Combined work/quality assurance project plan (CWQAPP)

for

The Diffuser Inspection Survey of June 2003

Massachusetts Water Resources Authority

Environmental Quality Department
Report ENQUAD ms-079

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COMBINED WORK QUALITY ASSURANCE PROJECT PLAN (CWQAPP)

for

THE DIFFUSER INSPECTION SURVEY OF JUNE 2003

Task 31.0

MWRA Harbor and Outfall Monitoring Project
Contract No. S366

Submitted to

MASSACHUSETTS WATER RESOURCES AUTHORITY
Environmental Quality Department
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ms-079

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Combined Work/Quality Assurance Project Plan (CWQAPP) *for*

Diffuser Inspection Survey of June 2003 Task 31.0

MWRA Harbor and Outfall Monitoring Project Contract No. S366 Concurrence and Approvals

Ms. Ellen Baptiste Carpenter Battelle Project Manager	Date
Dr. Carlton Hunt Battelle Technical Director	Date
Dr. James Bake ENSR Technical Director	Date
Ms. Rosanna Buhl Battelle Project QA Officer	Date
Dr. Michael Mickelson MWRA Project Manager	Date
Mr. Ken Keay MWRA Project Area Manager	Date
Ms. Wendy Leo MWRA EM & MS Manager	Date

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1.0 PROJECT NAME

MWRA Harbor and Outfall Monitoring Project
Task 31.0
Diffuser Inspection Survey, 2003

2.0 PROJECT REQUESTED BY

Massachusetts Water Resources Authority
Environmental Quality Department

3.0 DATE OF REQUEST

November 7, 2001

4.0 DATE OF PROJECT INITIATION

November 7, 2001

5.0 PROJECT MANAGEMENT

Dr. Andrea Rex, MWRA Director of Environmental Quality Department
Dr. Michael Mickelson, MWRA Harbor and Outfall Monitoring Project Manager
Mr. Ken Keay, MWRA Harbor and Department Outfall Monitoring Deputy Project Manager and Benthic (Sea-Floor) Monitoring Project Area Manager
Ms. Ellen Baptiste-Carpenter, Battelle Harbor and Outfall Monitoring Project Manager and Database Manager
Dr. Carlton Hunt, Battelle Harbor and Outfall Monitoring Project Technical Director
Ms. Jeanine Boyle, Battelle Harbor and Outfall Monitoring Deputy Project Manager
Dr. James A. Blake, ENSR Harbor and Outfall Monitoring, Benthic Area Task Manager

6.0 QUALITY ASSURANCE (QA) MANAGEMENT

Ms. Wendy Leo, MWRA EM & MS Manager
Ms. Rosanna Buhl, Battelle Project QA Officer
Ms. Debbie McGrath, ENSR QA Officer

7.0 PROJECT DESCRIPTION

The Massachusetts Water Resources Authority (MWRA) has constructed an outfall tunnel from the Deer Island Sewage Treatment Plant to a site offshore in Massachusetts Bay. Fifty-five diffuser caps, attached to riser pipes, are located on a line approximately 6000-ft long. Each riser pipe is connected to the tunnel, establishing the terminus of the outfall that discharges treated sewage from Deer Island. The diffuser caps and risers were installed in 1991-1992. The location of the outfall is shown on Figure 1 along with adjacent hard-bottom monitoring stations. Inspection of Diffusers Nos. 2 and 44 are included in the annual hard-bottom monitoring. The Diffuser Inspection survey described in this CW/QAPP is intended to provide information on the surficial condition of each of the 55 diffusers. This information includes any evidence of physical damage, degree of biofouling, and observations of water flow efficiency. Data will be recorded by observing underwater video images taken with a remotely operated vehicle (ROV). Expert observers will record observations of each individual inspection diffuser during the survey. These data will be tabulated, summarized, and compared with a subsequent review of the video in the laboratory. Results, including video footage, will be submitted to MWRA for review and submission to regulators.

7.1 Objective and Scope

The objective of this project is to inspect each of the 55 diffusers and each of the eight ports on each diffuser that constitute the MWRA Deer Island offshore sewage outfall in Massachusetts Bay. It is important, from an operational standpoint, to inspect these structures on a periodic basis. Damage to individual diffusers from anchors, trawl doors, or other means could impact water flow and impact the efficiency of the outfall. In addition to direct damage, the inspection will also evaluate the degree of biofouling and efficiency of the anti-fouling coating with regard to limiting the types of fouling organisms. Additional observations on the presence of debris, fishing nets, and lobster trap arrays will also be collected. The project scope therefore reflects the following;

1. Precise location of each rise and diffuser cap being observed.
2. 100% completion of observations on each of the 55 diffusers and 8 ports per diffuser.
3. Determine the functional status of each riser to assess damage status, fouling with marine growth, or debris such as fishing gear with special reference to any apparent occlusion of open ports.
4. Compilation of an audiovisual report of the inspection to document the status of each riser and cap. Additional detail on structures that appear to be damaged or not functioning will also be provided.

