**STATE OF CONNECTICUT**

**DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION**

# 2024 DRAFT INTEGRATED WATER QUALITY REPORT

DRAFT

September 2025

This document has been established pursuant
to the requirements of Sections 305(b) and 303(d)
of the Federal Clean Water Act

_____ _____

Brian Thompson, Acting Bureau Chief — Date
Bureau of Water Protection and Land Reuse

*Katie S. Dykes, Commissioner*

Bureau of Water Protection and Land Reuse
79 Elm Street
Integrated Water Quality Report
Hartford, CT 06106-5127
(860) 424-3704

# Table of Contents

Table of Contents ..... ii
Appendices ..... iii
Table of Acronyms ..... iv
Introduction ..... 1
Chapter 1 -Connecticut Consolidated Assessment and Listing Methodology (CT CALM) ..... 6
Chapter 2 – 305(b) Assessment Results ..... 35
Chapter 3 - Waterbodies Identified for Restoration and Protection Strategies Pursuant to Section 303 of the Clean Water Act ..... 40
IWQR Appendices ..... 53
References ..... 54

Figure 1-1. Connecticut Rivers and Lake Basins Index ..... 12
Figure 1-2. Connecticut Estuary Basins Index. ..... 13
Figure 1-3. CT DEEP Monitoring BCG Value Results Map ..... 17
Figure 1-4. Macroinvertebrate Multimetric Index (MMI) model results ..... 18
Figure 1-5. Map of Hypoxia interpolations ..... 25
Figure 1-6. Assessment units overlain on shellfish growing area classifications in Long Island Sound ..... 29
Figure 2-1. IWQR Web Mapping Application which includes Assessment and WQAP information for CT Waterbodies. ..... 35
Figure 2-2. Waterbody segments assessed for one or more Designated Uses ..... 37
Figure 3-1 Planning and Implementation Process ..... 40
Figure 3-2. Number of CT TMDLs and Subcategories ..... 47
Figure 3-3. CT Waterbodies with a ..... 47
Plan in Place ..... 47
Figure 3-4. CT Selected Waters for Action Plan Development for Bacteria ..... 51
Figure 3-5 Alternative/Protection Action Plan Development 2024-2026 ..... 51

Table 1-1. Designated Uses for surface waters as described in CT WQS and the IWQR. ..... 7
Table 1-2. Timeline for submitting data to CT DEEP. ..... 9
Table 1-3. Aquatic Life Use Support (ALUS) categories and contributing decision criteria for wadeable streams. ..... 16
Table 1-4. Stream flow classes adopted under the Connecticut Stream Flow Standards and Regulations ..... 19
Table 1-5. Aquatic Life Use Support (ALUS) categories and contributing decision criteria for lakes. ..... 22
Table 1-6. Aquatic Life Use Support (ALUS) in estuaries as determined by dissolved oxygen levels. ..... 23
Table 1-7. Fish consumption use support and criteria. ..... 26
Table 1-8. Shellfish harvesting use support as determined by shellfish growing area classifications ..... 28
Table 1-9. Decision criteria for various categories of recreational use support. ..... 31
Table 2-1. Designated Use support summaries for rivers, lakes, and estuaries ..... 38
Table 2-2. CT DEEP Probabilistic Monitoring Aquatic Life Use Support in Wadeable Streams Summary ..... 39
Table 3-1. Designated Uses by Water Quality Classification ..... 41
Table 3-2. Prioritization of TMDL Development ..... 45

DRAFT

# Appendices

Appendix A-1. Connecticut 305b Assessment Results for Rivers and Streams

Appendix A-2. Connecticut 305b Assessment Results for Lakes

Appendix A-3. Connecticut 305b Assessment Results for Estuaries

Appendix A-4. Connecticut 305b Site Specific Fish Consumption Advisories

Appendix B-1. List of Impaired Waters for Connecticut (EPA Category 5 and 5R)

Appendix B-2. Waterbodies with Adopted TMDLs (EPA Category 4a)

Appendix B-3. Pollution Control Measures for Waterbody Segments (EPA Category 4b)

Appendix B-4. Nonpollutant Impairments (EPA Category 4c)

Appendix B-5. Reconciliation List of Impaired Waters (Delistings and Listings, Additions and Removals)

Appendix C-1. Draft 2024 Priority List of Waters for Action Plan Development by 2024-2026 (including TMDL development)

Appendix C-2. Priority List of Waters for Action Plan Development Post 2026 (including TMDL development)

Appendix D-1. EPA's Ruling on Water Quality Standards Regulatory Revisions to Protect Tribal Reserved Rights

DRAFT

# Table of Acronyms

| | |
|---|---|
| 303(d) | Section 303(d) of the Federal Clean Water Act, which requires states to develop lists of waters based on support of Designated Uses and water quality standards and develop plans to restore or protect water quality within those waters. |
| 305(b) | Section 305(b) of the Federal Clean Water Act, which requires states to assess and report on the status of their waters every two years |
| 319(a) | Section 319(a) of the Federal Clean Water Act, which requires states to prepare a report that identifies waters impaired by nonpoint source pollution, its sources and programs to reduce such pollution |
| ADB | Assessment Database (Former database, replaced by ATTAINS in 2018) |
| ALUS | Aquatic Life Use Support |
| ATTAINS | Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System is the new online replacement for the obsolete ADB |
| AU | Assessment Unit; a section of a waterbody for which water quality is determined |
| CFU | Colony Forming Unit for bacteria enumeration |
| CSO | Combined Sewer Overflow |
| CT CALM | Connecticut Consolidated Assessment and Listing Methodology |
| CT DA/BA | Connecticut Department of Agriculture, Bureau of Aquaculture |
| CT DEP | Connecticut Department of Environmental Protection (previous name of Connecticut Department of Energy and Environmental Protection) |
| CT DPH | Connecticut Department of Public Health |
| CT WQS | Connecticut Water Quality Standards |
| CWA | (Federal) Clean Water Act |
| CWF | Connecticut Clean Water Fund |
| CT DEEP | Connecticut Department of Energy and Environmental Protection formally known as Connecticut Department of Environmental Protection |
| IWQR | Integrated Water Quality Report |
| MMI | Multimetric Index; used to assess the biological communities for Aquatic Life Use Support (ALUS) |
| NHD | National Hydrography Dataset |
| NSSP-MO | National Shellfish Sanitation Program Model Ordinance |
| QAPP | Quality Assurance Project Plan |
| RBP | Rapid Bioassessment Protocols |
| RBV | River Bioassessment for Volunteers |
| RCSA | Regulations of Connecticut State Agencies |
| SDWA | (Federal) Safe Drinking Water Act |
| TMDL | Total Maximum Daily Load |
| US EPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| WQS | Water Quality Standards |
| WQX | EPA's National Data Water Quality Data Exchange |

DRAFT

# Introduction

This report was prepared to satisfy statutory reporting requirements pursuant to Sections 305(b) and 303(d) of the federal Clean Water Act (CWA). CWA Section 305(b) requires each State to monitor, assess and report on the quality of its waters relative to attainment of Designated Uses established by the State's Water Quality Standards (CT WQS). In Connecticut, the Department of Energy and Environmental Protection (CT DEEP) is the agency with primary responsibilities to report on these CWA activities. Section 303(d) of the CWA requires each State identify and prioritize water quality limited waterbodies and develop Total Maximum Daily Loads (TMDLs) or other management actions consistent with Water Quality Standards. These reports are brought together in the Integrated Water Quality Report (IWQR) which is submitted to the United States Environmental Protection Agency (US EPA) every two years to review the States water assessment updates and approve waters identified as impaired pursuant to Section 303(d) of the CWA.

Water quality in Connecticut has improved over the last few decades as a result of protective laws, remediation efforts and a substantial investment in improved wastewater treatment. For example, the latest statewide assessment showed that 76% of the wadeable streams in Connecticut are healthy and meet aquatic life use support goals. Although difficult to compare with historic data because statistical surveys were not completed in the early years, it is appropriate to point out that the percentage of streams meeting aquatic life goals during the late 1970's and early 1980's was much lower.

Despite tremendous progress in water quality, there are still gains to be made particularly in the area of nonpoint source (NPS) stormwater management, and infrastructure maintenance and improvements. Many of the remaining causes of impairment of Connecticut surface waters are difficult to identify (e.g., "cause unknown") and/or correct (e.g., Combined Sewer Overflows, urban stormwater runoff). Initiatives to maintain and improve water quality will require input and cooperation from numerous public and private interests that regulate and oversee land use management and environmental policy, especially at the local level.

## Water Pollution Control Programs

### Maintenance and Improvements of Infrastructure

Public funding for improved sewage system infrastructure in Connecticut is substantial. The Connecticut Clean Water Fund (CWF) is the state's environmental infrastructure assistance program. The CWF program is defined by Sections 22a-475 through 22a-483 of the Connecticut General Statutes (CGS) and by regulations adopted February 19, 1992, pursuant to CGS 22a-482. The CWF is a nationally recognized program administered by the Office of the Treasurer and DEEP that provides grants and low interest loans to municipalities for wastewater infrastructure improvement projects.

The CWF is one of the most generous programs in the United States with 100% project financing, which includes grants for a percentage of the project cost and subsidized 2% interest rate loans for the balance of the project cost. Since its inception in 1986, the CWF program in Connecticut has been supported with an annual State Revolving Fund (SRF) capitalization grant through EPA. For many years, the SRF capitalization grant award to Connecticut averaged around $18 million per year. More recently, a portion of the annual SRF capitalization grant has been redirected to Congressional Directed Spending (CDS) projects, decreasing the total annual award to no more than $10 million. With the authorization of the Infrastructure Investment and Jobs Act (IIJA) in 2021, the Connecticut CWF program has also received a supplemental SRF capitalization grant averaging around $30 million. The remainder of the

DRAFT

Connecticut CWF program is funded through State General Obligation bonds and Revenue Bonds which support the grants and loans, respectively.

This investment has reaped great benefits to public health, water quality, economic development, and the beginning of restoring an oxygen depleted area in western Long Island Sound.

At no time in the history of the CWF has the demand for construction funding been higher. CT DEEP estimates wastewater infrastructure needs of nearly 5 billion dollars over the next twenty years. The projects include combined sewer overflow (CSO) correction projects to eliminate the discharge of nearly 2 billion gallons of combined sewage into Connecticut's waterways each year, denitrification projects necessary to restore the health of Long Island Sound, emerging water quality issues such as phosphorus removal, the need for increased treatment capacity for the state's growth and economic development and the continued maintenance of existing wastewater infrastructure.

The priority list typically funds projects to support wastewater infrastructure projects whose implementation is considered significant to reduce serious negative impacts on water quality in our state. These projects include nitrogen removal projects in order to meet the TMDL for the Long Island Sound; phosphorus removal projects in order to comply with effluent limits that are being incorporated into NPDES permit renewals; and CSO improvement projects in our state's largest cities. Details of fundable project and program detail can be found in the Clean Water Fund Priority List.

Prediction of the economic costs to meet the goals of the Clean Water Act is accomplished through the federally sponsored Clean Watersheds Needs Survey .The survey, which is a joint venture among the individual states and the US EPA, results in a report to the United States Congress delineating the level of economic needs necessary to address water quality problems related to municipal wastewater conveyance and treatment, municipal stormwater management, combined sewer overflow correction, and non-point source pollution control.

Major gains in water quality have been achieved through these public investments. Further maintenance and improvement of the quality of water resources will require continued public and private financial support. Essentially all aspects of Connecticut's clean water programs create long and short-term jobs. Upgrading of sewage treatment facilities, the extension of sewer lines, installation of industrial treatment facilities and ground water remediation all generate jobs in the design, engineering and construction industries. Operation and maintenance of these facilities creates long-term employment.

### Point Source Pollution

PS pollution can be traced back to a specific source such as a discharge pipe from an industrial facility, municipal treatment plant, permitted stormwater outfall or a regulated animal feeding operation, making this type of pollution relatively easy to identify. According to the CWA and RCSA 22a-426-1-51. A PS is defined as follows: "Point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture." Section 402 of the CWA requires all such PS discharges to be regulated under the NPDES permit program to control the type and quantity of pollutants discharged. NPDES is the national program for regulating PS discharges through issuance of permit limitations specifying monitoring, reporting, and other requirements under Sections 307, 318, 402, and 405 of the CWA. In Connecticut, CT DEEP has been delegated the authority to

DRAFT

implement the NPDES program. Permit limits issued for a discharge to any waterbody must be consistent with WQS and any relevant TMDLs approved for that waterbody.

### Nonpoint Source Pollution

Most nonpoint source pollution (NPS) is the result of human activities that generate diffuse pollutants over a wide geographic area. Precipitation washes these pollutants off of the landscape, creating polluted runoff that impacts the waterbodies into which it flows. However, NPS pollution may also be associated with non-precipitation events such as: malfunctioning septic systems, hydromodifications, atmospheric deposition, eroding streambanks and mine drainage. CT DEEP's NPS efforts work to abate known water quality impairments and prevent significant threats to water quality from nonpoint source pollution. For more information, see the Connecticut Nonpoint Source Management Program Plan which outlines Connecticut's approach to addressing NPS pollution for the next 5 years.

Additionally, TMDLs and other Water Quality Action Plans are developed to address both point and nonpoint sources of pollution. CT DEEP has updated development of these plans to better facilitate management of NPS pollution through the incorporation of components required for NPS plan development required under the CWA into these Water Quality Action Plans. The Connecticut Lake Nutrient TMDL and updated Statewide Bacteria TMDL are examples of this effort. Another example of a large scale TMDL that addresses both point and NPS pollution is the Total Maximum Daily Load for Long Island Sound was implemented to address the excessive discharge of nitrogen which is causing hypoxia (very low levels of dissolved oxygen) that impacts the survival of marine animals. To further nitrogen reduction implementation from point and NPS pollution to the Sound, CT DEEP developed a Second Generation Nitrogen Strategy which combines existing efforts with new initiatives under one plan. It engages nitrogen reduction efforts in three main focus areas: wastewater treatment plants, nonpoint source and stormwater, and embayments. Near-term actions that can be taken at the state level to enhance nutrient reduction efforts are proposed for each of the three main focus areas.

Connecticut's NPS efforts include all the components required under the CWA Section 319(h) (Nonpoint Source Pollution Management Programs). CT DEEP has developed a watershed management strategy that establishes a framework to work through a networked approach with federal, state, and municipal governments and non-government agencies and organizations to conduct watershed management and strengthen the state's ability to control nonpoint source pollution. CT DEEP continues to target grant funds based on watershed priorities. Consistent with this approach, CT DEEP offers competitive annual Section 319 NPS grants to watershed initiatives for the priority watersheds, and to statewide nonpoint source initiatives.

CT DEEP NPS efforts are supported by both federal and state funds. CWA Section 319 funds support staff involved in NPS efforts as well as grants for planning and implementation of environmental programs and projects with the goal of improving water quality. CT DEEP State and federal funds support staff in other units that are involved in various aspects of NPS management. State bond and other special legislative acts provide funds for projects and grant programs targeting specific resources that address NPS pollution. Coastal Zone Management Act funds, awarded by the National Oceanic and Atmospheric Administration, support CT DEEP Office of Long Island Sound Programs NPS efforts in the coastal area. Numerous other funding sources, from other federal and state agencies, and private foundations, are utilized when available.

Unlike wastewater infrastructure initiatives, the costs and benefits accrued from NPS pollution management measures are not as easily measured. This is due to several factors: projects are often funded by contributions from a combination of state, federal and local agencies as well as from landowners, volunteer groups, foundations, businesses which may include monetary support as well as

DRAFT

in-kind services; NPS controls take many shapes and forms and can be applied as structural or non-structural measures; projects can span several years; and many NPS efforts are focused on education, as a way to encourage adoption of recommended practices.

Educational components of NPS Programs often focus on preventative measures to keep high quality waters healthy. For example, maintenance of high-quality potable water supplies is critical to the health and economic well-being of every resident. Likewise, clean water for swimming, fishing, and boating is extremely important to quality of life issues such as commercial fishing, marine industries and recreation all of which have associated economic benefits to citizens and generate tax revenues. CT DEEP has initiated research on Healthy Watersheds in Connecticut and these studies help to identify high quality water resources to the attention of Connecticut's citizens.

CT DEEP has focused on increasing awareness of Low Impact Development (LID) techniques for reducing stormwater and NPS runoff by working with our partners at the federal, state and local levels to provide information, educational materials and technical assistance in the application of LID techniques, building on existing programs such as the Governor's Responsible Growth Initiative, the University of Connecticut's Nonpoint Education for Municipal Officials (NEMO) program and US EPA's Smart Growth Program. The goal is to build better relationships and promote LID management practices with local land use agencies, academic institutions, nonprofit groups, the building industry and the public. Incorporating LID into land use plans can decrease impervious surfaces and limit runoff, leading to improved water quality and recharge of our rivers, streams and groundwater supplies.

## IWQR Report Chapter Overview

### Chapter 1 Consolidated Assessment and Listing Methodology (CT CALM)

The CALM describes the procedure used by the CT DEEP to assess the quality of the State's waters relative to the attainment of Connecticut Water Quality Standards (CT WQS). The CT CALM serves to document the protocols used by CT DEEP to assess water quality data as well as establishing minimum standards for data acceptability to ensure that only credible data are used to perform the assessments. Although CT DEEP relies primarily on data collected as part of our Ambient Monitoring and Assessment Program, data from other state and federal agencies, local governments, drinking water utilities, volunteer organizations, and academic sources are also solicited and considered when making assessments. The listing methodology section of Chapter 1 discusses the various EPA and Connecticut category definitions and how waterbodies can move from one category to another.

### Chapter 2 Clean Water Act Section 305 (b)

Clean Water Act Section 305(b) Assessment Results provides summary tables and figures presenting the results of CT DEEP's assessment of all readily available data relating to Designated Use attainment in Connecticut waters. Designated Uses include "habitat for fish and aquatic life", also referred to as Aquatic Life Use Support (ALUS), "recreation", and "fish consumption", reflecting the principal Designated Uses assigned to all waters. Assessment results are provided in more detailed tables by waterbody type in Appendix A. Waterbody assessment results are presented in ascending order by waterbody ID number. Inland water (rivers, streams, and lakes) are presented first in Appendix A-1 and A-2, followed by estuarine waterbody segments in Appendix A-3.

### Chapter 3 Clean Water Act Section 303 (d)

Waterbodies Identified for Restoration and Protection Strategies Pursuant to Section 303 of the Clean Water Act, provides additional information for water quality planning efforts including water quality limited waterbodies, such as those assessed waters that do not currently meet water quality standards, commonly referred to as "impaired waters". This Chapter also provides information on the

DRAFT

identification of stressors which impact water quality and the development of TMDLs or other Water Quality Action Plans to restore or protect surface waters in Connecticut.

DRAFT

# Chapter 1 -Connecticut Consolidated Assessment and Listing Methodology (CT CALM)

## Introduction

CT DEEP submits an IWQR to the US EPA to fulfill the reporting requirements of CWA Sections 305(b) and 303(d). The CT CALM documents the decision-making process for assessing and reporting in the IWQR on the quality of surface waters of the state. The assessments conducted during this report cycle are based on the CT WQS established on October 10, 2013 and approved by EPA on December 11, 2013. CT WQS are adopted as regulations and are contained in Sections 22a-426-1 through 22a-426-9 of the Regulations of Connecticut State Agencies (RCSA).

The assessment and listing process outlined here should be viewed in context of the CWA and CT WQS. The CWA is the primary federal law that protects our nation's surface waters, including lakes, rivers, wetlands, estuaries and ocean waters. In authorizing the Act, Congress declared as a national goal the attainment, wherever possible, of "water quality, which provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water". This goal is popularly referred to as the "fishable / swimmable" requirement of the CWA. In 1967, predating the CWA, the State of Connecticut adopted Water Quality Standards as required under Section 22a-426 of the Connecticut General Statutes to accomplish this and other water quality goals.

The CT WQS contains policy statements addressing the protection of water quality and a classification of state waters. Described for each class are: 1) water quality classifications; 2) numeric or narrative criteria for various parameters or conditions to maintain water quality; and 3) Designated Uses that should be supported. For example, the Designated Uses for Class A waters are: habitat for fish and other aquatic life and wildlife; potential drinking water supplies; recreational use; and water supply for industry and agriculture. CT DEEP assesses whether the state waters meet the Designated Uses by categorizing them into levels of support. Table 1-1 identifies the Designated Uses for which waterbodies are assessed and associates these uses with the appropriate water quality classification.

