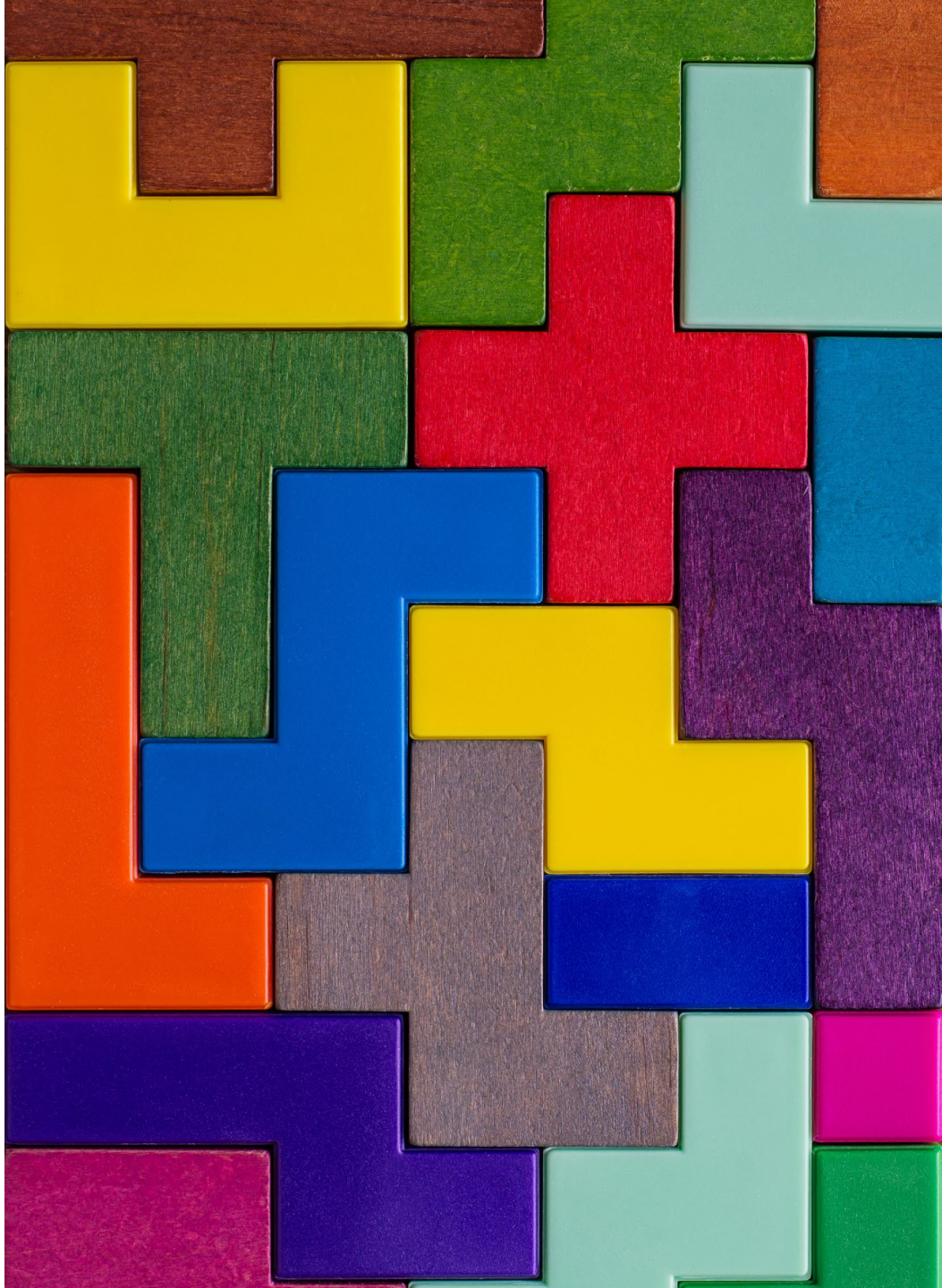
Jordan Nutrient Rules: Wastewater TAG#1

Ellie Rauh and Siying Chen
NC DWR, May 2024

Welcome to the first Technical Advisory Group (TAG) for Wastewater Jordan Rule Readoption.

Introductions: please state name, affiliation, relation to Jordan stormwater regulations



TAG Purpose & Process

- Purpose of TAGs: to get feedback from stakeholders on current implementation and rule revision concepts.

- TAG Process
  - May 30th – review current rule and implementation progress, get feedback on possible new targets and planned upgrades.
  - 2nd TAG (Spring-Sum) – aim to send **draft rule concept prior to meeting**, review in the meeting and discuss implementation questions.
  - 3rd TAG (Sum) – aim to send **draft rule language prior to meeting**, review in meeting and discuss implementation questions.

  - Intent: Complete stakeholder engagement, comments on all rules by November 2024. Draft rules to WQC mid-February for **March 2025 WQC meeting.**

‘Informal’ Stakeholder Engagement

2024

- DWR stakeholder engagement.
- DWR rule drafts and internal review.
- Stakeholder groups review rule language.

WQC Approval to Proceed (expected multiple reviews)

2025

- **March WQC**: Info item – draft rules
- Begin fiscal analysis.
- **May or July WQC**: Action item
  - Request to proceed w/rules
  - Share rough fiscal analysis
- Full fiscal analysis
- **Sept or Nov WQC**: 2nd attempt if needed
- **Fiscal – seek OSBM approval**

(filing dates = 1 mo prior to meetings)

“Formal” Rulemaking (steps can require > 1 pass)

2026-2027

- Fiscal Analysis - OSMB approval
- EMC approval to proceed
- 60-day public comment period
- Hearing Officers deliberate
- Develop Hearing Officers report
- EMC adopts rules
- Rules Review Commission approves

EMC responsibility to manage nutrient pollution

- EMC has obligations to issue regulations per the Clean Water Act and State statutes including SL 1997-458 and Water Supply Watershed.

- Clean Water Act:
  - Water quality criteria – Chlorophyll-a criterion
  - Section 303(d) list of impaired waters and 305(b) water quality reports – Integrated Report (IR)
  - TMDL or Alternative: A TMDL is the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant

- **1978 – Chlorophyll-a criterion: 40ug/L (10/90)**
- **Nutrient Rules are carrying out requirements of the Jordan TMDL**

Modeled Reductions to Meet Chl-a Standard

- Overall, new model is calling for significant additional nutrient loading reductions to meet chl-a standard

Current Rule – Lake Reduction Goals*		
	N	P
Upper NH	35%	5%
Lower NH	0%	0%
Haw	8%	5%

* relative to 1997-2001 baseline period

New Lake Model – Further Lake Reduction Needs*		
	N	P
Upper NH	**60-70%**	0-50%
Middle NH	**30-60%**	**0-70%**
Haw	**0-70%**	**0-40%**

* relative to 2014-2016 model period

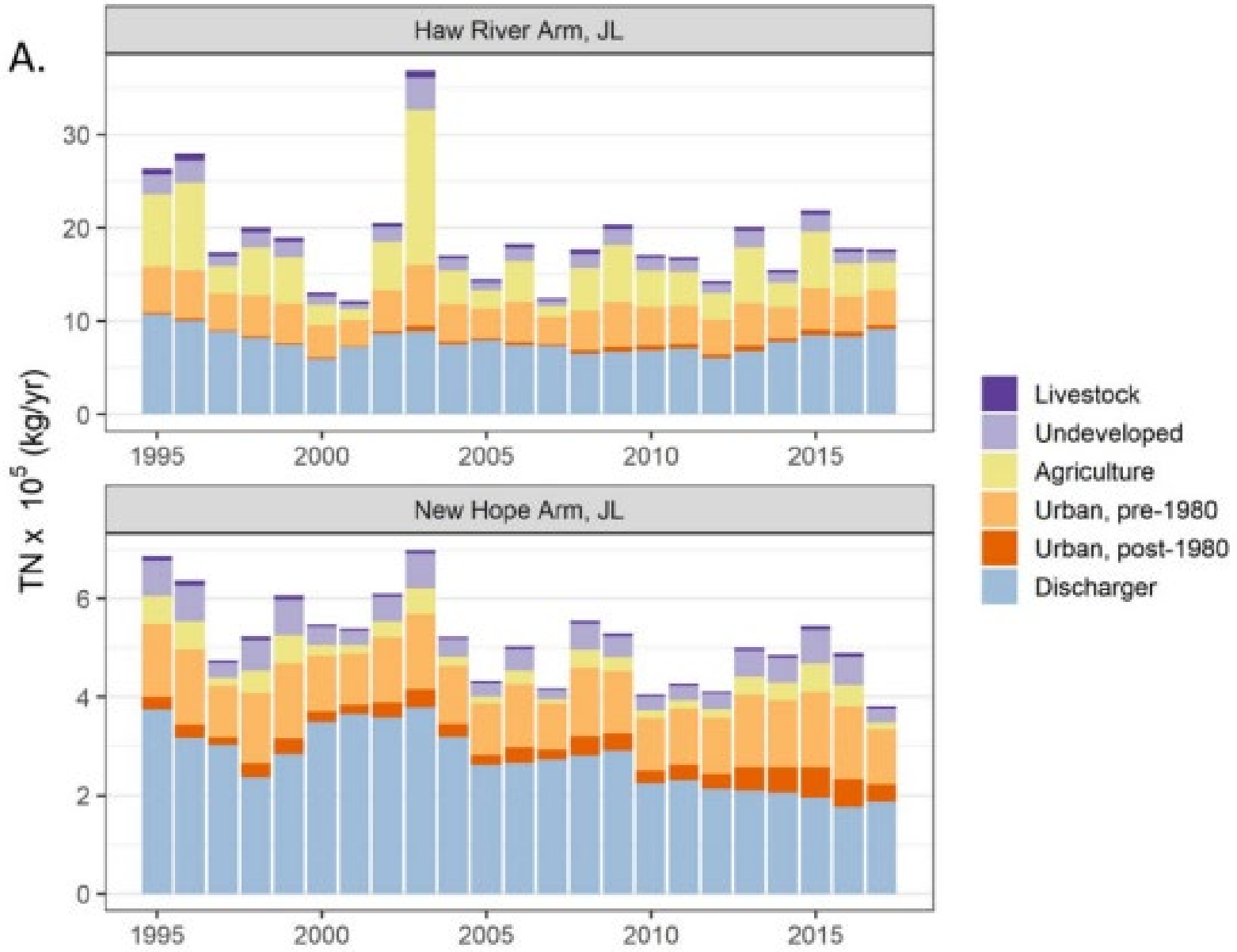
- Model is available for external review

Miller, J., Karimi, K., Arumugam, S. & Obenour, D. (2019). Jordan Lake Watershed Model Report. North Carolina Policy Collaboratory, North Carolina State University.

