Water Quality Data Report
For The
Norwalk River Watershed
May 2011 through September 2011

Site NR9.5 after a large rain resulting in a fast moving river and flooded banks

Submitted by:

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To: The Norwalk Mayor's Water Quality Committee**,** The Wilton Inland Wetlands Commission, King Industries, Norwalk River Watershed Association, Inc., NRG-Manresa, Town of Ridgefield, Norm Bloom, Leslie Bloom-Miklovich, and Trout Unlimited-Mianus River Chapter

From: Dick Harris, Principal Investigator, Earthplace, Harbor Watch Program

Date: October 11, 2011

Subject: The Norwalk River Watershed Project Water Quality Report for the period of May 2011 through September 2011

I. Introduction:

Purpose of Study: The Earthplace Harbor Watch (HW) Program was funded by the Connecticut Department of Energy and Environmental Protection (CT DEEP) to conduct water quality monitoring on the Norwalk River for six years, June 1998 through June 2005. HW/RW initially collected and analyzed water samples for fecal coliform bacteria at 21 sites, eleven of them along the main stem of the Norwalk River and one on the Silvermine River (Figures 1A & 1B).

Background: From June 1998 through May 1999, HW conducted a first-year water quality monitoring study in the Norwalk River Watershed. This study was funded by the CT DEEP and was intended to provide water quality information in support of the Norwalk River Watershed Initiative. The purpose of the study was to obtain data on the levels of fecal coliform bacteria, dissolved oxygen, and conductivity at selected locations in the Norwalk River and in its major tributaries (Silvermine River, Comstock Brook and Cooper Brook). The study indicated that fecal coliform bacteria levels frequently exceeded the state's water quality criterion for Class B water at a number of sites along the Norwalk River. Most sites met the dissolved oxygen level CT DEEP criterion for Class B waters. The first year study also showed that conductivity levels were consistently higher in the upper reaches of the watershed than in the lower watershed. Based upon the water quality data collected, HW/RW determined that the water quality in the Norwalk River Watershed was moderately impaired.

The CT DEEP and HW executed a contract for a second year funding in September 1999 (from September 1, 1999 through November 30, 2000). HW/RW was authorized to begin testing for *E. coli* bacteria in November 1999. Sampling then took place at 12 of the 21 most impacted sites along the Norwalk River. Monthly reports were prepared and submitted to the CT DEP and disseminated to the seven towns comprising the Norwalk River Watershed as well as the Norwalk River Watershed Initiative Advisory Committee.

Funding was then made available by the CT DEEP to continue testing on the Norwalk River for a third summer (April 1 to September 30, 2001) based on a continuing interest by Norwalk River Watershed Advisory Committees and the CT DEEP. The same testing protocols used in 2000 by HW/RW were again used under the original QAPP, which was extended on April 25, 2001 to September 30, 2001 by the EPA's Office of Environmental Measurement and Evaluation.

During 2002, the CT DEEP switched to *E. coli* bacteria as the "preferred" indicator species for freshwater, as it is a more specific indicator of fecal material arising from humans and other warm-blooded animals. For recreational waters, the US EPA recommends the use of *E. coli* because it is a better indicator of a human health risk from water contact than fecal coliform bacteria (Table 1).

Additional 319 funding was allocated to continue the HW/RW testing regime on the Norwalk River for twenty-three months beginning July 2002 and ending June 30, 2004. The last contract with the CT DEEP expired on 6/30/05. HW again renewed testing of the Norwalk River and its tributaries and resumed monitoring on May 1, 2005 thanks to the interest and generosity of the Town of Wilton, The Norwalk River Watershed Association, King Industries, and NRG Inc. at Manresa Island in Norwalk. Going forward, The Norwalk Mayor's Water Quality Committee, The Town of Ridgefield, Norm Bloom, Leslie Miklovich, and Trout Unlimited Mianus and Nutmeg chapters have collectively continued to provide additional funds to support the 2009, 2010, and 2011 monitoring season.

Although these water quality reports are submitted to the CT DEP for review and comment, Harbor Watch/River Watch is solely responsible for the collection, analysis and interpretation of the water quality data.

