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September 13, 2006

Linda Murphy  
EPA Region 1  
One Congress Street  
Boston, MA 02114

Re: Water Quality Certification for NPDES Permit MA 0004898  
(Mirant Kendall Station, Cambridge, MA)

Dear Ms. Murphy:

Your office has requested the Massachusetts Department of Environmental Protection ("MassDEP") to issue a water quality certification for the above referenced final NPDES permit pursuant to Section 401 of the federal Clean Water Act (the "CWA") and the related EPA regulation at 40 C.F.R. 124.53. MassDEP has reviewed the final permit and sets forth below its determinations regarding (1) the thermal discharge limits established by EPA pursuant to Section 316(a) of the CWA; and (2) the permit conditions applicable to the cooling water intake activity.

I. The Thermal Discharge Limits

The Massachusetts Water Quality Standards (the "WQS") at 314 CMR 4.00 classify the state's surface waters and identify each class by the most sensitive, and therefore governing, water uses to be achieved and protected. See 314 CMR 4.05(1). Class B inland waters are designated as a habitat for fish, other aquatic life, and wildlife, and suitable for primary and secondary contact recreation. See 314 CMR 4.05(3)(b). Any industrial cooling and process uses must be compatible with these designated uses. *Id.* The minimum, numerical temperature criteria for warm water fisheries provide that water temperatures shall not exceed 83°F, which MassDEP applies as an instantaneous maximum temperature. See 314 CMR 4.05(3)(b)2.

In applying the WQS, MassDEP may authorize the use of a mixing zone for the initial dilution of a discharge. See 314 CMR 4.03 and MassDEP's Implementation Policy for Mixing Zones (January 8, 1993) (the "Mixing Zone Policy"), and the related Thermal Discharge/NPDES Review memo (June 9, 1992). Waters within a mixing zone may fail to meet specific water quality criteria provided the requirements stated in 314 CMR 4.03(2) and the MassDEP Mixing

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Zone Policy are met. Conditions include providing a “safe and adequate passage for swimming and drifting organisms with no deleterious effects on their populations.” See 314 CMR 4.03(2). To provide an adequate zone of passage for swimming or drifting organisms, the mixing zone shall not exceed 50% of the receiving water’s area. The water quality within the mixing zone must also protect aquatic life. Section IV. (b) of the Mixing Zone Policy states “[t]o protect swimming and drifting organisms the in-zone quality must be such that these organisms can pass through the mixing zone without acute exposure to toxicants.”<sup>1</sup>

As explained in Section 5 of the Determination Document (“DD”) and the Response to Comments (“RTC”) (see, e.g., RTC F4), because the thermal discharge limits authorized in the draft permit will result in thermal impacts in the Zone of Dilution (the “ZD”) that have an acute effect on, at a minimum, organisms with limited mobility passing through the ZD, the limits will not meet MassDEP’s mixing zone requirements. More specifically, the DD references a study that documented that the No Observable Acute Limit Effect (“NOAEL”) for juvenile alewives was 84.2°F and that temperatures above 86°F were increasingly lethal (Otto, R.G., M.A. Kitchel and J. O’Hara Rice, 1976). The permittee’s own Surface Water Modeling Report predicted that temperatures exceeding 90°F on the Cambridge-side of the Charles River would occur on multiple occasions, including temperatures as high as 98°F near the discharge in the ZD. EPA also conducted monitoring in the vicinity of the permittee’s thermal discharge and recorded temperatures up to 100°F. See RTC F4, L2. These temperatures are expected to have an acute effect on juvenile alewives in the ZD.

Under Section 316(a) of the CWA, EPA is authorized to grant a variance from either or both the technology-based or water quality-based effluent limits if less stringent variance-based limits will nevertheless be sufficient to “assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife” (the “BIP”) in the receiving waters. Similarly, MassDEP is authorized under 314 CMR 3.12 of its state surface water discharge permit regulations to grant a variance for thermal discharges by applying the same Section 316(a) BIP standard. The WQS, in turn, provide that thermal discharge limits established in accordance with Section 316(a) are site-specific limits in compliance with the WQS.<sup>2</sup>

In February 2001, the permittee requested a Section 316(a) variance for the joint permit and proposed thermal discharge limits that would apply under the variance. EPA and MassDEP determined that the permittee’s requested Section 316(a) variance-based limits would not meet the BIP standard. In addition, as discussed in detail in the RTC (see, in particular, RTC C3), EPA and MassDEP have determined, based on biological data, that the permittee’s existing thermal discharge has caused appreciable harm to the BIP because the location and thermal

<sup>1</sup> “Toxicant” is another term for a “toxic pollutant,” defined in 314 CMR 3.02 to include any pollutant, which after discharge and upon exposure, may cause death, behavioral abnormalities, physiological malfunctions, etc. “Pollutant” is broadly defined in M.G.L. c. 21, s.26A of the MA CWA and 314 CMR 3.02 to include “heated effluent.” In addition, MassDEP’s proposed revisions to 314 CMR 4.03(2) further clarify that “there shall be no lethality to organisms passing through the mixing zone as determined by [MassDEP].”

<sup>2</sup> MassDEP is in the process of clarifying the WQS to expressly state that Section 316(a) variance limits for thermal discharges into *inland* waters are site-specific limits in compliance with the WQS. A revised WQS that includes this clarification has been the subject of public comment, and MassDEP expects to complete the final regulation promulgation process in the near future.

impact of the permittee's discharge has largely excluded juvenile bluebacks and juvenile alewives from important habitat in the lower Charles River Basin.

