Improving Wastewater Performance Evaluation: *Controlling for the effects of rainfall*

WWTWG Conference Call
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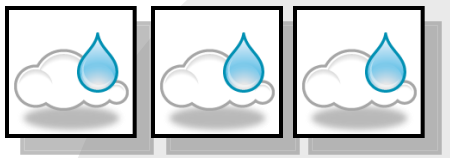
Problem

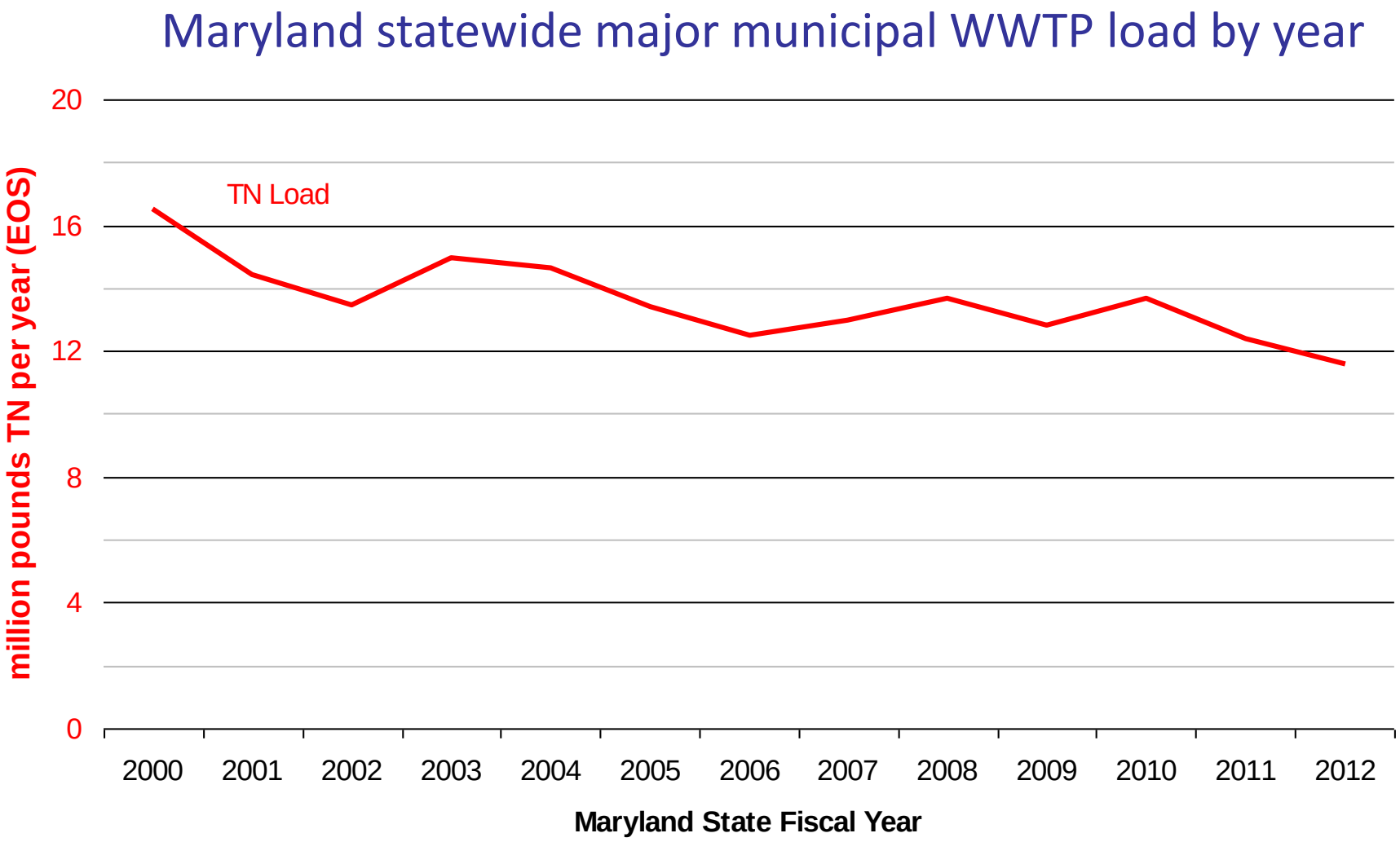
- Annual Progress scenarios do not accurately capture legitimate point source reductions – *those reductions achieved through management actions, such as ENR upgrades*
- Reductions are masked by the annual variability of loads which is mostly driven by rainfall
- Using Progress to judge Milestones means that attainment is largely a function of rainfall rather than management actions



Improving Wastewater Performance Evaluation

- Goals
  - Develop a tool that will better show the results of management actions on nutrient loads
  - Measure achievement of Milestone goals based on performance, not rainfall
- Two separate & complimentary proposals
  - Credit wastewater BMPs using ENR startup dates
  - Remove the effects of precipitation-induced load variability

Trends in WWTP Load



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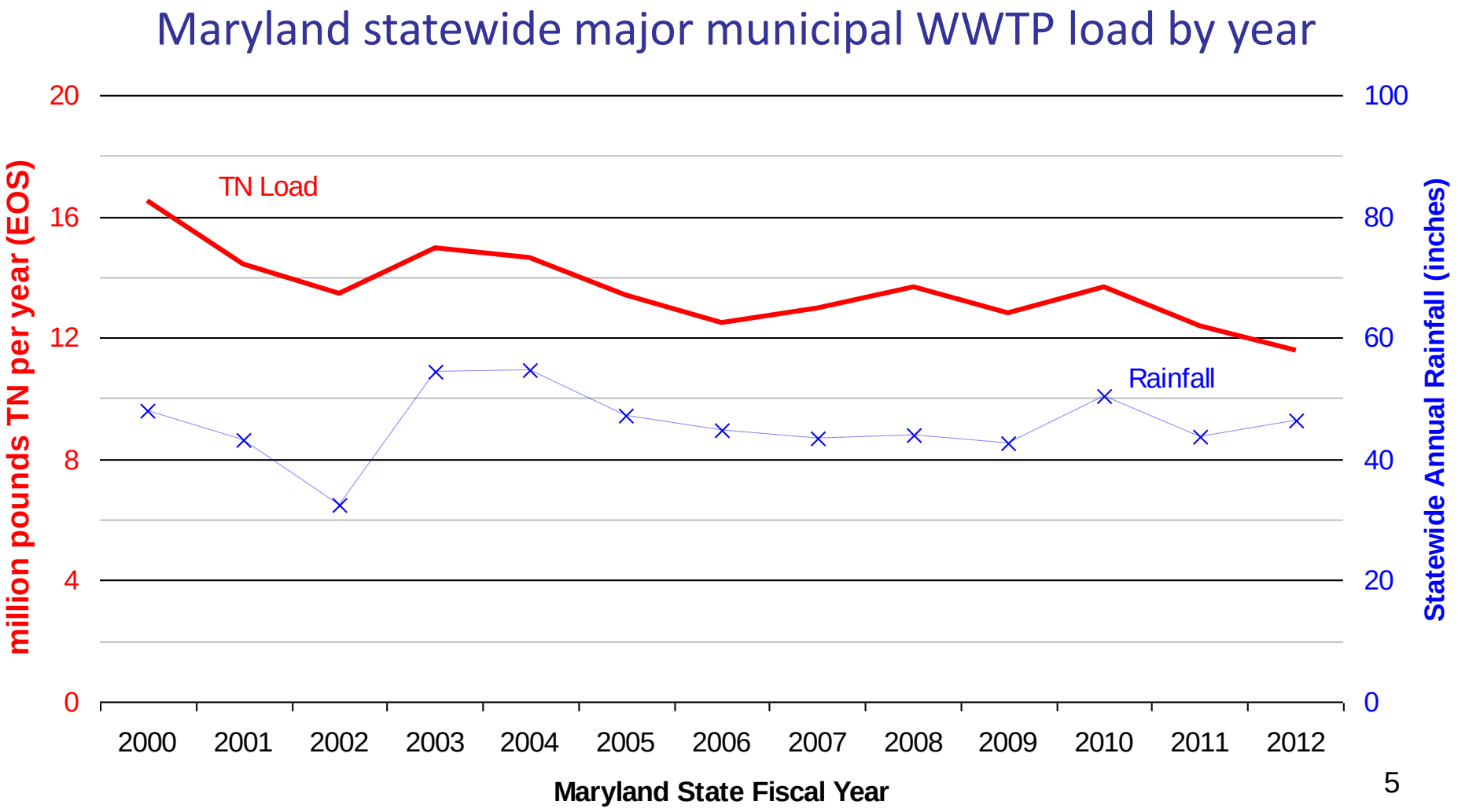

