CAST Upgrades

APRIL 25, 2022, WATER QUALITY GOAL IMPLEMENTATION TEAM

OLIVIA DEVEREUX, DEVEREUX CONSULTING, INC.

Outline

- Uses of CAST and the Dynamic Model

- Timeline for development of software upgrades

- Timeline for two-year data and BMP updates, following the two-year current guidance from the Management Board

- Updates requested
    - Transparency in BMP annual reporting
    - BMP Benefits and Eco-System Services
    - Integrating land use views in CAST

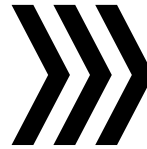- Software naming convention

Model Uses

Dynamic Watershed Model

Incorporates the following in the calibration process and produces the data used in CAST

- Assess lag times in UNEC, and Modflow
- Determines river delivery factors
- Supplies average hydrology (storm/baseflow inches per year)
- Provides hourly input the Estuarine model

Data Analyses used in CAST Phase 6

- Phase 5.3.2 for average loads and nitrogen sensitivity
- USGS Sparrow regression model for average loads, nitrogen sensitivity, land to water and stream delivery factors
- USDA CEAP/APEX Chesapeake model for average loads and nitrogen sensitivity
- APLE for phosphorus sensitivity
- RUSLE (equation, not software product) for sediment edge of field loads

- CAST is the model used for assessing impacts of BMPs
- CAST incorporates data from the time-variable, Dynamic Watershed Model
- CalCAST is used to calibrate the Dynamic Model

CAST Uses

- Uses are the same in Phase 7 as Phase 6

- Estimates the official scenario loads for informing progress assessments and for planning WIPs

- Used by local governments and their contractors for developing implementation plans for MS4s and local TMDLs

- Answers questions about the effect of different BMPs on loads, the impact of land use development over time, and to identify the geographical location where BMPs will reduce the most load

- *Does not* provide time variable inputs to the Estuary model

- *Is not the <u>cali</u>bration tool* (<u>Cal</u>CAST), but uses the calibration output for the delivery factors
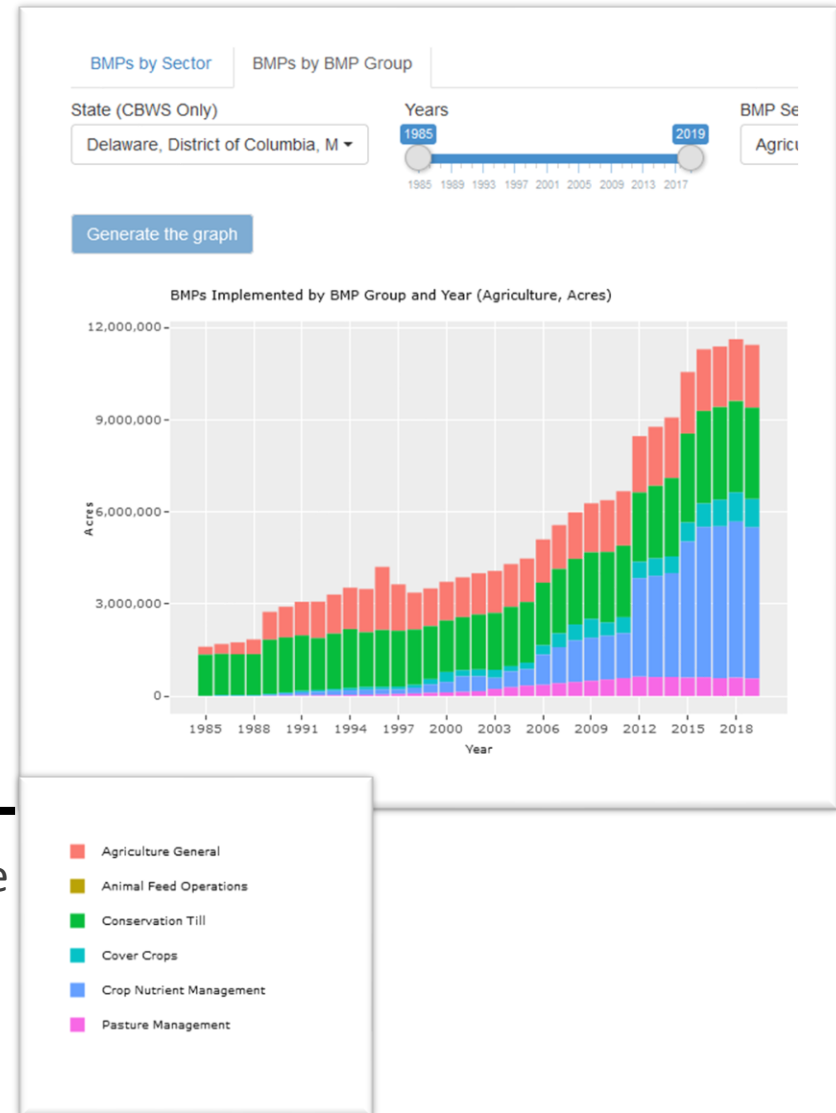
Timeline

