



CHESAPEAKE BAY PROGRAM MID-POINT ASSESSMENT

PSC Decisions December 19-20, 2017 Retreat

1. Adoption of the Phase 6 Suite of Modeling Tools

Phase 6.0 Model: What's Changed, Why, and Implications

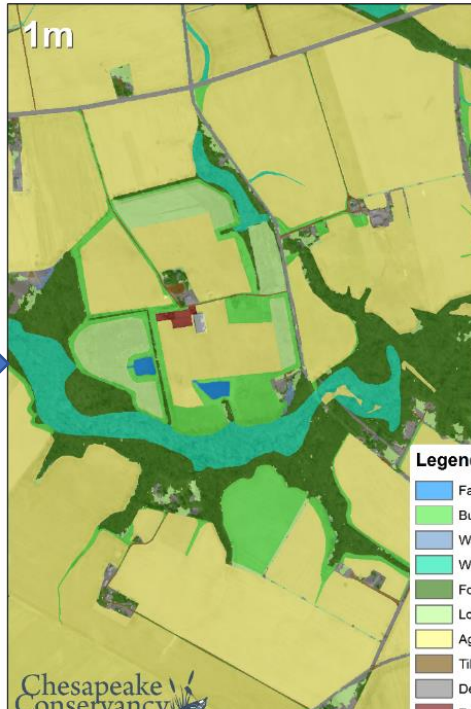
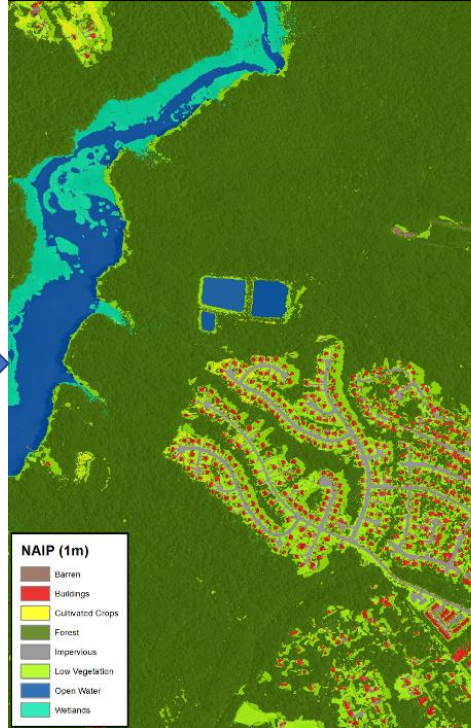
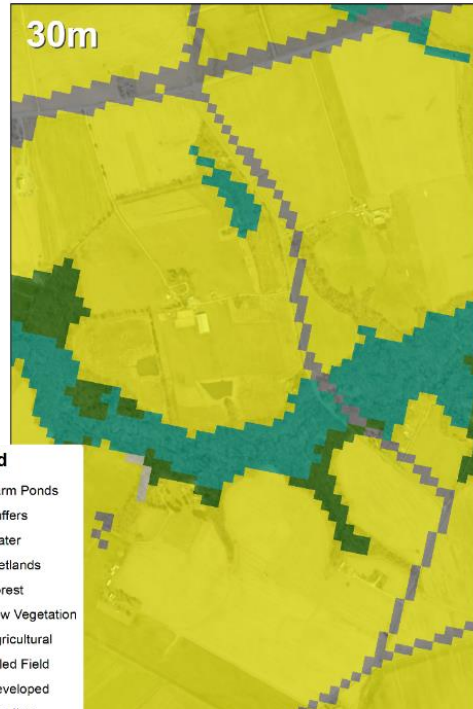
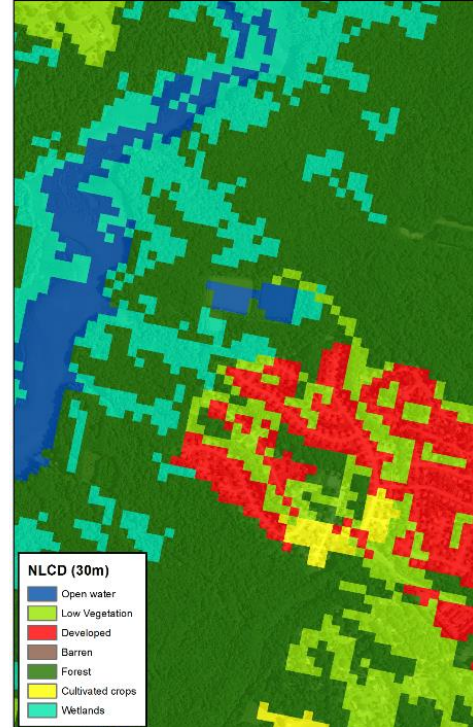
A lot has changed since 2010 and our Phase I and Phase II WIPs

