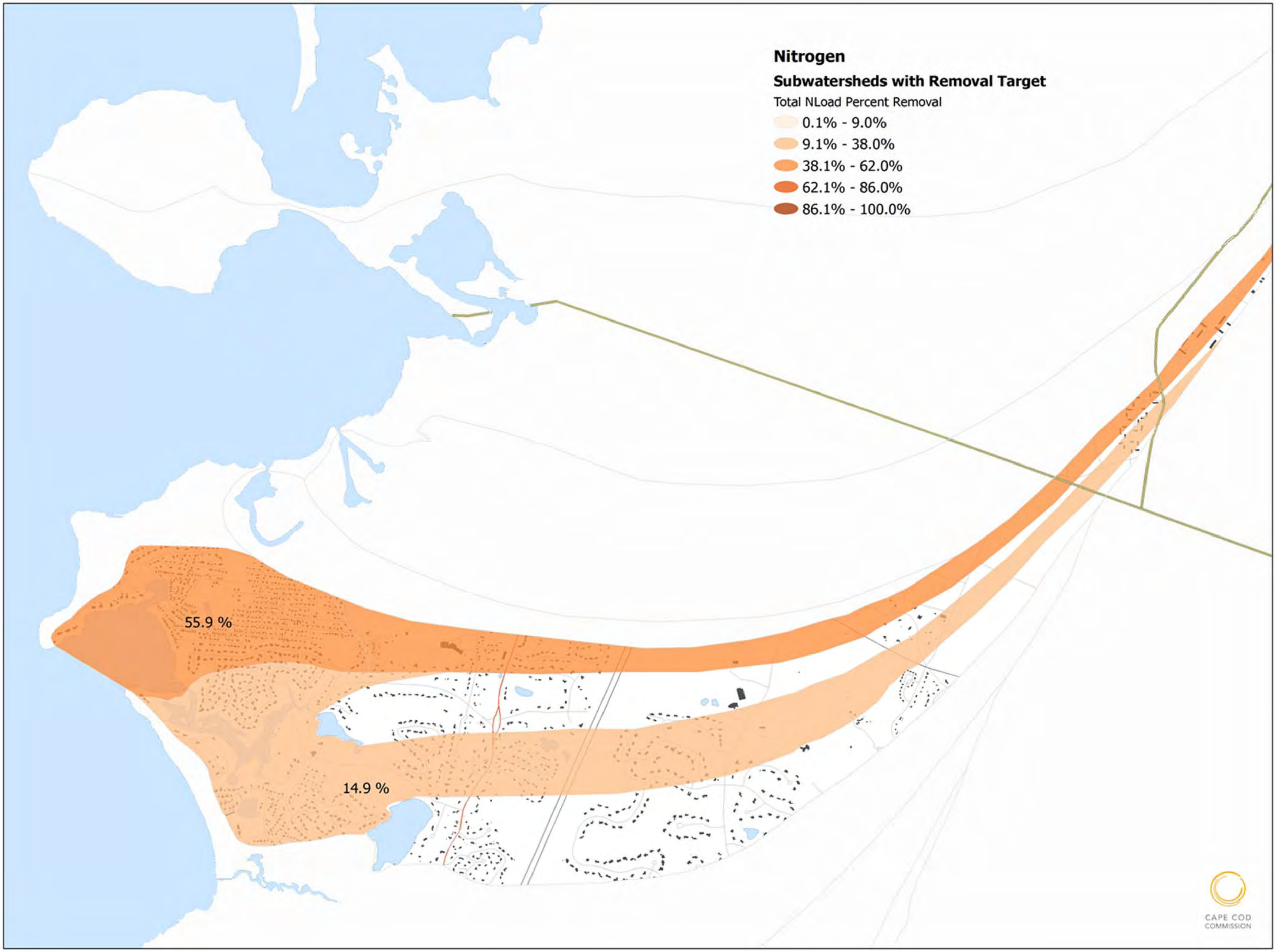
Surface Water Remediation Wetlands
Traditional Approach
Wastewater
Stormwater
Existing Water Bodies
Regulatory

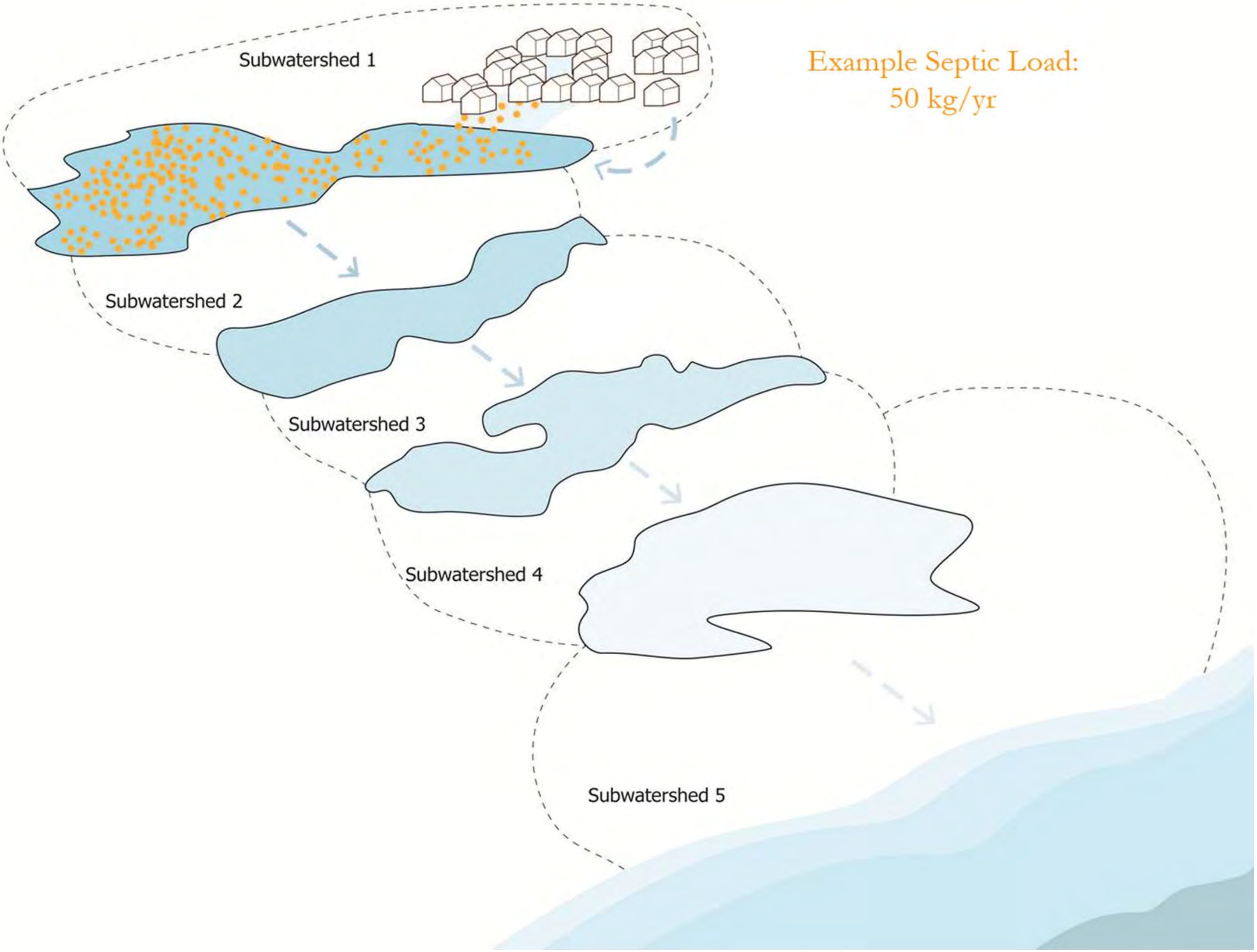
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems

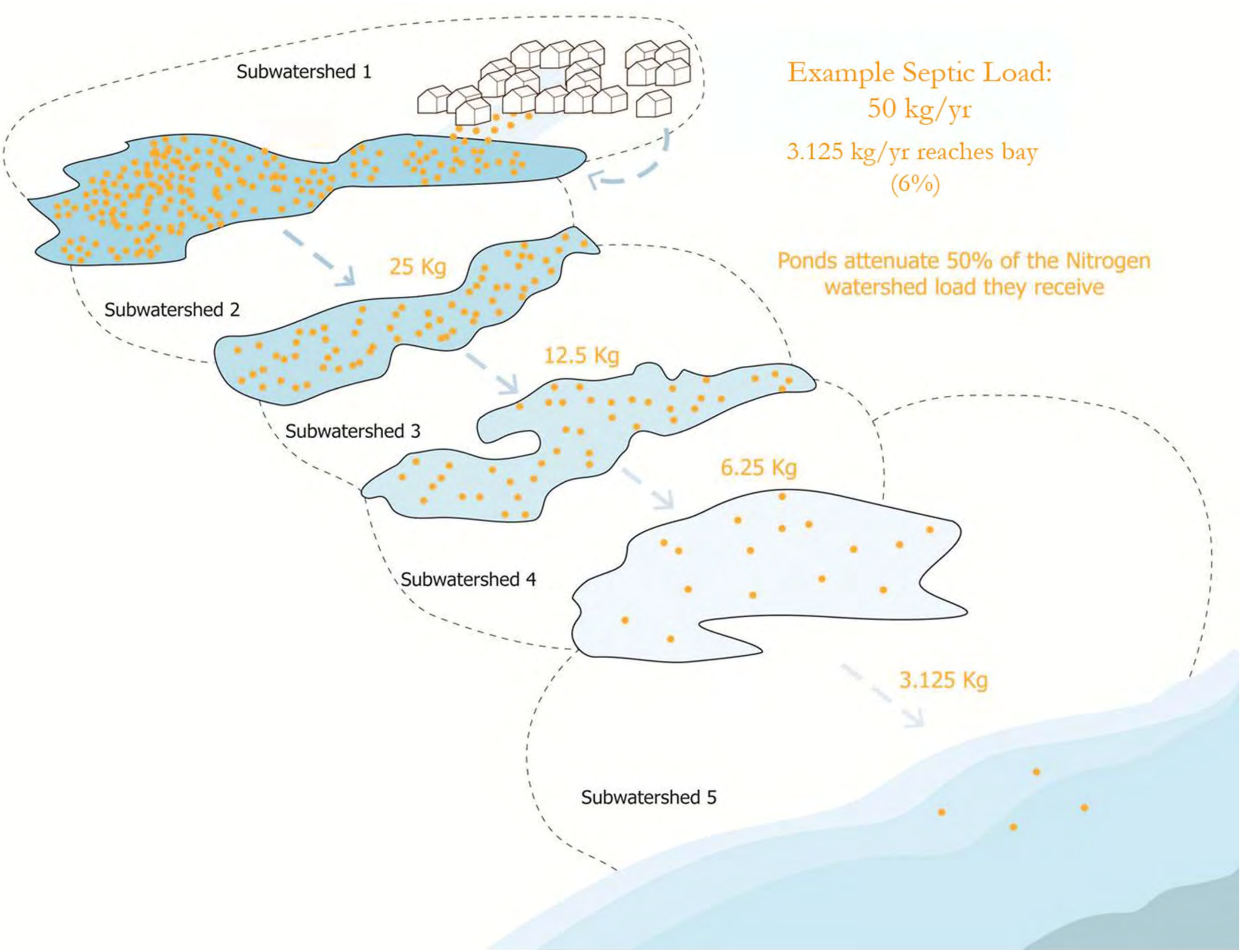


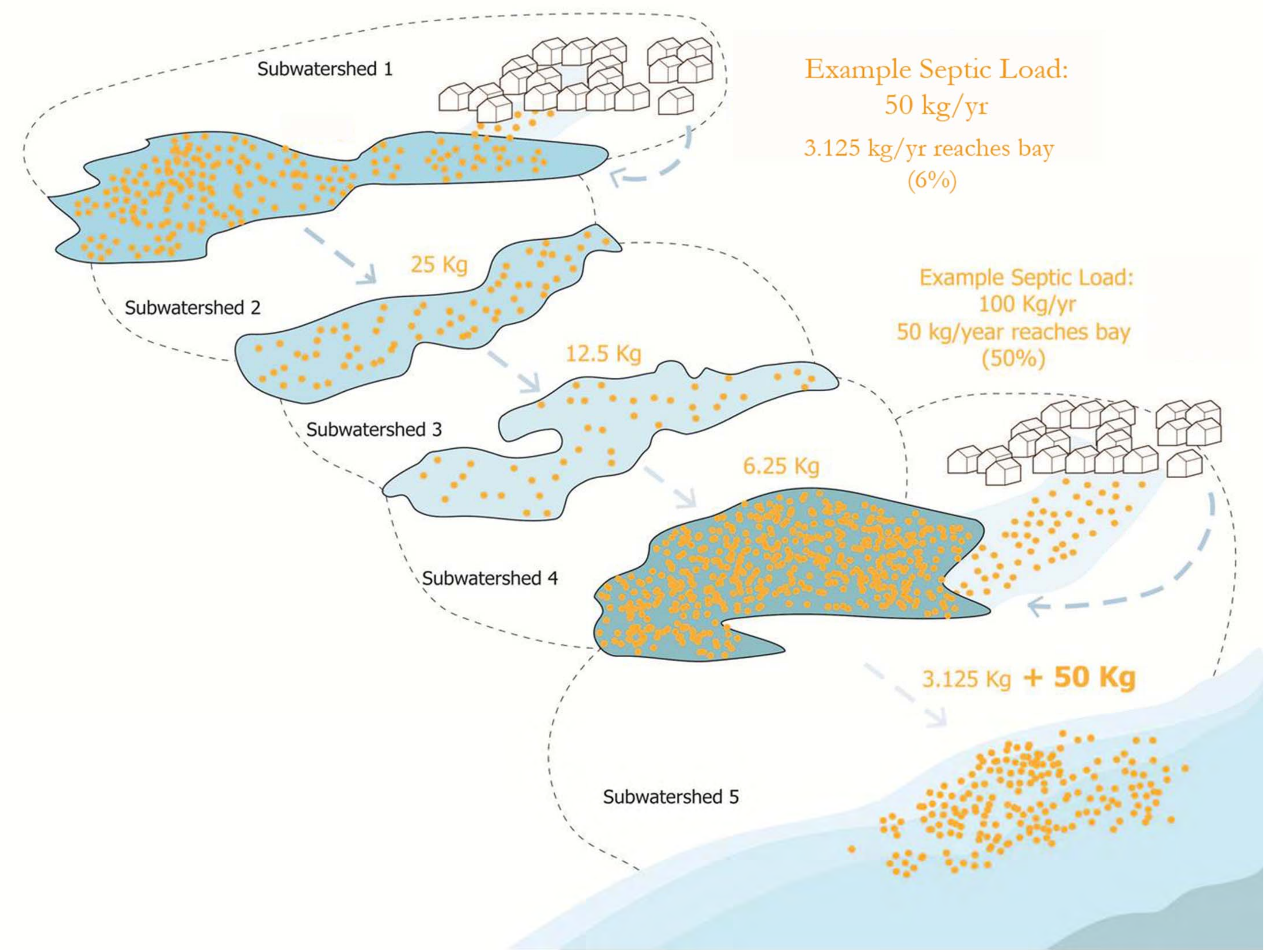
Watershed-Wide Centralized Treatment with Disposal Inside the Watershed



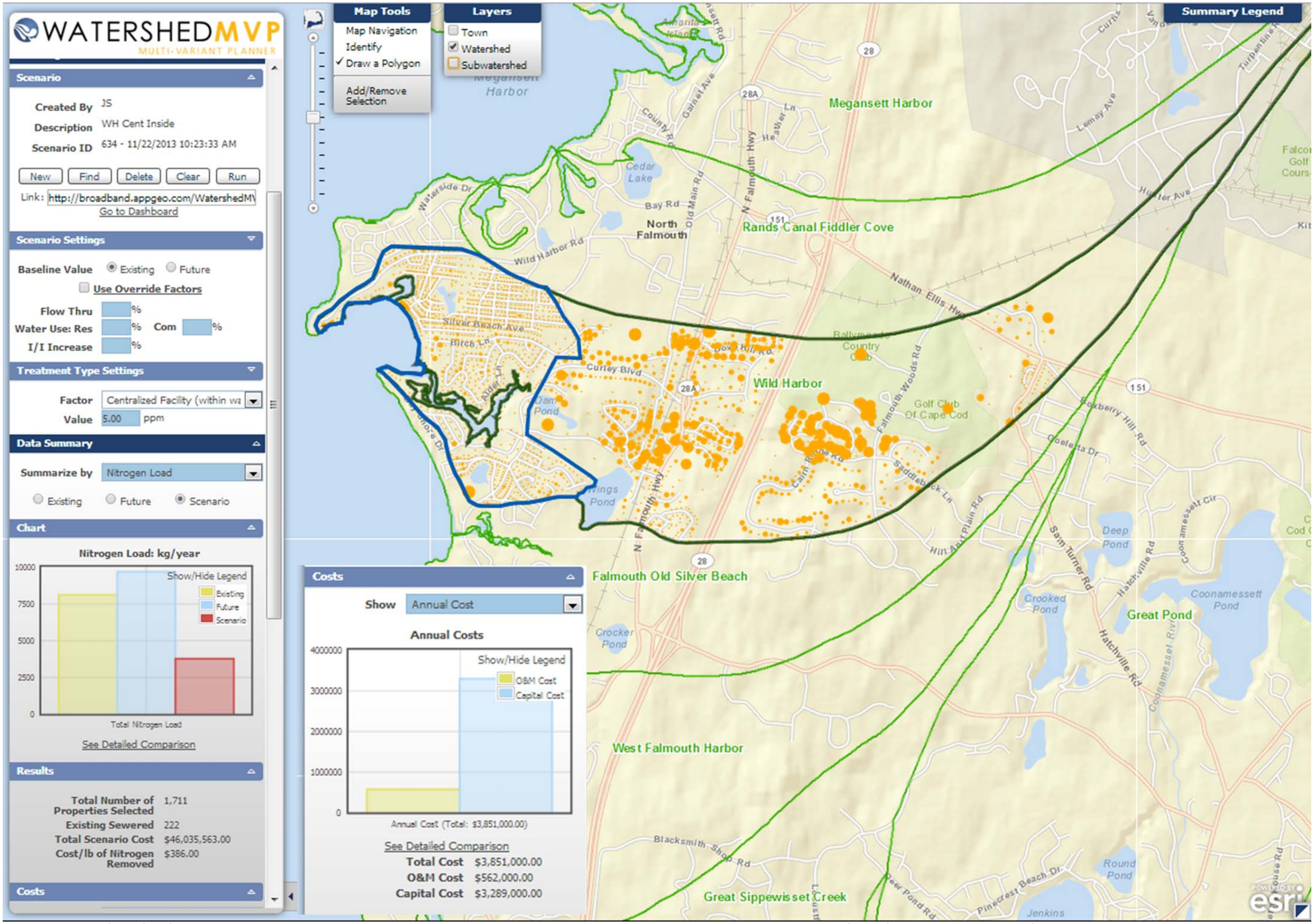

Nitrogen
Subwatersheds with Removal Target
Total NLoad Percent Removal
0.1% - 9.0%
9.1% - 38.0%
38.1% - 62.0%
62.1% - 86.0%
86.1% - 100.0%
55.9 %
14.9 %
CAPE COD COMMISSION

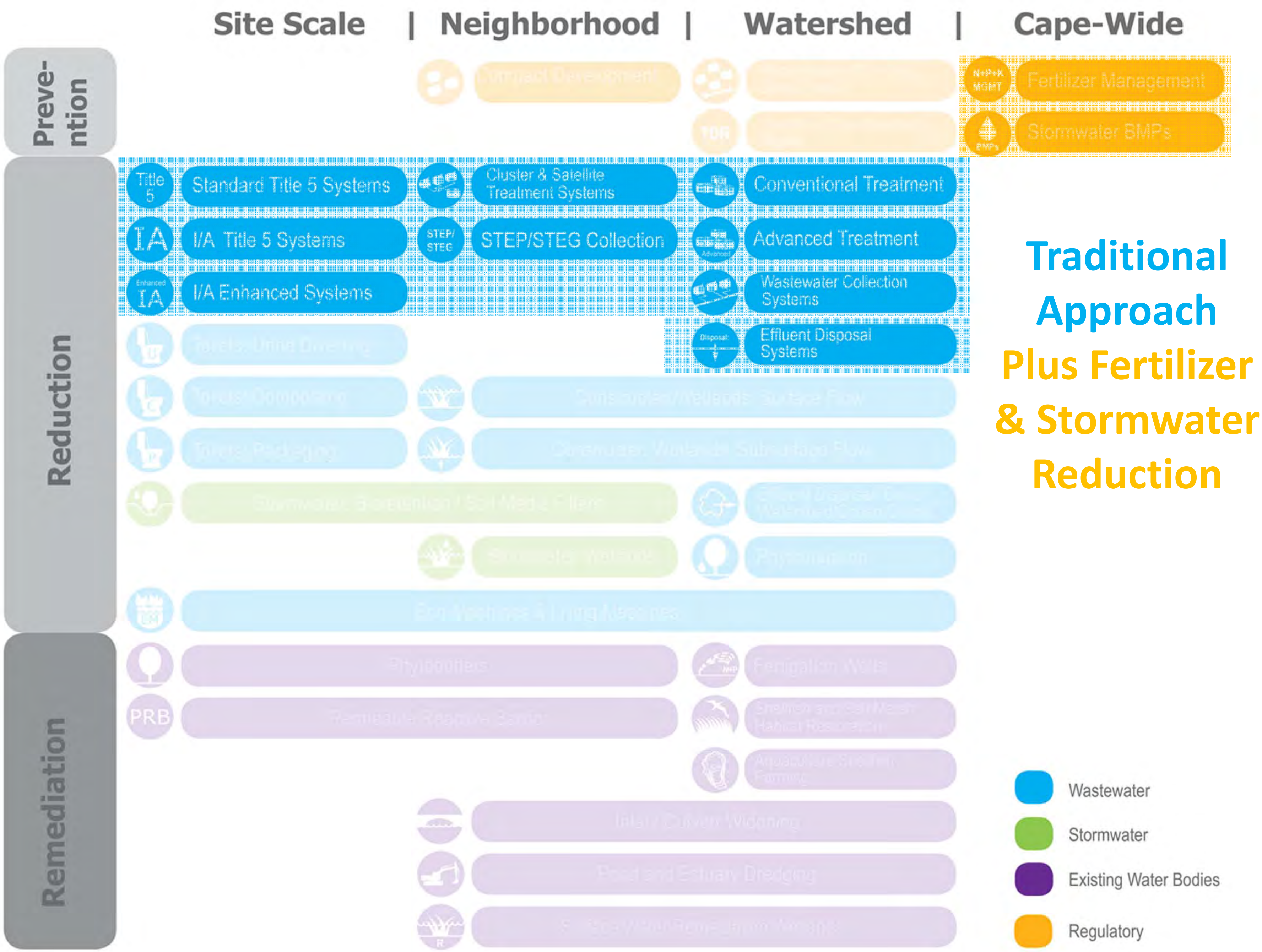

Subwatershed 1
Example Septic Load:
50 kg/yr
Subwatershed 2
Subwatershed 3
Subwatershed 4
Subwatershed 5


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

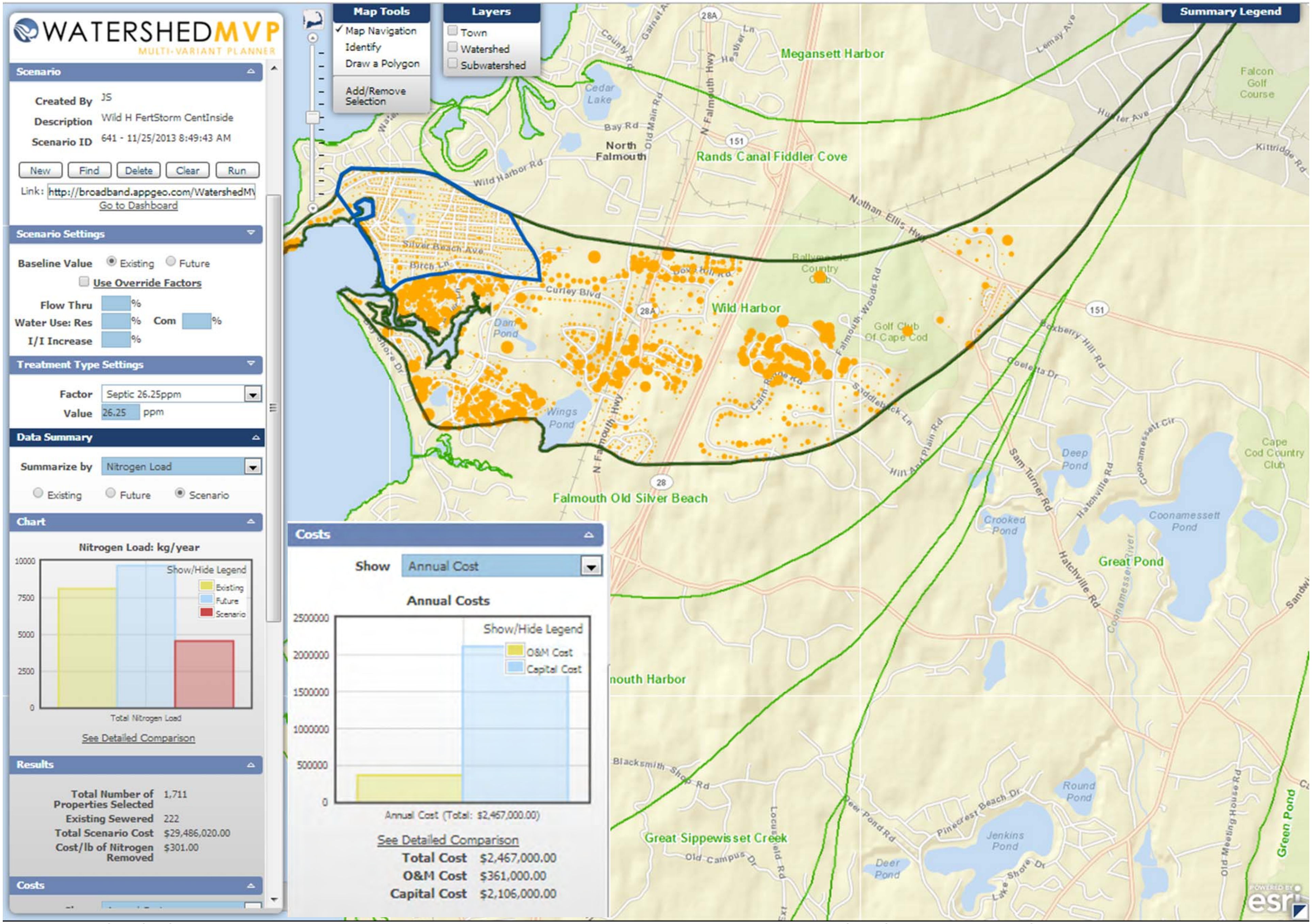

Subwatershed 1
Example Septic Load:
50 kg/yr
3.125 kg/yr reaches bay
(6%)
25 Kg
Subwatershed 2
Example Septic Load:
100 Kg/yr
50 kg/year reaches bay
(50%)
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg + 50 Kg
Subwatershed 5

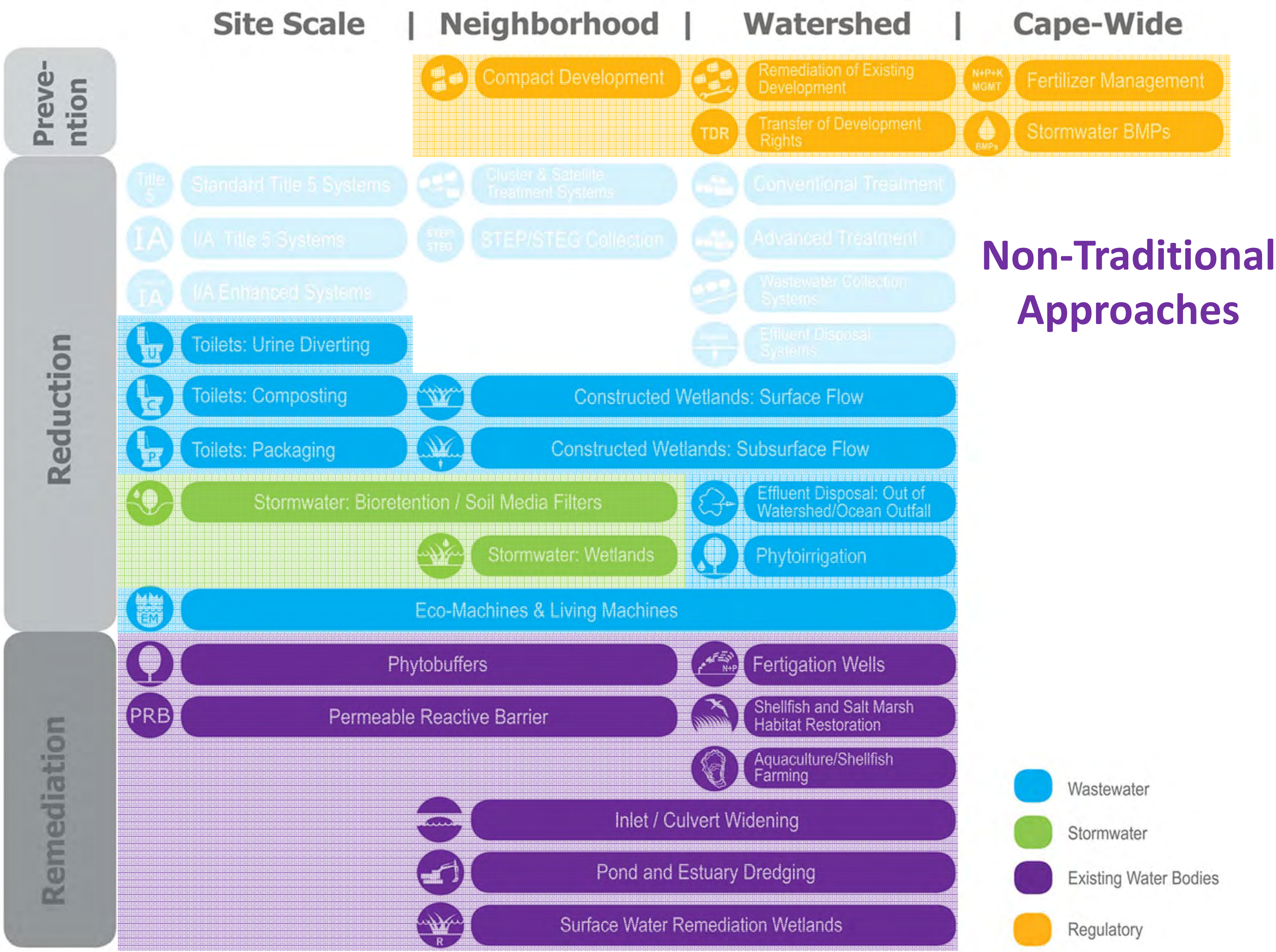
Targeted Centralized Treatment with Disposal Inside the Watershed




Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-ntion
Reduction
Remediation
N+P+K MGMT
Fertilizer Management
BMPs
Stormwater BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/ STEG
STEP/STEG Collection
Advanced Treatment
Enhanced IA
I/A Enhanced Systems
Wastewater Collection Systems
Disposal
Effluent Disposal Systems
PRB
Traditional Approach
Plus Fertilizer & Stormwater Reduction
Wastewater
Stormwater
Existing Water Bodies
Regulatory

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




Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-ntion
Reduction
Remediation
Compact Development
Remediation of Existing Development
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Fertilizer Management
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STEP STEG
STEP/STEG Collection
Advanced Treatment
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I/A Enhanced Systems
Wastewater Collection Systems
Effluent Disposal Systems
Non-Traditional Approaches
U
Toilets: Urine Diverting
C
Toilets: Composting
Constructed Wetlands: Surface Flow
P
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
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Eco-Machines & Living Machines
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory


Problem Solving Approach
Wastewater
Existing Water Bodies
Regulatory
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
N+P+K MGMT
BMPs
4
Watershed/Embayment Options
A. Permeable Reactive Barriers
B. Inlet/Culvert Openings
C. Constructed Wetlands
D. Aquaculture
PRB
R
5
Alternative On-Site Options
A. Eco-toilets (UD & Compost)
B. I/A Technologies
C. Enhanced I/A Technologies
D. Shared Systems
Title 5
Enhanced IA
C
IA
U
P
6
Priority Collection/High-Density Areas
A. Greater Than 1 Dwelling Unit/acre
B. Village Centers
C. Economic Centers
D. Growth Incentive Zones
Advanced
Disposal
STEP/STEG
7
Supplemental Sewering
Advanced

Watershed Calculator Wild Harbor

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
Present Total Nitrogen Load:		23.658	8635
wastewater		17.362	6337
fertilizer			1905
stormwater			764
Target Nitrogen Load:		16.121	5884
Nitrogen Removal Required:			**2751**
Total Number of Properties:	1474		

Watershed Calculator Wild Harbor

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Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

Watershed Calculator Wild Harbor

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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)**	**Total Annual Cost**
Fertilizer Management	953	1,799		
Stormwater Mitigation	382	1,417		

Watershed Calculator Wild Harbor

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Stormwater Mitigation		382	1,417		
Watershed/Embayment Options:					
Permeable Reactive Barrier (PRB)	144 Homes	443.5	973	$452	$441,036

Watershed Calculator Wild Harbor

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Fertigation Wells	1 Golf course	136	837	$438	$131,050

Watershed Calculator Wild Harbor

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Fertigation Wells	1	Golf course	136	837	$438	$131,050
Oyster Beds/Aquaculture	1	Acres	250	587	$0	$0

Watershed Calculator Wild Harbor

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Fertigation Wells	1	Golf course	136	837	$438	$131,050
Oyster Beds/Aquaculture	1	Acres	250	587	$0	$0
Alternative On-Site Options:						
Ecotoilets (UD & Compost)	74	Homes	293.0	294	$1,265	$815,530

Watershed Calculator Wild Harbor

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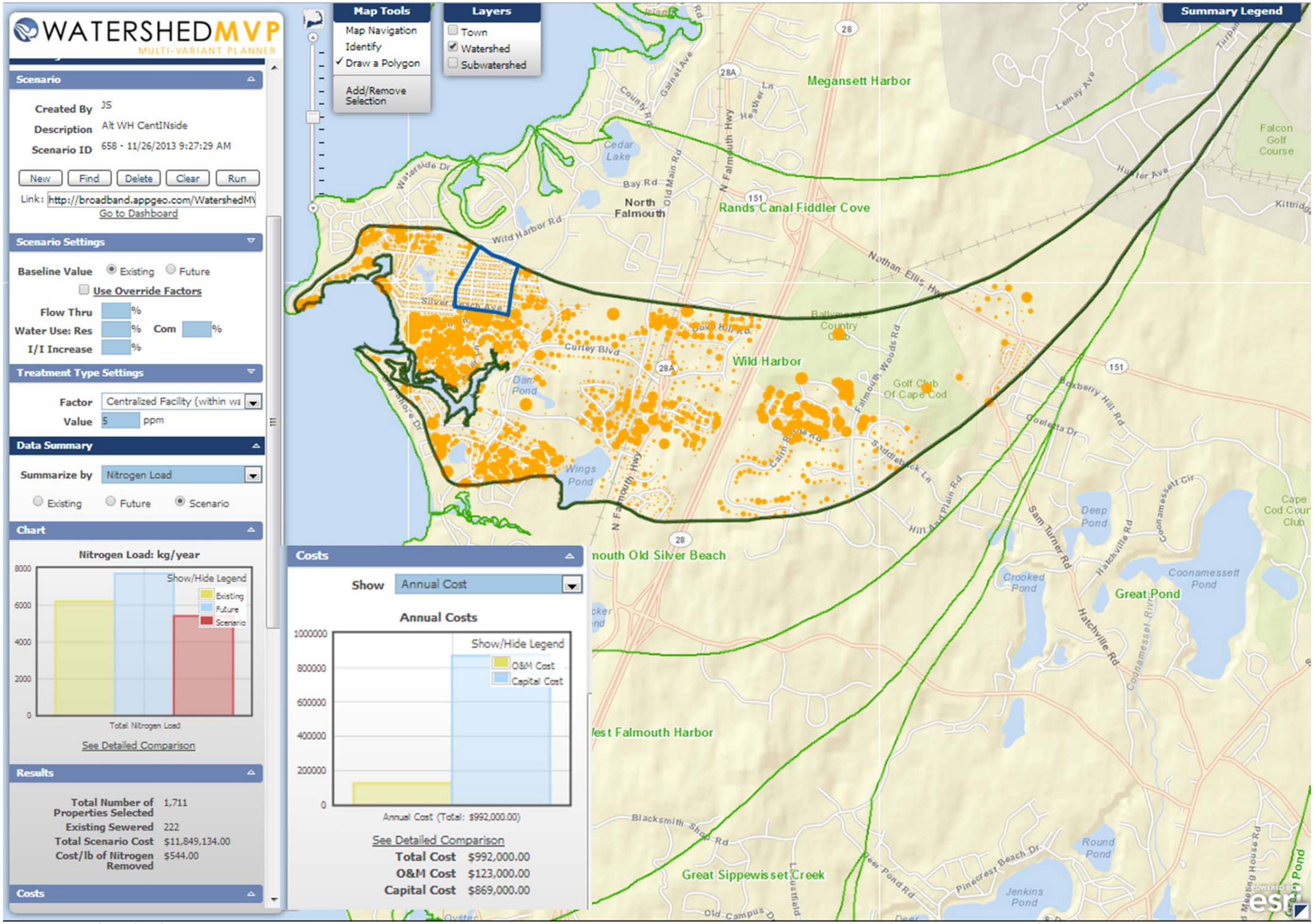
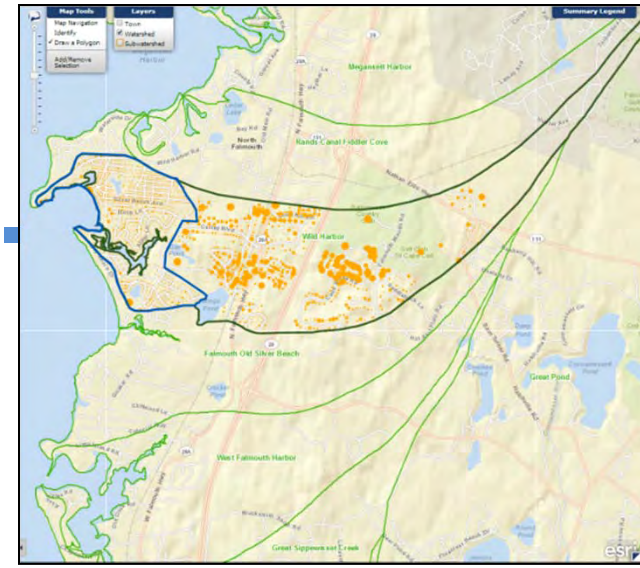
Oyster Beds/Aquaculture	1	Acres	250	587	$0	$0
Alternative On-Site Options:						
Ecotoilets (UD & Compost)	74	Homes	293.0	294	$1,265	$815,530
Sewering	67	Homes	294	0	$1,000	$646,679
			Total To Meet Goal (Kg/yr):	0	$336	$2,034,295
			Comparison to Conventional		$1,000	$6,052,211

Targeted Centralized Treatment after Applying Alternative Strategies (293 kg N/yr)



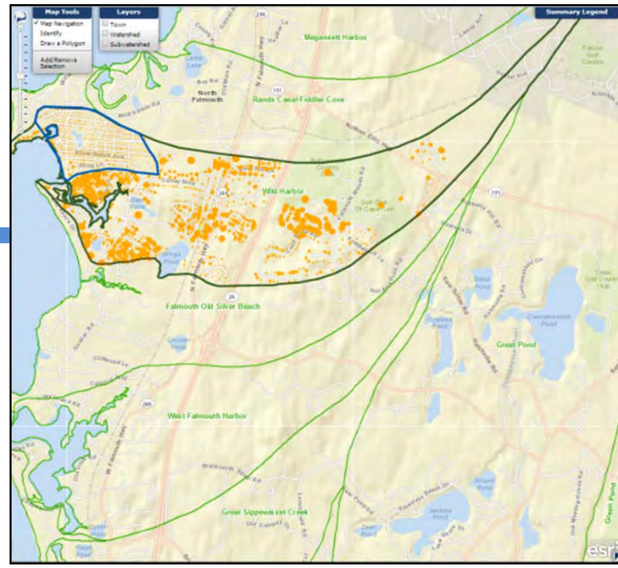
Scenario Comparison

Targeted Collection



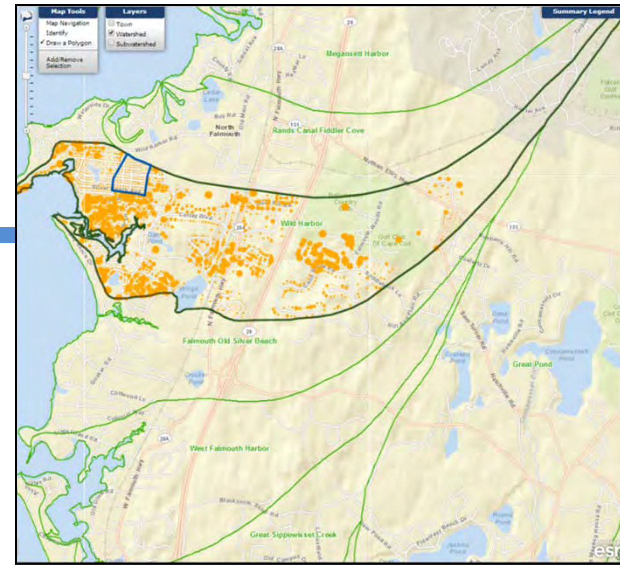
- Achieves TMDL[1]
- Total Cost = $46 Million
- Cost/lb N = $386
- Treated Flow = 85,000 gpd

Targeted Collection after a 50% reduction in fertilizer and stormwater



- Achieves TMDL[1]
- Total Cost = $29 Million
- Cost/lb N = $301
- Treated Flow = 42,000 gpd

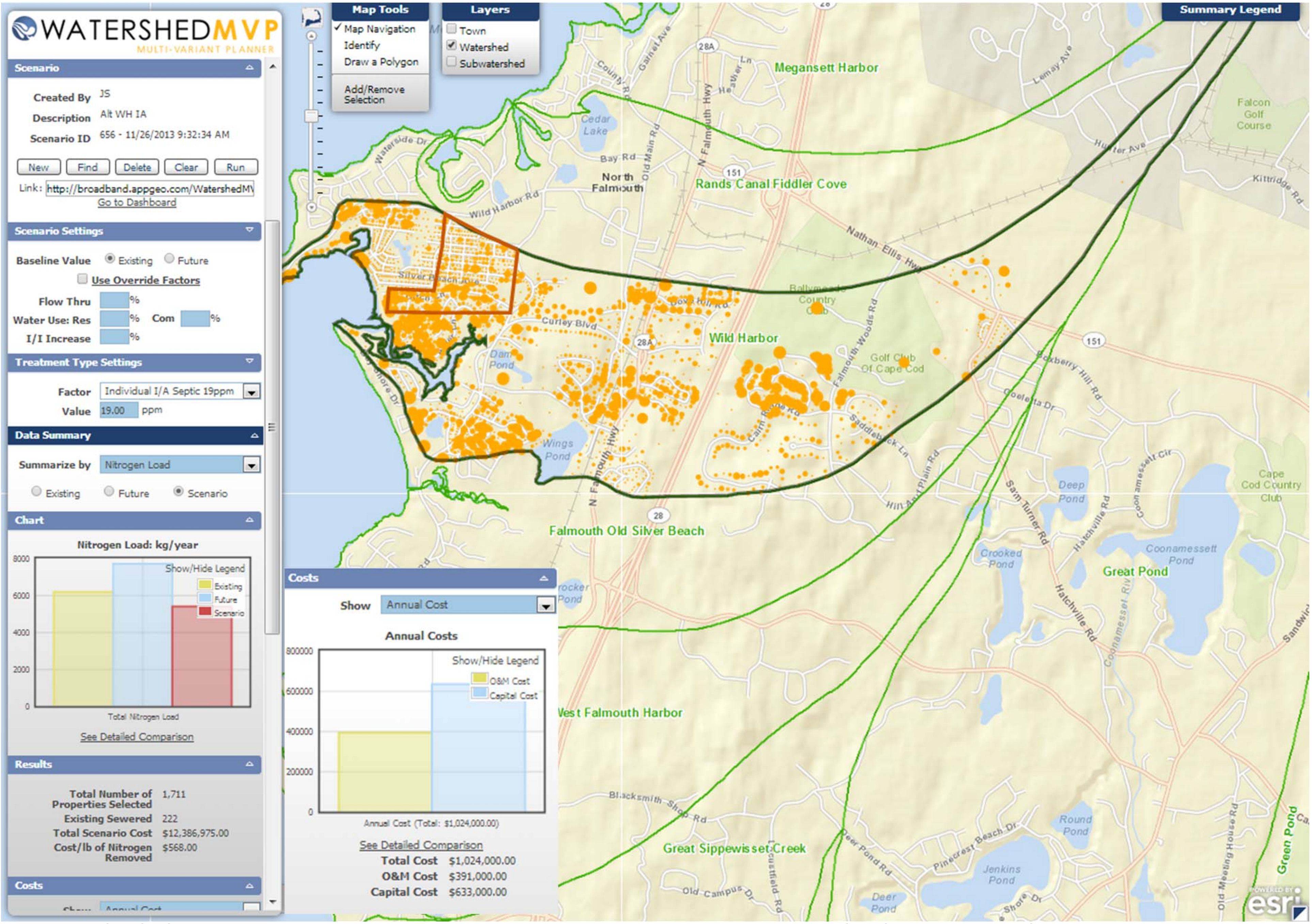
Targeted Collection after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



- Achieves TMDL[1]
- Total Cost = $12 Million
- Cost/lb N = $544
- Treated Flow = 11,000 gpd

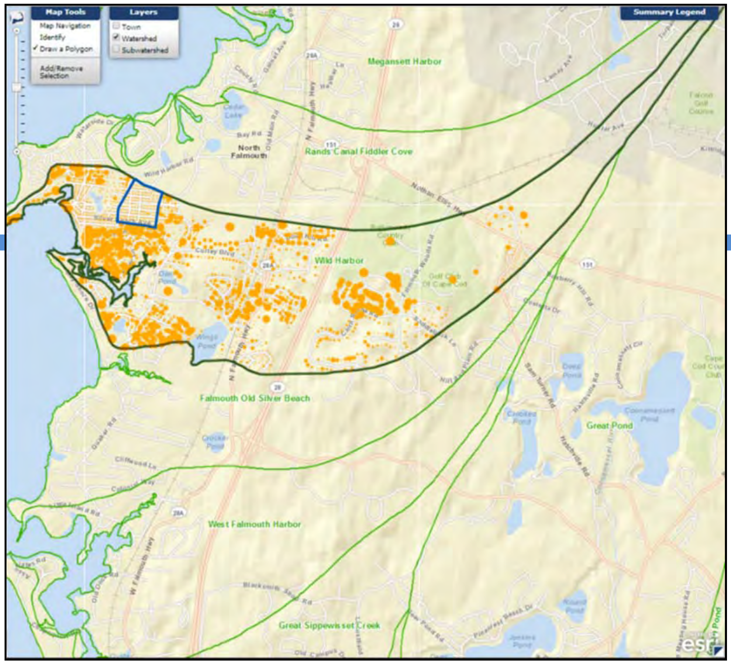
[1] within 5% of goal

Innovative/Alternative On-Site Systems after Applying Alternative Strategies (293 kg N/yr)



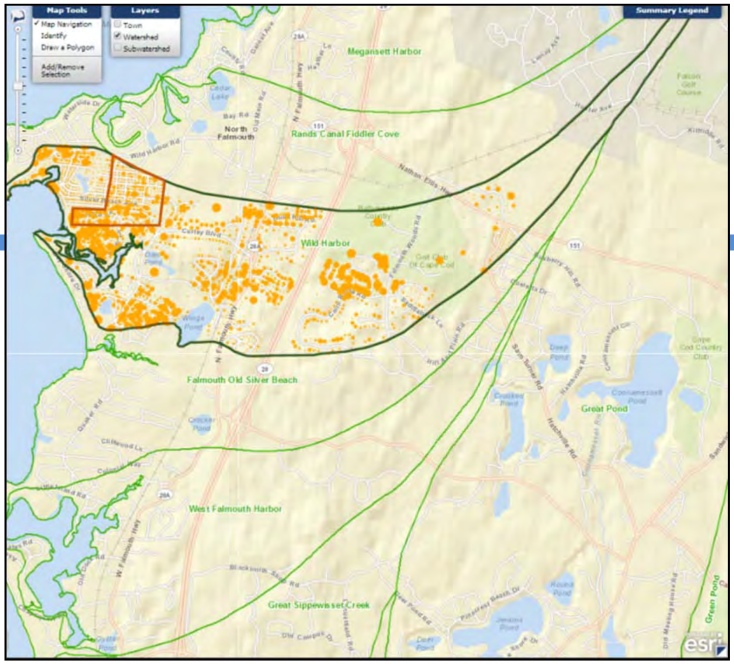
Scenario Comparison

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



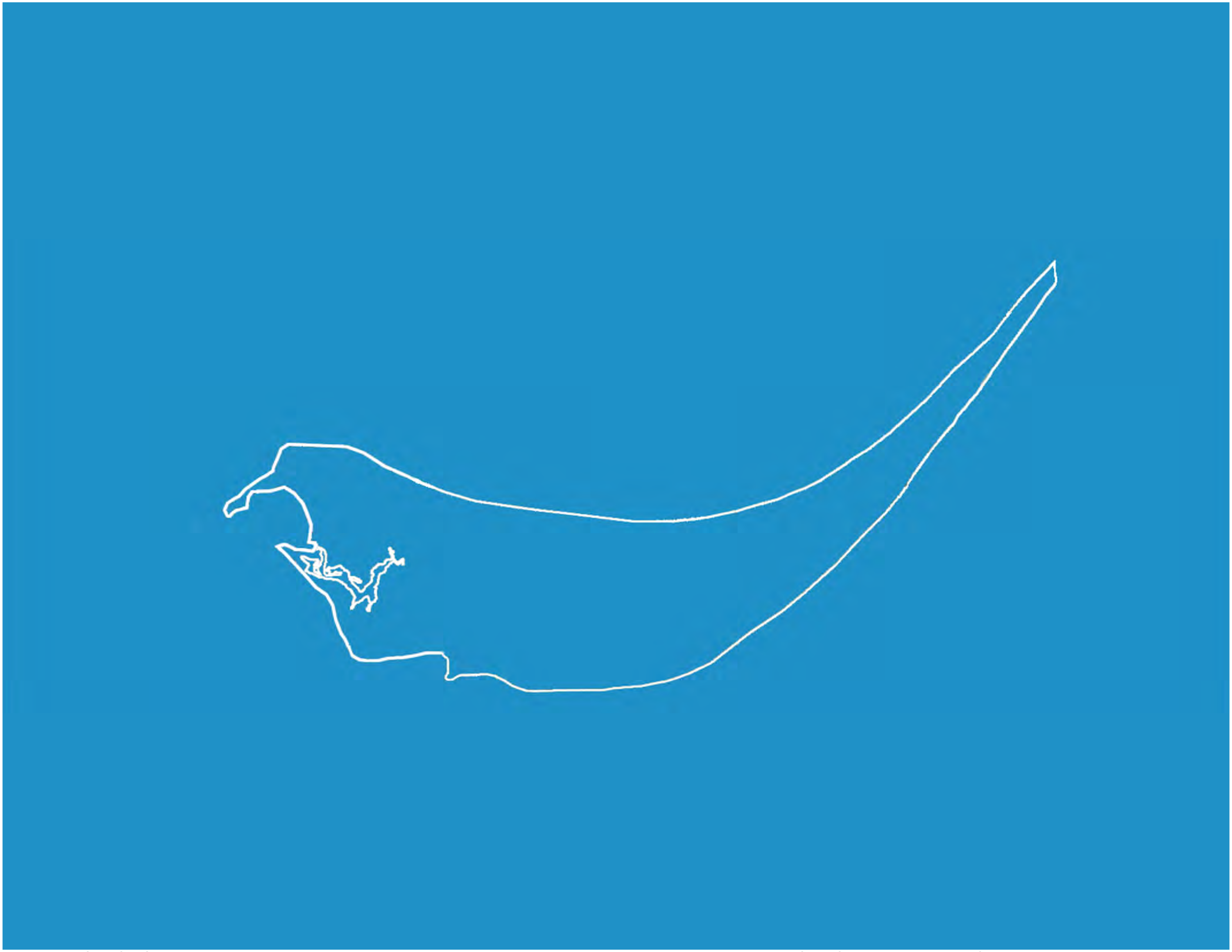
- Achieves TMDL[1]
- Total Cost = $12 Million
- Cost/lb N = $544
- Treated Flow = 11,000 gpd

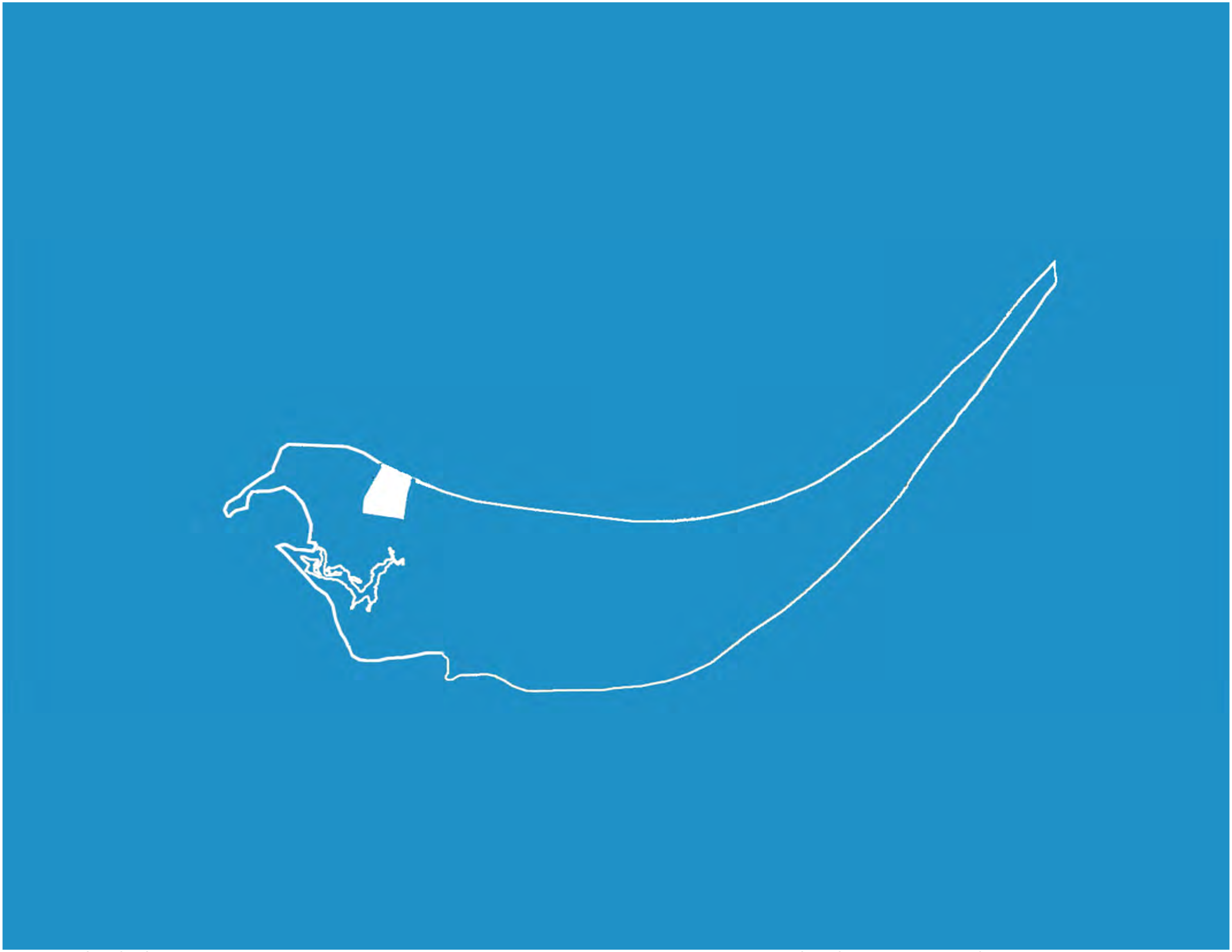
Innovative/alternative on-site systems after a 50% reduction in fertilizer and stormwater & after applying alternative approaches

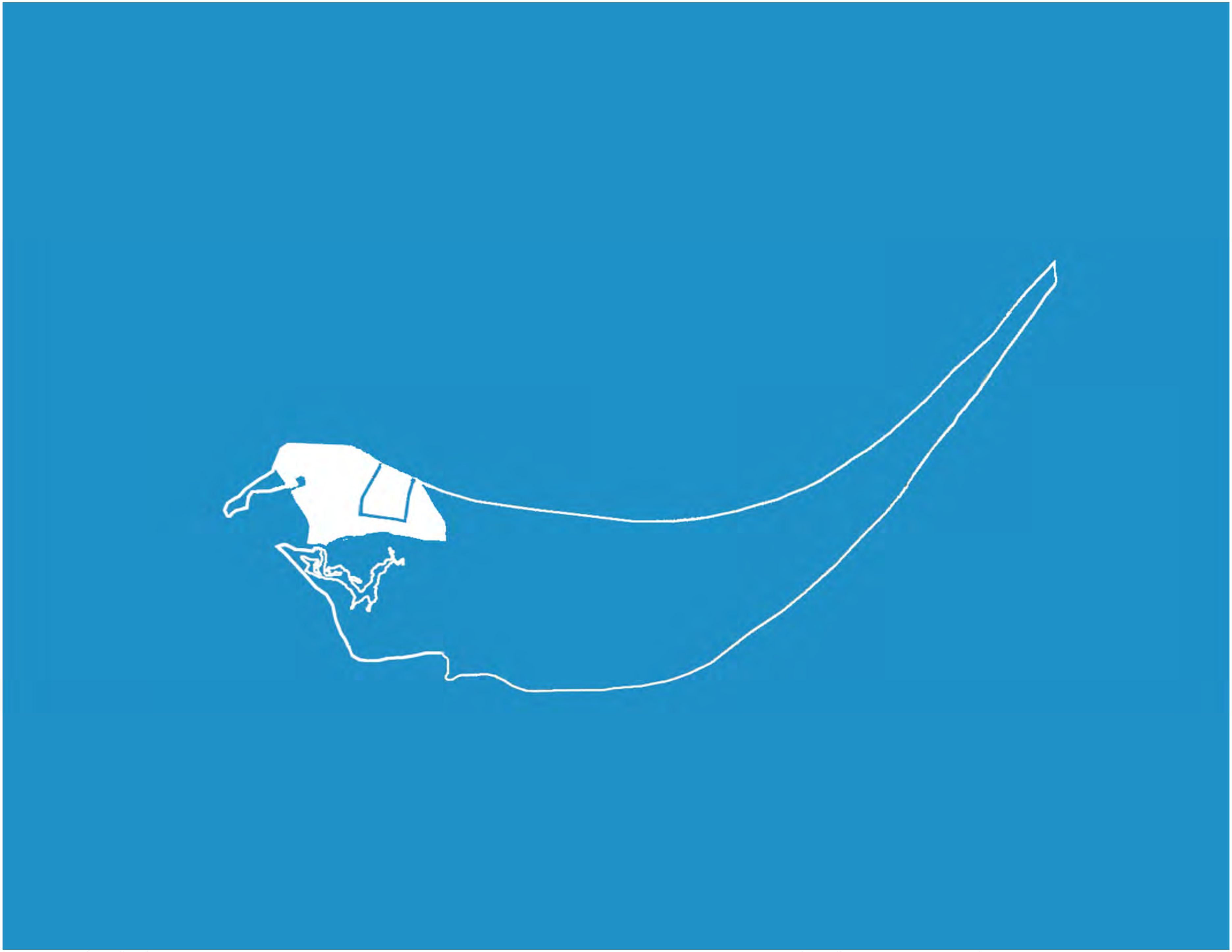


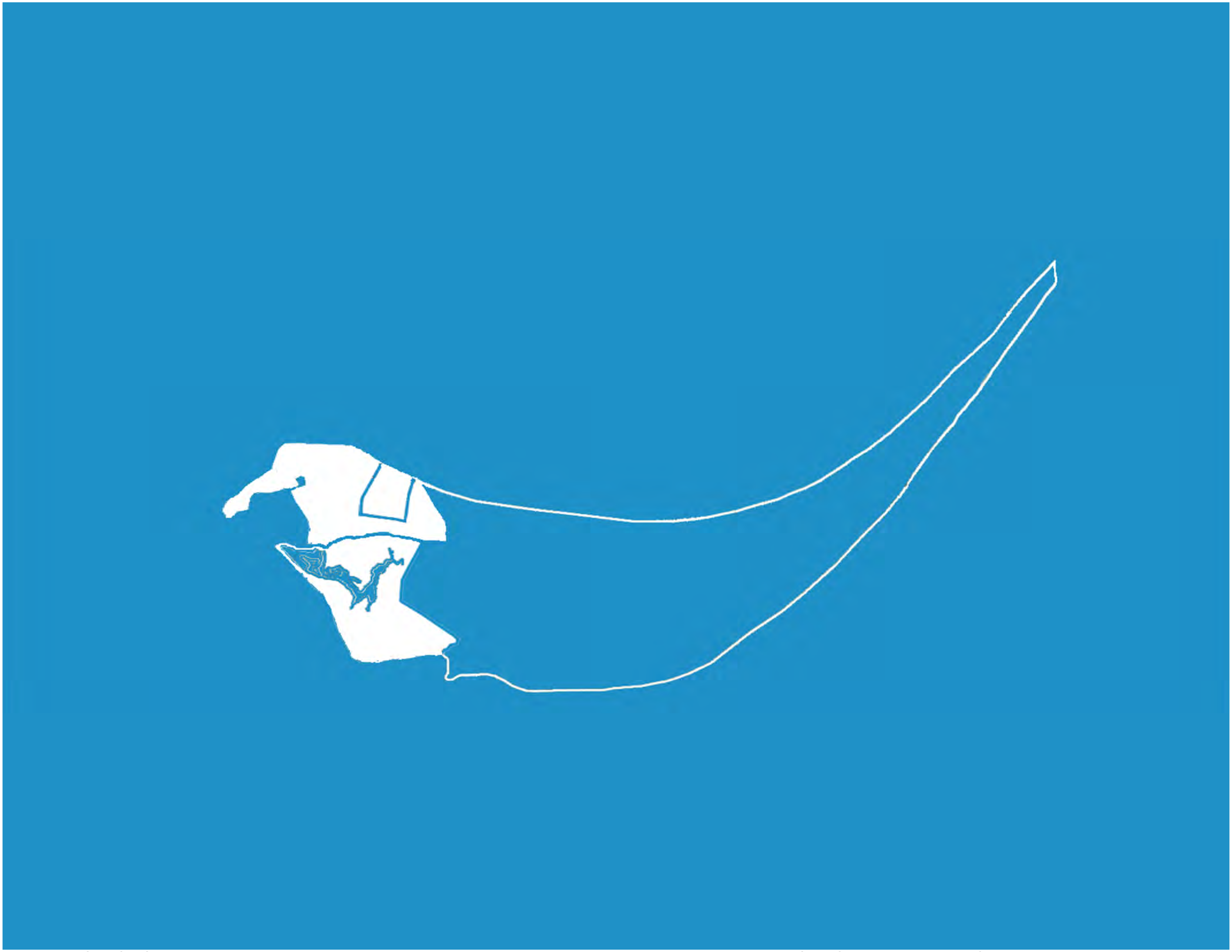
- Achieves TMDL[1]
- Total Cost = $12 Million
- Cost/lb N = $568
- Treated Flow = 32,000 gpd

[1] within 5% of goal









Adaptive Management:

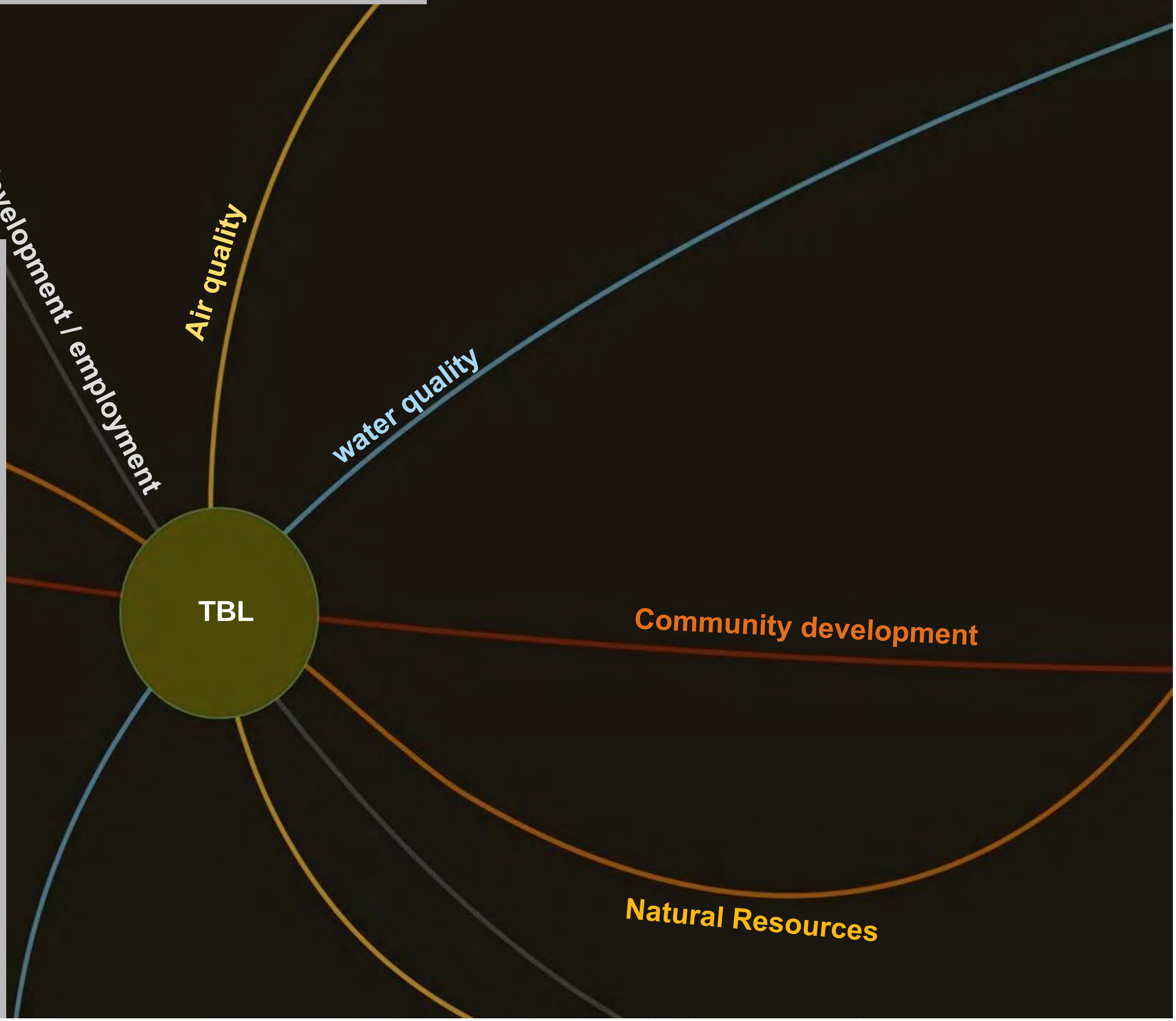
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient ways.

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

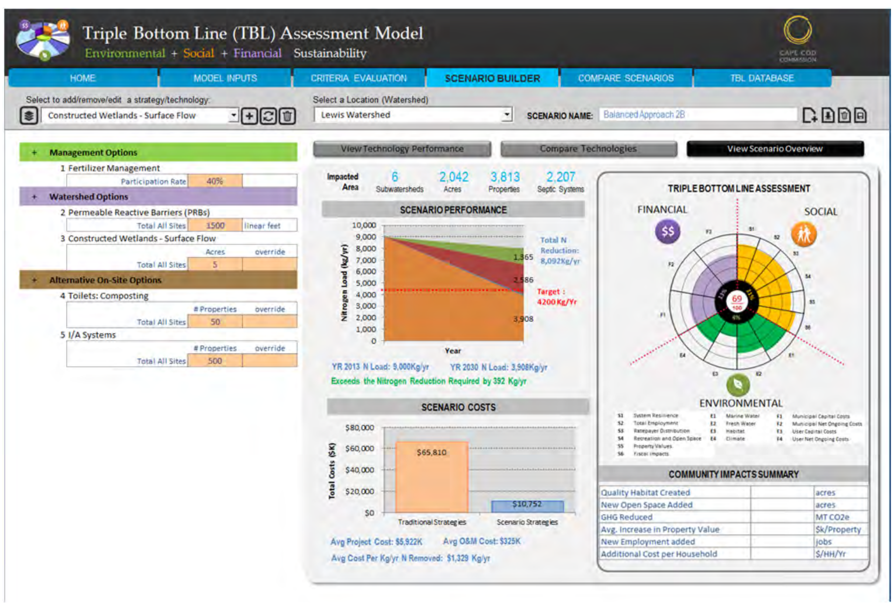
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

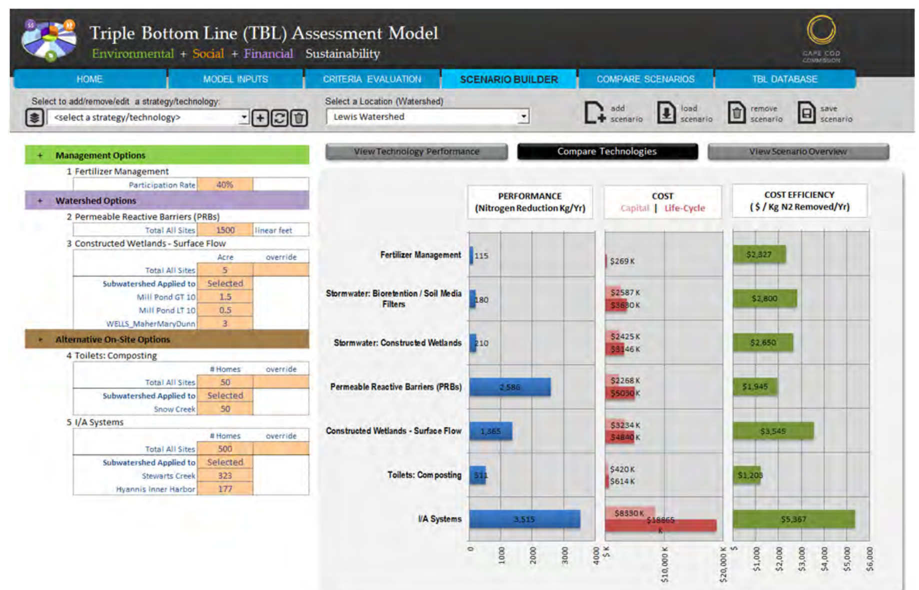


Why develop a TBL model?

- 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

HOME | MODEL INPUTS | CRITERIA EVALUATION | SCENARIO BUILDER | COMPARE SCENARIOS | TBL DATABASE

Alternative Definition | Alternative Results | Alternative Scoring Rules

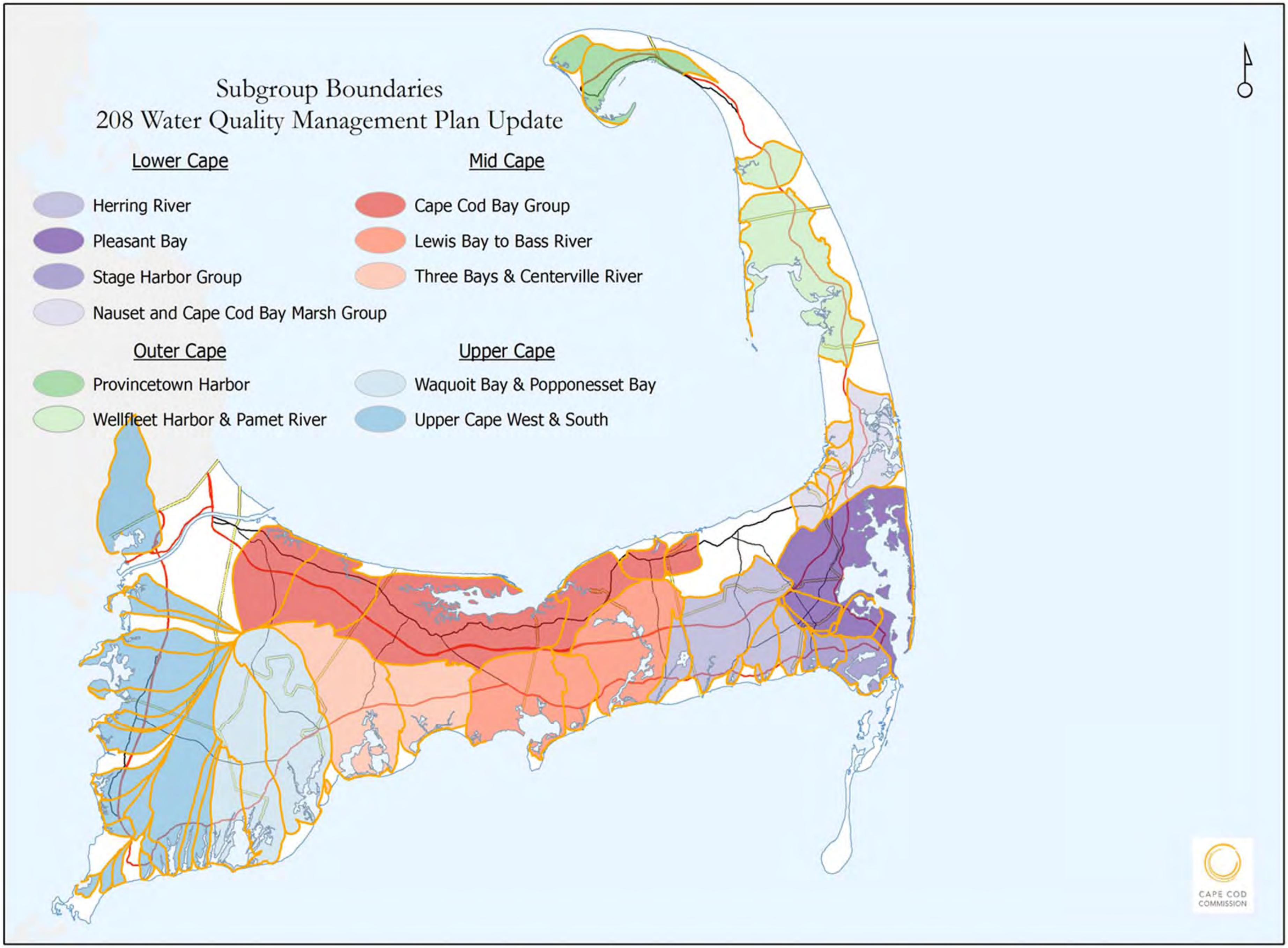
	Scenario 1	Scenario 2	Scenario 3
	Minimum Cost	Cost Effective	Maximum Performance

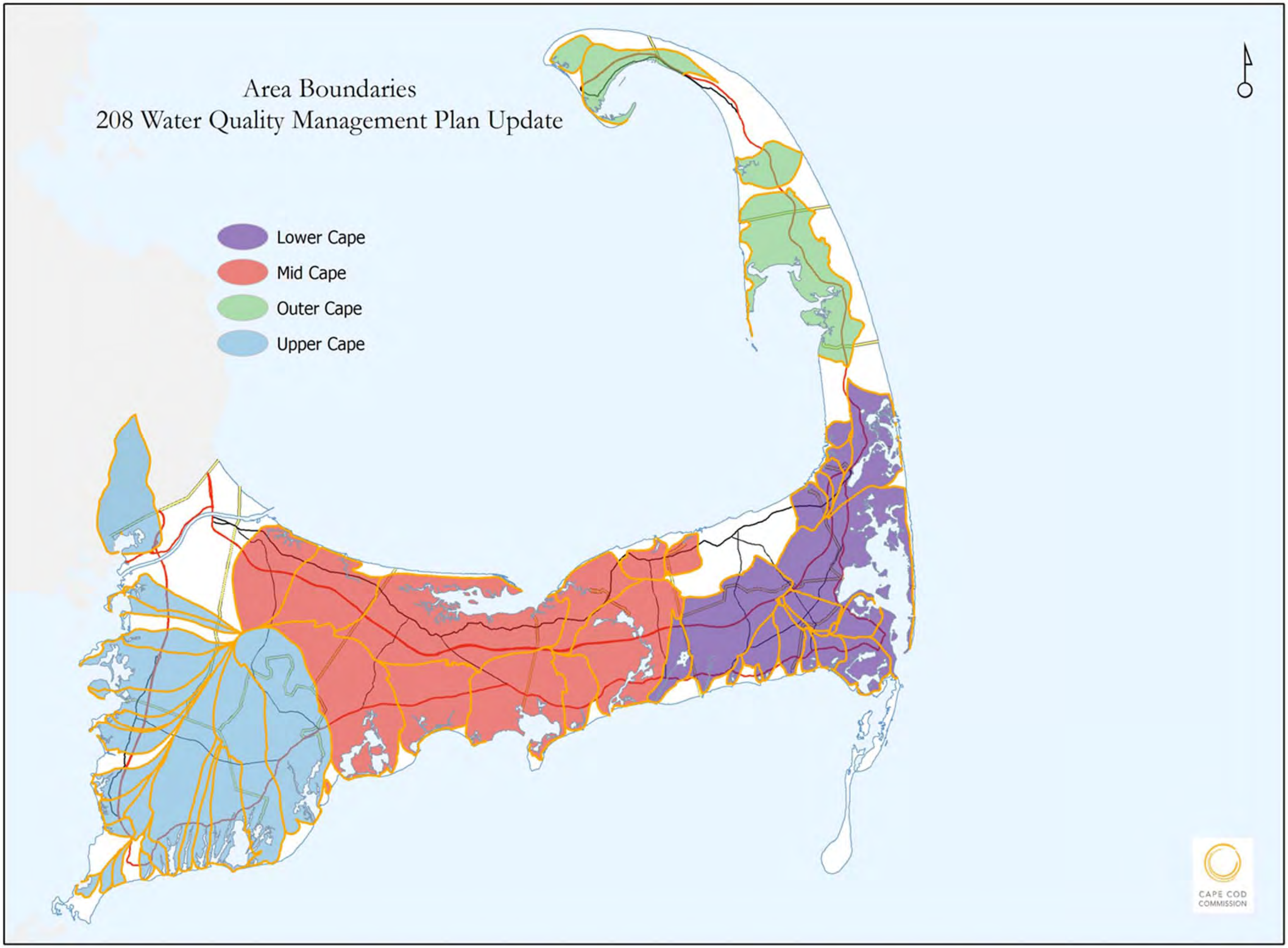
Criterion Scores

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
Upper Cape West and South Watershed Working Group

Meeting Three
Monday December 2, 2013
8:30 am- 12:30 pm
Falmouth Town Hall, 59 Town Hall Square, Falmouth, MA 02540

I. ACTION ITEMS

Working Group

- Provide any comments on the Meeting Two draft notes to Doug Thompson (dthomnpson@cbuilding.org).
- Provide comments and/or additional info on the town chronologies to Patty Daley.
- Provide comments on the Technology Matrix to Mark Owen at AECOM.
- Notify Doug Thompson to volunteer or nominate another for participation in the larger sub-basin working group meeting over the next several months.

Consensus Building Institute

- Facilitate communication between stakeholders and AECOM on assumptions and data used for ecotoilet calculations in the Technology Matrix.
- Finalize notes from Meeting Two, distribute to the Working Group, and post to the Cape Cod Commission's website.
- Send out draft notes from Meeting Three.

Cape Cod Commission

- Provide the Working Group with information on the assumptions behind the calculations of cost per pound of nitrogen removed for sewer, denitrifying septic systems, and I/A scenarios.
- Provide Working Group with the Commission's updated definition of adaptive management after incorporating feedback from the 11 working groups.
- Notify the Working Group of the selected date in January for the Stakeholder Summit.
- Remaining action item from Meeting Two: verify whether or not the eco machine example from South Burlington, Vermont was abandoned.

II. WELCOME, REVIEW 208 GOALS AND PROCESS AND THE GOALS OF MEETING

Doug Thompson, the facilitator from the Consensus Building Institute, and Ms. Patty Daley, Deputy Director of the Cape Cod Commission and Area Manager for the

Upper Cape West and South Watershed Working Group, welcomed participants. Ms. Daley offered a brief overview of the 208 Update Stakeholder Process, which started with public meetings in July and August. The first meetings of the eleven Watershed Working Groups, held in September, focused on baseline conditions in each of the watersheds, with the Upper Cape West and South Watershed Working Group looking specifically at the local conditions relevant to their represented area. The second workshop, held in October, explored the various technology options and approaches available. This third meeting in December is intended to focus on evaluating watershed scenarios, which are to be informed by the Working Groups' discussions about baseline conditions, priority areas, technology options/ approaches, and information provided in the Technology Matrix.

Ms. Daley shared the 208 Plan team's progress since Meeting Two, which includes:

- Meetings with the Advisory Board, the Tech Panel, the Finance Group, and the TAC.
- Development and distributed access to the Technology Matrix, which shows possible traditional and non-traditional technologies at the site, neighborhood, watershed, and cape-wide scales.
- Update of the town chronologies

Ms. Daley also shared the goals of Meeting Three:

- To discuss the approach for developing watershed scenarios that will remediate water quality impairments in the watersheds of concern to this group.
- 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.

Ms. Daley provided an overview of the various traditional approaches and non-traditional approaches possible to drive towards MEP nitrogen reduction targets. Both approaches also include a scenario with fertilizer reduction and stormwater mitigation that reduces the footprint of wastewater infrastructure needed. She noted that the presentation for Meeting Three is structured to explore evaluations of these various approaches in concert with fertilizer reduction and stormwater mitigation. She also noted that the goal is to minimize the infrastructure needed to meet water quality goals.

The facilitator then reviewed the agenda and led introductions. A participant list is found in Appendix A. Mr. Dan Milz, a doctoral student from University of Illinois at Chicago, announced that he would also be filming Meeting Three solely for research purposes (he also videotaped the second meeting). The facilitator reported that all action items from Meeting Two had been achieved, except for verifying whether the eco-machine in South Burlington, Vermont was abandoned, about which the Commission will report back to the Working Group.

Mr. Thompson reminded participants of the meeting guidelines and protocols for communication. He also noted that Virginia Valiela was absent but sent wishes that she could be present.

III. INITIAL SCENARIOS FOR THE WILD HARBOR WATERSHED

Mr. Scott Michaud, Hydrologist for the Cape Cod Commission, explained that management scenarios applied to the Wild Harbor Watershed would be used to explore the various traditional (permitted technologies such as sewers and I/A systems) and non-traditional treatment alternatives. He noted that Wild Harbor currently has a wastewater treatment facility that treats about 220 properties, and that the scenarios presented assume continued operation of that facility. He also noted that the MEP indicates that the nitrogen TMDL for this watershed can be met if 42% of existing wastewater nitrogen load is removed from the system.

He then introduced the Watershed MVP tool to develop traditional technology scenarios,.

Participants' questions and comments about the scenarios are included below *(in italics)*:

Traditional Scenarios

Mr. Michaud presented traditional wastewater management scenarios in the Wild Harbor watershed assuming denitrifying I/A onsite systems and centralized collection and treatment of wastewater with return load to thewatershed.

<u>Innovative/Alternative Septic Systems (I/A):</u> The first scenario presented applies I/A onsite septic systems to the entire Wild Harbor watershed. This scenario results in a 27% reduction in wastewater nitrogen load to the watershed, falling short of the wastewater nitrogen removal goal of 42%. The unit cost of this technology is about $800/lb of nitrogen removed.

<u>Conventional Sewer:</u> The second scenario that was presented applies centralized collection and treatment to the entire Wild Harbor watershed. This scenario results in a 74% reduction in wastewater nitrogen load to the watershed, exceeding the wastewater nitrogen removal goal of 42%. This scenario is estimated to cost approximately $600/lb of <u>wastewater</u> nitrogen removed. (The estimated 74% is below the general 81% presented for other watersheds because the nitrogen load from properties connected to the New Silver Beach treatment plant is assumed to remain unchanged.)

- *Several participants expressed concerns about the assumptions used to derive these cost calculations.*
  - The technical experts from the Commission said that they would get back to the Working Group about the assumptions and provide more information about how these calculations were derived (see Commission Action Items).
- *Specifically, one participant questioned why a smaller sewer infrastructure correlated to a less expensive cost per lb.*
  - Mr. Michaud explained that the difference derives from the fact that the targeted area is more densely populated and would require less pipeline distance.
- *Several participants also asked about how communities and individual homeowners would bear the cost burdens of additional sewer.*
  - The group concurred that a discussion on cost recovery should be revisited later, and that a comparative analysis of the unit costs per pound of nitrogen removed must be done first to determine which technologies are most cost effective.
- *Another participant suggested that the costs of sewer could have implications for approving future subdivisions.*

<u>The Role of Ponds/streams and Natural Nitrogen Attenuation in Targeting Sewer Installation:</u> *With the aid of a GIS image, Scott explained which areas of the watershed are up gradient versus down gradient of local ponds. He also explained natural attenuation of nitrogen and how that relates to overall loads. One possible solution is to collect wastewater in areas that are not attenuated naturally and move it to areas that are.*

- *One participant asked about the role of ponds in addressing excess phosphorous loads.*
  - Mr. Michaud assured that phosphorous would be included in future discussions, but that at this juncture, the Commission is focusing on the nitrogen issue.
- *Several participants showed concern that relying too much on natural attenuation will create adverse ecological impacts to pond ecosystems.*
  - The technical experts of the Commission pointed out that these attenuation processes are already occurring, and that their intent was only to illustrate the existing nitrogen dynamics within the natural environment. Mark Owen of AECOM added that nitrogen is not typically a limiting nutrient for ponds (though phosphorous is).
- *One participant asked whether the ratio of pond-to-watershed size influences the 50% nitrogen attenuation estimate.*
  - Mr. Michaud responded that attenuation rates do vary, but that the rate is generally assumed by the MEP to be 50% for ponds.

- *One participant asked if seasonality and variable rates of biological activity due to temperature were incorporated into the 50% nitrogen attenuation estimate.*
  - Mr. Michaud stated that he believes the estimate does factor in seasonal variability, and noted that the Commission is working to address that issue.
- *Another participant noted that the MEP studies factored in pond activity when determining the nitrogen TMDL.*

Targeted Conventional Sewer: The third scenario that was presented applies centralized collection and treatment to areas of the Wild Harbor watershed such that the wastewater nitrogen removal goal of 42% is met. This scenario results in the collection of wastewater from approximately 800 properties for centralized treatment. This scenario is estimated to cost approximately $670/lb of wastewater nitrogen removed.

The fourth scenario that was presented applies centralized collection and treatment to areas of the Wild Harbor watershed assuming that 50% of the fertilizer and stormwater nitrogen load is removed from the entire watershed and such that the wastewater nitrogen removal goal of 42% is met. This scenario results in the collection of wastewater from approximately 430 properties for centralized treatment. This scenario is estimated to cost approximately $610/lb of wastewater nitrogen removed.

Non-Traditional (7-Step) Scenario

Heather McElroy, Natural Resources and Land Protection Specialist for the Cape Cod Commission, presented one scenario in which a suite of non-traditional, green technologies is applied within the Wild Harbor Watershed to reach nitrogen reduction targets. Using the Watershed Calculator and a map of the watershed, she presented the reduction potential, costs, and potential locations of these various technologies.

Before running through the scenario, Ms. McElroy discussed further baseline conditions of the Wild Harbor Watershed. As studied by MEP, the current nitrogen load is about 8,900 kg/yr. Approximately 6,300 kg/yr is derived from wastewater, 1,900 kg/yr from fertilizer, and 760 kg/yr from stormwater. The total nitrogen reduction required is about 2,700 kg/yr. The watershed contains 1,474 properties, and other wastewater management needs persist, including ponds, Title V problem areas, and growth management.

Fertilizer Reduction and Stormwater Mitigation: For discussion purposes the Commission is anticipating that fertilizer nitrogen loads can be reduced by about 50% or 953 kg/yr, and stormwater mitigation loads reduced by 382 kg/yr, also roughly 50%. It is assumed that these options incur minimal costs to the town.

- *One participant asked about the likelihood that DEP would provide credit for 50% reductions in fertilizer and stormwater load.*

  - The technical experts stated that DEP and EPA have been receptive to the use of credits, but that an actual number of nitrogen credits remain undetermined at this time.

Permeable Reactive Barriers (PRBs): Ms. McElroy shared a GIS map indicating suitable areas for PRBs within the Wild Harbor Watershed, i.e., areas close to where groundwater discharges to estuaries, where the water table is 20 or fewer feet below the surface, and where road lengths run perpendicular to groundwater flow. Under the scenario, two potential PRB locations could treat the nitrogen load from 144 homes, reducing by 443 kg/yr. The unit cost is $452/lb. While the Commission is currently using fairly long road lengths in its location screening analysis, the technology could also be installed on shorter road segments in various locations.

- *Several participants were interested in specific siting recommendations for this technology.*
  - The entire technical team reminded the group that the suggested sites are only offered for the purpose of running the scenario simulation, and consideration of them is preliminary and illustrative.
- *One participant asked how deep PRBs can be installed into unsaturated zones.*
  - Ms. McElroy responded that they can be installed down to 40 feet below the surface, but that it depends on the type of PRB used (there are two types). The first type is a reactive barrier 3-4 feet wide. The second type involves injecting a carbohydrate into a well – these can often be deeper. The depth is also determined by how deep the nitrogen levels are in the groundwater.
- *Another participant expressed concern for constraints to this technology created by existing utilities.*
- *One participant shared that his community anticipated its PRB study for feasibility on Quaker Rd. would be complete soon.*

Fertigation wells: A hypothetical fertigation well along a golf course was used to illustrate the potential results from this technology. A well is drilled down-gradient from the golf course, from which nitrogen-laden groundwater is pumped and used to irrigate the greens. The unit cost of removing nitrogen via this technology is $438/lb.

- *One participant shared that West Yarmouth installed this technology to irrigate three golf courses, and noted that, despite perceptions, there is not a considerable nitrogen load from the golf courses – perhaps 5-10 ppm. He suggested that there is an opportunity to get credits for this technology due to the minimal nitrogen load from golf courses and the fact that the natural filtration process as a result of the irrigation runoff removes 90% or more.*
- *The group agreed that golf courses are no longer as significant a nitrogen source as had once been the case. Participants think this technology should be sited, for example, next to a densely populated area.*

  - Ms. McElroy confirmed that this technology could also be sited down gradient of a densely populated area, and that this fact should be made clearer in the Commission's presentations. She also mentioned that while golf courses are less of a problem for nitrogen loading, they are a suitable place for using the nitrogen-heavy groundwater. This will be corrected in further presentations.
- *Another participant noted that tertiary-treated effluent could also be used for golf course irrigation.*

<u>Oyster beds and aquaculture:</u> Under the scenario, one acre of cultivated oysters would be designated in Wild Harbor. Conservative estimates indicate that this would remove nitrogen at a rate of 250 kg/yr. The unit cost of this option is $0 kg/yr. Using the Watershed Calculator, the group determines that about 7 acres of oysters, in addition to 50% fertilizer reduction and stormwater mitigation, would achieve the nitrogen reduction target.

- *The group overall agreed that this is a good option to look into further. They noted that this could create municipal recreation opportunities by allowing public harvesting, which could bring in revenue for the town, making the unit cost negative. The group overall agreed that $0 unit cost was a fair estimate.*
  - Ms. McElroy noted that aquaculture could have other social costs, e.g., impacting navigation and other recreational activities in the harbor.
- *One participant noted that if commercial players were managing the aquaculture, costs and profit would be transferred to them, but it would have to be in partnership with the town.*
  - Ms. McElroy noted that even if the profit from oyster sales is private, it's a co-benefit, and said that the Commission will be looking into this topic further.
  - *Another participant added that even private profits have economic benefits to the community.*
- *The group discussed the impacts of nitrogen uptake on oyster health and any related public health risks from consumption. One participant suggested this could be a possible white paper topic.*
  - Ms. McElroy also noted that, presumably, the oysters can be harvested and consumed, but they could also be left in to enhance the salt marsh ecosystem. Wellfleet is doing this.
- *Another participant expressed concern about impacts of this treatment option to the shellfish industry. He suggested that the oysters could be dumped in a deepwater area where they wouldn't be likely harvested, though noted that this would add cost.*
- *Another also expressed concern about increased nitrate levels as a result of expanded aquaculture.*

- *One participant questioned the assumptions about oyster size, growth rate, and nitrogen process used to calculate the nitrogen removal rate of oysters, and the variability of size and seasonality*
    - The technical experts indicated that they looked at how much nitrogen was taken up within the shell and meat, and that the removal rate of 250 kg/yr is at the low end of estimates, with a range of 250-1,000 kg/yr.

Ecotoilets: Under this scenario, it is assumed that 74 out of the 1474 homes will switch to ecotoilets, removing 293 kg/yr. The unit cost is estimated at $1,265/lb nitrogen removed.

- *One participant asked about the assumptions used to derive the unit cost and disputed the removal rate proposed. The participant added that Urine Diversion and compost ecotoilets differ and should be separated when estimating costs.*
    - Ms. McElroy explained the calculations included the costs of retrofitting a home, the cost of the toilet, and the cost of maintenance. She welcomed further discussion and feedback on how to make these calculations more accurate.
- *Another participant noted that there are about 2-3 ecotoilets already installed in Falmouth and that the town will be able to share further information about this option once they have more installed.*

Remaining sewer footprint required

Ms. McElroy then noted that the implementation of this suite of non-traditional technologies, as described in this scenario, would require 67 homes to be targeted for conventional sewer infrastructure, and showed the targeted area simulated on a GIS map.

She reiterated that this is only one possibility for how these technologies could be paired and implemented, and that a community could decide to rely upon one or all of them. The group spent some time inputting different combinations of technologies in the Watershed Calculator.

Constructed wetland and phytoremediation site screening

While not included in this scenario, Ms. McElroy also showed maps created through GIS analysis that highlighted screened locations for freshwater constructed wetland and phytotechnology projects, options included in the Technology Matrix. For the constructed wetlands location screening, several criteria were used including:

- Parcel-size over 5 acres
- Outside the 100-year floodplain
- Outside priority rare species protected areas
- Outside protected open space areas.

The technical experts confirmed that this can be a very effective nitrogen removal strategy, and that it is less expensive than sewering.

- *One participant cautioned about introducing invasive species, and about the need for a maintenance program that includes harvesting.*
- *Another mentioned that constructed wetlands could be incorporated into new developments, though this is less relevant to watersheds already built out, e.g. Falmouth.*
- *Several participants noted that some screened sites would be impractical to pursue, e.g., cranberry bogs. This would not be feasible in Falmouth.*
    - Ms. McElroy agreed with the concerns about converting cranberry bogs to wetlands for nitrogen attenuation, but noted that towns might pursue lease agreements with growers on town-owned bogs for decommissioning a bog.
    - *Another noted that Harwich has municipally-owned cranberry bogs, and this could be more likely there.*
- *Several participants were interested in whether saltwater constructed wetlands were an option.*
    - Mark Owen and Ms. McElroy shared that there is less information on them, but that experts believe they may also be effective.
- *One participant noted that a constructed wetland treating wastewater would require a collection system and that this would have to be factored into cost estimates.*
- *One participant raised the issue of seasonality in these calculations as well.*
- *On the topic of phytotechnology, one participant noted that removal of Phragmites could be an effective and potentially cost-free option. Some studies indicate that this can remove up to 16% of nitrogen.* The participant suggested that the stalks, leaves, and seeds of the phragmites (not roots), be harvested to remove the nitrogen in these parts of the plants. The roots would remain and the plant would regrow and be harvested in subsequent years. The harvested phragmites would then be mixed with other compostable materials.

Overall scenario comparison

Ms. Daley showed an overall comparison of three scenarios – 1) sewer only, 2) sewer after 50% reduction in fertilizer and stormwater, 3) sewer after 50% reduction in fertilizer and stormwater and the application of green infrastructure (non-traditional) technologies, and 4) Innovative/Alternative on-site systems after 50% reduction in fertilizer and stormwater and the application of non-traditional technologies.

Scenario (Infrastructure required)	Total Cost	Cost /lb N	Treated flow (gpd)
Sewer (i.e. targeted collection)	$46 M	$670	85,000

Sewer after 50% reduction in fertilizer and stormwater	$29M	$610	42,000
Sewer after 50% reduction in fertilizer and stormwater and the application of non-traditional techs	$12M	$544	11,000
Innovative/Alternative on-site systems after 50% reduction in fertilizer and stormwater and the application of non-traditional techs	$12M	$568	32,000

The sewer footprint associated with each was shown on a map, shrinking and expanding depending on the scenario considered.

General discussion of scenario exercise

The workgroup raised the following comments and questions:

- *Several participants brainstormed ways in which sewer could be avoided – e.g., via increased oyster acreage or eco-toilets.*
- *One participant commended this analysis, but reminded the group that only sewers and I/A systems are currently approved for meeting TMDLS. This kind of suite of non-traditional technologies will require a paradigm shift, and that there are significant amounts of regulatory and scientific uncertainty.*
    - Ms. Daley and Ms. McElroy replied that the concept of adaptive management is central to this issue. They also noted that DEP and EPA are willing to allow for experimentation with non-traditional alternatives first. If they prove to be ineffective, we can revert to a more traditional approach.
- *The group agreed that they'd like to see greater level of specificity in analysis moving forward to determine how feasible each technology is within a given community.*
    - Ms. McElroy stated that the Technology Matrix provides information about where it is possible to install particular technologies. She and Mark Owen will be looking further at the site-specific factors moving forward.
- *Several participants expressed concern that certain considerations were not being factored into the unit costs of technologies. They also were concerned about the unit inconsistencies (kg vs. lb).*
- *One participant raised again the issue of seasonality, and how large nutrient loads in the winter tend to dissipate before they create water quality problems due to decreased biological activity. A better understanding of these dynamics could impact the nitrogen removal rate estimates for these technologies and possibly allow greater discharge levels in the winter.*

- The technical experts from the Commission noted that they are considering a white paper of this issue. From regulatory standpoint, a TMDL is constant throughout the year, but it might be prudent to seek an adaptable standard based on seasonal factors (e.g., climatology, population flux).
- *Other participants disagreed with the statement that there is no water quality problem in the winter.*
- *It was shared that Falmouth has already started taking measurements to understand seasonal dynamics.*

- *One participant expressed concern that climate change and other externalities were not part of the discussion.*
  - The facilitator confirmed that climate change and other considerations will be carried forward in the next phase of meta-analysis.
  - *Other participants argued that it is not the town's responsibility to address climate change, but that of the federal and state government, and that the primary concern before these working groups is pollution control.*

Takeaways from the scenarios

The group agreed to the following main takeaways provided by the scenario analysis and discussion:

- *The use of non-traditional alternatives can avoid the need for sewer infrastructure.*
- *A suite of approaches will likely be necessary to achieve nitrogen reductions.*
- *The decision about what specific combination of technologies to apply must be locally-driven. It should also be based on specific constraints within a watershed as well as the community's priorities and risk-tolerance.*

IV. ADAPTIVE MANAGEMENT

Ms. Daley explained that an adaptive management approach is critical because of the degree of uncertainty present in many of these alternatives. The idea behind this concept is to implement and monitor the non-traditional technologies and if they prove to be ineffective in meeting target nitrogen reduction goals, to fall back on the traditional approaches.

Defining Adaptive Management

Ms. Daley provided the Commission's current definition of 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 cost effective and efficient ways."

She then solicited feedback and suggested revisions from the Working Group. Several participants offered revisions, including (see italicized texts):

"A[n] *integrated* and *iterative* approach for addressing *regulatory and performance* uncertainties by linking science and monitoring to decision-making and adjusting implementation , as necessary, to increase the probability of meeting water quality goals in cost effective*, socially acceptable, and ecologically sustainable ways, in a specified period of time."*

Ms. Daley explained that feedback on this definition from all 11 Work Groups would be considered, and that the Commission would share the proposed revisions after the third series of workshops.

- *One participant asked how an adaptive management plan might be implemented.*
    - Ms. Daley replied that the concept will be integrated into the 208 Plan Update. She also said that the Commission is talking to federal and state regulators about using the definition as a framework for approving local and municipal plans in the future.

V. PREPARING FOR JANUARY-JUNE 2014

Triple Bottom Line (TBL) Analysis

Kristy Senatori, Deputy Director of the Cape Cod Commission, presented on the work that the Commission has done in concert with AECOM to develop a Triple Bottom Line model. First, she defined Triple Bottom Line Analysis as a full accounting of the financial, social, and environmental consequences of investments or policies ("People, Profit and Planet"). She also noted that TBL analysis is often used to:

- Evaluate scenario alternatives and rank them against each other; and
- Report to stakeholders on the public outcomes of a given investment.

In explaining why the Commission has decided to pursue a TBL model, Ms. Senatori shared that it will allow it to:

- Consider the financial, environmental, and social consequences of water quality investments and policies in Cape Cod
- Evaluate the "ancillary" or downstream consequences of water quality investments, not just direct phosphorous or nitrogen level reductions.

She also explained that AECOM is working with Commission staff and stakeholders to develop criteria that integrate social, environmental, and financial considerations into the TBL model. These include:

- **Social**: System Resilience (i.e. how communities respond to natural hazards), Employment, Property Values, Ratepayer Distribution, Recreation and Open Space, Fiscal Impacts
- **Environmental**: Marine Water Quality, Fresh Water Quality, Climate, Habitat
- **Financial**: Municipal Capital Costs, Municipal Other Costs, Property Owner Capital Costs, Property Owner Other Costs.

Ms. Senatori then showed how three different hypothetical scenarios (minimum cost, cost effective, and maximum performance) run through the model ranked comparatively, taking into consideration these social, environmental, and financial factors. She explained the model will be finalized by January or February 2014, and that the Commission will be using it over the next six months to assist in scenario evaluations and to address the "no action" alternative to water quality management.

- *One participant asked if seasonal human population dynamics were considered?*
    - Ms. Senatori responded that yes, the Commission has spent a lot of time on that aspect.
- *Another was interested in whether affordability and adverse economic impacts to certain populations was factored in.*
    - Ms. Senatori responded that it is a great point and that it will come into play over next series of meetings.
- *Another noted that regulatory incentives and disincentives were left out of the TBL model.*
    - Ms. Senatori responded that these two components will be considered moving forward by the Regulatory, Legal, and Institutional group.
- The facilitator noted that EPA has been supportive of the TBL model in efforts made by other regions, e.g., New Hampshire.

Next Steps

Ms. Senatori explained to the Working Group the anticipated next steps of the 208 Plan Updated include:

January 2014	Assemble all 175 stakeholders across Cape Cod for a one-day Stakeholder Summit (tentatively scheduled for Jan 31) to discuss further planning, share the outcomes from stakeholder meetings, and form four sub-groups representing the Upper-, Mid-, Lower-, and Outer-Cape.

	These groups will likely meet three more times (February, March, April). Also likely assemble an *ad-hoc* meeting discuss monitoring protocols for different technologies. The four sub-groups meet to further develop local scenarios and run them through the TBL model, discussions related to the Regulatory, Legal and Institutional work group, and implementation and financing and affordability considerations.
June 1, 2014	Submit a draft plan to DEP.
June – Dec 2014	Collect and consider public comments on the draft plan.
January 2015	Submit final plan to DEP

Ms. Senatori noted that the Commission would send out more information about the sub-groups, and that they will have 10-15 participants on them.

Shared Principles

The facilitator discussed the following list of shared principles that have been vetted by this Working Group over the three meetings, and suggested that these principles be considered as the planning process moves forward and as more details emerge about the various technologies:

- Affordability
- Climate change (i.e., awareness of it as a dynamic, and what effect technologies have in contributing to it)
- Ease of implementation ("low hanging fruit")
- Growth assumptions
- Multiple benefits (e.g., wildlife)
- Reliability and confidence
- Regulatory/legal
- Resiliency
- Public acceptance
- Speed and timing (re: adoption, re: realization of benefits)
- Unintended consequences
- "Real costs" (financial as well as ecological)

Several group members added additional principles, including:

- *Consequences of no action*

- *Consideration of scarce/valuable resources*
- *Large scale benefits/impacts beyond Cape Cod*
- *Confidence in baselines*

Mr. Thompson then invited the group to nominate representatives from this work group to be sent to the larger sub-basin work group (see Action Items).

VI. PUBLIC COMMENT AND FINAL THOUGHTS

- *One participant asked if the fact sheets had been updated.*
    - Commission staff replied that, yes, they had incorporated the comments.

Mr. Thompson and Ms. Daley thanked the group for their participation and adjourned the meeting.

APPENDIX A

Upper Cape West & South Workshop Three
December 2, 2013
Participant List

1. Earle Barnhardt - The Green Center
2. Michael Ciaranca - Sate of MA, Joint Base Cape Cod
3. Cynthia Coffin - Bourne BOH
4. Wesley Ewell - Bourne Wastewater Coordinator
5. Nate Jones - Health Agent, Town of Sandwich
6. Sia Karplus - CWMP, Falmouth
7. Hilde Maingay - The Green Center
8. Dan Milz - University of Illinois, Inst. of Envir. Science and
9. Ed Nash - Golf Course Supt. Assoc.
10. Mark Owen - AECOM
11. Charles Passios - Golf Course
12. Jerry Potamis - Wastewater Superintendent, Falmouth
13. Sallie Riggs - Wastewater Advisory Committee, Bourne
14. Linda Zuern - Board of Selectmen, Bourne
15. Ron Zweig - Falmouth WQMC

Cape Cod Commission Staff:

Patty Daley - Deputy Director
Kristy Senatori - Deputy Director
Shawn Goulet - GIS Analyst
Heather McElroy - Natural Resources/Land Protection Specialist

Scott Michaud - Hydrologist
Maria McCauley - Fiscal Officer/Staff Support

CBI Staff

Facilitator: Doug Thompson
Note-taker: Lauren Dennis

Cape Cod 208 Area Water Quality Planning
Herring River, Harwich Watershed Working Group

Meeting Three
Thursday, December 5, 2013
8:30 am- 12:30 pm
Harwich Community Center 100 Oak Street Harwich, MA

Meeting Agenda

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*

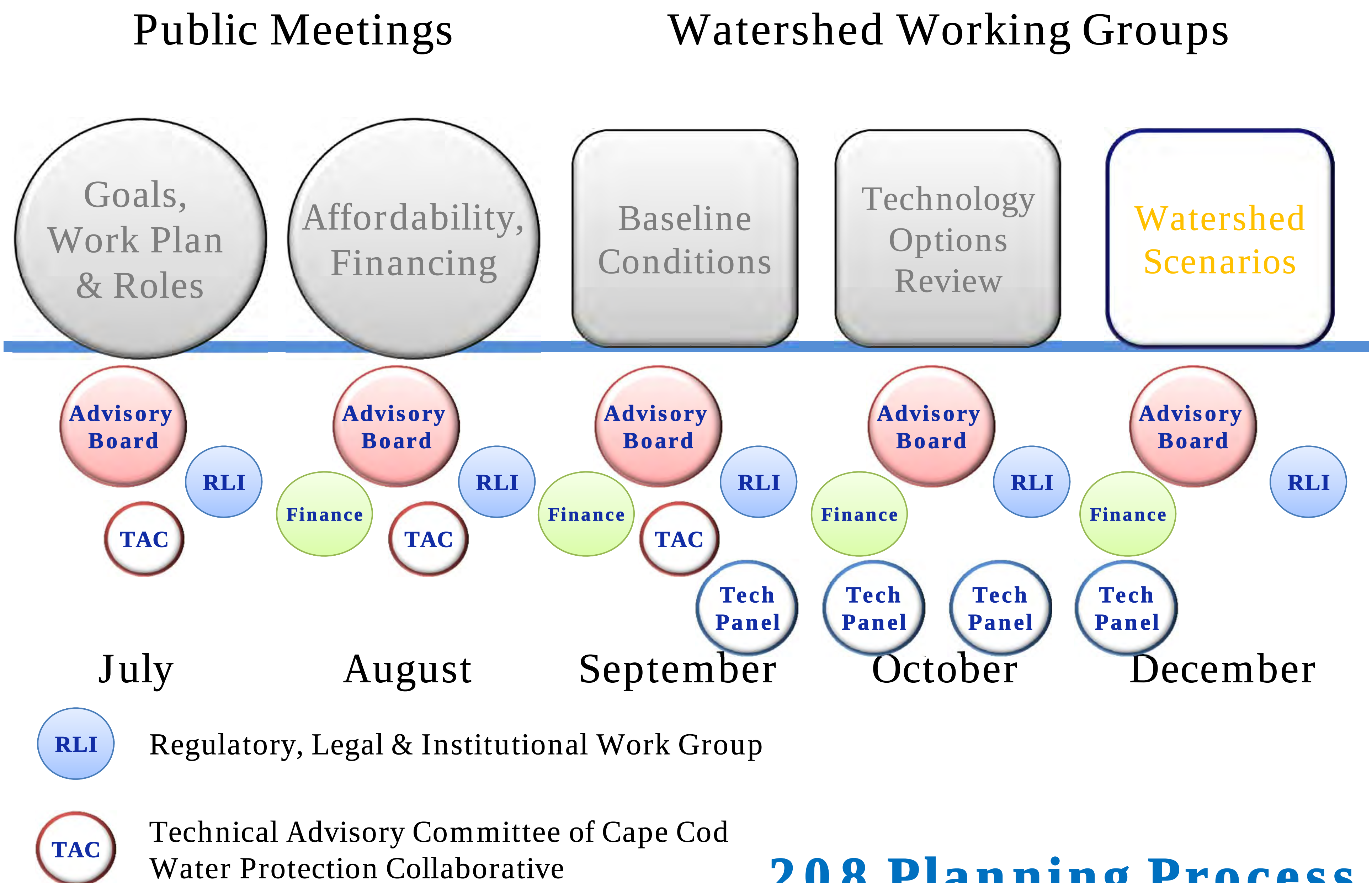
- Triple Bottom Line approach
- Identify Shared Principles and Lessons Learned
- Describe Next Steps

12:15 Public Comments

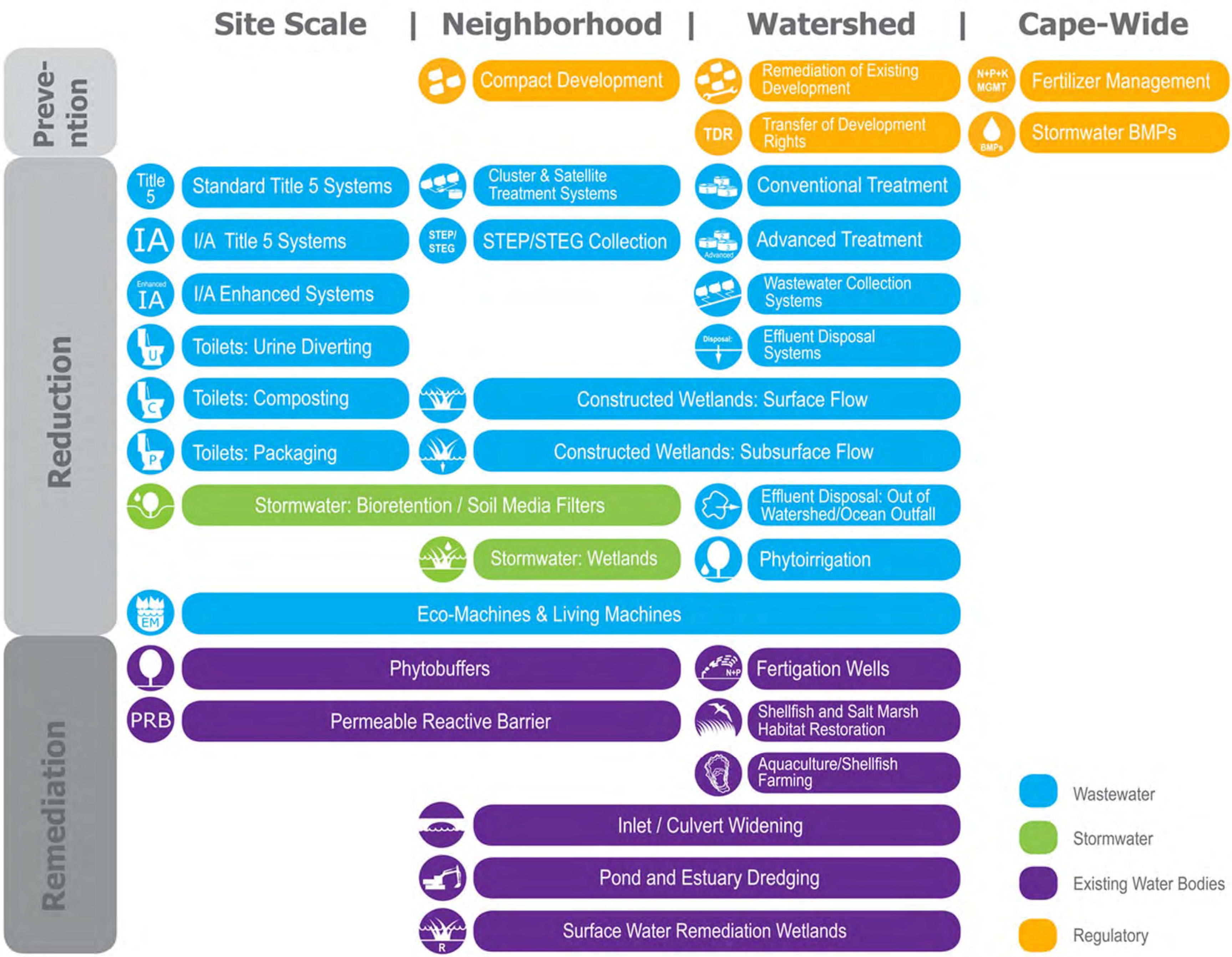
12:30 Adjourn

Herring River Group

Watershed Scenarios



208 Planning Process


Site Scale | Neighborhood | Watershed | Cape-Wide
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N+P
Fertigation Wells
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Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

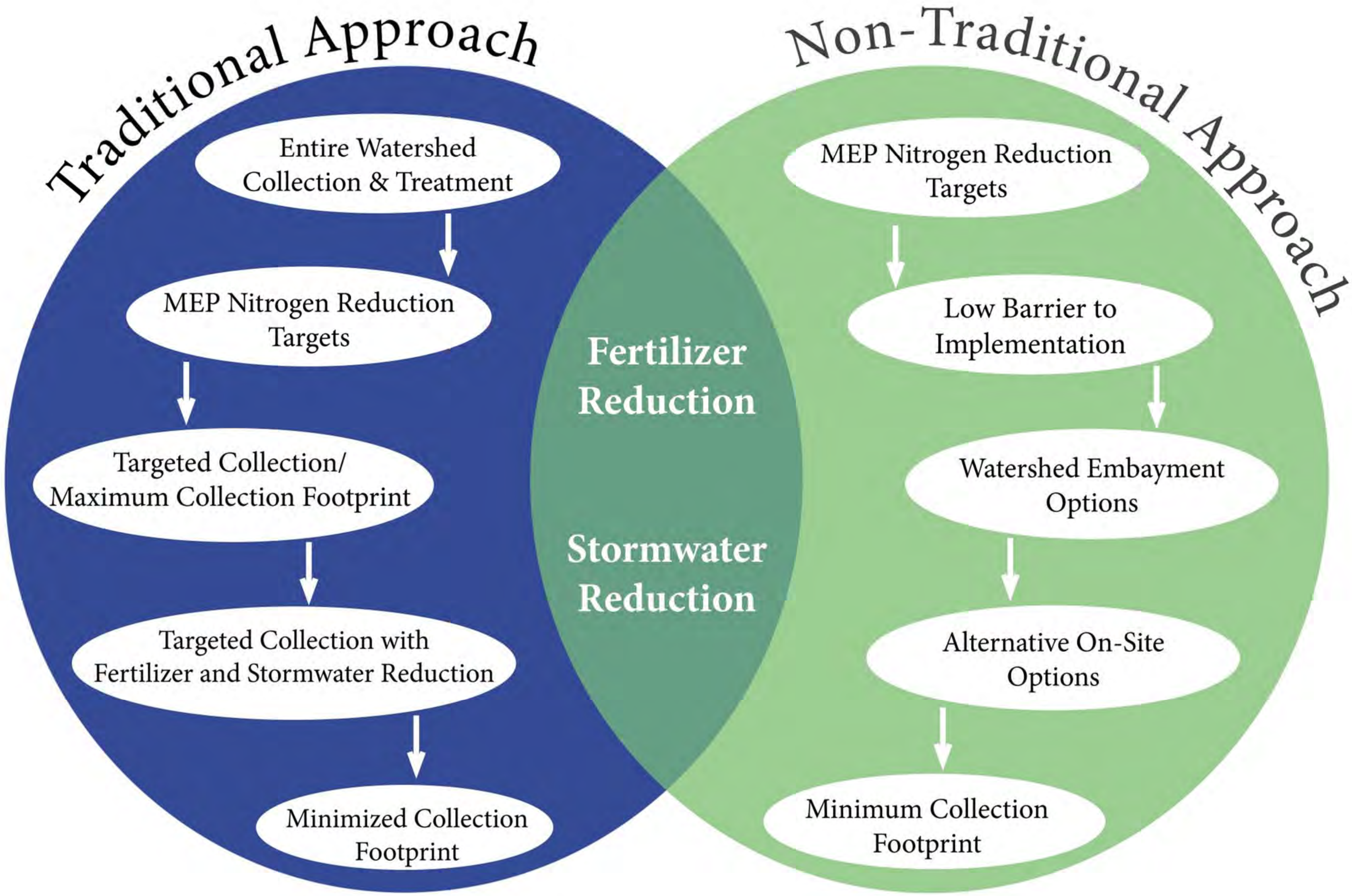
Watershed Scenarios

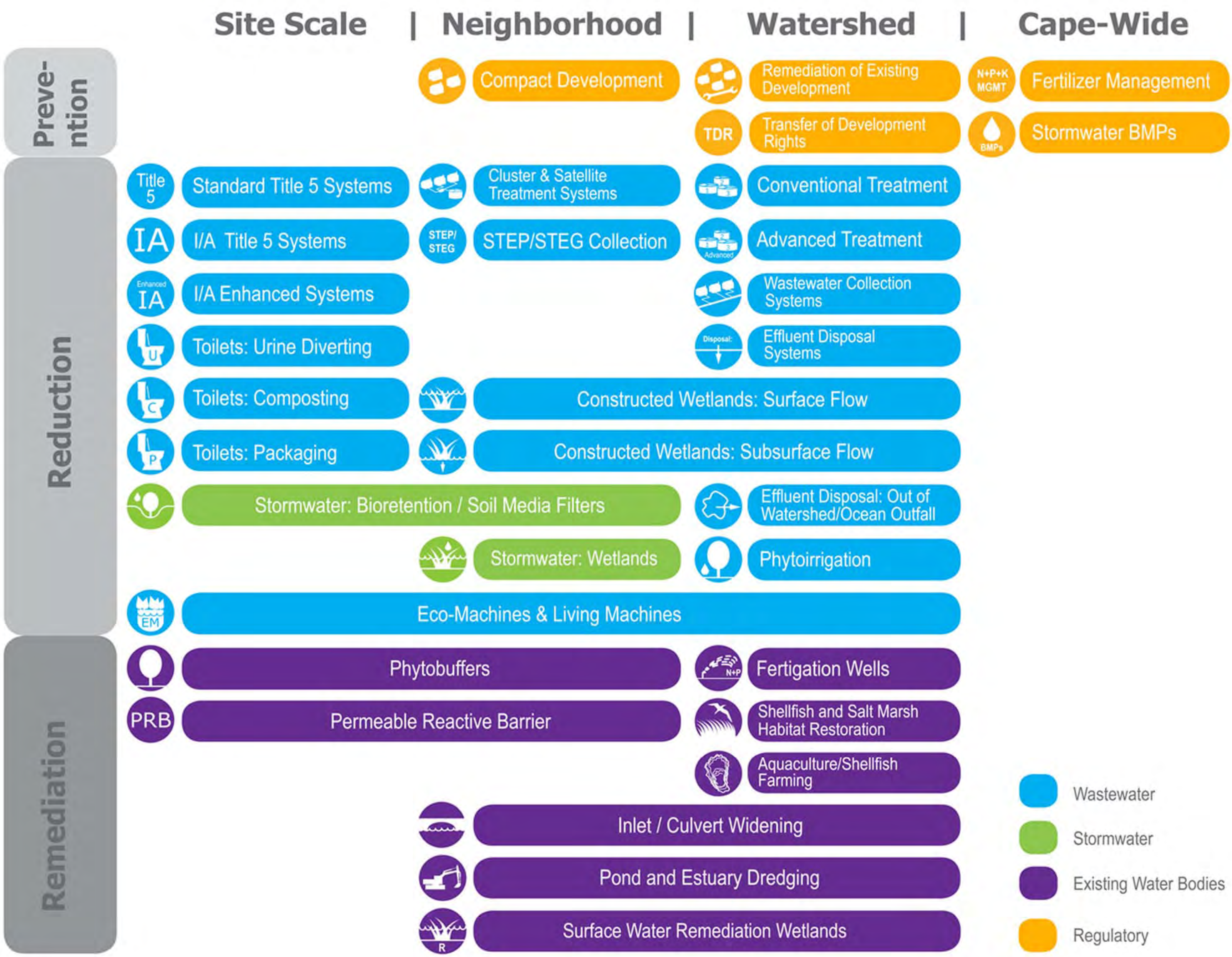
11 Working Group Meetings: Dec 2-11

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.

