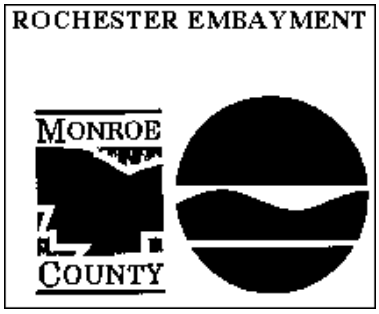
Rochester Embayment, New York
Remedial Action Plan
Beneficial Use Impairment (BUI) Indicator Redesignation (Delisting) for the BUI: Drinking Water Restrictions, Taste and Odor Problems



AUGUST 2010

County of Monroe, Monroe County Department of Health
(Local RAP Coordination)

Rochester Embayment Remedial Action Plan Oversight Committee
(Technical and Advisory Committee Members)

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(Great Lakes Areas of Concern Coordination and Oversight)

This BUI indicator redesignation report was compiled by Monroe County and NYSDEC primarily based on an assessment and recommendation draft report prepared by Ecology and Environment, Inc. along with the historical record and long-term efforts of the RAP Remedial Advisory Committee in collaboration with the current Rochester Embayment Oversight Committee for the Remedial Action Plan (RAP). Long-term and ongoing RAP Coordination funding and consultation has been provided by the United States Environmental Protection Agency, Region 2. The redesignation of this BUI indicator has involved government agencies, professionals, peers, and the public in review. All substantive comments have been incorporated into this final publication. For information or copies please contact the lead RAP Coordinator in Monroe County Department of Health or NYSDEC Division of Water per the committee contact information in Appendix A.

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I. Executive Summary

This Beneficial Use Impairment (BUI) indicator report identifies the background, criteria, supporting data, rationale and statements to redesignate (delist) the Taste and Odor concern in drinking water as not impaired in the Rochester Embayment Area of Concern (AOC). Drinking water restrictions were not identified for the AOC and are not an issue that needs to be addressed for the BUI redesignation. The listing and delisting of the drinking water taste and odor concern has therefore been accomplished for the Rochester Embayment AOC under the Great Lakes Program and guidance by the USEPA, Region 2 and NYSDEC on behalf of the Great Lakes Water Quality Agreement addressing BUIs in AOCs.

In the Stage I, Stage II, and two Addendum documents for the AOC, the Restrictions on Drinking Water, Taste and Odor Problems BUI was identified as impaired for Taste and Odor. As no use restriction was identified for the two primary sources of drinking water (watershed lakes and Lake Ontario), the focus of the impairment was based on taste and odor complaints, mainly in summer months. Scientific study and assessment has since determined the taste and odor characteristics to be non-health threatening and of an aesthetic or nuisance nature, and to be originating from whole lake processes rather than from something unique to the AOC.

Drinking water purveyors can address taste and odor by adding activated carbon filtration treatment (at a substantial cost) or by advising water service users to provide seasonal home filtration and refrigeration for drinking water to reduce taste and odor. The larger purveyors on the South Shore of Lake Ontario have installed tertiary carbon filtration treatment that does benefit taste and odor. Further, the taste and odor characteristics are not unique to the Rochester area but are found in many AOC communities throughout the Great Lakes. For the Monroe County Rochester service area, study has shown that complaints have dramatically decreased since 1999. Drinking water professionals and managers support these conclusions and the redesignation of the BUI for the Rochester Embayment AOC. This report documents this decision and identifies environmental protection.

II. Background

The Rochester Embayment of Lake Ontario is a shallow triangular indentation midway along the southern shore of Lake Ontario at the mouth of the Genesee River (see **Figure 1** next page). It includes a six mile segment of the lower Genesee River. The AOC was designated as one of the 43 Areas of Concern in the Great Lakes Basin in 1987. The accepted historic definition of the embayment is an area of Lake Ontario formed by the indentation of the Monroe County shoreline between Bogus Point in the Town of Greece and Nine Mile Point in the Town of Webster, both in Monroe County.

Both the Stage I and Stage II RAP indicate that occasional taste and odor problems were reported to the Monroe County Water Authority (MCWA) regarding water drawn from the Embayment and treated. From service records, we know the following:

- The occasional taste and odor problems complaints were highest in 1998 and 1999,

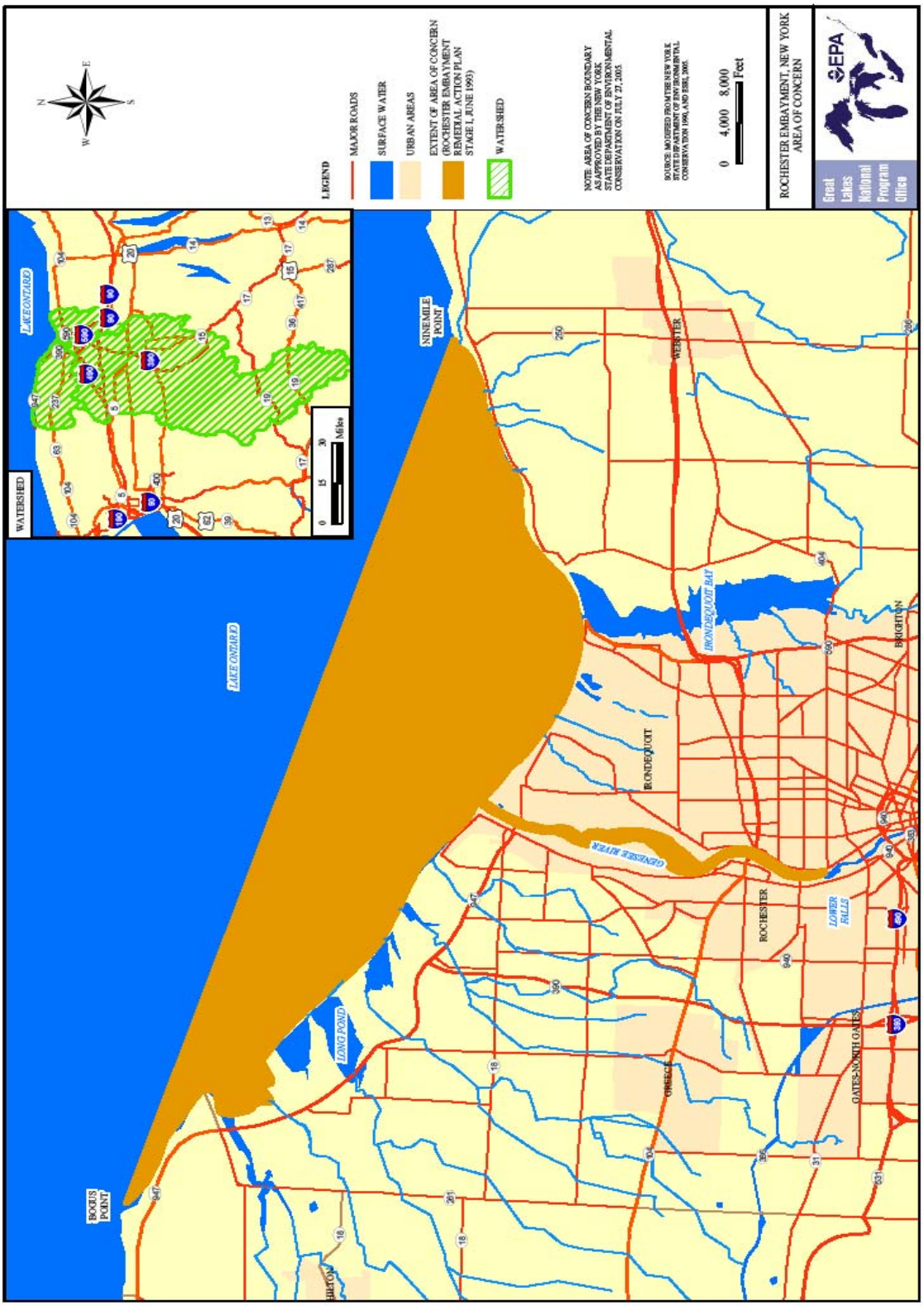

Figure 1 - Rochester Embayment Area of Concern

- One basis for the listing of the Drinking Water Taste and Odor Problem BUI as impaired in the Rochester Embayment portion of the AOC is where the drinking water intake for the Shoremont Water Treatment Plant is located. The MCWA intake is located approximately 1.5 miles offshore in the West central portion of the Rochester Embayment. Although situated at a depth of approximately 30 feet, this is still in the approximate nearshore area of Lake Ontario in the AOC where algae is present. Algae and taste and odor characteristics can add to aesthetic and nuisance conditions,
- Other watershed sources of drinking water including Hemlock and Candice Lakes, and other purveyors of drinking water who draw from Lake Ontario, have also experienced taste and odor characteristic complaints,
- There are no intakes in the lower Genesee River. Therefore, the River was not listed as impaired.

In 1994, the Stage I Remedial Action Plan indicated that occasional taste and odor problems were reported to the Monroe County Water Authority (MCWA) regarding water drawn from the Embayment. These were described as occurring "primarily in August, when prolonged hot temperatures promote blue-green algae blooms." It attributed these to non-point source phosphorus, but also indicated that weather phenomena could also contribute to the problem, saying that "sudden wind shifts can alter currents, changing the temperature or turbidity of the water reaching the supply intakes."

The Stage II Remedial Action Plan offered much the same information. No specific studies to detail or resolve this problem were identified in the Stage II RAP. The BUI was linked to a specific goal developed for the Rochester Embayment, that "drinking water produced from Lake Ontario has no unusual or unpleasant taste". This use impairment indicator was further linked to a number of water quality programs and initiatives that directly and indirectly contribute to resolution to the BUI. These program activities are both completed and ongoing and include: the Lake Ontario Lakewide Management Plan; rapid response to spills on Lake Ontario; work on the Greece Ponds (which are directly tributary to the western embayment); public education on lawn care and pesticides; the NYS Coastal Nonpoint Pollution Control Program; elimination of overflow dredging; and, watershed stewardship education. Other directly linked activities include: the NY SPDES program; the Environmental Benefits Permit Strategy; Federal Stormwater regulations; the Eastman Kodak Wastewater Treatment Plant; Combined Sewer Overflow Abatement Project (CSOAP) construction; BMP implementation; the CSOAP Modeling program; the phosphate detergent ban; the Pure Waters Program; Agricultural BMP's; and, efforts to minimize taste and odor problems at local water purveyors. Remedial measures to address this Use Impairment included Stormwater Quality Management; Impervious Surface reduction; control of point source phosphorus loadings; promotion of Agricultural BMP's; education on Lawn Care; development of a public education structure; completion of watershed basin plans; and, evaluation of new remedial measures identified in the 2002 RAP Addendum.