- Much improved modeling and other decision support tools
- High resolution land cover data for entire watershed
- Hundreds more BMPs available for crediting
- Significant data gathered from local agricultural and municipality partners incorporated into our models and other decision support tools

Hundreds More BMPs

Advanced Grey Infrastructure Nutrient Discovery Program	Dry Waste Storage Structure RI	Headwater Wetland Gains - Reestablished	Nutrient Management P Placement	Stream Restoration Urban	Waste Treatment - Dairy	Cover Crop Traditional - FED	Cover Crop Traditional - NutRND
Ag Shoreline Management	Dry Well	Headwater Wetland Restoration	Nutrient Management P Rate	Streambank and Shoreline Protection	Waste Treatment - Horse	Cover Crop Traditional - FEO	Cover Crop Traditional - NutRNO
Ag Shoreline Non-Vegetated	Erosion & Sediment Control	High Residue Tillage Management	Nutrient Management P Timing	Streambank Restoration	Waste Treatment - Layer	Cover Crop Traditional - FFEA	Cover Crop Traditional - NutTED
Ag Shoreline Vegetated	Erosion and Sediment Control Level 1	Horse Pasture Management	Pasture and Hay Planting	Streambank Stabilization	Waste Treatment - Other Cattle	Cover Crop Traditional - FPED	Cover Crop Traditional - NutTEO
Alternative Crop/Switchgrass RI	Erosion and Sediment Control Level 2	Hydrodynamic Structures	Permanent wildlife habitat, non-easement	Street Cleaning Practice 1	Waste Treatment - Poultry	Cover Crop Traditional - FPEO	Cover Crop Traditional - NutTLD
Alternative Crops	Erosion and Sediment Control Level 3	IFAS	Permeable Pavement - NoSVNoUDAB	Street Cleaning Practice 2	Waste Treatment - Pullet	Cover Crop Traditional - FPND	Cover Crop Traditional - NutTLO
Alternative Water System	Establishment of permanent introduced grasses and legumes	IFAS Elevated Mound	Permeable Pavement - NoSVUDAB	Street Cleaning Practice 3	Waste Treatment - Swine	Cover Crop Traditional - FPNO	Cover Crop Traditional - NutTND
Amendments for the Treatment of Agricultural Waste	Exclusion Fence with Forest Buffer	IFAS Shallow Pressure	Permeable Pavement - NoSVUDCD	Street Cleaning Practice 4	Waste Treatment - Turkey	Cover Crop Traditional - LEA	Cover Crop Traditional - NutTNO
Animal Compost Structure RI	Exclusion Fence with Forest Buffer RI	IMF	Permeable Pavement - SVNoUDAB	Street Cleaning Practice 5	Waste Treatment Lagoon	Cover Crop Traditional - LED	Cover Crop Traditional - NutWED
Animal Mortality Facility	Exclusion Fence with Grass Buffer	IMF Elevated Mound	Permeable Pavement - SVUDAB	Street Cleaning Practice 6	Wastewater Treatment Strip	Cover Crop Traditional - LEO	Cover Crop Traditional - NutWEO
Animal Trails and Walkways	Exclusion Fence with Grass Buffer RI	IMF Shallow Pressure	Permeable Pavement - SVUDCD	Street Cleaning Practice 7	Water Control Structure	Cover Crop Traditional - LGHEA	Cover Crop Traditional - NutWLD
Animal Waste Management Systems (All Types)	Exclusion Fence with Narrow Forest Buffer	Impervious Disconnection	Prescribed Grazing	Street Cleaning Practice 8	Water Control Structure RI	Cover Crop Traditional - LGHED	Cover Crop Traditional - NutWLO
Barnyard Clean Water Diversion RI	Exclusion Fence with Narrow Forest Buffer RI	Infiltration Basin	Proprietary Ex Situ	Street Cleaning Practice 9	Watering Facility	Cover Crop Traditional - LGHEO	Cover Crop Traditional - NutWND
