Implications of Climate Change on Large Scale Restoration Planning: A Policy-Level Perspective

Maryland State of the Coast Conference

May 22, 2018

Presented by Lee Currey
Director, Water & Science Administration
Maryland Department of Environment

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Presentation Overview

Past, present and possibilities into the future

- Chesapeake Bay TMDL and climate adaptation
- Restoration, adaptation and permitting in the watershed
- Shoreline protection

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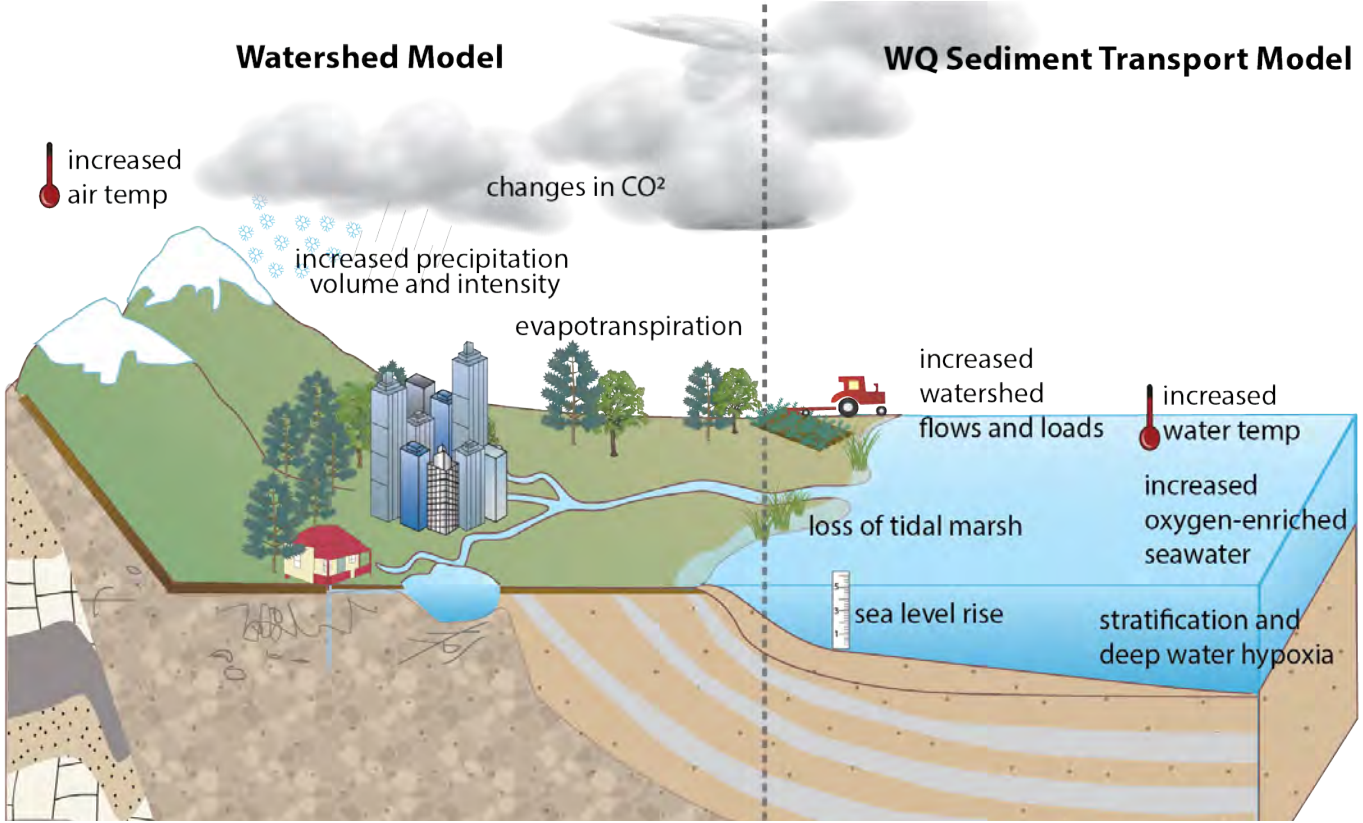
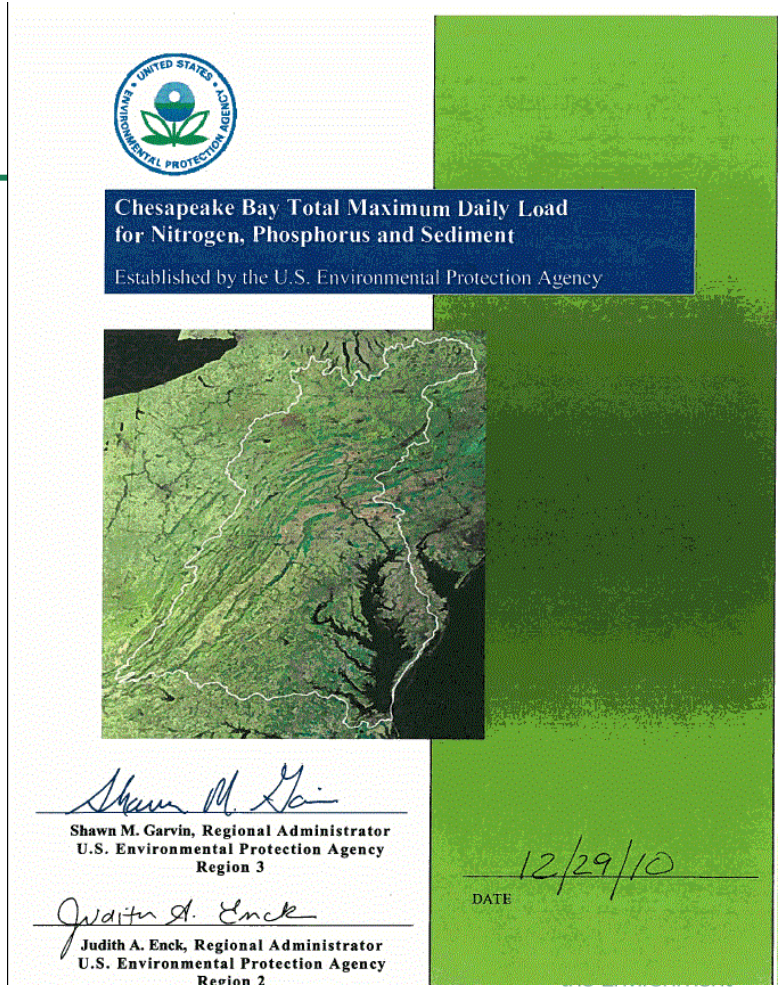
Changing Conditions



Source: Chesapeake Bay Program Climate Resiliency Workgroup

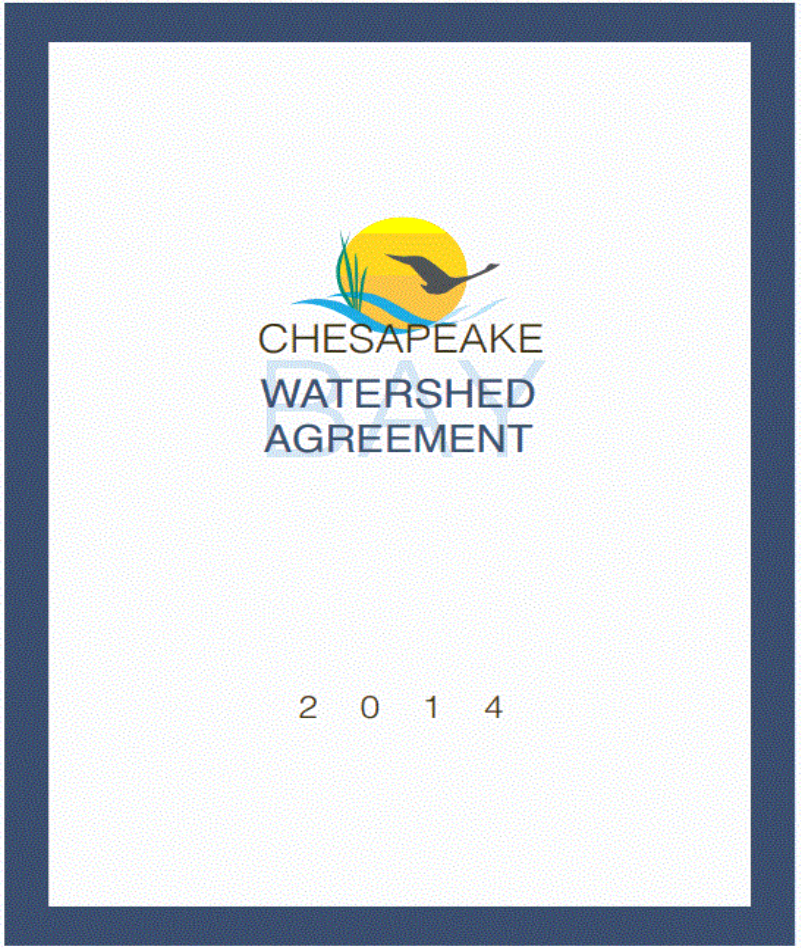
Chesapeake Bay TMDL

- Required by the Federal Clean Water Act and adopted in 2010
- EPA/State Collaboration
- 2025 restoration goal
- Watershed Implementation Plans (WIPs) drive restoration
- Discussed climate change impacts



Watershed Agreement

- Signed in 2014
- Includes principle to Anticipate changing conditions
- Many goals and outcomes
  - Water Quality
  - Sustainable fisheries
  - Vital habitats
  - Healthy watershed
  - Climate Resiliency



The Bay TMDL 2017 Midpoint Assessment

Bay TMDL and Bay Agreement are policy drivers to document impacts of climate change and take action

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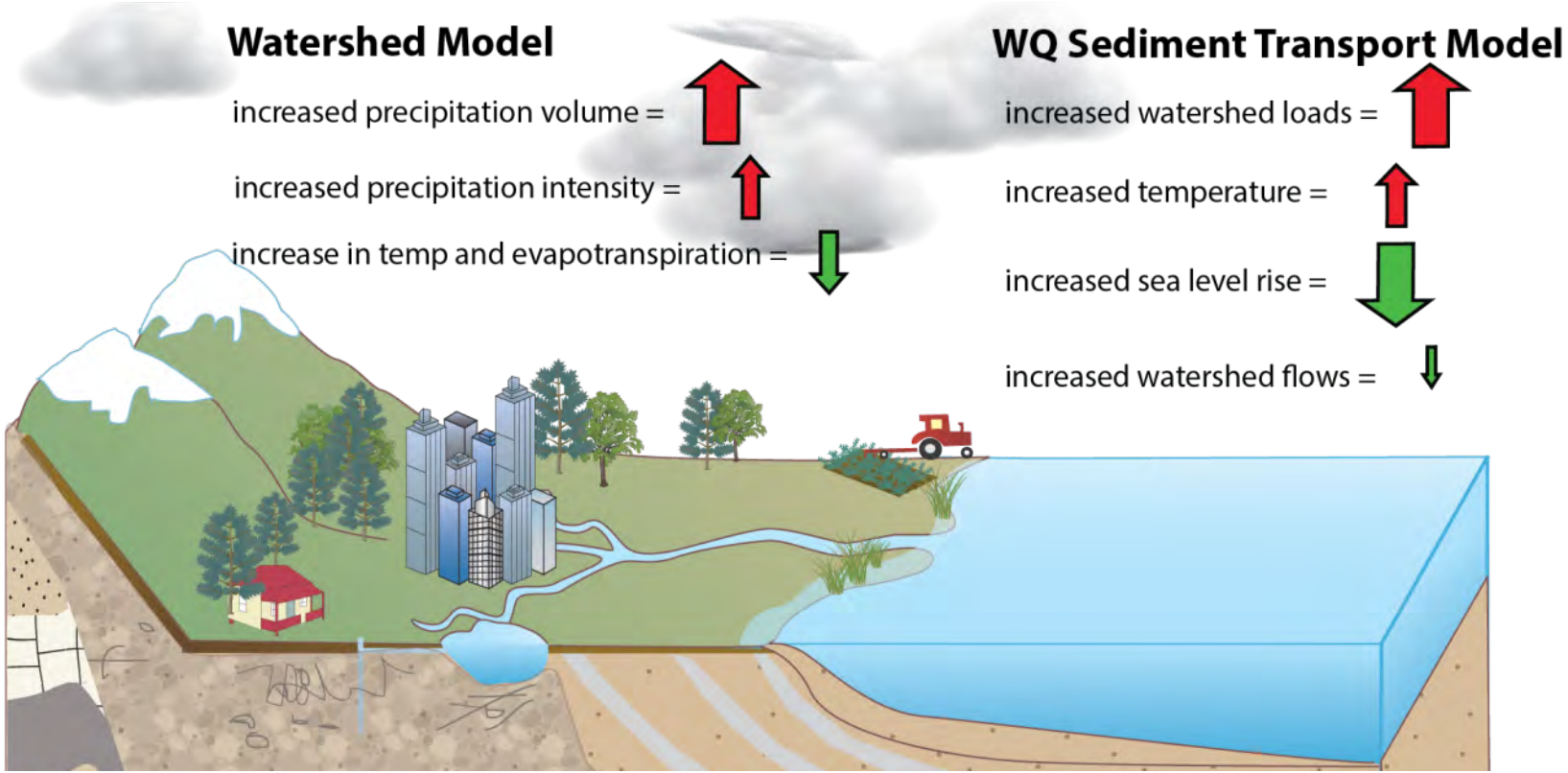
Future Climate Change Influence Nutrient Pollution



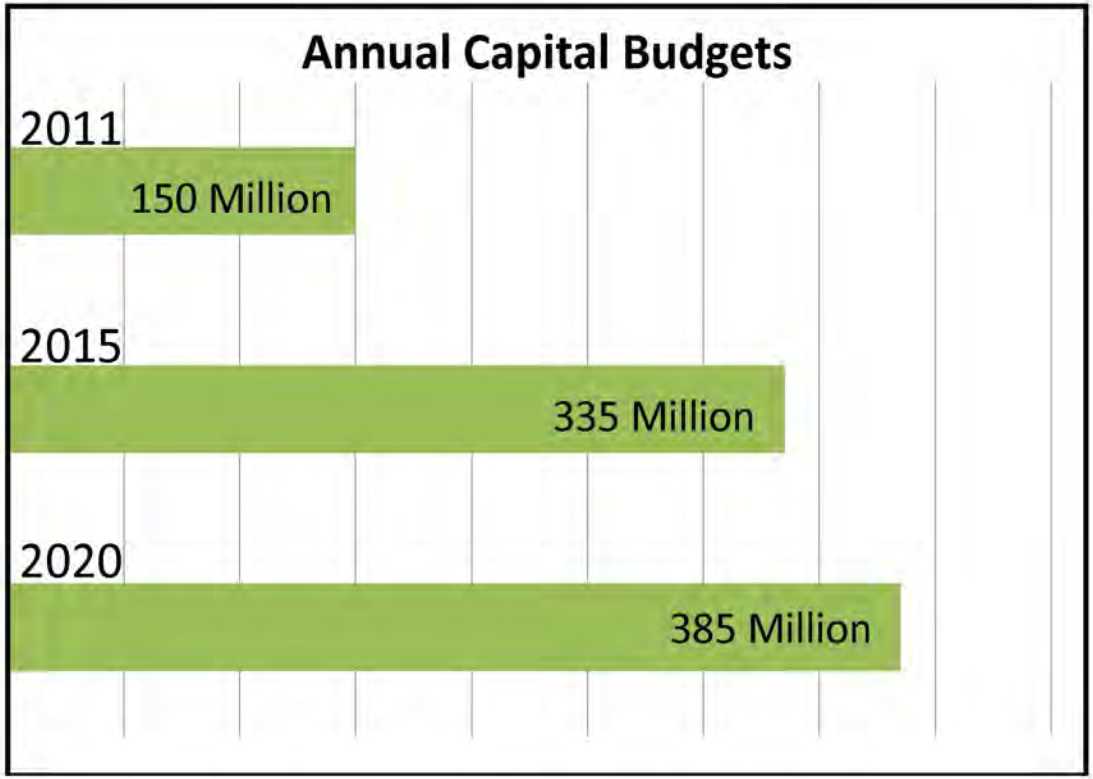
Source: Chesapeake Bay Program Climate Resiliency Workgroup

Bay Partnership Policy Direction

- Principal's Staff Committee (PSC): Agency Secretary Level Decision-Makers on Bay Policy
- PSC Three-Step Strategic Direction (Dec 2017):
  1. Describe current actions and strategies in Phase III WIP (2019)
  2. Better Understand Climate Science Effects by 2021
  3. States to Incorporate New Understanding of Climate Change impact on BMPs in their 2022 two-year Milestone Commitments.

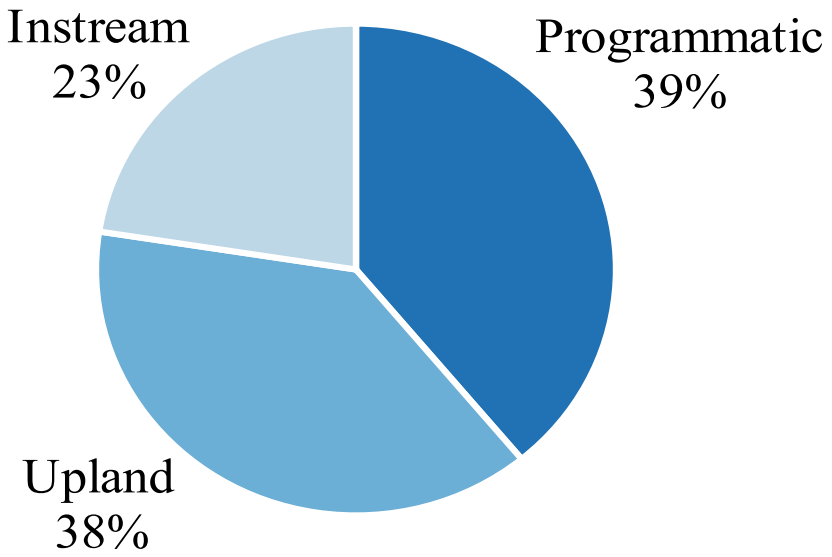
Greener and More Resilient Communities through MS4 Restoration

- Federal CWA requires restoration
- State law requires financial assurance
- Capital budgets for restoration are increasing
- Fosters a restoration economy
- Many opportunities for resiliency and adaptation



Budgets Directed Towards Diverse Projects

- Reflects local priorities
- MDE guidance
- Instream
  - –Stream Restoration
- Upland
  - –Retrofits & pond conversion
- Programmatic
  - –Street sweeping & water quality trading



Source: Annual Report on Financial Assurance Plans and the Watershed Protection and Restoration Program (2017)

Instream: Science Driven and Adaptive Permitting

Case Study: Stream Restoration

- Net functional uplift and collaboration
- Trained and dedicated staff for restoration project permit reviews
- Adapt by answering science questions through monitoring and research
- In 4 years, the number of permits and stream miles permitted has doubled, while permits issued within 90 days has increased from about 30% to 80%




Examples: Adaptation and Learning

- Chesapeake Bay Trust has funded many projects over the past several years to improve the science around stream restoration to better inform project design and improve permitting decisions. Examples include:

1. Evaluation of wet and dry construction techniques on sediment load, biology and riparian integrity.

2. Evaluation of regenerative stormwater conveyances on the removal of nutrients and sediments under a range of flow conditions.

3. Assessment of the efficacy of legacy sediment removal and floodplain reconnection considering a range of impervious cover and stream corridor length.

4. Quantifying ecological uplift and effectiveness of differing stream restoration approaches in Maryland

Future Directions in MS4 Restoration Project Selection

- MS4 permits are drivers for restoration
- opportunities in next generation permit (Fall 2018)
- More science needed on BMP resiliency
- More work needed in this area

Best Management Practices	Climate Adaptation	Energy Efficiency	Flood Risk Mitigation
Urban Shoreline Management	4	0.5	1
Urban Forest Buffers	3.5	4	3.5
Forest Conservation	3.5	3	3.5
Urban Stream Restoration	2.5	2.5	3.5
Agriculture Forest Buffer	2.5	0.5	3.5
Urban Tree Planting	2	4.5	2
Bioretention, Raingardens, Bioswales	2	3	3.5
Wetland Restoration	2	1	3.5
Agriculture Shoreline Management	0	0	4

*Values were taken from the Quantification of BMP Impact on the Chesapeake Bay Program Management Strategies study by Tetra Tech. Appendix E Final Impact Scores evaluates BMP effects on outcomes on a scale of +5 (very beneficial) to -5 (very harmful). This table shows BMPs that scored a 3.5 or higher for the Climate Adaptation Outcome.

Shoreline Protection: Living Shorelines

- 2008 statutorily mandated practice for shoreline stabilization and a practice that is credited in the Bay TMDL
- Before 2008, 9% of shoreline stabilization projects were “living” rather than structural
- Latest available analysis shows 17-19% of approved shoreline stabilization projects are “living”
- Much room for improvement; work underway at MDE to identify barriers and improve these percentages

Conclusions

- The Chesapeake Bay Partnership agreed to an adaptive science based approach for factoring in climate change and resiliency
- Federal MS4 permits result in local restoration and combined with incentives can be a key driver for climate resiliency
- Stream restoration permitting illustrates the importance of the “ecosystem thinking” while also factoring in new science
- Opportunities exist to guide local stormwater restoration toward resiliency but need more science on restoration practices
- Number of living shorelines increase but need to understand barriers

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Questions?

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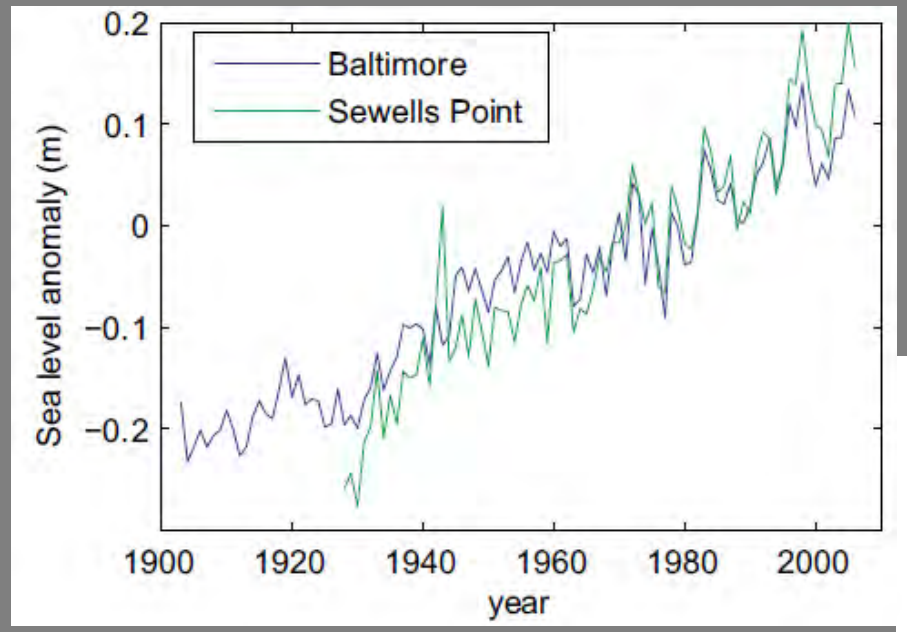
Selecting Projects for Resiliency to Climate Change

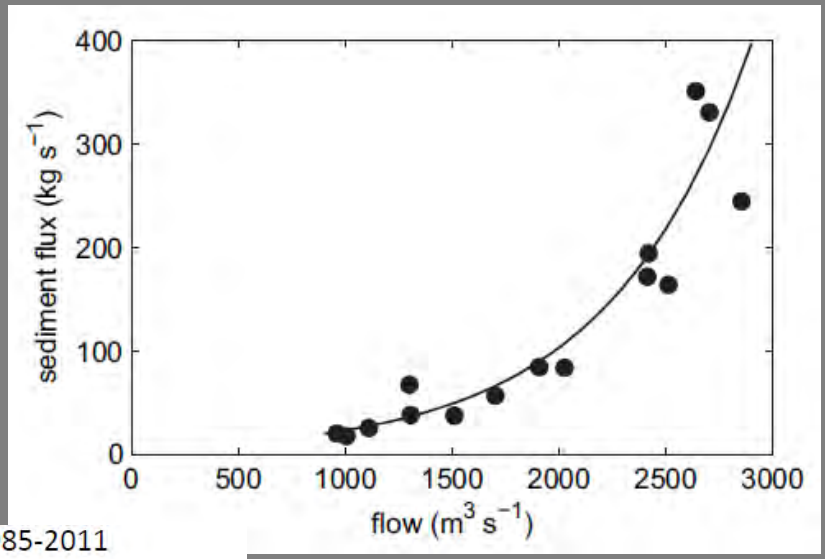
Dr. Anna Hamilton

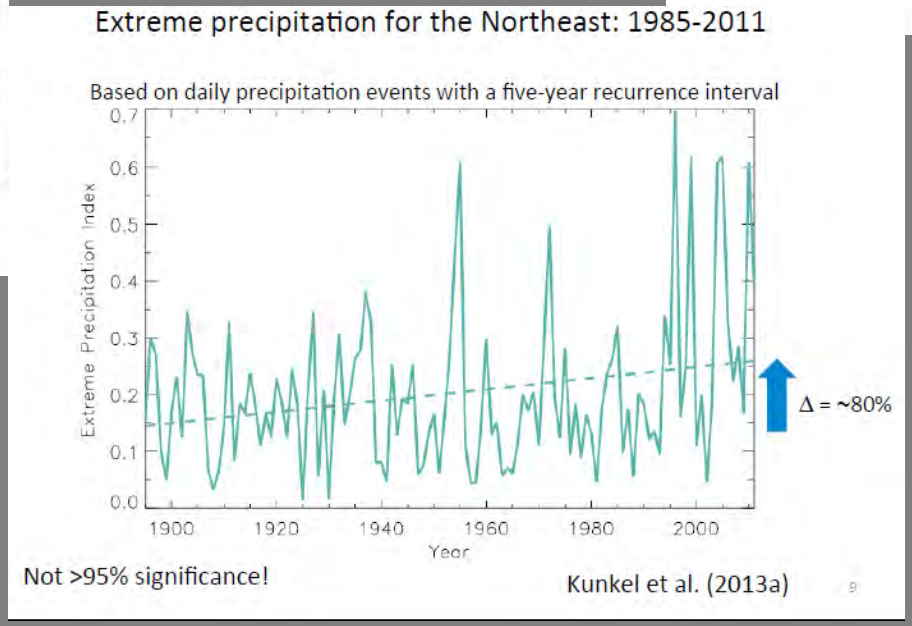
Maryland State of the Coast Conference

May 22, 2018

In the big picture, we accept the reality of climate change





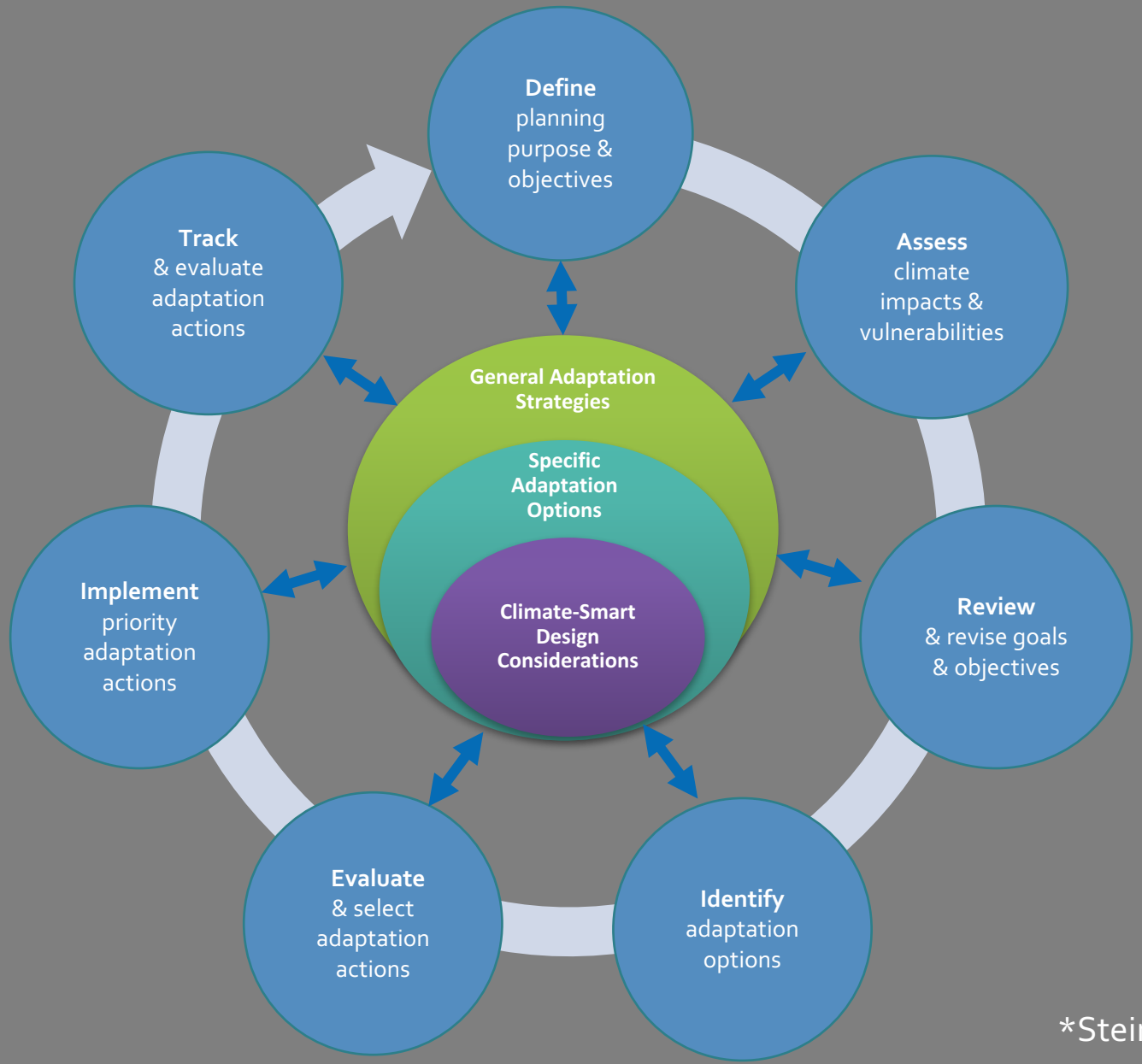


What is needed to do climate change adaptation?

- Integrate climate change considerations at multiple levels of planning (goals, strategies, actions) – developed decision support for doing this in the CBP
- Make each restoration project climate smart
- Move climate smart results forward to evaluation & selection
- Address uncertainties

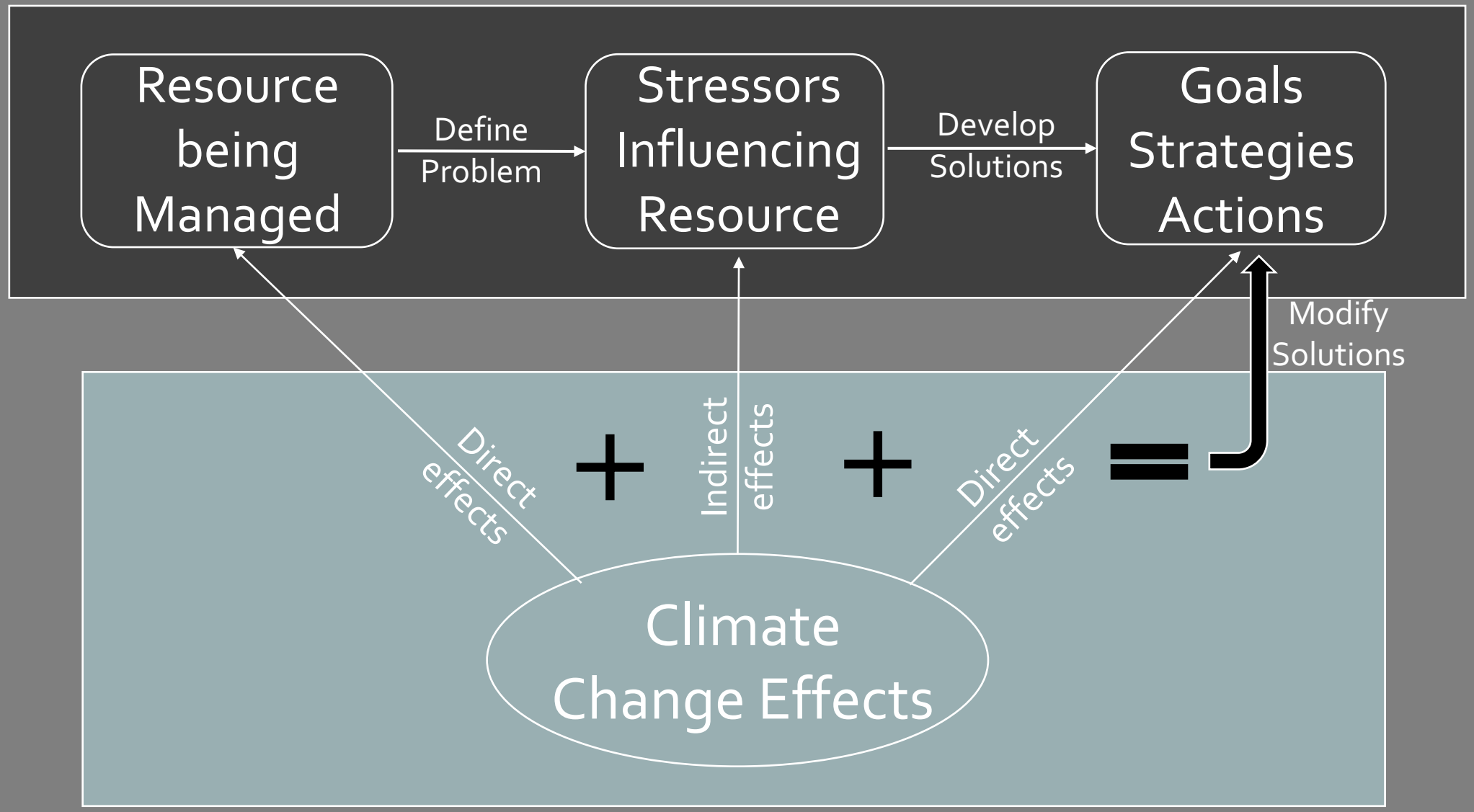
Key – using a simple but structured process to evaluate actions in a site-specific context. This generates actionable information, useable for revision of earlier planning steps, and moving forward to selection and implementation.

