

Charles River Monthly Monitoring Program

2008 Year-End Report

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1.0 Introduction

The Charles River Watershed Association (CRWA) is devoted to using sound science to conduct research on the Charles River to inform our policy platforms, advocacy work, and public outreach and education. Monitoring of the Charles River is extremely important in helping us comprehend the complex hydrological, biological and chemical interactions in the watershed, to identify and resolve problem areas and to track trends in water quality over time and under different weather conditions. Water quality sampling is time and resource intensive, and CRWA relies heavily upon volunteers to collect samples, make in-stream measurements and to observe river conditions. CRWA's Monthly Volunteer Monitoring Program is essential to establishing baseline water quality information that helps CRWA understand the overall health of the river, identify water quality issues and guide our management and restoration work.

The Charles River Monthly Volunteer Monitoring Program involves river monitoring at 35 sampling sites spanning the entire 80-mile stretch of the Charles River, including two sites located on tributaries: Stop River in Medfield and Muddy River in Boston (Figure 1 and Table 1). A network of over 70 trained volunteers and CRWA staff collect samples and take *in situ* measurements at 6:00 a.m. on the second or third Tuesday of every month. Samples are analyzed for *E. coli* bacteria concentrations on a monthly basis at all sites, while various nutrient parameters, such as chlorophyll *a* and different chemical forms of nitrogen and phosphorus, are monitored on a quarterly basis (March, June, September and December) at 12 sites. When funding is available, CRWA adds additional parameters such as total suspended solids (TSS) or collects and analyzes samples for nutrient parameters during additional months or from additional sites. *In situ* temperature and depth readings are taken at all sites monthly. All sampling is done in accordance with CRWA's approved quality assurance project plan (QAPP). Table 2 summarizes the parameters which were sampled in 2008.

Figure 1: Charles River Watershed Monthly Volunteer Monitoring Program Sampling Locations

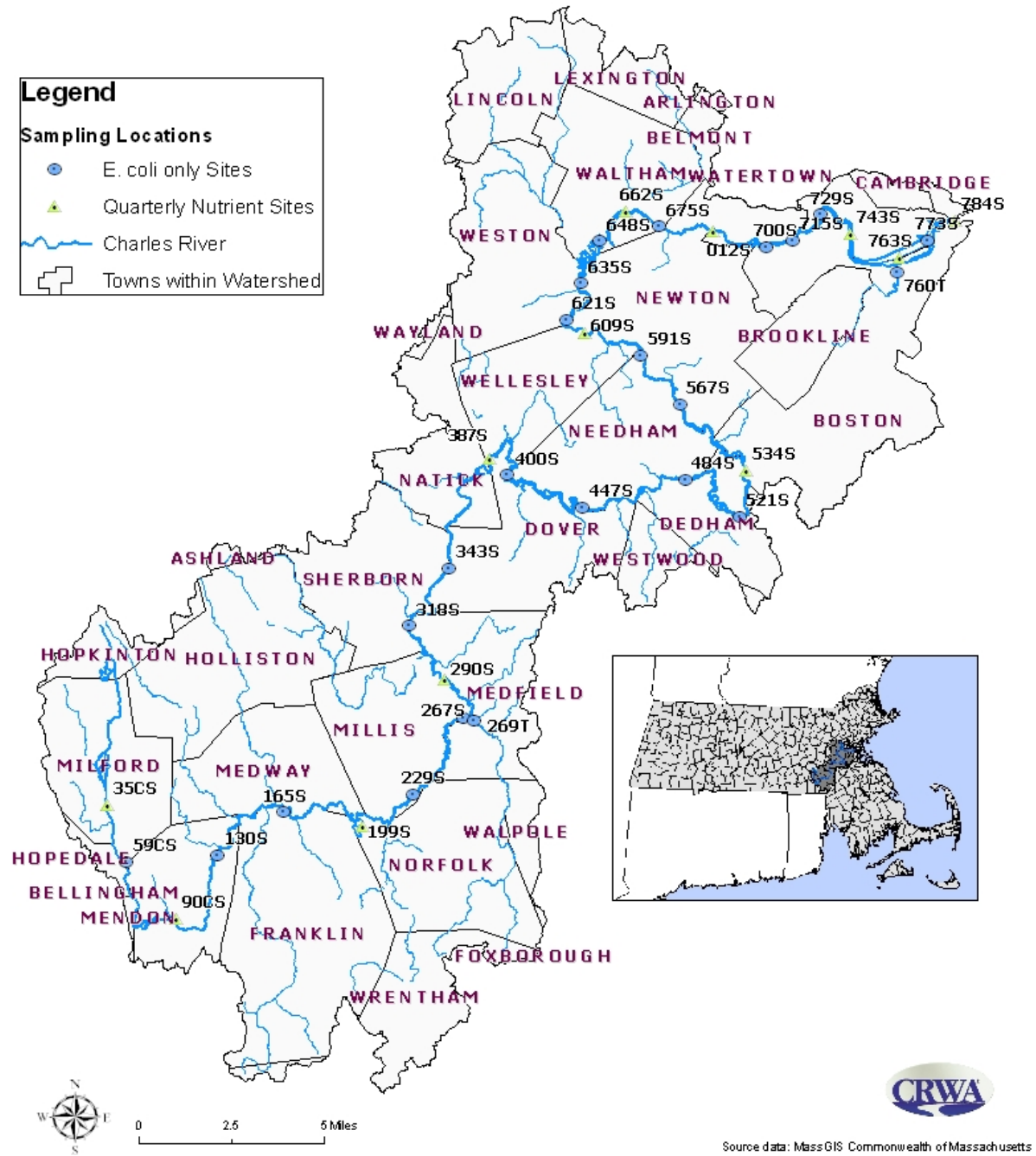


Table 1: Charles River Monthly Monitoring Program Sampling Location

Site #	Description	Town
35CS	Central Street Bridge	Milford
59CS	Mellen Street Bridge	Bellingham
90CS	Route 126, North Main Street	Bellingham
130S	Maple Street Bridge	Bellingham
165S	Shaw Street Bridge/Elm Street Bridge	Medway/Franklin
199S	Populatic Pond Boat Launch	Norfolk
229S	Route 115, Baltimore Street	Millis
267S	Dwight Street Bridge	Millis
269T	Causeway Street/Stop River	Medfield
290S	Old Bridge Street	Medfield
318S	Route 27 Bridge	Medfield
343S	Farm Road/Bridge Street	Sherborn/Dover
387S	Cheney Drive Bridge	Wellesley
400S	Charles River Road Bridge	Dover
447S	Dover Gage	Dover
484S	Dedham Medical Center	Dedham
521S	Ames Street Bridge	Dedham
534S	Route 109 Bridge	Dedham
567S	Nahanton Park	Newton
591S	Route 9 Gaging Station	Newton
609S	Washington Street/Hunnewell Bridge	Wellesley
621S	Leo J. Martin Golf Course/Park Road	Weston
635S	2391 Commonwealth Avenue	Newton
648S	Lakes Region	Waltham
662S	Moody Street Bridge	Waltham
675S	North Street	Waltham
012S	Watertown Dam Footbridge	Watertown
700S	North Beacon Street	Watertown/Brighton
715S	Arsenal Street	Watertown/Brighton
729S	Elliot Street	Cambridge
743S	Western Avenue	Cambridge
760T	Muddy River/Back Bay Fens	Boston
763S	Harvard Bridge	Boston
773S	Longfellow Bridge	Cambridge
784S	New Charles River Dam	Boston

2.0 Water Quality Results

Monitoring was conducted in ten out of twelve months in 2008. Monitoring was not conducted in January or February of 2008 due to cold temperatures and frozen river conditions. Table 2 summarizes sampling dates, weather conditions and sampling parameters for the ten sampling months. Sampling events are considered wet weather events when more than 0.1 inches of rain falls at the rain gauge located at Logan Airport in the 3 days preceding the sampling event. Conversely, sampling events are considered dry weather events when less than 0.1 inches of rain falls in the preceding 3 days.

Table 2: Summary of 2008 Sampling Events

Sampling Date	Wet or Dry	Parameters Analyzed
1/15/2008	<i>Cancelled due to inclement weather</i>	
2/12/2008	<i>Cancelled due to inclement weather</i>	
3/18/2008	Wet (0.30" of rain in preceding 3 days)	<i>E. coli</i> , Nitrate-Nitrite*, Orthophosphate*, Ammonia*, Total Phosphorus*, Total Nitrogen*, Chlorophyll <i>a</i> *, Phaeophytin*, Enterococcus*, TSS
4/15/2008	Wet (0.45" of rain in preceding 3 days)	<i>E. coli</i> , TSS
5/20/2008	Wet (0.44" of rain in preceding 3 days)	<i>E. coli</i> , TSS
6/24/2008	Wet (1.24" of rain in preceding 3 days)	<i>E. coli</i> , Nitrate-Nitrite*, Orthophosphate*, Ammonia*, Total Phosphorus*, Total Nitrogen*, Chlorophyll <i>a</i> *, Phaeophytin*, Enterococcus*
7/15/2008	Dry	<i>E. coli</i> , Total Phosphorus, Chlorophyll <i>a</i>
8/19/2008	Dry	<i>E. coli</i> , Nitrate-Nitrite*, Orthophosphate*, Ammonia*, Total Phosphorus, Total Nitrogen*, Chlorophyll <i>a</i> , Phaeophytin, Enterococcus
9/16/2008	Wet (0.35" of rain in preceding 3 days)	<i>E. coli</i> , Nitrate-Nitrite, Orthophosphate, Ammonia, Total Phosphorus, Total Nitrogen, Chlorophyll <i>a</i> , Phaeophytin*, Enterococcus*
10/14/2008	Dry	<i>E. coli</i>
11/18/2008	Wet (0.47" of rain in preceding 3 days)	<i>E. coli</i>
12/16/2008	Dry	<i>E. coli</i> , Nitrate-Nitrite*, Orthophosphate*, Ammonia*, Total Phosphorus*, Total Nitrogen*, Chlorophyll <i>a</i> *, Phaeophytin*, Enterococcus*

* Only at twelve nutrient sites

Table 3 shows the action limits for all of the parameters analyzed by CRWA. An action limit is a numerical value for a given parameter that alerts CRWA to impaired water quality. In

most cases, the action limits are based on a regulatory threshold such as the Massachusetts Surface Water Quality Standards for Class B Waterways established by the Massachusetts Department of Environmental Protection (MassDEP) and nutrient criteria recommended by the US Environmental Protection Agency (EPA) (MassDEP 2007, US EPA 2000).

Table 3: Water Quality Action Limits

Parameter	Action Limit	Source
<i>E. Coli</i> (bacteria)	126 cfu/100 mL (primary contact) 630 cfu/100 mL (secondary contact)	Massachusetts Surface Water Quality Standards
Total Phosphorus	0.0238 mg/l (as P)	U.S. EPA Ambient Water Quality Criteria Recommendations for Rivers and Streams in Nutrient Ecoregion XIV
Orthophosphate	0.0238 mg/l (as P)	
Ammonia	0.3 mg/l	
Nitrate/Nitrite	0.31 mg/l (as N)	
Total Nitrogen	0.5 mg/l	
Chlorophyll <i>a</i>	0.0037 mg/l	
Sodium	0.0238 mg/l	

2.1 Core Project Monitoring

CRWA’s core monitoring program involves monthly collection of samples at every site which are analyzed for *E. coli* bacteria and quarterly (March, June, September and December) collection of samples at 12 sites which are analyzed for nutrient parameters including chlorophyll *a* and different chemical forms of nitrogen and phosphorus. This year, we also took samples for nutrient parameters in August. All samples are analyzed at the MWRA’s Central Laboratory. This monitoring plan has been in place since 2002 and is consistent from year to year. These results are discussed below.

***E. coli* Bacteria**

The strain of *E. coli* bacteria cultured for water quality analysis is not directly implicated in causing adverse health effects, but its occurrence indicates the likely presence of other harmful bacteria and viruses. *E. coli* is present in the digestive tracts of warm-blooded mammals and increased presence in the river can indicate presence of fecal matter. *E. coli* levels are compared to the State Surface Water Quality Standards for primary (swimming) and secondary (boating) contact recreation. In January 2007, Mass DEP revised and approved the changes to the state standards which included changing the indicator bacteria from fecal coliform to *E. coli*. These standards are used to determine when the river is safe for human use.

In 2008, a total of 323 *E. coli* samples were collected; of these samples, 57% met, or fell below, the state swimming standard of 126 colony forming units (cfu) per 100 millimeters of water (mL), and 87% met the state boating standard (630 cfu/100mL of water) (Table 4). The March, April, May, June, September and November monitoring events were wet weather events,

meaning more than 0.1 inches of rain fell at the rainfall gauge at Logan Airport in the three days preceding sampling. All other monitoring events were considered dry weather events. During dry weather, 46.5% and 82.2% of samples met the state swimming and boating standards, respectively. During wet weather, 64.4% of samples met the state swimming standard, while 90.2% of samples met the state boating standards (Table 4). Figure 2 shows the average *E. coli* concentrations at each sampling location for 2008.