## Level of Support of Designated Uses

In making water quality assessments, each Designated Use of a waterbody is assigned a level of support (i.e., either fully supporting, not supporting, insufficient information, not assessed), which characterizes whether or not the water is suitable for that use. The level of use support attainment is based upon available data and other reliable information. The following use support categories are currently used for reporting in the IWQR. These are general definitions. Refer to the section in this report entitled *Assessment Methodology* for specific information regarding the criteria for determining levels of support for each Designated Use.

Fully Supporting: The Designated Use is fully achieved in the waterbody.

Not Supporting: The Designated Use is not supported in the waterbody

Insufficient Information: Insufficient data/information available to support an evaluation of attainment of Designated Uses in the waterbody.

Not Assessed: No current readily available information is available to assess use support.

DRAFT

Table 1-1. Designated Uses for surface waters as described in CT WQS and the IWQR.

| Designated Use | Applicable Class of Water or Class Goal | Functional Definition |
|---|---|---|
| Recreation | AA, A, B, SA, SB | Swimming, water skiing, surfing or other full body contact activities (primary contact), as well as boating, canoeing, kayaking, fishing, aesthetic appreciation or other activities that do not require full body contact (secondary contact). |
| Habitat for fish and other aquatic life and wildlife. | AA, A, B, SA, SB | Waters suitable for the protection, maintenance and propagation of a viable community of aquatic life and associated wildlife. |
| Fish Consumption is not specified independently as a use in the CT WQS, but implicit in "Habitat for fish and other wildlife as well as Recreational uses. However, CT will continue to report on Fish Consumption as a separate use for 305(b)/303(d) | AA, A, B, SA, SB | Waters supporting fish populations that are free of contaminants and allow for consumption of aquatic life by people and wildlife. |
| Shellfish harvesting for direct human consumption where authorized. | SA | Waters from which shellfish can be harvested both recreationally and commercially and consumed directly without depuration or relay. |
| Commercial shellfish harvesting where authorized. | SB | Waters supporting commercial shellfish harvesting for transfer to a depuration plant or relay (transplant) to approved areas for purification prior to human consumption ; also support seed oyster harvesting |
| Existing or proposed[b] drinking water supplies. | AA | Waters presently used for public drinking water supply or officially proposed for future public water supply. |
| Potential drinking water supplies. | A | Waters that have not been identified, officially, but may be considered for public or private drinking water supply in the future. |
| Navigation | AA, A, B, SA, SB | Waters capable of being used for shipping, travel or other transportation by private, military or commercial vessels. |
| Water Supply for Industry | AA, A, B, SA, SB | Waters suitable for industrial supply. |
| Agriculture | AA, A, B | Waters suitable for general agricultural purposes. |

[a] Also addressed in CT WQS : RCSA 22a-426-4(a)(5): "Surface waters... shall be free of chemical constituents in concentrations or combinations which will... bioconcentrate or bioaccumulate in tissues of fish, shellfish and other aquatic organisms at levels which will impair the health of aquatic organisms or wildlife or result in unacceptable tastes, odors or health risks to human consumers..."
[b] Surface waters identified as proposed drinking water supplies as specified in RCSA 22a-426-4(b).

DRAFT

## Information Used to Assess Use Support

Depending on the waterbody and data availability, any one or combination of several types of data may be used to assess water quality and use support: ambient physical and chemical; benthic macroinvertebrate and fish community; indicator bacteria; indicators of productivity and enrichment/eutrophication; aquatic toxicity; tissue contaminant; sediment chemistry/toxicity; and effluent analysis. Following guidance from US EPA (2005), the following sources of data and information are considered in conducting assessments:

- Results from recent ambient monitoring;
- Recent Section 305(b) reports, 303(d) lists, and 319(a) nonpoint assessments;
- Reports of water quality problems provided by local, state, territorial or federal agencies, volunteer monitoring networks, members of the public or academic institutions;
- Fish and shellfish advisories, restrictions on water sports or recreational contact;
- Reports of fish kills;
- Safe Drinking Water Act source water assessments;
- Superfund and Resource Conservation and Recovery Act reports;
- Results from predictive modeling, dilution calculations or landscape analysis; and
- Results from analysis of water quantity impacting aquatic life and other Designated Uses, including results from toxicity tests conducted on surface waters or sediments.

The primary sources of assessment information for rivers are ambient monitoring data collected by CT DEEP monitoring staff, and physical, chemical and bacteria data collected at fixed sites by the United States Geological Survey (USGS). Lake assessments and trophic status are generally determined from studies conducted by CT DEEP, the Connecticut Agricultural Experiment Station, USGS and Connecticut College since 1979 (Frink and Norvell, 1984; Canavan and Siver, 1995; Healy and Kulp, 1995; CT DEP, 1998) as well as recent studies by professional contractors. For estuaries, use assessments are based primarily on physical, chemical and biological monitoring by the CT DEEP Long Island Sound Study and National Coastal Assessment (Strobel, 2000), bacterial monitoring for shellfish sanitation by the Connecticut Department of Agriculture, Bureau of Aquaculture (CT DA/BA), embayment monitoring conducted by the USGS and the Unified Water Study, and bathing beach monitoring by state and local authorities.

Data from other state and federal agencies, municipalities, utilities, consultants, academia, and volunteer monitoring groups are also used for assessments. CT DEEP directs a monitoring program for volunteers from which monitoring information is obtained. The details of this program, A Tiered Approach to Citizen – Based Monitoring of Wadeable Streams and Rivers, can be obtained from the CT DEEP website.

Other types of information that may be used for assessments include water quality surveys conducted by municipalities and discharge monitoring data from municipal sewage treatment plants, industries and remediation projects. CT DEEP staff may conduct effluent or ambient toxicity tests as a follow-up to investigate suspected problems. Knowledge of a condition known to cause water quality impairment is also considered valid information for determining use support. For example, the presence of a CSO in a stream or estuarine segment may automatically preclude recreational use support.

DRAFT

## Schedule and Degree of Confidence in Assessment Information

CT DEEP will consider information for assessments up to November 1 prior to the year when the IWQR is due to US EPA (Table1-2). Data and information submitted after November 1 will be considered for the next IWQR reporting cycle and data quality will be evaluated for use in assessments using a three-tiered system.

Table 1-2. Timeline for submitting data to CT DEEP.

| IWQR Reporting Year | Deadline for Data Submission |
|---|---|
| ~~2020~~ | ~~11/1/2019~~ |
| ~~2022~~ | ~~11/1/2021~~ |
| ~~2024~~ | ~~11/1/2023~~ |
| 2026 | 11/1/2025 |
| 2028 | 11/1/2027 |
| 2030 | 11/1/2029 |
| 2032 | 11/1/2031 |
| 2034 | 11/1/2033 |
| 2036 | 11/1/2035 |

## Tiered data quality considerations for assessments of the State's waters

Tier 1- Data typically are in the form of digital photos or written descriptions of observations. This type of data is useful to record present conditions or episodic events. Tier 1 data are not likely to provide sufficient information for a complete formalized assessment but provide supporting information when other data exists for a waterbody.

Tier 2- Data collected may not have been collected under a formal Quality Assurance Project Plan (QAPP). Tier 2 data are not likely to be enough information for complete formalized assessment but provide supporting information when other data exists for waterbody.

Tier 3- Data are collected under a formal monitoring plan which follows a QAPP approved by CT DEEP or US EPA. QAPPs shall include laboratory tests to be used and data quality objectives. Standard Operating Procedures for field procedures and lab techniques should be explained as well as a plan for data management. Chemistry results should be provided from a state-certified laboratory. Taxonomic identifications should be from a taxonomist with sufficient experience to provide reliable taxonomic identifications, preferably with certifications by the Society for Freshwater Science and American Fisheries Society. Project objectives should be consistent with CT DEEP's use of data for waterbody assessment purposes. Tier 3 data may be used to support use assessments.

DRAFT

## Geographic and Temporal Extent of Assessment Coverage

### Assessment Units

Waterbodies, such as streams, lakes or estuaries are divided into water quality assessment units (AUs). Each unit is considered to have homogenous water quality (*i.e.*, use support is uniform throughout the unit). Generally, stream units are delimited by features that may cause a change in water quality or habitat, such as a confluence with a tributary, a point source discharge, an impoundment or a significant change in land use. Lakes are generally assessed as one segment. Long Island Sound, including its embayments and river-mouth estuaries, was divided into 212 AUs based primarily on Designated Uses such as shellfishing and recreation and physical features such as depth and distance from shore.

All AUs are organized by a unique identification number called the Waterbody Segment ID, which tracks assessment information stored in the online EPA Assessment, Total Maximum Daily Load Tracking and Implementation System (ATTAINS) database through each assessment cycle. Both river and lake AUs are derived from CT basin numbers (Figure 1-1) explained and cataloged in the Gazetteer of Drainage Areas of Connecticut (Nosal, 1997). Stream and river segments are indexed to the National Hydrography Dataset (NHD) at a scale of 1:24,000, and lakes are geographically indexed to the CT DEEP lakes data layer. Estuary segments were completely reorganized following the 2006 reporting cycle (Figure 1-2) to better consider bathymetry, water quality, shellfish classification maps, and geographic extent detailed in *Summary Report & Users Guide Connecticut Coastal Assessment and Segmentation Project Final – May 11, 2006 Amended – October 3, 2007* (Streich, 2007). All AUs are created and geographically indexed using USGS extension tools and ArcGIS software.

### Management of Assessment Information

All assessment data (*e.g.*, AU descriptions, assessment methods, use support, causes and sources of impairment) will be stored electronically in the new online EPA ATTAINS database. Raw monitoring data collected by CT DEEP staff since 1997 are stored and managed in an electronic database that contains sampling results and metadata. While CT DEEP uses this in-house database for monitoring and assessment purposes, US EPA's National Data Warehouse (WQX) is the ultimate repository for all monitoring results. CT DEEP is in the final stages of a long-term project that will provide seamless transfer of all water related data to the EPA's WQX. In the future, CT DEEP will require all external data generators to submit their data to WQX.

### Data used for Rivers and Stream Assessments

There are 7,772 river miles in the State of Connecticut based on the National Hydrography Dataset at the 1:24,000 scale. CT DEEP has developed an Ambient Water Quality Monitoring Program Strategy (CT DEEP, 2015) that incorporates a combination of targeted and probabilistic sampling designs for an ALUS assessment of rivers and streams. This strategy is intended to provide sufficient targeted data to answer questions about the effectiveness of specific water pollution control activities and also support a statewide probabilistic ALUS assessment. Sampling includes evaluations of benthic and fish community reference sites, focused monitoring (physical, chemical and/or biological) for TMDL development or other management actions, and follow-up to reported problems.

Physical, chemical and bacteria data from the cooperative CT DEEP/USGS long-term fixed-network were also reviewed for this report. This network of approximately thirty sites provides data for up to eight sampling events at each site per year on several major rivers and streams throughout the State.

Rivers and streams with new physical, chemical, and biological data collected during 2016-2020 were evaluated and assessed for this reporting cycle using the most recent available information from the CT

DRAFT

DEEP water monitoring and fisheries, USGS, municipalities, watershed groups and other quality assured volunteer groups. Updated assessment information can be found in Appendix A-1 of this report.

A Generalized Random Tessellation Stratified (GRTS) survey design (Stevens and Olsen 2004) was provided to CT DEEP from EPA and implemented with a target population of streams based on the National Hydrography Dataset at the 1:24,000 scale. No stratification was included in the survey design. A total of 55 wadeable stream sites were sampled to obtain a statewide estimate of aquatic life use attainment.

### Data Used for Lake Assessments

There are 72, 509 acres of lakes in the State of Connecticut based on the National Hydrography Dataset at the 1:24,000 scale. Historically, Connecticut has assessed between 105 and 115 "significant public" lakes statewide for 305(b) reporting. Significance was based on a lake having state or federal public access or providing unique or otherwise important habitats. CT DEEP reviewed assessment information on 182 lakes currently in ATTAINS. Lakes with new physical, chemical, and biological data collected during 2019-2021 were evaluated and assessed for this reporting cycle using the most recent available information from our CT DEEP water monitoring and fisheries, USGS, macrophyte data from the Connecticut Agricultural Experiment Station and CT DEEP Natural History Survey staff, municipalities, consultants, watershed groups and other quality assured volunteer groups, and surveys with data from CT DEEP administered grants applied for and awarded to local entities. Updated assessment information can be found in Appendix A-2 of this report.

Beach closure data from CT DEEP's State beach program, from the State Department of Public Health (CT DPH) and local municipalities from the summers of 2021 and 2022 were evaluated to determine recreation use support.

CT DEEP participates in the US EPA sponsored nationwide project called the National Lakes Assessment (NLA). This project is based on a probabilistic sampling design that randomly selects lakes from across the United States for the purpose of producing a comprehensive assessment of trophic status of the nation's lakes. CT DEEP samples all lakes randomly selected in Connecticut for this study, which averages 10-15 lakes every 5 years.

DRAFT

# Connecticut Water Basin Drainage Areas

Connecticut Water Basin Drainage as explained in the CT DEEP Gazetteer of Drainage Areas of Connecticut

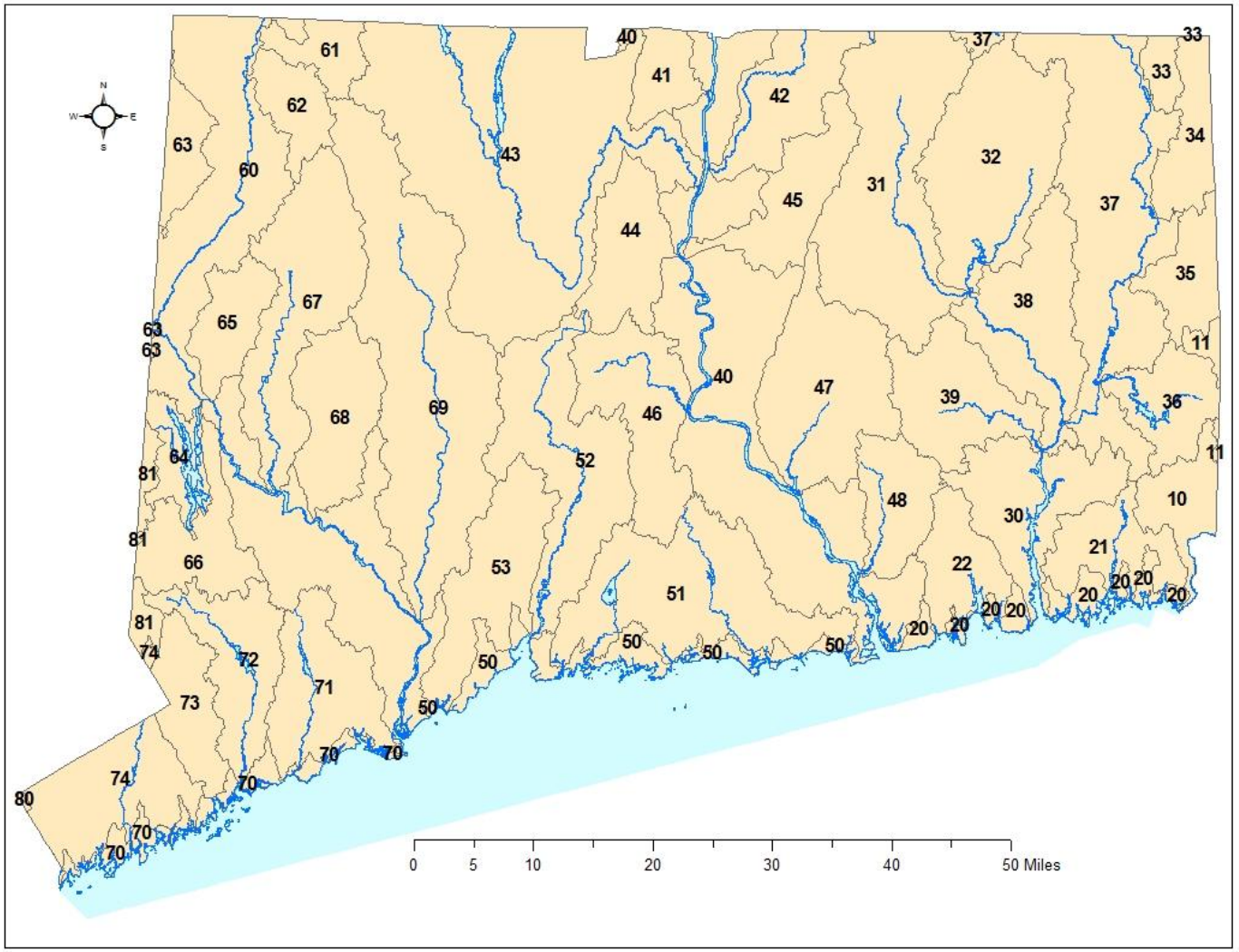



*Figure 1-1. Connecticut Rivers and Lake Basins Index*

| Number | Regional Name |
|---|---|
| 10 | Pawcatuck Main Stem |
| 11 | Wood |
| 20 | Southeast Shoreline |
| 21 | Southeast Eastern Complex |
| 22 | Southeast Western Complex |
| 30 | Thames Main Stem |
| 31 | Willimantic |
| 32 | Natchaug |
| 33 | French |
| 34 | Fivemile |
| 35 | Moosup |
| 36 | Pachaug |
| 37 | Quinebaug |
| 38 | Shetucket |
| 39 | Yantic |
| 40 | Connecticut Main Stem |
| 41 | Stony Brook |
| 42 | Scantic |
| 43 | Farmington |
| 44 | Park |
| 45 | Hockanum |
| 46 | Mattabesset |
| 47 | Salmon |
| 48 | Eightmile |
| 50 | South Central Shoreline |
| 51 | South Central Eastern Complex |
| 52 | Quinnipiac |
| 53 | South Central Western Complex |
| 60 | Housatonic Main Stem |
| 61 | Blackberry |
| 62 | Hollenbeck |
| 63 | Tenmile |
| 64 | Candlewood |
| 65 | Aspetuck |
| 66 | Still |
| 67 | Shepaug |
| 68 | Pomperaug |
| 69 | Naugatuck |
| 70 | Southwest Shoreline |
| 71 | Southwest Eastern |
| 72 | Saugatuck |
| 73 | Norwalk |
| 74 | Southwest Western Complex |
| 81 | Croton |

# Connecticut Estuarine Segmentation

Connecticut Estuarine Segmentation Basins as explained in CT DEEP *Summary Report & Users Guide Connecticut Coastal Assessment and Segmentation Project Final – May 11, 2006 amended – October 3, 2007* (Streich, 2007).

