Technical Memorandum

TM-51-10

BLACKSTONE RIVER WATERSHED 2003
DWM WATER QUALITY MONITORING DATA

May 2005

Stella D. Tamul
Massachusetts Department of Environmental Protection
Division of Watershed Management
DWM Control Number CN 240.1

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Ellen Roy Herzfelder, Secretary
Massachusetts Department of Environmental Protection
Robert Golledge Jr., Commissioner
Bureau of Resource Protection
Division of Watershed Management
Glenn Haas, Director

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Introduction

The Blackstone River Watershed water quality survey was conducted in 2003, along with limited benthic macroinvertebrate sampling, fish population sampling, lake sampling, and a temperature logging survey as part of the Division of Watershed Management (DWM) Year Two monitoring. Consistent with DWM's general approach to watershed monitoring to meet defined programmatic objectives, water quality surveys on streams/rivers in the Blackstone River Watershed were conducted once a month in April, May, June, July, August, September, and October in 2003 at a total of 20 locations (sixteen additional stations were added as the monitoring season progressed). Field measurements were taken for dissolved oxygen (including pre-dawn), temperature, conductivity, pH, and grab samples were taken for analytical parameters that are identified in the *Quality Assurance Project Plan 2003 MADEP-DWM Monitoring in the Blackstone, Chicopee, Connecticut and Nashua watersheds CN 127.0* (2003 QAPP) (MA DEP 2003). The study area included the mainstem Blackstone River and several of its major tributaries. Table 1 and figures 1, 1a, 1b, and 1c detail locations of the 2003 sampling sites. Additionally, water quality monitoring was conducted by DWM (seven of the thirty-six stations) during the 2003 field season in response to an emergency overflow of untreated sewage from the Upper Blackstone Water Pollution Abatement District (UBWPAD) into the Blackstone River (event occurred on October 2, 2003). Data collected (3 October and 6 October) from this emergency discharge event was in support of the DEP's Central Regional Office's response and subsequent enforcement actions towards the UBWPAD (Appendix 1).

Project Objectives

Monitoring data collected from the Blackstone River Watershed has met the specific data quality objectives (DQOs) outlined in the 2003 QAPP. Quality assurance for watershed monitoring by the DWM, as detailed in the 2003 QAPP, is provided to ensure implementation of an effective and efficient sampling design, and to provide data to meet specific data quality objectives.

The results of the 2003 Blackstone water quality monitoring factor into regulatory actions taken by MA DEP and the US EPA, are incorporated into DWM's Water Quality Assessment Reports, and are used to update Sections 305(b) and 303(d) reporting elements of the Clean Water Act. Additionally, these data are used in the development of Total Maximum Daily Loads (TMDLs) to address waters not attaining water quality standards and to aid in the development of National Pollutant Discharge Elimination System (NPDES) permits. The goal of the Blackstone River Watershed Year Two Survey was to obtain information that meets the following DWM programmatic objectives and watershed-specific sub-objectives:

Objective 1: Evaluate specific water bodies for support of designated uses, determine if surface water quality standards are being met, and evaluate the level of waterbody impairment.

Objective 2: Provide quality-assured data for use by DWM in developing TMDLs for impaired waterbodies.

Objective 3: Provide quality-assured *E. coli* data for the purpose of assessing primary and secondary contact recreational uses in rivers/streams, due to the proposed Massachusetts surface water quality standard for freshwater criteria for *E. coli* bacteria.

Table 1. MA DEP DWM 2003 Blackstone River Watershed Water Quality Sampling Station Descriptions and Sampling Schedule

Waterbody	Station (Unique ID)	Station Description	Survey Date												
			4/23	5/21	6/25	6/26	7/23	7/24	8/27	8/28	9/12	9/18	9/26	10/2	10/3*	10/6*
Kettle Brook	KB10 (W0510)	upstream/north of Earle Street, Leicester	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
Unnamed tributary	KB02 (W0501)	upstream/southeast of Oxford Street, Worcester (Outlet Leesville Pond, inlet Curtis Pond, tributary to Middle River)	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
Dark Brook	RB01 (W0504)	downstream/north of Route 12, Auburn	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
Middle River	BLK00 (W0502)	upstream/west of the northern most crossing of Millbury Street, Worcester	4	1,3,4	3,4	2	3,4	2	3	2,4	1	1		1,3,4		
Beaver Brook	BB01 (W0499)	upstream/northwest of Park Avenue, Worcester	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
Unnamed tributary "Mill Brook"	MB01 (W1024)	at mouth of unnamed tributary to Blackstone River locally known as Mill Brook (at CSO pipe), approximately 100 feet downstream/northeast of Millbury Street, Worcester									1	1				
Blackstone River	Station 1 (W1240)	approximately 60 feet upstream/north of Upper Blackstone WWTP effluent channel confluence, Millbury											1		1,3,4	1,3,4
	W1255 (W1255)	downstream/south of Route 90 overpass, directly upstream of the Worcester Flood Diversion Channel, Millbury											1			
	W1256 (W1256)	downstream/south of Route 90 overpass, directly downstream of the Worcester Flood Diversion Channel, Millbury											1			
	BLK02 (W0505)	upstream/northwest of McCracken Road, Millbury	4	1,3,4	3,4	2	3,4	2	3	2,4	1	1	1	1,3,4	1,3,4	1,3,4
	W1259 (W1259)	upstream at the Millbury WWTP discharge pipe, Millbury										1				
	W1257 (W1257)	approximately 50 feet upstream/northwest of Blackstone Street (in Singing Dam impoundment), Sutton										1				

Note: * = Data collected on 10/3 and 10/6 were part of the emergency response to the UBWPAD sewage overflow event, 1 = multiprobe day run, 2 = multiprobe predawn run, 3 = nutrients/solids (Total Suspended Solids, Ammonia Nitrogen, Total Phosphorus), 4 = bacteria (Fecal Coliform and E. coli)

Table 1 (continued). MA DEP DWM 2003 Blackstone River Watershed Water Quality Sampling Station Descriptions and Sampling Schedule

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			4/23	5/21	6/25	6/26	7/23	7/24	8/27	8/28	9/12	9/18	9/26	10/2	10/3*	10/6*
Blackstone River	BS12 (W1017)	downstream/south of Singing Dam, Blackstone Street, Sutton	4	1,3,4	3,4	2	3,4	2	3	2,4	1			1,3,4		
	W1258 (W1258)	downstream at Waters Street, Millbury									1	1	1			
	Station 3 (W1242)	upstream at Route 122A (below Fisherville Pond), Grafton													1,3,4	1,3,4
	Station 4 (W1243)	upstream at Depot Street, Grafton													1,3,4	1,3,4
Blackstone River Canal	Station 2 (W1241)	downstream at Pleasant Street, Grafton													1,3,4	1,3,4
Blackstone River	BLK07A (W0506)	upstream/northwest of Sutton Street, Northbridge	4	4	3,4	2	3,4	2	3	2,4				1,3,4	1,3,4	1,3,4
	BLK07B (W1060)	channel discharging from northeast bank upstream at Sutton Street, Northbridge	4													
	Station 5 (W1244)	downstream at Church Street, Northbridge													1.3,4	1,3,4
Quinsigamond River	QU05 (W1018)	downstream at Pleasant Street, Grafton	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
Blackstone River	W0670 (W0670)	at sluiceway north of East Hartford Avenue, Uxbridge	4													
	Station 6 (W1245)	approximately 160 feet downstream/south of Hartford Avenue East, Uxbridge													1,3,4	1,3,4
	Station 7 (W1246)	upstream at Route 16 (Mendon Street), Uxbridge														1,3,4
Mumford River	BLK09-08A (W1062)	upstream at Manchaug Street, Douglas	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
	MF03A (W1025)	south of Gilboa Street, approximately 500 feet downstream/northeast of Gilboa Pond, downstream of wastewater treatment plant diffuser pipes, Douglas	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		

Note: * = Data collected on 10/3 and 10/6 were part of the emergency response to the UBWPAD sewage overflow event, 1 = multiprobe day run, 2 = multiprobe predawn run, 3 = nutrients/solids (Total Suspended Solids, Ammonia Nitrogen, Total Phosphorus), 4 = bacteria (Fecal Coliform and E. coli)

Table 1 (continued). MA DEP DWM 2003 Blackstone River Watershed Water Quality Sampling Station Descriptions and Sampling Schedule

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Mumford River	MF07 (W1020)	downstream at Mendon Street (Route 16), downstream of Capron Pond, Uxbridge	4		3,4	2	3,4	2	3	2,4				1,3,4		
West River MA51-11	WR12 (W1073)	upstream at Hartford Avenue South, Upton	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
West River MA51-12	WR03 (W0515)	upstream/north of East Hartford Street, Uxbridge	4	4	3,4	2	3,4	2	3	2,4				1,3,4		
	WR05 (W1019)	upstream at Helca Street, Uxbridge	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
Blackstone River	BLK12B (W1066)	approximately 260 feet upstream/west of Central Street (above braid), Millville		1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
	Station 8 (W1247)	approximately 16 feet upstream/north of "Tupperware Dam" (west of Staples Lane), Blackstone													1,3,4	1,3,4
	BS19 (W1023)	upstream at Bridge Street/Canal Street (upstream of dam), Blackstone	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
Mill River	ML01 (W1021)	downstream at Route 16 (Mendon Street), Hopedale	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
	BLK15-1 (W0508)	upstream/northwest of Summer Street (Park Street), Blackstone	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		
Peters River	PR01 (W1022)	upstream at Paine Street, Bellingham	4	1,3,4	3,4	2	3,4	2	3	2,4				1,3,4		

Note: * = Data collected on 10/3 and 10/6 were part of the emergency response to the UBWPAD sewage overflow event, 1 = multiprobe day run, 2 = multiprobe predawn run, 3 = nutrients/solids (Total Suspended Solids, Ammonia Nitrogen, Total Phosphorus), 4 = bacteria (Fecal Coliform and E. coli)

Figure 1. MA DEP, DWM 2003 Water Quality Monitoring Station Locations in the Blackstone River Watershed.

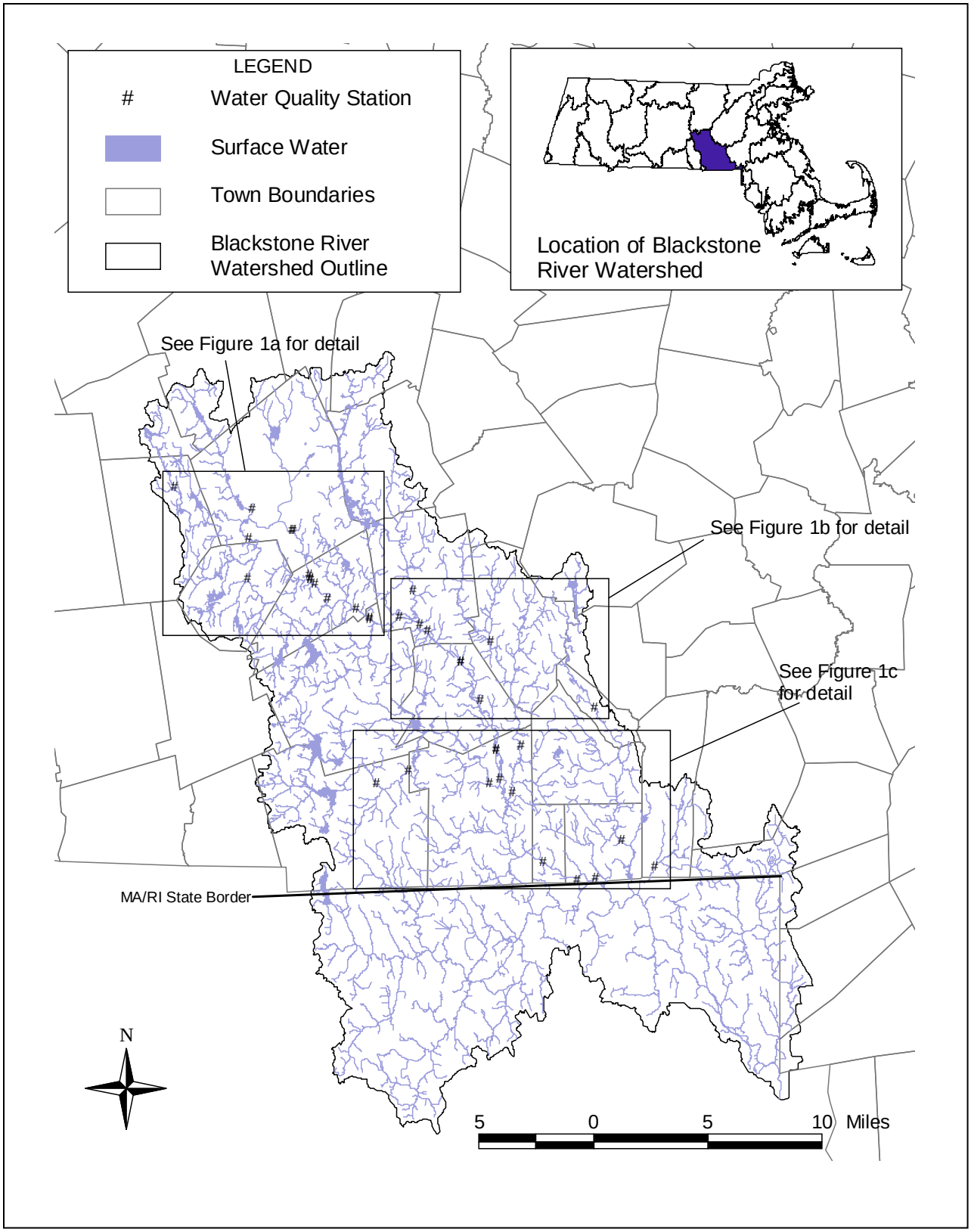


Figure 1a. Kettle Brook, Beaver Brook, Dark Brook, Middle River, Unnamed Tributary "Mill Brook", and the Blackstone River DWM 2003 Water Quality Monitoring Station Locations.

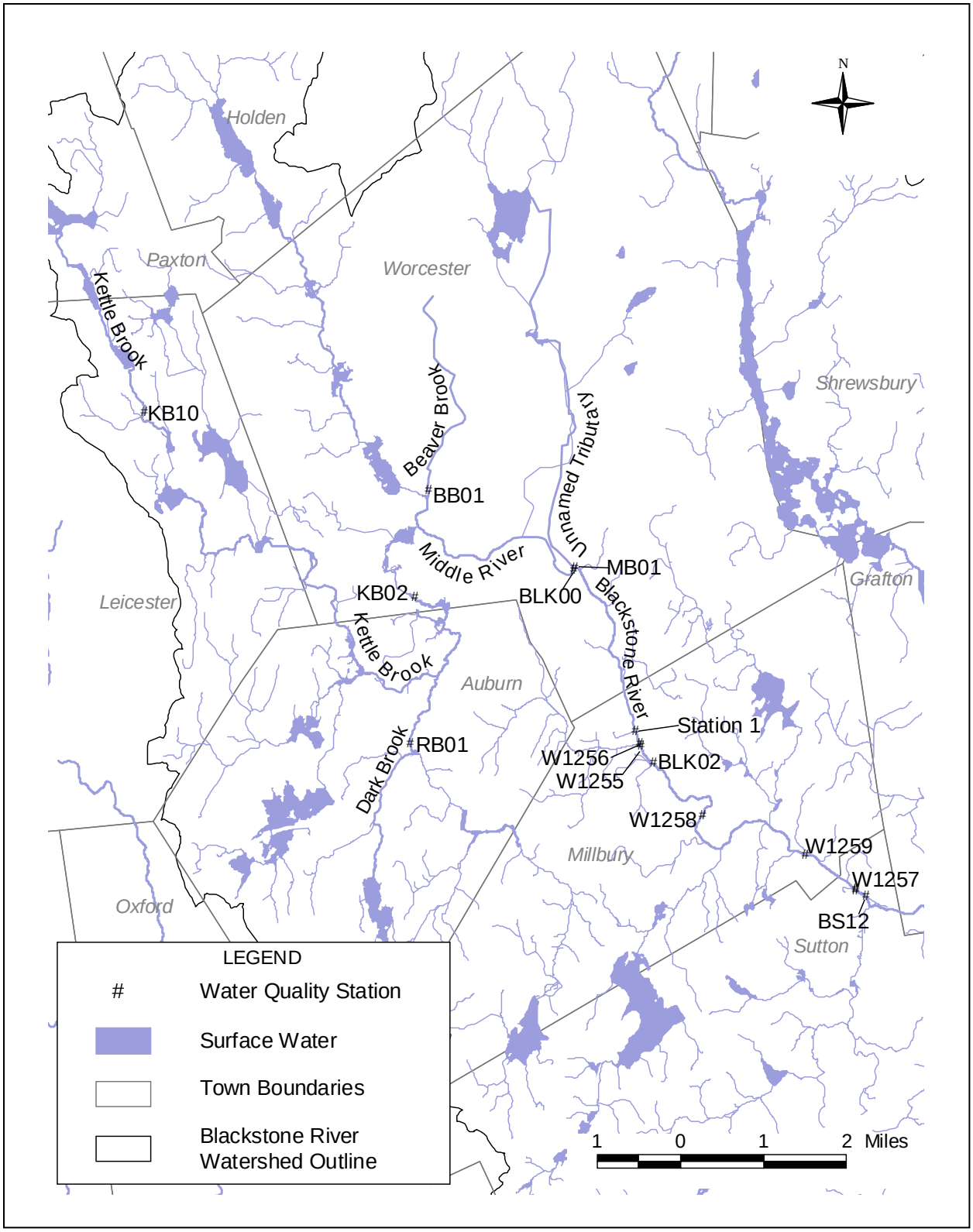


Figure 1b. Quinsigamond River, Blackstone River, West River, and Mill River DWM 2003 Water Quality Monitoring Station Locations.

