

INFORMATION BRIEFING

TO: Outfall Monitoring Science Advisory Panel, Dr. Andrew Solow, Chair
FROM: Dr. Andrea Rex, MWRA
DATE: October 28, 2009
RE: Proposed Revisions to MWRA's Outfall Ambient Monitoring Plan for Water Column monitoring

ACTION

For vote: "OMSAP recommends to DEP and EPA that MWRA modify the water column Ambient Monitoring Plan as summarized below in sections 2.1 and 2.2."

The changes below are excerpted from section 2.1 and 2.2 of the 2009 annual list of changes. MWRA has modified its request for proposed changes based on comments received from EPA, Massachusetts Coastal Zone Management, SBNMS, and members of the Public Interest Advisory Committee. The major differences between the changes now proposed in MWRA's list, which are reflected in the corresponding Draft 2 of the monitoring plan, and those that were proposed earlier, in April, are that stations in Cape Cod Bay and Stellwagen Bank National Marine Sanctuary (SBNMS) are now included in the proposed monitoring plan. Also, there is a nearfield station proposed at the edge of the zone of initial dilution.

Proposed water column changes, excerpted from MWRA's annual list of changes are:

2 Water column

- 2.1 **Reduce the total number of stations sampled from 33 to 14.** This change focuses the monitoring on the geographic area now known to have a possibility of being affected by the discharge. Reference stations are included, but most of the furthest stations are removed.
 - 2.1.1 **Delete the following stations: F03, F05, F07, F12, F14, F16, F17, F18, F19, F24, F25, F26, F27, F28, F30, F31, N10, N16, N20.**
 - 2.1.2 **Include the following stations: F06, F10, F13, F15, F22, F23, N01, N04, N07, N18, N21 (Figure 1, Table 1).** Measure dissolved nutrients at nearfield station N21 at the edge of the zone of initial dilution, 60 meters from midline of diffuser line.
 - 2.1.3 **Sample three stations in Cape Cod Bay-Stellwagen Bank National Marine Sanctuary: F01, F02, F29 (Figure 1, Table 2).** Parameters will include *in situ* water quality, water column chemistry, and plankton, sampled 9 times annually at two depths.



Figure 1 Map of proposed water column monitoring stations.

Table 1 List of proposed water column monitoring stations and purpose for monitoring

STATION ID	WATER DEPTH (M)	LOCATION DESCRIPTION RELATIVE TO OUTFALL	PURPOSE
F22	80	17 km NE	Northern reference station Gulf of Maine influence Regional physical forcing relates to nearfield DO Link between buoy and sampling data "Upstream" sentinel station in winter-spring
N04	50	7.1 km NE	Evaluate extent of plume northeast
N01	31	6.3 km NW	Evaluate extent of plume northwest
N21	35	60 m	Evaluate dissolved nutrients at ZID
N18	27	2.5 km S	Close to outfall Ammonium signature Primary "impact" station for comparison to other stations
N07	50	7 km SE	Near NOAA buoy MWRA instruments-data comparison
F23	25	12 km E	Boston Harbor
F15	38	9 km S	Evaluate extent of plume southeast
F13	25	14 km S	Near coastal (model, <i>Alexandrium</i>)
F10	33	20 km S	Furthest expected southern expression of effluent plume
F06	33	29 km SE	Southern reference station

Table 2 Proposed Cape Cod Bay-Stellwagen Bank NMS monitoring stations

STATION ID	WATER DEPTH (M)	LOCATION DESCRIPTION RELATIVE TO OUTFALL	PURPOSE
F29	65	50 km SE	Evaluate nutrients and plankton in Stellwagen Bank National Marine Sanctuary
F02	32	70 km SE	Evaluate nutrients and plankton in Cape Cod Bay
F01	26	66 km SE	

2.2 Change survey schedule from 12 nearfield and 6 farfield annually to 9 surveys annually that include the five nearfield and six reference stations. Unlike the existing design where different stations are sampled at different frequencies and for different parameters, all stations will be sampled during every survey, and all parameters measured at all stations (except N21), including reference stations. This will provide a synoptic picture of a broader area than was previously possible, facilitating data interpretation and enabling scientists to better discriminate between regional changes and potential outfall-related changes (Table 3). As much as logistically feasible, sample the three Cape Cod Bay-Stellwagen Bank NMS stations synoptically with outfall monitoring stations.

