09/27/12

EPA NEW ENGLAND'S TMDL REVIEW

TMDL: **Maine Impervious Cover TMDL**, multiple counties, Maine
HUC: multiple; ME ID#: 30 different stream segments (27 listed in 2010 303(d) list; 3 proposed for listing in 2012 303(d) list: aquatic life use impairment.

STATUS: Final

IMPAIRMENT/POLLUTANT: Aquatic life use impairment measured by Class A, B, and C aquatic life criteria (macroinvertebrates, habitat assessment, periphyton bioassessment); primary sources are a mix of regulated and unregulated urban stormwater. TMDLs are established in terms of percent impervious cover (% IC, serving as a surrogate for the mix of pollutants in stormwater).

BACKGROUND: The Maine Department of Environmental Protection (ME DEP) submitted a draft TMDL for public review on June 14, 2012. A public comment period was initially scheduled until July 16, 2012, which was extended to July19, 2012. ME DEP submitted to EPA Region 1 the final *Maine Impervious Cover TMDL* with a transmittal letter dated September 25, 2012. In addition to the TMDL itself, the submittal included, either directly or by reference, the following documents:

- *Water Quality Monitoring Plan & Recommended Future Actions*, Appendix 1, TMDL report.
- *Percent Impervious Cover TMDL Targets for Stream Restoration and Watershed Management*, Appendix 2, TMDL report.
- *Public Comments, Frequently Asked Questions and DEP Responses to Comments*, Appendix 3, TMDL report.
- *Waterbody-Specific TMDL Summaries*, Appendices 4-32, TMDL Report.

- *Maine Stormwater Best Practices Manual*.
http://www.maine.gov/dep/land/stormwater/stormwaterbmps/index.html

- ME DEP Rule, Chapter 579, *Classification Attainment Evaluation Using Biological Criteria for Rivers and Streams*. May 2003.
http://www.maine.gov/dep/water/monitoring/biomonitoring/material.html

The following review explains how the TMDL submission meets the statutory and regulatory requirements of TMDLs in accordance with § 303(d) of the Clean Water Act and EPA's implementing regulations in 40 CFR Part 130.

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REVIEW ELEMENTS OF TMDLs

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. § 130 describe the statutory and regulatory requirements for approvable TMDLs. The following information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation.

1. Description of Waterbody, Pollutant of Concern, Pollutant Sources and Priority Ranking

The TMDL analytical document must identify the waterbody as it appears on the State/Tribe's 303(d) list, the pollutant of concern and the priority ranking of the waterbody. The TMDL submittal must include a description of the point and nonpoint sources of the pollutant of concern, including the magnitude and location of the sources. Where it is possible to separate natural background from nonpoint sources, a description of the natural background must be provided, including the magnitude and location of the source(s). Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation. The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as: (1) the assumed distribution of land use in the watershed; (2) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources; (3) present and future growth trends, if taken into consideration in preparing the TMDL; and, (4) explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments, or chlorophyll a and phosphorus loadings for excess algae.

A. Description of Waterbody, Priority Ranking, and Background Information

A total of 27 impaired segments are listed in Maine's approved 2010 303(d) list. Maine intends to add 3 additional impaired segments for coverage under this TMDL, pending approval of Maine's 2012 303(d) list. These 30 segments, characterized as small, urban/suburban streams, are located within 7 of Maine's 21 major watersheds (8-digit hydrologic unit code basins). Section 2 of the TMDL document lists each of the 30 impaired riverine segments alphabetically by name, and includes each waterbody's assessment unit identifier, segment name and location, listing cause(s), segment size, and classification, which determines the applicable water quality criteria.

A state-wide map and the list of impaired streams are presented in the main body of the TMDL report, and site-specific maps and data are provided in appendices 4-32. The location of impaired streams generally corresponds with the more populated areas concentrated along the coast and in the southern portion of Maine, in or near populations centers between Bangor in the north to Saco in the south (pages viii & 7, TMDL report). The impaired streams' priority rankings for TMDL development ranged from low to high and were scheduled for completion in 2010 – 2012 (page 8, TMDL report).

B. Pollutant of Concern

ME DEP's earlier stressor identification studies of several small urban streams have provided extensive documentation of the "urban stream syndrome" in Maine, where biological impairments are due primarily to a combination of pollutant (temperature, low dissolved oxygen,

heavy metals) and non-pollutant aquatic life stressors (such as impaired stream habitat and altered hydrology) related to stormwater runoff from developed areas. Data developed by ME DEP in its 1998-2002 urban stream study of Long Creek and Red Brook in southern Maine resulted in a wealth of data on dissolved oxygen, altered flow regime, decreased woody debris, increased water temperatures, and increased toxicity (heavy metals), all analyzed by EPA ORD in the "EPA Stressor Report".[15.] The report identifies each probable cause/stressor, the anthropogenic activities related to that stressor, and the specific steps, or causal pathways between the source and the biological response. Impervious surfaces and the stormwater it generates are identified as an anthropogenic source that contributes to each of the probable causes of the biological impairments in Long Creek. ORD particularly notes the complex interactions of dissolved oxygen, altered flow regime and temperature, and that each of the individual proximate stressors may also be acting jointly to cause biological impairments. ORD's report concludes that multiple probable causes or environmental stressors are responsible for the biological impairment of Long Creek. These earlier studies detailing multiple stream impacts of excessive stormwater runoff provided extensive documentation and analyses to inform later assessments of similar small urban streams in Maine.

