UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND - REGION 1
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MASSACHUSETTS 02109-3912

FACT SHEET

DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES PURSUANT TO THE CLEAN WATER ACT (CWA)

NPDES PERMIT NUMBER: MA0103284 [This Draft Permit is also integrating existing permits MA0101192, MA0101974, MA0101877, MA0101982[1]]

PUBLIC NOTICE START AND END DATES: May 31, 2023 – July 31, 2023

NAME AND MAILING ADDRESS OF APPLICANT:

Massachusetts Water Resources Authority (MWRA)
Deer Island
33 Tafts Avenue
Boston, MA 02128

The Massachusetts municipalities listed below are Combined Sewer Overflow (CSO)-responsible Co-permittees:

MAC053284	MAC093284	MAC113284	MAC303284
City of Boston Boston Water and Sewer Commission 980 Harrison Avenue Boston, MA 02119	City of Cambridge Department of Public Works 147 Hampshire Street Cambridge, MA 02139	City of Chelsea Department of Public Works 380 Beacham Street Chelsea, MA 02150	City of Somerville Department of Public Works 1 Franey Road Somerville, MA 02144

and responsible for Parts I.B., I.C., I.D., I.E., I.F, and I.J of the Draft Permit.

The Massachusetts municipalities in Appendix A are Co-permittees for specific activities required by the Draft Permit as described in Section 5.6. of this Fact Sheet and as set forth in Parts I.C., I.E., I.F, and I.J of the Draft Permit.

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

MWRA Deer Island Treatment Plant ("DITP")
190 Tafts Avenue
Winthrop, MA 02152

[1] See Section 5.7, Combined Sewer Overflows

and from 4 Combined Sewer Overflows (CSO) Treatment Facilities with 5 outfalls and from 6 CSO Outfalls owned and operated by MWRA as well as 41 CSO Outfalls owned and operated by the CSO-responsible Co-permittees (Boston, Cambridge, Chelsea and Somerville) (see Appendix B).

NOTE: The former near shore DITP outfalls: 001, 002, 003, 004 and 005, are not authorized by the Draft Permit. The Draft Permit no longer requires the Permittee to maintain these nearshore Deer Island outfalls as a contingency option.

RECEIVING WATERS AND CLASSIFICATIONS:

Massachusetts Bay (no defined segment, North Coastal Drainage Area, *see* 314 CMR 4.06, Table 23), Class SA, Shellfishing
Boston Inner Harbor (MA70-02), Class SB (CSO)
Dorchester Bay (MA70-03), Class SB - Shellfishing
Chelsea River (also known as Chelsea Creek) (MA71-06), Class SB (CSO)
Charles River Basin (MA72-38), Class B, warm water fishery – with CSO variance
Back Bay Fens (Muddy River) (MA72-11), Class B, warm water fishery (CSO
Upper Mystic River (MA71-02), Class B, warm water fishery – with CSO variance
Lower Mystic River, below Earhart Dam (MA71-03), Class SB – CSO, Shellfishing
Alewife Brook (MA71-20), Class B, warm water fishery – with CSO variance
Little River (MA71-22), Class B, warm water fishery – with CSO variance

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1.0 Proposed Action

The above-named applicant, MWRA (the Permittee), has applied to the U.S. Environmental Protection Agency (EPA) for reissuance of a National Pollutant Discharge Elimination System (NPDES) Permit to discharge from the Deer Island Treatment Plant (DITP, the Facility) into Massachusetts Bay (the Bay).

The permit currently in effect, was issued on May 20, 1999, and subsequently modified on July 10, 2000. The Permit and modification became effective on August 10, 2000 and expired on August 10, 2005 (the 2000 Permit). The Permittee filed an application for permit reissuance with EPA, dated February 8, 2005, as required by 40 Code of Federal Regulations (CFR) § 122.6. Since the permit application was deemed timely and complete by EPA on April 26, 2005, the Facility's 2000 Permit has been administratively continued pursuant to 40 CFR § 122.6 and § 122.21(d). The Permittee has continued to provide updated data and information to EPA upon request (See Table 1). EPA and the State conducted a virtual site visit with meetings occuring on May 18, 2022, August 31, 2022, and October 18, 2022.

Table 1: Supplemental application and data request submittals

Date	Submittal
4/18/2023	Email. Wendy Leo, MWRA to Michele Barden, EPA. Subject: Updated values - DITP NPDES
2/13/2023	Email. Betsy Reilley, MWRA to Michele Barden, EPA. Subject: Update to sludge information
8/23/2022	CSO design/engineering details
7/15/2022	Email. Betsy Reilley, MWRA to Michele Barden, EPA. Subject: Discussion of Color/Clarity in Ambient Monitoring
7/15/2022	Email. Betsy Reilley, MWRA to Michele Barden, EPA. Subject: Design/Engineering Details for CSOs
6/2/2022	Rolling average dry day flow calculation
5/31/2022	MWRA Deer Island Treatment Plant pH Adjustment Demonstration
5/6/2022	List of Water Column Reports and Quality Assurance Project Plans; Plankton and ammonium data 1992-present
3/4/2022	CSO facility initial dilution
1/28/2022	Effluent sampling for bacteria and chlorine residual
1/6/2022	DP-29 Secondary Treatment Facilities Recommended Plan for Completion of the Deer Island Facilities
9/14/2021	Phytoplankton data 2016-2020
9/13/2021	Division of Marine Fisheries MOU Bacteria Data 2015-2021
8/26/2021	Zooplankton data 2016-2018
8/13/2021	Email. Betsy Reilley, MWRA to Michele Barden, EPA. Subject: RE: % of sludge that is sold as fertilizer
8/13/2021	Email. Betsy Reilley, MWRA to Michele Barden, EPA. Subject: RE: Oil & Grease data
7/28/2021	Email. Betsy Reilley, MWRA to Michele Barden, EPA. Subject: EPA Data Request for DITP NPDES. • Updated effluent data pollutants listed in Table C of Application Form

Date	Submittal
	2A; • Ambient data for Station N21 from 2016 through 2020; • Sediment organic carbon data from 2020 Benthic Monitoring; • 2020 results for phytoplankton and zooplankton abundance.
12/4/2017	Letter. Michael J. Hornbrook, MWRA to Michele Cobban Barden, EPA and Susannah King, MassDEP. RE: Supplement to Massachusetts Water Resources Authority's Application for Renewal of NPDES Permit No. MA0103284 for Deer Island Wastewater Treatment Plant and Combined Sewer Overflows – section I.1a, T01 Effluent Limitations and Monitoring Requirements – Blending
12/4/2017	Letter. Michael J. Hornbrook, MWRA to Michele Cobban Barden, EPA and Susannah King, MassDEP. RE: Supplement to Massachusetts Water Resources Authority's Application for Renewal of NPDES Permit No. MA0103284 for Deer Island Wastewater Treatment Plant and Combined Sewer Overflows – section I.1a, T01 Effluent Limitations and Monitoring Requirements – Indicator Bacteria
7/24/2017	Letter. Michael J. Hornbrook, MWRA to Michele Barden, EPA and Susannah King, MassDEP. RE: Supplement to Massachusetts Water Resources Authority's Application for Renewal of NPDES Permit No. MA0103284 for Deer Island Wastewater Treatment Plant and Combined Sewer Overflows - updated diagrams and attachments
6/30/2017	Letter. Michael J. Hornbrook, MWRA to Michele Barden, EPA and Susannah King, MassDEP. RE: Supplement to Massachusetts Water Resources Authority's Application for Renewal of NPDES Permit No. MA0103284 for Deer Island Wastewater Treatment Plant and Combined Sewer Overflows
12/7/2009	Letter. Andrea C. Rex, MWRA to Michele Cobban Barden, EPA. RE: Effluent data update and spreadsheet
2/25/2009	Letter. Michael J. Hornbrook, MWRA to Stephen Perkins, EPA and Glenn Haas, MassDEP. RE: Supplement to Massachusetts Water Resources Authority's Application for Renewal of its Deer Island Wastewater Treatment Plant NPDES Permit Number MA0103284 - CSO
3/4/2008	Letter. Michael J. Hornbrook, MWRA to Stephen Perkins, EPA and Glenn Haas, MassDEP. RE: Supplement to Massachusetts Water Resources Authority's Application for Renewal of NPDES Permit No. MA0103284 for Deer Island Wastewater Treatment Plant
11/13/2006	Letter. Andrea Rex, MWRA to Michele Cobban Barden, EPA. RE: Effluent chemistry results and spreadsheet
7/7/2006	Letter. Michael J. Hornbrook, MWRA to Michele Cobban Barden, EPA. RE: Design flow of Deer Island Treatment Plant
9/6/2005	Letter. Andrea C. Rex, Ph.D., MWRA to Michele Barden, EPA and Glenn Hass, MassDEP. RE: Massachusetts Water Resources Authority, NPDES Permit Number MA0103284, Permit Renewal Negotiations
5/18/2005	Expanded Effluent Testing Data – 2005 Application, Form 2A

EPA is also incorporating the individual NPDES permits for the municipalities of Boston (as Boston Water and Sewer Commission (BWSC)) (MA0101192), Cambridge (MA0101974), Chelsea (MA0101877), and Somerville (MA0101982) into the Draft Permit as the individual permits regulate discharges from CSOs that are part of the collection system that conveys wastewater to the DITP for treatment. These Permittees will be referred to as CSO-responsible Co-permittees in this Fact Sheet and the Draft Permit to help clarify their specific responsibilities (See Part I.B and I.D of the Draft Permit). The CSO outfalls regulated by these permits will now be authorized under this Permit with specific conditions applicable to each CSO-responsible Co-permittee who owns and operates a CSO discharge. Permit applications for each of the individual CSO permits were submitted, respectively, by BWSC on November 26, 2007 and deemed complete on February 17, 2009; the City of Cambridge on May 29, 2014 and deemed complete on October 1, 2014; the City of Chelsea on July 27, 2018 and deemed complete on December 19, 2018; and the City of Somerville on July 6, 2017 and deemed complete on July 11, 2017. These CSO-responsible Co-permittees are also responsible for all the obligations applicable to Co-permittees (See Parts I.C., I.E., I.F., and I.J. of the Draft Permit).

EPA is also adding the thirty-nine (39) municipalities that own and operate collections systems that convey flows to the DITP for treatment as Co-permittees to the Draft Permit. These municipalities are Co-permittees for certain activities pertaining to proper operation and maintenance of their respective collection systems (See Parts I.C., I.E., I.F., and I.J. of the Draft Permit). Adding them to the Draft Permit ensures that they comply with requirements to operate and maintain the collection systems to avoid discharges of sewage from the collection system. These Co-permittees did not apply for permit coverage; with letters sent on March 8, 2023, EPA waived the application requirements for the thirty-nine (39) Co-permittees that own and operate sanitary collection systems. The legal basis for including municipal satellite collection systems as Co-permittees is described in *In re Charles River Pollution Control District*, 16 E.A.D. 623 (EAB 2015)[2] (Also see Appendix D). When EPA refers to "Permittees" in the Draft Permit's Part II, Standard Conditions, the term "Permittees" includes MWRA, the CSO-responsible Co-permittees, and the 39 municipalities identified as Co-permittees.

2.0 Statutory and Regulatory Authority

Congress enacted the Federal Water Pollution Control Act, codified at 33 U.S.C. § 1251-1387 and commonly known as the Clean Water Act (CWA), "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." CWA § 101(a). To achieve this objective, the CWA makes it unlawful for any person to discharge any pollutant into the waters of the United States from any point source, except as authorized by specific permitting sections of the CWA, one of which is § 402. *See* CWA §§ 301(a), 402(a). Section 402(a) established one of the CWA's principal permitting programs, the NPDES Permit Program. Under this section, EPA may "issue a permit for the discharge of any pollutant or combination of pollutants" in accordance with certain conditions. CWA § 402(a). NPDES permits generally contain discharge limitations and establish related monitoring and reporting requirements. *See* CWA § 402(a)(1)

[2] The decision is available at: https://yosemite.epa.gov/oa/EAB_Web_Docket.nsf/Published%20and%20Unpublished%20Decisions/F89699D1A0710BCF85257DE200717A93/$File/Charles%20River%20Decision%20Vol%2016.pdf

and (2). The regulations governing EPA's NPDES permit program are generally found in 40 CFR §§ 122, 124, 125, and 136.

"Congress has vested in the Administrator [of EPA] broad discretion to establish conditions for NPDES permits" in order to achieve the statutory mandates of Section 301 and 402. *Arkansas v. Oklahoma,* 503 U.S. 91, 105 (1992). *See also* 40 CFR §§ 122.4(d), 122.44(d)(1), 122.44(d)(5). CWA §§ 301 and 306 provide for two types of effluent limitations to be included in NPDES permits: "technology-based" effluent limitations (TBELs) and "water quality-based" effluent limitations (WQBELs). *See* CWA §§ 301, and 304(d); 40 CFR Parts 122, 125, 131.

2.1 Technology-Based Requirements

Technology-based limitations, generally developed on an industry-by-industry basis, reflect a specified level of pollutant reducing technology available and economically achievable for the type of facility being permitted. *See* CWA § 301(b). As a class, publicly owned treatment works (POTWs) must meet performance-based requirements based on available wastewater treatment technology. *See* CWA § 301(b)(1)(B). The performance level for POTWs is referred to as "secondary treatment." Secondary treatment is comprised of technology-based requirements expressed in terms of biochemical oxygen demand (BOD_5), total suspended solids (TSS) and pH. *See* 40 CFR Part 133.

Under CWA § 301(b)(1), POTWs must have achieved effluent limits based upon secondary treatment technology by July 1, 1977. Since all statutory deadlines for meeting various treatment technology-based effluent limitations established pursuant to the CWA have expired, when technology-based effluent limits are included in a permit, compliance with those limitations is from the date the issued permit becomes effective. *See* 40 CFR § 125.3(a)(1).

2.2 Water Quality Based Requirements

The CWA and federal regulations also require that permit effluent limits based on water quality considerations be established for point source discharges when such limitations are necessary to meet state or federal water quality standards that are applicable to the designated receiving water. This is necessary when less stringent TBELs would interfere with the attainment or maintenance of water quality criteria in the receiving water. *See* CWA § 301(b)(1)(C) and 40 CFR §§ 122.44(d)(1), 122.44(d)(5).

2.2.1 Water Quality Standards

The CWA requires that each state develop water quality standards (WQSs) for all water bodies within the State. *See* CWA § 303 and 40 CFR § 131.10-12. Generally, WQSs consist of three parts: 1) the designated use or uses assigned for a water body or a segment of a water body; 2) numeric or narrative water quality criteria sufficient to protect the assigned designated use(s); and 3) antidegradation requirements to ensure that once a use is attained it will not be degraded and to protect high quality and National resource waters. *See* CWA § 303(c)(2)(A) and 40 CFR § 131.12. The applicable State WQSs can be found in 314 of the Code of Massachusetts Regulations, Chapter 4 (314 CMR 4.00).

As a matter of state law, state WQSs specify different water body classifications, each of which is associated with certain designated uses and numeric and narrative water quality criteria. When using chemical-specific numeric criteria to develop permit limitations, acute and chronic aquatic life criteria and human health criteria are used and expressed in terms of maximum allowable in-stream pollutant concentrations. In general, aquatic-life acute criteria are considered applicable to daily time periods (maximum daily limit) and aquatic-life chronic criteria are considered applicable to monthly time periods (average monthly limit). Chemical-specific human health criteria are typically based on lifetime chronic exposure and, therefore, are typically applicable to average monthly limits.

When permit effluent limitation(s) are necessary to ensure that the receiving water meets narrative water quality criteria, the permitting authority must establish effluent limits in one of the following three ways: 1) based on a "calculated numeric criterion for the pollutant which the permitting authority demonstrates will attain and maintain applicable narrative water quality criteria and fully protect the designated use," 2) based on a "case-by-case basis" using CWA § 304(a) recommended water quality criteria, supplemented as necessary by other relevant information; or, 3) in certain circumstances, based on use of an indicator parameter. *See* 40 CFR § 122.44(d)(1)(vi)(A-C).

2.2.2 Antidegradation

Federal regulations found at 40 CFR § 131.12 require states to develop and adopt a statewide antidegradation policy that maintains and protects existing in-stream water uses and the level of water quality necessary to protect these existing uses. In addition, the antidegradation policy ensures maintenance of high-quality waters which exceed levels necessary to support propagation of fish, shellfish, and wildlife and to support recreation in and on the water, unless the State finds that allowing degradation is necessary to accommodate important economic or social development in the area in which the waters are located.

Massachusetts' statewide antidegradation policy, entitled "Antidegradation Provisions" is found in the State's WQSs at 314 CMR 4.04. Massachusetts guidance for the implementation of this policy is in an associated document entitled "Implementation Procedure for the Anti-Degradation Provisions of the State Water Quality Standards," dated October 21, 2009. According to the policy, no lowering of water quality is allowed, except in accordance with the antidegradation policy, and all existing in-stream uses, and the level of water quality necessary to protect the existing uses, of a receiving water body must be maintained and protected.

This permit is being reissued with effluent limitations sufficiently stringent to satisfy the State's antidegradation requirements, including the protection of the existing uses of the receiving water.

2.2.3 Assessment and Listing of Waters and Total Maximum Daily Loads.

The objective of the CWA is to restore and maintain the chemical, physical and biological integrity of the Nation's waters. To meet this goal, the CWA requires states to develop information on the quality of their water resources and report this information to EPA, the U.S.

Congress, and the public. To this end, EPA released guidance on November 19, 2001, for the preparation of an integrated "List of Waters" that could combine reporting elements of both § 305(b) and § 303(d) of the CWA. The integrated list format allows states to provide the status of all their assessed waters in one list. States choosing this option must list each water body or segment in one of the following five categories: 1) unimpaired and not threatened for all designated uses; 2) unimpaired waters for some uses and not assessed for others; 3) insufficient information to make assessments for any uses; 4) impaired or threatened for one or more uses but not requiring the calculation of a Total Maximum Daily Load (TMDL); and 5) impaired or threatened for one or more uses and requiring a TMDL.

A TMDL is a planning tool and potential starting point for restoration activities with the ultimate goal of attaining water quality standards. A TMDL essentially provides a pollution budget designed to restore the health of an impaired water body. A TMDL typically identifies the source(s) of the pollutant from point sources and non-point sources, determines the maximum load of the pollutant that the water body can tolerate while still attaining WQSs for the designated uses, and allocates that load among to the various sources, including point source discharges, subject to NPDES permits. *See* 40 CFR § 130.7.

For impaired waters where a TMDL has been developed for a particular pollutant and the TMDL includes a waste load allocation (WLA) for a NPDES permitted discharge, the effluent limitation in the permit must be "consistent with the assumptions and requirements of any available WLA." 40 CFR § 122.44(d)(1)(vii)(B).

2.2.4 Reasonable Potential

Pursuant to CWA § 301(b)(1)(C) and 40 CFR § 122.44(d)(1), NPDES permits must contain any requirements in addition to TBELs that are necessary to achieve water quality standards established under § 303 of the CWA. *See also* 33 U.S.C. § 1311(b)(1)(C). In addition, limitations "must control any pollutant or pollutant parameter (conventional, non-conventional, or toxic) which the permitting authority determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any water quality standard, including State narrative criteria for water quality." 40 CFR § 122.44(d)(1)(i). To determine if the discharge causes, or has the reasonable potential to cause, or contribute to an excursion above any WQS, EPA considers: 1) existing controls on point and non-point sources of pollution; 2) the variability of the pollutant or pollutant parameter in the effluent; 3) the sensitivity of the species to toxicity testing (when evaluating whole effluent toxicity); and 4) where appropriate, the dilution of the effluent by the receiving water. *See* 40 CFR § 122.44(d)(1)(ii).

If the permitting authority determines that the discharge of a pollutant will cause, has the reasonable potential to cause, or contribute to an excursion above WQSs, the permit must contain WQBELs for that pollutant. *See* 40 CFR § 122.44(d)(1)(i).

2.2.5 State Certification

EPA may not issue a permit unless the State Water Pollution Control Agency with jurisdiction over the receiving water(s) either certifies that the effluent limitations contained in the permit are stringent enough to assure that the discharge will not cause the receiving water to violate the State WQSs, the State waives, or is deemed to have waived, its right to certify. *See* 33 U.S.C. § 1341(a)(1). Regulations governing state certification are set forth in 40 CFR §§ 124.53 and 124.55. EPA has requested permit certification by the State pursuant to 40 CFR § 124.53 and expects that the Draft Permit will be certified.

If the State believes that conditions more stringent than those contained in the Draft Permit are necessary to meet the requirements of either CWA §§ 208(e), 301, 302, 303, 306 and 307 or applicable requirements of State law, the State should include such conditions in its certification and, in each case, cite the CWA or State law provisions upon which that condition is based. Failure to provide such a citation waives the right to certify as to that condition. EPA includes properly supported State certification conditions in the NPDES permit. The only exception to this is that the permit conditions/requirements regulating sewage sludge management and implementing CWA § 405(d) are not subject to the State certification requirements. Reviews and appeals of limitations and conditions attributable to State certification shall be made through the applicable procedures of the State and may not be made through EPA's permit appeal procedures of 40 CFR Part 124.

In addition, the State should provide a statement of the extent to which any condition of the Draft Permit can be made less stringent without violating the requirements of State law. Since the State's certification is provided prior to final permit issuance, any failure by the State to provide this statement waives the State's right to certify or object to any less stringent condition.

It should be noted that under CWA § 401, EPA's duty to defer to considerations of State law is intended to prevent EPA from relaxing any requirements, limitations or conditions imposed by State law. Therefore, "[a] State may not condition or deny a certification on the grounds that State law allows a less stringent permit condition." 40 CFR § 124.55(c). In such an instance, the regulation provides that, "The Regional Administrator shall disregard any such certification conditions or denials as waivers of certification." *Id.* EPA regulations pertaining to permit limitations based upon WQSs and State requirements are contained in 40 CFR §§ 122.4 (d) and 122.44(d).

2.3 Effluent Flow Requirements

Sewage treatment plant discharge is encompassed within the definition of "pollutant" and is subject to regulation under the CWA. The CWA defines "pollutant" to mean, *inter alia*, "municipal...waste" and "sewage…discharged into water." 33 U.S.C. § 1362(6).

Generally, EPA uses effluent flow both to determine whether an NPDES permit needs certain effluent limitations and to calculate the limitations themselves. EPA practice is to use effluent flow as a reasonable and important worst-case condition in EPA's reasonable potential and WQBEL calculations to ensure compliance with WQSs under § 301(b)(1)(C). Should the effluent flow exceed the flow assumed in these calculations, the in-stream dilution would be reduced, and the calculated effluent limitations may not be sufficiently protective (i.e., might not

meet WQSs). Further, pollutants that do not have the reasonable potential to exceed WQSs at the lower discharge flow may have reasonable potential at a higher flow due to the decreased dilution. In order to ensure that the assumptions underlying the EPA's reasonable potential analyses and permit effluent limitation derivations remain sound for the duration of the permit, EPA may ensure the validity of its "worst-case" wastewater effluent flow assumptions through imposition of permit conditions for effluent flow.[3] In this regard, the effluent flow limitation is a component of WQBELs because the WQBELs are premised on a maximum level flow. The effluent flow limit is also necessary to ensure that other pollutants remain at levels that do not have a reasonable potential to exceed WQSs.

The limitation on wastewater effluent flow is within EPA's authority to condition a permit to carry out the objectives of the Act. *See* CWA §§ 402(a)(2) and 301(b)(1)(C); 40 CFR §§ 122.4(a) and (d); 122.43 and 122.44(d). A condition on the discharge designed to ensure the WQBEL and reasonable potential calculations account for "worst case" conditions is encompassed by the references to "condition" and "limitations" in CWA §§ 402 and 301 and implementing regulations, as they are designed to assure compliance with applicable water quality regulations, including antidegradation. Regulating the quantity of pollutants in the discharge through a restriction on the quantity of wastewater effluent is consistent with the overall structure and purposes of the CWA.

In addition, as provided in Part II.B.1 of this permit and 40 CFR § 122.41(e), the Permittee is required to properly operate and maintain all facilities and systems of treatment and control. Operating the facilities wastewater treatment systems as designed includes operating within the facility's design wastewater effluent flow.

EPA has also included the effluent flow limit in the Permit to minimize or prevent infiltration and inflow (I/I) that may result in unauthorized discharges and compromise proper operation and maintenance of the facility. Improper operation and maintenance may result in non-compliance with permit effluent limitations. Infiltration is groundwater that enters the collection system though physical defects such as cracked pipes or deteriorated joints. Inflow is extraneous flow added to the collection system that enters the collection system through point sources such as roof leaders, yard and area drains, sump pumps, manhole covers, tide gates, and cross connections from storm water systems. Significant I/I in a collection system may displace sanitary flow, reducing the capacity available for treatment and the operating efficiency of the treatment works and to properly operate and maintain the treatment works.

Furthermore, the extraneous flow due to significant I/I greatly increases the potential for sanitary sewer overflows (SSOs) in separate systems. Consequently, the effluent flow limit is a permit condition that relates to the Permittee's duty to mitigate (*i.e.*, minimize or prevent any discharge in violation of the permit that has a reasonable likelihood of adversely affecting human health or

[3] EPA's regulations regarding "reasonable potential" require EPA to consider "where appropriate, the dilution of the effluent in the receiving water," *id* 40 C.F.R. §122.44(d)(1)(ii). *Both* the effluent flow and receiving water flow may be considered when assessing reasonable potential. *In re Upper Blackstone Water Pollution Abatement Dist.,* 14 E.A.D. 577. 599 (EAB 2010). EPA guidance directs that this "reasonable potential: analysis be based on "worst-case" conditions. *See In re Washington Aquaduct Water Supply Sys. 11 E.A.D. 565, 584 (EAB 2004)*

the environment) and to properly operate and maintain the treatment works. *See* 40 CFR §§ 122.41(d), (e).

2.4 Monitoring and Reporting Requirements

2.4.1 Monitoring Requirements

Sections 308(a) and 402(a)(2) of the CWA and the implementing regulations at 40 CFR Parts 122, 124, 125, and 136 authorize EPA to include monitoring and reporting requirements in NPDES permits.

The monitoring requirements included in this Permit have been established to yield data representative of the Facility's discharges in accordance with CWA §§ 308(a) and 402(a)(2), and consistent with 40 CFR §§ 122.41(j), 122.43(a), 122.44(i) and 122.48. The Draft Permit specifies routine sampling and analysis requirements to provide ongoing, representative information on the levels of regulated constituents in the wastewater discharges. The monitoring program is needed to enable EPA and the State to assess the characteristics of the Facility's effluent, whether Facility discharges are complying with permit limits, and whether different permit conditions may be necessary in the future to ensure compliance with technology-based and water quality-based standards under the CWA. EPA and/or the State may use the results of the chemical analyses conducted pursuant to this permit, as well as national water quality criteria developed pursuant to CWA § 304(a)(1), State water quality criteria, and any other appropriate information or data, to develop numerical effluent limitations for any pollutants, including, but not limited to, those pollutants listed in Appendix D of 40 CFR Part 122.

NPDES permits require that the approved analytical procedures found in 40 CFR Part 136 be used for sampling and analysis unless other procedures are explicitly specified. Permits also include requirements necessary to comply with the *National Pollutant Discharge Elimination System (NPDES): Use of Sufficiently Sensitive Test Methods for Permit Applications and Reporting Rule*.[4] This Rule requires that where EPA-approved methods exist, NPDES applicants must use sufficiently sensitive EPA-approved analytical methods when quantifying the presence of pollutants in a discharge. Further, the permitting authority must prescribe that only sufficiently sensitive EPA-approved methods be used for analyses of pollutants or pollutant parameters under the permit. The NPDES regulations at 40 CFR § 122.21(e)(3) (completeness), 40 CFR § 122.44(i)(1)(iv) (monitoring requirements) and/or as cross referenced at 40 CFR § 136.1(c) (applicability) indicate that an EPA-approved method is sufficiently sensitive where:

- The method minimum level[5] (ML) is at or below the level of the effluent limitation established in the permit for the measured pollutant or pollutant parameter; or

[4] Fed. Reg. 49,001 (Aug 19, 2014).
[5] The term "minimum level" refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (MDL). Minimum levels may be obtained in several ways: They may be published in a method; they may be sample concentrations equivalent to the lowest acceptable calibration point used by a laboratory; or they may be calculated by multiplying the MDL in a method, or the MDL determined by a lab, by a factor. EPA is considering the following terms related to analytical method sensitivity to be synonymous: "quantitation limit," "reporting limit," "level of quantitation," and "minimum level." *See* Fed. Reg. 49,001 (Aug. 19, 2014).

- In the case of permit applications, the ML is above the applicable water quality criterion, but the amount of the pollutant or pollutant parameter in a facility's discharge is high enough that the method detects and quantifies the level of the pollutant or parameter in the discharge; or

- The method has the lowest ML of the analytical methods approved under 40 CFR Part 136 or required under 40 CFR chapter I, subchapter N or O for the measured pollutant or pollutant parameter.

2.4.2 Reporting Requirements

The Draft Permit requires the Permittee and Co-permittees to report monitoring results obtained during each calendar month to EPA and the State electronically using NetDMR. The Permittee and CSO-responsible Co-permittees must submit a Discharge Monitoring Report (DMR) for each calendar month no later than the 15th day of the month following the completed reporting period.

NetDMR is a national web-based tool enabling regulated CWA Permittees to submit DMRs electronically via a secure internet application to EPA through the Environmental Information Exchange Network. NetDMR has eliminated the need for participants to mail in paper forms to EPA under 40 CFR §§ 122.41 and 403.12. NetDMR is accessible through EPA's Central Data Exchange at https://cdx.epa.gov/. Further information about NetDMR can be found on EPA's NetDMR support portal webpage.[6]

With the use of NetDMR, the Permittee is no longer required to submit hard copies of DMRs and reports to EPA and the State unless otherwise specified in the Draft Permit. In most cases, reports required under the Permit shall be submitted to EPA as an electronic attachment through NetDMR. Certain exceptions are provided in the Permit, such as for providing written notifications required under the Part II Standard Conditions.

2.5 Standard Conditions

The standard conditions, included as Part II of the Draft Permit, are based on applicable regulations found in the Code of Federal Regulations. *See generally* 40 CFR Part 122.

2.6 Anti-backsliding

The CWA's anti-backsliding requirements prohibit a permit from being renewed, reissued or modified to include less stringent limitations or conditions than those contained in a previous permit except in compliance with one of the specified exceptions to those requirements. *See* CWA §§ 402(o) and 303(d)(4) and 40 CFR § 122.44(l). Anti-backsliding provisions apply to effluent limits based on technology, water quality and/or state certification requirements.

[6] https://netdmr.zendesk.com/hc/en-us/articles/209616266-EPA-Region-1-NetDMR-Information

All proposed limitations in the Draft Permit are at least as stringent as limitations included in the 2000 Permit unless specific conditions exist to justify relaxation in accordance with CWA § 402(o) or § 303(d)(4). Discussion of any less stringent limitations and corresponding exceptions to anti-backsliding provisions is provided in the sections that follow.

3.0 Description of Facility and Discharge

3.1 Location and Type of Facility

The locations of the Deer Island Treatment Plant (DITP) and Outfall T01 to Massachusetts Bay are shown in Figure 9. The latitude and longitude of the outfall diffuser begins approximately 8 miles offshore of the DITP at 42° 23' 3.2" N latitude / 70° 48' 13.5" W longitude and ends at 42° 23' 19.6" N latitude / 70° 46' 48.4" W longitude.

The DITP is a secondary wastewater treatment facility that is engaged in the collection and treatment of municipal and industrial wastewater. Flow is conveyed from the treatment facility, through an outfall tunnel that is approximately 9.5 miles in length and discharged into Massachusetts Bay. A diffuser comprises the last 1.25 miles of the outfall tunnel and consists of 55 riser pipes installed perpendicular to the tunnel and each riser is capped with an eight (8) port diffuser head (on average 5 of 8 ports have been opened per diffuser head). Currently, the Facility serves about 2,300,000 residents in the metropolitan Boston area. The regional collection system is operated in part by MWRA and in part by each of the 43 member communities (See Figure 10 and Appendix A).

The Facility has a design flow of 361 MGD[7], the annual average daily flow reported in the 2005 application was 356 MGD and the monthly average median for the review period (January 2018-December 2022) was 322 MGD (and a dry weather median of 298 MGD). The Facility has a peak treatment capacity of 1.27 billion gallons. Wastewater is comprised of domestic sewage with commercial and industrial sewage and some septage. The Facility receives flows from 69 categorical industrial users (CIUs) and 109 non-categorical significant industrial users (SIUs).[8]

A quantitative description of the Outfall T01 discharge in terms of effluent parameters, based on monitoring data submitted by the Permittee from January 2018 through December 2022 is provided in Appendix C of this Fact Sheet.

Additionally, EPA is adding forty-three (43) Co-permittees to the Draft Permit. The Massachusetts municipalities in Appendix A own and operate wastewater collection systems that discharge flows to the DITP for treatment. These municipalities are Co-permittees for certain activities pertaining to proper operation and maintenance of their respective collection systems. Adding them to the Draft Permit ensures that they comply with requirements to operate and

[7] Camp Dresser & McKee, 1995, Massachusetts Water Resources Authority, DP-29 Secondary Treatment Facilities, Recommended Plan for Completion of the Deer Island Facilities, pp. 2-21 and 2-23.
[8] EMAIL. Betsy Reilley, MWRA to Michele Barden, EPA. July 28, 2021. Subject: EPA Data Request for DITP NPDES.

maintain the collection systems to avoid discharges of sewage from the collection system. EPA did not require these Co-permittees (with the exception of Boston (BWSC), Cambridge, Chelsea, and Somerville) to apply for permit coverage; with letters sent March 8, 2023, EPA waived application requirements for 39 of the Co-permittees. The legal basis for including municipal satellite collection systems as Co-permittees is described in *In re Charles River Pollution Control District*, 16 E.A.D. 623 (EAB 2015)[9] (Also see Appendix D).

The cities of the Boston (BWSC), Cambridge, Chelsea and Somerville are currently Permittees under individual NPDES Permits for their respective CSO outfalls. On March 8, 2023, EPA informed each of these Cities by letter that they would be included as CSO-responsible Co-permittees in the Draft Permit and that they would retain the obligation to submit NPDES applications in the future. (See Section 5.7 of this Fact Sheet for more detail.)

As a general matter and as explained further in the Permit, the Permittee, the CSO-responsible Co-permittees, and each Co-permittee are severally liable for their own activities under the Standard Conditions of Part II, Parts I.C, I.E, I.F, and required reporting under Part I.J with respect to the portions of the POTW that they own or operate. This means that they are not liable for violations of the Standard Conditions of Part II, Parts I.C, I.E, I.F and Part I.J committed by others relative to the portions of the collection system owned and operated by others. Nor are they responsible for any reporting that is required of other Permittees under the Standard Conditions of Part II, Part I.C, Part I.E, Part I.F, and Part I.J. EPA welcomes public comments on the clarity of the several liability for the Permittee, the CSO-responsible Co-permittees, and each other Co-permittee with respect to Standard Conditions of Part II, Parts I.C, I.E, I.F and Part I.J.

3.1.1 Treatment Process Description

The DITP is a secondary treatment facility with chlorine disinfection and dechlorination. Influent enters the Facility from the North and South Systems and flows through the primary clarifiers A-D, followed by three batteries of secondary treatment and then the final clarifiers. During high flows, primary treated flows, in excess of 700 MGD,[10] may bypass the secondary batteries and final clarifiers and then be added back to main treatment train. All flows are combined prior to disinfection and dechlorination before discharge to Massachusetts Bay. A flow diagram of the Treatment Facility is shown in Figure 11.

Raw primary and secondary sludge are combined and anaerobically digested at the treatment plant. The digested sludge is thickened by centrifuges, then pumped via an underground harbor tunnel to the biosolids plant in Quincy. There, the liquid sludge is pumped into storage tanks prior to further mechanical dewatering. The dewatered cake is heat-dried and pelletized in rotary drum dryers. The final product is fertilizer and is stored in silos prior to shipment. In 2022, DITP

[9] The decision is available at: https://yosemite.epa.gov/oa/EAB_Web_Docket.nsf/Published%20and%20Unpublished%20Decisions/F89699D1A0710BCF85257DE200717A93/$File/Charles%20River%20Decision%20Vol%2016.pdf

[10] 700 MGD is the secondary process limit for the DITP as required by the Stipulation and Order in United States of America v. Massachusetts Water Resources Authority and Commonwealth of Massachusetts. Case 1:85-cv-004890RGS, Document 1707, Filed 09/08/2008, 18 pages.

generated 27,263 dry metric tons of sludge at the pellet plant.[11] Most of the fertilizer, 94%, is used in commercial agriculture or blended with other fertilizer products. A small percentage (6%) is bagged and used for smaller applications. Any material that is not beneficially used is disposed of at municipal solid waste landfills. The Permit requires monthly monitoring of the pelletized product and contains conditions for each use or disposal practice by MWRA.

3.1.2 Collection System Description

Although the collection system includes combined sewers, the majority of the system is a separate system with only 5%[12] of the system being combined sewers.[13] The MWRA-owned portion of the collection system consists of four (4) CSO treatment facilities with five (5) outfalls and six (6) additional CSO outfalls and approximately 225 miles of sewers. (See Appendix B and Figure 12.)

Four of the 43 Co-permittee municipalities own and operate CSO discharges which are currently authorized to discharge under separate NPDES permits. These permits will be terminated following the effective date of the Final MWRA DITP Permit which will include the CSO discharges from all four CSO communities. The City of Boston, as the Boston Water and Sewer Commission (BWSC), is currently permitted under NPDES permit number MA0101192[14] to discharge from 26 CSO outfalls with MWRA as a Co-permittee for CSO Treatment Facility MWR215. The discharges permitted under the BWSC Permit are to Boston Inner Harbor including the Chelsea River, Little Mystic Channel, Mystic River, Fort Point Channel, Reserved Channel, Dorchester Bay, and the Muddy River. The City of Cambridge is currently permitted under NPDES permit number MA0101974[15] to discharge from 12 CSO outfalls to the Little River (formerly listed as Alewife Brook) and the Charles River. The City of Chelsea is authorized under NPDES permit number MA0101877[16] to discharge from 4 CSO outfalls to the Boston Inner Harbor including the Chelsea River. The City of Somerville is currently authorized for 2 CSO outfalls that discharge to Alewife Brook and the Mystic River under NPDES permit number MA0101982[17].

The DITP collection system is divided into two distinct systems, the North System and the South System. There are 43 municipalities that own and operate individual municipal sewer systems that make up the larger collection system along with the interceptor system owned and operated by MWRA. Flows from the North System (~214 MGD[18] as a monthly average) begin treatment at the North System Grit Facility at Deer Island. South System flows (~114 MGD[19] as a monthly

[11] EMAIL. Betsy Reilley, MWRA to Michele Barden, EPA. February 13, 2023. Subject: Update to sludge information
[12] EMAIL. Wendy Leo, MWRA to Michele Barden, EPA. April 18, 2023. Subject: Updated values - DITP NPDES
[13] A combined sewer conveys domestic, industrial, and commercial sewage, in addition to stormwater. A separate sanitary sewer conveys domestic, industrial, and commercial sewage, but not stormwater.
[14] https://www3.epa.gov/region1/npdes/permits/2007/finalma0101192permitmod.pdf, https://www3.epa.gov/region1/npdes/permits/2003/bostonwspermit.pdf
[15] https://www3.epa.gov/region1/npdes/permits/2009/finalma0101974permit.pdf
[16] https://www3.epa.gov/region1/npdes/permits/2013/finalma0101877permit.pdf
[17] https://www3.epa.gov/region1/npdes/permits/2012/finalma0101982permit.pdf
[18] EMAIL. Wendy Leo, MWRA to Michele Barden, EPA. April 18, 2023. Subject: Updated values - DITP NPDES
[19] EMAIL. Wendy Leo, MWRA to Michele Barden, EPA. April 18, 2023. Subject: Updated values - DITP NPDES

average) are degritted at the Nut Island Pump Station in Quincy prior to pumping to the Deer Island Treatment Plant via the Inter-Island Tunnel. The South System flows enter the Deer Island Treatment Plant immediately following the North System Grit Facility.

4.0 Description of Receiving Water and Dilution

4.1 Receiving Waters

4.1.1 Massachusetts Bay

The DITP discharges through Outfall T01 into Massachusetts Bay. The DITP outfall diffuser begins approximately 8 miles offshore and extends 1.25 miles into Massachusetts Bay. Massachusetts Bay is classified as a Class SA water and designated for shellfishing in the MA WQS.[20]

The MA WQS at 314 CMR 4.05(4)(a) state that Class SA are:

> "Those coastal and marine waters so designated pursuant to 314 CMR 4.06; including, without limitation, 314 CMR 4.06(2) and (5), and certain qualified waters designated in 314 CMR 4.06(6)(b). These waters are designated as an excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, excellent habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. Where designated for shellfishing in 314 CMR 4.06(6)(b), these waters shall be suitable for shellfish harvesting without depuration (Approved and Conditionally Approved Shellfish Areas). These waters shall have excellent aesthetic value."

The receiving waters for Outfall T01 have not been included in the Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle[21] (2018/2020 Integrated List) and do not have a segment number.[22]

4.1.2 Boston Inner Harbor

The Draft Permit authorizes the MWRA to discharge from the CSO Treatment Facilities: Prison Point (MWR203) and Union Park (MWR215), into Boston Inner Harbor within Segment MA70-02.

The Draft Permit also authorizes the City of Boston for the following CSO outfalls: BOS003, BOS004, BOS009, BOS010, BOS012, BOS013, BOS014, BOS057, BOS060, BOS062, BOS064, BOS065, BOS068, BOS070, BOS073, BOS076, BOS078, BOS079 and BOS080 that discharge into Boston Inner Harbor within Segment MA70-02. CSO outfalls BOS060, BOS064,

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[20] 314 CMR 4.06, Table 19, https://www.mass.gov/doc/314-cmr-400/download

[21] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

[22] EMAIL. Claire Golden, MassDEP to Michele Barden, EPA. November 3, 2022. Subject: Request for Segment Number.

BOS68, and BOS073 all have an activation frequency of 0 and a volume of 0 during a Typical Year[23] as defined in the Long-Term Control Plan (LTCP).[24] Previously authorized CSO outfalls BOS005, BOS006, BOS007 and BOS072 have been closed.[25,26]

The Boston Inner Harbor segment is 2.56 square miles and encompasses the "Entire inner harbor, inclusive of the Reserved, Fort Point and Little Mystic channels, from the respective mouths of the Charles, Mystic and Chelsea rivers, southeasterly to its seaward boundary formed by a straight line drawn from the southern tip of Governors Island to Fort Independence, Boston."[27]

This segment of the Boston Harbor is classified in the MA WQS as Class SB (CSO) which denotes that all the designated uses that normally apply to Class SB waters are also designated for Class SB (CSO), except as described in the partial use description. The MA WQS at 314 CMR 4.02 define Class SB (CSO) waters as "Those Class SB partial use Coastal and Marine Waters so designated in accordance with 314 CMR 4.06(1)(d)11. and (6)(b)."

The partial designated use is further described in 314 CMR 4.06(1)(d)11 as follows:

> Partial Use, B(CSO) and SB(CSO) denotes those waters occasionally subject to short-term impairment of swimming or other recreational uses due to untreated CSO discharges in a typical year, and the aquatic life community may suffer adverse impact yet is still generally viable. In these waters, the uses for Class B and SB waters are maintained after the implementation of long-term control measures described in the approved CSO long-term control plan, except as identified in such plan. The Department may designate a segment partial use, B(CSO) or SB(CSO), provided that:
>
> a. a Department approved long-term control plan provides justification for the overflows;
> b. the Department finds through a use attainability analysis, and EPA concurs, that achieving a greater level of CSO control is not feasible for one of the reasons specified at 314 CMR 4.03(4);
> c. existing uses and the level of water quality necessary to protect the existing uses shall

[23] Typical Year Rainfall or Typical Year: The performance objectives of MWRA's approved Long-Term CSO Control Plan include annual frequency and volume of CSO discharge at each outfall based on "Typical Year" rainfall from 40 years of rainfall records at Logan Airport, 1949-1987 plus 1992. The Typical Year was a specifically constructed rainfall series that was based primarily on a single year (1992) that was close to the 40-year average in total rainfall and distribution of rainfall events of different sizes. The rainfall series was adjusted by adding and subtracting certain storms to make the series closer to the actual averages in annual precipitation, number of storms within different ranges of depth and storm intensities. The development of the Typical Year is described in MWRA's System Master Plan Baseline Assessment, June 15, 1994. The Typical Year consists of 93 storms with a total precipitation of 46.8 inches.
[24] MWRA remains subject to orders of the United States Court for the District of Massachusetts, Civil Action Nos. 85-04890MA and 83-1614-MA, including amended Schedule Seven, dated October, 2011 (the "Federal Court Order") regarding its implementation of the revised Long-Term Control Plan (LTCP).
[25] Boston Water and Sewer Commission. January 2023. Combined Sewer Overflow Final Public Notification Plan, Attachment A, page 1.
[26] Boston Water and Sewer Commission. April 2022. CSO Monitoring Report 2021.Table 1.
[27] Massachusetts Surface Water Quality Standards, December 10, 2021. 314 CMR 4.06, Table 2.

be maintained and protected; and

d. public notice is provided through procedures for permit reissuance under M.G.L. c. 21, §§ 26 through 53 and regulations promulgated pursuant to M.G.L. c. 30A. In addition, the Department will publish a notice in the Environmental Monitor. Other combined sewer overflows may be eligible for a variance granted pursuant to 314 CMR 4.03(4). When a variance is not appropriate, partial use may be designated for the segment after public notice and opportunity for a public hearing in accordance with M.G.L. c 30A.

For CSO outfalls that MWRA did not believe could be eliminated, such as the CSO Treatment Facilities: Prison Point and Union Park, the Long-Term Control Plan[28] includes information to support a Use Attainability Analysis (UAA) pursuant to 40 CFR 131.10(g). A UAA is defined as a "structured scientific assessment of the factors affecting the attainment of the use that [can] include physical, chemical, biological and economic factors as described in 40 CFR 131.10(g)." The evaluation is conducted by the state and supports removal of a National Use Goal based on criteria such as costs and impacts associated with attaining that use. Massachusetts submitted its final administrative determinations, including an UAA[29], to EPA for approval on December 31, 1997. On February 27, 1998, EPA approved the state's changes to water quality standards, which included a SB (CSO) designation for Boston Inner Harbor[30].

MassDEP's 2018/2020 Integrated List[31] includes this segment of the Boston Harbor as a Massachusetts Category 5 Water and in need of a TMDL due to contaminants in fish and/or shellfish, dissolved oxygen, *Enterococcus*, fecal coliform and PCBs in fish tissue. A Pathogen TMDL[32] has been completed for Boston Harbor and the contributing watersheds.

[28] The MWRA Long-Term Control Plan consists of numerous MWRA studies and reports but is best defined by Exhibit B of the Second Stipulation, March 15, 2006, "Second Stipulation of the United States and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflow Control, as amended on April 30, 2008".

[29] LETTER. Arleen O'Donnell, MassDEP to Ron Manfredonia, EPA. December 31, 1997. Re: MWRA, Combined Sewer Overflow Final Facilities Plan/Environmental Impact Report: State Administrative Determinations for Certain CSO-Impacted Waters; Use Attainability Analysis.

[30] LETTER. John P. DeVillars, EPA to David Struhs, MassDEP. February 27, 1998.

[31] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

[32] MassDEP, EPA Region 1 and ENSR International, 2018, Final Pathogen TMDL for Boston Harbor, Weymouth-Weir, and Mystic Watersheds, https://www.mass.gov/doc/final-pathogen-tmdl-report-for-the-boston-harbor-weymouth-weir-and-mystic-watersheds/download

Table 2: Summary of Designated Uses and Listing Status for Segment MA70-02, Boston Inner Harbor[33,34]

Designated Use	Status
Aquatic Life	Support with exception of the Fort Point Channel Fort Point Channel: Impaired – Cause(s): low DO; Source(s): unknown; Suspected source(s): industrial point source discharge, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Discharges from Municipal Separate Storm Sewer Systems (MS4).
Fish Consumption	Impaired/TMDL Completed – Cause(s): elevated PCB in fish tissue and other contaminants in fish/shellfish. Source(s): upstream sources, contaminated sediments, wet weather discharges (point source and combination of stormwater, sanitary sewer overflow - SSO or combined sewer overflow - CSO), discharges from biosolids (sludge) storage, application or disposal.
Primary Contact Recreation	Support with exception of Fort Point Channel Fort Point Channel: Impaired – Cause(s): Elevated *Enterococci* bacteria Source(s): Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Discharges from Municipal Separate Storm Sewer Systems (MS4)
Secondary Contact Recreation	Support with exception of Fort Point Channel Fort Point Channel: Impaired – Cause(s): Elevated *Enterococci* bacteria Source(s): Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Discharges from Municipal Separate Storm Sewer Systems (MS4)
Shellfish Harvesting	Impaired – Cause(s): Elevated fecal coliform bacteria Source(s): Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Discharges from Municipal Separate Storm Sewer Systems (MS4)
Aesthetics	Not Assessed

4.1.3 Dorchester Bay

The Draft Permit authorizes the City of Boston for CSO outfalls: BOS081, BOS082, BOS084, BOS085, and BOS086 that discharge into Dorchester Bay which is identified as Segment MA70-03. The Boston CSO outfalls are located along the South Boston beaches. MWRA's CSO storage tunnel provides a 25-year storm level of CSO control and a 5-year storm level of separate stormwater control for the Boston Outfalls BOS081, BOS082, BOS084, BOS085, and BOS086.

[33] MassDEP, 2010, Boston Harbor 2004-2008 Water Quality Assessment Report, https://www.mass.gov/doc/boston-harbor-2004-2008-water-quality-assessment-report-0/download

[34] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

Previously authorized outfalls BOS083 and BOS087 were closed in 2011 as a result of the construction of the storage tunnel. Other previously authorized outfalls BOS088, BOS089, BOS090, BOS093 and BOS095 have been closed.[35] The remaining CSO outfalls achieve the goals in the LTCP.

This segment is 3.46 square miles and is defined in 314 CMR 4.06, Table 2 as "Entire bay, from the mouth of the Neponset River, Boston/Quincy, northeasterly to the bay's seaward boundary formed by straight lines drawn from the southerly tip of Head Island, Boston, to the north side of Thompson Island, Boston; and from the southerly tip of Thompson Island to Chapel Rocks, Quincy."

Dorchester Bay is classified in the MA WQS as Class SB – Shellfishing. The MA WQS at 314 CMR 4.02 define Class SB waters as "those coastal and marine waters so designated pursuant to 314 CMR 4.06; including, without limitation, 314 CMR 4.06(2) and (5), and certain qualified waters designated in 314 CMR 4.06(6)(b). These waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. Where designated for shellfishing in 314 CMR 4.06(6)(b), these waters shall be suitable for shellfish harvesting with depuration (Restricted and Conditionally Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value."

Table 3: Summary of Designated Uses and Listing Status for Segment MA70-03, Dorchester Bay[36,37]

Designated Use	**Status**
Aquatic Life	Support
Fish Consumption	Impaired; Causes: Elevated PBCs in fish tissue and other contaminants in fish and/or shellfish; Sources: upstream sources, contaminated sediment, wet weather discharges (point source and combination of stormwater, sanitary sewer overflow-SSO or combined sewer overflow-CSO), discharges from biosolids (sludge) storage, application or disposal.
Shellfishing	Impaired; Causes: Elevated fecal coliform bacteria; Sources: Discharges from municipal storm sewer systems (MS4), unspecified urban stormwater.
Primary Contact Recreation	Impaired; Causes: Elevated *Enterococci* bacteria; Sources: Discharges from Municipal Separate Storm Sewer Systems (MS4), Unspecified urban stormwater.
Secondary Contact Recreation	Support
Aesthetics	Not Assessed

[35] Boston Water and Sewer Commission. April 2022. CSO Monitoring Report 2021. Table 1 and p.9
[36] MassDEP. 2010. Boston Harbor 2004-2008 Water Quality Assessment Report, https://www.mass.gov/doc/boston-harbor-2004-2008-water-quality-assessment-report-0/download
[37] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

MassDEP's 2018/2020 Integrated List[38] includes Dorchester Bay as a Massachusetts Category 5 Water and in need of a TMDL due to cause unknown (contaminants in fish and/or shellfish); dissolved oxygen, *Enterococcus*, fecal coliform, and PCBs in fish tissue. A Pathogen TMDL[39] has been completed for Boston Harbor and the contributing watersheds and includes Dorchester Bay.

4.1.4 Chelsea River

The Draft Permit authorizes the City of Chelsea to discharge from CSO outfalls: CHE003, CHE004, CHE008, into the Chelsea River in Segment MA71-06.

The Draft Permit also authorizes the City of Boston for CSO outfalls: BOS013 and BOS014, that discharge into the Chelsea River in Segment MA71-06.

This segment is 0.37 miles in length and travels from the confluence of Mill Creek, Chelsea/Revere to confluence with Boston Inner Harbor, Chelsea/East Boston. CSO Outfall CHE008 has an activation frequency of 0 and a volume of 0 for a "Typical Year" under the LTCP.

The Chelsea River is classified in the MA WQS as Class SB (CSO). The MA WQS at 314 CMR 4.02 define Class SB (CSO) waters as "those Class SB partial use coastal and marine waters so designated in accordance with 314 CMR 4.06(1)(d)11. and (6)(b).

> Partial Use, B(CSO) and SB(CSO) denotes those waters occasionally subject to short-term impairment of swimming or other recreational uses due to untreated CSO discharges in a typical year, and the aquatic life community may suffer adverse impact yet is still generally viable. In these waters, the uses for Class B and SB waters are maintained after the implementation of long-term control measures described in the approved CSO long-term control plan, except as identified in such a plan. The Department may designate a segment partial use, B(CSO) or SB(CSO), provided that:
>
> a. a Department approved long-term control plan provides justification for the overflows;
> b. the Department finds through a use attainability analysis, and EPA concurs, that achieving a greater level of CSO control is not feasible for one of the reasons specified at 314 CMR 4.03(4);
> c. existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected; and
> d. public notice is provided through procedures for permit reissuance under M.G.L. c. 21, §§ 26 through 53 and regulations promulgated pursuant to M.G.L. c. 30A. In addition, the Department will publish a notice in the

[38] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents
[39] MassDEP, EPA Region 1 and ENSR International, 2018, Final Pathogen TMDL for Boston Harbor, Weymouth-Weir, and Mystic Watersheds, https://www.mass.gov/doc/final-pathogen-tmdl-report-for-the-boston-harbor-weymouth-weir-and-mystic-watersheds/download

> Environmental Monitor. Other combined sewer overflows may be eligible for a variance granted pursuant to 314 CMR 4.03(4). When a variance is not appropriate, partial use may be designated for the segment after public notice and opportunity for a public hearing in accordance with M.G.L. c 30A.
>
> 314 CMR 4.06(1)(d)11.

Table 4: Summary of Designated Uses and Listing Status for Segment MA71-06, Chelsea River[40,41]

Designated Use	Status
Aquatic Life	Impaired; Causes: Sediment Screening Value, Petroleum; Source: Contaminated Sediments, Above Ground Storage Tank Leaks (Tank Farms), Accidental release/spill, Cargo loading/unloading, Municipal (Urbanized High Density Area)
Fish Consumption	Impaired; Causes: PCBs in Fish Tissue, Other (contaminants in fish and shellfish); Sources: Unknown
Shellfishing	Impaired; Causes: Fecal Coliform, Source: Unknown
Primary Contact Recreation	Impaired; Causes: Petroleum; Source: Above Ground Storage Tank Leaks (Tank Farms), Accidental release/spill, Cargo loading/unloading, Municipal (Urbanized High Density Area)
Secondary Contact Recreation	Impaired; Causes: Petroleum; Source: Above Ground Storage Tank Leaks (Tank Farms), Accidental release/spill, Cargo loading/unloading, Municipal (Urbanized High Density Area)
Aesthetics	Impaired; Causes: Petroleum; Source: Above Ground Storage Tank Leaks (Tank Farms), Accidental release/spill, Cargo loading/unloading, Municipal (Urbanized High Density Area)

For CSO outfalls that MWRA did not believe could be eliminated, such as the CHE003, CHE004, CHE008, BOS013 and BOS014, the Long-Term Control Plan[42] includes information to support a Use Attainability Analysis (UAA) pursuant to 40 CFR § 131.10(g). A UAA is defined as a "structured scientific assessment of the factors affecting the attainment of the use that [can] include physical, chemical, biological and economic factors as described in 40 CFR § 131.10(g)." The evaluation is conducted by the state and supports removal of a National Use Goal based on criteria such as costs and impacts associated with attaining that use. Massachusetts submitted its final administrative determinations, including an UAA[43], to EPA for approval on December 31, 1997. On February 27, 1998, EPA approved the State's changes to

[40] MassDEP, March 2010, Mystic River Watershed and Coastal Drainage Area, 2004-2008 Water Quality Assessment Report.
[41] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents
[42] The MWRA Long-Term Control Plan consists of numerous MWRA studies and reports but is best defined by Exhibit B of the Second Stipulation, March 15, 2006, "Second Stipulation of the United States and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflow Control, as amended on April 30, 2008."
[43] LETTER. Arleen O'Donnell, MassDEP to Ron Manfredonia, EPA. December 31, 1997. Re: MWRA, Combined Sewer Overflow Final Facilities Plan/Environmental Impact Report: State Administrative Determinations for Certain CSO-Impacted Waters; Use Attainability Analysis.

water quality standards, which included a SB (CSO) designation for Boston Inner Harbor[44] including the Chelsea River.

The MassDEP's 2018/2020 Integrated List[45] includes the Chelsea River as a Massachusetts Category 5 Water and in need of a TMDL due to debris, ammonia, un-ionized, cause unknown (contaminants in fish and/or shellfish; sediment screening value exceedance), fecal coliform, odor, PCBs in fish tissue, petroleum hydrocarbons, trash and turbidity. A Pathogen TMDL[46] has been completed for Boston Harbor and the contributing watersheds and includes the Chelsea River.

4.1.5 Charles River

Segment MA72-38

The Draft Permit authorizes MWRA to discharge from the CSO Treatment Facility Cottage Farm (MWR201) and the CSO discharges: MWR010, MWR018, MWR019, MWR020 and MWR023, into the Charles River within Segment MA72-38.

This segment, also referred to as the Charles River Basin, is 3.10 miles in length and travels from the Boston University Bridge, Boston/Cambridge to mouth at the New Charles River Dam, Boston. CSO Outfalls MWR010, MWR018, MWR019 and MWR020 each have an activation frequency of 0 and a volume of 0 under the LTCP.

The City of Cambridge is currently authorized for CSO discharges: CAM009, CAM011, and CAM017, that also discharge to the Charles River in Segment MA72-38. CAM-011 has an activation frequency of 0 and volume of 0 in a "Typical Year" under the LTCP.

Previously authorized CSO outfalls, MWR021 and MWR022 have been closed.[47]

The Charles River Basin has been classified in the MA WQS as Class B, warm water fishery with a variance for the CSO discharges. A variance is a temporary modification of surface water quality standards pursuant to 314 CMR 4.03(4). The current variance[48] for the Charles River Basin was adopted by MassDEP on August 30, 2019, approved by EPA on May 29, 2020[49] and ends on August 31, 2024. The MA WQS at 314 CMR 4.05(3)(b) states that Class B waters are

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[44] LETTER. John P. DeVillars, EPA to David Struhs, MassDEP. February 27, 1998.
[45] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents
[46] MassDEP, EPA Region 1 and ENSR International, 2018, Final Pathogen TMDL for Boston Harbor, Weymouth-Weir, and Mystic Watersheds, https://www.mass.gov/doc/final-pathogen-tmdl-report-for-the-boston-harbor-weymouth-weir-and-mystic-watersheds/download
[47] https://www.mwra.com/03sewer/html/sewcso.htm#1819floatables
[48] Kathleen M. Baskin, MassDEP, August 30, 2019, Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Charles River Basin, https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-the-charles/download
[49] LETTER. Ken Moraff, EPA to Martin Suuberg, MassDEP, May 29, 2020, RE: Lower Charles River/Charles Basin and Alewife Brook/Upper Mystic River Water Quality Standard Variances for Certain CSO Discharges, https://www.mass.gov/doc/epa-approval-of-the-massdep-adoption-of-the-2019-cso-variances/download

"those inland waters so designated pursuant to 314 CMR 4.06; including, without limitation, certain wetlands designated 314 CMR 4.06(2); certain other waters designated in 314 CMR 4.06(5); and certain qualified waters designated in 314 CMR 4.06(6)(b). These waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth, and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06(1)(d)6. and (6)(b), as a "Treated Water Supply" they shall be suitable as a source of public water supply with appropriate treatment. Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value." During wet-weather conditions, Class B requirements for bacteria, solids, color and turbidity, and taste and odor may not be met.[50] The variance requires continued implementation of the revised LTCP and implementation as required by the Federal Court Order, as modified.

The MassDEP's 2018/2020 Integrated List[51] includes this segment of the Charles River as a Massachusetts Category 5 Water and in need of a TMDL due to fish passage barrier, flow regime modification, cause unknown (sediment screening value exceedance), chlorophyll a, combined biota/habitat bioassessments, DDT in fish tissue, dissolved oxygen, dissolved oxygen supersaturation, *Escherichia Coli* (*E. coli)*, harmful algal blooms, nutrient/eutrophication biological indicators, odor, oil and grease, PCBs in fish tissue, total phosphorus, salinity, temperature, and transparency/clarity. A TMDL[52] has been developed for nutrients (phosphorus) in the lower Charles River basin. A Pathogen TMDL[53] for *E. coli* has also been completed for the Charles River Watershed. A regional TMDL[54] has been completed for the atmospheric deposition of mercury which is one impairment of the fish consumption use.

Table 5: Summary of Designated Uses and Listing Status for Segment MA72-38, Lower Charles River[55,56]

Designated Use	Status
Aquatic Life	Impaired – Causes: Elevated water temperatures, combined biota/habitat bioassessment, salinity, biological indicators of nutrient enrichment, blue-green algal bloom, low dissolved oxygen, elevated saturation of dissolved oxygen, elevated

[50] Kathleen M. Baskin, MassDEP, August 30, 2019, Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Charles River Basin, https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-the-charles/download

[51] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

[52] MassDEP, USEPA and Tetra Tech, Inc. 2007. Final Total Maximum Daily Load for Nutrients in the Lower Charles River Basin, Massachusetts. CN 301.0, https://www.mass.gov/doc/final-phosphorus-tmdl-report-for-the-lower-charles-river-basin/download

[53] MassDEP, EPA Region 1 and ENSR International, 2007, Final Pathogen TMDL for the Charles River Watershed. CN0156.0. *https://www.mass.gov/doc/final-pathogen-tmdl-reports-for-the-charles-river-watershed-0/download*

[54] New England Interstate Water Pollution Control Commission (NEWIPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont, 2007, Northeast Regional Mercury Total Maximum Daily Load, https://neiwpcc.org/wp-content/uploads/2020/08/FINAL-Northeast-Regional-Mercury-TMDL.pdf

[55] MassDEP, 2008, Charles River Watershed, 2002-2006 Water Quality Assessment Report, https://www.mass.gov/doc/charles-river-watershed-2002-2006-water-quality-assessment-report-0/download

[56] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

Designated Use	Status
	chlorophyll a, poor Secchi disk transparency, elevated total phosphorus, other flow regime alterations associated with dams/impoundments, sediment contamination (sediment screening values exceeded) Sources: Thermal discharge, habitat modification from thermal discharge, entrainment from cooling water intake structure, habitat alteration associated with dams/impoundments, changes in ordinary stratification and bottom water hypoxia/anoxia, contaminated sediments, upstream sources, discharges from municipal separate storm sewer systems, unspecified urban stormwater, urban runoff/storm sewers
Fish Consumption	Impaired/TMDL Completed – Causes: Elevated PCB in fish tissue, pesticides (total DDT) Source: Unknown Suspected source: Contaminated sediments
Primary Contact Recreation	Impaired – Causes: Blue-green algal bloom, poor Secchi disk transparency Sources: Upstream sources, discharges from municipal separate storm sewer systems, unspecified urban stormwater, urban runoff/storm sewers.
Secondary Contact Recreation	
Aesthetics	

Segment MA72-36

The Draft Permit authorizes the City of Cambridge to discharge from CSO outfalls: CAM005, CAM007, CAM009 and CAM011 to the Charles River in Segment MA72-36. CAM-005 has an activation frequency of 3 and volume of 0.84 MG and CAM007 has an activation frequency of 1 and volume of 0.03 MG in a "Typical Year" under the LTCP. CAM009 and CAM011 have been temporarily closed but remained authorized by the Draft Permit.[57]

This segment of the Charles River is 6.10 miles in length and travels from the Watertown Dam, Watertown to the Boston University Bridge, Boston/Cambridge. It is classified in the MA WQS as Class B, warm water fishery with a variance for the CSO discharges. A variance is a temporary modification of surface water quality standards pursuant to 314 CMR 4.03(4). The current variance[58] for the Charles River Basin was adopted by MassDEP on August 30, 2019, approved by EPA on May 29, 2020[59] and ends on August 31, 2024. The MA WQS at 314 CMR

[57] City of Cambridge , Department of Public Works. April 29, 2022, 2021 Annual Report National Pollutant Elimination System for the City of Cambridge, Massachusetts, Combined Sewer Overflow Permit #MA0101974, p.6

[58] Kathleen M. Baskin, MassDEP, August 30, 2019, Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Charles River Basin, https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-the-charles/download

[59] LETTER. Ken Moraff, EPA to Martin Suuberg, MassDEP, May 29, 2020, RE: Lower Charles River/Charles Basin and Alewife Brook/Upper Mystic River Water Quality Standard Variances for Certain CSO Discharges, https://www.mass.gov/doc/epa-approval-of-the-massdep-adoption-of-the-2019-cso-variances/download

4.05(3)(b) states that Class B waters are "those inland waters so designated pursuant to 314 CMR 4.06; including, without limitation, certain wetlands designated 314 CMR 4.06(2); certain other waters designated in 314 CMR 4.06(5); and certain qualified waters designated in 314 CMR 4.06(6)(b). These waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth, and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06(1)(d)6. and (6)(b), as a "Treated Water Supply" they shall be suitable as a source of public water supply with appropriate treatment. Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value." During wet-weather conditions, Class B requirements for bacteria, solids, color and turbidity, and taste and odor may not be met.[60] The variance requires continued implementation of the revised LTCP and implementation as required by the Federal Court Order, as modified.