Figure 1A Location of sampling sites located in the Norwalk River Watershed

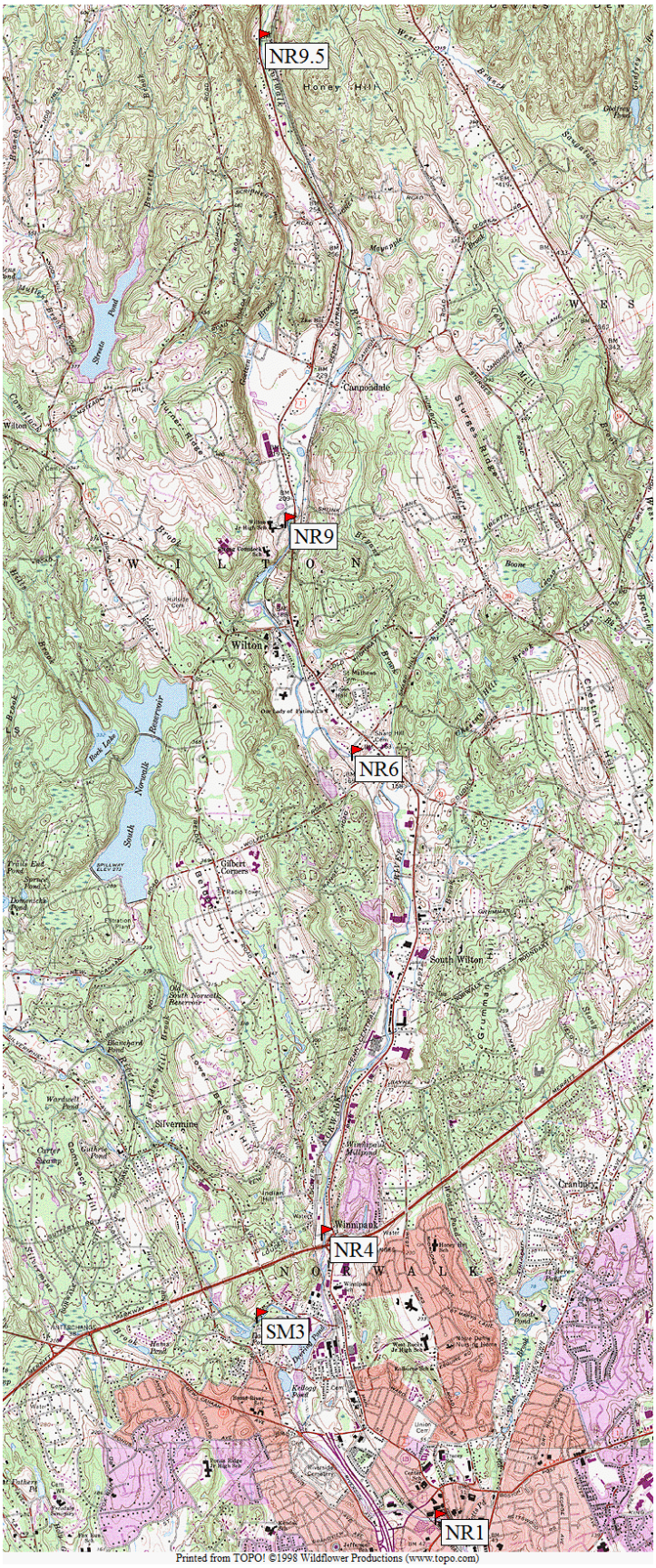
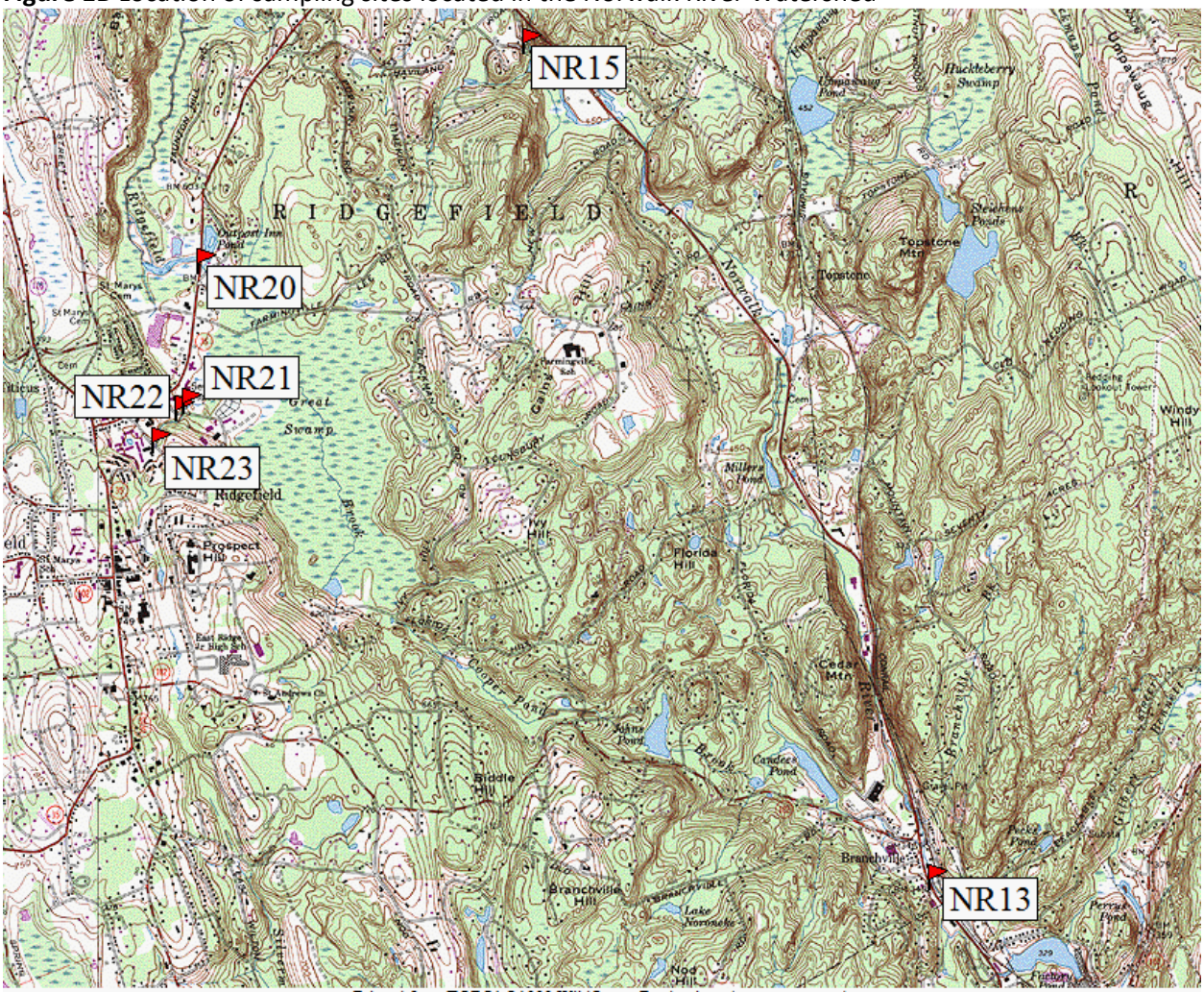


