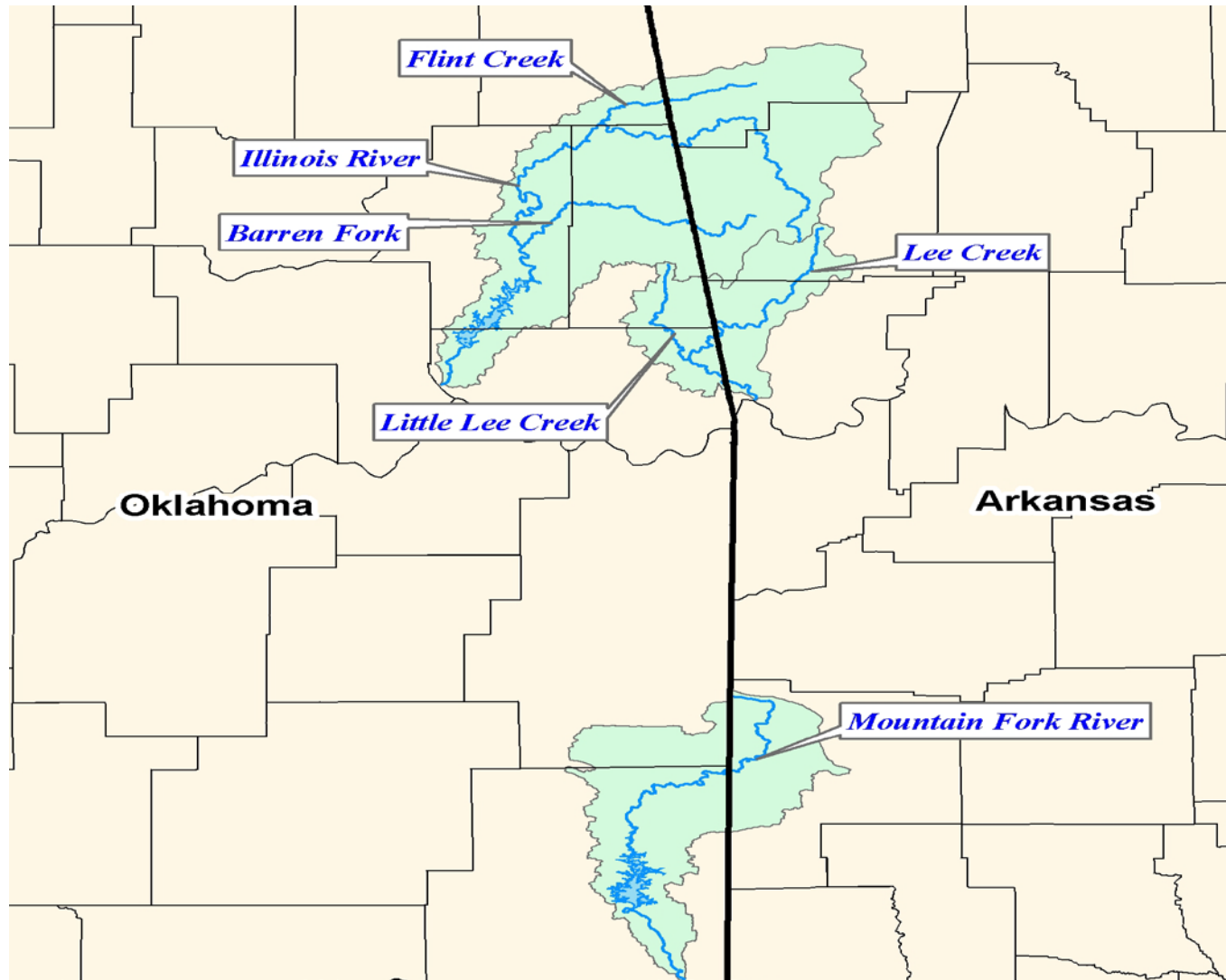


Evolution of the Implementation of Oklahoma's Scenic River Total Phosphorus Criterion

Monty Porter, Oklahoma Water Resources Board
Oklahoma Clean Lakes and Watersheds Symposium
April 3, 2019



Oklahoma's Scenic Rivers



➤ Tier III
Outstanding
Resource Waters

➤ Are of
exceptional
recreational and/or
ecological
significance

➤ Protected by
Oklahoma's
Antidegradation
Policy

➤ New or increased
loading prohibited

TOTAL PHOSPHORUS CRITERION

- Promulgated as a Permanent Rule in 2002
- 0.037 mg/L Total Phosphorus (30 day geometric mean)
- 10-year Implementation Period
- Tied to the Aesthetics Beneficial Use
- Linked to Antidegradation Policy (Scenic Rivers)



Based in Sound, Defensible Science

1. Clark, et al.
2. EPA Ecoregional
Quartiles
3. Eastern OK
Quartiles
4. OK Scenic Rivers
Commission
5. Other Literature
6. EPA R6 Approval



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graph TD; A[Promulgation of Scenic Rivers Total Phosphorus Criterion] --> B[1st Statement of Joint Principles and Actions (2003)]; B --> C[Re-evaluation of TP Criterion (2012)]; C --> D[2nd Statement of Joint Principles and Actions (2013)]; D --> E[Joint TP Study and Report (2015-2017)]; E --> F[Memorandum of Agreement (2018)];
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Promulgation of Scenic Rivers Total Phosphorus Criterion

1st Statement of Joint Principles and Actions (2003)

Re-evaluation of TP Criterion (2012)

2nd Statement of Joint Principles and Actions (2013)

Joint TP Study and Report (2015-2017)

Memorandum of Agreement (2018)

1st Statement of Joint Principles and Actions (2003)

- Attainability and Appropriateness of Criterion Questioned by Arkansas
- States agreed that “individual but coordinated strategies to meet water quality goals is in the best interest of both States”

Non Point Source Action

- Litter Removal/Reuse
- Joint Phosphorus Index
- Ark Act 1061—Nutrient Surplus Area
- Accounting of Poultry CAFO Practices (Ark Act 1060; Oklahoma)

Point Source Action

- 1mg/L limit on Larger Entities (1 MGD), including Rogers, Springdale, Fayetteville, Bentonville, and Tahlequah
- Work toward meeting a similar limit on smaller dischargers by 2012, including Westville, OK

Other Watershed Actions

- Coordinate Monitoring Programs/Protocol (led by OK-Ark Compact Commission)
- Development of a Watershed Plan
- Reopener Clause—Review with “best scientific information” and inclusion of both states

Criterion Re-evaluation (2012)