7.2 Data Usage

The diffuser inspection satisfies a requirement of MWRA's NPDES discharge permit for the offshore outfall, which requires in part (Section I.18.e):

> The permittee shall conduct a video inspection in the first year and third year of the permit, which may be submitted with the annual Contingency Plan report described under section 8.a., and whenever the flow versus hydraulic head relationship changes in such a way that indicates the diffusers may not be functioning properly. Attached to its monthly DMR report, the permittee shall submit a monthly report to EPA and the MADEP that includes . . . information available from any video inspections conducted that month.

This survey represents the third year inspection. The data obtained from this survey will be used by MWRA to compare with the results of previous diffuser inspections. A survey plan will be prepared describing survey dates, vessel, personnel, and methods including those that deviate from the CWQAPP that are known before the survey and survey operations. A survey report will be prepared following the "General Conditions for Tasks 1-34" for submission requirements and an audiovisual report of the inspection will also be submitted.

7.3 Technical Approach

Vessel support for the 2003 MWRA Outfall Diffuser survey will be provided by CR Environmental, Inc. The vessel will be the 62 ft F/V *Christopher Andrew* based in Scituate, MA and owned and operated by Mr. Frank Mirarchi. The *Christopher Andrew* has been used regularly on the annual Hard Bottom ROV surveys in the vicinity of the Diffuser site. The vessel has also been used on numerous other ROV and underwater video surveys for CR Environmental including a major two-year trawl impact study in Mass Bay.

The *Christopher Andrew* is equipped with a 20-foot high hydraulic A-Frame. The vessel has a large open deck, large pilot house for the topside equipment and survey personnel, a 10-kw generator to power the survey electronics, and an extensive suite of survey and safety equipment. A specification sheet for the F/V *Christopher Andrew* has been attached (Appendix A).

The vessel will be moored using the same technique that is used when surveying diffusers as part of the Hard Bottom Survey (Williams et al., 2002). The vessel will anchor using a taut single point mooring consisting of a 2000-pound railroad wheel anchor and steamer chain. The vessel will anchor between diffusers allowing us to survey two diffusers for each anchor deployment. Using this technique, we expect to survey 6-8 diffusers per day.

For navigation, the vessel will be equipped with a Trimble AG-132 DGPS system with plus or minus one meter accuracy. In addition, a Bathy 500 Precision echosounder with a narrow beam echosounder will be installed on the vessel. These systems will be interfaced to a laptop computer with the HYPACK survey software. The bottom depths and x-y position of the vessel, as well as the 55 diffuser locations will be displayed on the computer monitor. A second monitor will be provided as a navigational display for the captain. Target coordinates for the 55 diffusers are shown in Table 1.

A Benthos MiniRover Mk ll Remotely Operated Vehicle (ROV) will be used to perform the video inspection survey of the outfall diffusers. The MiniRover is equipped with a high resolution color video camera, two 100 watt video lights, horizontal, vertical, and lateral thrusters, 1000 feet of tether, a single function manipulator, and a Benthos Mini-camera and strobe (Appendix B).

Underwater video data will be displayed on two video monitors and recorded on both VHS and DVD recorders. A headset microphone will enable the chief scientist to narrate the video footage. The DVD recorder will permit high-resolution screen captures of the under water video coverage. In addition, still photographs will be taken with the Benthos Mini camera when higher resolution images of certain features or damaged areas are required. Higher resolution images will be required when water flow, turbulence, or other impairments to clarity obscure critical areas. Still photographs will also be taken to back up video when something unusual is observed.

MWRA has requested that water depths be obtained for the diffusers on the eastern end of the outfall, especially for Riser 2. This will help operators understand the hydraulic behavior of the outfall.