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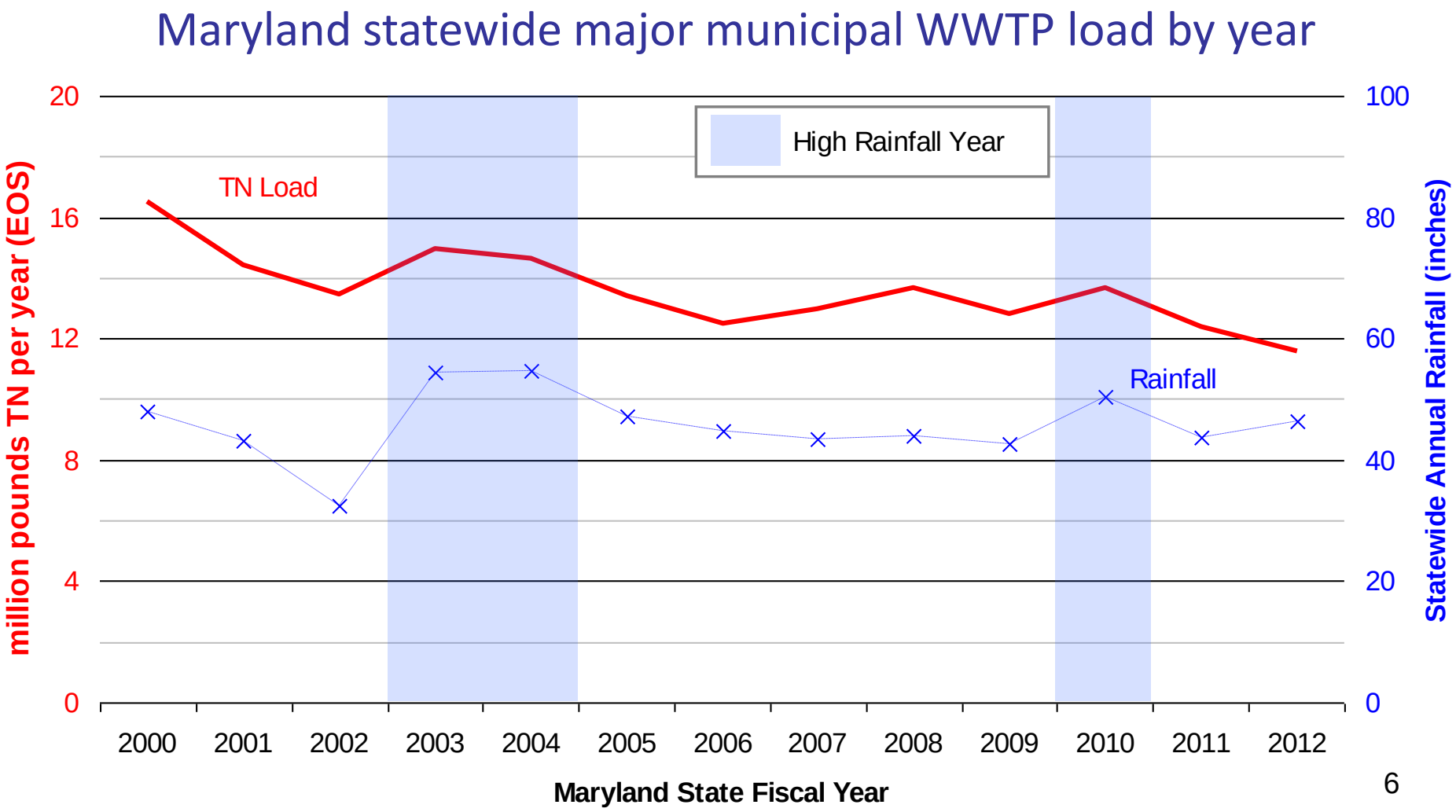