Project Tasks

Establish Technical Advisory Group

Prepare a Secondary Data QAPP

Solicit Best Scientific Information Available

Information Review

Criterion Re-evaluation with Full Inclusion of Arkansas

Recommendations

Literature Reviewed	Study Area	Concentration of TP (mg/L)
Haggard, Masoner & Becker (2005)	Oklahoma Streams	Statistical analysis shows that the 75 th percentile of TP concentrations were greater than the criterion.
Haggard (2005)	Illinois River Drainage Area	Dissolved P in the Illinois River (South of Siloam Springs) was generally around 3 times greater than the TP criterion
Stevenson et al (2006)	Kentucky and Michigan	0.010 – 0.030 (responses in benthic algal biomass)
Stevenson et al (2008)	Mid-Atlantic Highlands	0.010 – 0.020 (threshold responses occurred)
		0.010 – 0.012 (recommended P criterion)
		0.030 (to prevent Caldophora)
Justus, et al (2009)	Wadeable Ozark Streams	<0.018 (biotic metric scores were highest)
King (2009)	Brazos River Watershed, Texas	0.020 (shifts in periphyton communities)
		>0.025 – 0.050 (aquatic macrophyte cover declines)
		>0.020 – 0.030 (coupled with low flows will cause DO declines)
Haggard (2010)	Illinois River Drainage	The concentrations and transport of P within the Illinois River drainage area are significantly decreasing
Smith and Tran (2010)	Large Rivers	0.023 (numeric criteria based on percentile analysis)
		0.009 – 0.07 (threshold responses occurred)
		0.037 (based on macroinvertebrate data)
		0.030 (recommended nutrient criteria based on a weight-of-evidence approach)
Miltner (2010)	Ohio	0.038 (a change point in benthic chlorophyll a)
Stevenson, et al (2011)	Illinois River Watershed	0.027 (a threshold response in cover of stream bottoms by filamentous green algae)

Criterion Re-evaluation Recommendation

Based on the best scientific information available as of the date of this report, as well a lack of information to refute the criterion, the TAG finds that the 0.037 mg/L total phosphorus criterion is within the acceptable range of the total phosphorus concentration necessary to inhibit or limit algae growth to protect the aesthetics beneficial use of Oklahoma's Scenic Rivers.



The Oklahoma Scenic Rivers Total Phosphorus Criterion Technical Advisory Group concludes that the best scientific information available at this time does not show that *a substantial or material amendment* to the 0.037 mg/L total phosphorus concentration criterion should be considered by the Oklahoma Water Resources Board.



Promulgation of Scenic Rivers Total Phosphorus Criterion

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graph TD; A[Promulgation of Scenic Rivers Total Phosphorus Criterion] --> B[1st Statement of Joint Principles and Actions (2003)]; B --> C[Re-evaluation of TP Criterion (2012)]; C --> D[2nd Statement of Joint Principles and Actions (2013)]; D --> E[Joint TP Study and Report (2015-2017)]; E --> F[Memorandum of Agreement (2018)];
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1st Statement of Joint Principles and Actions (2003)

Re-evaluation of TP Criterion (2012)

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Joint TP Study and Report (2015-2017)

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2nd Statement of Joint Principles and Actions (2013)

- Disagreement on Oklahoma's Recommendations
- Threatened legal action and Expressed desire to work cooperatively
- 3 year extensions of commitments on PS and NPS from 2003
- Development of a Joint Phosphorus Study led by Joint Study Committee



Joint Phosphorus Study (2015-2017)

Study Question and Design

Determine TP response threshold where significant shift in algal community leads to undesirable aesthetic condition.

Study population adequate to determine frequency and duration components of the criterion

Use EPA guidance on “Stressor-response Relationships to Derive Numeric Nutrient Criteria”

Use reference streams in same ecoregion or watersheds



Use of Findings

Recommend phosphorus levels and frequency/duration components of measure to protect aesthetics beneficial use and ORW

Evaluate relationship between concentrations and biotic indicators of water quality, including algal taxonomic composition and biomass

Provide reliable and objective data to evaluate merit of any revision

Required revision only if magnitude is below 0.027 or above 0.047mg/L

Joint Phosphorus Study Key Study Findings on Thresholds

Change in algal taxonomic composition and periphyton biomass was statistically observed at TP concentrations as low as 0.011 mg/L and as high as 0.074 mg/L.

Statistically significant shifts in mean Cladophora biovolume and mean nuisance taxa proportion of total biovolume was observed between 0.032 and 0.058 mg/L.

Largest mean cumulative shift in the natural assemblage of algal species observed within the range from 0.011 to 0.049 mg/L TP.

Species declined in abundance within the range from 0.011 to 0.025 mg/L TP and increased in abundance within the range from 0.019 to 0.049 mg/L TP.

Joint Phosphorus Study Recommendations

6-month average total phosphorus concentration not to exceed 0.035 mg/L based on water samples taken during the critical condition.

Critical condition defined as “conditions where surface runoff is not the dominant influence of total flow and stream ecosystem processes.”

Develop a monitoring and assessment program to determine progress towards attainment of criterion

Protection should also focus also on other areas of pollution including hydrologic alteration, riparian zone protection, bank stabilization, channel habitat, in-stream mining, and other contaminants

Memorandum of Agreement (2018)

- Agreement to Implement Joint Study Recommendations
- Steering Committee formed to oversee implementation of the agreement

Monitoring and Assessment Workgroup

- Develop a robust, basin-wide monitoring program
- Designed to ascertain progress toward attainment of the criterion

Watershed Improvement Plan

- ID water quality improvement strategies from point/non-point sources
- Develop implementation milestones necessary to achieve criterion
- Consider other recommendations of Joint Study

Common Practices

- Data Sharing
- Communications Strategy

Total Phosphorus Criterion

- Reaffirmed 0.037 magnitude
- Commitment from Oklahoma to evaluate other criterion recommendations (frequency, duration, critical condition)

Permit Applications

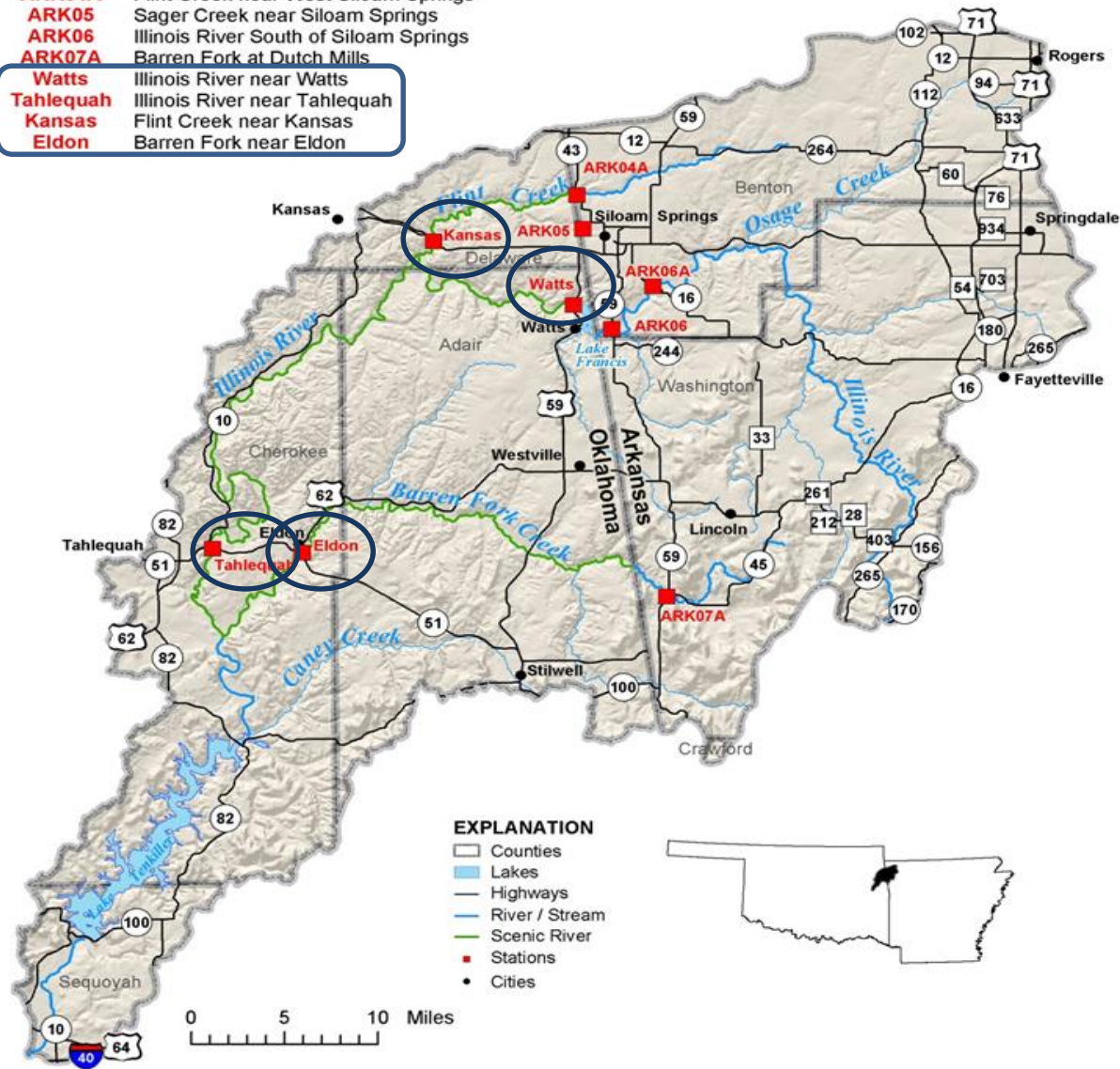
- New permits shall not increase loading beyond permitted design flow
- Amended permits to meet a limit of not more than 0.5 mg/L TP
- New dischargers meet limit not more than 0.2 mg/L