Nutrient source attributions by basin from 1994-2017 representing (A) TN that reached Jordan Lake.

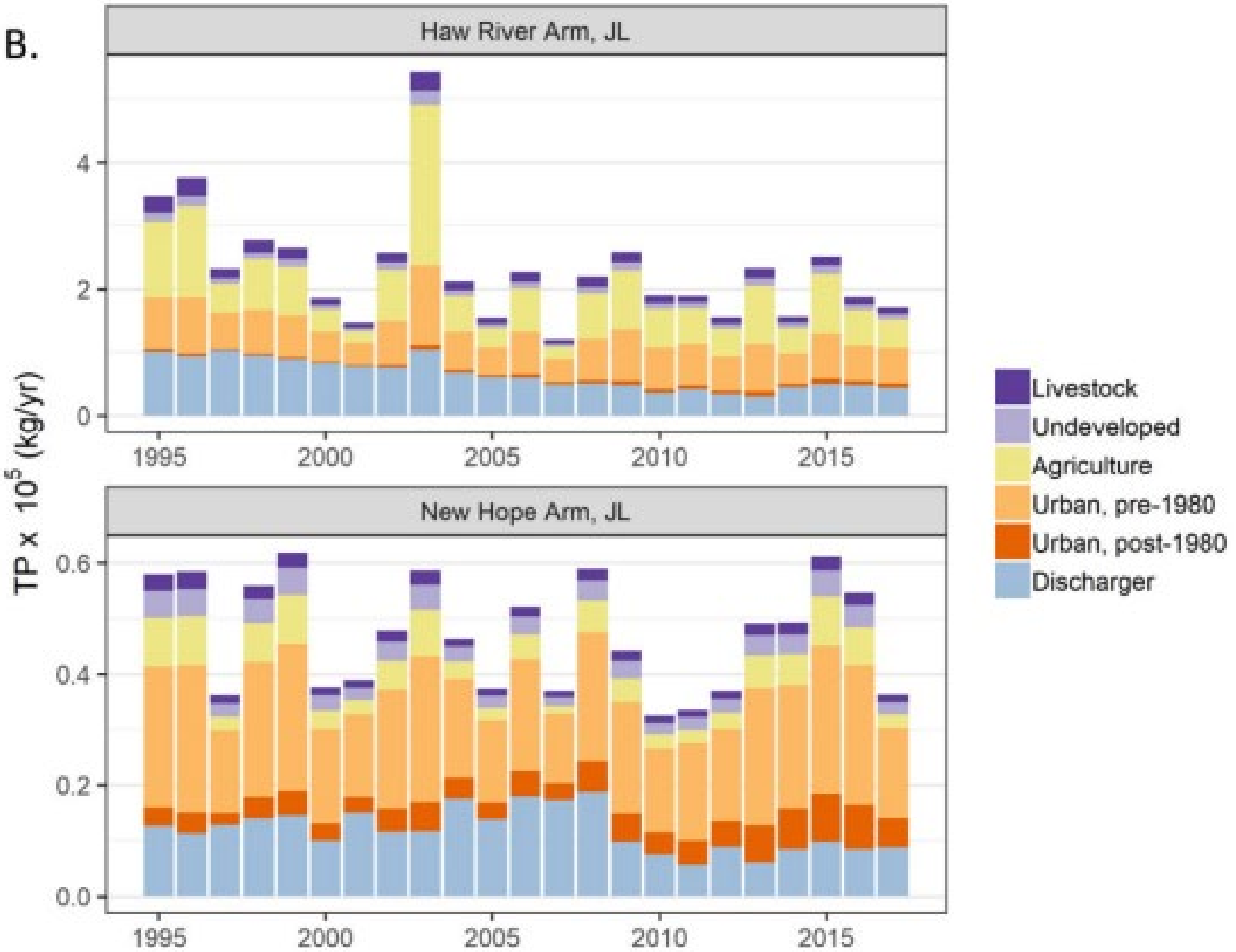
*pay attention to axis when comparing charts.

*Does not include 2021-22 Haw decreases from Greensboro T.Z. Ozborne.

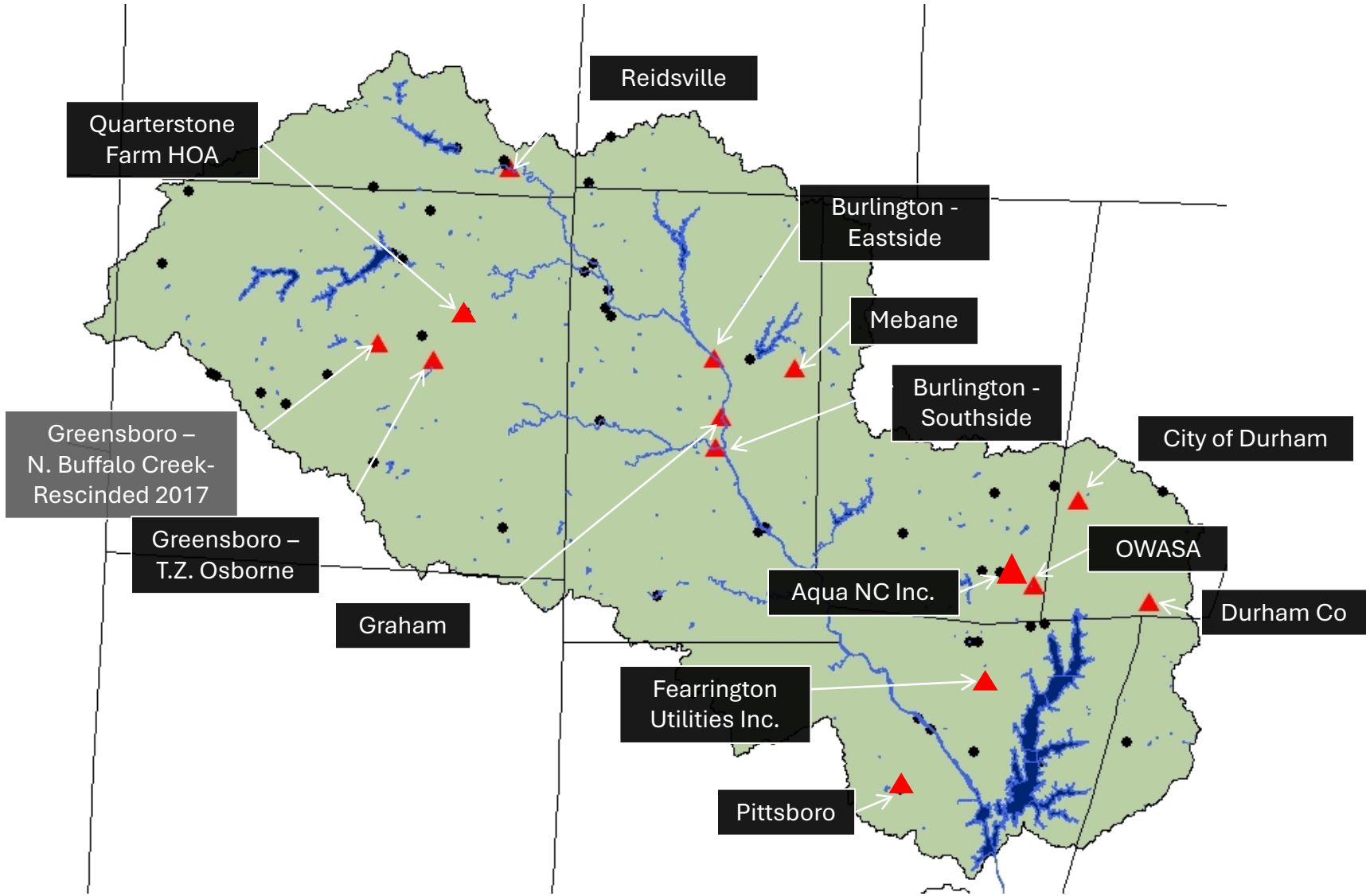


Nutrient source attributions by basin from 1994-2017 representing (B) TP that reached Jordan Lake.

*pay attention to axis when comparing charts.