The MassDEP's 2018/2020 Integrated List[61] includes this segment of the Charles River as a Massachusetts Category 5 Water and in need of a TMDL due to fish passage barrier, flow regime modification, non-native fish/shellfish/zooplankton, water chestnut, chlorophyll a, DDT in fish tissue, dissolved oxygen, *Escherichia Coli* (*E. coli)*, fish bioassessments, harmful algal blooms, nutrient/eutrophication biological indicators, oil and grease, PCBs in fish tissue, high pH, total phosphorus, sediment bioassay (acute toxicity freshwater), transparency/clarity and unspecified metals in sediments. A TMDL[62] has been developed for nutrients (phosphorus) in the lower Charles River basin. A Pathogen TMDL[63] for *E. coli* has also been completed for the Charles River Watershed. A regional TMDL[64] has been completed for the atmospheric deposition of mercury which is one impairment of the fish consumption use.

Table 6: Summary of Designated Uses and Listing Status for Segment MA72-36, Charles River[65,66]

Designated Use	Status
Aquatic Life	Impaired – Causes: Elevated water temperatures, combined biota/habitat bioassessment, salinity, biological indicators of

[60] Kathleen M. Baskin, MassDEP, August 30, 2019, Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Charles River Basin, https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-the-charles/download

[61] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

[62] MassDEP, USEPA and Tetra Tech, Inc. 2007. Final Total Maximum Daily Load for Nutrients in the Lower Charles River Basin, Massachusetts. CN 301.0, https://www.mass.gov/doc/final-phosphorus-tmdl-report-for-the-lower-charles-river-basin/download

[63] MassDEP, EPA Region 1 and ENSR International, 2007, Final Pathogen TMDL for the Charles River Watershed. CN0156.0. *https://www.mass.gov/doc/final-pathogen-tmdl-reports-for-the-charles-river-watershed-0/download*

[64] New England Interstate Water Pollution Control Commission (NEWIPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont, 2007, Northeast Regional Mercury Total Maximum Daily Load, https://neiwpcc.org/wp-content/uploads/2020/08/FINAL-Northeast-Regional-Mercury-TMDL.pdf

[65] MassDEP, 2008, Charles River Watershed, 2002-2006 Water Quality Assessment Report, https://www.mass.gov/doc/charles-river-watershed-2002-2006-water-quality-assessment-report-0/download

[66] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

Designated Use	Status
	nutrient enrichment, blue-green algal bloom, low dissolved oxygen, elevated saturation of dissolved oxygen, elevated chlorophyll a, poor Secchi disk transparency, elevated total phosphorus, other flow regime alterations associated with dams/impoundments, sediment contamination (sediment screening values exceeded) Sources: Thermal discharge, habitat modification from thermal discharge, entrainment from cooling water intake structure, habitat alteration associated with dams/impoundments, changes in ordinary stratification and bottom water hypoxia/anoxia, contaminated sediments, upstream sources, discharges from municipal separate storm sewer systems, unspecified urban stormwater, urban runoff/storm sewers
Fish Consumption	Impaired/TMDL Completed – Causes: Elevated PCB and pesticides (total DDT) in fish tissue, Source: Contaminated sediments and/or unknown
Primary Contact Recreation	Impaired – Causes: Elevated E. coli, poor Secchi disk transparency. Sources: Upstream sources, discharges from municipal separate storm sewer systems, unspecified urban stormwater, urban runoff/storm sewers
Secondary Contact Recreation	
Aesthetics	

4.1.6 Muddy River (Back Bay Fens)

The Draft Permit authorizes the City of Boston CSO discharge, BOS046, into the Back Bay Fens portion of the Muddy River within Segment MA72-11. The segment is 3.6 miles long and travels from the headwaters at the outlet Ward Pond in Olmsted Park, Boston through Leverett Pond, Boston/Brookline to confluence with Charles River, Boston (four culverted portions totaling approximately 2200 feet (0.42 mile)).

The segment had been classified in the MA WQS as Class B (CSO), warm water fishery. The MA WQS at 314 CMR 4.02 define Class B (CSO) waters as those Class B partial use Inland Waters so designated in accordance with 314 CMR 4.06(1)(d)11. and (6)(b).

> Partial Use, B(CSO) and SBO (CSO) denotes those waters occasionally subject to short-term impairment of swimming or other recreational uses due to untreated CSO discharges in a typical year, and the aquatic life community may suffer adverse impact yet is still generally viable. In these waters, the uses for Class B and SB waters are maintained after the implementation of long-term control measures described in the approved CSO long-term control plan, except as identified in such a plan. The Department may designate a segment partial use, B(CSO) or SB(CSO), provided that:
>
> a. a Department approved long-term control plan provides justification for the overflows;

b. the Department finds through a use attainability analysis, and EPA concurs, that achieving a greater level of CSO control is not feasible for one of the reasons specified at 314 CMR 4.03(4);
c. existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected; and
d. public notice is provided through procedures for permit reissuance under M.G.L. c. 21, §§ 26 through 53 and regulations promulgated pursuant to M.G.L. c. 30A. In addition, the Department will publish a notice in the Environmental Monitor. Other combined sewer overflows may be eligible for a variance granted pursuant to 314 CMR 4.03(4). When a variance is not appropriate, partial use may be designated for the segment after public notice and opportunity for a public hearing in accordance with M.G.L. c 30A.

314 CMR 4.06(1)(d)11.

The MassDEP's 2018/2020 Integrated List[67] includes this segment of the Muddy River as a Massachusetts Category 5 Water and in need of a TMDL due to bottom deposits, flow regime modification, non-native aquatic plants, physical substrate habitat alterations, DDT in fish tissue, dissolved oxygen, *Escherichia Coli* (*E. Coli*), odor, oil and grease, PCBs in fish tissue, total phosphorus, turbidity, and unspecified metals in sediment. A Pathogen TMDL[68] for *E. coli* has also been completed for the Charles River Watershed.

Table 7: Summary of Designated Uses and Listing Status for Segment MA72-11, Muddy River[69,70]

Designated Use	Status
Aquatic Life	Impaired – Causes: Bottoms deposits of sediment and silt, physical substrate habitat alteration, flow regime alterations, elevated total phosphorus, and the dense infestation of *Phragmites australis*, and other contamination including elevated concentrations of trace metals and organic compounds in sediment. Sources: Wet weather discharges (point source and combination of stormwater, sanitary sewer overflow (SSO) or combined sewer overflow (CSO), channelization, sediment contamination, the loss of riparian habitat
Fish Consumption	Impaired – Causes: Elevated PCB in fish tissue (carp, bullhead, and American eel); Source: Unknown and contaminated sediments

[67] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents
[68] MassDEP, EPA Region 1 and ENSR International, 2007, Final Pathogen TMDL for the Charles River Watershed. CN0156.0. *https://www.mass.gov/doc/final-pathogen-tmdl-reports-for-the-charles-river-watershed-0/download*
[69] MassDEP, 2008, Charles River Watershed, 2002-2006 Water Quality Assessment Report, https://www.mass.gov/doc/charles-river-watershed-2002-2006-water-quality-assessment-report-0/download
[70] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

Designated Use	Status
Primary Contact Recreation	Impaired – Causes: Elevated *E. coli*., turbidity; Sources: Wet weather discharges (point source and combination of stormwater, SSO or CSO), illicit connections/hookups to storm sewers. Suspected Sources: Channelization, loss of riparian habitat
Secondary Contact Recreation	Impaired – Causes: Turbidity; Sources: Wet weather discharges (point source and combination of stormwater, SSO or CSO), illicit connections/hookups to storm sewers. Suspected Sources: Channelization, loss of riparian habitat
Aesthetics	Impaired – Causes: Turbidity; Sources: Wet weather discharges (point source and combination of stormwater, SSO or CSO), illicit connections/hookups to storm sewers. Suspected Sources: Channelization, loss of riparian habitat

4.1.7 Mystic River

Segment MA71-02

The Draft Permit authorizes MWRA CSO Treatment Facility Outfall MWR205A to discharge into the Mystic River within Segment MA71-02. MWR205A is only activated during wet weather events, when high tide prevents the discharge of flows from MWR205. This segment is 5.0 miles in length and travels from the outlet of Lower Mystic Lake, Arlington/Medford to the Amelia Earhart Dam, Somerville/Everett.

The Draft Permit authorizes the City of Somerville to discharge from CSO outfall SOM007A into the Mystic River via the same outfall as MWR205A.

This segment of the Mystic River has been classified in the MA WQS as Class B, warm water with a variance for CSO discharges. A variance is a temporary modification of surface water quality standards. The latest variance[71] for the Mystic River was adopted by MassDEP on August 30, 2019, approved by EPA on May 29, 2020[72] and ends on August 31, 2024. The MA WQS at 314 CMR 4.05(3)(b) states that Class B waters are "those Inland Waters so designated pursuant to 314 CMR 4.06; including, without limitation, certain wetlands designated in 314 CMR 4.06(2); certain other waters designated in 314 CMR 4.06(5); and certain qualified waters designated in 314 CMR 4.06(6)(b)." These waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth, and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06(1)(d)6. and (6)(b), they shall be suitable as a source of public water supply with appropriate treatment ("Treated Water Supply"). Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value." The variance for this segment authorizes limited CSO

[71] Kathleen M. Baskin, MassDEP, August 30, 2019, Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin, https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-alewife/download
[72] LETTER. Ken Moraff, EPA to Martin Suuberg, MassDEP, May 29, 2020.

discharges. The variance requires continued implementation of the LTCP Plan and implementation as required by the Federal Court Order, as modified.

The MassDEP's 2018/2020 Integrated List[73] includes this segment of the Mystic River as a Massachusetts Category 5 Water and in need of a TMDL due to Eurasian Water Milfoil, *Myriophyllum Spicatum*, non-native aquatic plants, water chestnut, arsenic, chlordane in fish tissue, chlorophyll a, DDT in fish tissue, dissolved oxygen, dissolved oxygen supersaturation, *Escherichia Coli* (*E. coli)*, PCBs in fish tissue, high pH, , total phosphorus, sediment bioassay (chronic toxicity freshwater), and transparency/clarity. TMDLs[74,75] have been developed for phosphorus management and bacteria. A regional TMDL[76] has been completed for the atmospheric deposition of mercury which is one impairment of the fish consumption use.

Table 8: Summary of Designated Uses and Listing Status for Segment MA71-02, Mystic River[77,78]

Designated Use	Status
Aquatic Life	Impaired – Causes: Chlorophyll-a, DO saturation, fish-passage barrier, sediment bioassays -- chronic toxicity freshwater, elevated total phosphorus Sources: Contaminated sediments, hydrostructure impacts on fish passage, unspecified urban stormwater
Fish Consumption	Impaired – Causes: DDT, chlordane, and PCBs in fish tissue Source: Unknown
Primary Contact Recreation	Impaired – Causes: *E. coli*, secchi disk transparency Source: Unspecified urban stormwater
Secondary Contact Recreation	Impaired – Causes: secchi disk transparency Source: Unspecified urban stormwater
Aesthetics	Impaired – Causes: secchi disk transparency Source: Unspecified urban stormwater

Segment MA71-03

[73] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents
[74] Eastern Research Group, Inc. for EPA, Region 1, January 2020, Mystic River Watershed Alternative TMDL Development for Phosphorus Management – Final Report, https://www.epa.gov/sites/production/files/2020-06/documents/mystic-river-tmdl-report.pdf
[75] MassDEP, EPA Region 1, & ENSR International, October 2018, Final Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds, (Control Number CN 157.1), https://www.mass.gov/doc/final-pathogen-tmdl-report-for-the-boston-harbor-weymouth-weir-and-mystic-watersheds/download
[76] New England Interstate Water Pollution Control Commission (NEWIPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont, 2007, Northeast Regional Mercury Total Maximum Daily Load, https://neiwpcc.org/wp-content/uploads/2020/08/FINAL-Northeast-Regional-Mercury-TMDL.pdf
[77] MassDEP, March 2010, Mystic River Watershed and Coastal Drainage Area, 2004-2008 Water Quality Assessment Report, https://www.mass.gov/doc/mystic-river-watershed-2004-2008-water-quality-assessment-report-0/download
[78] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

The Draft Permit authorizes the MWRA to discharge from CSO Treatment Facility Outfall MWR205, the primary discharge from the Somerville Marginal Treatment Facility, into the Mystic River Segment MA71-03. The segment is 0.49 square miles and travels from the Amelia Earhart Dam, Somerville/Everett to confluence with Boston Inner Harbor Chelsea/Charlestown (Includes Island End River).

The Draft Permit also authorizes the City of Boston to discharge from CSO outfall BOS017 into the Mystic River Segment MA71-03.

This segment of the Mystic River is classified in the MA WQS as a Class SB (CSO) water. The MA WQS at 314 CMR 4.02 define Class SB (CSO) waters as "those Class SB partial use coastal and marine waters so designated in accordance with 314 CMR 4.06(1)(d)11. and (6)(b)".

> Partial Use, B (CSO) and SB(CSO) denotes those waters occasionally subject to short-term impairment of swimming or other recreational uses due to untreated CSO discharges in a typical year, and the aquatic life community may suffer adverse impact yet is still generally viable. In these waters, the uses for Class B and SB waters are maintained after the implementation of long-term control measures described in the approved CSO long-term control plan, except as identified in such a plan. The Department may designate a segment partial use, B(CSO) or SB(CSO), provided that:
>
> a. a Department approved long-term control plan provides justification for the overflows;
> b. the Department finds through a use attainability analysis, and EPA concurs, that achieving a greater level of CSO control is not feasible for one of the reasons specified at 314 CMR 4.03(4);
> c. existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected; and
> d. public notice is provided through procedures for permit reissuance under M.G.L. c. 21, §§ 26 through 53 and regulations promulgated pursuant to M.G.L. c. 30A. In addition, the Department will publish a notice in the Environmental Monitor. Other combined sewer overflows may be eligible for a variance granted pursuant to 314 CMR 4.03(4). When a variance is not appropriate, partial use may be designated for the segment after public notice and opportunity for a public hearing in accordance with M.G.L. c 30A."
>
> 314 CMR 4.06(1)(d)11.

The MassDEP's 2018/2020 Integrated List[79] includes this segment of the Mystic River as a Massachusetts Category 5 Water and in need of a TMDL due to ammonia (un-ionized), cause unknown (contaminants in fish and shellfish); sediment screening value (exceedance), dissolved oxygen, fecal coliform, flocculant masses, nutrient/eutrophication biological indicators, odor, oil

[79] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

and grease, PCBs in fish tissue, petroleum hydrocarbons, and scum/foam. TMDLs[80,81] have been developed for dissolved oxygen, flocculant masses, nutrient/eutrophication biological indicators, and fecal coliform bacteria. A regional TMDL[82] has been completed for the atmospheric deposition of mercury which is one impairment of the fish consumption use.

Table 9: Summary of Designated Uses and Listing Status for Segment MA71-03, Mystic River[83,84]

Designated Use	Status
Aquatic Life	Impaired – Causes: Sediment Bioassays – Chronic Toxicity Freshwater Sources: Contaminated sediments
Fish Consumption	Not Assessed
Shellfish	Impaired – Causes: Fecal Coliform; Sources: Unknown
Primary Contact Recreation	Support
Secondary Contact Recreation	Support
Aesthetics	Not assessed due to lack of data

4.1.8 Little River and Alewife Brook

Segment MA71-22 - Little River

The Draft Permit authorizes MWRA for CSO discharge, MWR003, that discharges to the Little River which is identified as Segment MA71-22 (formerly part of Segment MA71-04[85]). This segment is 0.03 miles in length and travels from MWRA CSO Outfall MWR003, approximately 150 feet upstream from the mouth, Cambridge to mouth at the confluence with Alewife Brook, Cambridge.

The Draft Permit also authorizes the City of Cambridge to discharge from CSO outfall, CAM401A into the Little River.

CSO discharge CAM004 has been closed.[86]

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[80] Eastern Research Group, Inc. for EPA, Region 1, January 2020, Mystic River Watershed Alternative TMDL Development for Phosphorus Management – Final Report, https://www.epa.gov/sites/production/files/2020-06/documents/mystic-river-tmdl-report.pdf

[81] MassDEP, EPA Region 1, & ENSR International, October 2018, Final Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds, (Control Number CN 157.1), https://www.mass.gov/doc/final-pathogen-tmdl-report-for-the-boston-harbor-weymouth-weir-and-mystic-watersheds/download

[82] New England Interstate Water Pollution Control Commission (NEWIPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont, 2007, Northeast Regional Mercury Total Maximum Daily Load, https://neiwpcc.org/wp-content/uploads/2020/08/FINAL-Northeast-Regional-Mercury-TMDL.pdf

[83] MassDEP, March 2010, Mystic River Watershed and Coastal Drainage Area, 2004-2008 Water Quality Assessment Report.

[84] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

[85] MassDEP re-defined Segment MA71-04 in the 2018/2020 Integrated List of Waters.

[86] City of Cambridge , Department of Public Works. April 29, 2022, 2021 Annual Report National Pollutant Elimination System for the City of Cambridge, Massachusetts, Combined Sewer Overflow Permit #MA0101974, p.6.

This segment of Little River has been classified in the MA WQS as a Class B, warm water with a variance for CSO discharges. The latest variance[87] for the Alewife Brook (which previously included Little River) was approved by EPA on May 29, 2020.[88] The MA WQS at 314 CMR 4.05(3)(b) states that Class B waters are "those Inland Waters so designated pursuant to 314 CMR 4.06; including, without limitation, certain wetlands designated in 314 CMR 4.06(2); certain other waters designated in 314 CMR 4.06(5); and certain qualified waters designated in 314 CMR 4.06(6)(b). These waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth, and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06(1)(d)6 and (6)(b), they shall be suitable as a source of public water supply with appropriate treatment ("Treated Water Supply"). Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value." A variance is a temporary modification of surface water quality standards. The variance for this segment authorizes limited CSO discharges. The variance requires continued implementation of the LTCP and implementation as required by the Federal Court Order, as modified.

The MassDEP's 2018/2019 Integrated List[89] includes this segment of the Little River as a Massachusetts Category 5 Water and in need of a TMDL due to debris, copper in sediment, DO, *E.coli*, flocculant masses, lead in sediment, odor, oil and grease, PCBs in fish tissue, total phosphorus, scum/foam, transparency/clarity and trash.

Segment MA71-20 - Alewife Brook

The Draft Permit authorizes the City of Cambridge to discharge from CSO outfall CAM001, CAM002, and CAM401B into Alewife Brook. CAM001 has an activation frequency of 0 and volume of 0 in a "Typical Year" under the LTCP.

CSO discharge CAM400 has been closed.[90]

The Draft Permit authorizes the City of Somerville to discharge from CSO outfall, SOM001A, into Alewife Brook.

Alewife Brook is identified as Segment MA71-20 (formerly part of Segment MA71-04). This segment is 1.6 miles in length and begins at the emergence north of Cambridgepark Drive, Cambridge to mouth at confluence with the Mystic River, Arlington/Somerville.

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[87] Kathleen M. Baskin, MassDEP, August 30, 2019, Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin, https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-alewife/download

[88] LETTER. Ken Moraff, EPA to Martin Suuberg, MassDEP, May 29, 2020.

[89] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

[90] City of Cambridge , Department of Public Works. April 29, 2022, 2021 Annual Report National Pollutant Elimination System for the City of Cambridge, Massachusetts, Combined Sewer Overflow Permit #MA0101974, p.6.

Alewife Brook is classified in the MA WQS as a Class B, warm water with a variance for CSO discharge. The latest variance[91] for Alewife Brook was approved by EPA on May 29, 2020.[92] The MA WQS at 314 CMR 4.05(3)(b) states that Class B waters are "those Inland Waters so designated pursuant to 314 CMR 4.06; including, without limitation, certain wetlands designated in 314 CMR 4.06(2); certain other waters designated in 314 CMR 4.06(5); and certain qualified waters designated in 314 CMR 4.06(6)(b). These waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth, and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06(1)(d)6 and (6)(b), they shall be suitable as a source of public water supply with appropriate treatment ("Treated Water Supply"). Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value." A variance is a temporary modification of surface water quality standards. The variance for this segment authorizes limited CSO discharges. The variance requires continued implementation of the LTCP and implementation as required by the Federal Court Order, as modified.

The MassDEP's 2018/2020 Integrated List[93] includes Alewife Brook (including Little River) as a Massachusetts Category 5 Water and in need of a TMDL due to debris, water chestnuts, chloride, trash, copper in sediment, dissolved oxygen, *Escherichia* (*E.coli)*, flocculant masses, lead in sediment, odor, oil and grease, PCBs in fish tissue, total phosphorus, scum/foam, sediment bioassay (chronic toxicity freshwater) and transparency/clarity. TMDLs[94,95] have been developed for phosphorus management and bacteria.

Table 10: Summary of Designated Uses and Listing Status for Segment MA71-04, Alewife Brook[96,97]

Designated Use	Status
Aquatic Life	Impaired – Causes: Sediment bioassays – chronic toxicity freshwater, low DO Sources: CSOs, contaminated sediments, unspecified urban stormwater
Fish Consumption	Not Assessed

[91] Kathleen M. Baskin, MassDEP, August 30, 2019, Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin.

[92] LETTER. Ken Moraff, EPA to Martin Suuberg, MassDEP, May 29, 2020.

[93] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

[94] Eastern Research Group, Inc. for EPA, Region 1, January 2020, Mystic River Watershed Alternative TMDL Development for Phosphorus Management – Final Report, https://www.epa.gov/sites/production/files/2020-06/documents/mystic-river-tmdl-report.pdf

[95] MassDEP, EPA Region 1, & ENSR International, October 2018, Final Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds, (Control Number CN 157.1), https://www.mass.gov/doc/final-pathogen-tmdl-report-for-the-boston-harbor-weymouth-weir-and-mystic-watersheds/download

[96] MassDEP, March 2010, Mystic River Watershed and Coastal Drainage Area, 2004-2008 Water Quality Assessment Report, https://www.mass.gov/doc/mystic-river-watershed-2004-2008-water-quality-assessment-report-0/download

[97] MassDEP, 2021, Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, https://www.epa.gov/tmdl/massachusetts-2018-2020-303d-list-report-and-related-documents

Designated Use	Status
Primary Contact Recreation	Impaired – Causes: *E. coli*, secchi disk transparency; Sources: CSOs, sediments, unspecified urban stormwater
Secondary Contact Recreation	Impaired – Causes: *E. coli*, secchi disk transparency; Sources: CSOs, sediments, unspecified urban stormwater
Aesthetics	Impaired – Causes: secchi disk transparency; Sources: CSOs, sediments, unspecified urban stormwater

4.2 Ambient Data

A summary of the ambient data collected in the receiving water in the vicinity of the Outfall T01 that is referenced in this Fact Sheet can be found in Appendix E of this Fact Sheet.

4.3 Available Dilution

To ensure that discharges do not cause or contribute to violations of WQSs under all expected conditions, WQBELs are derived assuming critical conditions for the receiving water.[98] Massachusetts water quality regulations state that the MassDEP "will establish extreme hydrologic conditions at which aquatic life criteria must be applied on a case-by-case basis." 314 CMR 4.03(3)(c).

The MWRA DITP discharge is located approximately 8 miles offshore at a depth of 110 feet below the surface. The last 1.25 miles of the outfall is a multiport diffuser with 55 riser pipes that are oriented perpendicular to the outfall. Each riser pipe is capped with an 8-port diffuser head (although, on average, only 5 ports were opened in each port head).[99]

Certain water quality-based effluent limits in the 2000 Permit were established with the use of a mixing zone. Mixing zones are regulated at 314 CMR 4.03(2) and are defined as "a limited area or volume of a waterbody as a mixing zone for the initial dilution of the discharge."

The MA WQS allow waters within a mixing zone to fail to meet specific water quality criteria provided specific conditions are met:

- Mixing zones shall be limited to an area or volume as small as feasible. There shall be no lethality to organisms passing through the mixing zone as determined by the Department. The location, design and operation of the discharge shall minimize impacts on aquatic life and other existing and designated uses within and beyond the mixing zone.

- Mixing zones shall not interfere with the migration or free movement of fish and other aquatic life. There shall be safe and adequate passage for swimming and drifting organisms with no deleterious effects on their populations.

[98]EPA Permit Writer's Manual, Section 6.2.4.
[99] Carlton D. Hunt, Alex D. Mansfield, Michael J. Mickelson, Carl S. Albro, W. Rockwell Geyer and Philip J.W. Roberts, Plume Track and Dilution of Effluent From the Boston Sewage Outfall, *Marine Environmental Research*, 2010, 70, pp. 150-161.

- Mixing zones shall not create nuisance conditions, accumulate pollutants in the sediments or biota in toxic amounts or otherwise interfere with the current or designated uses of the surface waters.

314 CMR 4.03(2)

The dilution ratio established for Outfall T01 in the 2000 Permit, 70:1, was predicted in the physical hydraulic modeling study[100] which was conducted to determine the most effective diffuser design for the outfall. Post-discharge plume tracking surveys were required by the 2000 Permit to evaluate whether the actual dilution was less than the dilution predicted by the modeling study. The surveys (i.e., dye studies) were conducted in April and July 2001 and are detailed in reports submitted by MWRA in June[101] and July 2002,[102] respectively. The July 2001 study and results were also published in a peer-reviewed journal.[103] MassDEP and EPA confirmed by letter[104] "that the field studies verified the minimum initial dilution (70 to 1) assumed in the NPDES Permit." This dilution is used for the evaluation of reasonable potential and the calculation of water quality-based effluent limits for Outfall T01 in the Draft Permit.

The dye studies were conducted by adding dye to the effluent prior to discharge to the outfall tunnel and diffuser. The July 2001 survey is considered by EPA to be the worst case scenario survey even though the ambient test conditions were not ideal as plant flows were lower than "typical" summertime flows due to drought conditions, and the stratification in Massachusetts Bay was moderate; therefore, conditions did not represent the critical conditions as recommended in EPA's Technical Support Document for Water Quality-based Toxics Control (TSD),[105] which advises that critical design periods for ocean mixing zone analyses must include maximum thermal or density stratification.

Initial dilution determined by the July 2001 dye study ranged between 94 and 102, which is higher than the estimates from the earlier model study. It does appear that the diffuser is performing as predicted. However, given the less than critical conditions during the dye study, EPA has maintained the dilution of 70:1.

In 2022, Deltares, an MWRA contractor, evaluated the effluent plume behavior using the Cornell Mixing Zone Expert System (CORMIX). The model simulation was not designed to determine

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[100] Phillip J.W. Roberts, and William H. Snyder, Hydraulic Model Study for Boston Outfall. II: Environmental Performance, *Journal of Hydraulic Engineering*, 1993, Vol. 119, No. 9, pp. 988-1002.
[101] Hunt, C.D., Steinhauer, W.S., Mansfield, A.D., Albro, C.A., Roberts, P.J.W., Geyer, W.R. ad Michelson, M.J. 2002. Massachusetts Water Resources Authority, Effluent Outfall Dilution: April 2001, June 2002, Report No. 2002-06. https://www.mwra.com/harbor/enquad/pdf/2002-06.pdf
[102] Hunt, C.D., Mansfield, A.D., Roberts, P.J.W., Albro, C.A., Geyer, W.R., Steinhauer, W.S. and Mickelson, M.J., 2002. Massachusetts Water Resources Authority, Effluent Outfall Dilution: July 2001, July 2002. Report No. 2002-07. https://www.mwra.com/harbor/enquad/pdf/2002-07.pdf
[103] Carlton D. Hunt, Alex D. Mansfield, Michael J. Mickelson, Carl S. Albro, W. Rockwell Geyer, and Philip J.W. Roberts, Plume Tracking and Dilution of Effluent from Boston Sewage Outfall, *Marine Environmental Research*
[104] LETTER. Steve G. Lipman, MassDEP to Michael J. Hornbrook, MWRA. October 28, 2002. Re: Massachusetts Water Resources Authority, NPDES Permit Number MA0103284, Part I.18e – Outfall and Diffusers: Predicted Minimum Dilution.
[105] USEPA, Technical Support Document for Water Quality-based Toxics Control, 1991, EPA/505/2-90-001, p. 74.

the dilution factor for regulatory purposes but the "results are consistent with past observational and model studies (e.g., Hunt et al., 2010, Roberts et al., 2011)."[106]

EPA has kept the more conservative initial dilution of 70:1 in the Draft Permit to assure that water quality standards are met during critical conditions (i.e., "typical" effluent flows, maximum ambient stratification and slack tide).

5.0 Proposed Effluent Limitations and Conditions

The proposed effluent limitations and conditions derived under the CWA and State WQSs are described below. These proposed effluent limitations and conditions, the basis of which are discussed throughout this Fact Sheet, may be found in Part I of the Draft Permit. In addition to the requirements described below, the Draft Permit includes a narrative condition prohibiting pollutants introduced into POTWs by non-domestic sources from passing through the POTW or interfering with the operation of the treatment works.

5.1 Effluent Limitations and Monitoring Requirements

In addition to the State and Federal regulations described in Section 2 of this Fact Sheet, EPA used data submitted by the MWRA in its 2005 permit application and subsequent permit application updates, monthly discharge monitoring reports (DMRs), WET test reports from January 2018 through December 2022, and additional data supplied by MWRA, at EPA's request, to identify pollutants of concern. The data was used to evaluate the discharge during the effluent limitation development process (See Appendices C, E & F**)**. The reasonable potential analysis to determine the need for effluent limits in the Draft Permit is in Appendix G and the results are discussed in the sections below.

5.1.1 Effluent Flow

The effluent flow limit in the 2000 Permit is 436 MGD, as a dry day, 365 calendar day running average flow. This flow is based on an early facility plan. For the purpose of the 2000 Permit, a dry day is defined as a day with 0.09 inches of precipitation or less and no snow melt, provided that the precipitation on the previous day is less than 0.3 inch, and the precipitation on the day two days prior to the day in question is less than 1.0 inch, and the precipitation on the day three days prior to the day in question is less than 2.0 inches. A day with snow melt is defined as a day when there is snow on the ground and the air temperature rises above 32 degrees Fahrenheit. Flows from the CSO storage facilities are not included in the dry day calculation.

In the 2000 Permit, compliance with the flow limit is determined each month by calculating the average dry day flow over the previous 365 calendar days. The once-a-month calculation includes all dry day flows that occurred during the reporting month.

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[106] Deltares. 2022. Massachusetts Bay Outfall Treated Effluent Discharge Plume Characteristics from the EPA-Supported Near-Field Mixing Model, Boston: Massachusetts Water Resources Authority. Report 2022-03. p. 15. https://www.mwra.com/harbor/enquad/pdf/2022-03.pdf

The DMR data during the review period shows that there have been no violations of the flow limit.

The Draft Permit includes an effluent flow limit of 361 MGD, which is the annual average design flow of the re-sized secondary treatment facilities.[107,108,109] Because of the extent of the collection system, compliance with the flow limit is determined each month by calculating the average dry day flow over the previous 365 calendar days, (total dry day flow/total number of dry days). The once-a-month calculation shall include all dry day flows that occurred during the reporting month.

This limit will apply to dry weather flows only. The definition of dry day is the same as in the 2000 Permit and is defined above.

5.1.2 Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)

The $CBOD_5$ limits in the 2000 Permit are based on secondary treatment standards pursuant to 40 CFR § 133.102(a)(4); the average monthly limit is 25 mg/L, and the average weekly limit is 40 mg/L. The 2000 Permit includes a maximum daily reporting requirement. The DMR data during the review period shows that there have been no violations of the $CBOD_5$ concentration limits.

The Draft Permit proposes the same $CBOD_5$ concentration limits as in the 2000 Permit as there have been no changes to the secondary treatment standards. The monitoring frequency remains once per day.

5.1.3 Total Suspended Solids (TSS)

The TSS limits in the 2000 Permit are based on the secondary treatment standards pursuant to 40 CFR § 133.102(b); the average monthly limit is 30 mg/L, and the weekly limit is 45 mg/L. The 2000 Permit includes a maximum daily reporting requirement. The DMR data from the review period shows that there have been no violations of TSS concentration-based limits.

The Draft Permit proposes the same TSS concentration limits as in the 2000 Permit as there have been no changes to the secondary treatment standards. The monitoring frequency remains once per day.

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[107] Camp Dresser & McKee, Massachusetts Water Resources Authority, DP-29 Secondary Treatment Facilities, Recommended Plan for Completion of the Deer Island Facilities, 1995, pp.2-21 and 2-23.
[108] LETTER. Michael J. Hornbrook, MWRA to Michele Barden, EPA. July 7, 2006. RE: Massachusetts Water Resources Authority NPDES Permit Number MA0103284, Renewal of NPDES Permit MA0103284, Design flow of Deer Island Wastewater Treatment Plant.
[109] In accordance with 314 CMR 3.11(2)(a)11, in any given calendar year where the average annual flow of a permitted facility exceeds 80% of the facility's average design flow, that facility shall submit a report to the Department describing what steps the permittee will take in order to remain in compliance with the limitations and conditions in its permit, including in particular, limitations on the amount of flow authorized to be discharged under the permit. https://www.mass.gov/doc/314-cmr-300-surface-water-discharge-permits

5.1.4 Eighty-Five Percent (85%) CBOD5 and TSS Removal Requirement

Federal regulations at 40 CFR § 133.103(a) (*Combined Sewers*) state: "]t]reatment works subject to this part may not be capable of meeting the percent removal requirements established under 133.102(a)(3) and 133.102(b)(3), or 133.105(a) and 133.105(b)(3) during wet weather where the treatment works receive flows from combined sewers (i.e., sewers which are designed to transport both storm water and sanitary sewage). For such treatment works, the decision must be made on a case-by-case basis as to whether any attainable percentage removal level can be defined, and if so, what the level should be."

The 2000 Permit required the reporting of the influent $CBOD_5$ and TSS in addition to the effluent on $CBOD_5$ and TSS. After reviewing the DMR record for both influent and effluent $CBOD_5$ and TSS, EPA has determined that the treatment plant is capable of meeting the 85 percent removal requirement for both parameters during dry weather conditions; and in fact, has been consistently achieving greater than 85% removal in all conditions. The DMR data during the review period shows that the median $CBOD_5$ and TSS removal percentages are 95% and 95%, respectively. Thus, EPA is including this requirement in the Draft Permit to ensure that extraneous flows to the collection system are adequately controlled. The monitoring frequency is once per month. EPA similarly has included this condition in permits issued to other Massachusetts POTWs with combined sewer systems, such as Springfield, Haverhill, Lowell, Greater Lawrence, New Bedford and Lynn.

The 85% removal requirement is not required during wet weather because a portion of the collection system is a combined system. Due to the inclusion of storm water from the combined portion of the collection system, influent $CBOD_5$ loads are lower (i.e., more dilute) than those in a separate collection system. Because the influent is more dilute, it requires more highly treated effluent to get 85% reduction in load.

For the purposes of this requirement, a dry day is defined as a day with 0.09 inches of precipitation or less and no snow melt, provided that the precipitation on the previous day is less than 0.3 inch, and the precipitation on the day two days prior to the day in question is less than 1.0 inch, and the precipitation on the day three days prior to the day in question is less than 2.0 inches. A day with snow melt is defined as a day when there is snow on the ground and the air temperature rises above 32 degrees Fahrenheit. Flow from the CSO storage facilities is not included in the dry day calculation.

5.1.5 pH

The pH limits in the 2000 Permit are a range of 6.0 to 9.0 standard units and reflect the requirements in 40 CFR § 133.102(c). These limits are less stringent than the State WQSs for a Class SA water at 314 CMR 4.05(4)(a)(3) and were based on the potential buffering effect of the effluent in the receiving water at the time the 2000 Permit was issued. The DMR data during the review period show that there have been no violations of the pH limitations.

Current State WQS for Class SA waters at 314 CMR 4.05(4)(a)3 have not changed for pH and require pH be in a range of 6.5 or greater than 8.5 standard units and not more than 0.2 standard

units outside the natural background range. MassDEP has developed a procedure for conducting a pH Adjustment Demonstration Project for Permittees that request an alternative pH limit in its NPDES permit.[110] For marine discharges, the demonstration project must be completed only once during a 1% occurrence spring tide, which is a tide with a maximum range of depths between high and low tides. When the requested pH limit is low (down to 6.0 S.U.), the study must be conducted when runoff conditions are greatest (during March/April or October/November) and during the last 2 hours of ebb tide (just before slack low tide).

MWRA conducted a pH demonstration project on April 20, 2022, following a study plan submitted to MassDEP on March 29, 2022. After completion of the demonstration project, MWRA stated in a letter to EPA and MassDEP dated May 31, 2022, that: "[b]oth grab and composite DITP effluent samples adjusted down to a pH of 6.0 did not change the pH when mixed with receiving water samples at the established 70:1 near-field dilution factor. Even at 60% of this dilution factor, this study showed the pH of Massachusetts Bay receiving water did not change more than 0.2 standard units and would be well within the pH range of 6.5 – 8.5 for Class SA waters as prescribed in 314 CMR 4.00." MassDEP approved this study by letter on June 17, 2022.[111]

The Draft Permit includes pH effluent limit range of 6.0-8.5 standard units. Sampling frequency is once per day.

Consistent with MassDEP's approval:

- MWRA shall provide ambient pH monitoring both outside the area of discharge influence and within the area of discharge influence to confirm compliance with SWQS.
- Minimum sampling frequency and duration shall be monthly for a period of six month immediately following the pH limit approval or as otherwise approved by MassDEP.
- Measurements of pH shall be taken using probes calibrated just prior to each use and at documented and representative locations.
- Whenever feasible, sampling should be conducted during dry weather conditions (little or no antecedent precipitation). Data shall be submitted to MassDEP's email portal on a monthly basis (wqdata.submit@state.ma.us).
- Any and all exceedances of SWQS for pH shall be immediately reported to MassDEP via that same email portal.
- Following the six-month period, MassDEP shall evaluate the submitted data to determine the need for additional monitoring and/or follow up.

5.1.6 Bacteria

The fecal coliform limits in the 2000 Permit are:

(1) An average weekly limit of 14,000 colonies/100 mL that is reported as a geometric mean.

[110] MassDEP, undated, Procedures for a pH Demonstration Project for NPDES Permits.
[111] LETTER. Lealdon Langley, MassDEP to Betsy Reilley, MWRA. June 17, 2002. RE: Massachusetts Water Resources Authority (MWRA), Deer Island Treatment Plant (DITP), NPDES Permit No. MA0103284, pH Adjustment Demonstration Project Approval.

(2) A maximum daily limit of not more than 10% of individual sample collected in a given month exceeds 14,000 colonies/100ml, and not more than three (3) consecutive samples shall exceed 14,000/100 mL

The effluent limits in the 2000 Permit were established using a mixing zone and compliance is required at the edge of the zone of initial dilution (ZID). The mixing zone for this discharge has an initial dilution of 70:1. Using the dilution of 70 times the applicable water quality criteria at the time of permit issuance of 200 colony forming units/100 mL; the effluent limit is 14,000 colonies/100 mL. The DMR data for the review period shows there have been no exceedances of the current fecal coliform bacteria limitations and fecal coliform counts are significantly below the limits in the 2000 Permit (See Appendix C).

As previously stated, Massachusetts Bay in the vicinity of the outfall is classified as a Class SA water and designated for shellfishing in the MA WQS in accordance with 314 CMR 4.06(4).[112]

The WQS at 314 CMR 4.05(4)(a) state that Class SA are "those coastal and marine waters so designated pursuant to 314 CMR 4.06; including without limitation, 314 CMR 4.06(2) and, (5), and certain qualified waters designated in 314 CMR4.06(6)(b). These waters are designated as an excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, excellent habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. Where designated for shellfishing in at 314 CMR 4.06(6)(b), these waters shall be suitable for shellfish harvesting without depuration (Approved and Conditionally Approved Shellfish Areas). These waters shall have excellent aesthetic value." Massachusetts Bay is listed in 314 CMR 4.06(b) Table 19 as designated for shellfishing and Massachusetts Bay in the vicinity of the DITP discharge is also designated for shellfishing as confirmed by MassDEP.[113] The receiving waters are currently classified as shellfishing waters although they are classified as "prohibited" for shellfishing by the Massachusetts Division of Marine Fisheries (MA Marine Fisheries) due to the existence of the DITP outfall. MassDEP does not consider the receiving waters as bathing beach waters as they are 9.5 miles offshore.

The MA WQS at 314 CMR 4.05(4)(a)4 require:

a. Waters designated for shellfishing: fecal coliform shall not exceed a geometric mean Most Probable Number (MPN) of 14 organisms per 100 ml, nor shall more than 10% of the samples exceed an MPN of 28 per 100 ml, or other values of equivalent protections based on sampling and analytical methods used by the Massachusetts Division of Marine Fisheries and approved by the National Shellfish Sanitation Program in the latest revision of the Guide For The Control of Molluscan Shellfish (more stringent regulations may apply, see 314 CMR 4.06(1)(d)(5));

[112] EMAIL. Claire Golden, MassDEP to Michele Barden, EPA. November 3, 2022. Subject: Request for Segment Number.
[113] EMAIL. Claire Golden, MassDEP to Michele Barden, EPA. November 3, 2022. Subject: Request for Segment Number.

b. For protection of primary contact recreation, surface waters shall meet the minimum criteria for bacteria set forth in 314 CMR 4.05(5)(f) 2. and 3.

The MA WQS at 314 CMR 4.05(5)(f) require:

2. Coastal and Marine Waters. Concentrations of bacteria in Coastal and Marine Waters, subject to the reduced interval requirements set forth in 314 CMR 4.05(5)(f)3. as applicable, and except as otherwise provided in the seasonal exception set forth in 314 CMR 4.05(5)(f)4. as applicable, shall, on a year-round basis, satisfy 314 CMR 4.05(5)(f)2.a.:

a. for enterococci:
i. concentrations shall not exceed 35 cfu per 100 mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and
ii. no more than 10% of all such samples shall exceed 130 cfu per 100 mL (the statistical threshold value).

b. The preceding requirements are summarized in the following table:

Bacterial Indicator	Bacterial Criteria for Coastal and Marine Waters (cfu/100 mL)*	
	Geometric Mean*	Statistical Threshold Value*
enterococci	≤35	≤130
*The geometric mean for this indicator shall not be exceeded in any 90-day or smaller interval. No more than 10% of all samples collected within that interval shall exceed the statistical threshold value for this indicator.		

3. Reduced Interval Requirements. The geometric mean and statistical threshold value used for calculating the minimum criteria for bacteria set forth in 314 CMR 4.05(5)(f)1. and 2., shall be calculated and assessed, respectively, over a 30-day or smaller interval in lieu of any otherwise applicable longer interval, if either of the conditions set forth in 314 CMR 4.05(5)(f)3.a.i. or ii. is met.

a. Conditions which require a reduced interval:
i. criteria are being applied to waters adjacent to any public or semi-public beach, at a location used for bathing and swimming purposes, and for the dates of operation of any such beach as posted or as otherwise established by the operator pursuant to 105 CMR 445.020: Operation; or
ii. criteria are being applied to segments impacted by CSO-, B(CSO)-, SB(CSO)-, or POTW-discharges.

b. Massachusetts Department of Public Health definitions: the terms "public bathing beach", "semi-public bathing beach" and "operator" as used in paragraph 314 CMR 4.05(5)(f)3.a.i. shall have the meanings as defined in 105 CMR 445.010: Public Bathing Beach; Semi-Public Bathing Beach; and Operator. (Standards and procedures for bathing water closures have been established by the Massachusetts Department of Public Health, at

105 CMR 445.000: Minimum Standards for Bathing Beaches (State Sanitary Code, Chapter VII).)

4. Seasonal Exception. The year-round minimum criteria for bacteria set forth in 314 CMR 4.05(5)(f)1. and 2., as subject to the reduced interval requirements set forth in 314 CMR 4.05(5)(f)3., as applicable, may be applied on a seasonal basis in lieu of a year-round basis upon MassDEP's determination that, because of a reduction in primary contact recreation during a specified period of time, such criteria are not needed to be protective. Bases for such determinations may include identification of periods when frequency of use is reduced due to cold weather (typically, from November through March); and/or consideration of other relevant and appropriate factors. Any such determinations shall be documented in writing (e.g., by the relevant provisions of surface water discharge permits issued pursuant to 314 CMR 3.00: Surface Water Discharge Permit Program) and made publicly available for review (e.g., through MassDEP's Surface Water Discharge Permit webpage).

5. Additional Bacteria Requirements. For additional bacteria requirements other than for primary contact recreation, see 314 CMR 4.05(3) and (4).

The design of the Facility's disinfection system and dechlorination system is unique to the DITP Facility. A portion of the 9.5 mile outfall tunnel is designed to be used as a chlorine contact chamber so that the Facility is able to maintain the minimum chlorine contact time of 15 minutes during peak plant flows of 1270 MGD. "The total disinfection time includes the time it takes for wastewater to flow through the two disinfection contact basins, the effluent launders, the outfall raceway, the outfall drop shaft and the first 850 feet of the 22.5 foot diameter outfall tunnel."[114]

In order to collect a representative sample of disinfected effluent, samples for fecal coliform (and *Enterococcus,* although not required by the 2000 Permit) analysis are collected at the end of the chlorine disinfection basin. The samples are then held for the amount of time that the effluent takes to reach the dechlorination point. The hold time is calculated using PI Process Book[115] (OSIsoft, LLC; San Leandro, CA) software available to both plant and laboratory staff or can also be calculated manually using the plant effluent flow rate. After that time has elapsed, the sample is manually dechlorinated. At that point in time, the sample has undergone the same amount of contact time with the disinfectant as the actual effluent.

[114] EMAIL. Betsy Reilley, MWRA to Michele Barden, EPA. January 28, 2022. RE: Effluent Bacteria Sampling Attachment: 20220128_sampleloop.docx.
[115] https://techsupport.osisoft.com/Products/Visualization/PI-ProcessBook/Overview

MWRA has also collected a long-term record of ambient bacteria monitoring data and data continues to be collected at 11 stations in Massachusetts Bay[116,117,118] (See Figure 13) to observe the presence, if any, of pathogen indicator bacteria in the waters around the outfall. MWRA has monitored fecal coliform and *Enterococcus* bacteria in Massachusetts Bay since 1999 (includes pre-discharge baseline data). The current ambient bacteria monitoring program was formalized under a Memorandum of Understanding between MWRA, the Massachusetts Division of Marine Fisheries (MA Marine Fisheries) and the US Food and Drug Administration (FDA)[119] and implementation of the MOU is required by the 2000 Permit.[120] The monitoring program consists of routine monthly surveys and adverse condition surveys which occur as needed. The adverse condition surveys are conducted in response to events at the treatment facility such as a chlorination system failure or a bypass of the secondary treatment that could result in an increased discharge of bacteria. MWRA has reported that "the vast majority of samples are non-detects, having bacteria levels below detectability by the methods used. Annual averages are much lower than water quality standards for shellfishing (fecal coliform) and swimming (*Enterococcus*)." [121]

MWRA sampling stations N20 and N16 are located at the ends of the outfall diffuser. Station N21 is located immediately above the diffuser, but sampling at this location did not begin until 2018. Stations N02, N04, N09 and N07 are in the outfall nearfield. Stations F18, F24, F25, F14 and F13 are near the coastline and between the outfall and the shoreward active shellfishing beds. At all stations, samples are collected at a depth of 1 meter below the surface during all surveys. When the water column is stratified (typically May-October), a sample is also collected below the pycnocline, at 2 meters above the seafloor.[122]

EPA reviewed ambient fecal coliform and *Enterococci* data collected between January 2018-December 2022, the review period for this permit reissuance.[123] These samples include both routine and adverse conditions sampling events and surface and sub-pycnocline samples. All the

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[116] Rex, Andrea, MWRA. 2011. Ambient water quality monitoring of the Massachusetts Water Resources Authority effluent outfall: indicator bacteria in Massachusetts Bay 1999-2011, https://www.mwra.com/harbor/enquad/pdf/2011-20.pdf

[117] Codiga, Daniel L., Andrea C. Rex and Kelly Coughlin, MWRA. 2016. Indicator Bacteria in Massachusetts Bay 1999-2014: Water quality monitoring in receiving waters of the Massachusetts Water Resources Authority outfall, https://www.mwra.com/harbor/enquad/pdf/2016-01.pdf

[118] Wu, David, MWRA. 2016. Seasonality of *Enterococcus* levels in Deer Island effluent https://www.mwra.com/harbor/enquad/pdf/2016-07.pdf

[119] See Appendix of Rex, Andrea, MWRA. 2011. Ambient water quality monitoring of the Massachusetts Water Resources Authority effluent outfall: indicator bacteria in Massachusetts Bay 1999-2011, https://www.mwra.com/harbor/enquad/pdf/2011-20.pdf

[120] EPA Region 1. 2000. NPDES Permit Number MA0103284, Footnote 15.

[121] Codiga, Daniel L., Andrea C. Rex and Kelly Coughlin, MWRA. 2016. Indicator Bacteria in Massachusetts Bay 1999-2014: Water quality monitoring in receiving waters of the Massachusetts Water Resources Authority outfall, p. 1

[122] Codiga, Daniel L., Andrea C. Rex and Kelly Coughlin, MWRA. 2016. Indicator Bacteria in Massachusetts Bay 1999-2014: Water quality monitoring in receiving waters of the Massachusetts Water Resources Authority outfall, p. 7

[123] For a review of prior data, please see MWRA reports: Andrea Rex. 2011. Ambient water quality monitoring of the Massachusetts Water Resources Authority outfall: indicator bacteria in Massachusetts Bay 1999-2011 and the updated report, Codiga et al. 2016. Indicator bacteria in Massachusetts Bay 1999-2014: Water quality monitoring in receiving waters of the Massachusetts Water Resources Authority outfall.

ambient fecal coliform samples collected during the review period meet the applicable WQS. The highest values were found at farfield stations, F18 and F14. These stations are more likely to be influenced by coastal sources (i.e., CSO outfalls and stormwater) rather than the DITP outfall. The high value at F18 was 122 *Enterococci* per 100 mL and was a surface sample collected 10/8/2019. The other high value was 108 *Enterococci* per 100 mL and was a sub-pycnocline sample collected on 7/5/2017. The surface sample collected at the same time and station was non-detect. If evaluated as a geometric mean of all samples taken within the six months prior to and including the high value, the WQS would still be met in both instances.

EPA finds that inclusion of effluent limits for fecal coliform bacteria and *Enterococcus,* that account for the treatment occuring in the outfall tunnel and the continuation of the ambient bacteria monitoring program, will ensure that WQSs in Massachusetts Bay continue to be met. Compared to other Massachusetts facilities, the DITP outfall, T01, is unique. First, the diffuser is located 8-9.5 miles offshore from the Deer Island Treatment Plant and at a depth of 110 feet so that incidental contact with the mixing effluent is unanticipated. Second, the diffuser was designed to cause rapid and thorough mixing with the ambient waters. The initial dilution for the discharge is estimated to be 70:1 in the worst-case scenario, though it appears, from the ambient monitoring data, that criteria are being consistently met within very close proximity of the diffuser. Finally, the continuation of the ambient bacteria monitoring, will provide an additional layer of accountability to ensure that the disinfection system continues to operate as intended. The *Enterococcus* limits are based on recreational criteria and are applicable on a seasonal basis from April 1 through October 31.[124] Fecal coliform limits apply year-round.

In addition to the effluent limits for bacteria, MWRA is required to update the existing Memorandum of Understanding (MOU) between the MWRA, the Massachusetts Division of Marine Fisheries (MA Marine Fisheries) and the US Food and Drug Administration (FDA)[125] and implementation of the MOU and the attached monitoring plan is required by the Draft Permit (See Footnote 11). The updated Plan shall follow the same procedures and locations as documented in Attachments A & B of the MOU with the addition of station N21, which is located over the mid-point of the diffuser. The updated MOU and monitoring plan shall be submitted to the MA Marine Fisheries and the FDA for review and signature. The signed MOU and attached updated monitoring plan shall be submitted to EPA and MassDEP within 12 months of the effective permit. *Enterococcus* should also continue to be monitored seasonally (April 1 through October 31) along with fecal coliform to ensure that MA WQS for bacteria are met.

The Permittee shall report the results of the monthly ambient fecal coliform and *Enterococcus* monitoring at station N21 on their monthly DMRs. If the Bay is stratified at the time of sampling, the Permittee shall sample at the surface and below the pycnocline. If the Bay is not stratified at the time of sampling, the Permittee should enter a NODI code = 9 for the below pycnocline DMR report line. The ambient fecal coliform bacteria and *Enterococcus* monitoring

[124] LETTER. Lealdon Langley, MassDEP to Lynne Jennings, EPA. May 23, 2023. RE: Massachusetts Water Resources Authority Deer Island Treatment Plant, NPDES No. MA0103284, Concurrence with EPA Approach to Determination of Bacteria Limits in Draft Permit.
[125] See Appendix of Rex, Andrea, MWRA. 2011. Ambient water quality monitoring of the Massachusetts Water Resources Authority effluent outfall: indicator bacteria in Massachusetts Bay 1999-2011, https://www.mwra.com/harbor/enquad/pdf/2011-20.pdf

results at the other sampling locations shall be submitted as an attachment to the monthly DMR. If an adverse-conditions monitoring event occurs, MWRA shall provide a letter summarizing the event and the sampling data collected as an attachment to the monthly DMR. Any updates or changes in the Ambient Bacteria Monitoring Plan shall be submitted to MA Marine Fisheries and the FDA for review. The signed MOU and plan shall be submitted to EPA in the monthly DMR following signing by Marine Fisheries and the FDA.

The MWRA reports and ambient data support the conclusion that water quality even in the immediate vicinity of the outfall exhibits bacteria levels that meet WQSs for existing and designated uses.

As calculated below, the proposed effluent limitations for fecal coliform are a monthly geometric mean, Most Probable Number (MPN) of 980 organisms/100 mL and a maximum daily limit of 1960 organisms/100 mL. This is more stringent than the fecal coliform bacteria limits in the 2000 Permit. The proposed effluent limitations for *Enterococcus* are a monthly geometric mean of 2450 cfu/100 mL and a maximum daily limit of 9100 cfu/100 mL and applicable on a seasonal basis, April 1 through October 31. The sampling frequency for fecal coliform and *Enterococcus* is three (3) times per day, which is the same as the 2000 Permit.

Fecal Coliform Bacteria:

14 organisms/100 mL * 70 (multiplying factor) = 980 organisms/100 mL
28 organisms/100 mL * 70 (multiplying factor) = 1960 organisms/100 mL

Enterococcus:

35 cfu/100 mL * 70 (multiplying factor) = 2450 cfu/100 mL
130 cfu/100 mL * 70 (multiplying factor) = 9100 cfu/100 mL

Effluent bacteria samples shall be collected at the end of the disinfection basin at the DITP. The holding time shall be calculated using MWRA's current procedure using PI Process Book or an accepted manual method. The holding time and supporting calculations shall be submitted as an attachment to the monthly DMRs (See Footnote 8 of the Draft Permit).

The Draft Permit also maintains the requirement that if the Massachusetts Division of Marine Fisheries and/or the U.S. Food and Drug Administration determine in writing that the fecal coliform bacteria limits are inadequate to ensure protection of shellfish resources, and EPA concurs in writing, then the Permittee shall meet the applicable Water Quality Standards at end-of-pipe (See Footnote 11 of the Draft Permit):

Table 11: Alternate effluent bacteria limits if MA Marine Fisheries and/or USFDA deem necessary.

	Effluent Limitation			Monitoring Requirements	
Effluent Characteristic	Average monthly	Average Weekly	Maximum Daily	Measurement Frequency	Sample Type
Fecal Coliform Bacteria, (organisms/100 mL)	14	---	28	3/Day	Grab

5.1.7 Total Residual Chlorine

The Permittee uses chlorine for disinfection of the effluent. The 2000 Permit includes effluent limitations for total residual chlorine (TRC) of 456 µg/L (monthly average) and 631 µg/L (maximum daily). There have been no violations of the TRC limitations during the review period.

The applicable total residual chlorine criteria are found in the MA WQS at 314 CMR 4.06, Table 29. The saltwater instream criteria for chlorine are 7.5 µg/L (chronic) and 13 µg/L (acute). The Draft Permit maintains the TRC limitations from the 2000 Permit.

Because it is impossible to collect a sample at the end of the outfall tunnel where the diffuser discharges into Massachusetts Bay, MWRA constructed a simulation loop that simulates the plant's chlorination and dechlorination process. "In order to simulate the disinfectant contact time from the sample point to the point of dechlorination 850 feet within the outfall tunnel, a portion of the chlorinated wastewater from the plant's disinfection contact basins is continuously pumped, using a variable speed hose pump paced with the total plant flow, through the pipe loop sampling system, consisting of 1550 feet of 2" diameter PVC pipe. The flow is then dechlorinated with sodium bisulfite, just as occurs for the main plant effluent, at a rate that is paced with the concurrent total plant and sodium bisulfite chemical feed flows. This mimics the dechlorination process in the main plant. Samples collected downstream from this simulated dechlorination process are representative of the effluent released in the bay and are expected to contain negligible chlorine residual. Sampler(s) designed to collect flow proportional composite samples and instantaneous grab samples are positioned at the end of this pipe loop sampling system. Total chlorine residual tests are collected at this location and analyzed in the field immediately."[126]

Total Residual Chlorine Limitations were calculated as follows:

Chronic criteria * dilution factor = Chronic limit
7.5 µg/L * 70 = 525 µg/L (average monthly)

Acute criteria * dilution factor = Acute limit

[126] EMAIL. Betsy Reilley, MWRA to Michele Barden, EPA. January 28, 2022. RE: Effluent Bacteria Sampling Attachment: 20220128_sampleloop.docx.

11 µg/L * 70 = 770 µg/L (maximum daily)

Based on anti-backsliding requirements described in Section 2.6 of this Fact Sheet, EPA has maintained the water quality based effluent limits from the previous permit of 456 µg/L as a monthly average limit and 631 µg/L as a maximum daily limit. The monitoring frequency is 3 times per day.

For any pollutant with an existing WQBEL, EPA notes that the analysis described in 40 CFR § 122.44(d)(l)(i) has already been conducted in a previous permitting action demonstrating that there is reasonable potential to cause or contribute to an excursion of WQSs. Given that the permit already contains a WQBEL based on the prior analysis and the pollutant continues to be discharged from the Facility, EPA has determined that there is still reasonable potential for the discharge of this pollutant to cause or contribute to an excursion of WQSs. Therefore, the WQBEL will be carried forward unless specific conditions exist to justify relaxation in accordance with CWA §§ 402(o) or 303(d)(4).

5.1.8 Oil and Grease

The 2000 Permit includes narrative language that "the effluent shall not cause or contribute to an exceedance of the water quality standard which requires that the receiving water shall be free from oil and grease and petrochemicals." EPA interprets this narrative language to represent the absence of oil and grease in Massachusetts Bay. In this situation, EPA is establishing the oil and grease effluent limit as non-detect to reflect the absence of oil and grease in the receiving waters and to comply with the state's water quality standards. Because the limit is below the analytical detection limit for this pollutant, the Region is following guidance set forth in Technical Support Document for Water Quality-based Toxics Control, March 1991, EPA/505/2-90-001, pages 111-112 which recommends, "... that the compliance level be defined in the permit as the minimum level (ML)."

Data submitted by MWRA at EPA's request indicates a maximum effluent value of 39 mg/L for oil and grease (See Appendix F) using EPA method 1664B. The oil and grease ML is 5 mg/L using EPA Method 1664 (Revisions A and B) where the ML is the lowest point on the curve used to calibrate the test equipment for the pollutant of concern. If EPA approves a method under 40 CFR Part 136 for either, oil and/or grease that has a ML lower than 5 mg/l, the Permittee shall be required to use the improved method.

The Draft Permit includes an effluent limit of non-detect as the narrative criteria is "free from oil and grease and petrochemicals" at 314 CMR 4.05(4)(a)7. The monitoring frequency is once per day.

5.1.9 Ammonia

The 2000 Permit does not include ammonia limits but does require monthly monitoring and reporting of effluent ammonia concentrations.

Ambient data, taken outside the zone of influence of the MWRA outfall in the Massachusetts Bay near site N18, is presented in Appendix E. The median concentration for the warm weather period (April 1 through October 31) is 0.026 mg/L and for the cold weather period (November 1 through March 31) is 0.028 mg/L.

The ammonia criteria in EPA's *National Recommended Water Quality Criteria,* 2002 (EPA 822-R-02-047) document are included by reference in the Massachusetts WQS (*See* 314 CMR 4.05(5)(e)). The marine water quality criteria are dependent on pH and temperature.

In determining whether the discharge has the reasonable potential to cause or contribute to excursions above the instream water quality criteria for ammonia, EPA used the mass balance equation presented in Appendix G for both warm and cold weather conditions to project the ammonia concentration in the vicinity of the discharge near N18. When there is reasonable potential, this mass balance equation is also used to determine the effluent limit(s) that would be required in the Draft Permit.

To determine the applicable ammonia criteria, EPA used the 95th percentile temperature data from the MWRA in the vicinity of the discharge to calculate a warm weather maximum temperature of 19.95° C and a cold weather maximum temperature of 12.75° C. EPA took the 95th percentile due to the extensive data record available. EPA used the ambient pH monitoring shown in Appendix E, which indicates that the median pH is 8.2 S.U.

Based on the information and assumptions described above, Appendix G presents the applicable ammonia criteria, the details of the mass balance equation, the reasonable potential determination, and, if necessary, the limits required in the Draft Permit. As shown, there is no reasonable potential; therefore, the Draft Permit does not require ammonia limits. However, effluent ammonia shall be reported on monthly DMRs. Ambient monitoring for ammonia shall also be required as part of the quarterly WET tests and reported on the DMRs.

5.1.10 Nutrients

Nutrients are compounds containing nitrogen and phosphorus. Although nitrogen and phosphorus are essential for plant growth, high concentrations of these nutrients can cause eutrophication, a condition in which aquatic plant and algal growth is excessive. Plant and algae respiration and decomposition reduces dissolved oxygen in the water, creating poor habitat for fish and other aquatic animals. Recent studies provide evidence that both phosphorus and nitrogen can play a role in the eutrophication of certain ecosystems. However, typically phosphorus is the limiting nutrient triggering eutrophication in freshwater ecosystems and nitrogen is the limiting nutrient in marine or estuarine ecosystems. Thus, for this receiving water, and this permit, nitrogen is the nutrient of concern evaluated for effluent limitations in the discussion below.

