

Validating Pollutant Load Estimates from Highways and Roads

**Conducted for NH Department of Transportation
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Objective

To understand pollutant load and export from various road types.

Pollutants: TSS, TN, TP, Cl, Zn

Only non-winter time monitoring

The SIMPLE Method

$$L = 0.226 * R * C * A$$

Where:

- L = Annual load (lbs)
- R = Annual runoff (inches)
- C = Pollutant concentration (mg/l)
- A = Area (acres)
- 0.226 = Unit conversion factor

Project Outline

- In depth literature review
- Identification of 3 sites of varying average daily traffic counts (ADT)
- Monitoring of a minimum of 15 storm events
- Reporting

Literature Review

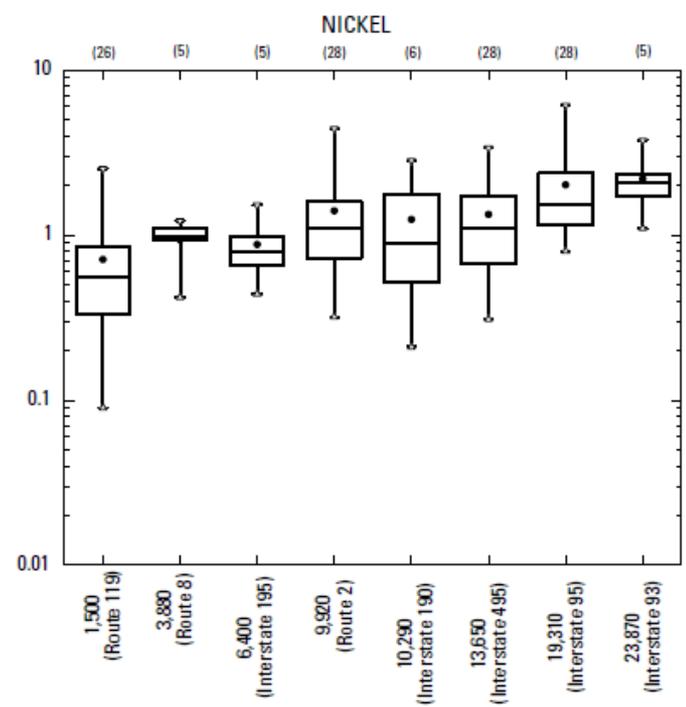
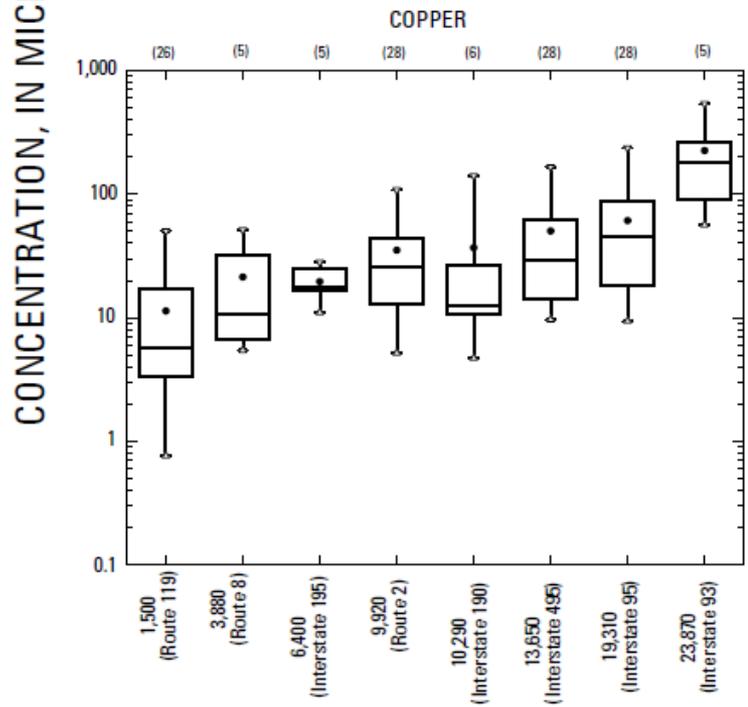
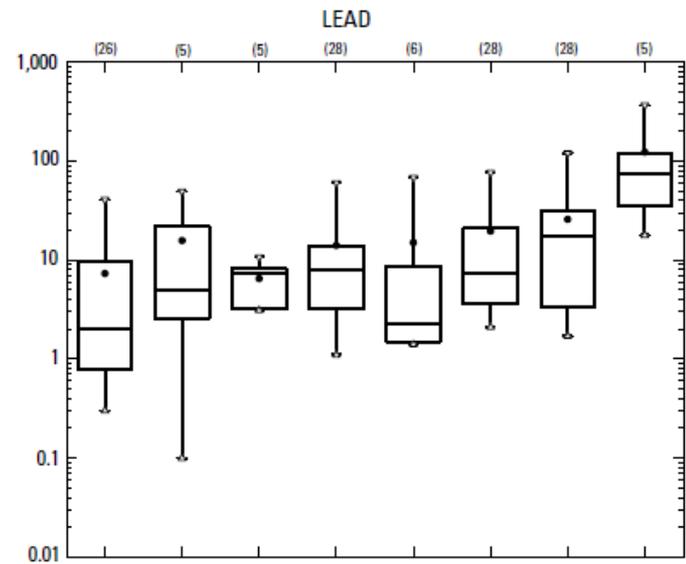
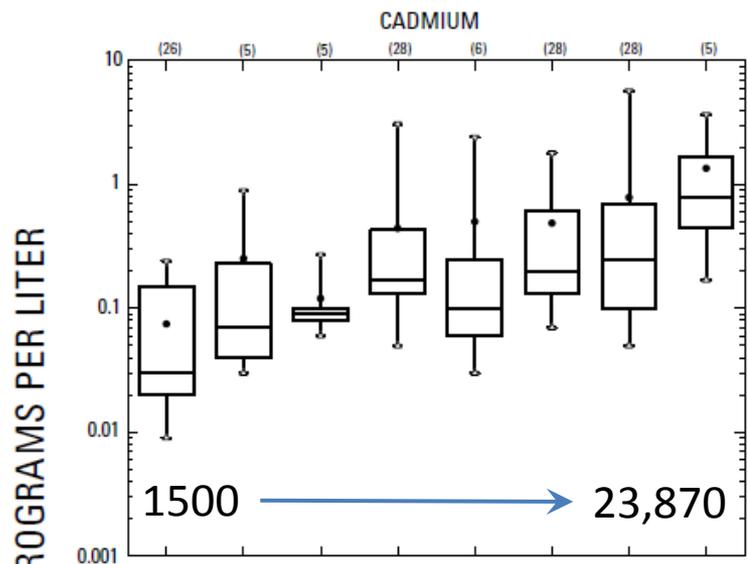
Source	Residential	Commercial	Roadway	Industrial
Schueler, 1987 mean	100 ¹	-	-	-
Gibb <i>et al.</i> , 1991 mean	150	-	220	-
Smullen and Cave, 1998 median	55	55	55	55
US EPA, 1983 median	101	69	-	-
Claytor and Schueler, 1996	-	-	142	124
Barrett and Malina, 1998	-	-	173	-