In 2008, monthly water quality monitoring was conducted ten out of twelve months; only four of the ten monitoring events occurred during dry weather, which may have skewed the percentages of the time the river met the swimming and boating standards. December was technically a dry weather event although there was approximately 3.5 inches of rain four days prior to the sampling event. The water quality was still likely affected by this large rainfall event. If December is classified as a wet weather event instead of a dry weather event, then during wet weather events 55.8% of samples met the state swimming standard, while 83.0% met the state boating standard, and during dry weather 60.6% met the state swimming standard, while 96.0% met the state boating standard. Figure 3 shows the percentage of time the river met the swimming standard in wet and dry weather, from 1995 to 2008.

In the Lower Charles River Basin, the area of the river stretching from Watertown Dam (site 012S) to the New Charles Dam (site 784S), 29.7% of all the samples were within the state swimming standard and 86.5% were within the boating standard. During the six wet weather events, 26.7% and 82.2% of samples collected in the Basin fell within swimming and boating standards, respectively. During the four dry weather events, 34.4% of samples met the swimming standard and 93.1% met the boating standard (Table 5 and Figure 4).

All *E. coli* samples were analyzed at MWRA's Central Laboratory. Raw data and statistical analysis can be found in the Appendix of Water Quality Tables included at the end of the report.

Table 4: Summary of Charles River 2008 *E. coli* Results

Description	3/18/2008	4/15/2008	5/20/2008	6/24/2008	7/15/2008	8/19/2008	9/16/2008	10/14/2008	11/18/2008	12/16/2008	Total
# Samples Met Swimming Standard	24	27	24	12	15	21	17	24	21	0	185
# Samples Met Boating Standard	32	31	31	18	30	33	34	32	29	11	281
# Sites Sampled	32	33	31	33	33	34	34	32	31	30	323
% Met Swimming Standard	75%	81.82%	77.42%	36.36%	45.45%	61.76%	50.00%	75.00%	67.74%	0.00%	57.28%
%Met Boating Standard	100.00%	93.94%	100.00%	54.55%	90.91%	97.06%	100.00%	100.00%	93.55%	36.67%	87.00%
Rainfall at Logan International Airport (inches)											
3 Days Prior to Sampling	0.31	0.45	0.44	0.00	0.00	Trace	0.00	0.00	0.47	0.00	1.67
2 Days Prior to Sampling	Trace	0.01	Trace	Trace	0.00	0.00	0.35	0.00	0.37	0.00	0.73
1 Day Prior to Sampling	0.00	0.00	0.00	0.46	0.07	0.00	0.00	0.00	0.00	0.00	0.53
Day of Sampling	Trace	0.00	Trace	0.78	0.00	0.01	0.00	0.00	0.00	0.02	0.81
Wet or Dry	Wet	Wet	Wet	Wet	Dry	Dry	Wet	Dry	Wet	Dry	

Figure 2: Mean *E. coli* Concentrations by Site for 2008

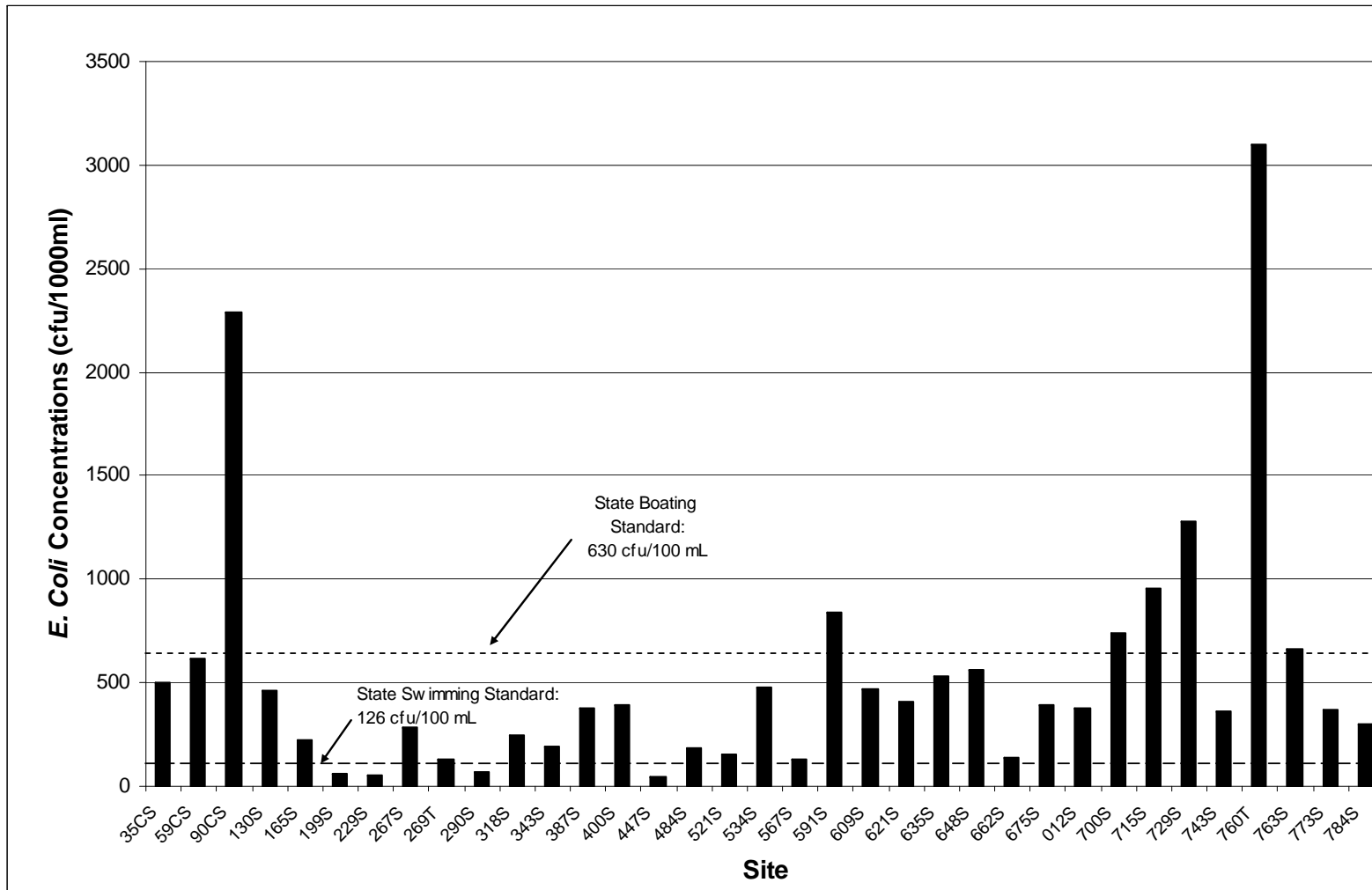


Table 5: Percentage of Time the Lower Charles Basin Met Bacteria Standards (1995-2008)

	Overall		Dry Weather		Wet Weather		EPA River Grade
	Swimming	Boating	Swimming	Boating	Swimming	Boating	
1995	19	39					D
1996	21	57	40	94	15	45	C-
1997	34	70	56	87	22	61	C-
1998	51	83	85	98	31	74	C+
1999	55	90	69	100	47	84	B-
2000	52	91	88	88	49	91	B-
2001	69	87	87	96	36	71	B-
2002 (a)	33	88	78	100	27	86	B-
2003(b)	50	89	48	90	56	89	B-
2004 (c)	53	98	48	96	57	100	B-
2005	33	87	41	89	12	76	B+
2006	49	90	53	100	42	67	B+
2007	55	97	60	98	38	94	B++
2008	30	86	34	93	27	82	B+

(a) Only one dry weather event (rainfall less than 0.1 inches in previous 72 hours) occurred in 2002. Rainfall data collected at Logan Airport in Boston.

(b) In 2003, monthly water quality monitoring was conducted seven out of twelve months; only two monitoring events occurred during wet weather, which may have skewed the percentages of the time the river met the swimming and boating standards.

(c) Statistics from 1995 to 2003 based on CRWA monthly fecal coliform testing. Since 2005, samples were analyzed for *E. coli* bacteria instead of fecal coliform bacteria and these results were compared to the State Surface Water Quality Standards for primary and secondary contact recreation.

Figure 3: Percentage of Time River Met Swimming Standard in Wet and Dry Weather (1995-2008)

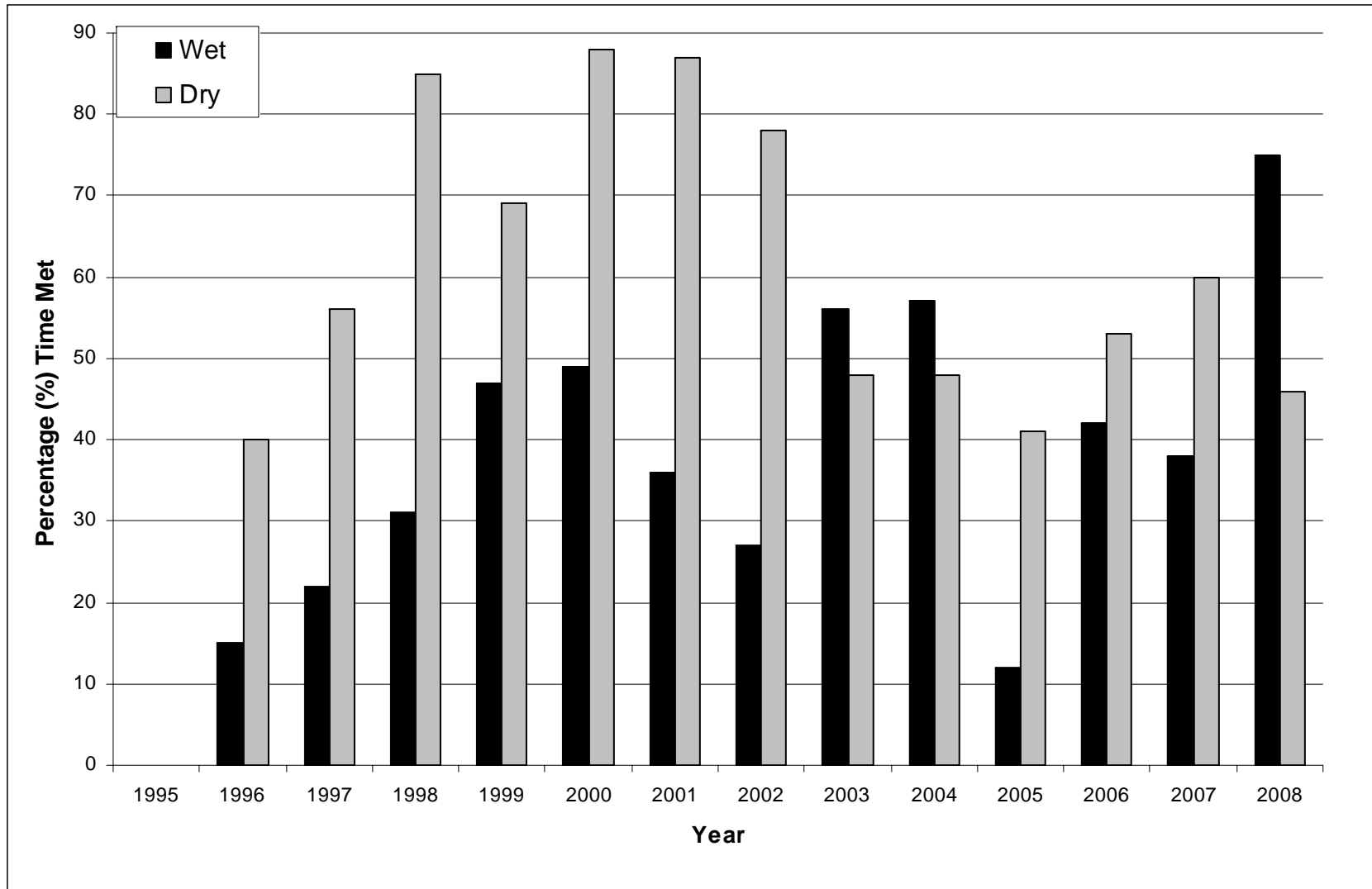
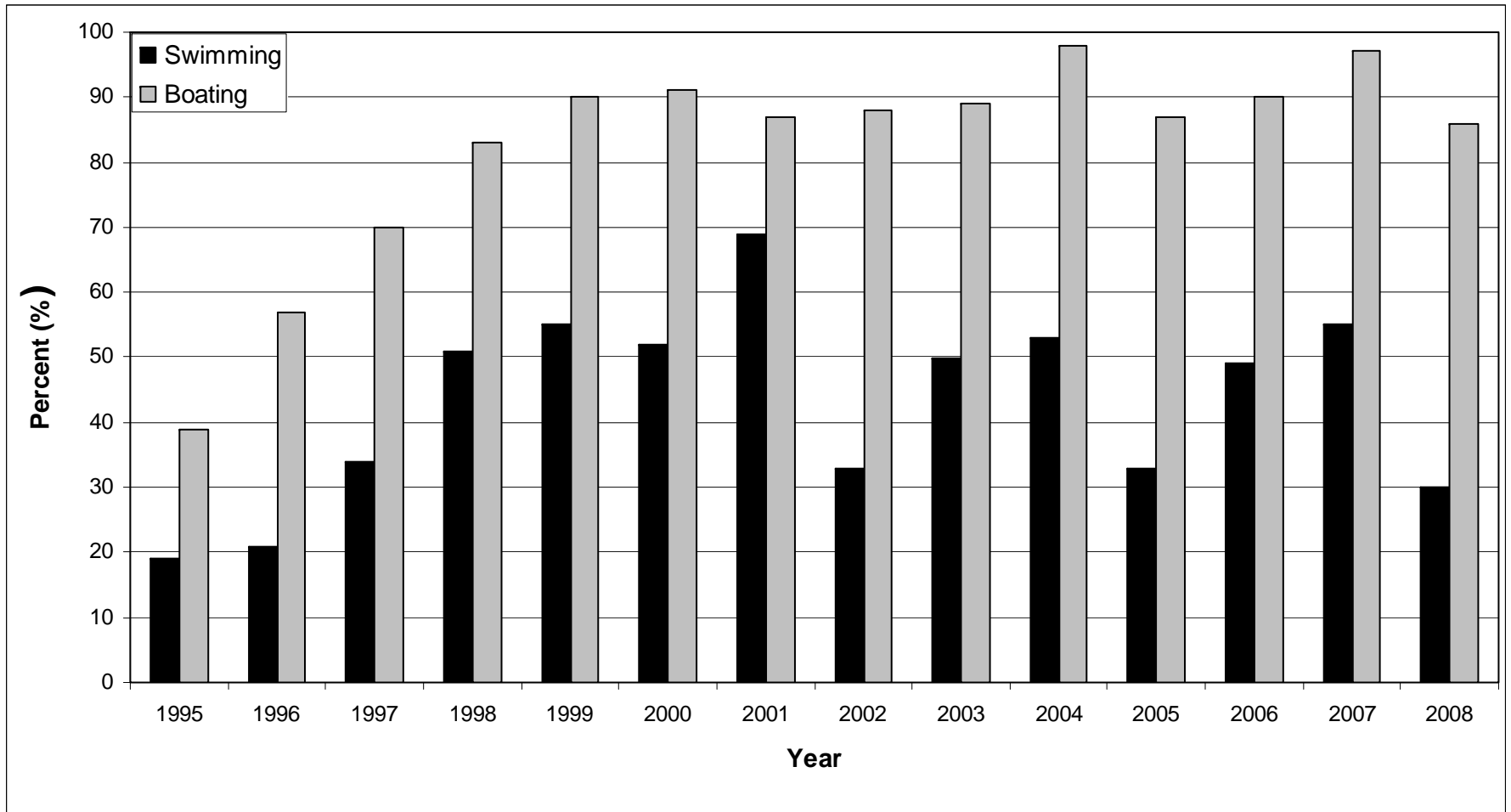


