Proposed Amendments to

Maine's Water Quality Standards

Maine Department of

Environmental Protection

Report to

the 121st Legislature

Joint Standing Committee on Natural Resources

January 5, 2004

Introduction

During the first session of the 121st Legislature, the Natural Resources Committee amended a bill proposing to make changes to the state's water quality criteria (L.D. 1485, An Act to Update Water Quality Criteria) to a resolve that instructed the Department to further review the necessity of amending the bacteria criteria for Class B and C, dissolved oxygen in Class C and the marine dissolved oxygen criteria. The Department could recommend any needed changes to these criteria and the Committee may report out legislation on these issues.

Recommendations

The following statutory changes are recommended by the Department:

- Adopt EPA's bacterial criteria for designated beach areas for Maine's Class B and C waters to protect the recreational swimming use of our waters.
- Adopt an additional dissolved oxygen criteria for Class C waters based on temperature that supports coldwater habitat for indigenous fish species (salmonids).
- Adopt a marine dissolved oxygen standard for SB and SC waters that does not rely on a percent saturation value, but is rather a concentration value that protects growth of marine species.

Proposed bacterial standards for Class B & C waters

Presently, Maine's ambient water quality standards for enteric indicator bacteria (bacteria from the gut of warm-blooded animals) exceed those recommended by the EPA for water contact recreation (EPA 1986; EPA 2003). Designated use of Maine's Class B and C waters includes "recreation in and on the water" (swimming or other contact exposure). Because the present bacterial standards were not deemed sufficient for swimming areas, the Maine Department of Human Services (DHS) has adopted recently EPA's criteria as their guidance for swimming areas in the state. Following this action by DHS, the State's interagency Beach Committee has recently recommended that the DEP revise its water quality standards in statute in order to be consistent with the DHS guidelines.

The DHS uses EPA criteria for swimming waters which allows for a water sample to have a geometric mean of 126 colony forming units (cfu) of bacteria per 100 milliliters (ml) of water, or a single sample (instantaneous) value of 236 cfu per 100ml. This provides an estimated risk level of 8 swimmers in 1000 that would be expected to contract some illness from swimming.

EPA guidelines provide a range of single sample criteria that may be applied to waters based on the expectation of the amount of water contact use ("designated beach area" to "infrequent full body use" with criteria ranges from 236 cfu/100 ml to 576 cfu/100 ml).

The Department recommends the adoption of the most stringent criteria for designated beach areas for all Class B and C waters. It is appropriate and reasonable to use the most conservative bacterial standard because rivers and streams are contiguous with each other, so the use of different bacterial standards on different stream reaches could become ineffective in safeguarding recreational uses. As well, State water quality standards as they presently read in statute do not presume to have different levels of recreational uses, so one standard is reasonable.

Table I provides a comparison of current and proposed bacteria standards for fresh water. All values are expressed in colony forming units (cfu) per 100 milliliters.

Table I.

	Class B Instantaneous	**Class B Geometric Mean**	**Class C Instantaneous**	**Class C Geometric Mean**
Current	427	64	949	142
Proposed	236	64	236	126

Presently, Maine's standards only specify bacteria of "human origin." This language was originally enacted to avoid situations where bacteria standards were exceeded, but only from aggregations of animals not expected to carry human pathogens. However, recent evidence, described below, indicates that waterborne disease from animal sources should be considered in establishing *Escherichia coli (E. coli)* standards where sources from livestock and domestic animals are involved (EPA 2003).

The Department also recommends changing the bacterial standard so that bacteria from livestock and domestic animals are included. The extension of the standard to livestock and domestic animals is intended to reduce the risk of waterborne disease from these sources. Because these animals have a close association with humans, they can harbor and shed human pathogens. The pathogenic form of *E. coli*, *Cryptosporidium*, and *Salmonella* are known to occur in cattle and/or pigs. Outbreaks of these diseases have been documented in recent years in a number of states other than Maine from contaminated water sources associated with livestock. Presently, impairment of water quality due to high bacteria counts is declared only when there is a known or potential source of human sewage involved. By including domestic animals in the statute,

sources such as manure would also be justification for a water quality impairment determination.

