Water Quality Data Report
For
The Norwalk River Watershed
May 2009 through September 2009

Measuring current flow in the Norwalk River in Branchville

Submitted by:

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Funded by:
The Fairfield County Community Foundation, The Wilton Conservation Department, King Industries, Norwalk River Watershed Association, Inc., NRG-Manresa, Town of Ridgefield, Norm Bloom, Leslie Miklovich, and The Jeniam Foundation

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Acknowledgements

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Organizations:

NRG Power Plant at Manresa Island, Norwalk

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Town of Wilton

City of Norwalk, Mayor's Water Quality Committee

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Individuals:

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Tony D'Andrea, Chairman of the Norwalk Harbor Committee

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Mike Harden, Chairman for the Mayor's Water Quality Commission

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We are pleased with the support offered by these individuals, and their willingness to go the extra mile to get the job done. Finding leaks in the infrastructure is only one aspect of pollution control. Fixing the system is beyond what HW/RW can accomplish, and this is where the above-mentioned people play a very valuable role.

To: The Fairfield County Community Foundation, The Wilton Conservation Department, King Industries, Norwalk River Watershed Association, Inc., Norwalk Conservation Department, NRG-Manresa, Town of Ridgefield, Norm Bloom, Leslie Miklovich, and The Jeniam Foundation

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

Date:

Subject: The Norwalk River Watershed Project Water Quality Report for the period of May 1, 2009 through September 30, 2009

I. Introduction:

Purpose of Study: The Earthplace Harbor Watch/River Watch (HW/RW) Program was funded by the Connecticut Department of Environmental Protection (CT DEP) to conduct water quality monitoring on the Norwalk River for six years, June 1998 through June 2005. HW/RW collected and analyzed water samples for both fecal coliform bacteria and *Escherichia coli* (*E. coli*) bacteria at a total of ten sites, nine of them along the main stem of the Norwalk River and one on the Silvermine River (Figure A2).

Background: From June 1998 through May 1999, HW/RW conducted a first-year water quality monitoring study in the Norwalk River Watershed. This study was funded by the CT DEP 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 DEP 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 DEP and HW/RW executed a contract for the second year funding in September 1999; the second year monitoring period was from September 1, 1999 through November 30, 2000. HW/RW was authorized to begin testing for *E. coli* bacteria in November 1999. Sampling took place at 12 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 DEP 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 DEP. 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 DEP switched to *E. coli* bacteria as the "preferred" indicator species for freshwater. *E.* coli is one of the two bacteria components of the fecal coliform bacteria group, and 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 DEP expired on 6/30/05. Renewed testing of the Norwalk River and its tributaries began on May 1, 2005 based on the interest and generosity of the Town of Wilton, The Norwalk River Watershed Association,

King Industries, and NRG Inc. at Manresa. The Fairfield County Community Foundation, the Town of Ridgefield, the Wilton Inland Conservation District, Leslie Miklovich and Norman Bloom have provided additional funds to support the 2007/2008 monitoring season.

Although these monthly 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.

II Methods and Procedures:

Water monitoring is carried out under protocols of an EPA approved and revised EPA Quality Assurance Project Plan (QAPP). Monitoring teams leave the 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 (Figure A2) 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. In addition to focusing monitoring efforts at these sites, it was determined to analyze for both fecal coliform and *E. coli* bacteria.

The following tests are run *in situ*: dissolved oxygen (QAPP Appendix A3.1) and conductivity (QAPP Appendix A3.5). 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/RW Data Sheet.

Upon return to the lab, fecal coliform and *E. coli* bacteria membrane filtration tests (QAPP Appendix A3.10) are performed and analyzed according to Standard Methods, 21st edition (9222D & 9222G) and recorded (QAPP Appendix 5) on the HW/RW 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 (November1st to March 31st) monitoring is done monthly.

E. coli bacteria will be evaluated using the criteria published in the CT DEP Surface Water Quality Standards, 12/17/02. 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 "Non-designated swimming" because people still swim in the river. The report will focus on *E. coli* bacteria levels, because it is the indicator bacteria of choice by the CT DEP. Fecal coliform bacteria levels are reported on Table B1 only as additional data for those who may be interested.

Nutrient Testing, Total Nitrogen (TN), Total Phosphorous (TP), and loading calculations

Nutrient sampling for TN and TP monitoring on the Norwalk River Watershed by HW/RW is underway (QAPP, Appendix A1.1). Samples are collected by HW/RW using acid washed bottles provided by York Analytical Laboratories, Inc. Phosphorous bottles are provided with 2 mLs H_2SO_4 to preserve the sample. All samples are submitted to York within 24 hours of collection. York analyzes TN samples using Standard Methods 4500 N and analyzes TP samples using EPA method 365.3 under their QAPP.

HW/RW is currently assessing TN and TP loading in pounds/day according to the following formula (F x C)8.34 = lbs/day TN or TP, where F equals flow (in millions of gallons), C equals nutrient concentrations (in mg/L), multiplied by a factor of 8.34.

Flow is calculated by HW/RW using a Swoffer Model 3000 current meter with software version 4.1, according to the operator manual. Nutrient concentrations are sampled at the same time that flow is calculated

III. Results:

Only Site NR 22 (the effluent stream from the Ridgefield Waste Water Treatment Plant) meets both the Ct DEP geometric mean of <126 CFU/100mLs and the Single Sample Maximum (SSM) of 410 CFU/100mLs at <10% of the total numbers of samples taken at each monitoring site for *E. coli* bacteria for a Class B river (Table 1, Table 2, Figure 1, Appendix A2). Site NR 9.5 meets the geometric mean at 96 CFU/100mLs but exceeds the SSM at 14.3% of the total number of samples taken (Table 1, Table 2, Appendix A2). All the other eleven monitoring sites on the Norwalk River exceed the geometric mean (Table 2) and, with a single exception (Site NR 13) exceed the SSM for a Class B river (Table 2, Figure 1, Figure 1A).

Site SM3.1 (a storm water discharge pipe on the Silvermine River at the James Street Bridge) was added to the list of permanent monitoring sites for the summer of 2009 after elevated *E. coli* bacteria counts were observed at Site SM3 (downstream) during the summer of 2008 (Harris, Fraboni, July 2008). The pipe was discovered upstream from Site SM 3 and after subsequent effluent testing was determined to be a prime source of *E. coli* bacteria. During the summer months of 2009 (Table 2, Figure 1) the discharge at the pipe continued to produce elevated *E. coli* counts and ended the season with a geometric mean of 1205 CFU/100 mLs and an SSM exceeding 80% (Table 2, Figure 1). Finally, on 11/5 after the closing date of this report, Site SM 3.1 was found discharging a plume of raw sewage into the Silvermine River during a routine monitoring survey (Appendix E). The observed *E. coli* count was 38,000 CFU/100mLs (HW/RW site records for 11/6) and subsequently verified by Norwalk's Public Health Lab with a bacteria count of 40,000CFU/100mLs.

Table 2 May 2009 through September 2009 *E. coli* bacteria concentrations, geometric means and % frequency exceeding 410 colonies/100 mLs at 13 sampling sites in the Norwalk River Watershed for the period of time when the two Ridgefield and the Georgetown wastewater treatment facilities are required by NPDES permits to disinfect effluent discharges

	Dates												
Sites	5/7/2009	5/14/2009	5/21/2009	5/28/2009	6/4/2009	6/11/2009	6/18/2009	6/25/2009	7/2/2009	7/9/2009	7/16/2009	7/23/2009	7/30/2009
NR23	1440	52	40	40	1600	1000	3600	400	40	36	32	72	420
NR22			2		29	N/A	10	1 *	1 *	3	1 *	N/A	17
NR21	164	70	136	124	1800	280	640	52	176	212	400	148	84
NR20	480	236	144	208	2700	330	1700	280	228	136	76	64	148
NR15	780	56	84	112	520	N/A	930	96	212	136	160	52	980
NR13	500	32	88	68	860	250	430	76	124	136	56	280	92
NR9.5	580	56	28	120	360	350	1300	92	64	60	24	32	100
NR9	600	92	20	140	1260	260	1000	200	64	68	88	160	310
NR6	940	132	52	92	820	510	700	92	80	116	112	204	140
NR4	1540	140	180	264	860	380	1600	208	140	156	188	188	280
SM3.1				1000	800		1200	160		n/a			2200
SM3	1020	88	28	172	920	580	700	116	900	128	88	168	490
NR1	1780	104	440	520	800	370	1500	280	228	96	116	180	560
Rainfall (in.)	1.00	0.33	0.26	0.16	0.45	1.04	3.82	0.56	0.51	0.18	0.12	0.61	0.27
Days prior	1	5	4	0	0	2	0	1	0	2	4	8	1

8/6/2009	8/13/2009	8/20/2009	8/27/2009	9/3/2009	9/10/2009	9/17/2009	9/24/2009	**Geomean**	%frequency over 576 colonies/100mLs
112	188	96	88	104	212	160	84	**160**	19.05%
	1 *			1 *	1 *	3	2	**6**	0.00%
112	140	148	1440	120	116	120	296	**193**	14.29%
40	32	40	52	48	620	76	40	**153**	14.29%
160	116	168	56	52	212	136	104	**160**	14.29%
108	180	156	184	128	40	96	52	**130**	4.76%
20	188	680	56	32	80	40	56	**96**	14.29%
68	136	760	80	88	188	56	68	**152**	19.05%
88	172	144	96	120	180	160	132	**167**	14.29%
228	196	164	136	196	132	208	264	**255**	14.29%
	1 *	TNTC	1300		2100	2000	2900	**1205**	80.00%
160	164	132	152	188	264	400	152	**225**	23.81%
260	116	168	120	124	220	180	164	**263**	14.29%
0.77	0.12	0.33	0.02	0.58	0.00	0.48	0.01		
4	2	7	1	6	7	1	7		

Observed dissolved oxygen means all meet the CT DEP DO criterion of 5mg/L or greater (Figure 2). Most of the individual DO readings also meet the CT DEP DO criteria for a Class B River with exceptions noted at NR 21 and NR 20 (Figure 2, Table 3, Table B1). Observed DO levels failed to meet the CT DEP DO criterion eight times at Site NR 21 and twice at Site NR 20 (Table 3).

Table 3 Observed DO levels at Site NR 20 and Site NR 21 and dates where recorded DO values failed to meet the CT DEP criterion of 5 mg/L

Date	6/11	7/2	7/9	7/23	7/30	8/6	8/13	8/27
Site NR 21 mg/L	3.0	4.6	4.9	3.0	2.6	3.8	2.3	4.6
Site NR 20 mg/L	3.4						4.5	

Observed conductivity means ranged from a maximum of 783 µS at Site NR 23, Steep Brook, Ridgefield, to a minimum of 293 µS at Site SM3, Silvermine River, Norwalk (Figure 3, Table 4). Individual site ranges were a maximum of 937 µS at Site NR 23 to a minimum of 118 µS at Site NR 9 (Table 4)

Table 4 Maximum, minimum, mean and site range conductivity values (µS) at 12 monitoring sites on the Norwalk River from 5/7/09 to 9/24/09

Site	NR23	NR22	NR21	NR20	NR15	NR13	NR9.5	NR9	NR6	NR4	SM3	NR1
Max	1060	899	910	877	713	477	475	401	530	432	363	450
Min	123	688	365	365	346	310	298	283	228	237	213	219
Mean	783	760	643	646	561	388	381	348	351	342	293	351
Range	937	211	245	512	367	167	177	118	302	195	150	231

Total Nitrogen (TN) concentrations were analyzed on 6/25/09 and 9/24/09. Samples were taken by HW/RW and transported to York Analytical Laboratories, Inc. in Stratford, CT. TN was analyzed by York under SM4500N with a Minimum Detection Level (MDL) of 0.1mgL. Samples were taken at 14 monitoring sites which include three WWTPs.