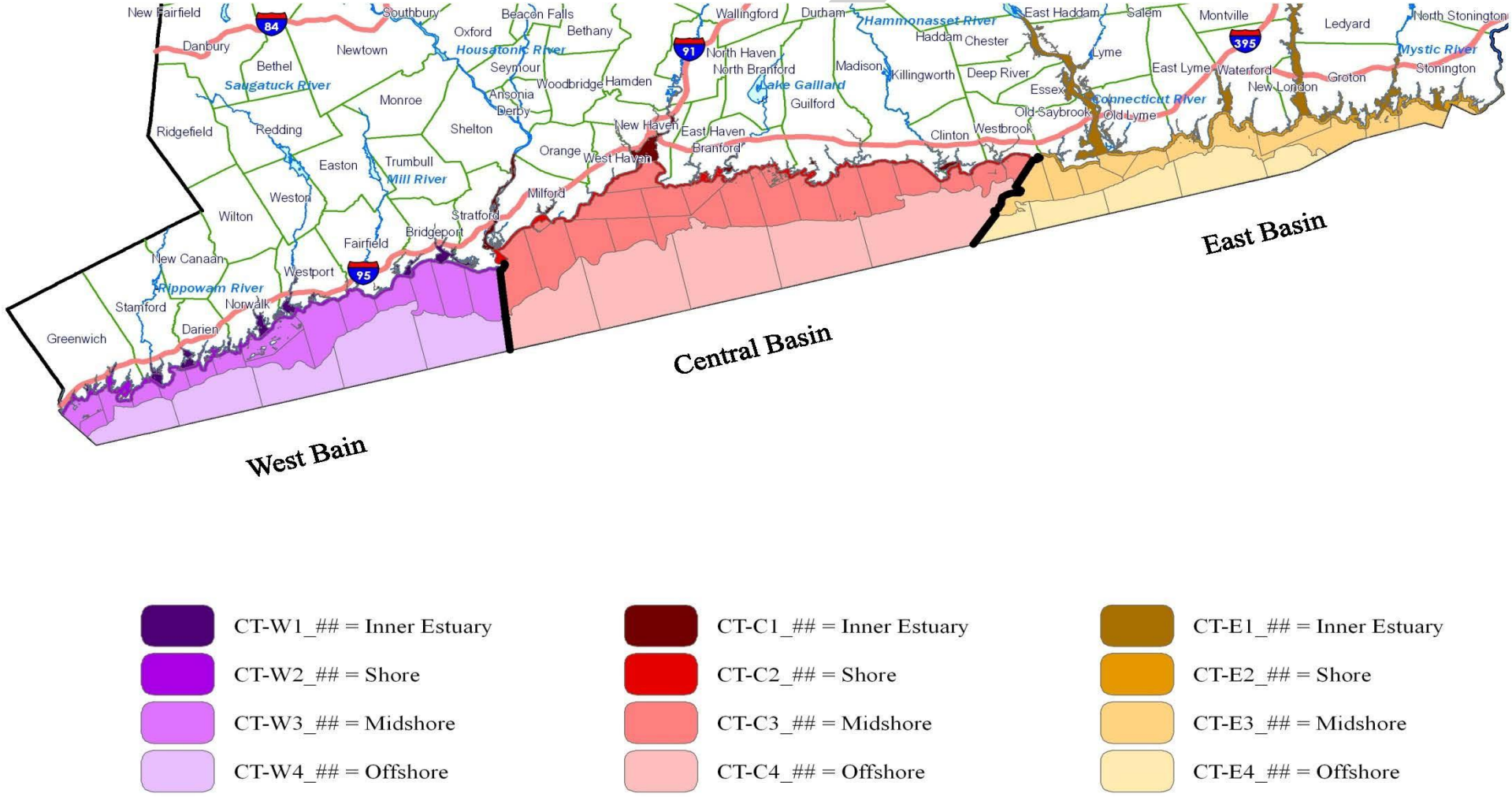



*Figure 1-2. Connecticut Estuary Basins Index.*

### Data Used for Estuary Assessments

There are 611.91 square miles of estuarine waters in the State of Connecticut, all of which are tracked for 305(b) reporting.

Long Island Sound (LIS) is monitored by CT DEEP on a monthly schedule for dissolved oxygen and nutrients at 17 fixed stations. In addition, 25-30 stations are added to the core 17 stations and monitored bi-weekly monitoring during summer months for dissolved oxygen. This monitoring is funded by the US EPA Long Island Sound Study. From 2000-2006 and in 2010 concurrent with this effort, CT DEEP collected water quality, sediment, biological community and tissue data at as many as 40 offshore and harbor sites for a US EPA probabilistic monitoring program, the National Coastal Condition Assessment (NCCA; Strobel, 2000). For the NCCA, representative stations in coastal harbors and offshore waters are chosen randomly to represent conditions of the entire Sound. Data from the LIS monitoring program and the NCCA provide the basis for aquatic life use assessments.

Annual shellfish bed monitoring and sanitary surveys conducted by the CT Department of Agriculture/Bureau of Aquaculture (DA/BA) provide assessment information for shellfish use support. Beach closure information and data from volunteer organizations as well as known sources of pollution, such as CSOs, are used to determine recreation use support.

All estuarine waters were re-assessed for this reporting cycle using the most recent available information. Dissolved oxygen data collected during the summers of 2022-2023 were used for this reporting cycle assessment. Beach closure information obtained from CT DPH for the 2021-2022 beach seasons was used for the assessment cycle. The Growing Area Classification data layer supplied by CT DA/BA, and annual, triennial and 12-year reports were evaluated for this assessment. Volunteer monitoring data collected during 2021-2023 and submitted to CT DEEP from estuary groups CUSH (Clean Up Sound and Harbors), Save the Bay - Westerly, Save the Sound, Harbor Watch, the Unified Water Study and the Millstone Environmental Laboratory, as well as data from local university researchers including UCONN (University of Connecticut) and the USGS, were also reviewed for the 2024 assessment cycle assessment.

## Assessment Methodology

CT DEEP's assessment methodology is listed in this section by Designated Use. Assessment procedures generally follow guidance provided by US EPA (1997) using a variety of information and data types. CT DEEP applies a "weight of evidence" approach using best professional judgment when using multiple types of data. A waterbody is generally considered impaired when one or more sources of data or information indicate a water quality standard is not attained, providing that information is considered sufficient and credible. In resolving discrepancies in conflicting information, consideration is given to data quality, age, frequency and site-specific environmental factors. If reconciliation of conflicting data is not possible or the data are determined to be insufficient, the assessment unit is flagged for further monitoring.

### Aquatic Life Use - Rivers and Streams

Because the biological community of a stream integrates the effects of pollutants and other conditions over time, biological community assessment is the best and most direct measure of Aquatic Life Use Support (ALUS), or as stated in the CT WQS "Habitat for fish and other aquatic life and wildlife". CT DEEP uses a weight of evidence approach based on biological, stream flow, and chemical indicators to make use support determinations for wadeable rivers and streams (Table 1-3). In addition, CT DEEP has developed a methodology for determining when nutrient enrichment by phosphorus is the cause of an

DRAFT

Aquatic Life Use Support impairment (Becker *et al*., 2018). The following sections provide more details about the indicators and assessment protocols.

### *Biological Indicators*

CT DEEP developed Biological Condition Gradient models for two of Connecticut's aquatic life communities (fish and macroinvertebrates). The Biological Condition Gradient (BCG) is a conceptual model that describes changes in aquatic communities. The BCG model provides a more refined way of assigning stream health than a pass/fail approach. Incorporation of the BCG into Connecticut's water quality assessment process allows CT to better define and identify stream condition in Connecticut.

The approach for using the BCG models and other biological data for assessments are described in technical support documents. For the BCG model for macroinvertebrates, please refer to the CT DEEP report: Calibration of the Biological Condition Gradient for High Gradient Streams of Connecticut. The fish community data are evaluated using one of two multimetric indices based upon upstream watershed area (Kanno *et al*. 2010), a Fish BCG Assessment Model, and best professional judgment of fisheries and water quality monitoring staff biologists. Methods for fish monitoring are described in CT DEEP (2013), Plafkin *et al*. (1989) and Barbour *et al*. (1999).

Figure 1-3 shows the sites assessed for the 2024 reporting cycle using the BCG Assessment Models for macroinvertebrates and fish. For a closer look at the data that supports the BCG tier for each biological community CT DEEP has developed an interactive BCG web application that allows a user to interface with the data spatially. This application can be used to identify the healthiest streams in the state (Tiers 1 and 2) and the most stressed streams (Tiers 5 and 6).

DRAFT

Table 1-3. Aquatic Life Use Support (ALUS) categories and contributing decision criteria for wadeable streams.

| Aquatic Life Use | Criteria / Indicators |
|---|---|
| Fully Supporting | Biological community with ecological attributes consistent with Biological Condition Gradient Tiers 1-4 as adopted in Connecticut Water Quality Standards Section 22a-426-5 of the Regulations of Connecticut State Agencies.<br>Benthic community: benthic MMI, value >48 (Gerritsen and Jessup, 2007) and meets narrative criteria in CT WQS (Biological Condition narrative standard: RCSA 22a-426-9(a)(1) Table 1)*.<br>Screening Approach data with 6 or more "Screening Taxa"<br>RBV data submitted to CT DEEP listed 4 or more pollution sensitive "Most Wanted" invertebrates<br>Fish community: species composition, trophic structure, and age class distribution as expected for an unimpaired stream of similar watershed size.<br>Conventional physical/chemical criteria are not exceeded.<br>Measured chemical constituent levels do not exceed acute or chronic numeric or narrative water quality criteria.<br>Biological communities show no evidence of impact from anthropogenic manipulations to stream flow.<br>No evidence of chronic toxicity in ambient waters. |
| Not Supporting | Biological community with ecological attributes consistent with Biological Condition Gradient Tiers 5-6 as adopted in Connecticut Water Quality Standards Section 22a-426-5 of the Regulations of Connecticut State Agencies<br>Benthic community: benthic MMI < 43 (Gerritsen and Jessup, 2007), and does not meet narrative criteria in CT WQS (Biological Condition narrative standard: RCSA 22a-426-9(a)(1)Table 1).*.<br>Screening Approach data with 2 or less "Screening Taxa"<br>Fish community: species composition, trophic structure and age class distribution significantly less than expected for a non-impacted stream of similar watershed size; diversity and abundance of intolerant species reduced or eliminated; top carnivores rare or absent; trophic structure skewed toward omnivory.<br>Physical/chemical or narrative or numeric water quality criteria for chemical constituents are exceeded in ≥ 10% of samples.<br>Biological communities show evidence of impact from anthropogenic manipulations to stream flow.<br>Stream completely enclosed in conduit or cleared concrete trough.<br>Evidence of chronic toxicity in ambient waters. |
| Insufficient Information | Some community data exist, but sampling was very limited and/or the results are ambiguous or conflicting, requiring follow-up monitoring. |

* When a bioassessment falls on the border between two use support categories, use support is determined by staff biologists giving consideration to site conditions, certain sensitive taxa present, and other available data. Occasionally, where habitat conditions are not optimal, a non-quantitative sample may be used to infer ALUS as a best professional judgment assessment.

DRAFT

Starting with the 2014 Assessment Cycle, CT DEEP began using a model that predicts macroinvertebrate multi-metric index (MMI) (Bellucci *et al.*, 2013) score using GIS derived landscape variables (percent impervious land cover, percent wetlands, and stream slope) in the upstream watershed for any monitored wadeable stream location (Figure1-4) to predict stream health across Connecticut. This model provides an expected baseline of MMI score to compare to actual results when evaluating an aquatic life assessment. This is especially helpful when sampling a stream reach for the first time without the benefit of existing data for comparison. Although not used alone to assess aquatic life, the model results can provide another line of evidence to support stream data, lending more confidence to assessments. The results shown in Figure 1-4 predicts, that 76% of stream miles should pass aquatic life goals and 24% of stream miles should fail aquatic life goals using modeled MMI values. Percent values were obtained by summing the stream miles with an MMI >48 (pass) and MMI < 48 (fail) and dividing by total stream miles.

Volunteer monitoring data from the CT DEEP-sponsored River Bioassessment for Volunteers are also used in assessments. The presence of four or more pollution sensitive "most wanted" invertebrate taxa reported at a given site can be considered for an assessment category of "Fully Supporting". CT DEEP also developed a Treasure Hunt for Healthy Waters Story Map to highlight work conducted by Volunteers focusing on the healthy streams in the state and to help guide future sampling using where volunteer map applications by prioritizing un-sampled watersheds that are predicted to be healthy based on the MMI Model (Bellucci et al 2013).

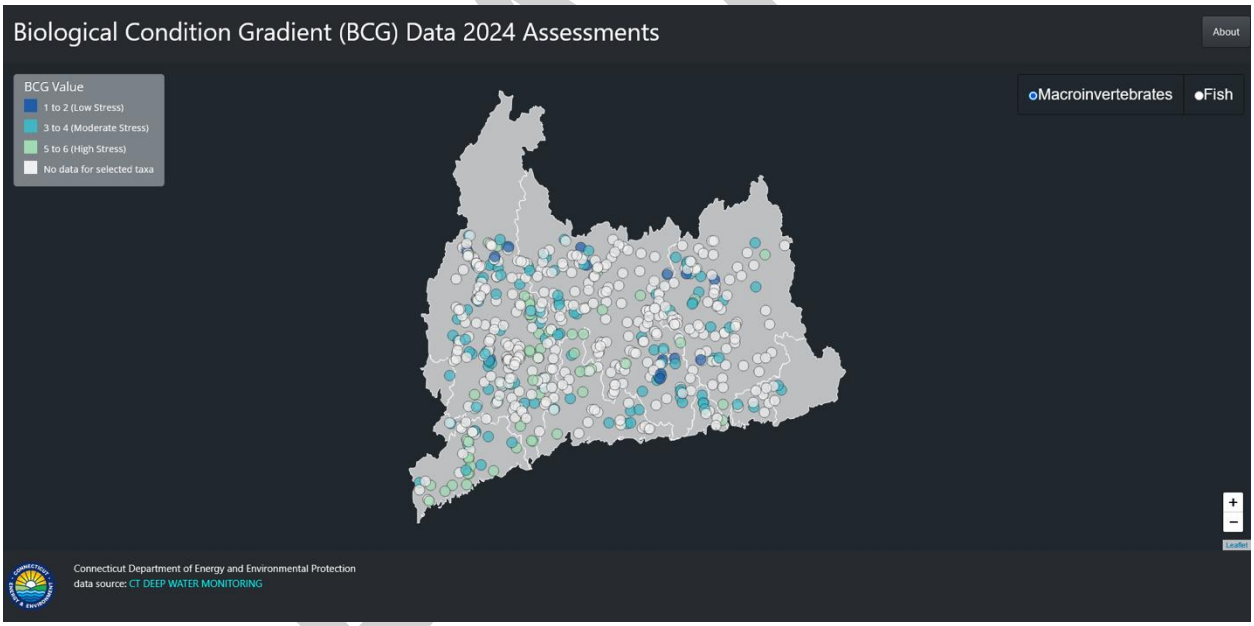



*Figure 1-3. CT DEEP Monitoring BCG Value Results Map* collected from 2016-2020 and assessed for the 2022 reporting cycle. For a closer look at the data that supports the BCG tier, go to this BCG web application .

DRAFT

# Connecticut Macroinvertebrate Multimetric Index (MMI) Model

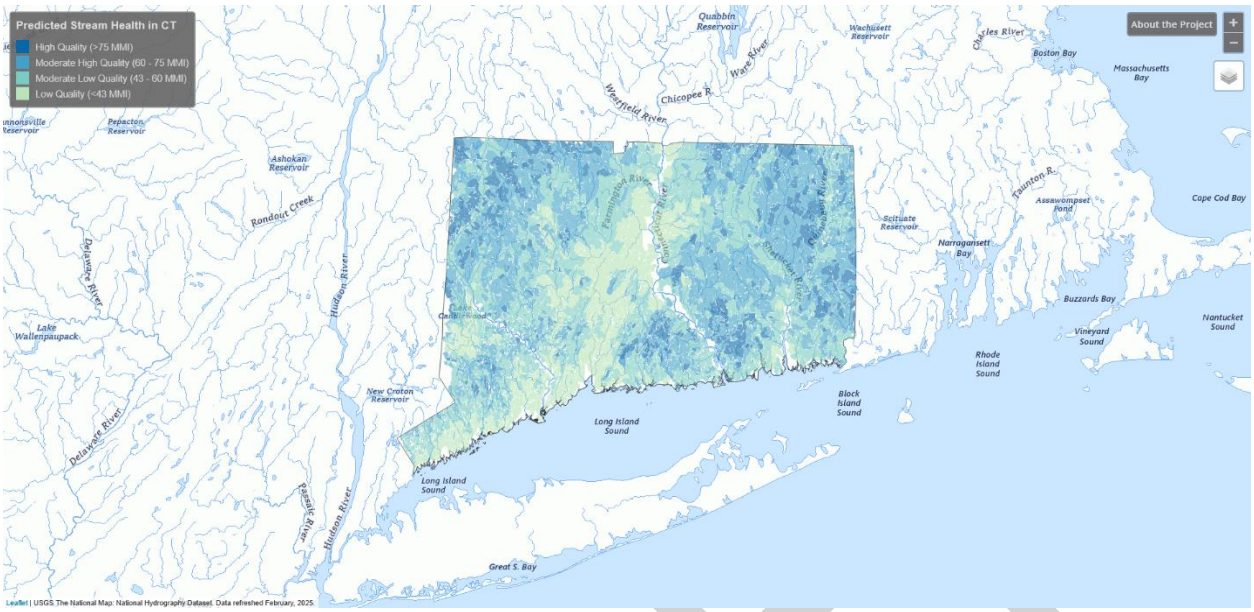



*Figure 1-4. Macroinvertebrate Multimetric Index (MMI) model results* showing the predicted stream health condition. *The Data can be explored in further detail through the* CT Stream Health web-based mapping application.

Additionally, data from toxicity tests conducted on surface waters and sediments also provide another line of evidence that directly measures biological impacts and are considered during the assessment process.

### *Stream Flow Indicators*

CT DEEP has made a significant effort to balance human and ecological needs relative to water quantity. Stream flow classes for the entire state have been adopted under the Connecticut Stream Flow Standards and Regulations. These stream flow classes can be useful to determine potential impacts due to hydrologic alteration since stream flow classes are scaled based on the natural flow paradigm (Poff et al 1997) and can provide a line of evidence to support biological community assessments that may be impacted by hydrologic alteration. Stream flow classes have narrative standards that represent a range of flow conditions (Table 1-4), and these classifications can be considered when making judgments on flow altered streams.

CT DEEP staff have developed a GIS application and a method using digital photos to help with documenting low flow conditions throughout the state to assist with aquatic life assessments. Assessments metrics developed from digital images are combined with other factors in the GIS to determine flow alteration as a cause of impairment. CT DEEP uses a weight of evidence approach following metrics based on best professional judgment. Flow conditions that result in disconnected flow and that limit habitat to fish and other aquatic life from non-natural causes are documented and listed under Category 4C. The following information is considered when making these assessments:

- Biological metrics such as MMIs and BCGs for fish and macroinvertebrates;
- Surficial geology in the watershed;
- Location of diversions and dams;

DRAFT

- Statistical summaries of streamflow or flow measurements in the field that indicate a deviation from the natural hydrograph that results in habitat alteration that can impact aquatic life;
- Stream flow classification adopted under the Connecticut Stream Flow Standards and Regulations;
- Dry or nearly dry streams with severely limited aquatic habitat documented by digital photos influenced by water diversions or registrations that alter the natural hydrologic regime.

Table 1-4. Stream flow classes adopted under the Connecticut Stream Flow Standards and Regulations

| Stream flow Class | Narrative Standard |
|---|---|
| Class 1 | River or stream segment shall exhibit, at all times, the depth, volume, velocity and variation of stream flow and water levels necessary to support and maintain habitat conditions supportive of an aquatic, biological community characteristic of that typically present in free-flowing river or stream systems of similar size and geomorphic characteristics under the prevailing climatic conditions. |
| Class 2 | River or stream segment shall exhibit, at all times, the depth, volume, velocity and variation of stream flow and water levels necessary to support and maintain habitat conditions supportive of an aquatic, biological community minimally altered from that typically present in free-flowing river or stream systems of similar size and geomorphic characteristics under the prevailing climatic conditions. |
| Class 3 | River or stream segment shall exhibit, at all times, the depth, volume, velocity and variation of stream flow and water levels necessary to support and maintain habitat conditions supportive of an aquatic, biological community moderately altered from that typically present in free-flowing river or stream systems of similar size and geomorphic characteristics under the prevailing climatic conditions. |
| Class 4 | River or stream segment may exhibit substantially altered stream flow conditions caused by human activity to provide for the needs and requirements of public health and safety, flood control, industry, public utilities, water supply, agriculture and other lawful uses; and shall, while giving consideration to societal needs, economic costs, and environmental impacts, exhibit to the maximum extent practicable the depth, volume, velocity and variation of stream flow and water levels consistent with the narrative standard for Class 3 river and stream segments. |

### *Chemical Indicators*

Indirect measurements of ALUS such as ambient physical/chemical data, discharge monitoring reports, Aquatic Toxicity Monitoring Reports, and sediment chemistry data are also evaluated against water quality criteria established in CT WQS. These data may be used independently or supplement the weight of evidence for Assessment Units with benthic invertebrate or fish community data. We generally

DRAFT

consider samples that exceed the water quality criteria > 10% of time for chemical constituents or toxicity test data for ambient waters as a potential for an impaired waters listing.

### *Nutrient Enrichment Indicators*

Nutrient enrichment has also been identified as one of the most pressing water quality issues facing the nation as a whole. As a result, US EPA has directed states to take aggressive action to limit the quantity of phosphorus being discharged to surface waters. In Region 1, US EPA has mandated that all New England states establish limitations on phosphorus (TP) in all wastewater discharge permits where the potential exists for the discharge to contribute to eutrophication and impair Designated Uses in downstream waters.

