

**COMBINED WORK/QUALITY ASSURANCE PROJECT PLAN**

*for*

**FECAL COLIFORM MONITORING 1998 – 2000**

**TASK 26**

**MWRA HARBOR AND OUTFALL MONITORING PROJECT  
CONTRACT NO. S274**

*Submitted to*

**MASSACHUSETTS WATER RESOURCES AUTHORITY  
ENVIRONMENTAL QUALITY DEPARTMENT  
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## COMBINED WORK/QUALITY ASSURANCE PROJECT PLAN

*for*

### FECAL COLIFORM MONITORING 1998 – 2000

#### TASK 26 MWRA HARBOR AND OUTFALL MONITORING PROJECT CONTRACT NO. S274

#### CONCURRENCE AND APPROVALS

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Dr. Carlton Hunt  
Battelle Project Manager

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Date

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Ms. Rosanna Buhl  
Battelle Project QA Officer

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Date

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Dr. Michael Mickelson  
MWRA Project Manager

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Date

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Dr. Andrea Rex  
MWRA Project Area Manager

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Ms. Wendy Leo  
MWRA EM & MS Manager

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Date

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## TABLE OF CONTENTS

1.0 PROJECT NAME .....	1
2.0 PROJECT REQUESTED BY .....	1
3.0 DATE OF REQUEST .....	1
4.0 DATE OF PROJECT INITIATION.....	1
5.0 PROJECT MANAGEMENT .....	1
6.0 QUALITY ASSURANCE (QA) MANAGEMENT .....	1
7.0 PROJECT DESCRIPTION .....	2
7.1 Objective and Scope.....	2
7.2 Data Usage .....	2
7.3 Technical Approach .....	2
7.3.1 Field Surveys Program.....	4
7.3.2 Laboratory Program for Survey Tasks (Tasks 14, 15).....	8
8.0 PROJECT FISCAL INFORMATION .....	9
9.0 SCHEDULE OF ACTIVITIES AND DELIVERABLES.....	9
10.0 PROJECT ORGANIZATION AND RESPONSIBILITIES .....	10
11.0 DATA QUALITY REQUIREMENTS AND ASSESSMENTS .....	11
11.1 Navigational and Hydrographic Data.....	11
11.2 Water Sampling.....	11
11.2.1 Precision and Accuracy.....	11
11.2.2 Completeness .....	11
11.2.3 Comparability.....	11
11.2.4 Representativeness .....	11
12.0 SAMPLING AND ANALYTICAL PROCEDURES .....	12
12.1 Navigation, Hydrographic Profile, and Water Sampling .....	12
12.2 Onboard Sample Processing.....	12
12.3 Laboratory Procedures .....	12
13.0 SAMPLE CUSTODY .....	12
13.1 Custody of Electronic Data .....	12
13.2 Custody of Water Samples .....	13
14.0 CALIBRATION PROCEDURES AND PREVENTIVE MAINTENANCE .....	13
14.1 Hydrographic Profiling Equipment .....	13
14.2 Navigation Equipment.....	13
14.3 Laboratory Equipment.....	13
15.0 DOCUMENTATION, DATA REDUCTION, AND REPORTING.....	16
15.1 Data Recording.....	16
15.2 Data Reduction.....	16
15.2.1 Hydrographic and Navigation Data.....	16
15.3 Reporting Data to be Loaded into the Database.....	16
15.3.1 Navigation and Sample Collection Data .....	17
15.3.2 Hydrographic Data.....	17
15.4 Loading Analytical Data into the Harbor Studies Database.....	17
15.5 Reporting Data to MWRA .....	17
16.0 DATA VALIDATION .....	17
17.0 PERFORMANCE AND SYSTEM AUDITS .....	17
18.0 CORRECTIVE ACTION.....	18

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19.0 REPORTS .....	18
19.1 Survey Plans .....	18
19.2 Survey Reports .....	18
19.3 Data Reports .....	18
20.0 REFERENCES .....	19

### LIST OF FIGURES

Figure 1. Transect Survey Sampling Stations .....	5
Figure 2. Conditional Classification and Adverse Condition Surveys Sampling Stations.....	7
Figure 3. Fecal Coliform Study Area Organization. ....	10
Figure 4. Battelle Chain-of-Custody Form.....	14
Figure 5. MWRA Chain-of-Custody Form .....	15

### LIST OF TABLES

Table 1. Technical Requirements for Fecal Coliform Monitoring .....	2
Table 2. Fecal Coliform Monitoring Survey Schedule. ....	3
Table 3. Transect Survey Station Locations.....	6
Table 4. Conditional Classification Sampling Stations.....	8
Table 5. Schedule of Deliverables.....	9
Table 6. Table of STUDY_IDS .....	17

## **1.0 PROJECT NAME**

MWRA Harbor and Outfall Monitoring  
Project Task 26  
Fecal Coliform Monitoring of Massachusetts Bay

## **2.0 PROJECT REQUESTED BY**

Massachusetts Water Resources Authority  
Environmental Quality Department

## **3.0 DATE OF REQUEST**

November 5, 1997

## **4.0 DATE OF PROJECT INITIATION**

November 5, 1997

## **5.0 PROJECT MANAGEMENT**

Dr. Michael, Connor, MWRA Director of Environmental Quality Department  
Dr. Michael Mickelson, MWRA Harbor and Outfall Monitoring Project Manager  
Mr. Kenneth Keay, MWRA Harbor and Outfall Monitoring Deputy Project Manager  
Dr. Andrea Rex, MWRA Project Area Manager for Fecal Coliform Monitoring  
Dr. Carlton Hunt, Battelle Project Manager for Harbor and Outfall Monitoring  
Mr. Carl Albro, Battelle Field Manager  
Ms. Heather Trulli, Battelle Laboratory Manager

## **6.0 QUALITY ASSURANCE (QA) MANAGEMENT**

Ms. Wendy Leo, MWRA EM & MS Manager  
Ms. Rosanna Buhl, Battelle Project Quality Assurance Officer

## 7.0 PROJECT DESCRIPTION

### 7.1 Objective and Scope

The purpose of this work is to provide to MWRA and the Massachusetts Division of Marine Fisheries (DMF) the monitoring data required to comply with shellfish-growing water regulations, and to assure that the operation of the MWRA's sewage effluent in Massachusetts Bay does not adversely affect shellfish-growing waters.