5.1.10.1 Background

The DITP discharges into Massachusetts Bay which is an embayment in the western Gulf of Maine. At the time of the last permit issuance, there were conflicting thoughts about how the

relocation of the discharge might affect the Bay. One theory was that relocating the outfall would result in cleaning up Boston Harbor at the expense of polluting Massachusetts Bay. The other theory was that moving the discharge from Boston Harbor to Massachusetts Bay would not have a significant effect on Massachusetts Bay as nitrogen from the existing discharge to Boston Harbor was already rapidly flushed into Massachusetts Bay.[127]

To address the uncertainties and assure that WQSs are met, the 2000 Permit requires monthly monitoring and reporting of the effluent concentrations for total Kjeldahl nitrogen (TKN), total nitrate, and total nitrite (See Appendix C) and additional requirements. The additional requirements were based on the conservation recommendations included in the 1993 Biological Opinion (BO)[128] authored by National Marine Fisheries Service (NMFS) for the Section 7 Consultation under the Endangered Species Act. In response, the 2000 Permit requires the Permittee to develop and implement an ambient monitoring plan[129] and contingency plan.[130] Additionally, the Permittee is required to quantify ambient nitrogen, maintain a comprehensive technical survey of effective treatment technologies for nitrogen removal, and implement the Contingency Plan which includes caution and warning levels for total nitrogen, dissolved oxygen (DO), chlorophyll, and nuisance/noxious algae (See Table 12) among other parameters. The Contingency Plan and its thresholds were developed to identify any adverse impacts and determine if environmental conditions are changing or may in the future. The thresholds were established with consideration of MA WQSs, applicable at the time, baseline/background levels and expert opinion from the Outfall Monitoring Task Force (OMTF)[131] and later the Outfall Monitoring Science Advisory Panel (OMSAP).[132]

Table 12: Contingency Plan Thresholds related to nitrogen and its potential impacts

Parameter Type/Location	Parameter	Caution Level	Warning Level	Baseline/ Background
Effluent	Total Nitrogen	12,500 metric tons/year[133]	14,000 metric tons/year	
Water Column nearfield bottom; Stellwagen, bottom	Dissolved Oxygen, concentration	6.5 mg/L for any survey during stratification (Jun-Oct) unless background	6.0 mg/L for any survey during stratification (Jun-Oct)	Nearfield: 6.05 mg/L

[127] EPA, 1998, MWRA Fact Sheet, p. 20.
[128] NMFS, 1993, Endangered Species Act – Section 7 Consultation, Biological Opinion on the Boston Harbor Project: Issuance of a National Pollutant Discharge Elimination System (NPDES) Permit for the Massachusetts Water Resources Authority (MWRA) Outfall, Northeast Region Office, NMFS, September 8, 1993.
[129] MWRA, 1997, Massachusetts Water Resources Authority effluent outfall monitoring plan: Phase II Post-discharge monitoring. https://www3.epa.gov/region1/npdes/mwra/pdf/n.pdf
[130] MWRA, 2001, Massachusetts Water Resources Authority Contingency Plan, Revision 1. https://www.mwra.com/harbor/enquad/pdf/2001-ms-71.pdf
[131] The OMTF was established by the Massachusetts Executive Office of Environmental Affairs to oversee the development and implementation of the Outfall Monitoring Plan which was a predecessor to the Ambient Monitoring Plan required by the 2000 Permit.
[132] The OMSAP is a scientific and technical advisory panel to advise EPA and MassDEP on all scientific and technical matters related to the DITP outfall and the impacts of the discharge on the receiving waters.
[133] Based on prediction in EPA. 1988. Boston Harbor Wastewater Conveyance System: Final Supplemental Environmental Impact Statement.

Parameter Type/Location	Parameter	Caution Level	Warning Level	Baseline/ Background
		conditions are lower[134]	unless background conditions are lower	Stellwagen Basin: 6.23 mg/L
Water Column nearfield bottom; Stellwagen, bottom	Dissolved Oxygen saturation	<80% saturation for any survey during stratification unless background conditions are lower	<75% saturation for any survey during stratification unless background conditions are lower	Nearfield: 65.3%
				Stellwagen Basin: 67.2%
Water Column nearfield bottom	Oxygen Depletion Rate	1.5 x baseline (>0.037)	2 x baseline (>0.049)	0.024
Water Column nearfield	Chlorophyll (nearfield mean, mg m^{-2})	1.5 x baseline annual mean	2 x baseline annual mean	
		Annual: >108 mg m^{-2}	Annual: >144 mg m^{-2}	72 mg m^{-2}
	Chlorophyll-a	95th percentile of baseline seasonal mean		
		Winter/Spring: >199	---	50
		Summer: >89	---	51
		Autumn: >239	---	90
Water Column nearfield	Nuisance algae (except *Alexandrium*)	95th percentile of baseline seasonal mean		
	Pseudo-nitzschia pungens (nearfield mean, cells L^{-1})	Winter/Spring: >17,900 cells L^{-1}	---	6,735 cells L^{-1}
		Summer: >43,100 cells L^{-1}	---	14,635 cells L^{-1}
		Autumn: >27,500 cells L^{-1}	---	10,500 cells L^{-1}
	Phaeocystis pouchetti	Winter/spring: >2,860,000 cells L^{-1}	---	622,000 cells L^{-1}
		Summer: >357 cells L^{-1}	---	79 cells L^{-1}
		Autumn: >2,960 cells L^{-1}	---	370 cells L^{-1}
Water Column nearfield	*Alexandrium tamarense,* later changed.	100 cells L[135]		
	Alexandrium catenella	Any nearfield sample >100 cells L^{-1}	---	163 cells L^{-1} (Baseline max)

[134] LETTER. Michael J. Hornbrook, MWRA to Glenn Haas, MassDEP and Linda Murphy, EPA Region 1, November 15, 2001. Re: Massachusetts Water Resources Authority, Permit Number MA0103284, Proposed Changes to Contingency Plan: Dissolved Oxygen and *Alexandrium* thresholds. https://www.mwra.com/harbor/pdf/20011115_cpmod.pdf

[135] LETTER. Michael J. Hornbrook, MWRA to Glenn Haas, MassDEP and Linda Murphy, EPA Region 1, November 15, 2001. Re: Massachusetts Water Resources Authority, Permit Number MA0103284, Proposed Changes to Contingency Plan: Dissolved Oxygen and *Alexandrium* thresholds. https://www.mwra.com/harbor/pdf/20011115_cpmod.pdf

Parameter Type/Location	Parameter	Caution Level	Warning Level	Baseline/ Background
	(nearfield mean, cells L^{-1})			
Water Column nearfield	Zooplankton			
Water Column farfield	PSP extent[4]	New incidence		
Sediments, nearfield	Redox potential discontinuity	0.5 x baseline		

Ecological Setting: Massachusetts Bay

Massachusetts Bay is a partially enclosed embayment that flows into the Gulf of Maine to the east. It is a coastal water as it lies between the mean highwater mark of the coastal baseline and the shelf break, as defined in EPA's Nutrient Criteria-Estuarine and Coastal Waters.[136] The Bay is approximately 62 miles long and 31 miles wide and has an average water depth of 115 feet.[137] The physical, chemical, and biological properties of Massachusetts Bay vary due to seasonal cycling. Stellwagen Bank is an underwater plateau that borders the Bay to the east and is only 65 feet below the water surface therefore partially enclosing the Bay.[138] Stellwagen Bank is a designated National Marine Sanctuary established on November 4, 1992.[139]

There is a weak but persistent current that flows counterclockwise through the Massachusetts and Cape Cod Bays (See Figure 14). This current flows southwesterly past Cape Ann, and then flows south along the eastern coast of Massachusetts, flowing out of the Bay north of Race Point on Cape Cod. [140] In the late spring and summer, Cape Cod Bay can become isolated from this larger circulation.[141] The larger scale current is responsible for the far-field movement of the diluted effluent.

Massachusetts Bay experiences a seasonal cycle of stratification. Stratification is driven in early spring (typically April) by salinity variations caused by freshwater inputs from the rivers of the Gulf of Maine including the Merrimack, Androscoggin, Kennebec, and Penobscot Rivers.[142]

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[136] EPA. 2001. Nutrient Criteria Technical Guidance Manual-Estuarine and Coastal Marine Waters. [EPA-822-B-01-003], p. 1-5. https://www.epa.gov/sites/default/files/2018-10/documents/nutrient-criteria-manual-estuarine-coastal.pdf

[137] Signell, R. P., Jenter, H. L., & Blumberg, A. F. (1996). Circulation and effluent dilution modeling in Massachusetts Bay: Model Implementation, verification and results. *Open-File Report*. https://doi.org/10.3133/ofr9615

[138] Signell, R. P., Jenter, H. L., & Blumberg, A. F. (1996). Circulation and effluent dilution modeling in Massachusetts Bay: Model Implementation, verification and results. *Open-File Report*. https://doi.org/10.3133/ofr9615

[139] https://stellwagen.noaa.gov/about/

[140] Rockwell Geyer, W., Gardner, G. B., Brown, W. S., Irish, J., Butman, B., Loder, T., & Signall, R. 1992. Physical Oceanographic Investigation of Massachusetts and Cape Cod Bays. Massachusetts Bays Program. p. 1. https://archives.lib.state.ma.us/bitstream/handle/2452/49977/ocm36241802.pdf?sequence=1&isAllowed=y

[141] MWRA. 2003. Briefing for OMSAP Workshop on Ambient Monitoring Revisions, June 18-19, 2003. Boston: Massachusetts Water Resources Authority. Report 2003-ms-085. p.4.2 https://www.mwra.com/harbor/enquad/pdf/2003-ms-85.pdf

[142] W.R. Geyer, R.P. Signell , D.A. Fong , J. Wang , D.M. Anderson , B.A. Keafer. 2004. The Freshwater Transport

Discharges from the Charles River as well as the MWRA outfall make up only a small percent of the total freshwater inputs to the Bay.[143] As surface water temperatures warm in May and June, the stratification of the Bay intensifies and becomes driven by the temperature differences between the warmer surface waters and colder bottom waters. Typically, Massachusetts Bay remains stratified until October/November when surface water temperatures begin to cool, and winds increase causing the water column to mix. The water column is well mixed in the winter months.

Tides in the Bay are semidiurnal (every 12.4 hours). Because they are semidiurnal, they play a negligible role in the horizontal transport of materials as there is no net transport (i.e., they move back and forth). The tidal oscillations, however, can have an impact on vertical mixing which is an important factor in the diffusion of material.[144]

Southwesterly winds in the summer can cause upwelling of cold, dense water while northeasterly winds in the fall and winter can cause strong downwelling and assist in the vertical mixing of stratified layers.[145] Stronger and short-lived currents are driven by weather and tidal activity.[146]

Residence time for surface water in the Bay is on average 20 to 45 days; however, residence time for water below the pycnocline can be upwards of 300 days.[147]

In general, the nutrient loading in the Bay follows the same seasonal patterns as the stratification cycle with surface level nutrients increasing in the spring due to nutrient-laden, freshwater inputs and again in the fall as nutrient levels increase as stratification ends and nutrients become re-mixed throughout the water column. These increases in nutrients contribute to phytoplankton blooms that primarily occur in early spring and again in the fall. During April through October, when the Bay is stratified, nutrient levels in surface waters are diminished as phytoplankton deplete available nutrients and dissolved oxygen.[148] In the fall, mixing events (such as increasing winds and northeasterly storms) end the stratification and the water column is replenished with

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and Dynamics of the Western Maine Coastal Current. *Continental Shelf Research*; 24 (2004) 1339-1357. https://www.whoi.edu/fileserver.do?id=36085&pt=2&p=28251

[143] Rockwell Geyer, W., Gardner, G. B., Brown, W. S., Irish, J., Butman, B., Loder, T., & Signall, R. 1992. Physical Oceanographic Investigation of Massachusetts and Cape Cod Bays. Massachusetts Bays Program. p. 2. https://archives.lib.state.ma.us/bitstream/handle/2452/49977/ocm36241802.pdf?sequence=1&isAllowed=y

[144] J.D. Irish, & R.P. Signell. 1992. Tides of Massachusetts and Cape Cod Bays. p. 44 https://doi.org/10.1575/1912/857

[145] Rockwell Geyer, W., Gardner, G. B., Brown, W. S., Irish, J., Butman, B., Loder, T., & Signall, R. 1992. Physical Oceanographic Investigation of Massachusetts and Cape Cod Bays. Massachusetts Bays Program. p. 3. https://archives.lib.state.ma.us/bitstream/handle/2452/49977/ocm36241802.pdf?sequence=1&isAllowed=y

[146] MWRA. 2019. Ambient Monitoring Plan and Contingency Plan for the Massachusetts Bay Outfall: Monitoring Questions Status and 2000-2018 Threshold Test Results. p. 7.

[147] Signell, R. P., Jenter, H. L., & Blumberg, A. F. (1996). Circulation and effluent dilution modeling in Massachusetts Bay: Model Implementation, verification and results. *Open-File Report*. https://doi.org/10.3133/ofr9615

[148] Rockwell Geyer, W., Gardner, G. B., Brown, W. S., Irish, J., Butman, B., Loder, T., & Signall, R. 1992. Physical Oceanographic Investigation of Massachusetts and Cape Cod Bays. Massachusetts Bays Program. p. 1. https://archives.lib.state.ma.us/bitstream/handle/2452/49977/ocm36241802.pdf?sequence=1&isAllowed=y
MWRA. 2003. Briefing for OMSAP workshop on ambient monitoring revisions, June 18-19, 2003. Boston: Massachusetts Water Resources Authority. Report 2003-ms-085. P.4.2 https://www.mwra.com/harbor/enquad/pdf/2003-ms-85.pdf

nutrients previously trapped below the pycnocline which can then trigger fall blooms. Zooplankton blooms tend to follow within several weeks of a phytoplankton bloom.

Pre-discharge modeling estimated that oceanic inputs from the Gulf of Maine contribute 92% of the total nitrogen entering the Bay, with MWRA effluent contributing 3% and other sources (mostly atmospheric and riverine) contributing 5%.[149] Modeling was most recently updated in 2020 using the overall mass balance of nitrogen for 2016. The percentages have changed slightly with 93% of inflows from the Gulf of Maine and 7% from the DITP and negligible contributions from rivers; however, this updated model did not include inputs from CSOs or non-point sources.[150]

Coastal Waters Generally; Effect of Nutrients on Coastal Water Quality

The basic cause of nutrient problems in coastal waters is the enrichment of freshwater with nitrogen (N) and phosphorus (P) on its way to the sea and by direct inputs within tidal systems. EPA defines nutrient over-enrichment as the anthropogenic addition of nutrients, in addition to any natural processes, causing adverse effects or impairments to beneficial uses of a waterbody.[151]

Eutrophication is an aspect of nutrient overenrichment and is defined as an increase in the rate of supply of organic matter to a waterbody. Increased nutrient inputs promote a progression of symptoms beginning with excessive growth of phytoplankton and macroalgae to the point where grazers cannot control growth. Phytoplankton are microscopic algae growing in the water column and their biomass is measured by chlorophyll-a concentrations. Macroalgae are large algae, commonly referred to as "seaweed." The primary symptoms of nutrient overenrichment include an increase in the rate of organic matter supply, changes in algal dominance, and loss of water clarity which are followed by one or more secondary symptoms such as loss of submerged aquatic vegetation, nuisance/toxic algal blooms and low dissolved oxygen. In U.S. coastal waters, nutrient overenrichment is a common thread that ties together a diverse suite of coastal problems such as harmful algal blooms, fish kills, some marine mammal deaths, outbreaks of shellfish poisonings, loss of seagrass and bottom shellfish habitats, coral reef destruction, and hypoxia and anoxia.[152] Figure 15 shows the characteristic progression of nutrient impacts on a waterbody.

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[149] HydroQual. 2000. Bays Eutrophication Model (BEM): modeling analysis for the period 1992-1994. Boston: Massachusetts Water Resources Authority. Report ENQUAD 2000-02. S. 6-2 https://www.mwra.com/harbor/enquad/pdf/2000-02.pdf

[150] Required by the 2000 Permit, the Bay Eutrophication Model is a three-dimensional hydrodynamic water quality model developed in 1995 by HydroQual and the USGS and most recently updated in 2020 for the purpose of predicting conditions caused by nutrient loading and in order to support decisions about the need for nutrient limits and the appropriate level of any such limit for the discharge. An overview of the model can be found here: https://www.mwra.com/harbor/enquad/pdf/2021-02.pdf

[151] Bricker, S., B. Longstaff, W. Dennison, A. Jones, K. Boicourt, C. Wicks, and J. Woerner. 2007. Effects of Nutrient Enrichment In the Nation's Estuaries: A Decade of Change. NOAA Technical Memorandum NOS NCCOS Coastal Ocean Program Decision Analysis Series 26. Silver Spring, MD. 328 pp. https://repository.library.noaa.gov/view/noaa/25526

[152] Bricker, S., B. Longstaff, W. Dennison, A. Jones, K. Boicourt, C. Wicks, and J. Woerner. 2007. Effects of Nutrient Enrichment In the Nation's Estuaries: A Decade of Change. NOAA Technical Memorandum NOS NCCOS

Nutrient dynamics are complex and are influenced by flushing time, freshwater inflow and stratification, and water depth. The deleterious physical, chemical, and biological responses in surface waters resulting from excessive plant growth impair designated uses in the receiving water. Excessive plant growth can result in a loss of diversity and other changes in the aquatic plant, invertebrate, and fish community structure and habitat.

Nutrient-driven impacts on aquatic life and habitat are felt throughout the eutrophic cycle of plant growth and decomposition. Nutrient-laden plant detritus can settle to the bottom of a water body. In addition to physically altering the benthic environment and aquatic habitat, organic materials (i.e., nutrients) in the sediments can become available for future uptake by aquatic plant growth, further perpetuating and potentially intensifying the eutrophic cycle.

The excessive growth of aquatic plants and algae within marine water ecosystems negatively impacts water quality and can interfere with the attainment of designated uses by: 1) increasing oxygen demand within the water body to support an increase in both plant respiration and the biological breakdown of dead organic (plant) matter;[153] 2) causing an unpleasant appearance and odor; 3) interfering with navigation and recreation, for instance, by fouling engines and propellers, making waters unappealing to swimmers, and interfering with fishing lures and equipment; 4) reducing water clarity; 5) reducing the quality and availability of suitable habitat for aquatic life; and 6) producing toxins during certain harmful algal blooms. Cultural (or accelerated) eutrophication is the term used to describe dense and excessive plant growth in a water body that results from nutrients entering the system as a result of human activities. Discharges from municipal and industrial wastewater treatment plants, agriculture runoff, and stormwater are examples of human-derived (*i.e.*, anthropogenic) sources of nutrients in surface waters. See generally, *Nutrient Criteria Technical Guidance Manual – Estuarine and Coastal Marine Waters*, EPA October 2001 [EPA-822-B-01-003], Chapters 1 and 3.

Water Quality Standards Applicable to Massachusetts Bay

The MA WQS under 314 CMR 4.05(5)(c) require that:

> … unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site-specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00 including, but not limited to, those established in 314 CMR 4.06(6)(c): Table 28: Site-specific Criteria.

Coastal Ocean Program Decision Analysis Series 26. Silver Spring, MD. 328 pp.
https://repository.library.noaa.gov/view/noaa/25526

[153] "Algae" includes phytoplankton (microscopic algae measured by levels of chlorophyll a), macroalgae (commonly referred to as seaweed), and other plants stimulated by nutrient over-enrichment. Excessive algal growth contributes to low levels of dissolved oxygen through increased plant respiration and decomposition of dead plant matter. Notably, during the day, algae provide oxygen to the water as a by-product of photosynthesis. At night, however, when photosynthesis ceases but plant respiration continues, dissolved oxygen levels decline. Additionally, as these algae die, they are decomposed by bacteria that consume yet more oxygen. When dissolved oxygen levels are low, aquatic organisms become stressed and die, and overall aquatic health is degraded.

Nutrients are also prohibited in concentrations that would cause or contribute to cultural eutrophication. Cultural eutrophication may also result in exceedances of other nutrient-related water quality standards such as low dissolved oxygen, decreased water clarity, objectionable odors, and surface scum. The MA WQS at 314 CMR 4.05(4)(a)(1) requires that dissolved oxygen not be less than 6.0 mg/L Further, the MA WQS at 4.05(4)(a)(5), (6) and (8) state that waters must be free from "floating, suspended, and settleable solids," free from "color and turbidity in concentrations or combinations that are aesthetically objectionable…", and have no taste and odor other than of natural origin. To prevent cultural eutrophication, the MA WQS at 4.05(5)(c) states that, *any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non-POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control*. Also see Part 2.2.2 of this Fact Sheet above regarding antidegradation and existing uses which may be impacted by nutrient over-enrichment.

Nitrogen and Endangered Species Act Concerns for Massachusetts Bay

In its 1993 Biological Opinion for Endangered Species Act consultation Environmental Impact Statement and ultimately the 2000 Permit, the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) found that the "outfall may affect, but is not likely to jeopardize, the continued existence of any listed or proposed species under NMFS jurisdiction."[154] NOAA identified nutrient impacts as a primary concern for the relocation of the MWRA's outfall to Massachusetts Bay. Specifically, the Biological Opinion addressed the possibility that nitrogen in the outfall's effluent might cause or contribute to: (1) changes in prey availability and feeding patterns, (2) increased frequency and distribution of toxic phytoplankton blooms, and (3) increased biological oxygen demand. In response to these concerns, the 2000 Permit required effluent nitrogen monitoring (total Kjeldahl nitrogen (TKN), total nitrate and total nitrite).

Additionally, the Ambient Monitoring Plan[155] and Contingency Plan[156] included in the 2000 Permit required MWRA to collect ambient data for total nitrogen (nitrite, nitrate, and TKN), dissolved oxygen concentrations, dissolved oxygen respiration rate, chlorophyll, nuisance and noxious algae, zooplankton, and sediment oxygen. MWRA has collected over 30 years of ambient monitoring data including over eight years of baseline monitoring and over 20 years of monitoring since the diversion of the outfall discharge to Massachusetts Bay (post-diversion monitoring).

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[154] NOAA, NMFS. 1993. NOAA Fisheries Endangered Species Act, Section 7 Consultation – Biological Opinion, Boston Harbor Project: Issuance of a National Pollutant Discharge Elimination System (NPDES) Permit for the Massachusetts Water Resources Authority (MWRA) Outfall. 9/8/1993.
[155] MWRA. 1997. Massachusetts Water Resources Authority effluent outfall monitoring plan: Phase II Post-discharge monitoring. https://www3.epa.gov/region1/npdes/mwra/pdf/n.pdf
[156] MWRA. 2001. Contingency Plan, Revision 1. https://www.mwra.com/harbor/enquad/pdf/2001-ms-71.pdf

5.1.10.2 Effluent Nitrogen Data

The 2000 Permit required the Permittee to monitor effluent TKN, total nitrite and total nitrate once per month. Effluent data submitted in DMRs between January 2018 and December 2022 shows the following characterization of nitrogen in the DITP effluent: total Kjeldahl nitrogen (median=26.8 mg/L, n=60), total nitrite (median=0.25 mg/L, n=60) and total nitrate (median=0.165 mg/L, n=60) (See Appendix C). Using this data, calculated Total Nitrogen (=TKN+NO2+NO3) has a median concentration of 27.2 mg/L.

Although the median concentration of total nitrogen is high, there appears to be no significant ambient impacts due to the discharge of nitrogen. EPA's Office of Research and Development (ORD) concluded that "the discharge does not cause a broadly eutrophic condition in Massachusetts Bay…although local effects of the discharge on nutrient conditions have been noted."[157] Thus, the Draft Permit maintains the requirements for the Permittee to monitor total Kjeldahl nitrogen, total nitrate, total nitrite and calculate and report total nitrogen. This information is important as the Permittee continues to study the potential impacts of the discharge and any relationship to other ambient changes.

5.1.10.3 Ambient Nitrogen Data

Due to concern that nitrogen could cause excessive algal blooms, the Ambient Monitoring Plan requires the monitoring of nitrogen in Massachusetts and Cape Cod Bays.

Data show that the concentration of nitrate reflects seasonal variation with maximum concentrations occuring in February with a steady decline to minimum levels from May into October, and then steadily increasing in November and December.[158] Similar patterns are found throughout the review period.[159] Additional ambient sampling collected at Station N021, located immediately above the diffuser, shows that nitrates followed this seasonal pattern (See Attachment F and Figure 16). [160]

The Ambient Monitoring Plan also required MWRA to evaluate the performance of the outfall at achieving the anticipated dilution. MWRA has completed several dye studies discussed in Section 4.3 of this Fact Sheet. Additionally, MWRA has found that ammonium, which is the largest fraction of the total nitrogen in DITP effluent, makes a good effluent tracer.[161] MWRA has been monitoring ammonium concentrations in the ambient waters since pre-2000. The data indicate, that following the move of the discharge to Massachusetts Bay, ammonium

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[157] Hagy, J., T. Gleason, A. Oczkowski, A. Tatters, and Y. Wan. 2022. Technical Memorandum: Review of MWRA Water Quality Monitoring Results to Address Potential for Harmful Effects of the Deer Island Discharge on Threatened and Endangered Species in Massachusetts Bay. US Environmental Protection Agency, Office of Research and Development, Narragansett, RI. EPA/600/R-22/063. p.5., https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=355407&Lab=CEMM

[158] https://www.mwra.com/harbor/enquad/pdf/2021-07.pdf

[159] https://www.mwra.com/harbor/enquad/pdf/2020-08.pdf, p. 2-8, figure 2-8; https://www.mwra.com/harbor/enquad/pdf/2019-08.pdf, p. 2-8, figure 2-8; https://www.mwra.com/harbor/enquad/pdf/2018-04.pdf, p 2-9, figure 2-8; and https://www.mwra.com/harbor/enquad/pdf/2018-04.pdf, p. 2-9, figure 2-9.

[160] Ambient sampling was conducted in the Summer 2021 by the Permittee at the request of EPA.

[161] MWRA. 2021. 2020 Water Column Report: https://www.mwra.com/harbor/enquad/pdf/omo.pdf

concentrations increased at the monitoring stations closest to the outfall (N21, N18 and F15) with the plume extending approximately 6-9 miles from the outfall.[162] All though ammonium concentrations are elevated over the background conditions, they remain relatively comparable year to year with allowances for natural conditions. In the years following outfall relocation, ambient water column monitoring has recorded decreasing ammonium levels in the stations furthest from the outfall, with levels approaching the 1999 pre-diversion levels. Such a decline has also been noted in other survey regions, most notably in the "coastal region," which is influenced by changes in Boston Harbor water quality. Ammonium concentrations in most of Massachusetts Bay, including the area near Stellwagen Bank and Cape Cod Bay have remained within the range of baseline levels.

The Ambient Monitoring Plan (See Draft Permit Part I.6.e) requires the continued monitoring of ammonium in Massachusetts Bay.

5.1.10.4 Ambient Dissolved Oxygen as a potential indicator of eutrophication

The Ambient Monitoring Plan requires the Permittee to monitor dissolved oxygen (DO) concentrations and percent saturation in the bottom waters of the nearfield and Stellwagen Basin to compare with the DO thresholds in the Contingency Plan. The Contingency Plan warning threshold is 6.0 mg/L which is the WQS for the receiving water and the caution threshold is 6.5 mg/L.

There have been several violations of the state WQS for DO during the review period, but they appear associated with regional events and not directly to the MWRA outfall.[163,164,165,166] It is also noted that the MA WQS no longer include criterion for percent saturation.

Table 13: Bottom Water DO Survey Mean Concentrations (mg/L)

Time Period	Caution Level	Warning Level	Baseline/Background	2021	2020	2019	2018	2017
Survey Mean June-October	<6.5	<6.0	Nearfield: 6.05	6.36	6.69	7.18	6.83	7.33
			Stellwagen Basin: 6.23	5.89	7.14	7.35	7.07	7.36

[162] MWRA. 2020 Water Column Report: https://www.mwra.com/harbor/enquad/pdf/omo.pdf
[163] https://www.mwra.com/harbor/pdf/20221207_amx.pdf
[164] https://www.mass.gov/news/monitoring-and-understanding-low-dissolved-oxygen-in-cape-cod-bay
[165] Hagy, J., T. Gleason, A. Oczkowski, A. Tatters, and Y. Wan. 2022. Technical Memorandum: Review of MWRA Water Quality Monitoring Results to Address Potential for Harmful Effects of the Deer Island Discharge on Threatened and Endangered Species in Massachusetts Bay. US Environmental Protection Agency, Office of Research and Development, Narragansett, RI. EPA/600/R-22/063. p.5., https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=355407&Lab=CEMM
[166] Jeff Rosen, OMSAP. 2023. Meeting minutes from OMSAP Annual Meeting, Annual Review of Massachusetts Water Resources Authority (MWRA) Outfall Monitoring Program, p. 1., https://www3.epa.gov/region1/npdes/mwra/omsap/pdfs/omsap-meeting-notes-attendance-20230210.pdf

Table 14: Bottom Water DO Survey Mean Percent Saturation (%)

Time Period	Caution Level	Warning Level	Baseline/ Background	2021	2020	2019	2018	2017
Survey Mean June-October	<80%	<75%	Nearfield: 65.3%	71.3%	73.1%	81.2%	75.5%	78.9%
			Stellwagen Basin: 67.2%	65.9%	74.3%	79.0%	76.3%	77.2%

DO levels in 2020 were low from February through June with May and June levels at or below historic minimums at many stations.[167]

In the summers of both 2019 and 2020, hypoxic events were documented in the shallow waters of southwestern Cape Cod Bay. The events were investigated by Massachusetts Division of Marine Fisheries, the Center for Coastal Studies and Woods Hole Oceanographic Institute and the subject of a MassBays Program Science Forum: Investigating and Responding to Hypoxia in Cape Cod Bay.[168]

Cape Cod Bay, near Barnstable Harbor, experienced a hypoxic event in late September/early October of 2019 that led to the mortality of bottom fish and lobsters in traps in the area. It was theorized that an August/September dinoflagellate (a type of phytoplankton) bloom and prolonged strong stratification that isolated a thin bottom water layer contributed to this hypoxic event.[169] The decomposition of the phytoplankton biomass at the end of the bloom likely led to low dissolved oxygen conditions which could not mix with the rest of the water column leading to marine life depth at the bottom depth.

Again, in the late summer of 2020, bottom water DO in Cape Cod Bay was <2.0 mg/L. High chlorophyll levels were observed concurrently. Phytoplankton abundance was also high, and a significant portion of the phytoplankton was identified as the dinoflagellate *Karenia mikimotoi. Karenia mikimotoi* is a recent phenomenon in the Massachusetts and Cape Cod Bays and was first observed in 2017. *Karenia mikimotoi* increases have been reported by others elsewhere in the northeast during the same period, suggesting regional processes are likely responsible.[170] The combination of the bloom, strong stratification and a thin bottom layer were thought to contribute to the low DO during this event.

Both hypoxia events appear to be localized to Cape Cod Bay, but part of a larger regional regime shift of warming temperatures and changes in dominant wind direction in the summer

[167] MWRA. 2021. 2020 Water Column Monitoring Results. pp. 2-17 through 2-19.
[168] https://www.mass.gov/news/massbays-science-forum-investigating-and-responding-to-hypoxia-in-cape-cod-bay
[169] MWRA 2020. 2019 Water Column Monitoring Results. p. vi., https://www.mwra.com/harbor/enquad/pdf/2020-08.pdf
[170] MWRA. 2020. 2019 Water Column Monitoring Results. p. vii. https://www.mwra.com/harbor/enquad/pdf/2020-08.pdf

months.[171,172] Ambient monitoring for dissolved oxygen will continue to be monitored in the revised ambient monitoring requirements.

5.1.10.5 Ambient Oxygen Depletion Rate as a potential indicator of eutrophication

Oxygen depletion rate is not in the MA WQS, but it was included in the Contingency Plan as it is a more direct measure of potential wastewater effluent impacts on dissolved oxygen levels than an ambient DO value. Rates over the review period are considerably lower than the baseline and threshold levels. Calculations for oxygen depletion rate will continue to be performed as required by the AMP in order to track this important measure and identify potential impacts in Massachusetts Bay related to nitrogen discharged from the MWRA outfall T01.

Table 15: Bottom water DO rate of decline/oxygen depletion rate

Time Period	Caution Level	Warning Level	Baseline /Background	2021	2020	2019	2018	2017
Survey Mean June-October	>0.037	>0.049	0.024	0.012	0.018	0.011	0.010	0.013

5.1.10.6 Ambient Chlorophyll as a potential indicator of eutrophication

Chlorophyll *a* concentration is the most common measure of algal biomass. The Ambient Plan requires the measurement of chlorophyll *a*. There are no state or federal water quality standards for chlorophyll *a*. The threshold levels in the Contingency Plan are based on the predictions in the SEIS[173] and the NOAA Estuarine Eutrophication Survey.[174]

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[171] Scully, Malcom E., Geyer, W. Rockwell, Borkman, David, Pugh, Tracy L., Costa, Amy, and Nichols, Owen C. 2022. Unprecedented summer hypoxia in southern Cape Cod Bay: an ecological response to regional climate change? Biogeosciences. 19, pp. 3523-3536, 2022. https://bg.copernicus.org/articles/19/3523/2022/bg-19-3523-2022.pdf

[172] Hagy, J., T. Gleason, A. Oczkowski, A. Tatters, and Y. Wan. 2022. Technical Memorandum: Review of MWRA Water Quality Monitoring Results to Address Potential for Harmful Effects of the Deer Island Discharge on Threatened and Endangered Species in Massachusetts Bay. US Environmental Protection Agency, Office of Research and Development, Narragansett, RI. EPA/600/R-22/063. p.6., https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=355407&Lab=CEMM

[173] EPA. 1988. Boston Harbor Wastewater Conveyance System Supplemental Environmental Impact Statement. EPA Region 1, Boston, MA., https://nepis.epa.gov/Exe/ZyNET.exe/91021J2C.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1986+Thru+1990&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C86thru90%5CTxt%5C00000033%5C91021J2C.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

[174] NOAA. 1993. Estuarine Eutrophication Survey.

In general, chlorophyll *a* concentrations in Massachusetts Bay exhibit a seasonal pattern similar to nitrate with elevated levels occuring during winter/spring and then again in fall.

Chlorophyll *a* concentrations did not exceed the Contingency Plan thresholds (see Table 16)[175] during the review period and were close to baseline values or a little higher. These concentrations have not significantly changed since the outfall was diverted.[176]

It is noted that sampling was not done in the winter/spring of 2020 due to COVID-19 safety requirements.

Table 16: Ambient Chlorophyll *a* (nearfield mean, mg m^{-2})

Time Period	Caution Level	Warning Level	Baseline /Background	2021	2020	2019	2018	2017
Annual	>108	>144	72	49	NV	92	71	77
Winter/spring	>199	---	50	62	NV	112	73	88
Summer	>89	---	51	43	54	57	58	58
Autumn	>239	---	90	42	102	132	95	99

*NV=no value

The most recent National Estuarine Eutrophication Assessment update from NOAA[177] reported Massachusetts Bay's eutrophic condition as moderate, in the middle of its ranking system, with no change in its condition between the 1999 assessment[178] and the 2004 update. The moderate rating denoted elevated chlorophyll *a* concentrations and low nuisance/toxic algal blooms which occurred less regularly and/or over a medium-sized area.[179] However, this rating of low for nuisance/toxic algal blooms did not take into account the potential presence of local *Alexandrium* cysts in Massachusetts Bay sediments or the *Pseudo-nitzschia* spp. and *Karenia mikimotoi* algal blooms which occurred after 2004. The possible local initiation of some of these algal blooms to Massachusetts Bay and resulting hypoxic conditions (in the case of *K. mikimotoi*) may increase the eutrophication rating. The outlook for Massachusetts Bay was positive in this report, as it has

[175] Libby, P. S., Borkman, D., Geyer, R., Turner, J., Costa, A., Taylor, D., Wang, J., & Codiga, D. (n.d.). (rep.). 2020 Water Column Monitoring Results., https://www.mwra.com/harbor/enquad/pdf/2021-07.pdf

[176] Reilley, B., Charlestra, L., Codiga, D., Keay, K., & Taylor, D. (2018). 25 Years of Monitoring, What Have We Learned? Nutrient Levels in Massachusetts Bay and Boston Harbor. *Proceedings of the Water Environment Federation*, *2018*(7), pp.5808–5818., https://doi.org/10.2175/193864718825138600

[177] Bricker, S., B. Longstaff, W. Dennison, A. Jones, K. Boicourt, C. Wicks, and J. Woerner. 2007. Effects of Nutrient Enrichment In the Nation's Estuaries: A Decade of Change. NOAA Technical Memorandum NOS NCCOS Coastal Ocean Program Decision Analysis Series 26. Silver Spring, MD. pp. 328 ., https://repository.library.noaa.gov/view/noaa/17779

[178] Bricker, S.B., C.G. Clement, D.E. Pirhalla, S.P. Orlando, and D.R.G. Farrow. 1999. National Estuarine Eutrophication Assessment: Effects of Nutrient Enrichment in the Nation's Estuaries. NOAA National Ocean Service Special Projects Office and the National Centers for Coastal Ocean Science. Silver Spring, MD. 71 pp., https://coastalscience.noaa.gov/data_reports/national-estuarine-eutrophication-assessment-effects-nutrient-enrichment-nations-estuaries/

[179] Bricker, S., B. Longstaff, W. Dennison, A. Jones, K. Boicourt, C. Wicks, and J. Woerner. 2007. Effects of Nutrient Enrichment In the Nation's Estuaries: A Decade of Change. NOAA Technical Memorandum NOS NCCOS Coastal Ocean Program Decision Analysis Series 26. Silver Spring, MD. pp. 328 , https://repository.library.noaa.gov/view/noaa/17779

been shown to have a low susceptibility to nitrogen inputs to its ability to dilute and flush nutrients.[180] Additionally, it was determined that natural variation in factors such as water temperature, stratification, and wind had a larger impact on chlorophyll *a* concentrations near the outfall than its nutrient output.[181] Warming water temperature and changing winds related to a regional regime shift may change this outlook and deviate chlorophyll *a* patterns, algal bloom dynamics, and other effects of eutrophication from the observed historical trends.

Ambient monitoring for chlorophyll *a* will be required by the revised ambient monitoring plan (see Part I.I.6 of the Draft Permit).

5.1.10.7 Nuisance Algae as a potential indicator of eutrophication

Nuisance and harmful algae are present in Massachusetts and Cape Cod Bays annually in low numbers. When certain algal species or genera increase in abundance and cause negative impacts to the environment or human health, then those are considered nuisance or harmful algal blooms. These blooms can become abundant because of anthropogenic nutrient sources, especially nitrogen, which is why they are a particular focus in the AMP. The Contingency Plan has thresholds set for the seasonal abundance for three microalgal or phytoplankton species of interest: the dinoflagellate *Alexandrium catenella,* the diatom *Pseudo-nitzschia pungens* and the prymnesiophyte *Phaeocyctis pouchetii.* Thresholds were set based on the 95th percentile of the baseline seasonal means.[182] The current Ambient Monitoring Plan requires *Alexandrium* sampling using a gene probe and Phytoplankton and zooplankton sampling by net tow for later identification and enumeration. These requirements continue in the Draft Permit (see Part I.I.6 of the Draft Permit).

Alexandrium catenella

Alexandrium catenella typically blooms during April to June and can cause Paralytic Shellfish Poisoning (PSP), which is colloquially called “red tide”. It has been found in Massachusetts’ coastal waters since the 1970s. The source of *Alexandrium* blooms within Massachusetts Bay has typically been from the advection of populations from cyst beds in the western Gulf of Maine; however, in 2019 and 2020, there has been detection of *Alexandrium* cysts in the western Massachusetts Bay seafloor suggesting the potential for localized germination of cysts.[183] Additional research is ongoing to investigate whether these cysts may be a local source of *Alexandrium* blooms to Massachusetts Bay.

The *Alexandrium* blooms in Massachusetts Bay in 2019 and 2021 varied from the usual trends observed in previous blooms that originated off the coast of Maine and traveled south. It was

[180] Bricker, S., B. Longstaff, W. Dennison, A. Jones, K. Boicourt, C. Wicks, and J. Woerner. 2007. Effects of Nutrient Enrichment In the Nation’s Estuaries: A Decade of Change. NOAA Technical Memorandum NOS NCCOS Coastal Ocean Program Decision Analysis Series 26. Silver Spring, MD. pp. 328 , https://repository.library.noaa.gov/view/noaa/17779
[181] Oviatt, Candace A., Hyde, Kimberly J.W., Keller, Aimee A., and Turner, Jefferson T. 2007. Production Patterns in Massachusetts Bay with Outfall Relocation. *Estuaries and Coasts*, Vol 30. No. 1. p. 35-46.
[182] MWRA. 2001. Contingency Plan Revision 1. p. 26., https://www.mwra.com/harbor/enquad/pdf/2001-ms-71.pdf
[183] MWRA. 2020 Water Column Monitoring Report. pp. 2-26., https://www.mwra.com/harbor/enquad/pdf/2001-ms-71.pdf

hypothesized that the first indications of an outfall effect on *Alexandrium* blooms would be earlier and higher toxicity detected in shellfish on the South Shore of Massachusetts, compared to samples from the North Shore. The *Alexandrium* blooms in 2019 and 2021 had some signs of this and in 2019, PSP toxins exceeded shellfish safety thresholds along the South Shore first. There were indications that this 2019 bloom originated north in the Gulf of Maine including early PSP toxicity in shellfish in New Hampshire and northeast winds which contributed to strong inshore currents to transport *Alexandrium* cells. However, the first detectable PSP toxicity samples[184] in shellfish were along the South Shore of Massachusetts, not along the North Shore as is typically expected. From June 19 – July 19, shellfishing areas were closed from Boston to Plymouth. There were no closures within Massachusetts Bay north of Boston. NOAA modelers suggested higher nutrients contributed to the 2019 *Alexandrium* bloom magnitude and duration, as *Alexandrium* can take advantage of nutrients below the summer pycnocline due to their vertical migration in the water column[185]. During the 2021 *Alexandrium* bloom in Massachusetts Bay, *Alexandrium* and its associated toxin were absent from the waters north of Massachusetts Bay[186], but were present at the more southern stations. These observations of the 2019 and 2021 *Alexandrium* blooms may indicate deviations from the past trends and potential influence from a possible Boston Harbor cyst bed and nutrients, such as those provided by the outfall. It is difficult to determine if the nutrients from the outfall are being directly utilized by *Alexandrium* during these events, but it is known that *Alexandrium* uses ammonium (the largest component of nitrogen released from the outfall) for its growth. EPA finds that *Alexandrium* rapid response surveys must continue to understand these changing bloom dynamics and possible outfall influences. Additionally, *Alexandrium* blooms typically last for about a month, so the routine monthly sampling may miss these events, and the typical whole water phytoplankton enumeration method may not appropriately capture these cell counts.

The Draft Permit requires sampling for *Alexandrium* during the nine (9) water column surveys that are listed in the Draft Permit at Part I.I.6.c. Table 1.

The Ambient Monitoring Plan in the Draft Permit (see Part I.I.6.f.(1)) details the conditions that initiate weekly *Alexandrium* Rapid Response Study (ARRS) including a bloom or imminent bloom in Massachusetts Bay, or *Alexandrium* cells exceed 100 cells/L, or if high levels of paralytic shellfish poisoning (PSP) are reported. PSP toxicity results should be monitored from the multiple sources identified in the Draft Permit. Once an ARRS survey begins, MWRA must continue weekly sampling for *Alexandrium* until abundance decreases below 100 cells/L and the toxicity data are no longer above the closure level (80 µg STX equiv./100 g).

Table 17: *Alexandrium catenella* (nearfield, cells L)

[184] Libby PS, Borkman DG, Geyer WR, Turner JT, Costa AS, Taylor DI, Wang J, Codiga D. 2020. 2019 Water Column Monitoring Results. Boston: Massachusetts Water Resources Authority. Report 2020- 08. pp.2-26., https://www.mwra.com/harbor/enquad/pdf/2020-08.pdf

[185] Libby PS, Borkman DG, Geyer WR, Turner JT, Costa AS, Taylor DI, Wang J, Codiga D. 2020. 2019 Water Column Monitoring Results. Boston: Massachusetts Water Resources Authority. Report 2020- 08. pp. 2-27., https://www.mwra.com/harbor/enquad/pdf/2020-08.pdf

[186] LETTER. Carolyn M. Fiore, MWRA to Todd Borci, EPA and Catherine Vakalopoulos, MWRA. June 29, 2021. RE: Massachusetts Water Resources Authority, Permit Number MA0103284, Quarterly Ambient Monitoring Results and Contingency Plan Reporting.

Time Period	Caution Level	Warning Level	Baseline /Background	2021	2020	2019	2018	2017
Any nearfield sample	>100	---	Baseline Max 163	7,386	45	24,342	4	494

Pseudo-nitzschia

Also relevant to Massachusetts Bay are harmful algal blooms caused by *Pseudo-nitzschia.* Some species of the diatom genus *Pseudo-nitzschia* produce a potent neurotoxin called domoic acid which causes Amnesic Shellfish Poisoning (ASP). An unprecedented bloom occurred in the Gulf of Maine in 2016 that led to the first shellfish bed closures in New England due to domoic acid exceeding the action limit in shellfish tissue.[187] The bloom began in the Gulf of Fundy in late September and progressed down the coast of Maine. [188] It continued down the coast and also led to a precautionary closure of shellfish beds in all waters south of Cape Cod in October 2016, but all concentrations of domoic acid in shellfish tissue in Massachusetts were below the action limit.[189] Since then, domoic acid has continued to close shellfish areas in Maine in 2017 – 2020[190]. Similar to *Alexandrium* bloom dynamics, toxic *Pseudo-nitzschia* may enter Massachusetts waters by being advected from north to south as shown by the 2016 closure which started north in the Bay of Fundy and traveled south to Massachusetts. However, there was a shellfish harvest closure due to domoic acid in 2017 which only impacted Rhode Island.[191, 192] There may be other processes influencing *Pseudo-nitzschia* blooms than Gulf of Maine currents.

Pseudo-nitzschia diatoms have been present in MWRA monitoring since its start in 1992;[193] however, it wasn't until 2016 that there were closures in Massachusetts Bay due to its toxin production. The apparent increased toxicity resulting in closures is likely due to the introduction

[187] Bates, Stephen S., et al. "Pseudo-nitzschia, Nitzschia, and domoic acid: New research since 2011." *Harmful Algae* 79 (2018): 3-43.
[188] Suzanna Clark, et. al. 2019. "*Pseudo-nitzschia* bloom dynamics in the Gulf of Maine: 2012-2016." *Harmful Algae* 88 (2019) 101656.
[189] Massachusetts Division of Marine Fisheries. 2016. Information regarding the current shellfish area closures in Massachusetts associated with Amnesic Shellfish Poisoning https://www.mass.gov/doc/asp-shellfish-area-closures-update-102116/download#:~:text=On%20October%2011%20The%20Massachusetts,toxin%20domoic%20acid%20(DA).
[190] Suzanne Clark et. al 2021. Investigation *Pseudo-nitzschia australis* introduction to the Gulf of Maine with observations and models. *Continental Shelf Research* 228(2021) 104493.
[191] Bates, Stephen S., et al. "Pseudo-nitzschia, Nitzschia, and domoic acid: New research since 2011." *Harmful Algae* 79 (2018): 3-43
[192] Sterling, Alexa R., Kirk, Riley D., Bertin, Matthew J., Rynearson, Tatiana A., Borkman, David G., Caponi, Marissa C., Carney, Jessica, Hubbard, Katherine A., King, Meagan A., Maranda, Lucie, McDermith, Emily J., Santos, Nina R., Strock, Jacob P., Tully, Erin M., Vaverka, Samantha B., Wilson, Patrick D., and Jenkins, Bethany D. 2021. "Emerging harmful algal blooms caused by distinct seasonal assemblages of the toxic diatom *Pseudo-nitzschia* in Narragansett Bay, RI, USA. bioRxiv: The Preprint Server for Biology. https://doi.org/10.1101/2021.08.18.456122
[193] MWRA. 2019. Ambient Monitoring Plan and Contingency Plan for Massachusetts Bay outfall: Monitoring questions status and 2000-2018 threshold test results. p. 11., https://www.mwra.com/harbor/enquad/pdf/2019-03.pdf

of *Pseudo-nitzschia australis*, a species previously not observed in New England waters.[194] The Contingency Plan thresholds focused on *Pseudo-nitzschia pungens* and were not exceeded during the review period. However, abundance was ~10% higher than long-term mean levels in 2020.[195] The continued monitoring of *Pseudo-nitzschia* is warranted, as species composition has shifted in the region and domoic acid related closures have increased. Enumerating *Pseudo-nitzschia* cells should include all species, as it is difficult to distinguish species using light microscopy and cell size does not correspond to toxin production. It should be noted that the *Pseudo-nitzschia pungens* cell type is large and so is the new species of concern *Pseudo-nitzschia australis.* The Draft Permit requires sampling for *Pseudo-nitzschia* during the nine (9) water column surveys that are listed in the Draft Permit at Part I.I.6.c. Table 1. *Pseudo-nitzschia* shall be identified and enumerated using the method detailed in the 2021 QAPP. *Pseudo-nitzschia* abundance shall be reported as all *Pseudo-nitzschia* cells at the genus level regardless of the assumed species or cells size, not just *Pseudo-nitzschia pungens* or *Pseudo-nitzschia multiseries* type cells. Additionally, a plankton sample shall be collected at each station during the regular water column surveys as detailed in the Draft Permit at Part I.I.6 f.(2). The sample shall be tested for the presence or absence of domoic acid if one of the following conditions are true: *Pseudo-nitzschia* spp. cell counts at the corresponding station exceed 15,000 *Pseudo-nitzschia* cells/L, or *Pseudo-nitzschia australis* is possibly present in the corresponding station sample at elevated abundance deduced from the presence of over 2,000 cells/L large *Pseudo-nitzschia* cells equal or greater than 3 µm in width or there is a co-occuring shellfish harvest closure due to domoic acid or elevated *Pseudo-nitzschia* cell abundance in Massachusetts Bay.

The Ambient Monitoring Plan in the Draft Permit (see Part I.I.6.f.(2)) details the conditions that initiate weekly *Pseudo-nitzschia* Surveys including a bloom in Massachusetts Bay or possibly imminent bloom in waters north of Massachusetts Bay; or *Pseudo-nitzschia* cells exceed 15,000 cells/L and/or *P. australis* is likely present in samples and domoic acid is present in the 20 µm concentrated sample; or if domoic acid in blue mussels is between over 1 mg toxin per 100 g shellfish meat in Cohasset, Scituate, or Marshfield MA DMF stations; or if domoic acid in blue mussels is equal to or exceeds 2 mg toxin per 100 g shellfish meat in any MA DMF stations. MWRA shall assess the availability of a species-specific DNA probe to confirm the presence of the highly toxic and problematic species *Pseudo-nitzschia australis* and if available, MWRA shall implement this probe into routine water column sampling and *Pseudo-nitzschia* Rapid Response Sampling. Once a *Pseudo-nitzschia* Rapid Response Study is initiated, weekly sampling will continue until all stations are below 15,000 cells/L and no domoic acid is present through the Rapid Scotia Test or equivalent method. If a *Pseudo-nitzschia* Rapid Response Study is commenced, the Permittee shall submit a written report with the monthly DMR occurring 60 days following the completion of the survey.

[194] Suzanna Clark, et. al. 2019. "*Pseudo-nitzschia* bloom dynamics in the Gulf of Maine: 2012-2016." *Harmful Algae* 88 (2019) 101656.
[195] MWRA. 2020 Water Column Monitoring Report. p. 2-22., https://www.mwra.com/harbor/enquad/pdf/2021-07.pdf

Table 17: *Pseudo-nitzschia pungens* (nearfield, cells L^{-1})

Time Period	Caution Level	Warning Level	Baseline /Background	2021	2020	2019	2018	2017
Winter/spring	>17,900	---	6,735	130	NV	18	122	68
Summer	>43,100	---	14,635	3110	366	598	245	273
Autumn	>27,500	---	10,500	94	1,150	523	518	1780

Phaeocystis pouchetti

Phaeocystis pouchetti is a cold-water species in Massachusetts Bay which may form nuisance blooms that use up a large portion on the nutrients in the environment and negatively impact food web dynamics. *Phaeocystis* blooms likely consume a large portion of nitrate and phosphate, and the species occurs in temperatures ranging from 1.7 – 10.6 °C in Massachusetts Bay.[196] *Phaeocystis* can also utilize ammonium as a source of nitrogen, such as the anthropogenic source from the outfall.[197] Significant blooms can alter ecosystem functions, causing low dissolved oxygen, fish mortality, and the formation of sea foam on beaches impacting aesthetics. However, blooms in Massachusetts Bay have not resulted in beach foaming events.[198] *Phaeocystis pouchetti* has been found in the waters of Massachusetts Bay since the 1990s and there is high variability in their blooms across years.[199] The formation of large blooms seems to be influenced by regional events such as the introduction of nutrients from the western Gulf of Maine[200] and reduced river flow into Massachusetts Bay.[201]

During the review period for this permit, there have been no exceedance of the former thresholds. MWRA requested at the October 27, 2016 OMSAP meeting that OMSAP drop the Contingency Plan threshold for *Phaeocystis pouchetti.* OMSAP agreed to drop the threshold but

[196] Borkman, D.G., Libby, P.S., Mickelson, M.J. *et al.* 2016. Variability of Winter-Spring Bloom *Phaeocystis pouchetii* Abundance in Massachusetts Bay. *Estuaries and Coasts* **39,** 1084–1099. https://doi.org/10.1007/s12237-016-0065-5
[197] Borkman, D.G., Libby, P.S., Mickelson, M.J. *et al.* 2016. Variability of Winter-Spring Bloom *Phaeocystis pouchetii* Abundance in Massachusetts Bay. *Estuaries and Coasts* **39,** pp. 1084–1099. https://doi.org/10.1007/s12237-016-0065-5
[198] Borkman, D.G., Libby, P.S., Mickelson, M.J. *et al.* 2016. Variability of Winter-Spring Bloom *Phaeocystis pouchetii* Abundance in Massachusetts Bay. *Estuaries and Coasts* **39,** pp. 1084–1099. https://doi.org/10.1007/s12237-016-0065-5
[199] Mingshun Jiang, et al. 2014. Nutrient input and the competition between Phaeocystis pouchetti and diatoms in Massachusetts Bay spring bloom. Journal of Marine Systems 134 (2014) 29-44.
[200] Mingshun Jiang, et al. 2014. Nutrient input and the competition between Phaeocystis pouchetti and diatoms in Massachusetts Bay spring bloom. Journal of Marine Systems 134 (2014) 29-44
[201] Borkman, D.G., Libby, P.S., Mickelson, M.J. *et al.* 2016. Variability of Winter-Spring Bloom *Phaeocystis pouchetii* Abundance in Massachusetts Bay. *Estuaries and Coasts* **39,** pp. 1084–1099. https://doi.org/10.1007/s12237-016-0065-5

required continued monitoring.[202] The changes were approved on an interim and final basis by EPA in 2017 and 2018, respectively.[203,204]

Phaeocystis pouchetii shall continue to be reported as part of the list of harmful or nuisance alga of interest (See Section 5.12.2 of this Fact Sheet for further discussion of harmful and nuisance alga).

Table 18: *Phaeocystis pouchetii* (nearfield mean, cells L^{-1})

Time Period	Caution Level*	Warning Level	Baseline /Background	2021	2020	2019	2018	2017
Winter/spring	>2,860,000	---	622,000	180,000	N/A	112	73	88
Summer	>357	---	79	N/A	N/A	57	58	58
Autumn	>2,960	---	370	N/A	N/A	132	95	99

*Thresholds were dropped in 2017/2018.

Additional

5.1.10.8 Nitrogen and related indicator data and responsiveness to NMFS concerns

As previously stated, back in 1993, NMFS found that the "outfall may affect, but is not likely to jeopardize, the continued existence of any listed or proposed species under NMFS jurisdiction."[205] As can be seen above, the Permittee has collected extensive data to address NMFS concerns about the impact that nitrogen may have on prey availability, the frequency and distribution of toxic phytoplankton blooms and increased biological oxygen demand. EPA has reviewed the previously discussed data with regard to NMFS's specific concerns.

Prey Availability

To address NMFS concerns about potential changes in prey availability, the Contingency Plan and the Ambient Monitoring Plan included in the 2000 Permit required monitoring of chlorophyll *a*, phytoplankton, and zooplankton abundance.

The monitoring data show that the elevated nutrient levels in the nearfield have not translated into significant biological responses.[206] BACI (Before/After Control Impact) analysis of nearfield and farfield chlorophyll levels found no significant changes resulting from the outfall

[202] OMSAP. 2016. Meeting Notes of October 27, 2016. https://www3.epa.gov/region1/npdes/mwra/omsap/pdfs/omsap-meeting-notes-attendance-20161027.pdf
[203] LETTER. Matthew Liebman, EPA to Michael J. Hornbrook, MWRA. February 3, 2017. Re: Interim Contingency Plan Threshold modifications.
[204] LETTER. Matthew Liebman, EPA to Michael J. Hornbrook, MWRA. February 15, 2018. Re: Final 2017 Contingency Plan Threshold modifications.
[205] NOAA. National Marine Fisheries Service. 1993. Boston Harbor Project: Issuance of a National Pollutant Discharge Elimination System (NPDES) Permit for the Massachusetts Water Resources Authority (MWRA) Outfall. National Marine Fisheries Service, Northeast Region, p. i
[206] Hunt, C.D., Borkman, D.G., Libby, P.S. *et al.* Phytoplankton Patterns in Massachusetts Bay—1992–2007. *Estuaries and Coasts* **33,** 448–470 (2010). https://doi.org/10.1007/s12237-008-9125-9

relocation. Ambient monitoring data have also been used to inform and calibrate hydrodynamic and water quality models. Projections from these models also show that relocation of the outfall has very little impact on chlorophyll levels throughout Massachusetts and Cape Cod Bays.[207]

Despite the lack of a causal link between outfall-related nutrient concentrations and plankton dynamics, some noteworthy regional trends in both phytoplankton and zooplankton communities have been observed since the diversion.

During the review period, total phytoplankton abundance was relatively low which has been an observed trend since the early 2000s. In 2020, total phytoplankton abundance in the nearfield was reported below the historic median. From May to October 2020, total phytoplankton abundance was often within the lower quartile of long-term levels or below the minima. This was due to very low abundances of the usually numerically dominant microflagellates and centric diatoms over the summer and fall.[208]

There has been a sustained trend of increasing abundance of total zooplankton from 2006 through 2017 that was driven by increases in adult copepod and larval copepodites.[209] Zooplankton abundances leveled off in 2018 and data from 2019-2021 continue to show the trend.[210]

These observed changes in plankton abundances have occurred over large spatial scales and are better explained by changes in the regional dynamics of the Gulf of Maine as described above and seasonal effects. Differences in plankton measurements at ambient water column survey stations across Massachusetts Bay and Cape Cod Bay are small, since both bays are subject to the influence of the Gulf of Maine, which is believed to be the driving factor. If the changes in plankton communities were resulting from a localized nutrient input (like the outfall) one would expect more of a difference in plankton communities[211] among water column monitoring stations.

EPA concludes that the impact of the outfall relocation is largely local in scale (as predicted), with major effects manifested as lower nutrient and chlorophyll concentrations in Boston Harbor (consistent with the removal of the Boston Harbor outfalls) and higher ammonia (NH_4) concentrations within 9 miles of the current outfall in Massachusetts Bay. Other noted changes appear better explained by regional effects unrelated to the outfall.

Toxic Phytoplankton Blooms

NMFS was concerned that toxic phytoplankton blooms could occur as a secondary ecological consequence of increased nutrient availability in the vicinity of the outfall. The BO discussed the possibility that the effluent could generate or exacerbate toxic blooms, particularly those related

[207] 2016 Bay Eutrophication Model: https://www.mwra.com/harbor/enquad/pdf/2017-13.pdf
[208] https://www.mwra.com/harbor/enquad/pdf/2021-07.pdf
[209] https://www.mwra.com/harbor/enquad/pdf/2019-08.pdf
[210] http://www.mwra.com/harbor/enquad/pdf/2022-13.pdf
[211] Plankton parameters measured at these stations include enumeration and identification. Ambient Monitoring Plan at 32-33. See Table 3-3 and 3-5.

to the red tide dinoflagellate *Alexandrium*. The BO noted a "strong likelihood" that the outfall's discharge would generate phytoplankton productivity in areas immediately surrounding the outfall. It expressed limited concern that seasonally the discharge might also stimulate nearfield phytoplankton productivity, which might attract the prey of listed species and consequently, the listed species themselves, thus potentially bringing them into contact with toxic blooms.

Acknowledging the limited scientific understanding of: (1) events controlling blooms in the Bays and (2) right whale ingestion and mortality from saxitoxin (produced by *Alexandrium*), the BO concluded that it could not rule out the possibility that nutrients from the outfall would contribute to toxic phytoplankton blooms which would, in turn, have an adverse effect on listed species. However, based on the best available information, it also observed that: (1) the proposed discharge was likely to "produce conditions similar to the existing discharge relative to red tides," and (2) the likelihood that the outfall's relocation would generate increased red tide toxicity within the Bays was "small."

The phytoplankton water column monitoring results include data on the abundance of three important potentially harmful or nuisance algae: *Phaeocystis, Alexandrium,* and *Pseudo-nitzschia.* Regional trends suggest that there have been increases in abundance and temporal extent of harmful algae blooms.

Although *Phaeocystis* is not toxic, there is evidence from the literature that it may impair zooplankton feeding. Satellite imagery of chlorophyll reflectance and reports from other monitoring programs show that spring blooms are clearly regional. During the review period, there were no bay wide spring blooms of *Phaeocystis,* and their abundance remained low, at less than 1 million cells/L which indicates that the outfall is not contributing to harmful blooms of this species.[212]

Alexandrium has also recently increased in incidence and spatial extent, with blooms in 2005, 2006, 2008, 2016, 2019 and 2021 that exceeded contingency threshold values. These majority of these blooms were regional in nature and were thought to have originated in the Gulf of Maine.[213,214] Most researchers believe this increase is related to two factors: expansion of cyst beds southward in the Gulf of Maine, and persistent easterly winds in the spring which move populations of cells into Massachusetts Bay. Based on both shellfish toxicity monitoring and water column monitoring from other agencies or organizations, Gulf of Maine red tide blooms are typically regional in scope with high levels of toxicity well "upstream" of the outfall.[215] Thus, the BO prediction of a "strong likelihood" that outfall effluent would enhance algal productivity has not been substantiated. Although *Alexandrium* has been detected near the

[212] The water column reports covering the review period are:
2016: https://www.mwra.com/harbor/enquad/pdf/2017-11.pdf
2017: https://www.mwra.com/harbor/enquad/pdf/2018-04.pdf
2018: https://www.mwra.com/harbor/enquad/pdf/2019-08.pdf
2019: https://www.mwra.com/harbor/enquad/pdf/2020-08.pdf
2020: https://www.mwra.com/harbor/enquad/pdf/2021-07.pdf
[213] https://northeasthab.whoi.edu/habs/alexandrium/
[214] https://www.mwra.com/harbor/enquad/pdf/2020-08.pdf
[215] Jones, S. 2010. (rep.). State of the Gulf of Maine: Microbial Pathogens and Biotoxins (pp. 1–23). Gulf of Maine Council on the Marine Environment.

outfall, there is no evidence that the effluent has attracted listed species identified in the BO (or their prey) to the outfall region or had any adverse effect on them.

In 2016, *Pseudo-nitzschia* blooms produced enough domoic acid to halt shellfish harvest in the Gulf of Maine, due to the introduction of *Pseudo-nitzschia australis*, a highly toxic species not previously observed in the region.[216] In 2016 and 2017, toxic *Pseudo-nitzschia* caused the closures of shellfish harvesting areas in Maine, Rhode Island, and/or Massachusetts (Buzzard's Bay). [217] In the years since, toxic blooms of *Pseudo-nitzschia* have persisted along the coast of Maine.[218] However, *Pseudo-nitzschia* cell counts within nearfield Massachusetts Bay and within the vicinity of the outfall remained moderate to low throughout the review period when compared to baseline.

Overall, harmful algal blooms are difficult to predict, may be influenced by both local and regional processes, and may change in magnitude and geographic range due to global climate change. This makes them of interest to continue monitoring within the scope of the outfall and its anthropogenic nutrient source which may trigger or enhance these blooms with changing ocean conditions and species range.

Benthic Community Analysis and Sediment Oxygen Levels

MWRA's benthic monitoring program has also confirmed the BO's predictions of minimal effects, using the sediment profile cameras and the benthic community analyses described above. These results show no evidence of an increase in organic matter enrichment (in Massachusetts Bay, Cape Cod Bay or in Stellwagen Basin), an increase in opportunistic species, or a decrease in sediment oxygen levels, leading to an alteration of the benthic community either within 2 km of the outfall — in the close nearfield — or at any farfield station. Furthermore, benthic community analysis of nearfield species diversity at hard bottom stations (using video and photographic data) shows no decrease from baseline levels. Cape Cod Bay soft bottom sediments have similarly not been altered; grab samples consistently contain indicators of the presence of keystone species. BACI analyses of benthic community threshold parameter data, collected using grab samples and sediment profile imaging, indicate that the discharge has not had an effect on any of the benthic community parameters tested in the Contingency Plan.

5.1.10.9 Summary

Based on the available data and analysis, EPA has determined that Massachusetts Bay has not reached its assimilative capacity for nitrogen and is not exhibiting adverse water quality impacts, including cultural eutrophication. Increased levels of nitrogen (measured as ammonium) have

[216] Clark, Suzanna & Hubbard, Katherine & Anderson, Donald & Mcgillicuddy, Dennis & Ralston, David & Townsend, David. (2019). Pseudo-nitzschia bloom dynamics in the Gulf of Maine: 2012–2016. Harmful Algae. 88. 101656. 10.1016/j.hal.2019.101656.
[217] Bates, Stephen S., et al. "Pseudo-nitzschia, Nitzschia, and domoic acid: New research since 2011." *Harmful Algae* 79 (2018): 3-43
[218] Clark, Suzanna & Hubbard, Katherine & Anderson, Donald & Mcgillicuddy, Dennis & Ralston, David & Townsend, David. (2019). Pseudo-nitzschia bloom dynamics in the Gulf of Maine: 2012–2016. Harmful Algae. 88. 101656. 10.1016/j.hal.2019.101656

been found in the Massachusetts Bay; however, not at levels that have the reasonable potential to cause or contribute to an impairment or exceed applicable WQS.