When there is an impairment to aquatic life in wadeable streams, CT DEEP has a weight of evidence approach to determine whether TP is the cause of this impairment. This procedure includes using a combination of three measures: stream aquatic life biological assessments, TP concentrations, and diatom TP tolerance metrics. Details of the method is summarized in a technical support document (Becker and Bellucci 2019). The approach draws on previous research conducted on phosphorus in CT (Becker 2012, Smucker et al 2013, Becker et al 2018) and follows recommendations in the phosphorus strategy report pursuant to CT public act 12-155 to use a stressor response model with multiple response parameters to establish phosphorus impairment (PA 12-155 Coordinating Committee, 2017).

DRAFT

### Aquatic Life Use – Lakes

The most recent available information from the CT DEEP Monitoring Program, government agencies and/or reliable contractors and lake associations are used to determine levels of support for aquatic life use in lakes. CT DEEP monitoring and assessment staff evaluate these data into lake trophic classifications to determine attainment of ALUS using a weight of evidence approach and best professional judgment. Factors taken into consideration are known problems, such as chronic algal blooms, the extent of coverage by exotic invasive plants, severe sedimentation, and results of surveys by fisheries biologists.

Lake trophic classifications, as listed in Section 22a-426-6 of the CT WQS are based on ambient measurements of four parameters: total phosphorus, total nitrogen, chlorophyll a, and Secchi disc transparency in specified seasons. Lakes are classified as either oligotrophic, mesotrophic, eutrophic, or highly eutrophic based on the range of values for these four parameters. Macrophyte coverage and density are used to adjust the trophic classification based on water column data described above. While trophic status is not a direct measure of aquatic community health, highly eutrophic conditions, beyond what is naturally expected (given the relative size of the lake/pond and watershed, the origin of the lake/pond, and other physiographic parameters), or a documented trend toward cultural eutrophy may indicate impairment or a threat to aquatic life. A naturally eutrophic lake, having nutrient concentrations that support high levels of biological activity without any significant anthropogenic source, would not be considered impaired. Lake trophic classifications were assigned for all lakes that had new monitoring data collected since the previous reporting cycle.

DRAFT

Table 1-5. Aquatic Life Use Support (ALUS) categories and contributing decision criteria for lakes.

| Aquatic Life Use | Criteria / Indicators |
|---|---|
| Fully Supporting | Lake Trophic Classification: classification consistent with the natural trophic state of the lake (given the relative size of the lake/pond and watershed, the origin of the lake/pond, and other physiographic parameters).<br>Fish community: species composition, and age class distribution as expected for a lake of similar watershed size.<br>Conventional physical/chemical constituent numeric and narrative criteria are not exceeded.<br>Macrophyte species composition and density supports a healthy biological community.<br>Measured levels of chemical constituents do not exceed acute or chronic numeric or narrative water quality criteria.<br>No evidence of chronic toxicity in ambient waters. |
| Not Supporting | Lake Trophic Classification: Highly eutrophic conditions, beyond the natural trophic state of the lake (given the relative size of the lake/pond and watershed, the origin of the lake/pond, and other physiographic parameters), or a documented trend toward cultural eutrophy.<br>Fish community: species composition, and age class distribution significantly less than expected for a non-impacted lake of similar watershed size; diversity and abundance of intolerant species reduced or eliminated; top carnivores rare or absent; trophic structure skewed toward omnivory.<br>Known problems due to excessive anthropogenic inputs, such as chronic algal blooms, extensive coverage by exotic invasive plants, severe sedimentation.<br>Physical/chemical or chemical constituent numeric criteria exceeded in $\geq$ 10% of samples<br>Evidence of chronic toxicity in ambient waters. |
| Insufficient Information | Some data exist, but sampling was very limited and/or the results are ambiguous or conflicting, requiring follow-up monitoring. |

### Aquatic Life Use – Estuaries

Aquatic life use assessments for estuaries are based primarily on dissolved oxygen and nutrient data (eutrophication assessments) collected by CT DEEP's Long Island Sound monitoring staff as part of the US EPA Long Island Sound Study. Evaluations are supplemented by special studies, intensive surveys, fish trawl surveys and National Coastal Condition Assessment (NCCA) samples, when available. Additional sources of dissolved oxygen data used for the assessments included data from the University of Connecticut/LISICOS Western and ARTG buoys (bottom water data); and multiple USGS gaging stations. In reviewing available data, measured values for a specific parameter are compared to water quality criteria as defined in the CT WQS. CT DEEP revised its dissolved oxygen criteria in 2011 for marine waters and this is the primary indicator evaluated. Low dissolved oxygen (Table 1-6), or hypoxia (Figure 1-5) in offshore waters and some embayments is the most frequently cited impairment of aquatic life. Benthic community analyses conducted as part of the NCCA are being used to support other findings on ALUS, but the coverage of LIS is not yet spatially or temporally adequate to support assessments on its own. CT DEEP Marine Fisheries trawl data are also used to support low dissolved oxygen findings with respect to ALUS. Other information sources include tissue analyses, sediment analyses, irregular sampling (*e.g.*, for spills, site assessments or research projects), and professional judgment evaluations of pollutant sources and water quality conditions. Tier 3 quality assured dissolved

DRAFT

oxygen data collected by volunteer researchers (CUSH, Harbor Watch, Unified Water Study, and Save the Bay-Westerly) in nearshore waters are also used to assess the Aquatic Life Use.

### *Assessments of Dissolved Oxygen Using Data from Individual Stations*

Assessment units are evaluated against the dissolved oxygen criteria where data/measurements are available. Data are reviewed for the summer period from May-September. If more than 10% of the Dissolved oxygen concentration measurements are less than 3.0 mg/L, this results in an assessment of "Impaired" for the Aquatic Life Use (Table 1-6). The 10% exceedance allowance is based on US EPA assessment guidance (US EPA, 1997).

Table 1-6. Aquatic Life Use Support (ALUS) in estuaries as determined by dissolved oxygen levels.

| Aquatic Life Use Assessment | Criteria |
|---|---|
| Fully Supporting | ACUTE: Measured dissolved oxygen concentrations of 3.0 mg/L and greater in 90% or more of samples<br>Map interpolations indicate at least 90% of AU area with dissolved oxygen concentrations of 3.0 mg/L and higher<br>CHRONIC: Cumulative periods of dissolved oxygen in the 3.0 – 4.8 mg/L range resulting in a decimal fraction of less than 1.0.<br>Benthic or fish communities are not impacted.<br>No violations of water quality criteria or excessive levels of sediment contamination. |
| Not Supporting | ACUTE: Measured dissolved oxygen concentrations less than 3.0 mg/L in more than 10% of the samples<br>Map interpolations indicate dissolved oxygen concentrations <3.0 mg/L for more than 10% of assessment unit area on multiple cruises over the assessment period<br>CHRONIC: Cumulative periods of dissolved oxygen in the 3.0 – 4.8 mg/L range resulting in a decimal fraction of greater than 1.0.<br>Benthic or fish communities are impacted.<br>Exceedances of water quality criteria or excessive levels of sediment contamination. |

DRAFT

### *Assessments of Dissolved Oxygen Using Hypoxia Maps*

Dissolved oxygen Hypoxia map interpolations are created based on near bottom water conditions and used to determine the ALUS status in those offshore AUs that do not contain LIS sampling stations. Using ArcGIS software, CT DEEP LIS Monitoring Program staff creates maps that depict the extent of low dissolved oxygen in the bottom waters of Long Island Sound based upon the data collected during the LISS bi-weekly hypoxia surveys from June through September. Maps are only created when concentrations fall below 4.8 mg/L. Concentrations between sampling stations are interpolated using the Spatial Analyst Tool from ESRI, Inc.(Inverse Distance Weighted Average Method, see http://www.esri.com/ ). Hypoxia maps are available on the CT DEEP website. Additional details related to map production can be found in the Standard Operating Procedure Document *Preparation of Hypoxia Maps and Summaries*.

The GIS raster data files are incorporated into a GIS map document created for assessment purposes. The files are overlain on a layer file of AUs to determine the location of sampling stations relative to AUs and to determine the frequency of excursions below the dissolved oxygen criterion (Figure 1-6). Using the zonal histogram tool in ArcGIS, the area of each segment that falls within the defined dissolved oxygen concentration classification scheme for each survey/cruise is calculated. For LIS, the classifications are: 0-0.99 mg/L, 1-1.99 mg/L, 2-2.99 mg/L, 3-3.49 mg/L, 3.5-4.79 mg/L, and >4.8 mg/L. If >10% of the assessment unit area falls below 3.0 mg/L, ALUS is assessed as impaired. The frequency of low dissolved oxygen events is determined based on the number of times the maps indicate dissolved oxygen concentrations fell below the criterion (i.e., X number of cruises < criterion/total number of cruises * 100).

### *Assessments of Aquatic Life Use Support Using Sediment Contamination Indicators*

Historic impairments based on dissolved oxygen data or sediment contamination are carried forward until new data shows parameters meeting criteria. Many of these impairments were documented in old Water Quality Reports to Congress and date back to the late 1980s/early 1990s. Impairments were based on interviews with staff engineers and reports that indicated elevated levels of sediment contaminants (Stacey, 2007). Additional historic sources of data included the National Oceanic and Atmospheric Administration's Benthic Surveillance Program and Mussel Watch Program, a project developed to analyze chemical and biological contaminant trends in sediment and bivalve tissue from over 280 coastal sites based on data collected from 1986 to the present. Data collected for the NCCA program data compiled into a sediment dredge geodatabase by the CT DEEP Office of Long Island Sound Program (K. O'Brien, undated), and data provided by the CT DEEP TMDL program were also used as supplemental sources.

DRAFT

## Connecticut Long Island Sound Hypoxia Map

CT DEEP estuarine segments with station locations and Hypoxia interpolations

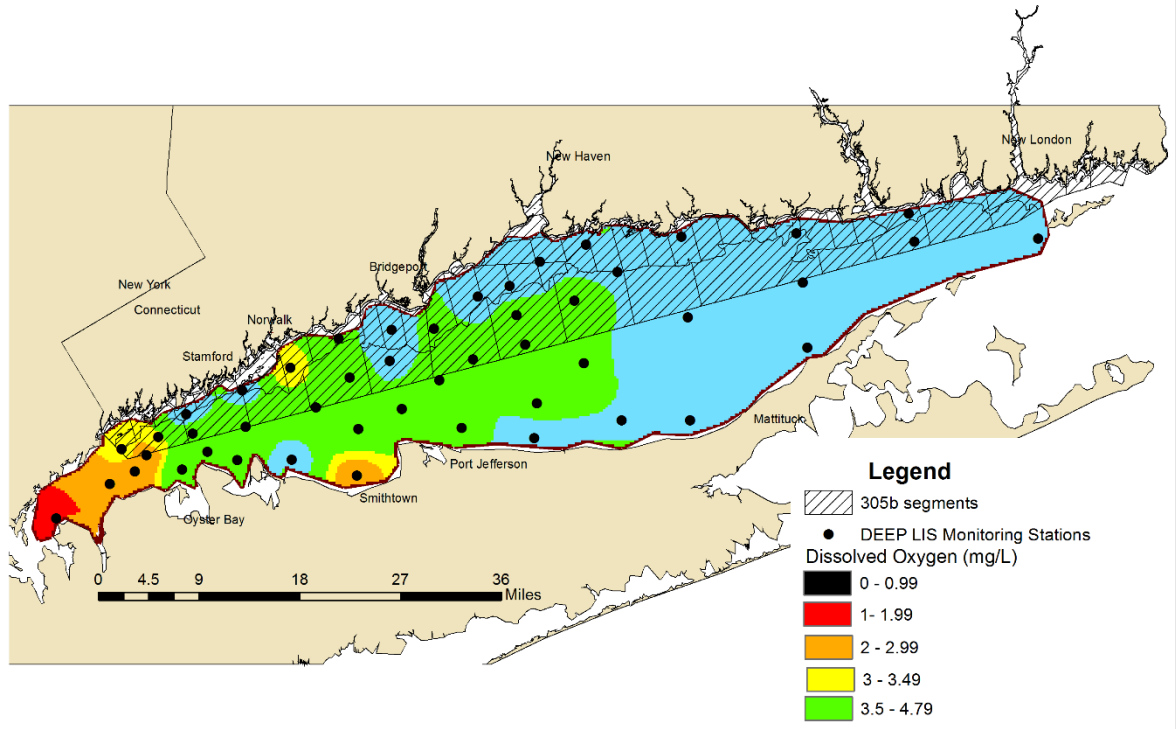



*Figure 1-5. Map of Hypoxia interpolations* overlain on sampling station locations and Connecticut assessment units to evaluate excursions below the dissolved oxygen criterion.

### Fish Consumption

Fish consumption advisories are issued by the Connecticut Department of Public Health. The advisories are based on risk assessments conducted by CT DPH using fish tissue contaminant data. A statewide fish consumption advisory was issued for all species except trout < 15 inches in length in the mid-1990s due to mercury contamination. This advisory was based on statewide surveys of mercury contamination in fish from lakes (Neumann et. al., 1996) and rivers (CT DEP, unpublished). A follow up study was completed in 2008 (Vokoun and Perkins, 2008) and the statewide fish consumption advisory was continued based on these data.

Therefore, in addition to fish consumption use support as determined by the criteria below (Table 1-7), all freshwaters of the State have a fish consumption advisory due to mercury contamination. Likewise, all estuarine waters have fish consumption advisories due to a statewide advisory for PCB contamination in migratory striped bass and bluefish. Refer to CT DEEP Fishing Guide or CT DPH Connecticut's Fish Consumption Advisory and the Safe Eating of Fish Caught in Connecticut for more information about fish consumption advisories. Waterbodies listed in Appendix A-4, Site Specific Fish Consumption Advisories, of this have site specific fish consumption advisories in addition to the statewide consumption advisories.

DRAFT

Table 1-7. Fish consumption use support and criteria.

| Fish Consumption Assessment | Criteria |
|---|---|
| Fully Supporting | No site-specific consumption advisory for any fish species or any consumer group. |
| Not Supporting | A site-specific consumption advisory exists for all or some fish species or for all or certain consumer groups. |

### Shellfish Harvesting in Estuaries

Starting with the 2006 reporting cycle, assessments based on shellfish harvesting have been divided into two Designated Uses as specified in the CT WQS: shellfish harvesting suitable for direct human consumption (SA waters), and shellfish harvesting suitable for commercial operations requiring depuration or relay (SB waters).

The CT DA/BA is responsible for regulating shellfish harvesting. A shellfish growing area is defined by CT DA/BA as any area that supports or could support the growth and/or propagation of molluscan shellstock. Shellfish are defined by CT DA/BA as oysters, clams, mussels, and scallops, either shucked or in the shell, fresh or frozen, whole or roe-on. All shellfish growing areas are classified by CT DA/BA in accordance with the Interstate Shellfish Sanitation Conference (ISSC) National Shellfish Sanitation Program Model Ordinance (NSSP-MO) and CT General Statutes Chapter 491, Sec 26-192e. These classifications, summarized below, are established to minimize health risks and may restrict the taking and use of shellfish from some areas. They are based on fecal coliform bacteria standards as provided in the NSSP-MO .

**APPROVED**- Open for harvest of shellfish for direct human consumption

**CONDITIONALLY APPROVED**- A shellfishing area classification that predictably does not conform to "Approved" area criteria due to the occurrence of specified hydrologic or meteorological events or conditions, but will predictably return to the "Approved" area criteria.

**RESTRICTED-RELAY/DEPURATION:** A shellfishing area classification that conforms to NSSP-MO criteria that allows the area to be used by CT DA/BA licensed operations for the relaying of shellfish to a depuration plant for controlled purification, to designated beds in Approved or Conditionally Approved areas for natural cleansing, or to areas satisfactory to the CT DA/BA, excluding Prohibited, Conditionally Restricted-Relay, and Restricted-Relay areas. These shellfish may not be directly harvested for market nor consumed prior to the purification process involving relay or depuration.

**RESTRICTED-RELAY:** A shellfishing area classification where CT DA/BA allows aquaculture, relay or transplant activities in conformance to NSSP-MO criteria. Operations may be licensed to relay shellfish to designated beds in Approved or Conditionally Approved areas for natural cleansing. These shellfish may not be directly harvested for market or consumed prior to a minimum purification period of 14 consecutive days after being relayed to Approved or Conditionally Approved “open” areas with a water temperature of 50 degrees Fahrenheit (10 degrees Celsius) or greater. CT DA/BA may require the shellfish purification time to be longer than 14 consecutive days, based upon shellfish purification verification studies.

DRAFT

**CONDITIONALLY RESTRICTED-RELAY:** A shellfishing area classification that predictably does not conform to Restricted-Relay area criteria due to the occurrence of specified events or conditions but predictably returns to the Restricted-Relay area criteria.

**PROHIBITED**: A shellfishing area classification that prohibits the harvesting of shellfish for any purpose except depletion or aquaculture operations (such as seed oystering) licensed by the CT DA/BA.

US EPA guidance (Grubbs and Wayland, 2000 and US EPA, 2002) identifies that areas closed to shellfish harvesting due to administrative closures and not based on monitoring data that indicated a water quality impairment, should not be assessed as Not Supporting. This approach has been incorporated into the CT CALM. To determine attainment of water quality standards and for integrated reporting purposes, CT DEEP utilizes CT DA/BA shellfish growing area classifications as listed in Table 1-8.

Administrative closures are established in areas around potential pollution sources, such as sewage outfalls and marinas/mooring fields, as a preventative measure to safeguard human health and preclude the harvest of possibly contaminated shellfish. A marina is defined in the NSSP-MO as "any water area with a structure (docks, basin, floating docks, etc.) which is used for docking or otherwise mooring vessels, and constructed to provide temporary or permanent docking space for more than ten boats".

Areas may also be classified as prohibited due to incomplete sanitary surveys, lack of water quality data, or insufficient resources/interest. Areas classified as prohibited for administrative reasons (i.e., around outfalls, marinas, no resources/interest) will not be considered as violating water quality standards and will be listed in the Integrated Water Quality Report as Not Assessed. Areas classified as prohibited due to incomplete sanitary surveys will also not be considered as violating water quality standards but will be listed in the Integrated Water Quality Report as Insufficient Information. This approach is consistent with US EPA guidance published in 2000 (Grubbs and Wayland, 2000) and in Chapter 3 of the 2002 US EPA document Consolidated Assessment and Listing Methodology Toward a Compendium of Best Practices. Additionally, other coastal states within US EPA Regions 1 and 2 have adopted this approach.

The CT DA/BA has regulatory authority and can place restrictions on direct harvest of shellfish from the shoreline out to the mid-Sound state boundary. However, beyond a depth of 50 feet, there is essentially no shellfishing conducted at this time, and these waters are not regularly monitored. Therefore, for Integrated Reporting purposes, shellfish harvesting is not evaluated as a use in waters between the 50-foot depth contour and the state line. The lack of monitoring should not be construed to mean these deeper offshore waters do not achieve applicable water quality criteria for indicator bacteria.

It should be noted that CT DA/BA shellfish growing areas do not necessarily coincide with CT DEEP waterbody segments (Figure 1-6). To determine use support, GIS is utilized. All CT DEEP segments from the various geographic areas (i.e., inner estuary, shore, midshore, and offshore) are merged into a single layer file. Then the shellfish area classifications are "unioned" with the merged layer file. The attribute table from this new layer is exported (as a .dbf file). Using Microsoft Excel, pivot tables are created that list each classification present per segment along with size of the area falling completely within the segment. A total area is calculated for each class. The segment is then assessed based on the guidelines in Table 1-8. Sources of impairment are based on shellfish reports compiled by CT DA/BA on an annual, triennial or twelve-year basis.