The observed TN values on 6/25/09 (Figure 4, and Table 5) range from a maximum of 5.68 mg/L in the Route 7 WWTP discharge stream to a minimum of 0.21 mg/L in the Georgetown WWTP discharge stream. The same profile of TN concentrations was observed on 9/24/09 except that the three POTW discharges contained a greater concentration of TN with a maximum of 11.61 mg/L in the Route 7 WWTP discharge stream and a minimum of 0.32 mg/L observed in the Georgetown plant discharge stream (Figure 4, Table 5).

Table 5 Observed TN concentrations on 6/25 and 9/24 in three waste water effluent discharges* and eleven stream monitoring sites in the Norwalk River Watershed

	6/25/2009		9/24/2009	
Site Number	TN Concentrations, mg/L	MDL, mg/L	TN Concentrations, mg/L	MDL, mg/L
NR23	1.60	0.1	1.05	0.1
NR22	2.00	0.1	5.82	0.1
NR21	0.75	0.1	4.25	0.1
NR20	1.48	0.1	2.44	0.1
NR16	5.68	0.1	11.61	0.1
NR15	1.10	0.1	0.75	0.1
NR13	1.09	0.1	0.68	0.1
NR9.8	0.21	0.1	0.32	0.1
NR9.5	0.89	0.1	0.73	0.1
NR9	1.10	0.1	0.77	0.1
NR6	0.93	0.1	0.78	0.1
NR4	1.06	0.1	0.59	0.1
SM3	1.19	0.1	1.31	0.1
NR1	1.07	0.1	0.77	0.1

* Bold indicates WWTP discharge

York Laboratories also analyzed total phosphorous in HW/RW samples under EPA method 365.3. Different levels of MDL were employed by York due to the great range in sample concentrations (Figure 5, Table 6). For Site NR16 and some of the northern monitoring sites, MDLs of 0.050 and .1 mg/L were used depending on the concentration of TP found in the sample (Table 6). The smaller concentrations on the river monitoring sites were analyzed against an MDL of 0.020mg/L (Table 6).

The observed concentrations of TP are at maximums of 4.82 and 4.42 mg/L at the Route 7 plant on 6/25/09 and 9/24/09 respectively. The only TP concentration found with the MDL levels employed by York Laboratories on 6/25/09 was at the Route 7 WWTP discharge on 6/25 (Figure 5, Table 6). A minimum TP value of 0.2 mg/L was observed at Site NR4 on 9/24/09 (Figure 5).

Table 6 The observed TP concentrations on 6/25 and 9/24 at three waste water effluent discharges* and eleven stream monitoring sites in the Norwalk River Watershed

	6/25/2009		9/24/2009	
Site Number	TP Concentrations, mg/L	MDL, mg/L	TP Concentrations, mg/L	MDL, mg/L
NR23	ND	0.05	1.07	0.05
NR22	ND	0.02	0.83	0.10
NR21	ND	0.05	0.46	0.02
NR20	ND	0.05	1.45	0.10
NR16	4.82	0.10	4.42	0.20
NR15	ND	0.05	1.12	0.05
NR13	ND	0.05	0.44	0.05
NR9.8	ND	0.02	0.24	0.02
NR9.5	ND	0.02	0.47	0.02
NR9	ND	0.02	0.44	0.02
NR6	ND	0.02	0.29	0.02
NR4	ND	0.02	0.20	0.02
SM3	ND	0.02	0.25	0.02
NR1	ND	0.02	0.09	0.02

*Bold indicates wastewater treatment discharge

Pounds of TN and TP observed in the three WWTP discharges were also determined using the formula (F x C) 8.34 = lbs/day as described in Methods and Procedures (page 3) Site NR22 due to its much larger volume (700,000 gpd) contains more nutrient pounds in the effluent discharge even with advanced SBR for nitrogen processing and phosphorous removal technology in place (Table 7). Site NR16 (Route 7 WWTP) at a much lower flow of 45,000 gpd is inefficient in removing nitrogen and has no method in place to remove phosphorous from the effluent stream (Table 7). Site NR9.8 (Georgetown WWTP) is newer Zenon® (GE) technology and is very efficient at removing both nutrients (Table 7).

Table 7 Site, average discharge volume, nutrient concentrations, and pounds per day of TN and TP released to the Norwalk River

Site	Avg. Effluent Volume gpd	Avg. Effluent Volume mmgd	Avg. TN mg/L	Avg. TP mg/L	Factor	Avg. TN lbs/day	Avg. TP lbs/day
NR22	700,000	.700	3.91	0.83	8.34	22.8	4.85
NR16	45,000	.045	8.64	4.62	8.34	3.24	1.73
NR9.8	50,000	.050	0.26	0.24	8.34	0.11	0.10

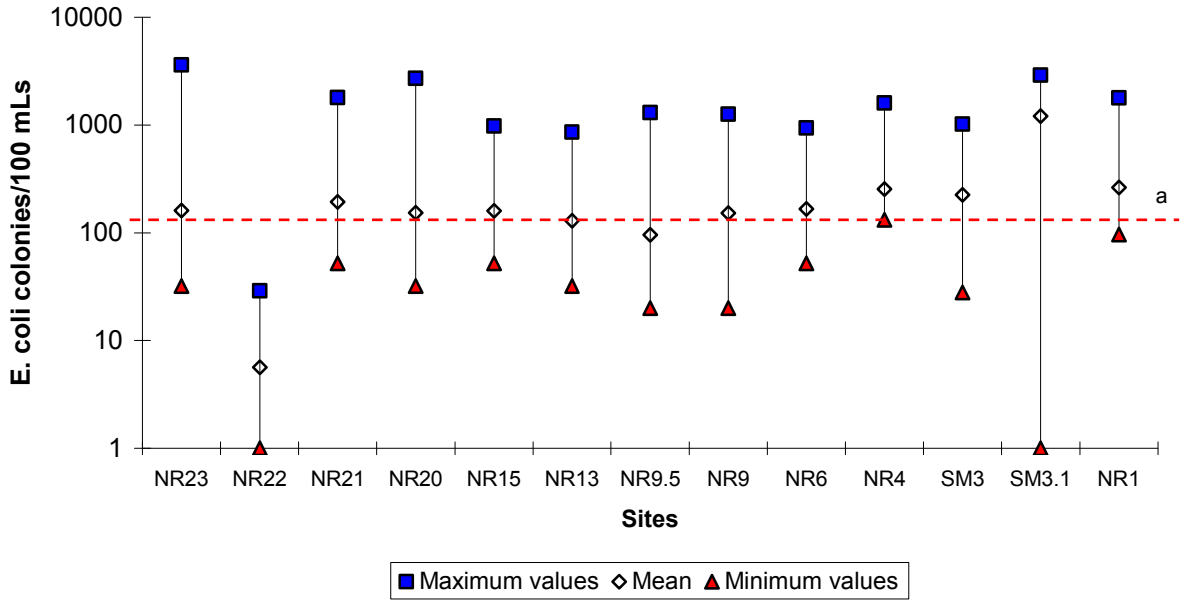
A summer objective of HW/RW for the Norwalk River was to determine nutrient loading from the WWTPs and the main tributaries. To this end, a pair of Swoffer current meters were acquired to assess flow from the tributaries. Using the formula (F x C) 8.34 = lbs/day, the lbs of nitrogen were completed for four tributaries (Table 8).

Table 8 TN concentration observed in four Norwalk River tributaries on 7/2/09 and 7/8/09, showing site, FT^3/sec, TN values, and lbs TN/ day

Tributary	Date	Flow[a],ft^3/sec	TN, mg/L	MDL, mg/l	TN, lbs/day
Bennett's Brook	7/2/09	2,936	1.01	0.1	13.9
Cooper Brook	7/2/09	3,668	0.82	0.1	16.8
Comstock Brook	7/8/09	1,688	1.08	0.1	9.8
Silvermine River	7/8/09	10,312	1.31	0.1	72.9

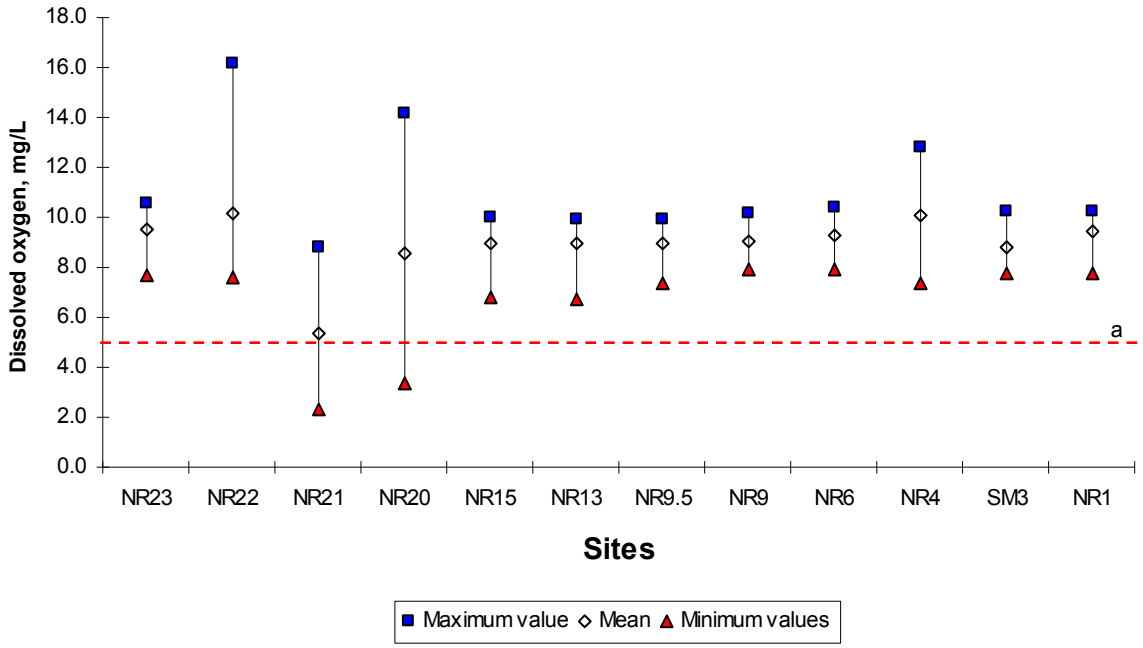
[a]Flow in ft^3/sec must be converted to million gallons/day

Figure 1 Maximum, geometric means, and minimum values of *E. coli* bacteria concentrations at 13 monitoring sites in the Norwalk River Watershed from May 2009 through September 2009 when the two Ridgefield and one Georgetown wastewater treatment facilities are required by NPDES permits to disinfect sewage effluent



[a]CT DEP geomean maximum value for a Class B river

Figure 2 Maximum, mean and minimum values for dissolved oxygen at 12 sampling sites on the Norwalk River Watershed from May 2009 through September 2009



[a]CT DEP minimum value for a Class B river

Figure 3 Maximum, geomean and minimum value for conductivity at 12 sampling sites in the Norwalk River Watershed from May 2009 through September 2009