In recent technical guidance regarding the reissuance of this Draft Permit[219], NMFS reported concerns about potential changes to phytoplankton community structure, including enhancement of nuisance forage species that result in decreased productivity and/or changes in the distribution and aggregation densities of the copepod *Calanus Finmarchicus*, which is prey for the whales.[220] NMFS expect Northern Atlantic right whales to be present in the action area and critical habitat is designated in Massachusetts Bay.[221] The recent changes in right whale distribution are being driven by warming deep waters that have altered the availability of late stage *C. finmarchicus*.[222] Eutrophication effects caused by high nutrient input is identified as one potential impact on the dense patches of *C. finmarchicus*. Therefore, NMFS assumes the MWRA outfall may cause or contribute to conditions that may reduce the number of *C. finmarchicus*, the essential features of late stage *C. finmarchicus* in dense aggregations in the region of the outfall, as well as diapausing or dormant *C. finmarchicus* in aggregations in Jordan, Wilkinson, and Georges Basins. In addition, the MWRA outfall has the potential to affect the essential biological and physical oceanographic features (i.e., currents, temperature) of critical habitat Unit 1.[223]

EPA Region 1 requested technical assistance from EPA's Center for Environmental Measurement and Modeling to help address NMFS concerns and to review MWRA's Water Column Monitoring Reports to address the potential impacts of the discharge on North Atlantic right whale.[224]

EPA has found that the Bay is not suffering cultural eutrophication. However, the ambient monitoring data has shown that water quality in the Bay is changing, and that change is consistent with regional changes as documented throughout the Gulf of Maine and the North Atlantic Ocean. Climate change, coastal development, and other anthropogenic factors are increasing eutrophic pressures within the region. The Gulf of Maine is warming at an accelerated rate, with surface water temperatures increasing by about 0.23 °C from 1982 to 2006.[225]

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[219] NOAA. 2021. Technical Guidance for EPA Reissuance of the Massachusetts Water Resources Authority NPDES Permit – Deer Island Treatment Plant.

[220] NMFS. 2015. North Atlantic Right Whale (*Eubalaena glacialis*): Source Document for the Critical Habitat Designation; A Review of Information pertaining the definition of "Critical Habitat, Silver Spring MD. https://repository.library.noaa.gov/view/noaa/18664

[221] NOAA. 2021. Technical Guidance for EPA Reissuance of the Massachusetts Water Resources Authority NPDES Permit – Deer Island Treatment Plant.

[222] NOAA. 2021. Technical Guidance for EPA Reissuance of the Massachusetts Water Resources Authority NPDES Permit – Deer Island Treatment Plant.

[223] NOAA. 2021. Technical Guidance for EPA Reissuance of the Massachusetts Water Resources Authority NPDES Permit – Deer Island Treatment Plant.

[224] Hagy, J., T. Gleason, A. Oczkowski, A. Tatters, and Y. Wan. 2022. Technical Memorandum: Review of MWRA Water Quality Monitoring Results to Address Potential for Harmful Effects of the Deer Island Discharge on Threatened and Endangered Species in Massachusetts Bay. US Environmental Protection Agency, Office of Research and Development, Narragansett, RI. EPA/600/R-22/063. p. 5., https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=355407&Lab=CEMM

[225] Belkin IM. 2009. Rapid warming of Large Marine Ecosystems. *Progress in Oceanography* 81: 207-213

Warming surface water can result in increased stratification as well as algae blooms.[226] Warming waters are also changing species distribution as temperature limited organisms expand or change their range in response to warming temperatures, such as what's hypothesized with the introduction of toxic *Pseudo-nitzschia australis* in the Gulf of Maine.[227] Warming surface water temperature is a growing concern due to research from the Long Island Sound Study that showed warming temperatures have dampened the observed increase in dissolved oxygen in Long Island Sound by 27%.[228] It can be expected that warming surface water temperatures in Massachusetts Bay could have a similar impact. Additionally, MWRA has also reported modest increases in DITP effluent nitrogen loads due to increases in population in MWRA communities.[229] Therefore, continued monitoring is needed to further understand these changes.

EPA's Center for Environmental Measurement and Modeling concurs with EPA Region 1's evaluation and has concluded independently:

- The MWRA reports do not show evidence that the discharge is currently harmful to North Atlantic right whales (Eubalaena glacialis) or that it is likely to cause harm in the future. However, these data also do not provide evidence for the opposite, namely that such an impact is not already occurring or that it would be unlikely in the future.
- These data and additional evidence documenting related biological changes from across the Gulf of Maine suggest that Massachusetts Bay is experiencing a shift in biological and oceanographic regimes. The regime shift increases the scientific uncertainty regarding the role of the discharge in supporting harmful algal blooms (HABs) in Massachusetts Bay and resulting effects on the marine food web, including whales.
- The MWRA water column monitoring results document biological changes both near the discharge and across Massachusetts Bay principally characterized by seasonal increases in the abundance of several HAB species including dinoflagellates *Alexandrium catenella* since 2005 and *Karenia mikimotoi* since 2017.
- Although there is little evidence that HABs are harming whales in New England, North Atlantic right whales in New England are currently exposed to saxitoxin and domoic acid, HAB toxins that elsewhere in the world have harmed or killed whales and other marine mammals, seabirds, and marine fisheries.
- Ship strikes and entanglements in fishing gear are the main anthropogenic cause of mortality of North Atlantic right whales; however, marine HABs currently present a relatively unpredictable, increasing, and potentially serious threat to

[226] Liebman, M., Benoy, G., Latimer, J. S., & Bricker, S. (n.d.). (issue brief). Eutrophication: State of the Gulf of Maine Report.
[227] Suzanne Clark et. al 2021. Investigation *Pseudo-nitzschia australis* introduction to the Gulf of Maine with observations and models. *Continental Shelf Research* 228(2021) 104493.
[228] Mark Tedesco, EPA. October 2021. Case Study: Responding to Hypoxia in Long Island Sound. Cape Cod Hypoxia Forum. MassBays Program.
[229] Reilley, Betsy & Charlestra, Lucner & Codiga, Daniel & Keay, Ken & Taylor, David. (2018). 25 Years of Monitoring, What Have We Learned? Nutrient Levels in Massachusetts Bay and Boston Harbor. *Proceedings of the Water Environment Federation*. 2018. 5808-5818. 10.2175/193864718825138600.

> North Atlantic right whales. Therefore, a cautious approach is warranted that includes continued monitoring of ecological changes near the outfall and in the surrounding areas of Massachusetts and Cape Cod Bays. Monitoring should be adjusted to focus on the most pertinent environmental concerns and their relationship to the discharge, while reducing effort to monitor issues that have been resolved significantly via decades of monitoring.[230]

The effluent monitoring and reporting requirements for total nitrate + nitrate and TKN remain in the Draft Permit with a monitoring frequency of once per week from April through October and once per month from November through March. The Draft Permit also includes calculating and reporting total nitrogen at the same frequency as total nitrate + nitrite and TKN. The data will provide EPA and MassDEP with information on the loading of nitrogen and its impact to the Bay. This data will also support interpretation of the ambient monitoring data discussed in Section 5.12 of this Fact Sheet and Part I.I.6 of the Draft Permit.

5.1.11 Metals

5.1.11.1 Applicable Metals Criteria

State water quality criteria for metals are established in terms of dissolved metals. However, many inorganic components of domestic wastewater, including metals, are in particulate form, and differences in the chemical composition between the effluent and the receiving water affects the partitioning of metals between the particulate and dissolved fractions as the effluent mixes with the receiving water, often resulting in a transition from the particulate to dissolved form (*The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion* (USEPA 1996 [EPA-823-B96-007]). Consequently, quantifying only the dissolved fraction of metals in the effluent prior to discharge may not accurately reflect the biologically-available portion of metals in the receiving water. Regulations at 40 CFR § 122.45(c) require, with limited exceptions, that effluent limits for metals in NPDES permits be expressed as total recoverable metals.

5.1.11.2 Reasonable Potential Analysis and Limit Derivation

To determine whether the effluent has reasonable potential to cause or contribute to an exceedance above the in-stream water quality criteria for each metal, EPA used a mass balance equation presented in Appendix G to project the concentration downstream of the discharge and, if applicable, to determine the limit required in the permit.

The same mass balance equation is used to determine if a more stringent limit is necessary (when there is already an effluent limit in the existing permit) to continue to meet WQS under current

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230 Hagy, James, Gleason, Tim, Oczkowski, Autumn, Tatters, Avery and Wan, Yongshun. 2022. Technical Memorandum: Review of MWRA Water Quality Monitoring Results to Address Potential Harmful Effects of the Deer Island Discharge on Threatened and Endangered Species in Massachusetts Bay. USEPA, Center for Environmental Measurement and Modeling, Atlantic Coastal and Environmental Sciences Division, Narragansett, RI and USEPA, Center for Environmental Measurement and Modeling, Gulf Environmental Measurement and Modeling Division., https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=355407&Lab=CEMM

conditions. The limit is determined to be the more stringent of either: (1) the existing limit or (2) the calculated effluent concentration (C_e) allowable to meet WQS based on current conditions. However, this did not apply, as the 2000 Permit did not include effluent limits for metals.

MWRA submitted ambient data collected in the summer of 2021 at EPA's request for cadmium, copper, lead, nickel and zinc since ambient sampling was not a requirement in the 2000 Permit. The 2021 ambient data submitted by MWRA was used in the reasonable potential analysis as shown in Appendix G. EPA now requires ambient data be submitted routinely as a requirement of whole effluent toxicity testing, but this was not a requirement when the 2000 Permit was issued.

As shown in Appendix G there is no reasonable potential to cause or contribute to an excursion of WQS for cadmium, copper, lead, nickel, and zinc and the Draft Permit does not include effluent limits for these metals.

Effluent and ambient monitoring for each of these metals will continue to be required in the WET tests.

5.1.12 Other Toxics

The 2000 Permit includes effluent reporting requirements for several toxic pollutants. These requirements were established in response to toxic pollutant concentrations in effluent samples collected from the old Deer Island and Nut Island treatment facilities both of which provided only primary treatment. Effluent limits may have been required if the treatment plant had remained only a primary treatment facility. However, the 2000 Permit was written for the new secondary treatment facility at Deer Island and it included reporting requirements for several toxic pollutants.

A secondary treatment pilot plant was built as a scale model of the final facility design. Results of effluent testing from the secondary pilot plant showed significant reductions in the concentration of toxic pollutants following secondary treatment. However, because there were no effluent data from the full-scale secondary treatment plant, monitoring requirements were established in the 2000 Permit.

There is now substantial effluent data (over 20 years) from the full-scale secondary plant, which continues to show significant reductions in the concentration of most toxics following secondary treatment. EPA reviewed DMR data for the toxic constituents identified in the 2000 Permit and the data over the twenty-year period were reported as zero for most of the individual constituents. EPA also reviewed monthly lab analyses reports attached to the Permittee's monthly DMR submittals. The lab analyses reports have information on EPA test methods used, the type of sample collected (grab or composite), and the reporting limit (RL).

The reasonable potential analysis for the toxic constituents identified covered the 5-year review period (January 2018 through December 2022). Appendix C shows effluent monitoring data from monthly DMRs for toxic pollutants required to be reported in the 2000 Permit for the review period. Based on the reasonable potential analysis, there is no reasonable potential to

cause or contribute to an excursion of WQS. The data is sufficiently definitive to justify eliminating the reporting requirements in the Draft Permit. MWRA's DMRs since the 2000 Permit became effective can be reviewed at https://www.mwra.com/harbor/html/archive.htm#dmr.

5.1.12.1 Aldrin

The Permittee has monitored the effluent for Aldrin at least once per month since September 2000. DMR data submitted by the Permittee for the review period are all reported as zero. All the DMR data since the secondary treatment facility went on-line in September 2000 have been reported as zero. The lab reports show that all analyses have resulted in non-detects using EPA Method 608/612.

EPA notes the highest reporting limit (RL) from January 2010 through December 2022 for Aldrin was less than 15.4 ng/L as noted in the lab analysis report of August 2016.

Given the basis for the monitoring requirement was data from the old primary treatment facility's effluent and Aldrin has not been detected in the secondary treatment plant effluent in over twenty years, the monitoring requirement for Aldrin has been removed from the Draft Permit.

5.1.12.2 Chlordane

The Permittee has monitored the effluent for alpha Chlordane, gamma Chlordane and Chlordane tech mix and metabolites (three components of Chlordane identified on the monthly DMRs) at least once per month since September 2000. DMR data submitted by the Permittee for the review period are all reported as zero. All the DMR data since the secondary treatment facility went on-line in September 2000 have been reported as zero. The lab reports show that all analyses have resulted in non-detects using EPA Method 608/612.

EPA notes the highest reporting limit (RL) from January 2010 through December 2022 for the alpha and gamma Chlordane components was less than 15.4 ng/L and less than 1540 ng/L for Chlordane tech mix and metabolites as noted in the lab analysis report of August 2106.

Given the basis for the monitoring requirement was data from the old primary treatment facilities' effluent and alpha Chlordane, gamma Chlordane and Chlordane tech mix and metabolites have not been detected in the secondary treatment plant effluent in over twenty years, the monitoring requirement for alpha Chlordane, gamma Chlordane and Chlordane tech mix and metabolites have been removed from the Draft Permit.

5.1.12.3 4,4-DDT

The Permittee has monitored the effluent for 4,4-DDT at least once per month since September 2000. DMR data submitted by the Permittee for the review period are all reported as zero. All the DMR data since the secondary treatment facility went on-line in September 2000 have been reported as zero. The lab report includes information on the analytical method used for this parameter and that all analyses have resulted in non-detects using EPA Methods 608/612.

EPA notes the highest reporting limit (RL) from January 2010 through December 2022 for 4,4 DDT as less than 30.8 ng/L as noted in the lab analysis report of August 2016.

Given the basis for the monitoring requirement was data from the old primary treatment facilities' effluent and 4,4 DDT has not been detected in the secondary treatment plant effluent in over twenty years, the monitoring requirement for 4,4 DDT has been removed from the Draft Permit.

5.1.12.4 Dieldrin

The Permittee has monitored the effluent for Dieldrin at least once per month since September 2000. DMR data submitted by the Permittee for the review period are all reported as zero. All the DMR data since the secondary treatment facility went on-line in September 2000 have been reported as zero. The lab reports show that all analyses have resulted in non-detects using EPA Method 608/612.

EPA notes the highest reporting limit (RL) from January 2010 through December 2022 for Dieldrin was 30.8 ng/L as noted in the lab analysis report of August 2016.

Given the basis for the monitoring requirement was data from the old primary treatment facilities' effluent and Dieldrin has not been detected in the secondary treatment plant the effluent in over twenty years the monitoring requirement for Dieldrin has been removed from the Draft Permit.

5.1.12.5 Heptachlor

The Permittee has monitored the effluent for Heptachlor at least once per month since September 2000. DMR data submitted by the Permittee for the review period are all reported as zero. All the DMR data since the secondary treatment facility went on-line in September 2000 have been reported as zero. The lab reports show that all analyses have resulted in non-detects using EPA Method 608/612.

EPA notes the highest reporting limit (RL) from January 2010 through December 2022 for Heptachlor was 15.4 ng/L as noted in the lab analysis report of August 2016.

Given the basis for the monitoring requirement was data from the old primary treatment facilities' effluent and Heptachlor has not been detected in the secondary treatment plant effluent in over twenty years, the monitoring requirement for Heptachlor has been removed from the Draft Permit.

5.1.12.6 Heptachlor Epoxide

The Permittee has monitored the effluent for Heptachlor Epoxide at least once per month since September 2000. DMR data submitted by the Permittee for the review period are all reported as zero. All the DMR data since the secondary treatment facility went on-line in September 2000 have been reported as zero. The lab reports show that all analyses have resulted in non-detects using EPA Method 608/612.

EPA notes the highest reporting limit (RL) from January 2010 through December 2022 for Heptachlor Epoxide was 15.4 ng/L as noted in the lab analysis report of August 2016.

Given that the basis for the monitoring requirement was data from the old primary treatment facilities' effluent and Heptachlor Epoxide has not been detected in the secondary treatment plant effluent for over twenty years the monitoring requirement for Heptachlor Epoxide has been removed from the Draft Permit.

5.1.12.7 Hexachlorobenzene

The Permittee has monitored the effluent for Hexachlorobenzene at least once per month since September 2000. DMR data submitted by the Permittee for the review period are all reported as zero. The lab reports show that all analyses have resulted in non-detects using EPA Method 608/612.

EPA notes the highest reporting limit (RL) in the lab from January 2010 through December 2022 for Hexachlorobenzene was 15.4 ng/L as noted in the lab analysis report of August 2016.

Given that the basis for the monitoring requirement was data from the old primary treatment facilities' effluent and Hexachlorobenzene has not been detected in the secondary treatment plant effluent in over the twenty years, the monitoring requirement for Hexachlorobenzene has been removed from the Draft Permit.

5.1.12.8 Arsenic

The Permittee has monitored the effluent for arsenic once per month since September 2000. Measurable concentrations of arsenic have been reported on DMRs during the review period. (See Appendix C). The acute and chronic applicable WQS are 69 µg/L and 36 µg/L, respectively.

To determine whether the effluent has the reasonable potential to cause or contribute to an exceedance above the in-stream water quality criteria, EPA used the mass balance equation to project the concentration downstream of the discharge and, if applicable, to determine the limit required in the Permit.

The results of this analysis are presented in Appendix G. As shown, there is no reasonable potential to cause or contribute to an excursion of WQS and the monitoring requirement for arsenic has been removed from the Draft Permit.

5.1.12.9 Mercury

The Permittee has monitored the effluent for mercury once per month since September 2000. Measurable concentrations of mercury have been reported on DMRs during the review period. See Appendix C. The acute and chronic applicable WQS are 2.1 µg/L and 11.1 µg/L, respectively.

To determine whether the effluent has the reasonable potential to cause or contribute to an exceedance above the in-stream water quality criteria, EPA used the mass balance equation to project the concentration downstream of the discharge and, if applicable, to determine the limit required in the permit.

The results of this analysis are presented in Appendix G. As shown, there is no reasonable potential to cause or contribute to an excursion of WQS and the monitoring requirement for mercury has been removed from the Draft Permit.

5.1.12.10 Cyanide

The Permittee has monitored the effluent for cyanide once per month since September 2000. Measurable concentrations of cyanide have been reported on DMRs during the review period. (See Appendix C). The acute and chronic applicable WQS are both 1 µg/L, respectively.

To determine whether the effluent has the reasonable potential to cause or contribute to an exceedance above the in-stream water quality criteria, EPA used the mass balance equation to project the concentration downstream of the discharge and, if applicable, to determine the limit required in the Permit.

The results of this analysis are presented in Appendix G. As shown, there is no reasonable potential to cause or contribute to an excursion of WQS and the monitoring requirement for cyanide has been removed from the Draft Permit.

5.1.12.11 Polychlorinated Biphenyls (PCBs), Total

The Permittee has monitored the effluent for total PCBs once per month since September 2000. Measurable concentrations of total PCBs have been reported on DMRs during the review period. (See Appendix G. The human health acute and chronic applicable WQS are both 0.0003 µg/L, respectively.

To determine whether the effluent has the reasonable potential to cause or contribute to an exceedance above the in-stream water quality criteria, EPA used the mass balance equation to project the concentration downstream of the discharge and, if applicable, to determine the limit required in the Permit.

The results of this analysis show there is no reasonable potential to cause or contribute to an excursion of WQS and the monitoring requirement for total PCBs has been removed from the Draft Permit.

5.1.12.12 PCB Aroclors: 1016, 1221, 1232, 1242, 1248, 1254, 1260

The 2000 Permit had a monthly average limit of 0.000045 µg/L and a maximum daily reporting requirement for PCB Aroclors: 1016, 1221, 1232, 1242, 1248, 1254 and 1260. DMR data of each Aroclor for the review period are all reported as zero. All the DMR data since the secondary treatment facility went online in September 2000 have been reported as zero. The lab reports show that all analyses have resulted in non-detects using EPA Method 608/612.

EPA notes the highest reporting limit (RL) from January 2010 through December 2022 was 1400 ng/L for PCB Aroclors: 1016, 1232, 1242, 1248, 1254 and 1260 and 2800 ng/L for PCB Arochlor 1221 in December 2010.

Given that the basis for the monitoring requirement was data from the old primary treatment facility's effluent and none of the PCB Aroclors have been detected in the secondary treatment plant effluent the monitoring requirement for the PCB Aroclors have been removed from the Draft Permit.

5.1.12.13 Volatile Organic Compounds (VOCs)

The current permit requires the Permittee to monitor the effluent for Volatile Organic Compounds (VOCs). MWRA reports data for individual VOCs twice per month and the DMR shows the monthly average total VOCs as the sum of individual VOCs divided by the number of samples collected in a given month. As an example, in February 2021, the DMR shows the monthly average total VOC reported as 17.47 µg/L and the maximum daily total VOC as 29.6 µg/L. MWRAs' lab report for this period shows two hits for Tetrachloroethene (29.6 µg/L and 5.33 µg/L).

Tetrachloroethene: 29.6 µg/L + 5.33 µg/L = 34.93 µg/L
Monthly Average VOC: 34.93 µg/L /2 = 17.4 µg/L
Maximum Daily VOC: 29.6 µg/L

There are no water quality criteria for total VOCs. There are, however, water quality criteria for a select number of individual VOCs. VOCs with water quality criteria that have been reported in the effluent for the review period include 1,2 Dichloroethane (maximum daily = 10.8 µg/L), Tetrachloroethylene (maximum

daily= 29.6 µg/L) and Toluene (maximum daily =14.5 µg/L µg/L). The results of the reasonable potential analysis are presented in Appendix G. As shown, there is no reasonable potential to cause or contribute to an excursion of WQS for 1,2 Dichloroethane, Tetrachloroethylene or Tolulene and EPA proposes to remove the VOC monitoring requirement from the Draft Permit.

5.1.12.14 Selenium and Silver

The Permittee has monitored the effluent for priority pollutants in addition to the monthly requirements submitted in its DMR. MWRA submitted effluent data requested by EPA for additional pollutants in July 2021. (See Appendix F). The Permittee reported detections of Selenium (Selenium maximum daily discharge = 1.7 µg/L) and Silver, (Silver maximum daily discharge = 0.174 µg/L).

To determine whether the effluent for these pollutants have reasonable potential to cause or contribute to an exceedance above the in-stream water quality criteria EPA used the mass balance equation to project the concentration downstream of the discharge and, if applicable, to determine the need for an effluent limit in the Permit.

EPA has determined that there is no reasonable potential for Selenium or Silver in the DITP effluent to cause an exceedance of the water quality standards for each of the individual pollutants and the Draft Permit does not include effluent limits for these pollutants.

5.1.13 Whole Effluent Toxicity

CWA §§ 402(a)(2) and 308(a) provide EPA and States with the authority to require toxicity testing. Section 308 specifically describes biological monitoring methods as techniques that may be used to carry out objectives of the CWA. Whole effluent toxicity (WET) testing is conducted to ensure that the additivity, antagonism, synergism and persistence of the pollutants in the discharge do not cause toxicity, even when the pollutants are present at low concentrations in the effluent. The inclusion of WET requirements in the Draft Permit will assure that the Facility does not discharge combinations of pollutants into the receiving water in amounts that would affect aquatic life or human health.

In addition, under CWA § 301(b)(1)(C), discharges are subject to effluent limitations based on WQSs. Under CWA §§ 301, 303 and 402, EPA and the States may establish toxicity-based limitations to implement the narrative water quality criteria calling for "no toxics in toxic amounts". *See also* 40 CFR § 122.44(d)(1). The Massachusetts WQSs at 314 CMR 4.05(5)(e) state, "All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife."

National studies conducted by the EPA have demonstrated that domestic sources, as well as industrial sources, contribute toxic constituents to POTWs. These constituents include metals, chlorinated solvents, aromatic hydrocarbons and others. Some of these constituents may cause synergistic effects, even if they are present in low concentrations. Because of the source

variability and contribution of toxic constituents in domestic and industrial sources, there may be reasonable potential for this discharge to cause or contribute to an exceedance of the "no toxics in toxic amounts" narrative water quality standard.

Further, EPA Region 1 and MassDEP require toxicity testing for all dischargers in Massachusetts. In accordance with these policies, whole effluent chronic effects are regulated by limiting the highest measured continuous concentration of an effluent that causes no observed chronic effect on a representative standard test organism, known as the chronic No Observed Effect Concentration (C-NOEC). Whole effluent acute effects are regulated by limiting the concentration that is lethal to 50% of the test organisms, known as the $LC_{50.}$ According to the current policy,[231] dischargers having a dilution factor between 20.1 and 100 are required to conduct acute toxicity testing at least four times per year with two species, and the LC_{50} limit is greater than or equal to 100%.

The 2000 Permit required the Facility to conduct a 7-day chronic and modified acute WET test with the Inland Silverside (*Menidia beryllina*), a 1-hour fertilization test with the Sea Urchin (*Arbacia punctulata*), and acute toxicity testing with the Mysid Shrimp (*Mysidopsis bahia*) once per month. The permit limits were acute, $LC_{50} \geq 50\%$ and chronic, C-NOEC $\geq$ 1.5%. The facility consistently met the 2000 Permit's chronic limit and the modified acute WET limit during the review period (See Appendix C).

The Draft Permit proposes an acute WET limit of LC_{50} greater than or equal to 100% in accordance with current state and federal policy with the Mysid Shrimp (*Mysidopsis bahia*) and Inland Silverside (*Menidia beryllina*), and a 1-hr fertilization test with the Sea Urchin (*Arbacia punctulata*). The tests must be performed in accordance with the test procedures and protocols specified in **Attachments C and D** of the Draft Permit. The Draft Permit maintains the chronic testing and limitation of C-NOEC > 1.5% from the 2000 Permit for Sea Urchin. The test must be performed in accordance with the test procedures and protocols specified in **Attachment D** of the Draft Permit. The Draft Permit proposes a testing frequency reduction from monthly to quarterly (4/Year). This revised testing frequency meets the EPA guidance and MassDEP WET policy. The $LC_{50} \geq 100\%$ permit limit is based on current state and federal policy.

The 2000 Permit also requires the Permittee to conduct three (3) toxicity tests during the use of each new polymer. MWRA has completed the required testing and rarely uses polymer. EPA has removed this requirement in the Draft Permit.

5.1.14 Per- and polyfluoroalkyl substances (PFAS)

As explained at https://www.epa.gov/pfas, PFAS are a group of synthetic chemicals that have been in use since the 1940s. PFAS are found in a wide array of consumer and industrial products. PFAS manufacturing and processing facilities, facilities using PFAS in production of other products, airports, and military installations can be contributors of PFAS releases into the air, soil, and water. Due to their widespread use and persistence in the environment, most people in the United States have been exposed to PFAS. Exposure to some PFAS above certain levels may

[231] MassDEP. 1990. Massachusetts Water Quality Standards Implementation Policy for the Control of Toxic Pollutants in Surface Waters. February 23, 1990.

increase risk of adverse health effects.[232] EPA is collecting information to evaluate the potential impacts that discharges of PFAS from wastewater treatment plants may have on downstream drinking water, recreational and aquatic life uses.

Background Information for Massachusetts

On October 20, 2020, MassDEP published final regulations establishing a drinking water standard, or a Maximum Contaminant Level (MCL) of 20 parts per trillion (ppt) for the sum of the following six PFAS. (*See* 310 CMR 22.00).

- Perfluorohexanesulfonic acid (PFHxS)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorononanoic acid (PFNA)
- Perfluorooctanesulfonic acid (PFOS)
- Perfluorooctanoic acid (PFOA)
- Perfluorodecanoic acid (PFDA)

Although the Massachusetts water quality standards do not include numeric criteria for PFAS, the Massachusetts narrative criterion for toxic substances at 314 CMR 4.05(5)(e) states:

> All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife.

The narrative criterion is further elaborated at 314 CMR 4.05(5)(e)2 which states:

> Human Health Risk Levels. Where EPA has not set human health risk levels for a toxic pollutant, the human health-based regulation of the toxic pollutant shall be in accordance with guidance issued by the Department of Environmental Protection's Office of Research and Standards. The Department's goal is to prevent all adverse health effects which may result from the ingestion, inhalation or dermal absorption of toxins attributable to waters during their reasonable use as designated in 314 CMR 4.00.

Since PFAS chemicals are persistent in the environment and may lead to adverse human health and environmental effects, and consistent with recent EPA guidance,[233] the Draft Permit requires that the Facility conduct quarterly influent, effluent and sludge sampling for PFAS chemicals and annual sampling of certain industrial users. The quarterly monitoring shall begin the first full calendar quarter beginning six months after the effective date of the permit. The annual monitoring for certain industrial users shall begin the first full calendar year following the effective date of the Permit.

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[232] EPA. 2019. EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan, EPA 823R18004, February 2019. Available at: https://www.epa.gov/sites/production/files/2019-02/documents/pfas_action_plan_021319_508compliant_1.pdf

[233] Radhika Fox, Assistant Administrator, EPA to Water Division Directors, EPA Regions 1-10, December 6, 2022, Subject: "Addressing PFAS Discharges in NPDES Permits and Through the Pretreatment Program and Monitoring Programs." Available at: https://www.epa.gov/system/files/documents/2022-12/NPDES_PFAS_State%20Memo_December_2022.pdf

The purpose of this monitoring and reporting requirement is to better understand potential discharges of PFAS from this facility and to inform future permitting decisions, including the potential development of water quality-based effluent limits on a facility specific basis. EPA is authorized to require this monitoring and reporting by CWA § 308(a), which states:

> SEC. 308. (a) Whenever required to carry out the objective of this Act, including but not limited to (1) developing or assisting in the development of any effluent limitation, or other limitation, prohibition, or effluent standard, pretreatment standard, or standard of performance under this Act; (2) determining whether any person is in violation of any such effluent limitation, or other limitation, prohibition or effluent standard, pretreatment standard, or standard of performance; (3) any requirement established under this section; or (4) carrying out sections 305, 311, 402, 404 (relating to State permit programs), 405, and 504 of this Act—
>
> (A) the Administrator shall require the owner or operator of any point source to (i) establish and maintain such records, (ii) make such reports, (iii) install, use, and maintain such monitoring equipment or methods (including where appropriate, biological monitoring methods), (iv) sample such effluents (in accordance with such methods, at such locations, at such intervals, and in such manner as the Administrator shall prescribe), and (v) provide such other information as he may reasonably require.

(See 40 CFR § 122.21(e)(3)(ii) and 40 CFR § 122.44(i)(1)(iv)(B)).

In the absence of a final 40 CFR § 136 method for measuring PFAS in wastewater and sludge, the Draft Permit requires the use Draft Method 1633 or, when it becomes available, the multi-lab validated Method 1633. Monitoring should include each of the 40 PFAS parameters detectable by Method 1633 (see Draft Permit Attachment H for list of PFAS parameters) and the monitoring frequency is quarterly. All PFAS results must be reported on DMRs (*see* 40 CFR § 122.41)(l)(4)(i)). This approach is consistent with 40 CFR § 122.44(i)(1)(iv)(B) which states that in the case of pollutants or pollutant parameters for which there are no approved methods under 40 CFR Part 136 or methods are not otherwise required under 40 CFR chapter I, subchapter N or O, monitoring shall be conducted according to a test procedure specified in the permit for such pollutants or pollutant parameters.

Additionally, EPA has recently published Method 1621 to screen for organofluorines in wastewater. Organofluorines (molecules with a carbon-fluorine bond) are rarely naturally occuring and the most common source of organofluorines are PFAS and non-PFAS fluorinated compounds such as pesticides and pharmaceuticals. The Permittee shall monitor Adsorbable Organic Fluorine using Method 1621 once per quarter concurrently with PFAS monitoring to screen for a broader range of these types of emerging contaminants. This requirement also takes effect the first full calendar quarter following six months after the effective date of the Permit.

All monitoring results may be used by EPA in the next permit reissuance to ensure the discharge continues to protect designated uses.

5.1.15 Contaminants of Emerging Concern (CECs)

Contaminants of Emerging Concern (CECs) are chemicals and toxins that have been detected at low levels in surface waters, and there is a concern that these compounds may have an impact on aquatic life but are not currently regulated. CECs are not necessarily new chemicals but recently identified in surface waters because of improvements in laboratory methods that have lowered detection levels. They are pollutants not currently included in routine monitoring programs and may be candidates for future regulation depending on their (eco)toxicity, potential health effects, public perception, and frequency of occurrence in environmental media. They include pollutants that have often been present in the environment, but whose presence and significance are only now being evaluated.[234]

As explained at: https://www.epa.gov/wqc/contaminants-emerging-concern-including-pharmaceuticals-and-personal-care-products, CECs have characteristics that require additional consideration when developing ambient water quality criteria for the protection of aquatic life. For example, many Pharmaceuticals and Personal Care Products (PPCPs) act as endocrine disrupting chemicals (EDCs). "EDCs can alter hormone levels leading to reproductive effects in aquatic organisms and evaluating these effects may require testing methodologies not typically available along with endpoints not previously evaluated using current guidelines. Emerging contaminants may also demonstrate low acute toxicity but cause significant reproductive effects at very low levels of exposure. In addition, the effects of exposure to aquatic organisms during early stages of life may not be observed until adulthood. Therefore, traditional toxicity test endpoints may not be sufficiently comprehensive of criteria derivation for these chemicals and the chemicals may also have specific modes of action that may affect only certain types of aquatic animals (e.g., vertebrates such as fish)."[235]

EPA has been working to address the challenges of developing aquatic life criteria for CECs.[236] Currently, the Agency is focused on developing criteria for PFAS.[237]

During the public workshop, *2300 Days at Sea: Monitoring Impacts of the Outfall on Massachusetts Bay,*[238] hosted by MIT Sea Grant, Save the Harbor/Save the Bay and OMSAP on November 13, 2018, OMSAP and other participants identified three categories of CECs: Per- and Polyfluoroalkyl Substances (PFAS), Pharmaceuticals and Personal Care Products (PPCPs)

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[234] EPA, OW/ORD Emerging Contaminants Working Group. 2008. "White Paper: Aquatic Life Criteria For Contaminants Of Emerging Concern, Part I: General Challenges And Recommendations., https://www.epa.gov/sites/default/files/2015-08/documents/white_paper_aquatic_life_criteria_for_contaminants_of_emerging_concern_part_i_general_challenges_and_recommendations_1.pdf

[235] https://www.epa.gov/wqc/contaminants-emerging-concern-including-pharmaceuticals-and-personal-care-products

[236] https://www.epa.gov/wqc/contaminants-emerging-concern-including-pharmaceuticals-and-personal-care-products

[237] EMAIL. Arsenault, Dan, EPA to Michele Barden, EPA. April 25, 2023 Subject: FW: Aquatic Life Criteria for CECs

[238] https://seagrant.mit.edu/2019/05/13/2300-days-at-sea-monitoring-the-impacts-of-the-outfall-on-massachusetts-bay/

and microplastics, as needing further investigation specifically as applied to the MWRA's T01 discharge.[239] Several subcommittees of OMSAP have since authored white papers for each category of CEC they identified as a priority. [240,241,242] On July 8, 2022, OMSAP sent a letter to EPA and MassDEP with recommendations on the including CECs monitoring as part of the Ambient Monitoring Plan.[243]

Additionally, NOAA's Office of National Marine Sanctuary (ONMS) Stellwagen Bank National Marine Sanctuary (SBNMS) has requested that EPA prepare a Sanctuary Resources Statement as part of the consultation process (See Section 304(d) of the National Marine Sanctuaries Act and Section 6.3 of this Fact Sheet). The SBNMS staff also submitted preliminary questions about the presence and roles of PFASs, pharmaceuticals and microplastics in the outfalls and the potential to impact the Sanctuary.[244]

MWRA has participated in several studies of CECs. Recent studies of PFAS,[245,246] PPCPs[247] and microplastics[248] in the MWRA DITP effluent and Massachusetts Bay were presented at the 2023 Annual OMSAP Meeting. Each of the studies quantified the contributions of CECs from the DITP to Massachusetts Bay. Research continues to evaluate the aquatic life and human health impacts of low-level CECs exposure. As such, and to date, there are no National Recommended

[239] Outfall Monitoring Science Advisory Panel. UNDATED. A Framework for Understanding Chemicals of Emerging Concern in Marine Waters, Executive Summary, Recommendations of the Outfall Monitoring Science Advisory Panel to the U.S. Environmental Protection Agency (Region 1) and Massachusetts Department of Environmental Protection., https://seagrant.mit.edu/wp-content/uploads/2022/09/Framework_Understanding_Contaminants_Concern_7_2022.pdf
[240] Pederson, Judith, Anna Robuck, and Mark Cantwell. 2022. Per- and Polyfluoroalkyl Substances: Their Sources, Fate, and Effects in Marine Ecosystems., https://seagrant.mit.edu/wp-content/uploads/2022/09/Framework_Understanding_Contaminants_Concern_7_2022.pdf
[241] Callaghan, Todd, Mark Cantwell, Peter Burn and Judith Pederson. 2020. Pharmaceuticals and Personal Care Products: Recommendations to the Massachusetts Water Resources Authority Outfall Monitoring Science Advisory Panel., https://seagrant.mit.edu/wp-content/uploads/2022/09/Framework_Understanding_Contaminants_Concern_7_2022.pdf
[242] Pederson, Judith, Robert Kenney, and Virginia Edgecomb. 2022. Microplastics: Their Sources, Transport, and Fate in the Ocean. https://seagrant.mit.edu/wp-content/uploads/2022/09/Framework_Understanding_Contaminants_Concern_7_2022.pdf
[243] Letter. OMSAP to Kenneth Moraff, EPA and Lealdon Langley, MassDEP. July 8, 2022. Recommendations on Contaminants of Emerging Concern for Considerations to the MWRA Monitoring Plan"
[244] Email. Alice Stratton, NOAA to James Carew, Lynne Jennings and John Nagle, EPA. April 24, 2023. Subject: SBMNS resources and questions.
[245] PRESENTATION. Reilley, Betsy and Matthew Dam, MWRA. February 10, 2023. PFAS Matters, a presentation of MWRA's Toxics Reduction and Control (TRAC) program and ongoing PFAS analysis of influent, effluent, and biosolids at Deer Island.
[246] PRESENTATION. Robuck, Anna R.; Michaela A. Cashman, Mark G. Cantwell, Michael A. Thompson, Christine L. Gardiner, Julia C. Sullivan, David N. Wiley, Pete DeCola and Rainer Lohmann. February 10, 2023. Concentrations of Chemicals of Emerging Concern are Mediated by Seasonal Hydrodynamics in an Offshore Marine Environment.
[247] PRESENTATION. Robuck et al. February 10, 2023. Concentrations of Chemicals of Emerging Concern are Mediated by Seasonal Hydrodynamics in an Offshore Marine Environment.
[248] PRESENTATION. Gallagher, Scott and James Churchill, WHOI. February 10, 2023. Assessing the Seasonal and Storm-impacted Transport and Biological Fate of Micro- and Nanoplastics Discharged from Wastewater Treatment Facilities into Massachusetts Coastal Waters.

Water Quality Criteria for PFAS, PPCPs and microplastics, [249] and therefore, no basis for establishing effluent limitations for any of these parameters.

Consistent with EPA's PFAS Strategic Roadmap,[250] the Draft Permit establishes influent, effluent and sludge monitoring requirements for 40 selected PFAS. Additionally, the Draft Permit includes monitoring from selected categories of industrial dischargers to quantify the PFAS from these sources. A detailed discussion of PFASs can be found above in Section 5.1.14 of this Fact Sheet and monitoring requirements can be found in the Draft Permit Part I.A.1, Part I.G.4, Part I.I.2. and Draft Permit Attachment H.

EPA discusses the other major categories of concern below.

5.1.15.1 Pharmaceuticals and Personal Care Products (PPCPs)

As stated in EPA's fact sheet, Contaminants of Emerging Concern in Fish, "Pharmaceuticals and personal care products (PPCPs) are a diverse group of chemicals that include all drugs (both prescription and over-the-counter medications) and non-medicinal consumer chemicals, such as the fragrances (musks) in lotions and soaps and the ultraviolent filters in sunscreens. PPCPs have only recently received attention as potential environmental pollutants. Results from studies in the past several years provide evidence that many PPCPs enter aquatic systems because they persist through wastewater treatment processes and are subsequently discharged from wastewater treatment plants into surface water or ground water. New developments in technology have led to improvements in detecting and quantifying PPCPs in water, sediments, and fish tissue. However, despite recent advances in PPCP research, the full extent, magnitude and consequences of their presence in aquatic environments is still largely unknown."[251]

MWRA recently participated in a study[252] to evaluate CECs in an offshore marine environment. The study measured 18 active pharmaceutical ingredients (APIs), caffeine and sucralose as well as 25 PFAS. "APIs, sucralose, caffeine and up to 18 PFAS were found in the MWRA effluent and in surface water up to ~25 miles offshore at low to very low concentrations." Depending on the season, the DITP discharge, the Merrimack River (with 41 permitted POTWs) and outflow from Boston Harbor are likely sources. A manuscript of this study is expected in the summer of 2023.

OMSAP's ad hoc focus group on PPCPs made many recommendations for the full OMSAP to consider in their development of recommendations to EPA[253]. Several of these recommendations are applicable for consideration in the context of the Draft Permit.

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[249] https://www.epa.gov/wqc/national-recommended-water-quality-criteria-tables
[250] https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024
[251] EPA. 2013. Contaminants of Emerging Concern (CECs) in Fish: Pharmaceuticals and Personal Care Products (PPCPs). p.1. EPA-820-F-13-004., https://www.epa.gov/sites/default/files/2018-11/documents/cecs-ppcps-factsheet.pdf
[252] PRESENTATION. Robuck et al. February 10, 2023. Concentrations of Chemicals of Emerging Concern are Mediated by Seasonal Hydrodynamics in an Offshore Marine Environment.
[253] Letter. OMSAP to Kenneth Moraff, EPA and Lealdon Langley, MassDEP. July 8, 2022. Recommendations on Contaminants of Emerging Concern for Considerations to the MWRA Monitoring Plan"

- Monitor influent and effluent levels of selected PPCPs at the MWRA DITP to determine treatment removal efficacy.
- Continue monitoring for PPCPs in the marine environment.
- Conduct modeling to better understand the fate of discharged PPCPs.
- Enact source reduction public education.

Currently, there are no National Recommended Water Quality Criteria for PPCPs as a group or individually. This limits EPA's ability to require monitoring as there nothing to compare the data to or ability to determine reasonable potential. MWRA effluent quality is consistent as shown in Appendix C of this Fact Sheet and that extends to the selected PPCPs.[254]

The 2000 Permit required MWRA to develop a Household Hazardous Waste booklet. The Draft Permit requires MWRA to update this booklet and to add information on PPCPs. MWRA shall update their Household Hazardous Waste booklet to include information on the sources and proper disposal of PPCPs. MWRA shall make this information available on their website and in hardcopy to all the sewer member communities. See Part I.I.2 of the Draft Permit for more detail.

5.1.15.2 Microplastics

As stated on EPA's website, "Plastics have become ubiquitous in natural and built environments which has caused concern regarding potential harms to human and aquatic life. Microplastics (plastic particles ranging in size from 5 mm–1 nm) and nanoplastics (plastic particles smaller than 1 nm) have been found in every ecosystem on the planet from the Antarctic tundra to tropical coral reefs. The wide range of particle sizes, densities and compositions pose a challenge for researchers because there is not a single method that can be used to characterize the wide variety of micro and nanoplastics particles. There is a pressing need to develop and standardize collection, extraction, quantification and identification methods for micro/nanoplastics to improve reliability, consistency and comparability across studies."[255]

Recent research[256] presented at the 2023 Annual OMSAP Meeting reported that microplastics concentrations from the DITP were significantly lower than concentrations from the New Bedford WWTP. It is likely that the difference in outfall design, long multiport diffuser versus a single open pipe, is the primary factor. Modeling of the microplastics discharged into the Bay were found to be low and consistent with the past dye studies discuss in Section 4.3 of this Fact Sheet.[257] Because there are no National Recommended Water Quality Criteria for microplastics. EPA is unable to evaluate the data further or determine reasonable potential.

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[254] Anna Robuck, Personal Communication, May 9, 2023.
[255] https://www.epa.gov/water-research/microplastics-research, retrieved 4/19/2023.
[256] PRESENTATION. Gallagher, Scott and James Churchill, WHOI. February 10, 2023. Assessing the Seasonal and Storm-impacted Transport and Biological Fate of Micro- and Nanoplastics Discharged from Wastewater Treatment Facilities into Massachusetts Coastal Waters.
[257] Gallagher, Scott M., WHOI Biology and James H. Churchill, WHOI Oceanography. 2023. "Woods Hole Oceanographic Institution Sea Grant Program, Woods Hole Oceanographic Institution, Research Program Annual/Final Report – Due April 19, 2023, Project Title: . Assessing the Seasonal and Storm-impacted Transport and Biological Fate of Micro- and Nanoplastics Discharged from Wastewater Treatment Facilities into Massachusetts Coastal Waters.

The 2000 Permit required MWRA to develop a Household Hazardous Waste booklet. The Draft Permit requires MWRA to update this booklet and to add information on microplastics. MWRA shall update their Household Hazardous Waste booklet to include information on the sources and proper disposal of plastics. MWRA shall make this information available on their website and to all the sewer member communities. See Part I.I.2 of the Draft Permit for more detail.

5.2 Industrial Pretreatment Program

The Permittee is required to administer a pretreatment program under 40 CFR Part 403. (*See also* CWA § 307; 40 CFR § 122.44(j)). The Permittee's pretreatment program received EPA approval on July 20, 1982 and, as a result, appropriate pretreatment program requirements were incorporated into the previous permit, which were consistent with that approval and federal pretreatment regulations in effect when the permit was issued.

As required by 40 CFR § 122.21(j)(6), EPA will continue to evaluate the need for a pretreatment program. EPA has reviewed the NPDES permit application related to pretreatment items and annual industrial pretreatment program reports have been submitted and reviewed prior to issuance of the NPDES Permit.

The Federal Pretreatment Regulations in 40 CFR Part 403 were amended in October 1988, in July 1990, and again in October 2005. Those amendments established new requirements for implementation of pretreatment programs. Upon reissuance of this NPDES permit, the Permittee is obligated to modify its pretreatment program to be consistent with current Federal Regulations. The activities that the Permittee must address include, but are not limited to, the following: 1) develop and enforce EPA-approved specific effluent limits (technically-based local limits); 2) revise the local sewer-use ordinance or regulation, as appropriate, to be consistent with federal regulations; 3) develop an enforcement response plan; 4) implement a slug control evaluation program; 5) track significant noncompliance for industrial users; and 6) establish a definition of and track significant industrial users.

These requirements are necessary to ensure continued compliance with the POTW's NPDES permit, and its sludge use or disposal practices.

In addition to the requirements described above, the Draft Permit requires the Permittee to submit to EPA in writing, within 180 days of the Permit's effective date, a description of proposed changes to Permittee's pretreatment program deemed necessary to assure conformity with current federal pretreatment regulations. These requirements are included in the Draft Permit to ensure that the pretreatment program is consistent and up-to-date with all pretreatment requirements in effect. Lastly, the Permittee must continue to submit, annually by October 31st, a pretreatment report detailing the activities of the program for the twelve-month period ending 60 days prior to the due date.

5.3 Sludge Conditions

Section 405(d) of the Clean Water Act requires that EPA develop technical standards regarding the use and disposal of sewage sludge. On February 19, 1993, EPA promulgated technical standards. These standards are required to be implemented through permits. The conditions in the Permit satisfy this requirement.

5.4 Infiltration/Inflow (I/I)

Infiltration is groundwater that enters the collection system though physical defects such as cracked pipes, or deteriorated joints. Inflow is extraneous flow entering the collection system through point sources such as roof leaders, yard and area drains, sump pumps, manhole covers, tide gates, and cross connections from storm water systems. Significant I/I in a collection system may displace sanitary flow, reducing the capacity and the efficiency of the treatment works and may cause bypasses of secondary treatment. It greatly increases the potential for sanitary sewer overflows (SSOs) in separate systems, and combined sewer overflows (CSOs) in combined systems.

The 2000 Permit includes specific I/I requirements appropriate to the extensive collection system that conveys flows to the DITP, which is comprised of over 225 miles of sewers owned and operated by MWRA and approximately 5,300 miles of sewers owned and operated by the 43 Co-permittees. The 2000 Permit requires MWRA: (1) in cooperation with its member communities, to eliminate "excessive" I/I to the MWRA system; (2) to prepare and submit an annual summary report of all actions taken to reduce I/I in the MWRA and member communities' collection systems and provide Community Wastewater Flow Estimates Flow Components for the MWRA member communities and place the information on the MWRA's web page for public information purposes,[258,259,260,261,262,263] (3) to submit to EPA and MassDEP a copy of the I/I Task Force Report[264] and upon approval by EPA and MassDEP implement the I/I reduction measures recommended in the Report; (4) to develop and submit a Regional I/I Reduction

[258] LETTER. Michael J. Hornbrook, MWRA to Susan Studlien, EPA and David Ferris, MassDEP. August 26, 2016. RE: MWRA Permit Number MA0103284, Attachments 1-6. https://www.mwra.com/harbor/pdf/infinf16.pdf
[259] LETTER. Michael J. Hornbrook, MWRA to Susan Studlien, EPA and Susannah King, MassDEP. August 25, 2017. RE: MWRA Permit Number MA0103284, Attachments 1-6. https://www.mwra.com/harbor/pdf/infinf17.pdf
[260] LETTER. David W. Coppes, MWRA to Karen Maquire, EPA and Lealdon Langley, MassDEP. August 28, 2018. RE: MWRA Permit Number MA0103284, Attachments 1-6. https://www.mwra.com/harbor/pdf/infinf18.pdf
[261] LETTER. David W. Coppes, MWRA to Karen Maquire, EPA and Kevin Brander, MassDEP. August 23, 2019. RE: MWRA Permit Number MA0103284, Attachments 1-6. https://www.mwra.com/harbor/pdf/infinf19.pdf
[262] LETTER. David W. Coppes, MWRA to Todd Borci, EPA and Kevin Brander, MassDEP. August 27, 2020. RE: MWRA Permit Number MA0103284, Attachments 1-6., http://ftp.mwra.com/harbor/pdf/infinf20.pdf
[263] LETTER. David W. Coppes, MWRA to Todd Borci, EPA and Susannah King, MassDEP. August 29, 2022. RE: MWRA NPDES Permit Number MA0103284 – MWRA Annual Infiltration and Inflow (I/I) Reduction Report for Fiscal Year 2022, Attachments 1-6., https://www.mwra.com/harbor/pdf/infinf.pdf
[264] MWRA Inflow/Infiltration Task Force. 2001. Inflow/Infiltration Task Force Report: A Guidance for the MWRA Member Communities and Regional Stakeholder. March 2001. https://www.mwra.com/comsupport/publications/iitaskforcereport-march2001.pdf

Plan[265] for the MWRA and community collection systems; and (5) to enter an updated MOA with MassDEP regarding I/I issues.

The 2000 Permit also encouraged MWRA to consider incentive programs, rate structures, grant and loan programs, technical assistance and public education efforts and evaluate at least the following:

1. Allocation of fiscal and legal responsibilities for implementation of elements of the Regional I/I Reduction Plan. The Plan may propose appropriate enforcement roles for EPA and MassDEP.
2. Financial assistance programs such as grants and loans for I/I removal. Include recommendations for future funding programs for eligible community reduction projects.
3. Flow based rate structure as a financial incentive to reduce I/I through wholesale sewer charge components, including consideration of modifying MWRA's current rate flow based rate structure.
4. Technical assistance programs to support community I/I reduction efforts.
5. Public education programs to support community I/I reduction efforts.
6. Wastewater metering program to quantify community wastewater flows and to estimate community I/I.
7. A program of internal pipeline and manhole inspection to identify and quantify I/I in MWRA's operated regional system.

MWRA developed a Region I/I Reduction Plan[266] which was submitted to EPA and MassDEP in June 2001 and MassDEP approved the Plan by letter dated November 19, 2002. MWRA is legally and fiscally responsible for operation and maintenance and I/I removal for the collection system owned and operated by MWRA. The Plan specifically notes that "each member community retains full legal and fiscal responsibility for implementation of operation and maintenance and I/I reduction programs for community-owned sewers."[267] MWRA does, however, provide technical and financial assistance to member communities as recommended by the 2000 Permit.

The Region I/I Reduction Plan has 5 major goals:

1. MWRA will continue its current operation and maintenance program for the MWRA-owned interceptor system leading to the identification, prioritization and rehabilitation of structural and I/I problems.
2. MWRA will work cooperatively with member communities, MassDEP and EPA to eliminate sewer system backups onto homes and other buildings and to minimize health and environmental impacts of SSOs related to I/I.

[265]MWRA, September 2002. Regional Infiltration/Inflow Reduction Plan. https://www.mwra.com/comsupport/ii/2010/iiplan.pdf
[266] MWRA. Regional Infiltration/Inflow Reduction Plan. September 2002. https://www.mwra.com/comsupport/ii/2010/iiplan.pdf

[267] LETTER. David W. Coppes, MWRA to Todd Borci, EPA and Susannah King, MassDEP. August 29, 2022. RE: MWRA NPDES Permit Number MA0103284 – MWRA Annual Infiltration and Inflow (I/I) Reduction Report for Fiscal Year 2022, Attachments 1-6, p. 1-1., https://www.mwra.com/harbor/pdf/infinf.pdf

3. MWRA will work cooperatively with member communities, MassDEP and EPA to reduce I/I in the regional collection system with emphasis on the following: (1) inflow reduction in areas tributary to sewer backups and SSOs, (2) private source inflow reduction, (3) infiltration that may impact groundwater or source water resources, and (4) excessive infiltration as defined in MassDEP regulations or guidance documents.
4. MWRA will work cooperatively with member communities, MassDEP and EPA to expand existing efforts to educate and involve the public regarding regional sewer backup, SSO, and I/I reduction issues.
5. MWRA will provide technical assistance and work cooperatively with member communities, MassDEP and EPA regarding guidance on local operation and maintenance and capital improvement programs intended to provide a reasonable level of sewer service to local sewer users/ratepayers.

As required by the 2000 Permit, MWRA submits annual summary reports which includes community wastewater flow data and estimates of wastewater flow components. Although the components of wastewater flows are considered estimates, they are estimated based on metering and engineering analysis[268]. EPA has used this information submitted over the term of the 2000 Permit (2000 to 2022 excluding 2004, 2005 & 2021 when metering equipment was being updated and estimates were not made) to evaluate system-wide progress on I/I reduction. EPA has found a slight increase in the system-wide average of infiltration as a percentage of average daily flows based on a system-wide average (See Figure 17). Conversely, the system-wide average of inflow as a percentage of average daily flows has improved significantly. (See Figure 18).

EPA also evaluated flow data from the MWRA's discharge monitoring reports (DMRs) in comparison with the EPA standards[269] for non-excessive infiltration/inflow of 275 gallons per capita day (gpcd) wet weather flow and for non-excessive infiltration of 120 gpcd dry weather flow. The standards are multiplied by population served for comparison with flow values from the DITP and in this evaluation EPA used a population value of 2,344,877 as reported in the most recent annual summary report.

Figure 19 shows the Daily Maximum Flow (the highest flow recorded in a particular month) at the DITP along with monthly precipitation data from Logan Airport. It is clear that the facility experiences wet weather flows far exceeding the standard for non-excessive I/I, particularly in wet months, indicating that these facilities are receiving high levels of inflow and wet weather infiltration. EPA recognizes that a portion of the MWRA collection system is combined and that CSO regulations encourage maximum use of the treatment facility for treating stormwater flows.

MWRA is also required to report the dry day flows to the DITP. The 2000 Permit defines a dry day "as a day with 0.09 inches of precipitation or less and no snow melt, provided that the precipitation on the previous day is less than 0.3 inch, and the precipitation on the day two days

[268] LETTER. David W. Coppes, MWRA to Todd Borci, EPA and Susannah King, MassDEP. August 29, 2022. RE: MWRA NPDES Permit Number MA0103284 – MWRA Annual Infiltration and Inflow (I/I) Reduction Report for Fiscal Year 2022, Attachments 1-6, p. 6-1., https://www.mwra.com/harbor/pdf/infinf.pdf
[269] EPA. 1985. I/I Analysis and Project Certification. *I/I Analysis and Project Certification*, EPA Ecol. Pub. 97-03 (1985); 40 CFR 35.2005(b)(28) and (29).

prior to the day in question is less than 1.0 inch, and the precipitation on the day three days prior to the day in question is less than 2.0 inches. A day with snow melt is defined as a day when there is snow on the ground and the air temperature rises above 32 fahrenheit degrees. Flow from CSO storage facilities [are] not be included in the dry day flow over the previous 365 calendar days. The once a month calculation shall include all dry days that occurred during the reporting months."[270] Even with this very conservative definition of a dry day, over 68% of the months between September 2000 and January 2023 had dry day flows that have exceeded the non-excessive infiltration standard (See Figure 20).

Each of these evaluations find that infiltration and inflow is at excessive levels in the MWRA collection system. Excessive I/I has human health and water quality impacts including discharges from SSOs and CSOs.

EPA compiled Sanitary Sewer Overflow (SSO) Notification Reports received by MassDEP from the MWRA member communities for the period of 2006 through 2020. Massachusetts regulations at 314 CMR 12.03(8) require the owner/operator of a sewer system to "report bypasses and/or overflows." Over 4000 SSOs were reported by MWRA sewer communities during the 14-year review period. However, EPA does not believe this record is complete, which may be due to staffing shortages at MassDEP, office closures during COVID, lack of a tracking system and many forms not being directly sent to EPA as required by the MassDEP form. The data is skewed to 2013-2018. Additionally, some communities have a more robust reporting system than others. The City of Boston, for instance, accounts for more than 50% of the reported SSOs. Also, due to the fact that SSOs are defined as "any overflow, spill, release, discharge or diversion of untreated or partially treated wastewater from a sanitary system,"[271] and as such there is no standard methodology to measure or estimate volume or rate of flow, it is impossible to determine the volume of sanitary overflows. Furthermore, a number of forms were lacking crucial data such as addresses/locations of discharge, dates when the SSOs started and ended, causes of the SSO, volume of the discharge, rate of the SSO discharge and where the SSO discharged to.

Given the continued excessive levels of I/I throughout the MWRA collection system and the significant number of SSO discharges, EPA has determined that it is necessary to include the MWRA sewer member communities as Co-permittees in the Draft Permit. This was anticipated in the 2000 Permit which included a reopener that stated; "If at any time after June 2001, the EPA and/or [MassDEP] is not satisfied that (1) member communities are reporting all SSOs in accordance with 314 CMR 12.03(8) and or (2) member communities are adopting and implementing effective SSO plans, then this permit may be reopened, utilizing permit modification procedures, to add requirements regarding MWRA regulation of the member communities and/or add the member communities as co-permittee directly regulated under this permit."

The Draft Permit includes a requirement for the Permittee and Co-permittees to control infiltration and inflow (I/I) within the portion of the sewer collection system that it owns and operates. The Permittee and Co-permittees shall develop I/I removal programs commensurate

[270] EPA. 2000. NPDES Permit No. MA0103284, p. 5.
[271] 314 CMR 12.02

with the severity of I/I in their respective collection systems. This program may be scaled down in sections of the collection system that have minimal I/I.

The Draft Permit requires the Permittee, MWRA, to update its Regional I/I Reduction Plan. As part of the update, the Permittee must identify the goals and strategies of the 2002 Regional I/I Reduction Plan that have been completed and justify that the goal or strategy be removed from the updated Plan. Uncompleted elements shall continue to be included in the Plan and be implemented. Additionally, the Permittee shall also consider new steps, strategies and technologies to be implemented in addressing I/I. Over 20 years have passed since the development of the current plan. Finally, the Permittee shall include a discussion of historical SSO locations and upstream levels of I/I, with a specific proposal including the use of new strategies and technologies to reduce I/I in these contributing areas.

The Draft Permit maintains the requirement for the Permittee to submit an annual summary report ("Annual Infiltration and Inflow (I/I) Reduction Report") of all actions taken to reduce I/I during the MWRA's past fiscal year by September 1st of each year. The Report shall continue to contain Community Wastewater Flow Components Estimates for each of the MWRA member communities which shall be placed on the MWRA web page for public informational purposes. The Community Wastewater Flow Components Estimates table should differentiate between CSO and non-CSO communities.

The Draft Permit also requires the Co-permittees to prepare and submit I/I Reduction Plans. Massachusetts regulations at 314 CMR 12.04 (2) required municipalities to submit I/I Analysis Reports to MassDEP by December 31, 2017. Municipalities were then required to conduct Sewer System Evaluation Surveys in accordance with their I/I Analysis Report. EPA believes these reports can be the basis for I/I Plans to be developed and submitted by the Co-permittees to remove excessive I/I from the collection system that it owns and/or operates.

The I/I reduction conditions in the Draft Permit are consistent with the I/I reduction conditions that MassDEP has stated shall be a standard State Certification requirement under Section 401 of the CWA and 40 CFR § 124.55(b).

5.5 Unauthorized Discharges

This draft permit only authorizes discharges from the outfalls described in Permit Parts I.A.1, Attachment A, and Part I.B.1. Permit Part I.C explains that discharges of wastewater from any other point sources, including SSOs, are unauthorized discharges. Bypasses are also unauthorized discharges. Part I.C sets out the specific obligations the permittee, CSO-responsible co-permittees, and co-permittees have to notify EPA, MassDEP, and the public of such unauthorized discharges.

5.6 Operation and Maintenance

The standard permit conditions for 'Proper Operation and Maintenance, found at 40 CFR § 122.41(e), require the proper operation and maintenance of permitted wastewater systems and related facilities to achieve compliance with permit conditions. The requirements at 40 CFR

§ 122.41(d) impose a 'duty to mitigate,' which requires the Permittee to "take all reasonable steps to minimize or prevent any discharge in violation of the permit that has a reasonable likelihood of adversely affecting human health or the environment. EPA maintains that an I/I removal program is an integral component of ensuring permit compliance with the requirements of the Permit under the provisions at 40 CFR §§ 122.41(d) and (e).

General requirements for proper operation and maintenance, and mitigation have been included in Part II of the permit. Specific permit conditions have also been included in Part I.E. of the Draft Permit. These requirements include mapping the wastewater collection system, preparing and implementing a collection system operation and maintenance plan, reporting of unauthorized discharges including SSOs, maintaining an adequate maintenance staff, performing preventative maintenance, controlling inflow and infiltration to separate sewer collection systems to the extent necessary to prevent SSOs and I/I related effluent violations at the Wastewater Treatment Facility, and maintaining alternate power where necessary. The Permit also requires the evaluation and implementation of a resiliency plan for the facilities and the collections. These requirements are included to minimize the occurrence of permit violations that have a reasonable likelihood of adversely affecting human health or the environment.

Several of the requirements in the Draft Permit are not included in the 2000 Permit, including collection system mapping, and preparation of wastewater treatment facility and sewer system operation and maintenance plans. EPA has determined that these additional requirements are necessary to ensure the proper operation and maintenance of the collection system and has included schedules in the Draft Permit for completing these requirements.

The Draft Permit makes clear that MWRA has sole responsibility for operation and maintenance of the DITP, the sludge pelletizing plant, MWRA-operated pumping stations and the sewer system owned and operated by MWRA. MWRA must provide adequate staff and perform both routine and preventive maintenance for these facilities. MWRA is also required to maintain an alternate power source for the treatment plant and pumping stations to ensure that the facilities can continue to operate in the event of an interruption of the primary power supply. The Draft Permit also requires MWRA to continue implementing a long-range operation and maintenance plan for the treatment plant designed to maximize the facility's life.

The Draft Permit requires MWRA to submit monthly reports to EPA and MassDEP regarding the operational status and performance of pumps at the treatment plant and the MWRA-operated pumping stations, as well as information on gate choking and daily flow rates at the headworks facilities. MWRA is also required to submit monthly reports to EPA and MassDEP on outfall diffuser performance and to conduct and submit reports of video inspections whenever the ratio of flow to hydraulic head suggests that the diffusers may not be functioning properly.

Because the municipalities listed in Attachment A, each own and operate collection systems that discharge to the DITP, these municipalities have been included as Co-permittees for the specific permit requirements discussed in the second paragraph of this section. The historical background and legal framework underlying this Co-permittee approach is set forth in Appendix D of this Fact Sheet, *EPA Region 1 NPDES Permitting Approach for Publicly Owned Treatment Works that Include Municipal Satellite Sewage Collection Systems*.