SIMPLE Method TSS

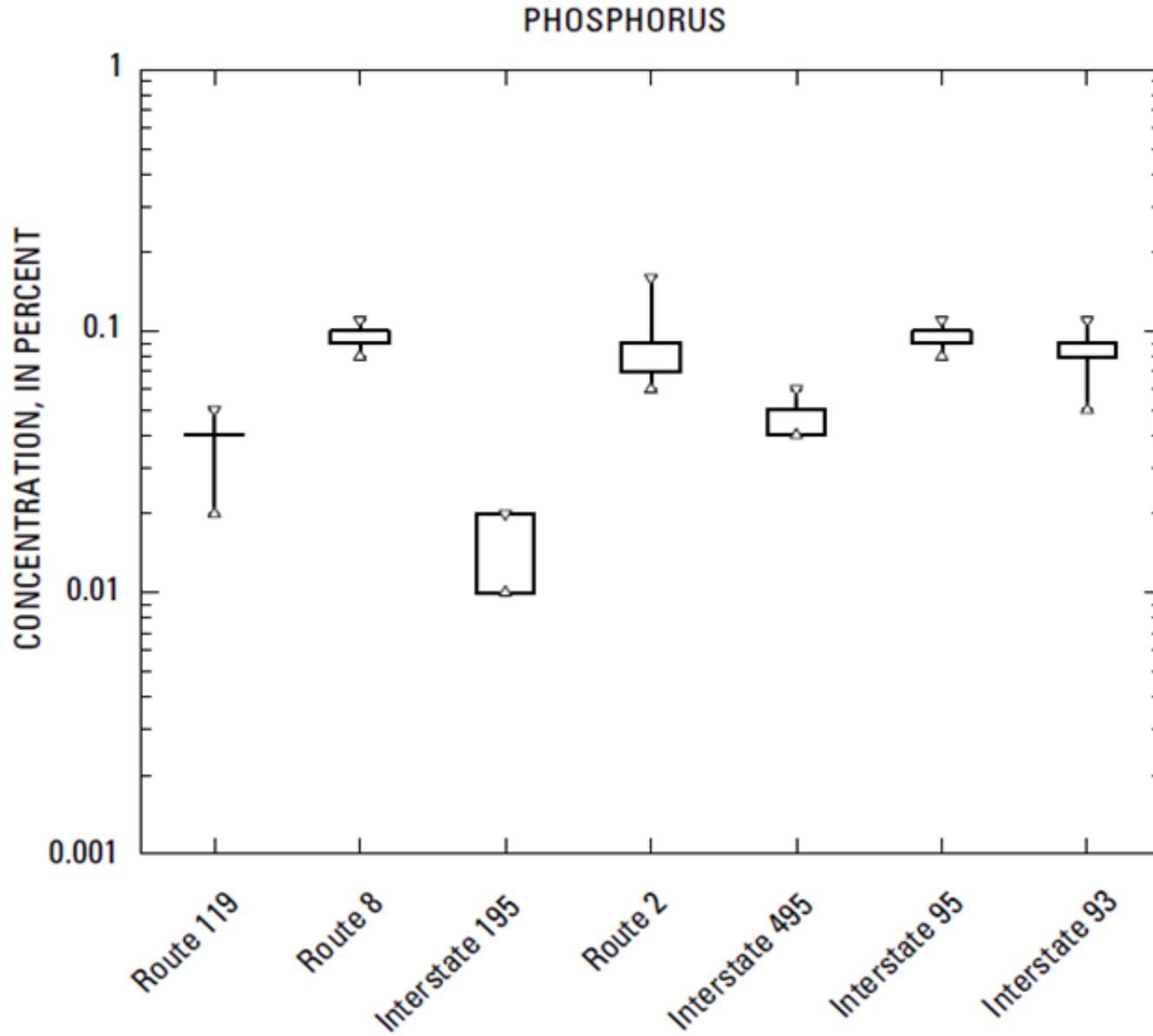
Model Default Value Roadway 150

TSS

	Interstate 93 (1999–2000) 25th percentile	Interstate 93 (1999–2000) median	Interstate 93 (1999–2000) 75th percentile	Interstate 93 (2006–07) median
Suspended sediment, mg/L	276	426	665	714
Suspended sediment < 0.063 mm, percent	43	72	86	21



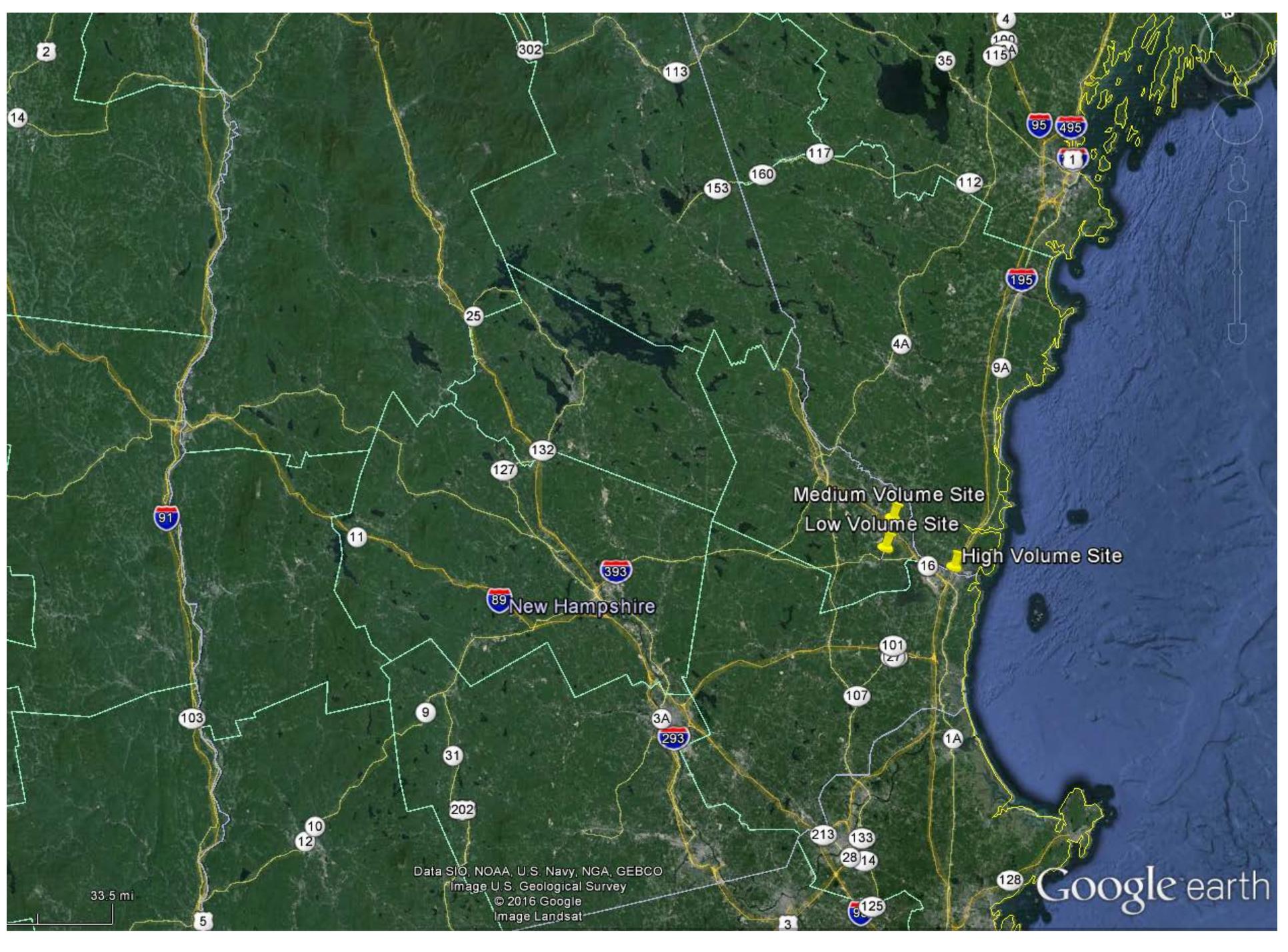
ANNUAL AVERAGE VEHICLES PER DAY PER TRAVEL LANE



Research Approach

Description of monitoring sites

Site	Description	Location	Number of Storms Sampled
1	High traffic count (>75,000 ADT)	Outfall located off I-95 draining a 32,670 sf section of highway with a 24” outfall. Access off of Edmond Avenue in Portsmouth, NH.	15
2	Moderate traffic count (> 35,000 ADT)	Outfall located off Route 16 draining a 13,500 sf section of the southbound highway with an 18” outfall. Accessed from the southbound lane off Rt. 108 across from Agway in Dover, NH.	23
3	Lower traffic count (< 15,000)	Outfall located off Route 4 draining a 10,080 sf section of highway with a 12” outfall. Accessed from the northbound lane of Rt. 108.	18