Regulatory Flexibility

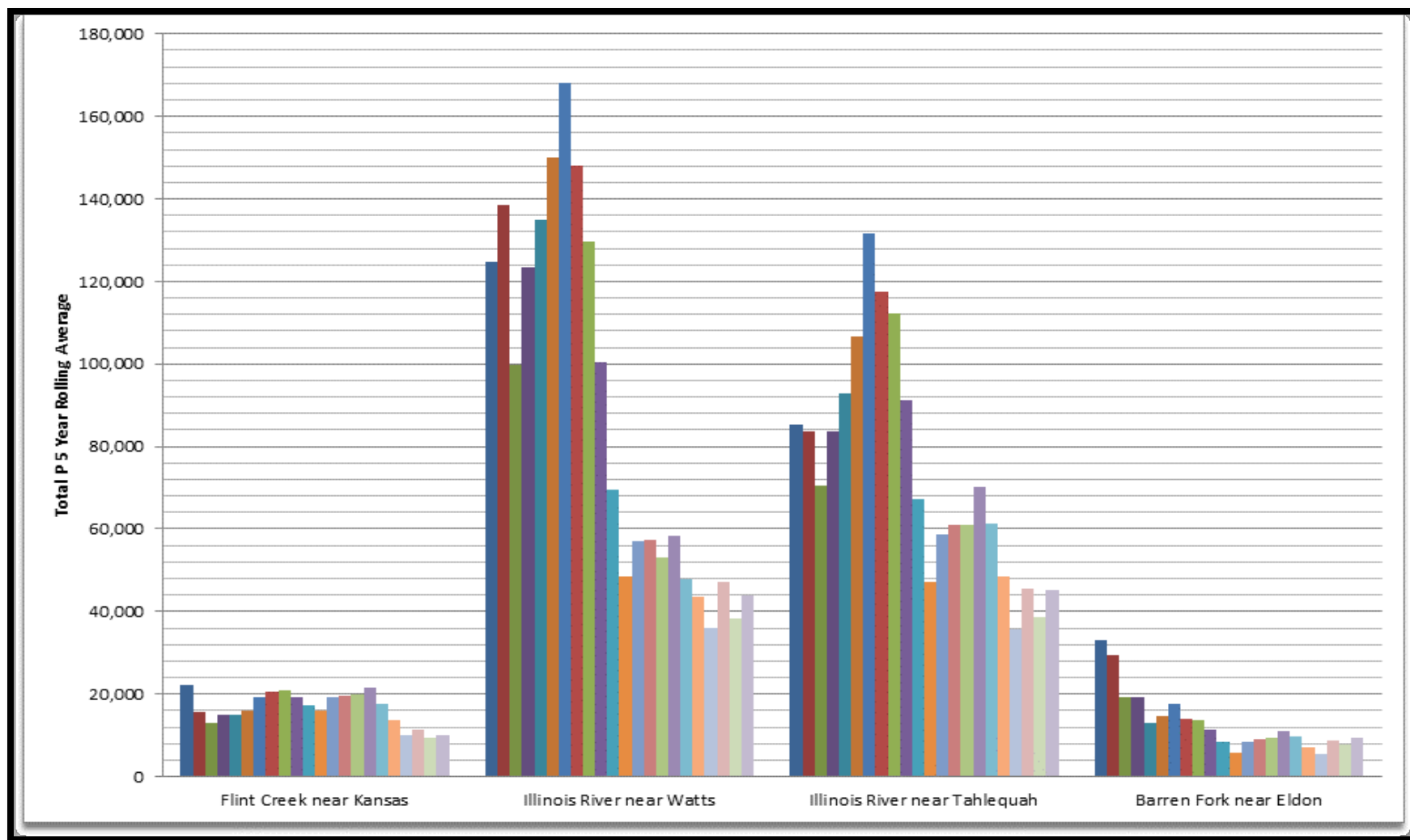
- Use of variance provisions to enhance progress toward criterion
- Nutrient trading programs and/or watershed based permits

How Are Our Scenic Rivers Doing Today?