Figure 1B Location of sampling sites located in the Norwalk River Watershed



II. Methods and Procedures:

Water monitoring is carried out under protocols of an EPA Quality Assurance Project Plan (QAPP RFA#10160 approved by the EPA for five years on 9/16/10). Monitoring teams leave Earthplace in Westport between 9:30AM and 10:00AM, and return in early afternoon. Each team is comprised of an experienced leader and one or two trained volunteers. Water samples are collected at 12 (Figures 1A & 1B) monitoring sites within the watershed (QAPP Appendix A1.1). These sites, which represent the more impacted areas, were selected in concert with the CT DEP, because results from the first year's study consistently demonstrated elevated fecal coliform bacteria counts at these locations.

The following tests are run *in situ*: dissolved oxygen (QAPP Appendix A3.3) and conductivity (QAPP Appendix A3.8). Water and air temperatures, as well as general observations and storm events are also recorded at each site visit. Observations are recorded (QAPP Appendix 5) on the HW Data Sheet according to the quality control requirements (QAPP Appendix 3.1).

Upon return to the lab, fecal coliform and *E. coli* bacteria membrane filtration tests (QAPP Appendix A3.13) are performed and analyzed according to Standard Methods, 21st edition (9222D & 9222G) and recorded (QAPP Appendix 5) on the HW bacteria log. The frequency of which water quality monitoring for bacteria concentrations occurs is separated into two seasonal testing periods. For the period when the three wastewater treatment plants (WTP) are required to disinfect their wastewater effluent (April 1st to October 30th) monitoring is done four times per month. For the period when effluent disinfection is not required (November 1st to April 30th) monitoring is done monthly.[1]

E. coli bacteria will be evaluated using the criteria published in the CT DEP Surface Water Quality Standards, 2/25/11. The CT DEP *E. coli* criteria for Class AA, A, and B water are established at three levels (Table 1).

Table 1 CT DEP criterion for *E. coli* bacteria levels as applied to recreational use, effective 12/17/02

Designated Use Recreation	**Class**	**Indicator**	**Criteria**
Designated Swimming	AA, A, B	*Escherichia coli*	Geometric Mean less than 126 CFUs/100mLs; Single Sample Maximum 235 CFUs/100mLs
Non-designated Swimming	AA, A, B	*Escherichia coli*	Geometric Mean less than 126 CFUs/100mLs; Single Sample Maximum 410 CFUs/100mLs
All Other Recreational Uses	AA, A, B	*Escherichia coli*	Geometric Mean less than 126 CFUs/100mLs; Single Sample Maximum 576 CFUs/100mLs

The Norwalk River is classified by the CT DEP for "all other recreational uses" because the river is too shallow for swimming with the exception of a few impoundments. The report will focus on *E. coli* bacteria levels; because it is the indicator bacteria of choice by the CT DEP.