2021	2022	2023	2024	2025	2026	2027	2028

Agricultural Census Released by NASS
February 22, 2024

New Planning Target with Any New Model Phase
January 5, 2028
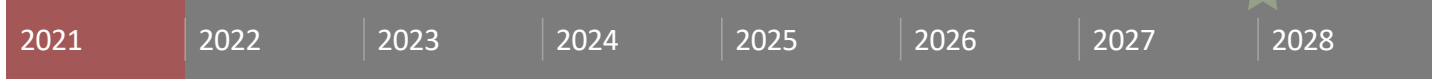
Evaluations

Evaluations

Annual and Phase 3 WIPs are evaluated in the version of CAST that is currently in use.

CAST Upgrades

CAST Upgrades

Include new features, updated BMP history, newly approved BMPs.

Watershed Model (dependent on MWG / Team)

Phase 7 Development and Review
December 30, 2027

Phase 7 Release
April 3, 2028

Land Use (Dependent on the LUWG / Land Data Team)

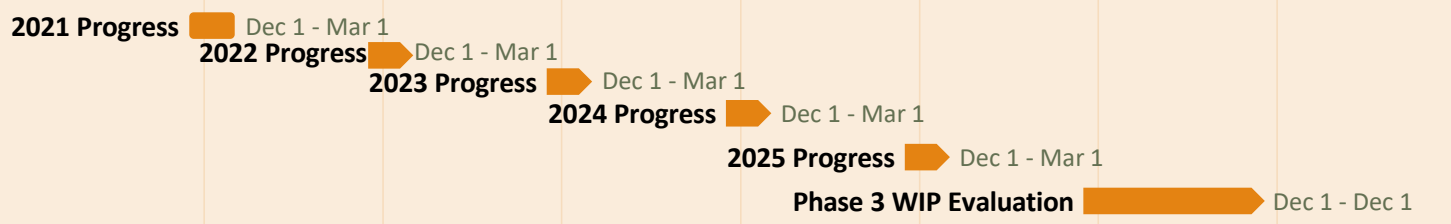Change Product from 2013 Available and Approved
December 9, 2024

All Years, New Data Available and Approved
November 8, 2025

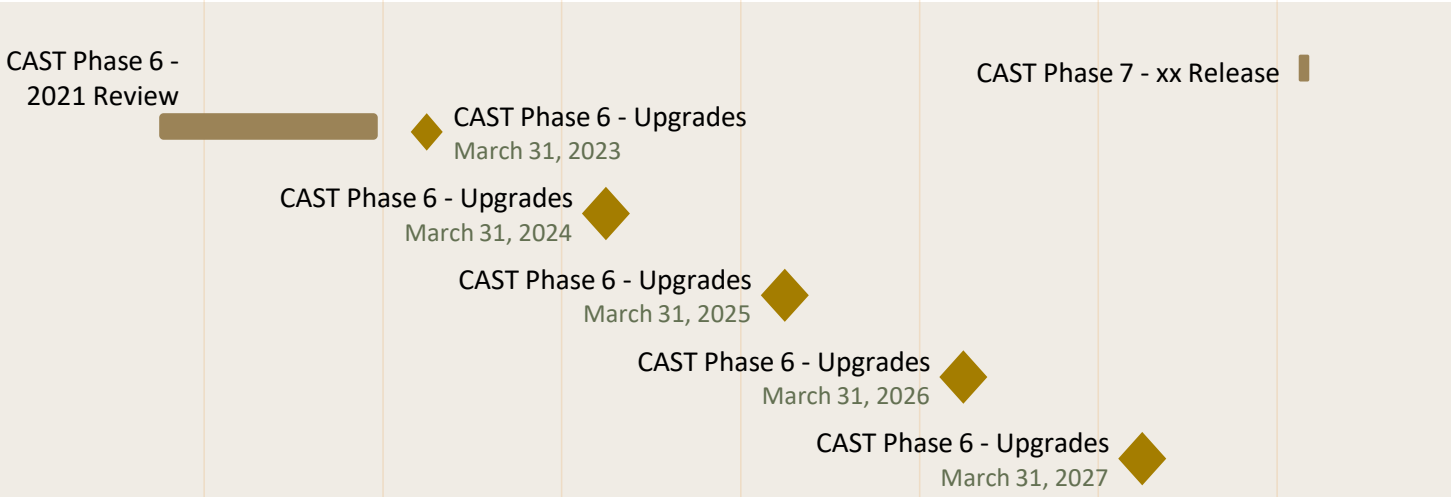**Agricultural Census Released by NASS**
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2022 Progress Dec 1 - Mar 1
2023 Progress Dec 1 - Mar 1
2024 Progress Dec 1 - Mar 1
2025 Progress Dec 1 - Mar 1
Phase 3 WIP Evaluation Dec 1 - Dec 1