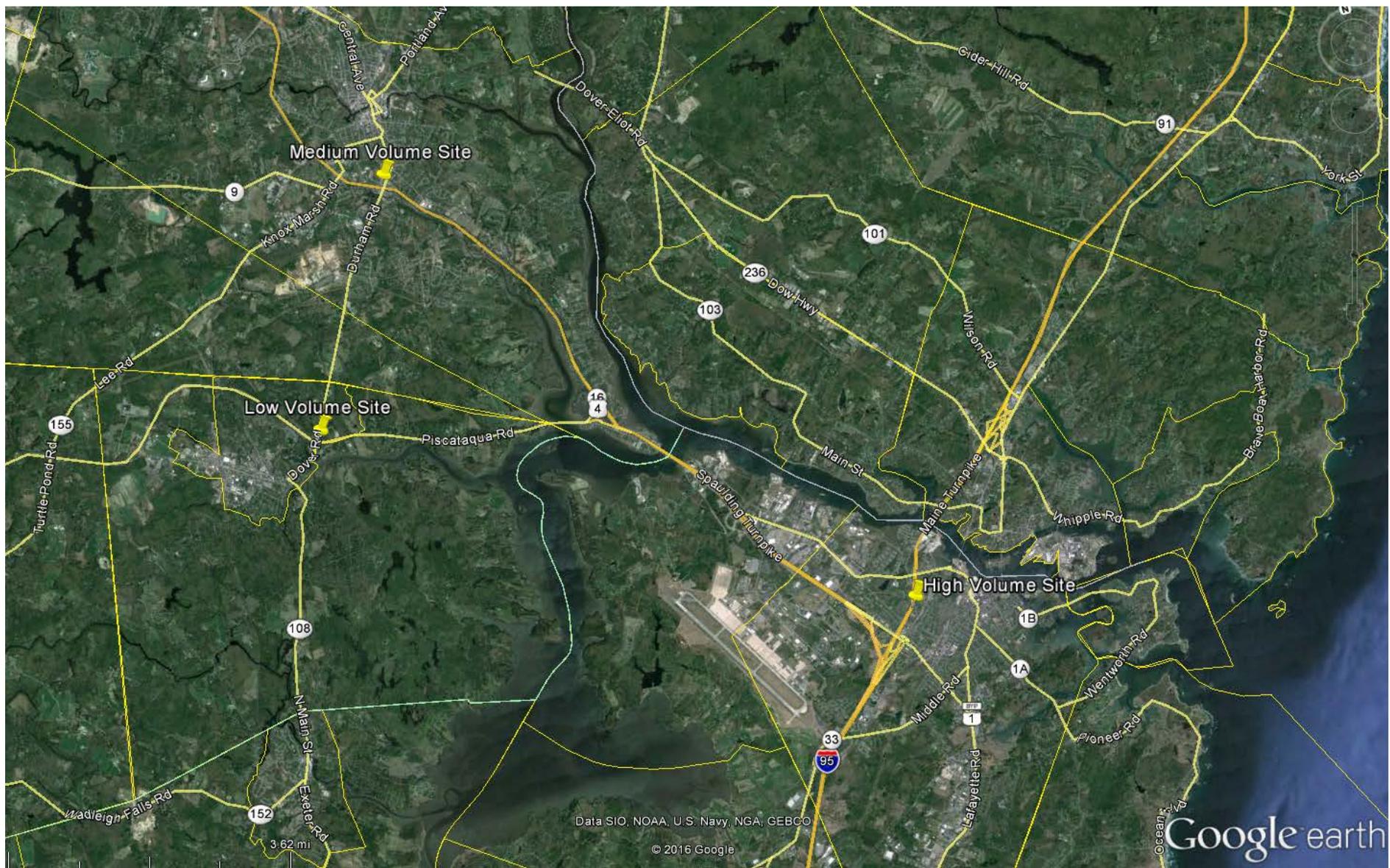
Medium Volume Site
Low Volume Site
High Volume Site

New Hampshire

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image U.S. Geological Survey
© 2016 Google
Image Landsat

