2024 Consolidated Assessment and Listing Methodology (CALM) for Section 305(b) and 303(d) Integrated Water Quality Monitoring and Assessment Reporting

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TABLE OF CONTENTS

LIST OF TABLES III

LIST OF FIGURES III

LIST OF ACRONYMS AND TERMS IV

1.0 INTRODUCTION 1
1.1 Background 1
1.2 Integrated Report 2
1.3 Assessment and Listing Methodology 4
1.4 Summary of Major Changes from the 2022 CALM 5

2.0 WATER QUALITY STANDARDS 6
2.1 Designated Uses 7
2.2 Numeric Water Quality Criteria 8
2.3 Narrative Water Quality Criteria 9
2.4 Antidegradation 9

3.0 ASSESSMENT UNITS 10

4.0 GENERAL DATA REQUIREMENTS 12
4.1 Data Sources 12
4.2 Data Management 13
4.2.1 Water Quality Database 13
4.2.2 Assessment Database 13
4.3 Data Quality Objectives 13
4.3.1 Frequency of sampling and sample/dataset size 14
4.3.2 Sampling conditions 15
4.3.3 Probabilistic sampling data 15
4.3.4 Spatial Extent of Assessment 15
4.3.5 Analytical Techniques 16
4.4 Data Quality Assurance 16

5.0 ASSESSMENT AND EVALUATION METHODOLOGY 17
5.1 Use Support Attainment Options 17
5.1.1 Observed Effects 18
5.2 Assessment Quality/Confidence 18
5.3 General Assessment Protocol 19
5.3.1 Assessment Indicators 20
5.3.2 Core Parameters 20
5.3.3 General Assessment Rules 21
5.4 Assessment Methodology by Designated Use 24

5.4.1 Aquatic Life Use Support (AQLUS) Assessment 24
5.4.2 Recreational/Swimming Use Assessment 33
5.4.3 Fish Consumption Use Assessment 35
5.4.4 Shellfish Harvesting/Consumption Use Assessment 36
5.4.5 Shellfish Controlled Relay and Depuration Assessment 37
5.4.6 Drinking Water Use Assessment 38
5.5 Causes and Sources of Impairments 39
5.5.1 Causes 39
5.5.2 Sources 40
6.0 Method to Rank and Prioritize Impaired Waterbodies 41
7.0 Delisting Methodology 43
8.0 Water Quality Monitoring 45
9.0 Public Participation 46
References 47

LIST OF TABLES

Table 1 Integrated Report Categories..... 3
Table 2 Designated Uses for Surface waters as Described in Rhode Island Water Quality Regulations and 305(b)/303(d) Assessments. 8
Table 3 2022 AUs by Waterbody Type[1]. 17
Table 4 Use Support Attainment and Meaning 18
Table 5 Data Quality Requirements 19
Table 6 Designated Uses and Indicators for Attainment Evaluations. 21
Table 7 Protocol for AQLUS Status for AUs with Biological and/or Toxics Data Assessments 25
Table 8 Habitat Assessment Category 26
Table 9 MBCI Score Calculation. 28
Table 10 Biological Condition Categories of MBCI Score 28
Table 11 Biological Condition Categories of Reference Site Approach 29
Table 12 Summary of Bioassessment Determinations 30
Table 13 Bacteria Assessment Framework for Recreational Use. 34
Table 14 Mercury in Fish Tissue Assessment Decision Framework. 35

LIST OF FIGURES

Figure 1 Bioassessment Level IV Ecoregions. 27

LIST OF ACRONYMS AND TERMS

305(b)	Section 305(b) of the Federal Clean Water Act requires states to assess the health of their surface waters and submit biennial reports describing the water quality conditions. In Rhode Island, this was known as the State of the State's Waters Report. In 2008 the 305(b) Report was integrated with the 303(d) List of Impaired Waters and published as the *Integrated Water Quality Monitoring and Assessment Report*.
303(d)	Section 303(d) of the Federal Clean Water Act requires that each state identify waters for which existing required pollution controls are not stringent enough to achieve State water quality standards. Any waterbody or waterbody segment that is assessed as not meeting its water quality standards under the 305(b) assessment process is placed on the 303(d) List of Impaired Waters.
AQLUS	Aquatic Life Use Support.
ATTAINS	USEPA Assessment and Total Maximum Daily Load Tracking and Implementation System Database.
AU	Assessment Unit is a waterbody or waterbody segment.
Acute	A stimulus severe enough to rapidly induce an effect; in aquatic toxicity tests, an effect observed in 96 hours or less is typically considered acute. When referring to aquatic toxicology or human health, an acute effect is not always measured in terms of lethality.
Aquatic Life Criteria	The highest concentration of a pollutant in a water that is not expected to cause toxicity to aquatic life.
Antidegradation	One of three water quality standard components, antidegradation rules contain provisions designed to preserve and protect the existing beneficial uses and to minimize degradation of water quality.
BPJ	Best professional judgment, means a determination, based on best engineering and/or scientific practices and best management practices, involving any pollutant, combination of pollutants or practice(s), on a case-by-case basis, which is determined by the Director to be necessary to carry out the provisions of the Clean Water Act and any applicable chapters of the General Laws of Rhode Island.
Benthic	Of the bottom of a river, lake, sea, or ocean.
CALM	Consolidated Assessment and Listing Methodology provides a description of the assessment and listing methodology used to develop the Section 305(b) water quality assessments and Section 303(d) impaired waters list.
CWA	Clean Water Act, formally the Federal Water Pollution Control Act (33 U.S.C. § 1251) et seq. and all amendments thereto.

Chronic	Defines a stimulus that lingers or continues for a relatively long period of time. The measurement of a chronic effect can be reduced growth, reduced reproduction, etc., in addition to lethality.
DQA	Data quality assurance
DQO	Data quality objective
Designated Uses	Those uses specified in water quality standards for each waterbody or segment whether they are being attained. In no case shall assimilation or transport of pollutants be considered a designated use.
EPA	United States Environmental Protection Agency.
Ecoregion	Relatively homogeneous areas with respect to ecological systems and the interrelationships among organisms and their environment.
Existing Uses	Those designated uses and any other uses that do not impair the designated uses and that are actually attained in a waterbody on or after November 28, 1975; except that in no case shall assimilation or transport of pollutants be considered an existing use.
FDA	United States Food and Drug Administration.
Human Health Criteria	The highest concentration of a pollutant in water that is not expected to pose a significant risk to human health.
IR	Integrated Water Quality Monitoring and Assessment Report. Format for reporting 305(b) water quality assessments and 303(d) Impaired Waters listings.
MCLs	Maximum contaminant levels, maximum permissible level of a contaminant in water which is delivered to any user of a public water system.
MDL	Method Detection Limit/Detection Limit - the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
Macroinvertebrates	Aquatic invertebrate (without a backbone) organisms that are used to assess water quality conditions.
NSSP	National Shellfish Sanitation Program.
OWR	Office of Water Resources at the Rhode Island Department of Environmental Management.
Probabilistic Sampling	Monitoring design where the site selection is random.
QA	Quality assurance.
QAPP	Quality Assurance Project Plan.
QC	Quality control.

QL	Quantitation Level, also known as the minimum level or minimum reporting level, is the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. In general, this is the minimum concentration of an analyte that can be measured and reported with an acceptable degree of confidence.
RBP	Rapid bioassessment protocol.
RIDEM	Rhode Island Department of Environmental Management.
RIDOH	Rhode Island Department of Health.
RIGIS	Rhode Island Geographic Information System.
RIPDES	Rhode Island Pollution Discharge Elimination System.
SDWA	Safe Drinking Water Act.
SWIMS	State Water Information Management System, a SQL database used by RIDEM/OWR to store water quality data.
TMDL	Total Maximum Daily Load is the amount of a pollutant that may be discharged into a waterbody without violating water quality standards. The TMDL is the sum of wasteload allocations for point sources, load allocations for nonpoint sources, and natural background. Also included is a margin of safety. Essentially a water quality restoration plan.
USGS	United States Geological Survey.
WET	Whole Effluent Toxicity.
WQUAL	Access database used by RIDEM/OWR to store shellfishing and historical water quality data.
Water Quality Criteria	Elements of the State water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use.
Water Quality Standards	Define the goals for a waterbody by designating its uses, setting criteria to protect those uses, and establishing provisions to protect water quality from pollution (antidegradation).

Rhode Island Consolidated Assessment and Listing Methodology

for 305(b) and 303(d) Integrated Water Quality Monitoring and Assessment Reporting

1.0 INTRODUCTION

Sections 305(b) and 303(d) of the federal Clean Water Act (CWA) direct states to monitor and report the condition of their water resources. Since 2001, the United States Environmental Protection Agency (EPA) has recommended that states integrate their 305(b) water quality assessment report with their 303(d) List of Impaired Waters into an Integrated Water Quality Monitoring and Assessment Report (Integrated Report). EPA's guidance for the Integrated Reporting and Listing Decisions provides recommendations on the delineation of waterbodies, reporting the status and progress towards comprehensive assessment of state waters, attainment of state water quality standards, and the basis for making attainment decisions.

For the 2024 submissions, EPA draft guidance focuses on planning and prioritizing equitable data acquisition and water quality outcomes with consideration of environmental justice, tribal water resources, consideration of climate change impacts on attainment of water quality standards, assessment and listing of trash impairments, and assessment and listing of nutrient-related impairments. The Integrated Report narrative will be prepared consistent with previous guidance including EPA's 2006 Integrated Reporting Guidance which is supplemented by EPA's subsequent Integrated Report Guidance memos available at https://www.epa.gov/tmdl/integrated-reporting-guidance.

In accordance with these CWA requirements and recent federal guidance, the Rhode Island Consolidated Assessment and Listing Methodology (CALM) documents the decision-making process for assessing and reporting on the quality of the State's surface waters following the Integrated Reporting format. This process is the basis for a majority of water pollution abatement actions undertaken in Rhode Island and is fundamental to watershed-based environmental protection.

1.1 Background

Section 305(b) of the CWA requires each state to assess the health of their surface waters and submit biennial reports describing the water quality conditions. Prior to 2008, the Rhode Island 305(b), *State of the State's Waters Report* provided information on the quality of all assessed waters in the state relative to their designated uses and the water quality criteria established in the Rhode Island Water Quality Regulations.

Section 303(d) of the CWA requires that each state identify waters for which existing required pollution controls are not stringent enough to achieve State water quality standards (water quality designated uses and criteria). These waters are referred to as "water quality limited" or "impaired". RIDEM develops this list of impaired waters from the 305(b) water quality assessments. Any waterbody or waterbody segment that is assessed as not meeting its water quality standards (water quality designated uses and criteria) for a pollutant under the 305(b) water quality assessment process is placed on the 303(d) Impaired Waters List. The 303(d) list

provides an inventory of these waterbodies and the water quality impairment and prioritizes them for restoration. Once a waterbody is identified as impaired, Section 303(d) requires that a Total Maximum Daily Load (TMDL) be developed. TMDLs describe the amount of a given pollutant that a waterbody can receive and still meet water quality standards. The allowable load is allocated among point and non-point sources of pollution with consideration to a margin of safety. The TMDL process provides an analysis of the sources causing the impairment and where possible, the specific actions necessary to achieve the required pollutant reductions needed to meet allocations set by the TMDL.

1.2 Integrated Report

The 305(b) water quality assessment report and the 303(d) impaired waters list must be submitted to EPA every even year. The Integrated Report combines the non-regulatory requirements of the 305(b) water quality assessments with the regulation-based 303(d) List of Impaired Waters, which mandates TMDL development. The RIDEM 2022 submission will continue to follow the Integrated Report format to provide an effective tool for assessing and reporting on the quality of the state's waters.

The Integrated Report allows for a more thorough evaluation of water quality for all designated uses thereby facilitating implementation of the recommendations for comprehensive monitoring detailed in the Rhode Island Monitoring Strategy (RIDEM 2019) (http://dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/ri-water-monitoring-strategy-19.pdf). Furthermore, the integrated approach emphasizes the importance of quality data and science-based decision making in both monitoring and assessment for implementing an effective water quality management program.

The integrated format provides five categories of assessment determination with Category 4 containing 3 subcategories. The Integrated Report categories are summarized below and further discussed in Section 6. Based on the assessment and listing methodology described in this document, each surface waterbody of the state will be placed into one of the following five assessment categories:

Table 1 Overall Waterbody Integrated Report Categories

Category		Integrated Reporting Description	Meaning
Category 1		Attaining all designated uses No use is threatened	Considered "fully supporting" all designated uses
Category 2		Attaining some designated uses No use is threatened Insufficient or no data is available to assess other designated uses	Some designated uses are "fully supporting", more data is needed for other designated uses
Category 3		Insufficient or no data is available to assess any of the designated uses	More monitoring is needed
Category 4		Impaired or threatened for 1 or more designated use but does not require a TMDL plan because:	Impaired or threatened but no TMDL plan development needed
	A	TMDL has already been completed	
	B	Other pollution control measures are reasonably expected to result in attainment of water quality standard in near future	
	C	Impairment is not caused by a pollutant (e.g. aquatic invasive species)	
Category 5[1]		Impaired or threatened for 1 or more designated uses and requires a TMDL plan	Development of TMDL plan needed 303(d) Impaired Waters List

[1]Category 5 represents reporting requirements under Section 303(d). Therefore, the regulatory requirements (i.e., EPA approval, public participation, etc.) only apply to Category 5 of the Integrated Report.

