REGION 1
BOSTON, MA 02109

February 13, 2025

Bonnie Heiple, Commissioner
Massachusetts Department of Environmental Protection
One Winter Street
Boston, MA 02108

Dear Commissioner Heiple:

Thank you for your Department's submittal of the pathogens TMDL analysis for the State's Watersheds on December 6th, 2024. We appreciate your efforts and involvement with our office to finalize these TMDLs. The U.S. Environmental Protection Agency (EPA) has reviewed the document entitled "Final Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies", Control #515.1, December 2024, and it is my pleasure to approve the 212 TMDLs for *Escherichia coli*, 18 TMDLs for fecal coliform, and 228 TMDLs for enterococcus, to apply to the surface waters of the watersheds as described in the TMDL document and appendices. EPA has determined, as set forth in the enclosed review document, that these TMDLs meet the requirements of Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 Code of Federal Regulations (CFR) Part 130.

MassDEP's efforts will help restore water quality and prevent further degradation of these, and adjacent, waterbody segments. My staff and I look forward to continued cooperation with the Massachusetts DEP in exercising our shared responsibility of implementing the requirements under Section 303(d) of the CWA. If you have any questions regarding this approval, please contact Katie Lamoureux at (617) 918-1373 or have your staff contact Ivy Mlsna of my staff at (617) 918-1311.

Sincerely,
/s/

Ken Moraff, Director
Water Division

Enclosure
cc:
Matthew Reardon, MassDEP
Richard Chase, MassDEP
Katie Lamoureux, US EPA
Ivy Mlsna, US EPA

EPA REGION 1 TOTAL MAXIMUM DAILY LOAD REVIEW

Date: February 13, 2025
State: Massachusetts
Title: Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies
Status: Final

IMPAIRMENT/POLLUTANT: Pathogens: 212 *Escherichia coli* TMDLs, 18 fecal coliform TMDLs, and 228 enterococcus TMDLs

BACKGROUND: EPA Region 1 received the *Final Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies* (Control Number: CN 254.1) with a transmittal letter dated December 12, 2024. In addition to the Final Pathogen TMDL itself, the submittal included, either directly or in reference, the following documents:

- Public Meeting Information and Response to Comments, pg. 57 and Appendix AC
- Applicable Massachusetts Surface Water Quality Standards (WQS)
- U.S. EPA November 26, 2014 Memorandum: Revisions to the November 22, 2002 Memorandum "*Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Stormwater Sources and NPDES Permit Requirements Based on Those WLAs*"
- *Mitigation Measures to Address Pathogen Pollution in Surface Waters: A TMDL Implementation Guidance Manual for Massachusetts.* ENSR. (2005). Retrieved from https://www.mass.gov/files/documents/2016/08/pu/impguide.pdf
- *Massachusetts Clean Water Toolkit. Prepared for MassDEP by Geosyntec Consultants, Inc.* Retrieved from Massachusetts Department of Environmental Protection: http://prj.geosyntec.com/npsmanual/default.aspx
- Final Massachusetts Integrated List of Waters for the Clean Water Act 2018-2020 Reporting Cycles

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.

REVIEWERS: Ivy Mlsna (617-918-1311) e-mail: mlsna.ivy@epa.gov

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

The Massachusetts Statewide TMDL for Pathogen-Impaired Waterbodies provides a watershed-based framework to address bacterial and other pathogenic pollutants in 210 freshwater river segments and 18 marine segments within twenty-eight watersheds in Massachusetts. The TMDL Core Document includes 212 TMDLs for *Escherichia coli (E. coli*), 18 TMDLs for fecal coliform, and 228 TMDLs for enterococcus. *E. coli* and/or enterococci are indicator organisms identified in the Massachusetts Surface Water Quality Standards (SWQS; 314 CMR 4.00) as the basis for water quality criteria established to protect the Primary Contact Recreation designated use in fresh water and coastal and marine waters, while fecal coliform criteria are the basis for assessing the Shellfishing use in coastal and marine waters as well as the Secondary Contact Recreation designated use in all waters.

A statewide watershed-based approach that uses the surface drainage area as the basic study unit enables resource managers to gain a more complete understanding of the potential pollutant sources impacting a waterbody and increases the precision of identifying local problem

areas or “hot spots” that may detrimentally affect water quality. This approach provides a format for guiding both remediation and protection efforts at the municipal and regional levels by providing a coordinating framework for environmental management that supports efforts to systematically identify, evaluate, and prioritize point and nonpoint sources of pollutants using natural hydrologic boundaries to define the problem areas. The main body of the TMDL report includes information common to all the impaired segments, while the appendices include information specific to each impaired segment. Appendices A through AB contain summaries of each impaired segment by watershed, as well as GIS-based maps showing sampling locations and surrounding watershed areas, the TMDL calculations and percent reductions needed, and recommendations for management activities to achieve the necessary pollutant reduction.