Task 26 (Fecal Coliform Monitoring) provides assistance to the MWRA in evaluating fecal coliform and *Enterococcus* densities at specific locations in Massachusetts Bay. Battelle's assistance is limited to field operations and data reporting. MWRA will conduct laboratory analyses and report data to DMF. Battelle will receive final data from MWRA and submit fecal coliform data reports to MWRA semi-annually.

### 7.2 Data Usage

The data will be used by the Massachusetts Division of Marine Fisheries to (1) evaluate baseline, pre-discharge conditions in Massachusetts (pre-discharge transect surveys); (2) compare pre-discharge bacteria counts to bacteria counts after the outfall begins operation (post-discharge transect surveys); (3) track the location of fecal coliform in the effluent plume and compare to model predictions (plume-tracking surveys); and (4) evaluate the water quality of the "conditional" classified shellfish-growing waters in areas of Massachusetts Bay potentially affected by operation of the outfall (conditional classification surveys).

### 7.3 Technical Approach

The technical requirements and schedule for Task 26 activities are listed in Tables 1 and 2.

**Table 1. Technical Requirements for Fecal Coliform Monitoring.**

Activity	Plume Tracking Surveys	Transect Surveys	Conditional Classification Surveys	Adverse Condition Surveys
Schedule	See Table 2	See Table 2	See Table 2	See Table 2
Stations	TBD	4 transects, 19 stations total	12 stations	12 stations
Water column measurements	See Albro <i>et al.</i> (1998)	Hydrographic profiling	Hydrographic profiling	Hydrographic profiling
Water Samples and Gear	12 samples per survey; GoFlo bottles	38 samples per survey; GoFlo bottles	24 samples per survey; GoFlo bottles	24 samples per survey; GoFlo bottles
Custody and Storage	MWRA LIMS sample IDs; Chilled	MWRA LIMS sample IDs; Chilled	MWRA LIMS sample IDs; Chilled	MWRA LIMS sample IDs; Chilled
Whale Observations	See Albro <i>et al.</i> (1998)	Jan – May	Dec - May 15	Dec - May 15

**Table 2. Fecal Coliform Monitoring Survey Schedule.**

MWRA will report preliminary bacterial analysis to the Massachusetts Division of Marine Fisheries within 72 hours of sample collection.

SurveyID	Start Date
PA984	15-Oct-98
PA985	09-Dec-98
PA991	12-Apr-99
PA992	10-Jun-99
PA993	02-Aug-99
PA994	20-Oct-99
PA995	07-Dec-99
PA001	10-Apr-00
PA002	08-Jun-00
PA003	01-Aug-00
PA004	18-Oct-00
PA005	04-Dec-00
PC98A	06-Oct-98
PC98B	23-Nov-98
PC98C	15-Dec-98
PC991	27-Jan-99
PC992	22-Feb-99
PC993	30-Mar-99
PC994	21-Apr-99
PC995	12-May-99
PC996	14-Jun-99
PC997	20-Jul-99
PC998	16-Aug-99
PC999	22-Sep-99
PC99A	05-Oct-99
PC99B	17-Nov-99

SurveyID	Start Date
PC99C	13-Dec-99
PC001	26-Jan-00
PC002	21-Feb-00
PC003	28-Mar-00
PC004	19-Apr-00
PC005	10-May-00
PC006	13-Jun-00
PC007	18-Jul-00
PC008	14-Aug-00
PC009	20-Sep-00
PC00A	03-Oct-00
PC00B	21-Nov-00
PC00C	11-Dec-00
PP991	17-Feb-99
PP992	19-May-99
PP993	03-Aug-99
PP994	15-Nov-99
PT981	18-Feb-98
PT982	13-May-98
PT983	06-Aug-98
PT984	24-Nov-98
PT991	16-Feb-99
PT992	13-May-99
PT993	06-Aug-99
PT994	23-Nov-99

**Survey ID Code**

- PA Adverse condition
- PC Conditional classification
- PP Plume tracking
- PT Transect



### **7.3.1 Field Surveys Program**

Four survey types will be conducted under the Fecal Coliform Monitoring. Samples collected by Battelle will be analyzed by MWRA.

#### **7.3.1.1 PLUME TRACKING SURVEYS (TASK 26.1)**

Water samples for fecal coliform analysis will be collected during the Plume Tracking Surveys as described in the Plume Tracking Survey CW/QAPP. A total of 48 water samples (12 samples per survey, four surveys) will be collected for fecal coliform analysis. Both surface and sub-pycnocline water samples will be collected. Pycnocline depths will be determined during field operations. If no pycnocline is observed, sub-pycnocline samples will be collected at approximately mid-depth.

Water samples will be collected using GoFlo sampling containers or an *in situ* pumping system installed on Battelle's BOSS towfish. GoFlo and BOSS tubing will be pre-rinsed with site water prior to sample collection. Surface water samples will be collected on the upstream side of the research vessel.

Each sample collected will receive a unique sample number assigned by the MWRA Laboratory Information Management System (LIMS). These identifications will be entered into Battelle's NAVSAM system at the time of collection. Specific sample collection information will relate the sample to the collection site and will indicate the collection date and time.

Water samples will be held chilled for no more than 12 hours until delivered to the Deer Island Central Laboratory. Delivery will be through either direct transfer at the Deer Island Dock or via land-based transportation.

#### **7.3.1.2 TRANSECT SURVEYS (TASK 26.2)**

Eight transect surveys will be conducted from Winter 1998 to Fall 1999. Four of the surveys will be conducted before the outfall is operational (Winter, Spring, Summer, and Fall of 1998) and will provide data to establish a seasonal baseline. The other four surveys will be conducted after the outfall is operational (Winter, Spring, Summer, and Fall of 1999), and data will be used to establish a seasonal post discharge pattern. A total of 304 water samples will be collected during the course of the eight surveys (four transects comprising 19 stations; two samples per station; four surveys per year x 2 years).