Monroe County has undertaken numerous activities intended to reduce phosphorus loadings to the Genesee River and the Rochester Embayment. Implementation of the Pure Waters Master Plan, and the Combined Sewer Overflow Abatement Project (CSOAP) improved municipal wastewater treatment and reduced discharge of phosphorus associated with these waste streams. The Monroe County Soil and Water Conservation District has been implementing programs for nutrient management, implementation of Agricultural BMP's, and streambank soil erosion

control. As part of the implementation of Federal Stormwater regulations, the Soil and Water District as also been doing construction site inspections, and conducting contractor training to insure that Stormwater Pollution Prevention Plans are maintained and adhered to. The Monroe County Stormwater Coalition is working to implement the Federal Stormwater regulations at the Municipal Separate Storm Sewer System (MS4) level. Monroe County has sponsored public outreach and education efforts to target non-point source pollutants, especially phosphorus, through lawn care education in the Great Lawns Great Lakes Program, and through the media campaigns of the Water Education Collaborative (WEC).

In conjunction with NYSDEC and USEPA GLNPO, Monroe County sponsored a program for conversion of dry detention basins to created wetlands to sponsor technology transfer to local municipalities for nutrient retention in stormwater facilities. The County has also continued efforts to reduce phosphorus in wastewater effluents by installation of equipment for phosphorus removal in small wastewater treatment plants in upstream areas such as Spencerport, which discharged to Northrup Creek, the main tributary to Long Pond, contiguous to the western embayment, and in Scottsville, which discharges to Oatka Creek, a major tributary to the Genesee River above the AOC, and by incorporating these discharges into the main treatment plants although these discharge to areas outside the embayment. Spencerport Treatment Plant went off line in mid-2008, the Churchville Plant that discharged to Black Creek, a major tributary to the Genesee River above the AOC, went off line in 2004 and the Scottsville plant is slated to go off line in 2010.

A. Delisting Criteria

The RAP process and focus for this Beneficial Use Impairment (BUI) indicator in the Area of Concern (AOC) determined that drinking water taste and odor was only impaired in the Embayment portion of the AOC and not the lower river because the lower Genesee River is not used as a source for either drinking or process water. Restrictions on drinking water were not identified and therefore not an issue in either the embayment or the lower river. According to the EPA-approved Rochester Embayment Beneficial Use Impairment Delisting Criteria Report (E & E 2009, and the 2002 RAP Addendum), the Drinking Water Taste and Odor Problems BUI will be restored when the following delisting criteria are met:

1. Current scientific literature indicates that drinking water taste and odor is a Great Lakes-wide problem; and

2. The scientific literature establishes cause(s) for taste and odor problems; and

3. The Rochester Embayment AOC does not contribute significantly to the taste and odor problem as determined using the findings of Delisting Criteria No. 2.

The monitoring methods developed for this BUI consist of a review of scientific literature, and consultation with drinking water supply experts and the public on an ongoing basis to determine if the Rochester Embayment watershed may contribute to causes of drinking water taste and odor and if the drinking water within the AOC has a taste and odor problem that can be improved by taking some action.

B. Endpoint

The desired endpoint for the RAP process to address this drinking water taste and odor BUI is to determine that the condition is not caused by an AOC specific and isolated source that could be acted upon in some direct way to resolve the impairment or that further drinking water treatment is required to be installed to mitigate such a source. With no actionable source identified that is unique to the Rochester Embayment, the condition can be attributed to seasonal and natural causes that occur throughout the Lake Ontario ecosystem, do not present a health problem, cannot be mitigated by any unique local action in the source water (although nutrient reduction strategies have been undertaken and are underway in the Rochester Embayment, as listed previously in this report) and that must be dealt with as having an aesthetic impact or constitute a nuisance condition.

C. BUI Redesignation Comments and Report Preparation

Support for the redesignation of this BUI was expressed from comments from expert reviewers as well as from the Public Meeting conducted on September 22, 2009. Notes on this public meeting are contained in Appendix B. Specific comments or questions that are addressed by explanation or actual modification to this redesignation document are further detailed in the Responsiveness Summary in Appendix C. At the public meeting, support for the delisting was expressed by citizens, committee members, and drinking water professionals. There are no identified health issues involved with the taste and odor characteristics in the Rochester Embayment AOC. Continuation of the documentation of the ongoing monitoring that is in place, as well as distribution of the information in reports by water purveyors to users, is important to assure that any health concern is addressed.

In response to comments received from NYSDEC, the initial report on this BUI delisting, written by Ecology and Environment, Inc (E&E), has been substantially rewritten to conform to guidelines provided by NYSDEC. This report incorporates the material employed by E&E, with additional information and elaboration that was either obtained through communication with researchers and purveyors or through review of more recent literature.

III. Indicator Status Resolution

A. Strategy and Rationale

The USEPA Delisting Guidance document: *Restoring United States Great Lakes Areas of Concern: Delisting Principles and Guidelines,* states the following:

"Re-designation of a BUI from impaired to unimpaired can occur if it can be demonstrated that:

- Approved delisting criteria for that BUI have been met;
- The impairment is not solely of local geographic extent, but is typical of upstream conditions OR conditions outside of the AOC boundaries on a regional scale. Such re-designation would be contingent upon evidence that sources within the AOC are controlled;
- The impairment is due to natural rather than human causes.

In some cases it may not be possible to fully restore some uses because of natural factors or social or economic factors. In these special cases there may be very logical and practical reasons why the impaired uses cannot be fully restored and these reasons and rationales should be provided in a Stage 3 Report."

The report herein contains the necessary information to state the case that the Drinking Water Taste and Odor Beneficial Use Impairment indicator for the Rochester Embayment AOC has met the above conditions for the Remedial Action Plan process to the maximum extent practicable. Further, the BUI is not impaired for the AOC and is being addressed by the ongoing activities and responsibilities of the larger Lake Ontario Lakewide Management Plan (LaMP).

B. Supporting Data and Assessment

Taste and odor problems came to the forefront in 1998 and 1999, as there were prolonged periods of intense taste and odor problems reported in Lake Ontario during the late summer during both those years. Causes of Lake-wide Taste and Odor Problem Constituents are described as follows:

"The most commonly reported taste and odour compounds, geosmin and MIB (2-methylisoborneol) are produced in aquatic environments by cyanobacteria (blue green algae) or mould-like, filamentous bacteria called actinomycetes. Intensive testing of Lake Ontario water during T&O events has confirmed that minute concentrations (measured in parts per trillion) of these compounds create the earthy/musty taste/odour.

Geosmin, the same substance that can be detected when rich soil is turned, is also found in some foods including beets. It can be detected at very low concentrations, with the average person noticing the odour of geosmin at as little as 4 nanograms per litre (ng/L) (a trillion nanograms equal one gram). MIB is usually noticeable at levels of approximately 9 ng/L.

Geosmin appears to be the sole cause of T&O for the water users on the north shore of the western basin of Lake Ontario. While, on the south shore, in the Region of Niagara, minute concentrations of the MIB have also contributed to the somewhat more prolonged T&O events." [Ontario Water Works Research Consortium (OWWRC) website]

In 1994 similar events to those identified in 1998-99, though less intense, were recorded in western Lake Ontario drinking water (OWWRC 2009). The intensity of these events lake-wide, coupled with the occurrence of taste and odor issues in drinking water drawn from the Rochester Embayment at the time of the development of the Stage II RAP, explains why the RAP Oversight Committee concluded that the impairment existed in the Embayment.

Taste and odor problems reported as a musty/earthy characteristic due to natural lake processes (and not due to drinking water treatment involving residual chlorine), were identified as the cause of impairment in the 2002 Stage II RAP Addendum (Monroe County 2002). These problems in the MCWA's drinking water were reported to the OWWRC as intermittent according to the OWWRC's definition (which indicates that reports of taste and odor problems are not made to the water purveyor every year) in a survey of all Great Lakes Water purveyors conducted by OWWRC in 2004. (see **Figure 2** next page)

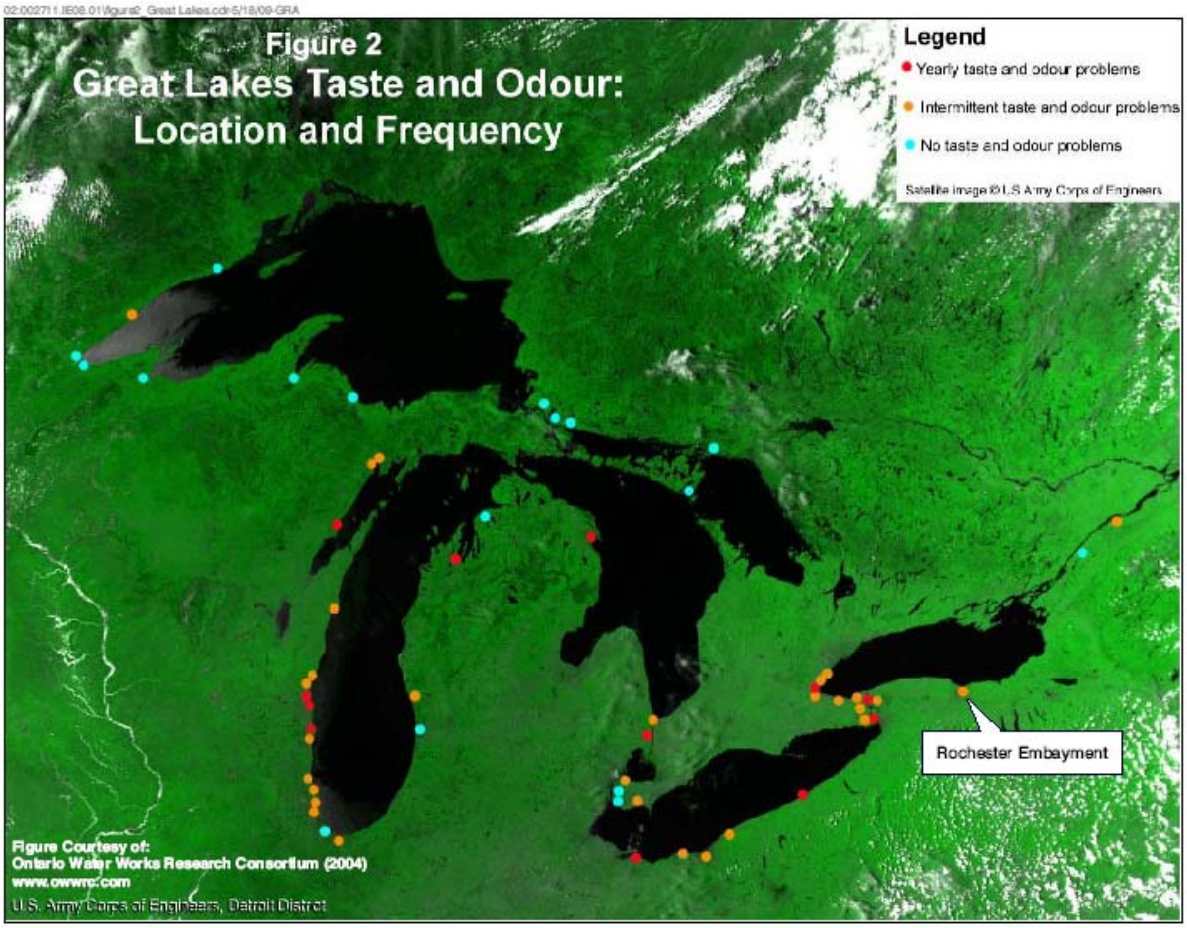

Figure 2 - Taste and Odor Characteristics in other Great Lakes Areas.
(Courtesy of the Ontario Water Works Research Consortium)

