Processing Urban Fertilizer Data for CAST

Chesapeake Bay Program

Background

- Chemical fertilizer* in the Chesapeake Bay Watershed is a large source of excess nutrients that leads to low dissolved oxygen and increased chlorophyll *a*
  - *Inorganic fertilizer available for application to turfgrass
- Modeling chemical fertilizer application rates is important for management decisions
- Jurisdictions are concerned with the accuracy of chemical fertilizer data used in modeling efforts

Working with the Data

Urban fertilizer data are summed for each of the six Chesapeake Bay Watershed states

- Calculate statewide fertilizer amounts by summing all counties that are wholly or partially in the Chesapeake Bay Watershed for each year
- Fertilizer data are processed using methods approved by the Chesapeake Bay Program Urban Stormwater Workgroup
- Urban fertilizer application rates (pounds per acre) are calculated as the total mass of nutrients divided by the total acres in turfgrass for each state and year

Turfgrass Definition

- Grass grown for lawns
- Type of grass that forms a dense, even turf if mowed and maintained
- Examples include urban lawns and golf courses
- Excludes farms that grow sod

Data Sources

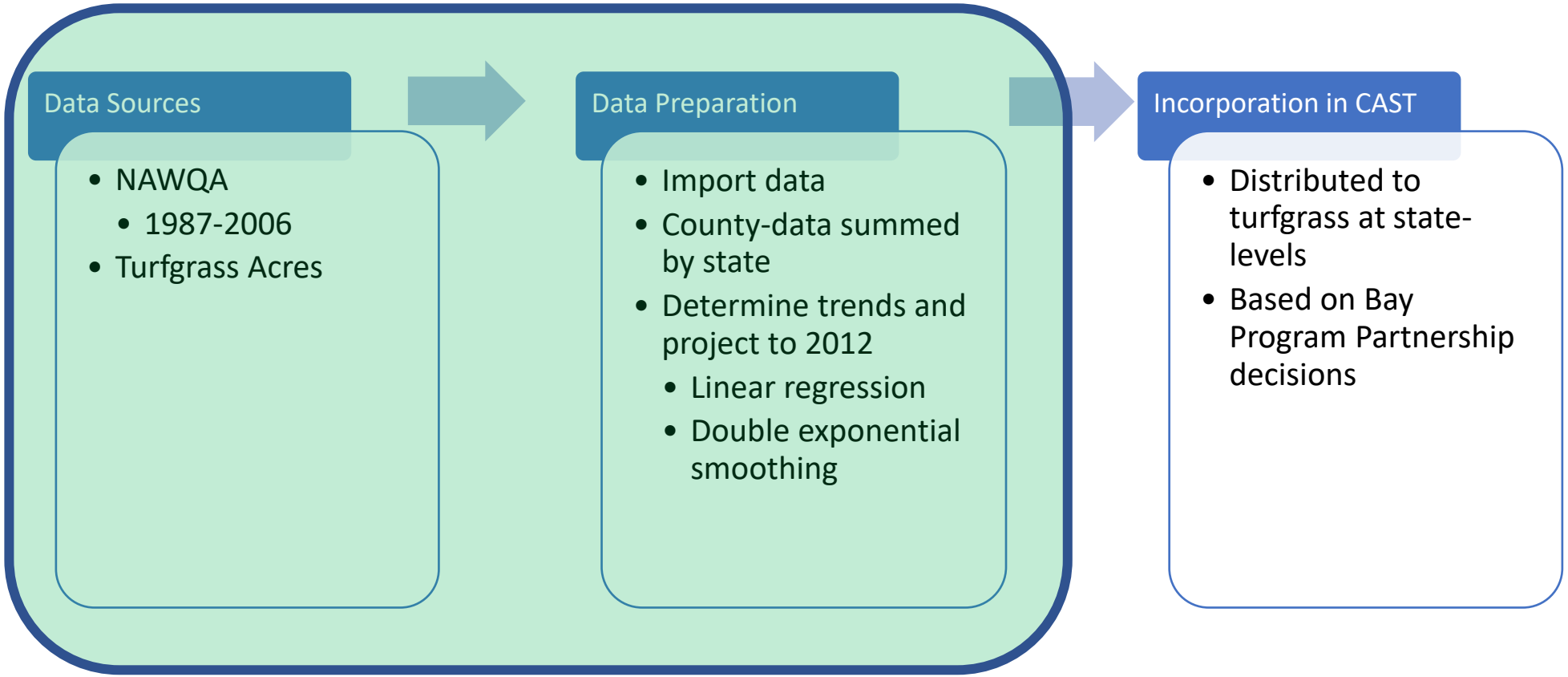
- Fertilizer: National Water-Quality Assessment (NAWQA)
  - U.S. Geological Survey (USGS) report with estimated county-level farm and non-farm nitrogen and phosphorus input from commercial fertilizer sales for 1987 – 2006
    - Based on American Association of Plant Food Control Officials (AAPFCO) data
    - USGS used some smoothing and outlier removal processes in their published data
    - These data are ***not*** raw AAPFCO data
  - Processing Methods:
    - 1987-2006 data are used to estimate 1984-2006
    - 1985-2006 data used project to 2012