It is becoming increasingly possible to identify bacterial contamination by source, such as human, pets, or wildlife. New test protocols using ribonucleic DNA are in development which can give a more precise accounting of animal source (Whiting-Grant, Dalton and Dillon 2003). These methods have already been used experimentally on waters of the Webhannet watershed in Maine and show promise in identifying groups of sources. In those tests, about 35-40% of the *E. coli* were identified from human, pet or livestock source.

Expected compliance with a change in standard.

In order to determine how a change in the bacterial standard would affect municipal wastewater treatment facility data was reviewed and analyzed. Recent performance data from municipal wastewater treatment facilities for period from January 2001 to July 2003 indicates generally good compliance with the proposed bacteria standards for Class B waters (64 facilities) and for the geometric mean value in Class C waters (52 facilities). The review revealed instances where facilities would be out of compliance with the new standard.

Class B waters:

- 64 facilities with current single sample criteria of 427 cfu/100 ml in permit
- 26 exceedences* of proposed 236 cfu/100 ml were recorded for 13 facilities (20%).

Class C waters:

- 52 facilities with current single sample criteria of 949 cfu/100 ml and geometric mean of 142 cfu/100 ml in permit
- 94 exceedences* of proposed 236 cfu/100 ml were recorded for 24 facilities (46%)
- 6 exceedences* of proposed geometric mean of 126 cfu/100 ml were recorded for 5 facilities (10%).

* exceedence is described as at least one occurrence within a month over the standard for a facility (a facility could have multiple exceedences within a particular month)

It is important to note that the facilities were not trying to attain the higher standards when this data was collected, so rather than an indication of noncompliance this is actually a better measure of existing compliance with the higher standard.

The Department has had several discussions with the Maine Wastewater Control Association about reasonable implementation of these new criteria. DEP's licensing policy has customarily been to require end-of-pipe effluent limits for bacteria to be the same as the ambient water quality criteria since these limits

have been proven to be technologically practical. This has always provided a good margin of safety to account for regrowth (a common phenomenon with bacteria testing) and for the presence of both point and nonpoint sources of bacteria.

The Department proposes that in adopting these new criteria, it will modify current licensing protocol to provide for compliance. Upon issuance of new licenses, the Department will establish a new geometric mean of 126 cfu/100 ml as an end-of-pipe effluent limit for Class C discharges. However, the present 427 cfu/100 ml or 949 cfu/100 ml, whichever is in effect, will remain as an end-of-pipe instantaneous effluent limit wherever the receiving water provides a sufficient dilution ratio to provide assurance that the ambient standard will be attained. Taking into account multiple discharges, the suggested dilution ratio is 2.2:1 for Class B receiving waters and 13:1 for Class C receiving waters based on the lowest seven day average flow that occurs at a frequency of once every 10 years (called 7Q10). The 7Q10 flow is a measure of low flow and so assumes low dilution into receiving waters.

These dilution ratios are recommended with the assumption that background bacteria numbers would be at the geometric mean of 64 cfu/100 ml for Class B and 126 cfu/100 ml for Class C waters. A relative volume of effluent was also assumed at the current single sample criteria of 427 cfu/100 ml for Class B and 949 cfu/100 ml for Class C water that would yield a single sample concentration of 236 cfu/100 ml. Then an additional safety factor of 2X is used to account for colony dispersion and regrowth of the bacteria. The formulas that describe the dilution ratios follow:

Class B: $427 + 64(X) = 236(X+1)$
$X = 1.1$

Class C: $949 + 126(X) = 236(X+1)$
$X = 6.5$

The effluent volume is 1 and the receiving volume is X in each of these equations.

The DEP has identified one facility on Class B water (Vassalboro) and four facilities on Class C waters (Sanford, Newport, Paris, Wilton) that do not meet these dilution ratios and where there are no upgrades pending that are expected to improve effluent quality.