Each survey will include running four transects from the future outfall site toward nearshore shellfish areas at Devereaux, Nahant, Hull, Cohasset Harbor (Figure 1).

Hydrographic profiling of conductivity, temperature, sensor depth, and dissolved oxygen will be performed at each station (Figure 1; Table 3) by using Battelle's BOSS system. Salinity and density will be calculated in real-time from the conductivity, temperature, and depth data. Water depth, navigational position, and time also will be recorded by the NAVSAM system. Results will be directly input to the EM & MS database (see Section 15.2.1). Profiles will extend to at least 5 m above the bottom and closer if dissolved oxygen levels decrease markedly with depth.

### Map of Transect Stations Produced by Battelle 1/30/98

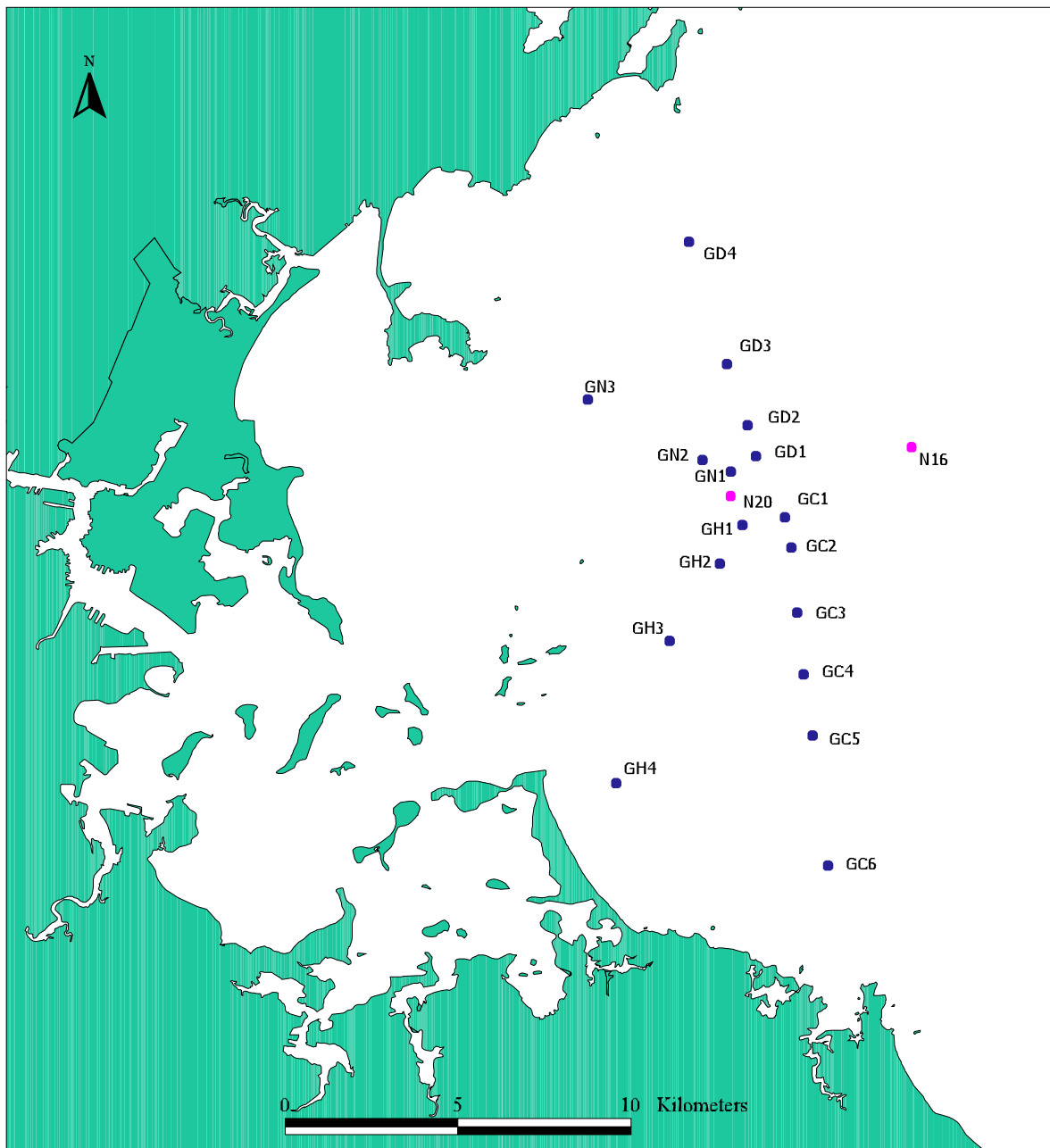


Figure 1. Transect Survey Sampling Stations

**Table 3. Transect Survey Station Locations**

<b>Station</b>	<b>Latitude</b>	<b>Longitude</b>
GD1	42.392	-70.808
GH2	42.364	-70.821
GH1	42.374	-70.813
GN3	42.407	-70.867
GN2	42.391	-70.827
GN1	42.388	-70.817
GD4	42.448	-70.831
GD3	42.416	-70.818
GD2	42.400	-70.811
GC1	42.376	-70.798
GC6	42.285	-70.784
GC5	42.319	-70.789
GC4	42.335	-70.792
GC3	42.351	-70.794
GC2	42.368	-70.796
GH4	42.307	-70.858
GH3	42.344	-70.839
N16	42.394	-70.753
N20	42.382	-70.817

Surface and subpycnocline water samples will be collected at each station, using GoFlo bottles deployed with a Rosette system. Sample bottles will not be closed until the oxygen sensor has come to equilibrium to ensure sample data represent the collected water.

Certified whale observers will be present on those surveys conducted between January through May. Whale observation results will be included in the survey report. Whale observations will be analyzed and the results included in the annual whale observation report described in the HOM3 contract, Task 33.1.