Given the importance of stormwater runoff and multiple stressors in the development of small urban stream TMDLs, ME DEP has used the total **extent of impervious cover (%IC)** in the watershed as a **surrogate** for the complex mixture of pollutant and non-pollutant aquatic life stressors which are attributable to stormwater runoff from developed areas (page 1 TMDL report; see Section 3 below on linking water quality and pollutant sources). A number of urban stressors (e.g., impaired stream habitat, increased temperature, toxic contaminants, and low base-flow) and their sources can be addressed simultaneously by reducing % IC or its effects, and DEP refers to a list of recommended future actions in Appendix 1 of the TMDL report.

ME DEP provides an explanation and analytical basis for assessing the TMDL for aquatic life impairment through the use of surrogate measures (page 1 TMDL report). See also Section 2 below which explains ME's water quality standards, and Section 3 below which explains the use of percent impervious cover as a surrogate for the mix of pollutants in stormwater.

C. Pollutant Sources

Municipalities with designated urbanized areas under Maine's Stormwater Program (and subject to coverage under Maine's MS4 general permit) are noted in the core report and on maps in the site-specific appendices. The major sources of pollutants and other stressors are stormwater and overland runoff from urbanized drainage areas, such as unconfined runoff from roads and development.

In the site-specific appendices, ME DEP also identifies the magnitude and location of point sources and nonpoint sources (in terms of land use distribution in the watershed). Analysis shows that the extent of development is significant in these impaired watersheds.

Assessment: EPA Region 1 concludes that the TMDL document meets the requirements for

describing the TMDL waterbody segments, pollutants of concern, identifying and characterizing sources of impairment, and priority ranking.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal must include a description of the applicable State/Tribe water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy. Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation. A numeric water quality target for the TMDL (a quantitative value used to measure whether or not the applicable water quality standard is attained) must be identified. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, usually site specific, must be developed from a narrative criterion and a description of the process used to derive the target must be included in the submittal.

The TMDL report defines the appropriate water quality criteria for aquatic life protection, designated uses (including habitat for fish and aquatic life), and antidegradation policy (pages 11-12 TMDL report). Water quality classification and water quality standards of all surface waters of the State of Maine have been established by the Maine Legislature at Title 38 MRSA 464-468. According to Maine's water classification program, freshwater rivers and streams are classified as Class AA, A, B, or C, and offer different levels of protection. In order for a waterbody to attain its classification, all applicable surface water quality standards must be met. Each classification of freshwater rivers and streams includes designated uses (Table 3-1 page 11 TMDL report); narrative and/or numeric water quality criteria for dissolved oxygen, habitat, and aquatic life (all applicable to the IC TMDLs) (Table 3-2 page 12 TMDL report); and antidegradation provisions (designed to protect and maintain all water uses and water quality).

A. Water Quality Target - Aquatic Life Criteria

The impact of excessive pollutant-laden stormwater runoff into the small urban streams has resulted in a violation of the ME water quality standards (WQS), specifically the designated use as habitat for fish and other aquatic life [MRSA Title 38 §465]. These narrative criteria have provided the regulatory basis for Maine's numeric tiered aquatic life criteria since 1992. Numeric biocriteria designed to protect aquatic life use were adopted by Maine in 2004 [DEP Rule, Chapter 579], submitted to EPA as a water quality standard revision, and approved by EPA on January 25, 2005 (as required by §303(c) of the Clean Water Act, 33 U.S.C. §1313(c)). The narrative and numeric biocriteria for waters in Maine's water quality standards were used as the TMDL end point, goal, and ultimate numeric water quality compliance measure for the impaired portions of the streams in order to address non-attainment of aquatic life uses.

Maine's freshwater biocriteria were initially developed through the use of macroinvertebrate sampling and associated community structure modeling. The biocriteria provide a quantitative methodology for interpreting Maine's narrative biological criteria and aquatic life uses for rivers and streams, and for making decisions about classification attainment. A waterbody is determined to be in attainment in accordance with Chapter 579.4. Maine's biocriteria are based on 20 years of data from (currently) 768 river and stream and 126 wetland sampling locations, and over 1300 individual sampling events. Required sampling methods are referenced in

Chapter 579.2 and included in the document entitled, *Methods for Biological Sampling and Analysis of Maine's Rivers and Streams* (DEP LW0387-B2002).

Assessment: EPA Region 1 concludes that ME DEP has properly presented its water quality standards, and has made a reasonable and appropriate application of its water quality standards to protect the designated uses of these streams. This conclusion is based on the following factors.