While each waterbody will be placed into only one of the 5 reporting categories, the attainment status of each designated use for each waterbody can be tracked to assist in addressing data gaps and directing monitoring. For the purposes of Section 303(d) impaired waters listing requirements (Categories 4A, 4B, and 4C and 5), it is important to distinguish if the impairment is due to pollution or a pollutant:

1. Pollutant generally refers to a chemical and/or physical parameter which will likely alter the physical, chemical, biological, or radiological characteristics and/or integrity of water[1].

2. Pollution is defined as the human-made or human-induced alteration of the physical, chemical, biological or radiological characteristics and/or integrity of water, including many types of changes to a waterbody such as alterations to the character of the water (e.g., exotic, non-native, or invasive species; habitat degradation; flow

[1] The legal definition of pollutant can be found in the Rhode Island Water Quality Regulations: https://rules.sos.ri.gov/regulations/part/250-150-05-1

alteration) that do not result from the introduction of a specific pollutant or presence of pollutants in a waterbody at a level that causes an impairment.

Section 303(d) is a mechanism that requires an accounting and allocation of pollutants introduced into impaired waters. In some cases, the pollution is caused by the presence of a pollutant, and a TMDL is required (Category 5). Not all pollution-causing activities must be analyzed and allocated in a TMDL (Category 5). In some waters, the impairment is caused by pollution activities other than the introduction of a pollutant. These waters impaired by pollution are listed in Category 4C to be addressed by a more appropriate program. Furthermore, 303(d) allows for use of Category 4B, which is another way to address pollution when a TMDL is the not most appropriate method.

The Integrated Report combines the non-regulatory requirements of the 305(b) water quality assessments with the regulation-based 303(d) List of Impaired Waters which mandates TMDL development. While all five Categories represent assessment status under Section 305(b), Category 5 represents reporting requirements under Section 303(d). Therefore, the regulatory requirements (i.e., USEPA approval, public participation, etc.) only apply to Category 5 of the Integrated Report.

1.3 Assessment and Listing Methodology

This Consolidated Assessment and Listing Methodology (CALM) document describes in detail the decision-making process for assessing the quality of surface waters in accordance with requirements of Section 305(b) and for generating the list of impaired waters in accordance with requirements of Section 303(d). The CALM describes the quality of data necessary to be used in the assessment and listing process and how that data and information are then interpreted to arrive at an assessment of water quality for placement in one of the 5 Integrated Report Categories. The assessment and listing methodology is based on the following documents:

- *Consolidated Assessment and Listing Methodology, Toward a Compendium of Best Practices*, USEPA, First Edition, July 2002. USEPA 2002 (https://www.epa.gov/waterdata/consolidated-assessment-and-listing-methodology-calm).
- *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Report Contents,* USEPA September 1997, EPA-841-B-97-002A (https://www.epa.gov/sites/production/files/2015-09/documents/guidelines_for_preparation_of_the_comprehensive_state_water_quality_assessments_305b_reports_and_electronic_updates_1997_volume1.pdf).
- *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Supplement*, USEPA September 1997, EPA-841-B-97-002B (https://www.epa.gov/sites/production/files/2015-09/documents/guidelines_for_preparation_of_the_comprehensive_state_water_qu

ality_assessments_305b_reports_and_electronic_updates_1997_supplement-volume2.pdf).

- *Rhode Island Water Quality Regulations, August 2018* (https://rules.sos.ri.gov/regulations/part/250-150-05-1).
- Guidance for Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act (https://www.epa.gov/tmdl/integrated-reporting-guidance)

1.4 Summary of Major Changes from the 2022 CALM

There are no assessment changes from the 2022 CALM. All updates in this document are editorial or grammatical in nature.

2.0 WATER QUALITY STANDARDS

The CALM is used to document the decision-making processes exercised to assess attainment of the State's water quality standards. Water quality standards serve as the foundation for the State's water quality management program. Water quality standards define the goals for a waterbody by designating its uses, setting criteria to protect those uses, and establishing provisions to maintain and protect water quality from pollutants. A water quality standard consists of three basic elements:

- ***Designated Uses*** are the goals for a specific waterbody (e.g. recreation, water supply, aquatic life, etc.),
- ***Water Quality Criteria*** are numeric pollutant concentrations and/or narrative requirements to protect designated uses
- ***Antidegradation Policy*** to maintain and protect existing uses and high-quality waters.

The Rhode Island water quality standards have been developed to restore, preserve, and enhance the water quality of Rhode Island waters, and to maintain existing uses. These standards provide for the protection of the waters from pollutants so that the waters shall, where attainable, be fishable and swimmable and be available for all designated uses; thus, assuring protection for the public health, welfare, and the environment. These objectives are implemented through the water quality standards, which are a fundamental element of the state's Water Quality Regulations (RIDEM 2018) (https://rules.sos.ri.gov/regulations/part/250-150-05-1).

Within the Water Quality Regulations are numeric water quality criteria that represent parameter-specific thresholds for acceptable levels of substances in waters of the state. For other parameters, the standard is descriptive (narrative) in nature (e.g. "no toxics in toxic amounts"). The Water Quality Regulations also contain antidegradation rules and policies. The provisions of the State Antidegradation Regulations have as their objective the maintenance and protection of various levels of water quality and uses.

As described in the Water Quality Regulations, all surface waters of the state are assigned to one of four freshwater (Class AA, A, B, B1) or one of three saltwater (Class SA, SB, SB1) classifications. Each class is defined by the designated uses (see Section 2.1) which are the most sensitive and, therefore, governing water use(s) which it is intended to protect. Surface waters may be suitable for other beneficial uses but are regulated to protect and enhance the designated uses. Another classification, Class C or SC, is described in the Water Quality Regulation and is available should it be proven through a Use Attainability Analysis (UAA) that this classification is appropriate. This C or SC classification is not, however, currently designated to any waterbodies because it does not meet the "swimmable" goals of the CWA.

In addition, the state has incorporated partial use classifications into the Water Quality Regulations. Partial use denotes specific restrictions of use assigned to a waterbody or waterbody segment that may affect the application of criteria. Partial use designations have been adopted in the Water Quality Regulations for waters which will likely be impacted by activities such as combined sewer overflows (CSOs) and concentrations of vessels (marinas and/or mooring fields). Partial use designation for waters impacted by CSOs are denoted by "{a}" following the classification. Partial use designation for waters with concentration of vessels are denoted by "{b}" following the classification.

2.1 Designated Uses

Designated uses are goals or intended uses for surface waterbodies, whether they are being attained or not. In accordance with Section 305(b) of the CWA, states are required to survey their water quality for attainment of the "fishable/swimmable" goals of the Act. The attainment of the CWA goals is measured by determining how well waters support their designated uses. Six designated uses are evaluated for the purposes of the 305(b) water quality assessment process. There are slight differences in the wording for designated uses as they are stated in the Water Quality Regulations and as they are described in 305(b) assessments. Table 1 lists the designated uses as they appear in the 305(b) assessment process, the comparable designated use as described in the Water Quality Regulations, and the applicable water classification to which the designated uses apply.

Table 2 Designated Uses for Surface waters as Described in Rhode Island Water Quality Regulations and 305(b)/303(d) Assessments.

305(b) Designated Use	RI WQ Regulations Designated Use	Applicable Classification of Water	Designated Use Definition
Drinking Water Supply	Public Drinking Water Supply	AA	The waterbody can supply safe drinking water with conventional treatment.
Swimming/ Recreation	Primary Contact Recreation	AA[1], A, B, B1, B{a}, B1{a}, SA, SA{b}, SB, SB{a}, SB1, SB1{a} (all surface waters)	Swimming, water skiing, surfing and similar water contact activities where a high degree of bodily contact with the water, immersion and ingestion are likely.
Swimming/ Recreation	Secondary Contact Recreation	AA[1], A, B, B1, B{a}, B1{a}, C, SA, SA{b}, SB, SB{a}, SB1, SB1{a}, SC (all surface waters)	Boating, canoeing, fishing, kayaking or other recreational activities in which there is minimal contact by the human body with the water and the probability of immersion and/or ingestion of the water is minimal.
Aquatic Life Support/ Fish, other Aquatic Life, and Wildlife	Fish and Wildlife Habitat	AA, A, B, B1, B{a}, B1{a}, C, SA, SA{b}, SB, SB{a}, SB1, SB1{a}, SC (all surface waters)	Waters suitable for the protection, maintenance, and propagation of a viable community of aquatic life and wildlife.
Shellfishing/ Shellfish Consumption	Shellfish harvesting for direct human consumption	SA, SA{b}	The waterbody supports a population of shellfish and is free from pathogens that could pose a human health risk to consumers
Shellfish Controlled Relay and Depuration	Shellfish harvesting for controlled relay and depuration	SB, SB{a}	Waters are suitable for the transplant of shellfish to Class SA waters for ambient depuration and controlled harvest.
Fish Consumption	No specific analogous use, but implicit in "Fish and Wildlife Habitat"	AA, A, B, B1, B{a}, B1{a}, C, SA, SA{b}, SB, SB{a}, SB1, SB1{a}, SC (all surface waters)	The waterbody supports fish free from contamination that could pose a human health risk to consumers.

[1]Class AA waters may be subject to restricted recreational use by State and local authorities.

2.2 Numeric Water Quality Criteria

Pursuant to the CWA requirements, Rhode Island has adopted water quality criteria for the protection of aquatic life and human health, in the Water Quality Regulations. The criteria consist of numeric values that represent parameter-specific thresholds for acceptable levels of substances in the waters of the state. The State has adopted numeric aquatic life criteria for conventional (dissolved oxygen, pH, temperature, etc.) parameters that are class-specific values. In other words, the criteria may vary depending on the water quality classification of the waterbody. The criteria for these chemical and physical parameters appear in §§1.10(D)(1) and 1.10(E)(1) of the Water Quality Regulations.

The State has also adopted numeric aquatic life criteria for toxic parameters (metals, organics, chlorine, and ammonia) that apply to *all* water classifications. The criteria for these parameters

can be found in §1.26 of the Water Quality Regulations. The Water Quality Regulations also contain water column criteria for the protection of human health from water and aquatic life consumption. These human health water quality criteria can be found in §1.26 of the Water Quality Regulations.

2.3 Narrative Water Quality Criteria

The state has adopted narrative criteria to supplement the numeric criteria. Narrative criteria are descriptions of the conditions necessary for a waterbody to attain its designated use. The narrative criteria are contained within the Water Quality Regulations. The state uses these descriptive criteria to evaluate water quality indicators such as toxicity, nutrients, excess algal growth, noxious aquatic plants, aesthetics, habitat, and biological condition. In general, the state's narrative criteria indicate that waters should be free from substances that:

- Cause injury to, are toxic to, or produce adverse physiological responses in humans, animals, or plants;
- Settle to form objectionable deposits;
- Float as debris, scum, oil, or other material in concentrations that form nuisances;
- Produce objectionable color, odor, taste, or turbidity; or
- Produce undesirable aquatic life or result in the dominance of nuisance species.

2.4 Antidegradation

The third component of water quality standards are the antidegradation rules that contain provisions designed to preserve and protect the existing beneficial uses and to minimize degradation of the state's water quality. The antidegradation provisions consist of four tiers of water quality protection as defined in the Water Quality Regulations:

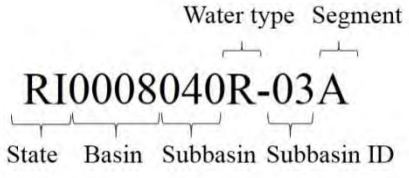
- Tier 1 – Protection of Existing Uses
- Tier 2 – Protection of Water Quality in High Quality Waters
- Tier 2½ – Protection of Water Quality for Special Resource Protection Waters
- Tier 3 – Protection of Water Quality for Outstanding Natural Resource Waters

Antidegradation applies to all projects or activities subject to the Rhode Island Water Quality Regulation which will likely lower water quality or affect existing or designated uses.

3.0 ASSESSMENT UNITS

The waters of the state that are reported under the 305(b) and 303(d) reporting have been assigned to an assessment unit (AU), which refers to a waterbody or waterbody segment. Each assessment unit has been assigned an identifying number, referred to as a waterbody ID (WBID). These identifying numbers are unique to the waterbody to allow for tracking of water quality data and assessment information and indexing in RIGIS (Rhode Island Geographic Information System) for mapping purposes. The state tracks and assesses surface waterbodies visible on a 1:24,000 scale map (USGS topographic map). In some cases, the entire waterbody is considered as one AU, which is generally the case for lakes in the state. In other cases, the waterbody is segmented into several AUs. This is the situation for most rivers and estuarine waters. Waters are segmented to reflect classification changes, hydrologic drainage basin boundaries, assessment changes, land use changes, and shellfish growing area status. Waters are also segmented to differentiate among waterbody types (lake, river, estuarine, coastal, or marine). There are, however, AUs for river segments that may include run-of-the-river lakes (impoundments/reservoirs) along the course of the river segment. The length or size of each AU is estimated by RIGIS. Due to refinements in software, estimates of AU size may vary slightly from year to year. Assessments are conducted on each individual assessment unit. Water quality data collected within an AU is considered to be representative of the entire AU unless and until more recent data or information indicate otherwise. A listing of the waterbodies/AUs and their waterbody ID numbers can be found in §1.25 of the Rhode Island Water Quality Regulations.

