Visualizing alternative pathways for reducing phosphorus loads into Lake Erie

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Motivation

- HABs have become endemic to the western basin of Lake Erie in recent years
- GLWQA has set revised targets to prevent HABs
- Can and how do we achieve these loads?

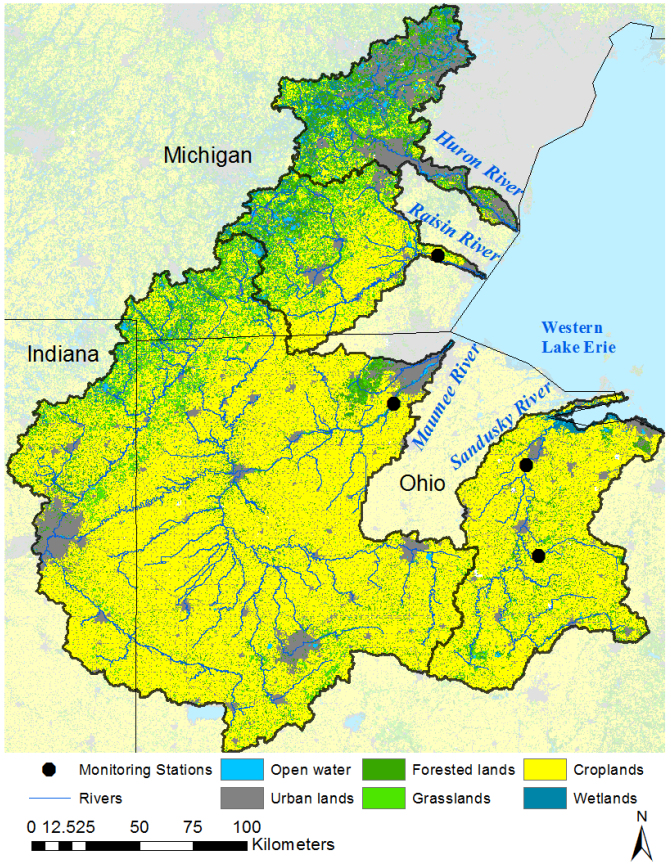
	Maumee River Watershed (MRW)	Western Lake Erie Basin
Dissolved Reactive Phosphorus (DRP)	186 metric tonnes	40% of 2008 loads
Total Phosphorus (TP)	860 metric tonnes	40% of 2008 loads

Goal & Objectives

- Evaluate *extreme* land management and land use changes to put bounds on what might be expected from changes in agricultural BMPs.
  - (1) Evaluate system response to stopping fertilizer applications
  - (2) Evaluate impact of extreme land cover and cropping changes on P loads

Study Area

- Maumee River Watershed
  - Primarily agricultural
  - Low sloping topography
  - A lot of clay soils



Important SWAT Details:

- Fixed bug in SWAT 2012 code to move P through tiles (~40% coming from tiles)
- Initialized SWAT at lower soil phosphorus conditions than default

Methods - Scenarios

- System response to stopping fertilizer applications:
  1. Business as usual
  2. No nitrogen or phosphorus fertilizers
  3. No phosphorus fertilizers (incl. manure)
  4. No inorganic phosphorus fertilizers
- Run under same year's weather: high spring rainfall, high spring streamflow, average year, dry year

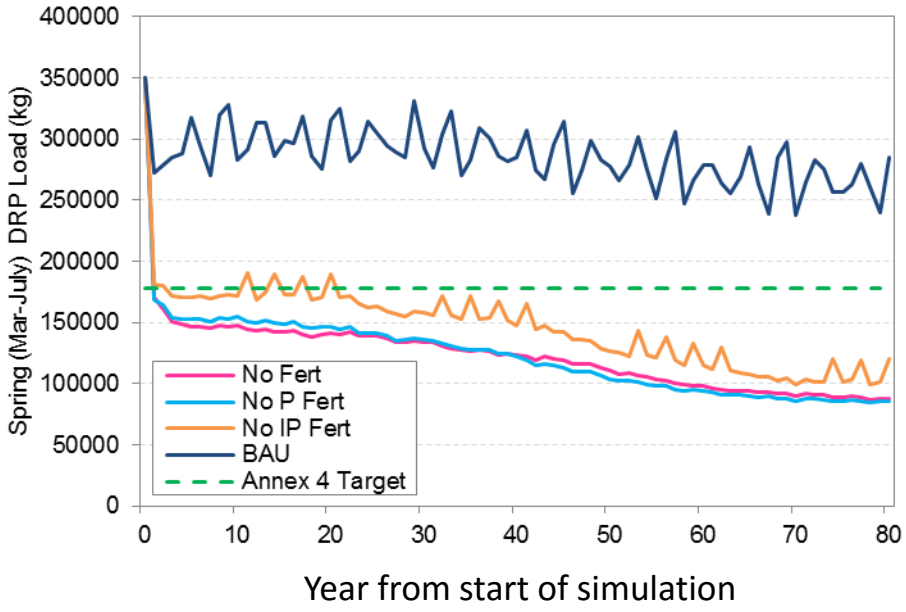
Methods - Scenarios

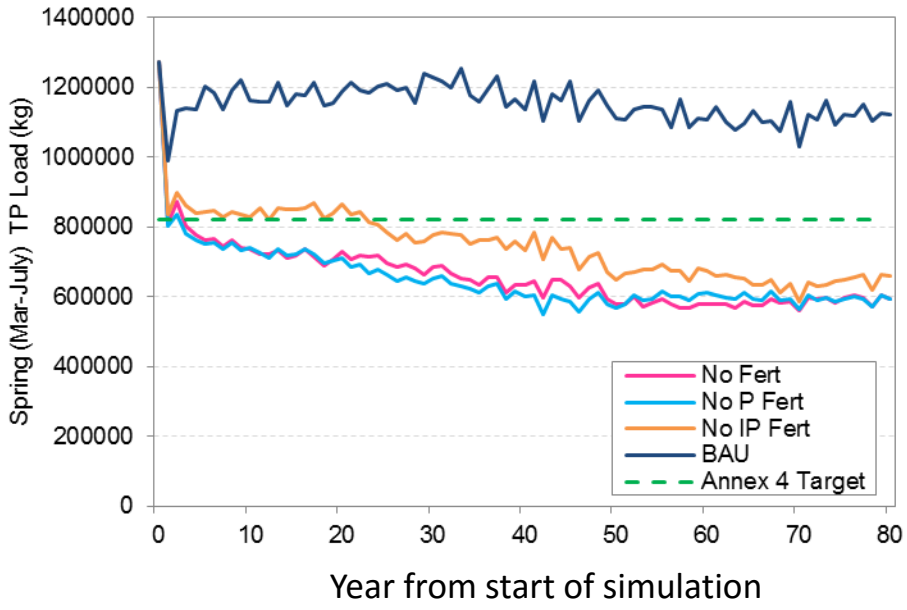
- Land management changes
  1. Rate of applications: 75%, 50%, 25%, 0% of baseline applications
  2. Filter strips: 25%, 50%, 75%, 100% of agricultural lands buffered
  3. Cover crops: cover crops added in winter (except when wheat is on) on 25%, 50%, 75%, and 100% of agricultural lands

Methods - Scenarios

- Land use changes
  1. Alternative row crops: continuous sunflower, continuous lentil, and sunflower-lentil rotation
  2. Cellulosic biofuel crops: switchgrass and Miscanthus with and without manure applications