- Fertilizer: American Association of Plant Food Control Officials (AAPFCO)
  - County-level commercial fertilizer sales (mass of N and P)
    - Coded by “Farm” and “Non-Farm” Categories
  - Updated annually but takes time to release
    - Most recent release is for 2017 data
  - Processing Methods:
    - 2012-2016 data used to estimate 2013-2016

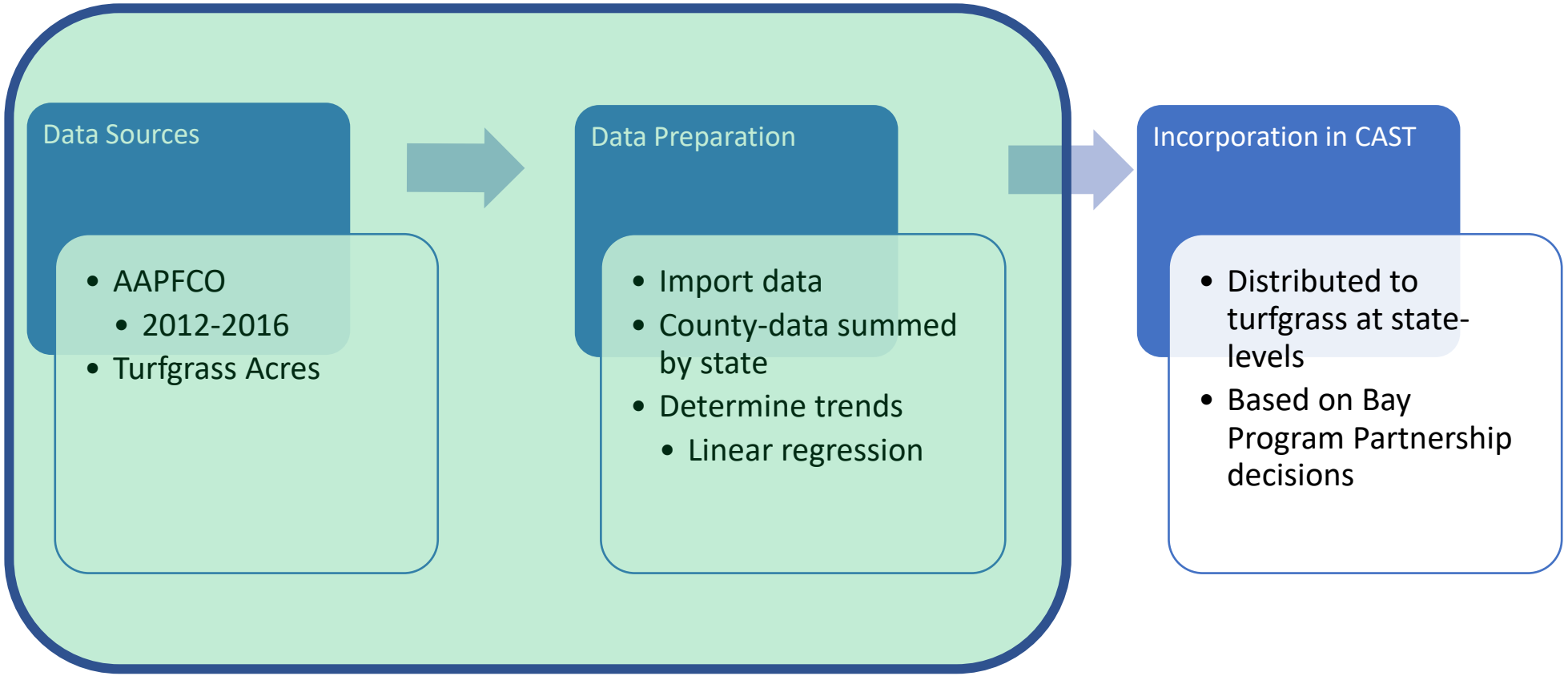
- Land Use: Chesapeake Bay Program/U.S. Geological Survey (USGS)
  - County-level turfgrass pre-BMP acres from CAST