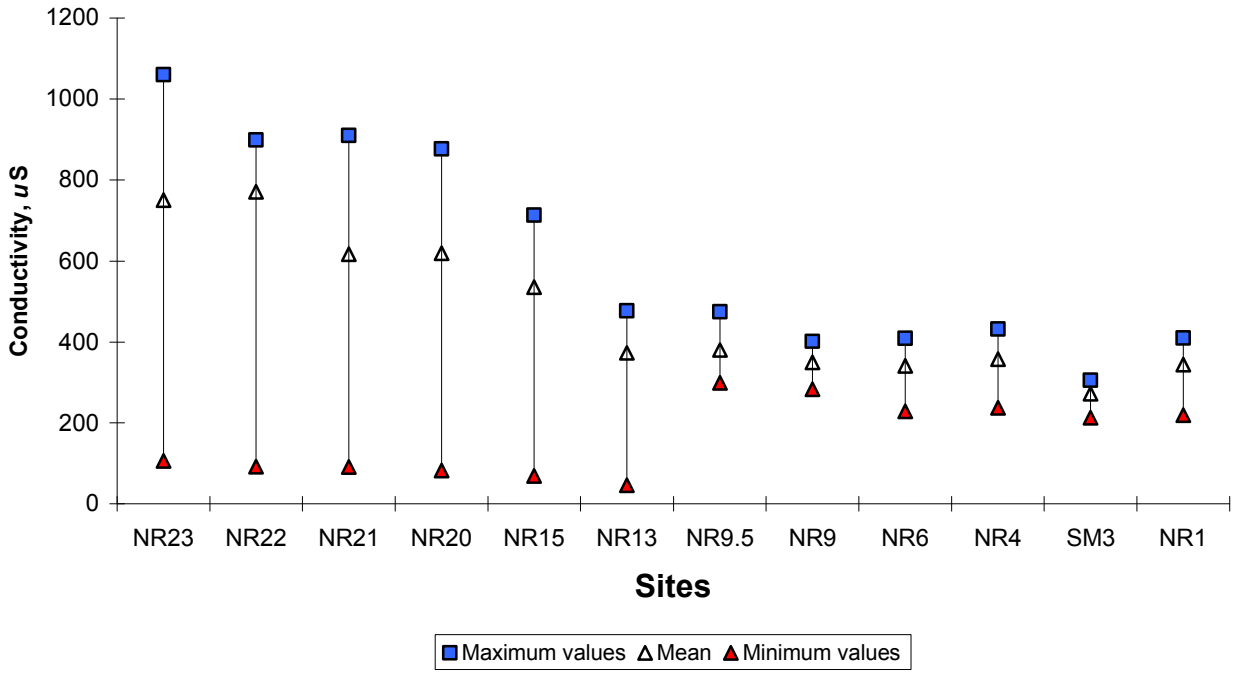


Figure 4 Total nitrogen (TN) concentrations observed at 14 monitoring sites in the Norwalk River Watershed on June 25 2009 and September 24, 2009

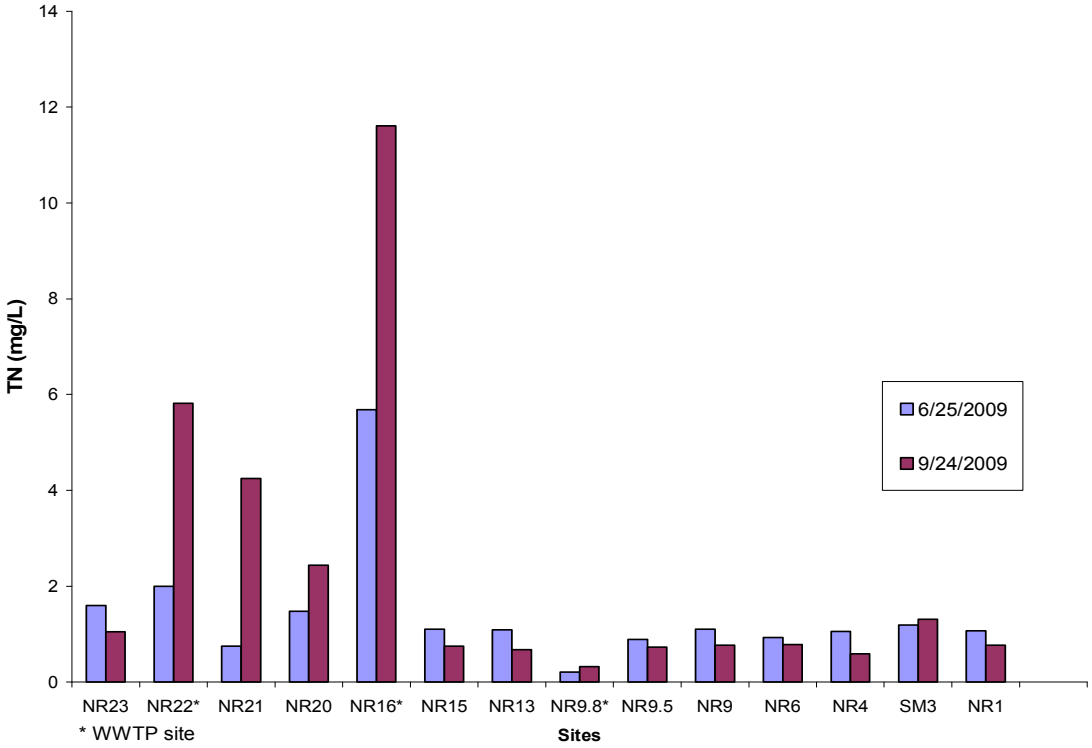


Figure 5 Total phosphorous (TP) concentrations observed at 14 monitoring sites in the Norwalk River Watershed on June 25, 2009 and September 24, 2009

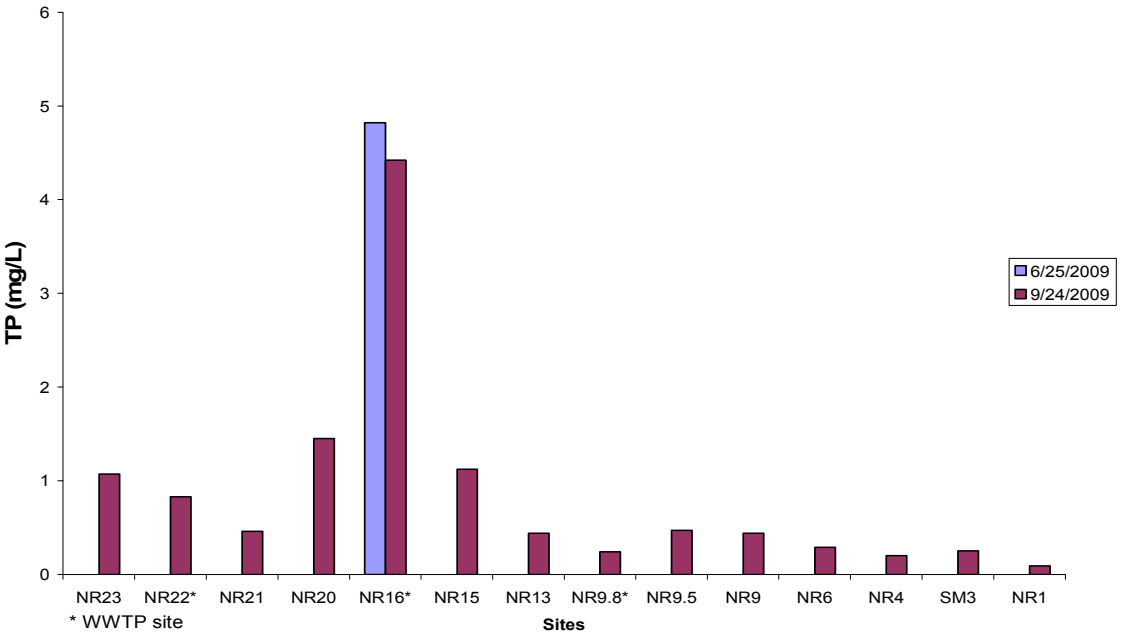
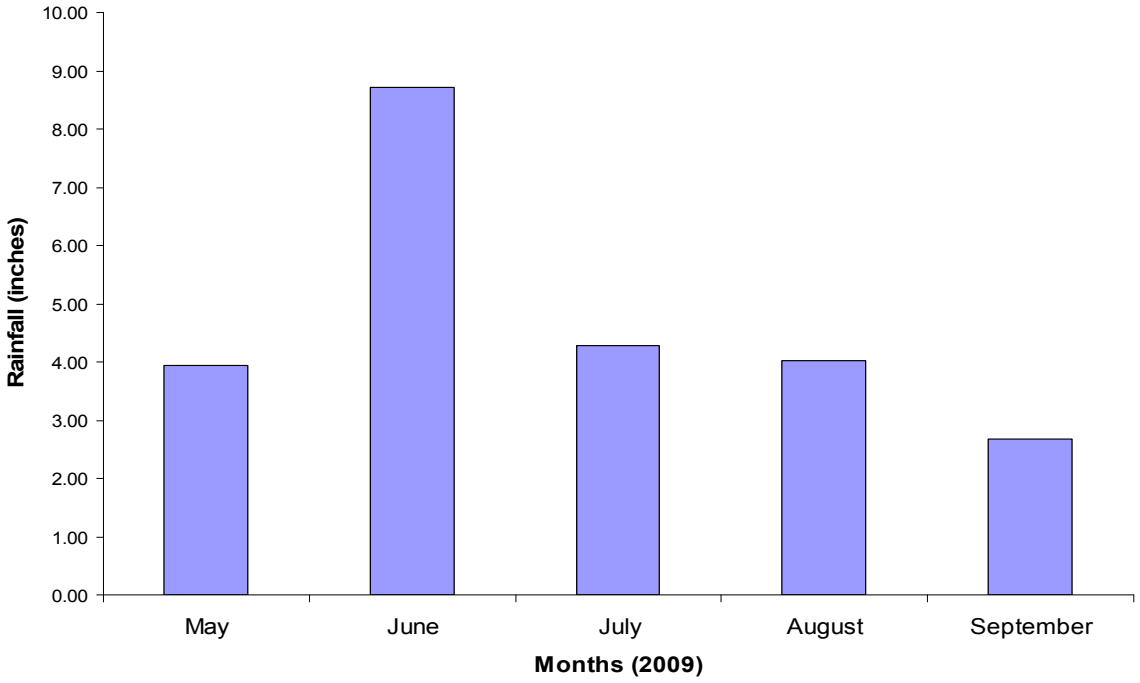


Figure 6 Monthly rainfall (inches) from May 2009 to September 2009



IV. Discussion:

Rainfall for the period of 5/1/09 through 9/30/09 totaled 23.62 inches, with one heavy month in June at 8.32 inches. This one month's precipitation is nearly double the monthly average of +/- 4.5 inches/month and is 35% of total precipitation for the period.[1] From June on, monthly rainfall tapered off with a minimum of 2.67 inches in September 2009. Another dry season was beginning.

Major rain monitoring dates were on 5/7, 6/4, 6/11 and 6/18 (Table 2, Table B1). Cumulative rainfall on 6/18 was heavy at 3.82 inches with all 13 monitoring sites showing elevated *E. coli* bacteria counts (Table 2). During this four-day period of heavy rain, all Norwalk River monitoring sites showed the impact of extended storm water runoff (Table 2, Table B1).

One old, concrete storm drain discharge pipe (Site SM3.1 at James Street on the Silvermine River) was kept under surveillance by HW/RW during the summer of 2009. This was due to a high count of 21,000 CFU/100mLs observed by HW/RW volunteers at the end of the 2008 monitoring season. On 11/5/2009 (after the closing date for this report), the pipe began discharging a plume of black septic waste to the Norwalk River and a sample was taken by HW/RW personnel. *E. coli* counts were observed at 38,000 CFU/100 mLs at the HW/RW laboratory and confirmed at 40,000 CFU/100 mLs at the Norwalk Public Health Laboratory (NPHL). Norwalk's Health, Conservation, and Public Works department were all notified by HW/RW and a thorough investigation is underway at James Street to determine the cause (Appendix E). As of December 1, 2009, a house (#7 James Street) failed a dye test initiated by Norwalk's Conservation Department. An investigation by the Norwalk Health Department is underway.

[1] All data is from a rain gauge at Norwalk Public Health Department

All observed DO means meet the CT DEP DO criterion of 5 mg/L or greater Figure 2. Observed instances of single DO tests failing to meet the DO criterion appear in Table 3. Reasons for the large number of low DO values found at Site NR21 (Table 3) are possibly due to low flow from the Great Swamp in August and the low DO at Site NR20 is possibly due to impaired conditions existing at NR21.