Results – Stopping Fertilizers Applications





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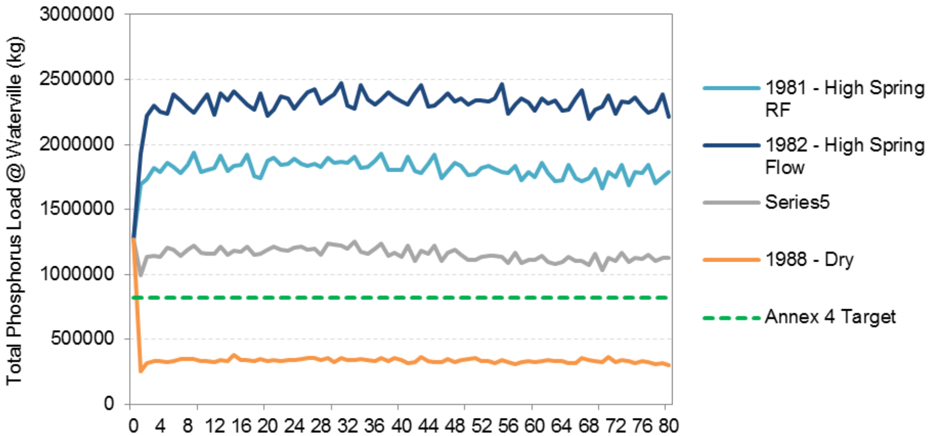

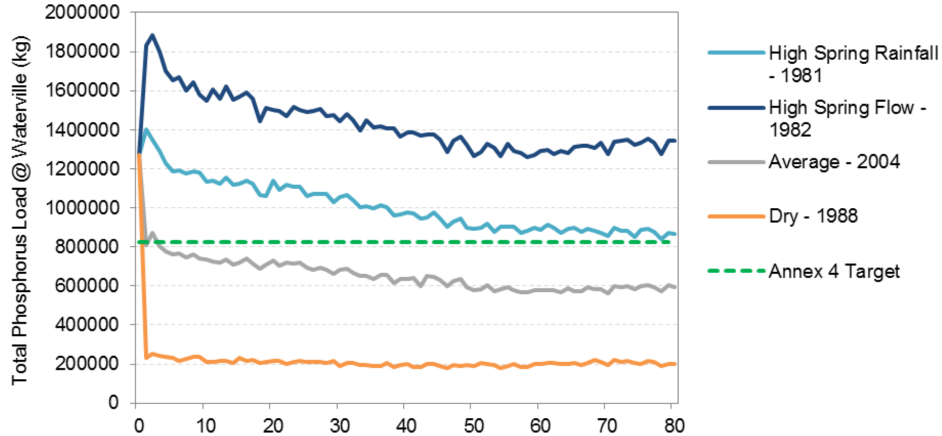

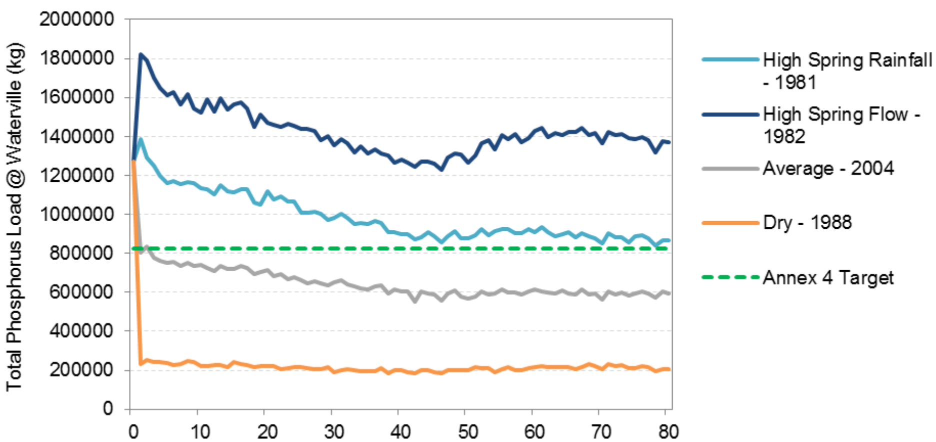

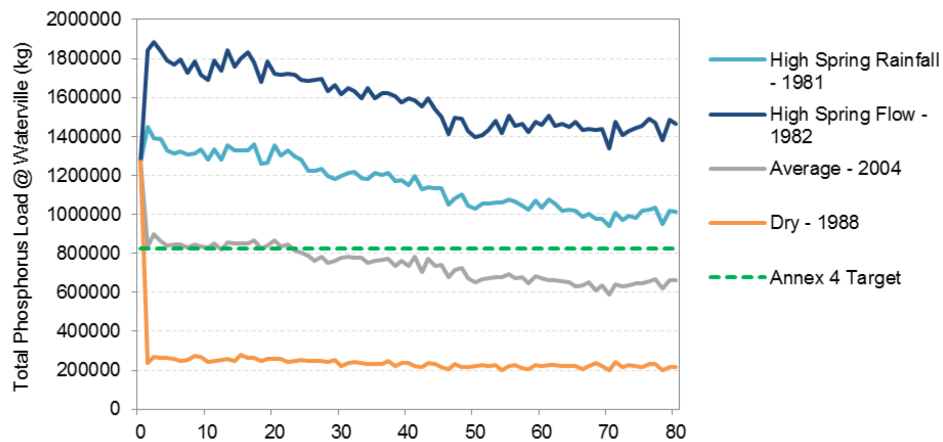

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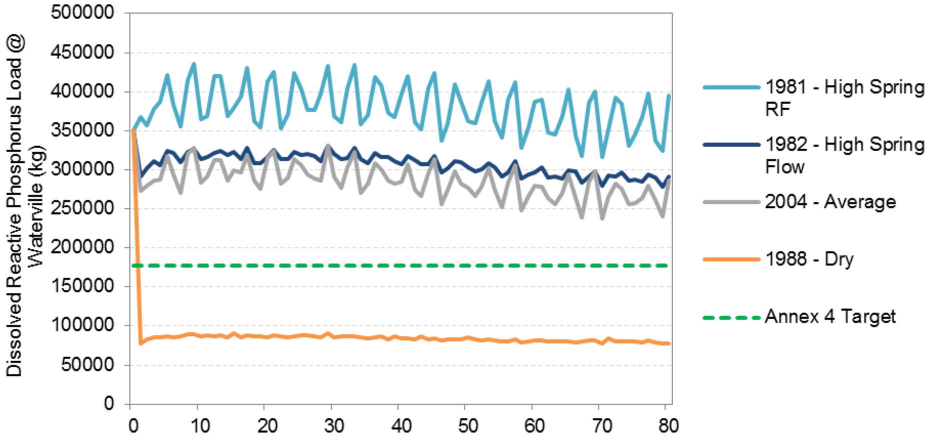