Based on the review of the January 2001 to July 2003 data, none of these 5 facilities showed a repeated problem of attaining even the new 236 cfu/100 ml criteria so there is no expectation that significant modifications of current practices will be needed for the facilities. For those facilities with a lower effluent

to receiving water ratio, an appropriate reduction in the single sample effluent limit will be made at the time of their next license renewal and a compliance schedule, as allowed in Maine law, will be implemented if needed. The compliance schedule will provide the facility with sufficient time to make whatever operational or structural changes are needed to comply with the new effluent limits. The Department expects that the new ambient standards can be achieved with this approach.

Additionally, at a later date the Department plans to initiate, in cooperation with interested parties, a review of Best Practicable Treatment (BPT) for wastewater facilities and establish, by rule, technology-based effluent limits for bacteria that may be applied to facilities. In determining BPT, the Department shall consider the existing state of technology, the effectiveness of the available alternatives and the economic feasibility of alternatives.

Proposed revision for Class C freshwater dissolved oxygen criteria

Class C waters shall be of such quality that they are suitable for the "designated uses of …fishing; …and as a habitat for fish and other aquatic life." Furthermore, "discharges to Class C waters may cause some changes to aquatic life, provided that the receiving waters shall be of sufficient quality to support all species of fish indigenous to the receiving waters and maintain the structure and function of the resident biological community" (38 MRSA Section 465 (4)). Indigenous is defined as "supported in a reach of water or known to have been supported according to historical records compiled by State and Federal agencies or published scientific literature" (38 MRSA Section 466 (8)). Salmonids (brook trout, brown trout, rainbow trout and Atlantic salmon) are indigenous throughout all the watersheds in Maine, although they may temporarily vacate areas during high summer temperature events.

The Department has consistently determined that "support" of indigenous species requires the protection of the critical life functions of survival, growth and reproduction.

The statutory dissolved oxygen value of 5.0 parts per million (ppm) is used in Class C waters as a standard to support the survival of salmonids. It is however biologically insufficient to protect for growth of these species, and therefore does not "support" indigenous fish populations. Since 1987, the DEP has incorporated a monthly value of 6.5 ppm as a criteria to support growth of salmonids when conducting license reviews and water quality certifications to provide for full support of salmonid populations (see Chronology in Appendix).

The existing narrative standard in statute that protects identified spawning habitat is sufficient to protect for the life stage of reproduction.

Cold-water Fish Habitat

Temperature and dissolved oxygen are the primary water quality characteristics that define the habitat for salmonids. According to the U.S. Environmental Protection Agency (EPA 1986) the daily average temperatures acceptable for survival and growth of brook trout and Atlantic salmon are 24^{o} C (75^{o} F) and 23^{o} C (73^{o} F) respectively. Higher temperatures can be tolerated for short periods of time, but lower temperatures are required for growth, development and reproduction.

Numerous studies support the correlation of decreasing growth to decreasing dissolved oxygen (EPA 1986). Warren et al. (1973) provides extensive data from tests conducted at different temperatures and dissolved oxygen levels on salmonids showing growth rate reductions associated with

higher temperatures and low dissolved oxygen. JRB Associates (1984) analyzed data from numerous sources for the EPA and found median growth rate reductions for various cold water species and various temperatures ranged from 4 to 9% at 6 mg/l. Estimated growth rate loss at 21.7°C is 14 % (based on Chinook salmon data, Warren et. al 1973).

Similarly, the EPA recommends a 6.5 ppm DO monthly average standard to ensure the long-term growth and survival of salmonids. Therefore, when the daily water temperature is 24^{o} C or less, growth is possible assuming adequate dissolved oxygen is available to preclude oxygen stress. Dissolved oxygen at 6.5 ppm is expected to have "slight impairment" on growth. When the average daily water temperature exceeds 24 ^{o} C, there is negligible growth.