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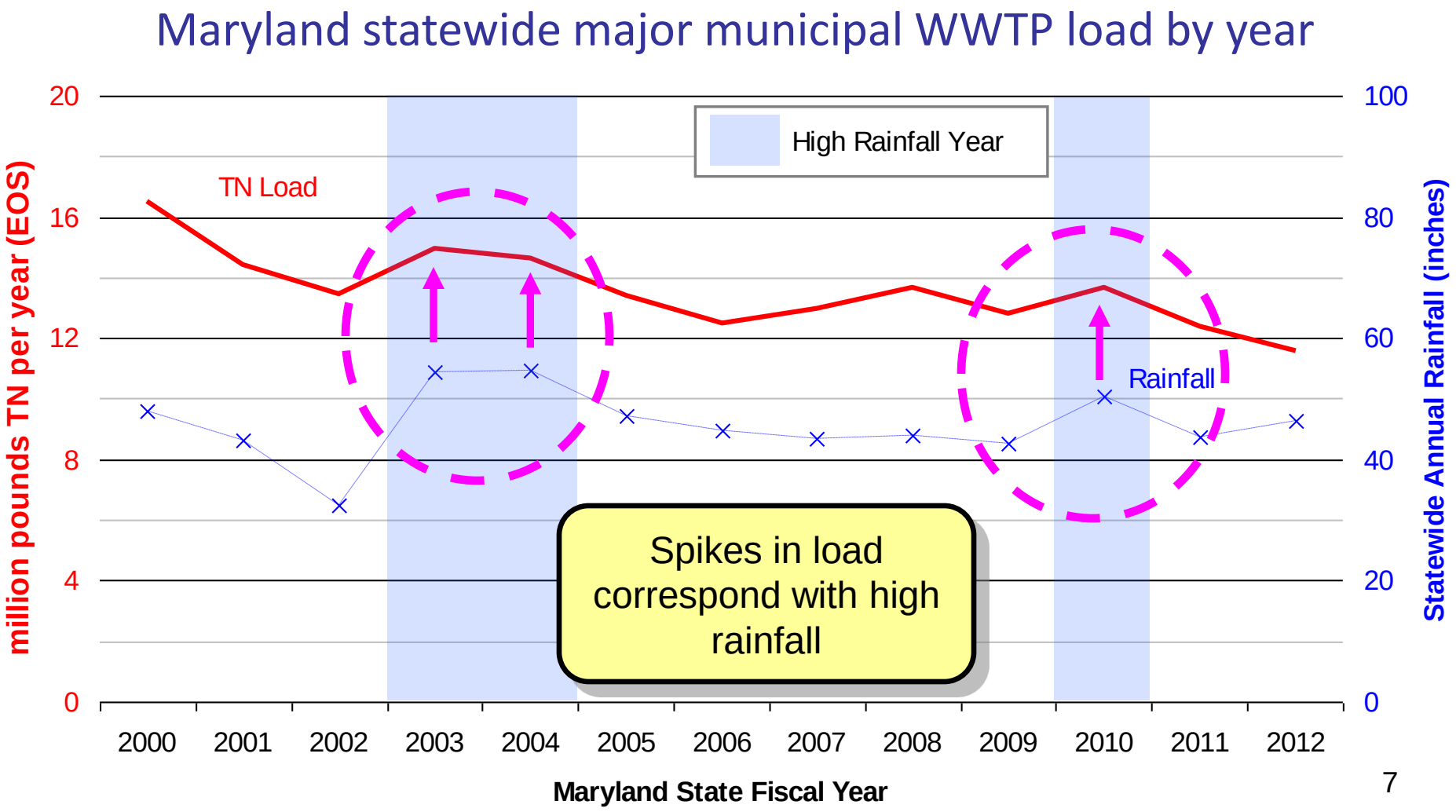
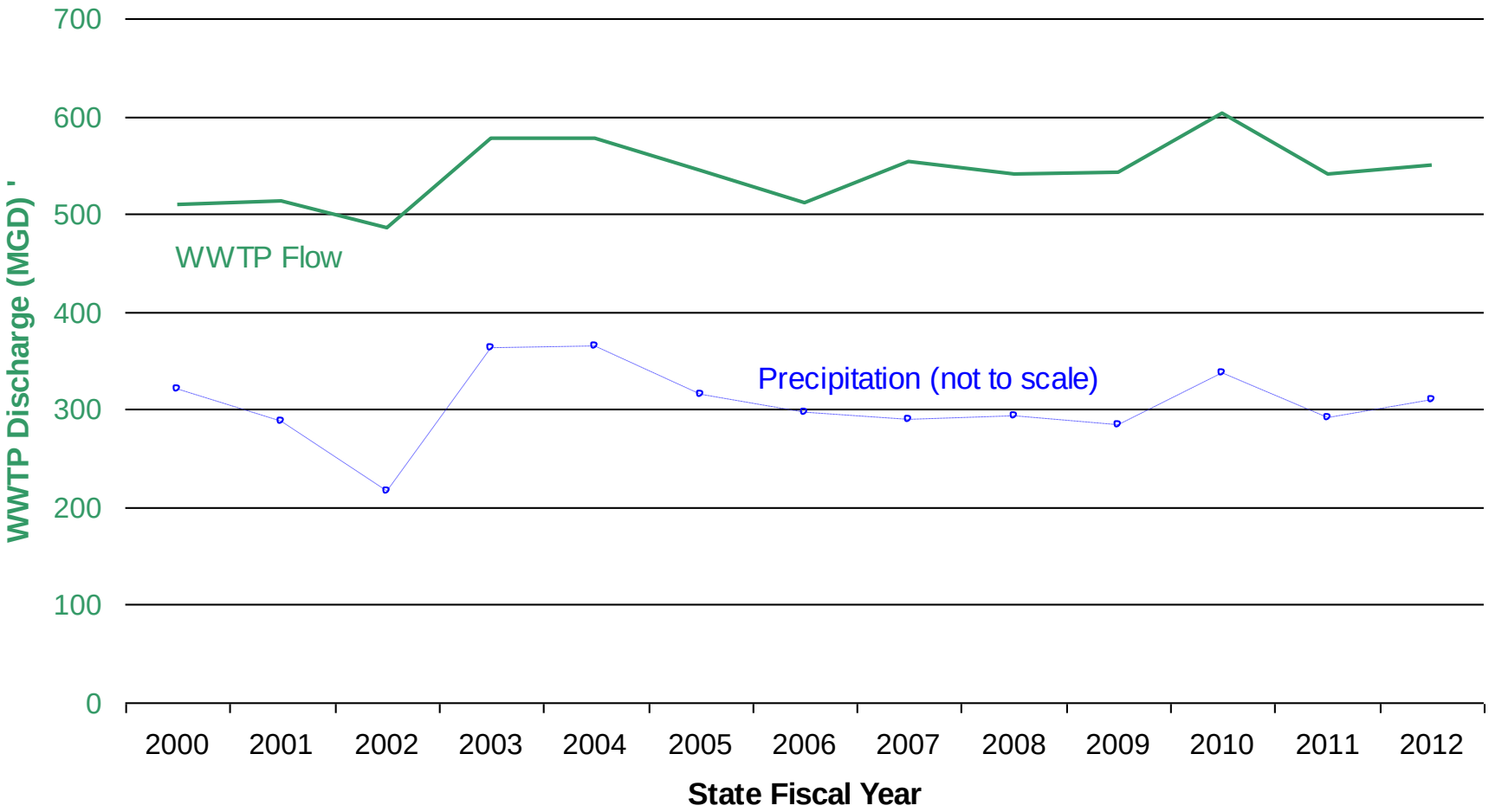


Trends in WWTP Flow

Maryland statewide major municipal WWTP outflow by year



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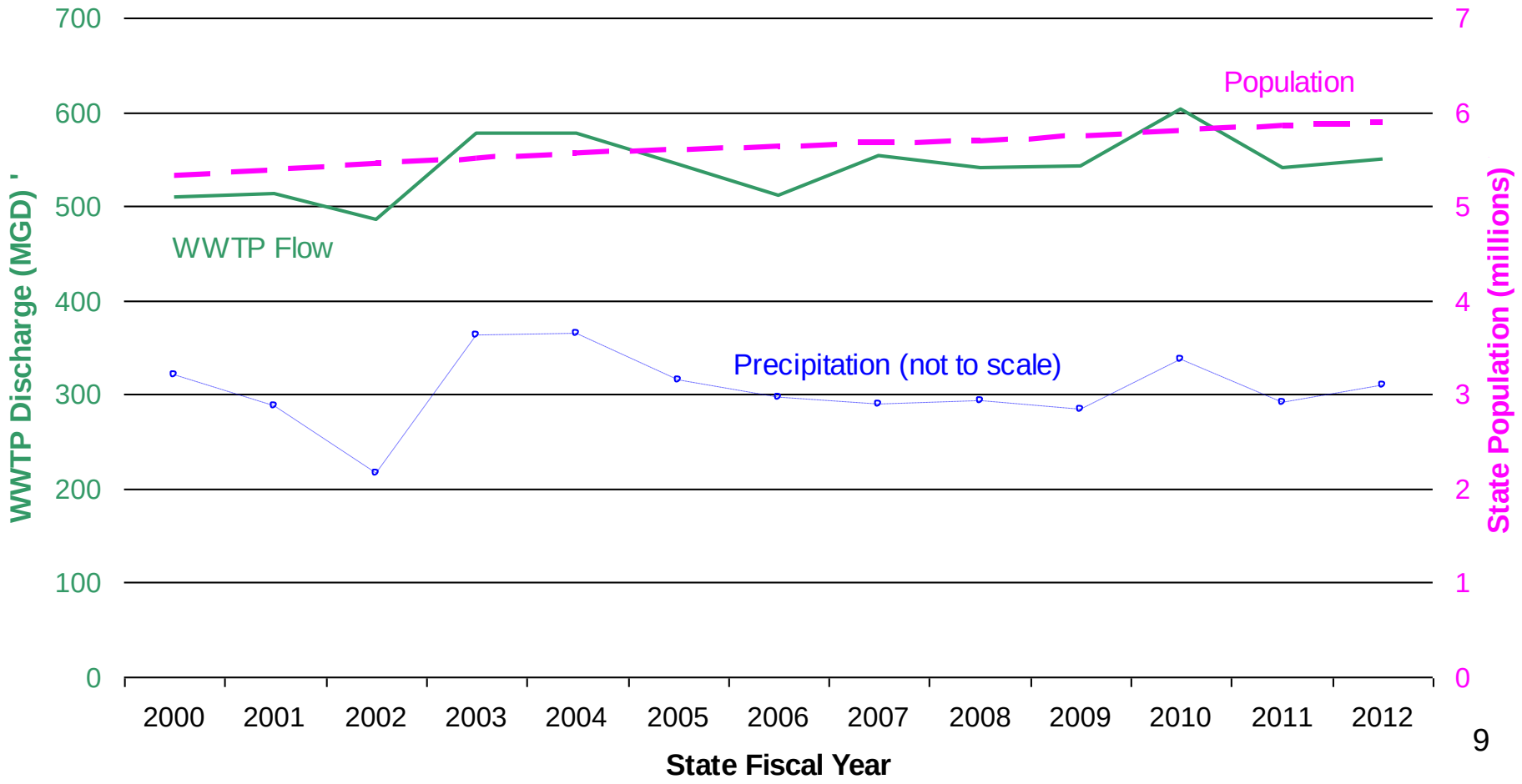