5.6.1 Operation and Maintenance of the Wastewater Treatment Facility

The Draft Permit, in Part I.E.1. requires the Permittee to address major storm and flood events as part of their wastewater treatment facility operation and maintenance planning. The major storm and flood plan addresses risks to the facility and its infrastructure from extreme weather events.[272] The Plan should address resiliency of the facility, evaluate,[273] and implement control measures to minimize[274] the impacts of major storm and flood events at the wastewater treatment facility. The Plan's requirements include: an asset vulnerability evaluation, systemic vulnerability evaluation, and alternative evaluation. These requirements are included to ensure the proper operation and maintenance of the wastewater treatment facility and to minimize the impacts of major storm and flood events.

These requirements are new. EPA has determined that these additional requirements are necessary to ensure the proper operation and maintenance of the wastewater treatment facility and has included schedules in the Draft Permit for completing these requirements.

5.6.2 Operation and Maintenance of the Sewer System

The Draft Permit, in Part I.E.2. requires the Permittee, CSO-responsible Co-Permittees, and Co-permittees to address major storm and flood events as part of their sewer system operation and maintenance planning. The major storm and flood plan should address risks to the sewer system and its infrastructure from extreme weather events.[275] The Plan should address resiliency of the system and evaluate and implement control measures to minimize the impacts of major storm and flood events throughout the sewer system. The requirements include: an asset vulnerability

[272] "Major storm and flood events" refer to instances resulting from major storms such as hurricanes, extreme/heavy precipitation events, and pluvial, fluvial, and flash flood events such as high-water events, storm surge, and high-tide flooding. "Extreme/heavy precipitation" refers to instances during which the amount of rain or snow experienced in a location substantially exceeds what is normal. What constitutes a period of heavy precipitation varies according to location and season. "Extreme/heavy precipitation" does not necessarily mean the total amount of precipitation at a location has increased-just that precipitation is occurring in more intense or more frequent events.

[273] To determine the vulnerabilities to the facilities from major storm and flood events, you must conduct the evaluation using, at a minimum, the worst-case data relating to changes in precipitation, sea level rise, extreme weather events, coastal flooding, inland flooding, sewer flow and inflow and infiltration and relevant to the facilities from: 1) the data generated by the 13 federal agencies that conduct or use research on global change that contributed to the latest National Climate Assessment produced by the U.S. Global Change Research Program (USGCRP); 2) climate data generated by the Commonwealth of Massachusetts; and 3) resiliency planning completed by the municipality in which a given facility is located (i.e., City of Boston) and incorporate the results of the evaluation in a manner that demonstrates that the control measures taken are precautionary and sufficiently protective. Evaluation must be completed by a qualified person on a five-year basis considering 1) historical observations from all years the Permittee has operated the facility prior to this permit's term; 2) the 25 to 100 years forward-looking from the review year to assess impacts that are likely to occur.

[274] For the purposes of this provision, the term "minimize" means to reduce and/or eliminate to the extent achievable the impacts to the facilities.

[275] "Major storm and flood events" refer to instances resulting from major storms such as hurricanes, extreme/heavy precipitation events, and pluvial, fluvial, and flash flood events such as high-water events, storm surge, and high-tide flooding. "Extreme/heavy precipitation" refers to instances during which the amount of rain or snow experienced in a location substantially exceeds what is normal. What constitutes a period of heavy precipitation varies according to location and season. "Extreme/heavy precipitation" does not necessarily mean the total amount of precipitation at a location has increased-just that precipitation is occurring in more intense or more frequent events.

evaluation, systemic vulnerability evaluation, and alternative evaluation. These requirements are included to ensure the proper operation and maintenance of the sewer system and to minimize the impacts of major storm and flood events.

Several of these requirements are new. EPA has determined that these additional requirements are necessary to ensure the proper operation and maintenance of the wastewater treatment facility and the sewer system and has included schedules in the Draft Permit for completing these requirements.

5.7 Combined Sewer Overflows

Description

The wastewater collection system that conveys flows to the MWRA DITP consists partially of combined sewers that convey both sanitary sewage and stormwater runoff during certain wet weather events.[276] During wet weather events that exceeds the capacity of the combined sewers, and/or the wastewater treatment plant, a portion of the combined flow is discharged through one or more CSO outfalls to Boston Inner Harbor including the Reserved, Fort Point and Little Mystic Channels, and Dorchester Bay, the Chelsea River, Charles River, Back Bay Fens, Mystic River, Alewife Brook and the Little River. CSOs have been identified as causing or contributing to water quality impairments in the segments of Boston Inner Harbor, Dorchester Bay, the Chelsea River, the Charles River, the Mystic River, Alewife Brook and the Little River where discharges from CSO outfalls owned by MWRA, and the Cities of Boston, Cambridge, Chelsea and Somerville's occur.[277] See Section 4.1 of this Fact Sheet for a full description of the receiving waters and their impairments.

The MWRA DITP provides wastewater treatment for 43 communities in the metropolitan Boston area (See Appendix A). The regional collection system is 95% separated sanitary sewers and 5% combined sewers.[278] The combined portion of the sewer system is limited to four communities: Boston, Cambridge, Chelsea and Somerville (Figure 12). MWRA owns and operates four (4) CSO treatment facilities and 6 CSO outfalls. Boston (BWSC), Cambridge, Chelsea and Somerville each currently have individual NPDES permits authorizing the discharge from the CSO outfalls they own and operate.[279, 280, 281, 282] This Draft Permit authorizes discharges from

[276] Precipitation events exceeding certain intensities, volume over a duration, or combined with snowmelt can exceed the capacity of certain parts of the combined sewer systems.
[277] MassDEP, 2019, Massachusetts Year 2016 Integrated List of Waters, Final Listing of the Condition of Massachusetts Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act, https://www.epa.gov/sites/production/files/2020-01/documents/2016-ma-303d-list-report.pdf
[278] EMAIL. Betsy Reilley, MWRA to Michele Barden, EPA. July 28, 2021. RE: EPA Data Request for DITP NPDES.
[279] Boston Water and Sewer Commission, NPDES# MA0101192, https://www3.epa.gov/region1/npdes/permits/2003/bostonwspermit.pdf , https://www3.epa.gov/region1/npdes/permits/2007/finalma0101192permitmod.pdf
[280] Cambridge, NPDES# MA0101974, https://www3.epa.gov/region1/npdes/permits/2009/finalma0101974permit.pdf
[281] Chelsea, NPDES# MA0101877, https://www3.epa.gov/region1/npdes/permits/2013/finalma0101877permit.pdf
[282] Somerville, NPDES# MA0101982, https://www3.epa.gov/region1/npdes/permits/2012/finalma0101982permit.pdf

47 CSO outfalls. A listing of the CSO outfalls, along with receiving waters and locations, can be found in Appendix B.

Originally, a total of 84 CSO outfalls were identified as hydraulically connected to the DITP. MWRA currently reports CSO activation frequency and volume for 86 locations (2 additional locations were added) including for those that have been closed. According to the Final CSO Post Construction Monitoring Program and Performance Assessment Report,[283] MWRA has eliminated 35 CSO outfalls. Seventy (this includes the 35 outfalls that were eliminated) of the 86 CSO outfalls are currently achieving or nearly achieving the goals in the LTCP. The remaining 16 CSO outfalls are being studied to determine whether additional changes to the combined sewer system can be made that would allow these CSO outfalls to meet the LTCP goals. Performance improvements for 6 of the 16 are either in construction or design as of December 2021.[284] For the remaining 10 outfalls, MWRA has identified alternatives that will achieve the LTCP goals at 4 outfalls and evaluations will continue for the remaining. 6

Appendix H includes CSO Treatment Facilities DMR data for January 2018 through December 2022. Appendix I is a summary of CSO activations and volumes for MWRA, Boston, Cambridge, Chelsea and Somerville for 2016-2020 based on Annual Reports.

Regulatory Framework

CSO outfalls are point sources subject to NPDES permit requirements for both water-quality based and technology-based requirements but are not subject to the secondary treatment regulations applicable to publicly owned treatment works in accordance with 40 CFR §133.103(a). Section 301(b)(1)(C) of the Clean Water Act of 1977 mandated compliance with water quality standards by July 1, 1977. Technology-based permit limits must be established for best conventional pollutant control technology (BCT) and best available technology economically achievable (BAT) based on best professional judgment (BPJ) in accordance with Section 301(b) and Section 402(a) of the Water Quality Act Amendments of 1987 (WQA). The framework for compliance with Clean Water Act requirements for CSOs is set forth in EPA's National CSO Control Policy, 59 Fed. Reg. 18688 (1994). It sets the following objectives:

1) To ensure that if the CSO discharges occur, they are only as a result of wet weather;

2) To bring all wet weather CSO discharge points into compliance with the technology-based requirements of the CWA and applicable federal and state water quality standards;

and

[283] AECOM. 2021. Task 6: Final CSO Post Construction Monitoring Program and Performance Assessment Report, https://www.mwra.com/cso/pcmpa-reports/Final12302021.pdf
[284] AECOM. 2021. Task 6: Final CSO Post Construction Monitoring Program and Performance Assessment Report. https://www.mwra.com/cso/pcmpa-reports/Final12302021.pdf

3) To minimize water quality, aquatic biota, and human health impacts from wet weather flows.

The CSO Policy explains EPA's best profession judgement is that on a consistent, national basis the nine minimum controls reflect the minimum BCT/BAT controls (i.e., technology-based limits) appropriate for CSOs. These are the Nine Minimum Controls (NMCs) defined in the CSO Policy and set forth in Part I.B. of the Draft Permit: 1) proper operation and regular maintenance programs for the sewer system and the combined sewer overflows; 2) maximum use of the collection system for storage; 3) review and modification of the pretreatment programs to assure CSO impacts are minimized; 4) maximization of flow to the POTW for treatment; 5) prohibition of dry weather overflows; 6) control of solid and floatable materials in CSOs; 7) pollution prevention programs which focus on contaminant reduction activities; 8) public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts; and 9) monitoring to effectively characterize CSO impacts and the efficacy of CSO controls.

To reflect advances in technologies and State regulations, the Draft Permit includes more specific public notification implementation level requirements to ensure that the public receives adequate notification of CSO occurrences and CSO impacts. The Draft Permit requires the Permittee and CSO-responsible Co-permittees to develop a public notification plan to fulfill NMC #8 and 314 CMR 16.00.

In January 2021, Massachusetts enacted a law, *An Act Promoting Awareness of Sewage in Public Waters.* The law requires that the public be aware when untreated sewage flows into Massachusetts waters. This includes CSO outfall discharges and certain Sanitary Sewer Overflows (SSOs). Per 314 CMR 16.06(1), a Permittee or Co-permittee with a combined sewer system shall submit to MassDEP for review and approval a preliminary CSO Notification Plan by May 1, 2022. The Permittee and CSO-responsible Co-permittees have submitted their preliminary plans. Per 314 CMR 16.06(2), a final CSO notification plan shall be submitted to MassDEP for review and approval by January 12, 2023.

MWRA submitted documentation of its Nine Minimum Control Plan for its CSO outfalls as well as for the CSO outfalls in Boston, Cambridge, Chelsea, Somerville by the deadline of January 1, 1997. MWRA and the CSO communities are currently required to update their Nine Minimum Control Plans in accordance with their individual NPDES Permits.

Permittee and Co-permittees	**Nine Minimum Control Plan submitted to EPA**	**Date of most recent update of the Nine Minimum Control Plan**
MWRA	December 31, 1996	---
Boston	December 31, 1996	2018
Cambridge	December 31, 1996	2010
Chelsea	December 31, 1996	2019
Somerville	December 31, 1996	2014

Table 18: Nine Minimum Control Plans for MWRA and CSO Communities.

The CSO Policy also recommended that each community that has a combined sewer system develop and implement a long-term CSO control plan (LTCP) that will ultimately result in

compliance with the requirements of the CWA. The MWRA has accepted liability for achieving the level of control set forth in the 1997 LTCP as amended (defined in the Second Stipulation[285]).

In accordance with the Clean Water Act and the CSO Policy, the untreated CSOs, and the CSOs from the CSO Treatment Facilities are not subject to the secondary treatment standards that apply to the POTW treatment plant but are required to achieve technology-based requirements as defined in the CSO policy (the nine minimum controls at a minimum) and limitations necessary to achieve water quality standards. Therefore, the Draft Permit includes applicable technology and water quality-based limitations on discharges from the CSO Treatment Facilities: MWR201, MWR203, MWR205/205A and MWR215. In addition, the Draft Permit includes monitoring requirements which will provide information necessary for evaluating the effectiveness of the CSO Treatment Facilities use as CSO control measures.

Permit Requirements

In accordance with the National CSO Policy, the Draft Permit contains the following conditions for the CSO discharges:

(i) Dry weather discharges from CSO outfalls are prohibited. Dry weather discharges must be immediately reported to EPA and MassDEP.

(ii) During wet weather, the discharges must not cause any exceedance of water quality standards.

(iii) The Permittee and CSO-responsible Co-permittees shall meet the technology-based Nine Minimum Controls described above and shall comply with the implementation levels as set forth in Part I.B of the Draft Permit.

(iv) The Permittee and CSO-responsible Co-permittee shall review its entire NMC program and revise it as necessary. Documentation of this review and any resultant revisions made to the NMC program shall be submitted to EPA and MassDEP within 6 months of the effective date of the permit. An annual report shall be provided by April 30th of each year which describes any subsequent revisions made to the NMC program and shall also include monitoring results from CSO discharges, and the status of CSO abatement projects.

In addition to the requirements described above, the operation of the CSO Treatment Facilities (MWR201, MWR203, MWR205/205A and MWR215) are subject to additional technology-based effluent limitations, water-quality based effluent limitations, and monitoring requirements. These CSO Treatment Facilities represent enhancements of the Nine Minimum Controls, allowing for greater use of the collection system for storage (NMC #2) and return of the flow to

[285] US District Court for District of Massachusetts, 2006, Second Stipulation of the United States of America and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflow Control, www.mwra.com/cso/2006/0306memo.pdf

the POTW for treatment (NMC #4), removal of floatable and solid materials (NMC #6), and reduction of pathogenic bacteria through disinfection (NMC #7).

MWRA CSO Permitting History and Federal Court-ordered Obligations

In 1987, the MWRA stipulated to responsibility and legal liability for all combined sewer overflows hydraulically connected to its collection system[286], which in addition to discharges owned and operated by MWRA, included CSO outfalls owned and operated by the municipalities of Boston, Cambridge, Chelsea and Somerville. The CSO planning conducted by the MWRA subsequent to 1987 addressed all of these CSO outfalls, in accordance with the stipulation, and MWRA has funded the planning, design, and construction of the recommended CSO control facilities.

In 1994, MWRA completed a Conceptual CSO Control Plan that formed the basis of its Final Combined Sewer Overflow Plan and Environmental Impact Report[287] which was completed in July 1997. MWRA's LTCP was recommended in the Final CSO Facilities Plan and Environmental Impact Report which was filed with EPA and MassDEP in August 1997. Together, with plan modifications recommended by MWRA in subsequent Notices of Project Change, Supplemental Environmental Impact Reports, and other regulatory filings,[288] the LTCP was comprised of 35 wastewater system improvement projects. Design and construction milestones for each of these projects were mandated by Federal District Court Order in the Boston Harbor Case (U.S. v. M.D.C, et al., No. 85-0489-RGS).

For those CSO outfalls that MWRA believed could not be eliminated, the LTCP included information to support a Use Attainability Analysis (UAA) pursuant to 40 CFR 131.10(g). A UAA is an evaluation conducted by the state which supports removal of a National Goal Use based on criteria such as costs and impacts associated with attaining that use. The state submitted its final administrative determinations, including a UAA, to EPA for approval on December 31, 1997. On February 27, 1998, EPA approved the state's changes to water quality standards, which included the removal of CSO-impacted designations for the Neponset River, North Dorchester

[286] Stipulation of the United States and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflows, February 17, 1987.
[287] MWRA, 1997, Final Combined Sewer Overflow Facilities Plan and Environmental Impact Report.
[288] Update to Existing CSO Facilities, Supplemental Environmental Impact Report, September 30, 1998; Upgrades to the Fox Point CSO Treatment Facility, Supplemental Environmental Impact Report, December 31, 1998; Fort Point Channel CSO Storage Conduit Notice of Project Change, June 2003; MWRA Long-term CSO Control Plan, Fort Point Channel Sewer Separation and System Optimization Project, Level of Control at CSO Outfalls BOS072 and BOS073, LETTER dated June 7, 2004; Re-Assessing Long-term Floatables Control for Outfalls MWR018, 019 and 020, February 2001; Report of Re-Assessment for CSO Activation Frequency and Volume for Outfall MWR010, April 2001 and supplemental letter report (Metcalf and Eddy, Inc), May 31, 2001; Final Variance Report for Alewife Brook and the Upper Mystic River, July 2003 and supplemental letter report (Metcalf and Eddy, Inc.) July 8, 2003; East Boston Branch Sewer Relief Project Reevaluation Report, February 2004; Recommendations and Proposed Schedule for Long-Term CSO Control for the Charles River, Alewife Brook and East Boston, August 2, 2005; Supplemental Facilities Plan and Environmental Impact Report on the Long-term CSO Control Plan for North Dorchester Bay and Reserved Channel, April 27, 2004; Recommendations and Proposed Schedule for Long-Term CSO Control for the Charles River, Alewife Brook and East Boston, August 2, 2005; MWRA Revised Recommended CSO Control Plan for the Charles River, Typical Year CSO Discharge Activations and Volumes, November 15, 2005

Bay, South Dorchester Bay, and Constitution Beach; a SB-CSO designation for Boston Inner Harbor, including the Chelsea River; a B-CSO designation for the Muddy River; and a tentative determination for the issuance of WQS variances for the Lower Charles River, the Alewife Brook, and the Upper Mystic River due to CSO discharges. Variance conditions for CSO outfalls discharging to the Lower Charles River were issued on September 2, 1998 and variance conditions for CSO outfalls discharging to Alewife Brook/Upper Mystic sub-basin were issued on March 5, 1999. Subsequent variances, every five years, have been issued. The latest variances for both the Charles River Basin[289] and Alewife Brook/Upper Mystic River Basin[290] were issued on August 30, 2019 and expire on August 31, 2024.

On March 15, 2006, MWRA and the United States supplanted the 1987 Stipulation defining responsibilities for CSO abatement and CWA compliance with a "Second Stipulation of the United States and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflow Control" (Second Stipulation).[291] In the Second Stipulation, the MWRA accepted "legal liability to…meet the levels of CSO control (including as to CSO activation and as to volume of CSO discharge) described in the Authority's Long-term CSO Control Plan". The most current estimates of CSO discharge frequency and volume expected in a typical year after full implementation of the CSO abatement projects required by the court order are documented in Exhibit B of the "Second Stipulation" (See Appendix I of this Fact Sheet).

As of December 2015, all 35 wastewater system improvement construction projects identified in the LTCP were completed.[292] The frequency and volume of CSO discharges were reduced as CSO abatement projects were completed. However, the required projects were not expected to eliminate CSO discharges entirely.

MWRA began a 3-year post-construction monitoring and performance assessment in November 2017. The monitoring and the performance assessment were the final two schedule requirements in the Court Order. MWRA has submitted semi-annual CSO Reports. It has promoted an iterative process between the MWRA, the CSO municipalities, and the EPA and MassDEP. MWRA requested and received a 1-year extension from the Court to submit the final report[293] which was submitted on December 30, 2021. The modeled estimates of the number of CSO activations and volumes currently discharged in a typical year and those actually discharged based on Quarter 4 2021 conditions and actual rainfall data are shown in Appendix I.

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[289] Kathleen M. Baskin, MassDEP. August 30, 2019. Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Charles River Basin. https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-the-charles/download

[290] Kathleen M. Baskin, MassDEP. August 30, 2019. Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin. https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-alewife/download

[291] US District Court for District of Massachusetts, 2006, Second Stipulation of the United States of America and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflow Control

[292] MWRA, 2016, Combined Sewer Overflow Control Plan, Annual Progress Report, 2015, p. 1., https://www.mwra.com/annual/csoar/2015/2015csoar-r4.pdf

[293] AECOM. 2021. Task 6: Final CSO Post Construction Monitoring Program and Performance Assessment Report., https://www.mwra.com/cso/pcmpa-reports/Final12302021.pdf

On February 4, 2022, the MWRA filed a motion[294,295] to amend Schedule Seven to include additional milestones including (a) annual reporting by MWRA over the next 3 years and (b) submission of a supplemental performance assessment report in December 2024. The Court issued an Order on February 18, 2022[296] which amended Schedule Seven as follows:

1. In April of 2022, April of 2023, and April of 2024, the MWRA will file an annual report that contains: (i) the Typical Year performance of all outfalls as compared to 1992 system conditions and the LTCP; (ii) a summary of measured overflows from MWRA treated and untreated CSO discharges; (iii) an analysis of the prior year's rainfall in comparison to the Typical Year; (iv) a comparison of MWRA meter and model data to community meter data for those outfalls where it exists; and (v) only as to the 16 outfalls (SOM007A/MWR205A; MWR205; BOS014; CHE008; BOS009; BOS003; MWR201; MWR018; MWR019; MWR020; CAM005; SOM001A, BOS017; BOS062; BOS065; and BOS070), a summary of any improvement work completed since the prior report, and an update on MWRA's investigative work and analysis.

2. In December of 2024, the MWRA will file a supplemental report that contains: (i) the final Typical Year performance of all 86 outfalls as compared to 1992 system conditions and the LTCP; and (ii) the MWRA's final results and conclusions as to the 16 outfalls, which shall include an alternatives analysis describing what further actions could be taken, and costs associated with those actions, to further reduce or meet the LTCP activation and volume goals for any of the 16 outfalls that have not met their respective LTCP goals. This supplemental report, coupled with the performance assessment report and water quality assessment report filed in December 2021, will provide information to EPA, MassDEP and the Court to make the final determinations as to attainment of the levels of control in the LTCP and draw any final conclusions.

The MWRA will submit its Annual Report on April 30, 2022. The court reserves the right to order reports with respect to work being performed on specific outfalls.

These additional requirements and deadlines have been included in the Draft Permit.

EPA's general practice is to integrate treatment plant and connected CSO authorizations into a single permit; therefore, EPA has integrated authorization for all CSO discharges hydraulically connected to the regional collection system that conveys wastewater to the DITP into the Draft Permit. All applicable CSO requirements from the individual permits will be incorporated into the Draft Permit.

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[294] US District Court for District of Massachusetts, February 4, 2022, Assented-to Motion of the Massachusetts Water Resources Authority to Amend Schedule Seven
[295] US District Court for District of Massachusetts, February 4, 2022, Memorandum in Support of the Assented-to Motion of the Massachusetts Water Resources Authority to Amend Schedule Seven
[296] US District Court for District of Massachusetts, February 18, 2022, Schedule Seven Compliance Order Number 250

Long-term Control Plan and Water Quality Standards

The LTCP recommended CSO abatement projects that would eliminate CSO discharges to a number of receiving waters, including Dorchester Bay (MWR209, MWR211) and Constitution Beach (MWR207). The MWRA also identified a number of CSO outfalls that it did not believe could be eliminated, so the Plan included information to support a Use Attainability Analysis (UAA) for the affected receiving waters pursuant to 40 CFR § 131.10(g). The State submitted its final administrative determinations, including a UAA, to EPA for approval on December 31, 1997.[297]

On February 27, 1998, EPA approved the State's changes to water quality standards, which included the removal of CSO impacted designations for the Neponset River, North Dorchester Bay, South Dorchester Bay and Constitution Beach; a SB-CSO designation for Boston Inner Harbor; a B-CSO designation for the Muddy River; and a tentative determination for the issuance of WQS variances for the Lower Charles River, the Alewife Brook, and the Upper Mystic River due to CSO discharges. Variance conditions for CSO outfalls discharging to the Lower Charles River were originally issued on September 2, 1998, and variance conditions for CSO outfalls discharging to the Alewife Brook/Upper Mystic sub-basin were originally issued on March 5, 1999.

For receiving waters designated SB (CSO), the water quality standard is achieved when MWRA completes CSO abatement facilities in the approved LTCP and achieves the performance levels described in the plan. This level of control and pollutant specific water quality based effluent limits in the Final CSO Facilities Plan therefore become the level of control necessary to achieve the water quality standard and is the basis for the discharger's permit requirements for that outfall.

For receiving waters granted a water quality standards variance, including the Lower Charles River, Alewife Brook and the Mystic River, the recommended abatement facilities, level of performance, and water quality benefits from the Final CSO Facilities Plan have been established as the minimum requirements to meet water quality standards, and are the basis for the Permittee's requirements for each outfall. The most current CSO variances for these waters were issued by MassDEP in 2019 and expire on August 31, 2024. The variances require the MWRA and the responsible CSO communities to move forward with the LTCP, further define storm water and CSO pollutant loads, and re-evaluate CSO controls.

At the end of the variance term, the variances may be extended, or MassDEP may make a final determination regarding water quality standards in the receiving waters. If MassDEP should modify the variance or make a final determination regarding water quality standards during the term of this permit, this would be considered new information pursuant to 40 CFR § 122.62(a)(2) and would be cause for modification of the Permit.

[297] LETTER. Arleen O'Donnell, MassDEP to Ron Manfredonia, EPA. December 31, 1997. Re: MWRA, Combined Sewer Overflow Final Facilities Plan/Environmental Impact Report: State Administrative Determinations for Certain CSO-Impacted Waters; Use Attainability Analysis.

Derivation of Effluent Limits under the Federal Clean Water Act and the Commonwealth of Massachusetts Surface Water Quality Standards - MWRA CSO Outfalls

The only CSO discharges authorized in the Draft Permit are those expected to be discharging to Class B(CSO), SB(CSO), or B-Variance receiving waters following completion of the LTCP (See Appendix B). CSO outfalls that have been eliminated as a result of the required CSO abatement projects are not authorized in the Draft Permit.

For the authorized discharges, the Draft Permit establishes discharge frequency and volume limitations based on expected performance during a typical year as defined in the LTCP following completion of abatement projects included in the LTCP. Information on the authorized CSO treatment facilities, and the activation frequency and annual volume limits are presented in Appendix I.

Boston Inner Harbor

The discharges from the MWRA CSO treatment facilities: MWR203, MWR205 and MWR215, and from CSO outfalls owned by MWRA, the BWSC (Boston) and City of Chelsea (See Table 19) into Boston Inner Harbor have been limited in accordance with the MA SWQS for Class SB (CSO) waters and the LTCP. The typical year activation frequency and volume for each discharge shall be in accordance with the performance required by LTCP, as defined in the Exhibit B of the Second Stipulation incorporated into the Federal Court Order on April 27, 2006.

Table 19: CSO discharges authorized to Boston Inner Harbor, Class SB – CSO

Outfall No.	Owner/Operator	Long-Term Control Plan	
		Activation Frequency	Volume (MG)
MWR203*	MWRA	17	243
MWR205*	MWRA	39	60.58
MWR215*	MWRA	17	71.37
BOS013	BWSC	4	0.54
BOS014	BWSC	0	0
BOS009	BWSC	5	0.59
BOS010	BWSC	4	0.72
BOS012	BWSC	5	0.72
BOS057	BWSC	1	0.43
BOS060	BWSC	0	0
BOS003	BWSC	4	2.87
BOS004	BWSC	5	1.84
BOS005	BWSC	1	0.01
BOS062	BWSC	1	0.01
BOS064	BWSC	0	0
BOS065	BWSC	1	0.06
BOS068	BWSC	0	0
BOS070	BWSC	3	2.19
BOS073	BWSC	0	0
BOS076	BWSC	3	0.91
BOS078	BWSC	3	0.28
BOS079	BWSC	1	0.04
BOS080	BWSC	3	0.25
BOS081	BWSC	0/25 year	N/A
BOS082	BWSC	0/25 year	N/A
BOS084	BWSC	0/25 year	N/A
BOS085	BWSC	0/25 year	N/A
BOS086	BWSC	0/25 year	N/A
CHE003	City of Chelsea	3	0.04
CHE004	City of Chelsea	3	0.32
CHE008	City of Chelsea	0	0

*Additional numerical effluent limitations apply to the CSO Treatment Facility discharges.

Since the limitations on discharge activation frequency and volume are based on a typical year of precipitation, compliance with these limits cannot be fully determined without comparing the precipitation for that year with the typical year used in the Final CSO Facilities Plan, and a determination is made, based on actual precipitation events, whether CSO activation and frequency were in accordance with the performance expected in the Final CSO Facilities Plan. Therefore, the Draft Permit requires the MWRA, BWSC (Boston) and the City of Chelsea to each provide an annual report which provides activation frequency and discharge volume for each of the CSO Treatment Facilities or CSO outfalls which it owns and operates during the previous year. The specifics of the reporting requirements can be found in the Draft Permit, Section I.B.5.

Charles River

The discharges from the MWRA CSO treatment facility, MWR201 and from CSO outfalls owned by MWRA, BWSC (Boston) and City of Cambridge (See Table 2021) into the Charles

River have been limited in accordance with the conditions of the current water quality variance for the Charles River Basin.[298] As required in the variance, the typical year activation frequency and volume for each discharge shall be in accordance with the performance of the LTCP as defined in Exhibit B of the Second Stipulation incorporated into the Federal Court Order on April 27, 2006. Additionally, the Permittee and Co-permittees must submit annual reports on the progress of additional CSO optimization measures.[299]

Table 20: CSO outfalls authorized to Charles River, Class B -Variance for CSO outfalls

Outfall No.	Owner/Operator	Long-Term Control Plan	
		Activation Frequency	Volume (MG)
MWR201*	MWRA	2	6.3
MWR010	MWRA	0	0
MWR018	MWRA	0	0
MWR019	MWRA	0	0
MWR020	MWRA	0	0
MWR023	MWRA	2	0.13
CAM005	City of Cambridge	3	0.84
CAM007	City of Cambridge	1	0.03
CAM017	City of Cambridge	1	0.45
BOS046	BWSC	2	5.38

*Additional numerical effluent limitations apply to the CSO Treatment Facility discharges.

The variance includes other conditions, all of which have been incorporated into the Draft Permit. Variance conditions B.i. (implementation of the nine minimum controls) and C.i. (public notification) have been specifically incorporated into the Draft Permit because they require specific practices to meet technology-based NMC requirements, and implementation of the NMC is a standard requirement of all NPDES CSO permits. The other requirements of the variance not specifically incorporated in the Permit are incorporated by reference and are equally enforceable conditions of the Permit.

The current variance extends to August 31, 2024. At the end of the variance term, it may be extended, or MassDEP may make a final determination regarding water quality standards. If MassDEP should modify the variance or make a final determination regarding water quality standards during the term of the permit, this would be considered new information pursuant to 40 CFR § 122.62(a)(2) and would be cause for modification of the Permit.

Alewife Brook/Little River

The discharges from CSO outfalls owned by MWRA, the City of Cambridge and the City of Somerville (Table 21) into Alewife Brook and the Little River (a tributary formerly included as a

[298] MassDEP, August 30, 2019, Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Charles River Basin, https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-the-charles/download

[299] LETTER. MWRA to Kevin Brander, MassDEP and Todd Borci, EPA Region 1, January 29, 2021, "Re: Charles River and Alewife Brook/Upper Mystic River CSO Variances Annual Report on Progress of Additional CSO System Optimization Measures," https://www.mwra.com/cso/variances/012921-csovariancemitigationprojects.pdf; MWRA, April 2021, "Task 8.1: Alewife Brook Pump Station Optimization Evaluation," https://www.mwra.com/cso/variances/042721-alewife.pdf

part of Alewife Brook[300]) have been limited in accordance with the conditions of the current water quality variance for Alewife Brook.[301] As required in the variance, the typical year activation frequency and volume for each discharge shall be in accordance with the performance of the LTCP as defined in Exhibit B of the Second CSO Stipulation incorporated into the Federal Court Order on April 27, 2006.

Table 21: CSO outfalls authorized to Alewife Brook/Little River, Class B -Variance for CSO outfalls

Outfall No.	Owner/Operator	Long-Term Control Plan	
		Activation Frequency	Volume (MG)
MWR003	MWRA	5	0.98
CAM001	City of Cambridge	5	0.19
CAM002	City of Cambridge	4	0.69
CAM401A	City of Cambridge	5	1.61
CAM401B	City of Cambridge	7	2.15
SOM001A	City of Somerville	3	1.67

The variance includes other conditions, all of which have been incorporated into the Draft Permit. Variance conditions B.i. (implementation of the nine minimum controls) and C.i. (public notification) have been incorporated into the Draft Permit (See Section I.B. of the Draft Permit) because they require specific practices to meet technology-based NMC requirements, and implementation of the NMC is a standard requirement of all NPDES CSO permits. The other requirements of the variance not specifically incorporated into the Permit are incorporated by reference and are equally enforceable conditions of the Permit.

The current variance extends to August 31, 2024. At the end of the term, it may be extended, or MassDEP may make a final determination regarding water quality standards. If MassDEP should modify the variance or make a final determination regarding water quality standards during the term of this Permit, this would be considered new information pursuant to 40 CFR § 122.62(a)(2) and would be cause for modification of the Permit.

Mystic River

The discharges from the MWRA CSO treatment facility, MWR205A and from CSO outfalls owned by MWRA, BWSC (Boston), City of Chelsea and the City of Somerville (See

[300] Massachusetts Water Quality Standards, 314 CMR 4.06, Table 12.
[301] MassDEP, August 30, 2019, Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic Basin, https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-alewife/download

Table 22) into the Upper Mystic River have been limited in accordance with the conditions of the current water quality variance for the Upper Mystic River.[302] As required in the variance, the typical year activation frequency and volume for each discharge shall be in accordance with the performance of the LTCP as defined in Exhibit B of the Second CSO Stipulation incorporated into the Federal Court Order on April 27, 2006.

Table 22:CSO outfalls authorized to Mystic River, Class B -Variance for CSO outfalls

Outfall No.	Owner/Operator	Long-Term Control Plan	
		Activation Frequency	Volume (MG)
MWR205A/SOM007A*	MWRA/City of Somerville	3	3.48
MWR205*	MWRA	39	60.58
BOS017	BWSC	1	0.02
BOS019	BWSC	2	0.58
CHE003	City of Chelsea	3	0.04
CHE004	City of Chelsea	3	0.32
CHE008	City of Chelsea	0	0

*Additional numerical effluent limitations apply to the CSO Treatment Facility discharges.

The discharges from MWRA's Somerville Marginal CSO Treatment Facility to the Upper Mystic River has been limited in accordance with the conditions of the current water quality variance.[303] As required in the variance, the typical year activation frequency and volume for each discharge shall be in accordance with the performance of the CSO Long-term Control Plan, as defined in Exhibit B of the Second CSO Stipulation incorporated into the Federal Court Order on April 27, 2006.

The variance includes other conditions, all of which have been incorporated into the Draft Permit. Variance conditions B.i. (implementation of the nine minimum controls) and C.i. (public notification) have been incorporated into the Draft Permit (See Section I.B. of the Draft Permit) because they require specific practices to meet technology-based NMC requirements, and implementation of the NMC is a standard requirement of all NPDES CSO permits. The other requirements of the variance not specifically incorporated into the Permit are incorporated by reference and are equally enforceable conditions of the Permit.

The current variance extends to August 31, 2024. At the end of the term, it may be extended, or MassDEP may make a final determination regarding water quality standards. If MassDEP should modify the variance or make a final determination regarding water quality standards during the terms of this Permit, this would be considered new information pursuant to 40 CFR § 122.62(a)(2) and would be cause for a modification of the Permit.

5.7.1 Numerical Effluent Limitations and Reporting Requirements for MWRA CSO Treatment Facilities, Outfalls MWR201, 203, 205/205A and 215

[302] MassDEP, August 30, 2019, "Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic Basin," https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-alewife/download

[303] MassDEP, August 30, 2019, Final Determination to Adopt a Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic Basin, https://www.mass.gov/doc/final-determination-to-adopt-a-variance-for-combined-sewer-overflow-discharges-to-alewife/download

The 2000 Permit contains numeric effluent limitations for the MWRA-owned CSO Treatment Facilities including limitations on total residual chlorine, fecal coliform bacteria, and pH. The 2000 Permit includes numerical effluent limitations for CSO Treatment Facilities (Outfalls MWR201, MWR203, MWR205/205A and MWR207) and CSO detention facilities (Outfalls MWR209 and MWR211). Since the issuance of the 2000 Permit, Outfalls MWR207, MWR209 and MWR211 have been eliminated and are no longer authorized. Outfall MWR215 has been added to the Draft Permit. MWR215 is the MWRA-owned CSO Treatment Facility, Union Park, and is currently authorized under NPDES Permit Number MA0101192, which was modified on April 10, 2007. The modified Permit for Outfall MWR215 also includes effluent limitations on total residual chlorine, fecal coliform bacteria, and pH.

The Draft Permit contains numeric effluent limitations for the CSO Treatment Facilities (Outfalls MWR201, MWR203, MWR205/205A and MWR215) including limitations on fecal coliform bacteria, *enterococci*, *e. coli*, total residual chlorine, and pH and monitoring requirements for whole effluent toxicity, total suspended solids, biochemical oxygen demand, flow, and precipitation. MWRA is the owner and operator of these facilities and is responsible for these limitations and requirements. The basis for the limits and monitoring requirements are discussed below.

5.7.1.1 Flow

(MWRA CSO Treatment Facilities, Outfalls MWR201, 203, 205/205A and 215)

The 2000 Permit requires the MWRA to report the discharge event average flow and the discharge event maximum flow. Specifically, the Permittee, MWRA, must "report the peak flow rate, duration and volume for each discharge event. Report the duration and volume of flow (or, if impracticable, report modeling results) that bypasses treatment for each discharge event."[304]

The Draft Permit requires MWRA to report specific characteristics about the flow and duration of each discharge event for each of the CSO treatment facilities. The MWRA shall report the start and stop times for each discharge event, the overall duration of the event, the peak flow rate and the total volume for each discharge event. The MWRA shall also monitor and report the start and stop times, duration, and the volume of flow that bypasses treatment for each discharge event for each of the CSO treatment facilities.

CSO Treatment Facility, MWR215, Union Park CSO Treatment Facility is currently authorized under NPDES Permit Number MA0101192 with the same requirements as above. Outfall MWR215 will be authorized under the Draft Permit MA0103284 with the same requirements and NPDES Permit MA0101192 will be terminated upon issuance of NPDES Permit MA0103284.

5.7.1.2 BOD_5

(MWRA CSO Treatment Facilities, Outfalls MWR201, 203, 205/205A and 215)

[304] NPDES Permit No. MA0103284, effective August 10, 2000, Footnote 3., https://www3.epa.gov/region1/npdes/mwra/pdf/permit.pdf

The 2000 Permit requires the MWRA to report the results of BOD_5 sampling at each of the CSO Treatment Facilities four (4) times per year for each CSO Treatment Facility outfall. Given continuing improvements to the combined sewer system, there is the possibility that a facility does not discharge four times in a year.

MWR215 is authorized under NPDES Permit Number MA0101192 with the same requirements as above.

The Draft Permit requires the MWRA to report the results of BOD_5 sampling at each of the CSO Treatment Facilities four (4) times per year for each CSO Treatment Facility outfall (MWR201, MWR203, MWR205/205A and MWR215). Sampling shall be concentrated during the "critical" use periods. The Permittee shall sample one Spring event (March 1st – April 30th), two Summer events (May 1st – August 31st) and one Fall event (September 1st – October 31st). The Draft Permit requires that at least one of the sampled events include a period of discharge from MWR205A.

MWR215 is currently authorized under NPDES Permit Number MA0101192 with the same requirements as above. Outfall MWR215 will be authorized under the Draft Permit MA0103284 with the same requirements and NPDES Permit MA0101192 will be terminated upon issuance of NPDES Permit MA0103284.

5.7.1.3 TSS

(MWRA CSO Treatment Facilities, Outfalls MWR201, 203, 205/205A and 215)

The 2000 Permit requires the MWRA to report the results of TSS sampling at each of the CSO Treatment Facilities four (4) times per year for each CSO Treatment Facility outfall. Given continuing improvements to the combined sewer system, there is the possibility that a facility does not discharge four times in a year.

MWR215 is authorized under NPDES Permit Number MA0101192 with the same requirements as above.

The Draft Permit requires MWRA to report the results of TSS sampling at each of the CSO Treatment Facilities four (4) times per year for each CSO Treatment Facility outfall. Sampling shall be concentrated during the "critical" use periods. The Permittee shall sample one Spring event (March 1st – April 30th), two Summer events (May 1st – August 31st) and one Fall event (September 1st – October 31st). The Draft Permit requires that at least one of the sampled events include a period of discharge from Outfall MWR205A.

MWR215 is currently authorized under NPDES Permit Number MA0101192 with the same requirements as above. Outfall MWR215 will be authorized under the Draft Permit MA0103284 with the same requirements and NPDES Permit MA0101192 will be terminated upon issuance of NPDES Permit MA0103284.

5.7.1.4 pH

The 2000 Permit requires the MWRA to report the results of pH monitoring at each of the CSO Treatment Facilities four (4) times per year for each CSO Treatment Facility outfall. Given continuing improvements to the combined sewer system, there is the possibility that a facility does not discharge four times in a year.

MWR215 is authorized under NPDES Permit Number MA0101192 with the same requirements as above.

The Draft Permit includes pH limitations which are required by state water quality standards and are at least as stringent as pH limitations set forth at 40 CFR §133.102(c).

5.7.1.4.1 **pH**

(MWRA CSO Treatment Facilities, Outfall MWR201 and 205A)

The Cottage Farm (MWR201) and Somerville Marginal Relief Outfall (MWR205A) CSO Treatment Facilities each discharge to Class B waters, Charles River and Mystic River, respectively. Consistent with the requirements of Massachusetts WQS at 314 CMR 4.05(3)(b) 3, the Draft Permit requires that the pH of the effluent is not less than 6.5 or greater than 8.3 standard units at any time.

A review of Cottage Farm (MWR201) DMR data submitted over the period of records shows that there have been several permit exceedances for pH on the low end of the range. See Appendix H.

Effluent data is not currently required for discharges from MWR205A as it is only used when MWR205 is unavailable due to tidal conditions.

The Draft Permit requires MWRA to report the results of pH sampling at MWR201 four (4) times per year. The Draft Permit requires that at least one of the sampled events include a period of discharge from Outfall MWR205A. Sampling shall be concentrated during the "critical" use periods. The Permittee shall sample one Spring event (March 1st – April 30th), two Summer events (May 1st – August 31st) and one Fall event (September 1st – October 31st).

5.7.1.4.2 **pH**

(MWRA CSO Treatment Facilities, Outfalls MWR203, 205 and 215)

The Prison Point (MWR203), Somerville Marginal (MWR205) and the Union Park (MWR215) CSO Treatment Facilities each discharge to Class SB (CSO) waters. Consistent with the requirements of Massachusetts WQS at 314 CMR 4.05(4)(b) 3, the Draft Permit requires that the pH of the effluent is not less than 6.5 or greater than 8.5 standard units at any time.

A review of Prison Point (MWR203) DMR data submitted over the period of records shows that there have been numerous permit exceedances for pH on the low end of the range. (See Appendix H).

A review of Somerville Marginal (MWR205) DMR data submitted over the period of records shows that there have been one permit exceedance for pH on the high end of the range. See Appendix H.

A review of Union Park (MWR215) DMR data submitted over the period of records shows that there have been numerous permit exceedances for pH on the low end of the range. See Appendix H.

The Draft Permit requires MWRA to report the results of pH sampling at MWR203, MWR205 and MWR215 four (4) times per year. The Draft Permit requires that at least one of the sampled events include a period of discharge from Outfall MWR205A. Sampling shall be concentrated during the "critical" use periods. The Permittee shall sample one Spring event (March 1st –April 30th), two Summer events (May 1st – August 31st) and one Fall event (September 1st – October 31st).

MWR215 is currently authorized under NPDES Permit Number MA0101192 with the same requirements as above. Outfall MWR215 will be authorized under the Draft Permit MA0103284 with the same requirements and NPDES Permit MA0101192 will be terminated upon issuance of NPDES Permit MA0103284.

5.7.1.5 Bacteria

The 2000 Permit requires that the discharge from the CSO Treatment Facilities, MWR201, MWR203, MWR205, MWR205A, "Shall meet MA Water Quality Standards" but specific effluent limits were not set.

MWR215 is currently authorized under NPDES Permit Number MA0101192 and includes effluent limitations for fecal coliform bacteria of 200 colonies/100 ml as a discharge event average and 400 colonies/100 ml as a discharge event maximum. The 2007 Permit Modification also included a reporting requirement for *Enterococci* for both discharge event average and discharge event maximum.

5.7.1.5.1 **Bacteria**

(MWRA CSO Treatment Facilities, Outfalls MWR201 and MWR 205A)

The 2000 Permit requires that the discharge from MWR201 and MWR205A "Shall meet MA Water Quality Standards" but specific effluent limits were not set.

The Draft Permit requires that these outfalls shall meet MA Water Quality Standards which at this time are set in the variances for the Charles River Basin and Alewife Brook/Upper Mystic River Basin

As required by the MassDEP implementation guidance for bacteria[305], the discharge event average shall be expressed as a discharge event geometric mean. The discharge event maximum shall be expressed as a discharge event maximum.

5.7.1.5.2 **Bacteria**

(MWRA CSO Treatment Facilities, Outfalls MWR203, MWR205 and MWR215)

The 2000 Permit requires that the discharge from MWR203 and MWR205: "[s]hall meet MA Water Quality Standards" but specific effluent limits were not set.

The Draft Permit includes limitations for *Enterococci* which are based upon the criteria in the MA SWQS for Class SB waters. The MA SWQS include criteria for bathing beaches as well as "other waters" (314 CMR 4.05(5)(f)2).

As required by the MassDEP implementation guidance for bacteria, the discharge event average limitation proposed in the Draft Permit is 35 cfu per 100 ml and shall be expressed as a discharge event geometric mean. The discharge event maximum limitation proposed in the Draft Permit is 130 cfu per 100 ml and shall be expressed as a discharge event maximum.

MWR215 is currently authorized under NPDES Permit Number MA0101192. Outfall MWR215 will be authorized under the Draft Permit MA0103284 with the same requirements as discussed above and NPDES Permit MA0101192 will be terminated upon issuance of NPDES Permit MA0103284.

5.7.1.6 Total Residual Chlorine (TRC)

Chlorine is used to disinfect the effluent at each of the CSO Treatment Facilities, but it is a toxic chemical. Limits on Total Residual Chlorine (TRC) were included in the 2000 Permit and the 2007 Modification of NPDES Permit MA0101192 for the Union Park CSO Treatment Facility. Limits for all the CSO Treatment Facilities were established as a discharge event average of 0.1 mg/L and a discharge event maximum of 0.25 mg/L. The previous limits were calculated assuming a dilution factor of 5 for each of the CSO Treatment Facilities, an acute limit (discharge event average) based on the WQS with a criteria of 13 ug/L for marine waters and 19 ug/L for freshwater and chronic limits (discharge event maximum) based on a best professional judgement (BPJ) value of 0.05 mg/L for both marine and fresh waters (See Attachment U[306] of the 2000 Permit).

EPA has gathered information from the MWRA, past reports, studies and streamflow data to better define the dilution at each of the MWRA CSO Treatment Facilities' discharge locations.

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[305] MassDEP. December 2021. Surface Water Quality Criteria for Bacteria: Implementation Guidance for the Protection of Human Health in Waters Designated for Primary Contact Recreation, https://www.mass.gov/doc/bacteria-surface-water-quality-criteria-for-bacteria-implementation-guidance-for-the-protection-of-human-health-in-waters-designated-for-primary-contact-recreation-cn-5630/download

[306] https://www3.epa.gov/region1/npdes/mwra/pdf/u.pdf

The physical characteristics of each five discharges is unique as is the physical characteristics of the five receiving waters.

The Draft Permit includes a requirement that a dye study be conducted during the five-year permit term for each of the five CSO Treatment Facility outfalls. The completed dye studies must be submitted by MWRA six months before the end of the permit term (concurrent with the NPDES application). The conditions for the studies can be found in Section I.7 of the Draft Permit.

The DMR data submitted during the review period show that there have been numerous exceedances of the TRC limitations.

The applicable total residual chlorine criteria is found in the MA WQS at 314 CMR 4.06, Table 29. The criteria for freshwater are 19 µg/L for acute effects and 11 µg/L for chronic effects. The criteria for marine waters are 13 µg/L for acute effects and 7.5 µg/L for chronic effects.

5.7.1.6.1 MWR201 – Cottage Farm CSO Treatment Facility

The Cottage Farm CSO Treatment Facility has a design capacity of 233 MGD.[307] The estimated 7Q10 in the vicinity of the discharge is 15.8 cfs (10.21 MGD).[308] EPA reviewed a MWRA CSO planning and water quality assessment report that provided some information about dilution and mixing for the Cottage Farm CSO Treatment Facility.[309] The Facility discharges via three (3) vertically-oriented diffuser pipes located midstream in the Lower Charles River. "There is limited distance between the tops of the pipes and the surface of the river so initial dilution is completed within a very short distance of the discharge and provides a dilution of 2. Based on an August 17-18, 1992 storm event and the results of a dye study conducted by CH_2M Hill (1990), near field plus intermediate field mixing provided a dilution of about 4 within less than 100 meters, by which time the plumes from the adjacent diffusers merge, having mixed with all the available river flow."[310]

Water levels in the Lower Charles River are managed by the Massachusetts Department of Conservation and Recreation's (DCR) operation of the new Charles River Dam at the mouth of the river. Water is released from the river into Boston Harbor during a period of hours around

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[307] EMAIL. Wendy Leo, MWRA to Michele Barden, EPA. November 5, 2021. RE: CSO facilities

[308] EPA calculated the 7Q10 for the Charles River at the Cottage Farm Treatment Facility based on data from United States Geological Survey (USGS) low-flow frequency statistics for the nearest USGS gaging station to the Facility along the Charles River (Station Number 01104500, Charles River at Waltham, MA, http://streamstatsags.cr.usgs.gov/gagepages/html/01104500.htm. EPA determined the estimated drainage area for the Facility, 282 square miles, using USGS StreamStats for Massachusetts watershed delineation tool. http://water.usgs.gov/osw/streamstats.massachusetts.html . The calculation of [282 mi^2 * (12.7 cfs/227 mi^2)] gives a receiving water flow of 15.8 cfs at the Cottage Farm CSO Treatment Facility.

[309] Leo, W.S., Collins, M., Domenica, M., Kirschen, P. Marx, L., Rex, A.C., 1994. Master Planning and CSO Facility Planning, Baseline Water Quality Assessment. MWRA Report 1994-MS-24. p. 465, https://www.mwra.com/harbor/enquad/pdf/1994-ms-24.pdf

[310] Leo, W.S., Collins, M., Domenica, M., Kirschen, P. Marx, L., Rex, A.C., 1994. Master Planning and CSO Facility Planning, Baseline Water Quality Assessment. MWRA Report 1994-MS-24. 465 p. 4-9., https://www.mwra.com/harbor/enquad/pdf/1994-ms-24.pdf

low tide. Water levels in the Lower Charles River steadily increase during high tide when the dam is closed.

Given that water levels in this segment of the Charles River are artificially controlled, EPA did not find using 7Q10 flow as applicable to this discharge; and therefore, has used the value of 5 from the CSO Planning document as the dilution factor for calculating water quality-based effluent limits for total residual chlorine for the Cottage Farm Treatment Facility discharge. This is the same dilution factor used in the 2000 Permit.

Because the upstream chlorine is assumed to be zero in this case, the water quality-based chlorine limits are calculated as the freshwater criteria times the dilution factor, as follows:

Chronic criteria * dilution factor = Chronic limit
11 ug/L * 5 = 55 ug/L = 0.055 mg/L (discharge event average)

Acute criteria * dilution factor = Acute limit
19 ug/L * 5 = 95 ug/L = 0.1 mg/L (hourly maximum)

The chronic limit is more stringent than that included in the 2000 Permit as the previous chronic limit was not calculated using the water quality criteria for TRC. The chronic limit is applied as a discharge event average. The acute limit is applied as a discharge event maximum. The sampling frequency is the same as the 2000 Permit and sampling shall be conducted four times per year, as follows: a grab sample shall be collected within the first two hours of the start of the discharge, and every hour thereafter for the duration of the overflow.

5.7.1.6.2 MWR203 – Prison Point CSO Treatment Facility

The Prison Point CSO Treatment Facility has a design capacity of 323 MGD.[311] The Facility discharges to Boston Inner Harbor (referred to in some documents as the Upper Inner Harbor) via a three (3) port diffuser at the base of the new Charles River Dam.[312] "Upper Inner Harbor is tidal with a range of approximately ten feet. It is seasonally weakly stratified. The largest CSO outfall in the segment is Prison Point, which discharges downstream from the Charles River Dam. Despite its large flow, salinity measurements indicate that good mixing occurs before the effluent reaches the main stem of the Inner Harbor…."[313]

EPA reviewed a July 1992 dye study[314] which was done to simulate the impact of CSO discharges from the Charles River to the Inner Harbor in support of MWRA's CSO Master

[311] EMAIL. Wendy Leo, MWRA to Michele Barden, EPA. November 5, 2021. RE: CSO facilities
[312] Leo, W.S., Collins, M., Domenica, M., Kirschen, P. Marx, L., Rex, A.C., 1994. Master Planning and CSO Facility Planning, Baseline Water Quality Assessment. MWRA Report 1994-MS-24. 465 p, https://www.mwra.com/harbor/enquad/pdf/1994-ms-24.pdf
[313] Leo, W.S., Collins, M., Domenica, M., Kirschen, P. Marx, L., Rex, A.C., 1994. Master Planning and CSO Facility Planning, Baseline Water Quality Assessment. MWRA Report 1994-MS-24. p. 9-4 – 9-8., https://www.mwra.com/harbor/enquad/pdf/1994-ms-24.pdf
[314] Adams, E. Eric, McGillivary, Drew L., Sub, Seung-Won and Luxenberg, Roland R., 1993. Analysis of Boston Inner Harbor Dye Study. https://archives.lib.state.ma.us/bitstream/handle/2452/205947/ocn855862279.pdf?sequence=1&isAllowed=y

Planning. Rhodamine WT dye (501.2 lbs) was added in the upper sluice at the new Charles River Dam, which is immediately upstream of the Prison Point CSO Treatment Facility discharge. Due to the specific operation of the dam all the flow from the Charles River was tagged with dye before discharging in to the Inner Harbor. It was estimated that a consistent river water flow rate of approximately 700 cfs was delivered during the 5.5 hour discharge period resulting in the discharge of $3.9x10^5$ m^3 with an average dye concentration of 116 ug/L. Vertical measurements taken during the first high tide after the discharge of the dyed river water indicated that the dye was initially concentrated near the surface at the confluence with the Charles River and gradually spreads longitudinally and vertically. The dye study estimated that a harbor wide dilution of the Charles River would be about 60 and occurs over 6 days and multiple tidal cycles. The study did not estimate an initial dilution for the Prison Point discharge. The initial high tide concentration of dye in the immediate vicinity of the Prison Point discharge is estimated as 20. Longitudinal survey from that period during the initial high tide period show that the dye stayed at the surface for a significant period. Based on the study, EPA estimates that the dilution factor in the vicinity of the Prison Point discharge is 6.

Because the upstream chlorine is assumed to be zero in this case, the water quality-based chlorine limits are calculated as the marine criteria times the dilution factor, as follows:

Chronic criteria * dilution factor = Chronic limit
7.5 ug/L * 6 = 45 ug/L = 0.045 mg/L (discharge event average)

Acute criteria * dilution factor = Acute limit
13 ug/L * 6 = 78 ug/L = 0.078 mg/L (hourly maximum)

These limits are more stringent than those included in the 2000 Permit as the previous chronic limit was not calculated using the water quality criteria for TRC. The chronic limit is applied as a discharge event average. The acute limit is applied as a discharge event maximum. The sampling frequency is the same as the 2000 Permit and sampling shall be conducted four times per year, as follows: a grab sample shall be collected within the first two hours of the start of the discharge, and every hour thereafter for the duration of the overflow.

5.7.1.6.3 MWR205 – Somerville Marginal Treatment Facility

Somerville Marginal Treatment Facility has a design capacity of 245 MGD.[315] The Facility discharges below the Amelia Earhart Dam except when the tide gate is closed. "The discharge occurs at the side of the riverbank, not fully submerged."[316]

According to the MWRA CSO Planning and Water Quality Assessment report,[317] "the flow of the Aberjona River in Winchester, the mean flow at the mouth of the Mystic River is

[315] EMAIL. Wendy Leo, MWRA to Michele Barden, EPA. November 5, 2021. RE: CSO facilities.
[316] MWRA. 2022. Description of Physical Characteristics of the outfalls from MWRA's CSO Treatment Facilities.
[317] Leo, W.S., Collins, M., Domenica, M., Kirschen, P. Marx, L., Rex, A.C., 1994. Master Planning and CSO Facility Planning, Baseline Water Quality Assessment. MWRA Report 1994-MS-24. p. 8-10., https://www.mwra.com/harbor/enquad/pdf/1994-ms-24.pdf

approximately 2.5 m^3/s (Alber and Chan 1994), while the low flow can be as little as 0.1 m^3/s (Metcalf & Eddy, 1994c). Flow in the river is regulated by the Amelia Earhart Dam. All drainage in the area, up to at least Mill Creek in Chelsea, is tidally influenced. This receiving water segment is always weakly stratified in salinity. The Chelsea River is mostly tidal, with a small freshwater discharge at the headwaters. The maximum tidal current in this segment is approximately 0.3 m^3/s (Eldridge 1992). The major CSO outfall is the Somerville Marginal Facility which can represent a substantial portion of the freshwater input (e.g., during August 17-18, 1992 storm, a discharge volume of 3.6 million gallons was measured, which represents an average flow of 0.6 $m^{3/s}$ over six hours). However, receiving water salinity measurements indicate that tidal flushing provides substantial dilution (a factor of 10 or more) immediately downstream of the discharge." Based on the information from this early analysis, EPA has used a dilution of 10 to calculate the total residual chorine limits for the marine discharge from the Somerville Marginal Relief Outfall.

Chronic criteria * dilution factor = Chronic limit
7.5 ug/L * 10 = 75 ug/L = 0.075 mg/L (discharge event average)

Acute criteria * dilution factor = Acute limit
13 ug/L * 10 = 130 ug/L = 0.13 mg/L (hourly maximum)

The limits are less stringent than those in the previous permit. The dilution factor has increased from 5 to 10. The chronic limit is applied as a discharge event average. The acute limit is applied as a discharge event maximum. The sampling frequency is the same as the 2000 Permit and sampling shall be conducted four times per year, as follows: a grab sample shall be collected within the first two hours of the start of the discharge, and every hour thereafter for the duration of the overflow.

5.7.1.6.4 MWR205A – Somerville Marginal CSO Treatment Facility Relief Outfall

As stated above in Section 5.6.1.6.3, the design capacity of the Somerville Marginal Treatment Facility is 245 MGD.[318] "At high tide, flow passes over both sides of a long V-shaped horizontal weir into a 132" x 104" rectangular overflow channel. The overflow is built into a vertical headwall on the river bank; the outlet is submerged."[319]

The only continuous USGS streamflow gage is "Aberjona at Winchester" (62.5 square kilometers). Given the record of 1940 to the present, mean monthly flows vary from 8.83 cfs in August to 65.69 cfs in March. The average flow is 28.6 cfs. The river is moderately narrow and swift in the uppermost portion, widening and slowing toward the dam. At the Amelia Earhart Dam, the average flow is approximately 74.16 cfs (calculated by adjusting the gaged flow for the drainage downstream of the gage as in Alber and Chan 1994).[320]

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[318] EMAIL. Wendy Leo, MWRA to Michele Barden, EPA. November 5, 2021. RE: CSO facilities
[319] MWRA. 2022. Description of Physical Characteristics of the outfalls from MWRA's CSO Treatment Facilities.
[320] Leo, W.S., Collins, M., Domenica, M., Kirschen, P. Marx, L., Rex, A.C., 1994. Master Planning and CSO Facility Planning, Baseline Water Quality Assessment. MWRA Report 1994-MS-24., https://www.mwra.com/harbor/enquad/pdf/1994-ms-24.pdf

EPA estimated the 7Q10 of the Mystic River at Outfall 205A, Somerville Marginal Treatment Facility Relief Outfall, as 3.77 cfs.[321]

"Like the Charles River, the Mystic River expands as it approaches the Amelia Earhart Dam. Thus, in the downstream section…, the flow is quite sluggish, and mixing is expected to be similar to that in the Charles River Basin."[322]

Because the upstream chlorine is assumed to be zero in this case, the water quality-based chlorine limits are calculated as the criteria times the dilution factor, as follows:

Chronic criteria * dilution factor = Chronic limit
11 ug/L * 1.0 = 11 ug/L = 0.01 mg/L (discharge event average)

Acute criteria * dilution factor = Acute limit
19 ug/L * 1.0 = 19 ug/L = 0.02 mg/L (hourly maximum)

These limits are more stringent than those included in the 2000 Permit. The dilution factor has decreased from 5 to 1. The chronic limit is applied as a discharge event average. The acute limit is applied as a discharge event maximum. The sampling frequency is the same as the 2000 Permit and sampling shall be conducted four times per year, as follows: a grab sample shall be collected within the first two hours of the start of the discharge, and every hour thereafter for the duration of the overflow.

5.7.1.6.5 MWR203 – Union Park CSO Treatment Facility

The design capacity of the Union Park CSO Treatment Facility is 288 MGD.[323] The Fort Point Channel is tidal with a range of approximately 10 feet. The Union Park CSO Treatment Facility is unique because it is a mixed discharge with BOS070. "The tide intrudes into the culvert, so some mixing takes place before discharge. Salinity measurements suggest this initial mixing results in a dilution of about 2 while dilution in the middle of the channel exceeds 10."[324]

Because the upstream chlorine is assumed to be zero in this case, the water quality-based chlorine limits are calculated as the criteria times the dilution factor, as follows:

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[321] EPA calculated the 7Q10 for the Mystic River at the Somerville Marginal Treatment Facility Relief Outfall based on data from the United States Geological Survey (USGS) low-flow frequency statistics for the furthest downstream point where USGS had data (where Mystic Valley Parkway crosses the River along I-93.[321]). USGS calculated a 7Q10 and drainage area of 3.52 cfs and 48.3 square miles, respectively (implying a flow factor of ~1.07). The 7Q10 at MWR205A using these data would be approximately 3.77 cfs.

[322] Leo, W.S., Collins, M., Domenica, M., Kirschen, P. Marx, L., Rex, A.C., 1994. Master Planning and CSO Facility Planning, Baseline Water Quality Assessment. MWRA Report 1994-MS-24., https://www.mwra.com/harbor/enquad/pdf/1994-ms-24.pdf

[323] EMAIL. Wendy Leo, MWRA to Michele Barden, EPA. November 5, 2021. RE: CSO facilities

[324] Adams, Eric; Stolzenbach, Keith, et. al. 1991. Transport of Contaminated Sediment in Boston Harbor: Fluorescent Tracer Studies. MWRA, Environmental Quality Department, Technical Report No. 92-9., https://www.mwra.com/harbor/enquad/pdf/1993-12.pdf

Chronic criteria * dilution factor = Chronic limit
7.5 ug/L * 2 = 15 ug/L = 0.015 mg/L (discharge event average)

Acute criteria * dilution factor = Acute limit
13 ug/L * 2 = 26 ug/L = 0.026 mg/L (hourly maximum)

These limits are more stringent than those included in the 2007 Permit Modification for NPDES MA0101192. The dilution factor has decreased from 5 to 2. The chronic limit is applied as a discharge event average. The acute limit is applied as a discharge event maximum. The sampling frequency is the same as the 2000 Permit and sampling shall be conducted four times per year, as follows: a grab sample shall be collected within the first two hours of the start of the discharge, and every hour thereafter for the duration of the overflow.

5.7.1.7 Whole Effluent Toxicity - MWRA Treatment Facilities, Outfalls MWR201 203, 205/205A and 215

Under Section 301(b)(1)(C) of the CWA, discharges are subject to effluent limitations based on water quality standards. The Massachusetts WQS include the following narrative statement and requires that EPA criteria established pursuant to Section 304(a)(1) of the CWA be used as guidance for interpretation of the following narrative criteria:

> All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife.

National studies conducted by the EPA have demonstrated that domestic sources contribute toxic constituents to POTWs. These constituents include metals, chlorinated solvents, aromatic hydrocarbons and others. The Region's current policy is to include toxicity testing requirements in all municipal permits, while Section 101(a)(3) of the CWA specifically prohibits the discharge of toxic pollutants in toxic amounts.

5.7.1.8 Whole Effluent Toxicity (Outfalls MWR201 and 205A)

The 2000 Permit requires the Permittee to conduct and report the results of WET testing biannually using two species. Results for the Cottage Farm CSO Treatment Facility (MWR201) have ranged between 17.7%-100%. Results for the Somerville Marginal CSO Treatment Facility Alternate Discharge (MWR205A) have ranged between 72%-100%.