These occasional instances of earthy/ musty taste and odor problems have been reported lake-wide and attributed to the presence of geosmin and 2-methylisoborneol (MIB); however, MCWA indicates that earthy and musty taste and odor complaints have not been an issue in reporting to MCWA since 1999. These issues, which are now historic in MCWA drinking water, are widely recognized as a lake-wide problem, as drinking water intakes throughout Lake Ontario were reporting annual (typically summer) or intermittent drinking water taste and odor problems in the late 1990s and early 2000s (OWWRC 2004). (Figure 2 above)

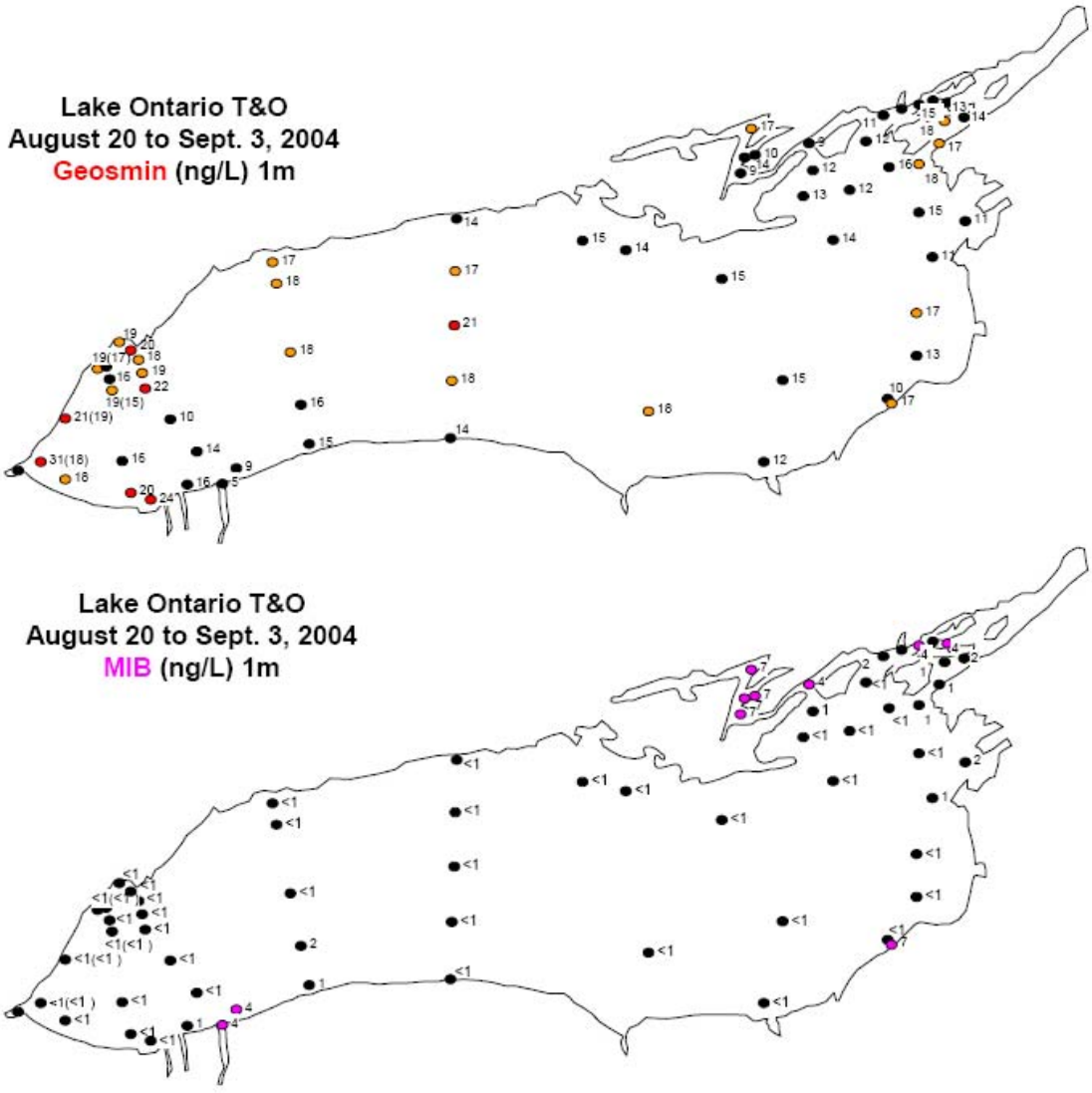

Fig. 13. Geosmin (above) and MIB (below) in the surface waters, Lake Ontario 2004. Higher values indicated in colour (red: geosmin>20ng/L; purple: MIB>4ng/L). Levels at stations sampled a second time during cruise indicated in brackets.

Figure 3 - Geosmin and MIB Levels in Lake Ontario 2004
(Courtesy of the Ontario Water Works Research Consortium)

In response to "prolonged and intense" taste and odor episodes in 1998 and 1999 on the Canadian side of the lake, the Ontario Water Works Research was formed to attempt to find the root cause of this problem and possible solutions. The OWWRC has since conducted research on the physical, chemical and biological factors leading to these taste and odor events, and the presence and causes of geosmin and MIB compounds in Lake Ontario. Geosmin and MIB are both produced in Lake Ontario, presumably by the decay of cyanobacteria and actinomycetes that occur naturally in lake ecosystems, and are at times (typically in late summer) present in excessive amounts due to eutrophication.

Taste and odor problems are most prevalent in Lake Ontario in late summer as a result of eutrophication characteristics in the Lake Ontario nearshore areas because warmer temperatures and increased sunlight in combination with nutrient input to the lake ecosystem provide all the limiting factors required by cyanobacteria to proliferate. Geosmin and MIB are produced when cyanobacteria or actinomycetes die and decay, and human sensitivity to these compounds, particularly geosmin, is very acute. Specifically, the average person can notice the odor of geosmin at 4 ng/L and MIB is noticeable at 9 ng/L and these compounds are difficult to remove with conventional water treatment (OWWRC 2009, Rao et al. 2003, and Zaitlin et al. 2003). In a study of the Lake that included the Northwestern region, the Bay of Quinte area (a Canadian AOC where Taste and Odor are also listed as a BUI) and the Saint Lawrence River, where drinking water is not listed as beneficially impacted, the OWWRC and others demonstrated that "different mechanisms produce and modify T&O" in the areas studied. In the Northwest basin, T&O were produced by geosmin which was not carried into the lake as part of runoff processes, but was produced by cyanobacteria, and not actinomycetes, in the offshore surface waters. Peaks occur annually in late summer but only reach nuisance levels in some years. Some form of cell disruption is necessary for release of geosmin into the water, and following production some climate driven event, normally an east wind driven movement of offshore surface water into the nearshore and subsequent down welling whereby the surface water can reach water treatment plant intakes, is required to produce a taste and odor event. In the Eastern Basin and Saint Lawrence areas studied, both geosmin and MIB occur annually over a longer period from late summer through fall, and are indicated as derived from biofilms on substrate and macrophytes consisting of both cyanobacteria and actinomycetes. Finally, in the Bay of Quinte, these researchers found association with both open water and inshore areas with heavy macrophyte growth, and association with a specific cyanobacteria, and indicated that while large scale transport processes like upwellings did not play a role at this location, wind and turbulence play a role in distribution of the cyanobacteria (Watson, et al 2007). These same patterns are apparent in the data presented for 2004 shown in **Figure 3** above.

While this Canadian study did not investigate Geosmin and MIB specifically for the United States shoreline of Lake Ontario, data on other facets of the taste and odor phenomenon are useful to resolving concern and context for the Rochester AOC. Cyanobacteria and actinomycetes both occur throughout Lake Ontario and are not specific to Rochester Embayment. Phycocyanin, a pigment unique to cyanobacteria used to track the presence of these algae, has been found to be prevalent at several Lake Ontario shorelines in New York, another indication that this source of taste and odor issues (cyanobacteria) is lakewide. Rochester Embayment concentrations of phycocyanin are lower than those found at the mouth of Oak Orchard Creek, a non-AOC area west of the Rochester Embayment on Lake Ontario, and are comparable to those found near the Niagara River, where drinking water taste and odor is not

impaired [Lake Ontario Coastal Initiative (LOCI) 2005]. On the next page, **Figure 4** shows sample results for Phycocyanin comparing near-shore and river sites with open Lake Ontario water sites (1 mile from shore). This pigment is unique to cyanobacteria and known to decay and contribute to odors. In this LOCI report, Dr. Makarewicz also shows similar sample results figures reporting for total phosphorus (see **Figure 5** following page). Lakewide conditions of both causes (sediment and nutrient loading) and effects (algal blooms) can be recognized.