Municipal WWTPs



Current Wastewater Regs in Jordan

- Individual NPDES permits
- Existing facilities - Annual individual mass load N and P allocations (lb/yr)
  - Based on equivalent concentrations
  - Major WWTP (over .1 MGD) equivalent concentrations at permitted flow
    - UNH: N=3.04; P=0.23
    - LNH: N=5.35; P=0.37
    - Haw: N=5.29; P=0.66

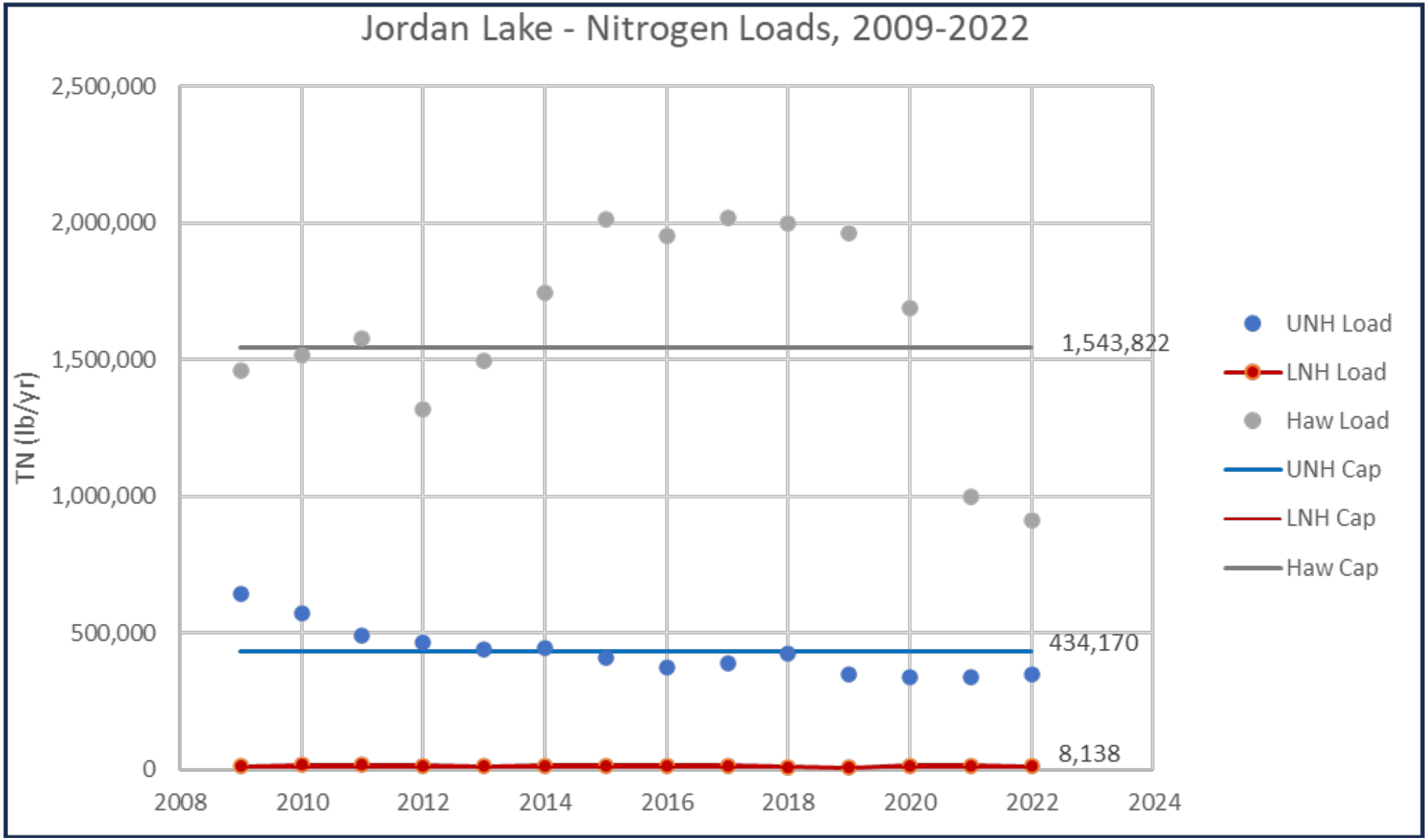
- New facilities – obtain allocation + 3.0 mg/L N, .18 mg/L P at permitted flow
- Option - Group compliance association w/group permit – none in watershed

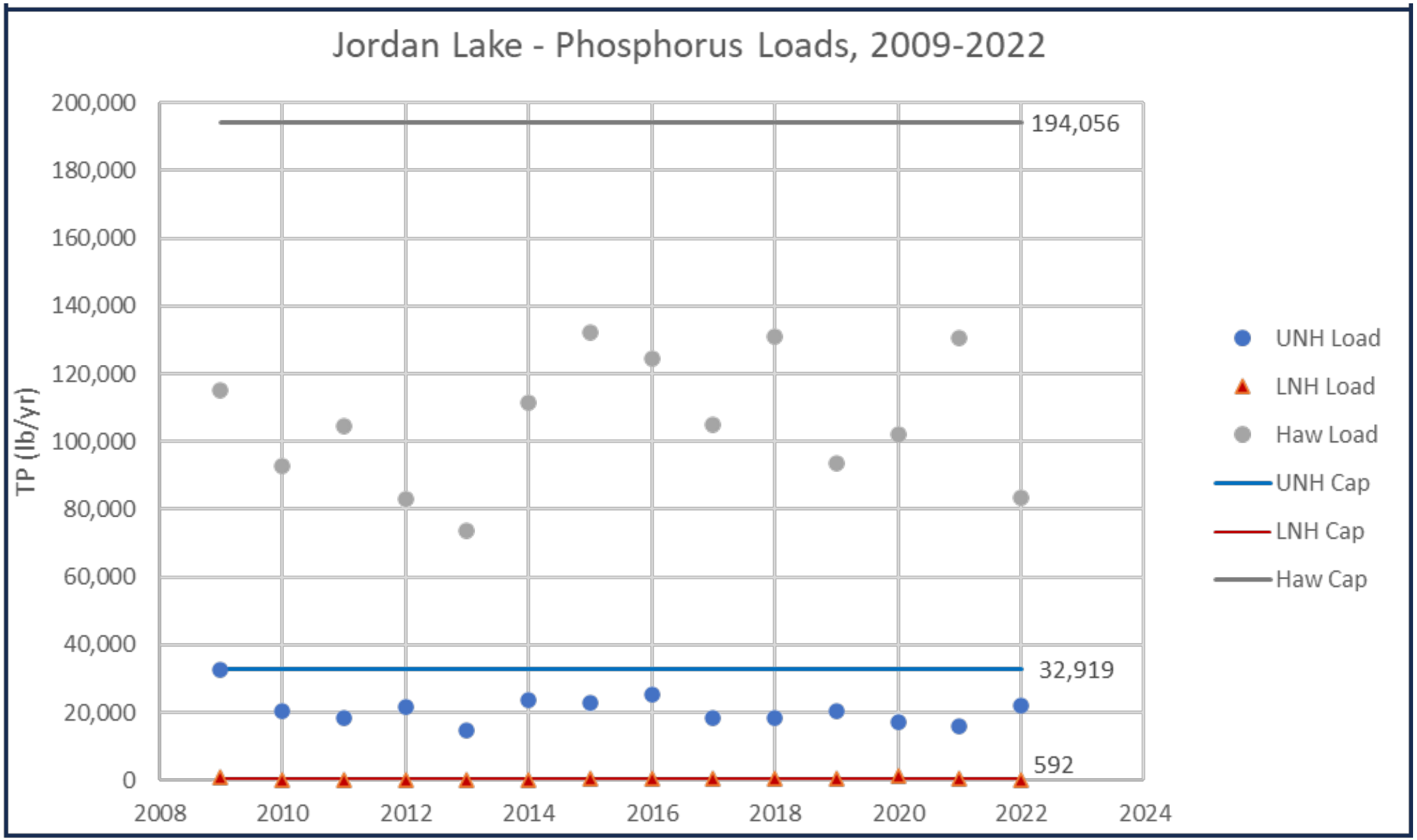
- DWR Municipal NPDES Permitting Unit Implements the Rule

Wastewater Implementation

- TP – compliance deadline – calendar 2010
- TN – compliance deadline - changed from 2016 to 2019
- All in compliance except Fearrington TN. All meeting TP requirements.

- **In 2021, Greensboro finalized plant upgrades and significantly reduced TN and TP loads, bringing the Haw arm into group compliance with the loading caps!**


Jordan Lake - Nitrogen Loads, 2009-2022
TN (lb/yr)
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2008
2010
2012
2014
2016
2018
2020
2022
2024
1,543,822
434,170
8,138
UNH Load
LNH Load
Haw Load
UNH Cap
LNH Cap
Haw Cap