[1] The waste water treatment plant at Georgetown based on a decision by the WPCA leaves its UV lights and phosphorous removal on all year.

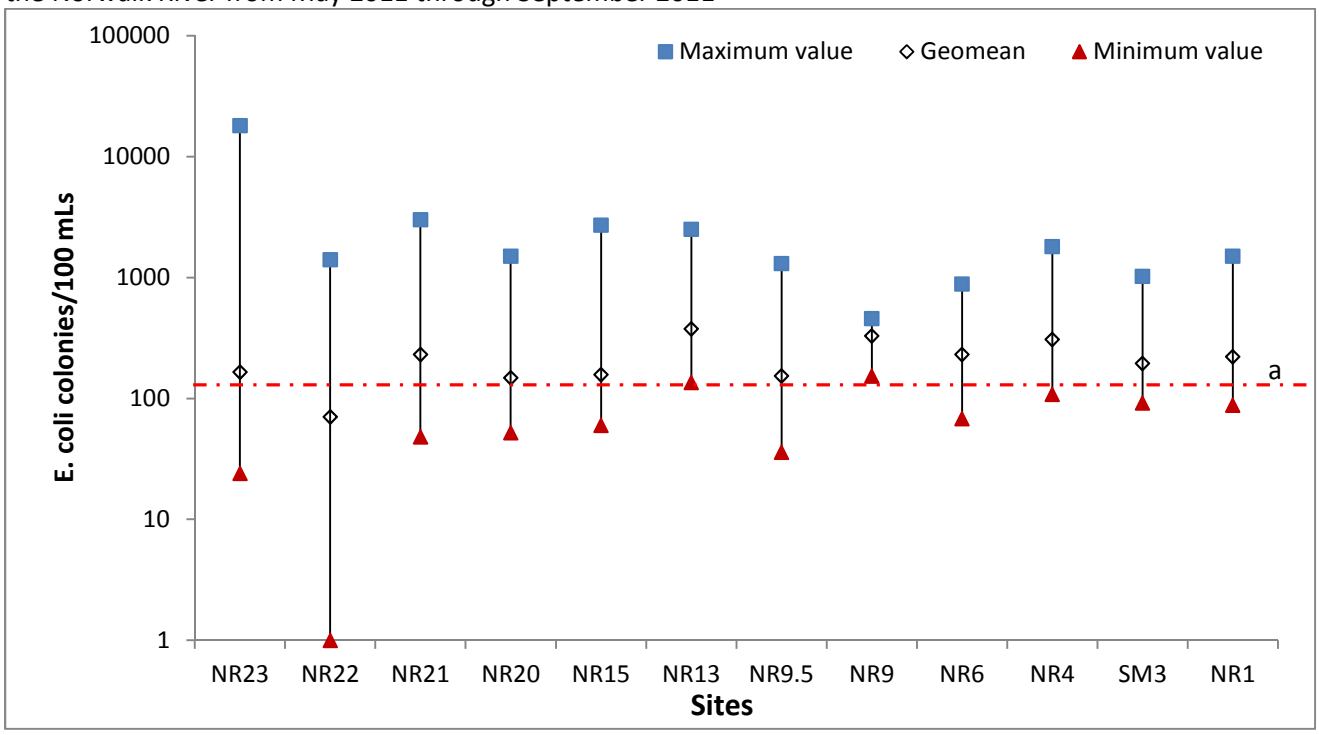
III. Results:

All monitoring sites with the exception of site NR22, the Ridgefield Waste Water Treatment Plant, exceeded the CT DEEP geomean *E. coli* bacteria criterion for a Class B river of <126 CFU/100mLs (Figure 2, Table 2). All sites except NR22, NR20, and NR9.5 exceeded the CT DEEP Single Sample Maximum (SSM) of 576 CFU/100mL for a Class B river (Table 2).

Observed dissolved oxygen (DO) means were all above the CT DEEP minimum criterion of 5.0mg/L for a Class B river (Figure 3). Individual observed DO readings at site NR21 and NR20 were below 5.0mg/L eight days and five days respectively (Table 4).

Observed conductivity mean values range from a maximum of 843µS at site NR23 to a minimum of 253 at site SM3 (Figure 4, Table 3). Conductivity ranges are wide at the headwaters and become narrower downstream (Figure 4). For example, NR23 shows a maximum observed conductivity reading of 1148µS and a minimum of 103µS (Table3). Conversely, SM3 has an observed range from a maximum of 310µS to 165µS (Table 3).