Data Processing Steps
Chesapeake Bay Program

NAWQA Data Processing Overview



AAPFCO Data Processing Overview



Urban Fertilizer Methods

- NAWQA/AAPFCO data and turfgrass acres are received at the county level (yellow)

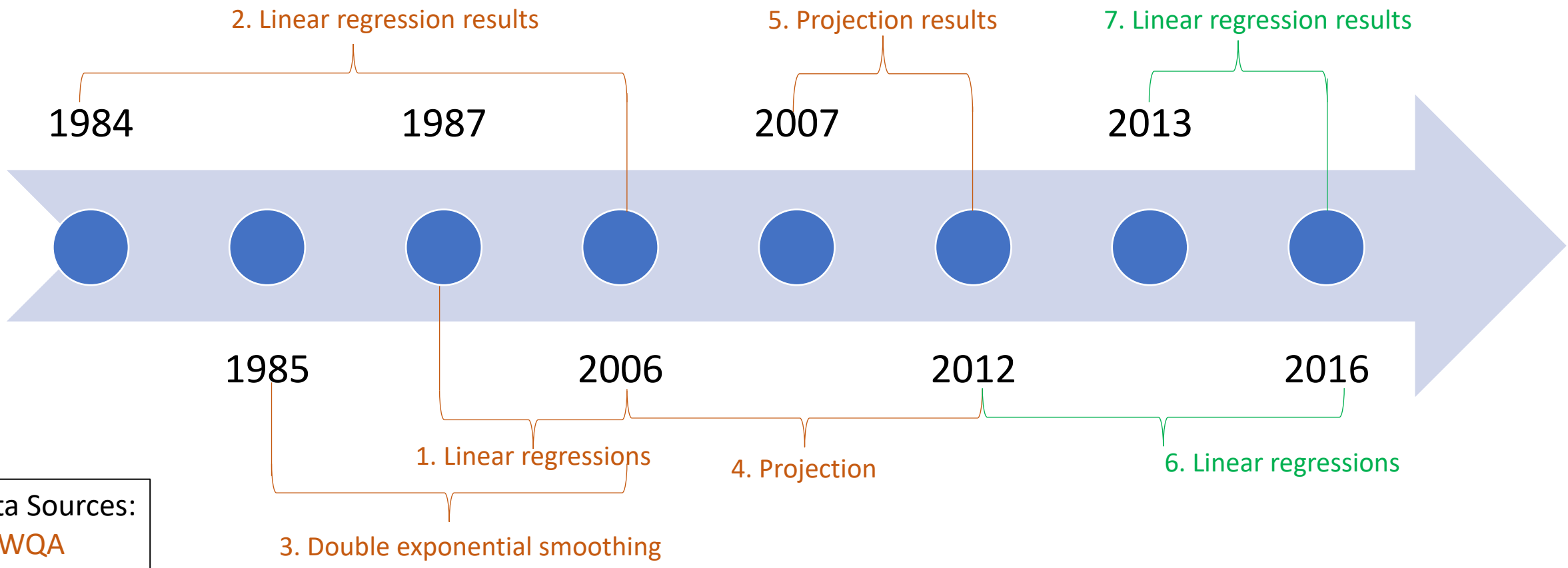
- Statewide fertilizer masses (N and P)
  - Summed for all counties that have a portion in the Chesapeake Bay Watershed (yellow)

- Statewide turfgrass acres
  - Summed for all counties that have a portion in the Chesapeake Bay Watershed (yellow)
  - Load sources that include turfgrass:
    - 1) turfgrass
    - 2) tree canopy over turfgrass