The unique identifying number for each AU is based upon the Basin and Subbasin within which each AU is located. For this purpose, Rhode Island has been divided into 10 major Basins: Blackstone, Woonasquatucket, Moshassuck, Ten Mile, Thames, Pawtuxet, Narragansett, Pawcatuck, Westport, and Coastal. Each ID number begins with “RI” to indicate that this waterbody is in Rhode Island. The next four digits indicate which Basin the waterbody is located within. The next three digits indicate which Subbasin the waterbody is located within. The next letter is an indication of the waterbody type where an “R” is for river, “E” is for estuarine, “L” is for lake, “C” is for coastal shoreline (classified in ATTAINS as ocean/near coastal), and “M” is for marine waters (classified in ATTAINS as ocean). The last two digits represent the Subbasin ID for the waterbody. Some waters also contain a letter that is used to indicate various segments within a particular subbasin ID:



For example, RI0008040R-03A represents the Pawcatuck River Basin (RI0008), Wood River Subbasin (040), a river waterbody type (R), Brushy Brook (03), segment A of the brook.

While assessments are determined on an individual AU basis; to comply with federal EPA reporting requirements, RIDEM will compile assessment results on the basis of 12-digit HUC watershed sub-basins. Performance measures associated with EPA's Strategic Plan, are intended to track improvements of these sub-basins over time.

4.0 General Data Requirements

As stated in RIDEM's Quality Management Plan (RIDEM 2017), it is the policy of the RIDEM that all environmental data generated and compiled shall be of known quality and adequate for its intended use, well documented, and be verifiable and defensible. RIDEM's OWR staff review all readily available data to be used in the assessment and listing determinations for consistency with data quality assurances (DQA) and data quality objectives (DQO) described below. Furthermore, OWR staff review monitoring data in accordance with the Department's *Summary Guidance for Reviewing Environmental Monitoring Data* (RIDEM 2007) (http://www.dem.ri.gov/pubs/sops/datarevw.pdf) and project-associated Quality Assurance Project Plans (QAPPs).

4.1 Data Sources

RIDEM strives to consider all readily available water quality data and related information in developing the 305(b) water quality assessments and 303(d) impaired waters listing. In determining if data are appropriate, RIDEM considers quality assurance/quality control, data quality objectives, monitoring design, age of data, accuracy of sampling location information, data documentation, and data format (hard copy versus electronic).

The primary source of data generated for assessments is developed from programs consistent with the Rhode Island Water Monitoring Strategy (RIDEM 2019). As the Monitoring Strategy is implemented, there continues to be gaps that have to be addressed with additional investments of resources. Data generated from implementation of the Monitoring Strategy are used in multiple programs but one of the primary purposes is to support the assessment process.

There is a variety of data generated in programs outside of the Water Monitoring Strategy framework. This includes data generated by special projects, research, volunteer efforts, and the federal government. RIDEM is interested in all such data and gives it consideration, but the applicability to the assessment process may be limited by the sampling design and data quality objectives of those projects. That data, because it generally has not been collected for assessment purposes, may be limited for application in assessments due to the frequency of sampling, indicators collected, number of samples, etc. The DQOs outlined below are used to allow RIDEM to determine, in a consistent manner, whether this data can be used to make decisions about the water quality attainment status.

Prior to initiating data review, RIDEM solicits water quality data through verbal requests at meetings and workshops, postings on the RIDEM website, and through written/email requests to organizations, individuals, and agencies that potentially collect water quality data. DQA and DQO preferences for use in assessments and a time schedule by which data must be submitted for consideration in developing the next Integrated Report assessments, are noted in the data request. A cutoff date is necessary to ensure adequate time for staff to process, assess, and report the information by the EPA mandated deadlines. RIDEM will accept hard copy and/or electronic data and information from all projects. However, electronic data are preferred, and

considered more readily available, due to the significant effort that may be needed to analyze large hard copy datasets.

Data must be submitted to RIDEM with the required quality assurance and quality objective documentation as noted below. If the data collection and analysis does not include appropriate DQA and DQO, the data may still be considered for the water quality assessments following a qualitative approach as discussed in Sections 4.3, 4.4 and 5. RIDEM is committed to using only data that meets the DQOs and DQAs as outlined below, to develop the impaired waters list (Category 5 of the Integrated Report).

4.2 Data Management

Both ambient water quality data and water quality assessment and listing information are stored in databases maintained by staff of RIDEM's Office of Water Resources (SWIMS) and EPA (ATTAINS).

4.2.1 Water Quality Database

For the 2022 assessments, ambient (instream) chemical monitoring data are managed by means of an SQL database, SWIMS (State Water Information Management System), that was developed by enfoTech and OWR staff. SWIMS has been developed to compare most water quality data to the appropriate Rhode Island water quality numeric criteria and to generate reports of the data for each AU.

RIDEM/OWR in coordination with a contractor (Tetra Tech) developed a Microsoft Access database, BioQual, that stores, retrieves, and analyzes data relating to benthic macroinvertebrate communities, instream habitat, and site physical characteristics. This database is currently used to maintain and evaluate macroinvertebrate data.

4.2.2 Assessment Database

Assessment information generated for the Integrated Reports will be maintained in a database called ATTAINS (Assessment and TMDL Tracking and Implementation System) that was developed by EPA and their contractors. ATTAINS is a data management tool designed to store assessment information in a way that is consistent with EPA's guidance on generating the Integrated Report, including listing the 5 categories of waterbodies. EPA developed ATTAINS to ease the burden of state reporting, encourage standardization of reporting among states, along with other goals.

4.3 Data Quality Objectives

Data Quality Objectives (DQOs) describe the intended use of the data and some of the requirements that must be attained (quality and quantity) to meet the intended use. For purposes of water quality assessments and impaired waters listings, data must be of a certain quantity and quality to adequately meet environmental management and regulatory decision-

making needs. DQOs for the water quality assessment and listing process ensure that the majority of data relied upon for assessment and listing decisions is of high quality. To meet the assessment and listing objectives, certain data quality, frequency, duration, dataset size, and type of data are required. While RIDEM will consider all available data, in some cases data may not meet these DQOs. Use of datasets that do not meet the DQOs described below, is discussed in Section 5.3.

4.3.1 Frequency of sampling and sample/dataset size

The number of water chemistry samples needed to make a use support decision plays a large role in how defensible and rigorous the assessment is. Due to variability of chemical (toxics and conventional parameters excluding dissolved oxygen) data, to support as an acceptable, valid analysis, a dataset based on a minimum of 5 data points is recommended. A smaller dataset may be utilized following the modified assessment method as described in Section 5.3.

For lakes, a growing seasonal sampling index period of monitoring data is considered sufficient for use in conducting lakes assessments. Given the biological response of lakes to variations in the weather, one year of data is not always considered representative of the general condition of the lake. Assessment decisions are enhanced when based on several years of data. Because the state currently obtains most lake water quality data from an agreement with the URI Watershed Watch Program (URIWW), the lake sampling index period is defined as April to November to be consistent with the URIWW's sampling schedule. Samples are collected on a monthly or twice-monthly basis depending on the parameter.

For rivers and streams, a seasonal sampling index period that extends from August through September is required for biological data, and the collection of chemical data extends from May through October. Chemical data is collected in support of biological and physical information. While it is not intended to be used alone for aquatic life use support assessments, in cases where no biological or physical data has been collected or assessment procedures for that type of data have not been developed, chemical data alone can be used to assess aquatic life use. Sampling following RIDEM's macroinvertebrate monitoring protocol for wadeable rivers (Section 5.4.3), includes one sample per site during the sampling index period. There are certain areas, including the coastal zone, in which current methods and metrics are not practical to collect biological data. In such cases, the only available data for aquatic life use assessments is chemical data. At this time, the macroinvertebrate sampling of large rivers has been discontinued until an acceptable method of sampling has been developed. Further assessment information is detailed in Section 5.4.1.

The Rhode Island saltwater dissolved oxygen criteria evaluates cumulative exposures of low dissolved oxygen with established minimum standards. Therefore, Rhode Island relies on continuously collected saltwater dissolved oxygen data or data that can correlate to continuous data. Grab samples or similar dissolved oxygen data may still be considered if it can be correlated to continuous data or is representative of a longer time period. The saltwater

dissolved oxygen criteria evaluates cumulative exposures of low dissolved oxygen observed during May to October.

4.3.2 Sampling conditions

RIDEM will accept data collected under any sampling conditions such as low or high tide, dry or wet weather. The Department requests that the sampling conditions and other metadata about sample collection are documented within the data report/submission. Useful sampling condition information includes date and time of sampling, tide conditions, depth sampled, flow, date, and amount of last rainfall event. This information will be examined during the determination of usability of the data for assessment purposes.

4.3.3 Probabilistic sampling data

Probabilistic surveys are targeted to populations of waterbodies rather than individual waterbodies. In most probabilistic surveys, the design results in collection of samples from a single point on a single day. Biological (macroinvertebrate) and fish tissue data collected by probabilistic monitoring may have applicability to the assessment process to individual waterbodies, but the data might be constrained by the applicability of the field methods or seasonality employed. Chemical data limited to a single sampling event will have less applicability given the DQOs of the assessment program. Single sample information may be used to direct additional targeted monitoring to those areas that indicate potential water quality degradation. Rhode Island is fulfilling its obligation to EPA to conduct probabilistic monitoring by coordination with EPA's Atlantic Coastal Environmental Sciences Division (ACESD) and RIDEM's Division of Fish and Wildlife to sample all lakes with publicly accessible boat ramps and fishing areas effectively conducting a census of that lake population.

4.3.4 Spatial Extent of Assessment

Assessments are based on one or more sampling stations the Department deems representative of an AU for a distance upstream and downstream where no significant influences (land use, point source discharges, etc.) exist that might change water quality or biological and habitat conditions. For lakes, a single sampling station (usually located at the deepest point of the lake) is generally considered representative for the entire lake. Future refinement to the monitoring strategy for lakes is to add additional sampling in larger lakes with geomorphologically unique areas. As described in Section 3, for rivers and estuarine waters, the boundaries of the AUs were defined taking into account land use changes, pollution sources, classification changes and assessment changes. Depending upon the consistency of the watershed conditions (land use, discharges, etc.), monitoring data from a sampling location in one AU may be considered applicable to upstream and/or downstream AUs as well. In general, for wadeable streams, a single monitoring station should only be considered representative of no more than 10 miles of stream length unless circumstances (e.g., watershed or landuse characteristics) suggest otherwise.

4.3.5 Analytical Techniques

Clean sampling and analytical techniques will be implemented as needed to meet DQOs for use of the data. In addition, adequately sensitive analytical methods will be implemented to achieve necessary detection limits and quantitation levels for intended use of the data.

4.4 Data Quality Assurance

Quality assurance (QA) is an important component of the major monitoring programs relied upon by state water protection programs. It is important to ensure that the data generated by monitoring and used to support decision-making in water protection programs is valid and appropriate. RIDEM maintains a goal of generating and compiling data of acceptable quality for use in the water quality assessment program. To achieve this goal, certain data quality assurance and quality control procedures must be met. QA is defined as the overall management system of a project including the organization, planning, data collection, quality control, documentation, evaluation, and reporting activities. QA provides the information needed to determine the data's quality and whether it meets the project's requirements. Quality control (QC) is defined as the routine technical activities intended primarily to control errors. Since errors can occur in either the field, the laboratory, or in the office, QC must be a part of each of these activities.

To comply with EPA regulations, monitoring projects funded by federal money are required to develop, submit, and implement an EPA approved Quality Assurance Project Plan (QAPP). QAPPs define the scope of work for the project, including the DQOs, and QA/QC. Not all monitoring programs operate with QAPPs oriented to EPA guidance. RIDEM may receive and use data from such programs but is obligated to document quality assurance to make decisions in the assessment of water quality, especially for development of the Category 5 Impaired Waters List, which is also known as the 303(d) List. Water quality monitoring data and information must follow EPA's Quality Assurance/Quality Control (QA/QC) guidelines as documented in EPA New England's *Quality Assurance Project Plan Program Guidance* (USEPA 2010), to be utilized in the development of the Rhode Island Impaired Waters List (Category 5). Where quality assurance is not documented or has not met minimum requirements, the data will be given less weight and may be used to assess waters into one of the other four categories of the Integrated Report but will most likely be considered as insufficient data. Use of datasets that do not meet these QA/QC protocols is discussed further in Section 5.

5.0 Assessment and Evaluation Methodology

Once data is evaluated for attainment of the DQO and DQA requirements described above, an assessment is conducted where the water quality data are compared to the narrative and numeric criteria to evaluate attainment of the designated uses defined for each waterbody. This section describes the assessment methodology for interpreting compliance with the water quality standards (designated uses and criteria) and determination of use support attainment for placement in one of the five Integrated Report Categories.

To comply with federal EPA reporting requirements, RIDEM will compile assessment results on the basis of 12-digit HUC watershed sub-basins. Performance measures associated with EPA's Strategic Plan are intended to track improvements of these sub-basins over time.

Table 3 2024 AUs by Waterbody Type[1].

Waterbody Type	Total Size in the State at 1:24,000	Total Size Tracked	Total Number of Assessment Units Tracked
Rivers and Streams	1,436.00 Miles	1,375.91 Miles	511
Lakes and Ponds	23,240.00 Acres	18,692.82 Acres	233
Estuarine	157.00 Sq. Miles	159.21 Sq. Miles	138
Coastal Shoreline (Ocean/Near Coastal)	73.40 Sq. Miles	73.3 Sq. Miles	4
Marine (Ocean)	226.70 Sq. Miles	226.27 Sq. Miles	4
		Total	889

[1]Included in ATTAINS as of April 2021.