Climate Smart* Planning



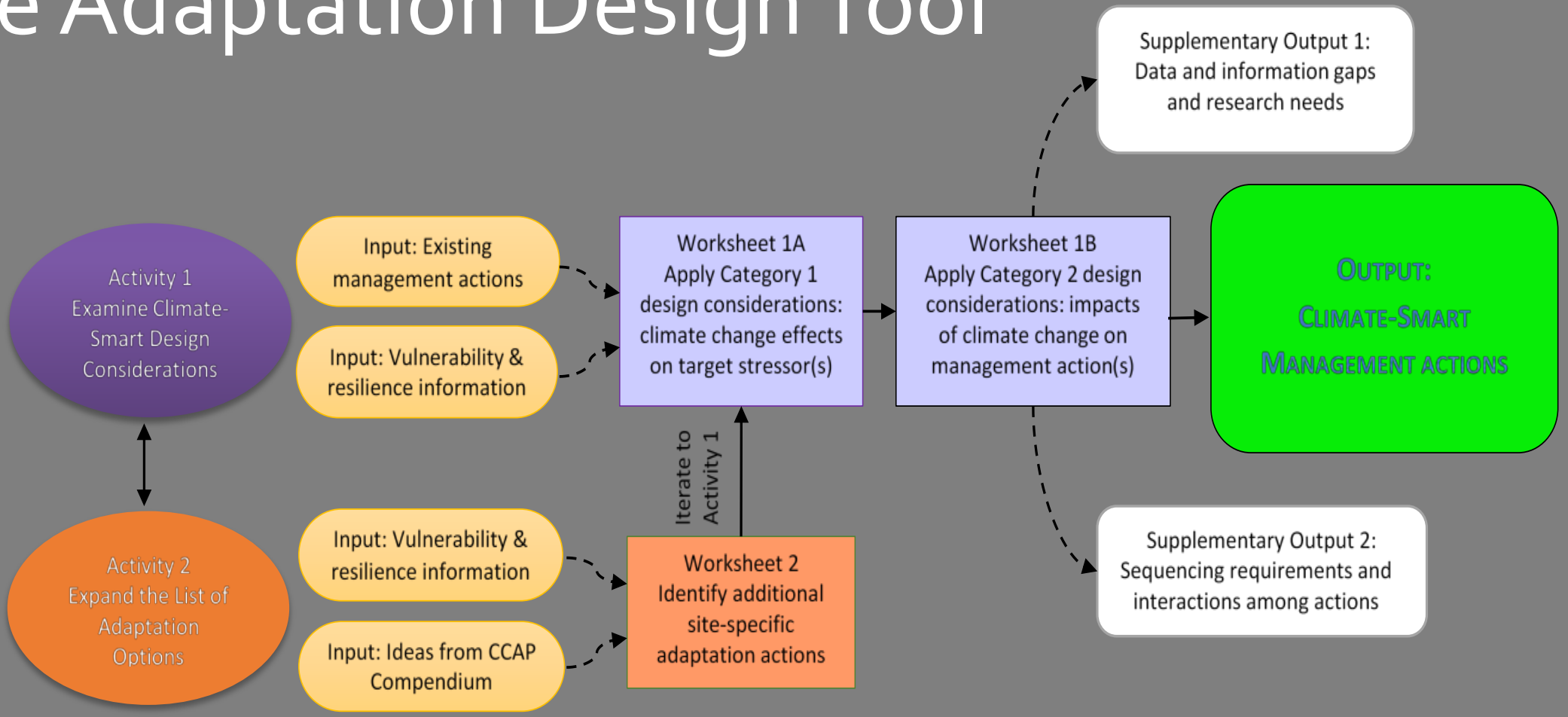
*Stein et al. 2015. Climate Smart Guide.

Original Management Approach



Climate Smart Considerations

The Adaptation Design Tool



CBP Example – Adaptation Decision Matrices

- Step 1 – Screening
- Step 2 – Category 1 Climate Smart Considerations
  - Climate change effects on the stressors and systems
- Step 3 – Category 2 Climate Smart Considerations
  - Climate change implications for functionality/effectiveness
- Step4 – Climate Smart Re-Design
- Other
  - Notes on needed interactions with other groups
  - Notes that inform climate questions at higher levels
  - Consideration of what is missing

Moving to evaluation & selection

- Myriad criteria (beyond climate-smart design) come into play
- Spirograph shows some commonly considered categories of criteria
- **Include robustness of climate-smart design in criteria for prioritization of projects for implementation**

Challenges for selection of climate smart actions

- Potential actions often arise opportunistically
  - Challenge to prioritize restoration efforts to maximize climate resilience under this circumstance
  - Even 'one-off' projects can be made 'climate smart'
  - Some restoration components, e.g., the Chesapeake Bay TMDL, can be reviewed more comprehensively
  - Augment project selection with a cumulative assessment of best places to work, best methods
- Many social/political limitations, e.g.,
  - Distribution of public/private lands

Dealing with uncertainty/surprises

- Selection of ‘robust’ strategies/actions
- A general strategy to accommodate uncertainties in climate change futures
- Refers to actions that are likely to have benefits over a wide range of possible futures

‘Co-benefits’ of BMPs

- Tool to assess co-benefits & unintended consequences of existing BMPs*
- Help select BMPs for inclusion in WIPs
- Include this information in the Chesapeake Assessment Scenario Tool (CAST)
- A valuable addition to the ‘climate smart’ selection process, but not a stand-alone, not a site-specific evaluation

* - Tetra Tech, Inc. 2017. Estimation of BMP Impact on Chesapeake Bay Program Management Strategies.

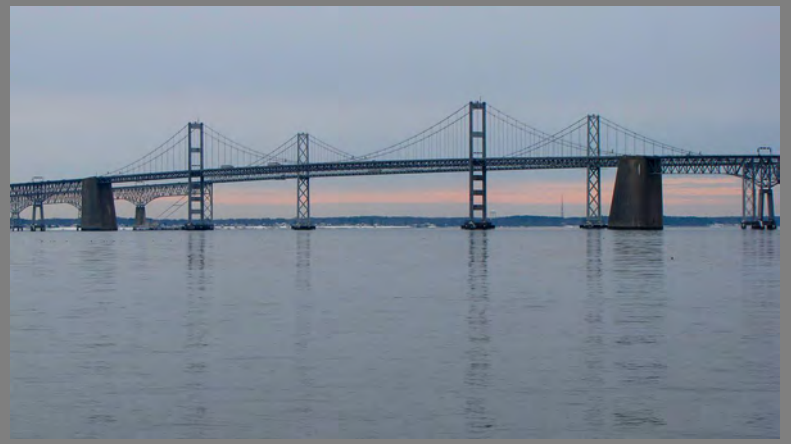
Example of Co-benefits Scoring Matrix

Sector	BMP Name	Fostering Chesapeake Stewardship GIT		Habitat GIT							Maintain Healthy Watersheds git	
		Citizen Stewardship	Protected Lands	Biodiversity and Habitat	Black Ducks	Brook Trout	Fish Passage	Stream Health	Submerged Aquatic Vegetation	Wetlands	Healthy Watersheds	Land Use Methods and Metric Development
Agriculture	Ag Forest Buffer	2.0	3.5	4.0	3.5	4.5	2.5	4.0	1.5	3.5	4.0	4.0
Agriculture	Ag Shoreline Management (incl. Non-Vegetated and Vegetated)	0.0	1.0	2.0	2.5	2.0	0.0	3.0	2.0	2.0	2.0	0.0
Agriculture	Ag Stream Restoration	0.0	1.0	3.0	3.5	3.0	2.5	5.0	3.0	3.0	1.0	0.0
Agriculture	Ag Tree Planting	2.0	1.5	2.0	2.0	3.0	1.0	2.0	1.0	1.5	2.0	1.5
Agriculture	Agricultural Ditch BMPs	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Agriculture	Alternative Crops and Alternative Crop/Switchgrass (RI)	0.0	1.0	3.0	1.0	1.0	1.0	1.0	0.0	1.0	1.0	3.0
Agriculture	Alternative Water System (Off Stream Watering Without Fencing)	0.0	1.0	1.0	1.0	2.0	0.0	5.0	0.0	3.0	3.0	1.0

Getting to implementation

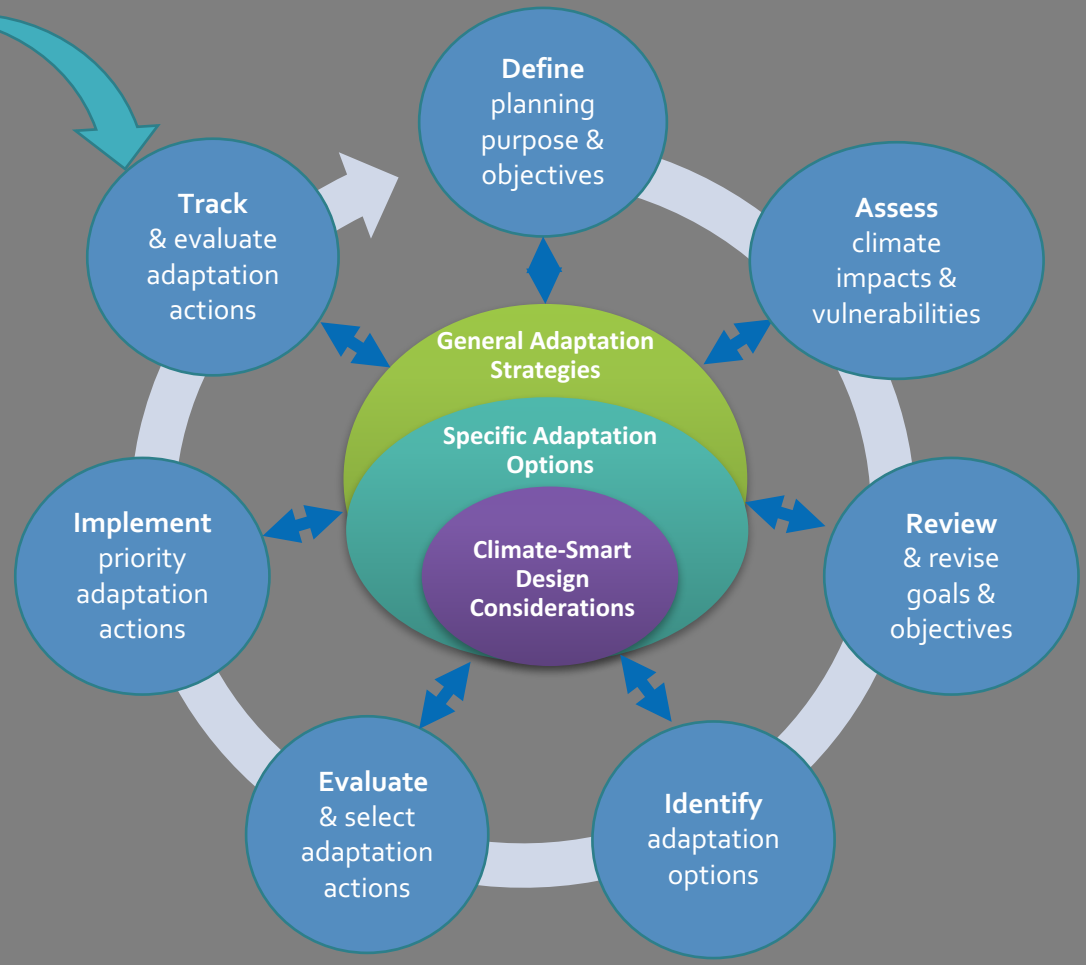
Experience - limited implementation of climate smart actions

- Bridge the gap between vulnerability assessment results (typically regional to global scale, long-term) & scale of restoration actions (site-specific, shorter-term)
- Uncertainties (e.g., climate change projections, ecosystem responses) & surprises (e.g. unanticipated threshold changes)



Adaptive Management

- Considered a key component of the Climate Smart Planning Cycle
- Linked explicitly to climate change vulnerabilities and uncertainty



- Learning-by-doing mode to –gain a deeper understanding of target system, effectiveness of different management options when existing info is limited (as with some climate change effects projections)
- Iterative
- Intended to reduce uncertainty over time through structured monitoring, evaluation, and adjustment of actions

West Maui Example

- Used the Adaptation Design Tool (described above)
- Plan - infiltration basins in low-lying urban areas, limit sediments, nutrients, other contaminants from entering nearshore waters
  - Because increased precipitation, severe storm-runoff due to climate change deemed likely to increase sedimentation & nutrient runoff above historic
- Models predicted vastly different future levels of precipitation—some wetter, others drier
- Documented these differing futures through the Adaptation Design Tool—explicitly account for uncertainties
- Monitoring and adaptive management used to adjust over time

Some related resources

Tetra Tech. 2018. Chesapeake Bay Program Climate-Smart Framework and Decision-Support Tool Final Report. Prepared for the Chesapeake Bay Trust. 43 pp.

West, J.M., C.A. Courtney, A.T. Hamilton, B.A. Parker, D.A. Gibbs, P. Bradley, and S.H. Julius. 2018 (accepted). Adaptation Design Tool for Climate-Smart Management of Coral Reefs and Other Natural Resources. Environmental Management.

Parker, B.A., J.M. West, A.T. Hamilton, C.A. Courtney, P. MacGowan, K.H. Koltes, D.A. Gibbs, and P. Bradley. 2017. Adaptation Design Tool: Corals and Climate Adaptation Planning. Silver Spring, MD: NOAA Coral Reef Conservation Program. NOAA Technical Memorandum CRCP 27. 59 pp.

West, J.M., C.A. Courtney, A.T. Hamilton, B.A. Parker, S.H. Julius, J. Hoffman, K.H. Koltes, and P. McGowan. 2017. Climate-Smart Design for Ecosystem Management: A Test Application for Coral Reefs. Environmental Management 59:102–117. DOI 10.1007/s00267-016-0774-3.

Questions?

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Resiliency through Restoration

Keith Underwood, Principal
Underwood & Associates, Inc.
www.ecosystemrestoration.com

Why was I asked to be here?

- Over 30 years of experience designing and building ecological restoration projects;
- We design and build projects to restore hydrologic functions and processes necessary to support living resources;
- Working to attain intact ecosystems in a world were resiliency is imperative.

Are you aware of how dysfunctional many of our streams are?

- Due to a number of historical factors, many of our streams are currently degraded and are likely to continue to degrade.

Use RSC Approach to achieve Resiliency

- What is the RSC approach?
  - Continuous treatment train from top of watershed to receiving waterway;
  - Regenerative approach to design and construction;
  - Adaptive management during and post construction.

Continuous treatment train from top of watershed to receiving waterway; Central Sanitation

This approach represents a paradigm shift where we treat water, including stormwater, as a resource – not as a problem.

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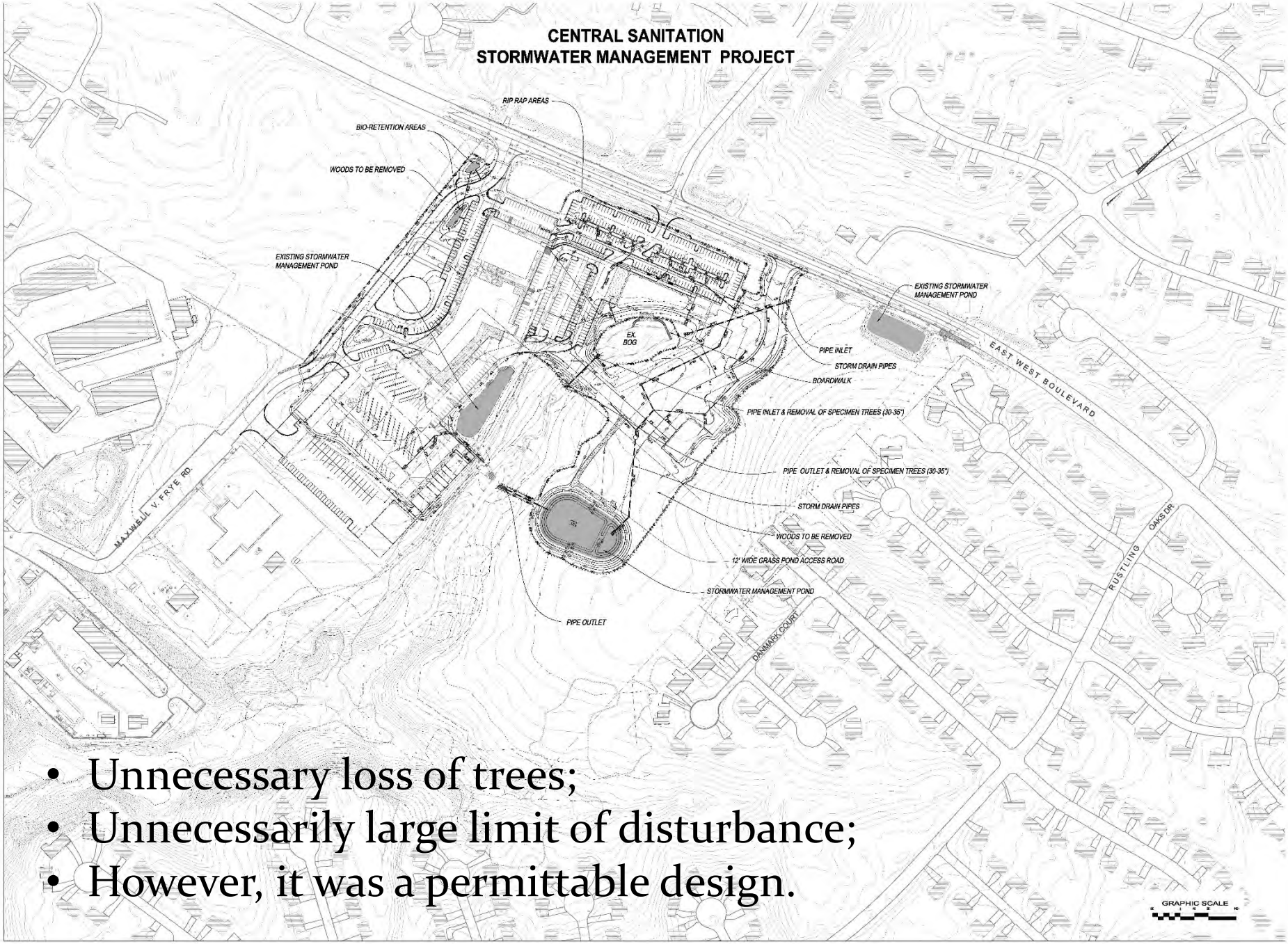
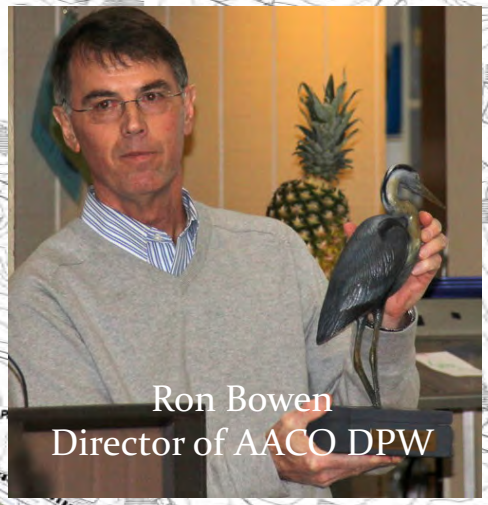


- Unnecessary loss of trees;
- Unnecessarily large limit of disturbance;
- However, it was a permittable design.

CENTRAL SANITATION
STORMWATER MANAGEMENT AND STREAM RESTORATION PROJECT



FOREST CONSERVATION AREA
PROPOSED RAIN GARDEN (TYP.)
PROPOSED DEPRESSED PLANTING AREA (TYP.)
PROPOSED COBBLE BEDDED PARKING LOT (TYP.)
FOREST CONSERVATION AREA
PROPOSED POOL (SHALLOW AQUATC BED) (TYP.)
PROPOSED SAND (TYP.)
EAST WEST BOULEVARD
EXISTING BOG
PROPOSED POOL (SHALLOW AQUATC BED) (TYP.)
PROPOSED POOL (SHALLOW AQUATC BED) (TYP.)
LOSING STREAM
STREAM RESTORATION PROJECT
APPROXIMATE FOREST CONSERVATION AREA
APPROXIMATE FOREST CONSERVATION AREA BOUNDARY
MAXWELL V. FRYE RD.
PROPOSED RIFFLE WEIR GRADE CONTROL STRUCTURE (TYP.)
PROPOSED SAND BERM (TYP.)
PROPOSED COBBLE BEDDED PARKING LOT (TYP.)
DRAINAGE AREA BOUNDARY
RUSTLING OAKS DR
PROPOSED RIFFLE WEIR GRADE CONTROL STRUCTURE (TYP.)
PROPOSED CASCADE (TYP.)
GAINING STREAM
ROXIMATE FORESTCONSERVATION AREA BOUNDARY
APPROXIMATE FOREST CONSERVATION AREA
FORMER CONFLUENCE BOG
DEEP BRANCH
EXISTING STREAM

STREAM RESTORATION DATA TABULATION	
STREAM RESTORATION	2,471 L.F.
FORESTED WETLAND ESTABLISHMENT	3.53 ACRES
AQUATIC BEDS	1.34 ACRES
WETLANDS CREATION	4.87 ACRES
WATER STORAGE	70,043 CU.FT.

STORMWATER MANAGEMENT DATA TABULATION	
COBBLE PARKING LOT	5.62 ACRES
STREAM RESTORATION	3,520.36 L.F.
FORESTED WETLAND ESTABLISHMENT	3.00 ACRES
AQUATIC BEDS	1.61 ACRES
WETLANDS CREATION	4.61 ACRES
*WATER STORAGE	377,012 CU.FT.

* COMBINES COBBLE AND POOL WATER STORAGE


What did this stream look like?

By using this regenerative approach, the following benefits were achieved;

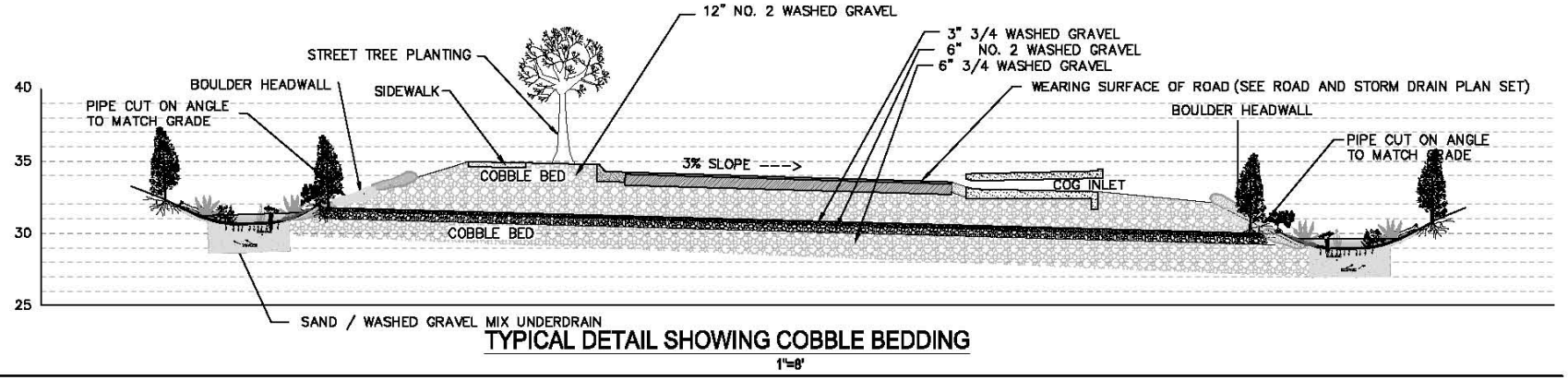
- Created 16 additional parking spots;
- Preserved 35 acres of riparian forest;
- Saved AACo $2,000,000.00;
- Conserved bog in urban setting.

- Riffle weirs designed and constructed to safely convey 100 year storm flows;
- Store water high in the landscape;
- Break the watershed down into the smallest components possible.

Continuous treatment train


Managing stormwater properly, you can maintain unique habitats in close proximity to urban development.

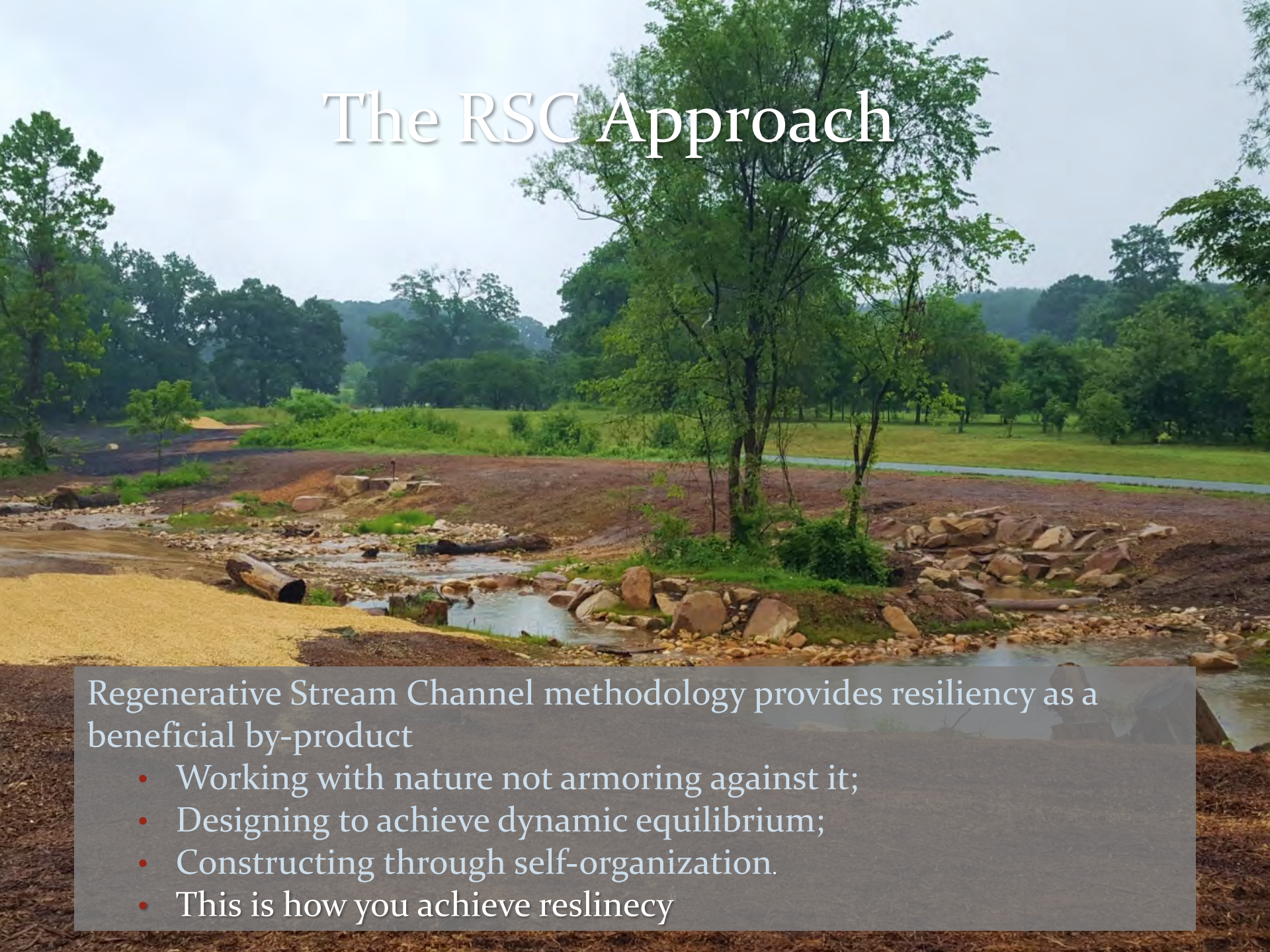
We have the science and the know-how to achieve smart development while maintaining good water quality, preserving living resources, and addressing resiliency.



TYPICAL DETAIL SHOWING COBBLE BEDDING

1"=8'

The RSC Approach



Regenerative Stream Channel methodology provides resiliency as a beneficial by-product

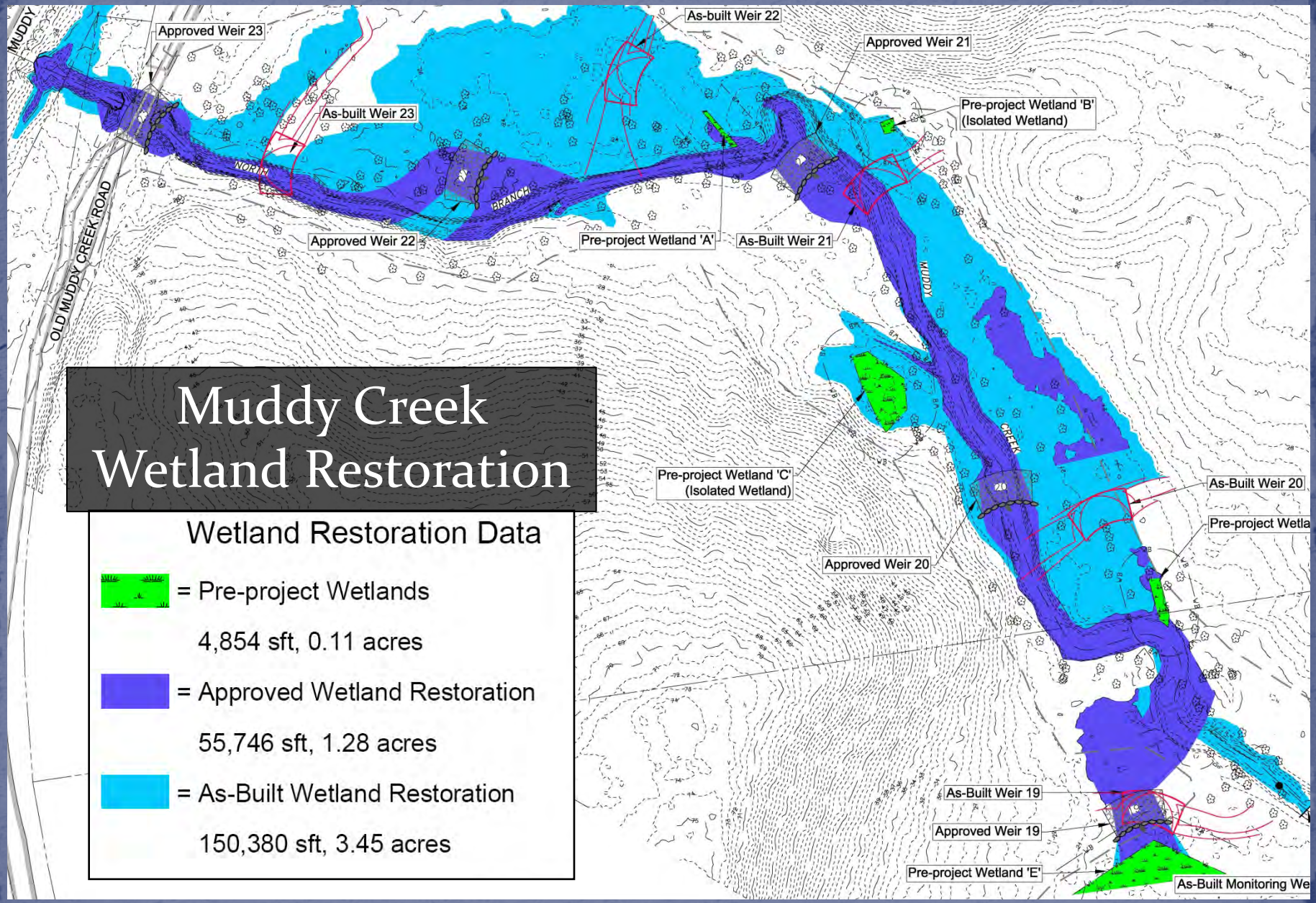
- Working with nature not armoring against it;
- Designing to achieve dynamic equilibrium;
- Constructing through self-organization.
- This is how you achieve reslinecy

Why Design/Build – Achieving Resiliency

- Design/build *is* adaptive management
- Provides optimal conditions to achieve long term resiliency
- Provides an integrated solution to restore process
- Allows for adaptive management from beginning of design through post-construction phase
  - Reduces post-construction adaptive management costs by incorporating solutions during design and construction
  - Cannot pick up accurate topo until clearing and grubbing is complete and water flows through the site
- Reduces design costs (60% plans)
- Provides consistent leadership throughout project

What is Adaptive Management?

- Designing a project with maximum ecological uplift based on site conditions
- Recognizing and acting upon opportunities for enhancement at every step during and after construction
  - Includes placement of materials onsite for possible future use with minimal disturbance
- Maintaining framework while embracing dynamic equilibrium
- Allows for minimally invasive construction process
- Required on all nature-based ecological restoration projects – if material isn't moving, the project isn't working.


Muddy Creek
Wetland Restoration
Wetland Restoration Data
= Pre-project Wetlands
4,854 sft, 0.11 acres
= Approved Wetland Restoration
55,746 sft, 1.28 acres
= As-Built Wetland Restoration
150,380 sft, 3.45 acres
Approved Weir 23
As-built Weir 22
Approved Weir 21
As-built Weir 23
Pre-project Wetland 'B'
(Isolated Wetland)
NORTH
BRANCH
Approved Weir 22
Pre-project Wetland 'A'
As-Built Weir 21
OLD MUDDY CREEK ROAD
MUDDY
CREEK
Pre-project Wetland 'C'
(Isolated Wetland)
As-Built Weir 20
Approved Weir 20
As-Built Weir 19
Approved Weir 19
Pre-project Wetland 'E'
As-Built Monitoring We

- This is what we need to achieve. Clear, cold, water that provides stream flow all year;
- This can only be achieved through adaptive management.

Springhouse Run Seep

Thank You!