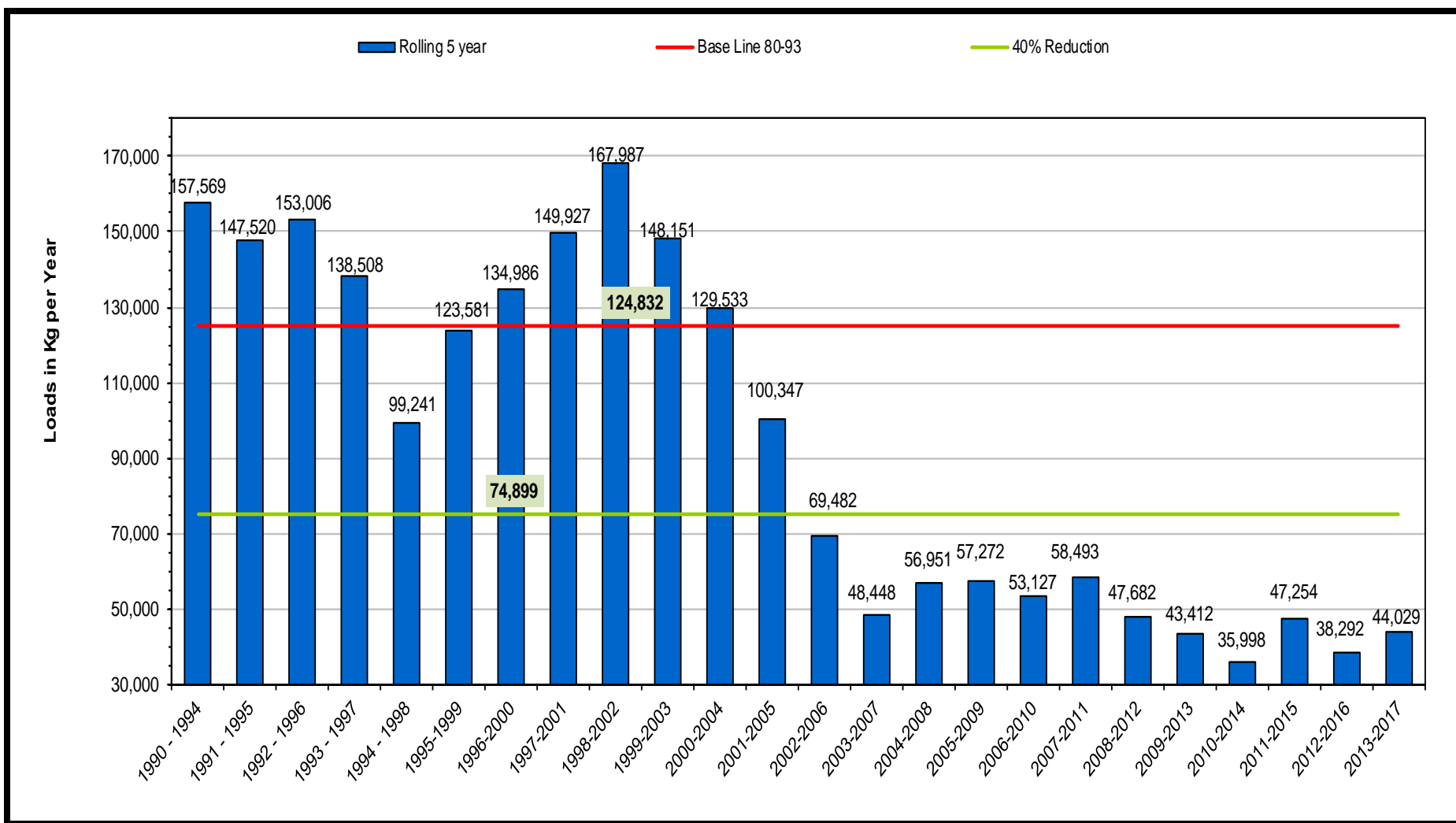
ARK04A	Flint Creek near West Siloam Springs
ARK05	Sager Creek near Siloam Springs
ARK06	Illinois River South of Siloam Springs
ARK07A	Barren Fork at Dutch Mills
Watts	Illinois River near Watts
Tahlequah	Illinois River near Tahlequah
Kansas	Flint Creek near Kansas
Eldon	Barren Fork near Eldon



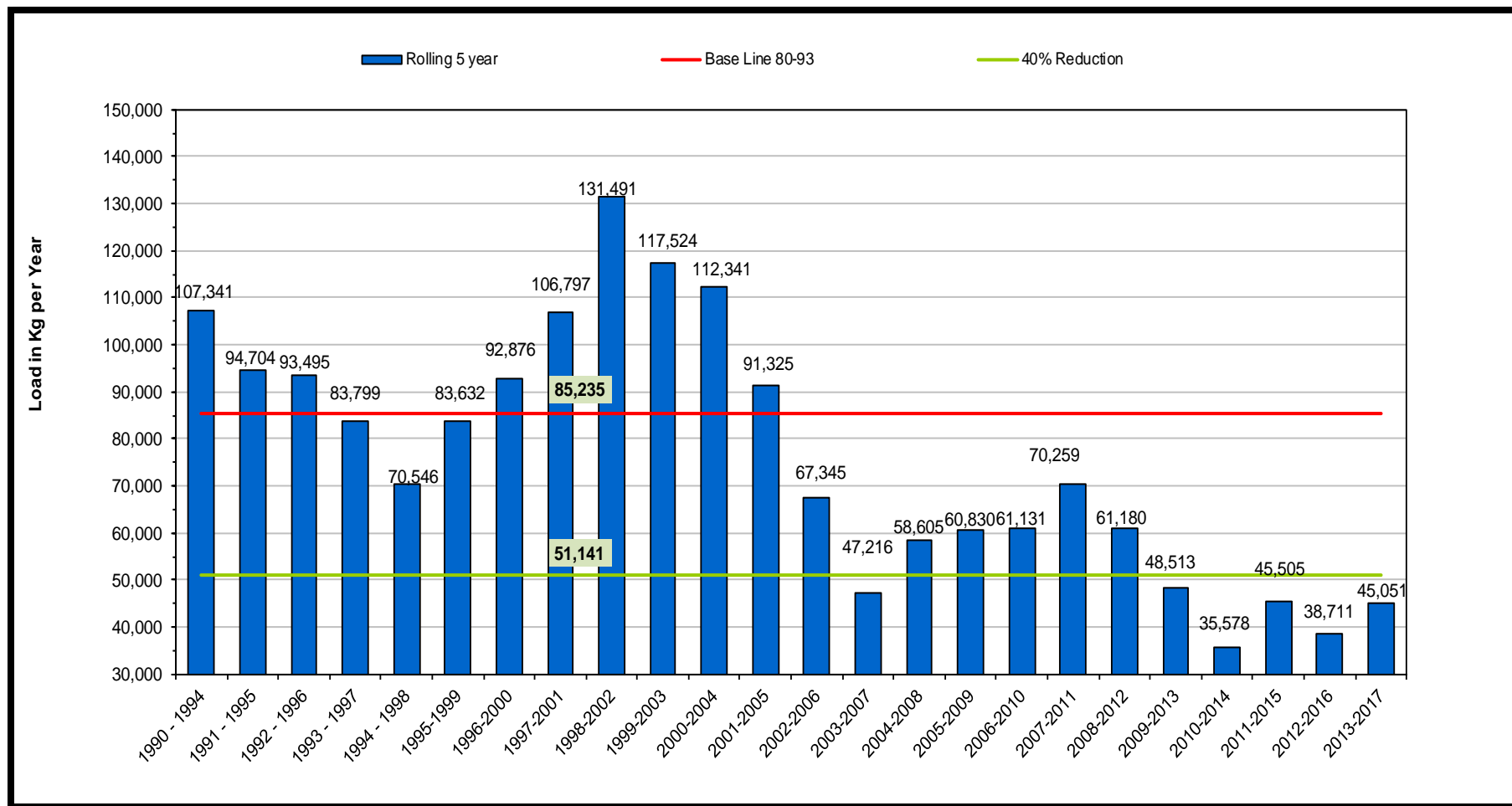
Total P 5-Year Loading Averages 1993-2017