5.1 Use Support Attainment Options

In conducting water quality assessments, each designated use (e.g. fish consumption, recreation, aquatic life) of a waterbody or waterbody segment is assigned a level of use support that characterizes the degree to which to the water is attaining that use. One of the following Use Support Attainment groups is assigned to each designated use for each AU:

Table 4 Use Support Attainment and Meaning

Use Support Attainment	Meaning
Fully Supporting	Sufficient data or information is available to demonstrate that water quality standards are being attained
Not Supporting	Sufficient data or information is available to indicate impairment (non-attainment) of water quality standards
Insufficient Data/Information	Data or information is not sufficient to make an assessment determination
Not Assessed	No data or information available
Threatened	Data or information indicate use is currently fully supporting, but impairment (non-attainment) is expected by the next Integrated Report cycle

For each AU, once each designated use is assessed and assigned into one of the use support attainment groups above, that information is summarized such that each AU is then placed into one of the Integrated Reporting Categories as discussed in Section 1.2.

5.1.1 Observed Effects

The Integrated Reporting guidance allows for tracking monitoring observations that may indicate a decline in water quality or response to pollutants or other stressors. These monitoring observations are called Observed Effects and do not affect the assessment and subsequent placement of the AU into one of the Integrated Reporting Categories discussed in Section 1.2. Observed Effects may be used to direct future monitoring efforts to determine if an impairment should be listed.

5.2 Assessment Quality/Confidence

Data used to make assessment decisions, especially for listing a waterbody into Category 5, must be defensible. Therefore, the quality of the data used to determine an assessment must be documented to define the basis of the final assessment determination. The four levels of information and a description of the data quality associated with each level, are as follows:

Table 5 Data Quality Requirements

Data Quality Level	Data Quality	Meaning
Level 1	Low	• Data or information does not have a Scope of Work (SOW) or QA/QC Plan or QAPP available; and/or the plans were not followed; and/or the plans do not meet requirements noted in this document; and/or samplers had no training. • Data may be 10 years old or older; considered evaluated (not monitored) or qualitative based upon land use, citizen complaints or observations. • This information is not considered sufficient for use in conducting an assessment and without other data would lead the waterbody to be considered unassessed or not assessed. Used to guide future monitoring activities under the Monitoring Strategy.
Level 2	Fair	• Data or information collected following a basic QA/QC plan or QAPP that is documented and available. The QA/QC Plan or QAPP meet some of the requirements noted in this document. Samplers had minor training. • Data may be between 5 and 10 years old and may include some evaluated or qualitative observations from qualified professionals. • This information would be used to conduct a water quality assessment but would most likely be considered insufficient data. The quality of this data may be questionable for an impairment determination.
Level 3	Good	• Data or information is collected following an adequate QA/QC plan or QAPP that is documented and available. The QA/QC Plan or QAPP meet most of the requirements noted in this document. Samplers had moderate training. • Data has been collected during the past 5 years. • This information is considered sufficient for an impairment determination and subsequent listing in Category 5.
Level 4	Excellent	• Data or information are of the highest quality and provide relatively high level of certainty. Data in this level are collected following a QAPP or QA/QC plan that is documented and available and samplers were well trained. • Data has been collected during the past 5 years. • This information and data is considered sufficient for an impairment determination and subsequent listing in Category 5.

5.3 General Assessment Protocol

This section describes the general rules followed for data evaluation and assessment and listing determinations. Some of these general rules have been discussed previously in this document. In addition, more information about the listing methodology can be found in Section 6.

5.3.1 Assessment Indicators

Under the assessment process, the term "indicators" refers to a wide range of measures of water quality (e.g., physical, chemical, biological, etc.). For any designated use, there are often many indicators that can be evaluated to determine the use attainment status. Table 6 shows the designated uses and associated indicators utilized to assess attainment of each designated use. Many of the indicators can be easily linked to enforceable water quality standards. In other cases, the data collected for an indicator may not be easily compared to a standard or threshold. Such data may not be directly used in the water quality assessment process but are needed to understand the functioning of aquatic ecosystems for purposes of effective protection and management.

For several uses there is a hierarchy of indicators used to assess attainment with the water quality standards. The core indicators, shown in bold in Table 6, represent the most direct measures of the use and are considered the primary data needed to support water quality standards attainment decisions and to identify impaired waters. Table 6 also notes several indirect measures of designated use attainment. These supplemental indicators may be evaluated for waters where there is a reasonable potential for specific pollutants to cause or contribute to water quality impairments based on evaluation of watershed conditions, including land use and source assessments.

5.3.2 Core Parameters

For the purposes of water quality assessments, core and supplemental indicators used to evaluate each use are shown in Table 6. For aquatic life use assessments, the current preferred practice is to use one biological assemblage, macroinvertebrates. Table 6 also notes several indirect measures of designated use attainment. These supplemental indicators may be added for waters where there is a reasonable potential for specific pollutants to cause or contribute to water quality impairments based on evaluation of waterbody and watershed conditions, including land use and source assessments.

For drinking water use assessments of surface waterbodies, the analysis is complex, covering a broader range of parameters/indicators. Rhode Island Department of Health (RIDOH) regulations require terminal reservoirs to be sampled in accordance with drinking water program requirements. Samples are usually collected from one location near the intake to the drinking water treatment plant. In these terminal reservoirs, the analyses entail a list of over 100 parameters that reflect the compounds for which MCLs have been established for *finished* drinking water. RIDOH uses this data to determine drinking water use attainment for the terminal reservoirs. In many water supply districts, upgradient reservoirs and tributaries are not routinely sampled by the water suppliers. Furthermore, in the upgradient waters the range of parameters analyzed is significantly less than the over 100 parameters that correspond to RIDOH's MCL's. RIDEM and RIDOH plan to work toward defining the core parameters/indicators required to assess drinking water use attainment for these up-gradient reservoirs and tributaries within drinking water supply systems.

Table 6 Designated Uses and Indicators for Attainment Evaluations.

Designated Use	Indicators Evaluated[1]
Drinking Water Supply	• Compliance with SDWA standards (MCLs) in the finished drinking water[2] • Finished Drinking Water Restrictions – use advisories associated with source water contamination[2] • Treatment Requirements – contaminants in source water that requires more than conventional treatment[2] • Fecal coliform bacteria (terminal reservoir)[3]
Swimming/Primary and Secondary Recreation	• **Enterococci**[3] • **Fecal coliform bacteria**[3] • **Beach closure information for designated beach waters**[2] • Minimum water quality general criteria and aesthetics (narrative criteria) [3]
Fish, other Aquatic Life, and Wildlife	• **Biological (macroinvertebrate) data including physical habitat information**[3] • **Conventional parameters**[3] • Toxic parameters in water column[3] • Toxicity data[3] • Minimum water quality general criteria and aesthetics (narrative criteria) [3]
Shellfish Consumption	• **Fecal coliform bacteria**[2] • **Rhode Island Shellfish Growing Area Monitoring Program classifications** • Minimum water quality general criteria and aesthetics (narrative criteria)[3]
Shellfish Controlled Relay and Depuration	• See Section 5.4.7
Fish Consumption	• **Fish consumption advisories for specific waterbodies**[4]

[1]Core indicators are represented in **bold** lettering.
[2]Evaluated by Rhode Island Department of Health (RIDOH)
[3]Evaluated using the Rhode Island Water Quality Regulations
[4]Described further in section 5.4.3

5.3.3 General Assessment Rules

This section describes the general rules followed for data evaluation and assessment and listing determinations. More information can be found in Section 6.

1. **Inconsistent Data**: Depending on the waterbody, different types of acceptable data may be available for water quality assessments and listings. It is not uncommon to have inconsistent water quality data (meaning different types of data); therefore, some interpretation is required in making the final assessment decision. RIDEM employs a weight of evidence approach that considers the amount of each type of

data, the quality of each dataset, the variability of each dataset, and the strength of the linkage of each dataset to protection of the water quality standards. For example, when making aquatic life use assessments, RIDEM weighs biological data, a core indicator, more heavily than toxics data. This is because the biological data provide a direct measure of the status of the aquatic biota and detect the cumulative impact of multiple stressors on the aquatic community (See Section 5.4.3 for further details).

2. **Multiple Stations**: In some AUs, especially rivers and estuarine areas, there may be multiple stations where data are collected. Data from each station are considered separately (e.g. geometric mean calculations are made at each station). When making the Use Support Decision, all stations are evaluated collectively. If the stations suggest fully supporting, the designated use will be determined as fully supporting. In cases where one or more stations suggest impairment, Best Professional Judgment will be used to evaluate whether station suggesting impairment is representative of the AU. In cases where the stations suggest impairment, the designated use will be determined to be impaired.

3. **Best Professional Judgment (BPJ)**: May be utilized to interpret water quality data for the purposes of determining use attainment status. This is often the case where waters in their natural hydraulic condition may fail to meet their assigned water quality criteria from time to time due to natural causes, without necessitating the modification of the assigned water quality standard. Such waters will not be considered to be violating their water quality standards if violations of criteria are due solely to naturally occurring conditions unrelated to human activities.

4. **Data Quality**: Qualitative information provided by qualified professionals that indicates a degraded condition may exist will be considered insufficient data upon which to conduct a use attainment determination. Sites with insufficient data that indicate a degraded condition will be given a higher priority for future monitoring.

   Evaluated or qualitative data representing Level 1 quality data are considered useful information but not defensible or sufficient for use in conducting an assessment. This information will be useful in making decisions about where to target monitoring efforts.

   Monitoring data that followed adequate DQO and DQA but which is more than five years old may be used, or continue to be used for assessments, on a case-by-case basis if conditions in the waterbody and the watershed have not changed. Data that is more than five years old that had previously been used to list a waterbody as impaired, will not be excluded due to age.

5. **Extrapolated Data**: Use support (assessment) determinations made from water quality data collected in one AU, may be extrapolated to another AU. Only fully

supporting assessment determinations may be extrapolated to another AU and only if the watershed conditions support the accuracy of that assessment extrapolation.

6. **Impairments**: Actual monitored water quality data collected following the DQO and DQA requirements as detailed in this document, will be given the greatest weight and will serve as the primary basis for determining impairments and listing waters into Category 5 (Requires a TMDL). AUs flagged as threatened for any designated use, will be listed in Category 5 (Requires a TMDL).

   AUs assessed with a biological impairment where the cause of the impairment is unknown, will be listed in Category 5 (Requires a TMDL). AUs assessed with a biological impairment where the cause is determined not to be due to a pollutant, will be listed in Category 4C (Not a pollutant, TMDL not required), pending no other pollutant-caused impairments.

   Determinations of impairment made by RIDEM's Office of Waste Management for site remediation projects are considered sufficient information to list an AU in Category 5 (Requires a TMDL).

7. **Modified Assessment Method**: A modified assessment method will be used for data sets that do meet the QA/QC requirements describe in Section 4.4, but do not meet the preferred data quality objectives (DQOs) requirements described in Section 4.3. For example, these types of data sets include adequate QA/QC protocol but have fewer than the required number of data points, and/or sampling less than the required frequency and duration. These data sets may still have value in assessing water quality and will be evaluated on a case-by-case basis to determine if they adequately represent existing water quality conditions. If it is determined that the data do not adequately represent existing water quality conditions, the information will result in an assessment of insufficient data. If it is determined that these data sets do adequately represent existing water quality, BPJ will be used to determine if an impairment exists and the factors used in the BPJ decision will be documented.

8. **Applicable Flow Conditions**: The water quality criteria apply under the most adverse conditions, as determined by the Director according to sound engineering and scientific practices as defined below. For non-flowing waters, the most adverse conditions will be defined on a case-by-case basis. The ambient water quality criteria are applicable at or in excess of the following flow conditions:

   Aquatic Life Criteria – the acute and chronic aquatic life criteria for freshwaters shall not be exceeded at or above the lowest average 7 consecutive day low flow with an average recurrence frequency of once in 10 years (7Q10).

   Human Health Criteria – The freshwater human health criteria for non-carcinogens and carcinogens are applicable at or in excess of the harmonic mean flow, which is a

long-term mean flow value calculated by dividing the number of daily flows analyzed by the sum of the reciprocals of those daily flows. For seawaters, the ambient human health water quality criteria are applicable when the most adverse hydrographic and pollution conditions occur at the particular point of evaluation.

9. **Mixing Zones**: The Water Quality Regulations allow for the establishment of a mixing zone. Mixing zones are defined as a limited area or volume in the immediate vicinity of a discharge where mixing occurs and the receiving surface water quality is not required to meet applicable standards or criteria, provided the minimum conditions described in §1.10(B) of the Water Quality Regulations (RIDEM 2018). Consistent with the Water Quality Regulations, water quality data used to conduct assessment determinations are based on samples taken outside of RIDEM designated mixing zones.

5.4 Assessment Methodology by Designated Use

This section describes the assessment methodology followed for each of the six individual use designations. Ambient water quality data are compared to the water quality standards and/or guidelines associated with the indicators noted in Table 6, to assess each designated use. Each designated use is then assigned a use support attainment status as listed in Section 5.1.