Since limited pollutant source information and data were available for each impaired segment, a simple scheme was used to prioritize segments based on the highest indicator bacteria concentrations observed. Data for each segment are summarized in the appendices. High priority was assigned to those segments where dry or wet weather concentrations regardless of the specific indicator bacteria, were equal to or greater than 10,000 CFU/100 mL, as such high levels generally indicate a direct sanitary source. Medium priority was assigned to segments where concentrations ranged from 1,000 to 9,999 CFU/100mL since this range of concentrations generally indicates a direct sewage source that may get diluted in the conveyance system. Low priority was assigned to segments where observed concentrations were less than 1,000 CFU/100 mL. Segments were also assigned a high priority if there was a public swimming area present, regardless of the availability of indicator bacteria data. Prioritization was adjusted one level upward based on the presence of suspected illicit discharges (dry weather exceedances), and/or Combined Sewer Overflow (CSO) or Publicly Owned Treatment Works (POTW) discharge(s). Prioritization was also adjusted upward based on proximity to sensitive environmental areas (e.g., Areas of Critical Environmental Concern, Cold Water habitats, Outstanding Resource Waters, public water supplies, and shellfishing) and areas at high risk for concentrated stormwater runoff from MS4-regulated areas (i.e., the MS4 area represents 10% or greater of the contributing watershed). Segments that satisfy more than one of these criteria were adjusted upward one priority level. These factors were used to determine the priority rank (High, Medium, or Low priority) for each segment. See Table 8 of TMDL Core Document for waterbody specific rankings.

B. Pollutant of Concern

Pathogens – including the pollutants of concern *E. coli*, enterococcus, and fecal coliform - are easily carried by stormwater runoff, as well as other discharges, into surface waterbodies. Once in a surface water, these pathogens can infect humans through consumption of contaminated fish and shellfish, skin contact, or ingestion of water. Infections due to pathogen-contaminated recreational waters include gastrointestinal, respiratory, eye, ear, nose, throat, and skin diseases. Of the designated uses listed in § 303(d) of the CWA, protection from pathogenic contamination is important for waters designated for recreation (primary and secondary contact), public water supplies, aquifer protection, and the protection and propagation of fish, shellfish, and wildlife.

The most common source of pathogens in surface waters is from the fecal wastes of warm-blooded animals. Wastes from warm-blooded animals contain many types of bacteria, including the coliform group and *Streptococcus, Lactobacillus, Staphylococcus,* and *Clostridia*. Each gram of human or animal feces contains approximately 12 billion bacteria that may include pathogenic bacteria, such as *Salmonella*, associated with gastroenteritis. Feces may contain other pathogens besides bacteria, including viruses, protozoa, and parasites. The wide variety of pathogenic organisms that might be present in waters makes it expensive and sometimes difficult to identify and measure the risk of each specific disease. Therefore, scientists and public health officials usually monitor non-pathogenic bacteria that are typically associated with harmful pathogens in fecal waste but are more easily identified and measured. These associated bacteria are called indicator organisms. Two commonly used indicators are coliform bacteria and fecal streptococci. Fecal coliform (a subset of total coliform) and *E. coli* (a subset of fecal coliform) are present in the intestinal tracts of warm-blooded animals. The presence of coliform bacteria in water indicates fecal contamination and the possible presence of pathogens. Fecal streptococci bacteria, specifically the subgroup enterococci, are also used as indicator bacteria. All these bacteria live in the intestinal tract of animals, but because enterococci have a lower die-off rate, their presence is a better predictor of human gastrointestinal illness than fecal coliform, particularly in brackish waters.