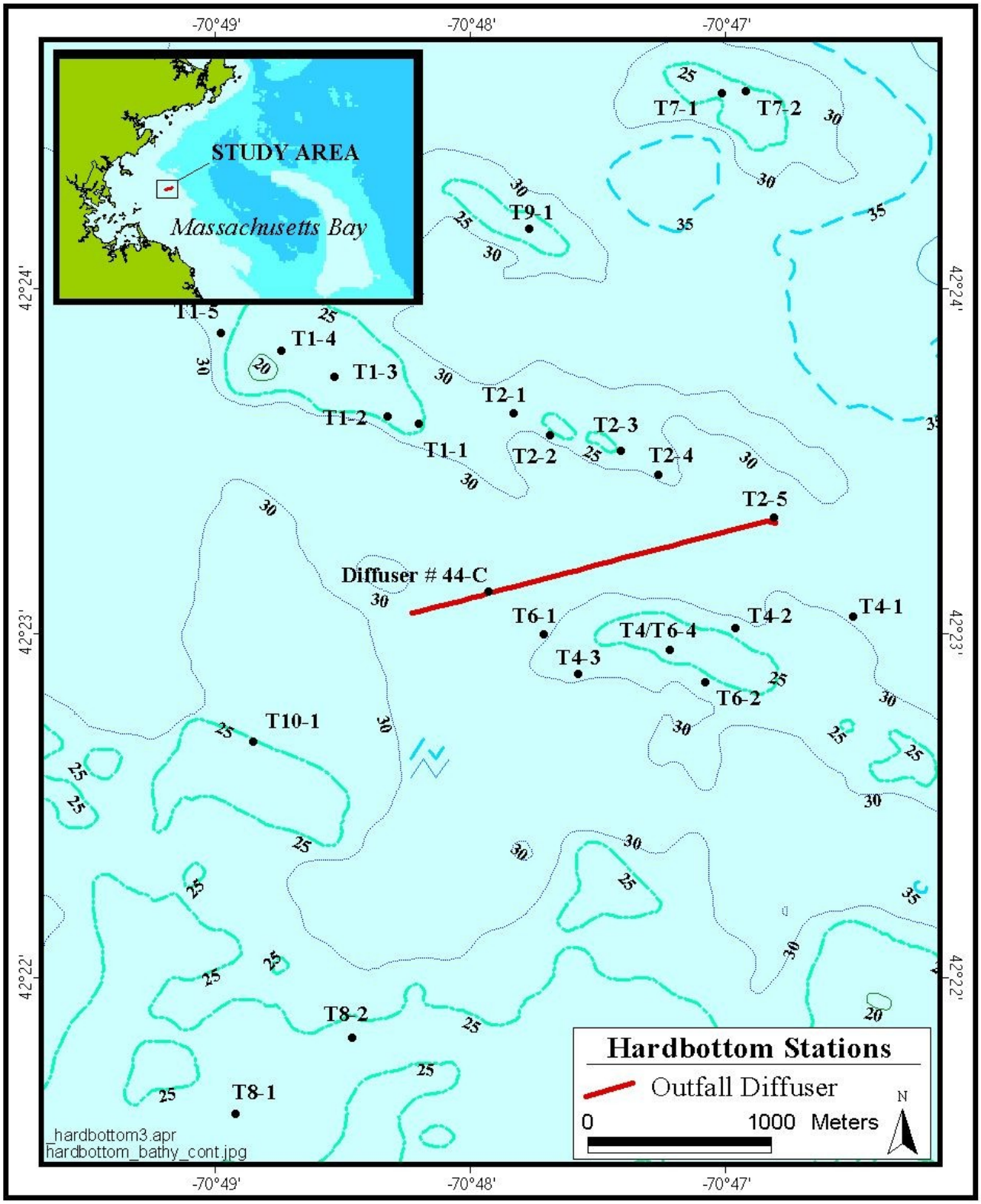

Figure 1. Map of Massachusetts Bay Showing Location of the Outfall Diffusers and Hardbottom Monitoring Stations.

Each diffuser inspection will begin with an overflight where a large-scale view will be obtained. This will provide immediate evidence of broad damage, fishing gear entanglement, and an overall view of attached organisms. It is likely that water flow characteristics will be evident. Following the overflight, the ROV will be moved closer to each diffuser to provide a detailed view of each of the eight ports. These ports will be identified and notes taken on their condition and whether or not water is flowing. The ROV will travel 360° around the diffuser in order to complete the inspection, stopping at each port. In addition to simply observing the port, a view will be taken from the top of the diffuser to the bottom at each port location. If the original overflight suggested damage or potential problems, those will be further investigated on a case by case basis. Video records will be obtained during the entire operation. 35-mm photographs will be taken to record damage or other unusual features. Observations will be recorded by narration of the video and on handwritten datasheets.

Table 1. Diffuser Coordinates.

(left in decimal degrees; right in degrees and decimal minutes)