### **7.3.1.3 CONDITIONAL CLASSIFICATION SURVEYS (TASK 26.3)**

After the outfall is operational, water column profiles and water samples for fecal coliform analysis will be obtained at each of 12 stations (Figure 2; Table 4). A total of 648 water samples will be collected during the course of this program (12 stations per survey; two samples per station x 27 surveys).

Hydrographic profiling and sample collection will be performed as described in Section 7.3.1.2. Water samples will be stored chilled and delivered to the Deer Island Central Laboratory within 12 hours of collection.

Certified whale observers will be present on those surveys conducted between December to mid-May. Whale observation results will be included in the survey report. Whale observations will be analyzed and the results included in the annual whale observation report, as described in the HOM3 contract, Task 33.1.

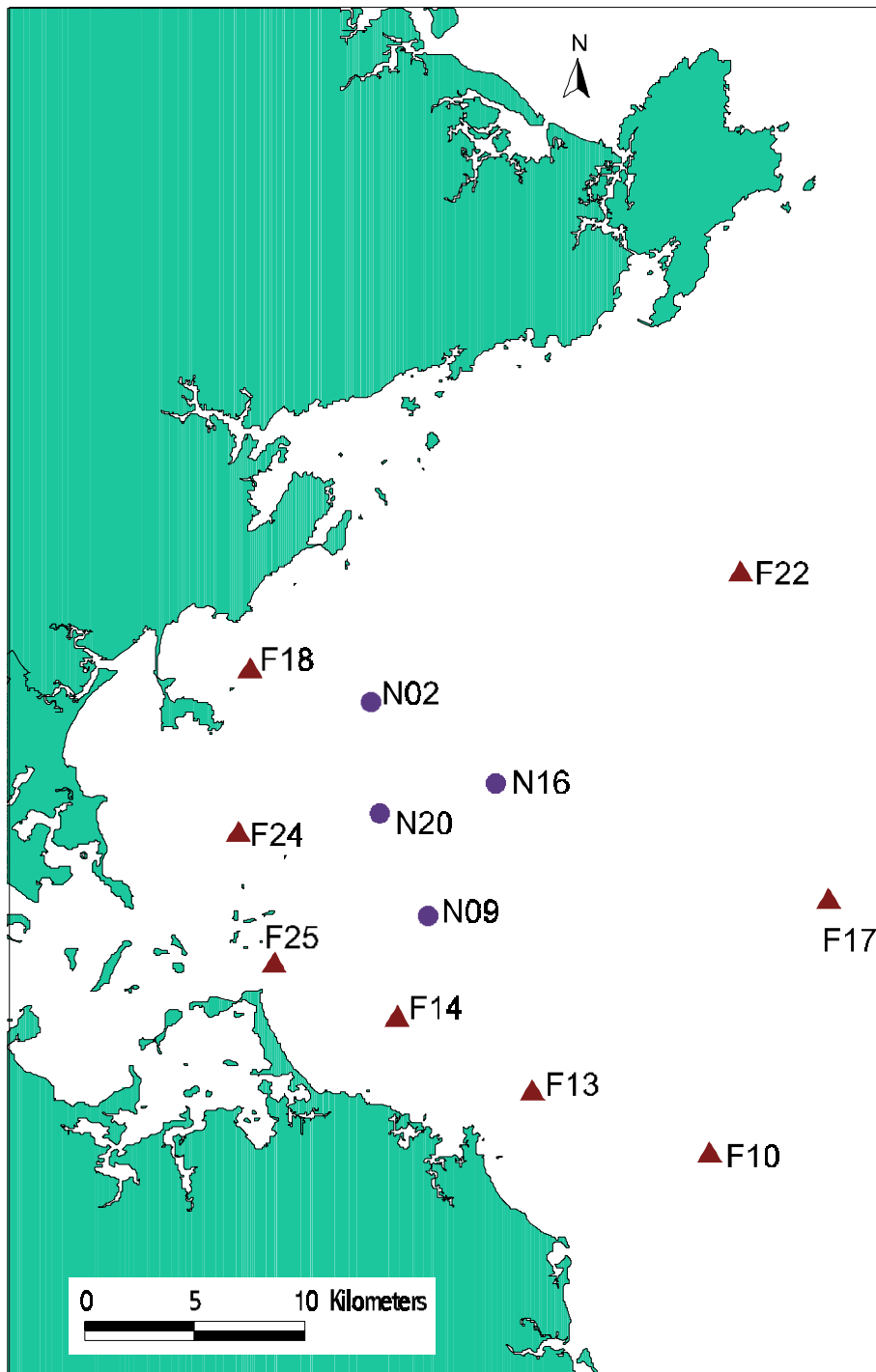


Figure 2. Conditional Classification and Adverse Condition Surveys Sampling Stations.

**Table 4. Conditional Classification Sampling Stations.**

<b>Station</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Depth (m)</b>
N02	42° 25.65' N	70° 49.31' W	40
N09	42° 20.39' N	70° 47.48' W	32
N16	42° 23.64' N	70° 45.20' W	40
N20	42° 22.90' N	70° 49.03' W	32
F10	42° 14.54' N	70° 38.24' W	30
F13	42° 16.10' N	70° 44.10' W	25
F14	42° 18.00' N	70° 48.50' W	20
F17	42° 20.75' N	70° 34.23' W	78
F18	42° 26.53' N	70° 53.30' W	24
F22	42° 28.79' N	70° 37.06' W	80
F24	42° 22.50' N	70° 53.75' W	20
F25	42° 19.30' N	70° 52.58' W	15

#### **7.3.1.4 ADVERSE CONDITION SURVEYS (TASK 26.4)**

In conjunction with the MWRA and Division of Marine Fisheries, Battelle will assist in developing criteria that will be used to determine the need for a water-column survey near the outfall. A rapid-response field-team will be designated. This team will be responsible for mobilizing and completing surveys in the event of chlorination failure or other conditions that might adversely affect the treatment plant's ability to provide adequate treatment and disinfection of effluent at the Deer Island Plant. The Field Manager will oversee the team and will be responsible for all communications with MWRA.