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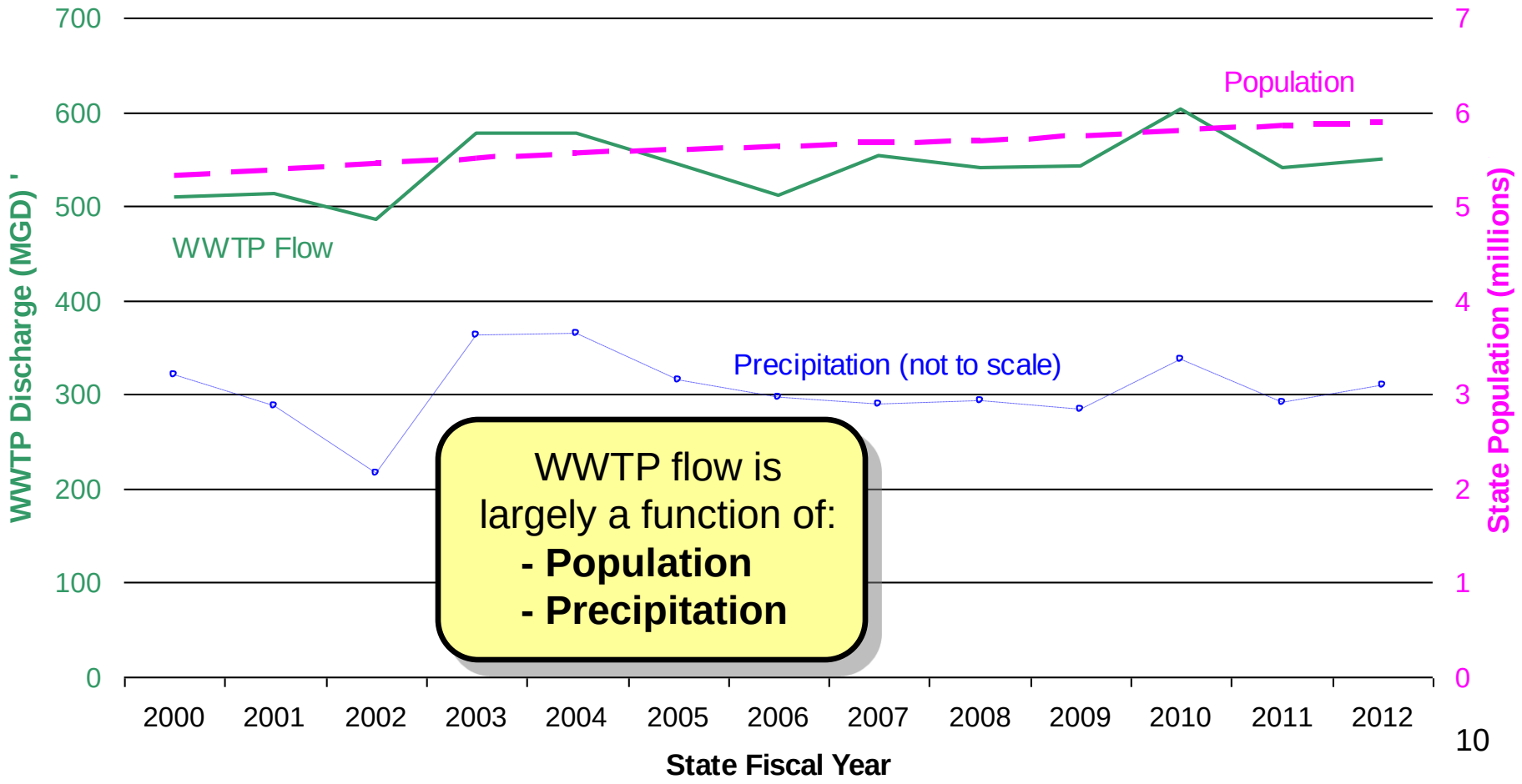
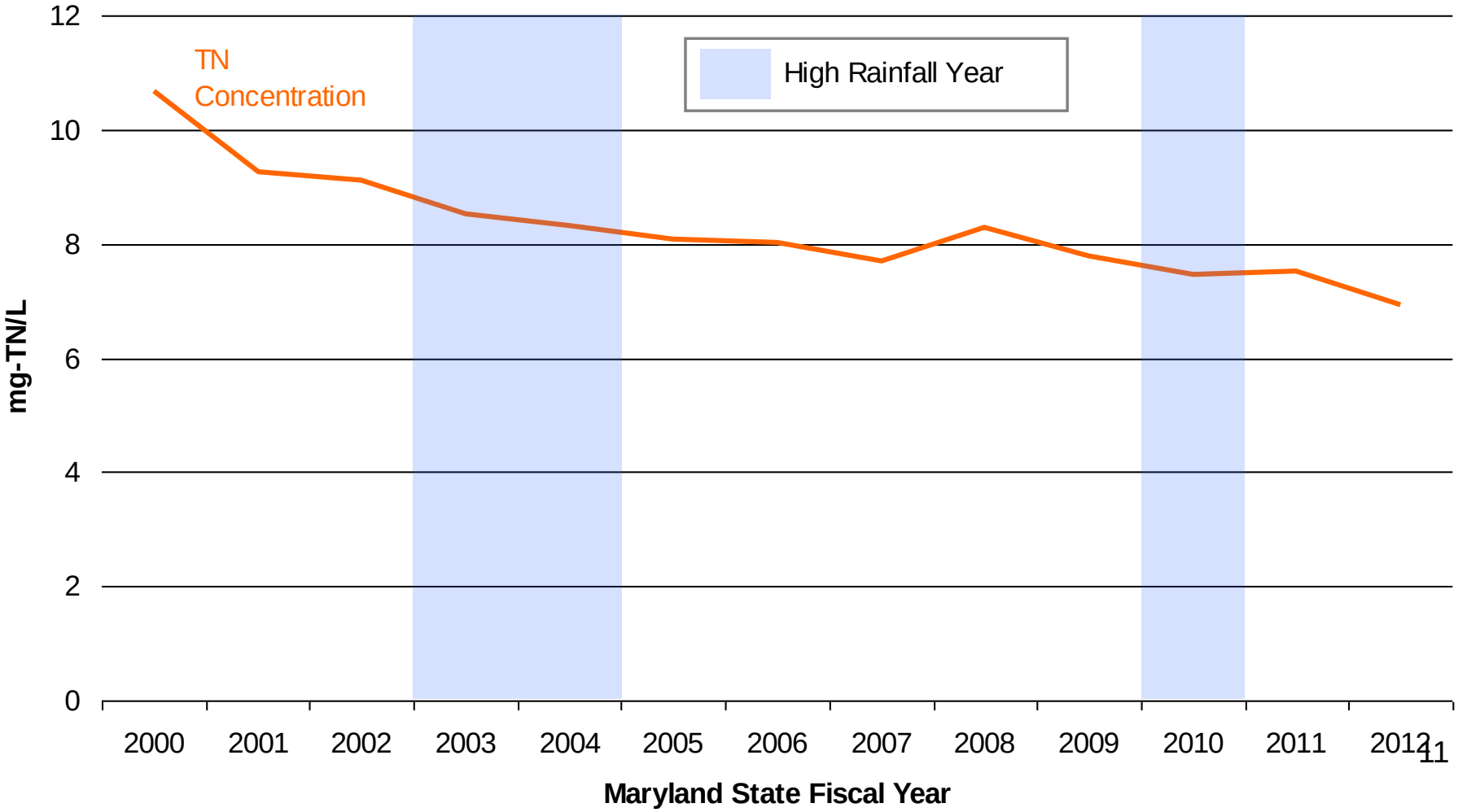