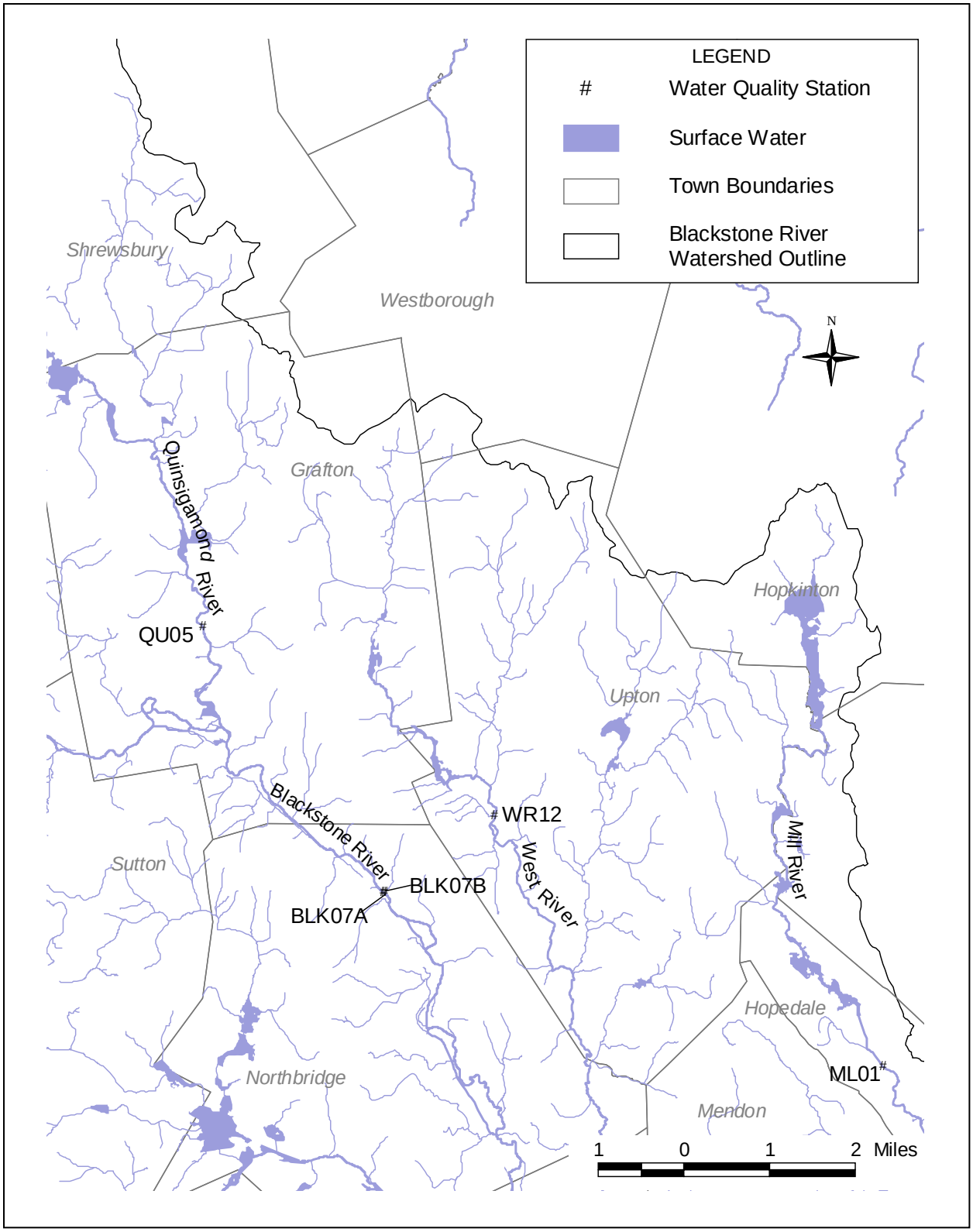
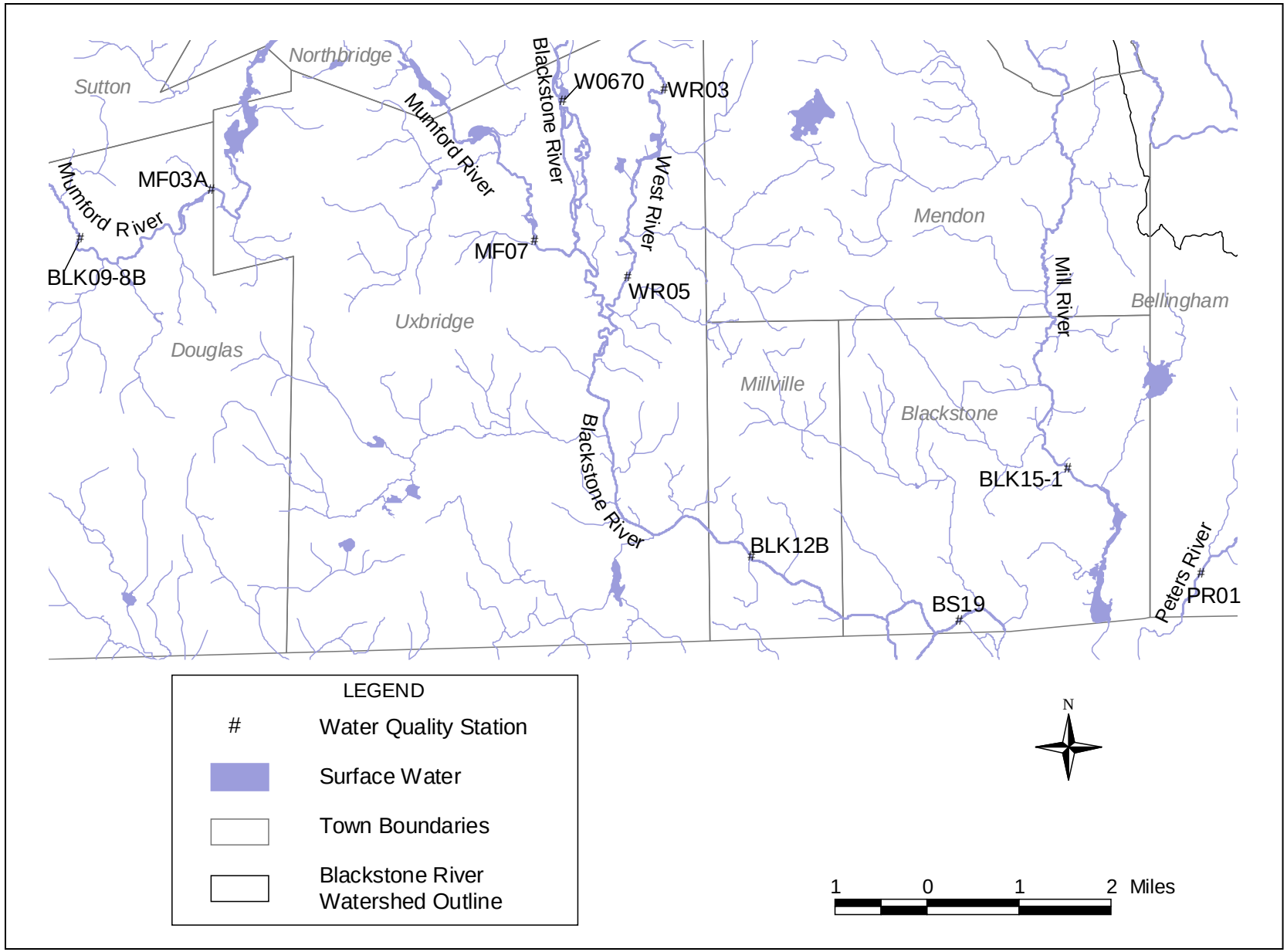


Figure 1c. Mumford River, Blackstone River, Mill River, and the Peters River DWM 2003 Water Quality Monitoring Station Locations.



Study Area Description
The drainage area of the Blackstone River Watershed encompasses a total of 540 square miles, of which, approximately 335 square miles are within Massachusetts. The Blackstone River is formed in the City of Worcester by the confluence of the Middle River and Mill Brook. The mainstem flows generally southeast through Worcester, Millbury, Sutton, and Grafton to Fisherville Pond, where it converges with the Quinsigamond River. Below Fisherville Pond, the Blackstone River flows in a southerly direction through Northbridge, Uxbridge, Millville, and Blackstone and crosses for the first time into Rhode Island (RI). Just south of the RI border, it is joined by the Branch River, turns north and re-enters Massachusetts for a short distance, then turns south again and enters Woonsocket RI.

Land Use
The MassGIS Land Use datalayer has 37 land use classifications interpreted from 1:25,000 aerial photography. Coverage is complete statewide for 1971, 1985, and 1999. Additionally, more than half the state was interpreted from aerial photography flown during 1990, 1991, 1992, 1995 or 1997 (MassGIS 2005). The land use datalayers for the Blackstone River Watershed show forest (53%), residential (24%), and open land (7%) as being the top three land uses. Concentrations of urban, residential, and commercial land uses are found along the Blackstone River corridor.

Tributaries
Major tributaries that discharge to the Blackstone River in Massachusetts include the Quinsigamond, West, and Mumford rivers. The Mill and Peters rivers join the Blackstone River in Rhode Island. The 2003 water quality survey monitored at least one location on each of these major tributaries to the Blackstone River.

Quality Assurance and Quality Control
Procedures used were consistent with the prevailing DWM sampling protocols that are described in the CN 1.21 - *Sample Collection Techniques for DWM Surface Water Quality Monitoring* (MA DEP 2004). For all water quality surveys, quality control samples (field blanks and sample splits) were taken at a minimum of one each per analyte per crew per survey. All water quality and bacteria samples were delivered to the WES laboratory for analysis.

DWM quality assurance and database management staff reviewed lab data reports and all multi-probe data. The data were validated and finalized per data validation procedures outlined in CN 56.2 - *DWM Data Validation Standard Operating Procedure* (MA DEP 2005a). All water sample data were validated by reviewing QC sample results, analytical holding time compliance, QC sample frequency and related ancillary data/documentation (at a minimum). A complete summary of censoring and qualification decisions for all 2003 DWM data is provided in the CN 211.0 – *2003 DWM Data Validation Report* (MA DEP 2005b). Appendix 2 of this technical memorandum contains data censoring/qualification decisions for the 2003 Blackstone River data. Definitions for the data qualifiers are included in Appendix 3.

Field and Analytical Methods
Information pertaining to station location, rationale, and objectives is available in the 2003 QAPP (CN 127.0, MADEP 2003). *In- situ* parameters measured using a multiprobe included dissolved oxygen, percent saturation, pH, conductivity, temperature, and total dissolved solids. Wade-in grab samples were also collected and sent to Wall Experiment Station (WES) in Lawrence, MA where they were analyzed for low-level total phosphorus (TP), total suspended solids (TSS), *E. coli* and fecal coliform bacteria, and ammonia as nitrogen (NH_3-N).

Prior to the collection of samples, riparian vegetation, observed uses, potential pollution sources, the presence/absence of objectionable deposits (trash and debris and scum), the percentage of periphyton/algae/aquatic plants covering the sampling reach, and sampling conditions were recorded on DWM field sheets.

Procedures used for water sampling and sample handling are described in the *Sample Collection Techniques for DWM Surface Water Quality Monitoring* (MA DEP 2004). WES supplied all sample bottles and field preservatives, which were prepared according to the WES *Laboratory Quality Assurance Plan and Standard Operating Procedures* (MA DEP 2001).

The analytical methods, associated detection limits and project data quality objectives for water sample analyses at WES were as follows in 2003 (Table 2).

Table 2. WES Analytical Methods and Detection Limits

Water Quality Analyte	Method *	MDL **	RDL **
Hydrolab® Multiprobe Series 3 and (4)	DWM SOP (CN 4.2)	NA	NA
YSI 600 XLM	DWM SOP (CN 4.2)	NA	NA
Total Phosphorus	SM 4500-P-E	0.005 mg/L	0.015 mg/L
TSS	SM 2540 D	1.0 mg/L	1.0 mg/L
NH3-N	EPA 350.1	0.02 mg/L	0.06 mg/L
Fecal Coliform ***	SM 9222D	6 CFU/100mls	6 CFU/100mls
E. coli ***	EPA 1603 (also modified 1103.1)	6 CFU/100mls	6 CFU/100mls

" * " = "Methods for Chemical Analysis of Water and Wastes", Environmental Protection Agency, Environmental Monitoring Systems Laboratory – Cincinnati (EMSL-CI), EPA-600/4-79-020, Revised March 1983 and 1979 where applicable; Standard Methods, Examination of Water and Wastewater, 20th edition

" ** " = WES typically reports results down to the MDL with a qualifier

" *** " = MDL and RDL not listed for fecal and E. coli results; 6 CFUs/100 mls was the practical RDL for WES, as no results were reported below 6 (these were reported as "<6")

" NA " = Not Applicable

Station Observations

Station observations were recorded on field sheets for each survey by a DWM investigator. Station observations are described below for each DWM sampling event (see Table 1 for survey frequency).

KB10, Kettle Brook upstream/north of Earle Street, Leicester, MA.
Station KB10 was accessed approximately 400 meters from Earle Street, Leicester. The surrounding landuse is a protected public water supply area. The immediate landuse is predominately wetland habitat and forest. Throughout the sampling season, sparse to moderate filamentous green algae attached to rocks was observed. The water levels were observed to be normal during all surveys.

KB02, Unnamed tributary upstream/southeast of Oxford Street, Worcester, MA.
Station KB02 was accessed upstream of Oxford Street, Worcester, downstream from the outlet of Leesville Pond and adjacent to a liquor store parking lot. The surrounding landuse is mixed commercial and residential; directly along the banks is a small buffer of woody vegetation. Dense periphyton cover and filamentous green algae was observed on rocks during all surveys. Submerged milfoil and duckweed were also identified. The observable substrate consisted of coarse gravel and sand. The water levels were observed to be normal during all surveys.

RB01, Dark Brook downstream/north of Route 12, Auburn, MA.
Station RB01 was accessed from a parking lot adjacent to the brook of off Route 12. The brook is bordered by a parking lot on the right bank and playing fields on the left bank; there was a minimal riparian buffer zone which consisted of hardwoods. Some trash was observed on both banks and there was minimal erosion to both banks. Sparse periphyton and filamentous green algae was observed on rocks. Submerged milfoil was also observed. The water levels were observed to be normal during all surveys.

BLK00, Middle River upstream/west of the northern most crossing of Millbury Street, Worcester, MA.
Station BLK00 was sampled using a basket sampler from the Millbury Street Bridge crossing in Worcester. This station is in a highly urbanized area, which is predominately industrial. The river is channelized at this location and the river substrate consisted of sand and silt. On every survey, trash and debris were observed on the river bottom and the water column appeared slightly turbid. By the 27 August survey the river water level had dropped to low and appeared normal again by the 2 October survey.

BB01, Beaver Brook upstream/northwest of Park Avenue, Worcester, MA.
Station BB01 was accessed upstream of the Park Avenue street crossing. The surrounding landuse is highly urbanized; commercial and residential. The river is bordered by a small riparian buffer of shrubs and hardwoods. Both banks and the river bottom were littered with trash and debris; additionally, an oil sheen, floating toilet paper, and soap scum were observed on several surveys. The bottom substrate consisted of sand, silt, and mud; moderate amounts filamentous green algae were also observed on the river bottom. The water levels were observed to be normal during all surveys.

MB01, Mill Brook 100 feet downstream/northeast of Millbury Street at end of CSO pipe/confluence with Middle River forming the Blackstone River, Worcester, MA.
Station MB01 was accessed at the corner of Ballard Street and Millbury Street. The surrounding landuse is highly urbanized. This brook is completely culverted at this location; therefore, field observations were not applicable.

Station 1, Blackstone River approximately 60 feet upstream/north of Upper Blackstone WWTP effluent channel confluence, Millbury, MA.
Station 1 was accessed along the bike path in Millbury. The surrounding landuse (adjacent to Route 146) is industrial and commercial. The river substrate consisted of sand and cobble. The water column appeared to be slightly turbid at the time of sampling (26 September – one survey) and the river water level was observed to be normal.

W1255, Blackstone River downstream/south of Route 90 overpass, directly upstream of the Worcester Flood Diversion Channel, Millbury, MA.
Station W1255 was accessed along the bike path in Millbury. The surrounding landuse (adjacent to Route 146) is industrial and commercial. The river substrate consisted of sand and silt and sparse submerged aquatic macrophytes were observed. The river water level was observed to be normal at the time of sampling (26 September – one survey).

W1256, Blackstone River downstream/south of Route 90 overpass, directly downstream of the Worcester Flood Diversion Channel, Millbury, MA.
Due to the close proximity to Station W1255 (< 50 meters), this station has the same observations.

BLK02, Blackstone River upstream/northwest of McCracken Road, Millbury, MA.
Station BLK02 was accessed along the bike path in Millbury. The surrounding landuse (adjacent to Route 146) is industrial and commercial. Throughout the survey season, the bike path construction (landscaping activities and bank stabilization along river) was ongoing. A strong effluent odor was noted during each survey at this site. As the summer progressed, the macrophyte cover increased dramatically. The river substrate consisted of coarse gravel and boulders. The water levels were observed to be normal during all surveys.

W1259, Blackstone River upstream at the Millbury WWTP discharge pipe, Millbury, MA.
Station W1259 was accessed through the property of the Millbury WWTP. This site was sampled one time using a multiprobe. The surrounding landuse is a mix of residential, industrial, and forest. The river is wide and deep at this location and both banks were thickly vegetated. The river level was normal at the time of this survey (26 September – one survey).

W1257, Blackstone River approximately 50 feet upstream/northwest of Blackstone Street (in Singing Dam impoundment), Sutton, MA.
Station W1257 was accessed upstream of the Singing Dam from the left bank. This site was sampled one time using a multiprobe. The surrounding landuse is a mix of residential, industrial, and forest. The river is wide and deep at this location and both banks were thickly vegetated. The river level was normal at the time of this survey (26 September – one survey).