5.4.1 Aquatic Life Use Support (AQLUS) Assessment

In Table 6, the core indicators, upon which aquatic life use assessments are based, include biological indicators, physical habitat, and conventional parameters. As noted in Section 5.3.2, biological data is weighted more than other data, because it is a direct measure of the aquatic biota and can detect the cumulative impact of multiple stressors on the aquatic community. Table 7 is used going from left to right to determine Aquatic Life Use Support when multiple kinds of data are available. Available water chemistry data are compared to applicable water quality standards and/or guidelines as described below to evaluate the Toxics Data column. The sections below describe the procedures used specific to each waterbody type (e.g. wadeable river, large river, etc.)

Table 7 Protocol for AQLUS Status for AUs with Biological and/or Toxics Data Assessments

Biological Data	Toxics Data	Pollution Source Present?	Aquatic Life Use Support Status
Fully Supporting	Fully Supporting or No data	Yes or No	Fully Supporting
	Not Supporting	Yes	Insufficient Data
		No	Fully Supporting
Not Supporting	Fully Supporting or Not Supporting or No data	Yes or No	Not Supporting
No data	Fully Supporting	Yes or No	Fully Supporting
	Not Supporting	Yes	Not Supporting
		No	Insufficient Data

5.4.1.1 Biological Data and Habitat Information in Wadeable Streams

Aquatic biological indicators, such as macroinvertebrates, algae, and fish communities, integrate the cumulative effects of different stressors, such as excess nutrients, toxic chemicals, and excessive sediment, during their life cycles. Biological data provide a more reliable reflection of the ecological condition of a waterbody than do snapshot measurements of water chemistry. The state's Water Quality Regulations list biocriteria as narrative descriptions that should be attained, rather than numeric values to describe expected biological conditions. These narrative criteria are utilized to evaluate the biological condition of the state's waters.

As recommended by EPA, RIDEM uses biological and habitat monitoring data as core indicators for aquatic life use support determinations (USEPA 2002). To date, benthic macroinvertebrate sampling is the primary form of bio-monitoring utilized by RIDEM in wadeable streams. Large rivers were previously sampled for benthic macroinvertebrates, but the program was suspended until a more rigorous sampling and assessment procedure can be developed. Algae and fish assemblages have been monitored in a number of streams and rivers to assist in understanding these biological communities, develop numeric nutrient criteria, and allow for more holistic assessments of aquatic life use, but their use in the assessment process is for supplementary information only. Additionally, RIDEM participated in the committee of state program representatives coordinated by the New England Interstate Water Pollution Control Commission (NEIWPCC) under an EPA Southeast New England Coastal Restoration Program (SNEP) grant for development of protocol for biological monitoring of low-gradient wadeable coastal streams in Rhode Island and Massachusetts. RIDEM is still evaluating incorporation of large river and low gradient wadeable methods into the bioassessment process. The high gradient wadeable stream data collection, analysis, and application to assessments described below is the process used to evaluate wadeable stream biological (macroinvertebrate) data in the 2024 IR cycle.

Sampling of the benthic macroinvertebrate community occurs annually during a single visit, usually in August or September, to capture the critical biological index period when base flows are at their lowest of the year and water quality is presumed to be a worst case scenario.

Biological data (benthic macroinvertebrate samples) are collected in riffle areas of perennial, wadeable streams/rivers. A single sampling methodology (EPA's Rapid Bioassessment Protocol, Plafkin et al. 1989) is implemented for macroinvertebrate collection and habitat evaluation. In the field, macroinvertebrate kick samples are collected over a 3-minute duration in the riffle/run areas using D-frame nets.

Habitat information, collected concurrently with biological sampling, are used as supplemental information to enhance the interpretation of biological conditions when making biological assessment determinations. Habitat evaluations are based on visual observations of the stream/river using the high gradient EPA's Rapid Bioassessment Protocols (RBP) for Use in Wadeable Streams and Rivers, July 1999, (EPA/841-B-99-002). This stream habitat assessment provides a method to rate specific stream habitat characteristics along a gradient using a standardized rubric. Ten specific habitat parameters (epifaunal substrate, embeddedness, depth regime, sediment deposition, channel flow status, channel alteration, frequency of riffles, bank stability, vegetated buffer condition, and buffer zone width)[2] are rated from 0-20 from worst to best habitat quality using the best professional judgment of a qualified professional. The values from each parameter are totaled for each station to create the habitat score as shown in the table below.

Table 8 Habitat Assessment Category

Habitat Assessment Category	Habitat Score
Optimal	>150
Suboptimal	101-150
Marginal	51-100
Poor	<50

Two approaches for analyzing the benthic macroinvertebrate communities are used for the 2024 assessment cycle as an interpretation of the current narrative standard. Both approaches are based on a comparison of various calculated macroinvertebrate community metrics, to either a reference *site* or a reference *condition*. Metrics are measures of the macroinvertebrate community's response to stressors, such as changes in water quality or habitat degradation. These metric values, which describe the health of the identified macroinvertebrate community, are then used to assess the biological condition of the stream.

Reference Condition

RIDEM has utilized a reference *site* approach where metrics that describe the macroinvertebrate community observed at each stream location are compared to metrics observed at a single reference location. RIDEM has also been refining a more accurate

[2] Refers to physical habitat assessment parameters for high-gradient streams as described in Section 5 of the Rapid Bioassessment Protocols For Use in Streams and Wadable Rivers (USEPA 1999) (https://www.epa.gov/sites/default/files/2019-02/documents/rapid-bioassessment-streams-rivers-1999.pdf)

reference *condition* approach utilizing a multimetric biological condition index (MBCI) to evaluate the biological communities of the State's rivers and streams (Tetra Tech 2012). Use of the MBCI reference condition approach is the preferred assessment method as it uses multiple sites to characterize the reference condition and therefore accounts for natural variability due to variable factors such as geology, slope, elevation, stream order, catchment area, or landscape in the watershed. This reference *condition* approach avoids any misinterpretation of dissimilar macroinvertebrate metric scores where monitoring stations are not naturally like a reference station and are not expected to be comparable. Further information on the sampling methods can be found in the Rhode Island Wadeable Streams Biomonitoring and Habitat Assessment QAPP (ESS 2014) http://www.dem.ri.gov/pubs/qapp/wadestea.pdf.

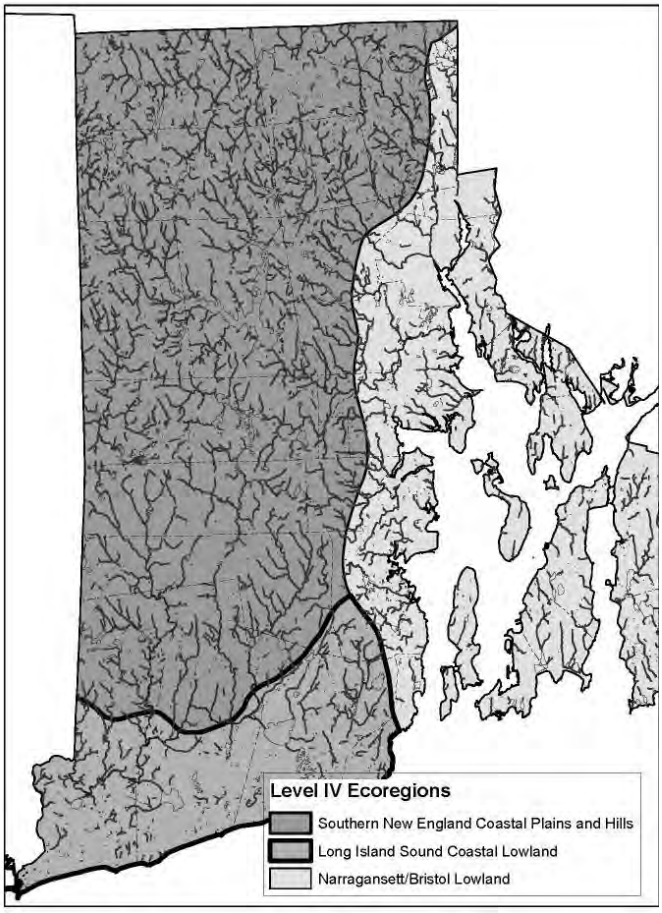


Figure 1 Bioassessment Level IV Ecoregions.

The preliminary work to develop an accurate MBCI restricted its applicability only to the higher gradient region which covers most of Rhode Island, known as the Southern New England Coastal Plains and Hills (SNECPH or CPH) area of the state (generally inland areas of the state; see map). Eighty-two percent (82%) of the RIDEM macroinvertebrate monitoring stations reviewed to develop the MBCI fell in the CPH ecoregion, including some sampling stations located just outside of the CPH area were incorporated into this approach if greater than 50% of their watersheds fell within the CPH area. The reference *condition* approach will be applied

to the macroinvertebrate stations in the SNECPH region for the 2024 assessments where new data is available. To determine the MBCI score, taxonomic data are analyzed using 6 selected metrics (Tetra Tech 2012): Total Taxa, % Non-insect, Beck's Index, Clinger Taxa, % Predators, and % Filterers.

Table 9 MBCI Metric Score Calculations Used to Describe the Biological Condition of the Macroinvertebrate Community.

Metric	Metric Category	Scoring Formula*
Total Taxa	Richness	100[1]metric value/32.8
% Non-insect	Composition	100[1] (46.3-metric value)/(46.3)
Beck's Index	Tolerance	100[1]metric value/24.8
Clinger Taxa	Habit	100[1]metric value/18
% Predators	Feeding Group	100[1]metric value/22.7
% Filterers	Feeding Group	100[1] (83.1-metric value)/80.8

[1]If the calculated score was outside of the valid scoring range of 0-100, the score was re-set to the nearest extreme before averaging all scores to arrive at the index score.

Each station is then classified into one of the Biological Condition Categories shown below based on its MBCI score:

Table 10 Biological Condition Categories of MBCI Score

Biological Condition Category	Approximate MBCI Score Thresholds
Non-impaired	>86%
Slightly impaired[1]	56-85%
Moderately impaired	36-55%
Severely impaired	<35%

[1]Terminology used in this table is taken directly from the RBP Methodology document (Plafkin 1989) and does not indicate impairment of AU when biological community is considered slightly impaired. Assessment is completed using Table 12 Summary of Bioassessment Determinations for final determination if impairment should be listed on 303(d) List.

Reference Site

The MBCI project determined that stations located on rivers/streams in the Long Island Sound Coastal Lowland and Narragansett/Bristol Lowland (Lowlands) areas of the state are different from the CPH area because natural landscape characteristics (elevation, slope) differ between the two regions (Figure 1). Therefore, the MBCI model cannot be applied to these lowland stations. Since the majority of the area in Rhode Island is classified as CPH, there are naturally fewer stations located in the Lowlands, resulting in a small dataset to evaluate this area for the MBCI development. Furthermore, the Lowland areas have more intense land uses so the range of disturbance among these stations is too narrow to identify an adequate number of reference stations to develop a reference condition and index model for these ecoregions relying only on

Rhode Island data. Instead, the reference site approach, historically applied statewide, was used to evaluate stations where appropriate in the smaller coastal lowland Level IV ecoregion areas of the Narragansett/Bristol Lowland and the Long Island Sound Coastal Lowland as new data is obtained, and until further development of a more robust assessment method for stations in these lowland ecoregions.

Under the reference site approach, biological conditions in streams/rivers were measured against conditions observed at a state reference station. A station located on Adamsville Brook serves as the reference in the coastal areas of Narragansett Bay, the islands, and the Narragansett/Bristol Lowland and Long Island Sound Coastal Lowland ecoregions. Taxonomic data were analyzed using eight selected measures of the macroinvertebrate community (metrics). These eight metrics (taxa richness, Hilsenhoff Biotic Index, ratio of scrapers/filtering-collectors, ratio of EPT/chironomids, % contribution of dominant taxa, EPT index, community loss index, ratio of shredders/total) were combined into an index score. Each station was then classified into one of the biological condition categories shown in the table below, based on a comparison of its index score to the index score from the reference station. Where index score percentage values are intermediate to the ranges below, best professional judgment is used for placement in the appropriate Biological Condition Category. Benthic macroinvertebrate bioassesments that have been previously determined using the Reference Site approach, will remain in place for the 2024 cycle.

Table 11 Biological Condition Categories of Reference Site Approach

Biological Condition Category	Approximate Index Score Ranges (as % reference station score)
Non-impaired	>83%
Slightly impaired[1]	54-79%
Moderately impaired	21-50%
Severely impaired	<17%

[1]Terminology used in this table is taken directly from the RBP Methodology document (Plafkin 1989) and does not indicate impairment of AU when biological community is considered slightly impaired. Assessment is completed using Table 12 Summary of Bioassessment Determinations for final determination if impairment should be listed on 303(d) List.

Biological Assessment – Generally, the biological assessments are determined using both the Biological Condition and Habitat Assessment Categories in accordance with Table 12 Summary of Bioassessment Determinations. Where available, general temporal trends in biological and habitat category assignments observed at each station over the course of several years are also used in the final bioassessment evaluation. Individual habitat parameters, physical site characteristics (e.g., drainage area size), photographic logs, and all other available physical or geomorphic information (e.g., sampled downstream of an impoundment, flow) are also evaluated to ensure macroinvertebrate sampling stations were located in appropriate

perennial, riffle habitats. This information is taken into account with BPJ to determine the appropriate biological condition status. For example, extended drought conditions or impoundments immediately upstream of a sampling station will have a significant effect on aquatic macroinvertebrate populations. Therefore, available information on river flow or precipitation for the year, to document wet or drought conditions, may be incorporated with station information, habitat scores, physical data and macroinvertebrate metrics to make the overall assessment.