33.5 mi

Google earth



High Traffic Volume Site – I95



High Traffic Site > 80,000 ADT



High Traffic Site > 80,000 ADT



Medium Traffic Volume Site Rt 16



Medium Traffic Site > 35,000 ADT



Medium Traffic Site > 35,000 ADT



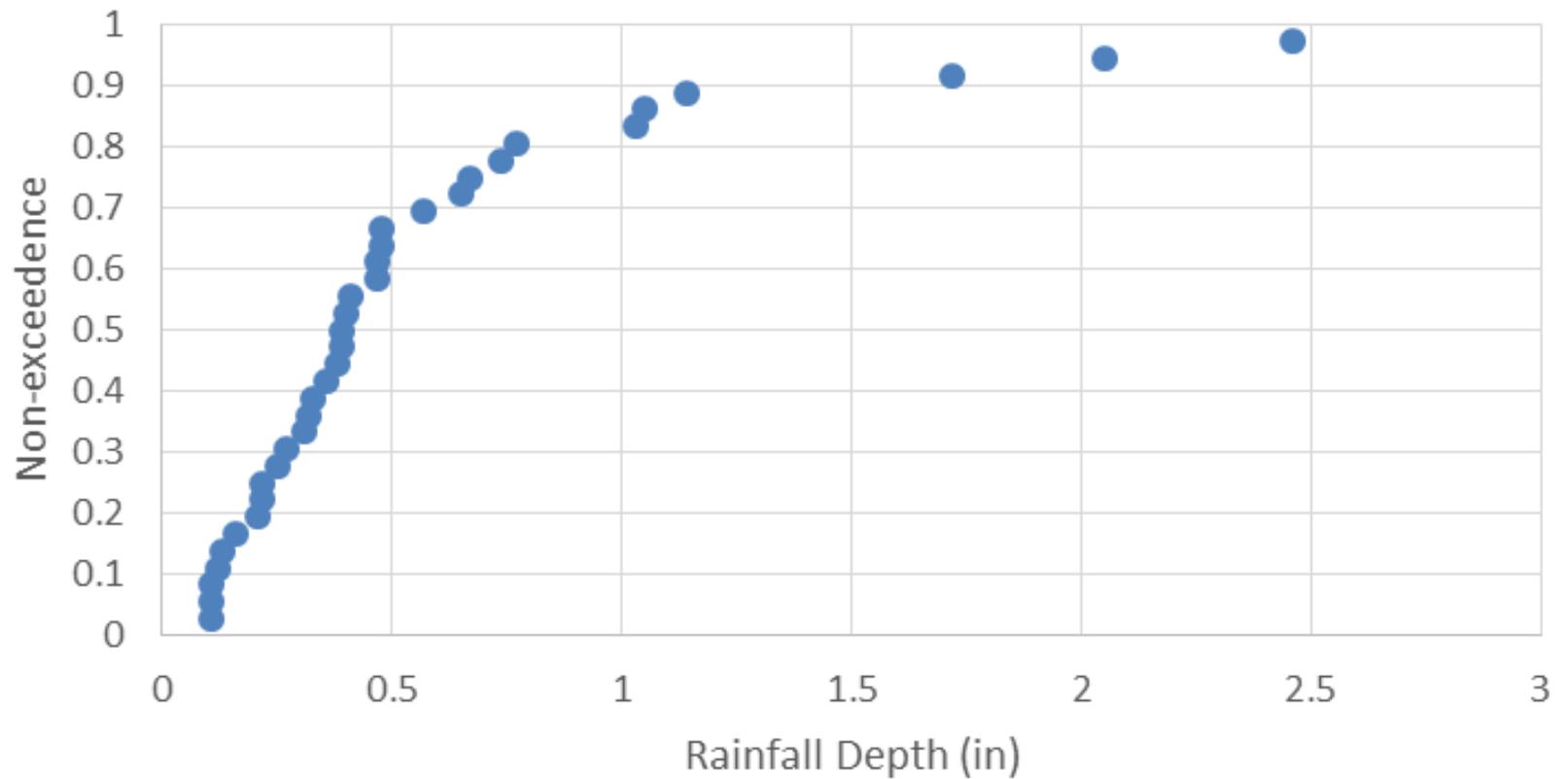
Low Traffic Volume Site – Rt 4



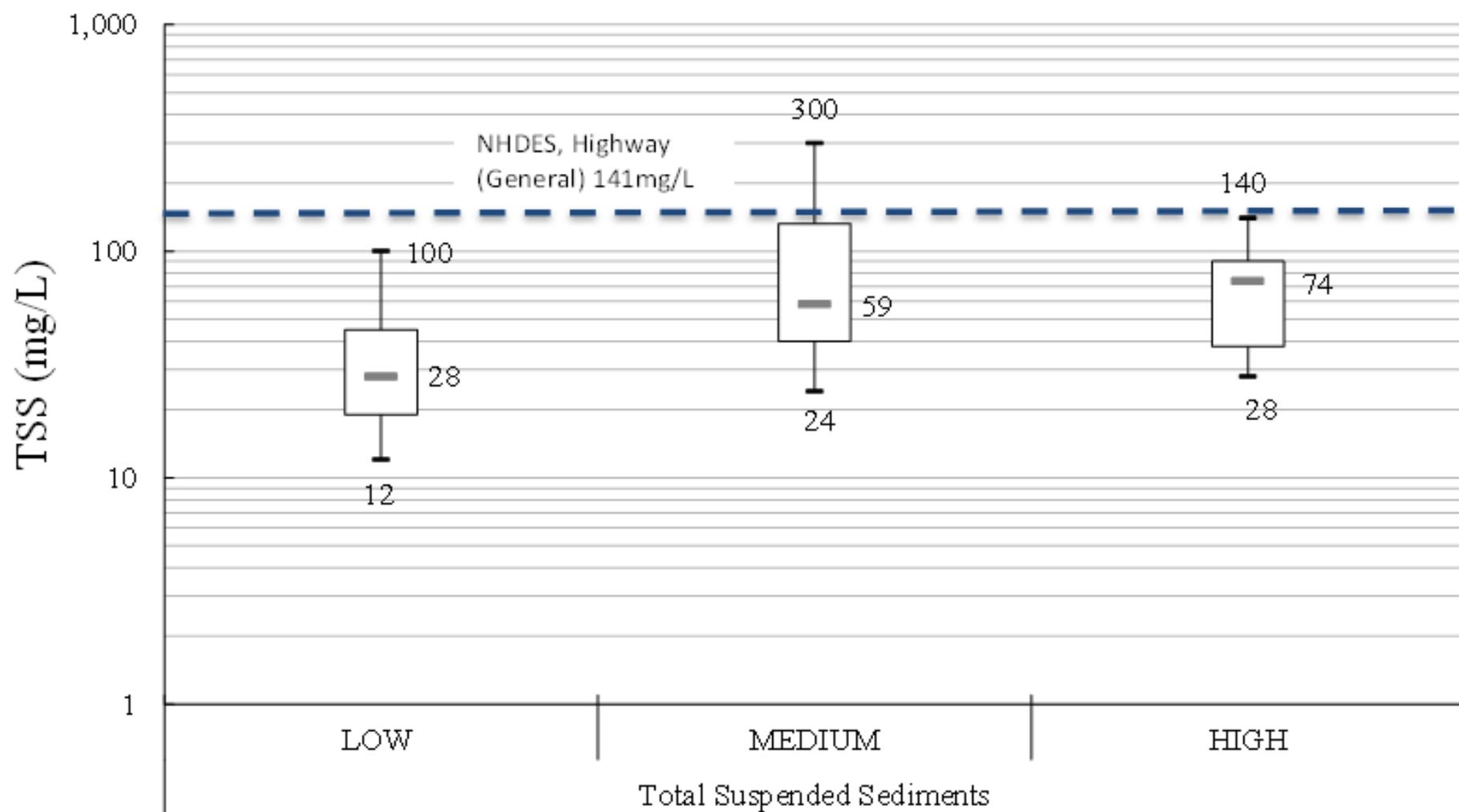
Storms

Event Date	Total Rainfall (in)	Peak Intensity (in/5-min)	Rt. 4 Storm Volume (gal)	Rt. 16 Storm Volume (gal)	I-95 Storm Volume (gal)	Antecedent Dry Period	Season
5/16/2014	1.03	0.07	-	8,078	-	5	Spring
5/22/2014	0.25	0.01	-	1,961	-	4	Spring
5/27/2014	0.47	0.03	-	3,686	-	3	Spring
6/5/2014	0.16	0.02	-	1,255	-	5	Spring
6/13/2014	0.67	0.05	3,923	-	-	7	Spring
6/25/2014	0.77	0.11	-	6,039	-	11	Summer
7/7/2014	0.48	0.08	-	3,765	-	1	Summer
7/13/2014	0.11	0.02	-	863	-	3	Summer
7/23/2014	0.47	0.05	-	3,686	-	6	Summer
7/27/2014	0.39	0.02	-	3,059	-	3	Summer
7/28/2014	0.57	0.02	3,338	-	-	1	Summer
7/31/2014	0.11	0.03	644	863	-	3	Summer
8/7/2014	0.41	0.27	-	3,216	-	5	Summer
8/13/2014	2.46	0.19	14,406	-	-	5	Summer
9/6/2014	0.13	0.01	761	-	-	3	Summer
9/13/2014	0.11	0.01	644	-	-	5	Summer
10/1/2014	0.22	0.02	1,874	1,725	-	9	Fall
10/4/2014	0.22	0.03	1,230	1,725	6,720	2	Fall
10/16/2014	0.65	0.14	3,338	5,098	15,477	11	Fall
10/21/2014	2.05	0.09	10,951	16,078	38,081	4	Fall
11/1/2014	0.48	0.01	2,050	3,765	7,128	8	Fall
11/6/2014	0.32	0.02	-	2,510	5,295	4	Fall
12/2/2014	0.39	0.02	2,284	-	7,942	5	Fall
6/9/2015	0.33	0.11	1,581	2,588	-	6	Spring
6/15/2015	0.31	0.02	-	2,431	8,349	5	Spring
6/20/2015	1.05	0.05	-	8,235	-	5	Spring
6/23/2015	0.38	0.05	-	-	7,738	1	Summer
7/1/2015	0.4	0.03	2,167	3,137	8,146	2	Summer
7/9/2015	0.12	0.01	703	-	3,055	1	Summer
7/15/2015	0.21	0.13	1,464	1,647	4,277	4	Summer
7/30/2015	0.27	0.13	-	-	5,498	7	Summer
8/21/2015	1.14	0.15	6,676	-	-	2	Summer
9/10/2015	0.36	0.08	2,167	2,823	7,331	17	Summer
10/9/2015	0.74	0.07	-	-	15,070	8	Fall
10/28/2015	1.72	0.1	-	-	35,027	5	Fall

