

OUTFALL MONITORING SCIENCE ADVISORY PANEL (OMSAP) MEETING

Tuesday, June 10, 2008, 10:00 AM - 2:00 PM, Ryan Lounge, U. Mass Boston

MEETING SUMMARY

AGENDA TOPICS

- Red tide 2008 update
- MWRA Boston Harbor monitoring results

ATTENDANCE

Members Present: Andy Solow, Woods Hole Oceanographic Institution (chair); Bob Beardsley, WHOI; Bob Kenney, U. Rhode Island; Mike Shiaris, U. Mass Boston; Jim Shine, Harvard School of Public Health; and Juanita Urban-Rich, U. Mass Boston.

Observers: Eric Adams, MIT; Bruce Berman, Save the Harbor/Save the Bay; Jim Blake, ENSR; Mike Bothner, USGS; Todd Callaghan, Mass Coastal Zone Management; Ellie Baptiste Carpenter, Battelle; Ria Convery, MWRA; Kelly Coughlin, MWRA; Mike Delaney, MWRA; Bob Diaz, RJ Diaz & Daughters; Patty Foley, SH/SB; Bernie Gardner, U. Mass Boston; Anne Giblin, Marine Biological Laboratory; Carlton Hunt, Battelle; Mingshun Jiang, U. Mass Boston; Ken Keay, MWRA; Ben Lasley, SH/SB; Wendy Leo, MWRA; Li Li, U. Mass Boston; Scott Libby, Battelle; Matt Liebman, EPA; Jack Looney, U. Mass Boston; Bill Martin, WHOI; Mike Mickelson, MWRA; Ann Michelle Morrison, Exponent/Normandeau; Susan Redlich, Corporate Wetlands Restoration Partnership; Andrea Rex, MWRA; Lev Rozman, Acton Health Department; Larry Schafer, Wastewater Advisory Committee; Jack Schwartz, Mass Division of Marine Fisheries; Chris Sweeney, U. Mass Boston; David Taylor, MWRA; Yong Tian, U. Mass Boston; Cathy Vakalopoulos, MassDEP; Meng Zhou, U. Mass Boston; and Yiwu Zhu, U. Mass Boston.

MEETING SUMMARY

Welcome, Andy Solow, WHOI (chair)

Boston Harbor discussion

Patty Foley, Executive Director of Save the Harbor/Save the Bay and the Public Interest Advisory Committee Chair thanked OMSAP for their hard work over the years. She showed a slideshow of photographs of children and people of all ages enjoying Boston Harbor. Bruce Berman said that Judge Mazzone who presided over the Boston Harbor court case was always interested in measuring the success of the Boston Harbor clean-up and one way to measure it is by looking at the number of people out on the harbor on a hot day. He thanked everyone involved in giving us our harbor back.

Red tide 2008 update

Mike Mickelson (MWRA) compared the *Alexandrium* blooms of 2005-2008 (through May 2008). All blooms have a similar pattern in that they begin in northern Maine waters and spread to the south. The 2005 bloom was the largest bloom since the first red tide in this area in 1972. It was a major regional event in New England made worse in Massachusetts Bay due to prevailing winds and storm patterns. Subsequent blooms have been less intense and widespread. However, so far in 2008, the bloom and shellfish closure patterns have been similar to 2005. No one can predict how severe the bloom will be this year. Last fall, dense cyst beds were mapped and they tend to be found right before large spring *Alexandrium*

blooms. B. Berman asked why the blooms seem to miss Boston Harbor. B. Beardsley is also interested in why some areas are not affected by red tides. D. Taylor thought perhaps the storms that bring the bloom close to shore with northeast winds also bring heavy rains that may flush the bloom out of Boston Harbor. S. Libby said that it's also interesting that Plymouth and Duxbury harbors are not affected by the blooms. This is still being studied by researchers.

MWRA Boston Harbor Monitoring

Timeline for Boston Harbor pollution abatement projects

Andrea Rex (MWRA) described the history of the Boston Harbor clean-up. For more information, go to:

<http://www.mwra.com/01news/2008/bhpenvironmentalsuccess/bhpenvsuccess.htm>

M. Shiaris asked about the plateau in total suspended solids (TSS) from 1998 to 2004. A. Rex replied that the start-up of secondary treatment stabilized TSS discharges. B. Berman asked A. Rex to elaborate on the South Boston CSO project. A. Rex replied that MWRA is building a large storm drain along the South Boston shore that will collect combined sewage and stormwater from seven combined sewer overflows at South Boston beaches. This project will end discharges during less than 50-year storms. B. Beardsley asked about changes in the salinity structure in Boston Harbor. D. Taylor replied that there has been about a 1% increase in salinity which matches what was predicted by the hydrodynamic model. M. Bothner asked about the sludge quality. A. Rex replied that the fertilizer pellets made from the treated sludge are of good quality and are used in agriculture. Metals are low except for seasonal spikes in molybdenum. When this occurs, depending on the concentration, the pellets can either be used in other states, or are landfilled.