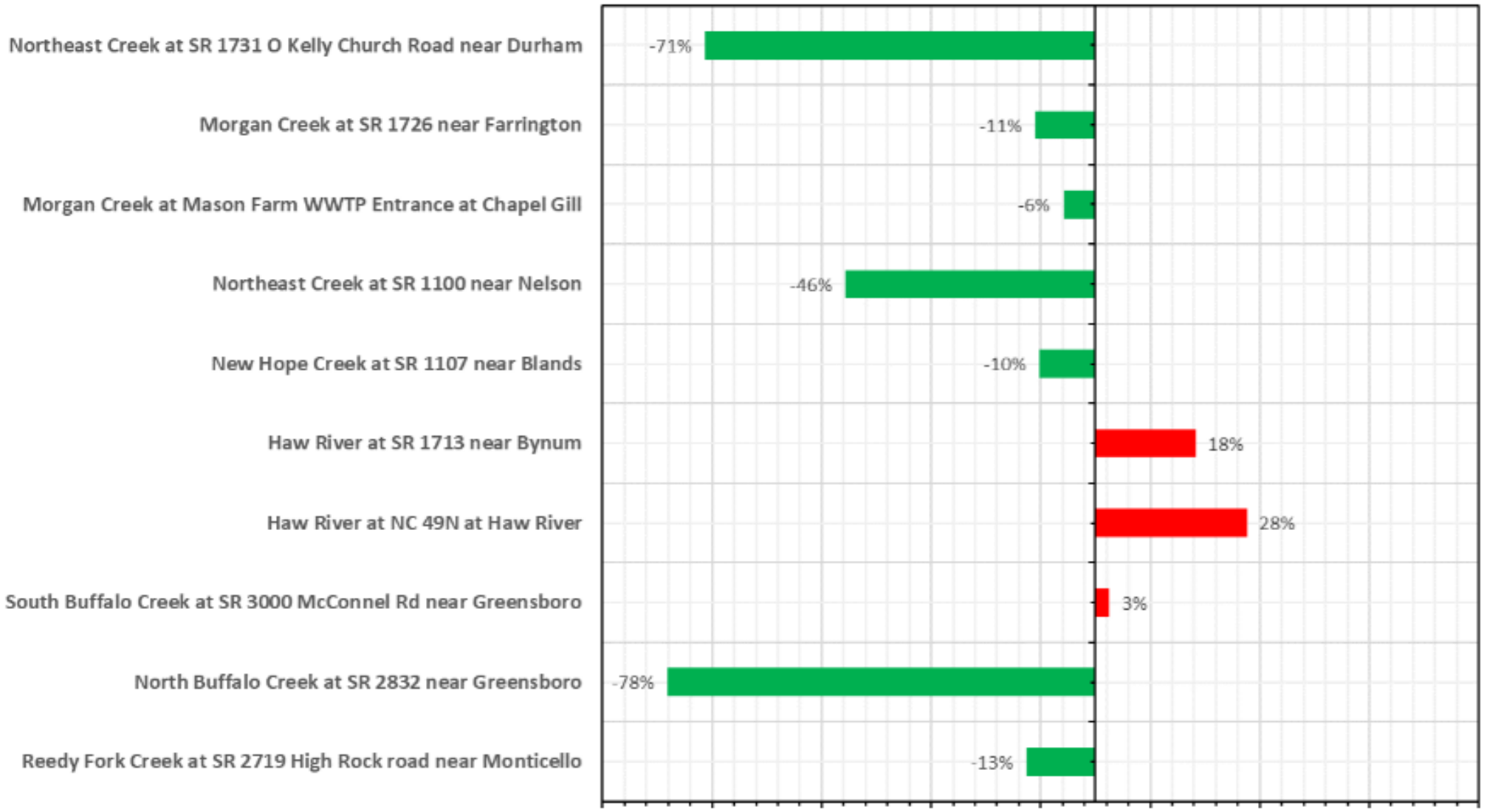

Jordan Lake - Phosphorus Loads, 2009-2022
TP (lb/yr)
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
2008
2010
2012
2014
2016
2018
2020
2022
2024
194,056
32,919
592
UNH Load
LNH Load
Haw Load
UNH Cap
LNH Cap
Haw Cap

2021 Cumulative E.O.P. Loading vs 2009 Caps

	TN CAP	2021 TN Loading	TP CAP	2021 TP Loading
UNH	434,170	349,701	32,919	22,245
LNH	8,138	12,190	566	281
HAW	1,543,822	910,752	194,056	83,314

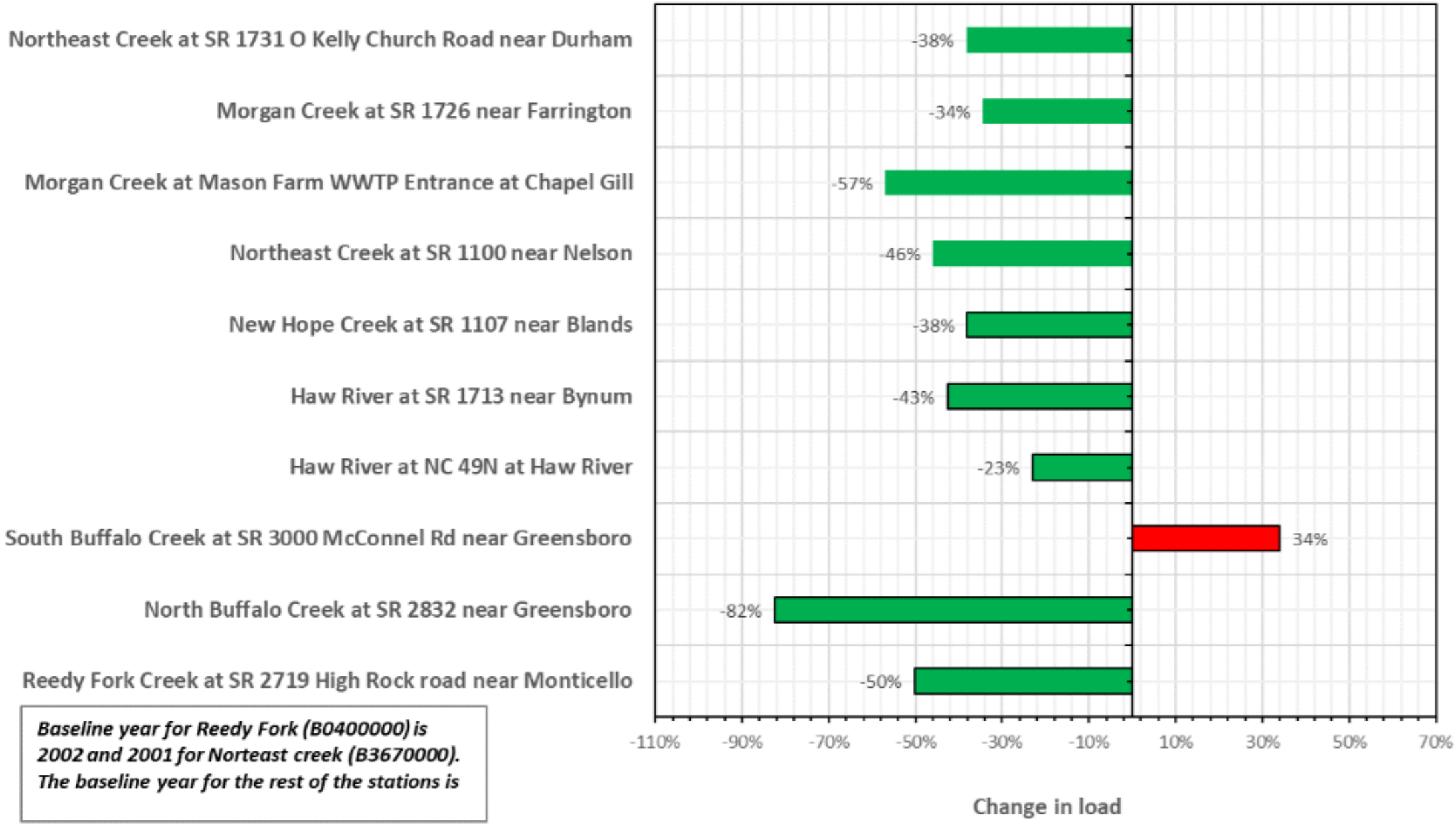
Note: All values are end-of-pipe.

Watershed Trends: Change in TN loading 1997-2020



Baseline year for Reedy Fork (B0400000) is 2002 and 2001 for Northeast creek (B3670000). The baseline year for the rest of the stations is 1997.

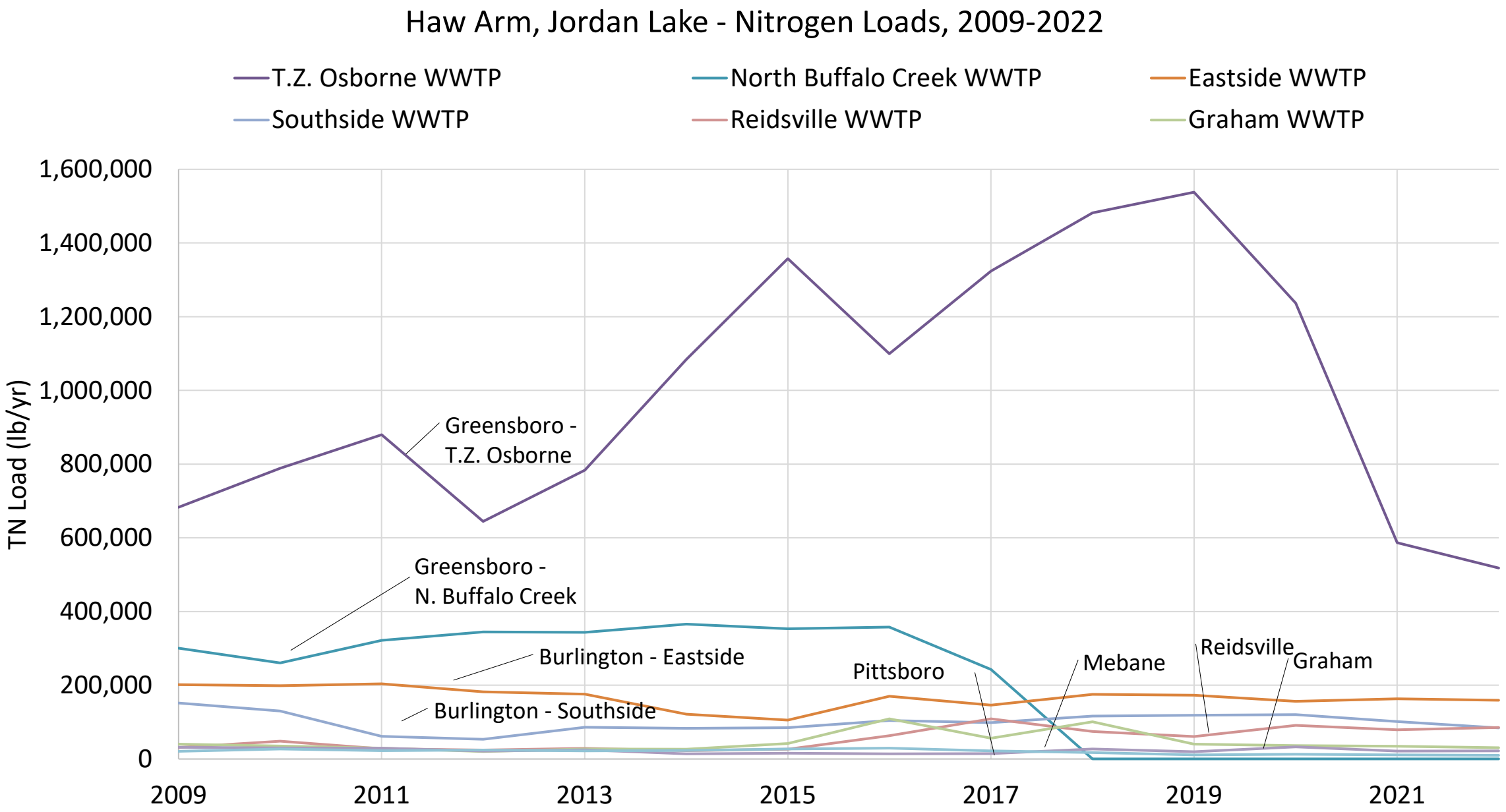
Watershed Trends: Change in TP loading 1997-2020