A total of 12 adverse condition surveys will be conducted, and a total of 288 water samples (12 stations (Figure 2) per survey, two samples per station, 12 surveys) will be collected for fecal coliform analysis by MWRA. Survey activities will include hydrographic profiling and water samples collection, performed as described in Section 7.3.1.2. MWRA will provide a set of bottles for the rapid response teams. These bottles will be stored on Battelle's research vessel at all times. An additional set will be maintained at Battelle as a backup. Water samples will be stored chilled and delivered to the Deer Island Central Laboratory within 12 hours of collection.

Certified whale observers will be on stand by status for all surveys. These staff will be present on those surveys conducted between December and mid-May. Whale observation results will be included in the survey report and annual whale observation report, as described in the HOM3 contract, Task 33.1.

#### **7.3.2 Laboratory Program for Survey Tasks (Tasks 14, 15)**

The MWRA laboratory will analyze all samples for fecal coliform abundance according to the methodology approved by the Massachusetts Division of Marine Fisheries. Samples will be tested for *Enterococcus* abundance according to MWRA's Standard Operating Procedure (MWRA 1996) at Stations GN1, GH4, GC6, N20, and N16.

## 8.0 PROJECT FISCAL INFORMATION

The Fecal Coliform Monitoring activities described in the CW/QAPP are being conducted under the Harbor and Outfall Monitoring contract (Contract No. S274) between Battelle and MWRA.

## 9.0 SCHEDULE OF ACTIVITIES AND DELIVERABLES

The schedule of deliverables is below (Table 5). The schedule of surveys is given in Table 1.

**Table 5. Schedule of Deliverables**

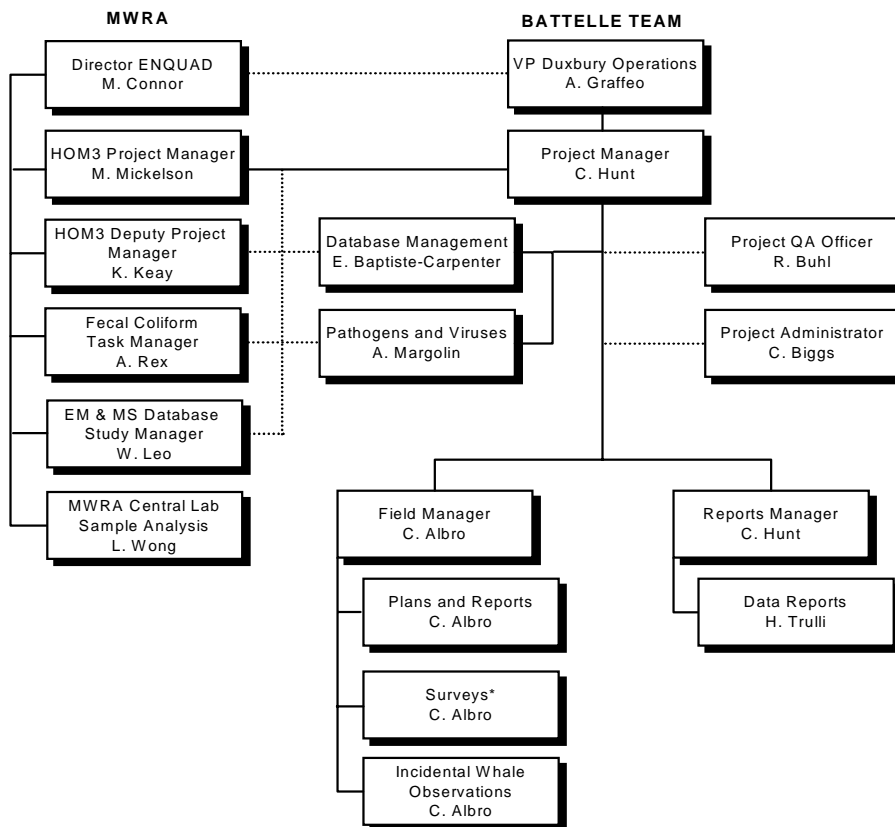
Deliverable	Due Dates According to Survey Type			
	Plume Tracking	Transect	Conditional Classification	Adverse Condition
Survey Plan	2 wks prior to survey, 1999	2 wks prior to survey, 1998, 1999	2 wks prior to survey, 1998, 1999, 2000	2 wks prior to survey, 1998, 1999, 2000
Surveys	Feb, May, Aug, Nov, 1999	1998, 1999 1x per season, 1998 and 1999	Oct, Nov, Dec 1998; Monthly 1999 and 2000	Oct and Dec 1998 Apr, Jun, Aug, Oct, Dec 1999 and 2000.
Survey Report	1999; due 4 weeks after each survey	1998, 1999; due 4 weeks after each survey	1998, 1999, 2000, 2001; due 4 weeks after each survey	1998, 1999, 2000, 2001; due 4 weeks after each survey
Data Reports	Jan-Jun samplings: Aug same year Jul-Dec samplings: Feb next year			

## 10.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Figure 3 presents the Project Management structure for the Fecal Coliform Monitoring surveys. This structure represents the major tasks necessary to complete the scope of work. Each element of the task has been assigned a separate subaccount with budget and milestones, and these accounts will be used to track costs against progress.

Dr. Michael Mickelson is the MWRA Project Manager and Dr. Andrea Rex is the MWRA Project Area Manager for Fecal Coliform Monitoring. They will be informed of all matters pertaining to work described in this CW/QAPP. Mr. Ken Key is the MWRA Deputy Project Manager and will serve as a back up to Dr. Mickelson. Ms. Wendy Leo is MWRA's EM & MS database manager. Ms. L. Wong is the MWRA Central Laboratory Supervisor responsible for Fecal Coliform and *Enterococcus* laboratory analysis.