C. Pollutant Sources

Point sources of bacteria regulated under the NPDES permit program include large facilities like wastewater treatment plants or facilities (WWTP, WWTF, POTW), CSOs, industrial plants, confined animal feeding operations (CAFOs), and separate storm sewer systems in municipalities. Pathogen-related point source pollution can occur during both wet and dry weather. Usually, pathogen levels are higher in wet weather conditions, as CSOs, sanitary sewer overflows (SSOs), and/or stormwater runoff carry fecal matter to rivers and estuaries. Massachusetts' discharge permits are issued under 314 CMR 3.00: Surface Water Discharge Permit Program. Nonpoint sources can be more difficult to identify and control as they are more diffuse. Nonpoint source pollution is typically driven by watershed runoff, or the movement of water over the land surface and through the unsaturated zone and groundwater into waterbodies. Nonpoint sources of pathogenic pollutants include failing septic systems, illicit discharges or leaky sewers, wild animal and pet waste, manure spreading, and others. Stormwater runoff, the water from rain or snowmelt that flows over the land surface or through the ground into surface waters, may also seep through soil to infiltrate to groundwater, eventually discharging to surface waters. As the runoff moves, it transports natural and anthropogenic pollutants, such as soil, trash, and fecal waste, and eventually deposits them into surface waters. In developed areas, stormwater is typically channelized in storm drains, discharging via outfalls to wetlands and surface waters. Stormwater runoff is one of the leading sources of impairment of our nation's waters and often contains high concentrations of various pollutants, including pathogens. Urbanization and associated impervious surfaces alter the natural drainage features of a watershed, thereby significantly impacting local hydrology with increased peak discharge rates and volumes, reduced recharge to wetlands and streams, and increased discharge of pollutants to wetlands and receiving surface waters.

Assessment: EPA Region 1 concludes that the TMDL document meets the requirements for describing the TMDL waterbody segments, pollutant 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.

All fresh waters covered by this TMDL are Class A or B and all coastal and marine waters are Class SA or SB. Based on the SWQS, these waters should be suitable for the following uses: (1) habitat for fish, other aquatic life, and wildlife, with Class A waters being excellent habitat, (2) primary and secondary contact recreation (e.g., swimming, or boating and fishing, respectively), and (3) consistently good aesthetic value, with Class A waters being of excellent aesthetic value. In addition to classification, individual waterbody segments may be assigned qualifiers, which reflect additional uses or special considerations of that waterbody that may affect the application of criteria or antidegradation provisions (see 314 CMR 4.06(1)(d)). Qualifiers are assigned to segments by category at 314 CMR 4.06(2) through (5) and to specific segments at (6)(b): *Figure A; Figures and Tables 1 through 27.*

In 2021, MassDEP proposed, and EPA approved, amendments to their SWQS which adopted the USEPA's 2012 human health bacteria criteria recommendations for waters designated for Primary Contact Recreational uses such as bathing. The SWQS include geometric means for *E. coli* and enterococci bacteria for freshwater samples and enterococci only for coastal and marine samples collected within a 90-day period year-round. A shorter evaluation period of 30-days is used for segments containing public or semi-public beaches (during the bathing season) or have discharges from CSOs or POTWs (year-round). In addition to the geometric means, the statistical threshold values (STVs) for *E. coli* and/or enterococci shall not be exceeded by more than 10% of samples in the same period. Under the SWQS, the bathing season at beaches is determined by beach operators; but for the purposes of assessment or TMDLs, is defined as April 1 to October 15 of each year. A summary of WQC for indicator bacteria is presented in Table 3 of the TMDL Core Document.

TMDLs can be expressed in terms of mass per unit of time (i.e., daily load), concentration, or other appropriate measures (40 CFR Part 103.2(i)). The WLA and LA both need to account for

existing and future loads. This TMDL consists of two types of targets for allowable levels of indicator bacteria:

- Concentrations of indicator bacteria (expressed as bacteria counts/100mL of water)
- Loads of indicator bacteria (expressed as numbers of bacteria/day)

For indicator bacteria, the numeric targets for the TMDLs presented in this report are equal to numeric WQC defined in the SWQS (314 CMR 4.00) and listed in Table 3 of the TMDL Core Document. The stated goal of this TMDL is to meet SWQS at the point of discharge for all the segments in this report. Both targets are designed to meet the designated Primary Contact Recreation and Shellfishing uses by ensuring that indicator bacteria criteria in the Massachusetts SWQS will be attained. Both targets in this TMDL are considered by MassDEP to be daily targets. The concentration-based TMDL is a useful format for guiding both remediation and protection efforts in the watersheds. A concentration target allows interested stakeholders to readily determine (through monitoring) whether a source is exceeding its allocation. As required by the CWA, the TMDL is also expressed in terms of indicator bacteria daily load or the number of organisms per day (CFU/day). The load varies with flow over the course of the day and season and can be very large (billions or trillions of indicator bacteria per day) and thus more difficult to understand and interpret and not directly comparable to WQC (expressed as concentrations).