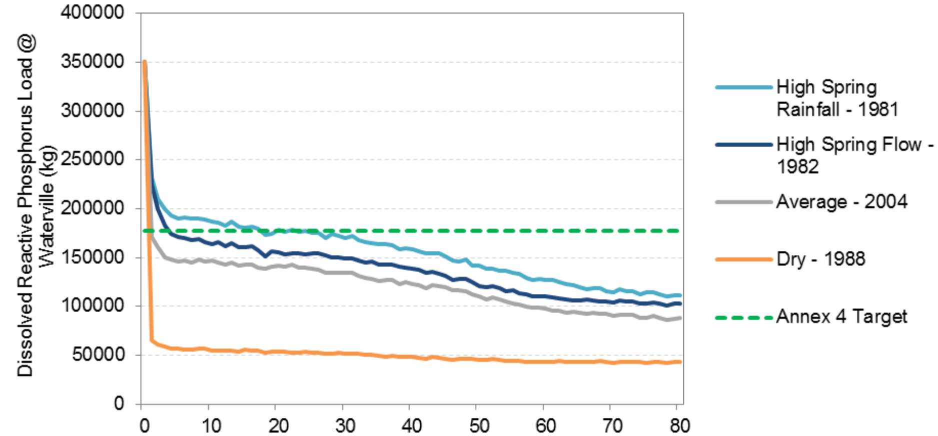

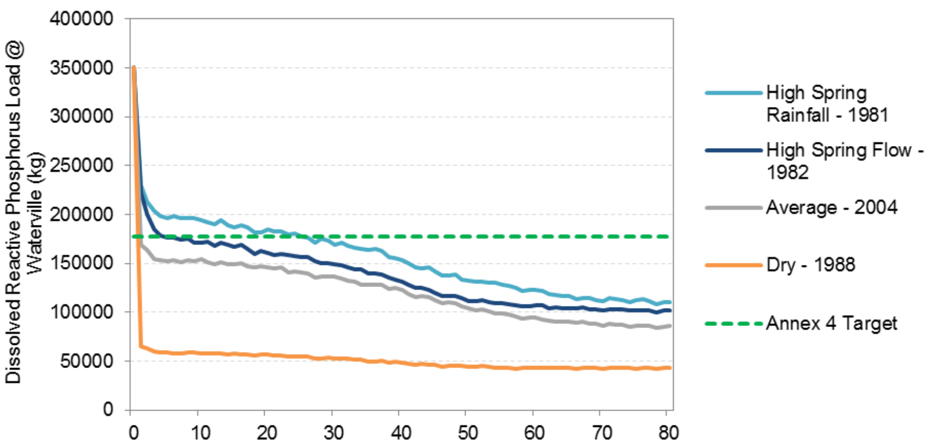

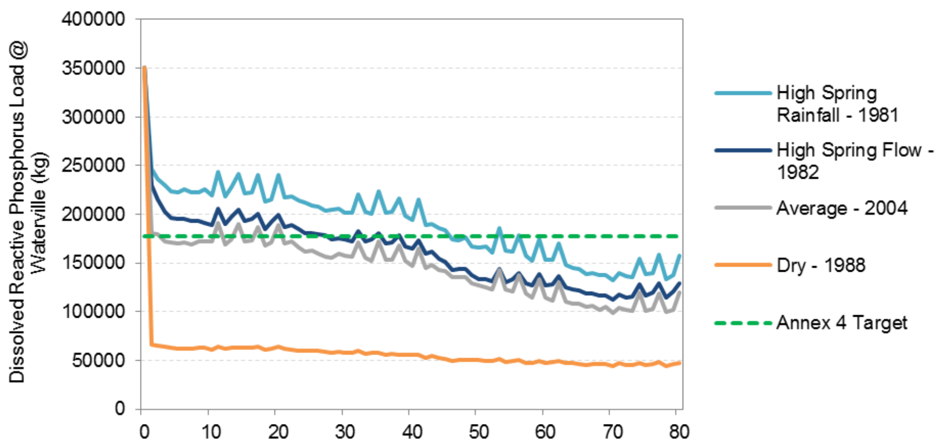

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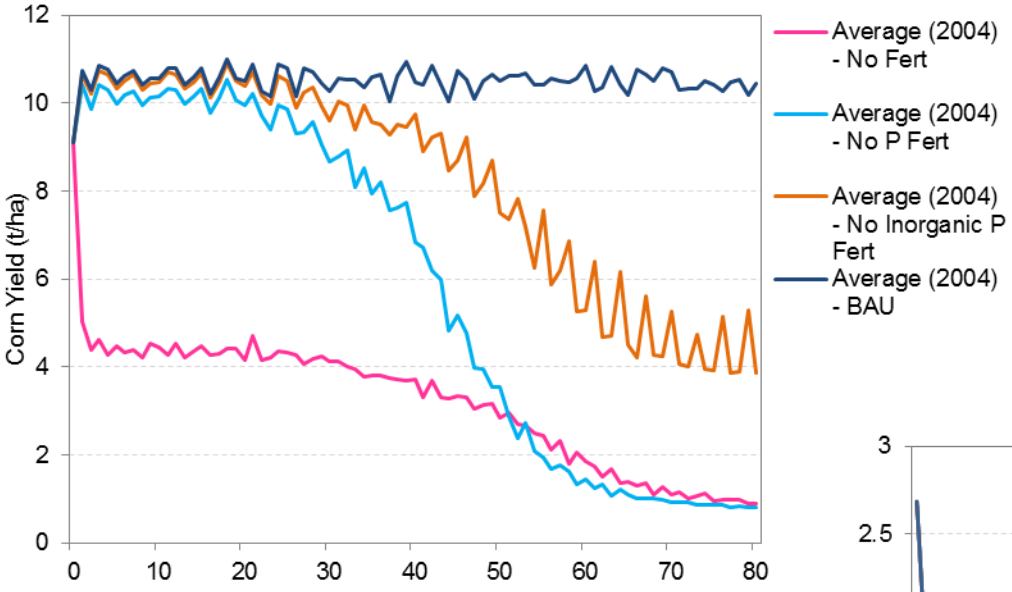
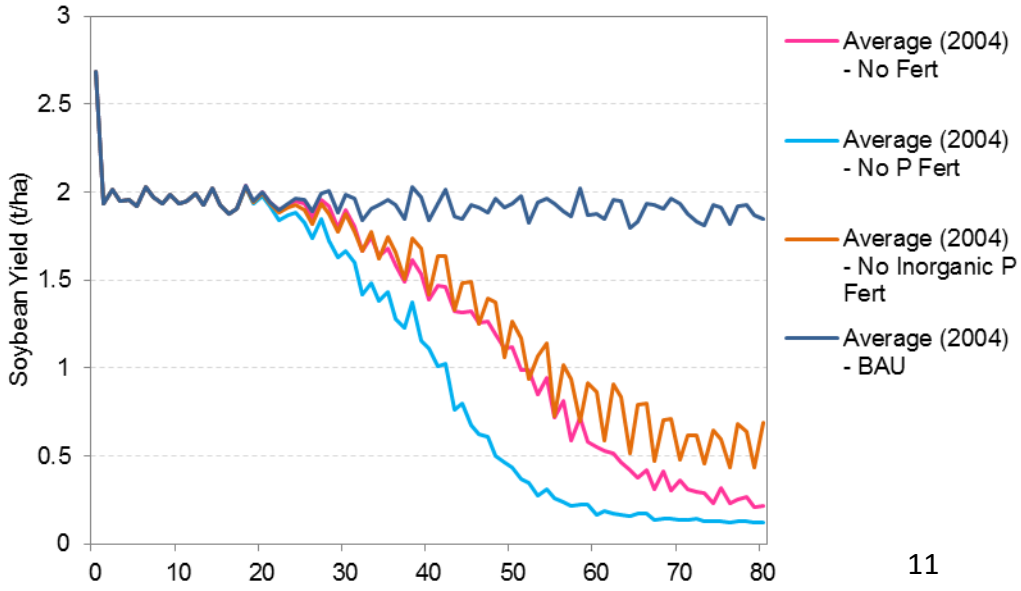
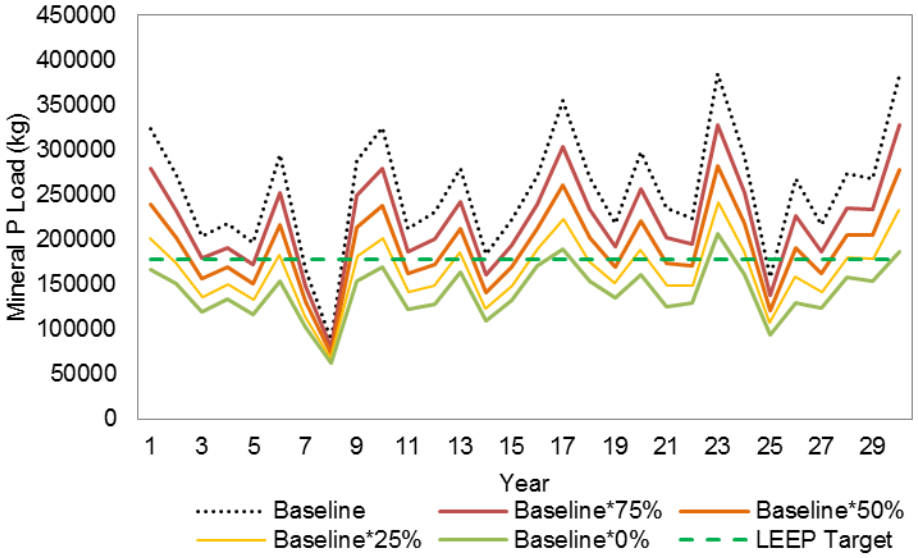
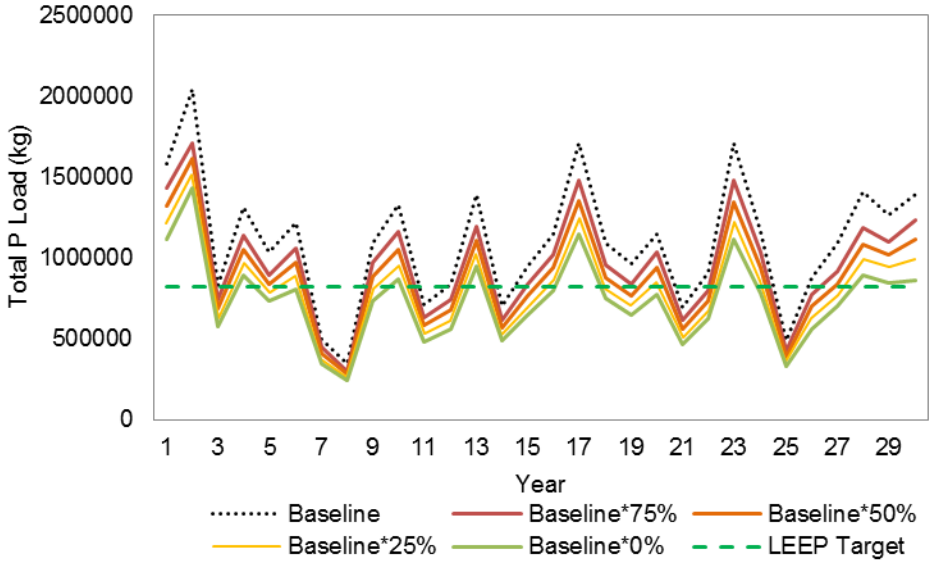