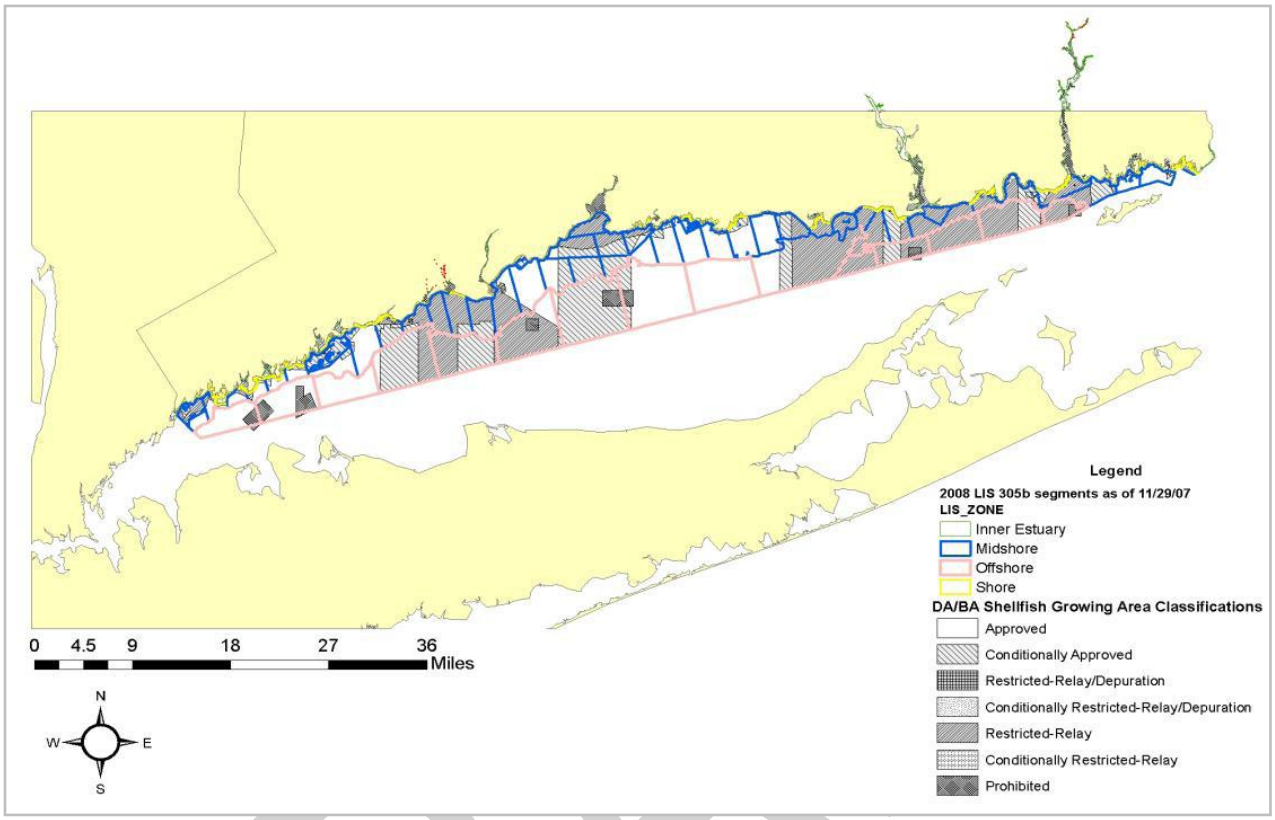
DRAFT

Table 1-8. Shellfish harvesting use support as determined by shellfish growing area classifications.

| Class SA waters:<br><br>Shellfish harvesting for direct human consumption where authorized. | Criteria |
|---|---|
| Fully Supporting | Waters classified by CT DA/BA as Approved. |
| Not Supporting | >10% of segment area classified by CT DA/BA as Prohibited, Conditionally Approved, Conditionally Restricted-relay, Restricted-relay, or Restricted-relay/depuration |
| Not Assessed | Waters closed administratively due to a safety management zone around wastewater treatment plants or marinas, no water quality data available, or lack of resources. |
| Insufficient Information | Waters closed administratively due to a lack of a current sanitary survey or insufficient monitoring data. |
| Class SB waters:<br><br>Shellfish harvesting with depuration or relay where authorized. | Criteria |
| Fully Supporting | Waters classified by CT DA/BA as Approved, Conditionally Approved, Conditionally restricted-relay, Restricted-relay/depuration. |
| Not Supporting | >10% of segment area classified by CT DA/BA as Prohibited |
| Not Assessed | Waters closed administratively due to a safety management zone around wastewater treatment plants or marinas, no water quality data available, or lack of resources. |
| Insufficient Information | Waters closed administratively due to a lack of a current sanitary survey or insufficient monitoring data. |

DRAFT

# Connecticut Long Island Sound Segment and Shellfish Map




Connecticut CT DEEP estuarine segments with shellfish growing area classifications in Long Island Sound

*Figure 1-6. Assessment units overlain on shellfish growing area classifications in Long Island Sound.*

DRAFT

## Recreation

Recreation assessments are based on sanitary/safety considerations and aesthetic/practical usability. Sanitary condition is determined from indicator bacteria data provided by CT DEEP, USGS, volunteer, or municipal monitoring, along with sanitary surveys where appropriate (see Table 1-9 Decision criteria). For lakes and estuaries, aesthetic and practical usability is considered based on algae and/or macrophyte surveys.

*Enterococci* group bacteria are used as the primary sanitary indicator organism in estuarine water, and *Escherichia coli* in fresh water per the Connecticut's WQS (RCSA 22a-426-9(a)(2)). For salt water, 104 Colony Forming Units (CFU)/100 ml of E*nterococci* is the single sample criterion for designated bathing areas, 500 CFU/100 ml for other recreational uses, and 35 CFU/100 ml is the geometric mean criterion for any recreational use. In fresh water, 235 Colony Forming Units or CFU/100 ml of *Escherichia coli* is the single sample criterion for designated bathing areas, 410 CFU/100 ml for non-designated swimming areas, 576 CFU/100 ml for other recreational uses, and 126 CFU/100 ml is the geometric mean criterion for any recreational use.

For AUs with designated bathing areas, beach closure information is generally used to determine use support. Closures of public bathing areas are, for the most part, based on the results of weekly sampling for indicator bacteria during the swimming season. A complete discussion of Connecticut's practices related to beach monitoring and closure may be found in "Guidelines for Monitoring Bathing Water and Closure Protocol" developed jointly by CT DEEP, the Connecticut Department of Health, the Connecticut Environmental Health Association, and the Connecticut Association of Directors of Health (CT DPH and CT DEP, 2003).

Additionally, beach personnel conduct daily inspections of shoreline bathing areas for evidence of contamination. State and local officials also utilize sanitary surveys of shorelines and watersheds as a primary tool to determine sanitary quality. Evidence of waste materials indicative of untreated sewage or human fecal contamination can be sufficient justification to support a beach closure decision by local or state authorities. Small quantities of temporary and/or transient sources of human fecal contamination transported to a site (*e.g.,* diapers / medical items) would likely result in a beach closure. Significant sources of contamination from a fixed location within the AU, such as a CSO, would automatically result in an assessment of impairment.

In some lakes, recreation may also be impaired by cyanobacteria blooms, excessive growth of aquatic invasive plants or algae, which hampers use by physical means (*e.g.*, dense weeds prevent boat mobility) or creates aesthetically offensive conditions. Lakes for which no bacteria data exist may be considered Fully Supporting of recreation if the lake is situated completely within an undeveloped area or if there have been no complaints of illness or excessive aquatic plant growth, or, as in the case of some urban ponds, swimming is not allowed but other recreation activities are supported.

DRAFT

Table 1-9. Decision criteria for various categories of recreational use support.

| Recreation Assessment | Criteria / Indicators for designated public bathing areas |
|---|---|
| Fully Supporting | Designated bathing area closed 10 % of swimming seasons[a] or less for a reporting cycle, and sanitary survey indicates no significant source [b] of human fecal contamination.<br>Recreational use is not hindered by weed or algal growth. |
| Not Supporting | Designated bathing area closed more than 10% of swimming seasons[a] for a reporting cycle, or sanitary survey indicates potential for significant source of human fecal contamination.<br>Algal or exotic weed growth precludes normal recreational use. |
| | **Criteria / Indicators for areas not designated as public bathing areas** |
| Fully Supporting | Sanitary survey indicates no significant source of human fecal contamination, and There are a minimum of 8 samples for the assessment period, and no more than 10% of samples exceed the single sample criterion for *Escherichia coli* (410 CFU [c]/ 100 ml for non-designated swimming areas, 576 CFU/100 ml for all other areas) or there is no exceedance of the geometric mean criterion (126 CFU/100 ml).<br>Recreational use is not hindered by excessive weed or algal growth. |
| Not Supporting | Sanitary survey indicates potential for significant source of human fecal contamination; or<br>There are a minimum of 8 samples for the assessment period, and more than 10% of samples exceed the single sample criterion for *Escherichia coli* (410 CFU [c]/ 100 ml for non-designated swimming areas, 576 CFU/100 ml for all other areas) or there is an exceedance of the geometric mean criterion (126 CFU/100 ml) or<br>Algal or exotic weed growth precludes normal recreational use. |
| Insufficient Information | Less than 8 samples in the assessment period [d]. |

[a] Swimming season is from Memorial Day to Labor Day. The swimming season for the report cycle consists of 2 summers of swimming days combined.

[b] A significant source of human fecal contamination is one that originates from a fixed location and is transported to or within the waterbody (*e.g.*, an untreated sewage discharge or a community with failing septic systems).

[c] CFU refers to colony-forming-unit, which is the unit of measure for indicator bacteria. It is the general equivalent of one bacterium (one bacterium will grow into one colony when incubated on a plate of growth medium.)

[d] In certain cases, best professional judgment can result in an assessment when there are fewer than 8 samples.

### Drinking Water Supply

The Connecticut Department of Public Health (CT DPH) implements the federal Safe Drinking Water Act (SDWA) in Connecticut and CT DEEP cooperates with those efforts. The CT DPH tracks and reports on the water quality of public drinking water supplies within the context of the SDWA. CT DEEP periodically surveys water utilities for updated information concerning closures, trophic status, and potential causes and sources of pollution.

Class AA drinking water reservoirs and Class AA tributaries, which is where Drinking Water is a Designated Use, are considered Fully Supporting for the CT DEEP Drinking Water Designated Use when filtration and disinfection are reliably maintained in accordance with State Public Drinking Water Standards (Regulations of Connecticut State Agencies Section 19-13-B102), unless CT DEEP finds chemical or physical evidence of conditions not meeting standards during targeted field assessments.

DRAFT

These waters are regulated by programs at CT DPH that coordinate, manage, and ensure treatment and source protection through oversight of existing treatment and source protection laws and regulations, coupled with water supply planning, education of local land use officials, and involvement with stakeholders on a continuous basis.

Many Class AA drinking water reservoirs and tributaries to drinking water reservoirs are tracked and assessed for aquatic life use support of ambient conditions (see discussion of ALUS assessment methodologies in the previous sections).

### Navigation

Navigation is assumed to be fully supported for all waters suitable for navigation.

### Agriculture and Industry

Agricultural uses are assumed to be fully supported for all AA, A, and B waters. Industrial use is assumed to be fully supported for all AA, A, B, SA and SB waters.

## Listing Methodology

The CWA requires states to track attainment of water quality goals for each waterbody using a five-category approach (Categories 1, 2, 3, 4, and 5) developed by the US EPA. States have the ability to amend the listing categories to provide additional state-specific information. Information on both the federal and state listing categories is provided below.

### Federal Listing Categories:

#### *Categories 1, 2, and 3*

Categories 1, 2 and 3 are used for waters that meet some, or all of the Designated Uses or for which insufficient information is available to allow for an assessment (Figure 1-7). These categories do not pertain to impaired waters but may include waterbodies that have an Action Plan in place (see sub-category descriptions below). Waterbodies that have been identified as impaired are assigned to Categories 4 and 5 under the reporting requirements of CWA Section 303(d).

#### *Category 4a*

Category 4a (*Impaired waters with adopted TMDLs)* for which a TMDL has been established but water quality has not yet been restored. A TMDL is specific to the Designated Uses and impairment causes (also called parameters), segments may have several TMDLs for each Designated Use and cause combination. Plans assigned to this category are identified in Appendix B-2.

#### *Category 4b*

This category is assigned to waterbodies where the planning and implementation of pollution control and management measures have been initiated with the expectation to achieve CT WQS attainment in future assessments. Pollution Control Measures for Waterbody Segments are provided as Appendix B-3 and includes a description of the non TMDL-based pollution control requirements expected to result in full attainment of CT WQS. Examples of other pollution control requirements include Consent Orders, Combined Sewer Overflow Control Plans, Remedial Action Plans, Restoration Plans, other plans or studies where activities in progress are expected to result in attainment of the applicable water quality standards and Designated Uses.

#### *Category 4c*

These waters are not meeting WQS as a result of something other than a specific pollutant. For example, waters impaired for stream flow regime modifications and physical substrate habitat which are not polluted due to a chemical or exceedance of criteria but are impaired due to a nonpolluting

DRAFT

activity. This category includes waterbodies that are impacted by flow alterations, stream alterations and channelization as well as invasive plant species. Information on the segments identified in US EPA Category 4c with impairment not due to a pollutant is provided as Appendix B-4.

### *Category 5*

This category constitutes the regulatory 303(d) List of Impaired Waterbodies for which a TMDL or equivalent plan is required. This list is updated every two years and submitted to EPA for review and approval pursuant to federal regulation 40 CFR 130.7. Updates to impaired waterbodies may include changes to waterbody assessments in Category 5, and revisions to segments in Category 4a, 4b, and 4c.

### Connecticut Listing Subcategories

Waterbodies can move around the various categories as their water quality status changes. This happens when new water quality data becomes available, indicating that the waterbody is meeting WQS for a Designated Use, a Water Quality Action Plan (WQAP) is developed (such as a TMDL) or if data becomes out of date or insufficient to determine if a waterbody is meeting WQS. However, as waters move through the EPA status categories, the WQAP remains in place. CT DEEP has created subcategories to reflect both the appropriate EPA category (categories 1-5) as well as the plan that has been developed for restoration or protection that is associated with the waterbody. The different types of plans that are developed to restore or protect water quality are discussed in further detail in Chapter 3 of this document. The addition of the sub-categories allows for better tracking of the attainment status of those waterbodies that have a restoration or protection plan associated with it. The majority of TMDLs remain in category 4a with a small amount that have attained water quality standards or have been moved to category 3 (insufficient information). If a segment that is associated with a protection plan becomes impaired that segment will require a TMDL and move back to category 5, but the protection plan remains in place.

The EPA categories and CT Subcategories are as follows:

- **EPA Category 1**- The waterbody is meeting all Designated Uses
  - **CT Subcategories**
    - 1 TMDL- Standards are met for all Designated Uses, there is a TMDL in place
    - 1 R- Standards are met for all Designated Uses, there is an Advance Restoration Plan in place
    - 1P- Standards are met for all Designated Uses, there is a Protection Plan in place
- **EPA Category 2**- Some of the waterbodies' Designated Uses are being met
  - **CT Subcategories**
    - 2 TMDL - Standards are met for one or more Designated Use and there is a TMDL in place
    - 2 R- Standards are met for one or more Designated Uses and there is an Advance Restoration Plan in place
    - 2 P- Standards are met for one or more Designated Uses and there is a Protection Plan in place
- **EPA Category 3**-There is not enough information to determine if one or Designated Uses are being met
  - **CT Subcategories**
    - 3 TMDL - There is not enough information to determine if one or Designated Uses are being met, but there is a TMDL in place

DRAFT

        - 3 R- There is not enough information to determine if one or Designated Uses are being met, but there is there is an Advance Restoration Plan in place
        - 3 P- There is not enough information to determine if one or Designated Uses are being met, but there is there is Protection Plan in place

- **EPA Category 4-** Waterbodies impaired for one or more Designated Uses that have an established TMDL and where a pollutant has been identified as the cause of the impairment
    - **CT Subcategories**
        - 4a-Standards not met, TMDL in place
        - 4b-Waterbodies impaired for one or more Designated Use by a pollutant that is being addressed by pollution control requirements other than a TMDL which are expected to address the impairment (typically involves a legal course of action)
        - 4c-Standards not met but the impairment is not caused by a pollutant
            - Examples include streamflow impairments, invasive plant species

- **EPA Category 5**- Data and /or other information indicate that one or more of the Designated Uses are not being supported. A TMDL or a Water Quality Action Plan is needed. Anytime a waterbody moves out of category 5 it is considered to be delisted.
    - **CT Subcategories**
        - 5R- Standards not met, Alternative Restoration Plan is in place (legal action not applicable)

### Reconciliation List of 303(d) Delistings and Listings

The assessment of surface waters is an on-going process that will result in the removal of some waterbodies from Category 5, and the addition of others. Removal of waters from Category 5 is considered to be a "delisting" while addition of waters to this category is considered "listing". A waterbody is delisted when it is no longer impaired based on an assessment of relevant data conducted in accordance with the CT CALM that confirms attainment of water quality standards. Additionally, waterbodies may be delisted when:

- An error was made in the initial listing causing an incorrect listing. These listings include those based on anecdotal information (information, often transmitted orally and undocumented, which cannot be confirmed through direct observation or measurement using generally accepted, reproducible analytical methods). In these circumstances, the waterbody usually was moved into US EPA Category 2 (supporting for some uses, other uses not assessed) or more often Category 3 (no or insufficient data available to make any assessment).
- Quality controlled data, which are acceptable to CT DEEP, demonstrate that Designated Uses are being met for the waterbody (with or without implementation of a TMDL or other type of Action Plan).
- Revisions in Water Quality Standards and Criteria and/or assessment methodologies result in a change in assessment from non-attainment to attainment.
- The waterbody meets conditions described in Categories 4a, 4b, 4c as described above; however, it will continue to be considered Not Supporting for one or more Designated Uses until water quality standards and Designated Uses are met, although the regulatory requirement to adopt a TMDL will no longer apply.

DRAFT

The Reconciliation List (Appendix B-5) is a summary of the assessments where data were available for this reporting cycle, resulting in a proposal for listing or delisting of impaired waterbodies In some cases, the assessment unit ID was added or removed for administrative purposes and not necessarily a change in assessment status.

# Chapter 2 – 305(b) Assessment Results

## Water Quality Assessments and Plans Web Mapping Application

CT DEEP's assessment results by waterbody type and Designated Use are summarized on the following pages. This information is also available on the CT DEEP Water Quality Plans and Assessments interactive web map available on CT DEEP's IWQR website. The application will also allow users to add their own geographic data for analysis. The application contains IR information for the 2020 cycle and beyond, it does not reflect cycle data prior to 2020. For previous Cyle information please refer to the Previous IR Webpage.

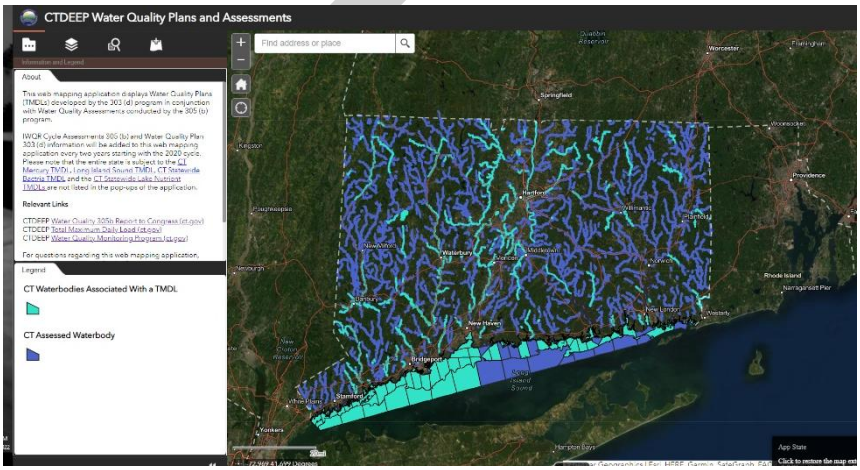



*Figure 2-1. IWQR Web Mapping Application which includes Assessment and WQAP information for CT Waterbodies.*

The following is a list of figures and tables that provides a summary of assessment information at a statewide-scale:

- Figure 2-2 is a map showing all waterbody type segments assessed for any Designated Uses over the entire State of Connecticut.
- Table 2-1 summarizes the total river miles, acres of lakes, and square miles of estuaries that were determined to be either Fully Supporting, Not Supporting, Insufficient Information, or Not Assessed for each Designated Use
- Table 2-2 contains the assessment results for the Aquatic Life Designated Use for all of the wadeable streams in Connecticut based on a probabilistic sampling design
- A short summary of segments that were determined to be Not Supporting for the Drinking Water Designated Use.

Note: Not all waterbodies in Connecticut are assessed for all possible Designated Uses and some waterbodies that were assessed previously as Fully Supporting may have dropped to Not Assessed in this reporting cycle due to use-specific data age limitations, which are important to maintain quality control in assessment information. Any waterbody assessed as Not Supporting in a prior report retains that assessment until new monitoring data confirm that use is supported (meeting standards).