EPA and MassDEP proposed in the draft permit more stringent, protective thermal limits that must be maintained at a minimum of 50% of the monitoring points in the four monitoring stations located in the path of the discharge plume, and at monitors located at the Zone Boundary Transect (a transect just upstream of the Longfellow Bridge), near the Museum of Science, and upstream of the New Charles River Dam and Locks. EPA and MassDEP determined that the resulting Zone of Passage and Habitat, as described in the draft permit (the "ZPH"), would be needed to assure the protection of the BIP, as required by a variance under Section 316(a) and 314 CMR 3.12.

More specifically, the ZPH is further delineated by compliance with the temperature limits at those monitoring points that also meet the dissolved oxygen ("DO") limit in the WQS, which are required to maintain the area as viable habitat. These requirements were proposed to ensure that at least 50% of the volume of the lower Charles River Basin, as described in EPA and DEP's Determination Document, is available as a protected habitat for the most thermally sensitive resident (yellow perch) and anadromous (alewife) species. See Section 5.8.1 of the DD and the RTC F4. Because the permit allows a ZD that will result in thermal discharges that exceed the temperature limits necessary for a viable habitat and movement of the above most sensitive species, assuring the maintenance of a ZPH that provides viable habitat and meets the BIP standard is required to support the granting of a variance under Section 316(a) and 314 CMR 3.12. The ZPH required in the permit is also consistent with the 1977 EPA 316(a) Technical Guidance Manual, which allows for a variance where it does not result in the exclusion of fish from an "unacceptably large area."

To summarize the more detailed explanation in the DD (see, in particular, Section 5.7.3i), EPA and MassDEP determined, based on a review of site-specific data and scientific literature, that a temperature of 81°F is a reasonably protective maximum temperature for alewife juveniles, the life stage of the fish species most sensitive to the elevated temperatures. EPA and MassDEP further determined that based on the draft permit's in-situ temperature compliance program and the ambient temperature characteristics documented in the lower Charles River Basin, a maximum temperature limit of 83°F, enforced at the monitoring points described in the draft permit, would ensure that temperatures lower than 81°F would be achieved in a large portion of the ZPH for a majority of the time. As a result, EPA and MassDEP proposed such conditions and determined that they would be protective of the alewife juvenile population and assure the protection of the BIP.

In addition to being the fish species most sensitive to high temperatures in the lower Charles River Basin, alewives are considered to be an integral part of the BIP of the lower Basin and the Charles River as a whole. Alewives are found in marine, estuarine and riverine habitats along the Atlantic coast and play an important ecological role in all three of these food webs, occupying a level between zooplankton, their principal food, and piscivores. They serve as prey for many important commercial and recreational fish species. Alewives are also an important direct commercial species, used fresh or salted for human consumption, and used for bait, fish meal and fish oil. See Pardue, G. B. 1983, Habitat suitability index models: alewife and blueback

herring, U.S. Int. Fish Wildl. Serv. FWS/OBS-82/10.58 22 pp. As explained in more detail in the DD and the RTC (see, e.g., RTC C3), the permittee's own data shows that there is an extremely low number of alewives in the Charles River. In addition, the number of river herring (alewives and bluebacks combined), on a statewide basis, has recently shown a noticeable decline. In response, the MA Division of Marine Fisheries ("MA DMF") has enacted a three year moratorium on the take of these species. Consequently, EPA, MassDEP, and MA DMF have focused attention on these inhabitants in the lower Charles Basin. Both MA DMF and U.S. Fish and Wildlife have informed MassDEP that the spawning and nursery habitat downstream of the Watertown Dam is very important to the population of bluebacks and alewives in the Charles River. The permittee's field data and observations by personnel from MA DMF have also confirmed that the wide section of the lower Charles River Basin downstream of the Boston University Bridge is a nursery area for alewives, bluebacks, white perch and yellow perch. The above information further supports the need to assure the maintenance of a ZPH that meets the BIP standard.

In addition, as discussed in the RTC (see, in particular, RTC C3), the fish sampling data submitted by the permittee to EPA and MassDEP in 2004 and 2005 documented that the alewife juvenile catch per unit effort of sampling was either substantially reduced or zero at temperatures above 81°F. This data is consistent with the analysis of the impact of temperature on the catch results in 2002 and 2003 that the agencies relied on in the draft permit determination that 81°F was the appropriate protective temperature. See the DD at p. 110.

As part of their review of public comments and data submitted subsequent to the issuance of the draft permit, EPA and MassDEP have reevaluated the temperature regime approach in the draft permit. As discussed in more detail in the RTC (see, in particular, RTC-23, in April, 2006, the permittee submitted to EPA and MassDEP vertical profile "hydro data" from selected stations in the Charles River Basin. The accompanying cover letter from the permittee characterized the data as providing "for the first time...a basis for evaluation of the actual impacts of the Station's discharge at full anticipated heat load." See the letter, dated April 5, 2006, from Shawn Konary, Mirant Kendall, to EPA. The *average* daily heat load from June 1, 2005 through September 30, 2005 was 469 MMBtu/hr, or approximately 84% of the facility's *maximum* daily heat load under the current permit. Mirant Kendall 2005 Field Data, April 2006 (AR 560), see especially "2005 heat load estimated from logbooks.xls." The permittee's report provides hydro data for different monitoring stations, depths and dates, and shows that temperatures in excess of 81°F (the temperatures determined to cause avoidance to the bulk of the juvenile alewife population in the lower Charles), and indeed higher than NOAEL of 84.2°F (the temperature above which acute adverse impacts are expected), were common in 2005 at stations both within and outside of the ZD. See Appendix 1 to the Hydro Data Report. Moreover, it appears from this data that, on certain dates at certain stations, there was no depth at which a refuge from temperatures in excess of 81°F or 84.2°F and/or low dissolved oxygen (concentrations below the WQS limit of 5.0 mg/L) was available to alewife juveniles and yellow perch. Temperatures in excess of 84.2°F appeared to persist at some stations for long periods.