208 Planning Process


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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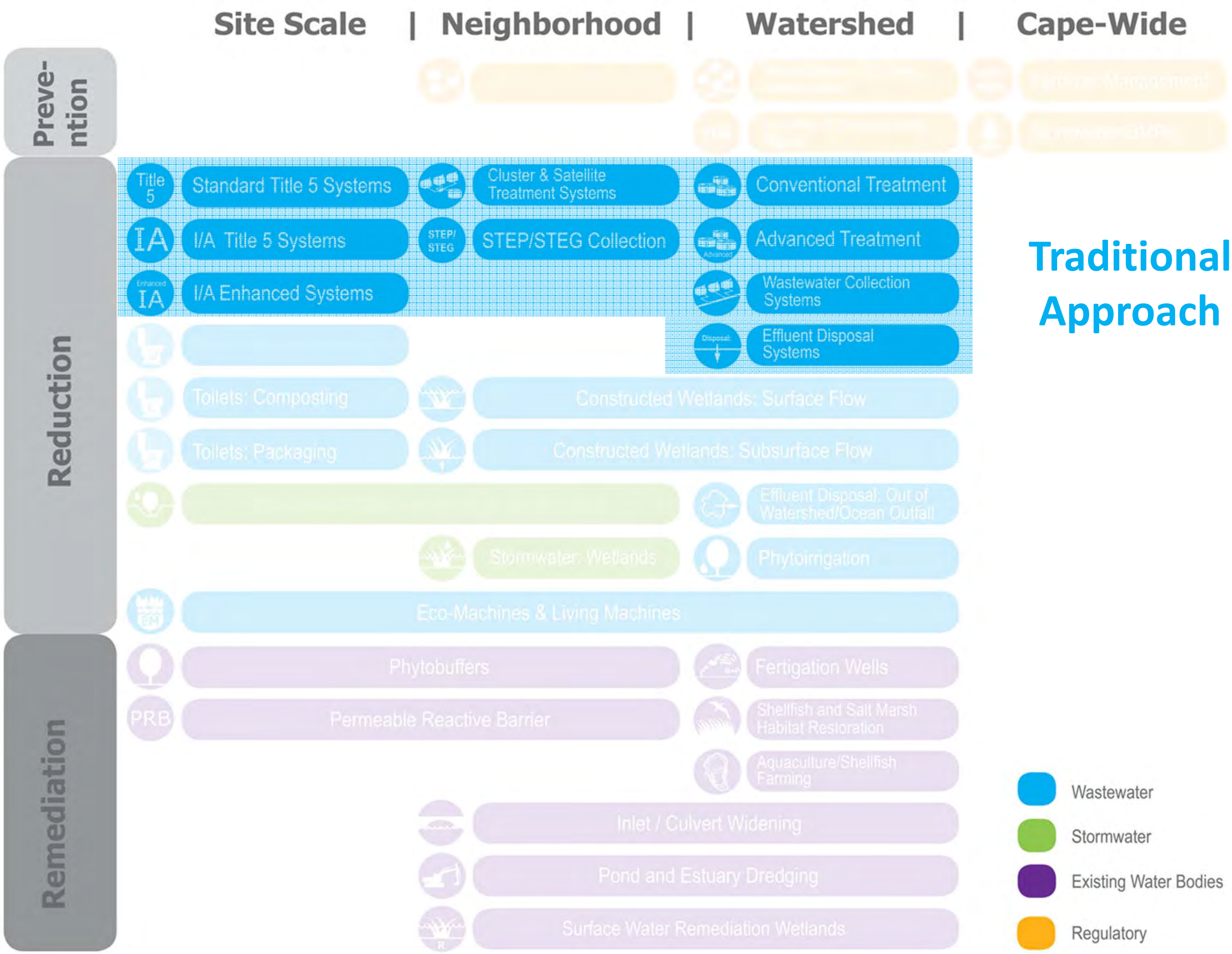
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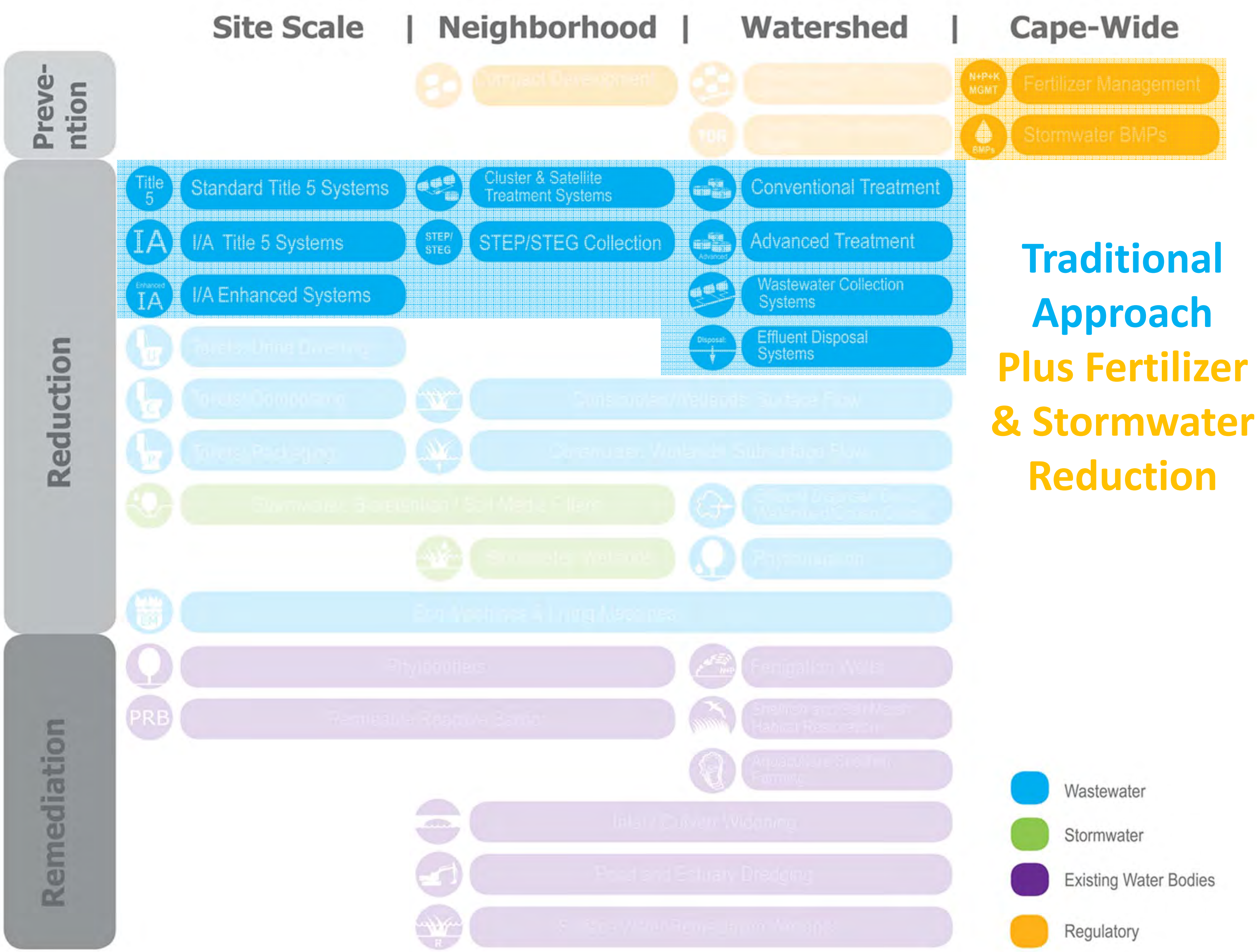
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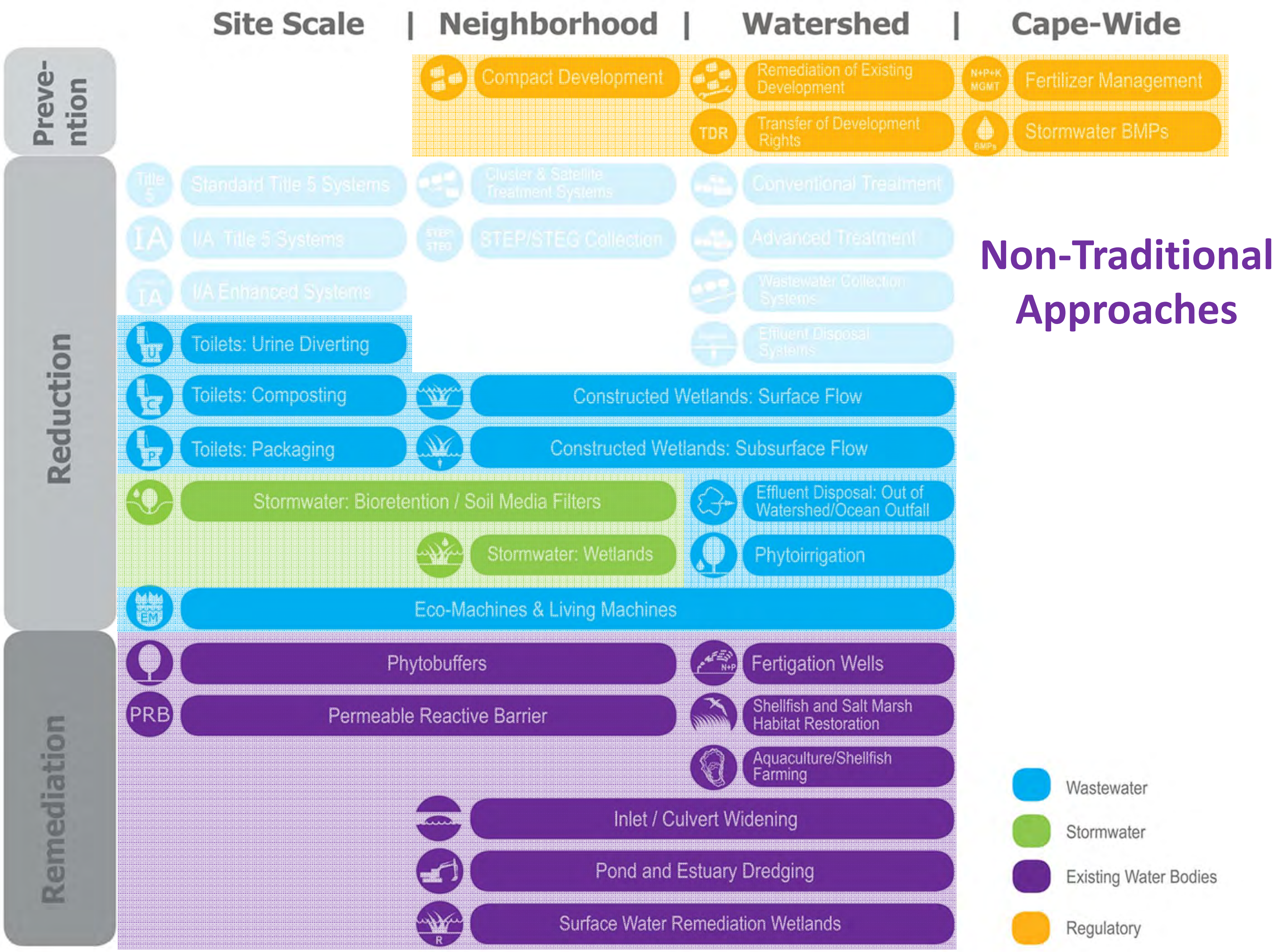

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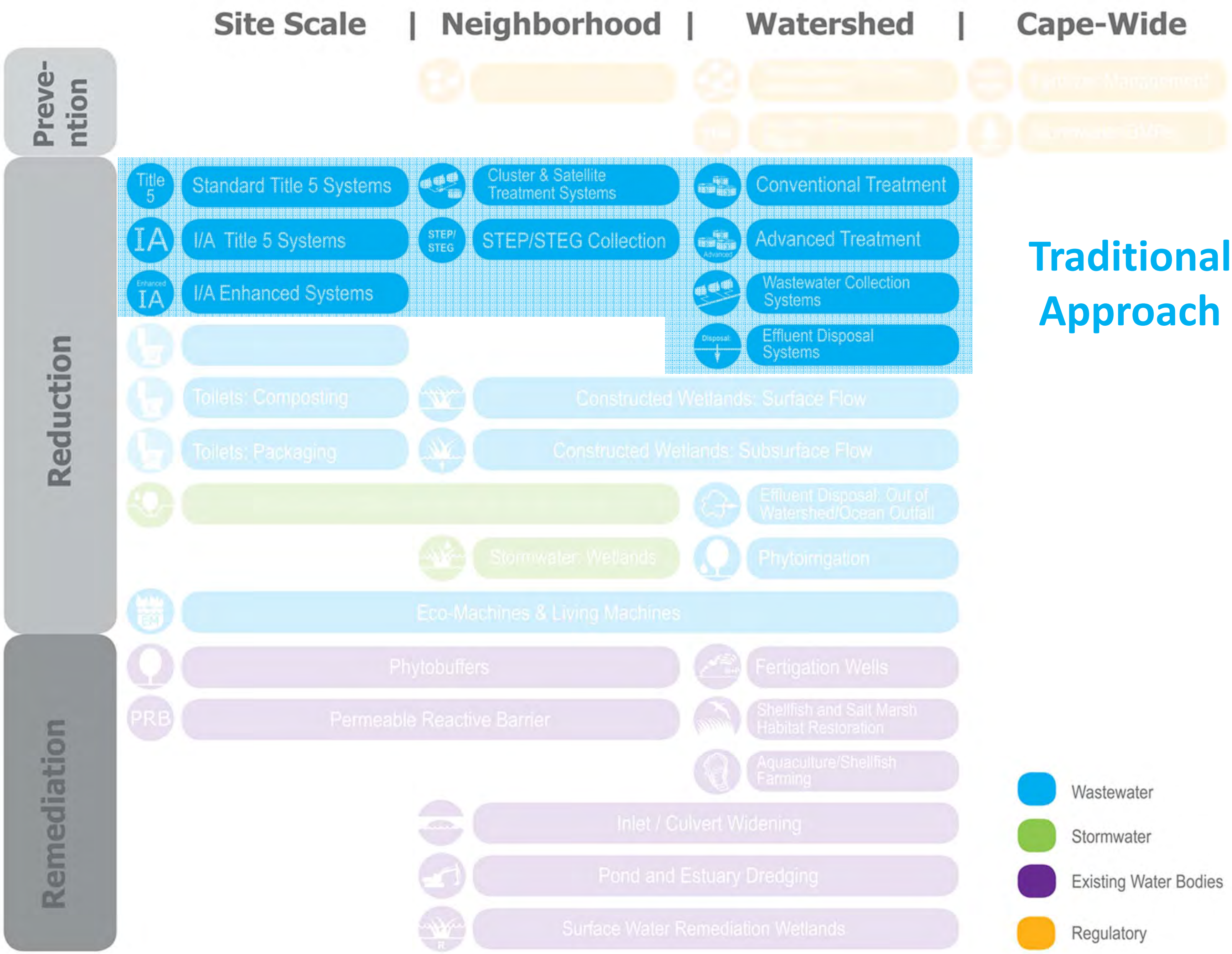
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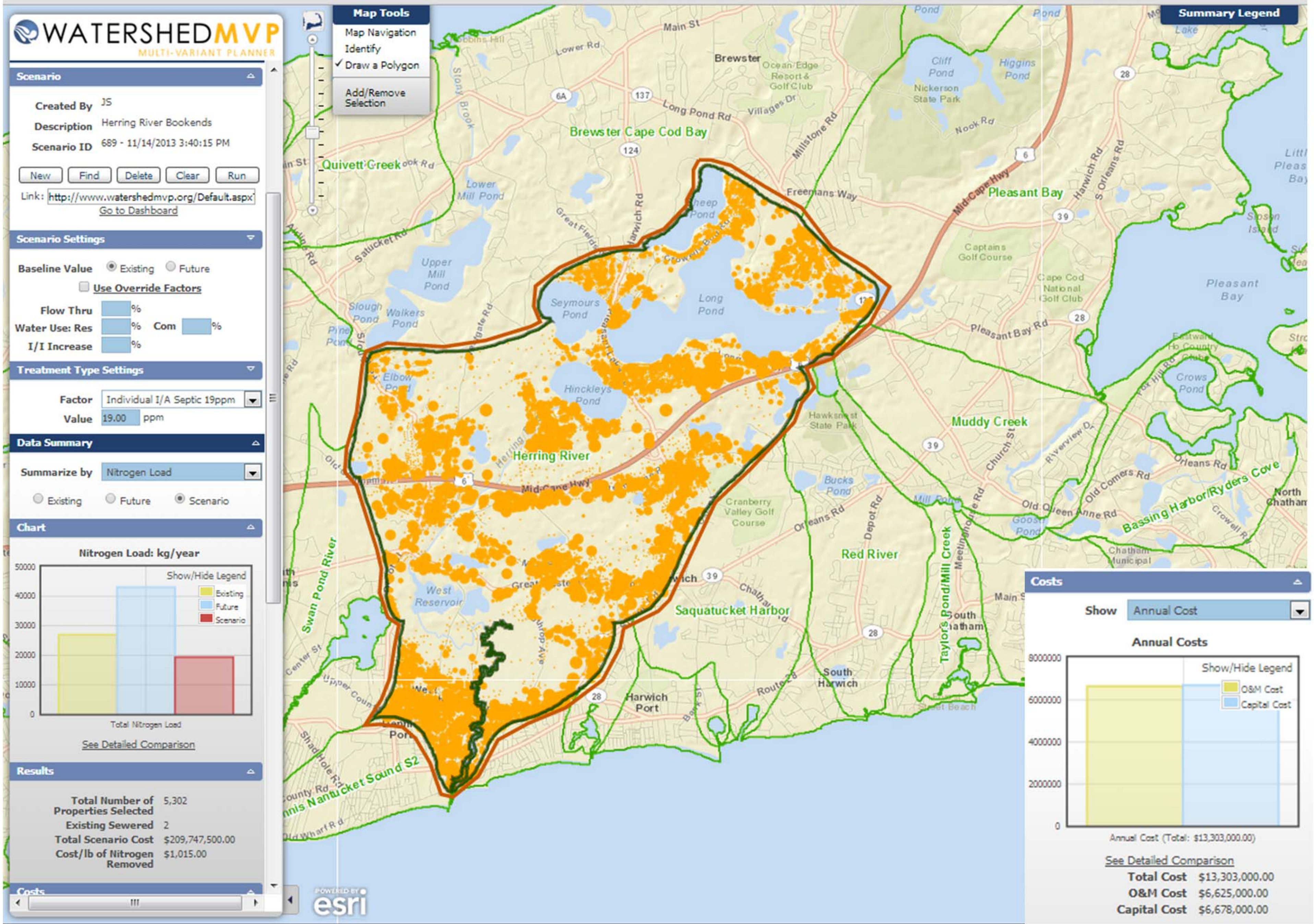
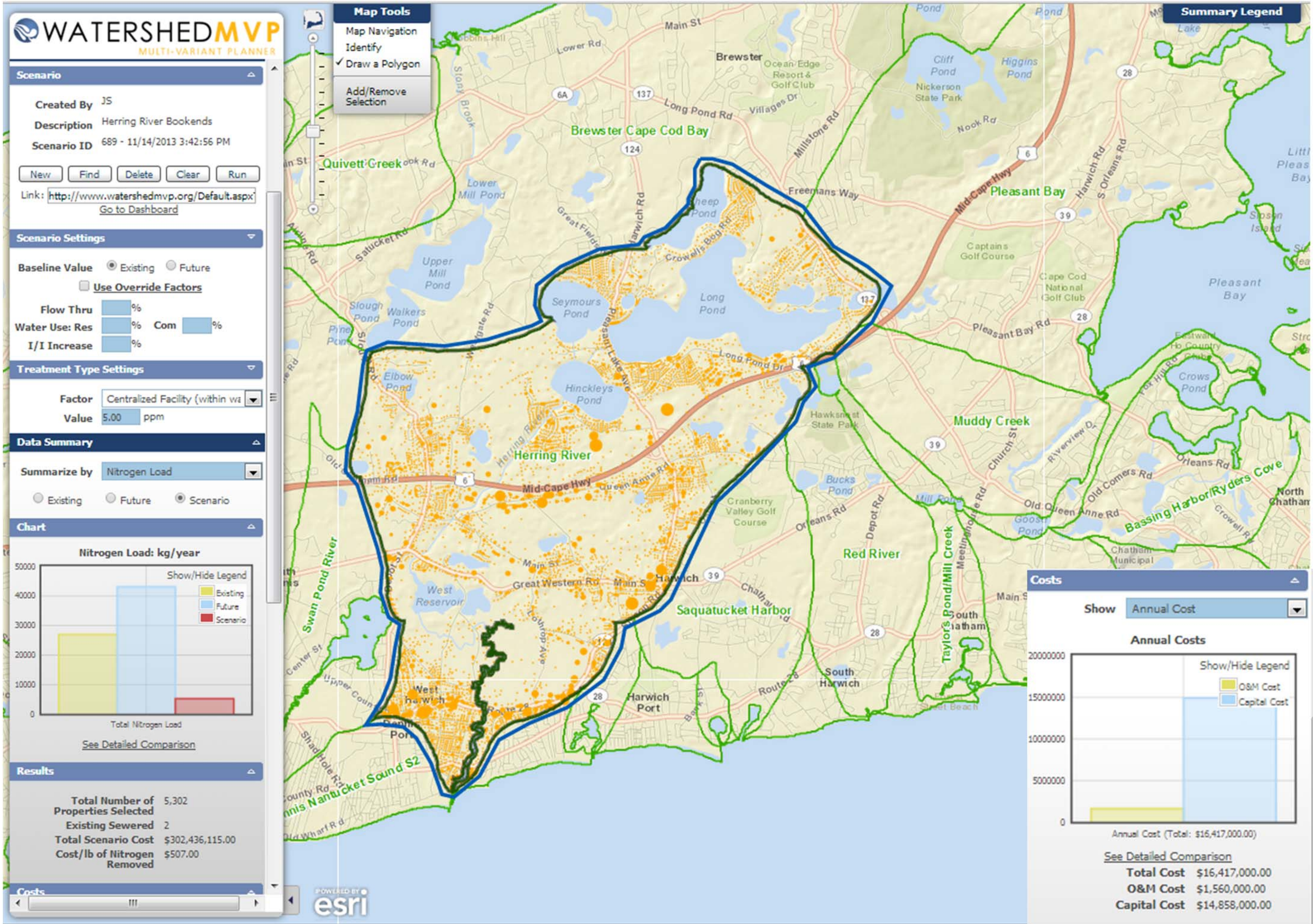
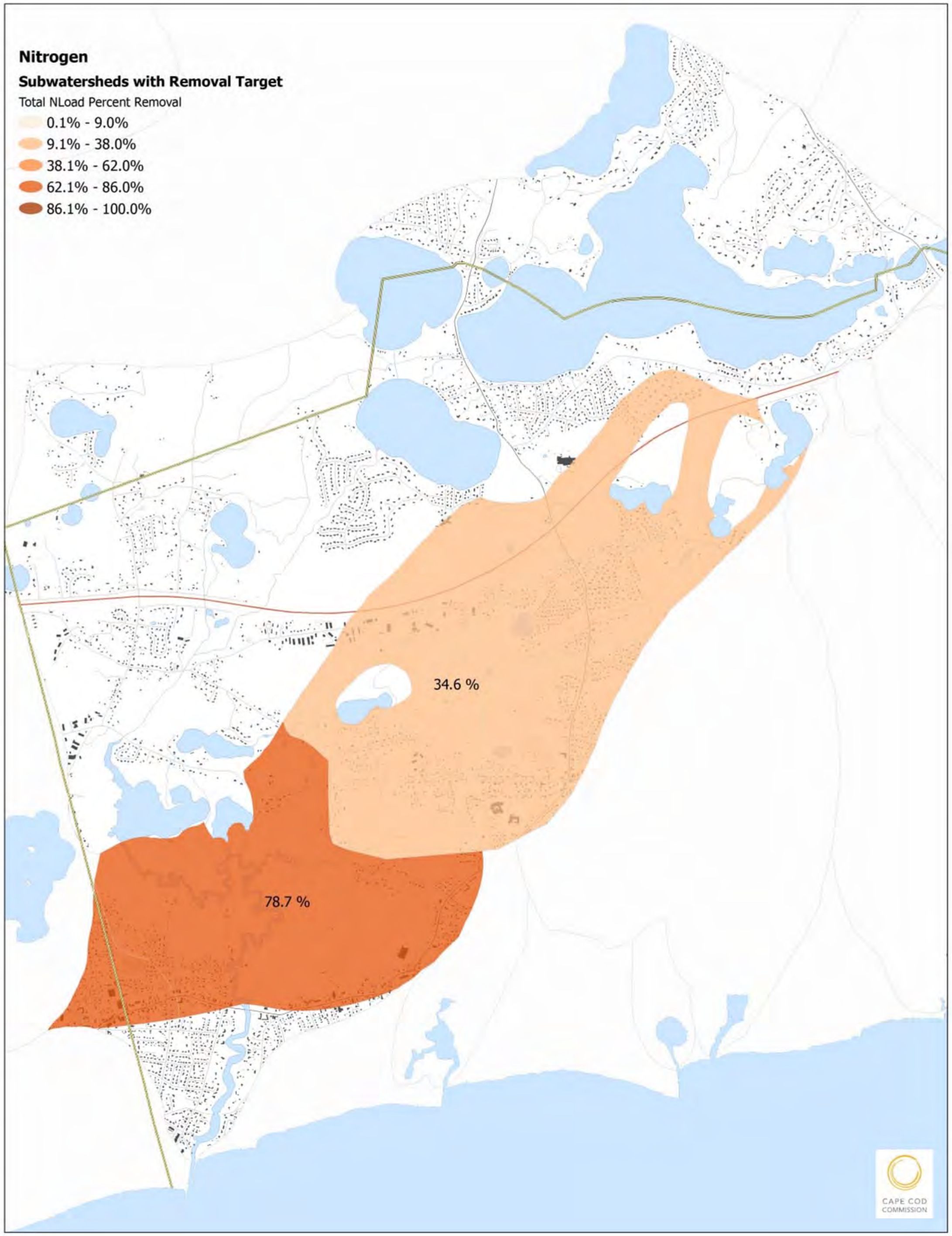
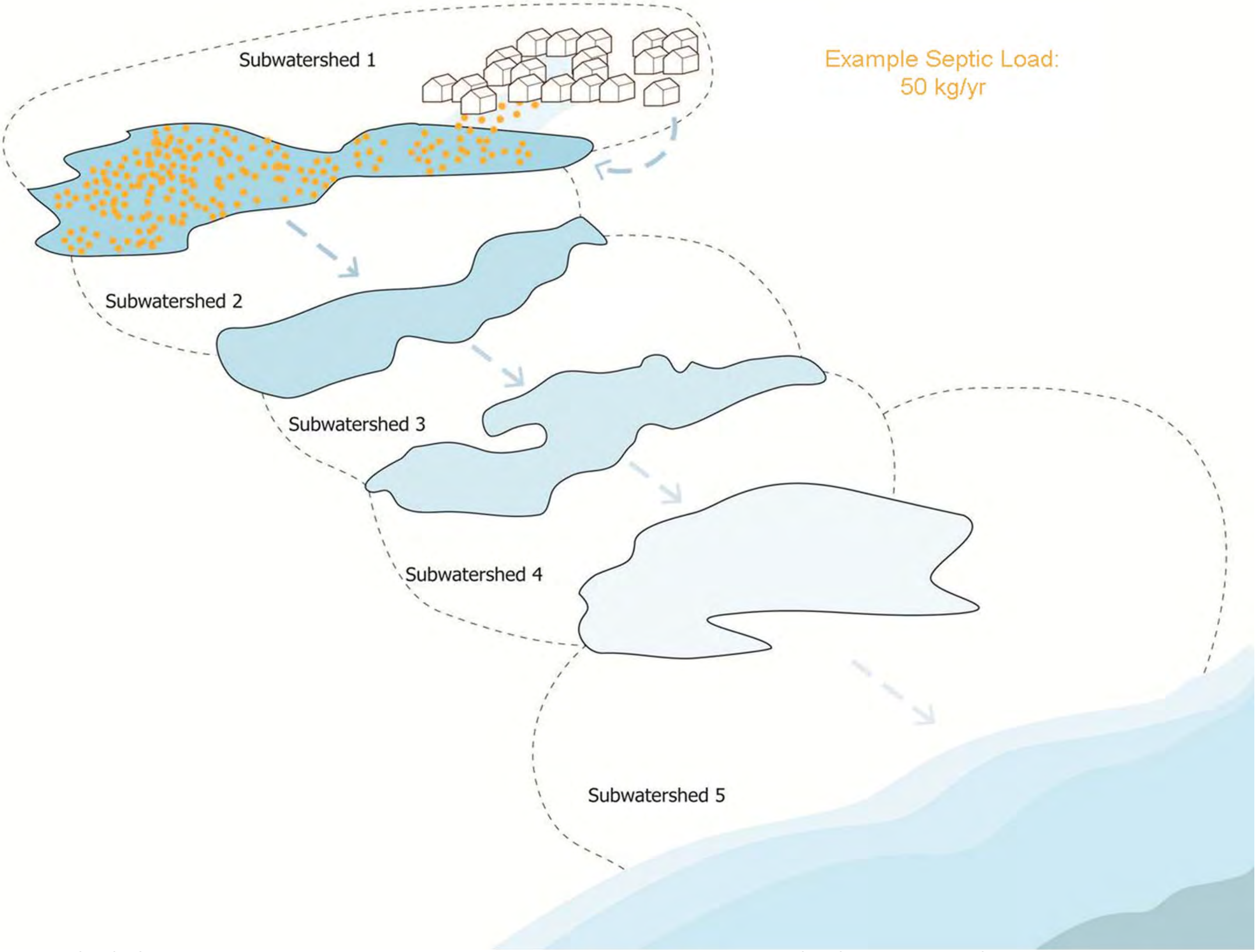
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems

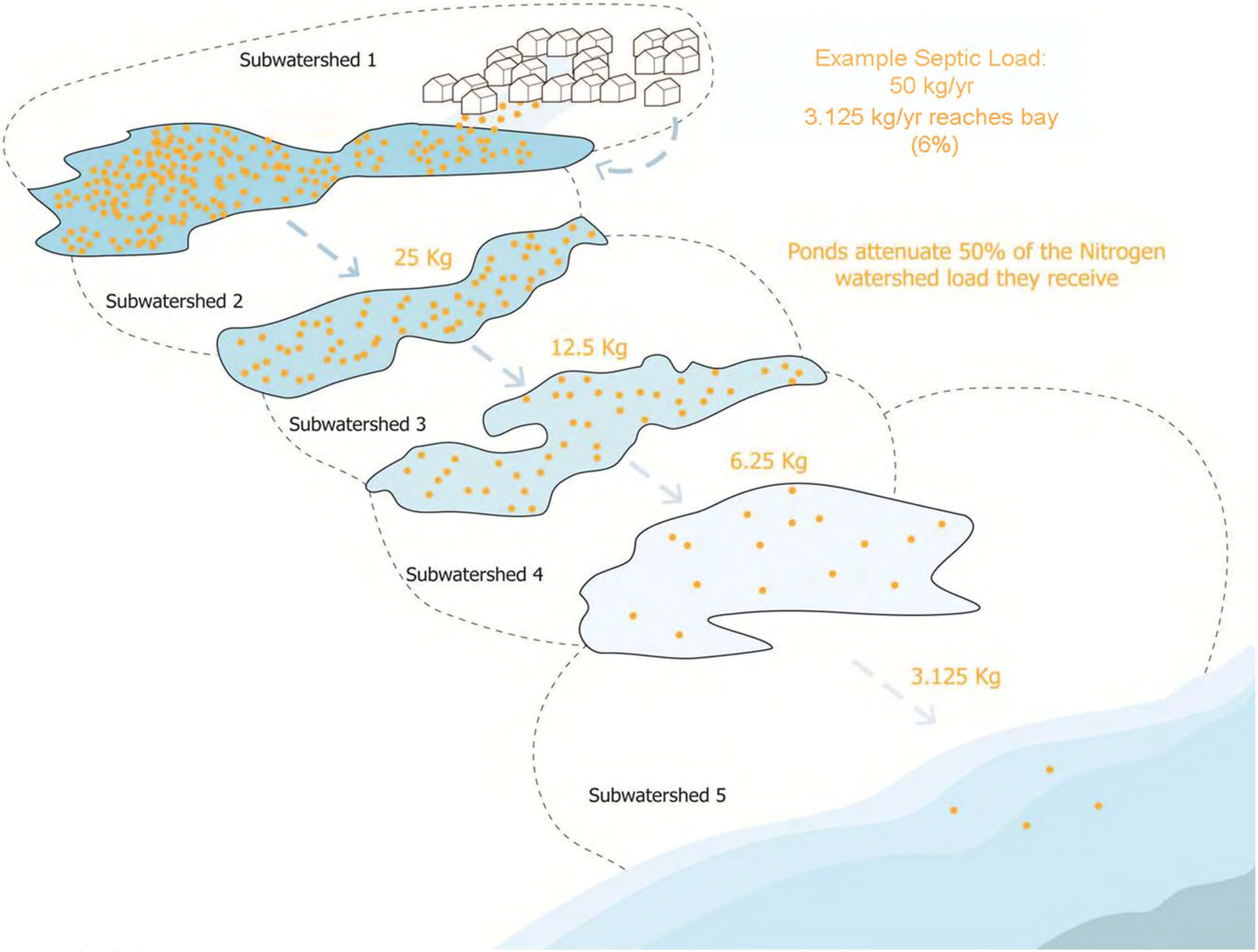


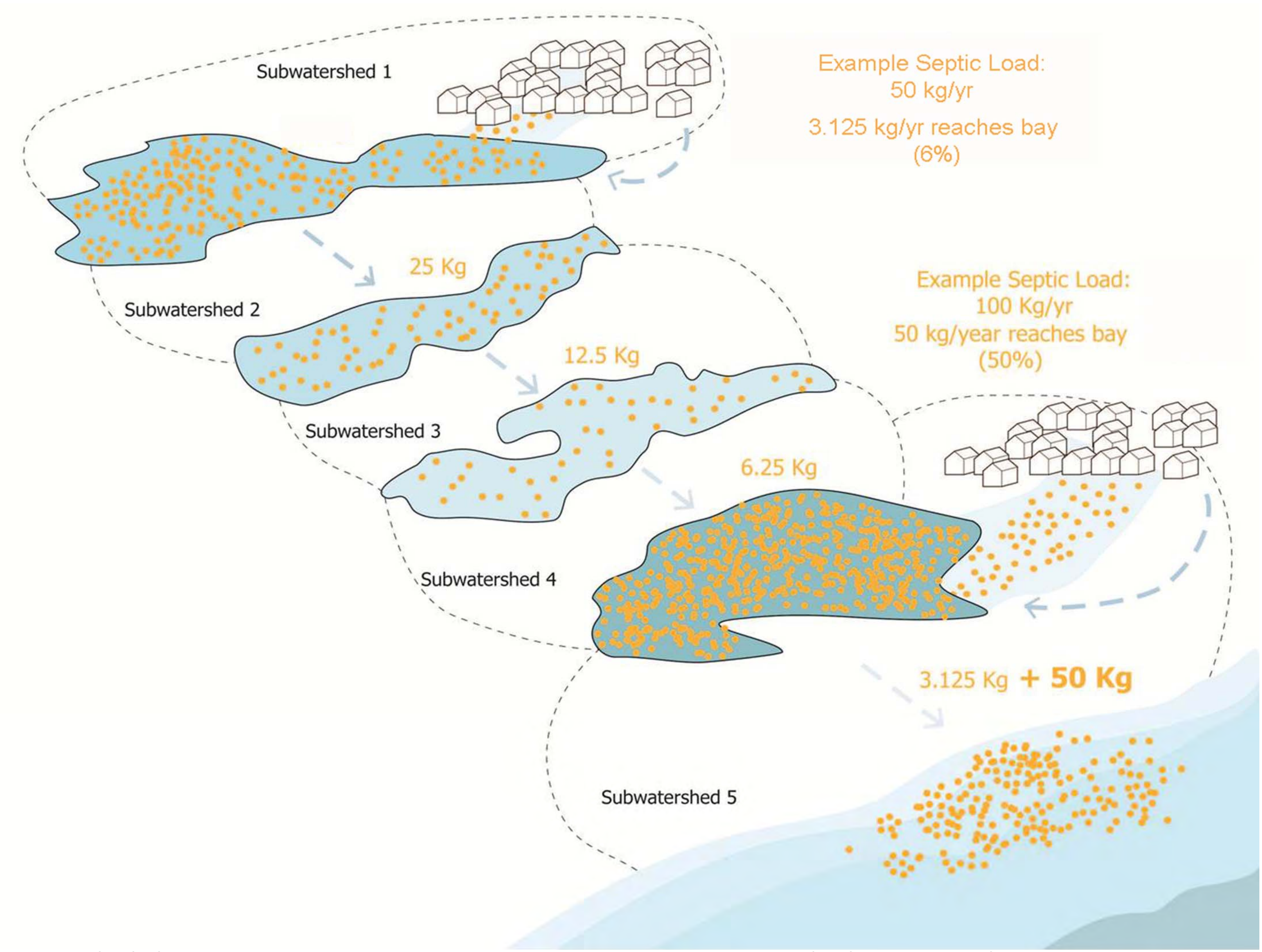
Watershed-Wide Centralized Treatment with Disposal Inside the Watershed




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%
34.6 %
78.7 %
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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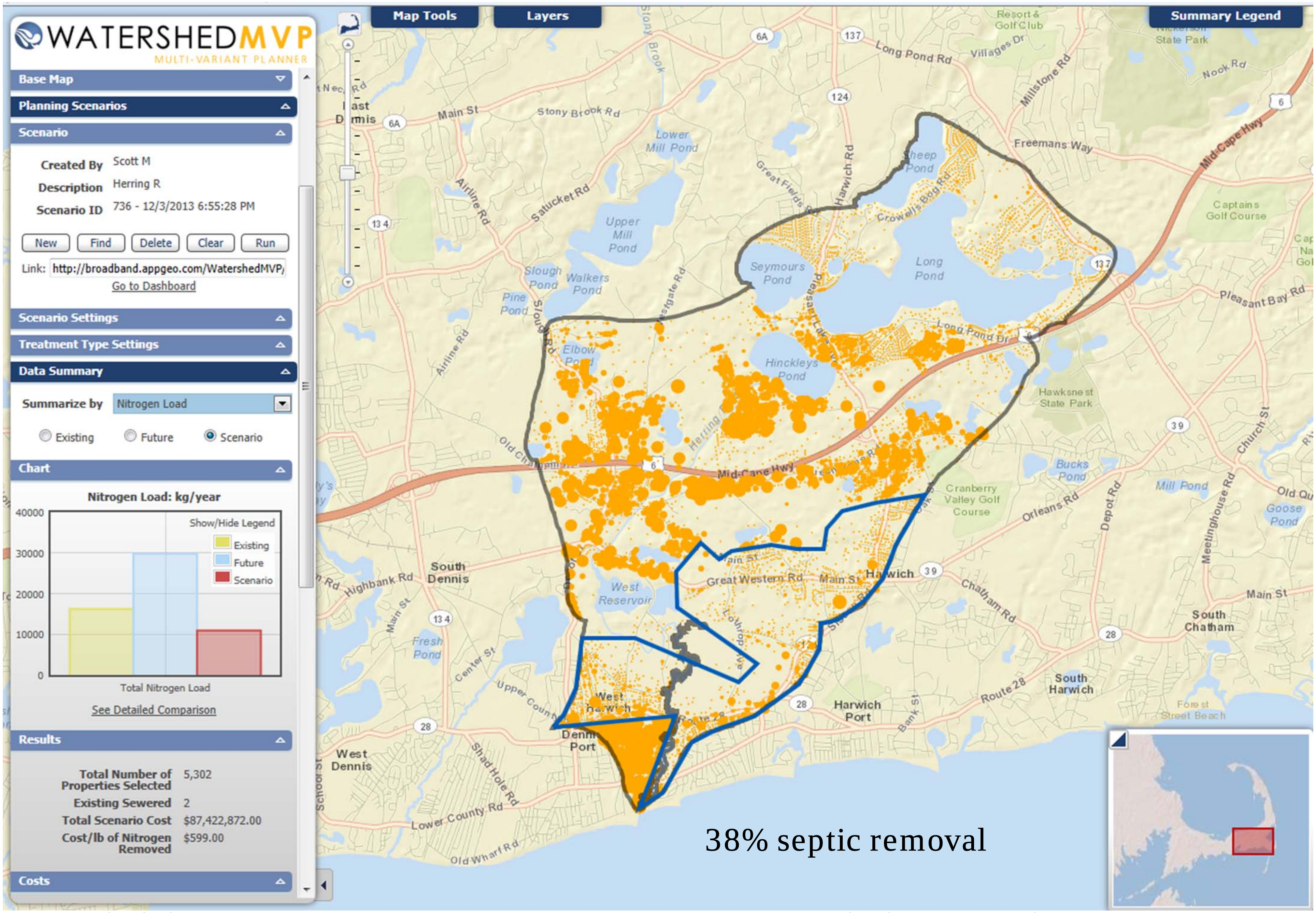
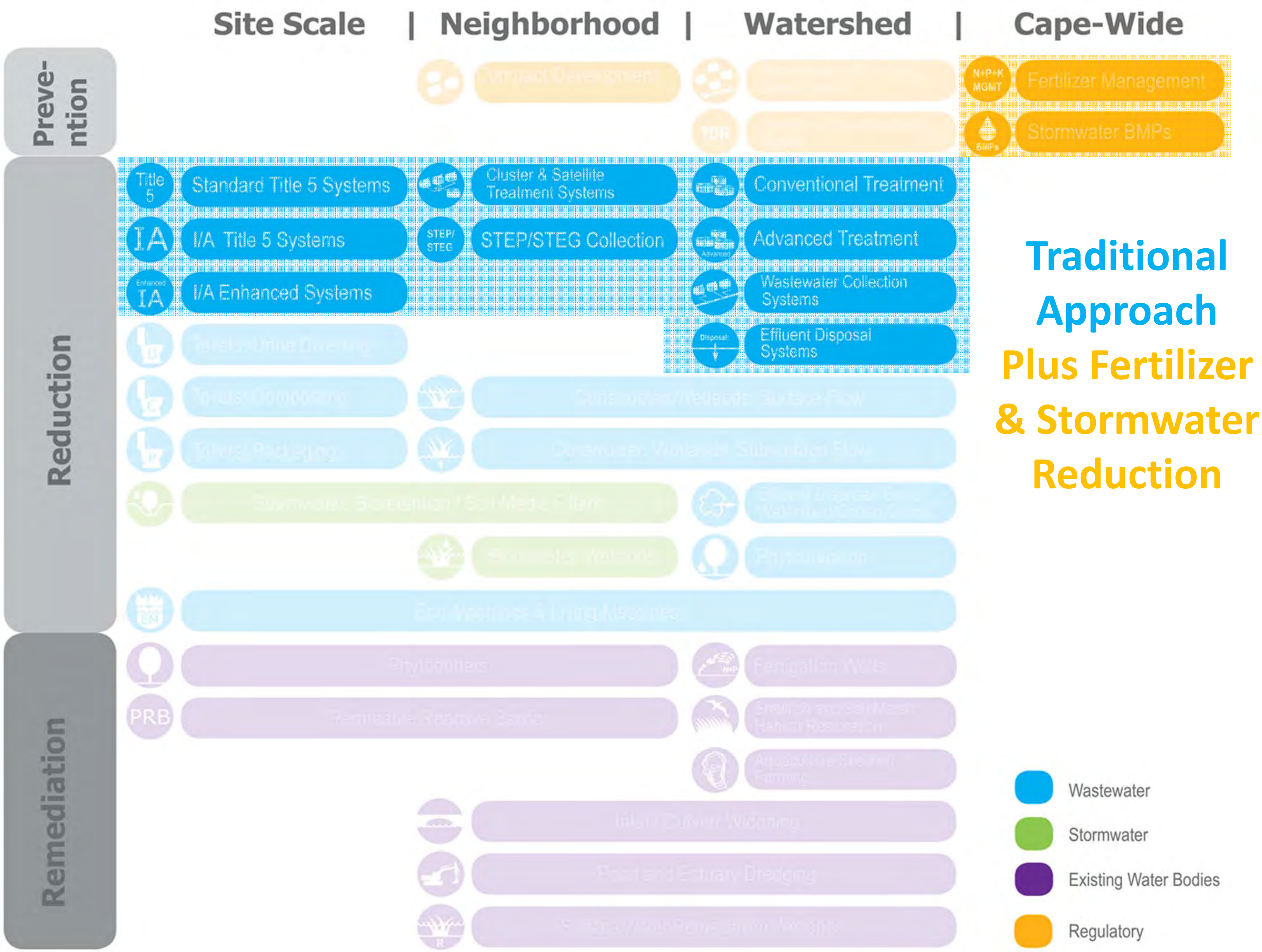
25 Kg
Subwatershed 2
Example Septic Load:
100 Kg/yr
50 kg/year reaches bay
(50%)
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg + 50 Kg
Subwatershed 5

Targeted Centralized Treatment with Disposal Inside the Watershed

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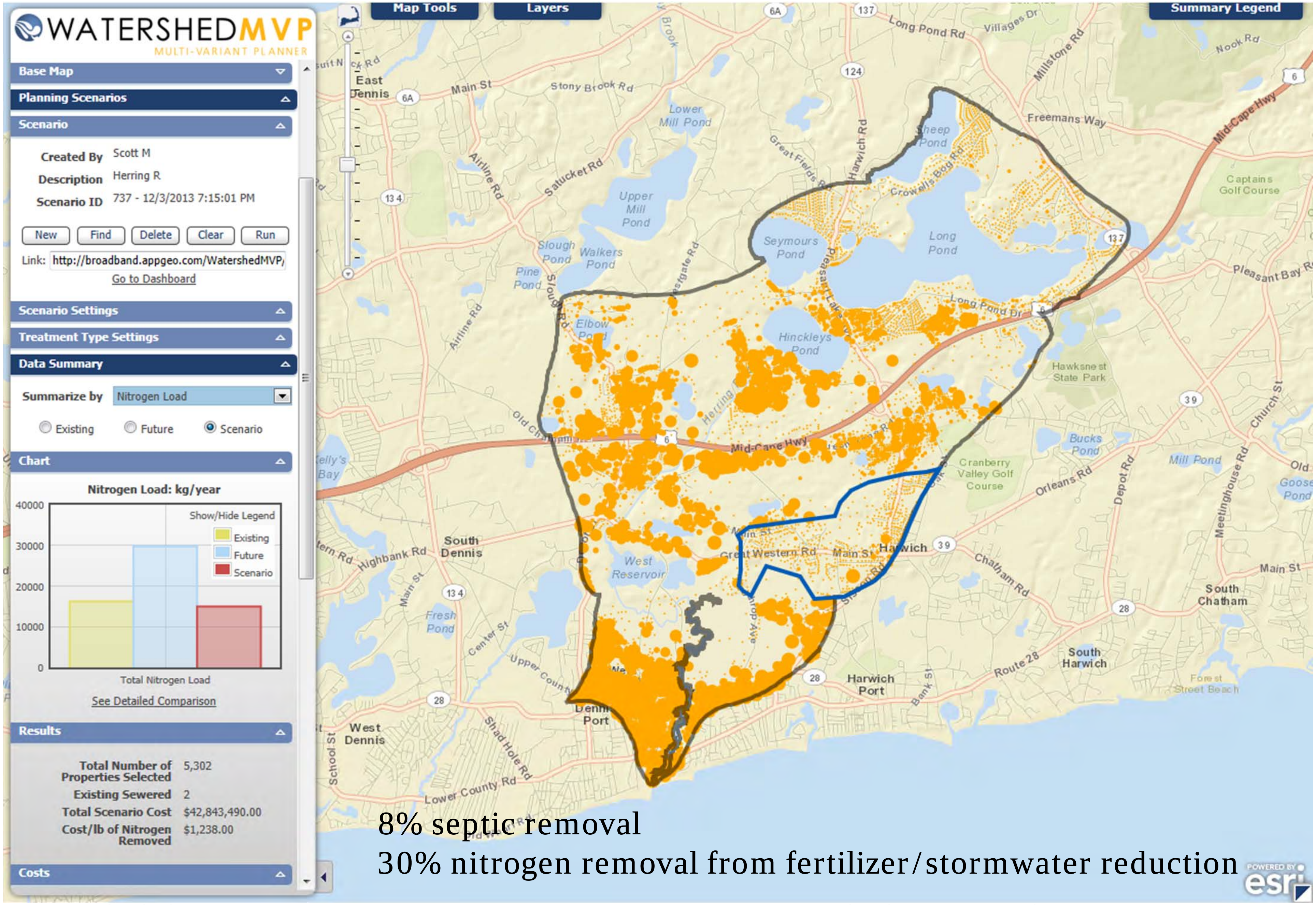
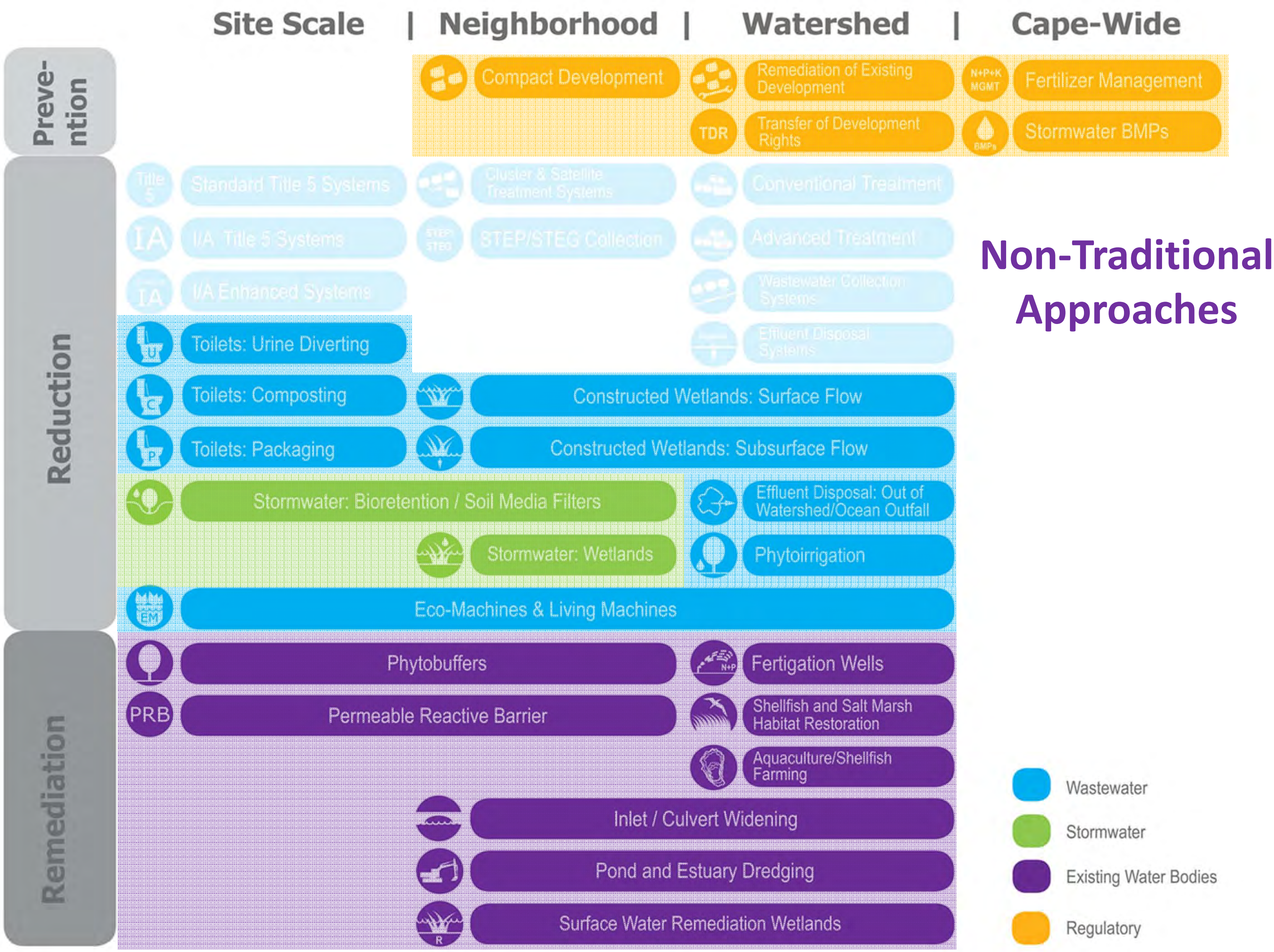
Targeted Centralized Treatment with a 50% Reduction in Fertilizer and Stormwater



8% septic removal
30% nitrogen removal from fertilizer/stormwater reduction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Stormwater
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Regulatory

Problem Solving Approach

Wastewater | Existing Water Bodies | Regulatory

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 Herring River

MEP Targets and Goals:			kg/day	Nitrogen (kg/yr)
Present Total Nitrogen Load:			62.816	22,928
	wastewater		38.602	14,090
	fertilizer			5,027
	stormwater			2,537
Target Nitrogen Load:			47.975	17,511
Nitrogen Removal Required:			**14.841**	**5,417**
Total Number of Properties:		5,302		

Watershed Calculator **Herring River**

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Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

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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	2,514	2,903	
Stormwater Mitigation	1,269	1,635	

Watershed Calculator — Herring River

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Stormwater Mitigation		1,269	1,635	
Watershed/Embayment Options:				
Permeable Reactive Barrier (PRB)	250 homes	770	865	$452

Watershed Calculator	**Herring River**			
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Fertigation Wells	1 golf course	136	729	$438

Watershed Calculator — Herring River

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Phytoremediation	1	acres	266	463	$254

Watershed Calculator **Herring River**

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Phytoremediation	1	acres	266	463	$254
Floating Constructed Wetlands	1000	cu feet	450	13	$61

Watershed Calculator **Herring River**

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Phytoremediation	1	acres	266	463	$254
Floating Constructed Wetlands	1000	cu feet	450	13	$61
Alternative On-Site Options:					
I&A Technologies	25	homes	58	-45	$1,607

Watershed Calculator — Herring River

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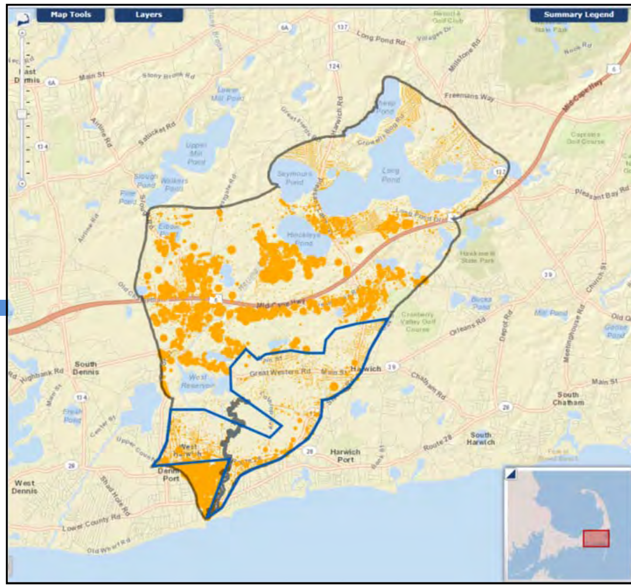
Floating Constructed Wetlands	1000	cu feet	450	13	$61
Alternative On-Site Options:					
I&A Technologies	25	homes	58	-45	$1,607
Sewering	-10	homes	-45	0	$1,000
		Total To Meet Goal (Kg/yr):		0	$102

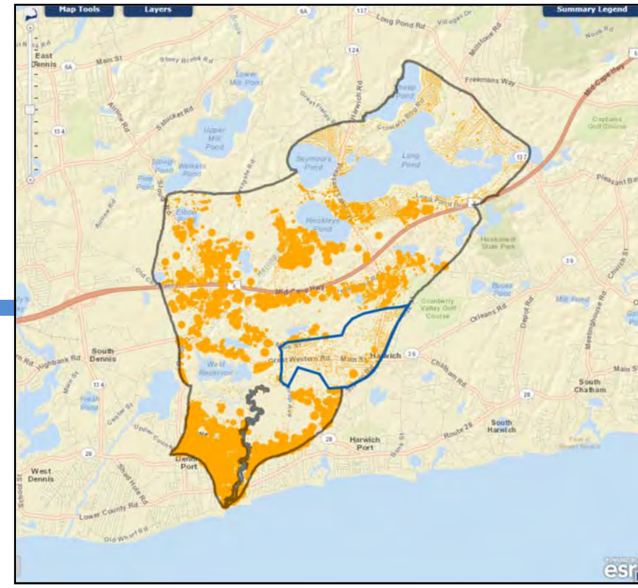
Scenario Comparison

Targeted Collection



- Achieves TMDL[1]
- Cost/lb N = $599
- Treated Flow = 222,000 gpd

Targeted Collection after a 50% reduction in fertilizer and stormwater



- Achieves TMDL[1]
- Cost/lb N = $1,238
- Treated Flow = 83,000 gpd

Collection is unnecessary is each alternative performs as presented in alternatives calculator.

[1] within 5% of goal

Adaptive Management:

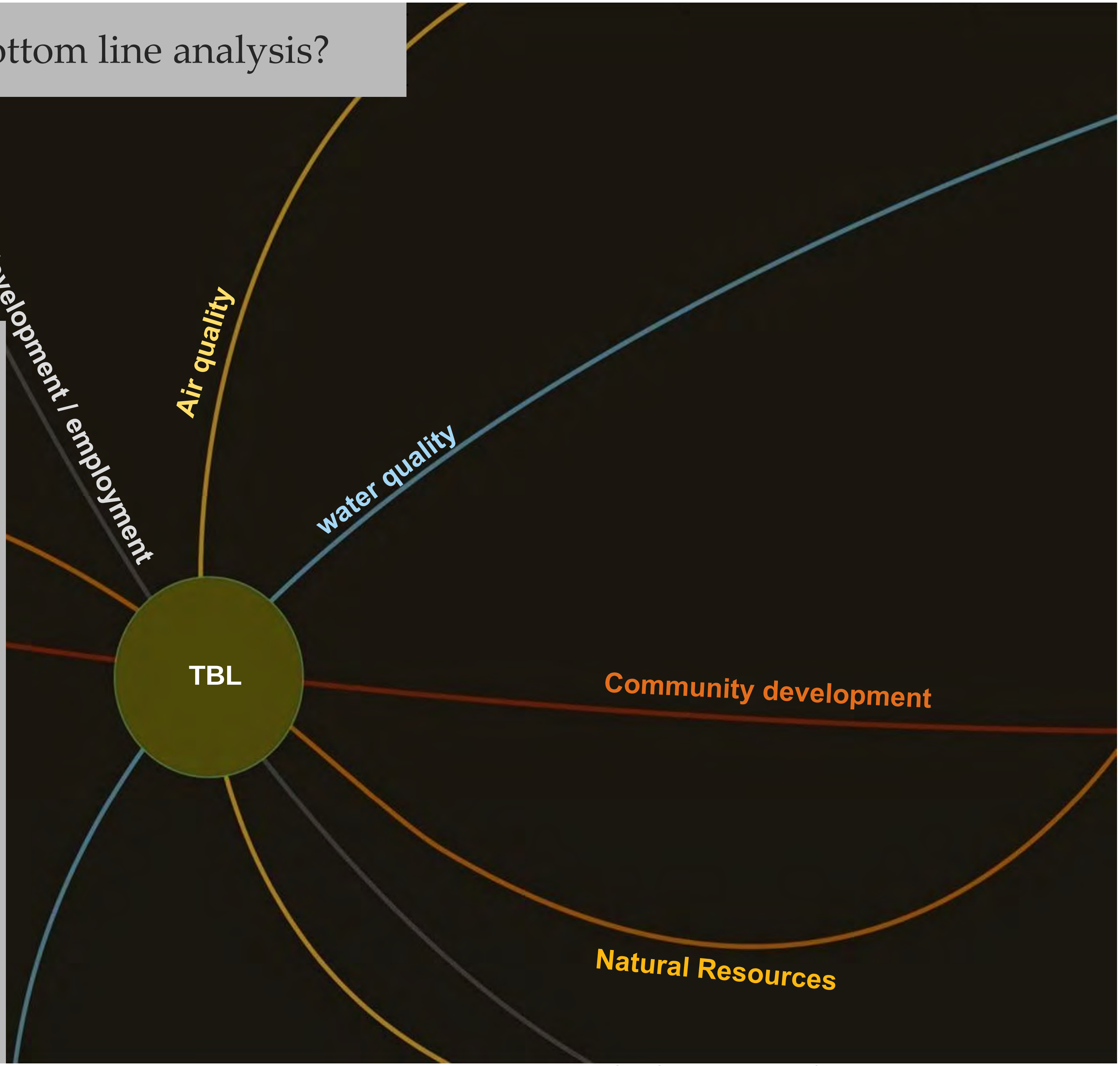
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient way.

Triple Bottom Line (TBL) Introduction

What is triple bottom line analysis?

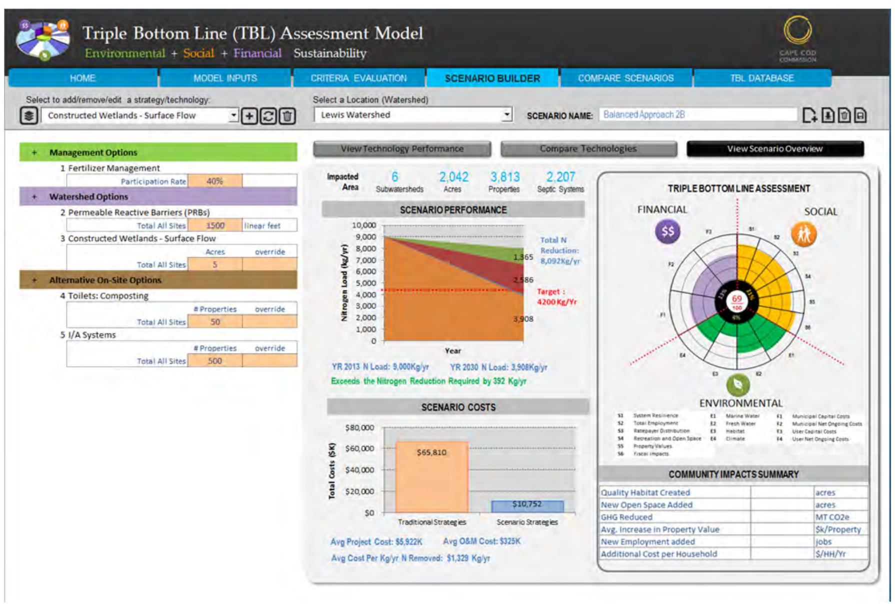
Triple Bottom Line Analysis
Provides a full accounting of the financial, social, and environmental consequences of investments or policies

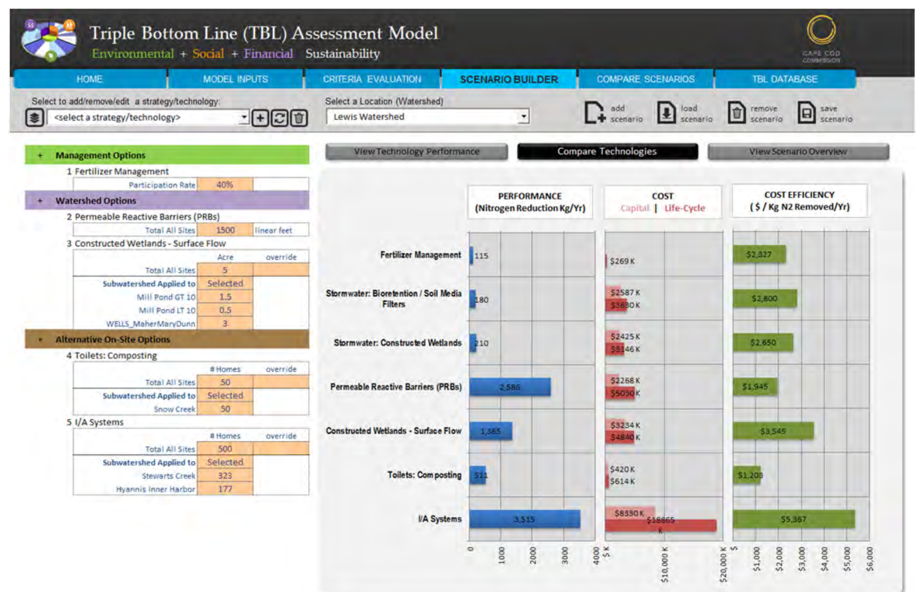
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.



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

HOME | MODEL INPUTS | CRITERIA EVALUATION | SCENARIO BUILDER | COMPARE SCENARIOS | TBL DATABASE

Alternative Definition | Alternative Results | Alternative Scoring Rules

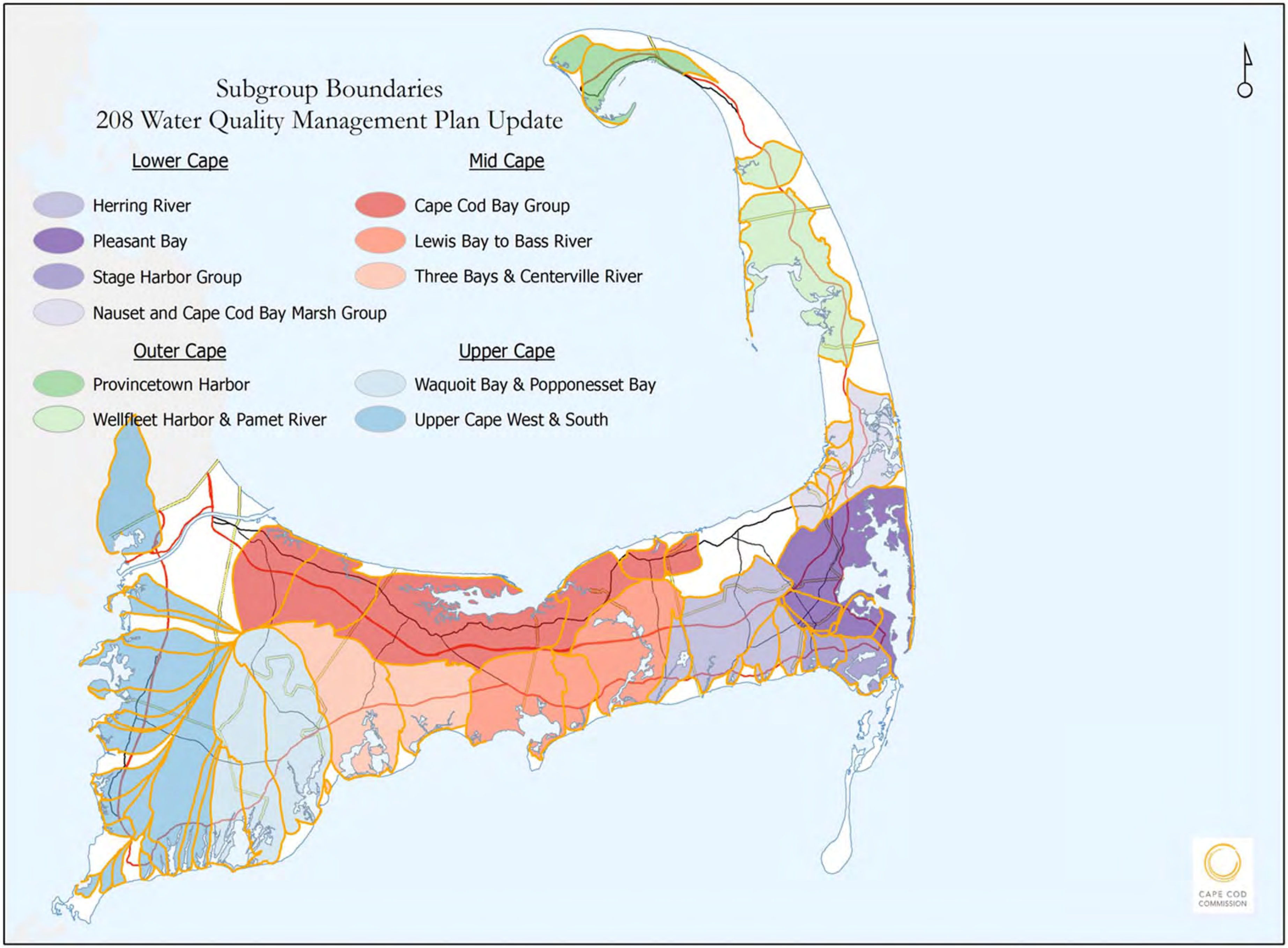
	Scenario 1	Scenario 2	Scenario 3
	Minimum Cost	Cost Effective	Maximum Performance

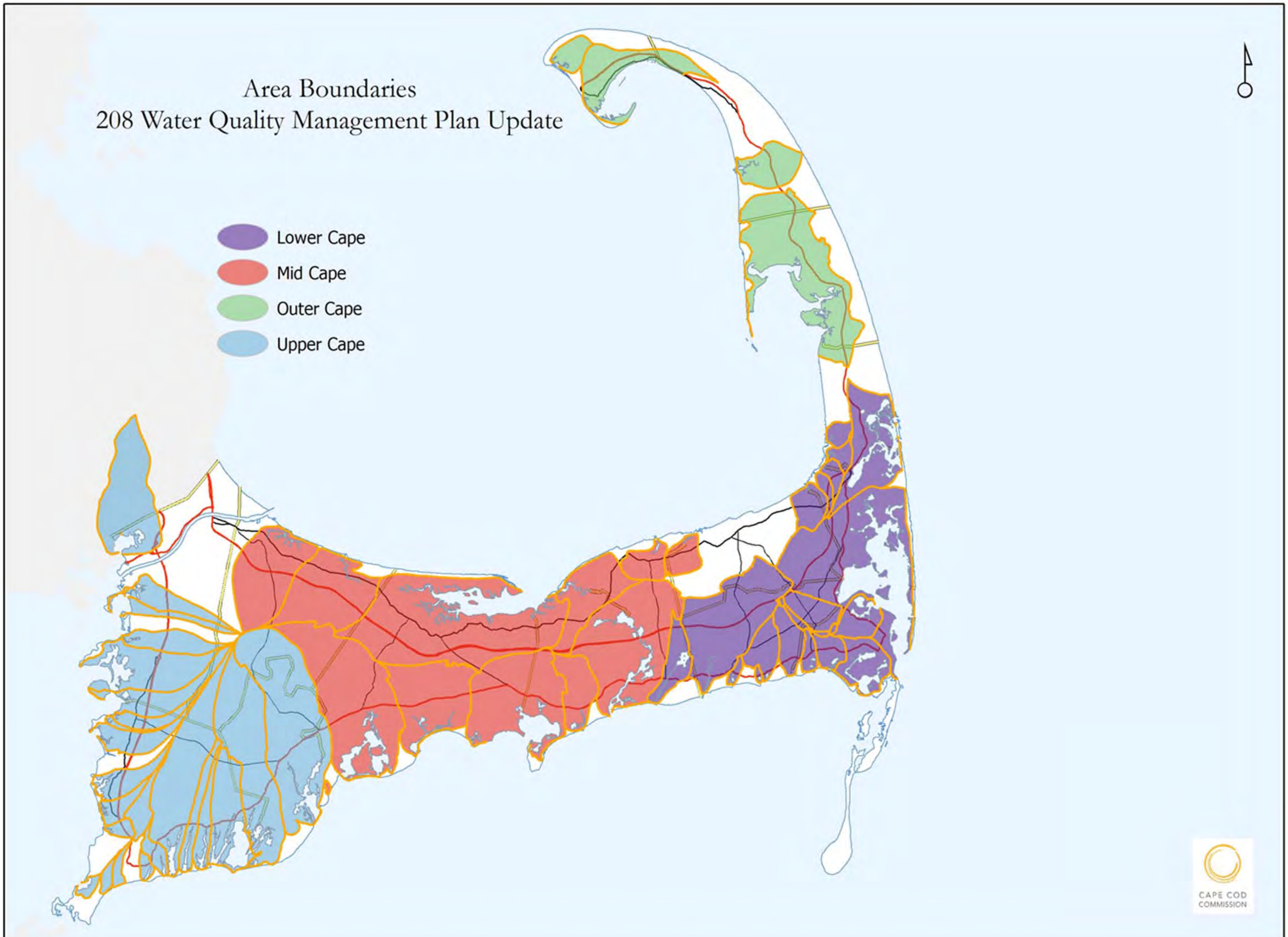
Criterion Scores

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
Herring River, Harwich Watershed Working Group

Meeting Three
Thursday, December 5, 2013
8:30 – 12:30 am
Harwich Community Center 100 Oak Street Harwich, MA

Revised Meeting Summary Prepared by the Consensus Building Institute

I. ACTION ITEMS

Working Group

- Provide any additional feedback on the meeting summary from Meeting #2 and, when it is circulated, Meeting #3.

Consensus Building Institute

- Circulate a draft meeting summary from Meeting #3 for review by the watershed working group.
- Conduct further outreach to working group members regarding the process moving forward and possible ongoing involvement, for example in the area working groups.

Cape Cod Commission

- Update the sample scenarios provided based on working group input.
- Further develop scenarios for different areas within the Herring River study area.
- Give working group members the opportunity to comment on the criteria being used in the Triple Bottom Line analysis tool (at January/February Stakeholder Summit).

II. WELCOME AND OVERVIEW

Patty Daley, Deputy Director and Area Manager, Cape Cod Commission, welcomed participants and offered an overview of the 208 Update stakeholder process.[1] 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 will focus on evaluating watershed scenarios. These scenarios are informed by Working Groups' discussions at previous meetings about baseline conditions, priority areas, and technology options/approaches.

[1] The PowerPoint Presentation made at this meeting is available at: http://watersheds.capecodcommission.org/index.php/watersheds/lower-cape/herring-river

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;
- To develop a set of adaptive management principles to guide subregional groups in refining scenarios for the 208 Plan.

Kate Harvey, the facilitator from the Consensus Building Institute (CBI), 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 but would not be asked to “vote” on a specific approach. The scenarios presented today should reflect the input that participants have already given in this process. She also reviewed action items including:

- Kate incorporated the changes submitted to the previous meeting summary and asked participants to submit final comments on that summary as soon as possible.
- The Commission has updated the chronologies.
- Stakeholder representation in the groups: for the next series of stakeholder engagement meetings starting in January, the Commission and CBI will continue to try to bring in broad representation.
- The revised technology fact sheets should be up on the Watershed website next week: http://watersheds.capecodcommission.org/index.php/watersheds/lower-cape/herring-river

III. INITIAL SCENARIOS FOR THE HERRING RIVER WATERSHED

Patty Daley explained the Commission’s process to develop watershed scenarios. Two teams were formed: one team is exploring “traditional” technologies and approaches (permitted technologies such as sewering and I/A systems), most of which are already permitted. Another team is exploring “alternative” or “non-traditional” technologies and approaches. The teams are both working under the assumption that fertilizer and stormwater reductions will reduce the footprint required for wastewater infrastructure.

Whole Watershed Conventional Scenarios

Scott Michaud, Hydrologist, Cape Cod Commission, led the discussion of “traditional” technologies and approaches. He explained that the scenarios were developed using the Commission’s Watershed Multivariant Planner (MVP) Tool. To meet the Total Maximum Daily Load (TMDL), the Herring River watershed area needs a 38% reduction in wastewater nitrogen. He offered 2 scenarios:

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

  - Deploying de-nitrifying septic systems for every property in the watershed results in 27% removal. Estimated cost/pound of N removed: $1,000.
- Watershed-Wide Centralized Treatment with Disposal Inside the Watershed
  - Connecting every property in the watershed to centralized treatment results in 81% removal, at $500/pound of N removed. This scenario over-achieves nitrogen reduction compared to target reduction goals.

With the aid of a GIS image, Scott explained which areas of the watershed are up gradient versus down gradient of local ponds. He also explained natural attenuation of nitrogen and how that relates to overall loads. Fresh water ponds attenuate an estimated 50% of nitrogen. One possible solution is to collect wastewater in areas that are not attenuated naturally and move it to areas that are.

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

- *Who bears the cost?* Mr. Michaud responded that onsite systems are typically the responsibility of the homeowner and a centralized system is typically under town management. However, each town must decide how to allocate costs.
- *These targets are based on existing loads, not including growth*. 100% of future nitrogen load will have to be removed assuming that the targets for existing loads are met.
- *Would a third party manage or inspect the I/A systems?* Ms. Daley responded that there are different ways to manage inspection and maintenance. It could be the responsibility of the individual, the town, or the county. For instance, the town could hire a contractor to service and inspect the systems to make sure they're performing as they should.
- *A stakeholder raised concerns about where the effluent goes when it's disposed inside the watershed, and concerns about having a high concentration of nitrogen in one area.*
- *Participants raised concerns about dealing with phosphorus, and concerns that the Commission is treating phosphorus and nitrogen as mutually exclusive*. Scott responded that phosphorus works very differently than nitrogen, and the 208 Plan update will address both. Phosphorus binds with the soil, so the further you are away from a pond, the less it enters the fresh water body.

Mr. Michaud presented traditional approaches that meet TMDLs, one of which is combined with a 50% reduction in fertilizer and stormwater.

- Targeted centralized treatment that removes wastewater nitrogen loads
  - Collection of approx. 220,000 gallons per day
  - Estimated cost/pound of wastewater nitrogen removed: $600 per pound.
- Targeted centralized treatment with a 50% reduction in fertilizer and stormwater
  - Fertilizer and stormwater make up about 63% of the wastewater nitrogen load in this area. With this approach, the infrastructure footprint size is much smaller than targeted collection without the fertilizer/stormwater reduction.
  - Collection of approx. 83,000 gallons per day

  - Estimated cost/pound of wastewater nitrogen removed: $1200 per pound. This Cost is higher than the $600/lb under the previous scenario because collection is focused on Harwich Center, where nitrogen in groundwater is naturally attenuated before it reaches the estuary. Hence, wastewater collection in this area removes less nitrogen otherwise entering the estuary than if wastewater were collected from a portion of the watershed where nitrogen is not naturally attenuated.

Working Group members had the following questions and comments about this scenario:

- *Participants requested that the Commission provide total cost estimates for sewering with and without fertilizer/stormwater removal. Participants understood that it is difficult to estimate this, but they worried it would be misleading to present the numbers in any other way*.
- *Have fertilizer reduction regulations already been passed?* Ms. Daley responded that the Commission has adopted a District of Critical Planning Concern (DCPC) allowing interested towns to adopt fertilizer control through 2014. *Another participant added that adopting the fertilizer bylaw confers a 50% credit from MA Department of Environmental Protection (DEP), which, in this watershed is a very significant amount of money to the town.*
- *Are there any innovative stormwater collection technologies in Harwich?* Other working group members responded that there are a few, with more being implemented each year.
- *Working group members discussed the tradeoffs between development density and designing for innovative stormwater removal. Techniques that allow for both can be found in: the smart growth toolkit, Hyannis's growth incentive zone design guidelines, the UNH Stormwater Center website.*
- *The working group discussed fertilizer management. A participant commented that three-quarters of the fertilizer use in this area comes from home lawns, and it will take a lot of public education in order to reduce this. Most golf courses have already reduced their use by 50%.* Participants raised concerns that if towns pass fertilizer regulations and get the 50% nitrogen reduction credit, their actual use may not reduce by 50%. They suggested that monitoring would be an ongoing challenge.

<u>Whole Watershed 7-Step Scenarios (Alternative Technology and Approaches)</u>

Mark Owen, AECOM, 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. Using the 7-step process, the Commission has developed a watershed calculator which outlines targets and goals and specifies how much nitrogen needs to be removed to meet the TMDL. The calculator is based on current development, not future development. These scenarios include an assumption of a 50% reduction (credit) from fertilizer and stormwater management. Mr. Owen presented one scenario for the Herring River watershed that includes a combination of alternative technologies and approaches.

<u>Watershed/Embayment Options</u>

- Permeable reactive barriers (PRBs)
    - 250 homes worth of nitrogen, 770 kg/year reduction, estimated cost $452 per pound of nitrogen. This treats nitrogen that enters the groundwater.
- Fertigation wells
    - Could be used on golf courses, but there are other areas that could use it too, e.g. playing fields. 1 golf course, 136 kg/year reduction, estimated cost $438 per pound of nitrogen.
- Phytoremediation
    - 1 acre, 266 kg/year reduction, estimated cost $254 per pound of nitrogen.
- Floating constructed wetlands
    - 1000 cubic feet, 450 kg/year reduction, estimated cost $61 per pound of nitrogen or $25 per cubic feet of wetland constructed.
    - This is a new technology just added to the matrix, hydroponic. You can walk on them, hang oysters, could use seaweed in salt water, and can install solar pumps to circulate water. They require some maintenance: cutting vegetation and harvesting oysters. They can be built with local materials and stocked with local plans. Can be very aesthetically attractive. They are not damaged if the pond freezes. They are very cost effective for the high amount of nitrogen they remove.

<u>Alternative on-site options</u>

- IA technologies
    - 25 homes, 58 kg/year reduction, estimated cost $1607 per pound of nitrogen

The combination of technologies in this scenario would meet the TMDLs with no sewering.

Working group members had the following questions and comments on this scenario *(in italics)*:

- *How deep do the PRBs go?* Mr. Owen responded that depth is site specific. They would mainly be installed in streets so that they don't affect people's property, although you need to consider utilities.
- *Do PRBs need to be maintained?* Mr. Owen replied that the trench PRBs last 20-30 years without much maintenance. The well PRBs that have carbohydrates injected do require some maintenance. The carbohydrate lasts about 20-25 days and could be syrup, vegetable oil, etc. depending on the groundwater quality. However, for the well-style PRBs, the cost of maintenance is often offset by the savings of not having to dig a trench.

- *If a neighborhood association wanted to build a floating constructed wetland, how would they get it permitted?* Ms. Daley responded that if the pond is over 10 acres, would need to go to state for permitting.

Working group members had the following overall comments, questions, and reactions to the three scenarios presented *(in italics)*:

- *How have the non-traditional approaches been perceived by the other working groups?* Ms. Daley responded that there seems to be acceptance and some consensus that we should look into the alternative technologies; many people share the attitude that we should find solutions that confer "the most bang for our buck". Various Herring River working group members commented that it makes sense to start with the least-cost low-hanging fruit before getting into more costly solutions.
- *Has the Commission looked at what solutions have been used in other places, such as the Chesapeake Bay?* Ms. Daley replied that the whole technology matrix is based on external research of solutions from other places, including the Chesapeake Bay. Two of the Technology Panel members advising the Commission in the development of the technologies matrix have a lot of past experience in the Chesapeake Bay.
- *Working group members discussed the timeline of different solutions, and commented that sewering has a very long phase-in period, while many of the alternative solutions could show results very quickly. A working group member added that, if we have a technology that works now and is inexpensive, we are not taking a big risk by trying it out. The plan should implement some solutions right away and some later*.
- *A participant raised a concern about the increase in nitrogen in the embayments from when the MEP studies were completed until the solutions are implemented. It's possible that we have not yet seen the height of the nitrogen concentration already in the groundwater. Some of the TMDLs might still go up.*
- *A participant asked if a given solution fails, is it a disruptive permanent feature or is it unobtrusive? Would it have to be removed?*
- Ms. Daley commented that the Commission would be adding a column on co-benefits, in addition to nitrogen removal, to the technology matrix.
- *Why is it difficult to have technologies pre-approved in a "toolbox" and pick and choose different ones as needed?* The Commission responded that state and federal permitting is what makes this difficult.
- *A working group member made the suggestion that having a traditional/conventional plan in place as a backup might help convince regulators to approve permits for the non-traditional approaches. It would convey the idea that we are serious about cleaning up our water.*
- *Owners' Unknown Land in the watershed should be analyzed to understand potential impact under traditional models and for the potential siting of alternative systems.*
- *There is a critical need to continue monitoring the Herring River Watershed.*

Kate Harvey, Facilitator, reminded participants of the priorities and concerns that they had raised at past Working Group meetings including. She asked if, given these priorities and concerns, they had suggestions on additional technologies or approaches that might be appropriate for this watershed. Stakeholders offered the following comments, questions, and recommendations about additional projects:

- *The plan should be flexible enough to allow for the incorporation of new technologies that do not exist yet.*
- *Do fertigation wells involve a lot of infrastructure?* Mr. Owen responded that it depends. It involves piping the water from an area of groundwater high in nitrogen to wherever you want to use it, and installing an irrigation system. In the future, for instance when building new playing fields, we could consider installing these from the start.
- *What is the byproduct of the microbes in constructed wetlands?* The microbes break down the nitrogen and it is released as a gas. It is a very efficient natural process that does not produce a lot of byproducts.
- Using the calculator, the working group found that if they built five acres of constructed wetlands, they would meet the TMDLs without sewering. Ms. Daley commented that constructed wetlands are very efficient at removing nitrogen, however they need to be sited and designed correctly. There is a range in all of these numbers, which is why adaptive management is so important.
- Mr. Owen remarked that he does not think it likely that any of the technologies implemented will result in zero improvement; they should all provide some benefit. However, it is possible that they may not perform as well as the estimates, and will require some adaptation.
- *A working group member suggested another possible technology: phragmites that grows at the intersection of salt and freshwater, which takes up the nitrogen from the water and can then be harvested and disposed of elsewhere.*

IV. ADAPTIVE MANAGEMENT

Patty Daley explained the concept of adaptive management. The Commission’s working definition is: a structured approach for addressing uncertainties by linking science and monitoring to decisions making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient way.

Ms. Daley asked the working group to share their input about other things that should be included in this definition and in the Commission’s approach to adaptive management. Working group members made the following comments and recommendations:

- Add the words “technology” and “social acceptability”;
- Address the NIMBY issues and apathy of the population, regardless of the issue. Figure out how to engage the public;
- A course of action that seeks to get consensus through monitoring and feedback, and

then takes adaptive management measures;
- List the goal of the 208 Plan before giving the definition of adaptive management. Ms. Daley summarized the general goals of the 208 Plan: to achieve water quality improvements to meet TMDLs and restore ecological systems. A participant responded that the language of the goal is very technical and suggested that it be stated in more conversational terms.

Ms. Daley asked working group members to help the Commission to think through what an adaptive management Plan for this watershed might look like, including:

<u>Time frame for monitoring:</u>
- *Numerous participants suggested five years*;
- *A working group member commented that the Cape should not be a testing ground for new technologies, suggesting that we should use technologies that have already been proven.* Ms. Daley responded that because many of these technologies are new, they would have to be tested here. One benefit is that if we find something works well in one part of the Cape, it could be useful throughout the Cape;
- Ms. Daley stated that, for each technology, DEP would determine the timeline for which they need monitoring, generally at least 3 years. DEP issues nitrogen credits to the towns. In the next part of the stakeholder engagement process, the Commission will put together a monitoring committee in order to discuss monitoring across town lines and whether there are efficiencies to be gained if towns share monitoring services.

<u>Additional projects (or Plan B if the innovative solutions don't work):</u>
- *Have CWMP as a fall-back plan;*
- *Sewering works; whether it's the best solution in this case is another question. This is the baseline against which you have to evaluate everything else;*
- *When thinking about alternatives, there are a number of other factors to be taken into account, like zoning, etc;*
- *The plan should create space for incorporating new technologies that don't exist yet.*
- *How are the adaptive management plans implemented? Do the towns hire an adaptive management plan manager?* Ms. Daley responded that, yes, many towns do.

<u>Suggestions for how to prioritize projects</u>:
- *Cost effectiveness;*
- *Target projects where there are synergistic opportunities with other towns;*
- *Minimizing risk: if we use many different solutions across the whole watershed and one fails, it's less of a problem than if we use a single solution and it fails.*

V. PREPARING FOR 2014 JAN-JUNE

Erin Perry shared the Commission's plans for continuing stakeholder engagement into 2014 which includes:

Triple Bottom Line approach

The Commission is developing the Triple Bottom Line (TBL) analysis tool to help communities weigh the pros and cons of the various scenarios, including the “no action” alternative. Often TBL analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment. It is helpful in order to consider the financial, environmental, and social consequences of water quality investment and policies on the Cape. It helps evaluate ancillary or downstream consequences of the scenarios.

- *A working group member asked how the Commission assigned values for the more social/subjective criterion?* Ms. Perry responded that AECOM is making the model based on a number of studies and existing research.
- Jay Detjens, GIS Analyst Cape Cod Commission, clarified that the TBL tool is for comparing scenarios within a single watershed, it is not a tool that is useful for comparing different watersheds’ solutions with each other.
- *A working group member asked for a list of the social criteria*. Ms. Perry replied that the criteria are still being finalized, but right now the social criteria include: system resilience, employment, recreation, property values, and fiscal impacts.
- *A working group member stated that they would like to be able to comment on all of the criteria being used in the TBL model.* Ms. Perry responded that there will be opportunities to give input on this during the rest of the stakeholder engagement process in 2014.

Stakeholder Process: Summit and Working Groups

Ms. Perry explained that stakeholder process for the Section 208 Planning process going forward. She said that the Commission would be convening an optional stakeholder summit with all eleven of the watershed subgroups in January. After this summit, the Commission will be aggregating the eleven subgroups into four area working groups (representing the areas of: Lower Cape, Mid Cape, Outer Cape, and Upper Cape). These area working groups will include local residents and stakeholders, including some members of the watershed subgroups, as well as representatives from MA DEP and EPA. The idea behind convening these area working groups is to continue to seek stakeholder participation and guidance without asking all of the members of the eleven watershed subgroups to continue to serve on their committees over the next six months.

VI. PUBLIC COMMENTS

Jackie Etsten commented that the Commission is basing their assumptions on land use data from a few years ago, which is going to become more and more out of date. She stressed that the Commission should take into account data on buildout. She feels they should overshoot rather than undershoot their estimates because there is a danger of spending a lot of public money and still not meeting the targets. She also commented that, although this process focuses on water quality in the embayments, in the future they will likely have to address coastal water quality as well. She has seen coastal water quality decline at the beaches she uses, which is a direct discharge area.

APPENDIX ONE: MEETING PARTICIPANTS

Name	**Affiliation**
Working Group Members	
Larry Ballantine	Harwich Board of Selectman
Peter deBakker	Harwich Water Quality Task Force
Diane Chamberlain	Dennis Board of Health and Comprehensive Water Management Task Force
Joan Kozar	Harwich Planning Board
Jason Klump	Brewster Planning Board
Michael Lach	Harwich Land Trust
Sue Leven	Town of Brewster, Planner
Ed Nash	Golf Course Superintendents Association
Russell Schell	Brewster Comprehensive Water Planning Committee
Steve Swain	Concerned Citizen
Brooke Williams	Harwich Civic Association
Public	
Jackie Etsten	Harwich
Staff and Consultants	
Patty Daley	Cape Cod Commission
Kate Harvey	Consensus Building Institute
Carly Ipken	Consensus Building Institute
Maria McCauley	Cape Cod Commission
Scott Michaud	Cape Cod Commission
Erin Perry	Cape Cod Commission
Mark Owen	AECOM

Cape Cod 208 Area Water Quality Planning
Lewis Bay to Bass River Watershed Working Group

Meeting Three
Thursday, December 5, 2013 | 8:30 am – 12:30 pm
Dennis Town Hall; 485 Main Street, South Dennis

Meeting Agenda

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*

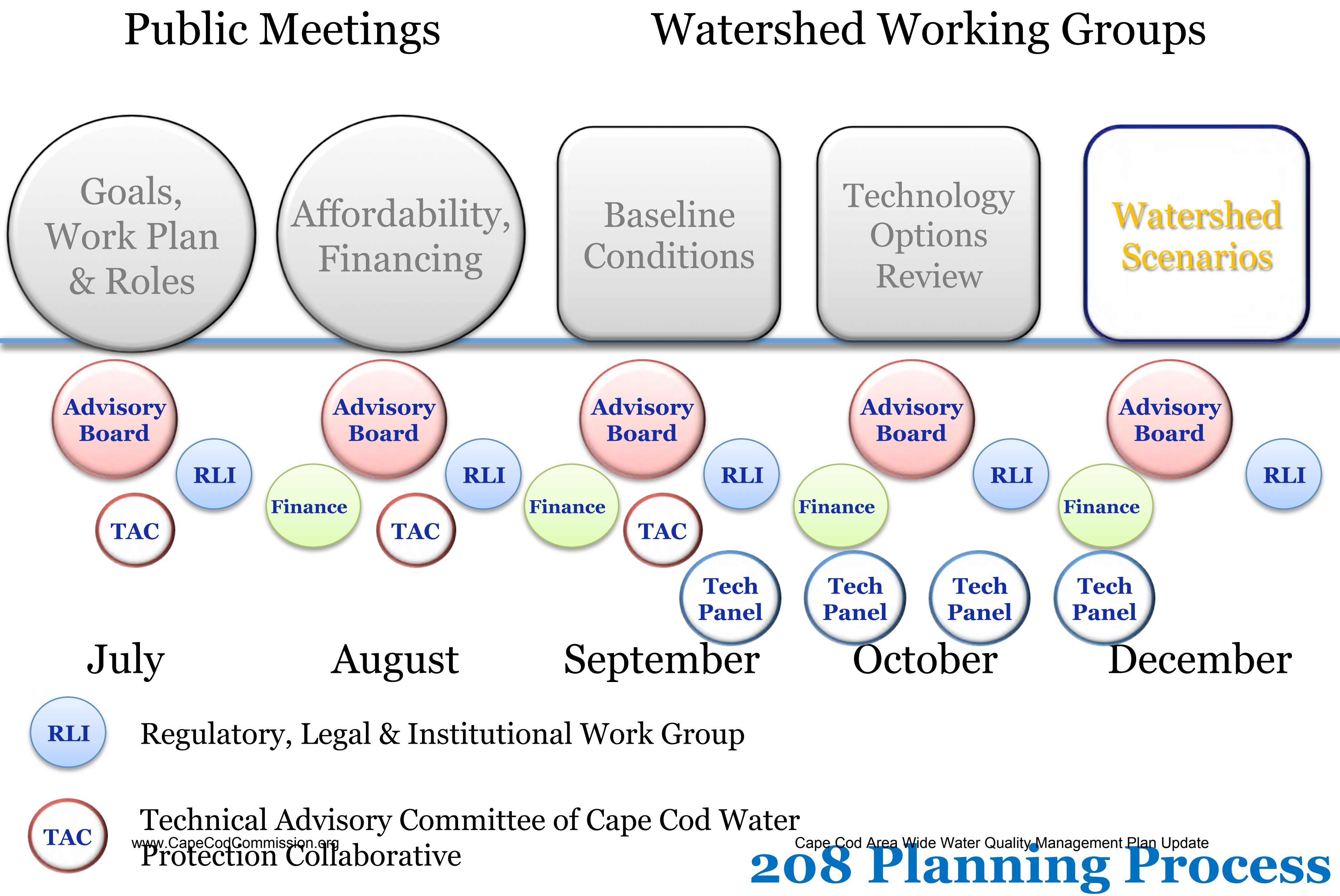
- Triple Bottom Line approach
- Identify Shared Principles and Lessons Learned
- Describe Next Steps

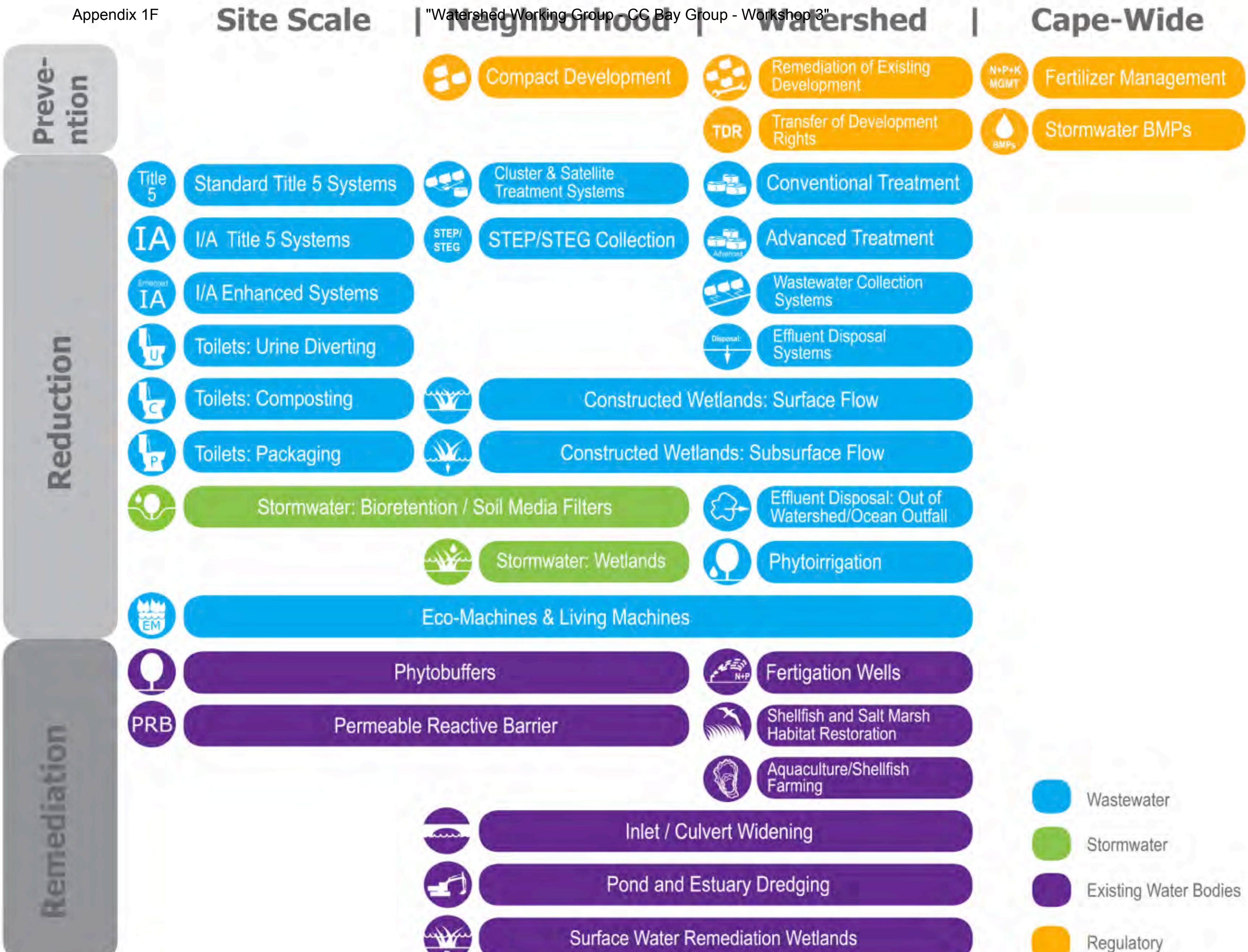
12:15 Public Comments

12:30 Adjourn

Lewis Bay to Bass River Group

Watershed Scenarios


Public Meetings
Watershed Working Groups
Goals, Work Plan & Roles
Affordability, Financing
Baseline Conditions
Technology Options Review
Watershed Scenarios
Advisory Board
RLI
TAC
Advisory Board
Finance
TAC
RLI
Advisory Board
Finance
TAC
RLI
Tech Panel
Advisory Board
Finance
RLI
Tech Panel
Tech Panel
Advisory Board
Finance
RLI
Tech Panel
July
August
September
October
December
RLI
Regulatory, Legal & Institutional Work Group
TAC
Technical Advisory Committee of Cape Cod Water Protection Collaborative
208 Planning Process

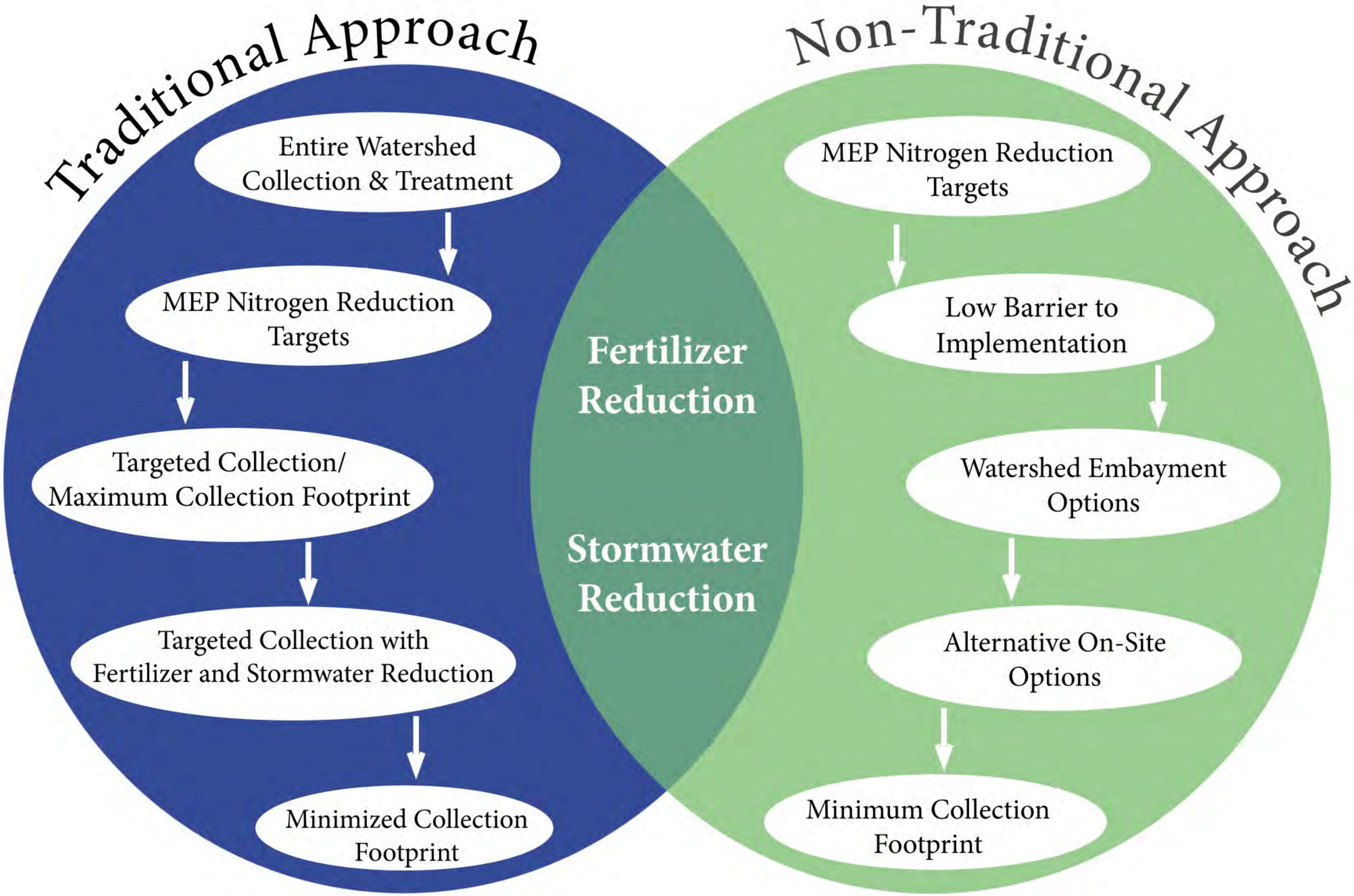

Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-ntion
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
Reduction
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced Treatment
IA
I/A Enhanced Systems
Wastewater Collection Systems
U
Toilets: Urine Diverting
Disposal
Effluent Disposal Systems
C
Toilets: Composting
Constructed Wetlands: Surface Flow
P
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Remediation
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

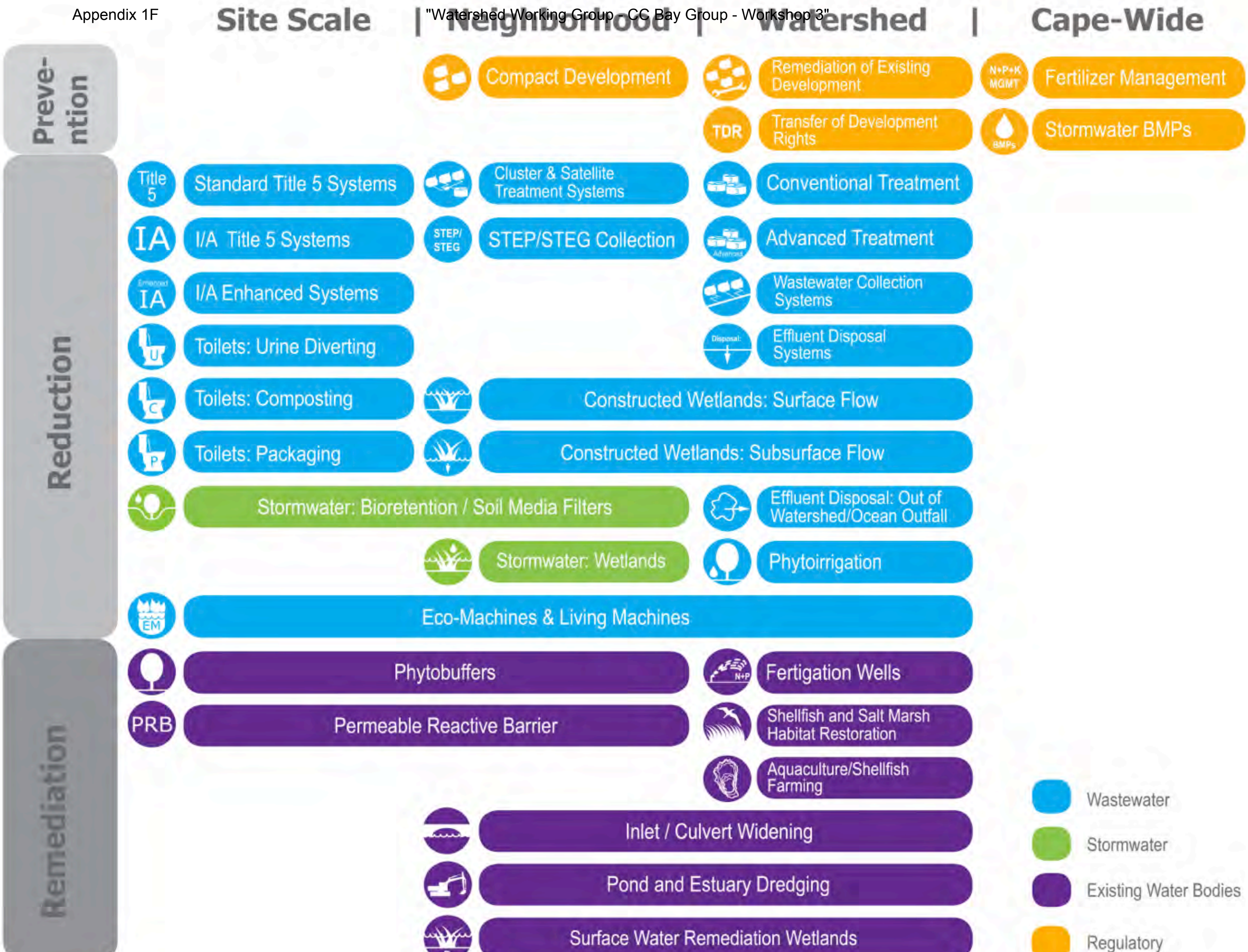
Watershed Scenarios

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


Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-ntion
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
Reduction
Title 5
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Cluster & Satellite Treatment Systems
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I/A Title 5 Systems
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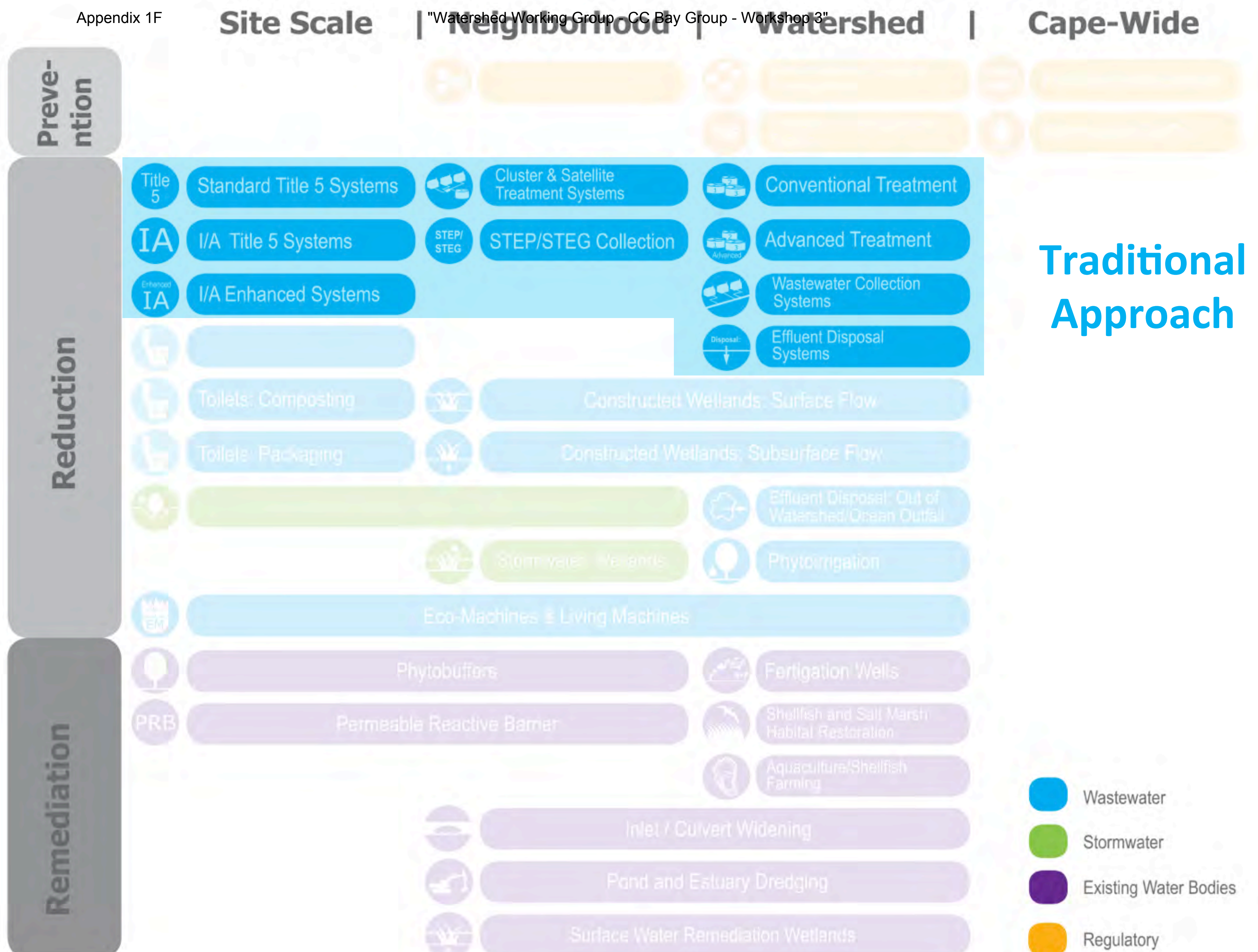
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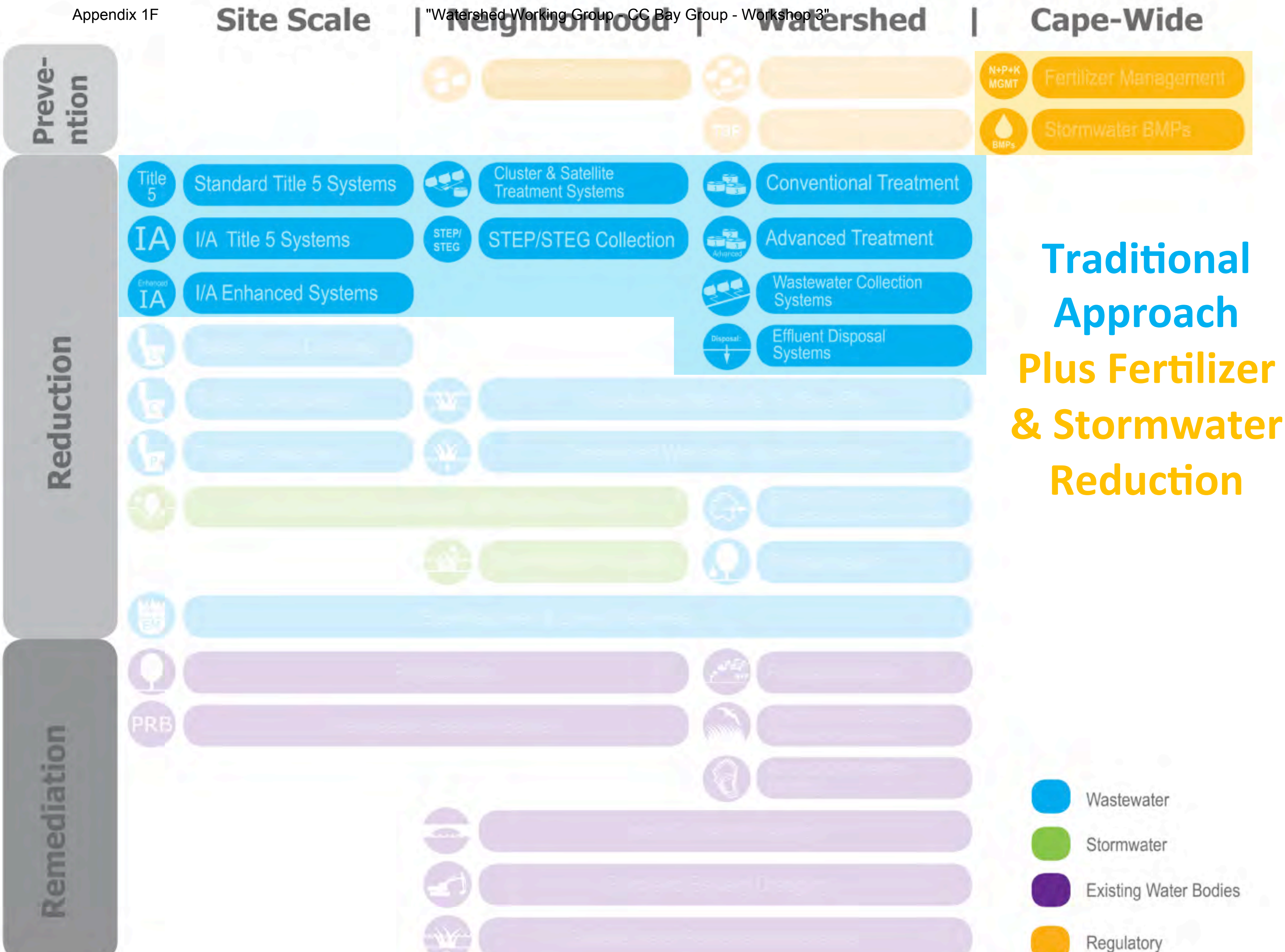
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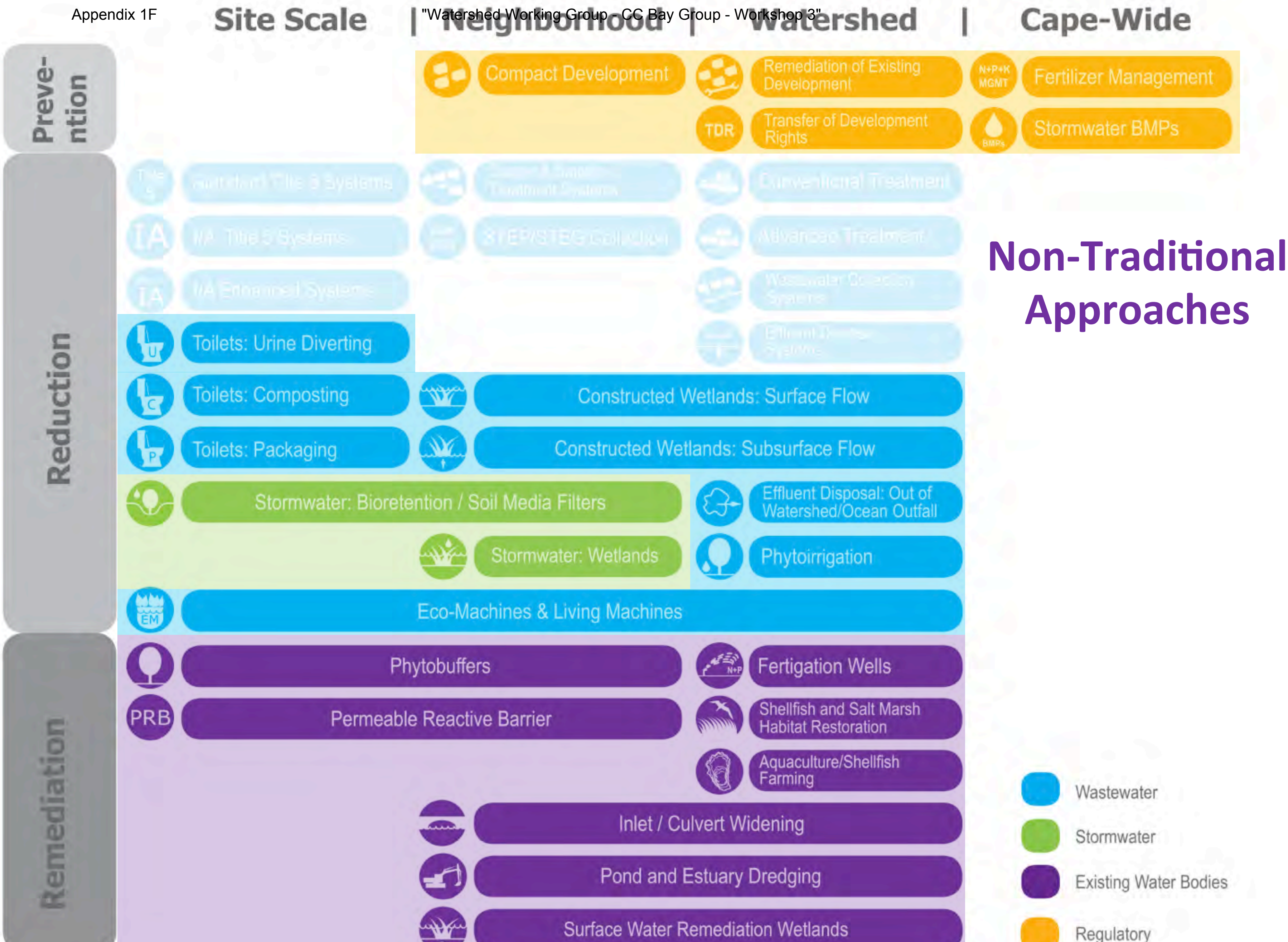
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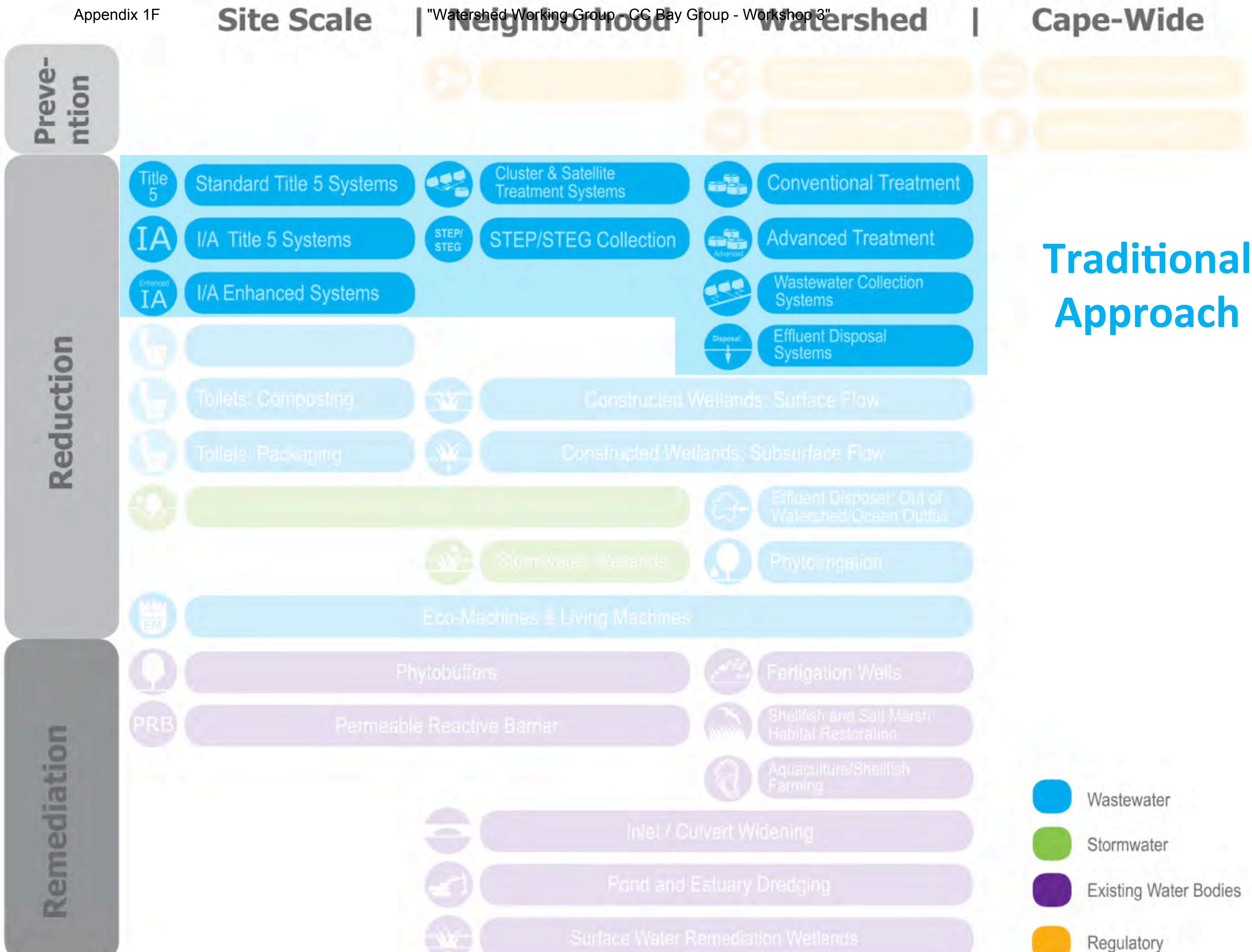
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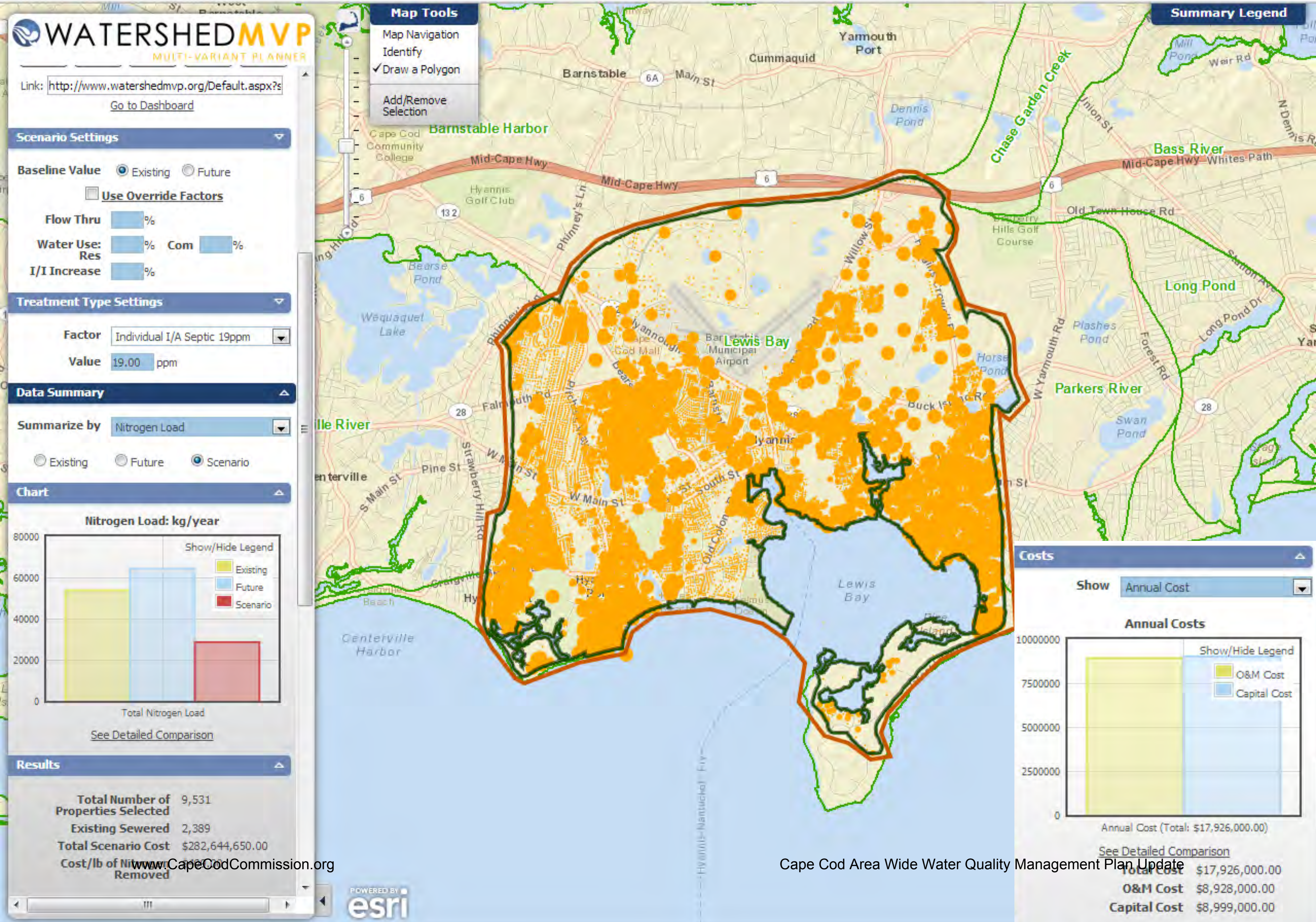
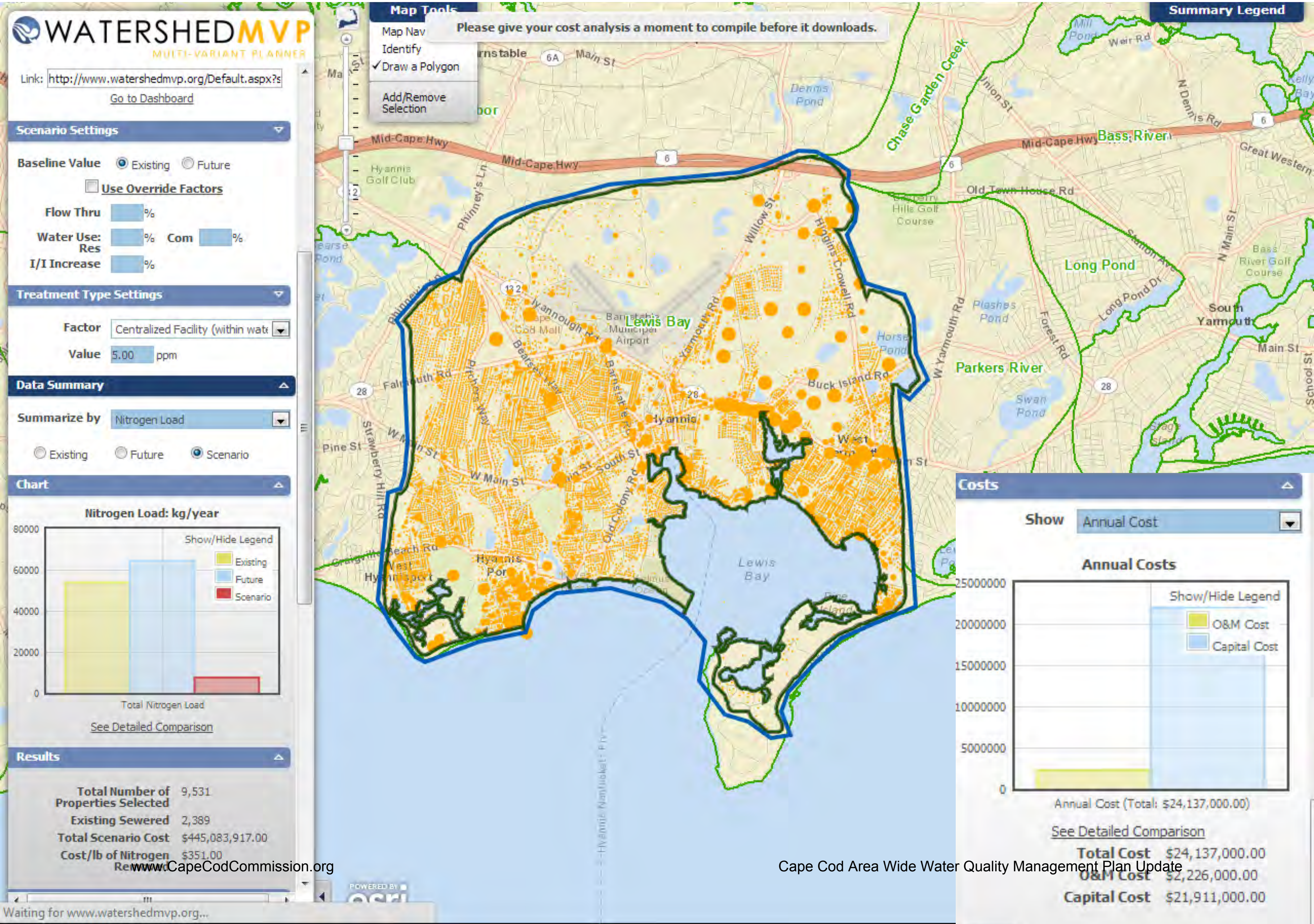
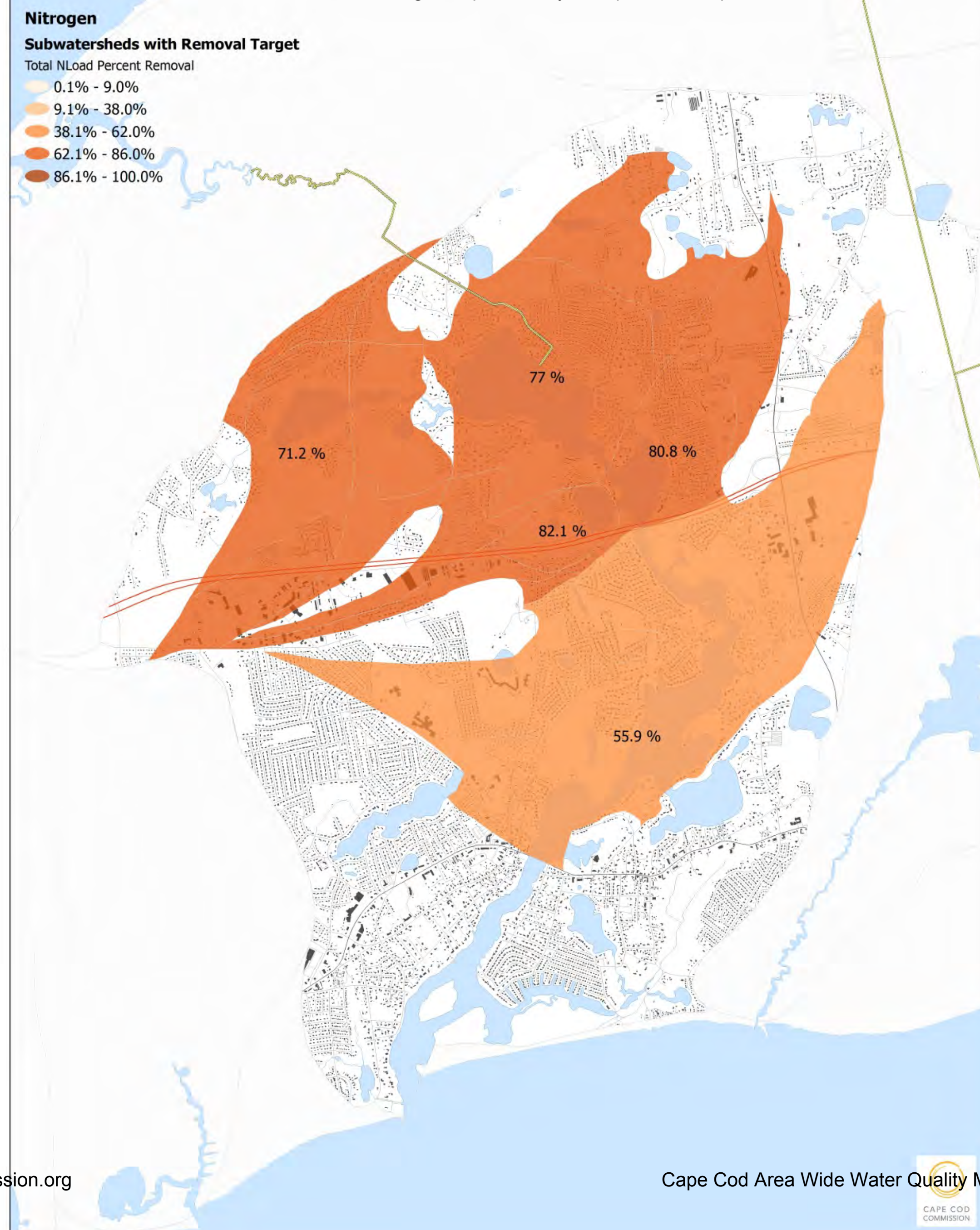
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems

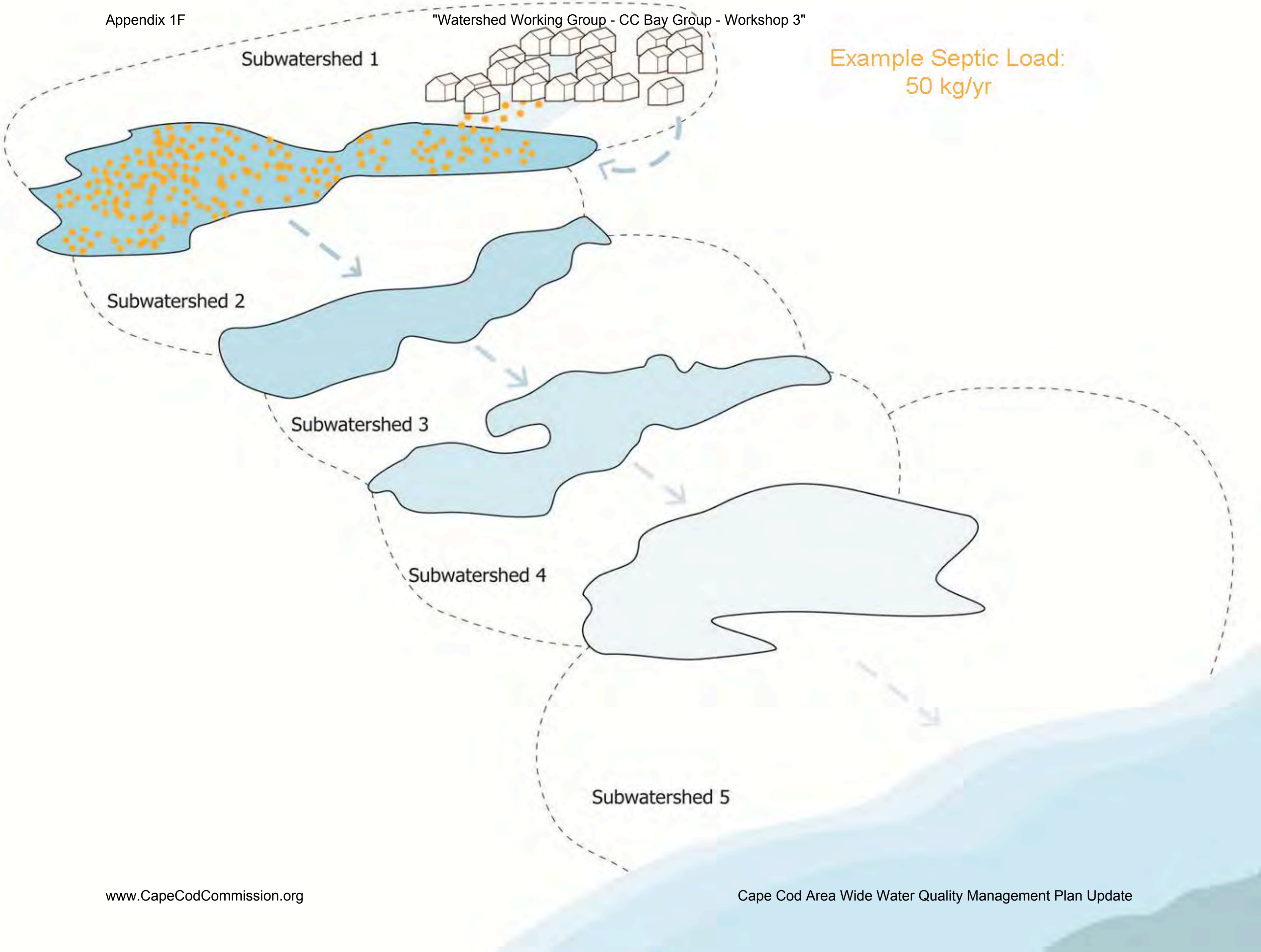


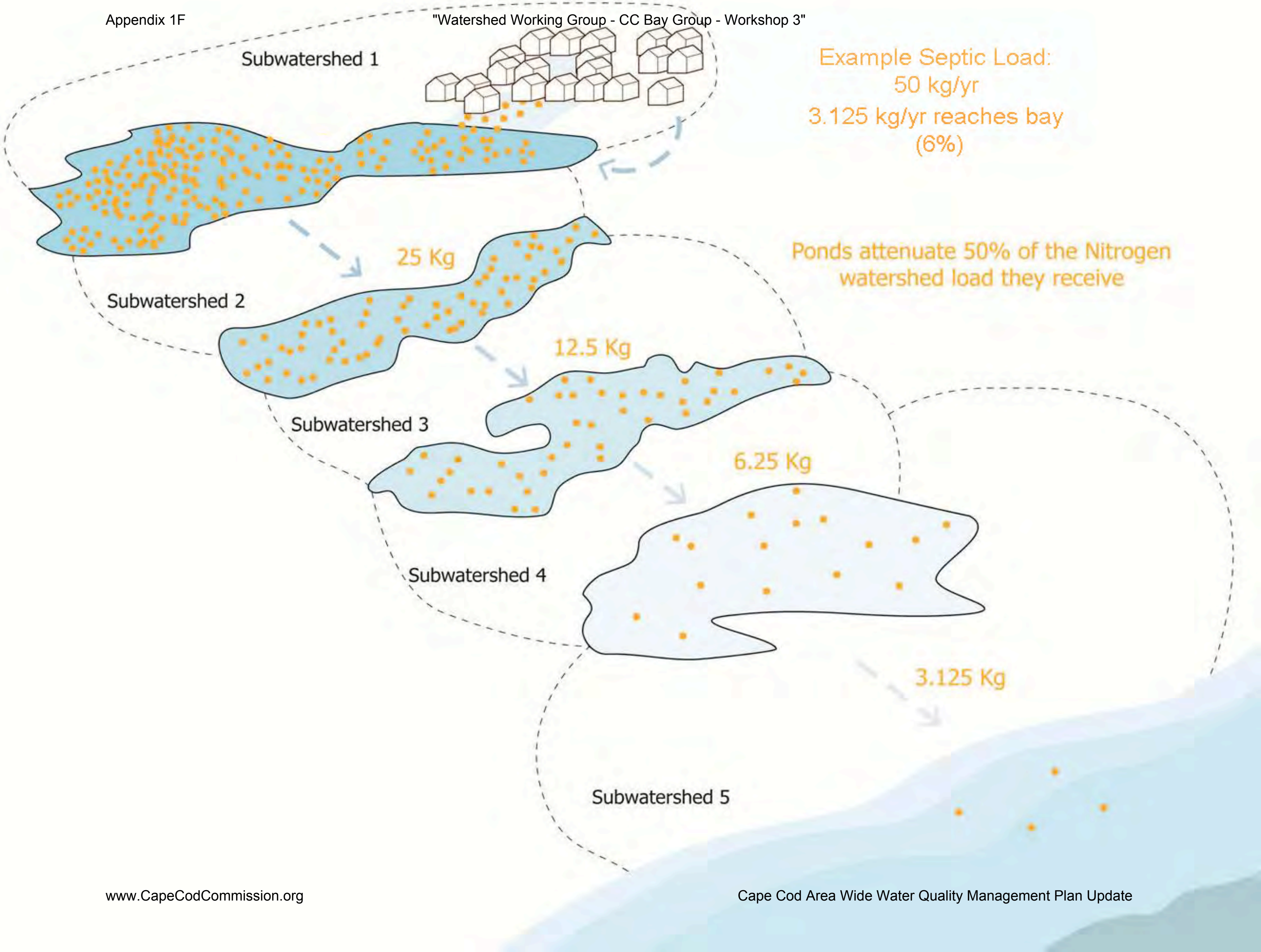
Watershed-Wide Centralized Treatment with Disposal Inside the Watershed

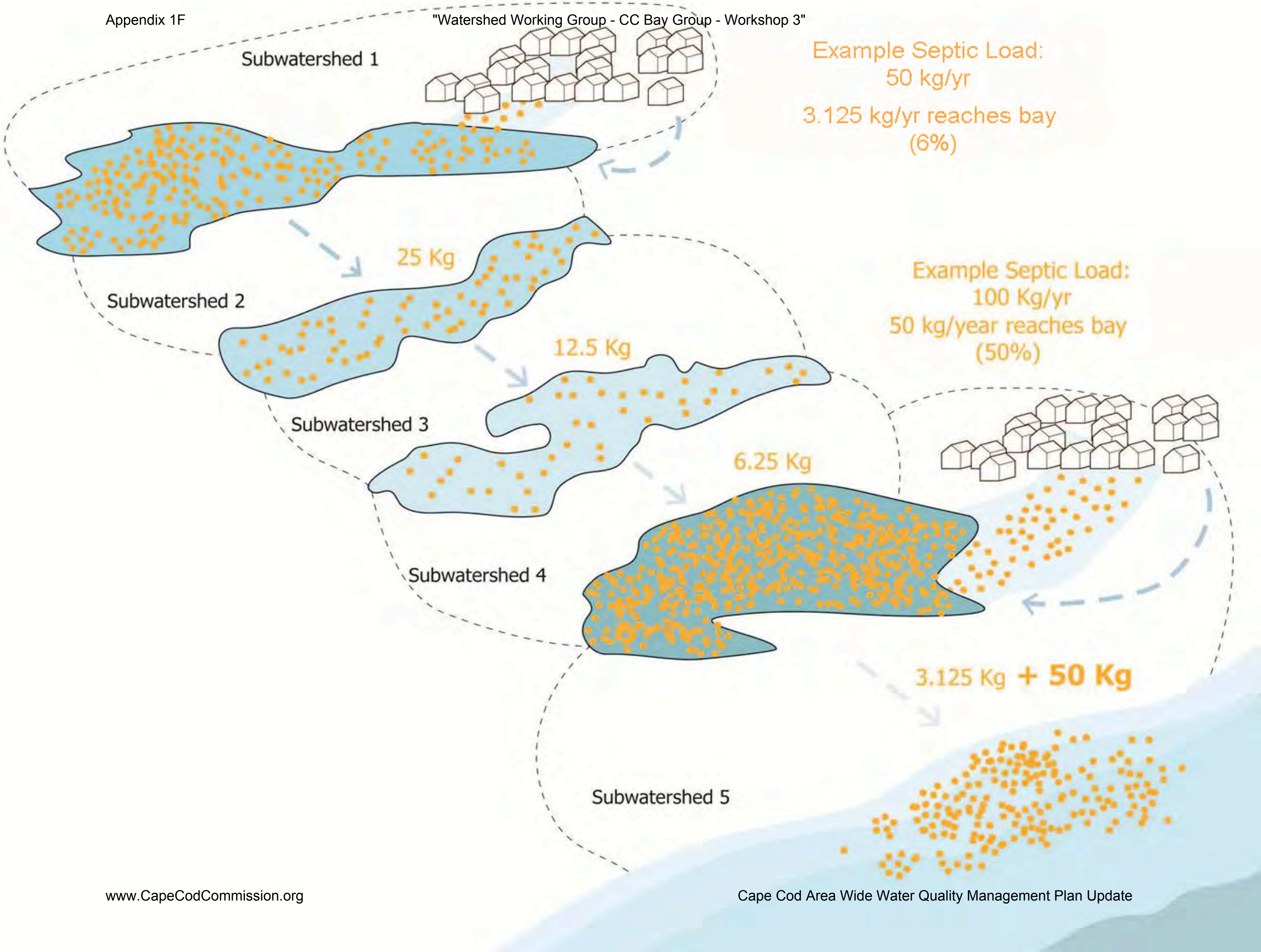


"Watershed Working Group - CC Bay Group - Workshop 3"