WWTP flow is largely a function of:
- Population
- Precipitation

Trends in WWTP Concentration

Maryland statewide average major muni WWTP concentration by year



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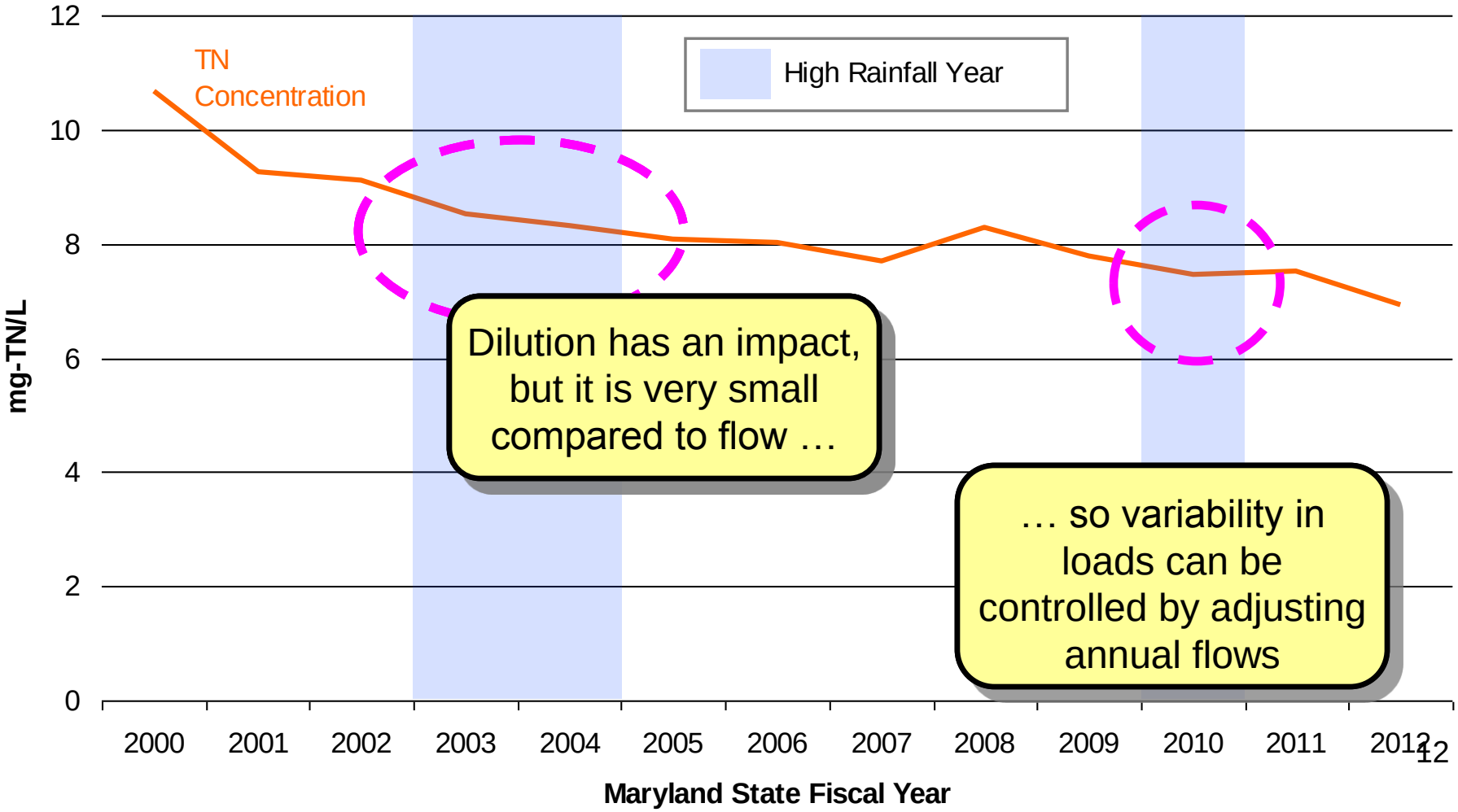
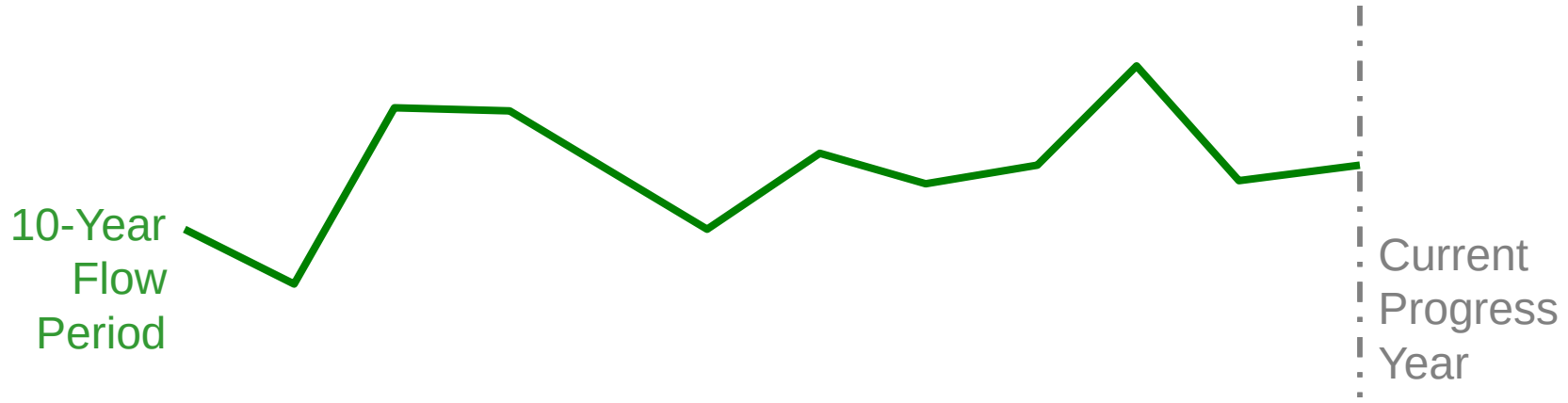


Flow Averaging Method

- 10-year rolling average of WWTP outflows
- Increased proportionally by population growth from the midpoint to the final year

$$\text{Adjusted 2010 Flow} = \frac{\text{average flow (2001 – 2010) x 2010 population}}{\text{midpoint population (2005.5)}}$$