Observed conductivity ranges in the upper Norwalk River sites (NR23 downstream to NR15) are primarily due to variable weather conditions. Wet weather (June 2009) create the lower values for the season due to dilution. For example, minimum conductivity values were observed on 5/7, where one inch of rain fell just prior to monitoring (Table 3, Figure 3, and Table B1). The opposite is true for dry weather, such as occurred in late August, where elevated conductivity values were observed on 9/29 (Table 3, Figure 3, Table B1).

What cannot be explained is the apparent stability of the lower river monitoring sites in terms of conductivity values under a variety of weather conditions (Figure 3). The reduced conductivity means observed from Site NR13 downstream to Site NR1 are due to the river's sequential convergence with Cooper Brook, Comstock Brook, and Silvermine River (Figure 3). These large tributaries all have lower conductivity values and serve to reduce the elevated conductivity levels the river has achieved at Ridgefield from exposure to limestone beds (Figure 3). Nevertheless, storm water runoff in the lower Norwalk River can be very intense under heavy rainfall, especially through the network of storm drains and has the ability to alter conductivity values in the receiving waters.

The analysis of water samples for TN and TP was conducted in the Norwalk River for all three WWTPs effluent discharges (Site NR22, NR16, and NR9.8) as well as the 11 other main river sites (Figure 5, Figure 6, and Appendix A2). Nutrient surveys were conducted twice during the summer of 2009 on 6/25 and 9/24 (Figure 5, Figure 6) in conjunction with *E. coli* surveys. York Analytical Laboratories, Inc., in Stratford, Connecticut, performed all nutrient tests using Standard Methods 4500N for TN and EPA 365.3 for TP. Minimum Detection Limits are specified in Table 5 for TN and in Table 6 for TP. The funding for nutrient research was generously provided by NRG Inc. at Manresa Island in Norwalk.

Site NR22 is a 1mgd nameplate capacity SBR WWTP at Ridgefield with throughput at 700,000gpd. Site NR16 is an older SBR WWTP on Route 7, south the intersection with Route 35 in Ridgefield. The plant's nameplate capacity is 125,000gpd and through put is presently 45,000gpd. Site NR9.8 is a newly installed Zenon® (GE) plant with a ZeeWeed® (GE) filter attached. The nameplate capacity is 240,000gpd, though currently, the new plant is operating at 45,000gpd. A large housing complex designed to replace the abandoned Gilbert and Bennett's Wire Mill never materialized. All three WWTPs discharge treated effluent directly to the Norwalk River (Appendix A2).

Observed TN and TP values in mg/L on 6/25 and 9/24 show the impact of the Ridgefield WWTP (Site NR22) effluent discharge on Site NR21 and NR20 downstream (Figure 4, Figure 5). Even though the Ridgefield WWTP is an efficient SBR unit with phosphorous removal technology installed (precipitation with alum), volume alone (700,000gpd) provides heavy nutrient loading to the Norwalk River (Table 7). The situation with the Route 7 WWTP (Site NR16) differs in that higher nutrient concentrations (Figure 4, Figure 5) provide little in the way of visible downstream pollution. Discharge volume (45,000gpd) is much less and therefore nutrient loading to the receiving waters is less (Table 7). The Route 7 WWTP has no phosphorous removal technology in place and is inefficient with nitrogen removal.

Finally, the Georgetown WWTP (Figure 7) shows very low concentrations of TN and TP in the effluent discharge (Table 5, Table 6). With a volume of 45,000gpd and new technology, the effluent concentration of TN and TP is less than background levels of the receiving waters (Table 5, Table 6). As a result, nutrient loading to the waterway is greatly reduced (Table 7).

Beginning with Site NR15, the nutrient concentrations observed in the lower Norwalk River decline, but are still elevated all the way down to Site NR1 (Figure 4, Figure 5). The sources of TN and TP in the lower river are possibly due to septic infiltration, net additions from numerous Norwalk storm drain discharges (Harris and Fraboni 2009) and fertilizer applications along the river banks. All observed levels exceed what would be healthy for a river (Howe, Ramsey, and Kelly 2002). The established CT DEP criterion on fresh water nutrient levels speaks only to impoundments where oligotrophic levels of TN and TP are shown at 0-10 µg/L for TP and 0-200 µg/L for TN during spring and summer levels.

Notwithstanding the finer points of standing water versus moving water, TN and TP concentrations exceed even these incomplete guidelines[2] and are in the "eutrophic" and "highly eutrophic" categories (Table 5, Table 6, Howe, Ramsey, and Kelly 2002). It is hoped that the CT DEP will issue more comprehensive regulations for nitrogen and ultimately finalize a classification system for phosphorous in receiving waters.

While observed TN levels in the upper river appear to follow a pattern based on the impact from treated effluent from two of the WWTPs (NR22 and NR16), the observed TN values on 6/25 and 9/24 differ in significant ways (Figure 4). Nitrogen concentrations from the two WWTPs are lower on 6/25 and considerably higher on 9/24 (Figure 4). Just the opposite is true for the lower river, i.e., observed TN values on 6/25 are higher (Site NR9.8 and Site SM3 are exceptions at most sites (Figure 4)).

Observed TP levels are also puzzling in that no TP is visible with MDLs utilized by York Analytical Laboratories, Inc. on 6/25 (Figure 5, Table 6). The only exception is the Route 7 discharge, observed at concentrations of 4.82 mg/L (Table 6). On 9/24, however, TP is visible (Figure 5) and would be considered to be highly eutrophic at 13 of the monitoring sites, with the exception of Site NR1 at 0.09 mg/L (Table 6, Figure 5).

The HW/RW data represent two snapshots of nutrient concentrations on the Norwalk River and not too much can be drawn from the available numbers. The existing data raise more questions than answers. From a biological perspective, it would seem that some nitrogen forms would be assimilated by aquatic plants during the growth season in June, and begin regeneration during naturally occurring biological decomposition in September. The opposite appears to be true (Figure 4) at the lower river sites, i.e., observed TN values are less on 9/24 than 6/25.

In the case of TP, assimilation by aquatic plants during the growth cycle and the end of the spring fertilizer season could possibly account for the absence of TP concentrations above the MDL during June (Figure 5, Table 6). The appearance of elevated TP concentrations in September possibly relates to the overuse of fertilizer by homeowners and TP regeneration from biological decomposition. From HW/RW experience, TP levels are fleeting and difficult to document (Table 5), while TN is more readily observable (Figure 4).

The HW/RW program to assess nutrient loading (lbs/day TN) did not move quickly because of difficulties in using the new current meters. Four tributaries were assessed for TN (Table 8). The Silvermine River has the highest TN loading, possibly due to lack of sound property management along the riverbanks.

[2] a CT DEP phosphorous survey of 21 least disturbed streams in CT showed median phosphorous values ranging from 0.004 mg/L to 0.0255 mg/L (Bellucci, et al, 2009)

V. Conclusion

The end of September marks the end of HW/RW's 11th year of continually monitoring the Norwalk River. CT DEP sponsored us for six years and then local sponsors from a growing support base of local sponsors, towns and individuals provided funding for the last five years. "Is the river improving or getting worse?" is the question most asked of our staff. Our answer to this question is this: if it is, we can't prove it with the data. Variable weather conditions continue to cloud the issue, causing greatly elevated *E. coli* bacteria counts one year, followed by lower counts the next. What remains fairly constant year after year is that most of the twelve HW/RW monitoring sites fail to meet the CT DEP *E. coli* bacteria criterion. Over the years, the visible pipes that once discharged raw sewage to the river have been eliminated. This improvement has been compromised with large population increases as growing numbers of new dwellings, expanding impervious surfaces and more infrastructure continues to impair the river's water quality. Point sources have been replaced with non-point sources, which are far more difficult to find and correct.

HW/RW remains committed to improving the health and public's perception of this beautiful and irreplaceable waterway. The research will continue and will now encompass nutrient studies in addition to bacteria analysis. Our primary goal is to continue to educate the public and younger generations about what is required to save this valuable river.

VI. Index of Figures, Tables, and Appendices:

VII. References

Belluci, C., M.B. Beauchene, and M. Becker. 2009. Physical, Chemical and Biological attributes of least disturbed watersheds in Connecticut, CT Department of Environmental Protection, Bureau of Water Protection and Land Reuse, Planning Standards Division, Hartford, CT, 2009

CT DEP, Water Quality Standard 12/17/02

Harris, R. B. and P. J. Fraboni: Quality Assurance/Quality Control Plan for the Norwalk River Watershed Monitoring Project (QA No. CT00162) (re-approved October 2001 and extending to September 2002).

Harris, R. B. and P. J. Fraboni. 2006. Water Quality Data Final Report for the Norwalk River Watershed (June 2006 –May 2006).

Harris, R. B. and P. J. Fraboni. 2007. Water Quality Data Final Report for the Norwalk River Watershed (July 2007–September 2007).

Harris, R. B. and P. J. Fraboni. 2008. Water Quality Data Final Report for the Norwalk River Watershed (July 2008 –September 2008).

Howe, B.L., J.S. Ramsey, and S.W. Kelley. 2002. Nitrogen Modeling to Support Watershed Managers: Comparison of Approaches and Sensitivity Analysis

US Environmental Protection Agency. 1986. Ambient Water Quality Criteria for Bacteria, US EPA 440/5-84-002, Washington, DC.

VIII. Reporting Period

Summary report for a five month monitoring period, May 2009 through September 2009

Monthly and Quarterly progress reports are available from June 1998 through April 2009

cc: Norwalk River Watershed Initiative Committee Co-Chairs
Norwalk River Watershed Association
Norwalk River Watershed Towns- Conservation Commissions- Norwalk, Wilton, Ridgefield, and Redding