EPA and MassDEP acknowledge that because temperature readings at a number of these stations<sup>3</sup> were not continuous, temperatures lower than 84.2°F or 81°F may have occurred at these stations between readings and that, because temperature readings were not obtained throughout the ZPH, temperatures lower than 84.2°F or 81°F may have occurred at these times elsewhere in the ZPH Still, with regard to exceedances of the 84.2°F value:

- On six of the seven dates for which temperatures were measured at the Shallow Diffuser Station, for the time period of August 9 through August 29, 2005, temperatures exceeded 84.2°F at the surface as well as at most monitoring depths where oxygen values met or exceeded 5.0 mg/L.
- In addition, during the July 20-21, 2005 period (depending on which of these days temperatures were measured at particular stations), the data indicate that no refuge existed for juvenile alewives from (a) temperatures at or above 84.2°F, and (b) dissolved oxygen ("DO") concentrations of less than 5.0 mg/L, at any of the depths where monitoring was conducted at the following stations: Shallow Diffuser, Boston, and Museum

Moreover, water temperatures downstream of the Longfellow Bridge appeared to have exceeded the 81°F "avoidance" value for long periods of time:

- For example, on all thirteen dates for which temperatures were measured at the Shallow Diffuser Station over the August 1 through September 14, 2005 time period, temperatures exceeded 81°F at the surface as well as at most monitoring depths where DO values met or exceeded 5.0 mg/L.
- In addition, temperatures exceeding 81°F were seen well beyond the edges of the ZD on many occasions: temperatures at the Boston station exceeded 81°F at all depths for which monitoring was conducted for all eleven monitoring dates from July 20<sup>th</sup> through August 23 2005; at the Old Channel Station, either temperatures were above 81°F or DO levels were below 5.0 mg/L at all depths where monitoring was conducted on four of the five monitoring dates between July 25 and August 22, 2005. At the Above Locks Station, surface water temperatures exceeded 81°F on eight of nine dates in which sampling was conducted at this site between July 5 and August 29; at the Museum Station, surface water temperatures exceeded 81°F on nine of ten dates in which sampling was conducted at this site between June 30 and August 29; and at the Old Locks Station, surface water temperatures exceeded 81°F on twelve of fifteen dates in which sampling was conducted at this site between June 30 and September 1. By comparison, temperatures at the Hyatt Station, located about 1.5 miles upstream from the discharge, only appear to have exceeded 81°F once in 2005, based on Mirant's monitoring data.

In short, MassDEP and EPA have concluded that these updated monitoring results, together with the other concerns summarized above, support the need to make the protective temperature of 81°F for alewives a permit compliance limit in the final permit at key stations, depths, and time periods, rather than rely solely on the assumption, as was the case in the draft

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<sup>3</sup> The Shallow Diffuser monitoring point is located in the Zone of Dilution (ZD) in close proximity to the ZPH. All the other stations were located within the ZPH.

permit, that 81°F will be achieved in a large portion of the ZPH for a majority of the time based on a compliance temperature of 83°F.

As explained in more detail in the RTC, based on a review of the public comments arguing that the permit should implement the 81° F temperature with more certainty, a review of historic temperature data in the lower Basin, and a review of the 2005 temperature data, EPA and MassDEP have jointly determined that requiring the permittee in the final permit to meet 81°F as a compliance limit at a minimum number of monitoring stations, depths, and day and night time periods is necessary to maintain an adequate ZPH that meets the Section 316(a) and 314 CMR 3.12 variance BIP standard. Consequently, the final permit has been revised to include the following thermal discharge limitations applicable for the period of June 12<sup>th</sup> through October 31<sup>st</sup>:

- **Daytime conditions.** A compliance temperature of 81° F or less shall be met in each of the four daytime temperature-averaging periods (4 am – 8 am; 8 am – 12 noon; 12 noon – 4 pm; and 4 pm – 8 pm) at either the six- or the twelve-foot monitoring depths at Monitoring Stations 2, 3, and 7.<sup>4</sup>
- **Nighttime conditions.** A compliance temperature of 81° F or less shall be met for at least one of the two nighttime temperature-averaging periods (8 pm – 12 midnight; or 12 midnight – 4 am) at the two-foot monitoring depth at Monitoring Stations 2, 3, and 7.<sup>5</sup>

In summary, EPA and MassDEP believe that the above revised temperature compliance limits are necessary to reasonably assure the availability of an adequate thermal refuge for alewife juveniles and yellow perch throughout the daytime in the ZPH. The maintenance of this thermal refuge throughout the daytime also addresses the reality that alewife juveniles are small in size (about 1 inch in length) at the beginning of this life stage and cannot move quickly across large distances to avoid unsuitable habitat conditions and reach distant, suitable feeding areas at different times of the diurnal cycle. Establishing an 81° F temperature compliance limit at the two-foot depth during at least one of the two four-hour nighttime blocks will confirm that alewife juveniles are able to access a surface feeding area, which is a characteristic of this species. See the DD, Section 5.7.3i, p. 113. In addition, by requiring the permittee to meet the 81° F temperature for one of the four-hour nighttime periods, EPA and MassDEP expect that a thermal refuge from temperatures in excess of 81° F will also be provided at lower depths during the other nighttime period at the identified monitoring stations.