Spatial and temporal patterns of sewage indicator bacteria in Boston Harbor and its tributary rivers

Kelly Coughlin (MWRA) described MWRA's bacterial monitoring of 90 stations near CSOs, CSO treatment facility outfalls, beaches, and offshore. Beach sampling is conducted with MassDCR (Department of Conservation and Recreation) and offshore sampling is conducted under agreement with Mass Fisheries. For more information go to:

<http://www.mwra.state.ma.us/harbor/enquad/pdf/2008-07.pdf>

B. Berman noted that there was a change in the bacteria being measured (fecal coliform vs. *Enterococcus*). K. Coughlin said that EPA believes *Enterococcus* is a better indicator of illness but it's not as abundant as fecal coliform. However, MWRA has done comparison testing and the two are comparable. B. Berman asked about the questionable data from Fort Point Channel. K. Coughlin replied that those were *E. coli* data. They are still analyzing that data, and are measuring fecal coliform there now. A. Solow asked how many samples per day are taken at Wollaston Beach. K. Coughlin replied four per day. B. Berman pointed out that it's usually the center two stations that have exceedances. He thinks that the four stations should be considered separately but if two or more stations exceed, then close the entire beach. C. Hunt asked if they have looked at rainfall events to see if there is a threshold that triggers a posting. K. Coughlin replied that they have looked at this but there is no threshold that is accurate all of the time. M. Shiaris asked if there have been exceedances in Massachusetts Bay over the outfall risers. K. Coughlin replied that there have been a few due to disruptions of treatment at the plant. L. Rozman asked what other statistical approaches have been used to examine the trends. K. Coughlin replied that they have done regression models and nonparametric work. This will be discussed in the next presentation.

Bayesian modeling for beach management at Boston Harbor beaches

Ann Michelle Morrison (Exponent/Normandeau) described Bayesian networks which are models that compare possible states of reality with probability. The name Bayesian comes from the name of this person that developed this modeling, Rev. Thomas Bayes. It is based on conditional probability – where everything is related. This modeling is used to better predict beach closures since there isn't a strong relationship between yesterday's sampling and today's postings. Bayesian networks are generally designed to follow causal linkages. She showed the Bayesian network for Constitution Beach which is used to help determine the probability of exceeding *Enterococcus*. A beach manager could input weather and sampling data to help make a decision. Data in the network include: winds, tides, precipitation, water temperature, salinity, sunlight, currents, and prior probability. She then showed a comparison of management models for Constitution, Wollaston, Tenean, and Carson beaches. The Bayesian networks for all of the beaches except for Carson worked as well or better than a rainfall only management model. Carson Beach is the cleanest and so an exceedance is not always related to rainfall therefore the Bayesian network did not work well there. Instead, 48-hour rainfall thresholds are the most protective, but they often close a clean beach. One important thing to note is that local rain gauges are very important. Using data from Logan isn't as accurate. M. Shiaris said that he has a graduate student sampling at Wollaston Beach. The sands are very high in *Enterococcus* and could be a reservoir. He asked if this is considered in the model. A. Morrison replied no, but perhaps this could be added, along with other meteorological information. She also thinks the water table may be pushing dirty water out of crumbling storm drains. M. Liebman asked if the Bayesian networks show 1-2 factors that contribute to closures the most. A. Morrison replied that this could be determined by doing a sensitivity analysis.

Changes in productivity in Boston Harbor

Scott Libby (Battelle) reviewed the harbor and outfall water quality and productivity sampling programs. There are three productivity stations, F23 is in the outer harbor and N04 and N18 are in the nearfield. He presented monitoring results. For more information go to: <http://www.mwra.state.ma.us/harbor/enquad/pdf/2009-04.pdf>

Overall, there have been large decreases in peak productivity on a seasonal basis in Boston Harbor. Summer peak productivity has decreased by 56% and annual production has decreased by >40% since the outfall diversion. However, production in the nearfield has also decreased and this is largely due to a reduction in the annual fall bloom. These results show that the outfall diversion has resulted in significant improvements in water quality in Boston Harbor. Though the decrease in nutrient loading was certainly a factor, annual production has been lower at all three stations since 2002 and this may be due to regional changes that are masking changes due to the outfall diversion. Ongoing analyses are focusing on winds and stratification. Preliminary results suggest a correlation between strong winds, less stratification, and higher productivity on a seasonal and annual basis. M. Liebman asked about water clarity. S. Libby replied that there is a disconnect between productivity, particulate organic carbon, and chlorophyll. They will be examining clarity further.