Table 3 Proposed list of water column survey dates

WHEN	TARGET WEEK	ORIGINAL SURVEY NUMBER	PURPOSE
Early February	6	1	Nutrient conditions near start of spring bloom
March	12	3	Spring bloom
Early April	15	4	Capture <i>Phaeocystis</i> bloom. Late winter/spring bloom nutrients
Mid-May	20	6	Nutrient/water column conditions at end of winter-spring, <i>Alexandrium</i>
Mid-June	25	7	Early summer stratification and nutrients. Mid-late red tide season.
Mid-July	30	9	Mid-summer stratification and nutrients
Mid-August	34	11	Mid-summer stratification and nutrients
Late September	40	13	Nutrients, etc. prior to overturn.
Late October	43	14	Mid-fall bloom nutrients, DO minima, etc.

In its comments June 3, 2009, EPA questioned whether there might be a need for an additional water column station in the nearfield at the edge of the mixing zone for regulatory purposes. MWRA believes that the mixing process at the outfall site has been well-characterized through computer modeling, use of a scale model of the outfall during design, and a major dye-dilution study during non-stratified and stratified conditions. Water column monitoring has confirmed the predictions of the models. However, if such a nearfield station is necessary for regulatory reasons, MWRA believes that measuring dissolved inorganic nutrients at station N21 during the nine annual surveys, with sampling targeted at 60 meters from the midline of the outfall diffuser line would satisfy this need.

BACKGROUND

This is the third OMSAP meeting held for the purpose of reviewing proposed changes to MWRA’s ambient monitoring plan. The first meeting was held in Woods Hole on June 29, 2009 in which information on the proposed changes was presented and discussed in detail. A subsequent teleconference meeting was held on August 18, 2009. At that meeting, OMSAP voted to recommend that EPA approve MWRA’s requested changes to effluent and benthic monitoring and certain water column changes, but postponed consideration of changes to the stations and survey schedule (parts 2.1 and 2.2 of the list).

Sampling locations: To help put the proposed new design in context with the previous and existing design Figures 2 and 3 show how the new design focuses on locations where plankton data have historically been collected. That is, most of the present stations not included in the proposed design are chemistry-only stations. MWRA chose the stations in Cape Cod Bay because these are the two locations where comprehensive measurements (including plankton) have historically been performed, and the Stellwagen site was suggested by SBNMS.