The discharges from Cottage Farm and Somerville Marginal Alternate are to Class B waters. The Draft Permit changes the test species to freshwater species as included in the Massachusetts toxics policy.[325] The Draft Permit requires the Permittee to conduct acute toxicity testing, biannually, using the daphnid (*Ceriodaphnia dubia*) and fathead minnow (*Pimephales promelas*) in accordance with the test procedures and protocols specified in **Attachment E** of the Draft Permit. Samples shall be collected during the first flush or as a composite over the duration of the overflow, not to exceed 24 hrs.

[325] MassDEP. 1990. Massachusetts Water Quality Standards, Implementation Policy for the Control of Toxic Pollutants in Surface Waters.

5.7.1.9 Whole Effluent Toxicity (Outfalls MWR203, 205 and 215)

The 2000 Permit requires the Permittee to conduct and report the results of WET testing biannually using two species. Results for MWR203 and MWR215 have all been 100%. Results at MWR205 have ranged between 46.9%-100%.

The discharges from Prison Point (MWR203), Somerville Marginal (MWR205) and Union Park (MWR215) are to Class SB waters. The Draft Permit changes the test species to marine species as included in the Massachusetts toxics policy.[326] The Draft Permit requires the Permittee to conduct acute toxicity testing, biannually, using Inland Silverside (*Menidia beryllina*) and Mysid Shrimp (*Mysidopsis beryllina*) in accordance with the test procedures and protocols specified in **Attachment C** of the Draft Permit. Samples shall be collected during the first flush or as a composite over the duration of the overflow, not to exceed 24 hrs.

5.7.2 Conditions for Discharge

The Draft Permit prohibits the discharge of CSO from CSO outfalls during dry weather. During wet weather, the discharges must not cause any exceedance of Water Quality Standards. Dry weather discharges must be reported immediately to EPA and MassDEP. Wet weather discharges must be monitored and reported as specified in the Permit.

Certain outfalls, such as MWR401 and MWR205 discharge in dry weather – they are connected to additional infrastructure and the weir/regulator controlling the CSO discharge is upstream of these connections or separate.

5.7.3 Reopener/Additional CSO Control Measures

The Draft Permit is conditioned to require an annual certification, no later than January 15th of each year, that states that all discharges from combined sewer outfalls were recorded, and other appropriate records and reports maintained for the previous calendar year.

The Permit may be modified or re-issued upon the completion of a Long-term Control Plan. Such modification may include performance standards for the selected controls, a post-construction water quality assessment program, monitoring for compliance with water quality standards, and a reopener clause to be used in the event that the selected CSO controls fail to meet water quality standards. Section 301(b)(1)(C) requires that a permit include limits that may be necessary to protect water quality standards.

5.7.4 Relationship with CSO Communities

EPA and the MassDEP have issued individual NPDES permits to MWRA's CSO communities. Communities within the MWRA system that own and operate CSO outfalls include the Boston Water and Sewer Commission and the Cities of Cambridge, Chelsea and Somerville.

[326] MassDEP. 1990. Massachusetts Water Quality Standards, Implementation Policy for the Control of Toxic Pollutants in Surface Waters.

EPA's general practice is to integrate treatment plant and connected CSO outfall authorizations into a single permit; therefore, the Draft Permit integrates authorization for all CSO outfalls hydraulically connected to the regional collection system that conveys wastewater to the DITP into the Draft Permit for the DITP. All applicable CSO requirements from the individual permits will be incorporated into the Draft Permit.

At the end of the LTCP, MWRA is no longer responsible for CSO outfalls owned and operated by the CSO-responsible Co-permittees.

5.8 Best Management Practices Plan (BMP Plan)

The 2000 Permit requires the Permittee to develop and implement a Best Management Practices (BMP) Plan. The Draft Permit requires the Permittee to continue implementing its BMP plan that was developed and approved by EPA and the MassDEP. The Plan shall continue to reflect activities at DITP, all headworks facilities, all CSO treatment facilities, and the sludge pelletizing area at Fore River, for the purpose and objectives of identifying and describing practices which minimize the amount of pollutants that may be ultimately discharged to the surface and subsurface waters.

Within 60 days of a change in the Facility which materially increases the potential for the ancillary activities to result in a release of hazardous or toxic pollutants, the Permittee shall: (1) notify EPA and MassDEP, (2) notify the public by posting this information to the MWRA's publicly available website, (3) develop an amendment or modification to the BMP plan, and (4) submit the amendment or modification to EPA and MassDEP for approval.

5.9 Assurance of Compliance with 436 MGD Flow Limit

The 2000 Permit includes a 365calendar day dry day flow limit of 436 MGD. The purpose of the calendar year dry day flow limit is to ensure the sanitary flow treated at the DITP does not exceed the flow limit of 436 MGD. The 2000 Permit sets a trigger notification requirement of 415 MGD for each month. If the dry day flow exceeds 415 MGD the Permittee is required to submit a report to EPA and MassDEP on the water and wastewater usage within the service area, the growth and future growth with the service area, the DITP's ability to process flows over a thirty-year period and evaluate the potential for water conservation, water reuse and other ways to reduce flows to DITP. The 2000 Permit requires the Permittee to submit a report to EPA and MassDEP each year by September 1 describing the demand management program.[327]

The five-year review period shows that the 436 MGD limit has not been exceeded or has not triggered the notification requirement. EPA reviewed the annual reports submitted from 2000 to 2021 and the range of 365 calendar day dry flow range was 261.1 MGD to 344.5 MGD.

[327] https://www.mwra.com/harbor/html/archive.htm#demand.

	365 Day Dry Flow Running Average Wastewater Flow
2017	270.6 MGD
2018	272.7 MGD
2019	307.9 MGD
2020	289.9 MGD
2021	262.0 MGD

Table 23: MWRA DITP Dry Day Flow

The Draft Permit proposes an effluent flow limit of 361 MGD as discussed in this Fact Sheet in sections 2.3 and 5.1.1. The Draft Permit also includes a requirement (See Section E. 6.f) that "if the average annual flow in the previous calendar year exceeded 80 percent of the facility's 361 MGD design flow (289 MGD), or there have been capacity related overflows, the report shall include: (1) plans for further potential flow increases describing how the Permittee will maintain compliance with the flow limit and all other effluent limitations and conditions; and (2) a calculation of the maximum daily, weekly, and monthly infiltration and the maximum daily, weekly, and monthly inflow for the reporting year." The effluent flow limit and 80 percent of design flow reporting trigger included in the Draft Permit replace the need for the annual Water and Wastewater Demand Management Report.

The 2000 Permit also required MWRA to submit an annual report describing demand management programs, including water conservation programs. EPA has discontinued this requirement in the Draft Permit as the flow limit protects the design capacity of the facility and encourages conservation.

5.10 Pollution Prevention Plan

The 2000 Permit required the Permittee to develop, submit for EPA and MassDEP approval, and implement a Pollution Prevention Plan that would address households and permitted industries in the MWRA sewer service area. Specifically, the 2000 Permit required the Permittee to (1) identify and reduce sources of PCBs; (2) require all companies be in compliance with chemical storage laws and regulations and that there is adequate spill containment prior to issuing industrial permits; (3) implement a pollution prevention outreach program focused on household hazardous waste and develop a household hazardous web page; (4) implement a school curriculum on wastewater treatment, household hazardous waste and the Boston Harbor Cleanup; and (5) employ pollution prevention through an Enforcement Response Plan.

The Massachusetts regulations at 360 CMR 10.00, Sewer Use, "are the rules and regulations of the Massachusetts Water Resources Authority, promulgated under the authority of St. 1984, c. 372, St. 1987, c.307, and St. 1991, c. 41, governing the discharge of sewage, drainage, substances, and wastes into any sewer under the control of the Authority, or any sewer tributary thereto. These regulations prohibit the discharge of PCBs to the MWRA sewer system (360 CMR 10.024(1)(a)2.). It is also noted that there is no reasonable potential for total PCBs in the effluent to cause or contribute to an exceedance of WQS and PCB Aroclors 1016, 1221, 1232,

1242, 1248, 1254, and 1260 have not been reported as zero in the DITP effluent DMR reports (see Sections 5.1.12.11 and 5.1.12.12).

The MWRA is also required to administer an Industrial Pretreatment Program (see Section 5.2 of this Fact Sheet and Section G. of the Draft Permit) and combined with the Sewer Use regulations at 360 CMR 10.00 many of these concerns have been addressed.

MWRA has developed a household hazardous waste booklet and provides information on their website: https://www.mwra.com/publications/hhw/hhw2005.pdf . The Draft Permit requires the Permittee to update the household hazardous waste booklet to add information on the emerging contaminants of PFAS, pharmaceuticals and personal care products (PPCPs), and microplastics. See Draft Permit Section I.2 The booklet shall continue to be available on MWRA's website.

EPA has reduced the requirements in the Pollution Prevention Plan as many of the elements are addressed via other Draft Permit requirements or by State and/or Federal regulations.

The Permittee shall continue to minimize to the greatest extent possible, contaminants that enter the MWRA wastewater system and the combined overflow system. In accordance with 40 CFR § 122.44(k) Best Management Practices may be implemented to control or abate the discharge of pollutants when the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of the Clean Water Act.

5.11 Groundwater Remediation Site Waters

Massachusetts regulations at 360 CMR 10.091(c) prohibit the issuance of a dewatering permit for the purpose of groundwater remediation to the MWRA sewer system. EPA has removed the Groundwater Remediation Site Waters review as a permit requirement.

5.12 Ambient Monitoring Plan

As part of the permitting process for the Secondary Treatment Facilities at Deer Island, the Massachusetts Secretary of Environmental Affairs identified a need for a long-term chemical and biological monitoring program near the proposed outfall site.[328] At that time, the Secretary established an Outfall Monitoring Task Force (OMTF) consisting of scientists, state and federal agency personnel, and environmental interest groups to provide technical and scientific review of the baseline monitoring program developed by MWRA.

[328] James S. Hoyte, Secretary, Massachusetts Executive Office of Environmental Affairs. 1988. Certificate of the Secretary of Environmental Affairs on the Final Environmental Impact Report, Secondary Treatment Facility Plan, Boston, EOEA Number: 6136. May 18, 1988.

In its Final Supplemental Environmental Impact Statement (Final SEIS)[329] and Record of Decision[330] on the siting of the offshore outfall, EPA corroborated the need for a monitoring program to obtain several years of pre-operational ecological sampling to establish an adequate statistical baseline against which to measure outfall impacts in order to assure the protection of: (1) water quality, (2) human health, and (3) endangered species, pursuant to Section 7 of the Endangered Species Act.

Baseline Ambient Monitoring Program

The Baseline Ambient Monitoring Plan (AMP) was developed by MWRA with input from the OMTF and finalized in 1991. [331] The Baseline AMP was approved by EPA and the Massachusetts Secretary of Environmental Affairs and was subsequently submitted to the Federal Court, and the Court ordered[332] MWRA to implement the AMP.

The ambient monitoring strategy was based on the guidance of the National Research Council book, "Managing Troubled Waters: The Role of Marine Environmental Monitoring."[333] The NRC found "that monitoring designed primarily to meet regulatory compliance needs generally does not adequately answer questions about regional and national risks…" Due to the complexity of the Massachusetts and Cape Cod Bays ecosystem, the Baseline AMP was designed to include regional monitoring for some parameters including nutrients and related variables. The Baseline AMP also presumed that the State of Massachusetts or the Massachusetts Bays Program would develop a regional monitoring program as had been done in the Southern California Bight and Chesapeake Bay.[334]

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[329] EPA. 1988. Boston Harbor Wastewater Conveyance System Supplemental Environmental Impact Statement. EPA Region 1, Boston, MA., https://nepis.epa.gov/Exe/ZyNET.exe/9100PBOH.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1981+Thru+1985&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C81thru85%5CTxt%5C00000019%5C9100PBOH.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

[330] Michael R. Deland, Regional Administrator, EPA Region 1, 1988. Public Record of Decision on the Final Supplemental Environmental Impact Statement for the Boston Harbor Wastewater Conveyance System. November 8, 1988.

[331] MWRA. 1991. Effluent Outfall Monitoring Plan, Phase I: Baseline Studies. https://www.mwra.com/harbor/enquad/pdf/1991-ms-02.pdf

[332] *See* Motion of Plaintiff United States to Require Implementation of Outfall Monitoring Plan entered June 26, 1992 in the Boston Harbor Case (U.S. v. Metropolitan District Commission et al., Civil Action No. 85-0489-MA) and Schedule Five Compliance Order No. 78 entered June 26, 1992, Judge Mazzone (U.S. v. Metropolitan District Commission et al., Civil Action No. 85-0489-MA).

[333] NRC. 1990. Managing Troubled Waters: The Role of Marine Environmental Monitoring. https://nap.nationalacademies.org/catalog/1439/managing-troubled-waters-the-role-of-marine-environmental-monitoring

[334] MWRA. 1991. Effluent Outfall Monitoring Plan, Phase I: Baseline Studies, p. 50. https://www.mwra.com/harbor/enquad/pdf/1991-ms-02.pdf

The AMP was designed to answer a series of questions related to public concerns that were expressed during the state and federal permitting processes and detailed in Appendix B of the 1991 Baseline AMP.

The court schedule for the Boston Harbor Case required the MWRA ocean outfall to be operational in 1995.[335] Therefore, the Baseline AMP was scheduled to begin in 1992 and capture three (3) years of pre-discharge data. The data from the baseline monitoring and pre-discharge special studies were to provide the OMTF the information necessary to establish early warning thresholds that would achieve the overall goal of detecting meaningful change in Massachusetts Bay attributed to the outfall, if it occurred. However, due to construction delays, the ocean outfall did not become operational until September 2000. Nine years of baseline (pre-discharge) data had been collected by that time. Results of these studies can be found on the MWRA Environmental Quality Department's Technical Reports webpage at: https://www.mwra.com/harbor/enquad/trlist.html.

Post-discharge Ambient Monitoring Program

The 2000 Permit required MWRA to implement a post-discharge AMP. The purpose of collecting ambient data was to characterize the environment after the discharge from the MWRA's ocean outfall began. The post-discharge AMP was designed to: (1) attempt to address significant environmental and human health concerns with regard to Boston Harbor, Massachusetts Bay and Cape Cod Bay, (2) attempt to answer resource questions, (3) evaluate compliance with water quality standards, (4) assess whether the impact of the discharge on the receiving water is within bounds of the SEIS (EPA, 1988), (5) assess whether the assumptions made in the planning process, including assumptions based on modeling, continue to be valid; and (6) assess compliance with the Endangered Species Act.

Additionally, the 2000 Permit created a new science advisory plan, the Outfall Monitoring Science Advisory Panel (OMSAP or Panel), to advise EPA and MassDEP on issues related to the effect of the MWRA discharge. Membership on the Panel was limited to scientists and engineers who are recognized for their expertise within their field and for their knowledge of the coupled aquatic system of Boston Harbor-Massachusetts Bay-Cape Cod Bay-Gulf of Maine. The purpose of the OMSAP was to: (1) review and provide recommendations for revisions of the outfall monitoring program, to ensure that it is capable of detecting changes at an early enough stage to allow action to prevent any unacceptable impacts of the discharge on public health or on the marine environment and its biota, and (2) advise EPA and MassDEP when there are any permit or contingency plan threshold exceedances and provide advice on any actions that may be needed to protect human health and ecosystem health.

[335] *See* Schedule One Compliance Order No. 6 entered June 27, 1986, Judge Mazzone, 1986 U.S. Dist. LEXIS 23542, 23.

The Phase II: Post-discharge AMP is an attachment[336] to the 2000 Permit. The Plan has been updated periodically according to the process detailed in the 2000 Permit. Significant changes to the AMP occurred in 2004,[337] 2010[338] and 2021.[339]

The post-discharge AMP is broken down into four major categories: Effluent Monitoring, Water Column Monitoring, Benthic Monitoring, and Fish and Shellfish Monitoring. Each category was designed to address specific resource questions. EPA has evaluated these charge questions to determine what questions remain unresolved or may need to be further evaluated to address regional changes in Massachusetts and Cape Cod Bays.

5.12.1 Effluent Monitoring

Many of the effluent monitoring parameters included in the post-discharge AMP directly reflect the effluent limits and/or monitoring requirements in the 1976 MDC NPDES Permit[340] and the 2000 MWRA Permit. Other parameters were included in the AMP to aid in the evaluation of other ambient monitoring data. Limited changes had been made to this category of the AMP. Only the effluent monitoring for total coliform (which is no longer a requirement in the state WQS) and floatables were dropped in 2004 and 2010, respectively. There was also a change in the sampling frequency of metals and organic chemicals from "weekly" to "4 times per month."

Results of Effluent Monitoring

Effluent monitoring data submitted by MWRA consistently meets the effluent limits in the 2000 Permit. The effluent data also documents improved effluent quality since the wastewater is now treated by secondary treatment. Many pollutants that were detected previously in the primary treated effluent are now either no longer present at detectable levels or present at levels significantly below water quality standards. (See Sections 5.1.11 and 5.1.12 of this Fact Sheet for further discussion.)

Effluent Monitoring Questions and Answers

There were five (5) questions that were to be answered by the effluent monitoring requirements in the Post-discharge AMP. EPA has evaluated the DMR data and MWRA reports related to each of these questions and has determined that these questions have been answered regarding the AMP. Note: Questions are numbered as in the document titled, Ambient Monitoring Plan and

[336] MWRA. 1997. "Massachusetts Water Resources Authority, effluent outfall monitoring plan: Phase II Post-discharge monitoring." https://www3.epa.gov/region1/npdes/mwra/pdf/n.pdf
[337] MWRA. 2004. "Ambient Monitoring Plan for the Massachusetts Water Resources Authority Effluent Outfall, Revision 1." https://www.mwra.com/harbor/enquad/pdf/2004-ms-92.pdf
[338] MWRA. 2010. "Ambient Monitoring Plan for the Massachusetts Water Resources Authority Effluent Outfall, Revision 2." https://www.mwra.com/harbor/enquad/pdf/2010-04.pdf
[339] MWRA. 2021. "Ambient Monitoring Plan for the Massachusetts Water Resources Authority Effluent Outfall, Revision 2.1." https://www.mwra.com/harbor/enquad/pdf/2021-08.pdf
[340] MWRA. 1991. "Effluent Outfall Monitoring Plan, Phase I: Baseline Studies", p. B-3.

Contingency Plan for the MWRA Outfall: Monitoring Questions Status and 2000-2018 Threshold Test Results.[341]

Question #1: Do pathogens exceed the permit limits?

There have been two (2) exceedances of the fecal coliform bacteria limitations over the 20+ years since the 2000 Permit has been in effect. The exceedances occurred in August 2001 and April 2004 and were related to storm events.[342] Otherwise, MWRA has consistently met the effluent limitations for pathogens in the 2000 Permit. Additional discussion of pathogen limitations can be found in Section 5.1.6 of this Fact Sheet.

Question #2: Does acute and chronic toxicity of effluent exceed the permit limits?

There have been four (4) exceedances of the Whole Effluent Toxicity (WET) Test effluent limitations in the 2000 Permit. All exceedances resulted from unknown sources. The exceedances occurred in January 2001, April 2001, September 2005, and August 2006. MWRA has consistently met the effluent limitations other than these exceedances. Additional discussion of WET Test effluent limitations can be found in Section 5.1.13 of this Fact Sheet.

Question #3: Do effluent contaminant concentrations exceed the permit limits?

There was a single exceedance of the chlorine effluent limitation in December 2000, which was prior to the completion of the automated dechlorination monitoring system. Since that time, MWRA has consistently met the effluent limitations for total residual chlorine. Additional discussion of total residual chlorine limitations, and the reasonable potential analysis for other pollutants can be found in Sections 5.1.7, 5.1.9, 5.1.10, 5.1.11, 5.1.12, 5.1.13, 5.1.14, and Appendix G of this Fact Sheet.

Question #4: Do conventional pollutants in the effluent exceed the permit limits?

There were exceedances of the TSS limitations back in August 2002 related to an upset of the secondary treatment process caused by an industrial discharger. There was a single violation of the effluent pH limit in December 2000. Since these exceedances, MWRA has consistently met the effluent limitations for the conventional pollutants of $CBOD_5$, TSS, pH, fecal coliform, and oil and grease. Additional discussion of conventional pollutants and related effluent limitations are found in Sections 5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.1.8 of this Fact Sheet.

Question #5: What are the concentrations of contaminants and characteristic tracers of sewage in the influent and effluent and their associated variability?

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[341] MWRA, 2019. Ambient Monitoring Plan and Contingency Plan for Massachusetts Bay outfall: Monitoring questions status and 2000-2018 threshold test results. Boston: Massachusetts Water Resources Authority. Report 2019-03. 36 p. https://www.mwra.com/harbor/enquad/pdf/2019-03.pdf

[342] MWRA. 2021. "Ambient Monitoring Plan for Massachusetts Water Resources Authority Effluent Outfall, Revision 2.1, August 2021" https://www.mwra.com/harbor/enquad/pdf/2021-08.pdf

MWRA conducts detailed monitoring of the DITP effluent for toxic contaminants as a requirement of the of the 2000 Permit and the AMP.[343,344] Analysis for the AMP is conducted using sensitive detection methods, and many results are still non-detect. None of the contaminants are found at concentrations which would exceed WQS. Many, in fact, are below the water quality standards without the consideration of the dilution. (See Section 2.2 for a discussion of water quality based effluent limits and reasonable potential). The results of the monitoring can be found in the referenced reports and in the most recent revision of the AMP.[345]

MWRA was also required by the 2000 Permit to "field test and certify whether the outfall's minimum dilution is equal to, or greater than, the predicted minimum dilution." MWRA conducted plume tracking surveys in April[346] and July[347] of 2001. Detailed discussion of the dye studies can be found in Section 4.3 of this Fact Sheet and the referenced reports. Water quality characteristics measured during the surveys found increases in metals, nutrients, and total suspended solids in the plume relative to background conditions but within water quality standards. In the July 2001 survey, copper concentrations, after initial mixing, were ~60% higher than background levels measured east and north of the diffuser. Ammonia and phosphate concentrations in the effluent plume were about 5- and 1.5- fold over background levels. Total suspended solids increased as much as 1.2 fold in the core of the plume. In contrast, bacterial indicators were near or below detection levels and did not display an increase relative to background conditions. The July survey represents the worst case of the two surveys.

The water quality data collected during the surveys demonstrated that state and federal water quality criteria were not exceeded. The highest measured copper concentration was 0.69 µg/L. This compares to the marine water quality criterion of 3.1 µg/L. The *Enterococcus* were not detected in 16 samples and only at a count of 2 colonies per 100 mL in two samples. Fecal coliform bacteria were measurable at 1 to 4 colonies per 100 mL (MDL = 2 colonies/100 mL). These values compare to current state water quality standards for shellfishing of a geometric mean Most Probable Number (MPN) for fecal coliform bacteria of 14 organisms per 100 mL, nor shall more than 10% of the samples exceed an MPN of 28 per 100 mL (314 CMR 4.05 (4)(a)4) and water quality standards for primary contact recreation of a geometric mean for *Enterococci* of ≤ 35 colony forming units/100 mL and a statistical threshold value of ≤ 130 (314 CMR 4.05 (5)(f)2).

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[343] Delaney, MF, Rex AC. 2009. "Contaminant Monitoring of Deer Island Treatment Plant Effluent 2000-2005." Boston: Massachusetts Water Resources Authority. Report ENQUAD 2007-02. pp. 40, https://www.mwra.com/harbor/enquad/pdf/2007-02.pdf

[344] Delaney, MF. 2009. "Addendum to Contaminant Monitoring of Deer Island Treatment Plant Effluent 2000-2005: Effluent Data for 2005-2008." Boston: Massachusetts Water Resources Authority. Report ENQUAD 2009-05. 4 pp., https://www.mwra.com/harbor/enquad/pdf/2009-05.pdf

[345] MWRA.2021. "Ambient monitoring plan for the Massachusetts Water Resources Authority effluent outfall revision 2.1. August 2021." Boston: Massachusetts Water Resources Authority. Report 2021-08. p. 107, https://www3.epa.gov/region1/npdes/mwra/omsap/pdfs/mwra-amp-rev-2-1-report-2021-08.pdf

[346] Hunt CD, Steinhauer WS, Mansfield AD, Albro CA, Roberts PJW, Geyer WR, and Mickelson, MJ. 2002. "Massachusetts Water Resources Authority Effluent Outfall Dilution: April 2001. Boston: Massachusetts Water Resources Authority. Report ENQUAD 2002-06 p. 69 plus appendices., https://www.mwra.com/harbor/enquad/pdf/2002-06.pdf

[347] Hunt CD, Mansfield AD, Roberts PJW, Albro CA, , Geyer WR, Steinhauer WS, and Mickelson, MJ. 2002. "Massachusetts Water Resources Authority Effluent Outfall Dilution: July 2001. Boston: Massachusetts Water Resources Authority. Report ENQUAD 2002-07 77 p., https://www.mwra.com/harbor/enquad/pdf/2002-07.pdf

Additionally, MWRA has been monitoring *Clostridium* in the Bay to track outfall-related benthic deposition (See Section 5.13.3 of this Fact Sheet for further discussion).

MWRA regularly measures influent characteristics as part of its process controls. Influent loadings for $CBOD_5$ and TSS are reported in DMR reports as required by the 2000 Permit. Additionally, the MWRA Outfall Monitoring Overview Reports[348] include influent and effluent information on chromium, copper, lead, mercury, nickel, silver, PCB and 4,4-DDT. Percent removal rates were calculated based on data in the 2020 Outfall Monitoring Overview.

Table 24: Removal rates for MWRA DITP *from* 2020 Outfall Monitoring Overview.

Parameter	2020 Influent Loading	2020 Effluent Loading	% Removal
Conventional Pollutants (mton/year)			
BOD	72,938	6997	90%
TSS	81,505	4100	95%
Metals (kg/year)			
Chromium	1,480	209	86%
Copper	31,406	2,530	92%
Lead	3,936	279	93%
Mercury	56	2	96%
Nickel	1,387	759	45%
Silver	180	21	88%
Organic Contaminants (kg/year)			
PCB	0.38	0.06	84%
4,4-DDE	0.16	0.13	19%

Summary

EPA finds that the effluent related questions in the AMP are addressed by the effluent limits and monitoring requirements in the 2000 Permit and the Draft. Effluent discharge monitoring data for the five-year review period used for the development of the Draft Permit can be found in Appendix C. A longer term record of the effluent monitoring data reported in discharge monitoring reports is available through EPA's ECHO web page at https://echo.epa.gov/tools/data-downloads. Additional information can be found in the reports on MWRA's Technical Reports web page https://www.mwra.com/harbor/enquad/trlist.html. Effluent monitoring is no longer required as part of the AMP as it is redundant with the requirements of the Draft Permit.

5.12.2 Water Column Monitoring

[348] Werme C, Codiga DL, Libby PS, Carroll, SR, Charlestra L, Keay KE. 2021. "2020 outfall monitoring overview." Boston: Massachusetts Water Resources Authority. Report 2021-10 p. 55, https://www.mwra.com/harbor/enquad/pdf/2021-10.pdf

Water column monitoring is the core of the AMP. One of the primary concerns with moving the discharge from Boston Harbor to Massachusetts Bay was the potential for changes in the nutrient balance of Massachusetts and Cape Cod Bays and the possible impacts to marine life, particularly, endangered species. The pre- and post-discharge AMPs were designed so that any potential changes in the Bays would be detected.

Over the last 20-plus years, since the 2000 Permit became effective, the numbers of surveys and stations for Water Column Monitoring have been revised upon request by MWRA and following assessment by the OMSAP and approval by MassDEP and EPA.

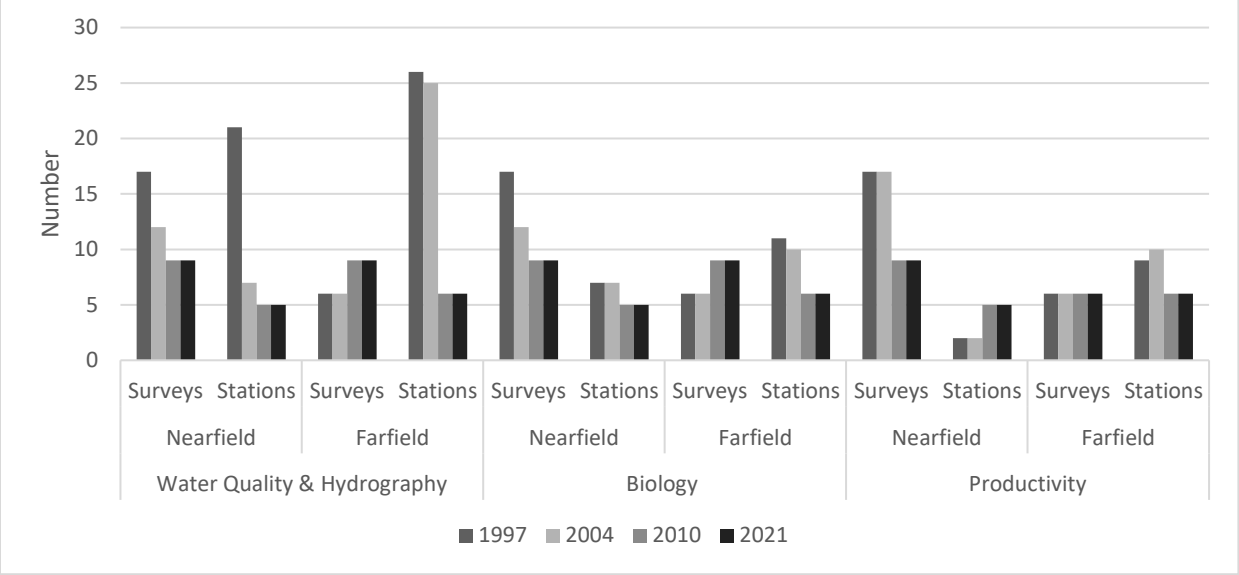

Figure 1: Water Column Monitoring: Number of Surveys and Stations with each Ambient Monitoring Plan Revision

Results of Water Column Monitoring

Water column monitoring, in general, has found that the DITP and outfall diffuser have been functioning well within the expectations of the SEIS. Water column studies have confirmed that dilution and transport of the effluent have met the expectations of pre-discharge modeling and that direct negative impacts have not occurred in the Bays. There are documented increases in ammonium in the vicinity of the outfall (see Section 5.1.10); however, these increases have not been found to cause significant changes in chlorophyll or DO levels thus far.

Water Column Monitoring Questions

There were fifteen (15) questions that were to be answered by Water Column Monitoring in the Post-discharge AMP.

Question #6: Are the model estimates of short-term (< 1 day) effluent dilution and transport accurate?

This question was answered by the dye studies conducted by MWRA in 2001. Discussion of these studies and the approval by MassDEP and EPA can be found Section 4.3 of this Fact Sheet and in the response to Question #5 above. A recent study[349] using CORMIX to model the discharge has again confirmed the dilutions found in previous studies.

Question #7: Do levels of contaminants outside the mixing zone exceed State Water Quality Standards?

The 2001 dye study included ambient measurements of copper and nutrients that are consistent with expectations and found that the ambient concentrations do not exceed water quality criteria. The effluent limitations in the 2000 Permit were calculated to ensure that State WQS are met at the edge of the mixing zone. Discussions of WQS, classification of the receiving waters, mixing zones and effluent limitations can be found in Sections 2.2.1, 4.1.1, 4.3 and 5.1 of this Fact Sheet, respectively.

Question #8: Are pathogens transferred to shellfish beds at levels that might affect shellfish consumer health?
Question #9: Are pathogens transported to beaches at levels that might affect swimmer health?

The 2000 Permit established effluent limits for fecal coliform bacteria based on State Water Quality Standards in effect at the time. At the time of the 2000 Permit issuance, fecal coliform bacteria were the indicator bacteria used to manage both shellfish beds and recreational uses (i.e., swimming). MWRA has consistently met these limitations with several exceptions. (See Section 5.1.6 of this Fact Sheet).

Furthermore, the 2000 Permit requires MWRA to implement a Memorandum of Understanding with Massachusetts Division of Marine Fisheries (Marine Fisheries) including a monitoring plan to provide the data necessary to evaluate water quality with regard to the National Shellfish Sanitation Program and a notification plan for any potential impacts to shellfish growing areas.

As far as concerns about pathogens being transported to beaches, MWRA has a long-term record of ambient bacteria data including nearfield samples which are significantly below State WQS and often below method detection limits. Since the outfall starts 8 miles off-shore and ambient data meets State WQS in the nearfield there is no concern about pathogens from the MWRA outfall to Massachusetts Bay transporting pathogens to coastal beaches. A detailed discussion can be found in Section 5.1.6 of this Fact Sheet.

Both of these questions have been answered and the effluent limitations in the Draft Permit are more stringent for fecal coliform bacteria and adds seasonal effluent limits for *Enterococcus* based on the current State WQS. The Draft Permit also requires that MWRA continue to implement the Memorandum of Understanding and attached monitoring plan with Marine Fisheries and FDA.

Question #10: Has the clarity and/or color around the outfall changed?

[349] MWRA. 2022. "Massachusetts Bay Outfall Treated Effluent Discharge Plume Characteristics from EPA-

MWRA has conducted visual observations of the aesthetics in the vicinity of the outfall during the dilution studies in 2001 and as part of the regular water column monitoring program. MWRA has not made colorimetric or secchi disk measurements. The Permittee has consistently measured photosynthetically active radiation (PAR) which can be derived to infer water clarity.[350] Plots of the vertical attenuation coefficient for PAR (k_{PAR}) provided by MWRA support the following conclusions: no change specific to N21 (sampling location directly over diffuser midpoint) before and after the outfall went online; no long-term trend in k_{PAR} values at N21 or N04 (reference station); spatial variability in k_{PAR}, between N21 and N04, is modest with values slightly higher at N21.

MWRA will continue to monitor PAR as part of the ambient monitoring plan so this dataset will continue.

Transmissivity or Turbidity data

Question #11: Has the amount of floatable debris around the outfall changed?

Floatables amounts in the DITP effluent are very low and MWRA has also not found petroleum grease or sewage-derived plastics in the vicinity of the outfall. Net tows were conducted during nearfield surveys at two sites. One site was near the outfall and the other a control site outside of the influence of the discharge. In some surveys, tows near the outfall site have found small particles of fat.[351] In the 2010 revision of the AMP, the floatables monitoring requirement was dropped in response to a request by MWRA and after a review by OMSAP, MassDEP and EPA.

Question #12: What are the nearfield and farfield water circulation patterns?
Question #13: What is the farfield fate of dissolved, conservative, or long-lived effluent constituents?

[350] EMAIL. Betsy Reilley, MWRA to Michele Barden, EPA, July 15, 2022. RE: Discussion of color/clarity in Ambient Monitoring – EPA Data Request.
[351] MWRA. 2021. "Ambient Monitoring Plan for the Massachusetts Water Resources Authority Effluent Outfall, Revision 2.1," p. 21., https://www.mwra.com/harbor/enquad/pdf/2021-08.pdf

Nearfield and farfield water circulation patterns have been detailed in MWRA reports[352] and in numerous peer-reviewed papers.[353, 354, 355, 356] See Section 5.1.10 of this Fact Sheet for a detailed discussion of the water circulation patterns of Massachusetts Bay.

The farfield fate of the effluent is initially controlled by the dilution of the effluent in the nearfield. As previously stated, dilution is a minimum of 70:1 (See Section 4.3). Any pollutants with reasonable potential to exceed State WQS have been limited in the 2000 Permit and the Draft Permit to assure that the effluent does not cause or contribute to an exceedance State WQS. The farfield fate of the effluent is controlled by the general circulation of Massachusetts Bay and the tides and winds; it is generally defined by flows entering the Bay at Cape Ann, following along the coast, and exiting at Race Point (See Figure 14 for the General Circulation of Massachusetts Bay).

Question #14: Have nutrient concentrations changed in the water near the outfall; have they changed at farfield stations in Mass or Cape Cod bays and, if so, are they correlated with changes in the nearfield?

As anticipated, ammonium concentrations have increased in the nearfield since MWRA began discharging into Massachusetts Bay. An ammonium signature from the effluent is typically observed within 6 to 12 miles of the outfall. Initially, with the commencement of discharge from the offshore outfall, ammonium levels in the nearfield doubled from about 1 µM to 2 µM but have decreased slightly over time (See Figure 2).

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[352] Libby PS, Borkman D, Geyer WR, Keller AA, Turner JT, Mickelson MJ, Oviatt CA. 2009. "Water column monitoring in Massachusetts Bay 1992-2007: focus on 2007 results." Appendix A., https://archives.lib.state.ma.us/bitstream/handle/2452/724310/ocn987272486-2007.pdf?sequence=1&isAllowed=y

[353] Rockwell Geyer, W., Gardner, G. B., Brown, W. S., Irish, J., Butman, B., Loder, T., & Signall, R. 1992. Physical Oceanographic Investigation of Massachusetts and Cape Cod Bays. Massachusetts Bays Program. p. 1. https://archives.lib.state.ma.us/bitstream/handle/2452/49977/ocm36241802.pdf?sequence=1&isAllowed=y

[354] Signell, R. P., Jenter, H. L., & Blumberg, A. F. (1996). Circulation and effluent dilution modeling in Massachusetts Bay: Model Implementation, verification and results. *Open-File Report*. https://doi.org/10.3133/ofr9615

[355] W.R. Geyer, R.P. Signell , D.A. Fong , J. Wang , D.M. Anderson , B.A. Keafer. 2004. The Freshwater Transport and Dynamics of the Western Maine Coastal Current. Continental Shelf Research; 24 (2004) 1339-1357. https://www.whoi.edu/fileserver.do?id=36085&pt=2&p=28251

[356] J.D. Irish, & R.P. Signell. 1992. Tides of Massachusetts and Cape Cod Bays. p. 44 https://doi.org/10.1575/1912/857

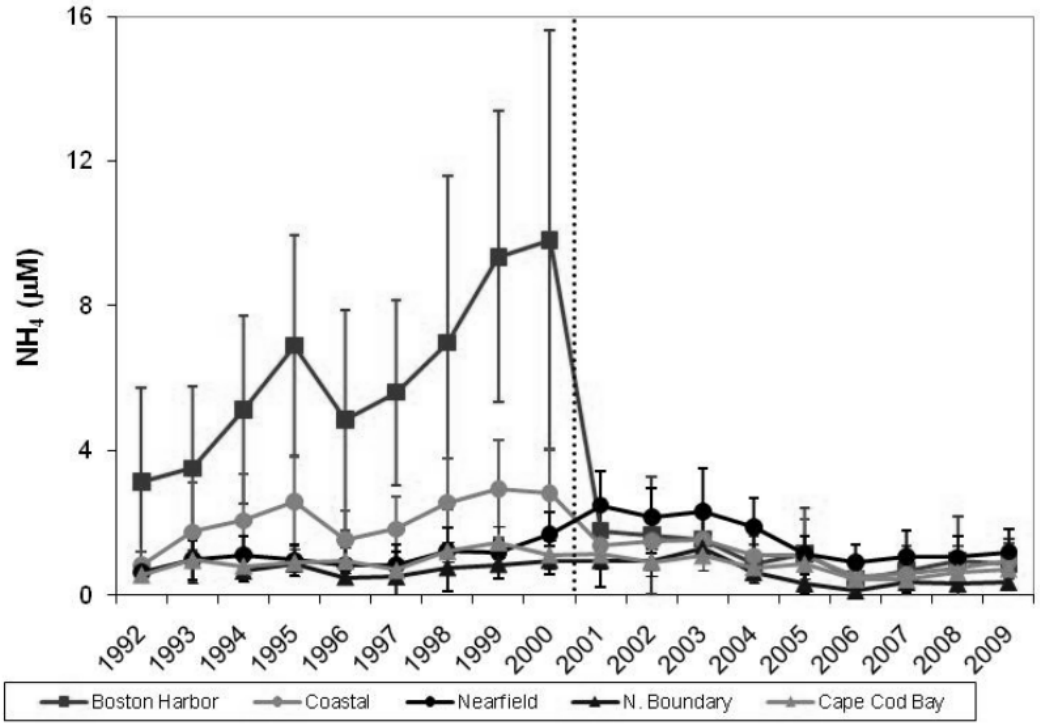

Figure 2: Annual mean ammonium by area 1992-2009 *from* MWRA Ambient Monitoring Plan Revision 2.1, August 2021

It is important to continue to monitor for nitrogen species and nitrogen concentrations in the effluent and in the ambient waters of Massachusetts and Cape Cod Bays to track potential water quality impacts. Monitoring is required in the Draft Permit as discrete samples and as part of a revised Ambient Monitoring Plan. (Also see Section 5.1.10 of this Fact Sheet).

Question #15: Do the concentrations (or % saturation) of dissolved oxygen in the vicinity of the outfall and a selected farfield station meet State Water Quality Standards?

Question #16: Have the concentrations (or percent saturation) of dissolved oxygen in the vicinity of the outfall or at selected farfield stations in Massachusetts Bay or Cape Cod Bay changed relative to pre-discharge baseline or a reference area? If so, can changes be correlated with effluent or ambient water nutrient concentrations, or can farfield changes be correlated with nearfield changes?

Ambient dissolved oxygen levels undergo natural variations, but they have consistently met State WQS (See Figure 3). While occasional values below numeric water quality standards are observed, recent results support the evaluation summarized in AMP Revision 2.1 (MWRA 2021):

"The state standard allows for natural variability, and oxygen levels in bottom waters of the nearfield and Stellwagen Basin have not yet fallen below natural background values (Libby et al. 2009, Werme et al. 2008)." Monitoring Questions Status and 2000-2018 Threshold Test Results, page 9.

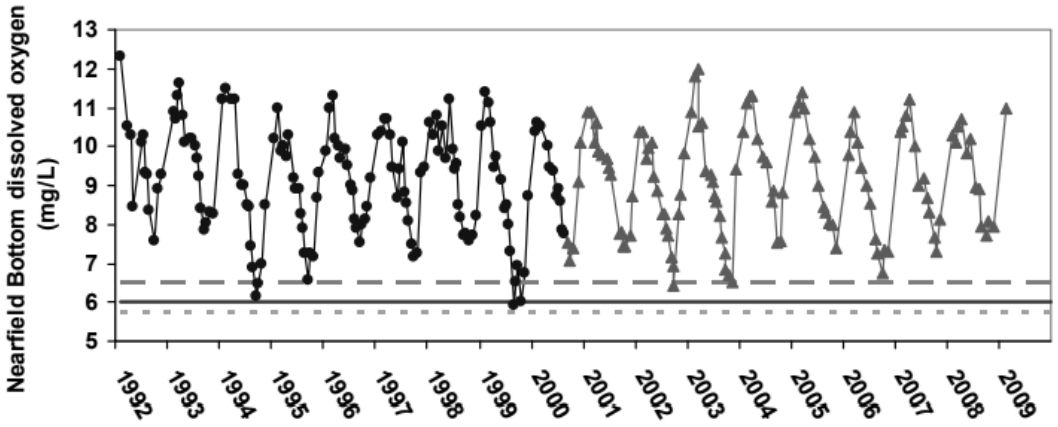

Figure 3: Nearfield bottom water dissolved oxygen concentration results *from* MWRA Ambient Monitoring Plan Revision 2.1, August 2021

Dots represent baseline data, triangles are post-diversion data. Caution, Warning and Background levels are indicated by dashed, solid, and dotted lines respectively.

Ambient DO data collected in the nearfield have been within background levels. However, in the late summer of 2019 and 2020, extremely low DO levels (<2.0 mg/L) were found in southwestern Cape Cod Bay. Investigations by Massachusetts Division of Marine Fisheries[357] and others are evaluating how regional changes, including rapid increases in regional sea water temperatures, may be contributing to hypoxia.[358] Wind patterns also appear to be changing. These changes may be contributing to changes in algal species that bloom in the late summer. Unusually large blooms in 2019 and 2020 may have resulted in a high oxygen demand as the excess organic matter sank to the bottom and decomposed. See Section 5.1.10 of this Fact Sheet for further discussion. EPA recommends that MWRA should continue to monitor ambient DO and calculate and report oxygen depletion rates. This question should be further explored in future ambient monitoring. It is also noted that % saturation is no longer a standard for DO in the state WQS.

Question #17: Has the phytoplankton biomass changed in the vicinity of the outfall or at selected farfield stations in Massachusetts Bay or Cape Cod Bay, and, if so, can these changes be correlated with effluent or ambient water nutrient concentrations, or can farfield changes be correlated with nearfield changes?

[357] https://www.mass.gov/news/monitoring-and-understanding-low-dissolved-oxygen-in-cape-cod-bay
[358] Scully, Malcolm E., W. Rockwell Geyer, David Borkman, Tracy L. Pugh, Amy Costa, and Owen C. Nichols. 2022. Unprecedented summer hypoxia in southern Cape Cod Bay: an ecological response to regional climate change? Biogeosciences, Volume 19, Issue 14, BG, 19. pp. 3523-3536, 2022. https://doi.org/10.5194/bg-19-3523-2022

In the 2021 Revision 2.1 of the AMP, MWRA provides a discussion of older (pre-2010) Before-After, Control-Impact (BACI) statistical analyses. At that time, MWRA concluded, "[t-]he only differences were seen for NH_4 concentrations, which were higher in the inner nearfield compared to the outer nearfield, Massachusetts Bay offshore and Cape Cod Bay during all three seasons ($P<0.002$). None of the other tested changes were significant. This indicates that even though there has been an increase in NH_4 at these stations close to the bay outfall, there have not been any significant changes in chlorophyll or particulate organic carbon (POC) in this "impacted" area compared to the "control" regions of the bays that are 5 to >50 km distant."[359]

Harmful algal blooms (HABs) in Massachusetts Bay may have different and changing dynamics that are not captured in analysis of bulk chlorophyll or POC measurements. Negative impacts from HABs may not be correlated with chlorophyll *a*, and NH_4 has been shown to increase the growth and toxicity of some HAB species. There have been some changes already observed with *Alexandrium* dynamics in Massachusetts Bay. Additionally, "there also have been biological and oceanographic regime changes throughout the Gulf of Maine. The regime shift increases the scientific uncertainty regarding the role of the discharge in supporting HABs in Massachusetts Bay."[360] EPA recommends that this question be explored further in a revised ambient monitoring program with a focus on HAB species including the continuation of *Alexandrium* rapid response surveys, the addition of rapid response criteria for *Pseudo-nitzschia* spp. and the enumerating and reporting *Dinophysis, Phaeocystis, Karenia mikimotoi,* and *Margalefidinium polykrikoides* as nuisance species of interest.

Question #18: Have the phytoplankton production rates changed in the vicinity of the outfall or at selected farfield stations, and, if so, can these changes be correlated with effluent or ambient water nutrient concentrations, or can farfield changes be correlated with nearfield changes?

MWRA states in the 2021 Revision 2.1 of the AMP, that "the trends observed in productivity for the pre- versus post-diversion comparisons appear to be driven by, or confounded by, more regional processes."[361] As part of the 2010 AMP Revisions, EPA approved the discontinuation of productivity measurements due to cost and that there was not a significant increase in outfall-related productivity. In its approval letter,[362] EPA says the revised AMP makes extensive use of tools to evaluate the occurrence and distribution of harmful phytoplankton such as satellite

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[359] MWRA. 2021. "Ambient monitoring plan for the Massachusetts Water Resources Authority effluent outfall revision 2.1. August 2021. Boston: Massachusetts Water Resources Authority. Report 2021-08. p. 25., https://www3.epa.gov/region1/npdes/mwra/omsap/pdfs/mwra-amp-rev-2-1-report-2021-08.pdf

[360] Hagy, J., Gleason, T., Oczkowski, A., Tatters, A. and Wan, Y., 2022. "Technical Memorandum: Review of MWRA Water Quality Monitoring Results to Address Potential for Harmful Effects of the Deer Island Discharge on Threatened and Endangered Species in Massachusetts Bay" https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=355407&Lab=CEMM

[361] [361] MWRA. 2021. "Ambient monitoring plan for the Massachusetts Water Resources Authority effluent outfall revision 2.1. August 2021. Boston: Massachusetts Water Resources Authority. Report 2021-08. p. 26., https://www3.epa.gov/region1/npdes/mwra/omsap/pdfs/mwra-amp-rev-2-1-report-2021-08.pdf

[362] LETTER. Stephen S. Perkins, EPA, Region 1 and Ann Lowery, MassDEP to Michael J. Hornbrook, MWRA. December 6, 2010. Re: Massachusetts Water Resources Authority, Permit Number MA0103284 – EPA and MassDEP Approval of the Proposed Revision to the Ambient Monitoring Plan for the MWRA Effluent Outfall. https://www3.epa.gov/region1/npdes/mwra/omsap/pdfs/MWRAAmbientMonitoringPlan.pdf

imagery and a network of scientist /agencies that routinely monitor blooms."

EPA recommends that this question continues to be explored through regional resources including the NERACOOS buoy off Cape Ann and the NOAA weather buoy 44013, remote sensing and potentially model analysis, especially as the potential regime shift in Massachusetts Bay may impact primary production rates. Since satellite imagery of chlorophyll cannot delineate specific species, additional tools like the Imaging FlowCytobot deployed in Harpswell Sound, ME (https://ifcb-data.whoi.edu/timeline?dataset=harpswell) may be helpful in understanding species specific unusual events in the region.

Question #19: Has the abundance of nuisance or noxious phytoplankton changed in the vicinity of the outfall?

The dynamics of harmful algal blooms have changed throughout Massachusetts Bay and the greater Gulf of Maine, especially in regard to the toxin producing *Alexandrium* and *Pseudo-nitzschia* and the nuisance alga *Karenia mikimotoi*. There is no evidence that the outfall is the cause of these regional changes but there is also no evidence that these taxa aren't utilizing the nutrients produced by the outfall. EPA recommends that this question be further explored in a revised AMP but also in future regional ambient monitoring. Monitoring program should focus on HAB species including the continuation of *Alexandrium* rapid response surveys, enumerating and reporting all *Pseudo-nitzschia* spp. abundance, and adding *Karenia mikimotoi, Dinophysis* and *Margalefidinium polykrikoides*[363] as nuisance species of interest. Additional rapid response variables will be included for *Pseudo-nitzschia.*

Question #20: Has the species composition of phytoplankton or zooplankton changed in the vicinity of the outfall or at selected farfield stations in Massachusetts Bay or Cape Cod Bay? If so, can these changes be correlated with effluent of ambient water nutrient concentrations, or can farfield changes be correlated with nearfield changes?

There have been changes to the composition of phytoplankton and zooplankton in Massachusetts and Cape Cod Bays; however, these changes are consistent with regional changes found in the Gulf of Maine. The Draft Permit requires sampling of phytoplankton and zooplankton continue in the revised ambient monitoring plan and recommends that this question be further explored in future regional ambient monitoring.

Summary

EPA has evaluated the data and reports related to each of these questions and has determined that these specific questions have been answered with regard to the MWRA outfall. However, Massachusetts Bay is experiencing regime change and these questions have not been considered in that light. EPA finds that many of these questions should continue to be studied with regard to the MWRA discharge and also on a regional basis. It is unknown if nutrients from the MWRA DITP discharge will have a different influence as sea temperatures warm. EPA recommends a

[363] Griffith AW, Doherty OM, Gobler CJ, 2019. Ocean warming along temperate western boundaries of the Northern Hemisphere promotes an expansion of *Cochlodinium polykrikoides* blooms. Proceedings Royal Society B 286L 20190340. https://royalsocietypublishing.org/doi/epdf/10.1098/rspb.2019.0340

regional ambient monitoring program be established to quantify the nutrient contributions to Massachusetts Bay from MWRA and other POTWs.

- A recent review of MWRA water column reports by EPA's CEMM has concluded: The MWRA reports do not show evidence that the discharge is currently harmful to North Atlantic right whales (Eubalaena glacialis) or that it is likely to cause harm in the future. However, these data also do not provide evidence for the opposite, namely that such an impact is not already occurring or that it would be unlikely in the future.
- These data and additional evidence documenting related biological changes from across the Gulf of Maine suggest that Massachusetts Bay is experiencing a shift in biological and oceanographic regimes. The regime shift increases the scientific uncertainty regarding the role of the discharge in supporting harmful algal blooms (HABs) in Massachusetts Bay and resulting effects on the marine food web, including whales.
- The MWRA water column monitoring results document biological changes both near the discharge and across Massachusetts Bay principally characterized by seasonal increases in the abundance of several HAB species including dinoflagellates *Alexandrium catenella* since 2005 and *Karenia mikimotoi* since 2017.
- Although there is little evidence that HABs are harming whales in New England, North Atlantic right whales in New England are currently exposed to saxitoxin and domoic acid, HAB toxins that elsewhere in the world have harmed or killed whales and other marine mammals, seabirds, and marine fisheries.
- Ship strikes and entanglements in fishing gear are the main anthropogenic cause of mortality of North Atlantic right whales; however, marine HABs currently present a relatively unpredictable, increasing, and potentially serious threat to North Atlantic right whales. Therefore, a cautious approach is warranted that includes continued monitoring of ecological changes near the outfall and in the surrounding areas of Massachusetts and Cape Cod Bays. Monitoring should be adjusted to focus on the most pertinent environmental concerns and their relationship to the discharge, while reducing effort to monitor issues that have been resolved significantly via decades of monitoring.[364]

Based on the uncertainty introduced by the regime shift in Massachusetts Bay and the increases in HABs and nuisance algae abundance and frequency, EPA finds that it is necessary to require MWRA to continue the water column monitoring portion of the Ambient Monitoring Plan to provide information on the potential influence of the MWRA discharge. The Draft Permit requires the Permittee to revise the current ambient monitoring plan, Ambient Monitoring Plan, Revision 2.1, to meet the requirements outlined in Draft Permit, Part I.6. The revised plan will

[364] Hagy, James, Gleason, Tim, Oczkowski, Autumn, Tatters, Avery and Wan, Yongshun. 2022. "Technical Memorandum: Review of MWRA Water Quality Monitoring Results to Address Potential Harmful Effects of the Deer Island Discharge on Threatened and Endangered Species in Massachusetts Bay." USEPA, Center for Environmental Measurement and Modeling, Atlantic Coastal and Environmental Sciences Division, Narragansett, RI and USEPA, Center for Environmental Measurement and Modeling, Gulf Environmental Measurement and Modeling Division., https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=355407&Lab=CEMM

continue to require MWRA to conduct the nine (9) surveys ("regular water column monitoring") targeting the same weeks in Revision 2.1 and in the Draft Permit, Part I.6.a. and the same fourteen stations in the Draft Permit Part I.6.b. The required monitoring parameters can be found in the Draft Permit Part I.6.c and include all of the existing parameters and adds monitoring for turbidity and PAR/Irradiance. Phytoplankton enumeration and identification will focus on the species of *Alexandrium catenella* and *Pseudo-nitzschia* spp. which are categorized as HABs and the species of *Dinophysis*, *Phaeocystis pouchetii, Karenia mikimotoi* and *Margalefidinium polykrikoides* which are categorized as nuisance species.

EPA has established thresholds based on current research and professional judgement that if exceeded trigger additional study or reporting for the specific HABs or nuisance algae. The HAB species of *Alexandrium catenella* and *Pseudo-nitzschia* spp. are potential high impact species that can impact human health and endangered species and are often found in Massachusetts Bay. Exceedance of the thresholds for the HABs triggers a rapid response survey for the HABs of concern.

Harmful Algal Blooms (HABs)

For *Alexandrium catenella,* the requirements do not change much. Weekly *Alexandrium* Rapid Response Surveys (ARRS) will be triggered by any of the following scenarios:[365] (1) if a bloom is present in Massachusetts Bay or imminent; or (2) if *Alexandrium* values exceed 100 cells/L; or (3) if high levels of paralytic shellfish poisoning (PSP) toxicity in blue mussels are reported as defined as: PSP toxicity in blue mussels at designated Massachusetts Division of Marine Fisheries (MADMF) stations in Cohasset, Scituate or Marshfield exceeds 40 ug toxin per 100 g shellfish meat, or if PSP toxicity in blue mussels exceeds 40 ug at stations between Gloucester, MA and Cape Elizabeth, ME, it will be assumed that there is a bloom in the Gulf of Maine. MWRA will evaluate the likelihood that wind and currents will bring the bloom into Massachusetts Bay and staff will use professional judgement to decide whether to begin the weekly ARRS surveys.

Once MWRA begins an ARRS survey, it will continue weekly sampling for *Alexandrium* until the measured *Alexandrium* abundance decreases below 100 cell/L and the toxicity data are no longer above closure levels (80 µg STX equiv./100 g[366]). This procedure is the same as the existing requirement. The Draft Permit requires that following an ARRS, the Permittee shall submit a written report along with the monthly DMR occuring 60 days following the completion of the survey. This will allow EPA and MassDEP to be current and responsive to HABs.

[365] Libby PS, Rex AC, Keay, KE, Mickelson, MJ. 2013. *Alexandrium* Rapid Response Study Survey Plan. Revision 1. Boston. Massachusetts Water Resources Authority. Report 2013-06. p.13, https://www.mwra.com/harbor/enquad/pdf/2013-06.pdf

[366] Libby PS, Rex AC, Keay, KE, Mickelson, MJ. 2013. *Alexandrium* Rapid Response Study Survey Plan. Revision 1. Boston. Massachusetts Water Resources Authority. Report 2013-06. p/ 13, https://www.mwra.com/harbor/enquad/pdf/2013-06.pdf

Pseudo-nitzschia is also categorized as a HAB due to the potential for severe impacts resulting from a large bloom. The Draft Permit includes specific requirements to address these concerns. The Permittee shall add the collection of a plankton sample for storage as part of regular water column monitoring surveys (See Draft Permit Section I.6.2.a). If any of the following scenarios occur, the Permittee will test the stored sample for the presence or absence of domoic acid; (1) *Pseudo-nitzschia* spp. cell counts at the corresponding station exceed 15,000 *Pseudo-nitzschia* cells/L;[367] (2) *Pseudo-nitzschia australis* is possibly present in the corresponding station sample at elevated abundance deduced from the presence of over 2,000 cells/L of large *Pseudo-nitzschia* cells equal to or greater than 3 µm in width;[368] (3) There is a co-occurring shellfish harvest closure due to domoic acid or elevated *Pseudo-nitzschia* cell abundance in Massachusetts.

MWRA shall assess the availability of a species-specific DNA probe to confirm the presence of the highly toxic and problematic species *Pseudo-nitzschia australis* and if available, MWRA shall implement this probe into routine water column sampling and *Pseudo-nitzschia* Rapid Response Sampling.

MWRA will conduct a weekly *Pseudo-nitzschia* Rapid Response Study (PRRS) when the follow scenarios occu if: (1) a bloom of *Pseudo-nitzschia* is present in Massachusetts Bay or possibly imminent from observations in waters north of Massachusetts Bay; (2) *Pseudo-nitzschia* spp. cell counts exceed 15,000 cells/L and/or *P. australis* is likely present in samples and domoic acid is present in the 20 µm concentrated sample; (3) domoic acid in blue mussels is over 1 mg toxin per 100 g shellfish meat in Cohasset, Scituate, or Marshfield MA DMF stations; or (4) domoic acid in blue mussels is equal to or exceeds 2 mg toxin per 100 g shellfish meat[369] in any MA DMF stations.

Once a *Pseudo-nitzschia* Rapid Response Study is initiated, it will continue weekly samples until all stations are below 15,000 cells/L and no domoic acid is present through the Rapid Scotia Test or equivalent method. If a *Pseudo-nitzschia* Rapid Response Study is commenced, the Permittee shall submit a written report with the monthly DMR occurring 60 days following the completion of the survey.

Nuisance Species

Dinophysis has been added to the list of nuisance species. The revised AMP should include it for enumeration and identification. A threshold value of greater than 100,000 cells/L[370] will trigger a reporting requirement within 45 days after the threshold is exceeded. Reporting will be attached to the next monthly DMR. A rapid response survey is not necessary as *Dinophysis* does not threaten human life as significantly as *Alexandrium* and *Pseudo-nitzschia* nor does it threaten marine life in the same way.

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[367] Maine Department of Marine Resources. 2020. Management Plan for the Control of Marine Toxins in Maine.
[368] Maine Department of Marine Resources. 2020. Management Plan for the Control of Marine Toxins in Maine.
[369] U.S. Food and Drug Administration, National Shellfish Sanitation Program. 2019. Guide for the Control of Molluscan Shellfish 2019 Revision. https://www.fda.gov/media/143238/download
[370] Kattenrath-Lehmann, TK, Marcoval, MA, Berry DL, Fire, S, Wang, Z, Morton, SL, Gobler, CJ,. 2013. The emergence of *Dinophysis acuminata* blooms and DSP toxins in shellfish in New York waters. Harmful Algae, Volume 26, pp. 33-44, https://www.sciencedirect.com/science/article/abs/pii/S1568988313000474

Phaeocystis pouchetti continues to require enumeration and identification as a nuisance species. EPA has set a threshold value of 6 x 10^6 cells/L[371] to trigger the reporting requirement 45 days after the threshold is exceeded. Reporting will be attached to the next monthly DMR.

Karenia mikimotoi has been added to the list of nuisance species requiring enumeration and identification. EPA has established a threshold value of 10,000 cells/L[372] to trigger the reporting requirement. Additionally, due the issues associated with *Karenia mikimotoi* in Cape Cod Bay in the summer of 2020 and 2021, if *Karenia mikimotoi* cell counts exceed the threshold and there is a subsequent decrease in dissolved oxygen concentrations, then MWRA shall investigate the probable *Karenia mikimotoi* bloom further by collecting water samples throughout the water column, including the subsurface chlorophyll maximum and bottom, in order to enumerate the presence of *Karenia mikimotoi* which is able to vertically migrate through the water column.

Margalefidinium polykrikoides (formerly known as *Cochlodinium polykrikoides*) has been added to the list of nuisance algae to be enumerated and identified. EPA has established a threshold value of 1,000 cells/L[373] to trigger the reporting requirements. If *Margalefidinium polykrikoides* cell counts exceeds 1,000 cells/L, then this shall be reported by the Permittee within 45 days with the next monthly DMR. If *Margalefidinium polykrikoides* cell counts exceed this threshold and there is a subsequent decrease in dissolved oxygen concentrations, then MWRA shall investigate the probable *Margalefidium polykrikoides* bloom further by collecting water samples throughout the water column, including the subsurface chlorophyll maximum and bottom, in order to enumerate the presence of *Margalefidinium polykrikoides* which is able to vertically migrate through the water column

Table 25: Harmful Algal Blooms to be enumerated and identified with thresholds for rapid response surveys.

Species	Method	Threshold	Response
Alexandrium catenella	Gene probe and Rapid-analysis method in 2021 QAPP	A bloom is present in Massachusetts Bay; or *Alexandrium* values > 100 cells/L; or PSP toxicity in blue mussels exceed	Commence *Alexandrium* Rapid Response Survey, weekly

[371] Borkman, DG, Libby, PS, Michelson, MJ, Jefferson, JT, & Jiang, M. 2016. Variability of Winter-Spring Bloom *Pharocystis pouchetti*, Abundance in Massachusetts Bay. Estuaries and Coasts. 39, 1084-1099. https://link.springer.com/article/10.1007/s12237-016-0065-5

[372] Scully, M.E., Geyer, W.R., Borkman, D., Pugh, T.L., Costa, A., and Nichols, O.C., 2022. Unprecedented summer hypoxia in southern Cape Cod Bay: an ecological response to regional climate change? Biogeosciences, 19, 3523-3536. https://bg.copernicus.org/articles/19/3523/2022/bg-19-3523-2022.pdf

[373] This threshold was established based on professional judgement, by Alexa Sterling, Ph.D., EPA Region 1, to select this number based off of blooms of *Margalefidinium* in RI being between 1,000 - 10,000 cells. Other blooms in MA and LIS went above 10,000 cells so 1,000 would be a bloom/during the bloom climb if a bloom was to occur in MA Bay. This is from cell counts summarized for this region in Griffin, Doherty, and Gobler 2019: https://royalsocietypublishing.org/doi/10.1098/rspb.2019.0340

Species	Method	Threshold	Response
		40 ug toxin per 100 g shellfish meat at Cohasset, Scituate or Marshfield (DMF Stations).	
		PSP in blue mussels exceeds 40 ug toxin per 100 g shellfish meat at stations between Gloucester, MA and Cape Elizabeth, ME	MWRA will evaluate the likelihood that wind and currents will bring the bloom into Massachusetts Bay and staff will use professional judgement to decide whether to begin the weekly ARRS surveys.
Pseudo-nitzschia spp.	Rapid-analysis method in 2021 QAPP	*Pseudo-nitzschia* spp. cell counts > 15,000 *Pseudo-nitzschia* cells/*L*	Test sample to measure domoic acid
		Pseudo-nitzschia australis is possibly present in the corresponding station sample at elevated abundance deduced from the presence of over 2,000 cells/L of large *Pseudo-nitzschia* cells equal to or greater than 3 µm in width.	
		There is a co-occurring shellfish harvest closure due to domoic acid or elevated *Pseudo-nitzschia* cell abundance in Massachusetts.	
		If a bloom of *Pseudo-nitzschia* is present in Massachusetts Bay or possibly imminent from observations in waters north of Massachusetts Bay.	Rapid Response Study
		If *Pseudo-nitzschia* spp. cell counts exceed 15,000 cells/L and/or *P. australis* is likely present in samples AND domoic acid is present in the 20 µm concentrated sample.	
		If domoic acid in blue mussels is over 1 mg toxin per 100 g shellfish meat in Cohasset, Scituate, or Marshfield MA DMF stations.	