Long-term patterns in sediment contaminants in Boston Harbor

William Martin (WHOI) described the processes influencing the long term fate of contaminant metals in Boston Harbor. He described results from monitoring in Hingham Bay from 2000 to 2008. He showed how concentrations of mercury, lead, and copper have decreased significantly in the surface sediments since 1980. He noted that organisms mix the sediments, bringing older contamination closer to the surface. These three metals are associated with organic material and can form stable complexes that may be trapped in the sediments. They can also co-precipitate/sorb to iron oxides potentially removing these metals

from pore waters. He then showed sampling and resuspension experiment results. It appears that the remobilization of contaminant metals deposited in the past may now be a significant source of metals to Boston Harbor. Further work includes updating and extending contaminant metal budgets for Boston Harbor, and determining the distributions of particulate metals in Massachusetts Bay, especially after significant resuspension events.

Changes in spatial patterns in harbor sediment contaminants

Carlton Hunt (Battelle) described the results of a study of contaminants in Boston Harbor from 1990 to 2000 undertaken as part of the 1997 CSO Control Plan. He began by describing the combined sewer system in Boston, Cambridge, Somerville, and Chelsea that collects and transports both sewage and stormwater to the Deer Island Treatment Plant. During heavy rains, this system discharges contaminated water into local waters. The 1997 CSO Control Plan was developed to improve the CSO system performance and reduce these discharges. As of 2006, 19 of 35 proposed projects were completed. The remaining projects are expected to be completed by 2015. For more information on CSOs, go to:

<http://www.mwra.state.ma.us/03sewer/html/sewco.htm>. He then described the harbor sediment contaminant study. A recent report on contaminants is located at: <http://www.mwra.state.ma.us/harbor/enquad/pdf/2006-23.pdf>.

Changes in nutrient flux and sediment oxygen demand in harbor sediments

Anne Giblin (Woods Hole Marine Biological Laboratory) gave an overview of benthic nutrient cycling in Boston Harbor. The sampling program monitors two stations in northern Boston Harbor (BH03 at the former sludge dumping site, and BH02 which is a heavily reworked site), one in Quincy Bay (QB01), and one in Hingham Bay (BH08A). Total organic carbon (TOC) decreased at all stations but most significantly at the former sludge disposal site. There has been a slight increase in sediment chlorophyll *a* in the spring and fall but it is not statistically significant. In 2007, the sediment oxygen demand (SOD) was lower than the range before the outfall was diverted and is comparable to other post-relocation years. Overall, they have seen a large decrease in variability from storms and amphipods. In 2007, BH02 had higher SOD and nutrient flux concentrations, consistent with the presence of amphipod mats. The *Eh* profiler did not show strong reducing conditions near the surface. When presenting denitrification data, she noted that changes in patterns may be due to changes in laboratories and techniques. She then described changes in nitrogen export, denitrification, and burial in the harbor over time. Overall, loading to the harbor has been reduced by 81%. Though denitrification appears to have decreased in Boston Harbor since the outfall was relocated, its significance as a nitrogen sink in the harbor total nitrogen budget has increased due to the decrease in loading. In a comparison of nitrogen-impacted estuaries around the country, Boston Harbor in 1995 had the highest SOD and now it is among the lowest, along with Mass Bay. The outfall relocation has not affected Mass Bay's productivity. For more information go to:

<http://www.mwra.state.ma.us/harbor/enquad/pdf/2008-14.pdf>. M. Shiaris thought that was good news about the denitrification. He asked what happens when there is more oxygen in the sediments. A. Giblin replied that denitrification works best when there is a good aerobic zone. J. Shine asked how important it is to correct for temperature differences when the various estuaries are compared. A. Giblin replied that the sediments can only metabolize what hits the bottom. So carbon loading drives the process and temperature is more of an issue when comparing seasons.