Diffuser	Longitude (W)	Latitude (N)		Longitude (W)	Latitude (N)
1	-70.780090°	42.388683°		-70° 46.80540′	42° 23.32098′
2	-70.780121°	42.388855°		-70° 46.80726′	42° 23.33130′
3	-70.780586°	42.388771°		-70° 46.83516′	42° 23.32626′
4	-70.781036°	42.388683°		-70° 46.86216′	42° 23.32098′
5	-70.781494°	42.388599°		-70° 46.88964′	42° 23.31594′
6	-70.781929°	42.388512°		-70° 46.91574′	42° 23.31072′
7	-70.782417°	42.388435°		-70° 46.94502′	42° 23.30610′
8	-70.782814°	42.388344°		-70° 46.96884′	42° 23.30064′
9	-70.783272°	42.388256°		-70° 46.99632′	42° 23.29536′
10	-70.783714°	42.388168°		-70° 47.02284′	42° 23.29008′
11	-70.784164°	42.388084°		-70° 47.04984′	42° 23.28504′
12	-70.784592°	42.387989°		-70° 47.07552′	42° 23.27934′
13	-70.785057°	42.387909°		-70° 47.10342′	42° 23.27454′
14	-70.785461°	42.387825°		-70° 47.12766′	42° 23.26950′
15	-70.785927°	42.387756°		-70° 47.15562′	42° 23.26536′
16	-70.786392°	42.387657°		-70° 47.18352′	42° 23.25942′
17	-70.786842°	42.387573°		-70° 47.21052′	42° 23.25438′
18	-70.787285°	42.387486°		-70° 47.23710′	42° 23.24916′
19	-70.787727°	42.387402°		-70° 47.26362′	42° 23.24412′
20	-70.788170°	42.387314°		-70° 47.29020′	42° 23.23884′
21	-70.788620°	42.387226°		-70° 47.31720′	42° 23.23356′
22	-70.789070°	42.387138°		-70° 47.34420′	42° 23.22828′
23	-70.789520°	42.387054°		-70° 47.37120′	42° 23.22324′
24	-70.789963°	42.386971°		-70° 47.39778′	42° 23.21826′
25	-70.790405°	42.386883°		-70° 47.42430′	42° 23.21298′
26	-70.790848°	42.386795°		-70° 47.45088′	42° 23.20770′
27	-70.791298°	42.386715°		-70° 47.47788′	42° 23.20290′
28	-70.791740°	42.386627°		-70° 47.50440′	42° 23.19762′
29	-70.792191°	42.386543°		-70° 47.53146′	42° 23.19258′
30	-70.792641°	42.386456°		-70° 47.55846′	42° 23.18736′
31	-70.793083°	42.386372°		-70° 47.58498′	42° 23.18232′
32	-70.793526°	42.386284°		-70° 47.61156′	42° 23.17704′

Table 1. (continued)

Diffuser	Longitude (W)	Latitude (N)		Longitude (W)	Latitude (N)
33	-70.793976°	42.386200°		-70° 47.63856′	42° 23.17200′
34	-70.794418°	42.386120°		-70° 47.66508′	42° 23.16720′
35	-70.794876°	42.386017°		-70° 47.69256′	42° 23.16102′
36	-70.795311°	42.385944°		-70° 47.71866′	42° 23.15664′
37	-70.795761°	42.385857°		-70° 47.74566′	42° 23.15142′
38	-70.796204°	42.385769°		-70° 47.77224′	42° 23.14614′
39	-70.796654°	42.385685°		-70° 47.79924′	42° 23.14110′
40	-70.797096°	42.385597°		-70° 47.82576′	42° 23.13582′
41	-70.797546°	42.385517°		-70° 47.85276′	42° 23.13102′
42	-70.797989°	42.385426°		-70° 47.87934′	42° 23.12556′
43	-70.798439°	42.385342°		-70° 47.90634′	42° 23.12052′
44	-70.798843°	42.385265°		-70° 47.93058′	42° 23.11590′
45	-70.799332°	42.385170°		-70° 47.95992′	42° 23.11020′
46	-70.799774°	42.385082°		-70° 47.98644′	42° 23.10492′
47	-70.800224°	42.384995°		-70° 48.01344′	42° 23.09970′
48	-70.800659°	42.384914°		-70° 48.03954′	42° 23.09484′
49	-70.801109°	42.384827°		-70° 48.06654′	42° 23.08962′
50	-70.801544°	42.384743°		-70° 48.09264′	42° 23.08458′
51	-70.802002°	42.384655°		-70° 48.12012′	42° 23.07930′
52	-70.802444°	42.384567°		-70° 48.14664′	42° 23.07402′
53	-70.802895°	42.384483°		-70° 48.17370′	42° 23.06898′
54	-70.803322°	42.384399°		-70° 48.19932′	42° 23.06394′
55	-70.803795°	42.384312°		-70° 48.22770′	42° 23.05872′

7.4 Monitoring Parameters and Frequency

The monitoring parameters to be collected as part of this Diffuser Inspection Survey are tabulated on the datasheet presented in Appendix C.

The following types of data will be obtained from each diffuser that is inspected:

General Information and Observations

- Date of Survey
- Diffuser Number
- Diffuser target coordinates
- Diffuser actual coordinates
- Arrival time at diffuser (begin inspection)
- Departure from diffuser (end of inspection)
- Water depth (ft)
- Overall evidence of physical damage
- Obstructions
- Fouling by fishing gear
- Other damage

Details of Damage and Biofouling

- Type of damage
- Possible origin of damage
- Location of damage
- Degree of biofouling
- Identification of Biofouling Organisms

Diffuser Port Observations (8 ports per diffuser)

- Water Flow characteristics
- Obstructions to port
- Damage if any

This datasheet has a main lead page and supplemental pages that will be added when additional comments are required. For example, if there is fouling by fishing gear, details will be written up on an extra page.