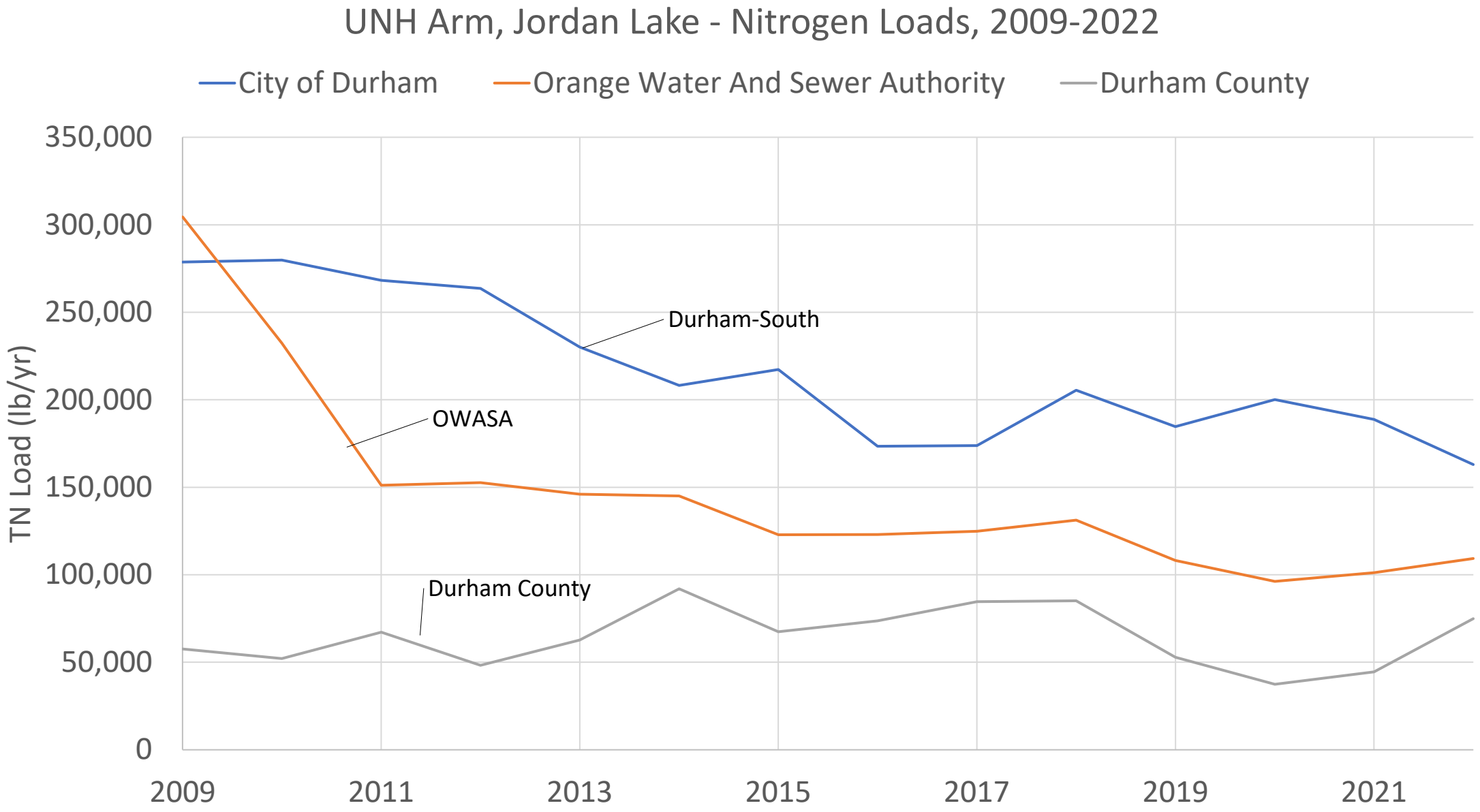


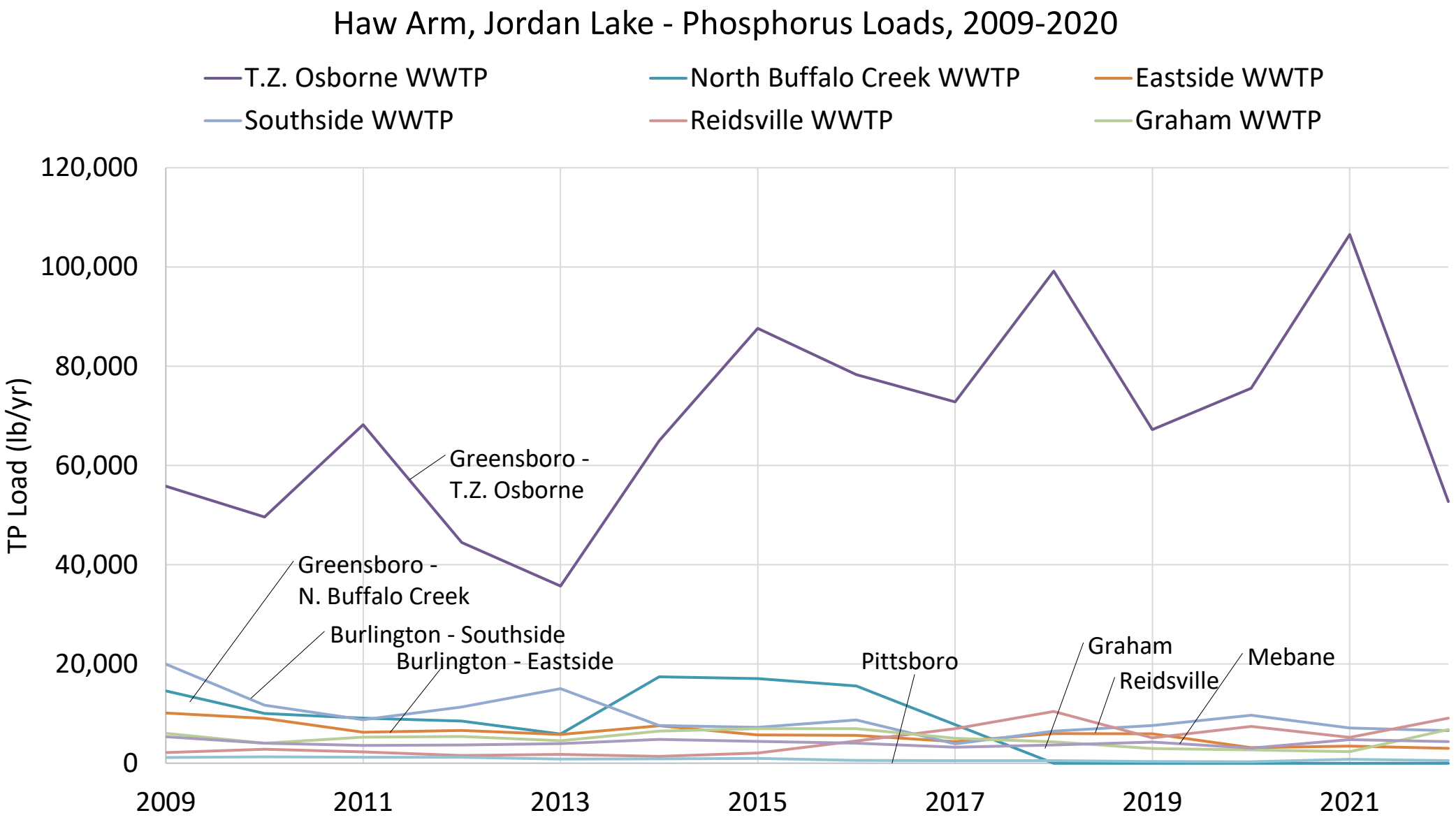
Baseline year for Reedy Fork (B0400000) is 2002 and 2001 for Norteast creek (B3670000). The baseline year for the rest of the stations is