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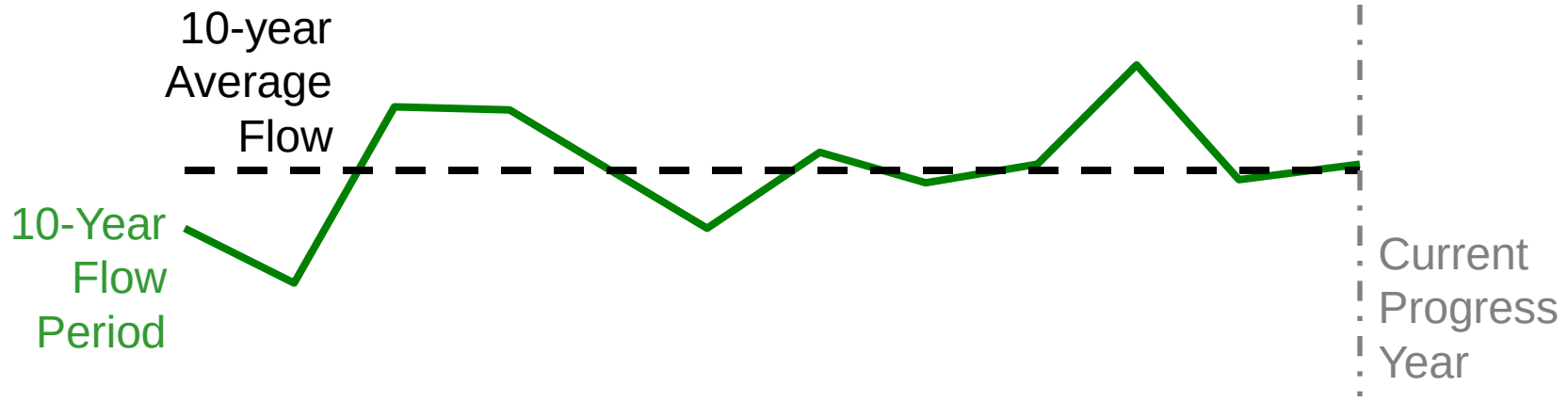

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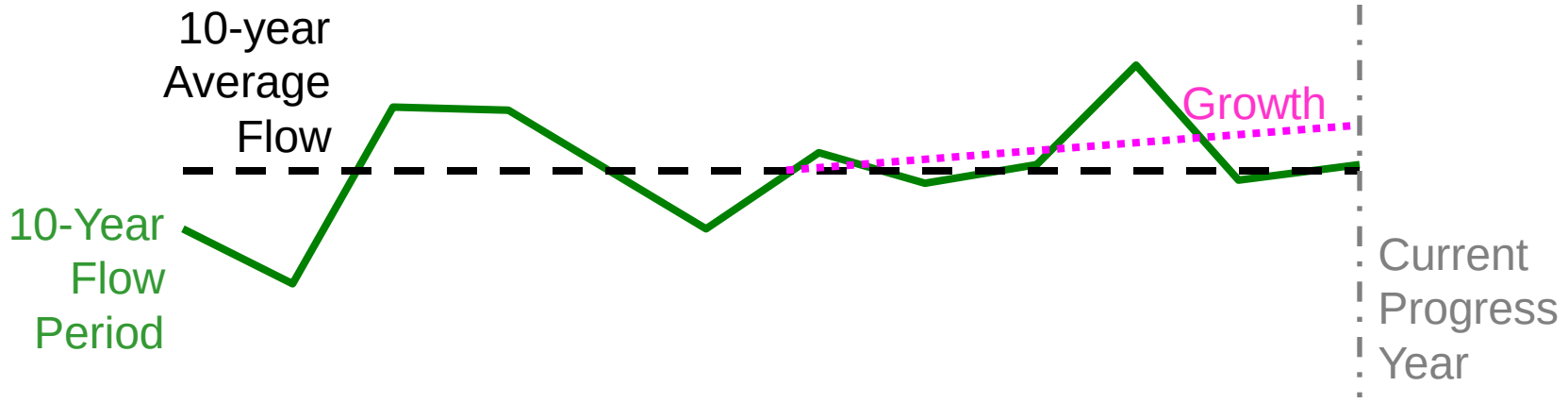

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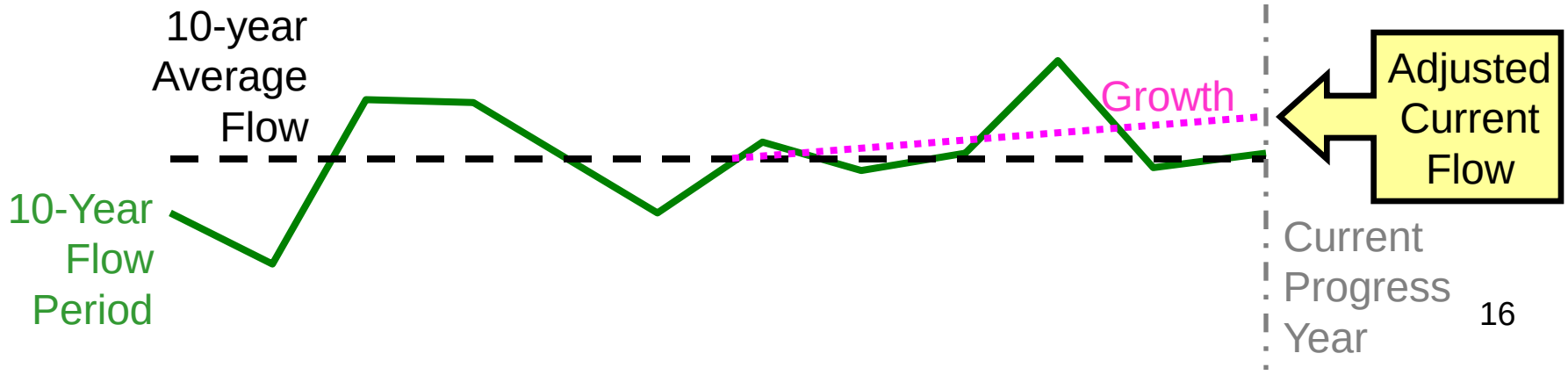