Table 12 Summary of Bioassessment Determinations

MBCI Score Thresholds	Biological Condition Category	Habitat Assessment Category	Bioassessment Determination
≥56%	Non-impaired or Slightly impaired	Optimal	Fully Supporting
		Suboptimal	
		Marginal	
		Poor	
<56%	Moderately impaired or Severely impaired	Optimal	Not Supporting
		Suboptimal	
		Marginal	
		Poor	

5.4.1.2 Biological Data in Non-wadeable Large Rivers, Lakes, and Estuarine Areas

Historically, evaluation of the biological condition of deeper, non-wadeable rivers was determined from multi-plate substrate sampling of the macroinvertebrate community. This macroinvertebrate monitoring methodology has been suspended until appropriate sampling and assessment options can be developed and implemented. In the interim, large, non-wadeable rivers will be assessed for Aquatic Life Use using water chemistry data. Lakes and estuarine areas also do not have a developed protocol or assessment methodology for biological data. Therefore, Aquatic Life Use in these waterbody types will also be assessed using water chemistry data.

5.4.1.3 Conventional Parameters

Conventional parameters include dissolved oxygen, turbidity, pH and temperature. Except as stated within the individual criteria for these parameters in in §§1.10(D)(1) and 1.10(E)(1) of the Water Quality Regulations or as noted below, the water quality standard is not attained whenever more than 10% of the measurements exceed the criteria. For small datasets (4 data points or less), there must be two exceedances of the criterion for the use to be considered impaired. The reasoning for this decision is to attempt to identify chronic or recurring exceedances that do justify listing in Category 5 (Needs a TMDL) and targeting with limited resources.

1. <u>Dissolved Oxygen</u>

Freshwater Dissolved Oxygen criteria are listed in in §§1.10(D)(1) of the Water Quality Regulations. Freshwater dissolved oxygen criteria are based upon cold water and warm water fish habitat. Daily averages and instantaneous (grab) measurements of dissolved oxygen should not exceed the criteria except as naturally occurs. To capture potential diurnal fluctuations in dissolved oxygen, grab samples should be collected in the early morning hours. Dissolved oxygen levels in bottom waters may be naturally low, especially in lakes, therefore, BPJ of qualified professionals will be used to interpret low dissolved oxygen levels in these situations. As noted in Section 5.3 and as defined in the Water Quality Regulations, natural hydraulic condition of ponds/lakes can result in establishment of a thermocline (thermal gradient) which can result in low dissolved oxygen levels in the hypolimnia (bottom waters). Under that state, hypoxia in the hypolimnia could be considered to result from the natural hydraulic condition of the pond and not be considered a violation of the dissolved oxygen criteria. Determinations of naturally low dissolved oxygen will be made by evaluating current and historical loadings, data collected over an entire season, and characteristics of the watershed.

Saltwater Dissolved Oxygen criteria, listed in §1.10(E) and §1.10(F) of the Water Quality Regulations, are based upon waters above or below a seasonal pycnocline (thermal gradient) or for waters without a seasonal pycnocline. These criteria evaluate cumulative exposures of low dissolved oxygen with established minimum standards. Rhode Island relies on continuously collected dissolved oxygen data or data that can correlate to continuous data. Grab samples or similar dissolved oxygen data may still be considered if it can be correlated to continuous data or is representative of a longer time period. The saltwater dissolved oxygen criteria evaluates cumulative exposures of low dissolved oxygen observed during May to October using by a software program called RIDOCS.

2. Nutrients

In accordance with the national initiative to develop nutrient criteria, RIDEM/OWR is currently working to further evaluate and refine numeric nutrient criteria for lakes and ponds and has initiated additional work to develop numeric nutrient criteria for rivers and streams. The Water Quality Regulations currently contain a numeric criterion for total phosphorus in lakes and tributaries at the point they enter lakes. The seasonal index period average total phosphorus concentration shall not exceed 25 ppb in any lake, pond, kettlehole or reservoir, except as naturally occurs, and the average total phosphorus in tributaries at the point where they enter lakes shall not cause an exceedance of this total phosphorus criteria, except as naturally occurs.

The Water Quality Regulations also contain a narrative nutrient criteria for nutrient concentrations associated with cultural eutrophication that cause undesirable or nuisance aquatic vegetation, or render waters unsuitable for the designated uses.

Although the regulations do not contain numeric criteria for nutrients in rivers or estuarine waters (besides tributaries covered by the total phosphorus criterion), in accordance with the narrative nutrient standard, evaluations of persistent, potentially severe eutrophication and/or low dissolved oxygen may result in a determination of impairment for the waterbody with total phosphorus listed as the suspected cause in freshwater rivers and total nitrogen listed as the suspected cause in saltwaters.

5.4.1.4 Toxics

Toxicants include metals, organics, chlorine, and ammonia. Chemical data provides direct information about whether specific pollutants are present in amounts that are causing or are likely to cause adverse impacts to aquatic organisms. The aquatic life water quality criteria for these parameters can be found in §1.26 of the Water Quality Regulations. The water quality standards include duration considerations of a one-hour averaging period for the acute criteria and a four-day averaging period for the chronic criteria. In addition to samples collected over a one-hour period, grab samples will be considered sufficient to assess the acute criteria. For the assessment of chronic aquatic life criteria, the sample(s) must be representative of conditions, including hydrologic conditions, during a four-day averaging period. For wet weather sampling events, if the data are collected during several days of high flow, the samples would be assumed representative of the four-day average conditions to assess chronic aquatic life criteria. These criteria should not be exceeded more than once every three years on average.

5.4.1.5 Non-Native Aquatic Plants

Aquatic invasive plants are non-native plants that have been introduced (accidentally or intentionally) into lakes and rivers that threaten the diversity or abundance of native species, the stability of the ecosystem, and/or the use of the waterbody. Generally unrelated to excess nutrients, invasive plants thrive and can out-compete beneficial native plants that are naturally a part of our aquatic ecosystems. RIDEM seasonal surveys initiated in 2007 coupled with additional data reported via the URI Watershed Watch Program and RI Natural History Survey has documented the widespread occurrence of aquatic invasive plants in Rhode Island freshwaters. The two most prevalent freshwater invasive species in Rhode Island are variable milfoil (*Myriophyllum heterophyllum*) and fanwort (*Cabomba caroliniana*)[3].

Using Best Professional Judgment, when a non-native population has invaded and become established in a waterbody creating large monotypic stands of a plant, decreasing plant diversity, and changing the available fish and wildlife habitat, the waterbody may be assessed as Not Supporting Aquatic Life Use and impaired due to the presence of non-native plants. Such an impairment is not included on the 303(d) List for development of a TMDL, which addresses impairments due to pollutants. Instead, such an impairment leads to listing the waterbody into Category 4C pending no other impairments requiring a TMDL or impairments which have an approved TMDL. RIDEM's Aquatic Invasive Species monitoring program and response efforts

[3] https://dem.ri.gov/sites/g/files/xkgbur861/files/programs/benviron/water/quality/surfwq/pdfs/aisridist.pdf

can be found at http://www.dem.ri.gov/programs/water/quality/surface-water/aquatic-invasive-species.php (RIDEM 2020a).

Waters where an impairment exists for a non-native aquatic invasive plant(s) shall be evaluated for delisting where long-term management (chemical, physical, or biological) of the waterbody has resulted in containment of the invasive population and an organizational structure exists to maintain control of the population (lake association, state or federal agency, conservation organization, or other). Waters may also be delisted if sufficient evidence exists that the population will be controlled by natural morphometric features, such as waters with limited littoral area due to depth.

5.4.1.6 Toxicity

Rhode Island has narrative toxicity criteria established as "no toxics in toxic amounts". Ambient water column and sediment toxicity tests are useful for examining the effects of unknown mixtures of chemicals in surface waters. Toxicity thresholds are expressed in terms of "toxic units" that cause toxic effects to aquatic organisms. Toxicity levels are determined by exposing aquatic organisms to ambient samples, which also addresses unknown toxicants. Rhode Island requires whole effluent toxicity (WET) testing of all major permitted facilities under the RIPDES Program. Such effluent tests are screening tools to indicate the potential for ambient water quality impacts. In Rhode Island, toxicity testing of ambient waters and sediment are currently conducted in accordance with site remediation projects to assess if there are toxic impacts at the site. Toxicity is determined by comparing toxicity test results from the site in question with tests conducted at unimpacted sites. Determinations of toxic impacts in ambient waters and sediments at site remediation locations are made in conjunction with the RIDEM Office of Waste Management and are listed as impaired for assessment purposes.

5.4.2 Recreational/Swimming Use Assessment

The assessment of recreational/swimming use is based on enterococci, fecal coliform, and/or *E. coli* bacteria data and bathing beach closure information at designated bathing beaches. Designated Bathing Beaches are defined as bathing beaches licensed and regulated by the Rhode Island Department of Health. The data from the Rhode Island Department of Health's Beach Program will only be used to evaluate assessment units when the beach is considered representative of the entire assessment unit's condition. §§1.10(D)(1) and 1.10(E)(1) of the Water Quality Regulations identify two types of recreational uses:

1. Primary Contact Recreation defined as those water-related recreational activities that involve significant ingestion risks and includes, but is not limited to, swimming, diving, surfing, and water skiing
2. Secondary Contact Recreation defined as those water-related recreational activities where the probability of water ingestion is minimal and includes, but is not limited to, boating and fishing.

Currently the same recreational bacteria criteria apply to both primary and secondary recreational uses. Therefore, the term 'recreational use' is frequently interchanged with the

term 'swimming use'. Enterococci is the primary bacteria indicator for assessing recreational/swimming use attainment. The water quality standards have maintained fecal coliform criteria for use in evaluating swimming use when adequate enterococci data are not available. In some freshwaters, data for another swimming use indicator, *E. coli*, are available and the EPA criteria (geometric mean of 126 colonies per 100 ml) for this indicator are used to evaluate that data.

The use of bacteriological data by the water quality assessment and beach monitoring programs may differ slightly to account for some of the inherent differences between the two programs. RIDOH's Beach program makes beach management decisions based on real time water quality data on a given day or weekend therefore focusing on more recently collected information to determine whether a swimming advisory should be issued. As noted in the Water Quality Regulations, RIDOH utilizes both the single sample maximum and geometric mean criteria and has recently utilized the Beach Action Value (BAV) recommended by the U.S. EPA (USEPA 2012) for determining swimming advisories at designated beaches.

This contrasts with the use of monitoring data for making a water quality assessment determination for non-designated beach waters where data collected over a longer period of time is considered. For assessment purposes on non-designated beach waters, the geometric mean is more relevant because it is a more reliable measure of long-term water quality that it is less subject to random variation. The disruption of recreational activities at designated bathing beaches is taken seriously by the state and investigated by RIDOH. It is, however, the state's experience that most beach closures are temporary, lasting only a few days and frequently related to transient sources.

The state's narrative criteria, that all waters shall be free from pollutants in concentrations or combinations that adversely affect human health, shall be applied to the presence of potentially hazardous chemicals in water and bottom sediment as an indicator of swimming use impairment

5.4.2.1 Non-designated Beach Waters

For assessment purposes, the recreational/swimming use support status of non-designated beach waters shall be determined by evaluating the geometric mean of all samples collected over the recreational bathing period of May through October. The following table summarizes the determination of fully supporting assessment status:

Table 13 Bacteria Assessment Framework for Recreational Use.

Waterbody Classification	Enterococci	Fecal coliform	*E. coli*
Freshwater	Geometric Mean <54 colonies/100ml	Geometric Mean <200 MPN/100ml **and** <10% of samples >400 MPN/100ml	Geometric Mean <126 colonies/100ml

Saltwater	Geometric Mean <35 colonies/100ml	Geometric Mean <200 MPN/100ml **and** <10% of samples >400 MPN/100ml	Geometric Mean <126 colonies/100ml

5.4.2.2 Designated Beach Waters

For designated beach waters, bacteria data and beach closure information collected under RIDOH's Beach Monitoring Program are utilized to assess recreational uses at these waters. The Rhode Island Department of Health (RIDOH) Beach Monitoring Program uses bacteriological (enterococci) data to issue beach advisories and make opening and closure decisions for designated bathing beaches (http://www.health.ri.gov/beaches). For recreational use attainment decisions at designated beach waters, beach closures as issued by the RIDOH are not considered an impairment of the recreational use, unless the closure is recurrent throughout a substantial part of the swimming season for several consecutive years and when the beach is considered representative of the entire assessment unit's condition. Such assessments are made in coordination with the RIDOH Beach Monitoring Program staff.

5.4.3 Fish Consumption Use Assessment

Fish can be a part of a healthy diet, and the Rhode Island state agencies recommend and promote the consumption of healthy fish choices. The most commonly measured contaminant is mercury in fish tissue. RIDEM will impair the fish consumption use of the assessment unit as described below. For mercury, the EPA guidance is concentrations above 0.3 ppm Hg wet weight.

Table 14 Mercury in Fish Tissue Assessment Decision Framework.