The EPA dissolved oxygen criteria and temperature criteria were developed after an extensive review of all relevant studies reported in the literature. Although one can find specific studies that may point to higher or lower criteria, the EPA criteria represent a valid synthesis of all relevant studies into recommended criteria. The 6.5 ppm dissolved oxygen monthly average criterion for other life stages of salmonids (other than early life stages) is based on production as affected by growth. The 6.5 ppm value selected by EPA represents a value between no production impairment and slight production impairment. The criterion may then be viewed as an estimate of the threshold concentration below which detrimental effects are expected. Detrimental effects are most likely in Maine rivers during the summer, because dissolved oxygen reductions below full saturation (which is actually 8.4 ppm at 24^{o} C) are most damaging as the water temperatures rise toward the upper acceptable levels.

In order to appropriately implement criteria for the growth of salmonids, the Department recommends a temperature of 24 ^{o} C or less for establishing when the 6.5 ppm monthly average dissolved oxygen criterion would be in effect. This is different from the way other states have used coldwater criteria (see below) but this is a reasonable method for incorporation of a growth criteria. For monitoring and modeling purposes, days when minimum daily temperature exceeds 24 ^{o} C would not be used in calculating compliance with a 6.5 ppm monthly average.

Thus, for support of indigenous fish species, the 5.0 ppm criteria at all times will ensure survival, the 6.5 ppm criteria as a 30 day average measured only during temperature less than 24 ^{o} C will ensure growth, and reproduction will be ensured through the narrative criteria in the present law.

<u>Adoption of comparable minimum coldwater (salmonid) standards by other states</u>

States have adopted dissolved oxygen criteria in many ways. The examples cited below include the use of absolute minimums, daily, weekly and monthly averages, and different life stages. The proposal for Maine waters falls

somewhere in the middle of the range of examples provided, and as previously noted, uniquely establishes temperature as a determinant for the use of growth criteria.

Washington: 6.5 ppm (lowest 1-day minimum) for coldwater and warmwater species, higher criteria are set for certain species (charr and redband trout), and for salmonid spawning, rearing and migration.

Oregon: 8.0 ppm absolute minimum or 90% saturation (where attainable accounting for temperature and altitude); otherwise 8.0 ppm (30-day average), 6.5 ppm (7-day average), 6.0 ppm absolute minimum. Higher criteria set for spawning areas.

Montana: 6.5 ppm (30-day average), 5.0ppm (7-day average)

Wyoming: 6.5 ppm (30-day average), 5.0 ppm (7 day average), 4.0 ppm (instantaneous), higher criteria for spawning and early life stages.

New York: 6.0 ppm (daily average), 7.0 ppm in spawning areas

Vermont: 7.0 ppm or 75% saturation daily minimum criteria for salmonid spawning and nursery areas; 6.0 ppm or 70% saturation daily minimum criteria in all other areas.

New Brunswick: 6.5 ppm minimum criteria for coldwater species, 9.5 ppm for early life stages.

Proposed revision for marine dissolved oxygen criteria

In 1965, then classes SA, SB-1, and SB-2 had dissolved oxygen standards 6.0 parts per million. Class SC had a dissolved oxygen standard of 5 parts per million. These standards continued until 1986 when Maine's dissolved oxygen criteria for SB and SC waters were changed to 85% and 70% of saturation respectively. At the time of this change, it was thought that percent saturation values provided a better way to accommodate the influence of temperature and salinity variability on oxygen content.

Oxygen levels in Maine's marine and estuarine waters have been measured more extensively in recent years by various monitoring groups, licensees, as well as the DEP (DEP 1996; DEP 1997). Despite the use of the percent saturation standard, dissolved oxygen saturation levels at some locations at some times do not meet class SB or SC standards where there are no apparent anthropogenic effects. As well, most of these unimpacted areas that do not meet the saturation standards have levels of dissolved oxygen concentrations that are generally considered adequate to fully protect marine life and have what appear to be a natural complement of expected marine organisms. Even when these areas meet saturation standards, it is often close to 85%, so there is no surplus. These circumstances have prompted DEP staff and others to question whether the saturation-based standards are appropriate.