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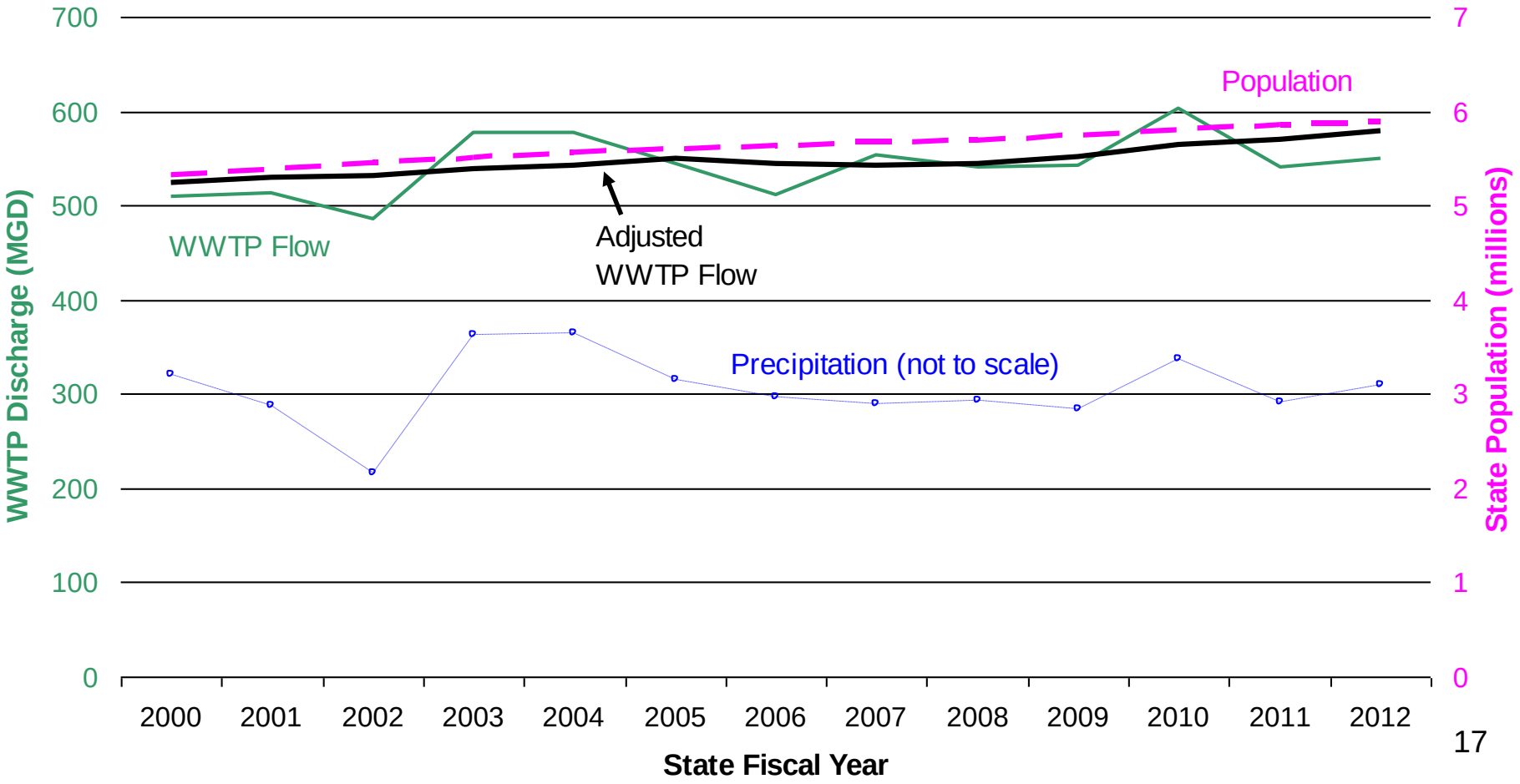
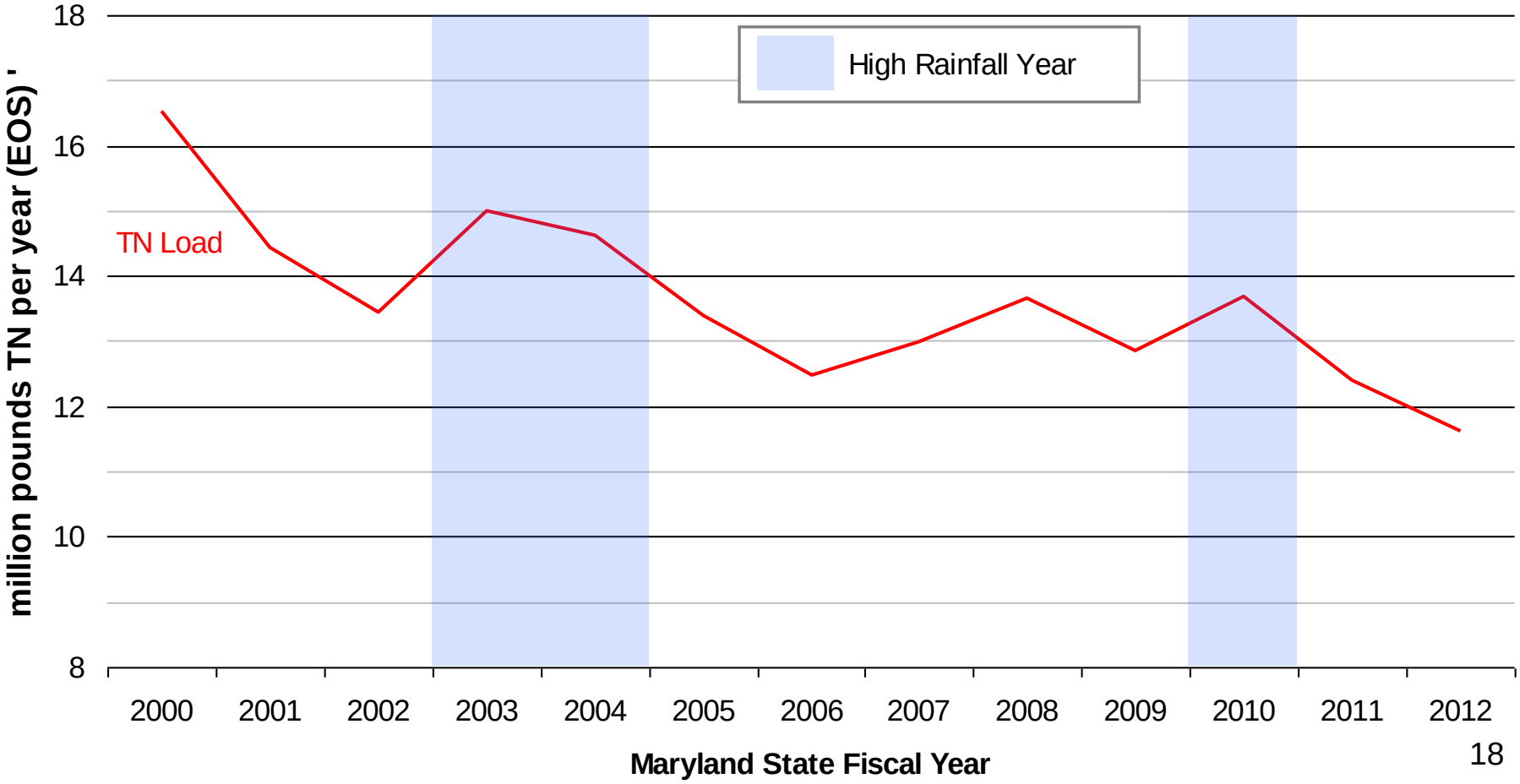


Adjusted WWTP Loads

Maryland statewide major municipal WWTP loads by year



Flow-Adjusted WWTP Loads

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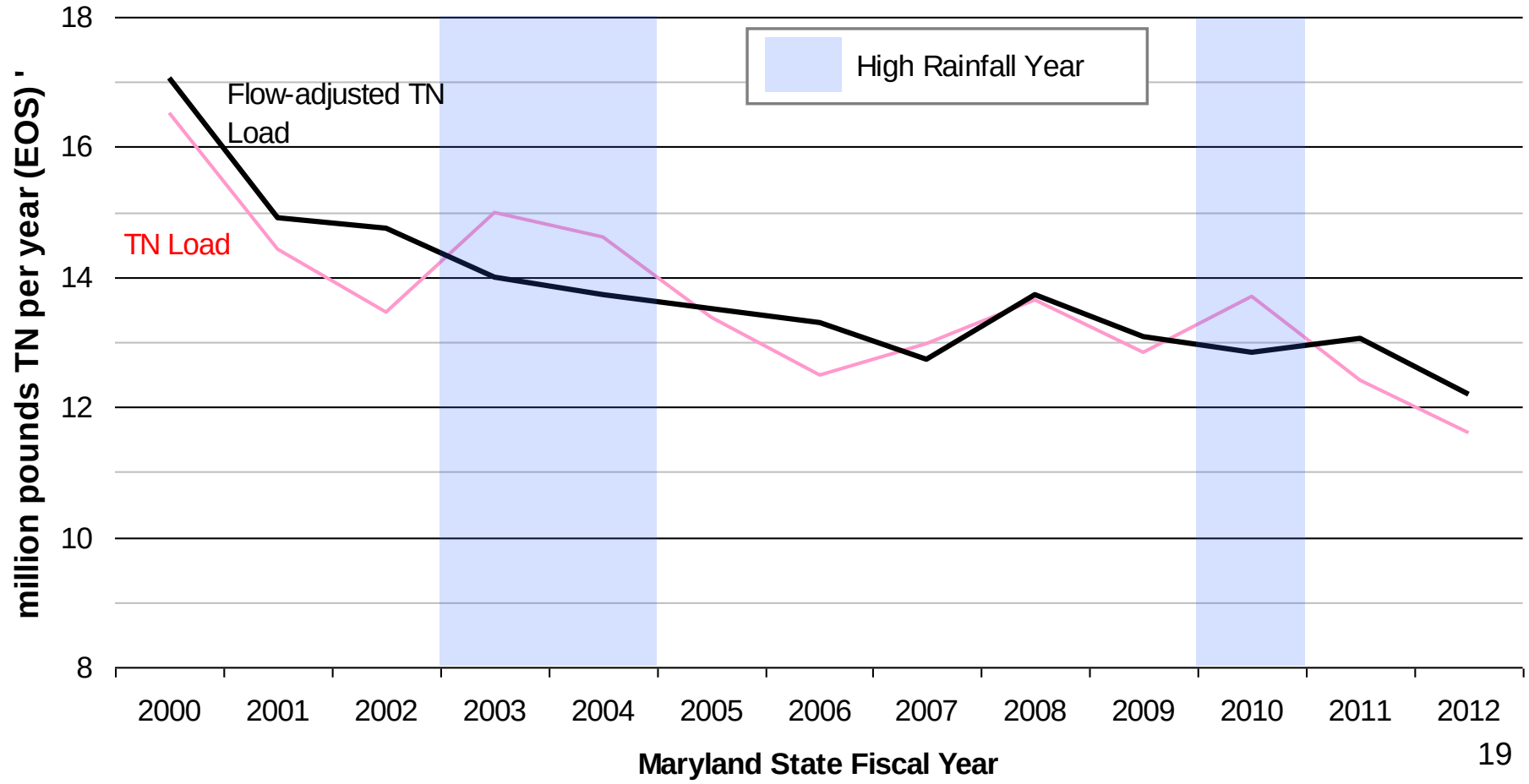