Percentage Exceeding Guidance	Consumption Advisory	Assessment Decision
<10	No advisory	Fully Supporting
10-30%	Limit to 1 meal/week	Not Supporting
30-50%	Limit to 1 meal/month	Not Supporting
>50%	Do not consume	Not Supporting

Other fish tissue contaminants, such as polychlorinated biphenyls (PCBs) and dioxins, have been infrequently sampled in Rhode Island AUs, primarily as part of Resource Conservation and Recovery Act (RCRA) or Comprehensive Environmental Response, Compensation, and Liability (CERCLA; aka Superfund) investigations. When this data is available, it is compared to U.S. EPA guidance of 12 ppb for PCBs and 0.15 ppt for dioxins.

5.4.5.1 Freshwater

Rhode Island State government has never sponsored a program to systematically assess fish tissue contamination. Data that is available has been generated by EPA researchers, site specific studies and a limited collaborative program implemented by the RIDEM Office of Water Resources (OWR) and Division of Fish and Wildlife (RIDFW), RIDOH, and EPA. This effort integrated the collection of samples for fish tissue analysis with the fish community surveys

being conducted by RIDEM DFW. As the current data indicates, the degree of contamination is variable, and it is difficult to extrapolate results from one freshwater to another. Accordingly, RIDEM/OWR is recommending that freshwater fish tissue be assessed systematically. The statewide advisory against consumption of freshwater fish species known to contain the most mercury are precautionary, region-wide advisories, and not based on any actual contaminant monitoring data collected within Rhode Island waters; therefore, these advisories are not reflected in the assessment of Fish Consumption use.

For freshwaters, the AU is considered fully supporting fish consumption use when fish tissue data collected in that AU, do not exceed consumption advisories in Table 9 for any fish species or any consumer group. The AU is considered impaired for fish consumption use when there is a consumption advisory in Table 9 for some fish species or for consumer groups as determined from fish tissue data collected within that AU.

5.4.5.2 Saltwater

For saltwaters, the statewide advisory against consumption of saltwater fish species known to contain mercury and PCBs are precautionary, region-wide advisories, and not based upon any actual contaminant monitoring data collected within Rhode Island waters. However, recent information from researchers at Roger Williams University on mercury contamination of fish tissue from fish collected in Narragansett Bay has revealed the potential for mercury bio-magnification in certain fish species from particular areas of the Bay. Further research currently underway and review of mercury in sediment data, fish species in Narragansett Bay, trophic status of fish, and mercury in fish tissue data will determine if there are resident species of fish living in particular areas of the Bay where a preponderance of data and evidence indicate the presence of mercury in sediment and/or the local food chain which allows for bio-magnification of mercury in certain species of resident fish at levels that may require a Fish Consumption use impairment for those areas of the Bay. Until these data gaps have been addressed, the saltwaters of the state are classified as having Insufficient Information for Fish Consumption Use with a reminder to consumers of the saltwater species-specific fish consumption advisories posted by RIDOH (see link above).

5.4.4 Shellfish Harvesting/Consumption Use Assessment

Shellfish Consumption Use assessments for AUs are determined by the Shellfish Growing Area Classification (Approved, Seasonal Closure, Conditional Closure, Prohibited) assigned in accordance with the State's U.S. Food and Drug Administration's (FDA) National Shellfish Sanitation Program (NSSP)-approved Shellfish Growing Area Monitoring Program, and supporting data. The protocol for shellfish use classification determinations is based upon the NSSP Model Ordinance requirements. These requirements include conducting routine bacteriological monitoring at established routine monitoring stations that are representative of the growing area waters and shoreline surveys where shellfish are intended for direct human consumption. Bacteriological samples for use in shellfish classification determinations must be analyzed by an FDA certified laboratory. Results are analyzed and classification status is determined in accordance with the Shellfish Growing Area Monitoring Program's Standard Operating Procedures (RIDEM 2020b).

The AU is considered fully supporting shellfishing use when there are no water quality related shellfishing restrictions in effect (Approved Status). The AU is considered impaired for shellfishing use when the waterbody has a Conditional or Prohibited closure status for shellfishing. It should be noted that as part of Shellfish management under the NSSP there can be conditional or prohibited closures that don't rise to the level of a long-term impairment to be listed on the 303(d) List.

There are two types of waters where further evaluation is required for water quality assessment purposes. Several Class SA estuarine areas are permanently closed to shellfishing strictly due to safety concerns. The boundaries of these closed safety zones have been defined by modeling complete failure of treatment at nearby wastewater treatment facilities. Other estuarine areas are seasonally closed to shellfishing under the partial use classification SA{b}. By definition of the SA{b} classification, these areas are in the vicinity of marinas and/or mooring fields and, in accordance with NSSP Model Ordinance requirements, are closed primarily in the summer months when anchorages or mooring fields are being used by boats. In these SA and SA{b} areas, if the actual water quality data attains the applicable fecal coliform criteria (geometric mean MPN or MF (mTEC) value of 14 per 100ml and not more than either 10% or the estimated 90th percentile of the samples shall exceed an MPN value of 49 per 100mL for a three-tube decimal dilution or 31 cfu per100 mL for MF (mTEC)[4]), the shellfishing use is considered Fully Supporting for assessment purposes. If the actual water quality data exceeds the applicable fecal coliform criteria, the shellfishing use is considered Not Supporting for assessment purposes.

The state's narrative criteria, that all waters shall be free from pollutants in concentrations or combinations that may adversely affect human health, shall be applied to the presence of potentially hazardous chemicals in the water column and bottom sediment as an indicator of shellfish consumption impairment.

5.4.5 Shellfish Controlled Relay and Depuration Assessment

Class SB waters are designated for shellfish harvesting for controlled relay and depuration. RIDEM's Division of Fish and Wildlife implements the state's only relay and depuration operation in cooperation with the Narragansett Bay Commission, the Rhode Island commercial shellfishing industry, and the RIDOH. The Shellfish Controlled Relay Transplant Program involves the transplant of shellfish from Class SB waters to Class SA waters suitable for shellfish harvesting for the purpose of ambient depuration and controlled harvest. The NSSP requires that the harvested shellfish will be made safe for human consumption by the ambient depuration treatment process. The specific SB waters currently managed for controlled relay have been determined to be safe for existing relay operations. Shellfish will not be harvested

[4] The Shellfish Program switched the fecal coliform analytical test from MPN to mTEC in mid-2012. Datasets with both MPN and mTEC samples have slightly different 90th percentile values determined using NSSP guidelines. All shellfish compliance calculations have ben mTEC only since the 2019 calendar year evaluation.

from any additional SB waters until an analysis has been completed confirming that the level of contamination in shellstock can be reduced to levels safe for human consumption. The analysis has been completed to assess compliance with the NSSP Model Ordinance classification of Restricted or Conditionally Restricted that allow controlled relay to occur.

In the NSSP protocol, a controlled relay water must meet the restricted classification guidelines below:

1. Meet water quality criteria for bacteria sampling when impacted by point sources
    a. Fecal coliform geomean of 88 per 100 ml MPN or MF (mTec) and not more than 10% of the samples shall exceed 163 CFU per 100 ml MF (mTec); calculated with a minimum of 5 samples per year by using a minimum of the most recent 15 If the restricted waters are impacted by non-point sources the same fecal coliform geomean is applicable but 90% of the samples shall not exceed the 163 CFU per 100 ml using the same criteria for sample set.
2. Current shoreline survey that indicates a limited degree of pollution.
3. Shellstock has levels of fecal coliform pollution, human pathogens, or poisonous or deleterious substances at such levels that they can be made safe for human consumption by relaying (ambient environmental treatment process)

Given that no SB waters will be considered for controlled relay without additional study, the assessment process will only consider the ambient water quality criteria for bacteria. If bacteria data are meeting the criteria, the assessment unit will be considered Fully Supporting its controlled relay designated use. If bacteria data are not meeting the criteria, the assessment unit will be considered Not Supporting its controlled relay designated use. If no bacteria data are available, then the assessment unit will be considered Not Assessed for controlled relay designated use.

5.4.6 Drinking Water Use Assessment

RIDOH's Center for Drinking Water Quality (DWQ) implements the federal Safe Drinking Water Act (SDWA) in Rhode Island (2020) (https://health.ri.gov/programs/detail.php?pgm_id=126). Drinking water use assessments of public surface water systems are conducted by, and based upon data and information compiled by, the DWQ staff. DWQ monitors drinking water quality at the source, at the entry to the distribution system, and within the distribution system to evaluate for compliance. The larger public drinking water suppliers monitor some of the source waters for several parameters to adjust treatment levels as necessary for compliance. RIDOH regulations require terminal reservoirs to be sampled in accordance with drinking water program requirements. Samples are usually collected from one location near the intake to the drinking water treatment plant. In these terminal reservoirs, the monitoring and analyses entails a list of over 100 parameters that reflect the compounds for which MCLs have been established for *finished* drinking water. In many water supply districts, upgradient reservoirs and tributaries within the drinking water supply watershed are not routinely or comprehensively sampled by the water suppliers. In the upgradient waters, the range of parameters sampled is significantly less than the over 100 parameters analyzed at the terminal reservoirs. RIDOH has determined that this data is too limited in scope to use in conducting a

drinking water use assessment. Therefore, these upstream waters within drinking water supply watersheds are considered unassessed for drinking water use at this time. RIDEM and RIDOH plan to work toward defining the core parameters/indicators required to assess drinking water use attainment for these upgradient reservoirs and tributaries within drinking water supply systems.

The data utilized by DWQ to determine the drinking water use attainment status for the terminal reservoirs consists of ambient (source) water quality data, information about the level of treatment required, and finished water quality data. The use support status is based on violations of the Maximum Contaminant Levels (MCLs), use restrictions, and/or best professional judgment by the DWQ staff. Surface source waters of the terminal reservoir are considered fully supporting drinking water use when there are no violations of MCLs and no restrictions or advisories, and no requirement of more than conventional treatment. Surface source waters of the terminal reservoir are considered impaired for drinking water use when there are violations of the MCLs, and/or requirements of more than conventional treatment, and/or, frequent taste and odor problems, and/or contamination-based closures of the source water.

5.5 Causes and Sources of Impairments

For those AUs that are not fully supporting their designated uses, the identity of the pollutants causing, or threatening to cause, water quality impairments and the sources of those pollutants, are reported where possible.

5.5.1 Causes

Causes of impairment are pollutants or stressors that prevent or threaten water quality from meeting the water quality standards. Causes of actual or threatened impairments may include chemical contaminants, physical parameters, and biological parameters. For the purposes of Section 303(d) impaired waters listing requirements, it is important to distinguish if the impairment is due to pollution or a pollutant. Pollutant, as defined in the Water Quality Regulations[5], generally refers to a chemical and/or physical parameter which will likely alter the physical, chemical, biological or radiological characteristics and/or integrity of water. In general, a pollutant can be thought of as something which can be expressed in terms of a loading (i.e. pounds per day) and physically allocated. Pollution is defined in the Water Quality Regulations[6] as the human-made or human-induced alteration of the physical, chemical, biological or radiological characteristics and/or integrity of water. This broad term may encompass many types of changes to a waterbody, including alterations to the character of the water (e.g., exotic, non-native, or invasive species; habitat degradation; flow alteration) that do not result from the introduction of a specific pollutant or presence of pollutants in a waterbody at a level that causes an impairment. Not all pollution-causing activities must be analyzed and allocated in a TMDL. Section 303(d) is a mechanism that requires an accounting and allocation

[5] https://rules.sos.ri.gov/regulations/part/250-150-05-1
[6] https://rules.sos.ri.gov/regulations/part/250-150-05-1

of pollutants introduced into impaired waters. In some cases, the pollution is caused by the presence of a pollutant, and a TMDL is required. In other cases, pollution is caused by activities other than the introduction of a pollutant. Therefore, waters impaired by pollution are listed in category 4C where they are flagged to be addressed by a more appropriate program.

Degradation of the biological community is considered a cause of impairment even though the actual cause (pollutant) may be unknown. When data for an AU indicates a biological impairment, even though the actual cause of the biological impairment is unknown, the AU will be listed in Category 5. However, when biological data and information indicate that the impairment is not caused by a pollutant, the AU will be placed in Category 4C, pending there are no other pollutant impairments for the AU that would keep it in Category 5.

5.5.2 Sources

In general, the sources of impairment are not determined until a TMDL or similar analysis is conducted on the waterbody. ATTAINS allows for documentation of confidence in source identification. The source may be listed as *suspected* for those situations where the information is based on BPJ and/or landuse information. The source may be listed as *confirmed* for those situations where the source causing the impairment has been identified and verified.

6.0 METHOD TO RANK AND PRIORITIZE IMPAIRED WATERBODIES

Section 303(d) of the CWA requires that waters on the 303(d) List be ranked in order of priority that the TMDLs will be developed. The Rhode Island 303(d) List identifies impaired waterbodies and provides a scheduled time frame for development of TMDLs. As such, the 303(d) List is used to help prioritize the State's water quality monitoring and restoration planning activities. Scheduling is not necessarily representative of the severity of water quality impacts but rather reflects the priority given for TMDL development with consideration to shellfishing waters, drinking water supplies and other areas identified by the public as high priority areas. It is important to note that TMDL schedules are dynamic and subject to revisions due to resources, public interest and support, and technical factors.