CAST Upgrades

CAST Phase 6 - 2021 Review

CAST Phase 7 - xx Release

CAST Phase 6 - Upgrades
March 31, 2023

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CAST Timeline
*contingent on funding and staff availability

| 2022 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2028 |

▲ Today

Land Use Views

Establish Contract
Feb 4 — Jan 26

Contractor develops map display within CAST
Mar 2 — Dec 29

Evaluation of additional spatial functionality needs
Jan 3 — Apr 3

Development of additional functionality
Apr 4 — Aug 27

BMP Reporting Transparency

Design Solutions (Multiple Options)
May 9 — May 13

Achieve Partnership Consensus on Solution
Jan 12 — Sep 11

Sep 11 **Reengineer the BMP reporting process** Dec 28

CAST-General

Multiple user interface updates
Nov 1 ▶

Documentation of CAST
Jan 3 — Aug 31

EcoSystem Services & Co-Benefits

EcoHealth Relationship Browser
Aug 31
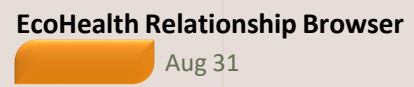
Evaluations

- Evaluations are made in the version of CAST that is current

- CAST is released with a new BMP history and updated source data every two years, once the annual progress scenario is finalized
  - Progress is finalized around March of each year
  - The progress BMPs are used in the new version of CAST

- The CAST version that was used when EPA reviewed your WIP is still the one that is used for official purposes.

- There is always a copy of your WIP BMPs and wastewater in the current version of CAST

Updates Requested

- Transparency in BMP annual reporting
- BMP Benefits and Eco-System Services
- Integrating land use views in CAST

Goal Implementation Teams					
Sustainable Fisheries	Protect & Restore Vital Habitats	Protect & Restore Water Quality	Maintain Healthy Watersheds	Foster Chesapeake Stewardship	Enhance Partnering, Leadership & Management

Transparency in NEIEN/CAST Progress data

STATE

Wastewater
- Municipal
- Industrial
- Spray Irrigation
- CSO
- RIB
- Large monitored septics
- Biosolids

Nonpoint Source BMPs
- Local governments
- Grantees
- Federal agencies and facilities
- Others-may be 100's of submitters

Chesapeake Bay Program

Wastewater App

NEIEN

CAST

BMP and Loads Data Reports

NEIEN Inspection Report

Cell B7091: VDH-2008-000011

	A	B	C	D	E	F	G	
1	ERROR_MESSAGE	state_unique_id	agency_code	state_code	bmp_name		life_span	GEOGRAPHY_NAME	im

CAST Land BMP Submission Errors

Cell A1: ErrorMessage

CAST Credited v. Submitted Report

Cell A1: StateAbbreviation

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	StateAbbr	Geograph	Geograph	Agency	BMPShort	BMP	BMPType	Unit	Sector	FromLoad	ToLoadSo	AmountSu	AmountBa	AmountNc	AmountCr	Excess	TotalAmou	Cost
2	MD	md	Maryland	Departmen	impsurred	Impervious	Landuse C	Acres	Developed	Non-Regul	Non-Regul	16.857	0.055	16.802	16.802	0.000	16.857	########
3	MD	md	Maryland	Departmen	impsurred	Impervious	Landuse C	Acres	Developed	Non-Regul	Non-Regul	60.664	0.556	60.108	60.108	0.000	60.664	########
4	MD	md	Maryland	Departmen	impsurred	Impervious	Landuse C	Acres	Developed	Non-Regul	Non-Regul	7.178	0.071	7.107	7.107	0.000	7.178	########
5	MD	md	Maryland	Departmen	impsurred	Impervious	Landuse C	Acres	Developed	MS4 Roads	MS4 Turf (	0.180	0.006	0.174	0.174	0.000	0.180	########
6	MD	md	Maryland	Departmen	impsurred	Impervious	Landuse C	Acres	Developed	MS4 Buildi	MS4 Turf (	0.041	0.002	0.039	0.039	0.000	0.041	2350.879
7	MD	md	Maryland	Departmen	impsurred	Impervious	Landuse C	Acres	Developed	MS4 Tree (	MS4 Tree (	0.024	0.001	0.023	0.023	0.000	0.024	1356.906
8	MD	md	Maryland	Departmen	impsurred	Impervious	Landuse C	Acres	Developed	CSS Road:	CSS Road:	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	MD	md	Maryland	Departmen	impsurred	Impervious	Landuse C	Acres	Developed	CSS Buildi	CSS Buildi	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	MD	md	Maryland	Departmen	impsurred	Impervious	Landuse C	Acres	Developed	CSS Tree (	CSS Tree (	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	MD	md	Maryland	Departmen	urbstrmres	Urban Stre	Pound Red	Feet	Natural	Stream Be	Stream Be	########	0.000	########	########	0.000	########	########
12	MD	md	Maryland	Departmen	nonurbstrm	Non Urban	Pound Red	Feet	Natural	Stream Be	Stream Be	78.000	0.000	78.000	78.000	0.000	78.000	8216.520
13	MD	md	Maryland	Departmen	shoreurb	Urban Sho	Pound Red	Feet	Natural	Shoreline	Shoreline	########	0.000	########	########	0.000	########	########
14	MD	md	Maryland	Departmen	wetpondwe	Wet Ponds	Efficiency	Acres Trea	Developed	Non-Regul	Non-Regul	13.797	0.000	13.797	13.797	0.000	13.797	########
15	MD	md	Maryland	Departmen	wetpondwe	Wet Ponds	Efficiency	Acres Trea	Developed	Non-Regul	Non-Regul	57.854	0.000	57.854	57.854	0.000	57.854	########
16	MD	md	Maryland	Departmen	wetpondwe	Wet Ponds	Efficiency	Acres Trea	Developed	Non-Regul	Non-Regul	4.150	0.000	4.150	4.150	0.000	4.150	5461.100
17	MD	md	Maryland	Departmen	wetpondwe	Wet Ponds	Efficiency	Acres Trea	Developed	Non-Regul	Non-Regul	19.105	0.000	19.105	19.105	0.000	19.105	########
	MD	md	Maryland	Departmen	wetpondwe	Wet Ponds	Efficiency	Acres Trea	Developed	Non-Regul	Non-Regul	75.366	0.000	75.366	75.366			