Continuous treatment train from top of watershed to receiving waterway;
Regenerative approach to design and construction;
Adaptive management during and post construction.

Building tidal marsh resiliency at the Blackwater National Wildlife Refuge

Sustainable Science LLC

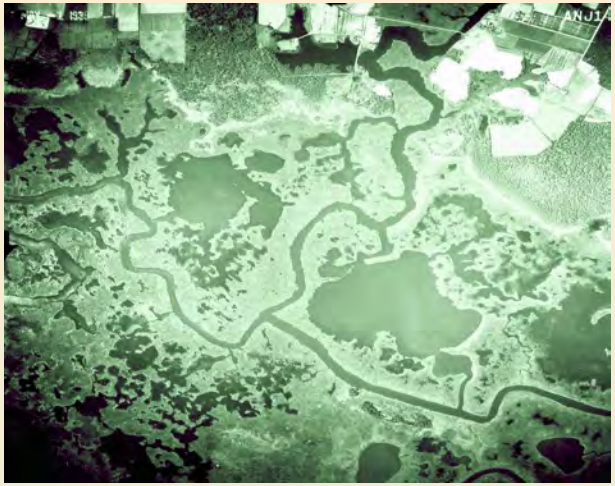
Audubon Maryland-DC

U.S. Fish & Wildlife Service

The Conservation Fund

Chesapeake Marshlands National Wildlife Refuge Complex

Blackwater's Disappearing Wetlands



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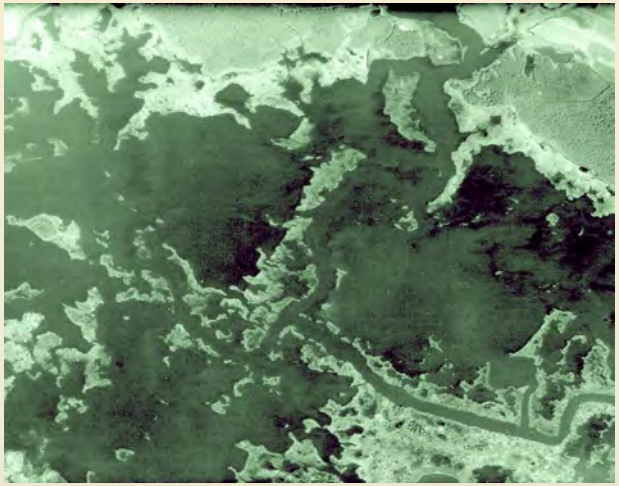

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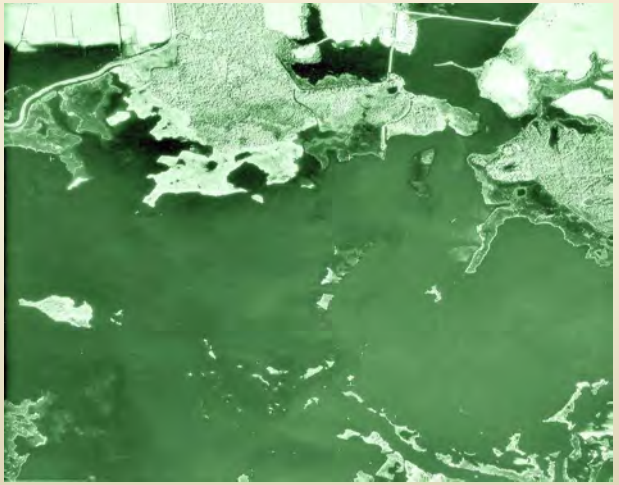

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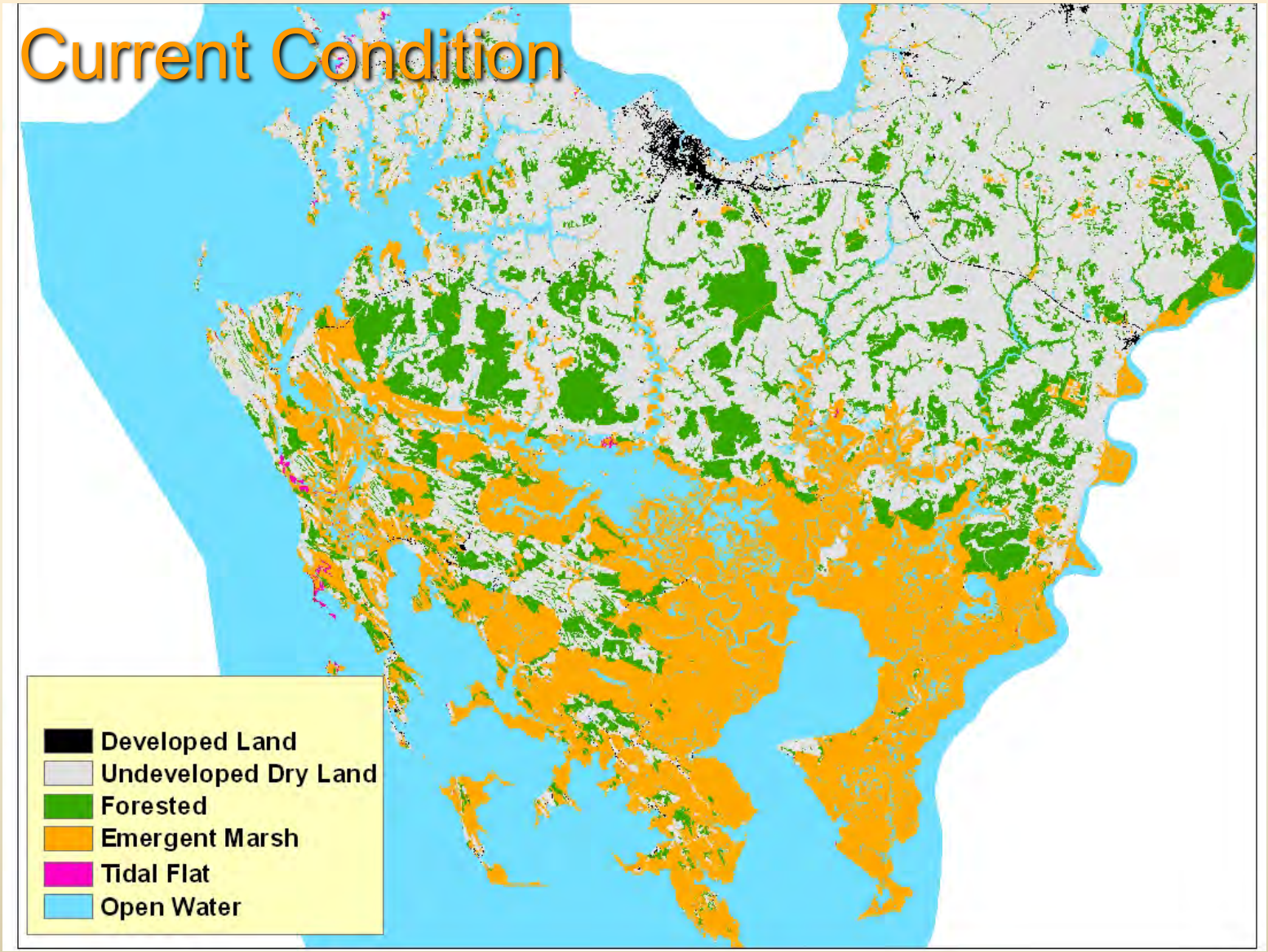
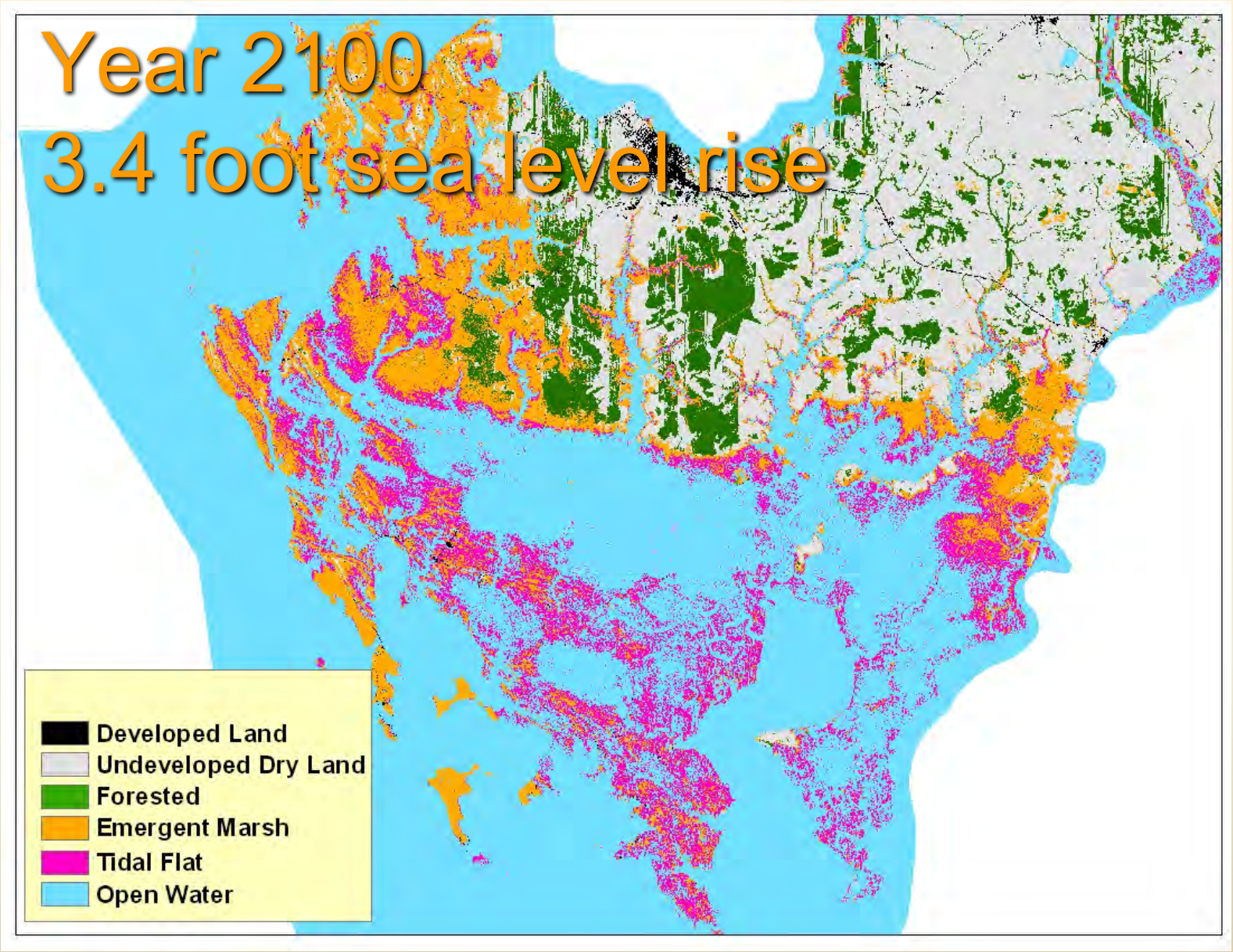
Chesapeake Marshlands National Wildlife Refuge Complex

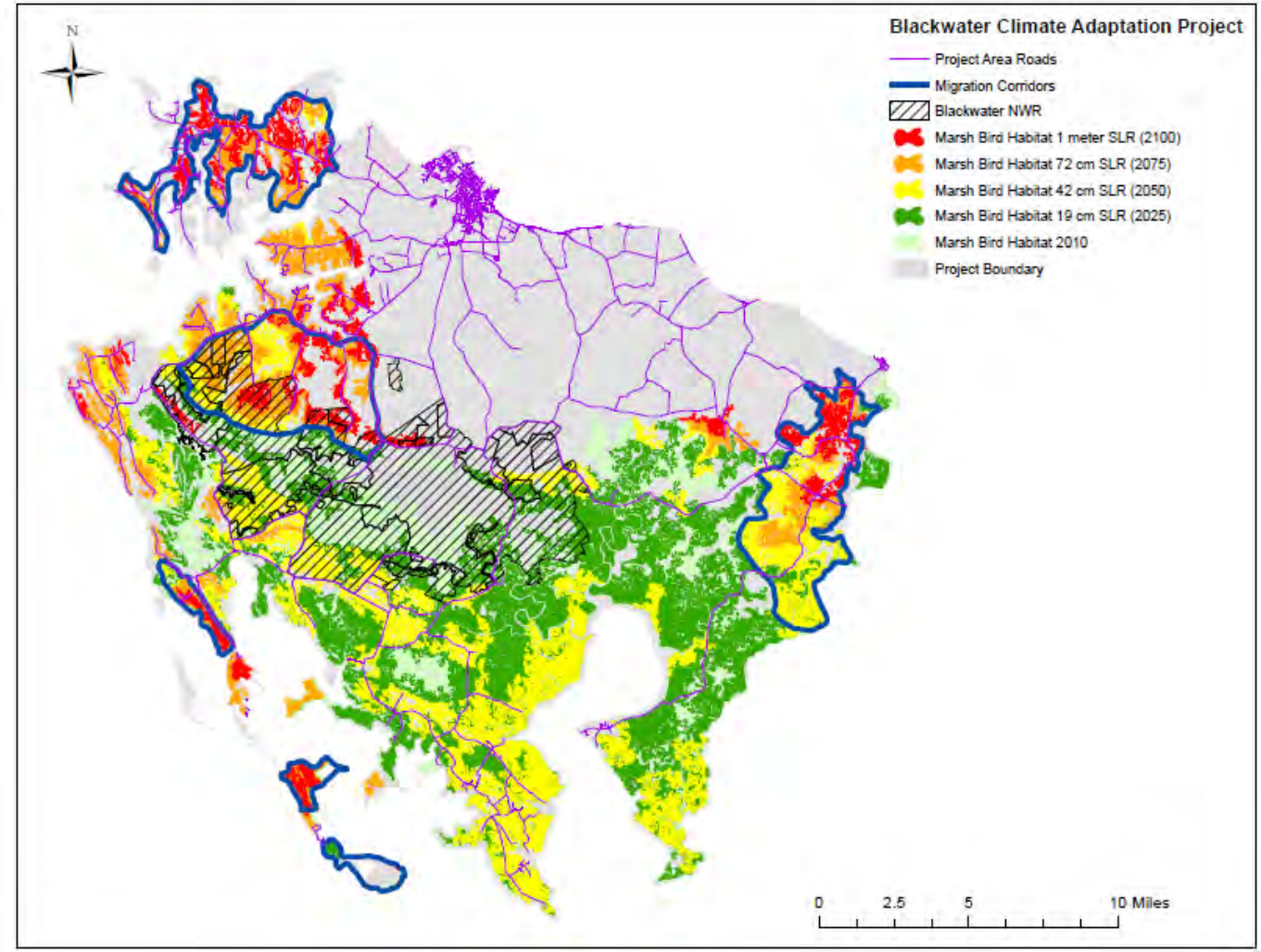
1. Blackwater marshes sit low in growth range and have small tidal variation (little elevation capital)

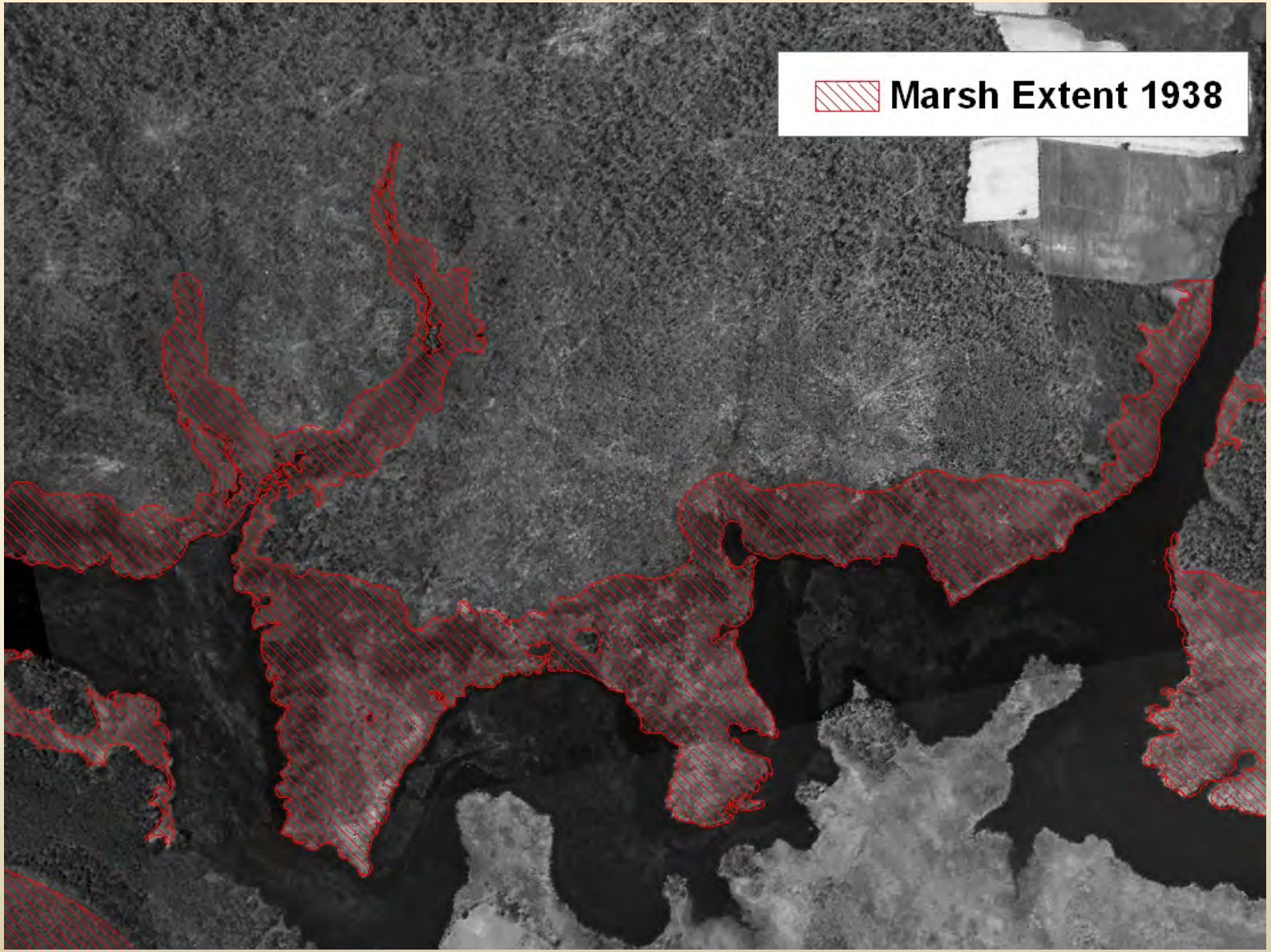
2. Marsh vertical development is not keeping pace with sea level rise and subsidence



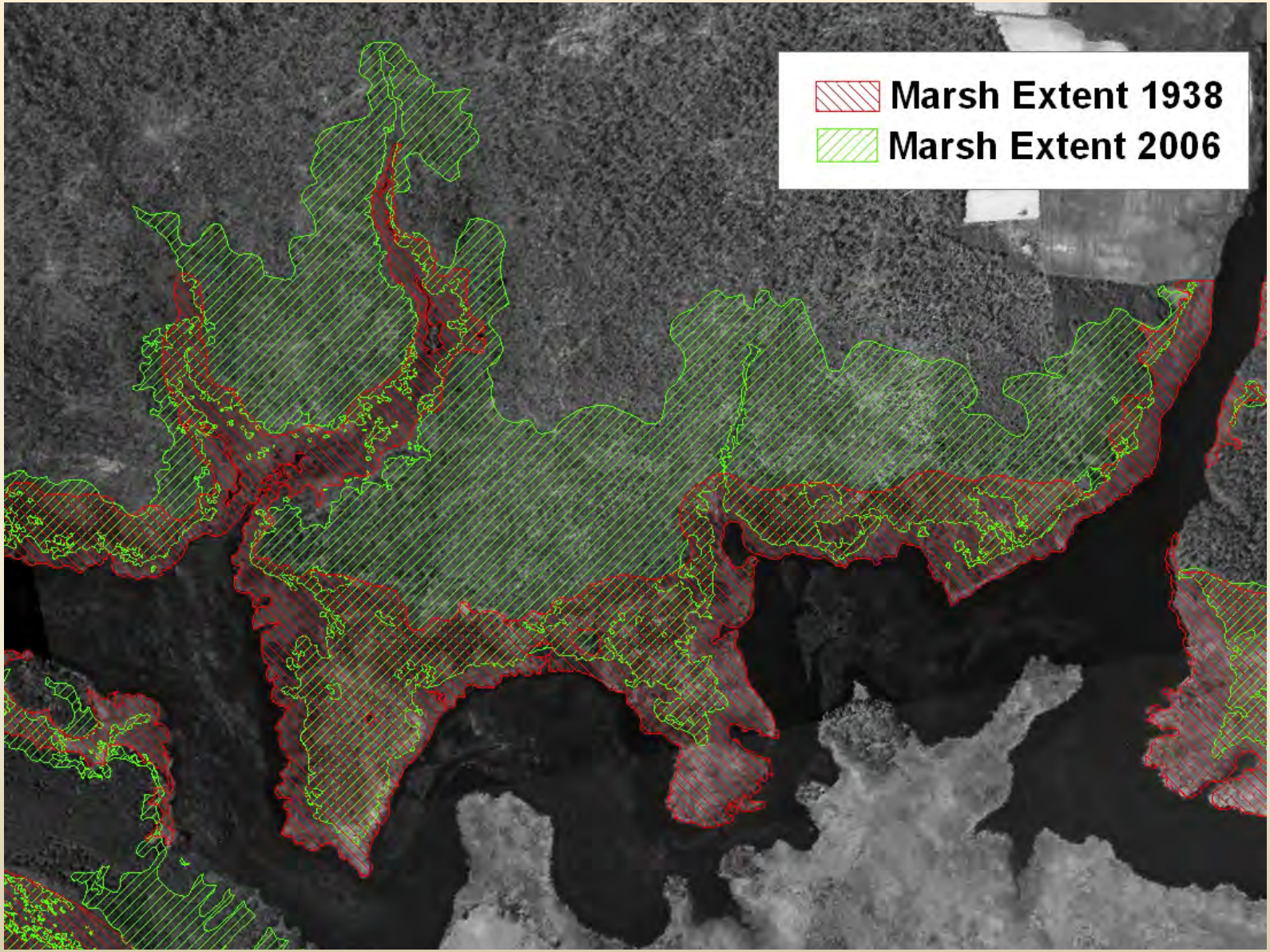
Chesapeake Marshlands National Wildlife Refuge Complex


Year 2100
3.4 foot sea level rise
Developed Land
Undeveloped Dry Land
Forested
Emergent Marsh
Tidal Flat
Open Water


N
Blackwater Climate Adaptation Project
Project Area Roads
Migration Corridors
Blackwater NWR
Marsh Bird Habitat 1 meter SLR (2100)
Marsh Bird Habitat 72 cm SLR (2075)
Marsh Bird Habitat 42 cm SLR (2050)
Marsh Bird Habitat 19 cm SLR (2025)
Marsh Bird Habitat 2010
Project Boundary
0
2.5
5
10 Miles

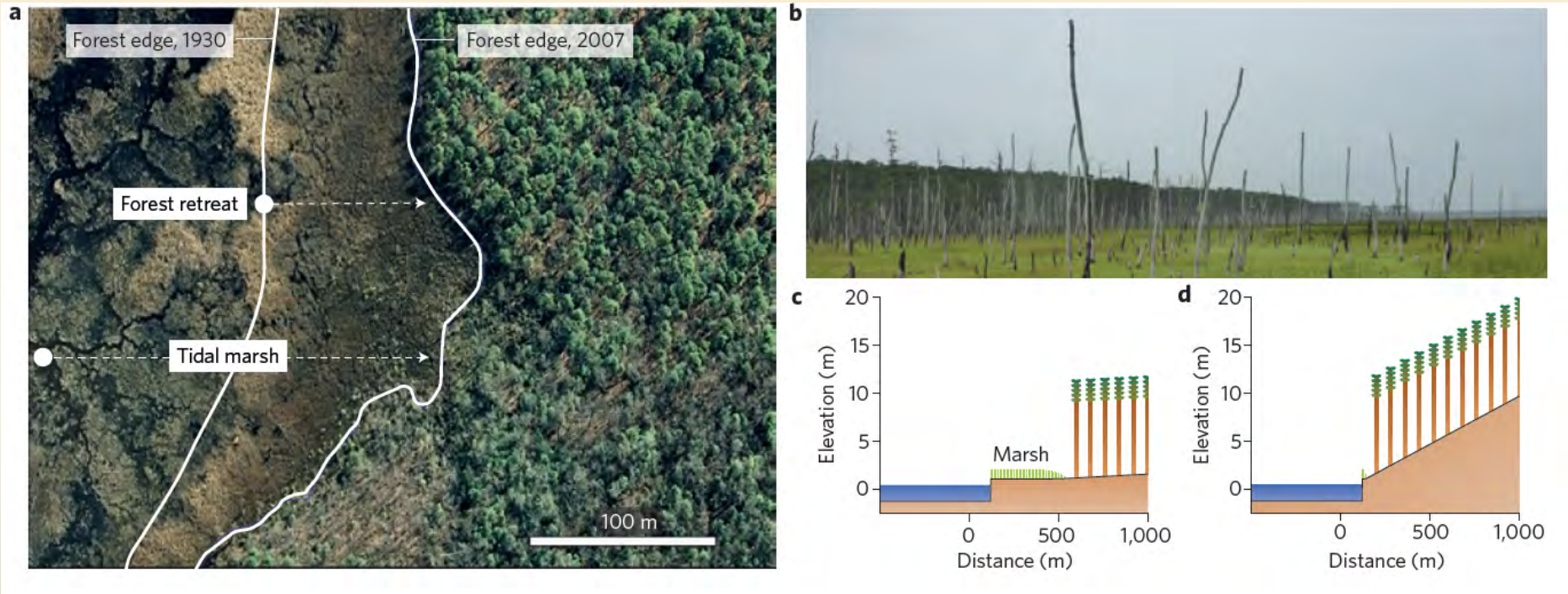


Chesapeake Marshlands National Wildlife Refuge Complex



Chesapeake Marshlands National Wildlife Refuge Complex

Potential for marsh migration into adjacent uplands

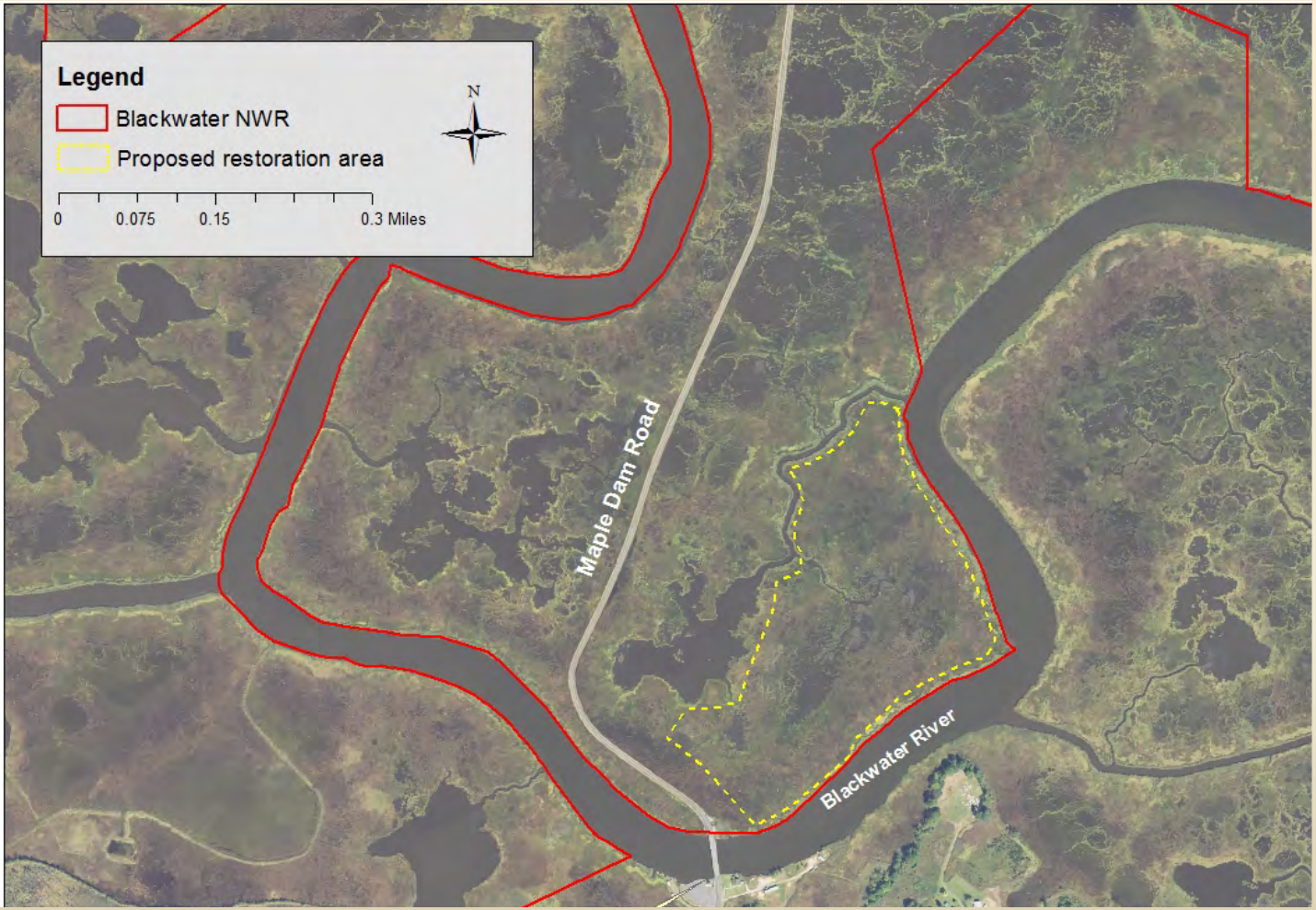


From: Kirwan et al. 2016

Chesapeake Marshlands National Wildlife Refuge Complex

Chesapeake Marshlands National Wildlife Refuge Complex

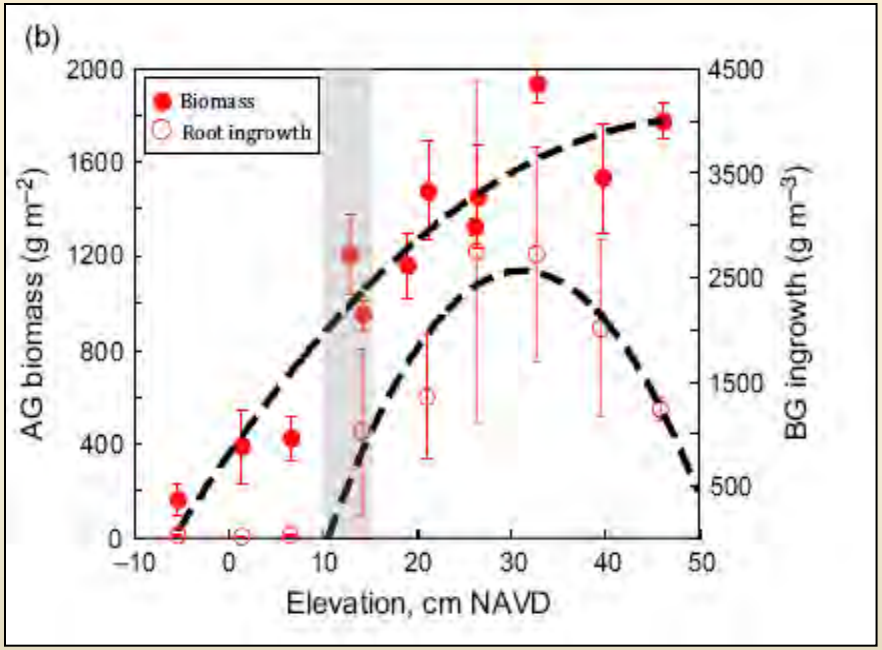
Thin-layer marsh restoration



Chesapeake Marshlands National Wildlife Refuge Complex

Science-based solution…

Kirwan, M.L. & Guntenspergen, G.R. (2012) Feedbacks between inundation, root production, and shoot growth in a rapidly submerging brackish marsh. Journal of Ecology, 100, 764-770



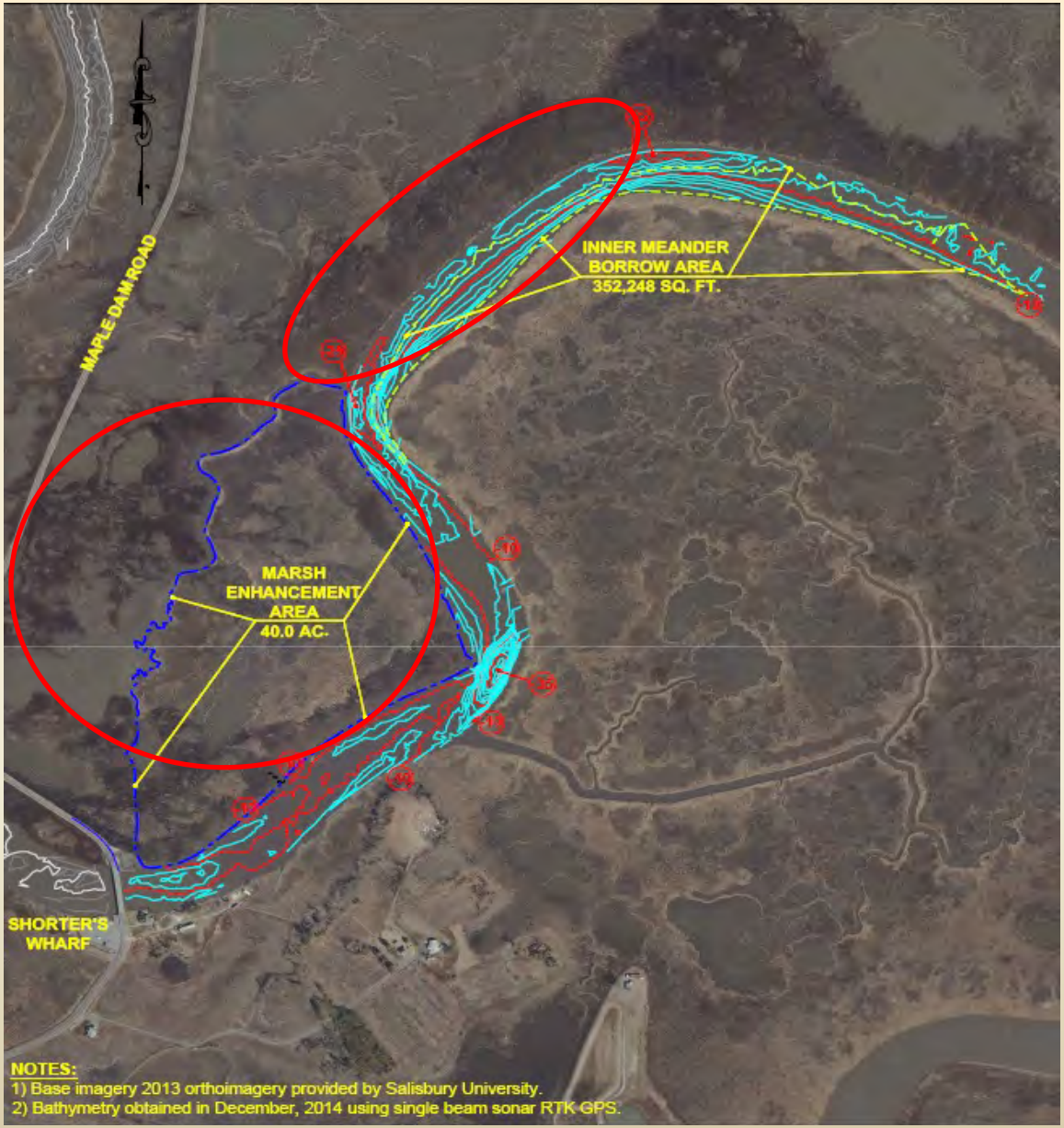

MAPLE DAM ROAD
INNER MEANDER
BORROW AREA
352,248 SQ. FT.
MARSH
ENHANCEMENT
AREA
40.0 AC.
SHORTER'S
WHARF
NOTES:
1) Base imagery 2013 orthoimagery provided by Salisbury University.
2) Bathymetry obtained in December, 2014 using single beam sonar RTK GPS.