Figure 2 Maximum, geomean, and minimum concentration for *E. coli* bacteria at 12 monitoring sites on the Norwalk River from May 2011 through September 2011



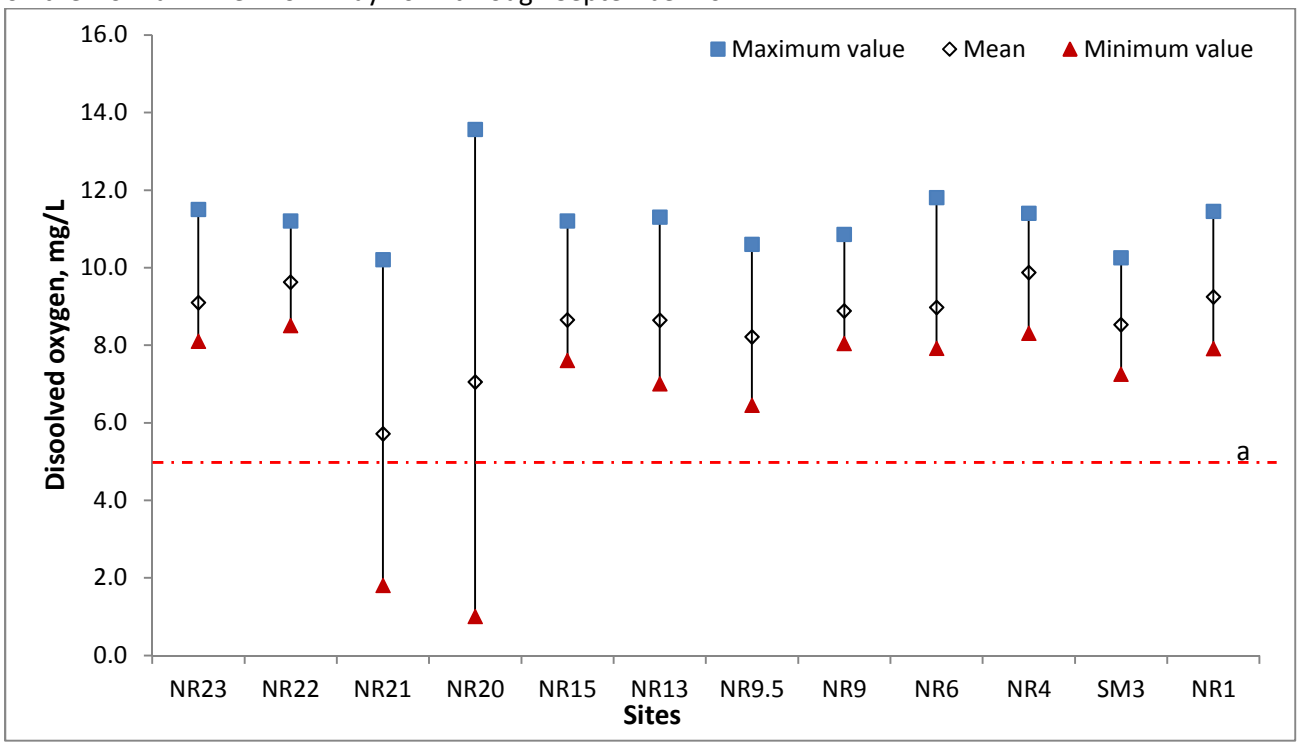
[a]CT DEEP geomean maximum for a Class B river

Table 2 Observed *E. coli* counts on each sampling date, geomeans, and % frequency exceeding 576 CFUs/100mLs for each site on the Norwalk River during the May 2011 through September 2011 testing period

Sites	5/5/2011	5/12/2011	5/19/2011	5/26/2011	6/2/2011	6/9/2011	6/16/2011	6/23/2011	7/7/2011	7/14/2011	7/21/2011
NR23	76	24	520	56	136	72	56	980	40	128	56
NR22	0	0	0	0	0	0	0	0	0	0	0
NR21	128	88	284	240	260	380	188	212	N/A	1160	224
NR20	136	84	196	104	420	216	200	288	72	180	176
NR15	68	64	300	60	104	108	76	580	136	280	84
NR13	136	142	520	740	520	240	192	1140	600	280	320
NR9.5	192	36	500	120	112	80	76	380	80	88	380
NR9	152	140	340	192	172	420	164	660	280	300	380
NR6	132	68	380	164	204	380	92	880	180	228	168
NR4	108	128	540	208	560	280	244	1160	300	180	380
SM3	120	100	380	172	164	212	156	1020	260	176	100
NR1	92	120	500	360	164	300	168	700	260	224	340
Rainfall (in.)	0.19	0.00	2.64	0.68	0.42	0.51	0.09	2.19	0.00	0.42	1.46
Days prior	7	7	1*	3	4	0	2	0*	7	6	3