Transparency in NEIEN/CAST Progress data

STATE

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Waste water App

NEIEN

CAST

The data structure in every one of these systems will need to be adapted

Technically complex
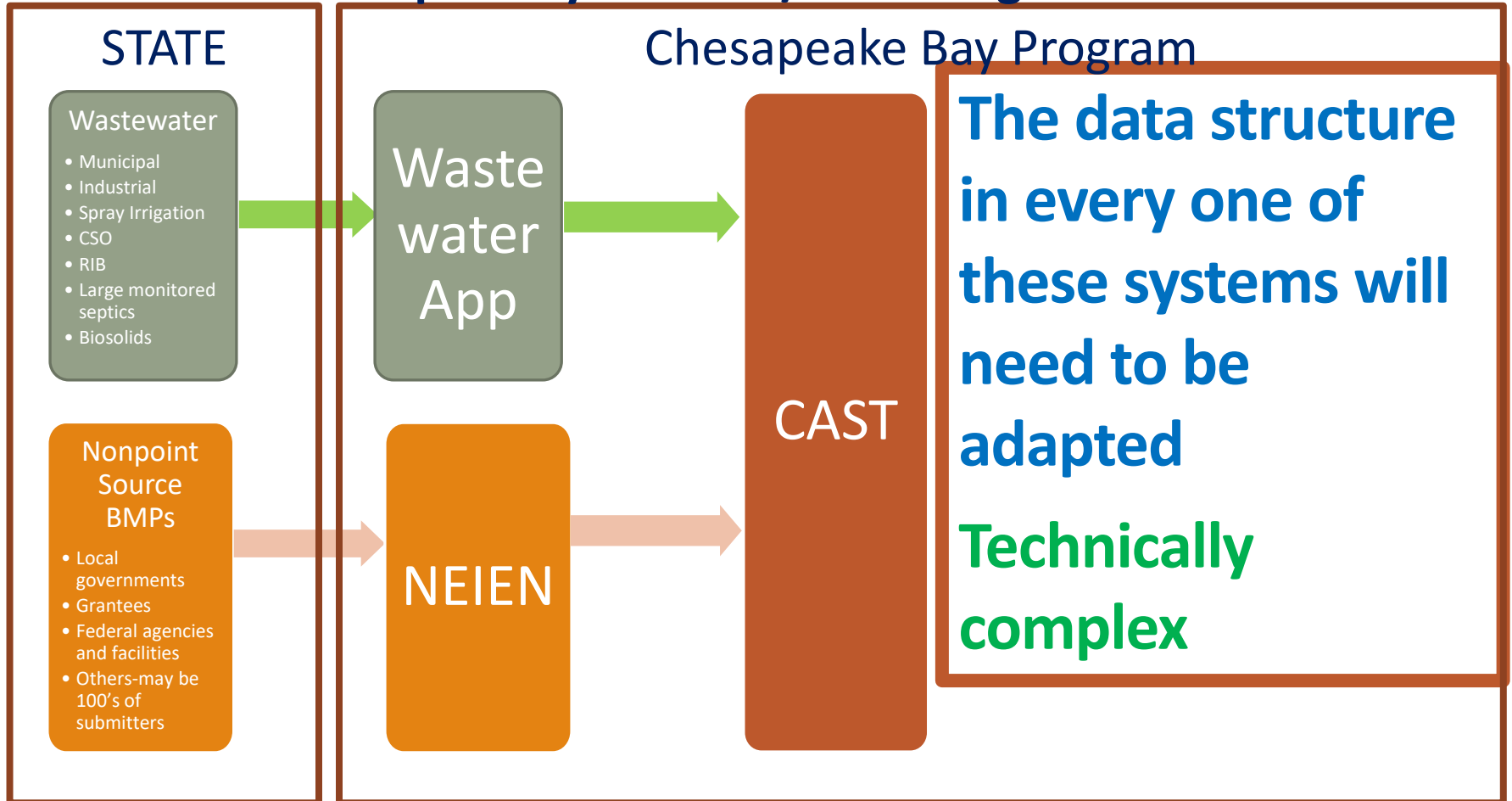
BMP Reporting System Updates