BS12, Blackstone River downstream/south of Singing Dam, Blackstone Street, Sutton, MA.
Station BS12 was accessed along a resident property off Blackstone Street. The surrounding landuse is a mix of residential, industrial, and forest. An effluent odor was noted during each survey at this site. The river substrate consisted of cobble and boulders. There was moderate periphyton cover on rocks, and sparse macrophyte cover. Both banks were vegetated with hardwoods and low shrubs and there was minimal shoreline erosion on both banks (more on right bank). The water levels were observed to be normal during all surveys.

W1258, Blackstone River downstream of Waters Street, Millbury, MA.
Station W1258 was sampled using a basket sampler from the Waters Street Bridge crossing in Millbury. The surrounding landuse is industrial and residential. Dense aquatic vegetation was observed and a slight effluent odor was noted. The water levels were observed to be normal during all surveys.

BLK07A, Blackstone River upstream/northwest of Sutton Street, Northbridge, MA.
Station BLK07A was sampled using a basket sampler from the Sutton Street Bridge crossing in Northbridge. The surrounding landuse is mix of residential and industrial. The right bank consisted of hardwoods and shrubs, a large mill is located on the left bank and there was minimal erosion on both banks. A slight chlorine odor was noted during the surveys. Moderate cover of periphyton was observed on rocks. The water levels were observed to be normal during all surveys.

BLK07B, A channel discharging from northeast bank upstream at Sutton Street, Northbridge, MA.
Station BLK07B was accessed along the mill property from the right bank of the Blackstone River off of Sutton Street. This station is only a few meters upstream of Station BLK07A; therefore the station observations are the same. This site was a sampled once for bacteria because the water flowing from the under the mill building appeared highly turbid.

QU05, Quinsigamond River downstream at Pleasant Street, Grafton, MA.
Station QU05 was accessed downstream of Pleasant Street in Grafton. The surrounding landuse is predominately residential. There was some erosion on the left bank from road runoff and recreational activity (fishing access). There were sparse amounts of macrophyte cover and periphyton cover on rocks. The river substrate consisted of sand, cobble, and boulders. The water levels were observed to be normal during most surveys (noted as low during the 27 August survey).

W0670, Blackstone River at sluiceway north of East Hartford Avenue, Uxbridge, MA.
This station was sampled once for bacteria and was dropped for the remainder of the survey season due to access issues.

BLK09-08A, Mumford River upstream at Manchaug Street, Douglas, MA.
Station BLK09-08 was accessed upstream of the Manchaug Street crossing in Douglas (adjacent to a residential property). The surrounding landuse is predominately residential. The river substrate was a mix of cobble, boulder, sand and silt. There was sparse periphyton cover attached on rocks. The river water levels were normal during most of the surveys (high water levels were observed on 25 June low river water levels were observed on 27 August).

MF03A, Mumford River south of Gilboa Street, approximately 500 feet downstream/northeast of Gilboa Pond, downstream of wastewater treatment plant diffuser pipes, Douglas, MA.
Station MF03A was accessed along Gilboa Street, downstream from an impoundment. The surrounding landuse is a mix of commercial, industrial, and residential. The river substrate was a mix of cobble, gravel, and silt. The left bank is adjacent to the road and the right bank consisted of hardwoods and low shrubs. There was sparse macrophyte cover noted on 27 August and the water column appeared slightly turbid. The water levels were observed to be normal during most surveys (noted as high on 25 June and low on 27 August).

MF07, Mumford River downstream at Mendon Street (Route 16), downstream of Capron Pond, Uxbridge, MA.
Station MF07 was accessed by driving behind a yarn shop property off of Depot Street and sampling next to a small dock in the river. The surrounding landuse is commercial and residential. The river substrate consisted of sand and cobble and the left bank was adjacent to a parking area and the right bank was buffered by hardwoods (there was a stone wall along the right bank). There was sparse periphyton cover attached on rocks. The water levels were observed to be normal during the April and May surveys and were noted as high on 25 June and low on 23 July, 27 August, and the 2 October surveys.

WR12, West River upstream at Hartford Avenue South, Upton, MA.
Station WR12 was accessed upstream of the road crossing. The surrounding landuse is residential and some agricultural. Bottom substrates were unobservable due to water depth and the both banks were buffered by hardwoods and low shrubs. The river water levels were observed to be normal during all surveys.

WR03, West River upstream/north of East Hartford Street, Uxbridge, MA.
Station WR03 was accessed upstream from the East Hartford Avenue road crossing. The surrounding landuse is residential and forested. The river is bordered by extensive wetlands at this station and the river bottom was unobservable due to water depths. The river water levels were observed to be normal during all surveys.

WR05, West River upstream at Helca Street, Uxbridge, MA.
Station WR05 was accessed upstream of the Hecla Street road crossing. The surrounding landuse is residential. Hardwoods and low shrubs border both river banks; the left bank is adjacent to a road and the right bank is adjacent to a residential property. Moderate to dense periphyton cover was attached on rocks. The river substrate was a mix of cobble, gravel, and silt. The river water levels were normal during most of the surveys (low river water levels were observed on 27 August).

BLK12B, Blackstone River approximately 260 feet upstream/west of Central Street (above braid), Millville, MA.
Station BLK12B was accessed by walking down to the braid in the river upstream of the road crossing. The surrounding landuse is residential and commercial. Bottom substrates were unobservable due to water depths, both river banks were buffered by hardwoods, and the river was deep and wide at this location. A slightly turbid water column was observed during most surveys. The water levels were observed to be normal during surveys (noted as high on 25 June and low on 27 August survey).

BS19, Blackstone River upstream at Bridge Street/Canal Street (upstream of dam), Blackstone, MA.
Station BS19 was sampled using a basket sampler from the Bridge Street/Canal Street Bridge crossing in Blackstone. The surrounding landuse is residential and commercial. The river is deep and wide at this location, therefore, bottom substrate observations were unobservable. The river was channelized by a rock wall. The river water levels were observed to be normal during all surveys.

ML01, Mill River downstream at Route 16 (Mendon Street), Hopedale, MA.
Station ML01 was accessed downstream of Mendon Street adjacent to a residential property. The surrounding landuse is predominately residential and commercial. Both river banks were buffered by hardwoods, low shrubs, and residential properties. The river substrate consisted of cobble, boulder, sand and sparse filamentous algae on rocks were observed. A large amount of sand deposits were observed in the river during all surveys. The water levels were observed to be normal during most surveys (was noted as high during the 25 June survey).

BLK15-1, Mill River upstream/northwest of Summer Street (Park Street), Blackstone, MA.
Station BLK15-1 is accessed along a recreational area off of Summer Street in Blackstone. The surrounding landuse is residential. The left river bank was buffered by hardwoods and low shrubs. A picnic area was adjacent to the right bank. Sparse periphyton cover was observed attached on rocks. The river substrate was a mix of cobble and gravel. The water levels were observed to be normal during most surveys (was noted as high on 25 June and low on 27 August survey).

PR01, Peters River upstream at Paine Street, Bellingham, MA.
Station PR01 was accessed upstream of Paine Street from a commercial property adjacent to the right bank. The surrounding landuse is a mix of commercial and residential. The left river bank is bordered by a stone wall next to a residential property and the left river bank has no riparian buffer and is adjacent to a parking area. The bottom substrate consisted of gravel, cobble, and sand. Slightly turbid conditions in the water column were observed on 23 July. The water levels were observed to be normal during the April and May surveys, high on 25 June and 23 July, and low on 27 August.

Survey Conditions
Information on precipitation and stream discharge were analyzed to determine hydrologic conditions leading up to and during the water quality sampling events (this is not inclusive of 3 October and 6 October, UBWPAD emergency sewage bypass event). Additionally, this review was used to determine whether the bacteria data were representative of "wet" or "dry weather" sampling conditions. Climate data were collected from the National Weather Service's website (http://www.erh.noaa.gov/box/dailystns.shtml) (NOAA 2005). One weather station precipitation gage was used to determine precipitation and weather conditions for five days prior to and on the sampling dates: Worcester Regional Airport, Worcester, MA (Table 3). Streamflow data were obtained from three continuous USGS stream gages in the watershed [Table 4, Blackstone River at West Main Street in Millbury (01109730), Quinsigamond River at North Grafton (01110000), and Blackstone River at Northbridge (01110500)]. Survey conditions are described below for each DWM sampling date.

23 April 2003 - Field notes indicated a slightly breezy day, cloudy skies, and air temperatures between 40°F and 50°F. One day prior to the sampling date (22 April) 0.23 inches of rain fell. This precipitation led to increase in discharge at the Quinsigamond gage (63 cfs to 70 cfs) and the Blackstone River gage in Northbridge (344 cfs to 360 cfs) for the sampling date. The Blackstone River gage in Millbury (located in the headwaters of the watershed) showed an increase in flow on the day prior to sampling and receded slightly on the sample date (202 cfs to 196 cfs). Additionally, rain fell on the sampling date (0.02 inches). There was no precipitation from 18 April to 21 April. This bacteria-only survey is considered to be conducted during wet weather.

21 May 2003 - Field notes indicated a drizzly day, overcast skies, with the air temperatures in the 60°F range. There was some precipitation on the sample date (0.14 inches), however, both the Quinsigamond gage (27 cfs to 26 cfs) and the Blackstone River gage in Northbridge (104 cfs to 102 cfs) showed a decrease in flow. The Blackstone River gage in Millbury (located in the headwaters of the watershed) showed a slight increase in flow on the sample date (95 cfs to 96 cfs). There was no precipitation five days prior to the sample date. This water quality survey is considered to be conducted during dry weather.

25 June 2003 - Field notes indicated clear skies and air temperatures between 70°F and 80°F. Three days prior to the sample date a significant rainfall occurred (2.06 inches); precipitation also occurred four days prior (0.28 inches) and two days prior (0.11 inches) to the samples date. All three streamflow gages recorded significant increases in flow three and two days prior to the sample date. However, flows had significantly decreased by the sample date. This water quality survey is considered to be conducted during wet weather.

26 June 2003 - This pre-dawn survey was conducted during wet weather, as was the 25 June survey above. Field notes indicated cloudy skies and air temperatures between 60°F and 70°F. There was no precipitation two days prior to the sample date.

23 July 2003 - Field notes indicated overcast skies and air temperatures in the 70°F range. Rain fell on the sample date but after samples had been collected. However, there was precipitation on five, four, two days prior to the sample date, and there was 0.51 inches of rainfall one day prior to the sample date. Both the Blackstone River gages showed an increase in flow on the sample date, however, the Quinsigamond River gage showed a slight decrease (218 cfs to 176 cfs). Overall, due to the frequency of precipitation during the five days leading up to the sample date, all gages showed an increase in flow from the beginning of the five days prior to the sample date. This water quality survey is considered to be conducted during wet weather.

24 July 2003 - This pre-dawn survey was conducted during wet weather, as was the 23 July survey above. Field notes indicated light rain that started halfway through the survey and air temperatures between 60°F and 70°F. There was 0.36 inches of rainfall one day prior to the sample date.

27 August 2003 - Field notes indicated a windy day, clear skies, and air temperatures in the 80°F range. The five days prior to sampling were dry with the exception of trace amounts of precipitation on day five and three prior to the sample date. This water quality survey is considered to be conducted during dry weather.

28 August 2003 - This pre-dawn survey (bacteria was also collected during this survey) was conducted during dry weather, as was the 27 August survey. Field notes indicated cloudy skies and air temperatures between 60°F and 70°F. There was no precipitation one day prior to the sample date.

12 September 2003 - Field notes indicated clear skies, calm winds, and air temperatures in the 60°F range. No precipitation fell over the five days prior to the sampling date. Therefore, this multiprobe-only survey is considered to be conducted during dry weather.

18 September 2003 - Field notes indicated clear skies, calm winds, and air temperatures in the 60°F range. Two days prior to the sample date, 0.55 inches of rain fell, there was also some precipitation on four and three days prior to the sample date. All three gages showed an increase in flow from the 0.55 inches of rainfall that occurred two days prior to the sample date. This multiprobe-only survey is considered to be conducted during wet weather.

26 September 2003 - Field notes indicated cloudy skies, a slight breeze, and air temperatures in the 60°F range. Only one rain event occurred during the five days prior to the sample date; three days prior to sampling 1.63 inches of rain fell. All three gages showed an increase in flow after this rain event; the flows had slightly decreased by the time multiprobe measurements were taken on the sample date. This multiprobe-only survey is considered to be conducted during wet weather.

2 October 2003 - Field notes indicated clear skies, calm winds, and air temperatures in the 60°F range. Trace amounts of precipitation fell throughout the five days prior to the sample date. According to all the field sheets, the river levels were observed to be normal and there was no rain recorded during the sampling event. Therefore, this water quality survey is considered to be conducted during dry weather.

Table 3. 2003 Precipitation data summaries for MA DEP DWM surveys obtained from the NOAA website (http://www.erh.noaa.gov/box/dailystns.shtml) for Worcester Regional Airport, Worcester, MA.

Blackstone River Watershed Survey
Precipitation Data Summary (reported in inches of rain)

Survey Dates	5 Days Prior	4 Days Prior	3 Days Prior	2 Days Prior	1 Day Prior	Sample Date
4/23/2003	0.00	0.00	0.00	T	0.23	0.02
5/21/2003	0.00	0.00	0.00	0.00	0.00	0.14
6/25/2003	T	0.28	2.06	0.11	T	0.00
6/26/2003	0.28	2.06	0.11	T	0.00	0.00
7/23/2003	0.39	0.39	0.00	0.02	0.51	0.36
7/24/2003	0.39	0.00	0.02	0.51	0.36	0.02
8/27/2003	0.09	0.00	0.00	T	0.00	0.00
8/28/2003	0.00	0.00	T	0.00	0.00	0.00
9/12/2003	0.00	0.00	0.00	0.00	0.00	0.00
9/18/2003	0.00	0.04	0.09	0.55	0.00	0.00
9/26/2003	0.00	0.00	1.63	0.00	0.00	0.02
10/2/2003	0.01	0.26	0.02	0.01	T	T

" T " = Trace amount of precipitation measured

Table 4. USGS gage data summaries in the Blackstone River Watershed for the 2003 MA DEP DWM surveys (Socolow *et al*. 2004).

Blackstone River Watershed Survey USGS Flow Data Summary (reported in cubic feet per second)						
Survey Dates	5 Days Prior	4 Days Prior	3 Days Prior	2 Days Prior	1 Day Prior	Sample Date
Blackstone River at West Main Street in Millbury, MA (01109730)						
4/23/2003	214	199	188	180	202	196
5/21/2003	114	108	100	99	95	96
6/25/2003	168	153	853	1,040	549	373
6/26/2003	153	853	1,040	549	373	291
7/23/2003	89	177	93	81	116	164
7/24/2003	177	93	81	116	164	118
8/27/2003	99	88	64	63	60	60
8/28/2003	88	64	63	60	60	57
9/12/2003	71	71	68	66	63	55
9/18/2003	49	49	52	155	119	104
9/26/2003	66	56	414	226	124	93
10/2/2003	77	87	70	--	65	54
Quinsigamond River at North Grafton, MA (01110000)						
4/23/2003	77	71	67	62	63	70
5/21/2003	36	33	31	30	27	26
6/25/2003	49	43	111	243	218	176
6/26/2003	43	111	243	218	176	140
7/23/2003	17	27	26	21	23	34
7/24/2003	27	26	21	23	34	33
8/27/2003	20	27	23	18	16	15
8/28/2003	27	23	18	16	15	12
9/12/2003	14	12	10	8.7	7.7	6.7
9/18/2003	6.2	6.0	5.8	20	21	18
9/26/2003	20	17	23	57	49	40
10/2/2003	28	27	23	--	19	18
Blackstone River at Northbridge, MA (01110500)						
4/23/2003	399	377	366	353	344	360
5/21/2003	119	113	109	107	104	102
6/25/2003	373	340	918	2,030	1,360	861
6/26/2003	340	918	2,030	1,360	861	582
7/23/2003	94	124	106	98	115	124
7/24/2003	124	106	98	115	124	123
8/27/2003	97	106	94	91	91	98
8/28/2003	106	94	91	91	98	90
9/12/2003	141	190	177	133	130	119
9/18/2003	85	84	84	105	104	104
9/26/2003	93	89	141	310	148	107
10/2/2003	96	99	94	--	--	--

" – " Data not available

Water Quality Data

Raw data files, field sheets, lab reports and chain of custody (COC) records are stored in open files at the DWM in Worcester. All DEP DWM water quality data are managed and maintained in the *Water Quality Data Access Database*. Data exports for publishing are provided by DWM's database manager. Tables 5 – 8 below are data exports for the Blackstone River Watershed. Data validation procedures are described in Appendix 2. Data qualifiers are listed at the bottom of each table and in Appendix 3.

Table 5. 2003 MA DEP Blackstone River Watershed *in-situ* multiprobe Data.