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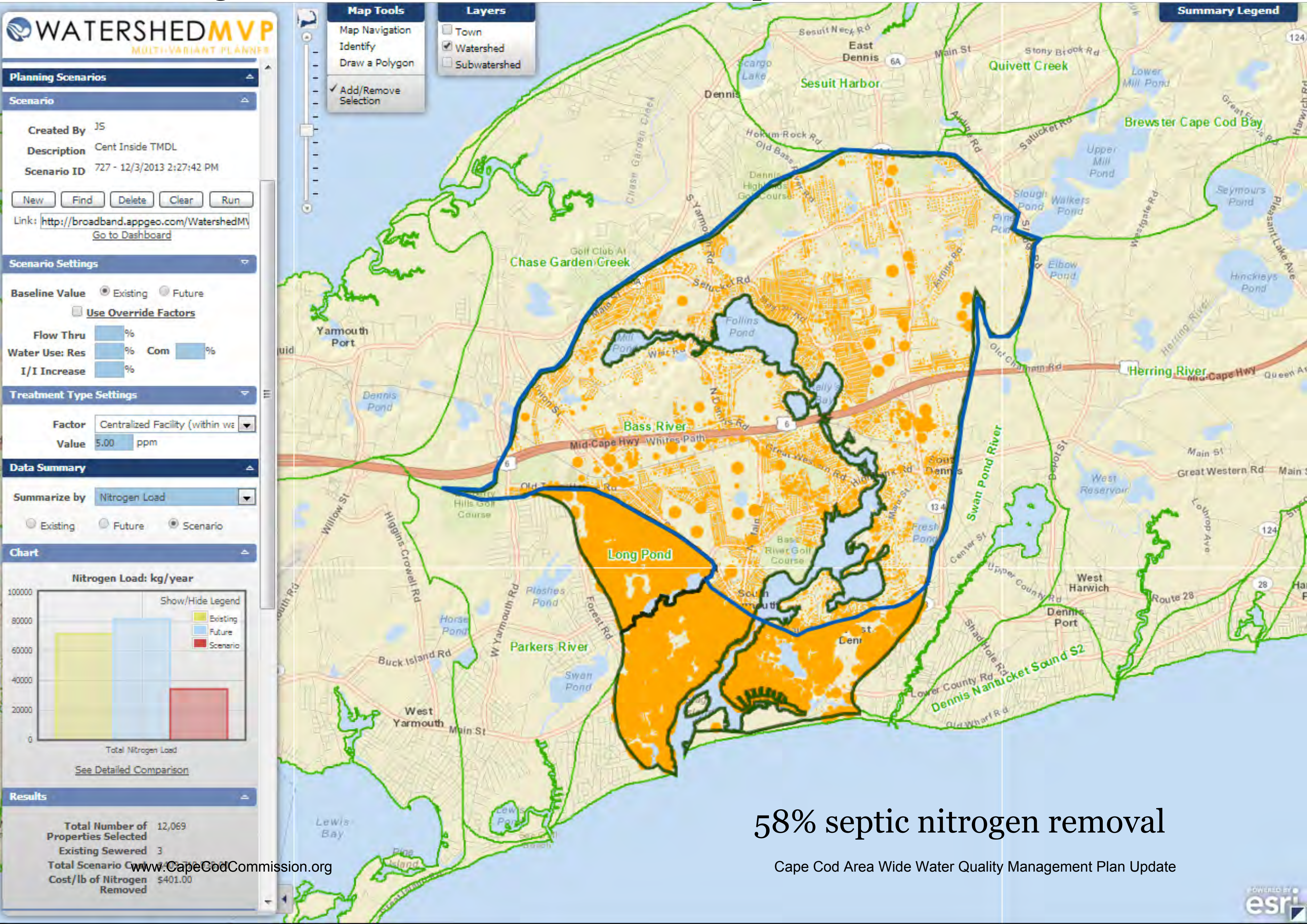
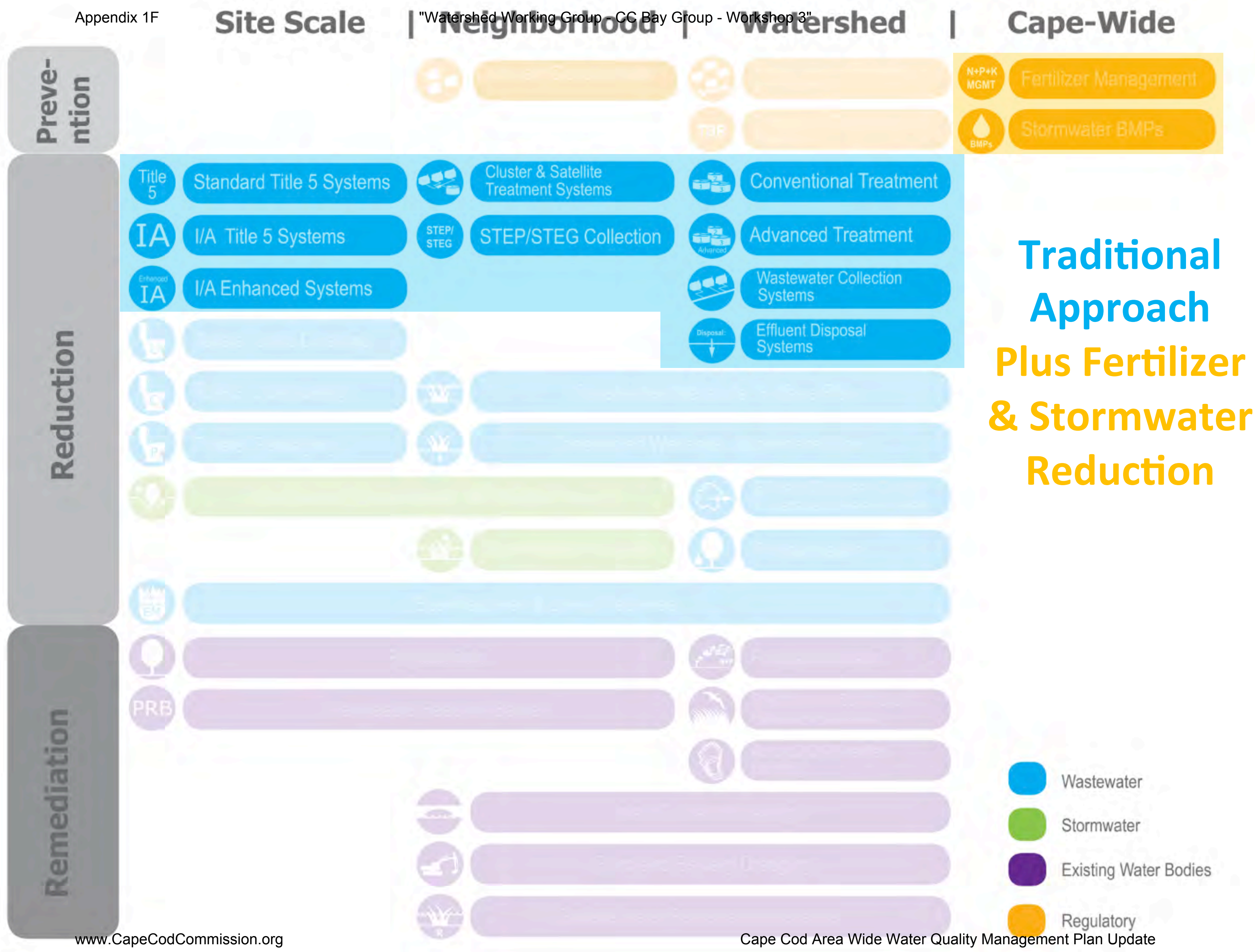
25 Kg
Subwatershed 2
Example Septic Load:
100 Kg/yr
50 kg/year reaches bay
(50%)
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg + 50 Kg
Subwatershed 5

Targeted Centralized Treatment with Disposal Inside the Watershed



58% septic nitrogen removal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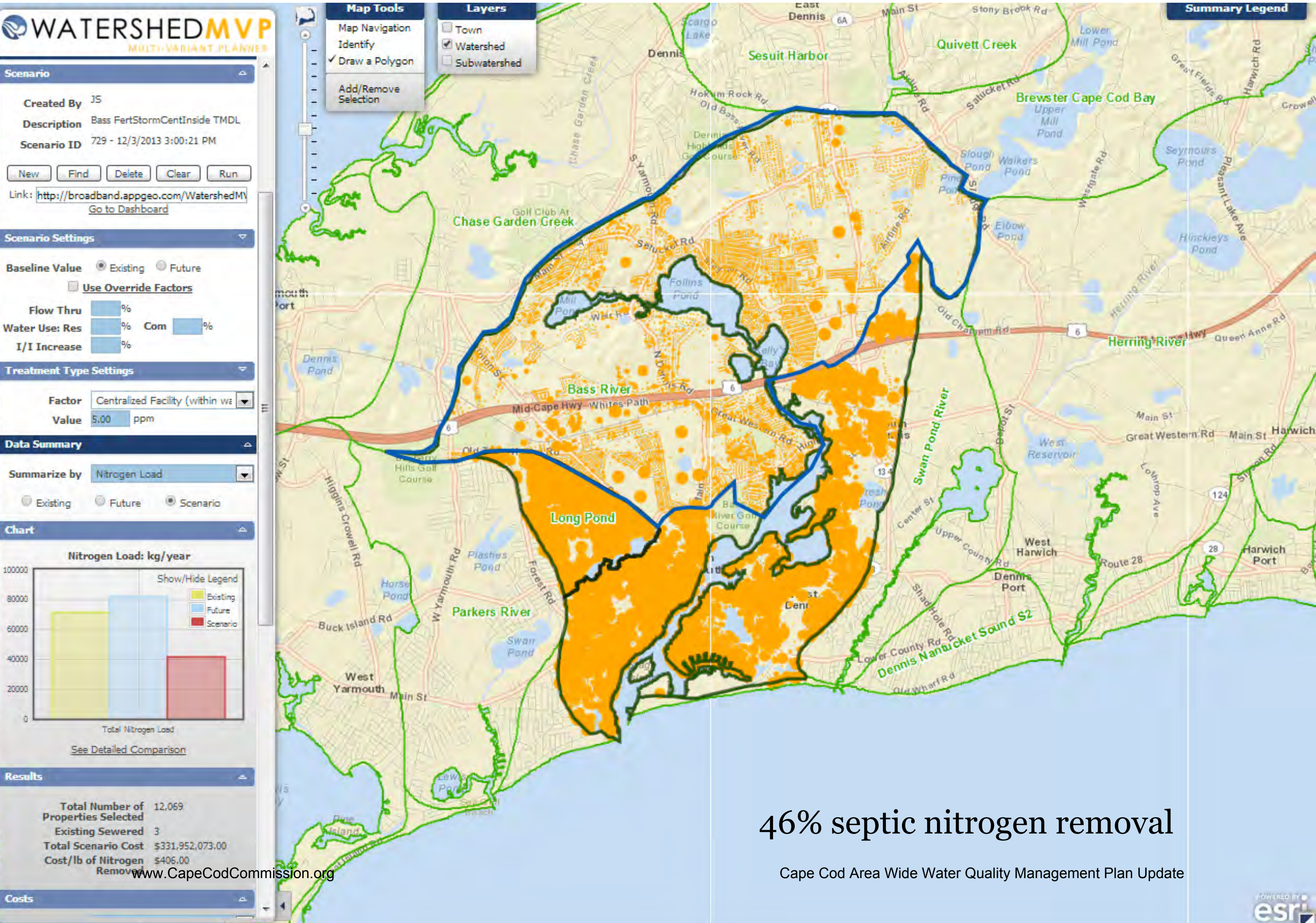
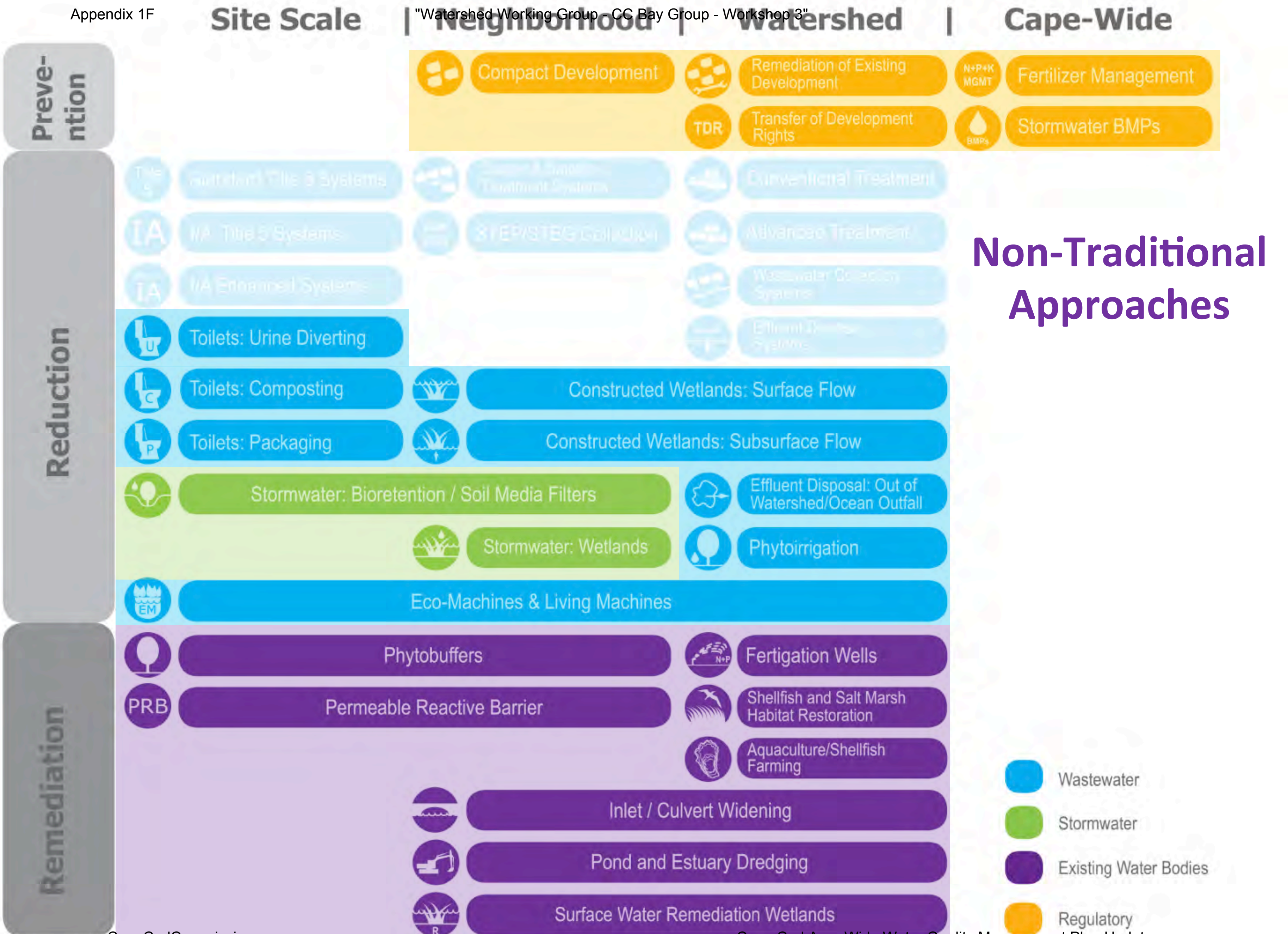
Existing Water Bodies
Regulatory

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



46% septic nitrogen removal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Wastewater
Stormwater
Existing Water Bodies
Regulatory

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 BASS RIVER

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
Present Total Nitrogen Load:		0	79,497
wastewater		0	66,905
fertilizer			6,296
stormwater			6,296
Target Nitrogen Load:		0	41,756
Nitrogen Removal Required:		**0**	**37,741**
Total Number of Properties:	9153		

Watershed Calculator BASS RIVER

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Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

Watershed Calculator BASS RIVER

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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	3,148	34,593	
Stormwater Mitigation	3,148	31,445	

Watershed Calculator BASS RIVER

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Watershed Calculator BASS RIVER

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Oyster Beds/Aquaculture	40	acres	10,000	14,085	$0

Watershed Calculator BASS RIVER

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Fertigation Wells	2	golf course	272	24,085	$438
Oyster Beds/Aquaculture	40	acres	10,000	14,085	$0
Alternative On-Site Options:					
Ecotoilets (UD & Compost)	458	homes	1,812	12,273	$1,265

Watershed Calculator BASS RIVER

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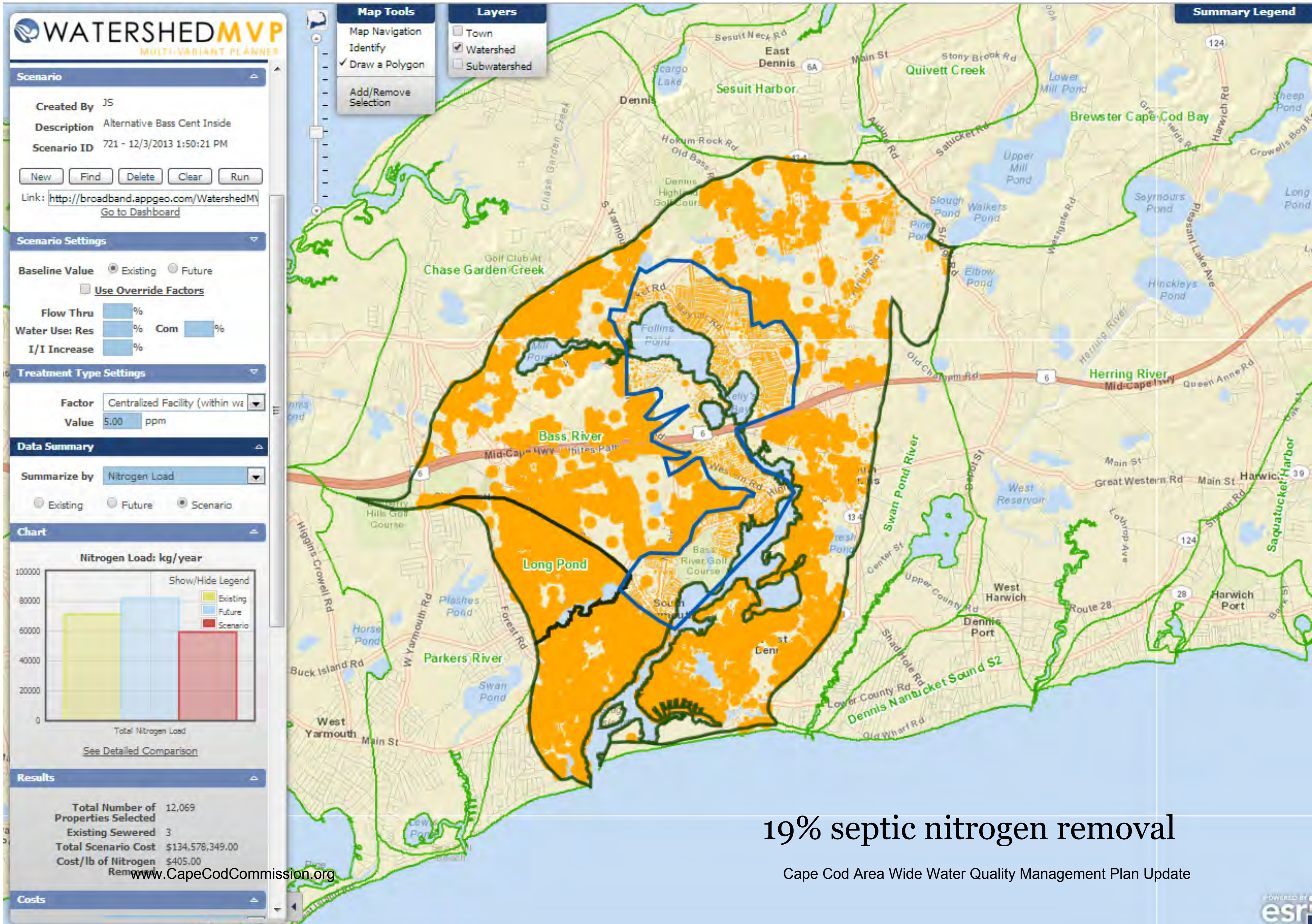
Alternative On-Site Options:					
Ecotoilets (UD & Compost)	458	homes	1,812	12,273	$1,265
Sewering	2789	homes	12273	0	$1,000
			Total To Meet Goal (Kg/yr):	0	$580

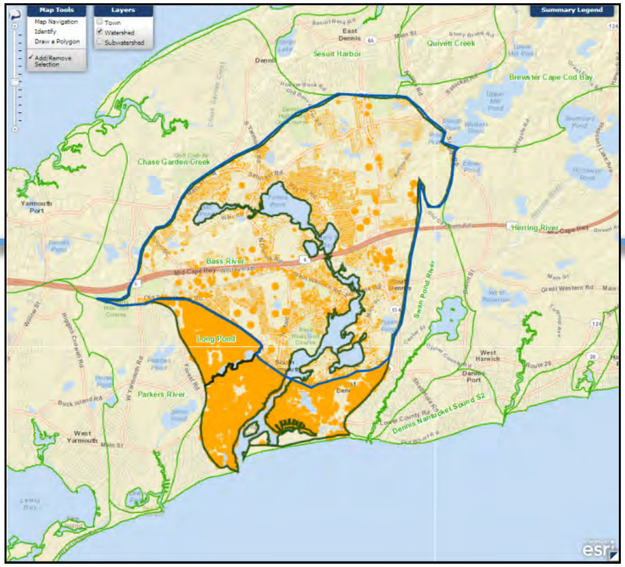
Targeted Centralized Treatment after Applying Alternative Strategies (12273 kg N/yr)



19% septic nitrogen removal

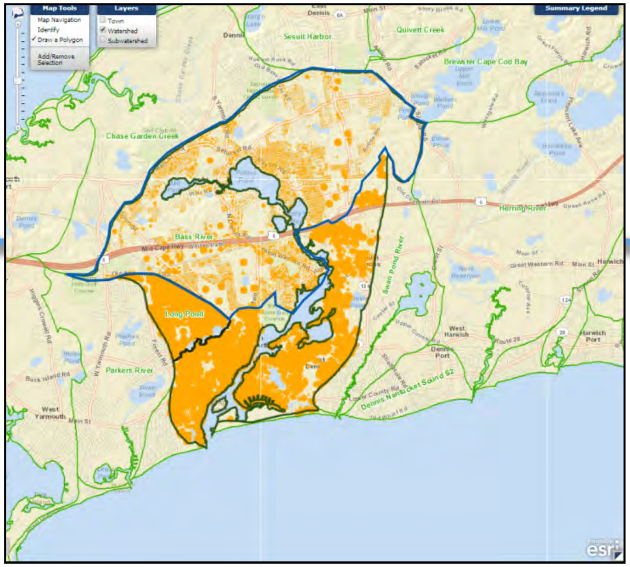
Scenario Comparison

Targeted Collection



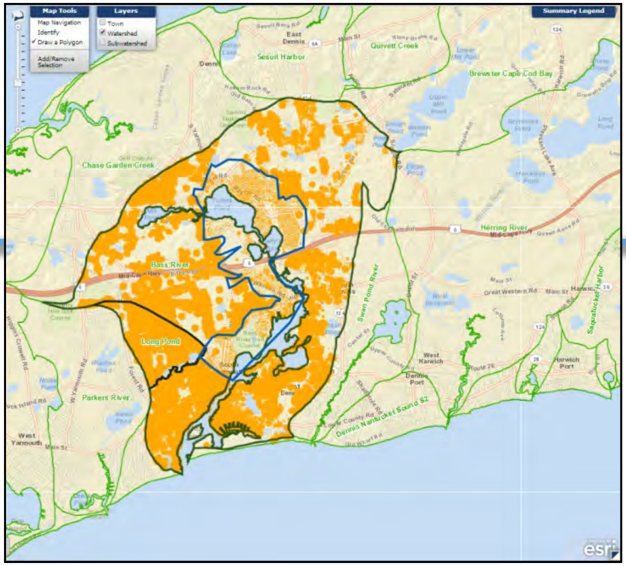
- Achieves TMDL[1]
- Total Cost = $410 Million
- Cost/lb N = $401
- Treated Flow = 1,316,000 gpd

Targeted Collection after a 50% reduction in fertilizer and stormwater



- Achieves TMDL[1]
- Total Cost = $332 Million
- Cost/lb N = $406
- Treated Flow = 1,055,000 gpd

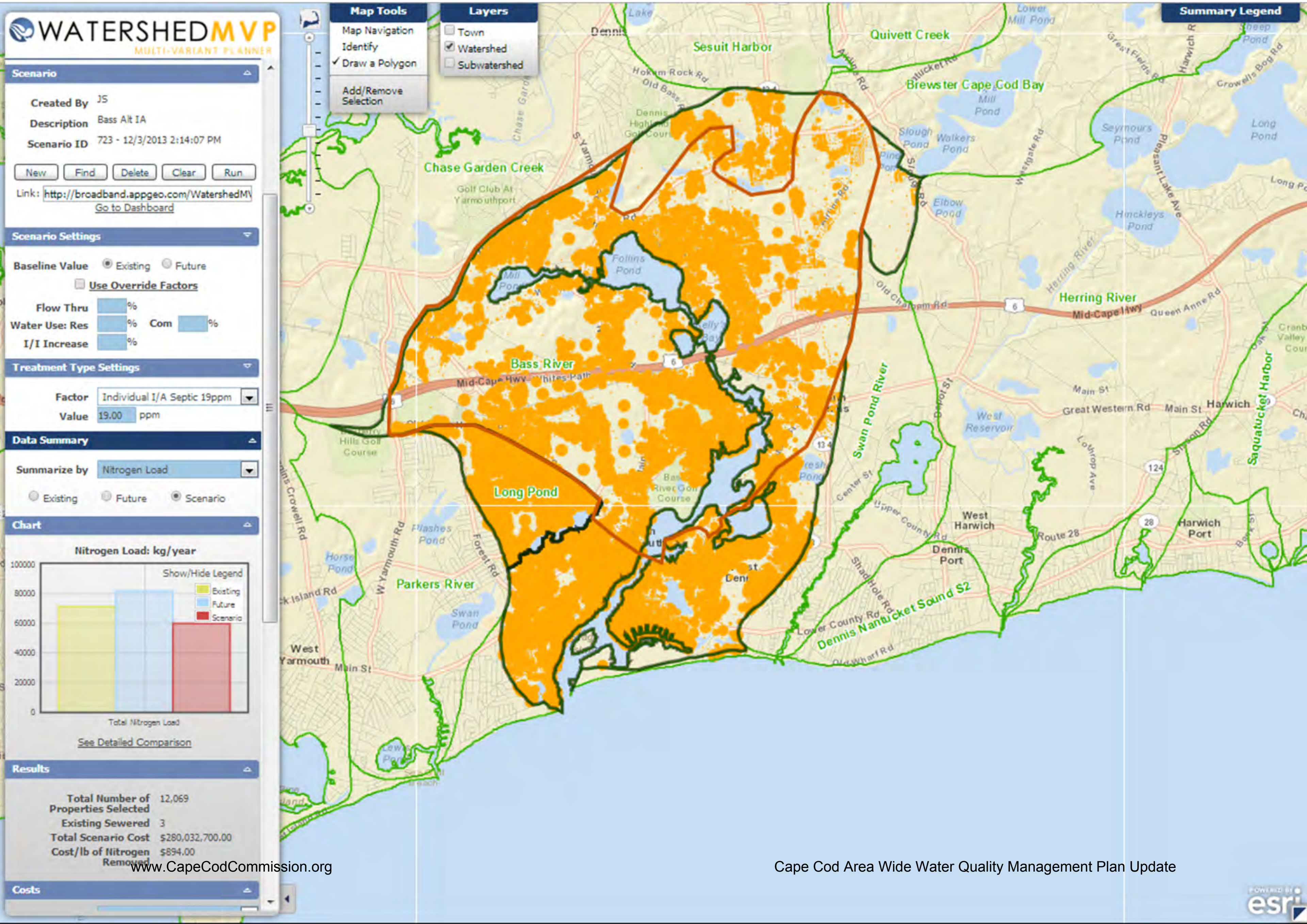
Targeted Collection after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



- Achieves TMDL[1]
- Total Cost = $135 Million
- Cost/lb N = $405
- Treated Flow = 397,000 gpd

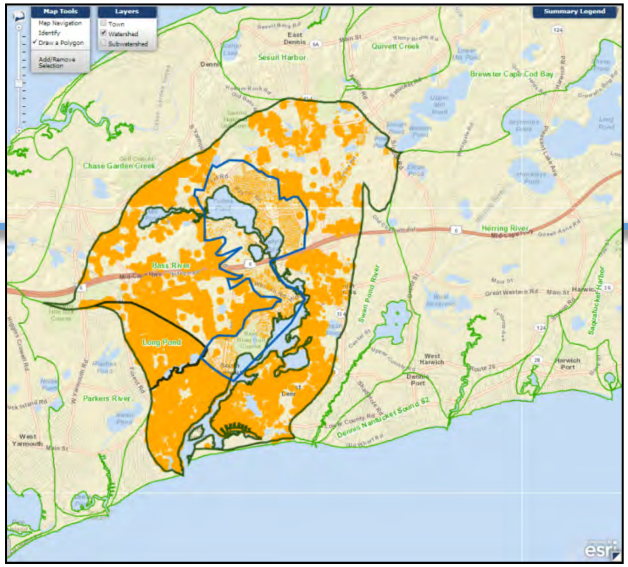
[1] within 5% of goal

Innovative/Alternative On-Site Systems after Applying Alternative Strategies (12273 kg N/yr)



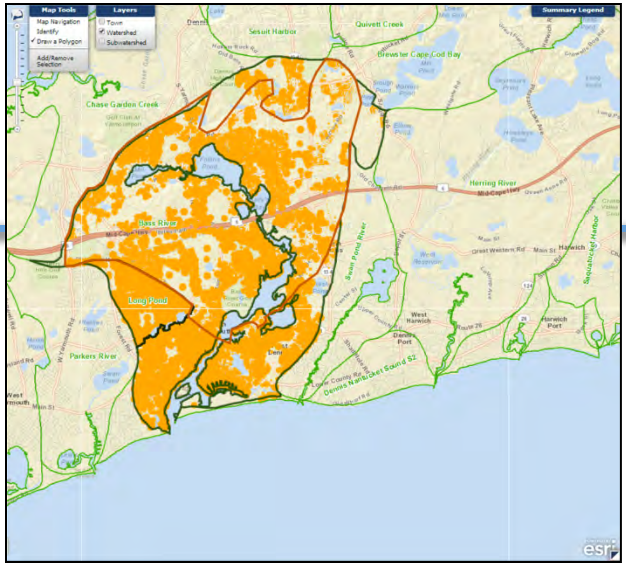
Scenario Comparison

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



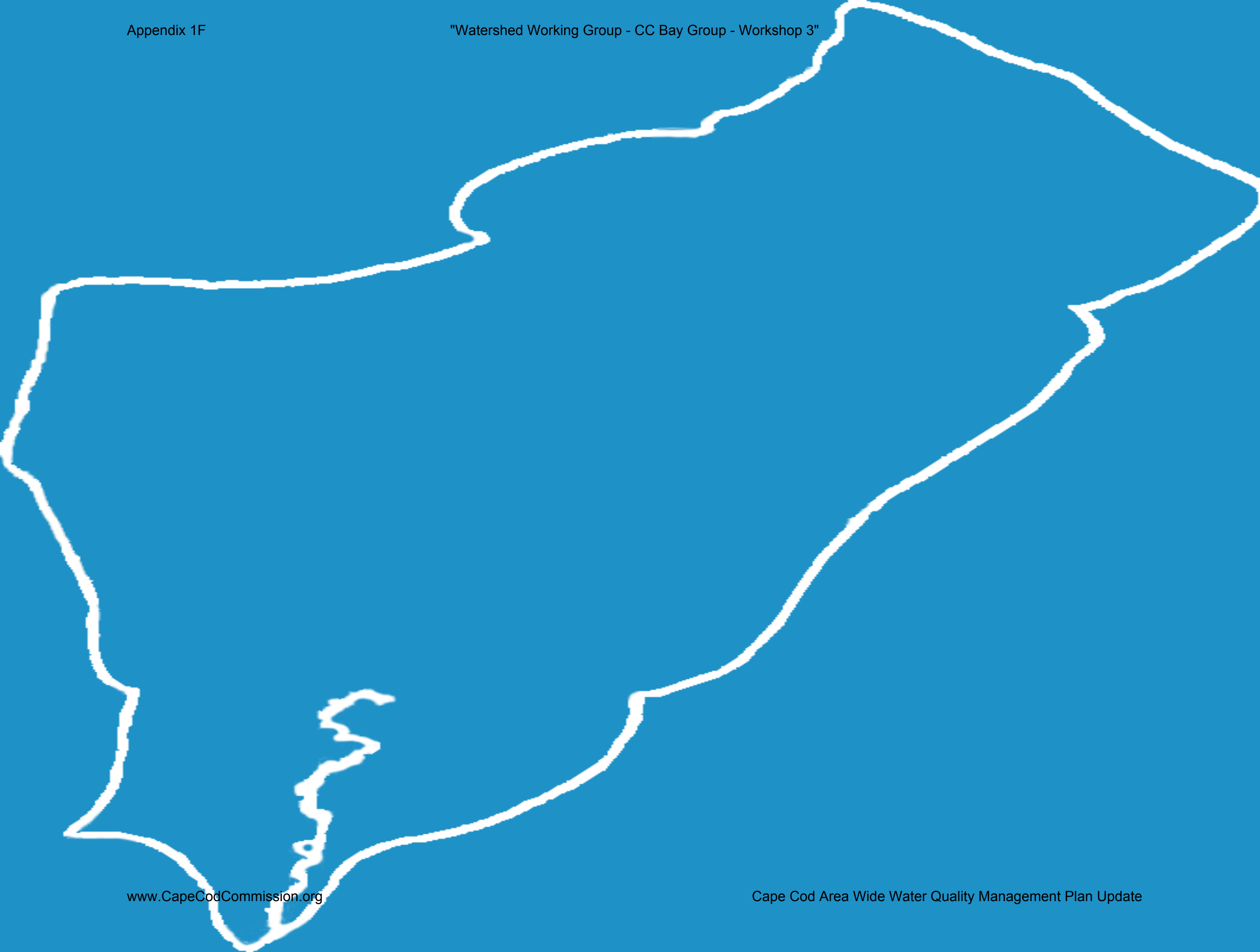
- Achieves TMDL[1]
- Total Cost = $135 Million
- Cost/lb N = $405
- Treated Flow = 397,000 gpd

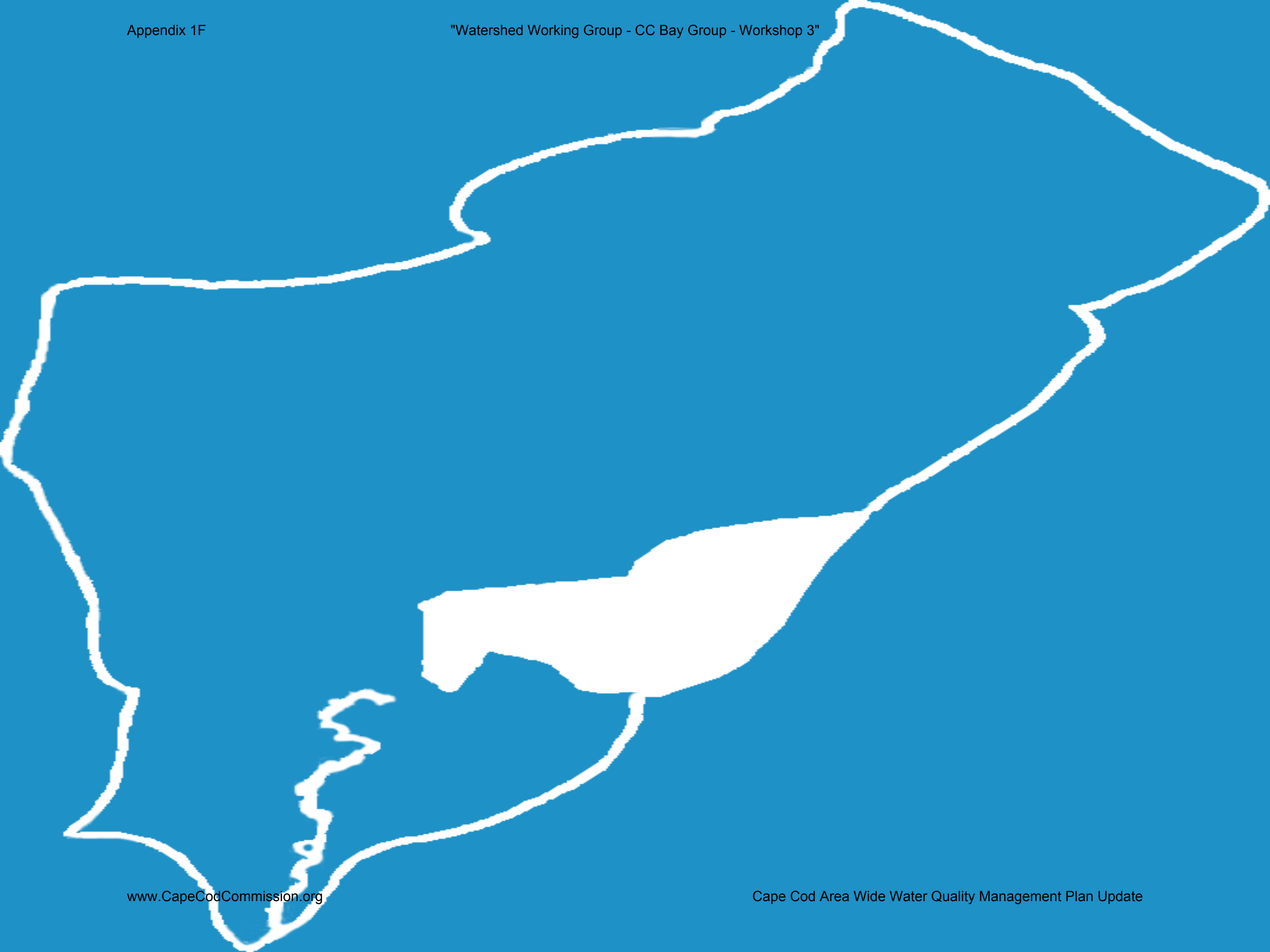
Innovative/alternative on-site systems after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



- Achieves TMDL[1]
- Total Cost = $280 Million
- Cost/lb N = $894
- Treated Flow = 1,172,000 gpd

[1] within 5% of goal



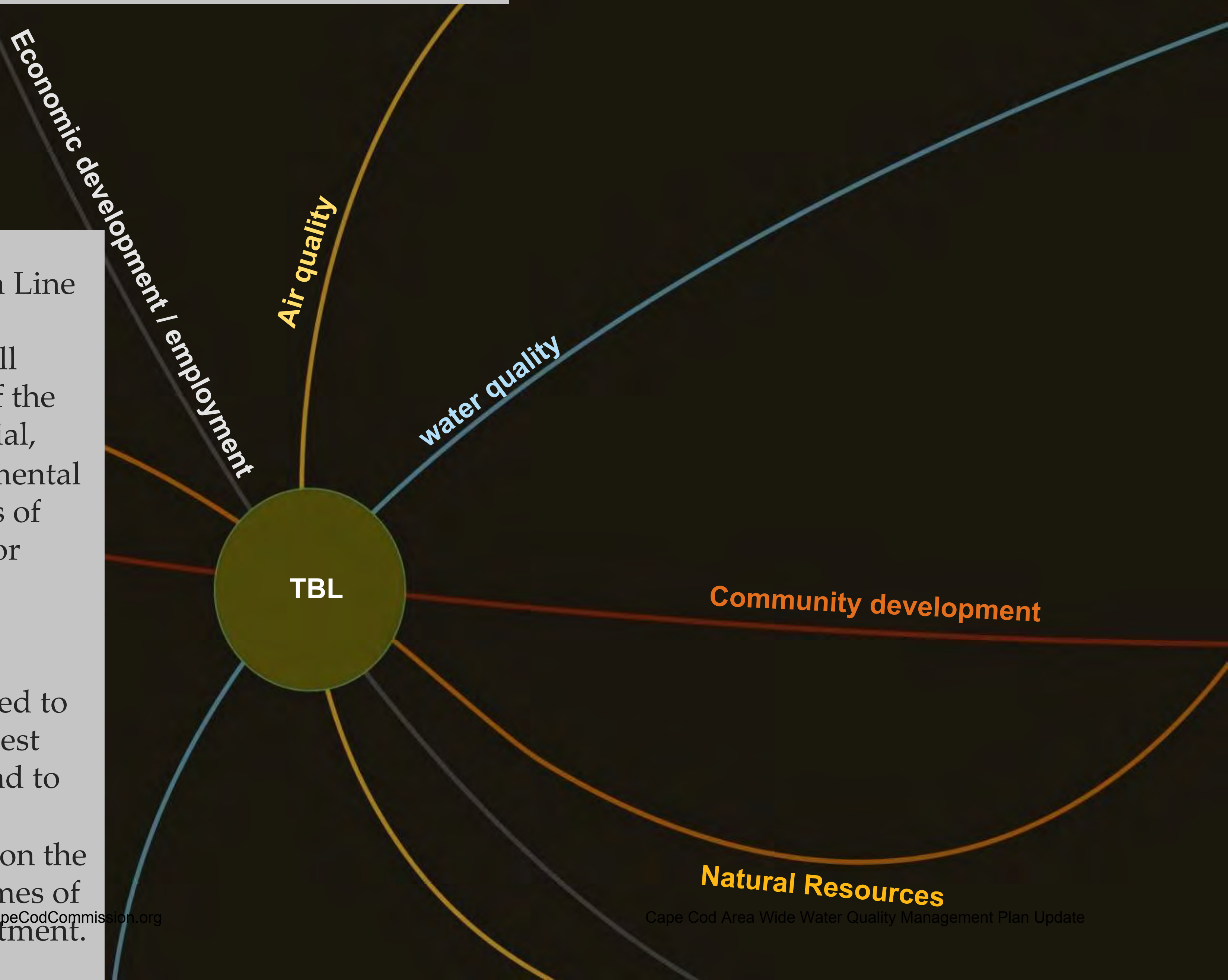


Adaptive Management:

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 way.

Triple Bottom Line (TBL) Introduction

What is triple bottom line analysis?



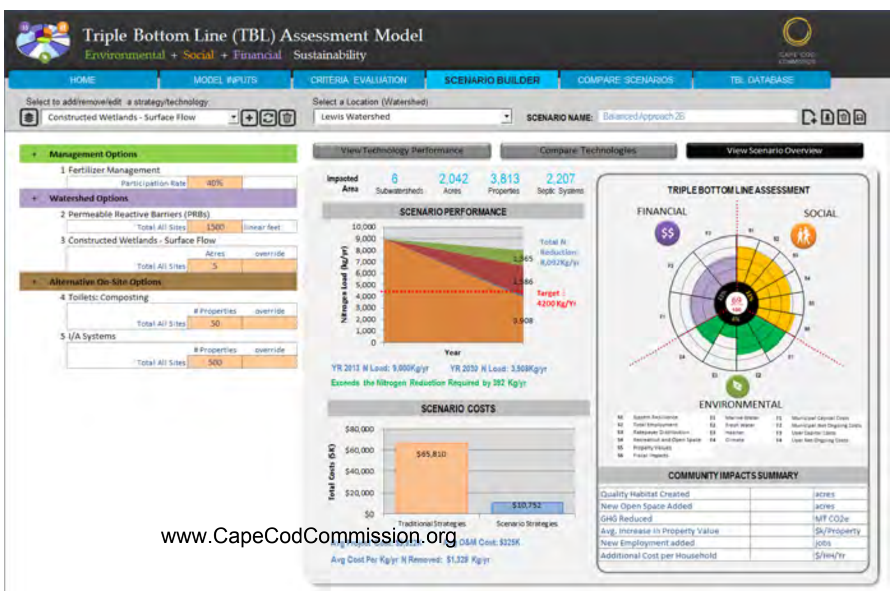
Triple Bottom Line Analysis
Provides a full accounting of the financial, social, and environmental consequences of investments or policies

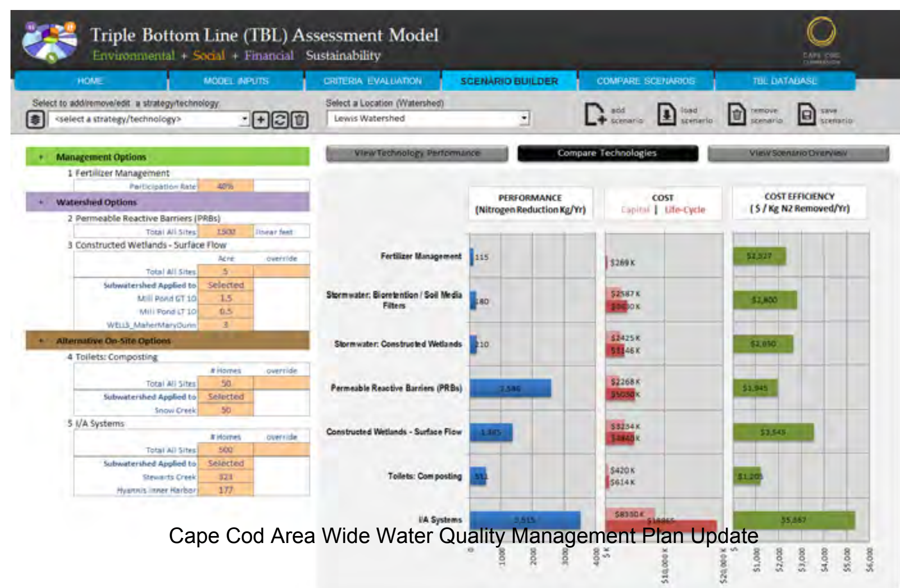
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

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

HOME | MODEL INPUTS | CRITERIA EVALUATION | SCENARIO BUILDER | COMPARE SCENARIOS | TBL DATABASE

Alternative Definition | Alternative Results | Alternative Scoring Rules

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

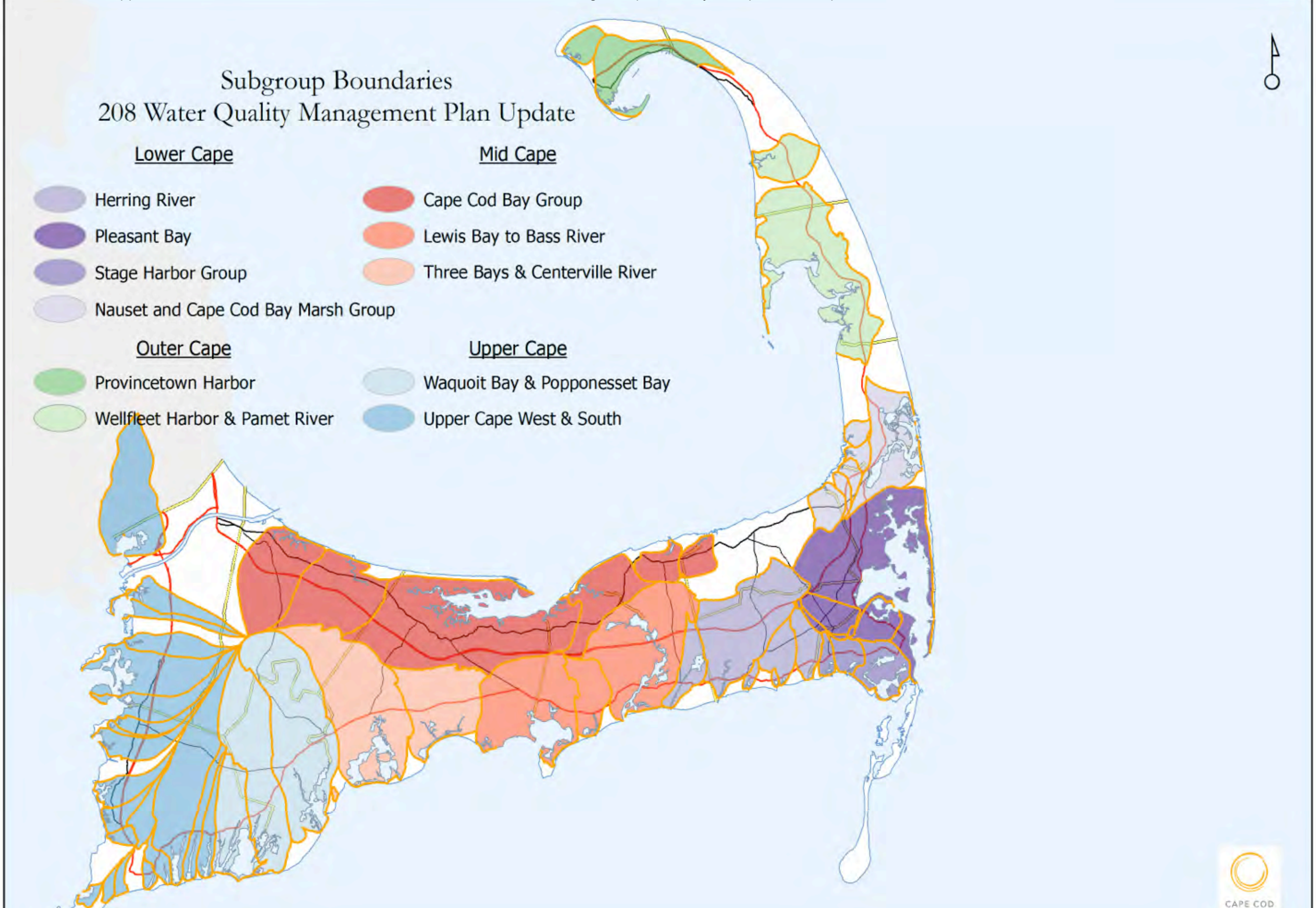
Scenario 1 — Minimum Cost

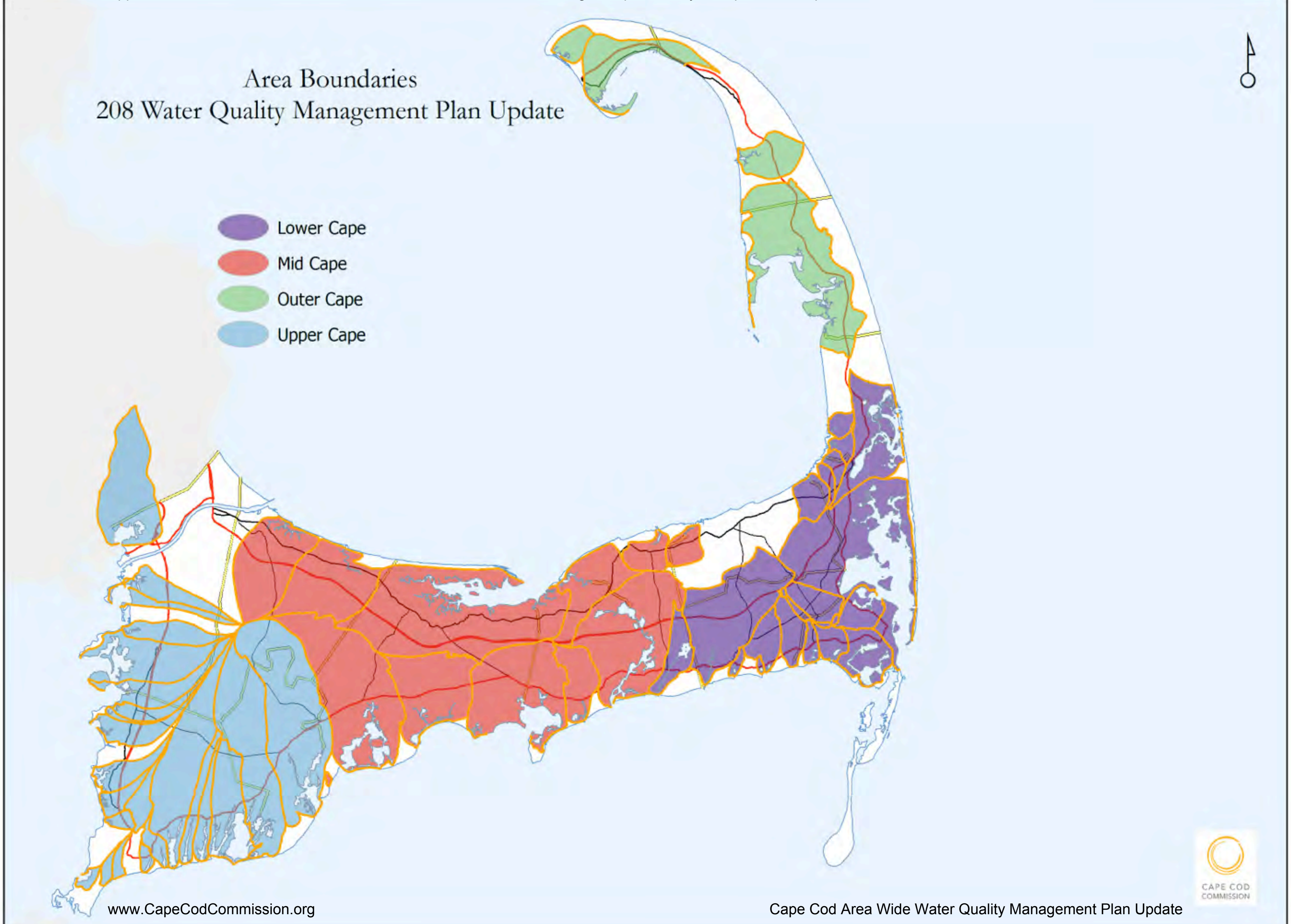
Scenario 2 — Cost Effective

Scenario 3 — Maximum Performance

Strategy/Technology Distribution

	Scenario 1	Scenario 2	Scenario 3
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. Increa[illegible]	$200	[illegible]	[illegible]
New Employment Added (jobs)	152	188	252
Additional Cost per Household ($/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
Lewis Bay to Bass River Watershed Working Group

Meeting Three
Thursday, December 5, 2013
8:30 AM – 12:30 PM
Dennis Town Hall

Meeting Summary

I. ACTION ITEMS

Working Group
- Contact the Cape Cod Commission if interested in participating in the Mid Cape sub-regional watershed group
- Contact the Commission if interested in participating in January ad hoc meeting on monitoring issues

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

Cape Cod Commission
- Publish report on Lewis Bay watershed on the working group's website
- Share information about date and time of the January stakeholder meeting and the ad hoc monitoring with the Working Group within the next week

II. WELCOME AND OVERVIEW

Carri Hulet, 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's task for the day would be to provide input on a few different scenarios the Commission had prepared to show how wastewater could be managed in the Bass River sub-watershed. The group would also be asked to evaluate the method by which the scenarios were developed, as it is expected that the same method will be applied to Lewis Bay and all other sub-watersheds on the Cape. She explained that the Cape Code Commission would only show the scenarios for the Bass River watershed at the meeting as an example, for the sake of time.

Scott Horsley, Area Manager and Consultant to the Cape Cod Commission, welcomed participants and offered an overview of the 208 Update stakeholder process.[1] In July, public meetings were held across the Cape to present the 208 Plan Update goals, work plan, and

[1] The PowerPoint Presentation made at this meeting is available at: http://watersheds.capecodcommission.org/index.php/watersheds/mid-cape/lewis-bay-to-bass-river

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. The third round of meetings of the Watershed Working Groups focus on evaluating watershed scenarios. These scenarios are informed by the Working Groups' discussions at previous meetings about baseline conditions, priority areas, and technology options and approaches.

Mr. Horsley shared the 208's Plan team's progress since Meeting 2, which includes:

- Meetings with the Advisory Board, the Tech Panel, the Finance Group, the Regulatory-Legal-Institutional Group, and the TAC.
- Further developed and shared the Technology Matrix, showing possible traditional and non-traditional technologies at the site, neighborhood, watershed, and cape-wide scales.

Mr. Horsley then reviewed the goals 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 using 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.

III. INITIAL SCENARIOS FOR THE BASS RIVER WATERSHED

Mr. Horsley explained the Commission's process to develop watershed scenarios. Two teams were formed: one team is exploring traditional (or "conventional") technologies and approaches (e.g. sewering and I/A systems) and another team is exploring non-traditional (or "alternative") technologies and approaches. The teams are both working under the assumption that fertilizer and stormwater reductions will be incorporated into all of the final scenarios, but for now, the traditional approach team also looked at two scenarios that do not include fertilizer and stormwater management in order to provide baseline estimates for comparison.

Traditional Approaches

Tom Cambareri, Water Resources Program Manager at the Cape Cod Commission, worked on the team that developed the "conventional" approaches and led this part of the discussion. 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 (not shown in the current scenarios), technology costs, and other factors.

He noted that the nitrogen TMDL for the overall watershed can be met if 47% of existing wastewater nitrogen load is removed from the system, as determined by the MEP studies.

He offered three main scenarios for the Bass River watershed[2]:

- Comparative I/A scenario
  - The installation of I/A systems in all homes in the Bass River watershed, which could reduce nitrogen to 19 parts per million and would remove 27% of the target nitrogen load, costing $430 per pound of nitrogen, and almost $18 million in total.
- Centralized treatment scenario
  - Modeled a hypothetical scenario in which treated water is put back into the watershed with nitrogen levels of 5 parts per million, resulting in an 81% reduction in nitrogen levels, costing $351 per pound, and $24 million in total.
- Targeted collection and treatment scenario
  - Mr. Cambareri explained that, according to the watershed MEP, 50% of nitrogen is attenuated when passing through a pond or lake, which can be modeled to find more effective remediation scenarios by focusing on downstream watersheds. Thus, it makes more sense to remove downstream nitrogen.
  - Mr. Cambareri also noted that fertilizer and stormwater runoff contribute significantly to nitrogen loads.
  - When fertilizer and stormwater runoff are reduced by 50% a smaller centralized sewering footprint or a reduced number of I/A systems can be utilized to address the target.

Working Group members had the following questions and comments about the conventional scenarios (Working Group questions and comments in italics; responses are from Mr. Cambareri unless otherwise noted):

- *Is the calculation of nitrogen in the sub watersheds in these models current or potential?* They show current loads.
- *If additional development came into the area, would it change the calculation?* Yes, future growth will be taken into consideration in the final analysis. *If we discussed future development contributing to 40% of mitigation needs at past meetings, then this could be a big deal.* Yes, we are showing a solid example of what is known today, but we need to be cognizant of future loads as well.
- Mr. Horsley noted that many of the technologies can be adapted to handle additional buildout. He added that Mr. Cambareri's analysis showed multiple ways to reduce the sewering footprint, which his techniques will also do.
- Ms. Hulet reminded the group that today presentation primarily serves to explain the Commission's approach, and that the final scenarios will be refined to take future development and other issues the working groups raise into account. She also

[2] See full presentation for details: http://watersheds.capecodcommission.org/index.php/watersheds/mid-cape/lewis-bay-to-bass-river

explained that Mr. Cambareri showed three approaches that prioritize sewers and I/A systems. She said Mr. Horsley would approach the same problem from the other end of the spectrum, by prioritizing non-traditional methods first.

Alternative Technology and Approaches

Mr. Horsley led the discussion of "alternative" technologies and approaches. He explained that the scenarios were developed for discussion purposes and encouraged the working group members to offer their own modifications and suggestions. He introduced the group to the watershed calculator his team used to evaluate these scenarios. The calculator starts with the nitrogen reduction target, then deducts the nitrogen load reduction potential (kg/yr) of a given technology. It then calculates the remaining nitrogen reduction needed to meet the target load (kg/yr), and the unit cost per pound of nitrogen removed ($/lb).

Mr. Horsley walked the Working Group through the proposed non-traditional scenario for Bass River watershed, showing how much nitrogen would be reduced by the addition of each alternative technology. The approach starts by assuming a 50% reduction in stormwater and fertilizer runoff because programs to achieve these reductions are assumed to be in place.

The proposed Bass River scenario seeks to meet the nitrogen reduction goal of 37,741 kg N/yr. Mr. Horsley noted that this watershed also has to be concerned with ponds, Title V problem areas, and growth management.

<u>Stormwater and Fertilizer</u>

Stormwater mitigation could remove 3,148 kg N/year. Massachusetts DEP also provides credits for stormwater management programs. Fertilizer management could remove 3,148 kg/year. This is done through better turf management and the CCC DCPC.

<u>Permeable Reactive Barriers (PRBs)</u>

PRBs could be placed perpendicular to roadways in several locations (see slides for detail). It is estimated that PRBs at the proposed locations could remove the nitrogen from 1220 homes, which would be equivalent to 3,757 kg N/yr.

<u>Constructed Wetlands</u>

If built in the proposed locations, 3 acres of constructed wetlands could remove 1,698 kg N/yr. These wetland locations were selected to intercept nitrogen-enriched groundwater downgradient from high-density septic areas.

<u>Phytoirrigation/phytobuffers</u>

In the proposed locations, 12 acres could remove 1,632 kg N/yr. Mr. Horsley explained that come phytobuffer plants could reach nitrogen in the underlying groundwater up to 20 feet deep because of their extensive root systems.

<u>Fertigation Wells</u>

These were proposed on 2 golf courses and could remove 272 kg N/yr. Mr. Horsley explained that fertigation wells on golf courses may not remove a great deal of nitrogen because the groundwater by golf courses often has low nitrogen levels due to better fertilizer management on the course, but groundwater downgradient from high density septic areas could be collected and pumped to golf courses and used as fertilizer. This option might also have return revenues (realized as fertilzer cost reductions) and existing wells could likely be used in some cases.

Oyster beds/aquaculture

40 acres of shellfish could remove 10,000 kg N/yr. The Commission used conservative removal numbers by using data that looked only at the amount of nitrogen in oyster meat and ignoring the shells and the benthic zone dentrification beneath the shellfish areas. This technology could be deployed either in aquaculture cages or reef beds.

Ecotoilets

Urine Diversion (U/D) and composting toilets in 458 homes (or 5% of the total number of homes in the Bass River watershed) could remove 1,812 kg N/yr. Mr. Horsley explained that 5% is an estimated number that might be adopted by future homeownere chosen by the team working on this approach. Some said that over a ten-year period, many more than 5% of the homes might want an eco-toilet. Others felt it was too much.

Sewering

After applying all of the previous alternative technologies, 12,273 kg N/yr remained to meet the target. Sewering 2,789 homes in targeted locations could meet that goal and would cost $580 per pound of nitrogen removed, or a total of $135 million.

Working Group Reactions, Questions, and Discussion

Ms. Hulet reviewed some of the priorities and concerns the participants had raised at past Working Group meetings. She asked if, given these priorities and concerns, they had feedback about the proposed technologies or suggestions on additional technologies that might be appropriate for this watershed. Working Group questions and comments follow in italics; responses are from Mr. Horsley unless otherwise noted.

Sewering

- *Would the effluent from a centralized treatment plant be released in or outside of our watershed?* Presumably it would be inside the watershed, unless an agreement could be made with another watershed, but no site has yet been identified.
- *The cost per pound is the same between the scenario with 'targeted collection after a 50% reduction in fertilizer and stormwater' and the 'scenario with targeted collection after a 50% reduction in fertilizer and stormwater and after applying alternative approaches,' but the second one has an overall lower cost. Why is this?* The first shows the additional sewering cost with a larger footprint. The second scenario allows a smaller footprint, which allows the town to be more efficient by targeting denser areas.

- *How many homes are sewered in each of the four scenarios?* There are about 9,000 in the first (sewer everything), 7,000 in the second (targeted sewering), 6,000 in the third (targeted sewering after fertilizer and stormwater management), and 3,000 in the fourth (sewering after fertilizer and stormwater management and applying various non-traditional technologies).
- *Are the public and private costs shown for sewering?* The capital costs and maintenance costs are included. Mr. Cambareri added that the life cycle costs were not included.
- *Shouldn't we consider areas where sewering will be required anyway (areas of dense future development)* Yes.
- *Sewering near shorelines might be problematic, as storms could destroy them and create disagreements about who should pay for the repair costs.*
- *Some areas will inevitably need to be sewered no matter what. These projects should be prioritized and built as soon as possible.*

Aquaculture

- *Though oyster beds have tremendous potential, there should not be too much optimism as there are currently limited seed supplies, and the final product may not be consumable because of water quality issues*. *There may also be disposal costs.* There are many details that would need to be worked out. If the oysters can be sold and consumed, this approach could generate revenue and private citizens and companies would be interested. If not, there could be some costs to the public to grow the beds.
- *In Barnstable, oysters could be moved to a clean water body after a certain point, which makes them consumable. They are also an immediate solution because you see the effects after just one season.*
- *How realistic is the proposed acreage for oysters?* The number was based on other studies. Mr. Horsley asked the group how it compared to the actual situation in Bass River. Some said there is potential for 40 acres.
- *Additional oyster beds have been established since the release of the MEP reports. Presumably those beds have reduced the nitrogen load already. We should get credit for that.* Another participant responded, saying *there has also been more population growth since the MEP reports were issued.*
- *Oyster reefs can be vulnerable to pollution from stormwater and other contaminants.* Yes, the technologies go hand in hand, so stormwater management could potentially improve water quality and boost aquaculture.

Ecotoilets

- *Ecotoilets get picked on for not being "permitted," but they are approved, just not for nitrogen credit. The other systems also do not have credit approval yet.* You are correct. They are allowed under Title V, but the nitrogen credit has not yet been worked out. *It should be easy to get approval for them, as all the human waste is contained inside the system.*

- *Having ecotoilets in 458 homes seems conservative to me. We might not be able to sewer 3,000 homes, so we will need to do a cost/benefit analysis and if ecotoilets make economic sense compared to tying into sewers, people will likely be attracted to whichever option is cheaper.*
- *There should not be a choice: new developments should be required to install ecotoilet systems. The general public would rather push the cost to developers. There could be permiting guidelines that require the adoption of eco-toilets for the some high percentage of the new homes.*
- *Any requirements like that could inhibit future growth.*
- *Are there also issues of seasonality? If you only use it in the summer, is that a problem?* (this question was not directly responded to, but one person said *sewers can also have problems with seasonality.*
- In the future, Mr. Horsley said, resistance toward ecotoilets will hopefully decrease with public education efforts, especially those directed at school children now.
- One participant suggested a specific method for getting more than 5% of the homes to use ecotoilets. He said *if 3% of septic systems need new permits each year anyway, and it costs them $10,000 for a septic upgrade, we should encourage homeowners to install eco-toilets instead. We could possibly increase adoption by 1 to 2% a year this way.*
- *If we build a sewer system for 3,000 people, we might just encourage more development.*
- *It's going to take 5 to 10 years to get approval for something like ocean outfall. We could spend that time installing other systems, such as ecotoilets.*
- *The cost of installing ecotoilets in homes is directly on the homeowners.* That depends on the policy, which might include incentives, said Mr. Horsley, and he confirmed that the Commission is looking into costs with financial models.
- One person asked *whether the town has the authority to require certain technologies (such as an ecotoilet) or if it can simply regulate the amount of nitrogen that needs to be managed.* It is more of the latter, though they can suggest and incentivize a proposed alternative system, and the Cape Cod Commission has some zero limit regulations for larger developments.
- *Another problem with ecotoilets is that the maintenance is left to the owner.* Yes. At the community scale, we need to consider long-term operations and maintenance management strategies. Some of those might involve the government. One person said *he didn't think people would want the government coming into their homes to inspect their system. Another person said they already do something similar with boiler inspections, while another said it's unavoidable so people will have to get used to it.* Ms. Hulet summarized the conversation by saying that privacy issues are a concern that need to be taken into account.

<u>Other Technologies and Overarching Technology Questions</u>

- One person recommended expanding the calculator sheet to include timeframes for implementation and impact.

- One person asked *whether PRBs are less effective if the groundwater hits them from the side, rather than straight on? PRBs would be designed to intercept groundwater flow perpendicular, not from the side.*
- *For dredging, when looking at the TMDL, can we consider the benthic sink contribution, and what are we doing relative to that?* The MEP report breaks down nitrogen into controllable and non-controllable sources, and benthic environments are considered non-controllable unless dredged.
- *Will costs be added to each of the technologies?* Yes, to the extent they can be predicted. It's assumed that non-traditional technologies will only be pursued if the costs are lower than those of traditional approaches. But it appears now that most of them are cheaper, especially aquaculture. Many of them also have co-benefits, such as return revenues and job creation. A participant seconded the value of looking at job creation when evaluating these technologies.
- *How old is the nitrogen reduction target*? The MEP report uses some data that is 10 years old. Since that time, the towns have better controlled nitrogen, but growth has also changed. Mr. Horsley acknowledged that updated information would be helpful.
- *Will these technologies also deal with emerging contaminants?* Yes, the Commission is considering this issue, though the main focus is nitrogen. It is discussing phosphorous in lakes, high microbe levels, and emerging contaminants. The problem is that, since they are still emerging, reducing them is somewhat of a moving target.
- *Have you planned these technologies with the understanding that atmospheric nitrogen levels are decreasing?* Yes, we will talk more about this in the adaptive management presentation.

Approach

Ms. Hulet reviewed the 7-step approach and asked the Working Group for their thoughts on the method.

Considerations to incorporate into the plan

Several members of the Working Group praised the approach, noting its flexibility. Others supported the approach but noted that it should include a more solid timeframe and consider other issues on the Cape, including TMDLs for bacteria, lake and estuary protection, and areas with vulnerable Title V systems, which may require sewering. Mr. Horsley agreed that weighing other considerations is important, and cited the potential adverse effects of sea level rise on septic systems as an example of a changing condition that needs to be taken into consideration.

A participant underscored the importance of protecting drinking water sources in Cape Cod, stating that the 208 Plan should prioritize the protection of drinking water wells with high levels of nitrogen. Mr. Horsley said that, overall, the drinking water has been well protected and agreed that any new approach should not trade improvements in nitrogen reduction for harm to drinking water. Mr. Cambareri added that open space protection and zoning have been quite effective at protecting drinking water, but still some wells have approached 5 parts per million for nitrogen. He said this was mostly because of development that occurred over forty years ago and is only now making it to the wells.

A group member asked how the process would handle interactions between towns as most of the watersheds have more than one community. Mr. Horsley highlighted the importance of collaborative work and added that the process might involve watershed-level rather than town-level permitting. This would require agreements between the towns.

Public Education

Some members said they were impressed with the approach and the tools it offers, as it makes the process easier to see with clear math and numbers. One person said the information might work well with STEM education in schools. Kristy Senatori, Deputy Director of the Cape Cod Commission, noted that students were very engaged in the Cape-2-O game, and one of the awards went to a Falmouth STEM program. Another participant added that public education, as well as seeking low hanging fruit, would be critical for overcoming resistance to the plan. A member of the public audience commented that the public would more easily digest the technologies if they were not proposed as sewer or wastewater issues, but instead as green space or transportation measures.

Political Appeal

A Working Group member noted that passing publicly-funded measures to manage wastewater has been very challenging on the Cape. One person said the Commission should consider public-private partnerships, and to what extent these solutions can be implemented at private cost rather than public. Others said sharing the cost among taxpayers is the only way the target will be met. Another said we need to be looking for money from federal sources. Mr. Horsley noted that voters may be more ready to choose alternatives than we think given the positive reception these approaches have received in the working groups. Ms. Hulet added that one of the areas of focus in the next six months will be figuring out how to create political will to pursue these solutions. A Working Group member added that, once homeowners need to be involved in the process, it becomes a nightmare, so a moderate approach that affects everyone equally and includes some of the alternative technologies will be more likely to succeed. He added that he was more optimistic about the process today than in the past because of the clear presentation of alternatives and outreach to the Working Groups.

Lewis Bay

A Working Group member asked if the Commission is considering any technologies for the Lewis Bay watershed, especially ones that target herbicide runoff. Mr. Horsley responded that the Commission is preparing a scenario for Lewis Bay, which is different because of its scale, sewer system, and PRB considerations. He said that herbicide mitigation is not the focus of the project but will be addressed in the report. Another participant asked if they could comment on the Lewis Bay plan once it is completed. Mr. Horsley said the Commission will have more meetings for people to engage in this and will also place the information on the website.

IV. ADAPTIVE MANAGEMENT

Scott Horsley explained the concept of adaptive management 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.

He noted that adaptive management does not mean endlessly waiting for new data before taking action. He said adaptive management is a way to move ahead, even in a situation with a great deal of uncertainty due to new technologies and a changing environment, as well as other dynamic factors. He emphasized that an adaptive management plan needs to meet the set water quality goals, while being cost effective and time sensitive. Mr. Horsley and Ms. Hulet then led the group in a discussion about how to construct this plan – including the critical elements of the plan and how to communicate and manage it.

Timeframe and Prioritization

Ms. Hulet asked the group to think about where you would start – what you would try first, and how you would propose to match up the monitoring and evaluation with the decision points to stick with the experiment or give up and go to another option.

A Working Group member, referring to sewering, stated that everything is adaptive management until the problem is solved with more expensive and permanent solutions having a longer timeframe and requiring more monitoring. Ms. Hulet asked if sewering should be part of a one- to five-year plan, or if it is a last resort. A participant supported including it in the plan from the start, adding that the process takes several years to plan and fund before it gets built anyway, and some places "we already know will need to be sewered."

Another participant said we should focus on low-hanging fruit, like PRBs and aquaculture to build confidence in the adaptive management approach, and to then be better positioned to implement more ambitious, longer term plans later. Another group member added that these low hanging fruit could include retrofitting projects and systems that will work immediately, such as urine diversion. A participant added that projects that involve co-benefits should also be highly prioritized.

Management Structure

A Working Group member emphasized the importance of an authoritative body to lead the process, consider the details, transcend town lines, and oversee the lengthy implementation and monitoring stages. One person said the Cape Code Commission is the default option. Another participant agreed that the plan needs to be dealt with cooperatively. One person cited the towns' cooperation on transportation as a successful example of cross-boundary coordination. Another said stormwater management provides some precedent for Cape-wide collaboration. Others worried that pushing for county level institutions would engender anti-government sentiment and recommended having a few towns work together or tasking the

Cape Cod Commission with orchestrating collaboration among several smaller watershed groups.

Private Sector

Several working group members said the private sector needs to be brought into the process, as the low-hanging fruit are also potentially profitable (including ecotoilets, aquaculture, fertigation, fertilizer management, etc.). One said developers could also be partners with the right incentives. Mr. Horsley responded that this makes sense and has already accomplished in certain areas, noting that several developments have been designed and permitted that actually result in a net reduction of nitrogen, commonly by providing sewering to neighboring developments that are currently on septic systems. A participant noted that several hotels in Yarmouth have old systems and would likely be willing to join together with a new development to build a treatment plant.

Summary of Adaptive Management Comments

Ms. Hulet summarized the comments on the adaptive management plan by highlighting some critical elements:

- Timing: What gets implemented when? How is it monitored and when do you know whether to go to Plan B or C?
- Prioritize co-benefits
- Incentivize and partner with the private sector
- Implementability – who will make sure the plan gets followed? How? With what authority and funds?
- Look to both retrofit and build better in the future
- Consider growth management

V. PREPARING FOR 2014 JAN-JUNE

Kristy Senatori, Deputy Director of the Cape Cod Commission, shared the Commission's plans for continuing stakeholder engagement into 2014.

Triple Bottom Line approach

Ms. Senatori presented on the work that the Commission has done with AECOM to develop a Triple Bottom Line model. First, she defined Triple Bottom Line Analysis as a full accounting of the financial, social, and environmental consequences of investments or policies. She also noted that TBL analysis is often used to 1) evaluate scenario alternatives and rank them against each other; and 2) report to stakeholders on the public outcomes of a given investment. To explain why the Commission has decided to pursue a TBL model, Ms. Senatori shared that it will allow the Commission to:

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

- Evaluate the "ancillary" or downstream consequences of water quality investments, not just direct phosphorous or nitrogen level reductions.

She also explained that AECOM is working with Commission staff and stakeholders to develop criteria that integrate social, environmental, and financial considerations into the TBL model. These include:

- **Social**: System Resilience (i.e. how communities respond to natural hazards), Employment, Property Values, Ratepayer Distribution, Recreation and Open Space, Fiscal Impacts
- **Environmental**: Marine Water Quality, Fresh Water Quality, Climate, Habitat
- **Financial**: Municipal Capital Costs, Municipal Other Costs, Property Owner Capital Costs, Property Owner Other Costs.

Ms. Senatori then showed how three different hypothetical scenarios (minimum cost, cost effective, and maximum performance), when run through the model, rank comparatively, taking into consideration these social, environmental, and financial factors. She explained the model will be finalized by January or February 2013, and that the Commission will be using it over the next six months to assist in scenario evaluations.

In response to questions from the Working Group, Ms. Senatori and Ms. Hulet explained that all of the proposed scenarios will meet the water quality goals, and triple bottom line analysis is a tool for choosing among different scenarios that all meet the regulatory requirements. They noted that costs are factored into the social considerations through Cape property values, with the model will potentially be able to shed light on the trade-offs between economic development and nitrogen reduction costs.

Stakeholder Process: Summit and Working Groups
Ms. Senatori explained the next steps of the 208 Plan Update, which include:

January 2014	Assemble all 175 stakeholders across Cape Cod for a one-day Stakeholder Summit (tentatively scheduled for Jan 31) to discuss further planning, share the outcomes from stakeholder meetings, and form four sub-groups representing the Upper-, Mid-, Lower-, and Outer-Cape. These groups will likely meet three more times (Feb, March, April) and guide discussions over the next six months. The Commission may also convene an ad-hoc meeting to discuss monitoring protocols for different technologies.
February 2014	Meetings with the four sub-groups to further develop local scenarios and run them through the TBL model.

March 2014	Analysis performed by the Regulatory, Legal, and Institutional Work Group. The scenarios developed by the four sub-groups will be evaluated based on this analysis.
April 2014	Meetings with the four sub-groups to discuss monitoring and financial considerations of implementation.
June 1, 2014	Draft plan submitted to DEP.
June – Dec 2014	Public comment period on the draft plan.
January 2015	Submit final plan to DEP.

A Working Group member said it is import to maintain focus on individual watersheds, rather than regional or even municipal boundaries. Ms. Senatori said the Commission is encouraging watershed-level coordination.

VI. PUBLIC COMMENTS

One person said what many call pollution is not waste, but a resource that is put in the wrong place. Ecosystems provide everything to us, and, as they function naturally, they have no waste. She expressed dismay at the focus of the discussion on removing nitrogen rather than using nitrogen, and said if we do not follow the rules of nature, we will destroy something somewhere else. We see this in the economy. She said phosphorous is another good example – we are running out of it and cannot grow food without, but then trying to remove and dispose of it elsewhere in the ecosystem. She said, when this is considered, ecotoilets become a no brainer.

Another person complemented the Commission and the group on its work and said if we truly embrace the triple bottom line approach, we will take into account the value of the specific use of a technology as a benefit, which is critical to sustaining our community.

APPENDIX A: MEETING PARTICIPANTS

Name	**Affiliation**
Working Group Members	
Linda Bollinger	Hyannis Park Civic Association
Debra Dagwan	Barnstable Town Council
Steven Didsbury	Nitrogen Neutral, Centreville
Terry Hayes	Town of Dennis, Health Director
Jan Hively (on the phone for half the meeting)	Civic Groups, Yarmouth

Rick Lawlor	Golf Course Superintendents Assoc., Yarmouth
Spiro Mitrokostas	Dennis Chamber of Commerce
Charles Spooner	Resident of Yarmouth
Mike Trovato	Town of Barnstable
Sam Wilson	Sotheby Realty, Barnstable
CCC Staff / Facilitators	
Scott Horsley	Consultant, Watershed Area Manager
Tom Cambareri	Cape Cod Commission
Erin Perry	Cape Cod Commission
Carri Hulet	Consensus Building Institute
Griffin Smith	Consensus Building Institute
Public/observers	
Brian Bradigan-Smith	Lark Bay Researcher
Tara Corseri	LBRC
John C. Dorris	Centerville Civic
Hilde Maingay	The Green Center
Ellen Merritt	LBRC
Dan Milz	University of IL, Inst. of Envir. Science & Policy
Rulon Wilcox	LBRC

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*

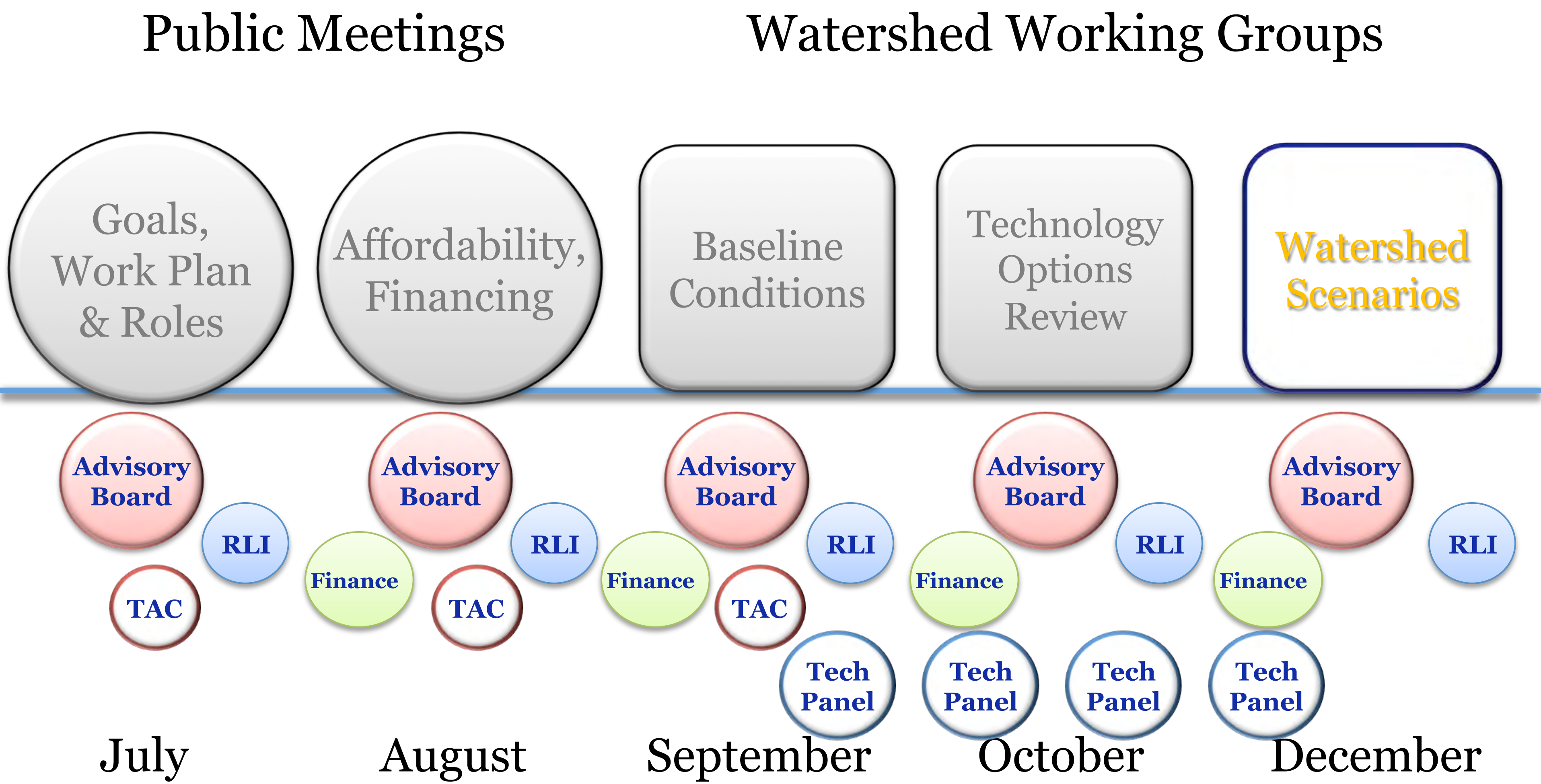
- Triple Bottom Line approach
- Identify Shared Principles and Lessons Learned
- Describe Next Steps

12:15 Public Comments

12:30 Adjourn

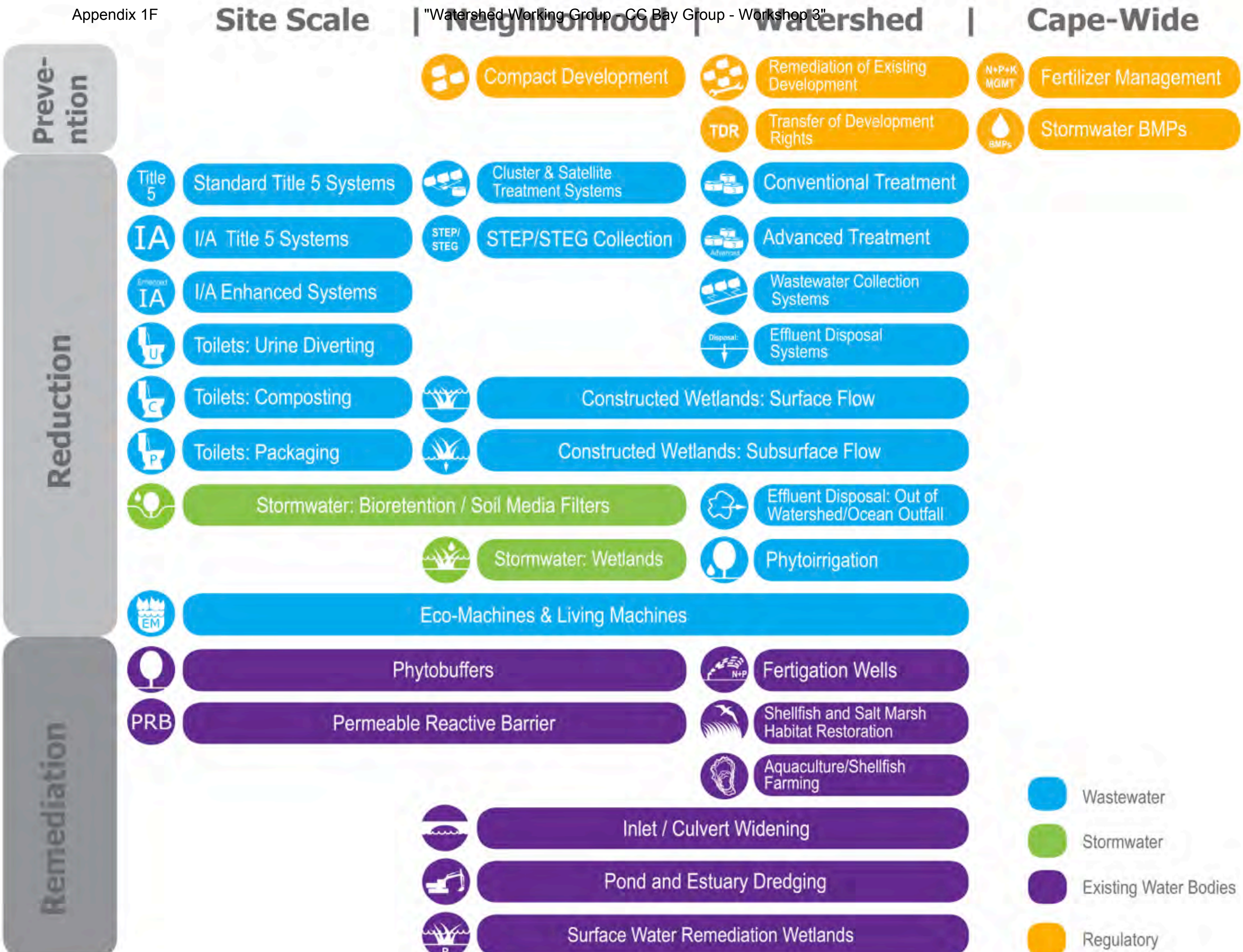
Nauset & Cape Cod Bay Marsh Group

Watershed Scenarios



RLI Regulatory, Legal & Institutional Work Group

TAC Technical Advisory Committee of Cape Cod Water Protection Collaborative

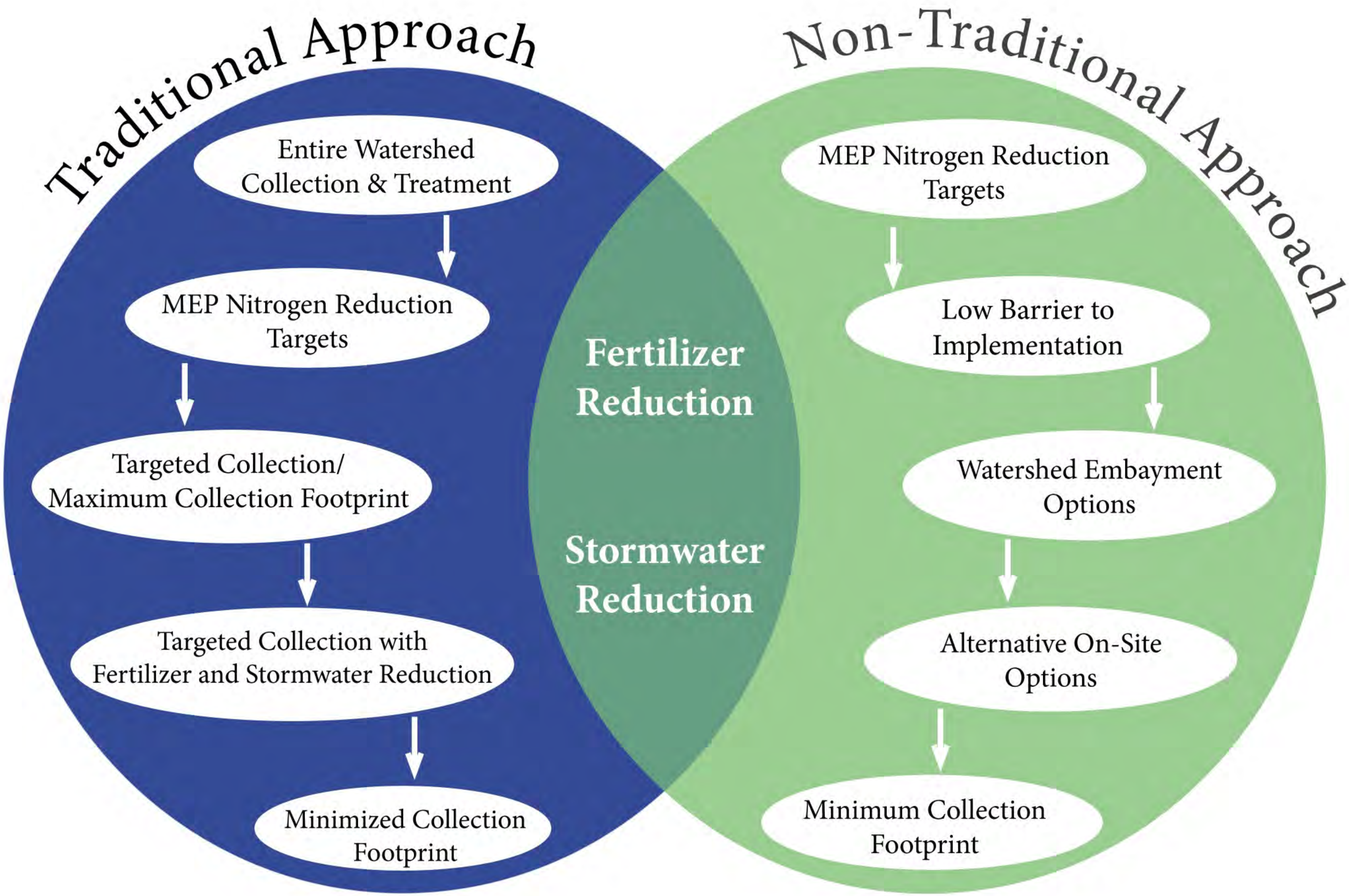

Site Scale | Neighborhood | Watershed | Cape-Wide
Prevention
Reduction
Remediation
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced
Advanced Treatment
Enhanced IA
I/A Enhanced Systems
Wastewater Collection Systems
U
Toilets: Urine Diverting
Disposal
Effluent Disposal Systems
C
Toilets: Composting
Constructed Wetlands: Surface Flow
P
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

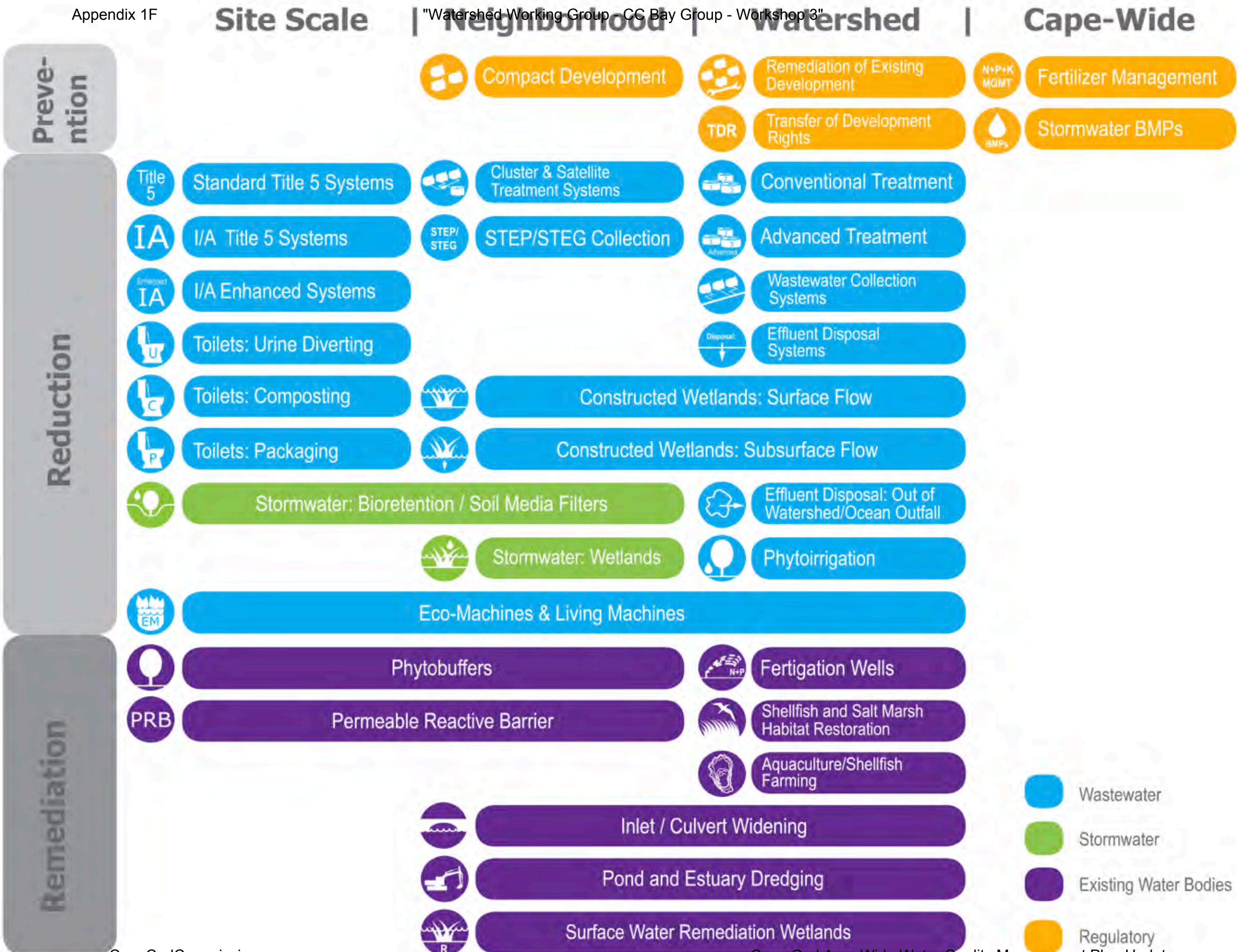
Watershed Scenarios

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



Site Scale | Neighborhood | Watershed | Cape-Wide
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Compact Development
Remediation of Existing Development
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Toilets: Packaging
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Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
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Eco-Machines & Living Machines
Phytobuffers
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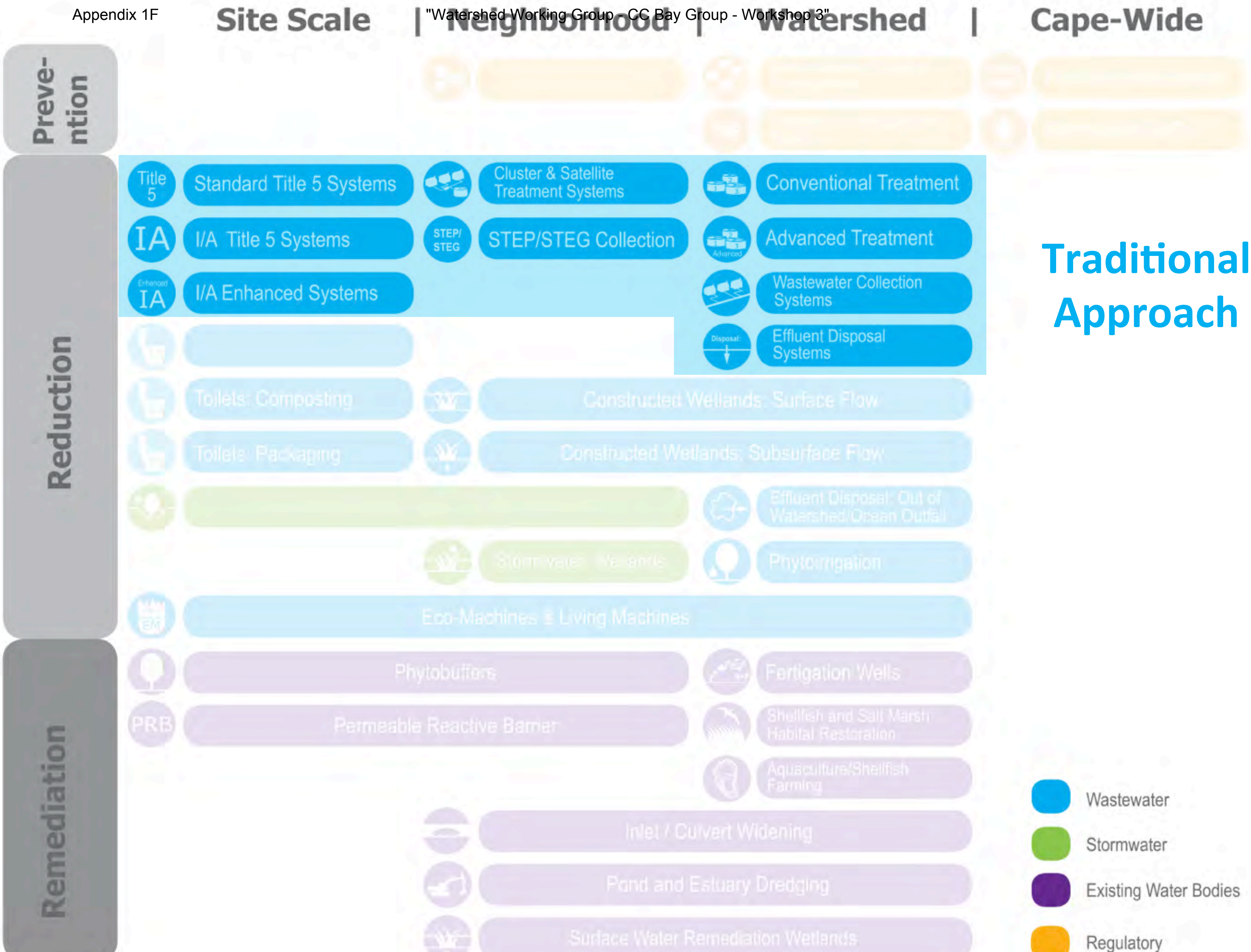
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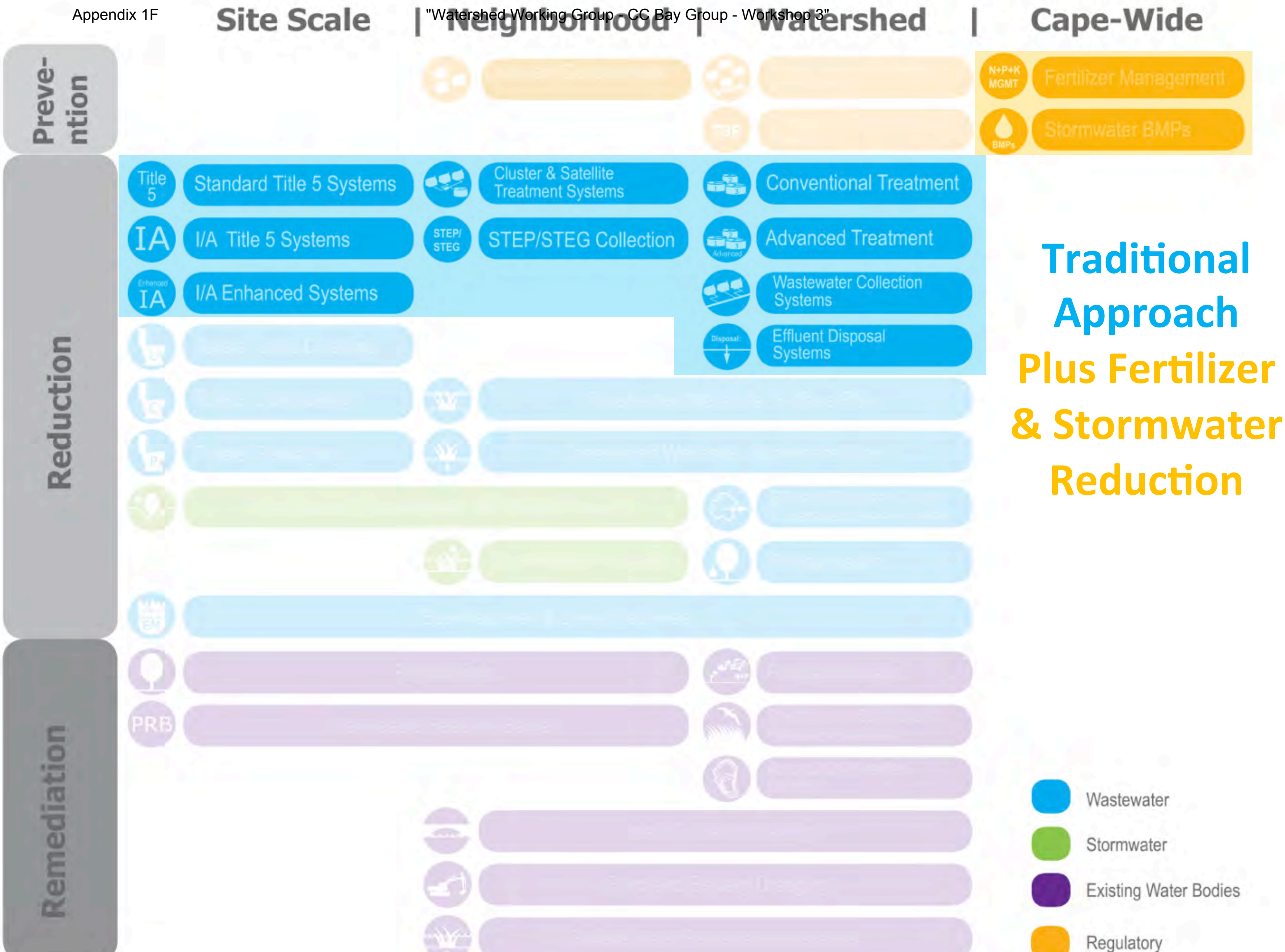
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Traditional Approach
Plus Fertilizer & Stormwater Reduction
Wastewater
Stormwater
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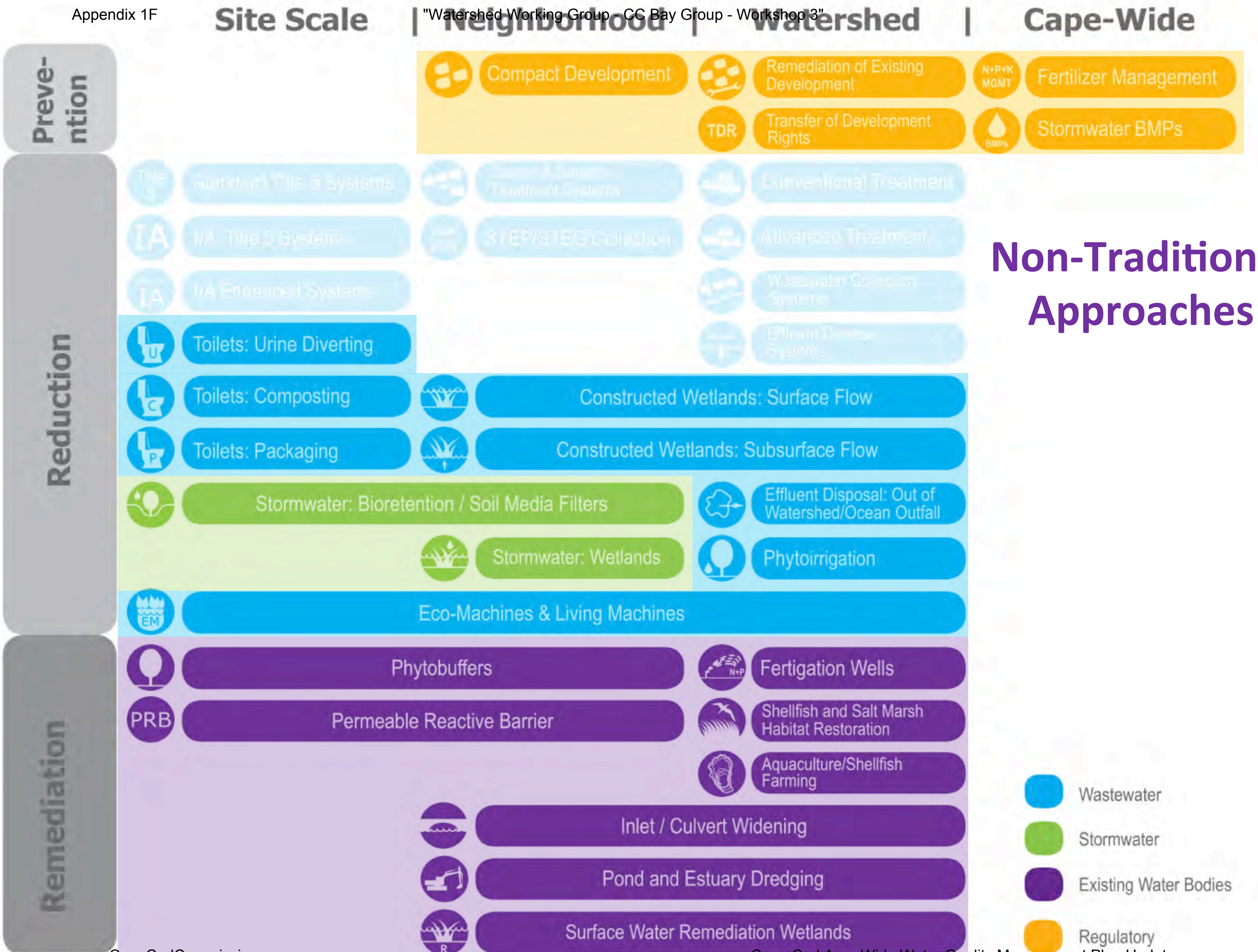
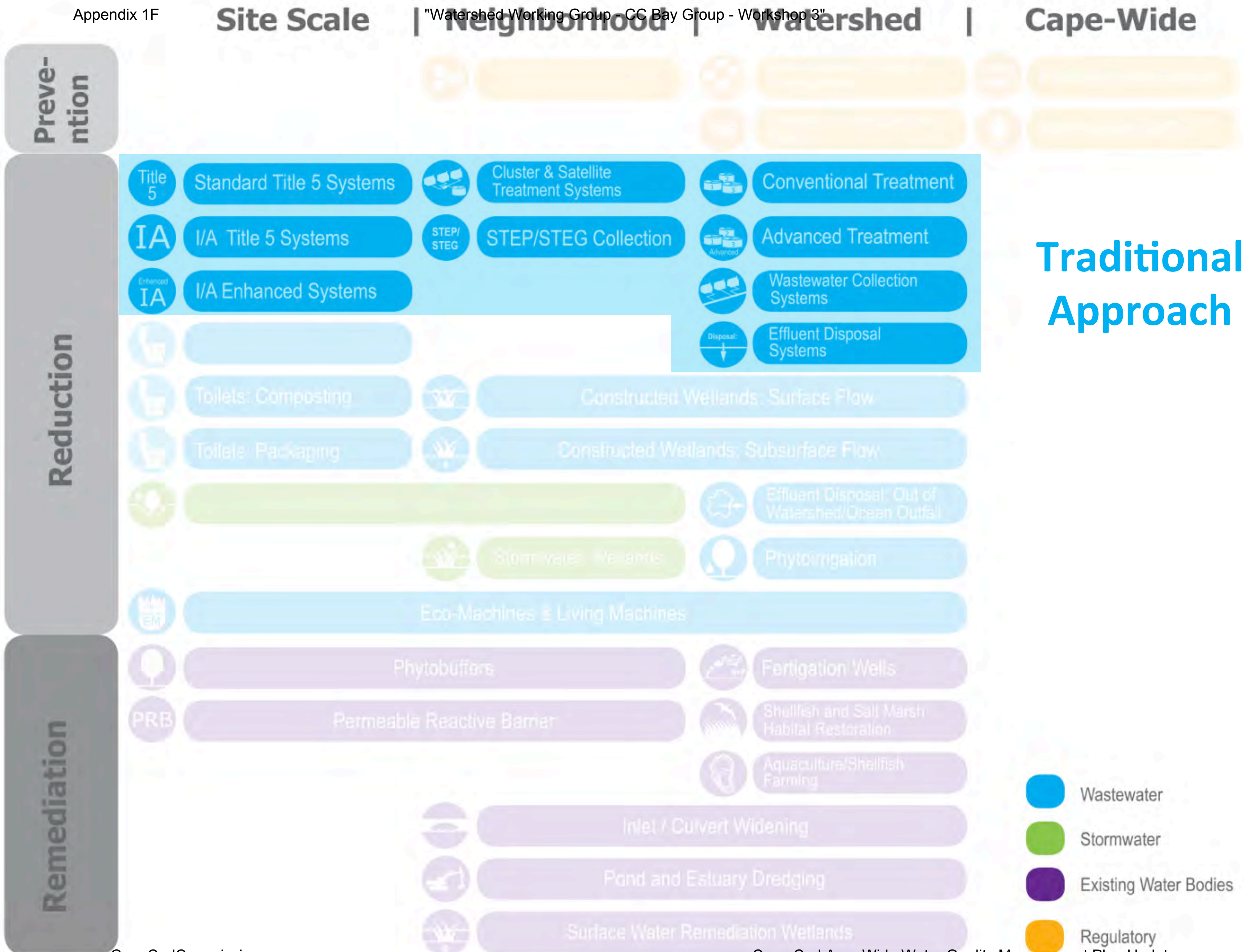
Non-Traditional Approaches

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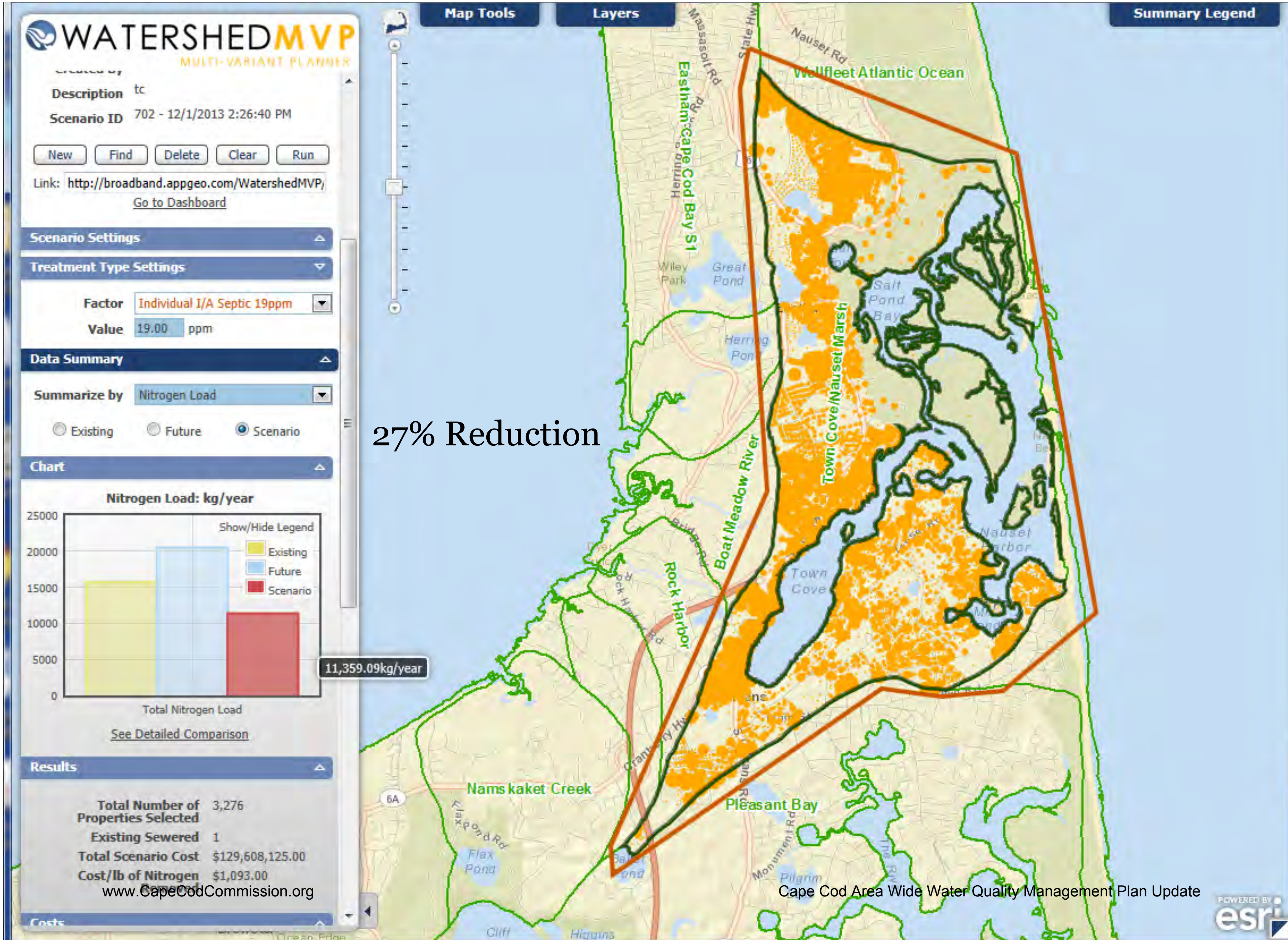
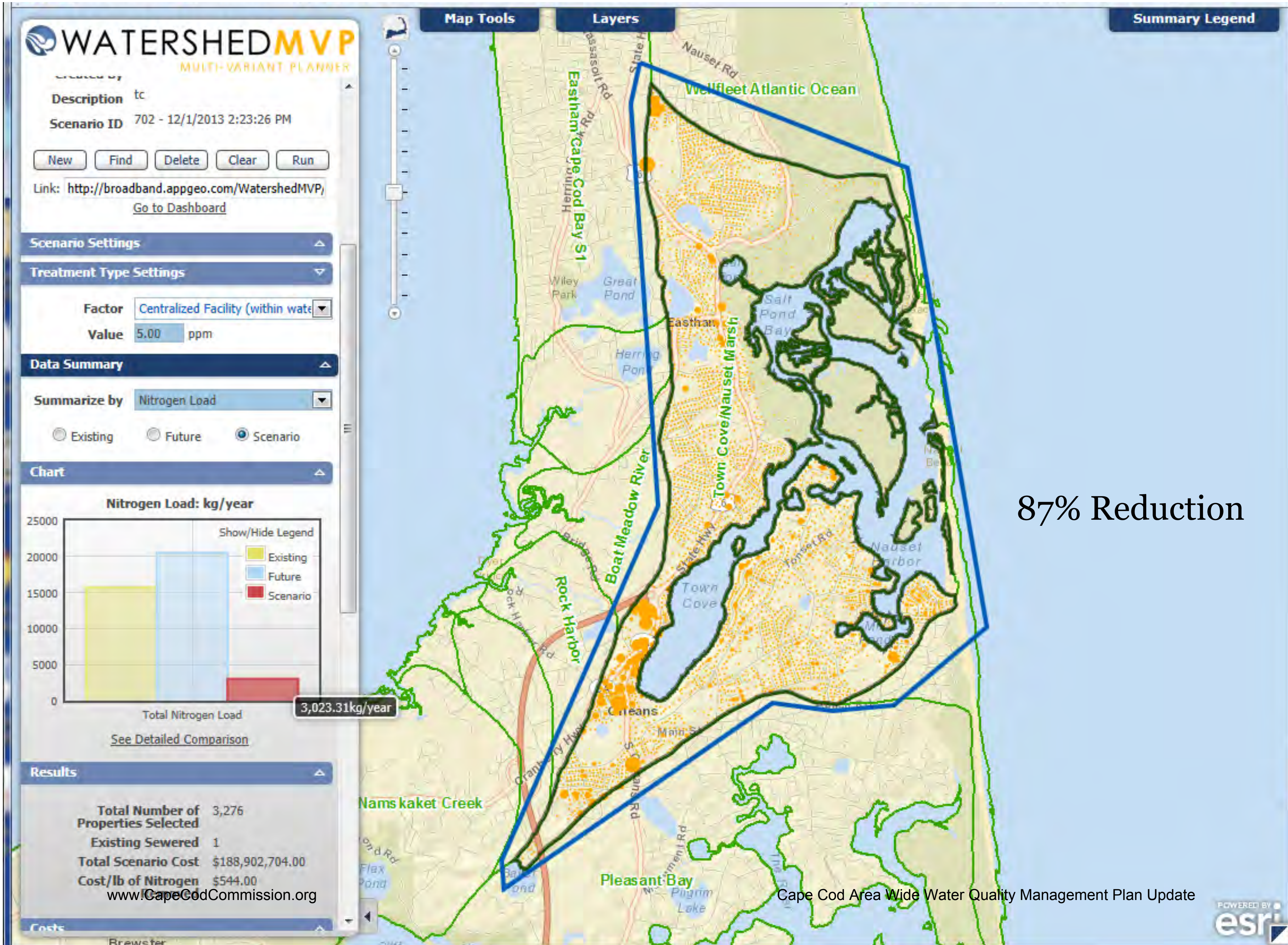
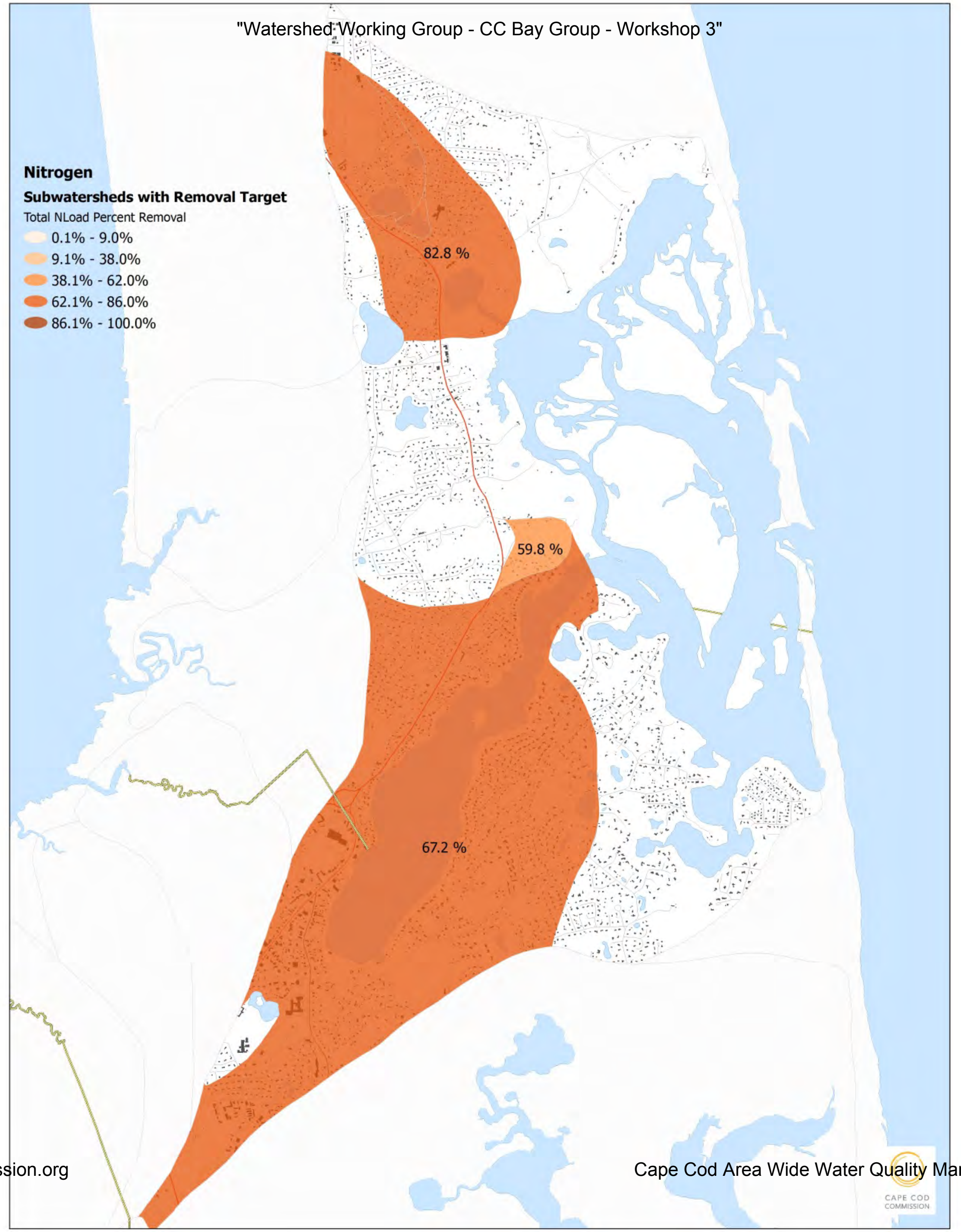
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems

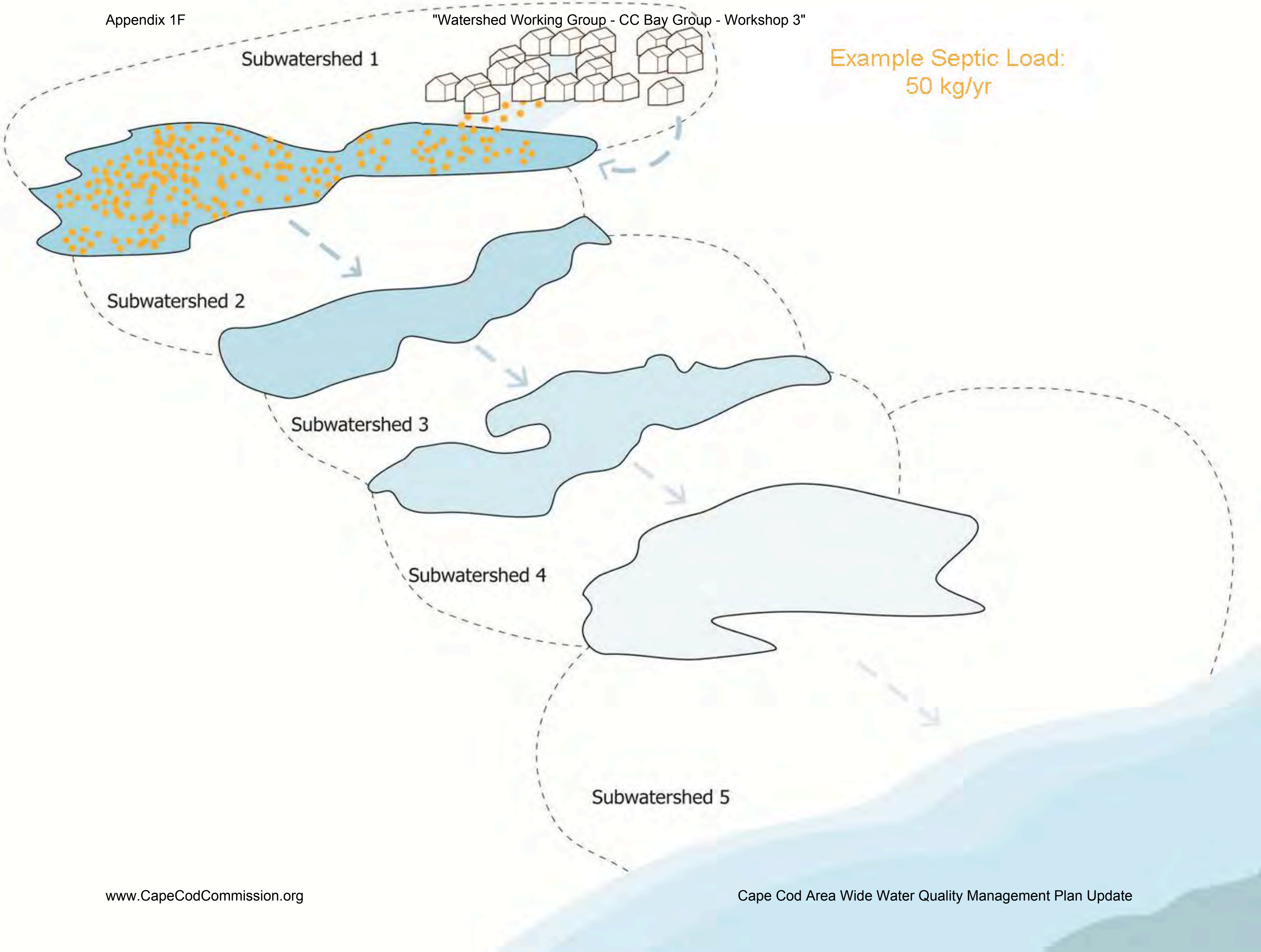


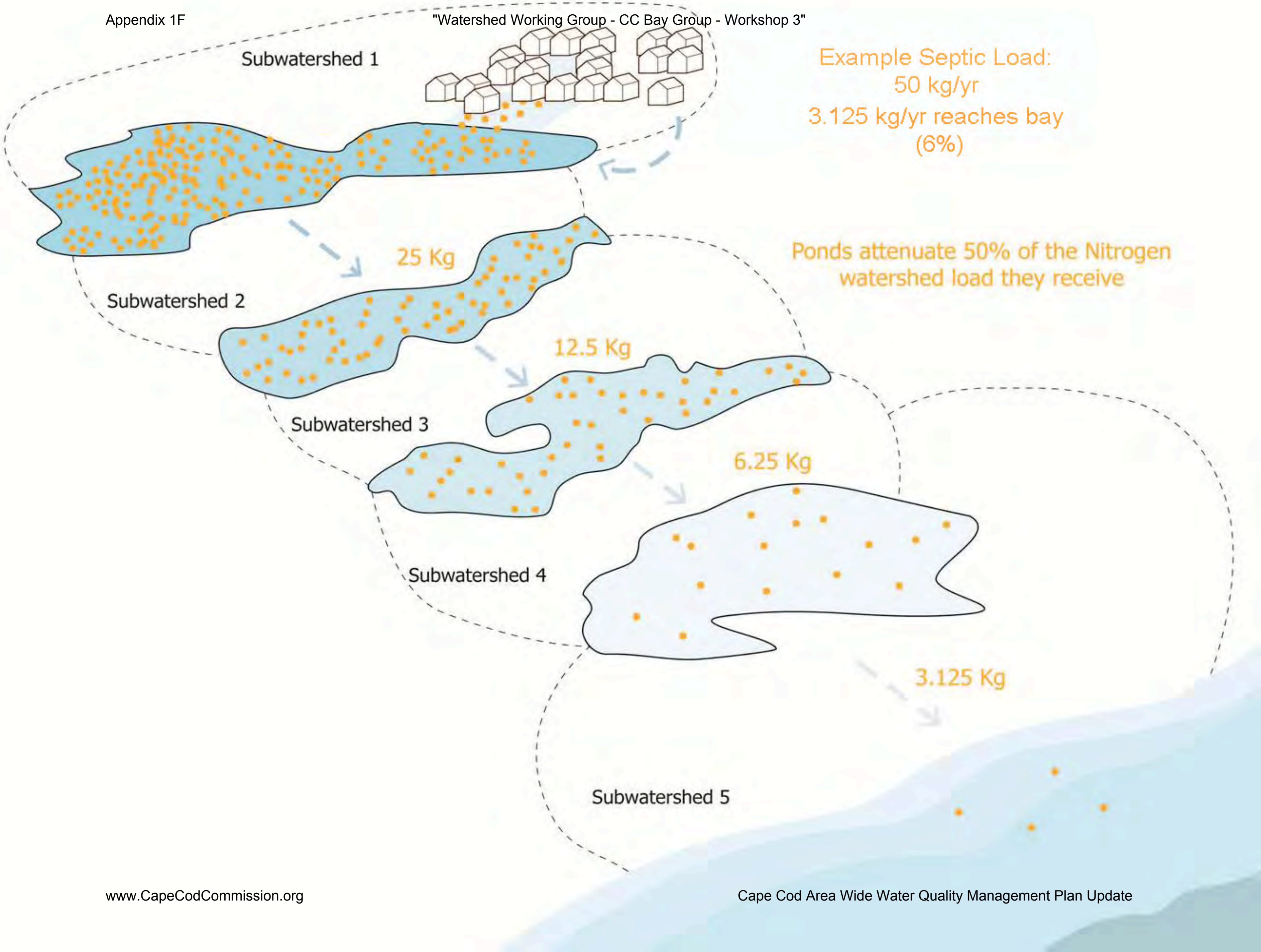
Watershed-Wide Centralized Treatment with Disposal Inside the Watershed



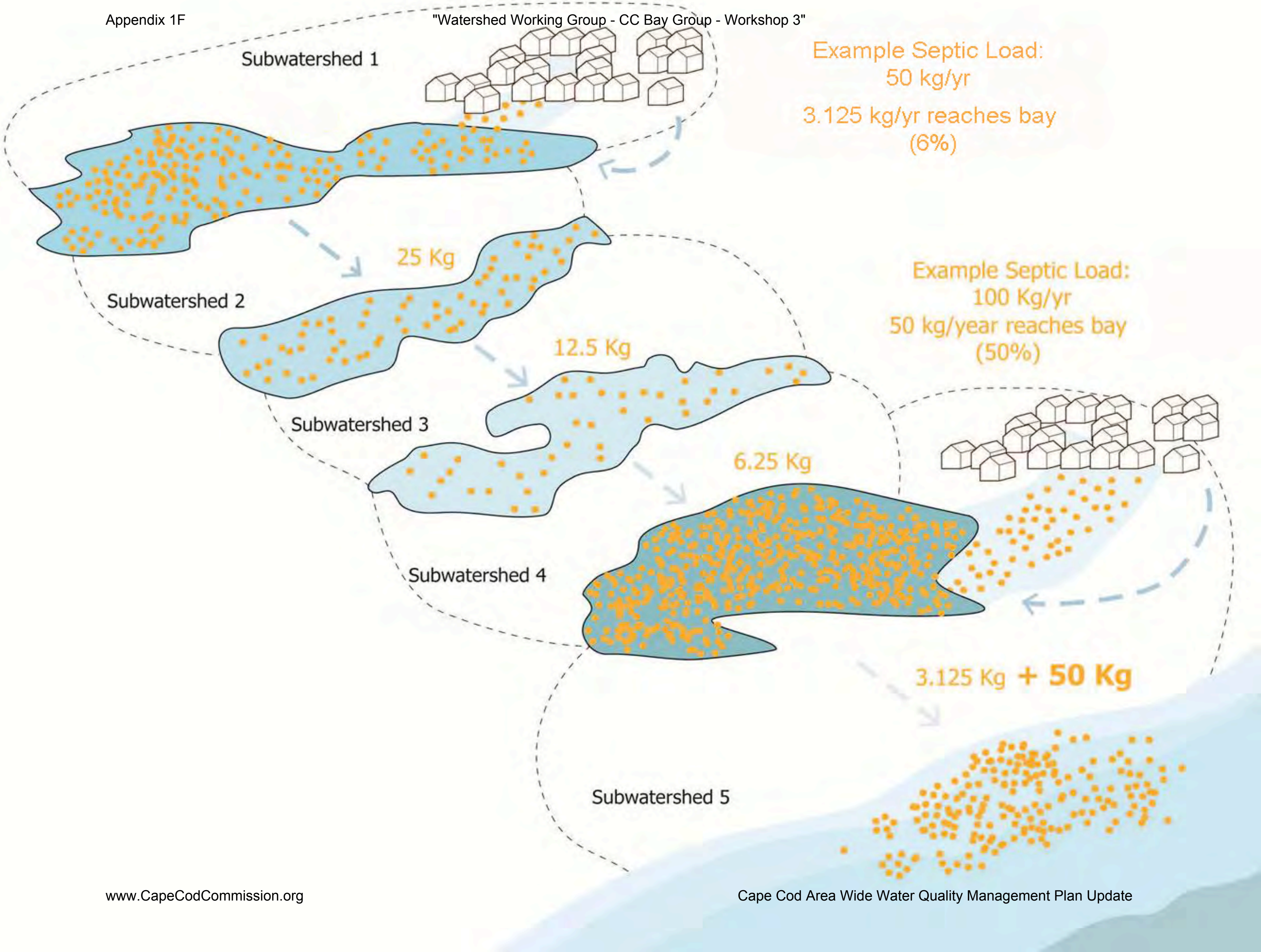
"Watershed Working Group - CC Bay Group - Workshop 3"



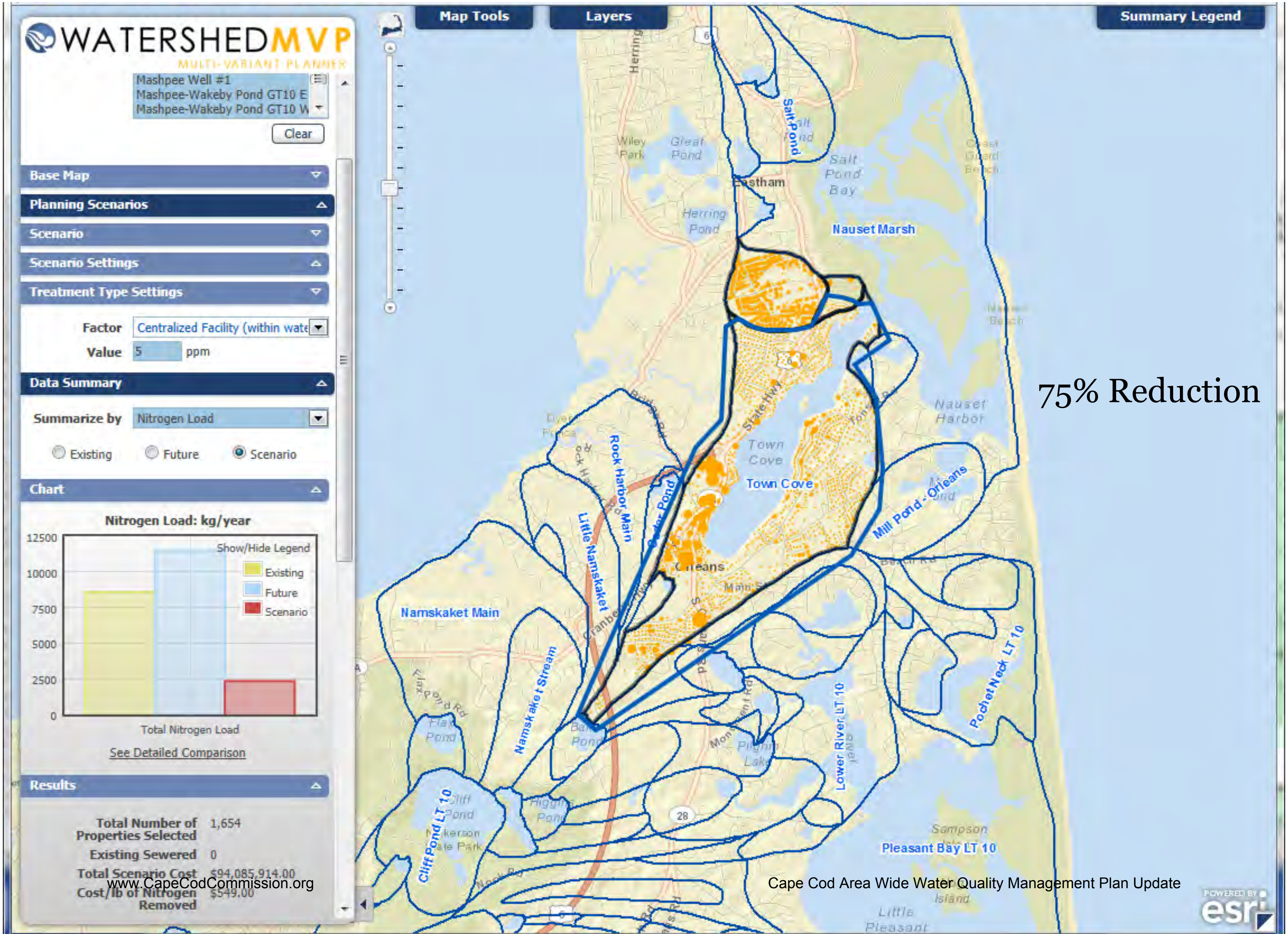

Subwatershed 1
Example Septic Load:
50 kg/yr
Subwatershed 2
Subwatershed 3
Subwatershed 4
Subwatershed 5