Barnyard Runoff Controls	Exclusion Fence with Narrow Grass Buffer	Infiltration Practices	Proprietary Ex Situ Elevated Mound	Street Cleaning Practice 10	Watering Trough RI	Cover Crop Traditional - LGHND	Cover Crop Traditional - NutWNO
Biofiltration	Exclusion Fence with Narrow Grass Buffer RI	Infiltration Trench	Proprietary Ex Situ Shallow Pressure	Street Cleaning Practice 11	Wet Extended Detention	Cover Crop Traditional - LGHNO	Cover Crop Traditional - OHEA
Bioretention - A/B soils, no underdrain	Extension of CREP Watering System	Land Reclamation, Abandoned Mined Land	Rain Garden	Street Sweeping	Wet Pond	Cover Crop Traditional - LGLEA	Cover Crop Traditional - OHED
Bioretention - C/D soils, underdrain	Feed Management	Land Retirement to Mixed Open	Reduced Tillage	Structure for Water Control	Wet Ponds & Wetlands	Cover Crop Traditional - LGLED	Cover Crop Traditional - OHEO
Bioswale	Field Border	Land Retirement to Pasture	Reduction of Impervious Surface	Surface Sand Filter	Wet Swale	Cover Crop Traditional - LGLEO	Cover Crop Traditional - OHND
Channel Bed Stabilization	Filter Strip	Loading Lot Management System	Reforestation of Erodible Crop and Pastureland	Tidal Algal Flow -way	Wetland Creation	Cover Crop Traditional - LGLND	Cover Crop Traditional - OHNO
Cisterns & Rain Barrels	Filtering Practices	Manure Incorporation High Disturbance	Regenerative Stormwater Conveyance	Tree Planting	Wetland Functional Gains - Enhanced	Cover Crop Traditional - LGLNO	Cover Crop Traditional - OKEA
Composter Facilities	Filtration	Manure Incorporation High Disturbance Immediate	Retirement of Highly Erodible Land	Tree/Shrub Establishment	Wetland Gains - Established	Cover Crop Traditional - LND	Cover Crop Traditional - OKED
Conservation Cover	Floating Treatment Wetland 1	Manure Incorporation High Disturbance Late	Retrofit Runoff Reduction	Underground Infiltration System	Wetland Gains - Reestablished	Cover Crop Traditional - LNO	Cover Crop Traditional - OKEO
Conservation Plans	Floating Treatment Wetland 2	Manure Incorporation Low Disturbance	Retrofit Stormwater Treatment	Urban Filter Strip Runoff Reduction	Wetland Rehabilitation	Cover Crop Traditional - NutARED	Cover Crop Traditional - REA
Conservation Tillage	Floating Treatment Wetland 3	Manure Incorporation Low Disturbance Immediate	Ridge Tillage	Urban Filter Strip Stormwater Treatment	Wetland Restoration	Cover Crop Traditional - NutAREO	Cover Crop Traditional - RED
Constructed Wetland	Floating Treatment Wetland 4	Manure Incorporation Low Disturbance Late	Riparian Forest Buffer	Urban Forest Buffer	Windbreak/Shelterbelt Establishment	Cover Crop Traditional - NutARND	Cover Crop Traditional - REO
Constructed Wetland Elevated Mound	Floating Treatment Wetland 5	Manure Injection	Riparian Herbaceous Cover	Urban Forest Planting	Woodland Buffer Filter Area	Cover Crop Traditional - NutARNO	Cover Crop Traditional - RLD
Constructed Wetland Septic	Forest Buffer on Watercourse RI	Manure Transport	RMF	Urban Infiltration Practices	Commodity Cover Crop - Early	Cover Crop Traditional - NutBED	Cover Crop Traditional - RLO
Constructed Wetland Shallow Pressure	Forest Buffers	Monitored Non-Tidal Algal Flow -way	RMF Elevated Mound	Urban Nutrient Management Plan	Commodity Cover Crop - Standard	Cover Crop Traditional - NutBEO	Cover Crop Traditional - RND
Conversion to Hayland RI	Forest Conservation	Monitored Tidal Algal Flow -way	RMF Shallow Pressure	Urban Nutrient Management Plan - MDCA	Cover Crops	Cover Crop Traditional - NutBND	Cover Crop Traditional - RNO