For the reasons summarized herein and discussed in more detail in the RTC, EPA and DEP have each determined that the revised thermal discharge limits in the joint final permit are needed to confirm compliance with the BIP standard - as required by Section 316(a) of the CWA, and by 314 CMR 3.12 and the WQS. Under the WQS, site-specific permit limits that

<sup>4</sup> If the temperature at Monitoring Station 1, averaged over the two- and six-foot depth monitoring points, exceeds 81° F, then the Monitoring Station 1 averaged-temperature becomes the new temperature compliance limit in place of 81° F for both the daytime and nighttime conditions.

<sup>5</sup> The final permit also provides that the nighttime conditions do not have to be met within the same four-hour block at all three monitoring stations.

meet the Section 316(a) BIP standard are deemed to be in compliance with the WQS.<sup>6</sup> Furthermore, it is the position of EPA and DEP that any less stringent thermal discharge limits will not be sufficient to meet the BIP standard because both agencies have concluded that requiring compliance with 81° F limit at the above referenced monitoring stations, depths, and daytime and nighttime periods is needed to confirm compliance with the BIP standard.

Accordingly, on this basis, MassDEP affirms that each of the variance-based thermal discharge limits and related conditions in the final permit is necessary to achieve compliance with the CWA and the Massachusetts Clean Waters Act, M.G.L.c. 21, ss.26-53, and the WQS and other relevant MassDEP regulations promulgated thereunder.

## II. Cooling Water Intake Activity

### A. MassDEP's Authority to Regulate the CWIS

The three cooling water intake structures at the permittee's facility (collectively the "CWIS") are located in the Broad Canal, a man-made inlet 15 feet deep extending approximately 700 feet perpendicular to the Charles River. The CWIS spans from the surface to a depth of 12 feet and draws water from the Broad Canal through flush mounted trash racks which are followed by traveling screens. The screens are rotated three times per day and are backwashed with river water. The permittee's CWIS is an integral component of its once-through cooling water operation, including the facility's thermal discharges, and this activity has resulted in the entrainment and impingement of fish and other aquatic organisms, including eggs and larvae, as documented in the DD and the RTC.

It is well established that if there is a discharge to trigger application of the state water quality certification provisions under Section 401 under the CWA, a state may place conditions on the permit applicant's activity as a whole to ensure compliance with any applicable water quality standard or other requirement of state law. *PUD No. 1 of Jefferson County v. Washington Department of Ecology*, 511 U.S. 700 (1994). See also Section 510 of the CWA and 40 C.F.R. ss.125.80 (d), 125.84(e), 125.90(d) and 125.94(e). Moreover, the Supreme Court determined that a project that does not comply with a water body's designated use does not comply with the WQS and, therefore, a state's water quality certification may condition the project to assure compliance with the designated uses. *Id.*<sup>7</sup>

As noted at the outset of this Water Quality Certification ("WQC"), Class B inland waters are designated in the Massachusetts WQS as habitat for fish, other aquatic life and

<sup>6</sup> Because the thermal discharge limits were established by EPA and MassDEP to meet the same BIP variance standard required under both federal and state law, the limits are regarded by EPA and MassDEP as being necessary for both Section 316(a) and Section 401 state certification purposes. Compare with MassDEP's conditions applicable to the permittee's cooling water intake activity in Section II of this water quality certification, certain of which are solely attributable to state certification.

<sup>7</sup> MassDEP also notes that EPA's Environmental Appeals Board ("EAB"), in its review of an appeal of the NPDES permit for the cooling water operation at Brayton Point Station in Somerset, MA, cited the *PUD No. 1* decision as the basis for its conclusion that the designated uses in MA's WQS could potentially be relied upon by MassDEP to regulate CWISs in a Section 401 water quality certification. See *In re: Dominion Energy Brayton Point, LLC, Remand Order at 186-187 (February 1, 2006)*.

wildlife, and for primary and secondary contact recreation. The WQS further require that any industrial cooling and process uses must be compatible with these designated uses. Thus, protecting the designated use of the lower Charles River Basin in the WQS as a “healthful” habitat for fish and other aquatic life is a supportable and appropriate basis for conditioning the permittee’s CWIS activity in MassDEP’s WQC.<sup>8</sup>

Apart from Section 401 of the CWA, MassDEP also has independent state law authority to condition a CWIS in the context of permitting a discharge of pollutants to MA waters. More specifically, the MA CWA provides that “no person shall engage in any other activity [i.e., other than a discharge of pollutants] which may reasonably result, directly or indirectly, in the discharge of pollutants to waters of the [state] without a currently valid permit from the Department”. *M.G.L. c. 21, s.43 (2) and 314 CMR 3.04 of MassDEP’s Surface Water Discharge Permit Regulations*. As an integral component of its cooling water operation, the water withdrawal through the permittee’s CWIS is an “activity” that directly results in a thermal discharge. A thermal discharge is a discharge of “pollutants,” which is broadly defined in *M.G.L. c. 21, s.26A* of the MA CWA and 314 CMR 3.02 to include “heated effluent.” On that basis, MassDEP has the authority to regulate the permittee’s withdrawal activity under the MA CWA.