Assessment results are provided in more detailed tables by waterbody type in Appendix A. Waterbody assessment results are presented in ascending order by waterbody ID number. Inland waters (rivers, streams, and lakes) are presented first in Appendix A-1 and A-2, followed by estuarine waterbody

segments in Appendix A-3. Figures 1-1 and 1-2 will assist readers in spatial overview and segmentation enumeration that corresponds with assessment results and impaired waters tables found in the appendices. In addition to the CT DEEP Water Quality Plans and Assessment interactive web map, assessment information can also be viewed using an interactive geographic information system map viewer and map services hosted by the University of Connecticut called Connecticut Environmental Conditions online (CTECO). Click to follow the link to CTECO, then using the simple map viewer, select the assessment layers for the reporting cycle you would like to view in the Water Resources tab. Layers can also be downloaded for use in GIS software. DEEP also produces a fact sheet, available on the IWQR web page, that highlights important where to locate IWQR information. Contact the CT DEEP Water Monitoring and Assessment Program at DEEP.watermonitoring@ct.gov for specific assessment questions.

DRAFT

# CT DEEP Waterbody Assessment Segments

Example Map of CT DEEP Waterbody Assessment Segments assessed for one or more Designated Uses

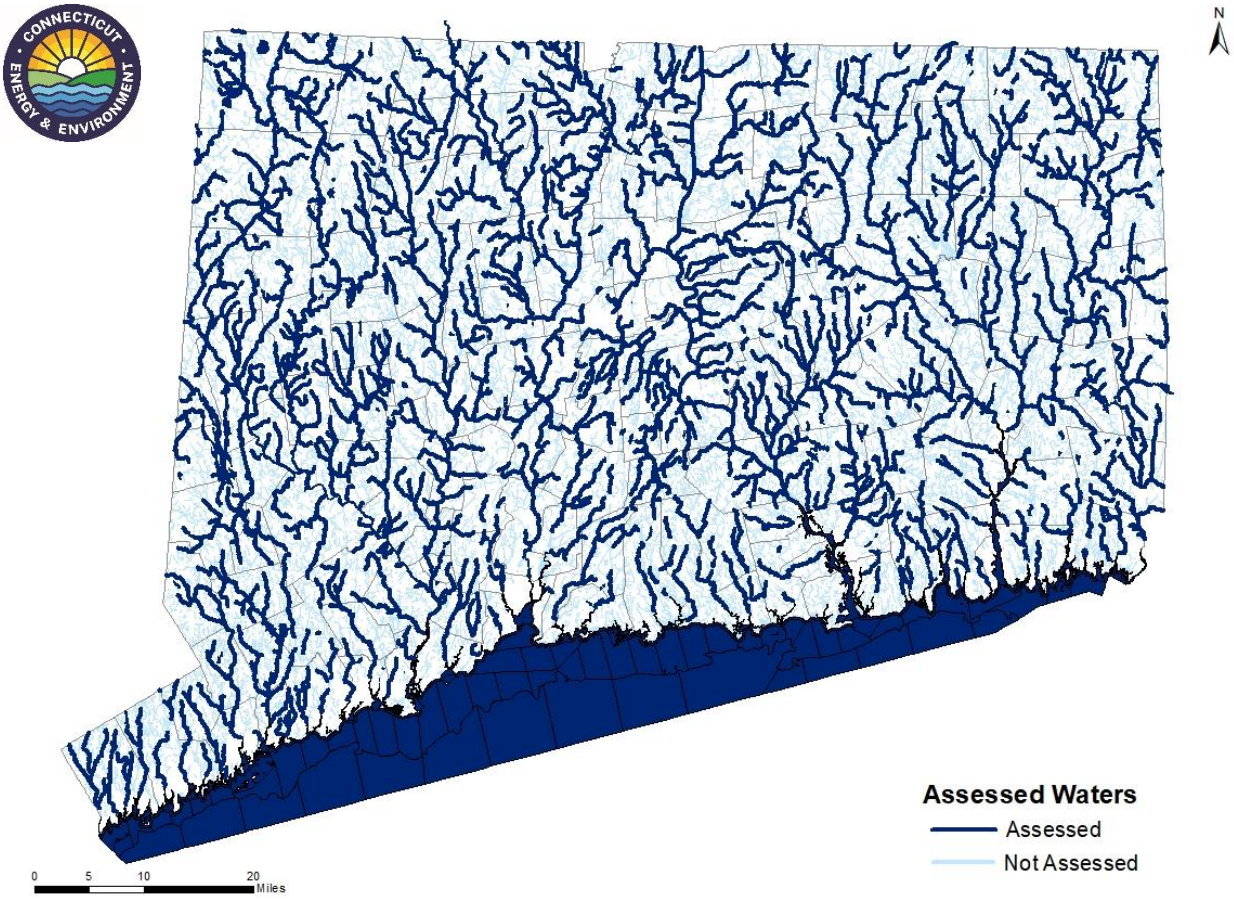



*Figure 2-2. Waterbody segments assessed for one or more Designated Uses*

DRAFT

Table 2-1. Designated Use support summaries for rivers, lakes, and estuaries

| USE SUPPORT 2024 | | FULLY SUPPORTING | NOT SUPPORTING | INSUFFICIENT INFORMATION | TOTAL ASSESSED | NOT ASSESSED | TOTAL TRACKED [a] |
|---|---|---|---|---|---|---|---|
| **Rivers** [b] | | | | | | | |
| Aquatic Life | Segments | 642 | 209 | 209 | 1060 | 283 | 1343 |
| | Miles | 1998.58 | 583.25 | 496.04 | 3077.87 | 434.85 | 3512.72 |
| Recreation | Segments | 122 | 301 | 96 | 519 | 824 | 1343 |
| | Miles | 486.71 | 947.00 | 233.77 | 1667.48 | 1845.24 | 3512.72 |
| Fish Consumption[c] | Segments | 0 | 40 | 1302 | 1342 | 1 | 1343 |
| | Miles | 0 | 207.12 | 3304.90 | 3512.20 | 0.70 | 3512.72 |
| **Lakes** | | | | | | | |
| Aquatic Life | Segments | 92 | 17 | 25 | 134 | 48 | 182 |
| | Acres | 23542.99 | 1158.90 | 2645.03 | 27346.92 | 3090.54 | 30437.46 |
| Recreation | Segments | 71 | 31 | 23 | 125 | 57 | 182 |
| | Acres | 16280.93 | 6711.70 | 1919.65 | 24912.28 | 5525.18 | 30437.46 |
| Fish Consumption[c] | Segments | 0 | 12 | 170 | 182 | 0 | 182 |
| | Acres | 0 | 3634.04 | 26803.42 | 30437.46 | 0 | 30437.46 |
| **Estuaries** | | | | | | | |
| Marine Aquatic Life | Segments | 48 | 75 | 7 | 130 | 82 | 212 |
| | $Mi^2$ | 251.52 | 309.49 | 6.61 | 567.61 | 44.30 | 611.91 |
| Recreation | Segments | 53 | 30 | 8 | 91 | 121 | 212 |
| | $Mi^2$ | 26.33 | 21.01 | 3.48 | 50.82 | 561.09 | 611.91 |
| Fish Consumption[c] | Segments | 0 | 4 | 208 | 212 | 0 | 212 |
| | $Mi^2$ | 0 | 8.63 | 603.28 | 611.91 | 0 | 611.91 |
| Shellfish Harvesting, Class SA Waters | Segments | 11 | 114 | 0 | 125 | 10 | 135 |
| | $Mi^2$ | 49.39 | 196.27 | 0 | 245.66 | 0.76 | 246.42 |
| Shellfish Harvesting, Class SB Waters | Segments | 19 | 29 | 0 | 48 | 12 | 60 |
| | $Mi^2$ | 34.25 | 21.79 | 0 | 56.03 | 9.08 | 65.11 |

[a] "Total Tracked" refers to the waterbody sizes tracked in the ATTAINS Database. The total estuarine waters of 611.91 square miles in Connecticut are tracked, but only a fraction of river miles and lake acres are tracked in ATTAINS. Referencing the United States Geological Survey, National Hydrography Dataset at 1:24,000 high resolution scale the total number of river miles estimated for Connecticut is 7,772 and the total number of lake acres is 72,509.

[b] Probabilistic or statistical sampling is the best way to make inferences about the totals by waterbody type. CT DEEP conducts probabilistic monitoring in freshwater streams and rivers. For those results, please see Statewide Assessments using a Probabilistic Sampling Design section below.

[c] All freshwaters in Connecticut are included in the statewide limited fish consumption advisory for all freshwater fish, except trout, due to atmospheric deposition of mercury. All estuarine waters in Connecticut are included in the statewide limited fish consumption advisory on striped bass and bluefish due to PCB contamination. Waters summarized in this table as NOT SUPPORTING contain fish consumption advisories beyond the statewide advisories. See Appendix A-4 for details.

DRAFT

## Statewide Assessments using a Probabilistic Sampling Design

### Probabilistic Monitoring of Rivers and Streams

Statistical surveys were implemented in accordance with Connecticut's Ambient Water Quality Monitoring Strategy (CT DEEP 2015) to characterize use support in wadeable streams for aquatic life and recreation on a statewide basis. A Generalized Random Tessellation Stratified (GRTS) survey design (Stevens and Olsen 2004) was provided to CT DEEP from EPA and implemented with a target population of streams based on the National Hydrography Dataset at the 1:24,000 scale. No stratification was included in the survey design.

A total of 55 wadeable stream sites were sampled in 2016-2020 to obtain a statewide estimate of aquatic life use attainment. In 2023, these stream samples were evaluated and summarized for Aquatic Life Use support assessment (Table 2-2) resulting in 76% Fully Supporting and 24% Not Supporting the statewide statistical assessment for aquatic life in wadeable streams.

Table 2-2. CT DEEP Probabilistic Monitoring Aquatic Life Use Support in Wadeable Streams Summary

| Use Support Category | Percent of Target | Standard Error | Upper and Lower 95% Confidence Intervals |
|---|---|---|---|
| Fully Supporting | 76 | 7 | 69.3-83.4 |
| Not Supporting | 24 | 7 | 16.6-30.6 |

### Drinking Water Use

Connecticut has 1 waterbody assessed as not supporting drinking water use. The segment CT5112-00_02, named Farm River (North Branford)-02 is a 1.24-mile section of the Farm River described as from the confluence of Burrs Brook just downstream of the Route 80 crossing, upstream to Pages Mill Pond outlet dam (Upstream side of Mill Road crossing, North Branford). Issues in this watershed are heavily influenced by commercial operations and are being reviewed and evaluated to identify best management practices to support water quality improvements.

DRAFT

# Chapter 3 - Waterbodies Identified for Restoration and Protection Strategies Pursuant to Section 303 of the Clean Water Act

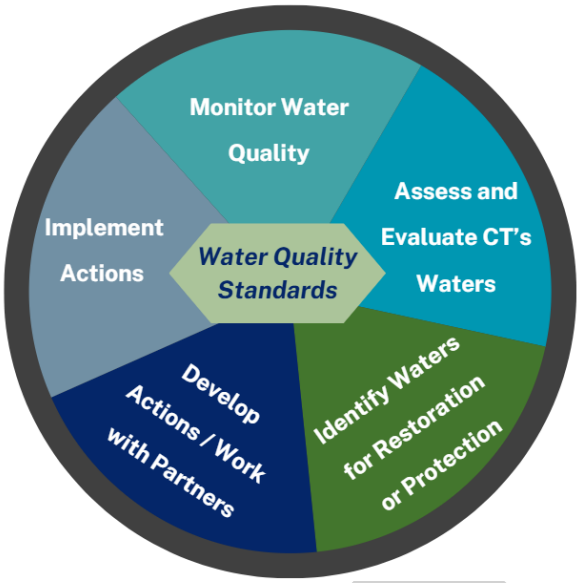



Figure 3-1 Planning and Implementation Process

## Background Information

In authorizing the Clean Water Act, Congress declared as a national goal the attainment, wherever possible, of "water quality, which provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water". This goal is popularly referred to as the "fishable / swimmable" requirement of the CWA. In 1967, predating the CWA, the State of Connecticut adopted Water Quality Standards as required under Section 22a-426 of the Connecticut General Statutes to accomplish this and other water quality goals. Using the information that is provided by the assessment of surface water quality described in Chapters 1 and 2 of this document, CT DEEP evaluates CT surface water bodies for the development of restoration and protection plans in accordance with section 303 (d) of the CWA.

The water quality planning process includes: 1) adoption of Connecticut Water Quality Standards (CT WQS); 2) monitoring and assessment of surface waters to evaluate consistency with those standards; 3) evaluating and prioritizing those waters for development of action plans; 4) working with partners and stakeholders to develop action plans; and 5) implementation of Water Quality Action Plans (WQAPs), to achieve consistency with the CT WQS illustrated in figure 3-1.

There are two key elements of the CT WQS critical to the development of restoration or protection strategies.

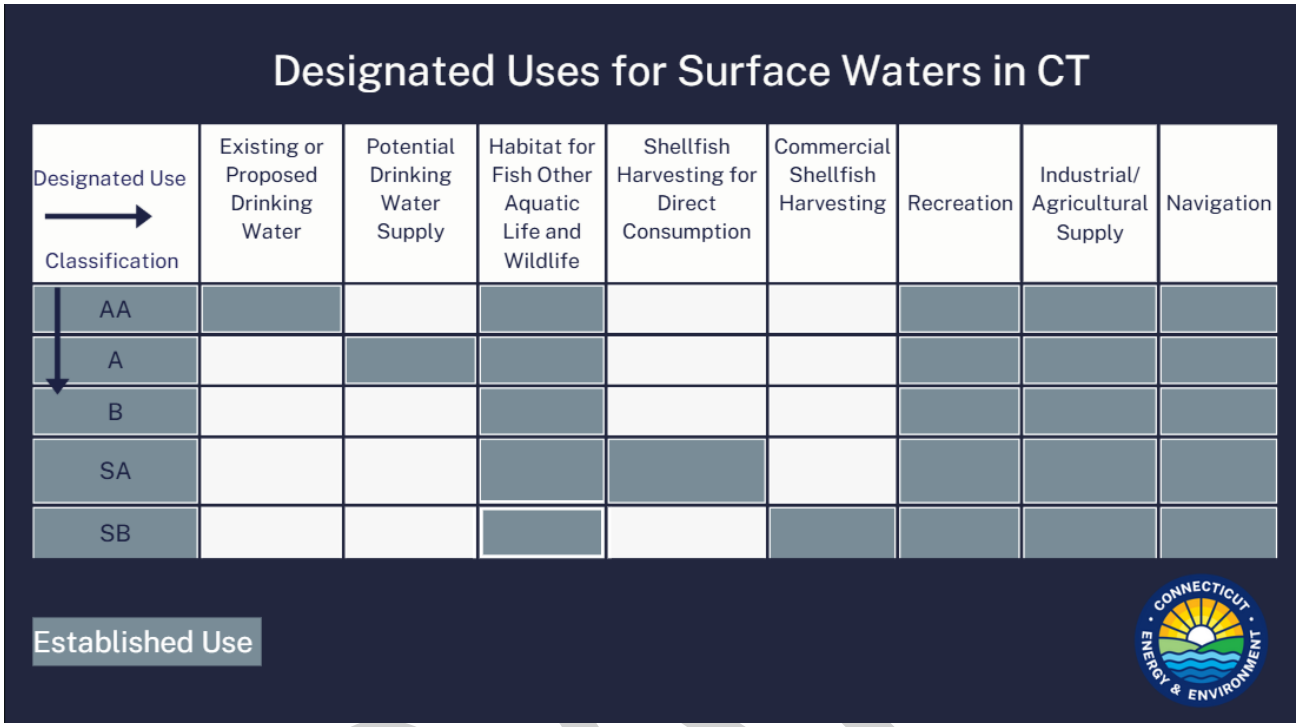
- the establishment of Designated Uses described in table 3-1 and
- the specified narrative and numeric Water Quality Criteria and Standards to protect and support those uses.

Physical, chemical, and biological monitoring data or other applicable information is compared to the Water Quality Criteria and Standards to assess whether a waterbody is meeting the attainment of Designated Uses discussed in Chapter 1 (CT CALM). Table 3-1 describes the Designated Uses that are associated with each Water Quality Classification for surface waters in Connecticut.

CT develops a variety of WQAPs to restore and protect surface waters including Total Maximum Daily Load Plans (TMDLs), Advance Restoration Plans (ARPs), and Protection Plans to restore and protect CT Waterbody's Designated Uses. These plans identify water quality conditions necessary to restore or protect water quality, point and nonpoint pollution sources that may affect water quality and Designated Use attainment, and provide recommended actions to achieve restoration or protection objectives. For more information regarding the various types of WQAPs in CT visit the Connecticut Water Quality Action Plans webpage.

DRAFT

Table 3-1. Designated Uses by Water Quality Classification




## Determining Causes and Sources of Impairment

Once a segment is designated for the development of a WQAP an investigative study is conducted to identify causes and sources of impairment. The causes and sources contributing to waterbody impairments or stress can best be determined through a stressor identification study conducted in support of development of TMDLs or other WQAPs. These investigations may include a detailed analysis of all available biological, chemical or physical data for surface waters or associated with permits or other activities within the watershed; conducting additional intensive ambient water quality sampling, aquatic toxicity studies, sediment or fish tissue analysis; evaluation of dilution calculations of known discharges or assimilative capacity within the watershed; conducting or reviewing water quality modeling or other evaluations of ambient conditions or potential sources within the watershed.

General information, where available, can help to identify sources potentially contributing to the observed impairments. For example, there are circumstances that generally contribute pollutants to waterbodies which may have an impact on Designated Uses. Some examples include:

- Bacterial contamination that poses a risk to human health can originate from waterfowl, wildlife, domestic animals (dogs, horses, poultry, swine and cattle) and human waste from malfunctioning septic systems, private/public sewers, and sewage discharges from watercraft. Potential sources of bacteria recognized by US EPA include Non-Point Source Pollution, Urban Stormwater, Sources Outside State Jurisdiction or Borders, Illicit Connections/Hook-ups to Storm Sewers, Combined Sewer Overflows, and Municipal Point Source Discharges.
- Land uses can contribute pollutants that vary depending on the type of land cover or activity. Developed areas whether industrial, commercial, residential or urban can contribute pollutants

through stormwater runoff. These pollutants originate from human activities that generally include heavy metals, nutrients, and petroleum-based products. Impervious cover, stormwater drainage systems and over land flow are primary factors in the transport of these pollutants to surface waters. Small and large agricultural operations can contribute nutrients, pesticides, bacteria and sediment to surface waters.

- Point Source Discharges are regulated by the state through applicable wastewater discharge permits. Industrial and municipal permittees may generate wastewater that is treated and discharged to a waterbody which has been determined to have a specific discharge assimilative capacity. However, short-term discharge violations of the permit limits can occur due to equipment malfunction, changes to wastewater processes and human error. The pollutants contributed to surface waters vary depending on the type of wastewater generated.
- Industrial contamination occurs in Connecticut which has had a long history of industrial activities such as textiles, firearms, glassware, metal finishing, and much more. Unfortunately, historical contamination from many industrial activities contributed pollutants directly to surface waters and sediments as well as groundwater which eventually discharges to surface water. Many sites have been remediated by eliminating the contaminant source, but others remain or need further investigation to determine the contaminant(s) that may be present and may be contributing to impairments.

Some of the more common sources of stressors associated with the various use impairments are identified in Table 3-2. Reporting the sources of impairment is not a listing requirement under Section 303(d) and is not subject to US EPA review and approval. As stated above, identifying sources is most appropriately done within a TMDL or similar evaluation. The list of common stressors and sources below is general and not comprehensive. The analysis of potential sources and their contributions is refined within the stressor identification evaluations conducted as part of the Water Quality Action Plan development process.