Conversion to Pasture RI	Forest Harvesting Practices	Mulch Tillage	Roof runoff management	Urban Nutrient Management Plan - MDDIY	CoverCropComLate	Cover Crop Traditional - NutBNO	Cover Crop Traditional - TEA
CREP Riparian Forest Buffer	Forest Nutrient Exclusion Area on Watercourse Narrow RI	Narrow Forest Buffers	Roof Runoff Structure	Urban Nutrient Management Plan - PlanHR	Cover Crop Traditional - AREA	Cover Crop Traditional - NutBRED	Cover Crop Traditional - TED
CREP Wetland Restoration	Forest Stand Improvement	Narrow Urban Forest Buffer	Rotational Grazing RI	Urban Nutrient Management Plan - PlanLR	Cover Crop Traditional - ARED	Cover Crop Traditional - NutBREO	Cover Crop Traditional - TEO
CREP Wildlife Habitat	Grass Buffer on Watercourse RI	New Runoff Reduction	SCWQP	Urban Shoreline Management	Cover Crop Traditional - AREO	Cover Crop Traditional - NutFPED	Cover Crop Traditional - TLD
Critical Area Planting	Grass Buffer Strip	New Stormwater Treatment	Septic Connections	Urban Shoreline Non-Vegetated	Cover Crop Traditional - ARND	Cover Crop Traditional - NutFPEO	Cover Crop Traditional - TLO
D&G Road - E&S Control and Outlets	Grass Buffers	No Tillage	Septic Denitrification	Urban Shoreline Vegetated	Cover Crop Traditional - ARNO	Cover Crop Traditional - NutFPND	Cover Crop Traditional - TND
D&G Road - Outlets Only	Grass Filter Strips	Non-Tidal Algal Flow -way	Septic Effluent Elevated Mound	Urban stream restoration	Cover Crop Traditional - BEA	Cover Crop Traditional - NutFPNO	Cover Crop Traditional - TNO
D&G Road - Surface Aggregate and Raised Roadbed	Grass Nutrient Exclusion Area on Watercourse Narrow RI	NSF 40	Septic Effluent Shallow Pressure	Vegetated Open Channels	Cover Crop Traditional - BED	Cover Crop Traditional - NutOHED	Cover Crop Traditional - WEA
Dead Bird Composting Facility	Grassed Waterway	NSF 40 Elevated Mound	Septic Tank Advanced Treatment	Vegetated Treatment Area	Cover Crop Traditional - BEO	Cover Crop Traditional - NutOHEO	Cover Crop Traditional - WED
Default - Bioretention - A/B soils, underdrain	Grazing Land Protection	NSF 40 Shallow Pressure	Septic Tank Pumpout	Waste Control Facilities	Cover Crop Traditional - BND	Cover Crop Traditional - NutOHND	Cover Crop Traditional - WEO
Disconnection of Rooftop Runoff	Green Roofs	Nutrient Management Core N	Solid/Liquid Waste Separation Facility	Waste Storage Facility	Cover Crop Traditional - BNO	Cover Crop Traditional - NutOHNO	Cover Crop Traditional - WLD
Dry Detention Ponds	Hardwood tree planting	Nutrient Management Core P	Storm Drain Cleaning	Waste Storage Pond	Cover Crop Traditional - BREA	Cover Crop Traditional - NutRED	Cover Crop Traditional - WLO
Dry Detention Ponds & Hydrodynamic Structures	Headwater CREP Wetland Restoration	Nutrient Management N Placement	Stream Channel Stabilization	Waste Storage Structure	Cover Crop Traditional - BREO	Cover Crop Traditional - NutREO	Cover Crop Traditional - VND
Dry Extended Detention Ponds	Headwater Wetland Creation	Nutrient Management N Rate	Stream Improvement for Fish Habitat	Waste Treatment - Beef	Cover Crop Traditional - BREO	Cover Crop Traditional - NutRLD	Cover Crop Traditional - WNO
Dry Swale	Headwater Wetland Gains - Established	Nutrient Management N Timing	Stream Restoration Ag	Waste Treatment - Broiler	Cover Crop Traditional - FEA	Cover Crop Traditional - NutRLO	