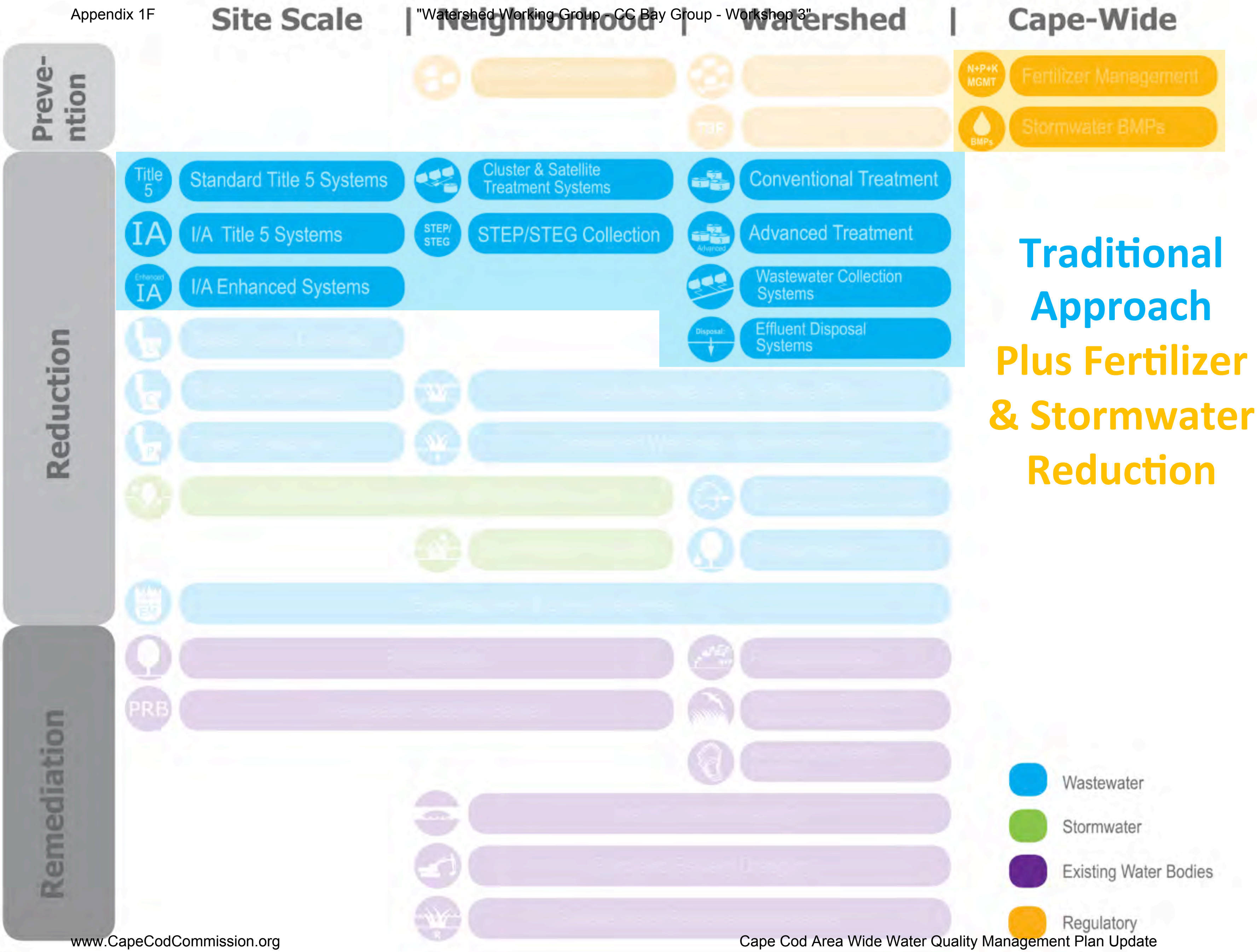
Subwatershed 1
Example Septic Load:
50 kg/yr
3.125 kg/yr reaches bay
(6%)
25 Kg
Subwatershed 2
Ponds attenuate 50% of the Nitrogen watershed load they receive
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg
Subwatershed 5


Subwatershed 1
Example Septic Load:
50 kg/yr
3.125 kg/yr reaches bay
(6%)
25 Kg
Subwatershed 2
12.5 Kg
Example Septic Load:
100 Kg/yr
50 kg/year reaches bay
(50%)
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg + 50 Kg
Subwatershed 5

Targeted Centralized Treatment with Disposal Inside the Watershed



75% Reduction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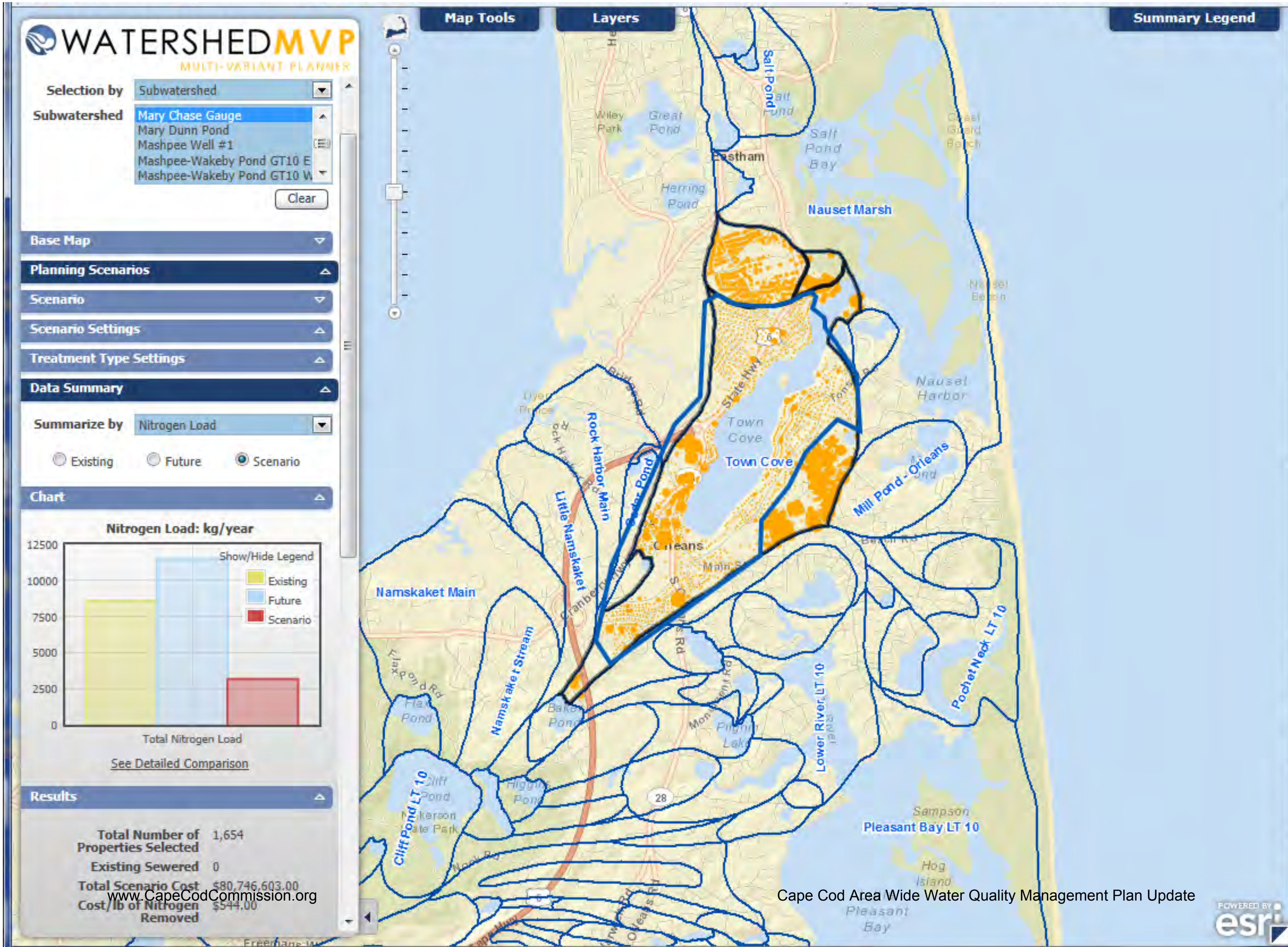
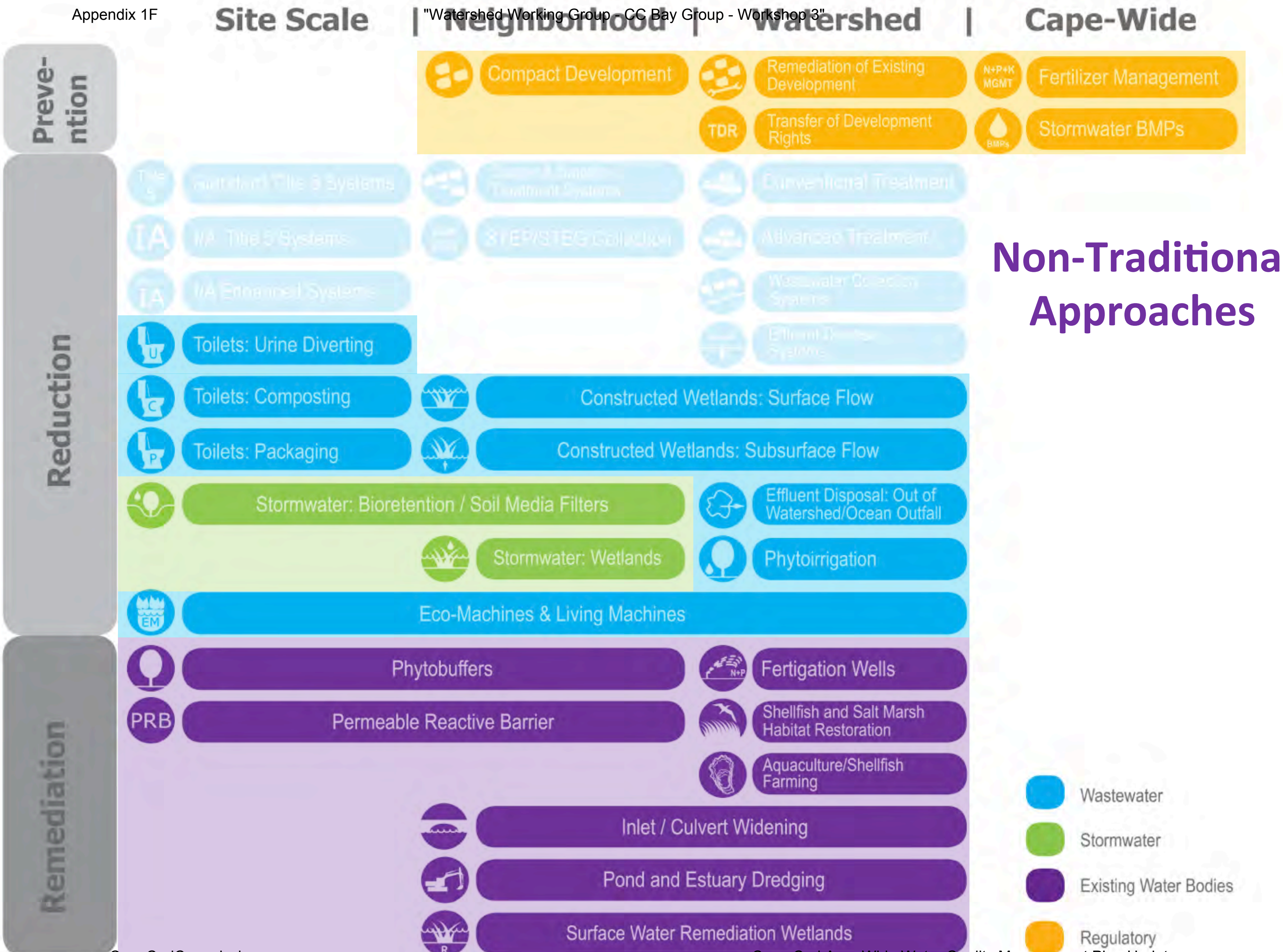
Existing Water Bodies
Regulatory

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

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Surface Water Remediation Wetlands
Non-Traditional Approaches
Wastewater
Stormwater
Existing Water Bodies
Regulatory

Problem Solving Approach

Wastewater | Existing Water Bodies | Regulatory

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

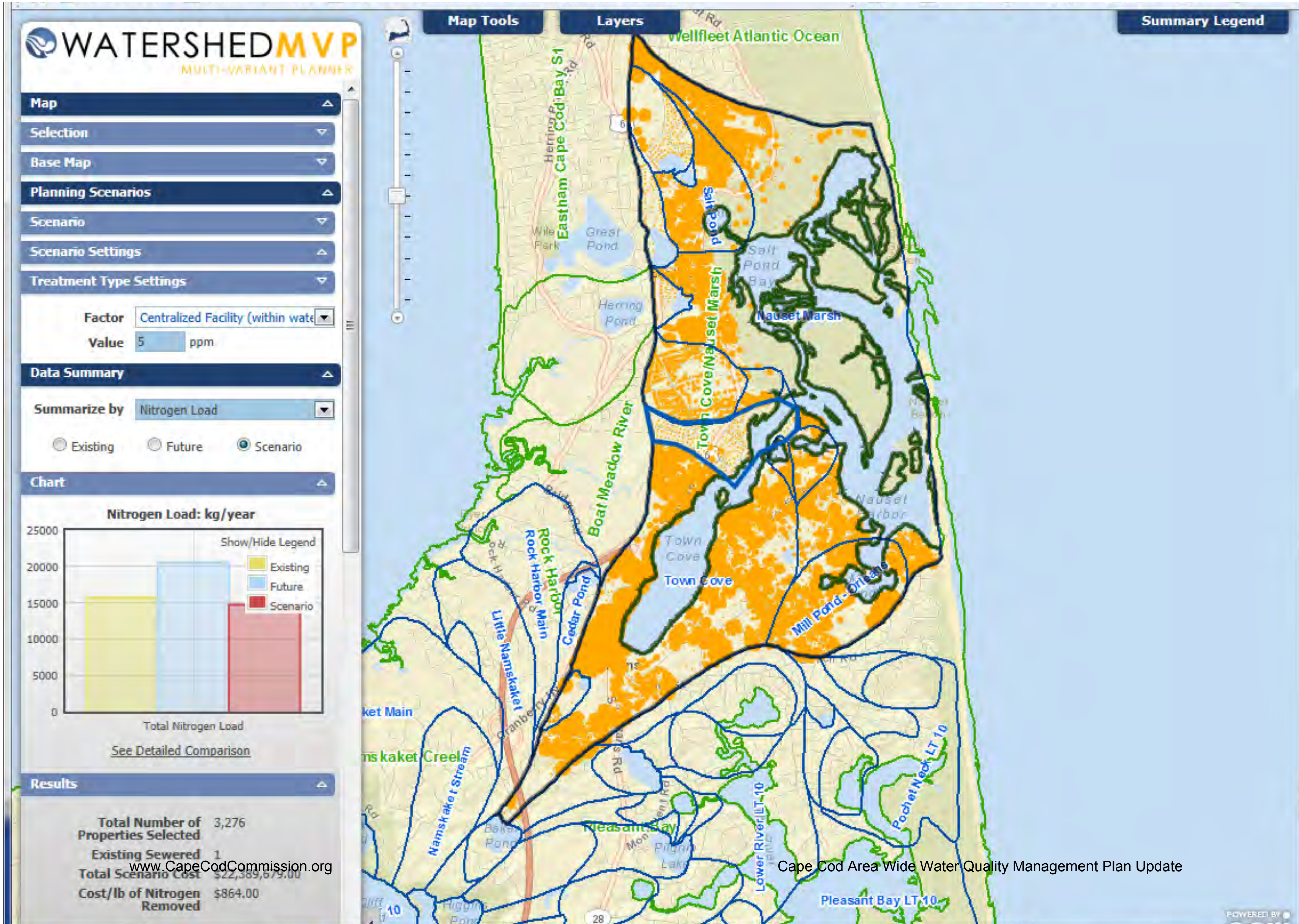
A. Greater Than 1 Dwelling Unit/acre
B. Village Centers
C. Economic Centers
D. Growth Incentive Zones

7 Supplemental Sewering

Watershed Calculator Nauset Marsh

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)

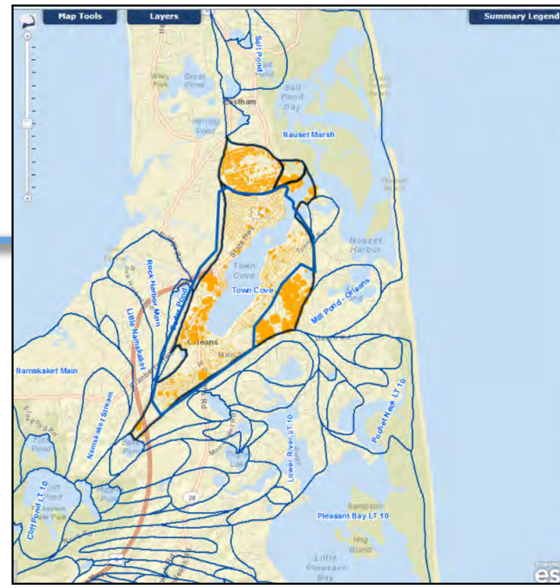


Scenario Comparison

Targeted Collection

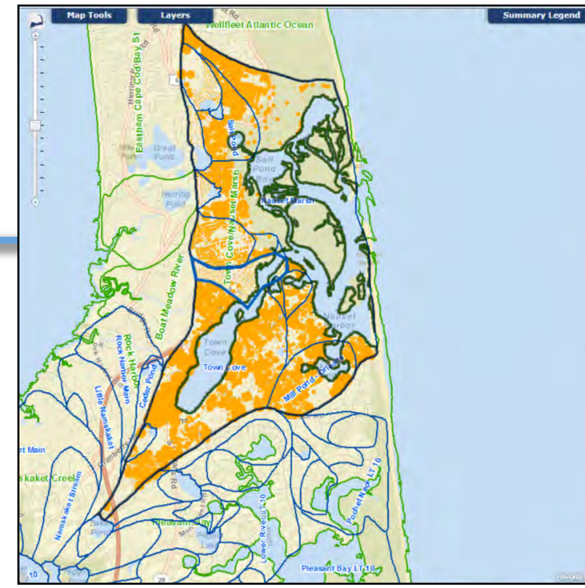
- Achieves TMDL[1]
- Total Cost = $94 Million
- Cost/lb N = $549
- Treated Flow = 212,000 gpd

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

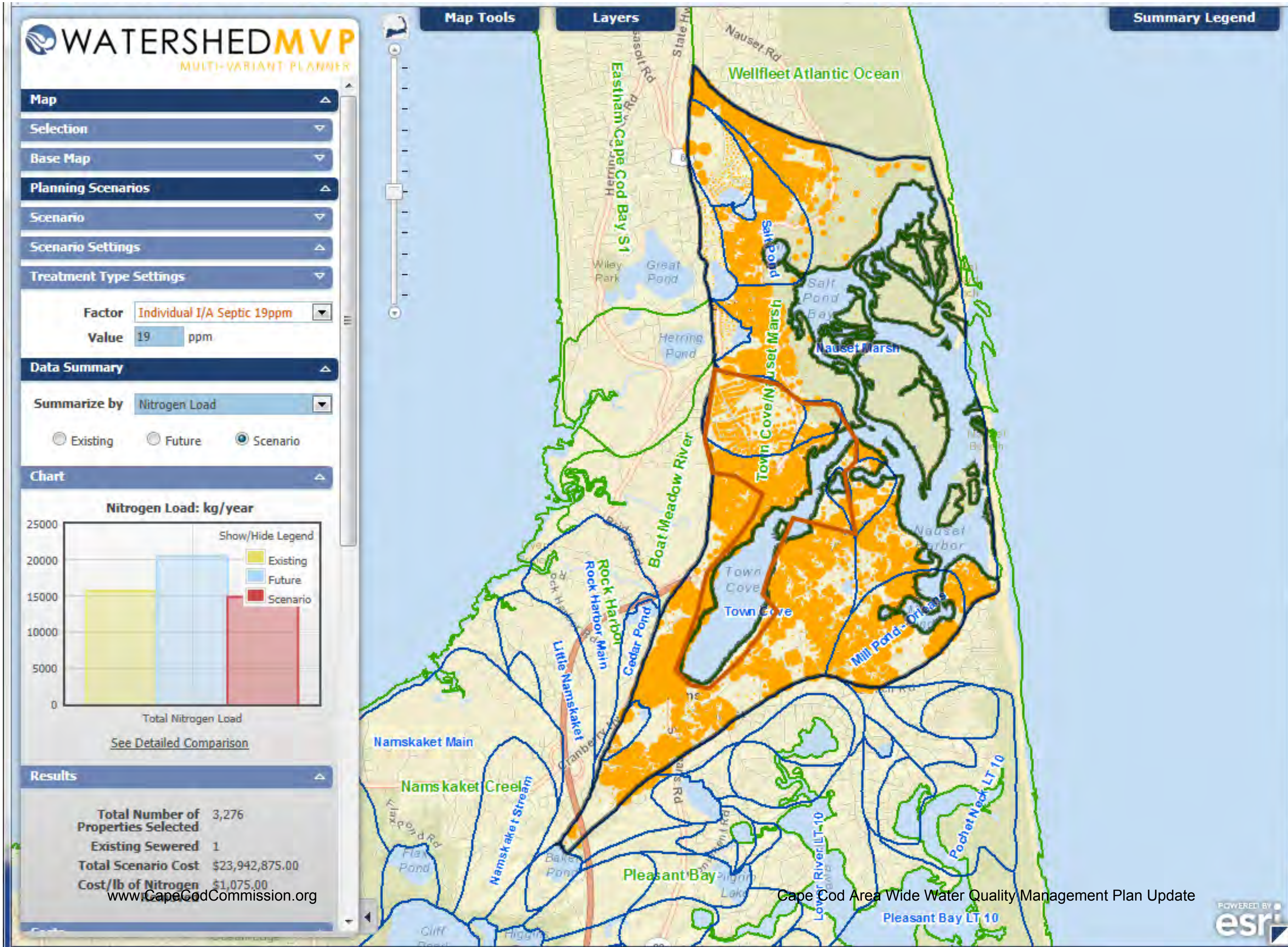
Targeted Collection after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



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

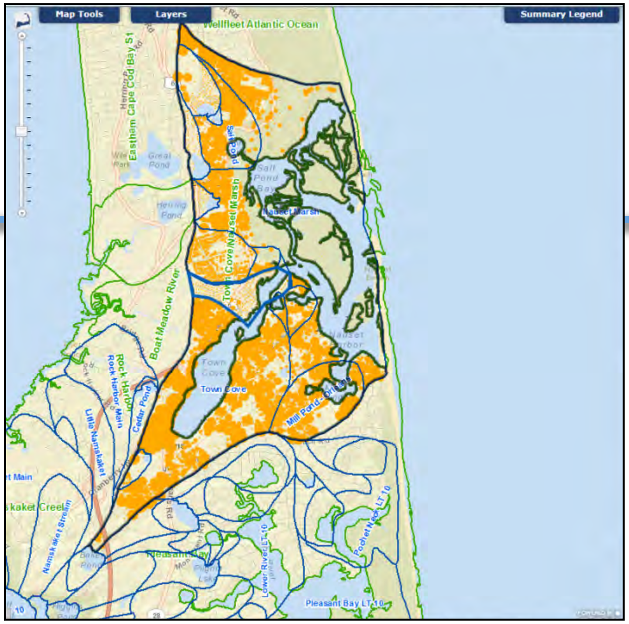
[1] within 5% of goal

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



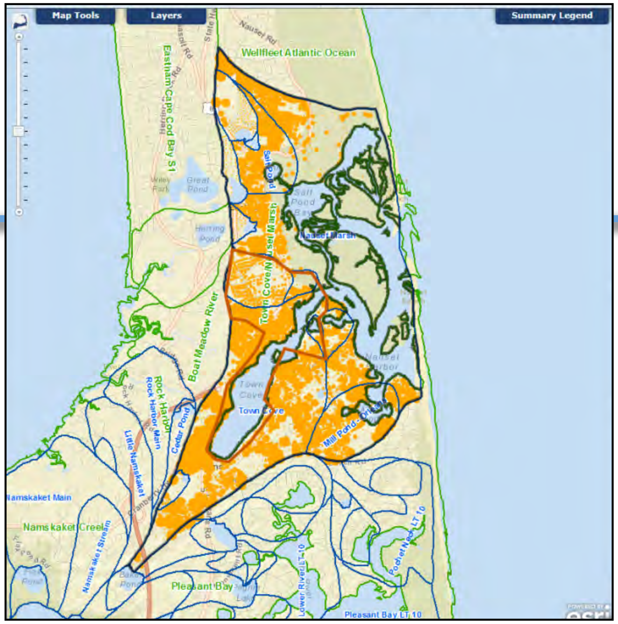
Scenario Comparison

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

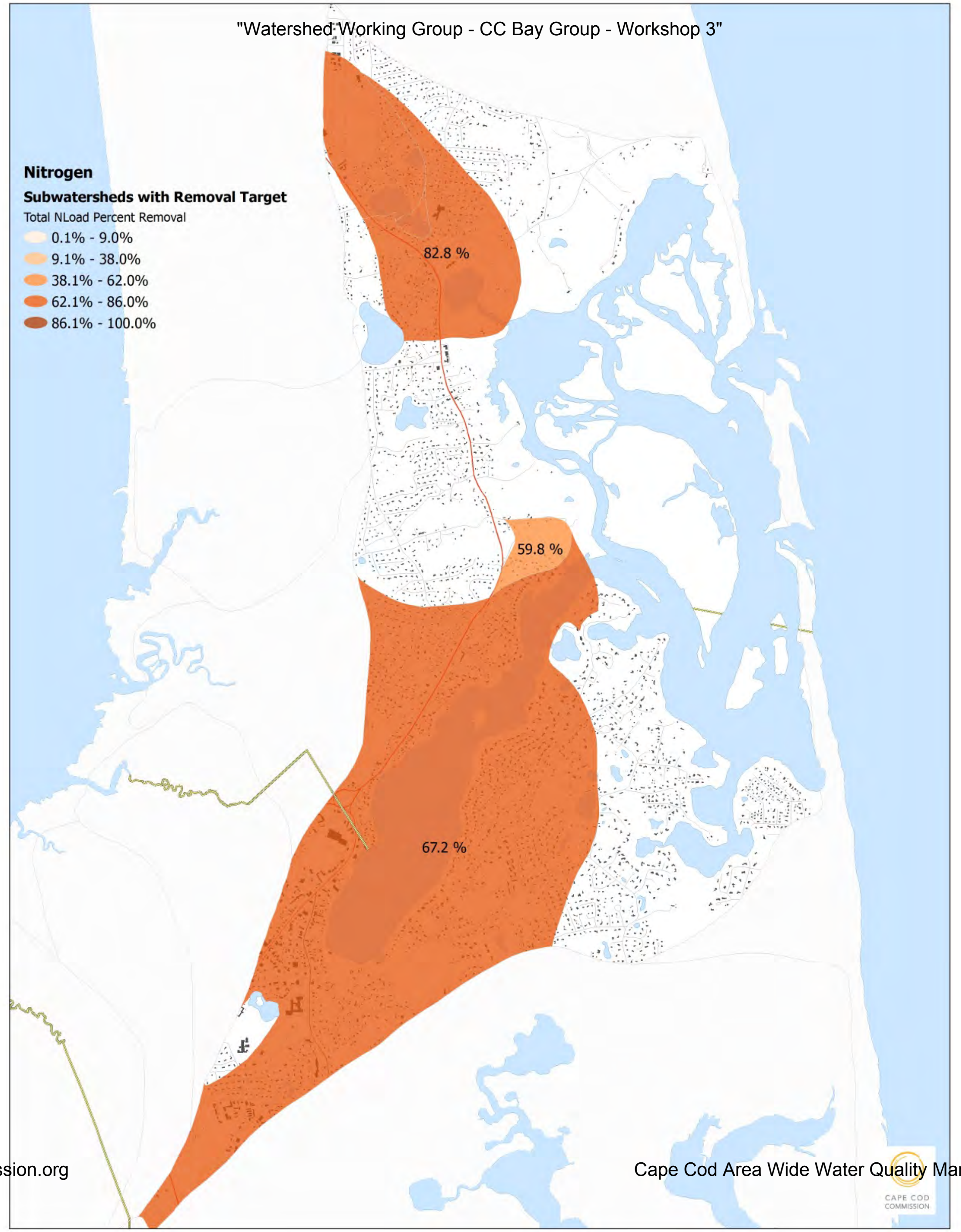
Innovative/alternative on-site systems after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



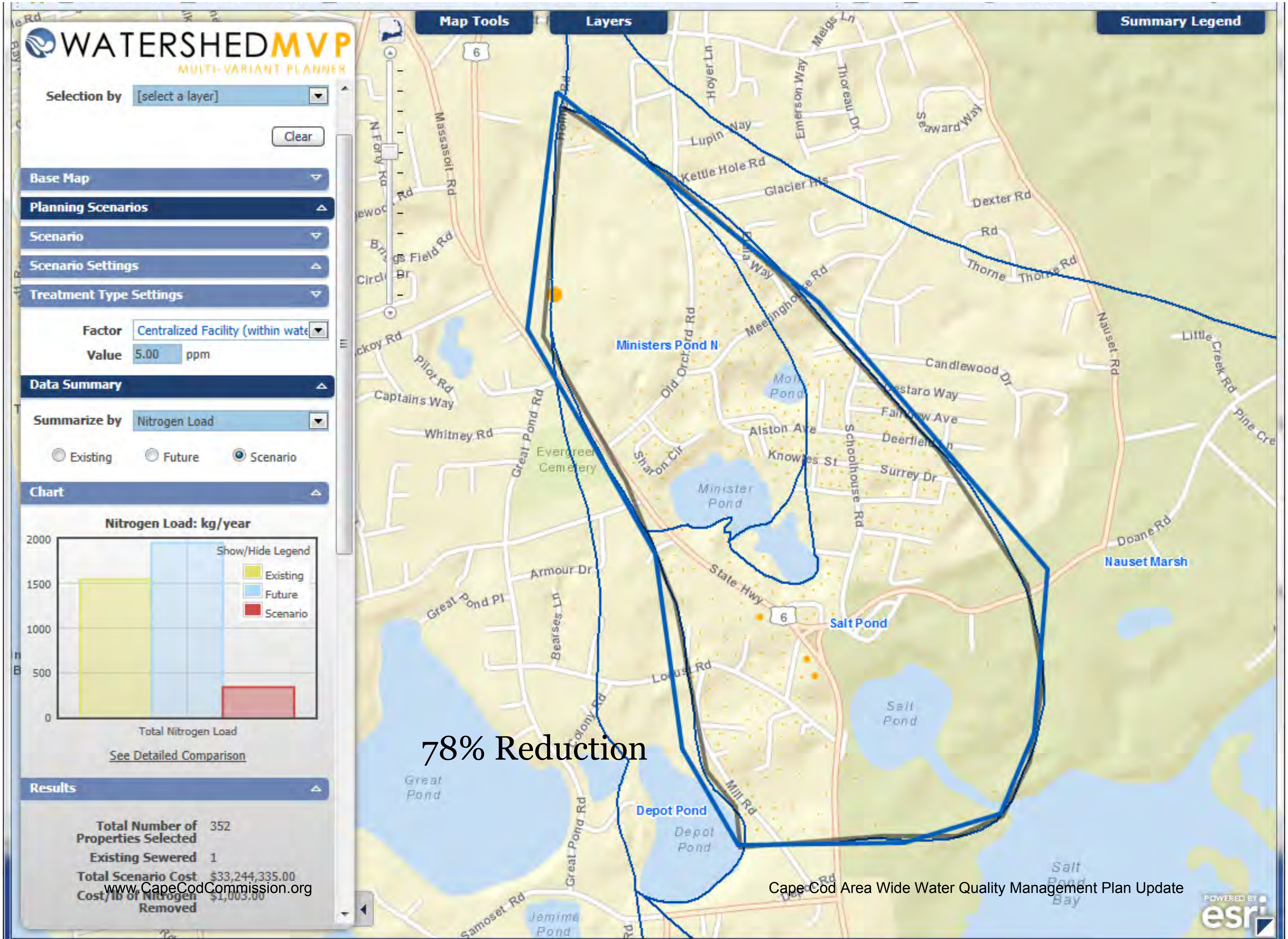
- Achieves TMDL[1]
- Total Cost = $27 Million
- Cost/lb N = $1390
- Treated Flow = 104,000 gpd

[1] within 5% of goal

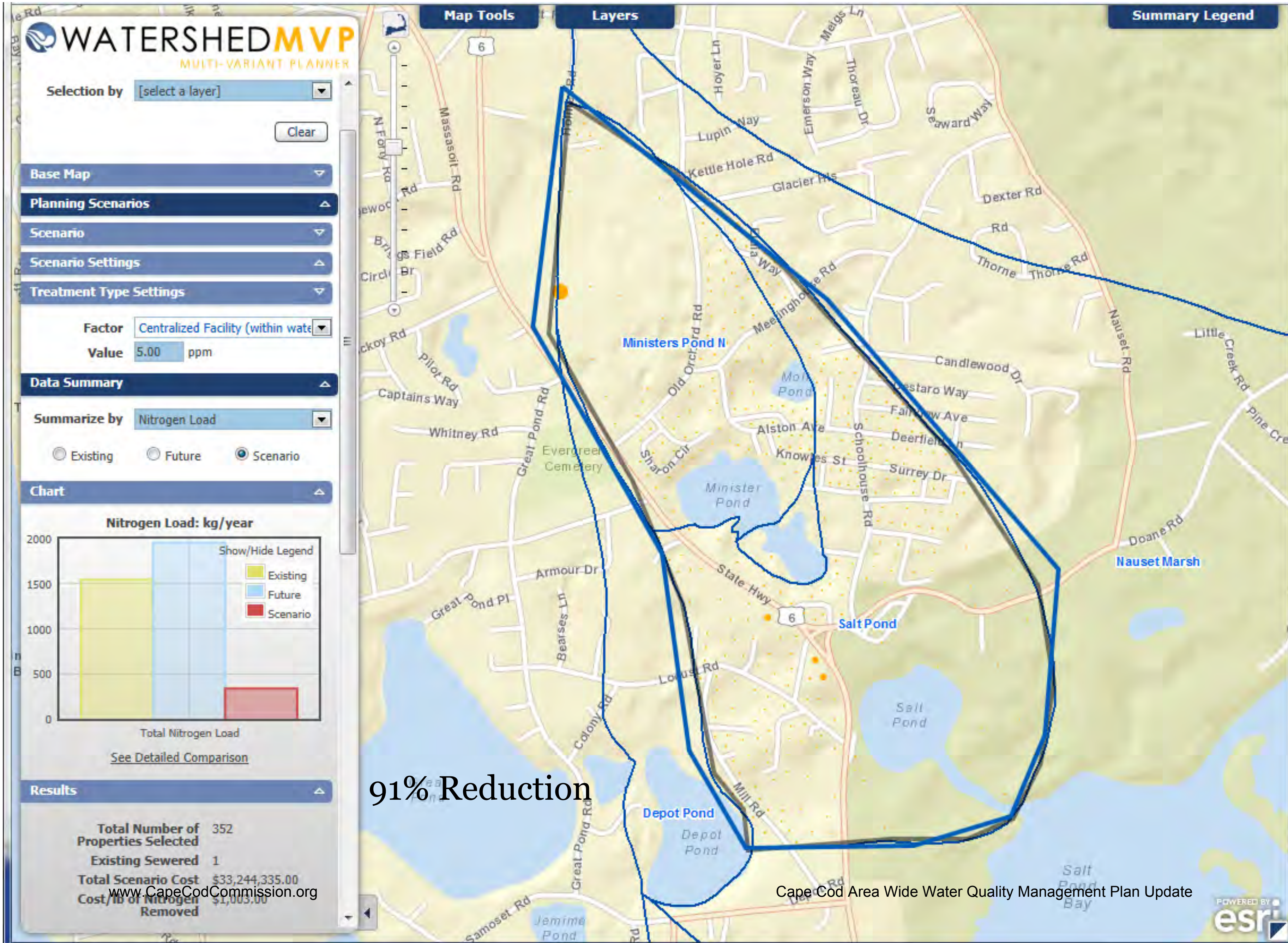
"Watershed Working Group - CC Bay Group - Workshop 3"



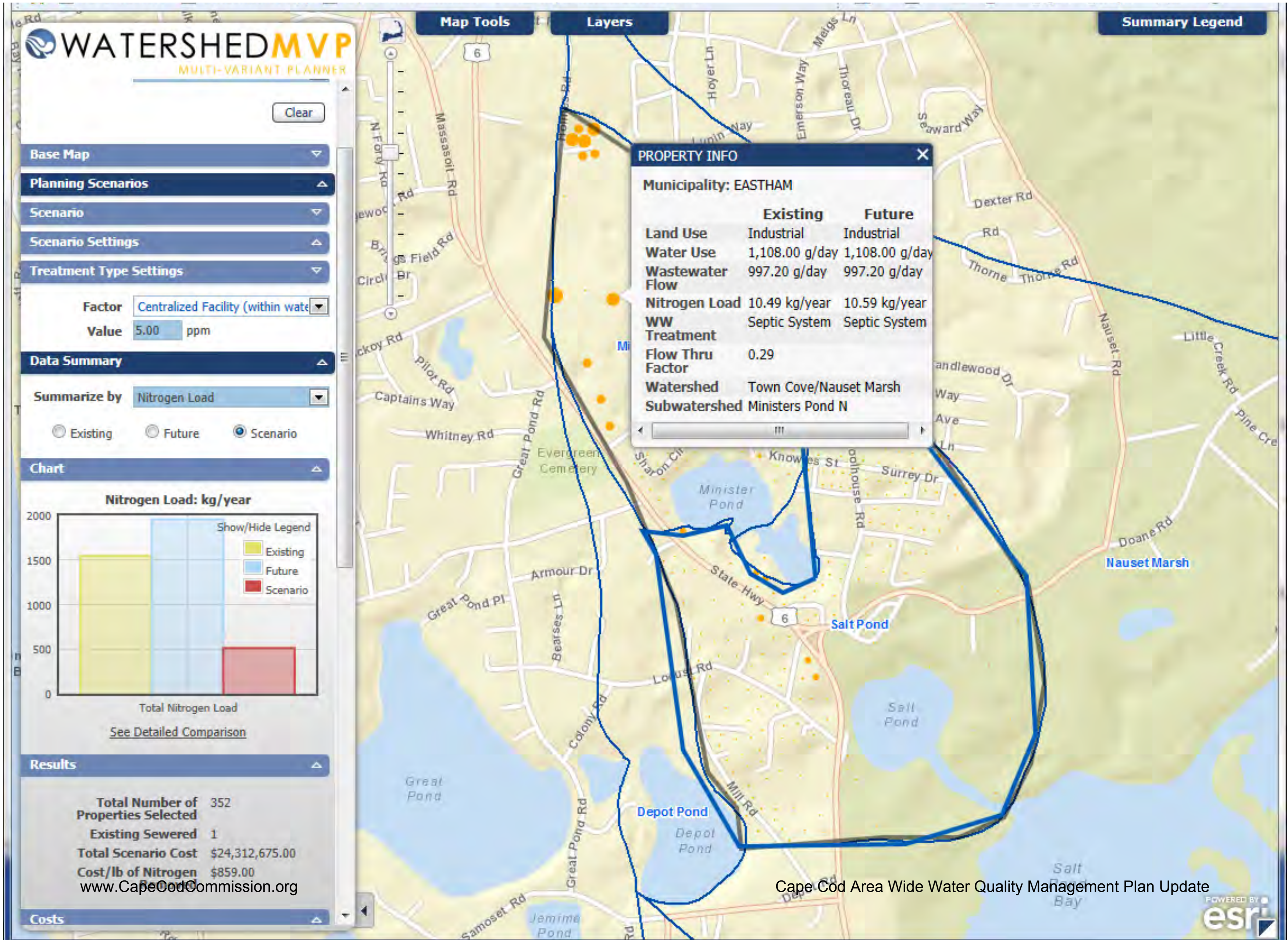
Centralized Treatment with Disposal Inside the Watershed



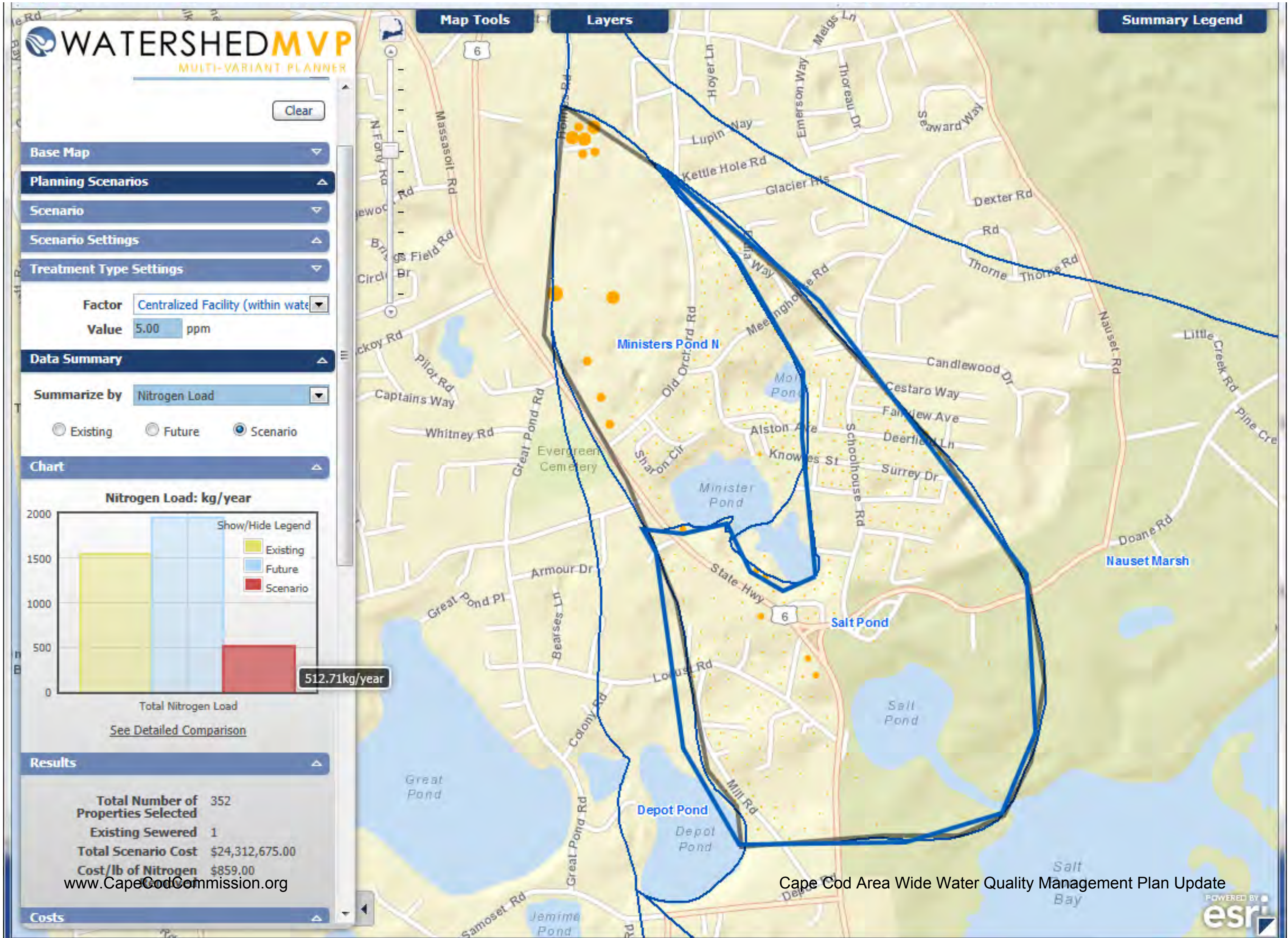
Centralized Treatment with a 50% Reduction in Fertilizer and Stormwater



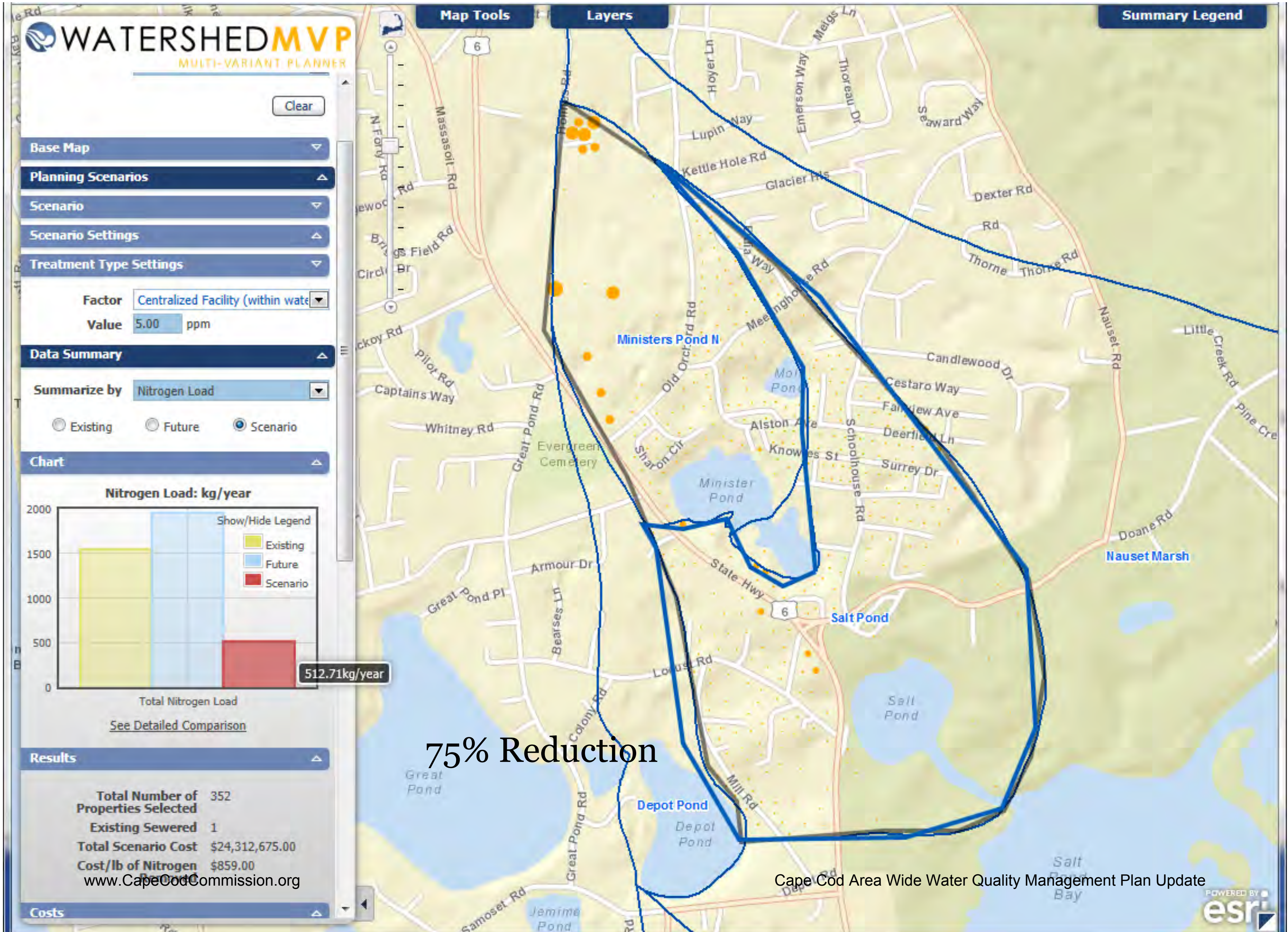
71% of the loads in the Upper Watershed are naturally attenuated



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   "Watershed Working Group - CC Bay Group - 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

Adaptive Management:

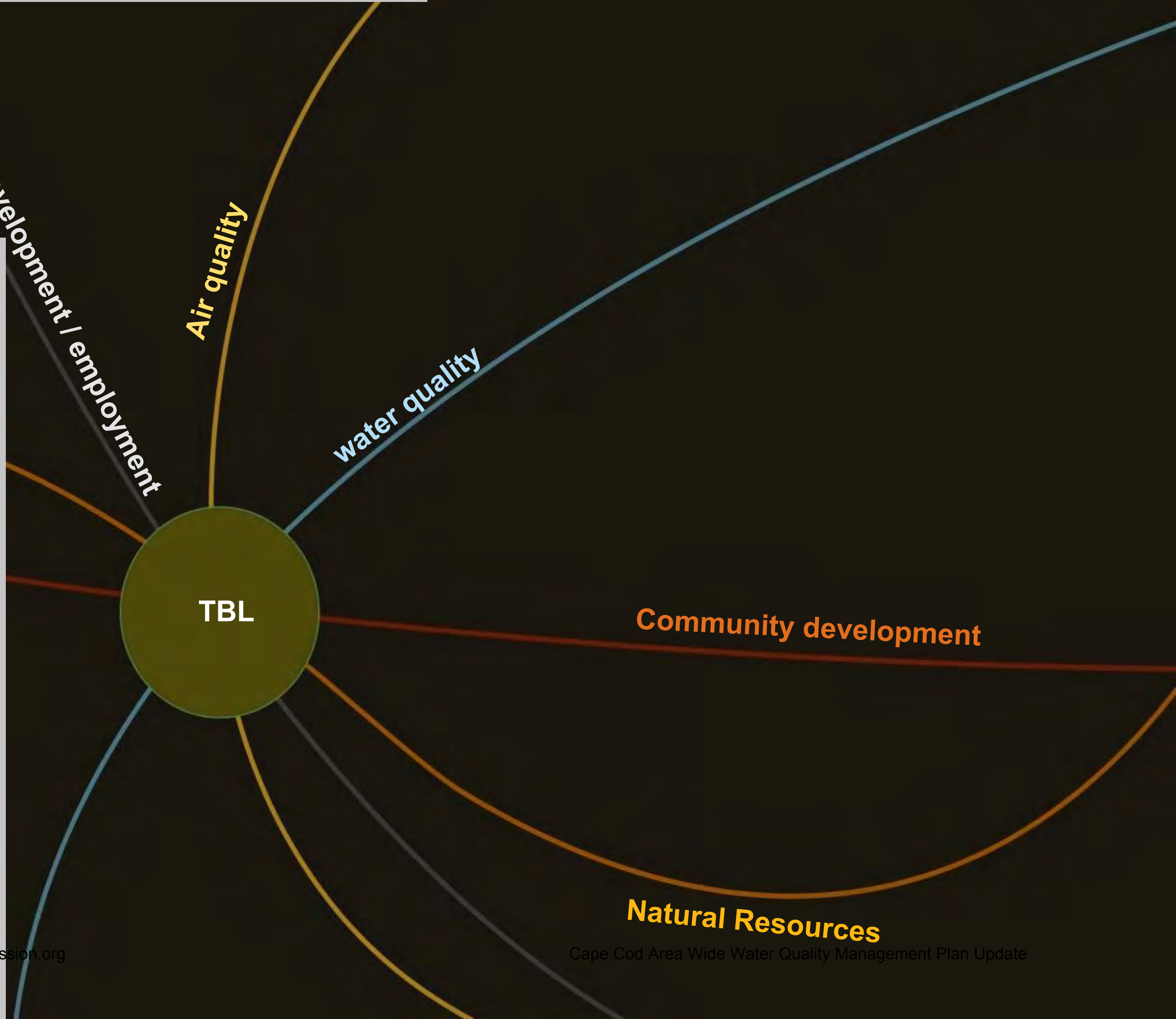
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient ways.

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

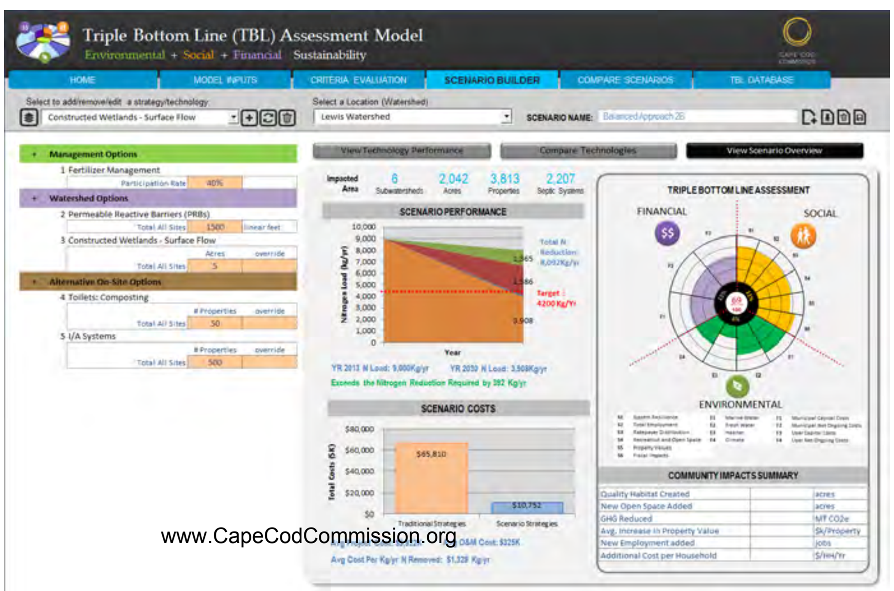
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

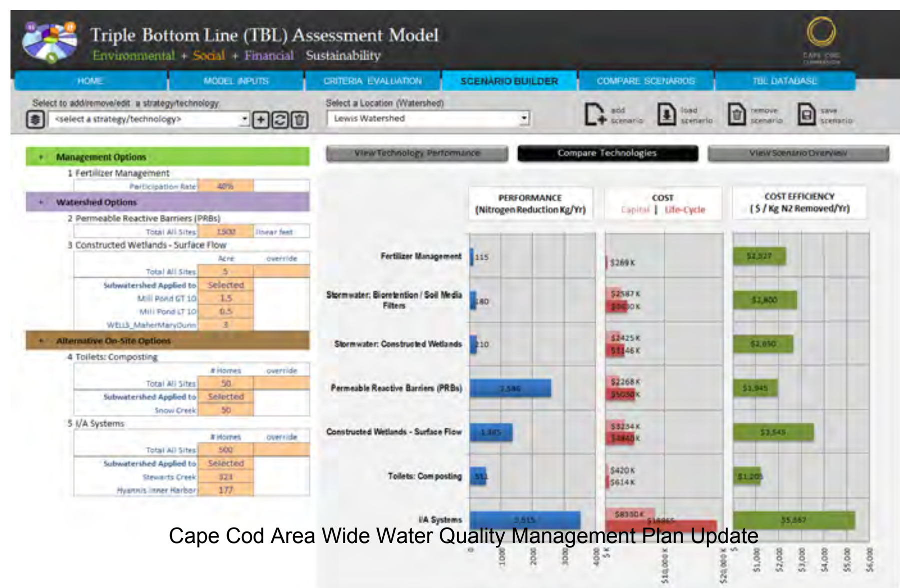


Why develop a TBL model?

- 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

HOME | MODEL INPUTS | CRITERIA EVALUATION | SCENARIO BUILDER | COMPARE SCENARIOS | TBL DATABASE

Alternative Definition | Alternative Results | Alternative Scoring Rules

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

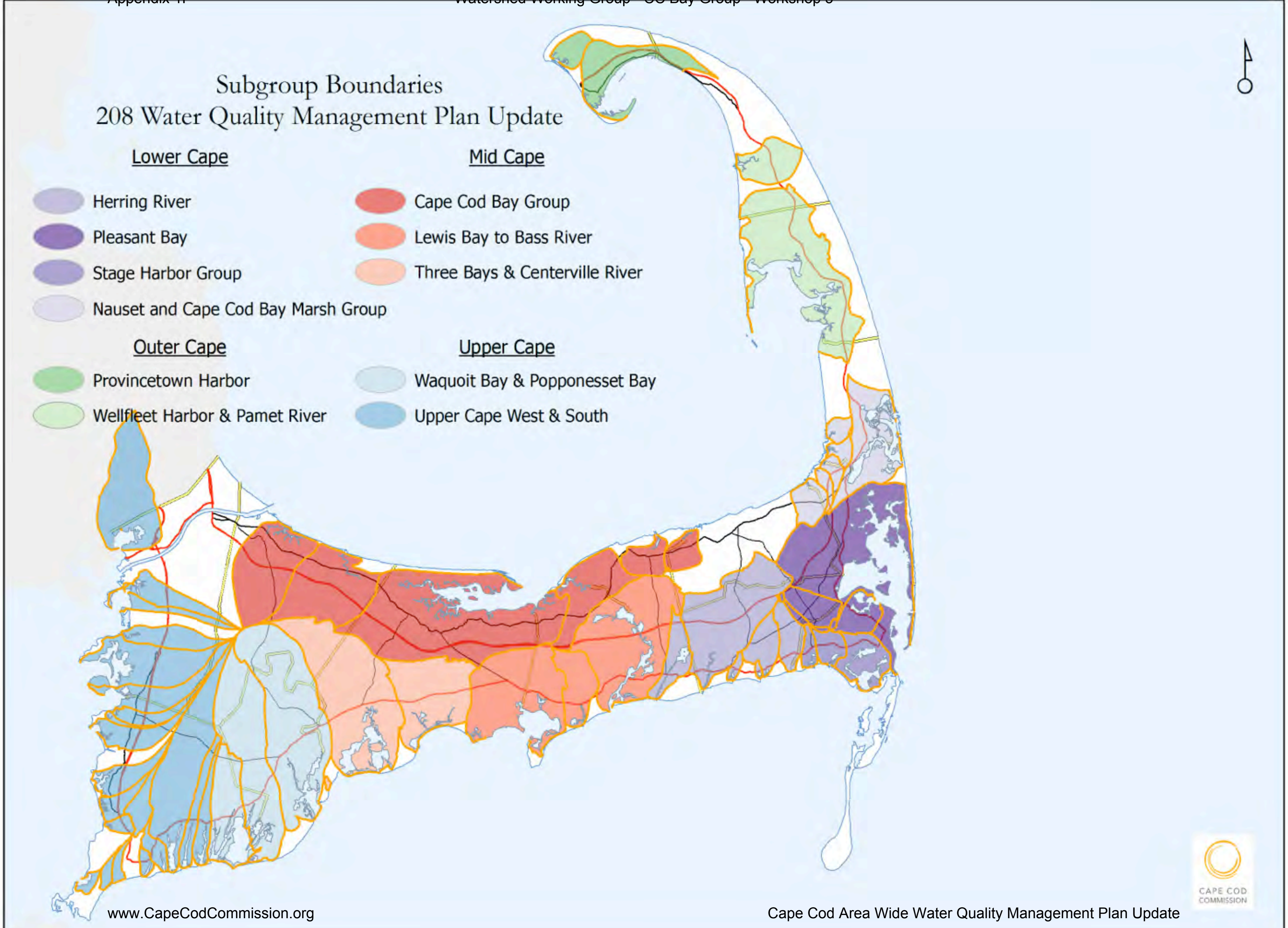
Scenario 1 — Minimum Cost

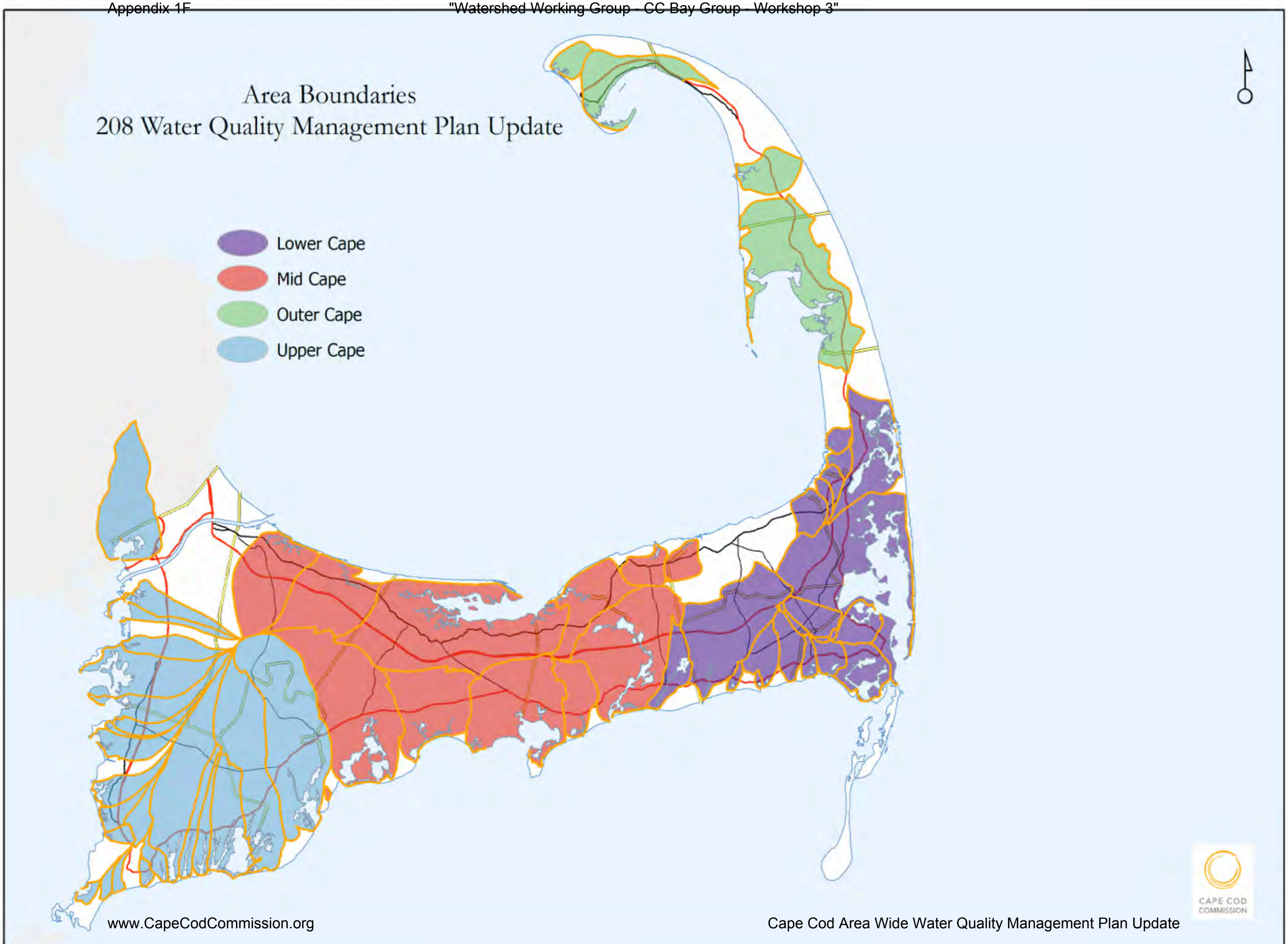
Scenario 2 — Cost Effective

Scenario 3 — Maximum Performance

Strategy/Technology Distribution

	Scenario 1	Scenario 2	Scenario 3
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. Increa[illegible]	$200	[illegible]	[illegible]
New Employment Added (jobs)	152	188	252
Additional Cost per Household ($/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.

Whole Watershed 7-Step Scenarios (Non-Traditional Alternative Technology and Approaches)
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 Nauset Bay:

- 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

Cape Cod 208 Area Water Quality Planning
Pleasant Bay Group Watershed Working Group

Meeting Three
Draft Meeting Agenda
Monday, December 9, 2013
Orleans Town Hall, 19 School Road, Orleans, MA 02653
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*

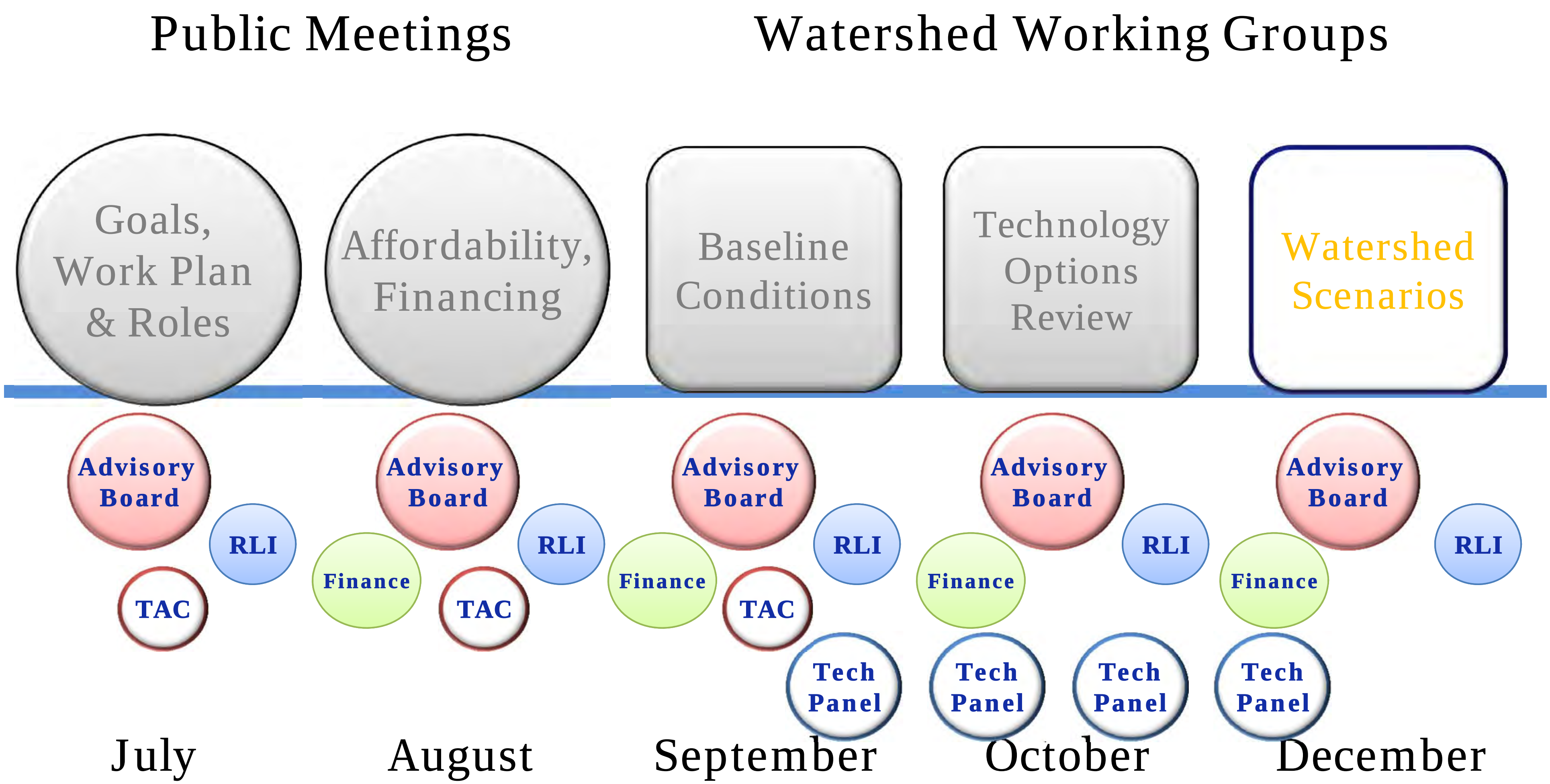
- Triple Bottom Line approach
- Identify Shared Principles and Lessons Learned
- Describe Next Steps

12:15 Public Comments

12:30 Adjourn

Pleasant Bay Group

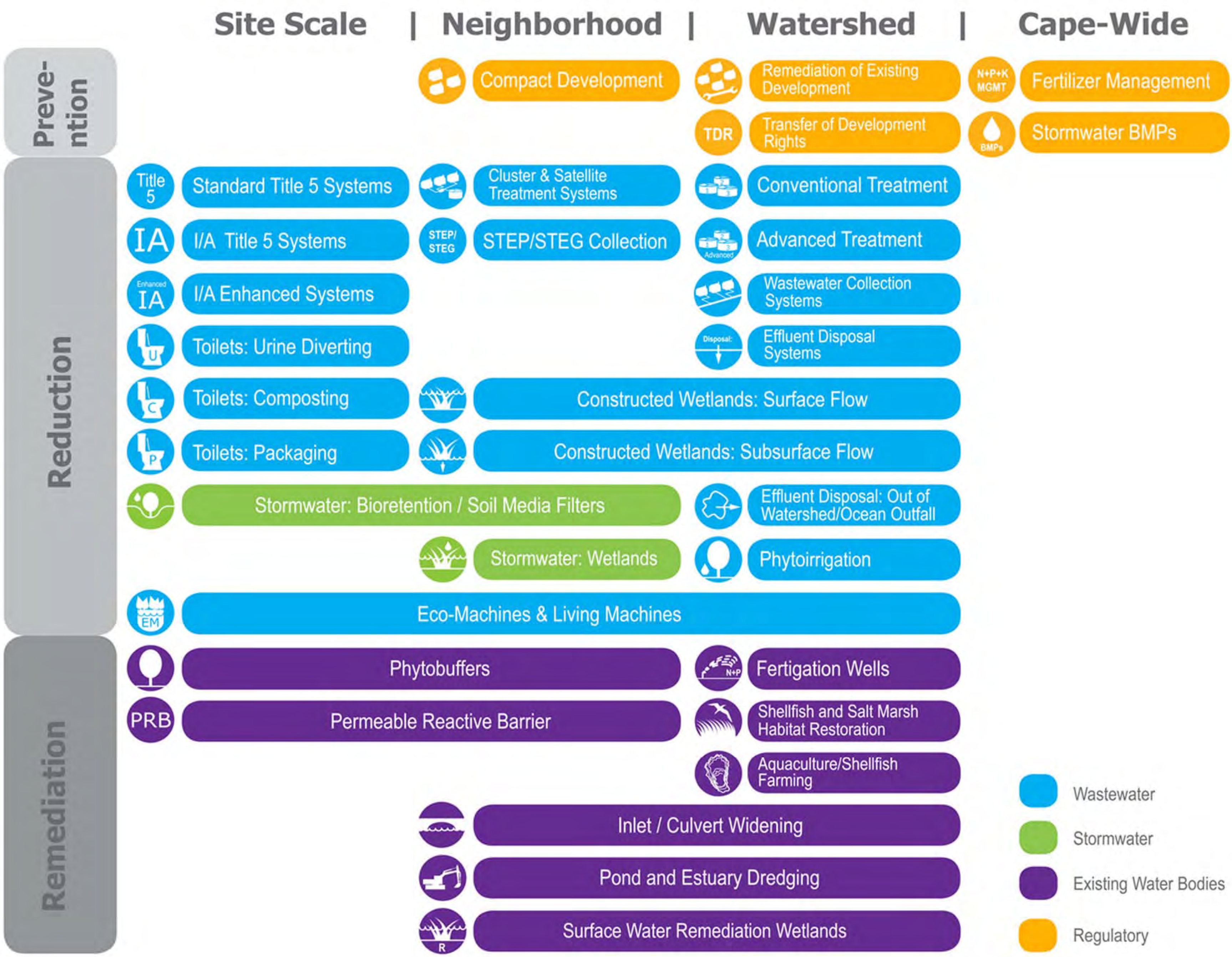
Watershed Scenarios



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
Preve-ntion
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
Reduction
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/ STEG
STEP/STEG Collection
Advanced
Advanced Treatment
Enhanced IA
I/A Enhanced Systems
Wastewater Collection Systems
U
Toilets: Urine Diverting
Disposal
Effluent Disposal Systems
C
Toilets: Composting
Constructed Wetlands: Surface Flow
P
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Remediation
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

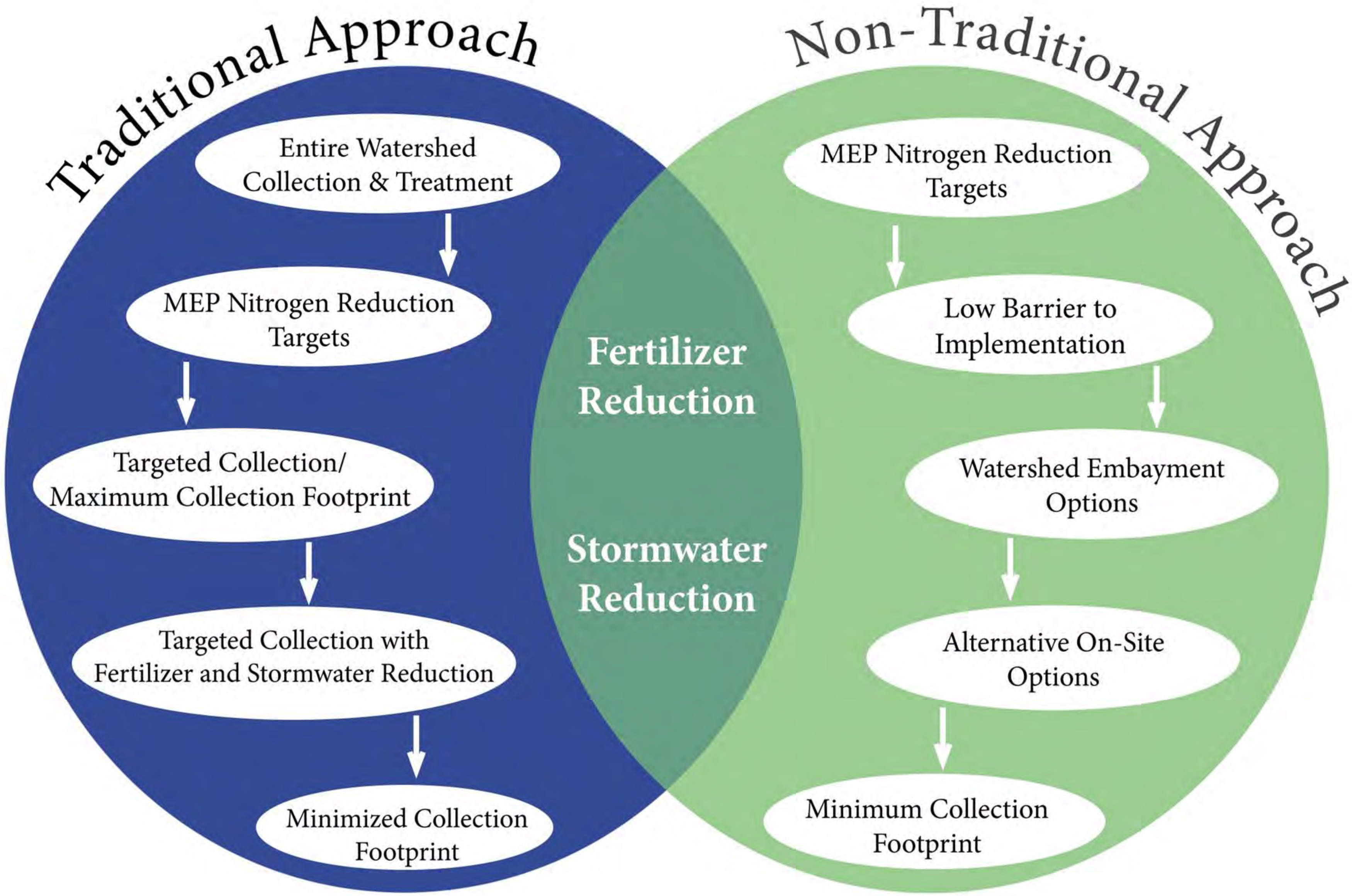
Watershed Scenarios

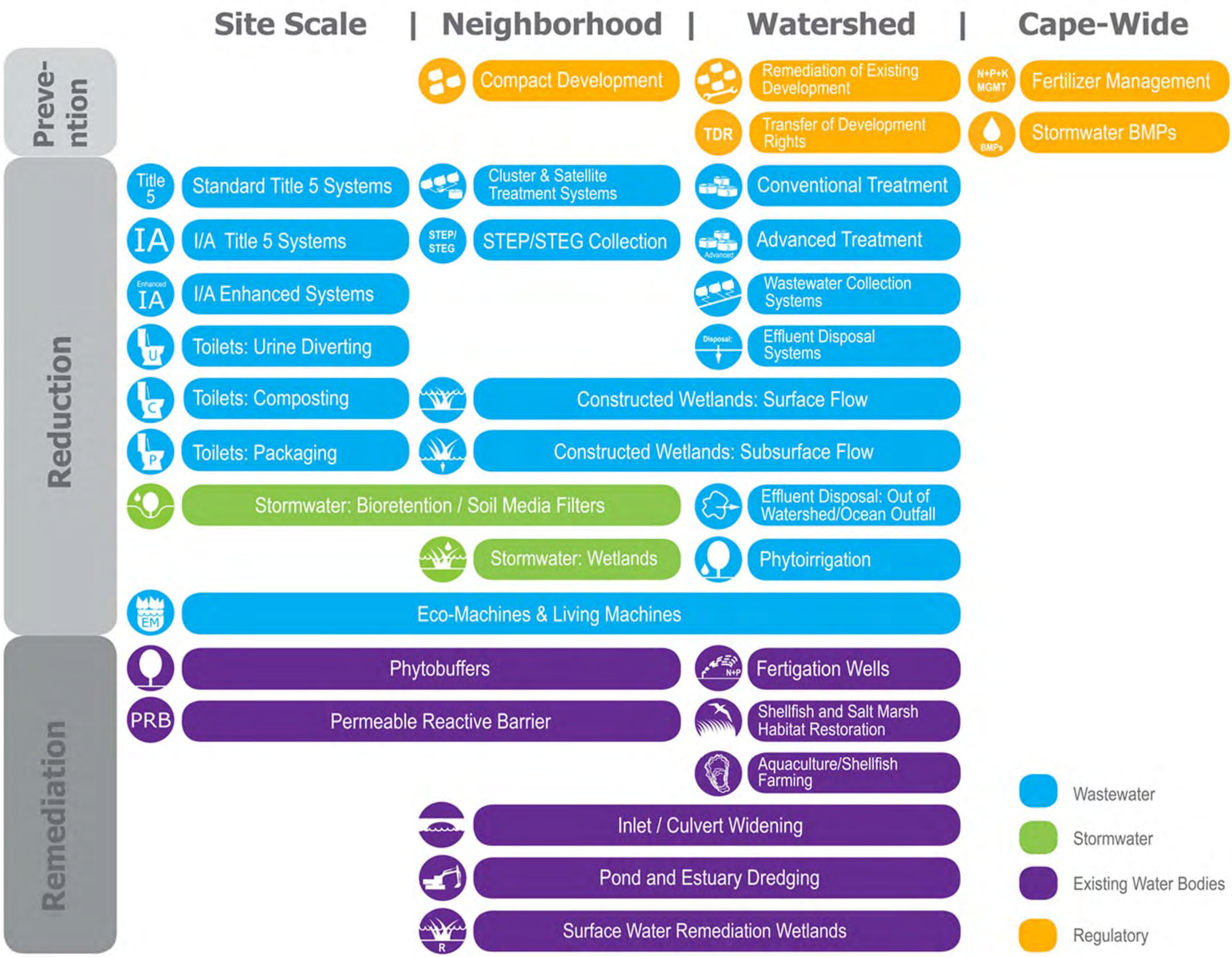
11 Working Group Meetings: Dec 2-11

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.

208 Planning Process


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


Site Scale
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Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
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Fertigation Wells
PRB
Permeable Reactive Barrier
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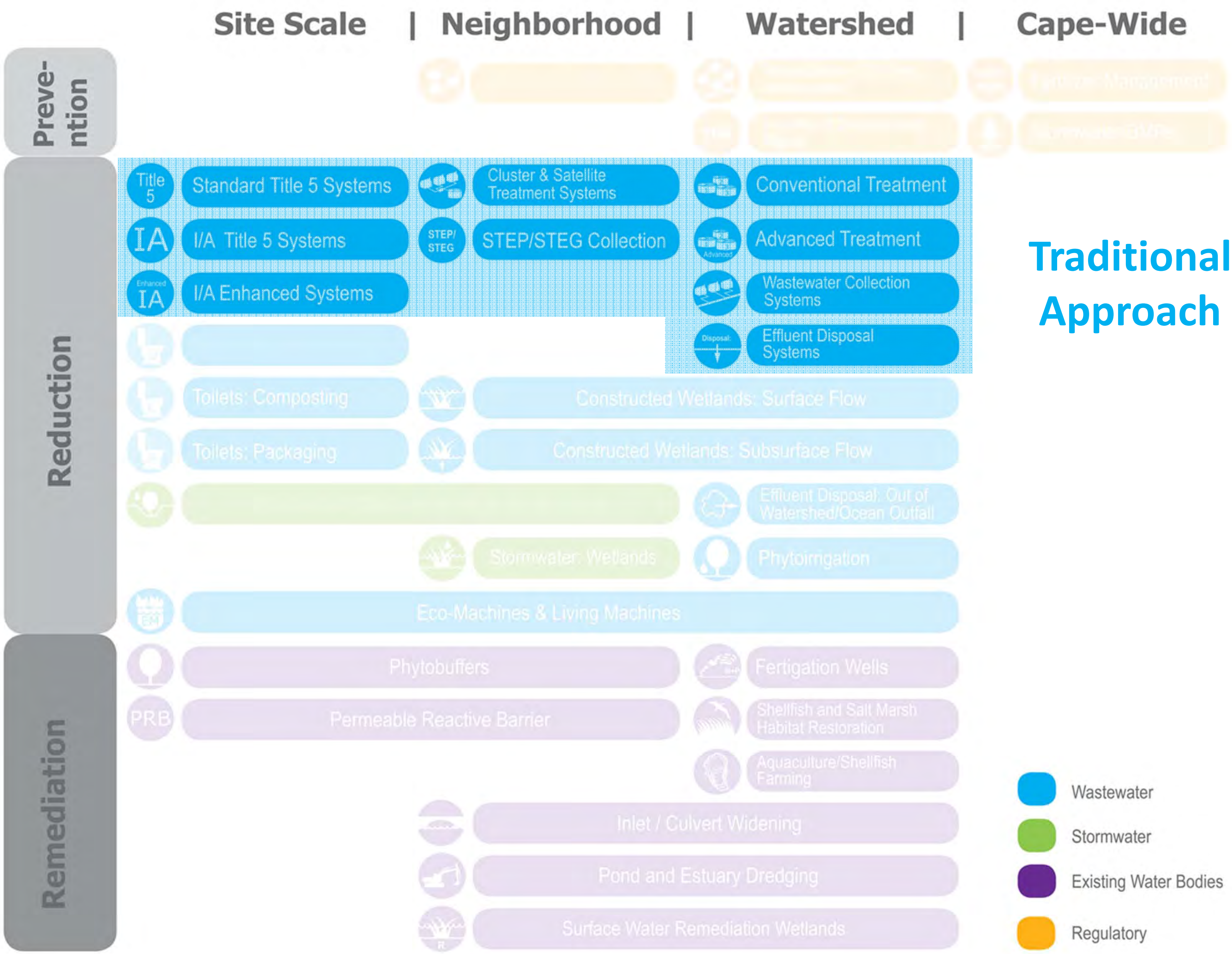
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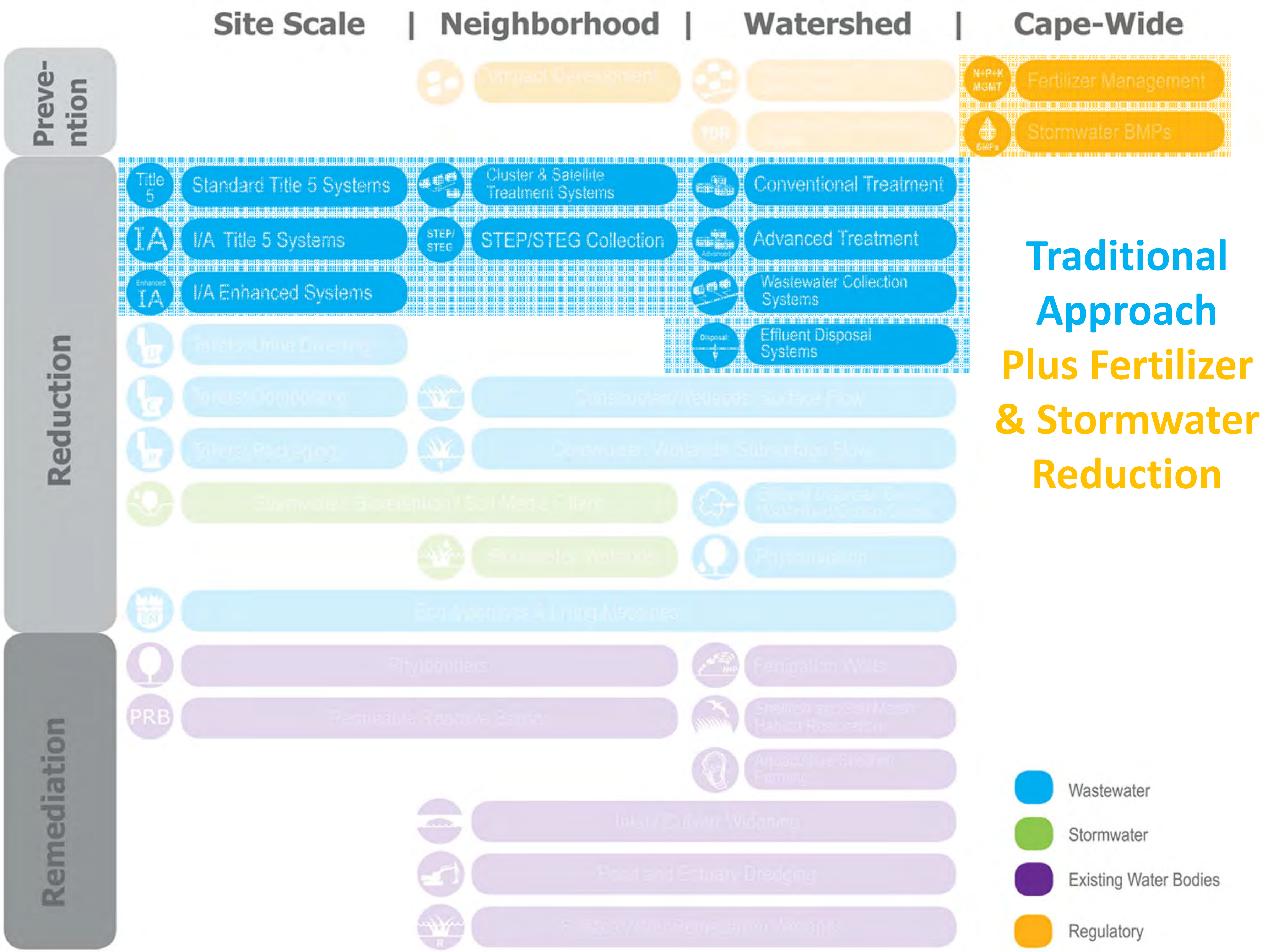
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Plus Fertilizer & Stormwater Reduction
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Existing Water Bodies
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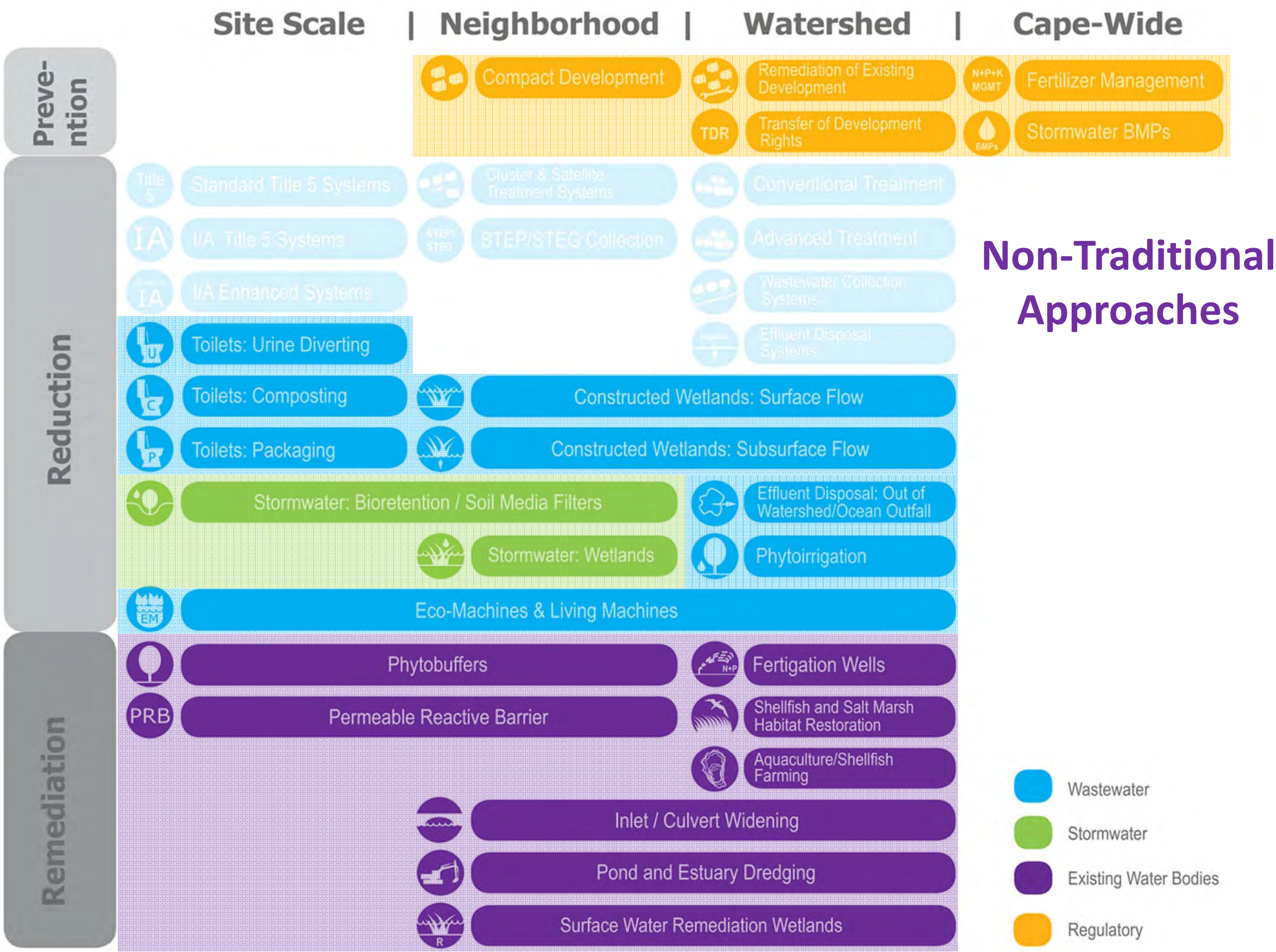
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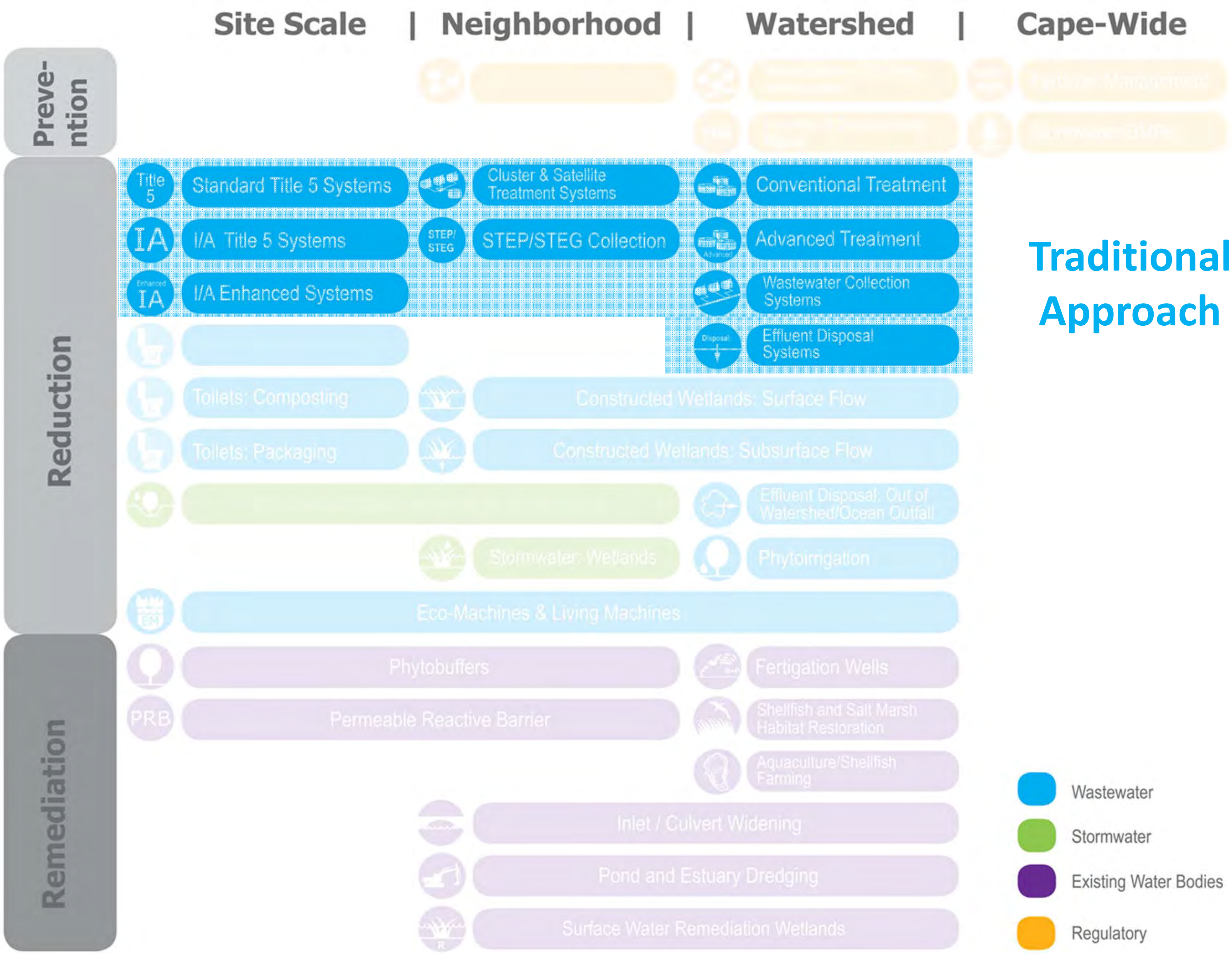
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Traditional Approach
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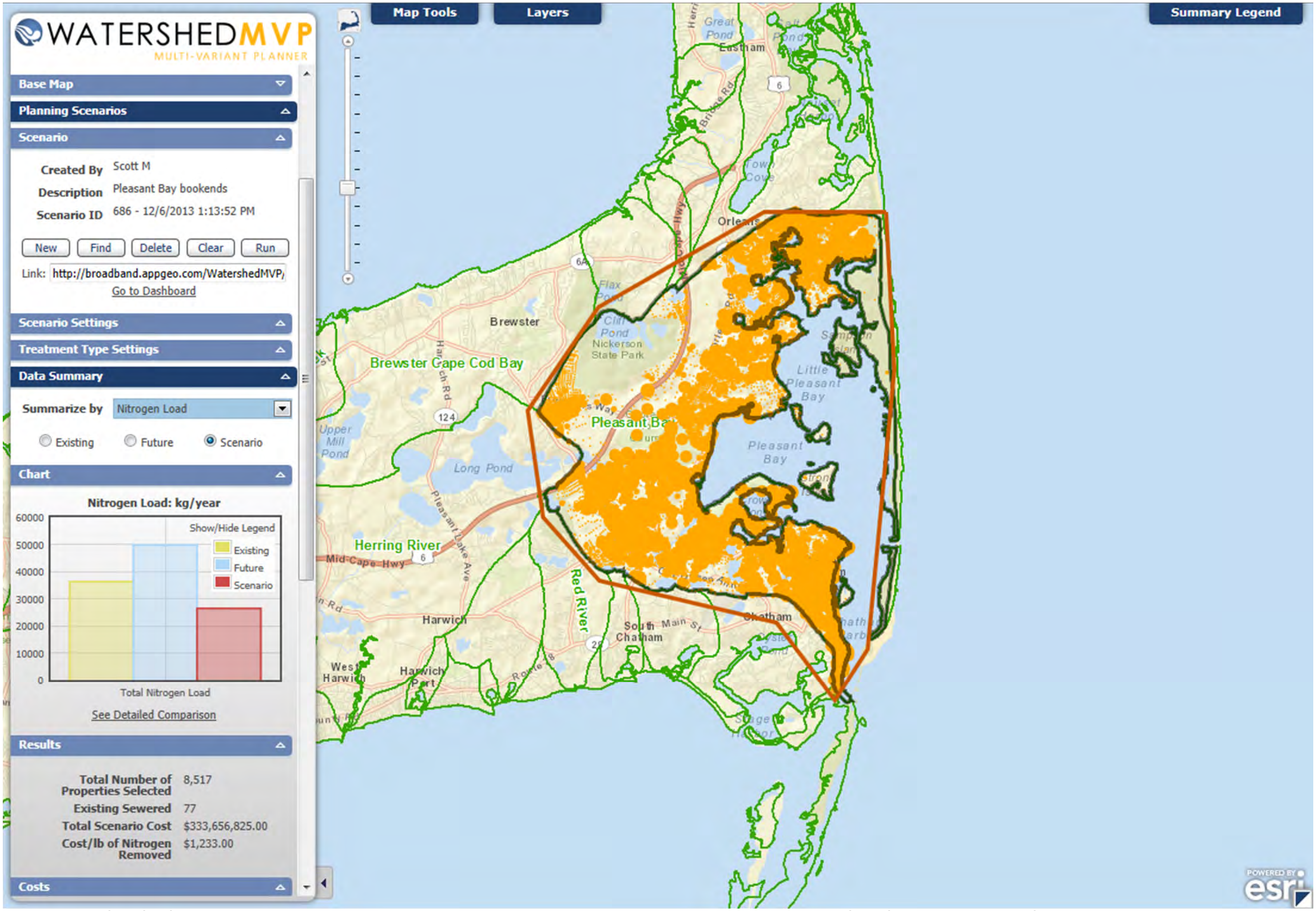
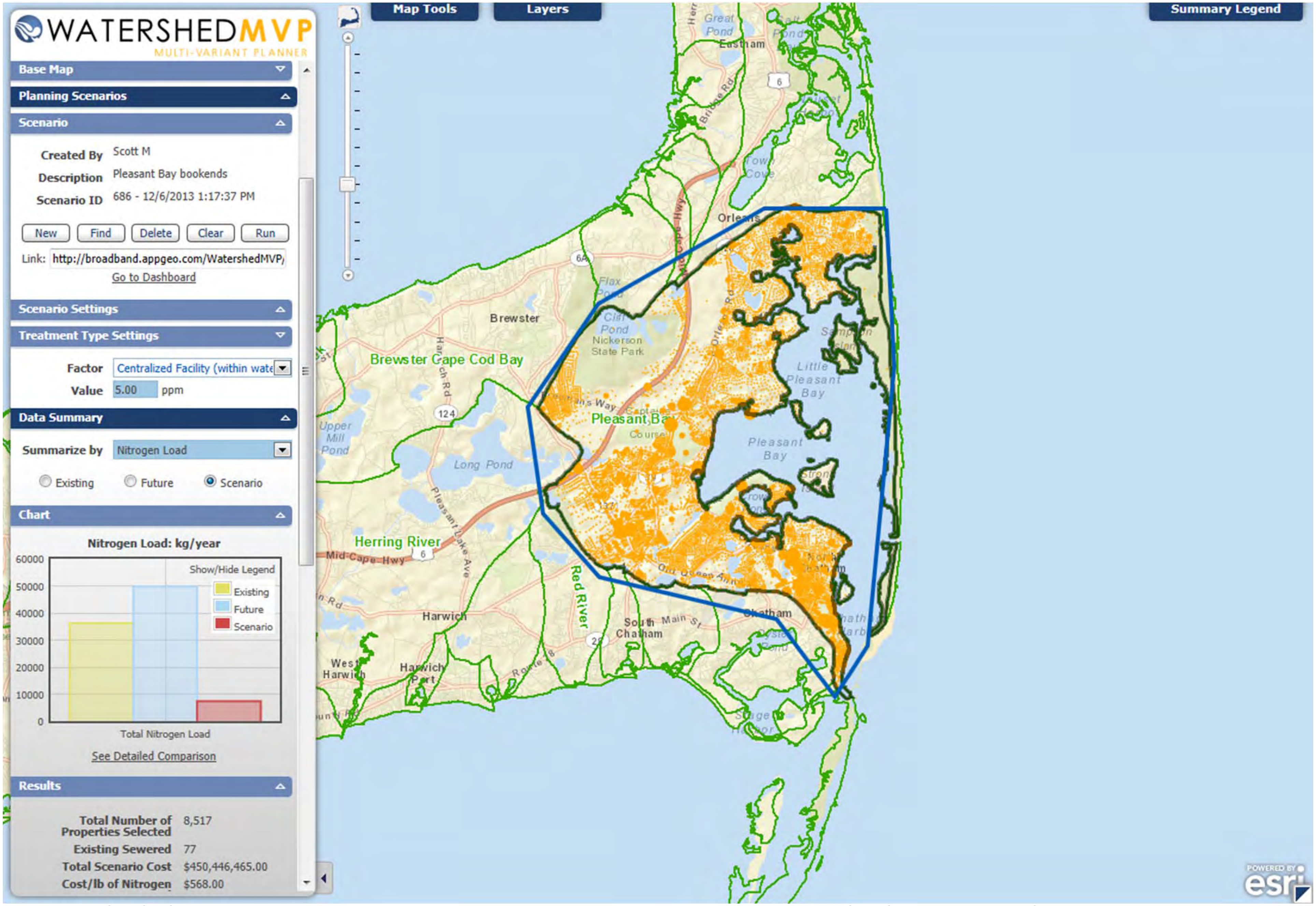
Stormwater
Existing Water Bodies
Regulatory

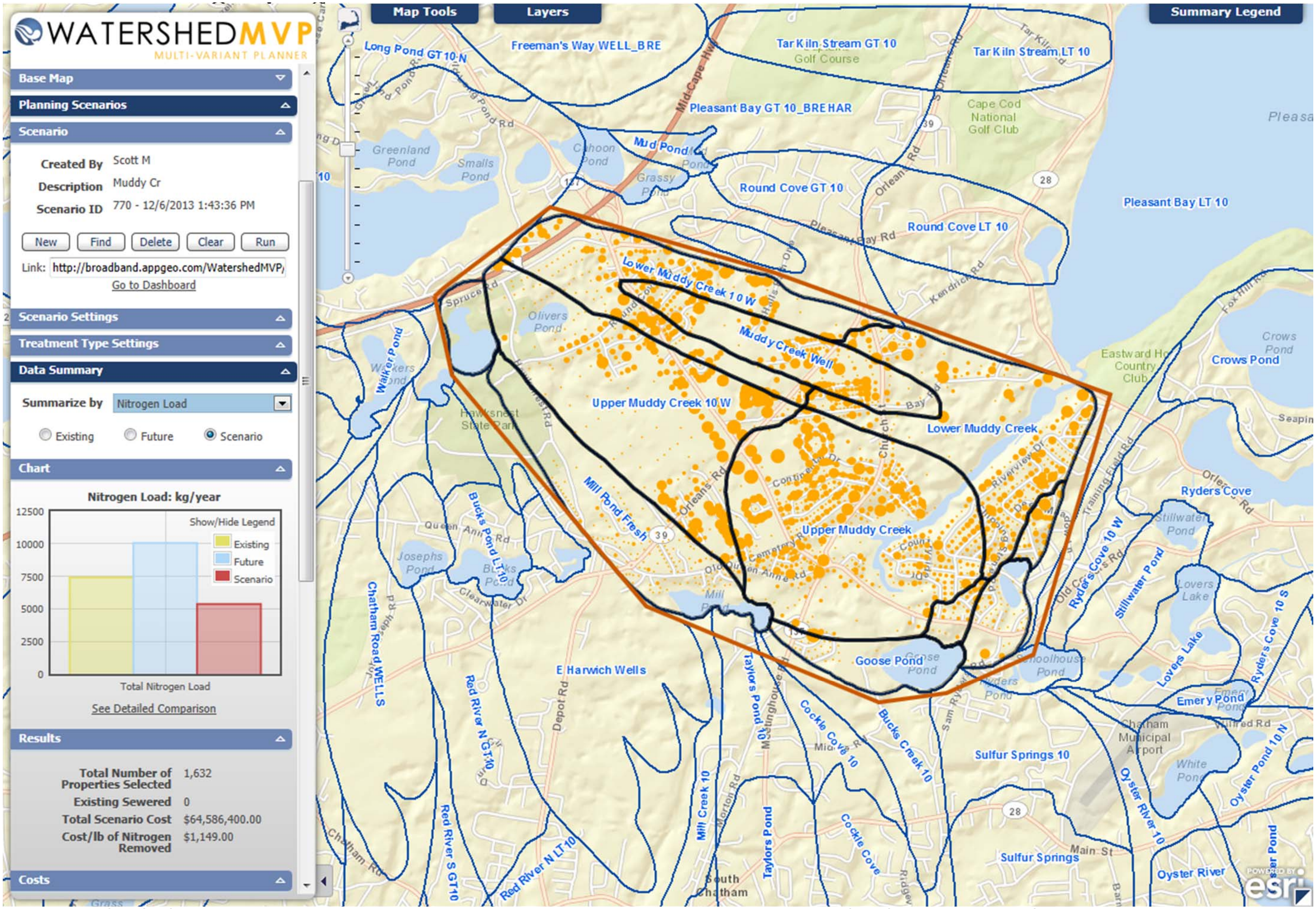
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems



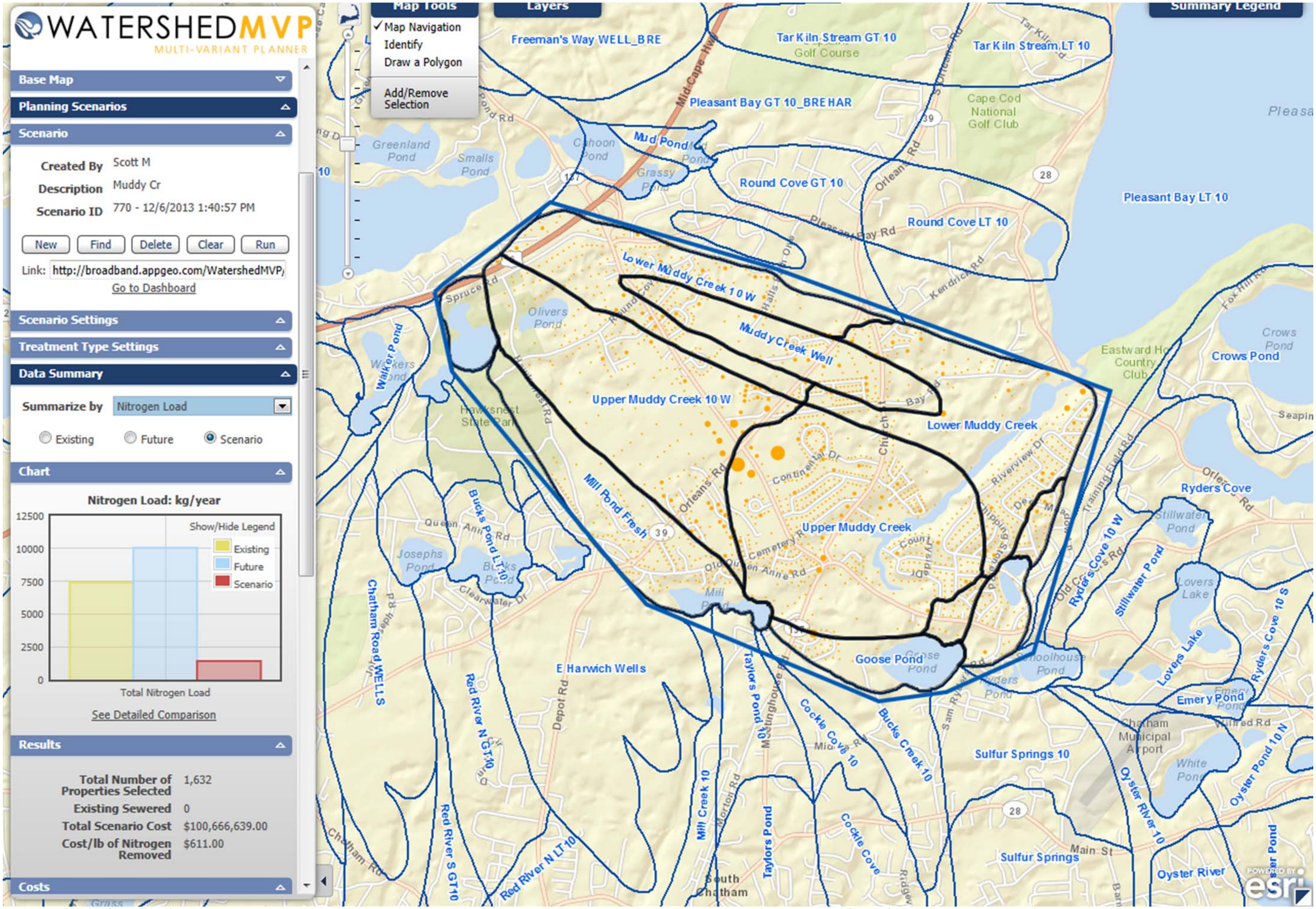
Watershed-Wide Centralized Treatment with Disposal Inside the Watershed

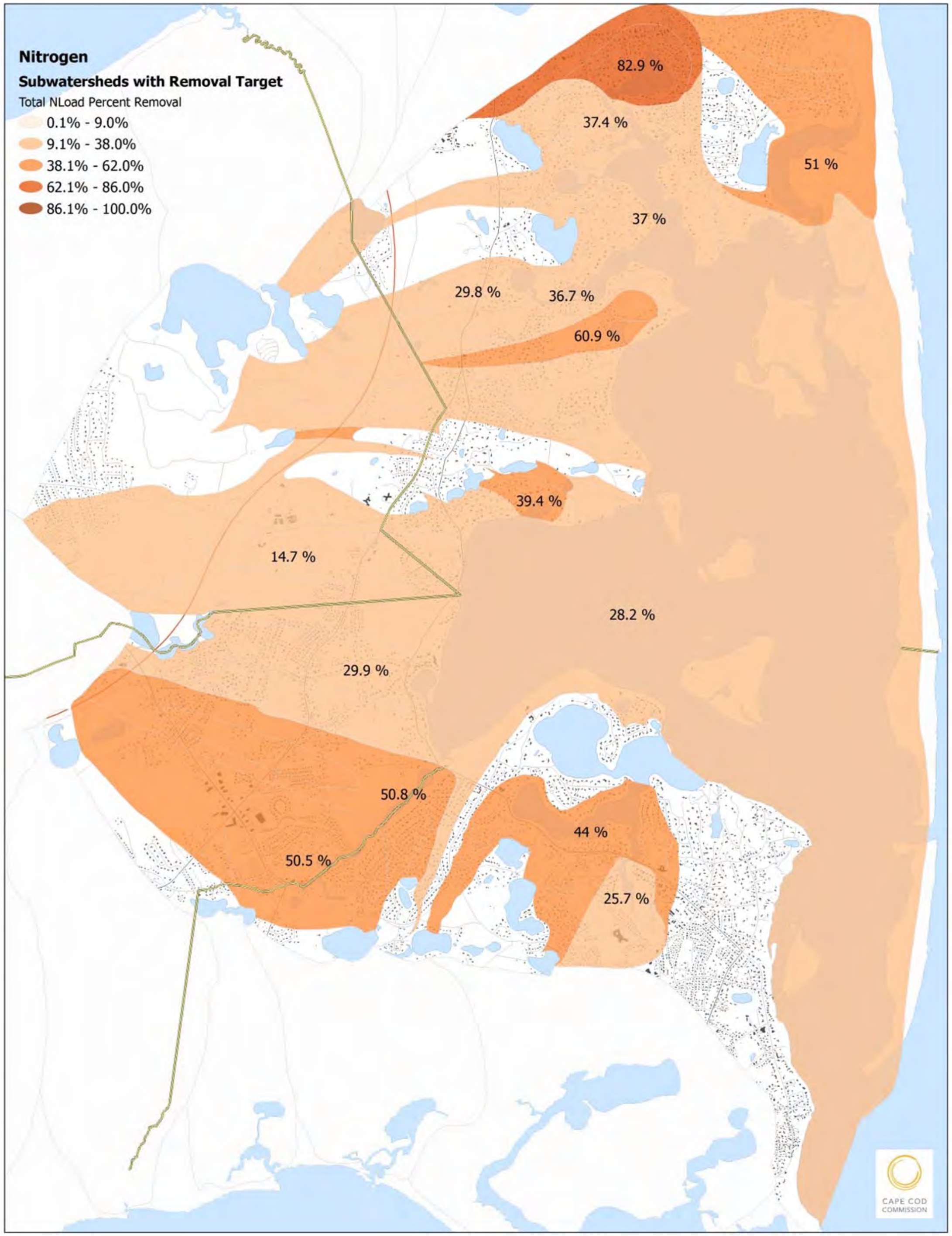


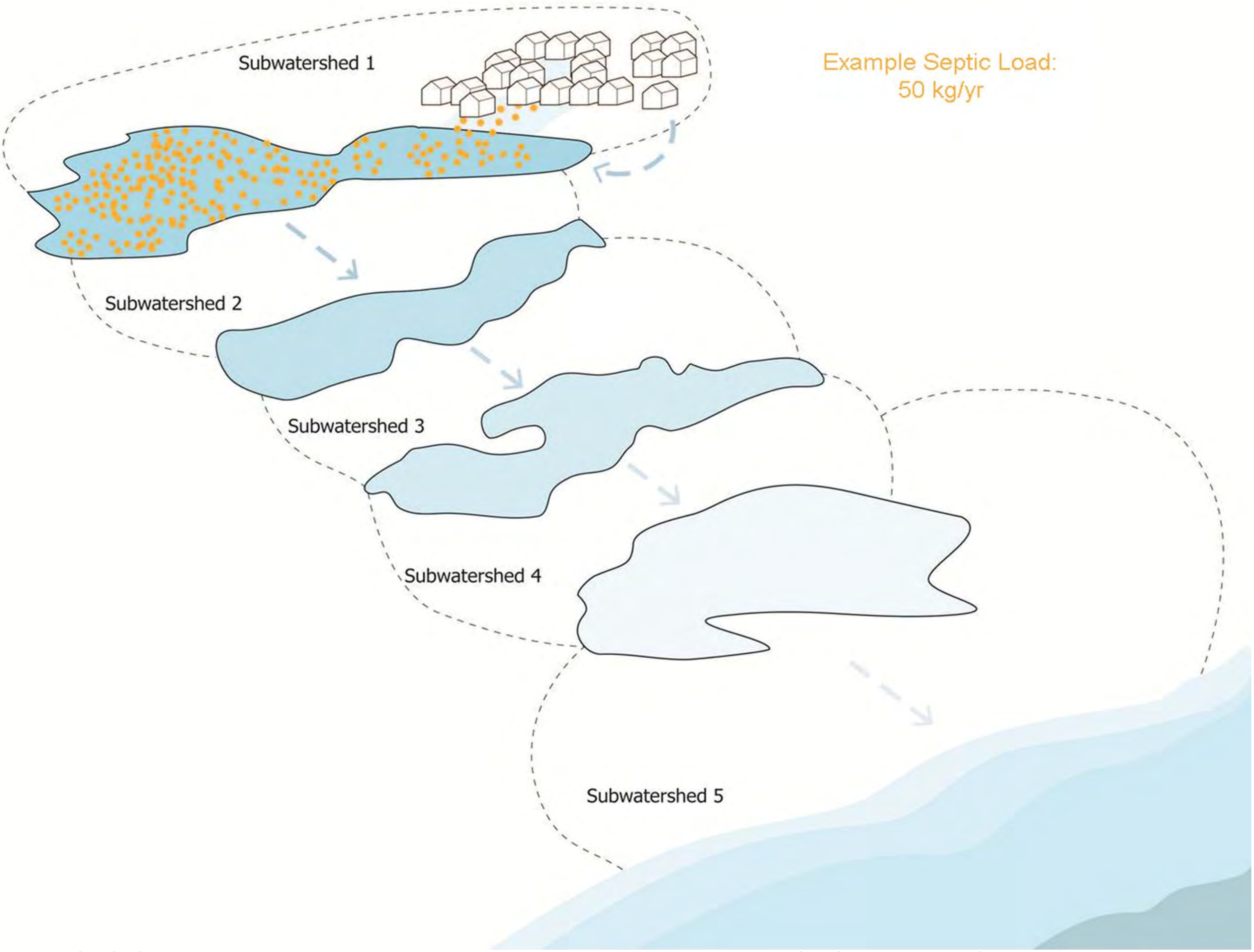
Watershed-Wide (Muddy Creek) Innovative/Alternative (I/A)

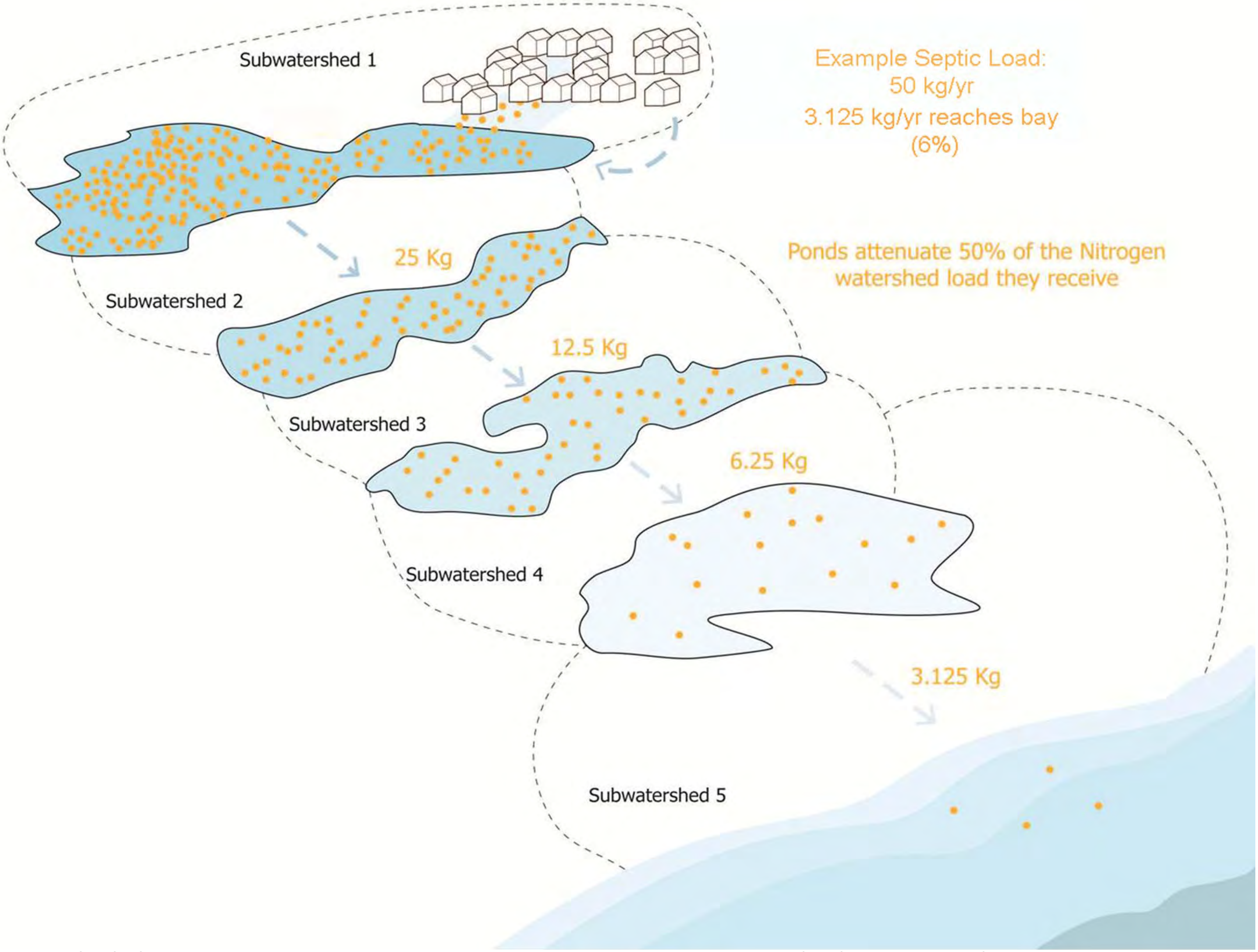


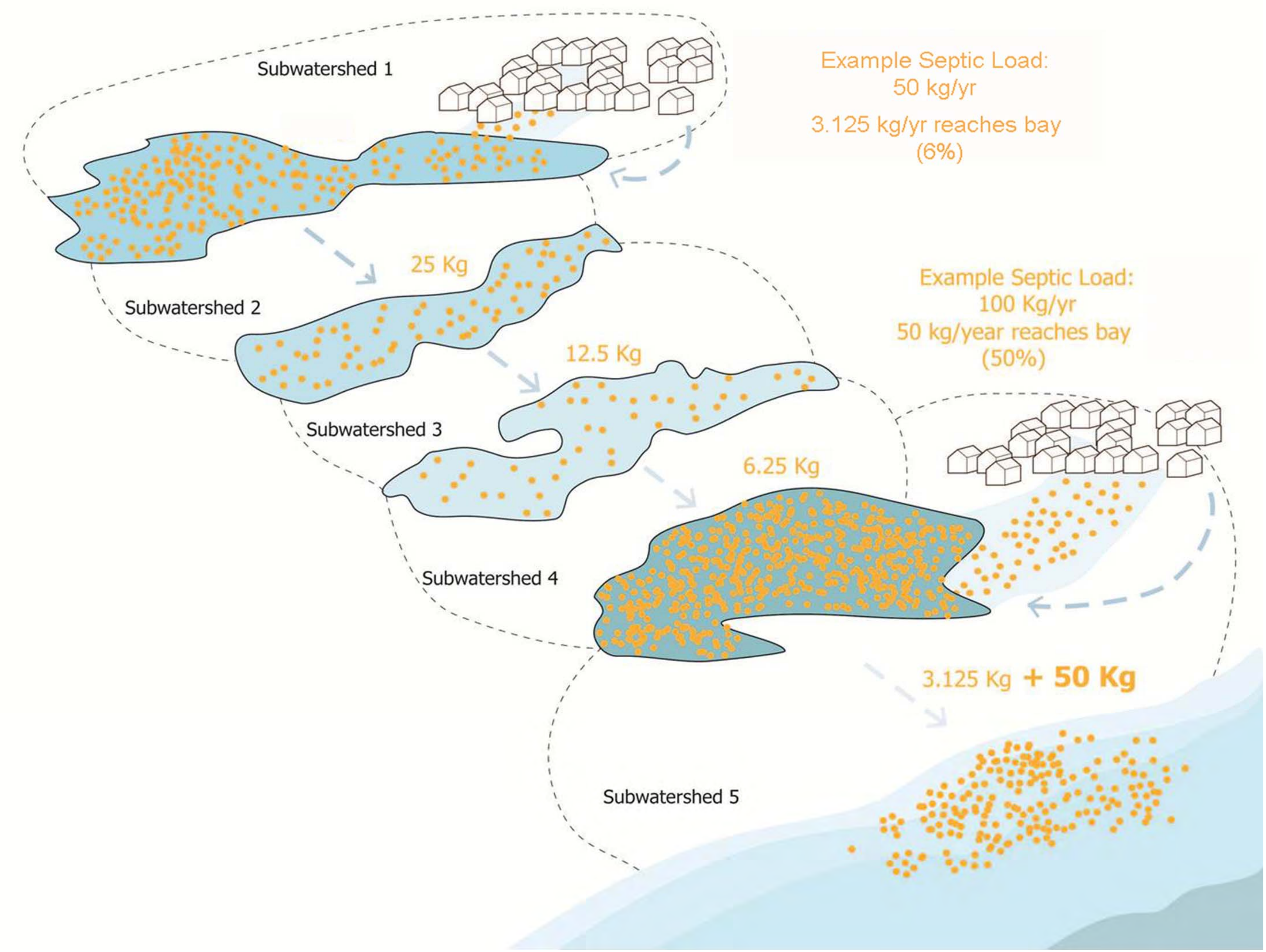
Watershed-Wide (Muddy Creek) Centralized Treatment with Disposal Inside the Watershed



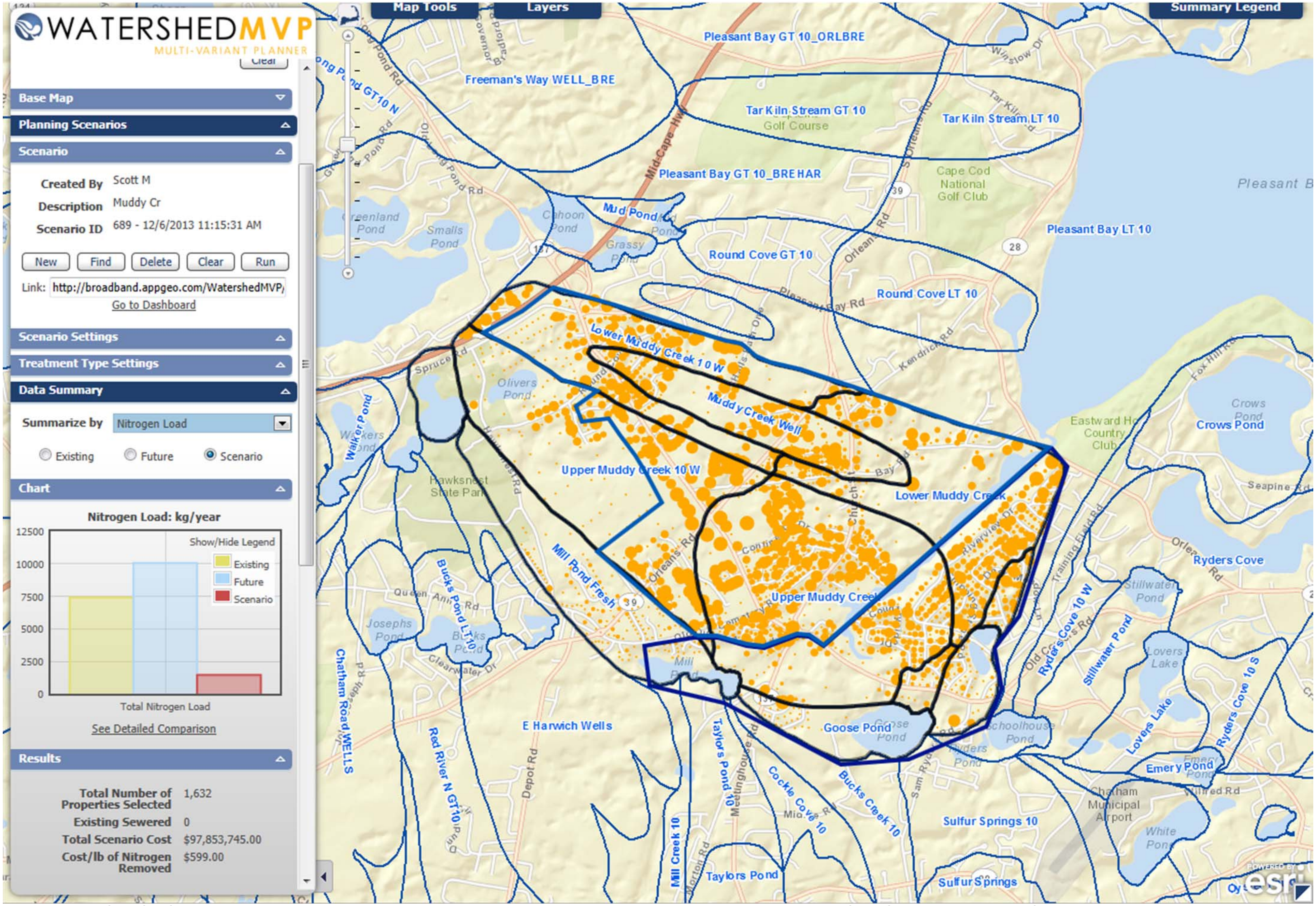

Nitrogen
Subwatersheds with Removal Target
Total NLoad Percent Removal
0.1% - 9.0%
9.1% - 38.0%
38.1% - 62.0%
62.1% - 86.0%
86.1% - 100.0%
82.9 %
37.4 %
51 %
37 %
29.8 %
36.7 %
60.9 %
39.4 %
14.7 %
28.2 %
29.9 %
50.8 %
44 %
50.5 %
25.7 %
CAPE COD COMMISSION

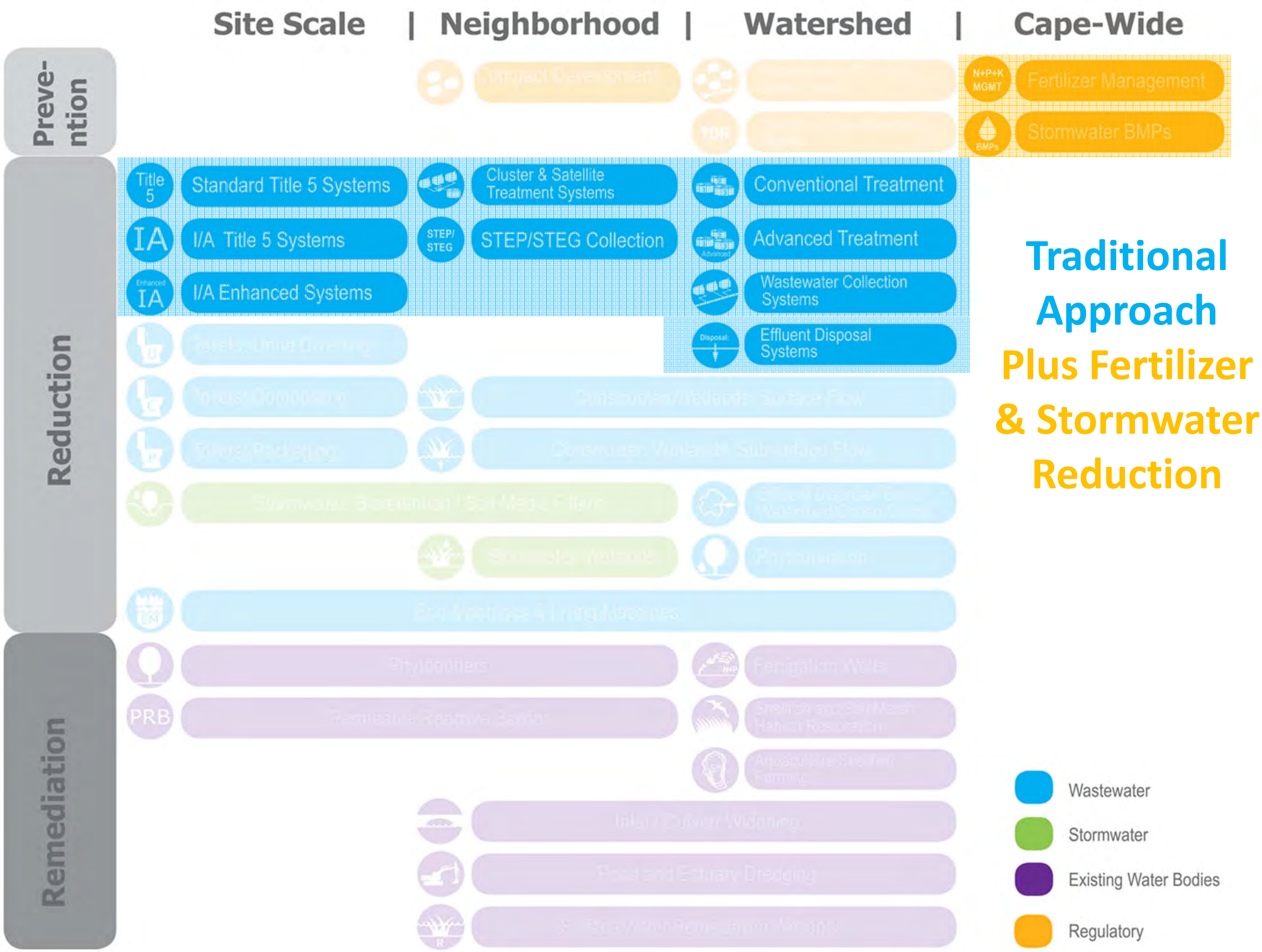

Subwatershed 1
Example Septic Load:
50 kg/yr
Subwatershed 2
Subwatershed 3
Subwatershed 4
Subwatershed 5


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


Subwatershed 1
Example Septic Load:
50 kg/yr
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 in Harwich