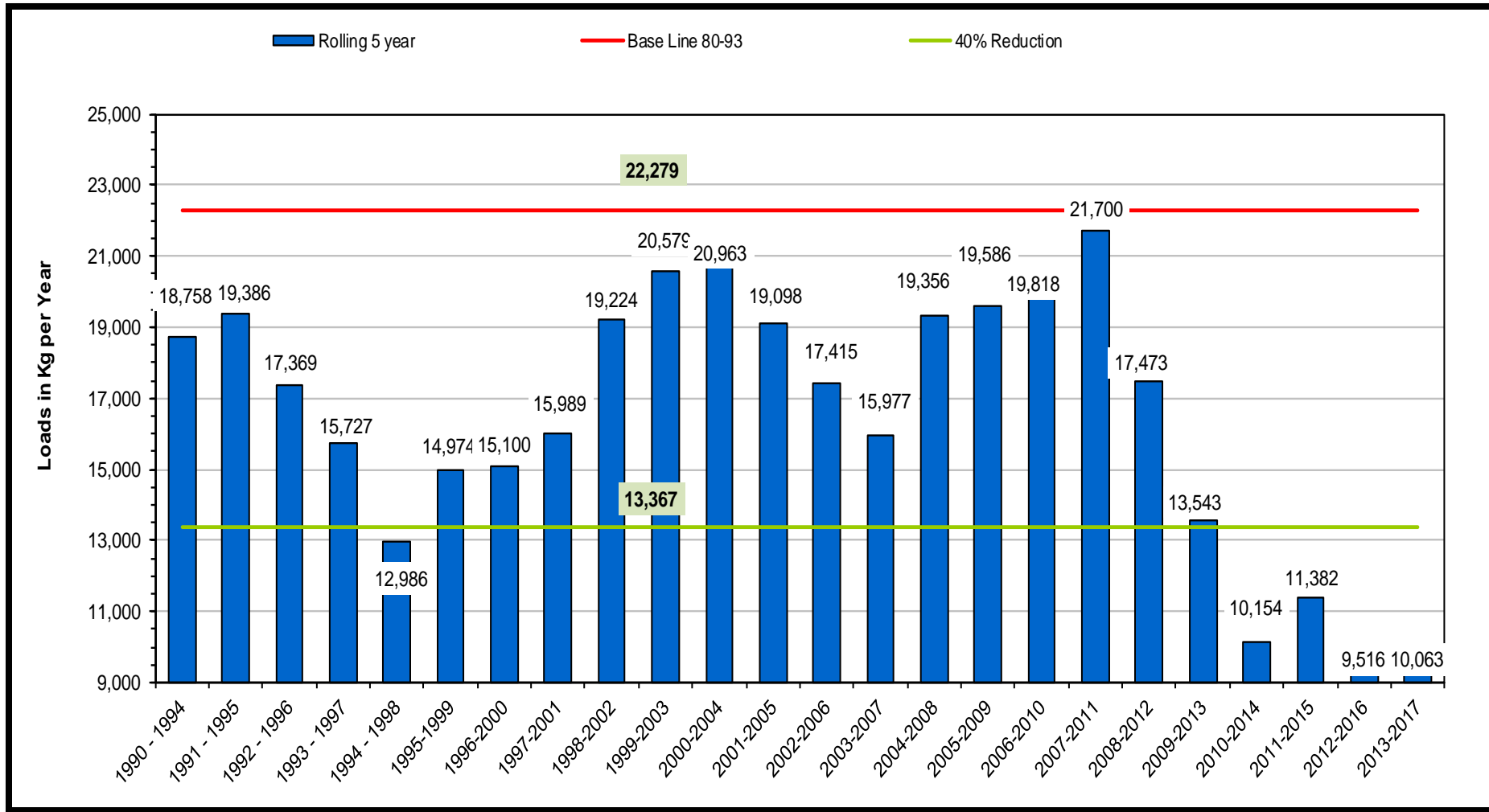
Illinois River near Watts Loading 1990-2017



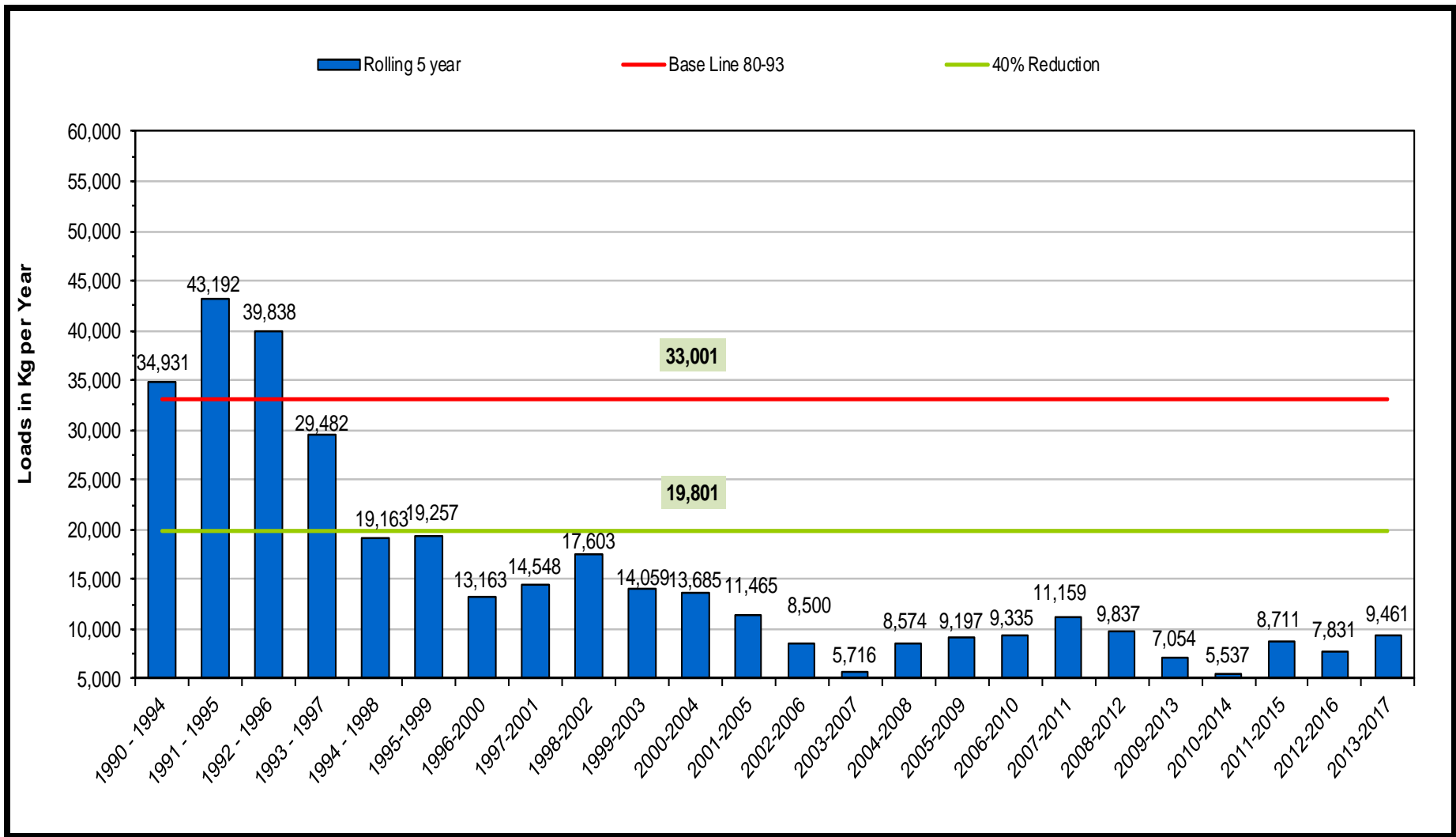
Illinois River near Tahlequah Loading 1990-2017