Urban Fertilizer *Detailed* Methods

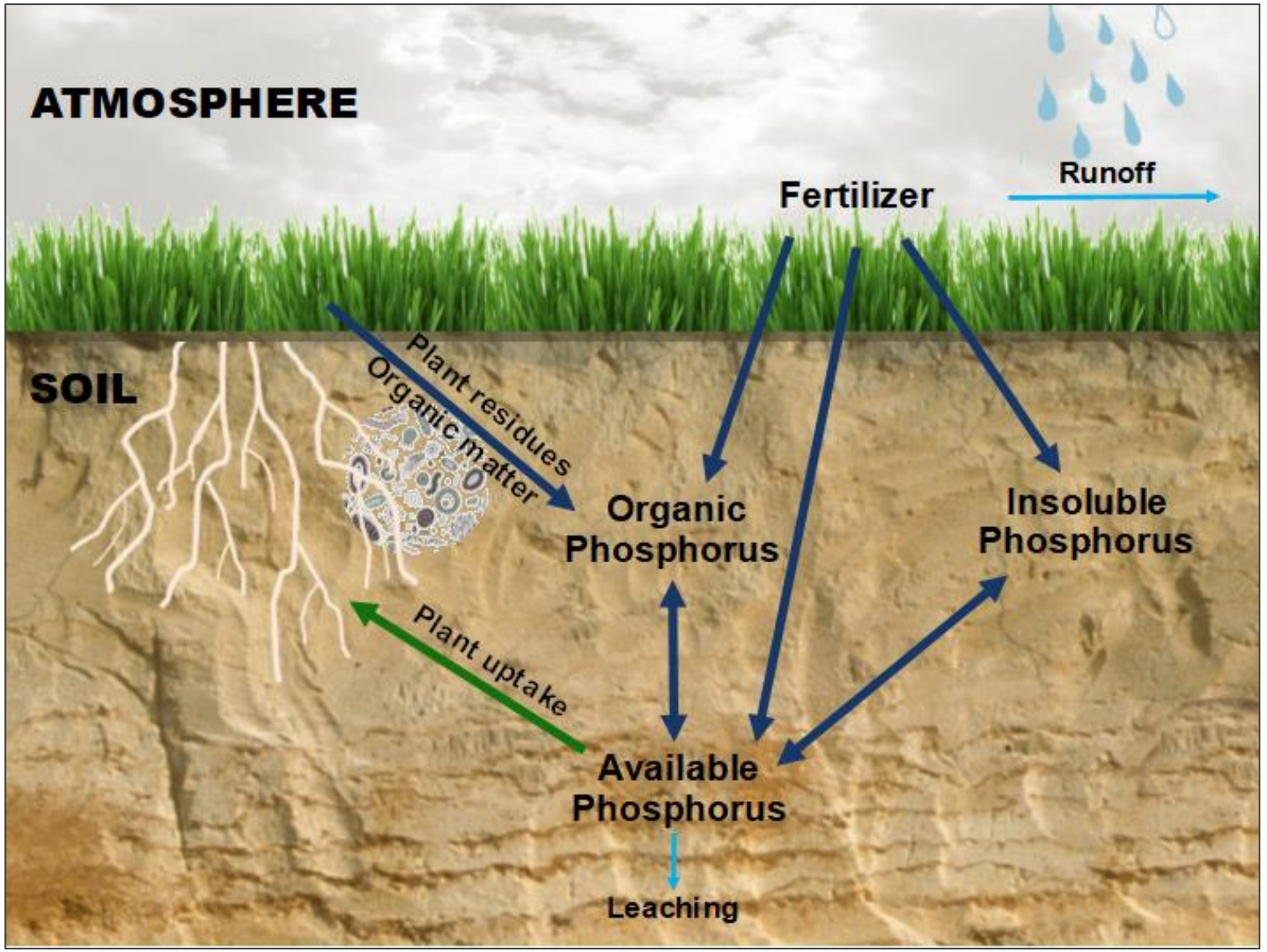
- Statewide fertilizer application rate
  - Fertilizer nutrient mass/turfgrass acres
- Estimates of statewide fertilizer application rates have been made for each year using *trends*
  - 1984 - 2006 were from a linear regression of 1987-2006 NAWQA data
  - 2007 – 2012 are estimates from double-exponential smoothing of 1985-2006 NAWQA data at the state scale
    - Resulting slope is used to project 2012
    - Slope added to 2006 value from the linear regression of the NAQWA data
  - 2013 – 2016 are state slopes of linear regressions of 2012-2016 AAPFCO data
    - Added to 2012 data
    - Application rates held constant after 2016