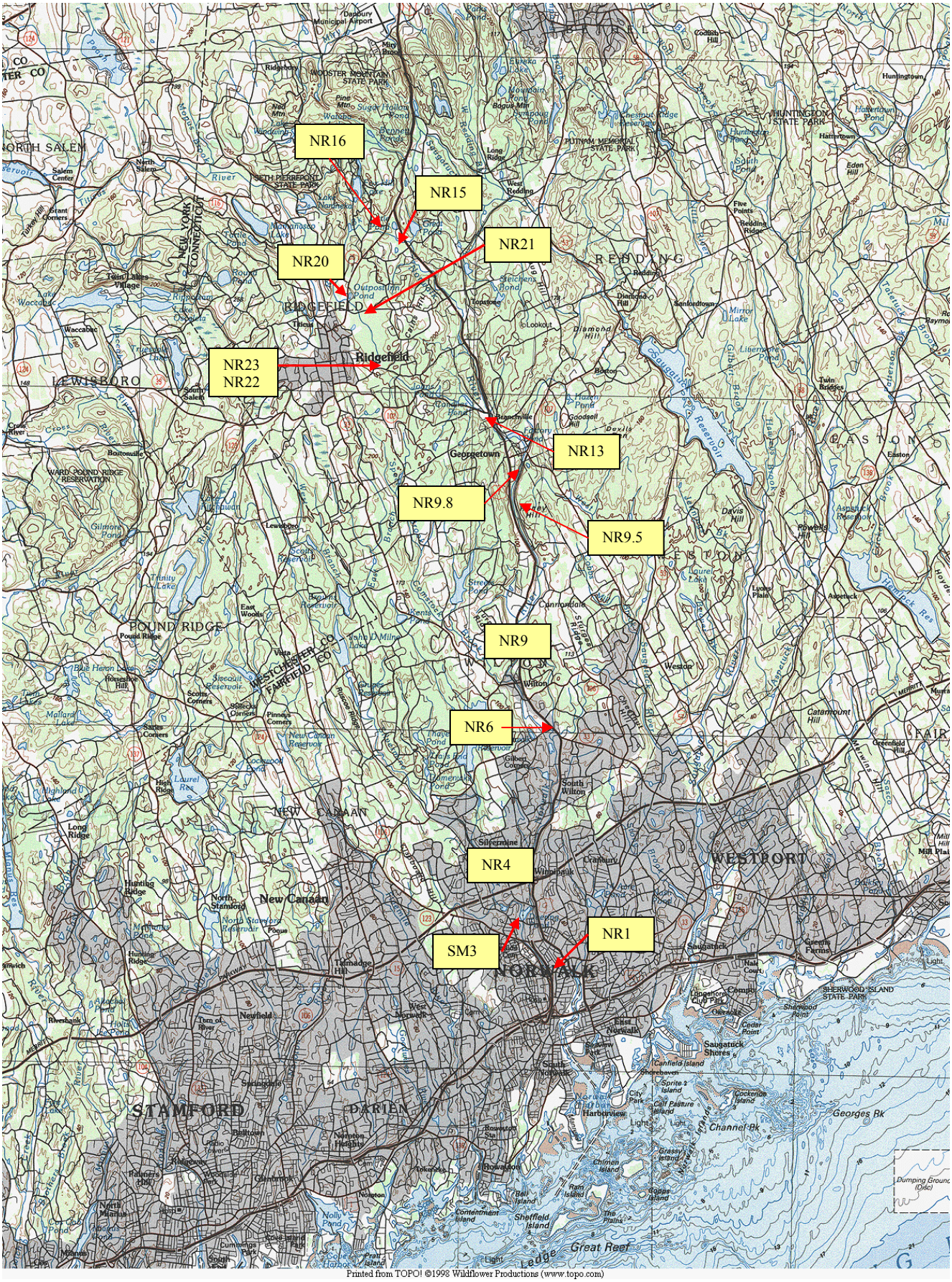
Appendix A

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
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"

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"

Appendix A2 Location of sampling sites located in the Norwalk River Watershed



Appendix B

Table B1 Site, date, time, air temperature, water temperature, dissolved oxygen, conductivity, fecal coliform bacteria, *E. coli* bacteria, amount of rainfall, days prior to sampling, and QAQC activity in the Norwalk River Watershed May 2009 to September 2009

Site	Date	Time	Air Temp. ° C	Water Temp. ° C	D.O. mg/L	COND. umho/cm	Fecal Coliform. CFU/100 mL	E. coli CFU/100 mL	Amount of rain (in)	Days prior to sampling	QA/QC	Fecal Coliform. CFU/100 mL
NR23	5/7/2009	1035	20.0	12.7	10.6	333	1440	1440	1.00	0		
NR22	5/7/2009	1045	22.0	13.7	10.9	688	400		1.00	0	Field Blank	0
NR21	5/7/2009	1100	20.5	13.6	6.6	408	200	164	1.00	0		
NR20	5/7/2009	1110	22.0	13.7	7.2	365	480	480	1.00	0	Duplicate	400
NR15	5/7/2009	1121	21.0	14.5	10.0	423	880	780	1.00	0	Replicate	600
NR13	5/7/2009	1130	24.0	13.6	9.8	315	580	500	1.00	0		
NR9.5	5/7/2009	1152	19.0	13.8	9.7	298	600	580	1.00	0		
NR9	5/7/2009	1137	19.0	13.9	9.7	294	600	600	1.00	0		
NR6	5/7/2009	1125	18.0	13.8	9.7	228	940	940	1.00	0	Replicate	840
NR4	5/7/2009	1107	19.0	13.4	9.8	237	1580	1540	1.00	0	Duplicate	1420
SM3	5/7/2009	1054	18.0	13.9	10.1	217	1060	1020	1.00	0	Field Blank	0
NR1	5/7/2009	1039	18.0	13.4	10.1	219	1780	1780	1.00	0		
NR23	5/14/2009	1052	15.0	12.5	10.1	935	52	52	0.33	5		
NR22	5/14/2009	1059	15.0	14.0	10.4	802	6		0.33	5		
NR21	5/14/2009	1107	15.0	13.3	7.2	618	72	70	0.33	5	Replicate	n/g
NR20	5/14/2009	1117	15.0	13.4	10.2	681	252	236	0.33	5	Field Blank	0
NR15	5/14/2009	1131	15.0	14.8	9.1	554	64	56	0.33	5	Duplicate	80
NR13	5/14/2009	1144	16.0	14.3	9.4	391	32	32	0.33	5		
NR9.5	5/14/2009	1200	14.0	14.7	9.7	368	60	56	0.33	5		
NR9	5/14/2009	1145	15.0	14.0	9.6	341	100	92	0.33	5		
NR6	5/14/2009	1131	15.0	13.3	9.9	331	152	132	0.33	5	Duplicate	160
NR4	5/14/2009	1109	16.0	13.6	10.0	398	160	140	0.33	5	Replicate	168
SM3	5/14/2009	1059	16.0	14.5	9.5	278	96	88	0.33	5	Field Blank	0
NR1	5/14/2009	1044	17.0	14.3	9.7	331	112	104	0.33	5		
NR23	5/21/2009	1038	26.0	15.0	8.9	972	40	40	0.26	4		
NR22	5/21/2009	1051	27.0	15.1	9.7	767	6	2	0.26	4		
NR21	5/21/2009	1059	29.0	17.1	8.8	675	136	136	0.26	4	Field Blank	0
NR20	5/21/2009	1111	26.0	18.2	14.2	687	144	144	0.26	4		
NR15	5/21/2009	1122	25.0	17.3	8.6	603	92	84	0.26	4	Replicate	84
NR13	5/21/2009	1141	26.0	16.3	9.3	417	92	88	0.26	4	Duplicate	156
NR9.5	5/21/2009	1137	29.0	16.1	9.9	398	34	28	0.26	4		
NR9	5/21/2009	1121	28.0	14.8	10.1	361	20	20	0.26	4	Duplicate	32
NR6	5/21/2009	1106	28.0	15.2	10.4	364	52	52	0.26	4	Replicate	44
NR4	5/21/2009	1050	30.0	15.8	10.7	382	184	180	0.26	4		
SM3	5/21/2009	1039	24.0	14.4	10.2	282	72	28	0.26	4	Field Blank	0
NR1	5/21/2009	1025	27.0	16.2	10.3	357	440	440	0.26	4		
NR23	5/28/2009	1030	19.0	13.8	10.4	941	40	40	0.16	0		
NR22	5/28/2009	1040	18.5	15.9	10.4	765	4		0.16	0		
NR21	5/28/2009	1055	18.0	17.7	7.0	668	124	124	0.16	0	Field Blank	0
NR20	5/28/2009	1110	19.5	15.1	9.9	694	228	208	0.16	0		
NR15	5/28/2009	1115	18.0	15.9	9.6	588	124	112	0.16	0	Replicate	112
NR13	5/28/2009	1130	18.0	15.4	9.3	427	80	68	0.16	0	Duplicate	60
NR9.5	5/28/2009	1147	14.5	18.9	9.6	417	120	120	0.16	0		
NR9	5/28/2009	12.09	14.5	14.9	9.8	390	140	140	0.16	0		
NR6	5/28/2009	1223	14.0	14.9	9.8	387	116	92	0.16	0		
NR4	5/28/2009	1244	14.0	17.7	10.4	398	272	264	0.16	0		
SM3.1	5/28/2009	1252					1100	1000	0.16	0	Field Blank	0
SM3	5/28/2009	1253	14.0	17.7	9.4	303	188	172	0.16	0	Replicate	224
NR1	5/28/2009	1315	13.0	15.1	10.1	408	520	520	0.16	0	Duplicate	500
NR23	6/4/2009	1020	17.0	14.6	9.9	557	1600	1600	0.45	0		
NR22	6/4/2009	1030	20.0	16.5	10.3	769	31	29	0.45	0	Field Blank	0
NR21	6/4/2009	1040	20.0	15.2	8.1	638	1900	1800	0.45	0		
NR20	6/4/2009	1047	17.5	15.6	9.6	527	2700	2700	0.45	0		
NR15	6/4/2009	1055	18.0	16.2	9.5	612	520	520	0.45	0	Duplicate	520
NR13	6/4/2009	1110	18.0	16.2	9.7	396	860	860	0.45	0	Replicate	600
NR9.5	6/4/2009	1013	17.0	16.4	9.2	412	360	360	0.45	0		
NR9	6/4/2009	1039	18.0	14.9	9.3	344	1260	1260	0.45	0		
NR6	6/4/2009	1051	19.0	15.0	9.2	339	820	820	0.45	0	Duplicate	N/A
NR4	6/4/2009	1114	21.0	15.3	10.9	343	860	860	0.45	0	Replicate	700
SM3.1	6/4/2009						860	800	0.45	0		
SM3	6/4/2009	1121	19.0	15.3	9.2	281	920	920	0.45	0	Field Blank	0
NR1	6/4/2009	1147	21.0	16.6	9.5	350	860	800	0.45	0		

Table B1 (continues)