As a result of these discrepancies, the Department initiated a review of its marine dissolved oxygen (DO) standards beginning in the summer of 2002. The current standards for Class SB and SC waters were reviewed to determine if they were set at appropriate levels to protect marine life stipulated in each class. The DEP ran a stakeholder process for the marine DO review to involve interested parties, solicit input and ideas, and share information as the review evolved and progressed. To date, eight stakeholder meetings have been conducted throughout the DO review process, starting in August 2002 through October 2003.

Criteria development

In order to start with a sufficiently technical basis for new dissolved oxygen standards, a review focused on the EPA's revision of dissolved oxygen criteria for the middle Atlantic region (EPA 2000). This document "recommends an approach to deriving the lower limits of dissolved oxygen necessary to protect coastal and estuarine animals in the Virginian Province (Cape Cod, MA, to Cape Hatteras, NC.)," and includes results from scientific reports and laboratory studies, and establishes separate criteria for different life stages (larvae, juveniles, and adults). Stakeholder input suggested a literature search to provide information that would allow the adaptation of the Virginian Province approach to

our more northerly waters by substituting cold water species for several of the species in the Virginian document which were not present in the Gulf of Maine. A subsequent literature review by DEP staff and one stakeholder produced limited information on dissolved oxygen needs of cold water species to allow species by species substitution. However other data for certain other marine species was used to modify this existing model for the Gulf of Maine.

EPA staff modified that segment of the Virginian Province approach that models dissolved oxygen impacts on larval recruitment, incorporating information provided by DEP and Department of Marine Resources (DMR). Adjustments to the model parameters were made based on Maine information on the timing, duration, and temporal distribution of spawning and larval production of lobster. After adjustments to the larval lobster recruitment model were completed, it was determined that the dissolved oxygen values that afforded protection for marine larvae were projected to be lower than dissolved oxygen values needed to protect the growth of other marine organisms in the Gulf of Maine.

Chronic effects of dissolved oxygen on growth of marine species were also investigated. Additional data on the impacts of dissolved oxygen on the growth of Atlantic cod were available. This information was incorporated into an updated plot of chronic growth effects of dissolved oxygen on several marine species. Logically, impacts on growth of marine species should drive the minimum acceptable dissolved oxygen concentrations in Maine.

Growth effects-based dissolved oxygen data were related to Maine saltwater classification standards. Virginian Province criteria numbers were calculated in part based on the “Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses (Stephan et al. 1985). However, these 1985 Guidelines are not intended to protect all species at all times. The most appropriate data to examine from the Virginian Province document are those used to calculate the criterion continuous concentration (CCC) which is based on growth data but allows up to a 25% reduction in growth (due to dissolved oxygen concentration) relative to a control in 95% of species. EPA’s freshwater dissolved oxygen document (EPA 1986) considers even a 10% reduction in growth to be significant and notes this level of impact as “slight impairment.”

To further assess how growth was impaired for different dissolved oxygen concentrations, the EPA provided Inhibition Concentration (IC) 25 and IC 10 values and their ratios for species from Appendix I of the Virginian document. IC 10 chronic value for saltwater similar to the EPA freshwater documents “slight production impairment” (or 10% growth impairment) for 95% of species is 5.4 mg/l. This calculation assumes that the fitting of a linear equation approximates the response of the animals at the lower end of the percent growth impairment range, as the percent reduction in growth becomes a low number. While this may be a reasonable approximation near 10% impairment in growth, it would not

be accurate to use a linear function at very small percent growth reduction values under 10% growth impairment. This is due to the asymptotic shape of the response of growth to slightly reduced oxygen concentrations. The use of a linear relationship might be useful at 10% growth reduction and above, but use of the linear relationship below 10% growth reduction would likely underestimate the reduction in growth at higher dissolved oxygen concentrations where growth reduction behaves asymptotically. This asymptotic trend is suggested in the lower percent growth reduction data points for species such as *Cancer*, *Palaemonetes*, and *Homarus* data sets in the CCC data figure (from Glen Thursby, Appendix I data, with cod data). The approach also assumes a 95% confidence in protecting marine species growth with this DO concentration.