Bringing the Methods Together (not to scale)



Data Sources:
NAWQA
AAPFCO

A Quick Phosphorus Detour



A Quick Primer on Forthcoming Plots

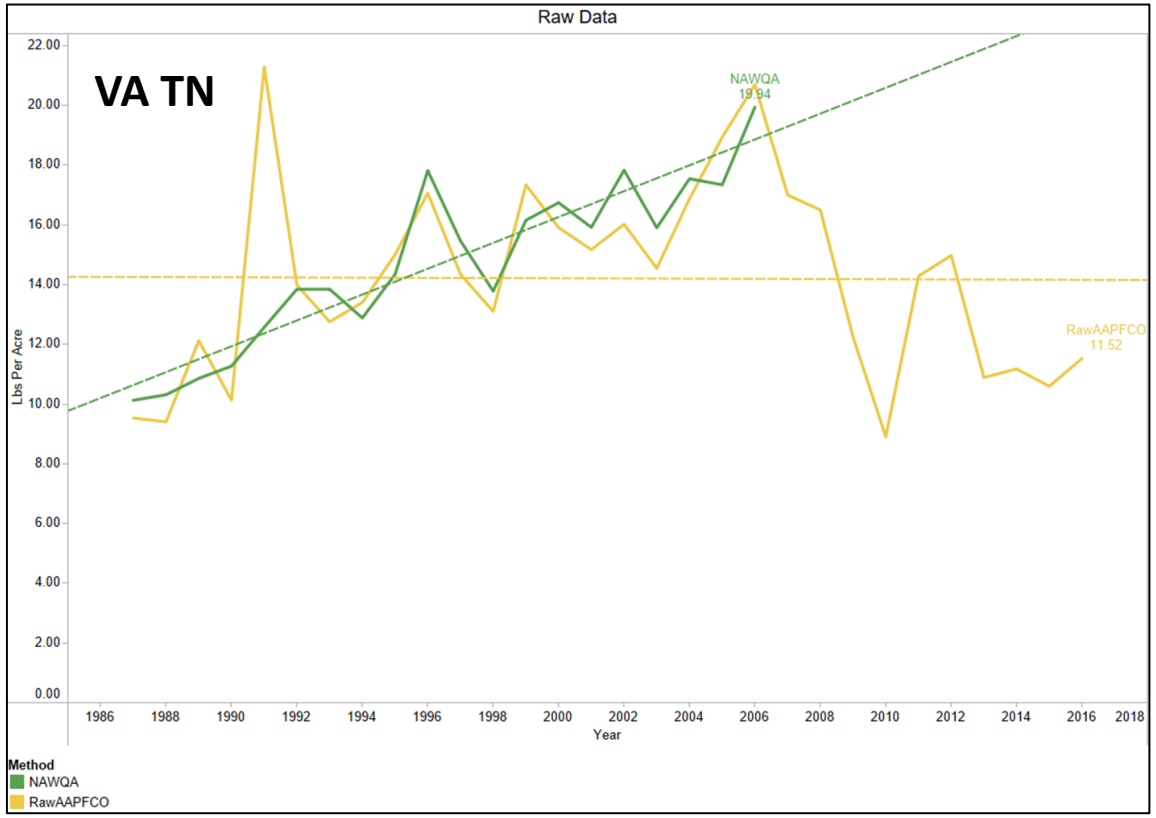
- Raw Data
  - AAPFCO data are converted from P2O5 to TP by multiplying by 0.4365
  - NAWQA data are converted from Kg to Lb by multiplying by 2.20462