Rapid assessment measures of sediment habitat quality; changes over time

Bob Diaz (Diaz and Daughters/ENSR) presented an assessment of changes in Boston Harbor's sediment habitat quality over time. From 1992 to 2007, there was a greater than

90% reduction in carbon loading, with lower phytoplankton and nutrient concentrations. With these improvements, benthic habitats shifted from anaerobic to a more aerobic state and there were also shifts in infaunal trophic structure. Though sediment profile imaging still shows a gradient in the RPD (redox potential discontinuity, i.e. how far oxygen penetrates into the sediments) from shallow to deeper as you move from the inner to outer harbor, improvements of RPD have been measured at individual stations. Though *Ampelisca* spp. tube mats dominated in the mid to late 1990's, they have declined along with decreasing amounts of carbon. Microalgal mats are now more common, along with deeper, more bioturbating species. For more information, go to:

<http://www.mwra.state.ma.us/harbor/enquad/pdf/2008-22.pdf>. M. Bothner asked about food sources for flounder and lobster. B. Diaz replied that the amphipods were a great source of food for young flounder. Now that amphipods have declined and the trophic structure is more complex, he suspects there is less food for them. B. Berman added that flounder are also affected by fishing pressure.

Spatial and temporal changes in Boston Harbor's benthic community

Jim Blake (ENSR) described benthic monitoring plan in Boston Harbor. Initial surveys were conducted by the Metropolitan District Commission (MDC) as part of their 301(h) waiver applications in 1978, 1979, and 1982. MWRA began its annual sampling in 1991. He then described the milestones of the Boston Harbor Clean-up and how the benthic monitoring plan is designed. He showed changes over time in faunal abundance, species richness, and diversity over time. He then discussed the composition of the benthic community including the abundances of *Ampelisca* spp. over time. He then focused on the Deer Island Flats station (T01) which has shown significant improvements in species diversity as well as a complete change in community structure. Though the abundances have decreased over time at station T01, the diversity has increased and this corresponds to the harbor-wide decline in *Ampelisca* spp. Overall, benthic communities in Boston Harbor have improved significantly since the diversion to the new outfall and there is no evidence of any adverse impacts on the infaunal benthos of Massachusetts or Cape Cod Bays since the new outfall came on-line. For more information go to: <http://www.mwra.state.ma.us/harbor/enquad/pdf/2008-22.pdf>.

J. Shine asked if this is an example of the intermediate stress theory and whether diversity increase as the harbor stabilizes. J. Blake replied that though there have been increases in the number of species in the harbor, things have slowed down. The "new" species in the harbor are all from Mass Bay and there isn't evidence that these species are taking hold. He thinks things have stabilized and the species in the harbor now will remain into the future. However, since the Deer Island Flats and Presidents Roads stations have undergone such a dramatic change, he doesn't know what the final community will look like. B. Berman noted that there are different communities at different locations at different times. J. Blake said that there is a definite seasonality in the benthos and different species dominate from season to season. They sample in August which is the peak of benthic productivity.

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Summary prepared by C. Vakalopoulos.

OUTFALL MONITORING SCIENCE ADVISORY PANEL (OMSAP) MEETING

Tuesday, December 2, 2008, 10:00 AM - 3:00 PM, Smith Conference Room, WHOI

SUMMARY

AGENDA TOPICS

ATTENDANCE

Members Present: Andy Solow, WHOI (chair); Bob Beardsley, WHOI; Bob Kenney, URI; Scott Nixon, URI; Judy Pederson, MIT/Sea Grant; and Mike Shiaris, U Mass Boston.

Observers: Eric Adams, MIT; Grace Bigornia-Vitale, MWRA; Mike Bothner, USGS; Ellie Baptiste Carpenter, Battelle; Martin Dowgert, USFDA; Matt Fitzpatrick, Battelle; Rocky Geyer, WHOI; Roger Janson, EPA; Chris John, MWRA; Ken Keay, MWRA; Yong Lao, MWRA; Ben Lasley, Save the Harbor/Save the Bay; Wendy Leo, MWRA; Scott Libby, Battelle; Matt Liebman, EPA; Mike Mickelson, MWRA; Tara Nye, Association to Preserve Cape Cod; Andrea Rex, MWRA; Rich Signell, USGS; David Taylor, MWRA; and Cathy Vakalopoulos, MADEP.