8.0 PROJECT FISCAL INFORMATION

This project will be carried out under the terms of the Harbor and Outfall Monitoring Contract S366 between the MWRA and Battelle Duxbury Operations.

9.0 SCHEDULE OF ACTIVITIES AND DELIVERABLES

The Survey Plan will be submitted in May 2003.

Mobilization for the Diffuser Inspection Survey is planned for Monday, June 9, 2003 at the fishing pier in Scituate, Massachusetts.

Inspection will begin on June 10 and continue through June 17, 2003 or completed earlier, depending on weather and the number of diffusers observed each survey day. The dates of June 18-20 are available as weather days should any of the planned survey days (June 10-17) not be used. The annual Hard-bottom Survey (HOM 4 Task 18.4 is scheduled to mobilize on the same vessel and at the same location on June 22, 2003, or immediately following the Diffuser Inspection Survey.

The Survey Report including film and video will be delivered by July 2003.

10.0 PROJECT ORGANIZATION

This Project falls under the overall Project Organization of the Benthic Monitoring tasks as described in Williams et al. (2002).

For the Diffuser Inspection Survey, Dr. James Blake, Leader for Benthic Monitoring on HOM4, will be the Task Manager and Chief Scientist. He is responsible for all aspects of the planning, conduct, and reporting for this task. He will report to Ms. Ellen Baptiste-Carpenter, Battelle Project Manager for the Harbor and Outfall Monitoring HOM4 Project. Ms. Baptiste-Carpenter is responsible for the overall performance of the team for this project.

The Project team that will carry out the Diffuser Inspection includes the following individuals:

Dr. James A. Blake, ENSR, Chief Scientist
Dr. Pamela L. Neubert, ENSR, Co-Chief Scientist and Observer
Mr. John (Chip) Ryther Jr., CR Environmental, logistical manager and navigator
Mr. Vince Capone, Consultant, ROV Operator
Mr. Frank Mirarchi, Captain of the F/V *Christopher Andrew*
Mr. John Shea, Mate on the F/V *Christopher Andrew*

11.0 DATA QUALITY REQUIREMENTS AND ASSESSMENTS

Requirements for ensuring that the data are of suitable quality for their intended use include accuracy, precision, representativeness, comparability, and completeness. When these requirements are met, the final product is technically defensible. Data elements for this project are discussed in terms of the appropriate characteristics, defined as:

Accuracy:	The extent of agreement between a measured value and the true value of interest.
Precision:	The extent of mutual agreement among independent, similar, or related measurements.
Representativeness:	The extent to which measurements represent true systems.
Comparability:	The extent to which data from one study can be compared directly to similar studies.
Completeness:	The measure of the amount of data acquired versus the amount of data required to fulfill the statistical criteria for the intended use of the data.

11.1 Navigation

The Navigation system being provided by CR Environmental has software that records navigation data, date, and time throughout the survey. This data will be stored and later downloaded into a database that will be available for submission as part of the Survey Report. The Trimble AG-132dGPS has an accuracy of "1 meter. The completeness goal for navigation is 100%.

11.2 ROV operations

The data quality objectives for the Diffuser Survey will be met by several procedures. Video will be viewed in real time thus ensuring that the tapes and DVDs are of sufficient quality to meet the needs of assessing damage, biofouling, and other objectives. EHG (extra high-grade) magnetic tapes will be used for this project. All equipment will be thoroughly checked and calibrated prior to the survey.

The field methods will be similar to those followed in previous inspection surveys. All diffusers (100% completion is required) will be inspected in a manner that will ensure that damage, fouling, and operation can be fully assessed (See Section 7.0).

Video will run continuously during each inspection with narrative provided either by the Chief Scientist or Co-Chief Scientist. Still photographs using 35-mm Ektachrome film will be taken to provide high quality images of selected items of interest such as obvious damage, unusual types of biofouling, entangled fishing or lobstering gear, or other items of interest to the observers considered of importance (See Section 7.0). Film will be developed on board the vessel to ensure quality and completeness.

The only post-survey laboratory activity on this project is to review the video and 35-mm images and compare narration with handwritten datasheets. The results will then be tabulated in the Survey Report and this and all visual products will be transmitted to the MWRA for further analysis.