The TMDL document is based on water quality standards current as of the publication date of these TMDLs. If the pathogen criteria change in the future, MassDEP intends to revise the TMDL by addendum to reflect the revised criteria.

Assessment: EPA concludes that MassDEP has properly described and interpreted the applicable water quality standards to set the TMDL targets as indicated in Sections 2 and 4 of the TMDL Core Document. Section 2 describes applicable water quality criteria by waterbody class, designated use, and indicator bacteria. Section 4 contains the table, figure, and equations that express the TMDLs as daily loads in terms of numbers of organisms per day. Although water quality criteria for pathogens are expressed as concentrations in the SWQS (and the target for restoration of the waterbody is the criterion), it is possible to evaluate pollutant loading in terms of the total number of indicator bacteria per day in a waterbody. For rivers, this means multiplying the volume of water that flows through the river per day by the concentration of observed indicator bacteria. For coastal and marine waterbodies, the numerical loading is calculated by multiplying the daily runoff volume to the waterbody by the concentration of indicator bacteria in that runoff. MassDEP is directly applying the numeric criteria in its WQS to derive the TMDL targets based on event mean concentration of pathogens per flow/runoff rates.

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.

The number of potential pathogens entering waterbodies is dependent on several factors, including watershed land use characteristics and meteorological conditions. As development density and land uses that affect water quality increase (e.g., including commercial, residential, and industrial land uses), the number of pathogens (as estimated by indicator bacteria) generally increases. Many impacts associated with increased impervious surface area also result in changes in pathogen loading (e.g., increased sediment loading can result in increased pathogen loading). In addition to increased impervious surface impacts, increased human and pet densities in developed areas increase potential fecal contamination.

Two studies in Massachusetts provide data to illustrate the relationship between land use, development intensity, and pathogen pollutants. To gain an understanding of the magnitude of pathogen loading from stormwater and avoid over or under estimating pathogen loading, event mean concentrations (EMC) are used. An EMC is the concentration of a flow-proportioned sample collected throughout the course of a storm event. Typical stormwater event mean concentrations for fecal coliform bacteria in Massachusetts' watersheds per land use category are provided in Table 4 and Table 5 of the TMDL Core Document. For marine waterbodies, total maximum daily pathogen loads are typically calculated based on long-term average runoff volumes. The numerical TMDL is calculated by multiplying the average daily runoff volume to the waterbody by the concentration of indicator bacteria in that runoff. The approach differs from rivers in how the runoff volume is calculated and includes two methods depending on the location of the impaired coastal waterbody

Loading Capacity Analysis – Riverine Assessment Units

River flow is highly variable depending on precipitation, season, snowmelt, and other factors. The U.S. Geological Survey (USGS) maintains a system of stream gages to measure flow, though not

every river segment has a stream gage and estimates are often required. To estimate the flow for an ungauged location or segment, flows at a gage in the watershed or nearby watershed can be weighted based on drainage area. The USGS StreamStats web-based application can also be used to estimate flow statistics at ungauged sites. The most severe hydrologic condition at which the WQC must be applied is outlined in the Massachusetts SWQS (314 CMR 4.03(3) Hydrologic Conditions). Accordingly, the pathogen TMDL is expressed in terms of the criteria for the indicator bacteria proportional to flow for days in which flow exceeds 7Q10 conditions.

Calculations for determining pathogen TMDLs for *rivers* using the load-based approach:
The TMDL associated with each 1.0 cubic foot per second (cfs) of flow to meet WQC of 126 CFU/100 mL (E. coli, Class A or B) or 35 CFU/100 mL (enterococci, Class A or B) is derived as follows:

$TMDL$(10^9 CFU/day) = $Flow(ft3$sec) × WQC (CFU/100mL) × 86,400 (sec/day) × 10 (100mL/L) × 28.3168 (L/ft^3) ÷10^9

Loading Capacity Analysis – Marine Assessment Units

For marine waterbodies, total maximum daily pathogen loads are typically calculated based on long-term average runoff volumes. The numerical TMDL is calculated by multiplying the average daily runoff volume to the waterbody by the concentration of indicator bacteria in that runoff. The approach differs from rivers in how the runoff volume is calculated and includes two methods depending on the location of the impaired coastal waterbody. For segments located on Cape Cod and the Islands basins, groundwatersheds are used, and for all other segments, surface water drainage areas (i.e., watersheds) are used.