Species	Method	Threshold	Response
		If domoic acid in blue mussels is equal to or exceeds 2 mg toxin per 100 g shellfish meat in any MA DMF stations.	

Table 26: Nuisance Algal Species to be Monitored and Reported

Species	Threshold
Dinophysis spp.	100,000 cells/L
Phaeocystis pouchetti	6 x 10^6 cells/L
Karenia mikimotoi	10,000 cells/L
Margalefidinium polykrikoides	1,000 cells/L

5.12.3 Benthic Monitoring

The relocation of the Deer Island outfall to Massachusetts Bay raised concerns about the potential impacts to the ocean floor. The SEIS predicted small increases in contaminant concentrations in nearby sediments due to an expectation that the first five years of discharge would be primary treated effluent. Other concerns were raised about eutrophication and low levels of dissolved oxygen, accumulations of toxic contaminants in depositional areas and smothering of animals by particulate matter. Due to delays, the outfall went online in September 2000 and by that point at least a portion of the effluent was treated to secondary treatment standards. The 1997 AMP was designed to measure the impacts of the primary treated effluent but was revised in 2004 to characterize the discharge of secondary treated effluent. Additional modifications to the AMP for benthic monitoring were made in 2010.

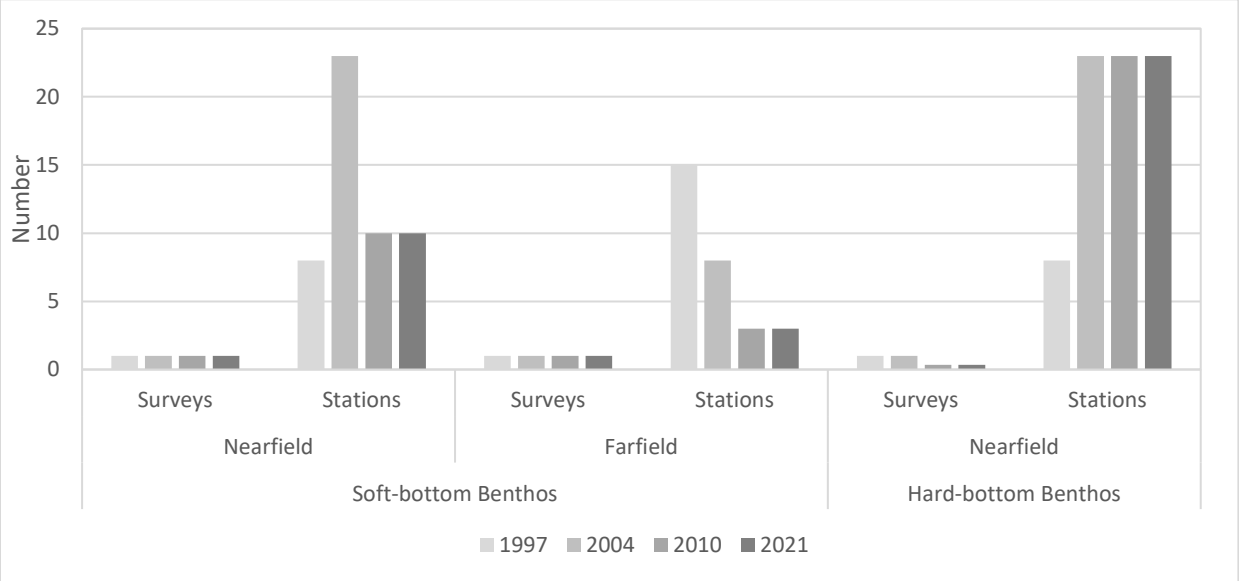

Figure 4: Benthic Monitoring: Number of Surveys and Stations with each Ambient Monitoring Plan Revision

Results of Benthic Monitoring

A benthic monitoring program began in 1992 to focus on depositional areas near the site of the new diffuser (nearfield) and selected reference stations in Massachusetts and Cape Cod Bays (farfield). After initial monitoring, it was found that contaminant loadings were much lower than anticipated and the plan was re-focused on measuring long-term effects.

Benthic Monitoring Questions

There were nine (9) questions that were to be answered by the Benthic Monitoring Requirements in the post-discharge AMP.

Question #21: What is the level of sewage contamination and its spatial distribution in Massachusetts and Cape Cod bays sediments before discharge through the new outfall?

Question #22: Has the level of sewage contamination or its spatial distribution in Massachusetts and Cape Cod bays sediments changed after discharge through the new outfall?

The benthic monitoring program focuses on soft sediments near the site of the new diffuser (nearfield) and selected reference stations in Massachusetts and Cape Cod Bays (farfield). Figure 5 from the 2020 Outfall Benthic Monitoring Results Report[374] shows the temporal and spatial distribution of *Clostridium perfringens*, an indicator of sewage-derived pollution, from pre-discharge to 2020.

[374] Rutecki DA, Hecker B, Nestler EC, Madray ME. 2022. "2020 Outfall Benthic Monitoring Results" Boston: Massachusetts Water Resources Authority. Report 2021-06. P. 40, plus appendices. https://www.mwra.com/harbor/enquad/pdf/2021-06.pdf

Figure 5: From 2020 Outfall Benthic Monitoring Results

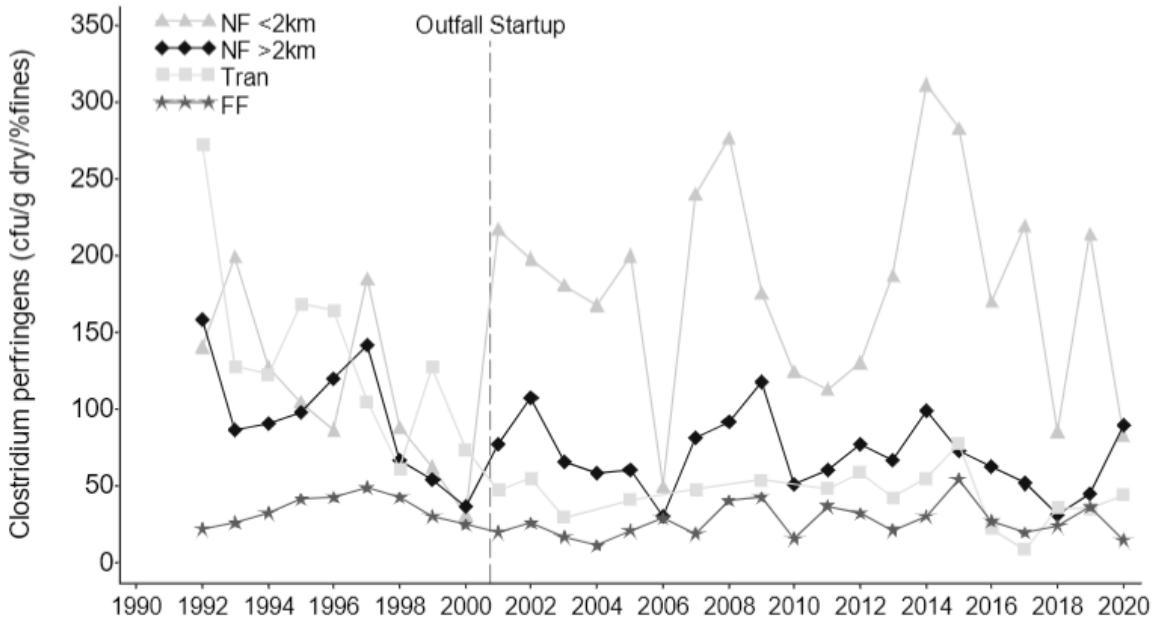

Figure 3-1. Mean concentrations of *Clostridium perfringens* in four areas of Massachusetts Bay, 1992 to 2020. Tran=Transition area; NF<2km=nearfield, less than two kilometers from the outfall; NF>2km=nearfield, more than two kilometers from the outfall; FF=farfield.

MWRA has detected a "signal" of the most sensitive effluent tracer, *Clostridium perfringens* spores in nearfield sediments. The abundance of *C. perfringens* increased in the nearfield following the commencement of discharge from the offshore outfall. That signature has continued to be detected at stations less than 2 km from the outfall. *Clostridium* abundances have decreased at nearfield stations located greater than 2 km from the outfall and at the farfield stations since the mid-to late 90s.[375]

Question #23: Have the concentrations of contaminants in sediments changed?

Past MWRA studies[376,377] have reported very low levels of priority pollutants in the effluent. Benthic monitoring has found no evidence that the effluent has contributed toxic contaminants to sediments in the Bay. "The spatial extent of particulate deposition from the discharge is measurable in the *Clostridium perfringens* concentrations in the nearfield sediments. *C.*

[375] MWRA. 2021. "Ambient monitoring plan for the Massachusetts Water Resources Authority effluent outfall revision 2.1. August 2021" Boston: Massachusetts Water Resources Authority. Report 2021-08. p. 47, https://www.mwra.com/harbor/enquad/pdf/2021-08.pdf
[376] Delaney, MF, Rex AC. 2009. "Contaminant Monitoring of Deer Island Treatment Plant Effluent 2000-2005." Boston: Massachusetts Water Resources Authority. Report ENQUAD 2007-02. Pp. 40, https://www.mwra.com/harbor/enquad/pdf/2007-02.pdf
[377] Delaney, MF. 2009. "Addendum to Contaminant Monitoring of Deer Island Treatment Plant Effluent 2000-2005: Effluent Data for 2005-2008." Boston: Massachusetts Water Resources Authority. Report ENQUAD 2009-05. p.4 , https://www.mwra.com/harbor/enquad/pdf/2009-05.pdf

perfringens concentrations provide evidence of the discharge footprint at stations close to the outfall. Within this footprint, no other changes to sediment composition and infauna communities have been detected."[378]

Question #24: Have the sediments become more anoxic; that is has the thickness of the sediment oxic layer decreased?

The sediments have not become more anoxic since the outfall went on-line. The caution level threshold of Redox Potential Discontinuity (RPD) layer caution level is 1.18 cm and the RPD layer has been greater than the caution level as shown by Figure 6.

"In 2006, a comparison of baseline to discharge years indicated that the discharge years had significantly deeper Redox Potential Discontinuity (RPD) layers. This is the exact opposite of what would be expected if effluent solids were adversely impacting the sediments. The color and texture of sediments in Sediment Profile Images (SPI) during the Post-discharge monitoring indicate that the amount of deposited organic matter has not changed."[379]

Figure 6: From AMP Revision 2.1, August 2021.

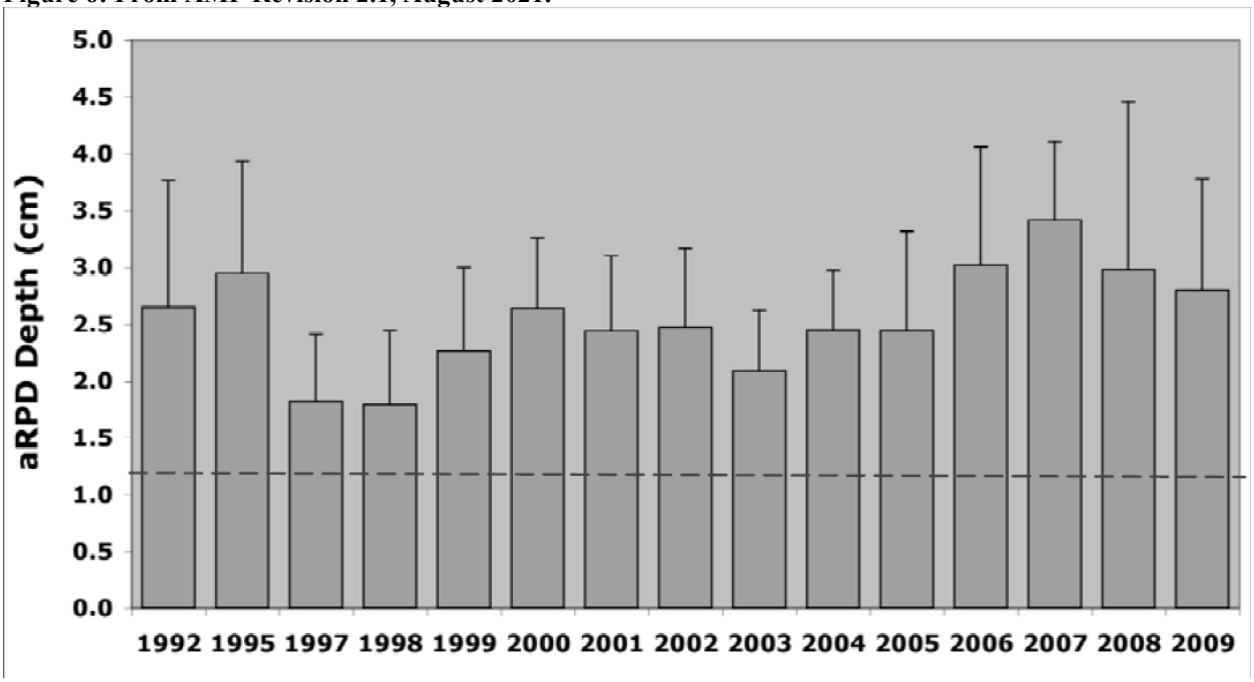

Figure 4-4 Average nearfield apparent color redox potential discontinuity depth (RPD) 1992-2009.

[378] Rutecki DA, Hecker B, Nestler EC, Madray ME. 2022. "2020 Outfall Benthic Monitoring Results" Boston: Massachusetts Water Resources Authority. Report 2021-06. p. 38, https://www.mwra.com/harbor/enquad/pdf/2021-06.pdf

[379] MWRA. 2021. "Ambient monitoring plan for the Massachusetts Water Resources Authority effluent outfall revision 2.1. August 2021" Boston: Massachusetts Water Resources Authority. Report 2021-08. p. 51, https://www3.epa.gov/region1/npdes/mwra/omsap/pdfs/mwra-amp-rev-2-1-report-2021-08.pdf

Data collected after the outfall began discharging begins in 2001. The oxygenated layer has remained well above (deeper than) the minimum threshold, indicated by the dashed line.

Question #25: Are any benthic community changes correlated with changes in levels of toxic contaminants (or sewage tracers) in sediments?

"Spatial and temporal patterns of abundance, species richness, species diversity and evenness generally support the conclusion that there is no evidence of negative impacts caused by operation of the offshore outfall."[380]

Question #26: Has the soft-bottom community changed?

"Surveys of soft-bottom benthic communities presented in this report continue to suggest that animals near the outfall have not been smothered by particulate matter from the wastewater discharge or experienced stress resulting from increased deposition of organic matter. The percentage of fine grain sediments has not increased in the nearfield stations since the diversion indicating no pattern of settlement of particulate matter from the discharge. There were no Contingency Plan threshold exceedances for any infaunal diversity measures in 2020."[381]

Question #27: Has the hard-bottom community changed?

"Hard-bottom benthic communities near the outfall have not changed substantially during the post-diversion period as compared to the baseline period. Some changes in hard-bottom communities (e.g., sediment drape, coralline algae, upright algae cover, and sponge abundance) have been observed; nonetheless, factors driving these changes are unclear. Since declines in upright algae started in the late 1990s, it is unlikely that the decrease was attributable to diversion of the outfall."[382]

Increases in sediment drape, and concurrent decreases in cover of coralline algae, were observed at several drumlin-top sites north of the outfall and at the two northernmost reference sites during all of the post-diversion years. The decrease in coralline algae became more pronounced in 2005 and spread to a number of additional sites south of the outfall. Decreased cover of coralline algae at the stations close to the outfall may be related to the diversion, or may just reflect long-term changes in sedimentation, and hence coralline algae patterns. Additionally, a decrease in the number of upright algae was observed at many of the stations. However, it is unlikely that this decrease was attributable to diversion of the outfall, since the general decline had started in the late 1990s and the number of upright algae appears to be increasing again at a number of stations. The decline had been quite pronounced at the northern reference stations and may

[380] Rutecki DA, Hecker B, Nestler EC, Madray ME. 2022. "2020 Outfall Benthic Monitoring Results" Boston: Massachusetts Water Resources Authority. Report 2021-06. p.17, https://www.mwra.com/harbor/enquad/pdf/2021-06.pdf
[381] Rutecki DA, Hecker B, Nestler EC, Madray ME. 2022. "2020 Outfall Benthic Monitoring Results" Boston: Massachusetts Water Resources Authority. Report 2021-06. p. 38., https://www.mwra.com/harbor/enquad/pdf/2021-06.pdf
[382] Rutecki DA, Hecker B, Nestler EC, Madray ME. 2022. "2020 Outfall Benthic Monitoring Results" Boston: Massachusetts Water Resources Authority. Report 2021-06. p. 5, https://www.mwra.com/harbor/enquad/pdf/2021-06.pdf

reflect physical disturbance of the seafloor, possibly due to anchoring of tankers at these locations following September 11, 2001. Disturbance of the seafloor in the form of overturned boulders and areas of shell lag had been noticed at the northern reference sites in the earlier post-diversion years. In recent years we have been noticing several other changes. Lush epifaunal growth continues to thrive on the diffuser heads surveyed for this study and throughout many of the other stations visited. The noticeable changes observed recently may reflect natural variability in the benthic communities or may represent other shifts in the environment. The massive and widespread barnacle settlement events observed in 2014, 2017 and 2020 may likely reflect natural cycles in the population. In contrast, the observed decrease in abundance and distribution of two of the sponge taxa may reflect competition among sessile fauna for settlement space or may be the result of cumulative habitat degradation. So, while outfall impacts have appeared to be minimal over time, changes in the hard-bottom communities could be chronic and/or cumulative and may take longer to manifest themselves.[383]

Question #28: How do the sediment oxygen demand, the flux of nutrients from the sediment to the water column, and denitrification influence the levels of oxygen and nitrogen in the water near the outfall?

Question #29: Have the rates of these processes changed?

In the 2004 Ambient Monitoring Plan, MWRA noted that sediment processes have a slow response time and suggested five years of benthic monitoring would be necessary to address these two questions. The 2010 Ambient Monitoring Plan addressed these two questions. MWRA determined that the outfall relocation had no impact on benthic respiration and nutrient regeneration in the sediment based on the results benthic nutrient flux studies and seven years of monitoring from the time the outfall went on-line. The discharge has not had an adverse impact on sediment oxygen demand and there has not been an increase in nutrient flux from the sediment to the water column. Denitrification has not resulted in changes to levels of oxygen and nitrogen in the sediment in the nearfield. In response to these finding, the agencies approved ending the annual nutrient benthic flux study since the questions had been answered.

Summary

Although there is a detectable signature of *Clostridium perfringens* in the nearfield, there is little impact from the outfall in the sediments. EPA has recommended that benthic monitoring requirements be dropped from the Ambient Monitoring Plan as the original questions have been answered and the operation of the Treatment Plant is steady, and the effluent quality is consistent over time.

[383] Rutecki DA, Hecker B, Nestler EC, Madray ME. 2022. "2020 Outfall Benthic Monitoring Results" Boston: Massachusetts Water Resources Authority. Report 2021-06. pp. 36-37, https://www.mwra.com/harbor/enquad/pdf/2021-06.pdf

5.12.4 Fish and Shellfish Monitoring

Fish and shellfish monitoring are included in the AMP to address the public's concern that the relocated outfall would adversely impact fish and shellfish consumed or have an adverse impact on the marine ecosystem in Massachusetts Bay. The Fish and Shellfish Monitoring section in the 2021 AMP notes, "[c]ommercial and recreational fishing are important parts of the regional identity and economy of Massachusetts. Concerns have been expressed that the relocation of the treatment plant effluent into the relatively clean Massachusetts Bay could adversely affect the health of the marine ecosystem or result in chemical contamination of commercial fisheries."[384]

The objectives of the fish and shellfish monitoring is to characterize the physical condition and histology of flounder and lobster and monitor flounder, lobster and caged blue mussels for toxic contaminants. The AMP requires annual monitoring at three locations, Deer Island, the outfall, and eastern Cape Cod Bay. EPA approved reducing toxic contaminant monitoring requirements for winter flounder, lobster, and caged mussel to once every three years, while retaining histology analyses for winter flounder every year with the 2004 revision to the AMP. Table 27 shows fish and shellfish monitoring from the 2021 update of the AMP.

Table 27: 2021 AMP Revision 2.1 Fish and Shellfish Monitoring Requirements

Fish and Shellfish	Monitoring Requirements
Winter Flounder fillet	PCB, pesticides, mercury
Winter Flounder liver	PAH, PCB, pesticides, silver, copper, cadmium, mercury, lead and zinc
Lobster meat	PCB, pesticides, mercury
Lobster heptopancreas	PAH, PCB, pesticides, silver, copper, cadmium, mercury, lead and zinc
Caged Blue Mussels	PAH, PCB, pesticides

[384] MWRA, 2021. Ambient monitoring plan for the Massachusetts Water Resources Authority effluent outfall revision 2.1. August 2021. Boston: Massachusetts Water Resources Authority. Report 2021-08. p. 67, https://www.mwra.com/harbor/enquad/pdf/2021-08.pdf

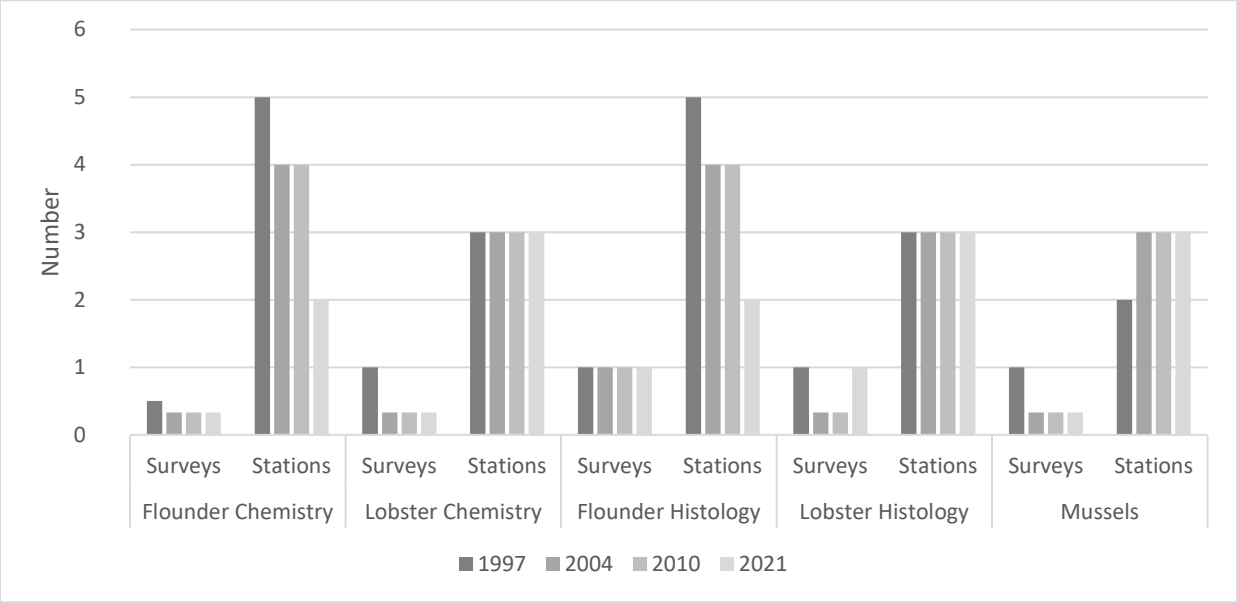

Figure 7: Fish and Shellfish Monitoring: Number of Surveys per year and Stations with each Ambient Monitoring Plan Revision

Results of fish and shellfish monitoring

A memo from MWRA to the OMSAP dated September 5, 2019,[385] show fish and shellfish data trends as well as the Contingency Plan warning and caution thresholds for toxic contaminants from the early 1990s to 2018. OMSAP requested MWRA provide data on long-term trends for fish and shellfish tissue sampling, liver disease in flounder, and contaminants, such as DDT and PCBs in flounder, lobster meat and mussel tissue. The memo has contaminant data presented in timeseries plots and show concentrations of contaminants below contingency plan thresholds in flounder and lobster meat from when the discharge began. The data from mussel tissue are below the caution level thresholds from 2006 to 2018.

The 2015 Fish and Shellfish Tissue Chemistry Report explains the basis of the thresholds as, "[t]he U.S. Food and Drug Administration (FDA) has set action limits for the maximum tissue concentrations of specific contaminants in the edible portions of fish and fishery products. For the MWRA monitoring program, caution and warning thresholds have been set for tissue contaminant concentrations (organic and inorganic) and liver disease incidence (MWRA 2001a, MWRA 2001b). These thresholds are derived from either the FDA Action Limits, when available, or from the baseline mean of contaminant concentrations at the Outfall Site (OS). These two levels provide reference benchmarks for detecting adverse changes (and their potential human health risks) from the discharge. All thresholds for flounder fillet (Table 3-6) and lobster meat (Table 3-7) have been easily met since outfall start-up. While there have been mussel threshold exceedances in the past for total chlordane (2001) and PAH (2001, 2002, and

[385] MWRA to OMSAP ad hoc Committee September 5, 2019

2003), there have been no exceedances since those times. In 2015 all thresholds were met (Table 3-8)."[386]

The most recent information on fish and shellfish monitoring as required in the Ambient Monitoring Plan is available in Contingency Plan Quarterly Reports available to the public on MWRA's website.[387]

Flounder

The Contingency Plan report from Quarter 3 of 2021 addresses the results of the winter flounder data stating: "[t]he prevalence in winter flounder (*Pseudopleuronectes americanus*) of centrotubular hydropic vacuolation (CHV), a liver disease associated with contaminant exposure and considered a precursor to liver tumors, is a useful measure of the effects of pollution in the coastal waters. In Boston Harbor rates of this disease were historically quite high but dropped considerably during the 1990s. The Caution Level (CL) threshold for the prevalence of flounder CHV liver disease is 45%, which is based on measurements collected from Boston Harbor during the baseline period (1991-2000). Since Massachusetts Bay monitoring began in 1991, prevalence of the early-stage liver disease near the outfall site has been much lower than the threshold. The result for 2021 is 4% from a survey conducted on April 28, which is one of the lowest among the post-diversion observations, and much lower than that observed at the site during the baseline period (Figure 1)."

Mussels

The Contingency Plan Report for Quarter 1 of 2022 addresses the results of mussel data stating, "[i]n 2021, concentrations of chlordane, DDT, PAHs and PCBs in mussel tissues remained very low. Mussel tissue mercury and lead concentrations in 2021 were also well below threshold levels, and within the range seen both before and after the outfall was relocated offshore. Dieldrin was not detected, as has been the case since 2009 (Figure 1)."[388]

Lobster

The Contingency Plan report for Quarter 4 of 2021 addresses the results of lobster data stating, "[l]obsters were collected from traps near the outfall site in mid-July. There were no exceedances of lobster tissue contamination thresholds in 2021; all contaminants were well below threshold levels. Lobster tissue contaminant tests have been performed every 3 years since 2003. In 2021, lobster meat chlordane, DDT, and PCB contamination remained very low. Lobster meat mercury concentrations in 2021 were well below threshold levels, and within the range seen both before and after the outfall was relocated offshore (Figure 3)."[389]

Fish and Shellfish Monitoring Questions

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[386] (Nestler EC, Pembroke AE, Lao Y. 2016. 2015 Fish and Shellfish Tissue Chemistry Report. Boston: Massachusetts Water Resources Authority. Report 2016-13. p. 44, plus Appendices. Table 3-8). https://www.mwra.com/harbor/enquad/pdf/2016-13.pdf

[387] https://www.mwra.com/harbor/html/archive.htm

[388] Contingency Plan Quarterly Report on Ambient Monitoring Results First Quarter 2022. https://www.mwra.com/harbor/pdf/2022q1cpqamb.pdf

[389] Contingency Plan Quarterly Report on Ambient Monitoring Results Fourth Quarter 2021.https://www.mwra.com/harbor/pdf/2021q4cpqamb.pdf

There were four (4) questions (questions #30-#33 below) that were to be answered by the fish and shellfish monitoring in the post-discharge AMP. EPA reviewed quarterly Contingency Plan Reports, Fish and Shellfish Reports, annual flounder monitoring results, the annual Outfall Monitoring Overview reports and the 2015 Fish and Shellfish Tissue Chemistry Report and acknowledge the questions have been answered in these reports. The answers to the questions are based on information from the 2021 AMP and the Ambient Monitoring Plan and Contingency Plan for the Massachusetts Bay Outfall: Monitoring Questions Status and 200-2018 Threshold Test Results.[390]

Question #30: Has the level of contaminants in the tissues of fish and shellfish around the outfall changed since the discharge began?

The level of contaminants in the tissue of fish and shellfish around the outfall have remained well below Contingency Plan caution and warning thresholds since 2006. The toxic contaminant parameters in the Contingency Plan for fish and shellfish tissue are mercury, PCB, lead (mussels only), lipid-normalized toxics and liver disease. The Contingency Plan reports for the first quarter of 2022 provides information on mussels, and the third and fourth quarters of 2021 provide an update on contaminates in lobster and flounder. The reports confirm that contaminant levels in the tissue of mussels, fish and shellfish are well below the Contingency Plan thresholds.

From 2001 to 2006, data showed increased concentrations of total chlordane, total PAHs and high molecular weight polynuclear aromatic hydrocarbons (HMW PAH) in mussel tissue. However, PAH concentration in 2006 dropped significantly from the concentrations in 2001-2003. Since 2006 there has been a notable downward trend compared with the concentration of contaminants in mussels in since the operation of the new outfall. In 2006 concentrations of chlordane and PAHS were lower than the Contingency Plan thresholds and contaminants have not exceeded U.S. Food and Drug Administration action limits. Comparing chlordane in mussels, the 2015 Fish and Shellfish Chemistry Toxicity Report compares Contingency Plan caution thresholds with sampling results of chlordane in mussel. The levels in mussels were 16.1 ng/g lipid compared to a Contingency Plan threshold of 205 ng/g lipid. The data for other contaminants are below the caution thresholds as well.

Question #31: Do the level of contaminants in the edible tissue of fish and shellfish around the outfall represent a risk to human health?

Edible tissue in fish and shellfish have been below Contingency Plan threshold levels since 2003 and the threshold trigger for contaminants are based on the U.S. Food and Drug Administration action limits.

Question #32: Are the contaminant levels in fish and shellfish different between the outfall site, Boston Harbor, and a reference site?

Yes, the data from MWRA reports (Outfall Monitoring Reviews, Fish and Shellfish Reports and annual flounder monitoring) confirm the contaminant levels in fish and shellfish in Boston

[390] MWRA, 2019. Ambient Monitoring Plan and Contingency Plan for the Massachusetts Bay Outfall: Monitoring Questions Status and 200-2018 Threshold Test Results, https://www.mwra.com/harbor/enquad/pdf/2019-03.pdf

Harbor, the outfall site and Cape Cod Bay are different. Contaminant concentrations in Boston Harbor have generally been higher than either contaminant concentrations at the outfall site and the reference site, Cape Cod Bay. The 2021 Outfall Monitoring Review supports this as well.

The Continency Plan Quarterly Report for the third quarter of 2022 state, "[t]he Caution Level threshold for the prevalence of flounder CHV liver disease is 45%, which is based on measurements collected from Boston Harbor during the baseline period (1991-2000). Since Massachusetts Bay monitoring began in 1991, prevalence of the early-stage liver disease near the outfall site has been much lower than the threshold. The result for 2022 is 4% from the flounder survey conducted on April 25, which is one of the lowest among the post-diversion observations, and much lower than that observed at the site during the baseline period."[391]

Body burdens of organics in winter flounder and lobsters have typically been higher at Deer Island Flats site but have generally declined over time at all stations according to information in the 2015 Fish and Shellfish Chemistry Toxics Report.[392] Metals, on the other hand, have usually been higher at the outfall site than other stations in these species and body burdens have not trended consistently over time. Similarly, concentrations of organic contaminants in mussels have historically been higher in Boston Harbor at the Deer Island Lighthouse site than offshore (Outfall Site Mussels and Outfall Site B Buoy). Organics are obviously declining in the harbor, but patterns offshore are less distinct. Lead has followed the same pattern both spatially and temporally. Despite the fact that there is evidence of anthropogenic contamination in the three indicator species, there were no exceedances of MWRA threshold levels in 2015, as has been the case for all parameters since 2003.[393]

Question #33: Has the incidence of disease and/or abnormalities in fish and shellfish changed?

Yes, the incidence of disease and/or abnormalities have decreased since the offshore outfall began in 2000. Body burdens of organics in winter flounder and lobsters have typically been higher at Deer Island Flats but have generally declined over time at all stations. Metals, on the other hand, have usually been higher at Outfall Site compared to other stations for these species and body burdens have not trended consistently over time.

Similarly, concentrations of organic contaminants in mussels have historically been higher in Boston Harbor (Deer Island Light) than offshore (Outfall Site and Outfall site B Buoy). Organics are obviously declining in the Harbor, but patterns offshore are less distinct. Lead has followed the same pattern both spatially and temporally. Despite the fact that there is evidence of anthropogenic contamination in the three indicator species, there were no exceedances of MWRA threshold levels in 2015, as has been the case for all parameters since 2006.

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[391] https://www.mwra.com/harbor/pdf/2022q3cpqamb.pdf
[392] Nestler EC, Pembroke AE, Lao Y. 2016. 2015 Fish and Shellfish Tissue Chemistry Report. Boston: Massachusetts Water Resources Authority. Report 2016-13. 44 p. plus Appendices. https://www.mwra.com/harbor/enquad/pdf/2016-13.pdf
[393] Nestler EC, Pembroke AE, Lao Y. 2016. 2015 Fish and Shellfish Tissue Chemistry Report. Boston: Massachusetts Water Resources Authority. Report 2016-13. 44 p. plus Appendices. https://www.mwra.com/harbor/enquad/pdf/2016-13.pdf

Summary

EPA has evaluated the fish, shellfish and mussel data in reports related to each of the original charge questions and considers the questions answered. A Contingency Plan exceedance is triggered when contaminant concentrations from ambient monitoring data exceeds the caution or warning levels. The concentration of total chlordane and PAH in mussels triggered the Contingency Plan caution level in 2002 and 2003 this was the last Contingency Plan exceedance for fish, shellfish and mussels.

There is over two decades of data that has been collected that show downward trends generally in the contaminant concentrations monitored in winter flounder, lobster and mussels. For winter flounder, the 2021 Flounder Monitoring Results[394] report notes tumors at the outfall site have not increased since baseline monitoring. There was an increase in liver disease between 2005 and 2010 in flounder collected at the outfall site but has declined although there has been variability between 2010 to 2020. However, as noted earlier the data for toxics listed in the Contingency Plan are well below the caution level.

MWRA monitoring for lobster and mussels is conducted every three years, the most recent data contaminant level is in the 2021 Outfall Monitoring Overview report. Table 5-1 of the report has baseline data, and contingency warning and thresholds levels to compare with the 2021 monitoring results of flounder fillets, lobster meat and mussel tissue.[395] Data collected in 2021 show that contaminant concentrations were considerably less than contingency warning and threshold levels and majority of the baseline data. Mercury was slightly higher than the baseline data in flounder fillet (baseline data-0.074 ppm vs 2021 results-0.083 ppm) and mussel tissue (baseline data – 0.019 ppm vs 2021 sampling results-0.022 ppm).[396]

EPA has removed fish and shellfish monitoring requirement in the Ambient Monitoring Plan

The Permittee is still responsible for the notification to the Massachusetts Division of Marine Fisheries within 4 hours of becoming aware of any emergency condition, plant upset, bypass, SSO discharges or other system failure which has the potential to violate bacteria permit limits and within 24 hours of becoming aware of a permit excursion or plant failure. See Section I.4. of the Draft Permit.

Overall Summary of Ambient Monitoring Plan Data and Need for Future Monitoring

The pre- and post- discharge ambient monitoring plans were well-designed to gather the data necessary to study the broad concerns related to moving of a significant wastewater discharge to a new discharge location. In general, the assumptions made in the planning process have been

[394] Moore MJ, Madray ME, Rutecki DA. 2021. Flounder monitoring report: 2021 results. Boston: Massachusetts Water Resources Authority. Report 2022-02. p. 20, https://www.mwra.com/harbor/enquad/pdf/2022-02.pdf

[395] https://www.mwra.com/harbor/enquad/pdf/2022-11.pdf
[396] https://www.mwra.com/harbor/pdf/2019q1cpqamb.pdf

proven accurate, the impacts from the MWRA discharge to Massachusetts Bay have been within the bounds of SEIS and the discharge has not caused violations of the WQS.

The post-discharge AMP has been in place for over 20 years and has answered the related charge questions that focused efforts toward addressing the greatest concerns of moving the discharge of wastewater from Boston Harbor to Massachusetts Bay. However, the data also show that Massachusetts Bay is exhibiting change from the conditions that existed during the planning and early post-discharge periods to present. EPA Region 1 requested the assistance of EPA's Center for Environmental Measurement and Modeling (CEMM) to evaluate recent water column reports and assess the potential for impacts to North Atlantic right whales and separately assess the changes to the AMP and Contingency Plan to address unanswered and new questions.

EPA's CEMM reviewed water column reports for the period 2016-2020[397] focusing primarily on the 2019 report. They reported the following findings:[398]

1. Consistent with prior conclusions, the DITP discharge does not create a eutrophic condition in Massachusetts Bay.
2. A new biological oceanographic regime, characterized by an increased frequency and intensity of the harmful algal blooms, may be emerging in Massachusetts Bay. If it persists, this new regime will create a new environmental context for potential impacts of the DITP discharge.
3. Toxin-producing algae are an increasingly important component of the Massachusetts Bay plankton community, reflecting regional-scale trends.
4. Where toxin-producing algae are present in coastal ecosystems, toxins have been transferred to fish, seabirds, and marine mammals, including North Atlantic right whales, and in many cases caused harmful effects.
5. An increase in HAB species in Massachusetts Bay could lead to reduced abundance of zooplankton, including *Calanus finmarchicus*, the preferred diet of North Atlantic right whales, harming right whales by reducing their food supply.

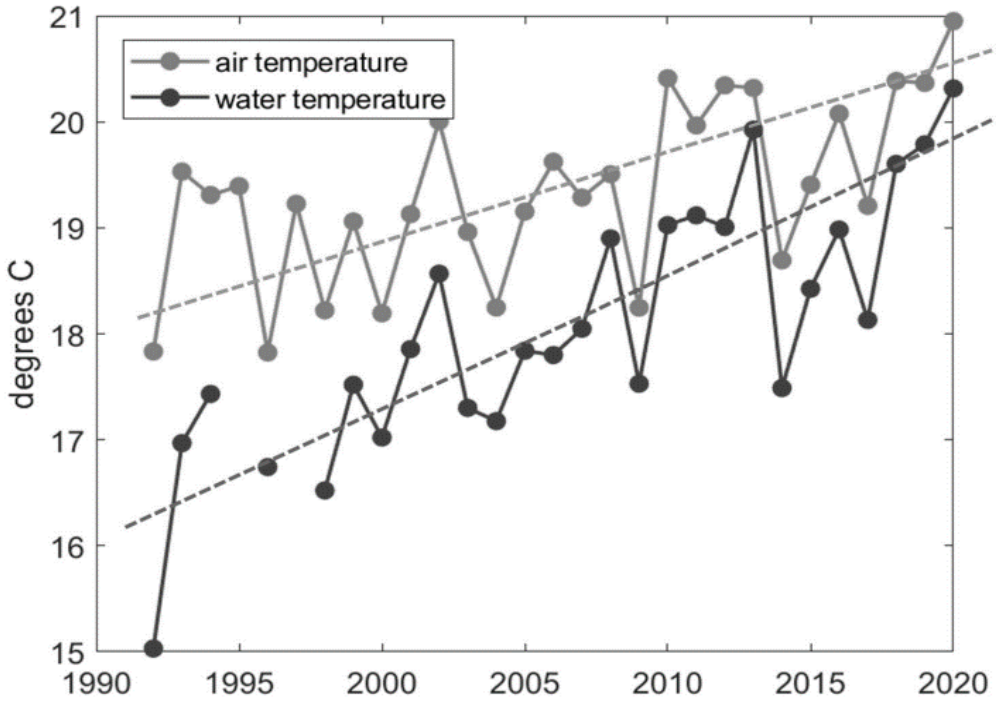
In light of the data collected over the last 20+ years, CEMM's statements about biological oceanographic regime change in Massachusetts Bay and the broader research in the Gulf of Maine that finds sea water temperatures are increasing at a faster rate than 99% of the

[397] https://www.mwra.com/harbor/enquad/pdf/2017-11.pdf, https://www.mwra.com/harbor/enquad/pdf/2018-04.pdf, https://www.mwra.com/harbor/enquad/pdf/2019-08.pdf, https://www.mwra.com/harbor/enquad/pdf/2020-08.pdf, https://www.mwra.com/harbor/enquad/pdf/2021-07.pdf

[398] Hagy, James, Gleason, Tim, Oczkowski, Autumn, Tatters, Avery and Wan, Yongshun. 2022. "Technical Memorandum: Review of MWRA Water Quality Monitoring Results to Address Potential Harmful Effects of the Deer Island Discharge on Threatened and Endangered Species in Massachusetts Bay." USEPA, Center for Environmental Measurement and Modeling, Atlantic Coastal and Environmental Sciences Division, Narragansett, RI and USEPA, Center for Environmental Measurement and Modeling, Gulf Environmental Measurement and Modeling Division. pp. 4-14., https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=355407&Lab=CEMM

ocean,[399,400] EPA Region 1 concludes that ambient monitoring must continue. However, the scope of future ambient monitoring can be reduced and refined to address new questions related to bio-stimulatory pollutants.

Figure 8: Comparison of average mid-June to mid-August air and surface water temperature (C) at Buoy 44013 in the vicinity of the nearfield from 1992-2020 from MWRA 2020 Water Column Monitoring Results, October 2021



The effluent monitoring, benthic monitoring and fish and shellfish monitoring are no longer requirements of the Ambient Monitoring Plan.

The water column monitoring has been an important element to assure that the discharge from DITP does not cause a negative impact on Massachusetts Bay. As recommended by EPA CEMM, the Ambient Monitoring Plan should emphasize identifying and quantifying trends and emerging issues or threats. MWRA should adopt trend analysis and more sophisticated analytical methods such as Generalized Additive Models to describe temporal trends in the context of seasonal and other drivers of short-term variability. These methods will allow MWRA to better

[399] Carlowicz, Michael. September 12, 2018. *Watery heatwave cooks the Gulf of Maine.* https://climate.nasa.gov/news/2798/watery-heatwave-cooks-the-gulf-of-maine/

[400] Pershing, Andrew J., Alexander, Michael A., Brady, Damian C., Brickman, David, Curchitser, Enrique N., Diamond, Antony W., McClenachan, Loren, Mills, Katherine E., Nicols, Owen C., Pendleton, Daniel E., Record, Nicolas R., Scott, James D., Staudinger, Michelle D., and Wang, Yanjun. 2021. *Climate impacts on the Gulf of Maine ecosystem: A review of observed and expected changes in 2050 from rising temperatures.* Elememtia: Science of the Anthropocene (2021)9 1:00076. https://online.ucpress.edu/elementa/article/9/1/00076/118284/Climate-impacts-on-the-Gulf-of-Maine-ecosystemA

quantify and understand evolving water quality and biological conditions in Massachusetts Bay specifically related to their discharge. Although, harmful algal blooms (HABs) are not a new threat to the ecology of Massachusetts Bay, the threat of HABS is evolving. MWRA should continue its *Alexandrium* rapid response surveys and improve its monitoring of algal toxins in open-water plankton, which are more likely to be transferred to North Atlantic right whales. Similarly, improved monitoring of the timing, sources, and pathways of toxin exposure would reduce scientific uncertainty regarding the current or future influence of the discharge on algal toxin exposure.

EPA CEMM also recommends expanding regional cooperation and coordinated monitoring of Massachusetts Bay. Many of the MWRA-specific monitoring issues have been addressed or significantly resolved over the past decades by the AMP. This makes other issues relatively more important, including possible risks to living organisms such as the North Atlantic right whales, cumulative effects of multiple stressors, and modulation of effects of natural variation. Interactions between regional environmental conditions and other wastewater discharges to Massachusetts Bay. One approach used to address this by the regulated community is to participate in innovative regional monitoring cooperatives to improve monitoring while sharing the associated expense and effort with other stakeholders. Examples include San Francisco Bay Regional Monitoring Program (SFEI 2022) and the Southern California Bight Regional Monitoring Program (SCCWRP 2022). MWRA already provides supplemental support to regional monitoring efforts such as the Gulf of Maine Observing System (MWRA, 2021), while also leveraging data from non-MWRA sources such as toxicity monitoring by the Massachusetts Division of Marine Fisheries and ocean color sensing from NASA's Moderate-resolution imaging spectroradiometer (MODIS). EPA recommends evaluating how expanded regional cooperation, coordination, and cost sharing could support improved monitoring and analysis of emerging concerns.

5.12.5 Additional Tasks/Studies Related to Ambient Monitoring Program

The 2000 Permit also required MWRA to conduct several additional tasks/studies to support the Ambient Monitoring Program.

5.12.5.1 Bays Eutrophication Model

MWRA was required to update, maintain, and run the three-dimensional hydrodynamic water quality "Bays Eutrophication Model" (BEM) developed in 1995 by Hydroqual and the USGS on a routine basis (at least every year). The purpose of BEM was to predict conditions cause by nutrient loading and to support decisions on the need for nutrient limits.

MWRA has run the BEM annually as required by the 2000 Permit. The model was updated by Deltares.[401] The BEM is a hindcast model and changing the model drivers simulate various ambient conditions in Massachusetts Bay. It is considered complementary to the ongoing

[401] Deltares. 2021. Demonstration of the updated Bays Eutrophication Model. http://www.mwra.com/harbor/enquad/pdf/2021-02.pdf

ambient monitoring program.

This requirement was an important tool when the 2000 Permit was issued because there was concern the discharge could potentially increase eutrophication in Massachusetts Bay, but that has not occurred. The MWRA discharge contribution to nutrients in Massachusetts Bay is significantly less than nutrients from the Gulf of Maine as noted in Section 5.1.10 of this Fact Sheet.

MWRA continues to collect ambient water quality data per the 2000 Permit and will be required to continue ambient monitoring in the Draft Permit. Between the effluent monitoring requirements for ammonia nitrogen, total Kjeldahl nitrogen, nitrate plus nitrite, and total nitrogen and the ambient monitoring for ammonia nitrogen, ammonium, nitrate, nitrite, total dissolved nitrogen and particulate nitrogen, EPA believes that it will have sufficient data to determine if there is reasonable potential for nitrogen to exceeds water quality standards and the need for effluent limits in a future permit. Therefore, the requirement for an annual modeling run is no longer necessary (since the model results remain consistent that the primary source of nutrients in Massachusetts Bay is from the Gulf of Maine) and it is not a requirement in the Draft Permit.

5.12.5.2 Plume Tracking

The 2000 Permit required MWRA to implement plume tracking, including the use of acoustical technology, to understand the dilution available for the discharge. The MWRA has completed this task which is discussed in Section 4.3 of this Fact Sheet. Plume Tracking is not a requirement in the Draft Permit.

5.12.5.3 Food Web Model

MWRA developed a scope of work[402] for the food web model and presented it to OMSAP at the end of 1998. The 2000 Permit required EPA and MassDEP, in consultation with OMSAP, to provide comments on the scope to MWRA. MWRA was to revise the scope and submit it for review by OMSAP and approval by EPA and MassDEP. After receiving the revised scope of work, EPA and MassDEP were to determine whether implementation of the food web model was warranted. The Agencies jointly determined this model was unnecessary. This requirement is not in the Draft Permit.

5.13 Contingency Plan (CP)

As discussed in the following sections, EPA finds that the CP and its caution and warning levels are no longer applicable. The discharge has been well within the expectations of the SEIS, WQS and consistently achieves permit limits. Discharge from the DITP via Outfall T01 is no longer a new discharge and there is negligible potential for catastrophic impacts. Therefore, EPA has removed the CP as a permit requirement though some elements of the CP such as thresholds for harmful and nuisance algal blooms have been updated and added to the Draft Permit (See Part I.I.6.). EPA has also continued the requirement for enhanced monitoring in rapid response to

[402] http://www.mwra.state.ma.us/harbor/enquad/pdf/99-09_enquad_report.pdf

detection of *Alexandrium* and added a new requirement for similar rapid response surveys for *Pseudo-nitzschia*. The trigging thresholds reflect current scientific knowledge.

The current Contingency Plan (CP) was developed in accordance with the 2000 Permit in order to link the results of the AMP directly to the environmental protection of Massachusetts and Cape Cod Bays. The impetus for and direction of the plan was derived from the regulatory review under the Endangered Species Act (ESA). (See Section 6.1 of this Fact Sheet).

EPA's Biological Assessment and NMFS' Biological Opinion both concluded that, based on the best available information, the discharge through the outfall is not likely to jeopardize any endangered or threatened species. NMFS included with its Biological Opinion several non-binding Conservation Recommendations, which were implemented under an Agreement entered into by EPA, NMFS and MWRA beginning in April 1995. MWRA agreed to develop a contingency plan to describe how treatment plant operations can be modified to respond to problems identified by monitoring.

In cooperation with regulatory agencies, the MWRA wrote a plan whose underlying structure serves as a model for making monitoring a tool that is actively used to improve the health of the environment and inform the public. The CP includes descriptions of potential modifications to the treatment plant, and also addresses the more difficult question of establishing how and when an alternative treatment method would be chosen and used.

Over the last 20 plus years, MWRA evaluated seven (7) categories of impacts of coastal discharges of treated sewage: nutrients, organic material, toxic contaminants, pathogens, solids, floatables, and plant performance (so that systemic problems with the plant can also be identified). The CP identifies approximately thirty (30) water quality characteristics monitored by MWRA that are indicators of relevant environmental problems. These indicators are trigger parameters because when they exceed threshold levels established in the Plan, they automatically trigger specific MWRA responses; the thresholds set quantitative boundaries for acceptable environmental change. Thresholds are either "caution levels" or "warning levels," depending on the degree of risk they indicate. Caution levels provide early indication of unanticipated environmental change, well before environmental health is compromised. If a parameter's trigger value reaches the warning level, no significant impact has necessarily occurred, but environmental conditions have moved sufficiently far from the baseline that it would be prudent to respond to prevent significant impact. This quantification of different levels of environmental risk is key to determining when and how to respond to environmental change.

To complement the thresholds, the CP describes what corrective actions could be taken to reduce the impact of the MWRA effluent. The Plan does not include fully developed engineering blueprints. Instead, it describes the kinds of technologies available and matches them to the environmental problem.

In 2019, MWRA released a report, “Ambient Monitoring Plan and Contingency Plan for the Massachusetts Bay Outfall: Monitoring Questions Status and 2000-2018 Threshold Test Results.” As discussed in Section 5.13 of the AMP, nearly all the original questions have been

answered. The AMP requirements has been revised to focus on the potential for nutrient-related impacts with regard to biological and oceanographic regime change in Massachusetts Bay.[403]

The 2000 Permit also includes additional requirements that were added to the CP which have been re-evaluated for this re-issuance.

1 Technical Survey of Nitrogen Removal Technologies

MWRA was required to maintain a technical survey of effective treatment technologies for nitrogen removal which are applicable to the DITP. The survey was to be updated at least annually and submitted to EPA and MassDEP annually. EPA has removed this requirement. If in the future, there is reasonable potential for an exceedance of WQS for nutrients, particularly nitrogen, MWRA would be responsible for meeting the effluent limits in a future permit. It would be in MWRA's best interest to stay current on nutrient removal technologies, but it is no longer a permit requirement.

2 Development of Data Concerning Wastewater Quality

MWRA was required to develop a monitoring program to characterize the quality of wastewater streams within the treatment plant. The plan was to produce data which would facilitate the selection of nitrogen removal technology, if necessary. EPA has removed this requirement. MWRA has a well-established process control monitoring program.

3 Outfall Contingency Simulation Plan

An Outfall Contingency Simulation Plan is no longer necessary. The Massachusetts Bay outfall has performed within the expectations of the SEIS, WQS and consistently meets permit limits. The Draft Permit also includes a notification requirement to the Massachusetts Division of Marine Fisheries within 4 hours of becoming aware of any emergency condition, plant upset, bypass, SSO discharges or other system failure which has the potential to violate bacteria permit limits and within 24 hours of becoming aware of a permit excursion or plant failure (See Part I.I.4. of the Draft Permit).

4 Reserve Funds

Two Reserve Funds: (1) $31 million dollars in an Operating Reserve to be available for unexpected operating costs, including monitoring, and (2) $50 million dollars in Renewal and Rehabilitation Reserve to be available for unanticipated capital expenses, such as new treatment requirements. The Reserve Funds requirements have been dropped as the operating expenses are well-known after 20+ years and the discharge is well within the expectations of the SEIS, WQS and permit limits.

[403] Hagy, J., Gleason, T., Oczkowski, A., Tatters, A. and Wan, Y. 2022. "Technical Memorandum: Recommendations to adapt Ambient Monitoring and Contingency Thresholds to monitor potential ecological risks to Massachusetts Bay resulting from the Deer Island Discharge."

5 Maintenance of physical integrity and capacity of the existing MWRA Outfall System

This requirement is no longer required to maintain the old Boston Harbor outfalls: 001, 002, 003, 004 and 005. The discharge is no longer a new discharge and is well within the expectations of the SEIS, WQS and permit limits.

The Draft Permit does include a requirement for outfall maintenance and inspection of Outfall T01 in Part I.I.3. of the Draft Permit.

5.14 Outfall Monitoring Science Advisory Panel

In the 2000 Permit, EPA established an independent panel of scientists to review monitoring data and advise EPA and the MassDEP on key scientific issues related to this 2000 Permit. This team of experts, called the Outfall Monitoring Science Advisory Panel (OMSAP), conducts peer reviews of monitoring reports; evaluates monitoring data and advises EPA and MassDEP on the implications of that data; advises EPA and MassDEP on proposed modifications to the monitoring plan; and meets at least annually with EPA and MassDEP staff and the public to ensure that any issues related to the MWRA discharge receive careful scientific attention. The OMSAP plays a role in evaluating any exceedances of caution or warning levels, and in advising EPA and the MassDEP as to whether the MWRA's discharge plays a role in such exceedances.

While the 2023 Draft Permit includes requirements to continue ambient monitoring in the vicinity of the outfall, it no longer includes a requirement to establish or maintain OMSAP. While OMSAP served a very important role in the design and implementation of the Ambient Monitoring Plan and Contingency Plan, data collected over the past 30 plus years, including the 20 years since the outfall was completed, has indicated to EPA that the primary questions OMSAP was tasked with responding to (regarding the impact of the discharge on aquatic life in the vicinity of the outfall) have been answered. Remaining questions, such as regarding nutrient driven eutrophication, are related to the discharge's impact on water quality and designated uses in Massachusetts Bay by itself and as one of the many point source and non-point discharges to that receiving water. In anticipation of this update, EPA has been working with OMSAP members and others to encourage the establishment of a regionally focused Massachusetts Bay Science Advisory Board that could review and comment on the results of ambient monitoring conducted by MWRA and others in the tributaries and waters of Massachusetts Bay.

5.15 Standard Conditions

The standard conditions of the Permit are based on 40 CFR § 122, Subparts A, C, and D and 40 CFR § 124, Subparts A, D, E, and F and are consistent with management requirements common to other permits.

6.0 Federal Permitting Requirements

6.1 Endangered Species Act

6.1.1 Introduction

Section 7(a) of the Endangered Species Act of 1973, as amended (ESA), grants authority to and imposes requirements on Federal agencies regarding endangered or threatened species of fish, wildlife, or plants (listed species) and any habitat of such species that has been designated as critical under the ESA (a "critical habitat").

Section 7(a)(2) of the ESA requires every federal agency, in consultation with and with the assistance of the Secretary of Interior, to ensure that any action it authorizes, funds or carries out, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. The United States Fish and Wildlife Service (USFWS) administers Section 7 consultations for freshwater species. The National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) administers Section 7 consultations for marine and anadromous species.

The federal action being considered in this case is EPA's proposed NPDES permit for the MWRA Deer Island Treatment Plant (DITP), which discharges through Outfall T01 into Massachusetts Bay. The Draft Permit is intended to replace the 2000 Permit in governing the Facility. As the federal agency charged with authorizing the discharge from this Facility, EPA determines potential impacts to federally listed species and initiates consultation with the Services when required under Section 7(a)(2) of the ESA.

The outfall diffuser is located between 42° 23' 3.2" N latitude / 70° 48' 13.5" W longitude and ends at 42° 23' 19.6" N latitude / 70° 46' 48.4" W longitude. The area of Massachusetts Bay receiving the discharge is 9.5 miles offshore in 100 feet of water. Because this discharge location is far off-shore, the receiving water is not included within a specific segment as defined in the Massachusetts WQS, though it is within state waters.[404,405] The Draft Permit also provides coverage for 47 combined sewer overflows (CSOs), that under certain wet weather conditions, discharge to receiving waters including the Reserved, Fort Point and Little Mystic Channels of Inner Boston Harbor, Dorchester Bay, the Chelsea River, Charles River, Back Bay Fens, Mystic River, Alewife Brook and the Little River.

EPA has reviewed the federal endangered or threatened species of fish, wildlife, and plants in the expected action areas of Outfall T01 and the CSO outfalls to determine if EPA's proposed NPDES permit could potentially impact any such listed species.

6.1.2 USFWS Protected Species

For protected species under jurisdiction of the USFWS,[406] two listed shore bird species have been documented in the general Boston area CSO discharges. The birds are the piping plover

[404] Massachusetts Coastal Zone Management (MA CZM), 2011, Massachusetts Coastal Zone Boundary Description. https://www.mass.gov/files/documents/2016/08/uf/cz-boundary-description-may2011.pdf
[405] MA CZM. 2014. Map: The Massachusetts Coastal Zone. https://www.mass.gov/files/documents/2016/11/nt/czm-regions.pdf
[406] See USFWS Information for Planning and Consultation Mapper for more information: https://ecos.fws.gov/ipac/location/index

(*Charadrius melodus*), listed as threatened, and the roseate tern (*Sterna dougallii dougallii*), listed as endangered. In addition, one protected mammal, the northern long-eared bat (*Myotis septentrionalis),* listed as endangered, has been identified as occurring in the vicinity of the CSO discharges.

The piping plover is a small migratory shorebird that nests and feeds along coastal sand and gravel beaches in North America. Coastal habitats include sand spits, small islands, tidal flats, shoals and sandbars with inlets. Primary foraging habitats include sandy mud flats, ephemeral pools and seasonally emergent seagrass beds with abundant invertebrates. They can be seen foraging along the waterline, on mudflats at low tide, and in wrack—marine vegetation and debris washed up on shore at the high tide line. Piping plovers feed on marine worms, mollusks, insects, and crustaceans.[407]

In Massachusetts, piping plovers nest on sandy, coastal beaches and dunes void of plants, beginning in late March. They build nests in the narrow section of land between the high tide line and the foot of coastal dunes. Occasionally piping plovers will build nests on plant-covered or in eroded areas behind dunes. They leave Massachusetts coastal areas when winter migration starts, between late July and early September.[408]

The roseate tern can be found on small barrier islands in the northeast North America, often at ends or breaks along a beach and almost always nest in colonies with common terns. Roseate terns are found in coastal New Hampshire and Massachusetts from the end of April until late August to early September. The bird eats small fish, primarily the American sand lance. The population has been greatly reduced by human activity and development on barrier islands, predation, and competition from expanding numbers of large gulls.

The outfall point from the Facility is in an established, deep, offshore location 9.5 miles from shore and does not interact with the shoreline habitat of these two birds. In addition, the CSO discharges are located in highly modified urban riverbank and harbor areas. They do not discharge near sandy beaches on barrier islands. The discharges do not come in contact with sandy, intertidal habitats where fish, worms and crustaceans that these birds feed on are found. Based on this assessment, EPA has determined that these USFWS federally protected shorebird species, as well as their prey, are not present in the action area. Therefore, consultation with USFWS under Section 7 of the ESA is not required for these protected birds.

According to the USFWS, the endangered northern long-eared bat is found in the following habitats based on seasons, "winter – mines and caves; summer – wide variety of forested habitats." This species is not considered aquatic. However, because the Facility's projected CSO action areas associated with the river systems in the Boston area overlaps with the general statewide range of the northern long-eared bat, EPA prepared an Effects Determination Letter for the MWRA Deer Island Treatment Plant NPDES Permit Reissuance and submitted it to USFWS. Based on the information submitted by EPA, the USFWS notified EPA by letter, dated March 30, 2023, that based upon a standing USFWS analysis, the permit reissuance has reached the

[407] https://www.fws.gov/species/piping-plover-charadrius-melodus

[408] https://www.mass.gov/files/documents/2016/08/rp/charadrius-melodus.pdf

determination of "No Effect" on the northern long-eared bat.[409] The USFWS determination letter concluded EPA's consultation responsibilities for the MWRA Deer Island Treatment Plant NPDES permitting action under ESA Section 7(a)(2) with respect to the northern long-eared bat. No further ESA Section 7 consultation is required with USFWS.

6.1.3 NOAA Fisheries Protected Species

Regarding protected species under the jurisdiction of NOAA Fisheries,[410] a number of federally protected anadromous and marine species and life stages are present in coastal Massachusetts waters. The MWRA Deer Island Treatment Plant (DITP) discharges through Outfall T01 into Massachusetts Bay. The outfall diffuser is located between 42° 23' 3.2" N latitude / 70° 48' 13.5" W longitude and ends at 42° 23' 19.6" N latitude / 70° 46' 48.4" W longitude. The area of Massachusetts Bay receiving the discharge is 9.5 miles offshore in 110 feet of water. Because this discharge location is far offshore, the receiving water is not included within a specific segment as defined in the Massachusetts WQS, though it is within state waters. The Draft Permit also provides coverage for 47 combined sewer overflows (CSOs), that under certain wet weather conditions, discharge to receiving waters including the Reserved, Fort Point and Little Mystic Channels of Inner Boston Harbor, Dorchester Bay, the Chelsea River, Charles River, Back Bay Fens, Mystic River, Alewife Brook and the Little River.

EPA delineated a preliminary action area based on the offshore outfall and CSO discharges. This action area likely overlaps with the presence of the following NOAA Fisheries protected species: All distinct population segments of the threatened and endangered Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) adult and subadult life stages are expected to migrate through and forage in the action area throughout the year; endangered shortnose sturgeon (*Acipenser brevirostrom*) adults are expected to migrate through and forage in the action area from April through November; protected sea turtles including adult and juvenile life stages of endangered leatherback sea turtles (*Dermochelys coriacea*), threatened loggerhead sea turtles (*Caretta caretta*), endangered Kemp's ridley sea turtles (*Lepidochelys kempii*) and threatened green sea turtles (*Chelonia mydas*) are expected to migrate through and forage in the action area from June through November; and adult and juvenile life stages of endangered North Atlantic right whales (*Eubalaena glacialis*) and endangered fin whales (*Balaenoptera physalus*) are expected to forage in the action area year-round. In addition, the action area overlaps with a coastal area that has been designated as part of North Atlantic right whale Critical Habitat Unit 1: Feeding Area.

These protected species life stages, as well as the listed North Atlantic right whale critical habitat, are likely influenced by the discharge from this Facility. Because these species and critical habitat may be affected by the discharge authorized by the proposed permit, ESA Section 7 consultation with NOAA Fisheries is required.

In 1993, NOAA Fisheries issued a biological opinion (BiOp) on the MWRA Deer Island Treatment Plant project. The opinion did not authorize incidental take of marine mammals and

[409] USEWS Project Code 2023-0062317, March 30, 2023.
[410] See NOAA: ESA Section 7 Mapper for more information: https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=1bc332edc5204e03b250ac11f9914a27

included monitoring recommendations, therefore, MWRA developed a monitoring plan and reports data regularly to NOAA Fisheries. Concerns in the BiOp included potential changes to the phytoplankton community structure, including enhancement of nuisance forage species that result in decreased productivity and/or changes in the distribution and aggregation densities of *C. finmarchicus.*[411]

EPA Region 1 requested support from EPA's Office of Research and Development (ORD) to review and evaluate the data in recent MWRA water column monitoring reports and determine how these data and analyses address the potential for the discharge to contribute to environmental conditions that may affect North Atlantic right whales.[412]

In order to fully evaluate the content and terms of the original 1993 BiOp, EPA will submit to NOAA Fisheries a re-initiation of consultation document which will include a biological assessment (BA) that includes the monitoring data evaluation noted above and supports EPA's preliminary determination that this proposed permit action may affect, but is not likely to adversely affect, the life stages of the protected species which are expected to inhabit the coastal and near shore action area of the discharges. EPA has judged that a formal consultation pursuant to section 7 of the ESA is not required and is seeking concurrence from NOAA Fisheries regarding this determination through the information in the Draft Permit, this Fact Sheet, as well as the detailed re-initiation of consultation document that will be submitted to NOAA Fisheries Protected Resources Division during the Draft Permit's public comment period.