11.3 Echosounder Operations

The Bathy 500 Precision Echosounder, the type that will be used during the 2003 diffuser survey, provides a high-contrast thermal chart record complete with alphanumeric annotation of important parameters such as depth, speed of sound, and offset for draft/tide. This unit is portable and allows automatic operation and unattended logging of digital depth data is required. It is connected to the Differential Global Positioning System (DGPS) though a laptop computer. Therefore, with the interconnection of DGPS and ecosounder, continuous logging of position and depth data will be collected. The Bathy echosounder has a combined accuracy and precision of 0.5% of the measured depth, corrected to local tides (i.e., Boston Harbor). The ecosounder display will show the exact location of the diffuser relative to the boat and will give the most accurate depth measurement. The continuously logged depth and coordinate data will be archived in electronic format but not processed unless evidence of damage or anomaly is observed near the diffuser area being investigated. If it is noted that there is such damage (e.g. anchor scars) then additional survey work will be performed in the vicinity of the damaged area. The additional survey work will allow the field team to obtain data to produce the necessary bathymetric maps to demonstrate changes in depth due to disturbance. The bathymetric maps will be created utilizing GIS software, such as ArcView, combined with the continuously logged ecosounder and coordinate data.

Echosounders determine the distance between its transducer and underwater objects such as fish or seabed and show the results on a display. The display for the Bathy 500 Precision Echosounder is a thermal chart. An ultrasonic wave transmitted through water travels at a nearly constant speed of 4800 feet (1500 meters) per second. When a sound wave strikes an underwater object such as the sea bottom, part of the sound is reflected back toward the source. The depth to the seafloor is determined by calculating the time difference between the transmission of a sound wave and the reception of the reflected sound.

12.0 SAMPLING AND ANALYTICAL PROCEDURES

12.1 Navigation

Navigation will be with a Trimble AG-132 Differential Global Positioning System (DGPS) that interfaces with HYPACK survey software on a PC laptop computer. The interaction between the Trimble DGPS and the HYPACK survey software allows for 1-meter accuracy to target coordinates. Bottom depths as recorded from the echosounder along with the DGPS coordinates of the vessel, and the 55 Diffuser target locations will be displayed on the laptop monitor to help guide the survey vessel to the target location. The coordinates of the survey vessel and depth are continuously logged and stored on the computer hard-drive every second. This provides a means to electronically capture station information and then generate data tables and bathymetric graphics for the survey report. In addition to logging station location and depth HYPACK will also log date, arrival and departure time. A second monitor linked to the laptop with HYPACK software will be provided as a navigation display for the captain.

At each station, the vessel will be positioned between two adjacent diffusers that will be determined by target coordinates. The documented arrival time will be the time at which the survey of the first of the two diffusers is initiated, usually just after deployment of the ROV. The survey event will be considered

finished when the Chief Scientist considers the inspection of that particular diffuser complete. The arrival time for the second diffuser at that mooring event will be determined when inspection of the next diffuser commences and finishes in the same manner as the first diffuser survey. This pattern will be continued until all 55 diffusers are completely inspected.

12.2 Video and Slide Film Collection/Shipboard Processing

A Benthos MiniRover Mk ll Remotely Operated Vehicle (ROV) will be used to perform the video inspection survey of the outfall diffusers. The MiniRover is equipped with a high resolution color video camera, two 100 watt video lights, compass, depth gauge, horizontal, vertical, and lateral thrusters, 1000 feet of tether, a single function manipulator, and a Benthos Mini-camera and strobe.

The ROV with its associated equipment will be used to achieve the following goals:

- Know precisely which riser and cap is being viewed.
- Examine each of the 55 risers and 8 ports per riser. Overflight is acceptable as long as the system can determine from which ports effluent is emerging (not all ports on all risers are open).
- Determine the functional status of every riser (damage status; fouling with marine growth or debris including fishing gear; condition of the antifouling coating).
- Compile an audiovisual report of the inspection to document the status of each riser and cap.
- Provide extra detail on structures that appear to be damaged or not functioning.

The date, time and water depth will be recorded on the video and will appear on two monitors during recording. The start of survey for each diffuser will be recorded in the handwritten log as well as entered into the HYPACK system on the laptop computer. The time being recorded on the video and film will be synchronized daily with that of the HYPACK. For this survey time will Eastern Daylight Savings time.

Underwater video data will be displayed on two video monitors and recorded on both VHS and DVD. A headset microphone will allow the Chief Scientist or designated person to narrate the video footage. The narration will include identification of the diffuser being survey and which of the eight ports is currently being observed. The DVD recorder will permit high-resolution screen captures of the underwater video coverage. In addition, 35-mm photographs, using Kodak Ektachrome film, will also be taken with the Benthos Mini camera if higher resolution images of certain features or damaged areas are required. The Ektachrome slide film will be developed on each day of the survey using Kodak E-6 processing. All slides will be labeled manually after they are mounted in the laboratory.

In the laboratory, the video and slides will be reviewed to confirm field observations, especially if certain diffusers exhibit damage or some unusual attribute. It may be possible to provide further estimates of water flow after observing each video in the laboratory.

Data developed, as part of this project, will include handwritten observations similar to those noted on the video and DVD to use as a guide during data analysis. A datasheet will be carefully handwritten for each diffuser. An example datasheet provided in Appendix C lists the different types of information that will be recorded during the survey on the handwritten datasheets. Additional information will include 35-mm photographs, along with the videotapes and recorded DVD disks. These photographs will be digitized and also made available on a CD disk. A spreadsheet of the navigation records for each diffuser will be provided and a field notebook will be maintained that includes redundant information on diffuser coordinates, time of observations, and a summary of major findings for each diffuser.