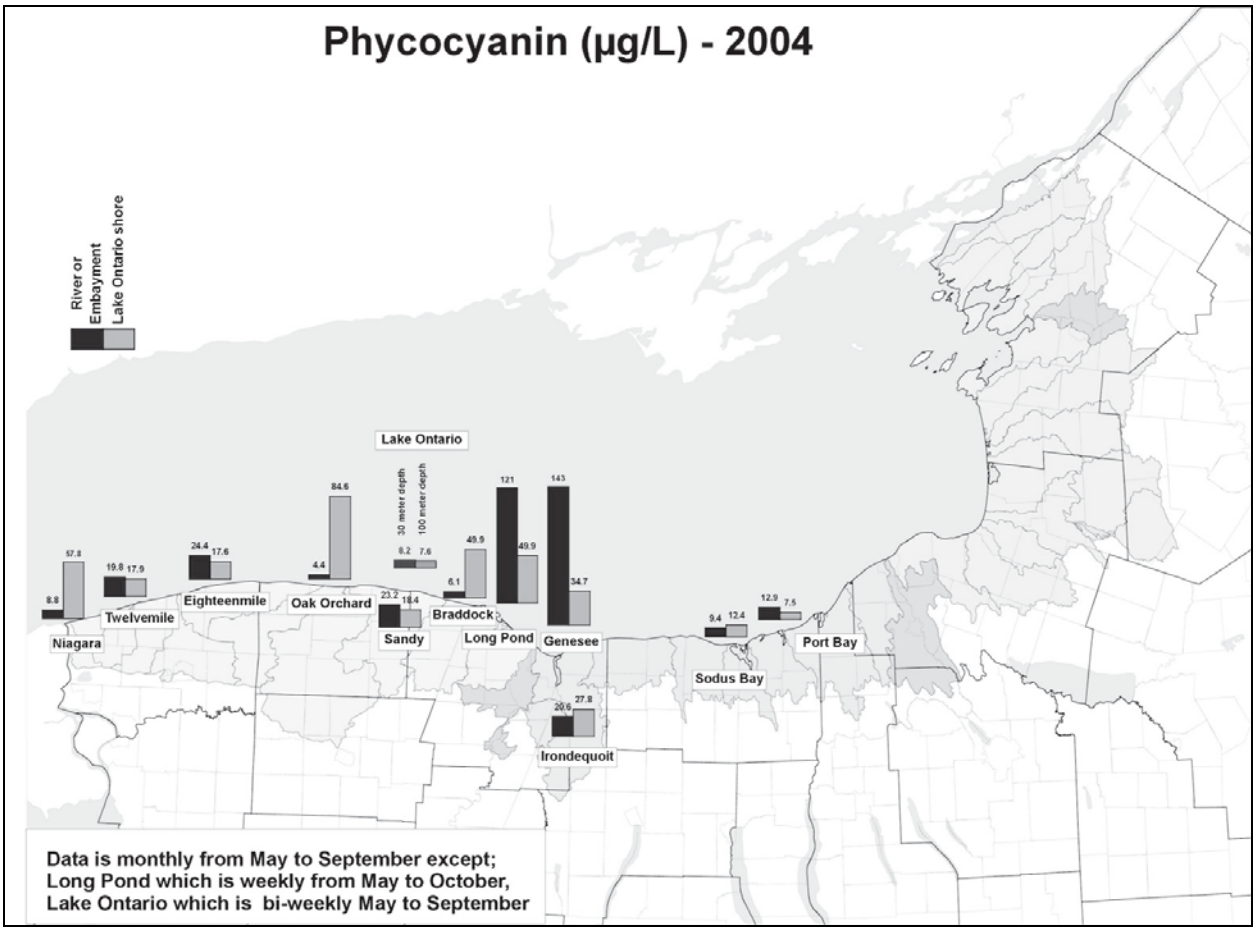

Figure 4 - Sample Results for Phycocyanin Comparing Near-Shore and River Sites with Open Lake Ontario Water Sites.
[This pigment is unique to cyanobacteria and known to decay and contribute to odors. This figure is from the Lake Ontario Coastal Initiative. N.B. Black Bars are in a river or ponded area, gray bars are in the Lakeshore area, and are what are used for the comparison.]

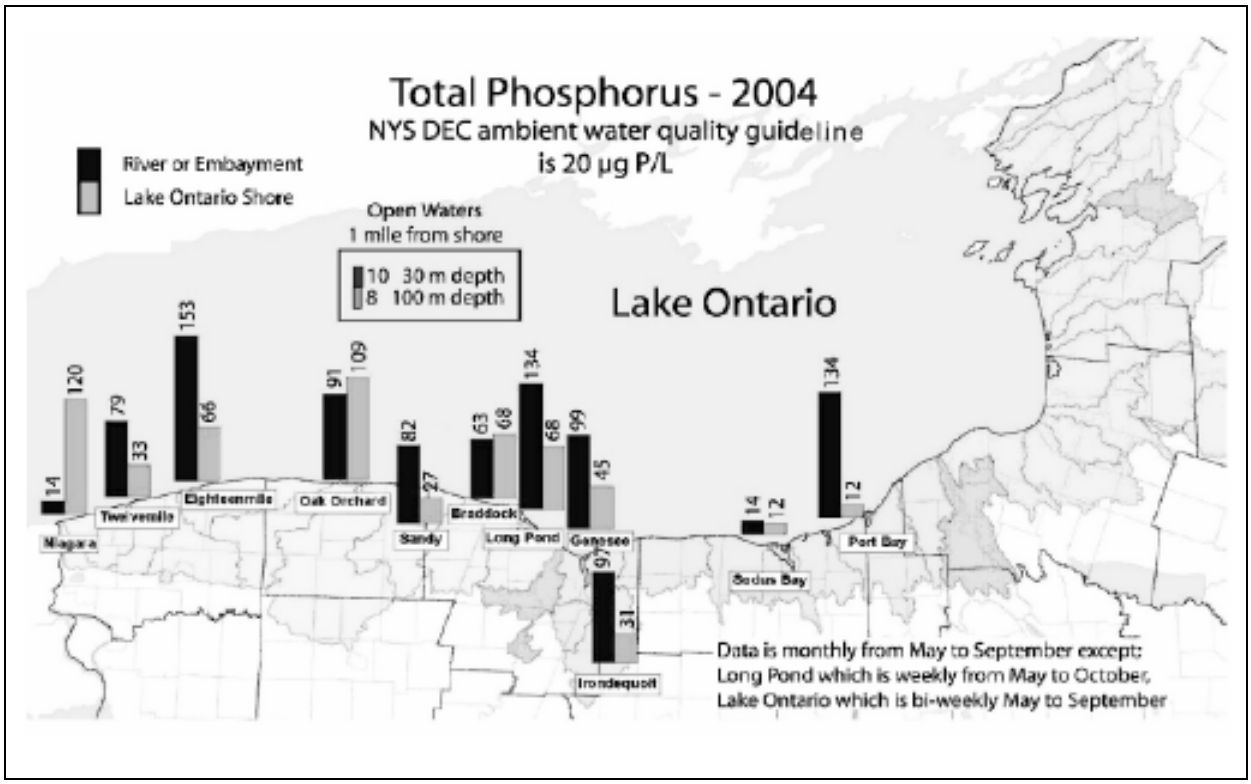

Figure 5 - Sample Results for Phosphorus Comparing Near-Shore and River Sites with Open Lake Ontario Water Sites.
[This compound is the limiting nutrient controlling plant (algae) growth in northeastern waters. (Figure is from the Lake Ontario Coastal Initiative)]

Cyanobacteria (blue green algae) blooms are often responsible for water that looks and smells bad. In addition, some of the organism's toxic compounds, such as the microcystins (in very high concentrations), have been associated with fish kills and illness in animals and humans, although to this date there have been neither high microcystin concentrations or incidents of toxicity in nearshore or open waters of Lake Ontario. From the LOCI report we know that total phosphorus levels in near-shore sites (less than 3.5 feet deep) measured two to five times greater than the NYS standard of 20 ug/l, as compared to open waters which measured an average of 8-10 ug/l. Nutrients contribute to algae growth and blooms. Dr. Makarewicz notes that sources of phosphorus are known in the watershed, but remediation can be quite costly. For chlorophyll *a*, open water sites measured 2-3 ug/l, and near-shore sites were five to fifty times higher. And for phycocyanin or blue green algae pigment, open water contains an average of 6-7 ug/l, while near-shore sites were between five and forty times higher. Efforts to control non-point source pollutants in Monroe County were detailed in an earlier section of this report

More recently the only reports of taste and odor were in 2004 and were associated with Hemlock Lake, which is located in the watershed of the AOC, but has little influence directly on the watershed because most all of its output is captured as the source of drinking water for the City of Rochester. So, identifiers of taste and odor are not unique to the AOC and in fact are found at higher concentrations in non-AOC areas. Taste and odor characteristics are a lakewide concern.

Actinomycetes, which also produce geosmin and MIB, but are likely less of a factor in taste and odor problems than cyanobacteria in Lake Ontario, are also prevalent throughout the Lake. Actinomycetes are widely believed to be of terrestrial origin and are transferred to aquatic environments through sediments. Zaitlin et al. 2003 supported this theory by finding that actinomycetes were most commonly found in association with sediments in surface water samples and were rarely found in free-floating or offshore sampling stations. Actinomycetes were also found in association with mussel populations and periphyton/macrophytic assemblages, likely attributed to the sediments trapped in these environments. While actinomycetes were found at all sampling locations in the upper and lower Lake (four sampling sites near Toronto and two sampling sites near Moses Saunders Dam), they were found to vary considerably in the amount of geosmin and MIB produced, indicating that not all actinomycetes produce taste and odor causing compounds and that production varies with environmental conditions among those actinomycetes that do. In conclusion, while actinomycetes are found lake-wide, their contribution to the taste and odor of drinking water is less predictable, and likely less prevalent, than the contribution of decaying cyanobacteria lake-wide (Zaitlin et al. 2003).

In northwestern Lake Ontario, instances of drinking water taste and odor problems in 1998 and 1999 that were more severe than most years have been attributed to researchers' beliefs that geosmin is being produced by cyanobacteria in the open lake and is delivered to the near shore zone and water intakes after a period of upwelling (calm lake conditions with low turbulence in the upper water column due to weak winds) is followed by down-welling events driven by easterly winds. Current and temperature measurements coupled with geosmin measures show upwelling and down-welling of the Lake's thermocline correlated with an increase in geosmin concentrations at water treatment plants along the north shore of Lake Ontario in Canada following down-welling events (Rao et al. 2003 and OWWRC 2009). The results of this study support the hypothesis that geosmin can originate offshore in Lake Ontario and becomes a taste and odor issue when carried to the shore and drinking water intakes by natural processes (Rao et al. 2003)

Monroe County Water Authority (MCWA) has two main sources for drinking water. MCWA maintains an intake for water from Lake Ontario. MCWA also obtains water from the City of Rochester Water Bureau, who maintains two reservoir lakes, Hemlock Lake and Candice Lake, approximately 50 miles south of the central metropolitan area. From the draft Ecology and Environment Report, assessment of information to support delisting of the BUI is provided as follows:

The MCWA reports that the drinking water testing program that is currently used at the Shoremont Water Treatment Plant (source: Lake Ontario) substantially exceeds EPA and New York State Health Department requirements. The MCWA's website states that some customers may occasionally experience chlorine-related taste and odor issues, which can be attributed to residual chlorine associated with the maintenance of the distribution system. The website and the last three City of Rochester Water Quality Reports do not however address earthy and musty taste and odors, the original reason for listing this BUI as impaired. Research on complaints notes that earthy and musty tastes and odors have not been an issue for MCWA since 1999. This is due in part to the installation of granulated activated carbon (GAC) caps in its treatment plants' filters (City of Rochester New York Bureau of Water 2006, 2007 and 2008 and Nugent 2009), which has essentially addressed the complaints associated with this BUI, resolved it as an

actionable problem, and therefore established the condition as one that must be dealt with as the aesthetic and nuisance characteristics of drinking water for Monroe County and the Remedial Action Plan. (see **Figure 6** below)