Photo credit Middleton Evans

Photo credit Dave Harp

December 2016
26,000 cubic yards of material
spread over approximately 40 acres

Photo credit Dave Harp

Restoring native plant productivity

- Natural re-colonization encouraged

New marsh platform

Old marsh platform

Restoring native plant productivity

- and where needed, active revegetation

Chesapeake Marshlands National Wildlife Refuge Complex

Next phase - Monitoring

- Vegetation cover & composition
- Breeding bird community
- Below ground biomass production
- Marsh elevation change

Matt Whitbeck
Supervisory Wildlife Biologist
Chesapeake Marshlands NWR Complex
410-221-2034
matt_whitbeck@fws.gov

Chesapeake Bay Program
Science. Restoration. Partnership.

Photos Courtesy Chesapeake Bay Program

Chesapeake Bay Stewardship Indicator

Steve Raabe, President, OpinionWorks LLC

OPINIONWORKS
PUBLIC SPIRITED RESEARCH

AFFIRMATION

As Chesapeake Bay Program Partners, we recognize the need to accelerate implementation of actions necessary to achieve the Goals and Outcomes outlined herein and realize our shared Vision of a healthy and vibrant Chesapeake Bay watershed.

As Chesapeake Bay Program Partners, we acknowledge that this Agreement is voluntary and dependent upon the availability of appropriated funds. This Agreement is not a contract or an assistance agreement. We also understand that this Agreement does not pre-empt, supersede or override any other law or regulation applicable to each signatory.

We, the undersigned members of the Chesapeake Executive Council, re-affirm our commitment to the Goals of this Agreement and to work cooperatively in its implementation. We agree to work both independently and collaboratively toward the Goals and Outcomes of this Agreement and to implement specific Management Strategies to achieve them. Every citizen of this great watershed is invited to join with the Partnership, uniting as a region and embracing the actions that will lead to success.

Date: June 16, 2014

For the Chesapeake Bay Commission

For the State of Delaware

For the District of Columbia

For the State of Maryland

For the Commonwealth of Pennsylvania

For the State of New York

For the Commonwealth of Virginia

For the State of West Virginia

For the United States of America
on behalf of the Federal Government and the
Federal Leadership Committee for the Chesapeake Bay:
U.S. Environmental Protection Agency
U.S. Department of Agriculture
U.S. Department of Commerce
U.S. Department of Defense
U.S. Department of Homeland Security
U.S. Department of the Interior
U.S. Department of Transportation

Chesapeake Bay Program
Science. Restoration. Partnership.

Chesapeake Bay Watershed Agreement

10 broad goals for Bay restoration

https://www.chesapeakebay.net/what/what_guides_us/watershed_agreement

Stewardship Outcome

"Increase the number and diversity of trained and mobilized citizen volunteers with the knowledge and skills needed to enhance the health of their local watersheds."

Citizen Stewardship Framework

Increasing citizen actions for watershed health

Citizen Stewardship Indicator

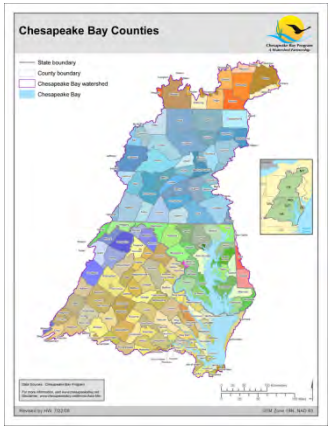
Survey Content

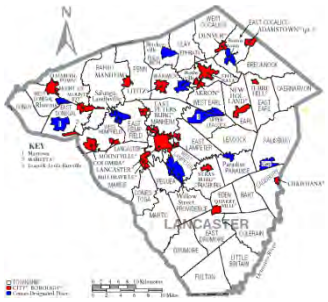
- Stewardship Behaviors: Personal Actions
- Volunteering: Collective Actions
- Civic Engagement: Advocating

- Likelihood to Take Personal Actions
- Likelihood to Volunteer and Advocate
- Individual Engagement: Motivating Attitudes

What This Survey Tool Can Do

- ✓ Measure and track Stewardship progress.
- ✓ Inform smart behavior selection for practitioners.
- ✓ Segment data by major jurisdiction, demographic.

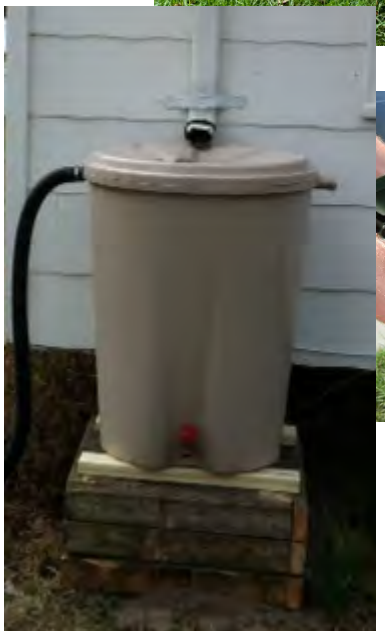




- ✓ Be a resource for other Bay Program priorities: Access, Diversity, Communications.

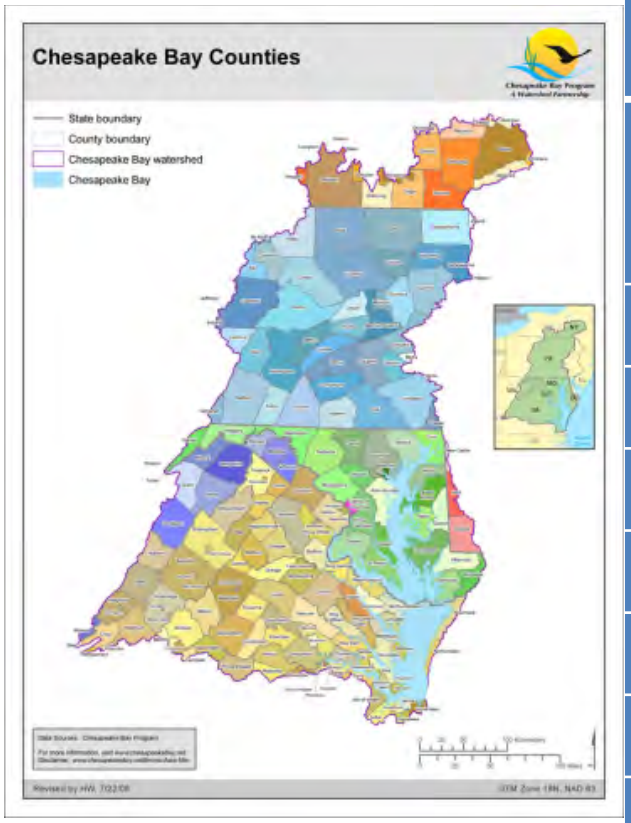
Measured Behaviors

- Pet waste (2: on property/off property)
- Leaves/Lawn clippings (2)
- Litter (2: drop/pick-up)
- Fats, grease/Medicines down the drain (2)
- Fertilizer use/keep off hard surfaces (2)
- Pesticide/Herbicide use (2)
- Conservation landscaping
- Rain garden installation
- Septic system
- Tree planting
- Downspout redirect
- Rain barrel/Connected, emptied (2)
- Water conservation



Citizen Stewardship Indicator

Sampling Methodology



	2017 Baseline
	All states statistically significant N=5,212
VA	1,001 (±3.1%)
MD	1,005 (±3.1%)
PA	1,003 (±3.1%)
DC	801 (±3.5%)
WV	600 (±4.0%)
NY	400 (±4.9%)
DE	402 (±4.9%)

Fielded March – May 2017
13-minute interview
Wireless and Landline
Spanish language interviewing

Stewardship Score: Performance Indicator

Individual Behavior[1]	38
Volunteerism[2]	23
Civic Engagement[3]	19
Rollup	**24**

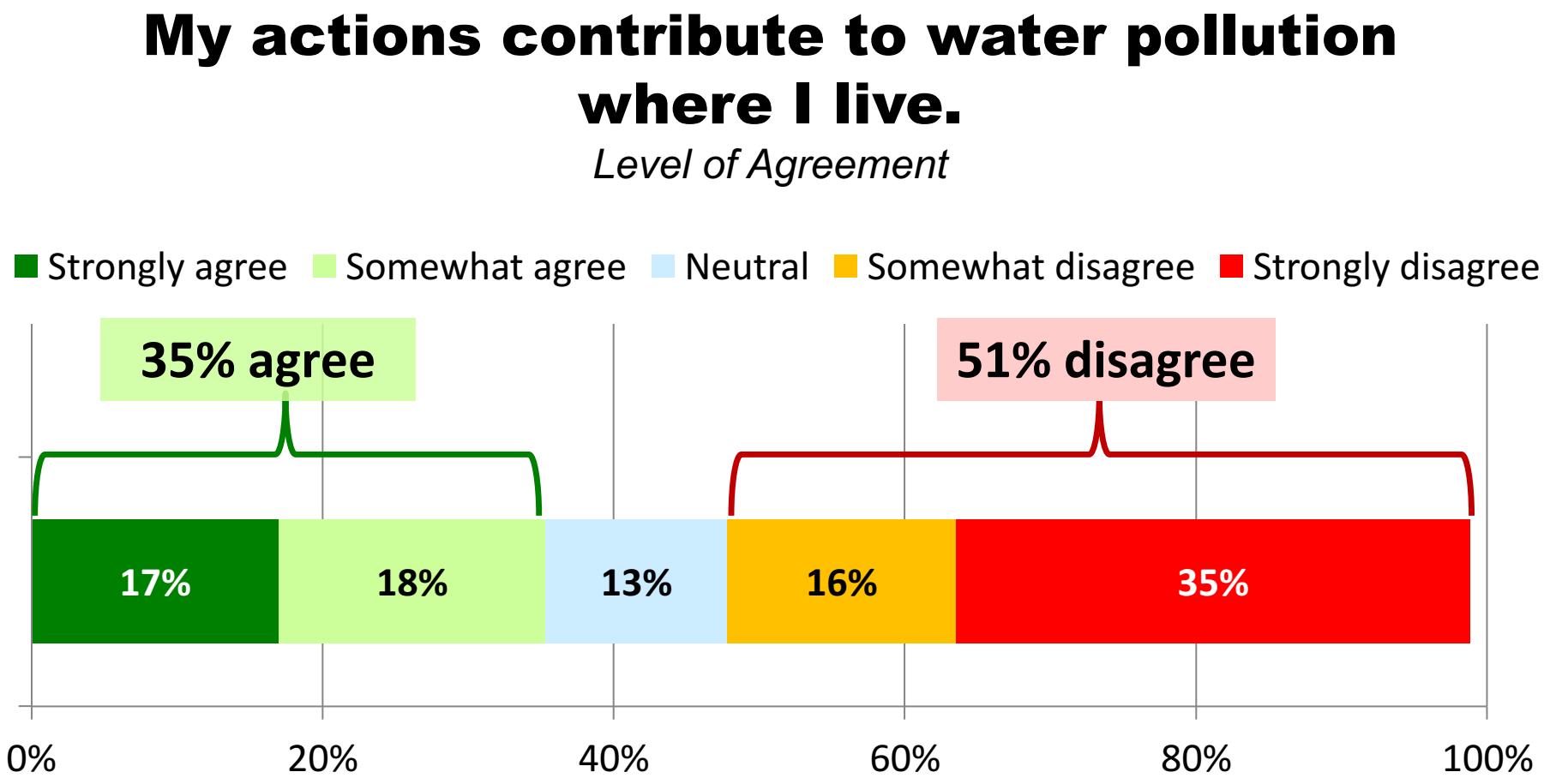
Bay-wide, based on 2017 Baseline data to date

[1]19 behaviors, weighted for water impact and % of population that could perform each behavior

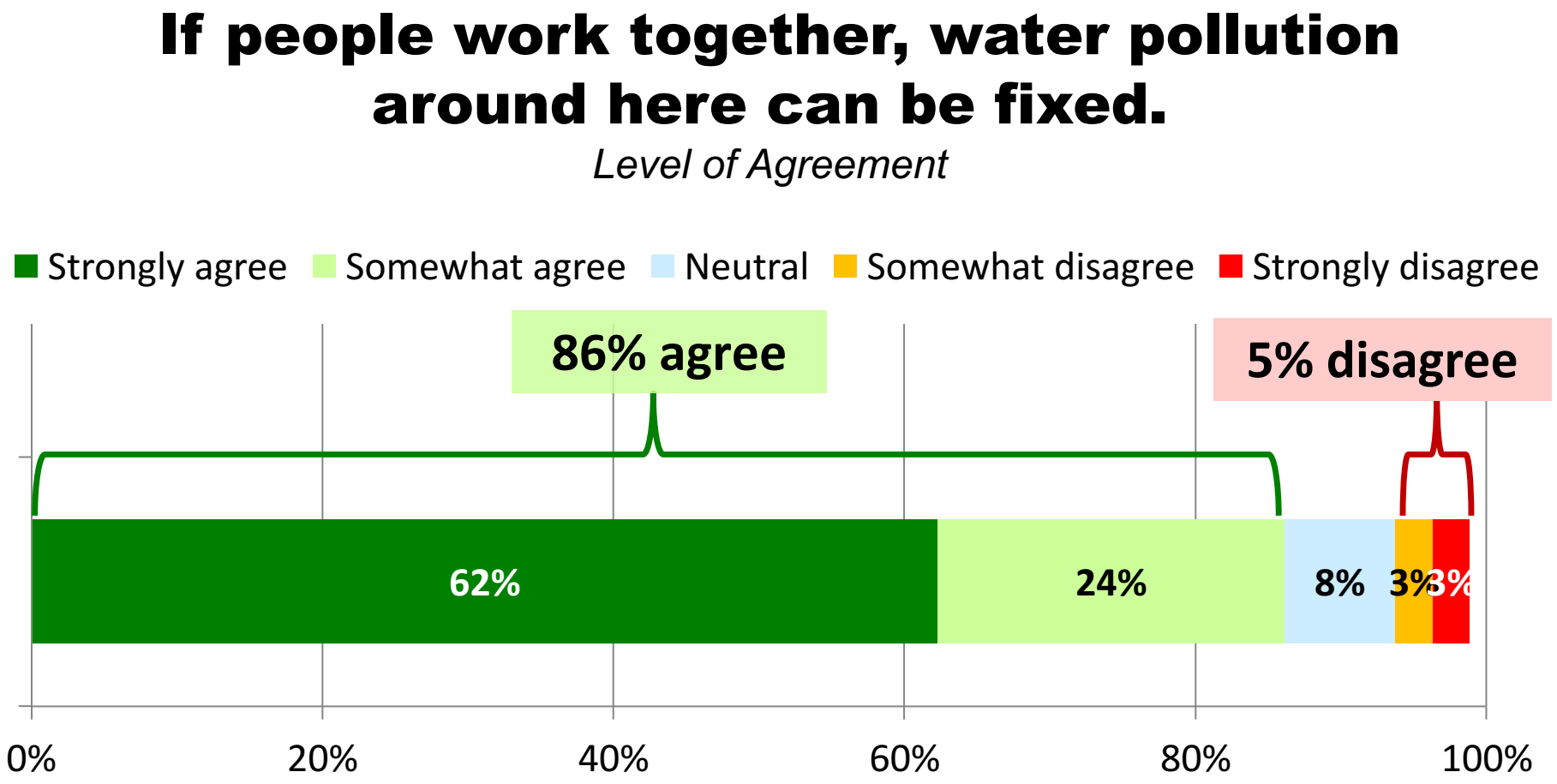
[2]Volunteered, given money for water restoration, or aware of a group in their local community

[3]Spoken out on behalf of an environmental cause

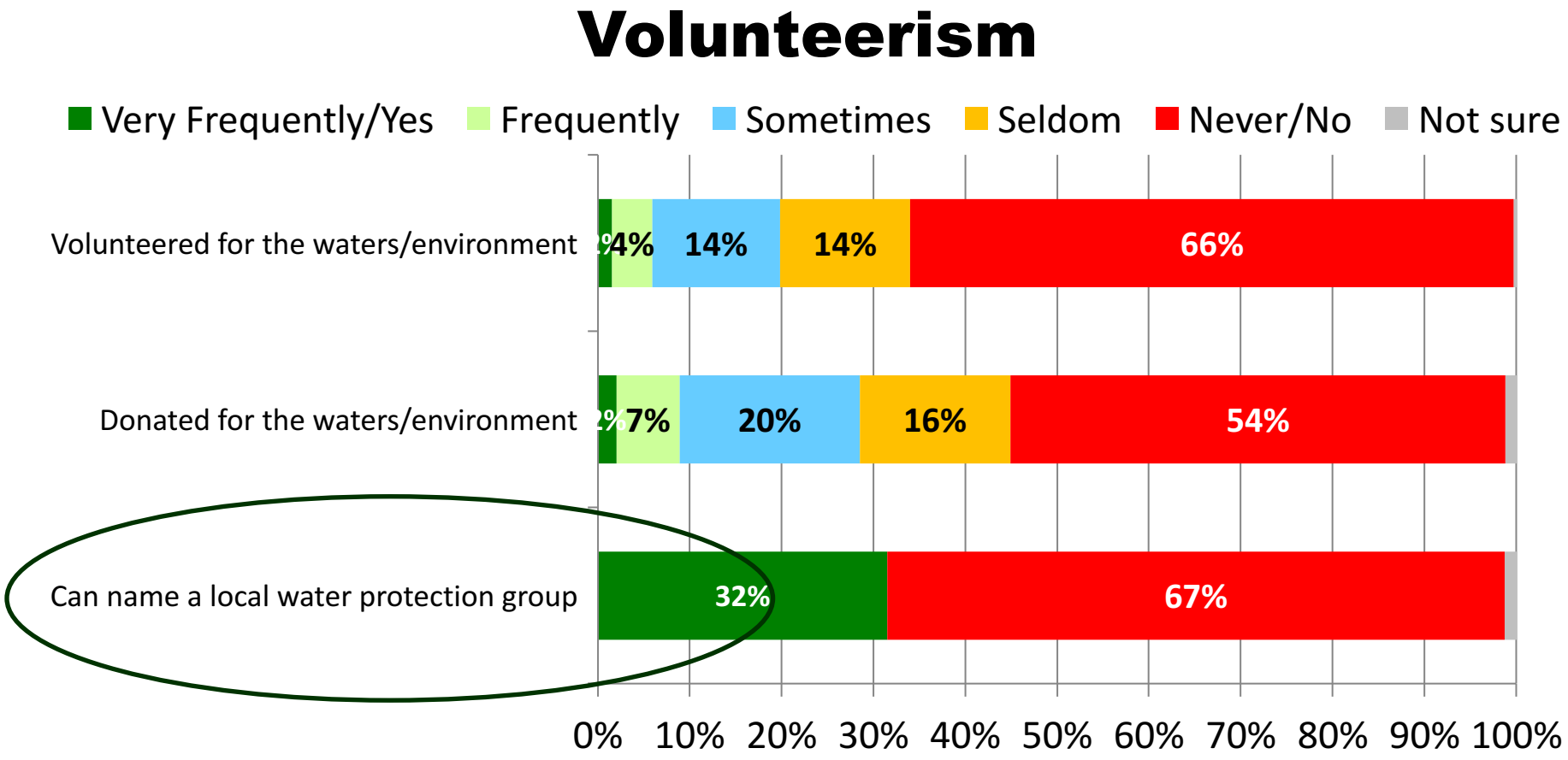
Citizen Stewardship Indicator: 2017 Final Baywide Data



Citizen Stewardship Indicator: 2017 Final Baywide Data



Citizen Stewardship Indicator: 2017 Final Baywide Data



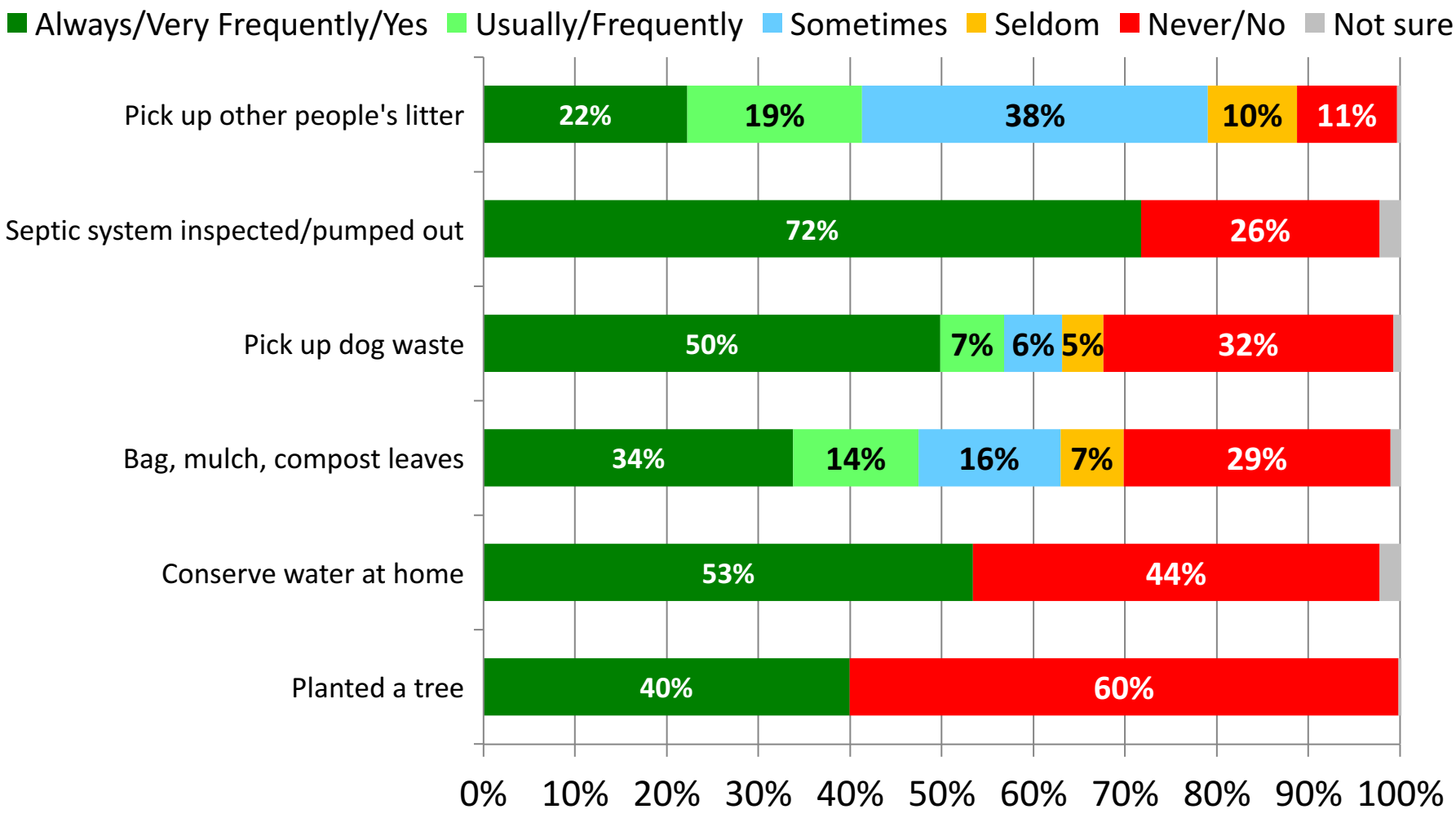
Never	Seldom	Sometimes	Frequently	Very frequently
No				Yes
0	25	50	75	100
100	75	50	25	0

Individual Behavior Measurement

Citizen Stewardship Indicator: 2017 Final Baywide Data

Positive Behaviors: Higher Tier

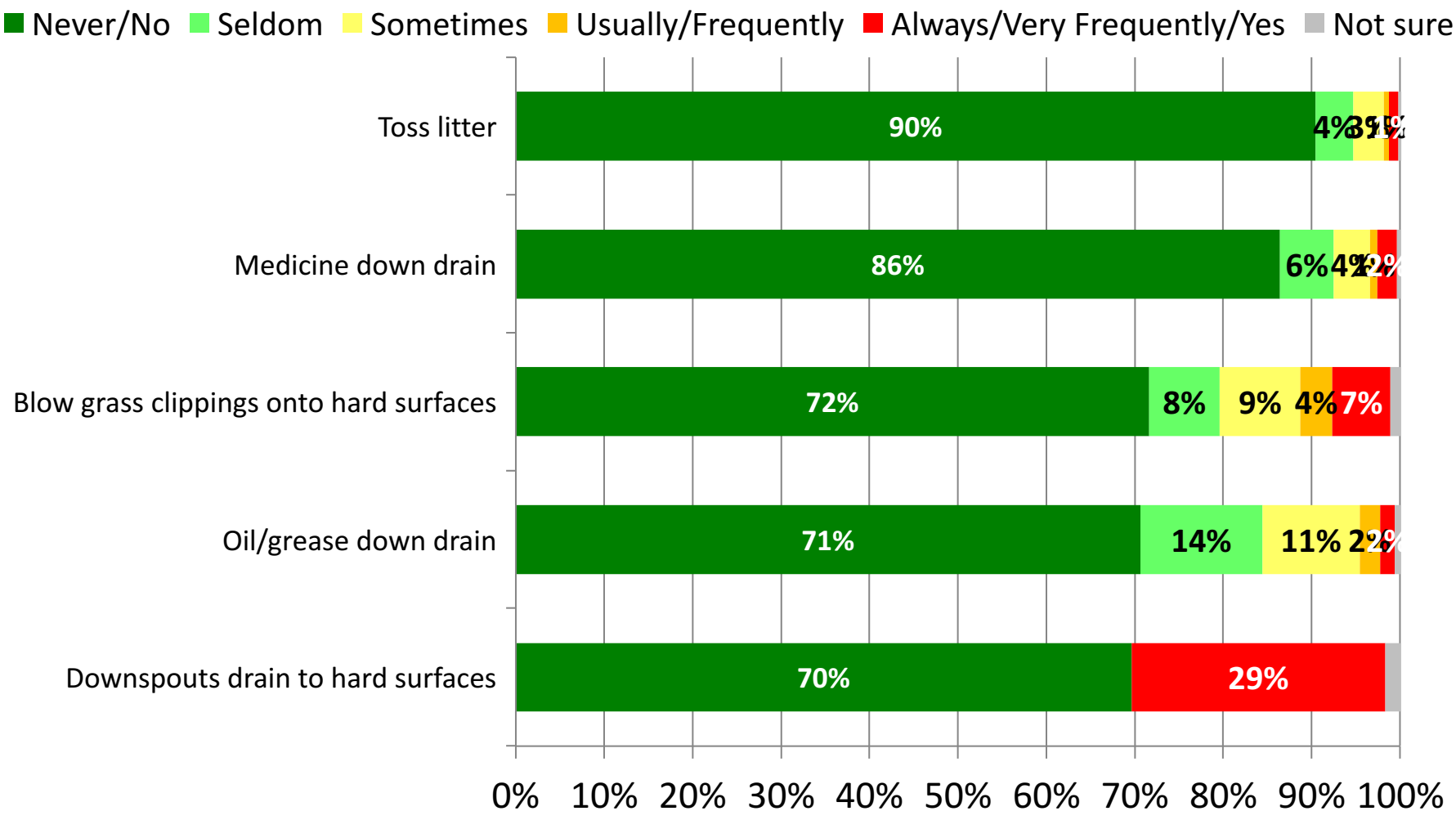
Desired = Always/Very Frequently/Yes → Sometimes



Citizen Stewardship Indicator: 2017 Final Baywide Data

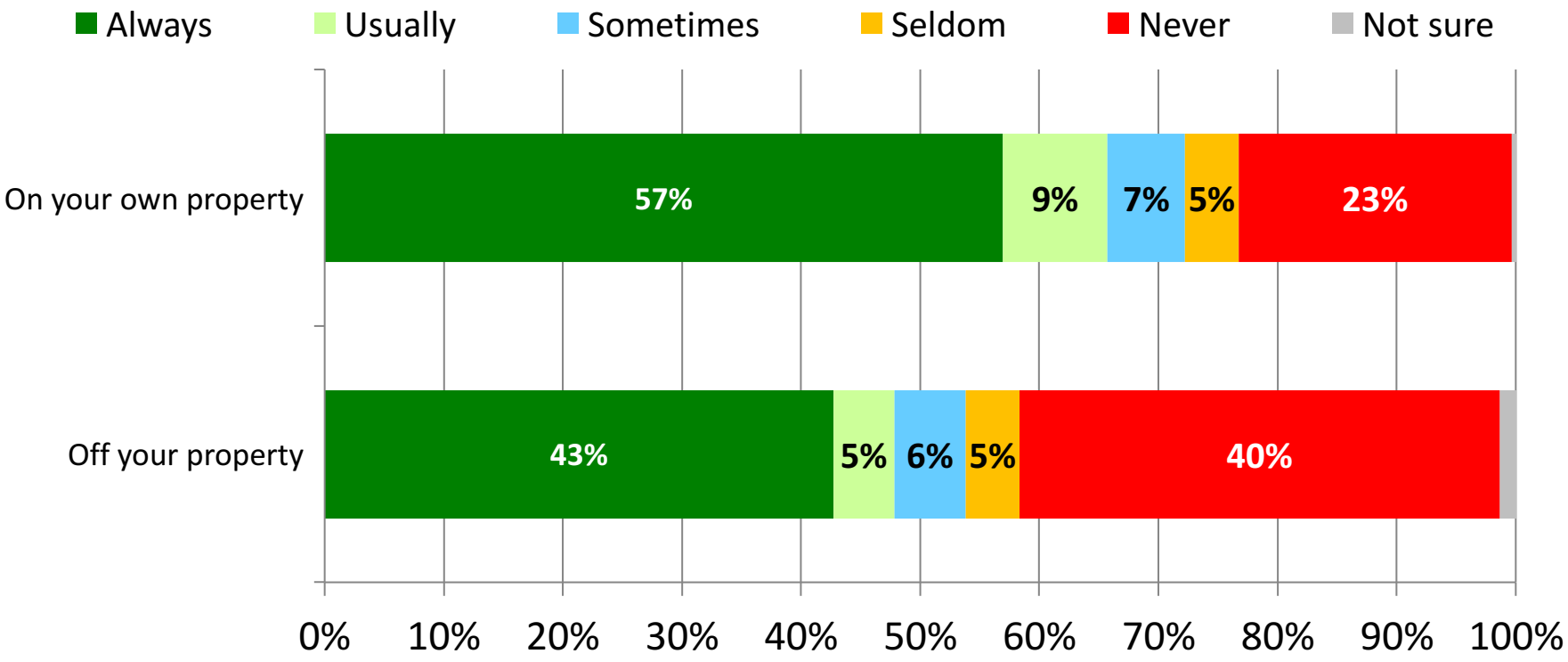
Negative Behaviors: Higher Tier

Desired = Never/No, or Seldom



Citizen Stewardship Indicator: 2017 Final Baywide Data

Focus Behavior: Picking up Dog Waste



For each of the following things, please tell me if you never, seldom, sometimes, usually, or always do it.
Pick up your dog's waste and dispose of it in the trash when you are…
…On your own property.
…Off your property.