OWMID (sample ID), Temp (Temperature), pH, Conductivity, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), and Percent Saturation

Kettle Brook (SARIS: 5132800) Unique ID: W0510 Station: KB10, Mile Point: 8.3

Description: upstream/north of Earle Street, Leicester

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0137	08:18	0.3	15.2	6.8 u	168	109	10.1	101
6/26/2003	51-0203	01:57	0.7	24.8	6.9 c	168	109	7.7	93
7/24/2003	51-0247	01:46	0.3	23.6	7.1 u,c	168	109	8.0	94
8/28/2003	51-0291	02:41	0.5	18.1	7.0 c	110	71.0	8.7	92
10/2/2003	51-0323	08:18	0.6	16.0	7.1 c	185	120	9.6	98

Unnamed Tributary Unique ID: W0501 Station: KB02, Mile Point: 0.09

Description: upstream/southeast at Oxford Street, Worcester (Outlet Leesville Pond, inlet Curtis Pond, tributary to Middle River)

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0139	08:49	0.4	18.8	7.3 u,c	326	212	9.6	103
6/26/2003	51-0204	02:25	0.5	24.3	6.8	223	145	7.3	88
7/24/2003	51-0250	02:15	0.5	23.9	7.2 c	400	260	7.7	92
8/28/2003	51-0292	03:11	0.7	22.5	7.1 c	447	290	7.7	89
10/2/2003	51-0325	08:46	1.0	15.0	7.0 u,c	394	256	9.4 u	93 u

Dark Brook (SARIS: 5132825) Unique ID: W0504 Station: RB01, Mile Point: 1.0

Description: downstream/north of Route 12, Auburn

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0143	09:10	0.3	17.1	6.9 c	442	288	8.9	93
6/26/2003	51-0205	02:44	0.3	22.4	6.7	267	173	7.6	88
7/24/2003	51-0249	02:33	0.3	23.0	7.0 c	363	236	7.2	84
8/28/2003	51-0293	03:29	0.2	22.0	7.0 c	738 c	480 c	7.3	84
10/2/2003	51-0329	09:07	0.2	14.4	6.8 u	336	218	8.2	80

Middle River (SARIS: 5132775) Unique ID: W0502 Station: BLK00, Mile Point: 0.1, Mile Point: 0.05

Description: upstream/west at the northern most crossing of Millbury Street, Worcester

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0145	09:33	0.5	16.9	7.1 c	421	274	9.5	98
6/26/2003	51-0206	03:07	0.2	23.8	7.0 c	256	166	7.9	94
7/24/2003	51-0248	02:54	0.3	23.4	7.3 c	392	255	7.9	92
8/28/2003	51-0294	03:55	0.3	21.6	7.3 c	489	318	8.1	92
9/12/2003	51-0311	09:43	0.1 i	17.7	7.2 u	517	336	9.1	96
9/18/2003	51-0315	07:14	0.3	19.0	7.1 u,c	519	337	8.9	96
10/2/2003	51-0331	09:32	0.3	14.0	7.1 u,c	415	270	9.8	95

Table 5 (continued). 2003 MA DEP Blackstone River Watershed *in-situ* multiprobe Data.

Beaver Brook (SARIS: 5133000) Unique ID: W0499 Station: BB01, Mile Point: 0.1
Description: upstream/northwest at Park Avenue, Worcester

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0135	07:51	0.3	12.2	6.8	523	340	9.3	87
6/26/2003	51-0202	01:25	0.3	15.4	6.7	480	312	8.5	85
7/24/2003	51-0246	01:18	0.3	19.0	6.8	397	258	7.4	80
8/28/2003	51-0290	02:16	0.3	17.2	6.8 u	493	321	7.3	76
10/2/2003	51-0321	07:52	0.4	14.9	6.7 u	463	301	5.9	59

Unnamed Tributary Unique ID: W1024 Station: MB01, Mile Point: 0.01
Description: at mouth of unnamed tributary to Blackstone River locally known as Mill Brook, approximately 100 feet downstream/northeast of Millbury Street, Worcester.

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
9/12/2003	51-0312	09:55	0.2	19.2	7.1	1,145 c	744 c	7.4	80
9/18/2003	51-0316	07:27	0.4	20.4	7.4 c	598	389	8.9	99

Blackstone River (SARIS: 5131000) Unique ID: W1240 Station: Station 1, Mile Point: 29.4
Description: approximately 60 feet upstream/north of Upper Blackstone WWTP effluent channel confluence, Millbury

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
9/26/2003	51-0364	07:35	0.4	18.5	7.0 u,c	444	289	7.8	84

Blackstone River (SARIS: 5131000) Unique ID: W1255 Station: W1255, Mile Point: 29.2
Description: downstream/south of Route 90 overpass, directly upstream of the Worcester Flood Diversion Channel, Millbury

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
9/26/2003	51-0365	07:49	0.8	20.0	6.9 c	594	386	6.5	71

Blackstone River (SARIS: 5131000) Unique ID: W1256 Station: W1256, Mile Point: 29.2
Description: downstream/south of Route 90 overpass, directly downstream of the Worcester Flood Diversion Channel, Millbury

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
9/26/2003	51-0366	07:58	0.5	19.9	6.9 c	587	381	6.4	71

Blackstone River (SARIS: 5131000) Unique ID: W0505 Station: BLK02, Mile Point: 28.9
Description: upstream/northwest at McCracken Road, Millbury

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0147	09:52	0.4 u	16.4	7.0 c	740 c	481 c	7.9	81
6/26/2003	51-0207	03:30	1.0	21.3	6.8	492	320	6.4	72
7/24/2003	51-0251	03:14	0.6	22.7	6.9 c	501	326	4.9	56
8/28/2003	51-0295	04:18	0.7	22.0	6.9 c	782 c	508 c	2.5	29
9/12/2003	51-0310	07:28	0.3	19.7	6.8 u,c	757 c	492 c	1.5 u	17 u
9/12/2003	51-0445	10:16	0.5	20.7	6.9	755 c	491 c	4.2	47
9/18/2003	51-0317	07:45	0.5	20.0	6.9 c	636	413	5.5	60
9/26/2003	51-0367	08:13	0.3	19.8	6.9 c	597	388	5.8	64
10/2/2003	51-0333	09:58	0.5	18.6 u	6.9 c	725 c	471 c	5.9	63

Blackstone River (SARIS: 5131000) Unique ID: W1259 Station: W1259, Mile Point: 25.6
Description: directly upstream at the Millbury WWTP discharge pipe, Millbury

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
9/18/2003	51-0447	08:30	0.4	19.5	6.9 c	591	384	6.9	75

Table 5 (continued). 2003 MA DEP Blackstone River Watershed *in-situ* multiprobe Data.

Blackstone River (SARIS: 5131000) Unique ID: W1257 Station: W1257, Mile Point: 24.9
Description: approximately 50 feet upstream/northwest of Blackstone Street (in Singing Dam impoundment), Sutton

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
9/18/2003	51-0319	08:48	0.8	19.2	6.8	595	387	4.9	53

Blackstone River (SARIS: 5131000) Unique ID: W1017 Station: BS12, Mile Point: 24.9
Description: downstream/south of Singing Dam, Blackstone Street, Sutton

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0149	10:15	0.3 u	16.1	7.3 c	706	459	9.5	97
6/26/2003	51-0208	03:53	0.4 u	21.7	7.0 c	480	312	8.4	95
7/24/2003	51-0252	03:35	0.2 u	22.4	7.1 c	514	334	7.6	88
8/28/2003	51-0296	04:43	0.5	21.7	7.0 c	737 c	479 c	7.4	84
9/12/2003	51-0314	11:10	0.4	19.4	7.0	734 c	477 c	7.3	80
10/2/2003	51-0335	10:21	0.5	16.5	7.2 c	684	445	8.7	89

Blackstone River (SARIS: 5131000) Unique ID: W1258 Station: W1258, Mile Point: 27.7
Description: Waters Street, Millbury

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
9/12/2003	51-0446	10:33	0.4	19.7	6.9	758 c	493 c	4.1	45
9/18/2003	51-0318	08:02	0.6	19.8	6.8	635	413	2.9	31
9/26/2003	51-0368	08:31	0.4	19.4	6.9 c	591	384	5.0	55

Blackstone River (SARIS: 5131000) Unique ID: W0506 Station: BLK07-A, Mile Point: 18.4
Description: upstream/northwest of the Sutton Street bridge, Northbridge

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
6/26/2003	51-0210	04:37	0.3	22.2	6.9 c	447	290	7.5	87
7/24/2003	51-0254	04:11	0.5 u	22.4	7.2 c	518	336	7.4	85
8/28/2003	51-0298	05:23	0.9	21.4	7.1 c	656	426	7.5 u	85 u
10/2/2003	51-0339	11:01	1.2	16.0	7.2 c	608	395	9.5	97

Quinsigamond River (SARIS: 5132425) Unique ID: W1018 Station: QU05, Mile Point: 0.8
Description: Pleasant Street, Grafton

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0151	08:12	0.3	17.8	7.1 c	651	423	9.0	95
6/26/2003	51-0209	04:18	0.3	23.7	6.7	483	314	5.9	70
7/24/2003	51-0253	03:55	0.6	23.9	7.0 u,c	506	329	6.6	79
8/28/2003	51-0297	05:06	0.6	21.9	7.0 u,c	502	326	6.8	78
10/2/2003	51-0337	10:44	0.6	15.9	7.3 u,c	496	323	9.1	92

Mumford River (SARIS: 5132050) Unique ID: W1062 Station: BLK09-8A, Mile Point: 11.1
Description: Manchaug Street, Douglas

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0156	11:32	0.3	16.1	6.4	94.0	61.0	9.4	95
6/26/2003	51-0212	01:43	0.6	21.8	6.3	81.0	53.0	7.5	85
7/24/2003	51-0256	01:41	0.7	22.1	6.4 u	89.0	58.0	7.7	88
8/28/2003	51-0300	02:41	##,i,m	22.5	6.4	82.0	53.0	7.6	88
10/2/2003	51-0343	08:00	0.2	14.6	6.3 u	86.0	56.0	8.9	88

Table 5 (continued). 2003 MA DEP Blackstone River Watershed *in-situ* multiprobe Data.

Mumford River (SARIS: 5132050) Unique ID: W1025 Station: MF03A, Mile Point: 8.6
Description: south of Gilboa Street, approximately 500 feet downstream/northeast of Gilboa Pond, downstream of wastewater treatment plant diffuser pipes, Douglas

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0158	12:03	0.3	16.9	6.9	142	92.0	9.9	102
6/26/2003	51-0213	01:57	0.5 u	22.0	6.5	93.0	60.0	8.3	95
7/24/2003	51-0257	01:52	0.4	21.7	6.7 u	114	74.0	8.3	94
8/28/2003	51-0301	02:57	##,i,m	22.2	6.7	116	75.0	8.1	93
10/2/2003	51-0345	08:14	0.3	14.6	6.7	110	71.0	9.7	95

Mumford River (SARIS: 5132050) Unique ID: W1020 Station: MF07, Mile Point: 0.6
Description: Mendon Street (Route 16), downstream of Capron Pond, Uxbridge

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
6/26/2003	51-0216	02:56	0.3 u	23.2	6.6 u	136	88.0	8.2	96
7/24/2003	51-0260	02:47	0.5	24.5	6.9 u,c	180	117	7.8	93
8/28/2003	51-0304	03:59	0.4 i	23.1	7.0 c	178	115	8.1	95
10/2/2003	51-0353	09:21	0.3	15.6	7.0 c	156	102	9.9	99

West River (SARIS: 5131800) Unique ID: W1073 Station: WR12, Mile Point: 10.0
Description: Hartford Avenue South, Upton

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0154	09:30	0.3	15.3	6.6	317	206	9.5	95
6/26/2003	51-0211	04:54	0.5 u	20.4	6.3	171	111	7.6	84
7/24/2003	51-0255	04:27	1.0	21.5	6.7 u	230	150	7.5	85
8/28/2003	51-0299	05:48	0.8	18.2	6.9 u,c	211	137	8.4	89
10/2/2003	51-0341	11:27	1.1	13.5	6.9 u,c	310	201	8.4 u	80 u

West River (SARIS: 5131800) Unique ID: W0515 Station: WR03, Mile Point: 3.4
Description: upstream/north, of East Hartford Street bridge, Uxbridge

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
6/26/2003	51-0214	02:21	0.2 u	20.2	5.8	156	101	4.9	54
7/24/2003	51-0258	02:16	1.1	22.0	6.1 u	204	133	2.9 u	33 u
8/28/2003	51-0302	03:24	##,i,m	21.2	6.4	261	170	4.3	49
10/2/2003	51-0347	08:47	0.6	13.4	6.5	270	175	6.2 u	60 u

West River (SARIS: 5131800) Unique ID: W1019 Station: WR05, Mile Point: 0.6
Description: Helca Street, Uxbridge

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0165	08:27	0.4	17.0	6.5	274	175	8.5	89
6/26/2003	51-0215	02:42	0.4	20.6	6.0	152	99.0	7.4	83
7/24/2003	51-0259	02:34	1.3	22.7	6.6	234	152	7.5	87
8/28/2003	51-0303	03:42	##,i,m	20.0	6.7	249	162	7.2	79
10/2/2003	51-0349	09:06	0.5	14.1	6.7	271	176	8.5	83

Blackstone River (SARIS: 5131000) Unique ID: W1066 Station: BLK12B, Mile Point: 3.9
Description: approximately 260 feet upstream/west of Central Street (above braid), Millville

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0167	09:14	0.4	16.6	6.6 u	482	308	7.5 u	78 u
6/26/2003	51-0217	03:15	0.4	22.3	6.6	290	189	7.2	83
7/24/2003	51-0261	03:11	1.2	23.3	7.0 c	329	214	7.2	85
8/28/2003	51-0305	04:19	0.3 i	22.1	7.0 u,c	523	340	6.8	78
10/2/2003	51-0355	09:44	0.4	15.0	7.1 c	464	302	8.9	88

Table 5 (continued). 2003 MA DEP Blackstone River Watershed *in-situ* multiprobe Data.

Blackstone River (SARIS: 5131000) Unique ID: W1023 Station: BS19, Mile Point: 0.7
Description: Bridge Street/Canal Street (upstream of dam), Blackstone

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0169	09:45	1.0	17.8	6.6	442	283	7.1	75
6/26/2003	51-0218	03:34	0.4 u	22.2	6.7	261	170	7.9 u	91 u
7/24/2003	51-0262	03:26	2.4	23.6	7.1 c	323	210	7.3	86
8/28/2003	51-0306	04:36	0.5 i	22.5	7.2 c	462	300	8.1	93
10/2/2003	51-0357	10:05	1.7	15.2	7.2 c	406	264	9.7	96

Mill River (SARIS: 5131200) Unique ID: W1021 Station: ML01, Mile Point: 10.4
Description: Route 16 (Mendon Street), Hopedale

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0177	11:17	0.2	17.3	6.6	505	323	9.0	95
6/26/2003	51-0221	04:36	0.3	22.8	6.4	338	220	8.4	98
7/24/2003	51-0265	04:23	0.4	23.6	6.9 uc	422	274	7.8	92
8/28/2003	51-0309	05:36	0.2 i	20.1	6.7 u	493	321	6.9	76
10/2/2003	51-0363	11:13	0.3	17.1	7.0 uc	454	295	9.9	103

Mill River (SARIS: 5131200) Unique ID: W0508 Station: BLK15-1, Mile Point: 2.2
Description: upstream/northwest of Summer Street (Park Street), Blackstone

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0173	10:07	0.3	15.5	6.5	332	213	8.8	90
6/26/2003	51-0219	03:49	0.3	20.7	6.2	263	171	6.9	77
7/24/2003	51-0263	03:39	0.9	21.0	6.7 u	225	146	7.4	83
8/28/2003	51-0307	04:52	0.2 i	18.7	6.9 u,c	302	196	8.0	86
10/2/2003	51-0359	10:21	0.1 i	12.8	6.9 u,c	314	204	10.1	96

Peters River (SARIS: 5131125) Unique ID: W1022 Station: PR01, Mile Point: 0.6
Description: Paine Street, Bellingham

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
5/21/2003	51-0175	10:31	0.4	14.6	6.7	339	217	8.9	88
6/26/2003	51-0220	04:03	0.8	19.9	6.4	249	162	6.2 u	68 u
7/24/2003	51-0264	03:52	0.4	21.1	6.5	240	156	6.1	68
8/28/2003	51-0308	05:06	0.5 i	18.2	6.9 u,c	388	252	7.6 u	81 u
10/2/2003	51-0361	10:40	0.5	12.6	7.0 c	364	237	9.6 u	90 u

" ## " = Censored data (i.e., data that have been discarded for some reason).
" c " = Greater than calibration standard used for pre-calibration, or outside the acceptable range about the calibration standard. See Section Appendix 2 for acceptance criteria
" i " = Inaccurate readings from multiprobe likely
" m " = Method SOP not followed. (only partially implemented or not implemented at all) due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (e.g. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, missing data or deviations from field sampling SOPs.
" u " = Unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc

Table 6. 2003 MA DEP Blackstone River Watershed Instream Physico/Chemical and Bacteria Data. OWMID (sample ID), Fecal coliform, E. coli, Ammonia Nitrogen (NH3-N), Total Phosphorus (TP), and Total Suspended Solids (TSS)

Kettle Brook (SARIS: 5132800) Unique ID: W0510 Station: KB10, Mile Point: 8.3
Description: upstream/north of Earle Street, Leicester

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0111	--	08:04	<7	--	<7	--	--	--
5/21/2003	51-0136	--	08:15	13	--	6	<0.02 d	0.009	<1.0
6/25/2003	51-0179	--	08:18	10*	--	6*	<0.02	0.014	3.0 j
7/23/2003	51-0223	--	08:25	110	--	65	<0.02	0.014	1.1
8/27/2003	51-0267	--	08:18	--	--	--	<0.06	0.009 d	5.7
8/28/2003	51-0431	--	02:36	13 e	32 e	--	--	--	--
10/2/2003	51-0322	--	08:17	13 e	39 e	--	<0.02	0.008	<1.0

Unnamed Tributary Unique ID: W0501 Station: KB02, Mile Point: 0.09
Description: upstream/southeast at Oxford Street, Worcester (Outlet Leesville Pond, inlet Curtis Pond, tributary to Middle River)

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0112	--	08:25	26 e	--	32 e	--	--	--
5/21/2003	51-0138	--	08:46	45	--	26	<0.02 d	0.040	3.2
6/25/2003	51-0180	--	08:40	128*	--	50*	<0.02	0.041	2.4 j
7/23/2003	51-0224	--	08:50	100	--	73	<0.02	0.076	1.6
8/27/2003	51-0268	--	08:46	--	--	--	<0.06	0.064 d	7.3
8/28/2003	51-0430	--	03:08	39	13	--	--	--	--
10/2/2003	51-0324	--	08:44	##,j,r	##,j,r	--	<0.06	0.058	2.1

Dark Brook (SARIS: 5132825) Unique ID: W0504 Station: RB01, Mile Point: 1.0
Description: downstream/north of Route 12, Auburn.