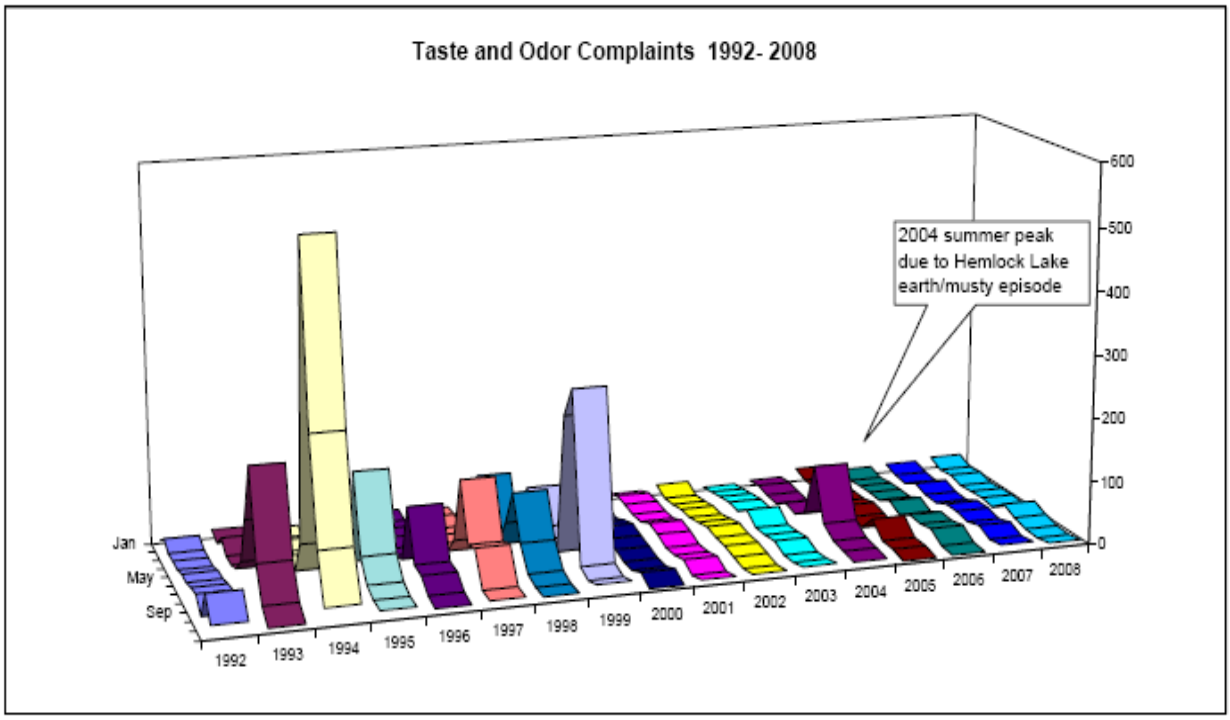

Figure 6 – Taste and Odor Complaints (Monroe County Water Authority)

In the Rochester area (outside the AOC), geosmin and MIB data were collected in conjunction with State University of New York at Brockport in 1999 in the vicinity of the Brockport drinking water treatment plant. Geosmin and MIB levels found outside of the Embayment were similar to those found within the Embayment (MCDWOC February 2000). This is a further indication that the problems experienced in 1999 were not Embayment or nearshore specific phenomenon.

The Monroe County Drinking Water Oversight Committee minutes also indicate that the City received the same taste and odor complaints from residents regarding water drawn from the AOC as water drawn from Hemlock Lake (one of the Finger Lakes tributary to the Genesee River, located outside of the AOC watershed), and most of these complaints are regarding chlorine residual in the water from treatment processes, not the musty/earthy tastes and odors attributed to the BUI (MCDWOC May 14, 1999).

C. Criteria, Principles and Guidance Application

The intent of the RAP process is to remedy the impairment (and cause) when the AOC is the source or an upstream source is contributing to a known impairment in the AOC. Studies since the original status determination of this BUI have identified taste and odor problems as a

lakewide impairment characteristic that does not originate from pollutants (or other causes of impairments) unique to the Rochester Embayment AOC. Each of the three Delisting Criteria for the Taste and Odor impairment is met in the following manner:

1. **Current scientific literature indicates that drinking water taste and odor is (can be attributed to) a Great Lakes-wide problem -**

The OWWRC's 2004 survey of water purveyors in the vicinity of the Great Lakes identified that taste and odor problems are reported annually or intermittently (in the case of Rochester, Stage I RAP) at six water treatment plants in Lake Ontario, including the Shoremont Water Treatment Plant in Monroe County, and at several water treatment plants on Lake Erie and Lake Michigan. This survey, which included both AOC and non AOC purveyors reported that the majority of users experienced some problems, an indication of a lakewide or non AOC issue, and intermittent events were more common than annual episodes, and that all facilities on Lakes Erie and Ontario experienced some Taste and Odor. According to one reviewer, over one third of AOC's list an impairment for drinking water taste and odor, and at least some AOC's where there are records of outbreaks recorded by water purveyors do not list the impairment.

The Ontario Water Works Research Consortium also indicates on their website that intense taste and odor episodes occurred on the Canadian side of the Lake in 1994 and 1998 and 1999, the same years cited in the Stage I, Stage II and 2002 Addendums as being the years in which these episodes occurred in the Rochester Embayment. The current literature clearly indicates that Drinking water Taste and Odor issues occur throughout the Great Lakes and throughout Lake Ontario.

2. **The scientific literature establishes cause(s) for taste and odor problems -**

The Stage I RAP tied Rochester Embayment Taste and Odor episodes to summer and phosphorus concentrations and noted that these could also be tied to wind driven perturbations of the lake current. No particular agent for Taste and Odor problems was indicated. The Stage II RAP expanded this discussion slightly to indicate the role of blue green Algae, and indicated that the occurrence was mainly in August, when warm temperatures promoted their growth. By 2002, when the Drinking Water Oversight Committee developed its delisting criteria and monitoring methods for this Use Impairment, and the 2002 RERAP Addendum was released, the scientific literature had developed to the point that earthy/musty taste and odor problems, which were what characterized complaints in the Rochester Embayment in the 1990's, were strongly tied to geosmin and methylisoborneal (MIB).

While further research has indicated that there are a number of possible compounds that could produce taste and odor of various types, the musty/earthy taste and odor producing compounds geosmin and MIB are most responsible for these complaints. According to Watson, Ridal and Boyer, "geosmin and 2-methylisoborneal (2-MIB) account for the global majority of drinking water odour outbreaks and are widespread in the Great Lakes. These VOC's are highly potent (detectable to humans at <10 $ngL^{-1)}$ stable and resist conventional water treatment."(Watson et al, 2008) The literature further indicates that the major sources of these compounds in surface

waters are blue green algae, and, to a lesser extent, actinomycetes, and that the compounds are not released during the normal life processes of the algae, but enter the water after algal death or during water treatment processes. Blue green algae are indicated to be indigenous to the Lake, while actinomycetes are more closely associated with soil, and are therefore with turbid discharge events to surface waters. However, the literature indicates that the majority of Lake Ontario Taste and Odor events are mainly associated with blue green algae.

In a study conducted by the National Water Research Institute of Canada and the Ontario Ministry of the Environment, researchers found that geosmin production in Lake Ontario in the northwest area of the lake "peaks annually, but only periodically at nuisance levels, and is hypothesized to originate from offshore cyanobacteria." Another study reported by OWWRC on their website indicated that metabolic process for taste and odor compound production occurred nearer to surface, and that water intakes located deeper than 30 m would not be subject to impacts from taste and odor compounds. This is also consistent with Rao's study, which attributed taste and odor incidents in the northwest portion of the lake to down welling patterns that brought the compounds down into the reach of the water intakes in that part of the lake.

This study indicated that geosmin production occurred in the offshore waters in response to blue green blooms, and that the taste and odor producing compounds were carried inshore and down into the bottom waters of the nearshore by east winds which forced offshore waters toward shore and down toward the bottom (see **Figure 7** below). This mechanism is consistent with possible delivery of Taste and Odor compounds to Monroe County Water Authority as the intake for the Shoremont plant is located approximately 1.5 miles offshore in approximately 35 feet of water. Finally, the measurements of phycocyanin conducted as part of the LOCI studies provides an indication that blue green algae are present in nearshore environments along much of the New York Lake Ontario Coast, and this surrogate indicator for the Taste and Odor compounds is actually at higher concentrations in some non-AOC areas west of the Rochester Embayment.

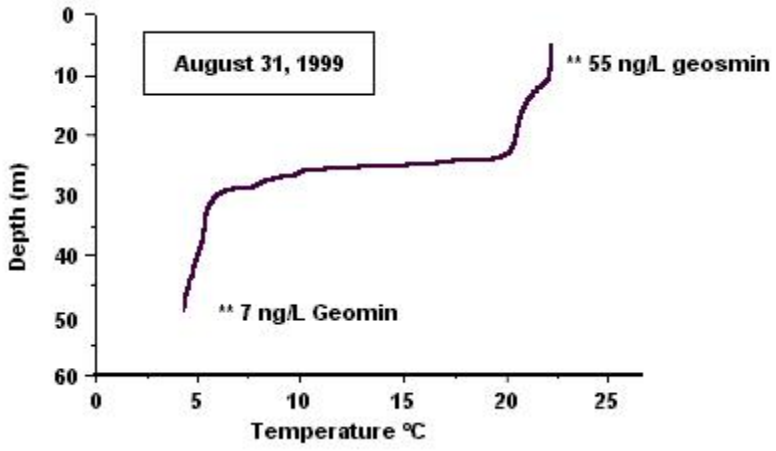

Figure 7 - Depth Profile of Geosmin – Ontario Water Works Consortium

3. **The Rochester Embayment AOC does not contribute significantly to the taste and odor problem as determined using the findings of Delisting Criteria No. 2.**

Geosmin and MIB are produced in the lake by blue green algae and/or actinomycetes. While the Rochester Embayment's watersheds may contribute phosphorus and other nutrients that contribute to algal growth in the Embayment, and there is phycocyanin, another marker for blue green algae present in the Embayment, taste and odor events associated with musty and/or earthy tastes and odors have not been identified in the Rochester Embayment since 1999. Figure 6 illustrates this reduction in complaints.

The literature indicates that spikes of geosmin and MIB in the Rochester Embayment in 1998 and 1999 also occurred at other locations around the lake. In those instances, it is possible to view the cause of any taste and odor characteristics reported as lakewide, or at least occurring in multiple locations therefore not unique to any one of them. While there has been no comprehensive monitoring of taste and odor compounds along the south shore of the Lake that would be comparable with the efforts of the Ontario Water Works Research consortium, a great deal of research has been conducted on blue green algae, or cyanobacteria. In recent years, researchers associated with the Lake Ontario Coastal Initiative (LOCI) have employed measurements of phycocyanin, the blue green pigment produced by cyanobacteria, as a measure of abundance of the algae.