Site Scale | Neighborhood | Watershed | Cape-Wide
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N+P+K MGMT
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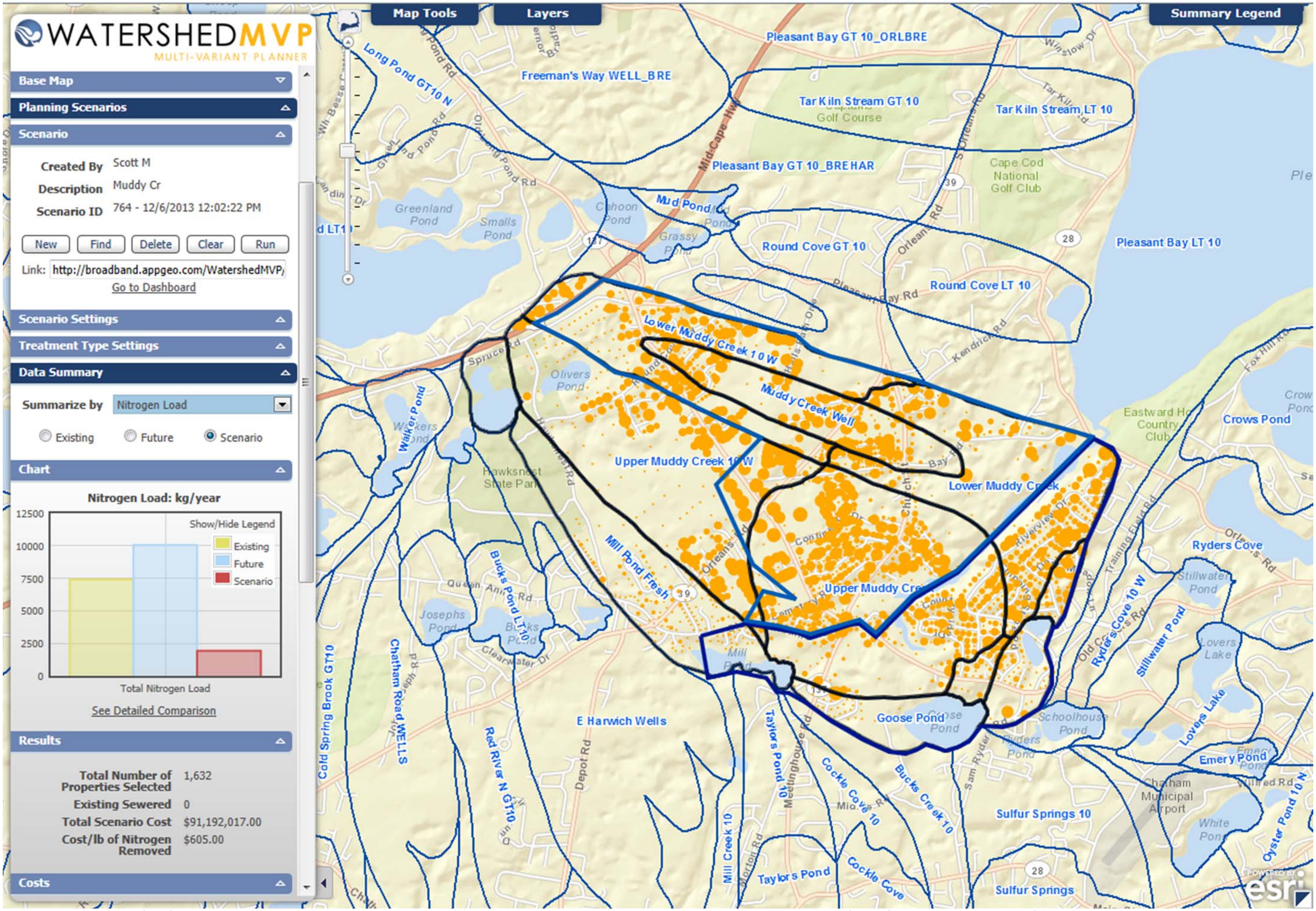
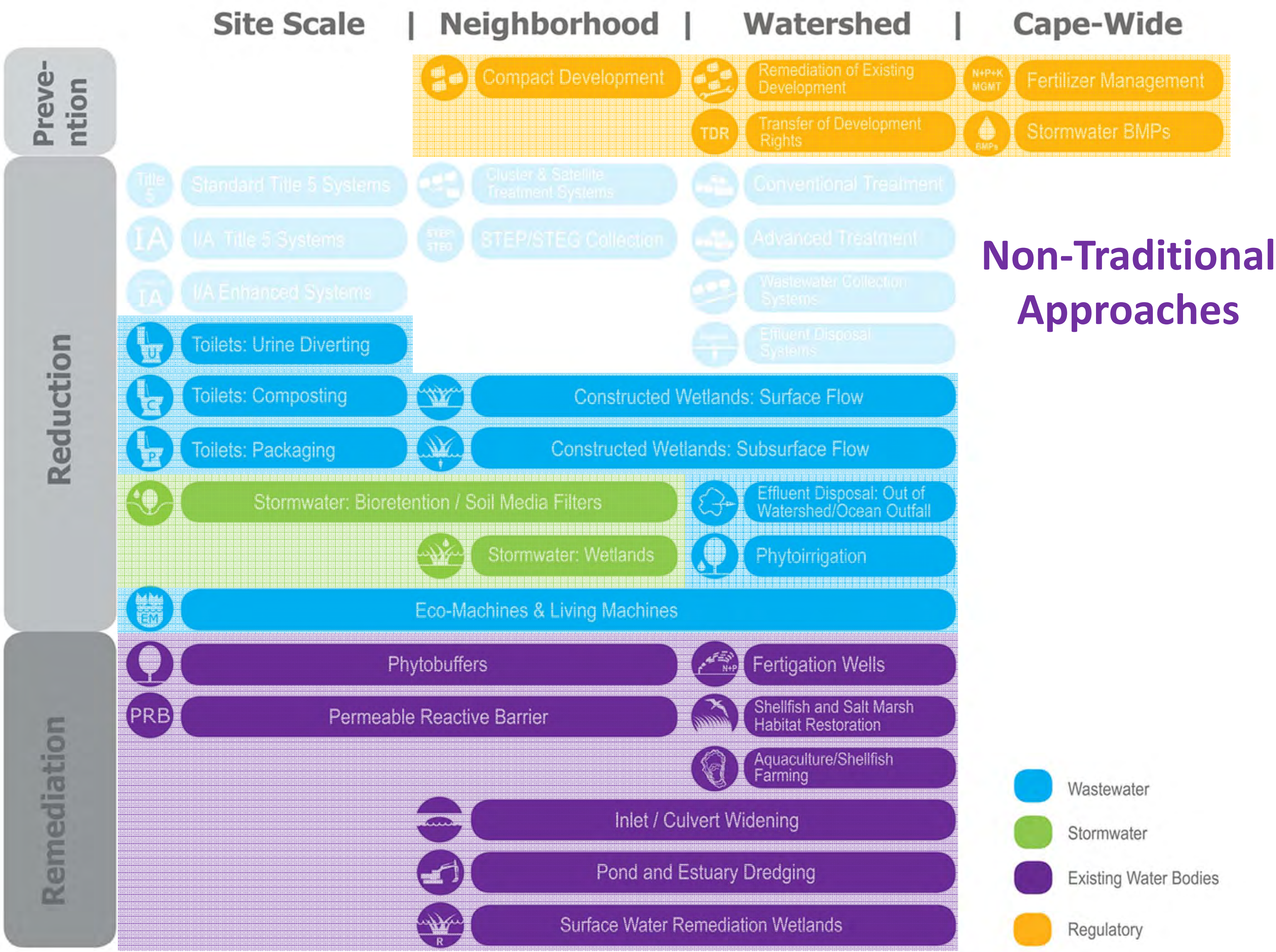
Traditional Approach
Plus Fertilizer & Stormwater Reduction
Wastewater
Stormwater
Existing Water Bodies
Regulatory

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




Site Scale | Neighborhood | Watershed | Cape-Wide
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Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Non-Traditional Approaches
Wastewater
Stormwater
Existing Water Bodies
Regulatory

Problem Solving Approach

Wastewater | Existing Water Bodies | Regulatory

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

N+P+K MGMT
BMPs

4 Watershed/Embayment Options

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

PRB
R

5 Alternative On-Site Options

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

Title 5
Enhanced IA
C
IA
U
P

6 Priority Collection/High-Density Areas

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

Advanced
Disposal
STEP/STEG

7 Supplemental Sewering

Advanced

Watershed Calculator **Muddy Creek**

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
Present Total Nitrogen Load:		18.458	6,737
wastewater		13.496	4,926
fertilizer			612
stormwater			776
Target Nitrogen Load:		6.751	2,464
Chatham Portion to WWTF		1,785	
Nitrogen Removal Required:		**6.817**	**2,488**
Total Number of Properties:	1408		

Watershed Calculator Muddy Creek

MEP Targets and Goals:		kg/day	Nitrogen (kg/yr)
Present Total Nitrogen Load:		18.458	6,737
wastewater		13.496	4,926
fertilizer			612
stormwater			776
Target Nitrogen Load:		6.751	2,464
Chatham Portion to WWTF		1,785	
Nitrogen Removal Required:		**6.817**	**2,488**
Total Number of Properties:	1408		

Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

Watershed Calculator **Muddy Creek**

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Chatham Portion to WWTF		1,785		
Nitrogen Removal Required:		**6.817**	**2,488**	
Total Number of Properties:	1408			
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		306	2,182	
Stormwater Mitigation		388	1,794	

Watershed Calculator **Muddy Creek**

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**	
Present Total Nitrogen Load:		18.458	6,737	
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Stormwater Mitigation		388	1,794	
Watershed/Embayment Options:				
Constructed Wetlands	1.5 acres	849	945	$521

Watershed Calculator **Muddy Creek**

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Present Total Nitrogen Load:			18.458	6,737	
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Stormwater Mitigation			388	1,794	
Watershed/Embayment Options:					
Constructed Wetlands	1.5	acres	849	945	$521
Oyster Beds/Aquaculture	2	acres	500	445	$0

Watershed Calculator **Muddy Creek**

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**	
Present Total Nitrogen Load:		18.458	6,737	
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Constructed Wetlands	1.5 acres	849	945	$521
Oyster Beds/Aquaculture	2 acres	500	445	$0
Floating Constructed Wetlands	1000 cu feet	450	-5	$61

Watershed Calculator **Muddy Creek**

MEP Targets and Goals:			**kg/day**	**Nitrogen (kg/yr)**	
Present Total Nitrogen Load:			18.458	6,737	
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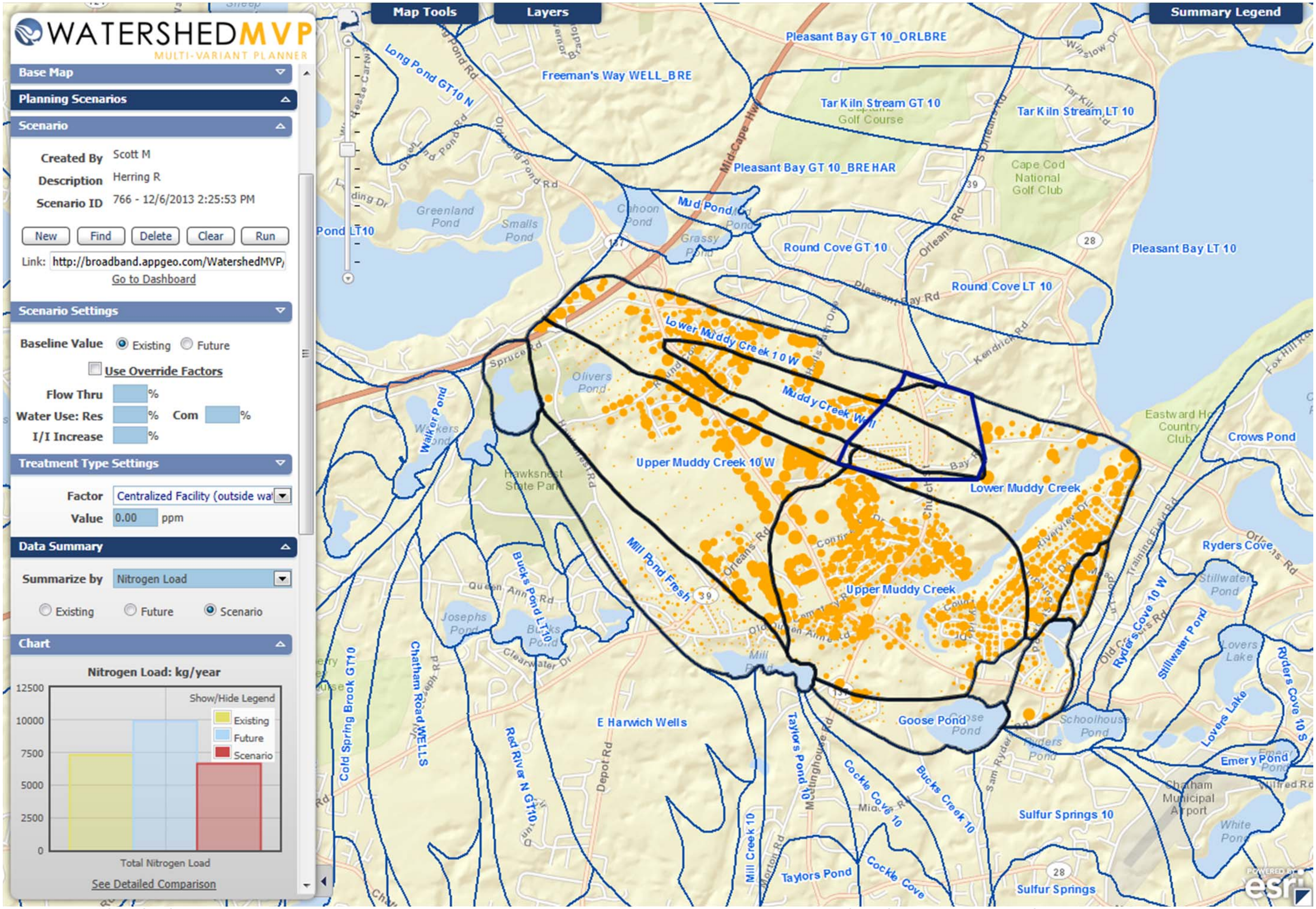
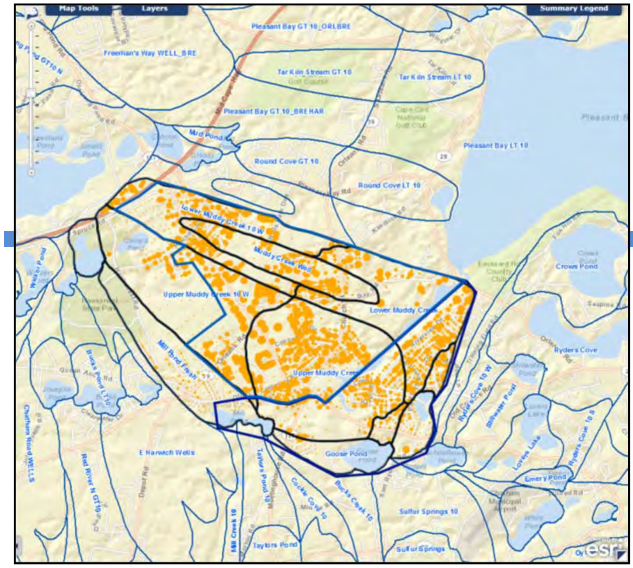
Floating Constructed Wetlands	1000	cu feet	450	-5	$61
Sewering	-1	homes	-5	0	$1,000

Targeted Centralized Treatment after Applying Alternative Strategies



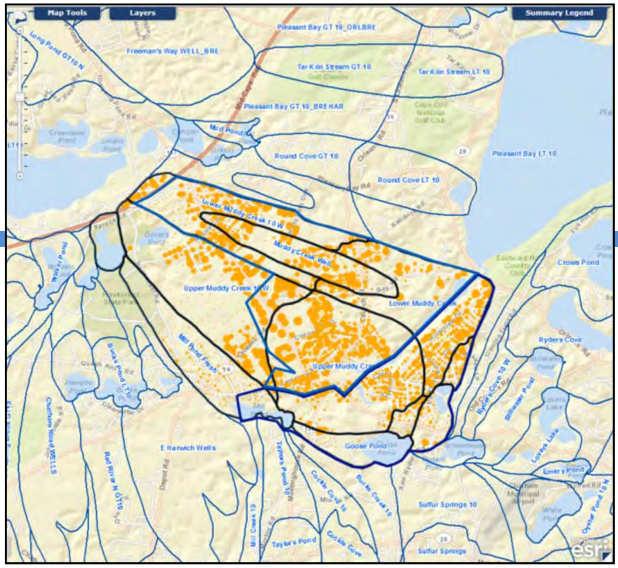
Scenario Comparison

Targeted Collection



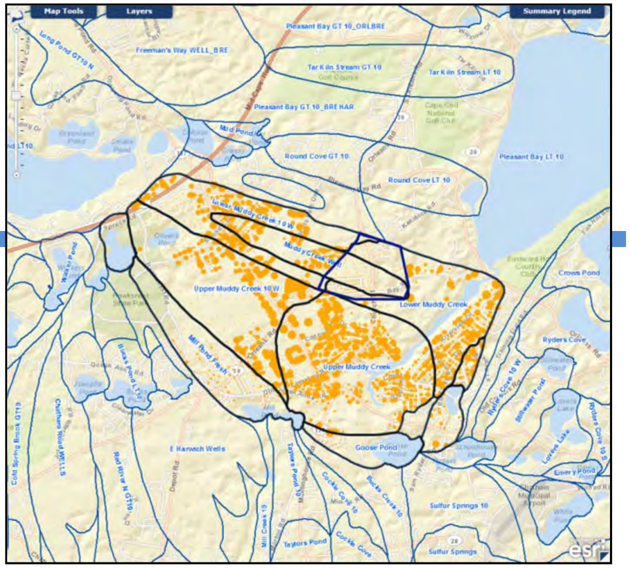
- Achieves TMDL[1]
- Cost/lb N = $600
- Treated Flow = 145,000 gpd

Targeted Collection after a 50% reduction in fertilizer and stormwater



- Achieves TMDL[1]
- Cost/lb N = $600
- Treated Flow = 125,000 gpd

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



- Achieves TMDL[1]
- Cost/lb N = $750
- Treated Flow = 20,000 gpd

[1] within 5% of goal

Adaptive Management:

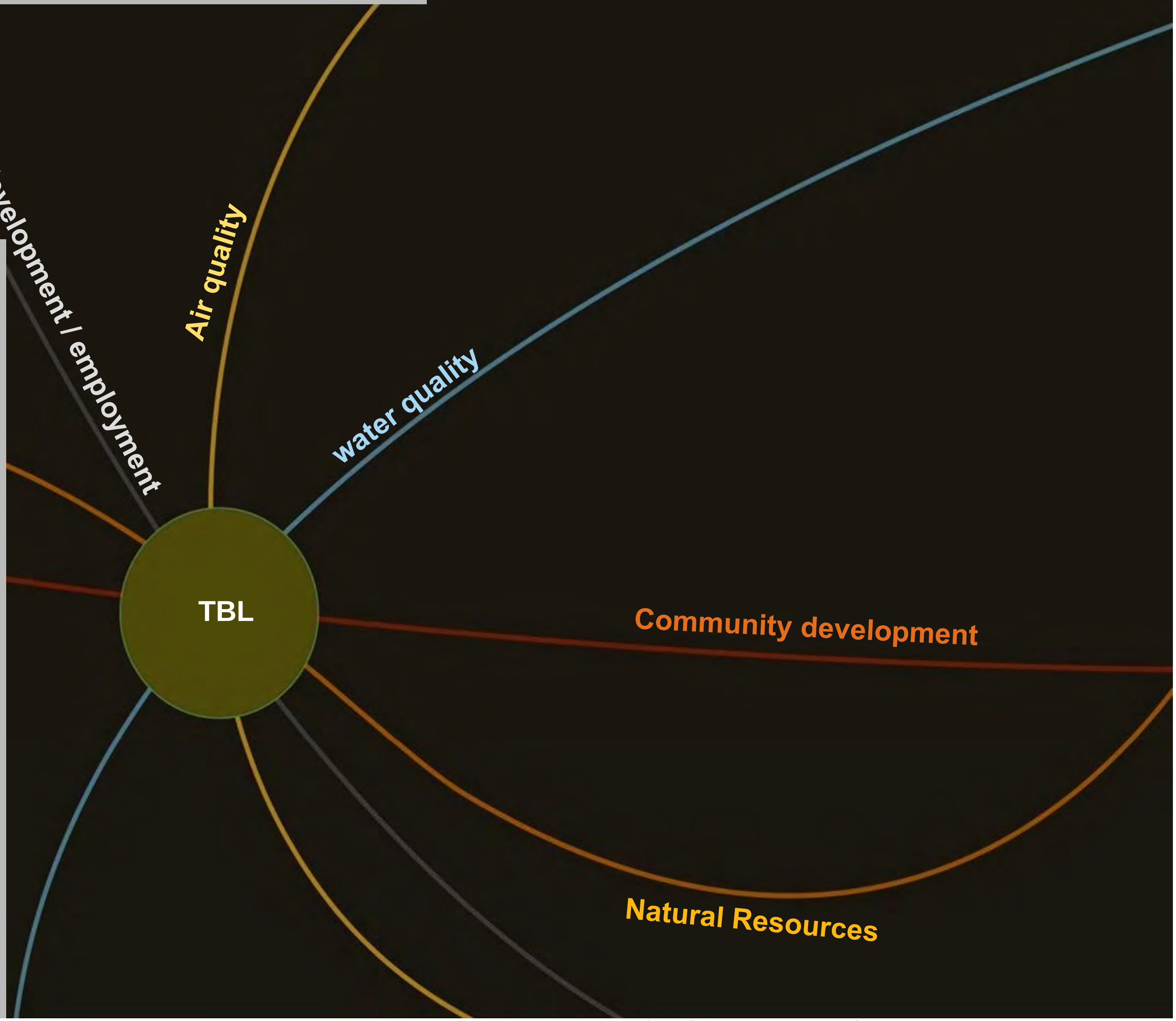
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient way.

Triple Bottom Line (TBL) Introduction

What is triple bottom line analysis?

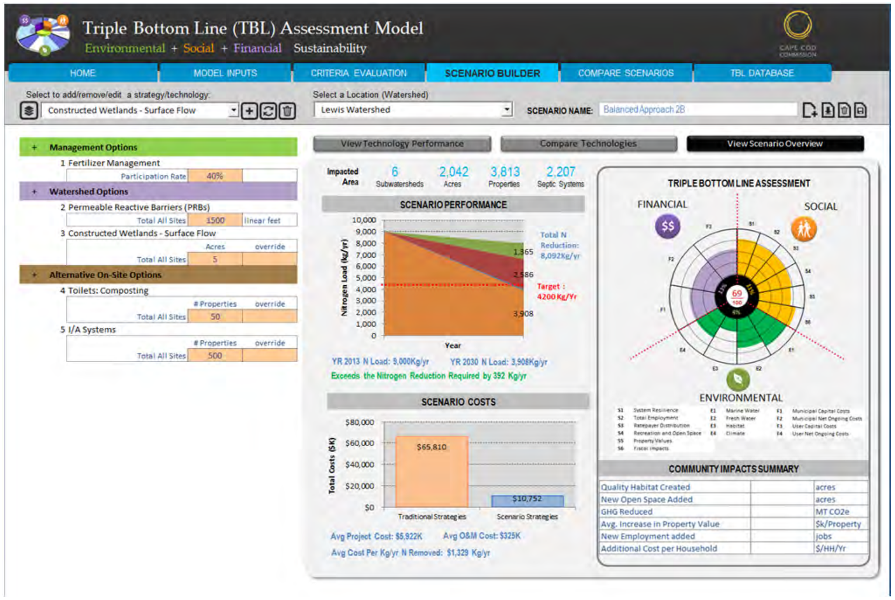
Triple Bottom Line Analysis
Provides a full accounting of the financial, social, and environmental consequences of investments or policies

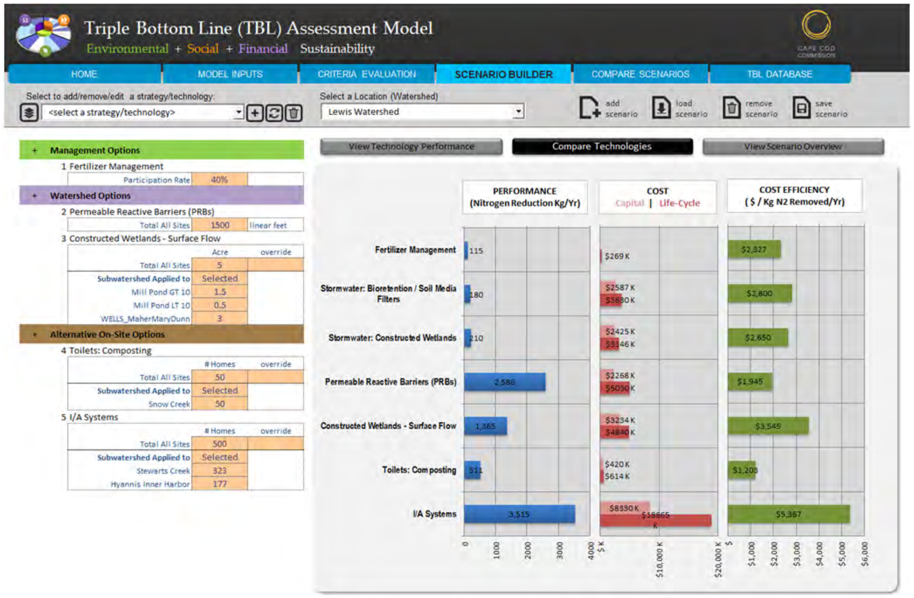
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.



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

HOME | MODEL INPUTS | CRITERIA EVALUATION | SCENARIO BUILDER | COMPARE SCENARIOS | TBL DATABASE

Alternative Definition | Alternative Results | Alternative Scoring Rules

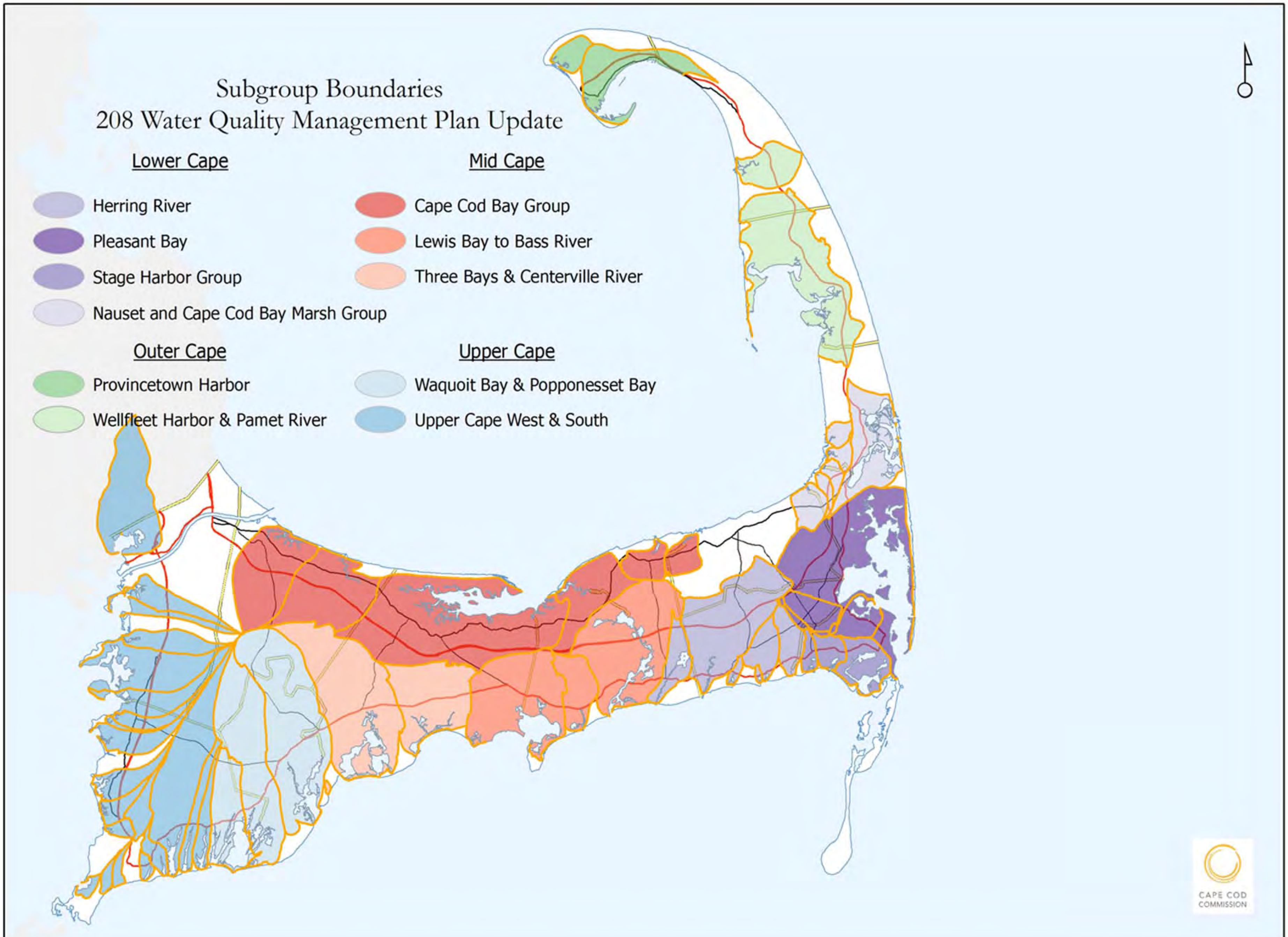
	Scenario 1	Scenario 2	Scenario 3
	Minimum Cost	Cost Effective	Maximum Performance

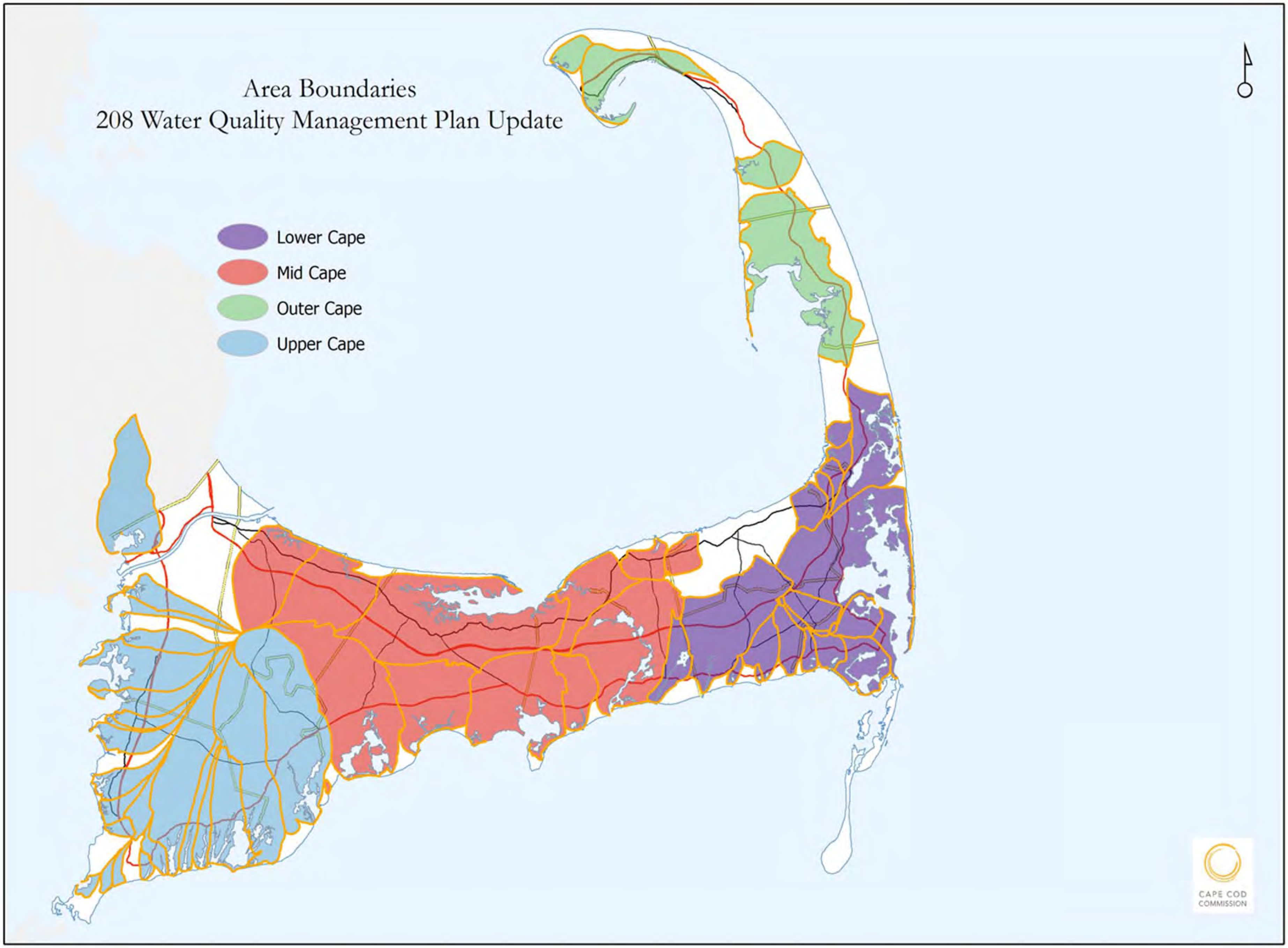
Criterion Scores

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

	Scenario 1	Scenario 2	Scenario 3
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
Lower Cape
Mid Cape
Outer Cape
Upper Cape
CAPE COD COMMISSION

Cape Cod 208 Area Water Quality Planning
Pleasant Bay Watershed Working Group

Meeting Three
December 9, 2013
Orleans Town Hall
8:30 am - 12:30 pm

Meeting Summary Prepared by the Consensus Building Institute

I. ACTION ITEMS

Working Group

- Provide feedback on the draft meeting for Meeting #3 after it is circulated.
- 208 Plan Stakeholders Summit meeting date and location to be announced soon.

Consensus Building Institute

- Draft, solicit feedback from Working Group, and finalize Meeting Three summary
- Conduct further outreach to working group members regarding the process moving forward and possible ongoing involvement, for example in the area working groups.

Cape Cod Commission

- Provide PowerPoint presentation to Working Group members
- Share information about date and time of the Stakeholder Summit meeting with the Working Group when determined.

II. WELCOME AND OVERVIEW

Patty Daley, Deputy Director and Area Manager, Cape Cod Commission, welcomed participants and offered an overview of the 208 Update stakeholder process.[1] 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 are focused on exploring technology options and approaches. These third meetings of the Watershed Working Groups will focus on evaluating watershed scenarios. These scenarios are informed by Working Groups' discussions at previous meetings about baseline conditions, priority areas, and technology options/approaches.

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

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 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 PLEASANT BAY WATERSHED

Patty Daley explained the Commission's process for developing watershed scenarios. Two teams were formed: one team is exploring "traditional " technologies and approaches (permitted technologies such as sewering and I/A systems) and another team is exploring "alternative" or "non-traditional" technologies and approaches. The teams are both working under the assumption that fertilizer and stormwater reductions will reduced the footprint of required wastewater infrastructure. 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 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 costs in the technologies matrix, and include a lifecycle analysis. This cost data is for comparative purposes. In response to a question, Ms. Daley also clarified that the thorough comments on the online technology matrix came from stakeholders, to which the Commission responded in a single document.

Scott Michaud, Hydrologist with 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 several scenarios based on currently permitted technologies:

<u>Whole Watershed Conventional Scenarios – Pleasant Bay</u>

The Pleasant Bay watershed has an aggregated MEP target for wastewater nitrogen removal of 87%.

- Watershed-Wide Innovative/Alternative (I/A) Onsite Systems. Installation of I/A systems for all properties in the Pleasant Bay Watershed. The cost of this approach would be $1200 per lb. of nitrogen removed. This would remove 27% of the system's wastewater nitrogen, well below the aggregated MEP target for wastewater nitrogen removal from the Pleasant Bay watershed of 87%.
- Watershed-Wide Centralized Treatment with Disposal Inside the Watershed. 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, at a cost of $600 per lb. of nitrogen. This would remove 81% of the system's nitrogen, also below the aggregated MEP target for wastewater nitrogen removal from the Pleasant Bay watershed of 87%.

Whole Watershed Conventional Scenarios – Muddy Creek

A similar evaluation was conducted for Muddy Creek, a tributary sub-system to Pleasant Bay:

- Muddy Creek Sub-Watershed-Wide Innovative/Alternative (I/A) approach, at $1150 per lb. of nitrogen removed. This would remove 27% of the system's nitrogen, well below the aggregated MEP target for wastewater nitrogen removal from the Muddy Creek watershed at 100% for the lower portion, and 75% for the upper portion.
- Muddy Creek Sub-Watershed-Wide Centralized Treatment with Disposal Inside the Watershed, at a cost of $600 per lb. of nitrogen. This would remove 81% of the system's nitrogen, also below the aggregated MEP target for wastewater nitrogen removal from the Muddy Creek watershed of 100% for the lower portion, and 75% for the upper portion.

Natural Attenuation

Mr. Michaud 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.

Targeted Watershed Conventional Scenarios – Muddy Creek

Targeted Approaches.

- Targeted Centralized Treatment, w/o reductions in fertilizer/stormwater loads. This scenario achieves the MEP wastewater nitrogen removal targets, acknowledges the Chatham CWMP which proposes to collect and remove wastewater nitrogen loads from the Chatham portion of the Muddy Creek watershed, assumes that reduced nitrogen loads collected from the Harwich portion of the watershed will be returned to the Muddy Creek watershed following treatment for nitrogen, and involves total collection (from Harwich and Chatham) of about 200,000 gallons per day, with a cost of about $600 per lb. of nitrogen removed.

He also noted that reducing fertilizer and stormwater runoff would reduce the amount of wastewater needing collection. When fertilizer and stormwater runoff are reduced by 50% and attenuation is used advantageously, the footprint of the proposed centralized system could be reduced.

- Targeted Centralized Treatment with a 50% Reduction in Fertilizer and Stormwater nitrogen. This scenario also achieves the MEP nitrogen removal target and involves collection of about 180,000 gallons per day at a similar cost of about $600 per lb. of nitrogen.

In order to achieve TMDLS in each of these two scenarios, the scenario transports the nitrogen loads within Harwich from the lower reach of the Muddy Creek watershed to the upper reach. Much of the Muddy Creek watershed is located in a Zone II wellhead protection area such that the option to dispose of treated wastewater effluent in this area would have to address stringent drinking water quality standards that can significantly add to treatment cost.

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

- *What costs do these estimates include?* They include operation and management and all the costs generally included in infrastructure projects. They do not include hookup costs.
- *Because most of this watershed is a Zone 2 wellhead protection area, there are additional regulatory and permitting issues that may increase the costs of disposal here up to 20%. Do the scenarios reflect this cost?* The scenarios do not currently include potential costs of disposing in Zone 2 areas.
- *This scenario doesn't reflect what Chatham is planning in terms of sewering.* We will look at that in the next section.
- *When we think about the percentage reductions and removals and costs, they are only for existing loads, and will all change based on future development. 100% of any future load has to be taken out to meet the TMDLs and this will increase costs.*
- *Are you expecting us to endorse any of these scenarios?* No, they're just meant to be illustrative.
- *This year Orleans substantially increased the amount of money they're putting towards stormwater reduction. It is not reflected in these scenarios, but stormwater management represents an increased cost for the town.* We haven't included the cost per pound of nitrogen for stormwater because we're following the assumption that, since EPA is requiring stormwater management, it is something that the towns are doing anyway. The costs within these scenarios are strictly related to wastewater. *It is still important for stakeholders to be aware of how much towns are spending on stormwater.*

<u>Whole Watershed 7-Step Scenarios (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.

The scenarios presented here focus on the Muddy Creek area. Nitrogen contributions from Chatham properties, which will be sewered and effluent discharged out of the sub-watershed, have been removed from these calculations. The scenarios also include assumptions of a 50% reduction of nitrogen coming from fertilizer and stormwater.

Using a calculator slide, he showed the group the subsequent reductions in nitrogen levels for each additional technology used to eventually achieve the required reduction targets. Mr. Owen 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 Muddy Creek[2]:

- Nitrogen reduction goals: 2,548 kg of nitrogen per year
- Low barrier options: assumes 50% reduction of fertilizer and stormwater runoff
    - Fertilizer reduction: 401 kg/year
    - Stormwater reduction: 505 kg/year
- Watershed/Embayment Options
    - Constructed wetlands
        - 1.5 acres, 849 kg/year reduction, estimated cost: $521 per pound of nitrogen.
    - Oyster beds/aquaculture
        - 2 acres, 500 kg/year reduction, estimated cost: $0 per pound of nitrogen. The cost is zero with the assumption that these would be implemented by private industry, and would provide revenues based on harvesting.
    - Floating constructed wetlands
        - 1000 cubic feet, 450 kg/year reduction, estimated cost: $61 per pound of nitrogen.
- Using these approaches, no additional sewering would be required to meet the TMDLs.
- Total unit cost of removing a pound of nitrogen: $123
- Total treated flow would be 0 gallons per day.

Working group members had the following comments and questions on the alternative technologies (in italics):

- In response to questions about target removal percentages, Mr. Michaud explained that the percentages are different depending on whether you're referring to the overall required removal, or if you're referring to the amount of nitrogen that needs to be

[2] Working Group members noted that these numbers were initially miscalculated on the slide. These were adjusted over the break to reflect the accurate numbers.

removed from the septic load. If you prioritize removal from fertilizer and stormwater, you can remove less septic nitrogen and still meet the overall target load.

- *Are the reduction numbers listed here reliable?* Mr. Owen responded that they are a conservative average based on research of actual implementations. However, there is more variability from these technologies than there is from a wastewater treatment plant where you have a very controlled environment.
- *Participants raised concerns that the scenarios assume it will be possible to remove 50% from fertilizer and stormwater, when, in reality, it may not be possible to remove this much.* Mr. Owen responded that this is why there will be continual monitoring, so that if certain technologies do not meet the expected removal, you can implement other technologies.
- *A participant remarked that the Commission and the Working Group need to be clear that these scenarios are only at a conceptual level, lest people see these and misunderstand them.*
- *Why has the future culvert widening not been included in this scenario, as it could significantly reduce nitrogen levels?* To stay on the conservative side, we have not included it here. *Working group members stated that they would like to see the planned culvert widening added to the watershed calculator. Another participant commented that the initial calculation is that the culvert widening will treat a third of the nitrogen (concentration not load).*
- *On the calculator, what does "other watershed management needs" mean?* Ms. Smith responded that it is being used as a placeholder now for target areas that may be identified later. It could be filled in as the process continues.
- *Growth management is one of the most powerful tools for reduction so it should not be sidelined, it should be highlighted and included in the calculator more so that it is clear to communities that it's one of their best tools.* Ms. Daley responded that the Commission chose to illustrate the scenarios using existing development. In the 2014 part of the process, we'll delve further into growth management issues. We are saving this topic for regional-level discussions because it is more relevant at that level.

<u>Questions and comments on oyster beds/aquaculture:</u>

- *Are the examples listed on the calculator, 1.5 acres of constructed wetlands and 2 acres of oyster beds, practical recommendations for our watershed?* Mr. Owen responded that they may be considered, but there are a lot of factors that have not been taken into account. Jay Detjens, GIS Analyst, Cape Cod Commission, added that there is technically space for 2 acres of oysters in this pond, although realistically you probably wouldn't put them in a single 2-acre rectangle.
- *A participant raised concerns about the uncertainty around "soft solutions" like culvert widening and oysters; the analysis needs to account for this uncertainty.* Mr. Owen responded that this highlights the importance of a site-specific approach for examining if certain solutions are viable. When you get into the design phase, costs will change somewhat.

- *There are 24 acres granted for aquaculture in this area, but there are now only two people undertaking any aquaculture. There used to be more. This implies that the conditions might not be good for oysters, or that it is not economically viable. It is misleading to assume that there will be no cost to the town for aquaculture, when private industry has already shown that they are not very interested in growing shellfish here. For aquaculture to work, the town may need to implement and run the program , or provide incentives for private industry.* Ms. Daley responded that it looks like the Commission should come up with cost estimates for municipal implementation of aquaculture projects.
- *If we did decide to implement a pilot oyster project, do we have the existing organizational structure across Towns to figure out how to do it? Who would apply for the grants? The Pleasant Bay Alliance might address some of this, but we would need to figure out how to organize MOUs with other towns, and address other organizational challenges.* Ms. Daley replied that, in the second round of stakeholder engagement, we look more at shared watersheds and sharing solutions between municipalities.
- *Numerous working group members reiterated their support in trying oysters or other shellfish, despite the decrease in shellfish aquaculture in this area over the years. It is low-hanging fruit, it is a natural process, and can be very effective if it works. At the same time, other working group members noted the uncertainty of shellfish aquaculture: shellfish populations in Pleasant Bay fluctuate a lot. We need to be aware that, if we count on aquaculture as a solution, it may not be equally effective from year to year.*
- *A participant pointed out that oysters have an almost immediate effect, whereas sewering takes a long time to affect the embayment.*
- *Other aquaculture factors discussed included: salinity, seasonality, bacterial levels, successes with oysters in Wellfleet and Falmouth, boat mooring and navigation, and the fact that Pleasant Bay is a very dynamic system and understanding these dynamics will help us understand if it can support oysters or other shellfish.*

<u>Questions and comments on floating constructed wetlands:</u>

- *Are there examples of where floating constructed wetlands have been used in salt water?* Mr. Owen responded that there are some, but it is limited. In order to enhance the attenuation, you would probably want to focus on areas with more freshwater or areas where the freshwater is on top of the salt. If it's more saline, you can use different plants, seaweed, and oysters.
- *How did you get the $61/unit cost?* Mr. Owen responded that the materials cost about $20-25 per sq/ft, and operation/management (OM) costs are low. This estimate includes construction costs, fees for design and implementation, and OM over 20 years.
- *Presumably they only work during 6 months of growing time?* Mr. Owen responded that the vegetation and oysters only work during the 6 months, but the microorganisms work longer than that.

Mr. Owen shared a summary slide comparing the three scenarios:

- Targeted collection – cost/lb of nitrogen: $600, treated flow: 145,000 gallons per day
- Targeted collection after 50% reduction in fertilizer and stormwater – cost /lb of nitrogen: $600, treated flow: 125,000 gallons per day
- Targeted collection after 50% reduction in fertilizer and stormwater and after applying alternative approaches – cost/lb of nitrogen: $123, treated flow: 0 gallons per day.

Working group members had the following overall comments, questions, and reactions to the scenarios presented *(in italics)*:

- *Participants felt that the summary slide was misleading because it did not give a clear comparison of the costs of each scenario and because it did not incorporate all the associated costs, e.g. costs for stormwater management. They suggested adding notation to the slide specifying that these are not the total costs. They stated that, although it is difficult to estimate the total cost of each scenario, it is important for stakeholders to have the total costs in order to consider and compare the different scenarios.* Ms. Smith clarified that these are not yet completed cost estimates and plans ready to take back to town meeting. Today we are having a high level discussion of approaches within this watershed, how to go about tackling the issue, what alternatives might be viable here to help us reduce the sewering footprint and cost, and whether the group is comfortable with the approach being put forward thus far.
- *A participant raised the concept of early adopters and late adopters, and stated New Englanders are generally not early adopters; it would feel more comfortable if we could point to another area that had successfully tackled a large-scale nitrogen problem with these alternative technologies.* Mr. Owen responded that many of these technologies have been implemented elsewhere. Some of them have not yet been applied in New England, but many have been used in neighboring states. *Another participant added that any of these technologies can work in the right place, but we need to figure out what level of risk we're willing to tolerate.*
- *A participant from Brewster noted that most of Brewster is not on Pleasant Bay. We have heard that the biggest impact for lowest cost will be closer to the water. Will Brewster be able to contribute, for instance, by making monetary contributions to larger-scale solutions implemented in other towns, where Brewster's investment will go further?* Ms. Daley responded that, yes, the Commission is hoping to find solutions like this and it will be discussed in the upcoming part of the process. The Commission is looking into whether DEP can permit by watershed, not municipality. *Participants discussed tensions around the fact that, if Chatham sewers, the watershed will meet the TMDLs and the other towns may feel like they don't have to do anything. The option to contribute to nitrogen reduction in neighboring towns in the watershed could be a response to this.*
- *Do we know if there are areas in this watershed with high enough concentrations of nitrogen in the groundwater to make it worthwhile to install fertigation wells?* Mr. Owen responded that there is a way to calculate this. *A participant added that Brewster has*

been discussing it. Could possibly put them in near the middle school in Orleans.

- *A working group member commented that there is some uncertainty in some places about whether specific solutions (e.g. I/A systems currently in place) were put in before the MEP baseline data was taken or not. Is there info on public record to figure this out?* Ms. Daley responded that there are spreadsheets that are available that should allow you to answer those questions. It is all parcel based. A town's consultant can go back into the data and figure out what was taken into account for the baseline data.

IV. ADAPTIVE MANAGEMENT

Patty Daley explained the concept of adaptive management. The Commission's working definition is: a structured approach for addressing uncertainties by linking science and monitoring to decisions making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient way.

Ms. Daley asked the working group to share their input about other things that should be included in this definition and in the Commission's approach to adaptive management. Working group members made the following comments and recommendations (in italics):

Questions and comments around what adaptive management means:

- *Adaptive management means that you're adapting to new information. Presumably you have the best information in the plan now, but new information will come along. The definition should reflect this.*
- *The description of adaptive management should be preceded by a description of the plan.*
- *The adaptive management plan should take into account uncontrollable nitrogen loads and what changes might have to be made if those change in future.*
- *A participant raised a concern that we may make a huge investment and may not end up fixing the water quality if some other factor changes (e.g. the embayment could silt up).* Mr. Michaud noted that the Commission will have to differentiate between TMDL compliance and how well a technology is performing.

Questions and comments about timing:

- *If you have an approved plan you should incorporate all possible alternative options, and not delay moving forward with the plan. But don't sit around and wait for the experimental things.*
- *What are the lifespans of these technologies, will the costs of replacing them be significant?* Mr. Owen responded that for each technology we've considered costs over 20 years. Traditional treatment plants also have to be updated after about 20 years.
- *The issue of timing should be reflected in the definition of adaptive management. The flow of which things you implement first, second, etc. is critical to the definition of adaptive management.* Ms. Smith added that this also relates to the risk management

issue: how long are you willing to wait to try solutions that may not be proven.

Questions and comments about monitoring/metrics:

- *The overall plan will have a number of different solutions within it and we may not have the luxury of waiting to see the outcome of the first solutions before we have to implement later solutions. Each solution should come with a defined feedback loop that includes the type of results we expect, clear monitoring, and a clear timeframe of expected information. The feedback might inform the next immediate solution, or it may be a slow loop that can only impact much later efforts.*
- Ms. Daley remarked that monitoring will be very site-specific. The Commission will put together a monitoring group during the next phase of the planning process.
- *Working group members discussed the importance of monitoring groundwater quality in the area. Some felt this is important for the 208 process, while others felt that monitoring water quality in the embayments was a better measure and that money should not be spent measuring groundwater. A participant added that, as a taxpayer, if we spend a lot of money and it turns out that the solution is not as effective as we'd hoped, I want to have a very specific reason why that happened. Others commented that even if you measure groundwater and know that nitrogen levels are high in certain areas, you still don't know what has caused it.*
- *We need to establish metrics that correlate to specific solutions we implement, so we can see what effect a specific solution has. Lower level metrics.*
- *What if we get the water chemistry back to what it should be, but the eelgrass and benthic community are not back to where they should be? How do these different metrics interact?* Eelgrass and the health of the benthic community will definitely be metrics used in monitoring. However, it's an open question who will do the measurements and how to create a uniform protocol.

V. PREPARING FOR 2014 JAN-JUNE

Erin Perry reminded the group that the draft plan is due at end of May 2014. The second six months of the process will focus on how to implement the plan. Ms. Perry shared the Commission's plans for continuing stakeholder engagement into 2014.

Triple Bottom Line approach

Ms. Perry explained that the Cape Cod Commission is developing the Triple Bottom Line (TBL) analysis tool to help communities weigh the pros and cons of the various scenarios. The Triple Bottom Line Approach model 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 walked the group through sample triple bottom line diagrams[3]. TBL analysis is used to identify the best alternative and to report to stakeholders on the public

[3] See presentation for diagrams at website.

outcomes of a given investment. It is helpful in order to consider the financial, environmental, and social consequences of water quality investment and policies on the Cape. It helps evaluate ancillary or downstream consequences of the scenarios.

Stakeholder Process: Summit and Working Groups

Ms. Perry explained that the Commission would be convening a 4-6 hour Stakeholder Summit with all 11 of the watershed subgroups in January/February. The goal of the summit is to give all 11 working groups a chance to talk about what they learned from the first phase of the process, and what we should do going into the next phase. The Commission will let the working group members know as soon as it has been scheduled. 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.

After this summit, the Commission will be aggregating the subgroups into 4 area working groups (representing the areas of: Lower Cape, Mid Cape, Outer Cape, and Upper Cape). These area working groups will include local residents and stakeholders, including some members of the watershed subgroups, as well as representatives from MA DEP and EPA. The subregional groups would be expected to meet in February, March, and April, and focus on some of the sub- and regional-scale issues of financing, growth management, and affordability. Ms. Smith noted that more detail would be provided in the coming weeks.

- *How do the 11 watersheds get broken up into the 4 groups, in terms of stakeholder representation?* Ms. Smith responded that this has not been completely determined yet. It will be similar to the process that was used to decide the working groups. Some of the issues will be high level, so there will be an emphasis on town staff and elected officials but not to the exclusion of others. All meetings will still be public. She asked that, if participants have suggestions for how the groups should be determined, please submit them to her.
- *A participant raised a concern that the Triple Bottom Line analysis doesn't take into account the specific risks of each individual technology and stakeholders' level of confidence with each technology.*

VI. PUBLIC COMMENTS

- *As an engineer I was always skeptical of oysters because I tend to think in terms of mechanical, hard systems. After discussing with people at both ends of the Cape, I'm surprised by how successful oysters have been. We should not disregard this option. They also have a very fast impact, whereas sewers are slow. Oysters have been very successful in Little Pond in Falmouth in only a year.* Ms. Daley added that the oysters are doing a great job in Little Pond, but the town is also sewering there because development is extremely dense and water quality has been severely impacted by wastewater.

- *I have major concerns about the use of the Commission's model to accurately model a very complex system of dynamic processes which normally requires iterative, discretized studies. It appears to be a very static model instead of a dynamic model. My concern was sparked by investigation into the Woods Hole study which was much more dynamic and showed a very high nitrogen input from the open ocean. The MEP study does not take into account oceanic nitrogen. When it comes to culvert widening and flushing, the model has no capacity to truly assess the impact of what would happen. The temperature of the water body also changes based on widening embayments, which can't be incorporated into this model. I appreciate the mindset that sewering should not be the default solution, however I want people to be able to have faith in the model you're using.* Ms. Daley responded that the Commission has been addressing these issues offline because they wanted to use these meetings to address other issues with stakeholders.

- *I am concerned that the Commission's approach doesn't take into account growth and the data being used is getting more and more inaccurate as growth occurs. You cant remove 100% of new nitrogen. The model needs to be updated according to time and potential growth.* Ms. Daley responded that they will get to this issue in the next part of the planning process. As we get to regional-level discussions, that's where we can start working more on solutions.

APPENDIX ONE: MEETING PARTICIPANTS

Primary Members:

Category	Name	Title
Local Elected Official	Linda Cebula	Harwich Board of Selectmen
	David Dunford	Orleans Selectman
	Florence Seldin	Chatham Board of Selectmen
	Sims McGrath	Orleans Selectman
Appointed/Committee	Russell Schell	Brewster Wastewater Committee
Town Staff	Robert Duncanson	Chatham, Program manger of CWMP
	George Meservey	Orleans Planning Director
	Sue Leven	Brewster Town Planner
Environmental and Civic Group	Mark Feigel (for Jeff Eagles)	Orleans Citizens Peer Review Group
	Fran McClennen	Orleans Pond Coalition
	Joy Cuming	Orleans Community Partnership Advisory Council member
	Carole Ridley	Coordinator, Pleasant Bay Alliance
Business	David Bennett	Brewster Chamber of Commerce
	Jim McCauley	Orleans
	Christine Cox	Chatham

Alternates and Members of the Public:

Lynn Bruneau
Ed Daly
Dan Milz
Ed Nash
Gordon Smith

Cape Cod 208 Area Water Quality Planning
Provincetown Harbor Watershed Working Group

Meeting Three
Tuesday, December 3, 2013
8:30 am- 12:30 pm
Provincetown Town Hall

Meeting Agenda

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*

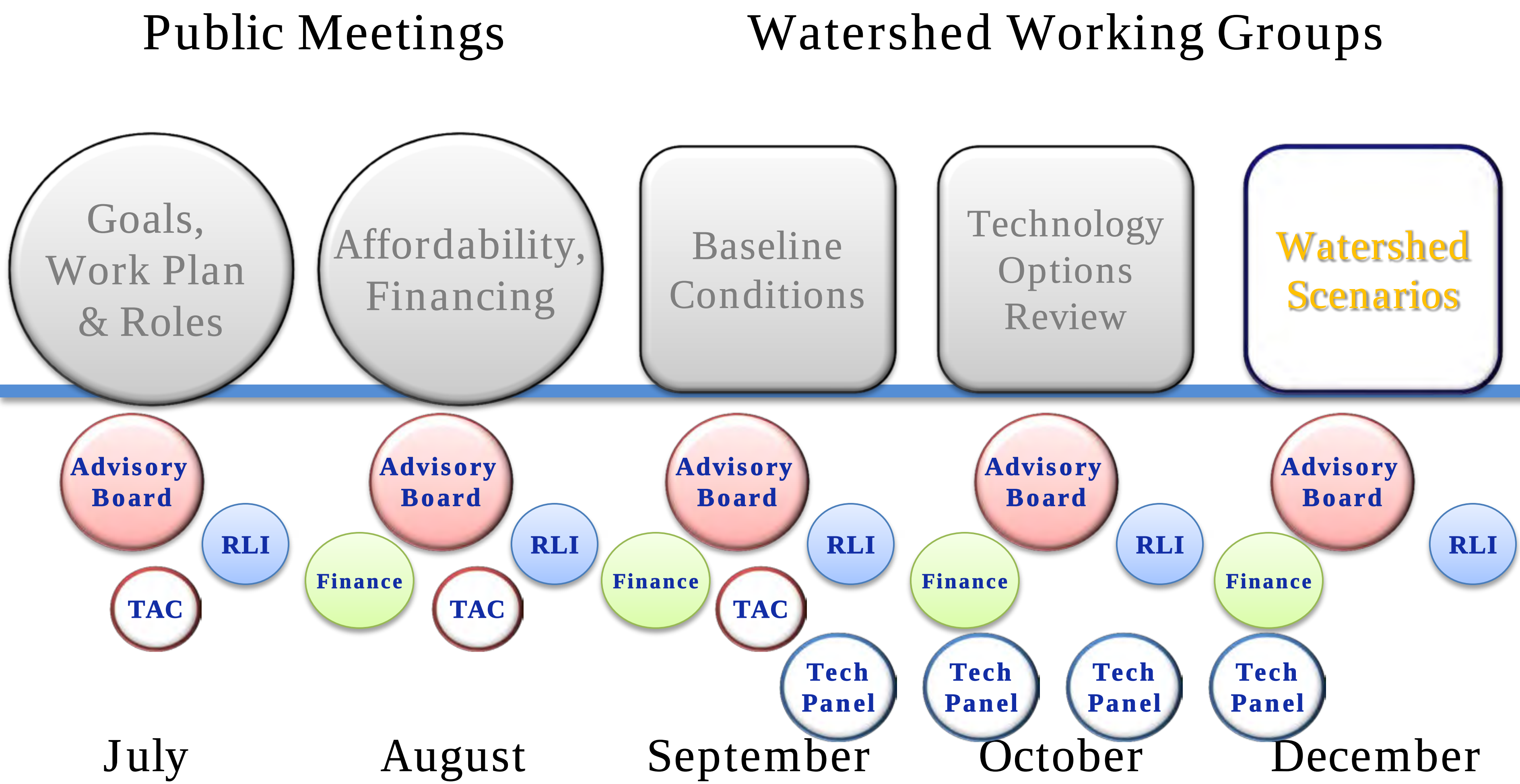
- Triple Bottom Line approach
- Identify Shared Principles and Lessons Learned
- Describe Next Steps

12:15 Public Comments

12:30 Adjourn

Provincetown Harbor Group

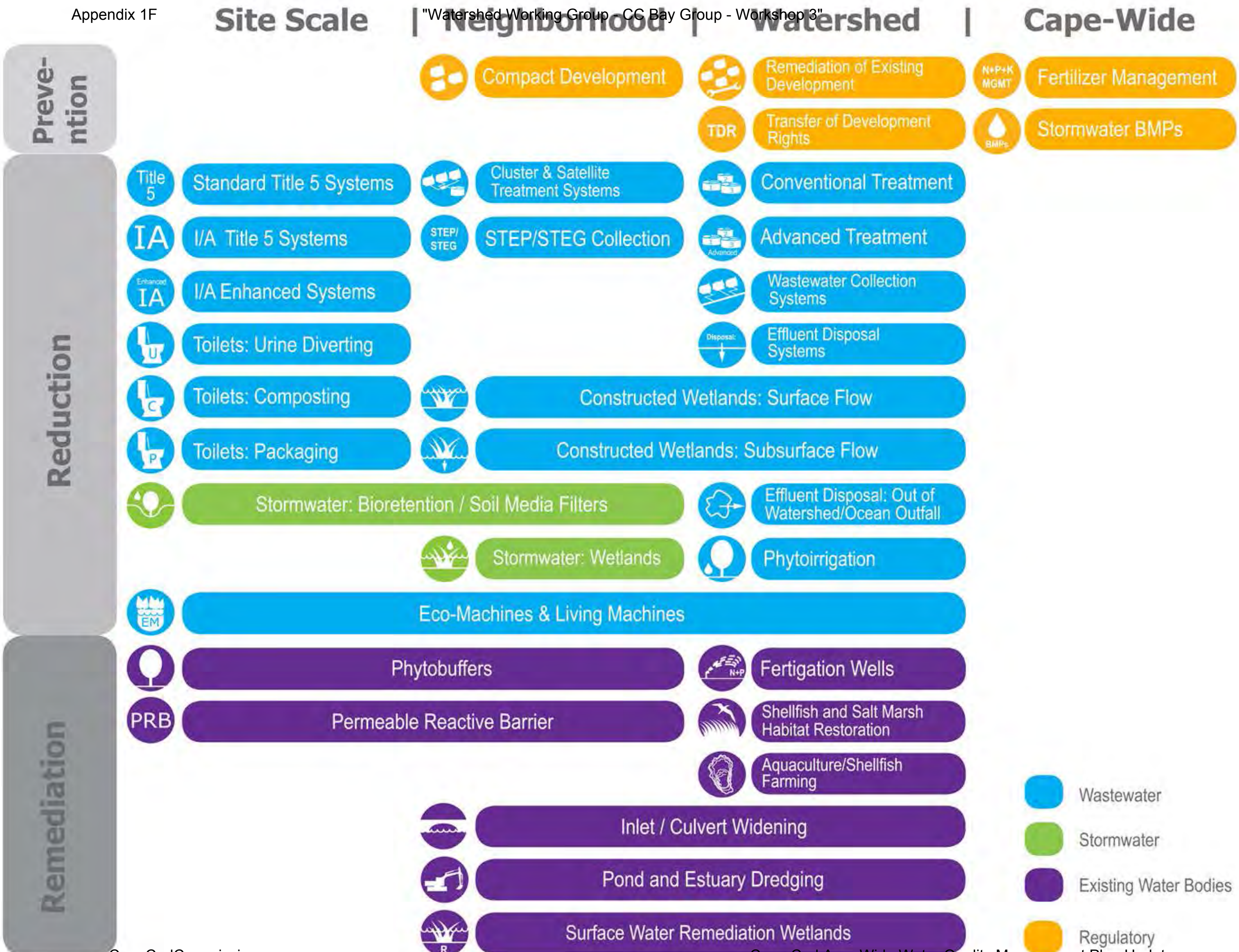
Watershed Scenarios



RLI Regulatory, Legal & Institutional Work Group

TAC Technical Advisory Committee of Cape Cod Water Protection Collaborative

208 Planning Process

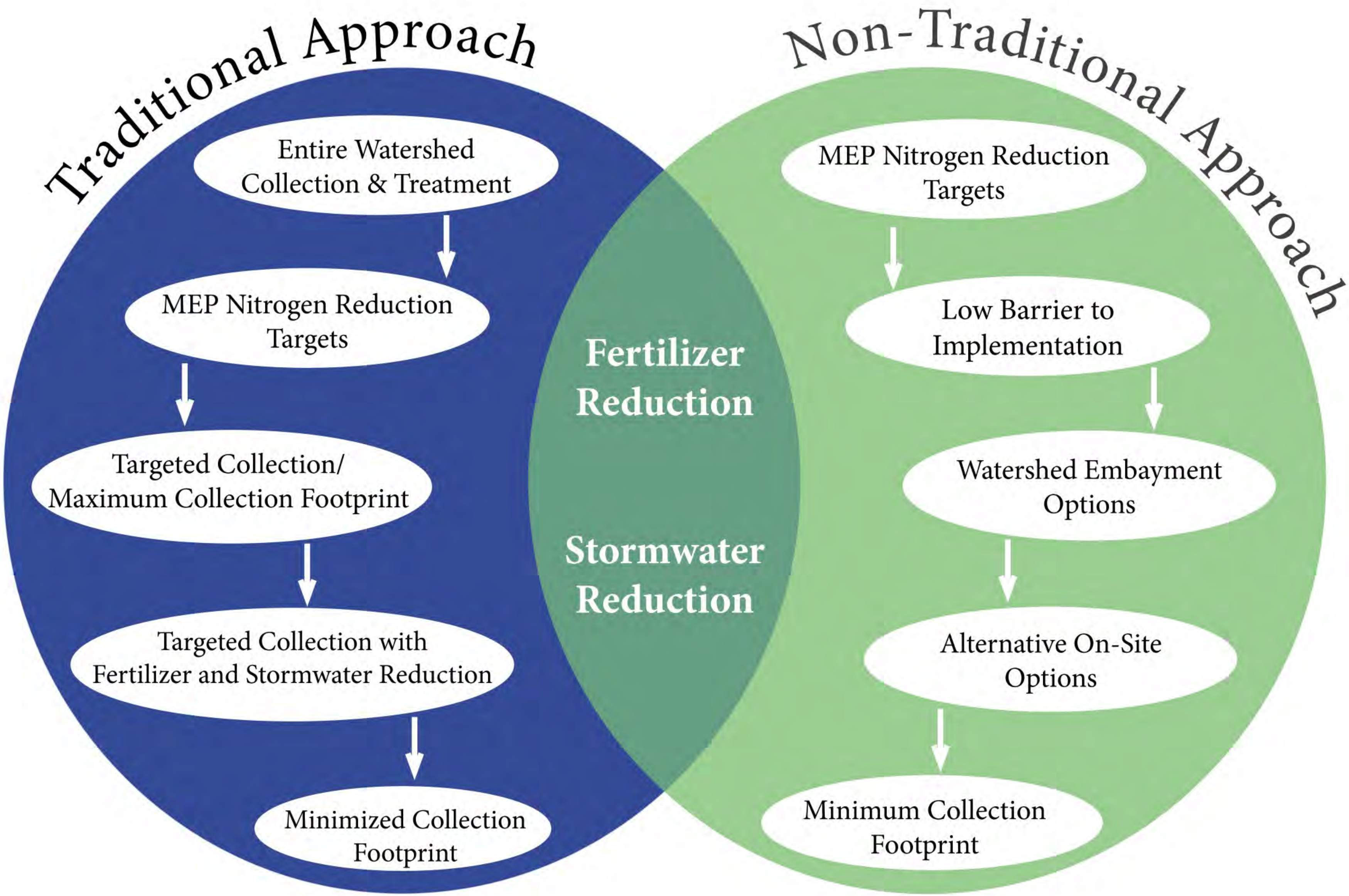

Site Scale
Neighborhood
Watershed
Cape-Wide
Prevention
Reduction
Remediation
Compact Development
Remediation of Existing Development
Fertilizer Management
N+P+K MGMT
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced
Advanced Treatment
Enhanced IA
I/A Enhanced Systems
Wastewater Collection Systems
U
Toilets: Urine Diverting
Disposal
Effluent Disposal Systems
C
Toilets: Composting
Constructed Wetlands: Surface Flow
P
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

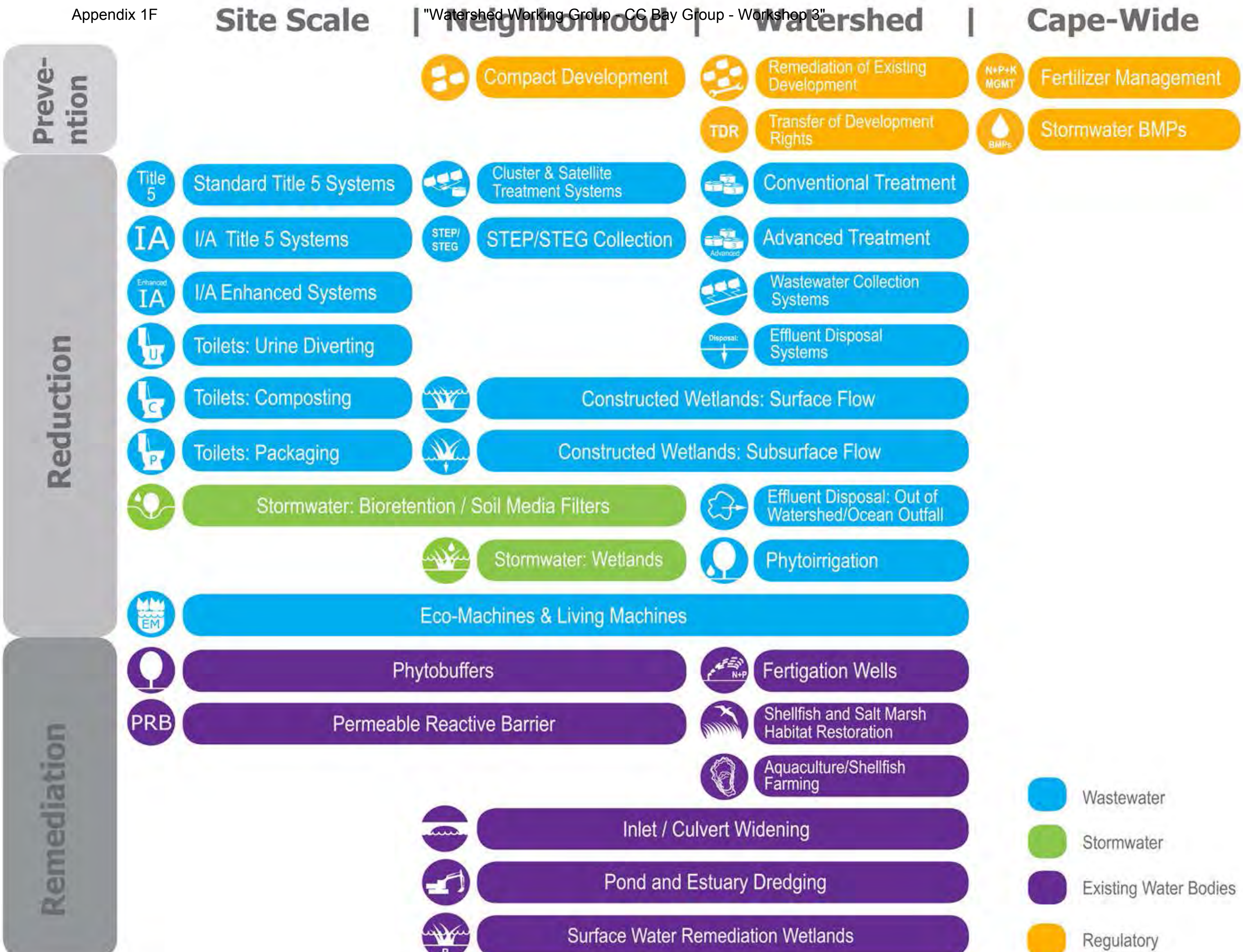
Watershed Scenarios

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


Site Scale | Neighborhood | Watershed | Cape-Wide
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Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
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Transfer of Development Rights
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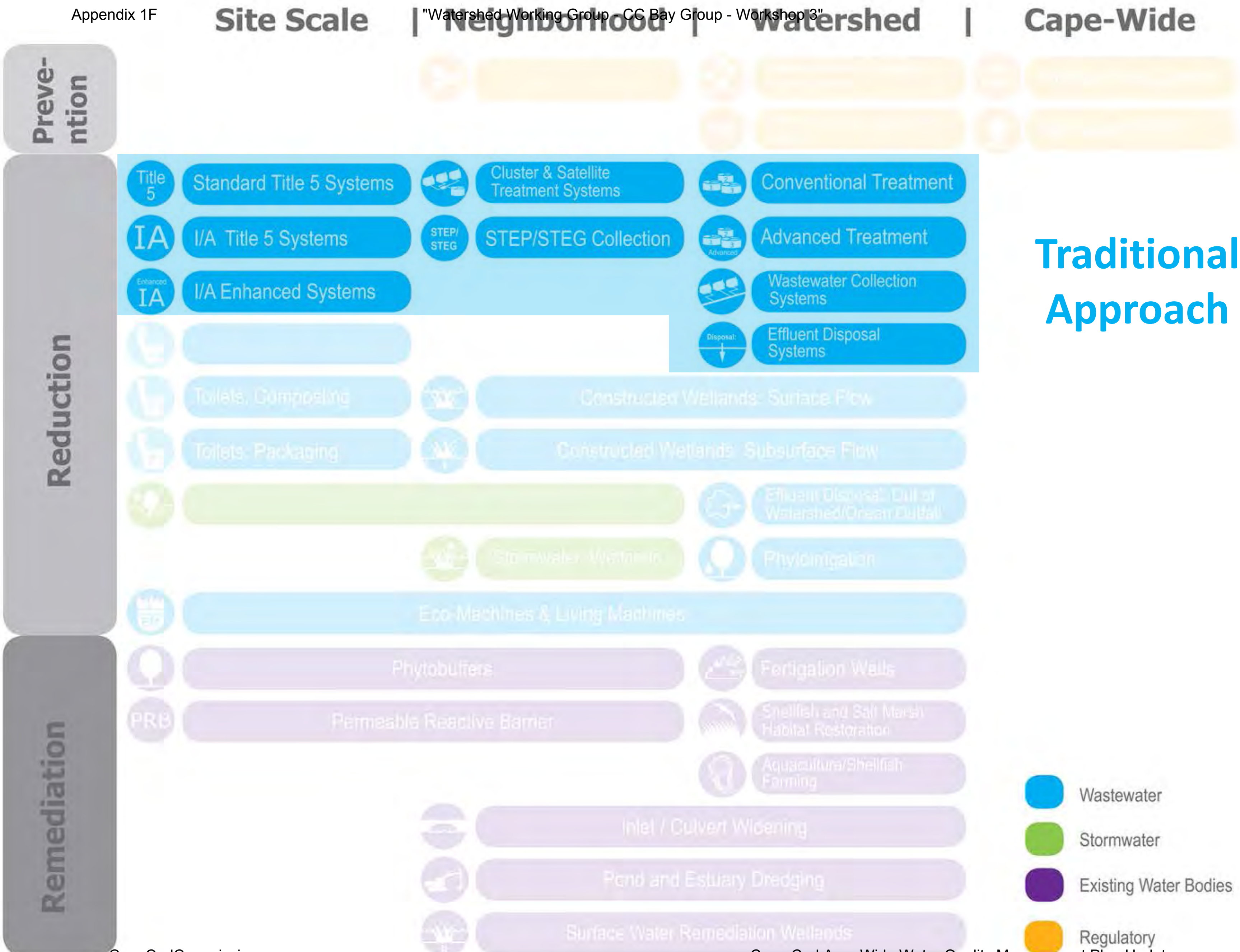
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Effluent Disposal Systems
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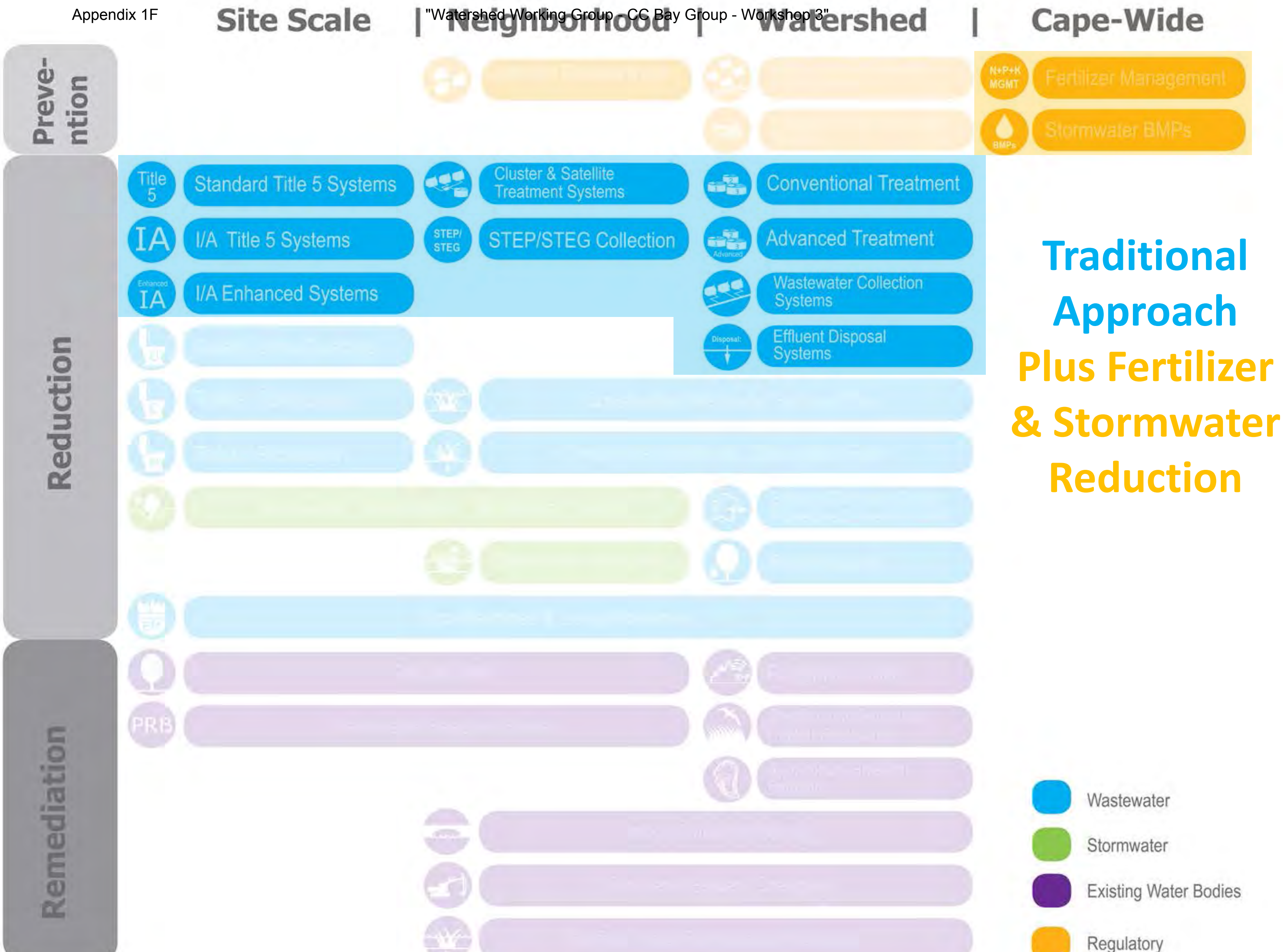
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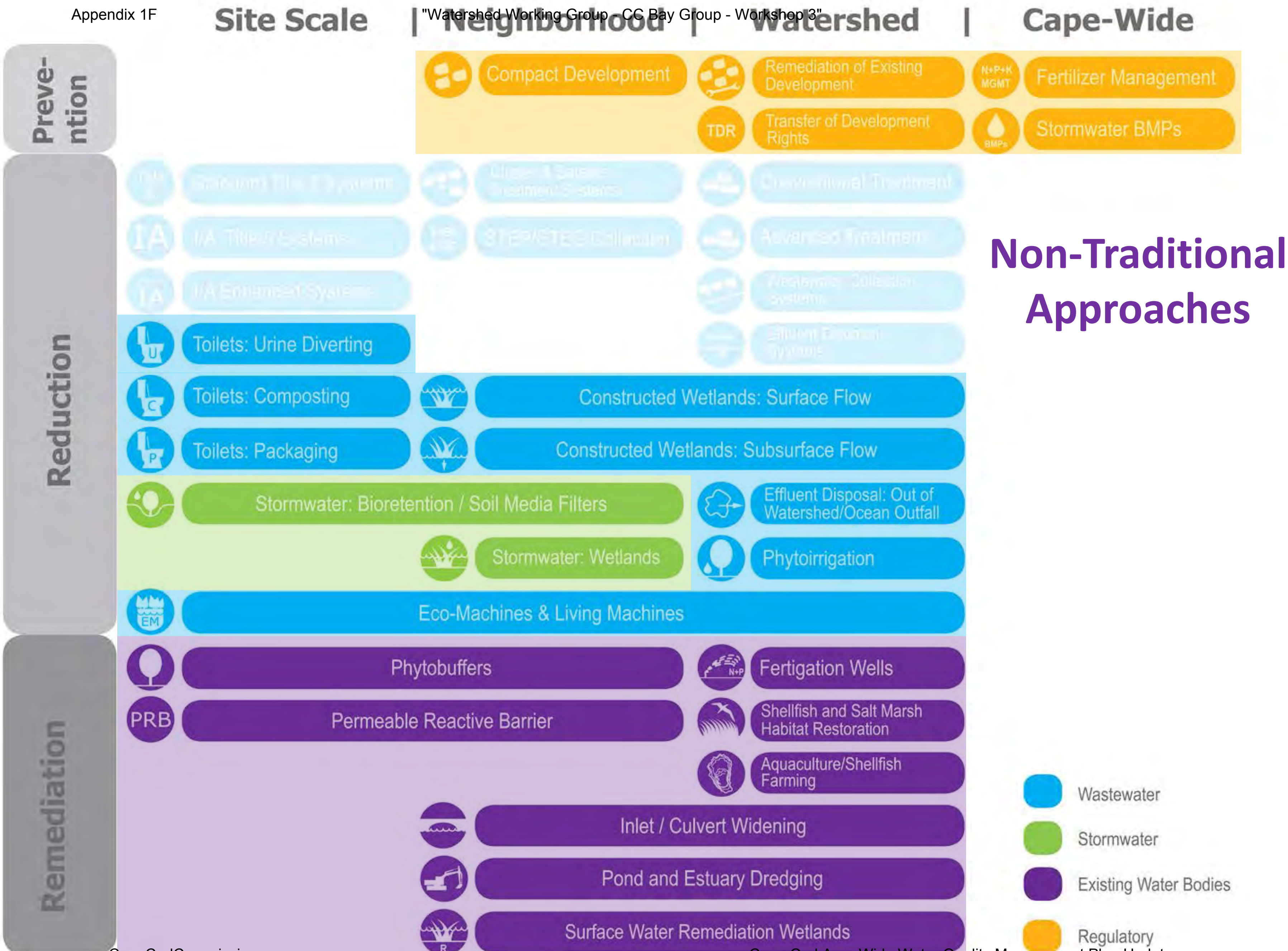
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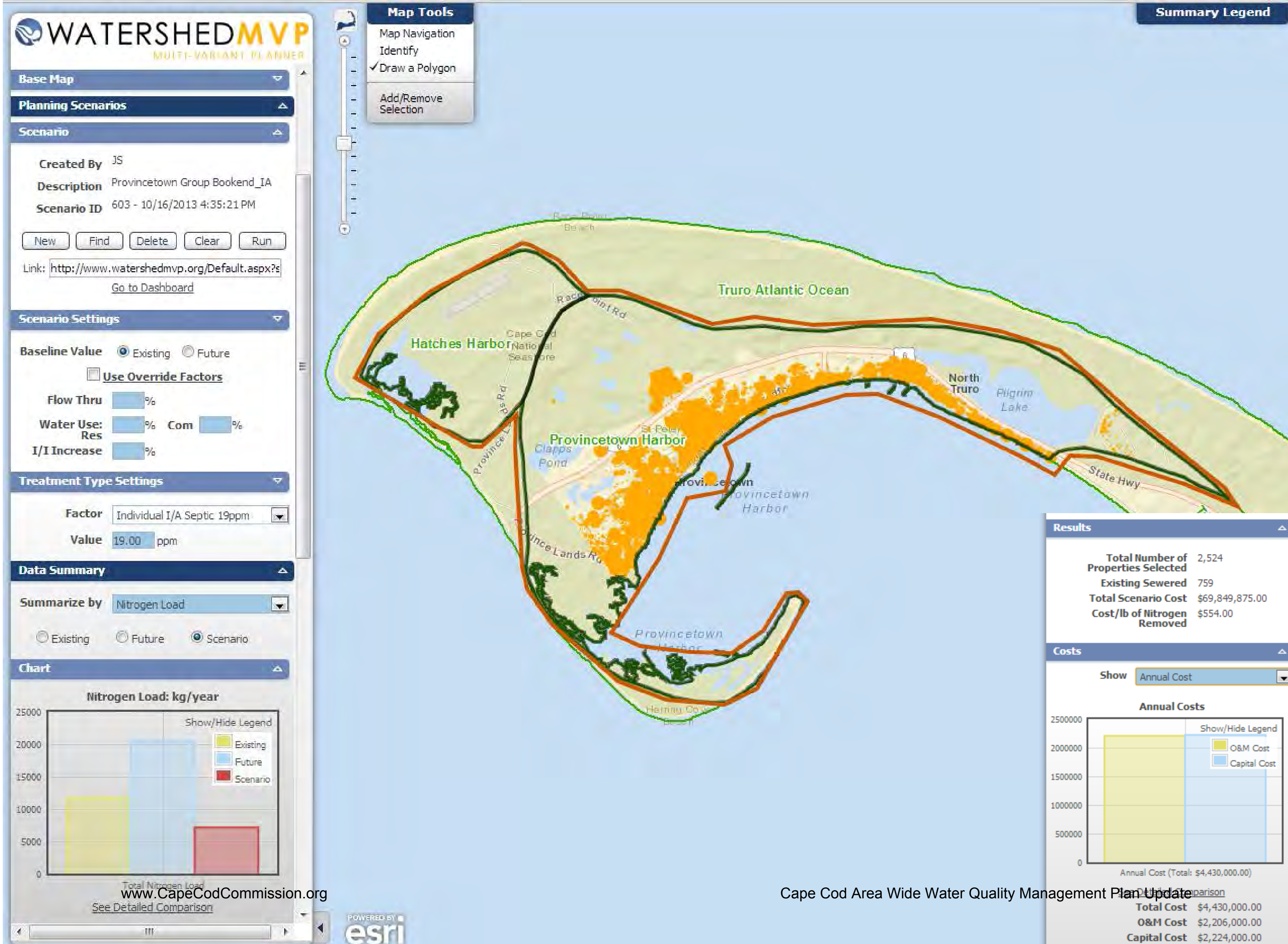
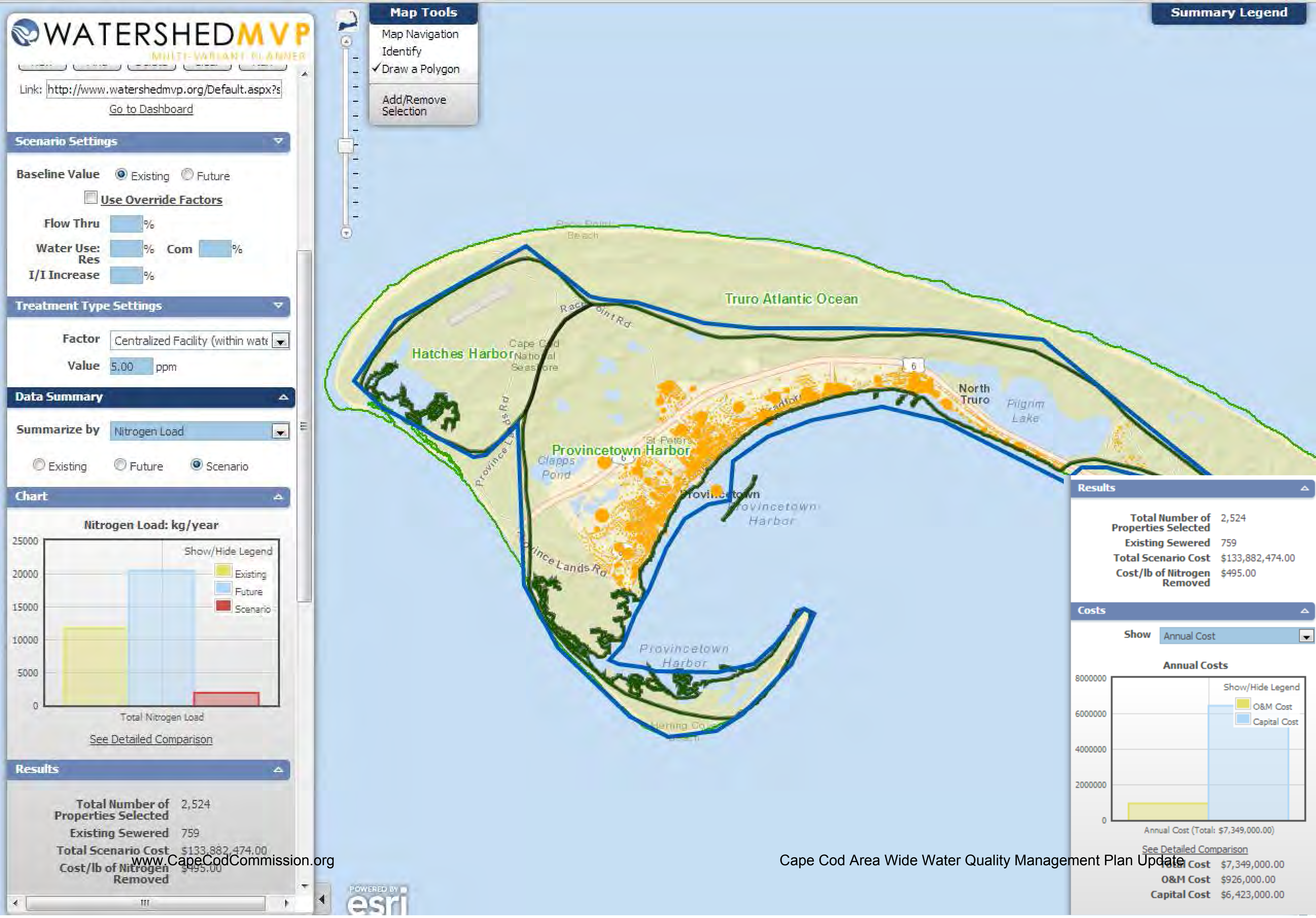
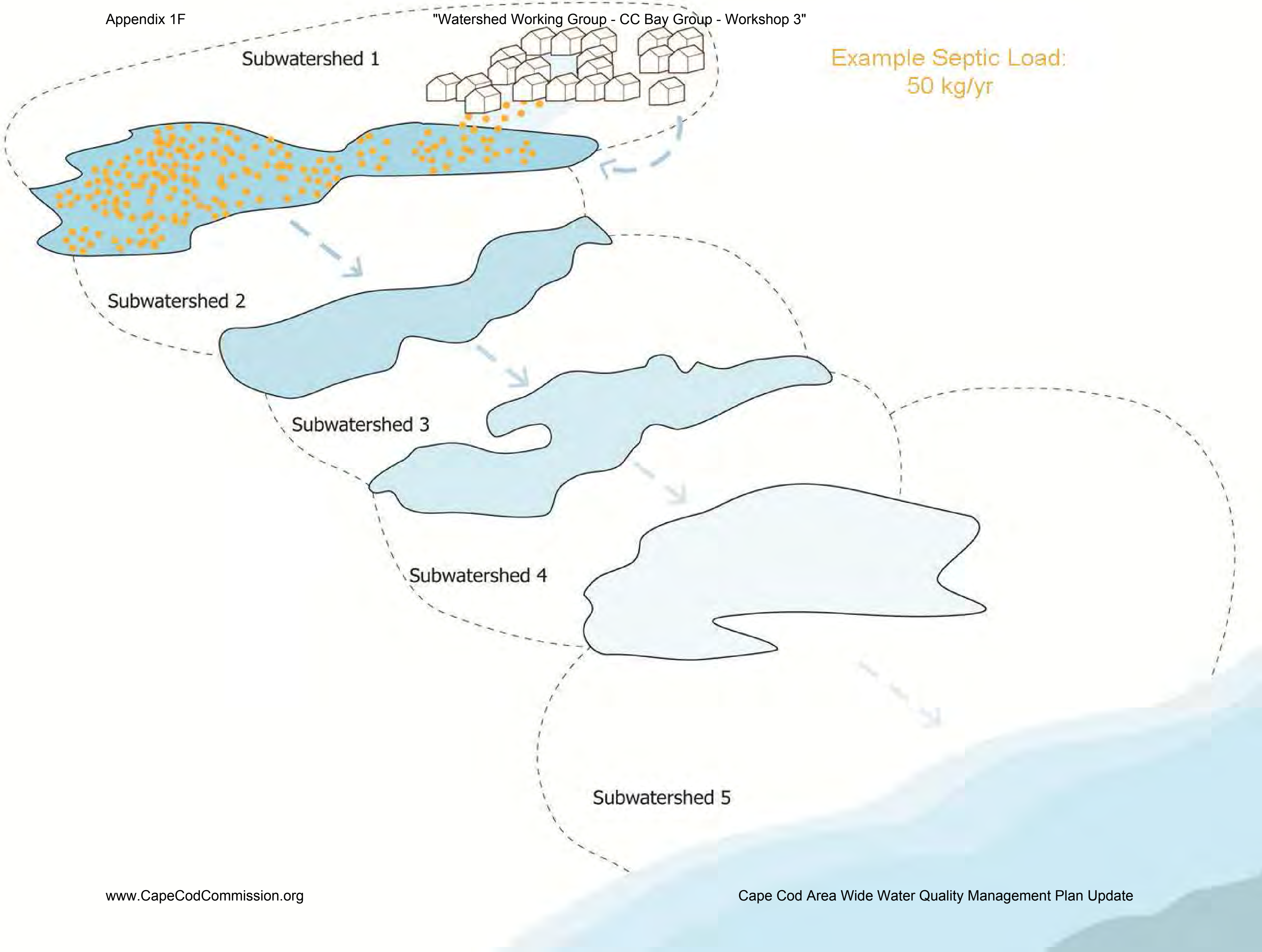
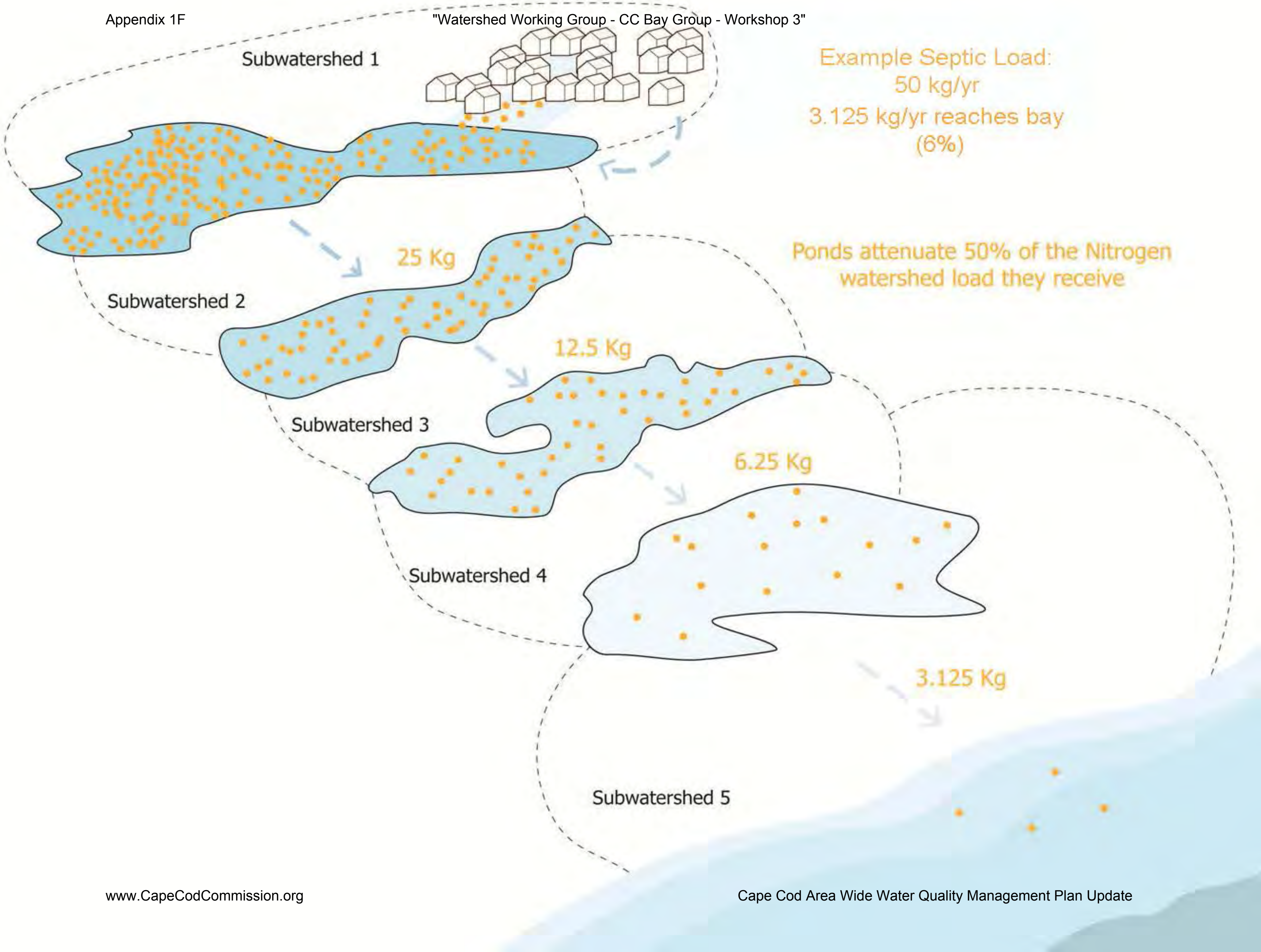
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems

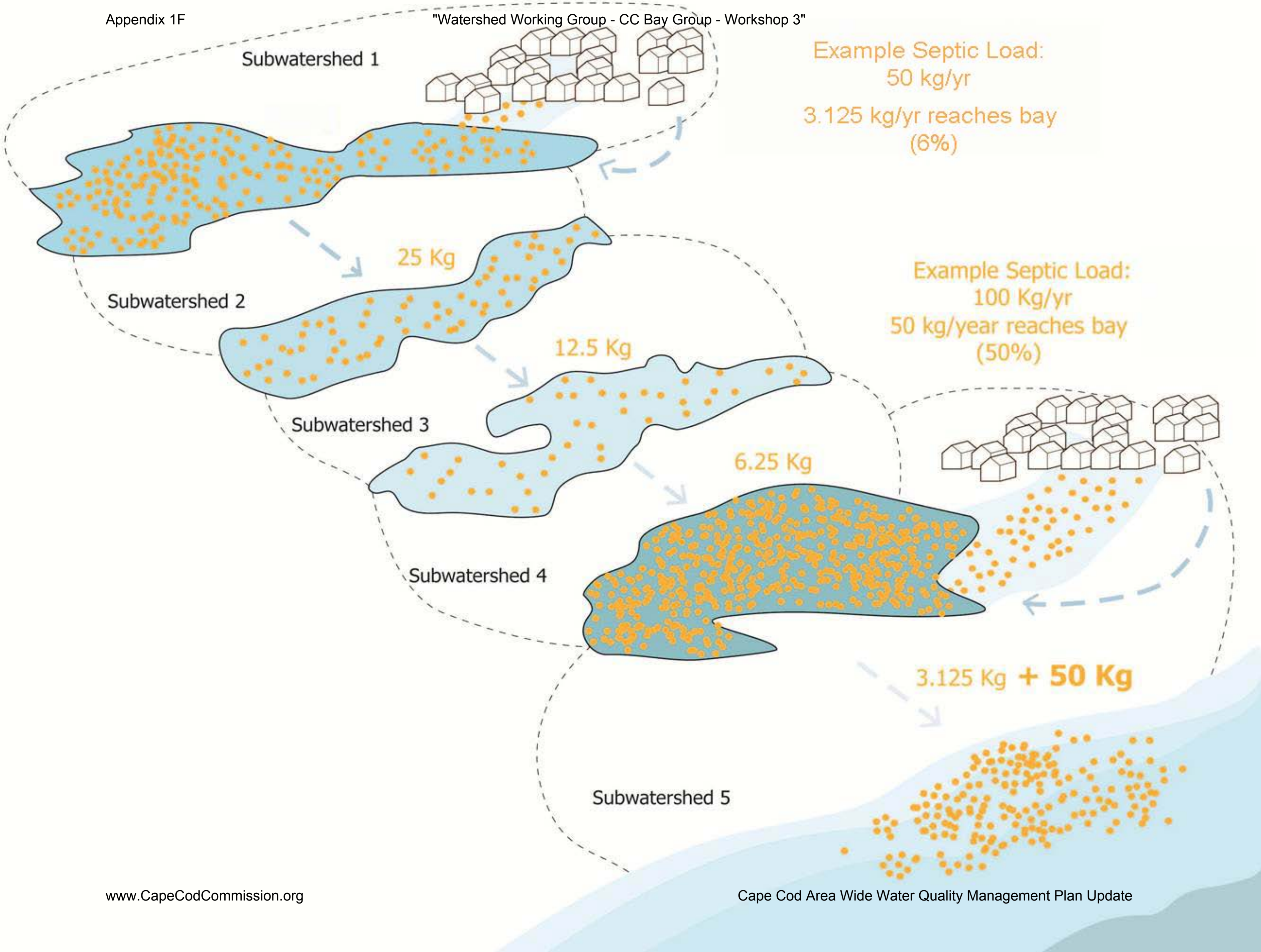


Watershed-Wide Centralized Treatment with Disposal Inside the Watershed




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
Ponds attenuate 50% of the Nitrogen
watershed load they receive
Subwatershed 2
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg
Subwatershed 5


Subwatershed 1
Example Septic Load:
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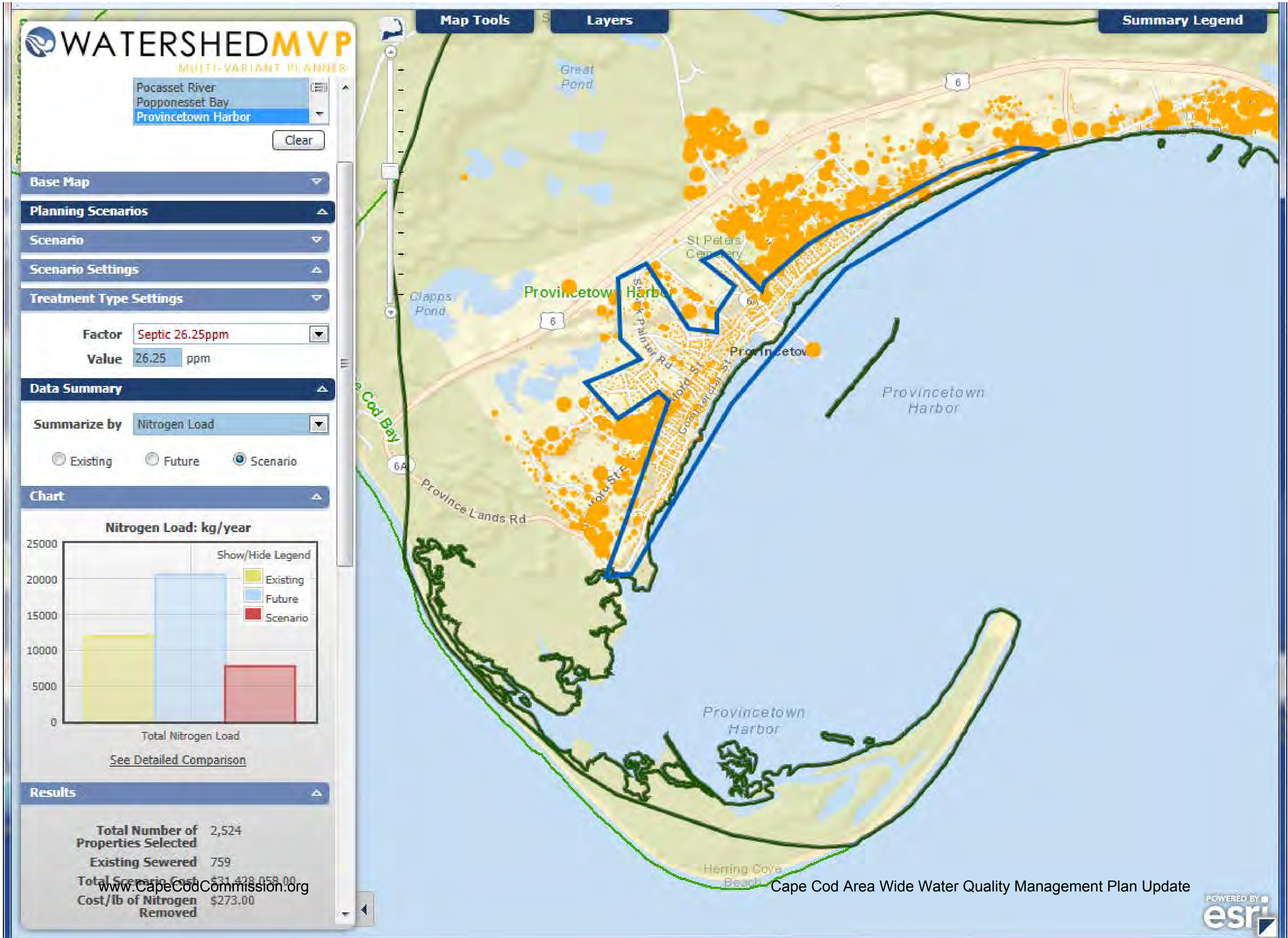
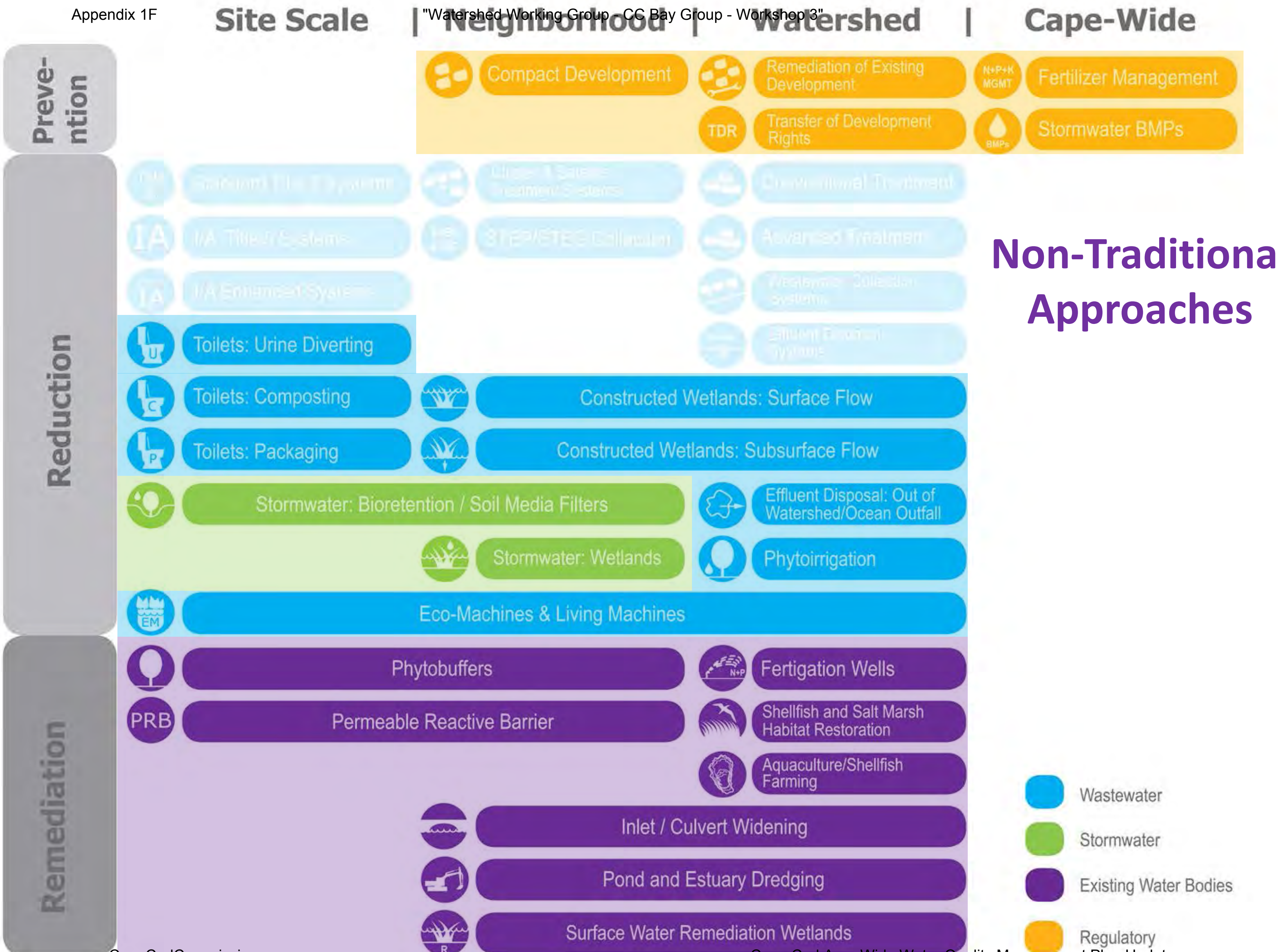
3.125 kg/yr reaches bay
(6%)
25 Kg
Subwatershed 2
Example Septic Load:
100 Kg/yr
50 kg/year reaches bay
(50%)
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg + 50 Kg
Subwatershed 5

Existing Centralized Treatment

"Watershed Working Group - CC Bay Group - Workshop 3"

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Regulatory

Problem Solving Approach

Wastewater | Existing Water Bodies | Regulatory

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

Adaptive Management:

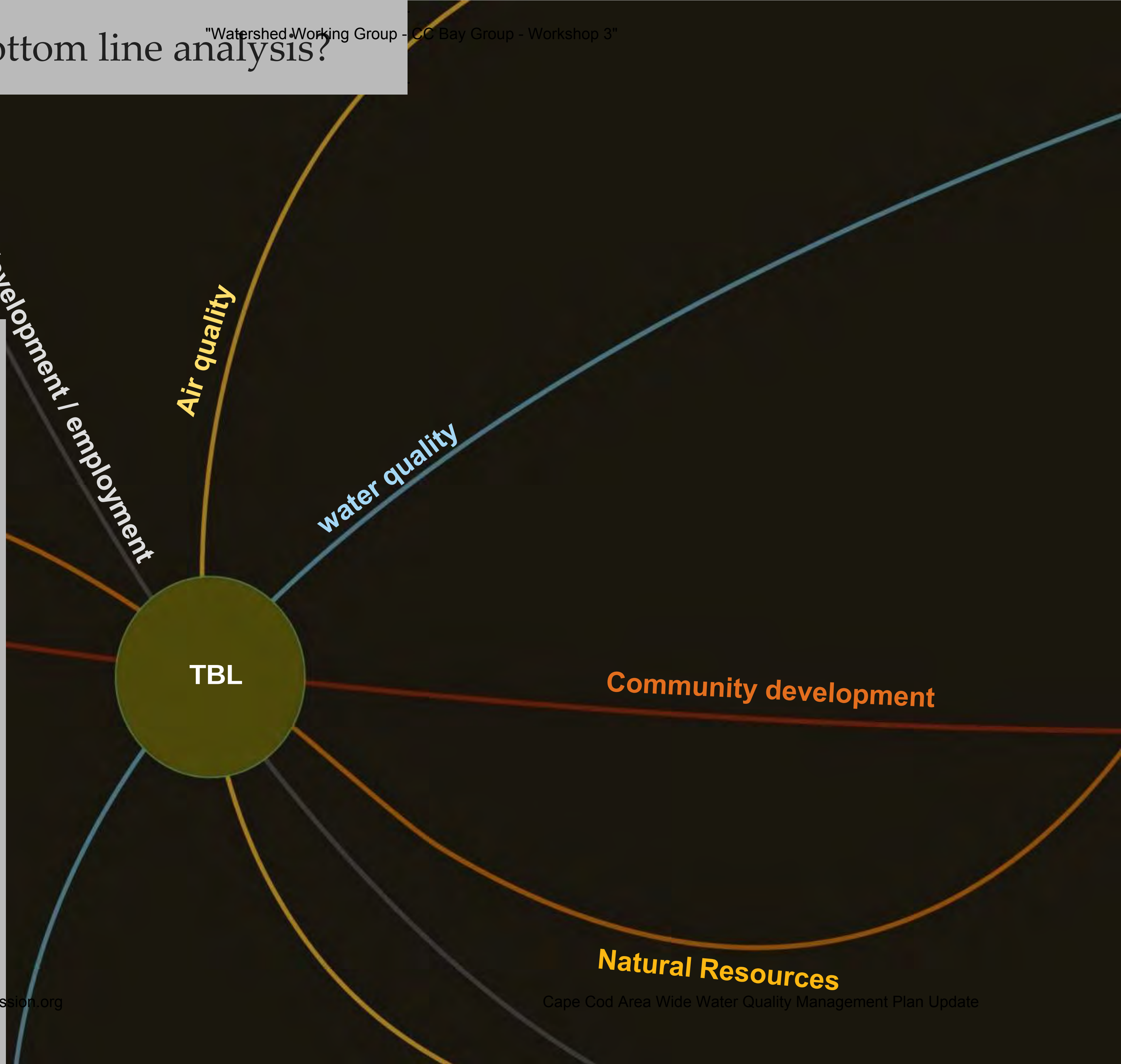
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient ways.

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

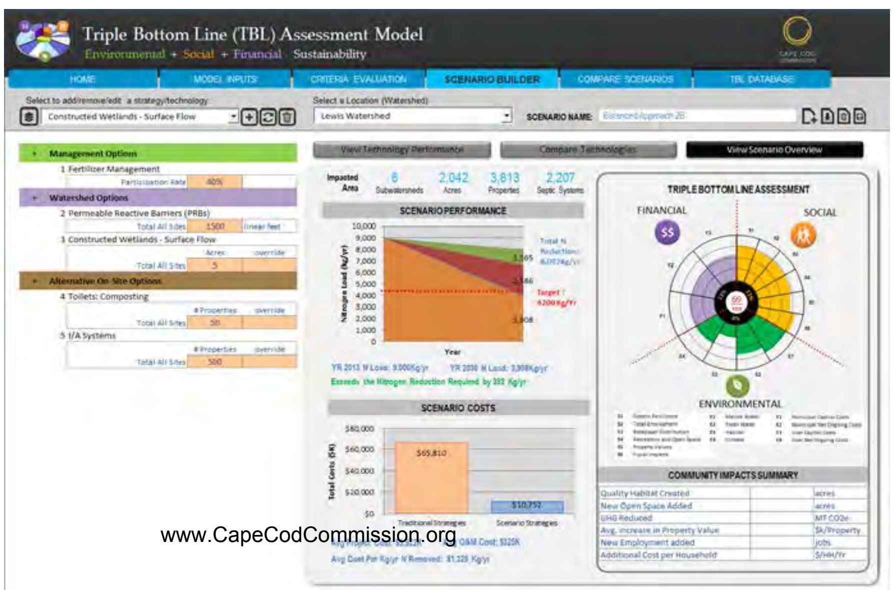
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

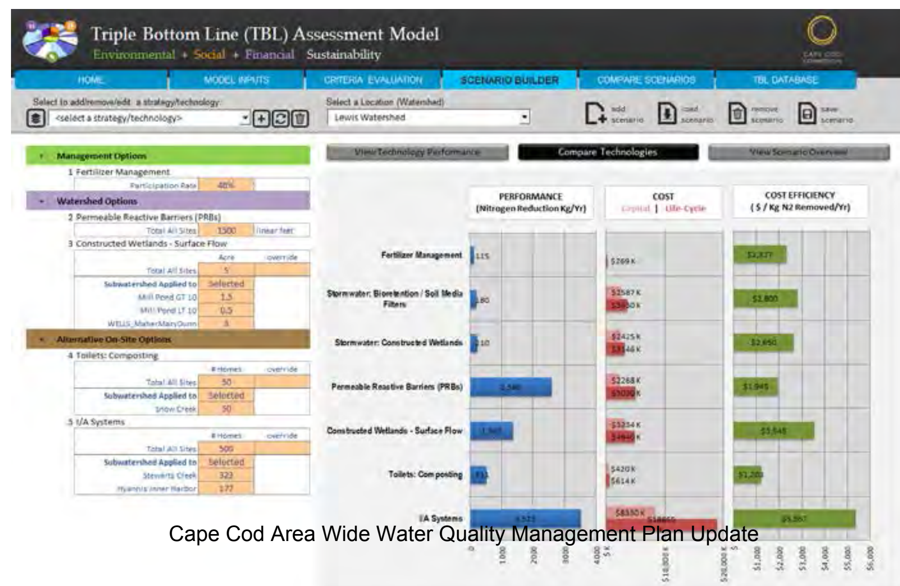


Why develop a TBL model?

- Develop triple bottom line 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

HOME | MODEL INPUTS | CRITERIA EVALUATION | SCENARIO BUILDER | COMPARE SCENARIOS | TBL DATABASE

Alternative Definition | Alternative Results | Alternative Scoring Rules

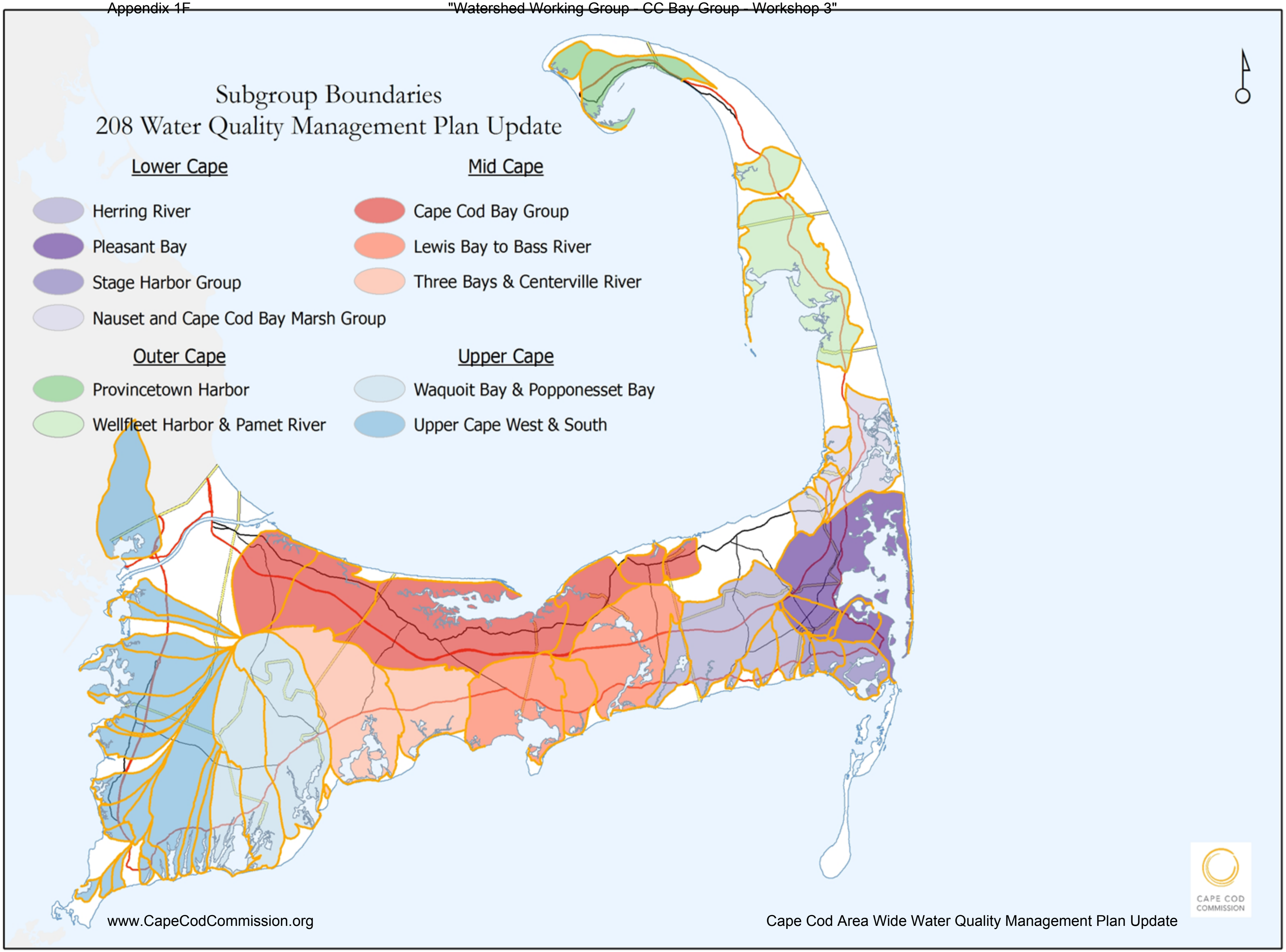
	Scenario 1	Scenario 2	Scenario 3
	Minimum Cost	Cost Effective	Maximum Performance

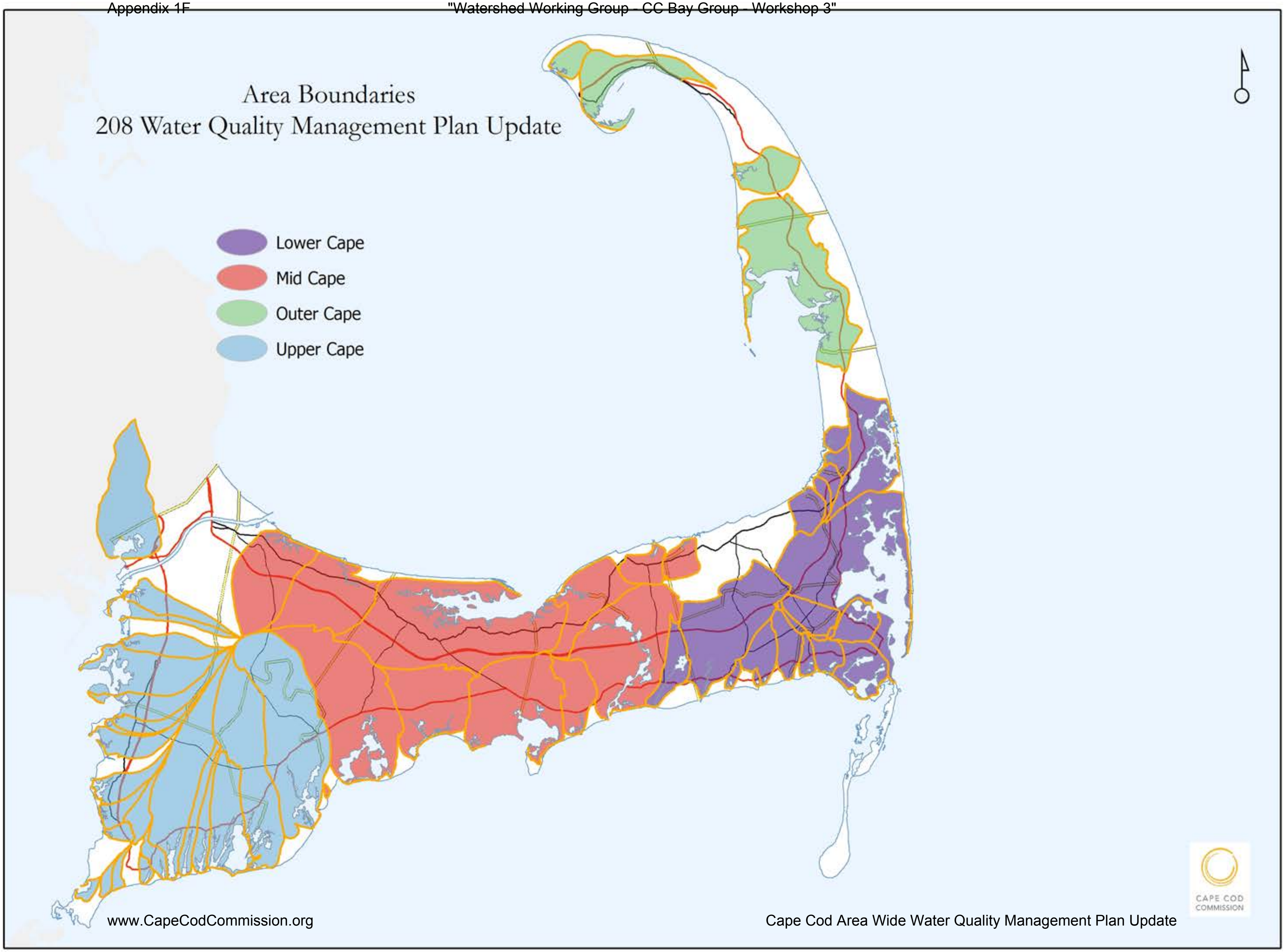
Criterion Scores

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)	$200	[illegible]	[illegible]
New Employment Added (jobs)	152	188	252
Additional Cost per Household ($/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
Provincetown Harbor Watershed Working Group

Meeting Three
Tuesday, December 3, 2013
8:30 AM – 12:30 PM
Provincetown Town Hall

Revised Meeting Summary Prepared by the Consensus Building Institute

I. ACTION ITEMS

Working Group

- Provide any additional feedback on the meeting summary from Meeting #2 and, when it is circulated, Meeting #3.

Consensus Building Institute

- Draft and solicit feedback from Working Group on Meeting Three summary.
- Conduct further outreach to working group members regarding the process moving forward and possible ongoing involvement, for example in the area working groups.

Cape Cod Commission

- Further develop scenarios for different areas within the Provincetown Harbor and Hatches Harbor study area.

II. WELCOME AND OVERVIEW

Scott Horsley, Area Manager and Consultant to the Cape Cod Commission, welcomed participants and offered an overview of the 208 Update stakeholder process.[1] 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 were focused on exploring technology options and approaches. The third meetings of the Watershed Working Groups, held in December, focused on evaluating watershed scenarios. These scenarios were informed by Working Groups' discussions at previous meetings about baseline conditions, priority areas, and technology options/approaches. Mr. Horsley noted that the Provincetown meeting is unique as the watershed has already installed a successful sewer system and has no (Total Maximum Daily Load) TMDL, but the presentation will help in exploring future options and fine-tuning existing systems.

[1] The PowerPoint Presentation made at this meeting is available at: http://watersheds.capecodcommission.org/index.php/watersheds/outer-cape/provincetown-harbor

Mr. Horsley 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;
- To develop a set of adaptive management principles to guide subregional groups in refining scenarios for the 208 Plan.

Kate Harvey, 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 but would not be asked to “vote” on a specific approach. She also reviewed the completed action items from the last meeting including:

- Updating the town’s chronology;
- Posting meeting summaries;
- Uploading information to the Cape Cod Commission’s website.

III. INITIAL SCENARIOS FOR THE WELLFLEET HARBOR AND PAMET RIVER WATERSHED

Scott Horsley explained the Commission’s process for developing watershed scenarios. Two teams were formed: one team is exploring “conventional” technologies and approaches (e.g. sewering and I/A systems) and another team is exploring “alternative” technologies and approaches. The teams are both working under the assumption that fertilizer and stormwater reductions will be incorporated into all of the scenarios.

<u>Conventional Scenarios</u>

James Sherrard, Hydrologist in the Water Resources Department at the Cape Cod Commission, led the discussion of “conventional” technologies and approaches. He explained that the scenarios were developed using the Commission’s Watershed MVP Tool. This tool allows the Commission to examine how implementing traditional technologies would affect nitrogen levels in particular areas and shows general costs. It will eventually include alternative technologies as well, but they are more difficult to model. Mr. Sherrard offered three scenarios:

- Watershed-Wide Innovative/Alternative (I/A) Onsite Systems
    - In this hypothetical scenario, Provincetown has I/A systems instead of sewering. There was a smaller reduction in nitrogen levels, so sewering was the right and more effective choice.
- Watershed-Wide Centralized Treatment with Disposal Inside the Watershed
    - In this hypothetical scenario, Provincetown sewered the whole watershed, costing an estimated annual costs of $495 to remove a pound of nitrogen and an estimated $134 million total.

- Existing Centralized Treatment
  - This scenario modeled the existing, targeted sewering systems where nitrogen costs $273 per pound to remove and $31 million total.
  - Mr. Sherrard noted that some sewer systems can take advantage of natural attenuation of nitrogen in water bodies by focusing on the collection of downstream nitrogen sources, but this watershed's soil is too sandy to take advantage of this.

Working Group members had the following questions and comments about the conventional scenarios (Working Group questions and comments in italics; responses are from Mr. Sherrard unless otherwise noted):

- *Truro does not have a sewer system, so we need to be able to consider alternative technologies with the MVP.* Yes, the MVP will be updated, allowing towns to compare alternative approaches against sewering.
- *Does that dark line in the National Seashore indicate possible sewering? And if so, why would we want to go through the expense of sewering there if there are no houses?* We understand that sewering will likely not happen there. This model just gives you an idea of the difference in cost between I/A systems and sewer system expansion.
- *What is the final nitrogen reduction goal for the Cape?* I do not have a firm answer. This depends on the individual watersheds, which have specific reduction targets. *I think it is important for everyone to know this.* Yes, the MEP reports are useful in that they give specific reduction levels for septic nitrogen.
- *I understand that ponds can help attenuate nitrogen, but phosphorous in ponds is also a problem.* Yes, the MEP reports specifically target nitrogen, but the 208 Plan will also consider phosphorous mitigation.
- *Are you going to use ponds to reduce nitrogen?* Analysis still needs to be done to make sure that this would not make the ponds more eutrophic. Mr. Horsley added that the Commission can make pond protection a focus if it hears this is a priority, and also commented that sewer expansions serve other purposes apart from the mitigation of nitrogen, including economic growth and health protection.
- *Phosphorous control was addressed at the state level. It cannot be applied without a soil test, proving that it is needed. Make sure you buy low phosphorous fertilizers.*
- *Barnstable County has asked for $80,000 for fertilizer education.*

<u>Alternative Technology and Approaches</u>
Scott Horsley, Area Manger, 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. He noted that the 7-step process is less relevant for the Provincetown Harbor Watershed, given

the existing sewer system, but added that the Commission still generated a few ideas to address the priorities of the Working Group.

He offered the following technology ideas for Provincetown Harbor Watershed:

- Constructed wetlands:
  - If added to the treatment facility, the treatment efficiency and capacity of the facility could be increased;
  - Could be a potential solution for emerging contaminants.
- Urine diversion systems in public restrooms:
  - Adding public two restrooms could help deal with the high volume of tourists during the summer;
  - Could capture 90% of septic nitrogen;
  - Could help deal with the strain that the influx of summer visitors puts on the treatment facility's capacity by storing urine until the off season;
  - Reduce disruption to businesses associated with tourists using private restrooms (as non-customers);
  - Preliminary analysis indicates that there are at least 30,000 visitors per day during the peak summer season that generates approximately 1.95 million gals/day. This peak demand generates significant costs to local businesses and the town. The analysis suggests that adding two additional public rest room facilities along Commercial Street and fitting these with urine diversion systems could reduce water and sewer demand by approximately one million gallons of water a day, saving an estimated $151,000 in wastewater bills that are currently paid by business owners to accommodate walk-in tourists over the course of the season;
  - This would provide additional capacity at the Wastewater Treatment Facility and an opportunity to service additional areas without expansion of the treatment works.
- Restoration projects by Pilgrim Lake and East Bay
  - Could include a permeable reactive barrier (PRB) along a road adjacent Pilgrim Lake (East Harbor).

Working Group members had the following questions and comments about the Provincetown Harbor scenario (Working Group questions and comments in italics; responses are from Mr. Horsley unless otherwise noted):

Sewering and Treatment Plant

- *We have expanded the treatment capacity of the treatment plant.*
- *We have the actual data that could be used to calculate savings from urine diversion.* If this is of interest, I could fine-tune these numbers with you.
- *The DPW mandated the towns deal with stormwater runoff into the bay. We installed stormwater and sewer systems at the same time, only digging once to save money.*

- *Our major issue is that many areas by ponds are economic development sites that will become denser.* We could look at expanding the sewer into these areas as well.

Urine Diversion

- *Aren't men already using urinals?* Yes, but it is not stored separately from other waste at the moment, but it could be stored and processed at the end of the season.
- *How much do the urine storage tanks cost?* We can provide cost estimates once we refine the analysis.

Baseline

- *This watershed does not have a baseline, so where do we go from here?* Later, we will talk about the idea of a triple bottom line to understand how some of these technologies could be beneficial outside of just nitrogen control. We would also appreciate hearing your ideas about this. Mr. Sherrard added that a possible baseline was the condition of the Cape without development, so efforts that push Cape Cod back to its natural state are beneficial.
- *We still need to know how big of an impact a project will make, so people can understand what their funding will go to.* Ms. Harvey noted that the Working Group had talked about the baseline at every meeting and acknowledged it as a factor that needs to be considered as the Working Group evaluates different options.

Other Comments

- *We know we need to do something to protect East Harbor, but we are not sure what to do.* The Commission is looking into PRBs for this area.
- *We have some concerns with stormwater runoff to ponds in the area.* We could look at additional stormwater projects.
- Mr. Horsley asked the Working Group whom the Commission should talk to get additional information about its stormwater remediation projects. *The DPW would be a good source.*

Discussion of technology ideas for Truro.

Kate Harvey, Facilitator, reminded participants of the priorities and concerns that they had raised at past Working Group meetings including: cost, efficiency, and pond protection. She asked if given these priorities and concerns, they had suggestions on additional technologies or approaches that might be appropriate for this watershed, including in Truro. Stakeholders offered the following recommendations for additional projects (Working Group questions and comments in italics; responses are from Mr. Sherrard unless otherwise noted):

Sewering

- *The towns should consider demonstrating alternative technology, but also sewering Beach Point.*
- *Yes, expanding the sewer to Beach Point and Shore Road could help protect East Harbor.*

Mr. Horsley and Mr. Sherrard discussed possible expansions of the sewer with the group.

- *There is an unused leaching field in the town that could deal with future development.*

Stormwater

- *There needs to be more stormwater remediation along Route 6.*
- *The lanes also flood sometimes.*
- *I agree; we should look at environmentally friendly approaches.* It is so shallow by Route 6 that it limits certain options but could possibly be brought to the state as a safety concern or tied into beach closure as a volume control and water quality issue. He urged the group to push the state to deal with the stormwater runoff from Route 6, as it is the state's responsibility.
- *We could consider installing retention basins along Commercial Street or Shore Road.* They have a large footprint, are difficult to make aesthetically pleasing, and could be damaged by storm spillovers. The area could also consider subsurface storage or bioretention as a different option.

Aquaculture

- *I wish we could do aquaculture in East Harbor.*
- *We could not do it commercially, but it could be done recreationally.*

IV. ADAPTIVE MANAGEMENT

Scott Horsley explained the concept of adaptive management 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.