The MA CWA further provides that in addition to specifying effluent limits, MassDEP permits may specify “technical controls and other components of treatment works to be constructed or installed...which [MassDEP] deems necessary to safeguard the quality of the receiving waters”. *M.G.L. c. 21, s.43 (7)*. “Treatment Works” is broadly defined to include “any and all devices, processes and properties, real or personal, used in the collection, pumping, transmission...recycling...or reuse of waterborne pollutants.” *M.G.L. c. 21, s.26A and 314 CMR 3.02*. Thus, in addition to a cooling water withdrawal being an activity directly related to a discharge of pollutants, the permittee’s CWIS also constitutes an integral component of permitted facility’s cooling water “treatment works.” MassDEP is again authorized, therefore, to impose permit conditions on the permittee’s CWIS.

When the relevant provisions of MassDEP’s Surface Water Discharge Permit Regulations and the WQS are read together, it is clear that a permitted CWIS must allow for attainment of the designated uses of state receiving waters, as required by the WQS. 314 CMR 3.07(4) states that MassDEP shall not issue a permit “when the imposition of conditions cannot ensure compliance with the applicable water quality requirements of all affected States.” This regulatory prohibition is not limited in its application only to permit conditions applying directly to the discharge. MassDEP is also authorized under 314 CMR 3.11(11)(a) to include in a permit any requirements established by MassDEP in its Section 401 WQC.

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<sup>8</sup> MassDEP acknowledges that the Class B standard for inland waters is distinct from the Class A standard which identifies the designated use as an “excellent” fish habitat. Nevertheless, consistent with the WQS interpretation by EPA and MassDEP of the Class SB standard for coastal waters in *Dominion*, MassDEP also believes that a Class B fish habitat must be healthful and of at least somewhat high water quality given the provisions of 314 CMR 4.01(4) and 314 CMR 4.05(1). See *EPA’s Response to Comments, dated October 3, 2003, on the Draft NPDES Permit No. MA-003654 for the Brayton Point Station, at p.V-11 and note 4 and Amicus Brief of the Massachusetts Department of Environmental Protection in Support of EPA NPDES Permit No. MA-003654, dated December 22, 2003) at p.11 and note 10.*



In summary, MassDEP has existing authority under Section 401 of the CWA and under the MA CWA and related regulations to condition the permittee's CWIS to assure compliance with the WQS.<sup>9</sup>

B. The Permit's Impingement and Entrainment Reduction Requirements

1. Impingement

In its current operating mode, the permittee's facility is impinging fish that are both too large to pass through the traveling screens (which have a 3/8" mesh size) and unable to escape due to the approach velocity of intake water traveling through the screen. Each of the three CWISs has an intake velocity between 0.57 and 0.76 feet per second ("fps"). As documented in the DD and the RTC (see, in particular, H13) and the facility's impingement data, the above existing intake velocities are within the range to result in fish impingement. Moreover, impingement can increase during seasonal influxes of fish and as a result of stress factors that may weaken fish including, e.g., spawning and exposures to temperature extremes. See the DD at section 8.1.1b; and RTC-H14. In addition, impinged fish at the permittee's facility are presently backwashed onto the trash racks and not returned to the River, offering them no chance of survival.

As discussed in the DD and RTC, the permittee's impingement sampling results from 1999 to 2005 show that alewife, blueback herring and white perch, among other species, are being impinged by the permittee's existing facility operation, and will continue to be impinged to the same degree without improvements to the CWIS. See the DD at section 8.1.1g; the RTC at H-14). Analysis of impingement rates at the permittee's facility from 1999 through 2005 shows that impingement takes place during most months and is not concentrated in the spring and summer months. See the RTC, H-11. This data also supports the conclusion that a wide range of benthic species is also impinged. See the RTC, H-12. EPA and MassDEP acknowledge that the extent of impingement (in terms of the total fish impinged and species distribution) has varied over the above time period. While the number of river herring impinged in 2004 and 2005 was noticeably lower than in previous years even as the volume of water withdrawals increased, the fact that river herring have been shown to be in lower densities nearer the influence of the permittee's thermal discharge during the same time period may account for this more recent decrease in numbers. See RTC at H-14.

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<sup>9</sup> MassDEP is in the process of revising the temperature criteria sections in the WQS to add the following language: "in the case of a cooling water intake structure (CWIS) regulated by EPA under 33 U.S.C. s.1251 (FWPCA s.316(b)), the Department has the authority under 33 U.S.C. s.1251 (FWPCA s.401), M.G.L. c. 21, ss.26 through 53 and 314 CMR 3.00 to condition the CWIS to assure compliance of the withdrawal activity with 314 CMR 4.00, including, but not limited to, compliance with the narrative and numerical criteria and protection of designated uses."

The purpose of this regulatory affirmation is to make clear in the WQS that MassDEP has existing authority under the above referenced statutes and regulations to condition a CWIS to assure compliance with the WQS. MassDEP's exercise of this authority is not dependent on or affected by whether it expressly references that authority in the WQS. MassDEP believes, however, that the WQS are a relevant regulatory context to put the regulated community on notice that MassDEP has the authority and responsibility under Section 401 of the CWA and state law to evaluate, and if necessary, condition CWISs to assure compliance with the WQS.

EPA and MassDEP agree that uncontrolled impingement represents a significant detriment to the habitat and may be particularly adverse to alewives, which are in general decline and appear to be present in the Charles River at levels substantially lower than the river's historical carrying capacity of river herring. The area of the lower Charles River Basin downstream of the Boston University Bridge has been documented to be an important spawning and nursery area for alewife and blueback herring, and early stage juvenile fish using the habitat in the area of the intake structures are highly susceptible to impingement due to their more limited ability to resist the intake velocities (above 0.5 fps) of the CWIS. See, e.g., the RTC, H14. As noted in the DD and the RTC, in determining the relative significance of impingement losses to maintaining a healthful fish habitat, EPA and MassDEP can also factor in the other cumulative stressors and barriers affecting anadromous fish in the lower Charles River Basin, such as impaired water quality (including elevated water temperatures), physical barriers to spawning and the advection of larvae and eggs out of the river during high flow periods. See the DD at section 5.4 and the RTC, H10.