Phase 5 30-Meter Resolution Land Use/Land Cover Data



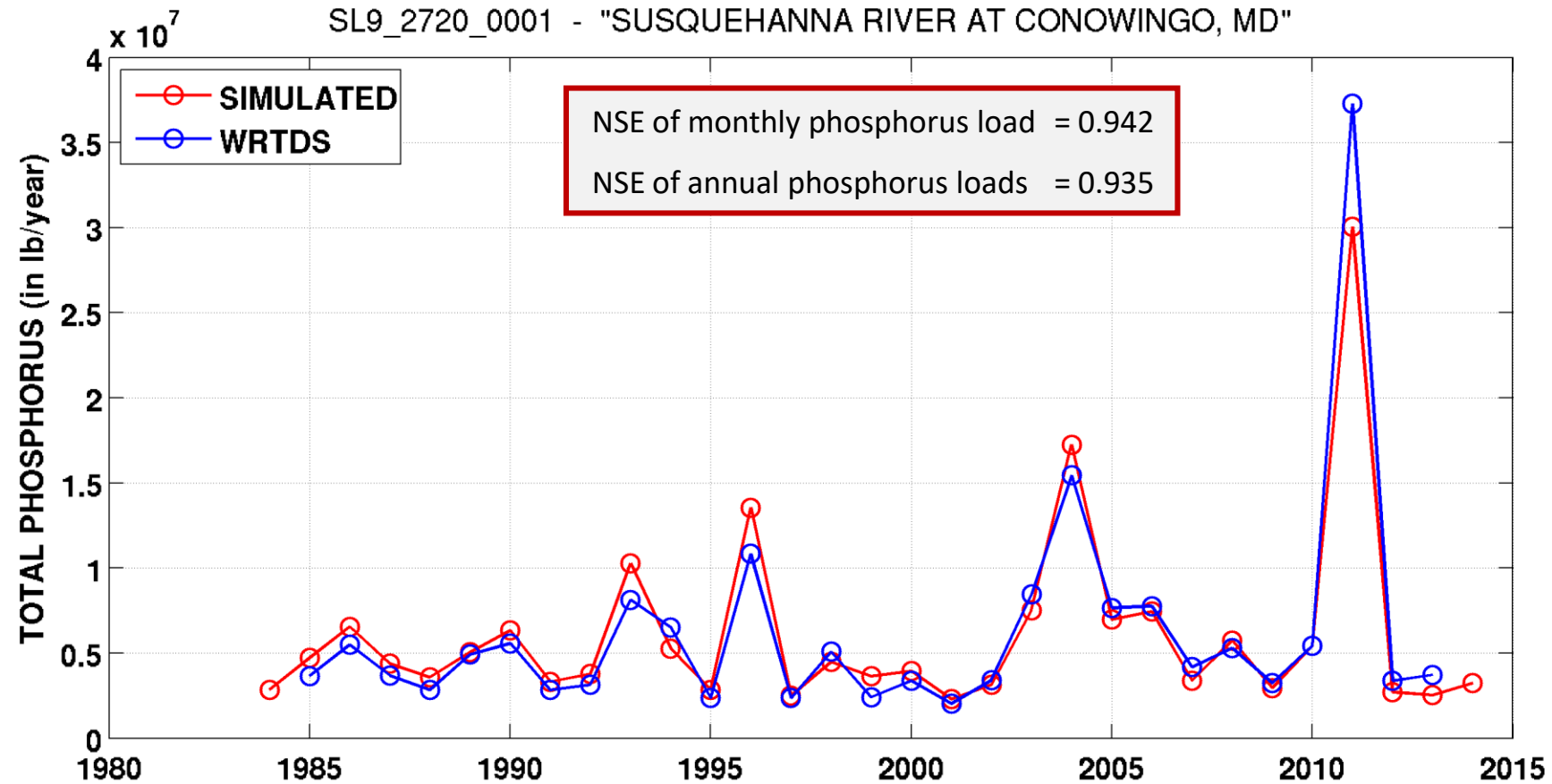
Phase 6 1-Meter Resolution Land Use/Land Cover Data