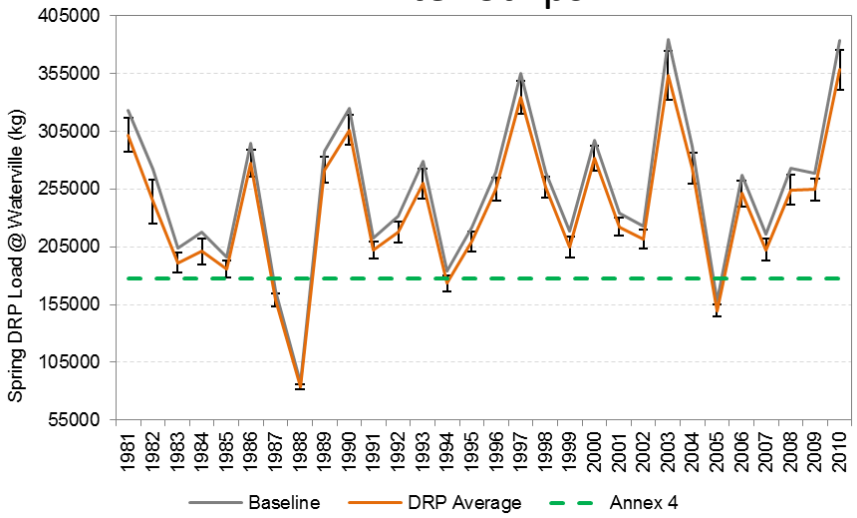
Results – Application Reduction



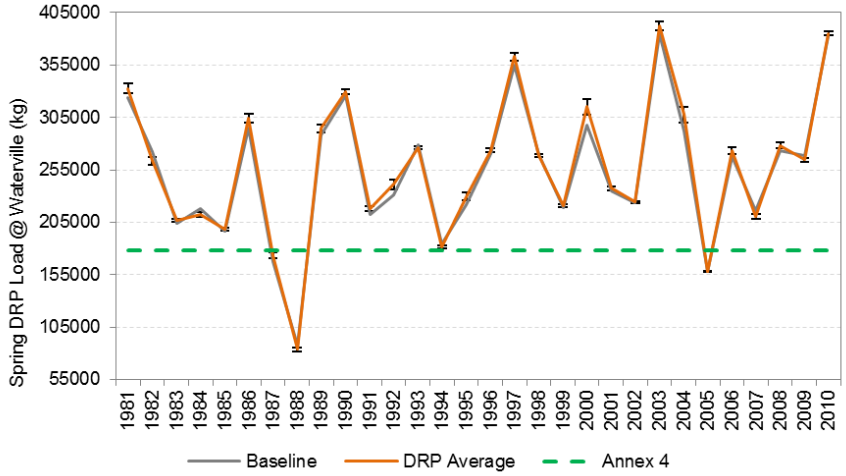


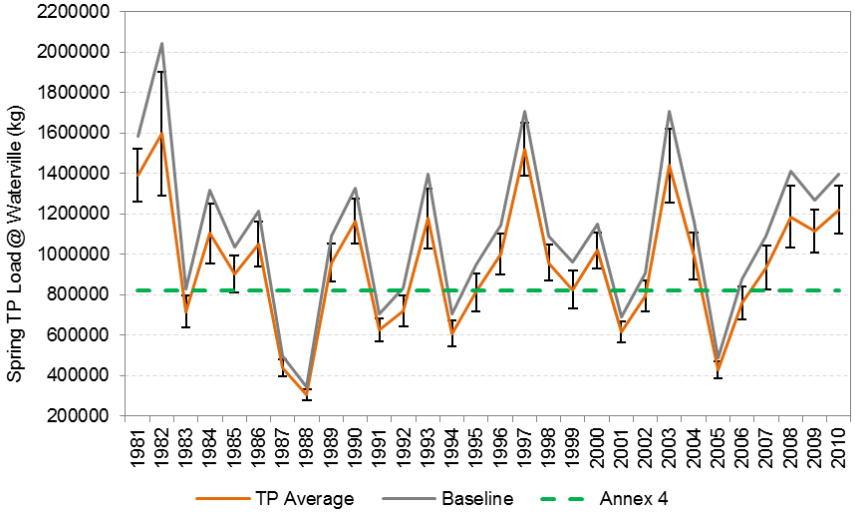
Results – Filter Strips & Cover Crops

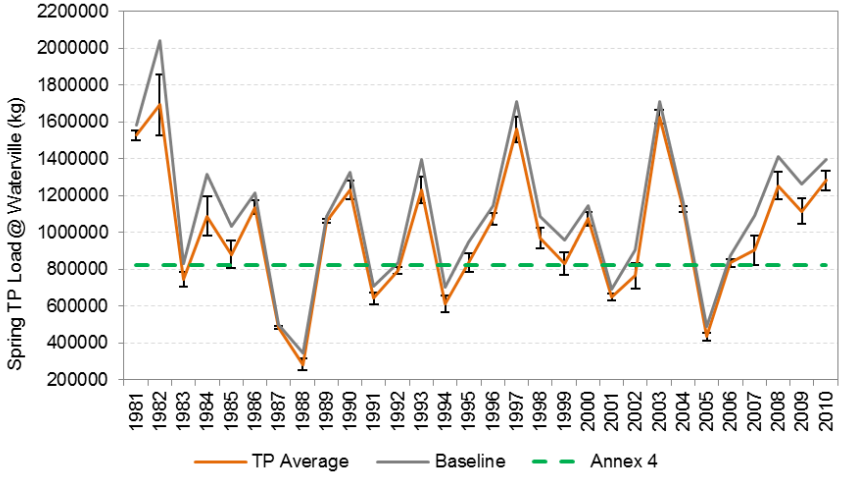
Filter Strips



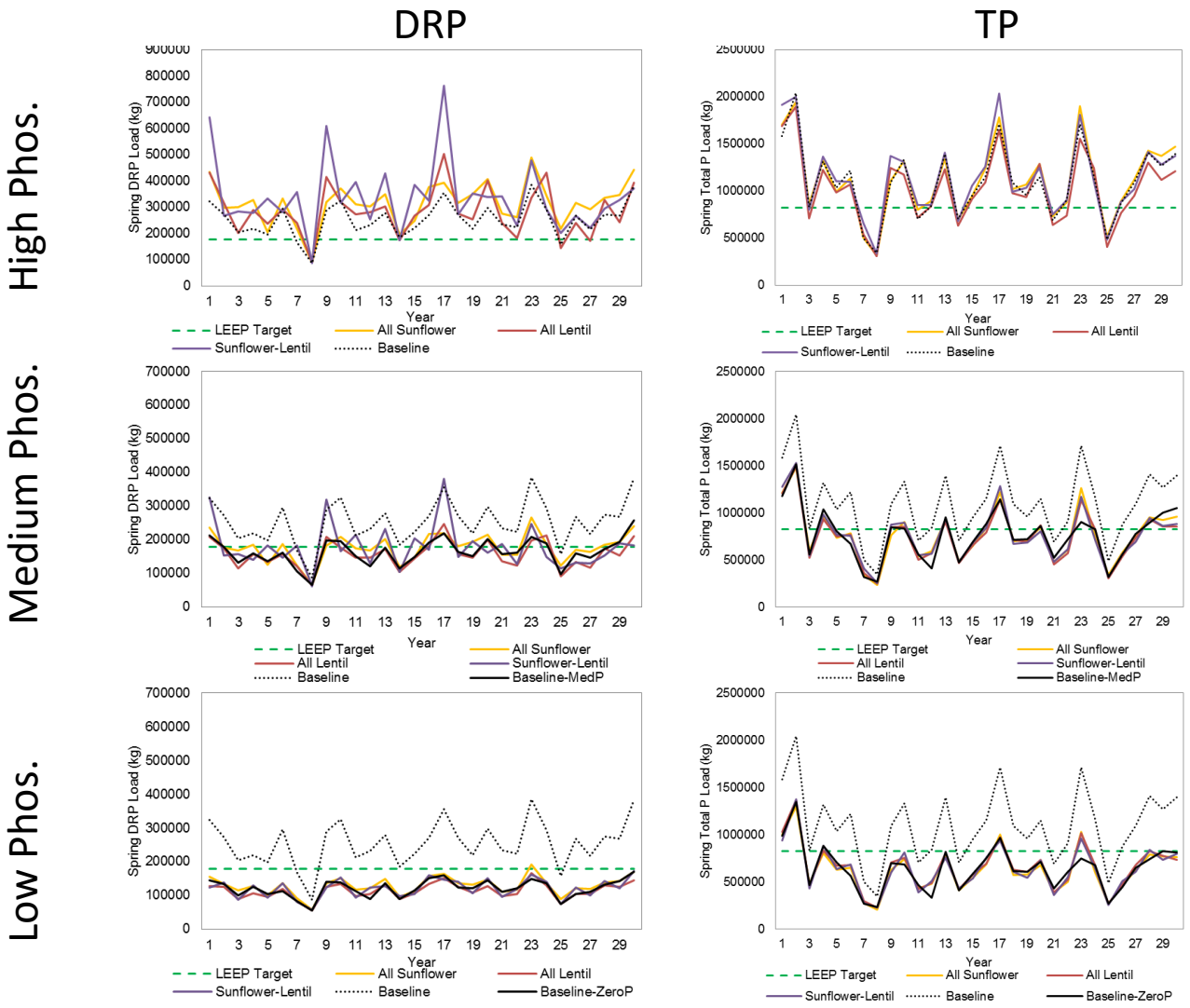
Cover Crops