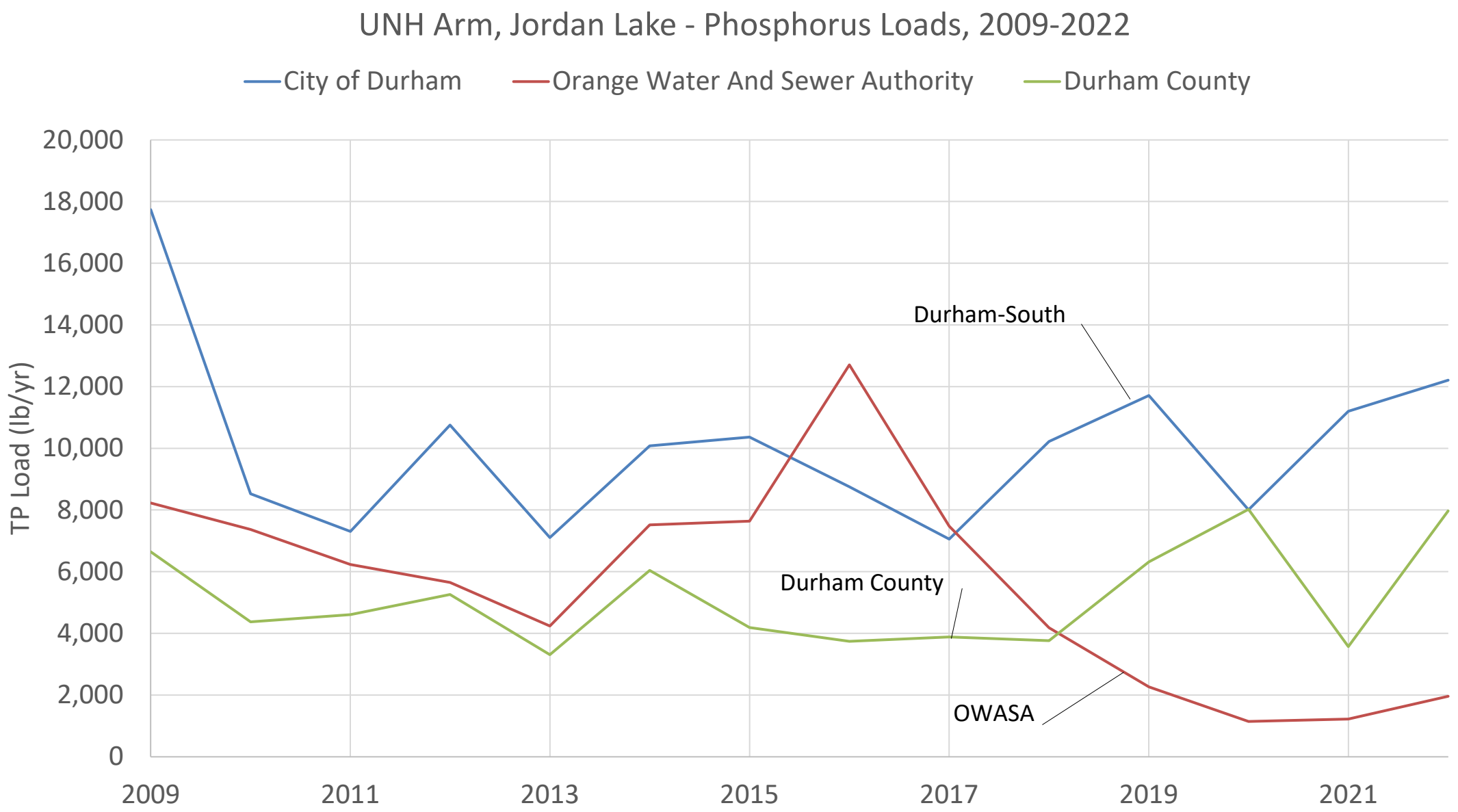
2021 Per Facility TN and TP Concentration and Loading ~top 4% highlighted

		Permitted Flow 2022	Actual Mean Flow	Mean Concentration		Loading		Concentration at +10% actual flow	
	Facility	MGD	MGD	TN (mg/L)	TP (mg/L)	N (lbs/yr)	P (lbs/yr)	TN(mg/l)	TP(mg/l)
UNH	South Durham	20	9.66	5.59	0.39	162,973	12,208	4.98	0.37
UNH	OWASA Mason Farm	14.5	4.20	8.41	0.13	109,214	1,957	7.68	0.14
UNH	Durham Co Triangle	12	4.22	5.73	0.62	74,870	7,972	5.24	0.56
UNH	Aqua - Chatham	0.35	0.1	8.58	0.35	2,641	105	7.77	0.31
LNH	Fearrington Village WWTP	0.27	0.14	27.93	0.59	12,190	280	24.06	0.55
HAW	T.Z. Osborne WWTP	40	32.55	5.22	0.54	518,040	52,736	4.70	0.48
HAW	Burlington Eastside	12	3.98	13.16	0.24	159,251	3,006	11.82	0.22
HAW	Burlington Southside	12	6.60	4.19	0.33	84,407	6,552	3.78	0.29
HAW	Reidsville WWTP	7.5	2.29	12.16	1.28	85,598	9,084	11.03	1.17
HAW	Graham WWTP	3.5	1.72	5.52	1.26	30,390	6,802	5.22	1.17
HAW	Mebane WWTP	2.5	1.55	4.59	0.91	21,801	4,362	4.15	0.83
HAW	Pittsboro WWTP	0.75	0.42	6.96	0.36	9,922	547	6.94	0.38
HAW	Quarterstone Farm WWTP	0.16	0.04	10.43	1.64	1,340	220	9.13	1.50

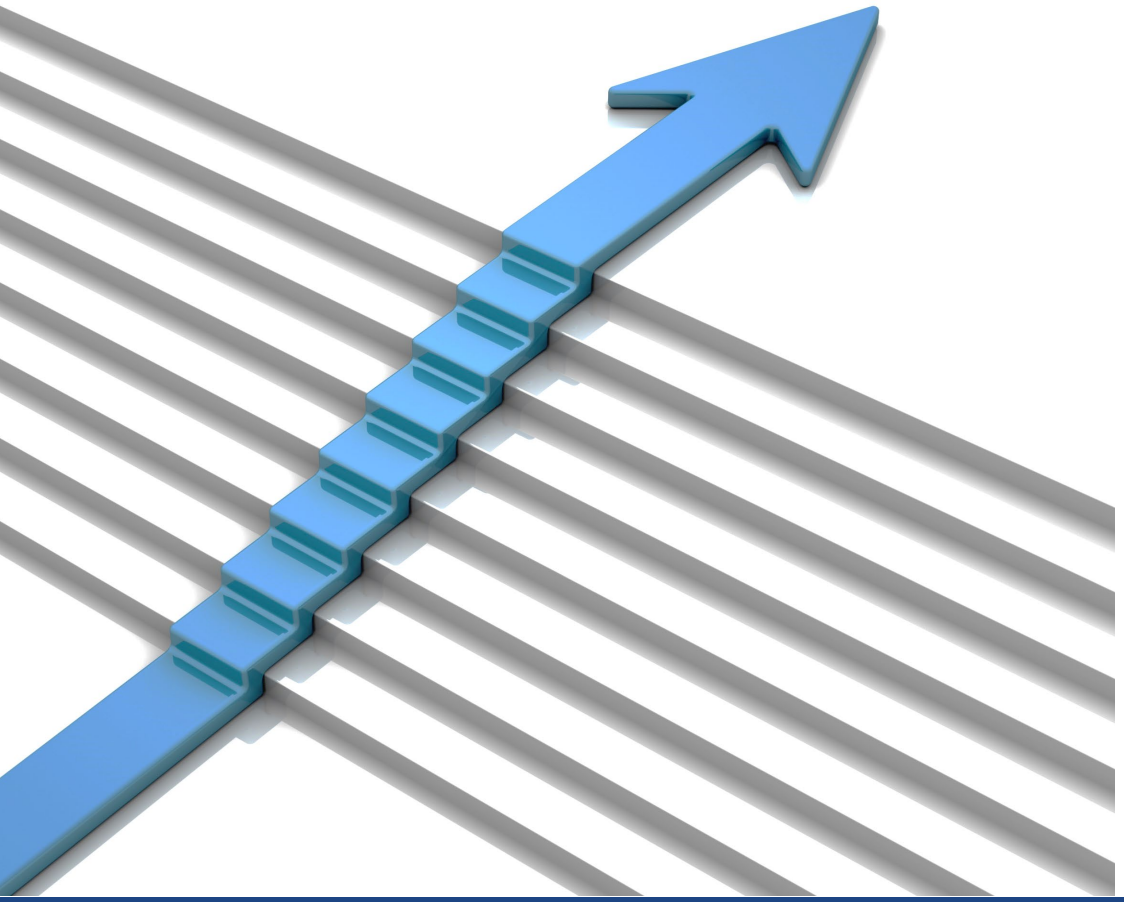

Haw Arm, Jordan Lake - Nitrogen Loads, 2009-2022
T.Z. Osborne WWTP
North Buffalo Creek WWTP
Eastside WWTP
Southside WWTP
Reidsville WWTP
Graham WWTP
TN Load (lb/yr)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2009
2011
2013
2015
2017
2019
2021
Greensboro - T.Z. Osborne
Greensboro - N. Buffalo Creek
Burlington - Eastside
Burlington - Southside
Pittsboro
Mebane
Reidsville
Graham


UNH Arm, Jordan Lake - Nitrogen Loads, 2009-2022
City of Durham
Orange Water And Sewer Authority
Durham County
TN Load (lb/yr)
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
2009
2011
2013
2015
2017
2019
2021
Durham-South
OWASA
Durham County


Haw Arm, Jordan Lake - Phosphorus Loads, 2009-2020
T.Z. Osborne WWTP
North Buffalo Creek WWTP
Eastside WWTP
Southside WWTP
Reidsville WWTP
Graham WWTP
TP Load (lb/yr)
120,000
100,000
80,000
60,000
40,000
20,000
0
2009
2011
2013
2015
2017
2019
2021
Greensboro - T.Z. Osborne
Greensboro - N. Buffalo Creek
Burlington - Southside
Burlington - Eastside
Pittsboro
Graham
Reidsville
Mebane


UNH Arm, Jordan Lake - Phosphorus Loads, 2009-2022
City of Durham
Orange Water And Sewer Authority
Durham County
TP Load (lb/yr)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
2009
2011
2013
2015
2017
2019
2021
Durham-South
Durham County
OWASA

Capacity to continue to reduce loading



- What has been done in similar watersheds?
- Would new limits reduce loading substantially?
- Do experts perceive ability to make meaningful wastewater advancements in Jordan?