Proposed DO concentrations to meet Maine standards for classification of estuarine and marine waters

Class SB standards require that the habitat for fish and other estuarine and marine life be characterized as unimpaired. As such SB waters should support unimpaired growth of estuarine and marine life. The EPA's freshwater dissolved oxygen document (EPA 1986) considers even a 10% reduction in growth to be significant and assigns this level of impact as "slight impairment." Therefore, growth impairment due to dissolved oxygen should be reduced to a negligible level to meet a definition that includes the term "unimpaired." Since the growth - dissolved oxygen relationship is non-linear and asymptotic at low levels of growth impairment, the dissolved oxygen concentration that would be deemed protective in SB waters would be higher than 5.4 mg/l which corresponds to a 10% level of impairment. The Department recommends using a 5% growth reduction figure as a reasonable metric for determining a dissolved oxygen number.

Providing that growth impairment is reduced to less than 5%, the dissolved oxygen concentration required to afford this protection would fall near 6.5 mg/l.

Class SC standards allows for discharges to Class SC waters to cause some changes to estuarine and marine life provided that the receiving waters are of sufficient quality to support all species of fish indigenous to the receiving waters and the structure and function of the resident community is maintained. This standard allows some impacts on estuarine and marine life and could be compared to the "slight impairment" mentioned in the EPA freshwater dissolved oxygen document (EPA 1986) as corresponding to a 10% reduction in growth of marine species.

Providing that the 10% growth impairment corresponds to the intent of the SC standard, dissolved oxygen concentration required in SC waters to protect 90% growth of marine species would closely match a standard of 5.4 mg/l.

The Department proposes to replace the current percent saturation values with short-term (1-day) averages of 6.5 and 5.5 ppm for Class SB and SC, respectively. Additionally, it is recommended that single sample (instantaneous) criteria not be less than 6.0 ppm for Class SB or 5.0 ppm for Class SC (values that were present in the previous law) to allow for some expected diurnal fluctuation.

Recommended statutory amendments

Sec. 1. 38 MRSA §465, sub-§3, ¶B is amended to read:

B. The dissolved oxygen content of Class B waters shall be not less than 7 parts per million or 75% of saturation, whichever is higher, except that for the period from October 1st to May 14th, in order to ensure spawning and egg incubation of indigenous fish species, the 7-day mean dissolved oxygen concentration shall not be less than 9.5 parts per million and the 1-day minimum dissolved oxygen concentration shall not be less than 8.0 parts per million in identified fish spawning areas. Between May 15th and September 30th, the number of *Escherichia coli* bacteria of human and domestic animal origin in these waters may not exceed a geometric mean of 64 per 100 milliliters or an instantaneous level of 236 ~~427~~ per 100 milliliters.

Sec. 2. 38 MRSA §465, sub-§4, ¶B is amended to read:

B. The dissolved oxygen content of Class C water may be not less than 5 parts per million or 60% of saturation, whichever is higher, and not less than 6.5 parts per million as a 30 day average whenever the minimum daily water temperature is equal to or less than 24° centigrade excluding any days that exceed 24° centigrade, except that in identified salmonid spawning areas where water quality is sufficient to ensure spawning, egg incubation and survival of early life stages, that water quality sufficient for these purposes must be maintained. Between May 15th and September 30th, the number of *Escherichia coli* bacteria of human and domestic animal origin in these waters may not exceed a geometric mean of 126 ~~142~~ per 100 milliliters or an instantaneous level of 236 ~~949~~ per 100 milliliters. The board shall promulgate rules governing the procedure for designation of spawning areas. Those rules must include provision for periodic review of designated spawning areas and consultation with affected persons prior to designation of a stretch of water as a spawning area.