The NEIEN post-processor is under full review

This will allow the CAST Development Team to make recommendations on ways to recode it to simplify analyses while meeting Partnership requirements for annual progress scenarios

NEIEN is currently on the EPA Environmental Information Exchange Network
- ◦ https://www.epa.gov/exchangenetwork
- ◦ OpenNode2
- ◦ Uses SOAP technology

Possibility of Transitioning to Virtual Exchange
- ◦ https://exchangenetwork.net/virtual-exchange-service/
- ◦ Uses RESTful web service
- ◦ Does not affect use, but does make the system more stable

Could move to a stand-alone service that is not part of the EPA Exchange Network
- ◦ Benefit is expanded options for de-duplicating data and allow more flexible services

Handling Data

A vegetable seller has the following vegetables in his cart. Help him by counting the vegetables. Write the number correctly in the list.

Q1. Count the vegetables and write the correct number in the list below.

brinjal	
pumpkin	
tomato	
cauliflower	
Bell pepper	
onion	

BMP Benefits and Ecosystem Services

Ecosystem Health Quantification (Ryann Rossi project)

- Quantifies ecosystem health outcomes by the amount of CAST – Water Quality BMP implemented
- EcoHealth Relationship Browser

Wetland Functional Benefits

- Wetlands Outcome
- Black Duck Outcome

Carbon-USDA Comet Data

Eco-Health Relationship Browser

Click on the topic bubbles to explore. Click on the linkages (i) to view the relationship between elements
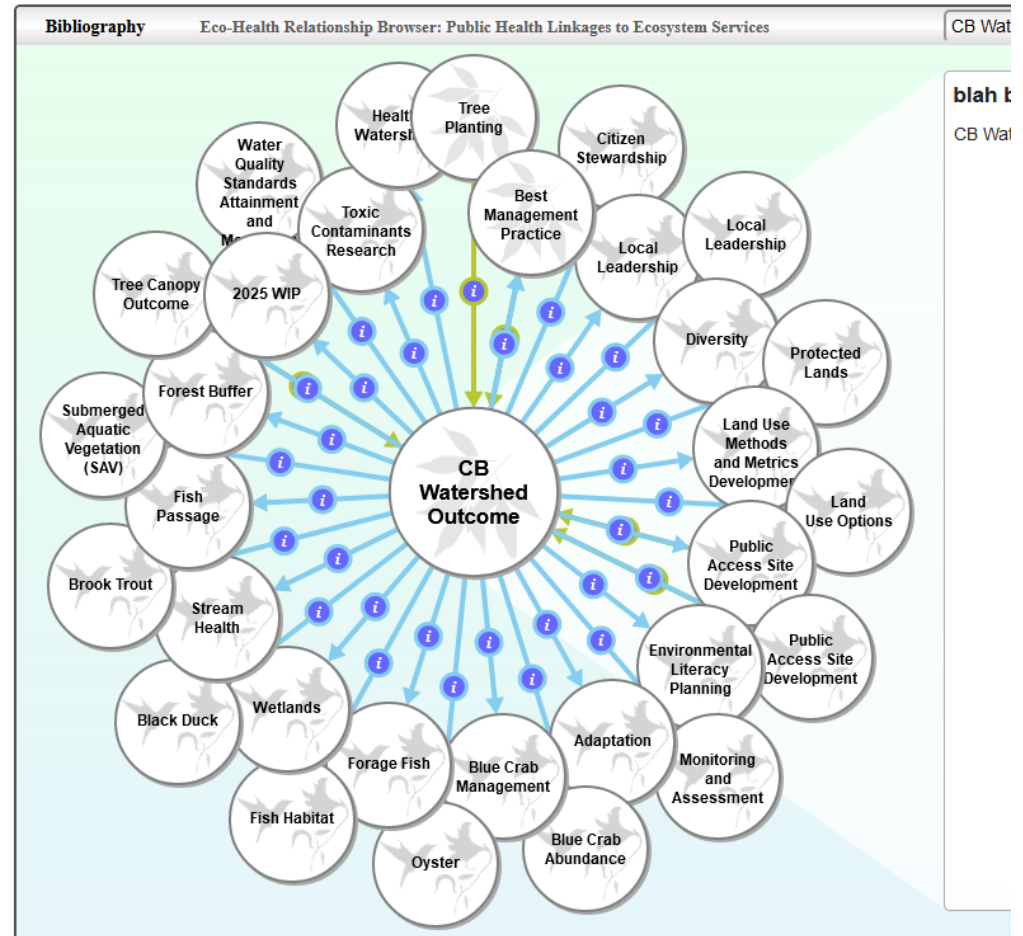
Integrate the land use with the TN, TP, and TSS planning and assessment functionality