Site	Date	Time	Air Temp. ° C	Water Temp. ° C	D.O. mg/L	COND. umho/cm	Fecal Coliform. CFU/100 mL	E. coli CFU/100 mL	Amount of rain (in)	Days prior to sampling	QA/QC	Fecal Coliform. CFU/100 mL
NR23	6/11/2009	1040	18.0	14.7	9.8	650	1400	1000	1.04	2	Field Blank	0
NR22	6/11/2009	1050	17.5	16.7	16.2	762	N/A	N/A	1.04	2		
NR21	6/11/2009	1103	18.0	15.2	3.0	365	320	280	1.04	2	Replicate	280
NR20	6/11/2009	1113	16.0	15.6	3.4	437	400	330	1.04	2		
NR15	6/11/2009	1125	18.0	16.2	9.6	346	N/A	N/A	1.04	2		
NR13	6/11/2009	1135	17.0	16.2	9.2	347	260	250	1.04	2	Duplicate	210
NR9.5	6/11/2009	1140	17.0	16.5	9.6	339	350	350	1.04	2	Field Blank	0
NR9	6/11/2009	1125	16.0	16.0	9.5	320	284	260	1.04	2	Replicate	200
NR6	6/11/2009	1110	17.0	15.8	9.5	318	530	510	1.04	2		
NR4	6/11/2009	1052	16.0	16.0	9.9	312	420	380	1.04	2		
SM3.1	6/11/2009								1.04	2		
SM3	6/11/2009	1035	16.0	16.5	9.6	251	610	580	1.04	2	Duplicate	460
NR1	6/11/2009	1020	16.0	16.4	9.8	287	450	370	1.04	2		
NR23	6/18/2009	1052	15.0	16.4	10.1	178	3900	3600	3.82	0	Replicate	3400
NR22	6/18/2009	1058	15.0	16.2	10.4	767	16	10	3.82	0	Field Blank	0
NR21	6/18/2009	1105	15.0	15.2	5.8	453	640	640	3.82	0		
NR20	6/18/2009	1115	16.0	15.6	7.2	481	1700	1700	3.82	0		
NR15	6/18/2009	1132	15.0	16.4	9.5	413	930	930	3.82	0	Duplicae	870
NR13	6/18/2009	1145	16.0	16.1	9.5	310	430	430	3.82	0		
NR9.5	6/18/2009	1140	18.0	16.5	9.6	311	1400	1300	3.82	0	Replicate	1000
NR9	6/18/2009	1127	18.0	16.4	9.3	283	1000	1000	3.82	0		
NR6	6/18/2009	1112	18.0	16.2	9.2	265	800	700	3.82	0		
NR4	6/18/2009	1101	21.0	16.2	9.6	264	1600	1600	3.82	0	Duplicate	1100
SM3.1	6/18/2009	1047	sample only				1200	1200	3.82	0		
SM3	6/18/2009	1045	18.0	17.0	9.4	255	800	700	3.82	0	Field Blank	0
NR1	6/18/2009	1029	20.0	16.6	9.4	275	1500	1500	3.82	0		
NR23	6/25/2009	1105	23.0	17.1	9.2	882	440	400	0.56	1		
NR22	6/25/2009	1115	26.0	17.4	10.2	762	0	0	0.56	1		
NR21	6/25/2009	1125	25.0	18.6	5.8	620	52	52	0.56	1	Field Blank	0
NR20	6/25/2009	1140	24.0	19.7	8.3	603	296	280	0.56	1	Replicate	292
NR15	6/25/2009	1150	23.0	19.6	8.7	501	96	96	0.56	1	Duplicate	76
NR13	6/25/2009	1205	23.0	18.6	9.0	354	96	76	0.56	1		
NR9.5	6/25/2009	1020	23.0	18.5	8.9	325	112	92	0.56	1		
NR9	6/25/2009	1040	24.0	17.9	9.0	304	228	200	0.56	1		
NR6	6/25/2009	1104	24.5	18.1	9.2	274	100	92	0.56	1	Duplicate	108
NR4	6/25/2009	1122	26.0	18.5	8.6	283	228	208	0.56	1	Replicate	248
SM3.1	6/25/2009	1139	sample only				160	160	0.56	1	Field Blank	0
SM3	6/25/2009	1138	25.0	18.8	9.0	255	156	116	0.56	1		
NR1	6/25/2009	1204	25.0	18.7	9.4	282	320	280	0.56	1		
NR23	7/2/2009	1023	23.0	17.4	9.3	871	44	40	0.51	0		
NR22	7/2/2009	1035	24.0	18.2	10.1	741	0	0	0.51	0	Field Blank	0
NR21	7/2/2009	1041	24.0	18.6	4.6	560	224	176	0.51	0	Replicate	288
NR20	7/2/2009	1050	23.0	19.3	8.1	626	268	228	0.51	0	Duplicate	236
NR15	7/2/2009	1100	24.0	20.1	9.8	544	252	212	0.51	0		
NR13	7/2/2009	1113	25.0	19.4	9.6	366	148	124	0.51	0		
NR9.5	7/2/2009	1028	21.0	19.7	8.8	337	76	64	0.51	0		
NR9	7/2/2009	1047	22.0	18.5	9.0	306	72	64	0.51	0	Duplicate	60
NR6	7/2/2009	1100	22.0	18.7	9.1	282	88	80	0.51	0	Replicate	112
NR4	7/2/2009	1117	22.0	18.9	9.3	300	168	140	0.51	0		
SM3	7/2/2009	1153	24.0	19.9	8.7	264	900	900	0.51	0	Field Blank	0
NR1	7/2/2009	1133	23.0	19.8	9.2	298	276	228	0.51	0		
NR23	7/9/2009	1054	19.0	16.0	9.4	956	44	36	0.18	2	Duplicate	n/g
NR22	7/9/2009	1114	20.0	18.0	9.8	760	7	3	0.18	2	Field Blank	0
NR21	7/9/2009	1125	20.0	16.7	4.9	490	244	212	0.18	2	Replicate	260
NR20	7/9/2009	1133	18.5	17.8	11.3	650	156	136	0.18	2		
NR15	7/9/2009	1144	18.0	18.9	9.1	569	136	136	0.18	2		
NR13	7/9/2009	1150	20.0	18.3	8.7	389	164	136	0.18	2		
NR9.5	7/9/2009	1044	20.0	18.7	9.5	379	72	60	0.18	2		
NR9	7/9/2009	1102	21.0	17.1	8.6	347	76	68	0.18	2	Duplicate	108
NR6	7/9/2009	1115	20.0	17.3	9.9	339	144	116	0.18	2		
NR4	7/9/2009	1133	22.0	17.4	10.9	373	156	156	0.18	2	Field Blank	0
SM3.1	7/9/2009	Sample Only					7000	n/a	0.18	2		
SM3	7/9/2009	1146	21.0	18.0	8.8	285	132	128	0.18	2		
NR1	7/9/2009	1208	22.0	18.6	10.2	351	120	96	0.18	2	Replicate	124

Table B1 (continues)

Site	Date	Time	Air Temp. ° C	Water Temp. ° C	D.O. mg/L	COND. umho/cm	Fecal Coliform. CFU/100 mL	E. coli CFU/100 mL	Amount of rain (in)	Days prior to sampling	QA/QC	Fecal Coliform. CFU/100 mL
NR23	7/16/2009	1040	25.0	18.4	9.6	938	44	32	0.12	4		
NR22	7/16/2009	1047	25.0	19.1	10.1	844	0	0	0.12	4		
NR21	7/16/2009	1055	29.0	19.1	5.0	640	460	400	0.12	4		
NR20	7/16/2009	1101	25.0	21.3	11.0	761	92	76	0.12	4	Replicate	116
NR15	7/16/2009	1113	23.0	20.1	8.8	668	156	160	0.12	4	Duplicate	
NR13	7/16/2009	1128	25.0	20.3	9.0	445	56	56	0.12	4	Field Blank	0
NR9.5	7/16/2009	1030	26.0	20.3	7.3	407	44	24	0.12	4	Duplicate	
NR9	7/16/2009	1049	26.0	18.3	8.2	352	108	88	0.12	4		
NR6	7/16/2009	1106	27.0	18.6	8.7	360	112	112	0.12	4		
NR4	7/16/2009	1120	31.0	20.0	9.5	381	204	188	0.12	4		
SM3.1	7/16/2009	Sample	only				3300		0.12	4	Field Blank	0
SM3	7/16/2009	1134	29.0	19.3	8.3	292	92	88	0.12	4	Replicate	136
NR1	7/16/2009	1156	28.0	21.4	9.7	374	132	116	0.12	4		124
NR23	7/23/2009	1040	26.0	19.0	9.3	836.0	76	72	0.61	2		
NR22	7/23/2009	1050	27.0	20.1	9.6	830.0	1	N/A	0.61	2	Field Blank	0
NR21	7/23/2009	1058	27.0	19.8	3.0	520.0	160	148	0.61	2		
NR20	7/23/2009	1106	26.0	21.1	7.4	592.0	76	64	0.61	2		
NR15	7/23/2009	11.17	25.0	21.3	8.6	516.0	60	52	0.61	2	Replicate	116
NR13	7/23/2009	1132	16.5	20.8	8.3	405.0	280	280	0.61	2		108
NR9.5	7/23/2009	1042	25.0	20.8	8.5	353.1	44	32	0.61	2		
NR9	7/23/2009	1104	24.0	20.0	9.8	338	172	160	0.61	2	Field Blank	0
NR6	7/23/2009	1124	25.0	20.2	8.8	336	240	204	0.61	2		
NR4	7/23/2009	1142	31.0	21.3	9.1	357	236	188	0.61	2	Replicate	360
SM3	7/23/2009	1157	29.0	20.3	8.3	296	184	168	0.61	2		240
NR1	7/23/2009	1215	25.5	21.3	9.1	351.4	204	180	0.61	2	Duplicate	
NR23	7/30/2009	1029	26.5	20.2	8.9	720	480	420	0.27	1		
NR22	7/30/2009	1039	28.0	21.1	9.4	867	19	17	0.27	1	Field Blank	0
NR21	7/30/2009	1047	32.0	21.8	2.6	605	104	84	0.27	1		
NR20	7/30/2009	1059	29.0	23.2	7.5	608	160	148	0.27	1	Duplicate	172
NR15	7/30/2009	1106	28.0	23.0	8.1	546	620	980	0.27	1		
NR13	7/30/2009	1119	28.5	22.5	8.3	375	116	92	0.27	1		
NR9.5	7/30/2009	1013	28.0	22.7	8.3	318	90	100	0.27	1		
NR9	7/30/2009	1031	29.0	21.6	8.3	348	360	310	0.27	1		
NR6	7/30/2009	1044	30.0	21.7	8.5	341	200	140	0.27	1	Duplicate	280
NR4	7/30/2009	1101	31.0	22.4	9.7	362	350	280	0.27	1		
SM3.1	7/30/2009	1112	Sample Only				2300	2200	0.27	1	Field Blank	0
SM3	7/30/2009	1111	31.0	21.7	8.1	263	540	490	0.27	1	Replicate	620
NR1	7/30/2009	1130	32.0	23.0	9.0	334	pink	560	0.27	1		
NR 23	8/6/2009	1045	23.0	18.3	9.3	894	124	112	0.77	4		
NR 22	8/6/2009	1101	24.0	20.2	9.5	791	1		0.77	4		
NR 21	8/6/2009	1109	24.0	19.2	3.8	635	124	112	0.77	4	Replicate	142
NR 20	8/6/2009	1118	24.0	20.4	7.6	633	44	40	0.77	4	Field Blank	0
NR 15	8/6/2009	1131	23.0	21.0	8.6	516	168	160	0.77	4	Duplicate	172
NR 13	8/6/2009	1146	25.0	20.6	8.3	364	128	108	0.77	4		
NR 9.5	8/6/2009	1010	23.0	21.0	8.2	365	28	20	0.77	4		
NR 9	8/6/2009	1031	23.0	19.7	8.0	349	76	68	0.77	4	Duplicate	92
NR 6	8/6/2009	1040	23.0	20.3	8.4	349	100	88	0.77	4		
NR 4	8/6/2009	1055	23.5	20.1	8.6	366	244	228	0.77	4	Replicate	212
SM 3.1	8/6/2009	SAMPLE ONLY							0.77	4		
SM 3	8/6/2009	1107	23.0	21.1	7.9	264	176	160	0.77	4	Field Blank	0
NR 1	8/6/2009	1125	21.5	21.3	8.0	344	272	260	0.77	4		
NR 23	8/13/2009	1100	20.0	19.2	7.7	1010	200	188	0.12	2	Duplicate	156
NR 22	8/13/2009	1107	21.0	21.2	7.6	855	0	0	0.12	2		
NR 21	8/13/2009	1120	21.0	20.4	2.3	840	148	140	0.12	2	Replicate	140
NR 20	8/13/2009	1125	20.0	20.8	4.5	760	40	32	0.12	2	Field Blank	0
NR 15	8/13/2009	1140	20.0	21.2	6.8	651	116	116	0.12	2		
NR 13	8/13/2009	1040	20.0	21.2	6.7	333	204	180	0.12	2		
NR 9.5	8/13/2009	1028	22.5	21.7	8.4	397	196	188	0.12	2	Replicate	160
NR 9	8/13/2009	1047	22.0	20.0	8.1	363	148	136	0.12	2	Duplicate	136
NR 6	8/13/2009	1105	24.0	20.5	7.9	364	228	172	0.12	2		
NR 4	8/13/2009	1118	24.0	20.6	7.4	382	228	196	0.12	2	Field Blank	0
SM 3.1	8/13/2009	1134	SAMPLE ONLY				0	0	0.12	2		
SM 3	8/13/2009	1133	23.5	21.1	8.0	296	192	164	0.12	2		
NR 1	8/13/2009	1156	24.0	22.0	8.9	375	128	116	0.12	2		

Table B1 (continues)