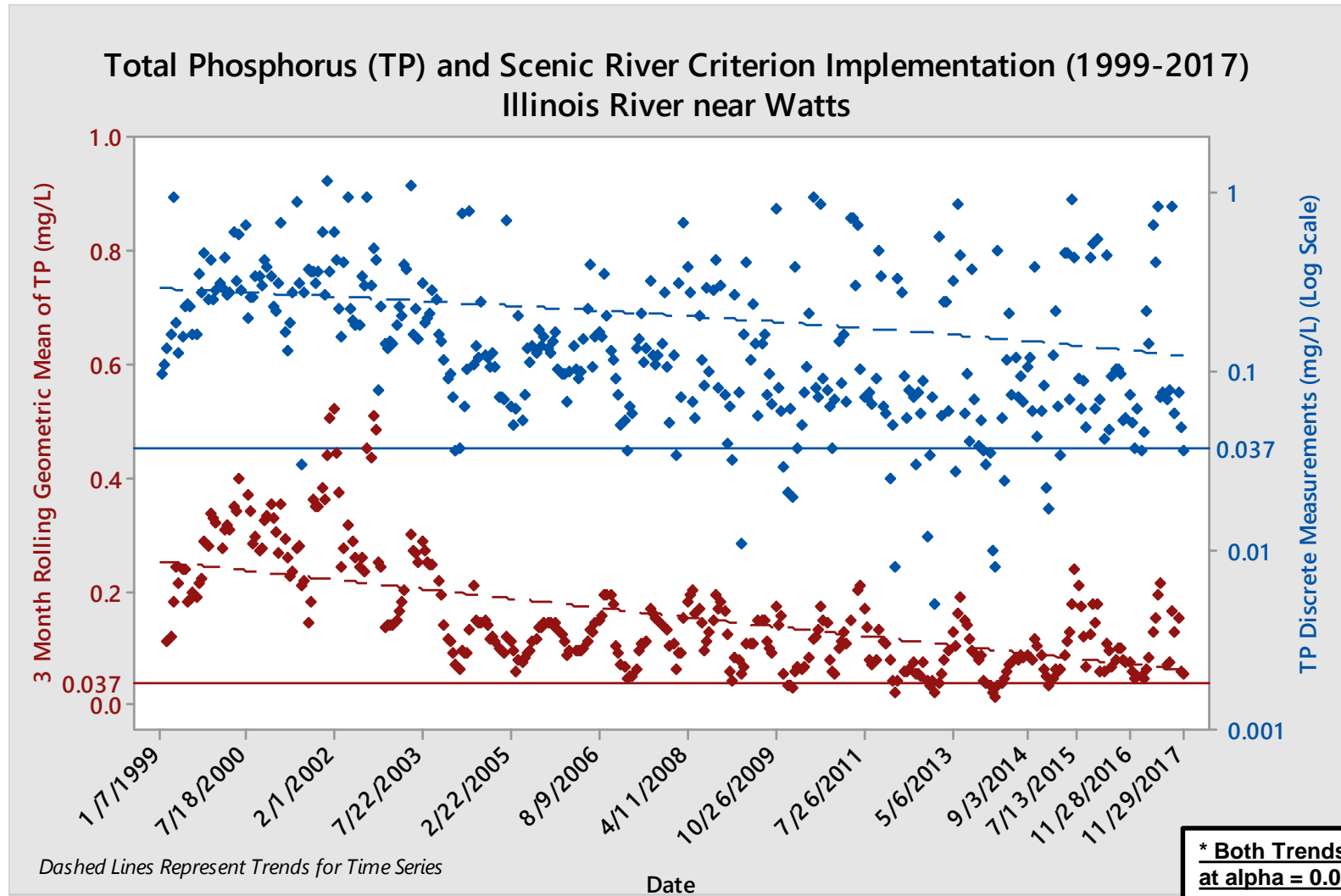
Flint Creek near Kansas Loading 1990-2017



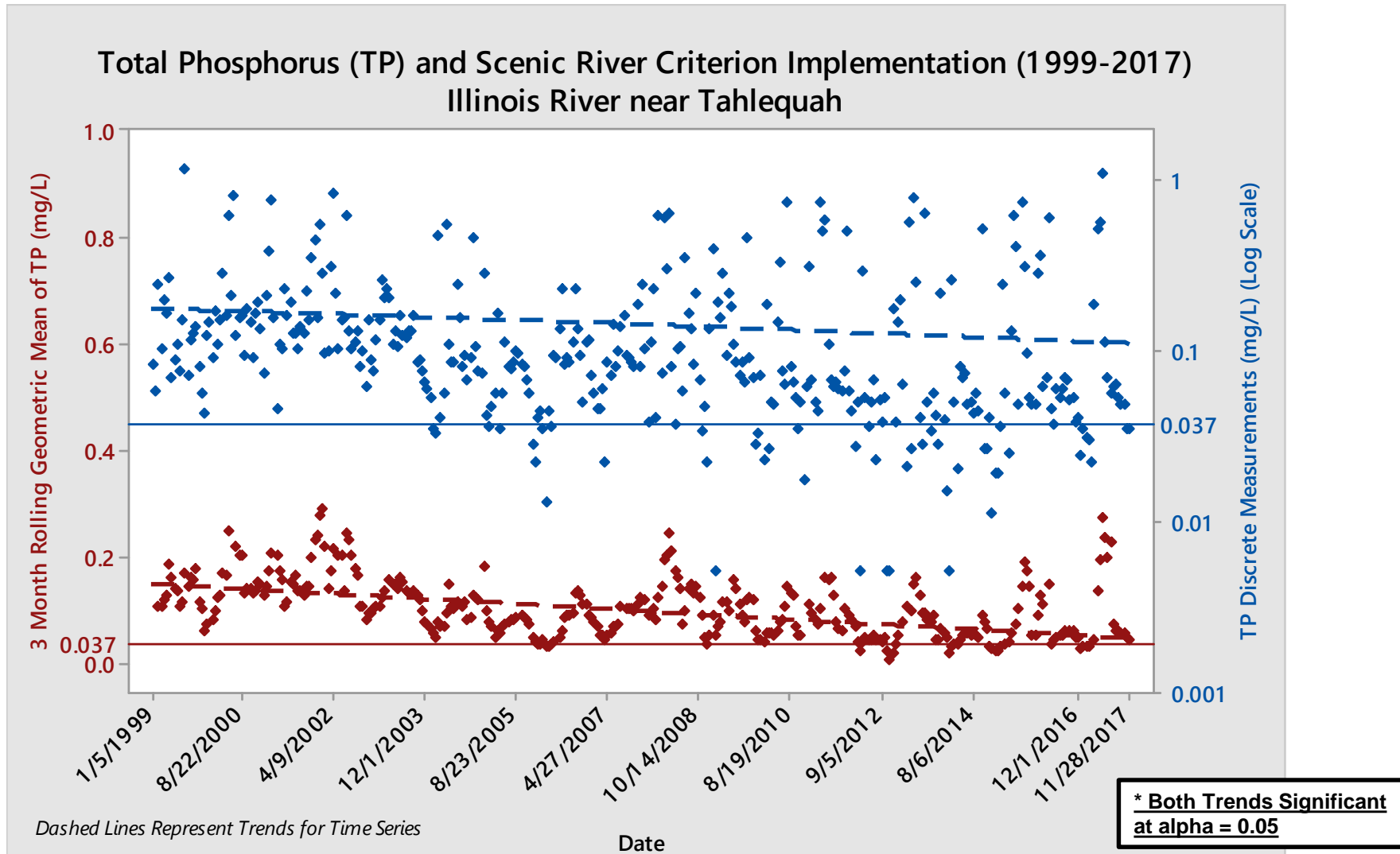
Barren Fork near Eldon Loading 1990-2017