As summarized in the RTC (see, e.g., H1), to address the above concerns, the proposed final permit specifies the following technology-based impingement mortality reduction requirements for the permittee's facility:

- (1) implement a fine-mesh "barrier net" system ("BNS") in front of each of the CWISs and locate the BNS either within the Broad Canal, at the entrance to the Broad Canal, or outside of the Broad Canal; the barrier nets must remain in place except when icing conditions in the river reasonably preclude their deployment;
- (2) design, install and operate the barrier nets so as to minimize impingement mortality to the extent practicable, recognizing that adjustments may be needed over time to optimize performance based on experience, with the ultimate performance goal being to reduce annual impingement mortality for adult and juvenile fish by at least 80% from a calculated baseline;
- (3) monitor and report year-round on the impingement mortality reduction performance at each of the three CWISs;
- (4) restrict the effective through-screen intake velocity at all three CWISs to 0.5 fps or less when the barrier nets are in place, including a requirement to demonstrate what the actual through-screen intake velocity is under both conditions ( i.e., at the barrier nets when the BNS is in place and at the traveling screens when the BNS is not place.)
- (5) restriction of non-contact cooling water flow to a monthly average rate of 70 MGD during each of the primary spawning months of April, May and June; and
- (6) design, install and operate the BNS to preclude bypasses due to circumstances within the permittee's control, to the extent practicable. If the permittee encounters unforeseen clogging or other operational difficulties with the BNS or if necessary to perform routine maintenance, the permittee may pass water through its intakes without all

of the water passing through the BNS for the shortest period of time sufficient to alleviate the problem.

The technology-based impingement reduction requirements in the final permit, summarized above, are sufficiently protective to address the impingement impacts to adult and juvenile fish from the CWIS. However, as explained in the entrainment section below, the proposed final permit that EPA presented to MassDEP does not impose technology-based entrainment reduction requirements on the CWIS or mandate a barrier net system designed to prevent the entrainment of larvae. MassDEP has concluded that this result is inconsistent with maintaining the designated use of the receiving waters as a healthful fish habitat, as required by the WQS. Consequently, for the reasons stated below, MassDEP is imposing as conditions of this WQC that the permittee design, install and operate a BNS, consistent with the BNS impingement provisions of the final permit, that minimizes the entrainment and related impingement mortality of river herring and white perch larvae to the extent practicable and maximizes the survival of and minimizes the adverse impact to river herring and white perch larvae and eggs impinged on the BNS.

## 2. Entrainment

Both EPA and MassDEP concluded that the barrier net technology required under the draft permit would reduce both impingement and entrainment mortality of adult and juvenile fish as well as of larger sized fish larvae. See RTC, H1. However, while the barrier nets may be capable of reducing entrainment, smaller sized fish larvae and most or all fish eggs expected to be present in the Charles River in the area near the permittee's facility are likely to be too small to be blocked by the nets at the permittee's facility and will continue to be entrained. Id. As to these latter organisms, EPA and MassDEP concluded that, absent a well-constructed site-specific entrainment survival study, a 100% mortality rate must be assumed. See the RTC, H16.

The DD at section 8.1.2 describes the sampling and analysis conducted by the permittee in an attempt to quantify the extent of the entrainment impact on larval fish of several prominent species and the resulting estimated mortality of adult equivalents. Both EPA and MassDEP have expressed serious concern regarding the permittee's entrainment. River herring and white perch larvae predominated in both the Broad Canal and the Charles River sampling stations in the study years of 1999 and 2000.<sup>10</sup> As discussed in the DD, the permittee estimated that in 1999, it entrained 14% of the river herring larvae produced in the lower Charles River Basin, and that in 2000 it entrained 23% of the river herring larvae, and nearly 30% of the white perch larvae. Id. The larvae mortality losses resulting from entrainment translated into 1,525 and 4,490 equivalent adult herring in 1999 and 2000 respectively. See the DD at section 8.1.2i. Those equivalent adult losses were substantially greater than the estimated losses associated with impingement<sup>11</sup>, which indicates that preventing entrainment-related losses could have a more significant positive impact on fish populations than impingement reductions.

Estimating the significance of larval entrainment to the species' populations is hampered by the absence of reliable population data. The only field data on herring population abundance

<sup>10</sup> River herring and white perch constituted well over 90% of the larvae collected in the River in both years.

<sup>11</sup> Estimated impingement related losses were 114 in 1999 and 1,856 in 2000.

in the Charles River is the hydro-acoustic pilot study conducted by the permittee in 2002. The study estimated a herring population of approximately 45,600, of which only 8,000 were estimated to be alewives based on gill net sampling.<sup>12</sup> EPA and MassDEP recognize that there were deficiencies in the study's data collection that affect the reliability of its conclusions. See the DD at section 5.7.3b, and the RTC at H-15. However, even assuming that the study's deficiencies resulted in a substantial population undercount, the overall magnitude of the entrainment losses documented by the permittee in 1999 and 2000 still show that the permittee's CWIS has resulted in sizeable levels of entrainment mortality to herring and white perch larvae.