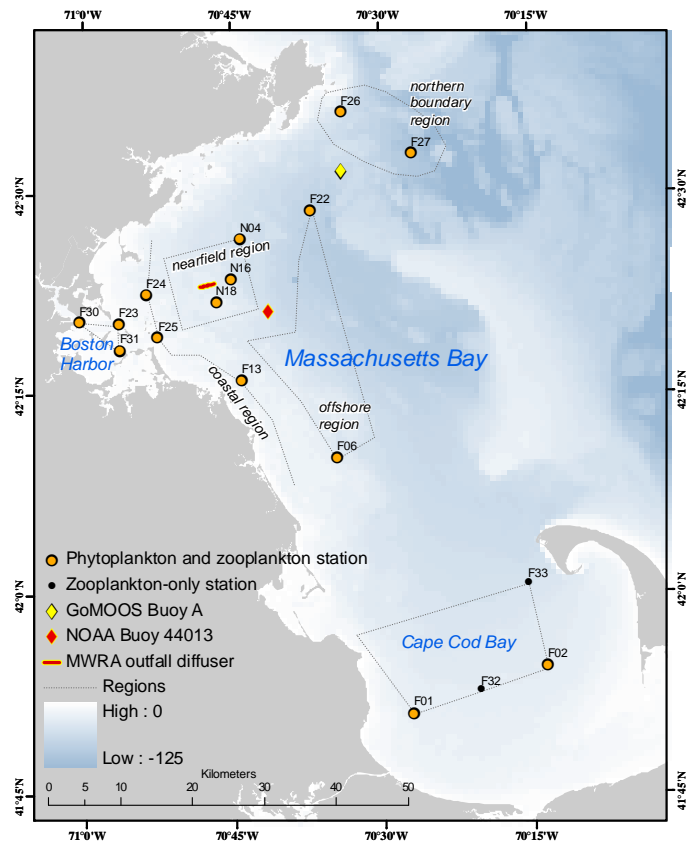
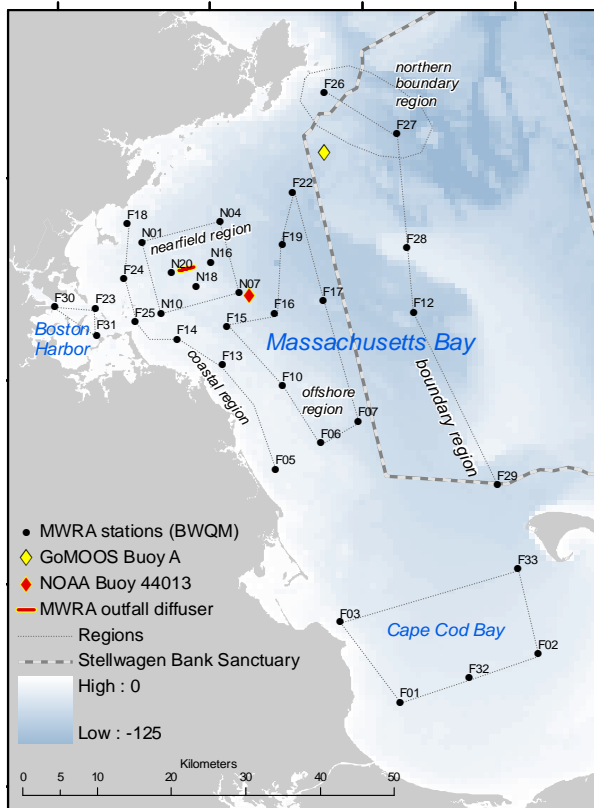
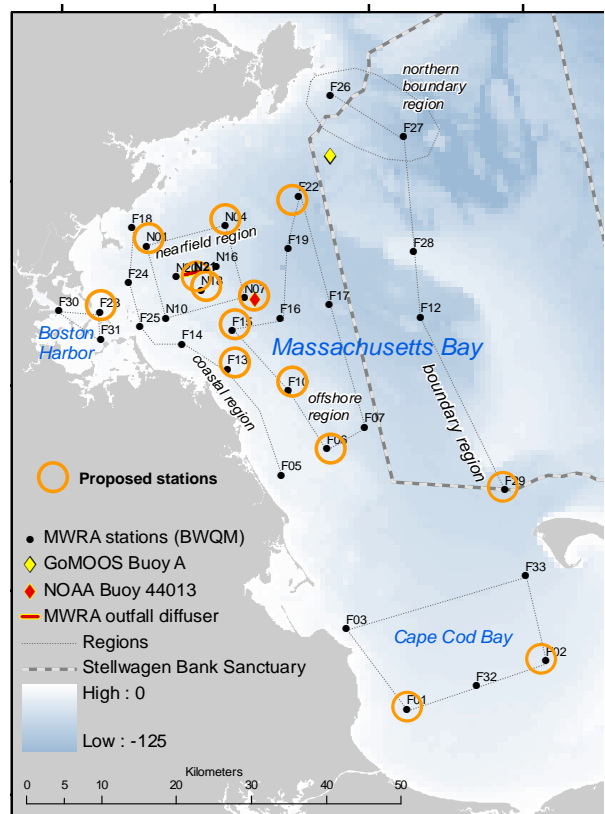


Figure 2 Existing water column monitoring stations (left) and the subset of stations where plankton are monitored (right).

Figure 3 Existing and proposed water column stations



Survey schedule changes. Table 4 shows how the survey schedule has changed over time, and how the proposed 9-survey schedule change relates to when surveys are occurring now. The previous revision dropped five nearfield-only surveys. Most of the proposed surveys are those that are now combined nearfield + farfield surveys. Two nearfield-only surveys would be dropped, and one combined survey would be dropped. Farfield sampling would be added to four existing nearfield-only surveys.

Table 4 Proposed and past changes in outfall monitoring survey schedule. Combined surveys are highlighted.

n	month	week	1993-2003	week	2004-2009	week	proposed 2010
1	February	6	Nearfield + Farfield	6	Nearfield + Farfield	6	Nearfield + Farfield
2	February/Mar	9	Nearfield + Farfield	9	Nearfield + Farfield		
3	March	12	Nearfield	12	Nearfield	12	Nearfield + Farfield
4	April	14	Nearfield + Farfield	15	Nearfield + Farfield	15	Nearfield + Farfield
5	April	17	Nearfield				
6	May	20	Nearfield	20	Nearfield	20	Nearfield + Farfield
7	June	25	Nearfield + Farfield	25	Nearfield + Farfield	25	Nearfield + Farfield
8	July	27	Nearfield				
9	July	30	Nearfield	30	Nearfield	30	Nearfield + Farfield
10	August	32	Nearfield				
11	August	34	Nearfield + Farfield	34	Nearfield + Farfield	34	Nearfield + Farfield
12	September	36	Nearfield	36	Nearfield		
13	September/Oct	39	Nearfield	40	Nearfield	40	Nearfield + Farfield
14	October	41	Nearfield + Farfield	43	Nearfield + Farfield	43	Nearfield + Farfield
15	October/Nov	44	Nearfield	46	Nearfield		
16	November	48	Nearfield				
17	December	51	Nearfield				