Dr. Carlton Hunt is the Battelle Project Manager and is responsible for the overall performance of this project. The Battelle Quality Assurance Officer for the project is Ms. Rosanna Buhl. For this task, Ms. Buhl is responsible for reviewing the data reports for completeness and adherence to the CW/QAPP. She is also responsible for reviewing the Final Reports for accuracy and completeness. An initiation audit consisting of a review of field SOPs and associated training records will be performed. Mr. Carl Albro is the Battelle Field Manager responsible for all Battelle field collections. Ms. Ellie Baptiste is Battelle's Database Manager.



\*Samples collected by Battelle and analyzed by MWRA

Figure 3. Fecal Coliform Study Area Organization.

## **11.0 DATA QUALITY REQUIREMENTS AND ASSESSMENTS**

### **11.1 Navigational and Hydrographic Data**

Data quality requirements and assessments for navigational and hydrographic data are detailed in the Water Column Monitoring CW/QAPP (Albro *et al.*, 1998) and the Plume Tracking CW/QAPP.

### **11.2 Water Sampling**

#### **11.2.1 Precision and Accuracy**

Precision and accuracy of water sampling procedures are not directly quantified, but are ensured by the collection procedures. The sampling objective is to obtain uncontaminated samples representative of their location. Procedures will follow standard methods that can achieve this objective. All samples will be handled and stored according to the procedures described in Section 12.

#### **11.2.2 Completeness**

In the event of sample loss or equipment malfunction, the Chief Scientist will determine the need for appropriate corrective action (e.g., resampling). The corrective action taken by the Chief Scientist will be recorded in the survey notebook. The goal is to collect 100% of the samples, however, a loss of 10% of the fecal coliform data for the entire program is not expected to compromise the objectives of the program.

#### **11.2.3 Comparability**

To ensure comparability of fecal coliform measurements, a seasonal baseline will be established under Task 26.2, Transect Surveys. The four initial transect surveys are scheduled to take place before the outfall is operational, to provide the data for the baseline. The remaining transect surveys will occur after the discharge is operational, thereby establishing a post-discharge pattern.

Hydrographic profiling data will be comparable to measurements from those collected for water column surveys Albro *et al.* (1998).

#### **11.2.4 Representativeness**

The representativeness of the planned station locations and frequency of sampling is defined by the sample collection plan. Water samples will be collected, handled, and transported using procedures (see Section 12 below) that will ensure that resulting data represent the sample material collected. To ensure that sample data represent the collected water, samples bottles used for fecal coliform collection will not close until the oxygen sensor has come to equilibrium.



## **12.0 SAMPLING AND ANALYTICAL PROCEDURES**

The method for collection of samples is identical for each of the four subtasks covered under Task 26. Each sample collected will receive a unique sample number assigned by the MWRA's Laboratory Information System (LIMS). These IDs will be entered into Battelle's NAVSAM™ system at the time of collection. Specific sample collection information will relate the sample to the collection site and will indicate the collection date and time.

### **12.1 Navigation, Hydrographic Profile, and Water Sampling**

Refer to the Water Column CW/QAPP (Albro *et al.*, 1998) for a complete description of navigation, hydrographic profiling, and water sampling procedures. Station logs used for this task are the same logs used for the water column sampling.

### **12.2 Onboard Sample Processing**

Methods for shipboard processing will be identical for each of the four subtasks described under Task 26. Pre-sterilized sample bottles will be provided to the Battelle sampling team by MWRA prior to departure for each survey. The shipboard technician will transfer the sample from the GoFlo bottle to the sample bottle using care to avoid contamination from his/her own bacteria (saliva, hands) or cross contamination from other samples. It is important that the inside surfaces of the sample bottle and cap remain uncontaminated. In order to minimize contamination, the technician will refrain from talking during the sample transfer. The sample volume will be at least 250 mL.

The sample bottles will be labeled and stored in coolers at <10° C. A thermometer will be kept in each cooler in a water-filled bottle (temperature blank) containing samples. Verification of storage conditions will be documented upon arrival to the Central Laboratory facility. Transfer to the laboratory must occur within 12 hours. Arrangements should be made by the Battelle crew prior to the survey to have samples received at the lab immediately upon return.

### **12.3 Laboratory Procedures**

Samples will be processed according to MWRA Central Laboratory Standard Operating Procedures. Laboratory methodologies are in MWRA 1996 and MWRA 1998.

The MWRA Central Laboratory data sheet will be used for documentation.

## **13.0 SAMPLE CUSTODY**

### **13.1 Custody of Electronic Data**

Field custody of electronic data will be the responsibility of the survey chief scientist. This person will be identified for each survey. The field custody of the electronic data consists of creating floppy-disk backups of all electronic data generated each day. Each floppy disk label will include a survey ID, date, name of person creating the backup files, and a disk number. When the equipment is returned to Battelle, a second complete backup, labeled as "Set 2", will be generated on floppy disks. The backup will be in the custody of Mr. Albro. The survey chief scientist maintains the original.

MWRA's Central Laboratory will maintain custody of electronic files of all data generated at that laboratory until an independent QC audit has been completed. Once the data have been marked

“approved” in the MWRA’s LIMS system, the data will be downloaded into MWRA’s EM & MS database. The laboratory results will be sent to Ms. Baptiste-Carpenter as an Oracle export file for loading into Battelle’s copy of the EM & MS.

### **13.2 Custody of Water Samples**

During field collection, COC forms will be completed and labels will be affixed to the sample containers, thereby creating a link between the sample and data recorded on the COC form. Fecal coliform samples will be identified using SAMPLE\_IDs which are the LIMS sample numbers provided by Deer Island Central Laboratory.

The samples will remain in the custody of the Chief Scientist who will be the Field Sample Custodian (designated for each survey) while in the field. COC forms (Figures 4 and 5) will accompany the samples when transferred from the field to the laboratory. Upon sample receipt by MWRA Central Laboratory, the Sample Custodian will examine the samples, verify that sample-specific information recorded on the COC is accurate and that the sample integrity is uncompromised, log the samples into the laboratory tracking system, complete the custody forms, and sign the COC form so that transfer of custody of the samples is complete. Any discrepancies between sample labels and transmittal forms, and unusual events or deviations from the CW/QAPP will be documented in detail on the COC and the Task Leader and Project Manager notified. The original COC forms will be submitted to the Battelle MWRA database administrator and maintained in the MWRA project files. Sample numbers assigned by MWRA will be used to track the samples through the laboratory.