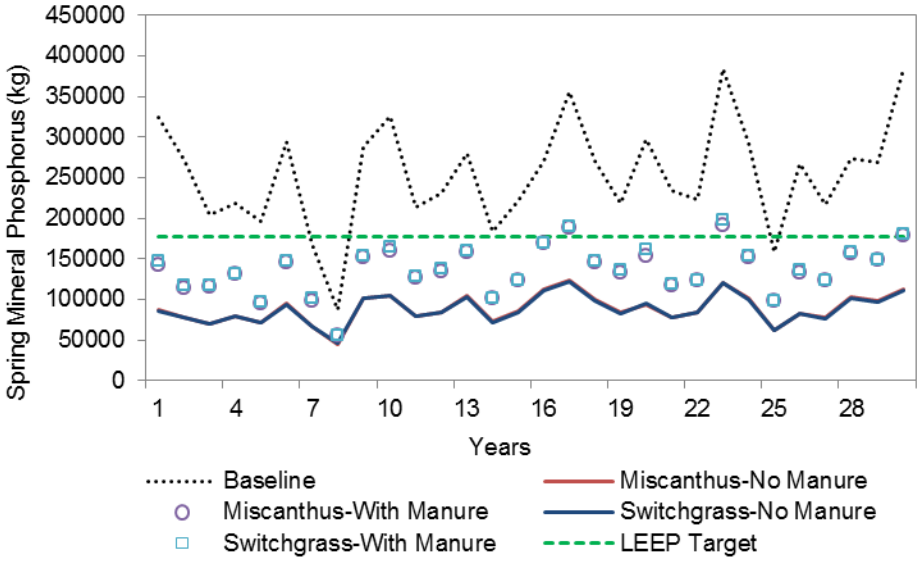


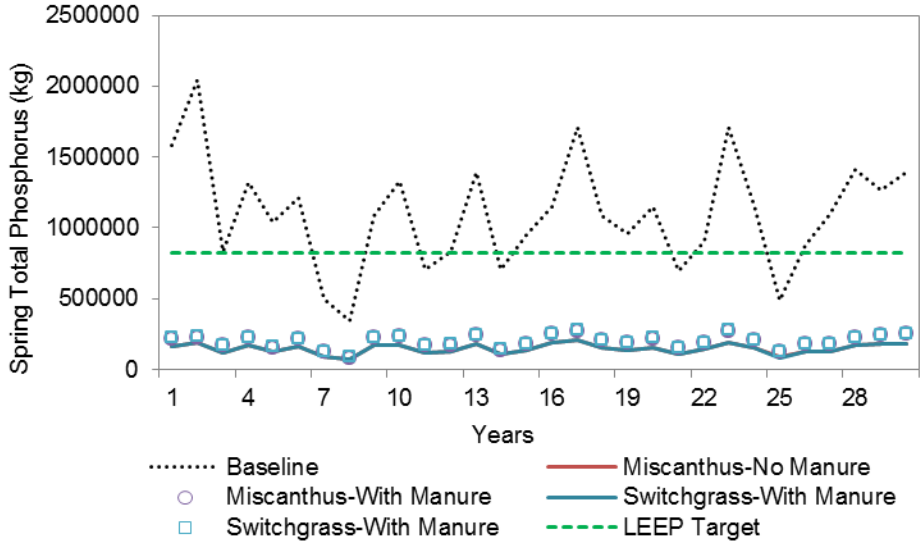


Results – Alternative Row Crops



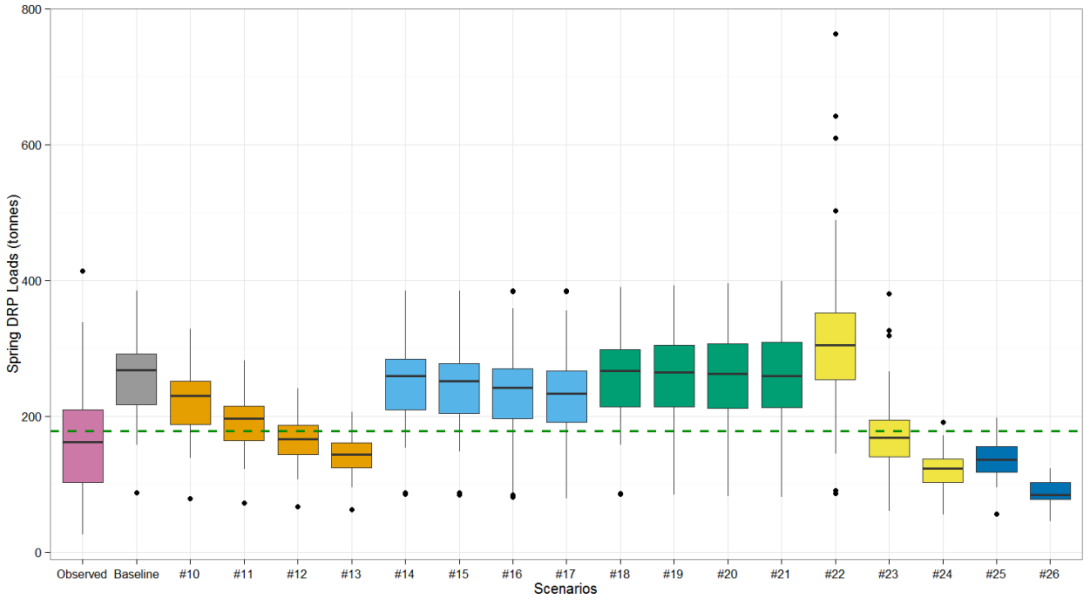
Results – Perennial Biofuel Crops



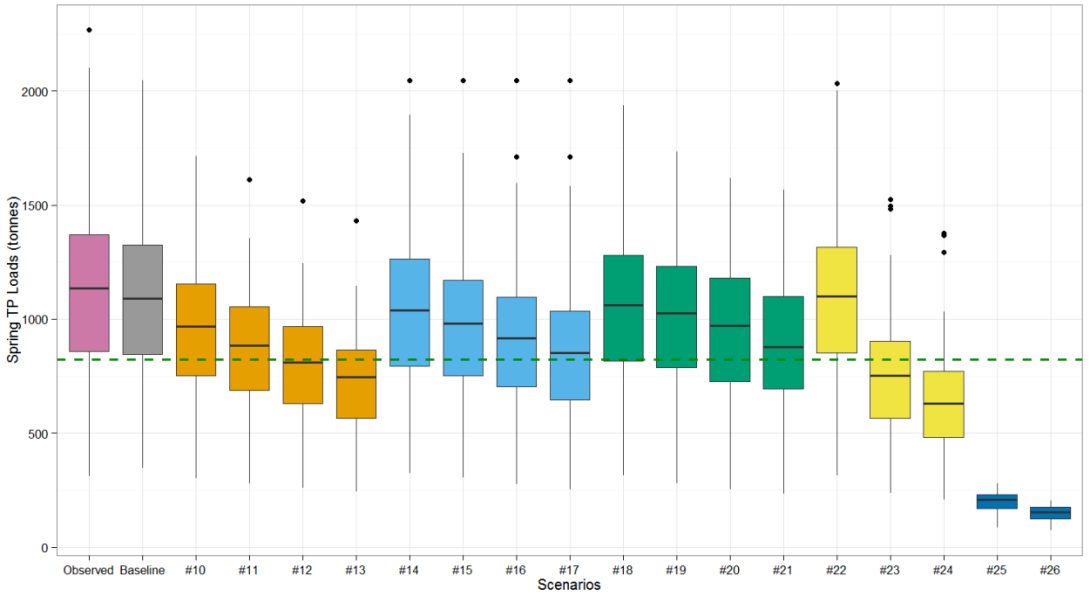


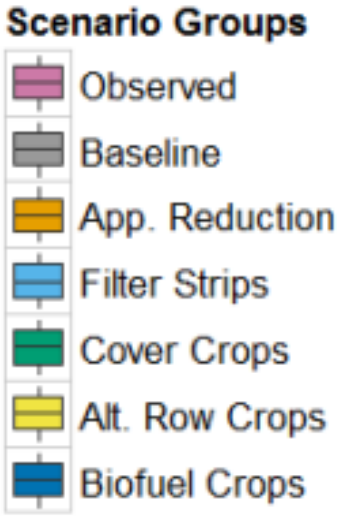
Results - Comparison