Falls Wastewater Limits

Falls WWTP Equivalent Concentrations Stage I / Stage II

Three major facilities were treated as a group and the Stage I % percent reduction goals were applied to the sum of the baseline discharge and then divided among the three WWTP based on their current flows plus 10%.

- **Stage I** mass limits for the Upper Falls dischargers are equivalent on average to **3.09 mg/L TN** and **0.34 mg/L TP** at 110 percent of current flows (an allowance selected for 2016 flows).

- **The Stage 2 mass limits**, on the other hand, are the most stringent the Division has ever proposed, equivalent to approximately **1.1 mg/L TN** and **0.06 mg/L TP** at the facilities' full permitted flows. At full flow, these limits are beyond the reach of economically achievable biological nutrient treatment technology.

Falls Wastewater Implemented

Treatment levels reports in Falls 2021 Report (Range over past 5 years)

- North Durham:

Total N range = 1.90 to 2.90 mg/L TN
Total P range = 0.08 to 0.18mg/L
Actual Flow = 10.5 MGD (Permitted for 20 MGD)

- SGWASA:

TN range = 1.70 to 2.67 mg/L
TP range = 0.10 to 0.34 mg/L. TP
Actual Flow = 2.0 MGD (Permitted for 5.5 MGD)

- Hillsborough:

TN range = 1.45 to 1.94 mg/L TN
TP range = 0.16 to 0.77 mg/L TP
Actual Flow = 1.5 MGD (Permitted for 3.0 MGD

All less than 3mg/l TN - mean concentration at actual flow

Neuse Wastewater: NRCA

- Neuse River Compliance Association (NRCA) WWTP: A Group Compliance Association for NPDES Permit, **25 Permittees.**

- The association currently has a permitted allocation of 1,184,165 lbs. of nitrogen at the estuary and in 2012 delivered 540,892 lbs, or an average estuary delivery concentration of 1.8 mg/L from the member facilities.

- Range of facilities mean concentrations at actual flow:
- 1.72 - 0.04mg/l TP
- 12.9 - 0.85mg/l **TN - Daily average 2.44mg/l**
- City of Raleigh Neuse River: 45.87MGD, 2.25mg/l TN, 1.34mg/l TP

- All facilities' investments to date are over $500 million.

Neuse Wastewater: NRCA Insights

- Top performers in the NRCA are all **optimizing their treatment process in different ways,** no single approach that is best for everyone.
  - Operator is key position.

- All are using some **form of biological nutrient removal**, most have to add a carbon source like methanol or a synthetic source to make the biological process work.
  - Raleigh has in-situ monitors.

- Many facilities treating below 3.0 mg/L nitrogen **use Denitrification Filter**.

- Achieving **both N and P reductions versus just N is challenging**. P reduction requires anaerobic biological processes while the Denitrification treatment process is creating O2 Most facilities have to add sulfates to remove the Oxygen to help facilitate P removal process.

Jordan Scenario Reductions

- Let's look at a few initial scenarios for reducing nutrient loading from Jordan major WWTPs - working backwards looking at potentially achievable concentration limits.
- Limits of technology are pushed below 2mg/l TN and .05 mg/l TP.

Partial Greensboro upgrades

	Scenarios - loading @ +110% flow									
	EOP- TN lbs/yr		EOP - TP lbs/yr			To Lake - TN lbs/yr		To -Lake - TPlbs/yr		
Facility	3mg/	2mg/l	0.23 (mg/l)	0.18 (mg/l)	0.05 (mg/l)	3mg/l	2mg/l	0.23 (mg/l)	0.18 (mg/l)	0.05 (mg/l)
South Durham	98,169	65,446	7,526	5,890	1,636	96,206	64,137	6,698	5,242	1,456
Mason Farm	42,657	28,438	3,270	2,559	711	41,377	27,585	3,140	2,457	683
Triangle	42,857	28,571	3,286	2,571	714	41,142	27,428	3,187	2,494	693
Chatham	1,020	680	78	61	17	990	660	75	59	16
Fearrington Villa	1,520	1,013	117	91	25	1,474	983	112	88	24
T.Z. Osborne	330,532	220,355	25,341	19,832	5,509	247,899	165,266	15,965	12,494	3,471
Eastside	40,423	26,949	3,099	2,425	674	32,743	21,829	2,200	1,722	478
Southside	67,048	44,699	5,140	4,023	1,117	54,309	36,206	4,061	3,178	883
Reidsville	23,288	15,525	1,785	1,397	388	15,603	10,402	982	768	213
Graham	17,471	11,648	1,339	1,048	291	13,104	8,736	951	744	207
Mebane	15,745	10,497	1,207	945	262	11,809	7,872	760	595	165
Pittsboro	4,289	2,860	329	257	71	3,260	2,173	270	211	59
Quarterstone Fa	440	294	34	26	7	330	220	21	17	5
Total:	685,460	456,973	52,552	41,128	11,424	560,245	373,497	38,422	30,070	8,353

Reductions in lbs/yr and percents relative to two baseline periods (2014 and 2019,21)	Scenarios - loading @ +110% flow									
	EOP- TN lbs/yr		EOP - TP lbs/yr			To Lake - TN lbs/yr		To Lake - TP lbs/yr		
	3mg/	2mg/l	0.23 mg/l	0.18 mg/l	0.05 mg/l	3mg/l	2mg/l	0.23 mg/l	.18 mg/l	0.05 mg/l
Difference in TN&TP lbs/yr from 2014	-1516627	-1745114	-82953.102	-94377.428	-124080.7	-1204233	-1390982	-56672.9	-65025.6	-86742.5
% Reduction from TN&TP 2014	-69%	-79%	-61%	-70%	-92%	-68%	-79%	-60%	-68%	-91%
Difference in TN&TP lbs/yr from 2019,21	-684037	-912524	-102030.05	-113454.37	-143157.6	-559639	-746387	-66874.1	-75226.8	-96943.8
% Reduction from TN&TP 2019,21	-50%	-67%	-66%	-73%	-93%	-50%	-67%	-64%	-71%	-92%

Discussion

- Are any further operational or facility improvements planned to reduce TN or TP concentrations?
- Are there current plans to upgrade facilities to treat other contaminants?
  - Greensboro is testing for 1-4 Dioxane and plans for PFAS
  - What would be needed for you to consistently achieve 3 mg/l TN and 0.18 mg/l TP at current and near-future flows?
  - Almost all facilities are currently around half to one-third of permitted flows
- Do you feel it would be equitable and feasible to require smaller dischargers - .02-.03 MGD – to meet limits?
- Is there interest in learning more about Neuse NRCA wastewater collaborations?
- Interest in starting/expanding group compliance associations in Jordan?
- Has anyone investigated nonpoint source nutrient reduction practices as an option?

Ellie Rauh

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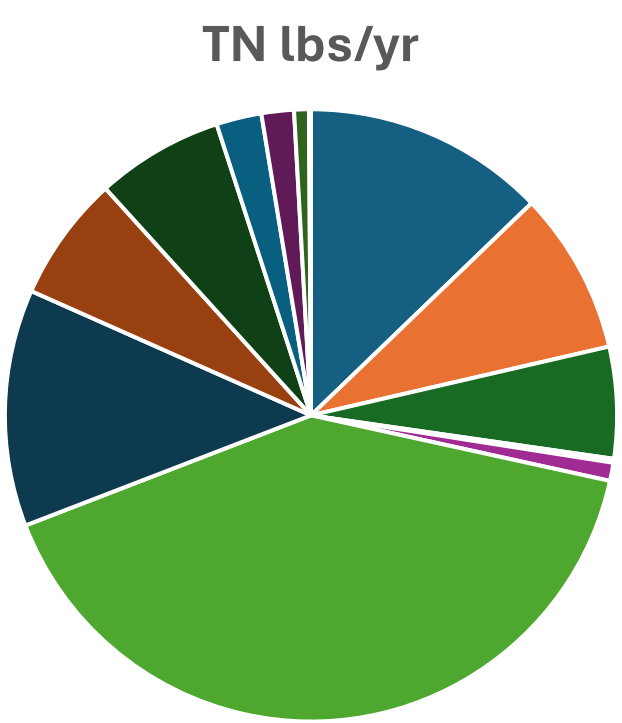
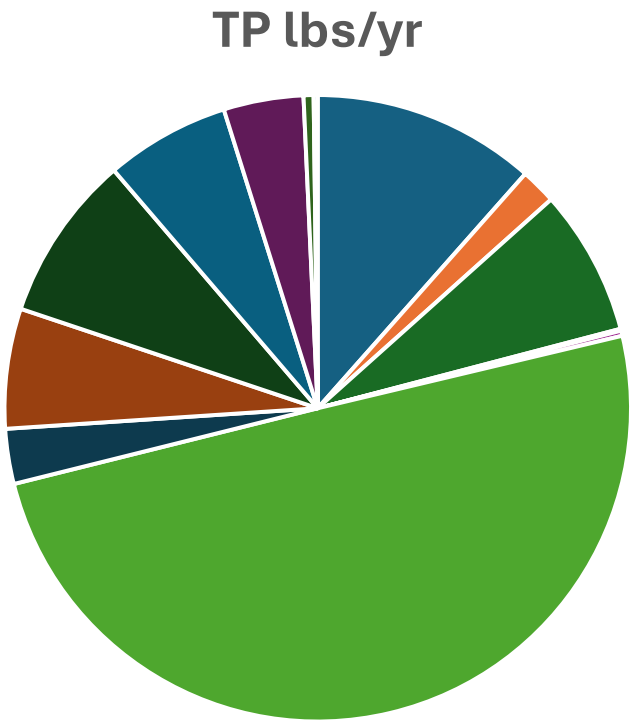
Thank you for your time and input.