## **14.0 CALIBRATION PROCEDURES AND PREVENTIVE MAINTENANCE**

### **14.1 Hydrographic Profiling Equipment**

Details of the calibration procedures and preventative maintenance for the hydrographic profiling equipment can be found in the Water Column Monitoring CW/QAPP (Albro *et al.*, 1998).

### **14.2 Navigation Equipment**

Details of the calibration procedures and preventative maintenance for the navigation equipment can be found in the Water Column Monitoring CW/QAPP (Albro *et al.*, 1998).

### **14.3 Laboratory Equipment**

The calibration procedures and acceptance criteria for laboratory equipment are detailed in the MWRA Central Laboratory SOP (MWRA, 1998).






















## MWRA Harbor and Outfall Monitoring Program Contract No. S274 Chain-of-Custody Form

Today's Date : 3/5/98 17:07:58

Laboratory : MTH Environmental Associates

Chain-of-Custody # : WF981-FE-  
 Survey ID : WF981  
 Analysis ID : FE  
 Analysis Description : Fecal coliform

183 White Moss Drive  
 Marstons Mills MA 02648  
 Dr. Robert Duncanson  
 508-420-0706 (Phone) (Fax)

Bottle ID :	Bottle ID :	Sampling Date :	Station ID :	Ck 1	Ck 2	Ck 3	Ck 4
	WF98104AUR1	2/1/98 01:41:00	F01	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF98104CUR1	2/1/98 01:43:00	F01	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF98106EUR1	2/3/98 13:49:35	F02	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981071UR1	2/3/98 13:51:43	F02	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF9810B1UR1	2/3/98 20:18:52	F27	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF9810B3UR1	2/3/98 20:22:04	F27	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981108UR1	2/4/98 13:10:31	N16	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF98110AUR1	2/4/98 13:12:06	N16	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF98112EUR1	2/7/98 08:33:49	F24	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981130UR1	2/7/98 08:35:44	F24	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981146UR1	2/7/98 10:43:53	F25	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981148UR1	2/7/98 10:45:13	F25	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981155UR1	2/7/98 12:35:49	F31	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981158UR1	2/7/98 12:36:56	F31	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981162UR1	2/7/98 13:44:51	F30	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981163UR1	2/7/98 13:46:00	F30	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981173UR1	2/9/98 07:12:23	N04	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981175UR1	2/9/98 07:15:04	N04	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981184UR1	2/9/98 08:51:33	N18	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981186UR1	2/9/98 08:53:54	N18	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WF981196UR1	2/9/98 10:24:12	F23	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Relinquished By / Date / Time / Company / Transport-Airbill #	Received By / Date / Time / Company

Figure 4. Battelle Chain-of-Custody Form

MWRA CHAIN OF CUSTODY  
 FOR  
 MISCELLANEOUS SAMPLES

SAMPLE LOC.	SAMPLE ID	DATE COLLECTED	TIME	SAMPLE LOCATION DESCRIPTION	PLANT	TYPE / TESTS	PRESERVATIVE	BOTTLE
						G C CG GS/ FCOLSUMFL	/	/ P G S
						G C CG GS/ EDCOAGNPL	/	/ P G S
						G C CG GS/ FCOLSUMFL	/	/ P G S
						G C CG GS/ EDCOAGNPL	/	/ P G S
						G C CG GS/ FCOLSUMFL	/	/ P G S
						G C CG GS/ EDCOAGNPL	/	/ P G S
						G C CG GS/ FCOLSUMFL	/	/ P G S
						G C CG GS/ EDCOAGNPL	/	/ P G S
						G C CG GS/ FCOLSUMFL	/	/ P G S
						G C CG GS/ EDCOAGNPL	/	/ P G S
						G C CG GS/ FCOLSUMFL	/	/ P G S
						G C CG GS/ EDCOAGNPL	/	/ P G S
						G C CG GS/ FCOLSUMFL	/	/ P G S
						G C CG GS/ EDCOAGNPL	/	/ P G S
						G C CG GS/ FCOLSUMFL	/	/ P G S
						G C CG GS/ EDCOAGNPL	/	/ P G S

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

SAMPLED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
 RELINQUISHED TO: \_\_\_\_\_ DATE: \_\_\_\_\_  
 RECEIVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_ (AT LAB)

Figure 5. MWRA Chain-of-Custody Form

## **15.0 DOCUMENTATION, DATA REDUCTION, AND REPORTING**

### **15.1 Data Recording**

All data will be initially recorded either (1) electronically onto computer storage media from BOSS or other laboratory systems or (2) manually into bound laboratory notebooks or onto established data forms. All notes will be written in black ink. Corrections to hand-entered data will be initialed, dated, and justified. Corrections to electronically captured data (e.g., electronic "spikes") will be documented on a hard-copy plot of the data. Completed data forms or other types of hand-entered data will be signed and dated by the individual entering the data. Direct-entry and electronic data entries will indicate the person collecting or entering the data. Station logs associated with field custody and tracking will be kept in survey notebook for each survey. These notebooks will be held in the custody of the Field Manager.

### **15.2 Data Reduction**

#### **15.2.1 Hydrographic and Navigation Data**

The hydrographic data generated during the survey will consist of rapidly sampled, high-resolution measurements of conductivity, temperature, depth, DO, transmissometry, underwater light levels, total incident radiation, altitude above bottom, and bathymetry. The BOSS data-acquisition software assigns a unique data filename to each vertical profile made during the survey. All data will be electronically logged with date, time, and concurrent GPS/LORAN vessel-position data. Battelle's NAVSAM™ software will be used to convert the raw engineering data into concentration units using factory or laboratory calibration coefficients. The irradiance data from the light sensor table will be electronically and manually reviewed for proper operation of the two light sensors. The converted hydrocast will be plotted in high resolution, parameter versus depth graphic form for visual inspection of data representativeness. NAVSAM™ will create a Microsoft Access database file consisting of two tables. One table will contain the downcast data that will exclude the ship upward motions and be averaged to 0.5-m depth bins, and another table that includes the upcast data corresponding to the average of the data between the top and bottom of the GoFlo bottle at each sampling depth. The database file will serve as an export file to the EM & MS database. The NAVSAM station data will be linked to the MWRA SAMPLE\_ID for data entry.