DRP



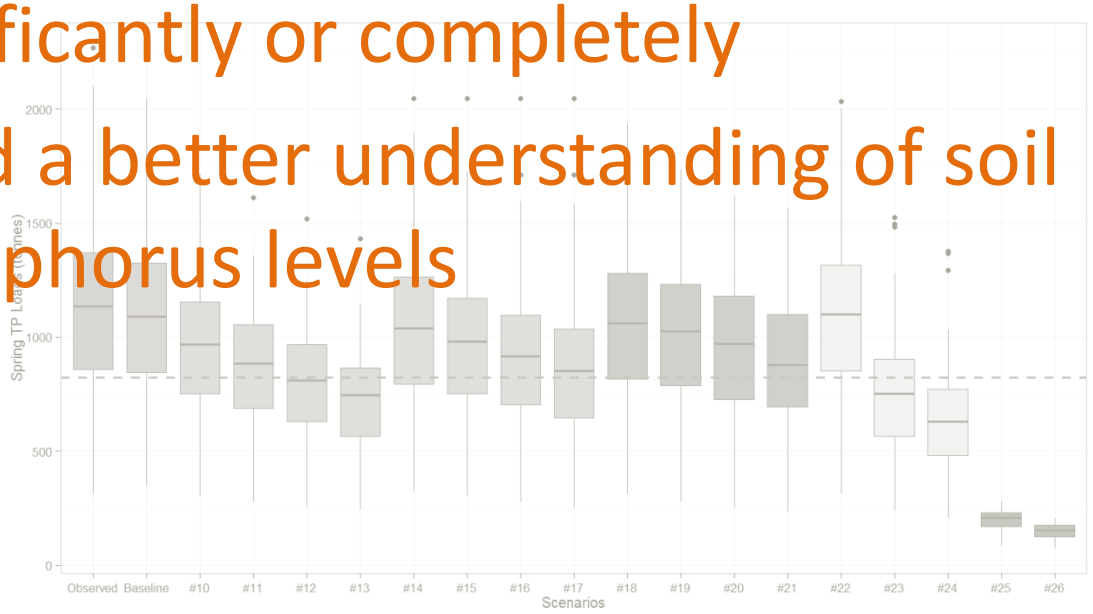
TP





Conclusions

- BMPs alone may not be enough to reach **both** DRP **and** TP targets
- Scenarios that achieved targets most often were those that reduced P application significantly or completely
- Need a better understanding of soil phosphorus levels