MassDEP has concluded that this uncontrolled entrainment of larvae is not consistent with maintaining a healthful fish habitat, as required by the WQS. This is evident when the above level of larval entrainment is considered together with cumulative adverse impacts on the lower Charles River Basin as fish spawning and nursery habitat, including the increase in intake withdrawals over historic levels<sup>13</sup> and the historical trend of diminishment in the size of the herring population, particularly as to alewife, as well as thermal discharge effects. Although the entrainment of eggs is also an adverse environmental effect and of concern to MassDEP and EPA, the lack of sufficient data makes it difficult to definitively determine the significance of the entrainment of eggs on the overall population. See the DD at 8.1.2i. It is expected, however, that the monitoring required under the final permit and this WQC will provide information useful for assessing the ramifications of the entrainment of fish eggs on the habitat.

In the draft permit, EPA included performance goals for the reduction of entrainment mortality that matched the standards expected for the Final Phase II Rule. As part of its final permit review, EPA decided that it would not set technology-based entrainment reduction performance standards or monitoring requirements. See the RTC, H1. While EPA's technology-based intake requirements are based on Best Professional Judgment rather than the application of the specific performance standards in the Phase II Rule, EPA had decided that it would not be a reasonable application of BPJ in this case to impose entrainment reduction requirements when the now effective Phase II Rule would not do so. While EPA has acknowledged that a barrier net system with sufficiently small mesh size would reduce the entrainment of fish and some fish larvae, and that the seasonal flow restrictions will place a certain ceiling on the potential entrainment of all organisms, EPA has not made these requirements technology-based requirements of the permit for the purpose of reducing entrainment. Instead, the proposed final permit requires the permittee to, if practicable, design the barrier nets to allow for any impinged larvae and eggs to be freed in a manner that would increase the probability of their survival.<sup>14</sup>

The CWIS requirements of the final permit, however, must also assure compliance with the WQS and include any conditions required by MassDEP's WQC. As discussed earlier in this

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<sup>12</sup> In its February 2001 application, the permittee estimated the herring population at over 203,000, but it appears that this estimate was based on estimates from a different river system.

<sup>13</sup> The permittee also acknowledged this outcome in its Final Environmental Impact Report: "Without mitigation... entrainment of aquatic organisms would be expected to increase commensurate with the increase in capacity utilization over current operational levels" (FEIR May 2000 at 6-12).

<sup>14</sup> This is because to the extent that barrier nets block any larvae and eggs from being entrained, those organisms will be impinged on the barrier nets. Thus, steps to maximize the survival of these impinged organisms are important if a benefit from reduced entrainment is to be realized.

WQC, the final permit conditions must be sufficient to protect the designated use of the lower Charles River Basin as a healthful fish habitat. Moreover, this project was subject to the Massachusetts' Environmental Policy Act, M.G.L. c. 30, ss. 61-62H (MEPA). Section 61 of MEPA requires that "Any determination made by an agency of the Commonwealth shall include... a finding that all feasible measures have been taken to avoid or minimize [environmental] impact."

In its environment impact report submissions pursuant to MEPA, the permittee recognized that the annual entrainment of an estimated 50 million herring larvae would increase as a result of its facility expansion proposal, and acknowledged that a barrier net system ("BNS") or equivalent screening technology would be required to reduce the adverse environmental impact of entrainment-related losses to the herring population. See the Final Environmental Impact Report, May 2000, at 4-12, 6-12. In that report, the permittee proposed a BNS that would limit entrainment loss of most of the larger larvae. Similarly, in its February 2001 NPDES permit application, the permittee proposed a BNS system that was subsequently modified through discussions with EPA and MassDEP. See the DD at section 3.2.3. As noted above, the proposed final permit that EPA presented to MassDEP adopts a BNS as the best available technology to reduce impingement of adult and juvenile fish, but it does not directly require entrainment reductions. In addition, the description of the required BNS allows for, but does not require on a technology basis, that it be designed to prevent the entrainment of larvae. See the DD at section 8.3. The BNS proposed by the permittee and piloted in 2002 had a mesh size of 1/32" (0.79mm) but in a 2003 written communication to staff from Coastal Zone Management, the permittee represented that the actual maximum mesh opening on the installed BNS would be a 0.5mm square. As originally proposed the BNS would prevent the entrainment of larvae reaching approximately 6mm in length, however the reduction in the mesh opening suggests smaller sized larvae may be captured. While data is lacking on whether the configuration of the proposed BNS is optimal for preventing entrainment of larvae, the permittee's proposal indicates that at a minimum it is practicable to design and operate the BNS with a 0.5mm opening and prevent larval entrainment down to 6mm or less. Optimization of the BNS will be evaluated as part of MassDEP's review of the permittee's proposed operating protocol for the BNS (see below).

The BNS as proposed by the permittee, and included in the draft and final permit, is not required to be located at the entrance to or outside of the Broad Canal where impinged larvae or eggs could be returned directly into the River rather than remaining in the Canal where their potential for re-impingement may be increased and their survival and maturation may be less likely. See the RTC-H-21. At this time there is insufficient technical feasibility data to mandate the installation of entrainment prevention and return system at the entrance to or outside of the Canal. A reliable assessment is also lacking regarding whether the system's location could result in a difference in the ichthyoplankton survival rate to the extent that it would affect the designated use of the lower Charles River Basin. In addition, the potential delays associated with the successful development and implementation of such a system would likely defer for an extended period of time the habitat benefits from an immediate and substantial reduction in fish impingement that will occur from the expedited installation of a BNS similar to the piloted system.