An average daily runoff volume from the Cape Cod and Islands watersheds (including eastern Buzzards Bay) was determined according to the methodology used most recently in the *Final Pathogen TMDL for the Islands Watershed*. The waterbodies in these basins are in areas of coarse and highly transmissive soils, where rain and runoff from impervious areas (IA) rapidly infiltrate into the ground and overland surface runoff is negligible. In these waterbodies, groundwatersheds (or groundwater-controlled watersheds) determine flow to the assessment unit waterbody and have been mapped by MassDEP or USGS. For the purposes of this TMDL, in the Cape Cod and Islands watersheds, all rainfall to impervious areas (IA) within a 200-foot buffer around the waterbody is assumed to directly enter the waterbody as runoff. In areas outside the 200-foot buffer, all precipitation is assumed to infiltrate into the ground. Average annual rainfall to this region is 45 inches per year based on precipitation recorded from 1941 to 1995, and average daily rainfall is 45 inches/365 days per year (or 0.123 inches/day). The total maximum annual load (TMAL) of pathogens to the Cape Cod/Island coastal and marine waterbodies is represented by the following equation:

$TMAL$(10^9CFU/year) = $IA\ in\ 200\ ft\ Buffer\ (ft^2)$ × 144(in^2/ft^2) × 45 ($in/year$) × WQC (CFU/100mL) × 10(100mL/L) × 0.0164(L/in^3) ÷10^9

Dividing the total maximum annual load by the number of days per year, the numerical TMDL for the Cape Cod and Islands marine waterbodies is therefore:

$TMDL$(10^9CFUday) = $TMAL$(10^9CFU/year)÷365

For marine waterbodies not located on Cape Cod and not in the Islands basin, surface watersheds are used to determine loading capacity. In these segments, average annual flow to the impaired segment is determined by the methodology used in the pathogen TMDLs for Buzzards Bay, South Coast, and North Coast watersheds and described in detail most recently in the *Pathogen TMDL for Boston Harbor, Weymouth-Weir, and Mystic Watersheds.* Average annual precipitation in coastal watersheds in this TMDL is determined to be 45.7 inches per year. All precipitation to impervious areas (45.7 inches per year of runoff) is assumed to enter waterways and ultimately the impaired segment. In pervious areas, 24.0 inches per year of runoff is assumed to enter the impaired waterbody, based on a long term (1905-2007) 50th percentile value from USGS gages in New England. The impervious and pervious land area in each watershed is thus multiplied by 45.7 and 24.0 inches of runoff, respectively, to get the total volume of runoff to each impaired segment. The runoff volume is then multiplied by the most stringent indicator bacteria concentration to get the maximum allowable number of indicator bacteria per year for that waterbody. Daily load is determined by dividing by 365 days in a year. Runoff from impervious areas (IA) make up the WLA, and runoff from pervious areas (PA) are the LA. Thus, the total maximum annual load of pathogens to coastal and marine waterbodies (excluding Cape Cod/Islands) is represented by the following equation:

$TMAL$(10^9CFU/year)=$Annual\ WLA$ [IA (ft^2) ×144(in^2/ft^2)×45.7 ($in/year$)× WQC(CFU/100mL)×10(100mL/L)×0.0164(L/in^3) ÷10^9]+ $Annual\ LA$ [PA (ft^2) ×144(in^2/ft^2)×24 ($in/year$)× WQC(CFU/100mL)×10(100mL/L)×0.0164(L/in^3) ÷10^9]

Dividing the annual load by the total number of days in the year (365), the numerical TMDL for marine segments, excluding those in the Cape Cod and Islands basins, is therefore:

$TMDL$(10^9CFU/day)=$TMAL$(10^9CFU/year)÷365

Assessment: TMDLs can be expressed in various ways, including in terms of multiple TMDL targets, or by some "other appropriate measure." 40 C.F.R. § 130.2(i). The target loading capacities expressed in the TMDL document are set at levels which assure WQS will be met (criteria at point of discharge and loading based on meeting ambient water quality criteria). The concentration loading capacity is based on the concentration criteria for each water body. If all sources of pathogens are below the water quality criteria, then it follows that the receiving water will meet the WQS for bacteria.

All of the loading capacity targets are directly linked to the MA SWQS bacteria criteria and the bacteria levels (pollutants) that must be reduced to achieve full primary contact recreation of the water bodies covered by this TMDL.

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.