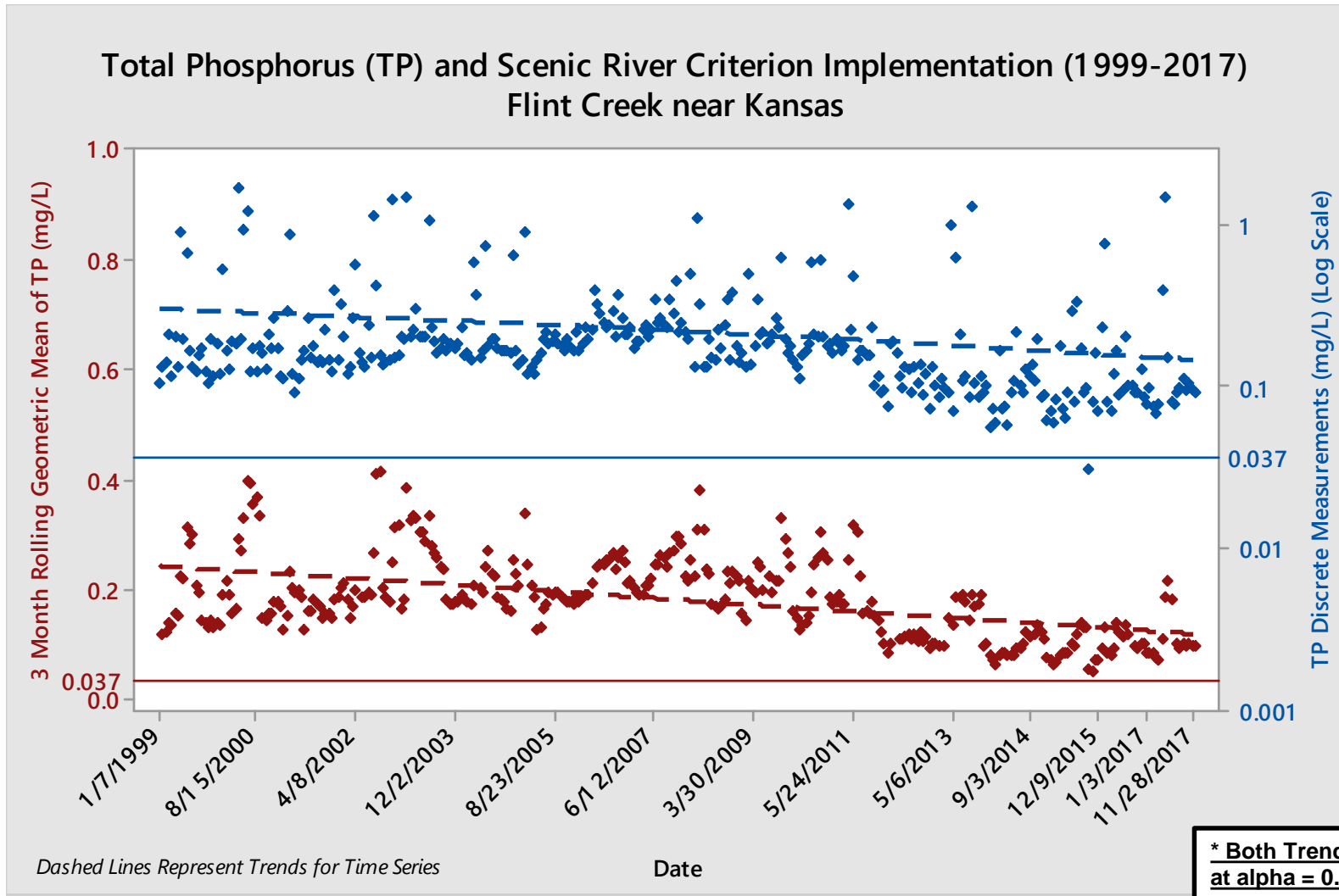
Illinois nr Watts Trends 1999-2017*



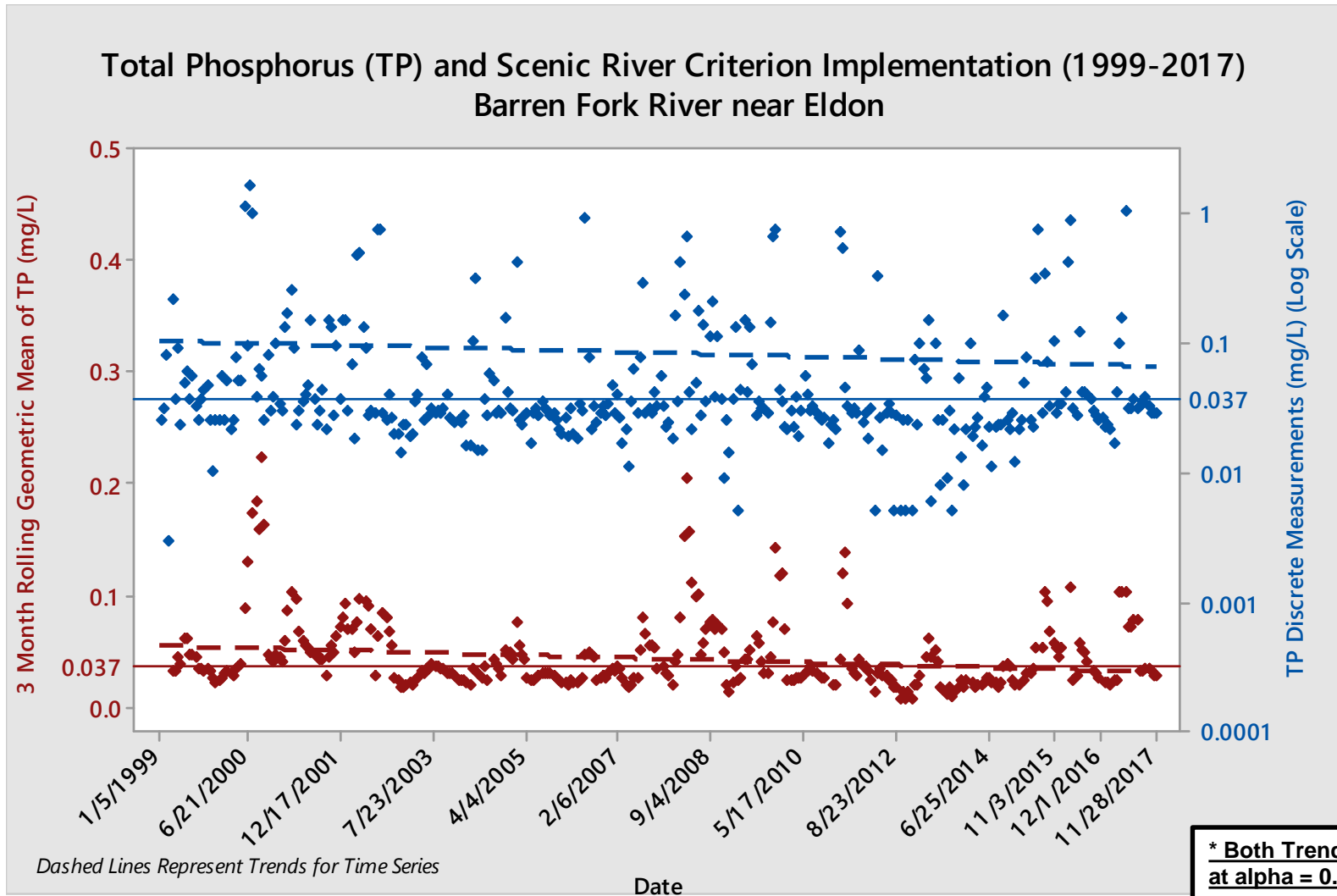
Illinois nr Tahlequah Trends 1999-2017*



Flint nr Kansas Trends 1999-2017*

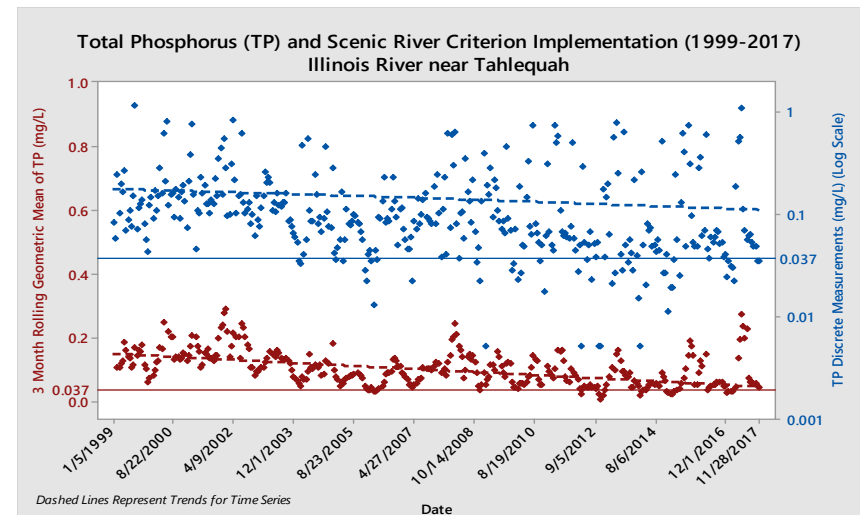
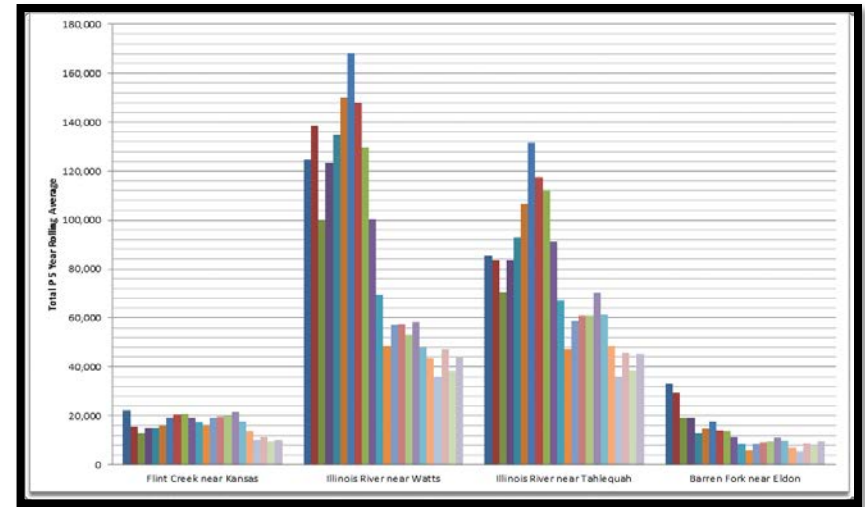


Barren Fork nr Eldon Trends 1999-2017*



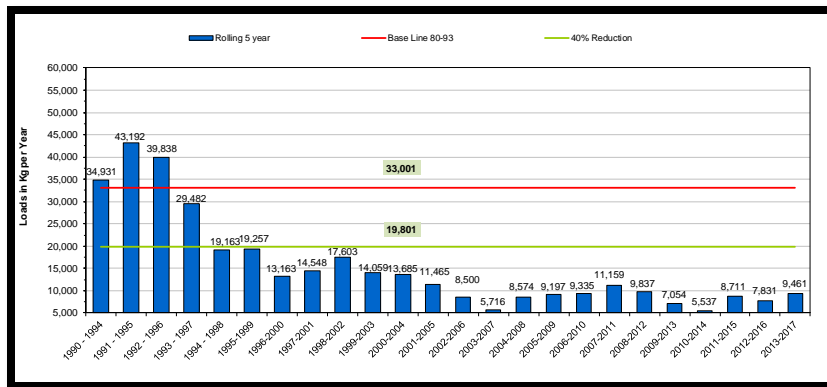
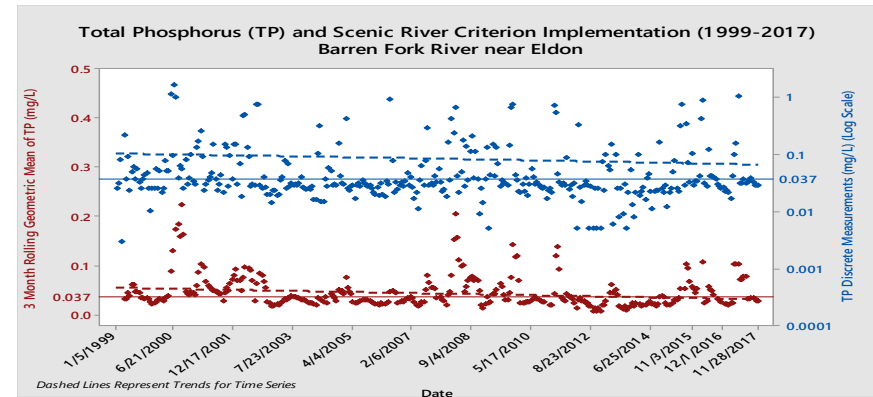
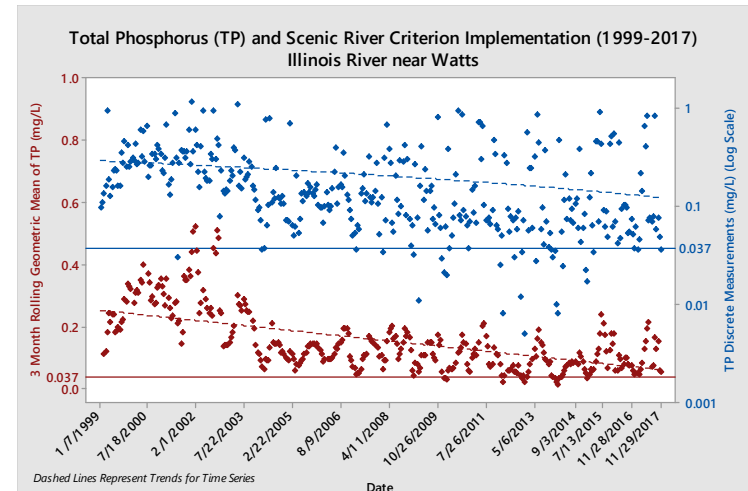
General Conclusions from Data

- Loads are generally decreasing
- Recent Loads are generally below the 40% reduction mark
- Concentrations, with targeted high flow, are trending downward
- Measures of criterion attainment are trending downward



General Conclusions from Data

- All sites are still not attaining the criterion
- Generally, very few samples are below the criterion
- Barren Fork with the lowest loads has the highest degree of attainment



A scenic view of a river or lake with a sandy beach, trees, and picnic tables in the background. The water is calm with gentle ripples. The background is filled with lush green trees. On the left bank, there are picnic tables with green and red umbrellas. A few ducks are visible on the sandy shore.

Questions & Discussion

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