Validating Pollutant Load Estimates from Highways and Roads

The UNH Stormwater Center and NHDOT

Proposal Goals

To understand pollutant load and export from various NHDOT owned roadways with various average daily traffic counts (ADT), and develop updated pollutant load export rates for future modeling efforts.

Pollutants studied were:

Total Suspended Sediments (TSS), Total Nitrogen (TN), Total Phosphorus (TP), metals (Zn and Cu) and Chloride (Cl).

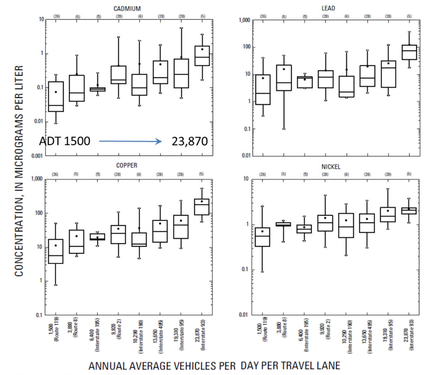
Monitoring Locations

High ADT Traffic Site:
I-95 Portsmouth, NH

Medium ADT Traffic Site:
Route 16 Dover, NH

Low ADT Traffic Site:
Route 4 Durham, NH

Literature Review



Smith and Granato, 2009

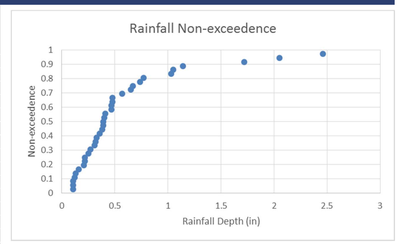
Literature reviews demonstrated increase pollutant load with increase ADT

Description of Monitoring Locations

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

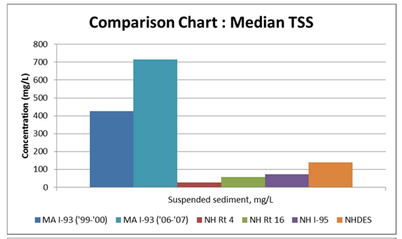
Rainfall Events

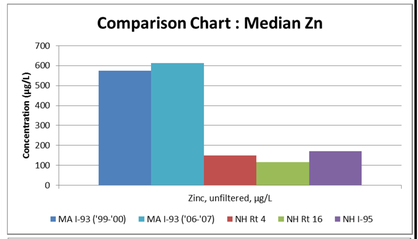
Event Date	Total Rainfall (in)	Peak Intensity (in/5-min)	Rt. 4 Storm Volume (gal)	Rt. 16 Storm Volume (gal)	I-95 Storm Volume (gal)	Antecedent Dry Period	Season
5/16/2014	1.03	0.07	-	8,078	-	5	Spring
5/22/2014	0.25	0.01	-	1,961	-	4	Spring
5/27/2014	0.47	0.03	-	3,686	-	3	Spring
6/5/2014	0.16	0.02	-	1,255	-	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

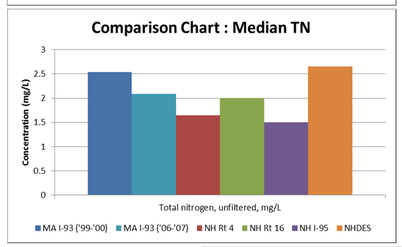


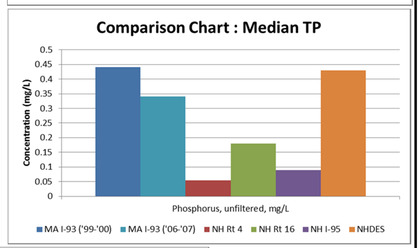
Over 35 storm events sampled predominantly in non-winter events.

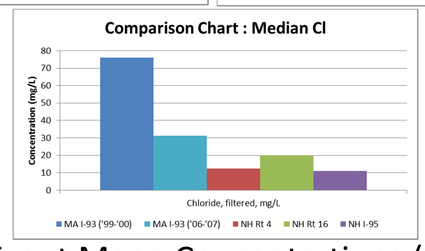
Water Quality Monitoring Results











Pollutant Event Mean Concentrations (EMCs) were low compared with other literature sources (MADOT) and not significantly different across the ADT ranges studied. Results could indicate that congestion or idling/breaking may be more significant than ADT to pollutant loading.

Pollutant Load Export Rates

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			

Conclusions

- Limited variability between pollutant load exports from NH highways with various ADT.
- 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.