Nonpoint source pollutants (i.e., diffuse sources of pollutants) receive load allocations (LA) specifying the amount of a pollutant that can be released to the waterbody. In the case of stormwater, it is often difficult to identify and distinguish between nonpoint source pollution and point source discharges that are subject to NPDES regulation. Stormwater runoff within urbanized areas regulated by the General Stormwater Permit for MS4s is considered a point source for the purposes of this TMDL. Stormwater runoff outside of MS4 areas, or that flows directly to surface water, is considered a nonpoint source of pollutants. Permitted stormwater runoff is accounted for in the WLA of the TMDL, while non-permitted runoff is accounted for in the LA of the TMDL. LAs apply to all nonpoint sources of pathogens (including stormwater runoff from pervious land cover types or runoff from non-regulated impervious areas) and are equal to the WQC applicable to each segment.

Assessment: EPA concludes that the TMDL document sufficiently addresses the calculation of the load allocations, as demonstrated by the foregoing and by the TMDL's administrative record.

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.

Any regulated discharge, including stormwater runoff subject to MS4 NPDES permits, NPDES wastewater treatment plant discharges, and combined storm sewer overflows, are included in the WLA of the TMDL. Runoff from impervious cover is likely to flow to receiving waters through a stormwater collection system. For prohibited point sources, including illicit discharges to stormwater systems and SSOs, the WLA is zero, which corresponds to complete elimination, or 100% reduction. The goal for controlling CSOs is meeting the WQC through implementation of approved Long Term CSO Control Plans. Stormwater runoff within urbanized areas regulated by the General Stormwater Permit for MS4s is considered a point source. Permitted stormwater runoff is accounted for in the WLA of the TMDL, while non-permitted runoff is accounted for in the LA of the TMDL.

Assessment: EPA concludes that the TMDL document sufficiently addresses the calculation of the waste load allocations, as demonstrated by the foregoing and by the TMDL's administrative record.

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 concentration-based TMDLs contain an implicit MOS by using the following conservative assumptions during the analysis:

1) The TMDLs are set equal to the appropriate criterion for each waterbody segment and include the goal of meeting indicator bacteria criteria at the point of discharge for all sources. This means the TMDLs do not rely on dilution in the waterbody to meet the criterion.
2) The TMDLs do not rely on in-stream processes such as bacteria die-off and settling, which are known to reduce in-stream indicator bacteria concentrations.

Consequently, the concentration-based TMDLs represent conservative TMDL target-setting, so there is a high level of confidence that the TMDLs established are consistent with the criteria in the SWQS, and the entire loading capacity can be allocated among sources. For these reasons,

the MOS is implicit. For compliance with this TMDL, ambient water quality will be considered at the point of discharge.

Assessment: EPA concludes that the approach used in developing the TMDL provides for an adequate implicit MOS, as demonstrated by the foregoing and by the TMDL's administrative record.

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).

TMDLs must account for season variation, and pathogen sources may be driven by a mixture of continuous and wet-weather driven sources such that no single critical condition will be protective for all other conditions. To ensure attainment independently of seasonal and climatic conditions, the TMDL has set the target equal to water quality standards for all known and suspected source categories. This will be protective of the surface water quality regardless of season or weather event.

Assessment: The pathogen TMDL applies across all seasons and weather events such that, when implemented, the TMDL targets will reduce pathogen concentrations equal to water quality standards. EPA concludes that the TMDL documents be adequately addressed seasonal variability.

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 long-term plan for statewide monitoring of indicator bacteria includes the following actions:

1) Identify and prioritize Massachusetts' waterbodies for which data are lacking or absent to determine if the waterbody meets the use criteria.

2) Monitor areas where BMPs and other control strategies have been implemented or discharges have been removed to assess the effectiveness of the modification or elimination.
3) Assemble available data to formulate a concise report such as a Watershed-Based Plan (MassDEP, n.d. (f)) to assess the basin as a whole for evaluation and selection of BMPs.
4) Continue to monitor for indicator bacteria during routine monitoring via random (probabilistic) sampling or by rotating basin.

Additional information on water quality monitoring plans in Massachusetts is found in *A Strategy for Monitoring and Assessing the Quality of Massachusetts' Waters to Support Multiple Water Resource Management Objectives 2016-2025.*

Assessment: EPA concludes that the anticipated monitoring is sufficient to evaluate the adequacy of the TMDL and attainment of water quality standards, although is not a required element of EPA's TMDL approval process.

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.