- Explore nutrient sources, application rates, and land use patterns:
  cast.chesapeakebay.net/TrendsOverTime/NutrientsApplied

- Explore BMP implementation patterns by source sector and geography:
  cast.chesapeakebay.net/TrendsOverTime/BMPs

- Explore BMP cost profiles:
  cast.chesapeakebay.net/Documentation/CostProfiles

- The Chesapeake Bay Phase 6 Land Use Viewer can be used to explore land use patterns throughout the watershed is accessible from:
  cast.chesapeakebay.net/Documentation/MapToolSpatialData

- The Chesapeake Bay Watershed Model Phase 6 Map Viewer includes a variety of data to guide management, including information on nutrient inputs, healthy watersheds, and aquatic resources is accessible from:
  cast.chesapeakebay.net/Documentation/MapToolSpatialData
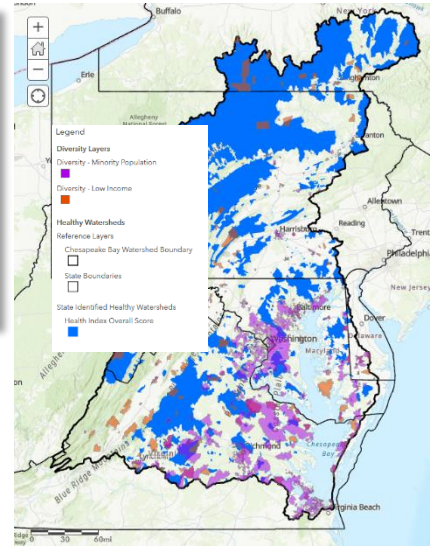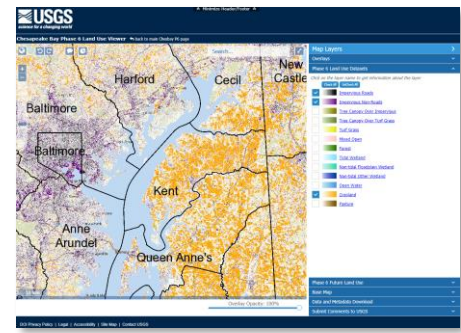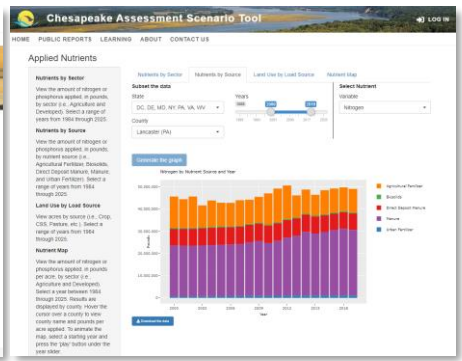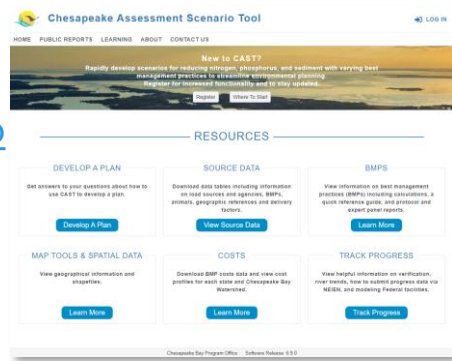
Above: *Screenshots of online tools and resources that can help guide effective watershed management.*