MEETING SUMMARY

Permit Update

Roger Janson (EPA) stated that EPA has a working draft of MWRA's new NPDES permit. When they are ready, they will discuss it with MWRA, as well as involve others and open it for public comment. Some of the key issues that they are working on are the level of monitoring and potentially making the MWRA communities co-permittees. The OMSAP requirement will also be revisited, the CSO section will be updated, and blending will be addressed. J. Pederson asked if EPA will be consulting with OMSAP. R. Janson replied that they will involve the appropriate folks at the appropriate time. A. Rex asked about the length of the public comment period and if portions of the draft permit are appealed, whether other portions can go into effect. R. Janson replied that the public comment period will be at least 60 days, and if parts of the permit are appealed, then the entire permit is stayed, but then unappealed portions can go into effect.

Annual Monitoring Review 2007 and Monitoring Update

Andrea Rex (MWRA) and her staff summarized the monitoring results for 2007. For a look at the results, read MWRA's 2007 Outfall Monitoring Overview:

<http://www.mwra.state.ma.us/harbor/enquad/pdf/2008-17.pdf>

In 2007, there were no permit or Contingency Plan exceedances. The group discussed the monitoring results.

Dave Taylor (MWRA) presented early signs of seagrass recovery in Boston Harbor. Because of the recent reductions in loadings of nitrogen, phosphorus, total suspended solids, and particulate organic carbon from wastewater treatment, rivers and non-point sources, phytoplankton biomass has been reduced, and water clarity and bottom water dissolved oxygen have improved. Because there was enough light reaching the bottom before the outfall diversion, it is likely that decreased nutrient loading caused a reduction of epiphytic growth on the seagrasses which in turn contributed to the recolonization of seagrasses in some small areas of Boston Harbor.

Mike Mickelson (MWRA) reviewed the results of the ambient water quality monitoring in 2007. We have observed annual *Phaeocystis* blooms since the outfall went on-line. S. Libby

and D. Borkman are examining factors during *Phaeocystis* years that reduce copepod numbers and also increase salinity. It appears that hot weather terminates these blooms. A. Solow noted that *Phaeocystis* blooms are regional. S. Libby added that they only see *Phaeocystis* in its colonial form. *Phaeocystis* may be present in its microflagellate form all of the time or the cells could be advected into the bays, much like red tide.

Ken Keay (MWRA) reviewed the 2007 benthic, fish and shellfish monitoring results. A. Solow asked about *Clostridium* in Boston Harbor. K. Keay replied that it has decreased in abundance. M. Shiaris asked if the treatment plant removes any *Clostridium*. A. Rex replied that only some is removed by aerobic secondary treatment. K. Keay added that *Clostridium* concentrations are roughly correlated to solids removal and the spores are resistant to chlorination. M. Bothner asked about silver as a tracer. K. Keay said that they do not see a strong silver signal in their sampling. During the flounder discussion, M. Bothner asked if they are finding more females now. K. Keay replied that the sex ratios have changed and there are more females. He added that when they were studying the flounder lesions a few years ago, ratios of male to females were closer to 50/50 later in the season. The next flounder sampling will be in 2009. M. Liebman asked if the drape over the hardbottom stations is significant. K. Keay replied that it is noteworthy but it is not clear whether it is due to the outfall because we do not see the drape at stations closer to the outfall.

Red Tide 2008

Scott Libby (Battelle) described the 2008 *Alexandrium* bloom dynamics. Based on large cyst distributions mapped in the fall of 2007 and model results, we braced for a large spring bloom. There was a large bloom, but closures only reached the Cape Cod Canal this year. Though the cell abundances and duration of the Contingency Plan exceedance were comparable to the historic bloom in 2005, the closures were not as extensive this year. One interesting note is that *Alexandrium* bloomed in Boston Harbor in 2008 and not in 2005. We are still looking at the data to get a better understanding of why this happened. Winds from the south-southwest caused upwelling and nutrients brought to the surface may have had some influence on the bloom in Boston Harbor. Looking back at bloom data back to 1972, it appears that we are in a more active regional bloom cycle that could last 10-20 years.

S. Nixon asked if there are nutrients in the red tide bloom model and whether there is nutrient limitation. S. Libby replied yes to both questions and added that nutrients affect *Alexandrium* but *Alexandrium* doesn't use up all of the nutrients. S. Nixon asked when the bloom suddenly decreased in Boston Harbor, what did the nutrients look like? S. Libby replied that the nutrients were depleted (but not by *Alexandrium*). When this occurs, the cells turn into cysts. S. Nixon thinks that MWRA should only monitor this bloom every year if nutrients are proven to play a large role in bloom dynamics. In 2005, we did not see a sustained bloom around the outfall, but there were also storms mixing and moving the waters. Was there a sustained bloom around the outfall in 2008? A. Rex replied no. S. Libby added that there were high cell numbers in western Mass Bay and elevated numbers south of the outfall and this will be examined further. A. Solow asked if Dennis McGillicuddy has modeled turning the outfall on and off. S. Libby replied that this can't be done because the nutrients in the model are climatological. They did remove the ammonium and the modeled reduction in cell count was very small (~3-5%) locally at the peak of the bloom.