The streams addressed by this TMDL are impaired for aquatic life use designation. The Department's determinations of impairment were based on habitat assessments and/or instream biological data collected according to required quality assurance protocols, and the modeling and assessment protocols for the implementation of Maine's water quality standards for assessment of aquatic life use. The approved biocriteria are the end point or goal for the TMDL, creating a direct connection between Maine's water quality standards and the TMDL targets. The approved biocriteria are based on a long-term, extensive database and a peer reviewed model, used and interpreted by highly qualified and experienced staff biologists.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

As described in EPA guidance, a TMDL identifies the loading capacity of a waterbody for a particular pollutant. EPA regulations define loading capacity as the greatest amount of loading that a water can receive without violating water quality standards (40 C.F.R. § 130.2(f)). The loadings are required to be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. § 130.2(i)). The TMDL submittal must identify the waterbody's loading capacity for the applicable pollutant and describe the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In most instances, this method will be a water quality model. Supporting documentation for the TMDL analysis must also be contained in the submittal, including the basis for assumptions, strengths and weaknesses in the analytical process, results from water quality modeling, etc. Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation.

In many circumstances, a critical condition must be described and related to physical conditions in the waterbody as part of the analysis of loading capacity (40 C.F.R. § 130.7(c)(1)). The critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards.

Establishment of TMDL Percent Impervious Cover (%IC) Target

In a pollutant-specific TMDL, a stream's loading capacity is the greatest amount of pollutant loading the water can receive without violating water quality standards. In these TMDLs, the "pollutant of concern" is a complex mixture of pollutant and non-pollutant aquatic life stressors, and is represented by the surrogate measure of impervious cover. The loading capacity for these TMDLs, therefore, is the greatest amount of impervious cover each watershed can support without violating each stream segment's assigned aquatic life criteria.

ME DEP explains the impervious cover TMDL method used to establish the link between water quality (attainment of aquatic life and other criteria) and the mix of pollutants in stormwater runoff. The benefit of using this method is that a number of urban stressors and their sources can be addressed simultaneously (e.g., toxic load from runoff and road deicers; habitat destruction due to storm flows including erosion and wash-out of aquatic life, and sedimentation problems from road sand and exposed soil; low base flows related to high imperviousness).

The basis of the TMDL development method used is the impervious cover model (ICM), which is used for illustrating the connection between land development and water quality. This model was initially developed by the Center for Watershed Protection (CWP, March 2003[1]). The research monograph, *Impacts of Impervious Cover on Aquatic Systems*, establishes the linkage between the level of IC in the watershed (causal variable), and water quality as measured by aquatic life criteria (response variable). [(1, page 2)] CWP's IC model is based on estimates of total % IC. Use of the ICM for TMDL development was suggested and piloted by ENSR in EPA Region 1 in 2004-5[2], and involves. :

- Watershed delineation;
- Mapping or estimation of total impervious cover;
- Establishment of % IC target for unimpaired conditions (based on state, regional, and national information);
- Comparison of estimated % IC to the % IC target for un-impaired conditions;
- For information purposes and to guide implementation, calculation of % IC reduction from current conditions needed to attain water quality standards.

ME DEP explains the assumptions, strength and weaknesses of the analytical process which is appropriate for TMDL assessment of small (high order, 1-3), stormwater-impaired streams (pages 19-20 TMDL report).

ME developed a technical support document for using this IC TMDL method in 2005, and subsequently updated the document in 2011 using more rigorous analysis and multiple lines of evidence to support TMDL target-setting in Maine (Appendix 2 TMDL report). For Class AA/A, Class B, and Class C freshwater streams, Maine recommends a level of total watershed IC not to exceed (Table 1, page 52 Appendix 2 TMDL report):

Maine	Class AA/A	Class B	Class C
IC TMDL TARGETS	$\leq$ 5%	$\leq$ 9%	$\leq$ 16%

Maine explains that the targets actually assigned to streams of the same class may vary because of differences in watershed setting, stream gradient, substrate composition, width and quality of riparian zone, canopy cover, groundwater impact, water temperature, and other factors. The TMDL target established reflects local conditions and factors in the watershed which both lessen (e.g., presence of riparian buffers) or increase (e.g., presence of impermeable soils) the volume of stormwater runoff. The % IC target applies at all times (instantaneous, daily, monthly, seasonal, annual) and will therefore achieve reductions in stormwater runoff volume in all storm events whenever they occur (e.g., on any given day) throughout the year. (See Discussion of TMDL time increment, page 9 below.)

Critical conditions
The % IC loading capacities for the streams are set to protect water quality for the full range of flows expected, and thus support uses during *critical conditions*. Since stormwater occurs throughout the year, with different environmental effects, at both low and high flows, critical conditions for aquatic life protection are not limited to particular flow conditions or time of year. Benefits realized from IC reductions will occur in all seasons because stormwater controls to be implemented to meet the IC targets will reduce adverse impacts (pollutant loading and damaging flows) for the full spectrum of storms throughout the year. Please see EPA's assessment of **climate change** issues in the assessment section below.