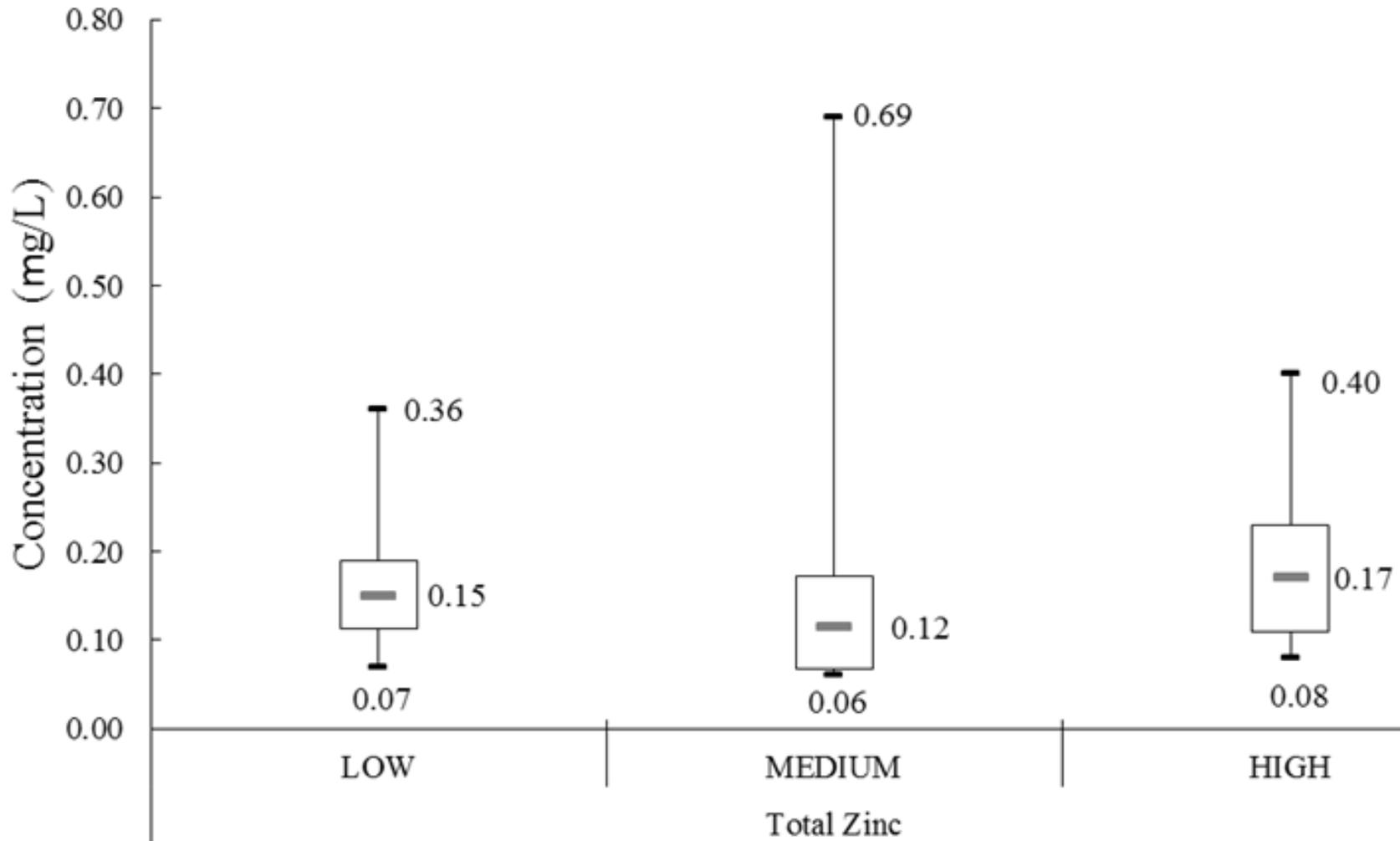
Rainfall Non-exceedence



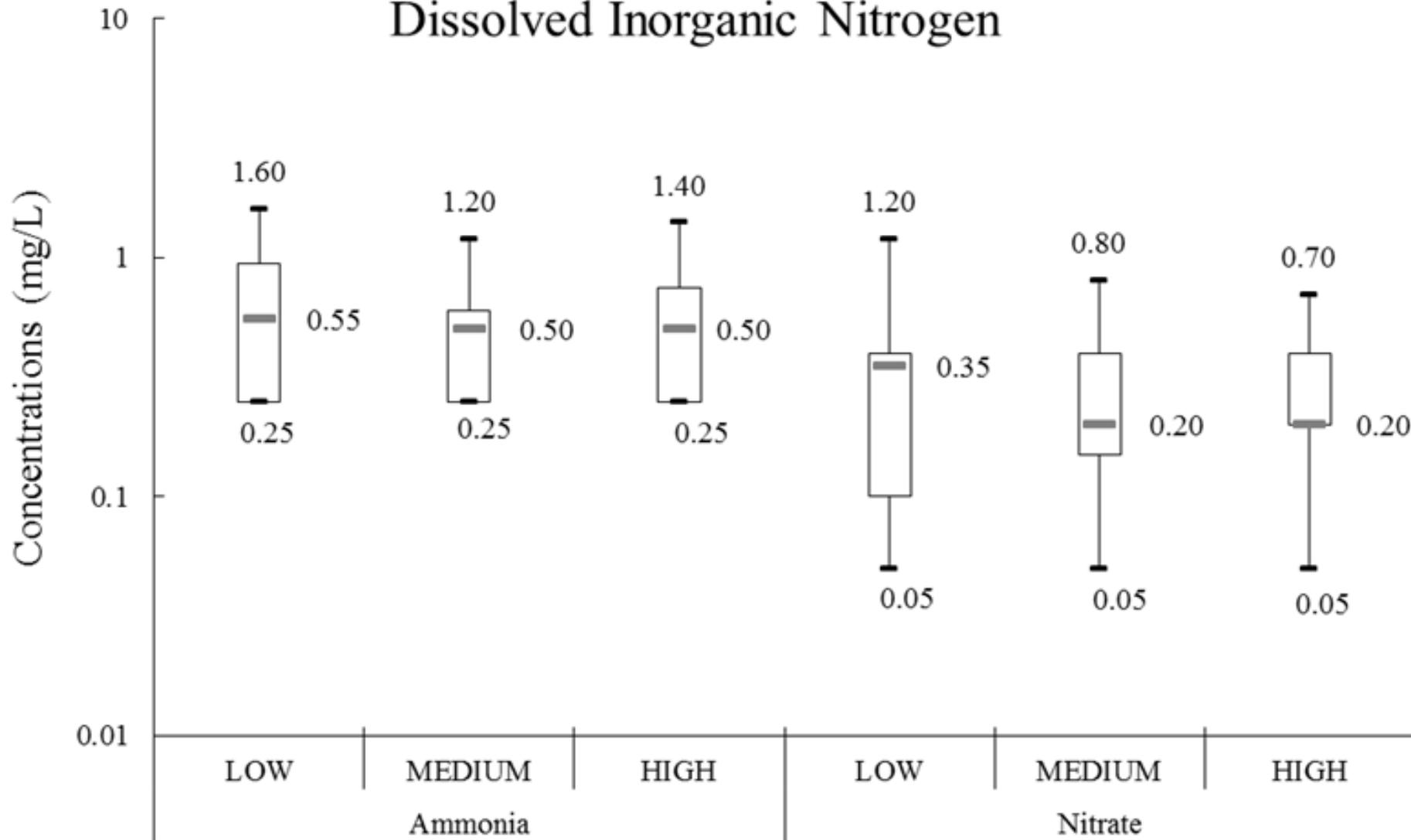
Pollutant Loading : Total Suspended Sediment



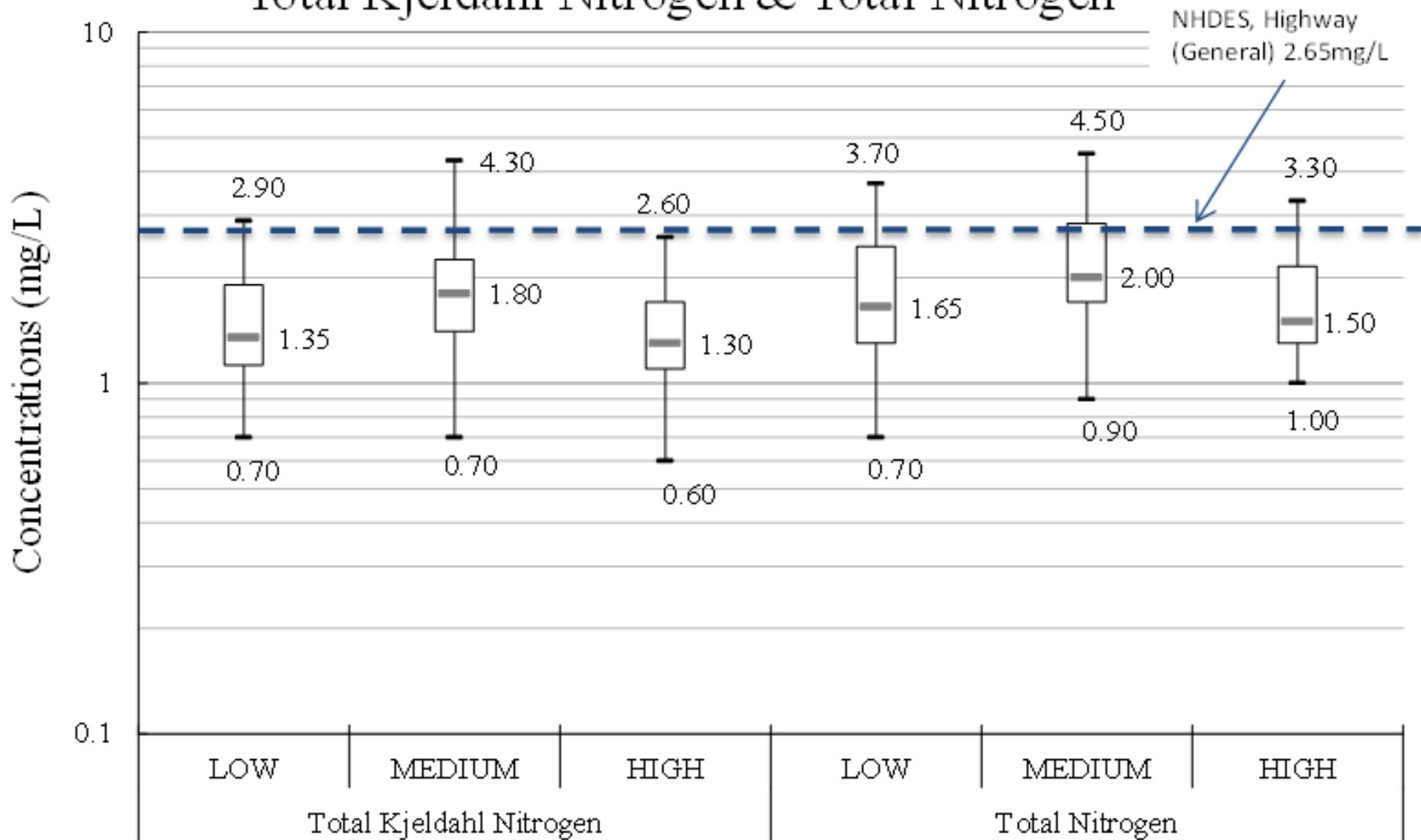
Pollutant Loading : Total Zinc



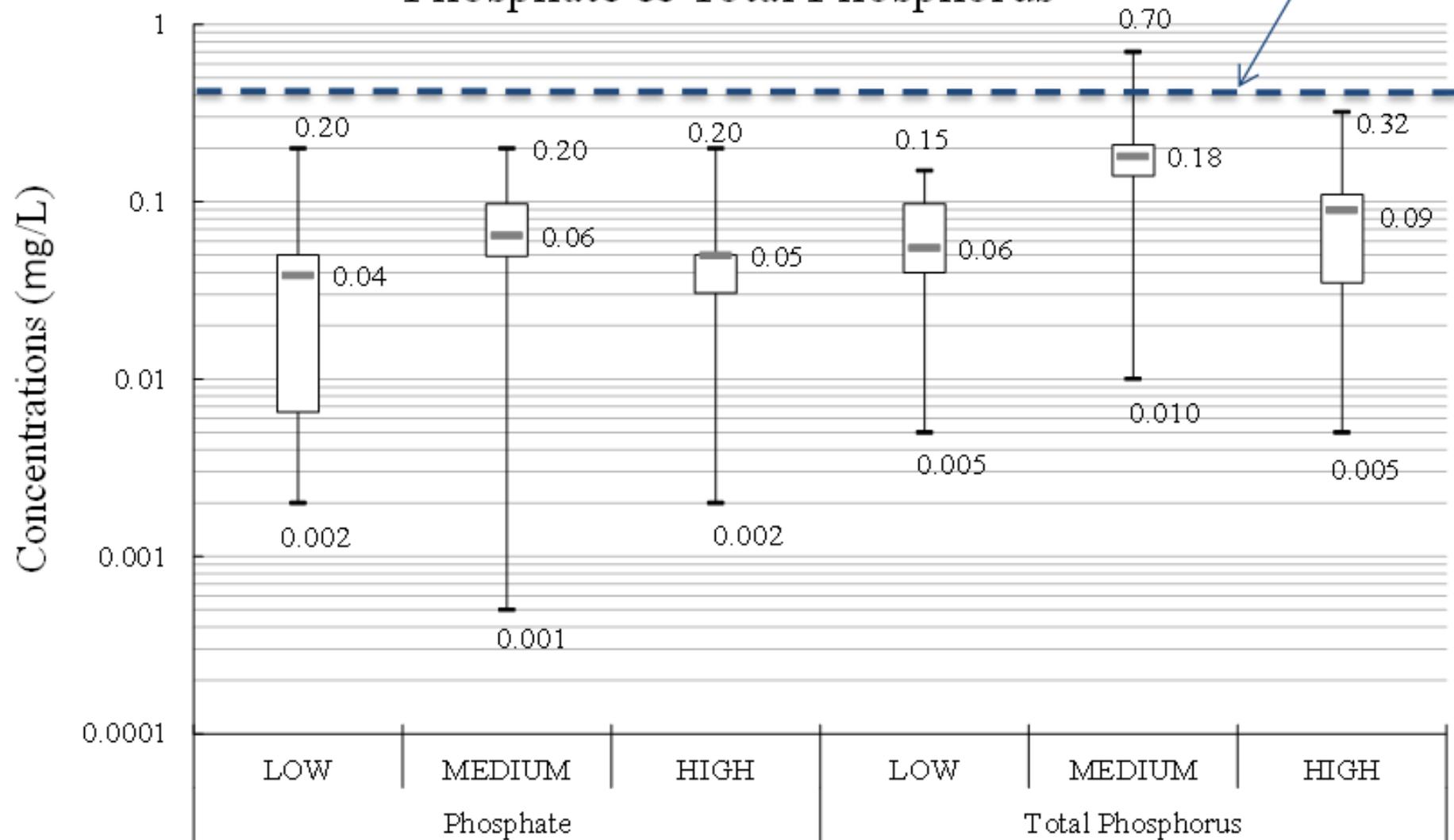
Pollutant Loading : Dissolved Inorganic Nitrogen