Choosing the Right Behavior to Influence

Behavior Weighting:

Impact of the Behavior on Water Quality

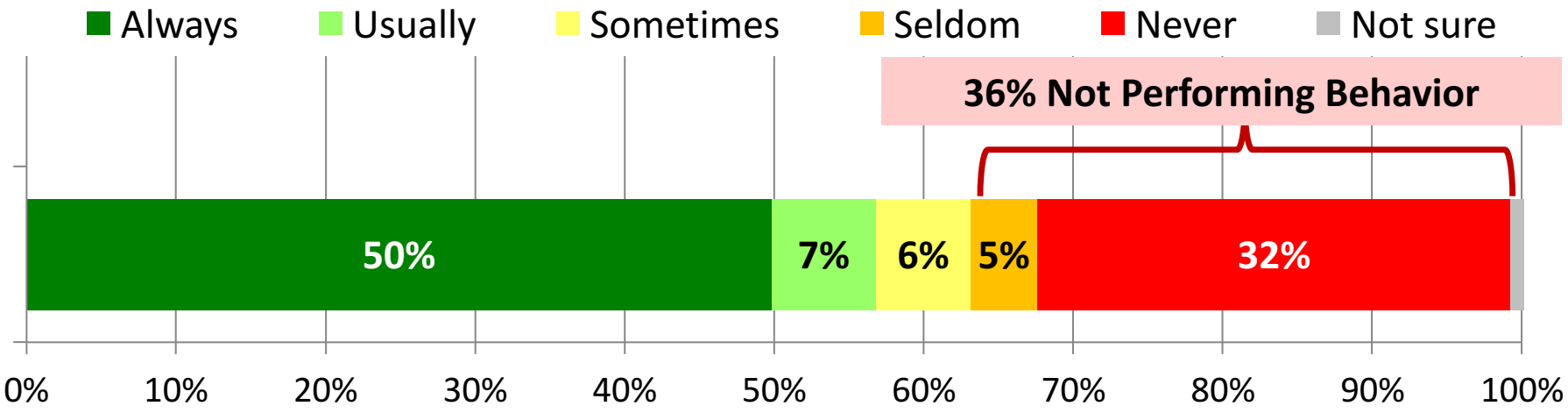
x

Inverse of the Penetration (Level of Adoption) in the Community

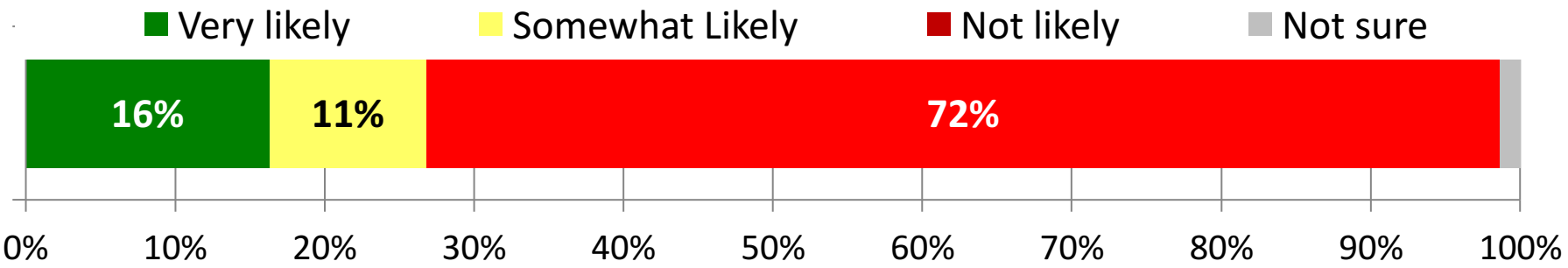
x

Likelihood the Public will Adopt the Behavior

Citizen Stewardship Indicator: 2017 Final Baywide Data
Picking up Dog Waste (Aggregated On & Off Property)



Likelihood among Non-Performers:



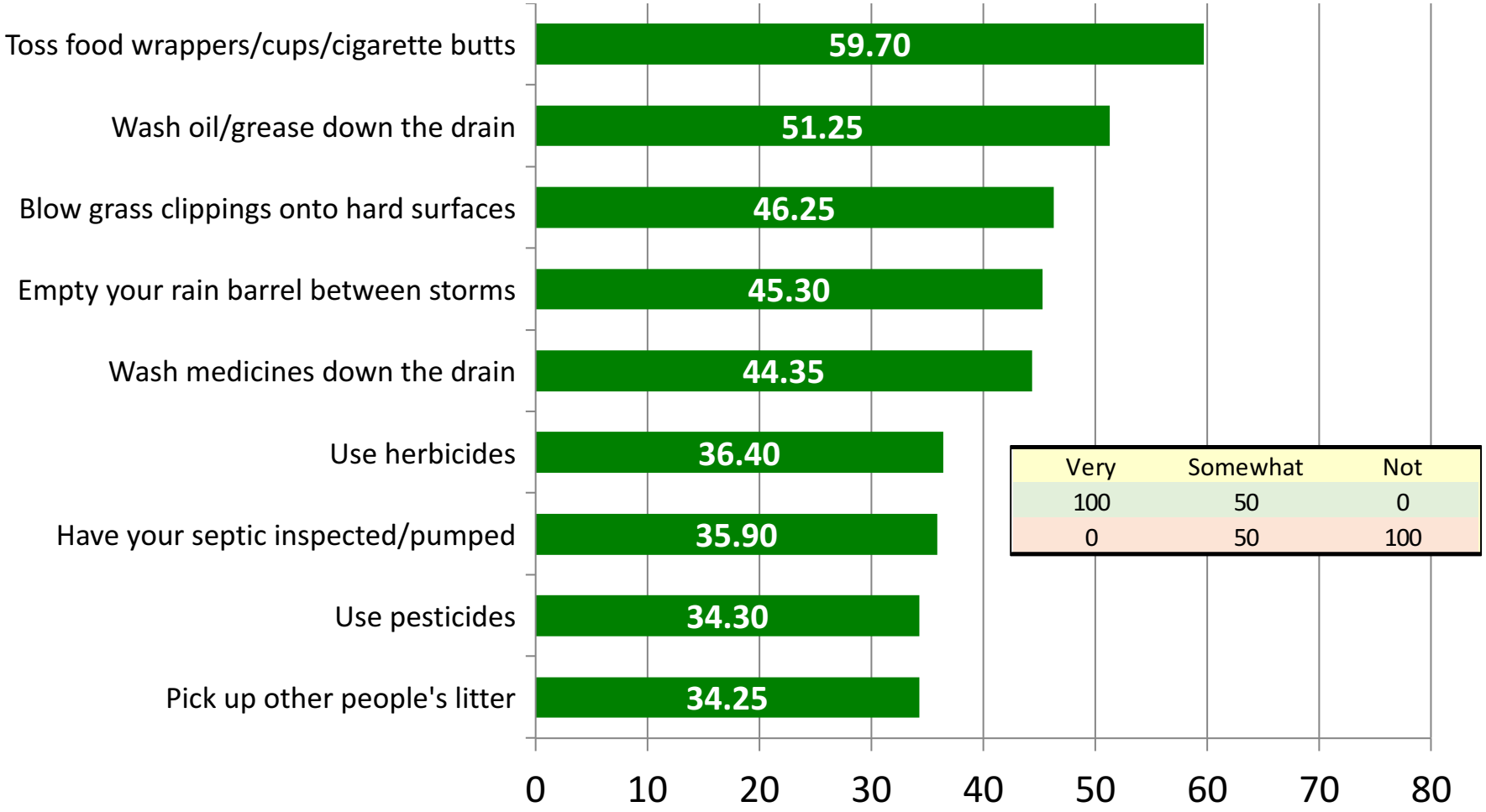
(Asked of those with a dog):
"For the next few things, please tell me if you never, seldom, sometimes, frequently, or very frequently do it.…Pick up your dog's waste and dispose of it in the trash when you are…on your own property/off your property."

(If seldom or never): "Looking forward over the next year or so, how likely are you to do each of these things using the scale very likely, somewhat likely, or not likely?
…Pick up your dog's waste and dispose of it in the trash while you are…on your own property/off your property."

Citizen Stewardship Indicator: 2017 Final Baywide Data

Behaviors More Susceptible to Change

Asked Only of Those Not Taking the Desired Action Today

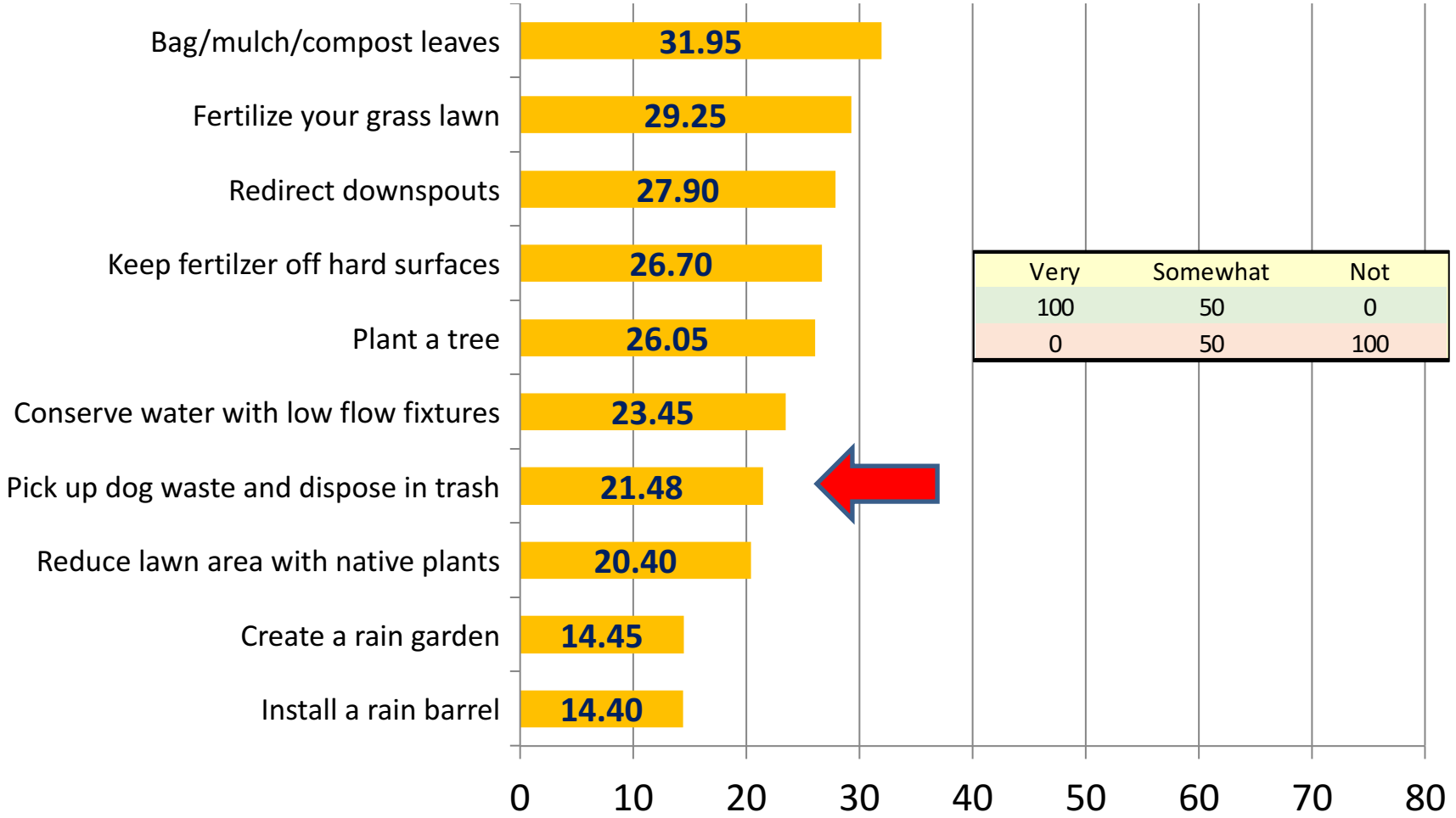


Looking forward over the next year or so, how likely are you to do each of these things using the scale (rotate high to low/low to high): [very likely, somewhat likely, (or) not likely]?

Citizen Stewardship Indicator: 2017 Final Baywide Data

Behaviors Less Susceptible to Change

Asked Only of Those Not Taking the Desired Action Today

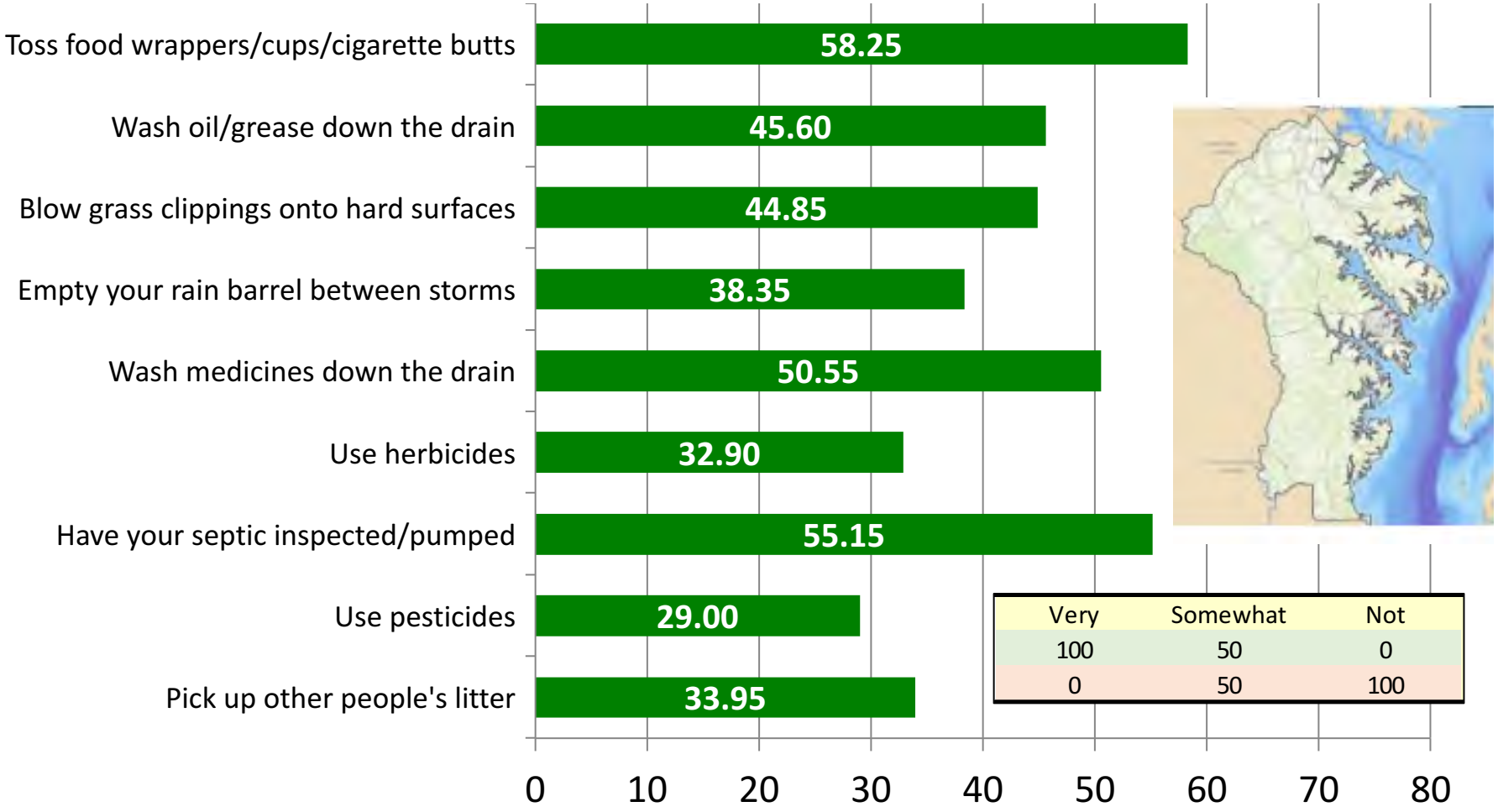


Looking forward over the next year or so, how likely are you to do each of these things using the scale (rotate high to low/low to high): [very likely, somewhat likely, (or) not likely]?

Citizen Stewardship Indicator: Anne Arundel County

Behaviors Susceptible to Change

Asked Only of Those Not Taking the Desired Action Today

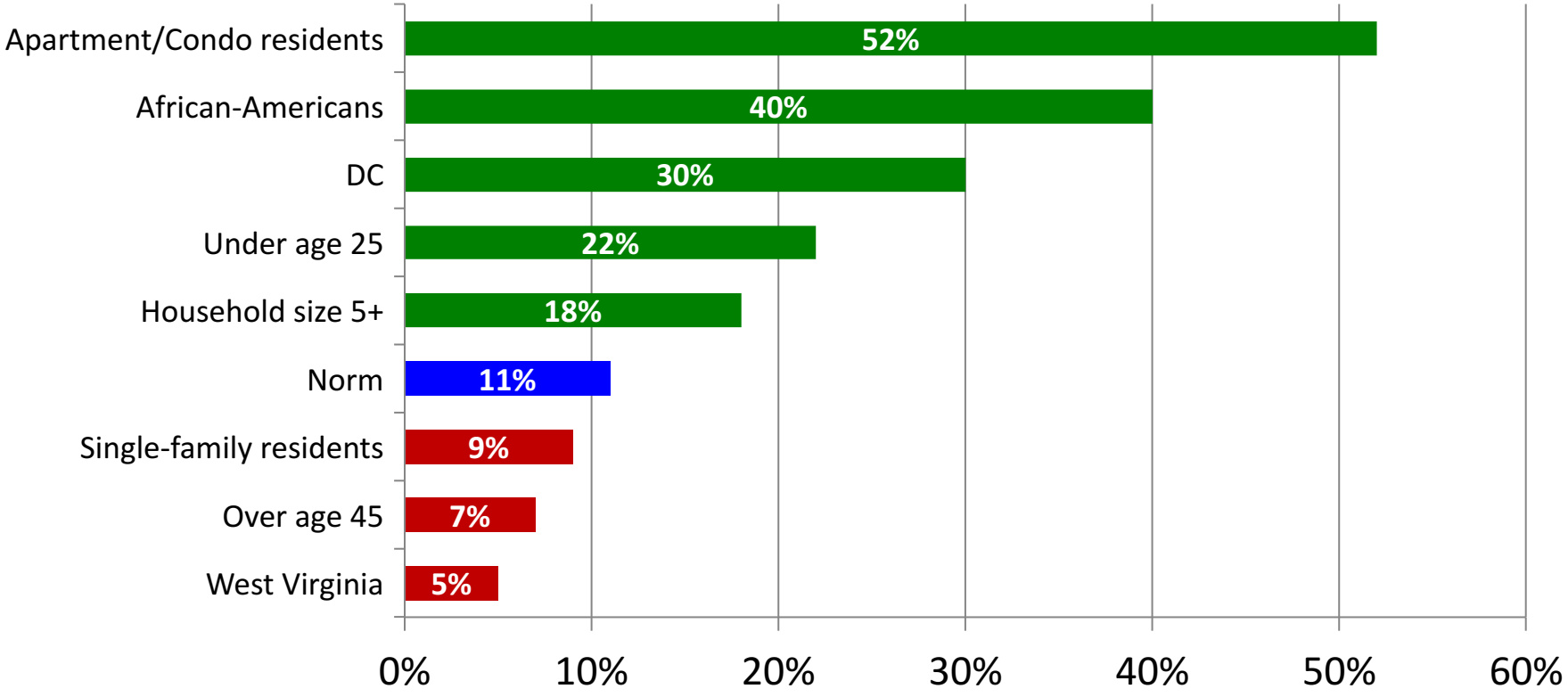


Looking forward over the next year or so, how likely are you to do each of these things using the scale (rotate high to low/low to high): [very likely, somewhat likely, (or) not likely]?

Citizen Stewardship Indicator: 2017 Final Baywide Data

Focus Behavior: Picking up Dog Waste

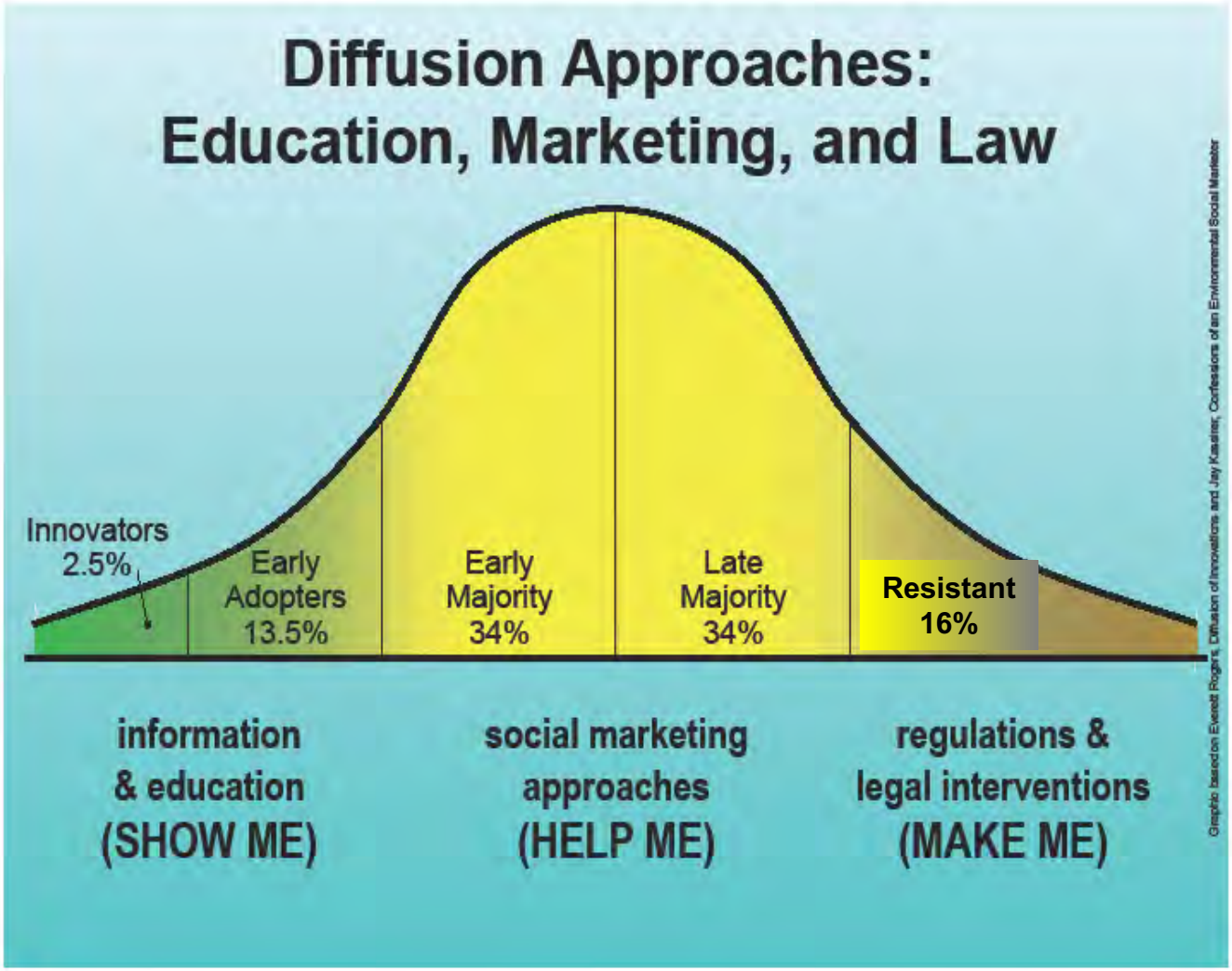
"Very Likely" to Begin Picking Up



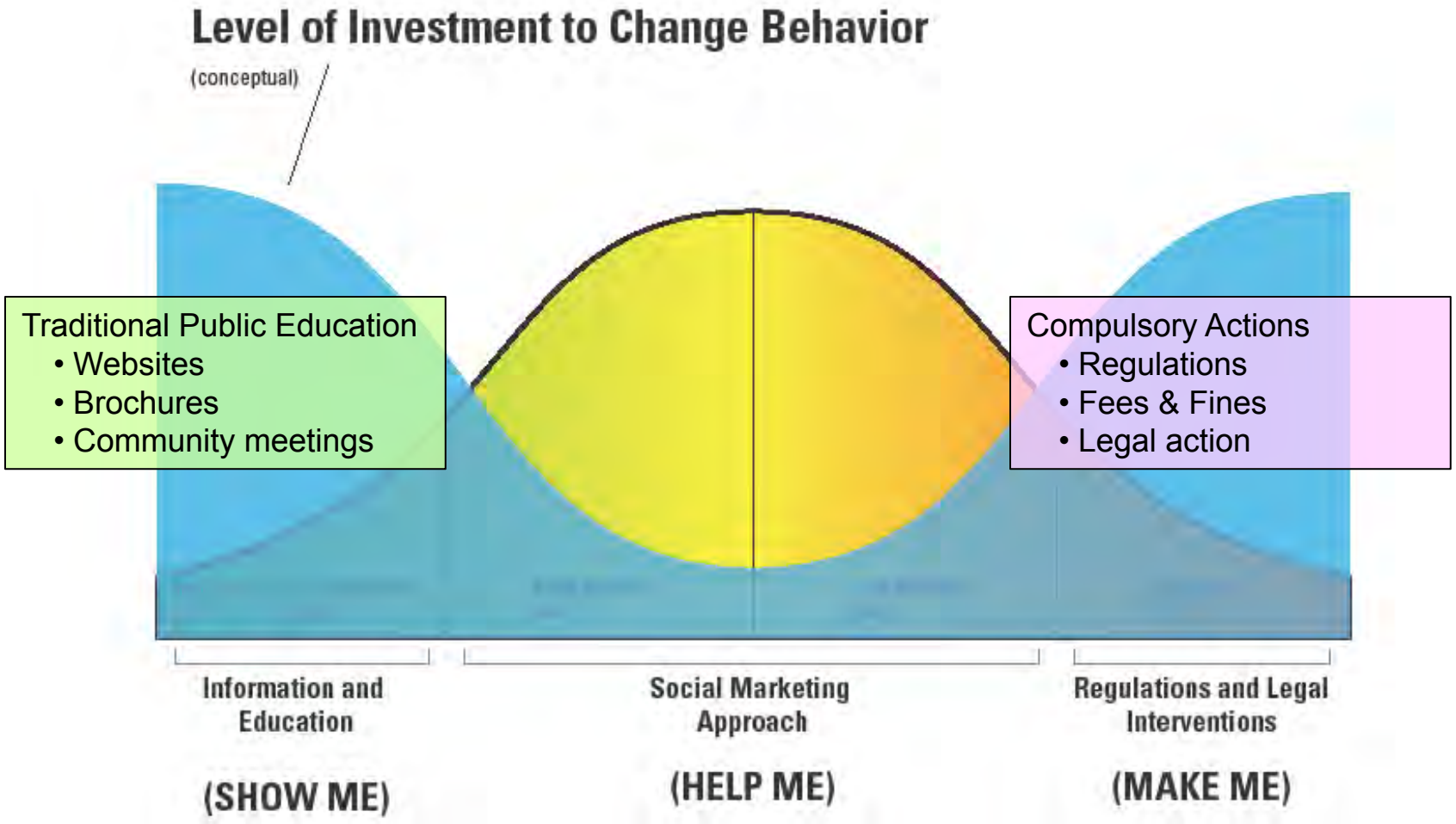
Looking forward over the next year or so, how likely are you to do each of these things using the scale very likely, somewhat likely, or not likely?
Pick up your dog's waste and dispose of it in the trash when you are…
…On your own property.

Segmentation Opportunities

- Jurisdiction
- Age
- Educational attainment
- Health status (self-assessed)
- Household size, presence of children
- Home ownership
- Housing type
- Community size
- Agriculture
- Religious affiliation, worship frequency
- Race/ethnicity
- Household income
- Gender



Credit: Nancy R. Lee, University of Washington & Puget Sound Partnership
Adapted from Everett Rogers, Jay Kassirer, Mike Rothschild, Dave Ward, Kristen Cooley



Credit: Nancy R. Lee, University of Washington & Puget Sound Partnership
Adapted from Everett Rogers, Jay Kassirer, Mike Rothschild, Dave Ward, Kristen Cooley

Example Tool: Pledge

“Free Upgrade”

A/B Test:
A. Flooding
B. Water quality

50% of homes visited signed the pledge

Taking Action for Clean Water in Capitol Heights

Am I contributing to water pollution?

Unfortunately, we all are. Every day, trash, oil, sediment, chemicals and other pollutants collect on our roofs, roads, parking lots and driveways. When it rains, the pollutants travel over these hard surfaces and flow into our creeks and rivers.

How Can I Help?

There are simple things we can do in our own yards to help reduce pollution in our local creek and the Anacostia River.

Disconnecting your downspout means redirecting your roof runoff away from hard surfaces like streets and driveways and onto planted areas where the water will soak in. This simple action can provide a BIG reduction in the amount of pollution.

Helping is easy, and it’s FREE!

Capitol Heights residents can get **FREE downspout redirectors** including pipe extenders and splash pads, and a **FREE visit from someone who can help you install them.**

Take the Pledge!

We know you care about your home and want the waters to be cleaner. Sign the pledge card and become part of the solution for your community.

I commit to helping reduce the impact of stormwater runoff in the Anacostia River by completing _____ *on my personal property.*

Signature_____ Date_____

What Happens Next?

Based on your availability, we will contact you to arrange follow up and installation.

MORE INFORMATION:

Prince George’s Department of Environment Stormwater Management Division: *bit.ly/PGDOESW*
Stormwater Fee FAQ: *bit.ly/PGDOESWFAQ* • Rain Check Rebate Program: *bit.ly/PGDOESWREBATES*

Outcome:

50% of homes signed the pledge.

24% followed through.

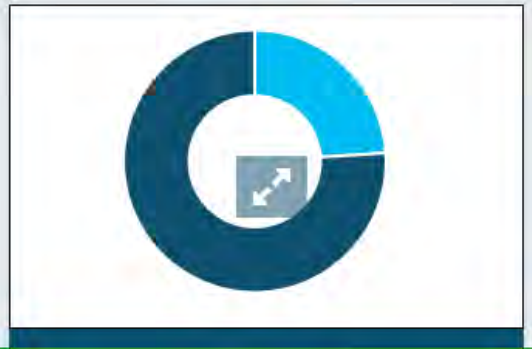
CLEAN WATER ACTION

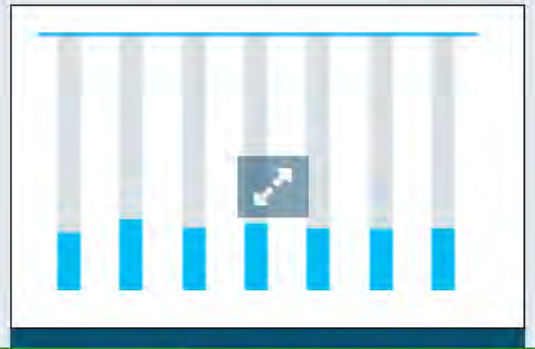
Citizen Stewardship

Increase the number and diversity of trained and mobilized citizen volunteers who have the knowledge and skills needed to enhance the health of their local watersheds.

Progress

In 2017, residents of the Chesapeake Bay region scored a 24 out of 100 on the Citizen Stewardship Index: the first comprehensive survey of stewardship actions and attitudes in the Chesapeake Bay watershed. There are three components to this score. The Personal Action score—which is currently 38—measures the adoption of 19 actions that individuals can take to improve water quality and environmental health. The Volunteering score—which is currently 23—measures the portion of the public participating in community efforts to improve water quality and environmental health. And the Advocating score—which is currently 19—measures the portion of the public engaging in local and regional activities on behalf of water quality and environmental health. To score a 100 on the Citizen Stewardship Index, everyone in the region would need to do everything they could in their daily lives to improve water quality and environmental health, from personal actions to volunteering and advocating for the environment.