Assessment: EPA Region 1 concludes that Maine selected reasonable surrogates for the complex mixture of pollutant and non-pollutant stressors causing water quality impairment, and that the targets for % IC have all been appropriately set at levels necessary to attain and maintain applicable water quality standards in Maine. The loading capacities are based on reasonable approaches for establishing the relationship between pollutant loading in stormwater runoff and water quality in stormwater-impaired streams. Furthermore, the TMDLs are based on analyses of site-specific monitoring data. EPA also concludes that Maine adequately documented the assumptions and strengths and weaknesses in the analytical approaches used to support the establishment of the loading capacities for % IC, and properly accounted for critical conditions for all the TMDLs established. The bases for these conclusions are explained below.

Maine's use of surrogates is reasonable and appropriate
While TMDLs are intended to address impairments resulting from pollutants, there is nothing in EPA's regulations that forbids expression of a TMDL in terms of a surrogate for pollutant-related impairments. EPA's regulations state that TMDLs can be expressed in several ways, including terms of toxicity, which is a characteristic of one or more pollutants, or by some "other appropriate measure" 40 CFR §130.2(i). EPA's regulations also state that TMDLs may be established using a biomonitoring approach as an alternative to the pollutant-by-pollutant approach 40 CFR §130.7(c)(1). The use of a surrogate impervious cover target in place of a numeric pollutant target is appropriate in this case because the impervious cover target serves as an indicator for conditions under which the water quality criteria for aquatic life can be attained. Appendix D of the TMDL submission provides a reasonable basis for linking % IC to attainment of aquatic life criteria and uses.

TMDL for Percent Impervious Cover (% IC)
EPA Region 1 concludes that the use of total impervious cover as a surrogate for loading capacity is reasonable and appropriate. EPA Region 1 concurs with expressing the TMDL surrogate for stormwater pollutants and impacts as a % IC TMDL, based on the reasons provided by ME DEP. Compelling evidence exists for the linkage between total watershed IC, increased stormwater runoff volume and peak discharge, [1, page 37] and lower baseflows. IC increases the volume of stormwater runoff and therefore, the total pollutant load [1, page 91].

The scientific record documenting the impact of watershed urbanization on surface water quality and the integrity and diversity of aquatic communities is quite strong. Research from the mid-1990's point to the emergence of impervious surface coverage as a key environmental indicator [5, pages 243-258]. Scientific literature summarized in 2003 generally shows that aquatic insect and freshwater fish diversity declines at fairly low levels of impervious cover (10-15% IC), and urban land use of 33% [1, page 116]. In general, the data summaries from CWP document that stream habitat diminishes at about 10% watershed IC, and becomes severely degraded beyond 25% watershed IC[1, page 54]. Earlier research has shown that the variety of fish species drops as well [4, pages 28-31].

A more regionally specific scientific record documenting the linkage between % IC and the integrity and diversity of aquatic communities in New England is also strong, and growing. Study results from USGS in the New Hampshire seacoast region confirm that the percent impervious surface in a watershed can be used as an indicator of stream quality: the biological condition score was negatively correlated with the percent impervious surface [7].

In southern New England, a study of benthic monitoring sites sampled by CTDEP from 1996 to 2001 (and more recently, a group of sites selected based on a probabilistic sampling design) demonstrated a threshold effect in Connecticut small streams: as the % IC increases to approximately 12%, no applicable streams met Connecticut's aquatic life criteria [8].

Regionally, IC target-setting in both CT and ME are based on analyses of their respective state-specific biological monitoring data. As explained in Appendix 2 of the TMDL report, Maine's analysis supports IC targets that are expected to attain tiered aquatic life uses [3].

As discussed above (page 7), the TMDL target specifically set for each stream is further based on site-specific conditions and factors in the watershed which both lessen or increase the volume of stormwater runoff. Maine's watershed-specific TMDLs represents a more localized refinement than provided by the CWP model's broader range of 10%-25% IC as an indication of some water quality impairment (based on data from a much broader geographic and climatic range).

Maine's use of Impervious Cover Model is reasonable and appropriate

The CWP states that the IC model with a 10% IC threshold applies to small streams (1st – 3rd order) in the East Coast and Midwest [1, page 116]. Earlier research from the CWP shows the influence of impervious cover on watersheds to be *very strong* at the catchment level (0.05 to 0.50 sq. mi.), *strong* at the subwatershed level (1 to10 sq. mi.), and *moderate* at the watershed level (10-100 sq. mi.) [6 page 135]. This makes sense because in smaller watersheds, the IC is more likely to be located in proximity of the monitoring location, whereas high IC clusters in a large watershed may be located far upstream of the monitoring site, and may have no effect on the macroinvertebrates at the monitoring location. With direct watershed sizes ranging from 0.26 – 9.83 square miles (166 – 6,291 acres), the watersheds in Maine currently addressed by this TMDL fall within the categories of very strongly and strongly influenced by impervious cover.