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0113	--	08:35	190	--	77	--	--	--
5/21/2003	51-0140	51-0142	09:10	270	--	230	##,d	0.032	3.1
5/21/2003	51-0142	51-0140	09:10	260 e	--	290 e	##,d	0.030	2.7
6/25/2003	51-0181	51-0183	09:00	230*	--	140*	<0.02	0.039	3.2 j
6/25/2003	51-0183	51-0181	09:00	310*	--	144*	<0.02	0.035	3.4 j
7/23/2003	51-0225	51-0227	09:05	5600	--	1600	<0.02	0.070	4.7
7/23/2003	51-0227	51-0225	09:05	7000	--	1400	<0.02	0.069	4.5
8/27/2003	51-0269	51-0271	09:00	--	--	--	0.11	##,d	5.1
8/27/2003	51-0271	51-0269	09:00	--	--	--	0.10	##,d	5.5
8/28/2003	51-0427	51-0428	03:30	140	130	--	--	--	--
8/28/2003	51-0428	51-0427	03:30	170	100	--	--	--	--
10/2/2003	51-0326	51-0327	09:05	150	77	--	0.09	0.040	1.9
10/2/2003	51-0327	51-0326	09:05	140 e	180 e	--	0.09	0.043	1.9

Middle River (SARIS: 5132775) Unique ID: W0502 Station: BLK00, Mile Point: 0.05
Description: upstream/west at the northern most crossing of Millbury Street, Worcester

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0114	--	08:58	280 e	--	310 e	--	--	--
5/21/2003	51-0144	--	09:35	390 e	--	440 e	<0.06 d	0.050	7.0
6/25/2003	51-0184	--	09:37	1240*	--	420*	0.07	0.079	7.7 j
7/23/2003	51-0228	--	09:35	2400	--	2200	<0.06	0.058	6.8
8/27/2003	51-0272	--	09:20	--	--	--	<0.06	0.041 d	2.3
8/28/2003	51-0426	--	03:55	410	210	--	--	--	--
10/2/2003	51-0330	--	09:30	300	190	--	0.14	0.047	2.3

Table 6(continued). 2003 MA DEP Blackstone River Watershed Instream Physico/Chemical and Bacteria Data.

Beaver Brook (SARIS: 5133000) Unique ID: W0499 Station: BB01, Mile Point: 0.1
Description: upstream/northwest at Park Avenue, Worcester

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0110	--	07:43	850	--	770	--	--	--
5/21/2003	51-0134	--	07:45	670	--	670	0.26 d	0.040	1.4
6/25/2003	51-0178	--	07:53	2500*	--	450*	0.12	0.045	1.6 j
7/23/2003	51-0222	--	07:55	36000	--	31000	0.19	0.16	6.8
8/27/2003	51-0266	--	07:53	--	--	--	0.32	0.047 d	1.5
8/28/2003	51-0432	--	02:15	6600	2800	--	--	--	--
10/2/2003	51-0320	--	07:48	##,j,r	##,j,r	--	<0.02	0.12	2.5

Blackstone River (SARIS: 5131000) Unique ID: W0505 Station: BLK02, Mile Point: 28.9
Description: upstream/northwest at McCracken Road, Millbury

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0115	--	09:15	220	--	130	--	--	--
5/21/2003	51-0146	--	09:52	210	--	110	4.8 d	0.76	4.3
6/25/2003	51-0185	--	09:55	860*	--	142*	0.76	0.19	6.8 j
7/23/2003	51-0229	--	09:50	3800	--	890	0.58	0.30	3.1
8/27/2003	51-0273	--	09:39	--	--	--	4.7	0.46 d	1.5
8/28/2003	51-0425	--	04:15	530	490	--	--	--	--
10/2/2003	51-0332	--	09:55	210 a,m	90 a,m	--	2.2	##,h	4.9

Blackstone River (SARIS: 5131000) Unique ID: W1017 Station: BS12, Mile Point: 24.9
Description: downstream/south of Singing Dam, Blackstone Street, Sutton

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0116	51-0117	09:29	97 e	--	100 e	--	--	--
4/23/2003	51-0117	51-0116	09:29	230	--	100	--	--	--
5/21/2003	51-0148	--	10:20	290	--	250	4.2 d	1.1	3.1
6/25/2003	51-0186	--	10:20	450*	--	116*	0.47	0.18	5.7 j
7/23/2003	51-0230	--	10:10	880	--	560	0.35	0.35	1.7
8/27/2003	51-0274	--	09:55	--	--	--	1.9	0.50 d	1.4
8/28/2003	51-0424	--	04:41	130	120	--	--	--	--
10/2/2003	51-0334	--	10:17	84	45	--	1.4	##,h	1.6

Blackstone River (SARIS: 5131000) Unique ID: W0506 Station: BLK07-A, Mile Point: 18.4
Description: upstream/northwest of the Sutton Street bridge, Northbridge

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0120	--	10:05	190	--	150	--	--	--
5/21/2003	51-0152	--	08:40	110 f	--	110 f	--	--	--
6/25/2003	51-0188	--	10:58	540*	--	74*	0.20	0.16	8.3 j
7/23/2003	51-0232	--	10:50	600 e	--	680 e	0.19	0.30	12
8/27/2003	51-0276	--	10:33	--	--	--	0.08	0.36 d	4.8
8/28/2003	51-0422	--	05:23	2600	1200	--	--	--	---
10/2/2003	51-0338	--	11:00	590	430	--	0.22	0.69	8.6

Pipe/Discharge to Unnamed Tributary Unique ID: W1060 Station: BLK07B, Mile Point: 0.01
Description: channel discharging from northeast bank upstream at Sutton Street, Northbridge

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0420	--	**	280	--	270	--	--	--

Table 6(continued). 2003 MA DEP Blackstone River Watershed Instream Physico/Chemical and Bacteria Data.

Quinsigamond River (SARIS: 5132425) Unique ID: W1018 Station: QU05, Mile Point: 0.8
Description: Pleasant Street, Grafton

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0119	--	09:45	13	--	<7	--	--	--
5/21/2003	51-0150	--	08:15	39 e,f	--	45 e,f	<0.06 f	0.027 f	2.5 f
6/25/2003	51-0187	--	10:40	160*	--	52*	<0.02	0.027	1.9 j
7/23/2003	51-0231	--	10:30	200	--	130	<0.02	0.043	2.8
8/27/2003	51-0275	--	10:17	--	--	--	<0.02	0.017 d	2.8
8/28/2003	51-0423	--	05:05	84	26	--	--	--	--
10/2/2003	51-0336	--	10:42	13	<6	--	0.46	0.018	<1.0

Blackstone River/Rice City Pond (SARIS: 5131000) (PALIS: 51131) Unique ID: W0670 Station: 670, Mile Point: 12.5
Description: at sluiceway north of East Hartford Avenue, Uxbridge

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0124	--	08:44	310	--	190	--	--	--

Mumford River (SARIS: 5132050) Unique ID: W1062 Station: BLK09-8A, Mile Point: 11.1
Description: Manchaug Street, Douglas

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0122	--	08:03	<7	--	<7	--	--	--
5/21/2003	51-0155	--	11:42	19 e,f	--	26 e,f	<0.02 f	0.014 f	<1.0 f
6/25/2003	51-0190	--	08:10	180*	--	110*	<0.02	0.020	1.5 j
7/23/2003	51-0234	--	08:15	3400 e	--	4000 e	<0.02	0.040	2.5 d
8/27/2003	51-0278	--	08:30	--	--	--	<0.02	0.009	<1.0
8/28/2003	51-0444	--	02:41	45	32	--	--	--	--
10/2/2003	51-0342	--	07:57	39	6	--	<0.02	0.013	1.0

Mumford River (SARIS: 5132050) Unique ID: W1025 Station: MF03A, Mile Point: 8.6
Description: south of Gilboa Street, approximately 500 feet downstream/northeast of Gilboa Pond, downstream of wastewater treatment plant diffuser pipes, Douglas

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0123	--	08:14	130	--	39	--	--	--
5/21/2003	51-0157	--	12:05	##,f,j	--	##,f,j	<0.06 f	0.20 f	2.6 f
6/25/2003	51-0191	--	08:23	280*	--	200*	0.06	0.028	3.9 j
7/23/2003	51-0235	--	08:26	2000	--	1000	<0.06	0.056	3.4 d
8/27/2003	51-0279	--	08:45	--	--	--	<0.06	0.042	1.7
8/28/2003	51-0443	--	02:54	110	65	--	--	--	--
10/2/2003	51-0344	--	08:10	26 e	39 e	--	0.07	0.052	1.6

Mumford River (SARIS: 5132050) Unique ID: W1020 Station: MF07, Mile Point: 0.6
Description: Mendon Street (Route 16), downstream of Capron Pond, Uxbridge

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0127	51-0128	09:25	32	--	19	--	--	--
4/23/2003	51-0128	51-0127	09:25	26	--	13	--	--	--
6/25/2003	51-0194	51-0196	09:15	370*	--	200*	<0.02	0.037	1.7 j
6/25/2003	51-0196	51-0194	09:15	308*	--	250*	<0.02	0.039	1.6 j
7/23/2003	51-0238	51-0240	09:16	600	--	540	<0.02	0.046	2.5 d
7/23/2003	51-0240	51-0238	09:16	810	--	590	<0.02	0.041	<1.0 d
8/27/2003	51-0282	51-0283	09:45	--	--	--	<0.02	0.018	<1.0
8/27/2003	51-0283	51-0282	09:45	--	--	--	<0.02	0.023	<1.0
8/28/2003	51-0438	51-0439	03:59	77	65	--	--	--	--
8/28/2003	51-0439	51-0438	03:59	90	84	--	--	--	--
10/2/2003	51-0350	51-0351	09:19	71	52	--	<0.02	0.025	1.6
10/2/2003	51-0351	51-0350	09:19	65 e	71 e	--	<0.02	0.026	1.3

Table 6(continued). 2003 MA DEP Blackstone River Watershed Instream Physico/Chemical and Bacteria Data.

West River (SARIS: 5131800) Unique ID: W1073 Station: WR12, Mile Point: 10.0
Description: Hartford Avenue South, Upton

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0121	--	10:20	<7	--	<7	--	--	--
5/21/2003	51-0153	--	09:35	52 f	--	39 f	<0.06 f	0.028 f	2.8 f
6/25/2003	51-0189	--	11:28	170*	--	130*	<0.02	0.029	2.3 j
7/23/2003	51-0233	--	11:15	370	--	270	<0.02	0.048	2.1
8/27/2003	51-0277	--	10:52	--	--	--	<0.02	0.034 d	13
8/28/2003	51-0421	--	05:43	530	430	--	--	--	--
10/2/2003	51-0340	--	11:25	90	65	--	<0.02	0.031	2.3

West River (SARIS: 5131800) Unique ID: W0515 Station: WR03, Mile Point: 3.4
Description: upstream/north, of East Hartford Street bridge, Uxbridge

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0125	--	08:55	<7	--	<7	--	--	--
5/21/2003	51-0163	--	08:00	27	--	<7	--	--	--
6/25/2003	51-0192	--	08:43	250*	--	110*	<0.02	0.034	<1.0 j
7/23/2003	51-0236	--	08:50	210 e	--	240 e	<0.06	0.046	1.3 d
8/27/2003	51-0280	--	09:05	--	--	--	0.07	0.024	1.5
8/28/2003	51-0442	--	03:21	120	65	--	--	--	--
10/2/2003	51-0346	--	08:42	13 e	19 e	--	<0.02	0.030	<1.0

West River (SARIS: 5131800) Unique ID: W1019 Station: WR05, Mile Point: 0.6
Description: Helca Street, Uxbridge

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0126	--	09:07	27	--	13	--	--	--
5/21/2003	51-0164	--	08:25	52	--	19	<0.06 d	0.032	2.3
6/25/2003	51-0193	--	09:05	200*	--	200*	0.07	0.042	2.2 j
7/23/2003	51-0237	--	09:04	370 e	--	400 e	<0.02	0.053	4.1 d
8/27/2003	51-0281	--	09:20	--	--	--	<0.06	0.024	<1.0
8/28/2003	51-0441	--	03:39	58	26	--	--	--	--
10/2/2003	51-0348	--	09:00	40 e	60 e	--	<0.02	0.029	1.6

Blackstone River (SARIS: 5131000) Unique ID: W1066 Station: BLK12B, Mile Point: 3.9
Description: approximately 260 feet upstream/west of Central Street (above braid), Millville

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
5/21/2003	51-0166	--	09:05	39 e	--	45 e	0.29 d	0.25	4.8
6/25/2003	51-0197	--	09:40	830*	--	450*	0.09	0.13	5.4 j
7/23/2003	51-0241	--	09:33	2200	--	400	<0.02	0.37	33 d
8/27/2003	51-0285	--	10:05	--	--	--	0.08	0.11	1.7
8/28/2003	51-0437	--	04:16	90	39	--	--	--	--
10/2/2003	51-0354	--	09:40	370	190	--	<0.06	0.31	4.5

Blackstone River (SARIS: 5131000) Unique ID: W1023 Station: BS19, Mile Point: 0.7
Description: Bridge Street/Canal Street (upstream of dam), Blackstone

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0130	--	09:50	33	--	33	--	--	--
5/21/2003	51-0168	--	09:40	32	--	19	0.16 d	0.22	5.3
6/25/2003	51-0198	--	10:02	144*	--	130*	0.08	0.12	7.6 j
7/23/2003	51-0242	--	09:54	1400	--	1200	0.08	0.21	20 d
8/27/2003	51-0286	--	10:20	--	--	--	0.07	0.11	3.5
8/28/2003	51-0436	--	04:33	160	58	--	--	--	--
10/2/2003	51-0356	--	10:01	430	250	--	<0.06	0.23	3.5

Table 6(continued). 2003 MA DEP Blackstone River Watershed Instream Physico/Chemical and Bacteria Data.

Mill River (SARIS: 5131200) Unique ID: W1021 Station: ML01, Mile Point: 10.4
Description: Route 16 (Mendon Street), Hopedale

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0133	--	10:45	26	--	26	--	--	--
5/21/2003	51-0176	--	11:10	52	--	45	0.06 d	0.023	1.3
6/25/2003	51-0201	--	11:15	170*	--	30*	<0.06	0.029	1.8 j
7/23/2003	51-0245	--	10:47	4200	--	2000	<0.02	0.052	7.4 d
8/27/2003	51-0289	--	11:25	--	--	--	0.09	0.017	1.8
8/28/2003	51-0433	--	05:34	230	180	--	--	--	--
10/2/2003	51-0362	--	11:12	240	190	--	<0.06	0.018	<1.0

Mill River (SARIS: 5131200) Unique ID: W0508 Station: BLK15-1, Mile Point: 2.2
Description: upstream/northwest of Summer Street (Park Street), Blackstone

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0131	--	10:00	58 e	--	120 e	--	--	--
5/21/2003	51-0170	51-0172	10:00	58	--	39	##,d	0.051	2.7
5/21/2003	51-0172	51-0170	10:00	20 e	--	47 e	##,d	0.050	3.8
6/25/2003	51-0199	--	10:18	280*	--	154*	0.07	0.047	3.3 j
7/23/2003	51-0243	--	10:05	4200	--	3600	<0.02	0.11	21 d
8/27/2003	51-0287	--	10:38	--	--	--	0.08	0.028	1.3
8/28/2003	51-0435	--	04:49	220	97	--	--	--	--
10/2/2003	51-0358	--	10:17	32 e	52 e	--	<0.02	0.027	<1.0

Peters River (SARIS: 5131125) Unique ID: W1022 Station: PR01, Mile Point: 0.6
Description: Paine Street, Bellingham

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0132	--	10:14	520	--	220	--	--	--
5/21/2003	51-0174	--	10:20	300	--	250	<0.06 d	0.029	3.6
6/25/2003	51-0200	--	10:33	512*	--	126*	<0.02	0.041	2.4 j
7/23/2003	51-0244	--	10:16	11000	--	6200	0.09	0.24	59 d
8/27/2003	51-0288	--	10:50	--	--	--	0.07	0.024	<1.0
8/28/2003	51-0434	--	05:03	970	770	--	--	--	--
10/2/2003	51-0360	--	10:35	780	580	--	<0.02	0.020	<1.0

" ## " = Censored data (i.e., data that has been discarded for some reason)
" * " = Analysis performed by Laboratory other than DEP's Wall Experiment Station (WES)
" -- " = No data (i.e., data not taken/not required)
" a " = Accuracy as estimated at WES Lab via matrix spikes, PT sample recoveries, internal check standards and lab-fortified blanks did not meet project data quality objectives identified for program or in QAPP
" d " = Precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected
" e " = Not theoretically possible. Specifically, used for bacteria data where colonies per unit volume for e-coli bacteria > fecal coliform bacteria and for other incongruous or conflicting results
" f " = Frequency of quality control duplicates did not meet data quality objectives identified for program or in QAPP
" j " = Used for lab-related issues where certain lab QC criteria are not met and re-testing is not possible (as identified by the WES lab only). Also used to report sample data where the sample concentration is less than the 'reporting' limit or RDL and greater than the method detection limit or MDL (mdl< *x* <rdl). Also used to note where values have been reported at levels less than the mdl. Denotes an 'estimated' value' when used as a qualifier only (i.e., not censored). When solely used for censored data, it denotes censure at the lab
" h " = Holding time violation (usually indicating possible bias low)
" m " = Method SOP not followed (only partially implemented or not implemented at all) due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (e.g. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, missing data or deviations from field sampling SOPs
" r " = Samples collected may not be representative of actual field conditions, based on documented or suspected field sampling error, or inexplicable or improbable ("outliers") values

Quality Control Data
Blackstone River Watershed quality control data for trip blanks and field duplicate samples can be found in Tables 7and 8. Data qualifiers are presented at the bottom of each table and in Appendix 3. Additional information pertaining to the data validation process is provided in Appendix 2.