Figure 4: Percentage of Time Lower Charles River Basin *E. coli* Concentration Met Bacteria Standards (1995-2008)



Phosphorus

Phosphorus is a natural part of any aquatic system and an essential component of primary production or photosynthesis. In fresh water systems like the Charles River, phosphorus is the limiting nutrient, meaning that the growth of aquatic plants, including algae, is limited by the supply of phosphorus, which is naturally relatively low. Phosphorus naturally enters rivers and other water bodies through erosion of rocks and soils and decomposition of organic matter. Today, human activities add excess phosphorus to the Charles River, and even minor increases in the phosphorus concentration of the river can cause eutrophication, the overgrowth of vegetation.

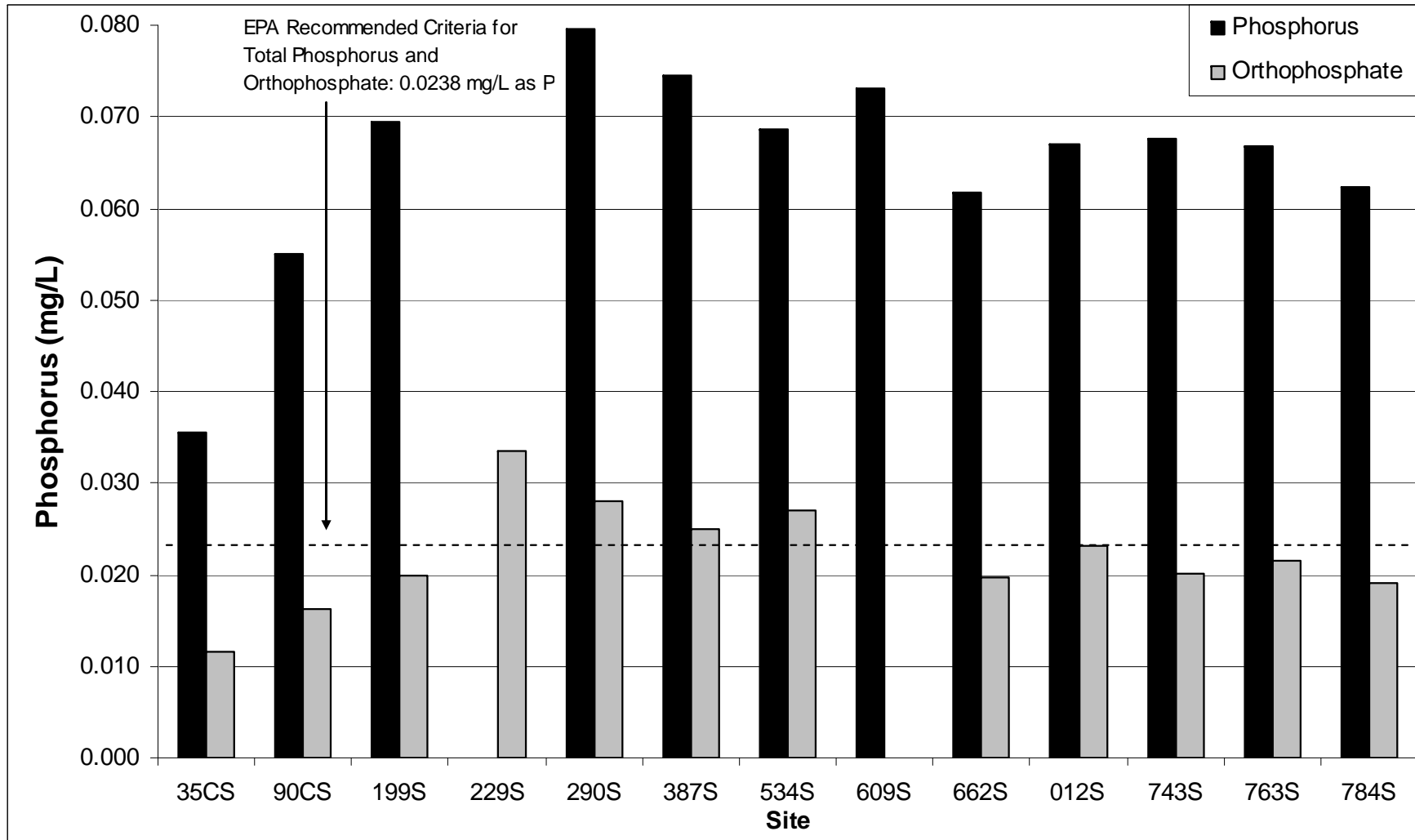
The primary sources of phosphorus to the Charles River are stormwater runoff, discharges from wastewater treatment plants and combined sewer overflows. Of these, stormwater is by far the largest contributor. Phosphorus is found in fertilizers, detergents used to wash cars and pets outdoors, loose sediment, automobile exhaust and animal waste, all of which contribute to stormwater runoff. Due to common human activities and natural abundance, phosphorus is ubiquitous in the environment and the larger the volume of stormwater runoff that enters the river, the larger the load of phosphorus it will carry with it.

Algal blooms are a potential result of the overloading of phosphorus to a river system such as the Charles. Algal blooms can have severe impacts on the ecological environment including depleting oxygen concentrations in the water column suffocating (oxygen dependent) organisms such as fish. Additionally, blooms of toxin-producing organisms, such as cyanobacteria, can have adverse impacts on humans and other mammals that come in contact with the water. Cyanobacteria are photosynthetic bacteria that produce toxins, which are harmful to humans and pets at large doses.

Many stretches of the Charles River are listed as impaired for nutrients in the Massachusetts Year 2006 Integrated List of Waters, which identifies water bodies that do not meet surface water quality standards (MassDEP, 2007). CRWA is working on a project to assess current phosphorus concentrations and sources in the upper watershed and to determine the maximum load of phosphorus and other nutrients the river can receive and still attain its designated use. Data collected from this Monthly Volunteer Monitoring Program has been invaluable to CRWA's total maximum daily load (TMDL) work.

The Monthly Monitoring Program includes analyses of total phosphorus and orthophosphate (the amount of soluble phosphorus in the water which is immediately available for use by plants). In 2008, 55 total phosphorus samples were collected, of which 87.3% exceeded the EPA recommended criterion of 0.0238 milligrams per liter (mg/L) (US EPA, 2000). Of the 55 orthophosphate tests, only 42% exceeded the EPA's recommended criterion for orthophosphate (0.0238 mg/L). Figure 5 displays mean concentration by site for 2008. Phosphorus parameter results are from samples analyzed at MWRA's Central Laboratory. Raw data and statistical analysis for total phosphorus and orthophosphate can be found in the Appendix of Water Quality Tables at the end of this report.

Figure 5: Mean Charles River Phosphorus Concentrations by Site 2008



Nitrogen

CRWA tests the river for ammonia, nitrate-nitrite and total nitrogen. These forms of nitrogen originate from atmospheric deposition of automobile emissions and power plant emissions, wastewater treatment plants, septic systems, animal wastes and fertilizers. Ammonia is commonly found in untreated sewage and also illicit connections of sewage to stormwater drainage systems. The oxidation of ammonia yields nitrite, which is quickly converted to nitrate, the form of nitrogen that is most readily available to algae and other aquatic plants. Total nitrogen is the sum of all organic and inorganic nitrogen forms. High levels of these forms of nitrogen can indicate the presence of untreated human sewage.

In 2008, 55 samples were collected and analyzed for ammonia. Only one sample (or 1.82%) exceeded EPA's recommended criterion of 0.30 mg/L for ambient waters in New England (Figure 6) (US EPA, 2000). Of the 55 nitrate-nitrite samples, however, 90.0% exceeded criterion of 0.31 mg/L (Figure 5). Of the 55 total nitrogen samples, all but one (or 98.2%) exceeded EPA's recommended criterion of 0.57 mg/L for total nitrogen (Figure 6). Nitrogen parameter results are from samples analyzed at MWRA's Central Laboratory. Complete results for ammonia, nitrate-nitrite and total nitrogen can be found in the Appendix of Water Quality Tables at the end of this report.

Chlorophyll *a*

Chlorophyll *a* is the principle photosynthetic pigment in algae and vascular plants. It is an indicator of the presence and concentration of algae in the water column. An abundance of algae can lead to oxygen depleted, or anoxic, conditions as the algae inhibit oxygen exchange with the air and the abundant, decaying organic matter depletes oxygen from the water as it decomposes. Algae can also block sunlight penetration into the water, clouding out submerged aquatic vegetation. These conditions are detrimental to fish and other aquatic fauna that are dependent on oxygen availability for their survival. Of the 56 chlorophyll *a* samples, 31 (or 55.4%) exceeded the EPA recommended criteria of 0.00375 mg/L (US EPA, 2000). The March sampling event had the highest percentage of samples exceeding this limit with 91.7%, or 11 out of 12 sites exceeding the limit. Nine samples exceeded this limit during the June sampling event, seven exceeded this limit during the August event, four exceeded the limit during the September event, and none exceeding this limit during the December event. These results are in-line with typical algae growth pattern which usually consist of large blooms in the spring time and smaller blooms in the fall. The levels of organic matter being observed in these samples, however, indicated that an excessive amount of algae is growing in the Charles. Therefore although we would expect to see high chlorophyll *a* concentrations in March, the concentrations being observed are indicative of eutrophic conditions. Figure 7 shows 2008 mean chlorophyll *a* concentrations for twelve nutrient sites.