After the survey is completed, data from these sources will be evaluated, compiled, and summarized in the Survey Report. Because there is no scientific objective for this survey, the recipients of the data products will evaluate the results relative to the efficiency or other operational aspects of the diffuser risers and caps.

13.0 SAMPLE CUSTODY

For the purposes of this survey, samples are defined as the videotapes, DVDs, 35-mm slides, field logbook, datasheets, and electronic navigation information. Each of these items will be carefully labeled and safely archived. It will be the responsibility of the Chief Scientist to ensure that these samples are safely archived and the appropriate chain of custody is followed. All data products will be replicated after the survey.

Labels for the videotapes and DVD disks will be handwritten when it is determined that the storage space on these media is full. Sample custody for this project includes the video and 35-mm slides. The originals will be under the supervision of the Chief scientist pending duplication. One full set of media collected for this survey will be kept at ENSR, one will be kept with the project files at Battelle, and one set will be submitted to MWRA. Battelle will archive the survey data for seven years, as specified by the contract.

14.0 CALIBRATION PROCEDURES AND PREVENTATIVE MAINTENANCE

The subcontractor, CR Environmental, Inc., is responsible for ensuring that all maintenance and calibration of the ROV, cameras, and navigation system is carried out prior to and during the survey in accordance with manufacturer's specifications. The navigation system will be calibrated against a known benchmark at the beginning and end of each survey day.

15.0 DATA DOCUMENTATION, REDUCTION, AND REPORTING

Field data will include: 1) a field logbook; 2) a binder of printed datasheets prepared for each diffuser; 3) electronic output from the navigation system; 4) output of the video, both as VCR and DVD formats; and 5) 35-mm slides. The slides will be digitized following the conclusion of the survey.

All handwritten data such as that in the field logbook and on the printed datasheets will be entered with waterproof/fade proof ink. Each datasheet will be signed and dated. Corrections or annotations will be initialed, dated, and justified in the same ink. An example of the proposed field datasheet is provided in Appendix C. There is no further data reduction required for this project apart from preparing written summaries in the Survey Report.

There is no subsequent data loading required for this project apart from managing the navigation data obtained from the Hypack. This will be set up in an Excel Spreadsheet and included with the Survey Report.

16.0 DATA VALIDATION

The navigation data provided by C.R. Environmental at the end of the survey will be cross-checked against the handwritten records in the field log book and on the datasheets. No other data require validation. Navigation accuracy is checked at the arrival of each diffuser by the Captain, the Chief

Scientist, and Chip Ryther from C.R. Environmental to be certain that each port and riser from the 55 diffusers is completely surveyed.

17.0 PERFORMANCE AND SYSTEM AUDITS

As the Battelle subcontractor for this project, ENSR will be fully responsible for the verification and validation of data submitted as part of the Survey Report. The ENSR QA Officer, Ms. Debra McGrath, will review the report and data products prior to submission of the Survey Report.

18.0 CORRECTIVE ACTION

The survey methods planned for the Diffuser Inspection are similar to those used for the annual hard-bottom survey and as such the field team is highly experienced. Nevertheless, it is possible that problems might arise.

All technical personnel share responsibilities for identifying and resolving problems encountered in the routine performance of their duties. Problems identified that affect technical and deliverable issues proposed in this Project Plan will be reported immediately to Ms. Ellen Baptiste-Carpenter, Battelle's Project Manager. She 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, or (3) require consultation with Battelle management or with MWRA. Problems encountered by the QA officer will be reported and corrected as described in Section 17 of the Project Management Plan (Battelle, 2002). If problems arise that necessitate changes to this CW/QAPP or the Survey Plan, these will be identified and resolved jointly with Dr. Carlton Hunt, Battelle's technical director and MWRA.

19.0 REPORTS

Documents (deliverables) that will be generated as part of the Diffuser Inspection Survey are:

1. Survey Plan
2. Survey Report including a tabulated summary of observations and raw datasheets.
3. Videotapes and DVD disks
4. 35-mm slides and digitized images of same

20.0 REFERENCES

Battelle. 2002. Project management plan for Massachusetts Water Resources Authority Harbor and Outfall Monitoring Project (HOM) IV. 29 pp. + Attachments.

Williams, I.P., N.J. Maciolek, J.D. Boyle, D.T. Dahlen, and E., Baptiste-Carpenter. 2002. Combined Work Quality Assurance Project Plan for Benthic Monitoring: 2002-2005. MWRA Environmental Quality Department, Miscellaneous Report Number ms-076. Massachusetts Water Resources Authority, Boston, MA. 109 pp.