### **15.3 Reporting Data to be Loaded into the Database**

Fecal coliform samples will be identified using SAMPLE\_IDs which are the LIMS sample numbers provided by the MWRA's Central Lab.

All field and laboratory data will be submitted to Battelle in electronic format. The field data will be available for data loading directly off the ship. The MWRA Central Laboratory will use the Multiple Tube Fermentation method using A-1 medium (LIMS code FCOLSWMTF). Fecal coliform and *Enterococcus* results will be entered by Deer Island Central Lab staff into the MWRA's LIMS system and subsequently downloaded into the BOTTLE and ANALYTICAL\_RESULTS tables in the MWRA's EM & MS database. The STUDY\_ID will be assigned to the data. MWRA ENQUAD staff will export the records in Oracle export format for inclusion in Battelle's copy of EM & MS, within two weeks of sample collection. Battelle will generate GEO\_STATION, EVENT, STATION, SAMPLE, and PROFILE records for this study.

### 15.3.1 Navigation and Sample Collection Data

Details can be found in the Water Column Monitoring CW/QAPP (Albro *et al.*, 1998).

### 15.3.2 Hydrographic Data

Details can be found in the Water Column Monitoring CW/QAPP (Albro *et al.*, 1998).

## 15.4 Loading Analytical Data into the Harbor Studies Database

Data submissions from the laboratory will be received from MWRA as Oracle export files and imported into EM & MS using STUDY\_IDs (Table 6). The submissions are logged in upon receipt and a copy is maintained on file under the login id. The MWRA check script will be run on the database as a batch job each night. Any issues will be sent to the data manager and MWRA via email. Any changes to the database as a result of quality control checks will also be submitted to MWRA with the data export.

**Table 6. Table of STUDY\_IDs**

DMF_PLUME	Plume tracking surveys
DMF_TRANS	Transect surveys
DMF_COND	Condition and classification surveys
DMF_ADV	Adverse conditions surveys

## 15.5 Reporting Data to MWRA

The data contained in each hard copy survey report are submitted to MWRA as a database export. The supporting documentation files are included with the data submission. Data deliverables will be combined only with permission from MWRA.

## 16.0 DATA VALIDATION

The MWRA will be responsible for conducting data validations of data generated in their laboratory. As an additional data validation step, the MWRA Fecal Coliform Task Manager will review all data for technical reasonableness.

## 17.0 PERFORMANCE AND SYSTEM AUDITS

The Battelle QA Officer for the Harbor and Outfall Monitoring Project is Ms. Rosanna Buhl. She will direct the conduct of at least one systems audit to ensure that Task 26 activities are carried out by Battelle in accordance with this CW/QAPP. The result of this audit will be reported to management as described in the project's Quality Management Plan. In addition, survey and data reports will be reviewed for accuracy and completeness.

Audits of the sample analysis and data collection procedures at the MWRA Central Laboratory will be the responsibility of MWRA personnel. The lab is fully responsible for the QA of the data it submits. Data submissions that will not load into the database for any reason will be returned to the submitting lab.

## **18.0 CORRECTIVE ACTION**

All technical personnel share responsibility for identifying and resolving problems encountered in the routine performance of their duties. Dr. Carlton Hunt, Battelle's Project Manager, will be accountable to MWRA and to Battelle management for overall conduct of the Harbor and Outfall Monitoring Project, including the schedule, costs, and technical performance. He is responsible for identifying and resolving problems that (1) have not been addressed timely or successfully at a lower level, (2) influence multiple components of the project, (3) necessitate changes in this CW/QAPP, or (4) require consultation with Battelle management or with MWRA.

Issues that affect schedule, cost, or performance of Task 26 will be reported to the Battelle Project Manager. They will be responsible for evaluating the overall impact of the problem on the project and for discussing corrective actions with the MWRA Project Manager.

Problems identified by the QA Officer will be reported and corrected as described in Section 17.0 and the Quality Management Plan.

## **19.0 REPORTS**

### **19.1 Survey Plans**

The survey plans will be developed using the standard template for survey plans described in Albro *et al.* (1998).

### **19.2 Survey Reports**

The survey report will include the items described in the contract. The table of fecal coliform analysis will include station (stat\_id), location (actual latitude and longitude), stat\_arriv, sample\_date\_time, depth, sample\_id, bottle\_id (if applicable), anal\_rep (if applicable), fecal coliform value (in #/100 mL), value qualifier, and detection limit (if applicable), temperature (C), salinity (PSU), and dissolved oxygen (mg/L).

### **19.3 Data Reports**

The semi-annual data reports will summarize the data reported in the survey reports. They will include a map and table of nominal station locations, a table of sampling events, and a table for each survey which includes the following: station, stat\_arriv, depth, anal\_rep (if applicable), fecal coliform value (in #/100 mL), value qualifier, and detection limit (if applicable), temperature (C), salinity (PSU), and dissolved oxygen (mg/L). These tables will be sorted so that all the results from one type of survey are together (i.e. plume tracking, transects, etc.)

## 20.0 REFERENCES

Albro *et al.* 1998. Combined Work/Quality Assurance Project Plan for Water Column Monitoring HOM3.

MWRA. 1996. Massachusetts Water Resources Authority Central Laboratory Standard Operating Procedure 10-IND-MFL-04. *Enterococcus* – Receiving Water Samples. (Reference: Standard Methods 18<sup>th</sup> Edition, Method 9230C.)

MWRA. 1998. Massachusetts Water Resources Authority Central Laboratory Standard Operating Procedure 10-IND-A1M-01. Fecal Coliforms by Multiple Tube Fermentation (A-1 Medium Method) AOAC Method 978.23 (16<sup>th</sup> Ed.)