Chlorophyll *a* results are from samples analyzed at MWRA's Central Laboratory. Chlorophyll *a* values are corrected for phaeophytin. Complete results for chlorophyll *a* can be found in the Appendix of Water Quality Tables at the end of this report.

Figure 6: Mean Charles River Nitrogen Concentrations by Site 2008

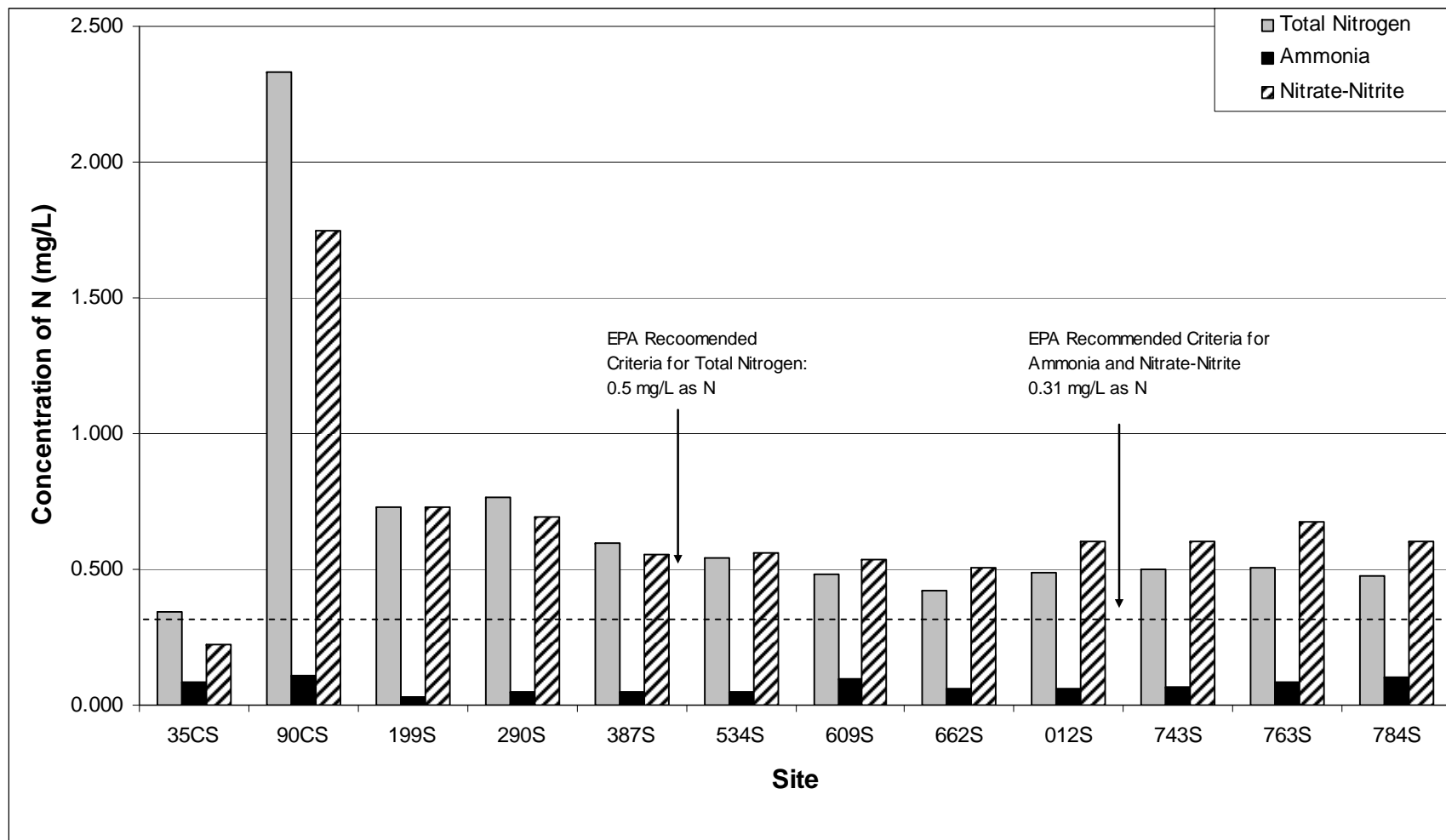
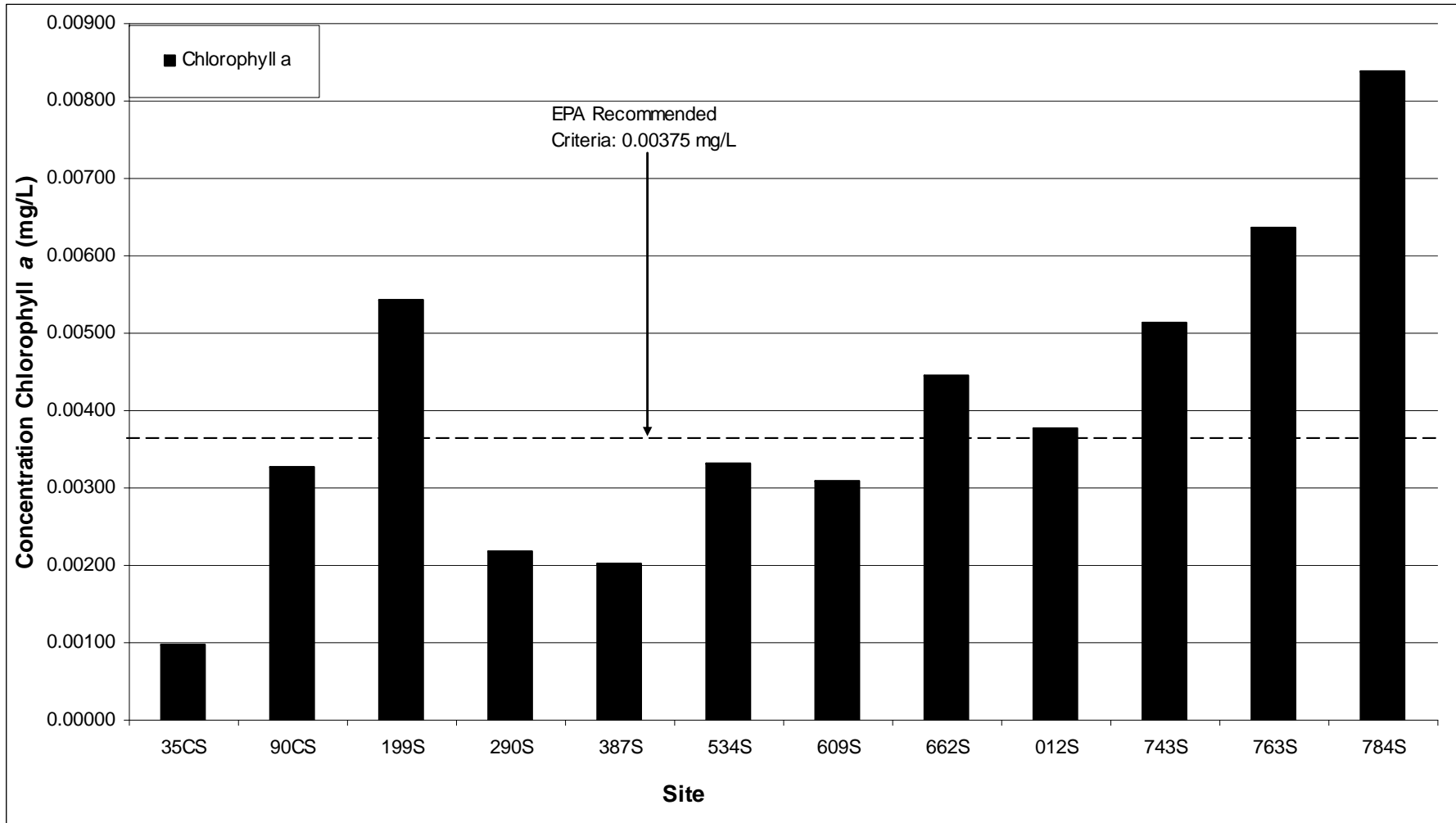


Figure 7: Mean Charles River Chlorophyll a Concentrations by Site 2008



Temperature

Water temperature is an important factor affecting the natural habitat of an aquatic system. Temperature has an important role in many of the biological and chemical processes which take place in the river. As a Class B Warm Water Fishery, Massachusetts Surface Water Quality Standards state that temperatures in the Charles River should not exceed 28.3°C. Temperature violations are often the result of river water being used as a coolant in various industrial practices, such as electricity production. There are multiple plants located along the Charles that use river water for this purpose. Nevertheless, no violations of this standard were observed in CRWA's 2008 Monthly Monitoring Results. Complete temperatures results are available in the appendix.

2.2 Supplemental Project Monitoring

When funding is available, CRWA adds additional parameters such as total suspended solids (TSS) or collects and analyzes samples for nutrient parameters during additional months or from more sites than are possible through our core monitoring program. In 2008, samples were collected and analyzed for TSS at all sites in March, April and May. Samples were collected and analyzed for total phosphorus at all sites in July, August and September. Finally, samples were collected and analyzed at selected sites for chlorophyll *a* in July, August, and September (Table 2). All samples collected under our supplemental project monitoring were analyzed at Alpha Analytical Laboratory.

Chlorophyll *a*

As part of the supplemental monitoring program data for chlorophyll *a* concentration was tested at seven select sites in July, August, and September. Out of the 11 samples collected in 2008, 63.6% exceeded the recommended action limit of 0.0037 mg/L. Complete results for chlorophyll *a* can be found in the Appendix of Water Quality Tables at the end of this report.

Total Phosphorus

As part of the supplemental monitoring program, total phosphorus levels were analyzed for the entire stretch of the river during summer months, when algae thrive in the Charles. Out of the 100 samples collected in 2008, 98% were above CRWA's action limit of 0.0238 mg/L. Complete results for total phosphorus collected as part of our 2008 supplementary monitoring plan can be found in the Appendix of Water Quality Tables at the end of this report.

Total Suspended Solids (TSS)

Beginning in late winter and continuing through the spring, stormwater runoff is laden with sand, sediment and other types of materials used to de-ice our roadways and parking lots. Dirt and sand can also be carried off of construction sites, playing fields and eroding river banks. This influx of particles can often have adverse effects on our waterways, making the water cloudy or murky. Particles can inhibit sunlight from reaching the aquatic vegetation that needs

it. CRWA collects samples which are analyzed for total suspended solids (TSS) to determine areas where high levels of sand or silt are being washed off into the river and tributaries.

Samples were collected and analyzed for TSS at all sites in March, April and May. None of the samples exceeded CRWA's action limit for TSS of 30 mg/L. The highest TSS value observed occurred at site 567S during the May sampling event, the TSS concentration was 12 mg/L. Complete TSS results can be found in the Appendix of Water Quality Tables at the end of this report.

Figure 8: Mean Charles River Chlorophyll *a* Concentrations by Site 2008 – Supplemental Monitoring (Analyzed at Alpha Analytical Laboratory)