He noted that adaptive management does not mean waiting longer to implement a plan. He noted that given several uncertainties with technology and the environment, including the baseline, credible science and monitoring would be important. He emphasized that an adaptive management plan needs to meet the set water quality goals, while being cost effective and time sensitive. The Commission will talk to the MA Department of Environmental Protection (DEP) in the near future about an adaptive management plan based on the technologies developed by the Working Group. He further noted that the DEP would likely make the towns have a plan B with less alternative technologies, which the towns should consider. Ms. Harvey asked the Working Group about what it considers to be the important elements of an adaptive management plan that need to be addressed (Working Group questions and comments in italics; responses are from Mr. Horsley unless otherwise noted).

Time frame for monitoring:

- *Monitoring our plan A for about ten years before implementing plan B seems reasonable*
- Mr. Horsley commented that it might take twenty years, as regulatory agencies will want that long to monitor what is happening.

Additional projects (or Plan B):

- *After the watershed has completed ongoing stormwater projects, it should look at expanding aquaculture. A stakeholder commented that some people have concerns about aquacultures effect on whales.*
- *Expanding the sewer is also an obvious choice.*
- *The expansion of Provincetown's sewer depends on whether Truro wants to connect with it.*
- *We could consider land use and zoning regulations to limit the density of development.*
- *Constructed wetlands seem like a reasonable technology to consider.*

Suggestions for how to prioritize projects:

- *In Provincetown, we should continue with existing projects, including culverts and remediating outfall pipes, and tackle existing problems, like stormwater runoff.*
- *For Truro, we should also continue with stormwater remediation, as it is cost efficient.*
- *Impact and immediate results are also important.*

V. PREPARING FOR 2014 JAN-JUNE

Scott Horsley and Erin Perry shared the Commission's plans for continuing stakeholder engagement into 2014.

Triple Bottom Line approach

Ms. Perry explained that the Cape Cod Commission would present triple bottom line approach models at future meetings that considers the economic, social, and environmental downstream impacts of each scenario, including a 'no action' plan to help the groups illustrate the pros and cons of the various scenarios. She walked the group through sample triple bottom line diagrams[2].

Stakeholder Process: Summit and Working Groups

Ms. Perry explained that, going forward, the eleven Working Groups will be combined into four subregional groups after a meeting tentatively scheduled for January 31st to which all stakeholders are invited to discuss some of the bigger issues of financing, growth management, and implementation.

Ms. Harvey added that the subregional groups would have approximately three meetings

[2] See presentation for diagrams: http://watersheds.capecodcommission.org/index.php/watersheds/outer-cape/provincetown-harbor

between February and June to discuss issues, including triple bottom line analysis, watershed permitting ideas, and regulatory institutions. The Cape Cod Commission is looking for about twenty people for each group with a range of interests to balance them 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, which the Commission is trying to bring more into the process. Ms. Perry added that, following these meetings, the Cape Cod Commission is planning on sending a draft of the 208 Plan to the DEP on June 1st 2014 and finalizing it by January 2015.

A Working Group member noted that the Cape Cod Commission could engage the selectmen by going to their breakfast event and encouraging them to write a letter of support for the 208 Plan.

VI. PUBLIC COMMENTS

No public comments were made.

APPENDIX ONE: MEETING PARTICIPANTS

Appendix A
Attendance

Name	Affiliation
Elaine Anderson	Provincetown Board of Selectmen
Joe Buteau	Energy Committee, Truro
Amy Costa	Provincetown Center for Coastal Studies
Laurie Demolino	Board of Health, Provincetown
Charleen Greenhalgh	Town Planner, Truro
Jerry Irmer	Provincetown Harbor Committee
Gloria McPherson	Planner, Provincetown
Laura Kelly	Owner, Littlefield Landscapes, North Eastham
Pat Pajaron	Health Agent, Truro
Staff and Consultants	
Scott Horsley	Cape Cod Commission
Erin Perry	Cape Cod Commission
Anne McGuire	Cape Cod Commission
James Sherrard	Cape Cod Commission
Kate Harvey	Facilitator, Consensus Building Institute
Griffin Smith	Facilitator, Consensus Building Institute
Public	
Ed Nash	Golf Course Superintendents of Cape Cod
Dan Milz	PhD Candidate, University of Chicago

Cape Cod 208 Area Water Quality Planning
Three Bays & Centerville River Watershed Working Group

Meeting Three
Wednesday, December 4, 2013 | 8:30 am – 12:30 pm
COMM Fire Station 1875 Falmouth Road, Centerville

Meeting Agenda

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*

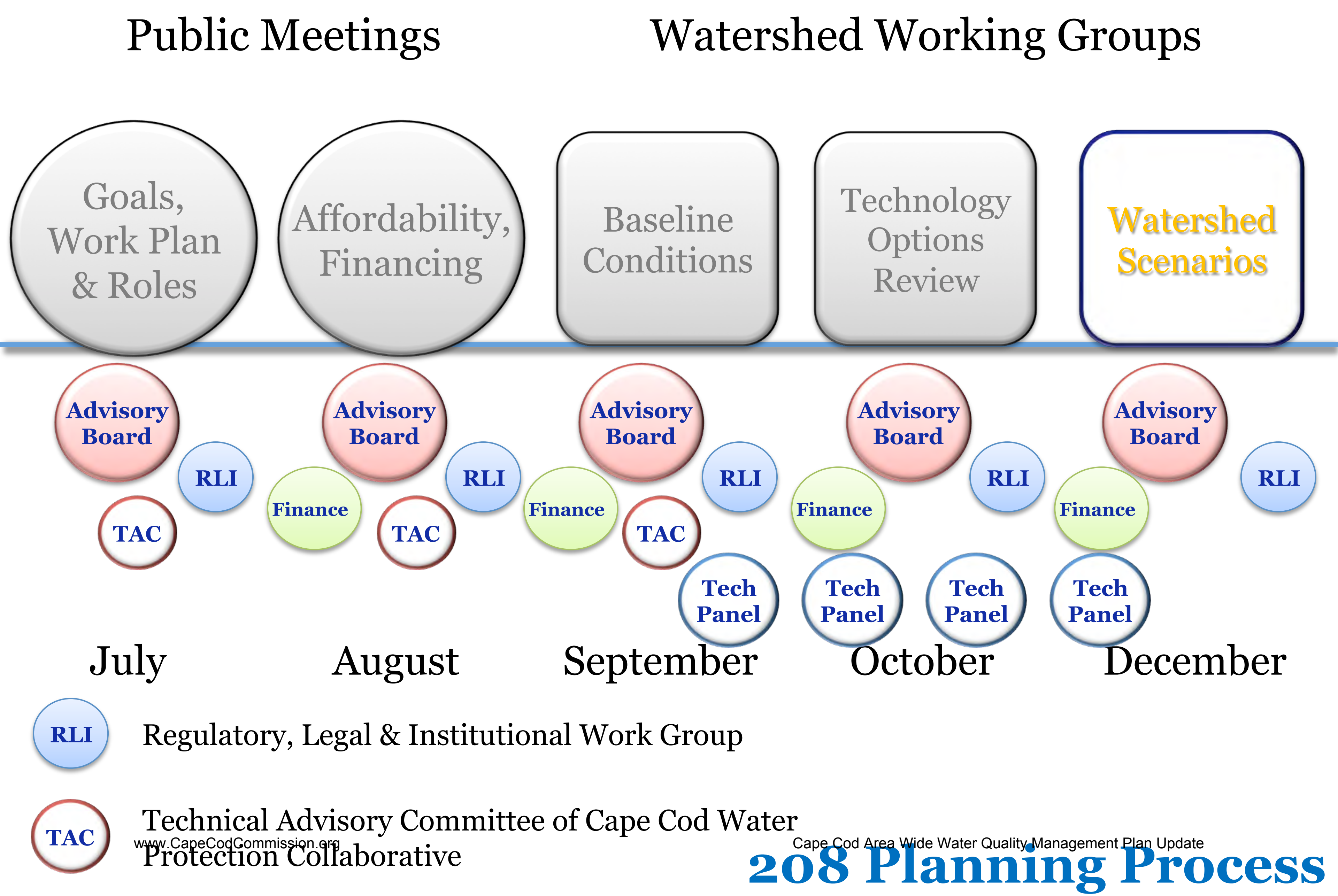
- Triple Bottom Line approach
- Identify Shared Principles and Lessons Learned
- Describe Next Steps

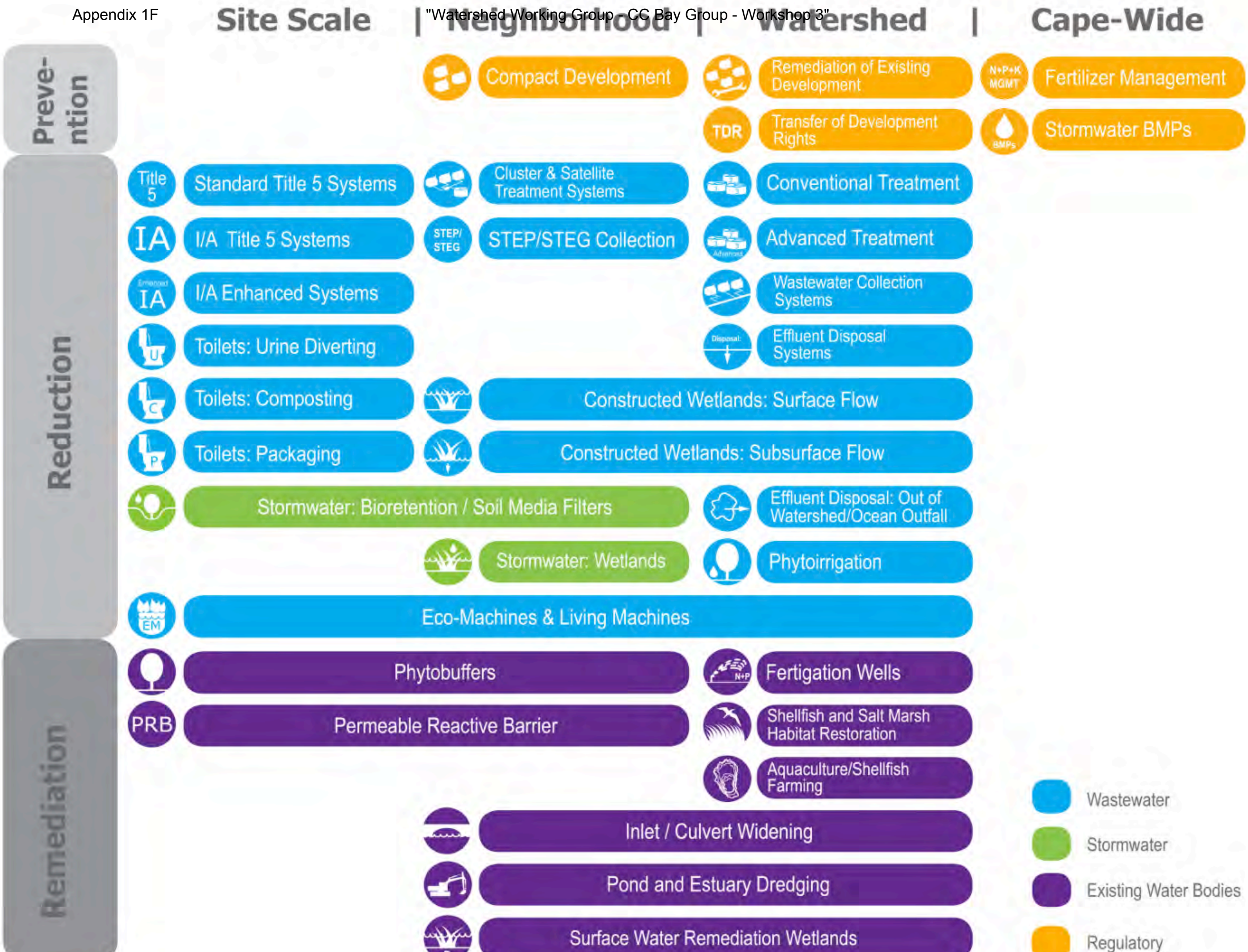
12:15 Public Comments

12:30 Adjourn

Three Bays & Centerville River Group

Watershed Scenarios


Public Meetings
Watershed Working Groups
Goals, Work Plan & Roles
Affordability, Financing
Baseline Conditions
Technology Options Review
Watershed Scenarios
Advisory Board
RLI
TAC
Finance
Tech Panel
July
August
September
October
December
RLI Regulatory, Legal & Institutional Work Group
TAC Technical Advisory Committee of Cape Cod Water Protection Collaborative
www.CapeCodCommission.org
Cape Cod Area Wide Water Quality Management Plan Update
208 Planning Process


Site Scale
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Cape-Wide
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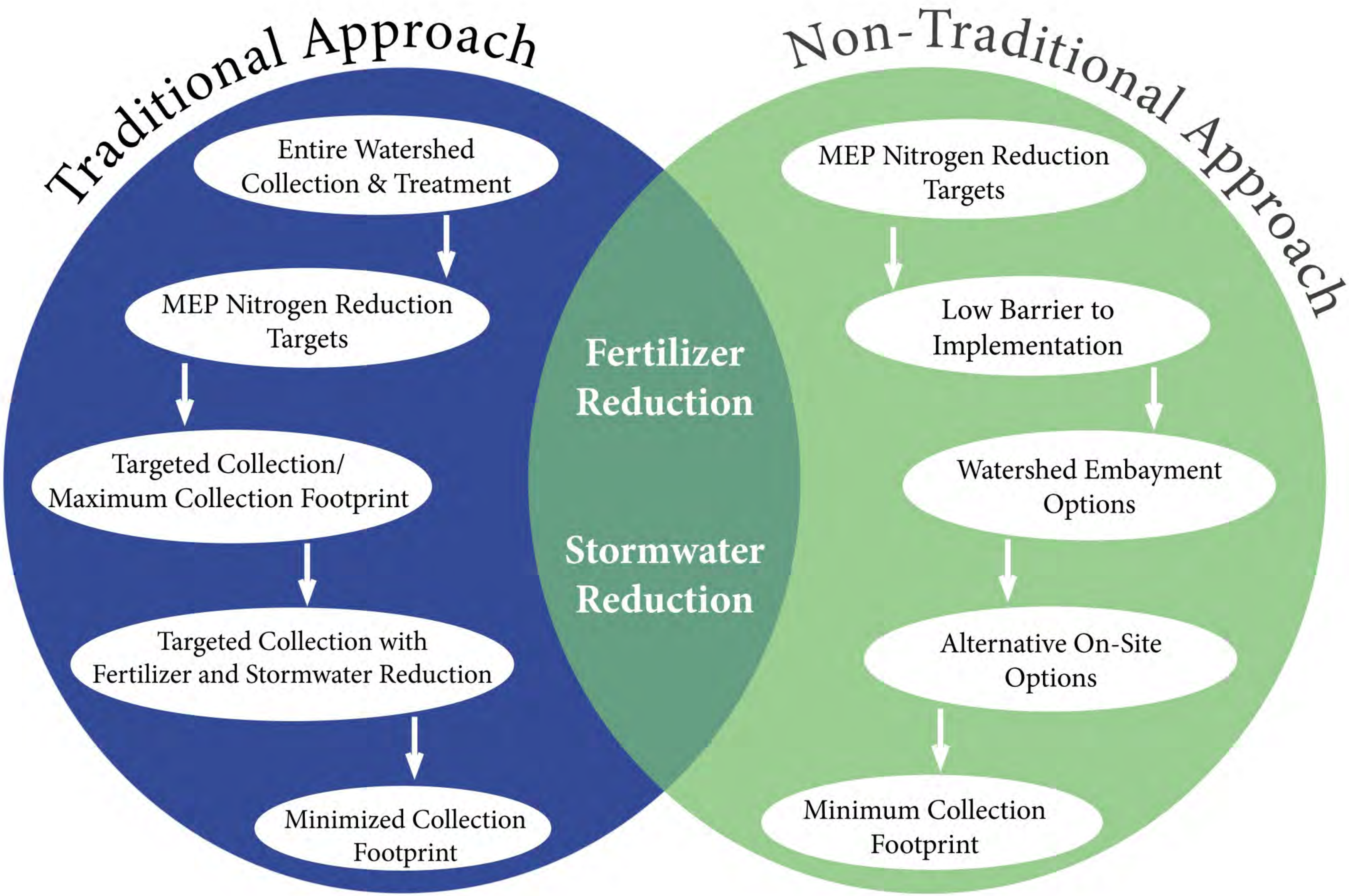
Reduction
Remediation
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced Treatment
IA
I/A Enhanced Systems
Wastewater Collection Systems
U
Toilets: Urine Diverting
Disposal
Effluent Disposal Systems
C
Toilets: Composting
Constructed Wetlands: Surface Flow
P
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

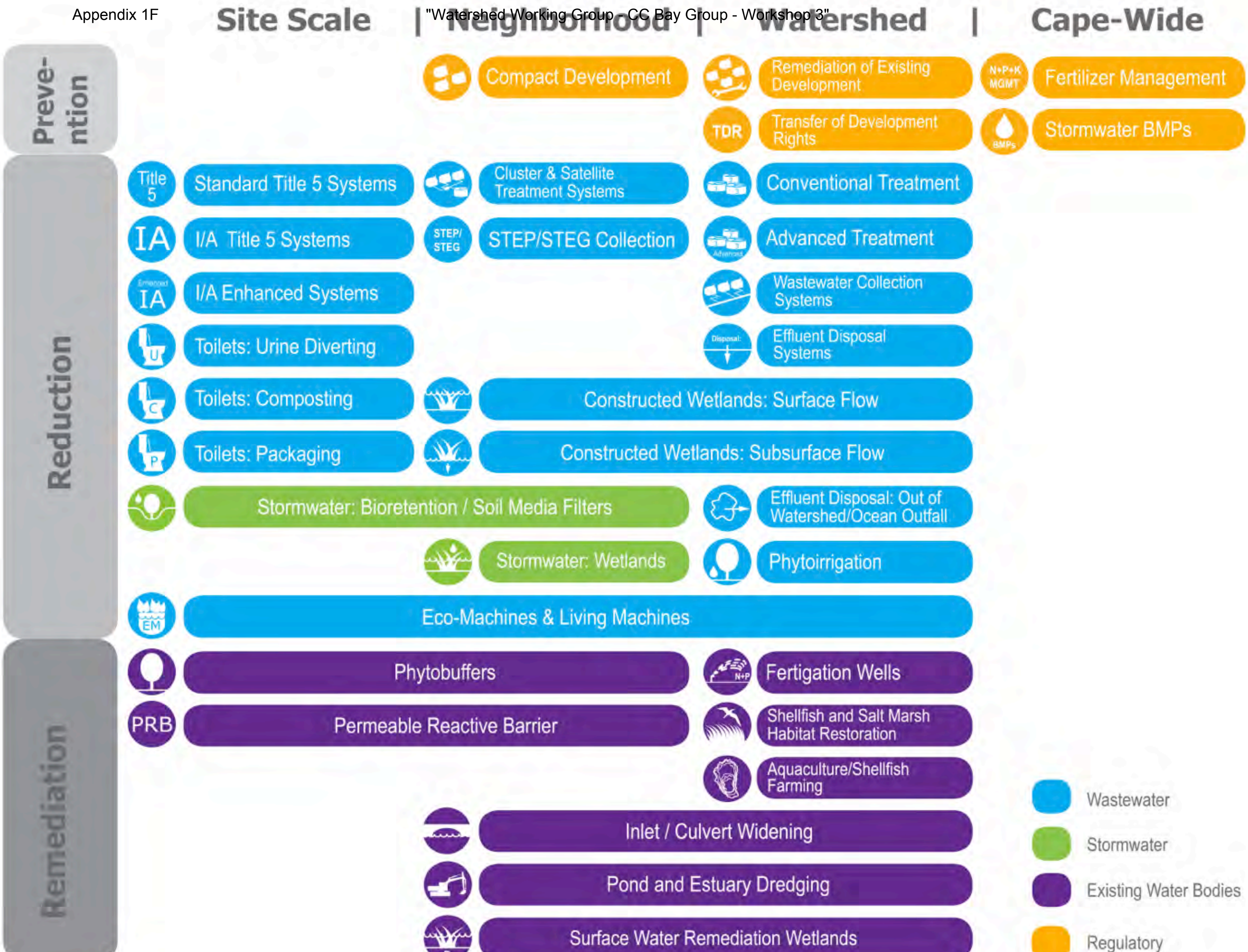
Watershed Scenarios

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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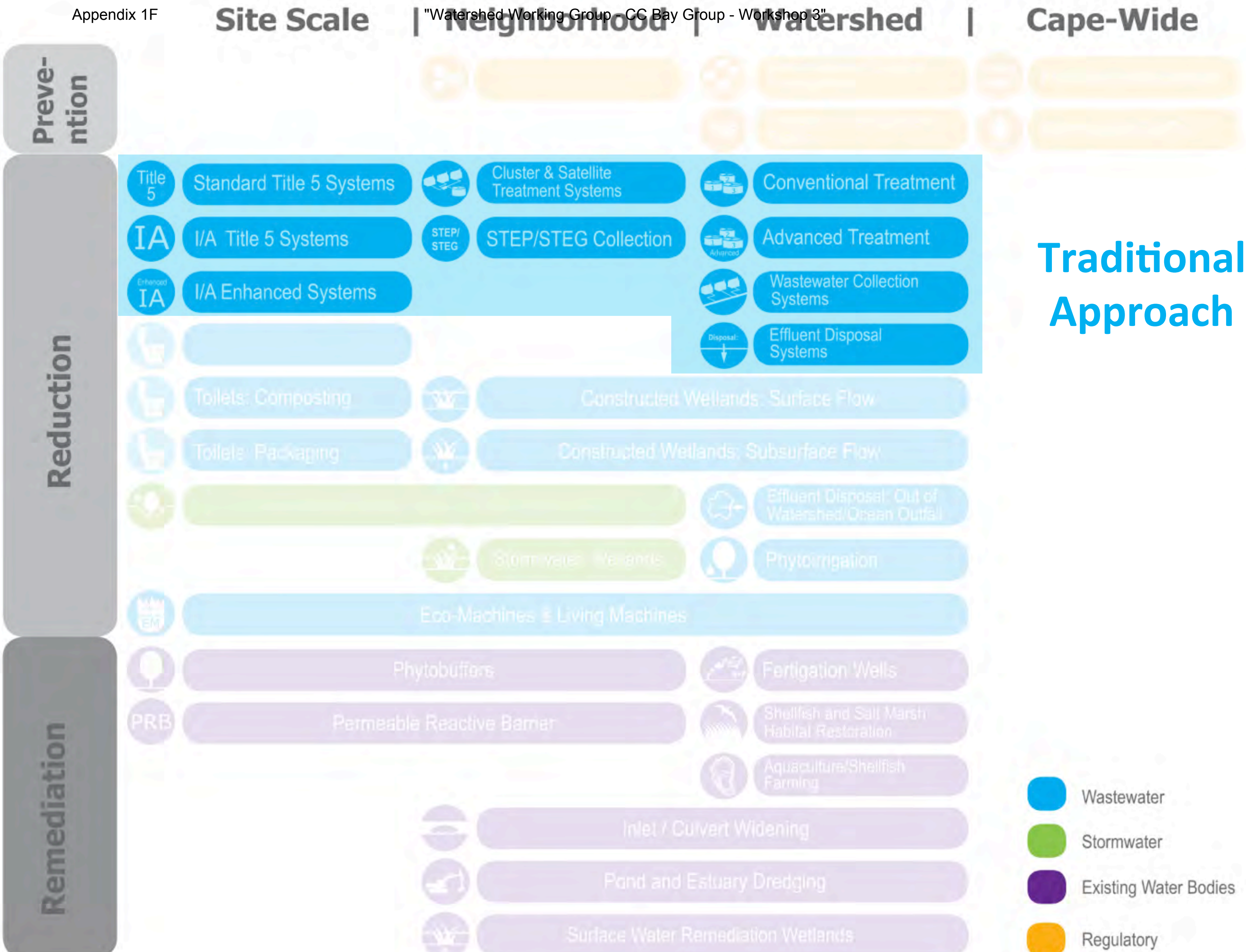
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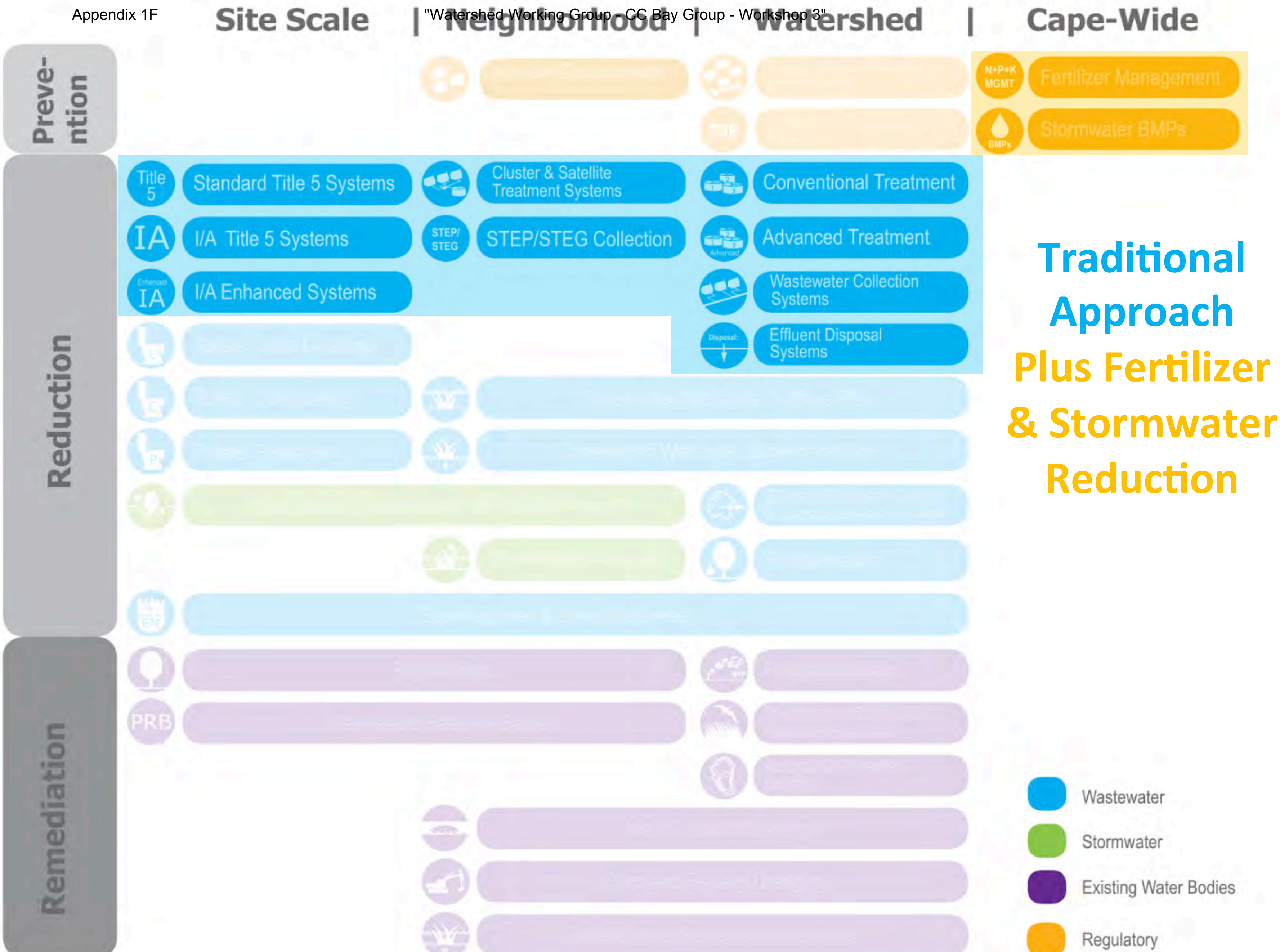
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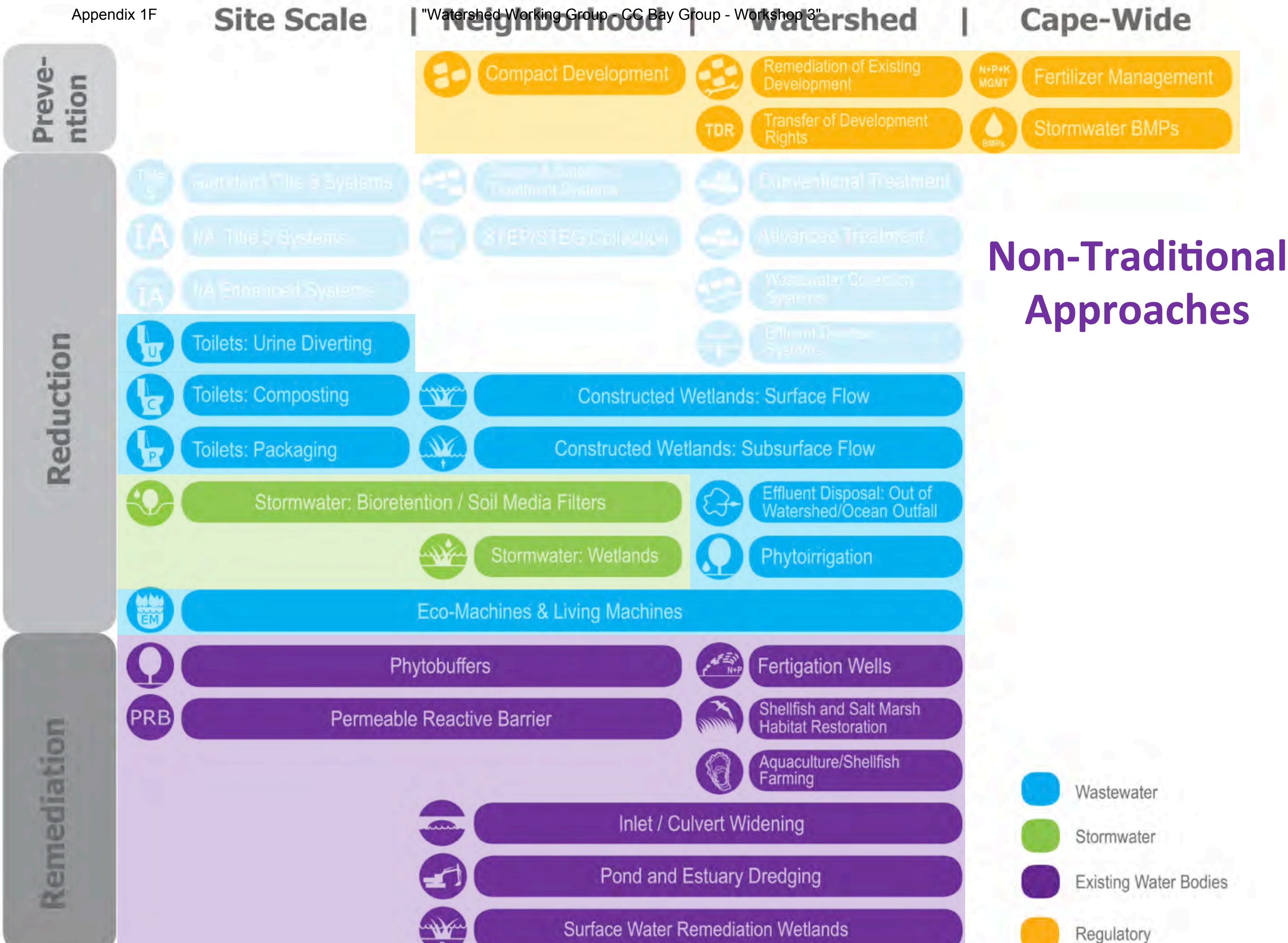
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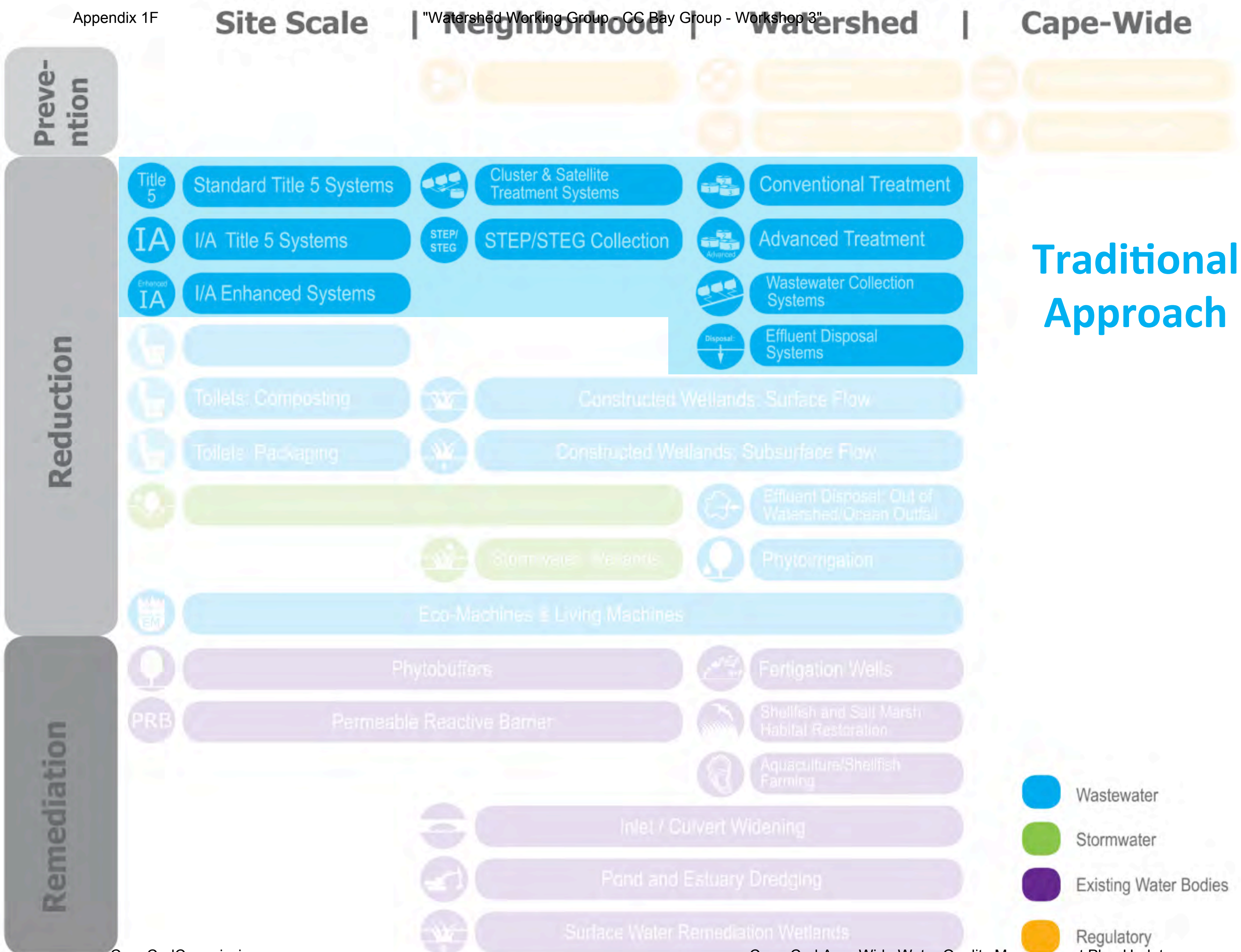
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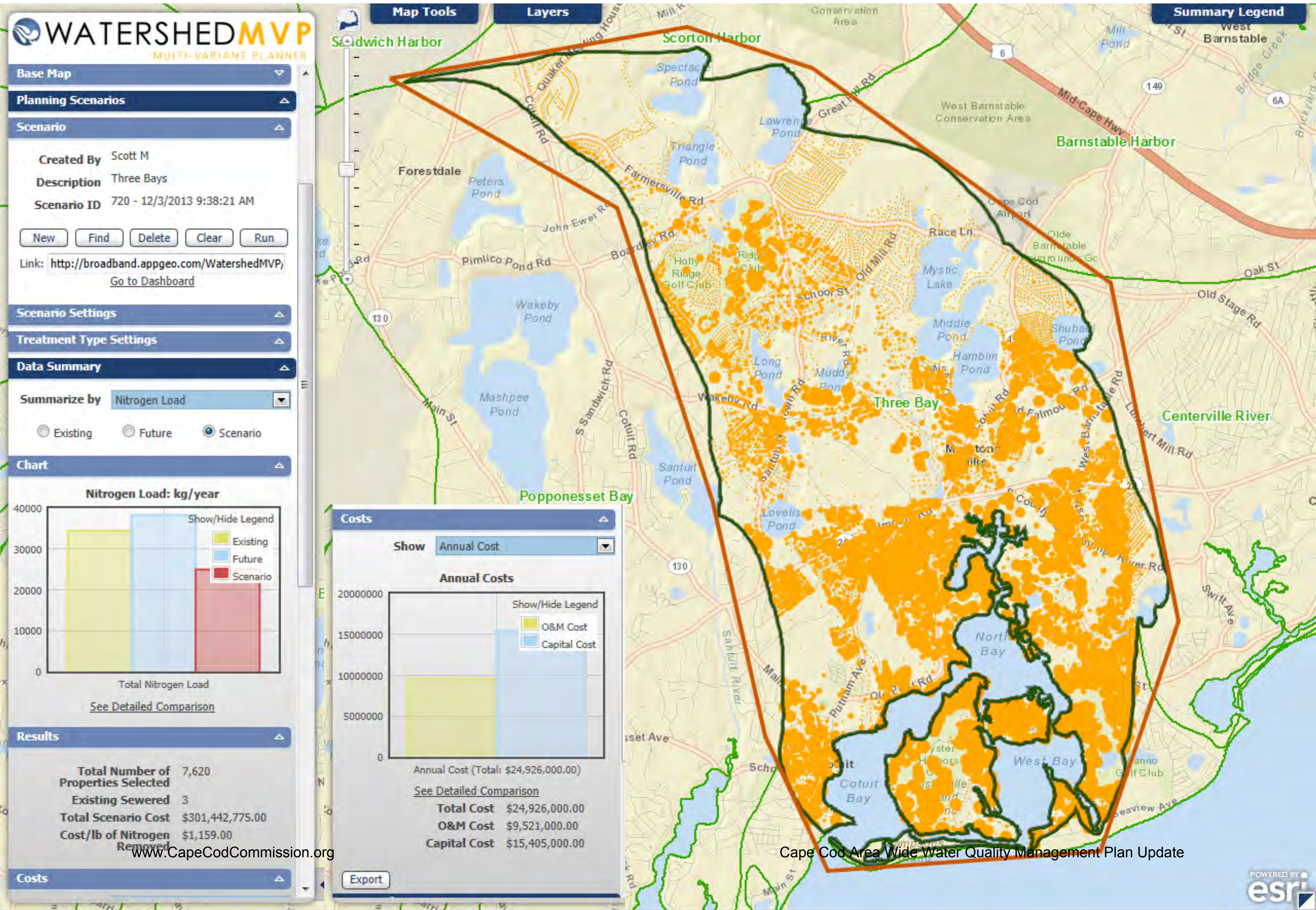
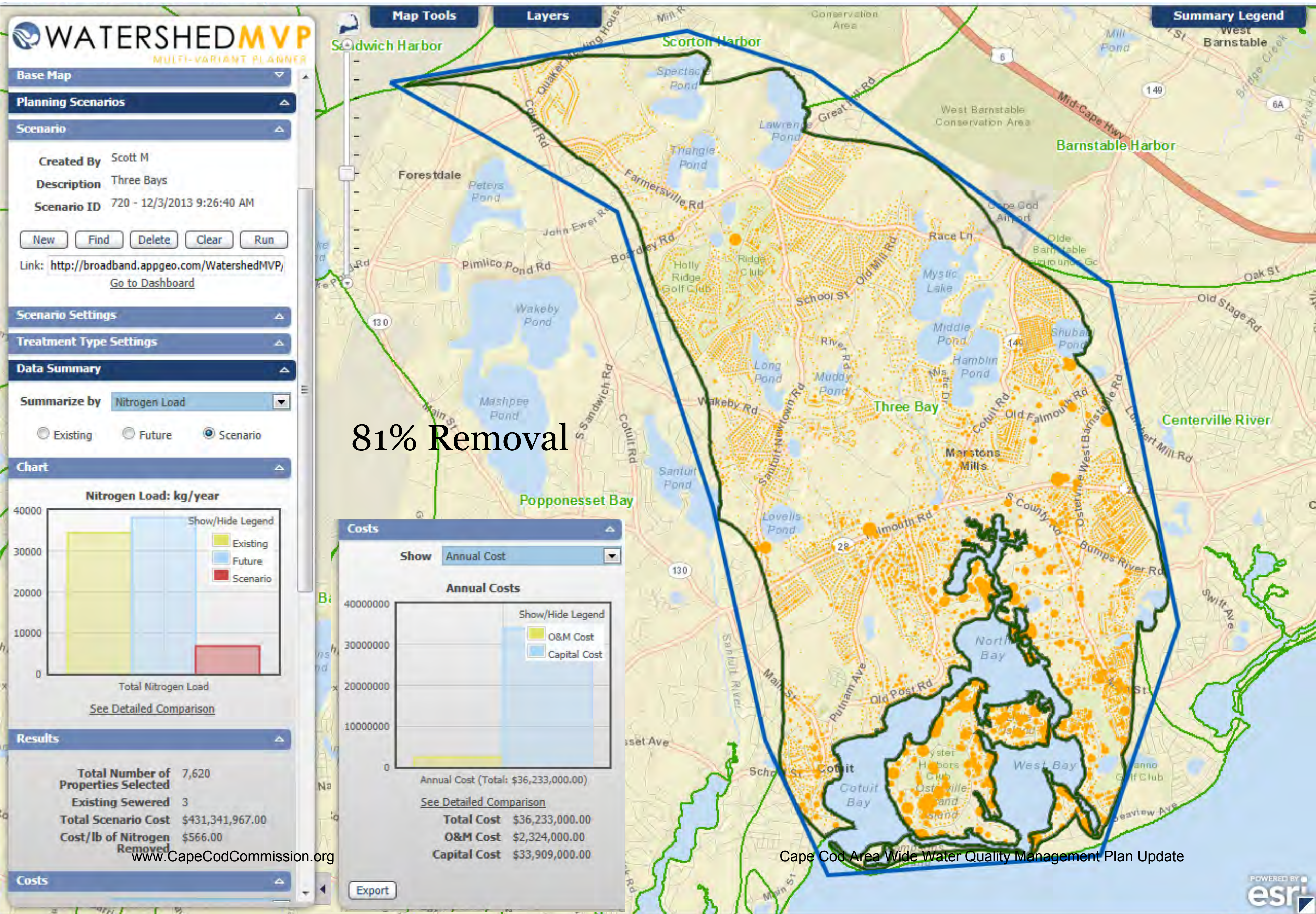
Conventional Treatment
IA
I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced Treatment
Enhanced IA
I/A Enhanced Systems
Wastewater Collection Systems
Disposal
Effluent Disposal Systems
Toilets: Composting
Constructed Wetlands: Surface Flow
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Effluent Disposal: Out of Watershed/Ocean Outfall
Phytoirrigation
Eco-Machines & Living Machines
Phytobuffers
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
Surface Water Remediation Wetlands
Traditional Approach
Wastewater
Stormwater
Existing Water Bodies
Regulatory

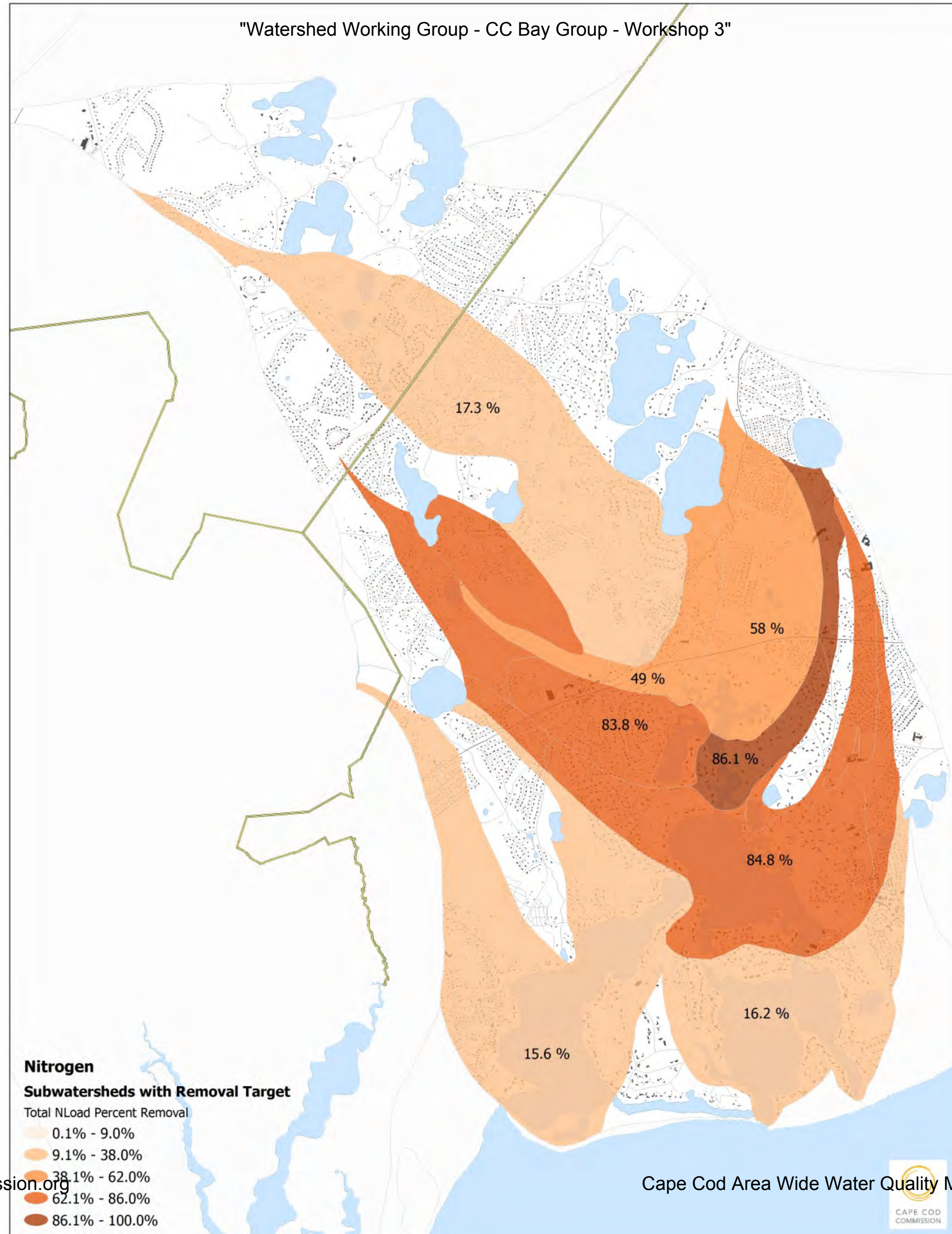
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems

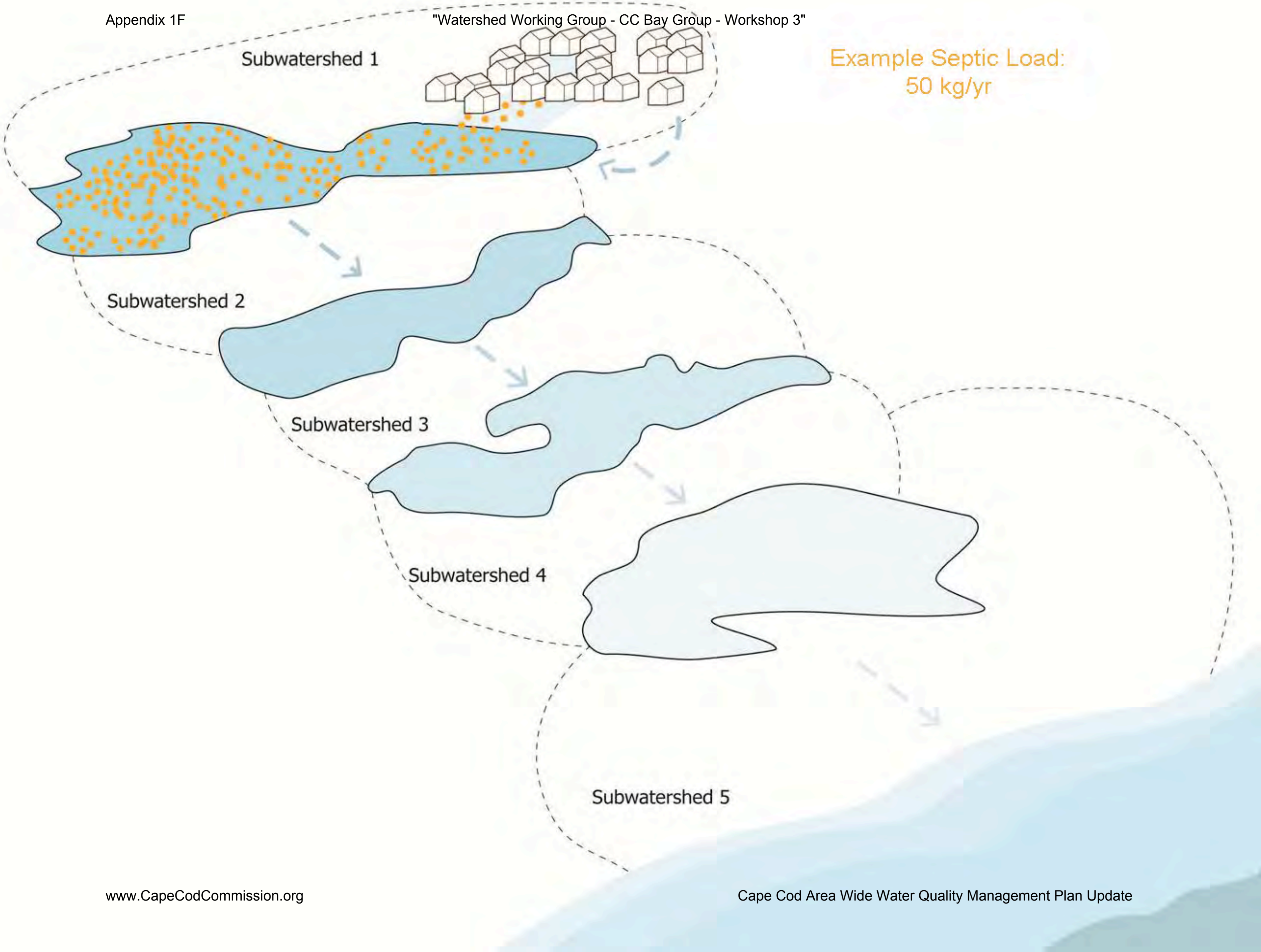


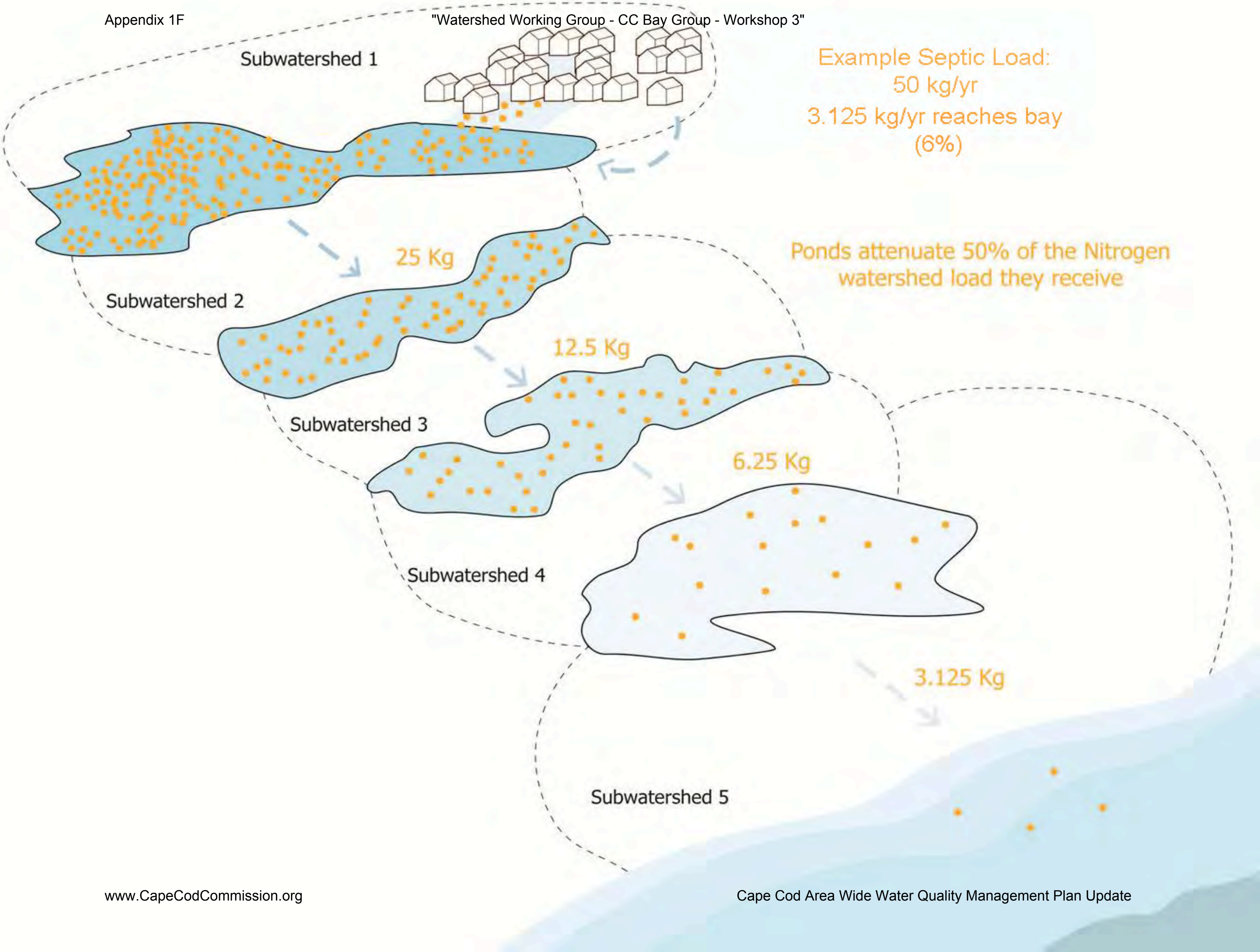
Watershed-Wide Centralized Treatment with Disposal Inside the Watershed

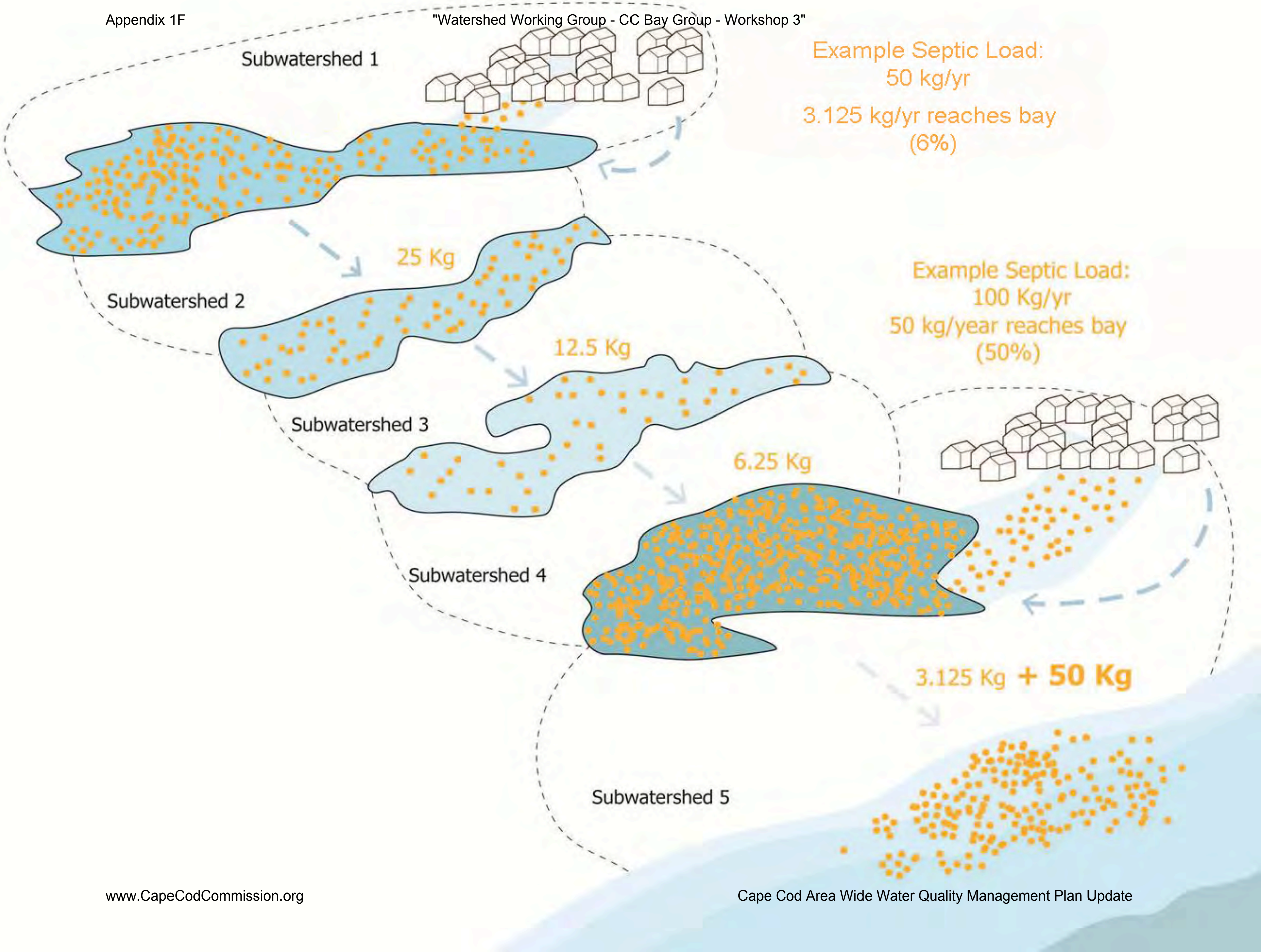


"Watershed Working Group - CC Bay Group - Workshop 3"

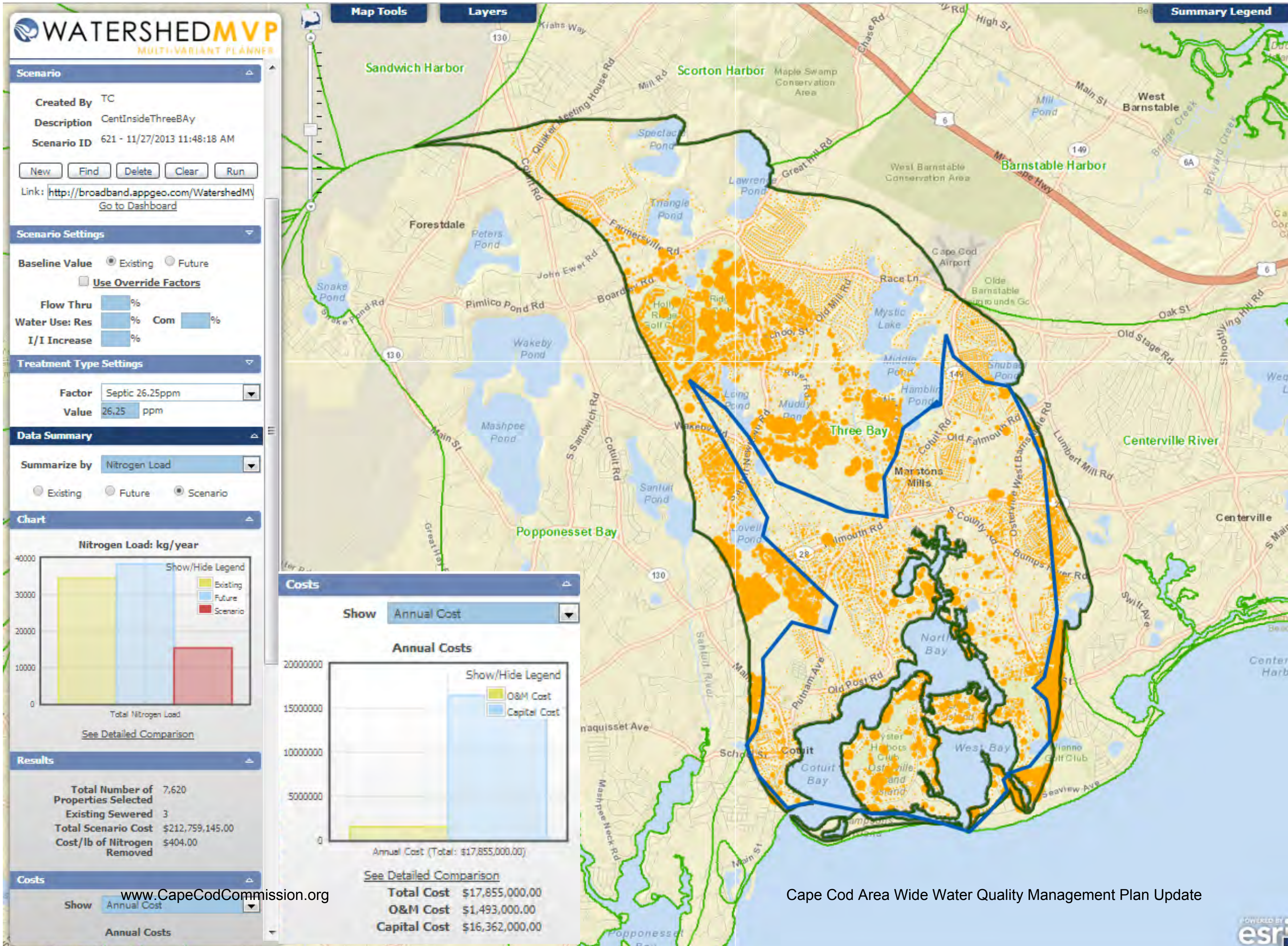


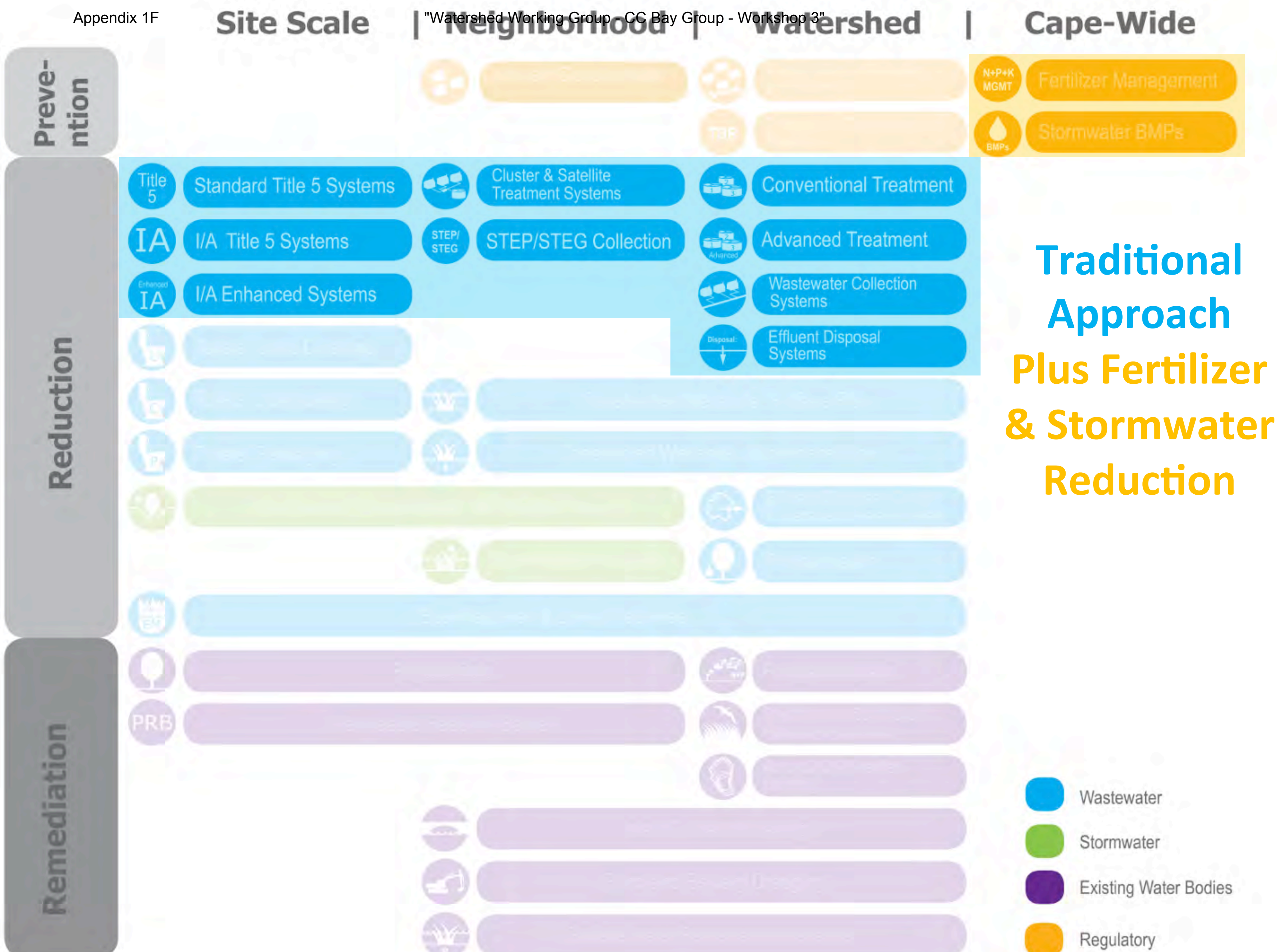

Subwatershed 1
Example Septic Load:
50 kg/yr
Subwatershed 2
Subwatershed 3
Subwatershed 4
Subwatershed 5


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

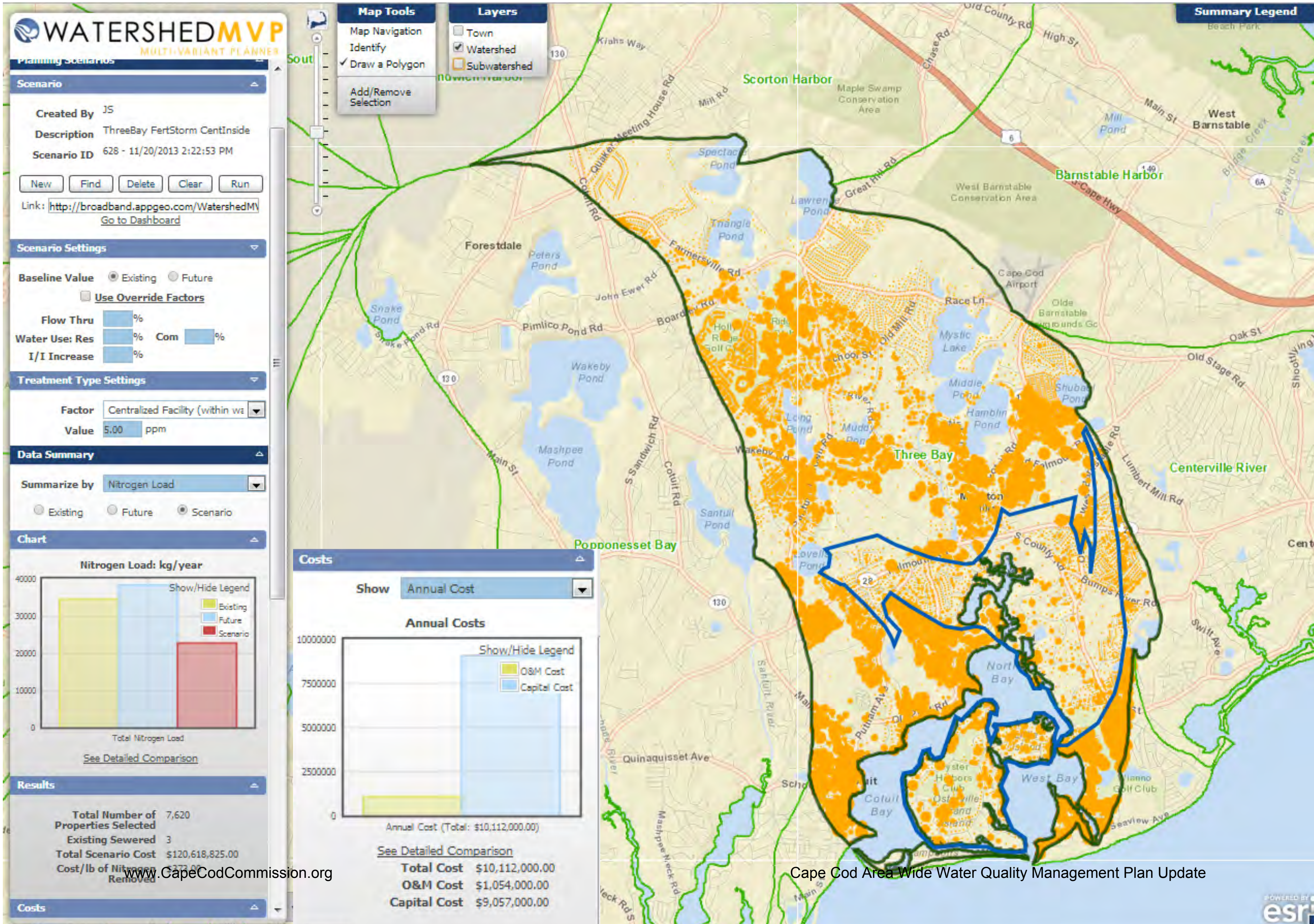

Subwatershed 1
Example Septic Load:
50 kg/yr
3.125 kg/yr reaches bay
(6%)
25 Kg
Subwatershed 2
Example Septic Load:
100 Kg/yr
50 kg/year reaches bay
(50%)
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg + 50 Kg
Subwatershed 5

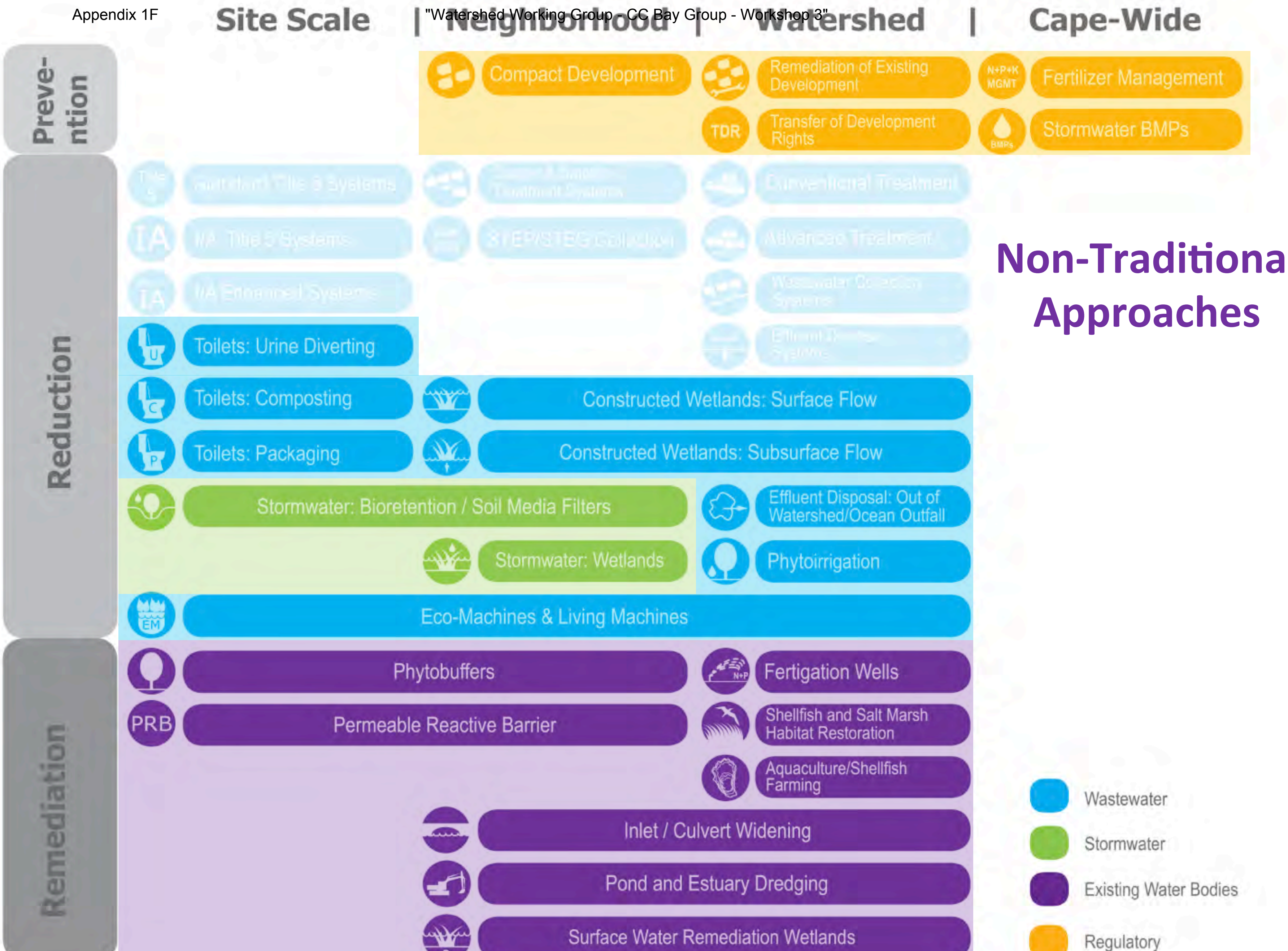
Targeted Centralized Treatment with Disposal Inside the Watershed




Site Scale
Neighborhood
Watershed
Cape-Wide
Preve-ntion
Reduction
Remediation
N+P+K MGMT
Fertilizer Management
BMPs
Stormwater BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/ STEG
STEP/STEG Collection
Advanced
Advanced Treatment
Enhanced IA
I/A Enhanced Systems
Wastewater Collection Systems
Disposal
Effluent Disposal Systems
PRB
Traditional Approach
Plus Fertilizer & Stormwater Reduction
Wastewater
Stormwater
Existing Water Bodies
Regulatory

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




Site Scale
Neighborhood
Watershed
Cape-Wide
Prevention
Reduction
Remediation
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
Non-Traditional Approaches
Toilets: Urine Diverting
Toilets: Composting
Constructed Wetlands: Surface Flow
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Phytobuffers
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

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 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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Nitrogen Removal Required:		**0**	**22,010**
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Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

Watershed Calculator THREE BAYS

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Fertilizer Management		4,107	17,904	
Stormwater Mitigation		1,460	16,444	

Watershed Calculator THREE BAYS

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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

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Constructed Wetlands	3 Acres	1,698	14,438	$521	$1,946,248

Watershed Calculator THREE BAYS

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Dredging	66000	cu. Yard	4,012	9,882	$7	$66,000

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Dredging	66000	cu. Yard	4,012	9,882	$7	$66,000
Oyster Beds/Aquaculture	28	Acres	7,000	2,882	$0	$0

Watershed Calculator THREE BAYS

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Dredging	66000	cu. Yard	4,012	9,882	$7	$66,000
Oyster Beds/Aquaculture	28	Acres	7,000	2,882	$0	$0
Alternative On-Site Options:						
Ecotoilets (UD & Compost)	458	Homes	1,812.3	1,069	$1,265	$5,043,614

Watershed Calculator THREE BAYS

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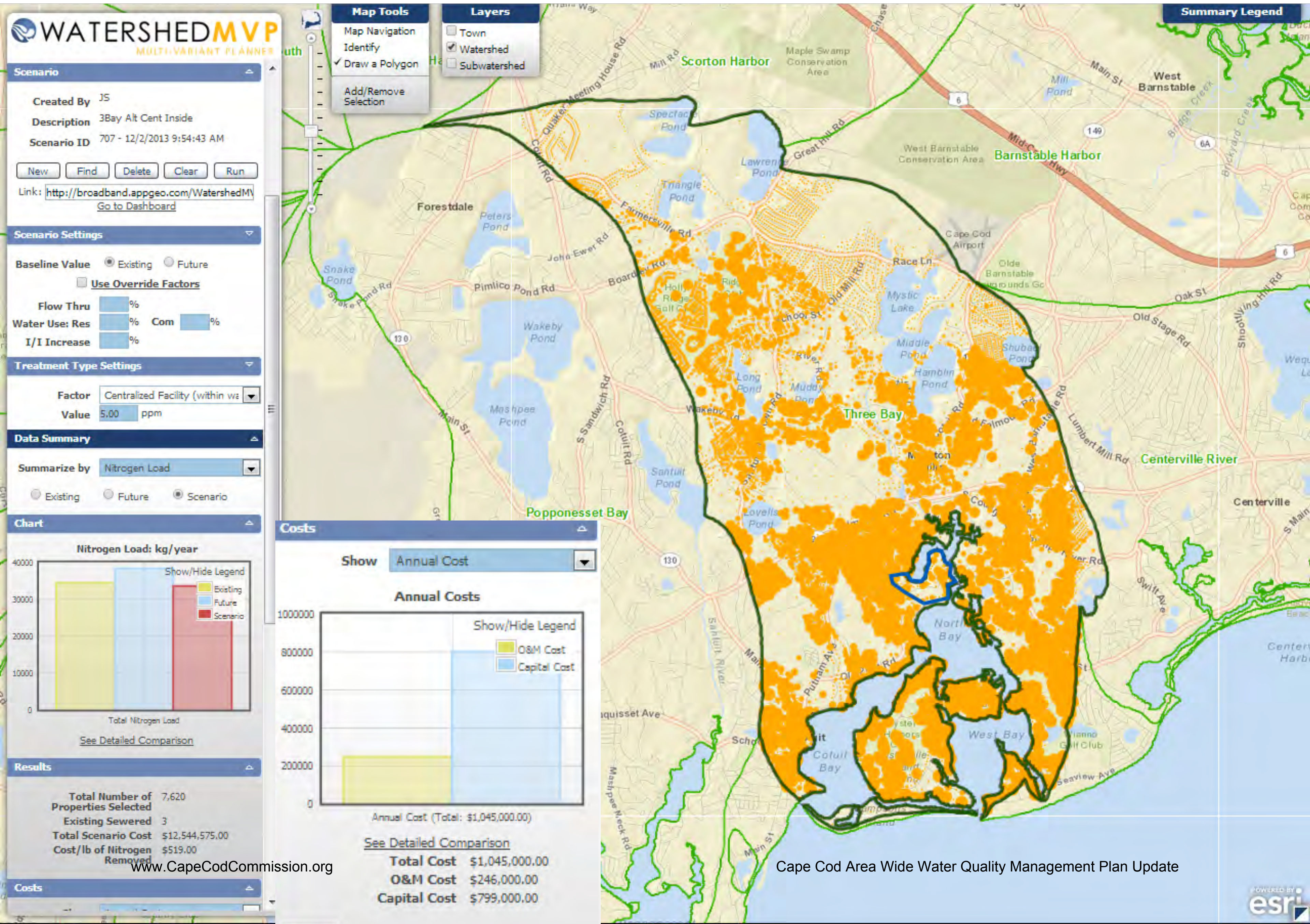
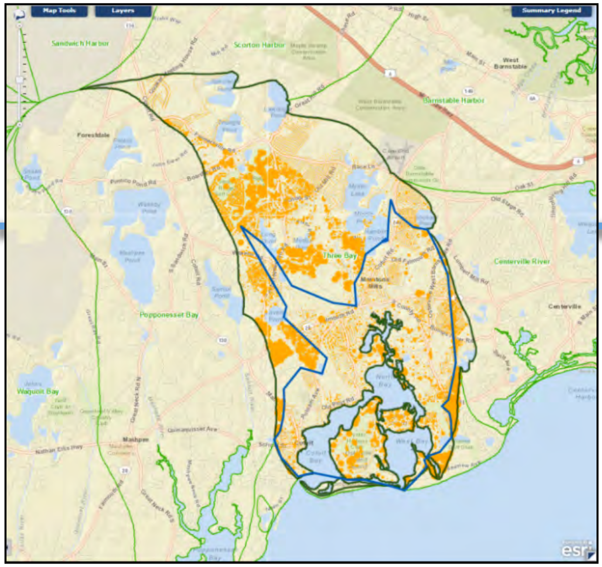
Alternative On-Site Options:						
Ecotoilets (UD & Compost)	458	Homes	1,812.3	1,069	$1,265	$5,043,614
Sewering	243	Homes	1069	0	$1,000	$2,352,253
		Total To Meet Goal (Kg/yr):		0	$295	$10,667,374
			Comparison to Conventional		$1,000	$48,422,000

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



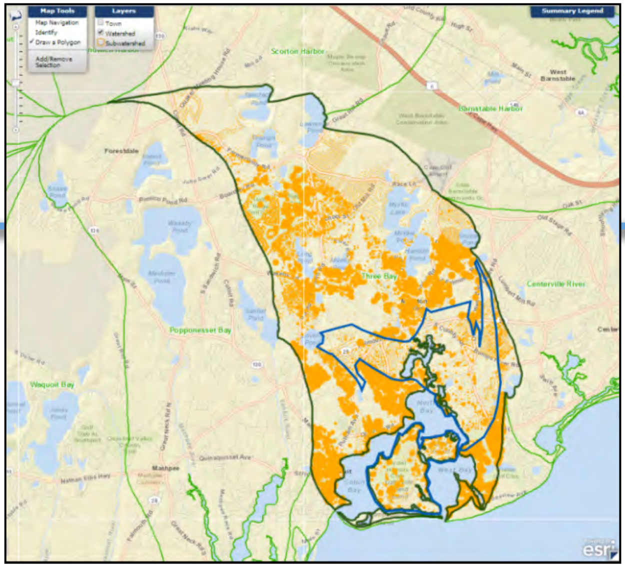
Scenario Comparison

Targeted Collection



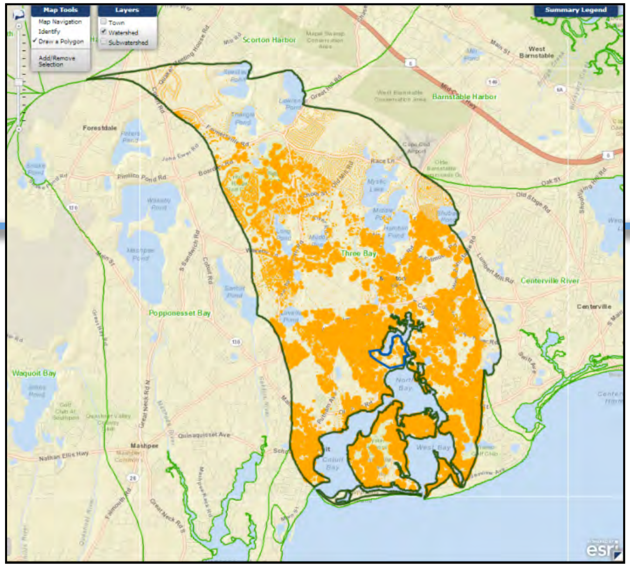
- Achieves TMDL[1]
- Cost/lb N = $405
- Treated Flow = 667,000 gpd

Targeted Collection after a 50% reduction in fertilizer and stormwater



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

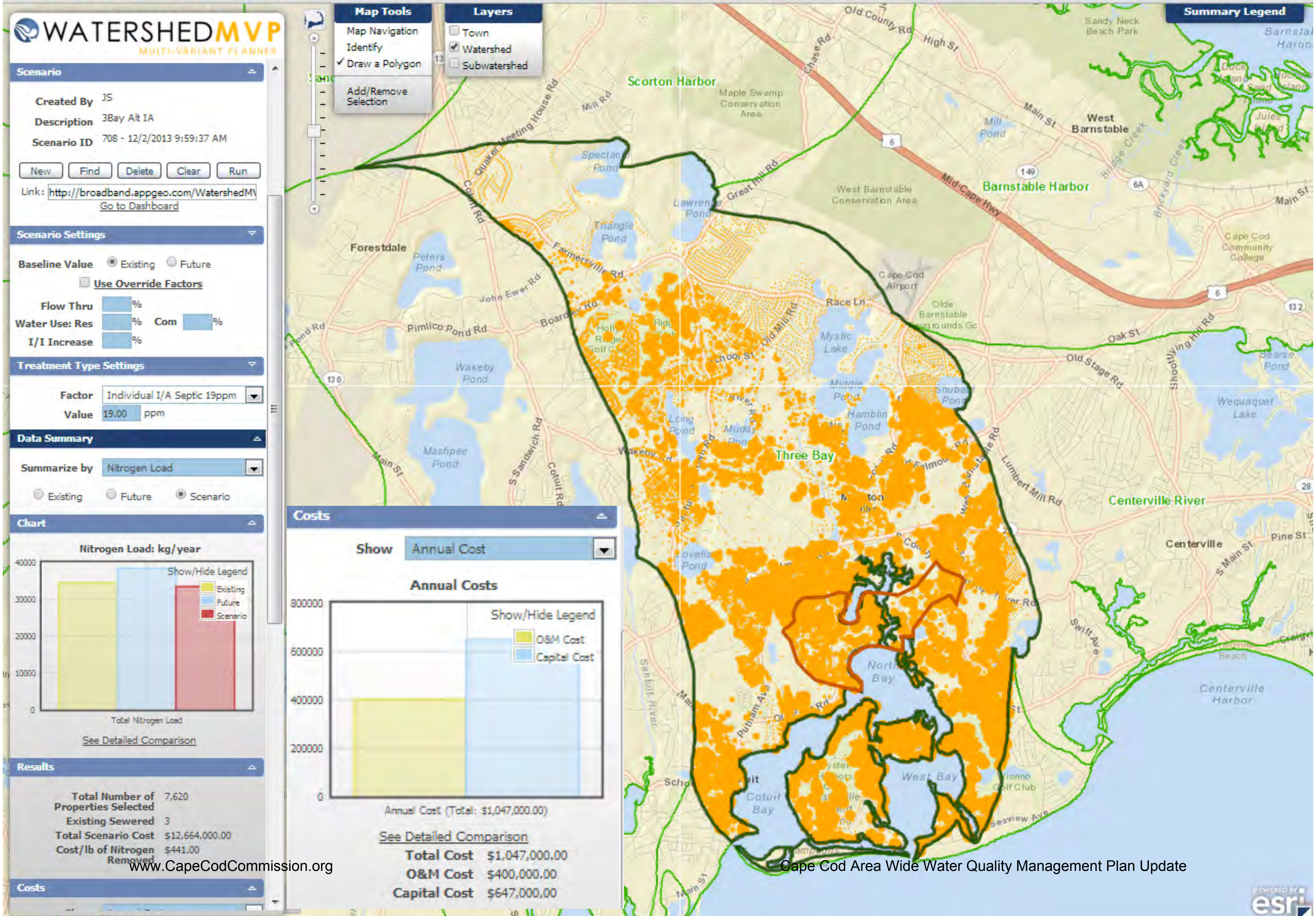
Targeted Collection after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



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

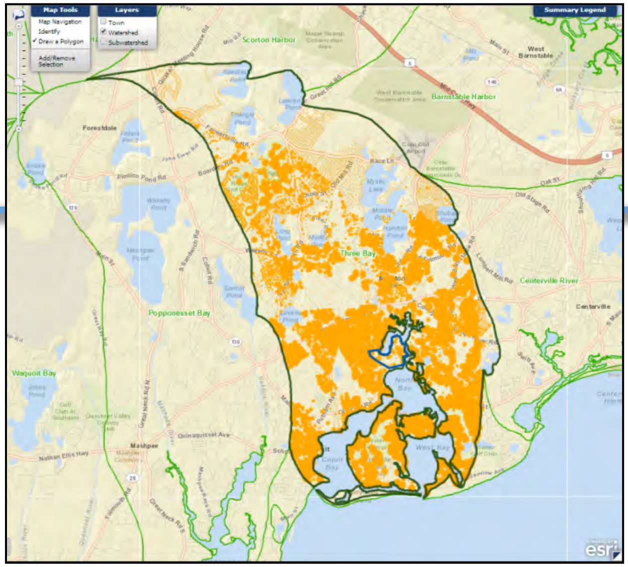
[1] within 5% of goal

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



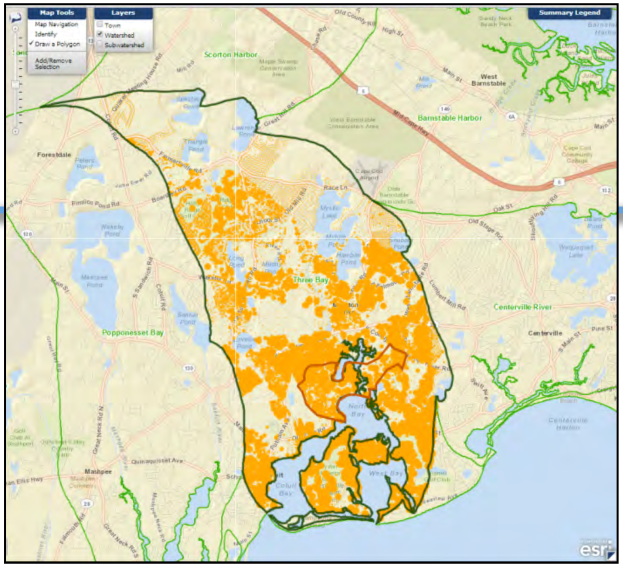
Scenario Comparison

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

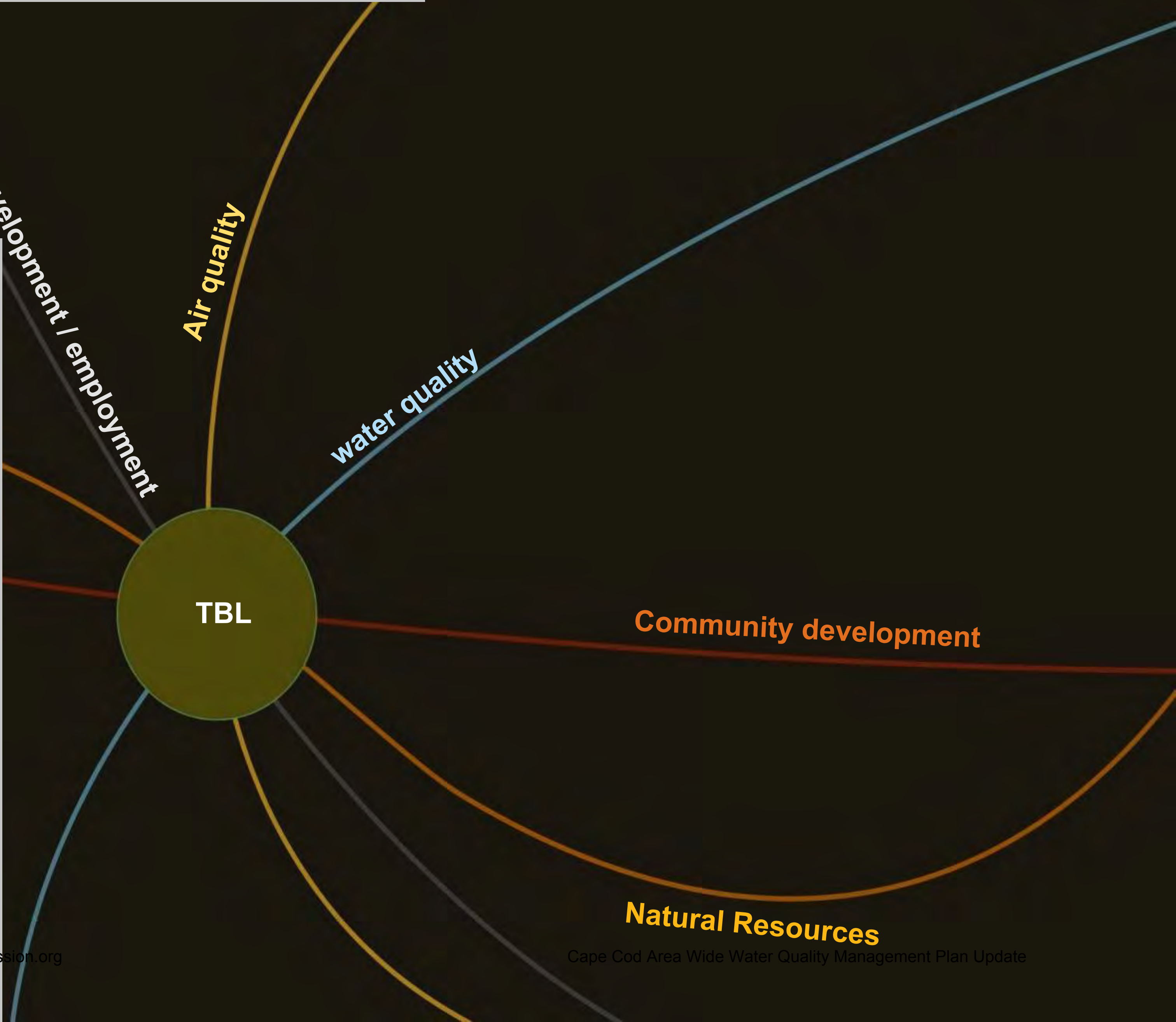
[1] within 5% of goal

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?



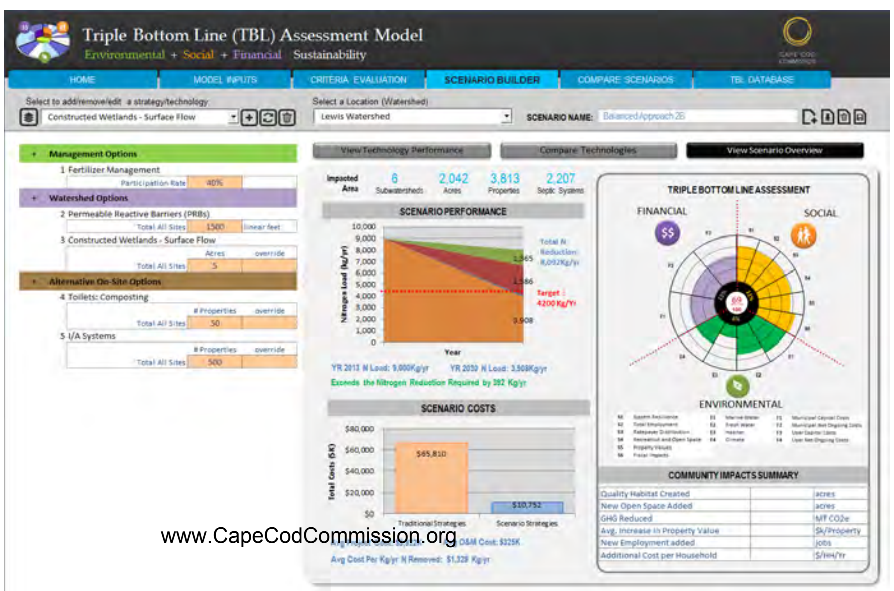
Triple Bottom Line Analysis
Provides a full accounting of the financial, social, and environmental consequences of investments or policies

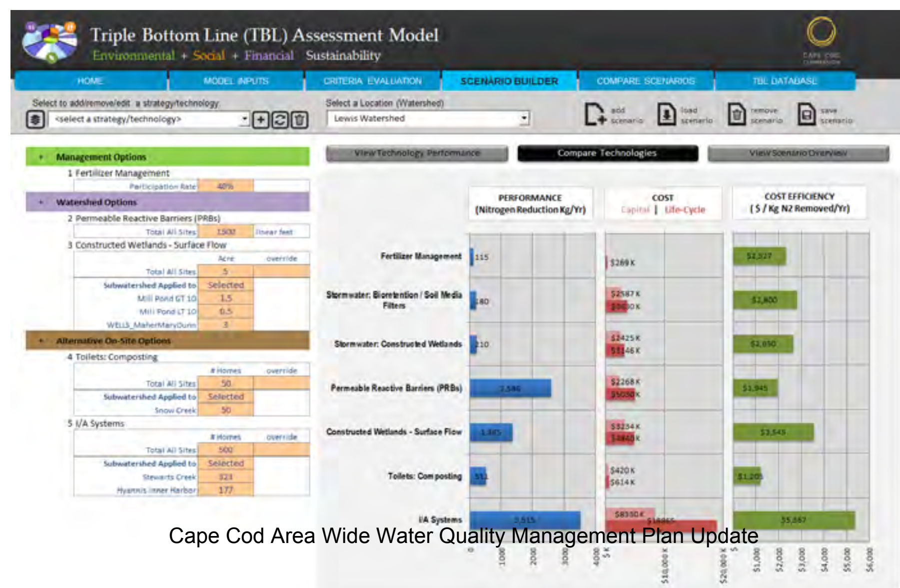
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

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

HOME | MODEL INPUTS | CRITERIA EVALUATION | SCENARIO BUILDER | COMPARE SCENARIOS | TBL DATABASE

Alternative Definition | Alternative Results | Alternative Scoring Rules

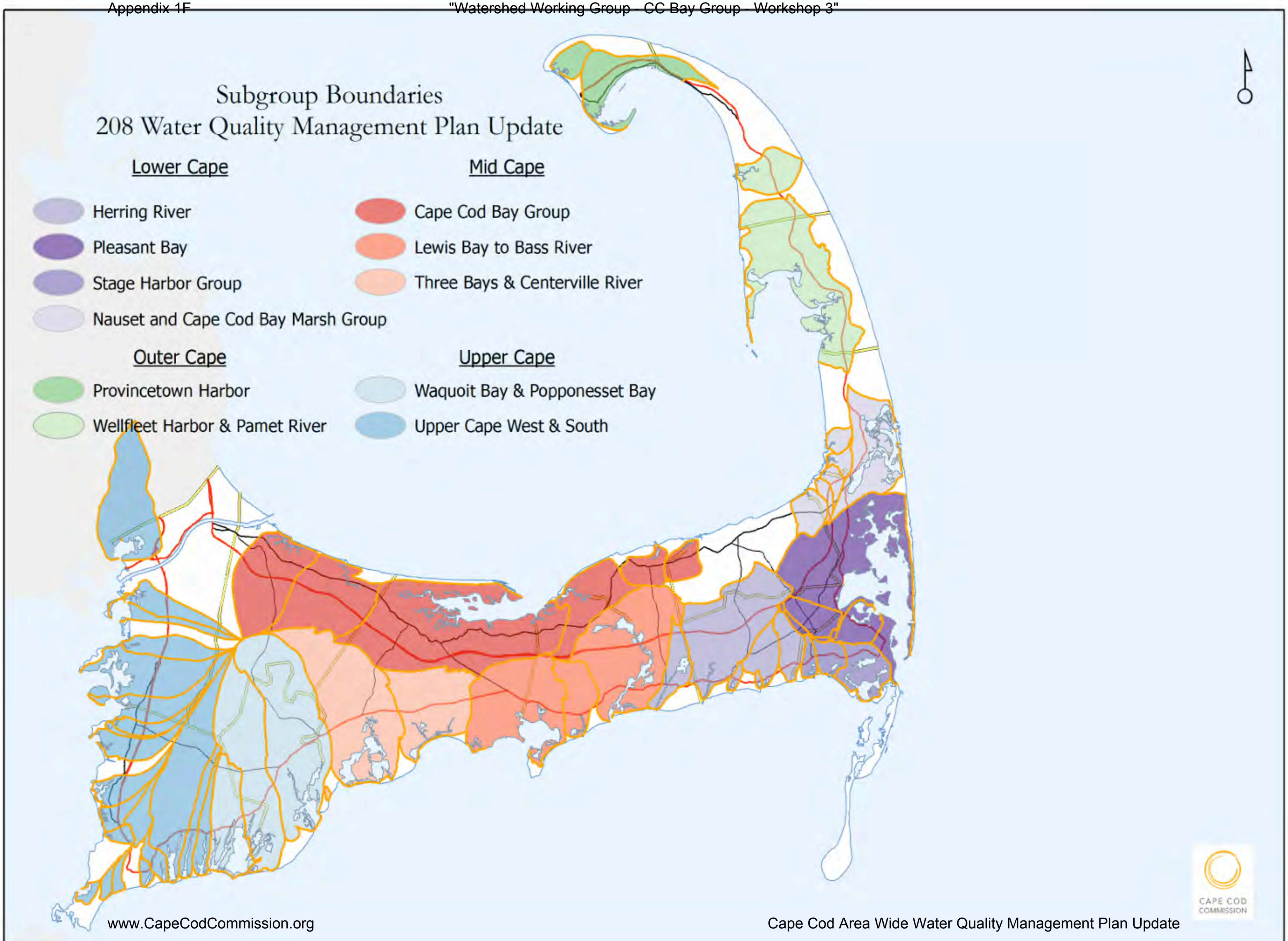
	Scenario 1	Scenario 2	Scenario 3
	Minimum Cost	Cost Effective	Maximum Performance

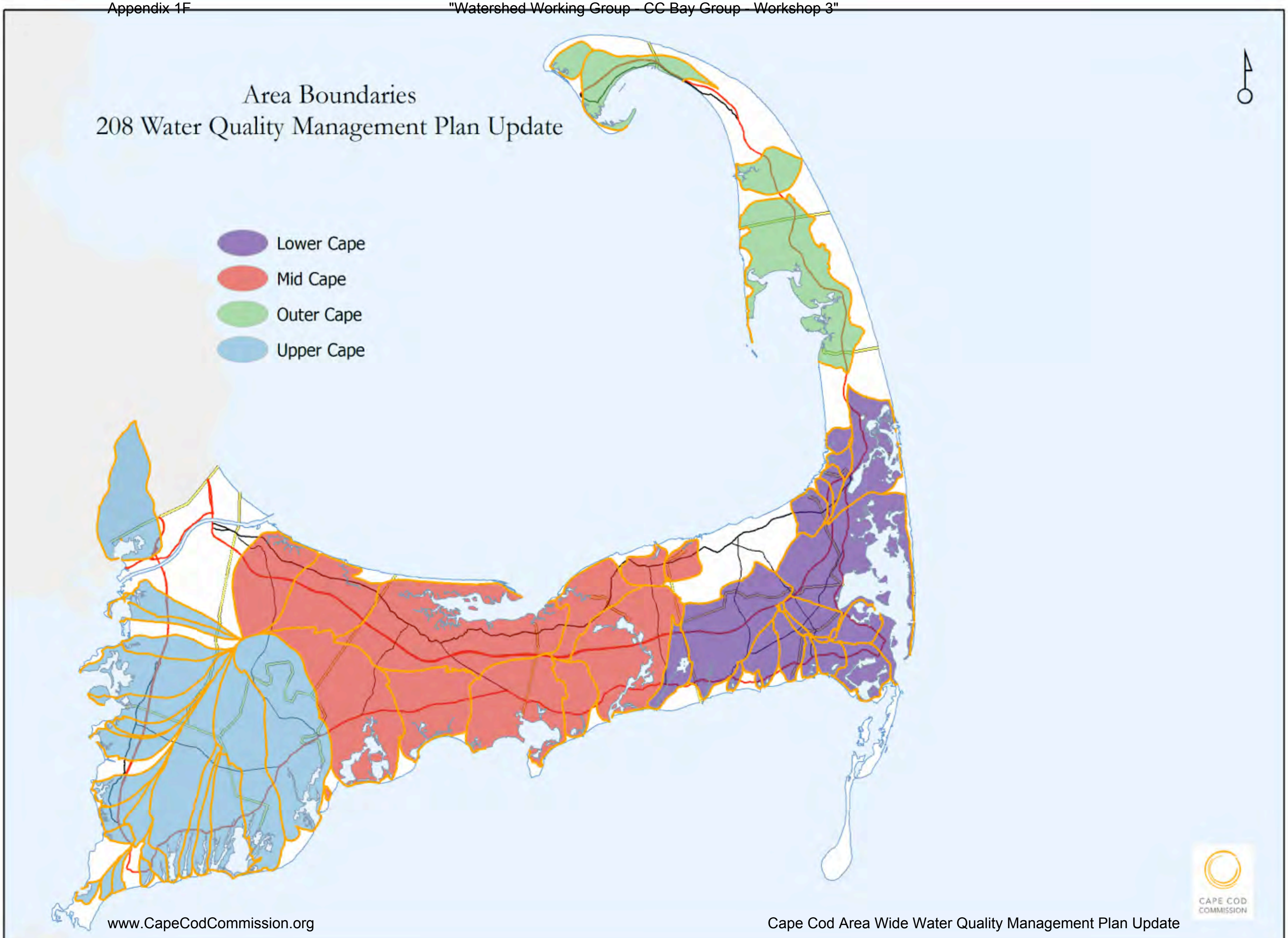
Criterion Scores

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. Increa[illegible]	$200	[illegible]	[illegible]
New Employment Added (jobs)	152	188	252
Additional Cost per Household ($/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
Three Bays and Centerville River Working Group

Meeting Three
Wednesday December 4, 2013
8:30 am- 12:30 pm
COMM Fire Station 1875 Falmouth Road, Centerville

MEETING SUMMARY

I. ACTION ITEMS

Working Group

- Provide comments or revisions to the Meeting 2 draft notes to Carri Hulet
- Notify Carri Hulet if you'd like to volunteer or nominate someone else to represent this working group in the larger sub-basin working group meeting over the next several months.

Cape Cod Commission

- Notify the Working Group of the selected date in January for the Stakeholder Summit.
- Share with the Financial Group points raised by this Working Group on interactive cost functions and trade-offs with economies of scale
- Confirm that the activities required to achieve a 50% reduction in fertilizer and stormwater are actually happening or going to happen.
- Add two columns to the technology matrix: 1) time required for implementation (i.e. construction), and 2) time required to observe results
- Account for growth management/development in the final plan
- Add a dredging symbol to the GIS maps, and update oyster/aquaculture layer to include existing oyster plots noted as missing.
- Add dredging of Cotuit inlet and phytobuffers to the analysis for this watershed.
- Account for the impact of any given technology or approach on emerging contaminants in order to discover co-benefits and avoid regulatory barriers.
- Suggest to Technology Matrix developers that ecotoilets be broken into two separate classes (self-contained and 2-year storage systems).

Consensus Building Institute

- Finalize notes from Meeting 2, distribute to the Working Group, and post to the Cape Cod Commission's website.
- Send out draft notes from Meeting 3.

II. WELCOME, REVIEW 208 GOALS AND PROCESS AND THE GOALS OF MEETING

Scott Horsley, Area Manager and Consultant to the Cape Cod Commission, welcomed participants and offered an overview of the 208 Update stakeholder process.[1] 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. The third round of meetings of the Watershed Working Groups will focus on evaluating watershed scenarios. These scenarios are informed by Working Groups' discussions at previous meetings about baseline conditions, priority areas, and technology options and approaches.

Mr. Horsley shared the 208's Plan team's progress since Meeting 2, which includes:

- Meetings with the Advisory Board, the Tech Panel, the Finance Group, the Regulatory-Legal-Institutional Group, and the TAC.
- Further developed and shared the Technology Matrix, showing possible traditional and non-traditional technologies at the site, neighborhood, watershed, and cape-wide scales.

Mr. Horsley then reviewed the goals 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 using 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.

Ms. Carri Hulet, the facilitator from the Consensus Building Institute, led introductions. A participant list is found in Appendix A. Monica Mejia spoke on behalf of Dan Milz, a doctoral student from University of Illinois at Chicago who is filming the working group meetings as part of his dissertation research on regional environmental planning and stakeholder decision-making. She said Mr. Milz would not publish the film or identify anyone by name in any of the documents he will produce. He is available by email or phone for any questions about his research.

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[1] This PowerPoint Presentation is available at: http://watersheds.capecodcommission.org/index.php/watersheds/mid-cape/three-bays-centerville-river

Ms. Hulet reviewed the agenda. She reiterated that one goal of Meeting 3 is to look at how traditional and non-traditional approaches might play out in the Three Bays Watershed, taking into account feedback from this Working Group. Another goal is to determine the group's buy-in for the evaluation process pursued by the Commission because they will use the same methods to evaluate the other water watersheds.

III. INITIAL SCENARIOS FOR THE THREE BAYS WATERSHED

Scott Horsley explained the Commission's process to develop watershed scenarios. Two teams were formed: one team is exploring traditional (or "conventional") technologies and approaches (e.g. sewering and I/A systems) and another team is exploring non-traditional (or "alternative") technologies and approaches. The teams are both working under the assumption that fertilizer and stormwater reductions will be incorporated into all of the final scenarios, but for now, the traditional approach analysis also included two scenarios that do not include fertilizer and stormwater management in order to provide some baseline estimates.

He then introduced the Watershed MVP, a web-based GIS tool that the Commission used to screen potential sites for the technologies based on a variety of factors specific to each watershed. The Commission also used the Watershed Calculator to help evaluate these scenarios, estimating, by technology, the nitrogen load reduction potential (kg/yr), the remaining nitrogen reduction needed to meet the target load (kg/yr), and the unit cost per pound of nitrogen removed ($/lb).

Traditional Approaches

Mr. Scott Michaud, Hydrologist for the Cape Cod Commission, led the discussion of traditional technologies and approaches and how they might be applied in the Three Bays Watershed. He noted that the nitrogen TMDL for the overall watershed can be met if 60% of existing wastewater nitrogen load is removed from the system, as determined by MEP.

Participants' questions and comments about the approaches are included below *(in italics)*.

<u>Watershed-wide sewer:</u> If the entire watershed (7,260 properties) is connected to centralized treatment and no other actions are taken, approximately 81% of the total nitrogen would be reduced, exceeding nitrogen removal targets. The unit cost for this removal approach is approximately $566/lb N, with a total cost of $431 million over 20 years including collection, treatment, and O&M expenditures.

<u>Targeted sewer:</u> Mr. Michaud provided a brief overview of natural nitrogen attenuation dynamics provided by ponds. Each pond with hydrologic connectivity to the water table

reduces (on average) about 50% of nitrogen load through anaerobic processes. As a result of the location of these ponds across any given watershed, the sub-watersheds within it have variable nitrogen loads and thus variable required wastewater reductions. Across the Three Bays sub-watersheds, the range for nitrogen reduction targets is 16% - 86%.

Taking this and the attenuating role of ponds into consideration, it is possible to target sewer infrastructure where greater reductions are needed. For example, a subdivision in the lower reaches of the watershed typically has less opportunity to have its septic load reach one or several ponds, and thus would be a good site to target sewer infrastructure.

If sewer is targeted to high nitrogen areas, rather than sewering everywhere, and no other actions are taken, the required amount of sewer infrastructure decreases significantly. The unit cost becomes approximately $400/lb N, with a total cost of $212 million over 20 years including collection, treatment, and O&M costs.

- *One participant asked about the potential for nitrification and other ecological costs to ponds due to large wastewater transactions.* Mr. Michaud replied that there is the potential for nitrification, and that it is dependent on the distance between the nitrogen load and the water body; the phosphorous in wastewater poses a greater threat to the ecological health of the pond, and is significantly attenuated through the soil. He then noted that the role of freshwater ponds will be discussed further over the next six months.

<u>Targeted sewer with 50% fertilizer reduction and stormwater mitigation:</u> It is anticipated that fertilizer nitrogen loads can be reduced by 4,000 kg/yr, and stormwater nitrogen loads by 1,500 kg/yr, representing a 50% reduction for each. When these 50% reductions are achieved, required sewer decreases significantly and would remove 60% of the total nitrogen load, treating 750,000 gallons per day (gpd) at a unit cost of approximately $373/lb N. The total cost would be approximately $120 million over 20 years including collection, treatment, and O&M expenditures.

- *Ms. Hulet asked if a 50% fertilizer and stormwater reduction is realistic.* Mr. Michaud and Mr. Horsley replied that 50% is a reasonable assumption. They provided an example of a low-cost bio-retention area that was recently constructed in Cotuit near the Town Dock. MA DEP has published a Stormwater Handbook that indicates that bioretention systems can achieve about 50% nitrogen removal. Fertilizer studies and actions within the golf course industries to remove fertilizer-based nitrogen inputs also suggest that 50% is reasonable. The Commission is in discussions with regulatory bodies to determine how to get credit for that reduction.

Non-Traditional (7-Step) Scenario

Mr. Horsley presented a scenario in which, following the 7-step process, a suite of non-traditional alternative technologies is applied within the Three Bays Watershed to reach nitrogen reduction targets. Using the watershed calculator and Watershed MVP, he shared the reduction potential and costs of these various technologies as well as potential locations for their implementation. He noted that the scenario is not a recommendation, but an illustration for what is possible when combining these technologies, and solicited feedback from the group.

Before presenting the scenario, Mr. Horsley discussed further baseline conditions of the Three Bays Watershed. As studied by MEP, the current nitrogen load includes about 48,000 kg/yr from controllable sources. Approximately 37,000 kg/yr is derived from wastewater, 8,000 kg/yr from fertilizer, and 3,000 kg/yr from stormwater. The total nitrogen reduction required is about 22,000 kg/yr to achieve a target load of 25,000 kg/yr. The watershed contains 9153 properties.

<u>Fertilizer Reduction and Stormwater Mitigation:</u> As stated previously, it is anticipated that fertilizer nitrogen loads can be reduced by 4,000 kg/yr, and stormwater mitigation loads by 1,500 kg/yr, representing a 50% reduction for each. These actions require no or minimal additional cost to the community beyond the on-going stormwater mitigation projects that are being sponsored by towns, the Cape Cod Commissions Fertilizer DCPC, or covered by private interests (such as golf courses).

<u>Permeable Reactive Barriers (PRBs):</u> Mr. Horsley shared a map indicating potential areas for PRBs within the Three Bays Watershed, i.e. areas close to water bodies where the water table is 20 feet or less below the surface and where road lengths run perpendicular to groundwater flow. GIS analysis indicates that there are three potential sites across the watershed for PRB installation: in Prince's Cove, near the Eel River in Osterville, and on the east end of Grand Island.

In this scenario, these PRBs could treat the nitrogen load from 140 homes, reducing nitrogen load by 430 kg/yr. The unit cost is $452/lb N. While the Commission is currently using fairly long road lengths in its siting analysis, Mr. Horsley explained that the technology could also be installed on shorter road segments in various locations. He also made the distinction between trenching and injection well PRBs.

- *One participant asked about unit cost comparisons, and noted that this is more expensive per pound of nitrogen reduced than sewer.* Mr. Horsley replied that the unit cost and the nitrogen removal estimates are being updated (the cost calculations for PRBs are based on 2010 data) and need further evaluation. The Technology Matrix assumes conservative estimates for PRB removal rates, and it is likely that the technology can perform better. Results from an intensive study in Falmouth are being integrated as they unfold. Overall, however, the assumption is that PRB will be less expensive than sewer.

- *Another participant asked whether land costs were incorporated into the assumptions.* Mr. Horsley responded that these potential PRB sites are located on public land (i.e. on or along roads with an easement). Land costs may be considered in the future if sites are chosen on privately-held land.
- *Another asked why PRBs need to be located near a road.* Mr. Horsley explained that siting installation at a road makes it easier from an implementation and permitting/regulatory standpoint for several reasons, as studied in Falmouth by CDM Smith. Roads are often dug up, are within the public domain, and require relatively little permitting. Waquoit Bay is considering a PRB installation along a beach, but there is significant permitting required for that location.
- *Another asked if there are septic systems that incorporate the same PRB technology.* Mr. Horsley shared that there are several I/A systems that use similar denitrifying technology. Most rely on a carbon source, e.g. wood chips or injected methane. He noted that the results of these systems are highly variable, however, and that the credit issued from DEP is minimal. *A public member noted that DEP has approved a system called Nitrex, which is better-performing and yields more consistent results. There are only one or two units installed thus far on the Cape in the Mashpee/Falmouth area.*

Constructed wetlands: Under the scenario, three acres of constructed wetlands would reduce approximately 1,700 kg/yr of nitrogen at a unit cost of $521/lb N. Mr. Horsley also presented the results of a GIS analysis screening for constructed wetlands locations. He noted that these wetlands include those that are connected to the water table and those where groundwater is pumped and injected into the area. Mr. Shawn Goulet, GIS Analyst for the Cape Cod Commission, explained the screening criteria:

- Parcel-size over 5 acres
- Outside the 100-year floodplain
- Outside priority rare species protected areas
- Outside protected open space areas.

He noted that the Commission is currently interested in low-technology wetlands that do not treat primary sewage, but rather treat groundwater in high-density areas. Constructed wetlands can perform better (in nitrogen removal) than some natural wetlands, the latter of which MEP is already giving credit.

- *One participant was interested in seeing phytobuffers incorporated into the analysis.* Mr. Horsley agreed to add them, and explained that they can be a low cost option. He also said phytobuffers sometimes run into pushback from the community because they can impact waterviews when tall growing species are utilized.

Fertigation wells: Under the scenario, four golf courses using fertigation wells would result in 544 kg/yr in nitrogen reductions, at a unit cost of $438/lb N. Mr. Horsley explained that four golf courses in the area are already irrigating with fertigation wells, but that they are not getting credit (or not enough) for the nitrogen removed via this technology. There is still opportunity for fine-tuning and optimization for nitrogen removal, e.g. via pumping schedules and better placement.

Dredging: A dredging project has been proposed for Mill Pond near the intersection of Rte 149 and Rte 28. Under the scenario, removing 66,000 cubic yards of dredged material would reduce nitrogen by 4,000 kg/yr at a unit cost of $7/lb N.

According to the MEP report, Mill Pond is degraded, due to a build-up of sediments and could be dredged to more of a natural condition. It could be possible to take a 50% credit with this dredging project. There would be a significant amount of permitting associated with it, but the costs are low and it could be a good option for significant nitrogen removal. There would need to be a monitoring program to determine actual results.

- *One participant asked about inlet widening in Cotuit. Three Bays Preservation estimates that this would contribute to 5% of the removal target in Cotuit Bay*. Mr. Horsley agreed to add this to the analysis.

Oyster beds / aquaculture: Under the scenario, 28 acres of shellfish are installed. The nitrogen removal rate is 7,000 kg/yr/acre – the highest among non-traditional technologies – with a unit cost of $0/lb nitrogen removed. (These removal rates use the most conservative estimates derived from three studies in Wellfleet, the Mashpee River, and Falmouth, which range from 250-1000 kg/yr per acre. Studies in Chesapeake may suggest even higher removal rates).

Mr. Horsley showed potential 5-acre plot locations, sited in areas with ongoing aquaculture operations. Some shellfish plots have already been established; nitrogen removal data from these plots are currently being recorded. In addition, several partners are conducting research and monitoring benefits of oyster beds, including Wellfleet, NRCS, UMass, and other institutional collaborators.

- *Participants noted oyster plots not displayed on the map.* Mr. Horsley and Mr. Goulet said they would update the map.
- *Particpants also urged the Commission to change verbage from "oyster" to "shellfish" to encompass the farming of other species.*
- *One participant suggested siting oysters in closed shellfishing area – such as Prince's Cove – which would be prohibited from harvesting.*
    - *The group discussed the public's and aquaculture community's response to this idea. Three Bays Preservation received pushback from commercial players on a shellfish reserve area proposed about 3 years ago. Additional floating oyster gear is prohibited due to navigational and aesthetic concerns, but the group agreed that there would be less resistance to*

submerged aquaculture used for restoration. The nitrogen removal benefits of submerged beds may be even greater than floating gear.

- *One participant noted that there are 1700 acres in the Three Bays and that it should be possible to find 28 acres for this purpose within them.*
- *The group also discussed oysters grown on the reef. These do not exist in Three Bays currently. Reef oysters are not profitable because they can't be sold on the half shell market. There are also poaching problems.*

Ecotoilets: Under the scenario, 1,800 kg/yr in nitrogen reduction is achieved with ecotoilets at a unit cost of $1000/lb N. Mr. Horsley mentioned that this number will change dramatically as better information is incorporated into the Technology Matrix. A 5% participation rate among homeowners in the next 10-20 years (i.e. 458 properties) is assumed.

- *One participant felt that a 5% participation rate was low, and cited Australia as a case study where ecotoilets have become a cultural norm. The Falmouth pilot program can be turned to for participation estimates.*
- *The group noted that the cost of composting ecotoilets with installation is often prohibitive for interested homeowners, especially for existing houses with second stories because renovation is required. Costs are less expensive and implementation is easier in new construction.*
- *Urine diversion or composting toilets may be easier and less costly. One participant suggested that $5,000 would pay for the permitting and equipment costs for simpler systems, suggesting that the estimates in the Technology Matrix are inflated by an order of magnitude.*
- *One participant suggested that ecotoilets be considered in two separate classes – self-contained and two-year storage systems. This would greatly affect the costs and likelihood of implementation.* Mr. Horsley agreed to share that comment with the Technology Matrix developers.

Remaining sewer needed: Mr. Horsley noted that using this scenario of non-traditional technologies, a total of 243 homes would still require sewer infrastructure to reduce the final 1000 kg/yr of nitrogen reductions to meet the target load. The unit associated with this sewershed is $300/lb N. He showed the targeted area simulated on a map, and reiterated that this is only one possibility for how these technologies could be paired and implemented – and that a community could decide to rely upon one or all of them.

Scenario Comparison

Mr. Horsley then showed an overall comparison of four scenarios described in the exercise – 1) sewer everything, 2) targeted sewer only, 3) targeted sewer after 50% reductions in fertilizer and stormwater, 4) primarily alternative or non-traditional approaches after 50% reduction in fertilizer and stormwater with targeted sewer if necessary to meet targets. All scenarios are assumed to achieve the TMDL for the watershed. The sewer footprint associated with each was shown on a map, shrinking and expanding depending on the scenario considered. Mr. Horsley noted that by adding additional measures to the non-traditional scenario – e.g. inlet dredging and phytobuffers – the watershed could potentially avoid the need for sewer.

General Discussion of the Scenarios and Methodology

- *One participant asked about the relationship of sewershed footprint size and unit cost.* Mr. Michaud explained that unit cost is dependent on development density. Large distances between parcels will drive costs up.
- *Another participant asked whether build-out is incorporated into the assumptions.* Mr. Horsley explained that the model assumes existing loads, and that the Commission decided to first investigate scenarios using the existing population and measured impact. Growth management and restoration adjustments will be taken into consideration moving forward in later stages of the process. *Another participant added that new growth will change the economics of these options, and stated that a separate model that factors in build-out and captures these dynamics should be developed.*
- The group discussed the relationship between cost and scale in these scenarios. For example, *sewering and I/A could impact the ecotoilet participation rate. Given the option to sewer or install ecotoilets, a community might choose to sewer because it is more familiar, or they may not have the choice because sewering is only cost-effective if nearly everyone connects*. Mr. Horsley noted that homes putting in ecotoilets in Falmouth are being exempted from future sewer costs through a new local bylaw recently adopted. *One participant said this could cause a reaction similar to a phenomenon occurring in Spain, where a mandate to meet a quota for solar energy production has made conventionally-produced energy significantly more expensive for rate payers. Interactive cost functions should be considered in the model, and there should be a comparison of fixed costs versus variable, as well as life cycle costs (i.e. capital or upfront costs vs. maintenance or ongoing costs).* Mr. Horsley stated that he hoped this discussion would take place within the financial group. Their next meeting is December 11 and is open to the public.
- *Another participant shared that EPA has a number of documents on the financial management of wastewater infrastructure.*
- *Another argued that the potential for emerging contaminants and changing regulations should be considered in these scenarios.* Mr. Horsley agreed that it is an important factor to remember, and noted that some approaches, e.g. phytobuffers, constructed wetlands, can address multiple contaminants. Mr. Michaud noted that this is an issue that will be given consideration over the next few months in the next stage of planning.

- Ms. Hulet raised the issue of phased implementation and differing time scales in which nitrogen reduction results are realized. Mr. Horsley noted that EPA has been assisting in the development of a systems dynamics model with time as a central component
    - *One participant noted that it would be helpful to add a column to the analysis representing timing of implementation and results.* Mr. Horsley stated that the Commission will consider adding this to the analysis.
- *The group also discussed the impacts of sea level rise and storm surge. One participant noted that increased storm surge areas should be considered in siting technologies. For example, sewers are not suitable in these areas; rather, self-contained systems (and less costly options) are more appropriate where storm damage is likely.* Mr. Goulet showed a map displaying projected storm surges. Mr. Horsley noted that this map does not take into account the six foot sea level rise that NOAA has projected by the end of the century, and that these need to be incorporated into the plan.[2] Salt marsh and wetland areas will likely be reduced due to both cultural and topographic obstacles as these systems attempt to migrate landward. Additionally, USGS has begun a study of the impacts of sea level rise on groundwater levels on Cape Cod – in nearshore areas, a six-foot sea level rise could result in a six-foot rise in the water table. This will compromise Title 5 systems in low-lying areas which require a minimum 4-foot separation to the underlying water table. Saltwater infiltration to freshwater ponds could also lead to a significant decrease in natural nitrogen attenuation. These effects are critical to the plan, and necessitate an adaptive management approach.
- *One participant noted that a six-foot sea level rise will cover Sampson's Island – which could help greatly with nitrogen flushing.*

IV. ADAPTIVE MANAGEMENT

Scott Horsley explained that an adaptive management approach is critical because of the degree of uncertainty of many of these alternatives and to allow for an integrated approach that involves the most cost-effective strategies over time. The idea behind this concept is to implement and monitor the (lower cost) non-traditional technologies, and if they are not as effective as expected in meeting target nitrogen reduction goals, to implement traditional approaches as necessary to make up the difference.

He provided the Commission's current definition of 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 cost effective and efficient ways."

[2] Sea level projections in 25-year increments are available at the Massachusetts Coastal Zone Management website

He then led the working group through a brainstorming session for a possible adaptive management plan for this watershed, including what non-traditional projects might be implemented first and what monitoring timeframes they would follow. He noted that DEP is receptive to a non-traditional approach, especially given that implementation and results can be achieved quickly relative to the impact timeframe for traditional sewering.

Potential Projects in the Three Bays Watershed

The group suggested that projects should be prioritized if they 1) are cost-effective, 2) have low regulatory barriers, 3) have high public visibility, 4) promise rapid results, and 5) have potential partners for implementation and monitoring.

Given this, the group suggested that non-traditional technologies could be tested by following four pilot projects as the first stage of a Three Bays Watershed adaptive management plan:

1. Oysters and aquaculture in Warren's Cove and other parts of the Three Bays Watershed.

- *Timeframe*: *Implementation: Summer 2014 (e.g.)*
- *Monitoring can be straightforward*
- *One barrier is opposition to floating bags from the town and/or upland land owners, due to aesthetic and navigation reasons*
    - *This might be overcome by careful selection of project sites, in limited use. (Example: Marstons Mills River)*
- *Poaching is an issue – can't have perceived usable shellfish.*
- *Necessitates a public-private partnership between the town and commercial players who can advise or manage implementation. As a starting point, Tamar Haspel can contact Cape Cod Oyster to see if they are willing to share data.*
- *Can generate profit for the town or a commercial partner.*
- *Project should include oysters and quahogs.*
- *The town already has an aquaculture project in Prince's Cove.*

2. PRB installation on Prince Ave

- *Timeframe:*
    - *Implementation: Summer 2015*
    - *Monitoring: Heavy monitoring (e.g. 5 sites) for the first three years. Could reduce to monitoring at two sites after initial monitoring phase.*
- *A co-benefit is that water and sewer lines can be repaired during installation. (One disadvantage, however, is that these lines need to be disconnected during installation)*

- *Falmouth has an example PRB project*

3. Dredging in Mill Pond and/or Cotuit Inlet.

- *Timeframe: This could also be implemented soon in Mill Pond due to studies already completed by Three Bays Preservation (though it should be verified that there have been no emerging contaminants since the last sediment testing).*
- *Monitoring a confined system like Mill Pond will be relatively easy.*
- *This action, by itself, could reduce nitrogen significantly*

4. Ecotoilet public demonstration projects

- *Potential sites include the Prince Cove Marina, the Kettle Ho, and public beaches.*
- *Potential partners include Cape Cod League, Young Professionals Network, the Kettle Ho, the library network, Ropes Beach and the CMYC.* Mr. Horsley noted that a strategic plan could help identify opportunities with partners.
- *Mr. Geyser shared that despite their low cost and ease of implementation, the current plumbing code only allows two-year retention systems to be used in two-story buildings. A change in the plumbing code is needed to address this barrier, or it could be overcome with special permits or variances. The Town of Barnstable is currently unwilling to issue variances, but the chairman is an advocate of ecotoilets and could be educated about the issue.*
- *Falmouth got a variance for a urine diversion system. The working group can look at the process they used.*
- *Cost is a common barrier to ecotoilets. Currently, there is additional funding available for additional systems through the Falmouth Ecotoilet Center's loan program.*

Overall timeframe: *Several participants agreed that a 10-year implementation and monitoring schedule is too long. These four projects could be installed concurrently in 5 years. The group also agreed that decision points should be integrated into the adaptive management plan to guide actions at specific points in time, depending on monitoring results.*

Targeted sewer: *Based on density and other factors, and assuming disposal could be found locally, the group determined that the best sites to initially target sewer infrastructure include:*

- *Cotuit Bay Shores – collected waste could be treated at Stop and Shop, which is already designated for regional use.*
- *Downtown Osterville – already of concern to the Board of Health*
- *Along Craigville Beach Road and the Centerville River – close to the wastewater treatment plant and geometrically linear.*

General Discussion on the Adaptive Management Plan

- *Three Bays Preservation has already developed a series of potential pilot projects with monitoring programs, but these received significant pushback from DEP when proposed several years ago. For example, the Mill Pond dredging project ran into several barriers including 1) concern over an endangered species (bridal shiners); 2) required archaeological surveys; and 3) DEP's inability to ensure credit for the project's estimated 12% nitrogen reduction.*
  - Mr. Horsley responded that DEP is now receptive to giving credit to pilot projects with monitoring schedules in the 208 Plan Update process
  - Ms. Hulet added that it is helpful to the process if the group anticipates the regulatory constraints that DEP is bound to consider (e.g. the Endangered Species Act, cultural preservation, etc.) and addresses those in the project and monitoring proposals.
- *Educating regulatory people, local entities (eg. Town Council, Town of Barnstable, the Board of Health), leaders, and the public is critical. Our most difficult obstacle is the regulatory staff who are accustomed to traditional approaches (e.g. sewer). As an example of ineffective communication on non-traditional alternatives, it was mentioned that proposals for ecotoilets and permeable parking for Sandy Neck were ill-received, and that the site now has a traditional Title V leaching field under the parking lot.*
  - Mr. Horsley noted that regulatory personnel are integrated into the 208 Plan Update process, are being informed of the current science on non-traditional technologies, and are transforming their approach to these alternatives. He also noted that demonstration projects can educate the public and decision-makers. (Examples: Wellfleet community composting toilet, Provincetown Urine Diversion units in public restrooms.) Conversations need to continue, however, and this needs to be a major focus for the Commission moving forward.
- *The plan needs to highlight fertilizer and stormwater reduction as the primary mitigation efforts in eliminating the influx of nitrogen. These can yield very quick results (Example: San Francisco Bay).*
  - Mr. Horsley clarified that the plan clearly states fertilizer and stormwater reductions as primary mitigation efforts.

V. PREPARING FOR 2014 JAN-JUNE

Triple Bottom Line (TBL) Analysis

Erin Perry, Special Projects Coordinator at the Cape Cod Commission, presented on the work that the Commission has done with AECOM to develop a Triple Bottom Line model. First, she defined Triple Bottom Line Analysis as a full accounting of the financial, social, and environmental consequences of investments or policies. She also noted that TBL analysis is often used to 1) evaluate scenario alternatives and rank them against each other; and 2) report to stakeholders on the public outcomes of a given investment. To explain why the Commission has decided to pursue a TBL model, Ms. Perry shared that it will allow the Commission to:

- Consider the financial, environmental, and social consequences of water quality investments and policies in Cape Cod
- Evaluate the “ancillary” or downstream consequences of water quality investments, not just direct phosphorous or nitrogen level reductions.

She also explained that AECOM is working with Commission staff and stakeholders to develop criteria that integrate social, environmental, and financial considerations into the TBL model. These include:

- **Social**: System Resilience (i.e. how communities respond to natural hazards), Employment, Property Values, Ratepayer Distribution, Recreation and Open Space, Fiscal Impacts
- **Environmental**: Marine Water Quality, Fresh Water Quality, Climate, Habitat
- **Financial**: Municipal Capital Costs, Municipal Other Costs, Property Owner Capital Costs, Property Owner Other Costs.

Ms. Perry then showed how three different hypothetical scenarios (minimum cost, cost effective, and maximum performance), when run through the model, rank comparatively, taking into consideration these social, environmental, and financial factors. She explained the model will be finalized by January or February 2013, and that the Commission will be using it over the next six months to assist in scenario evaluations.

- *Several participants expressed some confusion over how the financial dimension was visually depicted.*
- *One participant commented that it would be helpful to have a “no action” scenario run through this model so as to compare the social, environmental, and financial outcomes of doing nothing to the outcomes of other scenarios.*
- *Another participant noted that social criteria should include public health considerations such as days absent from work or school due to poor air or water quality across the community.*

Next Steps in the Stakeholder Process

Ms. Perry explained to the Working Group the next steps of the 208 Plan Update, which include:

January 2014 Assemble all 175 stakeholders across Cape Cod for a one-

	day Stakeholder Summit (tentatively scheduled for Jan 31) to discuss further planning, share the outcomes from stakeholder meetings, and form four sub-groups representing the Upper-, Mid-, Lower-, and Outer-Cape. These groups will likely meet three more times (Feb, March, April) and guide discussions over the next six months. The Commission may also convene an ad-hoc meeting to discuss monitoring protocols for different technologies.
February 2014	Meetings with the four sub-groups to further develop local scenarios and run them through the TBL model.
March 2014	Analysis performed by the Regulatory, Legal, and Institutional Work Group. The scenarios developed by the four sub-groups will be evaluated based on this analysis.
April 2014	Meetings with the four sub-groups to discuss monitoring and financial considerations of implementation.
June 1, 2014	Draft plan submitted to DEP.
June – Dec 2014	Public comment period on the draft plan.
January 2015	Submit final plan to DEP

VI. THE ROLE OF COMMUNITY

Ms. Hulet noted that over the next six months, the Commission will be considering how to best communicate the 208 Update process to the public and to educate the community on the proposed approaches. She invited Mr. Steve Brown, a working group member, to present some thoughts had shared with her previously on the role of community.

Mr. Brown shared a two-page document he developed on this subject (Appendix B). He discussed how to gain trust within the community, and highlighted the importance of language (e.g. using vocabulary such as "transaction" and "transformation" as opposed to "change," which people often resist). He also noted the relationships between data, identity, and relationships in the context of community, and said these are only leveraged effectively when community is engaged.