Table 7. 2003 MA DEP Blackstone River Watershed Quality Control Data-Blanks.
OWMID (sample ID), Fecal coliform, E. coli, Ammonia Nitrogen (NH3-N), Total Phosphorus (TP), and Total Suspended Solids (TSS)

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	E.coli CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0118	Blank	**	<7	--	<7	--	--	--
4/23/2003	51-0129	Blank	**	<7	--	<7	--	--	--
5/21/2003	51-0141	Blank	**	<6	--	<6	<0.02	<0.005	<1.0
5/21/2003	51-0171	Blank	**	<6	--	<6	<0.02	<0.005	<1.0
6/25/2003	51-0182	Blank	**	<2*	--	<2*	<0.02	<0.005	<1.0 j
6/25/2003	51-0195	Blank	**	<2*	--	<2*	<0.02	<0.005 h	<1.0 j
7/23/2003	51-0226	Blank	**	<6	--	<6	<0.02	<0.005	<1.0
7/23/2003	51-0239	Blank	**	<6	--	<6	<0.02	<0.005	<1.0
8/27/2003	51-0270	Blank	**	--	--	--	<0.02	<0.005	<1.0
8/27/2003	51-0284	Blank	**	--	--	--	<0.02	<0.005	<1.0
8/28/2003	51-0429	Blank	**	<6	<6	--	--	--	--
8/28/2003	51-0440	Blank	**	<7	<7	--	--	--	--
10/2/2003	51-0328	Blank	**	<6	<6	--	<0.02	<0.005	<1.0
10/2/2003	51-0352	Blank	09:19	<6	<6	--	<0.02	<0.005	<1.0

" * " = Analysis performed by Laboratory other than DEP's Wall Experiment Station (WES)
" ** " = Missing data (i.e., data that should have been reported)
" -- " = No data (i.e., data not taken/not required)
" h " = Holding time violation (usually indicating possible bias low)
" j " = Used for lab-related issues where certain lab QC criteria are not met and re-testing is not possible (as identified by the WES lab only). Also used to report sample data where the sample concentration is less than the 'reporting' limit or RDL and greater than the method detection limit or MDL (mdl< *x* <rdl). Also used to note where values have been reported at levels less than the mdl. Denotes an 'estimated' value' when used as a qualifier only (i.e., not censored). When solely used for censored data, it denotes censure at the lab

Table 8. 2003 MA DEP Blackstone River Watershed Quality Control Data-Duplicates.
OWMID (sample ID), Fecal coliform, E. coli, Ammonia Nitrogen (NH3-N), Total Phosphorus (TP), and Total Suspended Solids (TSS)

Blackstone River (SARIS: 5131000) Unique ID: W1017 Station: BS12, Mile Point: 24.9
Description: downstream/south of Singing Dam, Blackstone Street, Sutton

Date	OWMID	QAQC	Time (24hr)	Log10(Fecal) CFU/100ml	Log10(E.coli) CFU/100ml	Log10(E.coli) CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0116	51-0117	09:29	1.987	--	2.000	--	--	--
4/23/2003	51-0117	51-0116	09:29	2.362	--	2.000	--	--	--
Relative	*Percent*	*Difference*	--	*17.2%*	--	*0.0%*	--	--	--

Mill River (SARIS: 5131200) Unique ID: W0508 Station: BLK15-1, Mile Point: 2.2
Description: upstream/northwest of Summer Street (Park Street), Blackstone

Date	OWMID	QAQC	Time (24hr)	Log10(Fecal) CFU/100ml	Log10(E.coli) CFU/100ml	Log10(E.coli) CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
5/21/2003	51-0170	51-0172	10:00	1.763	--	1.591	##,d	0.051	2.7
5/21/2003	51-0172	51-0170	10:00	1.301	--	1.672	##,d	0.050	3.8
Relative	*Percent*	*Difference*	--	*30.2%*	--	*5.0%*	--	*2.0%*	*33.8%*

Table 8 (continued). 2003 MA DEP Blackstone River Watershed Quality Control Data-Duplicates.

Mumford River (SARIS: 5132050) Unique ID: W1020 Station: MF07, Mile Point: 0.6
Description: Mendon Street (Route 16), downstream of Capron Pond, Uxbridge

Date	OWMID	QAQC	Time (24hr)	Log10(Fecal) CFU/100ml	Log10(E.coli) CFU/100ml	Log10(E.coli) CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
4/23/2003	51-0127	51-0128	09:25	1.505	--	1.279	--	--	--
4/23/2003	51-0128	51-0127	09:25	1.415	--	1.114	--	--	--
Relative	*Percent*	*Difference*	--	*6.2%*	--	*13.8%*	--	--	--
6/25/2003	51-0194	51-0196	09:15	2.568	--	2.301	<0.02	0.037	1.7 j
6/25/2003	51-0196	51-0194	09:15	2.489	--	2.398	<0.02	0.039	1.6 j
Relative	*Percent*	*Difference*	--	*3.2%*	--	*4.1%*	*0.0%*	*5.3%*	*6.1%*
7/23/2003	51-0238	51-0240	09:16	2.778	--	2.732	<0.02	0.046	2.5 d
7/23/2003	51-0240	51-0238	09:16	2.908	--	2.771	<0.02	0.041	<1.0 d
Relative	*Percent*	*Difference*	--	*4.6%*	--	*1.4%*	*0.0%*	*11.5%*	*85.7%*
8/27/2003	51-0282	51-0283	09:45	--	--	--	<0.02	0.018	<1.0
8/27/2003	51-0283	51-0282	09:45	--	--	--	<0.02	0.023	<1.0
Relative	*Percent*	*Difference*	--	--	--	--	*0.0%*	*24.4%*	*0.0%*
8/28/2003	51-0438	51-0439	03:59	1.886	1.813	--	--	--	--
8/28/2003	51-0439	51-0438	03:59	1.954	1.924	--	--	--	--
Relative	*Percent*	*Difference*	--	*3.5%*	*6.0%*	--	--	--	--
10/2/2003	51-0350	51-0351	09:19	1.851	1.716	--	<0.02	0.025	1.6
10/2/2003	51-0351	51-0350	09:19	1.813	1.851	--	<0.02	0.026	1.3
Relative	*Percent*	*Difference*	--	*2.1%*	*7.6%*	--	*0.0%*	*3.9%*	*20.7%*

Dark Brook (SARIS: 5132825) Unique ID: W0504 Station: RB01, Mile Point: 1.0
Description: downstream/north of Route 12, Auburn

Date	OWMID	QAQC	Time (24hr)	Log10(Fecal) CFU/100ml	Log10(E.coli) CFU/100ml	Log10(E.coli) CFU/100ml	NH3-N mg/L	TP mg/L	TSS mg/L
5/21/2003	51-0140	51-0142	09:10	2.431	--	2.362	##,d	0.032	3.1
5/21/2003	51-0142	51-0140	09:10	2.415	--	2.462	##,d	0.030	2.7
Relative	*Percent*	*Difference*	--	*0.7%*	--	*4.2%*	--	*6.5%*	*13.8%*
6/25/2003	51-0181	51-0183	09:00	2.362	--	2.146	<0.02	0.039	3.2 j
6/25/2003	51-0183	51-0181	09:00	2.491	--	2.158	<0.02	0.035	3.4 j
Relative	*Percent*	*Difference*	--	*5.3%*	--	*0.6%*	*0.0%*	*10.8%*	*6.1%*
7/23/2003	51-0225	51-0227	09:05	3.748	--	3.204	<0.02	0.070	4.7
7/23/2003	51-0227	51-0225	09:05	3.845	--	3.146	<0.02	0.069	4.5
Relative	*Percent*	*Difference*	--	*2.6%*	--	*1.8%*	*0.0%*	*1.4%*	*4.3%*
8/27/2003	51-0269	51-0271	09:00	--	--	--	0.11	##,d	5.1
8/27/2003	51-0271	51-0269	09:00	--	--	--	0.10	##,d	5.5
Relative	*Percent*	*Difference*	--	--	--	--	*9.5%*	--	*7.5%*
8/28/2003	51-0427	51-0428	03:30	2.146	2.114	--	--	--	--
8/28/2003	51-0428	51-0427	03:30	2.230	2.000	--	--	--	--
Relative	*Percent*	*Difference*	--	*3.9%*	*5.5%*	--	--	--	--
10/2/2003	51-0326	51-0327	09:05	2.176	1.886	--	0.09	0.040	1.9
10/2/2003	51-0327	51-0326	09:05	2.146	2.255	--	0.09	0.043	1.9
Relative	*Percent*	*Difference*	--	*1.4%*	*17.8%*	--	*0.0%*	*7.2%*	*0.0%*

" ## " = Censored data (i.e., data that has been discarded for some reason)
" -- " = No data (i.e., data not taken/not required)
" d " = Precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected

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Appendix 1
2003 MA DEP Blackstone Sewage Bypass Response

On 2 October 2003, a failure at the UBWPAD, in Millbury, MA, led to the release of millions of gallons of untreated and partially treated sewage into the Blackstone River. Subsequent monitoring by MA DEP in the Massachusetts portion of the river, and DEM, US Filter, the Narragansett Bay Commission, and the Natural Resources Conservation Service in the Rhode Island portion of the river, revealed high fecal coliform bacteria levels down to Uxbridge, MA as of October 6, but declining levels at that location by October 8. The following data are the result of DWM and CERO monitoring in response to the emergency overflow. Tables 1 through 4 and Figure 1 detail locations of the 2003 sampling sites.

Table 1. 2003 MA DEP Blackstone Sewage Bypass Response *in-situ* multiprobe Data.
OWMID (sample ID), Temp (Temperature), pH, Conductivity, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), and Percent Saturation

Blackstone River (SARIS: 5131000) Unique ID: W0505 Station: BLK02, Mile Point: 28.9
Description: upstream/northwest at McCracken Road, Millbury

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
10/3/2003	51-0416	10:50	0.4	17.4	6.9 c	702	456	6.3	66
10/6/2003	51-0388	12:25	0.3	17.6	6.9 c	716	466	6.4	67

Blackstone River (SARIS: 5131000) Unique ID: W1240 Station: Station 1, Mile Point: 29.4
Description: approximately 60 feet upstream/north of Upper Blackstone WWTP effluent channel confluence, Millbury

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
10/3/2003	51-0415	10:33	0.4	12.3	6.9 u,c	592	385	9.0	85
10/6/2003	51-0387	12:40	0.2	11.7	7.2 c	620	403	9.7	89

Blackstone River (SARIS: 5131000) Unique ID: W1241 Station: Station 2, Mile Point23.3
Description: Blackstone River Canal, Pleasant Street, Grafton

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
10/3/2003	51-0417	11:17	0.3	13.4	7.1 c	658	428	6.1	59
10/6/2003	51-0389	12:02	0.7	13.3	7.1 c	613	398	9.4	90

Blackstone River (SARIS: 5131000) Unique ID: W1242 Station: Station 3, Mile Point: 21.3
Description: Route 122A (below Fisherville Pond), Grafton

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
10/3/2003	51-0418	11:38	0.4	14.3	7.2 c	608	395	7.7	75
10/6/2003	51-0390	11:51	0.9	13.5	7.2 c	588	382	10.0	97

Blackstone River (SARIS: 5131000) Unique ID: W1243 Station: Station 4, Mile Point: 20.6
Description: Depot Street, Grafton

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
10/3/2003	51-0419	12:00	0.7	14.2	7.2 c	597	388	9.2	89
10/6/2003	51-0391	11:38	0.5	13.1	7.2 c	589	383	10.5	100

Blackstone River (SARIS: 5131000) Unique ID: W0506 Station: BLK07-A, Mile Point: 18.4
Description: upstream/northwest of the Sutton Street bridge, Northbridge

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
10/3/2003	51-0369	12:19	0.8	14.3	7.3 c	598	388	10.2	100
10/6/2003	51-0392	11:24	1.6	12.9 u	7.2 c	586	381	10.4	99

Table 1 (continued). 2003 MA DEP Blackstone Sewage Bypass Response *in-situ* multiprobe Data.

Blackstone River (SARIS: 5131000) Unique ID: W1244 Station: Station 5, Mile Point: 15.9
Description: Church Street, Northbridge

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
10/3/2003	51-0370	12:45	0.2	14.5	7.0 c	592	385	7.9	77
10/6/2003	51-0393	11:07	0.1 i	12.6	7.0 c	575	374	8.2	77

Blackstone River (SARIS: 5131000) Unique ID: W1245 Station: Station 6, Mile Point: 12.5
Description: approximately 160 feet downstream/south of Hartford Avenue East, Uxbridge

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
10/3/2003	51-0371	13:11	1.1	15.0	7.2 c	587	382	9.7	96
10/6/2003	51-0394	10:47	0.4	12.1	7.1 c	580	377	9.8	92

Blackstone River (SARIS: 5131000) Unique ID: W1246 Station: Station 7, Mile Point: 10.3
Description: Route 16 (Mendon Street), Uxbridge

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
10/6/2003	51-0395	10:27	2.1	11.3	7.0 c	580	377	9.7	89

Blackstone River (SARIS: 5131000) Unique ID: W1247 Station: Station 8, Mile Point: 1.8
Description: approximately 16 feet upstream/north of "Tupperware Dam" (west of Staples Lane), Blackstone

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Conductivity (uS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)
10/3/2003	51-0372	13:53	0.5	14.0	7.1 c	472	307	8.9	87
10/6/2003	51-0396	10:03	0.5	11.8	6.9 u,c	494	321	9.3	86

" c " = Greater than calibration standard used for pre-calibration, or outside the acceptable range about the calibration standard (see Appendix 2 for acceptance criteria).
" i " = Inaccurate readings from multiprobe likely
" u " = Unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc

Table 2. 2003 MA DEP Blackstone Sewage Bypass Response Instream TSS and Bacteria Data.
OWMID (sample ID), Fecal coliform, E. coli, and Total Suspended Solids (TSS)

Blackstone River (SARIS: 5131000) Unique ID: W0505 Station: BLK02, Mile Point: 28.9
Description: upstream/northwest at McCracken Road, Millbury

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/3/2003	51-0376	--	10:45	8600	3300	5.0
10/6/2003	51-0398	--	11:55	210	210	3.6

Blackstone River (SARIS: 5131000) Unique ID: W1240 Station: Station 1, Mile Point: 29.4
Description: approx. 60 feet upstream/north of Upper Blackstone WWTP effluent channel confluence, Millbury

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/3/2003	51-0375	--	10:30	1000	500	1.7
10/6/2003	51-0397	--	12:00	780	730	1.5

Blackstone River (SARIS: 5131000) Unique ID: W1241 Station: Station 2, Mile Point: 23.3
Description: Blackstone River Canal, Pleasant Street, Grafton

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/3/2003	51-0377	--	11:12	300000	260000	8.5
10/6/2003	51-0399	--	11:30	160 e	210 e	1.3

Blackstone River (SARIS: 5131000) Unique ID: W1242 Station: Station 3, Mile Point: 21.3
Description: Route 122A (below Fisherville Pond), Grafton

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/3/2003	51-0378	--	11:35	390000	300000	8.5
10/6/2003	51-0400	--	11:15	170 e	190 e	2.7

Blackstone River (SARIS: 5131000) Unique ID: W1243 Station: Station 4, Mile Point: 20.6
Description: Depot Street, Grafton

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/3/2003	51-0379	51-0380	11:54	260000 e	300000 e	7.2
10/3/2003	51-0380	51-0379	11:54	320000 e	340000 e	7.1
10/6/2003	51-0401	51-0402	11:10	420	180	3.1
10/6/2003	51-0402	51-0401	11:10	280 e	300 e	2.8

Blackstone River (SARIS: 5131000) Unique ID: W0506 Station: BLK07-A, Mile Point: 18.4
Description: upstream/northwest of the Sutton Street bridge, Northbridge

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/3/2003	51-0382	--	12:14	6800 e	7800 e	4.3
10/6/2003	51-0404	--	11:00	21000	17000	2.9

Blackstone River (SARIS: 5131000) Unique ID: W1244 Station: Station 5, Mile Point: 15.9
Description: Church Street, Northbridge

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/3/2003	51-0383	--	12:40	340	240	5.9
10/6/2003	51-0405	--	10:45	21000	18000	6.1

Blackstone River (SARIS: 5131000) Unique ID: W1245 Station: Station 6, Mile Point: 12.5
Description: approximately 160 feet downstream/south of Hartford Avenue East, Uxbridge

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/3/2003	51-0384	--	13:05	270	190	8.3
10/6/2003	51-0406	--	10:30	4600	3800	5.3

Table 2 (continued). 2003 MA DEP Blackstone Sewage Bypass Response Instream TSS and Bacteria Data.