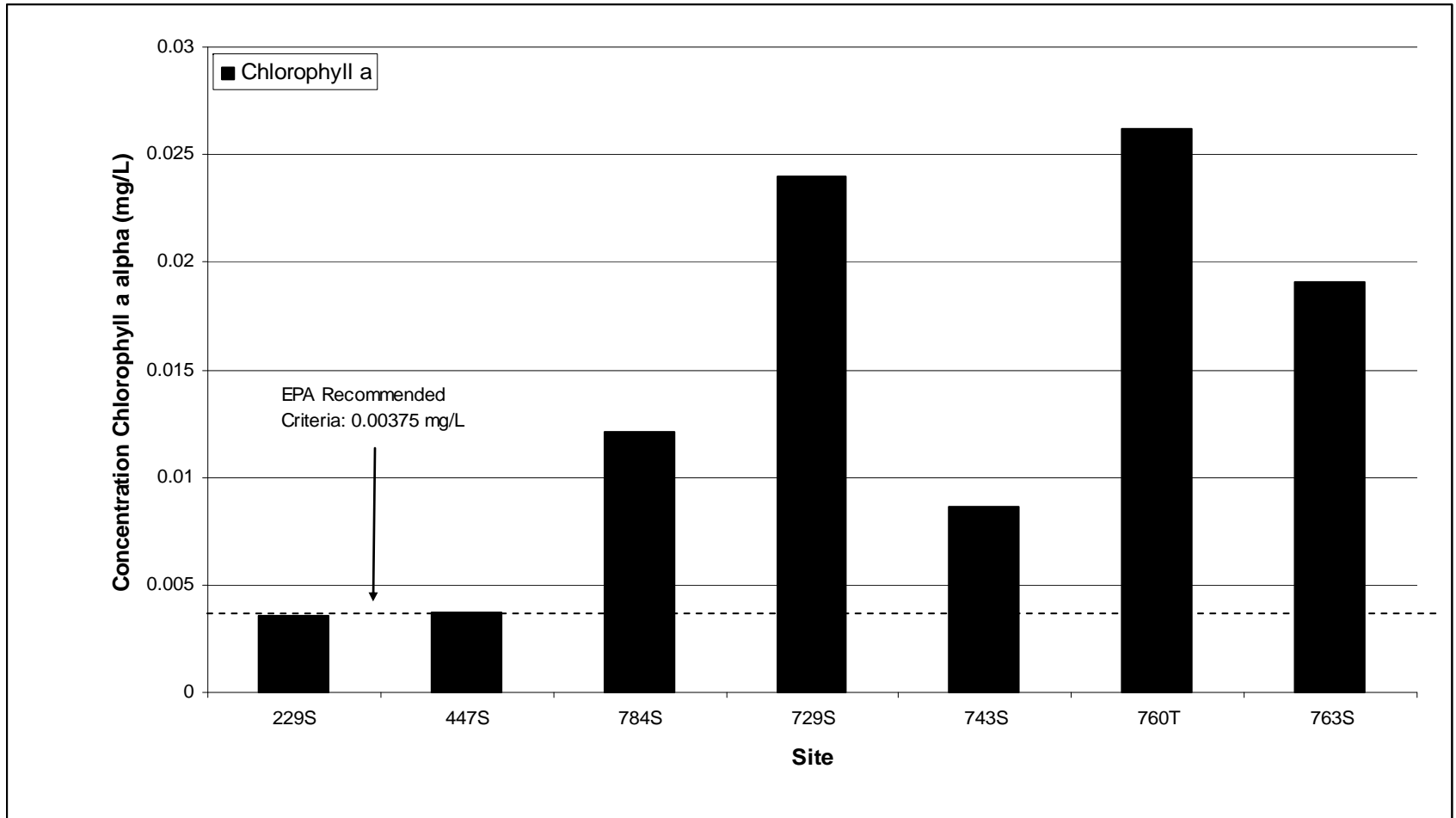
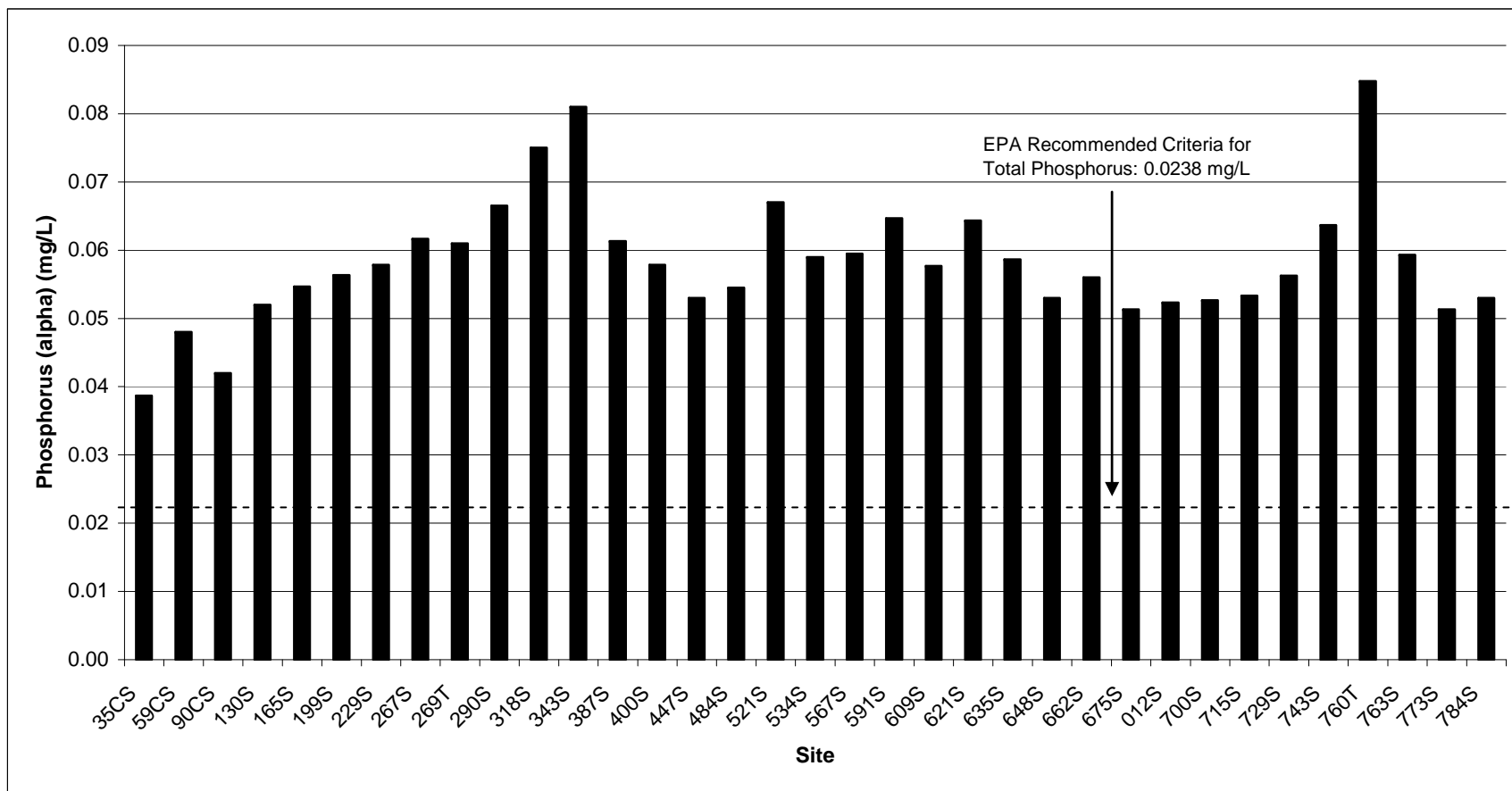


Figure 9: Mean Charles River Spring and Summer Phosphorus Concentrations by Site (samples collected July-September 2008) – Supplemental Monitoring (Analyzed at Alpha Analytical Laboratory)



3.0 Conclusions

Data generated from this water quality monitoring program helps to indicate current overall river health. Each month, we can identify new problems and refocus our efforts to tackle the most urgent water quality issues. Taken in conjunction with CRWA's other monitoring efforts, including tributary monitoring and summer recreational monitoring, we can obtain a better picture of the river's health and target areas of the watershed for remediation and improved watershed management. The Charles River achieved a B+ for water quality in 2008. The river's report card grade is determined by the EPA and is based partially upon CRWA's monthly monitoring data. Over the course of this thirteen-year program, water quality in the Charles has been steadily improving in large part due to the monitoring work of CRWA staff and volunteers, which has identified the most problematic areas in the river and guided where remediation and management efforts should occur in the watershed. With continued monitoring, the Charles is nearing its goal of an A grade by 2010.

4.0 References

MA Department of Environmental Protection, 2007. *Massachusetts Surface Water Quality Standards*. Massachusetts Department of Environmental Protection, Division of Water Pollution Control, Technical Services Branch. Westborough, MA (314 CMR 4.00).

MA Department of Environmental Protection, 2006. *Massachusetts Year 2006 Integrated List of Waters – Proposed listing of the condition of MA waters pursuant to Sections 303(d) and 305(b) Clean Water Act*. MassDEP, Division of Watershed Management. Worcester, MA.

U.S. Environmental Protection Agency, 2000. *Ambient Water Quality Criteria Recommendations for Rivers and Streams in Nutrient Ecoregion XIV*. EPA-822/B-00/022.US EPA Office of Water Regulations and Standards, Washington, DC.

Appendix of Water Quality Tables

E. coli Bacteria Results 2008

Site #	Description	Town	River mile	E. coli Concentrations (cfu/100 mL)												Mean	Median	Std Dev	Min	Max	
				1/15/2008 (h)	2/12/2008 (h)	3/18/2008	4/15/2008	5/20/2008	6/24/2008	7/15/2008	8/19/2008	9/16/2008	10/14/2008	11/18/2008	12/16/2008						
35CS	Central Street Bridge	Milford	3.5	Sampling cancelled due to freezing conditions or otherwise inclement weather	Sampling cancelled due to freezing conditions or otherwise inclement weather	52	216	388	2250	907	173	98	249	148	498	216	705	52	2250		
35CD	Discharge Pipe @ Central St	Milford	3.5												no data	no data	no data	no data	no data		
35C2	2nd Discharge Pipe @ Central St	Milford	3.5												no data	no data	no data	no data	no data		
59CS	Mellen St. Bridge	Bellingham/Milford/Hopedale	5.9			86	74	146	3610	464	313	148	294	63	985	618	221	1087	63	3610	
90CS	Rt. 126. N. Main St.	Bellingham	9.0			20	(a) 20		97	171	171	121	74	41	19900	2291	97	6604	20	19900	
130S	Maple St. Bridge	Bellingham	12.9			10	31	(a) 5	145	145	145	211	41	52	3870	466	99	1198	5	3870	
165S	Shaw St. Bridge	Franklin/Medway	16.5			20	10	52.5	(a) 173	187	97	109	74	10	1520	225	86	459	10	1520	
199S	Populatic Pond Boat Launch	Norfolk	19.9				20	41	41	(a) 52	122	84		52		59	52	34	20	122	
229S	Rt. 115, Baltimore St.	Norfolk/Millis	22.9			5	31	52	110	10	(a) 74	110	10	74		53	52	42	5	110	
267S	Dwight St. Bridge	Millis/Medfield	26.7			5	30	209	10	20	89.5	(a) 74	10	63	2400	289	47	744	5	2400	
269T	Causeway St. Stop River	Medfield	26.9			10	5	98	134	354	96	262	108	(a) 20	187	127	103	113	5	354	
290S	Old Bridge St.	Millis/Medfield	29.0			10	(a) 10		84	41	107	128.5	(a) 31			67	63	47	10	128.5	
318S	Rt. 27 Bridge	Medfield/Sherborn	31.8			5	5	47	(a) 74	20	86	85	31	30	(a) 2100	248	39	651	5	2100	
343S	Farm Rd./Bridge St.	Sherborn/Dover	34.3			5	12.5	(a) 10	41		109	74	20	20	1445	(a) 193	20	471	5	1445	
387S	Cherney Bridge	Wellesley/Natick	38.7			5	(a) 31	41	1540	465	63	41	63	20	1500	377	52	617	5	1540	
400S	Charles River Road Bridge	Dover/Wellesley	40.0			41	41	41	2010	155	(a) 85	52			1060	392	52	691	41	2010	
447S	Dover Gage	Dover	44.7			5	15	(a) 62	52	72	86	(a) 61	10			45	57	31	5	86	
484S	Dedham Medical Center	Dedham/Needham	48.4			10	5	31	108	301	41	41	(a) 5	20	1270	183	36	392	5	1270	
521S	Ames St. Bridge	Dedham	52.1			10	10	20	197	52	122	110	5	(a) 63	960	155	58	290	5	960	
534S	Rt. 109 Bridge	Dedham/Boston	53.4			5	10		226	2360	85	110	31	10	1005	(a) 427	85	791	5	2360	
567S	Nahanton Park	Newton/Needham	56.7			10		31	(a) 20	108	31		61	64.5	(a) 723	131	46	241	10	723	
591S	Rt. 9 Gaging Station	Newton	59.1			5	20	63	6870	169.5	(a) 31	183	41	96	932	841	80	2136	5	6870	
609S	Washington St. Hunnewell Bridge	Wellesley/Newton	60.9			5	31	63	2545	(a) 563	122	201	10	109	1050	470	116	800	5	2545	
621S	Leo J. Martin Golf Course/Park Rd.	Weston/Newton	62.1			5	10	52	2220	650	194	(a) 95	10	97	733	407	96	691	5	2220	
635S	2391 Commonwealth Ave.	Newton	63.5			10	5	63	3650	240	216	210.5	(a) 364	98	428	528	213	1106	5	3650	
648S	Lakes Region	Waltham	64.8					30.5	(a) 63	3450	20	120	175	103	(a)	566	103	1273	20	3450	
662S	Moody St. Bridge	Waltham	66.2			7.5	(a) 52	30	563	47.4	(a) 84	134	52		132	285	(a) 139	68	169	7.5	563
675S	North St.	Waltham/Newton	67.6			5	52	98	2480	309	134	216	41	173	(a) 408	392	154	744	5	2480	
012S	Watertown Dam Footbridge	Watertown	69.3			233	31	134	2610	161	134	108	41	63	262	378	134	788	31	2610	
700S	N. Beacon St.	Watertown/Brighton	70.9					132	98	(a) 5170	97	197	199	31	301	402	736	197	1666	31	5170
715S	Arsenal St.	Watertown/Brighton	71.5			410	97	97	7640	(a) 98	146	292	146	228	437	959	187	2351	97	7640	
729S	Eliot Bridge	Cambridge/Boston	72.9			457	120	314	9210	347.5	(a)	292	173	169	404	1276	314	2977	120	9210	
743S	Western Ave	Cambridge/Boston	74.3			323	132	41	1050			199	383	(a) 110	530	504	364	323	310	41	1050
760T	Muddy River at Comm. Ave.	Boston	76.0			413	97	238		464	873	(a) 441	495	637	24200	3095	464	7917	97	24200	
763S	Mass. Ave. at Harvard Bridge	Boston/Cambridge	76.3			309	644			20	201	272		563	2610	660	309	886	20	2610	
773S	Longfellow Bridge	Cambridge/Boston	77.3			613	723	471	20	5	74	295	495	681	(a) 323	370	397	270	5	723	
784S	New Charles River Dam	Boston/Cambridge	78.4			627	364	74	25.5	(a) 62	63	31	145	145	1450	(a) 299	110	446	25.5	1450	
	# sites swimable					24	27	23	12	15	21	17	24	21	0	WET	DRY	Total			
	# sites boatable					32	31	31	16	30	33	34	32	29	11	95	89	184			
	# sites sampled					32	33	31	33	33	34	34	32	31	30	123	156	279			
	% sites swimable					75%	82%	74%	36%	45%	62%	50%	75%	68%	0%	127	196	463			
	% sites boatable					75%	82%	74%	36%	45%	62%	50%	75%	68%	0%	75%	46%	40%			
	QA/QC Samples															97%	80%	60%			
	Equipment Blank																				
	Site No.																				
	Equipment Blank																				
	Site No.																				
	Rainfall At Logan International Airport (inches)					WET	WET	WET	DRY	DRY	DRY	DRY	DRY	WET	DRY						
	3 Days Prior to Sampling					0.31	0.45	0.44	0.00	0.00	Trace	0.00	0.00	0.47	0.00						
	2 Days Prior to Sampling					Trace	0.01	Trace	Trace	0.00	0.35	0.00	0.37	0.00							
	1 Day Prior to Sampling					0.00	0.00	0.00	0.46	0.07	0.00	0.00	0.00	0.00							
	Day of Sampling					Trace	0.00	Trace	0.78	(i) 0.00	0.01	0.00	0.00	0.00							