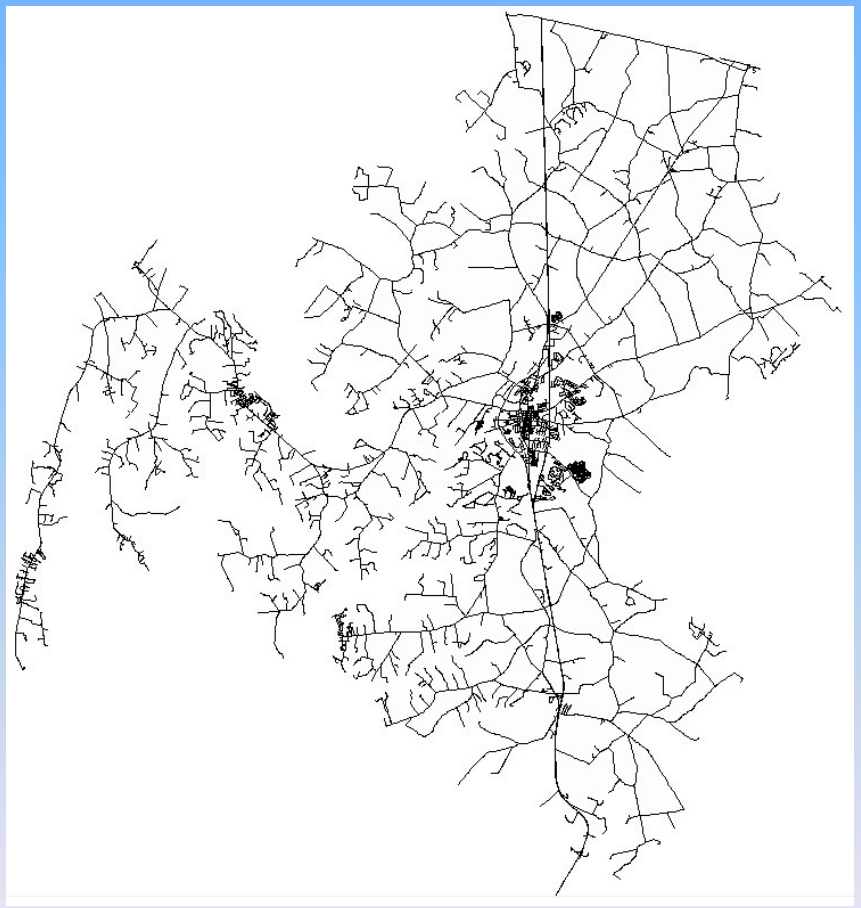
Talbot County
Ditch Enhancement Program

MAY 22,2018

PARTNERS

- Center for Watershed Protection
- Chesapeake Stormwater Network
- Environmental Concern
- Nature Conservancy

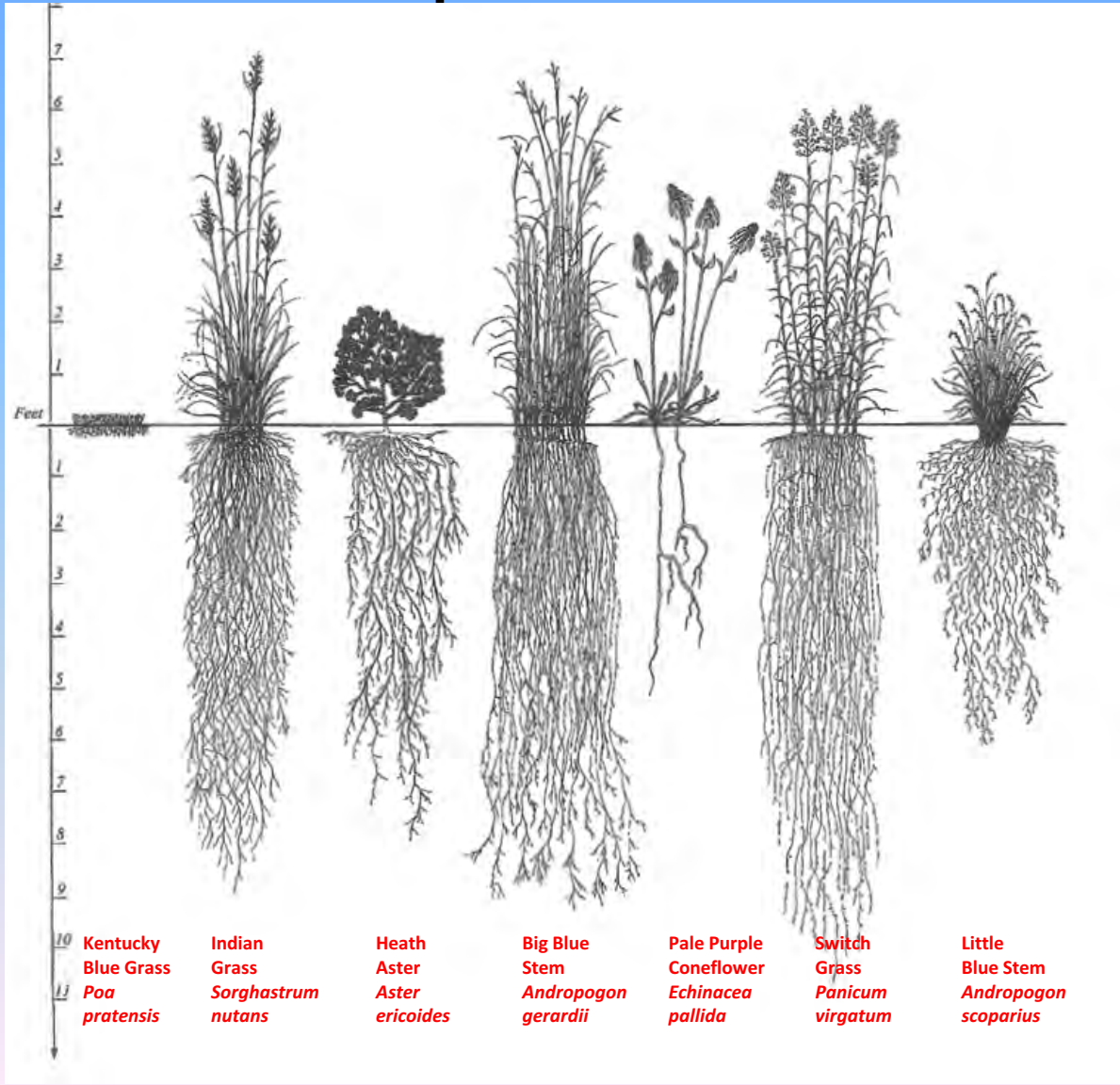
Ditch to Bio-Swale Conversion

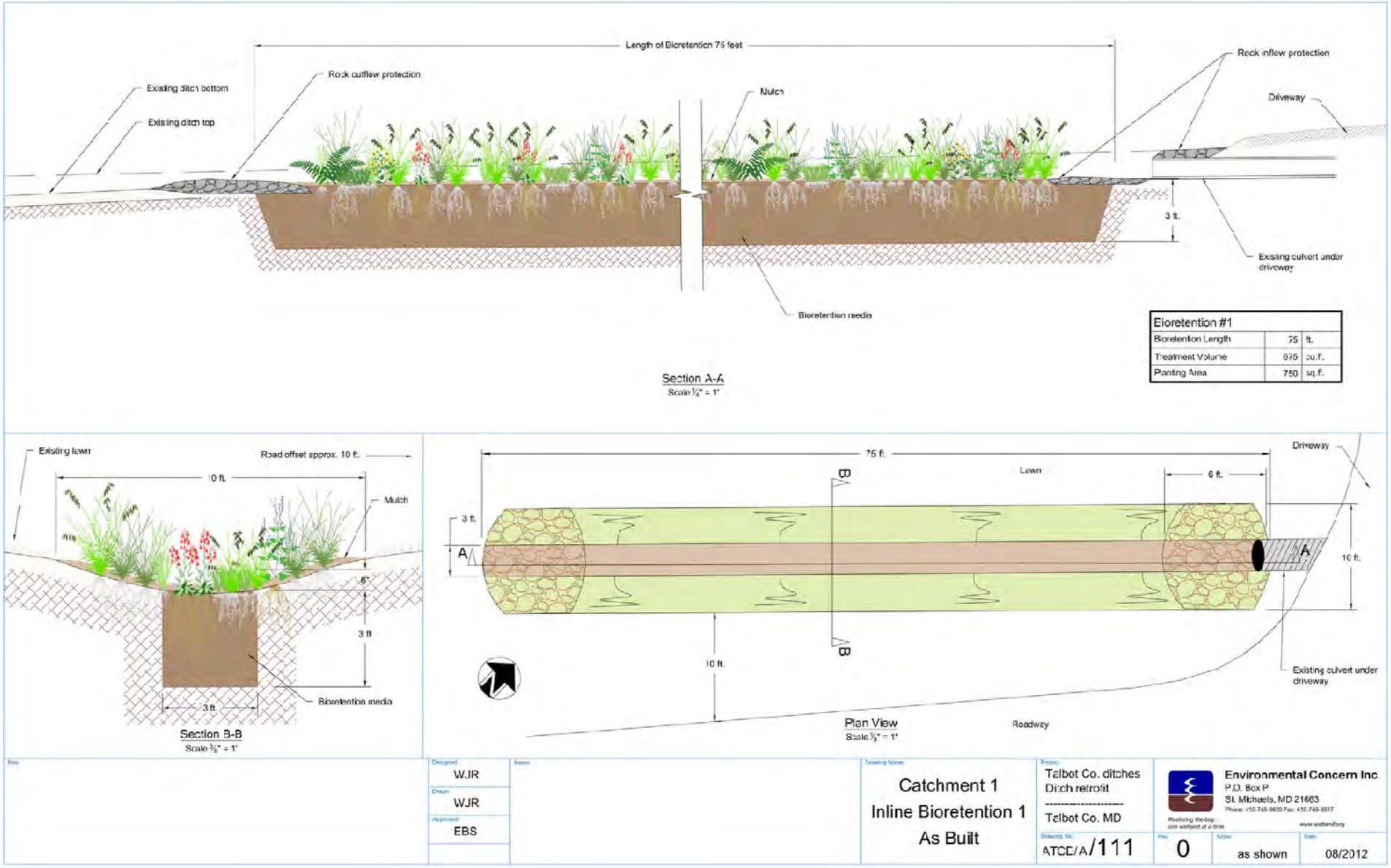


- 370 miles County roads
- 75 miles Town roads
- 140 miles private roads
- 155 miles State roads

Existing Ditch Conditions

Native Plants for Water Quality Improvement

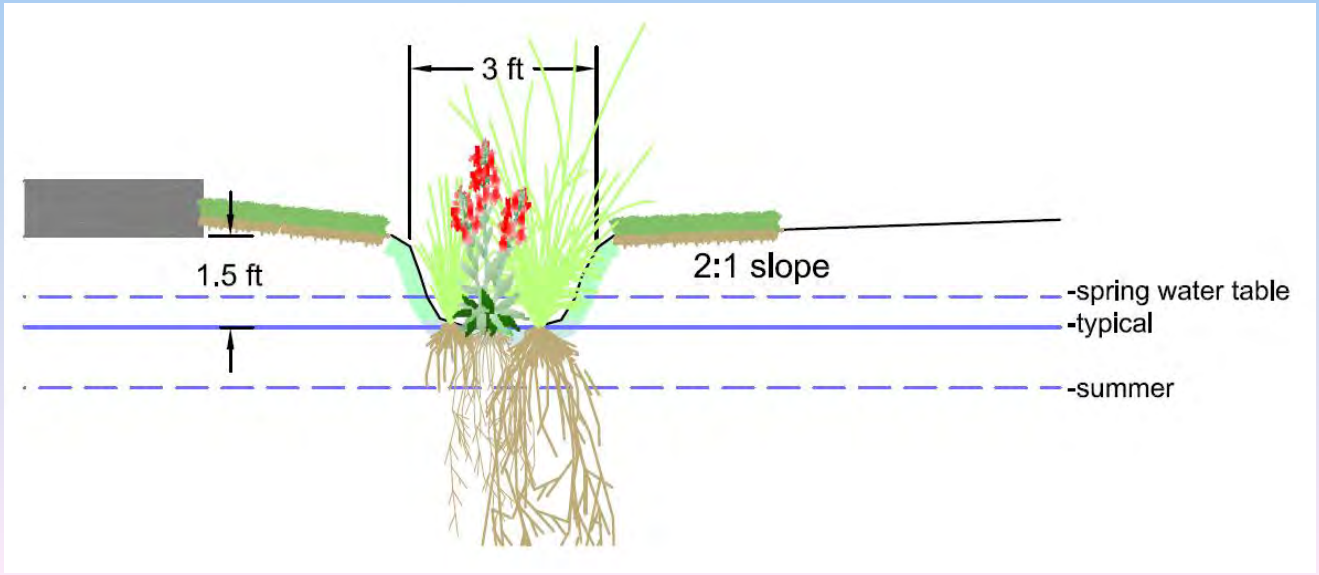




Catchment 1

Inline Bioretention #1

In-Line Bio-Swale Conversions

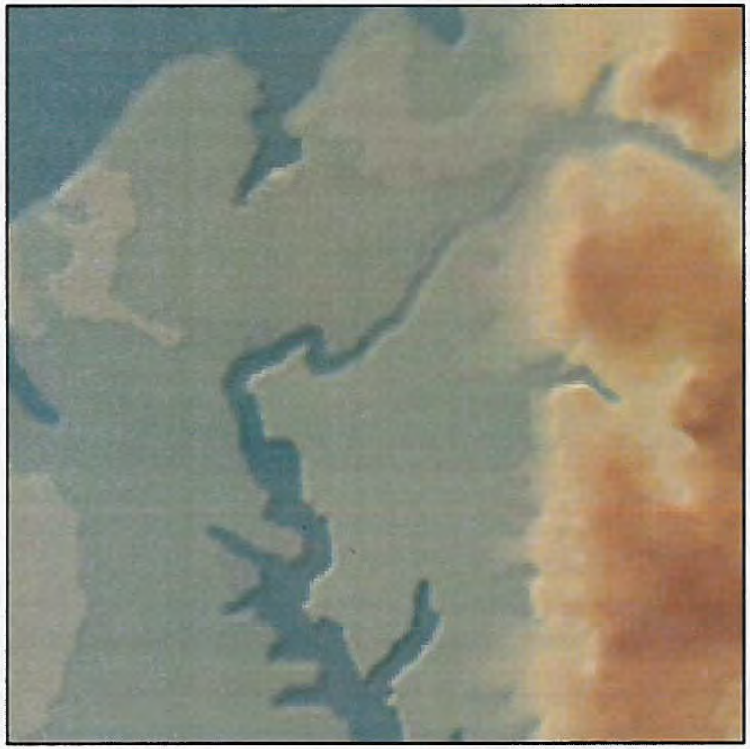


Retrofit Enhancements

- Application of targeting approach using LIDAR
- Adaption of bioreactor technology to treat shallow groundwater
- Use of biochar in bioretention media
- Incorporation of limestone to mitigate acidification

Identifying Priority Areas

USGS 30 m DEM
(7 to 10 m vertical accuracy)



LiDAR 2m DEM
(15 cm vertical accuracy)

Kathy Boomer


Woodland


Claiborne


Home Run Baker Park

Environmental Markets:
The DC Stormwater Retention Credit Market

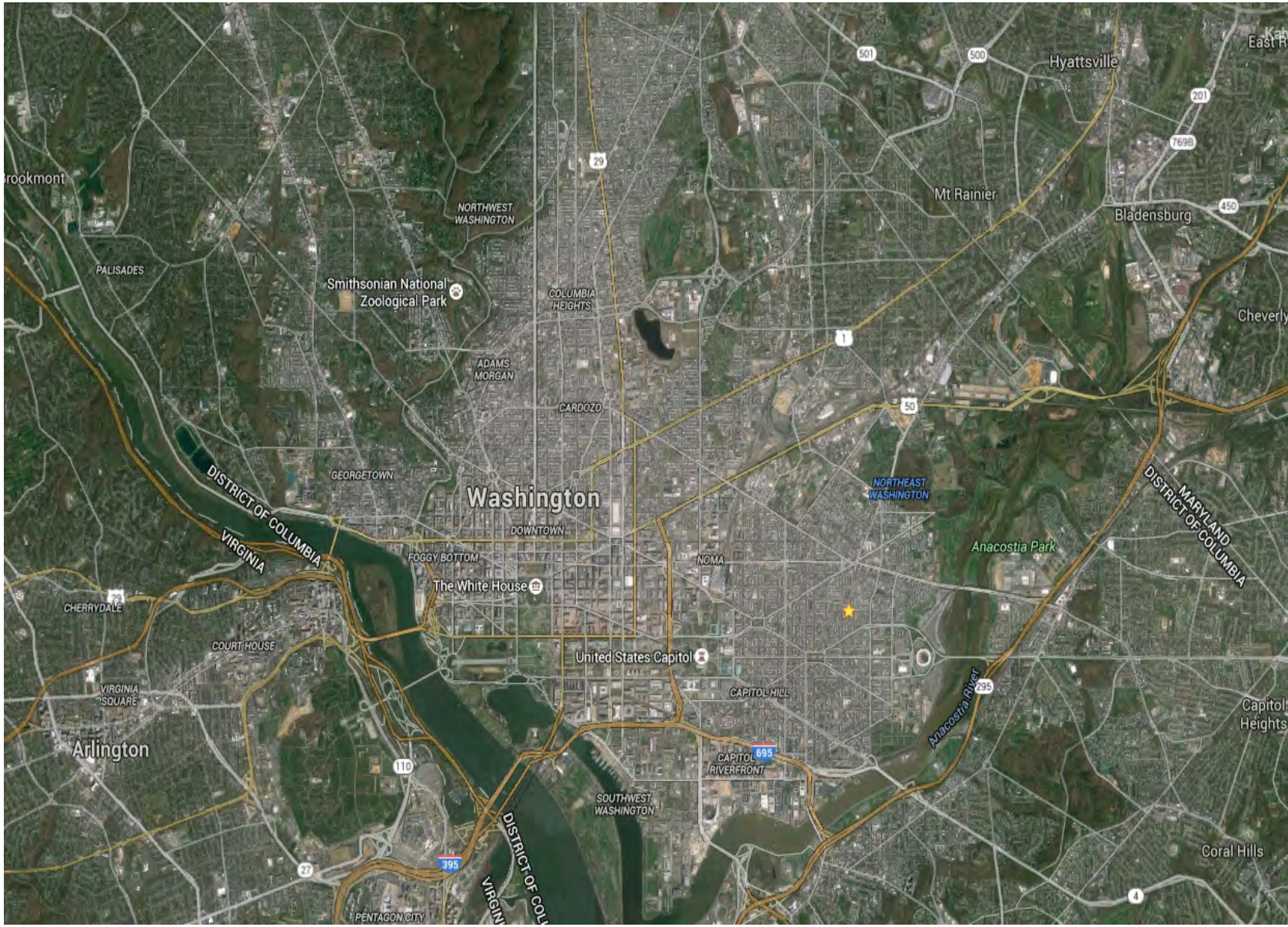
Kahlil Kettering
TNC MD/DC Urban Conservation Director

May 23, 2018

The Problem Of Stormwater Runoff in DC

43% of DC is impervious (concrete).

1.2” storm produces about 525 million gallons of stormwater runoff.



The 2013 Stormwater Rule

- New construction and renovation over 5,000 sf

3 Options to meet requirements:

- 100% Onsite
- 50% onsite +:
  - In-Lieu Fee paid to city or
  - Buy offsite credits

100% Retention Onsite in Practice

Less below ground parking

Less amenity space

More expensive structure and systems

The Market Place - Offsite Option

- Developers can purchase Stormwater Retention Credits (SRCs) for up to 50% of their retention requirement

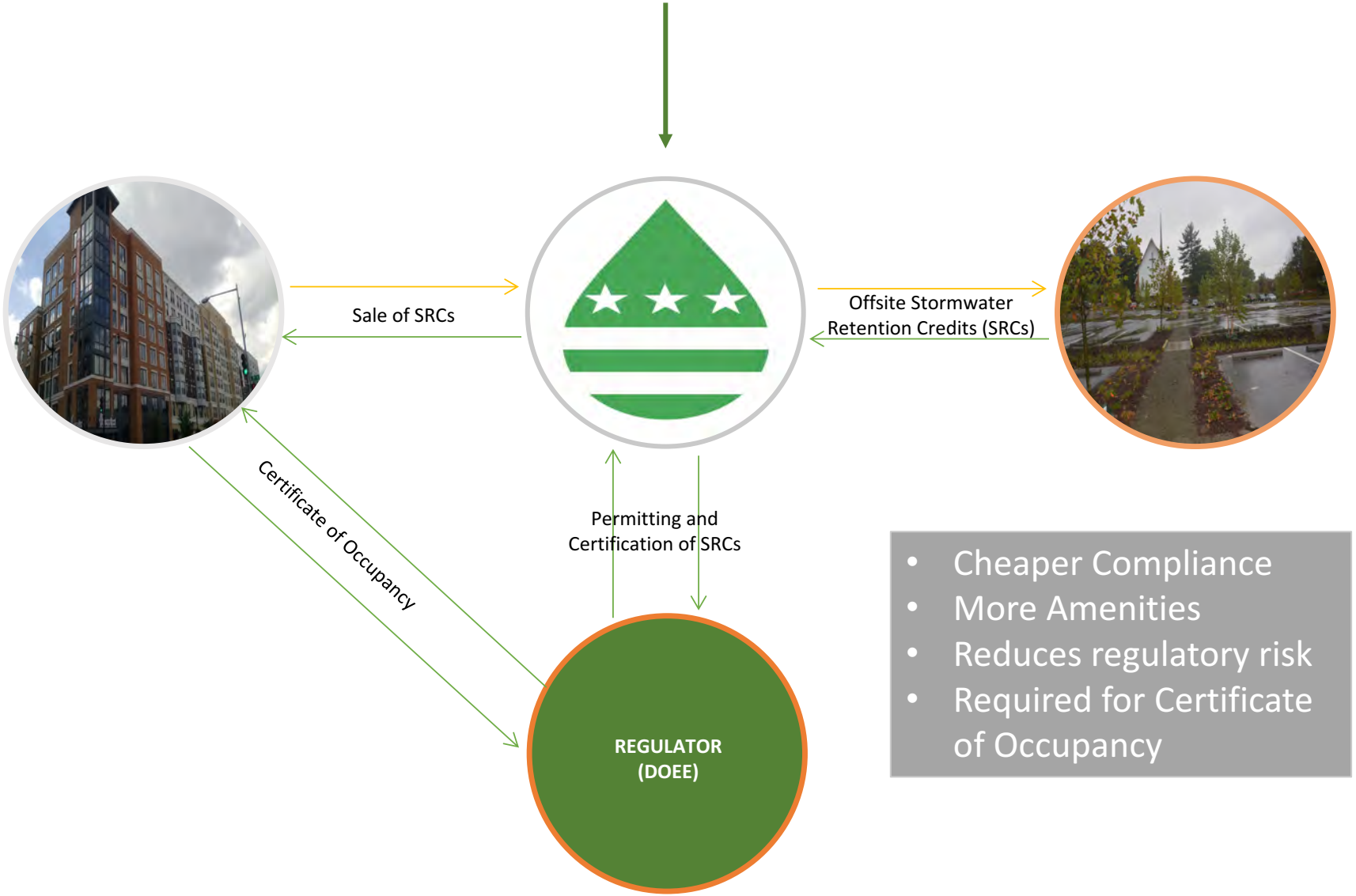
Buy offsite credits for cost savings and design flexibility

- Non-regulated site builds retention on their property to create credits
- Credits can only be generated in DC
- Credits have to be purchased in perpetuity to meet annual requirements

“Providing cost-effective Stormwater Retention Credit solutions for DC.”

DISTRICT STORMWATER

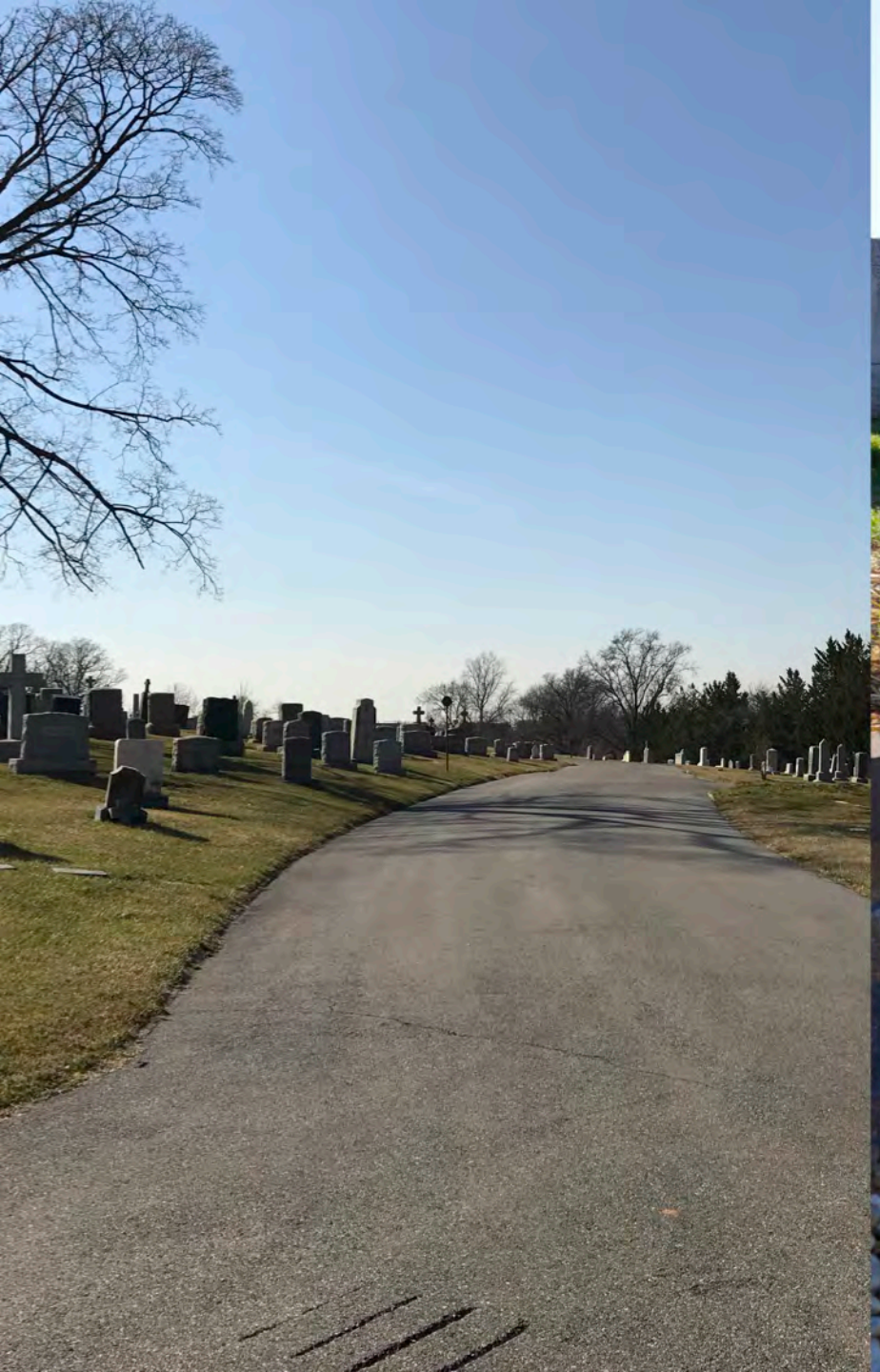
Prudential $



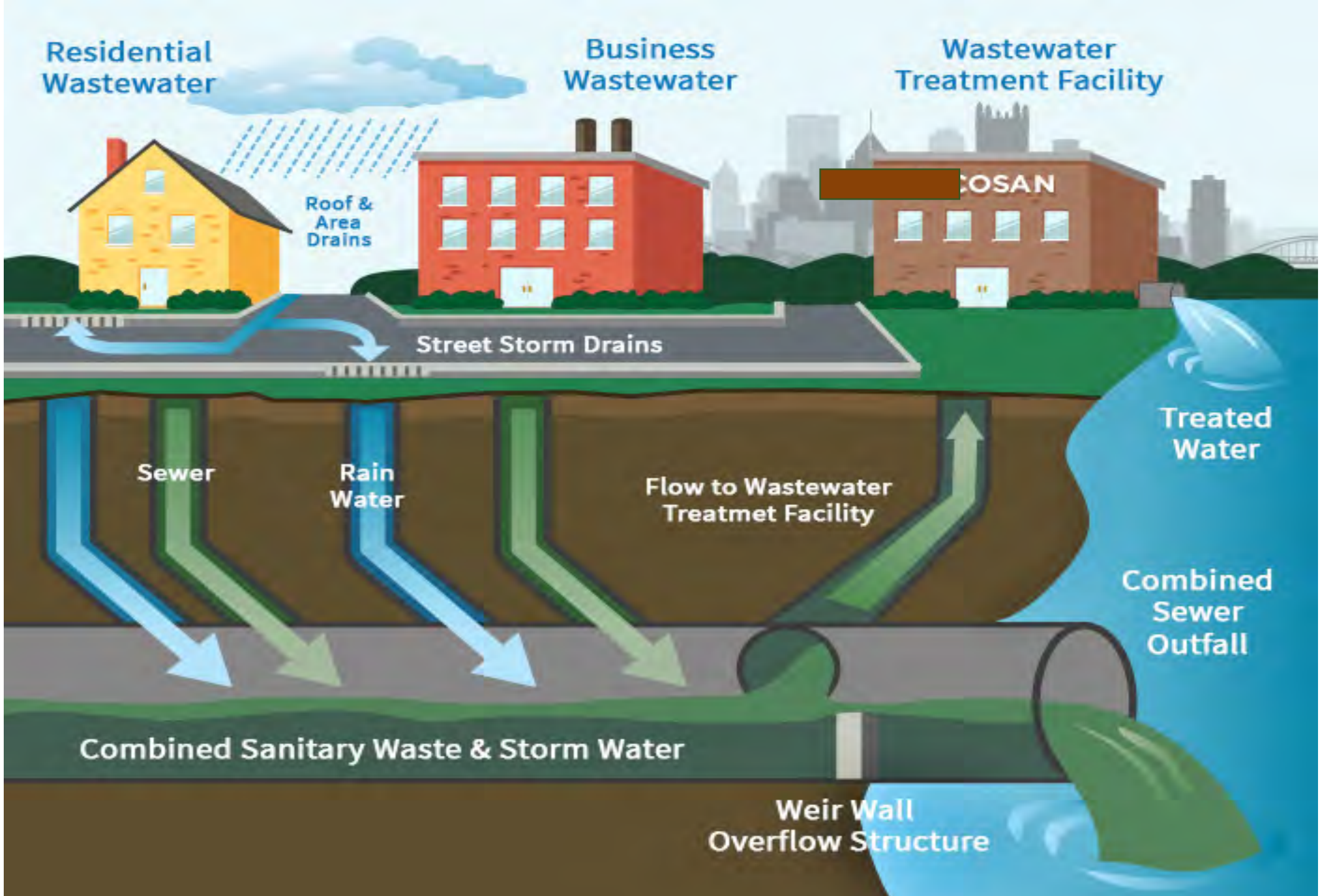
- Cheaper Compliance
- More Amenities
- Reduces regulatory risk
- Required for Certificate of Occupancy

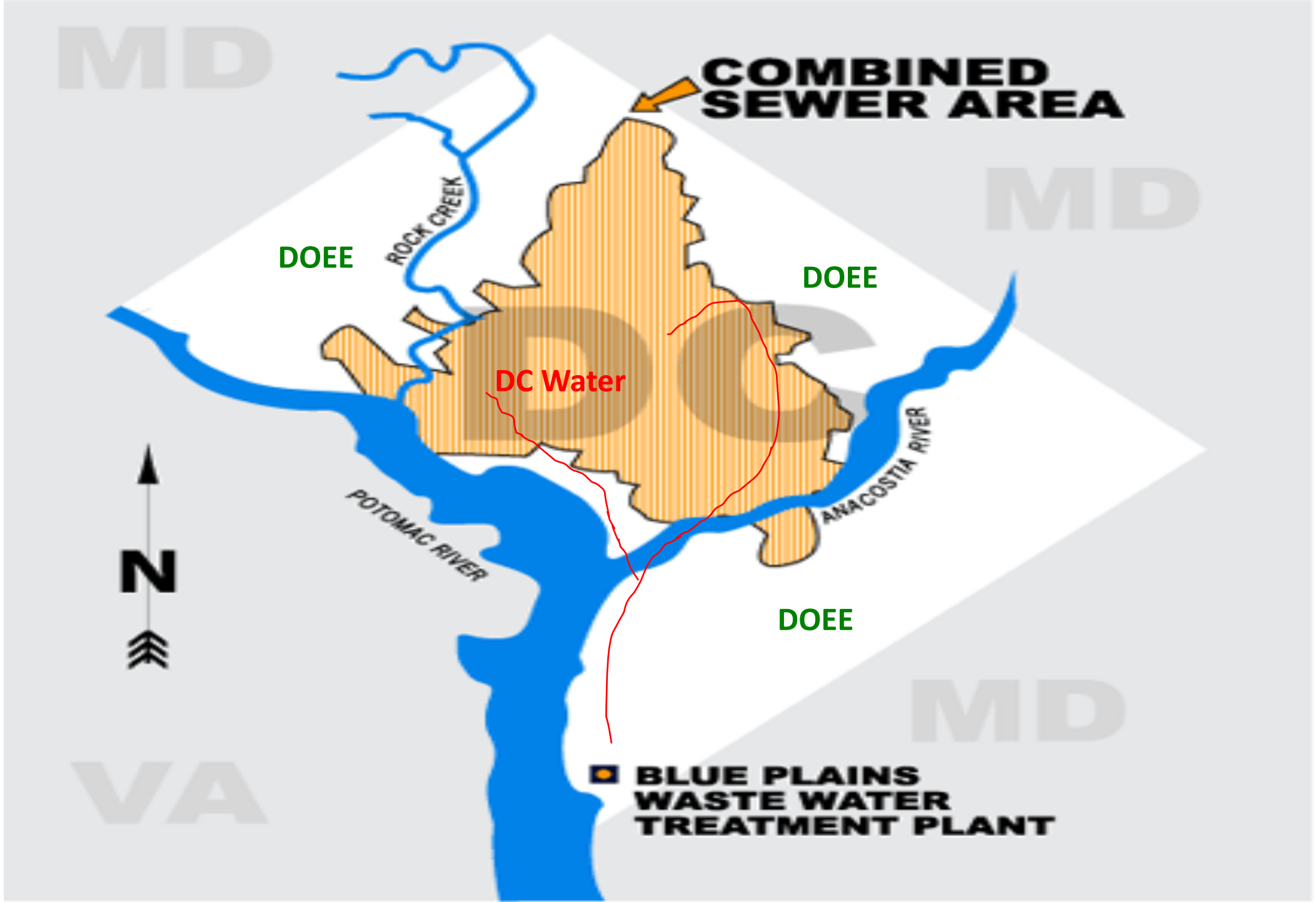

Mt Olivet Cemetery
Gallaudet University
Youth Services Center
Arboretum Recreation Center
Atlas Brew Works
Planet Fitness
MOM's Organic Market
Domino's Pizza
Holiday Inn Express & Suites Washington...
Washington DC Metropolitan Police...
KFC
Fairfield Inn & Su
Washington, DC/
Arbor House Gift S
Mt Olivet Rd NE
Okie St NE
Gallaudet St NE
West Virginia Ave NE
Capitol Ave NE
Kendall St NE
Corcoran St NE
Montello Ave NE
Simms Pl NE
Raum St NE
Meigs Pl NE
Queen St NE
Holbrook Terr NE
Trinidad Ave NE
Orren St NE
Lowman St NE
Switzer Dr NE
Entwood Pkwy NE
9th St NE
16th St NE
17th St NE
15th St NE
Fenwick St NE
Montana Ave NE
24th St NE
T St NE
S St NE
R St NE
Rand Pl NE
Azalea Rd NE
Meadow Rd NE
Eagle Nest Rd NE
50