Blackstone River (SARIS: 5131000) Unique ID: W1246 Station: Station 7, Mile Point: 10.3
Description: Route 16 (Mendon Street), Uxbridge

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/6/2003	51-0408	--	10:15	3800	3000	5.9

Blackstone River (SARIS: 5131000) Unique ID: W1247 Station: Station 8, Mile Point: 1.8
Description: approximately 16 feet upstream/north of "Tupperware Dam" (west of Staples Lane), Blackstone

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/3/2003	51-0385	--	13:45	100	38	4.7
10/6/2003	51-0407	--	10:00	4400	2700	4.2

" -- " = No data (i.e., data not taken/not required)
" e " = Not theoretically possible. Specifically, used for bacteria data where colonies per unit volume for e-coli bacteria > fecal coliform bacteria and for other incongruous or conflicting results

Quality Control Data
Blackstone River Watershed quality control data for trip blanks and field duplicate samples can be found in Tables 3 and 4. Data qualifiers are presented at the bottom of each table and in Appendix 3. Additional information pertaining to the data validation process is provided in Appendix 2.

Table 3. 2003 MA DEP Blackstone Sewage Bypass Response Quality Control Data-Blanks.
OWMID (sample ID), Fecal coliform, E. coli, and Total Suspended Solids (TSS)

Date	OWMID	QAQC	Time (24hr)	Fecal CFU/100ml	E.coli CFU/100ml	TSS mg/L
10/3/2003	51-0381	Blank	**	<6	<6	<1.0
10/6/2003	51-0403	Blank	**	<9	<9	<1.0

" ** " = Missing data (i.e., data that should have been reported)

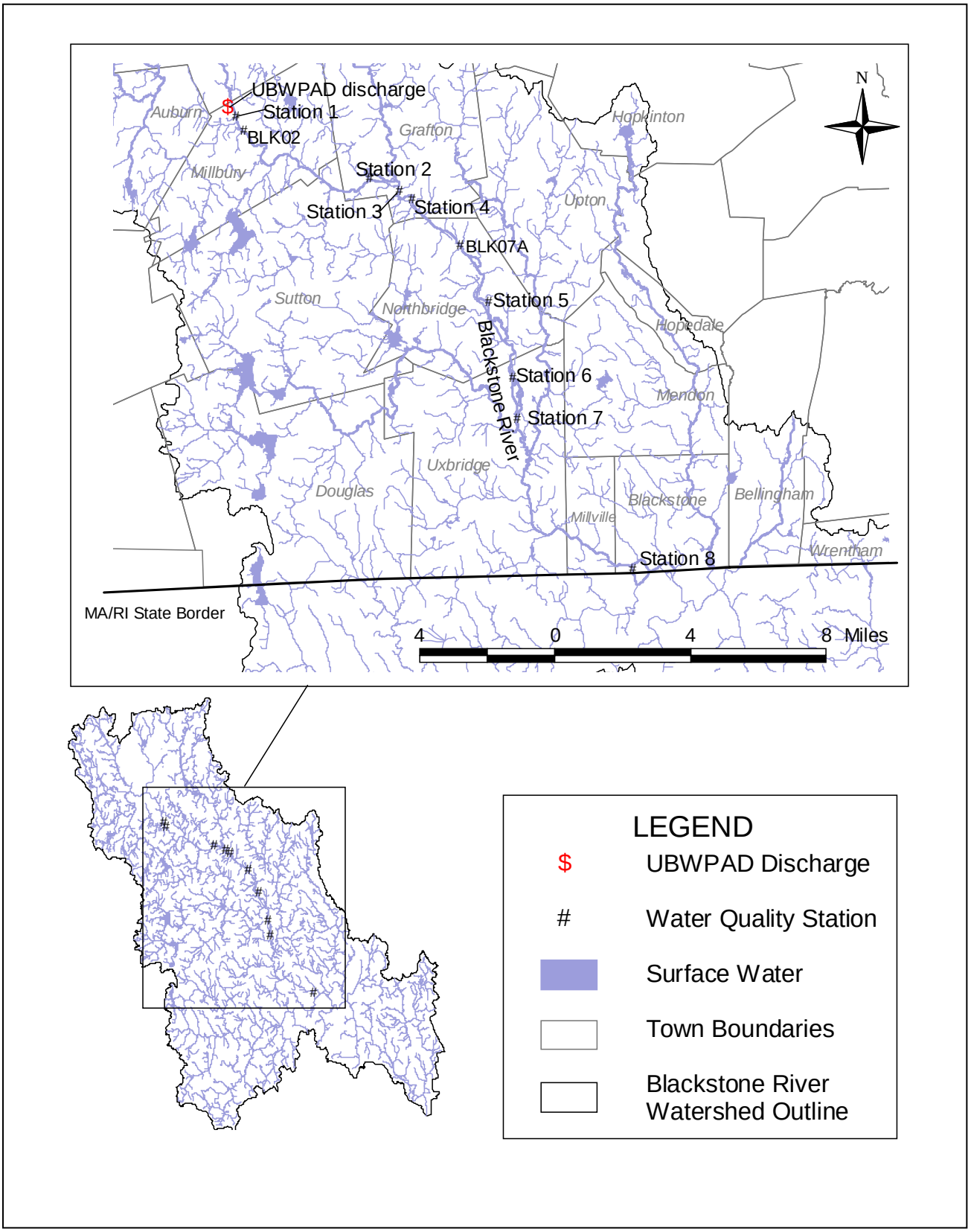
Table 4. 2003 MA DEP Blackstone Sewage Bypass Response Quality Control Data-Duplicates.
OWMID (sample ID), Fecal coliform, E. coli, Ammonia Nitrogen (NH3-N), Total Phosphorus (TP), and Total Suspended Solids (TSS)

Blackstone River (SARIS: 5131000) Unique ID: W1243 Station: Station 4, Mile Point: 20.6
Description: Depot Street, Grafton

Date	OWMID	QAQC	Time (24hr)	Log10(Fecal) CFU/100ml	Log10(E.coli) CFU/100ml	TSS mg/L
10/3/2003	51-0379	51-0380	11:54	5.415	5.477	7.2
10/3/2003	51-0380	51-0379	11:54	5.505	5.531	7.1
Relative	*Percent*	*Difference*	--	*1.7%*	*1.0%*	*1.4%*
10/6/2003	51-0401	51-0402	11:10	2.623	2.255	3.1
10/6/2003	51-0402	51-0401	11:10	2.447	2.477	2.8
Relative	*Percent*	*Difference*	--	*6.9%*	*9.4%*	*10.2%*

" -- " = No data (i.e., data not taken/not required)

Figure 1. 2003 MA DEP Blackstone Sewage Bypass Response Water Quality Monitoring Station Locations.



Appendix 2

Quality Assurance/Quality Control Data Validation for the Blackstone Watershed 2003 Water Quality Survey

Selected Excerpts from:
Data Validation Report for Year 2003 Project Data (CN 211.0)

5.0 2003 Discrete Water Sample Data

5.1 QA/QC Objectives and Criteria for 2003 Discrete Water Sample Data

The collection and analysis of discrete water samples in 2003 followed the DWM Standard Operating Procedures and lab analyte-specific SOPs. The majority of river samples were taken via the manual grab and basket sampler techniques (where ambient water enters the sample bottle directly). For Lakes, the majority of samples were taken using the Van Dorn thief-type sampler and manually.

For river sampling, field quality control samples consisted of approx. 10% ambient blanks and 10% field duplicates (i.e., separate, co-located (side-by-side), simultaneous field duplicates). For lakes, equipment blanks and sequential duplicates were taken using a Van Dorn apparatus.

Using the following criteria, as well as other considerations and input from data reviewers, individual datum were either:

Accepted
Accepted with qualification, or
Censored

In cases where poor quality control (e.g., blank/cross contamination, lab accuracy) affected batched analyses or entire surveys, censoring/qualification decisions were applied to groups of samples (e.g., a specific crew's samples, a specific survey's samples or all samples from a specific batch analysis).

Criteria for acceptance of discrete water quality sample data were as follows:

- For simplicity, samples that were "lost", "missing", "spilled" and "not analyzed" were denoted using the 'm' (method not followed) qualifier and ** symbol.

- **Sampling/Analysis Holding Time**: Each analyte has a standard holding time that has been established to ensure sample/analysis integrity. Refer to DWM Standard Operating Procedure CN# 1.2 for a complete listing. If the standard holding time was exceeded, this criterion is violated and the data may be censored, depending on the extent of exceedance. For minor exceedances (e.g., < than 20% of the holding time), the data is typically qualified ("h" for minor holding time violation).

- **Quality Control Sample Frequency**: At a minimum, one field blank and one replicate must be collected for every ten samples by any given sampling crew on any given date. If less than 10% blanks and replicates were collected, the data are typically qualified with "f". If blanks were omitted and duplicates taken, typically no data are qualified, as long as there are no documented historical problems for the survey-specific samplers or station locations with regard to field contamination. If blanks were taken but duplicates were not, the data may be qualified with "f". Typically, no censoring of data takes place for insufficient QC sample frequencies only.

- **Field Blanks:** Field blanks were prepared at the DWM Worcester Laboratory. Reagent grade water was transported into the field in a sample container where it was transferred into a different sample container directly or via a sampling device (equipment blank) using the same methods as for its corresponding field sample (e.g., blank samples were preserved in the same way). All blanks were submitted to the WES laboratory "blind". If the field blank results were greater than the MDL (indicating potential sampling error, airborne contaminants, dirty equipment, etc.), the data may be censored or qualified, depending on extent and other factors.

- **Field Replicates:** In 2003, field duplicate samples for rivers were taken as co-located, simultaneous duplicates. As a result, these duplicate results include any spatial, natural variability present between side-by-side samples (which should be minimal in most cases where site selection has accounted for uniform mixing). Duplicate lake samples were sequential and therefore also include any temporal variability. Samples were submitted to WES laboratory "blind". Results were compared to specific criteria contained in a 2003 QAPP document. If the criteria are not met, the sample/duplicate data may be censored or qualified, depending on extent of exceedance and other factors. Arguably, very poor precision of field duplicate samples reflects poor reproducibility for entire surveys and/or analytical batch runs, and should result in censoring or qualification of the entire survey/batch data. Decisions related to poor precision for entire surveys/batches were made on a case-by-case basis.

- Results of **Field and/or Lab Audits** and Miscellaneous Survey Information: If, based on the results of field evaluation of implementation of field sampling SOPs, samples are deemed to have been taken incorrectly or to not represent station conditions at the time of sampling, then individual or survey-based sample results may be qualified or censored. Likewise, the results of QC audits of lab(s) analytical accuracy (and precision) for specific parameters are evaluated. If results indicate poor accuracy or repeatability, batch run data may be qualified or censored. In addition, information from survey personnel regarding sample integrity and representativeness may lead to decisions to qualify or censor data.

- **Laboratory assessment of analytical precision and accuracy:** The WES Laboratory is solely responsible for the administration of its Quality Assurance Program and Standard Operating Procedures. WES staff release discrete water sample data when their established QA/QC criteria have been met. When the following criteria cannot be met, data are qualified using appropriate qualifiers:

Low Calibration Standards – Checks the stability of the instrument's calibration curve; analyzes the *accuracy* of an instrument's calibration within a 5% range.

Reference Standards – Generally, a second source standard (a standard different from the calibration stock standard) that analyzes the method *accuracy.*

Laboratory Reagent Blank/Method Blank (LRB) – Reagent grade water (de-ionized) extracted with every sample set used to ensure that the system is free of target analytes (< MDL) and to assess potential blank contamination.

Duplicate Sample – Measures the *precision* (as Relative Percent Difference or RPD) of the analytical process. The acceptable laboratory %RPD range is typically $\leq$ 25%. For bacteria, duplicate data are evaluated based the range of logged values.

Spike Sample (Laboratory Fortified Blank - LFB, Laboratory Fortified Matrix - LFM)– Measures the *accuracy* (% Recovery) of an analytical method. The acceptable laboratory % recovery range is typically between 80 – 120% for LFB samples and 70 –130% for LFM discrete water samples.

Field Audits – In 2003, three field audits (total) were performed by DWM's QC Analyst. These audits involved six different DWM staff members, and were useful in stressing:

Attention to required field safety precautions, including driving safety
Proper care of multi-probe units
Survey preparation so that needed field equipment is not forgotten
Importance of filling out fieldsheets completely, and
Need to depth-calibrate the multi-probe initially at the first station

All audits concluded that staff performance was good-excellent in terms of SOP adherence. Audit results did not impact validation of survey sample results.

Lab Audits – To provide external evaluation of lab performance with regard to sample analyses for specific analytes, the following lab audits were performed in 2003:

5.3 QA/QC Issues and Considerations for 2003 Data

The following are particularly noteworthy regarding 2003 DWM/CERO surveys. The validation decisions contained in the tables below reflect these considerations.

Blackstone Sewage Spill Project. Equipment failure at the Upper Blackstone Wastewater Treatment Plant resulted in a sewage (treated and untreated) spill into the Blackstone River on 10/2/03. Bacteria and TSS samples were taken 10/2, 10/3, 10/6 and 10/8. Based on the need to have final data quickly, data validation for these samples was expedited. This review is summarized in Appendix C. All bacteria samples from 10/2, 10/3 and 10/6 were accepted, except one sample (BLK 02 on 10/2) that was qualified due to the potential effect of chlorine (no dechlorination of sample). All data from 10/8 was not accepted, due to lack of field documentation.

Station Representativeness. For this data validation effort, all station locations were assumed to have been located to be representative of river/stream and lake/pond conditions at the sampling time. This assumption is applied to both historic station locations, as well as new sampling stations.

Frequency and Type of Field QC Samples (ambient field blanks and field duplicates/splits). DWM field sheet data were reviewed with respect to meeting the minimum frequency of survey QC samples (ambient field blanks and field duplicates/splits). Unless otherwise indicated in Sections 5, 6 and 7, all reported data from WES (and DWM for color and chl a) met the required minimum frequency of approx. 10% of the total sample number (and a minimum of one blank/analyte/survey and one duplicate/split per analyte per survey. In 2003, field duplicates were typically taken as co-located, simultaneous replicates.

High NH3-N in ambient field blanks. On more than one occasion, elevated levels of NH3-N were detected in ambient field blanks. The cause(s) for this could not be traced to the quality of DWM deionized water, WES/STL lab contamination, field effects (e.g., precipitation), or crew effects (high blanks observed for multiple crews). While the cause remains unknown, all survey data related to high NH3-N in ambient field blanks have been qualified.

WES Lab TSS Data. Lack of adherence to the WES lab SOP for TSS analysis resulted in WES' qualification of TSS data from 5 batches. These decisions have been carried through to the final DWM data.

WES Lab DRP Data. Field-filtered samples for dissolved reactive P analysis, part of a DWM QC study comparing P recovery from field vs. lab filtered samples, were lost by WES. These samples have been categorized by DWM as "missing" (**).

5.4 2003 Censored/Qualified Discrete Water Sample Data (Blackstone River Watershed)

All Year 2003 data for discrete water samples that have been censored or qualified are listed below by project, except for missing data (Table 1). For qualifier definitions see Appendix 2.

Table 1. 2003 Censored/Qualified Discrete Water Sample Data (Blackstone River Watershed)

PROJECT	ANALYTE	DATE	OWMID	LAB ID	RESULT	QUALIFIER	UNITS
Blackstone Sewage Bypass (2003)	Fecal Coliforms	10/3/2003	51-0379	2003195-005	260000	e	CFU/100mL
Blackstone Sewage Bypass (2003)	Fecal Coliforms	10/3/2003	51-0380	2003195-006	320000	e	CFU/100mL
Blackstone Sewage Bypass (2003)	Fecal Coliforms	10/3/2003	51-0382	2003195-008	6800	e	CFU/100mL
Blackstone Sewage Bypass (2003)	Fecal Coliforms	10/6/2003	51-0399	2003197-003	160	e	CFU/100mL
Blackstone Sewage Bypass (2003)	Fecal Coliforms	10/6/2003	51-0400	2003197-004	170	e	CFU/100mL
Blackstone Sewage Bypass (2003)	Fecal Coliforms	10/6/2003	51-0402	2003197-006	280	e	CFU/100mL
Blackstone Sewage Bypass (2003)	E. Coli - Modified m-TEC	10/3/2003	51-0379	2003195-005	300000	e	CFU/100mL
Blackstone Sewage Bypass (2003)	E. Coli - Modified m-TEC	10/3/2003	51-0380	2003195-006	340000	e	CFU/100mL
Blackstone Sewage Bypass (2003)	E. Coli - Modified m-TEC	10/3/2003	51-0382	2003195-008	7800	e	CFU/100mL
Blackstone Sewage Bypass (2003)	E. Coli - Modified m-TEC	10/6/2003	51-0399	2003197-003	210	e	CFU/100mL
Blackstone Sewage Bypass (2003)	E. Coli - Modified m-TEC	10/6/2003	51-0400	2003197-004	190	e	CFU/100mL
Blackstone Sewage Bypass (2003)	E. Coli - Modified m-TEC	10/6/2003	51-0402	2003197-006	300	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	4/23/2003	51-0112	2003043-003	26	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	4/23/2003	51-0114	2003043-005	280	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	4/23/2003	51-0116	2003043-007	97	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	4/23/2003	51-0131	2003043-023	58	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	5/21/2003	51-0142	2003062-006	260	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	5/21/2003	51-0144	2003062-007	390	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	5/21/2003	51-0150	2003062-010	39	ef	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	5/21/2003	51-0152	2003062-014	110	f	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	5/21/2003	51-0153	2003062-011	52	f	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	5/21/2003	51-0155	2003062-012	19	ef	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	5/21/2003	51-0157	2003062-013	##	fj	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	5/21/2003	51-0166	2003062-017	39	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	5/21/2003	51-0172	2003062-021	20	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	7/23/2003	51-0232	2003123-023	600	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	7/23/2003	51-0234	2003123-001	3400	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	7/23/2003	51-0236	2003123-003	210	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	7/23/2003	51-0237	2003123-004	370	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	8/28/2003	51-0431	2003167-002	13	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	10/2/2003	51-0320	2003192-013	<6	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	10/2/2003	51-0322	2003192-014	13	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	10/2/2003	51-0327	2003192-018	140	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	10/2/2003	51-0332	2003192-020	210	am	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	10/2/2003	51-0344	2003192-002	26	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	10/2/2003	51-0346	2003192-003	13	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	10/2/2003	51-0348	2003192-004	40	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	10/2/2003	51-0351	2003192-007	65	e	CFU/100mL
Blackstone, (2003)	Fecal Coliforms	10/2/2003	51-0358	2003192-010	32	e	CFU/100mL
Blackstone, (2003)	E. Coli - Modified m-TEC	8/28/2003	51-0431	2003167-002	32	e	CFU/100mL
Blackstone, (2003)	E. Coli - Modified m-TEC	10/2/2003	51-0320	2003192-013	6	e	CFU/100mL
Blackstone, (2003)	E. Coli - Modified m-TEC	10/2/2003	51-0322	2003192-014	39	e	CFU/100mL
Blackstone, (2003)	E. Coli - Modified m-TEC	10/2/2003	51-0327	2003192-018	180	e	CFU/100mL
Blackstone, (2003)	E. Coli - Modified m-TEC	10/2/2003	51-0332	2003192-020	90	am	CFU/100mL
Blackstone, (2003)	E. Coli - Modified m-TEC	10/2/2003	51-0344	2003192-002	39	e	CFU/100mL