DRAFT

Table 3-2. Summary of Designated Uses with Common Stressors

**Summary of Designated Uses with Common Stressors**

| Impaired Use | Examples of Common Stressors | Examples of Common Sources | Potential Stressors Types | | |
|---|---|---|---|---|---|
| | | | Chemical | Physical | Biological |
| Existing or Proposed Drinking Water | Bacteria | Stormwater, illicit discharges, agricultural runoff | x | x | x |
| Fish Consumption | Mercury, PCBs, Pesticides | Atmospheric deposition, industrial discharges, municipal wastewater treatment discharges hazardous waste sites, oil and chemical spills, land use, stormwater | x | x | |
| Marine and Freshwater Habitat for Fish, Other Aquatic Life and Wildlife | Habitat alterations, flow regime changes, Toxics, Nutrients, Interactions between multiple pollutants, Low Dissolved Oxygen, other pollutants | Industrial discharges, municipal wastewater treatment discharges hazardous waste sites, oil and chemical spills, land use, stormwater | x | x | x |
| Recreation | Bacteria | Stormwater, illicit discharges, agricultural runoff | x | x | x |
| Shellfish Harvesting for Direct Consumption | Bacteria | Stormwater, illicit discharges, agricultural runoff | | x | x |
| Commercial Shellfish Harvesting | Bacteria | Stormwater, illicit discharges, agricultural runoff | | x | x |

## Integrated Water Planning Management

Connecticut initiated Integrated Water Planning Management (IWPM) to clearly establish water quality program planning priorities and improve the effectiveness of the Department's water quality restoration and protection planning actions. This effort is based on prior collaborations between the states and EPA to develop enhancements to the 303d Program, within the current framework of the Federal Clean Water Act. This approach is referred to by EPA as the "Long-Term Vision for Assessment, Restoration and Protection under the Clean Water Act Section 303(d) Program" or the 303d Vision in short.

The foundation of IWPM is to identify water quality focus areas and waters for protection and/or restoration Action Plan development. Water quality planning approaches are tailored to specific water quality concerns and pollution sources for a waterbody. The 303(d) Program at CT DEEP broadly collaborated within CT DEEP and with outside partners and the public to identify these focus areas. These focus areas are revisited through robust coordination and outreach activities periodically, both through an in-depth review every ten years and through feedback provided through the IWQR public comment process.

More details are provided on the IWPM web page. CT DEEP conducted a review of the IWPM focus areas in 2024, referred to as IWPM2, and sought new ways to improve coordination within and outside of our Agency. We held meetings, inviting members from the different regulatory and environmental resource programs in CT DEEP to learn about and participate in IWPM. As part of initial efforts to identify potential areas for plan development, we sought data and participation from these various programs to help in identifying an initial group of focus areas for plan development. This included the CT DEEP Watershed Managers who work on nonpoint source pollution, members of regulatory programs such as site clean-up programs and permitting programs, staff involved in resource protection such as fisheries managers, staff

from our state parks programs and other DEEP programs. Additionally we held public meetings (1/10/2024 meeting) and requested feedback from the public on water quality focus areas as well as the waters which have been identified as candidates for developing plans for protection or restoration of water quality. Additional opportunities to provide feedback will be offered periodically, at a minimum, through the IWQR process. More information is available on the IWPM2 web page.

In addition to providing CT with the ability to identify water quality focus areas that are important to the state and allow for identifying water bodies to focus on for planning efforts, IWPM also provides flexibility to develop water quality planning approaches, tailored to individual watersheds, that best address water quality restoration and protection.

### Prioritization and TMDL Schedule

Section 303(d)(1)(A) requires states to "establish a priority ranking" for the segments it identifies on the list, considering the severity of the pollution and the uses to be made of such segments, and to establish TMDLs "in accordance with the priority ranking." Consistent with Section 130.7(b)(4) of the Code of Federal Regulations (CFR), each state shall also submit biennially a priority ranking including waters targeted for TMDL development in the next two years. Each listed pollutant-segment combination (i.e., those in Category 5) must receive a clear priority ranking, which EPA recommends be either in the form of a scheduled TMDL completion date or a ranking such as high, medium, or low. For example, a waterbody with a severe water quality problem may be given high priority for TMDL development considering the severity of the concern. Conversely, a severe water quality problem may require complex analysis before developing a TMDL, and the state may therefore give it a lower priority to allow time beyond the two-year timeframe to collect necessary information and complete the analysis. Thus, the most severe water quality problems or the most toxic pollutants need not always be given the highest priority for TMDL development, if circumstances warrant a lower priority.

For the purposes of compliance with Section 130.7(b)(4) CFR, CT uses a ranking system to identify water body priorities as high, medium or low, considering 1) the development status of the plan; 2) identification of pollutants that may affect water quality; 3) the uses of the waterbody and applicable criteria per the CT WQS, 4) the level of pollution; 5) the ability to implement actions to restore or protect water quality and 6) state water quality priorities identified through Integrated Water Planning Management as well as feedback from the public or environmental programs.

DRAFT

Table 3-2. Prioritization of TMDL Development

| Ranking | Development Status of TMDL | Identification of Pollutants that May Affect Water Quality | Consideration of Uses of Water Body and Feedback from the Public and Environmental Programs | Level of Pollution, Identification of Sources and the Ability to Implement Actions to Restore or Protect Water Quality |
|---|---|---|---|---|
| **High** | The TMDL is actively under development during the next two years. | The pollutants that may affect water quality are known or evaluations are being conducted to identify pollutants for inclusion in the TMDL | The uses and pollutant types associated with the TMDL are consistent with priorities identified under IWPM. Additional consideration may be given to requests from the public or priorities from other Environmental Programs | The level of pollution is well defined or is actively under evaluation and is either sufficient to cause or contribute to a water quality impairment or be of concern for waters that are currently meeting WQS. Sufficient information is available or is actively under development to identify potential pollution sources and their contributions. Preference is given for plans with existing or expected implementation partners. |
| **Medium** | The TMDL may or may not be actively in development during the next two years, but development is planned for the future, as resources allow | The pollutants that may affect water quality are known or evaluations are being or will be conducted to identify pollutants for inclusion in the TMDL | The uses and pollutant types associated with the TMDL are consistent with priorities identified under IWPM. Additional consideration may be given to requests from the public or priorities from other Environmental Programs | The level of pollution is known or evaluations are being conducted or will be conducted to describe the level of pollution and the level is either sufficient to cause or contribute to a water quality impairment or be of concern for waters that are currently meeting WQS. Sufficient information is available or is being or will be developed to identify pollution sources and their contributions. Preference is given for plans with existing or expected implementation partners. |
| **Low** | The TMDL is not actively in development. Timing for development of the TMDL will be re-evaluated during future IWQR cycles | The pollutants that may affect water quality are known or evaluations will be conducted in the future to identify pollutants for inclusion in the TMDL | The uses and pollutant types associated with the TMDL may or may not be consistent with priorities identified under IWPM | The level of pollution is known or evaluations will be conducted in the future to describe the level of pollution and the level is either sufficient to cause or contribute to a water quality impairment or be of concern for waters that are currently meeting WQS. Sufficient information is available or will be developed to identify pollution sources and their contributions. |

DRAFT

As part of identifying and prioritizing waters for TMDL development, CT also evaluates all the available data and sources to determine which type of WQAP will best address each impairment. Impairments which may be better addressed using a restoration plan other than a TMDL, would be identified as a low priority for TMDL development, to allow for the development and implementation of the restoration plan. If over time, the restoration plan is insufficient to restore water quality, the prioritization category for TMDL development for that water would be reconsidered. Every cycle the CT DEEP 303 (d) program publishes a table which includes all segments that are slated for plan development in tables C-1 and C-2 regardless of WQAP type.

CT DEEP communicates with EPA Regional program staff and managers regarding development of WQAPs, including TMDLs, progress on these projects and anticipated timelines for project milestones and completion.

## CT Water Quality Action Plans (WQAPs) in Place

Water quality for many Connecticut waterbodies is being addressed in various pollution control and management programs within CT DEEP. Information about waters for which TMDLs have been established and approved by the US EPA is provided as Appendix B-2. As previously mentioned in Chapter 1 of this document, Category 4 has been assigned to waterbodies where the planning and implementation of pollution control and management measures have been initiated with the expectation to achieve CT WQS attainment. This section describes WQAPs that are placed within categories 4a (2TMDL,3TMDL), 4b and 4c. Additionally, WQAPs that have alternative measures in place but are not meeting WQS are placed in category 5R and are listed in Appendix B-1 and Appendix B-2

The most recent WQAPs that CT has completed are the Bantam Lake TMDL for Nutrients and an Advance Restoration Plan for Phosphorus in Non-tidal Streams. Additionally, TMDLs for 23 freshwater watersheds were developed and went through a public notice process in 2024. These TMDLs are in the last stages of finalization.

The Bantam Lake TMDL was based on a translation of narrative criteria for lakes using watershed and water quality modeling. A Statewide Lake TMDL for Nitrogen and Phosphorus was completed in 2021. This Plan is unique, because it is the first TMDL to also provide a Watershed Based Addendum to support implementation projects to reduce pollutant loading.

A TMDL Alternative Plan has been developed using a “straight to implementation approach” which documents water quality based permitting efforts to address phosphorus discharges to nontidal fresh waters through the NPDES permitting program, focusing on discharges from sewage treatment plants and stormwater. See table C-1 for more information. This plan has been accepted by the EPA. Segments included in the Advance Restoration Plan for Total Phosphorus in Non-Tidal Surface Waters are listed in Appendix B-2.

DRAFT

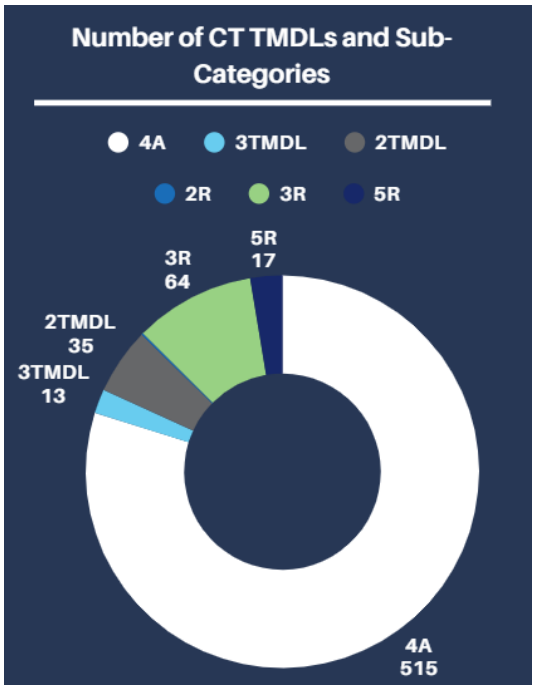



*Figure 3-2. Number of CT TMDLs and Subcategories*

## Impaired Waters with an Adopted TMDL (US EPA Category 4a)

Segments in EPA Category 4a (*Impaired waters with adopted TMDLs)* includes waters where a TMDL has been established but water quality has not yet been restored. A TMDL is specific to the Designated Uses and impairment causes. Therefore, segments can have several TMDLs for each Designated Use and cause combination. Figure 3-2 shows the number of segments with TMDLs not meeting WQS (4a) and segments where the impairment is restored and the TMDL document or implementation management plan remains in effect to ensure protection of Designated Uses for the waterbody. These segments are in either category 2 or 3 TMDL and not category 4a. For the 2024 cycle there are a total of 563 established TMDLs on CT waterbody segments, 515 of which have impaired Designated Uses within Category 4a, 35 segments within category 2 TMDL and 13 segments in category 3TMDL. There are 17 segments in category 5R, 64 segments in category 3R and 1 segment in 2R. The segments are included in the Connecticut Advance Restoration Plan for Total Phosphorus in Non-Tidal Surface Waters. Please refer to the Connecticut Assessment and Listing Methodology section for more details regarding CT Sub-Categories for Water Quality Plans. All CT WQAPs are listed in Appendix B-2.

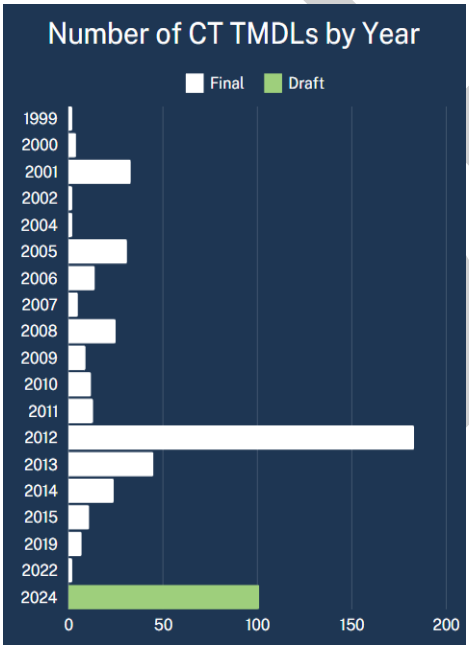



*Figure 3-3. CT Waterbodies with a Plan in Place*

Figure 3-3 depicts the cumulative development of TMDLs for Connecticut waterbodies over time, since 1999. In recent years, there was an increase in established TMDLs mostly due to the development of a number of bacteria TMDLs. Connecticut was able to establish a more efficient process for developing bacteria TMDLs. TMDLs for over 180 waterbody segments were developed in 2012 and 2013. However, there is a decline in TMDL development after 2015. During this time, CT DEEP worked to develop new Water Quality Planning approaches including the IWPM process, development of statewide modeling efforts to support nutrient related water quality analyses that are currently underway, in response to CT 303(d) program focus areas and Long Island Sound initiatives, development of updates for future bacteria TMDLs as well as development of new approaches for water quality protection planning. The program was also affected by staffing shortages for several years during this period. Connecticut has currently developed Draft TMDLs for over 100 segments, for bacteria which will be reflected in the 2026 cycle.

DRAFT

### Impaired Waters with Pollution Control Measures in place (US EPA Category 4b)

Pollution Control Measures for Waterbody Segments are provided in Appendix B-3 and includes a description of the non TMDL-based pollution control requirements expected to result in full attainment of CT WQS. Examples of other pollution control requirements include Consent Orders, Combined Sewer Overflow Control Plans, Remedial Action Plans or other plans / studies where activities in progress are expected to result in attainment of the applicable water quality standards and Designated Uses. Waters are not assigned to this category unless there is reasonable assurance that compliance with the requirements will result in attainment of uses and there are provisions for follow-up monitoring to track progress. In the event that follow-up monitoring indicates that the other pollution control requirements will fall short of achieving the goal of attaining standards, segments will be reassigned to Category 5 for TMDL development. There are many other waters, not listed under Category 4b, for which water quality-based pollution control measures have been established. There are a variety of alternative measures, such as water quality-based permitting or ecological risk assessment activities. These efforts are designed to support restoration or protection of water quality but may not be selected for inclusion in Category 4b.

### Impaired Waters with NonPolluting Pollutants(US EPA Category 4c)

The Clean Water Act defines pollution as "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water". For waters placed in Category 4c, the pollution is not from a chemical constituent, but it is from a human impact. While a TMDL is not typically prepared for 4c waters, this type of pollution does require management measures to meet the applicable water quality standards. For more information on waters where stream flow-based effects are identified, please refer to the Streamflow Regulations to better understand the regulatory programs in place to address flow impacts. These waters are listed in Appendix B-4

## CT Water Quality Action Plans Currently in Development

This report identifies areas where Action Plans are currently in development and plan to be completed within the next two years (2024-2026) in Appendix C-1. Appendix C-2 identifies Action Plans that are planned to be in development prior to 2026. CT DEEP continues to work in support of key statewide 303(d) Program initiatives including CT DEEP's Second-Generation Nitrogen Strategy for the Long Island Sound TMDL, the Statewide Bacteria TMDL, other projects identified under IWPM and the cleanup of the Housatonic River as a result of PCB contamination. The waters listed in Appendix C-1 were selected because they were either part of long-standing projects or sufficient data, information and resources are expected to be available to initiate or continue development of action plans during the next two years. Despite CT DEEP's focus on the selected water bodies for action plans, some level of the Water Quality Program's effort will continue for all waters of Connecticut. CT continues to work with various stakeholders in the Natchaug Watershed and is drafting CT's first Water Quality Protection Plan.

Not all efforts require the development of a new plan under Section 303(d) of the Clean Water Act. This includes other program work in CT DEEP, assistance from Department staff and sharing resources with non-government organizations and municipalities, as they are available. In addition to the waters identified in the List of Waters for Action Plan Development in Appendix C-1. CT DEEP also supports various implementation programs such as the Watershed Management Program, as well as State NPDES permitting and Remediation Programs through development of risk-based approaches to water quality restoration and protection. A summary of the status of water quality-based plans identified for development under Section 303(d) of the Clean Water Act is provided below. These waters are also placed in the various lists associated with this report based on water quality assessment information and the status of plan development. For more information on the listing process, please refer to the listing guidance provided in Chapter 1 of this report.

DRAFT

The review of water quality focus areas and identification of waters for plan development is updated periodically, including a public process for review and comment, both through the Integrated Water Quality Report and IWPM processes. The next IWPM review period is expected in 2026.

WQAPs currently in development under section 303 (d) of the Clean Water Act include;

## TMDLs

### *TMDLs for Bacteria (Recreation and Shellfishing)*

23 bacteria TMDLs were made available for public comment at the end of 2024 through the beginning of 2025. Responses to comments and final documents are in progress. These segments will be reflected in the 2026 cycle. In addition to updating the core document, TMDLs have been developed for waterbodies identified in Appendix C-1. Bacteria TMDLs for marine waters are planning to be in development in the future. More information is available on the project website.

### *TMDLs for Toxicity (Aquatic Life Use Support)*

A revised TMDL for Rainbow Brook and Seymour Hollow Brook is currently being evaluated. The TMDL or alternate strategy will seek to address water quality-based loadings necessary to protect aquatic life from exposure to de-icing compounds. Information on other nearby waterbodies and other pollutants such as chlorides and metals will also be considered to determine if load allocations for these waterbodies or parameters should also be included in the revised TMDL or alternate strategy. See table C-1 for more information.

### *TMDLs for Nutrients in Lakes (Recreation)*

Following the completion of the Bantam Lake TMDL, work continues to support the implementation of the narrative translation of standards for lakes. Data collection and modelling to TMDL development is currently in progress for West Thompson Lake and Lakes Lilinonah and Zoar. Additional TMDLs for other lakes are planned to be developed in the future.

### *TMDLs for Nutrients in Embayments (Aquatic Life Use Support)*

CT DEEP is working in collaboration with Rhode Island Department of Environmental Management, to develop and implement a new TMDL approach using HSPF watershed modeling to evaluate nutrient conditions in upland watersheds and to identify and evaluate sources contributing nutrients to the tidal estuaries of the Pawcatuck River and Little Narragansett Bay. Results from the upland model will be linked to estuary WASP and EFDC models to evaluate nutrient impacts on water quality indicators such as dissolved oxygen and water clarity. This project is supported in part by a grant from the Southeast New England Program (SNEP), which is funded by the U.S. EPA in collaboration with Restore America's Estuaries. (*www.snepgrants.org* ) Monitoring in the upland area by USGS has been completed along with the HSPF model. The WASP and EFDC models for the estuary were developed at the EPA Atlantic Coastal Science Environmental Laboratory. More information can be found the Pawcatuck Watershed Nutrient Project website. See table C-1 for more information. This project is still in development.

Efforts are on-going to extend the approach developed for the Pawcatuck Watershed/Estuary and Little Narragansett Bay to other coastal embayments in Connecticut identified for plan development through Integrated Water Resource Management. Data collection and model development is underway to develop an updated HSPF model for the rest of Connecticut. Studies have been conducted to evaluate water quality data and modeling needs for embayments across Connecticut. Data collection for the Mystic River and Norwalk River estuaries is underway. Data collection is planned for the Southport and Saugatuck Harbor estuaries this year. This effort also supports CT DEEP's Second-Generation Nitrogen Strategy for the Long Island Sound TMDL. See table C-1 for more information. A protection plan will be developed for

DRAFT

the Niantic River Watershed based on previously conducted local studies and analysis conducted by the Niantic Estuary Workgroup. The plan is expected to address nutrient impacts on the Niantic River Estuary.

## Protection Plans

In collaboration with the CT DEEP Watersheds Unit, a protection plan for The Natchaug River and Mount Hope Watersheds is in development. This plan supports the implementation analysis previously conducted by the Eastern Connecticut Conservation District in collaboration with CT DEEP. The goal is to develop and implement an approach that can be translated to other watersheds identified for protection activities. This work is supported in part by a Healthy Watersheds grant from EPA. See table C-1 for more information.

## Advance Restoration Plans (ARPs)

### *ARPs for Remediation Projects*

A TMDL Alternative Plan is in development using a "straight to implementation approach" which documents efforts to address contaminated surface waters, groundwaters and sediments at certain sites through Remediation Program activities. See table C-1 for more information.