Commemoration and Conservation

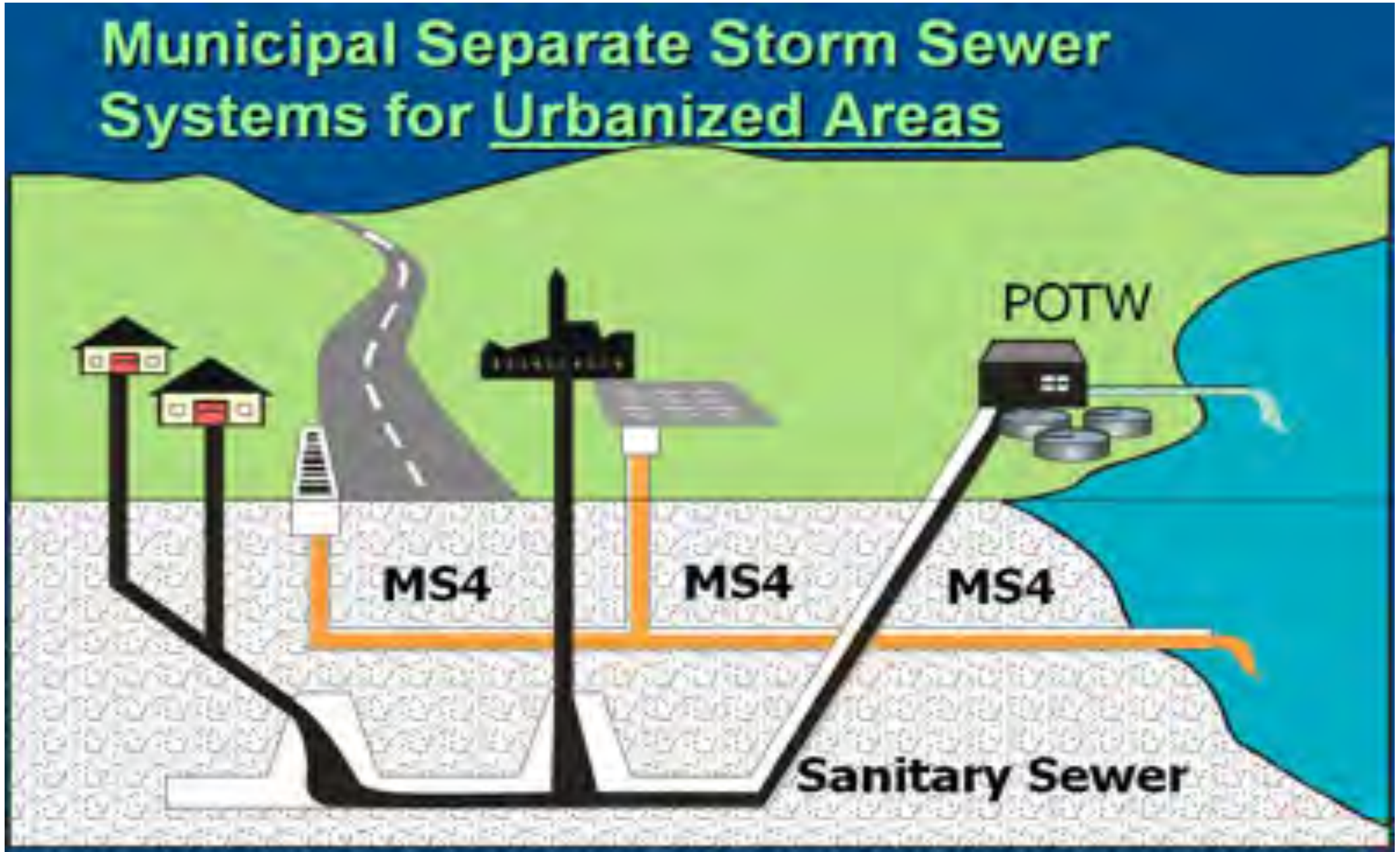


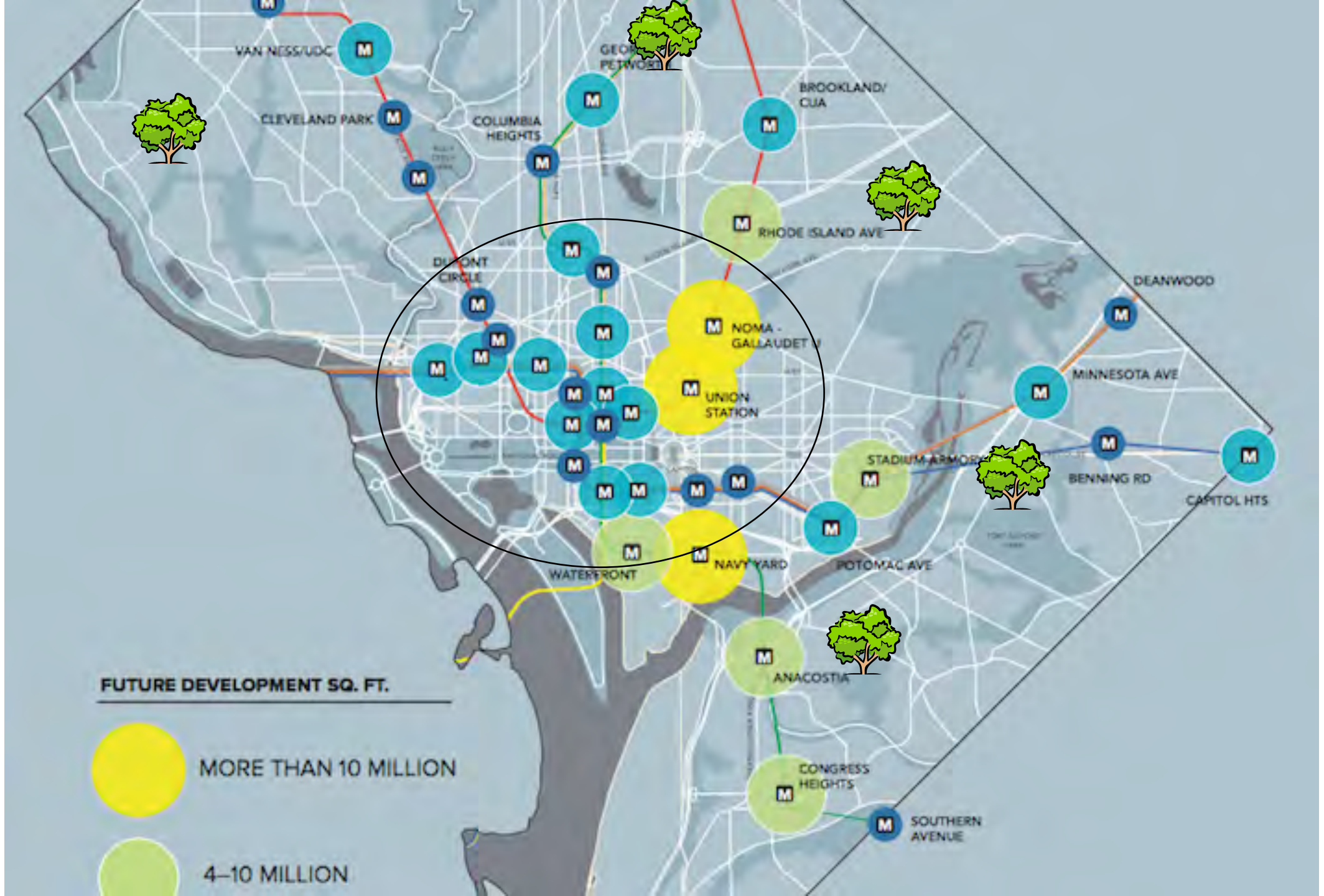

50


Residential Wastewater
Business Wastewater
Wastewater Treatment Facility
COSAN
Roof & Area Drains
Street Storm Drains
Sewer
Rain Water
Flow to Wastewater Treatmet Facility
Treated Water
Combined Sewer Outfall
Combined Sanitary Waste & Storm Water
Weir Wall Overflow Structure

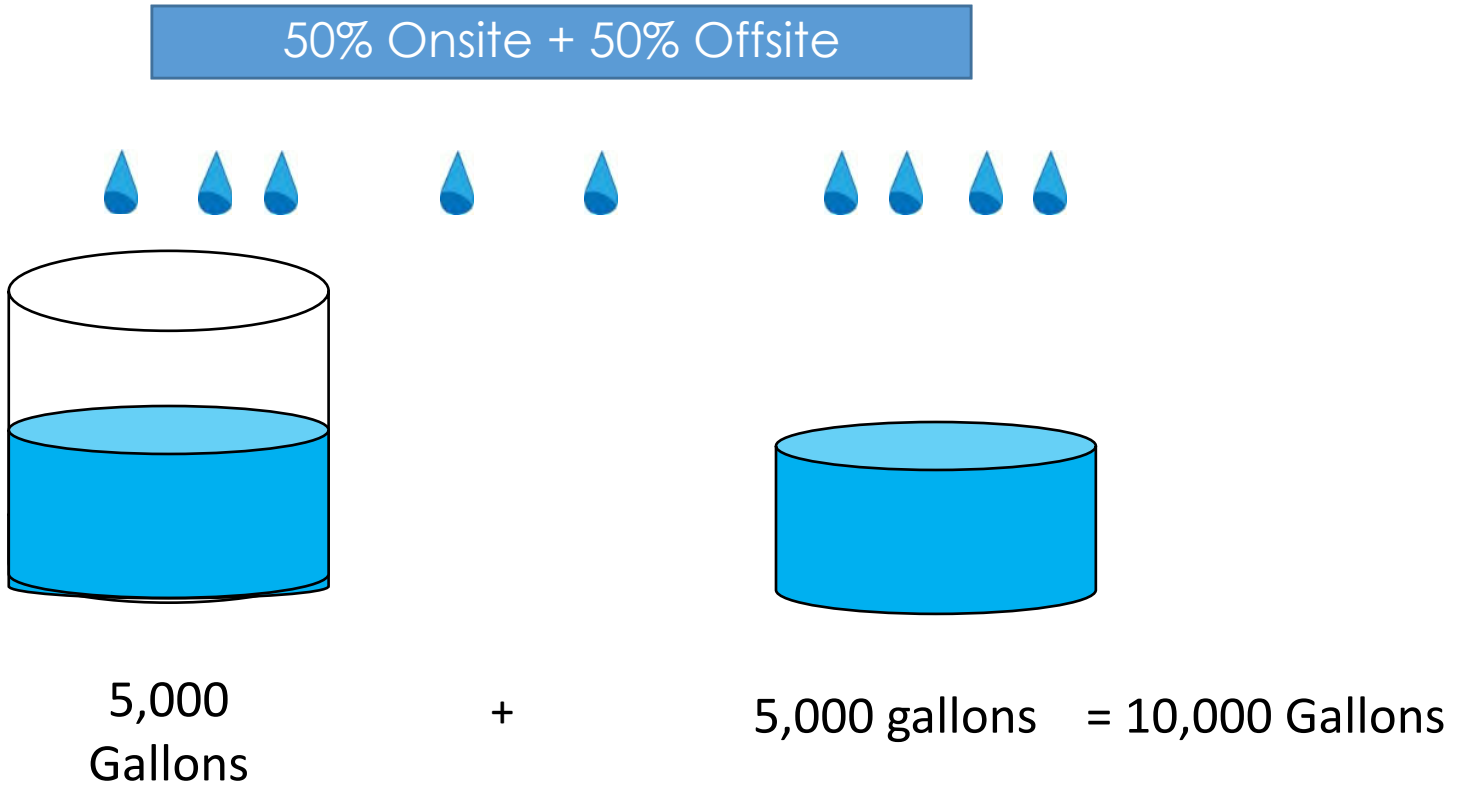

COMBINED SEWER AREA
ROCK CREEK
DOEE
DOEE
DC Water
POTOMAC RIVER
ANACOSTIA RIVER
N
DOEE
BLUE PLAINS WASTE WATER TREATMENT PLANT

MS4


Municipal Separate Storm Sewer
Systems for Urbanized Areas
POTW
MS4
MS4
MS4
Sanitary Sewer

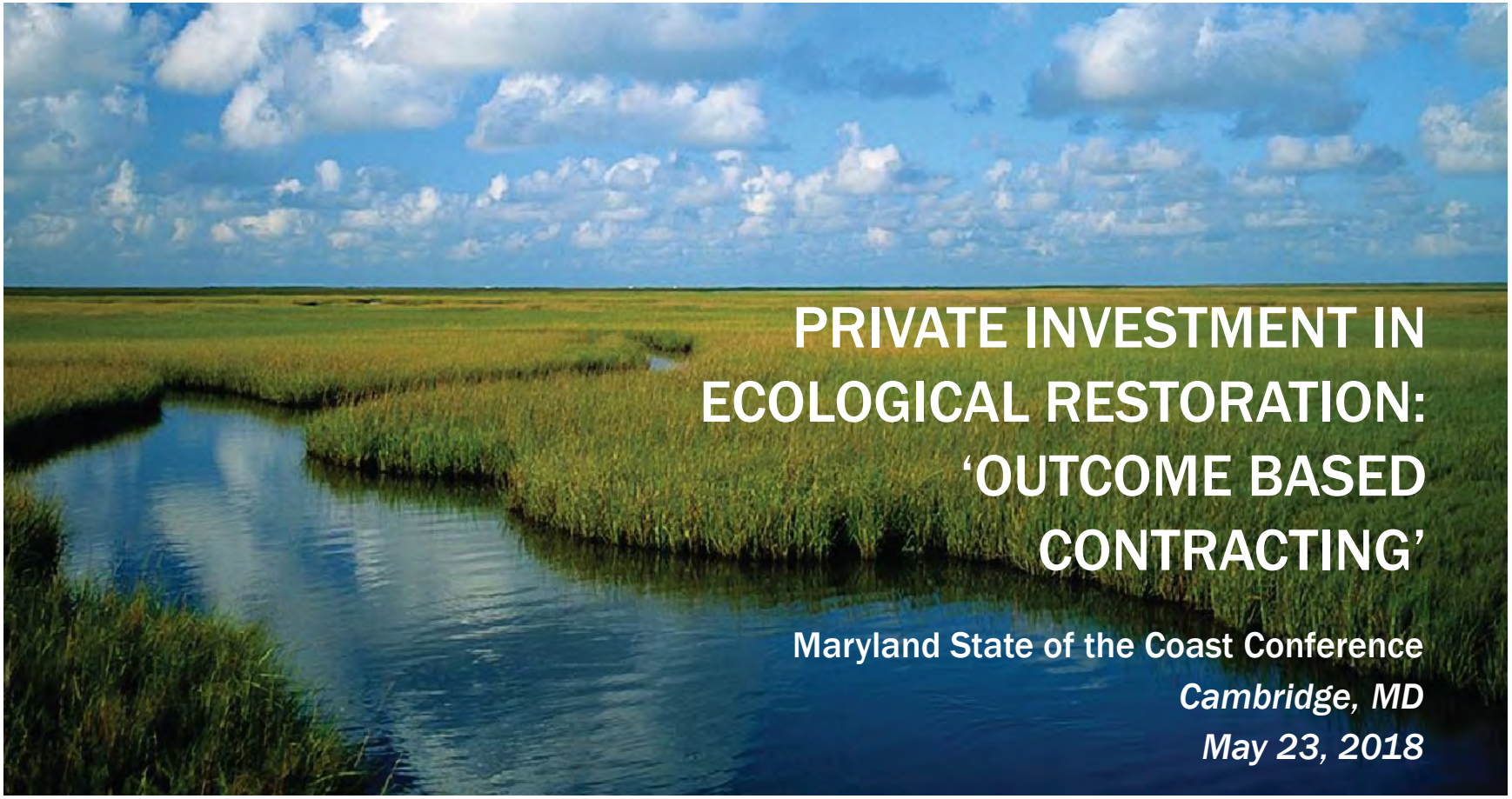

VAN NESS/UDC
CLEVELAND PARK
COLUMBIA HEIGHTS
BROOKLAND/ CUA
RHODE ISLAND AVE
DUPONT CIRCLE
NOMA - GALLAUDET U
UNION STATION
DEANWOOD
MINNESOTA AVE
BENNING RD
CAPITOL HTS
STADIUM ARMORY
WATERFRONT
NAVY YARD
POTOMAC AVE
ANACOSTIA
CONGRESS HEIGHTS
SOUTHERN AVENUE
FUTURE DEVELOPMENT SQ. FT.
MORE THAN 10 MILLION
4–10 MILLION

Impact of 50% Onsite Requirement = More Retention



- 1.2" retention standard reflects 90th percentile storm event
- Offsite retention allows more property to retain lesser storms

Ecosystem Investment Partners



PRIVATE INVESTMENT IN ECOLOGICAL RESTORATION: 'OUTCOME BASED CONTRACTING'

Maryland State of the Coast Conference

Cambridge, MD

May 23, 2018

Ecosystem Investment Partners ("EIP")

Maryland-based Private Equity Fund Manager

- 100% focus on ecological restoration
- Over $500M AUM
- Completed 23 major restoration investments in nine states

Primary Demand from Section 404 of the Clean Water Act

- 20+ year history of market-based compliance solutions
- 1 million acres protected and restored using private capital to achieve measurable, verifiable outcomes

New Opportunities for Investment in Ecological Restoration

- "What we do" is the same
  - Capital + Land + Restoration + Delivery of Measurable Outcomes
- A 'credit' = verifiable 'units' of uplift + permanent protection backed by payment only upon delivery and financial assurances
- Highly applicable to water quality offsets

140+ Miles
of Streams Restored

35,000+ Acres
of Wetlands Restored

80,000+ Acres
Managed

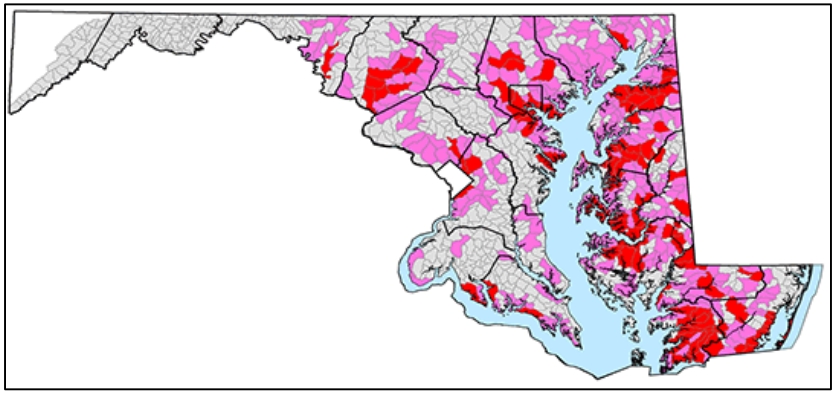
Applying CWA 404 Experience to Regional Restoration Needs

Maryland jurisdictions must offset, nutrient and sediment discharges to the Chesapeake Bay under NPDES permits.

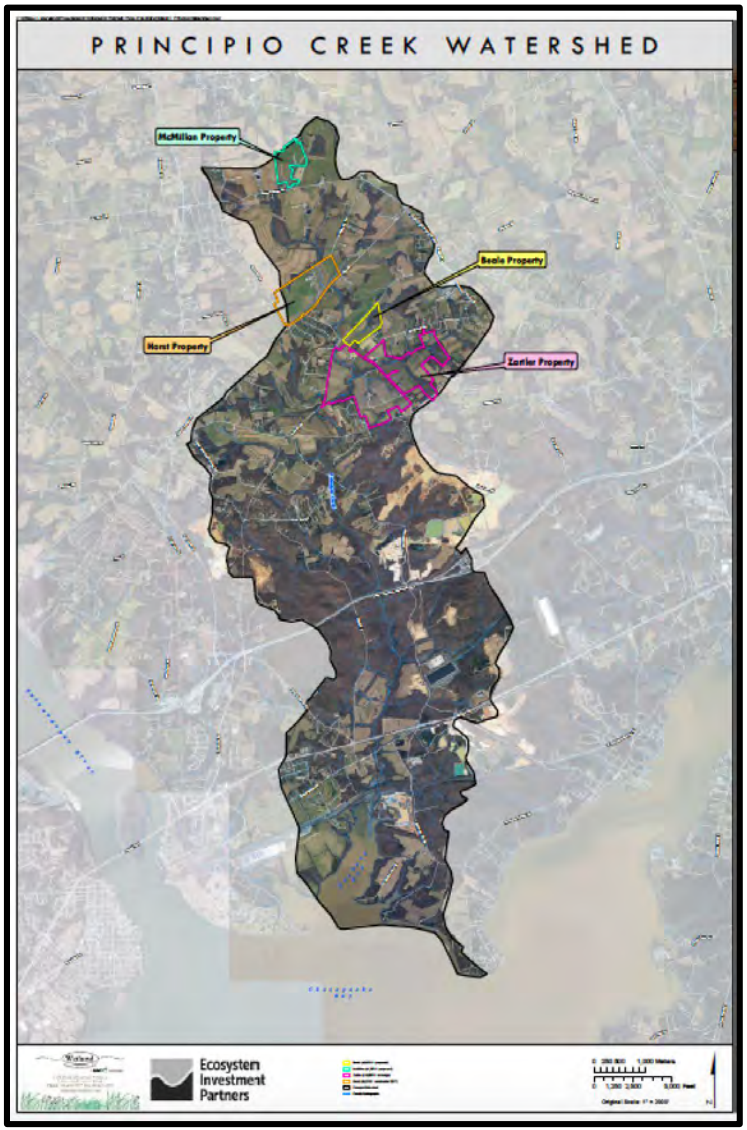
- MD DNR and EIP innovated a 'pay for success' contract under the terms of DNR **Bay Trust Fund** grant program.
- Three contracts are delivering **32,000 linear feet** of stream restoration within the Principio Creek watershed in Cecil County, Maryland.
- Property control, finance, design/engineering and construction are all required **prior to first payment**. Final payments with monitoring and performance over 5 years after construction.
- Payment on a calculated **per pound reduction** for N, P and sediment.

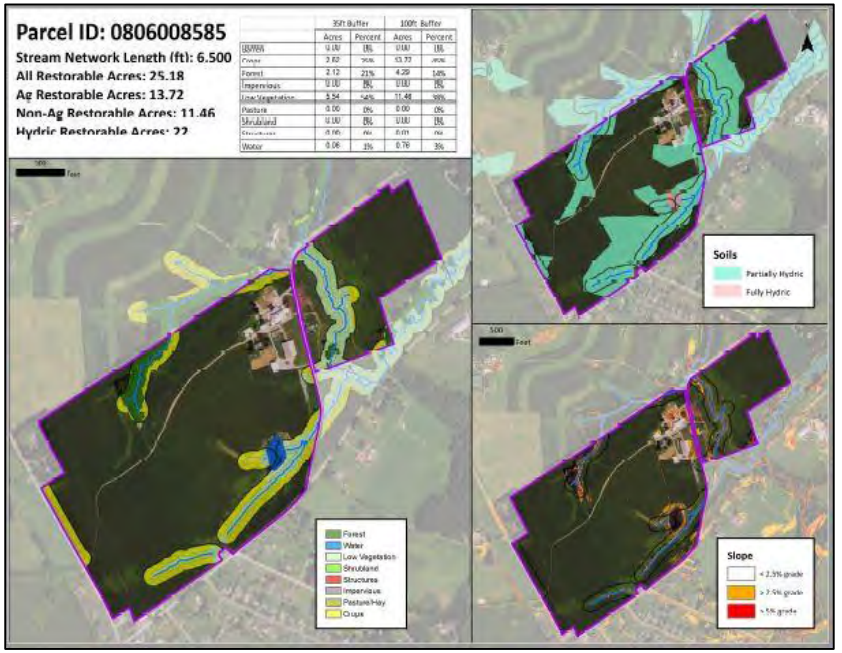
PILOT PROJECT – PRINCIPIO CREEK

- Encouragement from MD DNR's Bay Trust Fund program to find full-delivery, large scale, cost efficient projects in priority watersheds
- EIP worked with the Chesapeake Conservancy and Cecil Land Trust to identify appropriate parcels and willing landowners.
- EIP teamed with Wetland Studies and Solutions, Inc. and Appalachian Stream Restoration for design and construction.



PILOT PROJECT – PRINCIPIO CREEK





Ecosystem Investment Partners

Land Use Change = Legacy sediment and active erosion

Conversion of forested watersheds to fields and farms along with roads and other impervious surface dramatically changes the pace at which water moves.

Floodplain access is lacking, and streambeds are eroding and reconfiguring to adapt to the new, faster, pattern of regular inundation.

This releases 'legacy nutrients' (N, P and TSS) in the soil in addition to the increased loading of sediments.

PILOT PROJECT – PRINCIPIO CREEK

8,200 linear feet of stream restoration completed in 2017.

Total annual reductions of:

- *6,219 lbs. of N*
- *1,850 lbs of P*
- *1,344 tons of TSS*

16,000 linear feet now underway
Total annual reductions of:

- 15,133 lbs of N
- 580 lbs. of P
- 823 tons of TSS

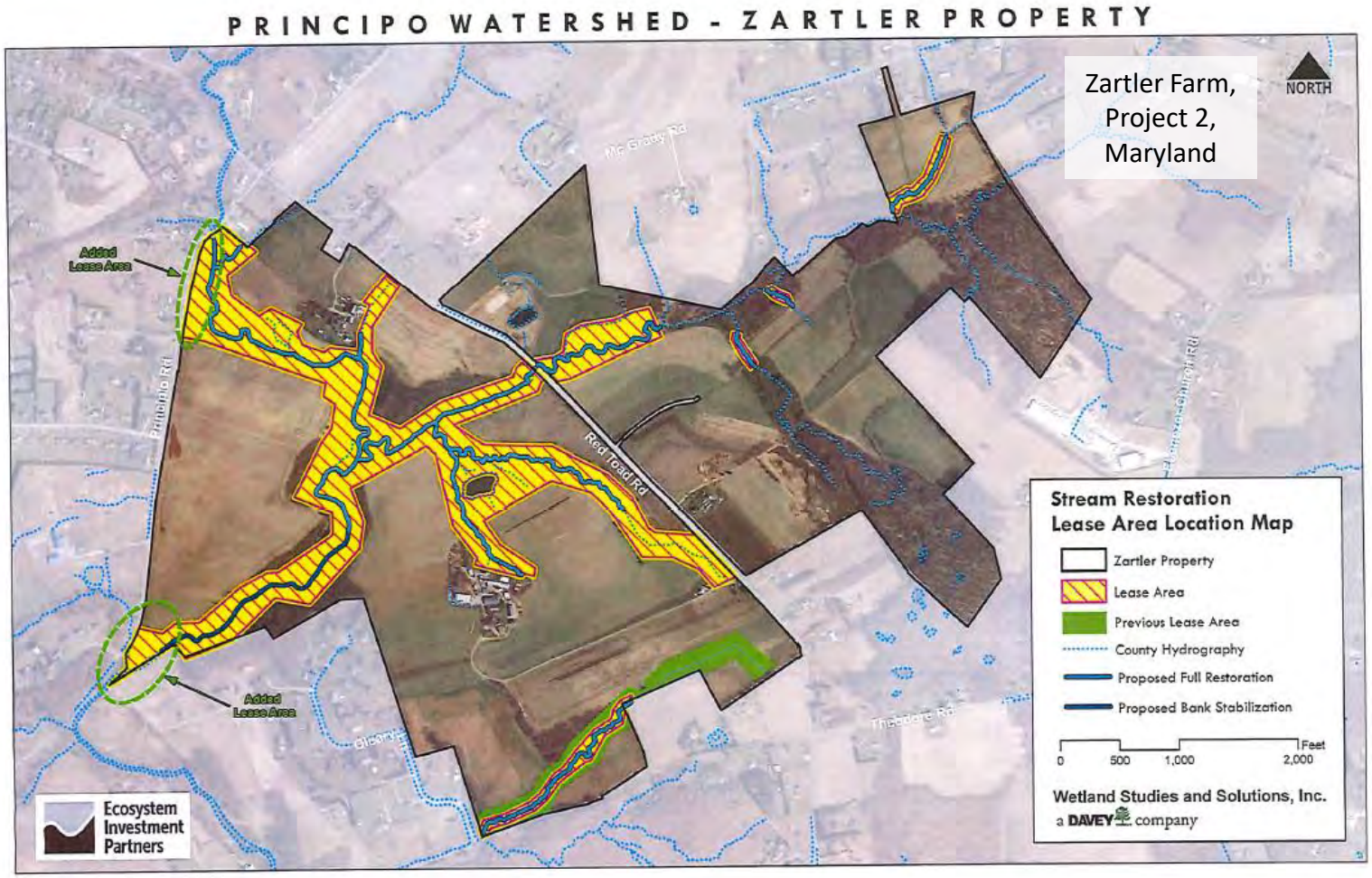
Riparian buffer plantings, floodplain access and cattle exclusion fencing as needed.

Restoration results in a more natural pattern, profile and dimension to streambeds.

PILOT PROJECT – PRINCIPIO CREEK

~16,000 Feet of Stream Restoration & Water Quality Improvement

Annual reductions: 15,000 lbs Nitrogen | ~580 lbs Phosphorous | 823 tons Sediment

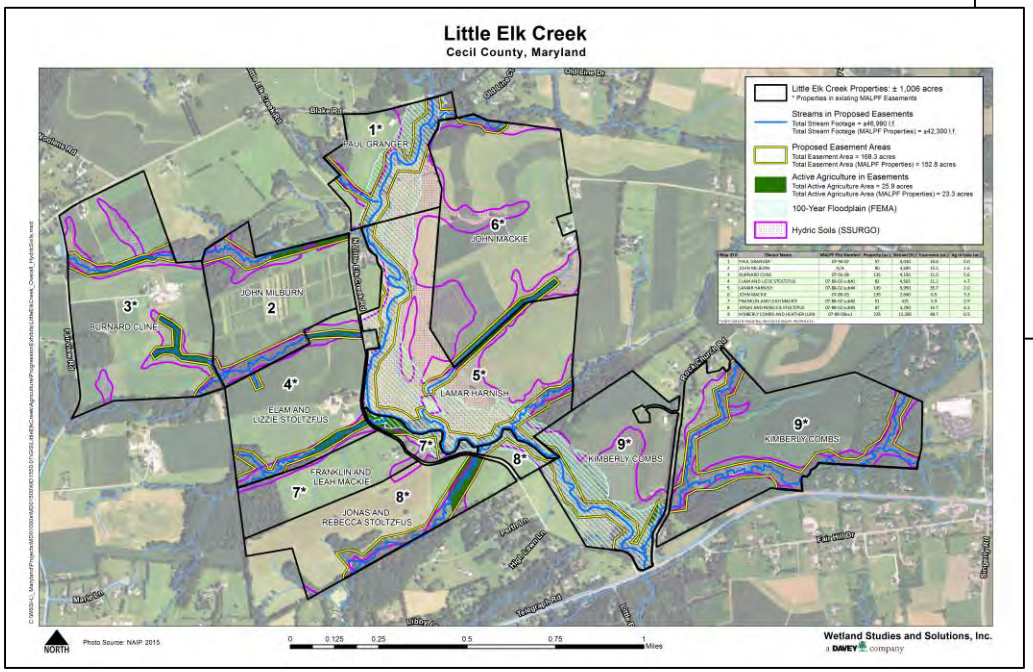


OPPORTUNITY GROWING

Maryland Water Quality – State Highway Authority Projects

EIP has contracted to provide the State of Maryland's DOT an additional **51,000+ linear feet** of stream restoration under a 'performance based contract'.

Payments occur based on milestones that signify successful outcomes and fully delivered restoration



MARYLAND

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

REQUEST FOR PROPOSALS (RFP)

SOLICITATION NO. XX1655182

Issue Date: June 9, 2017

FULL DELIVERY STREAM RESTORATION SERVICES

Anne Arundel, Baltimore, Carroll, Cecil, Charles, Frederick, Harford, Howard, Montgomery, Prince George's & Washington Counties

SUMMARY

Implications for Resilience

Experience based on providing outsourced compliance for 'no net loss' provisions of the Clean Water Act:

- 20+ year history of market-based compliance solutions
- 1+ million acres protected and restored using private capital on private land
- Competitive pricing: innovation and economies of scale

Move beyond planning!!