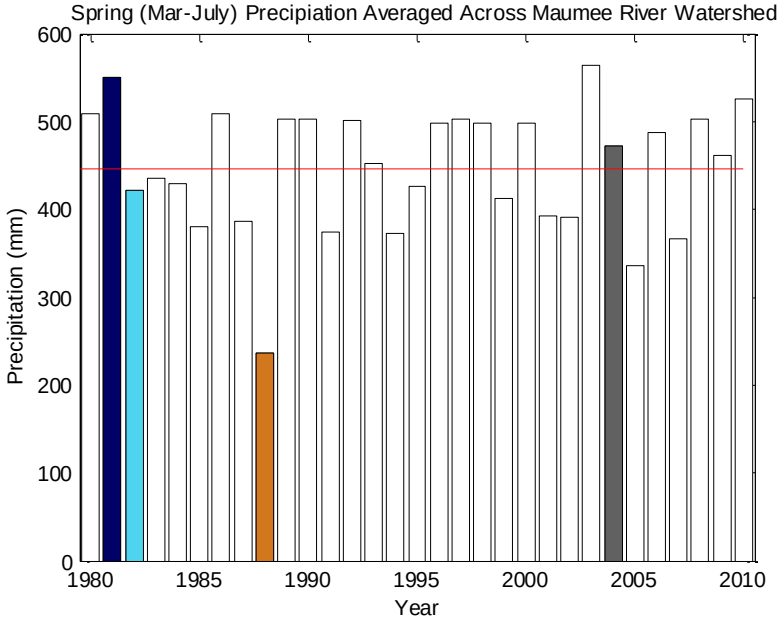


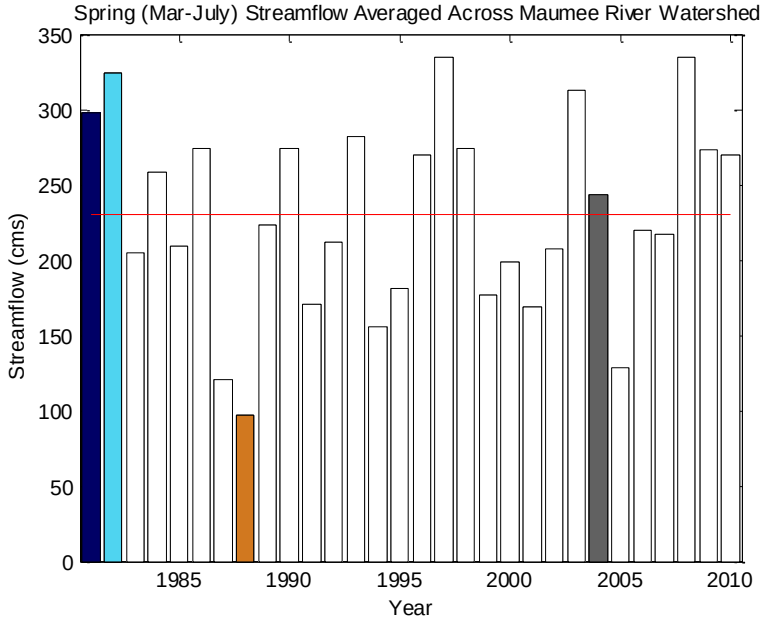
Extra Slides

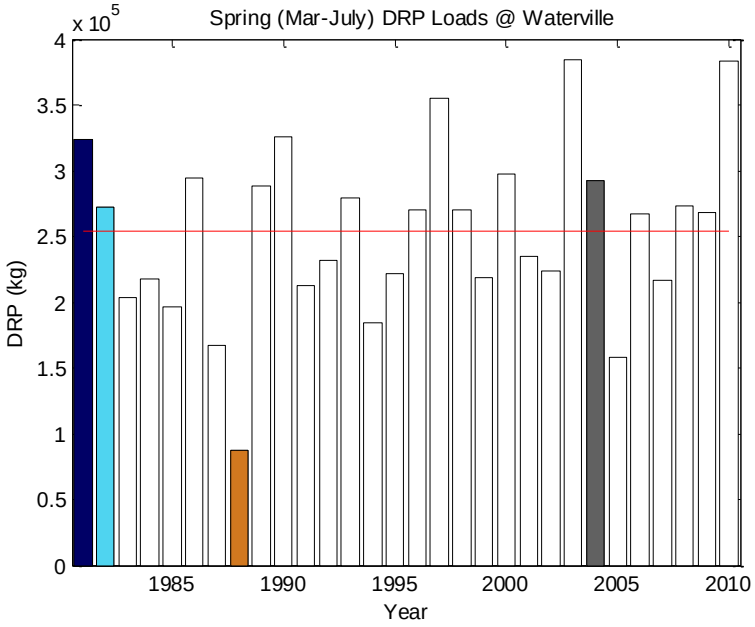
Methods: Model Development

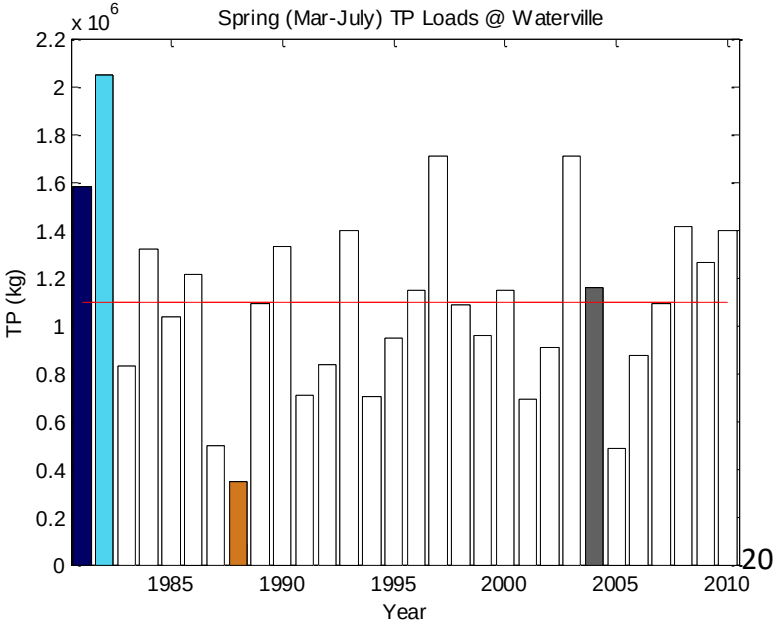
- Model Inputs
  - 2006 NLCD land use
  - SSURGO soils
  - NED DEM
  - NASS CDL to determine crop rotations
  - Wetlands & reservoirs added based on NHD medium-resolution waterbodies
  - Fertilizer, tillage, and manure applications based on county level fertilizer sales, NASS animal numbers, and CTIC tillage surveys
  - Tile drains on all poorly, very poorly, ands somewhat poorly drained croplands

Methods: Selecting Years









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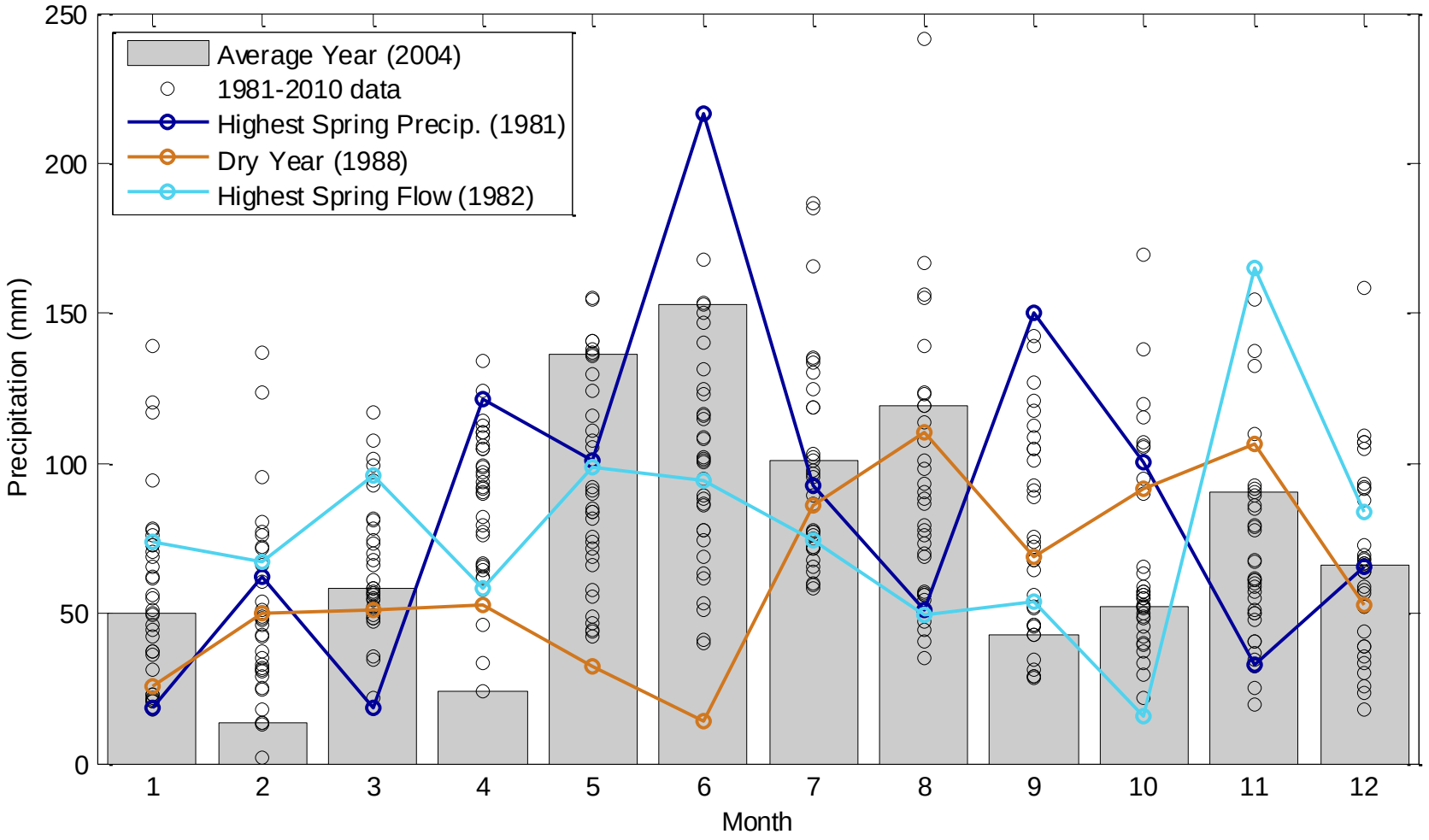