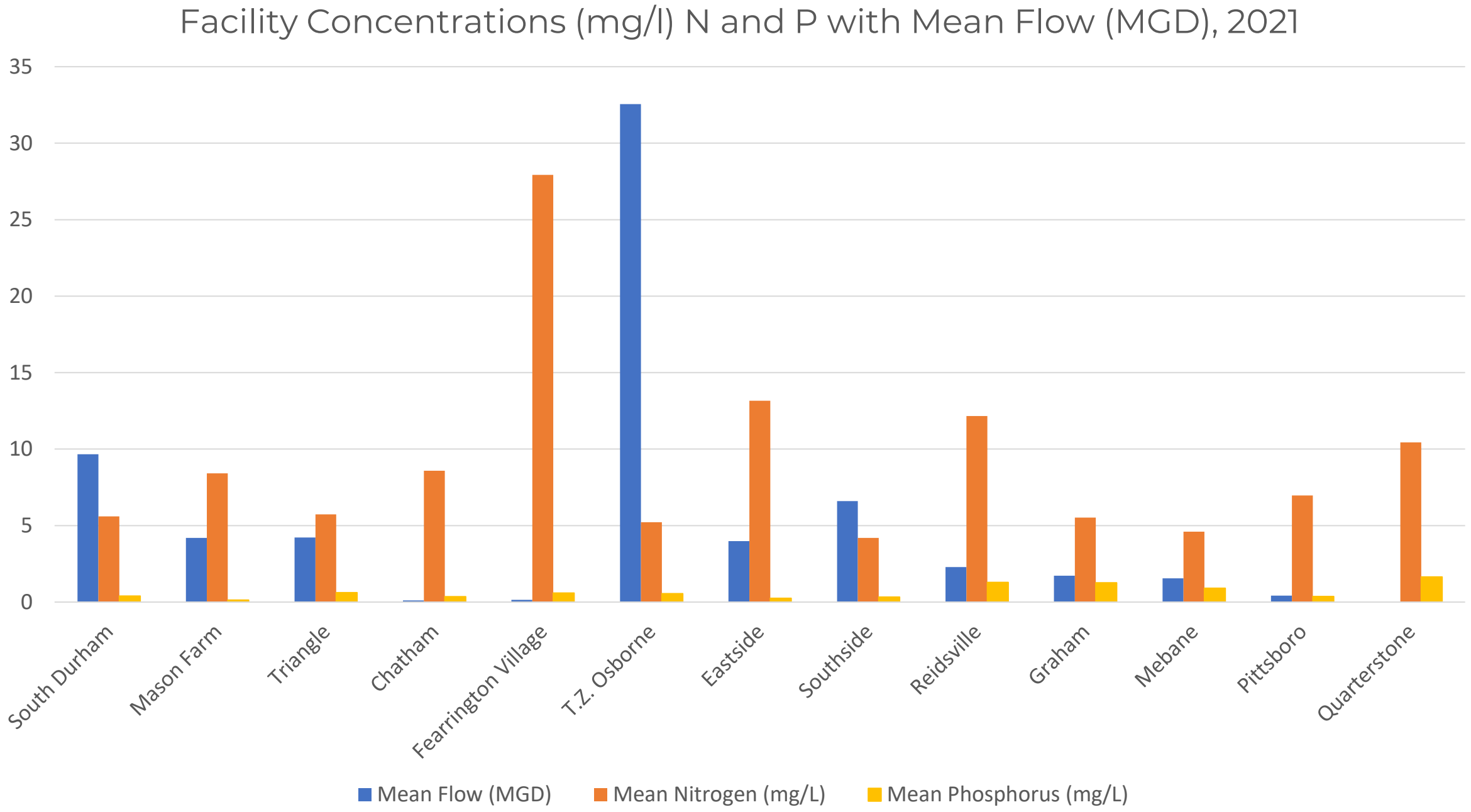
We appreciate your time sending us your comments and any data/reports that can support wastewater decisions.

Facility Loading, 2021



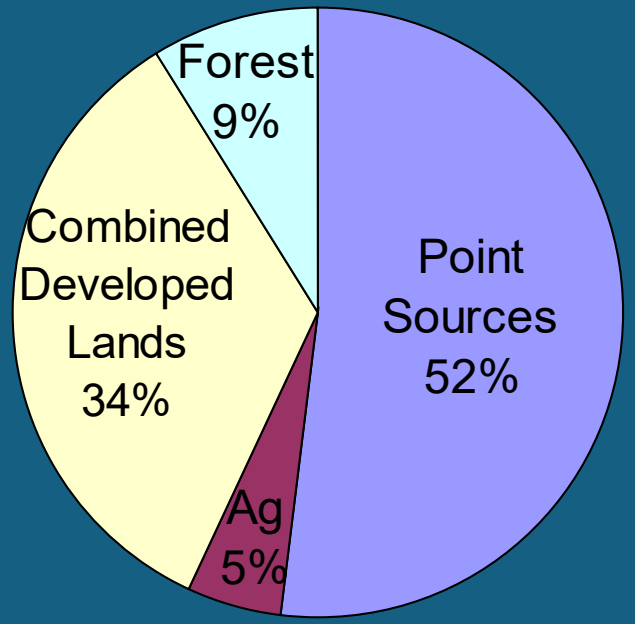


South Durham
Mason Farm
Triangle
Chatham
Fearrington Village
T.Z. Osborne
Eastside
Southside
Reidsville
Graham
Mebane
Pittsboro
Quarterstone

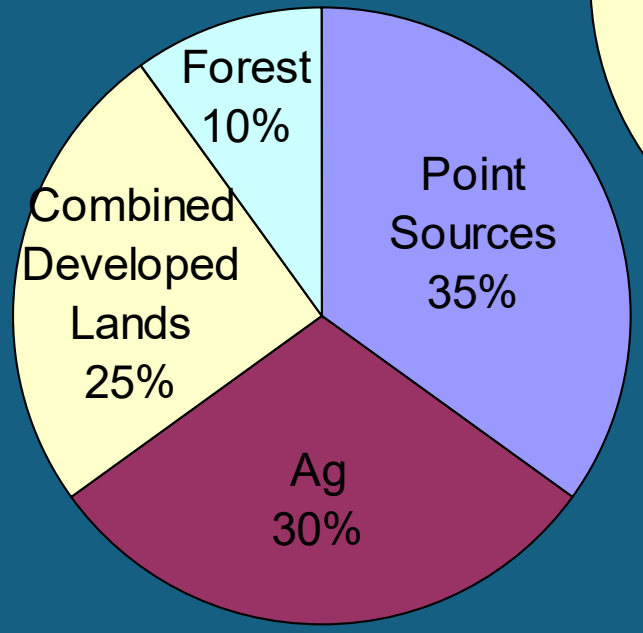

Facility Concentrations (mg/l) N and P with Mean Flow (MGD), 2021
35
30
25
20
15
10
5
0
South Durham
Mason Farm
Triangle
Chatham
Fearrington Village
T.Z. Osborne
Eastside
Southside
Reidsville
Graham
Mebane
Pittsboro
Quarterstone
Mean Flow (MGD)
Mean Nitrogen (mg/L)
Mean Phosphorus (mg/L)

N Inputs to Arms of Jordan Lake: 2003

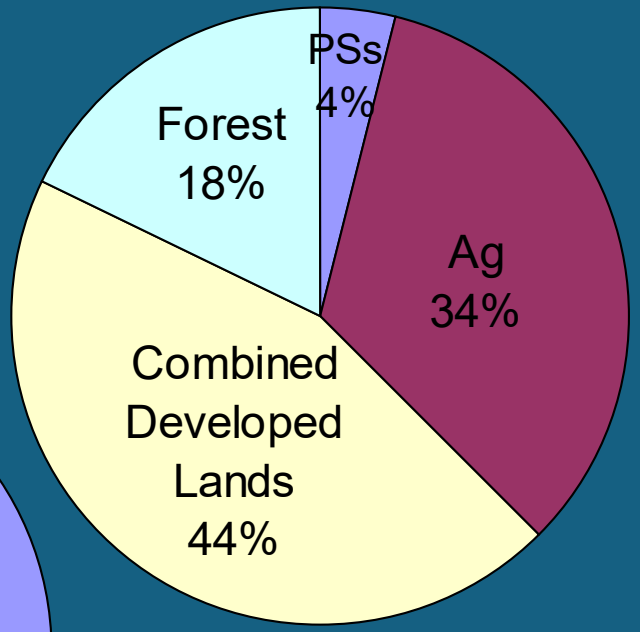
Upper New Hope Arm



Haw River Arm



Lower New Hope Arm



Component 3. Nutrient Delivery