- Focused capital resources with professional management allow engagement of institutional investors
- Risk transfer from public sector to private sector
- Division of labor
  - Public sector sets goals and standards
  - Private sector provides efficient implementation

Questions or Follow-up:

Contact:

Ecosystem Investment Partners
Nick Dilks

nick@ecosystempartners.com

443-921-9441

Main office:
5550 Newbury St., Suite B
Baltimore, MD 21209

Funding and Partnerships in Restoration

"Partnering with Nature and Landowners to Drive Ecological Restoration Outcomes"

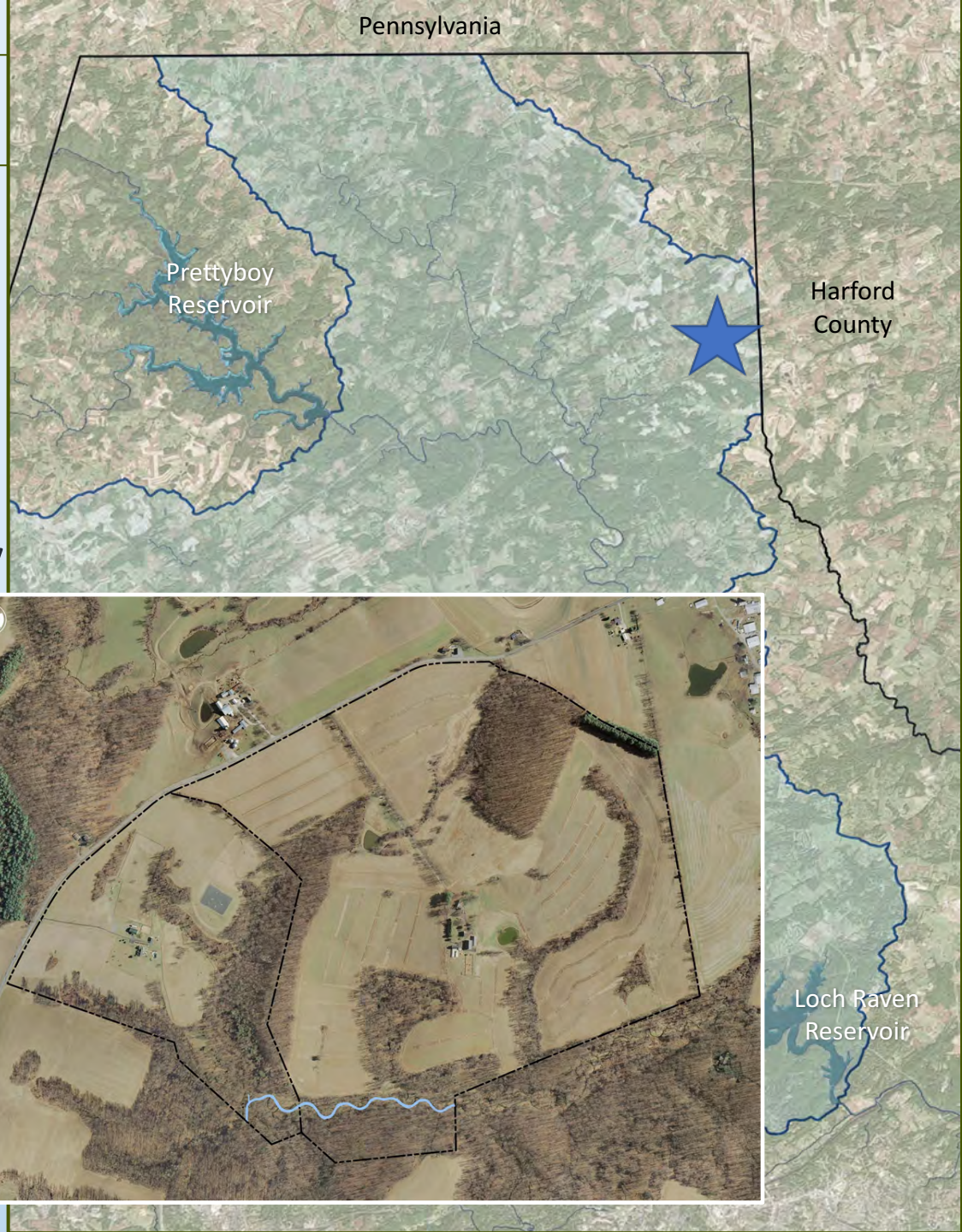
Scott McGill
smcgill@ecotoneinc.com

Takeaways

- Partnering with nature to restore nature
- Ecological restoration as a driver for landowner financial returns
- Dividends of ecosystem services
- Time and your project's net present value

First Mine Branch

- 1.3 Square Mile Drainage Area
- Loch Raven Watershed
- Northern Baltimore County
- Use III
- 2,400 linear feet stream restoration/3-5 acres wetland restoration



Existing Conditions

ecotone
ecological restoration

FIRST MINE STREAM RESTORATION

DESIGN SUSTAINABILITY REVIEW CHECKLIST

Mandatory Sustainability and Constructability Review at 60% design

INITIAL SITE INVENTORY

- ✓ Rock/Gravel source – Wide variety of gravel size/plenty to salvage d84 ≈ 30 mm
  - Are soil borings necessary/beneficial? Yes would be beneficial
- ✓ Wetland peat layer
  - Beneficial to plot profile? potential wetlands present to be delineated
- ✓ Wetland sod/upland sod sources – quantify – majority of site is completely wooded/source of upland sod
- ✓ Sod grow areas – quantify – large adjacent fields/discussion with the landowner
- ✓ Live stake source – quantify ≈120 trees (via tree survey)surrounded by trees to be used as potential live stake source
- ✓ Root wads/logs – quantify ≈120 trees (via tree survey) in construction area/adequate amount of quality tress
- ✓ Inventory summary spreadsheet completed

DESIGN CONSIDERATIONS

- ✓ Utilize inventory spreadsheet to maximize use of on-site materials
- ✓ Vegetation/wood vs. Rock – a lot of wood
  - Maximize use of vegetation/wood and keep submerged
  - If using Rock, justify – No rock to be used as main structures
- ✓ Are there opportunities to recycle/reuse materials? Yes-trees can be used for structures and adequate riffle material
- ✓ Sun vs. shade, aspect – consider for bioengineering plan Is currently forested/and will still have some tree cover
- ✓ Furnished materials available locally - Majority of material can be salvaged on site
- ✓ Reduce Transport Costs
  - Haul Off Reduced by using on-site materials and spoils areas -little/no haul off abundance of on-site material
  - Haul On Reduced by balancing cut/fill -adjacent fields for balance

CONSTRUCTABILITY CONSIDERATIONS

- ✓ Stockpiles
  - Short Dirt - Are locations of spoils areas adequate Yes-large adjacent fields, discuss with landowner if there is anywhere else they may want soil
  - Is the stockpile area large enough for construction needs Yes
- ✓ Is the LOD adequate for efficient construction Yes no restrictions
- ✓ Does the design allow for creativity/flexibility during construction Yes no restrictions
- ✓ Reviewed by Director of Construction at 60% design

FOR PLANS

- ✓ Description of project in 20 years – function, appearance, sediment transport condition (aggrading/degrading)
- ✓ Materials list with salvaged and furnished materials – completed at 90%, need additional construction review
- ✓ Local sources of material identified on plans with contact information – hopefully not required, hopeful to use all materials from on-site

What's on Site?

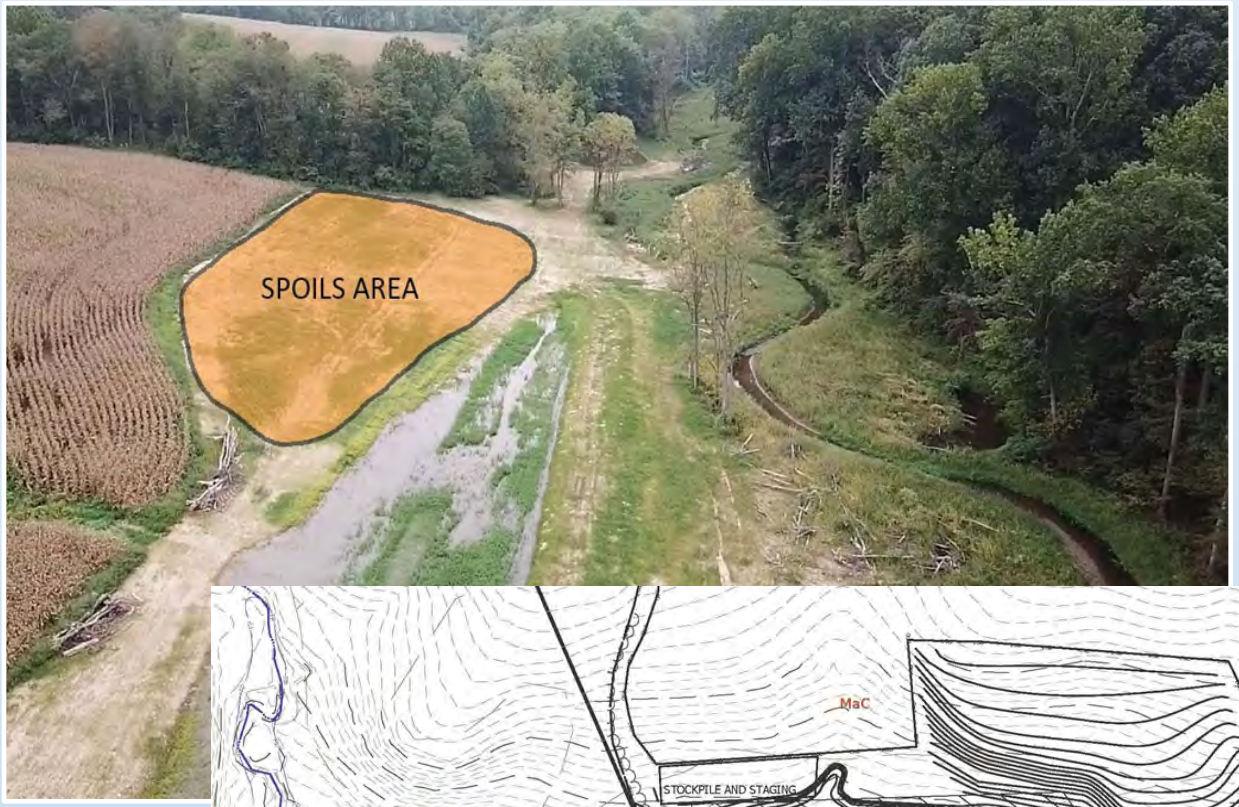
Design Approach


CAT
EX04
CAT
315D

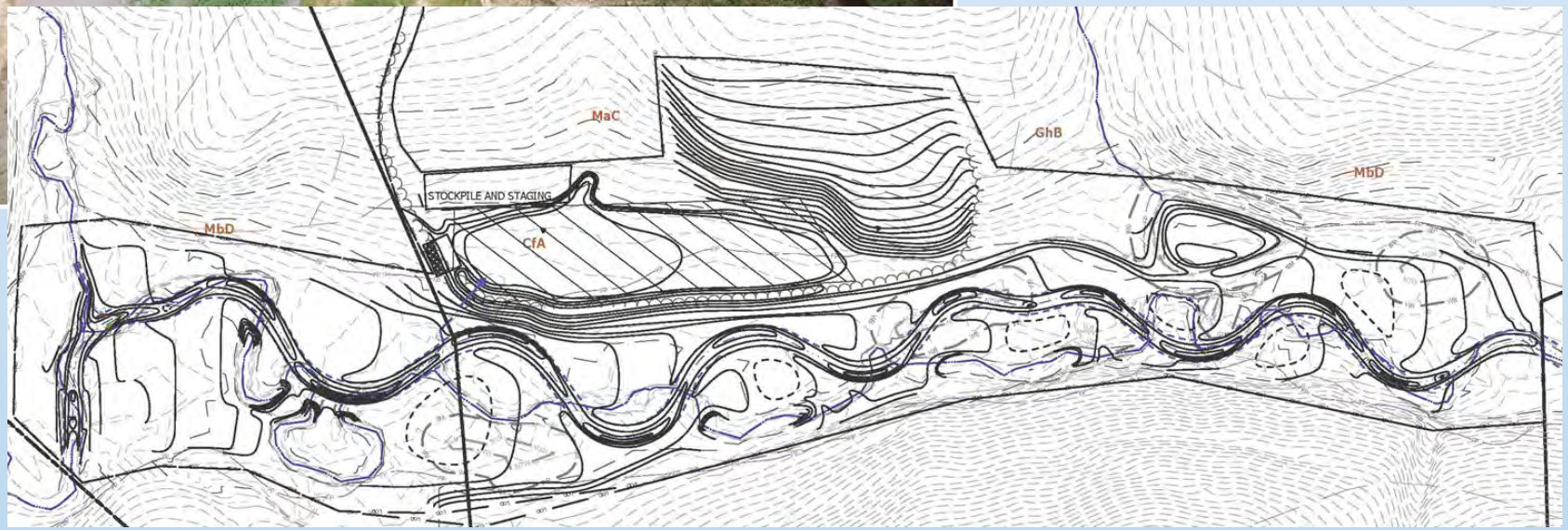

Legacy Sediment
Peat Layer
Cobble Layer


Peat

Spoil



Cut: 8,475
Fill: 2,647
Net: 5,827 (CUT)



Direct Cost comparison, 1.0 square mile drainage area, design/build:

***Ecotone certified* sustainable:**	**$146/foot**
Traditional Engineered Approach:	**$494/foot**

Cost savings/foot: $348
70% savings cost of goods

Ecological restoration can add to farm bottom line!

- 2 acre marginally wet hayfield
- 150 bales/acre/year
  - $1500/acre/year
- 2 acre wildlife wetland lease: $5,000/year (cost shared thru Soil Conservation District)

"The beaver has a major image problem. A chubby rodent with goofy buckteeth and a tail that looks like it was run over by a tractor tire - its no wonder beavers prefer to work under the cover of darkness."

Frances Backhouse, *Once They Were Hats*

Born to manage wood in streams

"Claiborne's elaborate preparations and largescale operation brought in ***7488 pounds of beaver pelts*** *(worth £4493 at 12 s./lb.)...in the s****ix years before Kent Island's takeover by Maryland in 1638"***

"Claiborne's timing was perfect, for in 1629 the English had captured Quebec in a war with France, and beaver fever spread throughout the London merchant community after the Canada Company ***brought home some three hundred thousand pounds of pelts in 1630.****"*

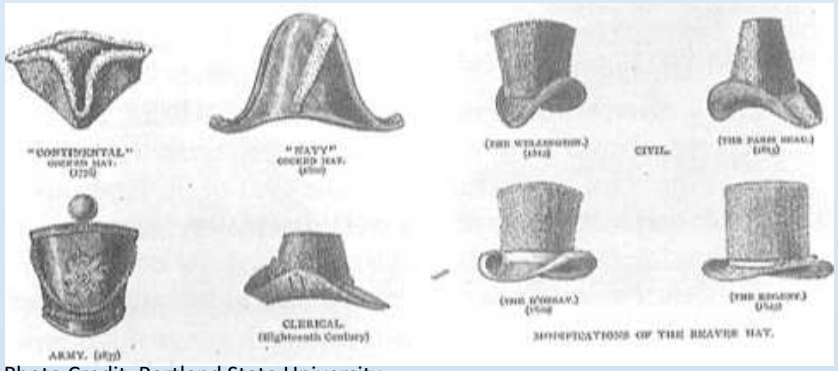


Photo Credit: Portland State University


Photo Credits: Canadian Museum of History

Fredrick J. Fausz, "Present at the Creation"

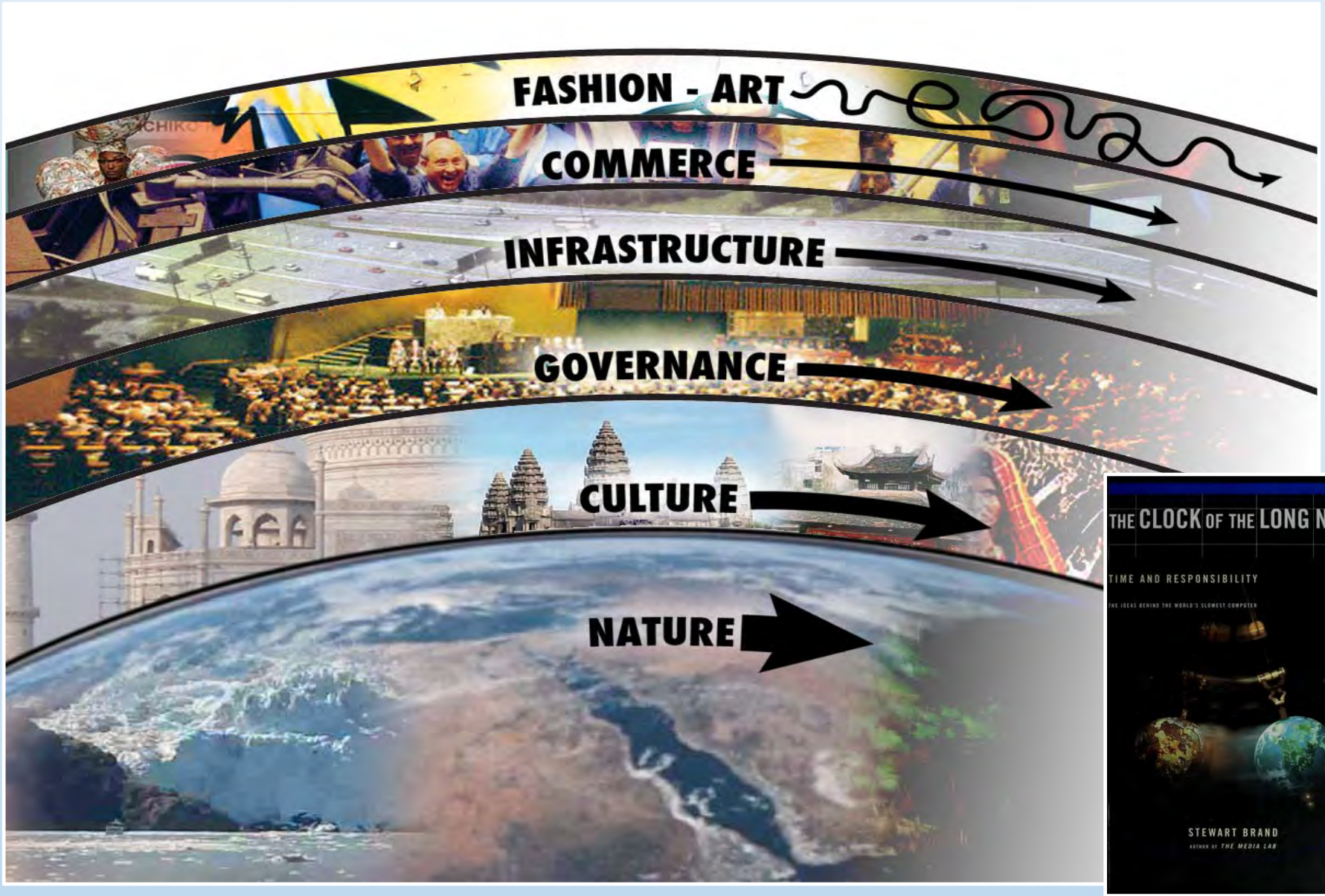
*"****In 1643-44 also, over 5700 pounds of beaver pelts were mentioned in debt cases****, at a time when one pound was worth between 12s. and 24s., or from 36 to 144 pounds of tobacco."*

"On more than one occasion, ***colonists found themselves so deeply in debt for beaver pelts*** *that they mortgaged, or had to put up as security, a large portion of their property"*

Bridge Creek, Oregon

- 10 year study
- Beaver dam analogs
- NOAA funding
  - Objective is to improve salmonid habitat

TMDL/MS4 – Economic/Commerce
Ecological Restoration – NATURE



Ecological Restoration is a Process, not an EVENT

15 years

7. Gilberts Addition – Surveyed 8 Mar. 1716 for Jarvis Gilbert, and granted to for 500 acres. Beginning at three W.O. ... at the head of a little swamp on the N. side of the N.W. branch of Swan Creek "and right halfe a mile to "ye Eastward of the said Jarvis's plantation"; and –

9. South, 90 " to the end of a small Island in a marsh,

1. E. S.E., 150 per to a R.O. by a small procession,

the Cattail Marsh,

swamp near Rumney River,

22. West, 2½ " to a W.O. by a swamp side

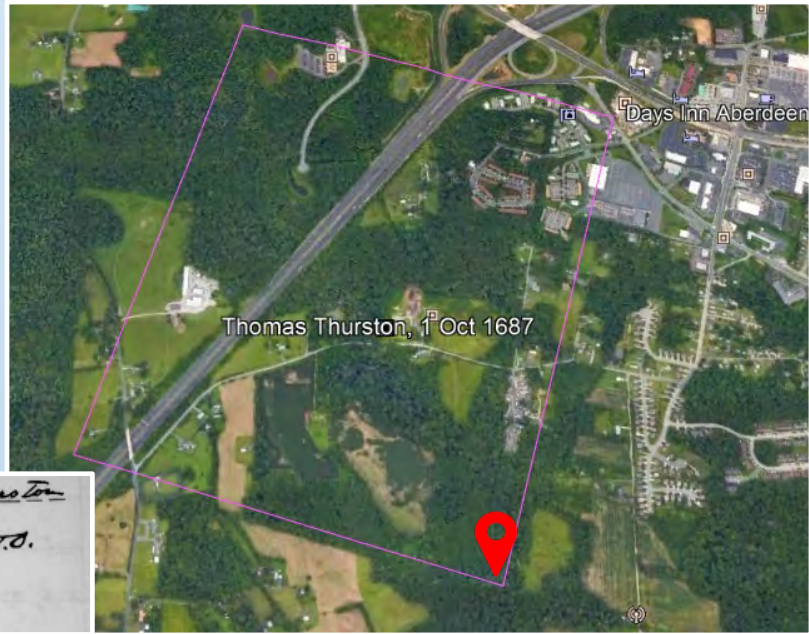
said Creek, near a small marsh,

ning point of the swamps or going under water,

West, 128 per. to a W.O. by a swamp side the Reg. thereof,

Beginning at a ... Sweet Gum ... by a great swamp or poccoson ...

26. Timber Swamp – Surv. 15 Dec. 1738 for John Taylor



1. The Agreement – Surv. gr. 10 Oct. 1687 to Thomas Thurston for 500 acres. Beginning at a bounded W.O. .. by a Poccoson and running thence

Net present value?

Ecological return on investment?

ecotone
ecological restoration

THINK LIKE A MOUNTAIN

Scott McGill
smcgill@ecotoneinc.com

Maryland
Department of the Environment

Chesapeake Bay Restoration: Maryland's Planning Process

2018 State of the Coast Conference

May 23, 2018

Gregorio Sandi
MDE Integrated Water Planning Program

CHANGING Maryland for the Better

Outline

- Chesapeake Bay WIP development
- 2017 Mid-Point Assessment and successes
- Phase III WIP development process
- Schedule

Chesapeake Bay WIP Development

2010 Chesapeake Bay TMDL established

General plan with strategies to meet at least 60% by 2017

Phase I WIP

2010 — 2025

More detailed strategies, extensive local engagement, local plans

Phase II WIP

2012 — **2017** — 2025

Detailed plan with local goals to meet 100% by 2025

Phase III WIP

2019 — **2025**

Why revise the Plan Now?

- 2017 Mid Point Assessment: Evaluation of Progress
- Updated Decision Tools
  - New Model
  - New Data Sources
  - New Objectives
  - New Challenges
- Draft targets for 2025 revised

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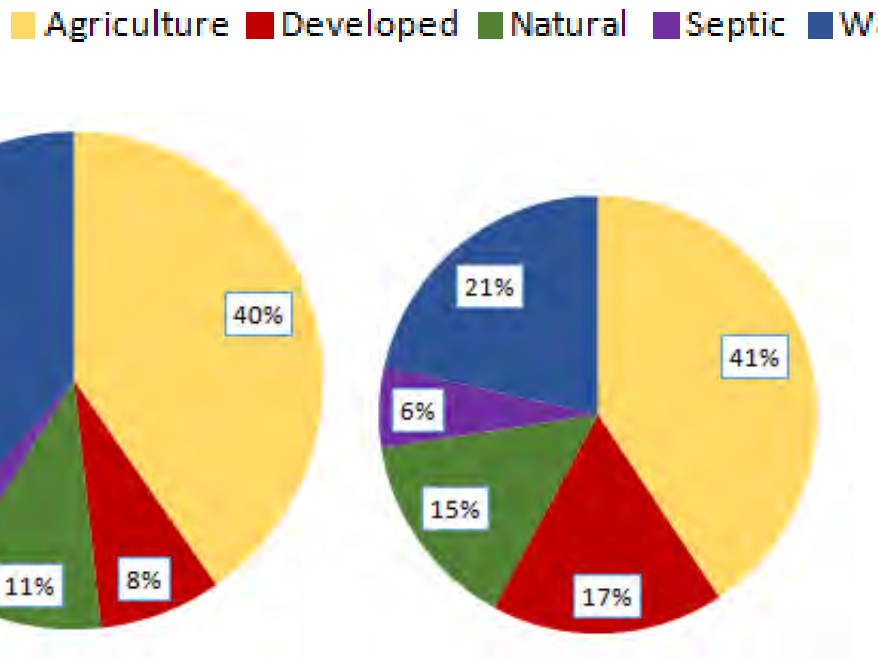
Department of
the Environment

2017 MID-POINT ASSESSMENT AND SUCCESSES

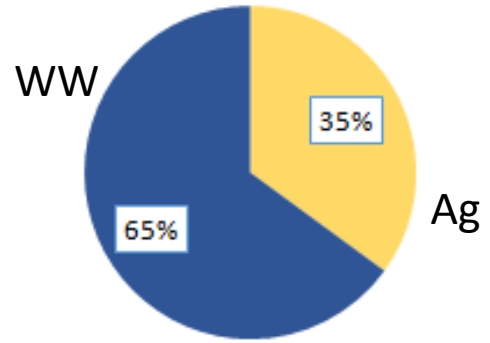
Maryland Nitrogen (Mid Point Assessment)



1985
83.6 M lbs

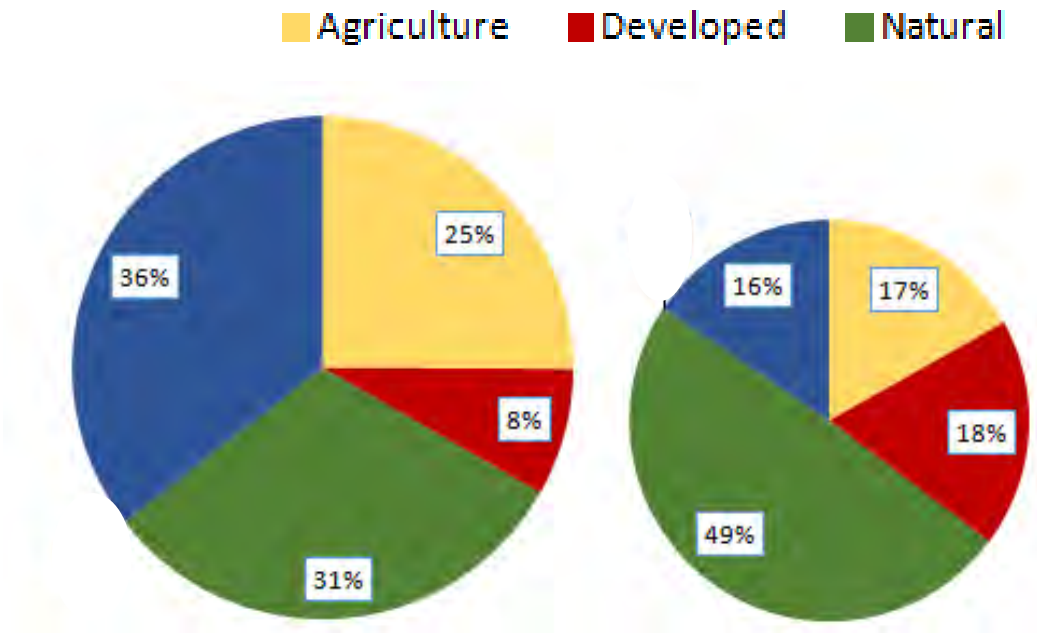
2017
56.0 M lbs

Where did the greatest reductions come from?



Results are based on loads estimated by the Phase 5.3.2 Chesapeake Bay Model

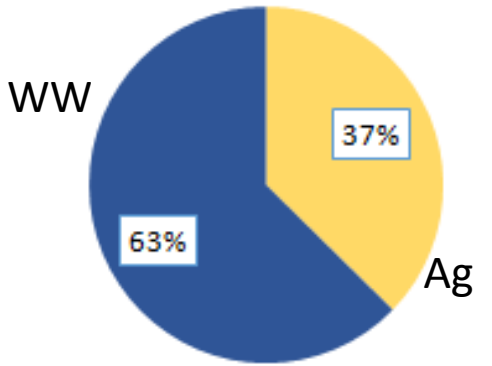
Maryland Phosphorus (Mid Point Assessment)



1985
7.42 M lbs

2017
3.79 M lbs

Where did the greatest reductions come from?



Results are based on loads estimated by the Phase 5.3.2 Chesapeake Bay Model

Achievements

Wastewater & Septic

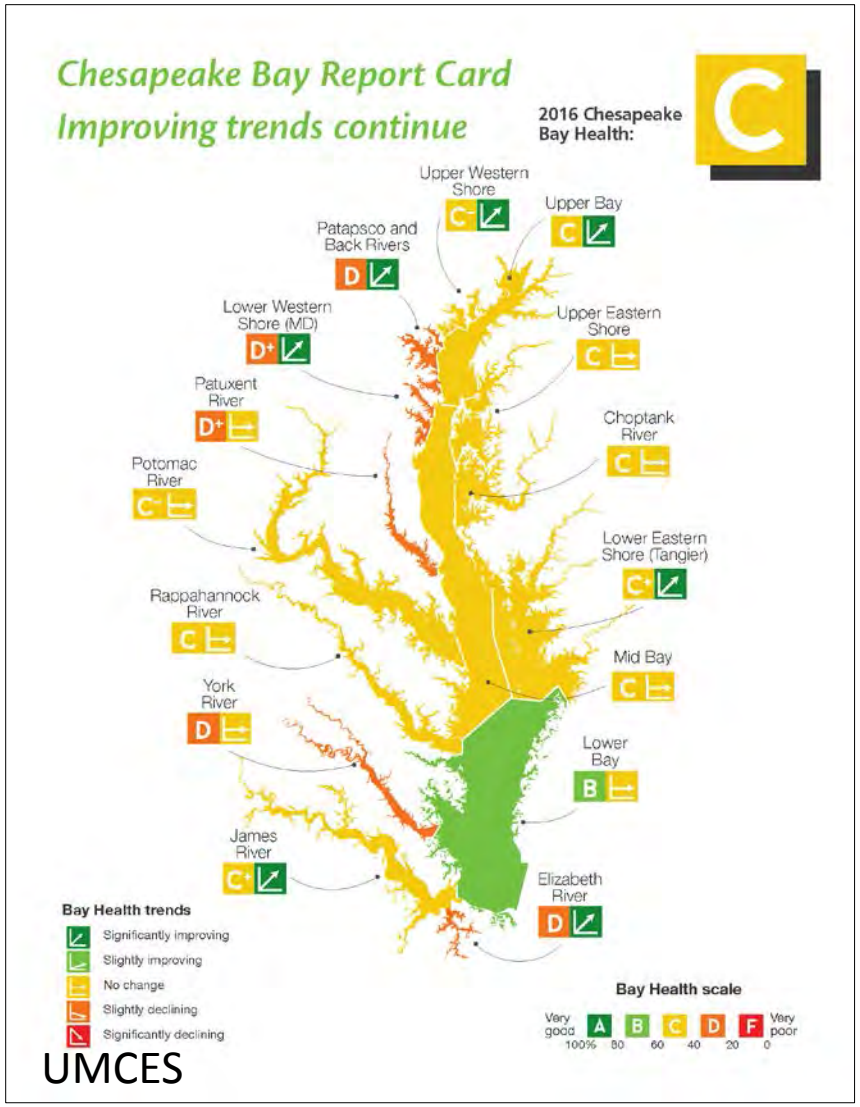
- Dedicated Fund
- 67 Majors to ENR
- Economies of Scale
- O & M Grants
- Shifting to Minors
- Septic Upgrades & Connections

Urban Stormwater

- MS4 Phase I permit revised
  - Financial Assurance Plans
  - Funding ~$300 M
  - P3
  - Nutrient Trading
- New MS4 Phase II permit
- Non-MS4 Assistance

Changes in Aquatic Communities

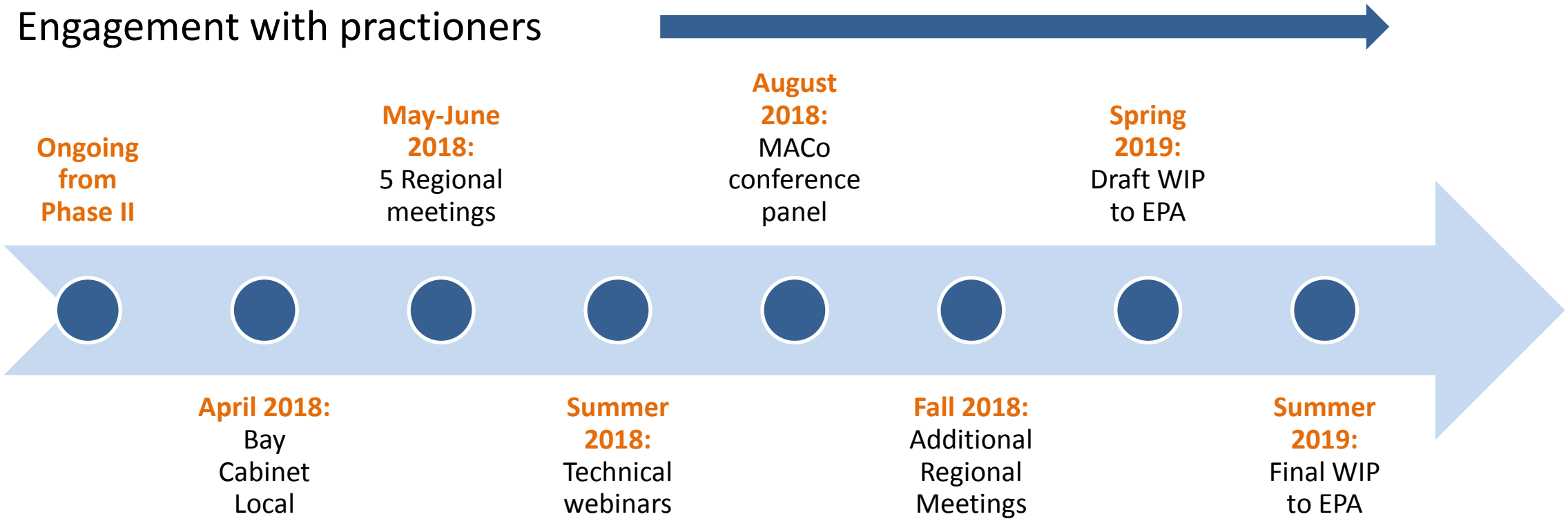
- **Overall health of Bay continues to improve**
  - Increases in the amount of Bay Grasses in tidal waters
  - Shrinking summer dead zones in the Bay
  - Oyster recovery continues at high levels in Maryland



Maryland
Department of
the Environment

REVISING THE PLAN

WIP III Development Schedule



Continuing to Engage by Sector

Stormwater & Septic

- Permit Development
  - Reach out to existing and new permitees
- Meeting with jurisdictions
  - One on one or in regular meetings
- Engaging Local Environmental Health Directors

Wastewater

- Bay Restoration Fund
- Permits
- Review of Water and Sewer Plans

Wastewater … Phase III WIP

- Participating in the Phase III WIP
  - Local WIP Inventory
  - Performance incentives
  - Capital improvements
  - Consider new technologies
- Key Planning Documents
  - Wastewater Permits
  - Bay Restoration Fund Annual Report
  - County Water and Sewer Plans

Septics … Phase III WIP

- Incentivizing Septic BMPs
  - Capital improvements using BRF
  - Credit through permits
- Key Planning Documents
  - NPDES permits
  - County Water and Sewer Plans
  - Septic Stewardship Plans

Stormwater … Phase III WIP

- Local Partner Engagement
  - MS4 Restoration Requirement
  - Non-MS4
- Key Planning Documents for permitted jurisdictions
  - MS4 Restoration Plans
  - MS4 Financial Assurance Plans
- BMPs with benefits (beyond nutrients)

The End?

More to come at our Regional Meetings

https://agresearch.umd.edu/agroecol/educationoutreach

June 5th – Central – Catonsville

June 14th – Lower Eastern Shore - Salisbury

June 15th – Upper Eastern Shore – Easton

June 18th – Southern MD - TBD

CHANGING Maryland *for the Better*

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Photo Credit: Patrick Gillespie