Local Agricultural and Municipality Data

- Municipal Separate Storm Sewer Systems
- Combined Sewer Systems
- Sewer Service Areas
- Land Cover
- Land Use
- Parcels
- Roads
- Beaches
- Institutional lands
- Federal lands
- Golf courses
- Surface mines
- Landfills
- Protected lands
- Streams
- Wetlands
- Tidal zones
- Floodplains
- Frequently flooded soils
- Livestock populations
- Poultry populations
- Crop, hay and pasture acreages
- Crop yields
- Soil P concentrations
- BMPs

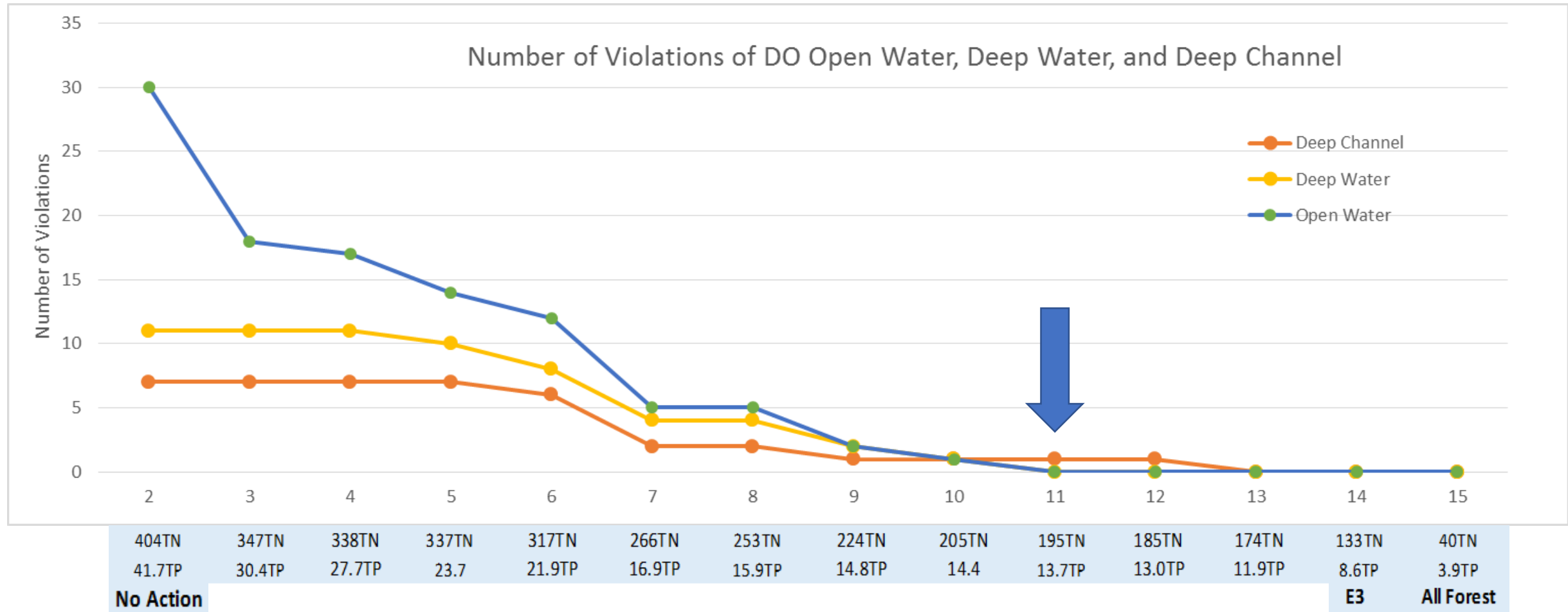
Best Match with Monitoring Data Ever!