The benefit of reduced larvae entrainment cannot be accurately quantified in terms of a population level impact without reliable information on the size of the population. However, MassDEP and EPA disagree with the permittee's assertion that reliable population estimates cannot be obtained. See RTC-I11. Population data will also inform MassDEP on whether modifications to the BNS or an alternative system to prevent or reduce egg entrainment, and further reduce larvae entrainment, are required. In addition, updating the baseline quantitative assessment of egg and larval abundance and the magnitude of entrainment reduction and survival is necessary to evaluate the effectiveness of the design and operation of the BNS in preventing degradation of the designated use of the Charles River from the facility's increase in intake withdrawals.

Consequently, MassDEP has determined that the final permit must include conditions requiring the permittee to undertake the following actions:

- (1) Design and install a BNS or alternative entrainment prevention system ("EPS") consistent with the BNS impingement-related provisions of the final permit and the WQC, provided that the BNS/EPS minimizes the entrainment and impingement mortality (i.e., maximizes the survival) of river herring and white perch larvae to the extent practicable. Within 30 days of the effective date of the permit, the permittee shall submit a plan for MassDEP's review and approval that sets out the proposed design and location to meet these performance standards.
- (2) Operate a BNS or EPS consistent with the BNS impingement-related provisions of the final permit and the WQC, provided that the system is operated in a manner to maximize the survival of and minimize the adverse impact to river herring and white perch larvae or eggs impinged on the barrier net, including, without limitation, evaluating the magnitude and condition of the impinged organisms at a reasonable frequency to determine whether they have the potential to survive if returned to the river, and returning the potential survivors to the river with the minimum of stress. Within 45 days of the effective date of the permit, the permittee shall submit a plan for MassDEP's review and approval that sets out the proposed operating protocol to meet these performance standards.

Accordingly, MassDEP has determined that the above-described entrainment-related conditions are needed to assure compliance with the WQS. MassDEP otherwise affirms that the other CWIS permit conditions in the final permit will achieve compliance with the CWA, the MA CWA, and the WQS and other relevant MassDEP regulations promulgated thereunder.

### 3. Monitoring

Except as required by MassDEP as conditions to this WQC, MassDEP has determined that the temperature, water quality and biological monitoring program components, as set forth in Section 14 of the final permit are adequate and appropriate and, together with the related permit conditions, will achieve compliance with the CWA, the MA CWA, and the WQS and other relevant MassDEP regulations promulgated thereunder.

As a condition of this WQC, the permittee shall, within 60 days of the effective date of the permit, submit an entrainment-related sampling and monitoring and reporting program plan for MassDEP's review and approval. The plan shall be designed and implemented to provide information to evaluate the entrainment impact of the CWIS on the habitat and designated use of the lower Charles River and the effectiveness of the BNS/EPS in meeting the WQC performance standards. The plan shall be integrated into the water quality and biological monitoring program in Section 14 of the final permit. The plan, upon implementation, shall include the following components:

(a) a reliable estimate of the river herring population that enters the lower Basin and the relative abundance of alewife in accordance with the provisions of Part 14(d) 5 and 6 of the final permit, provided that the monitoring at the Watertown dam shall also provide data on the number of river herring that pass over the dam;

(b) a sampling, monitoring and assessment methodology to evaluate the performance of the BNS/EPS. The plan shall include a methodology to determine the reduction in the entrainment of river herring and white perch eggs and larvae as a result of the operation of the BNS or EPS, a description of the locations where sampling/monitoring will take place, the dates and frequency of sampling/monitoring, the means and timing by which samples will be taken, a methodology to estimate the conditions of the eggs and larvae before the samples are preserved and the sample preservation methods. All fish eggs and larvae shall be identified to the lowest distinguishable taxonomic category and counted and an appropriate number shall be measured to the nearest 0.1mm to estimate the average and median size of larvae being impinged and entrained;

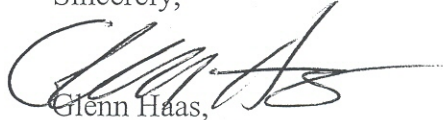
(c) a sampling, monitoring and assessment methodology to evaluate the survival potential of river herring and white perch larvae that are impinged on the BNS/EPS and returned to the Canal or the River; and

(d) methodologies to evaluate the impact of the permittee's CWIS on the populations of alewives and bluebacks that enter the lower Charles. The methods shall include: (1) an adult equivalent analysis for alewives and bluebacks; and (2) the percent loss of the egg and larval production for alewives, bluebacks and white perch within the Charles that is due to the facility's intake. Each of these impact evaluations shall take into account the total number of eggs and larvae drawn into the Canal, the total number of eggs, larvae and juveniles impinged on the BNS/EPS and the total number of eggs and larvae entrained through the facility.

The results of the above entrainment conditions, together with cumulative effect of all the permit conditions (including the thermal discharge limits and monitoring requirements) are essential for MassDEP and EPA to assess, at the time of permit renewal, whether or not more stringent or alternative permit conditions are needed to assure compliance with the applicable WQS.

In closing, MassDEP affirms that the Final NPDES Permit, as conditioned by this Water Quality Certification issued pursuant to Section 401 of the CWA, will achieve compliance with Sections 208(e), 301, 302, 303, 306, and 307 of the CWA, and with the provisions of the Massachusetts Clean Waters Act, M.G. L. c.21, ss.26-53, and the regulations promulgated there under, including the WQS.

Sincerely,

A handwritten signature in black ink, appearing to read 'G. Haas', written over the printed name.

Glenn Haas,  
Acting Assistant Commissioner  
Bureau of Resource Protection

CC: CZM