Site	Date	Time	Air Temp. ° C	Water Temp. ° C	D.O. mg/L	COND. umho/cm	Fecal Coliform. CFU/100 mL	E. coli CFU/100 mL	Amount of rain (in)	Days prior to sampling	QA/QC	Fecal Coliform. CFU/100 mL
NR 23	8/20/2009	1048	31.0	21.8	9.9	1060	128	96	0.33	7	Replicate	128
NR 22	8/20/2009	1049	31.0	22.0	9.8	884	0		0.33	7		
NR 21	8/20/2009	1055	33.0	22.2	5.1	908	160	148	0.33	7	Duplicate	144
NR 20	8/20/2009	1109	32.0	24.0	8.9	830	36	40	0.33	7	Field Blank	0
NR 15	8/20/2009	1121	31.0	22.6	8.6	706	184	168	0.33	7		
NR 13	8/20/2009	1134	30.0	23.4	8.7	455	184	156	0.33	7		
NR 9.5	8/20/2009	1251	29.0	24.4	8.1	406	680	680	0.33	7	Duplicate	n/a
NR 9	8/20/2009	1200	28.0	21.6	8.4	380	760	760	0.33	7	Field Blank	0
NR 6	8/20/2009	1140	28.0	22.7	10.3	387	144	144	0.33	7		
NR 4	8/20/2009	1125	32.0	23.9	12.8	408	176	164	0.33	7		
SM 3.1	8/20/2009	SAMPLE ONLY					TNTC	TNTC	0.33	7		
SM 3	8/20/2009	1107	27.0	23.3	7.8	305	132	132	0.33	7		
NR 1	8/20/2009	1050	29.0	24.6	9.6	404	216	168	0.33	7	Replicate	216
NR 23	8/27/2009	1110	25.0	19.3	8.9	887	124	88	0.02	1		
NR 22	8/27/2009	1116	26.0	21.3	9.2	854	1		0.02	1		
NR 21	8/27/2009	1123	26.0	21.2	4.6	767	1520	1440	0.02	1	Replicate	1540
NR 20	8/27/2009	1138	26.0	21.8	7.8	643	52	52	0.02	1	Field Blank	0
NR 15	8/27/2009	1151	24.0	21.6	8.4	500	64	56	0.02	1	Duplicate	96
NR 13	8/27/2009	1031	23.0	21.5	8.6	396	224	184	0.02	1		
NR 9.5	8/27/2009	1139	25.0	21.5	8.5	393	56	56	0.02	1		
NR 9	8/27/2009	1126	27.0	20.6	8.2	369	80	80	0.02	1		
NR 6	8/27/2009	1105	26.0	20.5	8.6	376	100	96	0.02	1		
NR 4	8/27/2009	1051	427.0	21.5	10.2	380	196	136	0.02	1	Field Blank	0
SM 3.1	8/27/2009	SAMPLE ONLY					1300	1300	0.02	1		
SM 3	8/27/2009	1028	25.0	21.4	7.9	249	168	152	0.02	1	Replicate	160
NR 1	8/27/2009	1017	26.0	22.2	7.8	347	128	120	0.02	1	Duplicate	200
NR 23	9/3/2009	1003	27.0	15.6	N/A	944	128	104	0.58	6	Duplicate	84
NR 22	9/3/2009	1012	27.0	18.9	N/A	832	0	0	0.58	6		
NR 21	9/3/2009	1018	27.0	15.6	N/A	750	124	120	0.58	6		
NR 20	9/3/2009	1020	26.0	15.9	N/A	708	48	48	0.58	6		
NR 15	9/3/2009	1035	25.0	16.5	N/A	560	64	52	0.58	6	Replicate	72
NR 13	9/3/2009	911	21.0	16.2	N/A	398	148	128	0.58	6		
NR 9.5	9/3/2009	1050	21.0	17.4	9.2	415	44	32	0.58	6		
NR 9	9/3/2009	1040	22.0	16.0	9.8	376	104	88	0.58	6		
NR 6	9/3/2009	1026	22.0	16.2	10.2	355	144	120	0.58	6		
NR 4	9/3/2009	1010	22.0	16.7	11.5	369	284	196	0.58	6	Replicate	208
SM 3	9/3/2009	956	21.0	17.1	9.3	271	220	188	0.58	6		
NR 1	9/3/2009	943	22.0	17.9	9.7	353	192	124	0.58	6		
NR 23	9/10/2009	1045	20.0	14.9	10.1	106	204	212	0.00	7	Field Blank	0
NR 22	9/10/2009	1053	22.0	19.2	10.0	92	0	0	0.00	7		
NR 21	9/10/2009	1100	20.0	16.4	6.7	91	128	116	0.00	7	Duplicate	140
NR 20	9/10/2009	1108	19.5	16.4	9.7	82	640	620	0.00	7	Replicate	600
NR 15	9/10/2009	1120	20.0	15.7	9.0	69	240	212	0.00	7		
NR 13	9/10/2009	1130	20.0	17.2	10.0	46	40	40	0.00	7		
NR 9.5	9/10/2009	1130	19.0	17.8	9.0	428	80	80	0.00	7		
NR 9	9/10/2009	1115	20.0	15.2	9.6	387	204	188	0.00	7		
NR 6	9/10/2009	1105	20.0	15.7	9.7	354	220	180	0.00	7		
NR 4	9/10/2009	1037	22.0	16.8	10.4	380	160	132	0.00	7	Replicate	160
SM 3.1	9/10/2009	SAMPLE ONLY					2100	2100	0.00	7	Field Blank	0
SM 3	9/10/2009	1024	20.0	17.3	9.0	213	294	264	0.00	7	Duplicate	280
NR 1	9/10/2009	1005	22.0	17.9	9.8	382	304	220	0.00	7		

Table B1 (continues)

Site	Date	Time	Air Temp. ° C	Water Temp. ° C	D.O. mg/L	COND. umho/cm	Fecal Coliform. CFU/100 mL	E. coli CFU/100 mL	Amount of rain (in)	Days prior to sampling	QA/QC	Fecal Coliform. CFU/100 mL
NR 23	9/17/2009	1040	27.0	14.3	10.1	974	188	160	0.48	1		
NR 22	9/17/2009	1048	27.0	19.1	9.7	868	3	3	0.48	1		
NR 21	9/17/2009	1058	20.0	15.4	6.3	788	136	120	0.48	1	Field Blank	0
NR 20	9/17/2009	1105	16.0	15.5	9.6	757	88	76	0.48	1	Duplicate	140
NR 15	9/17/2009	1115	18.0	15.5	9.9	652	152	136	0.48	1	Duplicate	172
NR 13	9/17/2009	1128	17.0	16.1	9.8	477	112	96	0.48	1		
NR 9.5	9/17/2009	1203	17.0	16.5	9.4	441	40	40	0.48	1		
NR 9	9/17/2009	1149	17.0	15.1	9.1	401	64	56	0.48	1		
NR 6	9/17/2009	1130	17.0	15.5	9.3	396	200	160	0.48	1	Replicate	172
NR 4	9/17/2009	1110	17.0	15.9	10.7	401	236	208	0.48	1	Duplicate	236
SM 3.1	9/17/2009	SAMPLE ONLY					2000	2000	0.48	1	Field Blank	0
SM 3	9/17/2009	1047	17.0	16.6	8.5	295	520	400	0.48	1		
NR 1	9/17/2009	1019	19.0	17.0	9.6	386	216	180	0.48	1		
NR 23	9/24/2009	1043	26.0	19.0	9.3	123	84	84	0.01	7		
NR 22	9/24/2009	1048	27.0	20.5	9.9	899	2	2	0.01	7	Field Blank	0
NR 21	9/24/2009	1103	28.0	20.2	6.1	910	304	296	0.01	7		
NR 20	9/24/2009	1120	27.0	20.8	8.2	877	44	40	0.01	7	Duplicate	44
NR 15	9/24/2009	1133	25.0	19.1	8.7	713	108	104	0.01	7	Field Blank	0
NR 13	9/24/2009	1140	28.0	19.5	8.7	419	52	52	0.01	7		
NR 9.5	9/24/2009	1203	27.0	19.7	8.6	475	56	56	0.01	7		
NR 9	9/24/2009	1143	27.0	18.4	8.9	387	84	68	0.01	7		
NR 6	9/24/2009	1127	28.0	18.6	8.6	409	172	132	0.01	7		
NR 4	9/24/2009	1110	30.0	19.7	12.4	432	344	264	0.01	7		
SM 3.1	9/24/2009	SAMPLE ONLY					3200	2900	0.01	7		
SM 3	9/24/2009	1045	26.0	18.0	8.1	296	456	152	0.01	7	Field Blank	0
NR 1	9/24/2009	1025	27.0	19.0	9.3	410	220	164	0.01	7		

TableB2 Results of fecal coliform bacteria counts (colonies/100 mLs) inter-laboratory services with the Norwalk Public Health Laboratory (NPHL)

Date	Site	Fecal coliform bacteria counts (NPHL)	Fecal coliform bacteria counts HW/RW Lab
5/7/2009	NR20	n/a	480/400
5/7/2009	NR4	n/a	1580/1420
5/14/2009	NR15	n/a	64/80
5/14/2009	NR6	n/a	152/160
5/21/2009	NR13	n/a	92/156
5/21/2009	NR9	n/a	20/32
5/28/2009	NR13	75	80/60
5/28/2009	NR1	621	520/500
6/4/2009	NR15	599	520/520
6/4/2009	NR6	1112	820/N/A
6/11/2009	NR13	295	260/210
6/11/2009	SM3	487	610/460
6/18/2009	NR15	794	930/870
6/18/2009	NR4	951	1600/1100
6/25/2009	NR15	97	96/76
6/25/2009	NR6	95	100/108
7/2/2009	NR20	n/a	268/236
7/2/2009	NR9	76	72/60
7/9/2009	NR23	59	44/NG
7/9/2009	NR9	74	76/108
7/16/2009	NR15	142	156/188
7/16/2009	NR9.5	39	44/48
7/23/2009	NR13	174	280/188
7/23/2009	NR1	229	204/176
7/30/2009	NR20	121	160/172
7/30/2009	NR6	201	200/280
8/6/2009	NR15	226	168/172
8/6/2009	NR9	54	76/92
8/13/2009	NR23	293	200/156
8/13/2009	NR9	156	136/136
8/20/2009	NR21	183	160/144
8/20/2009	NR9.5	62	680/N/A
8/27/2009	NR15	96	64/96
8/27/2009	NR1	140	128/200
9/3/2009	NR23	84	128/84
9/10/2009	NR21	97	128/140
9/10/2009	SM3	334	294/280
9/17/2009	NR15	n/a	152/172
9/17/2009	NR4	n/a	236/236
9/24/2009	NR20	39	44/44
9/24/2009	NR4	336	334/na

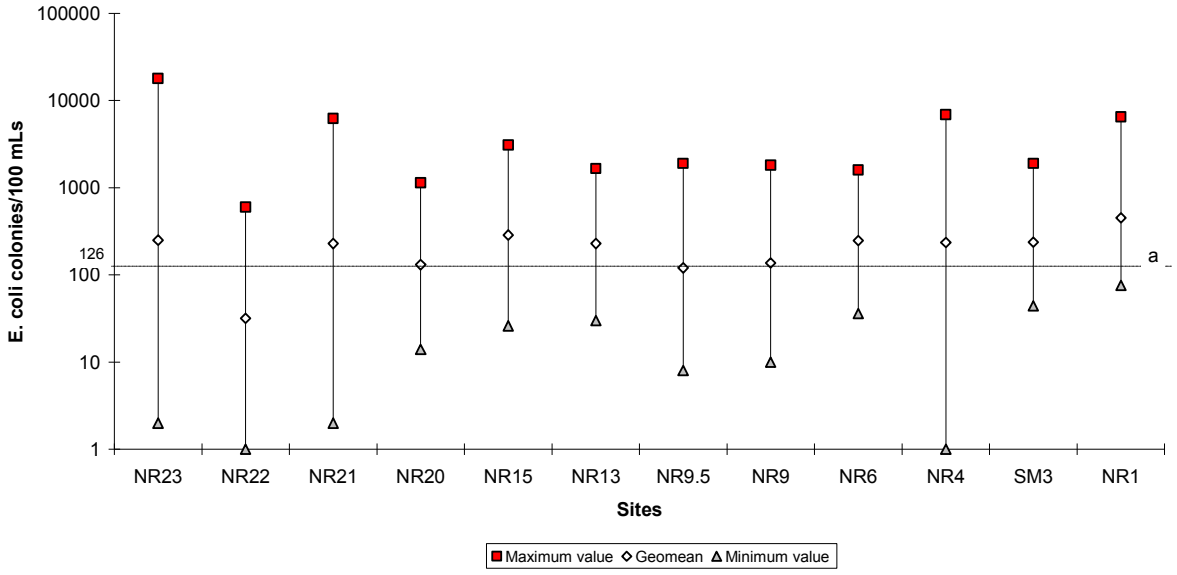
Appendix C

How to read the graphs in this report

Monitoring data are presented in this report with graphs and tables. Selected Figures and Tables are used to highlight critical parameters of the Norwalk River's water quality on either a monthly or total project basis. The following are some examples of the types of graphs and how to read them.