In 2013, U.S. EPA initiated a program framework to identify and prioritize waterbodies for restoration and protection, entitled A Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program (referred to as "the Vision"). The Vision was intended to help coordinate and focus EPA and State efforts to advance the effectiveness of the Clean Water Act Section 303(d) Program in the coming decade. The initial phase of the Vision was from 2016 to 2022. The Vision recommended that each State identify priority waters for restoration and/or protection plans by 2016, with the goal of completing those plans by 2022. In May 2016, RIDEM completed this planning process[7]. RIDEM's Vision Plan reinforces the prioritization of shellfishing waters, drinking water supplies, and other areas identified by the public as high priority areas and selected the Newport Water Supply Reservoirs as the initial priority waters for completion of TMDLs under the Vision. The Newport Water Supply Reservoir TMDL was approved by EPA November 15, 2021.

In 2022, the U.S. EPA announced the 2022 – 2032 Vision for the Clean Water Act Section 303(d) Program ("2022 Vision").[8] The 2022 Vision Prioritization Framework for each state, territory, or tribe should be shared with EPA by April 1, 2024, and states, territories, and tribes are encouraged to utilized the IR public process to develop and share their Prioritization Framework or use an independent public process.[9] As States begin to evaluate priorities for the second phase of the Vision process, EPA announced the FY23 – 24 Bridge Metric measure. For the Bridge Metric, states were required to identify priorities that are covered by, or are in the process of being covered by, EPA-approved/accepted TMDLs or other restoration plans for impaired waters and submit to ATTAINS by September 30, 2022. Rhode Island chose to continue work to complete three bacteria TMDLs in one of the Newport Water Supply reservoirs, Nonquit Pond in Tiverton, RI, which were in progress under the first Vision period. These three identified priority waterbody impairments are in: Borden Brook (RI0010031R-01), Quaker (aka Quaket) Creek (RI0010031R-04), and Tributary to Nonquit Pond (RI0010031R-20).

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[7] http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/vision16.pdf

[8] https://www.epa.gov/system/files/documents/2022-09/Final%20Cover%20Memo%20-%20CWA%20Section%20303d%20Vision%20-%20September2022.pdf

[9] https://www.epa.gov/system/files/documents/2022-09/CWA%20Section%20303d%20Vision_September%202022.pdf

7.0 DELISTING METHODOLOGY

Delisting is the term used to describe the process of removing a waterbody from the 303(d) List of Impaired Waters. The existing federal regulations require states to demonstrate good cause for not including waterbodies on the 303(d) list that were included on previous 303(d) lists. Good cause has been defined as including, but not being limited to:

- More recent and/or accurate data
- More sophisticated water quality modeling which indicates attainment of the water quality standards
- Flaws in the original analysis that led to the waterbody being listed
- Changes in conditions, e.g. new control equipment, or elimination of discharges.

As noted in Section 5.3, an AU may not be removed from an impaired category based solely on the age of the data used to originally list the waterbody as impaired. Although the data that was used to determine an original impairment may no longer meet data age requirements, the AU cannot be shifted to another category for this reason alone. Some reasons AUs may be removed from the 303(d) list include the following:

1. A determination that the AU is meeting water quality standards due to:
    - An error that was made in the initial assessment and listing
    - More recent data or information that meets the requirements of this assessment and listing methodology, demonstrates that water quality standards are being attained
    - Revisions to the Rhode Island water quality standards may cause a determination of compliance with the standards.

2. Reassessment of available information or data – AUs previously on the 303(d) list based upon data that is insufficient to meet current data quality and quantity requirements may be moved to Category 3 and scheduled for further monitoring.

3. TMDL has been completed – AUs with more than one pollutant associated with the impairment, will remain in Category 5 until TMDLs for each pollutant have been completed and approved by EPA. AUs will be removed from Category 5 and placed in Category 4A once all TMDLs for that AU have been developed and approved by EPA.

4. Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future – Consistent with the regulation under 40 C.F.R. 130.7(b)(I),(ii), and (iii), AUs will be placed in Category 4B where other pollution control requirements required by local, state, or federal authority are stringent enough to implement any water quality standard applicable to such waters.

5. Impairment is not caused by a pollutant – AUs will be placed in Category 4C if the impairment is caused by pollution and not a pollutant.

6. New spatial extent – When sufficient data warrants, waterbodies previously identified (numbered) and listed on a large scale may be broken into smaller assessment units (AUs) and placed in other categories, if appropriate.

8.0 WATER QUALITY MONITORING

The Integrated Report guidance emphasizes the importance of monitoring to obtain data and information necessary to characterize the attainment status of all AUs. The guidance notes that Section 106(e)(1) of the CWA, requires States to develop a comprehensive monitoring and assessment strategy that provides a description of the sampling approach, a list of parameters to be tested, and a schedule for collecting data and information. RIDEM accomplished this by preparing the Rhode Island Water Monitoring Strategy (RIDEM 2019). The strategy describes existing efforts as well as new monitoring initiatives that need to be implemented in order to meet the state's data needs regarding water resources.

The monitoring framework reflects the partnerships and collaborations that occur among state, local and federal agencies, universities, colleges, other organizations, and volunteers regarding monitoring activities. Specific monitoring activities for Rhode Island's coastal waters, rivers, streams, lakes, and ponds are recommended. When fully implemented, the strategy will yield data to support a statewide assessment of water quality conditions, allow measurements of key environmental indicators and provide important information to support management decision-making at both the state and local level. While the strategy has not yet been fully implemented, there has been progress. For more detail, see the 2012 Annual Report of the Rhode Island Environmental Monitoring Collaborative (2013) (http://www.dem.ri.gov/bayteam/documents/emcrep12.pdf) and the 2017 Workshop Report: Toward Comprehensive Monitoring of Narragansett Bay (http://www.rimonitoring.org/ws/wp-content/uploads/2018/05/Monitoring_Workshop_Proceedings_October_2017.pdf). There are still gaps in data collection that need to be addressed. RIDEM will be evaluating these and other issues as part of updating and refining the Monitoring Strategy. RIDEM, as part of the Coordination Team, will be continuing to seek the resources needed to support full implementation of the updated strategy.

9.0 PUBLIC PARTICIPATION

As noted previously, the Department solicited submittal of data and information for use in developing the Integrated Report. In addition, the Department will involve researchers or other water quality experts, in the assessment and listing determinations.

Under 40 CFR 130.7(b)(6), the Department is required to provide a description of the methodology used to develop the Impaired Waters 303(d) list. This Consolidated Assessment and Listing Methodology (CALM) document describes the framework for assessing data and determining which of the five categories an AU will be assigned to in fulfillment of that requirement.

The Integrated Report combines the non-regulatory Section 305(b) water quality assessment reporting with the more regulation-driven aspects of the Section 303(d) impaired waters listing requirements. The public participation requirements of these programs are different. In general, Category 5 of the Integrated Report is considered reporting under Section 303(d) for impaired waters. Regulatory requirements regarding public participation, EPA approval, and adoption of the Impaired Waters List apply only to Category 5 waters.

The Department will publish notice of the availability of the draft 2024 Category 5, Impaired Waters 303(d) List upon its completion. The notice will provide for an informational workshop and solicit comments on the draft 2024 Category 5, 303(d) Impaired Waters List. The Department maintains a comprehensive emailing list for the notification of the draft 303(d) Impaired Waters List that includes designated watershed councils, interested stakeholders, municipal contacts, and state, local, and federal government, among others. While comments will be solicited only on the Category 5, 303(d) Impaired Waters List, the entire Integrated Lists (Categories 1 through 5) will be provided during the public notice for informational purposes.

REFERENCES

ESS 2014. Quality Assurance Project Plan Rhode Island Wadeable Streams Biomonitoring and Habitat Assessment. Prepared for the Rhode Island Department of Environmental Management by ESS Group, Inc. East Providence, RI. (http://www.dem.ri.gov/pubs/qapp/wadestea.pdf)

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers: Benthic macroinvertebrates and fish. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, D.C. EPA 440-4-89-001.

RIDEM 2007. Summary Guidance for Reviewing Environmental Monitoring Data. SOP #BEP-WR-1, July 24, 2007. (http://www.dem.ri.gov/pubs/sops/datarevw.pdf)

RIDEM 2017. Quality Management Plan, March 14, 2017. Rhode Island Department of Environmental Management. (http://www.dem.ri.gov/programs/benviron/assist/pdf/quality-management-plan.pdf)

RIDEM 2018. Water Quality Regulations (250-RICR-150-05-1). Effective August 19, 2018. Rhode Island Department of Environmental Management, Office of Water Resources. (https://rules.sos.ri.gov/regulations/part/250-150-05-1)

RIDEM 2019. Water Monitoring Strategy. December 31, 2019. Rhode Island Department of Environmental Management, Office of Water Resources. (http://dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/ri-water-monitoring-strategy-19.pdf)

RIDEM 2020a. Introduction to Aquatic Invasive Species. Rhode Island Department of Environmental Management, Office of Water Resources. Accessed March 2021. (http://www.dem.ri.gov/programs/water/quality/surface-water/aquatic-invasive-species.php)

RIDEM 2020b. Shellfish Growing Area Monitoring Program Standard Operating Procedures. Rhode Island Department of Environmental Management, Office of Water Resources. April 2020.

RIDOH 2020. Center for Drinking Water Quality. Rhode Island Department of Health. Accessed March 2021. (https://health.ri.gov/programs/detail.php?pgm_id=126)

RIEMC 2013. 2012 Summary Report. Rhode Island Environmental Monitoring Collaborative. September 2013. (http://www.dem.ri.gov/bayteam/documents/emcrep12.pdf)

RIEMC 2017. Workshop Report: Toward Comprehensive Monitoring of Narragansett Bay. Workshop held 19-October-2017. (https://www.rimonitoring.org/environmental-monitoring-explained/monitoring-gaps/)

Tetra Tech Inc., 2012. A Multimetric Biological Condition Index for Rhode Island Streams. Final Report, March 2012.

USEPA 1997a. Guidelines for the Preparation of the Comprehensive State Water Quality assessments (305(b) Reports) and Electronic Updates: Report Contents. EPA 841-B-97-002A, September 1997. United States Environmental Protection Agency. Washington, D.C., U.S. EPA Office of Water. (https://www.epa.gov/waterdata/guidelines-preparation-comprehensive-state-water-quality-assessments-305b-reports-and)

USEPA 1997b. Guidelines for the Preparation of the Comprehensive State Water Quality assessments (305(b) Reports) and Electronic Updates: Supplement. EPA 841-B-97-002B, September 1997. United States Environmental Protection Agency. Washington, D.C., U.S. EPA Office of Water. (https://www.epa.gov/waterdata/guidelines-preparation-comprehensive-state-water-quality-assessments-305b-reports-and)

USEPA 1999. Rapid Bioassessment Protocols for use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates and Fish. Second Edition. USEPA Office of Water. July 1999. EPA 841-B-99-002. (https://www.epa.gov/sites/production/files/2019-02/documents/rapid-bioassessment-streams-rivers-1999.pdf)

USEPA 2002. Consolidated Assessment and Listing Methodology, Toward a Compendium of Best Practices, First Edition. July 2002. United States Environmental Protection Agency. Office of Wetlands, Oceans, and Watersheds (https://www.epa.gov/waterdata/consolidated-assessment-and-listing-methodology-calm)

USEPA 2005. Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Section 303(d) and 305(b) of the Clean Water Act. July 29, 2005. U.S. Environmental Protection Agency. Office of Wetlands, Oceans, and Watersheds. Assessment and Watershed Protection Branch. (https://www.epa.gov/sites/production/files/2015-10/documents/2006irg-report.pdf)

USEPA 2006. Memorandum from Diane Regas. Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions. October 12, 2006. (https://www.epa.gov/sites/production/files/2015-10/documents/2006_10_27_tmdl_2008_ir_memorandum.pdf)

USEPA 2009. Memorandum from Suzanne Schwartz. Information Concerning 2010 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions. May 5, 2009. (https://www.epa.gov/sites/production/files/2015-10/documents/2009_05_06_tmdl_guidance_final52009.pdf)

USEPA 2010. EPA New England Quality Assurance Project Plan Program Guidance. U.S. EPA New England Quality Assurance Unit Staff, Office of Environmental Measurement and Evaluation. January 9, 2010. (https://www.epa.gov/quality/epa-new-england-quality-assurance-project-plan-program-guidance-january-9-2010)

USEPA 2011. Memorandum from Denise Keehner. Information Concerning 2012 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions. March 21, 2011. (https://www.epa.gov/sites/production/files/2015-10/documents/final_2012_memo_document.pdf)

USEPA 2012. Recreational Water Quality Criteria. U.S. Environmental Protection Agency, Office of Water. 820-F-12-058. (https://www.epa.gov/sites/production/files/2015-10/documents/rwqc2012.pdf)

USEPA 2013. Memorandum from Denise Keehner. Information Concerning 2014 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions. September 3, 2013. (https://www.epa.gov/sites/production/files/2015-10/documents/final_2014_memo_document.pdf)

USEPA 2015. Memorandum from Benita Best-Wond. Information Concerning 2016 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions. August 13, 2015. (https://www.epa.gov/sites/production/files/2015-10/documents/2016-ir-memo-and-cover-memo-8_13_2015.pdf)

USEPA 2017. Memorandum from John Goodin. Information Concerning 2018 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions. December 22, 2017. (https://www.epa.gov/sites/production/files/2018-01/documents/final_2018_ir_memo.pdf)

USEPA 2021. Draft Information Concerning 2022 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions. February 2021.