(a) Average of duplicates

Total Phosphorus Results 2008

Site #	Description	Town	River mile	Total Phosphorus Concentrations (mg/L)												Mean	Median	Std Dev	Min	Max
				3/18/2008		6/24/2008		8/19/2008		9/16/2008		12/16/2008								
35CS	Central Street Bridge	Milford	3.5	0.022	0.000	0.063	1.000	0.034	1.000	0.023	0.000		0.000	0.268	0.029	0.452	0.000	1.000		
90CS	Rt. 126, N. Main St.	Bellingham/Milford/Hopedale	9.0	0.028	1.000 (a)	0.078	1.000	0.053	1.000	0.045	1.000	0.071	1.000	0.475	0.078	0.498	0.028	1.000		
199S	Populatic Pond Boat Launch	Norfolk	19.9	0.000		0.068	1.000 (a)	0.070	1.000	0.069	1.000		0.000	0.458	0.070	0.507	0.000	1.000		
229S	Rt. 115, Baltimore St.	Medfield/Millis	22.9	0.000		0.000		0.000		0.000			0.000	no data	no data	no data	no data	no data		
290S	Old Bridge St.	Natick/Wellesley	29.0	0.022	0.000 (a)	0.090	1.000	0.102	1.000	0.104	1.000 (a)		0.000	0.415	0.103	0.486	0.000	1.000		
387S	S. Natick Dam	Dedham/Boston	37.8	0.015	0.000 (a)	0.091	1.000	0.102	1.000	0.088	1.000	0.077	1.000	0.375	0.091	0.470	0.000	1.000		
534S	Rt. 109 Bridge	Wellesley/Newton	53.4	0.017	0.000	0.089	1.000	0.094	1.000	0.074	1.000	0.069	1.000 (a)	0.371	0.089	0.472	0.000	1.000		
609S	Washington St. Hunnewell Bridge	Weston/Newton	60.9	0.018	0.000	0.098	1.000 (a)	0.098	1.000	0.074	1.000	0.076	1.000	0.374	0.098	0.471	0.000	1.000		
662S	Moody St. Bridge	Waltham	66.2	0.021	0.000 (a)	0.067	1.000	0.090	1.000	0.071	1.000	0.060	1.000 (a)	0.368	0.071	0.475	0.000	1.000		
012S	Watertown Dam Footbridge	Watertown	69.3	0.025	1.000	0.085	1.000	0.090	1.000	0.074	1.000	0.062	1.000	0.482	0.090	0.492	0.025	1.000		
743S	Western Ave	Cambridge/Boston	74.3	0.031	1.000	0.080	1.000	0.094	1.000	0.074	1.000 (a)	0.059	1.000	0.482	0.094	0.492	0.031	1.000		
763S	Mass. Ave. at Harvard Bridge	Boston/Cambridge	76.3	0.033	1.000	0.000	1.000	0.101	1.000	0.072	1.000	0.061	1.000	0.408	0.087	0.491	0.000	1.000		
784S	New Charles River Dam	Boston/Cambridge	78.4	0.036	1.000	0.052	1.000 (a)	0.085	1.000	0.057	1.000	0.082	1.000 (a)	0.479	0.085	0.494	0.036	1.000		
	Total # of Samples exceeding action limit	48		5	5	11	11	12	12	11	11	9	9							
	Total # of Samples	55		11		11		12		12		9								
	% of samples exceeding action limit	87.3%		45.5%		100.0%		100.0%		91.7%		100.0%								
QA/QC Samples																				
	Equipment Blank																			
	Site No.																			
Rainfall At Logan International Airport (inches)																				
	3 Days Prior to Sampling			WET		WET		DRY		WET		DRY								
	2 Days Prior to Sampling			0.31		0.00		Trace		0.00		0.00								
	1 Day Prior to Sampling			Trace		Trace		0.00		0.35		0.00								
	Day of Sampling			0.00		0.46		0.00		0.00		0.00								
				Trace		0.78		0.01		0.00		0.02								

Samples analyzed at Massachusetts Water Resources Authority's Central Laboratory.

(a) Average of duplicate samples.

Orthophosphate Results 2008

Site #	Description	Town	River mile	Concentrations of Orthophosphate (mg/L)					Mean	Median	Std Dev	Min	Max	
				3/18/2008	6/24/2008	8/19/2008	9/16/2008	12/16/2008						
35CS	Central Street Bridge	Milford	3.5	0.005	0.019	0.013	0.010		0.012	0.011	0.006	0.005	0.019	
90CS	Rt. 126, N. Main St.	Bellingham/Milford/Hopedale	9.0	0.011	0.016	0.019	0.017	0.018	0.016	0.017	0.003	0.011	0.019	
199S	Populatic Pond Boat Launch	Norfolk	19.9		0.016	0.019	0.025		0.020	0.019	0.004	0.016	0.025	
229S	Rt. 115, Baltimore St.	Norfolk/Millis	22.9				0.000		0.000	0.000		0.000	0.000	
290S	Old Bridge St.	Medfield/Millis	29.0	0.007	0.035	0.036	0.057	(e)	0.034	0.035	0.021	0.007	0.057	
387S	S. Natick Dam	Natick/Wellesley	37.8	0.003	0.031	0.042	0.044	0.021	0.028	0.031	0.017	0.003	0.044	
534S	Rt. 109 Bridge	Dedham/Boston	53.4	0.004	0.028	0.039	0.033	0.021	(e)	0.025	0.028	0.014	0.004	0.039
609S	Washington St. Hunnewell Bridge	Wellesley/Newton	60.9	0.004	0.040	0.038	0.033	0.020	0.027	0.033	0.015	0.004	0.040	
662S	Moody St. Bridge	Waltham	66.2	0.005	0.014	0.032	0.030	0.017	(e)	0.020	0.017	0.011	0.005	0.032
012S	Watertown Dam Footbridge	Watertown	69.3	0.006	0.024	0.037	0.033	0.015	0.023	0.024	0.013	0.006	0.037	
743S	Western Ave.	Cambridge/Boston	74.3	0.006	0.013	0.037	0.028	(e)	0.020	0.016	0.012	0.006	0.037	
763S	Mass. Ave. at Harvard Bridge	Boston/Cambridge	76.3	0.009		0.033	0.027	0.018	0.021	0.022	0.010	0.009	0.033	
784S	New Charles River Dam	Boston/Cambridge	78.4	0.012	0.014	0.019	0.028	0.023	(e)	0.019	0.019	0.006	0.012	0.028
	Total # of Samples exceeding action limit	22		0	4	8	10	0						
	Total # of Samples	55		11	11	12	12	9						
	% of samples exceeding action limit	42%		0	0.5	0.7	0.8	0.0						
QA/QC Samples														
	Equipment Blank													
	Site No.													
Rainfall At Logan International Airport (inches)														
	3 Days Prior to Sampling			WET	WET	DRY	WET	DRY						
	2 Days Prior to Sampling			0.31	0.00	Trace	0.00	0.00						
	1 Day Prior to Sampling			Trace	Trace	0.00	0.35	0.00						
	Day of Sampling			0.00	0.46	0.00	0.00	0.00						
				Trace	0.78	0.01	0.00	0.02						

(e) Average of duplicate samples

Ammonia Results 2008

Site #	Description	Town	River mile	Ammonia Concentration (mg/L)						Mean	Median	Std Dev	Min	Max		
				3/18/2008		6/24/2008		8/19/2008							9/16/2008	
35CS	Central Street Bridge	Milford	3.5	0.030		0.240		0.049		0.028		0.086	0.086	0.103	0.028	0.2
90CS	Rt. 126, N. Main St.	Bellingham	9.0	0.167	(d)	0.160		0.034		0.043		0.107	0.131	0.064	0.034	0.167
199S	Populatic Pond Boat Launch	Norfolk	19.9			0.024	(d)	0.020		0.045		0.029	0.024	0.013	0.020	0.045
290S	Old Bridge St.	Millis/Medfield	29.0	0.064	(d)	0.055		0.031		0.054	(d)	0.051	0.054	12.946	0.031	0.064
387S	Cheney Bridge	Wellesley/Natick	38.7	0.013	(d)	0.093		0.029		0.057		0.047	0.043	0.031	0.013	0.093
534S	Rt. 109 Bridge	Dedham/Boston	53.4	0.008		0.106		0.025		0.059		0.046	0.032	0.038	0.008	0.106
609S	Washington St. Hunnewell Bridge	Wellesley/Newton	60.9	0.013		0.333	(d)	0.029		0.076		0.096	0.030	0.135	0.013	0.333
662S	Moody St. Bridge	Waltham	66.2	0.010	(d)	0.120		0.046		0.105		0.063	0.046	0.048	0.010	0.120
012S	Watertown Dam Footbridge	Watertown	69.3	0.013		0.123		0.052		0.094		0.063	0.052	0.045	0.013	0.123
743S	Western Ave	Cambridge/Boston	74.3	0.020		0.115		0.070		0.095	(d)	0.067	0.070	0.040	0.020	0.115
763S	Mass. Ave. at Harvard Bridge	Boston/Cambridge	76.3	0.039				0.128		0.111		0.085	0.086	0.041	0.039	0.128
784S	New Charles River Dam	Boston/Cambridge	78.4	0.059		0.195		0.061		0.119		0.105	0.091	0.056	0.059	0.195
	Total # of Samples exceeding action limit		1	0		1		0		0						
	Total # of Samples		55	11		11		12		12						
	% of samples exceeding action limit		1.8%	0		9.1%		0		0						
	QA/QC Samples															
	Equipment Blank					0.007				0.004						
	Site No.					90CS				012S						
	Rainfall At Logan International Airport (inches)			WET		WET		DRY		WET						
	3 Days Prior to Sampling			0.31		0		Trace		0.00						
	2 Days Prior to Sampling			Trace		Trace	(g)	0.00		0.35						
	1 Day Prior to Sampling			0.00		0.46		0.00		0.00						
	Day of Sampling			Trace		0.78		0.01		0.00						