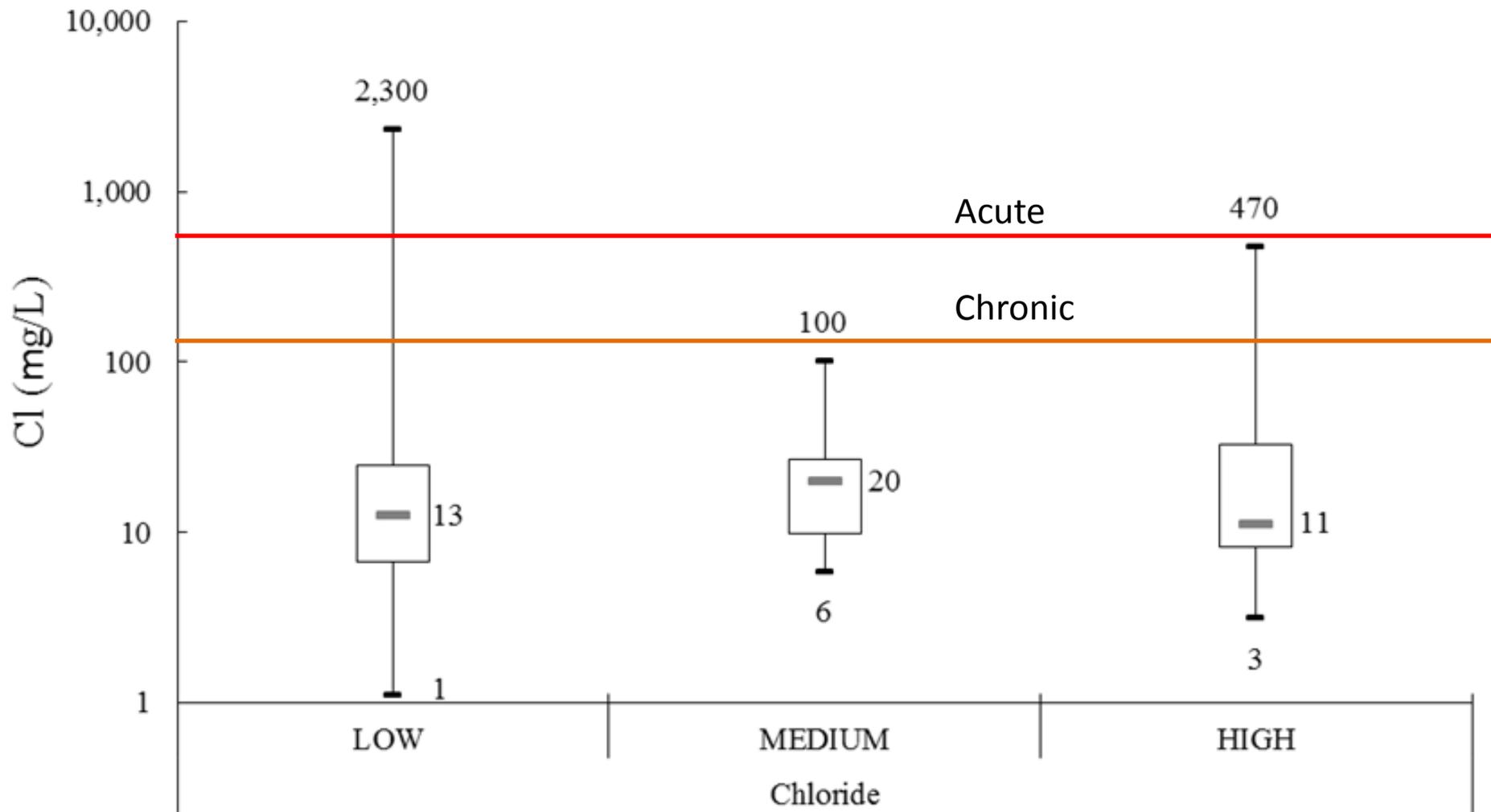
Pollutant Loading : Total Kjeldahl Nitrogen & Total Nitrogen