Alexandrium methods. OMSAP had requested a comparison of the newer gene probe method of detecting and enumerating *Alexandrium* with the previous method. One question was whether this would change the frequency of Contingency Plan threshold exceedances. Figure 4 and Table 5 show that the probe method is somewhat more sensitive than the older method, but that the threshold exceedance rate is similar. (Nine out of 52 samples exceeded the threshold with the probe method but were below the threshold with the older method). The main advantages of the probe method are its accuracy and speed, which are important to determining when and where to sample during a red tide event.

Alexandrium log screened vs log probe counts

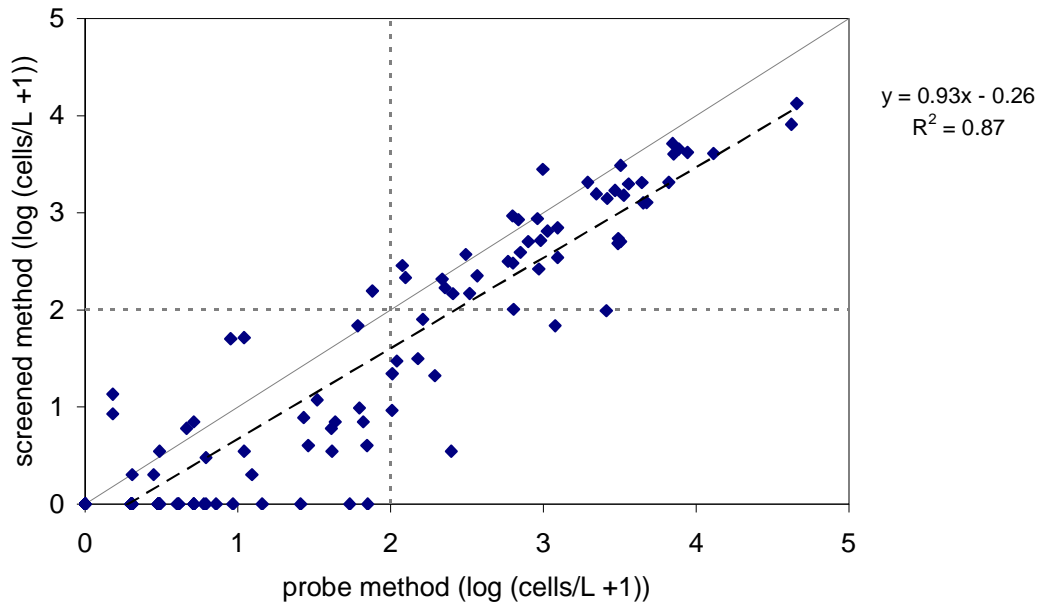


Figure 4 Correlation between log-transformed individual sample values of *Alexandrium fundyense* (probe) vs. *Alexandrium fundyense* + *Alexandrium* spp. (screened) in 115 samples from 2005-2009 in which both methods were used to enumerate *Alexandrium*. Dotted line shows threshold of 100 cells/l in any sample.

Table 5 Number of samples below or exceeding per-sample *Alexandrium* threshold of 100 cells/l, in 115 samples from 2005-2009 in which both methods were used to enumerate *Alexandrium*.

		SCREENED WATER COUNTS		
		Below Threshold	Exceeds Threshold	Total
PROBE COUNTS	Below Threshold	62	1	63
	Exceeds Threshold	9	43	52
	Total	71	44	115

Documents relevant to the review of these changes are listed below and available online at MWRA's website.

1. Report: **Massachusetts Water Resources Authority effluent outfall ambient monitoring plan Proposed Revision 2, 2009 draft 2**. Boston: Massachusetts Water Resources Authority. Report 2009-15
2. 2009 Annual List of proposed changes
3. EPA response and comments June 3, 2009
www.mwra.com/harbor/pdf/omsap/epa_response_20090603.pdf
4. MWRA response to EPA June 23, 2009
www.mwra.com/harbor/pdf/omsap/mwra_response_20090623.pdf
5. Comments from Provincetown Center for Coastal Studies, June 15, 2009
6. Comments from Massachusetts Coastal Zone Management, July 2, 2009
7. MWRA response to Coastal Zone Management, August 14, 2009
8. Comments from Stellwagen Bank National Marine Sanctuary, October 5, 2009