7/28/2011	8/4/2011	8/11/2011	8/18/2011	8/25/2011	9/1/2011	9/8/2011	9/15/2011	9/22/2011	**Geomean**	%frequency over 576 colonies/100mLs
140	380	108	360	200	116	18000	84	380	**165**	**10.00%**
0	0	0	0	0	8	1400	0	0	**70**	**5.00%**
240	520	220	132	380	48	3000	56	92	**231**	**10.53%**
300	120	96	52	100	72	1500	72	64	**148**	**5.00%**
300	400	76	104	140	128	2700	80	172	**157**	**10.00%**
460	740	240	600	300	144	2500	200	280	**376**	**25.00%**
380	172	132	52	96	128	1300	128	184	**153**	**5.00%**
600	400	192	128	196	116	800	124	260	**253**	**15.00%**
220	300	200	220	480	172	700	176	240	**230**	**10.00%**
320	340	156	192	440	228	1800	168	420	**308**	**10.00%**
120	92	400	140	148	124	900	160	180	**194**	**10.00%**
132	148	152	120	88	148	1500	160	320	**222**	**10.00%**
0.07	0.09	1.23	3.88	0.16	2.81	3.41	0.55	0.14		
3	1	2	3*	0	4	1*	7	0		

Figure 3 Maximum, geomean, and minimum concentration for dissolved oxygen at 12 monitoring sites on the Norwalk River from May 2011 through September 2011



[a]CT DEEP minimum criterion for dissolved oxygen for Class B river

Figure 4 Maximum, geomean, and minimum concentration for conductivity at 12 monitoring sites on the Norwalk River from May 2011 through September 2011