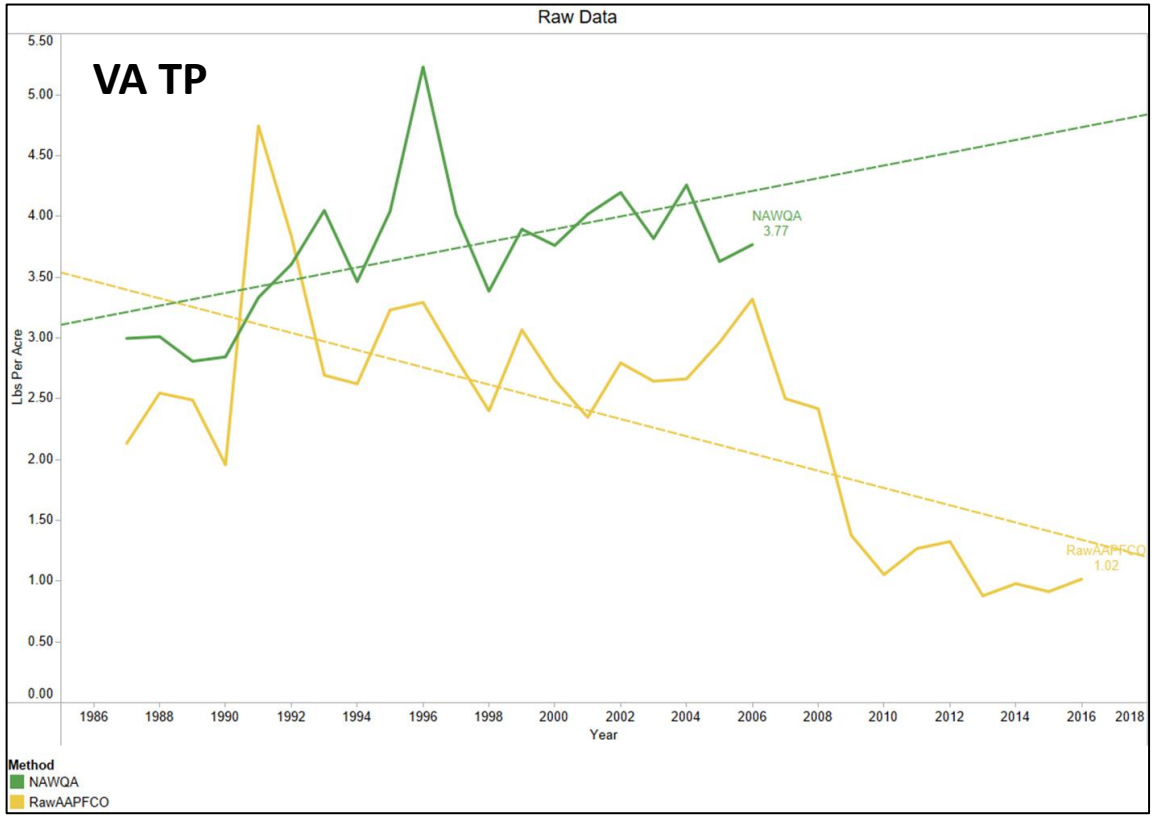
- Trends Line Disclaimer
  - Trends lines are show to elucidate differences between NAWQA and AAPFCO data
  - ***Not used in the processing methods***

- We can clearly see why CBP data looked like P205, as the differences between years are about half
  - CBP has worked with TP for turfgrass application rates

TN and TP comparison of all states CBWS counties only

Raw urban (non-farm) data from NAWQA and AAPFCO.





TN and TP comparison of VA CBWS counties only

Raw urban (non-farm) data from NAWQA and AAPFCO.

Crux of the Issue

- NAWQA data, although sourced from AAPFCO data, are substantially different

- While the processing methods are correct, and there were updates to the AAPFCO data CBP uses, the big issue stems from NAWQA being so different than raw AAPFCO data

Additional Disclaimer

- We will *never* use these data directly in Phase 6
- CBP will be using a change product based off of 1995
  - Ensures we are not moving the planning targets (e.g., goal post)
  - This allows us to better align the loads with the most up-to-date data (e.g., more accurate placement of football on the field)
  - Every two years we update the data (e.g., throw a flag on the play)

Summary

We need fertilizer data to estimate N and P applications to turfgrass.

We use nationally reported data sets.

Data are processed to assess urban fertilizer application trends.

Processed data are applied at the state level.


Questions?
Chesapeake Bay Program