Table 1 (continued). 2003 Censored/Qualified Discrete Water Sample Data (Blackstone River Watershed)

PROJECT	ANALYTE	DATE	OWMID	LAB ID	RESULT	QUALIFIER	UNITS
Blackstone, (2003)	E. Coli - Modified m-TEC	10/2/2003	51-0346	2003192-003	19	e	CFU/100mL
Blackstone, (2003)	E. Coli - Modified m-TEC	10/2/2003	51-0348	2003192-004	60	e	CFU/100mL
Blackstone, (2003)	E. Coli - Modified m-TEC	10/2/2003	51-0351	2003192-007	71	e	CFU/100mL
Blackstone, (2003)	E. Coli - Modified m-TEC	10/2/2003	51-0358	2003192-010	52	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	4/23/2003	51-0112	2003043-003	32	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	4/23/2003	51-0114	2003043-005	310	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	4/23/2003	51-0116	2003043-007	100	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	4/23/2003	51-0131	2003043-023	120	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	5/21/2003	51-0142	2003062-006	290	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	5/21/2003	51-0144	2003062-007	440	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	5/21/2003	51-0150	2003062-010	45	ef	CFU/100mL
Blackstone, (2003)	E. coli - MF	5/21/2003	51-0152	2003062-014	110	f	CFU/100mL
Blackstone, (2003)	E. coli - MF	5/21/2003	51-0153	2003062-011	39	f	CFU/100mL
Blackstone, (2003)	E. coli - MF	5/21/2003	51-0155	2003062-012	26	ef	CFU/100mL
Blackstone, (2003)	E. coli - MF	5/21/2003	51-0157	2003062-013	##	fj	CFU/100mL
Blackstone, (2003)	E. coli - MF	5/21/2003	51-0166	2003062-017	45	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	5/21/2003	51-0172	2003062-021	47	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	7/23/2003	51-0232	2003123-023	680	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	7/23/2003	51-0234	2003123-001	4000	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	7/23/2003	51-0236	2003123-003	240	e	CFU/100mL
Blackstone, (2003)	E. coli - MF	7/23/2003	51-0237	2003123-004	400	e	CFU/100mL
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0134	2003065-001	0.26	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0136	2003065-002	<0.02	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0138	2003065-003	<0.02	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0140	2003065-004	##	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0142	2003065-006	##	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0144	2003065-007	<0.06	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0146	2003065-008	4.8	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0148	2003065-009	4.2	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0150	2003065-010	<0.06	f	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0153	2003065-011	<0.06	f	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0155	2003065-012	<0.02	f	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0157	2003065-013	<0.06	f	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0164	2003065-015	<0.06	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0166	2003065-016	0.29	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0168	2003065-017	0.16	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0170	2003065-018	##	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0172	2003065-020	##	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0174	2003065-021	<0.06	d	mg/L
Blackstone, (2003)	Ammonia-N	5/21/2003	51-0176	2003065-014	0.06	d	mg/L
Blackstone, (2003)	Total Phosphorus	5/21/2003	51-0150	2003065-010	0.027	f	mg/L
Blackstone, (2003)	Total Phosphorus	5/21/2003	51-0153	2003065-011	0.028	f	mg/L
Blackstone, (2003)	Total Phosphorus	5/21/2003	51-0155	2003065-012	0.014	f	mg/L
Blackstone, (2003)	Total Phosphorus	5/21/2003	51-0157	2003065-013	0.20	f	mg/L
Blackstone, (2003)	Total Phosphorus	6/25/2003	51-0195	2003093-042	<0.005	h	mg/L

Table 1 (continued). 2003 Censored/Qualified Discrete Water Sample Data (Blackstone River Watershed)

PROJECT	ANALYTE	DATE	OWMID	LAB ID	RESULT	QUALIFIER	UNITS
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0266	2003166-025	0.047	d	mg/L
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0267	2003166-026	0.009	d	mg/L
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0268	2003166-027	0.064	d	mg/L
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0269	2003166-028	##	d	mg/L
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0271	2003166-029	##	d	mg/L
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0272	2003166-031	0.041	d	mg/L
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0273	2003166-032	0.46	d	mg/L
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0274	2003166-033	0.50	d	mg/L
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0275	2003166-034	0.017	d	mg/L
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0276	2003166-035	0.36	d	mg/L
Blackstone, (2003)	Total Phosphorus	8/27/2003	51-0277	2003166-036	0.034	d	mg/L
Blackstone, (2003)	Total Phosphorus	10/2/2003	51-0332	2003193-008	##	h	mg/L
Blackstone, (2003)	Total Phosphorus	10/2/2003	51-0334	2003193-009	##	h	mg/L
Blackstone, (2003)	Total Suspended Solids	5/21/2003	51-0150	2003065-031	2.5	f	mg/L
Blackstone, (2003)	Total Suspended Solids	5/21/2003	51-0153	2003065-032	2.8	f	mg/L
Blackstone, (2003)	Total Suspended Solids	5/21/2003	51-0155	2003065-033	<1.0	f	mg/L
Blackstone, (2003)	Total Suspended Solids	5/21/2003	51-0157	2003065-034	2.6	f	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0178	2003093-001	1.6	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0179	2003093-002	3.0	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0180	2003093-003	2.4	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0181	2003093-004	3.2	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0182	2003093-005	<1.0	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0183	2003093-006	3.4	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0184	2003093-007	7.7	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0185	2003093-008	6.8	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0186	2003093-009	5.7	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0187	2003093-010	1.9	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0188	2003093-011	8.3	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0189	2003093-012	2.3	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0190	2003093-013	1.5	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0191	2003093-014	3.9	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0192	2003093-015	<1.0	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0193	2003093-016	2.2	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0194	2003093-017	1.7	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0195	2003093-018	<1.0	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0196	2003093-019	1.6	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0197	2003093-020	5.4	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0198	2003093-021	7.6	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0199	2003093-022	3.3	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0200	2003093-023	2.4	j	mg/L
Blackstone, (2003)	Total Suspended Solids	6/25/2003	51-0201	2003093-024	1.8	j	mg/L
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0234	2003125-013	2.5	d	mg/L
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0235	2003125-014	3.4	d	mg/L
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0236	2003125-015	1.3	d	mg/L
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0237	2003125-016	4.1	d	mg/L

Table 1 (continued). 2003 Censored/Qualified Discrete Water Sample Data (Blackstone River Watershed)

PROJECT	ANALYTE	DATE	OWMID	LAB ID	RESULT	QUALIFIER	UNITS
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0238	2003125-017	2.5	d	mg/L
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0240	2003125-019	<1.0	d	mg/L
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0241	2003125-020	33	d	mg/L
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0242	2003125-021	20	d	mg/L
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0243	2003125-022	21	d	mg/L
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0244	2003125-023	59	d	mg/L
Blackstone, (2003)	Total Suspended Solids	7/23/2003	51-0245	2003125-024	7.4	d	mg/L

Appendix 3

Selected Excerpts from:
Data Validation Report for Year 2003 Project Data (CN 211.0)

Department of Environmental Protection
Division of Watershed Management

The following data qualifiers or symbols are used in the MADEP/DWM WQD database for qualified and censored water quality data. Decisions regarding censoring vs. qualification for specific, problematic data are made based on a thorough review of all pertinent information related to the data, including the magnitude or extent of the problem(s).

General Symbols (applicable to all types):

<MDL	Result is less than the Method Detection Limit
<RDL	Result is less than Reporting Detection Limit
>UQL	Result is greater than Upper Quantification Limit
**	Missing result for administrative reason – i.e. broken bottle
##	Result censored following laboratory and/or DWM QAQC criteria
*	Analysis performed by Laboratory OTHER than DEP's Wall Experiment Station (WES)

Multi-probe-specific Qualifiers:

" i " = **i**naccurate readings from multiprobe likely; may be due to significant pre-survey calibration problems, post-survey calibration readings outside typical acceptance range for the low ionic check and for the deionized blank water check, lack of calibration of the depth sensor prior to use, or to checks against laboratory analyses.

> Qualification Criteria for Depth (i):
>
> **General Depth Criteria**: Apply to each OWMID#
>
> - Clearly erroneous readings due to faulty depth sensor: Censor (i)
> - Negative and zero depth readings: Censor (i); (likely in error)
> - 0.1 m depth readings: Qualify (i); (potentially in error)
> - 0.2 and greater depth readings: Accept without qualification; (likely accurate)
>
> **Specific Depth Criteria**: Apply to entirety of depth data for survey date
>
> - If zero and/or negative depth readings occur more than once per survey date, censor all negative/zero depth data, and qualify all other depth data for that survey (indicates that erroneous depth readings were not recognized in the field and that corrective action (field calibration of the depth sensor) was not taken, i.e. that all positive readings may be in error.)

" **m "** = **m**ethod not followed; one or more protocols contained in the DWM multiprobe SOP not followed, i.e. operator error (e.g. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.

" **s "** = field **s**heet recorded data were used to accept data, not data electronically recorded in the field unit, due to operator error or equipment failure.

" **u "** = **u**nstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc. See Section 4.1 for acceptance criteria.

" **c** " = greater than **c**alibration standard used for pre-calibration, or outside the acceptable range about the calibration standard. Typically used for conductivity (>718, 1,413, 2,760, 6,668 or 12,900 uS/cm) or

turbidity (>10, 20 or 40 NTU). It can also be used for TDS and Salinity calculations based on qualified ("c") conductivity data, or that the calculation was not possible due to censored conductivity data (TDS and Salinity are calculated values and entirely based on conductivity reading). See Section 4.1 for acceptance criteria.

" **?** " = Light interference on Turbidity sensor (typ. error message). Data is typically censored.

Sample-specific Qualifiers:

" a " = **a**ccuracy as estimated at WES Lab via matrix spikes, PT sample recoveries, internal check standards and lab-fortified blanks did not meet project data quality objectives identified for program or in QAPP.

" **b** " = **b**lank Contamination in lab reagent blanks and/or field blank samples (indicating possible bias high and false positives).

" **d** " = precision of field **d**uplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected.

" **e** " = not theoretically possible. Specifically, used for bacteria data where colonies per unit volume for e-coli bacteria > fecal coliform bacteria, for lake Secchi and station depth data where a specific Secchi depth is greater than the reported station depth, and for other incongruous or conflicting results.

" **f** " = **f**requency of quality control duplicates did not meet data quality objectives identified for program or in QAPP.

" **h** " = **h**olding time violation (usually indicating possible bias low)

" **j** " = used for lab-related issues where certain lab QC criteria are not met and re-testing is not possible (as identified by the WES lab only). Also used to report sample data where the sample concentration is less than the 'reporting' limit or RDL and greater than the method detection limit or MDL (mdl< *x* <rdl). Also used to note where values have been reported at levels less than the mdl. Denotes an 'estimated' value' when used as a qualifier only (i.e., not censored). When solely used for censored data, it denotes censure at the lab.

" **m "** = **m**ethod SOP not followed (only partially implemented or not implemented at all) due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (eg. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, missing data or deviations from field sampling SOPs.

" **p** " = samples not **p**reserved per SOP or analytical method requirements.

" **r** " = samples collected may not be **r**epresentative of actual field conditions, based on documented or suspected field sampling error, or inexplicable or improbable ("outliers") values.

Appendix 4

Excerpted from:
Data Validation Report for Year 2003 Project Data (CN 211.0)

Expedited data validation results for October, 2003 sewage spill from the Upper Blackstone WWTP

Department of Environmental Protection
Division of Watershed Management

Email from R. Chase to Tom Dallaire and Art Johnson on 10/22/03 RE: Validation of BLK spill event data

Hi Tom and Art,

I have reviewed the recent survey data collected by DWM and CERO in the Blackstone Watershed pursuant to the recent spill by the UBWPAD. These data include multi-probe field readings, fieldsheet notes, sample COC forms and WES lab reports for the 10/2, 10/3 and 10/6 surveys (except for TP, TSS and NH3 data for the 10/2 survey; and 10/3 TSS data---not yet received).

NOTE: The 10/8 survey was not included in my review, due to lack of fieldsheets and station discrepancies.

The objective of this review is to provide an expedited validation of these data, in light of the need to discuss results in a timely manner. The review was guided by our SOP for data validation (CN 56.0), our data use guidance (CN 0.8) and best professional judgement.

Based on my review and in consultation with you, Jeff Smith, Stella Kiras and others, the following is concluded with respect to the validity of the data:

1) As a whole, these data appear to be representative of field conditions at the time of each survey.

2) These data were collected by trained, experienced DWM and CERO staff following accepted DWM protocols.

3) All survey data appear to represent "dry weather" conditions (based on precipitation data provided by survey coordinator).

4) All final multi-probe data (provided to you as highlighted rows on the raw YSI printouts) are indicative of stable ambient conditions, had acceptable pre-survey calibrations and post-survey checks, are based on proper instrument use, and the electronic date/time stamps matched the fieldsheet data.

5) In general, fieldsheet data look OK, albeit incomplete for the 10/6 CERO run. Stella filled out fieldsheets at a later time for the 10/6 survey run by Warren and Terry (CERO), based on their field notebook notes. Therefore, some of the data we typically gather from the fieldsheets is missing for this run. Also, "Site" #s used by CERO are different from "Station" #s used by DWM, but the stations are easily matched based on good station/site descriptions.

6) All lab analyses by WES for these survey samples were performed within holding times, and were accurate and precise based on the lab QC data. For the 10/2 bacteria analysis, two lab duplicates slightly exceeded the acceptance criteria for range of logs but were accepted by the lab due to low number effect.

7) A field blank sample and a sample duplicate were taken for each analyte for each crew survey (taking water samples). All ambient field blanks for bacteria were less than detection limits (6 and 9 org./100 mls.). Field duplicates (not splits, but co-located, sequential, less than 1 min. apart) for all bacteria survey data indicate good overall precision (meeting our data quality objectives) for fecal and E. coli, based on the RPD of log values:

Type	ID	x1	x2	rpd	log10 x1	log10 x2	rpd (log)
fecal	401/402	280	420	40.0	2.4	2.6	6.9
fecal	379/380	260000	320000	20.7	5.4	5.5	1.7
fecal	350/351	65	71	8.8	1.8	1.9	2.1
fecal	326/327	140	150	6.9	2.1	2.2	1.4
e-coli	350/351	52	71	30.9	1.7	1.9	7.6
e-coli	326/327	77	180	80.2	1.9	2.3	17.8
e-coli	379/380	300000	340000	12.5	5.5	5.5	1.0
e-coli	401/402	180	300	50.0	2.3	2.5	9.4

NOTE: Samples 51-326/327 (10/2 survey) for E. coli showed relatively low precision at low values (RPD=17.8). This can be attributed to both low number effect and the more variable nature of episodic event samples. The overall precision of the fecal results for the same samples was good (1.4 RPDlog).

The 10/6 TSS results for the field blank and field duplicate were <1.0 mg/L and 10% RPD, respectively.

8) The COC forms indicate that all samples were accounted for at all times and were dropped off/logged in at WES properly. Although the sodium thio- preservation code was not used for all samples on the COC, I confirmed with Stella that all wade-in stations used the sodium thio- tab bottles to dechlorinate, while all the basket drop stations did not dechlorinate with sodium thio: BLK02 (10/2 only), BLK07A, BS19, Station 3, and Station 7. This is mainly relevant for the basket drop stations closest downstream of the discharge channel--- mainly BLK02 (on 10/2 only) and to a much-lesser extent Station 3 and BLK07A on all dates. The duration and volume of the un-chlorinated discharge from the UBWPAD was approx. 1.5 hrs (2:30-4:00 pm, 10/2) and about 2 MG, respectively. At all other times, the normal discharge and the primary-treated spill discharge was chlorinated. Any bias due to lack of sample dechlorination (possible for the 10/2 BLK02 data) would be negative in terms of bacteria numbers.

9) New station locations are described adequately on all fieldsheets (as revised) for creation of stations in the WQD database. Of the 13 total stations visited during the week, 5 were historical stations downstream of the UBWPAD.

10) Note that the .shp map file denoting the approx. station locations and bacteria results is accurate, except for Station 7 results: should read 3800 cfu/100 mls., not 38,000 cfu/100 mls.

In summary, I recommend that all these data from the 10/2, 10/3 and 10/6 Blackstone surveys (except for not yet received 10/2 and 10/3 data) be accepted at "QC3" status without qualification or censure, except for:
ID# 51-0332 fecal and E. coli results for BLK02 (10/2 survey): accept, but qualify with "a" and "m" (potential low bias due to lack of sample dechlorination).

At your discretion, please forward these validation results to CERO, as appropriate.

If you have questions and/or comments, let's discuss.

Thank you.

Richard