APPENDIX A

SPECIFICATION SHEET FOR THE F/V *CHRISTOPHER ANDREW*

Fisheries Research
Benthic Coring/Grab Sampling
Oceanographic Mooring Operations

Water Quality Monitoring Studies
Side-scan surveys
ROV Operations

Past Experience

MWRA Water Quality and Benthic Surveys

Farfield/Nearfield Cruises for the Boston Harbor and Outfall Monitoring Program

MWRA ROV Hard Bottom Benthic Surveys off Boston Harbor

MA DEM Sediment Profile Camera Operations at the Cape Cod Disposal Site

New England Aquarium Study on the Survivorship of Discarded Fish

NOAA/NMFS Mesh Selectivity Studies

Specifications

Length: 62 feet
Draft: 8 feet
Fuel Consumption: 6 gal/hr

Beam: 20 feet
Speed: 9 knots
Berths: 4 personnel

150 sq feet of Lab Space in pilot house

100 sq ft of Lab Space w/lab benches and 110 and 220 KVA Power in Fish Hold

Machinery/ Deck Equipment

GM 871 Diesel Engine

(1) 10 KW Lister Generators

(2) 5 ton Marko Trawl Winches

(1) 500 pound Take Out Winch

(1) 20' 2 Ton Stern Mounted A-Frame

(1) 2 Ton Capacity Net Reel

Transducer/Hydrophone Boom

(1) 1000 lb capacity hydrographic winch

Electronics

Uniden MC-690 VHF Radio
Furuno 24 Mile Radar
Northstar Model 951X DGPS
Wood Freeman Autopilot with Remote Steering Station
Koden Color Video Sounder

3W Transportable Cellular Phone
Furuno LC-90 Loran C
Northstar 941 DGPS
Furuno FCV-201 Color Video Sounder
Davis Weather Station P-Sea Windplot Electronic Chart System

Safety Equipment

SOLAS 8 Man Life Raft

ACR Category 1 EPIRB

APPENDIX B

SPECIFICATION SHEET FOR THE MINI-ROVER MK II

Eric Steele holding Mini-Rover

Photograph taken at Diffuser 2 using Mini-Rover

High Resolution Color Video Camera	(2) 100 Watt Video Lights
Benthos Mini Still Cameras and Strobe	1,000 Feet of Tether
High Resolution Monitor and VCR	Ultra Thrusters
Single Function Manipulator	Hydrophone boom

APPENDIX C
TWO PAGE DATASHEET FOR THE DIFFUSER INSPECTION SURVEY

Name of Project	2003 MWRA Outfall Diffuser Inspection Survey-HOM4 **Sheet __ of __**		
Client	Massachusetts Water Resources Authority		
Vessel	F/V Christopher Andrew		
Contractor	ENSR International		
Chief Scientist	James A. Blake/ENSR		
Captain			
Crew			
Scientific Staff			
General Information			
Date of Survey			
Diffuser No.			
Diffuser Coordinates (Target)			
Diffuser Coordinates (Actual)			
Arrival time at diffuser			
Departure time from diffuser			
Water Depth (ft)			
Observations (check appropriate box)		Yes	No
Physical Damage			
Obstructions			
Fouling by Fishing Gear			
Other Damage			
Description-General			
Type of Damage			
Possible Origin			
Location of Damage on Diffuser			
Degree of Biofouling			
Identification of Biofouling Organisms			
Estimates of Percent Cover (Sp. 1)			
Estimates of Percent Cover (Sp. 2)			
Estimates of Percent Cover (Sp. 3)			
Estimates of Percent Cover (Sp. 4)			
Estimates of Percent Cover (Sp. 5)			
Estimates of Percent Cover (Sp. 6)			
Estimates of Percent Cover (Sp. 7)			
Other species notes			
Diffuser Port Observations (8 ports total)	Note: Water flow or lack there of, obstructions, damage to rip rap…etc.		
North			
Northeast			
East			
Southeast			
South			
Southwest			
West			
Northwest			
Signature of Observer and Date	**Signature:**	**Date:**	

Name of Project	2003 MWRA Outfall Diffuser Inspection Survey-HOM4 **Sheet __ of __**	
Client	Massachusetts Water Resources Authority	
Vessel	F/V Christopher Andrew	
Contractor	ENSR International	
Chief Scientist	James A. Blake/ENSR	
Captain		
Crew		
Scientific Staff		
General Information		
Date of Survey		
Diffuser No.		
Diffuser Coordinates (Target)		
Diffuser Coordinates (Actual)		
Arrival time at diffuser		
Departure time from diffuser		
Water Depth (ft)		
Further Observations [see previous page(s)]		
Signature of Observer and Date	**Signature:**	**Date:**

Massachusetts Water Resources Authority
Charlestown Navy Yard
100 First Avenue
Boston, MA 02129
(617) 242-6000
http://www.mwra.state.ma.us