Graphs of Physical and Bacteria Data
Physical and bacteria data are graphed in the following way:
During a sampling period (usually a three month period) the *E. coli* colony concentration, the dissolved oxygen level and the conductivity are graphed by displaying the maximum value, the minimum value, and the mean or geomean value for each sampling site. The graph below is an example of a graph displaying *E. coli* counts

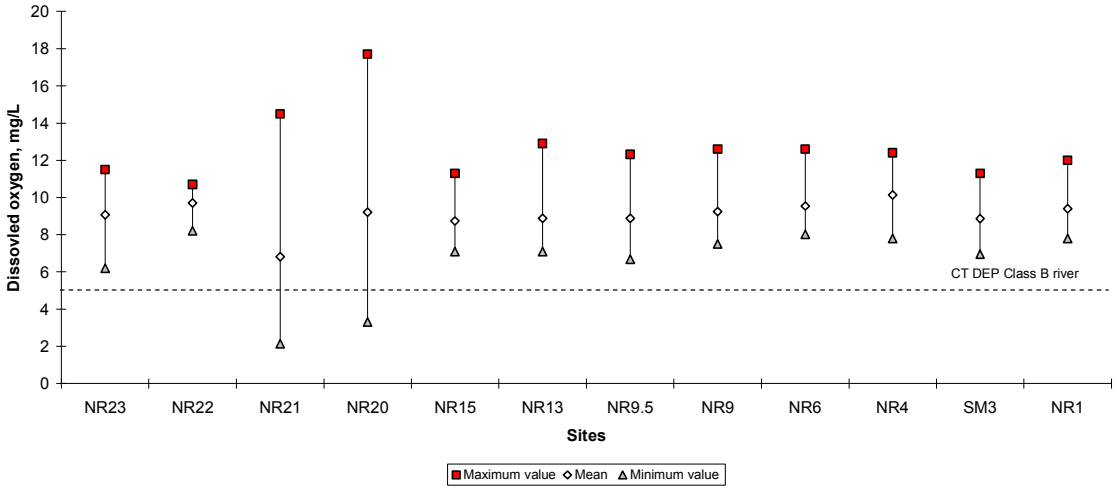
An example of a graph for maximum, geometric means, and minimum values of *E. coli* bacteria concentrations at 12 monitoring sites in the Norwalk River Watershed when the two Ridgefield and one Georgetown wastewater treatment facilities are required by NPDES permits to disinfect sewage effluent



Upstream to Downstream

[a]CT DEP water quality geometric mean limit for *E. coli* bacteria level for Class B rivers

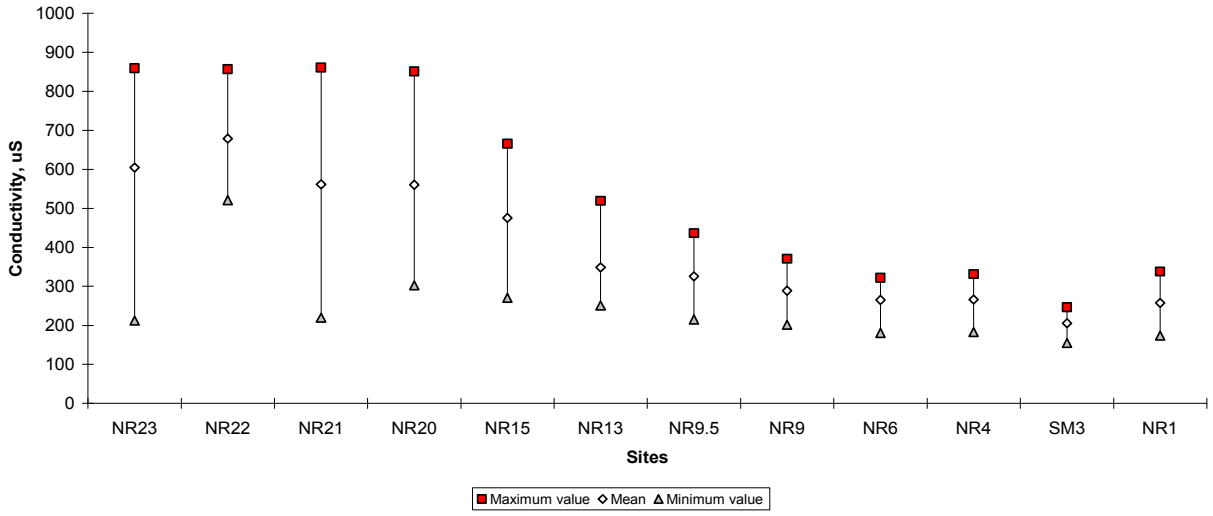
The previous graph shows the results for *E. coli* bacteria for the Norwalk River watershed. The sample sites are arranged along the bottom (X-axis), upstream to downstream, left to right. The concentration of *E. coli* bacteria forming units (CFUs) per 100 mL is arranged on the logarithmic scale along the left (Y-axis). The dashed horizontal line at 126 colonies/100 mL (left Yaxis) indicates the geomean *E. coli* criterion in the Connecticut Department of Environmental Protection (CT DEP) Water Quality Standards (WQS) that are set for Class B surface waters. The geometric mean presents results of all sample runs in a way that minimizes the impact on the entire data set by very high or very low individual results An *E. coli* geometric mean marker extending above this line exceeds the criterion. For example, every site except NR22 exceeded the geomean criterion
The graph below is an example of a graph showing maximum, mean and minimum values for dissolved oxygen at 12 sampling sites on the Norwalk River Watershed



5 mg/L dissolved oxygen = The CT DEP water quality standard for a Class B rivers

The graph above is read in the same way as the previous one. However, it displays the maximum, minimum values and the mean for dissolved oxygen levels for each sampling site during the sampling period. The dashed horizontal line shows the CT DEP water quality standard for dissolved oxygen for a Class B river. In the example above all mean values for dissolved oxygen meet the CT DEP Class B criterion for dissolved oxygen. However, Sites NR21 and NR20 had minimum readings below the CT DEP criterion.

An example of a Conductivity graph is below.



The line graph above again displays the conductivity range (maximum value to minimum value) with the mean for that range. The conductivity is recorded in micro-Siemens (*u*S)

Appendix D

Glossary

Dissolved oxygen: The oxygen dissolved in water and readily available to aquatic organisms expressed in milligrams per liter (mg/L) or parts per million (ppm). Connecticut's Water Quality Standards requires that the dissolved oxygen of a Class B stream shall not be less than 5 mg/L at any time.

Conductivity: Conductivity is a measure of the ability of water to pass an electrical current. Conductivity of water is positively affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, and phosphate (ions that carry a negative charge) as well as sodium, magnesium, calcium, iron and aluminum (ions that carry a positive charge). Conductivity is useful as a general measure of stream water quality. Each stream tends to have a relatively constant range of conductivity measurements. Significant changes in conductivity can be used as an indicator of pollution entering a stream. For example, the presence of metal trash in water and/or the use of iron pipes can increase conductivity. An elevated conductivity level can also occur from natural sources such as the presence of limestone in streambeds. Conductivity is measured in micromhos per cm, (μmhos/cm) a measure of conductance equal to one millionth of a mho/cm. While there is no CT DEP criterion for conductivity, the rivers in the United States generally range from 50 to 1500 μmhos/cm. Studies of inland fresh waters indicate that streams supporting good mixed fisheries have a range between 150 and 500 μmhos. Conductivity values outside this range could indicate that the water is not suitable for certain species of fish or macro invertebrates.

Fecal coliform bacteria: Fecal coliform bacteria are that portion of the coliform group that originates in the intestinal tract of man and other warm-blooded animals. Fecal bacteria are used as indicator organisms, which are not usually harmful to man. Their presence indicates that pathogens (such as cholera, salmonella, etc.) may be present in surface waters. The higher the count in colonies per 100 milliliters indicates a higher probability that pathogens are being discharged to surface waters. Fecal bacteria are used because they are more universal and survive for longer periods than pathogens in water. The Connecticut Water Quality Standards for a Class B stream are as follows: As an indicator of general sanitary quality Fecal coliform bacteria shall not exceed a geometric mean of 200 organisms/100 mL in any group of samples nor shall 10% of the samples exceed 400 organisms/100 mL.

***E. coli* bacteria:** *Escherichia coli* (*E. coli*) bacteria are one of two organisms that comprise fecal coliform bacteria. Studies have indicated that *E. coli* alone may be a more specific indicator organism of gut level contaminants to fresh surface waters from either man or animal. The other organism comprising coliform bacteria is *Klebsiella*, which sometimes occurs in soil or leaves. The EPA recommends *E. coli* as the best indicator of health risk from water contact in recreational waters.

Quality Assurance/Quality Control (QA/QC): Analytical measures taken to assure that field and laboratory work meets the highest standards of precision and accuracy. QA is an integrated management system designed to ensure that a product or service meets defined standards of quality with a stated level of confidence. QA activities involve planning quality control, quality assessment, data management and quality improvement. QC is the overall system of technical activities designed to measure quality and limit error in a product or service. A QC program
manages quality so that data meets the needs of the user as expressed in a quality assurance project plan. All scientific analysis of the Norwalk River is accomplished in accord with an EPA approved QA/QC which was re-approved on April 25, 2001 and covers the monitoring period from April 2001 through September 2001.

Water temperature: Water temperature is measured in degrees centigrade (^{o}C). Connecticut's Water Quality Standards state that no temperature increase is allowable except when the increase will not exceed the recommended limit on the most sensitive receiving water use. In no case shall the temperature exceed 85^{o}F (29.4^{o}C), or in any case raise the normal temperature of the receiving water more than 4^{o}F (2.2^{o}C).

Rainfall: Rainfall measurements used in this report follows criteria used by the CT State Health Services. The day of sampling is referred to as day zero. Days are numbered backwards from the testing date to the first rainfall in inches prior to the testing date. For example, if a test was conducted on Monday 5/25 and the previous rain of 0.2 inches occurred on 5/18, the records would indicate 0.2 inches for the amount of rain occurring seven days before the sampling date. If the rain were continuous over the time period, for example, if 0.3 inches fell on 5/17 and 0.2 more inches fell on 5/18, rainfall would be shown as 0.5 inches occurring seven days before the sampling. Rainfall is recorded at rainfall monitoring station located at the Town Hall in Norwalk.

Storm events: Storm events are classified as rainfall exceeding one inch in 24 hours. This much rain will increase surface runoff (input) and flow through the storm drain networks. Storm water runoff carries many pollutants to the river, especially during the first hour.

Observations: Observations are noteworthy occurrences in the river ecology such as the appearance of stranding blue-green algae, a flock of geese or fish kills. These observations can be incorporated into the data record sheets. These help provide a seasonal definition for water related problems which are not recorded elsewhere.

Seasonal Disinfection: Seasonal disinfection is action taken by a wastewater treatment plant to eliminate bacteria from the effluent discharge. Connecticut's Water Quality Standards require disinfection for the period of May 1st through September 30th at all Wastewater Treatment Plants discharging effluent into streams north of Route I-95. The process is carried out by chlorination or exposing the effluent to ultra violet light just prior to discharge. The period of this disinfection presently takes place when the public is deemed more likely to be fishing or bathing in the water.