In response, *one participant suggested that engaging local inspectors and board of health staff is critical to achieving the objectives of the working group. These local staff* *can wield a significant amount of influence in being able to change regulations or approve variances.*

VII. PUBLIC COMMENT

- *One participant suggested the work group look at what Falmouth has included in its comprehensive wastewater plan, which is based on an adaptive management approach. He suggested that the group consider knowledge exchange between the two communities to share their lessons learned.* Ms. Perry replied that this knowledge exchange is already occurring, and that the Commission has been closely following their wastewater plan. Additionally, a Falmouth representative will be in the Upper Cape sub-basin working group with Three Bays & Centerville participants in the next several months, so there will be plenty of opportunity for further knowledge transfer.

Mr. Horsley and Ms. Hulet thanked the group for their participation and adjourned the meeting.

APPENDIX A

Three Bays and Centerville River Workshop Three
December 4, 2013
Participant List

Name	**Affiliation**
Representatives	
Mary Barry	Resident of Barnstable
Jaci Barton	Barnstable Land Trust
Steve Brown	Red Lily Pond Project
Fred Chirigotis	Barnstable
Tom Colombo	Hyannisport Club
Lindsey Counsell	Three Bays Preservation
Beth Ferranti	Citizen
Conrad Geyser	Cotuit Dry Toilet
Tamar Haspel	Indian Ponds Association
Holly Hobart	Indian Ponds Association
Tom Klein	Citizen
Darren Meyer	Sandwich Health Department
Public Attendees	
Rob Adler	U.S. EPA
Fred Dempsey	Barnstable Association of Recreational Shellfishing
John Doriss	Cotuit Civic Association
Monica Mejia	Tufts University
Staff	
Scott Horsley	Area Manager, Cape Cod Commission
Erin Perry	Special Projects Coordinator, Cape Cod Commission
Scott Michaud	Hydrologist, Cape Cod Commission
Shawn Goulet	GIS Analyst, Cape Cod Commission
Carri Hulet	Consensus Building Institute
Lauren Dennis	Consensus Building Institute

APPENDIX B – STEVE BROWN'S THOUGHTS ON COMMUNITY

The Third Aspect of Triple Bottom Line: "Community"

The 208 Planning Process has devoted considerable time and energy to researching, categorizing and discussing technological strategies for addressing wastewater management, as well as projecting the cost and potential return on investment for these strategies.

In order for these positive environmental and economic outcomes to be implemented, I think we need to pay equal attention to the third bottom line, "community."

With this in mind, I'd like to share some insights from my work. Over the last fifteen years, I've consulted with Barnstable County, UMass, and a broad spectrum of organizations in both the public and private sectors, to define and foster community on Cape Cod.

Three perspectives come to mind.

First, how do we define community? In terms of the 208 Planning Process, I think we should discuss defining community. In my work with the "Monitoring the Human Condition" project through Barnstable County Department of Human Services, 2000- 2008, we drew on the work of Robert Putnam (Bowling Alone), and used the following definition of community, developed by Barbara Israel of the University of Michigan:

> "Community is characterized by a sense of identification and emotional connection to other members, common symbol systems, shared values and norms, mutual—though not necessarily equal—influence, common interest, and commitment to meeting shared needs. Communities of identity may be centered on a defined geographic neighborhood or a geographically dispersed ethnic group with a sense of common identity and shared fate."

We balanced this academic definition with a more poetic one, from Starhawk:

> "Community means strength that joins our strength to do the work that needs to be done."

Thinking about wastewater, along this spectrum it seems to me that four process questions should be addressed:

1. Values: What core values do Cape Codders share?
2. Politics: Who decides what will happen to Cape Cod's wastewater, and how will these decisions made?
3. Envisioning Outcomes: Is there an emerging consensus on what citizens want to see on Cape Cod in 50 years in terms of wastewater management?

4. Public involvement: What community-based strategies will be used for publicizing this work and promoting proven best practices?

Existing data: A second area that I think it would be useful to take a look at is local work that's been done on the "triple bottom line" over the last decade. For example, I was involved in the "Cape Cod Sustainability Projects" from 1998- 2006, which hosted many community discussions and produced reports (http://www.capecodedc.org/2020TableofContents.htm). This work contributed to the body of "community data" and may have led to our current work, and contains lots of relevant data which at some point should be explored.

CBO's and FBO's: Third, I think it would be a good idea to discuss a strategy to further engage community- and faith-based organizations such as non-profit agencies, churches, synagogues, schools, and civic associations, where the idea of "community" is discussed and debated. Imagine if all the school superintendents, priests, rabbis, ministers, and imams on Cape Cod embraced effective watershed-based wastewater management as a top priority for 2014? This is not that far-fetched—last weekend I attended the "Bioneers - Connecting for Change" conference in New Bedford, where more than a thousand people participated in three days of keynote presentations and group workshops on many of the issues we're discussing, and applied community-based advocacy strategies to solving real problems (http://www.marioninstitute.org/connecting-for- change).

I think these three areas tackle "community" in depth and could add value to our work and inform our 208 Planning Process. Thanks for the opportunity to share!

--Steve Brown

Cape Cod 208 Area Water Quality Planning
Waquoit and Popponesset Bays Watershed Working Group

Meeting Three
Wednesday, December 11, 2013
Mashpee Town Hall, 16 Great Neck Road North, Mashpee, MA
1:00 pm – 5:00 pm

Agenda

1:00 Welcome, Review 208 goals and Process and the Goals of today's meeting – *Cape Cod Commission Area Manager*

1:15 Introductions, Agenda Overview, Updates and Action Items– *Facilitator and Working Group*

1:30 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

3:00 Break

3:15 Adaptive Management – *Cape Cod Commission and Working Group*

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

4:00 Preparing for 2014 Jan-June – *Cape Cod Commission and Working Group*

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

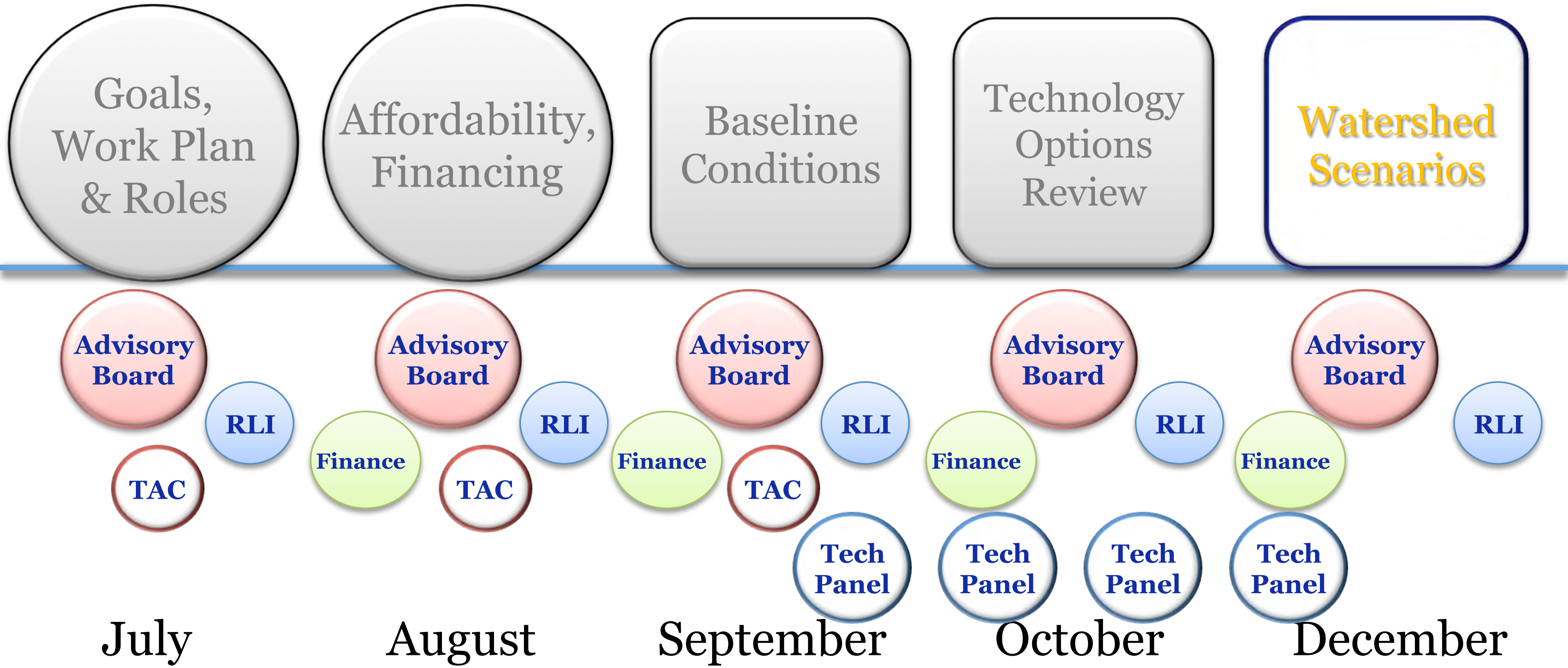
4:45 Public Comments

5:00 Adjourn

Waquoit Bay & Popponesset Bay Group

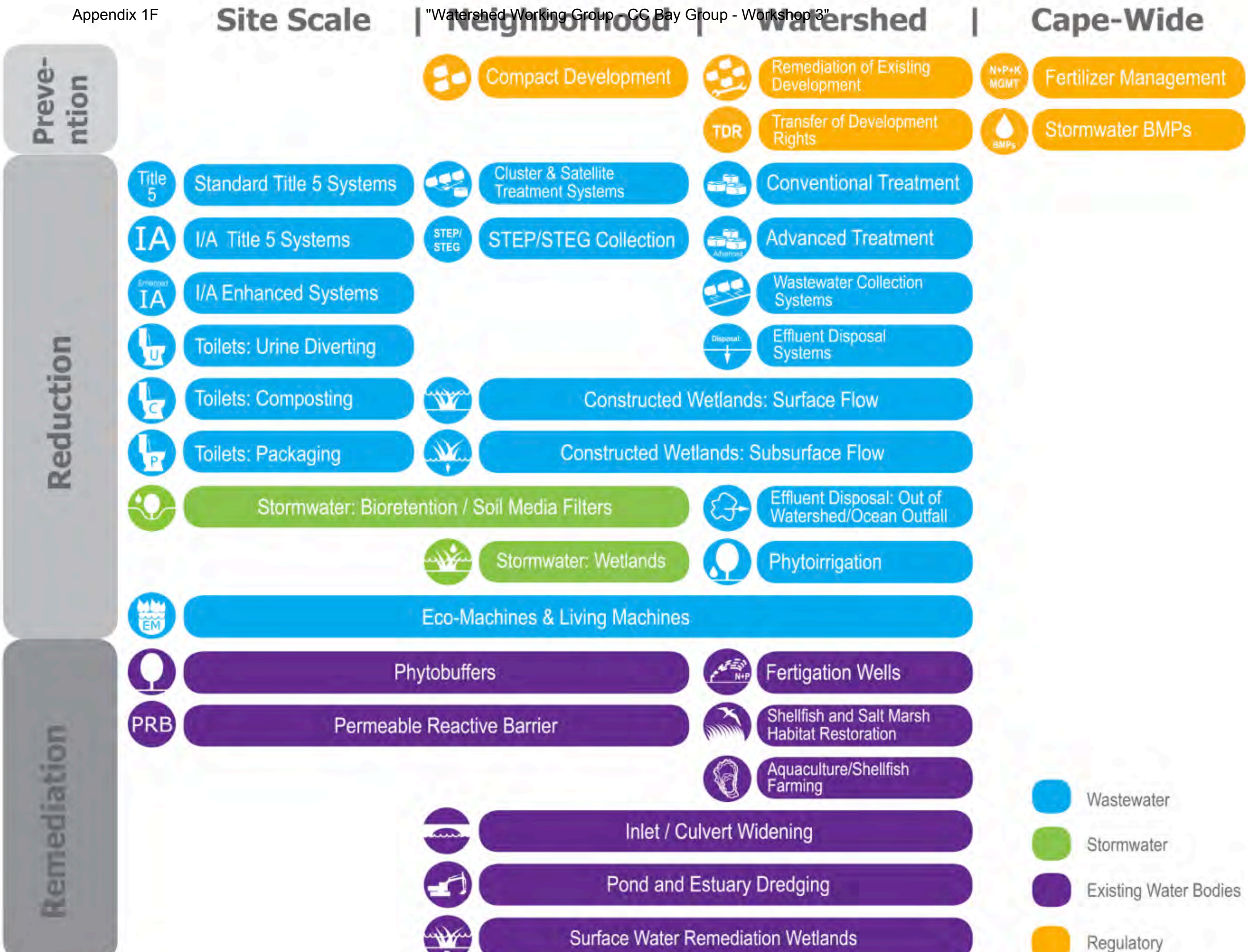
Watershed Scenarios

Public Meetings Watershed Working Groups



RLI Regulatory, Legal & Institutional Work Group

TAC Technical Advisory Committee of Cape Cod Water Protection Collaborative


Site Scale
Neighborhood
Watershed
Cape-Wide
Preve-ntion
Reduction
Remediation
Compact Development
Remediation of Existing Development
Fertilizer Management
TDR
Transfer of Development Rights
N+P+K MGMT
Stormwater BMPs
BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced Treatment
Advanced
IA
I/A Enhanced Systems
Wastewater Collection Systems
Toilets: Urine Diverting
Disposal
Effluent Disposal Systems
Toilets: Composting
Constructed Wetlands: Surface Flow
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
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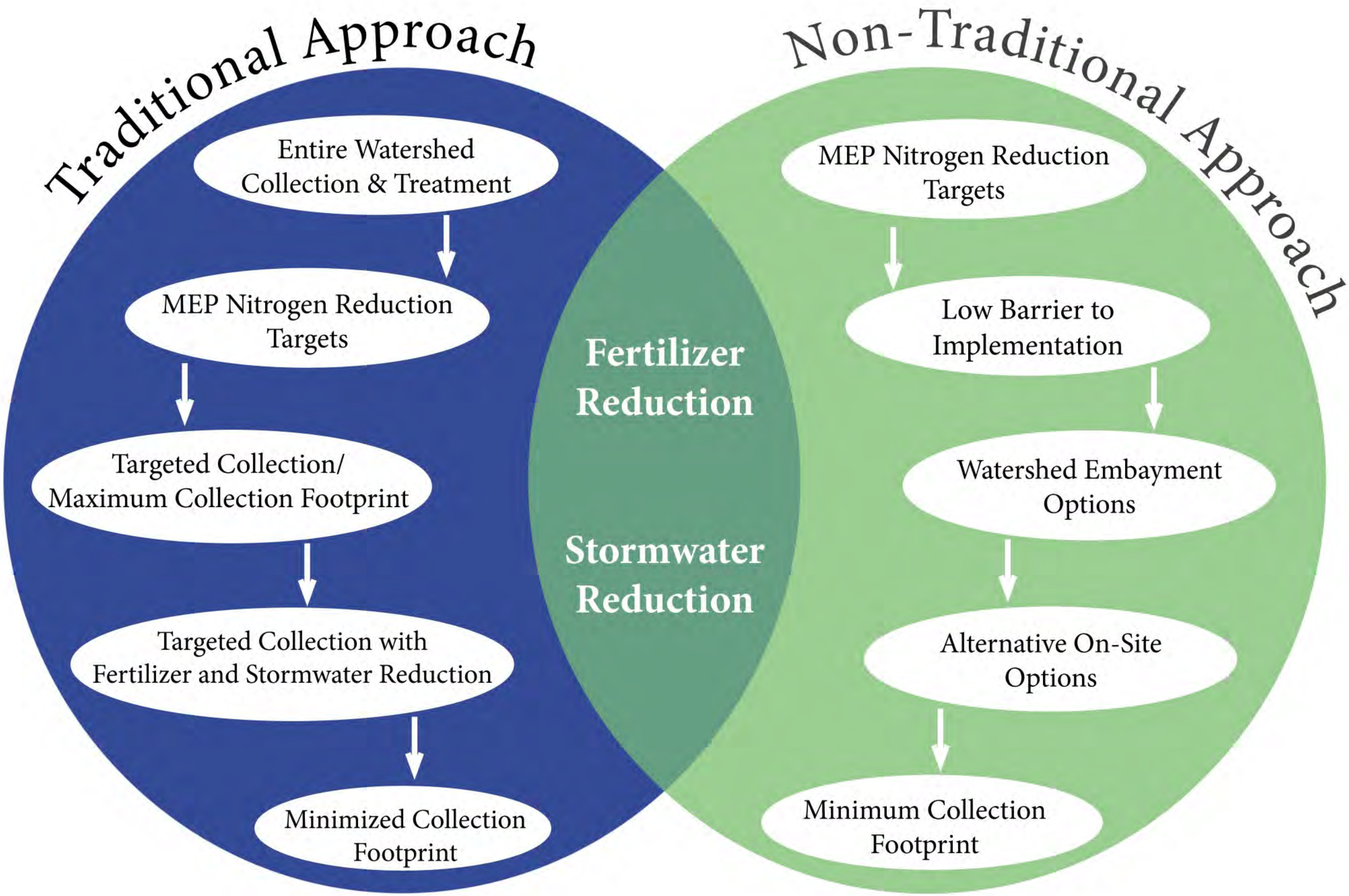
EM
Eco-Machines & Living Machines
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

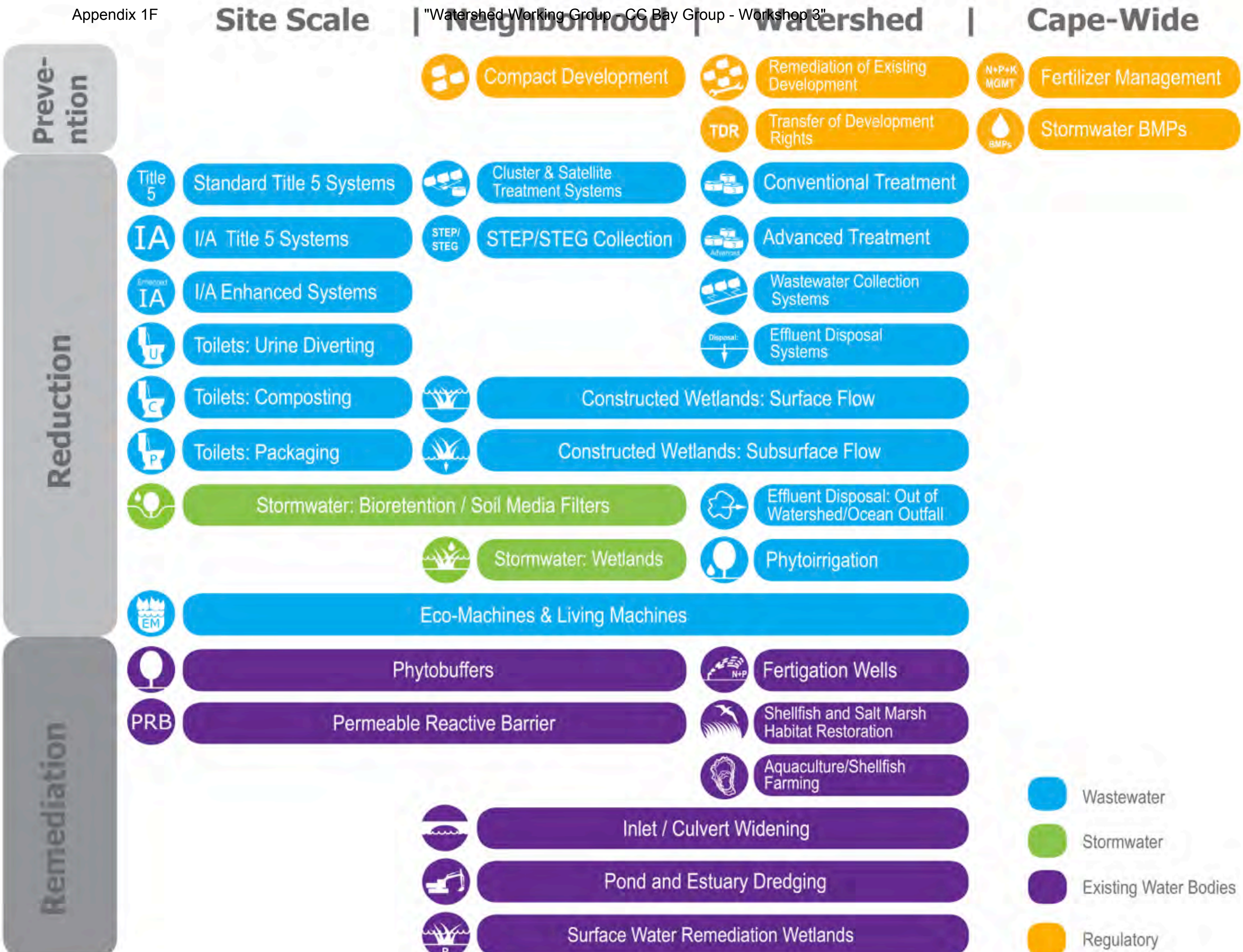
Watershed Scenarios

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


Site Scale | Neighborhood | Watershed | Cape-Wide
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Remediation
Compact Development
Remediation of Existing Development
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Transfer of Development Rights
Stormwater BMPs
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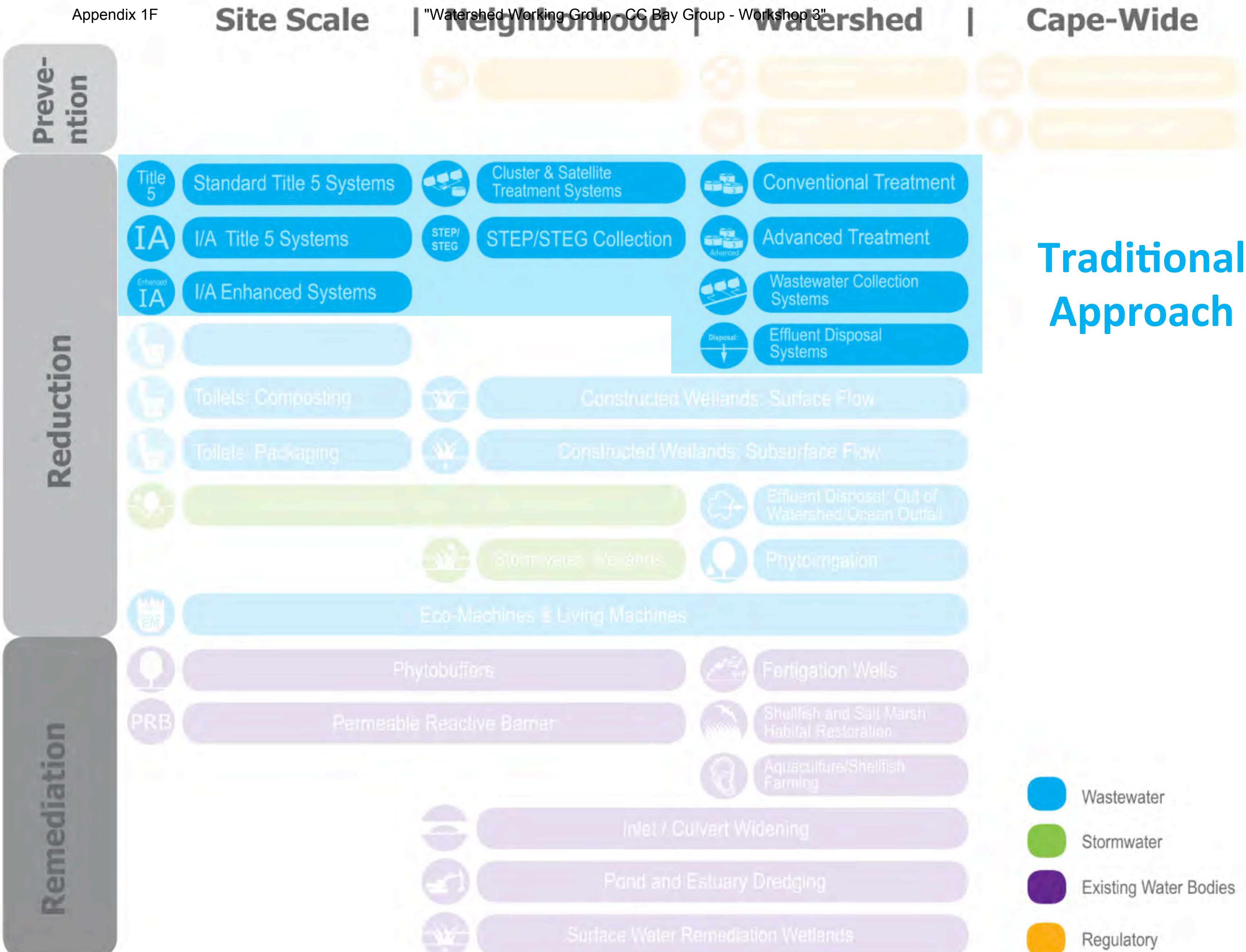
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
Eco-Machines & Living Machines
Phytobuffers
Fertigation Wells
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory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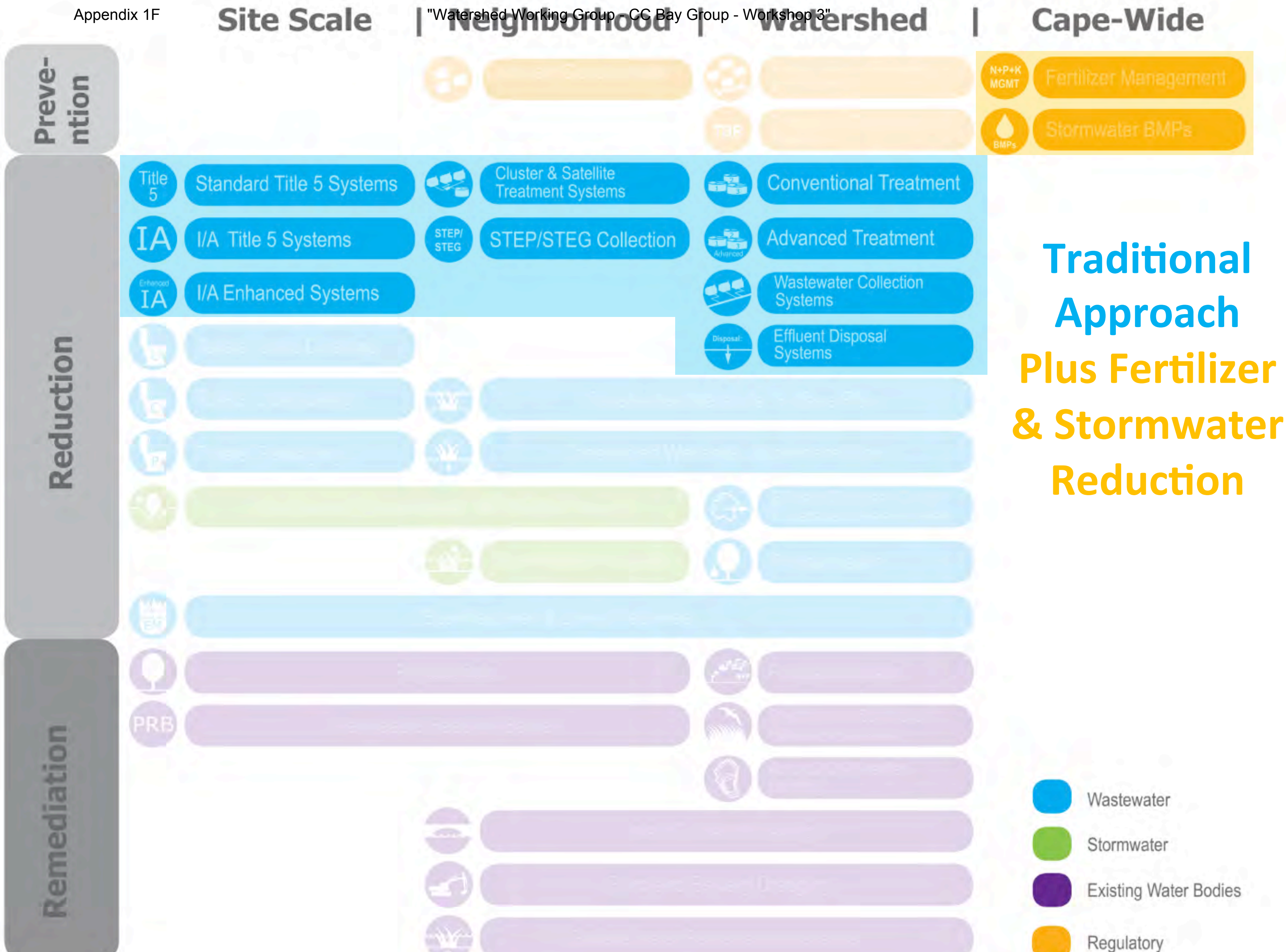
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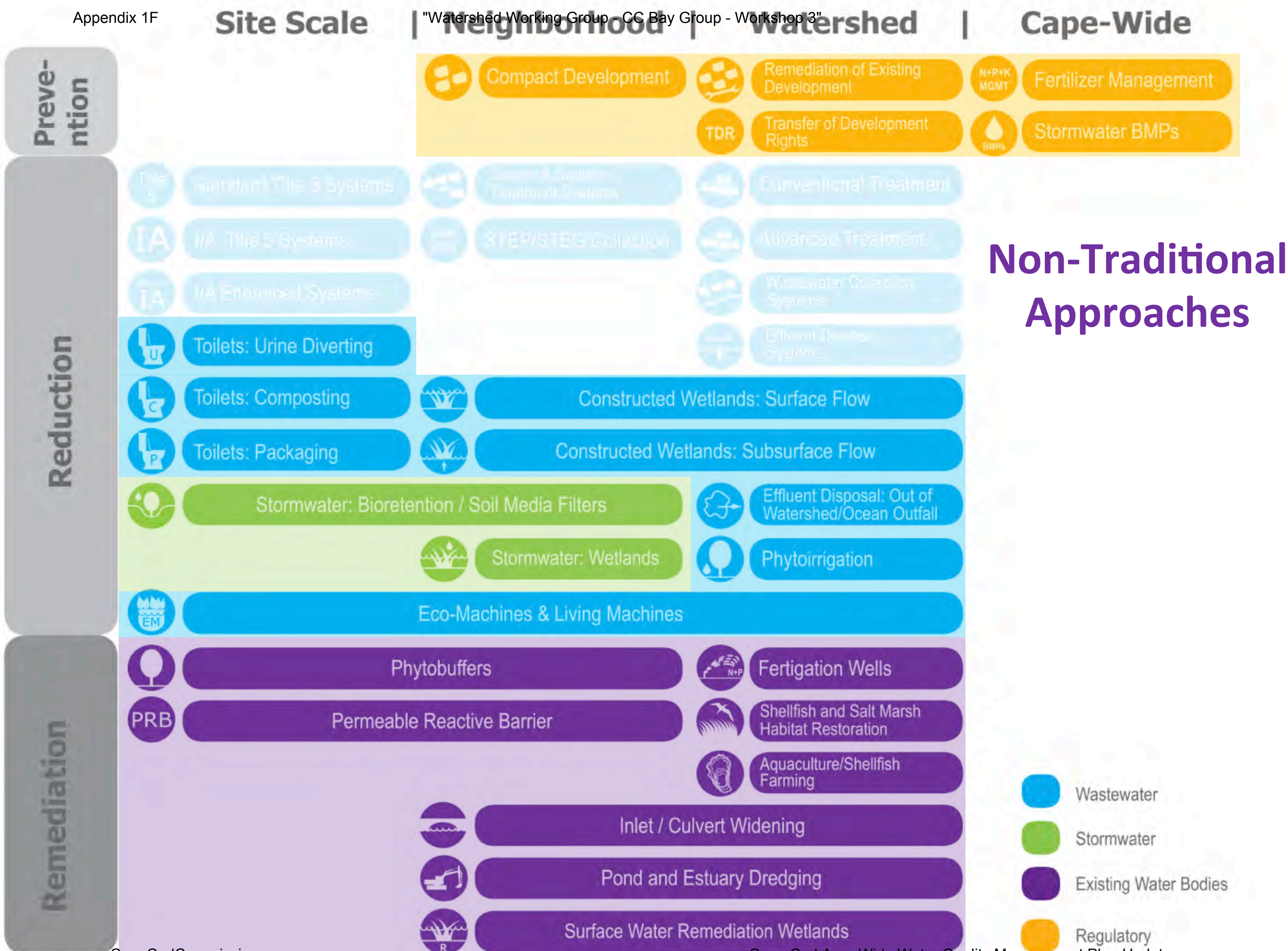
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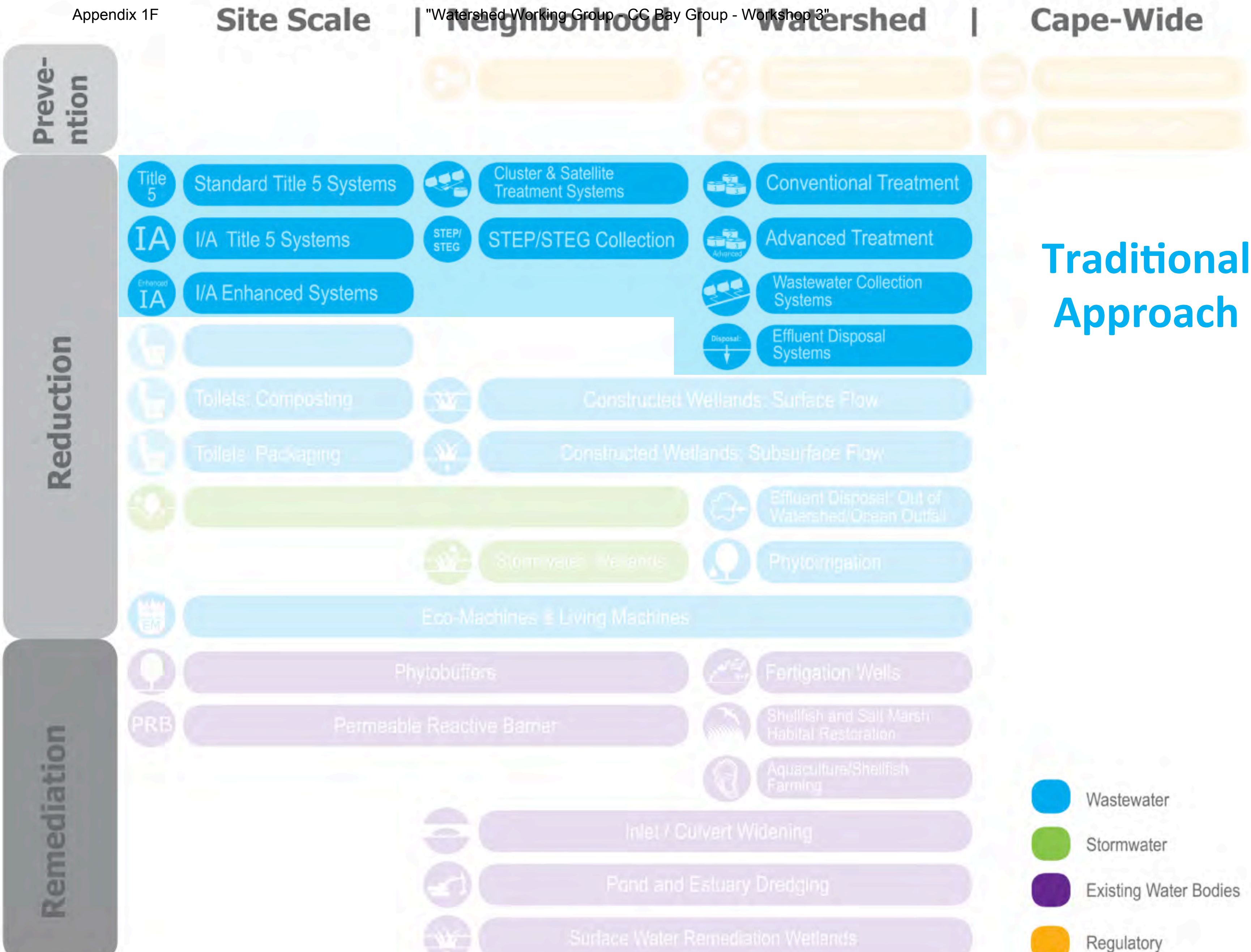
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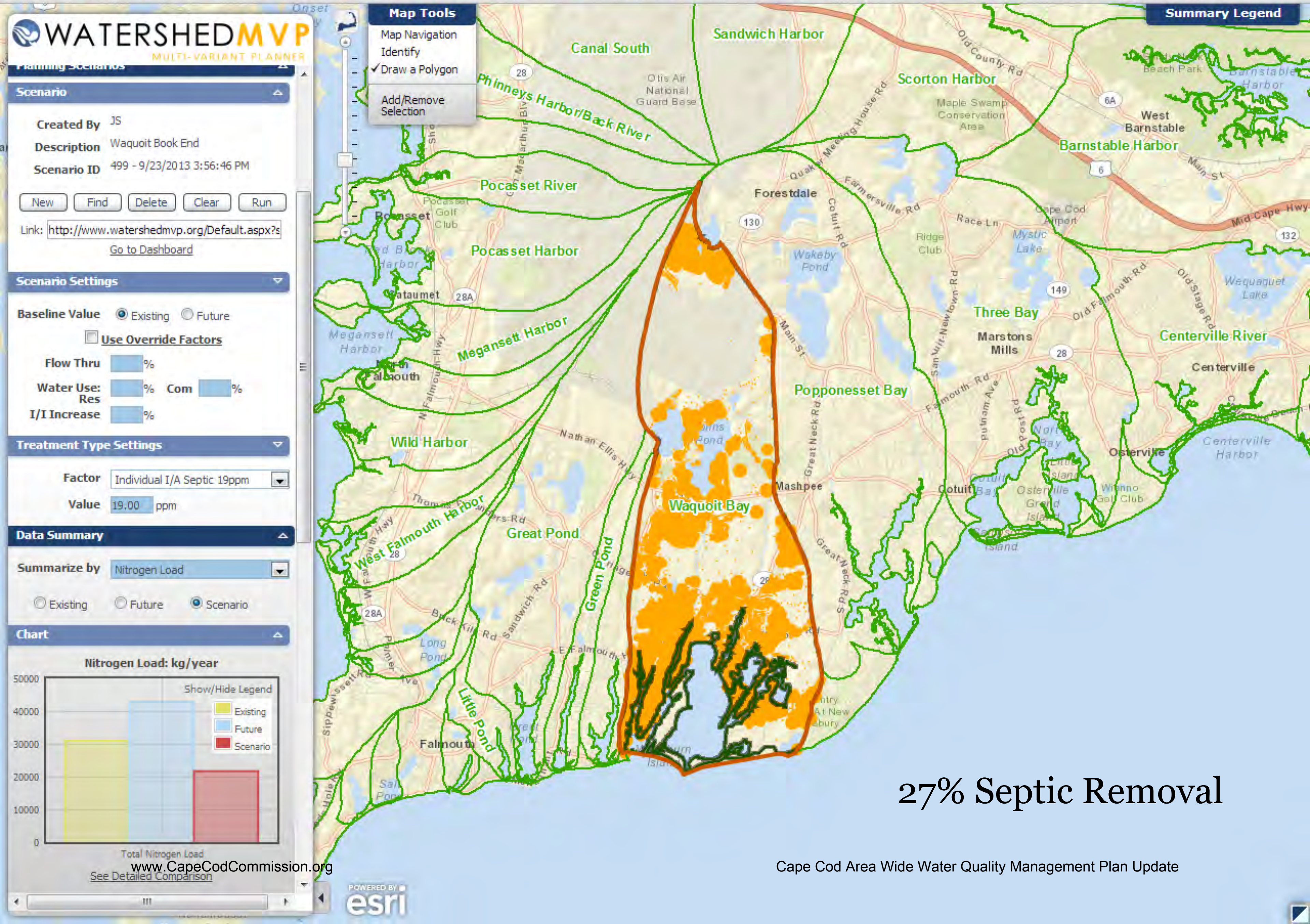
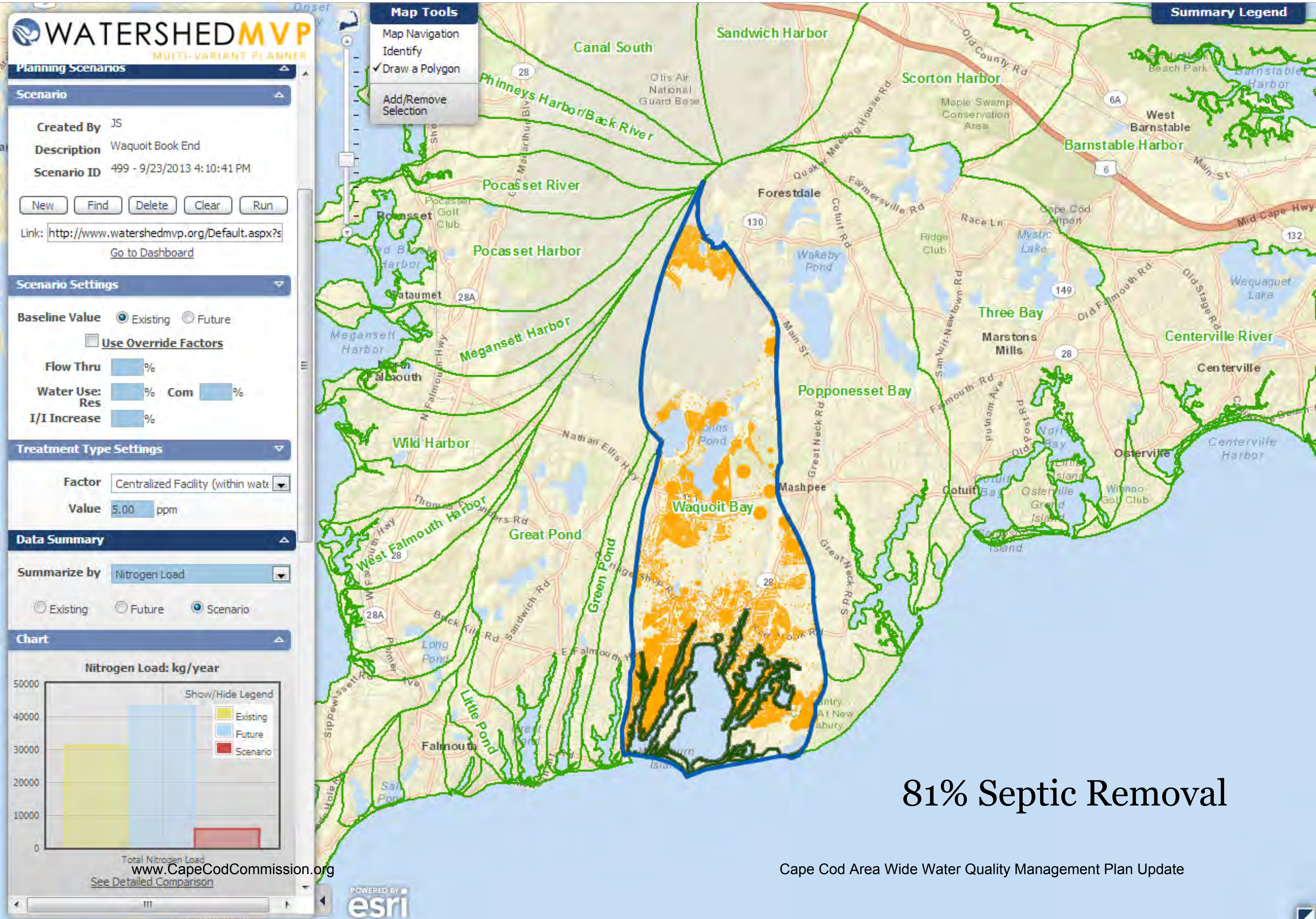
Regulatory

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



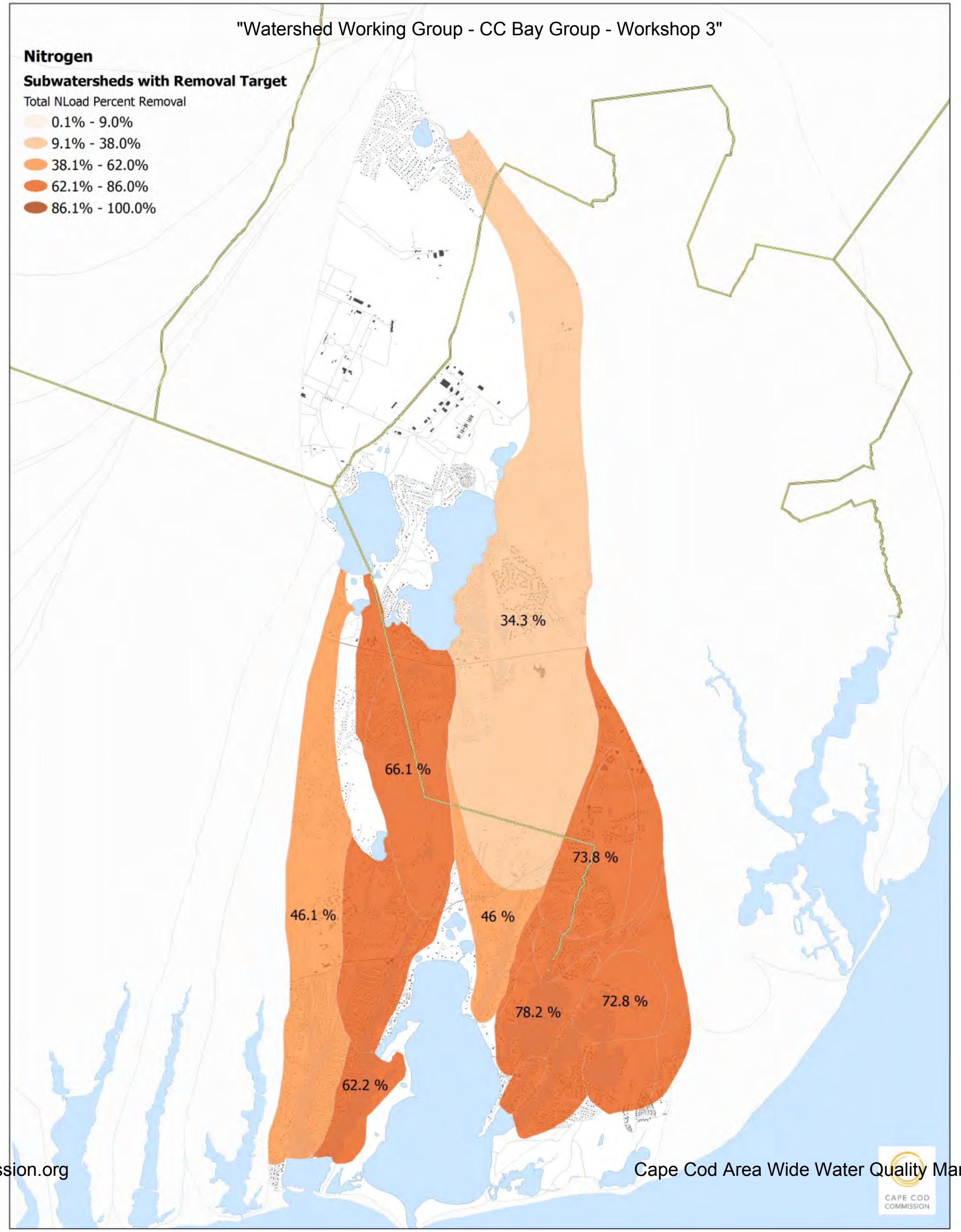
27% Septic Removal

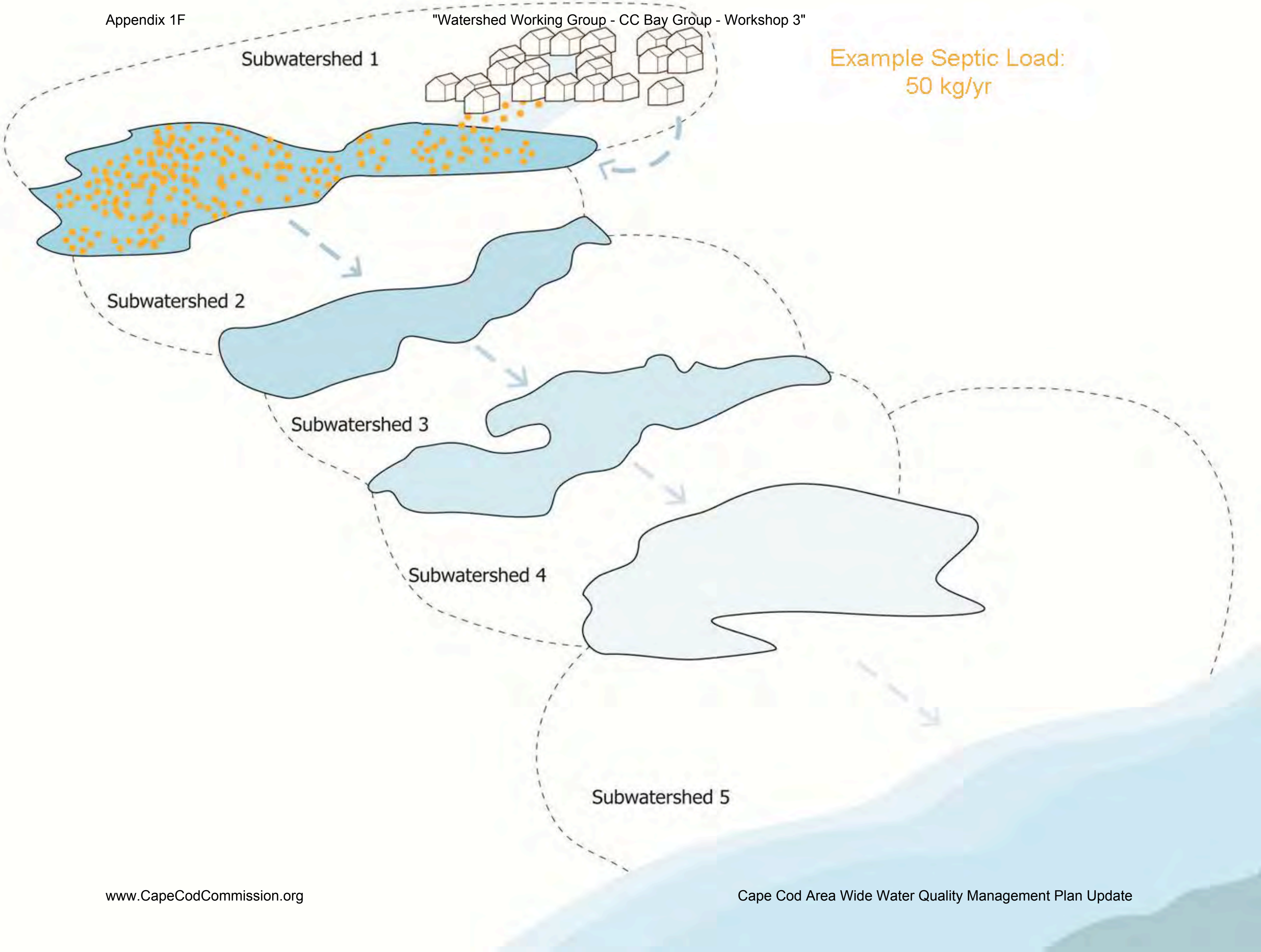
Watershed-Wide Centralized Treatment with Disposal Inside the Watershed

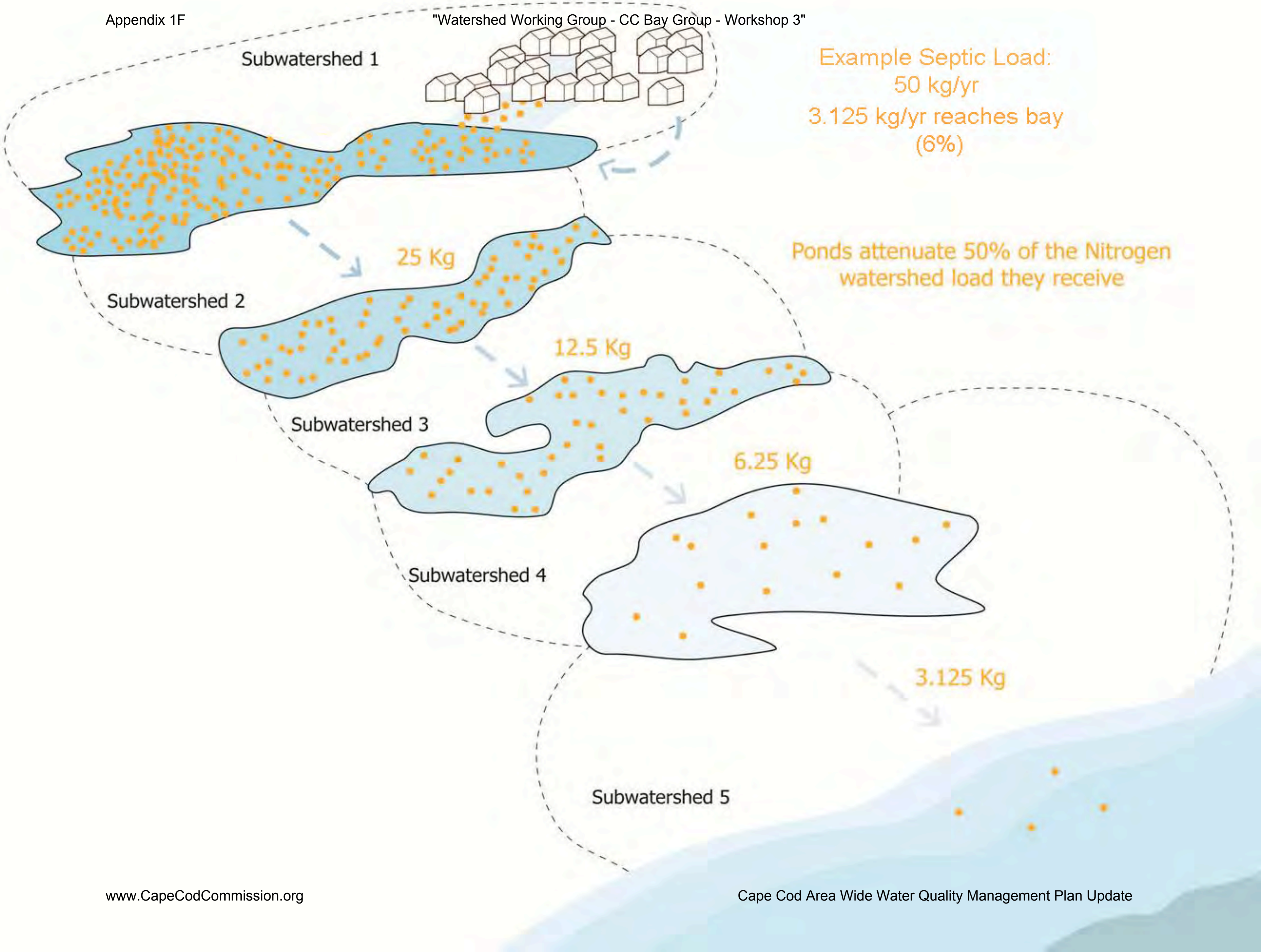


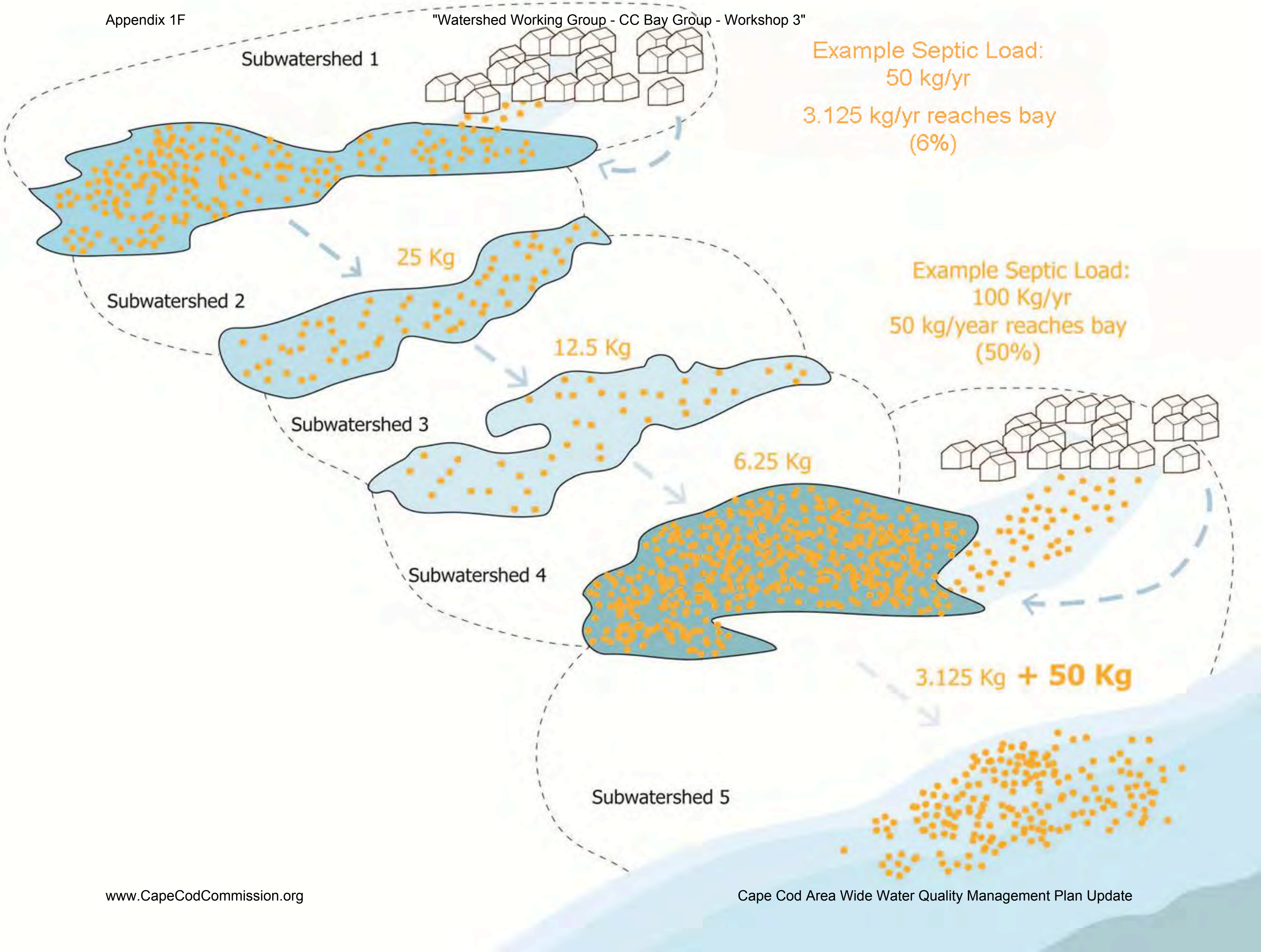
81% Septic Removal

"Watershed Working Group - CC Bay Group - Workshop 3"

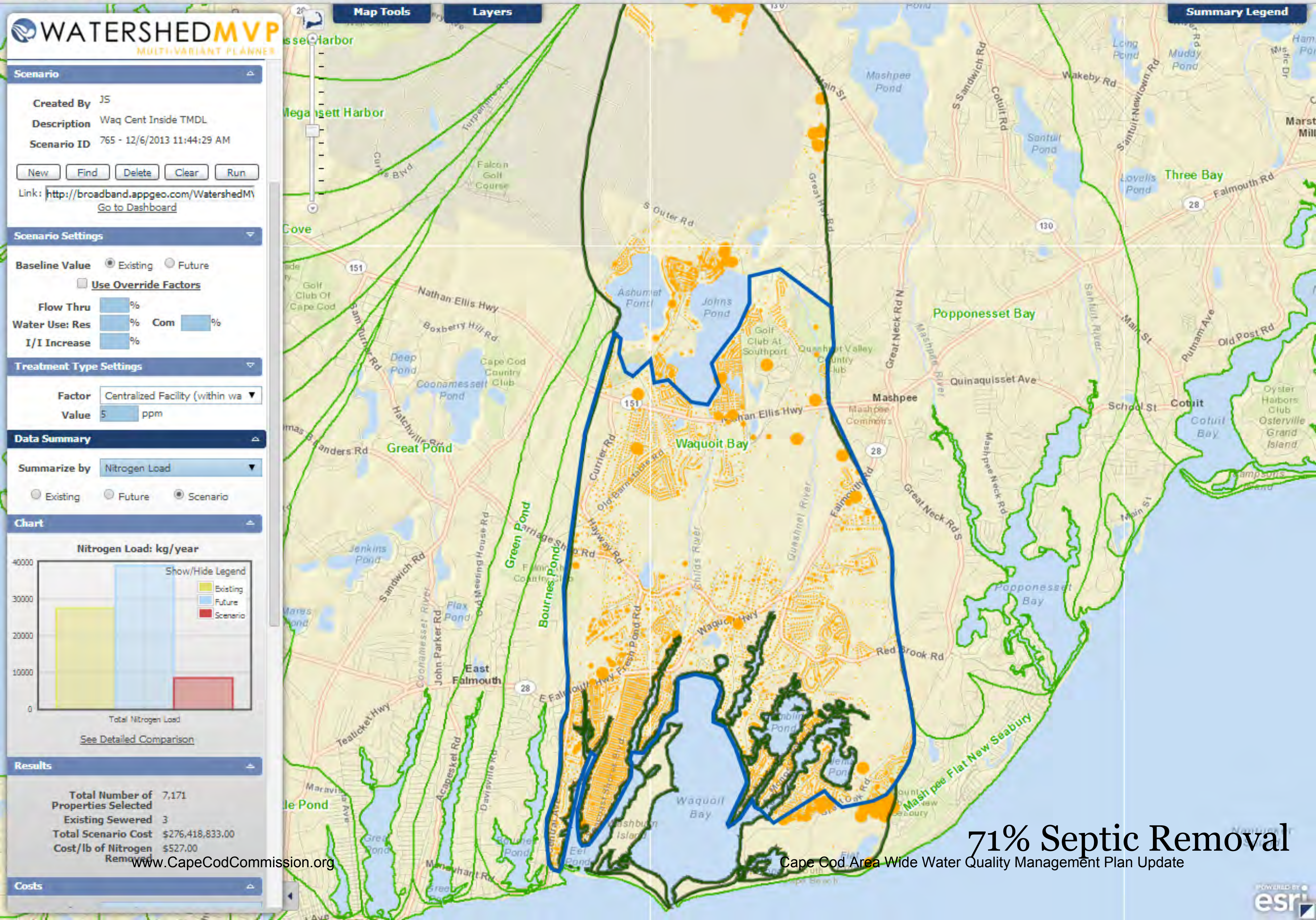



Subwatershed 1
Example Septic Load:
50 kg/yr
Subwatershed 2
Subwatershed 3
Subwatershed 4
Subwatershed 5

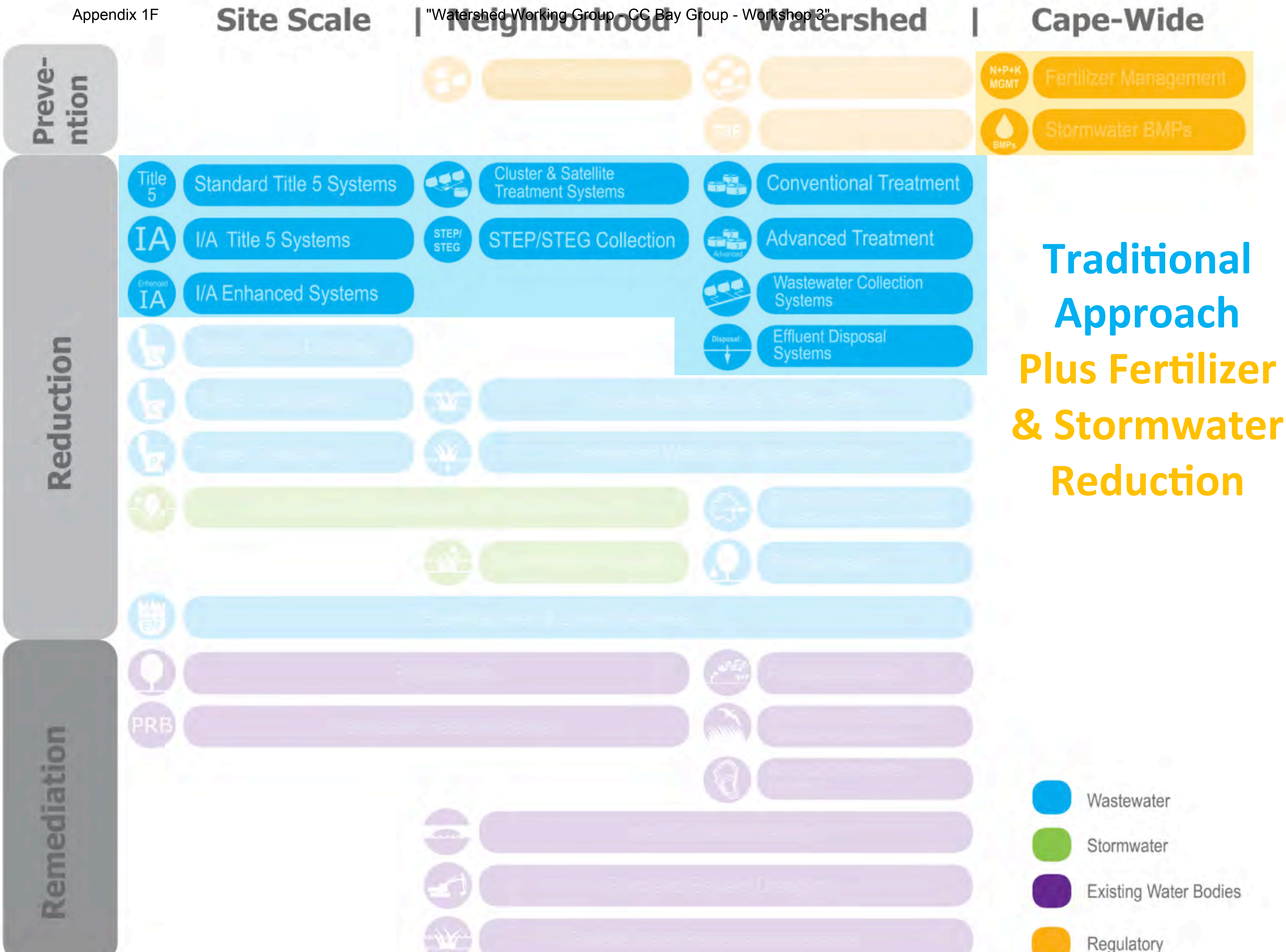

Subwatershed 1
Example Septic Load:
50 kg/yr
3.125 kg/yr reaches bay
(6%)
25 Kg
Subwatershed 2
Ponds attenuate 50% of the Nitrogen
watershed load they receive
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg
Subwatershed 5


Subwatershed 1
Example Septic Load:
50 kg/yr
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



71% Septic Removal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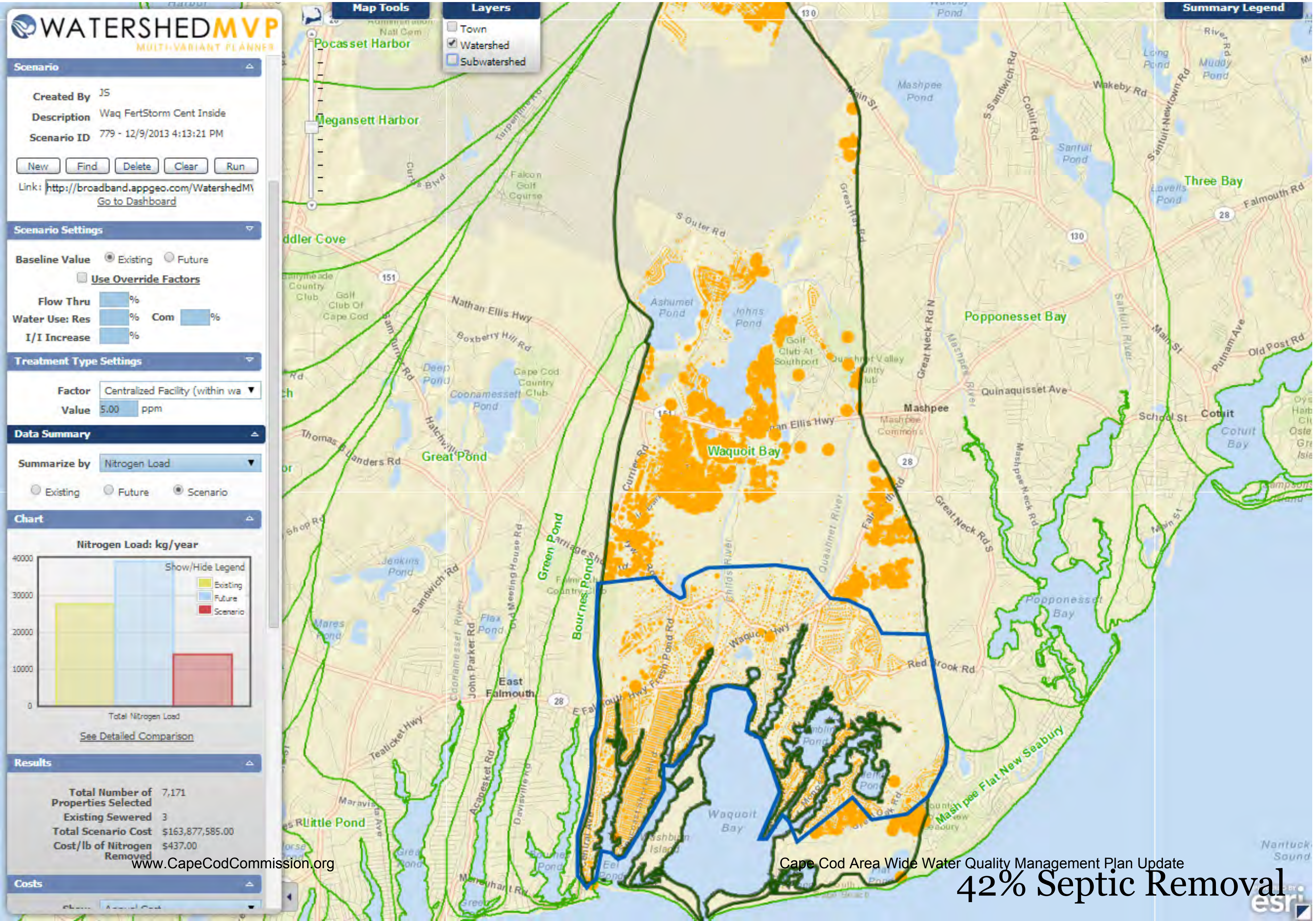
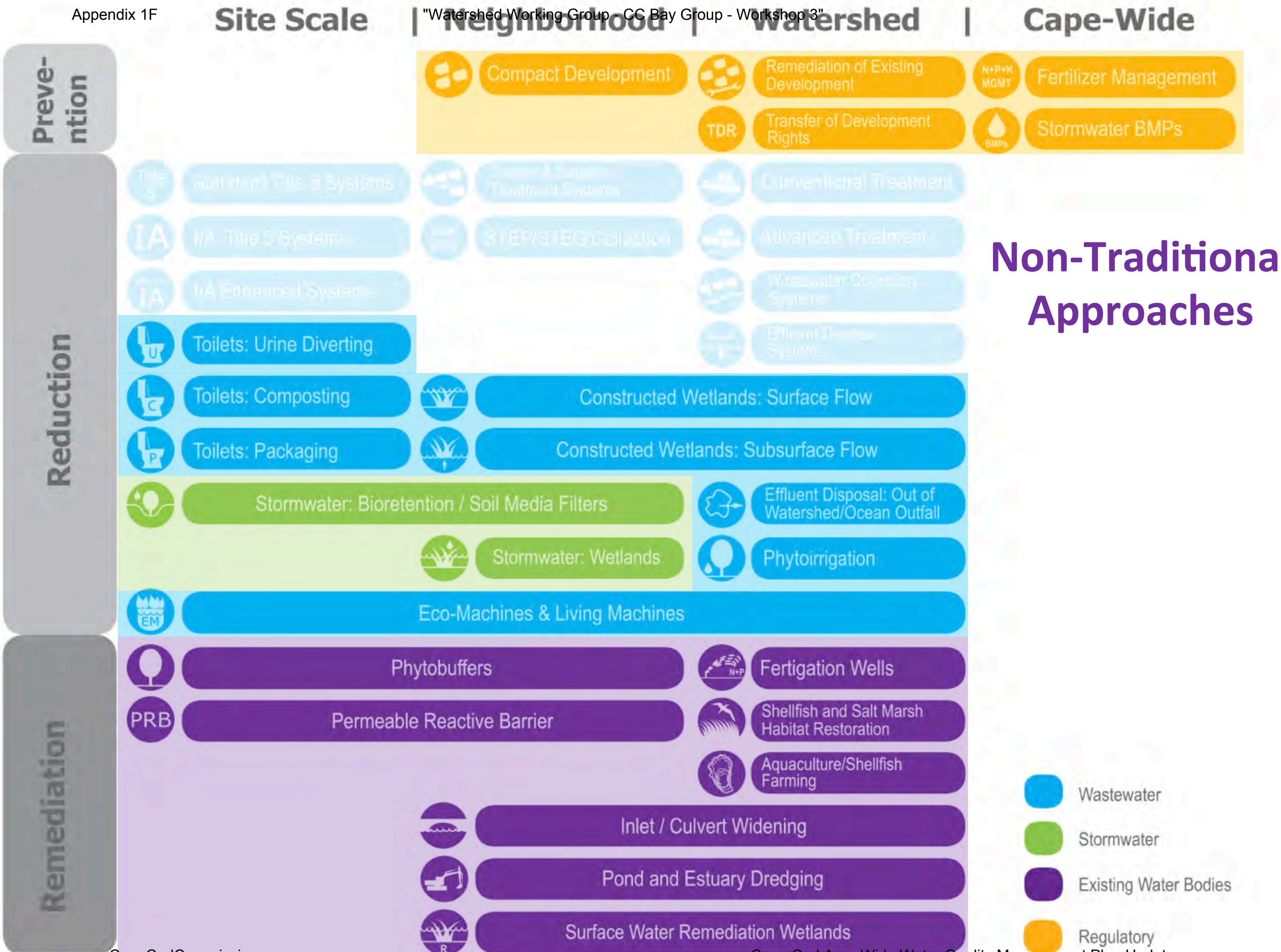
Effluent Disposal Systems
PRB
Traditional Approach
Plus Fertilizer & Stormwater Reduction
Wastewater
Stormwater
Existing Water Bodies
Regulatory

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



42% Septic Removal


Site Scale | Neighborhood | Watershed | Cape-Wide
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Pond and Estuary Dredging
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory


Problem Solving Approach
Wastewater
Existing Water Bodies
Regulatory
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
N+P+K MGMT
BMPs
4
Watershed/Embayment Options
A. Permeable Reactive Barriers
B. Inlet/Culvert Openings
C. Constructed Wetlands
D. Aquaculture
PRB
R
5
Alternative On-Site Options
A. Eco-toilets (UD & Compost)
B. I/A Technologies
C. Enhanced I/A Technologies
D. Shared Systems
Title 5
Enhanced IA
C
IA
U
P
6
Priority Collection/High-Density Areas
A. Greater Than 1 Dwelling Unit/acre
B. Village Centers
C. Economic Centers
D. Growth Incentive Zones
Advanced
Disposal
STEP/STEG
7
Supplemental Sewering
Advanced

Watershed Calculator **Waquoit Bay**

MEP Targets and Goals:		kg/day	Nitrogen (kg/yr)
Present Total Nitrogen Load:		90.866	33,166
wastewater		64.142	23,412
fertilizer			4,184
stormwater			4,775
Target Nitrogen Load:		42.3	15,440
Nitrogen Removal Required:		**48.566**	**17,727**
Total Number of Properties:	7171		

Watershed Calculator Waquoit Bay

MEP Targets and Goals:		kg/day	Nitrogen (kg/yr)
Present Total Nitrogen Load:		90.866	33,166
wastewater		64.142	23,412
fertilizer			4,584
stormwater			5,170
Target Nitrogen Load:		42.3	15,440
Nitrogen Removal Required:		**48.566**	**17,727**
Total Number of Properties:	7171		

Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

Watershed Calculator — Waquoit Bay

MEP Targets and Goals:		kg/day	Nitrogen (kg/yr)
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Total Number of Properties:	7171		

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	2,292	15,435	
Stormwater Mitigation	2,585	12,850	

Watershed Calculator Waquoit Bay

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**	
Present Total Nitrogen Load:		90.866	33,166	
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Low Barrier to Implementation:		**Reduction by Technology (Kg/yr)**	**Remaining to Meet Target (Kg/yr)**	**Unit Cost ($/lb N)**
Fertilizer Management		2,292	15,435	
Stormwater Mitigation		2,585	12,850	
Watershed/Embayment Options:				
Permeable Reactive Barrier (PRB)	879 homes	2,707	10,142	$452

Watershed Calculator Waquoit Bay

MEP Targets and Goals:		kg/day	Nitrogen (kg/yr)
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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			2,292	15,435	
Stormwater Mitigation			2,585	12,850	
Watershed/Embayment Options:					
Permeable Reactive Barrier (PRB)	879	homes	2,707	10,142	$452
Constructed Wetlands	5	acres	2,830	7,312	$521

Watershed Calculator **Waquoit Bay**

			kg/day	Nitrogen (kg/yr)	
MEP Targets and Goals:					
Present Total Nitrogen Load:			90.866	33,166	
wastewater			64.142	23,412	
fertilizer				4,584	
stormwater				5,170	
Target Nitrogen Load:			42.3	15,440	
Nitrogen Removal Required:			**48.566**	**17,727**	
Total Number of Properties:	7171				

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			2,292	15,435	
Stormwater Mitigation			2,585	12,850	
Watershed/Embayment Options:					
Permeable Reactive Barrier (PRB)	879	homes	2,707	10,142	$452
Constructed Wetlands	5	acres	2,830	7,312	$521
Fertigation Wells	2	golf course	272	7,062	$438

Watershed Calculator   Waquoit Bay

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Alternative On-Site Options:					
Ecotoilets (UD & Compost)	187	homes	740	947	$1,265

Watershed Calculator — Waquoit Bay

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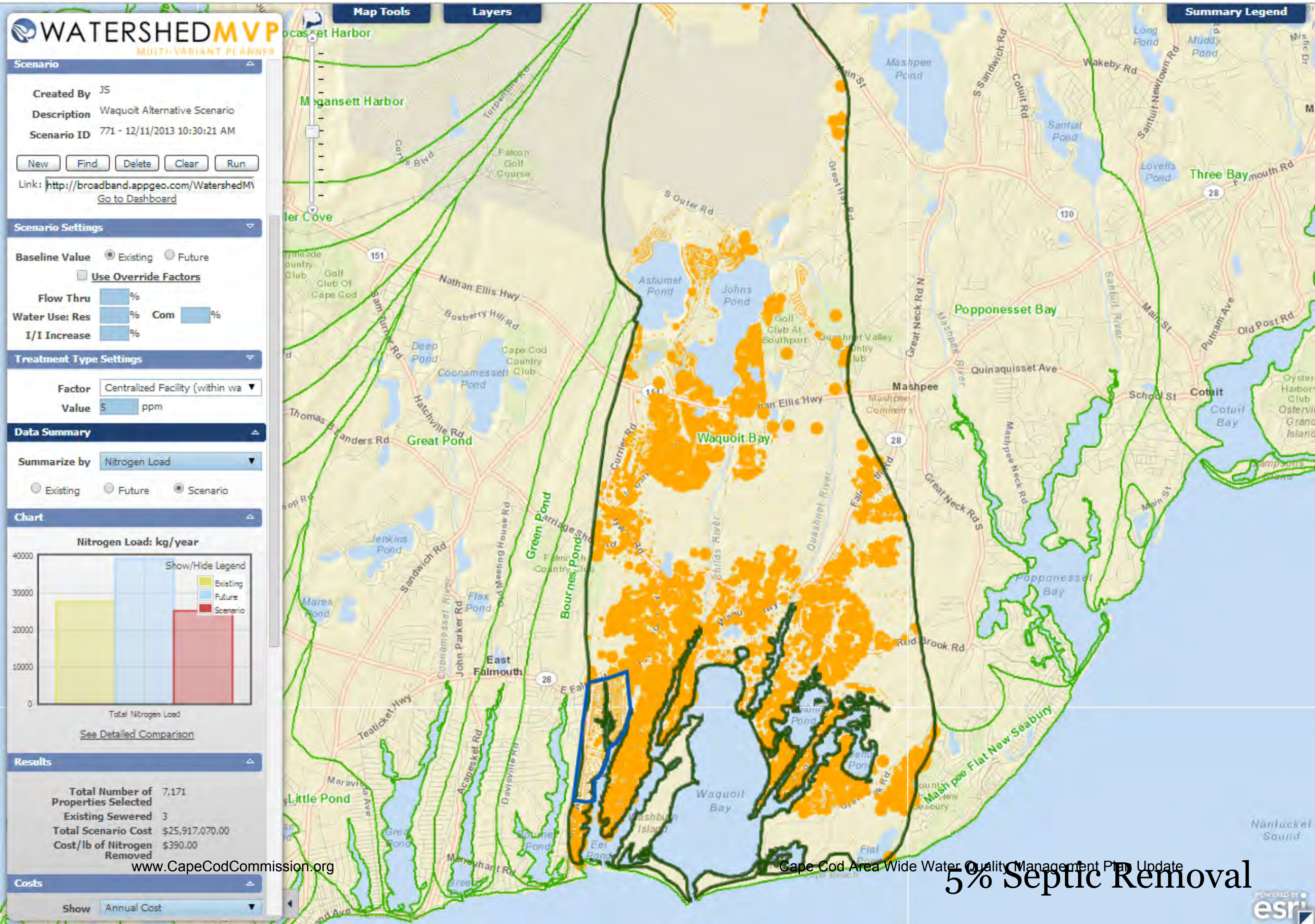
Floating Constructed Wetlands	2500	cu feet	1,125	1,687	$61
Alternative On-Site Options:					
Ecotoilets (UD & Compost)	187	homes	740	947	$1,265
Sewering	301	homes	1322	0	$1,000

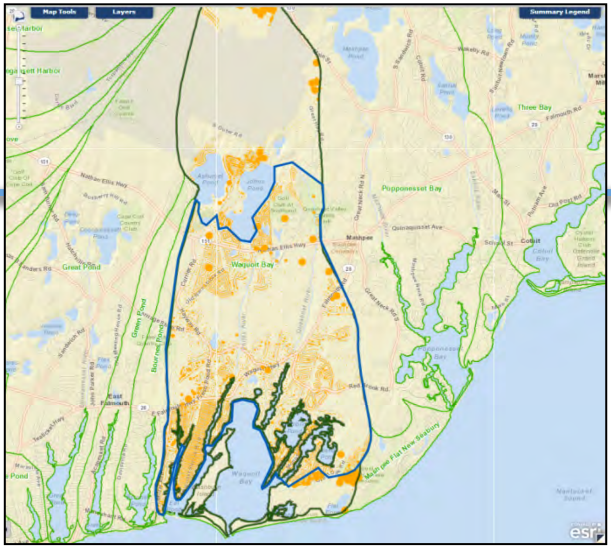
Targeted Centralized Treatment after Applying Alternative Strategies (1322 kg N/yr)



5% Septic Removal

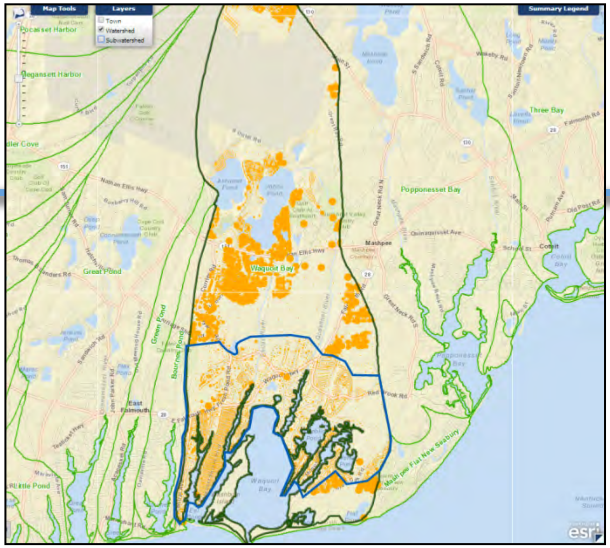
Scenario Comparison

Targeted Collection



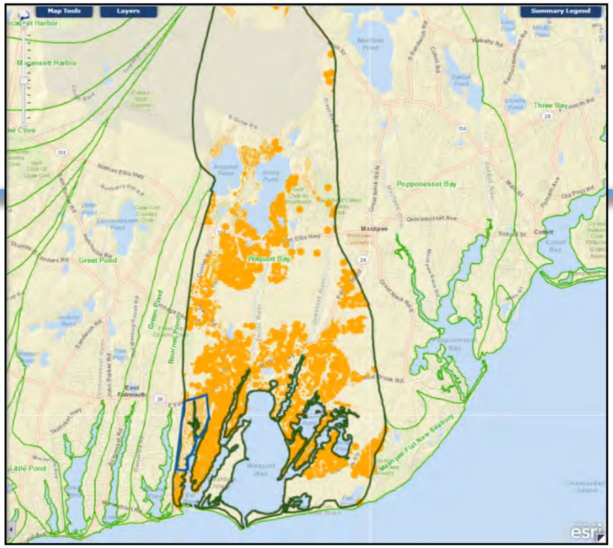
- Achieves TMDL[1]
- Cost/lb N = $527
- Treated Flow = 665,000 gpd

Targeted Collection after a 50% reduction in fertilizer and stormwater



- Achieves TMDL[1]
- Cost/lb N = $437
- Treated Flow = 443,000 gpd

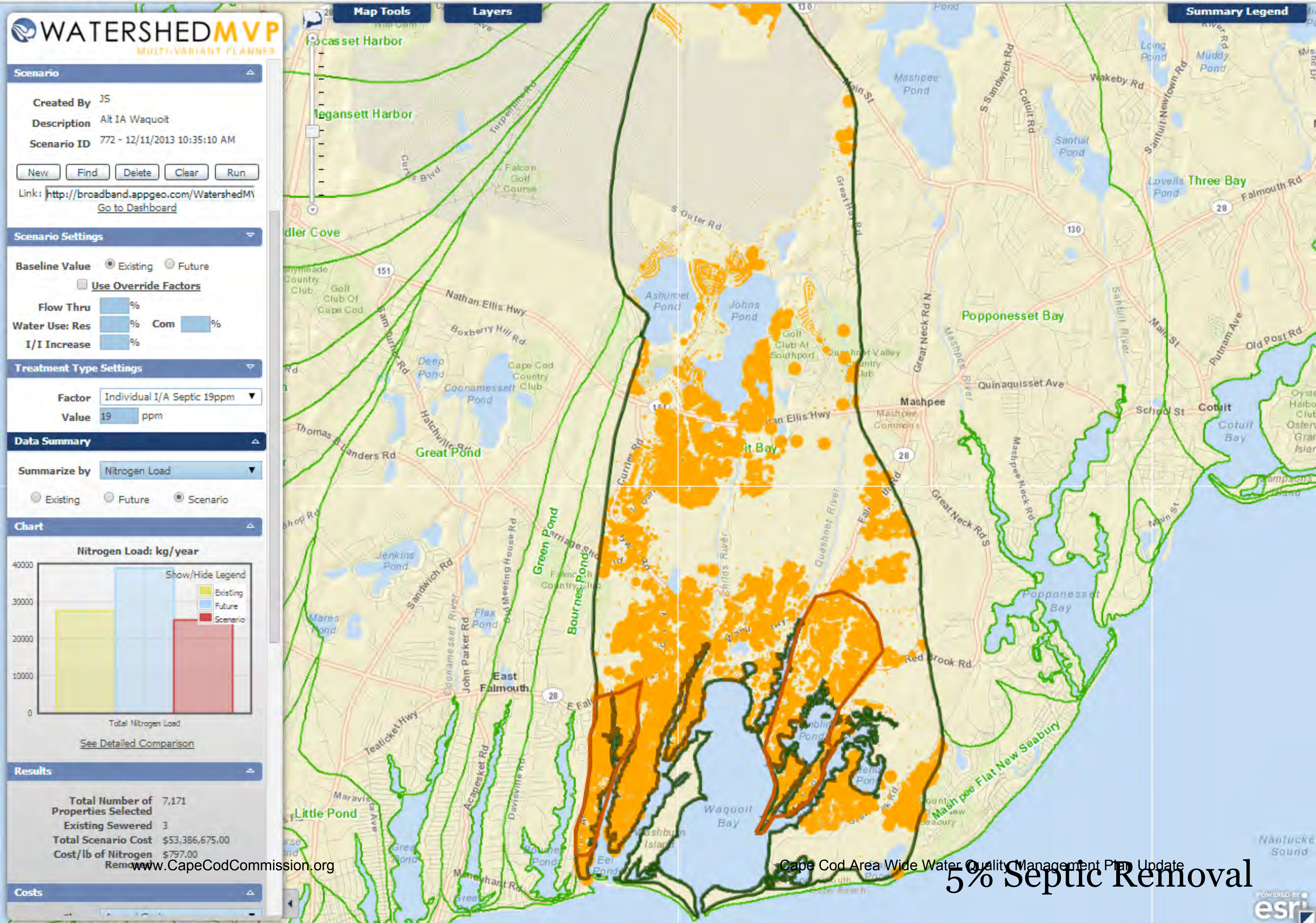
Targeted Collection after a 50% reduction in fertilizer and stormwater & after applying alternative approaches



- Achieves TMDL[1]
- Cost/lb N = $402
- Treated Flow = 47,000 gpd

[1] within 5% of goal

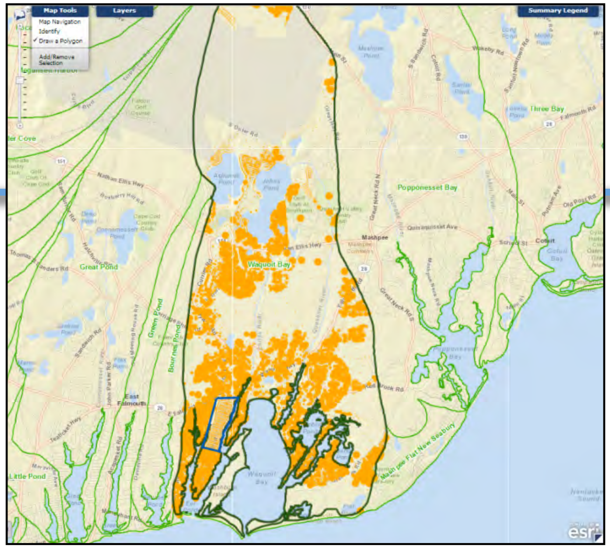
Innovative/Alternative On-Site Systems after Applying Alternative Strategies (1322 kg N/yr)



5% Septic Removal

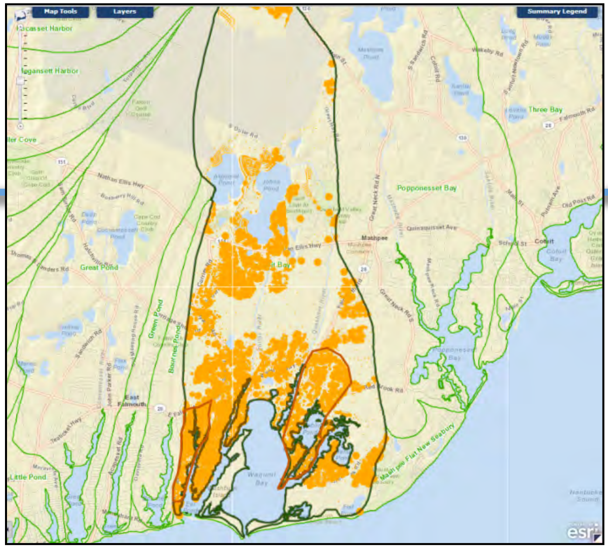
Scenario Comparison

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



- Achieves TMDL[1]
- Cost/lb N = $402
- Treated Flow = 47,000 gpd

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



- Achieves TMDL[1]
- Cost/lb N = $912
- Treated Flow = 135,000 gpd

[1] within 5% of goal

Adaptive Management:

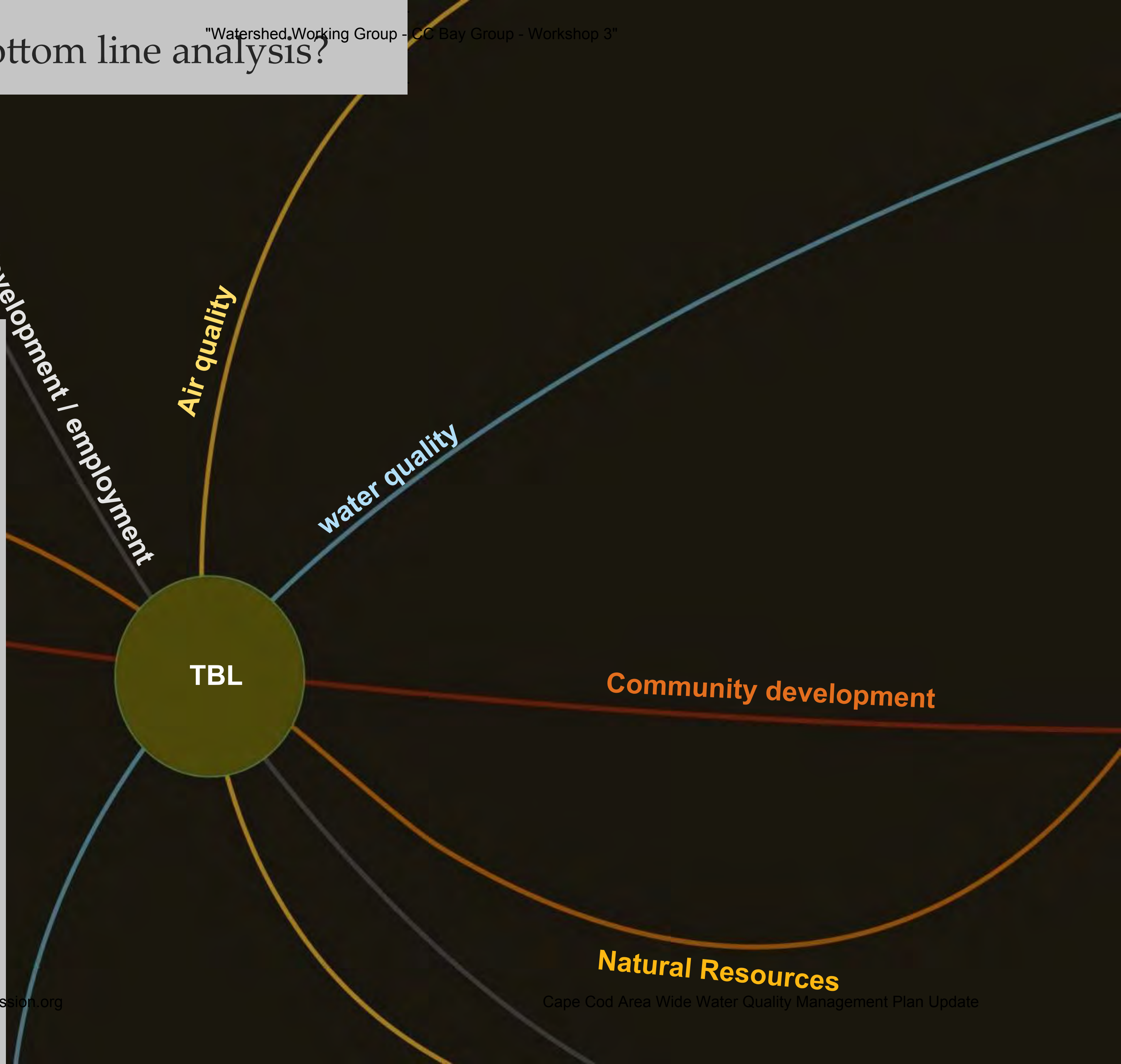
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient way.

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

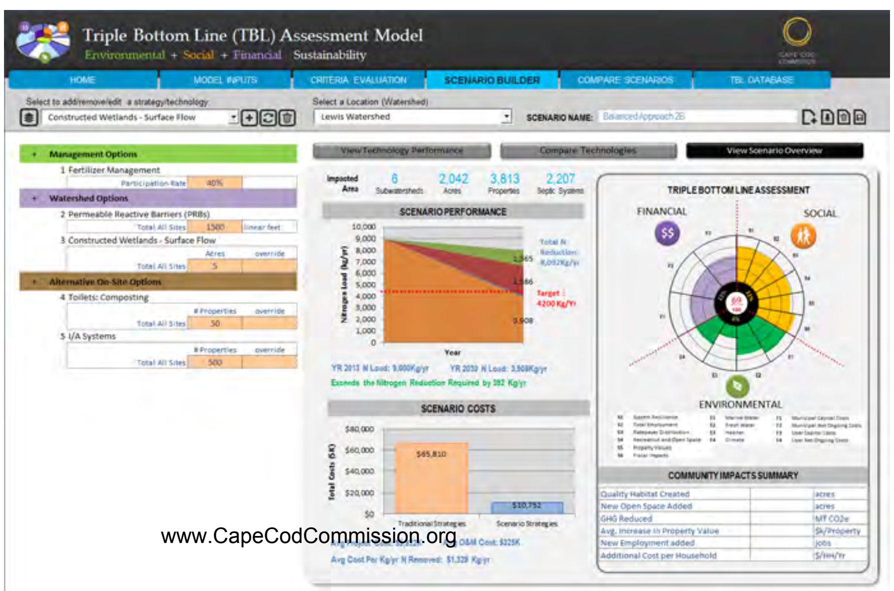
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

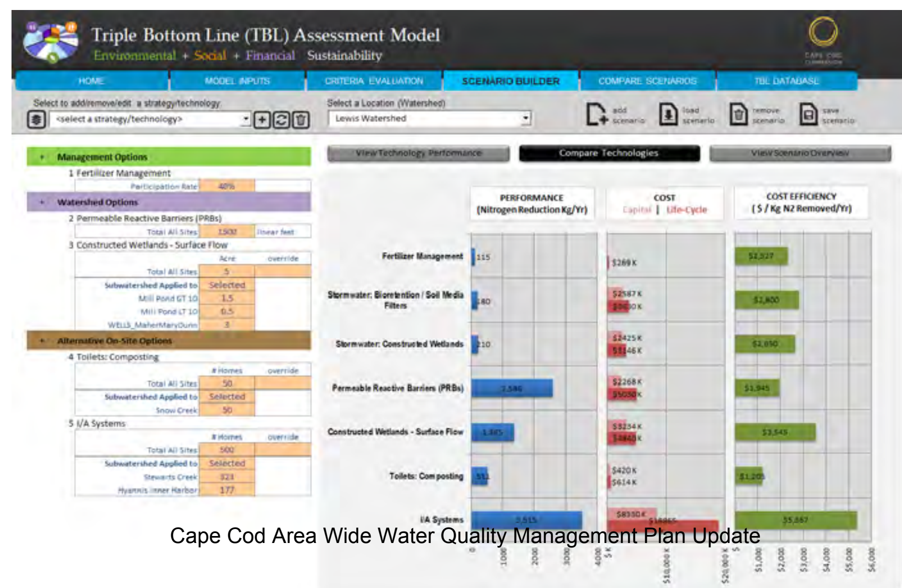


Why develop a TBL model?

- 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

HOME | MODEL INPUTS | CRITERIA EVALUATION | SCENARIO BUILDER | COMPARE SCENARIOS | TBL DATABASE

Alternative Definition | Alternative Results | Alternative Scoring Rules

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

Scenario 1

Minimum Cost

Scenario 2

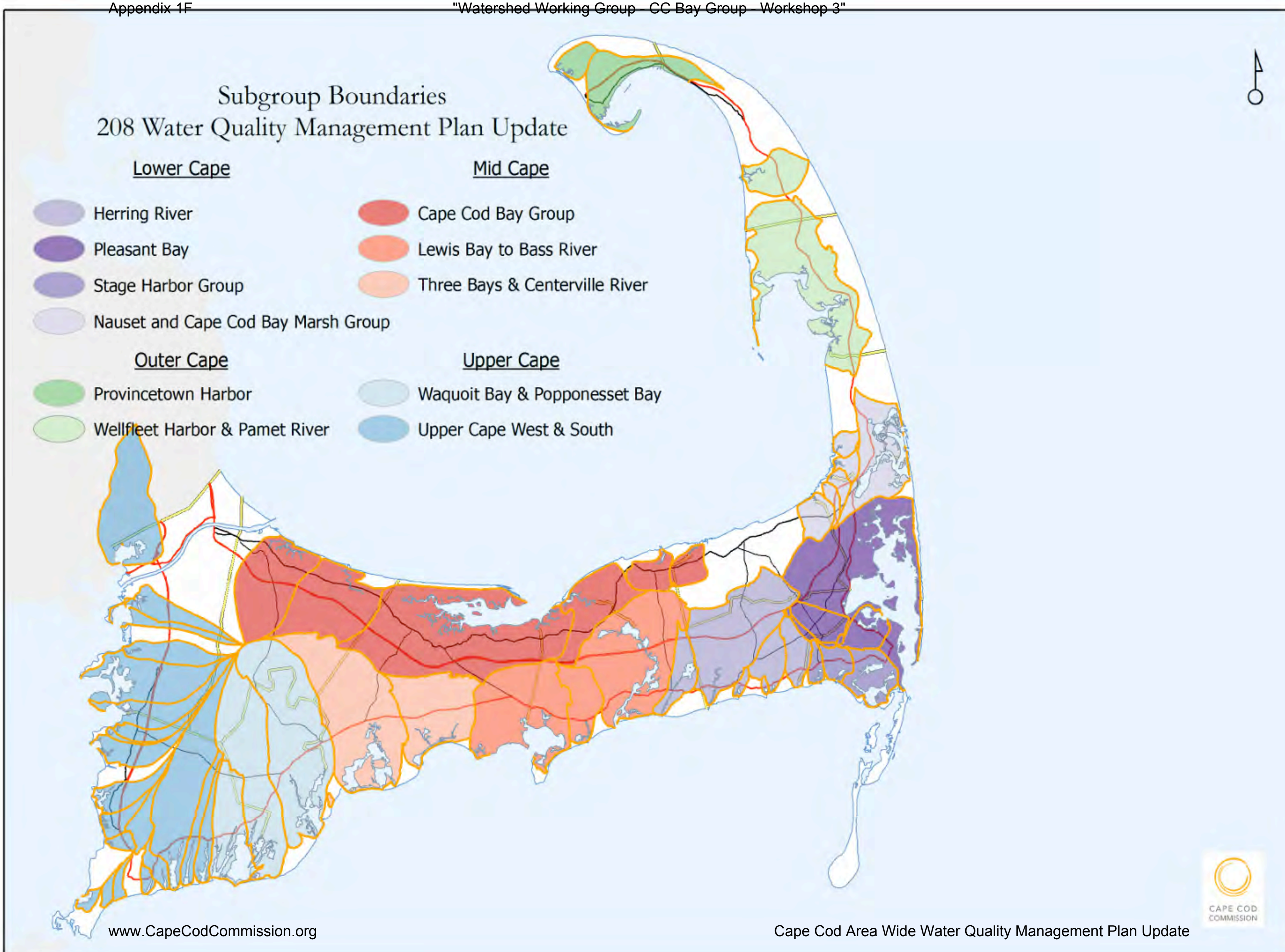
Cost Effective

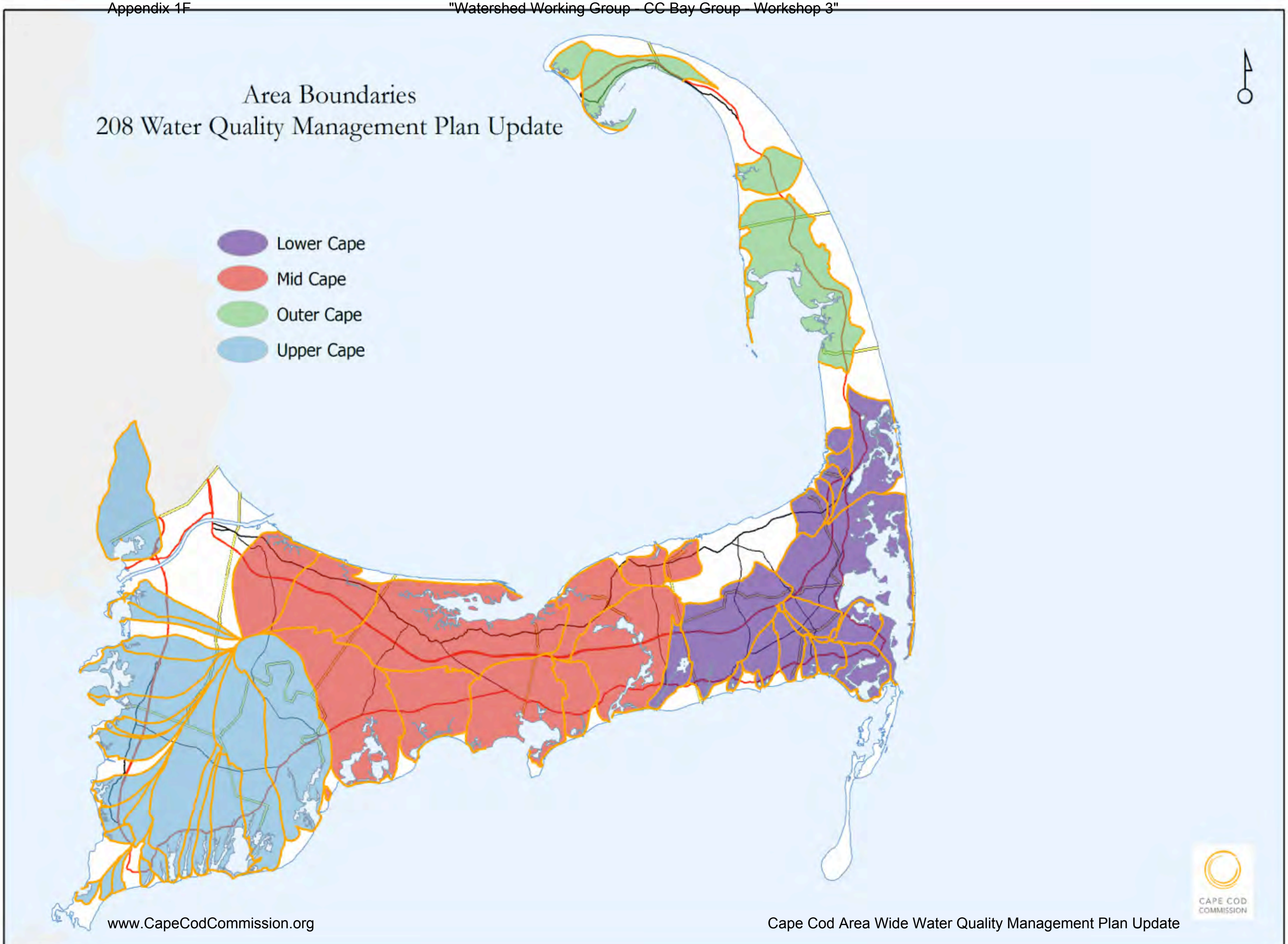
Scenario 3

Maximum Performance

Strategy/Technology Distribution

	Scenario 1	Scenario 2	Scenario 3
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. Increa[illegible]	$200	[illegible]	[illegible]
New Employment Added (jobs)	152	188	252
Additional Cost per Household ($/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
Waquoit and Popponesset Bays Watershed Working Group

Meeting Three
Wednesday December 11, 2013
Mashpee Town Hall, 16 Great Neck Road North, Mashpee, MA

I. ACTION ITEMS

Working Group

- Provide comments or revisions to the Meeting Two draft notes to Doug Thompson (dthomnpson@cbuilding.org) by December 30.
- Provide comments and/or additional info on the town chronologies to Patty Daley.
- Notify Doug if interested in volunteering or nominating another to represent this working group in the larger sub-basin working group meeting to occur during the next several months.

Cape Cod Commission

- Provide each town represented in the Working Group with a copy of its respective chronology.
- Notify the Working Group of the selected date and location for the February Stakeholder Summit.

Consensus Building Institute

- Finalize notes from the second meeting, distribute to the Working Group, and post to the Cape Cod Commission's website.
- Send out draft notes from the Meeting Three.

II. WELCOME, REVIEW 208 GOALS AND PROCESS AND THE GOALS OF MEETING

Patty Daley, Deputy Director of the Cape Cod Commission, welcomed participants and offered an overview of the 208 Update stakeholder process. 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, held in September, focused on baseline conditions in each of the watersheds. The second meetings of the Watershed Working Groups in October and early November explored technology options and approaches. The third round of meetings of the Watershed Working Groups will focus on evaluating watershed scenarios. These scenarios are informed by Working Groups' discussions at previous meetings about baseline conditions, priority areas, and technology options/approaches.

Ms. Daley shared the 208 Plan team's progress since Meeting Two, which includes:

- Meetings with the Advisory Board, the Technology Panel, the Finance Group, and the Regulatory-Legal-Institutional Group.
- Development and distributed access to the Technology Matrix, which shows possible traditional and non-traditional technologies at site-, neighborhood-, watershed-, and cape-wide scales.
- Development of the town chronologies.

Ms. Daley then reviewed the meeting goals:

- 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.
- To develop a set of adaptive management principles to guide sub-regional groups in refining scenarios for the 208 Plan

Mr. Doug Thompson, the meeting facilitator, led introductions. A participant list is found in Appendix A. He then reviewed the agenda and guidelines for communication. All action items from the second Meeting had been addressed. It was noted that the Commission was filming the meeting for internal use only.

III. INITIAL SCENARIOS FOR THE WAQUOIT BAY WATERSHED

Ms. Daley explained Commission's process to develop watershed scenarios. Two approaches are being investigated: a traditional approach, using technologies that are already permitted (e.g. conventional sewering and I/A systems) for nitrogen reduction, and a non-traditional approach, consisting of alternative "green infrastructure" technologies that are not yet necessarily creditable in the TMDL context. With both approaches, reductions in fertilizer and stormwater are also considered. She noted that the scenarios presented are illustrative examples for what is possible in the Waquoit Bay Watershed, and are meant to inspire discussion for how technologies could be applied locally.

Ms. Daley also noted that the unit costs per pound of nitrogen removed for each technology are derived from the 2010 Barnstable Country Report and the Technology Matrix; where a cost range exists, typically the average of that range is used. The Commission chose to present costs this way to facilitate comparative analysis across the technologies and across watersheds.

Tom Cambareri, Water Resources Program Manager for the Cape Cod Commission, introduced the Watershed MVP, a web-based GIS tool developed by the Commission to screen potential sites for technologies based on a variety of factors specific to each watershed. He also discussed the Watershed Calculator used to help evaluate scenarios, estimating by technology the nitrogen load reduction potential (kg/yr), the remaining nitrogen reduction needed to meet the target load (kg/yr), and the unit cost per pound of nitrogen removed ($/lb).

The TMDL nitrogen removal target for the entire Waquoit Bay Watershed, as identified by MEP, is 76% of the total load.

Traditional Approaches

Mr. Cambareri presented the following traditional approaches and how they might be applied in the Waquoit Bay Watershed, including potential implementation sites as screened by Watershed MVP:

<u>Watershed-Wide I/A onsite systems:</u> I/A systems as permitted by DEP treat septic wastewater nitrogen to a 19 ppm concentration. If I/A onsite systems are installed across the watershed, nitrogen would only be reduced by 27%, falling short of the 76% removal target.

<u>Watershed-Wide Sewering:</u> If conventional sewer (i.e. centralized treatment) was installed across the entire watershed, 81% of the nitrogen load would be removed, exceeding the TMDL target.

<u>Targeted Sewer:</u> Mr. Cambareri showed a map with variable nitrogen removal targets for total controllable load (from septic, stormwater, and fertilizer) across the Waquoit Bay subwatersheds. He explained that the natural nitrogen attenuation of ponds (each removing on average 50% of the nitrogen load received) accounts for this variation. He added that infrastructure is best targeted in lower subwatersheds that have less natural attenuation, higher nitrogen removal targets, and more direct interaction with the embayment.

If sewer installation is targeted to within these lower subwatersheds with higher nitrogen loads, the sewer footprint is reduced and 71% of nitrogen removal is possible. The unit cost for removal is $527/lb N.

Participants offered the following comments and questions:

- *The suitability of sewer infrastructure in the lower watersheds depends on whether the housing stock is occupied seasonally or year-round.*
- *What are the effects on water quality in freshwater ponds, and will these be taken into consideration in the plan?* Mr. Cambareri replied that water quality of freshwater ponds has been and will continue to be considered. He noted that there are freshwater pond data, and that water quality varies widely from pond to pond. Each pond will require a site-specific assessment and restoration program, and this need will be taken into consideration. The Commission is aware of measures to control phosphorous input (e.g. buffers), which has greater ecological implications than nitrogen. It will be a challenge to find

appropriate disposal locations for effluent, but the Commission is sensitive to this issue.

- *How accurate is the 50% nitrogen attenuation rate, and how much variation is there?* Mr. Cambareri replied that 50% is a conservative average, but that there is considerable variation; for example, there is data that indicates 79% attenuation for certain ponds. More focused site-specific studies can calculate exact site-specific attenuation.
- *Is dissolved organic nitrogen, ammonia, and nitrate included in this rate? The dissolved load in particular can be high.* MEP considers total nitrogen, which includes these forms.

Target sewer with 50% fertilizer reduction and stormwater mitigation: If targeted sewer is combined with a 50% reduction of fertilizer and stormwater across the watershed, 71% of nitrogen load is removed (42% from sewer) at a unit cost of $437/lb N. The collection area footprint decreases further in the lower reaches of the watershed.

Participants offered the following comments and questions:

- *What is basis for fertilizer and stormwater reduction estimates?* Mr. Cambareri explained that the numbers are from MEP report. In this watershed, the current load from these sources is roughly 8000 kg/yr (9,754 kg/yr), so the assumption is that reductions would be roughly 4000 kg/yr (4,877 kg/yr). How these reductions are demonstrated to DEP to receive credit remains a matter for discussion.
- *How would these reductions be made?* Mr. Cambareri noted that the EPA and MS4 program requires communities to address stormwater, so stormwater reductions are already being pursued. Communities can also institute low impact development requirements.
- *There is a state-designed demonstration project at Crocker Pond in Falmouth with infiltration basins that is reducing approximately 50% of the receiving nitrogen load. With the right filters, a lot of reduction is possible at low cost; this site filters 9000 gallons per day. The state can be a partner in these kinds of projects, as they are required to address nitrogen loads too.*
- *These scenarios assume that septic is treated and disposed in the watershed, and that there is some leaching. If it is disposed outside, the nitrogen removal rate could improve.* Mr. Cambareri verified that treatment outside of the watershed would allow further decreases in the sewer footprint.
- *According to the MEP models, fertilizer and stormwater are about 20% of overall load. A 50% reduction of 20% is only 10%, not the roughly 30% that this assumes.* Mr. Cambareri noted that the Commission will revisit these numbers. Fertilizer and stormwater nitrogen make up 27% of the total Waquoit Bay Load and 43% of the septic load.

Non-Traditional (7-Step) Scenario

Mark Owen of AECOM presented one potential scenario in which a suite of non-traditional alternative technologies is applied within the Waquoit Bay Watershed to reach the nitrogen reduction target. Using the Watershed Calculator and Watershed MVP, he shared the reduction potential and costs of these various technologies as well as potential locations for their implementation. He noted that the scenario is not a recommendation, but is an illustration of what is possible when combining these technologies, and soliciting feedback from the group.

Before running through the scenario, Mr. Owen discussed further baseline conditions of the Waquoit Bay Watershed. As studied by MEP, the current nitrogen load is about 33,000 kg/yr. Approximately 23,000 kg/yr is derived from wastewater, 4,000 kg/yr from fertilizer, and 5,000 kg/yr from stormwater. The total nitrogen reduction required to meet the TMDL is about approximately 18,000 kg/yr. The watershed contains 7,171 properties.

Fertilizer Reduction and Stormwater Mitigation: It is anticipated that fertilizer nitrogen loads can be reduced by about 50% or 2,000 kg/yr, and stormwater mitigation loads reduced by 2,400 kg/yr, also roughly 50%. These reductions in the nitrogen load are subtracted from total N load.

- *One participant noted that if fertilizer is reduced 100%, it could meet 25% of the total nitrogen reduction target at no cost. Arizona is doing this through subsidies in support of xeriscaping. It is helpful to look at it as a percentage of the solution, not of the load.* Mr. Cambareri noted that it may be difficult to get credit for more than 50% in the short-term future, but that this is a good point to keep in mind.

Permeable Reactive Barriers (PRBs): Mr. Owen shared a map indicating four areas suitable for PRBs within the Waquoit Bay Watershed, i.e. subwatershed areas with a higher nitrogen load, where the water table is 20 or fewer feet below the surface, and where road lengths run is perpendicular to groundwater flow. He made the distinction between trenched PRBs filled with organic materials and drilled well PRBs, in which a carbohydrate is injected. Trenched PRBs often require utilities to be disconnected. Drilled well PRBs can be installed around utilities. It is assumed that overall, PRBs capture about 70-80% of the nitrogen load they interact with.

Under the scenario, four PRBs could treat the nitrogen load from 879 homes, reducing nitrogen load by approximately 2,700 kg/yr. The unit cost is approximately $452/lb N. these costs are very preliminary there are many site specific details that cannot be addressed in these numbers.

Participants shared the following questions:

- *Does the unit cost consider construction only, or ongoing maintenance and other expenditures?* Mr. Owen explained that the estimated unit cost is based on construction, design, and includes annual O&M costs. The modeling team included replacement of small components in the estimate. For this and all the other technologies, the unit cost ($452/lb N here) is not an accurate, but rather an estimated cost. Cost will depend on the variability of the site; for PRBs relevant factors include utility presence in the targeted area and the level of the water table.

- *Taking into consideration this variability, do you have an estimated cost range for PRBs?* Mr. Owen noted that Technology Matrix includes a cost range for each technology. The scenarios use the average of the range. Ms. Daley added that the Technology Matrix is online on the group's watershed page.
- *Is the cost presented for injection well or trench PRBs? It would be nice to show the different costs of each.* Mr. Owen responded that he believed the rate used was $1000-1500 per foot of PRB, and invited further input on cost considerations.
- *At Sea Coast Shores, the feasibility of PRBs is low with beaches, the yacht club, etc. At what point in process does the site-specific information come into play?* Ms. Daley said that the experts will look at more specific site considerations, but that communities will ultimately be provided the tools to make these decisions. The 208 Plan Update will not outline the final site-specific options.
- *This will be a challenging option for our watershed.*

<u>Constructed wetlands:</u> Mr. Jay Detjens, GIS Analyst of the Cape Cod Commission presented the results of Watershed MVP's screening for constructed wetlands locations. He explained there will need to be further screening for practicability of these sites, but for this exercise the screening criteria used included:

- Parcel-size 5 acres or larger
- Outside the 100-year floodplain
- Outside priority rare species protected areas
- Outside protected open space areas

Mr. Owen further added that constructed wetland sites include those near a wastewater facility where the nitrogen load from effluent can be further treated. Constructed wetlands can also be used in stormwater retention areas. This technology presents an efficient method of reducing nitrogen load and requires less maintenance than other options.

Under the scenario, five acres of constructed wetlands would reduce approximately 2,800 kg/yr of nitrogen at a unit cost of $521/lb N.

Participants shared the following questions:

- *Do the nitrogen removal rates consider year-round fluctuations in biological activity?* Mr. Owen explained that all seasons, including winter when there is less nitrogen reduction, are included in the removal rate estimate.

- *Do cost estimates consider land acquisition?* Mr. Owen noted that the estimates do not include land costs. The modeling team has discussed this and is going to develop a range of costs for one acre of land and include that in the unit cost for this technology. Land costs will range significantly depending on location.

(Several low lying areas in the watershed were also screened as potential phytoremediation buffer sites, where the roots of planted tree roots would intersect the water table and naturally attenuate the nitrogen load. As with constructed wetlands, additional screening is needed to determine practicability of the proposed sites. It was not included in this scenario, but mentioned as another option.)

<u>Fertigation wells:</u> Mr. Owen explained that this technology uses irrigation wells to pump nitrogen-laden groundwater and apply it as irrigation water on golf courses, open space areas, or landscaping. Wells are sited down-gradient of an existing wastewater treatment facility or a dense neighborhood on septic. Under the scenario, two golf courses using fertigation wells would result in 272 kg/yr in nitrogen reductions, at a unit cost of $438/lb N.

- *One participant noted that the nitrogen reduction rate may be high. The nitrogen contributions from golf courses have decreased significantly over the last years, and comprise 10% or less of fertilizer loads. Total fertilizer load across the watershed is probably 7-12% percent. Mr. Owen explained that golf courses we considered target sites for using and treating high nitrogen groundwater. The groundwater could be collected from other locations such as down gradient form high density development and wastewater treatment facility discharges.*

<u>Oyster beds / aquaculture:</u> Watershed MVP screened 17 acres of shellfish, across 7 sites of differing sizes. Additional site-specific feasibility studies are needed. Mr. Owen noted that the aquaculture could be commercially run, or could be incorporated into salt marsh restoration efforts. In order to remove nitrogen from the system and take credit for the removal, the shellfish would need to removed and used. Assuming that 17 acres is installed, the nitrogen removal rate is 4,250 kg/yr – the highest among non-traditional technologies – with a unit cost of $0/lb N.

Participants shared the following questions and comments:

- *The Moonakis River is not open for harvesting and should be taken off the map of proposed sites. Another screened site is already a commercial farm.* Mr. Owen noted that the town could potentially grow submerged oysters in a non-harvesting site and remove them.
- *Why is the unit cost for aquiculture/oyster beds $0/lb N?* Mr. Owen explained that if the town manages the aquaculture, there would be some costs, though the option is highly cost-effective. If the aquaculture is run commercially, the costs and profits are transferred to a private entity.

- *A participant noted that a project has been started in Great River using quahogs, which do better than oysters in higher salinity areas. Pests and disease often threaten oysters. The entire area has the potential for additional aquaculture through town management due to ample sandy bottom. An addition of 20 -25 million shellfish would remove a significant amount of nitrogen and, across 30 acres, would have a low density of 20 individual shellfish per square foot. We're interested in restoring the fishery to its historic population.* Mr. Owen added that there are other co-benefits of this technology as well: it provides resiliency in storms and a low-cost alternative to sewering. If using aquaculture as an option, the nitrogen reduction target could probably be met with a combination of I/A systems and reductions in fertilizer stormwater.

<u>Floating constructed wetlands:</u> This technology consists of floating rafts of nitrate- and phosphate-absorbing plants. It works well in freshwater and in estuaries, and is best suited where there is flow (e.g. the mouth of freshwater pond or harbor), though water circulators can increase flow and enhance nitrogen reduction as well. Currently there is more information on freshwater use of this technology. The rafts are 1-2 feet deep but hanging oysters, shellfish, and seaweed can add depth as well as the potential for marginal revenue. This approach has been tested on Long Island. Under the Waquoit Bay scenario, 2,500 cubic feet would be installed, reducing nitrogen by 1,125 kg/yr at a unit cost of approximately $61/lb N.

<u>Eco-toilets:</u> Under the scenario, eco-toilets would be installed at a 5% participation rate amongst homeowners (187 properties), achieving 740 kg/yr in nitrogen reduction with a unit cost of $1,265/lb. N. Mr. Owen mentioned the unit cost is an average over the range of urine diversion and composting technologies and that is likely to change dramatically as better information is incorporated into the Technology Matrix.

- *One participant noted that while eco-toilet constituents are still trying to provide better estimates of cost, it is not likely that this option will be more expensive than sewer, as depicted here.*

<u>Remaining sewer needed:</u> Mr. Owen noted that using this scenario of non-traditional technologies, a total of 301 homes would still require sewer infrastructure to reduce the final 1,300 kg/yr. of nitrogen reductions to meet the TMDL. As such, 5% of the nitrogen reductions would be met by sewer. The unit cost associated with this sewering is roughly estimated at $1,000/lb. N. He showed the targeted sewering area on a map (with dense development and higher nitrogen loads), and reiterated that this is only one possibility for how these technologies could be paired and implemented – a community could decide to rely upon one or all of them. For example, clustered, on-site I/A could be pursued instead of the remaining sewer required, though this would require a larger footprint (see scenario comparison table below).

Scenario Comparison

Mr. Owen then showed an overall comparison of four scenarios described in the exercise – 1) targeted sewer only, 2) targeted sewer after 50% reductions in fertilizer and stormwater, 3) targeted sewer after 50% reduction in fertilizer and stormwater and the application of non-traditional technologies, and 4) Innovative/Alternative on-site systems after 50% reduction in fertilizer and stormwater and the application of non-traditional technologies. All scenarios are assumed to achieve the TMDL for the watershed (see table below). The sewer footprint associated with each was shown on a map, shrinking and expanding depending on the scenario considered.

Scenario	**Cost /lb. N**	**Treated flow (gpd)**
Targeted sewer	$527	665,000
Targeted sewer after 50% reduction in fertilizer and stormwater	$437	443,000
Targeted sewer after 50% reduction in fertilizer and stormwater and the application of non-traditional technologies	$402	47,000
I/A on-site systems after 50% reduction in fertilizer and stormwater and the application of non-traditional technologies	$265	135,000

General Discussion of the Scenarios and Methodology

Participants presented the following questions and comments:

- *MEP assumes that every household produces the same amount of wastewater. Its estimates are based on the average use across the watershed, not on individual households that vary based on seasonal or year-long use. A seasonal area will require a larger footprint.* Mr. Cambareri explained that the Commission used actual water use data on the parcel scale from the water district in this analysis.
- *This analysis should factor in growth and future development.* Mr. Owen and Ms. Daley shared that Watershed MVP incorporates existing building stock data from 2009-2011. The Commission is first considering infrastructure currently required, and will take into consideration the additional need from added growth over the next six months. Watershed MVP is adaptable to analyze build-out scenarios. The discussion at this round of workshops is centered on how different approaches and combinations of technologies can impact the need for sewer infrastructure.

- *This analysis creates the impression that the sewershed will be in a tiny area, when we know it will be larger as a result of future development.* Ms. Daley noted this and responded that the Commission wants feedback on how to integrate growth.
- *There are at least five TMDLs across the Waquoit Bay Watershed; are these considered?* Mr. Owen noted that Watershed MVP can be applied at the subwatershed level and to other contaminants. Another tool, called the Wastewater Tracker, has been developed to track percent nitrogen removals across subwatershed in the context of subwatershed TMDL attainment and total watershed removals required.
- *This is great work. Are the baseline nitrogen conditions and contributions by fertilizer and stormwater in this watershed similar to those of other watersheds across the Cape?* Mr. Cambareri responded that the ratios of stormwater and fertilizer differ across watersheds, and depend in part on watershed size. There are similarities (generally the nitrogen contributions from each of these inputs are less than 20% of the total load); however there are subwatersheds that could achieve the nitrogen target entirely through stormwater and fertilizer reductions.
- *The model presents a level of precision in cost and reduction rate estimates that doesn't exist. Participants recommended that the Commission round the numbers, e.g. $452/lb. to $450/lb.* The Commission staff noted that this suggestion has been raised by others and makes sense.
- *There should be better consistency in units -- kg/yr. and $/lb. is confusing. Also, think about what consumer-relevant language is. I think cost per home would be a good way to present unit costs of technologies, although this may not make sense for all cost distribution scenarios. One way to handle this may be to have several columns depicting different financing scenarios, i.e., spread across the tax base and cost per household.* The Commission staff noted that unit consistency has been mentioned by other working groups as well, and that as public outreach continues over the next six months, they will keep in mind how to best communicate cost to broader audiences. The Commission thinks that showing different financing options in the scenario tables is a good idea. Affordability of options is of great concern.
- *It would also help to show the current scenario and the unit cost of existing septic. The cost of doing nothing needs to be understood.* Ms. Daley noted that this was a good point.
- *Location is important in this discussion. Certain technologies will have different costs depending upon the watershed or subwatershed of implementation. For example, sewering at Little Pond is relatively inexpensive.*
- *Each approach has associated benefits – for example, improved natural habitat. It would be useful to show an economic multiplier effect that indicated direct and indirect economic benefits. If you focus more on the co-benefits of these options,*

the public may be more willing to invest in them, and it may show that the cheapest alternatives may not be the most preferable.

- *Is the cost column adapting with the utilization of technologies? The cost per pound will be different if 200 vs. 2,000 homes are sewering.* Mr. Owen explained that there wastewater treatment facility treatment options that changes the total cost of $/lb. N. Watershed MVP and the Technology Matrix consider this.
- *Does the model take into account the distance to a sewering plant?* Mr. Detjens noted that, in an effort to be conservative, it assumes a distance of 2 miles from the treatment plant to a disposal site, as well as the construction of a new treatment plant with added sewer. Ms. Daley added that the Commission would look at use of existing plants over the next six months. *Two miles from the plant to a discharge is too far; most discharges are adjacent.* Mr. Detjens replied that the team can incorporate existing plant locations into the screening analysis of disposal sites.
- *The Technology Matrix is an extraordinary tool that may have national influence, but the best way to present this information to communities may be to create a fact sheet for each technology option and present the columns as subsections within that fact sheet. This would create a manual or reference document that can be distributed, much like the stormwater manual.*
- *We have the long-term issue of sea level rise. It might be good to look at areas in the community that are subject to storm damage and to consider self-contained systems for those areas, e.g. composting toilets or I/A units. These high-risk areas should be significant in your considerations.* The Commission staff noted that sea level rise considerations will be integrated into the 208 Plan Update.
- *In our Facilities Plan, we are required to consider greenhouse gas impacts. Is the Commission addressing this too and do you have numerical evaluations? It would be helpful to have this.* Mr. Owen noted that some of the technologies presented (e.g., constructed wetlands) have positive effect when it comes to greenhouse gas impacts. This factor is integrated in the Technology Matrix as an eco-benefit, though it does not present actual numbers on greenhouse gas emissions. Other eco-benefits include system resilience, energy use, and chemical use. The team can reevaluate the presentation of this information.
- *Several of these technologies can be separated into classes for analysis because they have variable costs. These include PRBs, eco-toilets, and sewer (gravity or step fed).*
- *Can towns develop cost estimates? That would be very helpful. We are close to having numbers on the shellfish project and eco-toilets.* Mr. Owen encouraged feedback from pilot projects so that those results could be considered in the Technology Matrix.
- *Will the model be set up so that towns can explore different options on their own?* Ms. Daley noted that the Watershed Calculator tool will be available to communities.

- *Will communities be able to modify the baseline conditions in the Watershed Calculator? If the seaweed bed in Waquoit Bay is compromised, the baseline nitrogen load would be significantly larger.* Yes, you can manipulate the baseline watershed conditions.
- *The model assumes that treated effluent is disposed within the watershed. How does outside disposal influence these calculations?* Mr. Owen noted that Watershed MVP doesn't incorporate that consideration, but that it can be modified to do so. The model currently assumes that 5 mg/L of nitrogen is leached out from effluent (with pretreatment at 40 mg/L). Ms. Daley added that out of 105 watersheds on the Cape, only 57 directly flow into an embayment. The remainder could be used for disposal.
- *USGS has developed a 3D model of the watershed in Popponesset Bay. The groundwater is discharged beyond the shoreline and probably going to Nantucket Sound. There could be impacts on water quality there. The hydrogeology of the area is complex and varies greatly, but it is key when considering these technologies, especially PRBs. We need a regional hydrogeology model for the Cape. Maybe USGS could develop this.*
- *If effluent is disposed where groundwater transport takes 100 years, does it attenuate?* Mr. Owen noted that MEP assumes not much attenuation occurring outside of pond or surface water habitats. *Some participants challenge this assumption.*

Mr. Owen then led the group through an exercise using the Watershed Calculator to look at different options and levels of implementation. Through this exercise, the group learned that:

- 30 acres of oysters/aquaculture would achieve all nitrogen reductions and avoid the need for other technologies.
- Dredging and inlet widening is also an option. *Hamlin Pond could be a good, though expensive, candidate for this option. There are no inlets in the area to be widened, but bottom dredging is a good technology to add to the scenario for this watershed.*
- *Reductions greater than 50% in fertilizer use can significantly alter technology needs.*

In sum, the group agreed to the following main takeaways provided by the scenario analysis and discussion:

- *The right combination of non-traditional alternatives can avoid or greatly minimize the need for sewer infrastructure.*
- *A feasible combination of technologies must be based on site-specific constraints within a watershed, community priorities, projected storm damage areas, etc.*
- *A higher resolution of cost and reduction rate information is desired so that these site-specific decisions can be made.*

IV. ADAPTIVE MANAGEMENT

Ms. Daley explained that an adaptive management approach is critical to wastewater planning on the Cape because of the degree of uncertainty present in many of these alternatives. The idea behind this concept is to implement and monitor the non-traditional technologies, and if they prove to be ineffective in meeting target nitrogen reduction goals, to fall back on the traditional approaches.

Defining Adaptive Management

She provided the Commission's current definition of 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 cost effective and efficient ways."

Ms. Daley noted that a final definition would be shared with federal and state partners, and solicited comments on the one provided. The group offered the following thoughts:

- *The definition should incorporate the idea that updates should be made on the basis of new science and technology.*
- *The definition should be more consumer-friendly and accessible so that the public can appreciate and understand it. This is something that people will vote on. We don't want to confuse them with a wordy definition.*
- *The word "probability" could problematic depending upon how it is construed: The MEP targets ultimately need to be met.*

General Discussion on Adaptive Management

Participants discussed other considerations of adaptive management, including:

- *Monitoring is key to adaptive management.*
- *Science and monitoring are on a longer temporal scale than regulatory change, action plan development, and stakeholder-driven processes. We need to add a temporal component that captures that.* Ms. Daley noted that over the next sixth months, the Commission will pull together a monitoring group to talk about these issues.
- *There is also the issue of phasing technologies, which presents another temporal component. We should first implement those technologies that have a high probability of success.*

- *Has there been any attempt to address risk management associated with non-traditional approaches, and to look at the viability of these alternative technologies? There is a risk of lost public investment and public backlash.* Mr. Owen noted that the Technology Matrix factors increased costs associated with a wide range of uncertainty. Ms. Daley added that risk tolerance is specific to each community.
- *We need to remember that no technology can meet the TMDL unless DEP provides credit. Eco-toilets are allowed 50% credit for nitrogen reduction, but we are trying to change that. It's going to take time and bureaucratic effort to prove to DEP how much a technology actually reduces and how much we should get credit for.* Ms. Daley noted that DEP is open to looking at results from demonstration and pilot projects to determine credit allocations. The agency also wants to see a back-up plan of traditional technologies as well, however, in case the alternatives prove to be ineffective. The Commission is talking to DEP about the possibility of a watershed-wide permit, wherein DEP would issue a permit to all towns within a particular watershed. They are providing time to pilot alternative technologies.
- *Timelines will vary for each technology. We need to determine a timeline for each approach.* Mr. Detjens added that some of the Watershed Working Groups have been discussing potential time periods for their adaptive management plans, i.e. length of monitoring efforts, when to move to traditional technologies if the non-traditional are ineffective.
- *The cost of implementation for different technologies is contingent on place and the constraints of each watershed. These are other important factors to consider as well.*

V. PREPARING FOR 2014 JAN-JUNE

Triple Bottom Line (TBL) Analysis

Ms. Daley presented on the work that the Commission has done in concert with AECOM to develop a Triple Bottom Line model. First, she defined Triple Bottom Line Analysis as a full accounting of the financial, social, and environmental consequences of investments or policies. She also noted that TBL analysis is often used to 1) evaluate scenario alternatives and rank them relative to each other and 2) report to stakeholders on the public outcomes of a given investment. Using algorithms, it provides a graphic representation of the potential impacts of technology scenarios.