Conowingo Phase 6 Simulation Compared to Annual WRTDS Loads



2. Assimilative Capacity & Phase III Planning Targets

Here's Where We Want to Get to



Draft Phase III Planning Targets*: Nitrogen

Jurisdiction	1985 Baseline	2013 Progress	Phase III Planning Target
NY	18.71	15.44	11.59
PA	122.41	99.28	73.18
MD	83.56	55.89	45.30
WV	8.73	8.06	8.35
DC	6.48	1.75	2.43
DE	6.97	6.59	4.59
VA	84.29	61.53	55.82
Basinwide	331.15	248.54	201.25

Units: millions of pounds

*Draft planning targets are subject to change as a result of the Partnership's review period to be completed in May 2018

Draft Phase III Planning Targets*: Phosphorus

Jurisdiction	1985 Baseline	2013 Progress	Phase III Planning Target
NY	1.198	0.710	0.606
PA	6.115	3.696	3.073
MD	7.419	3.919	3.604
WV	0.793	0.560	0.456
DC	0.090	0.062	0.130
DE	0.225	0.115	0.120
VA	13.545	6.345	6.186
Basinwide	29.384	15.408	14.173

Units: millions of pounds

*Draft planning targets are subject to change as a result of the Partnership's review period to be completed in May 2018

Change in Level of Effort Under Draft WIP III Compared to the WIP II Targets

Nitrogen and Phosphorus

	Change in the Level of Effort under the draft WIP III Planning Targets compared to the WIP II Targets ¹ <u>Nitrogen</u> Load Reductions from 2009 to 2025 (in percentage points)	Change in the Level of Effort under the draft WIP III Planning Targets compared to the WIP II Targets ¹ <u>Phosphorus</u> Load Reductions from 2009 to 2025 (in percentage points)
PA	-5%	-6%
MD	0%	-5%
VA ²	-4%	-14%
NY	10%	-1%
WV	13%	1%
DE	8%	-17%
DC	-5%	-11%
Chesapeake Bay Watershed	-3%	-10%

¹ Negative means less level of effort under the draft Phase III WIP Planning Targets compared to the WIP II Planning Targets

² Virginia's draft Phase III Planning Targets for Nitrogen and Phosphorus do not include the additional load reductions in the James River watershed needed to meet VA's chlorophyll a standard for the tidal James River. Virginia's Phase II Planning Targets do include these additional load reductions in the James.

Managing for Change

Adjusting
Level of Effort to
Address New Loads

- Conowingo
- Climate Change
- Accounting for Growth

3. Conowingo Dam

Estimated Additional Nitrogen Reductions Required Under the Four Options

Jurisdiction	Susquehanna Only	Susquehanna + Effective Basins	Susquehanna + MD and VA	Entire Watershed
NY	0.57	0.50	0.36	0.32
PA	5.31	4.71	3.34	3.31
MD	0.12	0.78	1.97	1.76
WV	0.00	0.00	0.00	0.19
DC	0.00	0.00	0.00	0.00
DE	0.00	0.00	0.00	0.32
VA	0.00	0.14	1.54	1.38
Basinwide	6.01	6.12	7.21	7.28

*Units: millions of pounds

PSC Decision

Geographic Focus (Susquehanna and Effective Basins) with Watershed-Wide Responsibility

Part 1: Develop a separate Implementation Plan with timeline, which is a Partnership collaboration.