(d) Average of duplicates

(g) Rainfall took place after sampling event

(h) Rainfall took place during and following sampling event

Nitrate-Nitrite Results 2008

Site #	Description	Town	River mile	Concentrations of nitrate-nitrite (mg/L)						Mean	Median	Std Dev	Min	Max
				3/18/2008	6/24/2008	8/19/2008	9/16/2008	12/16/2008						
35CS	Central Street Bridge	Milford	3.5	0.534	0.511	0.220	0.120		0.346	0.366	0.20775356	0.120	0.534	
90CS	Rt. 126, N. Main St.	Bellingham	9.0	1.926 (a)	3.978	1.080 (f)	2.353	1.210	2.109	1.926	1.16758701	1.080	3.978	
199S	Populatic Pond Boat Launch	Norfolk	19.9		1.235 (a)	0.248	0.700		0.728	0.700	0.49396326	0.248	1.235	
290S	Old Bridge St.	Millis/Medfield	29.0	0.704 (a)	1.331	0.268	0.760 (a)		0.765	0.732	0.35768289	0.268	1.331	
387S	Cheney Bridge	Wellesley/Natick	38.7	0.585 (a)	0.980	0.249	0.578	0.431	0.565	0.578	0.26958363	0.249	0.980	
534S	Rt. 109 Bridge	Dedham/Boston	53.4	0.552	0.821	0.450	0.347	0.427 (a)	0.519	0.450	0.18361836	0.347	0.821	
609S	Washington St. Hunnewell Bridge	Wellesley/Newton	60.9	0.555	0.662 (a)	0.392	0.328	0.457	0.479	0.457	0.1323454	0.328	0.662	
621S	Leo J. Martin Golf Course/Park Rd.	Weston/Newton	62.1						0	0	0	0.000	0.000	
662S	Moody St. Bridge	Waltham	66.2	0.599 (a)	0.382	0.332	0.384	0.512 (a)	0.442	0.384	0.11014593	0.332	0.599	
012S	Watertown Dam Footbridge	Watertown	69.3	0.637	0.422	0.431	0.464	0.735	0.538	0.464	0.14076164	0.422	0.735	
743S	Western Ave	Cambridge/Boston	74.3	0.649	0.430	0.457	0.454 (a)	0.642	0.526	0.457	0.10907757	0.430	0.649	
763S	Mass. Ave. at Harvard Bridge	Boston/Cambridge	76.3	0.677		0.464	0.373	0.796	0.577	0.570	0.19350287	0.373	0.796	
784S	New Charles River Dam	Boston/Cambridge	78.4	0.691	0.468 (a)	0.423	0.328	0.700 (a)	0.522	0.468	0.16634042	0.328	0.700	
Total # of Samples exceeding action limit		50		11	11	8	11	9						
Total # of Samples		55		11	11	12	12	9						
% of samples exceeding action limit		90.9%		100.0%	100.0%	66.7%	91.7%	100.0%						
QA/QC Samples														
	Equipment Blank							2.93						
	Site No.							743S						
Rainfall At Logan International Airport (inches)														
	3 Days Prior to Sampling			WET	WET	DRY	WET	DRY						
	2 Days Prior to Sampling			0.31	0.00	Trace	0.00	0.00						
	1 Day Prior to Sampling			Trace	Trace	0.00	0.35	0.00						
	Day of Sampling			0.00	0.46	0.00	0.00	0.00						
				Trace	0.78	0.01	0.00	0.02						

(a) Average of duplicates

Total Nitrogen Results 2008

Site #	Description	Town	River mile	Total Nitrogen Concentration (mg/L)						Mean	Median	Std Dev	Min	Max
				3/18/2008	6/24/2008	8/19/2008	9/16/2008	12/16/2008						
35CS	Central Street Bridge	Milford	3.5	0.83	1.13	0.64	0.47		0.768	0.737	0.284	0.465	1.130	
90CS	Rt. 126, N. Main St.	Bellingham	9.0	2.49 (a)	4.87	1.72	3.11	1.75	2.789	2.486	1.300	1.723	4.874	
199S	Populatic Pond Boat Launch	Norfolk	19.9		1.87 (a)	2.35	1.33		1.851	1.870	0.512	1.331	2.353	
290S	Old Bridge St.	Millis/Medfield	29.0	1.10 (a)	1.88	0.98	1.43 (a)		1.346	1.429	0.402	0.982	1.877	
387S	Cheney Bridge	Wellesley/Natick	38.7	0.90 (a)	1.74	0.95	1.21	0.87	1.134	0.952	0.363	0.873	1.737	
534S	Rt. 109 Bridge	Dedham/Boston	53.4	0.87	1.43	1.10	1.00	0.81 (a)	1.041	1.050	0.244	0.866	1.429	
609S	Washington St. Hunnewell Bridge	Wellesley/Newton	60.9	0.86	1.56 (a)	1.09	1.04	0.89	1.088	1.041	0.282	0.861	1.562	
621S	Leo J. Martin Golf Course/Park Rd.	Weston/Newton	62.1				0.00		0.000	0.000	0.000	0.000	0.000	
662S	Moody St. Bridge	Waltham	66.2	0.95 (a)	0.98	1.10	1.10	0.90 (a)	1.006	0.980	0.090	0.901	1.100	
012S	Watertown Dam Footbridge	Watertown	69.3	0.95	1.03	1.10	1.15	0.96	1.038	1.030	0.087	0.952	1.150	
743S	Western Ave	Cambridge/Boston	74.3	0.99	1.08	1.13	1.12 (a)	1.06	1.077	1.080	0.055	0.993	1.130	
763S	Mass. Ave. at Harvard Bridge	Boston/Cambridge	76.3	1.06		1.22	1.03	1.20	1.128	1.130	0.097	1.030	1.220	
784S	New Charles River Dam	Boston/Cambridge	78.4	1.06	1.18 (a)	1.11	0.92	1.21 (a)	1.095	1.109	0.113	0.922	1.205	
Total # of Samples exceeding action limit		54		11	11	12	12	9						
Total # of Samples		55		11	11	12	13	9						
% of samples exceeding action limit		98.2%		100.0%	100.0%	100.0%	92.3%	100.0%						
QA/QC Samples														
	Equipment Blank				0.007		0.004	1.7						
	Site No.				90CS		012S	743S						
Rainfall At Logan International Airport (inches)														
	3 Days Prior to Sampling			WET	WET	DRY	WET	DRY						
	2 Days Prior to Sampling			0.31	0	Trace	0.00	0.00						
	1 Day Prior to Sampling			Trace	Trace	0.00	0.35	0.00						
	Day of Sampling			0.00	0.46	0.00	0.00	0.00						
				Trace	0.78	0.01	0.00	0.02						

(a) Average of duplicates

Chlorophyll a Analysis 2008

Site #	Description	Town	River mile	Chlorophyll a Concentrations (mg/L)					Mean	Median	Std Dev	Min	Max
				3/18/2008	6/24/2008	8/19/2008	9/16/2008	12/16/2008					
35CS	Central Street Bridge	Milford	3.5	0.00350	0.00147	0.00069	0.00078		0.00161	0.00113	0.00131	0.00069	0.00350
90CS	Rt. 126, N. Main St.	Bellingham/Milford/Hopedale	9.0	0.00900	0.01180	0.00106	0.00191	0.00056	0.00487	0.00191	0.00517	0.00056	0.01180
199S	Populatic Pond Boat Launch	Norfolk	19.9	0.01990	(a) 0.01139	(a) 0.00561	0.00476		0.01041	0.00850	0.00698	0.00476	0.01990
290S	Old Bridge St.	Medfield/Millis	29.0	0.02900	0.00511	0.00152	0.00072	(a)	0.00909	0.00332	0.01341	0.00072	0.02900
387S	Cheney Bridge	Natick/Wellesley	37.8	0.03780	(a) 0.00440	0.00216	0.00090	0.00109	0.00927	0.00216	0.01601	0.00090	0.03780
534S	Rt. 109 Bridge	Dedham/Boston	53.4	0.05340	(a) 0.00685	0.00417	0.00171	0.00171	(a) 0.01357	0.00417	0.02237	0.00171	0.05340
609S	Washington St./Hunnewell Bridge	Wellesley/Newton	60.9	0.06090	0.00336	(a) 0.00556	0.00193	0.00194	0.01474	0.00336	0.02585	0.00193	0.06090
621S	Leo J. Martin Golf Course/Park Rd.	Weston/Newton	62.1					0.00000	no data	no data	no data	no data	no data
662S	Moody St. Bridge	Waltham	66.2	0.06620	0.00765	0.00737	0.00274	0.00195	(a) 0.01718	0.00737	0.02753	0.00195	0.06620
012S	Watertown Dam Footbridge	Watertown	69.3	0.06930	(a) 0.00992	0.00288	0.00120	0.00208	0.01708	0.00288	0.02940	0.00120	0.06930
743S	Western Ave	Cambridge/Boston	74.3	0.07430	0.01070	0.00459	0.00544	(a)	0.00230	0.01947	0.00544	0.00230	0.07430
763S	Mass. Ave. (Harvard) Bridge	Boston/Cambridge	76.3	0.07630		0.00913	0.01160	0.00219	0.02481	0.01037	0.03456	0.00219	0.07630
784S	New Charles River Dam	Boston/Cambridge	78.4	0.07840	0.01395	(a) 0.01550	0.00638	0.00235	(a) 0.02332	0.01395	0.03126	0.00235	0.07840
	Total # of samples exceeding action limit	31		11	9	7	3	0					
	Total # of Samples	56		12	11	12	12	9					
	% of samples exceeding action limit	55.4%		91.7%	81.8%	58.3%	25.0%	0.0%					
QA/QC Samples													
	Equipment Blank												
	Site No.												
	Equipment Blank												
	Site No.												
Rainfall At Logan International Airport (inches)													
	3 Days Prior to Sampling			0.31	0.00	Trace	0.00	0.00					
	2 Days Prior to Sampling			Trace	Trace	0.00	0.35	0.00					
	1 Day Prior to Sampling			0.00	0.46	0.00	0.00	0.00					
	Day of Sampling			Trace	0.78	0.01	0.00	0.02					

Samples analyzed at Massachusetts Water Resources Authority's Central Lab.

(a) Average of duplicates

Chlorophyll a Phaeophytin Ratios 2008

Site #	Description	Town	River mile	Chlorophyll A Phaeophytin Ratios					Mean	Median	Std Dev	Min	Max
				3/18/2008	6/24/2008	8/19/2008	9/16/2008	12/16/2008					
35CS	Central Street Bridge	Milford	3.5	0.00045	0.00060	0.00051	0.00076		0.00058	0.00056	0.00014	0.00045	0.00076
90CS	Rt. 126, N. Main St.	Bellingham/Milford/Hopedale	9.0	0.00100	0.00110	0.00125	0.00076	0.00077	0.00098	0.00100	0.00021	0.00076	0.00125
199S	Populatic Pond Boat Launch	Norfolk	19.9	0.00000	0.00129	0.00283	0.00203		0.00154	0.00166	0.00120	0.00000	0.00283
290S	Old Bridge St.	Medfield/Millis	29.0	0.00094	0.00101	0.00095	0.00060		0.00088	0.00094	0.00019	0.00060	0.00101
387S	Cheney Bridge	Natick/Wellesley	37.8	0.00073	0.00089	0.00096	0.00048	0.00065	0.00074	0.00073	0.00019	0.00048	0.00096
534S	Rt. 109 Bridge	Dedham/Boston	53.4	0.00112	0.00122	0.00139	0.00068	0.00142	0.00117	0.00122	0.00030	0.00068	0.00142
609S	Washington St./Hunnewell Bridge	Wellesley/Newton	60.9	0.00133	0.00061	0.00120	0.00057	0.00128	0.00100	0.00120	0.00037	0.00057	0.00133
621S	Leo J. Martin Golf Course/Park Rd.	Weston/Newton	62.1						no data	no data	no data	no data	no data
662S	Moody St. Bridge	Waltham	66.2	0.00124	0.00121	0.00139	0.00107	0.00144	0.00127	0.00124	0.00015	0.00107	0.00144
012S	Watertown Dam Footbridge	Watertown	69.3	0.00118	0.00115	0.00062	0.00038	0.00141	0.00095	0.00115	0.00043	0.00038	0.00141
743S	Western Ave	Cambridge/Boston	74.3	0.00101	0.00143	0.00116	0.00177	0.00154	0.00138	0.00143	0.00030	0.00101	0.00177
763S	Mass. Ave. (Harvard) Bridge	Boston/Cambridge	76.3	0.00139	0.00000	0.00139	0.00212	0.00187	0.00135	0.00139	0.00082	0.00000	0.00212
784S	New Charles River Dam	Boston/Cambridge	78.4	0.00177	0.00173	0.00149	0.00127	0.00151	0.00155	0.00151	0.00020	0.00127	0.00177
	Total # of Samples exceeding action limit	0		1	0	0	0	0					
	Total # of Samples	57		12	12	12	12	9					
	% of samples exceeding action limit	0.0%		0.0%	0.0%	0.0%	0.0%	0.0%					
QA/QC Samples													
	Equipment Blank												
	Site No.												
	Equipment Blank												
	Site No.												
Rainfall At Logan International Airport (inches)													
	3 Days Prior to Sampling			WET	WET	DRY	WET	DRY					
				0.31	0	Trace	0	0					
	2 Days Prior to Sampling			Trace	Trace	0.00	0.35	0					
				0.00	0.46	0.00	0	0					
	1 Day Prior to Sampling			0.00	0.46	0.00	0	0					
				Trace	0.78	0.01	0	0.02					
	Day of Sampling			Trace	0.78	0.01	0	0.02					