EPA concludes that Maine adequately documented the assumptions and strengths and weaknesses in the modeling approach used to support the establishment of the % IC loading

capacity, and explained why the model is appropriate for these streams. The IC model is appropriate for use in Maine for several reasons. First, the State is located in the East Coast range of applicability identified by the CWP. Second, the waterbodies are small, 1st – 3rd order streams whose watershed sizes fall within an appropriate range of watershed area for evaluating the influence of impervious cover on water quality. Furthermore, there are no known significant non-stormwater sources in the watershed. For the reasons explained above, EPA believes the % IC surrogate approach is suitable for such small stream systems, where the impairment is for aquatic life, and where stormwater, with its associated pollutants and other stressors, is the cause of the impairment. Additionally, use of an impervious cover TMDL target offers an implementation advantage because IC relates directly to both the source of impairment and to BMP measures needed to restore water quality.

Critical Conditions

The critical conditions for these streams are associated with storm events from developed areas which, in addition to potential immediate damage to aquatic biota, produce cumulative impacts to the biota over time. These urban/suburban storm events dramatically change watershed hydrology by affecting the quantity and quality of runoff. Urban development results in increases in stormwater runoff peaks and volumes [(9)], and increased frequency of runoff from smaller storms. As the amount of impervious cover in watersheds increases, greater quantities of stormwater flows destabilize, alter structure, and destroy and impair habitat for aquatic life, while increased runoff of pollutants creates water quality problems, and less base flow is available to aquatic life in streams during low flow periods. [(10, page 1-1)]

These higher peak volumes scour macroinvertebrates along with other stream bed materials. Lower base flows reduce the amount and extent of wetted aquatic habitat, and increase aquatic temperatures and stress on aquatic life. More frequent post-development runoff from smaller storms (that used to infiltrate or soak into pervious ground and surfaces) subject aquatic life to more frequent exposure to pollutants, and increased destabilization of stream morphology and aquatic habitat.

EPA concludes that critical conditions are adequately accounted for because the target for % IC directly addresses the effect of % IC on stormwater runoff in the watershed, and thus the range of the stormwater impacts under varying critical conditions at different flows.

Climate Change

Increasing atmospheric greenhouse gas concentrations are anticipated to drive climate change resulting in deviations in atmospheric temperature and precipitation patterns from their historic norms in many areas (IPCC, 2007; Karl et al., 2009; USGCRP, 2009). These climate changes, in turn, will affect key parameters influencing water quality such as flow and water temperature.

Over 40,000 TMDLs have been developed for the nation's waters to determine the maximum pollutant loads allowable that would still permit attainment of water quality standards. Until recently, all were based upon historical water data, without consideration of the plausible range of future flow and water temperature profiles in a climate-change altered world.

National research at EPA and other parts of the Federal government, States, etc., is currently developing tools and projections for assessing the impacts of climate change on future water quality and, by extension, TMDLs. Multi-decadal projections of possible future climate conditions at local to regional scales are variable depending on the choice of general circulation model and economic growth assumptions used to drive the levels of greenhouse gas emissions upon which the models rely. In most locations, models agree that temperature will go up, though they vary on how much. Projected precipitation changes vary significantly by region, and in many locations models disagree on the direction of changes, especially in the northeastern United States. Climate models currently have limited skill in accurately projecting local to regional scale changes in frequency, intensity, and duration of precipitation events, though current observations and theory suggest these factors will change.

The ultimate goal of these TMDLs is achieving water quality consistent with Maine's current water quality standards and criteria, in this case, aquatic life use measured by habitat assessments and/or ambient biomonitoring for benthic macroinvertebrates) [38 MRSA 38 §465]. Any substantial future increases in stormwater flow and associated pollutants due to climate change in New England may require additional implementation efforts to achieve the ultimate TMDL goal of achieving Maine's aquatic life criteria. Implementation plan recommendations may need to be re-evaluated periodically and revised to account for such changes in runoff and water quality if future water quality assessments continue to document non-attainment of water quality standards.

TMDL Time Increment

EPA's November 15, 2006 guidance entitled "Establishing TMDL 'Daily' Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in Friends of the Earth, Inc. v. EPA, et al., No.05-5015, (April 25, 2006) and Implications for NPDES Permits," recommends that TMDL submittals express allocations in terms of daily time increments. In this case, the TMDL's % IC targets are not explicitly expressed in terms of a daily increment. However, they are, in effect, daily targets because they will achieve reductions in stormwater runoff volume in all storm events whenever they occur (e.g., on any given day) throughout the year. (14, page 9)

4. Load Allocations (LAs)

EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity allocated to existing and future nonpoint sources and to natural background (40 C.F.R. § 130.2(g)). Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. § 130.2(g)). Where it is possible to separate natural background from nonpoint sources, load allocations should be described separately for background and for nonpoint sources.

If the TMDL concludes that there are no nonpoint sources and/or natural background, or the TMDL recommends a zero load allocation, the LA must be expressed as zero. If the TMDL recommends a zero LA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero LA implies an allocation only to point sources will result in attainment of the applicable water quality standard, and all nonpoint and background sources will be removed.