- Jurisdictions
- CBC
- EPA
- Exelon

Part 2: Create an approach that pools resources

4. Climate Change

Accounting for Changing Conditions

Cumulative Assessment of Bay Low Dissolved Oxygen Impacts

Watershed Model

increased precipitation volume =



increased precipitation intensity =



increase in temp and evapotranspiration =



WQ Sediment Transport Model

increased watershed loads =



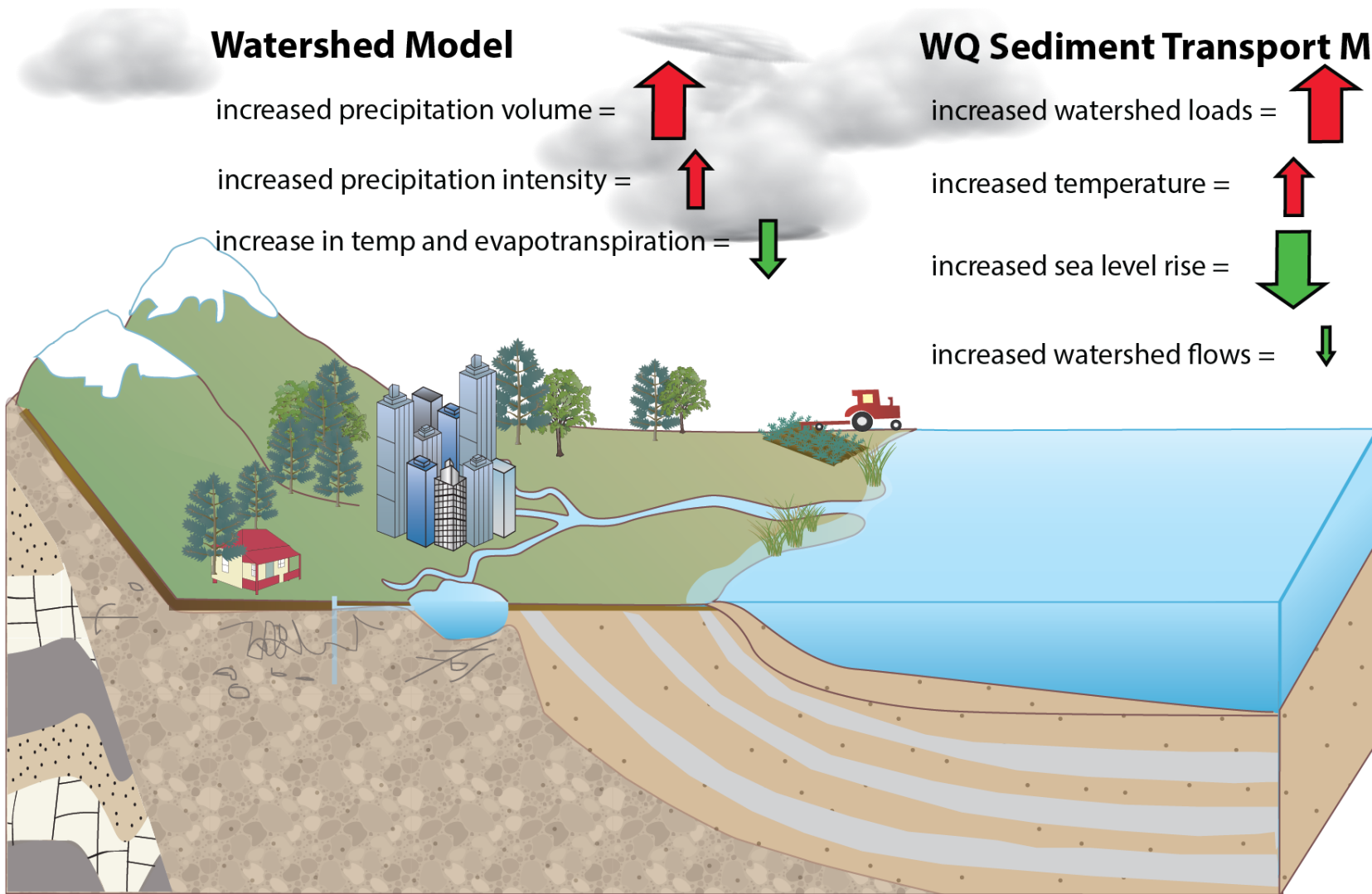
increased temperature =



increased sea level rise =



increased watershed flows =



***Estimated
WQ Impact
Projected to
2025***

**Nitrogen
9 m lbs (4.6%)**

**Phosphorus
.5 m lbs (3.4%)**

PSC Decision

1. Incorporate Climate Change narratively in the Phase III WIPs

2. Understand the Science

- Develop an estimate of pollutant load changes (N, P and Sediment) due to climate change
- Develop a better understanding of the BMP responses, including new or emerging.
- In 2021, the Partnership will revisit existing estimated loads due to climate change to determine if updates to numeric load estimates are needed.
- Jurisdictions will be expected to account for additional nutrient and sediment pollutant loads due to 2025 climate change conditions.

3. In 2022-2023, Incorporate Loads Into WIP III/Milestones

5. Accounting for Growth

PSC Decision

Use the Partnership's Land Change Model to establish growth projections, with the opportunity for states to provide data or alternative modeling approaches in future years, using the Partnership approval process.

- Use 2025 growth projections based on current zoning as base conditions for the Phase III WIPs.
- Update the growth projections every 2 years, using best available data to inform the two-year milestones.

QUESTIONS?