At the beginning of the public comment period, EPA notified NOAA Fisheries Protected Resources Division that the Draft Permit and Fact Sheet were available for review and provided a link to the EPA NPDES Permit website to allow direct access to the documents.

Initiation of consultation is required and shall be requested by the EPA or by NOAA Fisheries where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the analysis; (b) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this analysis; or (c) If a new species is listed or critical habitat designated that may be affected by the identified action. No take is anticipated or exempted. If there is any incidental take of a listed species, re-initiation of consultation would be required.

6.2 Essential Fish Habitat

6.2.1 Introduction

[411] Christine Michele Vaccaro, NMFS. August 9, 2021. "Technical Guidance for EPA Reissuance of the Massachusetts Water Resource Authority NPDES Permit – Deer Island Treatment Plant.
[412] Hagy, J., et al. 2022. "Technical Memorandum: Review of MWRA Water Quality Monitoring Results to Address Potential Harmful Effects of the Deer Island Discharge on Threatened and Endangered Species in Massachusetts Bay" https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=355407&Lab=CEMM

Under the 1996 Amendments (PL 104-267) to the Magnuson-Stevens Fishery Conservation and Management Act (*see* 16 U.S.C. § 1801 *et seq.*, 1998), EPA is required to consult with NOAA Fisheries if EPA's action or proposed actions that it funds, permits, or undertakes, "may adversely impact any essential fish habitat." 16 U.S.C. § 1855(b).

The Amendments broadly define "essential fish habitat" (EFH) as: "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." 16 U.S.C. § 1802(10). "Adverse impact" means any impact that reduces the quality and/or quantity of EFH. (*see* 50 CFR § 600.910(a)). Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), or site specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions. The EFH regulations clarify that "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by the managed fish species, and those areas historically used by those species, where appropriate.

EFH is only designated for fish species for which federal Fisheries Management Plans exist. (*See* 16 U.S.C. § 1855(b)(1)(A)). EFH designations for New England were approved by the U.S. Department of Commerce on March 3, 1999. A New England Fishery Management Council's Omnibus Essential Fish Habitat Amendment in 2017 updated the descriptions.[413] In some cases, a narrative identifies rivers and other waterways that should be considered EFH due to present or historic use by federally managed species. In a letter to EPA New England dated October 10, 2000, NOAA Fisheries agreed that for NPDES permit actions, EFH initial notification for purposes of consultation can be accomplished in the EFH section of the Draft Permit's supporting Fact Sheet or Federal Register Notice.

The federal action being considered in this case is EPA's proposed NPDES permit for the MWRA Deer Island Treatment Plant (DITP), which discharges through Outfall T01 into Massachusetts Bay. The Draft Permit is intended to replace the 2000 Permit in governing the Facility. The outfall diffuser begins along the discharge pipe at approximately eight miles offshore, at 42° 23' 3.2" N latitude / 70° 48' 13.5" W longitude and continues for approximately 1.5 miles, until it terminates at 42° 23' 19.6" N latitude / 70° 46' 48.4" W longitude, approximately 9.5 miles offshore. The area of Massachusetts Bay receiving the discharge is in approximately 110 feet of water. Because this discharge location is far offshore, the receiving water is not included within a specific segment as defined in the Massachusetts WQS, though it is within state waters. The Draft Permit also provides coverage for 47 combined sewer overflows (CSOs), that under certain wet weather conditions, discharge to receiving waters including the Reserved, Fort Point and Little Mystic Channels of Inner Boston Harbor, Dorchester Bay, the Chelsea River, Charles River, Back Bay Fens, Mystic River, Alewife Brook and the Little River.

A review of the relevant essential fish habitat information provided by NOAA Fisheries[414] indicates that the outfall exists within designated EFH for 34 federally managed species and one Habitat Area of Particular Concern (HAPC). The EFH species, life stages and the HAPC are listed in Table 28.

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[413] https://www.nefmc.org/library/omnibus-habitat-amendment-2.
[414] NOAA EFH Mapper available at https://www.habitat.noaa.gov/apps/efhmapper/

Table 28. Species and life stages with designated EFH and one Habitat Area of Particular Concern in the vicinity of the MWRA Deer Island Treatment Plant Outfall T01 and 47 CSO Discharges.

Species/Management Unit	Lifestage(s) Found at Location
Atlantic Sea Scallop	ALL
Atlantic Wolffish	ALL
Haddock	Juvenile, Eggs
Winter Flounder	Eggs, Juvenile, Larvae/Adult
Little Skate	Juvenile, Adult
Ocean Pout	Adult, Eggs, Juvenile
Atlantic Herring	Juvenile, Adult, Larvae, Eggs
Atlantic Cod	Larvae, Adult, Juvenile, Eggs
Pollock	Adult, Juvenile, Eggs, Larvae
Red Hake	Adult, Eggs/Larvae/Juvenile
Silver Hake	Eggs/Larvae, Adult
Yellowtail Flounder	Adult, Juvenile, Larvae, Eggs
Monkfish	Eggs/Larvae
White Hake	Larvae, Adult, Eggs, Juvenile
Windowpane Flounder	Adult, Larvae, Eggs, Juvenile
Winter Skate	Adult, Juvenile
Witch Flounder	Adult, Larvae, Eggs
American Plaice	Adult, Juvenile, Larvae, Eggs
Acadian Redfish	Larvae
Thorny Skate	Juvenile
Bluefin Tuna	Adult, Juvenile
Basking Shark	ALL
White Shark	Juvenile/Adult
Sand Tiger Shark	Neonate/Juvenile
Northern Shortfin Squid	Adult
Longfin Inshore Squid	Juvenile, Adult
Atlantic Mackerel	Eggs, Larvae, Juvenile, Adult
Bluefish	Adult, Juvenile
Atlantic Butterfish	Eggs, Larvae, Adult, Juvenile
Spiny Dogfish	Sub-Adult Female, Adult Male, Adult Female
Atlantic Surfclam	Juvenile, Adult
Scup	Juvenile, Adult
Summer Flounder	Adult
Black Sea Bass	Adult
Habitat Area of Particular Concern	
Inshore 20m Juvenile Cod	

6.2.2 EPA's Finding of All Potential Impacts to EFH Species

EPA has determined that the operation of this Facility, as governed by this permit action, may adversely affect the EFH in Massachusetts Bay, Reserved, Fort Point and Little Mystic Channels of Inner Boston Harbor, Dorchester Bay, the Chelsea River, Charles River, Back Bay Fens, Mystic River, Alewife Brook and the Little River. The Draft Permit has been conditioned in the following way to minimize any impacts that reduce the quality and/or quantity of EFH:

- The Draft Permit action does not constitute a new source of pollutants. It is the reissuance of an existing NPDES permit;
- The Facility withdraws no water from Massachusetts Bay, Boston Inner Harbor or river systems in the Boston area, so the EFH will not be reduced in quality and/or quantity through impingement or entrainment of EFH designated species or their prey;
- The effluent is discharged 9.5 miles off-shore at a depth of 110 feet. This provides mixing in a deep-water ocean environment;
- The effluent has a fairly high dilution factor of 70, which will facilitate full mixing of the discharge;
- Flow, total suspended solids, carbonaceous biochemical oxygen demand, total residual chlorine, fecal coliform bacteria, *Enterococci*, pH and oil and grease are regulated by the Draft Permit to meet water quality standards;
- Long-term Control Plans for CSO discharges are in place to treat CSO discharges, reduce the volume of CSO discharges, or eliminate discharges;
- Whole effluent toxicity testing of the effluent is proposed four times a year and must meet an LC_{50} to ensure that the discharge does not present toxicity problems;
- The Draft Permit proposes a comprehensive monitoring program to evaluate effects of the operation of the Facility on the receiving waters;
- The Draft Permit prohibits the discharge of pollutants or combination of pollutants in toxic amounts;
- The effluent limitations and conditions in the Draft Permit were developed to be protective of all aquatic life;
- The Draft Permit prohibits violations of state water quality standards; and
- The proposed Draft Permit requirements minimize any reduction in quality and/or quantity of EFH, either directly or indirectly.

EPA believes that the conditions and limitations contained in the Draft Permit adequately protect all aquatic life, as well as the essential fish habitat in Massachusetts Bay, Boston Inner Harbor and river systems in the vicinity of Boston. Further mitigation is not warranted. Should adverse impacts to EFH be detected as a result of this permit action, or if new information is received that changes the basis for EPA's conclusions, NOAA Fisheries Habitat and Ecosystem Services Division will be contacted and an EFH consultation will be reinitiated.

At the beginning of the public comment period, EPA notified NOAA Fisheries Habitat and Ecosystem Services Division that the Draft Permit and Fact Sheet were available for review and provided a link to the EPA NPDES Permit website to allow direct access to the documents. In addition to this Fact Sheet and the Draft Permit, information to support EPA's finding was included in a letter under separate cover that will be sent to the NOAA Fisheries Habitat and Ecosystem Services Division during the public comment period.

6.3 National Marine Sanctuary Act

The National Marine Sanctuaries Act (16 U.S.C. § 1431 et seq.; the Act or NMSA) authorizes the Secretary of Commerce to designate and manage areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries. The NMSA provides the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries (ONMS) with authority to comprehensively manage uses of the National Marine Sanctuary System (System) and protect its resources through regulations, permitting, enforcement, research, monitoring, education and outreach.

In 1992, Congress amended the NMSA to require interagency coordination pursuant to section 304(d). Section 304(d) requires Federal agencies to consult with the ONMS whenever their proposed actions are likely to destroy, cause the loss of, or injure a sanctuary resource. Through the same legislation, Congress designated the Gerry E. Studds Stellwagen Bank National Marine Sanctuary (SBNMS) and required Federal agencies to consult on proposed actions of that area. For SBNMS specifically, rather than maintaining the consultation threshold at the level of "the proposed actions are likely to destroy, cause the loss of, or injure a sanctuary resource," the amendment modified the SBNMS threshold to required Federal agencies to consult on "proposed actions that may affect resources" of that area.

The Federal Action being considered in this case is EPA's reissuance of the NPDES permit for the MWRA DITP, which discharges through Outfall T01 into Massachusetts Bay. The outfall diffuser begins along the discharge pipe at approximately eight miles offshore, at 42° 23' 3.2" N latitude / 70° 48' 13.5" W longitude and continues for approximately 1.5 miles, until it terminates at 42° 23' 19.6" N latitude / 70° 46' 48.4" W longitude, approximately 9.5 miles offshore. The area of Massachusetts Bay receiving the discharge is in approximately 110 feet of

water. The outfall is located approximately 12 nautical miles from the western boundary of the SBNMS.[415] (See Figure 21).

EPA conducted a preliminary review of the regulated discharge from DITP in relation to whether it may affect the resources of the SBNMS. Taking into account:

- the dilution factor of the discharge (70);
- the permit requirements that the discharge must meet water quality standards;
- the distance between the outfall diffuser and the western boundary of the SBNMS (approximately 12 nautical miles); and
- "Ongoing monitoring suggests that the MWRA [DITP] discharge is not adversely influencing monitored water quality parameters in SBNMS, and no evidence suggests that eutrophication is occuring."[416]

A case could be made that that the proposed action does not affect sanctuary resources and therefore does not trigger consultation with ONMS under Section 304(d) of the NMSA.

EPA reached out to ONMS SBNMS staff on February 14, 2023, and April 17, 2023, to discuss EPA's preliminary review. As a result of these meetings, EPA was made aware that the evaluation of the resources of the marine sanctuary is not confined to the boundaries of the sanctuary. The ONMS staff identified important resources of the sanctuary, including, but not limited to: the North Atlantic right whale (*Eubalaena glacialis*), listed as endangered under the Endangered Species Act, endangered Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), American lobster *(Homarus americanus),* the American sand lance (*Ammodytes americanus)*, the seabird known as the great shearwater *(Ardenna gravis)* and the marine copepod calanus. These important resources of the sanctuary are among key marine and anadromous species that forage, migrate and spawn within the Stellwagen Bank Sanctuary as well as far outside the boundary of the sanctuary.

Since the movement of these sanctuary resources through the area outside of the sanctuary could likely result in contact between the resources and the DITP discharge plume, EPA has determined that consultation with ONMS is warranted under Section 304(d) of the NMSA.

Massachusetts Bay and the MWRA discharge have been the subject of significant ambient monitoring from the pre-discharge period to present. NOAA's own Stellwagen Basin National Marine Sanctuary Condition Report rates water quality in the Sanctuary as "Good/Fair" and notes that "some potentially harmful activities exist, but they have not been shown to degrade water quality."[417] The Report also reaches similar conclusions as EPA that the HAB dynamics in the Gulf of Maine or more specifically, Massachusetts Bay, may be related to climate change.[418]

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[415] Office of National Marine Sanctuaries, National Oceanic and Atmospheric Administration, "Stellwagen Bank National Marine Sanctuary 2020 Conditions Report, Findings of Status and Trends, 2007-2018," https://sanctuaries.noaa.gov/media/docs/2020-stellwagen-condition-report.pdf
[416] Office of National Marine Sanctuaries, National Oceanic and Atmospheric Administration, "Stellwagen Bank National Marine Sanctuary 2020 Conditions Report, Findings of Status and Trends, 2007-2018," p. 12.
[417] https://sanctuaries.noaa.gov/media/docs/2020-stellwagen-condition-report.pdf, p. 18.
[418] https://sanctuaries.noaa.gov/media/docs/2020-stellwagen-condition-report.pdf, p. 12.

Throughout this Fact Sheet, EPA has reviewed the voluminous data and reports available. Many reports are cited in this Fact Sheet and full copies of MWRA-produced reports are available on their Environmental Quality Department's technical reports page at: https://www.mwra.com/harbor/enquad/trlist.html. Hyperlinks to additional reports from outside experts are also provided when available.

EPA will incorporate this monitoring data into the Sanctuary Resource Statement. This document will be submitted to ONMS during the DITP Draft Permit public comment period as part of the sanctuary consultation process.

6.4 Coastal Zone Management (CZM) Consistency Review

The regulation at 40 CFR § 122.49(d) states "The Coastal Zone Management Act, 16 U.S.C. 1451 et seq. section 307(c) of the Act and implementing regulations (15 CFR Part 930) prohibit EPA from issuing a permit for an activity affecting land or water in the coastal zone until the applicant certifies that the proposed activity complies with the State Coastal Zone Management program, and the State or its designated agency concurs with the certification (or the Secretary of Commerce) overrides the State's nonconcurrence.

The discharge is within the defined CZM boundaries. The Permittee has submitted a letter dated March 4, 2005[419] and an updated letter date May 11, 2023[420] to the Massachusetts Coastal Zone Management Program stating their intention to abide by the CZM water quality and habitat policies. EPA expects that CZM will find the discharge consistent with its policies.

6.5 Environmental Justice (EJ)

Executive Order 12898 entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" states in relevant part that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations...." The order also provides that federal agencies are required to implement the order consistent with and to the extent permitted by existing law.

In addition, in May 2013, EPA Region 1 issued the *EPA Region 1 Regional Implementation Plan to Promote Meaningful Engagement of Overburdened Communities in Permitting Activities* which describes actions that the Region's permitting programs will take when issuing EPA permits in order to promote greater participation in the permitting process by communities that

[419] Letter. Frederick A. Laskey, MWRA to Jane Mead, MA CZM. March 4, 2005. Re: CZM Federal Consistency Certification, NPDES Permit No. MA0103284, MWRA Deer Island and Combined Sewer Overflows into Boston Harbor and Massachusetts Bay.
[420] Letter. David W. Coppes, MWRA to Robert Boeri, MA CZM. May 11, 2023. RE: Application for NPDES Permit; MWRA Deer Island Wastewater Treatment Plant and Combined Sewer Overflows, NPDES Permit No. MA0103284, Boston Harbor and Massachusetts Bay.

have historically been underrepresented in the process.[421] It addresses four elements: 1) what types of permits will be prioritized, 2) how these permits will be reviewed for EJ concerns, 3) roles and responsibilities within Region 1 to carry out this plan, and 4) what actions Region 1 will take to ensure enhanced meaningful involvement where there are EJ concerns. Conducting enhanced outreach for permits that impact communities that have been historically underrepresented in the permitting process is a key element of Region 1's efforts to help ensure meaningful involvement.

Consistent with this plan, EPA's enhanced outreach activities for the Draft Permit will include: phone calls and email notification to community stakeholders; a 60-day public comment period; the release of a concise information sheet for the benefit of the community, explaining in simple language the Draft Permit and the public process; designating an EPA point of contact that the community can contact to discuss EJ concerns; and translating key documents into the primary languages spoken by community members. EPA will also host a virtual public meeting during which EPA will present an overview of the Draft Permit and answer questions from meeting participants. EPA will also host a separate virtual public hearing to allow the public an opportunity to provide oral comments for the record. EPA will provide necessary translation and interpretation services in the primary languages spoken by community members during the meeting and the hearing.

The Draft Permit implements water pollution prevention and control requirements, including applicable technology-based and water quality-based limits, standards, and practices to ensure compliance with applicable CWA requirements, and meet State WQSs. The monitoring program is designed to obtain additional information, which can be used in ongoing surveillance of permitted activities and in future permit decisions. Conditions continue to be included in the Draft Permit to ensure adverse impacts do not occur because of combined sewer overflow (CSOs) or sanitary sewer overflows (SSOs). Additionally, the Draft Permit includes new numeric limits on *Enterococcus bacteria* discussed in Section 5.1.6. above, monitoring for PFAS analytes and adsorbable organic fluorine discuss in Section 5.2.4. EPA has the authority to modify a permit if the threat of adverse environmental impact from the discharges were to occur, that is, a discharge which violates State WQSs. EPA therefore determined that the pollutant discharge levels authorized by the Draft Permit will not cause, have the reasonable potential to cause, or contribute to an excursion above WQSs.

EPA has determined that the following communities served by the MWRA are covered by one or more EJ designations: Arlington, Boston, Braintree, Cambridge, Chelsea, Dedham, Everett, Framingham, Malden, Quincy, Randolph, Revere and Winthrop.[422] The water pollution prevention and control requirements in the Draft Permit address current adverse impacts to aquatic life, aesthetics and recreation in Massachusetts Bay, Boston Inner Harbor, Charles River, Mystic River and Little River and the Draft Permit will lead to continued water quality improvements in these waters. EPA therefore has determined that the Facility's discharges will

[421] Available at: https://www.epa.gov/environmentaljustice/epa-region-1-regional-implementation-plan-promotemeaningful-engagement
[422] EPA's Environmental Justice Screening and Mapping Tool (Version 2.1) is currently available at: https://ejscreen.epa.gov/mapper/

not result in disproportionately high and adverse human health or environmental effects on minority or low-income populations within the meaning of Executive Order 12898. EPA's EJ Screen evaluation is included in the administrative record associated with the Draft Permit.

7.0 Public Comments, Hearing Requests and Permit Appeals

All persons, including applicants, who believe any condition of the Draft Permit is inappropriate must raise all issues and submit all available arguments and all supporting material for their arguments in full by the close of the public comment period, to the permit writer, Michele Cobban Barden at the following email address: barden.michele@epa.gov.

The Regional Administrator has determined, pursuant to 40 CFR §124.12, that a significant degree of public interest exists in the proposed Permit and that a public meeting and a public hearing will be held virtually to consider the permit. This notice serves to announce that a public meeting and public hearing will be held on the following dates and times:

Public Informational Meeting:
DATE: **July 12, 2023**
TIME: 7:00pm
LOCATION: Virtual Meeting Information will be provided on EPA's website, noted above

Public Hearing:
DATE: **July 12, 2023**
TIME: 8:00pm
LOCATION: Virtual Meeting Information will be provided on EPA's website, noted above

The following is a summary of the procedures that will be followed at the public informational meeting:

a. The Presiding Chairperson will have the authority to open and conclude the meeting and to maintain order.
b. EPA will make a short presentation describing the NPDES permit process and the Draft Permit Conditions, and then accept clarifying questions from the audience.
c. Formal oral comments concerning the Draft Permit will not be accepted at the public meeting. Formal oral comments will be accepted at the subsequent public hearing.

The following is a summary of the procedures that will be followed at the public hearing:

a. The Presiding Chairperson will have the authority to open and conclude the hearing and to maintain order.
b. Any person appearing at such a hearing may submit oral or written statements concerning the draft permit.

In reaching a Final Decision on the Draft Permit, EPA will respond to all significant comments in a Response to Comments document attached to the Final Permit and make these responses available to the public on EPA's website.

Following the close of the comment period, and after any public hearings, if such hearings are held, EPA will issue a Final Permit Decision, forward a copy of the Final Decision to the applicant, and provide a copy or notice of availability of the Final Decision to each person who submitted written comments or requested notice. Within 30 days after EPA serves notice of the issuance of the Final Permit Decision, an appeal of the federal NPDES permit may be commenced by filing a petition for review of the Permit with the Clerk of EPA's Environmental Appeals Board in accordance with the procedures at 40 CFR § 124.19.

If for any reason, comments on the Draft Permit and/or a request for a public hearing cannot be emailed to the permit writer specified above, please contact them at telephone number: (617) 918-1539.

8.0 Administrative Record

The administrative record on which this Draft Permit is based may be accessed by contacting Michele Barden, at 617-918-1539 or via email to barden.michele@epa.gov .

_____
Date

_____
Ken Moraff, Director
Water Division
U.S. Environmental Protection Agency

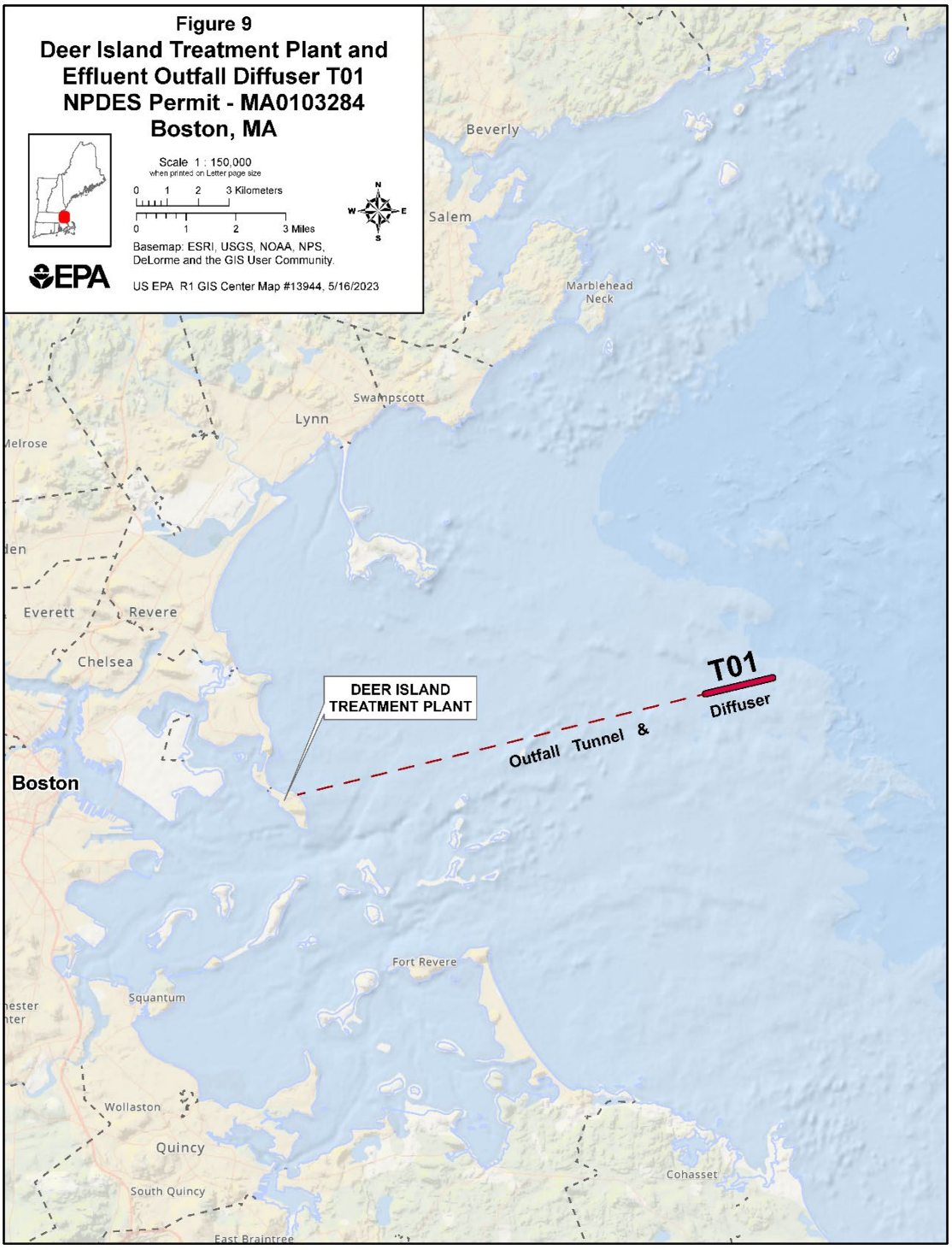

Figure 9: MWRA DITP and Outfall T01 locations.

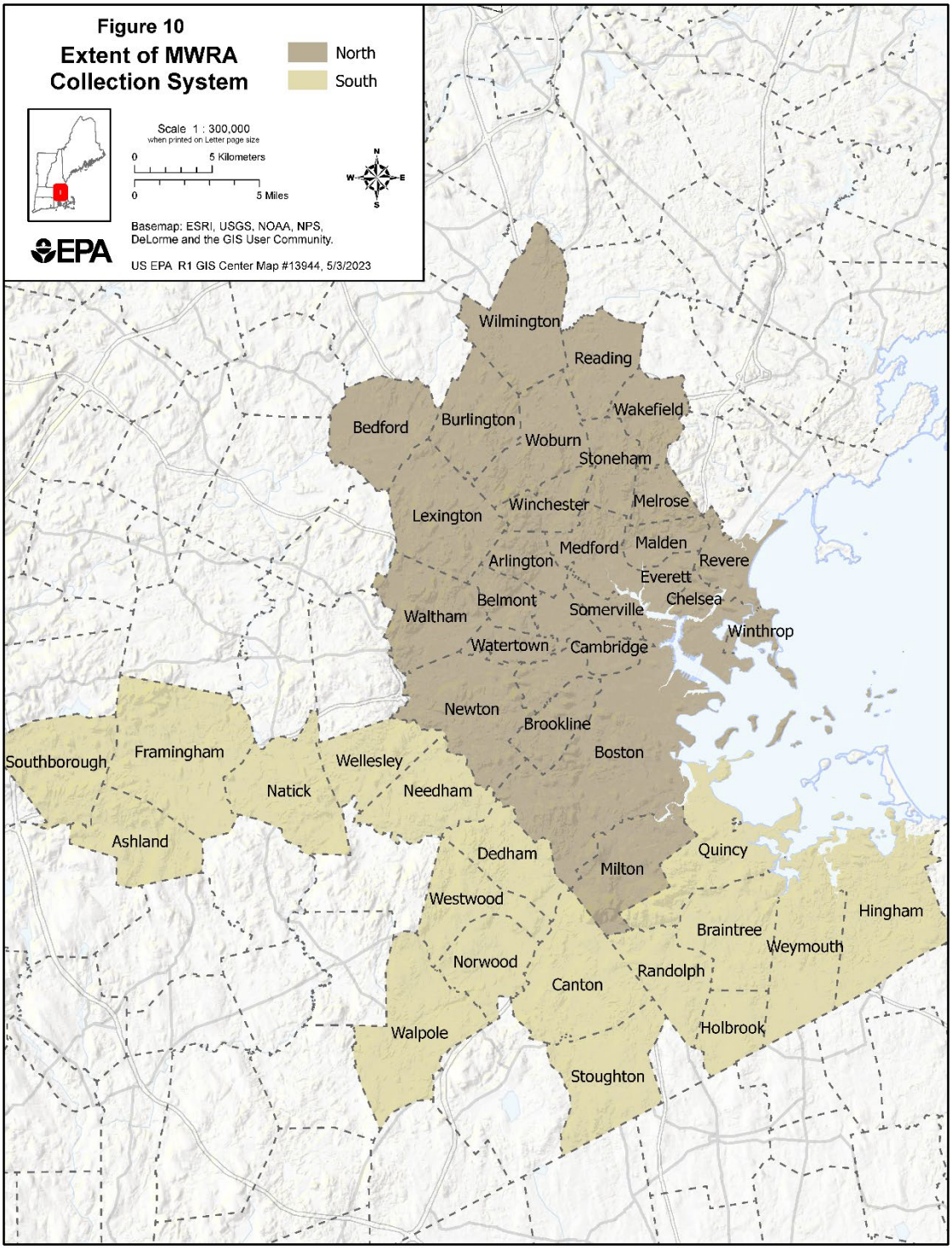

Figure 10: Extent of MWRA Collection System

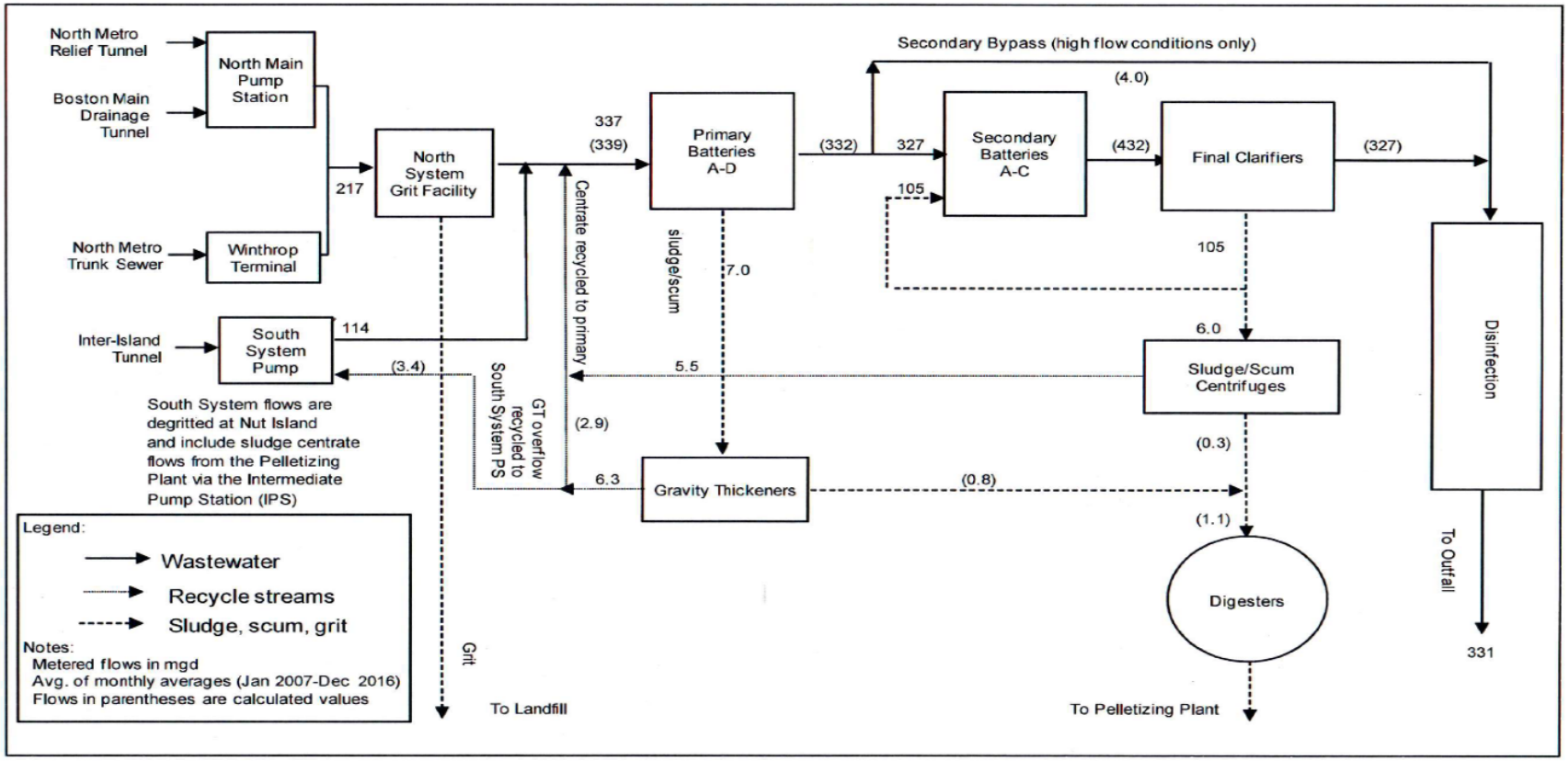

Figure 11: Flow diagram

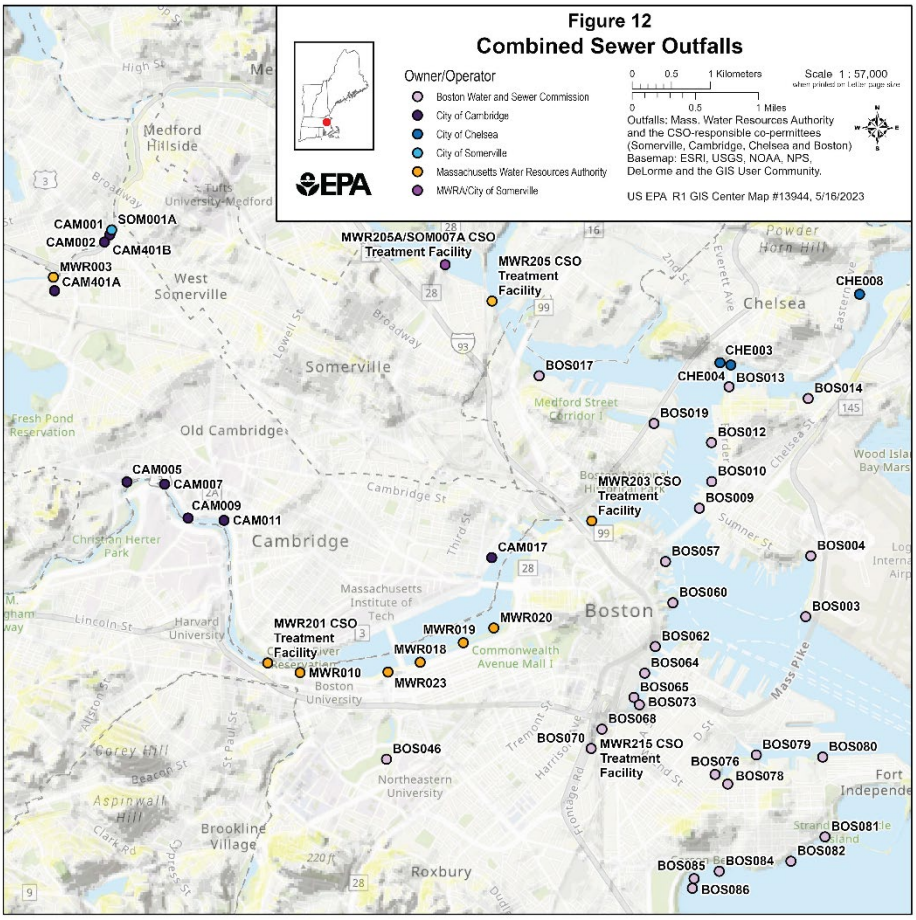

Figure 12: CSO outfall locations from MWRA

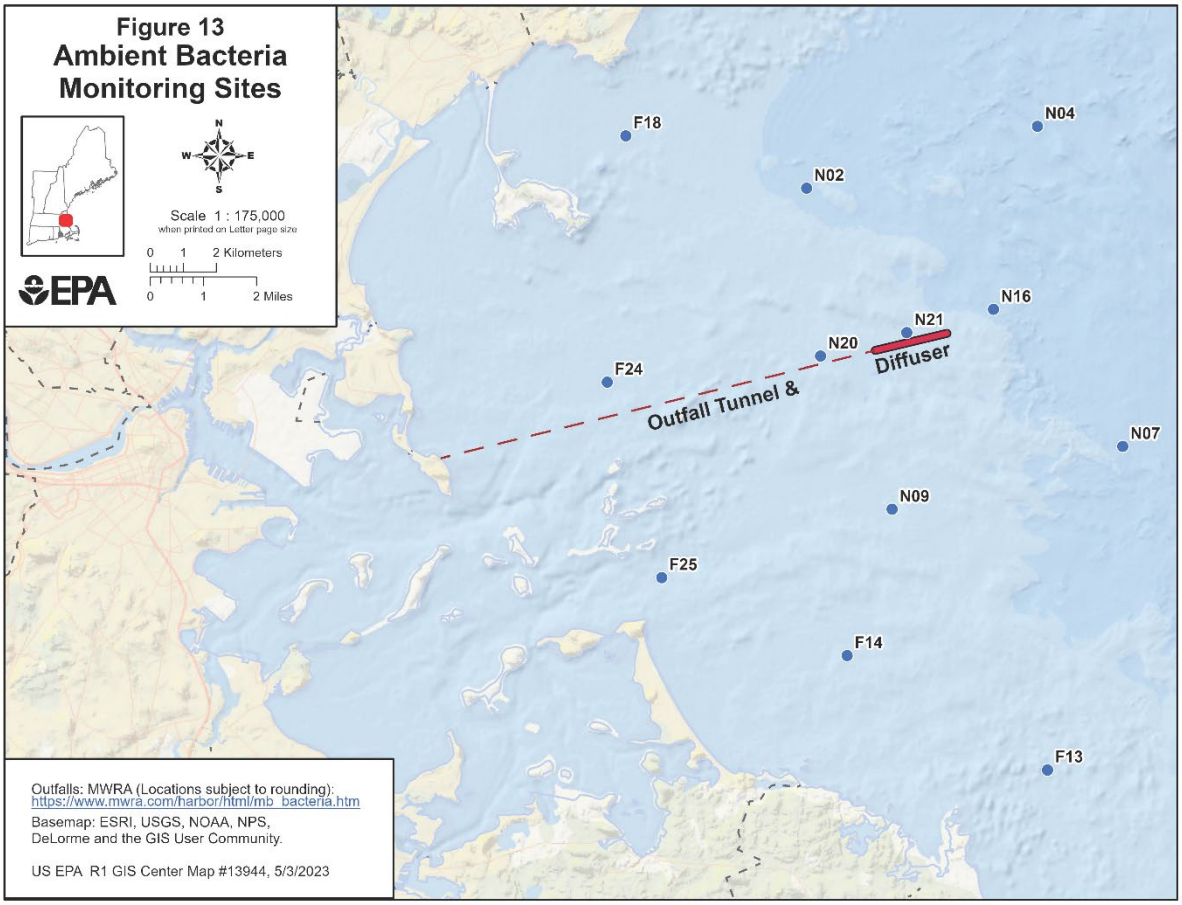

Figure 13: Locations of Ambient Bacteria Monitoring Sites

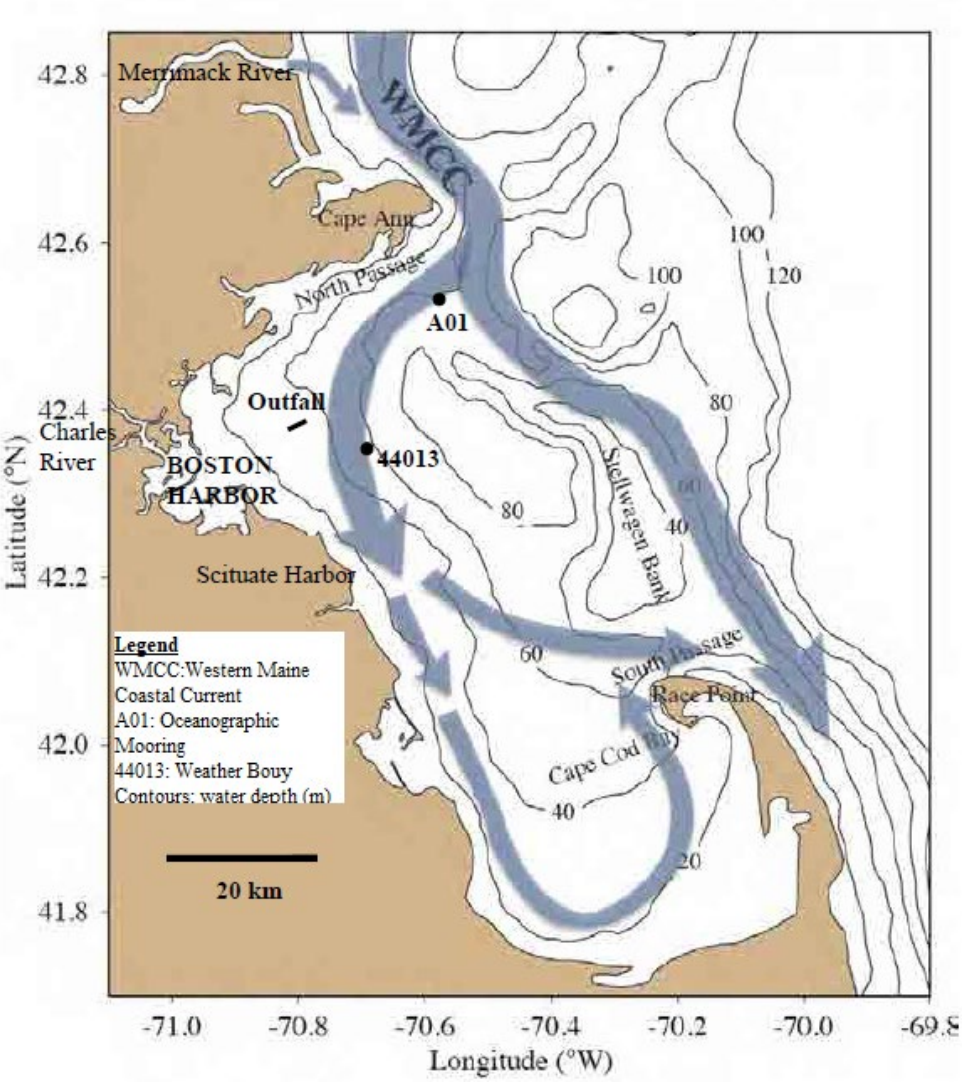

Figure 14: Geography, bathymetry, schematic long-term mean circulation, adapted from https://www.mwra.com/harbor/enquad/pdf/2017-13.pdf

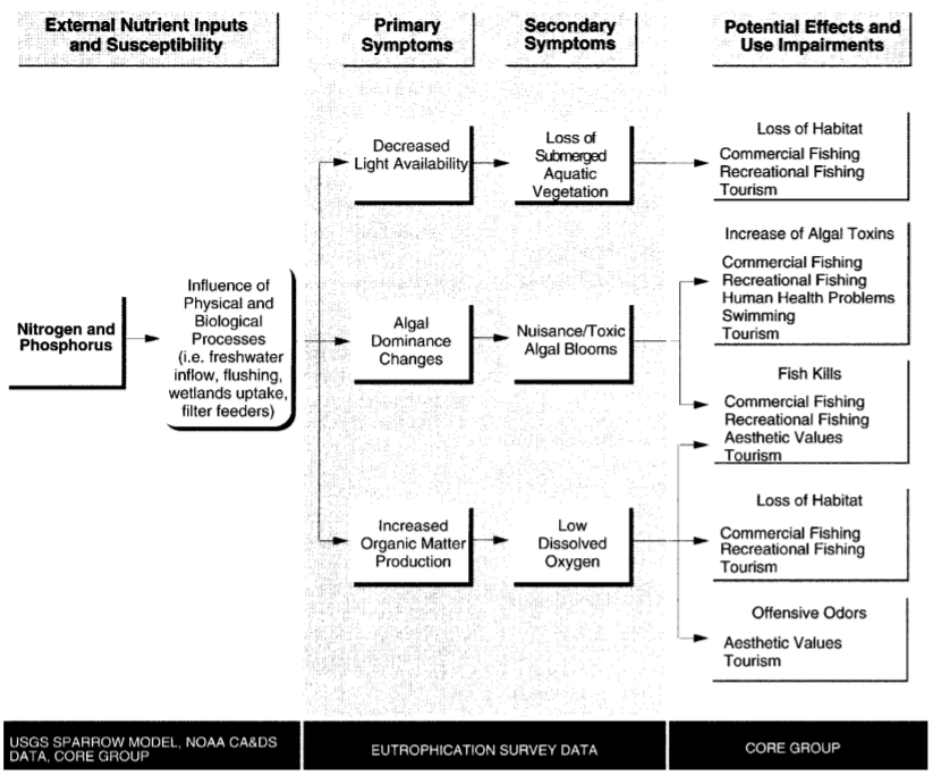

Figure 15: Expanded nutrient enrichment model. Source: Bricker et al. 1999.[423]

[423] Bricker, S.B., C.G. Clement, D.E. Pirhalla, S.P. Orlando, and D.R.G. Farrow. 1999. National Estuarine Eutrophication Assessment: Effects of Nutrient Enrichment in the Nation's Estuaries. NOAA, National Ocean Service, Special Projects Office and the National Centers for Coastal Ocean Science. Silver Spring, MD: pp.71

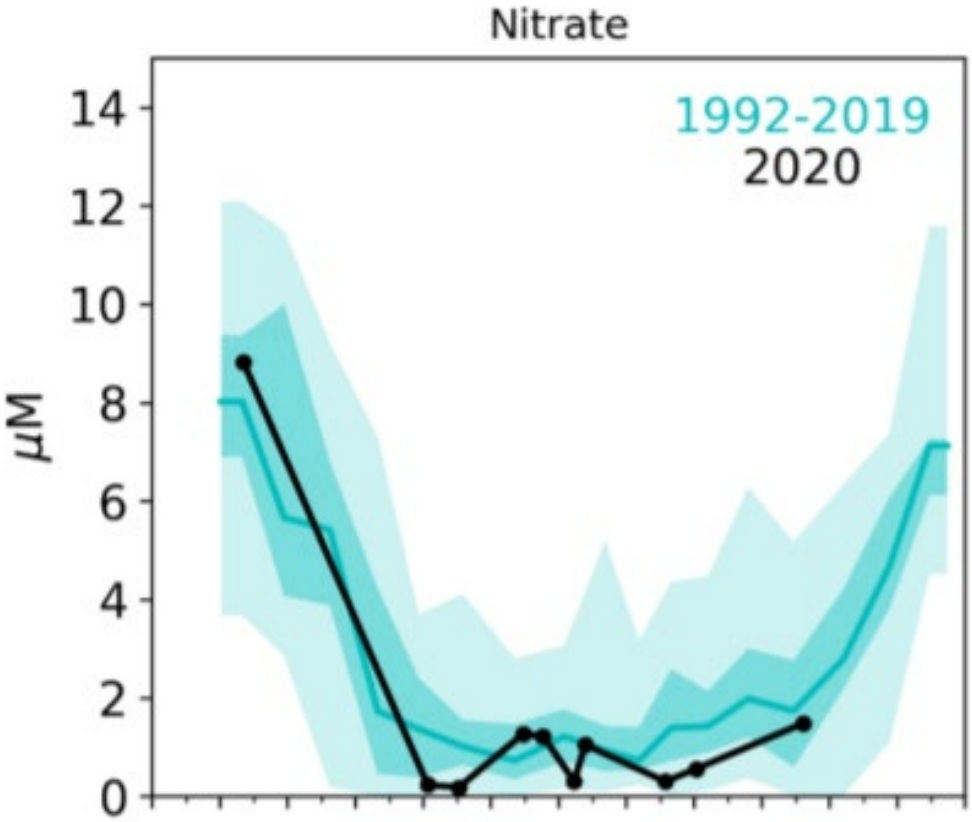

Figure 16: Depth-averaged dissolved nitrate (µM) at Station N18. The shaded areas are the data ranges from 1992-2020 with the trend as the darker color in the center of the shading. The line with the dots represents the actual 2020 values *from* MWRA 2020 Water Column Monitoring Report.

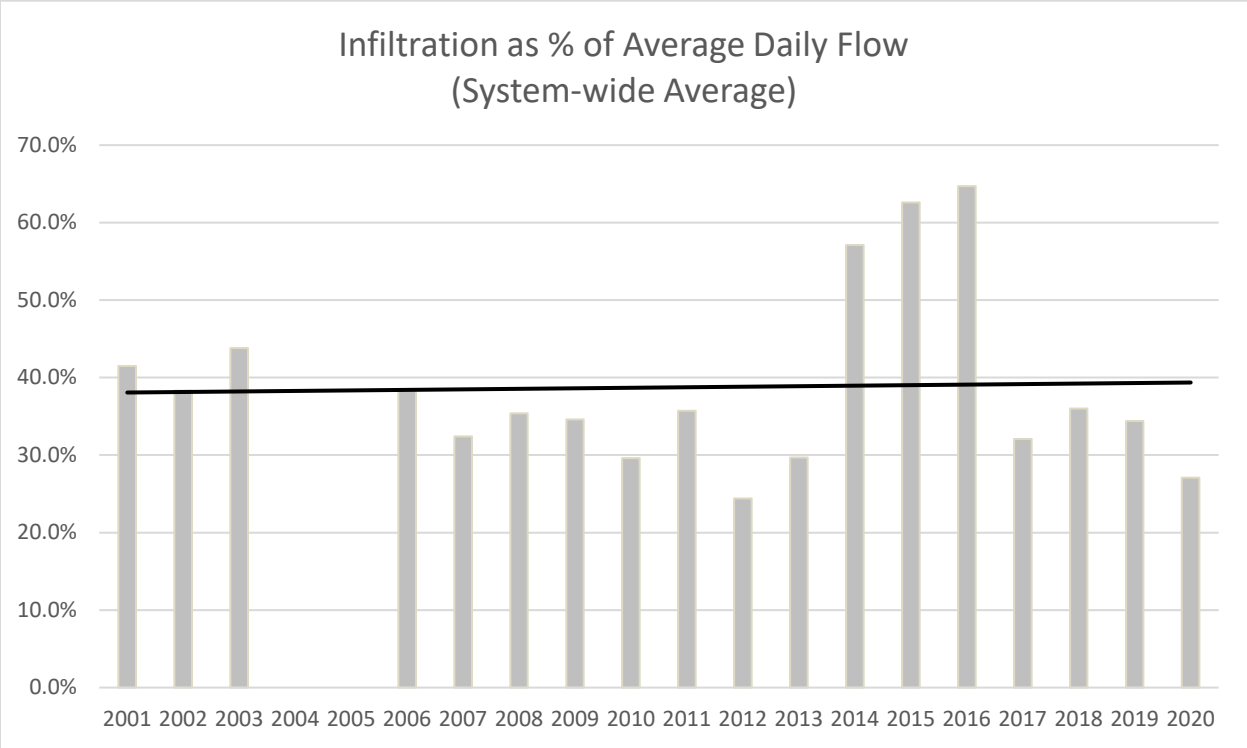

Figure 17: Infiltration as a percentage of average daily flow for all MWRA sewer communities averaged. *From* MWRA Annual I/I Reports for Calendar Years 2001-2020.

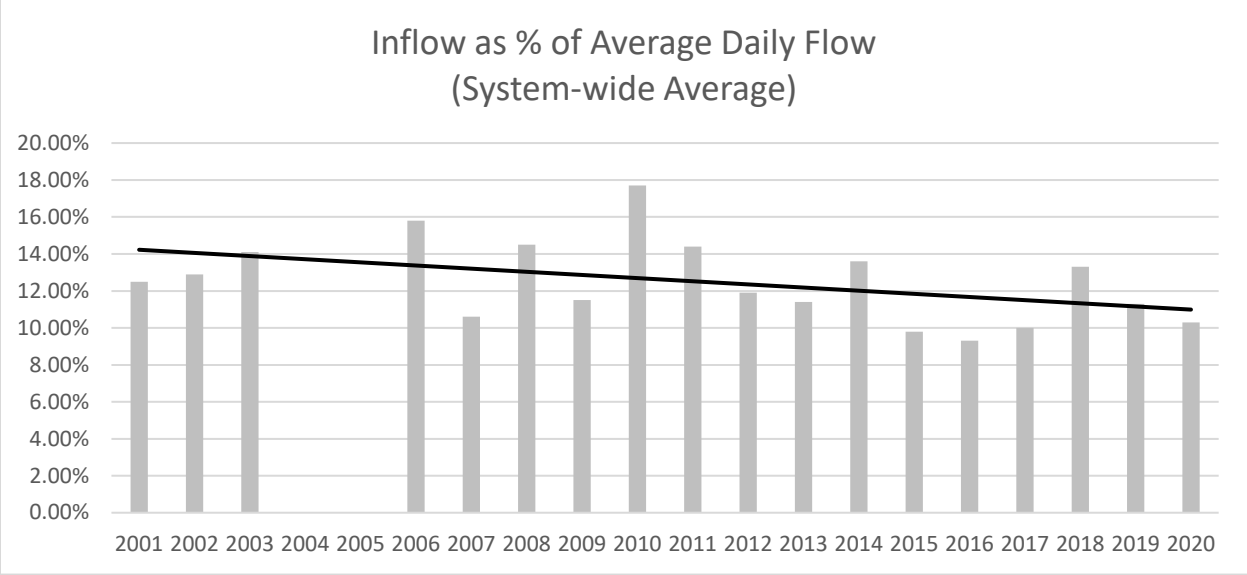

Figure 18: Inflow as a percentage of average daily flow for all MWRA sewer communities averaged. *From* MWRA Annual I/I Reports for Calendar Years 2001-2020.

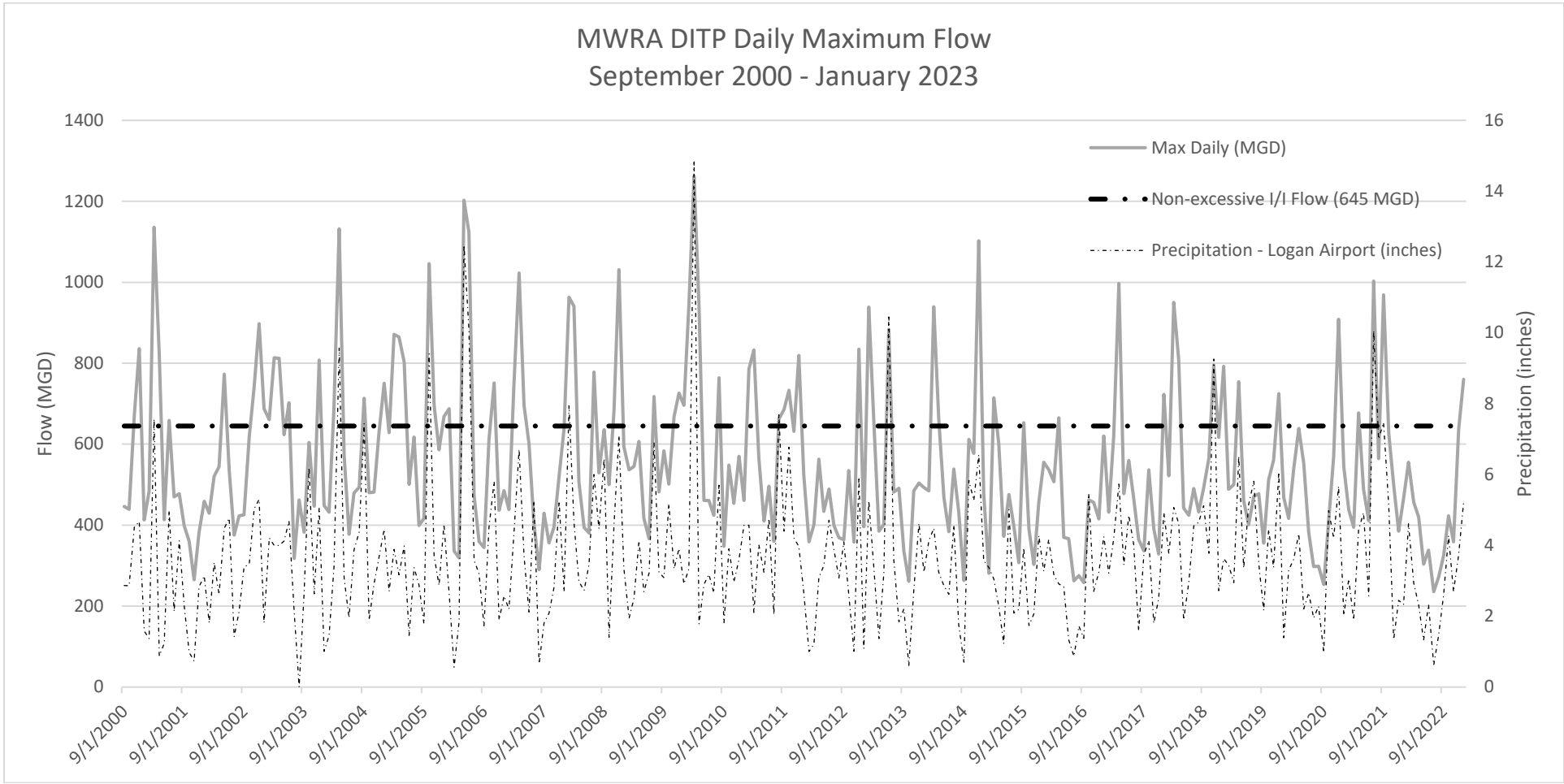

Figure 19: MWRA DITP Daily Maximum Flow compared to non-excessive infiltration/inflow standard.

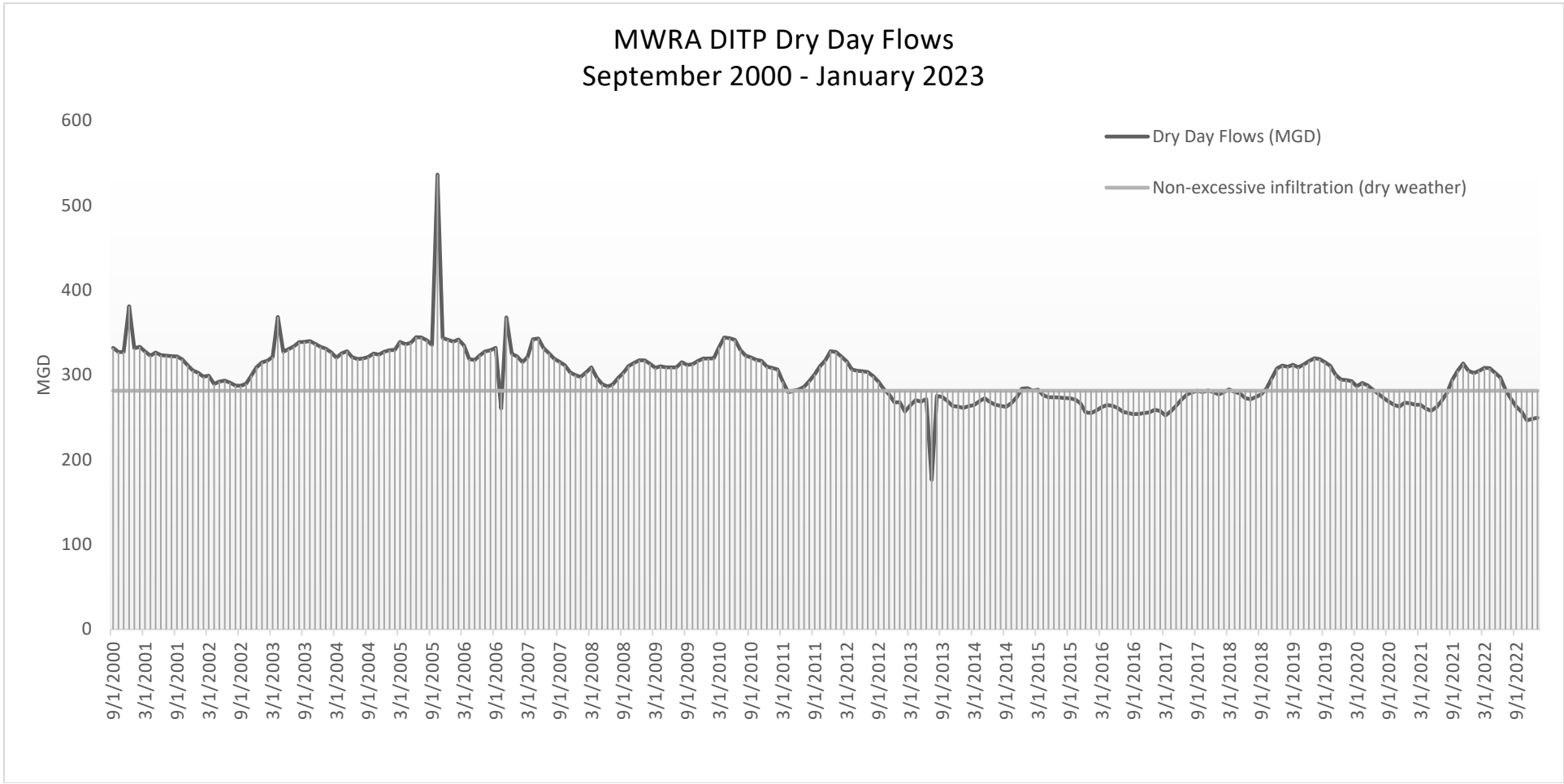

Figure 20: MWRA DITP Dry Day Flows compares to non-excessive infiltration (dry weather) standard.

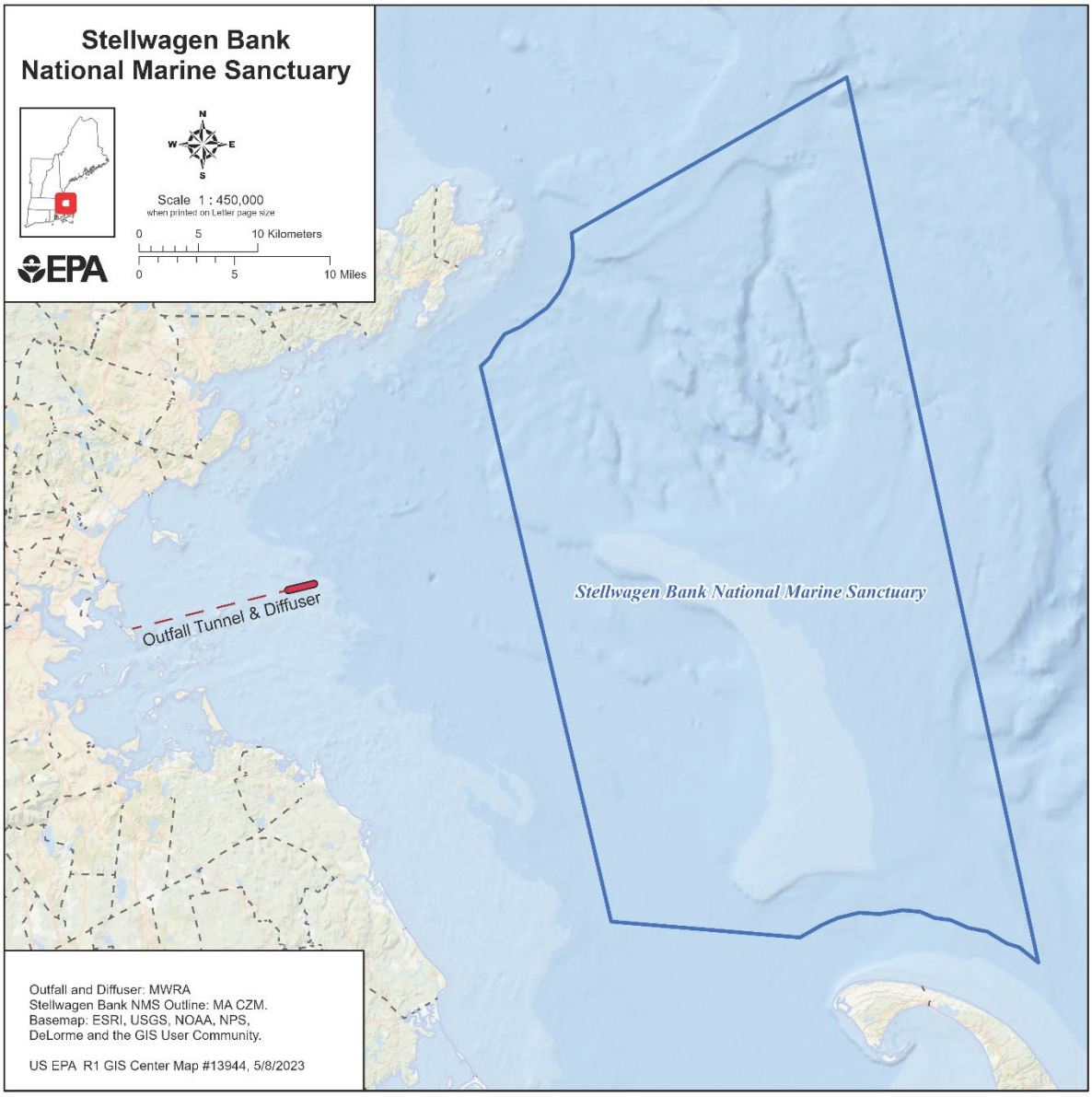

Figure 21: Stellwagen Bank National Marine Sanctuary Boundary and location of the MWRA DITP Outfall T01.

Appendices