For Class AA/A and Class B streams addressed by this TMDL, the TMDL loading capacity was

reduced by 1% in order to provide a margin of safety (discussed below); for Class C streams, the loading capacity was reduced by 2% IC. The resulting % IC allocation applies to all stormwater drainage areas and affects all sources subject to load allocations (LA) and wasteload allocations (WLA) in the watershed (WLA=LA). The LA relates to existing and future nonpoint sources, natural background, and stormwater runoff not subject to NPDES permitting. (See WLA discussion below.)

The % IC WLA and LA target is based on achieving an impervious cover goal across the whole watershed. ME DEP states that it was not feasible to separate the loading contributions from nonpoint sources, background, regulated and unregulated stormwater (page 17 TMDL report), and explains that parsing out loads to each source is not possible because of the large number of diffuse stormwater point and nonpoint sources, differences in natural geologic conditions, and the wide variability in storm flows. (See WLA section below, page 11, for discussion of future sources.)

Assessment: The impervious cover wasteload and load allocations apply irrespective of the type of stormwater (nonpoint source or point source) that is generated from any given parcel of land. Since stormwater discharges are highly variable in frequency and duration, and because insufficient data are available for each parcel in the watershed, it is not feasible to establish specific % IC allocations for each area that generates stormwater, nor is it feasible to draw a clear distinction among stormwater from nonpoint sources, stormwater from non-NPDES-regulated point sources, and stormwater from NPDES-regulated point sources (which require a wasteload allocation – see next section). EPA agrees that it is reasonable to address the combined loading contributions for % IC into one allocation because separating the loading contributions is infeasible and because the control measures necessary to abate point and nonpoint sources of stormwater are not affected by this practice. EPA Region 1 concludes that the load allocations for % IC are adequately specified in the TMDL at levels necessary to attain and maintain water quality standards.

5. Wasteload Allocations (WLAs)

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to existing and future point sources (40 C.F.R. § 130.2(h)). If no point sources are present or if the TMDL recommends a zero WLA for point sources, the WLA must be expressed as zero. If the TMDL recommends a zero WLA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero WLA implies an allocation only to nonpoint sources and background will result in attainment of the applicable water quality standard, and all point sources will be removed.

In preparing the wasteload allocations, it is not necessary that each individual point source be assigned a portion of the allocation of pollutant loading capacity. When the source is a minor discharger of the pollutant of concern or if the source is contained within an aggregated general permit, an aggregated WLA can be assigned to the group of facilities. But it is necessary to allocate the loading capacity among individual point sources as necessary to meet the water quality standard.

The TMDL submittal should also discuss whether a point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur. In such cases, the State/Tribe will need to demonstrate reasonable assurance that the nonpoint source reductions will occur within a reasonable time.

In the past, ME DEP has set the % IC wasteload allocations (WLA) for MEPDES-regulated stormwater discharges at two levels, one for CSO discharges (set at zero), and one for non-CSO stormwater discharges. Since there are no CSO discharges to the streams currently addressed by this TMDL report, the only currently applicable WLA is for non-CSO stormwater discharges.

Stormwater Discharges (Non-CSO)
The WLA for stormwater discharges is set for other (non-CSO) stormwater discharges in the contributing watershed**.** As mentioned above, the TMDL establishes the WLA at the same % IC that is established for the LA for each impaired stream segment, as a gross allotment or watershed allocation, because it was not possible to establish WLAs for individual parcels or stormwater sources. As discussed under pollutant sources (page 3 this document), stormwater runoff is addressed by MEPDES MS4 general permit for any stormwater runoff entering an MS4 collection system.

The necessary reduction in % IC discussed in the TMDL reflects reduction from current conditions. Future development activities have the potential to increase effective impervious cover and resulting stormwater runoff and associated pollutants, and these future activities will need to be addressed in the watershed management plan (prepared by watershed stakeholders with support from ME DEP). To ensure that the WLA and LA targets are attained, future development either will need to be constructed and operated in such a way that there is no net increase in stormwater runoff, or additional reduction in effective IC will need to occur at existing sites that contribute stormwater runoff.

DEP recommends that the % IC WLA and LA target be used to guide TMDL implementation because stormwater impacts can be reduced most effectively by reducing the volume of stormwater discharge and the effect of impervious cover in the contributing watershed (as well as using stream restoration techniques). DEP also explains that ultimate compliance with the TMDL and all of Maine's water quality standards will be determined by habitat assessments and/or measuring instream water quality.

Assessment:
Stormwater Discharges (Non-CSO)
WLAs are required for NPDES regulated point sources of pollutants. In this case, WLAs would be needed for areas from which there are NPDES (or, in Maine, MEPDES)-regulated stormwater discharges. EPA's TMDL guidance suggests that it is acceptable, in cases when data and information are unavailable, to allocate stormwater by gross allotments. See EPA's November 22, 2002 guidance entitled *Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs).* Given the data limitations mentioned above, it is acceptable to group all NPDES eligible stormwater discharges into a common wasteload allocation target for % IC. In addition, given the difficulty of separating out % IC associated with different stormwater sources (point and nonpoint, regulated and nonregulated), it is acceptable to include all sources in the one aggregate allocation (WLA and LA) for each waterbody. Future construction projects in the watershed may be subject to the Maine stormwater permitting program and will require control

of stormwater on site or potential further IC reduction by existing sources, and Maine's ambient water quality criteria must be met.