Sec. 3. 38 MRSA §465-B, sub-§2, ¶B is amended to read:

B. The dissolved oxygen content of Class SB water shall be not less than 6.5 parts per million as a one day average, and not less than 6.0 parts per million at any time ~~85% of saturation~~. Between May 15th and September 30th, the numbers of enterococcus bacteria of human and domestic animal origin in these waters may not exceed a geometric mean of 8 per 100 milliliters or an instantaneous of 54 per 100 milliliters. The numbers of total coliform bacteria or other specified indicator organisms in samples representative of the waters in shellfish harvesting areas may not exceed

the criteria recommended under the National Shellfish Sanitation Program Manual of Operations, Part I, Sanitation of Shellfish Growing Areas, United States ~~Department of~~ Food and Drug Administration.

Sec. 4. 38 MRSA §465-B, sub-§3, ¶B is amended to read:

B. The dissolved oxygen content of Class SC waters shall be not less than 5.5 parts per million as a one-day average, and not less than 5.0 parts per million at any time ~~70% of saturation~~. Between May 15th and September 30th, the numbers of enterococcus bacteria of human and domestic animal origin in these waters may not exceed a geometric mean of 14 per 100 milliliters or an instantaneous level of 94 per 100 milliliters. The numbers of total coliform bacteria or other specified indicator organisms in samples representative of the waters in restricted shellfish harvesting areas may not exceed the criteria recommended under the National Shellfish Sanitation Program Manual of Operations, Part I, Sanitation of Shellfish Growing Areas, United States Food and Drug Administration.

APPENDIX

Chronology of DEP use of monthly average DO criterion of 6.5 ppm.

Spring 1986-Maine legislature adopts new classification without EPA monthly average since EPA DO criteria are still draft.

May 1, 1986 EPA Gold Book publication date with final DO criteria which includes chronic monthly average of 6.5 ppm.

June 6, 1986 BEP applies new EPA chronic monthly average to Lewiston Falls hydro thereby establishing policy for DEP staff to follow for ensuring attainment of narrative criteria 'support of indigenous species of fish'.

June 24, 1986 final DO criteria, including the new EPA chronic monthly average, published in Federal Register.

July 16, 1986 Letter from Michael Deland, EPA Region I Administrator to DEP Commissioner Kenneth Young saying that 'Maine should examine this document (i.e. the newly published criteria) when updating its standards again.

September 5, 1986 Letter from DEP Commissioner Kenneth Young to Michael Deland, EPA Region I Administrator replying that the way Maine implements its minimum criterion should ensure that the monthly average is met.

May 21, 1987 Letter from Michael Deland, EPA Region I Administrator to new DEP Commissioner Dean Marriott acknowledging the argument in DEP's September 5, 1986 letter, but requesting that DEP reply within 30 days assuring EPA that DEP will recommend adoption of EPA's chronic monthly average DO criterion in its next standards revision.

July 16, 1987 letter from DEP Commissioner Marriott to Michael Deland, EPA Region I Administrator addressing some other EPA issues, but did not address the DO criterion.

August 31, 1987 letter from Michael Deland, EPA Region I Administrator to DEP Commissioner Marriott acknowledging the July 16, letter but noting that written confirmation is still needed that DEP will recommend adoption of EPA's chronic monthly average DO criterion in its next standards revision.

November 3, 1988 letter from David Fierra, Director Water Management Division, EPA Region I to Steven Groves, Director of the Maine DEP's Bureau of Water Quality Control, noting EPA had still not received written assurance about adoption of EPA's monthly DO criterion.

April 12, 1993 Letter from Ronald Manfredonia, Water Quality Branch Chief, Region I commenting that the monthly average DO criterion of 5.5 ppm proposed in LD 1019 is “not adequate to protect the designated uses of Maine’s Class C waters and cannot be approved by EPA” and that “ in order to provide for the protection and propagation of salmonids (indigenous species) Maine must use a 30 day average of 6.5 ppm or higher”.

April 21, 2003 letter from Stephen Silva to Dawn Gallagher specifying EPA’s expectation that the DEP adopt a criteria of 6.5 ppm monthly average in Gulf Island Pond to protect indigenous fish species or “scientific justification for how an alternate criterion would satisfy Maine’s narrative standard to protect designated uses (including salmonid growth)”.

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