Better Targeting CBP Resources to Achieve Multiple Outcomes: Approach and Tools
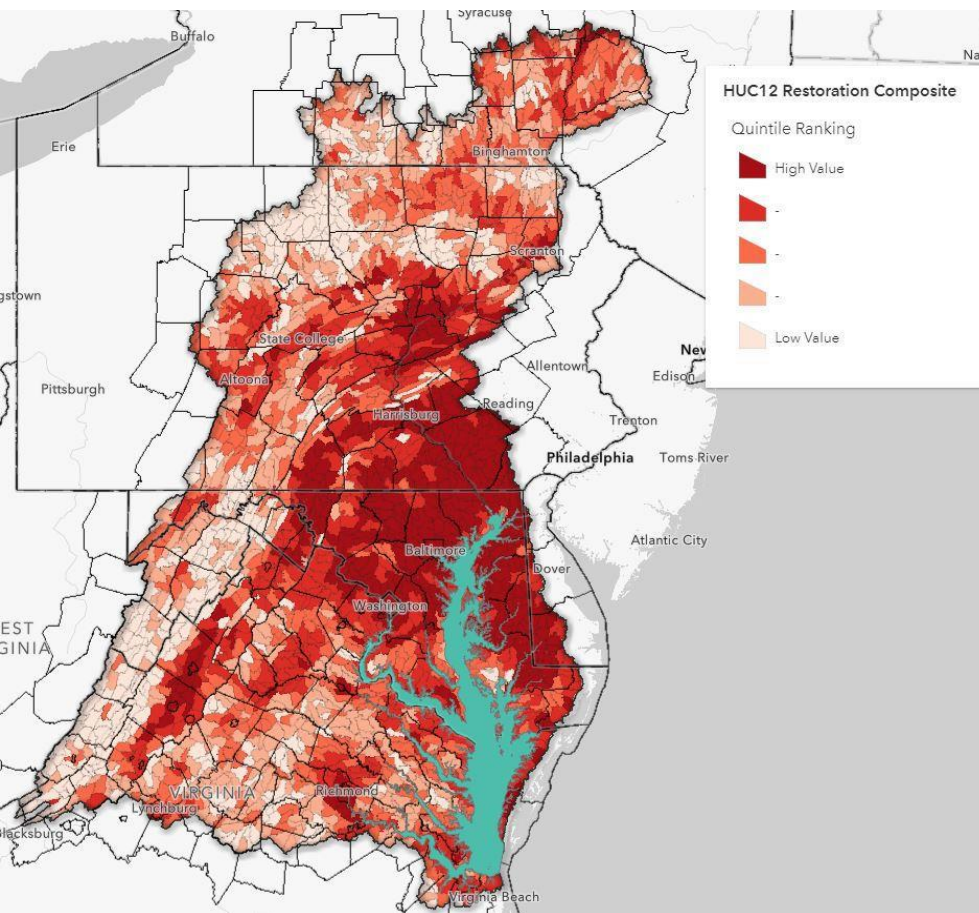
Figure 4 shows the composite restoration map of places where multiple outcomes can be met for water-quality improvements, toxic contaminants, and habitat connectively. These outcomes were selected by the GITs.
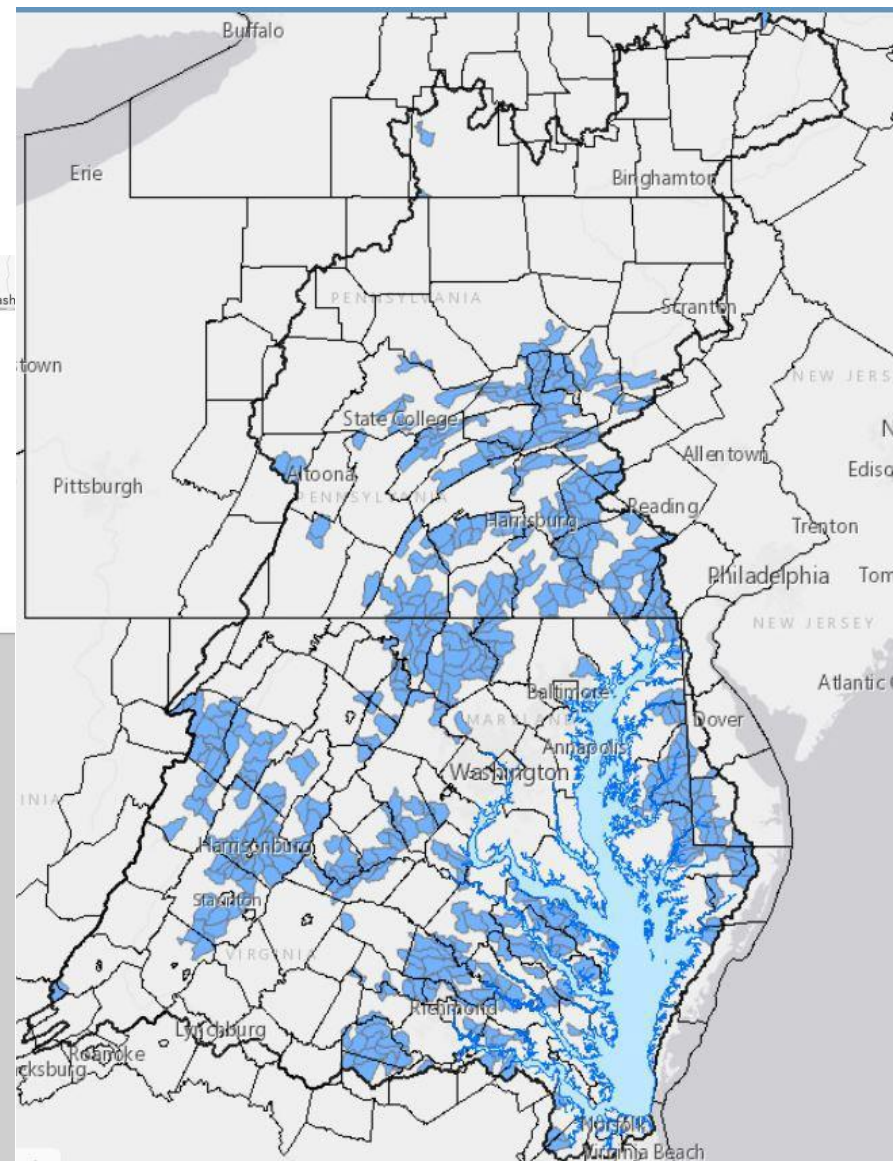
Figure 3. Ranking by states for places to get the highest reduction of nitrogen loading to the Bay and local water-quality improvements (from the Chesapeake Agricultural Priority Watersheds tool).