Proposed Change in Modeling

Before the discussion began, B. Beardsley announced that he is an unpaid advisor to the modelers. As such, he would participate in the discussion but not vote on any decisions. M. Mickelson described MWRA's proposal to update the hydrodynamic model which is a component of the Bays Eutrophication model (BEM). According to their NPDES permit,

MWRA is required to update, maintain, and run the BEM. Since 1989, MWRA has used the same hydrodynamic model (Estuarine and Coastal Ocean Model, semi-implicit, or ECOMsi). There are newer models preferred by the modeling community. The most promising alternative is called FVCOM (Finite Volume Coastal Ocean Model). Eric Adams (MIT and chair of OMSAP's Model Evaluation Group, or MEG) reviewed the opinions of the MEG members. Out of eight members, five were in favor of switching the model, one was undecided and two did not provide an opinion. R. Signell, M. Mickelson, S. Nixon, B. Beardsley, and E. Adams discussed the pros and cons of the two models. R. Signell thinks that ECOMsi is still a good model but FVCOM can provide more detail. Pros of FVCOM are that it is more modern, user-friendly, flexible with gridding and can make calculations in areas that need refinement. In addition, Changshen Chen (U Mass Dartmouth) is already modeling the Gulf of Maine and Massachusetts Bay with FVCOM. One drawback is the amount of comparison needed between the models and data before the FVCOM replaces ECOMsi. E. Adams would like to see FVCOM run with old data and compared to the calibrated ECOMsi model results. Also, ECOMsi seems to model outfall mixing well and we would have to test to see how well FVCOM models it. Overall MEG approves of moving to FVCOM, but with extensive testing.

R. Janson asked about the model as it relates to what MWRA should be concerned about. What conditions of nutrient loading has the model predicted? Will this new model be able to predict this? If not, then the viability of this will not survive. A. Rex replied that the model predicted an increase in nearfield ammonium as well as changes in the phytoplankton. M. Mickelson added that the purpose of the model is to address concerns about the outfall. We have compared model runs with the outfall turned on and off, and the difference is minimal. R. Janson said that EPA needs to be able to support each permit condition. At some point, the model needs to be more predictive. R. Signell thinks that "prediction" could be a numerical simulation to fill in the gaps where there are no data and it can also be used for forecasting. R. Janson said that one important model prediction would be to see whether or not there should be nutrient limitations. A. Rex said that they are requesting this change to the modeling because it would make the model more useable. M. Mickelson added that this change will not affect the model's ability to predict. M. Liebman said that the permit language can be modified to reflect the current capabilities of the model. The frustration is that we are not using the model enough to predict.

The group continued to discuss modeling details. B. Beardsley said that the main concerns that he has heard about FVCOM is that the outfall risers need to be modeled well and that more effort needs to be placed on learning more about the system (e.g. test blending). E. Adams thinks FVCOM is a better model, but that it just needs more testing. A. Solow asked E. Adams if he could list the tests that are needed. E. Adams agreed.

S. Nixon asked if the current model has been run for 10 years using chlorophyll and productivity data with a focus on the nearfield and the boundary. M. Mickelson replied that ECOMsi used to only be able to run one month at a time. Now it can run two years at a time but we can't answer decadal questions with ECOMsi. E. Adams thinks FVCOM should run past years for comparison but that we don't have to run all of the years. S. Nixon agreed that running FVCOM with past years would provide a symmetry of closure. Given the practical difficulties of ECOMsi, we should encourage the easier model to test new questions, but do all of the necessary testing. Go with the best available tools. **ACTION:** OMSAP decided to approve the proposed change from the ECOMsi model to the FVCOM model with one addition to the language (see underlined): "OMSAP recommends to MassDEP and EPA that they allow MWRA to fulfill its permit requirement to update the Bays Eutrophication Model

by coupling the water quality model RCA to the hydrodynamic model FVCOM provided suitable test intercalibrations are run, including checking dilution at the outfall.”

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Summary prepared by C. Vakalopoulos.