In a detailed discussion in Section 5 of the TMDL Core Document, MassDEP suggests a state-wide basin-based implementation strategy that suggests controls on several types of pathogen sources are required as part of a comprehensive pathogen management strategy. Sources like sewer connections to drainage systems, leaking sewer pipes, SSOs, and failing septic systems are prohibited and must be eliminated. Individual sources must be first identified in the field before they can be abated. Pinpointing sources typically requires extensive monitoring of the receiving waters and upstream stormwater systems under both dry and wet weather conditions. A comprehensive program is needed to ensure illicit sources are identified and that appropriate actions will be taken to eliminate them. MassDEP, USEPA, municipalities, watershed associations, and other stakeholder groups have been successful in carrying out such monitoring, identifying sources, and, in some cases, mobilizing the responsible municipality and other entities to take corrective actions, largely through the MS4 General Permit program, which requires minimal control measures to identify and eliminate

illicit discharges.

Many point source stormwater discharges in the TMDL study area are regulated under the NPDES Phase I and Phase II permitting programs, and the most critical stormwater point sources are described in Section 3 of the TMDL Core Document. The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum Extent Practicable is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve; it is a narrative effluent limitation that is satisfied through implementation of Stormwater Management Plans (SWMPs) and achievement of measurable goals. Nonpoint source discharges are generally characterized as sheet flow runoff and are not categorically regulated under the NPDES program, and therefore can be difficult to manage. However, some of the same principles for mitigating point source impacts may be applicable. Individual municipalities not regulated under a NPDES Stormwater Permit should implement the same six minimum control measures to minimize stormwater contamination. Stormwater Phase II Annual Reports are submitted by regulated communities each May. Recent annual reports indicate that substantial progress is being made, particularly with certain communities, on those aspects of the six-point plan requirements that would address pathogen pollutant sources. Community-specific progress with stormwater management is presented in the TMDL appendices.

Geometric means of indicator bacteria data measured from 2005-2019 were calculated using the appropriate rolling 30- or 90-day period for all sampling stations in the impaired segments. This geomean was used to provide an estimation of pathogen reduction required to meet the TMDL. For those segments with multiple sampling stations, the sampling station with the highest geometric mean relative to the applicable criterion was used to calculate a percent reduction needed for that segment to attain applicable criteria established in the Massachusetts SWQS. These TMDL reductions provide a rough estimation of the pollutant abatement action needed for each segment to meet SWQS.

Initial percent reduction = [(highest geomean of indicator bacteria data – water quality criteria)/highest geomean of indicator bacteria data] x 100

The result of this analysis for each impaired segment is provided in the TMDL appendices. The reductions necessary to achieve the TMDLs are based on estimates of current indicator bacteria concentrations. Future development activities and land use changes have the potential to increase levels of indicator bacteria or stormwater runoff associated with pollutants. These future activities will need to meet the TMDLs and be addressed in applicable watershed management plans and by state or local requirements. Since limited pollutant source information and data were available for each impaired segment, a simple scheme was used to prioritize segments based on the highest indicator bacteria concentrations observed. Data for each segment are summarized in the appendices along with existing local management strategies.

Assessment: MassDEP has addressed the implementation plan. Although EPA is not approving the implementation plan, EPA has concluded that it outlines a reasonable approach to implementation, as demonstrated by the foregoing and by the TMDL's administrative record.

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, 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."

The TMDL targets for point sources in this TMDL are not less stringent based on any assumed nonpoint source reductions in the future. MassDEP addresses the concept of reasonable assurance insofar as it relates to overall TMDL implementation in Section 7 of the TMDL Core Document. Reasonable assurances that the TMDL will be implemented include both application and enforcement of current regulations, availability of financial incentives including low interest loans to communities through the SRF, and the various local, state, and federal programs for pollution control. Stormwater NPDES permit coverage is designed to address discharges from municipal owned stormwater drainage systems. Enforcement of regulations controlling nonpoint source discharges includes local enforcement of the state Wetlands Protection Act and Rivers Protection Act, Title 5 regulations for septic systems, and various local regulations including zoning regulations. Financial incentives may include federal funds available under CWA § 319, 604(b), and 104(b) grant programs, which are provided as part of the Performance Partnership Agreement between MassDEP and USEPA. However, CWA § 319 funds to address nonpoint source pollution cannot be used for point source remediation or to address the requirements of NPDES stormwater permits. Additional financial incentives include state income tax credits and low interest loans for Title 5 upgrades through municipalities participating in this portion of the SRF program.

Assessment: MassDEP did not increase WLAs based on expected LA reductions. EPA acknowledges MassDEP's reasonable assurance discussion for the record.