Data recently published to the internet by LOCI shows great variability in phycocyanin concentrations along the lake. Lake side values for Oak Orchard Creek, approximately 30 miles west of the western border of the Embayment, and for the lakeshore area off Long Pond in the western Embayment are of similar magnitude in 2004 and 2006, but the values for the Lake off Sandy Creek, just west of the Embayment and east of Oak Orchard are much lower. In 2009, average phycocyanin concentrations are much lower for all three sites, but show a similar pattern with almost no phycocyanin at Sandy Creek. Similarly, summer 2009 average phycocyanin values collected lakeside off the Genesee River were nearly 100 µg/L, but the lakeside average off Irondequoit Bay, down current from the mouth of the Genesee only a few miles, was slightly less than 20µg/L. Clearly, there is great variability to the location and extent of bluegreen algae blooms along the United States shore of Lake Ontario. Similar variability would be expected in terms of taste and odor producing compounds. (Data presented on the LOCI website at http://www.ceinfo.org/loci/index.php)

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The assumption of the Stage I and Stage II RAPs was that the major cause of embayment blooms was non-point source (NPS) Phosphorus. While this may be the case, major efforts to reduce NPS Phosphorus have been undertaken, and in the main continue, within Monroe County, as detailed earlier in the report. Also detailed in this report is the ubiquitous nature of elevated phosphorus concentrations along the New York Shore of Lake Ontario as illustrated in Figure 5, and as shown for more recent years on the LOCI website.

In response to taste and odor complaints, water purveyors along the New York coast of Lake Ontario have for the most part installed granular activated carbon (GAC). MCWA stated that complaints to taste and odor were a concern 10 years ago; however, the installation of activated carbon and improved plant operations has greatly mitigated any such complaints. In fact recent concerns focus on costs and infrastructure needs.

The improved carbon filtration treatment serves to restore and protect the beneficial use. The lack of reports of musty taste and odor issues since 1999 to the MCWA further supports the decision to delist this BUI.

Concerns related to the nearshore condition of excessive algae (commonly grass greens, rather than bluegreens), nutrients, and the effect on swimming are to be addressed by the Eutrophication and Beach Closings BUIs respectively. The degradation of aesthetics BUI will also assist in addressing these concerns. Delisting principles and guidance provide for one BUI to act as a lead for condition effects identified in several BUIs (e.g. algae concerns and impacts on beneficial uses can be addressed by a lead BUI, either eutrophication or beach closing depending on the restoration and protection activities determined appropriate by the Oversight Committee for the RAP Area of Concern.)

D. Redesignation Statement

With the lakewide establishment of the exotic species (zebra and quagga mussels), increased water clarity has contributed to the presence of the compounds "Geosmin and MIB". Research has indicated that these compounds can create a taste and odor in drinking water supply that is considered a nuisance. Typically, taste and odor problems are seasonal occurrences and are treatable with activated carbon treatment in the water supply. Residual chlorine can also cause taste and odor problems. Local governments in the Rochester AOC watershed have focused much effort on the control of nonpoint sources of pollution (nutrients and pesticide application) to protect drinking water supplies and recreational uses of water resources. These efforts contribute to protecting and improving water quality best uses including a reduction of taste and odor characteristics in drinking water.

The restrictions on drinking water consumption or taste and odor impairment indicator has been determined not impaired for the AOC because there are no drinking water supply intakes in the AOC that have restrictions after treatment for consumption or warrant further actions be taken by a water purveyor to address taste and odor characteristics. In New York State and the Genesee River watershed, a number of water supply protection measures are in place that maintain good drinking water quality for both groundwater and surface water sources. The Safe Drinking Water Act of 1996 required Lake Ontario Water Purveyors in New York to develop a "Source Water Assessment Program" or SWAP to identify potential sources of water supply, to determine protection threats/needs, to expand monitoring, and to streamline testing procedures. These requirements are in response to a real need to implement measures for the protection of drinking water sources and to provide additional treatment where needed. The algae and compounds observed in drinking water sources and the occasional water quality taste characteristic is monitored by survey and other drinking water quality standard parameters so as not to become a threat to public health.

Beyond monitoring, a "multibarrier" approach to drinking water supply protection includes the NYSDEC initiatives such as the Wellhead Protection Program and the Watershed Protection Approach. These NYSDEC programs, along with other environmental protection programs, put a strong emphasis on trying to prevent contamination of a water supply. Most recently, this same

general approach called, “Source Water Protection” focused attention on identifying the sources of water supply, the possible sources of contamination to a supply, and the susceptibility of that supply to inventoried contaminants. These contaminants and their potential pathways for entry into a stream, river, lake, or aquifer are the same sources of degradation with which natural resource managers have traditionally been concerned. Each of these environmental protection measures serves to protect our drinking water supplies.

With no restrictions on drinking water consumption supplies and with taste and odor a seasonal occurrence of nuisance nature only, indicated to originate from a ubiquitous source around the lake, the taste and odor BUI is to be redesignated as “not impaired” for the Rochester Embayment AOC at large.

IV. BUI Redesignation (Delisting) Steps and Follow-up

A. BUI Redesignation Steps

1. √ 12/08 Delisting criteria completed and finalized with USEPA
2. √ 1/09 Original impaired conditioned reviewed to identify causes and sources
3. √ 2/09 Review of technical information assembled and data synthesis conducted
4. √ 3/09 RAP advisory / oversight committee discussed endpoint for BUI based on criteria
5. √ 4/09 Expert involvement and development of supporting statements performed
6. √ 5/09 Additional/ related monitoring, data review and assessment conducted
7. √ 6/09 Engineering consultant employed to assist in assembling technical assessment
8. √ 7/09 Discussion of redesignation by RAP advisory / oversight committee
9. √ 8/09 Collaboration with EPA and DEC for draft technical report preparation
10. √ 9/09 Public meeting held, information, outreach, and comment on redesignation conducted (included a 30-day public comment period)
11. √ 12/09 Comments assembled, BUI report redrafted, T&O incident investigation begins
12. √ 04/10 Re-drafted BUI redesignation report prepared to include necessary changes

13. √ 07/10 Monroe Co. and NYSDEC (in consultation with OC and EPA R2) completes final modifications to the Taste and Odor BUI redesignation document.

14. 09/10 Coordinate the formal transmittal of the BUI redesignation (delisting) with USEPA GLNPO. Communicate result with IJC.

15. 10/10 Communicate results to local RAP Coordination for appropriate recognition and follow-up.

B. Post (delisting) Redesignation Responsibilities

Post- delisting activities are to be conducted by responsibilities identified to implement the actions that are to address the remaining concerns of the BUI redesignation process. Following are identified specific responsible organizations that are to continue ongoing environmental program activities to assure protection of the beneficial uses:

1. Monroe County Water Authority - continue to conduct the annual monitoring and reporting for public on drinking water supply in the Area of Concern and its watershed. Report on contaminants, water characteristics, system conditions and public responses to water services on an annual basis. Provide corrective action and explanations as appropriate.

2. Monroe County Department of Health - provide oversight for the RAP Coordination process and the drinking water conditions in the Area of Concern and its watershed. Report to local governments and public organizations on issues and concerns regarding drinking water. Seek to take corrective action to prevent issues and protect long term health.

3. New York State Department of Environmental Conservation – provide assistance to the oversight for RAP Coordination and restoration and protection of beneficial uses in the AOC and its watershed.

4. United States Environmental Protection Agency – continue to assist and fund RAP Coordination in the Rochester Embayment AOC to achieve the long-term goal of delisting the entire AOC. Assure that provisions of the Clean Water Act and Safe Drinking Water Act are accomplished for the Rochester Embayment area and its watershed.

5. Lake Ontario Coastal Initiative (LOCI) – Continue in its goal to restore the ecological integrity of New York's North Coast—Lake Ontario's 300 miles of southern and eastern shoreline, embayments, river and creek mouths, wetlands and ponds—which is key to the region's economic vitality. Actions are to address public commitment, mitigation measures, land use, habitat protection; and water quality research.

6. Lake Ontario Lakewide Management Plan (LaMP) - Report on use impairment indicator monitoring of beneficial uses as developed and documented by the state, provincial, and federal governmental (US and Canada) Workgroup and Management Committee. Continue to develop and implement the workplan for the restoration and protection of beneficial uses for the lake, nearshore areas, and the drainage basin.

7. Other Local Environmental Protection and Action Organizations:

a. Monroe County Soil and Water Conservation District - Continue implementation projects to protect against erosion and provide stream bank protection and best management practices in Monroe County as resources permit. Assist NYSDEC in monitoring and surveillance activities for improved water quality. Implement SWCD mission to protect, promote, and improve natural resources. Continue to work with land users to educate and encourage actions that mitigate erosion and runoff.

b. Monroe County Department of Planning and Development - Implement actions to further the protection and planned development of the lands around the Genesee River. Maintain a healthy balance between environmental and economic interests.

c. Monroe County Water Quality Coordinating Committee - Work to maintain and restore the quality of Monroe County's water resources, through a cooperative, coordinated manner which includes educational and technical efforts. Coordinate activities with Monroe County's Water Education Collaborative.

d. Monroe County Environmental Management Council - Work with citizen support and with county governments to achieve environmental goals of the local community in conjunction with the county government.

e. Center for Environmental Information (CEI) - The locally driven Lake Ontario Coastal Initiative (LOCI) is responding to the needs of New York's North Coast. The initiative, spearheaded by the Center for Environmental Information (CEI), has strategic planning for development and implementation activities. CEI is working with its partners, the Finger Lakes-Lake Ontario Water Protection Alliance (FL-LOWPA), SUNY Brockport Department of Environmental Sciences and Biology, and the LOCI Steering committee, representing public and private stakeholders. Projects are to remediate, restore, protect and sustain the Lake Ontario, New York Great Lakes Coastal region including the St. Lawrence River.

f. Finger Lakes-Lake Ontario Watershed Protection Alliance (FL-LOWPA) – Works to foster and expand a collaborative, watershed based approach to water quality protection and enhancement in the Lake Ontario watershed; assists local counties with funding for projects for watershed protection.

V. Appendices

Appendix **A** - List of Oversight Committee Members
Appendix **B** - Public Meeting Notes
Appendix **C** - Responsiveness Summary
Appendix **D** - References
Appendix **E** - Taste and Odor Incident Fall 2009

Appendix A
List of Oversight Committee Members and Participants

Charles Knauf, Local AOC Coordinator - Monroe County Water Quality Coordinating Committee; (585) 753-5440

Alinda Drury, Mayor's Office - City of Rochester

Raymond Yacuzzo, Special Assistant - New York State Department of Environmental Conservation

Wayne D. Howard, Great Lakes Committee Chair - Sierra Club

Brian Slack - Genesee Finger Lakes Regional Planning Council

Chris Fredette - Rochester Committee for Scientific Information

Charlie Valeska - Eastman Kodak

David Klein - The Nature Conservancy

Gary Neuderfer, Ph. D., - NYSDEC retired, SUNY at Brockport, Rochester Institute of Technology.