### *ARPs for Impervious Cover*

A TMDL Alternative Plan is in development using a "straight to implementation approach" which documents efforts to address the impacts of stormwater on water quality through Impervious Cover Watershed Response Plans as well as the stormwater permitting program. See table C-1 for more information.

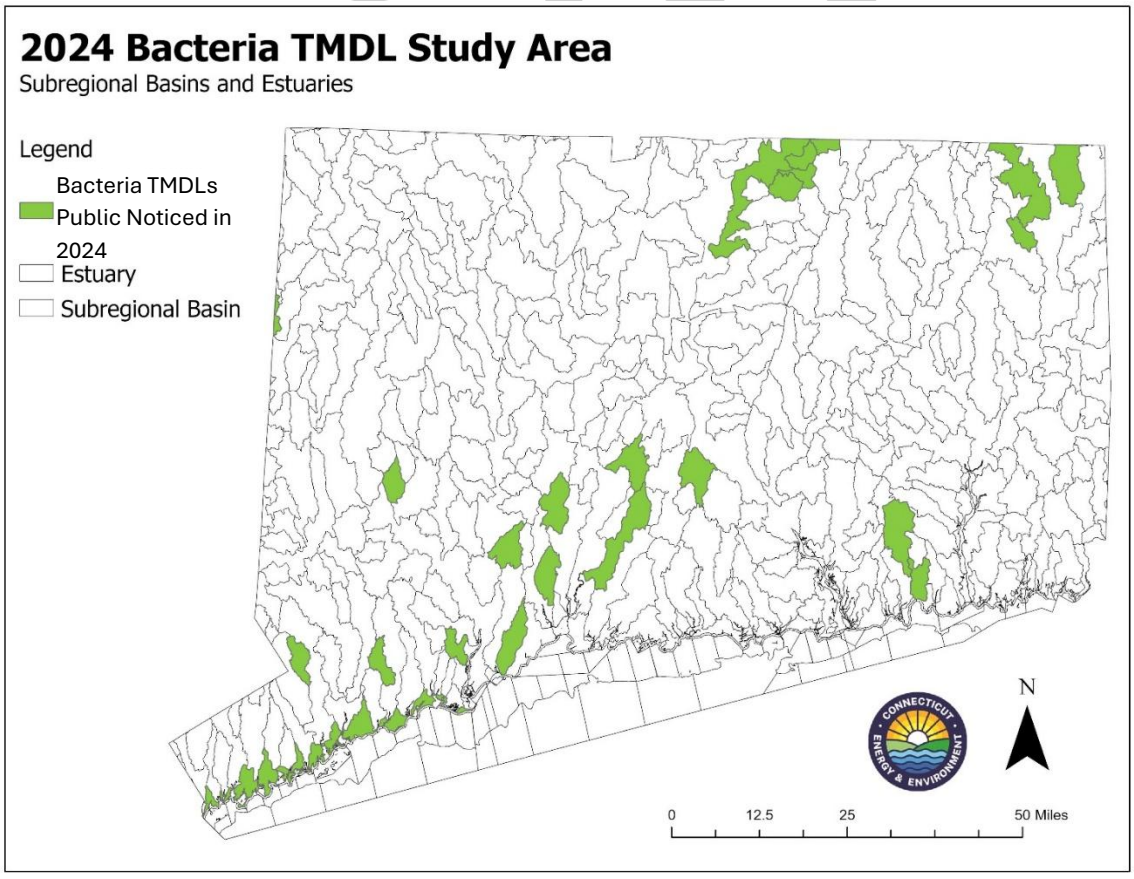


*Figure 3-4. CT Selected Waters for Action Plan Development for Bacteria* (does not show waterbodies chosen for Alternative Action Plan Development.)

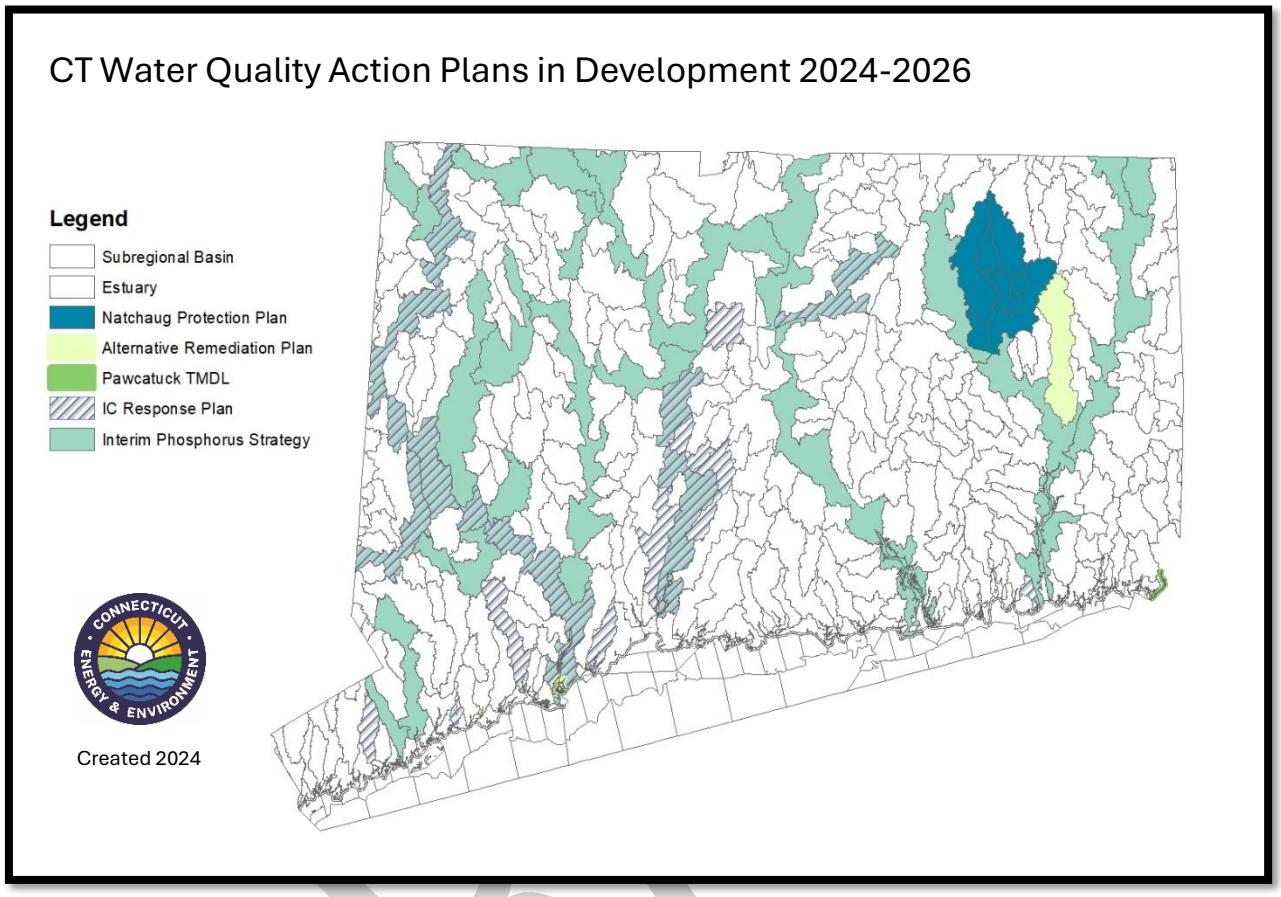



*Figure 3-5 Alternative/Protection Action Plan Development 2024-2026*

## Water Quality Assessments and Plans Web Mapping Application

CT DEEP has created an interactive web mapping application for users to view and download 305 (b) and 303 (d) geospatial information. The application will also allow users to add their own geographic data for analysis. The application contains 2020 IR information and will reflect future IR cycles; however, it will not reflect cycle data prior to 2020.

## Tribal Waters within Connecticut

Connecticut is a small state and water resources within state and tribal areas may be interconnected. There are two (2) federally recognized Tribal Nations, the Mashantucket (Western) Pequot and Mohegan, and three (3) state-recognized Tribal Nations, the Schaghticoke, Golden Hill Paugussett, and Paucatuck Eastern Pequot Tribal Nations, in Connecticut. As sovereign nations, federally recognized tribes manage the water resources within their tribal boundaries.

The Connecticut Water Quality Standards and other programs under the Clean Water Act apply to waters within the State of Connecticut. This includes water resources within the Tribal Reservations for the three state-recognized tribal nations. Water resources within the two federally recognized Tribal Nations, are managed by the Tribes. As with other water resources where state waters may intersect with resources of another jurisdiction, it is important to understand the connections between these resources.

Draft 2024 State and Tribal Waters in Connecticut Appendix D-1 is intended to help identify the water resources within state-recognized Tribal Reservations as well as the relationship between waters state water resources and those within federally recognized Tribal Nations. By understanding which waters within Connecticut intersect with waters in tribal areas, environmental management programs, members of Tribal Nations, and the public will be better able to understand the intersection between activities authorized within Connecticut watersheds and water quality within water resources in federal and state Tribal Nations.

For more details on the water resources managed by the State of Connecticut and water resources within tribal areas please see Appendix D-1.

## Public Engagement and Outreach

Comments on the draft IWQR document must be received at the Department by **October 14, 2025,** in writing, in order to be considered prior to submission of the final document to US EPA. Comments should be directed electronically to Rebecca Jascot (rebecca.jascot@ct.gov). P**lease use subject line** "***2024 IWQR Comment***."

**A public meeting will be held (registration required) on September 17, 2025, via ZOOM from** 11:00 a.m.-12:30 p.m. **Eastern Time (US and Canada)**. After registering, you will receive a confirmation email containing information about joining the meeting.

CT DEEP is an Affirmative Action and Equal Opportunity Employer that is committed to complying with the Americans with Disabilities Act. To request an accommodation contact us at 860-418-5910 or deep.accommodations@ct.gov.

DRAFT

# IWQR Appendices

In previous report cycles, many of the tables (Assessment Results, TMDLs approved, Impaired Waters, etc.) were found within the report as one large electronic file, but now these tables are included as appendices and as separate electronic files for this report cycle. The list of appendices can be found in the Table of Contents (p. iii) of this report.

Appendix A-1. Connecticut 305b Assessment Results for Rivers and Streams

Appendix A-2. Connecticut 305b Assessment Results for Lakes

Appendix A-3. Connecticut 305b Assessment Results for Estuaries

Appendix A-4. Connecticut 305b Site Specific Fish Consumption Advisories

Appendix B-1. List of Impaired Waters for Connecticut (EPA Category 5 and 5R)

Appendix B-2. Waterbodies with Adopted TMDLs (EPA Category 4a)

Appendix B-3. Pollution Control Measures for Waterbody Segments (EPA Category 4b)

Appendix B-4. Nonpollutant Impairments (EPA Category 4c)

Appendix B-5. Reconciliation List of Impaired Waters (Delistings and Listings, Additions and Removals)

Appendix C-1. Draft 2024 Priority List of Waters for Action Plan Development by 2024-2026 (including TMDL development)

Appendix C-2. Priority List of Waters for Action Plan Development Post 2026 (including TMDL development)

Appendix D-1. EPA's Ruling on Water Quality Standards Regulatory Revisions to Protect Tribal Reserved Rights

DRAFT

# References

Barbour, M.T., J. Gerritsen, B.D. Snyder and J.B. Stribling. 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition*. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington D.C.

Becker, M. 2012. Quality Assurance Project Plan-Aquatic Life Response to Cultural Eutrophication in Connecticut Freshwater Wadeable Rivers and Stream (2012-2015). Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Planning and Standards Division Hartford, CT.

Becker, M.E., Becker, T.J., Bellucci, C.J., 2018. Diatom tolerance metrics to identify total phosphorus as candidate cause of aquatic life impairment in Connecticut, USA freshwater streams. Ecol. Indic. 93.

Becker, M.E., and Bellucci, C.J., 2019. A Method to Identify Total Phosphorus as a Cause of Aquatic Life Impairment in Connecticut Freshwater High Gradient Non-Tidal Streams. Technical Support Document. CT DEEP

Bellucci, C.J., M.E. Becker, M. Czarnowski, and C. Fitting. 2020. A novel method to evaluate stream connectivity using trail cameras. Rivers Research and Applications 36:1504-1514.

Bellucci, C. TMDL information. CT Department of Environmental Protection, Bureau of Water Protection and Land Reuse, Planning and Standards Division, Hartford, CT. Personal communication to P. Stacey, CT Department of Environmental Protection, Bureau of Water Protection and Land Reuse, Planning and Standards Division Hartford, CT.

Bellucci, C.J., M.E. Becker, M. Beauchene, and L. Dunbar. 2013. Classifying the Health of Connecticut Streams Using Benthic Macroinvertebrates with Implications for Water Management. Environmental Management 51:1274-1283.

Canavan, R.W. IV and P.A. Siver. 1995. *Connecticut Lakes: A Study of Chemical and Physical Properties of Fifty-six Connecticut lakes*. Connecticut College Arboretum, New London, CT.

CT DEEP. *Water Quality Standards*. CT Department of Environmental Protection, Bureau of Water Management, Planning Division, Hartford, CT. www.ct.gov/deep/wqsc

CT DEEP. 2015. Ambient Water Quality Monitoring Program Strategy, 2015-2024. Connecticut Department of Energy and Environmental Protection. Hartford, CT 06106.

CT DEP. 1996. *Quality Assurance Project Plan for Ambient Biological Monitoring*. CT Department of Environmental Protection, Bureau of Water Management, Planning Division, Hartford, CT.

CT DEP. 1998. *Trophic Classifications of Twelve Connecticut Lakes*. CT Department of Environmental Protection, Bureau of Water Management, Lakes Program, Hartford, CT.

CT DEP. 1999. *Ambient Monitoring Strategy for Rivers and Streams: Rotating Basin Approach*. CT Department of Environmental Protection, Bureau of Water Management, Planning Division, Hartford, CT.

DRAFT

CT DEEP. 2013. Standard Operating Procedures for the Collection of Fish Community Data from Wadeable Streams for Aquatic Life Assessment. Bureau of Water Protection and Land Reuse, Planning and Standards Division, Hartford, CT.

CT DEP. 2005. *Connecticut Comprehensive Ambient Water Quality Monitoring Strategy*. CT Deptartment of Environmental Protection, Bureau of Water Management, Planning Division, Hartford, CT.

CT DEP. Unpublished data. CT Department of Environmental Protection, Bureau of Water Management, Planning Division, Hartford, CT

CT DPH and CT DEP. 2003. *State of Connecticut Guidelines for Monitoring Bathing Water and Closure Protocol: revised 2003.* CT Department of Health Services, CT Department of Environmental Protection, Hartford, CT.

CT DPH. 2025 *If I Catch It, Can I Eat It? A Guide to Eating Fish Safely Connecticut Fish Consumption Advisory*. Connecticut Department of Public Health, Hartford, CT. www.ct.gov/dph/fish

Frink, C.R. and W.A. Norvell. 1984. *Chemical and Physical Properties of Connecticut Lakes*. The Connecticut Agricultural Experiment Station, New Haven, CT.

Gerritsen, J. and B. Jessup. 2007. *Calibration of the Biological Condition Gradient for High Gradient Streams of Connecticut*. Tetra Tech, Inc. Owings Mills, MD. Prepared for US EPA, Office of Science and Technology and the CT DEP.

Grubbs, G. H. and R.H. Wayland. 2000. [Online] *Guidance: Use of Fish and Shellfish Advisories and Classifications in 303(d) and 305(b) Listing Decisions (October 24, 2000) WQSP-00-03* United States Environmental Protection Agency, Office of Water, Washington, DC. https://www.epa.gov/sites/production/files/2015-01/documents/standards-shellfish.pdf

Healy, D.F. and K.P. Kulp. 1995. *Water Quality Characteristics of Selected Public Recreational Lakes and Ponds in Connecticut.* U.S. Geologic Survey Water-Resources Investigations Report 95-4098, prepared in cooperation with the State of Connecticut Department of Environmental Protection, Hartford, CT.

Kanno, Y., J.C. Vokoun, and M. Beauchene. 2010. *Development of dual fish multi-metric indices of biological condition for streams with characteristic thermal gradients and low species richness*. Ecol. Indicators.

Neumann, R.M., R.J. Carley, C.P. Perkins, and R. Pirrie. 1996. *Preliminary Assessment of Total Mercury Concentrations in Fishes from Connecticut Water Bodies*. Department of Natural Resource Management and Engineering and Environmental Research Institute. University of Connecticut, Storrs, CT.

Nosal, T. 1997. *Gazetteer of Drainage Areas of Connecticut*. Water Resources Bulletin Number 35. CT Department of Environmental Protection. Available at http://www.cteco.uconn.edu/docs/wrb/WRB45_Gazetteer_of_Drainage_Areas_of_Connecticut.pdf

DRAFT

O'Brien, K. undated. *OLISP sediment geodatabase*. CT Department of Environmental Protection Bureau of Water Protection and Land Reuse, Office of Long Island Sound Programs, Hartford, CT.

PA 12-155 Coordinating Committee – Phosphorus Reduction Strategy. Recommendations for Phosphorus Strategy Pursuant to PA 12-155 Final Report [WWW Document]. URL https://www.ct.gov/deep/lib/deep/water/water_quality_standards/p/pa12_155_fullccreport.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*. EPA/444/4-89-00. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Poff, N.L., J.D. Allan, M.B. Bain, J.R. Karr, K.L. Prestegaard, B.D. Richter, R.E. Sparks, and J.C. Stromberg. 1997. The Natural Flow Regime-A Paradigm for River Conservation and Restoration. Bioscience 47:769-784.

Smucker, N.J., Becker, M., Detenbeck, N.E., Morrison, A.C., 2013. Using algal metrics and biomass to evaluate multiple ways of defining concentration-based nutrient criteria in streams and their ecological relevance. Ecol. Indic. 32, 51–61.

Stacey, P. 2007. *RE: determination of impairment based on sediment contamination- CALM update* State of Connecticut, Department of Environmental Protection, Bureau of Water Protection and Land Reuse, Division Director, Hartford, CT. Email to Katie O'Brien-Clayton, Department of Environmental Protection, Bureau of Water Protection and Land Reuse dated 12/27/2007.

Stevens, D. L., Jr. and A. R. Olsen. 2004. Spatially-balanced sampling of natural resources. Journal of American Statistical Association 99(465): 262-278.

Streich, K. 2007. *Summary Report & Users Guide Connecticut Coastal Assessment And Segmentation Project Final - May 11, 2006 Amended - October 3, 2007* State of Connecticut. Department of Environmental Protection. Hartford, CT

Strobel, C.J. 2000. *Coastal 2000 - Northeast Component: Field Operation Manual*. EPA/620/R-00.002. U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division, Narragansett, RI.

US EPA. Clean Water Act. https://www.epa.gov/laws-regulations/summary-clean-water-act

US EPA. 1997. *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Report Contents*. EPA-841-B-97-002A. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

US EPA. 2000. *Ambient aquatic life water quality criteria for dissolved oxygen (saltwater): Cape Cod to Cape Hatteras*. EPA-822-R-00-012. U.S. Environmental Protection Agency, Office of Water, Washington, DC. 49 p.

US EPA. 2002. [Online] *Consolidated Assessment and Listing Methodology Toward a Compendium of Best Practices/*. First Edition. July 2002. U.S. Environmental Protection

Agency, Office of Wetlands, Oceans, and Watersheds, Washington, D.C. http://www.epa.gov/owow/monitoring/calm.html

US EPA. 2005. *Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act*. U.S. Environmental Protection Agency, Assessment and Watershed Protection Division, Office of Water, United States Protection Agency, Washington, DC.

US EPA. 2013. *Long-Term Vision for Assessment, Restoration and Protection under the Clean Water Act Section 303(d) Program*. U.S. Environmental Protection Agency, Office of Water, Washington, DC. https://www.epa.gov/tmdl/new-vision-cwa-303d-program-updated-framework-implementing-cwa-303d-program-responsibilities

Vokoun, J.C and C.R. Perkins. 2008. *Second Statewide Assessment of Mercury Contamination in Fish Tissue from Connecticut Lakes (2005-2006)* Department of Natural Resource Management and Center for Environmental Sciences and Engineering. University of Connecticut, Storrs, CT.

DRAFT