EPA Region 1 concurs that the WLA components of the TMDLs are appropriately set to assure attainment of water quality standards.

6. Margin of Safety (MOS)

The statute and regulations require that a TMDL include a margin of safety to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA § 303(d)(1)(C), 40 C.F.R. § 130.7(c)(1)). EPA guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is explicit, the loading set aside for the MOS must be identified.

The Maine % IC TMDLs provide two explicit margins of safety (MOS) (page 16, TMDL report): 1% IC MOS applied to Class AA/A, and B streams, and a 2% IC MOS for Class C streams. Class C waters are assigned a higher MOS because of the greater variability in assessment results for Maine Class C streams (see appendix 2 TMDL report), and to provide adequate protection for each stream class by accounting for the increasing magnitude of the TMDL target ranges among the three stream classes.

Assessment: EPA Region 1 has evaluated the margins of safety and believes that the two explicit MOSs are each adequate for their respective water classifications. The 1% IC MOS for A/AA and streams represents a minimum of 20% of the maximum TMDL target of $\leq$5% IC; the 1% IC MOS represents a minimum of 11% of the maximum TMDL target of $\leq$9 % IC for Class B streams; the 2% IC MOS represents a minimum of 12.5% of the maximum TMDL target of $\leq$16% IC for Class C streams.

EPA notes (1) that CLF's July 19, 2012 comments on Maine's public review draft of the IC TMDL admonish DEP to "Set a MOS that accounts for increased runoff secondary to **climate change**;", and (2) that DEP's response to comments explains that "The TMDL does account for observed changes in climate because targets were set using data collected during recent changes.", and that the "TMDL also relies on attainment of water quality standards as the ultimate measure of success…" (page 18, Appendix 3, TMDL report). EPA also notes that CLF provided no meaningful analysis of whether or how climate change will alter the impacts of runoff in the Maine watersheds addressed by this TMDL.

In support of, but not part of the MOS, EPA also notes ME DEP's commitment to future monitoring, and adaptive management, based on measurement of actual physical, chemical and biological responses of the streams to future pollutant loadings.

7. Seasonal Variation

The statute and regulations require that a TMDL be established with consideration of seasonal variations. The method chosen for including seasonal variations in the TMDL must be described (CWA § 303(d)(1)(C), 40 C.F.R. § 130.7(c)(1)).

ME DEP considered seasonal variations in conditions when developing the TMDL because stormwater volume and pollutant loads occur and vary throughout the year, and because impairment to aquatic life and habitat in stormwater-impaired streams occurs at both low and high flows, with different environmental impacts (page 19, TMDL report). The TMDL was established to protect during critical conditions throughout the year. The IC target will result in reductions in the effects of IC which will improve water quality for all flows and seasonal conditions. In addition, specific BMPs implemented will be designed to address loadings during all seasons.

Assessment: EPA Region 1 concludes that seasonal variation has been adequately accounted for in the TMDL because the TMDL was developed to be protective year round. Seasonal fluctuations in flow, and varying contributions of pollutants from snow and rainfall runoff are taken into account. There is no need to apply different targets on a seasonal basis because the stormwater controls to be implemented to meet the IC targets will reduce adverse impacts (pollutant loading and damaging flows) for the full spectrum of storms throughout the year.

8. Monitoring Plan

EPA's 1991 document, Guidance for Water Quality-Based Decisions: The TMDL Process (EPA 440/4-91-001), and EPA's 2006 guidance, Clarification Regarding "Phased" Total Maximum Daily Loads, recommend a monitoring plan when a TMDL is developed using the phased approach. The guidance indicates that a State may use the phased approach for situations where TMDLs need to be developed despite significant data uncertainty and where the State expects that the loading capacity and allocation scheme will be revised in the near future. EPA's guidance provides that a TMDL developed under the phased approach should include, in addition to the other TMDL elements, a monitoring plan that describes the additional data to be collected, and a scheduled timeframe for revision of the TMDL.

The IC TMDLs are not phased TMDLs, so a monitoring plan is not required, but the document includes a description of a monitoring plan designed to measure attainment of water quality standards. ME DEP explains that progress towards attainment of water quality standards will be evaluated by monitoring the macroinvertebrate community according to an existing rotating basin sampling schedule (page 24, Appendix 1, TMDL report).

Assessment: EPA Region 1 concludes that the anticipated monitoring by and in cooperation with ME DEP is sufficient to evaluate the adequacy of the TMDL and attainment of water quality standards.

9. Implementation Plans

On August 8, 1997, Bob Perciasepe (EPA Assistant Administrator for the Office of Water) issued a memorandum, "New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs)," that directs Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired solely or primarily by nonpoint sources. To this end, the memorandum asks that Regions assist States/Tribes in developing implementation plans that include reasonable assurances that the nonpoint source load allocations established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. The memorandum also includes a discussion of renewed focus on the public participation process and recognition of other relevant watershed management processes used in the TMDL process. Although implementation plans are not approved by EPA, they help establish the basis for EPA's approval of TMDLs.