George. Thomas, P.E., - Center for Environmental Information

James Haynes, Ph. D., - SUNY at Brockport

John Waud, Ph. D., - Rochester Institute of Technology

L Hartshorn - Monroe County Environmental Management Council

Mark Gregor - City of Rochester Director of Environmental Quality

Paul Sawyko - Water Education Collaborative

Robert Townshend, RAP Coordinator - New York State Department of Environmental Conservation; (518) 402-8284

Silvia Patterson - The Seneca Nation

Steve Lewendowski - Lake Ontario Coastal Initiative

Appendix B - Public Meeting Notes

Public Meeting:

Delisting Beneficial Use Impairments in the Rochester Embayment Area of Concern
September 22, 2009
Town of Greece Town Hall Meeting Room,
1 Vince Tofany Blvd.
Greece NY 14612

Attendees:

Paul Sawyko, Water Education Collaborative, Rochester Embayment Remedial Action Plan Oversight Committee

Charles Knauf, Monroe County Department of Public Health, Rochester Embayment Remedial Action Plan Oversight Committee, Coordinator

Louise Hartshorn, Monroe County Environmental Management Council, Rochester Embayment Remedial Action Plan Oversight Committee

George Thomas, Center for Environmental Information, Rochester Embayment Remedial Action Plan Oversight Committee

Chris Akios, Ecology and Environment, Inc.

David Weeks, Ecology and Environment, Inc.

Suzanne Albright, Grandview Beach Neighborhood Association

Sue Jackson, Grandview Beach Neighborhood Association

James Nugent, Monroe County Water Authority

John Perrecone, United States Environmental Protection Agency, Great Lakes National Program Office

Barbara Belasco, United States Environmental Protection Agency, Region 2

Katrina Korfmacher, University of Rochester Medical Center

Meeting Notes:

Meeting Notes are assembled from notes taken at the meeting by David Weeks and by Barbara Belasco, edited by Charles Knauf, and reviewed for accuracy by James Nugent.

A public meeting on the Rochester Embayment Remedial Action Plan was held Tuesday, September 22, 2009 from 7 to 9 p.m. at the Greece Town Hall, 1 Vince Tofany Blvd, Greece, New York. Residents of the AOC and nearby areas as well as agency representatives were invited to attend.

Representatives of the Monroe County Department of Health and the USEPA presented draft delisting documents for Drinking Water Taste and Odor and Added Costs to Agriculture and Industry Use

Impairments. The presentation was followed by a question and answer period to solicit comments from the public. Those attending the meeting were given the opportunity to ask questions and make comments during and after each presentation.

Notices of the meeting provided links to the draft documents on Monroe County's website at http://www.monroecounty.gov/.

Following the presentation on the two draft delisting documents, a presentation was given on the status and strategy for delisting other impairments including: Restrictions on Fish Consumption; Loss of Fish and Wildlife Habitat; and Eutrophication or Undesirable Algae.

Representatives of U.S. Environmental Protection Agency, the Monroe County Department of Public Health, and the Local Remedial Action Plan Advisory Committee were on hand to answer questions and record public comments.

John Perrecone of the USEPA Great Lakes National Program Office (GLNPO) introduced the topic of Great Lakes Areas of Concern (AOC), Remedial Action Plans (RAP), and Beneficial Use Impairments (BUI). The slides from the Power Point that was used for the meeting are attached at the conclusion of the narrative description of the meeting.

Charles Knauf, Environmental Health Project Analyst with the Monroe County Department of Public Health, continued by reviewing milestones in the Rochester RAP process, highlighted language from the Guidance document on Delisting developed by the US Policy Committee indicating that AOC's can only be responsible for mitigation of impairments that originate or are caused within the AOC, and explained how this guidance applied to the BUI's being presented for the Rochester Embayment AOC. His presentation included summaries of draft documents that state the case for delisting two BUIs: Restrictions on Drinking Water Consumption or Taste and Odor Problems; and Added Costs to Agriculture and Industry.

During and after Mr. Knauf's presentation, he addressed questions and comments from members of the public and representatives of other agencies. Various attendees also provided information relative to the subject.

A summary of such questions, comments, and responses by Mr. Knauf and others follows.

A. For the BUI: Restrictions on Drinking Water Taste and Odor Problems

Mr. Knauf summarized this delisting proposal by saying the taste and odor problems experienced in the AOC have been experienced lakewide and are not a problem specific to or caused by the Rochester AOC.

Comment 1: Mr. Jim Nugent of the Monroe County Water Treatment lab described the recent history of taste and odor problems. When taste and odor problems became common several years ago, his agency installed granular activated carbon filter caps which addressed the taste and odor problems experienced in those years. Taste and odor problems have not been significant in the last 5 years, however. (no response)

Question 1: Ms. Suzanne Albright of the Grand View Beach Association asked what might be the public health implications when taste and odor problems occur?

Question 1 Response: Mr. Nugent said the taste and odor problems were normally attributed to algae growth but the etiology is not clearly defined. Earthy/musty taste and odor problems in surface waters are typically caused by Geosmin and Methyl Isoborneol (MIB), compounds produced by biological metabolic processes in the lake. Blue green algae blooms can produce these compounds but again in larger water bodies the specific causative factor is usually not identifiable. Sensitive individuals can detect these compounds at extremely low concentrations, in the low nanogram per liter range. There are no known health problems from these chemicals at the levels encountered in the AOC.

Mr. Knauf added that blue green algae, one source of geosmin and MIB, have been a Health Department concern at Ontario Beach since they were made aware of the possible problem in the late 1990's. The Health Department has been very vigilant over the years in looking for these algae in samples collected at the beach, but has not found them in these samples. Professor Makarewicz of SUNY Brockport has found phycocyanin, a chemical also released to the water by breakdown of blue greens, in nearshore areas, of the Lake, as illustrated in the presentation slide. Mr. Knauf stressed that delisting for taste and odor will not cause authorities to cease monitoring for related compound and problems.

B. For the BUI: Added Costs to Agriculture and Industry

Mr. Knauf summarized this delisting proposal. The Rochester Embayment was listed for added costs due to Zebra mussels in intake pipes for the Water Authority, Rochester Gas and Electric, and Eastman Kodak Company. Mr. Knauf presented indications from the literature that dreissenid mussels are in fact a Great Lakes (and further) problem, and indications that mechanisms for introduction and maintenance of these species is also not an AOC phenomenon.

Comment 2: Mr. Nugent stated that his department cleans its water intake annually to alleviate clogging by zebra and quagga mussels, but that accumulations have not been as great as in the early years after those species initially became established. In addition to removing the live mussels, shells of dead mussels also have to be periodically cleaned up.

Comment 2 Response: Mr. Knauf reiterated that he is not saying the mussels and associated costs to industry are not a long-term problem, but that the problem is lakewide and not unique to or originating in the Rochester AOC, so under the language of the Guidance, the BUI should be delisted..

C. Concluding statements about the two BUI delisting documents reviewed at this meeting:

The BUI documents reviewed at this meeting, Restrictions on Drinking Water Consumption or Taste and Odor Problems, and Added Costs to Agriculture and Industry, will be submitted to NYSDEC along with comments from this public meeting. These BUIs should be delisted in the Rochester AOC because the problems are lakewide and are not caused by or specific to the AOC. Mr. Knauf's office will also accept additional comments from the public for 30 days from this meeting. After DEC comments are received, they will be incorporated in to the documents and submitted to EPA for consideration. The IJC will be informed as to the status of delisting of the BUIs.

D. Other BUIs Delisting Recommendations in Preparation:

Mr. Knauf reviewed the arguments for delisting three additional BUIs for which delisting recommendations are currently being prepared:

- Restrictions on Fish and Wildlife Consumption
- Eutrophication or Undesirable Algae
- Loss of Fish and Wildlife Habitat

He reviewed the listing and delisting criteria for each BUI and presented data supporting the argument that, in the cases of Restrictions on Fish and Wildlife Consumption, and Eutrophication, the impairments are lakewide problems and not AOC specific. In the case of Loss of Fish and Wildlife Habitat, Mr. Knauf presented data that indicate that some of the criteria are likely now being met and that the status of the remaining criteria are not substantially different from non-AOC areas, or, as in the case of sediment problems, that the impairments originate outside the AOC.

E. For the BUI: Restrictions on Fish and Wildlife Consumption

No specific comments were received.

F. For the BUI: Eutrophication or Undesirable Algae

No specific comments were received.

G. For the BUI: Loss of Fish and Wildlife Habitat

Question 2: Ms. Suzanne Albright of the Grand View Beach Association asked if NYSDEC would want to be notified if minks were sighted within the AOC. She said she understood that mink have been spotted in Long Pond channel.

Question 2 Response: Mr. Knauf said NYSDEC might want this information, but he definitely would and that people could contact him directly, and provided his contact information to Ms. Albright.

Comment 3: With respect to sedimentation and dredging in the lower Genesee River, Ms. Albright stated that following dredging this year, a terrible odor could be smelled in the Edgemere area. Ms. Sue Jackson, also of the Grand View Beach Association, stated that the wind was out of the East right after dredging was done.

Comment 3 Response: Mr. Knauf stated that dredge materials that come from the lower River at this time should be just sediment and not contain materials that would cause a significant odor problem. Also, given the location of the disposal site approved by the Army Corps of Engineers, no odors that might originate with sediments should be evident at Edgemere Drive. The Corps tests sediments every 5 years and sediments have met the criteria for open lake disposal since 1994. The river is dredged every 3 years. Also, the combined sewer overflow abatement program has reduced overflow events dramatically. That also reduces the likelihood that odor-causing pollutants would be present in those sediments. However, he indicated that he had received no complaints during this period, and if calls were received, investigation of the complaint would have been investigated.

Question 3: Ms. Albright asked if the Corps is done dredging for the year.

Question 3 Response: Mr. Knauf answered that the Corps finished dredging earlier in the summer.

Question 4: A resident asked "When Charlotte (Ontario) Beach closes, does Durand Beach also close?"

Question 4 Response: Mr. Knauf responded that there are 2 separate beach closing models, and under many scenarios one beach would be open even though the other would close.

Question 5: The resident also asked if there is a "rule of thumb" for staying out of the water in the unregulated areas adjacent to private properties along the lake.

Question 5 Response: Mr. Knauf indicated that a decision could be made based on Rainfall. If there has been ½ inch rain, it is a good idea to avoid swimming for one day if there is a storm sewer outfall or a stream nearby, nearly everywhere along the urban portions of Monroe County's lakeshore. If there is 1½ inches or more of rain, staying out of the water for 2 days is a good idea.

General Comments:
Comment 4: Professor Katrina Korfmacher of the University of Rochester Medical Center commented that the arguments for delisting the BUIs appear to take the emphasis away from addressing watershed issues.

Comment 4 Response: John Perrecone replied that the new focus will be the Lakewide Management Plan. Also, the Section 319 water quality planning process will be used to address problems that need to be addressed on a watershed basis. EPA does have a watershed perspective and will continue and even increase its efforts to address such problems. Barbara Belasco, of EPA Region 2, added that the EPA under the LaMP process has been working with Canadian agencies and others on biodiversity issues in Lake Ontario. They have developed a list of targets and remedies. EPA is hoping for new funding to work with partners to address lakewide issues, including emerging problems such as chemicals such as pharmaceuticals.