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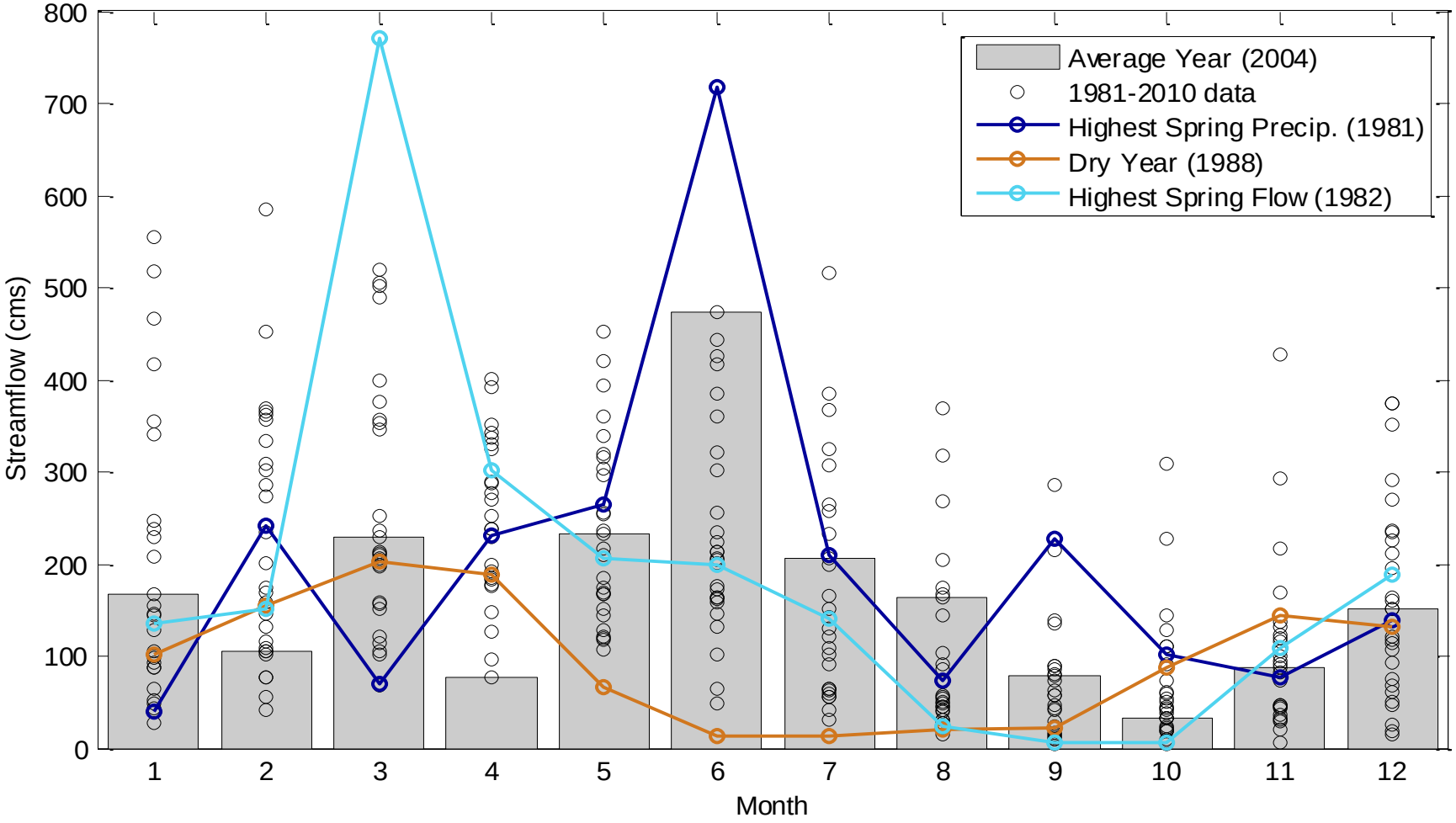

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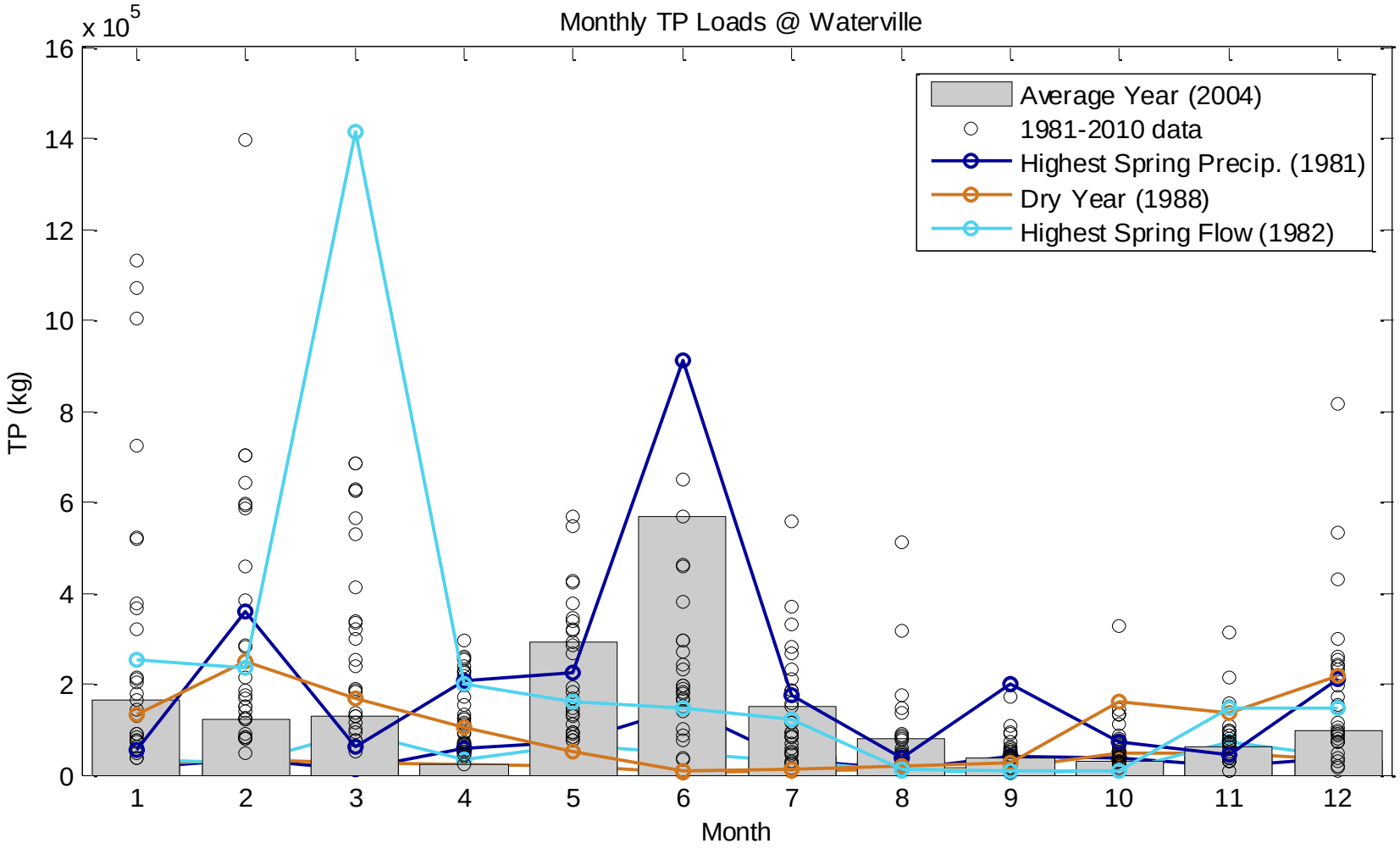

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