The Chesapeake Bay Program uses state-of-the-art science and real data (such as rainfall, river flow and pollution from sources such as urban, suburban and agricultural runoff) to replicate conditions of the Chesapeake Bay watershed. This information is then used by decision-makers at the federal, state and local levels to determine how best to restore and protect local waterways, and, ultimately, the Chesapeake Bay. By combining sophisticated modeling data and real-world monitoring data, we gain a comprehensive view of the Chesapeake ecosystem— from the depths of the Bay to the upper reaches of the watershed.

What is included in the Chesapeake Bay Program's Suite of Modeling Tools?
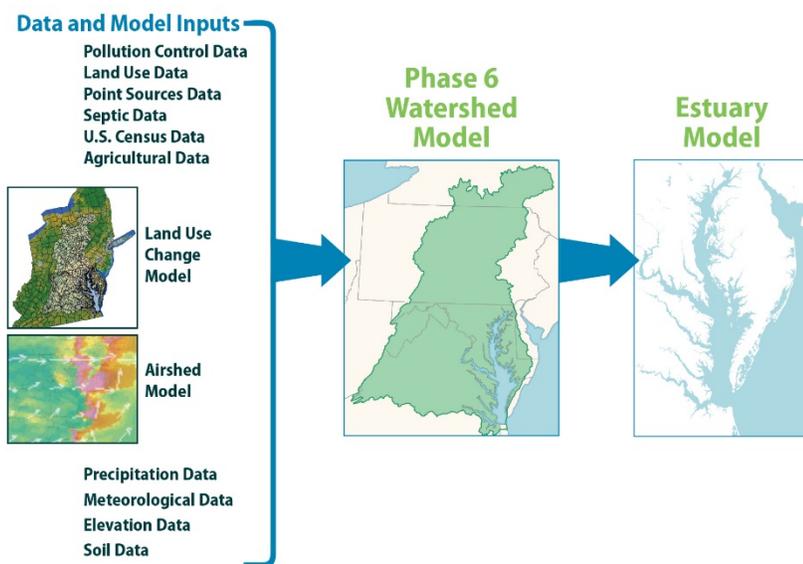
The Chesapeake Bay Program has a suite of four models. Watershed partners and others can use these to test scenarios and simulations of possible actions that answer the following questions:

- How much pollution is entering the nation's largest estuary?
- Where is this pollution coming from?
- How will the pollution-reducing policies and practices put in place under the Chesapeake Bay Total Maximum Daily Load affect nutrient and sediment loads, water quality and living resources?

These four models include:

- Airshed Model - estimates the amount of nitrogen deposited onto the land and water by vehicles, power plants and other emission sources;
- Land Use Change Model - predicts the impacts that urban population and development will have on sewer and septic systems;
- Phase 6 Watershed Model - estimates the amount of nitrogen, phosphorus and sediment reaching the Chesapeake Bay; and
- Estuary Model - examines the effects that pollution loads have on water quality.

Data and Model Inputs
Pollution Control Data
Land Use Data
Point Sources Data
Septic Data
U.S. Census Data
Agricultural Data

Land Use Change Model

Airshed Model

Precipitation Data
Meteorological Data
Elevation Data
Soil Data

Phase 6 Watershed Model

Estuary Model

How do the models work together?

Step 1. Data from the following are input into the Phase 6 Watershed Model:
  a) Sampling and monitoring data from existing pollution control measures
  b) Existing land use data
  c) Data from point sources (i.e., wastewater treatment plants)
  d) Septic system data
  e) U.S Census Bureau and U.S. Census of Agriculture data

f) Data from the Land Use Change Model

g) Data from the Airshed Model

h) Precipitation and meteorological data

i) Elevation and soil data

Step 2. Results of Phase 6 Watershed Model are input into the Estuary Model

Why is the Chesapeake Bay Suite of Modeling Tools important?

The suite of modeling tools was launched in 1982 and has undergone six revisions over the past 35 years. It divides the 64,000-square-mile watershed into thousands of smaller segments, and helps us understand how pollution-reducing policies and practices can impact water quality and living resources at the regional and local scales.

The most significant value of the suite of modeling tools is the ability to predict how the Chesapeake Bay will respond to future conditions such as pollutant loads, land use changes and climate change.

How has the Chesapeake Bay Suite of Modeling Tools improved over time?

The development and ongoing improvement of the suite of modeling tools is a highly collaborative process involving many partners, stakeholders and experts. Since its inception, the suite of modeling tools has undergone extensive peer review by federal, state and academic modeling experts and scientists.

The newest version of the suite is known as Phase 6 Suite of Modeling Tools. Its simplified structure makes it easy to use. The Phase 6 Suite of Modeling Tools includes expanded and improved data about:

- The sources and amount of nutrients entering the water;

- The latest, cutting-edge high-resolution land cover data from satellites; and

- New and updated information about the efficiencies of pollution-reducing best management practices.

The Phase 6 Suite of Modeling Tools can also simulate the environmental impacts of population growth, climate change and sediment build-up behind the Conowingo Dam (on the Susquehanna River in Maryland), which helps decision makers explore options for addressing these factors.

How can I use the Chesapeake Bay Suite of Modeling Tools?

The suite of modeling tools can be accessed online for free through the Chesapeake Assessment Scenario Tool, or CAST. CAST is a web-based tool that allows local communities to run model simulations for various situations (or scenarios) that are relevant to their locality. The modeling results can help states, local governments and others identify which pollution prevention strategies and conservation practices make the most sense, given their available resources. CAST helps local planners better understand which pollution control practices can provide the greatest reduction in nitrogen, phosphorus and sediment loads—and how much various implementation options might cost. Plus, CAST can indicate which practices would be most successful in different geographic areas, and how water quality and land use patterns might change as a result. Based on scenario outputs, planners can refine their choices.

For more information on CAST, view the Watershed Academy webinar at https://www.epa.gov/watershedacademy/using-cast-develop-implementation-plans-meet-loading-targets-chesapeake-bay.