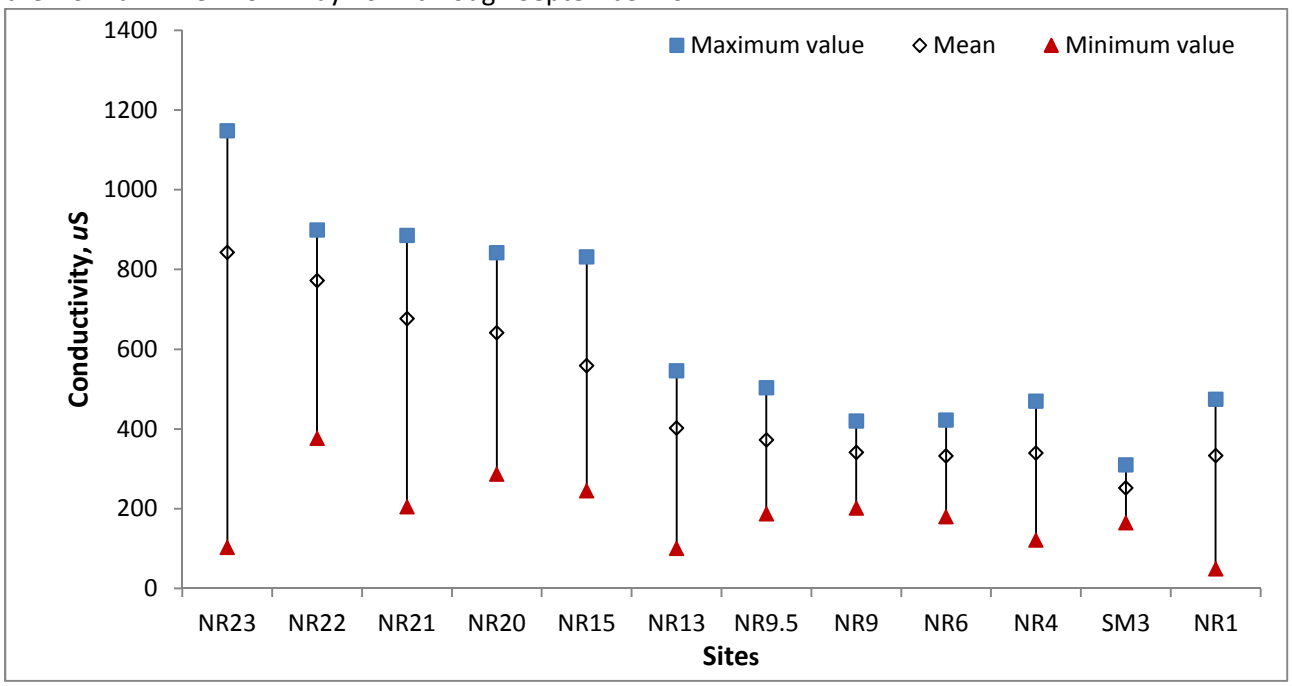


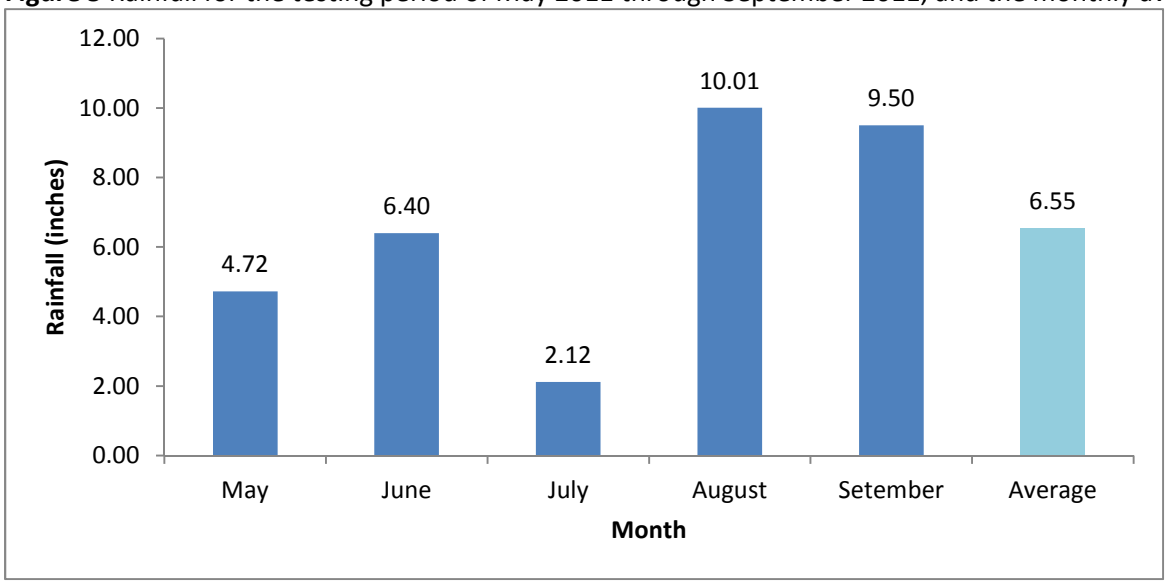
Table 3 Conductivity maximum, minimum, ranges, and mean for each site on the Norwalk River from May 2011 through September 2011

	NR23	NR22	NR21	NR20	NR15	NR13	NR9.5	NR9	NR6	NR4	SM3	NR1
Max	1148	899	886	842	832	546	504	420	423	470	310	475
Min	103	377	205	287	245	101	188	202	180	122	165	50
Range	1045	522	681	555	587	445	317	218	243	348	145	425
mean	843	772	677	642	559	403	373	341	333	340	253	333

Table 4 Individual dissolved oxygen readings that fell below 5.0mg/L

NR21	6/23/2011	3.0
	7/14/2011	3.3
	7/28/2011	4.7
	8/4/2011	4.3
	8/18/2011	4.8
	9/1/2011	1.8
	9/15/2011	4.6
	9/22/2011	4.8
NR20	8/18/2011	3.7
	8/25/2011	4.3
	9/1/2011	1.0
	9/15/2011	2.1
	9/22/2011	4.9

Figure 5 Rainfall for the testing period of May 2011 through September 2011, and the monthly average



IV. Discussion:

The monthly rainfall average for the testing period was 6.55 inches which is above the normal monthly average of 4.5 inches. Only July yielded rainfall below 4.5 inches, collecting only 2.12 inches (Figure 5). Elevated *E. coli* counts were observed on days that sampling was done the day of a rain, or the day after a rainfall. September 8th had the largest observed *E. coli* counts ranging from 800 CFU/100mLs to 18000 CFU/100mLs (Table 2).

April through October, the Ridgefield Wastewater Treatment Plant (WTP) is required to keep its UV lights on to kill bacteria before the effluent is released into the Norwalk River. During this time, HW has consistently observed *E. coli* levels at 0 CFU/100mLs (Table 2, Figure 2). Two weeks in a row NR22, the Ridgefield WTP, had observed *E. coli* counts that were 8 and 1400 on 9/1 and 9/8 respectively (Table 2). This is attributed to the increased volume of water that had to pass through the system. The plant is rated for a million gallon throughput, normally only running at 700,000 gpd. A large storm like Hurricane Irene (August 28th) or the storm that yielded 3.41 inches over two days (September 7-8th) can cause the plant to partially treat two to four million gallons a day. Once the rain subsided, site NR22 returned to having observed counts at 0 CFU/100mLs (Table 2).