ME DEP provides general recommendations for future actions in the TMDL report (pages 24-32 and site-specific case studies pages 34-47, Appendix 1, TMDL report). Emphasis is placed on development and implementation of watershed management plans (pages 24-28); various steps involved in stream restoration are outlined (pages 29-32); and non structural and structural BMPs designed to restore impaired waters are listed and explained (pages 33-47). The DEP recommends using an adaptive management approach toward lessening stormwater impacts and improving water quality.

Assessment: Addressed, though not required. EPA is taking no action on the implementation plan.

10. Reasonable Assurances

EPA guidance calls for reasonable assurances when TMDLs are developed for waters impaired by both point and nonpoint sources. In a water impaired by both point and nonpoint sources, where a point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur, reasonable assurance that the nonpoint source reductions will happen must be explained in order for the TMDL to be approvable. This information is necessary for EPA to determine that the load and wasteload allocations will achieve water quality standards.

In a water impaired solely by nonpoint sources, reasonable assurances that load reductions will be achieved are not required in order for a TMDL to be approvable. However, for such nonpoint source-only waters, States/Tribes are strongly encouraged to provide reasonable assurances regarding achievement of load allocations in the implementation plans described in section 9, above. As described in the August 8, 1997 Perciasepe memorandum, such reasonable assurances should be included in State/Tribe implementation plans and "may be non-regulatory, regulatory, or incentive-based, consistent with applicable laws and programs."

Varying portions of each stream's watershed are located within designated urban MS4 areas. Most stormwater sources are regulated under the MEPDES Program. As described in Sections 4 and 5 above, single allocations of % IC (WLA and LA) are established for all sources within a watershed. No point sources have been given less stringent limits assuming nonpoint source reductions, therefore, reasonable assurance is not required.

Nevertheless, ME DEP addresses reasonable assurances that point and nonpoint source reductions will occur in the following ways by providing: technical assistance in collaboration

with local stakeholders; case studies on local efforts underway to address watershed protection and stormwater management; and extensive references to more detailed information available on necessary remedial measures (page 20 and Appendix 1 TMDL report).

Assessment: Although not required, reasonable assurance is addressed in the TMDL report and in public comments and ME DEP's response to comments. Based on the commitment of the ME DEP and its watershed partners to work together to abate adverse stormwater impacts, backed up by ME DEP's regulatory authority, EPA concludes that adequate reasonable assurance has been provided.

11. Public Participation

EPA policy is that there must be full and meaningful public participation in the TMDL development process. Each State/Tribe must, therefore, provide for public participation consistent with its own continuing planning process and public participation requirements (40 C.F.R. § 130.7(c)(1)(ii)). In guidance, EPA has explained that final TMDLs submitted to EPA for review and approval must describe the State/Tribe's public participation process, including a summary of significant comments and the State/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. § 130.7(d)(2)).

Inadequate public participation could be a basis for disapproving a TMDL; however, where EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

The lengthy public participation process through various stages of the urban streams TMDL development is described (Appendix 3, TMDL report).

Initial Public Presentations

- A series of public presentations and outreach meetings were held in four geographic areas of the state April – May, 2011 (Bangor, Portland, Topsham, Augusta).

Preliminary Draft Release

-Preliminary draft of the TMDL and site-specific appendices were posted on the Department's website in June 2011 to encourage review by watershed stakeholders;

- Follow-up meetings with stakeholders in two locations were held in July 2011 (Portland, Ellsworth);

- Statewide draw meeting was held in Augusta December 15, 2011;

- Two more follow-up stakeholder meetings were held in January 2012 (Portland and Ellsworth).

Public Review Draft

- Notices were sent to the Department's much broader public interest contact list when the public review draft of the TMDL and appendices were posted on the web June 14, 2012. This draft included a *Frequently Asked Questions* section, prepared in response to stakeholder's preliminary

concerns.

- On June 29, 2012, ME DEP extended the public comment deadline from July 16 to July 19, 2012 in order to accommodate *DEP Public Input Session* held on Tuesday, July 17, 2012 in Augusta, Maine.

ME DEP fully addressed comments received during public review in Appendix 3 of the TMDL report.

Assessment: EPA Region 1 concludes that ME DEP has done an adequate job of involving the public during the development of the TMDL, has provided sufficient opportunities for the public to comment on the TMDL, and has provided reasonable responses to the public comments.

12. Submittal Letter

A submittal letter should be included with the TMDL analytical document, and should specify whether the TMDL is being submitted for a technical review or is a final submittal. Each final TMDL submitted to EPA must be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter, whether for technical review or final submittal, should contain such information as the name and location of the waterbody, the pollutant(s) of concern, and the priority ranking of the waterbody.

Assessment: ME DEP's letter of September 25, 2012 states that the TMDL is being formally submitted for EPA approval.

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15. EPA, 2007, *Causal Analysis of Biological Impairment in Long Creek: A Sandy-Bottomed Stream in Coastal Southern Maine*, NCEA/ORD, EPA/600/R-06/065F, December 2007.