Comment 5: Professor Korfmacher noted that keeping community connected to watershed issues will be more difficult than AOC issues due to their dispersed across wide areas.

Comment 5 Response: Mr. Perrecone observed that there is a need to keep the energy moving, but that the question of how to do so is open. Mr. Knauf observed that it will be important to keep community awareness. He also stated that there may be new funding of up to $475 million per year for 5 years under the Great Lakes Restoration Initiative to address AOC and watershed issues starting in the near future.

Appendix C - Responsiveness Summary

I. Questions and Answers:

Question 1 - What is the background of this Beneficial Use Impairment and why was it designated for the Rochester Embayment?

Question 1 Answer - In 1994, the Stage I Remedial Action Plan indicated that occasional taste and odor problems were reported to the Monroe County Water Authority (MCWA) regarding water drawn from the Embayment. These were described as occurring "primarily in August, when prolonged hot temperatures promote blue green algae blooms." It attributed these to non-point source phosphorus, but also indicated that weather phenomena could also contribute to the problem, saying that "sudden wind shifts can alter currents, changing the temperature or turbidity of the water reaching the supply intakes."

The Stage II Remedial Action Plan offered much the same information. No specific studies to detail or resolve this problem were identified in the Stage II RAP. The BUI was linked to a specific goals developed for the Rochester Embayment, that "drinking water produced from Lake Ontario has no unusual or unpleasant taste. The Use impairment was linked to a number of water quality programs and initiatives, completed and ongoing, including, indirectly, the Lake Ontario Lakewide Management Plan, the Lake Ontario Toxics Management Plan, rapid response to spills on Lake Ontario, work on the Greece Ponds, public education on lawn care and pesticides, the NYS Coastal Non point Pollution Control, elimination of overflow dredging, and watershed stewardship education; and directly to the NY SPDES program, the Environmental Benefits Permit Strategy, Federal Stormwater regulations, the Eastman Kodak Wastewater Treatment Plant, CSOAP Construction, and BMP implementation, the CSOAP Modeling program, the phosphate detergent ban, the Pure Waters Program, Agricultural BMP's, and efforts to minimize Taste and Odor problems at local water purveyors. Remedial measures to address this Use Impairment included Stormwater Quality Management, Impervious Surface reduction, control of Point Source Phosphorus Loadings, promotion of Agricultural BMP's, education on Lawn Care, development of a public education structure, completion of watershed basin plans, and evaluation of new remedial measures.

In follow-up to the Stage II RAP, A subcommittee was formed to formulate delisting criteria for this use impairment, and in 2002, they presented their recommendation for Delisting Criteria and Monitoring methods, and furthermore recommended that the full Oversight Committee pursue delisting at that time.

Question 2 - What are the Public Health Implications of Taste and Odor Episodes?

Question 2 Answer - Taste and odor problems were normally attributed to algae growth but the etiology is not clearly defined. Earthy/musty taste and odor problems in surface waters are typically caused by Geosmin and Methyl Isoborneol (MIB), compounds produced by biological metabolic processes in the lake. Blue green algae blooms can produce these compounds but again in larger water bodies the specific causative factor is usually not identifiable. Sensitive individuals can detect these compounds at extremely low concentrations, in the low nanogram

per liter range. There are no known health problems from these chemicals at the levels encountered in the AOC.

Blue green algae, one source of geosmin and MIB, have been a concern along the lake, although to date no human or animal problems caused by blue green algae have been reported for Lake Ontario. The Health Department has been very vigilant over the years in looking for these algae in samples collected at Monroe County beaches, but has not found them in these samples. Researchers are tracking phycocyanin, a chemical also released to the water by breakdown of blue greens, in nearshore areas of the lake. Delisting for taste and odor will not cause authorities to cease monitoring for related compounds and possible problems.

II. Agency Comments Received and Incorporated or Answered in the Final Document -

Comment 1 - from Dr. Stephen Gould of USEPA Region 2

Barbara, I spoke with Lisa Yesensky, the chief water quality chemist with the Metropolitan Water Board, which treats water drawn from Eastern Lake Ontario and supplies the Onondaga County Water Authority and a portion of the City of Syracuse. They have water samples tested for the major compounds found to be responsible for taste and odor problems--geosmin and MIB--three times a week beginning in July, when water temperatures reach levels that support significant algal growth. The water samples are sent to the Erie County Water Authority's lab for the analysis. Values for geosmin and MIB are typically in the range of 2 to 9 ppt, which is similar to what MCWA has reported, suggesting that those values indeed are typical for the entire lake.

I spoke with Paul Whittam, the chief chemist in the Erie County Water Authority lab and he told me they perform the analysis for geosmin and MIB using solid-phase extraction, to concentrate the sample, followed by GC-MS. The detection levels is ~1 ppt.

Although conventional water treatment is not always successful in removing the two major compounds responsible for the taste and odor problems, GAC (activated carbon) that is treated subsequently with either ozone or allowed to build a biofilm *has* been successful. It would be helpful to find out if MCWA is in a position to provide this treatment should levels of geosmine and MIB spike in the future.

I don't see any compelling reason *not* to remove the BUI for the embayment unless a rash of customer complaints and follow up analyses demonstrate that the water in the embayment is significantly higher in geosmin and MIB than in the overall lake. To date, that does not seem to be the case.

Comment 2 - from Michael Lowy of USEPA Region 2

Barbara: I see no red flags in the attached information. As far as DW standards for taste/odor, it falls within secondary standards (SMCLs), as opposed to MCLs. SMCLs are set for the purpose of controlling aesthetic qualities that may affect public acceptance of the drinking water. Note that the SMCLs, unlike MCLs, are not federally enforceable. The specific parameter that has the SMCL, odor, has a SMCL of 3 threshold odor number. EPA recommends these particular standards, States can choose to enforce, or not. I believe that NYS has chosen to consider the odor threshold (same level as ours - 3 ton) as an enforceable standard. Hope this helps, let me know if you need more.

Michael J. Lowy, Environmental Scientist
Drinking Water Ground Water Protection Section, USEPA Region 2

Comment 3 - from Paula Zevin of USEPA Region 2

Hi Barbara, I will be taking over Dick Coleates' projects on the Niagara River and the Lake Ontario tributaries as he retires from EPA. Randy asked me to look at your request. The document looks perfectly sensible and well researched. As you can see from Randy's note below, we didn't test for odor and taste. I would suggest that you also check with the Drinking Water Program and determine whether the raw and finished drinking water in the AOC meets or exceeds federal and/or state standards, whichever are stricter. Monroe County may have a tally of all complaints over the past few years and be able to provide fast figures on what percentage could have been attributed to taste and odor versus other types (chlorine, etc.) Please let me know if you have any questions or concerns.

Paula Zevin, Division of Environmental Science and Assessment
U.S.E.P.A. - Region 2

Comment 4 - from Lloyd R Wilson, NYSDOH

Barbara, I read through the attached document and based on that review I agree with the proposal to delist the Rochester Embayment since nothing specific to that area is a cause of the taste and odor concerns. The taste and odor concerns are a lake-wide issue, the attached document clearly provides the data to draw that conclusion in Figure 13. Additionally, I reached out to the Monroe County Water Authority (MCWA) through our regional office, and as stated in the attached document, MCWA is in support of the delisting.

Finally, it is clear the number of taste and odor complaints have diminished, probably as a result of work from the MCWA. However, I am not sure that MCWA's efforts to address taste and odor through treatment (carbon filters) is a reason for delisting, it certainly is not in contrast.

In summary, NYSDOH supports the delisting. Should you have any questions or other issues please feel to contact me. If something similar is contemplated in the future, please do not hesitate to ask us to get involved sooner. Lloyd

Lloyd R Wilson, PhD.
Director's Office, Special Projects and Research,
Bureau of Water Supply Protection
New York State Department of Health

Comment 5 - from Betsy Trometer, US Fish and Wildlife Service

Joanna and all, I have reviewed the draft documents: Drinking water taste and odor problems & Added costs to agriculture and Industry. I have no comments or changes to these documents and I have no objections to delisting these two BUIs. Thanks. I have not received any of the other 3 documents for review. Betsy

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Betsy Trometer
US Fish and Wildlife Service
Lower Great Lakes Fish & Wildlife Conservation Office

Appendix D – References

[The following references are listed from the Draft Technical Recommendation Report (noted below in the additional references) by Ecology and Environment, Inc.]:

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United States Policy Committee. December 6, 2001. *Restoring United States Areas of Concern: Delisting Principles and Guidelines.*

(The following references are additions by MCDOH and NYSDEC):

Ecology and Environment, Inc., May 22, 2009. draft technical report to USEPA, as modified by MCDOH and NYSDEC and entitled: *Removal Recommendation for Drinking Water Taste and Odor Problems Beneficial Use Impairment.*

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Appendix E - Taste and Odor Incident Fall 2009

In late October of 2009, James Nugent, Water Quality Laboratory Manager for the Monroe County Water Authority, called C. Knauf, RAP Coordinator for the Rochester Embayment RAP, to inform him that, ironically in light of the public meeting just held and the intention to delist for the Taste and Odor BUI, the Water Authority had received a number of complaints, reported as approximately 60, concerning earthy musty taste and odor over the prior weeks, but after the public meeting on 9/22/09.

Mr. Nugent characterized the outbreak as mild, and indicated that samples sent to the Erie County Laboratory for geosmin analysis were found to be between 2.4 and 2.6 ng/L, much lower than concentrations associated with the outbreaks of the 1990's. Mr. Nugent said that only people who were sensitive to geosmin noticed the taste, and that in some cases two people living in the same house would differ on the perception, with one able to notice the outbreak and the other completely unaware of it. MCWA also reported that other purveyors along the lake shore, most noticeably Onondaga Water and Metropolitan Water also reported taste and odor complaints during the period. Discrepancies in the number of complaints between different purveyors were attributed to variable procedures for recording of complaints.

MCWA also indicated that a scheduled change out of Granular Activated Carbon (GAC) did not occur until after the complaints, and indicated that had the changeover occurred earlier, it is possible that at the low levels recorded, no complaints may have been received. Samples collected from the Oswego intake, approximately 80 miles east on the Lake had similar concentrations to the samples collected from MCWA during approximately the same time period. Smaller water purveyors in Ontario and Williamson also reported that they did have complaints, but that they do not record complaints so could not provide numbers.

Also indicated as a possible factor in this year' event was the unusual stability to the thermal stratification of the Lake during the late summer, with none of the usual inversions and upwellings that may have dispersed blue greens thought to cause the outbreaks. Nevertheless, although there was another perceptible Taste and Odor incident, it was not isolated to the Rochester Embayment, but occurred at multiple locations along the lakeshore. As of this writing, April 2010, no further complaints have been reported.