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 public participation process for the Statewide Pathogen TMDL is described in Section 8 of the TMDL Core Document. MassDEP publicly announced the draft TMDL and provided copies of the draft documents on their website. Three public meetings were held in 2024 on May 8th, May 9th, and June 13th. The May 8th meeting was held in-person at the MassDEP Central Regional Office (CERO) in Worcester from 1 p.m. to 3 p.m. and marked the beginning of the public comment period. The May 9th meeting was held virtually via Zoom from 6 p.m. to 8 p.m. and presented the same information as the May 8th meeting. An additional hybrid public information session held on June 13, 2024, at the MassDEP Southeastern Regional Office (SERO) in Lakeville from 1 p.m. to 3 p.m. Each meeting was open to anyone throughout the Commonwealth to attend. A notice of the public meetings was issued through a press release, a notice was placed in the Massachusetts Environmental Policy Act (MEPA) Monitor, and an email was sent to interested parties, including Environmental Justice (EJ) and Tribal communities.

The public comment period was extended to 5 p.m., June 21, 2024. Public comments received during the public meetings and comments received in writing within an extended comment period following the public meetings were considered by the Department. This final version of the TMDL report includes a summary of the public comments, the Department's response to the comments, and attendance records from the virtual meeting and physical meeting (Appendix AC).

Assessment: EPA concludes that MassDEP has done a sufficient job of involving the public in the development of the TMDL, provided opportunities for the public to comment and has addressed the comments received as set forth in the response to comment section of the TMDL document.

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**:* On December 6, 2024, MassDEP submitted the Final Statewide Pathogen TMDL for the Islands Watersheds (Control #515.1) and associated documents for EPA approval. The documents contained all the elements necessary to approve the TMDL

Attachment 1:

Table 6. Concentration-Based Waste Load Allocations (WLAs) and Load Allocations (LAs)

Class	Indicator Bacteria Concentration-Based Load	Waste Load Allocation Pathogen Sources	Load Allocation Pathogen Sources
A, B, SA, & SB (prohibited)	0 (No load allocation)	Illicit discharges to storm drains	*Not Applicable*
		Leaking sanitary sewer lines, SSOs	*Not Applicable*
		Not Applicable	Failing septic systems
A & B for Primary Contact Recreation designated use	*E. coli* geomean[5] ≤ 126 CFU/100 mL; and no more than 10% of samples ≥ 410 CFU/100 mL (STV)[6];	Any regulated discharge, including stormwater runoff[1] subject to MS4 NPDES permits, NPDES wastewater treatment plant discharges[2,3], and combined storm sewer overflows[4].	Nonpoint source stormwater runoff[1]
	Enterococci geomean[5] ≤ 35 CFU/100 mL; no more than 10% of samples ≥ 130 CFU/100 mL (STV)[6]		
SA & SB for Primary Contact Recreation designated use	Enterococci geomean[5] ≤ 35 CFU/100 mL; no more than 10% of samples ≥ 130 CFU/100 mL (STV)[6]		
SA for Shellfishing designated use	Fecal coliform geomean[5] ≤ 14 MPN/100 mL; Statistical Threshold Value; no more than 10% of samples ≥ 28 MPN/100 mL		
SB for Shellfishing designated use	Fecal coliform median or geomean[5] ≤ 88 MPN/100 mL; and no more than 10% of samples ≥ 260 MPN/100 mL (STV)[6]		

[1] WLAs and LAs for stormwater discharges will be achieved through the implementation of structural and non-structural BMPs, source reduction, and other controls to the Maximum Extent Practicable.

[2] Or shall be consistent with the Wastewater Treatment Plant (WWTP) National Pollutant Discharge Elimination System (NPDES) permit.

[3] Seasonal disinfection may be allowed by the MassDEP on a case-by-case basis.

[4] Or other applicable SWQS for CSOs.

[5] Geometric mean is calculated using sample results within a rolling 30-day period at bathing beaches during bathing season (April 1 to October 15). The 30-day rolling period applies year-round to CSO-discharge and POTW-impacted waters. For all other waters and at beaches during the non-bathing season, the geometric mean is calculated using samples collected within a rolling 90-day period.

[6] Statistical Threshold Value, STV. If <10 samples collected, no samples shall exceed 410 CFU/100 mL for *E.coli*, 130 CFU/100 mL for enterococci, and 260 MPN/100 mL for Fecal coliform.

Note: this table represents waste load and load allocations based on the current SWQS as of the publication date. If the pathogen criteria change in the future, MassDEP intends to revise the TMDL by addendum to reflect the revised criteria.