Pollutant Loading : Phosphate & Total Phosphorus

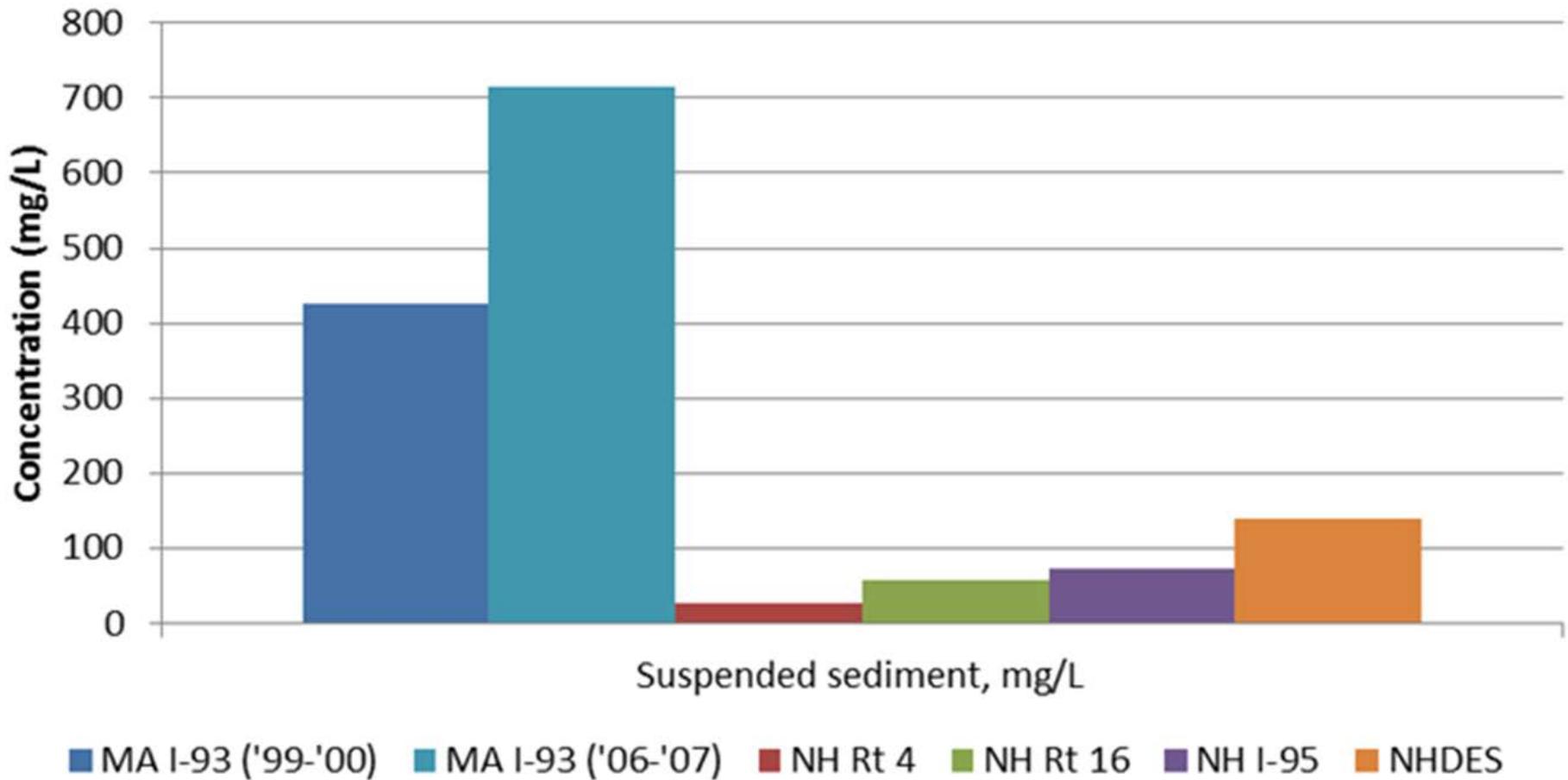


Pollutant Loading : Chloride

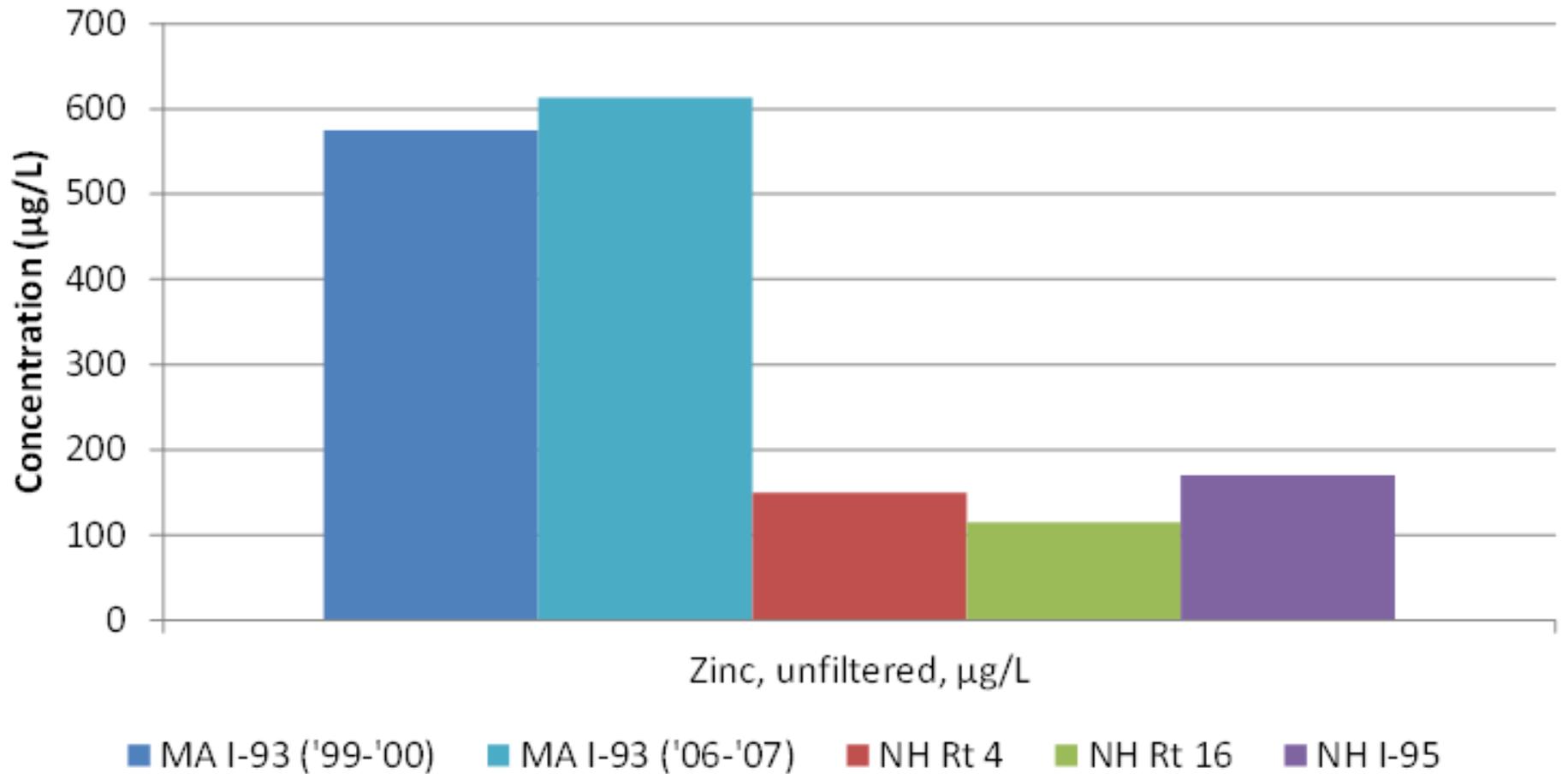


Data Comparison

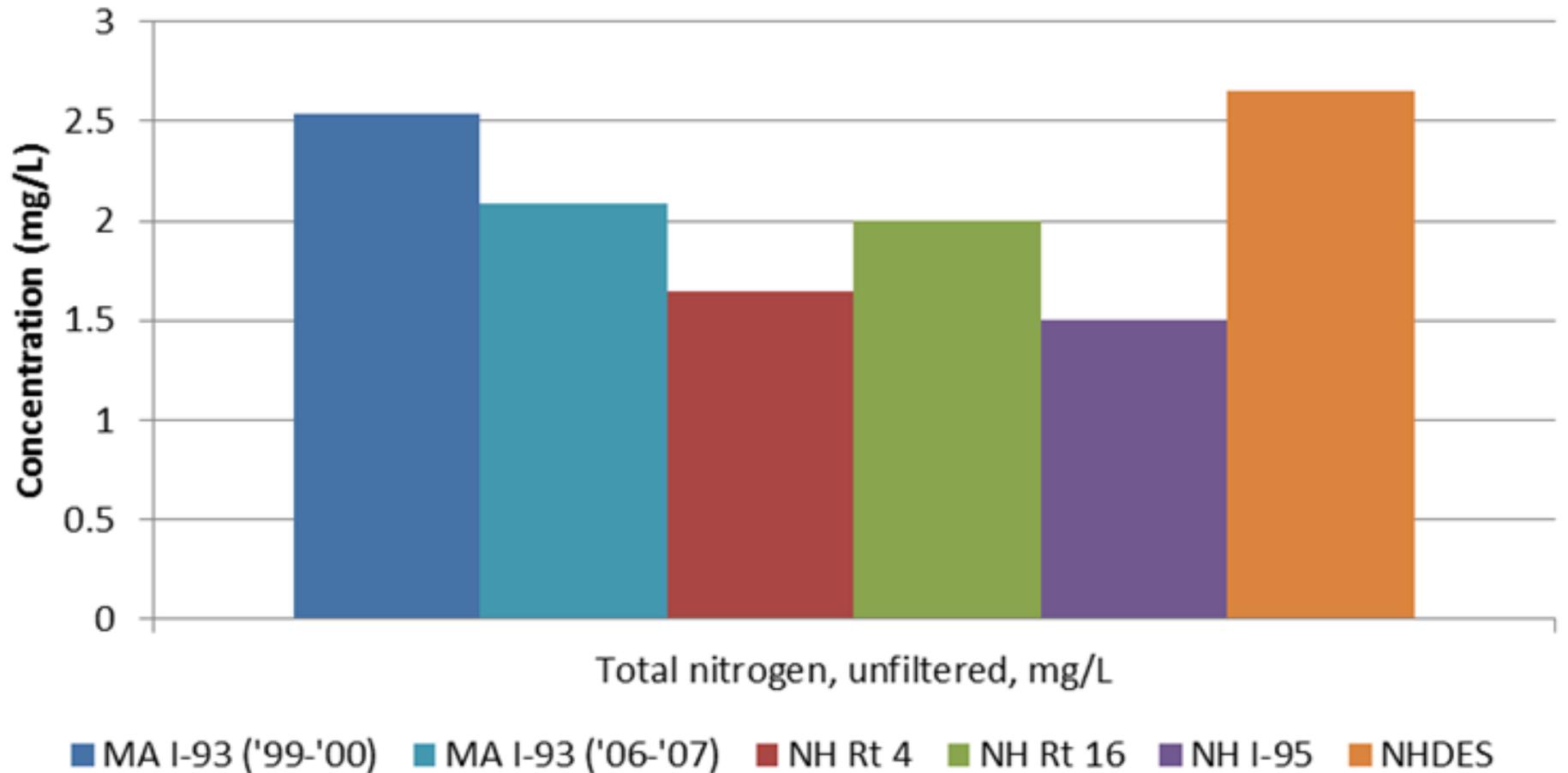
Comparison Chart : Median TSS



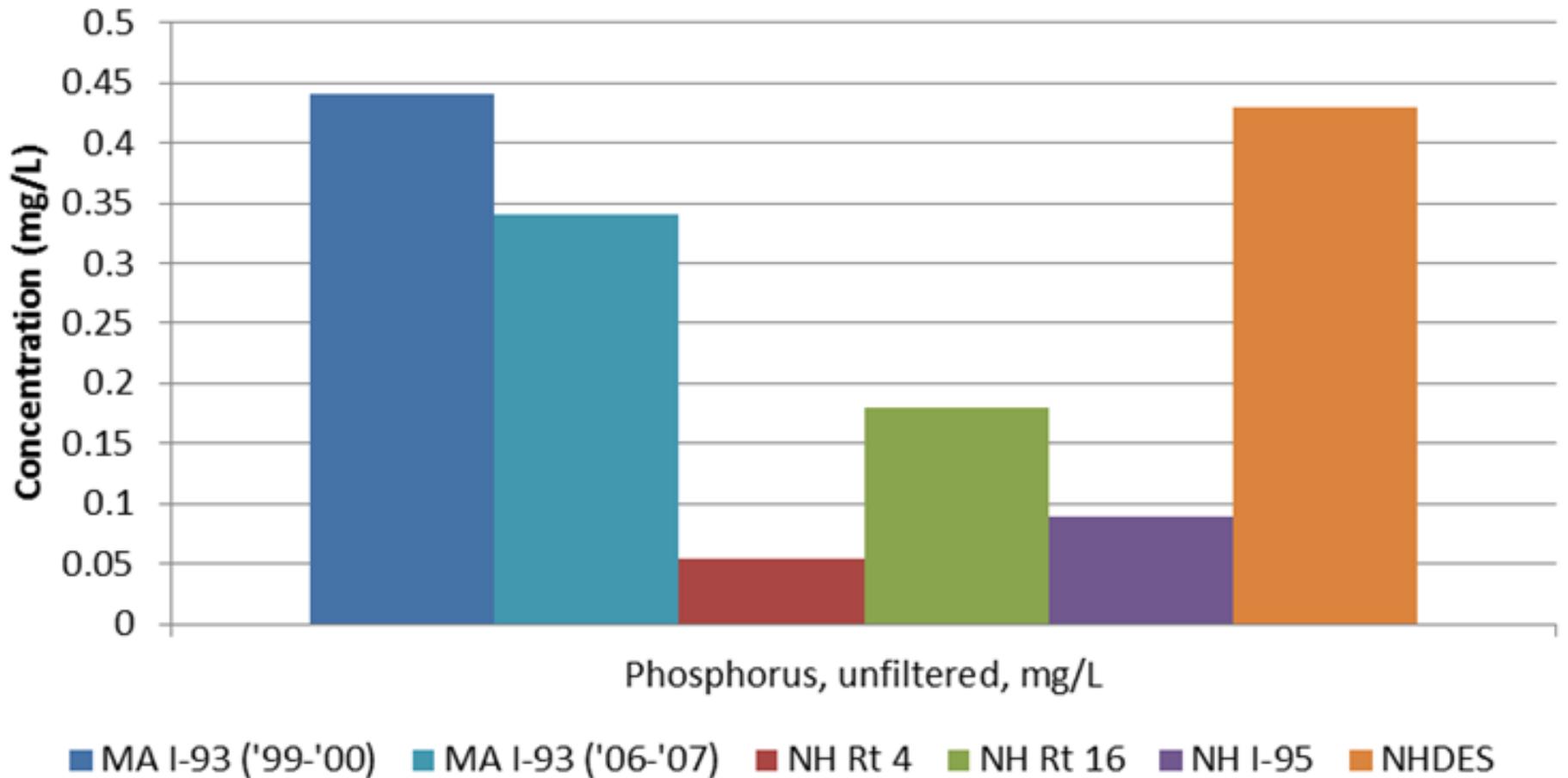
Comparison Chart : Median Zn



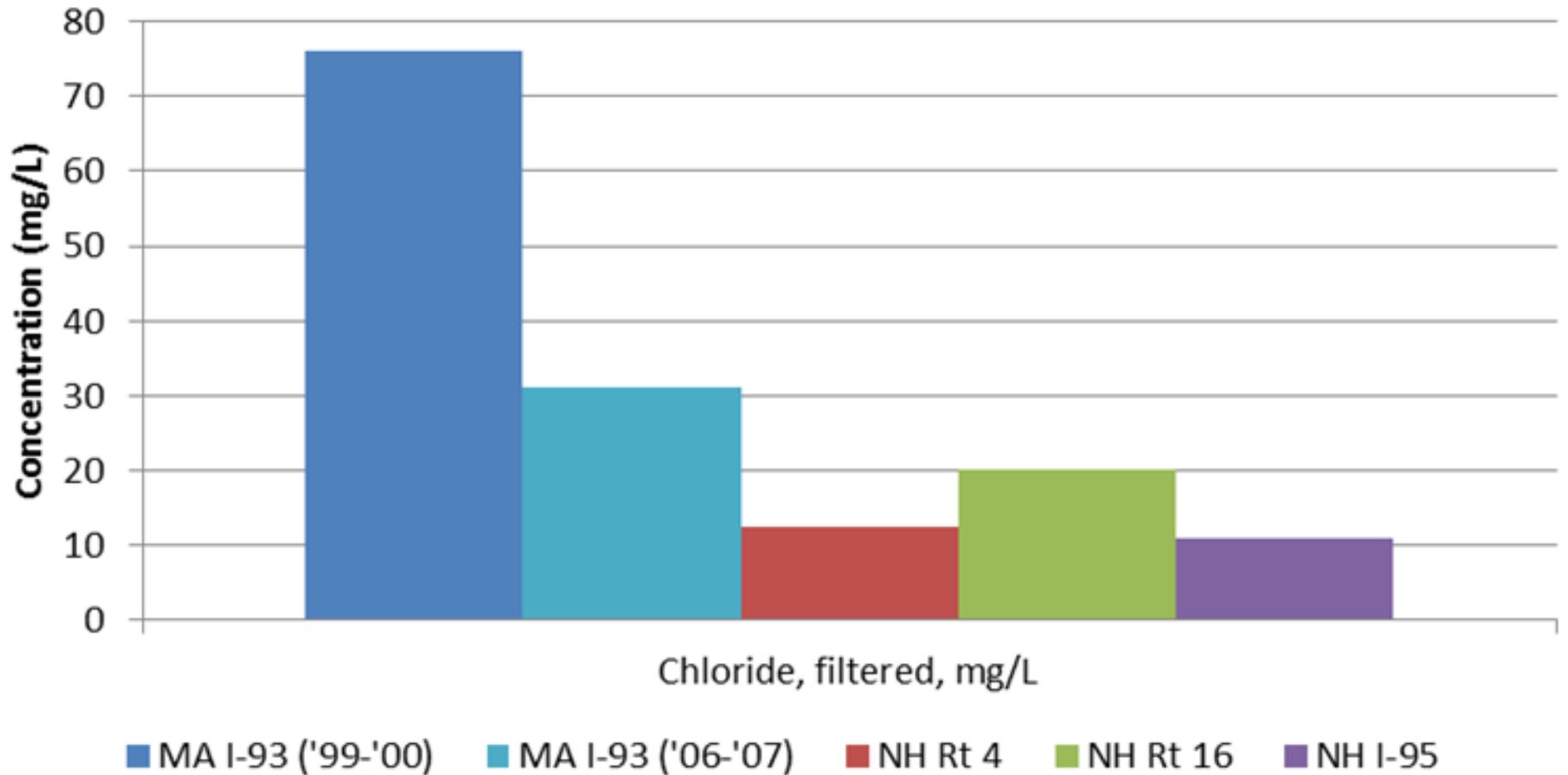
Comparison Chart : Median TN



Comparison Chart : Median TP



Comparison Chart : Median Cl



Comparison of annual pollutant export rates (PER) between NHDOT sites USEPA Region 1 MS4 Permit recommendations and NHDES Simple Method calculations.

Summary Pollutant Export Rates (Kg/ha/yr)			
Pollutant	DOT (avg)*	EPA	NHDES
Total Suspended Sediments	697	1,659	1,463
Total Zinc	1.8	2.0	-
Total Nitrogen	20.7	11.4	27.5
Total Phosphorus	1.2	1.5	4.5
*Average PER from all three NHDOT monitored locations			

Summary

- limited variability between pollutant load exports from NH highways with various AADT.
- Pollutant load export rates measured in this study are generally consistent with those reported and used by NHDES and EPA Region 1.
- In most instances the export rates measured are lower than those used by NHDES and EPA Region 1 indicating a factor of safety or conservative modeling approach
- The lone exceptions are with respect to total phosphorus and total nitrogen.
- In the case of total phosphorus the export rate measured in this study is consistent with the EPA Region 1 modeled values whereas the NHDES values are 3-3.75 times greater.
- For total nitrogen the export rate measured in this study is consistent with the NHDES modeled values whereas the EPA Region 1 values are 1.9-2.4 times lower.

An aerial photograph of a wide river winding through a landscape with autumn foliage. A bridge spans the river in the upper middle section. The banks are covered in trees with yellow, orange, and green leaves. There are some muddy, exposed areas along the riverbanks. The word "Questions?" is overlaid in large black font in the center of the image.

Questions?