Chlorophyll a Alpha Results 2008

Site #	Description	Town	River mile	Chlorophyll a Concentration (mg/L)			Mean	Median	Std Dev	Min	Max
				7/15/2008	8/19/2008	9/16/2008					
35CS	Central Street Bridge	Milford	3.5				no data	no data	no data	no data	no data
59CS	Mellen St. Bridge	Bellingham/Milford/Hopedale	5.9				no data	no data	no data	no data	no data
90CS	Rt. 126, N. Main St.	Bellingham	9.0				no data	no data	no data	no data	no data
130S	Maple St. Bridge	Bellingham	12.9				no data	no data	no data	no data	no data
165S	Shaw St. Bridge	Franklin/Medway	16.5				no data	no data	no data	no data	no data
199S	Populatic Pond Boat Launch	Norfolk	19.9				no data	no data	no data	no data	no data
229S	Rt. 115, Baltimore St.	Norfolk/Millis	22.9		0.00471	0.00245	0.00358	0.00358	0.00159806	0.00245	0.00471
267S	Dwight St. Bridge	Millis/Medfield	26.7				no data	no data	no data	no data	no data
269T	Causeway St. Stop River	Medfield	26.9				no data	no data	no data	no data	no data
290S	Old Bridge St.	Millis/Medfield	29.0				no data	no data	no data	no data	no data
318S	Rt. 27 Bridge	Medfield/Sherborn	31.8				no data	no data	no data	no data	no data
343S	Farm Rd./Bridge St.	Sherborn/Dover	34.3				no data	no data	no data	no data	no data
387S	Cheney Bridge	Wellesley/Natick	38.7				no data	no data	no data	no data	no data
400S	Charles River Road Bridge	Dover/Wellesley	40.0				no data	no data	no data	no data	no data
447S	Dover Gage	Dover	44.7		0.00375	0.00367	0.00371	0.00371	5.6569E-05	0.00367	0.00375
484S	Dedham Medical Center	Dedham/Needham	48.4				no data	no data	no data	no data	no data
521S	Ames St. Bridge	Dedham	52.1				no data	no data	no data	no data	no data
534S	Rt. 109 Bridge	Dedham/Boston	53.4				no data	no data	no data	no data	no data
567S	Nahanton Park	Newton/Needham	56.7				no data	no data	no data	no data	no data
591S	Rt. 9 Gaging Station	Newton	59.1				no data	no data	no data	no data	no data
609S	Washington St. Hunnewell Bridge	Wellesley/Newton	60.9				no data	no data	no data	no data	no data
621S	Leo J. Martin Golf Course/Park Rd.	Weston/Newton	62.1				no data	no data	no data	no data	no data
635S	2391 Commonwealth Ave.	Newton	63.5				no data	no data	no data	no data	no data
648S	Lakes Region	Waltham	64.8				no data	no data	no data	no data	no data
662S	Moody St. Bridge	Waltham	66.2				no data	no data	no data	no data	no data
675S	North St.	Waltham/Newton	67.6				no data	no data	no data	no data	no data
012S	Watertown Dam Footbridge	Watertown	69.3				no data	no data	no data	no data	no data
700S	N. Beacon St.	Watertown/Brighton	70.9				no data	no data	no data	no data	no data
715S	Arsenal St.	Watertown/Brighton	71.5				no data	no data	no data	no data	no data
729S	Eliot Bridge	Cambridge/Boston	72.9	0.0232	(a)	0.001	0.0121	0.0121	0.01569777	0.001	0.0232
743S	Western Ave.	Cambridge/Boston	74.3	0.024			0.024	0.024		0.024	0.024
760T	Muddy River at Comm. Ave.	Boston	76.0		0.01395	(a)	0.008655	0.008655	0.00748826	0.00336	0.01395
763S	Mass. Ave. at Harvard Bridge	Boston/Cambridge	76.3	0.0262			0.0262	0.0262	no data	0.0262	0.0262
773S	Longfellow Bridge	Cambridge/Boston	77.3				no data	no data	no data	0	0
784S	New Charles River Dam	Boston/Cambridge	78.4	0.0191			0.0191	0.0191	no data	0.0191	0.0191
	Total # of Samples exceeding action limit	7		4	3	0					
	Total #of Samples	11		4	3	4					
	% of samples exceeding action limit	63.6%		100.00%	100.0%	0.0%					
	QA/QC Samples										
	Equipment Blank										
	Site No.										
	Equipment Blank										
	Site No.										
	Rainfall At Logan International Airport (inches)										
	3 Days Prior to Sampling			0.00	Trace	0.00					
	2 Days Prior to Sampling			0.00	0.00	0.35					
	1 Day Prior to Sampling			0.07	0.00	0.00					
	Day of Sampling			0.00	0.01	0.00					

(a) Average of duplicates

Depth Results 2008

Site #	Description	Town	River mile	Depth (feet)												Mean	Median	Std Dev	Min	Max
				1/15/2008	2/12/2008	3/18/2008	4/15/2008	5/20/2008	6/24/2008	7/15/2008	8/19/2008	9/16/2008	10/14/2008	11/18/2008	12/16/2008					
35CS	Central Street Bridge	Milford	3.5	Sampling cancelled due to freezing conditions or otherwise inclement weather	Sampling cancelled due to freezing conditions or otherwise inclement weather	1.5	1.5	1.2	1.0	0.7	1.3	1.2	0.7		1.4	1.2	1.2	0.3	0.7	1.5
35CD	Discharge Pipe @ Central St.	Milford	3.5													no data	no data	no data	0.0	0.0
35C2	2nd Discharge Pipe @ Central St.	Milford	3.5													no data	no data	no data	0.0	0.0
59CS	Mellen St. Bridge	Bellingham/Milford/Hopedale	5.9			1.5	1.6	1.2	0.7	0.5	2.2	2.3	1.5	1.6	3.3	1.6	1.6	0.8	0.5	3.3
90CS	Rt. 126, N. Main St.	Bellingham	9.0			2.1	2.4		0.9	1.3	2.2	2.7	1.8			1.9	2.1	0.6	0.9	2.7
130S	Maple St. Bridge	Bellingham	12.9			1.2	1.0	0.8	0.6	0.3	1.1	1.0	0.9	0.9	1.7	1.0	1.0	0.4	0.3	1.7
165S	Shaw St. Bridge	Franklin/Medway	16.5			1.5	1.9	2.3	0.7	0.5	2.3	1.7	1.8	1.9	4.9	2.0	1.8	1.2	0.5	4.9
199S	Populatic Pond Boat Launch	Norfolk	19.9													no data	no data	no data	0.0	0.0
229S	Rt. 115, Baltimore St.	Norfolk/Millis	22.9			4.3	3.3	2.8	1.9	2.1	3.6	2.7	3.2	2.8		3.0	2.8	0.7	1.9	4.3
267S	Dwight St. Bridge	Millis/Medfield	26.7				2.5	1.8	0.8	0.5	3.8	2.3	1.2	0.8		1.7	1.5	1.1	0.5	3.8
269T	Causeway St. Stop River	Medfield	26.9			4.6	3.0	2.8	1.3	1.1	4.0	2.6	2.1	2.1	6.9	3.0	2.7	1.7	1.1	6.9
290S	Old Bridge St.	Millis/Medfield	29.0			10.3		8.1	5.9	5.5	8.9	8.2	7.0			7.7	8.1	1.7	5.5	10.3
318S	Rt. 27 Bridge	Medfield/Sherborn	31.8			12.0	7.5	6.0	5.0	4.0	7.0	7.0	5.5	6.0	8.0	6.8	6.5	2.2	4.0	12.0
343S	Farm Rd./Bridge St.	Sherborn/Dover	34.3			8.5	7.0	6.5	4.8		7.0	6.0	6.1	6.4	10.3	7.0	6.5	1.6	4.8	10.3
387S	S. Natick Dam	Wellesley/Natick	37.8			6.3	5.5	4.9	4.1	3.8	6.3	6.0	5.2	5.0		5.2	5.2	0.9	3.8	6.3
400S	Charles River Road Bridge	Dover/Wellesley	40.0			9.0	6.8	6.2	5.7	5.8	7.3	6.1		5.9	15.3	7.6	6.2	3.1	5.7	15.3
447S	Dover Gage	Dover	44.7					2.3	1.8	1.5	2.5	2.2	2.0			2.0	2.1	0.4	1.5	2.5
484S	Dedham Medical Center	Dedham/Needham	48.4			6.2	4.9	5.7	3.0	5.3		6.0	4.5	4.5	18.1	6.5	5.3	4.5	3.0	18.1
521S	Ames St. Bridge	Dedham	52.1			5.1	3.8	3.3	2.8	2.4	3.9	3.3	3.3		5.5	3.7	3.3	1.0	2.4	5.5
534S	Rt. 109 Bridge	Dedham/Boston	53.4			7.8	6.1		4.8	4.6	6.2	7.0	5.1	5.8	9.4	6.3	6.1	1.6	4.6	9.4
567S	Nahanton Park	Newton/Needham	56.7			8.5		7.2	5.8	5.6	7.5		6.2	7.5	9.0	7.2	7.3	1.2	5.6	9.0
591S	Rt. 9 Gaging Station	Newton	59.1			1.7	0.6	1.1	1.1	1.1	2.3		1.9	1.6	1.3	1.4	1.3	0.5	0.6	2.3
609S	Washington St. Hunnewell Bridge	Wellesley/Newton	60.9													no data	no data	no data	0.0	0.0
621S	Leo J. Martin Golf Course/Park Rd.	Weston/Newton	62.1			10.2		5.6	5.9	4.9	4.5	5.6	5.2	5.1		5.9	5.4	1.8	4.5	10.2
635S	2391 Commonwealth Ave.	Newton	63.5			5.3	4.9	4.3	4.5	4.0	4.3	4.3	4.5	4.3	6.0	4.6	4.4	0.6	4.0	6.0
648S	Lakes Region	Waltham	64.8				9.5	9.1	8.5	8.4	9.3	9.1	9.0			9.0	9.1	0.4	8.4	9.5
662S	Moody St. Bridge	Waltham	66.2			9.0	8.9	8.8	9.3	7.3	8.4	8.1	8.3	8.0	9.2	8.5	8.6	0.6	7.3	9.3
675S	North St.	Waltham/Newton	67.6				2.7	1.9	1.8		2.4	1.6	2.0	2.3		2.1	2.0	0.4	1.6	2.7
012S	Watertown Dam Footbridge	Watertown	69.3			4.1	3.5	3.0	3.2	2.9	3.4	4.0	3.1	3.1	4.1	3.4	3.3	0.5	2.9	4.1
700S	N. Beacon St.	Watertown/Brighton	70.9				8.3	8.6	8.8	8.4	8.3	8.1	7.9	8.1		8.3	8.3	0.3	7.9	8.8
715S	Arsenal St.	Watertown/Brighton	71.5			9.6	8.4	7.2	9.4	8.8	8.2	8.9	9.3	8.9	8.5	8.7	8.9	0.7	7.2	9.6
729S	Eliot Bridge	Cambridge/Boston	72.9			13.6	14.7	14.8	17.1	15.7		15.2	14.0	13.7	13.3	14.7	14.7	1.2	13.3	17.1
743S	Western Ave.	Cambridge/Boston	74.3			12.6	14.5	14.1	14.8	13.6	13.5	14.0	15.0	15.0	14.9	14.2	14.3	0.8	12.6	15.0
760T	Muddy River at Comm. Ave.	Boston	76.0			5.2	6.4	6.7			6.4	6.8	6.4	7.0	6.1	6.4	6.4	0.6	5.2	7.0
763S	Mass. Ave. at Harvard Bridge	Boston/Cambridge	76.3			12.0	12.0			15.6	15.9	15.8		15.5	18.0	15.0	15.6	2.2	12.0	18.0
773S	Longfellow Bridge	Cambridge/Boston	77.3			7.0	6.2	6.6	6.7	6.3	6.3	6.8	6.8	6.5	6.3	6.5	6.6	0.3	6.2	7.0
784S	New Charles River Dam	Boston/Cambridge	78.4			21.0	26.0	26.7	26.1	24.9	26.8	15.2	26.1	25.5	24.9	24.3	25.8	3.6	15.2	26.8
	Rainfall At Logan International Airport (inches)																			
	3 Days Prior to Sampling					0.31	0.45	0.44	0.00	0.00	Trace	0.00	0.00	0.47	0.00					
	2 Days Prior to Sampling					Trace	0.01	Trace	Trace	0.00	0.00	0.35	0.00	0.37	0.00					
	1 Day Prior to Sampling					0.00	0.00	0.00	0.46	0.07	0.00	0.00	0.00	0.00	0.00					
	Day of Sampling					Trace	0.00	Trace	0.78	0.00	0.01	0.00	0.00	0.00	0.02					