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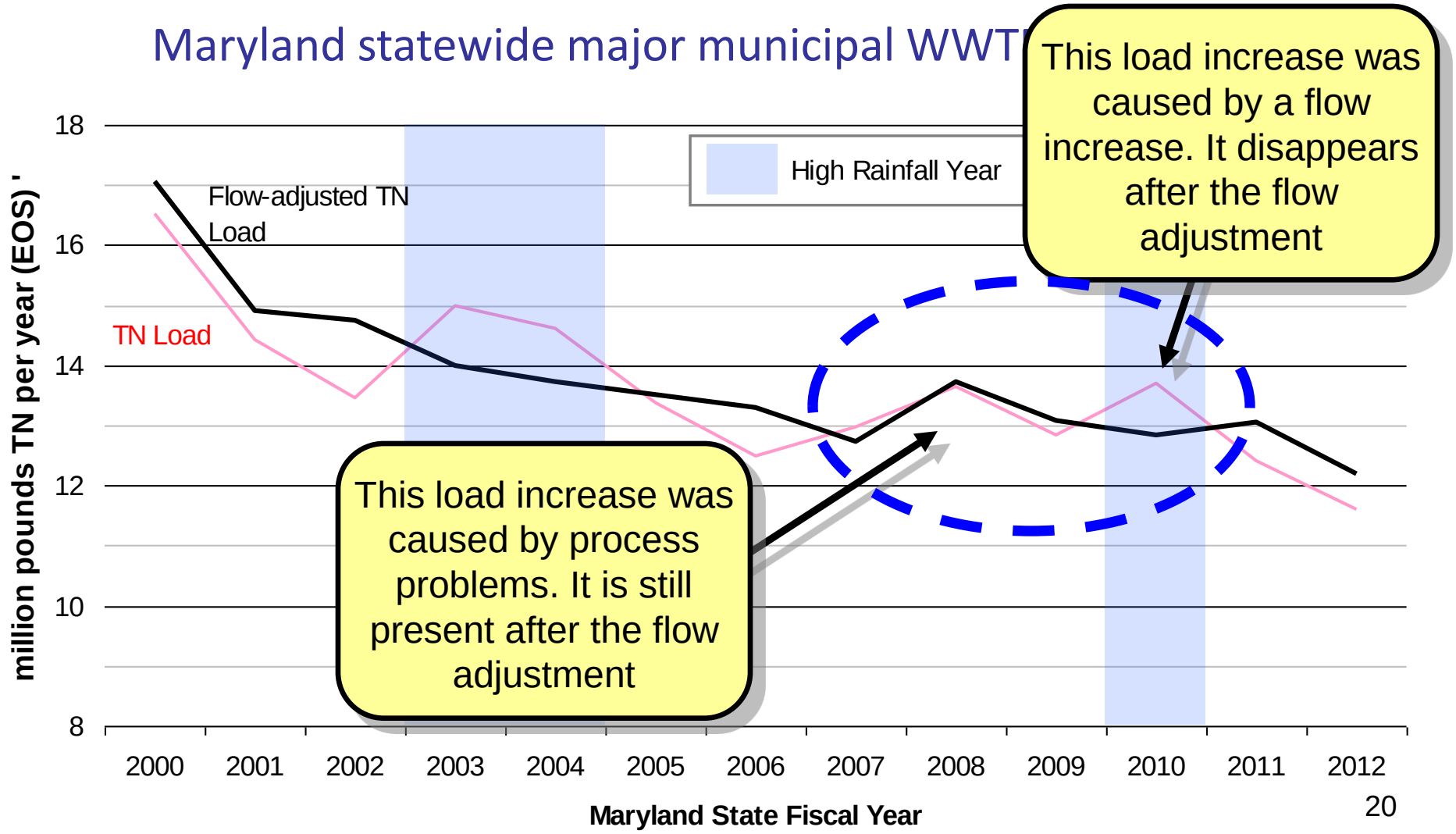
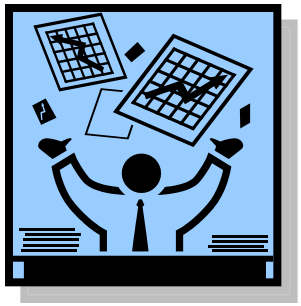
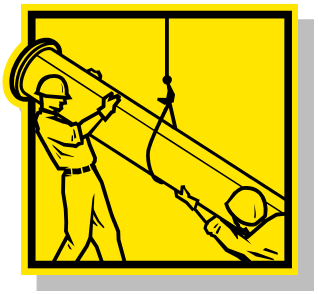


Potential Technical Issues



- This method requires additional data for population growth
  - The US Census Bureau provides yearly population estimates by county
  - Must assume proportionality between county population and number of WWTP users



- Using a 10-year averaging period masks the benefits of I&I improvements
  - Facilities that have done significant I&I projects could opt for a 3-year average flow

Consistency with NPS Reporting

- Nonpoint sources currently report progress using a fixed 10-year average for rainfall
  - 10-year period simulates average hydrologic conditions.
  - No annual variability in scenario due to rainfall fluctuations
  - Growth is accounted for through land use changes

- Estimating point sources with a rolling 10-year average would make them more consistent with nonpoint sources
  - Like for NPS, a long-term averaging period simulates average hydrologic conditions
  - Minimal annual variability due to rainfall fluctuations
  - Growth is accounted for through changes in adjusted annual flow

Conclusions

- Using the current Progress methodology for reporting point source loads, the benefits of important management actions are being masked by precipitation variability
- To control for rainfall-driven fluctuations in annual point source loads:
  - WWTP flows should be averaged over a 10-year period and adjusted by population growth
  - Annual WWTP nutrient concentrations do not need adjustment since they provide a good measure of statewide WWTP performance
- This method highlights legitimate (process-driven) changes in annual load while de-emphasizing the impact of precipitation-driven fluctuations.
  - It also increases the internal consistency between PS and NPS evaluation

We would like the WWTWG's assessment about whether this is a technically sound method to normalize loads by controlling for precipitation-driven flow variability. *Please provide any feedback to MDE by the end of June.*

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