In explaining why the Commission has decided to pursue a TBL model, Ms. Daley said that it will allow interested parties to:

- Consider the financial, environmental, and social consequences of water quality investments and policies on Cape Cod.
- Evaluate the "ancillary" or downstream consequences of water quality investments, not just direct phosphorous or nitrogen level reductions.

She also explained that the AECOM is working with Commission staff and stakeholders to develop criteria that integrate social, environmental, and financial considerations into the TBL model. These include:

- **Social**: System Resilience (i.e. how communities respond to natural hazards), Employment, Property Values, Ratepayer Distribution, Recreation and Open Space, Fiscal Impacts
- **Environmental**: Marine Water Quality, Fresh Water Quality, Climate, Habitat
- **Financial**: Municipal Capital Costs, Municipal Other Costs, Property Owner Capital Costs, Property Owner Other Costs.

Ms. Daley then showed how three different hypothetical scenarios (minimum cost, cost effective, and maximum performance) run through the model ranked comparatively, taking into consideration these social, environmental, and financial factors. She explained the model will be finalized by January or February 2013, and that the Commission will be using it over the next six months to assist in scenario evaluations.

Next Steps in the Stakeholder Process

Ms. Daley then explained to the Working Group the next immediate steps of the 208 Plan Update, which include:

January 2014	Assemble all 175 stakeholders across Cape Cod for a one-day Stakeholder Summit (tentatively scheduled for Jan 31) to discuss further planning, share the outcomes from stakeholder meetings, and form four sub-groups representing the Upper-, Mid-, Lower-, and Outer-Cape. These groups will likely meet three more times (Feb, March, April). Also likely is the creation of an *ad-hoc* committee to discuss monitoring protocols for different technologies.
	The four sub-groups meet to further develop local scenarios and run them through the TBL model, discussions related to the Regulatory, Legal and Institutional work group, and implementation and financing and affordability considerations.

June 1, 2014	Submit a draft plan to DEP.
June – Dec 2014	Collect and consider public comments on the draft plan.
January 2015	Submit final plan to DEP

- *Several participants showed interest in the process and how representatives for the four-subgroups would be chosen.* Ms. Daley responded that the Commission has yet to finalize how representatives will be chosen, but the subgroups will be formed at the Stakeholder Summit. The Commission will report to the watershed working groups in advance of that meeting on the protocol for selecting subgroup members. Subgroup meetings will be open to the public, however, and the public comment section of each will be expanded to allow interested stakeholders to continue providing input. Additionally, the Stakeholder Summit will be open to the public.

Shared Principles

The facilitator summarized the following list of shared principles (listed alphabetically) that have been vetted by this Working Group over the three meetings, and asked for confirmation that the group wished them to be considered as the planning process moves forward and as more details emerge about the various technologies:

- Affordability
- Climate change
- Ease of implementation
- Growth assumptions
- Multiple (or co-) benefits
- Reliability and confidence
- Regulatory and legal landscapes
- Resiliency and adaptability
- Public acceptance
- Speed and time (re: adoption and realization of benefits)
- Unintended consequences
- Confidence (or lack of) in the baselines
- Importance of local context

VI. PUBLIC COMMENT

No public comments were made.

Mr. Thompson and Ms. Daley thanked the group for time and input.

APPENDIX A

Waquoit & Popponesset Bay Working Group Workshop Three
December 11, 2013
Participant List

1. Rob Adler - US EPA
2. Victoria Brisson - AmeriCorps CC, Town of Mashpee
3. David Dow - Sierra Club
4. Tom Fudala - Mashpee Planning, Sewer & Water District
5. Paul Gobell - Town of Mashpee, Sewer Department
6. Jessica Rapp Grassetti - Town of Barnstable, Town Councilor
7. Peter Hargraves - FACES
8. Alison Leschen - WBNERR
9. Win Munro - Wastewater Committee, Falmouth
10. Ed Nash - Golf Superintendents Assoc.
11. Mark Owen - AECOM
12. Tonna Marie Rogers - WBNERR
13. Francis J. Sheehan, MD - Sandwich Board of Health
14. Art Traczyk - Town of Barnstable, Design/Regulatory Review Planner
15. Richard York - Town of Mashpee, Shellfish Constable

CCC Staff:

16. Patty Daley - Deputy Director
17. Philips "Jay" Detjens - GIS Analyst II/Database Administrator
18. Tom Cambareri - Watershed Management Director
19. Maria McCauley - Fiscal Officer/Staff Support

Consensus Building Institute Staff:

20. Doug Thompson, Facilitator
21. Lauren Dennis, Note taker

Cape Cod 208 Area Water Quality Planning
Wellfleet Harbor and Pamet River Watershed Working Group

Meeting Three
Monday, December 2, 2013
1:00 – 5:00 pm
Wellfleet Council on Aging

Meeting Agenda

1:00 pm Welcome, Review 208 goals and Process and the Goals of today's meeting – *Cape Cod Commission Area Manager*

1:15 Introductions, Agenda Overview, Updates and Action Items– *Facilitator and Working Group*

1:30 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

3:00 Break

3:15 Adaptive Management – *Cape Cod Commission and Working Group*

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

4:00 Preparing for 2014 Jan-June – *Cape Cod Commission and Working Group*

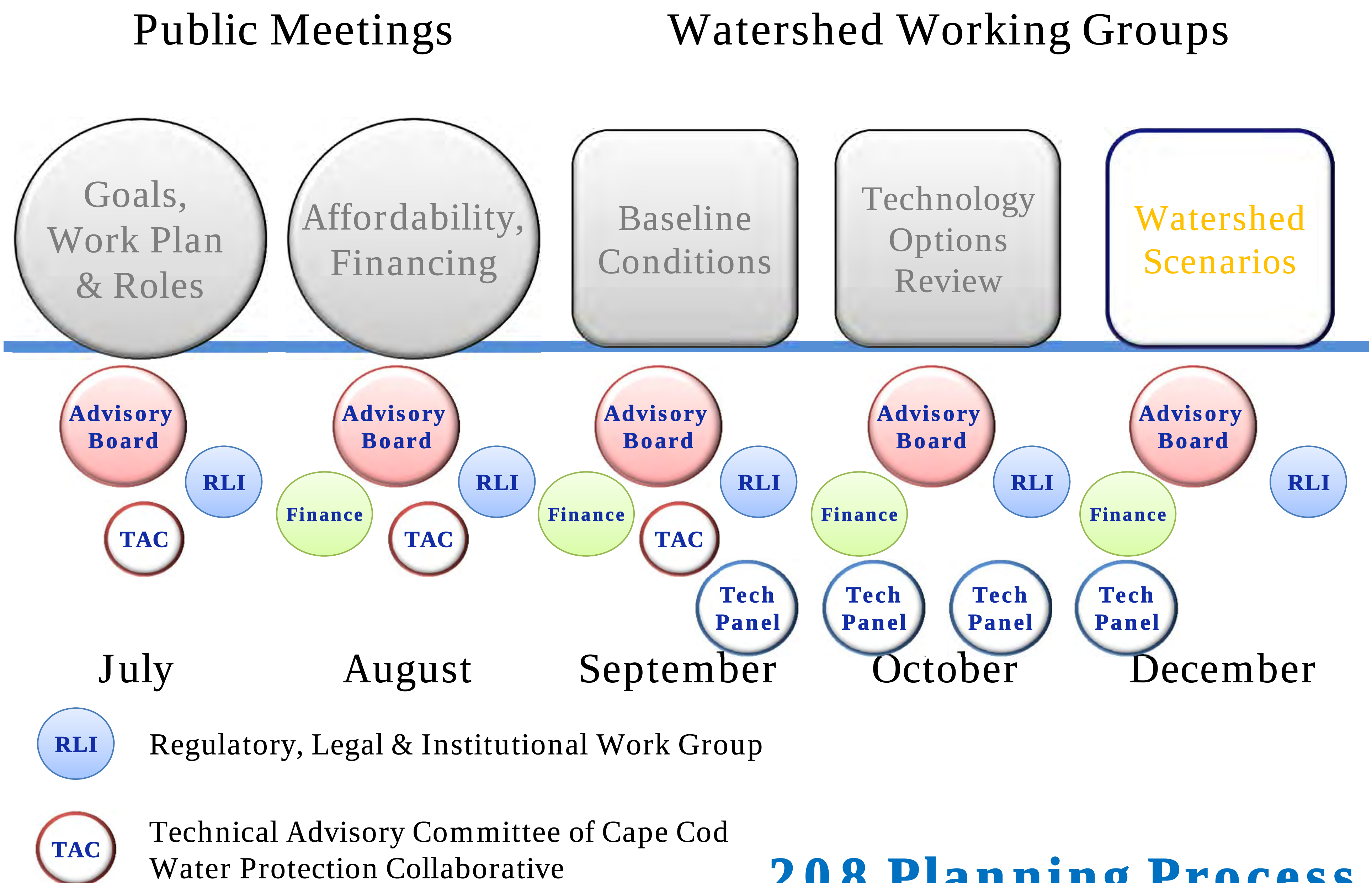
- Triple Bottom Line approach
- Identify Shared Principles and Lessons Learned
- Describe Next Steps

4:45 Public Comments

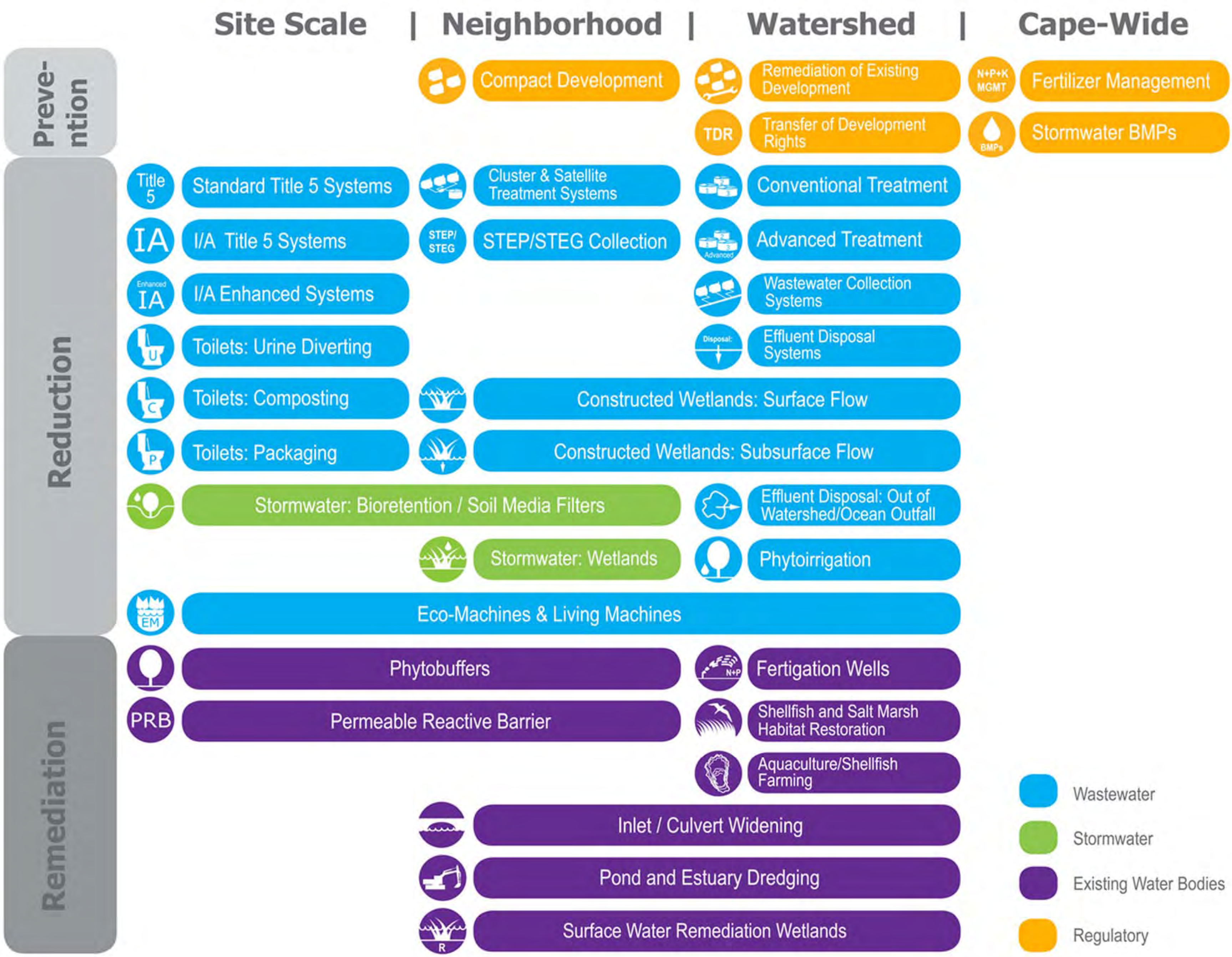
5:00 pm Adjourn

Wellfleet Harbor & Pamet River Group

Watershed Scenarios



208 Planning Process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Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
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BMPs
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Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
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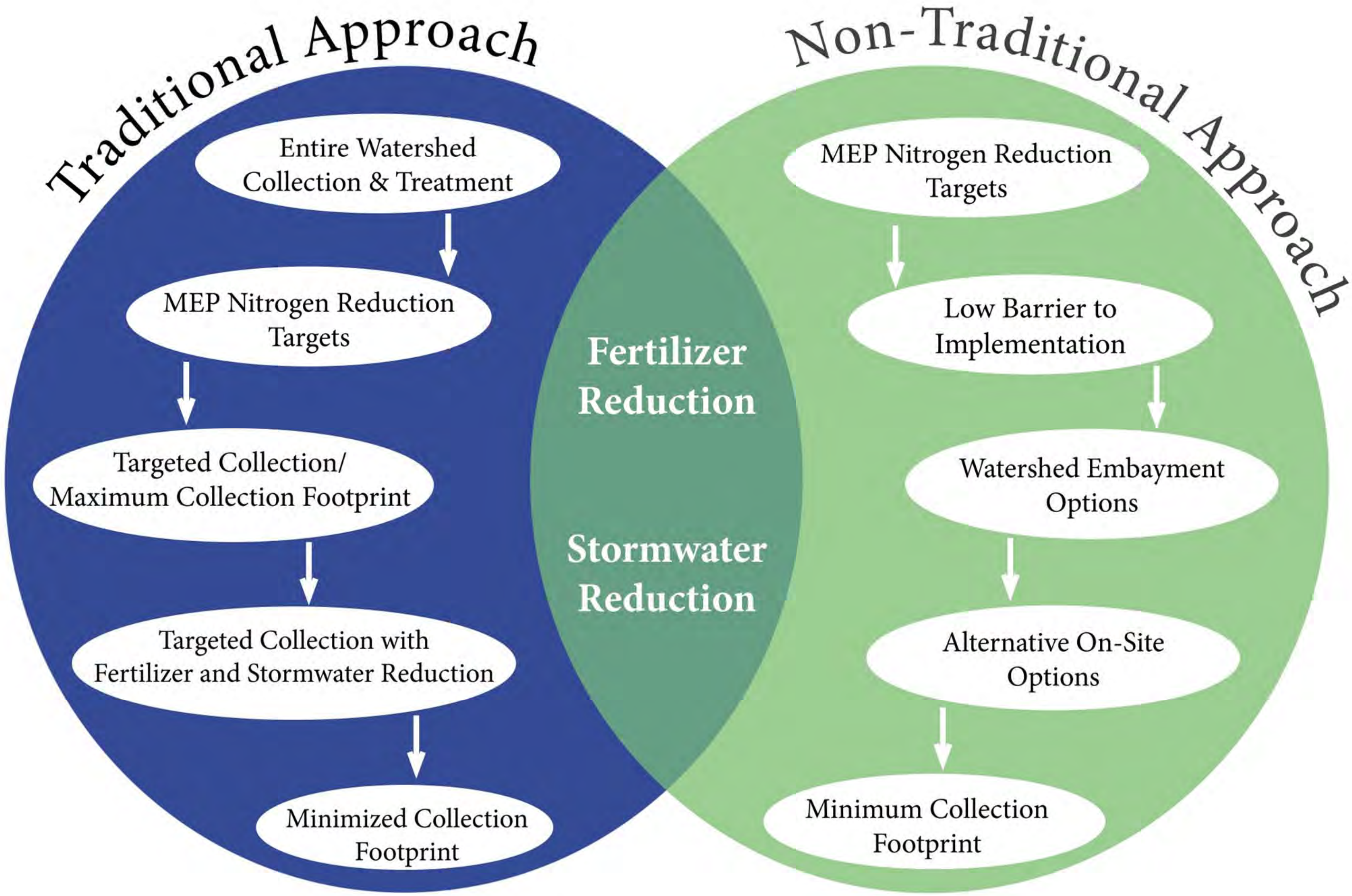
Surface Water Remediation Wetlands
Wastewater
Stormwater
Existing Water Bodies
Regulatory

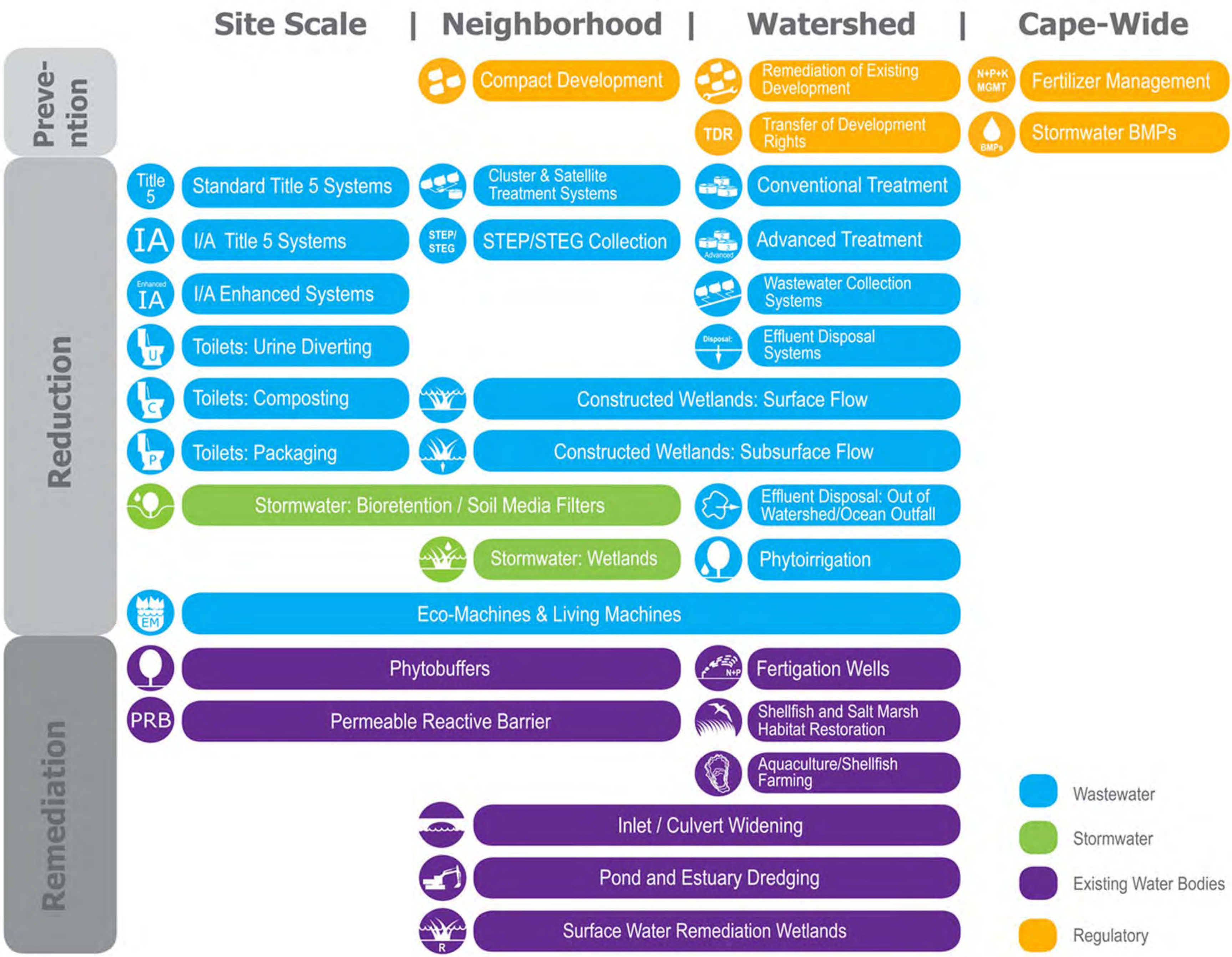
Watershed Scenarios

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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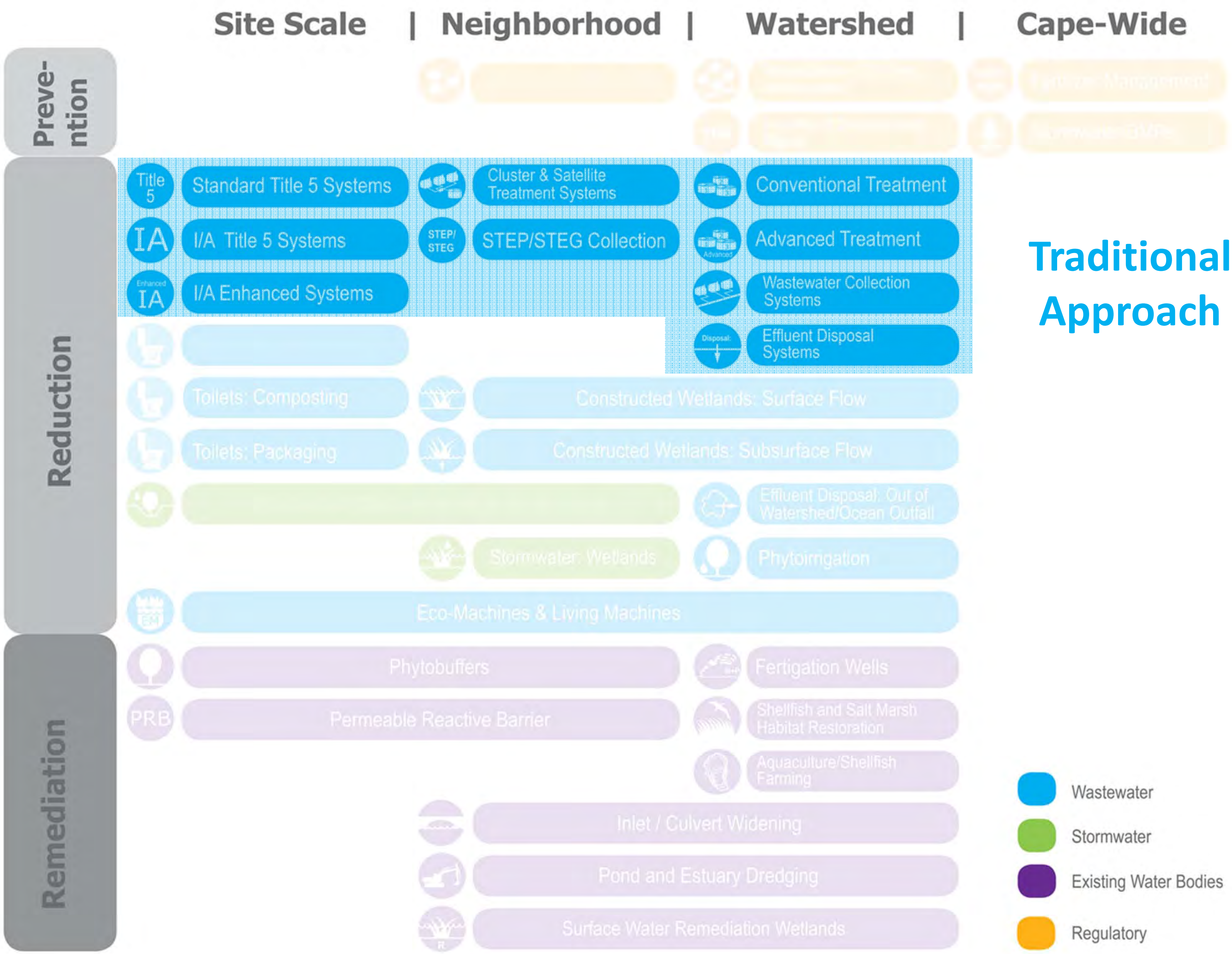
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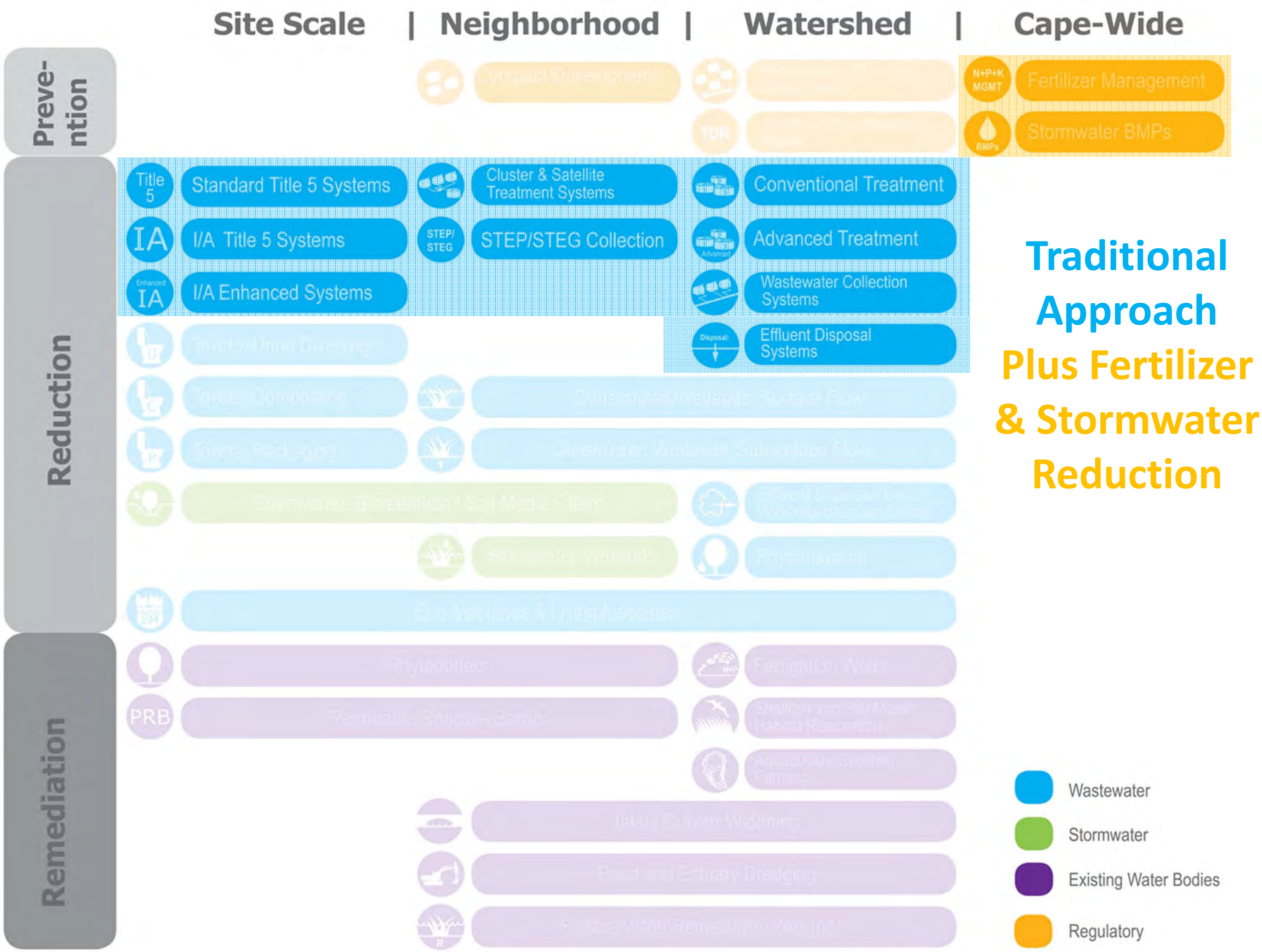
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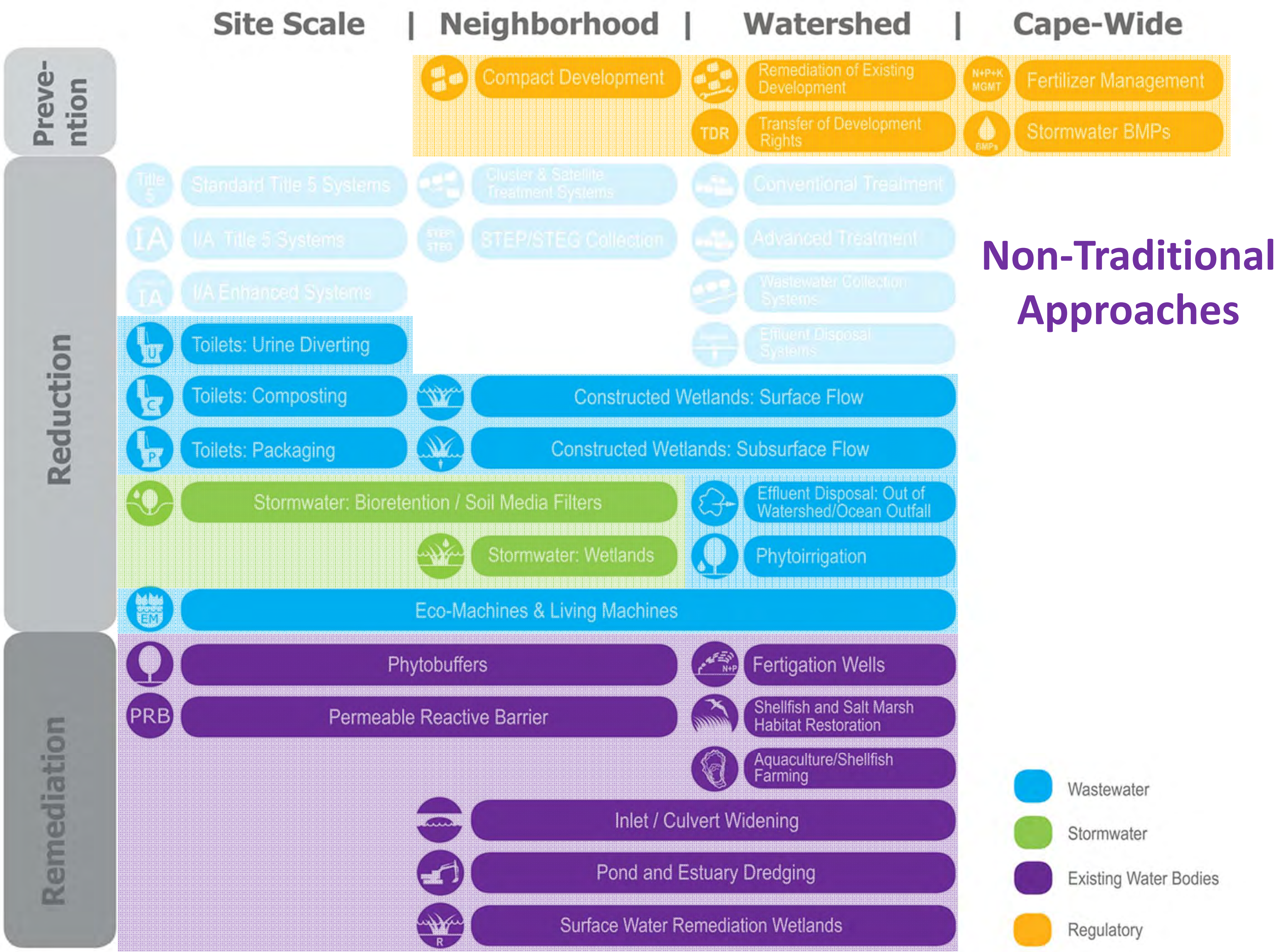
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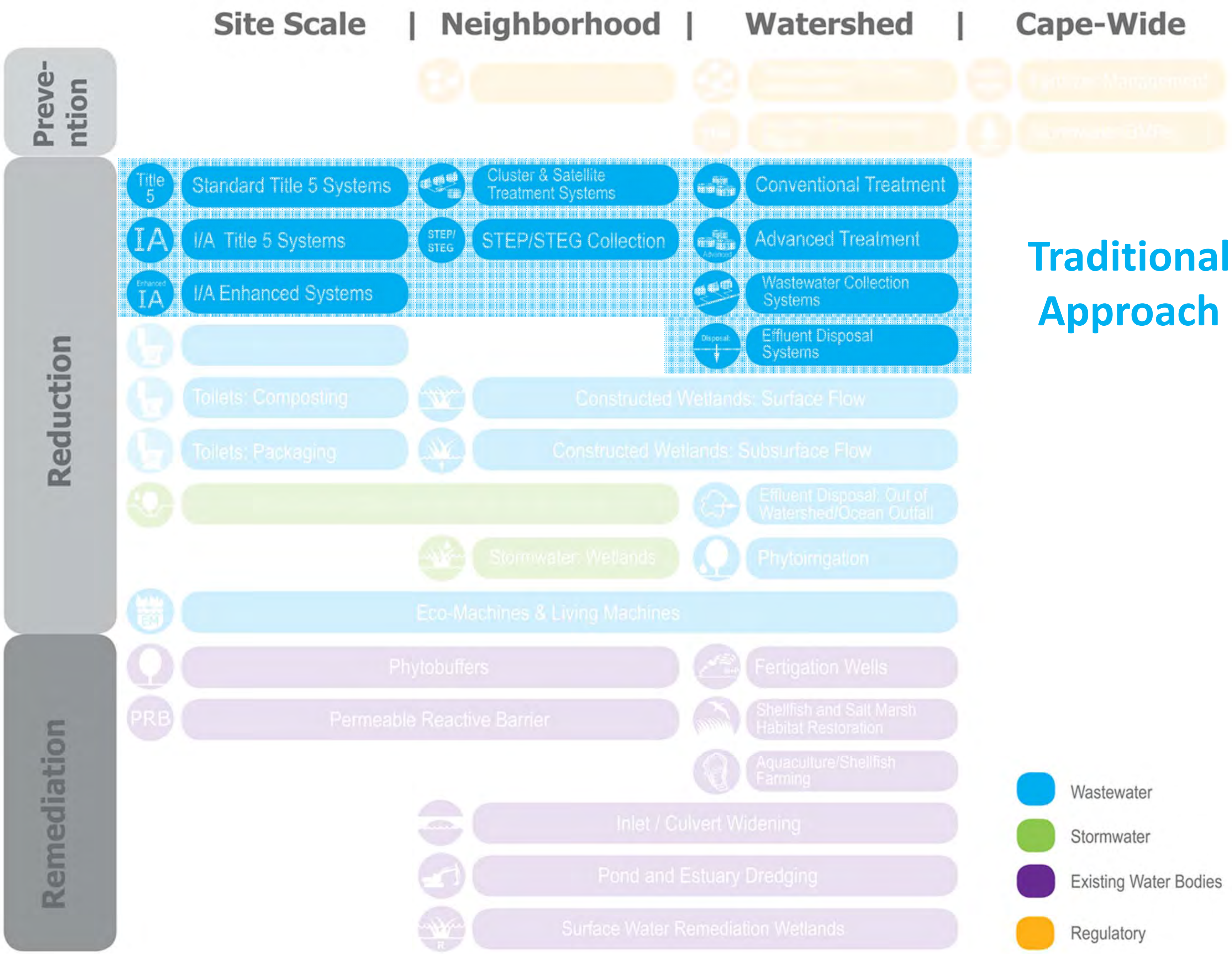
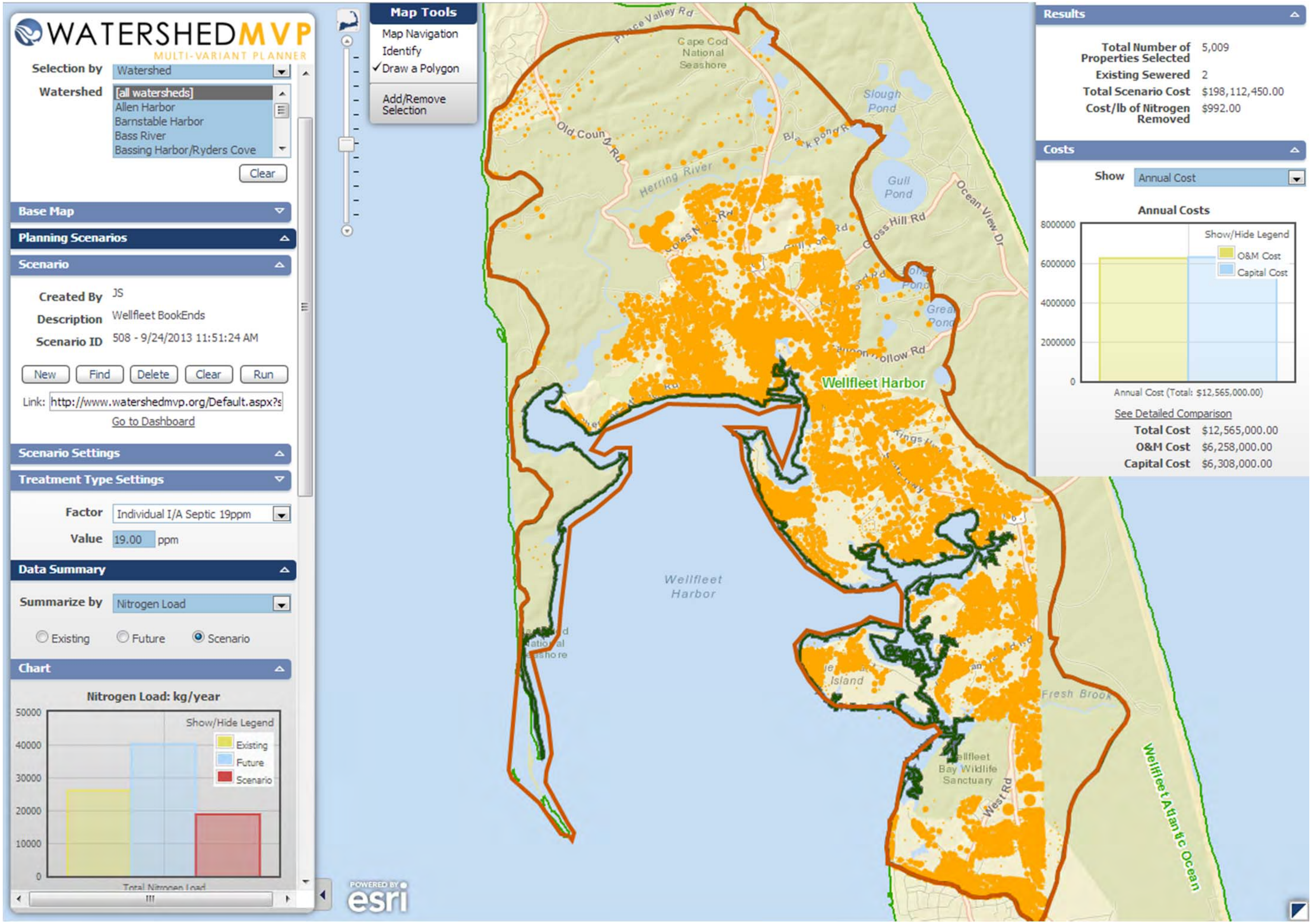
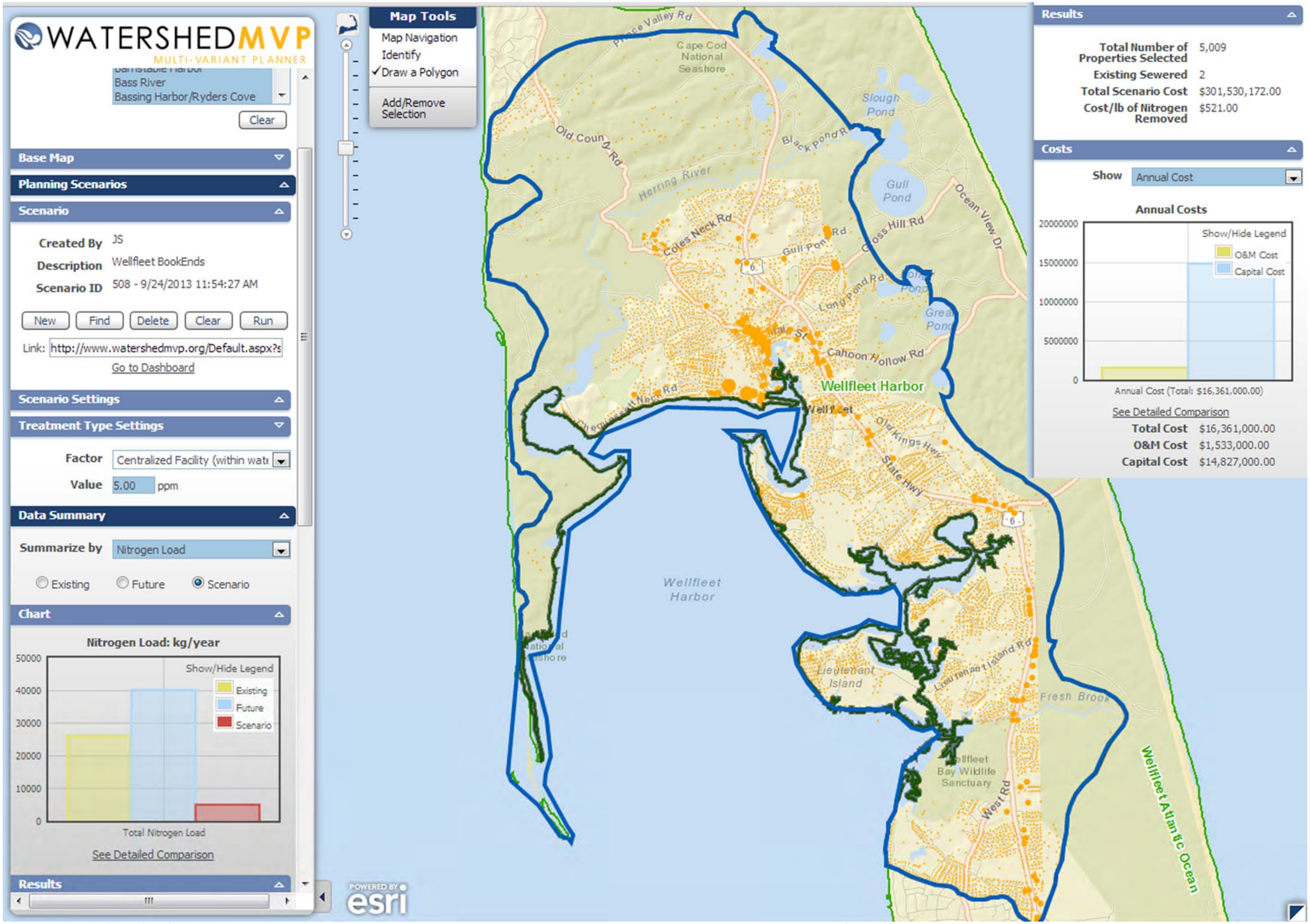
Existing Water Bodies
Regulatory

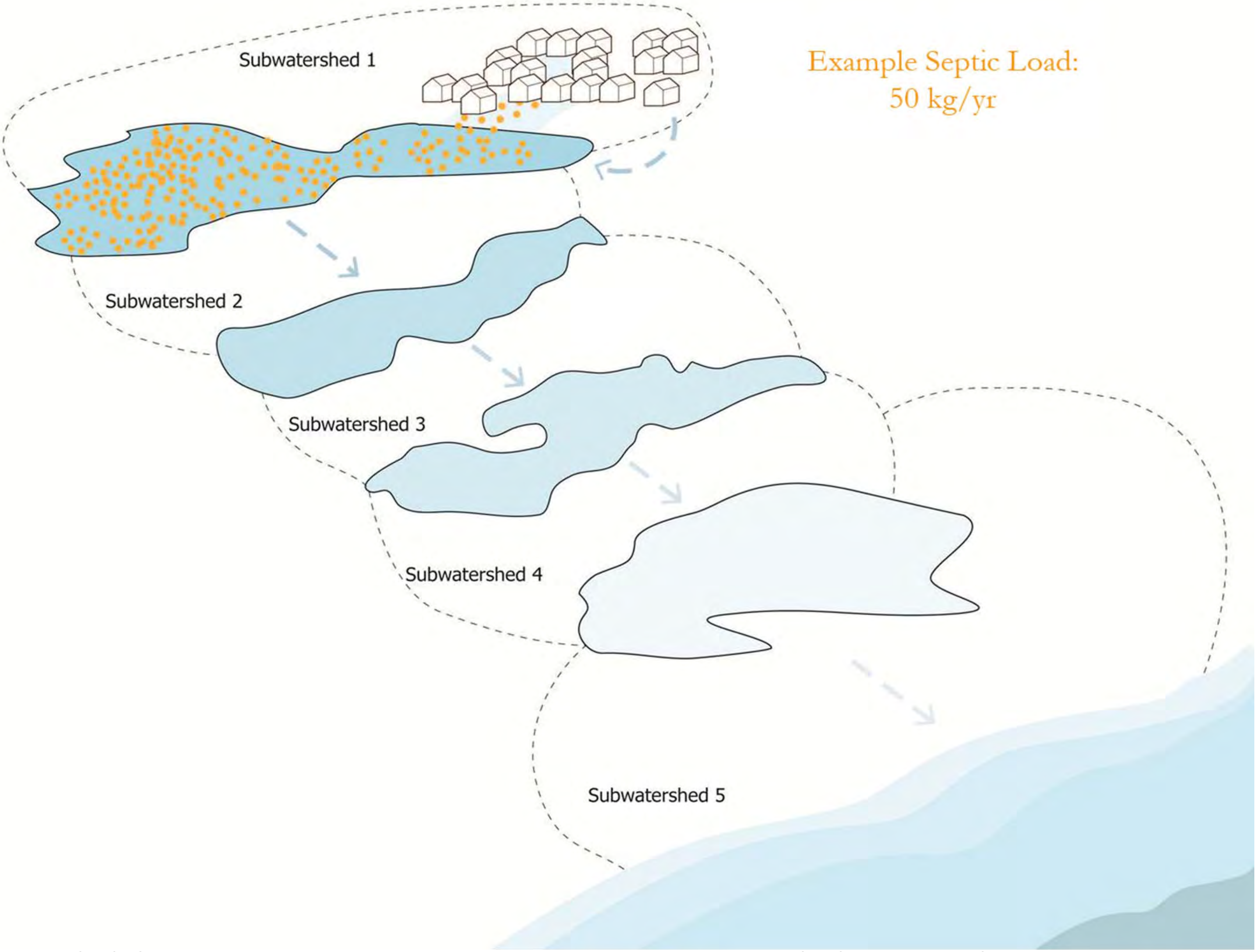

Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-ntion
Reduction
Remediation
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced Treatment
I/A Enhanced Systems
Wastewater Collection Systems
Effluent Disposal Systems
Toilets: Composting
Constructed Wetlands: Surface Flow
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
Eco-Machines & Living Machines
Phytobuffers
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
Surface Water Remediation Wetlands
Traditional Approach
Wastewater
Stormwater
Existing Water Bodies
Regulatory

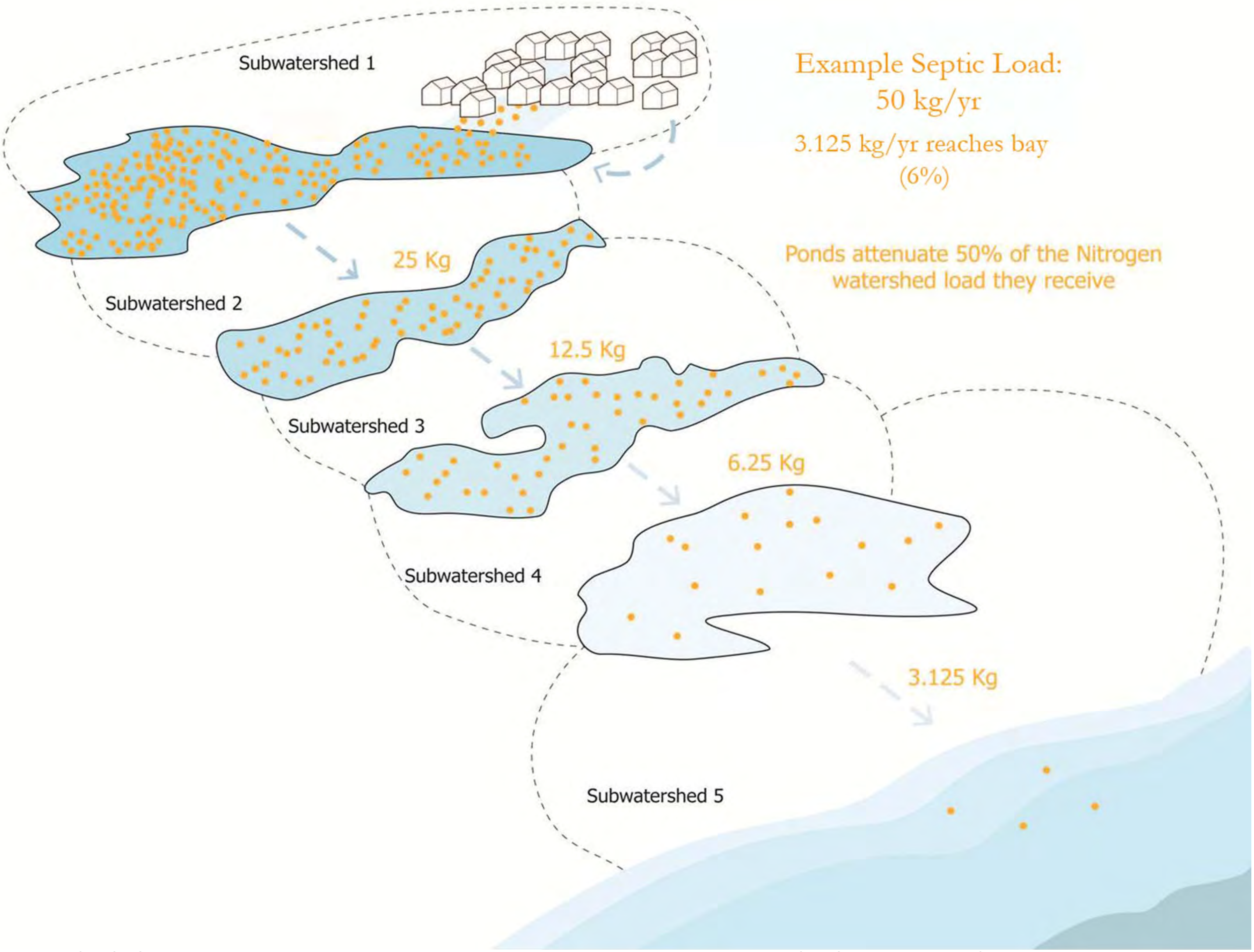
Watershed-Wide Innovative/Alternative (I/A) Onsite Systems

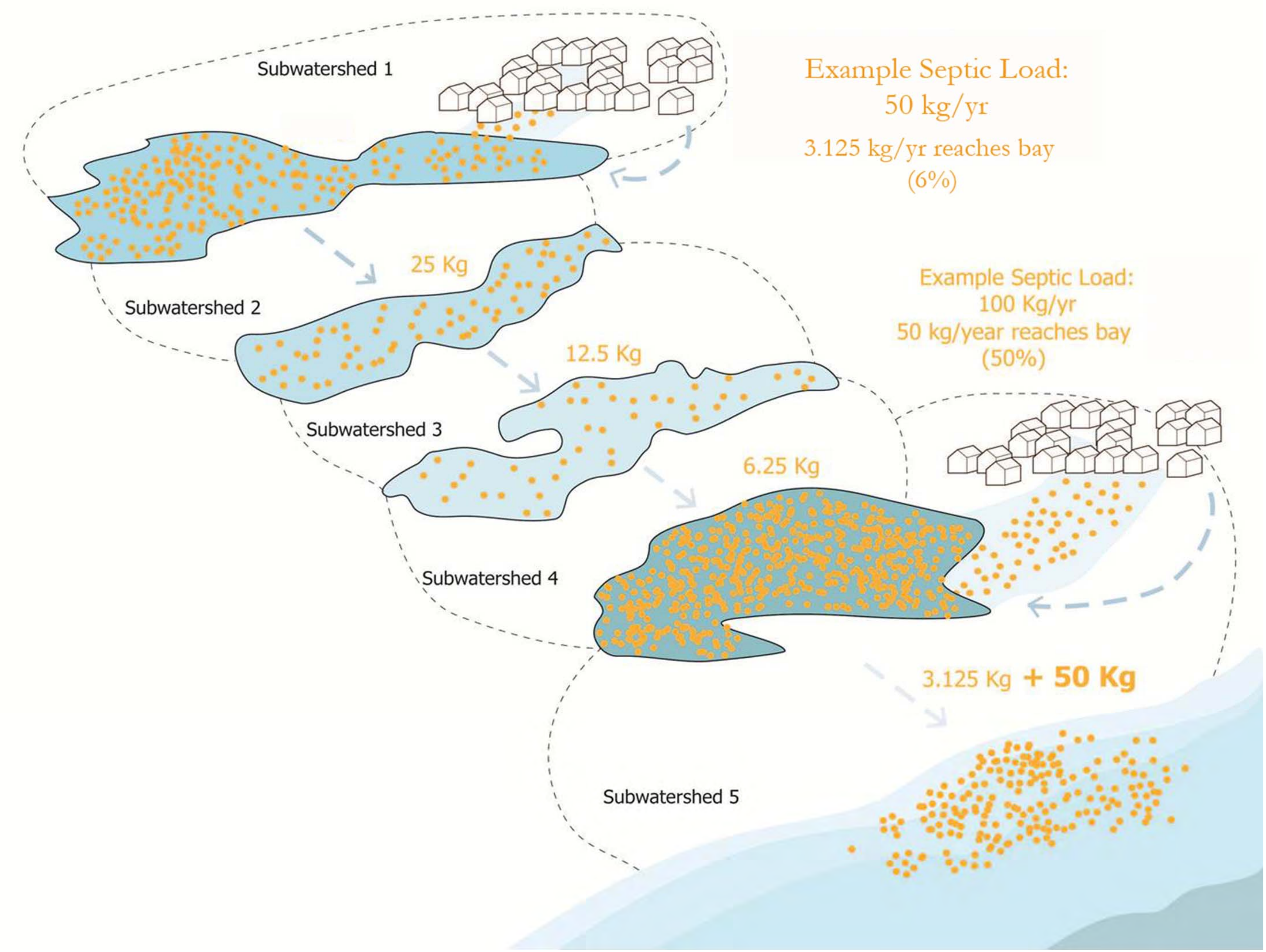


Watershed-Wide Centralized Treatment with Disposal Inside the Watershed

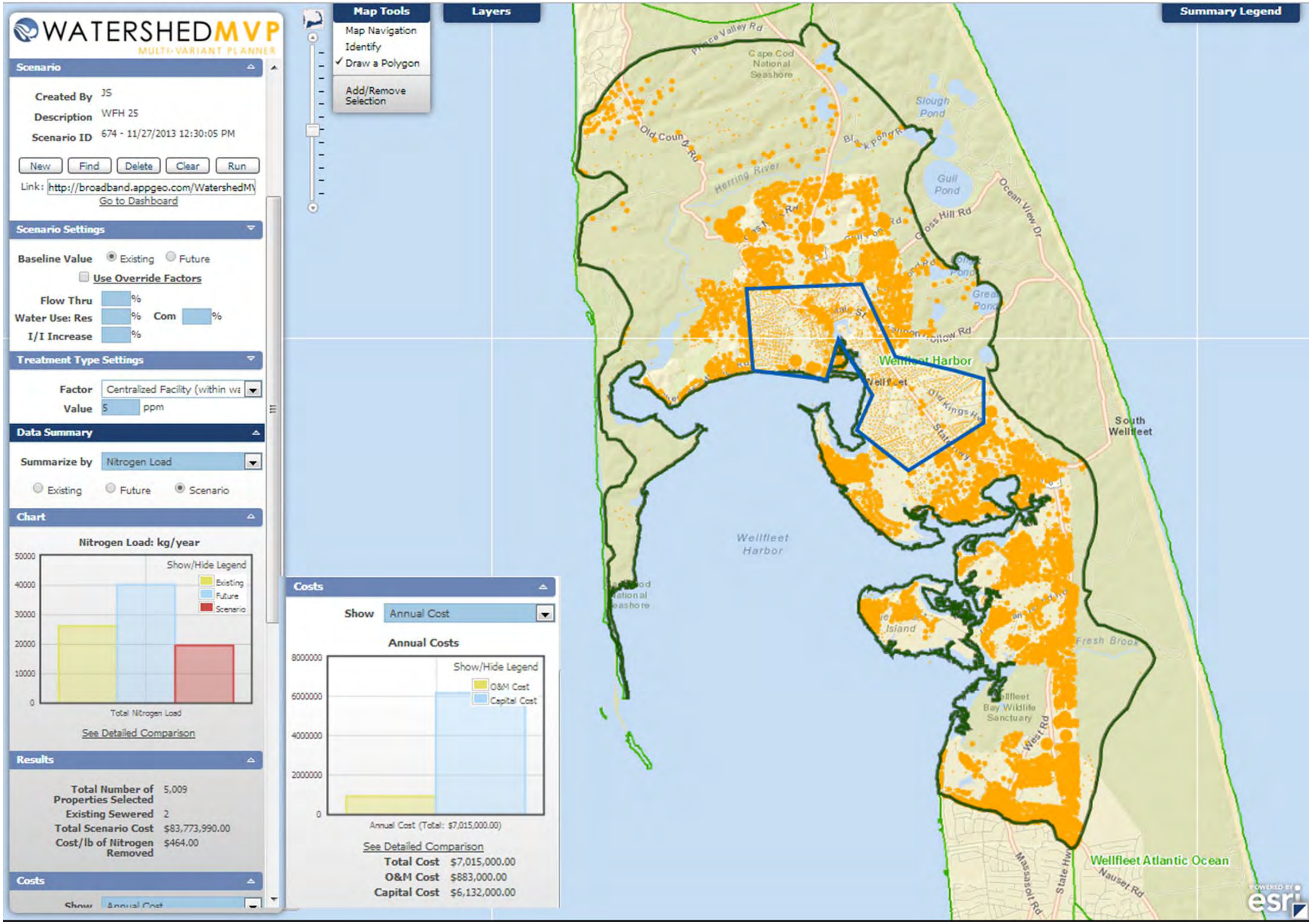



Subwatershed 1
Example Septic Load:
50 kg/yr
Subwatershed 2
Subwatershed 3
Subwatershed 4
Subwatershed 5

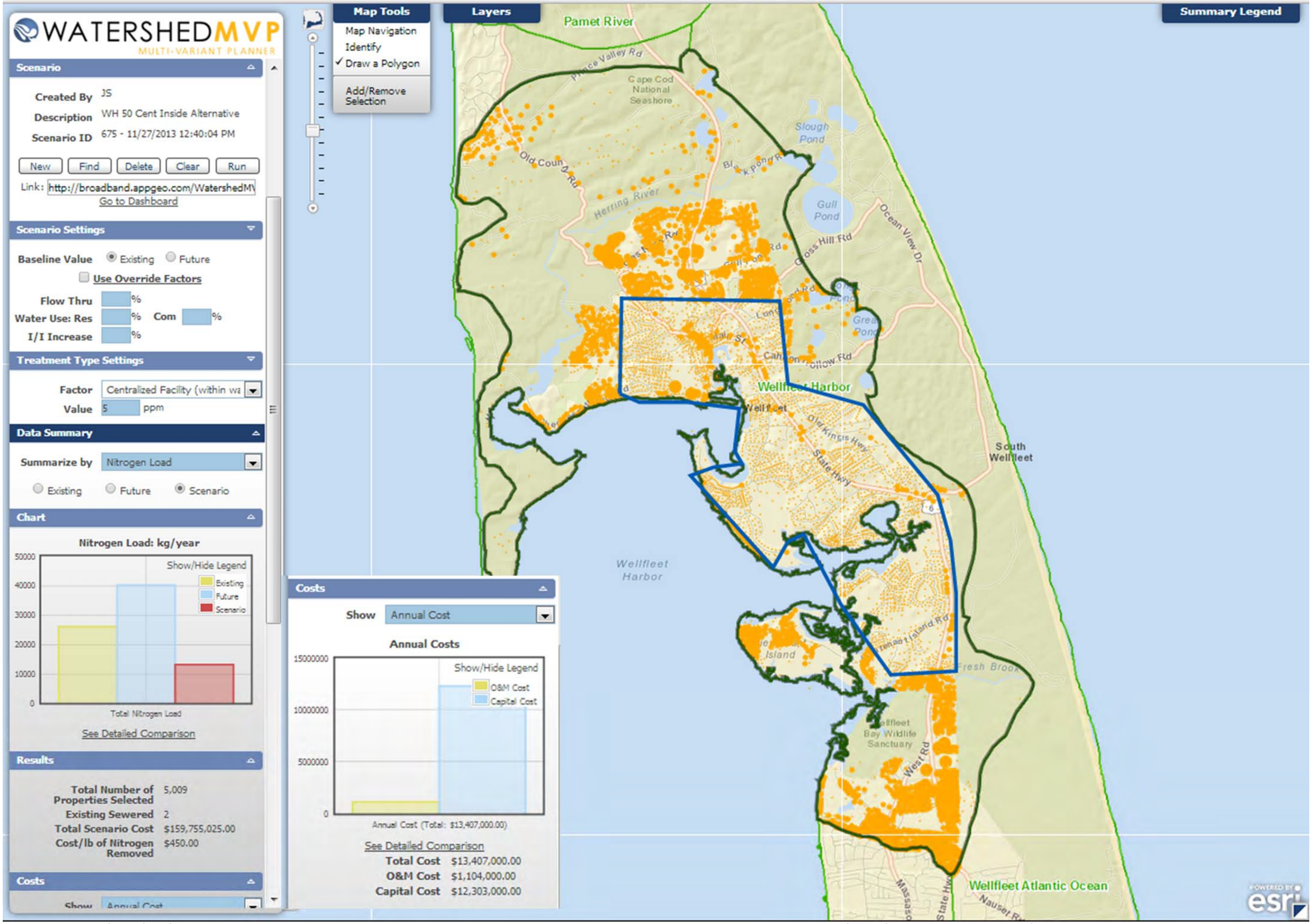

Subwatershed 1
Example Septic Load:
50 kg/yr
3.125 kg/yr reaches bay
(6%)
25 Kg
Subwatershed 2
Ponds attenuate 50% of the Nitrogen
watershed load they receive
12.5 Kg
Subwatershed 3
6.25 Kg
Subwatershed 4
3.125 Kg
Subwatershed 5


Subwatershed 1
Example Septic Load:
50 kg/yr
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 to achieve a 25% Reduction in Nitrogen

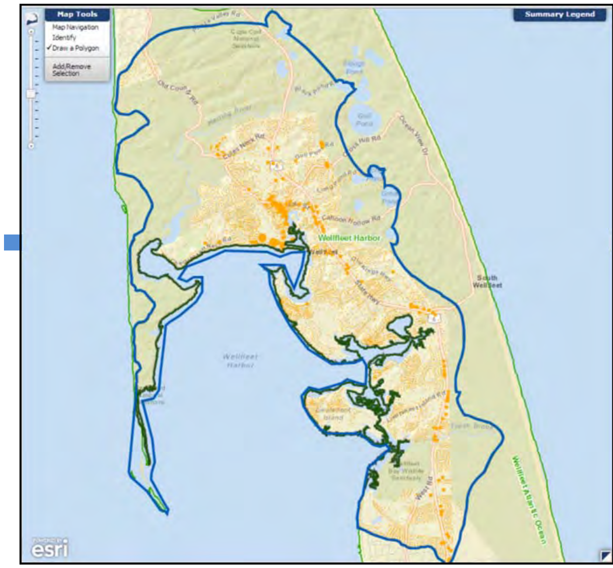


Targeted Centralized Treatment to achieve a 50% Reduction in Nitrogen



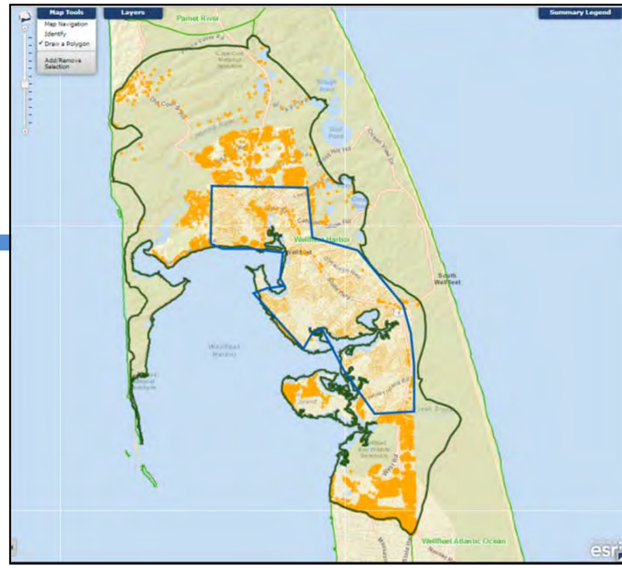
Scenario Comparison

Watershed-wide collection and treatment



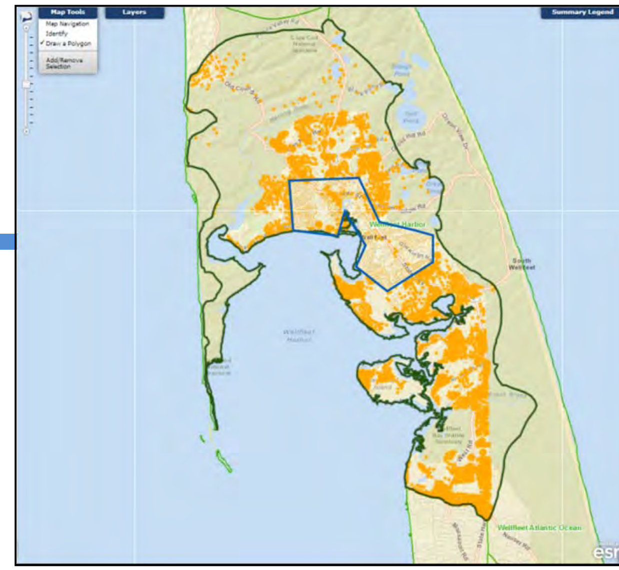
- Total Cost = $302 Million
- Cost/lb N = $521
- Treated Flow = 714,000 gpd

Targeted collection and treatment to achieve a 50% reduction in nitrogen



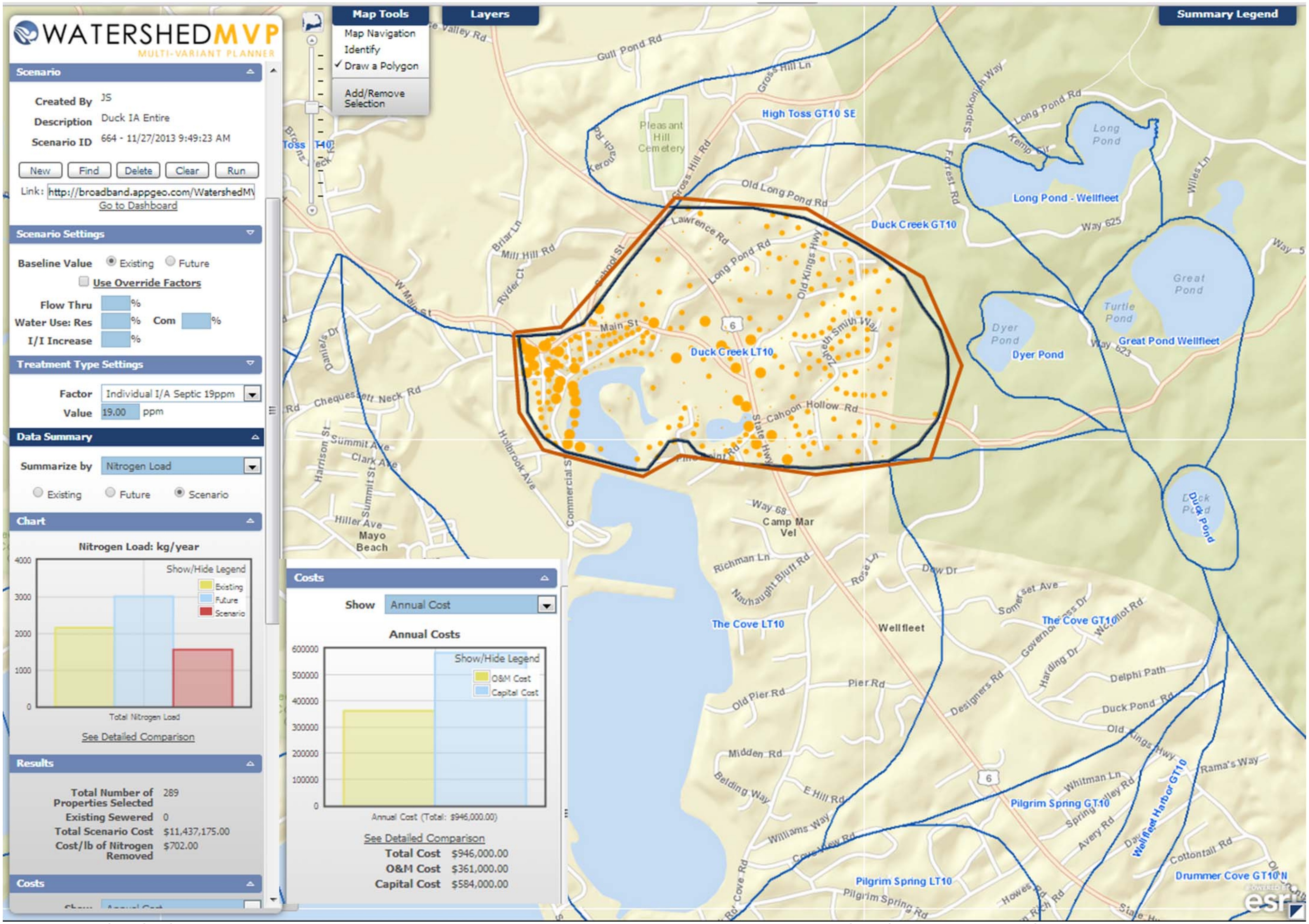
- Total Cost = $160 Million
- Cost/lb N = $450
- Treated Flow = 440,000 gpd

Targeted collection and treatment to achieve a 25% reduction in nitrogen

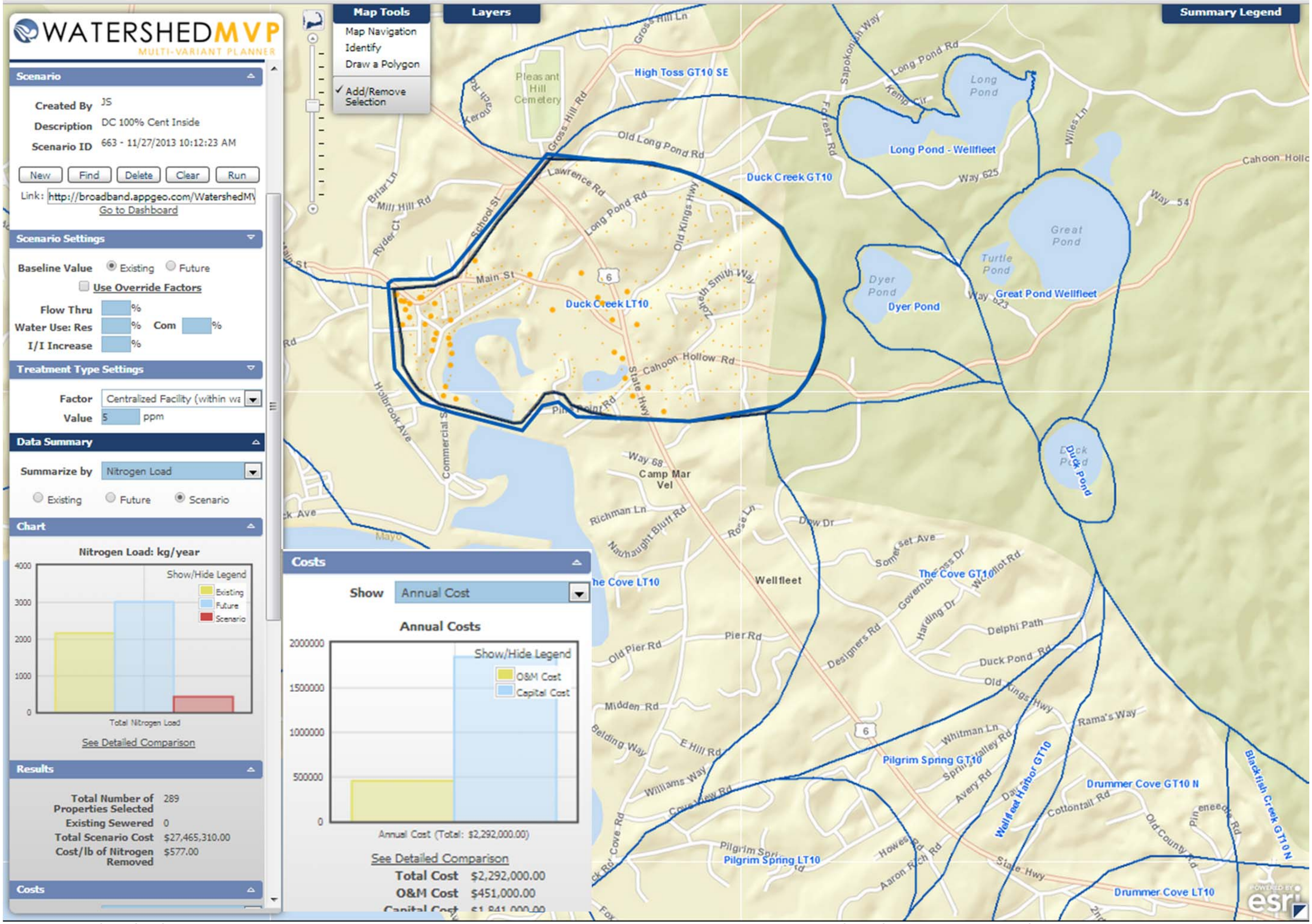


- Total Cost = $84 Million
- Cost/lb N = $464
- Treated Flow = 224,000 gpd

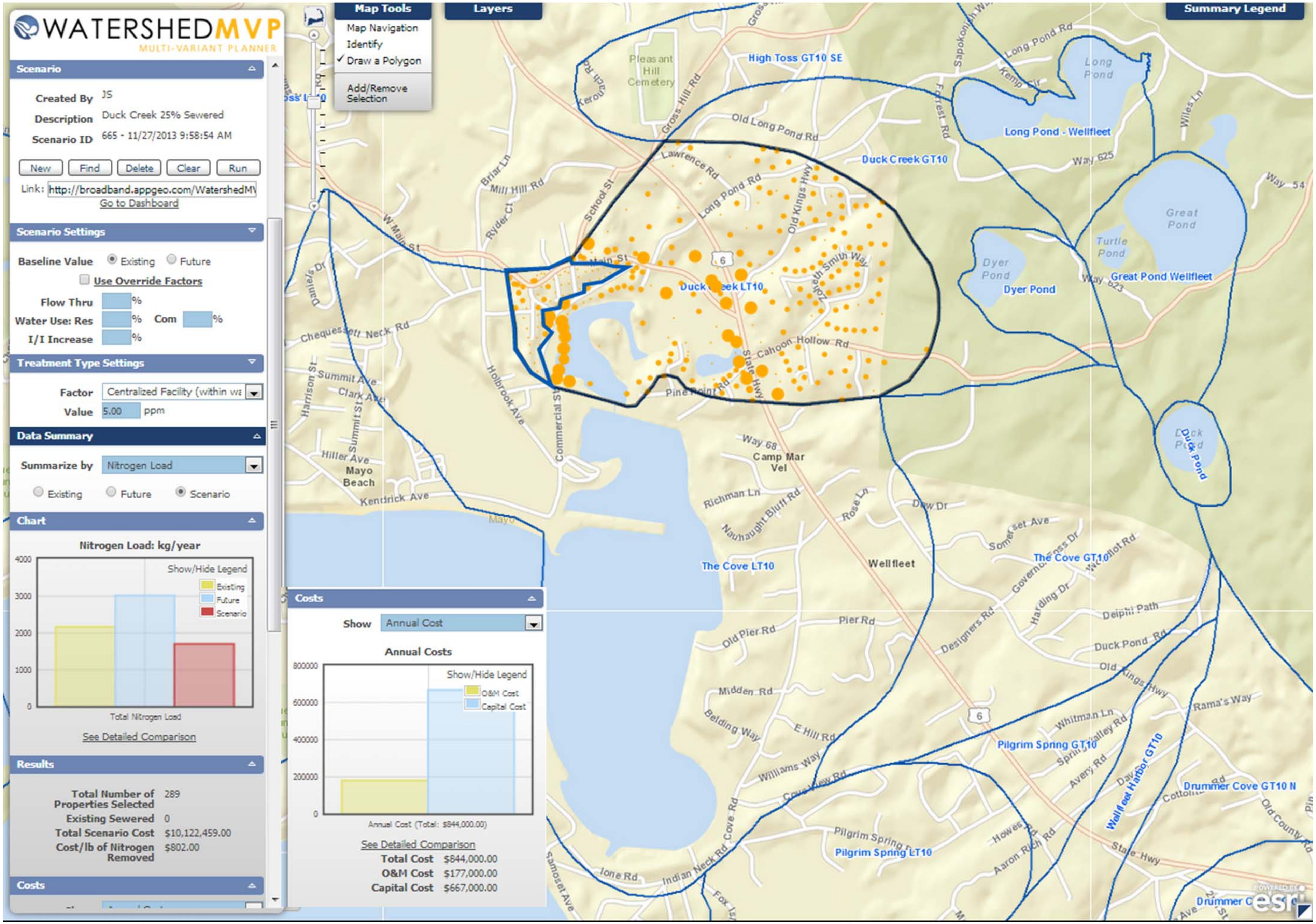
Duck Creek – Applying Innovative/Alternative On-Site Systems to the Entire Subwatershed



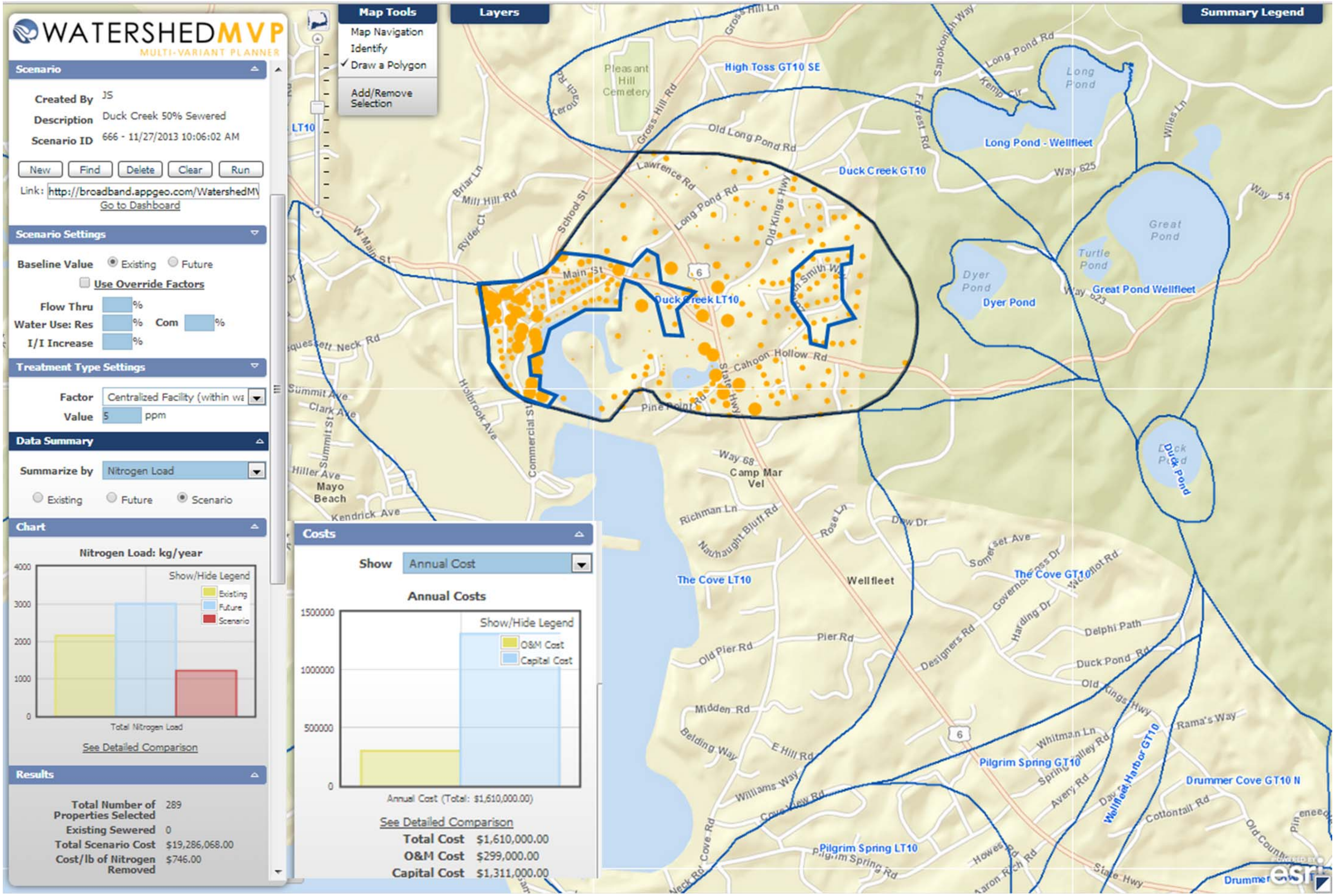
Duck Creek – Applying Centralized Treatment to the Entire Subwatershed



Duck Creek – Targeted Centralized Treatment to achieve a 25% Reduction in Nitrogen

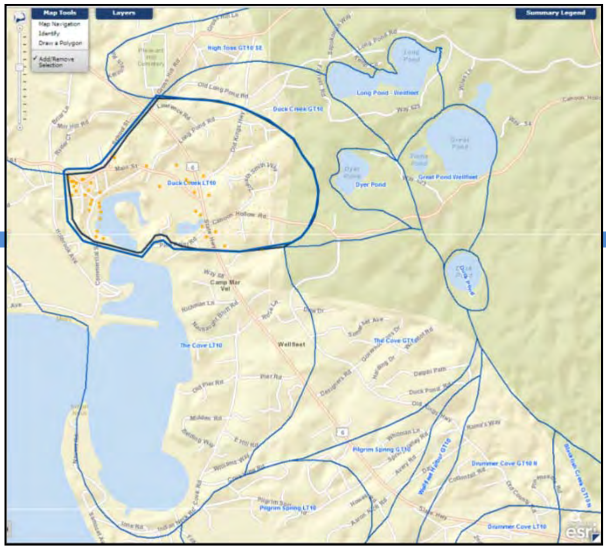


Duck Creek – Targeted Centralized Treatment to achieve a 50% Reduction in Nitrogen



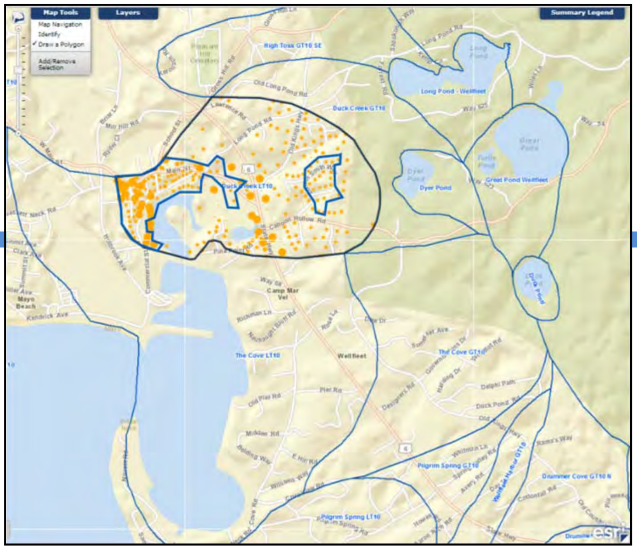
Scenario Comparison

Subwatershed-wide collection and treatment



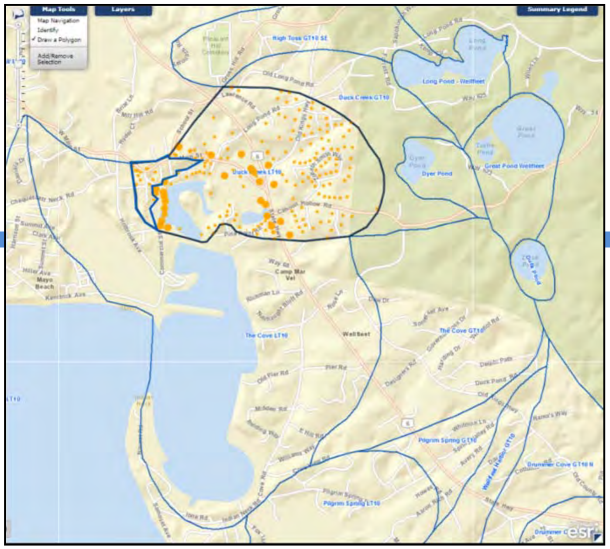
- Total Cost = $27 Million
- Cost/lb N = $577
- Treated Flow = 59,000 gpd

Targeted collection and treatment to achieve a 50% reduction in nitrogen

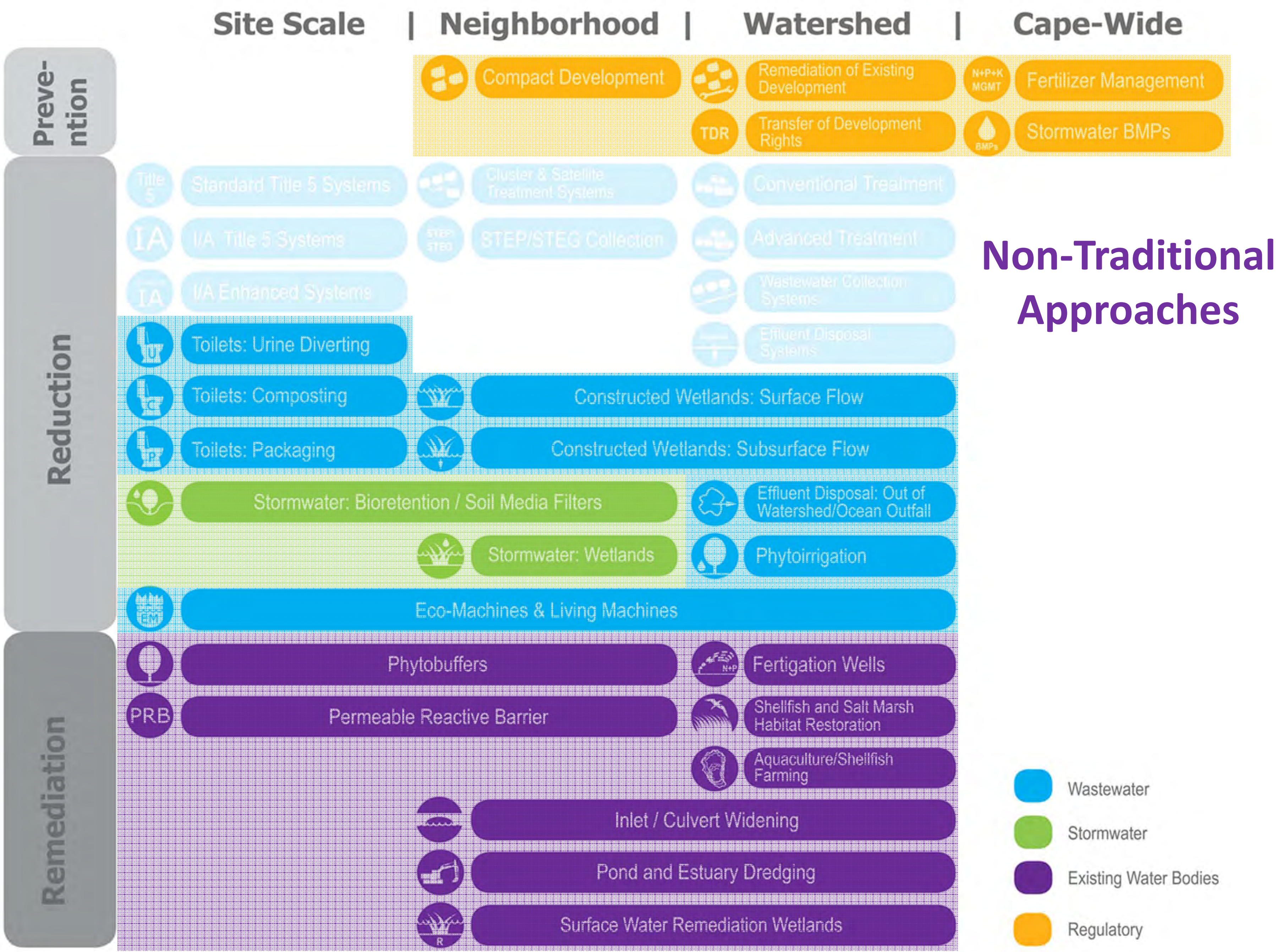


- Total Cost = $19 Million
- Cost/lb N = $746
- Treated Flow = 32,000 gpd

Targeted collection and treatment to achieve a 25% reduction in nitrogen



- Total Cost = $10 Million
- Cost/lb N = $802
- Treated Flow = 16,000 gpd


Site Scale | Neighborhood | Watershed | Cape-Wide
Preve-ntion
Reduction
Remediation
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced Treatment
IA
I/A Enhanced Systems
Wastewater Collection Systems
Toilets: Urine Diverting
Effluent Disposal Systems
Toilets: Composting
Constructed Wetlands: Surface Flow
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Non-Traditional Approaches
Wastewater
Stormwater
Existing Water Bodies
Regulatory


Problem Solving Approach
Wastewater
Existing Water Bodies
Regulatory
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
N+P+K MGMT
BMPs
4
Watershed/Embayment Options
A. Permeable Reactive Barriers
B. Inlet/Culvert Openings
C. Constructed Wetlands
D. Aquaculture
PRB
R
5
Alternative On-Site Options
A. Eco-toilets (UD & Compost)
B. I/A Technologies
C. Enhanced I/A Technologies
D. Shared Systems
Title 5
Enhanced IA
C
IA
U
P
6
Priority Collection/High-Density Areas
A. Greater Than 1 Dwelling Unit/acre
B. Village Centers
C. Economic Centers
D. Growth Incentive Zones
Advanced
Disposal
STEP/STEG
7
Supplemental Sewering
Advanced

Watershed Calculator WELLFLEET HARBOR

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
Present Total Nitrogen Load:		0	0
wastewater		0	0
fertilizer			5,100
stormwater			5,100
Target Nitrogen Load:		0	
Nitrogen Removal Required:		**0**	
Total Number of Properties:	3000		

Watershed Calculator WELLFLEET HARBOR

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
Present Total Nitrogen Load:		0	0
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Target Nitrogen Load:		0	
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Total Number of Properties:	3000		

Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

Watershed Calculator WELLFLEET HARBOR

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Nitrogen Removal Required:		**0**	
Total Number of Properties:	3000		

Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

Low Barrier to Implementation:	**Reduction by Technology (Kg/yr)**	**Cumulative Total Reduction (Kg/yr)**	**Unit Cost ($/lb N)**	**Total Annual Cost**
A) Fertilizer Management	2,550	2,550		
B) Stormwater Mitigation	2,550	5,100		

Watershed Calculator WELLFLEET HARBOR

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**		
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Target Nitrogen Load:		0			
Nitrogen Removal Required:		**0**			
Total Number of Properties:	3000				
Other Wastewater Management Needs	Ponds		Title 5 Problem Areas		Growth Management
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A) Fertilizer Management		2,550	2,550		
B) Stormwater Mitigation		2,550	5,100		
Watershed/Embayment Options:					
Permeable Reactive Barrier (PRB)	170 Homes	523.6	5,624	$452	$520,668
Permeable Reactive Barrier (PRB)	120 Homes	369.6	5,993	$452	$367,530

Watershed Calculator WELLFLEET HARBOR

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stormwater			5,100
Target Nitrogen Load:		0	
Nitrogen Removal Required:		**0**	
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Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

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Permeable Reactive Barrier (PRB)	120	Homes	369.6	5,993	$452	$367,530
Fertigation Wells	1	Golf course	136	6,129	$438	$131,050

Watershed Calculator WELLFLEET HARBOR

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
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stormwater			5,100
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Nitrogen Removal Required:		**0**	
Total Number of Properties:	3000		

Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

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Fertigation Wells	1	Golf course	136	6,129	$438	$131,050
Oyster Beds/Aquaculture	20	Acres	5,000	11,129	$0	$0

Watershed Calculator WELLFLEET HARBOR

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
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Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

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Fertigation Wells	1	Golf course	136	6,129	$438	$131,050
Oyster Beds/Aquaculture	20	Acres	5,000	11,129	$0	$0
Coastal Habitat Restoration	1100	Acres	65,837	76,966	$444	$3,215,479

Watershed Calculator WELLFLEET HARBOR

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Other Wastewater Management Needs Ponds Title 5 Problem Areas Growth Management

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Oyster Beds/Aquaculture	20	Acres	5,000	11,129	$0	$0
Coastal Habitat Restoration	1100	Acres	65,837	76,966	$444	$3,215,479
Alternative On-Site Options:						
Ecotoilets (UD & Compost)	150	Homes	594.0	76,372	$1,265	$1,653,102
Ecotoilets - Bakers Field	10	Homes	39.6	77,560	$1,265	$110,207

Watershed Calculator WELLFLEET HARBOR

MEP Targets and Goals:		**kg/day**	**Nitrogen (kg/yr)**
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stormwater			5,100
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Other Wastewater Management Needs	Ponds	Title 5 Problem Areas	Growth Management

Low Barrier to Implementation:			**Reduction by Technology (Kg/yr)**	**Cumulative Total Reduction (Kg/yr)**	**Unit Cost ($/lb N)**	**Total Annual Cost**
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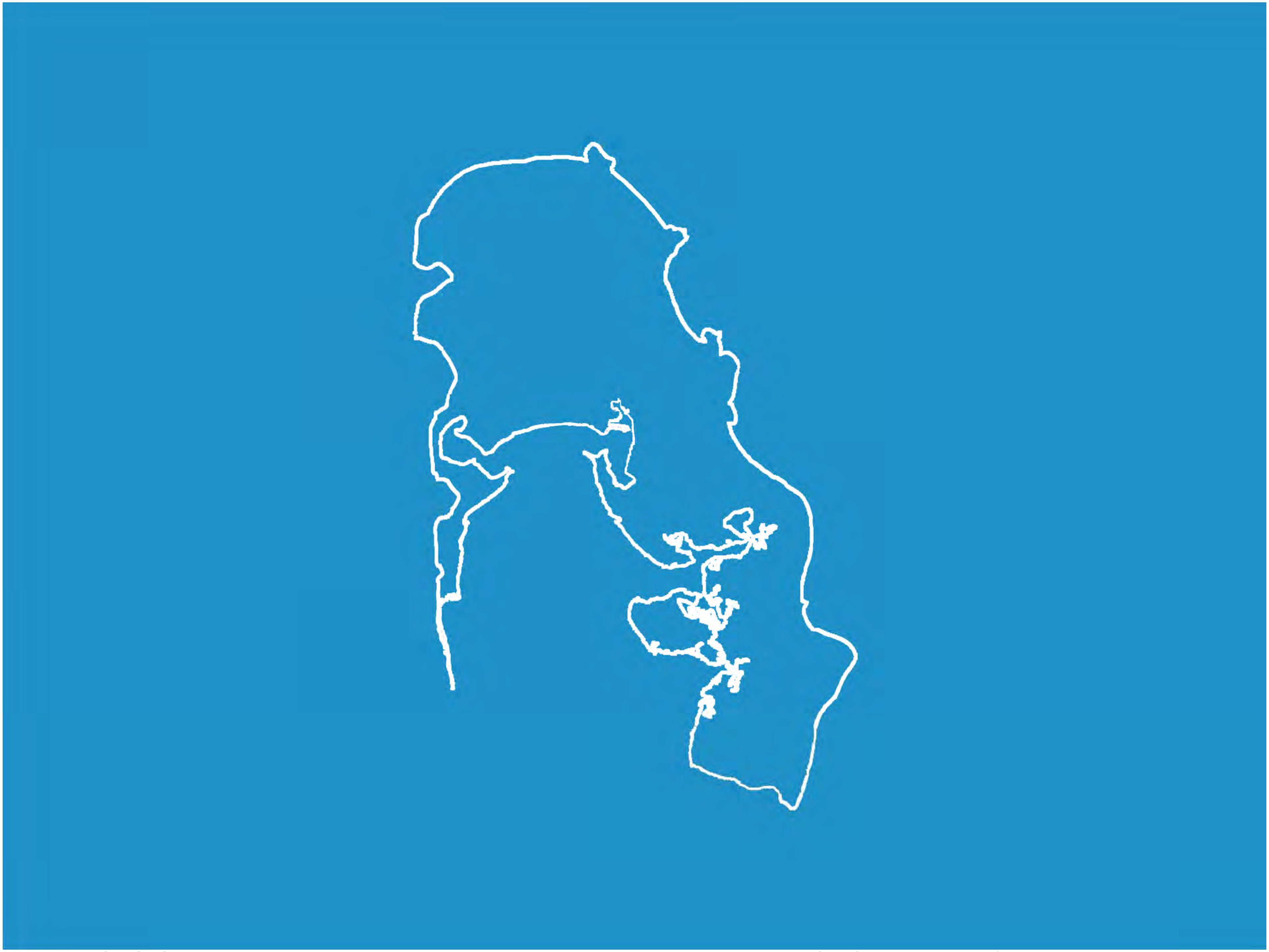
Alternative On-Site Options:						
Ecotoilets (UD & Compost)	150	Homes	594.0	76,372	$1,265	$1,653,102
Ecotoilets - Bakers Field	10	Homes	39.6	77,560	$1,265	$110,207
			Cumulative Total Reduction (Kg/yr):	77,560	$535	$5,998,036



Adaptive Management:

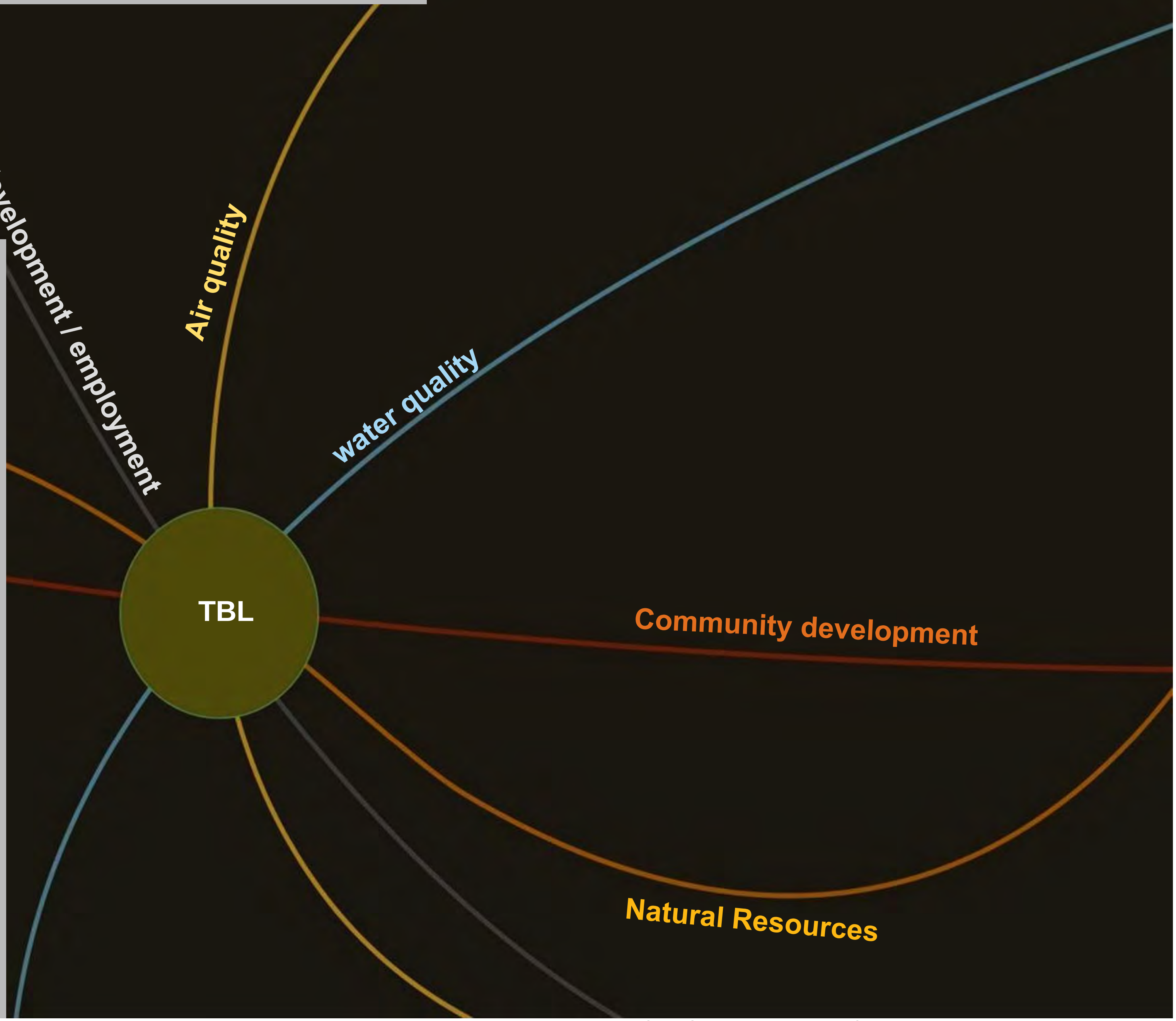
A structured approach for addressing uncertainties by linking science and monitoring to decision-making and adjusting implementation, as necessary, to increase the probability of meeting water quality goals in a cost effective and efficient ways.

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

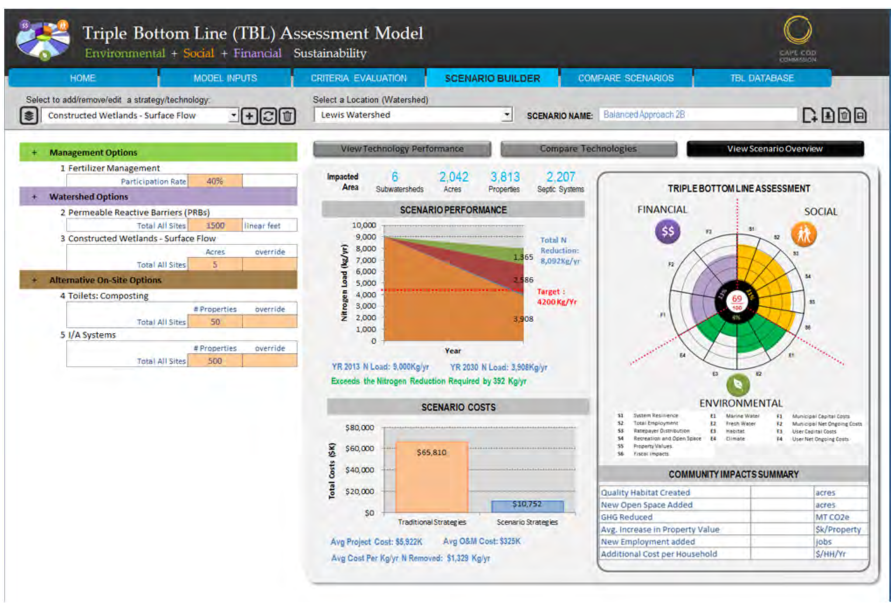
Often "TBL" analysis is used to identify the best alternative and to report to stakeholders on the public outcomes of a given investment.

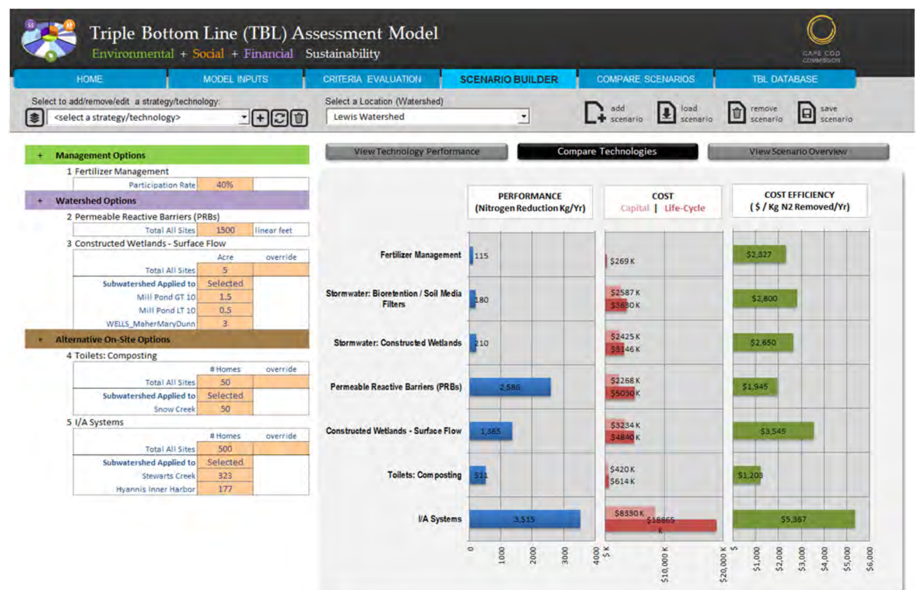


Why develop a TBL model?

- Develop triple bottom line 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

HOME | MODEL INPUTS | CRITERIA EVALUATION | SCENARIO BUILDER | COMPARE SCENARIOS | TBL DATABASE

Alternative Definition | Alternative Results | Alternative Scoring Rules

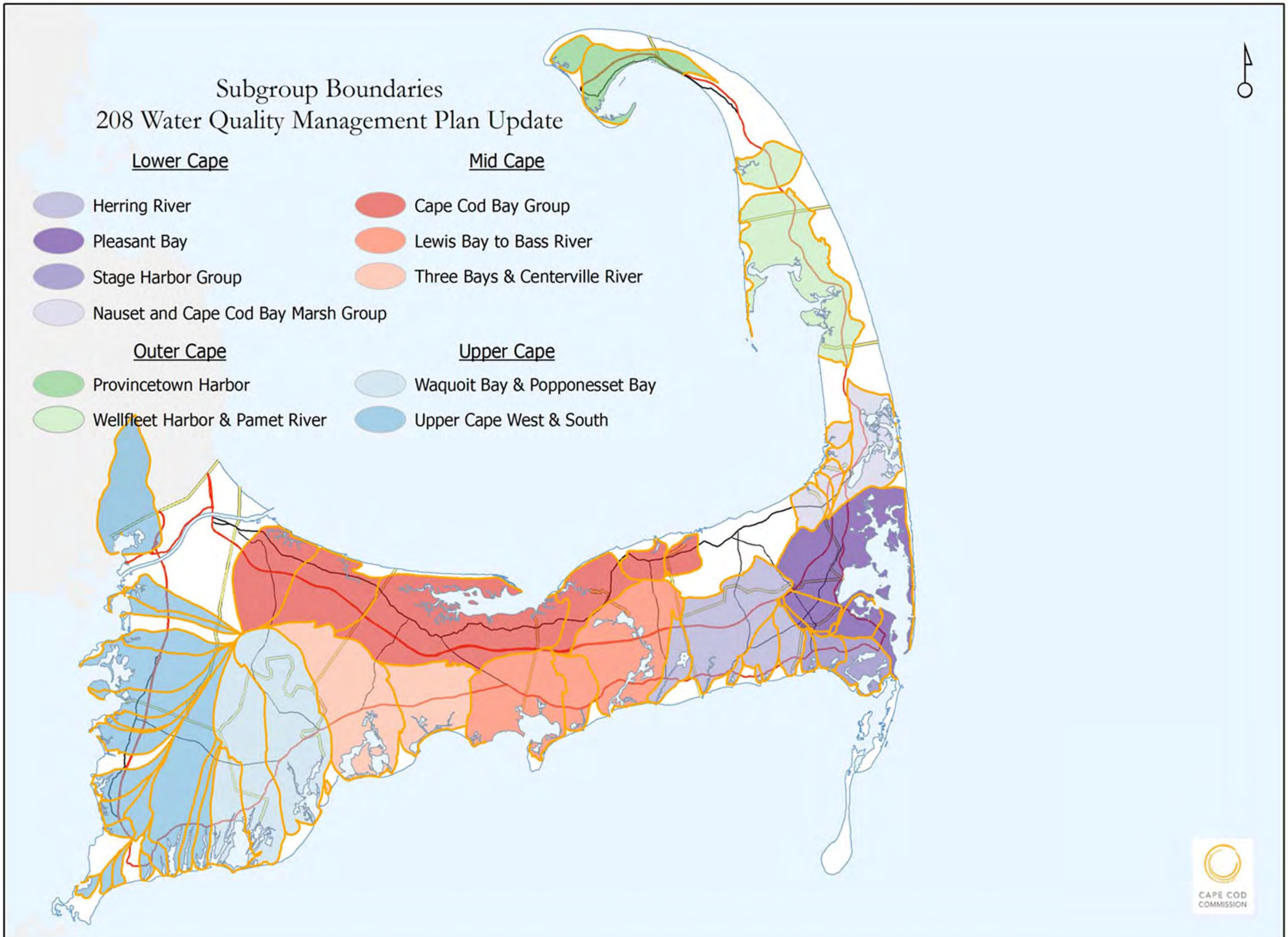
	Scenario 1	Scenario 2	Scenario 3
	Minimum Cost	Cost Effective	Maximum Performance

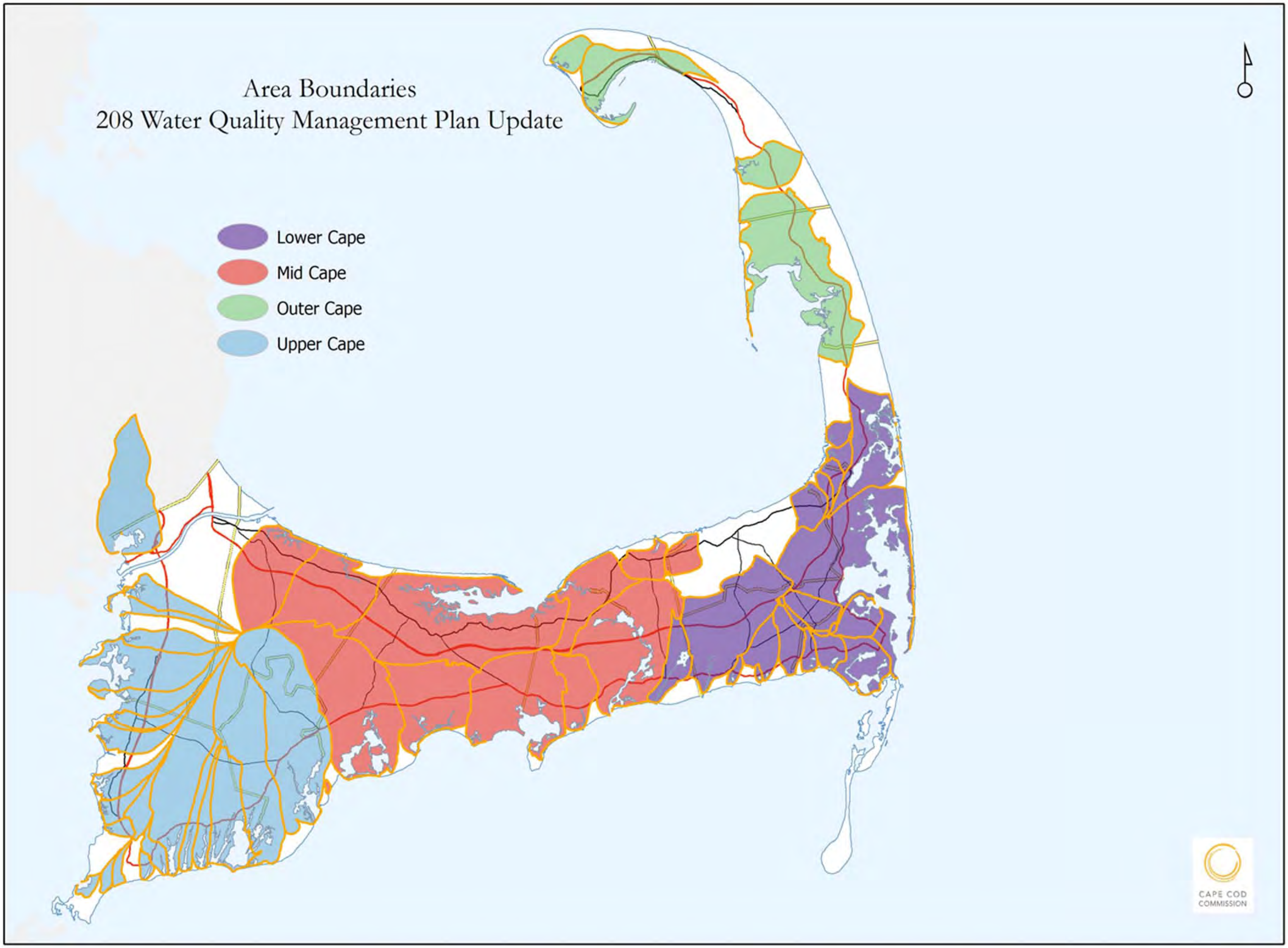
Criterion Scores

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
Wellfleet Harbor and Pamet River Watershed Working Group

Meeting Three
Monday, December 2, 2013
1:00 – 5:00 pm
Wellfleet Council on Aging

Revised Meeting Summary Prepared by the Consensus Building Institute

I. ACTION ITEMS

Working Group

- Provide any additional feedback on the meeting summary from Meeting #2 and, when it is circulated, Meeting #3.

Consensus Building Institute

- Circulate a draft meeting summary from Meeting #3 for review by the watershed working group.
- Distribute updated chronologies for water-quality developments.
- Conduct further outreach to working group members regarding the process moving forward and possible ongoing involvement, for example in the area working groups.

Cape Cod Commission

- Examine further the issue of nitrogen removal efficiency and capacity from coastal habitat restoration.
- Update the sample scenarios provided based on working group input.
- Further develop scenarios for different areas within the Wellfleet Harbor and Pamet River Watershed.

II. WELCOME AND OVERVIEW

Scott Horsley, Area Manager and Consultant to the Cape Cod Commission, welcomed participants and offered an overview of the 208 Update stakeholder process.[1] 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 were focused on exploring technology options and

[1] The PowerPoint Presentation made at this meeting is available at: http://watersheds.capecodcommission.org/index.php/watersheds/outer-cape/wellfleet-harbor-pamet-river

approaches. The third meetings of the Watershed Working Groups, held in December, focused on evaluating watershed scenarios. These scenarios are informed by Working Groups' discussions at previous meetings about baseline conditions, priority areas, and technology options/approaches.

Mr. Horsley 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.

Kate Harvey, 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 but would not be asked to "vote" on a specific approach. She also reviewed action items, including:
- Erin Perry and other staff at the Cape Cod Commission updated the chronologies for water-quality developments for the jurisdictions in the Wellfleet Harbor and Pamet River Watershed based on input received in Meeting 1.
- Ms. Harvey requested that any Working Group members with input about the meeting summary from Meeting 2 provide that feedback to her during the week of Meeting 3 (from December 2 to December 6).
- Scott Horsley and Tom Cambareri, Cape Cod Commission, met with representatives Wellfleet's Comprehensive Wastewater Planning Committee to discuss the Committee's current thinking about wastewater projects in the community. The Commission has incorporated these ideas into their own scenarios for the watershed.

III. INITIAL SCENARIOS FOR THE WELLFLEET HARBOR AND PAMET RIVER WATERSHED

Scott Horsley explained the Commission's process to develop watershed scenarios. Two teams were formed: one team is exploring "conventional" technologies and approaches (e.g. sewering and I/A systems) and another team is exploring "alternative" technologies and approaches. The teams are both working under the assumption that fertilizer and stormwater reductions will be incorporated into all of the scenarios.

Conventional Scenarios

James Sherrard, Hydrologist in the Water Resources Department at the Cape Cod Commission, led the discussion of "conventional" technologies and approaches. He explained that the scenarios were developed using the Commission's Watershed MVP Tool. This modeling tool allows the Commission to model and illustrate how different conventional technologies and approaches (such as innovative/alternative (I/A) onsite systems, natural attenuation, and centralized treatment) would be implemented geographically in a given area.[2]

Mr. Sherrard offered the following scenarios for the Wellfleet Harbor and Pamet River Watershed as a whole:

- Innovative/Alternative (I/A) Onsite Systems:
  - Implemented watershed-wide, this would yield only a marginal reduction in nitrogen loads, and was therefore not considered further. The reduction in nitrogen loads would be from 26 parts per million (ppm) to 19 ppm. It would cost approximately $13 million to install I/A systems on every property in the watershed.
- Natural Attenuation:
  - Freshwater ponds can attenuate 50% of the nitrogen watershed load that they receive. Using a series of ponds, a watershed could attenuate the vast majority of its nitrogen outflow before it reaches embayments. This approach would not be very effective in the Wellfleet Harbor and Pamet River Watershed, however, because this watershed has human settlements located very close to the coast, meaning that nitrogen from these septic loads reach the coast without having the opportunity to pass through a series of freshwater watersheds.
- Centralized Treatment with Disposal Inside the Watershed:
  - Watershed-wide collection and treatment would treat a flow of 714,000 gallons per day (gpd) at a total estimated cost of $302 million, or $16 million per year.
  - Targeted collection and treatment to achieve a 50% reduction in nitrogen would treat a flow of 440,000 gallons per day (gpd) at a total estimated cost of $160 million.
  - Targeted collection and treatment to achieve a 25% reduction in nitrogen would treat a flow of 224,000 gallons per day (gpd) at a total estimated cost of $84 million.

Mr. Sherrard also reviewed modeling that the Cape Cod Commission conducted to meet expected total maximum daily loads (TMDLs) reduction targets by focusing efforts in just a portion of the watershed. He offered the following scenarios for the targeted Duck Creek area sub-watershed:

- Innovative/Alternative (I/A) Onsite Systems:
  - Implemented throughout the Duck Creek sub-watershed, this would yield only a marginal reduction in nitrogen loads. It would cost an estimated $11 million to install I/A systems on every property in the Duck Creek sub-watershed.
- Centralized Treatment:
  - Subwatershed-wide collection and treatment would treat a flow of 59,000 gallons per day (gpd) at a total estimated cost of $27 million.

[2] His presentation is available at: http://watersheds.capecodcommission.org/index.php/watersheds/outer-cape/wellfleet-harbor-pamet-river

- Targeted collection and treatment to achieve a 50% reduction in nitrogen would treat a flow of 32,000 gallons per day (gpd) at a total estimated cost of $19 million.
- Targeted collection and treatment to achieve a 25% reduction in nitrogen would treat a flow of 16,000 gallons per day (gpd) at a total estimated cost of $10 million.

Mr. Horsley noted that the reduction targets of 50% and 25% presented for the Wellfleet Harbor and Pamet River Watershed are general, round figures because the Massachusetts Estuaries Project (MEP) has not yet produced nitrogen-reduction targets for this watershed. He added that, despite the seemingly high cost of centralized treatment, some towns nevertheless opt to pursue that option because they believe that sewering can achieve multiple goals.

- *A working group member responded that Chatham has actually opted for a zero-growth plan.* Mr. Horsley answered that some jurisdictions do install centralized treatment for the purpose, at least in part, of promoting economic development.

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

- *Where would the outfall pipe from the sewer system go?*
  - Mr. Sherrard responded that the MVP system simply models how much nutrient attenuation a given system can achieve and an estimated cost. At present, the Commission has not mapped out and designed a whole system, including where an outfall pipe would be located.
  - Mr. Horsley added that the modeling for the centralized treatment systems show a non-zero quantity of nitrogen on the assumption that a small portion of nitrogen is re-entered into the ground through outflow.
- *As a matter of scale, Wellfleet's annual operating budget is about $15 million per year, whereas the cost of implementing watershed-wide sewering would be $16 million per year.* Mr. Sherrard explained that the intention of showing the modeling results was not to propose that watershed-wide sewering be implemented, but rather to show what the impact would be of installing a given technology, in this case sewering, on every parcel.
- *The "100% nitrogen removal" that the Commission is presenting would actually address only 6% of the total nitrogen load that is in the watershed.* Mr. Sherrard and Mr. Horsley agreed that the Commission's proposals for nitrogen reduction focus only on nitrogen loads from wastewater, not on other sources of nitrogen.
- *How would the planned remediation of Herring River impact these scenarios?* Mr. Sherrard responded that the Herring River remediation would be covered as part of the discussion on alternative technologies and approaches, later in the agenda.
- *Sewering seems very, very expensive for what it provides.*
- *Is it true that Massachusetts requires that drinking water pipes be installed before sewering is installed?* Mr. Sherrard and Mr. Horsley responded that they were not aware of such a condition, if it exists.

- *How would sewering handle other contaminants, including emerging contaminants of concern?*
  - Mr. Sherrard responded that one of the benefits of sewering is to centralize all of the loads into one flow, which would make it much easier to address and treat other contaminants that are identified in the future. He added that, more generally and beyond sewering, an adaptive management strategy would help to address other contaminants that arise in the future.
  - Mr. Horsley said that, while the Commission is considering contaminants other than nitrogen in its planning, the current Section 208 process is driven by nitrogen, which is the only contaminant for which the Commission has sufficient information to set quantitative reduction targets.
- *Currently, technologies do not even exist to treat many contaminants. Generally, the more flexibility that you have in your wastewater management plan, the better off you are in terms of future growth and addressing future concerns.*
- *Without concrete figures from the Massachusetts Estuaries Project for nitrogen loads and reduction targets for the Pamet River Watershed, we do not really know what we are talking about. It seems premature to proceed with any sort of remediation strategy without having more information about what the targets are.* Mr. Horsley responded that, while those numbers are forthcoming, the general concept of adaptive management is not to wait until you have all of the data. There will always be information that decision-makers do not know, and emerging contaminants coming around the corner, but prudent action can be taken despite these limitations.

Alternative Technology and Approaches

Scott Horsley, Area Manger, 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.

He offered the following scenario for Wellfleet Harbor:

- *Nitrogen reduction goals:*
  - As noted above, the MEP has not yet released figures regarding current nitrogen loads or removal targets for the Wellfleet Harbor watershed. However, existing nitrogen loads from septic systems and fertilizers was based upon the town's CWMP report.
- *Low barrier options:*
  - Options with low barriers to implementation include fertilizer management, which is projected to reduce 2,550 kilograms of nitrogen per year, and stormwater mitigation, which is projected to reduce another 2,550 kilograms of nitrogen per year.

- *Watershed/embayment options:*
  - The Cape Cod Commission identified two sites in the Wellfleet Harbor area that could be explored for installation of permeable reactive barriers (PRBs). PRBs are deemed reasonable to install where a road passes perpendicular to groundwater flow directions, in areas where the water table is relatively shallow, and at close-proximity to a water body. One of these two PRBs that that Commission identified would filter the flow of wastewater from 170 homes and the other would filter the flow of wastewater from 120 homes. The first PRB would reduce 524 kilograms of nitrogen per year and the second would reduce 370 kilograms of nitrogen per year, both at a unit cost of $452 per pound of nitrogen.
  - A fertigation well on the one golf course in Wellfleet would reduce 136 kilograms of nitrogen per year at a unit cost of $438 per pound of nitrogen.
  - Twenty acres of oyster beds could reduce 5,000 kilograms of nitrogen per year at a unit cost of $0 per pound of nitrogen (assuming that Wellfleet does nothing more than permit the creation of oyster beds and the actual implementation is undertaken by oystermen for their own profit).
  - 1,100 acres of coastal habitat restoration associated with the Herring River project could reduce 66,000 kilograms of nitrogen per year at an estimated unit cost of $444 per pound of nitrogen.
- *Alternative on-site options:*
  - Assuming that, some day, 5% of homes (totaling 150 homes) in Wellfleet adopt either composting toilets or urine diversion toilets, Wellfleet would be able to reduce 594 kilograms of nitrogen per year at an estimated unit cost of $1,265 per pound of nitrogen (assuming that the town provides financial incentives for the adoption of these toilets).
  - Installing eco-toilets at a town-sponsored project at Bakers Field would reduce 40 kilograms of nitrogen per year at an estimated unit cost of $1,265 per pound of nitrogen.
- If Wellfleet were to adopt all of these measures, it would be able to mitigate an estimated 77,600 kilograms of nitrogen per year at an estimated unit cost of $535 per pound of nitrogen and a total estimated cost of $5,998,036.

Working Group members had the following questions and comments about the Wellfleet Harbor scenario.

- *The $0 cost estimate that the Commission has given for installing oyster beds does not seem realistic. My understanding is that the best way to achieve nitrogen-reduction using this method is actually to introduce oyster beds and let the oysters mature without actually harvesting the oysters. If this strategy were followed, there would be no return-revenues from oystering, and so no fishermen would install oyster beds at their own expense. So in that way, there would be a cost for the town. In addition, in New York Harbor, the authorities attempted this strategy of installing oyster beds to reduce contamination but ended up having to put security guards on 24-hour watch to make sure that no one harvested the oysters for human consumption.* Mr. Horsley responded that, based on the conversations he has had, the return revenues from the installation of oyster beds are significant enough to generate a profit. Regarding the New York example, oysters harvested from Wellfleet Harbor would be safe for human consumption since they would not have the industrial contaminants present in New York Harbor.

- *What is the assumed amortization period used for these calculations?* Mr. Horsley responded that a 20-year amortization is assumed for each of the presented technologies.
- *The 3,000 properties that you have listed for Wellfleet Harbor is a little complicated because the area actually has 4,300 properties, but many of these are seasonally occupied.* Yes, that is how we arrived at the 3,000 figure.
- In response to a comment from a member of the public, Working Group members and Commission representatives discussed the differential in nitrogen removal efficacy between freshwater and saltwater wetlands and how the Commission arrived at its projections for nitrogen removal due to coastal habitat restoration. Mr. Horsley noted that the Commission does not have unequivocal data about the nitrogen-mitigation effects of coastal habitat restoration on the Cape and Commission representatives pledged to examine this issue of nitrogen removal efficiency and capacity further. He also added that the Technologies Advisory Panel has encouraged the Commission to consider oyster beds and coastal habitat restoration, which they believe may be two of the most promising and cost-effectiveness technologies that currently exist.
- *The town should take account of the nitrogen-reduction impacts of other actions that are already being implemented for other reasons. For example, the restoration of Herring River will probably happen, and so the incremental cost of nitrogen mitigation from that project is very small.* Commission representatives agreed.
- *How large or long would the permeable reactive barriers be?* Mr. Horsley responded that the PRBs would be installed underground and so would not really be visible from the surface. A PRB would likely need to be at least 1,000 feet long to make it cost effective to install, but it could easily be longer than that also.
- *What if the figures and assumptions that the Commission used for the nitrogen-reduction effects of oyster beds and coastal habitat restoration are incorrect?* Mr. Horsley responded that an adaptive management plan would be able to address those sorts of issues. Generally, however, the Commission used the most conservative figures from different examples on the Cape for its assumptions.
- *It would be very difficult to win a vote for sewering in Wellfleet when there are other technologies, such as sewering, that already seem to be working. If further nitrogen mitigation is needed, we could install more oyster beds.*
- *What about plans for Truro, Pamet River?* Mr. Horsley explained that analysis would be done for each of the watersheds on Cape Cod and noted that Truro has not been completed yet. He offered some initial suggestions but indicated that these would need to be fleshed out during the next few months, with input from Truro participants.

Kate Harvey, Facilitator, reminded participants of the priorities and concerns that they had raised at past Working Group meetings including: contaminants of emerging concern, prioritizing co-benefits and return revenues, secondary impacts to wildlife, who is responsible for implementing solutions, aesthetics, seasonality, property values, who bears the cost, and public buy-in. She asked if, given these priorities and concerns, working group members had suggestions on additional technologies or approaches that might be appropriate for this watershed. Stakeholders offered the following recommendations for additional projects:

- A stormwater mitigation system on the wharf,
- A stormwater system on the southern part of Commercial Street,
- Harvesting phragmites would potentially reduce up to 16% of nitrogen,
- Implement a restoration project upstream of Duck Creek,
- Add a permeable reactive barrier at the intersection of Main Street and Route 6.

IV. ADAPTIVE MANAGEMENT

Scott Horsley explained the concept of adaptive management 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 cost effective and efficient ways. He asked Working Group members to help the Commission to think through what an adaptive management plan for the Wellfleet Harbor and Pamet River Watershed might look like, including:

Time frame for monitoring:

- Working Group members and Commission representatives discussed what sort of timeframe would be appropriate for monitoring the initial implementation of nitrogen-mitigation technologies. Participants noted that, while the Herring River restoration would take at least ten years to move from planning to implementation to testing (at least for the first phase of the project), it may not actually be a good model to use to estimate an appropriate time frame for monitoring because of the complexity of the project.

Additional projects (or Plan B):

- Installation of additional oyster beds
- Widening the channel in Duck Creek to improve flushing
- Permeable reactive barriers
- Herring River restoration
- Improving the bathrooms at the marina
- Mayo Creek project

Suggestions for how to prioritize projects:

- Projects that are already working and that can easily be implemented, such as oyster beds;
- Projects that would be implemented for another reasons, such as improving the

bathrooms at the marina and the Mayo Creek project;
  - Hillary at Environmental Partners has a list of projects that local towns are considering implementing that could also have co-benefits in terms of nitrogen mitigation
- Projects that are relatively low-cost, such as widening the Duck Creek channel.

V. PREPARING FOR 2014 JAN-JUNE

Scott Horsley and Erin Perry shared the Commission's plans for continuing stakeholder engagement into 2014, which includes the following:

Triple Bottom Line (TBL) approach

Mr. Horsley and Ms. Perry explained that 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. A TBL model will consider the financial, environmental, and social consequences of water quality investments and policies in Cape Cod. The TBL Model under development by the Commission will evaluate the "ancillary" or downstream consequences of water quality investments that are not the direct phosphorous or nitrogen levels that are the primary area of concern.

Stakeholder Process: Summit and Working Groups

Ms. Perry explained that stakeholder process for the Section 208 Planning process going forward. She said that the Commission would be convening an optional stakeholder summit with all 11 of the watershed subgroups in January. After this summit, the Commission will be aggregating the subgroups into 4 Area Working groups (representing the areas of: Lower Cape, Mid Cape, Outer Cape, and Upper Cape). These Area Working groups will include local residents and stakeholders, including some members of the watershed subgroups, as well as representatives from MA DEP and EPA. The idea behind convening these Area Working groups is to continue to seek stakeholder participation and guidance without asking all of the members of the eleven watershed subgroups to continue to serve on their committees over the next six months.

In response to Ms. Perry's comments, working group members had the following questions and comments:

- *At the local level, who will be signing off on the plans? Will the Board of Selectmen in each town have a chance to weigh in?* Ms. Perry and Ms. Harvey, the facilitator, responded that the Cape Cod Commission is putting together a plan for the entire Cape that includes a broad range of options that represent a variety of interests and perspectives. The four area working groups will include Selectmen and also various other interests, including business and real estate interests, environmental interests, etc. Ultimately, the plan is under the authority of the Cape Cod Commission and will not require an affirmative vote from local governments, although the Commission is committed to seeking local input and guidance.

- *It is absolutely critical that the Commission review this process and these plans with the Board of Selectmen in each and every town. A lot of good work has been done by the Commission, but all of it is in jeopardy because, if local stakeholders like the Selectmen are left out of the process, there may be a backlash against the plan.*
- *The people in this room have been participating in this process over the past three months and understand the thinking and the evolution of the plans. However, many other people, including the Selectmen and other members of the public, have not been engaged in this process. An education and outreach effort will probably be needed to gain buy-in from this broader constituency.* Ms. Perry responded that such an effort is planned for coming months.

VI. PUBLIC COMMENTS

No public comments were made.

APPENDIX ONE: MEETING PARTICIPANTS

Name	Affiliation
Working Group Members	
Joanna Buffington	Eastham Board of Health
Curt Felix	Comprehensive Wastewater Planning Committee, Wellfleet
Deborah Freeman	Wellfleet Conservation Trust; Friends of Herring River
Charleen Greenhalgh	Town Planner, Truro; Assistant Town Administrator
Charles Harris	Water Management Committee, Eastham
Ned Hitchcock	Wastewater Committee, Wellfleet
Laura Kelley	Littlefield Landscapes, Eastham
Lauren McKean	National Parks Service
John Morrissey	Selectman, Wellfleet
Patricia Pajaron	Health Agent, Truro
Tracey Rose	Real Estate Agent, Thomas D. Brown Real Estate Agency
Harry Turkanian	Town Administrator, Wellfleet
Bill Worthington	Planning Board, Truro
Staff	
Kate Harvey	Consensus Building Institute
Tushar Kansal	Consensus Building Institute
Scott Horsley	Cape Cod Commission
Anne McGuire	Cape Cod Commission
Erin Perry	Cape Cod Commission
James Sherrard	Cape Cod Commission
Observers	
Joseph Buteau	Truro, Energy Committee
Dan Milz	PhD Candidate, University of Chicago
Ed Nash	Golf Course Superintendents Association of Cape Cod