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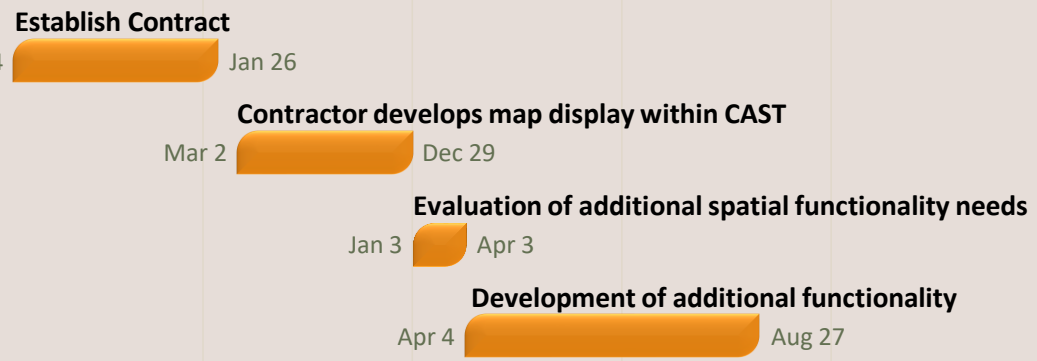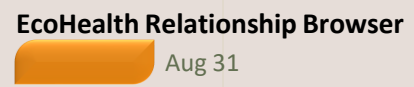
Software Version Naming Convention

- Release is contingent on progress being finished so we can include those BMPs.

- Old Method is "CAST-21"

- New Method is "Phase 6 – 7.2.0"

- No longer named after years

New versions of CAST that change scenario loads are listed under About, Model Documentation

Upgrades of all types are described in detail under About, Upgrade History
Model version history is listed here

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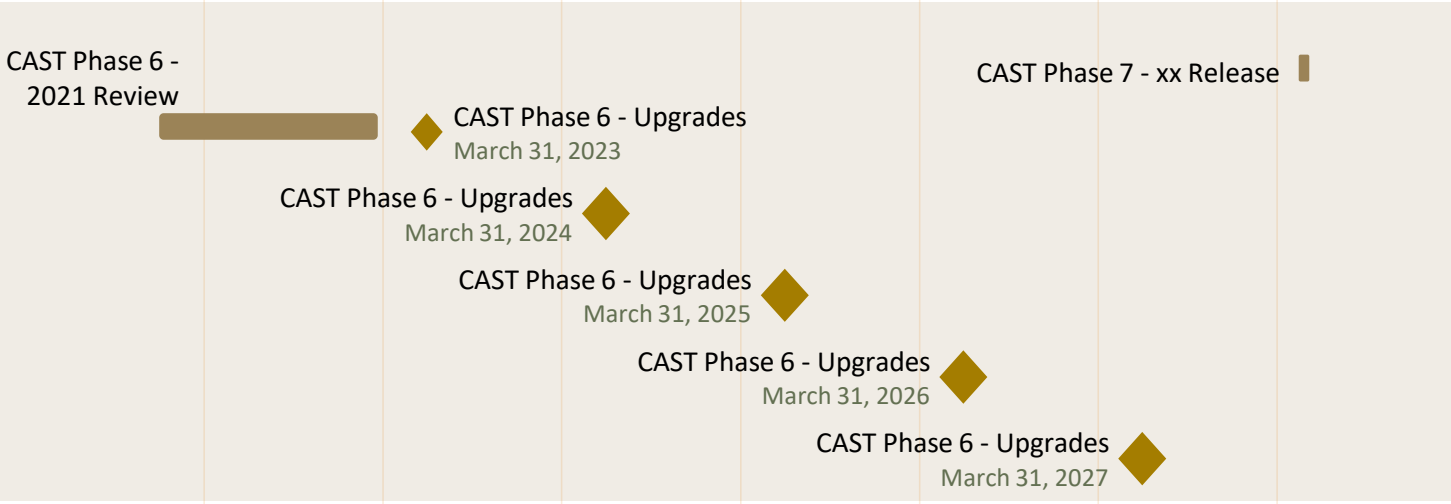
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