In addition to hydraulic overload problems incurred at the waste water treatment plant, two sites, NR13 and NR4 deserve special mention (Figure1A, Table 2, Figure 2). There is a sharp increase in *E. coli* counts from site NR 15 downstream to NR13 (Table 2). This situation has evolved over the last few years and the source or sources of *E. coli* bacteria remain elusive. HW has determined, however, that Cooper Brook, which makes a confluence with the Norwalk River approximately 100 meters upstream is not a contributing factor. Based on recent data it would appear that the bacteria source is within 200 to 300 meters upstream. The search continues with a team of students from Wilton High School.

The second site of interest, site NR4, is in an area of the most overdeveloped section of the river. The Merritt Seven Complex which straddles or rests on the shoreline of the river in Norwalk is north of site NR4 (Figure 1A). There are many pipes discharging to the river in this area, which discharge storm water and/or air conditioning process water. With numerous parking lots, the areas of impervious surfaces are extensive. Many detailed searches by HW have occurred over the years with little success to date in locating sources of *E. coli* bacteria.

Observed dissolved oxygen means pass the CT DEEP minimum of 5.0mg/L (Figure 3). There were multiple days throughout the testing period where site NR21 and NR20 had observed readings that fell below the SSM (Table 4). The river above site NR21 is a swamp (Figure 1B). The water sits in the sun and warms up which does not allow the water to hold a large amount of oxygen. The excess organic matter in the swamp is from septic infiltration, or waste from the treatment plant which uses up the oxygen during decomposition. The path that the Norwalk River travels between NR21 and NR20 is not the normal river bed one would expect. It is more of a flat, marshy area which does not allow for natural turning and aeration of the water like falls or strong movement over rocky areas, which is why HW finds low DO levels at NR 20 as well. Marshy areas also tend to have a lot of natural decomposition which would remove some of the DO present.

Observed conductivity ranges show elevated ranges and means at the headwaters due to the presence of limestone beds (Figure 1, Figure 4, Table 3). As the Norwalk River flows south, it is fed by tributaries, mainly Cooper Brook, Comstock Brook, and the Silvermine River, all which have lower conductivity water (Figure 1). The lower conductivity from the tributaries dilutes the Norwalk River's conductivity, resulting in lower means and ranges as the sites move downstream.

V. Conclusion:

This completes the thirteenth year that HW has done research on the Norwalk River. Little has changed. Most of the monitoring sites exceed the CT DEEP criteria for *E. coli* bacteria and much of their pollution is the result of non-point sources. Misuse of properties adjoining the river continues; lawns are mowed to the water's edge causing erosion and easy access to the waterway by storm water runoff. People along the river still throw leaves into river to the detriment of Norwalk Harbor benthic fish. Being "green" has a long way to go.

Appendix A

Table A1 Site number identification, site location and town for sampling and testing (headwaters to mouth), *=tributary to the Norwalk River

Site No.	Site Area	Town	GPS Coordinates
NR23	Steep Brook next to South Street WTP	Ridgefield	Latitude: N 41° 17' 24.3" Longitude: W 73° 29' 35.6"
NR22	South Street WTP outfall	Ridgefield	Latitude: N 41° 17' 26.8" Longitude: W 73° 29' 29.6"
NR21	Farmingville Road at the Great Swamp outlet	Ridgefield	Latitude: N 41° 17' 40.2" Longitude: W 73° 29' 18.5"
NR20	Route 35 at Fox Hill Condos	Ridgefield	Latitude: N 41° 17' 52.1" Longitude: W 73° 29' 32.2"
NR15	Stonehenge Road at the top of the dam	Ridgefield	Latitude N 41° 18' 32.0" Longitude: W 73° 28' 8.3"
NR13	Branchville at the railroad station (Route 7)	Ridgefield/Wilton	Latitude: N 41° 15' 55.8" Longitude: W 73° 26' 27.2"
NR 9.5	Downstream of the Georgetown Wastewater Treatment Plant -- Old Mill Road	Wilton	Latitude: N 41° 14' 46.0" Longitude: W 73° 26' 2.5"
NR9	School Road	Wilton	Latitude: N 41° 12' 15.3" Longitude: W 73° 25' 51.6"
NR6	Near Wolfpit Road in back of the Wilton Corporate Office Complex	Wilton	Latitude: N 41° 11' 0.1" Longitude: W 73° 25' 18.4"
NR4	Upstream of Route 15 (Glover Avenue) and downstream of the Merritt 7 Office Complex	Norwalk	Latitude: N 41° 8' 3.5" Longitude: W 73° 25' 35.8"
SM3*	James Street (on the Silvermine River)	Norwalk	Latitude: N 41° 8' 10.3" Longitude: W 73° 26' 4.0"
NR1	Post Road (US Route 1) adjacent to the Ash Creek Grille Restaurant	Norwalk	Latitude: N 41° 7' 10.8" Longitude: W 73° 25' 1.3"